

# ***OMAP5910*** ***Dual-Core Processor***

## ***Data Manual***



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## REVISION HISTORY

This data sheet revision history highlights the technical changes made to the SPRS197C device-specific data sheet to make it an SPRS197D revision.

**Scope:** This document has been reviewed for technical accuracy; the technical content is up-to-date as of the specified release date and includes the following changes.

| PAGE(S)<br>NO. | ADDITIONS/CHANGES/DELETIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All            | Removed all references to MMC/SD SPI mode that is no longer supported.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 18 – 21        | In Table 2-1:<br>Added footnote for GZG pin V12; "See Section 5.6.1 and Section 5.6.2 for special $V_{SS}$ considerations with oscillator circuits."<br><br>Changed GZG pin P9 from "USB0.DP" to "USB.DP"                                                                                                                                                                                                                                                                                                                                                                                                          |
| 22 – 24        | In Table 2-2:<br>Added footnote for GDY pin F6; "See Section 5.6.1 and Section 5.6.2 for special $V_{SS}$ considerations with oscillator circuits."<br><br>Changed GDY pin P5 from "USB0.DP" to "USB.DP"                                                                                                                                                                                                                                                                                                                                                                                                           |
| 34 – 46        | In Table 2-4:<br>Added A11, A13, H9, and G9 to list of $V_{SS}$ Pins<br>Changed U21 to N16 in the GDY column<br>Changed USB1.TXEN pin in the GDY column from T6 to P14<br>Changed LCD.PCLK and LCD.P[15:0] description from "LCD panels" to "LCD panel"<br>Changed SDRAM.CLK description to include "SDRAM.CLK can also be configured as an input to monitor skew control."<br>Changed STAT_VAL/ $\overline{WKUP}$ description to remove "STAT_VAL/ $\overline{WKUP}$ may be configured via software to function as an external wake-up signal to the OMAP5910 device to request chip wake-up during sleep modes." |
| 48             | Changed last bullet in Section 3.1<br>from: LCD controller supporting monochrome panels or STN and TFT color panels<br>to: LCD controller supporting monochrome panels (STN) and color panels (STN or TFT)                                                                                                                                                                                                                                                                                                                                                                                                         |
| 54             | In Section 3.3.4, changed the last sentence in the first paragraph<br>from: Accessing registers with the incorrect access width may result in unexpected results including a TI Peripheral Bus (TIPB) bus error and associated TIPB interrupt.<br>to: Accessing registers with the incorrect access width may cause unexpected results including a TI Peripheral Bus (TIPB) bus error and associated TIPB interrupt.                                                                                                                                                                                               |
| 64             | Combined bullets:<br><ul style="list-style-type: none"> <li>Selectable UART/autobauding modes (autobauding on UART1 and UART2)</li> <li>Auto bauding between 1200bits/s and 115.2K bits/s</li> </ul> To read as follows:<br><ul style="list-style-type: none"> <li>Selectable UART/autobauding modes (autobauding on UART1 and UART2) with autobauding between 1200 bits/s and 115.2K bits/s</li> </ul>                                                                                                                                                                                                            |
| 66             | Revised Section 3.11 to removed bulleted list and replace with the following: "The EMIF Interface provides access to 16-bit-wide access to standard SDRAM memories and the IMIF provides access to the 192K bytes of on-chip SRAM."                                                                                                                                                                                                                                                                                                                                                                                |

| PAGE(S)<br>NO. | ADDITIONS/CHANGES/DELETIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 68             | <p>In Section 3.13, removed the following bulleted items:</p> <ul style="list-style-type: none"> <li>• Quantization /Dequantization (useful for JPEG, MPEG, H.26x Encoding/Decoding)</li> <li>• Flexible 1D/2D Wavelet Processing (useful for JPEG2000, MPEG4, and other compression standards)</li> <li>• Boundary and Perimeter Computation (useful for Machine Vision applications)</li> <li>• Image Threshold and Histogram Computations (useful for various Image Analysis applications)</li> </ul>                                   |
| 72             | Revised Table 3–17 to change access width from 32 bit to 16 bit. Changed MPU_READ_TIM_WD address to FFFE:C804 and changed MPU_TIMER_MODE_WD address to FFFE:C808.                                                                                                                                                                                                                                                                                                                                                                          |
| 120            | Revised Section 4.1 and added Figure 4–1, OMAP Device Nomenclature                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 126            | Changed Section 5.6.2, first paragraph, third line from “If the internal oscillator is not used (configured in software), an external clock source must be applied to the OSC1_IN pin and the OSC1_OUT pin must be left unconnected.” to “If the internal oscillator is not used (configured in software using FUNC_MUX_CTRL_B register), an external clock source must be applied to the OSC1_IN pin and the OSC1_OUT pin must be left unconnected.”                                                                                      |
| 130            | Revised Table 5–10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 131            | Revised Table 5–11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 141 – 142      | Changed footnote of Table 5–14 from: “ $P = 1/(\text{Base frequency})$ for McBSP1 and 3, or $1/(\text{AMPER\_CK clock frequency})$ in nanoseconds (ns) for McBSP 2. Base frequency is 12 or 13MHz”. to: “Regardless of whether MCBSP.CLKS is internally or externally clocked, $P = 1/(\text{DSPXOR\_CK})$ for McBSP1 and McBSP3, and $P = 1/(\text{AMPER\_CK})$ for McBSP2. See the <i>OMAP5910 Dual-Core Processor Clock Generation and System Reset Management Reference Guide</i> (literature number SPRU678) for additional details.” |

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# 1 OMAP5910 Features

- **Low-Power, High-Performance CMOS Technology**
  - 0.13- $\mu$ m Technology
  - 1.6-V Core Voltage
- **TI925T (MPU) ARM9TDMI™ Core**
  - Support 32-Bit and 16-Bit (Thumb® Mode) Instruction Sets
  - 16K-Byte Instruction Cache
  - 8K-Byte Data Cache
  - Data and Program Memory Management Units (MMUs)
  - Two 64-Entry Translation Look-Aside Buffers (TLBs) for MMUs
  - 17-Word Write Buffer
- **TMS320C55x™ (C55x™) DSP Core**
  - One/Two Instructions Executed per Cycle
  - Dual Multipliers (Two Multiply-Accumulates per Cycle)
  - Two Arithmetic/Logic Units
  - One Internal Program Bus
  - Five Internal Data/Operand Buses (3 Read Buses and 2 Write Buses)
  - 32K x 16-Bit On-Chip Dual-Access RAM (DARAM) (64K Bytes)
  - 48K x 16-Bit On-Chip Single-Access RAM (SARAM) (96K Bytes)
  - 16K x 16-Bit On-Chip ROM (32K Bytes)
  - Instruction Cache (24K Bytes)
  - Video Hardware Accelerators for DCT, iDCT, Pixel Interpolation, and Motion Estimation for Video Compression
- **192K Bytes of Shared Internal SRAM**
- **Memory Traffic Controller (TC)**
  - 16-Bit EMIFS External Memory Interface to Access up to 128M Bytes of Flash, ROM, or ASRAM
  - 16-Bit EMIFF External Memory Interface to Access up to 64M Bytes of SDRAM
- **9-Channel System DMA Controller**
- **DSP Memory Management Unit**
- **Endianism Conversion Logic**
- **Digital Phase-Locked Loop (DPLL) for MPU/DSP/TC Clocking Control**
- **DSP Peripherals**
  - Three 32-Bit Timers and Watchdog Timer
  - Level1/Level2 Interrupt Handlers
  - Six-Channel DMA Controller
  - Two Multichannel Buffered Serial Ports (McBSP)
  - Two Multichannel Serial Interfaces (MCSI)
- **TI925T Peripherals**
  - Three 32-Bit Timers and Watchdog Timer
  - 32-kHz Timer
  - Level1/Level2 Interrupt Handlers
  - USB (Full/Low Speed) Host Interface With up to 3 Ports
  - USB (Full Speed) Function Interface
  - One Integrated USB Transceiver for Either Host or Function
  - Multichannel Buffered Serial Port
  - Inter-Integrated Circuit (I<sup>2</sup>C) Master and Slave Interface
  - MICROWIRE™ Serial Interface
  - Multimedia Card (MMC) and Secure Digital (SD) Interface
  - HDQ/1-Wire® Interface
  - Camera Interface for CMOS Sensors
  - ETM9 Trace Module for TI925T Debug
  - Keyboard Matrix Interface (6 x 5 or 8 x 8)
  - Up to Ten MPU General-Purpose I/Os
  - Pulse-Width Tone (PWT) Interface
  - Pulse-Width Light (PWL) Interface
  - Two LED Pulse Generators (LPGs)
  - Real-Time Clock (RTC)
  - LCD Controller With Dedicated System DMA Channel
- **Shared Peripherals**
  - Three Universal Asynchronous Receiver/Transmitters (UARTs) (One Supporting SIR Mode for IrDA)
  - Four Interprocessor Mailboxes
  - Up to 14 Shared General-Purpose I/Os
- **Individual Power-Saving Modes for MPU/DSP/TC**
- **On-Chip Scan-Based Emulation Logic**
- **IEEE Std 1149.1<sup>†</sup> (JTAG) Boundary Scan Logic**
- **Two 289-Ball Ball Grid Array Package Options (GZG and GDY Suffixes)**

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ARM9TDMI is a trademark of ARM Limited.

Thumb is a registered trademark of ARM Limited.

MICROWIRE is a trademark of National Semiconductor Corporation.

1-Wire is a registered trademark of Dallas Semiconductor Corporation.

<sup>†</sup> IEEE Standard 1149.1-1990 Standard Test-Access Port and Boundary Scan Architecture.

## 2 Introduction

This section describes the main features of the OMAP5910 device, lists the terminal assignments, and describes the function of each terminal. This data manual also provides a detailed description section, electrical specifications, parameter measurement information, and mechanical data about the available packaging.

### 2.1 Description

The OMAP5910 is a highly integrated hardware and software platform, designed to meet the application processing needs of next-generation embedded devices.

The OMAP™ platform enables OEMs and ODMs to quickly bring to market devices featuring rich user interfaces, high processing performance, and long battery life through the maximum flexibility of a fully integrated mixed processor solution.

The dual-core architecture provides benefits of both DSP and RISC technologies, incorporating a TMS320C55x DSP core and a high-performance TI925T ARM core.

The OMAP5910 device is designed to run leading open and embedded RISC-based operating systems, as well as the Texas Instruments (TI) DSP/BIOS™ software kernel foundation, and is available in a 289-ball MicroStar BGA™ package.

The OMAP5910 is targeted at the following applications:

- Applications processing devices
- Mobile communications
  - 802.11
  - Bluetooth™ wireless technology
  - GSM (including GPRS and EDGE)
  - CDMA
  - Proprietary government and other
- Video and image processing (MPEG4, JPEG, Windows® Media Video, etc.)
- Advanced speech applications (text-to-speech, speech recognition)
- Audio processing (MPEG-1 Audio Layer3 [MP3], AMR, WMA, AAC, and other GSM speech codecs)
- Graphics and video acceleration
- Generalized web access
- Data processing (fax, encryption/decryption, authentication, signature verification and watermarking)

#### 2.1.1 TMS320C55x DSP Core

The DSP core of the OMAP5910 device is based on the TMS320C55x DSP generation CPU processor core. The C55x DSP architecture achieves high performance and low power through increased parallelism and total focus on reduction in power dissipation. The CPU supports an internal bus structure composed of one program bus, three data read buses, two data write buses, and additional buses dedicated to peripheral and DMA activity. These buses provide the ability to perform up to three data reads and two data writes in a single cycle. In parallel, the DMA controller can perform up to two data transfers per cycle independent of the CPU activity.

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The C55x CPU provides two multiply-accumulate (MAC) units, each capable of 17-bit x 17-bit multiplication in a single cycle. A central 40-bit arithmetic/logic unit (ALU) is supported by an additional 16-bit ALU. Use of the ALUs is under instruction set control, providing the ability to optimize parallel activity and power consumption. These resources are managed in the address unit (AU) and data unit (DU) of the C55x CPU.

The C55x DSP generation supports a variable byte width instruction set for improved code density. The instruction unit (IU) performs 32-bit program fetches from internal or external memory and queues instructions for the program unit (PU). The program unit decodes the instructions, directs tasks to AU and DU resources, and manages the fully protected pipeline. Predictive branching capability avoids pipeline flushes on execution of conditional instructions. The OMAP5910 DSP core also includes a 24K-byte instruction cache to minimize external memory accesses, improving data throughput and conserving system power.

#### **2.1.1.1 DSP Tools Support**

The 55x DSP core is supported by the industry's leading eXpressDSP™ software environment including the Code Composer Studio™ integrated development environment, DSP/BIOS software kernel foundation, the TMS320™ DSP Algorithm Standard, and the industry's largest third-party network. Code Composer Studio features code generation tools including a C-Compiler, Visual Linker, simulator, Real-Time Data Exchange (RTDX™), XDS510™ emulation device drivers, and Chip Support Libraries (CSL). DSP/BIOS is a scalable real-time software foundation available for no cost to users of Texas Instruments' DSP products providing a preemptive task scheduler and real-time analysis capabilities with very low memory and megahertz overhead. The TMS320 DSP Algorithm Standard is a specification of coding conventions allowing fast integration of algorithms from different teams, sites, or third parties into the application framework. Texas Instruments' extensive DSP third-party network of over 400 providers brings focused competencies and complete solutions to customers.

#### **2.1.1.2 DSP Software Support**

Texas Instruments has also developed foundation software available for the 55x DSP core. The C55x DSP Library (DSPLIB) features over 50 C-callable software kernels (FIR/IIR filters, Fast Fourier Transforms (FFTs), and various computational functions). The DSP Image/Video Processing Library (IMGLIB) contains over 20 software kernels highly optimized for C55x DSPs and is compiled with the latest revision of the C55x DSP code generation tools. These imaging functions support a wide range of applications that include compression, video processing, machine vision, and medical imaging.

### **2.1.2 TI-Enhanced TI925T RISC Processor**

The MPU core is a TI925T reduced instruction set computer (RISC) processor. The TI925T is a 32-bit processor core that performs 32-bit or 16-bit instructions and processes 32-bit, 16-bit, or 8-bit data. The core uses pipelining so that all parts of the processor and memory system can operate continuously.

The MPU core incorporates:

- A coprocessor 15 (CP15) and protection module
- Data and program Memory Management Units (MMUs) with table look-aside buffers.
- A separate 16K-byte instruction cache and 8K-byte data cache. Both are two-way associative with virtual index virtual tag (VIVT).
- A 17-word write buffer (WB)

The OMAP5910 device uses the TI925T core in little endian mode only.

To reduce effective memory access time, the TI925T has an instruction cache, a data cache, and a write buffer. In general, these are transparent to program execution.

eXpressDSP, Code Composer Studio, TMS320, RTDX, and XDS510 are trademarks of Texas Instruments.

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## 2.2 Terminal Assignments

Figure 2–1 illustrates the ball locations for the 289-ball GZG ball grid array (BGA) package and is used in conjunction with Table 2–1 to locate signal names and ball grid numbers. GZG BGA ball numbers in Table 2–1 are read from left-to-right, top-to-bottom.

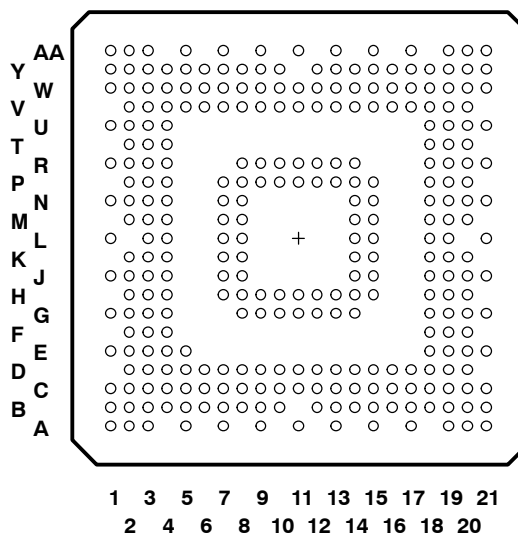


Figure 2–1. OMAP5910 GZG MicroStar BGA™ Package (Bottom View)

In Table 2–1, signals with multiplexed functions are separated with forward slashes as follows:

- **signal1/signal2/signal3** (for example, GPIO11/HDQ)

Signals which are associated with specific peripherals are denoted by using the peripheral name, followed by a period, and then the signal name; as follows:

- **peripheral1.signal1** (for example, MCBSP1.DR)

Table 2–1. GZG BGA Terminal Assignments

| GZG BGA BALL # | SIGNAL            | GZG BGA BALL # | SIGNAL           | GZG BGA BALL # | SIGNAL            | GZG BGA BALL # | SIGNAL            |
|----------------|-------------------|----------------|------------------|----------------|-------------------|----------------|-------------------|
| A1             | DV <sub>DD4</sub> | A2             | SDRAM.RAS        | A3             | CV <sub>DD1</sub> | A5             | DV <sub>DD4</sub> |
| A7             | DV <sub>DD4</sub> | A9             | CV <sub>DD</sub> | A11            | V <sub>SS</sub>   | A13            | V <sub>SS</sub>   |
| A15            | DV <sub>DD1</sub> | A17            | LCD.P[13]        | A19            | DV <sub>DD1</sub> | A20            | LCD.P[5]          |
| A21            | V <sub>SS</sub>   | B1             | V <sub>SS</sub>  | B2             | V <sub>SS</sub>   | B3             | SDRAM.DQML        |
| B4             | SDRAM.D[13]       | B5             | V <sub>SS</sub>  | B6             | SDRAM.D[8]        | B7             | V <sub>SS</sub>   |
| B8             | SDRAM.D[4]        | B9             | SDRAM.D[0]       | B10            | DV <sub>DD4</sub> | B12            | DV <sub>DD4</sub> |
| B13            | CV <sub>DD3</sub> | B14            | SDRAM.A[0]       | B15            | LCD.AC            | B16            | V <sub>SS</sub>   |
| B17            | LCD.P[11]         | B18            | V <sub>SS</sub>  | B19            | LCD.P[6]          | B20            | CV <sub>DD3</sub> |
| B21            | LCD.P[1]          | C1             | FLASH.A[3]       | C2             | DV <sub>DD5</sub> | C3             | SDRAM.WE          |
| C4             | SDRAM.D[14]       | C5             | SDRAM.D[11]      | C6             | SDRAM.D[9]        | C7             | SDRAM.D[6]        |
| C8             | SDRAM.D[2]        | C9             | SDRAM.CLK        | C10            | SDRAM.BA[0]       | C11            | SDRAM.A[10]       |
| C12            | SDRAM.A[7]        | C13            | SDRAM.A[4]       | C14            | SDRAM.A[1]        | C15            | LCD.PCLK          |

<sup>†</sup> See Section 5.6.1 and Section 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

MicroStar BGA is a trademark of Texas Instruments.

Table 2–1. GZG BGA Terminal Assignments (Continued)

| GZG BGA BALL # | SIGNAL                                 | GZG BGA BALL # | SIGNAL                              | GZG BGA BALL # | SIGNAL                                            | GZG BGA BALL # | SIGNAL                                            |
|----------------|----------------------------------------|----------------|-------------------------------------|----------------|---------------------------------------------------|----------------|---------------------------------------------------|
| C16            | LCD.P[14]                              | C17            | LCD.P[10]                           | C18            | LCD.P[7]                                          | C19            | LCD.P[2]                                          |
| C20            | KB.C[5]                                | C21            | KB.C[4]                             | D2             | FLASH.A[5]                                        | D3             | FLASH.A[2]                                        |
| D4             | SDRAM.DQM $\overline{U}$               | D5             | SDRAM.D[15]                         | D6             | SDRAM.D[12]                                       | D7             | SDRAM.D[7]                                        |
| D8             | SDRAM.D[5]                             | D9             | SDRAM.CKE                           | D10            | SDRAM.BA[1]                                       | D11            | SDRAM.A[9]                                        |
| D12            | SDRAM.A[6]                             | D13            | SDRAM.A[3]                          | D14            | LCD.VS                                            | D15            | LCD.P[15]                                         |
| D16            | LCD.P[9]                               | D17            | LCD.P[8]                            | D18            | LCD.P[0]                                          | D19            | KB.C[2]                                           |
| D20            | KB.C[1]                                | E1             | DV $_{DD5}$                         | E2             | V $_{SS}$                                         | E3             | FLASH.A[7]                                        |
| E4             | FLASH.A[4]                             | E5             | RSVD                                | E18            | KB.C[3]                                           | E19            | KB.R[4]                                           |
| E20            | KB.R[3]                                | E21            | DV $_{DD1}$                         | F2             | CV $_{DD}$                                        | F3             | FLASH.A[9]                                        |
| F4             | FLASH.A[6]                             | F18            | KB.C[0]                             | F19            | KB.R[1]                                           | F20            | V $_{SS}$                                         |
| G1             | V $_{SS}$                              | G2             | FLASH.A[12]                         | G3             | FLASH.A[11]                                       | G4             | FLASH.A[10]                                       |
| G8             | SDRAM.D[3]                             | G9             | SDRAM.D[1]                          | G10            | SDRAM.A[12]                                       | G11            | SDRAM.A[8]                                        |
| G12            | SDRAM.A[2]                             | G13            | LCD.P[12]                           | G14            | LCD.P[3]                                          | G18            | KB.R[0]                                           |
| G19            | PWRON_RESET                            | G20            | MCBSP1.CLKS                         | G21            | MCBSP1.CLKX                                       | H2             | DV $_{DD5}$                                       |
| H3             | FLASH.A[15]                            | H4             | FLASH.A[14]                         | H7             | FLASH.RDY                                         | H8             | SDRAM.D[10]                                       |
| H9             | SDRAM.CAS                              | H10            | SDRAM.A[11]                         | H11            | SDRAM.A[5]                                        | H12            | LCD.HS                                            |
| H13            | LCD.P[4]                               | H14            | KB.R[2]                             | H15            | MCBSP1.FSX/<br>MCBSP1.DX                          | H18            | MCBSP1.DX/<br>MCBSP1.FSX                          |
| H19            | CAM.EXCLK/<br>ETM.SYNC/<br>UWIRE.SDO   | H20            | MCBSP1.DR                           | J1             | FLASH.A[20]                                       | J2             | FLASH.A[17]                                       |
| J3             | FLASH.A[19]                            | J4             | FLASH.A[18]                         | J7             | FLASH.A[8]                                        | J8             | FLASH.A[1]                                        |
| J14            | CAM.D[5]/<br>ETM.D[5]/<br>UWIRE.SDI    | J15            | CAM.LCLK/<br>ETM.CLK/<br>UWIRE.SCLK | J18            | CAM.D[7]/<br>ETM.D[7]/<br>UWIRE.CS $\overline{0}$ | J19            | CAM.D[6]/<br>ETM.D[6]/<br>UWIRE.CS $\overline{3}$ |
| J20            | V $_{SS}$                              | J21            | CV $_{DD3}$                         | K2             | V $_{SS}$                                         | K3             | FLASH.A[23]                                       |
| K4             | FLASH.A[22]                            | K7             | FLASH.A[16]                         | K8             | FLASH.A[13]                                       | K14            | CAM.D[1]/ETM.D[1]/<br>UART3.RTS                   |
| K15            | CAM.D[2]/<br>ETM.D[2]/<br>UART3.CTS    | K18            | CAM.D[4]/<br>ETM.D[4]/<br>UART3.TX  | K19            | CAM.D[3]/<br>ETM.D[3]/<br>UART3.RX                | K20            | V $_{SS}$                                         |
| L1             | DV $_{DD5}$                            | L3             | FLASH.BE[0]                         | L4             | FLASH.ADV                                         | L7             | FLASH.A[24]                                       |
| L8             | FLASH.A[21]                            | L14            | UART3.RX/PWL/<br>UART2.RX           | L15            | CAM.HS/<br>ETM.PSTAT[1]/<br>UART2.CTS             | L18            | CAM.VS/<br>ETM.PSTAT[2]                           |
| L19            | CAM.D[0]/<br>ETM.D[0]/<br>MPUIO12      | L21            | DV $_{DD1}$                         | M2             | CV $_{DD4}$                                       | M3             | FLASH.CST                                         |
| M4             | FLASH.CS $\overline{2}$ /<br>FLASH.BAA | M7             | FLASH.CS $\overline{0}$             | M8             | FLASH.BE[1]                                       | M14            | GPIO2/<br>SPI.CLK                                 |
| M15            | GPIO7/<br>MMC.DAT2                     | M18            | UART3.TX/<br>PWT/<br>UART2.TX       | M19            | CAM.RSTZ/<br>ETM.PSTAT[0]/<br>UART2.RTS           | M20            | GPIO15/<br>KB.R[7]                                |
| N1             | V $_{SS}$                              | N2             | FLASH.D[1]                          | N3             | FLASH.CLK                                         | N4             | FLASH.D[0]                                        |
| N7             | FLASH.D[2]                             | N8             | FLASH.CS $\overline{3}$             | N14            | UWIRE.CS $\overline{0}$ /<br>MCBSP3.CLKX          | N15            | MPUIO2/<br>EXT_DMA_REQ $\overline{0}$             |
| N18            | GPIO12/<br>MCBSP3.FSX                  | N19            | GPIO13/<br>KB.R[5]                  | N20            | GPIO11/<br>HDQ                                    | N21            | GPIO14/<br>KB.R[6]                                |
| P2             | FLASH.D[3]                             | P3             | DV $_{DD5}$                         | P4             | FLASH.D[4]                                        | P7             | FLASH.D[5]                                        |

† See Section 5.6.1 and Section 5.6.2 for special V $_{SS}$  considerations with oscillator circuits.

Table 2–1. GZG BGA Terminal Assignments (Continued)

| GZG BGA BALL # | SIGNAL                                              | GZG BGA BALL # | SIGNAL                           | GZG BGA BALL #   | SIGNAL                                  | GZG BGA BALL # | SIGNAL                                              |
|----------------|-----------------------------------------------------|----------------|----------------------------------|------------------|-----------------------------------------|----------------|-----------------------------------------------------|
| P8             | FLASH.D[11]                                         | P9             | USB.DP                           | P10              | MCBSP2.DR/<br>MCBSP2.DX                 | P11            | MMC.CMD/SPI.DO                                      |
| P12            | CV <sub>DD</sub>                                    | P13            | CLK32K_IN                        | P14              | RST_HOST_OUT/<br>MCBSP3.DX/<br>USB1.SE0 | P15            | UWIRE.CS3/<br>KB.C[6]                               |
| P18            | GPIO3/<br>SPI.CS3/<br>MCBSP3.FSX/LED1               | P19            | GPIO6/<br>SPI.CS1/<br>MCBSP3.FSX | P20              | GPIO4/<br>SPI.CS2/<br>MCBSP3.FSX        | R1             | DV <sub>DD5</sub>                                   |
| R2             | FLASH.D[6]                                          | R3             | FLASH.D[7]                       | R4               | FLASH.D[8]                              | R8             | USB.DM                                              |
| R9             | UART2.RX/<br>USB2.VM                                | R10            | MCLKREQ/EXT_<br>MASTER_REQ       | R11              | MMC.DAT0/SPI.DI                         | R12            | OSC32K_OUT                                          |
| R13            | BCLKREQ/<br>UART3.CTS/<br>UART1.DSR                 | R14            | UART1.CTS                        | R18              | GPIO0/<br>SPI.RDY/<br>USB.VBUS          | R19            | GPIO1/<br>UART3.RTS                                 |
| R20            | CV <sub>DD3</sub>                                   | R21            | V <sub>SS</sub>                  | T2               | FLASH.D[9]                              | T3             | FLASH.D[10]                                         |
| T4             | FLASH.D[14]                                         | T18            | I2C.SCL                          | T19              | MPUIO4/<br>EXT_DMA_REQ1/<br>LED2        | T20            | MPUIO5/<br>LOW_PWR                                  |
| U1             | FLASH.D[12]                                         | U2             | V <sub>SS</sub>                  | U3               | FLASH.D[13]                             | U4             | FLASH.OE                                            |
| U18            | UWIRE.SDI/<br>UART3.DSR/<br>UART1.DSR/<br>MCBSP3.DR | U19            | MPUIO1                           | U20              | V <sub>SS</sub>                         | U21            | DV <sub>DD1</sub>                                   |
| V2             | DV <sub>DD5</sub>                                   | V3             | FLASH.D[15]                      | V4               | FLASH.WP                                | V5             | V <sub>SS</sub>                                     |
| V6             | UART2.TX/<br>USB2.TXD                               | V7             | MCBSP2.CLKR/<br>GPIO11           | V8               | MPUIO3                                  | V9             | MCSI2.SYNC/<br>GPIO7                                |
| V10            | MMC.DAT1/<br>MPUIO7                                 | V11            | MMC.CLK                          | V12 <sup>†</sup> | V <sub>SS</sub>                         | V13            | MCSI1.SYNC/<br>USB1.VP                              |
| V14            | UART1.RX                                            | V15            | MPU_RST                          | V16              | EMU0                                    | V17            | TMS                                                 |
| V18            | CONF                                                | V19            | UWIRE.SCLK/<br>KB.C[7]           | V20              | I2C.SDA                                 | W1             | FLASH.RP                                            |
| W2             | FLASH.WE                                            | W3             | OSC1_OUT                         | W4               | USB.PUEN/<br>USB.CLKO                   | W5             | UART2.RTS/<br>USB2.SE0/<br>MPUIO5                   |
| W6             | MCBSP2.FSR/<br>GPIO12                               | W7             | MCBSP2.FSX                       | W8               | GPIO9                                   | W9             | MCSI2.DOUT/<br>USB2.TXEN                            |
| W10            | MMC.DAT2/<br>MPUIO11                                | W11            | MMC.DAT3/<br>MPUIO6              | W12              | OSC32K_IN                               | W13            | MCSI1.DIN/<br>USB1.RCV                              |
| W14            | MCSI1.DOUT/<br>USB1.TXD                             | W15            | RST_OUT                          | W16              | MCBSP3.CLKX/<br>USB1.TXEN               | W17            | EMU1                                                |
| W18            | TCK                                                 | W19            | BFAIL/<br>EXT_FIQ                | W20              | V <sub>SS</sub>                         | W21            | UWIRE.SDO/<br>UART3.DTR/<br>UART1.DTR/<br>MCBSP3.DX |
| Y1             | CV <sub>DD2</sub>                                   | Y2             | OSC1_IN                          | Y3               | V <sub>SS</sub>                         | Y4             | UART2.BCLK                                          |
| Y5             | UART2.CTS/<br>USB2.RCV/<br>GPIO7                    | Y6             | MCBSP2.CLKX                      | Y7               | DV <sub>DD3</sub>                       | Y8             | GPIO8                                               |
| Y9             | MCLK                                                | Y10            | MCSI2.CLK/<br>USB2.SUSP          | Y12              | CLK32K_OUT/<br>MPUIO0/<br>USB1.SPEED    | Y13            | BCLK/<br>UART3.RTS/<br>UART1.DTR                    |
| Y14            | UART1.TX                                            | Y15            | V <sub>SS</sub>                  | Y16              | DV <sub>DD1</sub>                       | Y17            | STAT_VAL/<br>WKUP                                   |

<sup>†</sup> See Section 5.6.1 and Section 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–1. GZG BGA Terminal Assignments (Continued)

| GZG BGA BALL # | SIGNAL          | GZG BGA BALL # | SIGNAL                               | GZG BGA BALL # | SIGNAL            | GZG BGA BALL # | SIGNAL                  |
|----------------|-----------------|----------------|--------------------------------------|----------------|-------------------|----------------|-------------------------|
| Y18            | TRST            | Y19            | TDI                                  | Y20            | CV <sub>DD</sub>  | Y21            | CV <sub>DDA</sub>       |
| AA1            | V <sub>SS</sub> | AA2            | DV <sub>DD2</sub>                    | AA3            | CV <sub>DD2</sub> | AA5            | MCBSP2.DX/<br>MCBSP2.DR |
| AA7            | V <sub>SS</sub> | AA9            | MCS12.DIN/<br>USB2.VP                | AA11           | DV <sub>DD1</sub> | AA13           | MCS11.CLK/<br>USB1.VM   |
| AA15           | UART1.RTS       | AA17           | MPU_BOOT/<br>MCBSP3.DR/<br>USB1.SUSP | AA19           | TDO               | AA20           | CLK32K_CTRL             |
| AA21           | V <sub>SS</sub> |                |                                      |                |                   |                |                         |

† See Section 5.6.1 and Section 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Figure 2–2 illustrates the ball locations for the 289-ball GDY ball grid array (BGA) package and is used in conjunction with Table 2–1 to locate signal names and ball grid numbers. GDY BGA ball numbers in Figure 2–2 are read from left-to-right, top-to-bottom.

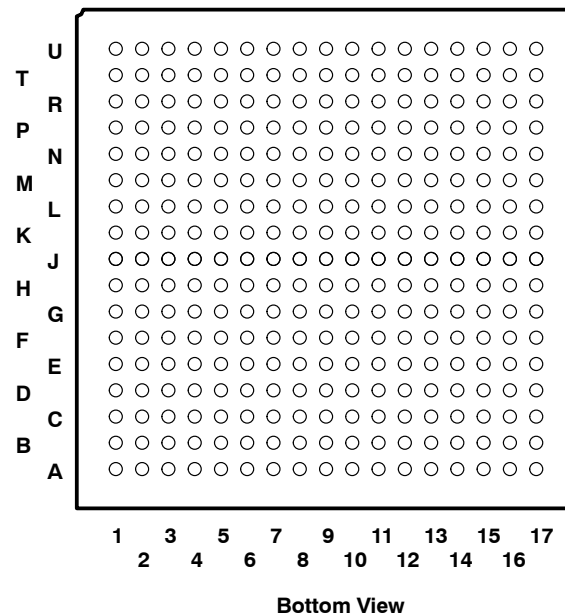


Figure 2–2. OMAP5910 GDY Package (Bottom View)

In Table 2–2, signals with multiplexed functions are separated with forward slashes as follows:

- **signal1/signal2/signal3** (for example, GPIO11/HDQ)

Signals which are associated with specific peripherals are denoted by using the peripheral name, followed by a period, and then the signal name; as follows:

- **peripheral1.signal1** (for example, MCBSP1.DR)

Table 2–2. GDY BGA Terminal Assignments

| GDY<br>BGA<br>BALL # | SIGNAL                          | GDY<br>BGA<br>BALL # | SIGNAL                              | GDY<br>BGA<br>BALL # | SIGNAL                               | GDY<br>BGA<br>BALL # | SIGNAL                              |
|----------------------|---------------------------------|----------------------|-------------------------------------|----------------------|--------------------------------------|----------------------|-------------------------------------|
| A1                   | SDRAM.WE                        | A2                   | SDRAM.DQM $\overline{U}$            | A3                   | SDRAM.D[9]                           | A4                   | SDRAM.D[6]                          |
| A5                   | DV $_{DD4}$                     | A6                   | SDRAM.D[0]                          | A7                   | SDRAM.CLK                            | A8                   | SDRAM.A[9]                          |
| A9                   | SDRAM.A[5]                      | A10                  | SDRAM.A[1]                          | A11                  | LCD.AC                               | A12                  | LCD.PCLK                            |
| A13                  | LCD.P[9]                        | A14                  | DV $_{DD1}$                         | A15                  | LCD.P[6]                             | A16                  | LCD.P[3]                            |
| A17                  | KB.C[5]                         | B1                   | FLASH.A[1]                          | B2                   | SDRAM.DQML                           | B3                   | CV $_{DD1}$                         |
| B4                   | SDRAM.D[12]                     | B5                   | SDRAM.D[11]                         | B6                   | SDRAM.D[5]                           | B7                   | SDRAM.D[2]                          |
| B8                   | SDRAM.BA[0]                     | B9                   | SDRAM.A[11]                         | B10                  | SDRAM.A[2]                           | B11                  | SDRAM.A[0]                          |
| B12                  | LCD.P[13]                       | B13                  | LCD.P[11]                           | B14                  | LCD.P[7]                             | B15                  | LCD.P[4]                            |
| B16                  | LCD.P[0]                        | B17                  | KB.C[3]                             | C1                   | FLASH.A[3]                           | C2                   | FLASH.A[4]                          |
| C3                   | FLASH.RDY                       | C4                   | SDRAM.RAS $\overline{S}$            | C5                   | SDRAM.D[14]                          | C6                   | SDRAM.D[10]                         |
| C7                   | SDRAM.D[3]                      | C8                   | SDRAM.A[12]                         | C9                   | SDRAM.BA[1]                          | C10                  | SDRAM.A[8]                          |
| C11                  | SDRAM.A[3]                      | C12                  | DV $_{DD1}$                         | C13                  | LCD.P[14]                            | C14                  | LCD.P[8]                            |
| C15                  | LCD.P[5]                        | C16                  | LCD.P[1]                            | C17                  | KB.C[0]                              | D1                   | DV $_{DD5}$                         |
| D2                   | FLASH.A[7]                      | D3                   | DV $_{DD4}$                         | D4                   | SDRAM.D[15]                          | D5                   | DV $_{DD4}$                         |
| D6                   | SDRAM.D[7]                      | D7                   | SDRAM.CKE                           | D8                   | DV $_{DD4}$                          | D9                   | SDRAM.A[6]                          |
| D10                  | SDRAM.A[4]                      | D11                  | LCD.VS                              | D12                  | LCD.P[15]                            | D13                  | KB.R[0]                             |
| D14                  | KB.R[1]                         | D15                  | LCD.P[2]                            | D16                  | KB.C[4]                              | D17                  | KB.R[4]                             |
| E1                   | FLASH.A[12]                     | E2                   | CV $_{DD}$                          | E3                   | FLASH.A[5]                           | E4                   | FLASH.A[6]                          |
| E5                   | V $_{SS}$                       | E6                   | SDRAM.D[8]                          | E7                   | SDRAM.D[1]                           | E8                   | CV $_{DD}$                          |
| E9                   | SDRAM.A[10]                     | E10                  | DV $_{DD4}$                         | E11                  | LCD.HS                               | E12                  | LCD.P[10]                           |
| E13                  | V $_{SS}$                       | E14                  | DV $_{DD1}$                         | E15                  | KB.C[2]                              | E16                  | KB.C[1]                             |
| E17                  | KB.R[3]                         | F1                   | DV $_{DD5}$                         | F2                   | FLASH.A[11]                          | F3                   | FLASH.A[9]                          |
| F4                   | FLASH.A[10]                     | F5                   | FLASH.A[8]                          | F6 $^{\dagger}$      | V $_{SS}$                            | F7                   | SDRAM.D[4]                          |
| F8                   | SDRAM.CAS $\overline{S}$        | F9                   | SDRAM.A[7]                          | F10                  | CV $_{DD3}$                          | F11                  | LCD.P[12]                           |
| F12                  | V $_{SS}$                       | F13                  | MCBSP1.CLKS                         | F14                  | PWRON_RESET                          | F15                  | KB.R[2]                             |
| F16                  | MCBSP1.FSX/<br>MCBSP1.DX        | F17                  | MCBSP1.DX/<br>MCBSP1.FSX            | G1                   | FLASH.A[16]                          | G2                   | FLASH.A[17]                         |
| G3                   | FLASH.A[14]                     | G4                   | FLASH.A[13]                         | G5                   | FLASH.A[15]                          | G6                   | FLASH.A[2]                          |
| G7                   | V $_{SS}$                       | G8                   | SDRAM.D[13]                         | G9                   | V $_{SS}$                            | G10                  | CV $_{DD3}$                         |
| G11                  | V $_{SS}$                       | G12                  | CAM.D[6]/<br>ETM.D[6]/<br>UWIRE.CS3 | G13                  | CAM.EXCLK/<br>ETM.SYNC/<br>UWIRE.SDO | G14                  | CAM.D[7]/<br>ETM.D[7]/<br>UWIRE.CS0 |
| G15                  | MCBSP1.CLKX                     | G16                  | MCBSP1.DR                           | G17                  | CAM.D[3]/<br>ETM.D[3]/<br>UART3.RX   | H1                   | FLASH.ADV                           |
| H2                   | FLASH.A[20]                     | H3                   | FLASH.A[18]                         | H4                   | FLASH.A[19]                          | H5                   | FLASH.A[21]                         |
| H6                   | FLASH.A[22]                     | H7                   | DV $_{DD5}$                         | H8                   | V $_{SS}$                            | H9                   | V $_{SS}$                           |
| H10                  | V $_{SS}$                       | H11                  | CV $_{DD3}$                         | H12                  | UART3.RX/PWL/<br>UART2.RX            | H13                  | DV $_{DD1}$                         |
| H14                  | CAM.D[1]/ETM.D[1]/<br>UART3.RTS | H15                  | CAM.LCLK/<br>ETM.CLK/<br>UWIRE.SCLK | H16                  | CAM.D[5]/<br>ETM.D[5]/<br>UWIRE.SDI  | H17                  | CAM.D[2]/<br>ETM.D[2]/<br>UART3.CTS |
| J1                   | FLASH.BE[1]                     | J2                   | FLASH.CS0                           | J3                   | FLASH.A[24]                          | J4                   | FLASH.A[23]                         |
| J5                   | FLASH.BE[0]                     | J6                   | V $_{SS}$                           | J7                   | V $_{SS}$                            | J8                   | V $_{SS}$                           |

 $^{\dagger}$  See Section 5.6.1 and Section 5.6.2 for special V $_{SS}$  considerations with oscillator circuits.

Table 2–2. GDY BGA Terminal Assignments (Continued)

| GDY BGA BALL # | SIGNAL                                | GDY BGA BALL # | SIGNAL                                  | GDY BGA BALL # | SIGNAL                             | GDY BGA BALL # | SIGNAL                                |
|----------------|---------------------------------------|----------------|-----------------------------------------|----------------|------------------------------------|----------------|---------------------------------------|
| J9             | V <sub>SS</sub>                       | J10            | V <sub>SS</sub>                         | J11            | V <sub>SS</sub>                    | J12            | V <sub>SS</sub>                       |
| J13            | UART3.TX/<br>PWT/<br>UART2.TX         | J14            | CAM.RSTZ/<br>ETM.PSTAT[0]/<br>UART2.RTS | J15            | CAM.D[4]/<br>ETM.D[4]/<br>UART3.TX | J16            | CAM.D[0]/<br>ETM.D[0]/<br>MPUIO12     |
| J17            | CAM.VS/<br>ETM.PSTAT[2]               | K1             | FLASH.CST                               | K2             | CV <sub>DD4</sub>                  | K3             | FLASH.D[1]                            |
| K4             | FLASH.CLK                             | K5             | FLASH.CS2/<br>FLASH.BAA                 | K6             | DV <sub>DD5</sub>                  | K7             | CV <sub>DD2</sub>                     |
| K8             | V <sub>SS</sub>                       | K9             | V <sub>SS</sub>                         | K10            | V <sub>SS</sub>                    | K11            | CV <sub>DD3</sub>                     |
| K12            | GPIO3/<br>SPI.CS3/<br>MCBSP3.FSX/LED1 | K13            | GPIO6/<br>SPI.CS1/<br>MCBSP3.FSX        | K14            | GPIO13/<br>KB.R[5]                 | K15            | CAM.HS/<br>ETM.PSTAT[1]/<br>UART2.CTS |
| K16            | GPIO15/<br>KB.R[7]                    | K17            | GPIO14/<br>KB.R[6]                      | L1             | FLASH.CS3                          | L2             | DV <sub>DD5</sub>                     |
| L3             | DV <sub>DD5</sub>                     | L4             | FLASH.D[2]                              | L5             | FLASH.D[0]                         | L6             | FLASH.D[3]                            |
| L7             | V <sub>SS</sub>                       | L8             | CV <sub>DD2</sub>                       | L9             | V <sub>SS</sub>                    | L10            | BCLKREQ/<br>UART3.CTS/<br>UART1.DSR   |
| L11            | V <sub>SS</sub>                       | L12            | UWIRE.CS3/<br>KB.C[6]                   | L13            | MPUIO5/<br>LOW_PWR                 | L14            | GPIO4/<br>SPI.CS2/<br>MCBSP3.FSX      |
| L15            | GPIO12/<br>MCBSP3.FSX                 | L16            | GPIO11/<br>HDQ                          | L17            | GPIO7/<br>MMC.DAT2                 | M1             | FLASH.D[4]                            |
| M2             | FLASH.D[5]                            | M3             | FLASH.D[11]                             | M4             | FLASH.D[6]                         | M5             | FLASH.D[7]                            |
| M6             | V <sub>SS</sub>                       | M7             | UART2.RX/<br>USB2.VM                    | M8             | GPIO9                              | M9             | MMC.DAT1/<br>MPUIO7                   |
| M10            | UART1.CTS                             | M11            | RST_OUT                                 | M12            | V <sub>SS</sub>                    | M13            | UWIRE.SCLK/<br>KB.C[7]                |
| M14            | MPUIO1                                | M15            | GPIO2/<br>SPI.CLK                       | M16            | GPIO0/<br>SPI.RDY/<br>USB.VBUS     | M17            | GPIO1/<br>UART3.RTS                   |
| N1             | FLASH.D[9]                            | N2             | FLASH.D[13]                             | N3             | FLASH.OE                           | N4             | FLASH.D[8]                            |
| N5             | V <sub>SS</sub>                       | N6             | UART2.CTS/<br>USB2.RCV/<br>GPIO7        | N7             | DV <sub>DD3</sub>                  | N8             | MCLKREQ/<br>EXT_MASTER_REQ            |
| N9             | CLK32K_IN                             | N10            | CLK32K_OUT/<br>MPUIO0/<br>USB1.SPEED    | N11            | RSVD                               | N12            | MCS11.DOUT/<br>USB1.TXD               |
| N13            | V <sub>SS</sub>                       | N14            | I2C.SDA                                 | N15            | MPUIO4/<br>EXT_DMA_REQ1/<br>LED2   | N16            | DV <sub>DD1</sub>                     |
| N17            | MPUIO2/<br>EXT_DMA_REQ0               | P1             | FLASH.D[10]                             | P2             | FLASH.WE                           | P3             | OSC1_OUT                              |
| P4             | USB.DM                                | P5             | USB.DP                                  | P6             | MCBSP2.FSR/<br>GPIO12              | P7             | MPUIO3                                |
| P8             | MCS12.DIN/<br>USB2.VP                 | P9             | DV <sub>DD1</sub>                       | P10            | CV <sub>DD</sub>                   | P11            | BCLK/<br>UART3.RTS/<br>UART1.DTR      |
| P12            | MPU_RST                               | P13            | UART1.TX                                | P14            | MCBSP3.CLKX/<br>USB1.TXEN          | P15            | I2C.SCL                               |

† See Section 5.6.1 and Section 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–2. GDY BGA Terminal Assignments (Continued)

| GDY BGA BALL # | SIGNAL                                              | GDY BGA BALL # | SIGNAL                                              | GDY BGA BALL # | SIGNAL                  | GDY BGA BALL # | SIGNAL                            |
|----------------|-----------------------------------------------------|----------------|-----------------------------------------------------|----------------|-------------------------|----------------|-----------------------------------|
| P16            | UWIRE.SDO/<br>UART3.DTR/<br>UART1.DTR/<br>MCBSP3.DX | P17            | UWIRE.SDI/<br>UART3.DSR/<br>UART1.DSR/<br>MCBSP3.DR | R1             | FLASH.D[12]             | R2             | OSC1_IN                           |
| R3             | FLASH.WP                                            | R4             | UART2.TX/<br>USB2.TXD                               | R5             | MCBSP2.DX/<br>MCBSP2.DR | R6             | MCBSP2.DR/<br>MCBSP2.DX           |
| R7             | MCSI2.SYNC/<br>GPIO7                                | R8             | MMC.DAT2/<br>MPUIO11                                | R9             | MMC.DAT3/<br>MPUIO6     | R10            | MCSI1.DIN/<br>USB1.RCV            |
| R11            | UART1.RX                                            | R12            | MPU_BOOT/<br>MCBSP3.DR/<br>USB1.SUSP                | R13            | TMS                     | R14            | BFAIL/<br>EXT_FIQ                 |
| R15            | CV <sub>DDA</sub>                                   | R16            | UWIRE.CS0/<br>MCBSP3.CLKX                           | R17            | EMU0                    | T1             | FLASH.D[14]                       |
| T2             | FLASH.RP                                            | T3             | USB.PUEN/<br>USB.CLKO                               | T4             | UART2.BCLK              | T5             | MCBSP2.CLKR/<br>GPIO11            |
| T6             | MCBSP2.FSX                                          | T7             | MCSI2.DOUT/<br>USB2.TXEN                            | T8             | MCSI2.CLK/<br>USB2.SUSP | T9             | OSC32K_OUT                        |
| T10            | OSC32K_IN                                           | T11            | MCSI1.SYNC/<br>USB1.VP                              | T12            | DV <sub>DD1</sub>       | T13            | EMU1                              |
| T14            | TCK                                                 | T15            | CLK32K_CTRL                                         | T16            | CONF                    | T17            | CV <sub>DD</sub>                  |
| U1             | DV <sub>DD5</sub>                                   | U2             | FLASH.D[15]                                         | U3             | DV <sub>DD2</sub>       | U4             | UART2.RTS/<br>USB2.SE0/<br>MPUIO5 |
| U5             | MCBSP2.CLKX                                         | U6             | GPIO8                                               | U7             | MCLK                    | U8             | MMC.CMD/SPI.DO                    |
| U9             | MMC.DAT0/SPI.DI                                     | U10            | MMC.CLK                                             | U11            | MCSI1.CLK/<br>USB1.VM   | U12            | UART1.RTS                         |
| U13            | RST_HOST_OUT/<br>MCBSP3.DX/<br>USB1.SE0             | U14            | STAT_VAL/<br>WKUP                                   | U15            | TRST                    | U16            | TDO                               |
| U17            | TDI                                                 |                |                                                     |                |                         |                |                                   |

<sup>†</sup> See Section 5.6.1 and Section 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

## 2.3 Terminal Characteristics and Multiplexing

Table 2–3 describes terminal characteristics and the signals multiplexed on each ball. The table column headers are explained below:

- **SIGNAL NAME:** The names of all the signals that are multiplexed on each ball.
- **TYPE:** The terminal type when a particular signal is multiplexed on the terminal.
- **MUX CTRL SETTING:** The register field that controls multiplexing on the terminal and the proper register field setting necessary to select the signal to be multiplexed on the terminal. The reset values of these register fields are indicated in bold type.
- **DESELECTED INPUT STATE:** The logic level internally driven to the signal when it is not selected to be multiplexed on the corresponding terminal.
- **PULLUP/PULLDN:** Denotes the presence of an internal pullup or pulldown. Pullups and pulldowns can be enabled or disabled via software.
- **BUFFER STRENGTH:** Drive strength of the associated output buffer.

- **OTHER:** Contains various terminal information, such as buffer type, boundary scan capability, and gating/inhibit functionality. Certain terminals may be gated or 3-stated based on the state of other terminals and/or software configuration register settings.
- **RESET STATE:** The state of the terminal at reset.
- **SUPPLY:** The voltage supply which powers the terminal's I/O buffers.

**NOTE:** Due to the extensive pin multiplexing options which are available on the OMAP5910 device, a software utility is available to ease the process of configuring the pins based on the peripheral set required by a specific application. The 5910 OMAP Pin Configuration Utility is currently available from Texas Instruments.

**NOTE:** Configuring two pins to the same input signal is not supported as it can yield unexpected results. This can be easily avoided with proper software configuration.

**Table 2–3. Terminal Characteristics and Multiplexing**

| GZG BALL                                                                                     | GDY BALL                                                                                     | SIGNAL NAME            | TYPE <sup>†</sup> | MUX CTRL SETTING <sup>‡</sup> | DESELECTED INPUT STATE | PU/PD <sup>§</sup> | BUFFER STRENGTH | OTHER <sup>¶</sup> | RESET STATE <sup>#</sup> | SUPPLY            |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------|-------------------|-------------------------------|------------------------|--------------------|-----------------|--------------------|--------------------------|-------------------|
| C3                                                                                           | A1                                                                                           | SDRAM.WE               | O/Z               | NA                            | NA                     |                    | 4 mA            | A                  | 1                        | DV <sub>DD4</sub> |
| A2                                                                                           | C4                                                                                           | SDRAM.RAS              | O/Z               | NA                            | NA                     |                    | 4 mA            | A                  | 1                        | DV <sub>DD4</sub> |
| D4                                                                                           | A2                                                                                           | SDRAM.DQM <sub>U</sub> | O/Z               | NA                            | NA                     |                    | 4 mA            | A                  | 1                        | DV <sub>DD4</sub> |
| B3                                                                                           | B2                                                                                           | SDRAM.DQML             | O/Z               | NA                            | NA                     |                    | 4 mA            | A                  | 1                        | DV <sub>DD4</sub> |
| D5<br>C4<br>B4<br>D6<br>C5<br>H8<br>C6<br>B6<br>D7<br>C7<br>D8<br>B8<br>G8<br>C8<br>G9<br>B9 | D4<br>C5<br>G8<br>B4<br>B5<br>C6<br>A3<br>E6<br>D6<br>A4<br>B6<br>F7<br>C7<br>B7<br>E7<br>A6 | SDRAM.D[15:0]          | I/O/Z             | NA                            | NA                     |                    | 4 mA            | E                  | 0                        | DV <sub>DD4</sub> |
| D9                                                                                           | D7                                                                                           | SDRAM.CKE              | O/Z               | NA                            | NA                     |                    | 4 mA            | A                  | 1                        | DV <sub>DD4</sub> |
| C9                                                                                           | A7                                                                                           | SDRAM.CLK              | I/O/Z             | NA                            | NA                     |                    | 8 mA            | E                  | LZ                       | DV <sub>DD4</sub> |
| H9                                                                                           | F8                                                                                           | SDRAM.CAS              | O/Z               | NA                            | NA                     |                    | 4 mA            | A                  | 1                        | DV <sub>DD4</sub> |
| D10<br>C10                                                                                   | C9<br>B8                                                                                     | SDRAM.BA[1:0]          | O/Z               | NA                            | NA                     |                    | 4 mA            | A                  | 0                        | DV <sub>DD4</sub> |

<sup>†</sup> I = Input, O = Output, Z = High-Impedance

<sup>‡</sup> 'regx' denotes the terminal multiplexing register that controls the specified terminal where regx = FUNC\_MUX\_CTRL\_x

<sup>§</sup> PD20 = 20- $\mu$ A internal pulldown, PD100 = 100- $\mu$ A pulldown, PU20 = 20- $\mu$ A internal pullup, PU100 = 100- $\mu$ A internal pullup

<sup>¶</sup> A = Standard LVCMOS input/output

B = Fail-safe LVCMOS input/output

C = USB transceiver input/output

D = I<sup>2</sup>C input/output buffers

E = Fail-safe LVCMOS input and Standard LVCMOS output

F = analog oscillator terminals

<sup>#</sup> Z = High-Impedance, LZ = Low-Impedance (pin is driven), 1 = Output driven high, 0 = Output driven low

|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL                                                                                                     | GDY BALL                                                                                                     | SIGNAL NAME   | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶   | RESET STATE# | SUPPLY            |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------|-------|-------------------|------------------------|--------|-----------------|----------|--------------|-------------------|
| G10<br>H10<br>C11<br>D11<br>G11<br>C12<br>D12<br>H11<br>C13<br>D13<br>G12<br>C14<br>B14                      | C8<br>B9<br>E9<br>A8<br>C10<br>F9<br>D9<br>A9<br>D10<br>C11<br>B10<br>A10<br>B11                             | SDRAM.A[12:0] | O/Z   | NA                | NA                     |        | 4 mA            | A        | 0            | DV <sub>DD4</sub> |
| D14                                                                                                          | D11                                                                                                          | LCD.VS        | O     | NA                | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
| H12                                                                                                          | E11                                                                                                          | LCD.HS        | O     | NA                | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
| B15                                                                                                          | A11                                                                                                          | LCD.AC        | O     | NA                | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
| C15                                                                                                          | A12                                                                                                          | LCD.PCLK      | O     | NA                | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
| D15<br>C16<br>A17<br>G13<br>B17<br>C17<br>D16<br>D17<br>C18<br>B19<br>A20<br>H13<br>G14<br>C19<br>B21<br>D18 | D12<br>C13<br>B12<br>F11<br>B13<br>E12<br>A13<br>C14<br>B14<br>A15<br>C15<br>B15<br>A16<br>D15<br>C16<br>B16 | LCD.P[15:0]   | O     | NA                | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
| C20<br>C21<br>E18<br>D19<br>D20<br>F18                                                                       | A17<br>D16<br>B17<br>E15<br>E16<br>C17                                                                       | KB.C[5:0]     | O     | NA                | NA                     |        | 4 mA            | A, J     | 0            | DV <sub>DD1</sub> |
| E19<br>E20<br>H14<br>F19<br>G18                                                                              | D17<br>E17<br>F15<br>D14<br>D13                                                                              | KB.R[4:0]     | I     | NA                | NA                     |        |                 | A, J     | input        | DV <sub>DD1</sub> |
| G19                                                                                                          | F14                                                                                                          | PWRON_RESET   | I     | NA                | NA                     |        |                 | B, J     | input        | DV <sub>DD1</sub> |
| G20                                                                                                          | F13                                                                                                          | MCBSP1.CLKS   | I     | NA                | NA                     |        |                 | B, J     | input        | DV <sub>DD1</sub> |
| G21                                                                                                          | G15                                                                                                          | MCBSP1.CLKX   | I/O/Z | NA                | NA                     |        | 4 mA            | J, B, G1 | Z            | DV <sub>DD1</sub> |
| H15                                                                                                          | F17                                                                                                          | MCBSP1.FSX    | I/O/Z | reg4[14:12] = 000 | 0                      |        | 4 mA            | J, B, G1 | Z            | DV <sub>DD1</sub> |
|                                                                                                              |                                                                                                              | MCBSP1.DX     | O     | reg4[14:12] = 001 | NA                     |        |                 |          |              |                   |

† I = Input, O = Output, Z = High-Impedance

‡ 'regx' denotes the terminal multiplexing register that controls the specified terminal where regx = FUNC\_MUX\_CTRL\_x

§ PD20 = 20-µA internal pulldown, PD100 = 100-µA pulldown, PU20 = 20-µA internal pullup, PU100 = 100-µA internal pullup

¶ A = Standard LVC MOS input/output

G1 = Terminal may be gated by BFAIL

B = Fail-safe LVC MOS input/output

G2 = Terminal may be gated by GPIO9 and MPUIO3

C = USB transceiver input/output

G3 = Terminal may be gated by BFAIL and PWRON\_RESET

D = I<sup>2</sup>C input/output buffers

H1 = Terminal may be 3-stated by BFAIL input

E = Fail-safe LVC MOS input and Standard LVC MOS output

J = Boundary-scannable terminal

F = analog oscillator terminals

# Z = High-Impedance, LZ = Low-Impedance (pin is driven), 1 = Output driven high, 0 = Output driven low

|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL | GDY BALL | SIGNAL NAME  | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶   | RESET STATE# | SUPPLY            |
|----------|----------|--------------|-------|-------------------|------------------------|--------|-----------------|----------|--------------|-------------------|
| H18      | F16      | MCBSP1.DX    | O     | reg4[17:15] = 000 | NA                     |        | 4 mA            | J, B, G1 | 0            | DV <sub>DD1</sub> |
|          |          | MCBSP1.FSX   | I/O/Z | reg4[17:15] = 001 | 0                      |        |                 |          |              |                   |
| H20      | G16      | MCBSP1.DR    | I     | NA                | NA                     | PD20   |                 | B, J     | input        | DV <sub>DD1</sub> |
| H19      | G13      | CAM.EXCLK    | O     | reg4[23:21] = 000 | NA                     |        | 8 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
|          |          | ETM.SYNC     | O     | reg4[23:21] = 001 | NA                     |        |                 |          |              |                   |
|          |          | UWIRE.SDO    | O     | reg4[23:21] = 010 | NA                     |        |                 |          |              |                   |
| J15      | H15      | CAM.LCLK     | I     | reg4[26:24] = 000 | 0                      |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.CLK      | O     | reg4[26:24] = 001 | NA                     |        |                 |          |              |                   |
|          |          | UWIRE.SCLK   | O     | reg4[26:24] = 010 | NA                     |        |                 |          |              |                   |
| J18      | G14      | CAM.D[7]     | I     | reg4[29:27] = 000 | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.D[7]     | O     | reg4[29:27] = 001 | NA                     |        |                 |          |              |                   |
|          |          | UWIRE.CS0    | O     | reg4[29:27] = 010 | NA                     |        |                 |          |              |                   |
| J19      | G12      | CAM.D[6]     | I     | reg5[2:0] = 000   | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.D[6]     | O     | reg5[2:0] = 001   | NA                     |        |                 |          |              |                   |
|          |          | UWIRE.CS3    | O     | reg5[2:0] = 010   | NA                     |        |                 |          |              |                   |
| J14      | H16      | CAM.D[5]     | I     | reg5[5:3] = 000   | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.D[5]     | O     | reg5[5:3] = 001   | NA                     |        |                 |          |              |                   |
|          |          | UWIRE.SDI    | I     | reg5[5:3] = 010   | NA                     | PD20   |                 |          |              |                   |
| K18      | J15      | CAM.D[4]     | I     | reg5[8:6] = 000   | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD8</sub> |
|          |          | ETM.D[4]     | O     | reg5[8:6] = 001   | NA                     |        |                 |          |              |                   |
|          |          | UART3.TX     | O     | reg5[8:6] = 010   | NA                     |        |                 |          |              |                   |
| K19      | G17      | CAM.D[3]     | I     | reg5[11:9] = 000  | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.D[3]     | O     | reg5[11:9] = 001  | NA                     |        |                 |          |              |                   |
|          |          | UART3.RX     | I     | reg5[11:9] = 010  | NA                     | PD20   |                 |          |              |                   |
| K15      | H17      | CAM.D[2]     | I     | reg5[14:12] = 000 | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.D[2]     | O     | reg5[14:12] = 001 | NA                     |        |                 |          |              |                   |
|          |          | UART3.CTS    | I     | reg5[14:12] = 010 | NA                     | PD20   |                 |          |              |                   |
| K14      | H14      | CAM.D[1]     | I     | reg5[17:15] = 000 | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.D[1]     | O     | reg5[17:15] = 001 | NA                     |        |                 |          |              |                   |
|          |          | UART3.RTS    | O     | reg5[17:15] = 010 | NA                     |        |                 |          |              |                   |
| L19      | J16      | CAM.D[0]     | I     | reg5[20:18] = 000 | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.D[0]     | O     | reg5[20:18] = 001 | NA                     |        |                 |          |              |                   |
|          |          | MPUIO12      | I/O/Z | reg5[20:18] = 010 | NA                     |        |                 |          |              |                   |
| L18      | J17      | CAM.VS       | I     | reg5[23:21] = 000 | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.PSTAT[2] | O     | reg5[23:21] = 001 | NA                     |        |                 |          |              |                   |
| L15      | K15      | CAM.HS       | I     | reg5[26:24] = 000 | NA                     |        | 8 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | ETM.PSTAT[1] | O     | reg5[26:24] = 001 | NA                     |        |                 |          |              |                   |
|          |          | UART2.CTS    | I     | reg5[26:24] = 010 | NA                     | PD20   |                 |          |              |                   |

† I = Input, O = Output, Z = High-Impedance

‡ 'regx' denotes the terminal multiplexing register that controls the specified terminal where regx = FUNC\_MUX\_CTRL\_x

§ PD20 = 20-μA internal pulldown, PD100 = 100-μA pulldown, PU20 = 20-μA internal pullup, PU100 = 100-μA internal pullup

¶ A = Standard LVCMOS input/output

G1 = Terminal may be gated by BFAIL

B = Fail-safe LVCMOS input/output

G2 = Terminal may be gated by GPIO9 and MPUIO3

C = USB transceiver input/output

G3 = Terminal may be gated by BFAIL and PWRON\_RESET

D = I<sup>2</sup>C input/output buffers

H1 = Terminal may be 3-stated by BFAIL input

E = Fail-safe LVCMOS input and Standard LVCMOS output

J = Boundary-scannable terminal

F = analog oscillator terminals

# Z = High-Impedance, LZ = Low-Impedance (pin is driven), 1 = Output driven high, 0 = Output driven low

|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL | GDY BALL | SIGNAL NAME             | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶   | RESET STATE# | SUPPLY            |
|----------|----------|-------------------------|-------|-------------------|------------------------|--------|-----------------|----------|--------------|-------------------|
| M19      | J14      | CAM.RSTZ                | O     | reg5[29:27] = 000 | NA                     |        | 8 mA            | J, B, G1 | 0            | DV <sub>DD1</sub> |
|          |          | ETM.PSTAT[0]            | O     | reg5[29:27] = 001 | NA                     |        |                 |          |              |                   |
|          |          | UART2.RTS               | O     | reg5[29:27] = 010 | NA                     |        |                 |          |              |                   |
| M18      | J13      | pin forced to drive low | O     | reg6[2:0] = 000   | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
|          |          | UART3.TX                | O     | reg6[2:0] = 001   | NA                     |        |                 |          |              |                   |
|          |          | PWT                     | O     | reg6[2:0] = 010   | NA                     |        |                 |          |              |                   |
|          |          | IRQ_OBS                 | O     | reg6[2:0] = 011   | NA                     |        |                 |          |              |                   |
|          |          | UART2.TX                | O     | reg6[2:0] = 100   | NA                     |        |                 |          |              |                   |
| L14      | H12      | UART3.RX                | I     | reg6[5:3] = 000   | 1                      |        | 4 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | PWL                     | O     | reg6[5:3] = 001   | NA                     |        |                 |          |              |                   |
|          |          | DMA_REQ_OBS             | O     | reg6[5:3] = 010   | NA                     |        |                 |          |              |                   |
|          |          | UART2.RX                | I     | reg6[5:3] = 011   | NA                     |        |                 |          |              |                   |
| M20      | K16      | GPIO15                  | I/O/Z | reg6[8:6] = 000   | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | KB.R[7]                 | I     | reg6[8:6] = 001   | 1                      |        |                 |          |              |                   |
| N21      | K17      | GPIO14                  | I/O/Z | reg6[11:9] = 000  | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | KB.R[6]                 | I     | reg6[11:9] = 001  | 1                      |        |                 |          |              |                   |
| N19      |          | GPIO13                  | I/O/Z | reg6[14:12] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | KB.R[5]                 | I     | reg6[14:12] = 001 | 1                      |        |                 |          |              |                   |
| N18      | L15      | GPIO12                  | I/O/Z | reg6[17:15] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | MCBSP3.FSX              | I/O/Z | reg6[17:15] = 001 | 0                      | PD20   |                 |          |              |                   |
| N20      | L16      | GPIO11                  | I/O/Z | reg6[20:18] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | HDQ                     | I/O   | reg6[20:18] = 001 | NA                     | PD20   |                 |          |              |                   |
| M15      | L17      | GPIO7                   | I/O/Z | reg6[23:21] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | MMC.DAT2                | I/O/Z | reg6[23:21] = 001 | 1                      |        |                 |          |              |                   |
| P19      | K13      | GPIO6                   | I/O/Z | reg6[26:24] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | SPI.CS1                 | O     | reg6[26:24] = 001 | NA                     |        |                 |          |              |                   |
|          |          | MCBSP3.FSX              | I/O/Z | reg6[26:24] = 010 | NA                     | PD20   |                 |          |              |                   |
| P20      | L14      | GPIO4                   | I/O/Z | reg6[29:27] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | SPI.CS2                 | O     | reg6[29:27] = 001 | NA                     |        |                 |          |              |                   |
|          |          | MCBSP3.FSX              | I/O/Z | reg6[29:27] = 010 | NA                     | PD20   |                 |          |              |                   |
| P18      | K12      | GPIO3                   | I/O/Z | reg7[2:0] = 000   | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | SPI.CS3                 | O     | reg7[2:0] = 001   | NA                     |        |                 |          |              |                   |
|          |          | MCBSP3.FSX              | I/O/Z | reg7[2:0] = 010   | NA                     | PD20   |                 |          |              |                   |
|          |          | LED1                    | O     | reg7[2:0] = 011   | NA                     |        |                 |          |              |                   |
| M14      | M15      | GPIO2                   | I/O/Z | reg7[5:3] = 000   | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | SPI.CLK                 | O     | reg7[5:3] = 001   | NA                     |        |                 |          |              |                   |

† I = Input, O = Output, Z = High-Impedance

‡ 'regx' denotes the terminal multiplexing register that controls the specified terminal where regx = FUNC\_MUX\_CTRL\_x

§ PD20 = 20-µA internal pulldown, PD100 = 100-µA pulldown, PU20 = 20-µA internal pullup, PU100 = 100-µA internal pullup

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G3 = Terminal may be gated by BFAIL and PWRON\_RESET

D = I<sup>2</sup>C input/output buffers

H1 = Terminal may be 3-stated by BFAIL input

E = Fail-safe LVCMOS input and Standard LVCMOS output

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F = analog oscillator terminals

# Z = High-Impedance, LZ = Low-Impedance (pin is driven), 1 = Output driven high, 0 = Output driven low

|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL | GDY BALL | SIGNAL NAME          | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶   | RESET STATE# | SUPPLY            |
|----------|----------|----------------------|-------|-------------------|------------------------|--------|-----------------|----------|--------------|-------------------|
| R19      | M17      | GPIO1                | I/O/Z | reg7[8:6] = 000   | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | UART3.RTS            | O     | reg7[8:6] = 001   | NA                     |        |                 |          |              |                   |
| R18      | M16      | GPIO0                | I/O/Z | reg7[11:9] = 000  | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | SPI.RDY              | I     | reg7[11:9] = 001  | NA                     |        |                 |          |              |                   |
|          |          | USB.VBUS             | I     | reg7[11:9] = 010  | 0                      | PD20   |                 |          |              |                   |
| T20      | L13      | MPUIO5               | I/O/Z | reg7[14:12] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | LOW_PWR              | O     | reg7[14:12] = 001 | NA                     |        |                 |          |              |                   |
| T19      | N15      | MPUIO4               | I/O/Z | reg7[17:15] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | EXT_DMA_REQ1         | I     | reg7[17:15] = 001 | NA                     |        |                 |          |              |                   |
|          |          | LED2                 | O     | reg7[17:15] = 010 | NA                     |        |                 |          |              |                   |
| N15      | N17      | MPUIO2               | I/O/Z | reg7[20:18] = 000 | NA                     | PD20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | EXT_DMA_REQ0         | I     | reg7[20:18] = 001 | NA                     |        |                 |          |              |                   |
| U19      | M14      | MPUIO1               | I/O/Z | NA                | NA                     |        | 4 mA            | B, J     | input        | DV <sub>DD1</sub> |
| T18      | P15      | I2C.SCL              | I/O/Z | NA                | NA                     |        | 6 mA            | J, D, H1 | Z            | DV <sub>DD1</sub> |
| V20      | N14      | I2C.SDA              | I/O/Z | NA                | NA                     |        | 6 mA            | J, D, H1 | Z            | DV <sub>DD1</sub> |
| U18      | P17      | UWIRE.SDI            | I     | reg8[2:0] = 000   | NA                     | PD20   | 4 mA            | B, J     | input        | DV <sub>DD1</sub> |
|          |          | UART3.DSR            | I     | reg8[2:0] = 001   | 1                      | PD20   |                 |          |              |                   |
|          |          | UART1.DSR            | I     | reg8[2:0] = 010   | 1                      | PD20   |                 |          |              |                   |
|          |          | MCBSP3.DR            | I     | reg8[2:0] = 011   | NA                     | PD20   |                 |          |              |                   |
| W21      | P16      | UWIRE.SDO            | O     | reg8[5:3] = 000   | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
|          |          | UART3.DTR            | O     | reg8[5:3] = 001   | NA                     |        |                 |          |              |                   |
|          |          | UART1.DTR            | O     | reg8[5:3] = 010   | NA                     |        |                 |          |              |                   |
|          |          | MCBSP3.DX            | O     | reg8[5:3] = 011   | NA                     |        |                 |          |              |                   |
| V19      | M13      | UWIRE.SCLK           | O     | reg8[8:6] = 000   | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
|          |          | KB.C[7]              | O     | reg8[8:6] = 001   | NA                     |        |                 |          |              |                   |
| N14      | R16      | pin forced to high-z | Z     | reg8[11:9] = 000  | NA                     |        | 4 mA            | J, A     | Z            | DV <sub>DD1</sub> |
|          |          | UWIRE.CS0            | O     | reg8[11:9] = 001  | NA                     |        |                 |          |              |                   |
|          |          | MCBSP3.CLKX          | I/O/Z | reg8[11:9] = 010  | NA                     |        |                 |          |              |                   |
| P15      | L12      | pin forced to high-z | Z     | reg8[14:12] = 000 | NA                     |        | 4 mA            | J, A     | Z            | DV <sub>DD1</sub> |
|          |          | UWIRE.CS3            | O     | reg8[14:12] = 001 | NA                     |        |                 |          |              |                   |
|          |          | KB.C[6]              | O     | reg8[14:12] = 010 | NA                     |        |                 |          |              |                   |
| W19      | R14      | BFAIL/EXT_FIQ        | I     | NA                | NA                     |        |                 | J, B     | input        | DV <sub>DD1</sub> |
| AA20     | T15      | CLK32K_CTRL          | I     | NA                | NA                     |        |                 | J, B     | input        | DV <sub>DD1</sub> |
| V18      | T16      | CONF                 | I     | NA                | NA                     | PD100  |                 | A        | input        | DV <sub>DD1</sub> |
| Y19      | U17      | TDI                  | I     | NA                | NA                     | PD20   |                 | B        | input        | DV <sub>DD1</sub> |
| AA19     | U16      | TDO                  | O     | NA                | NA                     |        | 4 mA            | A        | 0            | DV <sub>DD1</sub> |
| V17      | R13      | TMS                  | I     | NA                | NA                     | PD20   |                 | B        | input        | DV <sub>DD1</sub> |

† I = Input, O = Output, Z = High-Impedance

‡ 'regx' denotes the terminal multiplexing register that controls the specified terminal where regx = FUNC\_MUX\_CTRL\_x

§ PD20 = 20-μA internal pulldown, PD100 = 100-μA pulldown, PU20 = 20-μA internal pullup, PU100 = 100-μA internal pullup

¶ A = Standard LVCMOS input/output

B = Fail-safe LVCMOS input/output

C = USB transceiver input/output

D = I<sup>2</sup>C input/output buffers

E = Fail-safe LVCMOS input and Standard LVCMOS output

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G1 = Terminal may be gated by BFAIL

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G3 = Terminal may be gated by BFAIL and PWRON\_RESET

H1 = Terminal may be 3-stated by BFAIL input

J = Boundary-scannable terminal

# Z = High-Impedance, LZ = Low-Impedance (pin is driven), 1 = Output driven high, 0 = Output driven low

|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL | GDY BALL | SIGNAL NAME             | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶       | RESET STATE# | SUPPLY            |
|----------|----------|-------------------------|-------|-------------------|------------------------|--------|-----------------|--------------|--------------|-------------------|
| W18      | T14      | TCK                     | I     | NA                | NA                     | PD20   |                 | B            | input        | DV <sub>DD1</sub> |
| Y18      | U15      | TRST                    | I     | NA                | NA                     | PD100  |                 | B            | input        | DV <sub>DD1</sub> |
| V16      | R17      | EMU0                    | I/O/Z | NA                | NA                     | PU100  | 2 mA            | B            | Z            | DV <sub>DD1</sub> |
| W17      | T13      | EMU1                    | I/O/Z | NA                | NA                     | PU100  | 2 mA            | B            | Z            | DV <sub>DD1</sub> |
| Y17      | U14      | STAT_VAL/WKUP           | I     | NA                | NA                     |        |                 | A            | input        | DV <sub>DD1</sub> |
| AA17     | R12      | MPU_BOOT                | I     | reg8[29:27] = 000 | NA                     | PD20   | 4 mA            | J, B         | input        | DV <sub>DD1</sub> |
|          |          | MCBSP3_DR               | I     | reg8[29:27] = 001 | NA                     | PD20   |                 |              |              |                   |
|          |          | USB1_SUSP               | O     | reg8[29:27] = 010 | NA                     |        |                 |              |              |                   |
| P14      | U13      | RST_HOST_OUT            | O     | reg9[2:0] = 000   | NA                     |        | 4 mA            | J, A, G1     | 0            | DV <sub>DD1</sub> |
|          |          | MCBSP3.DX               | O     | reg9[2:0] = 001   | NA                     |        |                 |              |              |                   |
|          |          | USB1_SE0                | O     | reg9[2:0] = 010   | NA                     |        |                 |              |              |                   |
| W16      | P14      | pin forced to high-z    | Z     | reg9[5:3] = 000   | NA                     | PD20   | 4 mA            | J, A, G1     | Z            | DV <sub>DD1</sub> |
|          |          | MCBSP3.CLKX             | I/O/Z | reg9[5:3] = 001   | NA                     | PD20   |                 |              |              |                   |
|          |          | USB1.TXEN               | O     | reg9[5:3] = 010   | NA                     |        |                 |              |              |                   |
| V15      | P12      | MPU_RST                 | I     | NA                | NA                     |        |                 | J, B         | input        | DV <sub>DD1</sub> |
| W15      | M11      | RST_OUT                 | O     | NA                | NA                     |        | 4 mA            | J, A         | 0            | DV <sub>DD1</sub> |
| AA15     | U12      | pin forced to drive low | O     | reg9[14:12] = 000 | NA                     |        | 2 mA            | J, A, G1     | 0            | DV <sub>DD1</sub> |
|          |          | UART1.RTS               | O     | reg9[14:12] = 001 | NA                     |        |                 |              |              |                   |
| R14      | M10      | UART1.CTS               | I     | NA                | NA                     | PD20   |                 | J, B         | input        | DV <sub>DD1</sub> |
| V14      | R11      | UART1.RX                | I     | NA                | NA                     | PD20   |                 | J, B         | input        | DV <sub>DD1</sub> |
| Y14      | P13      | pin forced to drive low | O     | reg9[23:21] = 000 | NA                     |        | 2 mA            | J, A, G1     | 0            | DV <sub>DD1</sub> |
|          |          | UART1.TX                | O     | reg9[23:21] = 001 | NA                     |        |                 |              |              |                   |
| W14      | N12      | MCSI1.DOUT              | O     | reg9[26:24] = 000 | NA                     |        | 2 mA            | J, A, G1, H1 | 0            | DV <sub>DD1</sub> |
|          |          | USB1.TXD                | O     | reg9[26:24] = 001 | NA                     |        |                 |              |              |                   |
|          |          | UART1.TX                | O     | reg9[26:24] = 001 | NA                     |        |                 |              |              |                   |
| R13      | L10      | BCLKREQ                 | I     | reg9[29:27] = 000 | 0                      | PD20   |                 | J, B         | input        | DV <sub>DD1</sub> |
|          |          | UART3.CTS               | I     | reg9[29:27] = 001 | 0                      | PD20   |                 |              |              |                   |
|          |          | UART1.DSR               | I     | reg9[29:27] = 010 | 1                      | PD20   |                 |              |              |                   |
| Y13      | P11      | BCLK                    | O     | regA[2:0] = 000   | NA                     |        | 4 mA            | J, A, G1     | 0            | DV <sub>DD1</sub> |
|          |          | UART3.RTS               | O     | regA[2:0] = 001   | NA                     |        |                 |              |              |                   |
|          |          | UART1.DTR               | O     | regA[2:0] = 010   | NA                     |        |                 |              |              |                   |
| V13      | T11      | MCSI1.SYNC              | I/O/Z | regA[5:3] = 000   | 0                      | PD20   | 2 mA            | J, B, G1     | input        | DV <sub>DD1</sub> |
|          |          | USB1.VP                 | I     | regA[5:3] = 001   | NA                     | PD20   |                 |              |              |                   |

† I = Input, O = Output, Z = High-Impedance

‡ 'regx' denotes the terminal multiplexing register that controls the specified terminal where regx = FUNC\_MUX\_CTRL\_x

§ PD20 = 20-μA internal pulldown, PD100 = 100-μA pulldown, PU20 = 20-μA internal pullup, PU100 = 100-μA internal pullup

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D = I<sup>2</sup>C input/output buffers

H1 = Terminal may be 3-stated by BFAIL input

E = Fail-safe LVCMOS input and Standard LVCMOS output

J = Boundary-scannable terminal

F = analog oscillator terminals

# Z = High-Impedance, LZ = Low-Impedance (pin is driven), 1 = Output driven high, 0 = Output driven low

|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL | GDY BALL | SIGNAL NAME        | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶   | RESET STATE# | SUPPLY            |
|----------|----------|--------------------|-------|-------------------|------------------------|--------|-----------------|----------|--------------|-------------------|
| AA13     | U11      | MCSI1.CLK          | I/O/Z | regA[8:6] = 000   | 0                      | PD20   | 2 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | USB1.VM            | I     | regA[8:6] = 001   | 0                      | PD20   |                 |          |              |                   |
|          |          | UART1.RX           | I     | regA[8:6] = 001   | 0                      | PD20   |                 |          |              |                   |
| W13      | R10      | MCSI1.DIN          | I     | regA[11:9] = 000  | NA                     | PD20   |                 | J, B     | input        | DV <sub>DD1</sub> |
|          |          | USB1.RCV           | I     | regA[11:9] = 001  | 0                      | PD20   |                 |          |              |                   |
|          |          | UART1.CTS          | I     | regA[11:9] = 001  | 0                      | PD20   |                 |          |              |                   |
| Y12      | N10      | CLK32K_OUT         | O     | regA[14:12] = 000 | NA                     |        | 8 mA            | J, A     | LZ           | DV <sub>DD1</sub> |
|          |          | MPUIO0             | I/O/Z | regA[14:12] = 001 | NA                     |        |                 |          |              |                   |
|          |          | USB1.SPEED         | O     | regA[14:12] = 010 | NA                     |        |                 |          |              |                   |
| P13      | N9       | CLK32K_IN          | I     | NA                | NA                     |        |                 | J, B     | input        | DV <sub>DD1</sub> |
| W12      | T10      | OSC32K_IN          | –     | NA                | NA                     |        |                 | F        | NA           | NA                |
| R12      | T9       | OSC32K_OUT         | –     | NA                | NA                     |        |                 | F        | NA           | NA                |
| W11      | R9       | MMC.DAT3           | I/O/Z | regD[14:12] = 000 | 1                      | PU20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | Reserved           | NA    | regD[14:12] = 001 | NA                     |        |                 |          |              |                   |
|          |          | MPUIO6             | I/O/Z | regD[14:12] = 010 | NA                     | PU20   |                 |          |              |                   |
| V11      | U10      | MMC.CLK            | O     | NA                | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD1</sub> |
| R11      | U9       | MMC.DAT0/SPI.DI    | I/O/Z | NA                | NA                     | PU20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
| W10      | R8       | MMC.DAT2           | I/O/Z | regA[20:18] = 000 | 1                      | PU20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | pin forced to hi-z | Z     | regA[20:18] = 001 | NA                     |        |                 |          |              |                   |
|          |          | MPUIO11            | I/O/Z | regA[20:18] = 010 | NA                     | PU20   |                 |          |              |                   |
| V10      | M9       | MMC.DAT1           | I/O/Z | regA[26:24] = 000 | 1                      | PU20   | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
|          |          | Reserved           | NA    | regA[26:24] = 001 | NA                     |        |                 |          |              |                   |
|          |          | MPUIO7             | I/O/Z | regA[26:24] = 010 | NA                     | PU20   |                 |          |              |                   |
| P11      | U8       | MMC.CMD/SPI.DO     | I/O/Z | NA                | NA                     | PU100  | 4 mA            | J, B, G1 | input        | DV <sub>DD1</sub> |
| Y10      | T8       | MCSI2.CLK          | I/O/Z | regB[5:3] = 000   | 0                      | PD20   | 4 mA            | J, E     | input        | DV <sub>DD3</sub> |
|          |          | USB2.SUSP          | O     | regB[5:3] = 001   | NA                     |        |                 |          |              |                   |
| AA9      | P8       | MCSI2.DIN          | I     | regB[8:6] = 000   | NA                     | PD20   |                 | J, B     | input        | DV <sub>DD3</sub> |
|          |          | USB2.VP            | I     | regB[8:6] = 001   | 0                      | PD20   |                 |          |              |                   |
| W9       | T7       | MCSI2.DOUT         | O     | regB[11:9] = 000  | NA                     |        | 4 mA            | J, A, G2 | 0            | DV <sub>DD3</sub> |
|          |          | USB2.TXEN          | O     | regB[11:9] = 001  | NA                     |        |                 |          |              |                   |
| V9       | R7       | MCSI2.SYNC         | I/O/Z | regB[14:12] = 000 | 0                      | PD20   | 4 mA            | J, E     | input        | DV <sub>DD3</sub> |
|          |          | GPIO7              | I/O/Z | regB[14:12] = 001 | NA                     | PD20   |                 |          |              |                   |
| Y9       | U7       | MCLK               | O     | NA                | NA                     |        | 4 mA            | J, A, G1 | 0            | DV <sub>DD3</sub> |
| R10      | N8       | MCLKREQ            | I     | regB[20:18] = 000 | 0                      | PD20   | 4 mA            | J, E     | input        | DV <sub>DD3</sub> |
|          |          | EXT_MASTER_REQ     | O     | regB[20:18] = 001 | NA                     |        |                 |          |              |                   |
| W8       | M8       | GPIO9              | I/O/Z | NA                | NA                     | PD20   | 4 mA            | J, E, G3 | input        | DV <sub>DD3</sub> |
| Y8       | U6       | GPIO8              | I/O/Z | NA                | NA                     | PD20   | 4 mA            | J, E, G3 | input        | DV <sub>DD3</sub> |

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|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL | GDY BALL | SIGNAL NAME             | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶   | RESET STATE# | SUPPLY            |
|----------|----------|-------------------------|-------|-------------------|------------------------|--------|-----------------|----------|--------------|-------------------|
| V8       | P7       | MPUIO3                  | I/O/Z | NA                | NA                     | PD20   | 4 mA            | J, E, G1 | input        | DV <sub>DD3</sub> |
| P10      | R6       | MCBSP2.DR               | I     | regC[2:0] = 000   | NA                     | PD20   | 4 mA            | J, B, G2 | input        | DV <sub>DD3</sub> |
|          |          | MCBSP2.DX               | O     | regC[2:0] = 001   | NA                     |        |                 |          |              |                   |
| W7       | T6       | MCBSP2.FSX              | I/O/Z | NA                | 0                      | PD20   | 4 mA            | J, E, G2 | input        | DV <sub>DD3</sub> |
| V7       | T5       | MCBSP2.CLKR             | I/O/Z | regC[8:6] = 000   | 0                      |        | 4 mA            | J, E     | Z            | DV <sub>DD3</sub> |
|          |          | GPIO11                  | I/O/Z | regC[8:6] = 001   | NA                     | PD20   |                 |          |              |                   |
| Y6       | U5       | MCBSP2.CLKX             | I/O/Z | NA                | NA                     | PD20   | 4 mA            | J, E, G2 | input        | DV <sub>DD3</sub> |
| W6       | P6       | MCBSP2.FSR              | I/O/Z | regC[14:12] = 000 | 0                      |        | 4 mA            | J, E     | Z            | DV <sub>DD3</sub> |
|          |          | GPIO12                  | I/O/Z | regC[14:12] = 001 | NA                     | PD20   |                 |          |              |                   |
| AA5      | R5       | MCBSP2.DX               | O     | regC[17:15] = 000 | NA                     |        | 4 mA            | J, E, G2 | 0            | DV <sub>DD3</sub> |
|          |          | MCBSP2.DR               | I     | regC[17:15] = 001 | NA                     | PD20   |                 |          |              |                   |
| R9       | M7       | UART2.RX                | I     | regC[20:18] = 000 | 1                      | PD20   | 4 mA            | J, B     | input        | DV <sub>DD3</sub> |
|          |          | USB2.VM                 | I     | regC[20:18] = 001 | 0                      | PD20   |                 |          |              |                   |
| Y5       | N6       | UART2.CTS               | I     | regC[23:21] = 000 | 1                      | PD20   | 4 mA            | J, B     | input        | DV <sub>DD3</sub> |
|          |          | USB2.RCV                | I     | regC[23:21] = 001 | 0                      | PD20   |                 | J, B     |              |                   |
|          |          | GPIO7                   | I/O/Z | regC[23:21] = 010 | NA                     | PD20   |                 | J, E     |              |                   |
| W5       | U4       | pin forced to drive low | O     | regC[26:24] = 000 | NA                     |        | 4 mA            | J, E, G2 | 0            | DV <sub>DD3</sub> |
|          |          | UART2.RTS               | O     | regC[26:24] = 001 | NA                     |        |                 |          |              |                   |
|          |          | USB2.SEO                | O     | regC[26:24] = 010 | NA                     |        |                 |          |              |                   |
|          |          | MPUIO5                  | I/O/Z | regC[26:24] = 011 | NA                     |        |                 |          |              |                   |
| V6       | R4       | pin forced to drive low | O     | regC[29:27] = 000 | NA                     |        | 4 mA            | J, A, G2 | 0            | DV <sub>DD3</sub> |
|          |          | UART2.TX                | O     | regC[29:27] = 001 | NA                     |        |                 |          |              |                   |
|          |          | USB2.TXD                | O     | regC[29:27] = 010 | NA                     |        |                 |          |              |                   |
| Y4       | T4       | UART2.BCLK              | O     | NA                | NA                     |        | 4 mA            | J, A, G2 | 0            | DV <sub>DD3</sub> |
| W4       | T3       | USB.PUEN                | O     | regD[5:3] = 000   | NA                     |        | 8 mA            | J, B, G1 | 0            | DV <sub>DD2</sub> |
|          |          | USB.CLKO                | O     | regD[5:3] = 001   | NA                     |        |                 |          |              |                   |
| P9       | P5       | USB.DP                  | I/O/Z | NA                | NA                     |        | 18.3 mA         | C        | Z            | DV <sub>DD2</sub> |
| R8       | P4       | USB.DM                  | I/O/Z | NA                | NA                     |        | 18.3 mA         | C        | Z            | DV <sub>DD2</sub> |
| Y2       | R2       | OSC1_IN                 | –     | NA                | NA                     |        |                 | F        | NA           | NA                |
| W3       | P3       | OSC1_OUT                | –     | NA                | NA                     |        |                 | F        | NA           | NA                |
| V4       | R3       | FLASH.WP                | O/Z   | NA                | NA                     |        | 4 mA            | A        | 0            | DV <sub>DD5</sub> |
| W2       | P2       | FLASH.WE                | O/Z   | NA                | NA                     |        | 4 mA            | A        | 1            | DV <sub>DD5</sub> |
| W1       | T2       | FLASH.RP                | O/Z   | NA                | NA                     |        | 4 mA            | A        | 0            | DV <sub>DD5</sub> |
| U4       | N3       | FLASH.OE                | O/Z   | NA                | NA                     |        | 4 mA            | A        | 1            | DV <sub>DD5</sub> |

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Table 2–3. Terminal Characteristics and Multiplexing (Continued)

| GZG BALL                                                                                                                                     | GDY BALL                                                                                                                                     | SIGNAL NAME   | TYPE† | MUX CTRL SETTING‡ | DESELECTED INPUT STATE | PU/PD§ | BUFFER STRENGTH | OTHER¶    | RESET STATE# | SUPPLY            |
|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------|-------------------|------------------------|--------|-----------------|-----------|--------------|-------------------|
| V3<br>T4<br>U3<br>U1<br>P8<br>T3<br>T2<br>R4<br>R3<br>R2<br>P7<br>P4<br>P2<br>N7<br>N2<br>N4                                                 | U2<br>T1<br>N2<br>R1<br>M3<br>P1<br>N1<br>N4<br>M5<br>M4<br>M2<br>M1<br>L6<br>L4<br>K3<br>L5                                                 | FLASH.D[15:0] | I/O/Z | NA                | NA                     |        | 4 mA            | E         | 0            | DV <sub>DD5</sub> |
| N3                                                                                                                                           | K4                                                                                                                                           | FLASH.CLK     | O/Z   | NA                | NA                     |        | 8 mA            | E, G1, H2 | 0            | DV <sub>DD5</sub> |
| N8                                                                                                                                           | L1                                                                                                                                           | FLASH.CS3     | O/Z   | NA                | NA                     |        | 4 mA            | A         | 1            | DV <sub>DD5</sub> |
| M4                                                                                                                                           | K5                                                                                                                                           | FLASH.CS2     | O/Z   | regD[8:6] = 000   | NA                     |        | 4 mA            | A         | 1            | DV <sub>DD5</sub> |
|                                                                                                                                              |                                                                                                                                              | FLASH.BAA     | O/Z   | regD[8:6] = 001   | NA                     |        |                 |           |              |                   |
| M3                                                                                                                                           | K1                                                                                                                                           | FLASH.CS1     | O/Z   | NA                | NA                     |        | 4 mA            | A         | 1            | DV <sub>DD5</sub> |
| M7                                                                                                                                           | J2                                                                                                                                           | FLASH.CS0     | O/Z   | NA                | NA                     |        | 4 mA            | A         | 1            | DV <sub>DD5</sub> |
| M8<br>L3                                                                                                                                     | J1<br>J5                                                                                                                                     | FLASH.BE[1:0] | O/Z   | NA                | NA                     |        | 4 mA            | A         | 0            | DV <sub>DD5</sub> |
| L4                                                                                                                                           | H1                                                                                                                                           | FLASH.ADV     | O/Z   | NA                | NA                     |        | 4 mA            | A         | 1            | DV <sub>DD5</sub> |
| L7<br>K3<br>K4<br>L8<br>J1<br>J3<br>J4<br>J2<br>K7<br>H3<br>H4<br>K8<br>G2<br>G3<br>G4<br>F3<br>J7<br>E3<br>F4<br>D2<br>E4<br>C1<br>D3<br>J8 | J3<br>J4<br>H6<br>H5<br>H2<br>H4<br>H3<br>G2<br>G1<br>G5<br>G3<br>G4<br>E1<br>F2<br>F4<br>F3<br>F5<br>D2<br>E4<br>E3<br>C2<br>C1<br>G6<br>B1 | FLASH.A[24:1] | O/Z   | NA                | NA                     |        | 4 mA            | A, G1     | 0            | DV <sub>DD5</sub> |
| H7                                                                                                                                           | C3                                                                                                                                           | FLASH.RDY     | I     | NA                | NA                     |        |                 | B         | input        | DV <sub>DD5</sub> |
| E5                                                                                                                                           | N11                                                                                                                                          | RSVD          | NA    | NA                | NA                     |        |                 |           | NA           | NA                |

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¶ A = Standard LVCMOS input/output

G1 = Terminal may be gated by BFAIL

B = Fail-safe LVCMOS input/output

G2 = Terminal may be gated by GPIO9 and MPUIO3

C = USB transceiver input/output

G3 = Terminal may be gated by BFAIL and PWRON\_RESET

D = I<sup>2</sup>C input/output buffers

H1 = Terminal may be 3-stated by BFAIL input

E = Fail-safe LVCMOS input and Standard LVCMOS output

J = Boundary-scannable terminal

F = analog oscillator terminals

# Z = High-Impedance, LZ = Low-Impedance (pin is driven), 1 = Output driven high, 0 = Output driven low

|| UART1 signals can be multiplexed to this pin via additional multiplexing in the USB module.

## 2.4 Signal Description

Table 2–4 provides a description of the signals on OMAP5910. Many signals are available on multiple pins depending upon the software configuration of the pin multiplexing options. Ball numbers which are italicized indicate the default pin muxings at reset. Ball numbers for busses are listed from MSB to LSB (left to right, top to bottom).

**Table 2–4. Signal Description**

| SIGNAL                       | GZG BALL                                                              | GDY BALL                                                              | DESCRIPTION                                                                                                                                                                                                                                                                                                  | TYPE† |
|------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>EMIFF SDRAM Interface</b> |                                                                       |                                                                       |                                                                                                                                                                                                                                                                                                              |       |
| SDRAM.WE                     | <i>C3</i>                                                             | <i>A1</i>                                                             | SDRAM write enable. $\overline{\text{SDRAM.WE}}$ is active (low) during writes, DCAB, and MRS commands to SDRAM memory.                                                                                                                                                                                      | O/Z   |
| SDRAM.RAS                    | <i>A2</i>                                                             | <i>C4</i>                                                             | SDRAM row address strobe. $\overline{\text{SDRAM.RAS}}$ is active (low) during ACTV, DCAB, REFR, and MRS commands to SDRAM memory.                                                                                                                                                                           | O/Z   |
| SDRAM.DQMU                   | <i>D4</i>                                                             | <i>A2</i>                                                             | SDRAM upper data mask. Active-low data mask for the upper byte of the SDRAM data bus (SDRAM.D[15:8]). The data mask outputs allow for both 16-bit-wide and 8-bit-wide accesses to SDRAM memories.                                                                                                            | O/Z   |
| SDRAM.DQML                   | <i>B3</i>                                                             | <i>B2</i>                                                             | SDRAM lower data mask. Active-low data mask for the lower byte of the SDRAM data bus (SDRAM.D[7:0]). The data mask outputs allow for both 16-bit-wide and 8-bit-wide accesses to SDRAM memories.                                                                                                             | O/Z   |
| SDRAM.D[15:0]                | <i>D5, C4, B4, D6, C5, H8, C6, B6, D7, C7, D8, B8, G8, C8, G9, B9</i> | <i>D4, C5, G8, B4, B5, C6, A3, E6, D6, A4, B6, F7, C7, B7, D7, A6</i> | SDRAM data bus. SDRAM.D[15:0] provides data exchange between the Traffic Controller and SDRAM memory.                                                                                                                                                                                                        | I/O/Z |
| SDRAM.CKE                    | <i>D9</i>                                                             | <i>D7</i>                                                             | SDRAM clock enable. Active-high output which enables the SDRAM clock during normal operation; SDRAM.CKE is driven inactive to put the memory into low-power mode.                                                                                                                                            | O/Z   |
| SDRAM.CLK                    | <i>C9</i>                                                             | <i>A7</i>                                                             | SDRAM clock. Clock for synchronization SDRAM memory commands/accesses. To minimize voltage undershoot and overshoot effects, it is recommended to place a series resistor (typically ~33 $\Omega$ ) close to the SDRAM.CLK driver pin. SDRAM.CLK can also be configured as an input to monitor skew control. | I/O/Z |
| SDRAM.CAS                    | <i>H9</i>                                                             | <i>F8</i>                                                             | SDRAM column address strobe. $\overline{\text{SDRAM.CAS}}$ is active (low) during reads, writes, and the REFR and MRS commands to SDRAM memory.                                                                                                                                                              | O/Z   |
| SDRAM.BA[1:0]                | <i>D10, C10</i>                                                       | <i>C9, B8</i>                                                         | SDRAM bank address bus. Provides the bank address to SDRAM memories.                                                                                                                                                                                                                                         | O/Z   |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special  $V_{SS}$  considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                               | GZG BALL                                                                                                    | GDY BALL                                                                                                    | DESCRIPTION                                                                                                                                                                                              | TYPE† |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>EMIFF SDRAM Interface (Continued)</b>             |                                                                                                             |                                                                                                             |                                                                                                                                                                                                          |       |
| SDRAM.A[12:0]                                        | G10,<br>H10,<br>C11,<br>D11,<br>G11,<br>C12,<br>D12,<br>H11,<br>C13,<br>D13,<br>G12,<br>C14,<br>B14         | C8,<br>B9,<br>E9,<br>A8,<br>C10,<br>F9,<br>D9,<br>A9,<br>D10,<br>C11,<br>B10,<br>A10,<br>B11                | SDRAM address bus. Provides row and column address information to the SDRAM memory as well as MRS command data. SDRAM.A[10] also serves as a control signal to define specific commands to SDRAM memory. | O/Z   |
| <b>EMIFS FLASH and Asynchronous Memory Interface</b> |                                                                                                             |                                                                                                             |                                                                                                                                                                                                          |       |
| FLASH.WP                                             | V4                                                                                                          | R3                                                                                                          | EMIFS write protect. Active-low output for hardware write protection feature on standard memory devices.                                                                                                 | O/Z   |
| FLASH.WE                                             | W2                                                                                                          | P2                                                                                                          | EMIFS write enable. Active-low write enable output for Flash or SRAM memories or asynchronous devices.                                                                                                   | O/Z   |
| FLASH.RP                                             | W1                                                                                                          | T2                                                                                                          | EMIFS power down or reset output (Intel™ flash devices)                                                                                                                                                  | O/Z   |
| FLASH.OE                                             | U4                                                                                                          | N3                                                                                                          | EMIFS output enable. Active-low output enable output for Flash or SRAM memories or asynchronous devices.                                                                                                 | O/Z   |
| FLASH.D[15:0]                                        | V3,<br>T4,<br>U3,<br>U1,<br>P8,<br>T3,<br>T2,<br>R4,<br>R3,<br>R2,<br>P7,<br>P4,<br>P2,<br>N7,<br>N2,<br>N4 | U2,<br>T1,<br>N2,<br>R1,<br>M3,<br>P1,<br>N1,<br>N4,<br>M5,<br>M4,<br>M2,<br>M1,<br>L6,<br>L4,<br>K3,<br>L5 | EMIFS data bus. Bidirectional 16-bit data bus used to transfer read and write data during EMIFS accesses.                                                                                                | I/O/Z |
| FLASH.CLK                                            | N3                                                                                                          | K4                                                                                                          | EMIFS clock. Clock output that is active during synchronous modes of EMIFS operation for synchronous burst Flash memories.                                                                               | O/Z   |
| FLASH.CS3                                            | N8                                                                                                          | L1                                                                                                          | EMIFS chip selects. Active-low chip-select outputs that become active when the appropriate address is decoded internal to the device. Each chip select decodes a 32M-byte region of memory space.        | O/Z   |
| FLASH.CS2                                            | M4                                                                                                          | K5                                                                                                          |                                                                                                                                                                                                          |       |
| FLASH.CS1                                            | M3                                                                                                          | K1                                                                                                          |                                                                                                                                                                                                          |       |
| FLASH.CS0                                            | M7                                                                                                          | J2                                                                                                          |                                                                                                                                                                                                          |       |
| FLASH.BE[1:0]                                        | M8,<br>L3                                                                                                   | J1,<br>J5                                                                                                   | EMIFS byte enables. Active-low byte enable signals used to perform byte-wide accesses to memories or devices that support byte enables.                                                                  | O/Z   |
| FLASH.ADV                                            | L4                                                                                                          | H1                                                                                                          | EMIFS address valid. Active-low control signal used to indicate a valid address is present on the FLASH.A[24:1] bus.                                                                                     | O/Z   |
| FLASH.BAA                                            | M4                                                                                                          | K5                                                                                                          | EMIFS burst advance acknowledge. Active-low control signal used with Advanced Micro Devices™ burst Flash. FLASH.BAA is multiplexed with FLASH.CS2.                                                       | O/Z   |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

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Table 2–4. Signal Description (Continued)

| SIGNAL                                                           | GZG BALL                                                                                                                                                            | GDY BALL                                                                                                                                                            | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                | TYPE† |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>EMIFS FLASH and Asynchronous Memory Interface (Continued)</b> |                                                                                                                                                                     |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                            |       |
| FLASH.A[24:1]                                                    | L7,<br>K3,<br>K4,<br>L8,<br>J1,<br>J3,<br>J4,<br>J2,<br>K7,<br>H3,<br>H4,<br>K8,<br>G2,<br>G3,<br>G4,<br>F3,<br>J7,<br>E3,<br>F4,<br>D2,<br>E4,<br>C1,<br>D3,<br>J8 | J3,<br>J4,<br>H6,<br>H5,<br>H2,<br>H4,<br>H3,<br>G2,<br>G1,<br>G5,<br>G3,<br>G4,<br>E1,<br>F2,<br>F4,<br>F3,<br>F5,<br>D2,<br>E4,<br>E3,<br>C2,<br>C1,<br>G6,<br>B1 | EMIFS address bus. Address output bus for all EMIFS accesses. FLASH.A[24:1] provides the upper 24 bits of a 25-bit byte address. The byte enables must be used to implement 8-bit accesses.                                                                                                                                                                | O/Z   |
| FLASH.RDY                                                        | H7                                                                                                                                                                  | C3                                                                                                                                                                  | EMIFS ready. Active-high ready input used to suspend the EMIFS interface when the external memory or asynchronous device is not ready to continue the current cycle. <b>It is recommended that this pin should be pulled high externally and unused. See the OMAP5910 Dual-Core Processor Silicon Errata (literature number SPRZ016) for more details.</b> | I     |
| <b>LCD Interface</b>                                             |                                                                                                                                                                     |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                            |       |
| LCD.VS                                                           | D14                                                                                                                                                                 | D11                                                                                                                                                                 | LCD vertical sync output. LCD.VS is the frame clock which signals the start of a new frame of pixels to the LCD panel. In TFT mode, LCD.VS is the vertical synchronization signal.                                                                                                                                                                         | O     |
| LCD.HS                                                           | H12                                                                                                                                                                 | E11                                                                                                                                                                 | LCD horizontal sync. LCD.HS is the line clock which signals the end of a line of pixels to the LCD panel. In TFT mode, LCD.HS is the horizontal synchronization signal.                                                                                                                                                                                    | O     |
| LCD.AC                                                           | B15                                                                                                                                                                 | A11                                                                                                                                                                 | LCD AC-bias. LCD.AC is used to signal the LCD to switch the polarity of the row and column power supplies to counteract charge buildup causing DC offset. In TFT mode, LCD.AC is used as the output enable to latch LCD pixel data using the pixel clock.                                                                                                  | O     |
| LCD.PCLK                                                         | C15                                                                                                                                                                 | A12                                                                                                                                                                 | LCD pixel clock output. Clock output provided to synchronize pixel data to the LCD panel. In passive mode, LCD.PCLK only transitions when LCD.P[15:0] is valid. In active mode, LCD.PCLK transitions continuously and LCD.AC is used as the output enable when LCD.P[15:0] is valid.                                                                       | O     |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                             | GZG BALL                                                                       | GDY BALL                                                                       | DESCRIPTION                                                                                                                                                                                                                                                                                               | TYPE† |
|----------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>LCD Interface (Continued)</b>                   |                                                                                |                                                                                |                                                                                                                                                                                                                                                                                                           |       |
| LCD.P[15:0]                                        | D15, C16, A17, G13, B17, C17, D16, D17, C18, B19, A20, H13, G14, C19, B21, D18 | D12, C13, B12, F11, B13, E12, A13, C14, B14, A15, C15, B15, A16, D15, C16, B16 | LCD pixel data bus. Pixel data is transferred on this output bus to LCD panel.                                                                                                                                                                                                                            | O     |
| <b>Keyboard Matrix Interface</b>                   |                                                                                |                                                                                |                                                                                                                                                                                                                                                                                                           |       |
| KB.C[7:0]                                          | V19, P15, C20, C21, E18, D19, D20, F18                                         | M13, L12, A17, D16, B17, E15, E16, C17                                         | Keyboard matrix column outputs. KB.Cx column outputs are used in conjunction with the KB.Rx row inputs to implement a 6x5 or 8x8 keyboard matrix.                                                                                                                                                         | O     |
| KB.R[7:0]                                          | M20, N21, N19, E19, E20, H14, F19, G18                                         | K16, K17, K14, D17, E17, F15, D14, D13                                         | Keyboard matrix row inputs. KB.Rx row inputs are used in conjunction with the KB.Cx column outputs to implement a 6x5 or 8x8 keyboard matrix.                                                                                                                                                             | I     |
| <b>Multichannel Buffered Serial Ports (McBSPs)</b> |                                                                                |                                                                                |                                                                                                                                                                                                                                                                                                           |       |
| MCBSP1.CLKS                                        | G20                                                                            | F13                                                                            | McBSP1 clock source. Provides external clock reference for use with transmitter or receiver. CLKS is only present on McBSP1.                                                                                                                                                                              | I     |
| MCBSP1.CLKX                                        | G21                                                                            | G15                                                                            | McBSP transmit clock. Serial shift clock reference for the transmitter. CLKX is present on all McBSPs. In the case of McBSP1 and McBSP3, the clock input to the McBSP receiver may also be provided on this terminal via an internal loop-back connection between the transmitter and receiver clocks.    | I/O/Z |
| MCBSP2.CLKX                                        | Y6                                                                             | U5                                                                             |                                                                                                                                                                                                                                                                                                           |       |
| MCBSP3.CLKX                                        | W16, N14                                                                       | P14, R16                                                                       |                                                                                                                                                                                                                                                                                                           |       |
| MCBSP1.FSX                                         | H15, H18                                                                       | F17, F16                                                                       | McBSP transmit frame sync. Frame synchronization for transmitter. FSX is present on all McBSPs. In the case of McBSP1 and McBSP3, the frame sync input to the McBSP receiver may also be provided on this terminal via an internal loop-back connection between the transmitter and receiver frame syncs. | I/O/Z |
| MCBSP2.FSX                                         | W7                                                                             | T6                                                                             |                                                                                                                                                                                                                                                                                                           |       |
| MCBSP3.FSX                                         | N18, P18, P19, P20                                                             | L15, K12, K13, L14                                                             |                                                                                                                                                                                                                                                                                                           |       |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                                  | GZG BALL                               | GDY BALL                               | DESCRIPTION                                                                                             | TYPE† |
|---------------------------------------------------------|----------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------|-------|
| Multichannel Buffered Serial Ports (McBSPs) (Continued) |                                        |                                        |                                                                                                         |       |
| MCBSP1.DX                                               | H18, H15                               | F16, F17                               | McBSP transmit data. Serial transmit data output. DX is present on all McBSPs.                          | O     |
| MCBSP2.DX                                               | AA5, P10                               | R5, R6                                 |                                                                                                         |       |
| MCBSP3.DX                                               | P14, W21                               | U13, P16                               |                                                                                                         |       |
| MCBSP2.CLKR                                             | V7                                     | T5                                     | McBSP2 receive clock. Serial shift clock reference for the receiver. CLKR is only present on McBSP2.    | I/O/Z |
| MCBSP2.FSR                                              | W6                                     | P6                                     | McBSP2 receive frame sync. Frame synchronization for the receiver. FSR is only present on McBSP2.       | I/O/Z |
| MCBSP1.DR                                               | H20                                    | G16                                    | McBSP receive data. Serial receive data input. DR is present on all McBSPs.                             | I     |
| MCBSP2.DR                                               | P10, AA5                               | R6, R5                                 |                                                                                                         |       |
| MCBSP3.DR                                               | AA17, U18                              | R12, P17                               |                                                                                                         |       |
| Camera Interface                                        |                                        |                                        |                                                                                                         |       |
| CAM.EXCLK                                               | H19                                    | G13                                    | Camera interface external clock. Output clock used to provide a timing reference to a camera sensor.    | O     |
| CAM.LCLK                                                | J15                                    | H15                                    | Camera interface line clock. Input clock to provide external timing reference from camera sensor logic. | I     |
| CAM.VS                                                  | L18                                    | J17                                    | Camera interface vertical sync. Vertical synchronization input from external camera sensor.             | I     |
| CAM.HS                                                  | L15                                    | K15                                    | Camera interface horizontal sync. Horizontal synchronization input from external camera sensor.         | I     |
| CAM.D[7:0]                                              | J18, J19, J14, K18, K19, K15, K14, L19 | G14, G12, H16, J15, G17, H17, H14, J16 | Camera interface data. Data input bus to receive image data from an external camera sensor.             | I     |
| CAM.RSTZ                                                | M19                                    | J14                                    | Camera interface reset. Reset output used to reset or Initialize external camera sensor logic.          | O     |
| ETM9 Trace Macro Interface                              |                                        |                                        |                                                                                                         |       |
| ETM.CLK                                                 | J15                                    | H15                                    | ETM9 Trace Clock. Clock output for standard ETM9 test/debug equipment.                                  | O     |
| ETM.SYNC                                                | H19                                    | G13                                    | ETM9 Trace Synchronization. Trace Sync output for standard ETM9 test/debug equipment.                   | O     |
| ETM.D[7:0]                                              | J18, J19, J14, K18, K19, K15, K14, L19 | G14, G12, H16, J15, G17, H17, H14, J16 | ETM9 Trace Packet data. Trace Packet outputs for standard ETM9 test/debug equipment.                    | O     |

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‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                                | GZG BALL      | GDY BALL      | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                             | TYPE† |
|-------------------------------------------------------|---------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>ETM9 Trace Macro Interface (Continued)</b>         |               |               |                                                                                                                                                                                                                                                                                                                                                                         |       |
| ETM.PSTAT[2:0]                                        | L18, L15, M19 | J17, K15, J14 | ETM9 Trace Pipe State 2–0. Pipeline status outputs for standard ETM9 test/debug equipment.                                                                                                                                                                                                                                                                              | O     |
| <b>MICROWIRE Interface</b>                            |               |               |                                                                                                                                                                                                                                                                                                                                                                         |       |
| UWIRE.SCLK                                            | V19, J15      | M13, H15      | MICROWIRE serial clock. This pin drives a clock to a MICROWIRE device. The active edge is software configurable.                                                                                                                                                                                                                                                        | O     |
| UWIRE.SDO                                             | W21, H19      | P16, G13      | MICROWIRE serial data out. Write data is transferred to a MICROWIRE device on this pin.                                                                                                                                                                                                                                                                                 | O     |
| UWIRE.SDI                                             | U18, J14      | P17, H16      | MICROWIRE serial data in. Read data is transferred from a MICROWIRE device on this pin.                                                                                                                                                                                                                                                                                 | I     |
| UWIRE.CS0                                             | N14, J18      | R16, G14      | MICROWIRE chip select 0. The CS0 output selects a single MICROWIRE device (configurable as active high or active low).                                                                                                                                                                                                                                                  | O     |
| UWIRE.CS3                                             | P15, J19      | L12, G12      | MICROWIRE chip select 3. The CS3 output selects a single MICROWIRE device (configurable as active high or active low).                                                                                                                                                                                                                                                  | O     |
| <b>HDQ/1-Wire Interface</b>                           |               |               |                                                                                                                                                                                                                                                                                                                                                                         |       |
| HDQ                                                   | N20           | L16           | HDQ/1-wire interface. HDQ optionally implements one of two serial protocols: HDQ or 1-Wire.                                                                                                                                                                                                                                                                             | I/O   |
| <b>General-Purpose I/O (GPIO) and MPU I/O (MPUIO)</b> |               |               |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO15                                                | M20           | K16           | <p>Shared General-Purpose I/O. Each GPIO pin can be used by either the DSP core or the MPU core. Control of each GPIO pin between the two cores is selected by the MPU via control registers. Each GPIO pin may also be configured to cause an interrupt to its respective core processor.</p> <p><b>GPIO5 and GPIO10 are not available on the OMAP5910 device.</b></p> | I/O/Z |
| GPIO14                                                | N21           | K17           |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO13                                                | N19           | K14           |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO12                                                | N18, W6       | L15, P6       |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO11                                                | N20, V7       | L16, T5       |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO9                                                 | W8            | M8            |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO8                                                 | Y8            | U6            |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO7                                                 | M15, Y5, V9   | L17, N6, R7   |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO6                                                 | P19           | K13           |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO4                                                 | P20           | L14           |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO3                                                 | P18           | K12           |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO2                                                 | M14           | M15           |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO1                                                 | R19           | M17           |                                                                                                                                                                                                                                                                                                                                                                         |       |
| GPIO0                                                 | R18           | M16           |                                                                                                                                                                                                                                                                                                                                                                         |       |

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§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                                     | GZG BALL    | GDY BALL   | DESCRIPTION                                                                                                                                               | TYPE† |
|------------------------------------------------------------|-------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| General-Purpose I/O (GPIO) and MPU I/O (MPUIO) (Continued) |             |            |                                                                                                                                                           |       |
| MPUIO12                                                    | L19         | J16        | MPU General-Purpose I/O. MPUIO pins may only be used by the MPU core.<br><br><b>MPUIO8, MPUIO9, AND MPUIO10 are not available on the OMAP5910 device.</b> | I/O/Z |
| MPUIO11                                                    | W10         | R8         |                                                                                                                                                           |       |
| MPUIO7                                                     | V10         | M9         |                                                                                                                                                           |       |
| MPUIO6                                                     | W11         | R9         |                                                                                                                                                           |       |
| MPUIO5                                                     | T20,<br>W5  | L13,<br>U4 |                                                                                                                                                           |       |
| MPUIO4                                                     | T19         | N15        |                                                                                                                                                           |       |
| MPUIO3                                                     | V8          | P7         |                                                                                                                                                           |       |
| MPUIO2                                                     | N15         | N17        |                                                                                                                                                           |       |
| MPUIO1                                                     | U19         | M14        |                                                                                                                                                           |       |
| MPUIO0                                                     | Y12         | N10        |                                                                                                                                                           |       |
| Pulse-Width Tone and Pulse-Width Light Interface           |             |            |                                                                                                                                                           |       |
| PWT                                                        | M18         | J13        | Pulse Width Tone output. The PWT output pin provides a modulated output for use with an external buzzer.                                                  | O     |
| PWL                                                        | L14         | H12        | Pulse Width Light output. The PWL output pin provides a pseudo-random modulated voltage output used for LCD or keypad backlighting.                       | O     |
| Multimedia Card/Secure Digital Interface (MMC/SD)          |             |            |                                                                                                                                                           |       |
| MMC.CLK                                                    | V11         | U10        | MMC/SD clock. Clock output to the MMC/SD card.                                                                                                            | O     |
| MMC.CMD                                                    | P11         | U8         | MMC/SD command output. MMC/SD commands are transferred to/from this pin.                                                                                  | I/O/Z |
| MMC.DAT3                                                   | W11         | R9         | SD card data bit 3. Data bit 3 used in 4-bit Secure Digital mode.                                                                                         | I/O/Z |
| MMC.DAT2                                                   | W10,<br>M15 | R8,<br>L17 | SD card data bit 2. Data bit 2 used in 4-bit Secure Digital mode.                                                                                         | I/O/Z |
| MMC.DAT1                                                   | V10         | M9         | SD card data bit 1. Data bit 1 used in 4-bit Secure Digital mode.                                                                                         | I/O/Z |
| MMC.DAT0                                                   | R11         | U9         | MMC/SD dat0 input. MMC.DAT0 functions as data bit 0 during MMC and Secure Digital operation. The pin functions as the data input in generic SPI mode.     | I/O/Z |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                                        | GZG BALL      | GDY BALL      | DESCRIPTION                                                                                                                                                                                                                                            | TYPE† |
|---------------------------------------------------------------|---------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Universal Asynchronous Receiver/Transmitter Interfaces</b> |               |               |                                                                                                                                                                                                                                                        |       |
| UART1.TX                                                      | Y14           | P13           | UART transmit. Transmit data output. TX is present on all UARTs. On UART3, the TX pin implements the TXIR function during SIR mode operation.                                                                                                          | O     |
| UART2.TX                                                      | V6, M18       | R4, J13       |                                                                                                                                                                                                                                                        |       |
| UART3.TX                                                      | M18, K18      | J13, J15      |                                                                                                                                                                                                                                                        |       |
| UART1.RX                                                      | V14           | R11           | UART receive. Receive data input. RX is present on all UARTs. On UART3, the RX pin implements the RXIR function during SIR mode operation.                                                                                                             | I     |
| UART2.RX                                                      | R9, L14       | M7, H12       |                                                                                                                                                                                                                                                        |       |
| UART3.RX                                                      | L14, K19      | H12, G17      |                                                                                                                                                                                                                                                        |       |
| UART1.CTS                                                     | R14           | M10           | UART clear-to-send. CTS is present on all UARTs.                                                                                                                                                                                                       | I     |
| UART2.CTS                                                     | Y5, L15       | N6, K15       |                                                                                                                                                                                                                                                        |       |
| UART3.CTS                                                     | R13, K15      | L10, H17      |                                                                                                                                                                                                                                                        |       |
| UART1.RTS                                                     | AA15          | U12           | UART request-to-send. RTS is present on all UARTs. On UART3 in IrDA mode, this pin is SD_MODE.                                                                                                                                                         | O     |
| UART2.RTS                                                     | W5, M19       | U4, J14       |                                                                                                                                                                                                                                                        |       |
| UART3.RTS                                                     | Y13, R19, K14 | P11, M17, H14 |                                                                                                                                                                                                                                                        |       |
| UART1.DTR                                                     | W21, Y13      | P16, P11      | UART data-terminal-ready. DTR is only present on UART1 and UART3.                                                                                                                                                                                      | O     |
| UART3.DTR                                                     | W21           | P16           |                                                                                                                                                                                                                                                        |       |
| UART1.DSR                                                     | U18, R13      | P17, L10      | UART data-set-ready. DSR is only present on UART1 and UART3.                                                                                                                                                                                           | I     |
| UART3.DSR                                                     | U18           | P17           |                                                                                                                                                                                                                                                        |       |
| UART2.BCLK                                                    | Y4            | T4            | UART baud clock output. A clock of 16x of the UART2 baud rate is driven onto this pin. This feature is only implemented on UART2.                                                                                                                      | O     |
| <b>Inter-Integrated Circuit Master and Slave Interface</b>    |               |               |                                                                                                                                                                                                                                                        |       |
| I2C.SCL                                                       | T18           | P15           | I2C serial clock. I2C.SCL provides the timing reference for I2C transfers.                                                                                                                                                                             | I/O/Z |
| I2C.SDA                                                       | V20           | N14           | I2C serial data. I2C.SDA provides control and data for I2C transfers.                                                                                                                                                                                  | I/O/Z |
| <b>LED Pulse Generator Interface</b>                          |               |               |                                                                                                                                                                                                                                                        |       |
| LED1                                                          | P18           | K12           | LED Pulse Generator output 1. LED1 produces a static or pulsing output used to drive an external LED indicator.                                                                                                                                        | O     |
| LED2                                                          | T19           | N15           | LED Pulse Generator output 2. LED2 produces a static or pulsing output used to drive an external LED indicator.                                                                                                                                        | O     |
| <b>Multichannel Serial Interfaces (MCSIs)</b>                 |               |               |                                                                                                                                                                                                                                                        |       |
| MCSI1.CLK                                                     | AA13          | U11           | MCSI clock. Multichannel Serial Interface clock reference. The clock can be driven in master mode or an external clock may be driven on this signal in slave mode.                                                                                     | I/O/Z |
| MCSI2.CLK                                                     | Y10           | T8            |                                                                                                                                                                                                                                                        |       |
| MCSI1.SYNC                                                    | V13           | T11           | MCSI sync. Multichannel Serial Interface frame synchronization signal. The frame sync can be driven in master mode or an external clock may be driven on this signal in slave mode. MCSIx.SYNC may be configured as an active-low or active-high sync. | I/O/Z |
| MCSI2.SYNC                                                    | V9            | R7            |                                                                                                                                                                                                                                                        |       |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                                                                     | GZG BALL | GDY BALL | DESCRIPTION                                                                                                                                                                                                                                | TYPE† |
|--------------------------------------------------------------------------------------------|----------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Multichannel Serial Interfaces (MCSIs) (Continued)                                         |          |          |                                                                                                                                                                                                                                            |       |
| MCSI1.DIN                                                                                  | W13      | R10      | MCSI data in. Multichannel Serial Interface data input pin.                                                                                                                                                                                | I     |
| MCSI2.DIN                                                                                  | AA9      | P8       |                                                                                                                                                                                                                                            |       |
| MCSI1.DOUT                                                                                 | W14      | N12      | MCSI data out. Multichannel Serial Interface data output pin.                                                                                                                                                                              | O     |
| MCSI2.DOUT                                                                                 | W9       | T7       |                                                                                                                                                                                                                                            |       |
| USB (Integrated Transceiver Interface, can be used with Host or Function)                  |          |          |                                                                                                                                                                                                                                            |       |
| USB.DP                                                                                     | P9       | P5       | USB internal transceiver D+. The positive side of the integrated USB transceiver's differential bus. A series resistor of 27 Ω (5% tolerance) is required on the USB.DP pin.                                                               | I/O/Z |
| USB.DM                                                                                     | R8       | P4       | USB internal transceiver D-. The negative side of the integrated USB transceiver's differential bus. A series resistor of 27 Ω (5% tolerance) is required on the USB.DM pin.                                                               | I/O/Z |
| USB Pin Group 1 and 2 (Utilizing External Transceivers, can be used with Host or Function) |          |          |                                                                                                                                                                                                                                            |       |
| USB1.TXEN                                                                                  | W16      | P14      | USB transmit enable. Driven active (low) when the USB host or Function peripheral is driving data onto the USB bus via the TXD output.                                                                                                     | O     |
| USB2.TXEN                                                                                  | W9       | T7       |                                                                                                                                                                                                                                            |       |
| USB1.TXD                                                                                   | W14      | N12      | USB transmit data. Single-ended logic output used to transmit data to the transmit input of an external USB transceiver. USBx.TXD may also be used for transceiverless connection between OMAP5910 and another transceiverless USB device. | O     |
| USB2.TXD                                                                                   | V6       | R4       |                                                                                                                                                                                                                                            |       |
| USB1.VP                                                                                    | V13      | T11      | USB vplus data. Single-ended input used to monitor the logical state of the D+ line of the USB bus. USBx.VP should be driven by an external USB transceiver based on the state of D+.                                                      | I     |
| USB2.VP                                                                                    | AA9      | P8       |                                                                                                                                                                                                                                            |       |
| USB1.VM                                                                                    | AA13     | U11      | USB vminus data. Single-ended input used to monitor the logical state of the D- line of the USB bus. USBx.VM should be driven by an external USB transceiver based on the state of D-.                                                     | I     |
| USB2.VM                                                                                    | R9       | M7       |                                                                                                                                                                                                                                            |       |
| USB1.RCV                                                                                   | W13      | R10      | USB receive data. Single-ended logic input used to receive data from the receive output of an external USB transceiver. USBx.RCV may also be used for transceiverless connection between OMAP5910 and another transceiverless USB device.  | I     |
| USB2.RCV                                                                                   | Y5       | N6       |                                                                                                                                                                                                                                            |       |
| USB1.SUSP                                                                                  | AA17     | R12      | USB bus segment suspend control. Active-high output indicates detection of IDLE condition on the USB bus for greater than 5 ms. USBx.SUSP is implemented on both USB ports 1 and 2.                                                        | O     |
| USB2.SUSP                                                                                  | Y10      | T8       |                                                                                                                                                                                                                                            |       |
| USB1.SE0                                                                                   | P14      | U13      | USB single-ended zero. Active-high output indicates detection of the single-ended zero state on the USB bus. USBx.SE0 is implemented for both USB ports 1 and 2.                                                                           | O     |
| USB2.SE0                                                                                   | W5       | U4       |                                                                                                                                                                                                                                            |       |
| USB1.SPEED                                                                                 | Y12      | N10      | USB 1 bus segment speed control. Static control output used by the external transceiver to determine whether USB port 1 is operating in full-speed or low-speed mode. USB1.SPEED is only implemented on USB port 1.                        | O     |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                           | GZG BALL | GDY BALL | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                            | TYPE <sup>†</sup> |
|----------------------------------|----------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>USB Miscellaneous Signals</b> |          |          |                                                                                                                                                                                                                                                                                                                                                                        |                   |
| USB.CLKO                         | W4       | T3       | USB clock output. 6-MHz divided clock output of the internal USB DPLL provided for reference. Common for all USB host and Function peripherals.                                                                                                                                                                                                                        | O                 |
| USB.PUEN                         | W4       | T3       | USB pullup enable. Control output used in conjunction with an external pullup resistor to implement USB device connect and disconnect via software. USB.PUEN is used with the USB Function peripheral.                                                                                                                                                                 | O                 |
| USB.VBUS                         | R18      | M16      | USB voltage bus enable. USB.VBUS is used to provide a logic-high voltage level which may be used to enable pullup resistors on the USB bus to indicate connection or disconnection status of the OMAP5910 device as a USB Function device.                                                                                                                             | I                 |
| <b>JTAG/Emulation Interface</b>  |          |          |                                                                                                                                                                                                                                                                                                                                                                        |                   |
| TCK                              | W18      | T14      | IEEE Standard 1149.1 test clock. TCK is normally a free-running clock signal with a 50% duty cycle. The changes on the test access port (TAP) of input signals TDI and TMS are clocked into the TAP controller, instruction register, or selected test data register on the rising edge of TCK. Changes at the TAP output signal TDO occur on the falling edge of TCK. | I                 |
| TDI                              | Y19      | U17      | IEEE Standard 1149.1 test data input. TDI is clocked into the selected register (instruction or data) on the rising edge of TCK.                                                                                                                                                                                                                                       | I                 |
| TDO                              | AA19     | U16      | IEEE Standard 1149.1 test data output. The contents of the selected register (instruction or data) are shifted out of TDO on the falling edge of TCK. TDO is in the high-impedance state except when the scanning of data is in progress.                                                                                                                              | O                 |
| TMS                              | V17      | R13      | IEEE Standard 1149.1 test mode select. This serial control input is clocked into the TAP controller on the rising edge of TCK.                                                                                                                                                                                                                                         | I                 |
| TRST                             | Y18      | U15      | IEEE Standard 1149.1 test reset. TRST, when high, gives the IEEE standard 1149.1 scan system control of the operations of the device. If TRST is not connected, or driven low, the device operates in its functional mode, and the IEEE standard 1149.1 signals are ignored.                                                                                           | I                 |
| EMU0                             | V16      | R17      | Emulation pin 0. When TRST is driven high, EMU0 is used as an interrupt to or from the emulator system and is defined as input/output by way of the IEEE standard 1149.1 scan system.                                                                                                                                                                                  | I/O               |
| EMU1                             | W17      | T13      | Emulation pin 1. When TRST is driven high, EMU1 is used as an interrupt to or from the emulator system and is defined as input/output by way of the IEEE standard 1149.1 scan system.                                                                                                                                                                                  | I/O               |
| <b>Device Clock Pins</b>         |          |          |                                                                                                                                                                                                                                                                                                                                                                        |                   |
| CLK32K_IN                        | P13      | N9       | 32-kHz clock input. Digital CMOS 32-kHz clock input driven by an external 32-kHz oscillator if the internal 32-kHz oscillator is not used.                                                                                                                                                                                                                             | I                 |
| CLK32K_OUT                       | Y12      | N10      | 32-kHz clock output. Clock output reflecting the internal 32-kHz clock.                                                                                                                                                                                                                                                                                                | O                 |
| CLK32K_CTRL                      | AA20     | T15      | 32-kHz clock selection control input. CLK32K_CTRL selects whether or not the internal 32-kHz oscillator is used or if the 32-kHz clock is to be provided externally via the CLK32K_IN input. If CLK32K_CTRL is high, the 32-kHz internal oscillator is used; if CLK32K_CTRL is low, the CMOS input CLK32K_IN is used as a 32-kHz clock source.                         | I                 |
| OSC32K_IN                        | W12      | T10      | 32-kHz crystal XI connection. Analog clock input to 32-kHz oscillator for use with external crystal.                                                                                                                                                                                                                                                                   | analog            |
| OSC32K_OUT                       | R12      | T9       | 32-kHz crystal XO connection. Analog output from 32-kHz oscillator for use with external crystal.                                                                                                                                                                                                                                                                      | analog            |
| OSC1_IN                          | Y2       | R2       | Base crystal XI connection. Analog input to base oscillator for use with external crystal or to be driven by external 12- or 13-MHz oscillator.                                                                                                                                                                                                                        | analog            |

<sup>†</sup> I = Input, O = Output, Z = High-Impedance

<sup>‡</sup> All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

<sup>§</sup> See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                                             | GZG BALL | GDY BALL | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                  | TYPE†  |
|--------------------------------------------------------------------|----------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| <b>Device Clock Pins (Continued)</b>                               |          |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |
| OSC1_OUT                                                           | W3       | P3       | Base crystal XO connection. Analog output from base oscillator for use with external 12- or 13-MHz crystal.                                                                                                                                                                                                                                                                                                                                                  | analog |
| MCLK                                                               | Y9       | U7       | M-Clock. General-purpose clock output which may be configured to run at 12 MHz or 48 MHz. MCLK may be configured to drive constantly or only when the MCLKREQ signal is asserted active high.                                                                                                                                                                                                                                                                | O      |
| BCLK                                                               | Y13      | P11      | B-Clock. General purpose clock output which may be configured to run at 12 MHz. BCLK may be configured to drive constantly or only when the BCLKREQ signal is asserted active high.                                                                                                                                                                                                                                                                          | O      |
| MCLKREQ                                                            | R10      | N8       | M-Clock Request. Active high request input which allows an external device to request that MCLK be driven.                                                                                                                                                                                                                                                                                                                                                   | I      |
| BCLKREQ                                                            | R13      | L10      | B-Clock Request. Active high request input which allows an external device to request that BCLK be driven.                                                                                                                                                                                                                                                                                                                                                   | I      |
| <b>Reset Logic Pins</b>                                            |          |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |
| PWRON_RESET                                                        | G19      | F14      | Reset input to device. Active-low asynchronous reset input resets the entire OMAP5910 device.                                                                                                                                                                                                                                                                                                                                                                | I      |
| MPU_RST                                                            | V15      | P12      | MPU reset input. Active-low asynchronous reset input resets the MPU core.                                                                                                                                                                                                                                                                                                                                                                                    | I      |
| RST_OUT                                                            | W15      | M11      | Reset output. Active-low output is asserted when MPUST is active (after synchronization.)                                                                                                                                                                                                                                                                                                                                                                    | O      |
| <b>Interrupts and Miscellaneous Control and Configuration Pins</b> |          |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |
| MPU_BOOT                                                           | AA17     | R12      | MPU boot mode. When MPU_BOOT is low, the MPU boots from chip select 0 of the EMIFS (Flash) interface. When MPU_BOOT is high, the MPU boots from chip select 3 of EMIFS.                                                                                                                                                                                                                                                                                      | I      |
| DMA_REQ_OBS                                                        | L14      | H12      | DMA request external observation output.                                                                                                                                                                                                                                                                                                                                                                                                                     | O      |
| IRQ_OBS                                                            | M18      | J13      | IRQ external observation output.                                                                                                                                                                                                                                                                                                                                                                                                                             | O      |
| EXT_DMA_REQ1                                                       | T19      | N15      | External DMA requests. EXT_DMA_REQ0 and EXT_DMA_REQ1 provide two DMA request inputs which external devices may use to trigger System DMA transfers. The System DMA must be configured in software to respond to these external requests.                                                                                                                                                                                                                     | I      |
| EXT_DMA_REQ0                                                       | N15      | N17      |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |
| BFAIL/EXT_FIQ                                                      | W19      | R14      | Battery power failure and external FIQ interrupt input. BFAIL/EXT_FIQ may be used to gate certain input pins when battery power is low or failing. The pins which may be gated are configured via software. This pin can also optionally be used as an external FIQ interrupt source to the MPU. The function of this pin is configurable via software.                                                                                                      | I      |
| EXT_MASTER_REQ                                                     | R10      | N8       | External master request. If the 12-MHz clock is provided by an external device instead of using the on-chip oscillator, a high level on this output indicates to the external device that the clock must be driven. A low level indicates that the OMAP5910 device is in sleep mode and the 12-MHz clock is not necessary.                                                                                                                                   | O      |
| LOW_PWR                                                            | T20      | L13      | Low-power request output. This active-high output indicates that the OMAP5910 device is in a low-power sleep mode. During reset and functional modes, LOW_PWR is driven low. This signal can be used to indicate a low-power state to external power management devices in a system or it can be used as a chip select to external SDRAM memory to minimize current consumption while the SDRAM is in self-refresh and the OMAP5910 device is in sleep mode. | O      |
| CONF                                                               | V18      | T16      | Configuration input. CONF selects reserved factory test modes. CONF should always be pulled low during device operation.                                                                                                                                                                                                                                                                                                                                     | I      |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                                                                         | GZG BALL                                                                                                                                                                                                  | GDY BALL                                                                                                                                                                                            | DESCRIPTION                                                                                                                                                                                                                                                                                           | TYPE† |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Interrupts and Miscellaneous Control and Configuration Pins (Continued)</b> |                                                                                                                                                                                                           |                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                       |       |
| STAT_VAL/WKUP                                                                  | Y17                                                                                                                                                                                                       | U14                                                                                                                                                                                                 | Static Valid / Chip wake-up input. STAT_VAL/WKUP is also sampled at reset to select the MMC/SD port. If the MMC/SD peripheral is to be used, this pin must be pulled high during reset. It is recommended that this pin be pulled high during reset regardless of whether or not MMC/SD will be used. | I     |
| RST_HOST_OUT                                                                   | P14                                                                                                                                                                                                       | U13                                                                                                                                                                                                 | Reset Host output. A software controllable Reset or Shutdown output to an external device.                                                                                                                                                                                                            | O     |
| RSVD                                                                           | E5                                                                                                                                                                                                        | N11                                                                                                                                                                                                 | Reserved pin. This pin must be left unconnected.                                                                                                                                                                                                                                                      | –     |
| <b>Power Supplies</b>                                                          |                                                                                                                                                                                                           |                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                       |       |
| V <sub>SS</sub> §                                                              | A11,<br>A13,<br>A21,<br>B1,<br>B2,<br>B5,<br>B7,<br>B16,<br>B18,<br>E2,<br>F20,<br>G1,<br>J20,<br>K2,<br>K20,<br>N1,<br>R21,<br>U2,<br>U20,<br>V5,<br>V12,<br>W20,<br>Y3,<br>Y15,<br>AA1,<br>AA7,<br>AA21 | G9,<br>H9,<br>N5,<br>H8,<br>G11,<br>M6,<br>L11,<br>K8,<br>J12,<br>J9,<br>G7,<br>E5,<br>J7,<br>J8,<br>J6,<br>J10,<br>K10,<br>H10,<br>F12,<br>L7,<br>F6,<br>L9,<br>K9,<br>M12,<br>E13,<br>J11,<br>N13 | Ground. Common ground return for all core and I/O voltage supplies.                                                                                                                                                                                                                                   | power |
| CV <sub>DD</sub> ‡                                                             | A9,<br>F2,<br>P12,<br>Y20                                                                                                                                                                                 | E8,<br>E2,<br>T17,<br>P10                                                                                                                                                                           | Core supply voltage. Supplies power to OMAP5910 core logic and low-voltage sections of I/O.                                                                                                                                                                                                           | power |
| CV <sub>DD1</sub> ‡                                                            | A3                                                                                                                                                                                                        | B3                                                                                                                                                                                                  | Core Supply Voltage 1. Supplies power to the on-chip shared SRAM memory (192k-Bytes).                                                                                                                                                                                                                 | power |
| CV <sub>DD2</sub> ‡                                                            | Y1,<br>AA3                                                                                                                                                                                                | K7,<br>L8                                                                                                                                                                                           | Core Supply Voltage 2. Supplies power to the MPU subsystem logic and memory.                                                                                                                                                                                                                          | power |
| CV <sub>DD3</sub> ‡                                                            | B13,<br>B20,<br>J21,<br>R20                                                                                                                                                                               | F10,<br>G10,<br>H11,<br>K11                                                                                                                                                                         | Core Supply Voltage 3. Supplies power to the DSP subsystem logic and memory.                                                                                                                                                                                                                          | power |
| CV <sub>DD4</sub> ‡                                                            | M2                                                                                                                                                                                                        | K2                                                                                                                                                                                                  | Core Supply Voltage 4. Supplies power to the DPLL which provides internal clocks to the core and peripherals (excluding USB peripherals). <b>NOTE:</b> The voltage to this supply pin should be kept as clean as possible to maximize performance.                                                    | power |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

Table 2–4. Signal Description (Continued)

| SIGNAL                            | GZG BALL                                             | GDY BALL                                           | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                           | TYPE† |
|-----------------------------------|------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Power Supplies (Continued)</b> |                                                      |                                                    |                                                                                                                                                                                                                                                                                                                                                                                       |       |
| CV <sub>DDA</sub> ‡               | Y21                                                  | R15                                                | Analog supply voltage. Supplies power to ULPD DPLL which provides an internal clock to the USB peripherals. <b>NOTE:</b> The voltage to this supply pin should be kept as clean as possible to maximize performance.                                                                                                                                                                  | power |
| DV <sub>DD1</sub>                 | A15,<br>A19,<br>E21,<br>L21,<br>U21,<br>AA11,<br>Y16 | C12,<br>A14,<br>E14,<br>H13,<br>N16,<br>P9,<br>T12 | I/O Supply Voltage 1. Supplies power to the majority of peripheral I/O buffers. DV <sub>DD1</sub> may be connected in common with the other DV <sub>DD</sub> supplies if the same operating voltage is desired.                                                                                                                                                                       | power |
| DV <sub>DD2</sub>                 | AA2                                                  | U3                                                 | I/O Supply Voltage 2. Supplies power to the internal USB transceiver buffers. DV <sub>DD2</sub> may optionally be used for USB connect and disconnect detection by connecting DV <sub>DD2</sub> to the power from the USB bus in the system. DV <sub>DD2</sub> may be connected in common with the other DV <sub>DD</sub> supplies if the same operating voltage is desired.          | power |
| DV <sub>DD3</sub>                 | Y7                                                   | N7                                                 | I/O Supply Voltage 3. Supplies power to the MCS12 and McBSP2 peripheral I/O buffers as well as GPIO[9:8] I/O buffers. The DV <sub>DD3</sub> supply may operate within a high-voltage or low-voltage range (see Section 5.2 for operating conditions). DV <sub>DD3</sub> may be connected in common with the other DV <sub>DD</sub> supplies if the same operating voltage is desired. | power |
| DV <sub>DD4</sub>                 | A1,<br>A5,<br>A7,<br>B10,<br>B12                     | D3,<br>D5,<br>A5,<br>D8,<br>E10                    | I/O Supply Voltage 4. Supplies power to the SDRAM interface I/O buffers. The DV <sub>DD4</sub> supply may operate within a high-voltage or low-voltage range (see Section 5.2 for operating conditions). DV <sub>DD4</sub> may be connected in common with the other DV <sub>DD</sub> supplies if the same operating voltage is desired.                                              | power |
| DV <sub>DD5</sub>                 | C2,<br>E1,<br>H2,<br>L1,<br>P3,<br>R1,<br>V2         | H7,<br>D1,<br>F1,<br>K6,<br>L2,<br>L3,<br>U1       | I/O Supply Voltage 5. Supplies power to the FLASH interface I/O buffers. The DV <sub>DD5</sub> supply may operate within a high-voltage or low-voltage range (see Section 5.2 for operating conditions). DV <sub>DD5</sub> may be connected in common with the other DV <sub>DD</sub> supplies if the same operating voltage is desired.                                              | power |

† I = Input, O = Output, Z = High-Impedance

‡ All core voltage supplies should be tied to the same voltage level (within 0.3 V). During system prototyping phases, it may be useful to maintain a capability for independent measurement of core supply currents to facilitate power optimization experiments.

§ See Sections 5.6.1 and 5.6.2 for special V<sub>SS</sub> considerations with oscillator circuits.

The diagram illustrates the internal architecture of the OMAP5910 (299-Ball Package). Key components and their interconnections include:

- External Interfaces:**
  - Flash and SRAM Memories:** Connected to the Memory Interface Traffic Controller (TTC) via 16-bit buses.
  - SDRAM Memories:** Connected to the TTC via 16-bit buses.
  - External Clock, Reset, and Requests:** Provided to the Clock/Reset/Power Management block.
  - External Clock:** 12 MHz or 13 MHz, connected to the OSC blocks.
- DSP Section (Left):**
  - OMAP5910 (299-Ball Package):** The main device identifier.
  - DSP MMU:** Connected to the TMS320C55x DSP via a 32-bit bus.
  - TMS320C55x DSP:** Includes Instruction Cache, SRAM, DARAM, DMA, and H/W Accelerators.
  - DSP Private Peripheral Bus:** Connects the DSP to its private peripherals.
  - DSP Public (Shared) Peripheral Bus:** Connects the DSP to shared peripherals.
  - DSP Public Peripherals:** Includes McBSP1, McBSP3, MCS11, and MCS12.
  - DSP Private Peripherals:** Includes Timers (3), Watchdog Timer, and Level 1/2 Interrupt Handlers.
- MPU Section (Right):**
  - MPU Peripheral Bridge:** Connects the DSP and MPU buses.
  - System DMA Controller:** Manages data flow between the DSP and MPU.
  - MPU Interface:** Connects the DSP MMU to the System DMA Controller.
  - MPU Public Peripheral Bus:** Connects the MPU to its public peripherals.
  - MPU Private Peripheral Bus:** Connects the MPU to its private peripherals.
  - MPU Public Peripherals:** Includes Mailboxes, GPIO I/F, UART1, UART2, UART3, McBSP2, USB Function, and USB Host.
  - MPU Private Peripherals:** Includes Timers (3), Watchdog Timer, Level 1/2 Interrupt Handlers, and Configuration Registers.
  - Local Bus I/F and MMU:** Connects the MPU to the System DMA Controller.
  - MPU Core (T1925T):** Includes Instruction Cache, Data Cache, and MMUs.
  - ETM9<sup>†</sup>:** Embedded Trace Macrocell.
  - JTAG/Emulation I/F:** For debugging and emulation.
  - LCD I/F:** Connected to the LCD display.
  - Local Bus I/F and MMU:** Connects the MPU to the System DMA Controller.
- Shared Components:**
  - Memory Interface Traffic Controller (TTC):** Manages data flow between the DSP and MPU.
  - Clock/Reset/Power Management:** Manages the system's clock, reset, and power.
  - SRAM 192K Bytes:** Shared between the DSP and MPU.

<sup>†</sup> ETM9 pins are shared with the Camera Interface.

### Figure 3–1. OMAP5910 Functional Block Diagram

### 3.1 Functional Block Diagram Features

The OMAP5910 device includes the following functional blocks:

- ARM9TDMI-based MPU core
  - 16K-byte instruction cache and 8K-byte data cache
  - Memory Management Units (MMUs) for Instruction and Data
  - Two 64-entry Translation Look-Aside Buffers (TLBs) for MMUs
  - 17-word write buffer
- C55x DSP subsystem
  - 48K-word single-access RAM (SARAM) (96K bytes)
  - 32K-word dual-access RAM (DARAM) (64K bytes)
  - 16K-word ROM (32K bytes)
  - 24K-byte instruction cache
  - Six-channel DMA controller
  - Hardware Accelerators for DCT, iDCT, pixel interpolation, and motion estimation
- Nine-channel system DMA controller
- Traffic controller providing shared access to three memory interfaces:
  - EMIFF External Memory Interface providing 16-bit interface to 64M bytes of standard SDRAM
  - EMIFS External Memory Interface providing 16-bit interface to 128M bytes of Flash, ROM, or asynchronous memories
  - Internal Memory Interface (IMIF) providing 32-bit interface to 192K bytes of internal SRAM
- DSP Memory Management Unit (MMU) configured by the MPU
- MPU Interface (MPUI) allowing MPU and System DMA to access DSP subsystem memory and DSP public peripherals
- Local Bus Interface (with MMU) allowing USB host peripheral direct access to system memories.
- DSP Private Peripherals (accessible only by the DSP)
  - Three 32-bit general-purpose timers
  - Watchdog timer
  - Level 1/Level 2 interrupt handlers
- DSP Public Peripherals (accessible by the DSP, DSP DMA, and the MPU via the MPU interface)
  - Two Multichannel Buffered Serial Ports (McBSPs)
  - Two Multichannel Serial Interfaces (MCSIs) ideal for voice data
- MPU Private Peripherals (accessible only by the MPU)
  - Three 32-bit general-purpose timers
  - Watchdog Timer
  - Level 1/Level 2 interrupt handlers
  - Configuration Registers for pin-multiplexing and other device-level configurations
  - LCD controller supporting monochrome panels (STN) and color panels (STN or TFT)

- MPU Public Peripherals (accessible by the MPU and the System DMA)
  - Multichannel Buffered Serial Port (McBSP)
  - USB Function interface (optional internal transceiver shared with USB Host interface)
  - USB Host interface with up to three ports (optional internal transceiver shared with USB Function interface)
  - One integrated USB transceiver for either host or Function
  - Inter-Integrated Circuit (I<sup>2</sup>C) Multi-mode master and slave interface
  - MICROWIRE serial interface
  - Camera interface providing connectivity to CMOS image sensors
  - Up to ten MPU general-purpose I/Os (MPUIOs)
  - 32-kHz timer for use with MPU OS
  - Pulse-Width Tone (PWT) module for tone generation
  - Pulse-Width Light (PWL) module for LCD backlight control
  - Keyboard interface (6 x 5 or 8 x 8 matrix)
  - Multimedia Card or Secure Digital interface (MMC/SD)
  - Two LED Pulse Generator modules (LPG)
  - Real-Time Clock module (RTC)
  - HDQ or 1-Wire Master interface for serial communication to battery management devices
  - Frame Adjustment Counter (FAC)
- MPU/DSP Shared Peripherals (Controlling processor is selected by the MPU)
  - Four Mailboxes for interprocessor communications
  - Up to 14 General-Purpose I/O pins with interrupt capability to either processor
  - Three UARTs (UART3 has SIR mode for IrDA functionality)
- Clock/Reset/Power Management modules
  - Configurable Digital Phase-Locked Loop (DPLL) providing clocks to MPU, DSP, and TC
  - Dedicated DPLL with a 12 MHz input clock, or dedicated APLL with a 13 MHz input clock providing clocking to USB peripherals
  - Integrated base (12- or 13-MHz) and 32-kHz oscillators utilizing external crystals
  - Reset, clocking and idle/sleep controls for power management
- JTAG and ETM9 interfaces for emulation and debug

## 3.2 MPU Memory Maps

### 3.2.1 MPU Global Memory Map

The MPU has a unified address space. Therefore, the internal and external memories for program and data as well as peripheral registers and configuration registers are all accessed within the same address space. The MPU space is always addressed using byte addressing. Table 3–1 provides a high level illustration of the entire MPU addressable space. Further detail regarding the peripheral and configuration registers is provided in Sections 3.2.2, 3.15, and 3.17.

**Table 3–1. OMAP5910 MPU Global Memory Map**

| BYTE ADDRESS RANGE         | ON-CHIP                                                       | EXTERNAL INTERFACE             |
|----------------------------|---------------------------------------------------------------|--------------------------------|
| 0x0000 0000 – 0x01FF FFFF  |                                                               | EMIFS (Flash CS0)<br>32M bytes |
| 0x0200 0000 – 0x03FF FFFF  | Reserved                                                      |                                |
| 0x0400 0000 – 0x05FF FFFF  |                                                               | EMIFS (Flash CS1)<br>32M bytes |
| 0x0600 0000 – 0x07FF FFFF  | Reserved                                                      |                                |
| 0x0800 0000 – 0x09FF FFFF  |                                                               | EMIFS (Flash CS2)<br>32M bytes |
| 0x0A00 0000 – 0x0BFF FFFF  | Reserved                                                      |                                |
| 0x0C00 0000 – 0x0DFF FFFF  |                                                               | EMIFS (Flash CS3)<br>32M bytes |
| 0x0E00 0000 – 0x0FFF FFFF  | Reserved                                                      |                                |
| 0x1000 0000 – 0x13FF FFFF  |                                                               | EMIFF (SDRAM)<br>64M bytes     |
| 0x1400 0000 – 0x1FFF FFFF  | Reserved                                                      |                                |
| 0x2000 0000 – 0x2002 FFFF  | IMIF Internal SRAM<br>192K bytes                              |                                |
| 0x2003 0000 – 0x2FFF FFFF  | Reserved                                                      |                                |
| 0x3000 0000 – 0x5FFF FFFF  | Local Bus space for USB Host                                  |                                |
| 0x6000 0000 – 0xDFFF FFFF  | Reserved                                                      |                                |
| 0xE000 0000 – 0xE0FF FFFF  | DSP public memory space<br>(accessible via MPUI)<br>16M bytes |                                |
| 0xE100 0000 – 0xEFFF FFFF  | DSP public peripherals<br>(accessible via MPUI)               |                                |
| 0xF000 0000 – 0xFFFF FFFF  | Reserved                                                      |                                |
| 0xFFFFB 0000 – 0xFFFF FFFF | MPU public peripherals <sup>†</sup>                           |                                |
| 0xFFFFC 0000 – 0xFFFF FFFF | MPU/DSP shared peripherals                                    |                                |
| 0xFFFFD 0000 – 0xFFFF FFFF | MPU private peripherals                                       |                                |
| 0xFFFFF 0000 – 0xFFFF FFFF | Reserved                                                      |                                |

<sup>†</sup> Some peripherals within this memory region are actually shared peripherals (UART 1,2,3).

### 3.2.2 MPU Subsystem Registers Memory Map

The MPU accesses peripheral and configuration registers in the same way that internal and external memory is accessed. The following tables specify the MPU base addresses where each set of registers is accessed. All accesses to these registers must utilize the appropriate access width (8-, 16-, or 32-bit-wide accesses) as indicated in the tables. Accessing registers with the incorrect access width cause unexpected results including a TI Peripheral Bus (TIPB) bus error and associated TIPB interrupt.

Refer to Sections 3.15, 3.16, and 3.17 for more detail about each of these register sets including individual register addresses, register names, descriptions, supported access types (read, write or read/write) and reset values.

**Table 3–2. MPU Private Peripheral Registers**

| MPU BASE ADDRESS | REGISTER SET                            | ACCESS WIDTH |
|------------------|-----------------------------------------|--------------|
| 0xFFFE 0000      | MPU Level 2 Interrupt Handler Registers | 32           |
| 0xFFFE C000      | LCD Controller Registers                | 32           |
| 0xFFFE C500      | MPU Timer1 Registers                    | 32           |
| 0xFFFE C600      | MPU Timer2 Registers                    | 32           |
| 0xFFFE C700      | MPU Timer3 Registers                    | 32           |
| 0xFFFE C800      | MPU Watchdog Timer Registers            | 32           |
| 0xFFFE CB00      | MPU Level 1 Interrupt Handler Registers | 32           |
| 0xFFFE D800      | System DMA Controller Registers         | 16           |

**Table 3–3. MPU Public Peripheral Registers**

| MPU BASE ADDRESS | REGISTER SET                             | ACCESS WIDTH |
|------------------|------------------------------------------|--------------|
| 0xFFFB 1000      | McBSP2 Registers                         | 16           |
| 0xFFFB 3000      | MICROWIRE Registers                      | 16           |
| 0xFFFB 3800      | I <sup>2</sup> C Registers               | 16           |
| 0xFFFB 4000      | USB Function Registers                   | 16           |
| 0xFFFB 4800      | RTC Registers                            | 8            |
| 0xFFFB 5000      | MPUIO/Keyboard Registers                 | 16           |
| 0xFFFB 5800      | Pulse Width Light (PWL) Registers        | 8            |
| 0xFFFB 6000      | Pulse Width Tone (PWT) Registers         | 8            |
| 0xFFFB 6800      | Camera Interface Registers               | 32           |
| 0xFFFB 7800      | MMC/SD Registers                         | 16           |
| 0xFFFB 9000      | Timer 32k Registers                      | 32           |
| 0xFFFB A000      | USB Host Registers                       | 32           |
| 0xFFFB A800      | Frame Adjustment Counter (FAC) Registers | 16           |
| 0xFFFB C000      | HDQ/1-Wire Registers                     | 8            |
| 0xFFFB D000      | LED Pulse Generator 1 (LPG1) Registers   | 8            |
| 0xFFFB D800      | LED Pulse Generator 2 (LPG2) Registers   | 8            |

**Table 3–4. MPU/DSP Shared Peripheral Registers**

| MPU BASE ADDRESS | REGISTER SET             | ACCESS WIDTH |
|------------------|--------------------------|--------------|
| 0xFFFB 0000      | UART1 Registers          | 8            |
| 0xFFFB 0800      | UART2 Registers          | 8            |
| 0xFFFB 9800      | UART3 Registers          | 8            |
| 0xFFFC E000      | GPIO Interface Registers | 16           |
| 0xFFFC F000      | Mailbox Registers        | 16           |

**Table 3–5. DSP Public Peripheral Registers (Accessible via MPUI Port)**

| MPU BASE ADDRESS | REGISTER SET     | ACCESS WIDTH |
|------------------|------------------|--------------|
| 0xE101 1800      | McBSP1 Registers | 16           |
| 0xE101 2000      | MCSI2 Registers  | 16           |
| 0xE101 2800      | MCSI1 Registers  | 16           |
| 0xE101 7000      | McBSP3 Registers | 16           |

**Table 3–6. MPU Configuration Registers**

| MPU BASE ADDRESS | REGISTER SET                                    | ACCESS WIDTH |
|------------------|-------------------------------------------------|--------------|
| 0xFFFB C800      | MPU UART TIPB Bus Switch Registers              | 16           |
| 0xFFFE 0800      | Ultra Low-Power Device (ULPD) Registers         | 16           |
| 0xFFFE 1000      | OMAP5910 Configuration Registers                | 32           |
| 0xFFFE 1800      | Device Die Identification Registers             | 32           |
| 0xFFFE C100      | Local Bus Control Registers                     | 32           |
| 0xFFFE C200      | Local Bus MMU Registers                         | 32           |
| 0xFFFE C900      | MPU Interface (MPUI) Registers                  | 32           |
| 0xFFFE CA00      | TIPB (Private) Bridge 1 Configuration Registers | 32           |
| 0xFFFE CC00      | Traffic Controller Registers                    | 32           |
| 0xFFFE CE00      | MPU Clock/Reset/Power Control Registers         | 32           |
| 0xFFFE CF00      | DPLL1 Configuration Registers                   | 32           |
| 0xFFFE D200      | DSP MMU Registers                               | 32           |
| 0xFFFE D300      | TIPB (Public) Bridge 2 Configuration Registers  | 16           |
| 0xFFFE D400      | JTAG Identification Registers                   | 32           |

### 3.3 DSP Memory Maps

The DSP supports a unified program/data memory map (program and data accesses are made to the same physical space), however peripheral registers are located in a separate I/O space which is accessed via the DSP's port instructions.

#### 3.3.1 DSP Global Memory Map

The DSP Subsystem contains 160K bytes of on-chip SRAM (64K bytes of DARAM and 96K bytes of SARAM). The MPU also has access to these memories via the MPUI (MPU Interface) port. The DSP also has access to the shared system SRAM (192K bytes) and both EMIF spaces (EMIFF and EMIFS) via the DSP Memory Management Unit (MMU) which is configured by the MPU.

Table 3–7 shows the high-level program/data memory map for the DSP subsystem. DSP data accesses utilize 16-bit word addresses while DSP program fetches utilize byte addressing.

**Table 3–7. DSP Global Memory Map**

| BYTE ADDRESS RANGE    | WORD ADDRESS RANGE    | INTERNAL MEMORY      | EXTERNAL MEMORY <sup>†</sup>      |
|-----------------------|-----------------------|----------------------|-----------------------------------|
| 0x00 0000 – 0x00 FFFF | 0x00 0000 – 0x00 7FFF | DARAM<br>64K bytes   |                                   |
| 0x01 0000 – 0x02 7FFF | 0x00 8000 – 0x01 3FFF | SARAM<br>96K bytes   |                                   |
| 0x02 8000 – 0x04 FFFF | 0x01 4000 – 0x02 7FFF | Reserved             |                                   |
| 0x05 0000 – 0xFF 7FFF | 0x02 8000 – 0x7F BFFF |                      | Managed by DSP MMU                |
| 0xFF 8000 – 0xFF FFFF | 0x7F C000 – 0x7F FFFF | PDRAM<br>(MPNMC = 0) | Managed by DSP MMU<br>(MPNMC = 1) |

<sup>†</sup> This space could be external memory or internal shared system memory depending on the DSP MMU configuration.

### 3.3.2 On-Chip Dual-Access RAM (DARAM)

The DARAM is located in the byte address range 000000h–00FFFFh and is composed of eight blocks of 8K bytes each (see Table 3–8). Each DARAM block can perform two accesses per cycle (two reads, two writes, or a read and a write).

**Table 3–8. DARAM Blocks**

| BYTE ADDRESS RANGE    | WORD ADDRESS RANGE    | MEMORY BLOCK |
|-----------------------|-----------------------|--------------|
| 0x00 0000 – 0x00 1FFF | 0x00 0000 – 0x00 0FFF | DARAM 0      |
| 0x00 2000 – 0x00 3FFF | 0x00 1000 – 0x001FFF  | DARAM 1      |
| 0x00 4000 – 0x00 5FFF | 0x00 2000 – 0x00 2FFF | DARAM 2      |
| 0x00 6000 – 0x00 7FFF | 0x00 3000 – 0x00 3FFF | DARAM 3      |
| 0x00 8000 – 0x00 9FFF | 0x00 4000 – 0x00 4FFF | DARAM 4      |
| 0x00 A000 – 0x00 BFFF | 0x00 5000 – 0x00 5FFF | DARAM 5      |
| 0x00 C000 – 0x00 DFFF | 0x00 6000 – 0x00 6FFF | DARAM 6      |
| 0x00 E000 – 0x00 FFFF | 0x00 7000 – 0x00 7FFF | DARAM 7      |

### 3.3.3 On-Chip Single-Access RAM (SARAM)

The SARAM is located at the byte address range 010000h–03FFFFh and is composed of 12 blocks of 8K bytes each (see Table 3–9). Each SARAM block can perform one access per cycle (one read or one write).

**Table 3–9. SARAM Blocks**

| BYTE ADDRESS RANGE    | WORD ADDRESS RANGE    | MEMORY BLOCK |
|-----------------------|-----------------------|--------------|
| 0x01 0000 – 0x01 1FFF | 0x00 8000 – 0x00 8FFF | SARAM 0      |
| 0x01 2000 – 0x01 3FFF | 0x00 9000 – 0x00 9FFF | SARAM 1      |
| 0x01 4000 – 0x01 5FFF | 0x00 A000 – 0x00 AFFF | SARAM 2      |
| 0x01 6000 – 0x01 7FFF | 0x00 B000 – 0x00 BFFF | SARAM 3      |
| 0x01 8000 – 0x01 9FFF | 0x00 C000 – 0x00 CFFF | SARAM 4      |
| 0x01 A000 – 0x01 BFFF | 0x00 D000 – 0x00 DFFF | SARAM 5      |
| 0x01 C000 – 0x01 DFFF | 0x00 E000 – 0x00 EFFF | SARAM 6      |
| 0x01 E000 – 0x01 FFFF | 0x00 F000 – 0x00 FFFF | SARAM 7      |
| 0x02 0000 – 0x02 1FFF | 0x01 0000 – 0x01 0FFF | SARAM 8      |
| 0x02 2000 – 0x02 3FFF | 0x01 1000 – 0x01 1FFF | SARAM 9      |
| 0x02 4000 – 0x02 5FFF | 0x01 2000 – 0x01 2FFF | SARAM 10     |
| 0x02 6000 – 0x02 7FFF | 0x01 3000 – 0x01 3FFF | SARAM 11     |

### 3.3.4 DSP I/O Space Memory Map

The DSP I/O space is a separate address space from the data/program memory space. The I/O space is accessed via the DSP's port instructions. The Public and Shared peripheral registers are also accessible by the MPU through the MPUI (MPU Interface) port. The DSP I/O space is accessed using 16-bit word addresses. The following tables specify the DSP base addresses where each set of registers is accessed. All accesses to these registers must utilize the appropriate access width as indicated in the tables. Accessing registers with the incorrect access width may cause unexpected results including a TI Peripheral Bus (TIPB) bus error and associated TIPB interrupt.

Refer to Sections 3.16 and 3.17 for more detail about each of these register sets including individual register addresses, register names, descriptions, supported access types (read, write or read/write) and reset values.

**Table 3–10. DSP Private Peripheral Registers**

| DSP BASE ADDRESS | REGISTER SET                       | ACCESS WIDTH |
|------------------|------------------------------------|--------------|
| 0x00 0C00        | DSP DMA Controller Registers       | 16           |
| 0x00 2800        | DSP Timer1 Registers               | 16           |
| 0x00 2C00        | DSP Timer2 Registers               | 16           |
| 0x00 3000        | DSP Timer3 Registers               | 16           |
| 0x00 3400        | DSP Watchdog Timer Registers       | 16           |
| 0x00 3800        | DSP Interrupt Interface Registers  | 16           |
| 0x00 4800        | Level2 Interrupt Handler Registers | 16           |

**Table 3–11. DSP Public Peripheral Registers**

| DSP BASE ADDRESS | REGISTER SET     | ACCESS WIDTH |
|------------------|------------------|--------------|
| 0x00 8C00        | McBSP1 Registers | 16           |
| 0x00 9000        | MCS12 Registers  | 16           |
| 0x00 9400        | MCS11 Registers  | 16           |
| 0x00 B800        | McBSP3 Registers | 16           |

**Table 3–12. DSP/MPU Shared Peripheral Registers**

| DSP BASE ADDRESS | REGISTER SET             | ACCESS WIDTH |
|------------------|--------------------------|--------------|
| 0x00 8000        | UART1 Registers          | 8            |
| 0x00 8400        | UART2 Registers          | 8            |
| 0x00 CC00        | UART3 Registers          | 8            |
| 0x00 F000        | GPIO Interface Registers | 16           |
| 0x00 F800        | Mailbox Registers        | 16           |

**Table 3–13. DSP Configuration Registers**

| DSP BASE ADDRESS | REGISTER SET                            | ACCESS WIDTH |
|------------------|-----------------------------------------|--------------|
| 0x00 0000        | DSP TIPB Bridge Configuration Registers | 16           |
| 0x00 0800        | DSP EMIF Configuration Registers        | 16           |
| 0x00 1400        | DSP I-Cache Registers                   | 16           |
| 0x00 4000        | DSP Clock Mode Registers                | 16           |
| 0x00 E400        | DSP UART TIPB Bus Switch Registers      | 16           |

### 3.4 DSP External Memory (Managed by MMU)

When the DSP MMU is off, the 24 address lines are directly copied to the traffic controller without any modification. There is no virtual-to-physical address translation. All the addresses between 0x05 0000 and 0x00FF F800 (0x00FF FFFF if DSP bit MP/MC = 1) are redirected to the first sector of flash (CS0) in the shared memory space (shared by MPU and DSP).

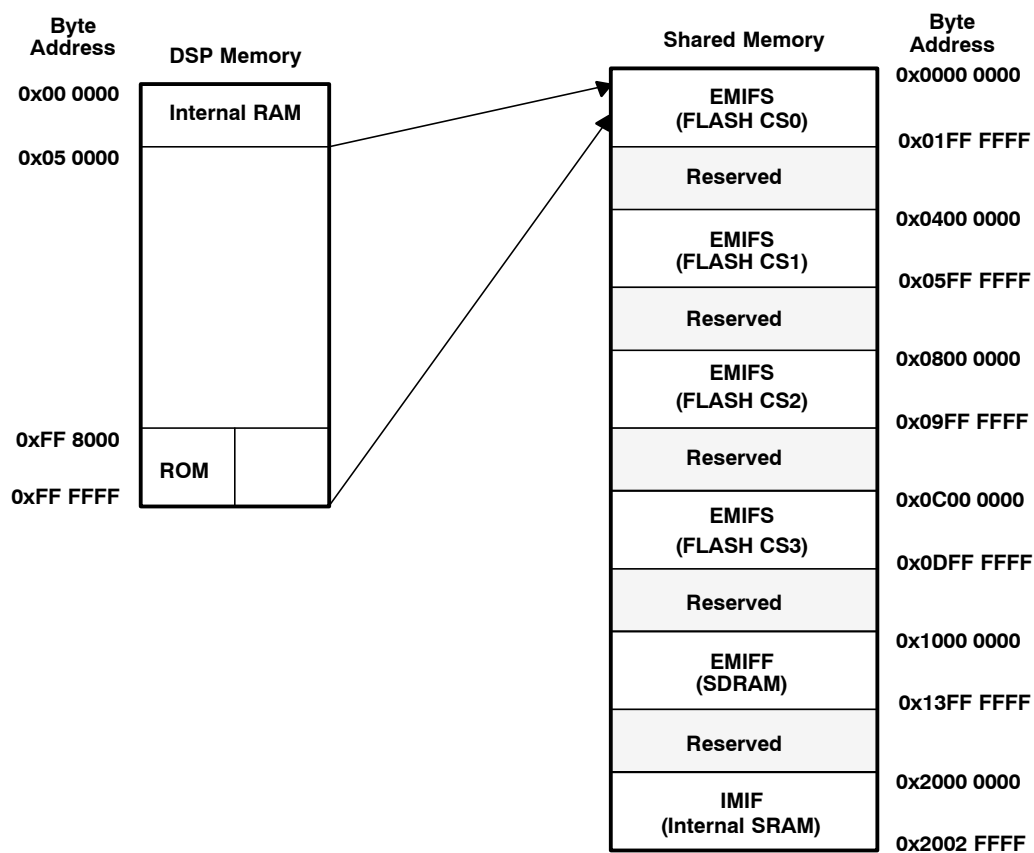


Figure 3–2. DSP MMU Off

When the DSP MMU is on, the 24 address lines (virtual address) are relocated within a physical 32-bit address by the DSP MMU. The DSP MMU is controlled by the MPU.

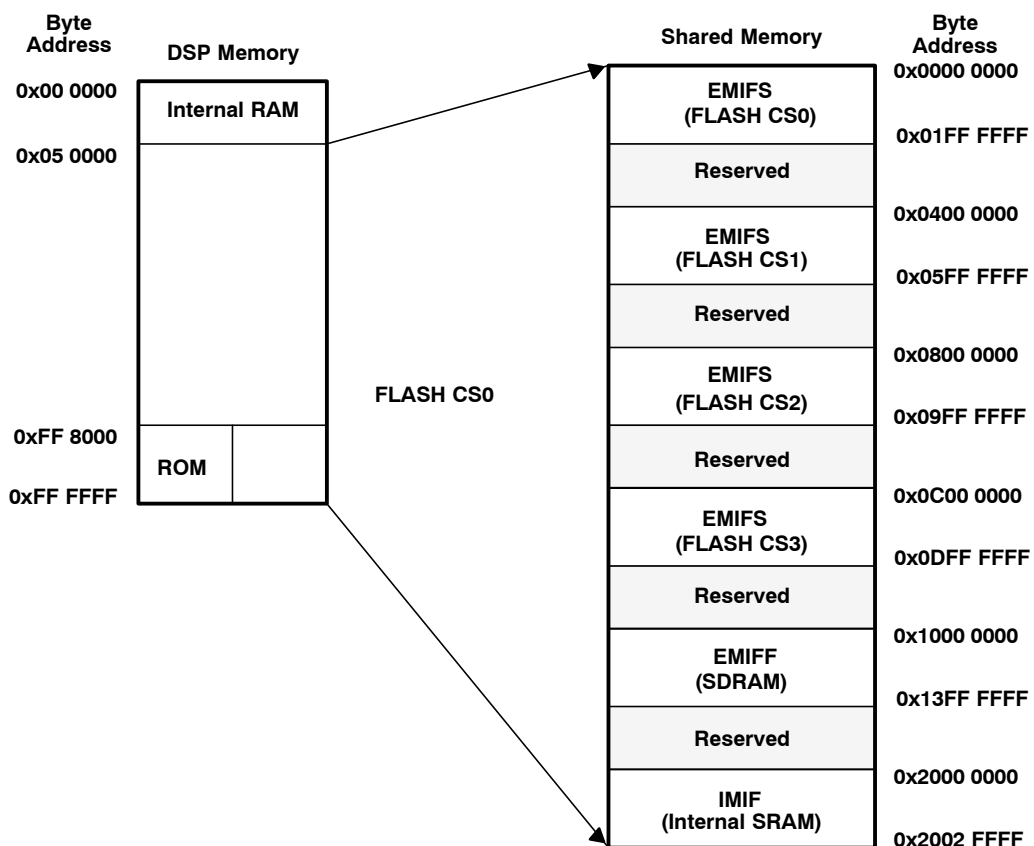


Figure 3-3. DSP MMU On

## 3.5 MPU and DSP Private Peripherals

The MPU and DSP each have their own separate private peripheral bus. Peripherals on each of these private buses may only be accessed by their respective processors. For instance, the DSP timers on the DSP private peripheral bus are not accessible by the MPU or the System DMA controller.

### 3.5.1 Timers

The MPU and DSP each have their own three 32-bit timers available on their respective private TI Peripheral Bus (TIPB). These timers are used by the operating systems to provide general-purpose housekeeping functions, or in the case of the DSP, to also provide synchronization of real-time processing functions. These timers may be configured either in auto-reload or one-shot mode with on-the-fly read capability. The timers generate an interrupt to the respective processor (MPU or DSP) when the timer's down-counter is equal to zero.

### 3.5.2 32k Timer (MPU only)

The MPU has one 32k Timer that runs on the 32-kHz clock as opposed to the MPU subsystem domain clock.

The MPU subsystem operating system (OS) requires interrupts at regular time intervals for OS scheduling purpose (typically 1 ms to 30 ms). These time intervals can be generated using the MPU's three 32-bit general-purpose timers. However, these timers cannot be used in sleep modes when the system clock is not operating. Therefore, a 32-kHz clock-based timer is needed to provide the required OS timing interval.

### 3.5.3 Watchdog Timer

The MPU and DSP each have a single Watchdog Timer. Each watchdog timer can be configured as either a watchdog timer or a general-purpose timer.

A watchdog timer requires that the MPU or DSP software or OS periodically write to the appropriate WDT count register before the counter underflows. If the counter underflows, the WDT generates a reset to the appropriate processor (MPU or DSP). The DSP WDT resets only the DSP processor while the MPU WDT resets both processors (MPU and DSP). The watchdog timers are useful for detecting user programs that are stuck in an infinite loop, resulting in loss of program control or in a runaway condition.

When used as a general-purpose timer, the WDT is a 16-bit timer configurable either in autoreload or one-shot mode with on-the-fly read capability. The timer generates an interrupt to the respective processor (MPU or DSP) when the timer's down-counter is equal to zero.

### 3.5.4 Interrupt Handlers

The MPU and DSP each have two levels of interrupt handling, allowing up to 39 interrupts to the DSP and 63 interrupts to the MPU.

### 3.5.5 LCD Controller

The OMAP5910 device includes an LCD Controller that interfaces with most industry-standard LCDs. The LCD Controller is configured by the MPU and utilizes a dedicated channel on the System DMA to transfer data from the frame buffer. The frame buffer can be implemented using the internal shared SRAM (192K bytes) or optionally using external SDRAM via the EMIF. Using the frame buffer as its data source, the System DMA must provide data to the FIFO at the front end of the LCD controller data path at a rate sufficient to support the chosen display mode and resolution. Optimal performance is achieved when using the internal SRAM as the frame buffer.

The panel size is programmable, and can be any width (line length) from 16 to 1024 pixels in 16-pixel increments. The number of lines is set by programming the total number of pixels in the LCD. The total frame size is programmable up to 1024 x 1024. However, frame sizes and frame rates supported in specific applications will depend upon the available memory bandwidth allowed by the specific application as well as the maximum configurable pixel clock rate.

The screen is intended to be mapped to the frame buffer as one contiguous block where each horizontal line of pixels is mapped to a set of consecutive bytes of words in the frame memory.

The principle features of the LCD controller are:

- Dedicated 64-entry x 16-bit FIFO
- Dedicated LCD DMA channel for LCD
- Programmable display including support for 2-, 4-, 8-, 12-, and 16-bit graphics modes
- Programmable display resolutions up to 1024 pixels by 1024 lines (assuming sufficient system bandwidth)
- Support for passive monochrome (STN) displays
- Support for passive color (STN) displays
- Support for active color (TFT) displays
- Patented dithering algorithm, providing:
  - 15 grayscale levels for monochrome passive displays
  - 3375 colors for color passive displays
  - 65536 colors for active color displays
  - 256-entry x 12-bit palette
- Programmable pixel rate
- Pixel clock plus horizontal and vertical synchronization signals
- ac-bias drive signal
- Active display enable signal
- 256-entry x 12-bit palette
- Dual-frame buffers

## 3.6 MPU Public Peripherals

Peripherals on the MPU Public Peripheral bus may only be accessed by the MPU and the System DMA Controller, which is configured by the MPU. This bus is called a public bus because it is accessible by the System DMA controller. The DSP cannot access peripherals on this bus.

### 3.6.1 USB Host Controller

The OMAP5910 USB host controller communicates with USB devices at the USB low-speed (1.5M-bit/s maximum) and full-speed (12M-bit/s maximum) data rates. The controller is USB compliant. For additional information, see the *Universal Serial Bus Specification, Revision 2.0* and the *OpenHCI – Open Host Controller Interface Specification for USB, Release 1.0a*, hereafter called the OHCI Specification for USB.

The OMAP5910 USB host controller implements the register set and makes use of the memory data structures which are defined in the OHCI Specification for USB. These registers and data structures are the mechanism by which a USB host controller driver software package may control the OMAP5910 USB host controller.

The USB host controller is connected to the MPU public peripheral bus for MPU access to registers. The USB host controller gains access to the data structures in system memory via the internal Local Bus interface. The OMAP5910 device implements a variety of signal multiplexing options that allows use of the USB host controller with any of the three available USB interfaces on the device. One of these interfaces utilizes an integrated USB transceiver, while the other two require external transceivers. The host controller can support up to three downstream ports.

The OMAP5910 USB host controller implementation does not implement every aspect of the functionality defined in the OHCI Specification for USB. The differences focus on power switching, overcurrent reporting, and the OHCI ownership change interrupt. Other restrictions are imposed by OMAP5910 system memory addressing mechanisms and the effects of the OMAP5910 pin-multiplexing options.

### 3.6.2 USB Function Peripheral

The USB Function peripheral provides a full-speed Function interface between the MPU and the USB wire. The module handles USB transactions with minimal MPU intervention and is fully compliant to USB standard.

The USB Function module supports one control endpoint (EP0), up to 15 IN endpoints, and up to 15 OUT endpoints. The exact endpoint configuration is software-programmable. The specific items of a configuration for each endpoint are: the size in bytes, the direction (IN, OUT), the type (bulk/interrupt or isochronous), and the associated endpoint number. The USB Function module also supports the use of three System DMA channels for IN endpoints and three System DMA channels for OUT endpoints for either bulk/interrupt or isochronous transactions.

The OMAP5910 device implements a variety of signal-multiplexing options that allow use of the USB Function peripheral with any one of the three available USB interfaces on the device. One of these interfaces utilizes an integrated USB transceiver, while the other two require external transceivers. The USB Function can only utilize one of these ports at a time. The other ports may be used simultaneously by the USB Host controller peripheral.

### 3.6.3 Multichannel Buffered Serial Port (McBSP)

The Multichannel Buffered Serial Port (McBSP) provides a high-speed, full-duplex serial port that allow direct interface to audio codecs, and various other system devices. The MPU public peripheral bus has access to one McBSP, which is McBSP2.

The McBSP provides:

- Full-duplex communication
- Double-buffer data registers, which allow a continuous data stream
- Independent framing and clocking for receive and transmit

In addition, the McBSP has the following capabilities:

- Direct interface to:
  - T1/E1 framers
  - MVIP switching-compatible and ST-BUS compliant devices
  - IOM-2 compliant device
  - AC97-compliant device
  - I2S-compliant device
  - Serial peripheral interface (SPI)
- Multichannel transmit and receive of up to 128 channels
- A wide selection of data sizes, including: 8, 12, 16, 20, 24, or 32 bits
- $\mu$ -law and A-law companding
- Programmable polarity for both frame synchronization and data clocks
- Programmable internal clock and frame generation

**NOTE:** All of the standard McBSP pins are not necessarily available on every McBSP on the OMAP5910 device.

In the case of the MPU's McBSP2, the following pins are available:

- CLKX and CLKR (transmit and receive clocks)
- FSX and FSR (transmit and receive frame syncs)
- DX and RX (transmit and receive data)

The functional clock to the McBSP2 peripheral is configurable to the DPLL clock rate with a divider of 1, 2, 4, or 8.

McBSP2 does not have a CLKS external clock reference pin. Therefore, if the McBSP2 Sample Rate Generator (SRG) is used, the only reference clock available to the Sample Rate Generator is a programmable clock from the MPU domain.

### 3.6.4 I<sup>2</sup>C Master/Slave Interface

The I<sup>2</sup>C Master/Slave Interface is compliant to Philips *I<sup>2</sup>C-Bus Specification Version 2.1* master bus. The I<sup>2</sup>C controller supports the multimaster mode, which allows more than one device capable of controlling the bus to be connected to it. Including the OMAP5910 device, each I<sup>2</sup>C device is recognized by a unique address and can operate as either transmitter or receiver, depending on the function of the device. In addition to being a transmitter or receiver, a device connected to the I<sup>2</sup>C bus™ can also be considered as master or slave when performing data transfers.

The I<sup>2</sup>C Interface supports the following features:

- Compliant to Philips *I<sup>2</sup>C-Bus Specification Version 2.1*
- Support standard mode (up to 100K bits/s) and Fast mode (up to 400K bits/s)
- 7-bit and 10-bit device addressing modes
- General call
- Start/Restart/Stop
- Multimaster transmitter/slave receiver mode
- Multimaster receiver/slave transmitter mode
- Combined master transmit/receive and receive/transmit mode
- Built-in FIFO for buffered read or write
- Module enable/disable capability
- Programmable clock generation
- Supports use of two DMA channels

The I<sup>2</sup>C Interface does not support the following features:

- High-speed (HS) mode for transfer rates up to 3.4M bits
- C-bus compatibility mode

### 3.6.5 MICROWIRE Serial Interface

The MICROWIRE interface is a serial synchronous interface that can drive up to four serial external components. The interface is compatible with the MICROWIRE standard and is seen as the master.

MICROWIRE is typically used to transmit control and status information to external peripheral devices or to transmit data to or from small nonvolatile memories such as serial EEPROMs or serial Flash devices.

### 3.6.6 Multimedia Card/Secure Digital (MMC/SD) Interface

The MMC/SD Interface controller provides an interface to MMC or SD memory cards. The controller handles MMC/SD transactions with minimal MPU intervention, allowing optional use of two system DMA channels for transfer of data.

The following combination of external devices is supported:

- One or more MMC memory cards sharing the same bus.
- One single SD memory card.

**NOTE:** Other combinations such as two SD cards or one MMC card with one SD card are not supported.

The MPU software must manage transaction semantics, while the MMC/SD controller deals with MMC/SD protocol at the transmission level: packing data, adding the CRC, generating the start/end bit and checking for syntactical correctness. SD mode wide bus width is also supported.

### 3.6.7 HDQ/1-Wire Interface

This module allows implementation of both HDQ and the 1-Wire protocols. These protocols use a single wire to communicate between a master and a slave. The HDQ/1-Wire pin is open-drain and requires an external pullup resistor.

HDQ and 1-Wire interfaces can be found on commercially available battery management and power management devices. The interface can be used to send command and status information between OMAP5910 and such a battery or power management device.

### 3.6.8 Camera Interface

The camera interface is an 8-bit external port which may be used to accept data from an external camera sensor. The interface handles multiple image formats synchronized on vertical and horizontal synchronization signals. Data transfer to the camera interface may be done synchronously or asynchronously.

The camera interface module converts the 8-bit data transfers into 32-bit words and utilizes a 128-word buffer to facilitate efficient data transfer to memory. Data may be transferred from the camera interface buffer to internal memory by the system DMA controller or directly by the MPU. The interface may utilize an externally driven clock at rates up to 13 MHz or may optionally provide an output reference clock at rates of 8 MHz, 9.6 MHz, or 24 MHz when the camera interface is configured for clocking from the internal 48 MHz. When the camera interface is configured to obtain clocking from the base oscillator frequency (12 MHz or 13 MHz), the camera interface clock is configurable to operate at the base frequency or one half the base frequency (6 MHz or 6.5 MHz).

### 3.6.9 MPUIO/Keyboard Interface

The MPUIO pins may be used as either general-purpose I/O for the MPU or as a Keyboard Interface to a 6 x 5 or 8 x 8 keypad array. If a 6 x 5 keypad array is implemented, the unused MPUIO pins may be used as GPIO. When used as GPIO, each pin may be configured individually as either an output or an input, and they may be individually configured to generate MPU interrupts based on a level change (falling or rising) after a debouncing process. These MPUIO interrupts may be used to wake up the device from deep-sleep mode using the 32-kHz clock.

The MPUIO pins may also be used as a keyboard interface. The keyboard interface provides the following pins:

- KB.R[7:0] input pins for row lines
- KB.C[7:0] output pins for column lines

To allow key-press detection, all input pins (KB.Rx) are pulled up to  $DV_{DD}$  and all output pins (KB.Cx) are driven low level. The KB.R[7:0] and KB.C[7:0] pins should be connected to an external keyboard matrix such that when a key on the matrix is pressed, the corresponding row and column lines are shorted together. Any action on a key generates an interrupt to the MPU, which then scans the column lines in a particular sequence to determine which key or keys have been pressed.

### 3.6.10 Pulse-Width Light (PWL)

The Pulse-Width Light (PWL) module provides control of the LCD or keypad backlighting by employing a random sequence generator. This voltage-level control technique decreases the spectral power at the modulator harmonic frequencies. The module uses a switchable 32-kHz clock.

### 3.6.11 Pulse-Width Tone (PWT)

The Pulse-Width Tone (PWT) module generates a modulated frequency signal for use with an external buzzer. The frequency is programmable between 349 Hz and 5276 Hz with 12 half-tone frequencies per octave. The volume level of the output is also programmable.

### 3.6.12 LED Pulse Generator

There are two separate LED Pulse Generator (LPG) modules. Each LPG module provides an output for an indication LED. The blinking period is programmable between 152 ms and 4 s or the LED can be switched on or off permanently.

### 3.6.13 Real-Time Clock

The Real-Time Clock (RTC) module provides an embedded RTC for use in applications which need to track real time. This peripheral is not an ultra-low-power module—meaning that the RTC module cannot be powered independently without powering the OMAP5910 MPU core. Therefore, if an ultra-low-power RTC is desired for a system application, an external RTC should be used.

The RTC module has the following features:

- Time information (seconds/minutes/hours) directly in BCD code
- Calendar information (day/month/year/day of the week) directly in BCD code up to year 2099
- Interrupts generation, periodically (1s/1m/1h/1d period) or at a precise time of the day (alarm function)
- 30-s time correction
- Oscillator frequency calibration

### 3.6.14 Frame Adjustment Counter

The frame adjustment counter (FAC) is a simple peripheral that counts the number of rising edges of one signal (start of frame interrupt of the USB Function) during a programmable number of rising edges of a second signal (transmit frame synchronization of McBSP2). The FAC may only be used with these specific USB Function and McBSP2 signals. The count value can be used by system-level software to adjust the duration of the two time domains with respect to each other to reduce overflow and underflow. If the data being transferred is audio data, this module can be part of a solution that reduces pops and clicks. The FAC module generates one second-level interrupt to the MPU.

## 3.7 DSP Public Peripherals

Peripherals on the DSP Public Peripheral bus are directly accessible by the DSP and DSP DMA. These peripherals may also be accessed by the MPU and System DMA Controller via the MPUI interface. The MPUI interface must be properly configured to allow this access.

### 3.7.1 Multichannel Buffered Serial Port (McBSP)

The Multichannel Buffered Serial Port (McBSP) provides a high-speed, full-duplex serial port that allow direct interface to audio codecs and various other system devices. Refer to Section 3.6.3 for a list of features provided by the McBSP. The DSP public peripheral bus has access to two McBSPs: McBSP1 and McBSP3.

**NOTE:** All of the standard McBSP pins are not necessarily available on every McBSP on the OMAP5910 device. In the case of the two DSP McBSPs, the following pins are available:

- McBSP1 pins:
  - CLKX (transmit clock)
  - FSX (transmit frame sync)
  - DX and DR (transmit and receive data)
  - CLKS (external reference to Sample Rate Generator)
- McBSP3 pins:
  - CLKX (transmit clock)
  - FSX (transmit frame sync)
  - DX and DR (transmit and receive data)

Because McBSP1 and McBSP3 do not have the CLKR and FSR pins available, the transmit clock and frame sync pins (CLKX and FSX) must be used for bit clock and frame synchronization on both the transmit and receive channels of these McBSPs.

The functional clock to McBSP1 and McBSP3 is fixed at the OMAP5910 base operating frequency (12 MHz or 13 MHz). The bit-clock rate for these McBSPs is therefore limited to 6 or 6.5 MHz (one half the base frequency).

Only McBSP1 has the CLKS pin available. If the sample rate generator (SRG) is used on McBSP1, the reference clock to the SRG can be configured to be either an external reference provided on the CLKS pin, or the internal base (12- or 13-MHz) device clock. However, if the SRG is used on McBSP3, the only reference clock available to this SRG is the base device clock as clock reference.

### 3.7.2 Multichannel Serial Interface (MCSI)

The multichannel serial interface (MCSI) provides flexible serial interface with multichannel transmission capability. The MCSI allows the DSP to access a variety of external devices, such as audio codecs and other types of analog converters. The DSP public peripheral bus has access to two MCSIs: MCSI1 and MCSI2. These MCSIs provide full-duplex transmission and master or slave clock control. All transmission parameters are configurable to cover the maximum number of operating conditions. The MCSIs have the following features:

- Master or slave clock control (transmission clock and frame synchronization pulse)
- Programmable transmission clock frequency (master mode) up to one half the OMAP5910 base frequency (12 or 13 MHz)
- Reception clock frequency (slave mode) of up to the base frequency (12 or 13 MHz)
- Single-channel or multichannel (x16) frame structure
- Programmable word length: 3 to 16 bits
- Full-duplex transmission
- Programmable frame configuration
- Continuous or burst transmission
- Normal or alternate framing
- Normal or inverted frame and clock polarities
- Short or long frame pulse
- Programmable oversize frame length
- Programmable frame length
- Programmable interrupt occurrence time (TX and RX)
- Error detection with interrupt generation on wrong frame length
- System DMA support for both TX and RX data transfers

## 3.8 Shared Peripherals

The shared peripherals are connected to both the MPU Public Peripheral bus and the DSP Public Peripheral bus. In the case of the UARTs, these connections are achieved via a TI Peripheral Bus Switch, which must be configured to allow MPU or DSP access to the UARTs. The other shared peripherals have permanent connections to both public peripheral buses, although read and write accesses to each peripheral register may differ.

### 3.8.1 Universal Asynchronous Receiver/Transmitter (UART)

The OMAP5910 device has three Universal Asynchronous Receiver/Transmitter (UART) peripherals which are accessible on the DSP public and MPU public peripheral buses. A TI peripheral bus switch configured by the MPU allows either TIPB access to these UART peripherals. All three UARTs are standard 16C750-compatible UARTs implementing an asynchronous transfer protocol with various flow control options. Two of the three UARTs (UART1 and UART2) have autobaud capability to automatically determine and adjust to the baud rate of the external connected device. One of the UARTs (UART3) can function as a general UART or can optionally function as an IrDA interface.

The main features of the UART peripherals include:

- Selectable UART/autobaud modes (autobauding on UART1 and UART2) with autobauding between 1200 bits/s and 115.2K bits/s
- Dual 64-entry FIFOs for received and transmitted data payload
- Programmable and selectable transmit and receive FIFO trigger levels for DMA and interrupt generation
- Programmable sleep mode
- Complete status-reporting capabilities in both normal and sleep mode
- Frequency prescaler values from 0 to 65535 to generate the appropriate baud rates
- Interrupt request generated if multiple System DMA requests
- Baud rate from 300 bits/s up to 1.5M bits/s
- Software/hardware flow control
- Programmable XON/XOFF characters
- Programmable auto-RTS and auto-CTS
- Programmable serial interface characteristics
  - 5-, 6-, 7-, or 8-bit characters
  - Even-, odd-, or no-parity bit generation and detection
  - 1, 1.5, or 2 stop-bit generation
  - False start bit detection
  - Line break generation and detection
  - Fully prioritized interrupt system controls
  - Internal test and loopback capabilities
  - Modem control functions (CTS, RTS, DSR, DTR)

**NOTE:** DSR and DTR are only available on UART1 and UART3.

The IrDA functions available on UART3 are as follows:

- Slow infrared (SIR) operations
- Framing error, cyclic redundancy check (CRC) error, abort pattern (SIR) detection
- 8-entry status FIFO (with selectable trigger levels) available to monitor frame length and frame errors

### **3.8.2 General-Purpose I/O (GPIO)**

There are up to 14 shared GPIO pins on the OMAP5910 device which may be accessed and controlled by either the DSP public peripheral bus or the MPU public peripheral bus. Each GPIO pin is independently configurable to be used by either the DSP or MPU. The MPU controls which processor owns each GPIO pin by configuring a pin control register that only the MPU can access.

Each GPIO pin can be used as either an input or output pin with GPIO inputs being synchronized internally to a peripheral clock. GPIO inputs may also optionally be configured to generate an interrupt condition to the processor which owns the GPIO pin. The sense of the interrupt condition is configurable such that either a high-to-low or low-to-high transition causes the interrupt condition.

Some of the GPIO pins are multiplexed with other interface pins specific to other device peripherals. Refer to Table 2–3 to decide which GPIO pins are multiplexed with other peripheral signals.

### **3.8.3 Mailbox Registers**

Four sets of shared mailbox registers are available for communication between the DSP and MPU. These registers are discussed further in Section 3.12, Interprocessor Communication.

### 3.9 System DMA Controller

The System Direct Memory Access (DMA) controller transfers data between points in the memory space without intervention by the MPU. The System DMA allows movements of data to and from internal memory, external memory, and peripherals to occur in the background of MPU operation. It is designed to off-load the block data transfer function from the MPU processor. The System DMA is configured by the MPU via the MPU private peripheral bus.

The System DMA controller has nine independent general-purpose channels and seven ports that it may transfer to/from. An additional tenth channel is dedicated for use with the LCD controller. Of the seven available ports, the DMA transfers may occur between any two ports with the exception of the LCD port, which may only be used as a destination with the EMIFF or IMIF as the source. For maximum transfer efficiency, all nine channels are independent. This means that if multiple channels are exclusively accessing different ports, then simultaneous transfers performed by the channels will occur uninhibited. If the multiple channels are accessing common ports, however, some arbitration cycles will be necessary. Arbitration occurs in a round-robin fashion with configurable priority for each channel (high or low).

The basic functional features of the system DMA controller are as follows:

- Nine general-purpose and one dedicated (LCD) DMA channels
- Round-robin arbitration scheme with programmable priorities
- Concurrent DMA transfer capability
- Start of transfer on peripheral request or host request
- Byte-alignment and Byte-packing/unpacking capability
- Burst transfer capability (IMIF, EMIFF, EMIFS, LCD, and Local ports)
- Time-out counter for each DMA channel to prevent a channel locking on a memory location or peripheral.
- Constant, post-incrementing, and Single- or Double-Indexed addressing modes
- Autoinitialization for multiple block transfers without MPU intervention
- Access available to all of the memory range (physical memory mapping and TIPB space)
- Seven ports are available for different kinds of hardware resources.
  - EMIFS port (allowing access to external asynchronous memory or devices)
  - EMIFF port (allowing access to external SDRAM)
  - IMIF port (allowing access to 192K bytes of shared SRAM)
  - MPUI port (allowing access to DSP memory and peripherals)
  - TIPB port (allowing peripheral register access)
  - Local port (used for Host USB only)
  - LCD port (allowing transfers to the LCD controller)
- Memory-to-memory transfer granularity of 8, 16, and 32 bits.

### 3.10 DSP DMA Controller

The DSP subsystem has its own dedicated DMA Controller, which is entirely independent of the MPU or the System DMA Controller. The DSP DMA Controller has many of the same major features that the System DMA Controller possesses (see Section 3.9).

The DSP DMA Controller has six generic channels and five physical ports available for source or destination data. These five ports are the SARAM port, DARAM port, EMIF (External memory port), DSP TIPB port, and MPUI port. The DSP may configure the DSP DMA Controller to transfer data between the SARAM, DARAM, EMIF, and TIPB ports, but the MPUI port is a dedicated port used for MPU or System DMA initiated transfers to DSP subsystem resources. The SARAM and DARAM ports are used to access local DSP memories and the TIPB port is used to access the registers of the DSP peripherals. The EMIF port of the DSP DMA controller is used to access the Traffic Controller via the DSP MMU (Memory Management Unit).

### 3.11 Traffic Controller (Memory Interfaces)

The Traffic Controller (TC) manages all accesses by the MPU, DSP, System DMA, and Local Bus to the OMAP5910 system memory resources. The TC provides access to three different memory interfaces: External Memory Interface Slow (EMIFS), External Memory Interface Fast (EMIFF), and Internal Memory Interface (IMIF). The IMIF allows access to the 192K bytes of on-chip SRAM.

The EMIFS interface provides 16-bit-wide access to asynchronous or synchronous memories or devices such as Intel StraFlash<sup>TM</sup> memory (28FxxxJ3A, Static Byte Enable) and Asynchronous SRAMs.

The EMIFF Interface provides access to 16-bit-wide access to standard SDRAM memories and the IMIF provides access to the 192K bytes of on-chip SRAM.

The TC provides the functions of arbitrating contending accesses to the same memory interface from different initiators (MPU, DSP, System DMA, Local Bus), synchronization of accesses due to the initiators and the memory interfaces running at different clock rates, and the buffering of data allowing burst access for more efficient multiplexing of transfers from multiple initiators to the memory interfaces.

The TC's architecture allows simultaneous transfers between initiators and different memory interfaces without penalty. For instance, if the MPU is accessing the EMIFF at the same time, the DSP is accessing the IMIF, transfers may occur simultaneously since there is no contention for resources. There are three separate ports to the TC from the System DMA (one for each of the memory interfaces), allowing for greater bandwidth capability between the System DMA and the TC.

## 3.12 Interprocessor Communication

Several mechanisms allow for communication between the MPU and the DSP on the OMAP5910 device. These include mailbox registers, MPU Interface, and shared memory space.

### 3.12.1 MPU/DSP Mailbox Registers

The MPU and DSP processors may communicate with each other via a mailbox-interrupt mechanism. This mechanism provides a very flexible software protocol between the processors. There are four sets of mailbox registers located in public TIPB space. The registers are shared between the two processors, so the MPU and DSP may both access these registers within their own public TIPB space, but read/write accessibility of each register is different for each processor.

There are four sets of mailbox registers: two for the MPU to send messages and issue an interrupt to the DSP, the other two for the DSP to send messages and issue an interrupt to the MPU. Each set of mailbox registers consists of two 16-bit registers and a 1-bit flag register. The interrupting processor can use one 16-bit register to pass a data word to the interrupted processor and the other 16-bit register to pass a command word.

Communication is achieved when one processor writes to the appropriate command word register which causes an interrupt to the other processor and sets the appropriate flag register. The interrupted processor acknowledges by reading the command word which causes the flag register to be cleared. An additional data-word register is also available in each mailbox register set to optionally communicate two words of data between the processors for each interrupt instead of just communicating the command word.

The information communicated by the command and data words are entirely user-defined. The data word may be optionally used to indicate an address pointer or status word.

### 3.12.2 MPU Interface (MPUI)

The MPU interface (MPUI) allows the MPU and the system DMA controller to communicate with the DSP and its peripherals. The MPUI allows access to the full memory space (16M bytes) of the DSP and the DSP public peripheral bus. Thus, the MPU and System DMA Controller both have read and write access to the complete DSP I/O space (128K bytes), including the control registers of the DSP public peripherals.

The MPUI port supports the following features:

- Four access modes:
  - Shared-access mode (SAM) for MPU access of DSP SARAM, DARAM, and external memory interface
  - Shared-access mode (SAM) for peripheral bus access
  - Host-only mode (HOM) for SARAM access
  - Host-only mode (HOM) for peripheral bus access
- Interrupt to MPU if access time-out occurs
- Programmable priority scheme (MPU vs. DMA)
- Packing and unpacking of data (16 bits to 32 bits, and vice versa)
- 32-bit single access support
- Software control endianness conversion
- System DMA capability to full DSP memory space (16M bytes)
- System DMA capability to the DSP public TIPB peripherals (up to 128K bytes space)

This port can be used for many functions, such as: MPU loading of program code into DSP program memory space, sharing of data between MPU and DSP, implementing interprocessing communication protocols via shared memory, or allowing MPU to use and control DSP Public TIPB Peripherals.

### **3.12.3 MPU/DSP Shared Memory**

The OMAP5910 device implements a shared memory architecture via the Traffic Controller. Therefore, the MPU and DSP both have access to the same shared SRAM memory (192K bytes) as well as to the EMIFF and EMIFS memory space. Through the DSP Memory Management Unit (MMU), the MPU controls which regions of shared memory space the DSP is allowed to access. By setting up regions of shared memory, and defining a protocol for the MPU and DSP to access this shared memory, an interprocessor communication mechanism may be implemented. This method may be used in conjunction with the mailbox registers to create handshaking interrupts which will properly synchronize the MPU and DSP accesses to shared memory. Utilizing the shared memory in this fashion may be useful when the desired data to be passed between the MPU and DSP is larger than the two 16-bit words provided by each set of mailbox command and data registers.

For example, the MPU may need to provide the DSP with a list of pointers to perform a specific task as opposed to a single command and single pointer. Using shared memory and the mailboxes, the DSP could read the list of pointers from shared memory after receiving the interrupt caused by an MPU write to the mailbox command register.

### **3.13 DSP Hardware Accelerators**

The TMS320C55x DSP core within the OMAP5910 device utilizes three powerful hardware accelerator modules which assist the DSP core in implementing specific algorithms that are commonly used in video compression applications such as MPEG4 encoders/decoders. These accelerators allow implementation of such algorithms using fewer DSP instruction cycles and dissipating less power than implementations using only the DSP core. The hardware accelerators are utilized via functions from the TMS320C55x Image/Video Processing Library available from Texas Instruments.

Utilizing the hardware accelerators, the Texas Instruments Image/Video Processing Library implements many useful functions, which include the following:

- Forward and Inverse Discrete Cosine Transform (DCT) (used for video compression/decompression)
- Motion Estimation (used for compression standards such as MPEG video encoding and H.26x encoding)
- Pixel Interpolation (enabling high-performance fractal-pixel motion estimation)
- Flexible 1D/2D Wavelet Processing (useful for JPEG2000, MPEG4, and other compression standards)

#### **3.13.1 DCT/iDCT Accelerator**

The DCT/iDCT hardware accelerator is used to implement Forward and Inverse DCT (Discrete Cosine Transform) algorithms. These DCT/iDCT algorithms can be used to implement a wide range of video compression standards including JPEG Encode/Decode, MPEG Video Encode/Decode, and H.26x Encode/Decode.

#### **3.13.2 Motion Estimation Accelerator**

The Motion Estimation hardware accelerator implements a high-performance motion estimation algorithm, enabling MPEG Video encoder or H.26x encoder applications. Motion estimation is typically one of the most computation-intensive operations in video-encoding systems.

#### **3.13.3 Pixel Interpolation Accelerator**

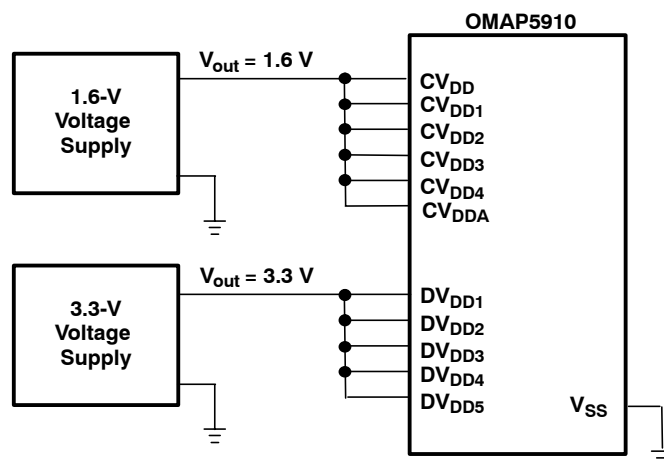
The Pixel Interpolation Accelerator enables high-performance pixel-interpolation algorithms, which allows for powerful fractal pixel motion estimation when used in conjunction with the Motion Estimation accelerator. Such algorithms provide significant improvement to video-encoding applications.

### **3.14 Power Supply Connection Examples**

#### **3.14.1 Core and I/O Voltage Supply Connections**

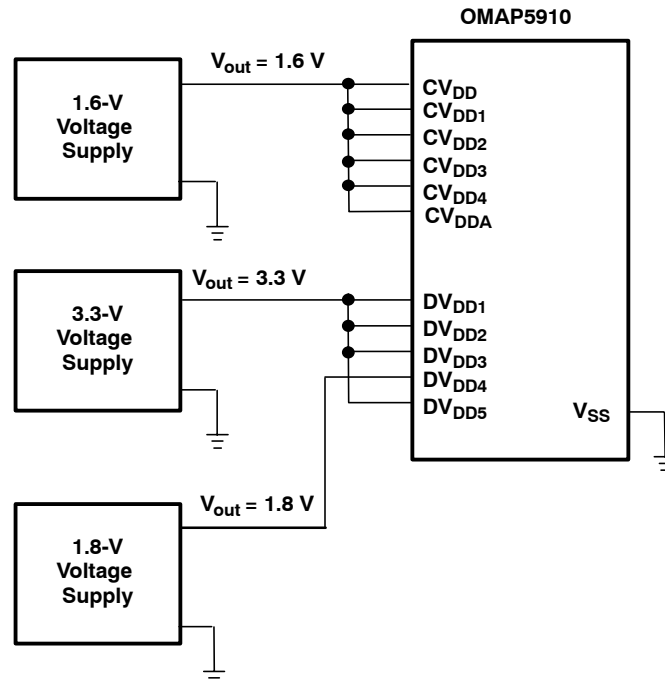
The OMAP5910 device is extremely flexible regarding the implementation of the core and I/O voltage supplies of the device.

In a typical system, all of the core voltage supplies ( $CV_{DDx}$ ) may be connected together and powered from one common supply. Likewise, all of the I/O voltage supplies ( $DV_{DDx}$ ) may be connected together and powered from a common supply. Figure 3–4 illustrates this common system configuration.



**Figure 3–4. Supply Connections for a Typical System**

Several of the I/O voltage supplies ( $DV_{DD3}$ ,  $DV_{DD4}$  and  $DV_{DD5}$ ) are capable of operating at lower voltages (1.8 V nominal) while the other I/O supplies run at 3.3 V nominal. This is advantageous for systems which mix standard 3.3-V devices with low voltage memory devices or other low voltage logic. Refer to Table 2–4 to determine which I/O pins are powered by each of the  $DV_{DDx}$  supplies. Figure 3–5 illustrates an example of this type of mixed voltage system configuration.



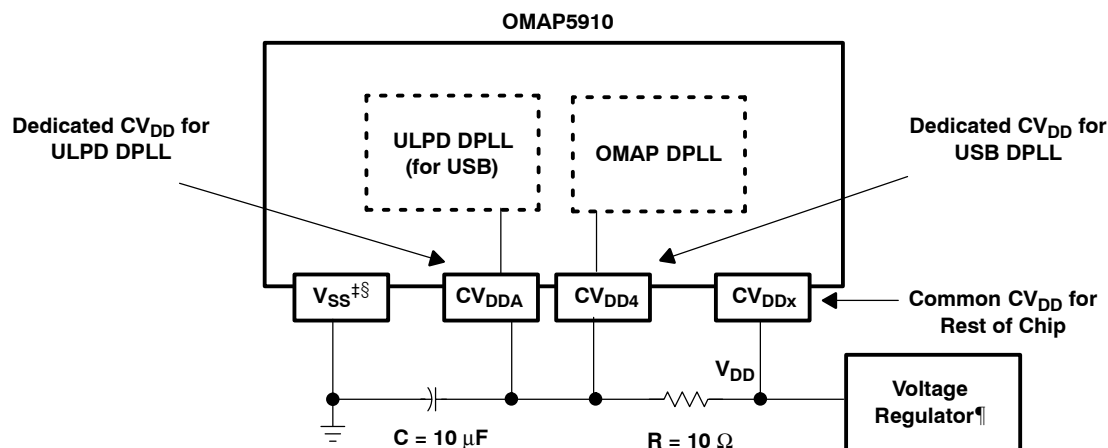
**Figure 3–5. Supply Connections for a System With 1.8-V SDRAM**

In the previous two examples, all CV<sub>DDx</sub> pins are connected in common. However, the OMAP5910 device has dedicated CV<sub>DD</sub> pins which supply power to different sections of the chip (as described in Table 2–4, Signal Descriptions). This feature could be useful in prototyping phases to troubleshoot power management features and perform advanced power. By isolating each CV<sub>DDx</sub> bus from the power source through isolation jumpers or current sense resistors, the current draw into different domains may be measured separately. This type of supply isolation should only be done during prototyping as production system designs should connect all the CV<sub>DDx</sub> pins together, preferably to a common board plane.

**NOTE:** There is no specific power sequencing for the different voltage supplies as long as all CV<sub>DDx</sub> and DV<sub>DDx</sub> voltages are ramped to valid operating levels within 500 ms of one another. Additionally, if certain I/O pins are unused in a specific system application, the DV<sub>DDx</sub> supply pins which power these I/O must still be connected to valid operating voltage levels. See Section 5.2, *Recommended Operating Conditions*, for complete voltage requirements on all CV<sub>DDx</sub> and DV<sub>DDx</sub> power supply pins.

### 3.14.2 Core Voltage Noise Isolation

Two of the CV<sub>DD</sub> pins on the OMAP5910 device, CV<sub>DDA</sub> and CV<sub>DD4</sub>, are dedicated to supply power for the ULPD DPLL and OMAP DPLL, respectively. In addition to using sound board design principles, these dedicated pins allow for added supply noise isolation circuitry to enable maximum performance from the OMAP5910 DPLLs. An example circuit is shown in Figure 3–6.



<sup>†</sup> This circuit is provided only as an example. Specific board layout implementation must minimize noise on the OMAP5910 voltage supply pins.

<sup>‡</sup> Except where stated otherwise in this document, all VSS pins on the OMAP5910 are common and must be connected directly to a common ground; however, the discrete capacitor in the RC filter circuit should be placed as close as possible to the VSS (GZG balls AA1/Y3 or GDY balls E13/K9).

<sup>§</sup> For special consideration with respect to the connection of VSS (GZG ball V12 or GDY ball F6), refer to Section 5.6.1, *32-kHz Oscillator and Input Clock*.

<sup>¶</sup> The voltage regulator must be selected to provide a voltage source with minimal low frequency noise.

**Figure 3-6. External RC Circuit for DPLL CVDD Noise Isolation<sup>†</sup>**

### 3.15 MPU Register Descriptions

The following tables describe the MPU registers including register addresses, descriptions, required access widths, access types (R = read, W = write, RW = read/write) and reset values. These tables are organized by function with like peripherals or functions together and are therefore not necessarily in the order of ascending register addresses.

**NOTE:** All accesses to these registers must be of the data access widths indicated to avoid a TIPB bus error condition and a corresponding interrupt. Reserved addresses should never be accessed.

### 3.15.1 MPU Private Peripheral Registers

The MPU private peripheral registers include the following:

- Timers
  - MPU Timer 1 Register
  - MPU Timer 2 Registers
  - MPU Timer 3 Registers
  - MPU Watchdog Timer Registers
- Interrupt Handlers
  - MPU Level 1 Interrupt Handler Registers
  - MPU Level 2 Interrupt Handler Registers
- System Peripherals
  - System DMA Controller Registers
  - LCD Controller Registers

**Table 3–14. MPU Timer 1 Registers**

| BYTE ADDRESS | REGISTER NAME    | DESCRIPTION                        | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|------------------|------------------------------------|--------------|-------------|-------------|
| FFFE:C500    | MPU_CNTL_TIMER_1 | MPU Timer 1 Control Timer Register | 32           | RW          | 0000 0000h  |
| FFFE:C504    | MPU_LOAD_TIM_1   | MPU Timer 1 Load Timer Register    | 32           | W           | undef       |
| FFFE:C508    | MPU_READ_TIM_1   | MPU Timer 1 Read Timer Register    | 32           | R           | undef       |

**Table 3–15. MPU Timer 2 Registers**

| BYTE ADDRESS | REGISTER NAME    | DESCRIPTION                        | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|------------------|------------------------------------|--------------|-------------|-------------|
| FFFE:C600    | MPU_CNTL_TIMER_2 | MPU Timer 2 Control Timer Register | 32           | RW          | 0000 0000h  |
| FFFE:C604    | MPU_LOAD_TIM_2   | MPU Timer 2 Load Timer Register    | 32           | W           | undef       |
| FFFE:C608    | MPU_READ_TIM_2   | MPU Timer 2 Read Timer Register    | 32           | R           | undef       |

**Table 3–16. MPU Timer 3 Registers**

| BYTE ADDRESS | REGISTER NAME    | DESCRIPTION                        | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|------------------|------------------------------------|--------------|-------------|-------------|
| FFFE:C700    | MPU_CNTL_TIMER_3 | MPU Timer 3 Control Timer Register | 32           | RW          | 0000 0000h  |
| FFFE:C704    | MPU_LOAD_TIM_3   | MPU Timer 3 Load Timer Register    | 32           | W           | undef       |
| FFFE:C708    | MPU_READ_TIM_3   | MPU Timer 3 Read Timer Register    | 32           | R           | undef       |

**Table 3–17. MPU Watchdog Timer Registers**

| BYTE ADDRESS | REGISTER NAME     | DESCRIPTION                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|-------------------|--------------------------------|--------------|-------------|-------------|
| FFFE:C800    | MPU_CNTL_TIMER_WD | MPU WDT Control Timer Register | 16           | RW          | 0002h       |
| FFFE:C804    | MPU_LOAD_TIM_WD   | MPU WDT Load Timer Register    | 16           | W           | FFFFh       |
| FFFE:C804    | MPU_READ_TIM_WD   | MPU WDT Read Timer Register    | 16           | R           | FFFFh       |
| FFFE:C808    | MPU_TIMER_MODE_WD | MPU WDT Timer Mode Register    | 16           | RW          | 8000h       |

**Table 3–18. MPU Level 1 Interrupt Handler Registers**

| BYTE ADDRESS          | REGISTER NAME       | DESCRIPTION                           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|---------------------|---------------------------------------|--------------|-------------|-------------|
| FFFE:CB00             | MPU_L1_ITR          | Interrupt Register                    | 32           | RW          | 0000 0000h  |
| FFFE:CB04             | MPU_L1_MIR          | Mask Interrupt Register               | 32           | RW          | FFFF FFFFh  |
| FFFE:CB08 – FFFE:CB0C |                     | Reserved                              |              |             |             |
| FFFE:CB10             | MPU_L1_SIR_IRQ_CODE | IRQ Interrupt Encoded Source Register | 32           | R           | 0000 0000h  |
| FFFE:CB14             | MPU_L1_SIR_FIQ_CODE | FIQ Interrupt Encoded Source Register | 32           | R           | 0000 0000h  |
| FFFE:CB18             | MPU_L1_CONTROL_REG  | Interrupt Control Register            | 32           | RW          | 0000 0000h  |
| FFFE:CB1C             | MPU_L1_ILR0         | Interrupt 0 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB20             | MPU_L1_ILR1         | Interrupt 1 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB24             | MPU_L1_ILR2         | Interrupt 2 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB28             | MPU_L1_ILR3         | Interrupt 3 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB2C             | MPU_L1_ILR4         | Interrupt 4 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB30             | MPU_L1_ILR5         | Interrupt 5 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB34             | MPU_L1_ILR6         | Interrupt 6 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB38             | MPU_L1_ILR7         | Interrupt 7 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB3C             | MPU_L1_ILR8         | Interrupt 8 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB40             | MPU_L1_ILR9         | Interrupt 9 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:CB44             | MPU_L1_ILR10        | Interrupt 10 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB48             | MPU_L1_ILR11        | Interrupt 11 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB4C             | MPU_L1_ILR12        | Interrupt 12 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB50             | MPU_L1_ILR13        | Interrupt 13 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB54             | MPU_L1_ILR14        | Interrupt 14 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB58             | MPU_L1_ILR15        | Interrupt 15 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB5C             | MPU_L1_ILR16        | Interrupt 16 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB60             | MPU_L1_ILR17        | Interrupt 17 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB64             | MPU_L1_ILR18        | Interrupt 18 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB68             | MPU_L1_ILR19        | Interrupt 19 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB6C             | MPU_L1_ILR20        | Interrupt 20 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB70             | MPU_L1_ILR21        | Interrupt 21 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB74             | MPU_L1_ILR22        | Interrupt 22 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB78             | MPU_L1_ILR23        | Interrupt 23 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB7C             | MPU_L1_ILR24        | Interrupt 24 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB80             | MPU_L1_ILR25        | Interrupt 25 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB84             | MPU_L1_ILR26        | Interrupt 26 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB88             | MPU_L1_ILR27        | Interrupt 27 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB8C             | MPU_L1_ILR28        | Interrupt 28 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB90             | MPU_L1_ILR29        | Interrupt 29 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB94             | MPU_L1_ILR30        | Interrupt 30 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB98             | MPU_L1_ILR31        | Interrupt 31 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:CB9C             | MPU_L1_ISR          | Software Interrupt Set Register       | 32           | RW          | 0000 0000h  |

**Table 3–19. MPU Level 2 Interrupt Handler Registers**

| BYTE ADDRESS          | REGISTER NAME       | DESCRIPTION                           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|---------------------|---------------------------------------|--------------|-------------|-------------|
| FFFE:0000             | MPU_L2_ITR          | Interrupt Register                    | 32           | RW          | 0000 0000h  |
| FFFE:0004             | MPU_L2_MIR          | Mask Interrupt Register               | 32           | RW          | FFFF FFFFh  |
| FFFE:0008 – FFFE:000C |                     | Reserved                              |              |             |             |
| FFFE:0010             | MPU_L2_SIR_IRQ_CODE | IRQ Interrupt Encoded Source Register | 32           | R           | 0000 0000h  |
| FFFE:0014             | MPU_L2_SIR_FIQ_CODE | FIQ Interrupt Encoded Source Register | 32           | R           | 0000 0000h  |
| FFFE:0018             | MPU_L2_CONTROL_REG  | Interrupt Control Register            | 32           | RW          | 0000 0000h  |
| FFFE:001C             | MPU_L2_ILR0         | Interrupt 0 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0020             | MPU_L2_ILR1         | Interrupt 1 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0024             | MPU_L2_ILR2         | Interrupt 2 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0028             | MPU_L2_ILR3         | Interrupt 3 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:002C             | MPU_L2_ILR4         | Interrupt 4 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0030             | MPU_L2_ILR5         | Interrupt 5 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0034             | MPU_L2_ILR6         | Interrupt 6 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0038             | MPU_L2_ILR7         | Interrupt 7 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:003C             | MPU_L2_ILR8         | Interrupt 8 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0040             | MPU_L2_ILR9         | Interrupt 9 Priority Level Register   | 32           | RW          | 0000 0000h  |
| FFFE:0044             | MPU_L2_ILR10        | Interrupt 10 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0048             | MPU_L2_ILR11        | Interrupt 11 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:004C             | MPU_L2_ILR12        | Interrupt 12 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0050             | MPU_L2_ILR13        | Interrupt 13 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0054             | MPU_L2_ILR14        | Interrupt 14 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0058             | MPU_L2_ILR15        | Interrupt 15 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:005C             | MPU_L2_ILR16        | Interrupt 16 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0060             | MPU_L2_ILR17        | Interrupt 17 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0064             | MPU_L2_ILR18        | Interrupt 18 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0068             | MPU_L2_ILR19        | Interrupt 19 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:006C             | MPU_L2_ILR20        | Interrupt 20 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0070             | MPU_L2_ILR21        | Interrupt 21 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0074             | MPU_L2_ILR22        | Interrupt 22 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0078             | MPU_L2_ILR23        | Interrupt 23 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:007C             | MPU_L2_ILR24        | Interrupt 24 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0080             | MPU_L2_ILR25        | Interrupt 25 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0084             | MPU_L2_ILR26        | Interrupt 26 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0088             | MPU_L2_ILR27        | Interrupt 27 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:008C             | MPU_L2_ILR28        | Interrupt 28 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0090             | MPU_L2_ILR29        | Interrupt 29 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0094             | MPU_L2_ILR30        | Interrupt 30 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:0098             | MPU_L2_ILR31        | Interrupt 31 Priority Level Register  | 32           | RW          | 0000 0000h  |
| FFFE:009C             | MPU_L2_ISR          | Software Interrupt Set Register       | 32           | RW          | 0000 0000h  |

Table 3–20. System DMA Controller Registers

| BYTE ADDRESS          | REGISTER NAME      | DESCRIPTION                                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|--------------------|--------------------------------------------------|--------------|-------------|-------------|
| FFFE:D800             | SYS_DMA_CSDP_CH0   | Channel 0 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D802             | SYS_DMA_CCR_CH0    | Channel 0 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D804             | SYS_DMA_CICR_CH0   | Channel 0 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D806             | SYS_DMA_CSR_CH0    | Channel 0 Status Register                        | 16           | R           | 0000h       |
| FFFE:D808             | SYS_DMA_CSSA_L_CH0 | Channel 0 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D80A             | SYS_DMA_CSSA_U_CH0 | Channel 0 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D80C             | SYS_DMA_CDSA_L_CH0 | Channel 0 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D80E             | SYS_DMA_CDSA_U_CH0 | Channel 0 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D810             | SYS_DMA_CEN_CH0    | Channel 0 Element Number Register                | 16           | RW          | undef       |
| FFFE:D812             | SYS_DMA_CFN_CH0    | Channel 0 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D814             | SYS_DMA_CFI_CH0    | Channel 0 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D816             | SYS_DMA_CEI_CH0    | Channel 0 Element Index Register                 | 16           | RW          | undef       |
| FFFE:D818             | SYS_DMA_CPC_CH0    | Channel 0 Progress Counter Register              | 16           | RW          | undef       |
| FFFE:D81A – FFFE:083E |                    | Reserved                                         |              |             |             |
| FFFE:D840             | SYS_DMA_CSDP_CH1   | Channel 1 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D842             | SYS_DMA_CCR_CH1    | Channel 1 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D844             | SYS_DMA_CICR_CH1   | Channel 1 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D846             | SYS_DMA_CSR_CH1    | Channel 1 Status Register                        | 16           | R           | 0000h       |
| FFFE:D848             | SYS_DMA_CSSA_L_CH1 | Channel 1 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D84A             | SYS_DMA_CSSA_U_CH1 | Channel 1 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D84C             | SYS_DMA_CDSA_L_CH1 | Channel 1 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D84E             | SYS_DMA_CDSA_U_CH1 | Channel 1 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D850             | SYS_DMA_CEN_CH1    | Channel 1 Element Number Register                | 16           | RW          | undef       |
| FFFE:D852             | SYS_DMA_CFN_CH1    | Channel 1 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D854             | SYS_DMA_CFI_CH1    | Channel 1 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D856             | SYS_DMA_CEI_CH1    | Channel 1 Element Index Register                 | 16           | RW          | undef       |
| FFFE:D858             | SYS_DMA_CPC_CH1    | Channel 1 Progress Counter Register              | 16           | RW          | undef       |
| FFFE:D85A – FFFE:D87E |                    | Reserved                                         |              |             |             |
| FFFE:D880             | SYS_DMA_CSDP_CH2   | Channel 2 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D882             | SYS_DMA_CCR_CH2    | Channel 2 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D884             | SYS_DMA_CICR_CH2   | Channel 2 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D886             | SYS_DMA_CSR_CH2    | Channel 2 Status Register                        | 16           | R           | 0000h       |
| FFFE:D888             | SYS_DMA_CSSA_L_CH2 | Channel 2 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D88A             | SYS_DMA_CSSA_U_CH2 | Channel 2 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D88C             | SYS_DMA_CDSA_L_CH2 | Channel 2 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D88E             | SYS_DMA_CDSA_U_CH2 | Channel 2 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D890             | SYS_DMA_CEN_CH2    | Channel 2 Element Number Register                | 16           | RW          | undef       |
| FFFE:D892             | SYS_DMA_CFN_CH2    | Channel 2 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D894             | SYS_DMA_CFI_CH2    | Channel 2 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D896             | SYS_DMA_CEI_CH2    | Channel 2 Element Index Register                 | 16           | RW          | undef       |
| FFFE:D898             | SYS_DMA_CPC_CH2    | Channel 2 Progress Counter Register              | 16           | RW          | undef       |

Table 3–20. System DMA Controller Registers (Continued)

| BYTE ADDRESS          | REGISTER NAME      | DESCRIPTION                                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|--------------------|--------------------------------------------------|--------------|-------------|-------------|
| FFFE:D89A – FFFE:D8BE |                    | Reserved                                         |              |             |             |
| FFFE:D8C0             | SYS_DMA_CSDP_CH3   | Channel 3 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D8C2             | SYS_DMA_CCR_CH3    | Channel 3 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D8C4             | SYS_DMA_CICR_CH3   | Channel 3 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D8C6             | SYS_DMA_CSR_CH3    | Channel 3 Status Register                        | 16           | R           | 0000h       |
| FFFE:D8C8             | SYS_DMA_CSSA_L_CH3 | Channel 3 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D8CA             | SYS_DMA_CSSA_U_CH3 | Channel 3 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D8CC             | SYS_DMA_CDSA_L_CH3 | Channel 3 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D8CE             | SYS_DMA_CDSA_U_CH3 | Channel 3 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D8D0             | SYS_DMA_CEN_CH3    | Channel 3 Element Number Register                | 16           | RW          | undef       |
| FFFE:D8D2             | SYS_DMA_CFN_CH3    | Channel 3 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D8D4             | SYS_DMA_CFI_CH3    | Channel 3 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D8D6             | SYS_DMA_CEI_CH3    | Channel 3 Element Index Register                 | 16           | RW          | undef       |
| FFFE:D8D8             | SYS_DMA_CPC_CH3    | Channel 3 Progress Counter Register              | 16           | RW          | undef       |
| FFFE:D8DA – FFFE:D8FE |                    | Reserved                                         |              |             |             |
| FFFE:D900             | SYS_DMA_CSDP_CH4   | Channel 4 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D902             | SYS_DMA_CCR_CH4    | Channel 4 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D904             | SYS_DMA_CICR_CH4   | Channel 4 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D906             | SYS_DMA_CSR_CH4    | Channel 4 Status Register                        | 16           | R           | 0000h       |
| FFFE:D908             | SYS_DMA_CSSA_L_CH4 | Channel 4 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D90A             | SYS_DMA_CSSA_U_CH4 | Channel 4 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D90C             | SYS_DMA_CDSA_L_CH4 | Channel 4 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D90E             | SYS_DMA_CDSA_U_CH4 | Channel 4 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D910             | SYS_DMA_CEN_CH4    | Channel 4 Element Number Register                | 16           | RW          | undef       |
| FFFE:D912             | SYS_DMA_CFN_CH4    | Channel 4 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D914             | SYS_DMA_CFI_CH4    | Channel 4 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D916             | SYS_DMA_CEI_CH4    | Channel 4 Element Index Register                 | 16           | RW          | undef       |
| FFFE:D918             | SYS_DMA_CPC_CH4    | Channel 4 Progress Counter Register              | 16           | RW          | undef       |
| FFFE:D91A – FFFE:D93E |                    | Reserved                                         |              |             |             |
| FFFE:D940             | SYS_DMA_CSDP_CH5   | Channel 5 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D942             | SYS_DMA_CCR_CH5    | Channel 5 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D944             | SYS_DMA_CICR_CH5   | Channel 5 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D946             | SYS_DMA_CSR_CH5    | Channel 5 Status Register                        | 16           | R           | 0000h       |
| FFFE:D948             | SYS_DMA_CSSA_L_CH5 | Channel 5 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D94A             | SYS_DMA_CSSA_U_CH5 | Channel 5 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D94C             | SYS_DMA_CDSA_L_CH5 | Channel 5 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D94E             | SYS_DMA_CDSA_U_CH5 | Channel 5 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D950             | SYS_DMA_CEN_CH5    | Channel 5 Element Number Register                | 16           | RW          | undef       |
| FFFE:D952             | SYS_DMA_CFN_CH5    | Channel 5 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D954             | SYS_DMA_CFI_CH5    | Channel 5 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D956             | SYS_DMA_CEI_CH5    | Channel 5 Element Index Register                 | 16           | RW          | undef       |

**Table 3–20. System DMA Controller Registers (Continued)**

| BYTE ADDRESS          | REGISTER NAME      | DESCRIPTION                                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|--------------------|--------------------------------------------------|--------------|-------------|-------------|
| FFFE:D958             | SYS_DMA_CPC_CH5    | Channel 5 Progress Counter Register              | 16           | RW          | undef       |
| FFFE:D95A – FFFE:D97E |                    | Reserved                                         |              |             |             |
| FFFE:D980             | SYS_DMA_CSDP_CH6   | Channel 6 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D982             | SYS_DMA_CCR_CH6    | Channel 6 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D984             | SYS_DMA_CICR_CH6   | Channel 6 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D986             | SYS_DMA_CSR_CH6    | Channel 6 Status Register                        | 16           | R           | 0000h       |
| FFFE:D988             | SYS_DMA_CSSA_L_CH6 | Channel 6 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D98A             | SYS_DMA_CSSA_U_CH6 | Channel 6 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D98C             | SYS_DMA_CDSA_L_CH6 | Channel 6 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D98E             | SYS_DMA_CDSA_U_CH6 | Channel 6 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D990             | SYS_DMA_CEN_CH6    | Channel 6 Element Number Register                | 16           | RW          | undef       |
| FFFE:D992             | SYS_DMA_CFN_CH6    | Channel 6 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D994             | SYS_DMA_CFI_CH6    | Channel 6 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D996             | SYS_DMA_CEI_CH6    | Channel 6 Element Index Register                 | 16           | RW          | undef       |
| FFFE:D998             | SYS_DMA_CPC_CH6    | Channel 6 Progress Counter Register              | 16           | RW          | undef       |
| FFFE:D99A – FFFE:D9BE |                    | Reserved                                         |              |             |             |
| FFFE:D9C0             | SYS_DMA_CSDP_CH7   | Channel 7 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:D9C2             | SYS_DMA_CCR_CH7    | Channel 7 Control Register                       | 16           | RW          | 0000h       |
| FFFE:D9C4             | SYS_DMA_CICR_CH7   | Channel 7 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:D9C6             | SYS_DMA_CSR_CH7    | Channel 7 Status Register                        | 16           | R           | 0000h       |
| FFFE:D9C8             | SYS_DMA_CSSA_L_CH7 | Channel 7 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:D9CA             | SYS_DMA_CSSA_U_CH7 | Channel 7 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:D9CC             | SYS_DMA_CDSA_L_CH7 | Channel 7 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:D9CE             | SYS_DMA_CDSA_U_CH7 | Channel 7 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:D9D0             | SYS_DMA_CEN_CH7    | Channel 7 Element Number Register                | 16           | RW          | undef       |
| FFFE:D9D2             | SYS_DMA_CFN_CH7    | Channel 7 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:D9D4             | SYS_DMA_CFI_CH7    | Channel 7 Frame Index Register                   | 16           | RW          | undef       |
| FFFE:D9D6             | SYS_DMA_CEI_CH7    | Channel 7 Element Index Register                 | 16           | RW          | undef       |
| FFFE:D9D8             | SYS_DMA_CPC_CH7    | Channel 7 Progress Counter Register              | 16           | RW          | undef       |
| FFFE:D9DA – FFFE:D9FE |                    | Reserved                                         |              |             |             |
| FFFE:DA00             | SYS_DMA_CSDP_CH8   | Channel 8 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| FFFE:DA02             | SYS_DMA_CCR_CH8    | Channel 8 Control Register                       | 16           | RW          | 0000h       |
| FFFE:DA04             | SYS_DMA_CICR_CH8   | Channel 8 Interrupt Control Register             | 16           | RW          | 0003h       |
| FFFE:DA06             | SYS_DMA_CSR_CH8    | Channel 8 Status Register                        | 16           | R           | 0000h       |
| FFFE:DA08             | SYS_DMA_CSSA_L_CH8 | Channel 8 Source Start Address Register LSB      | 16           | RW          | undef       |
| FFFE:DA0A             | SYS_DMA_CSSA_U_CH8 | Channel 8 Source Start Address Register MSB      | 16           | RW          | undef       |
| FFFE:DA0C             | SYS_DMA_CDSA_L_CH8 | Channel 8 Destination Start Address Register LSB | 16           | RW          | undef       |
| FFFE:DA0E             | SYS_DMA_CDSA_U_CH8 | Channel 8 Destination Start Address Register MSB | 16           | RW          | undef       |
| FFFE:DA10             | SYS_DMA_CEN_CH8    | Channel 8 Element Number Register                | 16           | RW          | undef       |
| FFFE:DA12             | SYS_DMA_CFN_CH8    | Channel 8 Frame Number Register                  | 16           | RW          | undef       |
| FFFE:DA14             | SYS_DMA_CFI_CH8    | Channel 8 Frame Index Register                   | 16           | RW          | undef       |

**Table 3–20. System DMA Controller Registers (Continued)**

| BYTE ADDRESS          | REGISTER NAME        | DESCRIPTION                                            | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|----------------------|--------------------------------------------------------|--------------|-------------|-------------|
| FFFE:DA16             | SYS_DMA_CEI_CH8      | Channel 8 Element Index Register                       | 16           | RW          | undef       |
| FFFE:DA18             | SYS_DMA_CPC_CH8      | Channel 8 Progress Counter Register                    | 16           | RW          | undef       |
| FFFE:DA1A – FFFE:DAFE |                      | Reserved                                               |              |             |             |
| FFFE:DB00             | SYS_DMA_LCD_CTRL     | LCD Channel Control Register                           | 16           | RW          | 0000h       |
| FFFE:DB02             | SYS_DMA_LCD_TOP_F1_L | LCD Channel Top Address Frame Buffer 1 Register LSB    | 16           | RW          | undef       |
| FFFE:DB04             | SYS_DMA_LCD_TOP_F1_U | LCD Channel Top Address Frame Buffer 1 Register MSB    | 16           | RW          | undef       |
| FFFE:DB06             | SYS_DMA_LCD_BOT_F1_L | LCD Channel Bottom Address Frame Buffer 1 Register LSB | 16           | RW          | undef       |
| FFFE:DB08             | SYS_DMA_LCD_BOT_F1_U | LCD Channel Bottom Address Frame Buffer 1 Register MSB | 16           | RW          | undef       |
| FFFE:DB0A             | SYS_DMA_LCD_TOP_F2_L | LCD Channel Top Address Frame Buffer 2 Register LSB    | 16           | RW          | undef       |
| FFFE:DB0C             | SYS_DMA_LCD_TOP_F2_U | LCD Channel Top Address Frame Buffer 2 Register MSB    | 16           | RW          | undef       |
| FFFE:DB0E             | SYS_DMA_LCD_BOT_F2_L | LCD Channel Bottom Address Frame Buffer 2 Register LSB | 16           | RW          | undef       |
| FFFE:DB10             | SYS_DMA_LCD_BOT_F2_U | LCD Channel Bottom Address Frame Buffer 2 Register MSB | 16           | RW          | undef       |
| FFFE:DB12 – FFFE:DBFE |                      | Reserved                                               |              |             |             |
| FFFE:DC00             | SYS_DMA_GCR          | DMA Global Control Register                            | 16           | RW          | 0008h       |

**Table 3–21. LCD Controller Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                   | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-------------------------------|--------------|-------------|-------------|
| FFFE:C000    | LCD_CONTROL   | LCD Control Register          | 32           | RW          | 0x0000 0000 |
| FFFE:C004    | LCD_TIMING0   | LCD Timing 0 Register         | 32           | RW          | undef       |
| FFFE:C008    | LCD_TIMING1   | LCD Timing 1 Register         | 32           | RW          | 0x0000 0000 |
| FFFE:C00C    | LCD_TIMING2   | LCD Timing 2 Register         | 32           | RW          | 0x0000 0000 |
| FFFE:C010    | LCD_STATUS    | LCD Status Register           | 32           | RW          | 0x0000 0000 |
| FFFE:C014    | LCD_SUBPANEL  | LCD Subpanel Display Register | 32           | RW          | 0x0000 0000 |

### **3.15.2 MPU Public Peripheral Registers**

The MPU public peripheral registers include the following:

- Serial Ports
  - McBSP2 Registers
  - MICROWIRE Registers
  - I<sup>2</sup>C Registers
  - HDQ/1-Wire Interface Registers
  - MMC/SD Registers
  - USB Function Registers
  - USB Host Registers
- Parallel Ports
  - Camera Interface Registers
- Human Interface support
  - MPUIO/Keyboard Registers
  - PWL Registers
  - PWT Registers
  - LED Pulse Generator 1 Registers
  - LED Pulse Generator 2 Registers
- Timers and Counters
  - 32k Timer Registers
  - Real-Time Clock Registers
  - Frame Adjustment Counter Registers

**Table 3–22. McBSP2 Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                                         | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-----------------------------------------------------|--------------|-------------|-------------|
| FFFB:1000    | MCBSP2_DRR2   | McBSP2 Data Receive Register 2                      | 16           | RW          | 0000h       |
| FFFB:1002    | MCBSP2_DRR1   | McBSP2 Data Receive Register 1                      | 16           | RW          | 0000h       |
| FFFB:1004    | MCBSP2_DXR2   | McBSP2 Data Transmit Register 2                     | 16           | RW          | 0000h       |
| FFFB:1006    | MCBSP2_DXR1   | McBSP2 Data Transmit Register 1                     | 16           | RW          | 0000h       |
| FFFB:1008    | MCBSP2_SPCR2  | McBSP2 Serial Port Control Register 2               | 16           | RW          | 0000h       |
| FFFB:100A    | MCBSP2_SPCR1  | McBSP2 Serial Port Control Register 1               | 16           | RW          | 0000h       |
| FFFB:100C    | MCBSP2_RCR2   | McBSP2 Receive Control Register 2                   | 16           | RW          | 0000h       |
| FFFB:100E    | MCBSP2_RCR1   | McBSP2 Receive Control Register 1                   | 16           | RW          | 0000h       |
| FFFB:1010    | MCBSP2_XCR2   | McBSP2 Transmit Control Register 2                  | 16           | RW          | 0000h       |
| FFFB:1012    | MCBSP2_XCR1   | McBSP2 Transmit Control Register 1                  | 16           | RW          | 0000h       |
| FFFB:1014    | MCBSP2_SRGR2  | McBSP2 Sample Rate Generator Register 2             | 16           | RW          | 2000h       |
| FFFB:1016    | MCBSP2_SRGR1  | McBSP2 Sample Rate Generator Register 1             | 16           | RW          | 0001h       |
| FFFB:1018    | MCBSP2_MCR2   | McBSP2 Multichannel Control Register 2              | 16           | RW          | 0000h       |
| FFFB:101A    | MCBSP2_MCR1   | McBSP2 Multichannel Control Register 1              | 16           | RW          | 0000h       |
| FFFB:101C    | MCBSP2_RCERA  | McBSP2 Receive Channel Enable Register Partition A  | 16           | RW          | 0000h       |
| FFFB:101E    | MCBSP2_RCERB  | McBSP2 Receive Channel Enable Register Partition B  | 16           | RW          | 0000h       |
| FFFB:1020    | MCBSP2_XCERA  | McBSP2 Transmit Channel Enable Register Partition A | 16           | RW          | 0000h       |
| FFFB:1022    | MCBSP2_XCERB  | McBSP2 Transmit Channel Enable Register Partition B | 16           | RW          | 0000h       |
| FFFB:1024    | MCBSP2_PCR0   | McBSP2 Pin Control Register 0                       | 16           | RW          | 0000h       |
| FFFB:1026    | MCBSP2_RCERC  | McBSP2 Receive Channel Enable Register Partition C  | 16           | RW          | 0000h       |
| FFFB:1028    | MCBSP2_R CERD | McBSP2 Receive Channel Enable Register Partition D  | 16           | RW          | 0000h       |
| FFFB:102A    | MCBSP2_XCERC  | McBSP2 Transmit Channel Enable Register Partition C | 16           | RW          | 0000h       |
| FFFB:102C    | MCBSP2_XCERD  | McBSP2 Transmit Channel Enable Register Partition D | 16           | RW          | 0000h       |
| FFFB:102E    | MCBSP2_RCERE  | McBSP2 Receive Channel Enable Register Partition E  | 16           | RW          | 0000h       |
| FFFB:1030    | MCBSP2_RCERF  | McBSP2 Receive Channel Enable Register Partition F  | 16           | RW          | 0000h       |
| FFFB:1032    | MCBSP2_XCERE  | McBSP2 Transmit Channel Enable Register Partition E | 16           | RW          | 0000h       |
| FFFB:1034    | MCBSP2_XCERF  | McBSP2 Transmit Channel Enable Register Partition F | 16           | RW          | 0000h       |
| FFFB:1036    | MCBSP2_RCERG  | McBSP2 Receive Channel Enable Register Partition G  | 16           | RW          | 0000h       |
| FFFB:1038    | MCBSP2_R CERH | McBSP2 Receive Channel Enable Register Partition H  | 16           | RW          | 0000h       |
| FFFB:103A    | MCBSP2_XCERG  | McBSP2 Transmit Channel Enable Register Partition G | 16           | RW          | 0000h       |
| FFFB:103C    | MCBSP2_XCERH  | McBSP2 Transmit Channel Enable Register Partition H | 16           | RW          | 0000h       |

**Table 3–23. MICROWIRE Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|---------------------------------------|--------------|-------------|-------------|
| FFFB:3000    | TD            | MICROWIRE Transmit Data Register      | 16           | W           | undef       |
| FFFB:3000    | RD            | MICROWIRE Receive Data Register       | 16           | R           | undef       |
| FFFB:3004    | CSR           | MICROWIRE Control and Status Register | 16           | RW          | undef       |
| FFFB:3008    | SR1           | MICROWIRE Setup Register 1            | 16           | RW          | undef       |
| FFFB:300C    | SR2           | MICROWIRE Setup Register 2            | 16           | RW          | undef       |
| FFFB:3010    | SR3           | MICROWIRE Setup Register 3            | 16           | RW          | 0000h       |
| FFFB:3014    | SR4           | MICROWIRE Setup Register 4            | 16           | RW          | 0000h       |
| FFFB:3018    | SR5           | MICROWIRE Setup Register 5            | 16           | RW          | 0000h       |

**Table 3–24. I<sup>2</sup>C Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|------------------------------------------------|--------------|-------------|-------------|
| FFFB:3800    | I2C_REV       | I <sup>2</sup> C Module Version Register       | 16           | RW          | 0011h       |
| FFFB:3804    | I2C_IE        | I <sup>2</sup> C Interrupt Enable Register     | 16           | RW          | 0000h       |
| FFFB:3808    | I2C_STAT      | I <sup>2</sup> C Status Register               | 16           | R           | 0000h       |
| FFFB:380C    | I2C_IV        | I <sup>2</sup> C Interrupt Vector Register     | 16           | R           | 0000h       |
| FFFB:3810    |               | Reserved                                       |              |             |             |
| FFFB:3814    | I2C_BUF       | I <sup>2</sup> C Buffer Configuration Register | 16           | RW          | 0000h       |
| FFFB:3818    | I2C_CNT       | I <sup>2</sup> C Data Counter Register         | 16           | RW          | 0000h       |
| FFFB:381C    | I2C_DATA      | I <sup>2</sup> C Data Access Register          | 16           | RW          | 0000h       |
| FFFB:3820    |               | Reserved                                       |              |             |             |
| FFFB:3824    | I2C_CON       | I <sup>2</sup> C Configuration Register        | 16           | RW          | 0000h       |
| FFFB:3828    | I2C_OA        | I <sup>2</sup> C Own Address Register          | 16           | RW          | 0000h       |
| FFFB:382C    | I2C_SA        | I <sup>2</sup> C Slave Address Register        | 16           | RW          | 03FFh       |
| FFFB:3830    | I2C_PSC       | I <sup>2</sup> C Clock Prescaler Register      | 16           | RW          | 0000h       |
| FFFB:3834    | I2C_SCLL      | I <sup>2</sup> C SCL Low Timer Register        | 16           | RW          | 0000h       |
| FFFB:3838    | I2C_SCLH      | I <sup>2</sup> C SCL High Timer Register       | 16           | RW          | 0000h       |
| FFFB:383C    | I2C_SYSTEST   | I <sup>2</sup> C System Test Register          | 16           | RW          | 0000h       |

**Table 3–25. HDQ/1-Wire Interface Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                 | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-----------------------------|--------------|-------------|-------------|
| FFFB:C000    | TXR           | TX Write Data Register      | 8            | RW          | 00h         |
| FFFB:C004    | RXR           | RX Receive Buffer Register  | 8            | R           | undef       |
| FFFB:C008    | CSR           | Control and Status Register | 8            | RW          | 00h         |
| FFFB:C00C    | ISR           | Interrupt Status Register   | 8            | RW          | 00h         |

**Table 3–26. MMC/SD Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                 | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-----------------------------|--------------|-------------|-------------|
| FFFB:7800    | MMC_CMD       | MMC Command                 | 16           | RW          | 0000h       |
| FFFB:7804    | MMC_ARGL      | MMC Argument Low            | 16           | RW          | 0000h       |
| FFFB:7808    | MMC_ARGH      | MMC Argument High           | 16           | RW          | 0000h       |
| FFFB:780C    | MMC_CON       | MMC System Configuration    | 16           | RW          | 0000h       |
| FFFB:7810    | MMC_STAT      | MMC Status                  | 16           | RW          | 0000h       |
| FFFB:7814    | MMC_IE        | MMC System Interrupt Enable | 16           | RW          | 0000h       |
| FFFB:7818    | MMC_CTO       | MMC Command Timeout         | 16           | RW          | 0000h       |
| FFFB:781C    | MMC_DTO       | MMC Data Timeout            | 16           | RW          | 0000h       |
| FFFB:7820    | MMC_DATA      | MMC TX/RX FIFO Data         | 16           | RW          | 0000h       |
| FFFB:7824    | MMC_BLEN      | MMC Block Length            | 16           | RW          | 0000h       |
| FFFB:7828    | MMC_NBLK      | MMC Number Of Blocks        | 16           | RW          | 0000h       |
| FFFB:782C    | MMC_BUF       | MMC Buffer Configuration    | 16           | RW          | 1F00h       |
| FFFB:7834    | MMC_SDIO      | MMC SDIO Mode Configuration | 16           | RW          | 0000h       |
| FFFB:7838    | MMC_SYST      | MMC System Test             | 16           | RW          | 2000h       |
| FFFB:783C    | MMC_REV       | MMC Module Version          | 16           | R           | –           |
| FFFB:7840    | MMC_RSP0      | MMC Command Response 0      | 16           | R           | undef       |
| FFFB:7844    | MMC_RSP1      | MMC Command Response 1      | 16           | R           | undef       |
| FFFB:7848    | MMC_RSP2      | MMC Command Response 2      | 16           | R           | undef       |
| FFFB:784C    | MMC_RSP3      | MMC Command Response 3      | 16           | R           | undef       |
| FFFB:7850    | MMC_RSP4      | MMC Command Response 4      | 16           | R           | undef       |
| FFFB:7854    | MMC_RSP5      | MMC Command Response 5      | 16           | R           | undef       |
| FFFB:7858    | MMC_RSP6      | MMC Command Response 6      | 16           | R           | undef       |
| FFFB:785C    | MMC_RSP7      | MMC Command Response 7      | 16           | R           | undef       |

Table 3–27. USB Function Registers

| BYTE ADDRESS         | REGISTER NAME | DESCRIPTION                                  | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|----------------------|---------------|----------------------------------------------|--------------|-------------|-------------|
| FFFB:4000            | REV           | Revision Register                            | 16           | R           | –           |
| FFFB:4004            | EP_NUM        | Endpoint Selection Register                  | 16           | RW          | 0000h       |
| FFFB:4008            | DATA          | Data Register                                | 16           | RW          | undef       |
| FFFB:400C            | CTRL          | Control Register                             | 16           | RW          | 0000h       |
| FFFB:4010            | STAT_FLG      | Status Flag Register                         | 16           | R           | 0202h       |
| FFFB:4014            | RXFSTAT       | Receive FIFO Status Register                 | 16           | R           | 0000h       |
| FFFB:4018            | SYSCON1       | System Configuration 1 Register              | 16           | RW          | 0000h       |
| FFFB:401C            | SYSCON2       | System Configuration 2 Register              | 16           | RW          | 0000h       |
| FFFB:4020            | DEVSTAT       | Device Status Register                       | 16           | R           | undef       |
| FFFB:4024            | SOF           | Start of Frame Register                      | 16           | R           | 0000h       |
| FFFB:4028            | IRQ_EN        | Interrupt Enable Register                    | 16           | RW          | undef       |
| FFFB:402C            | DMA_IRQ_EN    | DMA Interrupt Enable Register                | 16           | RW          | undef       |
| FFFB:4030            | IRQ_SRC       | Interrupt Source Register                    | 16           | RW          | 0000h       |
| FFFB:4034            | EPN_STAT      | Endpoint Interrupt Status Register           | 16           | R           | 0000h       |
| FFFB:4038            | DMAN_STAT     | DMA Endpoint Interrupt Status Register       | 16           | R           | 0000h       |
| FFFB:403C            |               | Reserved                                     |              |             |             |
| FFFB:4040            | RXDMA_CFG     | Receive Channels DMA Configuration Register  | 16           | RW          | 0000h       |
| FFFB:4044            | TXDMA_CFG     | Transmit Channels DMA Configuration Register | 16           | RW          | 0000h       |
| FFFB:4048            | DATA_DMA      | DMA FIFO Data Register                       | 16           | RW          | undef       |
| FFFB:404C            |               | Reserved                                     |              |             |             |
| FFFB:4050            | TXDMA0        | Transmit DMA Control 0 Register              | 16           | RW          | 0000h       |
| FFFB:4054            | TXDMA1        | Transmit DMA Control 1 Register              | 16           | RW          | 0000h       |
| FFFB:4058            | TXDMA2        | Transmit DMA Control 2 Register              | 16           | RW          | 0000h       |
| FFFB:405C            |               | Reserved                                     |              |             |             |
| FFFB:4060            | RXDMA0        | Receive DMA Control 0 Register               | 16           | RW          | 0000h       |
| FFFB:4064            | RXDMA1        | Receive DMA Control 1 Register               | 16           | RW          | 0000h       |
| FFFB:4068            | RXDMA2        | Receive DMA Control 2 Register               | 16           | RW          | 0000h       |
| FFFB:406C – FFB:407C |               | Reserved                                     |              |             |             |
| FFFB:4080            | EP0           | Endpoint Configuration 0 Register            | 16           | RW          | 0000h       |
| FFFB:4084            | EP1_RX        | Receive Endpoint Configuration 1 Register    | 16           | RW          | undef       |
| FFFB:4088            | EP2_RX        | Receive Endpoint Configuration 2 Register    | 16           | RW          | undef       |
| FFFB:408C            | EP3_RX        | Receive Endpoint Configuration 3 Register    | 16           | RW          | undef       |
| FFFB:4090            | EP4_RX        | Receive Endpoint Configuration 4 Register    | 16           | RW          | undef       |
| FFFB:4094            | EP5_RX        | Receive Endpoint Configuration 5 Register    | 16           | RW          | undef       |
| FFFB:4098            | EP6_RX        | Receive Endpoint Configuration 6 Register    | 16           | RW          | undef       |
| FFFB:409C            | EP7_RX        | Receive Endpoint Configuration 7 Register    | 16           | RW          | undef       |
| FFFB:40A0            | EP8_RX        | Receive Endpoint Configuration 8 Register    | 16           | RW          | undef       |
| FFFB:40A4            | EP9_RX        | Receive Endpoint Configuration 9 Register    | 16           | RW          | undef       |
| FFFB:40A8            | EP10_RX       | Receive Endpoint Configuration 10 Register   | 16           | RW          | undef       |
| FFFB:40AC            | EP11_RX       | Receive Endpoint Configuration 11 Register   | 16           | RW          | undef       |
| FFFB:40B0            | EP12_RX       | Receive Endpoint Configuration 12 Register   | 16           | RW          | undef       |
| FFFB:40B4            | EP13_RX       | Receive Endpoint Configuration 13 Register   | 16           | RW          | undef       |
| FFFB:40B8            | EP14_RX       | Receive Endpoint Configuration 14 Register   | 16           | RW          | undef       |

Table 3–27. USB Function Registers (Continued)

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                                 | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|---------------------------------------------|--------------|-------------|-------------|
| FFFB:40BC    | EP15_RX       | Receive Endpoint Configuration 15 Register  | 16           | RW          | undef       |
| FFFB:40C0    |               | Reserved                                    |              |             |             |
| FFFB:40C4    | EP1_TX        | Transmit Endpoint Configuration 1 Register  | 16           | RW          | undef       |
| FFFB:40C8    | EP2_TX        | Transmit Endpoint Configuration 2 Register  | 16           | RW          | undef       |
| FFFB:40CC    | EP3_TX        | Transmit Endpoint Configuration 3 Register  | 16           | RW          | undef       |
| FFFB:40D0    | EP4_TX        | Transmit Endpoint Configuration 4 Register  | 16           | RW          | undef       |
| FFFB:40D4    | EP5_TX        | Transmit Endpoint Configuration 5 Register  | 16           | RW          | undef       |
| FFFB:40D8    | EP6_TX        | Transmit Endpoint Configuration 6 Register  | 16           | RW          | undef       |
| FFFB:40DC    | EP7_TX        | Transmit Endpoint Configuration 7 Register  | 16           | RW          | undef       |
| FFFB:40E0    | EP8_TX        | Transmit Endpoint Configuration 8 Register  | 16           | RW          | undef       |
| FFFB:40E4    | EP9_TX        | Transmit Endpoint Configuration 9 Register  | 16           | RW          | undef       |
| FFFB:40E8    | EP10_TX       | Transmit Endpoint Configuration 10 Register | 16           | RW          | undef       |
| FFFB:40EC    | EP11_TX       | Transmit Endpoint Configuration 11 Register | 16           | RW          | undef       |
| FFFB:40F0    | EP12_TX       | Transmit Endpoint Configuration 12 Register | 16           | RW          | undef       |
| FFFB:40F4    | EP13_TX       | Transmit Endpoint Configuration 13 Register | 16           | RW          | undef       |
| FFFB:40F8    | EP14_TX       | Transmit Endpoint Configuration 14 Register | 16           | RW          | undef       |
| FFFB:40FC    | EP15_TX       | Transmit Endpoint Configuration 15 Register | 16           | RW          | undef       |

Table 3–28. USB Host Controller Registers

| BYTE ADDRESS          | REGISTER NAME      | DESCRIPTION                                                       | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|--------------------|-------------------------------------------------------------------|--------------|-------------|-------------|
| FFFB:A000             | HcRevision         | OHCI Revision Register                                            | 32           | R           | 0000 0010h  |
| FFFB:A004             | HcControl          | Host Controller Operating Mode Register                           | 32           | RW          | 0000 0000h  |
| FFFB:A008             | HcCommandStatus    | Host Controller Command and Status Register                       | 32           | RW          | 0000 0000h  |
| FFFB:A00C             | HcInterruptStatus  | Host Controller Interrupt Status Register                         | 32           | RW          | 0000 0000h  |
| FFFB:A010             | HcInterruptEnable  | Host Controller Interrupt Enable Register                         | 32           | RW          | 0000 0000h  |
| FFFB:A014             | HcInterruptDisable | Host Controller Interrupt Disable Register                        | 32           | R           | 0000 0000h  |
| FFFB:A018             | HcHCCA             | LB Virtual Address HCCA Register                                  | 32           | RW          | 0000 0000h  |
| FFFB:A01C             | HcPeriodCurrentED  | LB Virtual Address Current Periodic EP Descriptor Register        | 32           | RW          | 0000 0000h  |
| FFFB:A020             | HcControlHeadED    | LB Virtual Address Control EP Descriptor List Head Register       | 32           | RW          | 0000 0000h  |
| FFFB:A024             | HcControlCurrentED | LB Virtual Address Current Control EP Descriptor Register         | 32           | RW          | 0000 0000h  |
| FFFB:A028             | HcBulkHeadED       | LB Virtual Address Bulk EP Descriptor List Head Register          | 32           | RW          | 0000 0000h  |
| FFFB:A02C             | HcBulkCurrentED    | LB Virtual Address Current Bulk EP Descriptor Register            | 32           | RW          | 0000 0000h  |
| FFFB:A030             | HcDoneHead         | LB Virtual Address Retired Transfer Descriptor List Head Register | 32           | R           | undef       |
| FFFB:A034             | HcFmInterval       | Frame Interval Register                                           | 32           | RW          | 0000 2EDFh  |
| FFFB:A038             | HcFmRemaining      | Remaining Frame Time Register                                     | 32           | R           | 0000 0000h  |
| FFFB:A03C             | HcFmNumber         | Remaining Frame Number Register                                   | 32           | R           | 0000 0000h  |
| FFFB:A040             | HcPeriodicStart    | Periodic Start Time Register                                      | 32           | RW          | 0000 0000h  |
| FFFB:A044             | HcLSThreshold      | Low Speed Start Threshold Register                                | 32           | RW          | 0000 0628h  |
| FFFB:A048             | HcRhDescriptorA    | USB Root Hub Descriptor Register A                                | 32           | RW          | 0A00 1203h  |
| FFFB:A04C             | HcRhDescriptorB    | USB Root Hub Descriptor Register B                                | 32           | RW          | 0000 0000h  |
| FFFB:A050             | HcRhStatus         | USB Root Hub Status Register                                      | 32           | RW          | 0000 0000h  |
| FFFB:A054             | HcRhPortStatus1    | Port 1 Control and Status Register                                | 32           | RW          | 0000 0100h  |
| FFFB:A058             | HcRhPortStatus2    | Port 2 Control and Status Register                                | 32           | RW          | 0000 0100h  |
| FFFB:A05C             | HcRhPortStatus3    | Port 3 Control and Status Register                                | 32           | RW          | 0000 0100h  |
| FFFB:A060 – FFFB:A0DC |                    | Reserved                                                          |              |             |             |
| FFFB:A0E0             | HostUEAddr         | LB Virtual Address Last Unrecoverable Error Register              | 32           | R           | 0000 0000h  |
| FFFB:A0E4             | HostUESatus        | LB Cycle Type Last Unrecoverable Error Register                   | 32           | R           | 0000 0000h  |
| FFFB:A0E8             | HostTimeoutCtrl    | USB Host Mastered Local Bus Time-out Enable Register              | 32           | RW          | 0000 0000h  |
| FFFB:A0EC             | HostRevision       | USB Host Controller Revision Register                             | 32           | R           | –           |

Table 3–29. Camera Interface Registers

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                 | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-----------------------------|--------------|-------------|-------------|
| FFFB:6800    | CTRLCLOCK     | Clock Control Register      | 32           | RW          | 0000 0000h  |
| FFFB:6804    | IT_STATUS     | Interrupt Status Register   | 32           | R           | 0000 0000h  |
| FFFB:6808    | MODE          | Mode Configuration Register | 32           | RW          | 0000 0200h  |
| FFFB:680C    | STATUS        | Status Register             | 32           | R           | 0000 0000h  |
| FFFB:6810    | CAMDATA       | Image Data Register         | 32           | R           | 0000 0000h  |
| FFFB:6814    | GPIO          | GPIO Register               | 32           | RW          | 0000 0000h  |
| FFFB:6818    | PEAK_COUNTER  | Fifo Peak Counter Register  | 32           | RW          | 0000 0000h  |

**Table 3–30. MPU I/O/Keyboard Registers**

| BYTE ADDRESS | REGISTER NAME   | DESCRIPTION                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|-----------------|----------------------------------|--------------|-------------|-------------|
| FFFB:5000    | INPUT_LATCH     | Input Register                   | 16           | R           | undef       |
| FFFB:5004    | OUTPUT_REG      | Output Register                  | 16           | RW          | undef       |
| FFFB:5008    | IO_CNTL         | Input Output Control Register    | 16           | RW          | FFFFh       |
| FFFB:500C    |                 | Reserved                         |              |             |             |
| FFFB:5010    | KBR_LATCH       | Keyboard Row Inputs Register     | 16           | R           | undef       |
| FFFB:5014    | KBC_REG         | Keyboard Column Outputs Register | 16           | RW          | 0000h       |
| FFFB:5018    | GPIO_EVENT_MODE | GPIO Event Mode Register         | 16           | RW          | 0000h       |
| FFFB:501C    | GPIO_INT_EDGE   | GPIO Interrupt Edge Register     | 16           | RW          | 0000h       |
| FFFB:5020    | KBD_INT         | Keyboard Interrupt Register      | 16           | R           | 0000h       |
| FFFB:5024    | GPIO_INT        | GPIO Interrupt Register          | 16           | R           | 0000h       |
| FFFB:5028    | KBD_MASKIT      | Keyboard Mask Interrupt Register | 16           | RW          | 0000h       |
| FFFB:502C    | GPIO_MASKIT     | GPIO Mask Interrupt Register     | 16           | RW          | 0000h       |
| FFFB:5030    | GPIO_DEBOUNCING | GPIO Debouncing Register         | 16           | RW          | 0000h       |
| FFFB:5034    | GPIO_LATCH      | GPIO Latch Register              | 16           | R           | 0000h       |

**Table 3–31. PWL Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|----------------------|--------------|-------------|-------------|
| FFFB:5800    | PWL_LEVEL     | PWL Level Register   | 8            | RW          | 0000h       |
| FFFB:5804    | PWL_CTRL      | PWL Control Register | 8            | RW          | 0000h       |

**Table 3–32. PWT Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|--------------------------------|--------------|-------------|-------------|
| FFFB:6000    | PWT_FRC       | PWT Frequency Control Register | 8            | RW          | 0000h       |
| FFFB:6004    | PWT_VCR       | PWT Volume Control Register    | 8            | RW          | 0000h       |
| FFFB:6008    | PWT_GCR       | PWT General Control Register   | 8            | RW          | 0000h       |

**Table 3–33. LED Pulse Generator 1 Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|--------------------------------|--------------|-------------|-------------|
| FFFB:D000    | LCR_1         | LPG1 Control Register          | 8            | RW          | 00h         |
| FFFB:D004    | PMR_1         | LPG1 Power Management Register | 8            | RW          | 00h         |

**Table 3–34. LED Pulse Generator 2 Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|--------------------------------|--------------|-------------|-------------|
| FFFB:D800    | LCR_2         | LPG2 Control Register          | 8            | RW          | 00h         |
| FFFB:D804    | PMR_2         | LPG2 Power Management Register | 8            | RW          | 00h         |

**Table 3–35. 32k Timer Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-----------------------|--------------|-------------|-------------|
| FFFB:9000    | TVR           | Tick Value Register   | 32           | RW          | 00FF FFFFh  |
| FFFB:9004    | TCR           | Tick Counter Register | 32           | R           | 00FF FFFFh  |
| FFFB:9008    | CR            | Control Register      | 32           | RW          | 0000 0008h  |

**Table 3–36. Real-Time Clock Registers**

| BYTE ADDRESS          | REGISTER NAME      | DESCRIPTION                   | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|--------------------|-------------------------------|--------------|-------------|-------------|
| FFFB:4800             | SECONDS_REG        | RTC Seconds Register          | 8            | RW          | 00h         |
| FFFB:4804             | MINUTES_REG        | RTC Minutes Register          | 8            | RW          | 00h         |
| FFFB:4808             | HOURS_REG          | RTC Hours Register            | 8            | RW          | 00h         |
| FFFB:480C             | DAYS_REG           | RTC Days Register             | 8            | RW          | 01h         |
| FFFB:4810             | MONTHS_REG         | RTC Months Register           | 8            | RW          | 01h         |
| FFFB:4814             | YEARS_REG          | RTC Years Register            | 8            | RW          | 00h         |
| FFFB:4818             | WEEK_REG           | RTC Day of the Week Register  | 8            | RW          | 00h         |
| FFFB:481C             |                    | Reserved                      |              |             |             |
| FFFB:4820             | ALARM_SECONDS_REG  | RTC Alarm Seconds Register    | 8            | RW          | 00h         |
| FFFB:4824             | ALARM_MINUTES_REG  | RTC Alarm Minutes Register    | 8            | RW          | 00h         |
| FFFB:4828             | ALARM_HOURS_REG    | RTC Alarm Hours Register      | 8            | RW          | 00h         |
| FFFB:482C             | ALARM_DAYS_REG     | RTC Alarm Days Register       | 8            | RW          | 01h         |
| FFFB:4830             | ALARM_MONTHS_REG   | RTC Alarm Months Register     | 8            | RW          | 01h         |
| FFFB:4834             | ALARM_YEARS_REG    | RTC Alarm Years Register      | 8            | RW          | 00h         |
| FFFB:4838 – FFFB:483C |                    | Reserved                      |              |             |             |
| FFFB:4840             | RTC_CTRL_REG       | RTC Control Register          | 8            | RW          | 00h         |
| FFFB:4844             | RTC_STATUS_REG     | RTC Status Register           | 8            | RW          | 00h         |
| FFFB:4848             | RTC_INTERRUPTS_REG | RTC Interrupts Register       | 8            | RW          | 00h         |
| FFFB:484C             | RTC_COMP_LSB_REG   | RTC Compensation LSB Register | 8            | RW          | 00h         |
| FFFB:4850             | RTC_COMP_MSB_REG   | RTC Compensation MSB Register | 8            | RW          | 00h         |

**Table 3–37. Frame Adjustment Counter Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                               | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-------------------------------------------|--------------|-------------|-------------|
| FFFB:A800    | FARC          | Frame Adjustment Reference Count Register | 16           | RW          | 0000h       |
| FFFB:A804    | FSC           | Frame Start Count Register                | 16           | R           | 0000h       |
| FFFB:A808    | CTRL          | Control and Configuration Register        | 16           | RW          | 0000h       |
| FFFB:A80C    | STATUS        | Status Register                           | 16           | R           | 0000h       |
| FFFB:A810    | SYNC_CNT      | Frame Synchronization Register            | 16           | R           | undef       |
| FFFB:A814    | START_CNT     | Frame Start Counter Register              | 16           | R           | undef       |

### **3.15.3 MPU Configuration Registers**

The MPU Configuration Registers include the following:

- Pin Multiplexing Setup:
  - OMAP5910 Pin Configuration Registers
- Local Bus and MMU Setup:
  - Local Bus Control Registers
  - Local Bus MMU Registers
  - DSP MMU Registers
- MPUI and TIPB Setup:
  - MPU Interface (MPUI) Registers
  - TIPB (Private) Bridge 1 Configuration Registers
  - TIPB (Public) Bridge 2 Configuration Registers
  - MPU UART TI Peripheral Bus Switch Registers
  - Traffic Controller Registers
- Clock and Power Management:
  - MPU Clock/Reset/Power Mode Control Registers
  - DPLL1 Configuration Register
  - Ultra Low-Power Device Module Registers
- Device Identification:
  - Device Die Identification Registers
  - JTAG Identification Code Register

**Table 3–38. OMAP 5910 Pin Configuration Registers**

| BYTE ADDRESS             | REGISTER NAME    | DESCRIPTION                                | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------------------|------------------|--------------------------------------------|--------------|-------------|-------------|
| FFFE:1000                | FUNC_MUX_CTRL_0  | Functional Multiplexing Control 0 Register | 32           | RW          | 0000 0000h  |
| FFFE:1004                | FUNC_MUX_CTRL_1  | Functional Multiplexing Control 1 Register | 32           | RW          | 0000 0000h  |
| FFFE:1008                | FUNC_MUX_CTRL_2  | Functional Multiplexing Control 2 Register | 32           | RW          | 0000 0000h  |
| FFFE:100C                | COMP_MODE_CTRL_0 | Compatibility Mode Control 0 Register      | 32           | RW          | 0000 0000h  |
| FFFE:1010                | FUNC_MUX_CTRL_3  | Functional Multiplexing Control 3 Register | 32           | RW          | 0000 0000h  |
| FFFE:1014                | FUNC_MUX_CTRL_4  | Functional Multiplexing Control 4 Register | 32           | RW          | 0000 0000h  |
| FFFE:1018                | FUNC_MUX_CTRL_5  | Functional Multiplexing Control 5 Register | 32           | RW          | 0000 0000h  |
| FFFE:101C                | FUNC_MUX_CTRL_6  | Functional Multiplexing Control 6 Register | 32           | RW          | 0000 0000h  |
| FFFE:1020                | FUNC_MUX_CTRL_7  | Functional Multiplexing Control 7 Register | 32           | RW          | 0000 0000h  |
| FFFE:1024                | FUNC_MUX_CTRL_8  | Functional Multiplexing Control 8 Register | 32           | RW          | 0000 0000h  |
| FFFE:1028                | FUNC_MUX_CTRL_9  | Functional Multiplexing Control 9 Register | 32           | RW          | 0000 0000h  |
| FFFE:102C                | FUNC_MUX_CTRL_A  | Functional Multiplexing Control A Register | 32           | RW          | 0000 0000h  |
| FFFE:1030                | FUNC_MUX_CTRL_B  | Functional Multiplexing Control B Register | 32           | RW          | 0000 0000h  |
| FFFE:1034                | FUNC_MUX_CTRL_C  | Functional Multiplexing Control C Register | 32           | RW          | 0000 0000h  |
| FFFE:1038                | FUNC_MUX_CTRL_D  | Functional Multiplexing Control D Register | 32           | RW          | 0000 0000h  |
| FFFE:103C                |                  | Reserved                                   |              |             |             |
| FFFE:1040                | PULL_DWN_CTRL_0  | Pulldown Control 0 Register                | 32           | RW          | 0000 0000h  |
| FFFE:1044                | PULL_DWN_CTRL_1  | Pulldown Control 1 Register                | 32           | RW          | 0000 0000h  |
| FFFE:1048                | PULL_DWN_CTRL_2  | Pulldown Control 2 Register                | 32           | RW          | 0000 0000h  |
| FFFE:104C                | PULL_DWN_CTRL_3  | Pulldown Control 3 Register                | 32           | RW          | 0000 0000h  |
| FFFE:1050                | GATE_INH_CTRL_0  | Gate and Inhibit Control 0 Register        | 32           | RW          | 0000 0000h  |
| FFFE:1054 –<br>FFFE:105C |                  | Reserved                                   |              |             |             |
| FFFE:1060                | VOLTAGE_CTRL_0   | Voltage Control 0 Register                 | 32           | RW          | 0000 0000h  |
| FFFE:1064 –<br>FFFE:106C |                  | Reserved                                   |              |             |             |
| FFFE:1070                | TEST_DBG_CTRL_0  | Test Debug Control 0 Register              | 32           | RW          | 0000 0000h  |
| FFFE:1074 –<br>FFFE:107C |                  | Reserved                                   |              |             |             |
| FFFE:1080                | MOD_CONF_CTRL_0  | Module Configuration Control 0 Register    | 32           | RW          | 0000 0000h  |

**Table 3–39. Local Bus Control Registers**

| BYTE ADDRESS | REGISTER NAME   | DESCRIPTION                                     | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|-----------------|-------------------------------------------------|--------------|-------------|-------------|
| FFFE:C100    | LB_MPU_TIMEOUT  | Local Bus MPU Access TIMEOUT                    | 32           | RW          | 0000 00FFh  |
| FFFE:C104    | LB_HOLD_TIMER   | Local Bus Hold Timer                            | 32           | RW          | 0000 0000h  |
| FFFE:C108    | LB_PRIORITY_REG | Local Bus MPU Access Priority                   | 32           | RW          | 0000 0000h  |
| FFFE:C10C    | LB_CLOCK_DIV    | Local Bus Clock Divider                         | 32           | RW          | 0000 00FCh  |
| FFFE:C110    | LB_ABORT_ADD    | Local Bus Address Of Aborted MPU Cycle          | 32           | R           | FFFF FFFFh  |
| FFFE:C114    | LB_ABORT_DATA   | Local Bus Cycle Data Of Aborted MPU Write Cycle | 32           | R           | FFFF FFFFh  |
| FFFE:C118    | LB_ABORT_STATUS | Local Bus Cycle Type Of Aborted MPU Write Cycle | 32           | R           | 0000 0000h  |
| FFFE:C11C    | LB_IRQ_OUTPUT   | Local Bus External Interrupt Output Control     | 32           | RW          | 0000 0000h  |
| FFFE:C120    | LB_IRQ_INPUT    | Local Bus External Interrupt Status             | 32           | RW          | 0000 0000h  |

Table 3–40. Local Bus MMU Registers

| BYTE ADDRESS | REGISTER NAME          | DESCRIPTION                                  | ACCESS WIDTH | ACCESS TYPE     | RESET VALUE |
|--------------|------------------------|----------------------------------------------|--------------|-----------------|-------------|
| FFFE:C204    | LB_MMU_WALKING_ST_REG  | Local Bus MMU Walking Status                 | 32           | RW <sup>†</sup> | 0000h       |
| FFFE:C208    | LB_MMU_CNTL_REG        | Local Bus MMU Control                        | 32           | RW <sup>†</sup> | 0000h       |
| FFFE:C20C    | LB_MMU_FAULT_AD_H_REG  | Local Bus MMU Fault Address High             | 32           | R               | 0000h       |
| FFFE:C210    | LB_MMU_FAULT_AD_L_REG  | Local Bus MMU Fault Address Low              | 32           | R               | 0000h       |
| FFFE:C214    | LB_MMU_FAULT_ST_REG    | Local Bus MMU Fault Status                   | 32           | R               | 0000h       |
| FFFE:C218    | LB_MMU_IT_ACK_REG      | Local Bus MMU Interrupt Acknowledge          | 32           | W               | 0000h       |
| FFFE:C21C    | LB_MMU_TTB_H_REG       | Local Bus MMU TTB Register High              | 32           | RW <sup>†</sup> | 0000h       |
| FFFE:C220    | LB_MMU_TTB_L_REG       | Local Bus MMU TTB Register Low               | 32           | RW <sup>†</sup> | 0000h       |
| FFFE:C224    | LB_MMU_LOCK_REG        | Local Bus MMU Lock Counter                   | 32           | RW              | 0000h       |
| FFFE:C228    | LB_MMU_LD_TLB_REG      | Local Bus MMU TLB Load/Read Control          | 32           | RW              | 0000h       |
| FFFE:C22C    | LB_MMU_CAM_H_REG       | Local Bus MMU CAM Entry High                 | 32           | RW              | 0000h       |
| FFFE:C230    | LB_MMU_CAM_L_REG       | Local Bus MMU CAM Entry Low                  | 32           | RW              | 0000h       |
| FFFE:C234    | LB_MMU_RAM_H_REG       | Local Bus MMU RAM Entry High                 | 32           | RW              | 0000h       |
| FFFE:C238    | LB_MMU_RAM_L_REG       | Local Bus MMU RAM Entry Low                  | 32           | RW              | 0000h       |
| FFFE:C23C    | LB_MMU_GFLUSH_REG      | Local Bus MMU Global Flush Control           | 32           | RW              | 0000h       |
| FFFE:C240    | LB_MMU_FLUSH_ENTRY_REG | Local Bus MMU Individual Entry Flush Control | 32           | RW              | 0000h       |
| FFFE:C244    | LB_MMU_READ_CAM_H_REG  | Local Bus MMU CAM Read High                  | 32           | RW              | 0000h       |
| FFFE:C248    | LB_MMU_READ_CAM_L_REG  | Local Bus MMU CAM Read Low                   | 32           | RW              | 0000h       |
| FFFE:C24C    | LB_MMU_READ_RAM_H_REG  | Local Bus MMU RAM Read High                  | 32           | RW              | 0000h       |
| FFFE:C250    | LB_MMU_READ_RAM_L_REG  | Local Bus MMU RAM Read Low                   | 32           | RW              | 0000h       |

<sup>†</sup> Write access in ARM supervisor mode only.

**Table 3–41. DSP MMU Registers**

| BYTE ADDRESS | REGISTER NAME           | DESCRIPTION                        | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|-------------------------|------------------------------------|--------------|-------------|-------------|
| FFFE:D200    | DSP_MMU_PREFETCH_REG    | DSP MMU Prefetch Register          | 32           | RW          | 0000h       |
| FFFE:D204    | DSP_MMU_WALKING_ST_REG  | DSP MMU Prefetch Status Register   | 32           | R           | 0000h       |
| FFFE:D208    | DSP_MMU_CNTL_REG        | DSP MMU Control Register           | 32           | RW          | 0000h       |
| FFFE:D20C    | DSP_MMU_FAULT_AD_H_REG  | DSP MMU Fault Address Register MSB | 32           | R           | 0000h       |
| FFFE:D210    | DSP_MMU_FAULT_AD_L_REG  | DSP MMU Fault Address Register LSB | 32           | R           | 0000h       |
| FFFE:D214    | DSP_MMU_F_ST_REG        | DSP MMU Fault Status Register      | 32           | R           | 0000h       |
| FFFE:D218    | DSP_MMU_IT_ACK_REG      | DSP MMU IT Acknowledge Register    | 32           | W           | 0000h       |
| FFFE:D21C    | DSP_MMU_TTB_H_REG       | DSP MMU TTB Register MSB           | 32           | RW          | 0000h       |
| FFFE:D220    | DSP_MMU_TTB_L_REG       | DSP MMU TTB Register LSB           | 32           | RW          | 0000h       |
| FFFE:D224    | DSP_MMU_LOCK_REG        | DSP MMU Lock Counter Register      | 32           | RW          | 0000h       |
| FFFE:D228    | DSP_MMU_LD_TLB_REG      | DSP MMU Load Entry TLB Register    | 32           | RW          | 0000h       |
| FFFE:D22C    | DSP_MMU_CAM_H_REG       | DSP MMU CAM Entry Register MSB     | 32           | RW          | 0000h       |
| FFFE:D230    | DSP_MMU_CAM_L_REG       | DSP MMU CAM Entry Register LSB     | 32           | RW          | 0000h       |
| FFFE:D234    | DSP_MMU_RAM_H_REG       | DSP MMU RAM Entry Register MSB     | 32           | RW          | 0000h       |
| FFFE:D238    | DSP_MMU_RAM_L_REG       | DSP MMU RAM Entry Register LSB     | 32           | RW          | 0000h       |
| FFFE:D23C    | DSP_MMU_GFLUSH_REG      | DSP MMU Global Flush Register      | 32           | RW          | 0000h       |
| FFFE:D240    | DSP_MMU_FLUSH_ENTRY_REG | DSP MMU Individual Flush Register  | 32           | RW          | 0000h       |
| FFFE:D244    | DSP_MMU_READ_CAM_H_REG  | DSP MMU Read CAM Register MSB      | 32           | RW          | 0000h       |
| FFFE:D248    | DSP_MMU_READ_CAM_L_REG  | DSP MMU Read CAM Register LSB      | 32           | RW          | 0000h       |
| FFFE:D24C    | DSP_MMU_READ_RAM_H_REG  | DSP MMU Read RAM Register MSB      | 32           | RW          | 0000h       |
| FFFE:D250    | DSP_MMU_READ_RAM_L_REG  | DSP MMU Read RAM Register LSB      | 32           | RW          | 0000h       |

**Table 3–42. MPUI Registers**

| BYTE ADDRESS | REGISTER NAME   | DESCRIPTION                          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|-----------------|--------------------------------------|--------------|-------------|-------------|
| FFFE:C900    | CTRL_REG        | MPUI Control Register                | 32           | RW          | 0003 FF1Bh  |
| FFFE:C904    | DEBUG_ADDR      | MPUI Debug Address Register          | 32           | R           | 01FF FFFFh  |
| FFFE:C908    | DEBUG_DATA      | MPUI Debug Data Register             | 32           | R           | FFFF FFFFh  |
| FFFE:C90C    | DEBUG_FLAG      | MPUI Debug Flag Register             | 32           | R           | 0800h       |
| FFFE:C910    | STATUS_REG      | MPUI Status Register                 | 32           | R           | 0000h       |
| FFFE:C914    | DSP_STATUS_REG  | MPUI DSP Status Register             | 32           | R           | undef       |
| FFFE:C918    | DSP_BOOT_CONFIG | MPUI Boot Configuration Register     | 32           | RW          | 0000h       |
| FFFE:C91C    | DSP_MPUI_CONFIG | MPUI DSP MPUI Configuration Register | 32           | RW          | FFFFh       |

**Table 3–43. TIPB (Private) Bridge 1 Configuration Registers**

| BYTE ADDRESS | REGISTER NAME      | DESCRIPTION                            | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|--------------------|----------------------------------------|--------------|-------------|-------------|
| FFFE:CA00    | TIPB_CNTL          | Private TIPB Control Register          | 32           | RW          | FF11h       |
| FFFE:CA04    | TIPB_BUS_ALLOC     | Private TIPB Bus Allocation Register   | 32           | RW          | 0009h       |
| FFFE:CA08    | MPU_TIPB_CNTL      | Private MPU TIPB Control Register      | 32           | RW          | 0000h       |
| FFFE:CA0C    | ENHANCED_TIPB_CNTL | Private Enhanced TIPB Control Register | 32           | RW          | 0007h       |
| FFFE:CA10    | ADDRESS_DBG        | Private Debug Address Register         | 32           | R           | FFFFh       |
| FFFE:CA14    | DATA_DEBUG_LOW     | Private Debug Data LSB Register        | 32           | R           | FFFFh       |
| FFFE:CA18    | DATA_DEBUG_HIGH    | Private Debug Data MSB Register        | 32           | R           | FFFFh       |
| FFFE:CA1C    | DEBUG_CNTR_SIG     | Private Debug Control Signals Register | 32           | R           | 00F8h       |

**Table 3–44. TIPB (Public) Bridge 2 Configuration Registers**

| BYTE ADDRESS | REGISTER NAME      | DESCRIPTION                           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|--------------------|---------------------------------------|--------------|-------------|-------------|
| FFFE:D300    | TIPB_CNTL          | Public TIPB Control Register          | 16           | RW          | FF11h       |
| FFFE:D304    | TIPB_BUS_ALLOC     | Public TIPB Bus Allocation Register   | 16           | RW          | 0009h       |
| FFFE:D308    | MPU_TIPB_CNTL      | Public MPU TIPB Control Register      | 16           | RW          | 0000h       |
| FFFE:D30C    | ENHANCED_TIPB_CNTL | Public Enhanced TIPB Control Register | 16           | RW          | 0007h       |
| FFFE:D310    | ADDRESS_DBG        | Public Debug Address Register         | 16           | R           | FFFFh       |
| FFFE:D314    | DATA_DEBUG_LOW     | Public Debug Data LSB Register        | 16           | R           | FFFFh       |
| FFFE:D318    | DATA_DEBUG_HIGH    | Public Debug Data MSB Register        | 16           | R           | FFFFh       |
| FFFE:D31C    | DEBUG_CNTR_SIG     | Public Debug Control Signals Register | 16           | R           | 00F8h       |

**Table 3–45. MPU UART TIPB Bus Switch Registers**

| BYTE ADDRESS          | REGISTER NAME | DESCRIPTION                                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|---------------|------------------------------------------------|--------------|-------------|-------------|
| FFFB:C800             | RHSW_ARM_CNF1 | UART1 TIPB Switch Configuration Register (MPU) | 16           | RW          | 0001h       |
| FFFB:C804             | RHSW_ARM_STA1 | UART1 TIPB Switch Status Register (MPU)        | 16           | R           | 0001h       |
| FFFB:C808 – FFFB:C83C |               | Reserved                                       |              |             |             |
| FFFB:C840             | RHSW_ARM_CNF2 | UART2 TIPB Switch Configuration Register (MPU) | 16           | RW          | 0001h       |
| FFFB:C844             | RHSW_ARM_STA2 | UART2 TIPB Switch Status Register (MPU)        | 16           | R           | 0001h       |
| FFFB:C848 – FFFB:C87C |               | Reserved                                       |              |             |             |
| FFFB:C880             | RHSW_ARM_CNF3 | UART3 TIPB Switch Configuration Register (MPU) | 16           | RW          | 0001h       |
| FFFB:C884             | RHSW_ARM_STA3 | UART3 TIPB Switch Status Register (MPU)        | 16           | R           | 0001h       |

**Table 3–46. Traffic Controller Registers**

| BYTE ADDRESS | REGISTER NAME        | DESCRIPTION                                | ACCESS WIDTH | ACCESS TYPE | RESET VALUE         |
|--------------|----------------------|--------------------------------------------|--------------|-------------|---------------------|
| FFFE:CC00    | IMIF_PPIO            | TC IMIF Priority Register                  | 32           | RW          | 0000 0000h          |
| FFFE:CC04    | EMIFS_PPIO_REG       | TC EMIFS Priority Register                 | 32           | RW          | 0000 0000h          |
| FFFE:CC08    | EMIFF_PPIO_REG       | TC EMIFF Priority Register                 | 32           | RW          | 0000 0000h          |
| FFFE:CC0C    | EMIFS_CONFIG_REG     | TC EMIFS Configuration Register            | 32           | RW          | y00z0b <sup>†</sup> |
| FFFE:CC10    | EMIFS_CS0_CONFIG     | TC EMIFS CS0 Configuration Register        | 32           | RW          | 0010 FFFBh          |
| FFFE:CC14    | EMIFS_CS1_CONFIG     | TC EMIFS CS1 Configuration Register        | 32           | RW          | 0010 FFFBh          |
| FFFE:CC18    | EMIFS_CS2_CONFIG     | TC EMIFS CS2 Configuration Register        | 32           | RW          | 0010 FFFBh          |
| FFFE:CC1C    | EMIFS_CS3_CONFIG     | TC EMIFS CS3 Configuration Register        | 32           | RW          | 0010 FFFBh          |
| FFFE:CC20    | EMIFF_SDRAM_CONFIG   | TC EMIFF SDRAM Configuration Register      | 32           | RW          | 0061 8800h          |
| FFFE:CC24    | EMIFF_MRS            | TC EMIFF SDRAM MRS Register                | 32           | RW          | 0000 0037h          |
| FFFE:CC28    | TIMEOUT1             | TC Timeout 1 Register                      | 32           | RW          | 0000 0000h          |
| FFFE:CC2C    | TIMEOUT2             | TC Timeout 2 Register                      | 32           | RW          | 0000 0000h          |
| FFFE:CC30    | TIMEOUT3             | TC Timeout 3 Register                      | 32           | RW          | 0000 0000h          |
| FFFE:CC34    | ENDIANISM            | TC Endianism Register                      | 32           | RW          | 0000 0000h          |
| FFFE:CC38    |                      | Reserved                                   | 32           | RW          | 0000 0000h          |
| FFFE:CC3C    | EMIFF_SDRAM_CONFIG_2 | TC EMIFF SDRAM Configuration Register 2    | 32           | RW          | 0000 0003h          |
| FFFE:CC40    | EMIFS_CFG_DYN_WAIT   | TC EMIFS Wait-State Configuration Register | 32           | RW          | 0000 0000h          |

<sup>†</sup> The value of y is dependent upon the state of the FLASH.RDY pin and the value of z is dependent upon the state of the MPU\_BOOT pin upon power-on reset.

**Table 3–47. MPU Clock/Reset/Power Mode Control Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|--------------------------------------|--------------|-------------|-------------|
| FFFE:CE00    | ARM_CKCTL     | MPU Clock Control Register           | 32           | RW          | 3000h       |
| FFFE:CE04    | ARM_IDLECT1   | MPU Idle Control 1 Register          | 32           | RW          | 0400h       |
| FFFE:CE08    | ARM_IDLECT2   | MPU Idle Control 2 Register          | 32           | RW          | 0100h       |
| FFFE:CE0C    | ARM_EWUPCT    | MPU External Wakeup Control Register | 32           | RW          | 003Fh       |
| FFFE:CE10    | ARM_RSTCT1    | MPU Reset Control 1 Register         | 32           | RW          | 0000h       |
| FFFE:CE14    | ARM_RSTCT2    | MPU Reset Control 2 Register         | 32           | RW          | 0000h       |
| FFFE:CE18    | ARM_SYSST     | MPU System Status Register           | 32           | RW          | 0038h       |

**Table 3–48. DPLL1 Register**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION            | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|------------------------|--------------|-------------|-------------|
| FFFE:CF00    | DPLL1_CTL_REG | DPLL1 Control Register | 32           | RW          | 0000 2002h  |

**Table 3–49. Ultra Low-Power Device Module Registers**

| BYTE ADDRESS          | REGISTER NAME         | DESCRIPTION                              | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|-----------------------|------------------------------------------|--------------|-------------|-------------|
| FFFE:0800             | COUNTER_32_LSB        | ULPD 32-kHz Counter Register LSB         | 16           | R           | 0001h       |
| FFFE:0804             | COUNTER_32_MSB        | ULPD 32-kHz Counter Register MSB         | 16           | R           | 0001h       |
| FFFE:0808             | COUNTER_HIGH_FREQ_LSB | ULPD High-Frequency Counter LSB Register | 16           | R           | 0001h       |
| FFFE:080C             | COUNTER_HIGH_FREQ_MSB | ULPD High-Frequency Counter MSB Register | 16           | R           | 0000h       |
| FFFE:0810             | GAUGING_CTRL_REG      | ULPD Gauging Control Register            | 16           | RW          | 0000h       |
| FFFE:0814             | IT_STATUS_REG         | ULPD Interrupt Status Register           | 16           | R           | 0000h       |
| FFFE:0818 – FFFE:0820 |                       | Reserved                                 |              |             |             |
| FFFE:0824             | SETUP_ULPD1_REG       | ULPD Wakeup Time Setup Register          | 16           | RW          | 03FFh       |
| FFFE:0828 – FFFE:082C |                       | Reserved                                 |              |             |             |
| FFFE:0830             | CLOCK_CTRL_REG        | ULPD Clock Control Register              | 16           | RW          | 0000h       |
| FFFE:0834             | SOFT_REQ_REG          | ULPD Soft Clock Request Register         | 16           | RW          | 0000h       |
| FFFE:0838             | COUNTER_32_FIQ_REG    | ULPD Modem Shutdown Delay Register       | 16           | RW          | 0001h       |
| FFFE:083C             | DPLL_CTRL_REG         | ULPD USB DPLL Control Register           | 16           | RW          | 2211h       |
| FFFE:0840             | STATUS_REQ_REG        | ULPD Hardware Request Status Register    | 16           | RW          | undef       |
| FFFE:0844             |                       | Reserved                                 |              |             |             |
| FFFE:0848             | LOCK_TIME_REG         | ULPD APLL Lock Time Register             | 16           | RW          | 0960h       |
| FFFE:084C             | APLL_CTRL_REG         | ULPD APLL Control Register               | 16           | RW          | undef       |
| FFFE:0850             | POWER_CTRL_REG        | ULPD Power Control Register              | 16           | RW          | 0008h       |

**Table 3–50. Device Die Identification Registers**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                              | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|------------------------------------------|--------------|-------------|-------------|
| FFFE:1800    | DIE_ID_LSB    | Device Die Identification Register (LSB) | 32           | R           | –           |
| FFFE:1804    | DIE_ID_MSB    | Device Die Identification Register (MSB) | 32           | R           | –           |

**Table 3–51. JTAG Identification Code Register**

| BYTE ADDRESS | REGISTER NAME | DESCRIPTION                       | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|--------------|---------------|-----------------------------------|--------------|-------------|-------------|
| FFFE:D404    | JTAG_ID       | JTAG Identification Code Register | 32           | R           | –           |

## 3.16 DSP Register Descriptions

The following tables describe the DSP registers including register addresses, descriptions, required access widths, access types (R-read, W-write, RW-read/write) and reset values. These tables are organized by function with like peripherals or functions together and are therefore not necessarily in the order of ascending register addresses.

**NOTE:** All accesses to these registers must be of the data access widths indicated to avoid a TIPB bus error condition and a corresponding interrupt. Reserved addresses should never be accessed

### 3.16.1 DSP Private Peripheral Registers

The DSP private peripheral registers include the following:

- DMA Controller:
  - DSP DMA Controller Registers
- Timers:
  - DSP Timer 1 Registers
  - DSP Timer 2 Registers
  - DSP Timer 3 Registers
  - DSP Watchdog Timer Registers
- Interrupt Control:
  - DSP Interrupt Interface Registers
  - DSP Level 2 Interrupt Handler Registers

**Table 3–52. DSP DMA Controller Registers**

| DSP WORD ADDRESS           | REGISTER NAME | DESCRIPTION                                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|----------------------------|---------------|--------------------------------------------------|--------------|-------------|-------------|
| 0x00 0C00h                 | DMA_CSDP0     | Channel 0 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| 0x00 0C01h                 | DMA_CCR0      | Channel 0 Control Register                       | 16           | RW          | 0000h       |
| 0x00 0C02h                 | DMA_CICR0     | Channel 0 Interrupt Control Register             | 16           | RW          | 0003h       |
| 0x00 0C03h                 | DMA_CSR0      | Channel 0 Status Register                        | 16           | R           | 0000h       |
| 0x00 0C04h                 | DMA_CSSA_L0   | Channel 0 Source Start Address Register LSB      | 16           | RW          | undef       |
| 0x00 0C05h                 | DMA_CSSA_U0   | Channel 0 Source Start Address Register MSB      | 16           | RW          | undef       |
| 0x00 0C06h                 | DMA_CDSA_L0   | Channel 0 Destination Start Address Register LSB | 16           | RW          | undef       |
| 0x00 0C07h                 | DMA_CDSA_U0   | Channel 0 Destination Start Address Register MSB | 16           | RW          | undef       |
| 0x00 0C08h                 | DMA_CEN0      | Channel 0 Element Number Register                | 16           | RW          | undef       |
| 0x00 0C09h                 | DMA_CFN0      | Channel 0 Frame Number Register                  | 16           | RW          | undef       |
| 0x00 0C0Ah                 | DMA_CSFIO     | Channel 0 Frame Index Register                   | 16           | RW          | undef       |
| 0x00 0C0Bh                 | DMA_CSEIO     | Channel 0 Element Index Register                 | 16           | RW          | undef       |
| 0x00 0C0Ch                 | DMA_CSAC0     | Channel 0 Source Address Counter Register        | 16           | RW          | undef       |
| 0x00 0C0Dh                 | DMA_CDAC0     | Channel 0 Destination Address Counter Register   | 16           | RW          | undef       |
| 0x00 0C0Eh                 | DMA_CDFIO     | Channel 0 Destination Frame Index                | 16           | RW          | undef       |
| 0x00 0C0Fh                 | DMA_CDEIO     | Channel 0 Destination Element Index              | 16           | RW          | undef       |
| 0x00 0C10h –<br>0x00 0C1Fh |               | Reserved                                         |              |             |             |
| 0x00 0C20h                 | DMA_CSDP1     | Channel 1 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| 0x00 0C21h                 | DMA_CCR1      | Channel 1 Control Register                       | 16           | RW          | 0000h       |
| 0x00 0C22h                 | DMA_CICR1     | Channel 1 Interrupt Control Register             | 16           | RW          | 0003h       |
| 0x00 0C23h                 | DMA_CSR1      | Channel 1 Status Register                        | 16           | R           | 0000h       |
| 0x00 0C24h                 | DMA_CSSA_L1   | Channel 1 Source Start Address Register LSB      | 16           | RW          | undef       |
| 0x00 0C25h                 | DMA_CSSA_U1   | Channel 1 Source Start Address Register MSB      | 16           | RW          | undef       |
| 0x00 0C26h                 | DMA_CDSA_L1   | Channel 1 Destination Start Address Register LSB | 16           | RW          | undef       |
| 0x00 0C27h                 | DMA_CDSA_U1   | Channel 1 Destination Start Address Register MSB | 16           | RW          | undef       |
| 0x00 0C28h                 | DMA_CEN1      | Channel 1 Element Number Register                | 16           | RW          | undef       |
| 0x00 0C29h                 | DMA_CFN1      | Channel 1 Frame Number Register                  | 16           | RW          | undef       |
| 0x00 0C2Ah                 | DMA_CSF11     | Channel 1 Frame Index Register                   | 16           | RW          | undef       |
| 0x00 0C2Bh                 | DMA_CSEI1     | Channel 1 Element Index Register                 | 16           | RW          | undef       |
| 0x00 0C2Ch                 | DMA_CSAC1     | Channel 1 Source Address Counter Register        | 16           | RW          | undef       |
| 0x00 0C2Dh                 | DMA_CDAC1     | Channel 1 Destination Address Counter Register   | 16           | RW          | undef       |
| 0x00 0C2Eh                 | DMA_CDFI1     | Channel 1 Destination Frame Index                | 16           | RW          | undef       |
| 0x00 0C2Fh                 | DMA_CDEI1     | Channel 1 Destination Element Index              | 16           | RW          | undef       |
| 0x00 0C30h –<br>0x00 0C3Fh |               | Reserved                                         |              |             |             |
| 0x00 0C40h                 | DMA_CSDP2     | Channel 2 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| 0x00 0C41h                 | DMA_CCR2      | Channel 2 Control Register                       | 16           | RW          | 0000h       |
| 0x00 0C42h                 | DMA_CICR2     | Channel 2 Interrupt Control Register             | 16           | RW          | 0003h       |
| 0x00 0C43h                 | DMA_CSR2      | Channel 2 Status Register                        | 16           | R           | 0000h       |
| 0x00 0C44h                 | DMA_CSSA_L2   | Channel 2 Source Start Address Register LSB      | 16           | RW          | undef       |
| 0x00 0C45h                 | DMA_CSSA_U2   | Channel 2 Source Start Address Register MSB      | 16           | RW          | undef       |
| 0x00 0C46h                 | DMA_CDSA_L2   | Channel 2 Destination Start Address Register LSB | 16           | RW          | undef       |
| 0x00 0C47h                 | DMA_CDSA_U2   | Channel 2 Destination Start Address Register MSB | 16           | RW          | undef       |

Table 3–52. DSP DMA Controller Registers (Continued)

| DSP WORD ADDRESS           | REGISTER NAME | DESCRIPTION                                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|----------------------------|---------------|--------------------------------------------------|--------------|-------------|-------------|
| 0x00 0C48h                 | DMA_CEN2      | Channel 2 Element Number Register                | 16           | RW          | undef       |
| 0x00 0C49h                 | DMA_CFN2      | Channel 2 Frame Number Register                  | 16           | RW          | undef       |
| 0x00 0C4Ah                 | DMA_CSF12     | Channel 2 Frame Index Register                   | 16           | RW          | undef       |
| 0x00 0C4Bh                 | DMA_CSE12     | Channel 2 Element Index Register                 | 16           | RW          | undef       |
| 0x00 0C4Ch                 | DMA_CSAC2     | Channel 2 Source Address Counter Register        | 16           | RW          | undef       |
| 0x00 0C4Dh                 | DMA_CDAC2     | Channel 2 Destination Address Counter Register   | 16           | RW          | undef       |
| 0x00 0C4Eh                 | DMA_CDF12     | Channel 2 Destination Frame Index                | 16           | RW          | undef       |
| 0x00 0C4Fh                 | DMA_CDE12     | Channel 2 Destination Element Index              | 16           | RW          | undef       |
| 0x00 0C50h –<br>0x00 0C5Fh |               | Reserved                                         |              |             |             |
| 0x00 0C60h                 | DMA_CSDP3     | Channel 3 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| 0x00 0C61h                 | DMA_CCR3      | Channel 3 Control Register                       | 16           | RW          | 0000h       |
| 0x00 0C62h                 | DMA_CICR3     | Channel 3 Interrupt Control Register             | 16           | RW          | 0003h       |
| 0x00 0C63h                 | DMA_CSR3      | Channel 3 Status Register                        | 16           | R           | 0000h       |
| 0x00 0C64h                 | DMA_CSSA_L3   | Channel 3 Source Start Address Register LSB      | 16           | RW          | undef       |
| 0x00 0C65h                 | DMA_CSSA_U3   | Channel 3 Source Start Address Register MSB      | 16           | RW          | undef       |
| 0x00 0C66h                 | DMA_CDSA_L3   | Channel 3 Destination Start Address Register LSB | 16           | RW          | undef       |
| 0x00 0C67h                 | DMA_CDSA_U3   | Channel 3 Destination Start Address Register MSB | 16           | RW          | undef       |
| 0x00 0C68h                 | DMA_CEN3      | Channel 3 Element Number Register                | 16           | RW          | undef       |
| 0x00 0C69h                 | DMA_CFN3      | Channel 3 Frame Number Register                  | 16           | RW          | undef       |
| 0x00 0C6Ah                 | DMA_CSF13     | Channel 3 Frame Index Register                   | 16           | RW          | undef       |
| 0x00 0C6Bh                 | DMA_CSE13     | Channel 3 Element Index Register                 | 16           | RW          | undef       |
| 0x00 0C6Ch                 | DMA_CSAC3     | Channel 3 Source Address Counter Register        | 16           | RW          | undef       |
| 0x00 0C6Dh                 | DMA_CDAC3     | Channel 3 Destination Address Counter Register   | 16           | RW          | undef       |
| 0x00 0C6Eh                 | DMA_CDF13     | Channel 3 Destination Frame Index                | 16           | RW          | undef       |
| 0x00 0C6Fh                 | DMA_CDE13     | Channel 3 Destination Element Index              | 16           | RW          | undef       |
| 0x00 0C70h –<br>0x00 0C7Fh |               | Reserved                                         |              |             |             |
| 0x00 0C80h                 | DMA_CSDP4     | Channel 4 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| 0x00 0C81h                 | DMA_CCR4      | Channel 4 Control Register                       | 16           | RW          | 0000h       |
| 0x00 0C82h                 | DMA_CICR4     | Channel 4 Interrupt Control Register             | 16           | RW          | 0003h       |
| 0x00 0C83h                 | DMA_CSR4      | Channel 4 Status Register                        | 16           | R           | 0000h       |
| 0x00 0C84h                 | DMA_CSSA_L4   | Channel 4 Source Start Address Register LSB      | 16           | RW          | undef       |
| 0x00 0C85h                 | DMA_CSSA_U4   | Channel 4 Source Start Address Register MSB      | 16           | RW          | undef       |
| 0x00 0C86h                 | DMA_CDSA_L4   | Channel 4 Destination Start Address Register LSB | 16           | RW          | undef       |
| 0x00 0C87h                 | DMA_CDSA_U4   | Channel 4 Destination Start Address Register MSB | 16           | RW          | undef       |
| 0x00 0C88h                 | DMA_CEN4      | Channel 4 Element Number Register                | 16           | RW          | undef       |
| 0x00 0C89h                 | DMA_CFN4      | Channel 4 Frame Number Register                  | 16           | RW          | undef       |
| 0x00 0C8Ah                 | DMA_CSF14     | Channel 4 Frame Index Register                   | 16           | RW          | undef       |
| 0x00 0C8Bh                 | DMA_CSE14     | Channel 4 Element Index Register                 | 16           | RW          | undef       |
| 0x00 0C8Ch                 | DMA_CSAC4     | Channel 4 Source Address Counter Register        | 16           | RW          | undef       |
| 0x00 0C8Dh                 | DMA_CDAC4     | Channel 4 Destination Address Counter Register   | 16           | RW          | undef       |
| 0x00 0C8Eh                 | DMA_CDF14     | Channel 4 Destination Frame Index                | 16           | RW          | undef       |
| 0x00 0C8Fh                 | DMA_CDE14     | Channel 4 Destination Element Index              | 16           | RW          | undef       |

**Table 3–52. DSP DMA Controller Registers (Continued)**

| DSP WORD ADDRESS        | REGISTER NAME | DESCRIPTION                                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-------------------------|---------------|--------------------------------------------------|--------------|-------------|-------------|
| 0x00 0C90h – 0x00 0C9Fh |               | Reserved                                         |              |             |             |
| 0x00 0CA0h              | DMA_CSDP5     | Channel 5 Source/Destination Parameters Register | 16           | RW          | 0000h       |
| 0x00 0CA1h              | DMA_CCR5      | Channel 5 Control Register                       | 16           | RW          | 0000h       |
| 0x00 0CA2h              | DMA_CICR5     | Channel 5 Interrupt Control Register             | 16           | RW          | 0003h       |
| 0x00 0CA3h              | DMA_CSR5      | Channel 5 Status Register                        | 16           | R           | 0000h       |
| 0x00 0CA4h              | DMA_CSSA_L5   | Channel 5 Source Start Address Register LSB      | 16           | RW          | undef       |
| 0x00 0CA5h              | DMA_CSSA_U5   | Channel 5 Source Start Address Register MSB      | 16           | RW          | undef       |
| 0x00 0CA6h              | DMA_CDSA_L5   | Channel 5 Destination Start Address Register LSB | 16           | RW          | undef       |
| 0x00 0CA7h              | DMA_CDSA_U5   | Channel 5 Destination Start Address Register MSB | 16           | RW          | undef       |
| 0x00 0CA8h              | DMA_CEN5      | Channel 5 Element Number Register                | 16           | RW          | undef       |
| 0x00 0CA9h              | DMA_CFN5      | Channel 5 Frame Number Register                  | 16           | RW          | undef       |
| 0x00 0CAAh              | DMA_CSF15     | Channel 5 Frame Index Register                   | 16           | RW          | undef       |
| 0x00 0CABh              | DMA_CSEI5     | Channel 5 Element Index Register                 | 16           | RW          | undef       |
| 0x00 0CACH              | DMA_CSAC5     | Channel 5 Source Address Counter Register        | 16           | RW          | undef       |
| 0x00 0CADh              | DMA_CDAC5     | Channel 5 Destination Address Counter Register   | 16           | RW          | undef       |
| 0x00 0CAEh              | DMA_CDFI5     | Channel 5 Destination Frame Index                | 16           | RW          | undef       |
| 0x00 0CAFh              | DMA_CDEI5     | Channel 5 Destination Element Index              | 16           | RW          | undef       |
| 0x00 0CB0h – 0x00 0DFFh |               | Reserved                                         |              |             |             |
| 0x00 0E00h              | DMA_GCR       | Global Control Register                          | 16           | RW          | 0008h       |
| 0x00 0E01h              | DMA_GTCR      | Global Timeout Control Register                  | 16           | RW          | 0000h       |
| 0x00 0E02h              | DMA_GSCR      | Global Software Incompatible Control Register    | 16           | RW          | 0000h       |

**Table 3–53. DSP Timer 1 Registers**

| DSP WORD ADDRESS | REGISTER NAME     | DESCRIPTION                          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|-------------------|--------------------------------------|--------------|-------------|-------------|
| 0x00 2800h       | DSP_CNTL_TIMER_1  | DSP Timer 1 Control Timer Register   | 16           | RW          | 0000h       |
| 0x00 2801h       |                   | Reserved                             |              |             |             |
| 0x00 2802h       | DSP_LOAD_TIM_HI_1 | DSP Timer 1 Load Timer High Register | 16           | W           | undef       |
| 0x00 2803h       | DSP_LOAD_TIM_LO_1 | DSP Timer 1 Load Timer Low Register  | 16           | W           | undef       |
| 0x00 2804h       | DSP_READ_TIM_HI_1 | DSP Timer 1 Read Timer High Register | 16           | R           | undef       |
| 0x00 2805h       | DSP_READ_TIM_LO_1 | DSP Timer 1 Read Timer Low Register  | 16           | R           | undef       |

**Table 3–54. DSP Timer 2 Registers**

| DSP WORD ADDRESS | REGISTER NAME     | DESCRIPTION                          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|-------------------|--------------------------------------|--------------|-------------|-------------|
| 0x00 2C00h       | DSP_CNTL_TIMER_2  | DSP Timer 2 Control Timer Register   | 16           | RW          | 0000h       |
| 0x00 2C01h       |                   | Reserved                             |              |             |             |
| 0x00 2C02h       | DSP_LOAD_TIM_HI_2 | DSP Timer 2 Load Timer High Register | 16           | W           | undef       |
| 0x00 2C03h       | DSP_LOAD_TIM_LO_2 | DSP Timer 2 Load Timer Low Register  | 16           | W           | undef       |
| 0x00 2C04h       | DSP_READ_TIM_HI_2 | DSP Timer 2 Read Timer High Register | 16           | R           | undef       |
| 0x00 2C05h       | DSP_READ_TIM_LO_2 | DSP Timer 2 Read Timer Low Register  | 16           | R           | undef       |

**Table 3–55. DSP Timer 3 Registers**

| DSP WORD ADDRESS | REGISTER NAME     | DESCRIPTION                          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|-------------------|--------------------------------------|--------------|-------------|-------------|
| 0x00 3000h       | DSP_CNTL_TIMER_3  | DSP Timer 3 Control Timer Register   | 16           | RW          | 0000h       |
| 0x00 3001h       |                   | Reserved                             |              |             |             |
| 0x00 3002h       | DSP_LOAD_TIM_HI_3 | DSP Timer 3 Load Timer High Register | 16           | W           | undef       |
| 0x00 3003h       | DSP_LOAD_TIM_LO_3 | DSP Timer 3 Load Timer Low Register  | 16           | W           | undef       |
| 0x00 3004h       | DSP_READ_TIM_HI_3 | DSP Timer 3 Read Timer High Register | 16           | R           | undef       |
| 0x00 3005h       | DSP_READ_TIM_LO_3 | DSP Timer 3 Read Timer Low Register  | 16           | R           | undef       |

**Table 3–56. DSP Watchdog Timer Registers**

| DSP WORD ADDRESS | REGISTER NAME     | DESCRIPTION                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|-------------------|--------------------------------|--------------|-------------|-------------|
| 0x00 3400h       | DSP_CNTL_TIMER_WD | DSP WDT Control Timer Register | 16           | RW          | 0002h       |
| 0x00 3401h       |                   | Reserved                       |              |             |             |
| 0x00 3402h       | DSP_LOAD_TIM_WD   | DSP WDT Load Timer Register    | 16           | W           | FFFFh       |
| 0x00 3402h       | DSP_READ_TIM_WD   | DSP WDT Read Timer Register    | 16           | R           | FFFFh       |
| 0x00 3403h       |                   | Reserved                       |              |             |             |
| 0x00 3404h       | DSP_TIMER_MODE_WD | DSP WDT Timer Mode Register    | 16           | RW          | 8000h       |

**Table 3–57. DSP Interrupt Interface Registers**

| DSP WORD ADDRESS | REGISTER NAME | DESCRIPTION                                          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|---------------|------------------------------------------------------|--------------|-------------|-------------|
| 0x00 3800h       | ET_LS_CTRL_HI | Edge Triggered/Level Sensitive Control Register High | 16           | RW          | 0000h       |
| 0x00 3801h       | ET_LS_CTRL_LO | Edge Triggered/Level Sensitive Control Register Low  | 16           | RW          | 0000h       |
| 0x00 3802h       | RST_LVL_LO    | Level Sensitive Clear Low Register                   | 16           | W           | 0000h       |
| 0x00 3803h       | RST_LVL_HI    | Level Sensitive Clear High Register                  | 16           | W           | 0000h       |

**Table 3–58. DSP Level 2 Interrupt Handler Registers**

| DSP WORD ADDRESS | REGISTER NAME       | DESCRIPTION                           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|---------------------|---------------------------------------|--------------|-------------|-------------|
| 0x00 4800h       | DSP_L2_ITR          | Interrupt Register                    | 16           | RW          | 0000h       |
| 0x00 4802h       | DSP_L2_MIR          | Mask Interrupt Register               | 16           | RW          | FFFFh       |
| 0x00 4804h       | DSP_L2_SIR_IRQ_CODE | IRQ Interrupt Encoded Source Register | 16           | R           | 0000h       |
| 0x00 4806h       | DSP_L2_SIR_FIQ_CODE | FIQ Interrupt Encoded Source Register | 16           | R           | 0000h       |
| 0x00 4808h       | DSP_L2_CONTROL_REG  | Interrupt Control Register            | 16           | RW          | 0000h       |
| 0x00 480Ah       | DSP_L2_ISR          | Software Interrupt Set Register       | 16           | RW          | 0000h       |
| 0x00 480Ch       | DSP_L2_ILR0         | Interrupt 0 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 480Eh       | DSP_L2_ILR1         | Interrupt 1 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 4810h       | DSP_L2_ILR2         | Interrupt 2 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 4812h       | DSP_L2_ILR3         | Interrupt 3 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 4814h       | DSP_L2_ILR4         | Interrupt 4 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 4816h       | DSP_L2_ILR5         | Interrupt 5 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 4818h       | DSP_L2_ILR6         | Interrupt 6 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 481Ah       | DSP_L2_ILR7         | Interrupt 7 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 481Ch       | DSP_L2_ILR8         | Interrupt 8 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 481Eh       | DSP_L2_ILR9         | Interrupt 9 Priority Level Register   | 16           | RW          | 0000h       |
| 0x00 4820h       | DSP_L2_ILR10        | Interrupt 10 Priority Level Register  | 16           | RW          | 0000h       |
| 0x00 4822h       | DSP_L2_ILR11        | Interrupt 11 Priority Level Register  | 16           | RW          | 0000h       |
| 0x00 4824h       | DSP_L2_ILR12        | Interrupt 12 Priority Level Register  | 16           | RW          | 0000h       |
| 0x00 4826h       | DSP_L2_ILR13        | Interrupt 13 Priority Level Register  | 16           | RW          | 0000h       |
| 0x00 4828h       | DSP_L2_ILR14        | Interrupt 14 Priority Level Register  | 16           | RW          | 0000h       |
| 0x00 482Ah       | DSP_L2_ILR15        | Interrupt 15 Priority Level Register  | 16           | RW          | 0000h       |

### 3.16.2 DSP Public Peripheral Registers

The DSP public peripheral registers include the following:

- Serial Ports:
  - McBSP1 Registers
  - McBSP3 Registers
  - MCS11 Registers
  - MCS12 Registers

**Table 3–59. McBSP1 Registers**

| DSP WORD ADDRESS | MPU BYTE ADDRESS (VIA MPUI) | REGISTER NAME | DESCRIPTION                                         | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|-----------------------------|---------------|-----------------------------------------------------|--------------|-------------|-------------|
| 0x00 8C00h       | E101:1800                   | MCBSP1_DRR2   | McBSP1 Data Receive Register 2                      | 16           | RW          | 0000h       |
| 0x00 8C01h       | E101:1802                   | MCBSP1_DRR1   | McBSP1 Data Receive Register 1                      | 16           | RW          | 0000h       |
| 0x00 8C02h       | E101:1804                   | MCBSP1_DXR2   | McBSP1 Data Transmit Register 2                     | 16           | RW          | 0000h       |
| 0x00 8C03h       | E101:1806                   | MCBSP1_DXR1   | McBSP1 Data Transmit Register 1                     | 16           | RW          | 0000h       |
| 0x00 8C04h       | E101:1808                   | MCBSP1_SPCR2  | McBSP1 Serial Port Control Register 2               | 16           | RW          | 0000h       |
| 0x00 8C05h       | E101:180A                   | MCBSP1_SPCR1  | McBSP1 Serial Port Control Register 1               | 16           | RW          | 0000h       |
| 0x00 8C06h       | E101:180C                   | MCBSP1_RCR2   | McBSP1 Receive Control Register 2                   | 16           | RW          | 0000h       |
| 0x00 8C07h       | E101:180E                   | MCBSP1_RCR1   | McBSP1 Receive Control Register 1                   | 16           | RW          | 0000h       |
| 0x00 8C08h       | E101:1810                   | MCBSP1_XCR2   | McBSP1 Transmit Control Register 2                  | 16           | RW          | 0000h       |
| 0x00 8C09h       | E101:1812                   | MCBSP1_XCR1   | McBSP1 Transmit Control Register 1                  | 16           | RW          | 0000h       |
| 0x00 8C0Ah       | E101:1814                   | MCBSP1_SRGR2  | McBSP1 Sample Rate Generator Register 2             | 16           | RW          | 2000h       |
| 0x00 8C0Bh       | E101:1816                   | MCBSP1_SRGR1  | McBSP1 Sample Rate Generator Register 1             | 16           | RW          | 0001h       |
| 0x00 8C0Ch       | E101:1818                   | MCBSP1_MCR2   | McBSP1 Multichannel Control Register 2              | 16           | RW          | 0000h       |
| 0x00 8C0Dh       | E101:181A                   | MCBSP1_MCR1   | McBSP1 Multichannel Control Register 1              | 16           | RW          | 0000h       |
| 0x00 8C0Eh       | E101:181C                   | MCBSP1_RCERA  | McBSP1 Receive Channel Enable Register Partition A  | 16           | RW          | 0000h       |
| 0x00 8C0Fh       | E101:181E                   | MCBSP1_RCERB  | McBSP1 Receive Channel Enable Register Partition B  | 16           | RW          | 0000h       |
| 0x00 8C10h       | E101:1820                   | MCBSP1_XCERA  | McBSP1 Transmit Channel Enable Register Partition A | 16           | RW          | 0000h       |
| 0x00 8C11h       | E101:1822                   | MCBSP1_XCERB  | McBSP1 Transmit Channel Enable Register Partition B | 16           | RW          | 0000h       |
| 0x00 8C12h       | E101:1824                   | MCBSP1_PCR0   | McBSP1 Pin Control Register 0                       | 16           | RW          | 0000h       |
| 0x00 8C13h       | E101:1826                   | MCBSP1_RCERC  | McBSP1 Receive Channel Enable Register Partition C  | 16           | RW          | 0000h       |
| 0x00 8C14h       | E101:1828                   | MCBSP1_RCERD  | McBSP1 Receive Channel Enable Register Partition D  | 16           | RW          | 0000h       |
| 0x00 8C15h       | E101:182A                   | MCBSP1_XCERC  | McBSP1 Transmit Channel Enable Register Partition C | 16           | RW          | 0000h       |
| 0x00 8C16h       | E101:182C                   | MCBSP1_XCERD  | McBSP1 Transmit Channel Enable Register Partition D | 16           | RW          | 0000h       |
| 0x00 8C17h       | E101:182E                   | MCBSP1_RCERE  | McBSP1 Receive Channel Enable Register Partition E  | 16           | RW          | 0000h       |
| 0x00 8C18h       | E101:1830                   | MCBSP1_RCERF  | McBSP1 Receive Channel Enable Register Partition F  | 16           | RW          | 0000h       |
| 0x00 8C19h       | E101:1832                   | MCBSP1_XCERE  | McBSP1 Transmit Channel Enable Register Partition E | 16           | RW          | 0000h       |
| 0x00 8C1Ah       | E101:1834                   | MCBSP1_XCERF  | McBSP1 Transmit Channel Enable Register Partition F | 16           | RW          | 0000h       |

**Table 3–59. McBSP1 Registers (Continued)**

| DSP WORD ADDRESS | MPU BYTE ADDRESS (VIA MPU) | REGISTER NAME | DESCRIPTION                                         | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|----------------------------|---------------|-----------------------------------------------------|--------------|-------------|-------------|
| 0x00 8C1Bh       | E101:1836                  | MCBSP1_RCERG  | McBSP1 Receive Channel Enable Register Partition G  | 16           | RW          | 0000h       |
| 0x00 8C1Ch       | E101:1838                  | MCBSP1_RCERH  | McBSP1 Receive Channel Enable Register Partition H  | 16           | RW          | 0000h       |
| 0x00 8C1Dh       | E101:183A                  | MCBSP1_XCERG  | McBSP1 Transmit Channel Enable Register Partition G | 16           | RW          | 0000h       |
| 0x00 8C1Eh       | E101:183C                  | MCBSP1_XCERH  | McBSP1 Transmit Channel Enable Register Partition H | 16           | RW          | 0000h       |

**Table 3–60. McBSP3 Registers**

| DSP WORD ADDRESS | MPU BYTE ADDRESS (VIA MPU) | REGISTER NAME | DESCRIPTION                                         | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|----------------------------|---------------|-----------------------------------------------------|--------------|-------------|-------------|
| 0x00 B800h       | E101:7000                  | MCBSP3_DRR2   | McBSP3 Data Receive Register 2                      | 16           | RW          | 0000h       |
| 0x00 B801h       | E101:7002                  | MCBSP3_DRR1   | McBSP3 Data Receive Register 1                      | 16           | RW          | 0000h       |
| 0x00 B802h       | E101:7004                  | MCBSP3_DXR2   | McBSP3 Data Transmit Register 2                     | 16           | RW          | 0000h       |
| 0x00 B803h       | E101:7006                  | MCBSP3_DXR1   | McBSP3 Data Transmit Register 1                     | 16           | RW          | 0000h       |
| 0x00 B804h       | E101:7008                  | MCBSP3_SPCR2  | McBSP3 Serial Port Control Register 2               | 16           | RW          | 0000h       |
| 0x00 B805h       | E101:700A                  | MCBSP3_SPCR1  | McBSP3 Serial Port Control Register 1               | 16           | RW          | 0000h       |
| 0x00 B806h       | E101:700C                  | MCBSP3_RCR2   | McBSP3 Receive Control Register 2                   | 16           | RW          | 0000h       |
| 0x00 B807h       | E101:700E                  | MCBSP3_RCR1   | McBSP3 Receive Control Register 1                   | 16           | RW          | 0000h       |
| 0x00 B808h       | E101:7010                  | MCBSP3_XCR2   | McBSP3 Transmit Control Register 2                  | 16           | RW          | 0000h       |
| 0x00 B809h       | E101:7012                  | MCBSP3_XCR1   | McBSP3 Transmit Control Register 1                  | 16           | RW          | 0000h       |
| 0x00 B80Ah       | E101:7014                  | MCBSP3_SRGR2  | McBSP3 Sample Rate Generator Register 2             | 16           | RW          | 2000h       |
| 0x00 B80Bh       | E101:7016                  | MCBSP3_SRGR1  | McBSP3 Sample Rate Generator Register 1             | 16           | RW          | 0001h       |
| 0x00 B80Ch       | E101:7018                  | MCBSP3_MCR2   | McBSP3 Multichannel Control Register 2              | 16           | RW          | 0000h       |
| 0x00 B80Dh       | E101:701A                  | MCBSP3_MCR1   | McBSP3 Multichannel Control Register 1              | 16           | RW          | 0000h       |
| 0x00 B80Eh       | E101:701C                  | MCBSP3_RCERA  | McBSP3 Receive Channel Enable Register Partition A  | 16           | RW          | 0000h       |
| 0x00 B80Fh       | E101:701E                  | MCBSP3_RCERB  | McBSP3 Receive Channel Enable Register Partition B  | 16           | RW          | 0000h       |
| 0x00 B810h       | E101:7020                  | MCBSP3_XCERA  | McBSP3 Transmit Channel Enable Register Partition A | 16           | RW          | 0000h       |
| 0x00 B811h       | E101:7022                  | MCBSP3_XCERB  | McBSP3 Transmit Channel Enable Register Partition B | 16           | RW          | 0000h       |
| 0x00 B812h       | E101:7024                  | MCBSP3_PCR0   | McBSP3 Pin Control Register 0                       | 16           | RW          | 0000h       |
| 0x00 B813h       | E101:7026                  | MCBSP3_RCERC  | McBSP3 Receive Channel Enable Register Partition C  | 16           | RW          | 0000h       |
| 0x00 B814h       | E101:7028                  | MCBSP3_RCERD  | McBSP3 Receive Channel Enable Register Partition D  | 16           | RW          | 0000h       |
| 0x00 B815h       | E101:702A                  | MCBSP3_XCERC  | McBSP3 Transmit Channel Enable Register Partition C | 16           | RW          | 0000h       |
| 0x00 B816h       | E101:702C                  | MCBSP3_XCERD  | McBSP3 Transmit Channel Enable Register Partition D | 16           | RW          | 0000h       |
| 0x00 B817h       | E101:702E                  | MCBSP3_RCERE  | McBSP3 Receive Channel Enable Register Partition E  | 16           | RW          | 0000h       |
| 0x00 B818h       | E101:7030                  | MCBSP3_RCERF  | McBSP3 Receive Channel Enable Register Partition F  | 16           | RW          | 0000h       |

**Table 3–60. McBSP3 Registers (Continued)**

| DSP WORD ADDRESS | MPU BYTE ADDRESS (VIA MPUI) | REGISTER NAME | DESCRIPTION                                         | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|-----------------------------|---------------|-----------------------------------------------------|--------------|-------------|-------------|
| 0x00 B819h       | E101:7032                   | MCBSP3_XCERE  | McBSP3 Transmit Channel Enable Register Partition E | 16           | RW          | 0000h       |
| 0x00 B81Ah       | E101:7034                   | MCBSP3_XCERF  | McBSP3 Transmit Channel Enable Register Partition F | 16           | RW          | 0000h       |
| 0x00 B81Bh       | E101:7036                   | MCBSP3_RCERG  | McBSP3 Receive Channel Enable Register Partition G  | 16           | RW          | 0000h       |
| 0x00 B81Ch       | E101:7038                   | MCBSP3_RCERH  | McBSP3 Receive Channel Enable Register Partition H  | 16           | RW          | 0000h       |
| 0x00 B81Dh       | E101:703A                   | MCBSP3_XCERG  | McBSP3 Transmit Channel Enable Register Partition G | 16           | RW          | 0000h       |
| 0x00 B81Eh       | E101:703C                   | MCBSP3_XCERH  | McBSP3 Transmit Channel Enable Register Partition H | 16           | RW          | 0000h       |

Table 3–61. MCSI1 Registers

| DSP WORD ADDRESS          | MPU BYTE ADDRESS (VIA MPUI) | REGISTER NAME             | DESCRIPTION                     | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|---------------------------|-----------------------------|---------------------------|---------------------------------|--------------|-------------|-------------|
| 0x00 9400h                | E101:2800                   | MCSI1_CONTROL_REG         | MCSI1 Control Register          | 16           | RW          | 0000h       |
| 0x00 9401h                | E101:2802                   | MCSI1_MAIN_PARAMETERS_REG | MCSI1 Main Parameters Register  | 16           | RW          | 0000h       |
| 0x00 9402h                | E101:2804                   | MCSI1_INTERRUPTS_REG      | MCSI1 Interrupts Register       | 16           | RW          | 0000h       |
| 0x00 9403h                | E101:2806                   | MCSI1_CHANNEL_USED_REG    | MCSI1 Channel Used Register     | 16           | RW          | 0000h       |
| 0x00 9404h                | E101:2808                   | MCSI1_OVER_CLOCK_REG      | MCSI1 Over-Clock Register       | 16           | RW          | 0000h       |
| 0x00 9405h                | E101:280A                   | MCSI1_CLOCK_FREQUENCY_REG | MCSI1 Clock Frequency Register  | 16           | RW          | 0000h       |
| 0x00 9406h                | E101:280C                   | MCSI1_STATUS_REG          | MCSI1 Status Register           | 16           | RW          | 0000h       |
| 0x00 9407h–<br>0x00 941Fh |                             | Reserved                  |                                 |              |             |             |
| 0x00 9420h                | E101:2840                   | MCSI1_TX0                 | MCSI1 Transmit Word Register 0  | 16           | RW          | Undefined   |
| 0x00 9421h                | E101:2842                   | MCSI1_TX1                 | MCSI1 Transmit Word Register 1  | 16           | RW          | Undefined   |
| 0x00 9422h                | E101:2844                   | MCSI1_TX2                 | MCSI1 Transmit Word Register 2  | 16           | RW          | Undefined   |
| 0x00 9423h                | E101:2846                   | MCSI1_TX3                 | MCSI1 Transmit Word Register 3  | 16           | RW          | Undefined   |
| 0x00 9424h                | E101:2848                   | MCSI1_TX4                 | MCSI1 Transmit Word Register 4  | 16           | RW          | Undefined   |
| 0x00 9425h                | E101:284A                   | MCSI1_TX5                 | MCSI1 Transmit Word Register 5  | 16           | RW          | Undefined   |
| 0x00 9426h                | E101:284C                   | MCSI1_TX6                 | MCSI1 Transmit Word Register 6  | 16           | RW          | Undefined   |
| 0x00 9427h                | E101:284E                   | MCSI1_TX7                 | MCSI1 Transmit Word Register 7  | 16           | RW          | Undefined   |
| 0x00 9428h                | E101:2850                   | MCSI1_TX8                 | MCSI1 Transmit Word Register 8  | 16           | RW          | Undefined   |
| 0x00 9429h                | E101:2852                   | MCSI1_TX9                 | MCSI1 Transmit Word Register 9  | 16           | RW          | Undefined   |
| 0x00 942Ah                | E101:2854                   | MCSI1_TX10                | MCSI1 Transmit Word Register 10 | 16           | RW          | Undefined   |
| 0x00 942Bh                | E101:2856                   | MCSI1_TX11                | MCSI1 Transmit Word Register 11 | 16           | RW          | Undefined   |
| 0x00 942Ch                | E101:2858                   | MCSI1_TX12                | MCSI1 Transmit Word Register 12 | 16           | RW          | Undefined   |
| 0x00 942Dh                | E101:285A                   | MCSI1_TX13                | MCSI1 Transmit Word Register 13 | 16           | RW          | Undefined   |
| 0x00 942Eh                | E101:285C                   | MCSI1_TX14                | MCSI1 Transmit Word Register 14 | 16           | RW          | Undefined   |
| 0x00 942Fh                | E101:285E                   | MCSI1_TX15                | MCSI1 Transmit Word Register 15 | 16           | RW          | Undefined   |
| 0x00 9430h                | E101:2860                   | MCSI1_RX0                 | MCSI1 Receive Word Register 0   | 16           | R           | Undefined   |
| 0x00 9431h                | E101:2862                   | MCSI1_RX1                 | MCSI1 Receive Word Register 1   | 16           | R           | Undefined   |
| 0x00 9432h                | E101:2864                   | MCSI1_RX2                 | MCSI1 Receive Word Register 2   | 16           | R           | Undefined   |
| 0x00 9433h                | E101:2866                   | MCSI1_RX3                 | MCSI1 Receive Word Register 3   | 16           | R           | Undefined   |
| 0x00 9434h                | E101:2868                   | MCSI1_RX4                 | MCSI1 Receive Word Register 4   | 16           | R           | Undefined   |
| 0x00 9435h                | E101:286A                   | MCSI1_RX5                 | MCSI1 Receive Word Register 5   | 16           | R           | Undefined   |
| 0x00 9436h                | E101:286C                   | MCSI1_RX6                 | MCSI1 Receive Word Register 6   | 16           | R           | Undefined   |
| 0x00 9437h                | E101:286E                   | MCSI1_RX7                 | MCSI1 Receive Word Register 7   | 16           | R           | Undefined   |
| 0x00 9438h                | E101:2870                   | MCSI1_RX8                 | MCSI1 Receive Word Register 8   | 16           | R           | Undefined   |
| 0x00 9439h                | E101:2872                   | MCSI1_RX9                 | MCSI1 Receive Word Register 9   | 16           | R           | Undefined   |
| 0x00 943Ah                | E101:2874                   | MCSI1_RX10                | MCSI1 Receive Word Register 10  | 16           | R           | Undefined   |
| 0x00 943Bh                | E101:2876                   | MCSI1_RX11                | MCSI1 Receive Word Register 11  | 16           | R           | Undefined   |
| 0x00 943Ch                | E101:2878                   | MCSI1_RX12                | MCSI1 Receive Word Register 12  | 16           | R           | Undefined   |
| 0x00 943Dh                | E101:287A                   | MCSI1_RX13                | MCSI1 Receive Word Register 13  | 16           | R           | Undefined   |
| 0x00 943Eh                | E101:287C                   | MCSI1_RX14                | MCSI1 Receive Word Register 14  | 16           | R           | Undefined   |
| 0x00 943Fh                | E101:287E                   | MCSI1_RX15                | MCSI1 Receive Word Register 15  | 16           | R           | Undefined   |

Table 3–62. MCSI2 Registers

| DSP WORD ADDRESS        | MPU BYTE ADDRESS (VIA MPU) | REGISTER NAME             | DESCRIPTION                     | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-------------------------|----------------------------|---------------------------|---------------------------------|--------------|-------------|-------------|
| 0x00 9000h              | E101:2000                  | MCSI2_CONTROL_REG         | MCSI2 control register          | 16           | RW          | 0000h       |
| 0x00 9001h              | E101:2002                  | MCSI2_MAIN_PARAMETERS_REG | MCSI2 main parameters register  | 16           | RW          | 0000h       |
| 0x00 9002h              | E101:2004                  | MCSI2_INTERRUPTS_REG      | MCSI2 interrupts register       | 16           | RW          | 0000h       |
| 0x00 9003h              | E101:2006                  | MCSI2_CHANNEL_USED_REG    | MCSI2 channel used register     | 16           | RW          | 0000h       |
| 0x00 9004h              | E101:2008                  | MCSI2_OVER_CLOCK_REG      | MCSI2 over-clock register       | 16           | RW          | 0000h       |
| 0x00 9005h              | E101:200A                  | MCSI2_CLOCK_FREQUENCY_REG | MCSI2 clock frequency register  | 16           | RW          | 0000h       |
| 0x00 9006h              | E101:200C                  | MCSI2_STATUS_REG          | MCSI2 status register           | 16           | RW          | 0000h       |
| 0x00 9007h – 0x00 901Fh |                            | Reserved                  |                                 |              |             |             |
| 0x00 9020h              | E101:2040                  | MCSI2_TX0                 | MCSI2 Transmit Word Register 0  | 16           | RW          | Undefined   |
| 0x00 9021h              | E101:2042                  | MCSI2_TX1                 | MCSI2 Transmit Word Register 1  | 16           | RW          | Undefined   |
| 0x00 9022h              | E101:2044                  | MCSI2_TX2                 | MCSI2 Transmit Word Register 2  | 16           | RW          | Undefined   |
| 0x00 9023h              | E101:2046                  | MCSI2_TX3                 | MCSI2 Transmit Word Register 3  | 16           | RW          | Undefined   |
| 0x00 9024h              | E101:2048                  | MCSI2_TX4                 | MCSI2 Transmit Word Register 4  | 16           | RW          | Undefined   |
| 0x00 9025h              | E101:204A                  | MCSI2_TX5                 | MCSI2 Transmit Word Register 5  | 16           | RW          | Undefined   |
| 0x00 9026h              | E101:204C                  | MCSI2_TX6                 | MCSI2 Transmit Word Register 6  | 16           | RW          | Undefined   |
| 0x00 9027h              | E101:204E                  | MCSI2_TX7                 | MCSI2 Transmit Word Register 7  | 16           | RW          | Undefined   |
| 0x00 9028h              | E101:2050                  | MCSI2_TX8                 | MCSI2 Transmit Word Register 8  | 16           | RW          | Undefined   |
| 0x00 9029h              | E101:2052                  | MCSI2_TX9                 | MCSI2 Transmit Word Register 9  | 16           | RW          | Undefined   |
| 0x00 902Ah              | E101:2054                  | MCSI2_TX10                | MCSI2 Transmit Word Register 10 | 16           | RW          | Undefined   |
| 0x00 902Bh              | E101:2056                  | MCSI2_TX11                | MCSI2 Transmit Word Register 11 | 16           | RW          | Undefined   |
| 0x00 902Ch              | E101:2058                  | MCSI2_TX12                | MCSI2 Transmit Word Register 12 | 16           | RW          | Undefined   |
| 0x00 902Dh              | E101:205A                  | MCSI2_TX13                | MCSI2 Transmit Word Register 13 | 16           | RW          | Undefined   |
| 0x00 902Eh              | E101:205C                  | MCSI2_TX14                | MCSI2 Transmit Word Register 14 | 16           | RW          | Undefined   |
| 0x00 902Fh              | E101:205E                  | MCSI2_TX15                | MCSI2 Transmit Word Register 15 | 16           | RW          | Undefined   |
| 0x00 9030h              | E101:2060                  | MCSI2_RX0                 | MCSI2 Receive Word Register 0   | 16           | R           | Undefined   |
| 0x00 9031h              | E101:2062                  | MCSI2_RX1                 | MCSI2 Receive Word Register 1   | 16           | R           | Undefined   |
| 0x00 9032h              | E101:2064                  | MCSI2_RX2                 | MCSI2 Receive Word Register 2   | 16           | R           | Undefined   |
| 0x00 9033h              | E101:2066                  | MCSI2_RX3                 | MCSI2 Receive Word Register 3   | 16           | R           | Undefined   |
| 0x00 9034h              | E101:2068                  | MCSI2_RX4                 | MCSI2 Receive Word Register 4   | 16           | R           | Undefined   |
| 0x00 9035h              | E101:206A                  | MCSI2_RX5                 | MCSI2 Receive Word Register 5   | 16           | R           | Undefined   |
| 0x00 9036h              | E101:206C                  | MCSI2_RX6                 | MCSI2 Receive Word Register 6   | 16           | R           | Undefined   |
| 0x00 9037h              | E101:206E                  | MCSI2_RX7                 | MCSI2 Receive Word Register 7   | 16           | R           | Undefined   |
| 0x00 9038h              | E101:2070                  | MCSI2_RX8                 | MCSI2 Receive Word Register 8   | 16           | R           | Undefined   |
| 0x00 9039h              | E101:2072                  | MCSI2_RX9                 | MCSI2 Receive Word Register 9   | 16           | R           | Undefined   |
| 0x00 903Ah              | E101:2074                  | MCSI2_RX10                | MCSI2 Receive Word Register 10  | 16           | R           | Undefined   |
| 0x00 903Bh              | E101:2076                  | MCSI2_RX11                | MCSI2 Receive Word Register 11  | 16           | R           | Undefined   |
| 0x00 903Ch              | E101:2078                  | MCSI2_RX12                | MCSI2 Receive Word Register 12  | 16           | R           | Undefined   |
| 0x00 903Dh              | E101:207A                  | MCSI2_RX13                | MCSI2 Receive Word Register 13  | 16           | R           | Undefined   |
| 0x00 903Eh              | E101:207C                  | MCSI2_RX14                | MCSI2 Receive Word Register 14  | 16           | R           | Undefined   |
| 0x00 903Fh              | E101:207E                  | MCSI2_RX15                | MCSI2 Receive Word Register 15  | 16           | R           | Undefined   |

### 3.16.3 DSP Configuration Registers

The DSP configuration registers include the following:

- I-Cache and EMIF setup
  - DSP Instruction Cache Registers
  - DSP EMIF Configuration Registers
- TIPB setup
  - DSP TIPB Bridge Configuration Registers
  - DSP UART TI Peripheral Bus Switch Registers
- Clock Control:
  - DSP Clock Mode Registers

**Table 3–63. DSP Instruction Cache Registers**

| DSP WORD ADDRESS | REGISTER NAME | DESCRIPTION                       | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|---------------|-----------------------------------|--------------|-------------|-------------|
| 0x00 1400h       | ICGC          | I-Cache Global Control Register   | 16           | RW          | C006h       |
| 0x00 1401h       |               | Reserved                          | 16           | RW          | 0000h       |
| 0x00 1402h       |               | Reserved                          | 16           | RW          | 0000h       |
| 0x00 1403h       | ICWC          | I-Cache Way Control Register      | 16           | RW          | 000Dh       |
| 0x00 1404h       | ICST          | I-Cache Status Register           | 16           | R           | 0000h       |
| 0x00 1405h       | ICRC1         | I-Cache Ramset 1 Control Register | 16           | RW          | 000Dh       |
| 0x00 1406h       | ICRTAG1       | I-Cache Ramset 1 TAG Register     | 16           | RW          | 0000h       |
| 0x00 1407h       | ICRC2         | I-Cache Ramset 2 Control Register | 16           | RW          | 000Dh       |
| 0x00 1408h       | ICRTAG2       | I-Cache Ramset 2 TAG Register     | 16           | RW          | 0000h       |

**Table 3–64. DSP EMIF Configuration Register**

| DSP WORD ADDRESS | REGISTER NAME | DESCRIPTION                      | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|---------------|----------------------------------|--------------|-------------|-------------|
| 0x00 0800h       | DSP_EMIF_GCR  | DSP EMIF Global Control Register | 16           | RW          | 0020h       |
| 0x00 0801h       | DSP_EMIF_GRR  | DSP EMIF Global Reset Register   | 16           | RW          | undef       |

**Table 3–65. DSP TIPB Bridge Configuration Registers**

| DSP WORD ADDRESS | REGISTER NAME | DESCRIPTION                           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|---------------|---------------------------------------|--------------|-------------|-------------|
| 0x00 0000h       | TIPB_CMR      | DSP TIPB Bridge Control Mode Register | 16           | RW          | FE4Dh       |
| 0x00 0001h       | TIPB_ICR      | DSP TIPB Bridge Idle Control Register | 16           | RW          | 0000h       |
| 0x00 0002h       | TIPB_ISTR     | DSP TIPB Bridge Idle Status Register  | 16           | R           | 0000h       |

**Table 3–66. DSP UART TIPB Bus Switch Registers**

| DSP WORD ADDRESS        | REGISTER NAME | DESCRIPTION                                    | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-------------------------|---------------|------------------------------------------------|--------------|-------------|-------------|
| 0x00 E400h              | RHSW_DSP_CNF1 | UART1 TIPB Switch Configuration Register (DSP) | 16           | RW          | 0001h       |
| 0x00 E402h              | RHSW_DSP_STA1 | UART1 TIPB Switch Status Register (DSP)        | 16           | R           | 0001h       |
| 0x00 E404–<br>0x00 E0Eh |               | Reserved                                       |              |             |             |
| 0x00 E410h              | RHSW_DSP_CNF2 | UART2 TIPB Switch Configuration Register (DSP) | 16           | RW          | 0001h       |
| 0x00 E412h              | RHSW_DSP_STA2 | UART2 TIPB Switch Status Register (DSP)        | 16           | R           | 0001h       |
| 0x00 E414–<br>0x00 E1Eh |               | Reserved                                       |              |             |             |
| 0x00 E420h              | RHSW_DSP_CNF3 | UART3 TIPB Switch Configuration Register (DSP) | 16           | RW          | 0001h       |
| 0x00 E422h              | RHSW_DSP_STA3 | UART3 TIPB Switch Status Register (DSP)        | 16           | R           | 0001h       |

**Table 3–67. DSP Clock Mode Registers**

| DSP WORD ADDRESS           | MPU BYTE ADDRESS (VIA MPUI) | REGISTER NAME | DESCRIPTION                           | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|----------------------------|-----------------------------|---------------|---------------------------------------|--------------|-------------|-------------|
| 0x00 4000h                 | E100:8000                   | DSP_CKCTL     | DSP Clock Control Register            | 16           | RW          | 0000h       |
| 0x00 4002h                 | E100:8004                   | DSP_IDLECT1   | DSP Idle Control 1 Register           | 16           | RW          | 0000h       |
| 0x00 4004h                 | E100:8008                   | DSP_IDLECT2   | DSP Idle Control 2 Register           | 16           | RW          | 0000h       |
| 0x00 4006h –<br>0x00 4008h |                             | Reserved      |                                       |              |             |             |
| 0x00 400Ah                 | E100:8014                   | DSP_RSTCT2    | DSP Peripheral Reset Control Register | 16           | RW          | 0000h       |
| 0x00 400Ch                 | E100:8018                   | DSP_SYSST     | DSP System Status Register            | 16           | RW          | 0000h       |

### 3.16.4 MPU/DSP Shared Peripheral Register Descriptions

The following tables describe the MPU/DSP shared peripheral registers including register addresses, descriptions, required access widths, access types (R-read, W-write, RW-read/write) and reset values. These tables are organized by function with like peripherals or functions together and are therefore not necessarily in order of ascending register addresses. Reserved addresses should never be accessed.

**NOTE:** All accesses to these registers must be of the data access widths indicated to avoid a TIPB bus error condition and a corresponding interrupt. Reserved addresses should never be accessed.

The MPU/DSP shared peripheral registers include the following:

- UARTs:
  - UART1 Registers
  - UART2 Registers
  - UART3/IrDA Registers
- GPIO and Mailboxes
  - MPU/DSP Shared GPIO Registers
  - MPU/DSP Shared Mailbox Registers

Table 3–68. UART1 Registers

| DSP WORD ADDRESS        | MPU BYTE ADDRESS      | MPU BYTE ADDRESS (VIA MPUI) | REGISTER NAME                  | DESCRIPTION                                 | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-------------------------|-----------------------|-----------------------------|--------------------------------|---------------------------------------------|--------------|-------------|-------------|
| 0x00 8000h              | FFFB:0000             | E101:0000                   | UART1_RHR <sup>†</sup>         | UART1 Receive Holding Register              | 8            | R           | Undefined   |
| 0x00 8000h              | FFFB:0000             | E101:0000                   | UART1_THR <sup>†</sup>         | UART1 Transmit Holding Register             | 8            | W           | Undefined   |
| 0x00 8000h              | FFFB:0000             | E101:0000                   | UART1_DLL <sup>‡§</sup>        | UART1 Divisor Latch Low Register            | 8            | RW          | 00h         |
| 0x00 8001h              | FFFB:0004             | E101:0002                   | UART1_IER <sup>†</sup>         | UART1 Interrupt Enable Register             | 8            | RW          | 00h         |
| 0x00 8001h              | FFFB:0004             | E101:0002                   | UART1_DLH <sup>‡§</sup>        | UART1 Divisor Latch High Register           | 8            | RW          | 00h         |
| 0x00 8002h              | FFFB:0008             | E101:0004                   | UART1_IIR <sup>†‡</sup>        | UART1 Interrupt Identification Register     | 8            | R           | 01h         |
| 0x00 8002h              | FFFB:0008             | E101:0004                   | UART1_FCR <sup>†¶</sup>        | UART1 FIFO Control Register                 | 8            | W           | 00h         |
| 0x00 8002h              | FFFB:0008             | E101:0004                   | UART1_EFR <sup>§</sup>         | UART1 Enhanced Feature Register             | 8            | RW          | 00h         |
| 0x00 8003h              | FFFB:000C             | E101:0006                   | UART1_LCR                      | UART1 Line Control Register                 | 8            | RW          | 00h         |
| 0x00 8004h              | FFFB:0010             | E101:0008                   | UART1_MCR <sup>†¶</sup>        | UART1 Modem Control Register                | 8            | RW          | 00h         |
| 0x00 8004h              | FFFB:0010             | E101:0008                   | UART1_XON1 <sup>§</sup>        | UART1 XON1 Register                         | 8            | RW          | 00h         |
| 0x00 8005h              | FFFB:0014             | E101:000A                   | UART1_LSR <sup>†‡</sup>        | UART1 Mode Register                         | 8            | R           | 60h         |
| 0x00 8005h              | FFFB:0014             | E101:000A                   | UART1_XON2 <sup>§</sup>        | UART1 XON2 Register                         | 8            | RW          | 00h         |
| 0x00 8006h              | FFFB:0018             | E101:000C                   | UART1_MSR <sup>†‡</sup>        | UART1 Modem Status Register                 | 8            | R           | Undefined   |
| 0x00 8006h              | FFFB:0018             | E101:000C                   | UART1_TCR <sup>#</sup>         | UART1 Transmission Control Register         | 8            | RW          | 0Fh         |
| 0x00 8006h              | FFFB:0018             | E101:000C                   | UART1_XOFF1 <sup>§</sup>       | UART1 XOFF1 Register                        | 8            | RW          | 00h         |
| 0x00 8007h              | FFFB:001C             | E101:000E                   | UART1_SPR <sup>†‡</sup>        | UART1 Scratchpad Register                   | 8            | RW          | 00h         |
| 0x00 8007h              | FFFB:001C             | E101:000E                   | UART1_TLR <sup>#</sup>         | UART1 Trigger Level Register                | 8            | RW          | 00h         |
| 0x00 8007h              | FFFB:001C             | E101:000E                   | UART1_XOFF2 <sup>§</sup>       | UART1 XOFF2 Register                        | 8            | RW          | 00h         |
| 0x00 8008h              | FFFB:0020             | E101:0010                   | UART1_MDR1                     | UART1 Mode Definition 1 Register            | 8            | RW          | 07h         |
| 0x00 8009h – 0x00 800Dh | FFFB:0024 – FFFB:0034 |                             |                                | Reserved                                    |              |             |             |
| 0x00 800Eh              | FFFB:0038             | E101:001C                   | UART1_UASR <sup>‡§</sup>       | UART1 Autobauding Status Register           | 8            | R           | 00h         |
| 0x00 800Fh              | FFFB:003C             |                             |                                | Reserved                                    |              |             |             |
| 0x00 8010h              | FFFB:0040             | E101:0020                   | UART1_SCR                      | UART1 Supplementary Control Register        | 8            | RW          | 00h         |
| 0x00 8011h              | FFFB:0044             | E101:0022                   | UART1_SSR                      | UART1 Supplementary Status Register         | 8            | R           | 00h         |
| 0x00 8012h              | FFFB:0048             |                             |                                | Reserved                                    |              |             |             |
| 0x00 8013h              | FFFB:004C             | E101:0026                   | UART1_OSC_12M_SEL <sup>†</sup> | UART1 12-/13-MHz Oscillator Select Register | 8            | W           | 00h         |
| 0x00 8014h              | FFFB:0050             | E101:0028                   | UART1_MVR                      | UART1 Module Version Register               | 8            | R           | –           |

<sup>†</sup> Register is accessible when LCR[7] = 0 (normal operating mode)

<sup>‡</sup> Register is accessible when LCR[7] = 1 and LCR[7:0] ≠ 0BFh

<sup>§</sup> Register is accessible when LCR[7] = 0BFh

<sup>¶</sup> Register is write accessible when EFR[4] = 1

<sup>#</sup> Register is accessible when EFR[4] = 1 and MCR[6] = 1

Table 3–69. UART2 Registers

| DSP WORD ADDRESS      | MPU BYTE ADDRESS      | MPU BYTE ADDRESS (VIA MPU) | REGISTER NAME                   | DESCRIPTION                                 | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|-----------------------|-----------------------|----------------------------|---------------------------------|---------------------------------------------|--------------|-------------|-------------|
| 0x00 8400h            | FFFB:0800             | E101:0800                  | UART2_RHR <sup>†</sup>          | UART2 Receive Holding Register              | 8            | R           | Undefined   |
| 0x00 8400h            | FFFB:0800             | E101:0800                  | UART2_THR <sup>†</sup>          | UART2 Transmit Holding Register             | 8            | W           | Undefined   |
| 0x00 8400h            | FFFB:0800             | E101:0800                  | UART2_DLL <sup>‡§</sup>         | UART2 Divisor Latch Low Register            | 8            | RW          | 00h         |
| 0x00 8401h            | FFFB:0804             | E101:0802                  | UART2_IER <sup>†</sup>          | UART2 Interrupt Enable Register             | 8            | RW          | 00h         |
| 0x00 8401h            | FFFB:0804             | E101:0802                  | UART2_DLH <sup>‡§</sup>         | UART2 Divisor Latch High Register           | 8            | RW          | 00h         |
| 0x00 8402h            | FFFB:0808             | E101:0804                  | UART2_IIR <sup>†‡</sup>         | UART2 Interrupt Identification Register     | 8            | R           | 01h         |
| 0x00 8402h            | FFFB:0808             | E101:0804                  | UART2_FCR <sup>†‡¶</sup>        | UART2 FIFO Control Register                 | 8            | W           | 00h         |
| 0x00 8402h            | FFFB:0808             | E101:0804                  | UART2_EFR <sup>§</sup>          | UART2 Enhanced Feature Register             | 8            | RW          | 00h         |
| 0x00 8403h            | FFFB:080C             | E101:0806                  | UART2_LCR                       | UART2 Line Control Register                 | 8            | RW          | 00h         |
| 0x00 8404h            | FFFB:0810             | E101:0808                  | UART2_MCR <sup>†‡¶</sup>        | UART2 Modem Control Register                | 8            | RW          | 00h         |
| 0x00 8404h            | FFFB:0810             | E101:0808                  | UART2_XON1 <sup>§</sup>         | UART2 XON1 Register                         | 8            | RW          | 00h         |
| 0x00 8405h            | FFFB:0814             | E101:080A                  | UART2_LSR <sup>†‡</sup>         | UART2 Mode Register                         | 8            | R           | 60h         |
| 0x00 8405h            | FFFB:0814             | E101:080A                  | UART2_XON2 <sup>§</sup>         | UART2 XON2 Register                         | 8            | RW          | 00h         |
| 0x00 8406h            | FFFB:0818             | E101:080C                  | UART2_MSR <sup>†‡</sup>         | UART2 Modem Status Register                 | 8            | R           | Undefined   |
| 0x00 8406h            | FFFB:0818             | E101:080C                  | UART2_TCR <sup>#</sup>          | UART2 Transmission Control Register         | 8            | RW          | 0Fh         |
| 0x00 8406h            | FFFB:0818             | E101:080C                  | UART2_XOFF1 <sup>§</sup>        | UART2 XOFF1 Register                        | 8            | RW          | 00h         |
| 0x00 8407h            | FFFB:081C             | E101:080E                  | UART2_SPR <sup>†‡</sup>         | UART2 Scratchpad Register                   | 8            | RW          | 00h         |
| 0x00 8407h            | FFFB:081C             | E101:080E                  | UART2_TLR <sup>#</sup>          | UART2 Trigger Level Register                | 8            | RW          | 00h         |
| 0x00 8407h            | FFFB:081C             | E101:080E                  | UART2_XOFF2 <sup>§</sup>        | UART2 XOFF2 Register                        | 8            | RW          | 00h         |
| 0x00 8408h            | FFFB:0820             | E101:0810                  | UART2_MDR1                      | UART2 Mode Definition 1 Register            | 8            | RW          | 07h         |
| 0x00 8409 – 0x00840Dh | FFFB:0824 – FFFB:0834 |                            |                                 | Reserved                                    |              |             |             |
| 0x00 840Eh            | FFFB:0838             | E101:081C                  | UART2_UASR <sup>‡§</sup>        | UART2 Autobauding Status Register           | 8            | R           | 00h         |
| 0x00 840Fh            | FFFB:083C             |                            |                                 | Reserved                                    |              |             |             |
| 0x00 8410h            | FFFB:0840             | E101:0820                  | UART2_SCR                       | UART2 Supplementary Control Register        | 8            | RW          | 00h         |
| 0x00 8411h            | FFFB:0844             | E101:0822                  | UART2_SSR                       | UART2 Supplementary Status Register         | 8            | R           | 00h         |
| 0x00 8412h            | FFFB:0848             |                            |                                 | Reserved                                    |              |             |             |
| 0x00 8413h            | FFFB:084C             | E101:0826                  | UART2_OSC_12M_SELV <sup>†</sup> | UART2 12-/13-MHz Oscillator Select Register | 8            | W           | 00h         |
| 0x00 8414h            | FFFB:0850             | E101:0828                  | UART2_MVR                       | UART2 Module Version Register               | 8            | R           | –           |

<sup>†</sup> Register is accessible when LCR[7] = 0 (normal operating mode)

<sup>‡</sup> Register is accessible when LCR[7] = 1 and LCR[7:0] ≠ 0BFh

<sup>§</sup> Register is accessible when LCR[7] = 0BFh

<sup>¶</sup> Register is write accessible when EFR[4] = 1

<sup>#</sup> Register is accessible when EFR[4] = 1 and MCR[6] = 1

Table 3–70. UART3/IrDA Registers

| DSP WORD ADDRESS | MPU BYTE ADDRESS | MPU BYTE ADDRESS (VIA MPUI) | REGISTER NAME            | DESCRIPTION                             | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|------------------|-----------------------------|--------------------------|-----------------------------------------|--------------|-------------|-------------|
| 0x00 CC00h       | FFFB:9800        | E101:9800                   | UART3_RHR <sup>†</sup>   | UART3 Receive Holding Register          | 8            | R           | Undefined   |
| 0x00 CC00h       | FFFB:9800        | E101:9800                   | UART3_THR <sup>†</sup>   | UART3 Transmit Holding Register         | 8            | W           | Undefined   |
| 0x00 CC00h       | FFFB:9800        | E101:9800                   | UART3_DLL <sup>‡§</sup>  | UART3 Divisor Latch Low Register        | 8            | RW          | 00h         |
| 0x00 CC01h       | FFFB:9804        | E101:9802                   | UART3_IER <sup>†</sup>   | UART3 Interrupt Enable Register         | 8            | RW          | 00h         |
| 0x00 CC01h       | FFFB:9804        | E101:9802                   | UART3_DLH <sup>‡§</sup>  | UART3 Divisor Latch High Register       | 8            | RW          | 00h         |
| 0x00 CC02h       | FFFB:9808        | E101:9804                   | UART3_IIR <sup>†‡</sup>  | UART3 Interrupt Identification Register | 8            | R           | 01h         |
| 0x00 CC02h       | FFFB:9808        | E101:9804                   | UART3_FCR <sup>†‡¶</sup> | UART3 FIFO Control Register             | 8            | W           | 00h         |
| 0x00 CC02h       | FFFB:9808        | E101:9804                   | UART3_EFR <sup>§</sup>   | UART3 Enhanced Feature Register         | 8            | RW          | 00h         |
| 0x00 CC03h       | FFFB:980C        | E101:9806                   | UART3_LCR                | UART3 Line Control Register             | 8            | RW          | 00h         |
| 0x00 CC04h       | FFFB:9810        | E101:9808                   | UART3_MCR <sup>†‡¶</sup> | UART3 Modem Control Register            | 8            | RW          | 00h         |
| 0x00 CC04h       | FFFB:9810        | E101:9808                   | UART3_XON1 <sup>§</sup>  | UART3 XON1 Register                     | 8            | RW          | 00h         |
| 0x00 CC05h       | FFFB:9814        | E101:980A                   | UART3_LSR <sup>†‡</sup>  | UART3 Mode Register                     | 8            | R           | 60h         |
| 0x00 CC05h       | FFFB:9814        | E101:980A                   | UART3_XON2 <sup>§</sup>  | UART3 XON2 Register                     | 8            | RW          | 00h         |
| 0x00 CC06h       | FFFB:9818        | E101:980C                   | UART3_MSR <sup>†‡</sup>  | UART3 Modem Status Register             | 8            | R           | Undefined   |
| 0x00 CC06h       | FFFB:9818        | E101:980C                   | UART3_TCR <sup>#</sup>   | UART3 Transmission Control Register     | 8            | RW          | 0Fh         |
| 0x00 CC06h       | FFFB:9818        | E101:980C                   | UART3_XOFF1 <sup>§</sup> | UART3 XOFF1 Register                    | 8            | RW          | 00h         |
| 0x00 CC07h       | FFFB:981C        | E101:980E                   | UART3_SPR <sup>†‡</sup>  | UART3 Scratchpad Register               | 8            | RW          | 00h         |
| 0x00 CC07h       | FFFB:981C        | E101:980E                   | UART3_TLR <sup>#</sup>   | UART3 Trigger Level Register            | 8            | RW          | 00h         |
| 0x00 CC07h       | FFFB:981C        | E101:980E                   | UART3_XOFF2 <sup>§</sup> | UART3 XOFF2 Register                    | 8            | RW          | 00h         |
| 0x00 CC08h       | FFFB:9820        | E101:9810                   | UART3_MDR1               | UART3 Mode Definition 1 Register        | 8            | RW          | 07h         |
| 0x00 CC09h       | FFFB:9824        | E101:9812                   | UART3_MDR2               | UART3 Mode Definition Register 2        | 8            | RW          | 00h         |
| 0x00 CC0Ah       | FFFB:9828        | E101:9814                   | UART3_SFLSR              | UART3 Status FIFO Line Status Register  | 8            | R           | 00h         |
| 0x00 CC0Ah       | FFFB:9828        | E101:9814                   | UART3_TXFLL              | UART3 Transmit Frame Length Low         | 8            | W           | 00h         |
| 0x00 CC0Bh       | FFFB:982C        | E101:9816                   | UART3_RESUME             | UART3 Resume Register                   | 8            | R           | 00h         |
| 0x00 CC0Bh       | FFFB:982C        | E101:9816                   | UART3_TXFLH              | UART3 Transmit Frame Length High        | 8            | W           | 00h         |
| 0x00 CC0Ch       | FFFB:9830        | E101:9818                   | UART3_SFREGL             | UART3 Status FIFO Low Register          | 8            | R           | Undefined   |
| 0x00 CC0Ch       | FFFB:9830        | E101:9818                   | UART3_RXFLL              | UART3 Receive Frame Length Low          | 8            | W           | 00h         |
| 0x00 CC0Dh       | FFFB:9834        | E101:981A                   | UART3_SFREGH             | UART3 Status FIFO High Register         | 8            | R           | Undefined   |
| 0x00 CC0Dh       | FFFB:9834        | E101:981A                   | UART3_RXFLH              | UART3 Receive Frame Length High         | 8            | W           | 00h         |
| 0x00 CC0Eh       | FFFB:9838        | E101:981C                   | UART3_BLR <sup>†</sup>   | UART3 BOF Control Register              | 8            | RW          | 40h         |
| 0x00 CC0Fh       | FFFB:983C        | E101:981E                   | UART3_ACREG <sup>†</sup> | UART3 Auxiliary Control Register        | 8            | RW          | 00h         |

<sup>†</sup> Register is accessible when LCR[7] = 0 (normal operating mode)

<sup>‡</sup> Register is accessible when LCR[7] = 1 and LCR[7:0] ≠ 0BFh

<sup>§</sup> Register is accessible when LCR[7] = 0BFh

<sup>¶</sup> Register is write accessible when EFR[4] = 1

<sup>#</sup> Register is accessible when EFR[4] = 1 and MCR[6] = 1

**Table 3–70. UART3/IrDA Registers (Continued)**

| DSP WORD ADDRESS | MPU BYTE ADDRESS | MPU BYTE ADDRESS (VIA MPU) | REGISTER NAME             | DESCRIPTION                          | ACCESS WIDTH | ACCESS TYPE | RESET VALUE |
|------------------|------------------|----------------------------|---------------------------|--------------------------------------|--------------|-------------|-------------|
| 0x00 CC0Fh       | FFFB:983C        | E101:981E                  | UART3_DIV16 <sup>†‡</sup> | UART3 Divide 1.6 Register            | 8            | RW          | 00h         |
| 0x00 CC10h       | FFFB:9840        | E101:9820                  | UART3_SCR                 | UART3 Supplementary Control Register | 8            | RW          | 00h         |

<sup>†</sup> Register is accessible when LCR[7] = 0 (normal operating mode)

<sup>‡</sup> Register is accessible when LCR[7] = 1 and LCR[7:0] ≠ 0BFh

<sup>§</sup> Register is accessible when LCR[7] = 0BFh

<sup>¶</sup> Register is write accessible when EFR[4] = 1

<sup>#</sup> Register is accessible when EFR[4] = 1 and MCR[6] = 1

**Table 3–71. MPU/DSP Shared GPIO Registers**

| DSP WORD ADDRESS | MPU BYTE ADDRESS | REGISTER NAME     | DESCRIPTION                | ACCESS WIDTH | MPU ACCESS | DSP ACCESS | RESET VALUE |
|------------------|------------------|-------------------|----------------------------|--------------|------------|------------|-------------|
| 0x00 F000h       | FFFC:E000        | DATA_INPUT        | Data Input Register        | 16           | R          | R          | 0000h       |
| 0x00 F002h       | FFFC:E004        | DATA_OUTPUT       | Data Output Register       | 16           | RW         | RW         | FFFFh       |
| 0x00 F004h       | FFFC:E008        | DIRECTION_CONTROL | Direction Control Register | 16           | RW         | RW         | FFFFh       |
| 0x00 F006h       | FFFC:E00C        | INTERRUPT_CONTROL | Interrupt Control Register | 16           | RW         | RW         | FFFFh       |
| 0x00 F008h       | FFFC:E010        | INTERRUPT_MASK    | Interrupt Mask Register    | 16           | RW         | RW         | FFFFh       |
| 0x00 F00Ah       | FFFC:E014        | INTERRUPT_STATUS  | Interrupt Status Register  | 16           | RW         | RW         | 0000h       |
| 0x00 F00Ch       | FFFC:E018        | PIN_CONTROL       | Pin Control Register       | 16           | RW         | R          | FFFFh       |

**Table 3–72. MPU/DSP Shared Mailbox Registers**

| DSP WORD ADDRESS | MPU BYTE ADDRESS | REGISTER NAME | DESCRIPTION                   | ACCESS WIDTH | MPU ACCESS TYPE | DSP ACCESS TYPE | RESET VALUE |
|------------------|------------------|---------------|-------------------------------|--------------|-----------------|-----------------|-------------|
| 0x00 F800h       | FFFC:F000        | ARM2DSP1      | MPU to DSP 1 Data Register    | 16           | RW              | R               | 0000h       |
| 0x00 F802h       | FFFC:F004        | ARM2DSP1B     | MPU to DSP 1 Command Register | 16           | RW              | R               | 0000h       |
| 0x00 F804h       | FFFC:F008        | DSP2ARM1      | DSP to MPU 1 Data Register    | 16           | R               | RW              | 0000h       |
| 0x00 F806h       | FFFC:F00C        | DSP2ARM1B     | DSP to MPU 1 Command Register | 16           | R               | RW              | 0000h       |
| 0x00 F808h       | FFFC:F010        | DSP2ARM2      | DSP to MPU 2 Data Register    | 16           | R               | RW              | 0000h       |
| 0x00 F80Ah       | FFFC:F014        | DSP2ARM2B     | DSP to MPU 2 Command Register | 16           | R               | RW              | 0000h       |
| 0x00 F80Ch       | FFFC:F018        | ARM2DSP1_FLAG | MPU to DSP 1 Flag Register    | 16           | R               | R               | undef       |
| 0x00 F80Eh       | FFFC:F01C        | DSP2ARM1_FLAG | DSP to MPU 1 Flag Register    | 16           | R               | R               | undef       |
| 0x00 F810h       | FFFC:F020        | DSP2ARM2_FLAG | DSP to MPU 2 Flag Register    | 16           | R               | R               | undef       |
| 0x00 F812h       | FFFC:F024        | ARM2DSP2      | MPU to DSP 2 Data Register    | 16           | RW              | R               | 0000h       |
| 0x00 F814h       | FFFC:F028        | ARM2DSP2B     | MPU to DSP 2 Command Register | 16           | RW              | R               | 0000h       |
| 0x00 F816h       | FFFC:F02C        | ARM2DSP2_FLAG | MPU to DSP 2 Flag Register    | 16           | R               | R               | undef       |

### 3.17 Interrupts

**Table 3–73. MPU Level 1 and Level 2 Interrupt Mappings**

| INTERRUPT                     | DEFAULT SENSITIVITY | LEVEL 1 MAPPING | LEVEL 2 MAPPING | FUNCTION                                                     |
|-------------------------------|---------------------|-----------------|-----------------|--------------------------------------------------------------|
| Level 2 Interrupt handler FIQ | Level               | IRQ_0           | –               | FIQ Interrupt From Level 2 Handler                           |
| CAMERA_IF_INTERRUPT           | Level               | IRQ_1           | –               | Camera Interface Interrupt                                   |
| Reserved                      | –                   | IRQ_2           | –               | Reserved, Keep Masked                                        |
| External FIQ                  | Edge                | IRQ_3           | –               | External FIQ Interrupt                                       |
| McBSP2 TX INT                 | Edge                | IRQ_4           | –               | McBSP2 Transmit Interrupt                                    |
| McBSP2 RX INT                 | Edge                | IRQ_5           | –               | McBSP2 Receive Interrupt                                     |
| IRQ_RTDX                      | Level               | IRQ_6           | –               | Real-Time Data Exchange Interrupt (for RTDX Emulation Tools) |
| IRQ_DSP_MMU_ABORT             | Level               | IRQ_7           | –               | DSP MMU Abort Interrupt                                      |
| IRQ_HOST_INT                  | Level               | IRQ_8           | –               |                                                              |
| IRQ_ABORT                     | Level               | IRQ_9           | –               |                                                              |
| IRQ_DSP_MAILBOX1              | Level               | IRQ_10          | –               | DSP2ARM1 Mailbox Interrupt                                   |
| IRQ_DSP_MAILBOX2              | Level               | IRQ_11          | –               | DSP2ARM2 Mailbox Interrupt                                   |
| Reserved                      | –                   | IRQ_12          | –               | Reserved, Keep Masked                                        |
| IRQ_TIPB_BRIDGE_PRIVATE       | Level               | IRQ_13          | –               | TIPB Private Bridge Interrupt                                |
| IRQ_GPIO                      | Level               | IRQ_14          | –               | MPU Interrupt for MPU-Owned Shared GPI                       |
| IRQ_UART3                     | Level               | IRQ_15          | –               | UART3 Interrupt                                              |
| IRQ_TIMER3                    | Edge                | IRQ_16          | –               | MPU Timer 3 Interrupt                                        |
| IRQ_LB_MMU                    | Level               | IRQ_17          | –               | Local Bus MMU Interrupt                                      |
| Reserved                      | –                   | IRQ_18          | –               | Reserved, Keep Masked                                        |
| IRQ_DMA_CH0_CH6               | Level               | IRQ_19          | –               | System DMA Channel 0 and 6 Interrupt                         |
| IRQ_DMA_CH1_CH7               | Level               | IRQ_20          | –               | System DMA Channel 1 and 7 Interrupt                         |
| IRQ_DMA_CH2_CH8               | Level               | IRQ_21          | –               | System DMA Channel 2 and 8 Interrupt                         |
| IRQ_DMA_CH3                   | Level               | IRQ_22          | –               | System DMA Channel 3 Interrupt                               |
| IRQ_DMA_CH4                   | Level               | IRQ_23          | –               | System DMA Channel 4 Interrupt                               |
| IRQ_DMA_CH5                   | Level               | IRQ_24          | –               | System DMA Channel 5 Interrupt                               |
| IRQ_DMA_CH_LCD                | Level               | IRQ_25          | –               | System DMA LCD Channel Interrupt                             |
| IRQ_TIMER1                    | Edge                | IRQ_26          | –               | MPU Timer 1 Interrupt                                        |
| IRQ_WD_TIMER                  | Edge                | IRQ_27          | –               | MPU Watchdog Timer Interrupt                                 |
| IRQ_TIPB_BRIDGE_PUBLIC        | Level               | IRQ_28          | –               | TIPB Public Bridge Interrupt                                 |
| IRQ_LOCAL_BUS_IF              | Level               | IRQ_29          | –               | Local Bus Interrupt                                          |
| IRQ_TIMER2                    | Edge                | IRQ_30          | –               | MPU Timer 2 Interrupt                                        |
| IRQ_LCD_CTRL                  | Level               | IRQ_31          | –               | LCD Controller Interrupt                                     |
| FAC                           | Level               | IRQ_0           | IRQ_0           | Frame Adjustment Counter Interrupt                           |
| KBD                           | Edge                | IRQ_0           | IRQ_1           | Keyboard Interrupt                                           |
| MICROWIRE_TX                  | Edge                | IRQ_0           | IRQ_2           | MICROWIRE Transmit Interrupt                                 |
| MICROWIRE_RX                  | Edge                | IRQ_0           | IRQ_3           | MICROWIRE Receive Interrupt                                  |
| I2C                           | Edge                | IRQ_0           | IRQ_4           | I <sup>2</sup> C Interrupt                                   |
| MPUIO                         | Level               | IRQ_0           | IRQ_5           | MPUIO Interrupt                                              |

**Table 3–73. MPU Level 1 and Level 2 Interrupt Mappings (Continued)**

| INTERRUPT              | DEFAULT SENSITIVITY | LEVEL 1 MAPPING | LEVEL 2 MAPPING | FUNCTION                                              |
|------------------------|---------------------|-----------------|-----------------|-------------------------------------------------------|
| USB_HHC1               | Level               | IRQ_0           | IRQ_6           | USB Host HHC1 Interrupt                               |
| Reserved               | –                   | IRQ_0           | IRQ_7           |                                                       |
| Reserved               | –                   | IRQ_0           | IRQ_8           |                                                       |
| Reserved               | –                   | IRQ_0           | IRQ_9           |                                                       |
| MCBSP3_TX_INT          | Edge                | IRQ_0           | IRQ_10          | McBSP3 Transmit Interrupt                             |
| MCBSP3_RX_INT          | Edge                | IRQ_0           | IRQ_11          | McBSP3 Receive Interrupt                              |
| MCBSP1_TX_INT          | Edge                | IRQ_0           | IRQ_12          | McBSP1 Transmit Interrupt                             |
| MCBSP1_RX_INT          | Edge                | IRQ_0           | IRQ_13          | McBSP1 Receive Interrupt                              |
| UART1                  | Level               | IRQ_0           | IRQ_14          | UART1 Interrupt                                       |
| UART2                  | Level               | IRQ_0           | IRQ_15          | UART2 Interrupt                                       |
| MCSI1_TX_RX_FE_INT     | Level               | IRQ_0           | IRQ_16          | MCSI1 Combined Transmit/Receive/Frame Error Interrupt |
| MCSI2_TX_RX_FE_INT     | Level               | IRQ_0           | IRQ_17          | MCSI2 Combined Transmit/Receive/Frame Error Interrupt |
| Reserved               | –                   | IRQ_0           | IRQ_18          | Reserved, Keep Masked                                 |
| Reserved               | –                   | IRQ_0           | IRQ_19          | Reserved, Keep Masked                                 |
| USB_CLNT_GENI_INT      | Level               | IRQ_0           | IRQ_20          | USB Function General-Purpose Interrupt                |
| 1WIRE_INT              | Level               | IRQ_0           | IRQ_21          | 1-Wire Interface Interrupt                            |
| TIMER_32K_INT          | Edge                | IRQ_0           | IRQ_22          | 32k Timer Interrupt                                   |
| MMC_INT                | Level               | IRQ_0           | IRQ_23          | MMC/SD Interrupt                                      |
| ULPD_INT               | Level               | IRQ_0           | IRQ_24          | Ultra-Low Power Device module Interrupt               |
| RTC_PERIODIC_TIMER     | Edge                | IRQ_0           | IRQ_25          | Real-Time Clock Periodic Timer Interrupt              |
| RTC_ALARM              | Level               | IRQ_0           | IRQ_26          | Real-Time Clock Alarm Interrupt                       |
| Reserved               | –                   | IRQ_0           | IRQ_27          |                                                       |
| DSPMMU_IRQ             | Level               | IRQ_0           | IRQ_28          | DSP MMU Interrupt                                     |
| USB_FUNC_IRQ_ISO_ON    | Level               | IRQ_0           | IRQ_29          | USB Function Isochronous On Interrupt                 |
| USB_FUNC_IRQ_NONISO_ON | Level               | IRQ_0           | IRQ_30          | USB Function Non-Isochronous On Interrupt             |
| MCBSP2_RX_OVERFLOW_INT | Edge                | IRQ_0           | IRQ_31          | McBSP2 Receive Overflow Interrupt                     |

Table 3–74. DSP Level 1 Interrupt Mappings

| INTERRUPT            | DSP INTERRUPT | DSP IFR/IMR REGISTER BIT | VECTOR LOCATION (BYTE ADDRESS) | PRIORITY | FUNCTION                                               |
|----------------------|---------------|--------------------------|--------------------------------|----------|--------------------------------------------------------|
| RESET                | –             | –                        | FFF00h                         | 0        | DSP Reset Interrupt                                    |
| NMI                  | –             | –                        | FFF08h                         | 1        | DSP Nonmaskable Interrupt                              |
| EMULATOR_TEST        | INT2          | 2                        | FFF10h                         | 3        | DSP Emulator/Test Interrupt                            |
| LEVEL2_INTH_FIQ      | INT3          | 3                        | FFF18h                         | 5        | FIQ Interrupt From DSP Level 2 Handler                 |
| TC_ABORT             | INT4          | 4                        | FFF20h                         | 6        | Traffic Controller Abort Interrupt                     |
| MAILBOX_1 (ARM2DSP1) | INT5          | 5                        | FFF28h                         | 7        | MPU-to-DSP Mailbox 1 Interrupt                         |
| Reserved             | INT6          | 6                        | FFF30h                         | 9        | Unused, Keep Masked                                    |
| GPIO                 | INT7          | 7                        | FFF38h                         | 10       | Interrupt for DSP-Owned Shared GPIO                    |
| TIMER3               | INT8          | 8                        | FFF40h                         | 11       | DSP Timer 3 Interrupt                                  |
| DMA_CHANNEL_1        | INT9          | 9                        | FFF48h                         | 13       | DSP DMA Channel 1 Interrupt                            |
| MPU                  | INT10         | 10                       | FFF50h                         | 14       | MPU Interrupt to DSP                                   |
| Reserved             | INT11         | 11                       | FFF58h                         | 15       | Unused, Keep Masked                                    |
| UART3                | INT12         | 12                       | FFF60h                         | 17       | UART Interrupt                                         |
| WDGTIMER             | INT13         | 13                       | FFF68h                         | 18       | DSP Watchdog Timer Interrupt                           |
| DMA_CHANNEL_4        | INT14         | 14                       | FFF70h                         | 21       | DSP DMA Channel 4 Interrupt                            |
| DMA_CHANNEL_5        | INT15         | 15                       | FFF78h                         | 22       | DSP DMA Channel 5 Interrupt                            |
| EMIF                 | INT16         | 16                       | FFF80h                         | 4        | Interrupt for DMA EMIF Interface to Traffic Controller |
| LOCAL_BUS            | INT17         | 17                       | FFF88h                         | 8        | Local Bus Interrupt                                    |
| DMA_CHANNEL_0        | INT18         | 18                       | FFF90h                         | 12       | DSP DMA Channel 0 Interrupt                            |
| MAILBOX2 (ARM2DSP2)  | INT19         | 19                       | FFF98h                         | 16       | MPU-to-DSP Mailbox 2 Interrupt                         |
| DMA_CHANNEL_2        | INT20         | 20                       | FFFA0h                         | 19       | DSP DMA Channel 2 Interrupt                            |
| DMA_CHANNEL_3        | INT21         | 21                       | FFFA8h                         | 20       | DSP DMA Channel 3 Interrupt                            |
| TIMER2               | INT22         | 22                       | FFFB0h                         | 23       | DSP Timer 2 Interrupt                                  |
| TIMER1               | INT23         | 23                       | FFFB8h                         | 24       | DSP Timer 1 Interrupt                                  |

**Table 3–75. DSP Level 2 Interrupt Mappings**

| INTERRUPT             | DEFAULT SENSITIVITY | LEVEL 1 MAPPING | LEVEL 2 MAPPING | FUNCTION                    |
|-----------------------|---------------------|-----------------|-----------------|-----------------------------|
| MCBSP3_TX             | Edge                | INT3            | IRQ_0           | McBSP3 Transmit Interrupt   |
| MCBSP3_RX             | Edge                | INT3            | IRQ_1           | McBSP3 Receive Interrupt    |
| MCBSP1_TX             | Edge                | INT3            | IRQ_2           | McBSP1 Transmit Interrupt   |
| MCBSP1_RX             | Edge                | INT3            | IRQ_3           | McBSP1 Receive Interrupt    |
| UART2                 | Level               | INT3            | IRQ_4           | UART2 Interrupt             |
| UART1                 | Level               | INT3            | IRQ_5           | UART1 Interrupt             |
| MCSI1_TX              | Level               | INT3            | IRQ_6           | MCSI1 Transmit Interrupt    |
| MCSI1_RX              | Level               | INT3            | IRQ_7           | MCSI1 Receive Interrupt     |
| MCSI2_TX              | Level               | INT3            | IRQ_8           | MCSI2 Transmit Interrupt    |
| MCSI2_RX              | Level               | INT3            | IRQ_9           | MCSI2 Receive Interrupt     |
| MCSI1_FRAME_ERROR_INT | Level               | INT3            | IRQ_10          | MCSI1 Frame Error Interrupt |
| MCSI2_FRAME_ERROR_INT | Level               | INT3            | IRQ_11          | MCSI2 Frame Error Interrupt |
| Reserved              | –                   | INT3            | IRQ_12          | Reserved, Keep Masked       |
| Reserved              | –                   | INT3            | IRQ_13          | Reserved, Keep Masked       |
| Reserved              | –                   | INT3            | IRQ_14          | Reserved, Keep Masked       |
| Reserved              | –                   | INT3            | IRQ_15          | Reserved, Keep Masked       |

### 3.18 MPU System DMA Request Mapping

Table 3–76 shows the MPU system DMA request mapping for the OMAP5910 device.

**Table 3–76. DMA Request Mapping**

| MPU SYSTEM DMA REQUESTS | MPU SYSTEM DMA |
|-------------------------|----------------|
| MCSI1 TX                | DMA_REQ_01     |
| MCSI1 RX                | DMA_REQ_02     |
| I <sup>2</sup> C RX     | DMA_REQ_03     |
| I <sup>2</sup> C TX     | DMA_REQ_04     |
| EXT_DMA_REQ0 (MPUIO2)   | DMA_REQ_05     |
| EXT_DMA_REQ1 (MPUIO4)   | DMA_REQ_06     |
| MicroWire TX            | DMA_REQ_07     |
| McBSP1 TX               | DMA_REQ_08     |
| McBSP1 RX               | DMA_REQ_09     |
| McBSP3 TX               | DMA_REQ_10     |
| McBSP3 RX               | DMA_REQ_011    |
| UART1 TX                | DMA_REQ_012    |
| UART1 RX                | DMA_REQ_013    |
| UART2 TX                | DMA_REQ_014    |
| UART2 RX                | DMA_REQ_015    |
| McBSP2 TX               | DMA_REQ_016    |
| McBSP2 RX               | DMA_REQ_017    |
| UART3 TX                | DMA_REQ_018    |
| UART3 RX                | DMA_REQ_019    |
| Camera RX               | DMA_REQ_020    |
| MMC TX                  | DMA_REQ_021    |
| MMC RX                  | DMA_REQ_022    |
| Reserved                | DMA_REQ_023    |
| Reserved                | DMA_REQ_024    |
| Reserved                | DMA_REQ_025    |
| USB function RX0        | DMA_REQ_026    |
| USB function RX1        | DMA_REQ_027    |
| USB function RX2        | DMA_REQ_028    |
| USB function TX0        | DMA_REQ_029    |
| USB function TX1        | DMA_REQ_030    |
| USB function TX2        | DMA_REQ_031    |

### 3.19 DSP DMA Event Mapping

Table 3–77 defines the mappings of the DMA channel synchronization settings to the different request sources that can be used to create DSP DMA events on OMAP5910.

**Table 3–77. DSP DMA Mapping**

| DSP REQUEST SOURCE    | DSP DMA REQUEST LINE |
|-----------------------|----------------------|
| MCSI1 TX              | DMA_REQ_01           |
| MCSI1 RX              | DMA_REQ_02           |
| MCSI2 TX              | DMA_REQ_03           |
| MCSI2 RX              | DMA_REQ_04           |
| EXT_DMA_REQ0 (MPUIO2) | DMA_REQ_05           |
| EXT_DMA_REQ1 (MPUIO4) | DMA_REQ_06           |
| Reserved              | DMA_REQ_07           |
| McBSP1 TX             | DMA_REQ_08           |
| McBSP1 RX             | DMA_REQ_09           |
| McBSP3 TX             | DMA_REQ_10           |
| McBSP3 RX             | DMA_REQ_011          |
| UART1 TX              | DMA_REQ_012          |
| UART1 RX              | DMA_REQ_013          |
| UART2 TX              | DMA_REQ_014          |
| UART2 RX              | DMA_REQ_015          |
| Reserved              | DMA_REQ_016          |
| Reserved              | DMA_REQ_017          |
| UART3 TX              | DMA_REQ_018          |
| UART3 RX              | DMA_REQ_019          |

## 4 Documentation Support

Extensive documentation supports all OMAP platform of devices from product announcement through applications development. The following types of documentation are available to support the design and use of the OMAP platform of dual-core processor devices:

- Device-specific data sheets
- Development-support tools
- Hardware and software application reports

The OMAP5910 reference documentation includes, but is not limited to, the following:

- *TMS320C55x DSP CPU Programmer's Reference Supplement* (literature number SPRU652)
- *OMAP5910 Dual-Core Processor Functional and Peripheral Overview* (literature number SPRU602)
- *OMAP5910 Dual-Core Processor MPU Subsystems Reference Guide* (literature number SPRU671)
- *OMAP5910 Dual-Core Processor DSP Subsystems Reference Guide* (literature number SPRU672)
- *OMAP5910 Dual-Core Processor Memory Interface Traffic Controller Reference Guide* (literature number SPRU673)
- *OMAP5910 Dual-Core Processor System DMA Controller Reference Guide* (literature number SPRU674)
- *OMAP5910 Dual-Core Processor LCD Controller Reference Guide* (literature number SPRU675)
- *OMAP5910 Dual-Core Processor Universal Asynchronous Receiver/Transmitter (UART) Devices Reference Guide* (literature number SPRU676)
- *OMAP5910 Dual-Core Processor Universal Serial Bus (USB) and Frame Adjustment Counter (FAC) Reference Guide* (literature number SPRU677)
- *OMAP5910 Dual-Core Processor Clock Generation and System Reset Management Reference Guide* (literature number SPRU678)
- *OMAP5910 Dual-Core Processor General-Purpose Input/Output (GPIO) Reference Guide* (literature number SPRU679)
- *OMAP5910 Dual-Core Processor MultiMedia Card/Secure Data Memory Card (MMC/SD) Reference Guide* (literature number SPRU680)
- *OMAP5910 Dual-Core Processor Inter-Integrated Circuit (I<sup>2</sup>C) Controller Reference Guide* (literature number SPRU681)
- *OMAP5910 Dual-Core Processor Timer Reference Guide* (literature number SPRU682)
- *OMAP5910 Dual-Core Processor Inter-Processor Communication Reference Guide* (literature number SPRU683)
- *OMAP5910 Dual-Core Processor Camera Interface Reference Guide* (literature number SPRU684)
- *OMAP5910 Dual-Core Processor Multichannel Serial Interface (MCSI) Reference Guide* (literature number SPRU685)
- *OMAP5910 Dual-Core Processor MicroWire Interface Reference Guide* (literature number SPRU686)
- *OMAP5910 Dual-Core Processor Real-Time Clock (RTC) Reference Guide* (literature number SPRU687)
- *OMAP5910 Dual-Core Processor HDQ/1-Wire Interface Reference Guide* (literature number SPRU688)
- *OMAP5910 Dual-Core Processor PWL, PWT, and LED Reference Guide* (literature number SPRU689)
- *OMAP5910 Dual-Core Processor Multichannel Buffered Serial Port (McBSP) Reference Guide* (literature number SPRU708)
- *OMAP5910 Dual-Core Processor Silicon Errata* (literature number SPRZ016)

A series of DSP textbooks is published by Prentice-Hall and John Wiley & Sons to support digital signal processing research and education. The TMS320 DSP newsletter, *Details on Signal Processing*, is published quarterly and distributed to update TMS320 DSP customers on product information.

Information regarding Texas Instruments (TI) OMAP and DSP products is also available on the Worldwide Web at <http://www.ti.com> uniform resource locator (URL).

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## 4.1 Device and Development-Support Tool Nomenclature

To designate the stages in the product development cycle, TI assigns prefixes to the part numbers of all OMAP™ processors and support tools. Each commercial OMAP platform member has one of three prefixes: X, P, or null (no prefix). Texas Instruments recommends two of three possible prefix designators for its support tools: TMDX and TMDS. These prefixes represent evolutionary stages of product development from engineering prototypes (TMDX) through fully qualified production devices/tools (TMDS).

Device development evolutionary flow:

- X** Experimental device that is not necessarily representative of the final device's electrical specifications and may not use production assembly flow. (TMX definition)
- P** Prototype device that is not necessarily the final silicon die and may not necessarily meet final electrical specifications. (TMP definition)
- null** Production version of the silicon die that is fully qualified. (TMS definition)

Support tool development evolutionary flow:

- TMDX** Development support product that has not yet completed Texas Instruments internal qualification testing.
- TMDS** Fully qualified development support product

TMX and TMP devices and TMDX development-support tools are shipped against the following disclaimer:

"Developmental product is intended for internal evaluation purposes."

Production devices and TMDS development-support tools have been characterized fully, and the quality and reliability of the device have been demonstrated fully. TI's standard warranty applies.

Predictions show that prototype devices (X or P), have a greater failure rate than the standard production devices. Texas Instruments recommends that these devices not be used in any production system because their expected end-use failure rate still is undefined. Only qualified production devices are to be used.

For additional description of the device nomenclature markings, see the *OMAP5910 Dual-Core Processor Silicon Errata* (literature number SPRZ016).

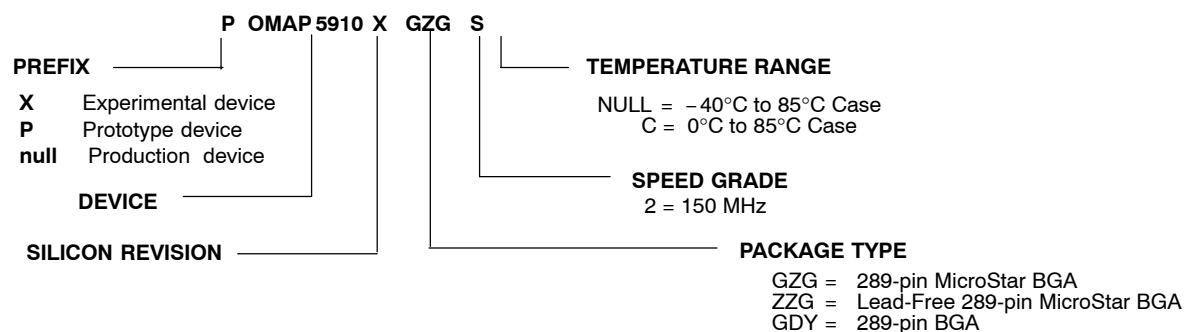


Figure 4–1. OMAP Device Nomenclature

## 5 Electrical Specifications

This section provides the absolute maximum ratings and the recommended operating conditions for the OMAP5910 device.

All electrical and switching characteristics in this data manual are valid over the recommended operating conditions unless otherwise specified.

### 5.1 Absolute Maximum Ratings

The list of absolute maximum ratings are specified over operating case temperature. Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Section 5.2, Recommended Operating Conditions, is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. All supply voltage values (core and I/O) are with respect  $V_{SS}$ .

**NOTE:** The OMAP5910 device has undergone Charged Device Model Electrostatic Discharge (ESD) testing, passing at the  $\pm 500$  V level. Human Body Model (HBM) ESD testing per EIA/JESD22-A114 has also been performed. Test results indicate that the OMAP5910 passes at a  $\pm 500$  V HBM (maximum) level. Caution in handling devices is advised.

This section provides the absolute maximum ratings for the OMAP5910 device.

|                                                           |                             |
|-----------------------------------------------------------|-----------------------------|
| Supply voltage range (core), $CV_{DD}, CV_{DD1/2/3/4/A}$  | –0.3 V to 1.8 V             |
| Supply voltage range (I/O), $DV_{DD1/2/3/4/5}$            | –0.3 V to 4 V               |
| Input voltage range, $V_I$ (12-MHz and 32-kHz oscillator) | –0.3 V to $CV_{DD} + 0.5$ V |
| Input voltage range, $V_I$ (standard LVCMOS)              | –0.3 V to $DV_{DD} + 0.5$ V |
| Input voltage range, $V_I$ (fail-safe LVCMOS)             | –0.3 V to 4.5 V             |
| Input voltage range, $V_I$ (USB transceivers)             | –0.3 V to $DV_{DD} + 0.5$ V |
| Input voltage range, $V_I$ (I <sup>2</sup> C)             | –0.3 V to 4.5 V             |
| Output voltage range, $V_O$ (standard LVCMOS)             | –0.3 V to $DV_{DD} + 0.5$ V |
| Output voltage range, $V_O$ (fail-safe LVCMOS)            | –0.3 V to 4.5 V             |
| Output voltage range, $V_O$ (USB transceivers)            | –0.3 V to $DV_{DD} + 0.5$ V |
| Output voltage range, $V_O$ (I <sup>2</sup> C)            | –0.3 V to 4.5 V             |
| Operating temperature range, $T_C$                        | –40°C to 85°C               |
| Storage temperature range, $T_{stg}$                      | –55°C to 150°C              |

## 5.2 Recommended Operating Conditions

|                                               |                                                       |                                     | MIN                  | NOM         | MAX   | UNIT |    |
|-----------------------------------------------|-------------------------------------------------------|-------------------------------------|----------------------|-------------|-------|------|----|
| CV <sub>DD</sub><br>CV <sub>DD1/2/3/4/A</sub> | Device supply voltage, core <sup>†</sup>              | Low Power Standby mode <sup>‡</sup> | 1                    | 1.1         | 1.675 | V    |    |
|                                               |                                                       | Active mode                         | 1.525                | 1.6         | 1.675 |      |    |
| DV <sub>DD1</sub>                             | Device supply voltage, I/O (Peripheral I/O)           |                                     | 2.5                  | 2.75 or 3.3 | 3.6   | V    |    |
| DV <sub>DD2</sub>                             | Device supply voltage, I/O (USB transceiver)          |                                     | 3                    | 3.3         | 3.6   | V    |    |
| DV <sub>DD3</sub>                             | Device supply voltage, I/O (MCSI2, McBSP2, GPIO[9:8]) | Low-voltage range <sup>§</sup>      | 1.65                 | 1.8         | 1.95  | V    |    |
|                                               |                                                       | High-voltage range <sup>§</sup>     | 2.5                  | 2.75 or 3.3 | 3.6   |      |    |
| DV <sub>DD4</sub>                             | Device supply voltage, I/O (SDRAM interface)          | Low-voltage range <sup>§</sup>      | 1.65                 | 1.8         | 1.95  | V    |    |
|                                               |                                                       | High-voltage range <sup>§</sup>     | 2.5                  | 2.75 or 3.3 | 3.6   |      |    |
| DV <sub>DD5</sub>                             | Device supply voltage, I/O (FLASH interface)          | Low-voltage range <sup>§</sup>      | 1.65                 | 1.8         | 2     | V    |    |
|                                               |                                                       | High-voltage range <sup>§</sup>     | 2.5                  | 2.75 or 3.3 | 3.6   |      |    |
| CV <sub>DD</sub> – DV <sub>DD</sub>           | Device supply voltage difference <sup>¶</sup>         |                                     | 1.65                 |             |       | V    |    |
| DV <sub>DD</sub> – CV <sub>DD</sub>           | Device supply voltage difference <sup>¶</sup>         |                                     | 2.6                  |             |       | V    |    |
| V <sub>SS</sub>                               | Supply voltage, GND                                   |                                     | 0                    |             |       | V    |    |
| V <sub>IH</sub>                               | High-level input voltage, I/O                         | Standard LVCMOS                     | 0.7 DV <sub>DD</sub> |             |       | V    |    |
|                                               |                                                       | Fail-safe LVCMOS                    | 0.7 DV <sub>DD</sub> |             |       |      |    |
|                                               |                                                       | USB.DP, DM (mode 1)                 | 2                    |             |       |      |    |
|                                               |                                                       | I <sup>2</sup> C                    | 0.7 DV <sub>DD</sub> |             |       |      |    |
| V <sub>IL</sub>                               | Low-level input voltage, I/O                          | Standard LVCMOS                     | 0                    |             |       | V    |    |
|                                               |                                                       | Fail-safe LVCMOS                    | 0                    |             |       |      |    |
|                                               |                                                       | USB.DP, DM (mode 1)                 | 0                    |             |       |      |    |
|                                               |                                                       | I <sup>2</sup> C                    | 0                    |             |       |      |    |
| V <sub>I</sub>                                | Input voltage                                         | USB.DP, DM (mode 2)                 | 0.8                  |             |       | V    |    |
|                                               |                                                       | OSC1 and OSC32K pins                | CV <sub>DD</sub>     |             |       |      |    |
| V <sub>ID</sub>                               | Differential input voltage, I/O                       | USB.DP, DM (mode 2)                 | 200                  |             |       | mV   |    |
| I <sub>OH</sub>                               | High-level output current                             | 2-mA drive strength buffers         | –2                   |             |       | mA   |    |
|                                               |                                                       | 4-mA drive strength buffers         | –4                   |             |       |      |    |
|                                               |                                                       | 8-mA drive strength buffers         | –8                   |             |       |      |    |
|                                               |                                                       | 18.3-mA drive strength buffers      | –18.3                |             |       |      |    |
| I <sub>OL</sub>                               | Low-level output current                              | 2-mA drive strength buffers         | 2                    |             |       | mA   |    |
|                                               |                                                       | 4-mA drive strength buffers         | 4                    |             |       |      |    |
|                                               |                                                       | 6-mA drive strength buffers         | 6                    |             |       |      |    |
|                                               |                                                       | 8-mA drive strength buffers         | 8                    |             |       |      |    |
|                                               |                                                       | 18.3-mA drive strength buffers      | 18.3                 |             |       |      |    |
| T <sub>C</sub>                                | Operating case temperature                            |                                     | –40                  |             |       | 85   | °C |

<sup>†</sup> All core voltage supplies should be tied to the same voltage level (within 0.3 V).

<sup>‡</sup> Low Power Standby is defined as follows: the device is in Deep Sleep mode and LOW\_PWR = 1. The device runs from 32 kHz clock in this mode.

<sup>§</sup> High and low voltage ranges are selectable via software configuration.

<sup>¶</sup> In systems where the CV<sub>DDx</sub> and DV<sub>DDx</sub> power supplies are ramped at generally the same time (within 500 ms of one another), there are no specific power sequencing requirements for the supplies. The only sequencing requirement is that the maximum voltage difference between CV<sub>DD</sub> and DV<sub>DD</sub> is not exceeded for greater than 500 ms. Likewise, if different voltages are used for the separate DV<sub>DDx</sub> supplies, all DV<sub>DDx</sub> supplies should be ramp up to valid voltage levels within 500 ms of one another.

### 5.3 Electrical Characteristics Over Recommended Operating Case Temperature Range (Unless Otherwise Noted)

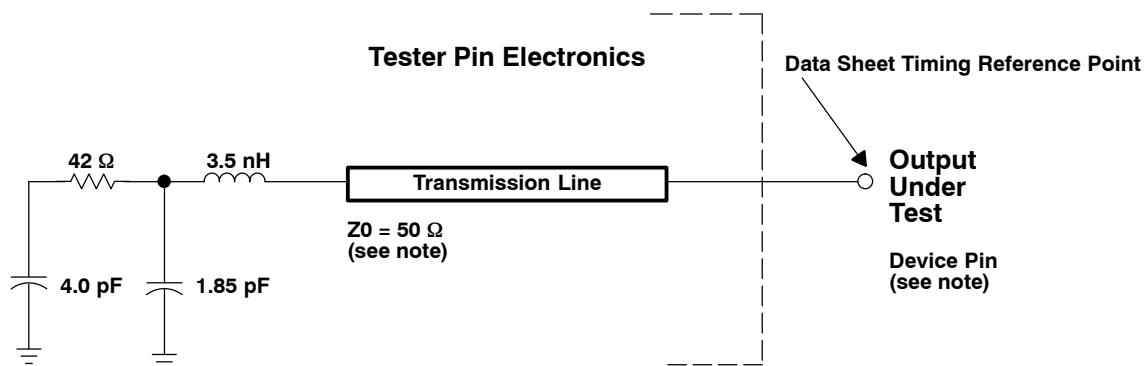
| PARAMETER             |                                             | TEST CONDITIONS                                                                    | MIN                                                                         | TYP | MAX                    | UNIT  |    |      |
|-----------------------|---------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----|------------------------|-------|----|------|
| V <sub>OH</sub>       | High-level output voltage                   | Standard LVCMOS                                                                    | DV <sub>DD</sub> = 3.3 V, I <sub>OH</sub> = MAX                             |     | 0.8 DV <sub>DD</sub>   | V     |    |      |
|                       |                                             | Fail-safe LVCMOS                                                                   | DV <sub>DD</sub> = 3.3 V, I <sub>OH</sub> = MAX                             |     | 0.8 DV <sub>DD</sub>   |       |    |      |
|                       |                                             | USB.DP, DM                                                                         | I <sub>O</sub> = −12 mA                                                     |     | DV <sub>DD</sub> − 0.5 |       |    |      |
| V <sub>OL</sub>       | Low-level output voltage                    | Standard LVCMOS                                                                    | DV <sub>DD</sub> = 3.3 V, I <sub>OL</sub> = MAX                             |     | 0.22 DV <sub>DD</sub>  | V     |    |      |
|                       |                                             | Fail-safe LVCMOS                                                                   | DV <sub>DD</sub> = 3.3 V, I <sub>OL</sub> = MAX                             |     | 0.22 DV <sub>DD</sub>  |       |    |      |
|                       |                                             | USB.DP, DM                                                                         | I <sub>O</sub> = 12 mA                                                      |     | 0.5                    |       |    |      |
|                       |                                             | I <sup>2</sup> C                                                                   | Fast mode at 6-mA load                                                      |     | 0.6                    |       |    |      |
|                       |                                             |                                                                                    | Fast mode at 3-mA load                                                      |     | 0.4                    |       |    |      |
|                       |                                             |                                                                                    | Standard mode at 3-mA load                                                  |     | 0.4                    |       |    |      |
| I <sub>I</sub>        | Input current                               | Fail-safe LVCMOS inputs without internal pullups/pulldowns enabled                 | V <sub>I</sub> = V <sub>I</sub> MAX to V <sub>I</sub> MIN                   |     | − 20                   | 20    | μA |      |
|                       |                                             | Other Inputs without internal pullups/pulldowns enabled                            | V <sub>I</sub> = V <sub>I</sub> MAX to V <sub>I</sub> MIN                   |     | −1                     | 1     |    |      |
|                       |                                             | Input pins with 20-μA pulldowns enabled                                            | DV <sub>DD</sub> = MAX, V <sub>I</sub> = V <sub>SS</sub> to V <sub>DD</sub> |     | 6                      | 20    |    | 60   |
|                       |                                             | Input pins with 100-μA pulldowns enabled                                           | DV <sub>DD</sub> = MAX, V <sub>I</sub> = V <sub>SS</sub> to V <sub>DD</sub> |     | 30                     | 100   |    | 300  |
|                       |                                             | Input pins with 20-μA pullups enabled                                              | CV <sub>DD</sub> = MAX, V <sub>I</sub> = V <sub>SS</sub> to V <sub>DD</sub> |     | − 60                   | − 20  |    | − 6  |
|                       |                                             | Input pins with 100-μA pullups enabled                                             | DV <sub>DD</sub> = MAX, V <sub>I</sub> = V <sub>SS</sub> to V <sub>DD</sub> |     | − 300                  | − 100 |    | − 30 |
| I <sub>OZ</sub>       | Input current for outputs in high-impedance |                                                                                    | − 20                                                                        |     | 20                     | μA    |    |      |
| I <sub>DDC</sub> (Q)  | Core voltage supply current, quiescent      | Sum of CV <sub>DDx</sub> currents. (Deep sleep mode with CV <sub>DD</sub> = 1.6 V) | 210                                                                         |     | μA                     |       |    |      |
|                       |                                             | Sum of CV <sub>DDx</sub> currents. (Deep sleep mode with CV <sub>DD</sub> = 1.1 V) | 110                                                                         |     |                        |       |    |      |
| I <sub>DDC</sub> (A)  | Core voltage supply current, active         | Sum of CV <sub>DDx</sub> currents (Case 1 <sup>†</sup> ).                          | 150                                                                         |     | mA                     |       |    |      |
|                       |                                             | Sum of CV <sub>DDx</sub> currents (Case 2 <sup>‡</sup> ).                          | 170                                                                         |     | mA                     |       |    |      |
| I <sub>DDCP</sub> (A) | Core and I/O voltage supply current, active | Sum of CV <sub>DDx</sub> and DV <sub>DDx</sub> currents (Case 3 <sup>§</sup> ).    | 45                                                                          |     | mA                     |       |    |      |
|                       |                                             | Sum of CV <sub>DDx</sub> and DV <sub>DDx</sub> currents (Case 4 <sup>¶</sup> ).    | 6                                                                           |     | mA                     |       |    |      |
| C <sub>i</sub>        | Input capacitance                           | USB.DP,DM                                                                          | 7                                                                           |     | pF                     |       |    |      |
|                       |                                             | All other I/O pins                                                                 | 4                                                                           |     |                        |       |    |      |
| C <sub>O</sub>        | Output capacitance                          | USB.DP,DM                                                                          | 7                                                                           |     | pF                     |       |    |      |
|                       |                                             | All other I/O pins                                                                 | 4                                                                           |     |                        |       |    |      |

<sup>†</sup> Case 1: MPU running OS, DSP running GSM Vocoder from internal memory, DSP MMU and all clock domains active, no LCD activity.

<sup>‡</sup> Case 2: Same conditions as Case 1 only DSP running from external memory with I-cache enabled.

<sup>§</sup> Case 3: Only LCD activity (MPU and DSP idled with clocks off). LCD running 320x240 TFT at 70 Frames per second with frame buffer in internal memory (DPLL at 120 MHz).

<sup>¶</sup> Case 4: Same as Case 3 only LCD running at 10 Frames per second with DPLL at 6MHz.



NOTE: The data sheet provides timing at the device pin. For output timing analysis, the tester pin electronics and its transmission line effects must be taken into account. A transmission line with a delay of 2 ns or longer can be used to produce the desired transmission line effect. The transmission line is intended as a load only. It is not necessary to add or subtract the transmission line delay (2 ns or longer) from the data sheet timings.

Input requirements in this data sheet are tested with an input slew rate of < 4 Volts per nanosecond (4 V/ns) at the device pin.

Figure 5–1. Tester Pin Electronics

## 5.4 Package Thermal Resistance Characteristics

Table 5–1 provides the thermal resistance characteristics for the package types available for use on the OMAP5910 device.

Table 5–1. Thermal Resistance Characteristics

| $R_{\theta JA}$ (°C/W) | $R_{\theta JC}$ (°C/W) | PACKAGE TYPE |
|------------------------|------------------------|--------------|
| 32.77                  | 10.76                  | 289GZG       |
| 25.54                  | 10.11                  | 289GDY       |

## 5.5 Timing Parameter Symbolology

Timing parameter symbols used in the timing requirements and switching characteristics tables are created in accordance with JEDEC Standard 100. To shorten the symbols, some of the pin names and other related terminology have been abbreviated as follows:

Lowercase subscripts and their meanings:

|     |                                        |
|-----|----------------------------------------|
| a   | access time                            |
| c   | cycle time (period)                    |
| d   | delay time                             |
| dis | disable time                           |
| en  | enable time                            |
| f   | fall time                              |
| h   | hold time                              |
| r   | rise time                              |
| su  | setup time                             |
| t   | transition time                        |
| v   | valid time                             |
| w   | pulse duration (width)                 |
| X   | Unknown, changing, or don't care level |

Letters and symbols and their meanings:

|   |                |
|---|----------------|
| H | High           |
| L | Low            |
| V | Valid          |
| Z | High impedance |

## 5.6 Clock Specifications

This section provides the timing requirements and switching characteristics for the OMAP5910 system clock signals.

### 5.6.1 32-kHz Oscillator and Input Clock

The 32.768-kHz clock signal (often abbreviated to 32-kHz) may be supplied by either the on-chip 32-kHz oscillator (requiring an external crystal) or an external CMOS signal. The state of the CLK32K\_CTRL pin determines which is used.

The on-chip oscillator requires an external 32.768-kHz crystal connected across the OSC32K\_IN and OSC32K\_OUT pins. The connection of the required circuit, consisting of the crystal and two load capacitors, is shown in Figure 5–2. The load capacitors,  $C_1$  and  $C_2$ , should be chosen such that the equation below is satisfied (recommended values are  $C_1 = C_2 = 10$  pF).  $C_L$  in the equation is the load specified for the crystal. All discrete components used to implement the oscillator circuit should be placed as close as possible to the associated oscillator pins (OSC32K\_IN and OSC32K\_OUT) and to the  $V_{SS}$  pin closest to the oscillator pins (GZG ball V12 or GDY ball F6).

**NOTE:** The 32.768-kHz oscillator is powered by the  $CV_{DD}$  supply. If an external clock source is used instead of using the on-chip oscillator, care must be taken that the voltage level driven onto the OSC32K\_IN and OSC32K\_OUT pins is no greater than the  $CV_{DD}$  voltage level.

$$C_L = \frac{C_1 C_2}{(C_1 + C_2)}$$

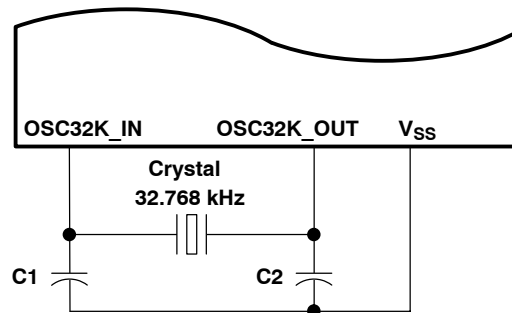


Figure 5–2. 32-kHz Oscillator External Crystal

Table 5–2 shows the switching characteristics of the 32-kHz oscillator and Table 5–3 shows the input requirements of the 32-kHz clock input.

Table 5–2. 32-kHz Oscillator Switching Characteristics

| PARAMETER                                                                         | MIN | TYP    | MAX | UNIT    |
|-----------------------------------------------------------------------------------|-----|--------|-----|---------|
| Start-up time (from power up until oscillating at stable frequency of 32.768 kHz) |     | 200    | 800 | ms      |
| $I_{DDA}$ , active current consumption                                            |     | 4      |     | $\mu A$ |
| Oscillation frequency                                                             |     | 32.768 |     | kHz     |

Table 5–3. 32-kHz Input Clock Timing Requirements

| NO. |                                | MIN | NOM    | MAX | UNIT |
|-----|--------------------------------|-----|--------|-----|------|
| CK1 | $t_{cyc}$ Frequency            |     | 32.768 |     | kHz  |
| CK2 | $t_f$ Fall time                |     |        | 25  | ns   |
| CK3 | $t_r$ Rise time                |     |        | 25  | ns   |
| CK4 | Duty cycle (high-to-low ratio) | 30% |        | 70% | %    |
| CK5 | Frequency stability            | –70 |        | 70  | ppm  |

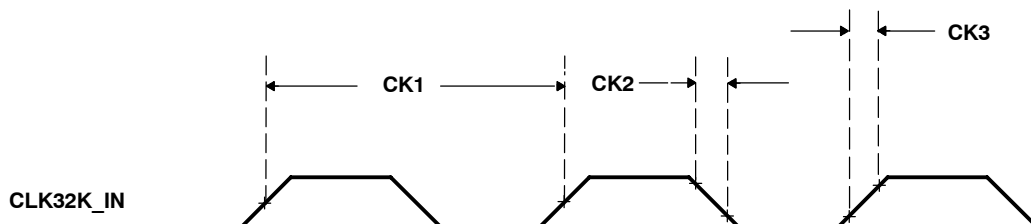


Figure 5–3. 32-kHz Input Clock

### 5.6.2 Base Oscillator (12 MHz or 13 MHz) and Input Clock

The internal base system oscillator is enabled following a device reset. The oscillator requires an external crystal to be connected across the OSC1\_IN and OSC1\_OUT pins. If the internal oscillator is not used (configured in software using FUNC\_MUX\_CTRL\_B register), an external clock source must be applied to the OSC1\_IN pin and the OSC1\_OUT pin must be left unconnected. Because the internal oscillator can be used as a clock source to the OMAP DPLL, the 12- or 13-MHz crystal oscillation frequency can be multiplied to generate the DSP clock, MPU clock, traffic controller clock.

The crystal must be in fundamental-mode operation, and parallel resonant, with a maximum effective series resistance of 60  $\Omega$  maximum. The connection of the required circuit, consisting of the crystal and two load capacitors, is shown in Figure 5–4. The load capacitors,  $C_1$  and  $C_2$ , must be chosen such that the equation below is satisfied (recommended values are  $C_1 = C_2 = 10$  pF).  $C_L$  in the equation is the load specified for the crystal. All discrete components used to implement the oscillator circuit must be placed as close as possible to the associated oscillator pins (OSC1\_IN and OSC1\_OUT) and to the  $V_{SS}$  pins closest to the oscillator pins (GZG balls AA1/Y3 or GDY balls E13/K9).

**NOTE:** The base oscillator is powered by the  $CV_{DD}$  supply. If an external clock source is used instead of using the on-chip oscillator, care must be taken that the voltage level driven onto the OSC1\_IN pin is no greater than the  $CV_{DD}$  voltage level.

$$C_L = \frac{C_1 C_2}{(C_1 + C_2)}$$

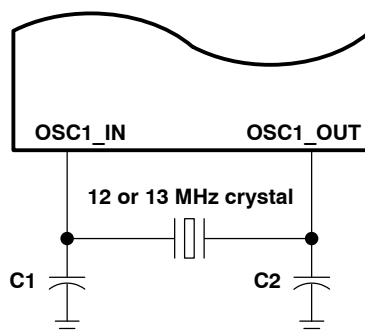


Figure 5–4. Internal System Oscillator External Crystal

If USB host function is used, it is recommended that a very low PPM crystal ( $\leq 50$  ppm) be used for the 12- or 13-MHz oscillator circuit. If the USB host function is not used, then a crystal of  $\leq 180$  ppm is recommended. When selecting a crystal, the system design must take into account the temperature and aging characteristics of a crystal versus the user environment and expected lifetime of the system.

Table 5–4 shows the switching characteristics of the base oscillator.

**Table 5–4. Base Oscillator Switching Characteristics**

| PARAMETER                                                                           | MIN | TYP      | MAX | UNIT    |
|-------------------------------------------------------------------------------------|-----|----------|-----|---------|
| Start-up time (from power up until oscillating at stable frequency of 12 or 13 MHz) |     | 1        | 4   | ms      |
| $I_{DDA}$ , active current consumption                                              |     | 350      |     | $\mu A$ |
| Oscillation frequency                                                               |     | 12 or 13 |     | MHz     |

### 5.6.3 Internal Clock Speed Limitations

Table 5–5 provides a summary of the maximum frequencies that each clock domain may be configured to run on the OMAP5910 device.

**Table 5–5. Internal Clock Speed Limitations**

| CLOCK       | MAX OPERATING FREQUENCY | UNIT |
|-------------|-------------------------|------|
| MPU (CLKM1) | 150                     | MHz  |
| DSP (CLKM2) | 150                     | MHz  |
| TC (CLKM3)  | 75                      | MHz  |
| DPLL1       | 150                     | MHz  |

All clock domains must be derived from the same DPLL1 frequency setting; therefore, the following conditions must be satisfied where 'm', 'n', and 'o' are each equal to either 1, 2, 4, or 8:

- MPU frequency = (DPLL1 clock frequency) / m
- DSP frequency = (DPLL1 clock frequency) / n
- TC frequency = (DPLL1 clock frequency) / o

For example, the following configuration is valid:

- MPU/DSP/TC = 150 MHz/150 MHz/75 MHz, where m = n = 1 and o = 2

## 5.7 Reset Timings

This section provides the timing requirements for the OMAP5910 hardware reset signals.

### 5.7.1 OMAP5910 Device Reset

The  $\overline{\text{PWRON\_RESET}}$  signal is the active-low asynchronous reset input responsible for the reset of the entire OMAP5910 device. When using an external crystal to supply the 32-kHz system clock,  $\overline{\text{PWRON\_RESET}}$  must be asserted low a minimum of two 32-kHz clock cycles longer than the worst-case start-up time of the 32-kHz oscillator after stable power supplies (see Figure 5–5). If an external CMOS input signal is used to source 32 kHz,  $\overline{\text{PWRON\_RESET}}$  must be asserted low a minimum of two 32-kHz clock cycles after stable power supplies. See Table 5–6 and Table 5–7.

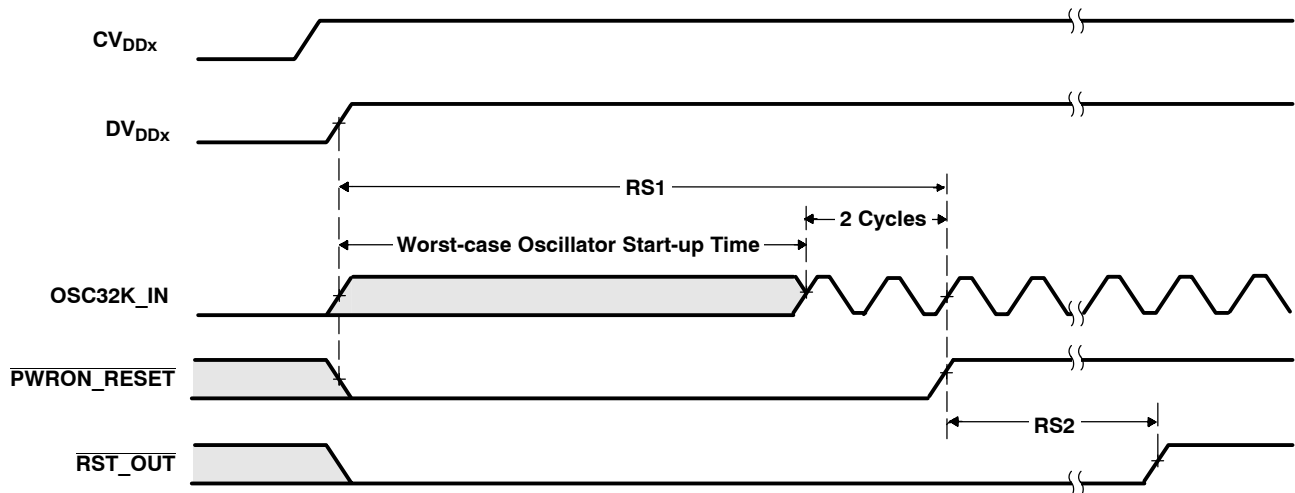
**Table 5–6. OMAP5910 Device Reset Timing Requirements**

| NO. |                                                                                 | MIN | MAX | UNIT |
|-----|---------------------------------------------------------------------------------|-----|-----|------|
| RS1 | $t_{w(\text{PWRON\_RST})}$ Pulse duration, $\overline{\text{PWRON\_RESET}}$ low | 800 |     | ms   |

**Table 5–7. OMAP5910 Device Reset Switching Characteristics<sup>†</sup>**

| NO. | PARAMETER                                                                                                          | MIN | MAX      | UNIT          |
|-----|--------------------------------------------------------------------------------------------------------------------|-----|----------|---------------|
| RS2 | $t_{d(\text{PWRONH-RSTH})}$ Delay time, $\overline{\text{PWRON\_RESET}}$ high to $\overline{\text{RST\_OUT}}$ high |     | $T + 10$ | $\mu\text{s}$ |

<sup>†</sup> P = period of 32-kHz clock, C = Value of ULPD wakeup time setup register,  $\text{SETUP\_ULPD1\_REG}$  (Default 03FFh),  $T = P \cdot C$



**Figure 5–5. Device Reset Timings**

### 5.7.2 OMAP5910 MPU Core Reset

The  $\overline{\text{MPU\_RST}}$  signal is the active-low asynchronous input responsible for the reset of the OMAP5910 MPU core. Stable power supplies are assumed prior to  $\overline{\text{MPU\_RST}}$  assertion. Table 5–6 illustrates the behavior of  $\overline{\text{MPU\_RST}}$  and  $\text{RST\_OUT}$ . In Table 5–7, a logic high level is assumed on the  $\text{PWRON\_RESET}$  input. In the case where an application ties the  $\text{PWRON\_RESET}$  and  $\overline{\text{MPU\_RST}}$  together, the behavior described in Section 5.7.1, *OMAP5910 Device Reset*, will override. See Table 5–8 and Table 5–9.

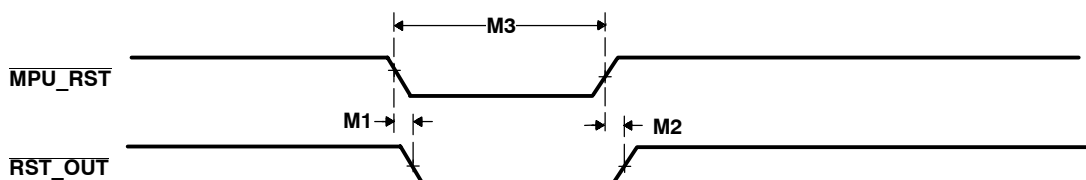
**Table 5–8.  $\overline{\text{MPU\_RST}}$  Timing Requirements**

| NO. |                                                                                    | MIN | MAX | UNIT          |
|-----|------------------------------------------------------------------------------------|-----|-----|---------------|
| M3  | $t_w(\overline{\text{MPU\_RST}})$ Pulse duration, $\overline{\text{MPU\_RST}}$ low | 50  |     | $\mu\text{s}$ |

**Table 5–9.  $\overline{\text{MPU\_RST}}$  Switching Characteristics<sup>†</sup>**

| NO. | PARAMETER                                                    |                                                                         | MIN                                                  | MAX    | UNIT          |
|-----|--------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------|--------|---------------|
| M1  | $t_d(\overline{\text{MPUL}}\text{--}\overline{\text{RSTL}})$ | Delay time, $\overline{\text{MPU\_RST}}$ low to $\text{RST\_OUT}$ low   |                                                      | 1      | $\mu\text{s}$ |
| M2  | $t_d(\overline{\text{MPUH}}\text{--}\overline{\text{RSTH}})$ | Delay time, $\overline{\text{MPU\_RST}}$ high to $\text{RST\_OUT}$ high | MPU_RST asserted during<br>OMAP5910 awake state      |        | $\mu\text{s}$ |
|     |                                                              |                                                                         | MPU_RST asserted during<br>OMAP5910 deep sleep state |        |               |
|     |                                                              |                                                                         |                                                      | T + 10 |               |

<sup>†</sup> P = period of 32-kHz clock, C = Value of ULPD wakeup time setup register,  $\text{SETUP\_ULPD1\_REG}$  (Default 03FFh),  $T = P \cdot C$



**Figure 5–6. MPU Core Reset Timings**

## 5.8 External Memory Interface Timing

### 5.8.1 EMIFS/Flash Interface Timing

Table 5–10 and Table 5–11 assume testing over recommended operating conditions (see Figure 5–7 through Figure 5–11).

**Table 5–10. EMIFS/Flash Interface Timing Requirements**

| NO. |                           |                                                   |                          | DV <sub>DD5</sub> = 1.8 V<br>Nominal |     | DV <sub>DD5</sub> = 2.75 V<br>Nominal |     | DV <sub>DD5</sub> = 3.3 V<br>Nominal |     | UNIT |
|-----|---------------------------|---------------------------------------------------|--------------------------|--------------------------------------|-----|---------------------------------------|-----|--------------------------------------|-----|------|
|     |                           |                                                   |                          | MIN                                  | MAX | MIN                                   | MAX | MIN                                  | MAX |      |
| F6  | t <sub>su</sub> (DV–CLKH) | Setup time, read data valid before FLASH.CLK high | Async modes <sup>†</sup> | 9                                    |     | 9                                     |     | 9                                    |     | ns   |
|     |                           |                                                   | Sync Modes <sup>†</sup>  | 3                                    |     | 3                                     |     | 3                                    |     | ns   |
| F7  | t <sub>h</sub> (CLKH–RDV) | Hold time, read data valid after FLASH.CLK high   | Async modes <sup>†</sup> | 0                                    |     | 0                                     |     | 0                                    |     | ns   |
|     |                           |                                                   | Sync Modes <sup>‡</sup>  | 2                                    |     | 2                                     |     | 2                                    |     | ns   |

<sup>†</sup> The external FLASH.CLK is disabled for async modes. Async modes are only supported with the RT bit in the EMIFS configuration register set to 0.

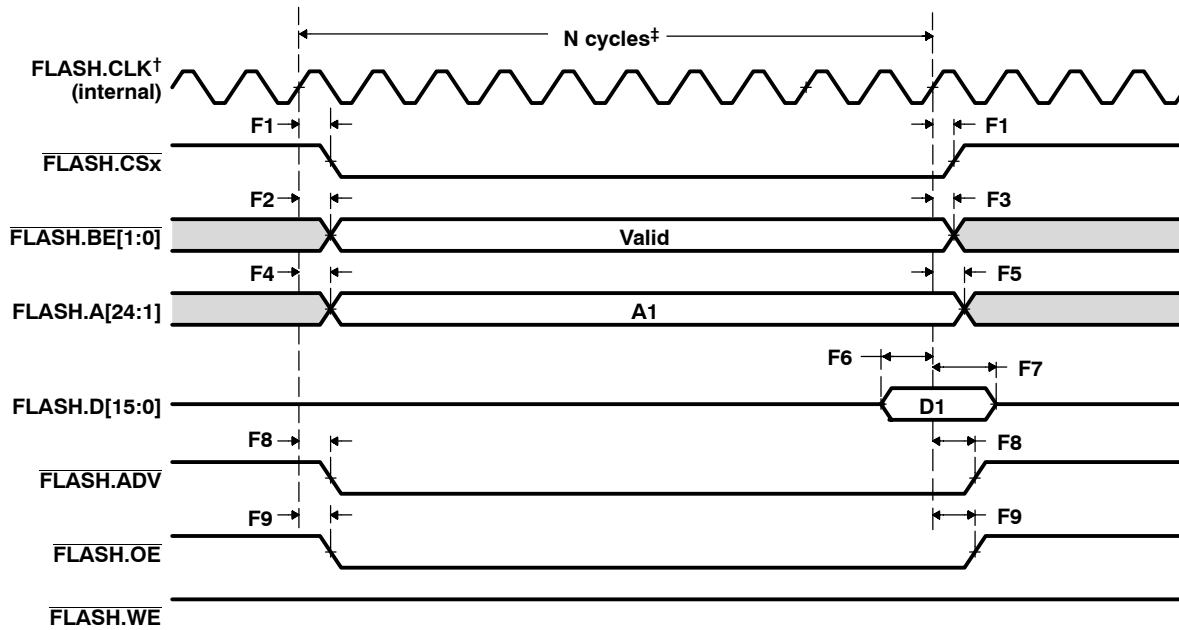
<sup>‡</sup> Sync modes are only supported with the RT bit in the EMIFS configuration register set to 1.

Table 5–11. EMIFS/Flash Interface Switching Characteristics

| NO. | PARAMETER                                                                                                 |                             | DV <sub>DD5</sub> = 1.8 V<br>Nominal |          | DV <sub>DD5</sub> = 2.75 V<br>Nominal |            | DV <sub>DD5</sub> = 3.3 V<br>Nominal |            | UNIT |
|-----|-----------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------|----------|---------------------------------------|------------|--------------------------------------|------------|------|
|     |                                                                                                           |                             | MIN                                  | MAX      | MIN                                   | MAX        | MIN                                  | MAX        |      |
| F1  | $t_{d(\text{CLKH-CSV})}$<br>Delay time,<br>FLASH.CLK high<br>to FLASH.CSx<br>transition                   | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 11         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 12       | –1                                    | 10         | –1                                   | 11         |      |
| F2  | $t_{d(\text{CLKH-BEV})}$<br>Delay time,<br>FLASH.CLK high<br>to FLASH.BEx<br>valid                        | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 12       | –1                                    | 10         | –1                                   | 11         |      |
| F3  | $t_{d(\text{CLKH-BEIV})}$<br>Delay time,<br>FLASH.CLK high<br>to FLASH.BEx<br>invalid                     | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 12       | –1                                    | 10         | –1                                   | 11         |      |
| F4  | $t_{d(\text{CLKH-AV})}$<br>Delay time,<br>FLASH.CLK high<br>to address valid                              | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 8        | 0                                     | 7          | 0                                    | 7          |      |
| F5  | $t_{d(\text{CLKH-AIV})}$<br>Delay time,<br>FLASH.CLK high<br>to address invalid                           | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 8        | 0                                     | 7          | 0                                    | 7          |      |
| F8  | $t_{d(\text{CLKH-ADV})}$<br>Delay time,<br>FLASH.CLK high<br>to FLASH.ADV<br>transition                   | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 12       | –1                                    | 10         | –1                                   | 11         |      |
| F9  | $t_{d(\text{CLKH-OEV})}$<br>Delay time,<br>FLASH.CLK high<br>to FLASH.OE<br>transition                    | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 12       | –1                                    | 10         | –1                                   | 11         |      |
| F12 | $t_{d(\text{CLKH-WEV})}$<br>Delay time,<br>FLASH.CLK high<br>to FLASH.WE<br>transition                    | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | –1                                   | 12       | –1                                    | 10         | –1                                   | 11         |      |
| F13 | $t_{d(\text{CLKH-WDV})}$<br>Delay time,<br>FLASH.CLK high<br>to write data valid                          | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | 1                                    | 22       | 1                                     | 20         | 1                                    | 18         |      |
| F14 | $t_{d(\text{CLKH-WDIV})}$<br>Delay time,<br>FLASH.CLK high<br>to write data<br>invalid                    | Async<br>Modes <sup>†</sup> | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
|     |                                                                                                           | Sync<br>Modes               | 1                                    | 22       | 1                                     | 20         | 1                                    | 18         |      |
| F15 | $t_{d(\text{CLKH-DHZ})}$<br>Delay time, FLASH.CLK high<br>to data bus high-impedance <sup>†</sup>         |                             |                                      | 24       |                                       | 21         |                                      | 20         | ns   |
| F16 | $t_{d(\text{CLKH-DLZ})}$<br>Delay time, FLASH.CLK high<br>to data bus driven                              |                             | 1                                    | 24       | 1                                     | 21         | 1                                    | 20         | ns   |
| F17 | $t_{d(\text{CLKH-BAAV})}^{\dagger}$<br>Delay time, FLASH.CLK high<br>to FLASH.BAA transition <sup>‡</sup> |                             | –1 + 0.5P                            | 8 + 0.5P | –1 + 0.5P                             | 7.5 + 0.5P | –1 + 0.5P                            | 7.5 + 0.5P | ns   |

<sup>†</sup> Data is referenced to the internal FLASH.CLK. The external FLASH.CLK is disabled for async modes.

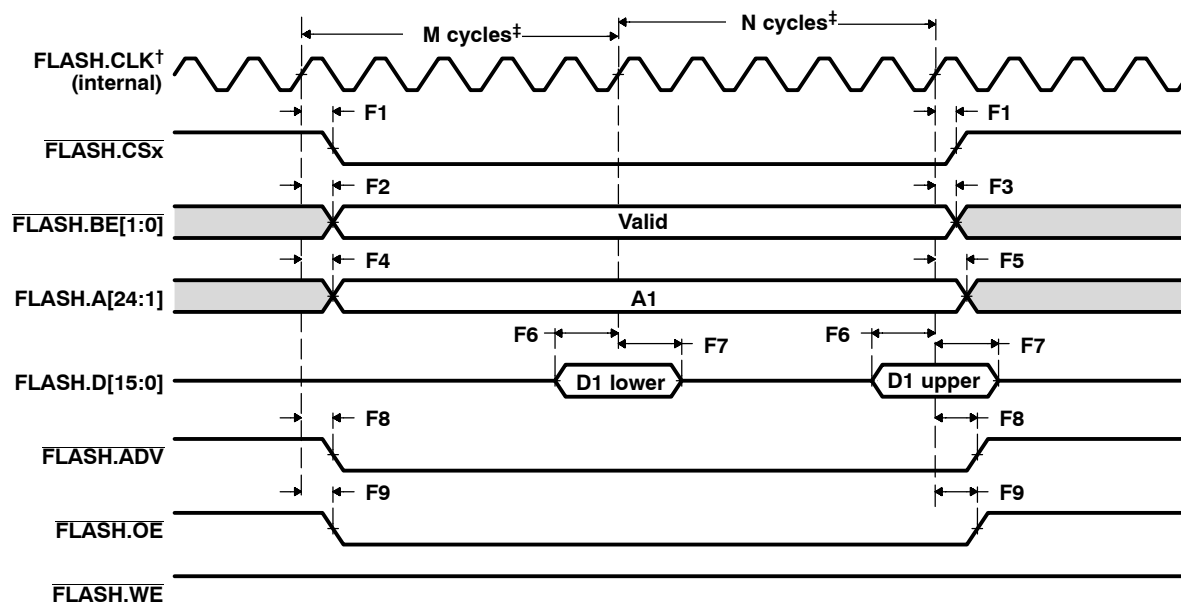
<sup>‡</sup> P = period of undivided Traffic Controller clock regardless of FLASH.CLK divider configuration



<sup>†</sup> FLASH.CLK is not driven during this mode of operation. The signal shown represents the internal FLASH.CLK signal given as a reference to express relative timings.

<sup>‡</sup> Number of cycles is configurable via EMIFS setup registers.

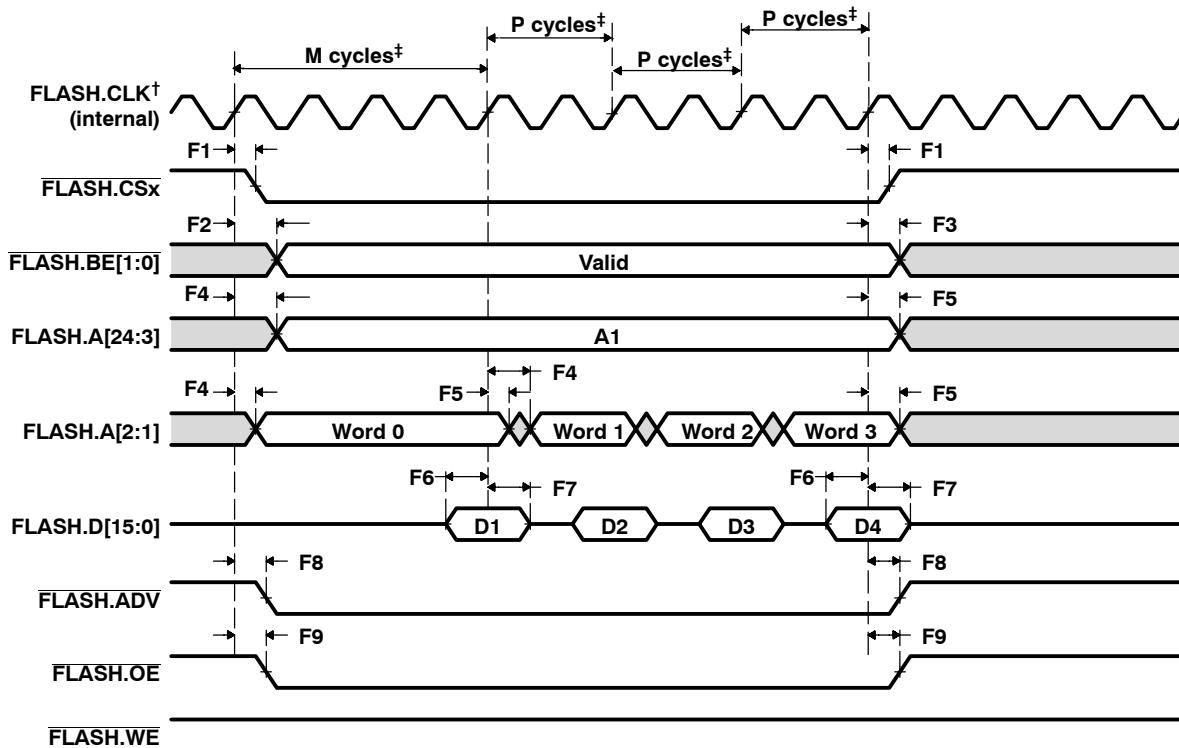
**Figure 5–7. Asynchronous Memory Read Timing**



<sup>†</sup> FLASH.CLK is not driven during this mode of operation. The signal shown represents the internal FLASH.CLK signal given as a reference to express relative timings.

<sup>‡</sup> Number of cycles is configurable via EMIFS setup registers.

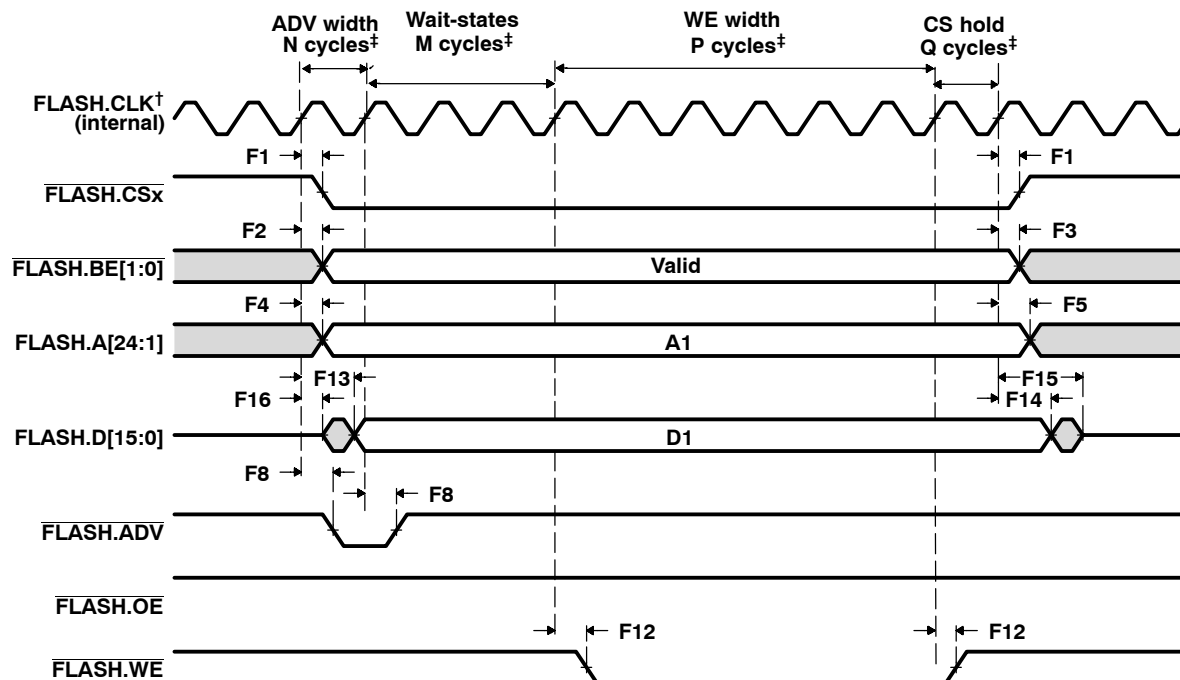
**Figure 5–8. Asynchronous 32-Bit Read**



<sup>†</sup> FLASH.CLK is not driven during this mode of operation. The signal shown represents the internal FLASH.CLK signal given as a reference to express relative timings.

<sup>‡</sup> Number of cycles is configurable via EMIFS setup registers.

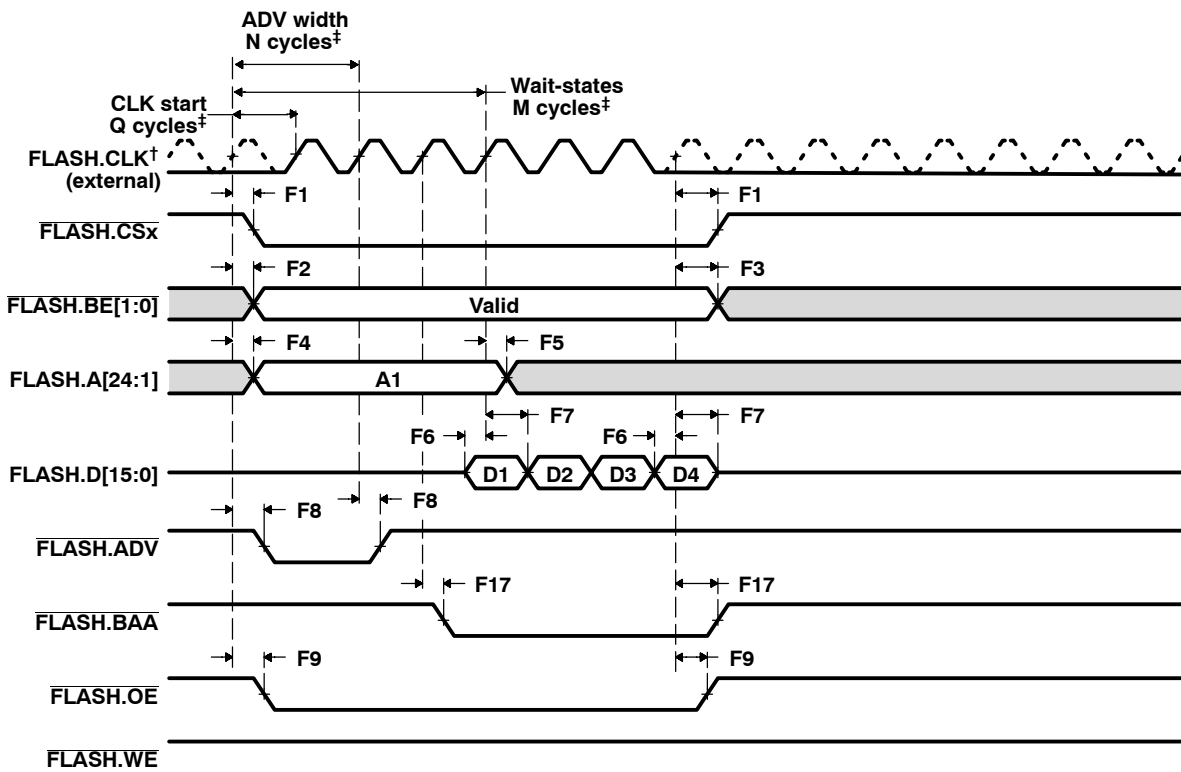
**Figure 5–9. Asynchronous Read – Page Mode ROM**



<sup>†</sup> FLASH.CLK is not driven during this mode of operation. The signal shown represents the internal FLASH.CLK signal given as a reference to express relative timings.

<sup>‡</sup> Number of cycles is configurable via EMIFS setup registers.

**Figure 5–10. Asynchronous Memory Write Timing**



<sup>†</sup> FLASH.CLK is only driven during the active portion of the cycle. For reference, the dashed line shows FLASH.CLK as if it were continuous.

<sup>‡</sup> Number of cycles is configurable via EMIFS setup registers.

**Figure 5–11. Synchronous Burst Read**

## 5.8.2 EMIFF/SDRAM Interface Timing

Table 5–12 and Table 5–13 assume testing over recommended operating conditions (see Figure 5–12 through Figure 5–17).

**Table 5–12. EMIFF/SDRAM Interface Timing Requirements<sup>†</sup>**

| NO. |                           |                                                   | DV <sub>DD4</sub> = 1.8 V<br>Nominal |     | DV <sub>DD4</sub> = 2.75 V<br>Nominal |     | DV <sub>DD4</sub> = 3.3 V<br>Nominal |     | UNIT |
|-----|---------------------------|---------------------------------------------------|--------------------------------------|-----|---------------------------------------|-----|--------------------------------------|-----|------|
|     |                           |                                                   | MIN                                  | MAX | MIN                                   | MAX | MIN                                  | MAX |      |
| SD7 | t <sub>su</sub> (DV-CLKH) | Setup time, read data valid before SDRAM.CLK high | 2                                    |     | 2                                     |     | 2                                    |     | ns   |
| SD8 | t <sub>h</sub> (CLKH-DV)  | Hold time, read data valid after SDRAM.CLK high   | 1                                    |     | 1                                     |     | 1                                    |     | ns   |

<sup>†</sup> Timing requirements are with the SD\_RET field equal to 1 in the EMIFF configuration register.

**Table 5–13. EMIFF/SDRAM Interface Switching Characteristics**

| NO.  | PARAMETER                               |                                                              | DV <sub>DD4</sub> = 1.8 V<br>Nominal |     | DV <sub>DD4</sub> = 2.75 V<br>Nominal |     | DV <sub>DD4</sub> = 3.3 V<br>Nominal |     | UNIT |
|------|-----------------------------------------|--------------------------------------------------------------|--------------------------------------|-----|---------------------------------------|-----|--------------------------------------|-----|------|
|      |                                         |                                                              | MIN                                  | MAX | MIN                                   | MAX | MIN                                  | MAX |      |
| SD1  | t <sub>c</sub> (CLK)                    | Cycle time, SDRAM.CLK                                        | H <sup>‡</sup>                       |     | H <sup>‡</sup>                        |     | H <sup>‡</sup>                       |     | ns   |
| SD2  | t <sub>w</sub> (CLK)                    | Pulse duration, SDRAM.CLK high/low                           | 2.5                                  |     | 2.5                                   |     | 2.5                                  |     | ns   |
| SD3  | t <sub>d</sub> (CLKH-DQM <sub>V</sub> ) | Delay time, SDRAM.CLK high to SDRAM.DQM <sub>x</sub> valid   | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD4  | t <sub>d</sub> (CLKH-DQM <sub>I</sub> ) | Delay time, SDRAM.CLK high to SDRAM.DQM <sub>x</sub> invalid | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD5  | t <sub>d</sub> (CLKH-AV)                | Delay time, SDRAM.CLK high to SDRAM.A[12:0] address valid    | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD6  | t <sub>d</sub> (CLKH-AIV)               | Delay time, SDRAM.CLK high to SDRAM.A[12:0] address invalid  | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD9  | t <sub>d</sub> (CLKH-SDCASL)            | Delay time, SDRAM.CLK high to SDRAM.CAS low                  | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD10 | t <sub>d</sub> (CLKH-SDCASH)            | Delay time, SDRAM.CLK high to SDRAM.CAS high                 | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD11 | t <sub>d</sub> (CLKH-DV)                | Delay time, SDRAM.CLK high to SDRAM.D[15:0] data valid       | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD12 | t <sub>d</sub> (CLKH-DIV)               | Delay time, SDRAM.CLK high to SDRAM.D[15:0] data invalid     | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD13 | t <sub>d</sub> (CLKH-SDWEL)             | Delay time, SDRAM.CLK high to SDRAM.WE low                   | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD14 | t <sub>d</sub> (CLKH-SDWEH)             | Delay time, SDRAM.CLK high to SDRAM.WE high                  | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD15 | t <sub>d</sub> (CLKH-BAV)               | Delay time, SDRAM.CLK high to SDRAM.BA[1:0] valid            | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD16 | t <sub>d</sub> (CLKH-BAIV)              | Delay time, SDRAM.CLK high to SDRAM.BA[1:0] invalid          | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD17 | t <sub>d</sub> (CLKH-RASL)              | Delay time, SDRAM.CLK high to SDRAM.RAS low                  | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |
| SD18 | t <sub>d</sub> (CLKH-RASH)              | Delay time, SDRAM.CLK high to SDRAM.RAS high                 | 1.5                                  | 9   | 1.5                                   | 9   | 1.5                                  | 9   | ns   |

<sup>‡</sup> H = 1/2 CPU cycle.

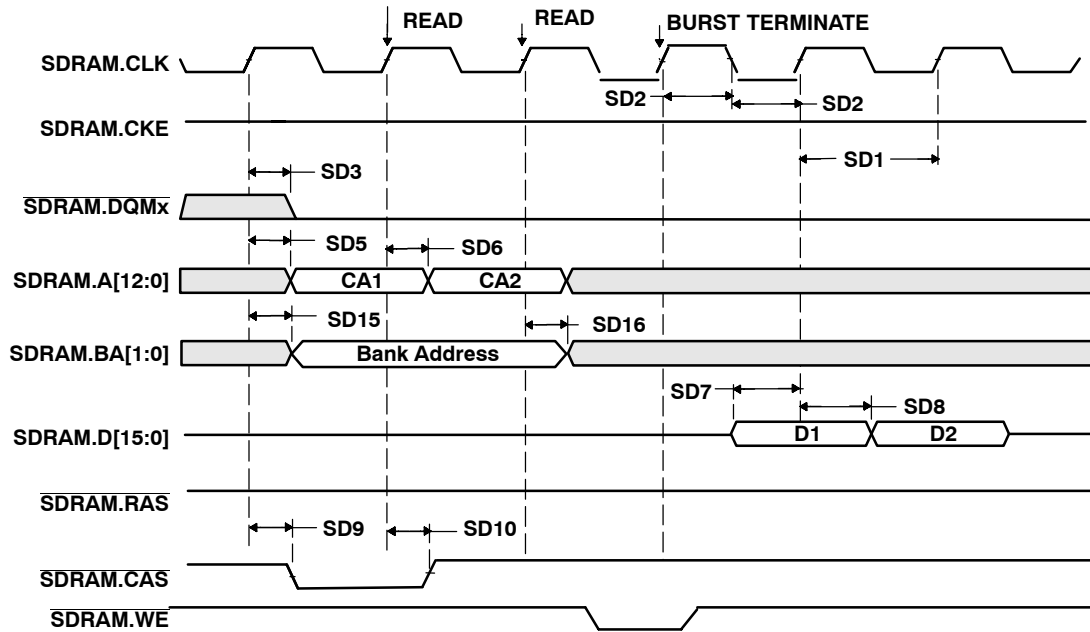


Figure 5–12. 32-Bit (2 x 16-Bit) SDRAM RD (Read) Command (Active Row)

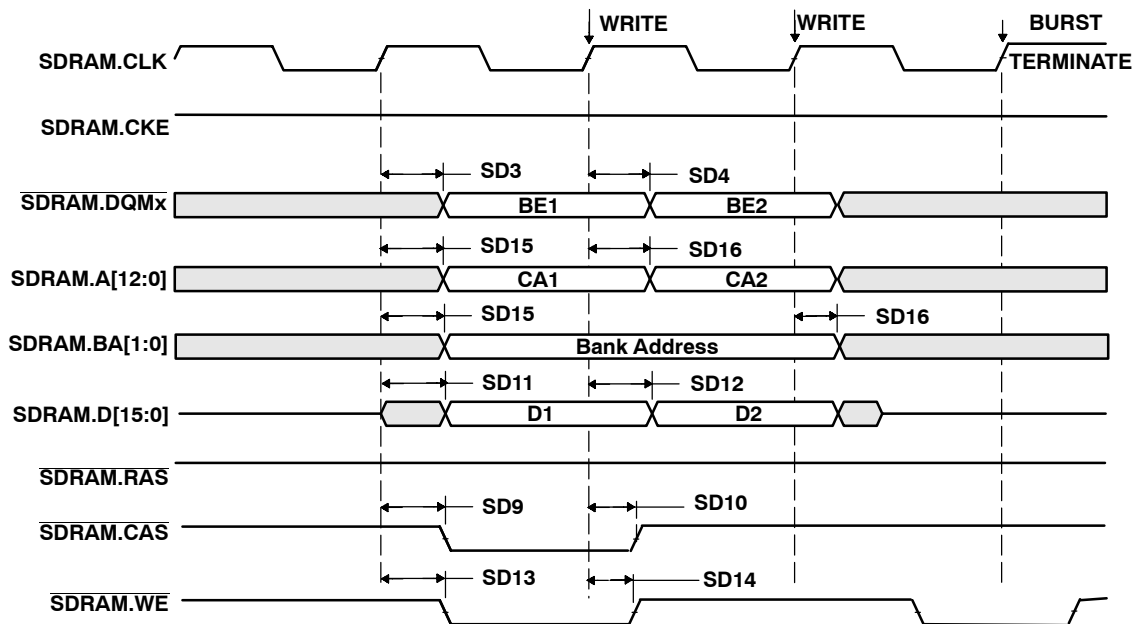


Figure 5–13. 32-Bit (2 x 16-Bit) SDRAM WRT (Write) Command (Active Row)

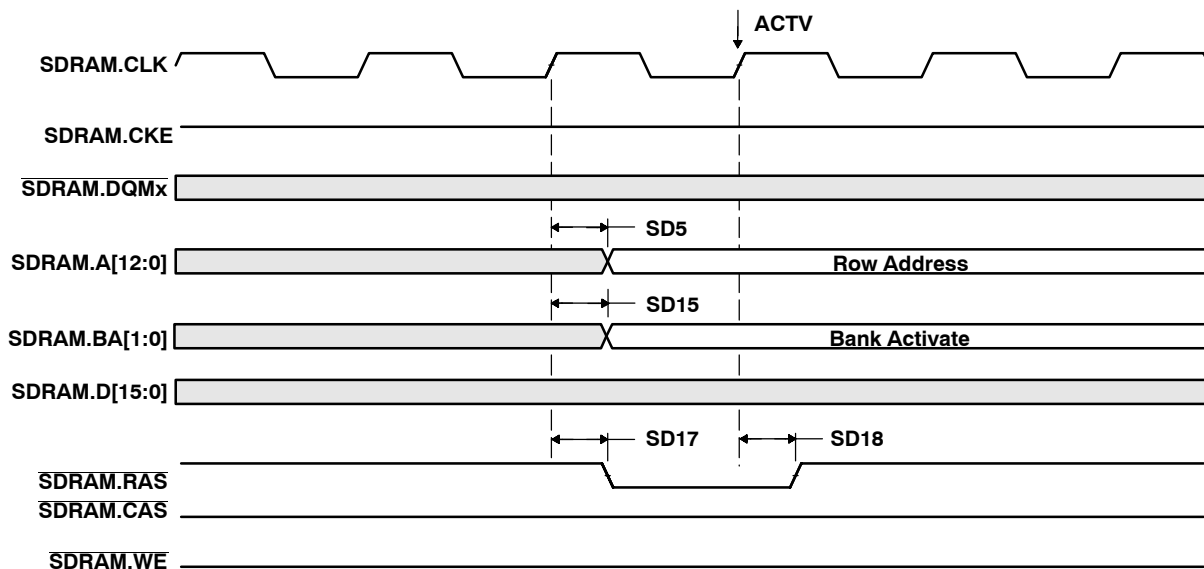


Figure 5–14. SDRAM ACTV (Activate Row) Command

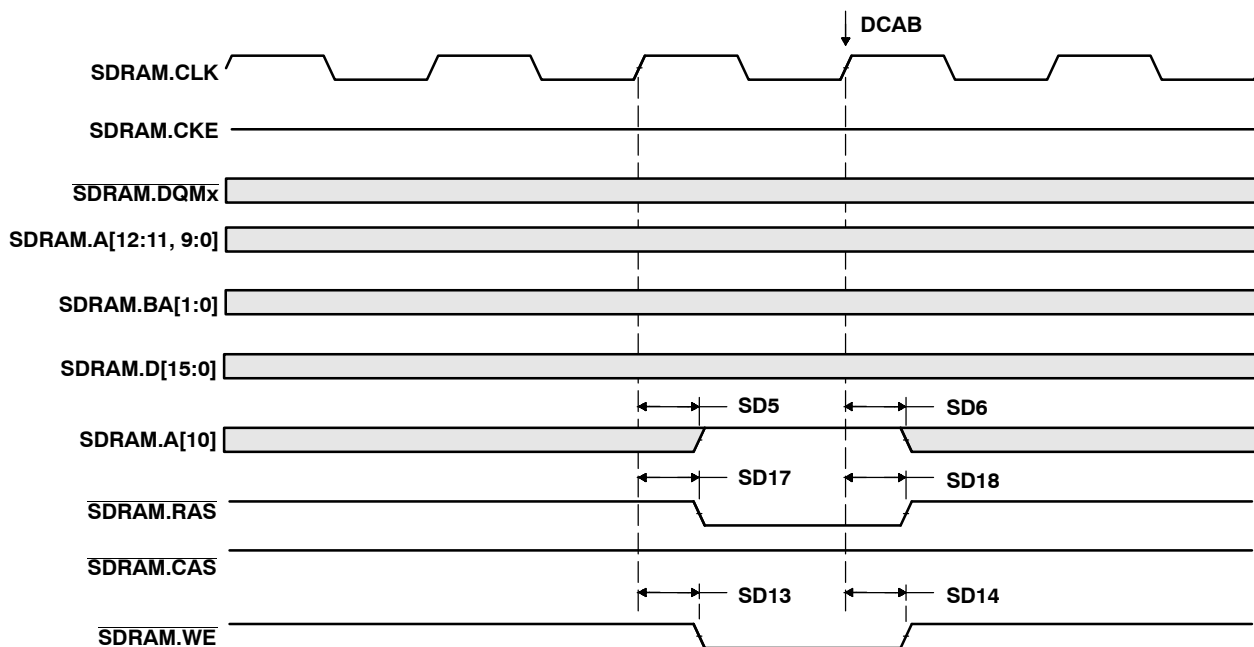


Figure 5–15. SDRAM DCAB (Precharge/Deactivate Row) Command

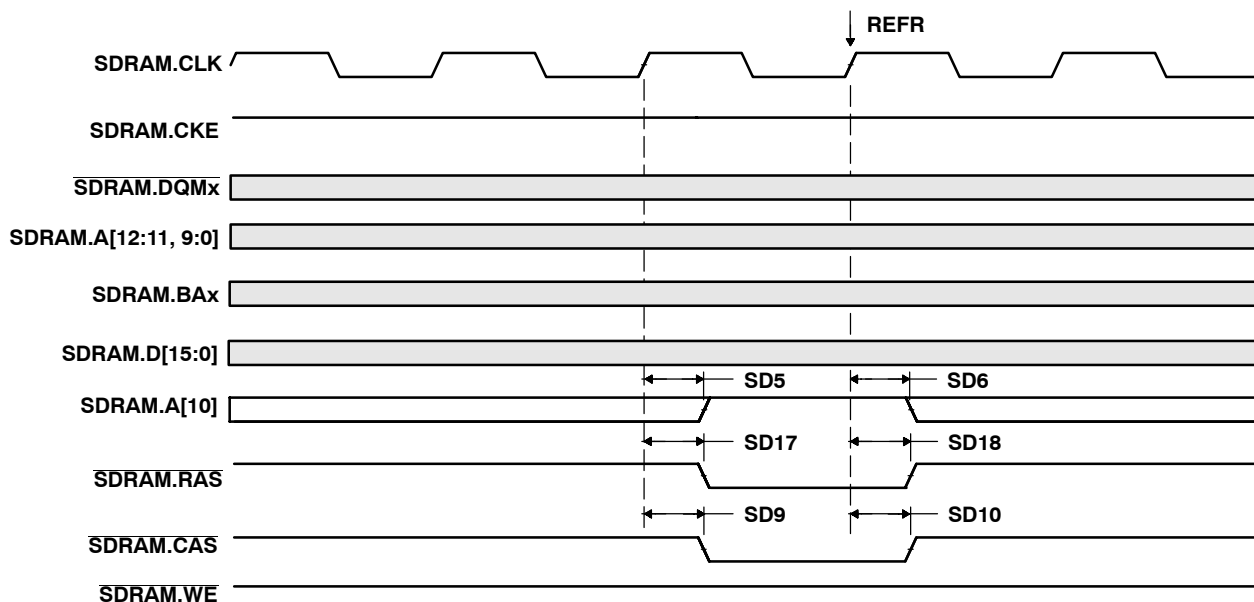


Figure 5–16. SDRAM REFR (Refresh) Command

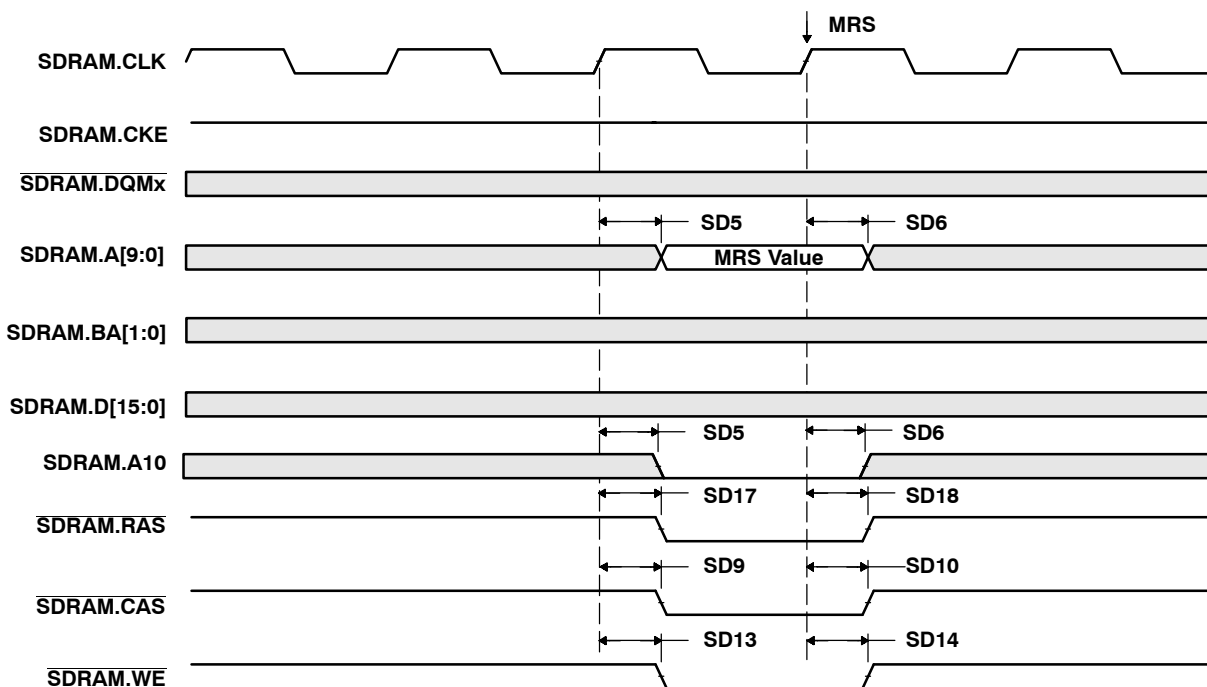


Figure 5–17. SDRAM MRS (Mode Register Set) Command

## 5.9 Multichannel Buffered Serial Port (McBSP) Timings

### 5.9.1 McBSP Transmit and Receive Timings

Table 5–14 and Table 5–15 assume testing over recommended operating conditions (see Figure 5–18 and Figure 5–19). In Table 5–14 and Table 5–15, “ext” indicates that the device pin is configured as an input (slave) driven by an external device and “int” indicates that the pin is configured as an output (master).

**Table 5–14. McBSP Timing Requirements<sup>†‡</sup>**

| NO. |                    |                                                                                      |              | MIN                           | MAX | UNIT |
|-----|--------------------|--------------------------------------------------------------------------------------|--------------|-------------------------------|-----|------|
| M11 | $t_{c(CKRX)}$      | Cycle time, CLKR/X                                                                   | CLKR/X ext   | 2P                            |     | ns   |
| M12 | $t_{w(CKRX)}$      | Pulse duration, CLKR/X high or CLKR/X low                                            | CLKR/X ext   | 0.45P                         |     | ns   |
| M13 | $t_r$              | Rise time, CLKR/X, MCBSP2.FSR/X                                                      | McBSP1       | CLKR/X ext                    | 12  | ns   |
|     |                    |                                                                                      | McBSP2       | CLKR/X ext, MCBSP2.FS R/X ext | 12  |      |
|     |                    |                                                                                      | McBSP3       | CLKR/X ext                    | 6   |      |
| M14 | $t_f$              | Fall time, CLKR/X, MCBSP2.FSR/X                                                      | McBSP1       | CLKR/X ext                    | 12  | ns   |
|     |                    |                                                                                      | McBSP2       | CLKR/X ext, MCBSP2.FS R/X ext | 12  |      |
|     |                    |                                                                                      | McBSP3       | CLKR/X ext                    | 6   |      |
| M15 | $t_{su(FRH-CKRL)}$ | Setup time, external receiver frame sync (FSR/X) high before CLKR/X low <sup>§</sup> | McBSP1 (FSX) | CLKX int <sup>§</sup>         | 25  | ns   |
|     |                    |                                                                                      |              | CLKX ext <sup>§</sup>         | 31  |      |
|     |                    |                                                                                      | McBSP2 (FSR) | CLKR int                      | 25  |      |
|     |                    |                                                                                      |              | CLKR ext                      | 7   |      |
|     |                    |                                                                                      | McBSP3 (FSX) | CLKX int <sup>§</sup>         | 24  |      |
|     |                    |                                                                                      |              | CLKX ext <sup>§</sup>         | 15  |      |
| M16 | $t_h(CKRL-FRH)$    | Hold time, external receiver frame sync (FSR/X) high after CLKR/X low <sup>§</sup>   | McBSP1 (FSX) | CLKX int <sup>§</sup>         | 3   | ns   |
|     |                    |                                                                                      |              | CLKX ext <sup>§</sup>         | 16  |      |
|     |                    |                                                                                      | McBSP2 (FSR) | CLKR int                      | 3   |      |
|     |                    |                                                                                      |              | CLKR ext                      | 3   |      |
|     |                    |                                                                                      | McBSP3 (FSX) | CLKX int <sup>§</sup>         | 13  |      |
|     |                    |                                                                                      |              | CLKX ext <sup>§</sup>         | 13  |      |
| M17 | $t_{su(DRV-CKRL)}$ | Setup time, DR valid before CLKR/X low <sup>§</sup>                                  | McBSP1       | CLKX int <sup>§</sup>         | 21  | ns   |
|     |                    |                                                                                      |              | CLKX ext <sup>§</sup>         | 3   |      |
|     |                    |                                                                                      | McBSP2       | CLKR int                      | 22  |      |
|     |                    |                                                                                      |              | CLKR ext                      | 3   |      |
|     |                    |                                                                                      | McBSP3       | CLKX int <sup>§</sup>         | 19  |      |
|     |                    |                                                                                      |              | CLKX ext <sup>§</sup>         | 10  |      |

<sup>†</sup> Polarity bits CLKRP = CLKXP = FSRP = FSXP = 0. If the polarity of any of the signals is inverted, then the timing references of that signal are also inverted.

<sup>‡</sup> Regardless of whether MCBSP.CLKS is internally or externally clocked, P = 1/(DSPXOR\_CLK) for McBSP1 and McBSP3, and P = 1/(AMPER\_CLK) for McBSP2. See the *OMAP5910 Dual-Core Processor Clock Generation and System Reset Management Reference Guide* (literature number SPRU678) for additional details.

<sup>§</sup> For McBSP1 and McBSP2, the receiver clock and frame sync inputs are driven by FSX and CLKX via internal loopback connections enabled via software configuration.

**Table 5–14. McBSP Timing Requirements<sup>†‡</sup> (Continued)**

| NO. |                    |                                                   |        | MIN                   | MAX | UNIT |
|-----|--------------------|---------------------------------------------------|--------|-----------------------|-----|------|
| M18 | $t_{h(CKRL-DRV)}$  | Hold time, DR valid after CLKR/X low <sup>§</sup> | McBSP1 | CLKX int <sup>§</sup> | 3   | ns   |
|     |                    |                                                   |        | CLKX ext <sup>§</sup> | 3   |      |
|     |                    |                                                   | McBSP2 | CLKR int              | 3   |      |
|     |                    |                                                   |        | CLKR ext              | 3   |      |
|     |                    |                                                   | McBSP3 | CLKX int <sup>§</sup> | 3   |      |
|     |                    |                                                   |        | CLKX ext <sup>§</sup> | 3   |      |
| M19 | $t_{su(FXH-CKXL)}$ | Setup time, external FSX high before CLKX low     | McBSP1 | CLKX int              | 30  | ns   |
|     |                    |                                                   |        | CLKX ext              | 25  |      |
|     |                    |                                                   | McBSP2 | CLKX int              | 28  |      |
|     |                    |                                                   |        | CLKX ext              | 27  |      |
|     |                    |                                                   | McBSP3 | CLKX int              | 28  |      |
|     |                    |                                                   |        | CLKX ext              | 27  |      |
| M20 | $t_{h(CKXL-FXH)}$  | Hold time, external FSX high after CLKX low       | McBSP1 | CLKX int              | 3   | ns   |
|     |                    |                                                   |        | CLKX ext              | 10  |      |
|     |                    |                                                   | McBSP2 | CLKX int              | 3   |      |
|     |                    |                                                   |        | CLKX ext              | 3   |      |
|     |                    |                                                   | McBSP3 | CLKX int              | 3   |      |
|     |                    |                                                   |        | CLKX ext              | 3   |      |

<sup>†</sup> Polarity bits CLKRP = CLKXP = FSRP = FSXP = 0. If the polarity of any of the signals is inverted, then the timing references of that signal are also inverted.

<sup>‡</sup> Regardless of whether MCBSP.CLKS is internally or externally clocked,  $P = 1/(DSPXOR\_CK)$  for McBSP1 and McBSP3, and  $P = 1/(AMPER\_CK)$  for McBSP2. See the *OMAP5910 Dual-Core Processor Clock Generation and System Reset Management Reference Guide* (literature number SPRU678) for additional details.

<sup>§</sup> For McBSP1 and McBSP2, the receiver clock and frame sync inputs are driven by FSX and CLKX via internal loopback connections enabled via software configuration.

**Table 5–15. McBSP Switching Characteristics<sup>†‡§</sup>**

| NO. | PARAMETER           |                                                                                                                                          |        | MIN        | MAX            | UNIT |
|-----|---------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------|------------|----------------|------|
| M0  | $t_{d(CKSH-CKRXH)}$ | Delay time, CLKS high to CLKR/X high for internal CLKR/X generated from CLKS input                                                       | McBSP1 | CLKR/X int | 2    33        | ns   |
| M1  | $t_c(CKRX)$         | Cycle time, CLKR/X                                                                                                                       |        | CLKR/X int | 2P             | ns   |
| M2  | $t_w(CKRXH)$        | Pulse duration, CLKR/X high                                                                                                              |        | CLKR/X int | 0.45D    0.55D | ns   |
| M3  | $t_w(CKRXL)$        | Pulse duration, CLKR/X low                                                                                                               |        | CLKR/X int | 0.45C    0.55C | ns   |
| M4  | $t_{d(CKRH-FRV)}$   | Delay time, CLKR high to internal FSR valid                                                                                              | McBSP2 | CLKR int   | –1    13       | ns   |
|     |                     |                                                                                                                                          |        | CLKR ext   | –3    24       | ns   |
| M5  | $t_{d(CKXH-FXV)}$   | Delay time, CLKX high to internal FSX valid                                                                                              | McBSP1 | CLKX int   | –4    13       | ns   |
|     |                     |                                                                                                                                          |        | CLKX ext   | 7    39        |      |
|     |                     |                                                                                                                                          | McBSP2 | CLKX int   | –1    4        |      |
|     |                     |                                                                                                                                          |        | CLKX ext   | 2    24        |      |
|     |                     |                                                                                                                                          | McBSP3 | CLKX int   | –1    9        |      |
|     |                     |                                                                                                                                          |        | CLKX ext   | 2    37        |      |
| M7  | $t_{d(CKXH-DXV)}$   | Delay time, CLKX high to DX valid.<br>This applies to all bits except the first bit transmitted when in Data Delay 0 (XDATDLY=00b) mode. | McBSP1 | CLKX int   | –2    7        | ns   |
|     |                     |                                                                                                                                          |        | CLKX ext   | 7    40        |      |
|     |                     |                                                                                                                                          | McBSP2 | CLKX int   | 0    10        |      |
|     |                     |                                                                                                                                          |        | CLKX ext   | 3    27        |      |
|     |                     |                                                                                                                                          | McBSP3 | CLKX int   | –1    10       |      |
|     |                     |                                                                                                                                          |        | CLKX ext   | 1    16        |      |
| M9  | $t_{d(FXH-DXV)}$    | Delay time, FSX high to DX valid <sup>¶</sup><br>Only applies to first bit transmitted when in Data Delay 0 (XDATDLY=00b) mode.          | McBSP1 | FSX int    | 28             | ns   |
|     |                     |                                                                                                                                          |        | FSX ext    | 25             |      |
|     |                     |                                                                                                                                          | McBSP2 | FSX int    | 30             |      |
|     |                     |                                                                                                                                          |        | FSX ext    | 27             |      |
|     |                     |                                                                                                                                          | McBSP3 | FSX int    | 10             |      |
|     |                     |                                                                                                                                          |        | FSX ext    | 27             |      |

<sup>†</sup> Polarity bits CLKRP = CLKXP = FSRP = FSXP = 0. If the polarity of any of the signals is inverted, then the timing references of that signal are also inverted.

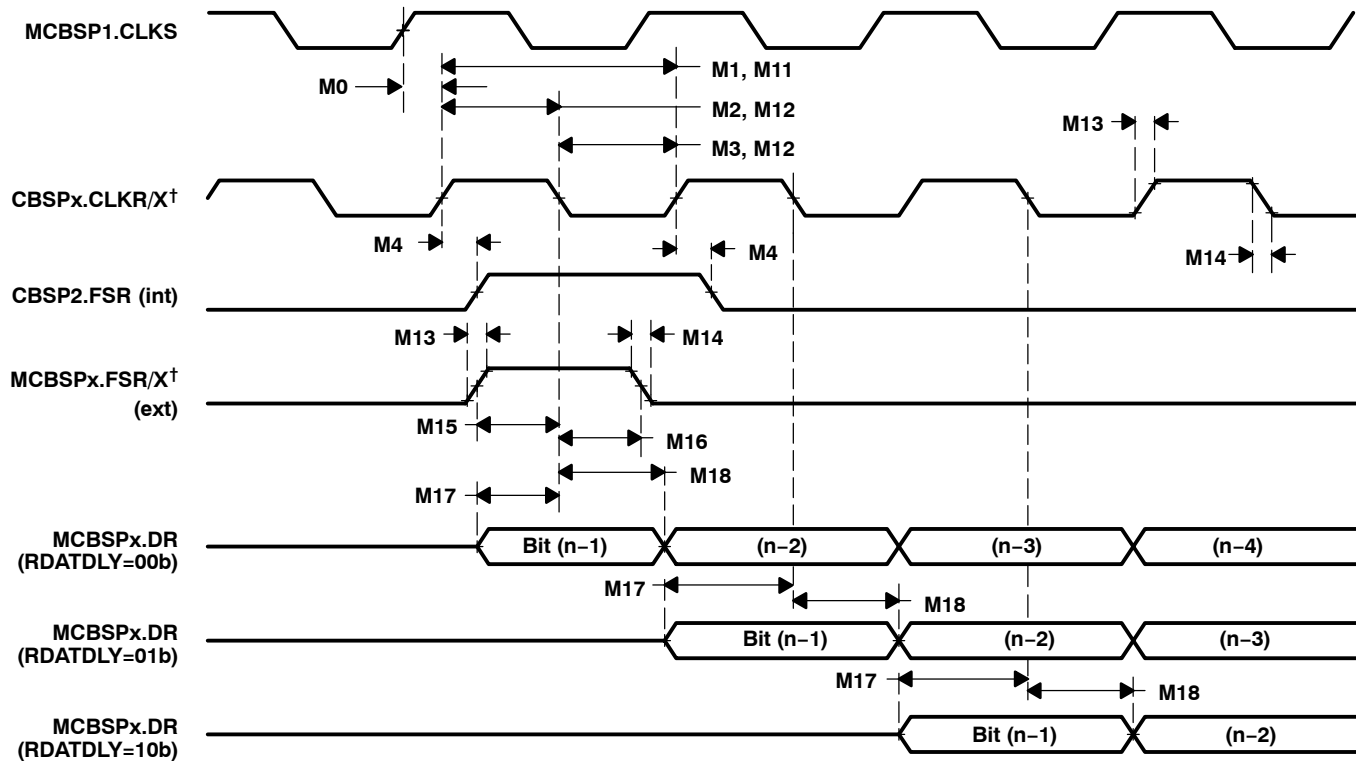
<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

<sup>§</sup> T=CLKRX period = (1 + CLKGDV) \* P

C=CLKRX low pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2) \* P when CLKGDV is even

D=CLKRX high pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2 + 1) \* P when CLKGDV is even

<sup>¶</sup> Only DXENA=0 is supported for all OMAP5910 McBSPs.



† For McBSP1 and McBSP3, the receiver clock and frame sync inputs are driven by FSX and CLKX via internal loopback connections enabled via software configuration. The M13 and M14 descriptors are applicable only to McBSP2.

Figure 5-18. McBSP Receive Timings

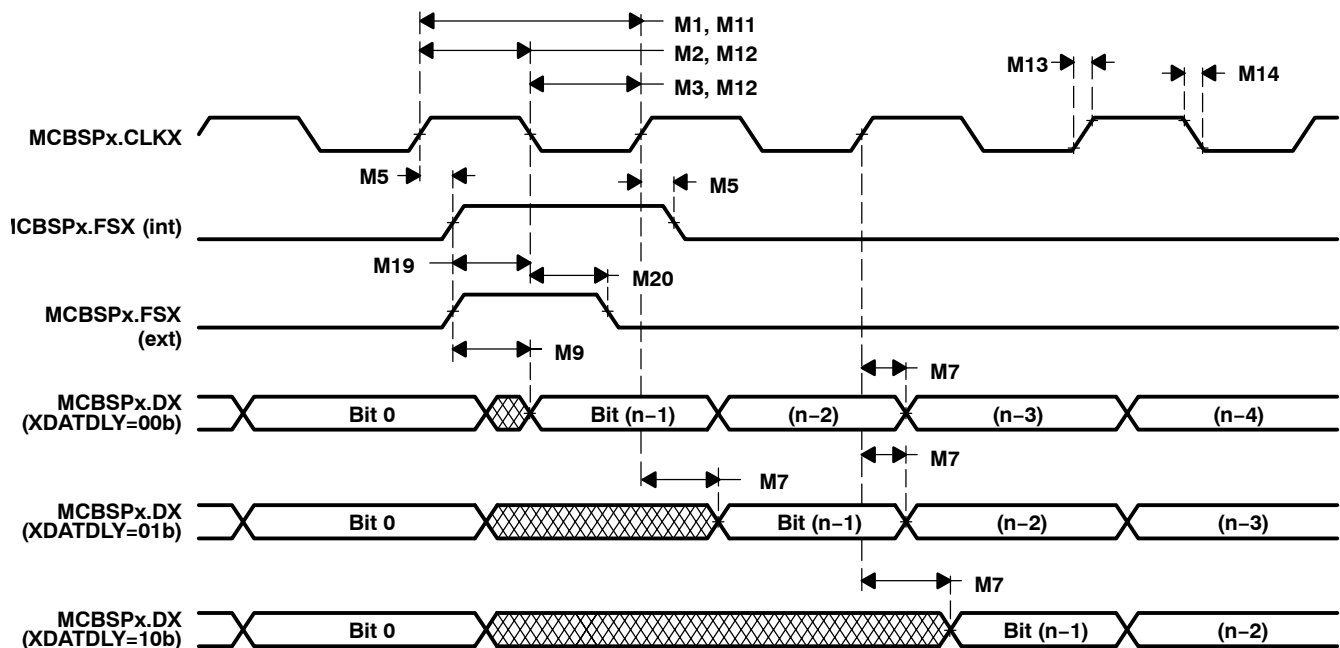


Figure 5-19. McBSP Transmit Timings

## 5.9.2 McBSP as SPI Master or Slave Timing

Table 5–16 to Table 5–23 assume testing over recommended operating conditions (see Figure 5–20 through Figure 5–23).

**Table 5–16. McBSP as SPI Master or Slave Timing Requirements (CLKSTP = 10b, CLKXP = 0)<sup>†‡</sup>**

| NO. |                     |                                                    | MASTER |     | SLAVE  |     | UNIT |
|-----|---------------------|----------------------------------------------------|--------|-----|--------|-----|------|
|     |                     |                                                    | MIN    | MAX | MIN    | MAX |      |
| M30 | $t_{su}(DRV-CKXL)$  | Setup time, MCBSPx.DR valid before MCBSPx.CLKX low | 15     |     | 2 – 6P |     | ns   |
| M31 | $t_h(CKXL-DRV)$     | Hold time, MCBSPx.DR valid after MCBSPx.CLKX low   | 2      |     | 6 + 6P |     | ns   |
| M32 | $t_{su}(BFXL-CKXH)$ | Setup time, MCBSPx.FSX low before MCBSPx.CLKX high | McBSP1 |     | 21     |     | ns   |
|     |                     |                                                    | McBSP2 |     | 5      |     |      |
|     |                     |                                                    | McBSP3 |     | 10     |     |      |
| M33 | $t_c(CKX)$          | Cycle time, MCBSPx.CLKX                            | 2P     |     | 16P    |     | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the internal reference clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

**Table 5–17. McBSP as SPI Master or Slave Switching Characteristics (CLKSTP = 10b, CLKXP = 0)<sup>†‡</sup>**

| NO. | PARAMETER                 |                                                              | MASTER <sup>§</sup> |       | SLAVE  |         | UNIT |
|-----|---------------------------|--------------------------------------------------------------|---------------------|-------|--------|---------|------|
|     |                           |                                                              | MIN                 | MAX   | MIN    | MAX     |      |
| M24 | t <sub>h</sub> (CKXL-FXL) | Hold time, MCBSPx.FSX low after MCBSPx.CLKX low <sup>¶</sup> | 0.45T               | 0.55T |        |         | ns   |
| M25 | t <sub>d</sub> (FXL-CKXH) | Delay time, MCBSPx.FSX low to MCBSPx.CLKX high <sup>#</sup>  | 0.45C               | 0.55C |        |         | ns   |
| M26 | t <sub>d</sub> (CKXH-DXV) | Delay time, MCBSPx.CLKX high to MCBSPx.DX valid              | –1                  | 7     | 3P + 2 | 5P + 18 | ns   |
| M29 | t <sub>d</sub> (FXL-DXV)  | Delay time, MCBSPx.FSX low to MCBSPx.DX valid                |                     |       |        | 4P + 18 | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the internal reference clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

<sup>§</sup> T = CLKX period = (1 + CLKGDV) \* P

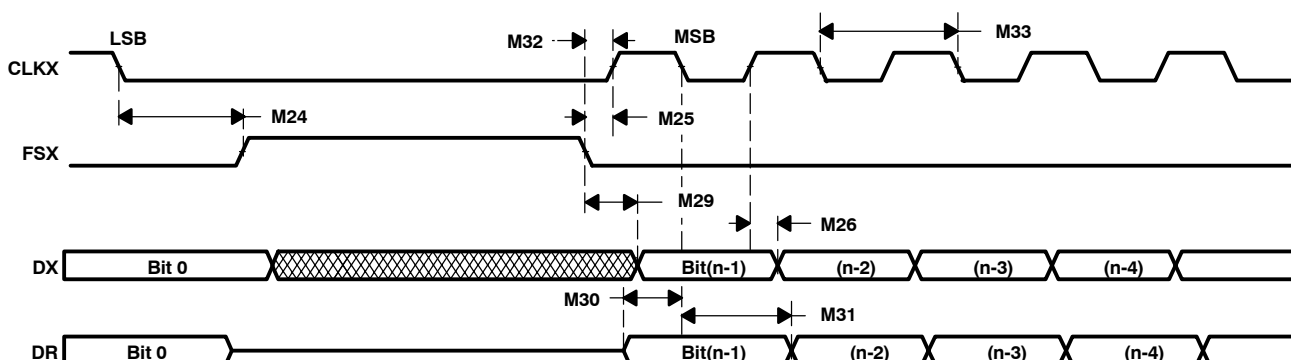
C = CLKX low pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2) \* P when CLKGDV is even

<sup>¶</sup> FSRP = FSXP = 1. As a SPI master, MCBSPx.FSX is inverted to provide active-low slave-enable output. As a slave, the active-low signal input on MCBSPx.FSX and MCBSPx.FSR is inverted before being used internally.

CLKXM = FSXM = 1, CLKRM = FSRM = 0 for master McBSP

CLKXM = CLKRM = FSXM = FSRM = 0 for slave McBSP

<sup>#</sup> MCBSPx.FSX should be low before the rising edge of clock to enable slave devices and then begin a SPI transfer at the rising edge of the master clock (MCBSPx.CLKX).



**Figure 5–20. McBSP Timing as SPI Master or Slave: CLKSTP = 10b, CLKXP = 0**

**Table 5–18. McBSP as SPI Master or Slave Timing Requirements (CLKSTP = 11b, CLKXP = 0)<sup>†‡</sup>**

| NO. |                    |                                                     | MASTER |     | SLAVE  |     | UNIT |
|-----|--------------------|-----------------------------------------------------|--------|-----|--------|-----|------|
|     |                    |                                                     | MIN    | MAX | MIN    | MAX |      |
| M39 | $t_{su}(DRV-CKXH)$ | Setup time, MCBSPx.DR valid before MCBSPx.CLKX high | 15     |     | 2 – 6P |     | ns   |
| M40 | $t_h(CKXH-DRV)$    | Hold time, MCBSPx.DR valid after MCBSPx.CLKX high   | 2      |     | 6 +6P  |     | ns   |
| M41 | $t_{su}(FXL-CKXH)$ | Setup time, MCBSPx.FSX low before MCBSPx.CLKX high  | McBSP1 |     | 21     |     | ns   |
|     |                    |                                                     | McBSP2 |     | 5      |     |      |
|     |                    |                                                     | McBSP3 |     | 10     |     |      |
| M42 | $t_c(CKX)$         | Cycle time, MCBSPx.CLKX                             | 2P     |     | 16P    |     | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the internal reference clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

**Table 5–19. McBSP as SPI Master or Slave Switching Characteristics (CLKSTP = 11b, CLKXP = 0)<sup>†‡</sup>**

| NO. | PARAMETER       |                                                              | MASTER <sup>§</sup> |       | SLAVE   |         | UNIT |
|-----|-----------------|--------------------------------------------------------------|---------------------|-------|---------|---------|------|
|     |                 |                                                              | MIN                 | MAX   | MIN     | MAX     |      |
| M34 | $t_h(CKXL-FXL)$ | Hold time, MCBSPx.FSX low after MCBSPx.CLKX low <sup>¶</sup> | 0.45C               | 0.55C |         |         | ns   |
| M35 | $t_d(FXL-CKXH)$ | Delay time, MCBSPx.FSX low to MCBSPx.CLKX high <sup>#</sup>  | 0.45T               | 0.55T |         |         | ns   |
| M36 | $t_d(CKXL-DXV)$ | Delay time, MCBSPx.CLKX low to MCBSPx.DX valid               | –1                  | 7     | 3P + 2  | 5P + 18 | ns   |
| M38 | $t_d(FXL-DXV)$  | Delay time, MCBSPx.FSX low to MCBSPx.DX valid                | D + 20              |       | 4P + 18 |         | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the internal reference clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

<sup>§</sup> T = CLKX period = (1 + CLKGDV) \* P

C = CLKX low pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2) \* P when CLKGDV is even

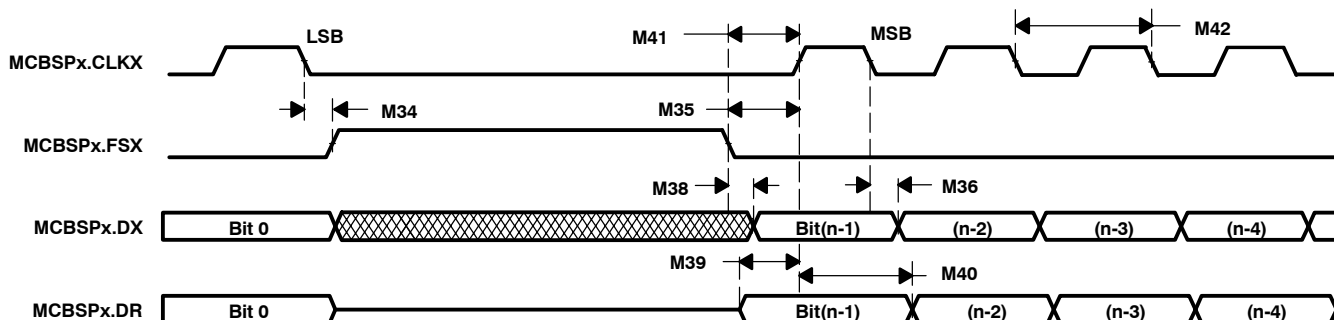
D = CLKX high pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2 + 1) \* P when CLKGDV is even

<sup>¶</sup> FSRP = FSXP = 1. As a SPI master, MCBSPx.FSX is inverted to provide active-low slave-enable output. As a slave, the active-low signal input on MCBSPx.FSX and MCBSPx.FSR is inverted before being used internally.

CLKXM = FSXM = 1, CLKRM = FSRM = 0 for master McBSP

CLKXM = CLKRM = FSXM = FSRM = 0 for slave McBSP

<sup>#</sup> MCBSPx.FSX should be low before the rising edge of clock to enable slave devices and then begin a SPI transfer at the rising edge of the master clock (MCBSPx.CLKX).

**Figure 5–21. McBSP Timing as SPI Master or Slave: CLKSTP = 11b, CLKXP = 0**

**Table 5–20. McBSP as SPI Master or Slave Timing Requirements (CLKSTP = 10b, CLKXP = 1)<sup>†‡</sup>**

| NO. | MIN                        |                                                     | MASTER |     | SLAVE  |     | UNIT |
|-----|----------------------------|-----------------------------------------------------|--------|-----|--------|-----|------|
|     |                            |                                                     | MIN    | MAX | MIN    | MAX |      |
| M49 | t <sub>su</sub> (DRV-CKXH) | Setup time, MCBSPx.DR valid before MCBSPx.CLKX high | 15     |     | 2 – 2P |     | ns   |
| M50 | t <sub>h</sub> (CKXH-DRV)  | Hold time, MCBSPx.DR valid after MCBSPx.CLKX high   | 2      |     | 6 + 6P |     | ns   |
| M51 | t <sub>su</sub> (FXL-CKXL) | Setup time, MCBSPx.FSX low before MCBSPx.CLKX low   | McBSP1 |     | 21     |     | ns   |
|     |                            |                                                     | McBSP2 |     | 5      |     |      |
|     |                            |                                                     | McBSP3 |     | 10     |     |      |
| M52 | t <sub>c</sub> (CKX)       | Cycle time, MCBSPx.CLKX                             | 2P     |     | 16P    |     | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the CPU clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

**Table 5–21. McBSP as SPI Master or Slave Switching Characteristics (CLKSTP = 10b, CLKXP = 1)<sup>†‡</sup>**

| NO. | PARAMETER       | MASTER <sup>§</sup>                                           |     | SLAVE |         | UNIT |
|-----|-----------------|---------------------------------------------------------------|-----|-------|---------|------|
|     |                 | MIN                                                           | MAX | MIN   | MAX     |      |
| M43 | $t_h(CKXH-FXL)$ | Hold time, MCBSPx.FSX low after MCBSPx.CLKX high <sup>¶</sup> |     | 0.45T | 0.55T   | ns   |
| M44 | $t_d(FXL-CKXL)$ | Delay time, MCBSPx.FSX low to MCBSPx.CLKX low <sup>#</sup>    |     | 0.45D | 0.55D   | ns   |
| M45 | $t_d(CKXL-DXV)$ | Delay time, MCBSPx.CLKX low to MCBSPx.DX valid                |     | –1    | 7       | ns   |
| M48 | $t_d(FXL-DXV)$  | Delay time, MCBSPx.FSX low to MCBSPx.DX valid                 |     |       | 4P + 18 | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the internal reference clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

<sup>§</sup> T = CLKX period = (1 + CLKGDV) \* P

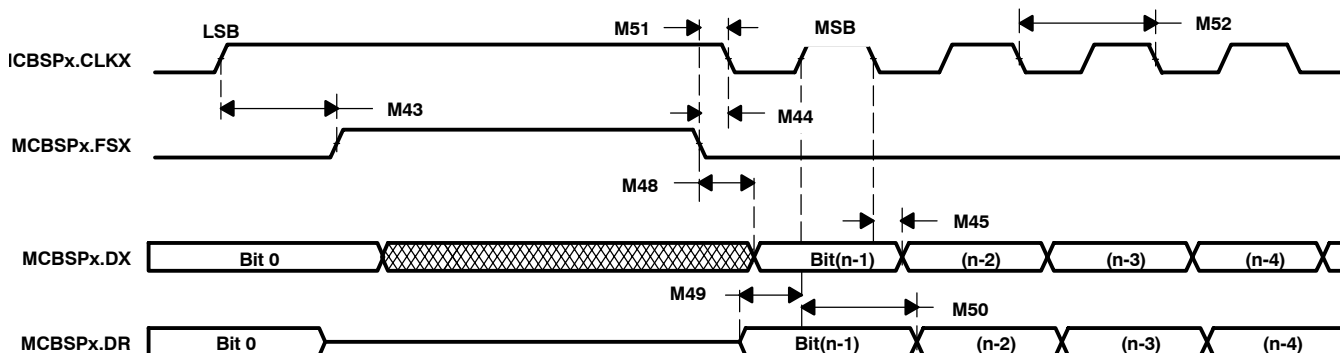
D = CLKX high pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2 + 1) \* P when CLKGDV is even

<sup>¶</sup> FSRP = FSXP = 1. As a SPI master, MCBSPx.FSX is inverted to provide active-low slave-enable output. As a slave, the active-low signal input on MCBSPx.FSX and MCBSPx.FSR is inverted before being used internally.

CLKXM = FSXM = 1, CLKRM = FSRM = 0 for master McBSP

CLKXM = CLKRM = FSXM = FSRM = 0 for slave McBSP

<sup>#</sup> MCBSPx.FSX should be low before the rising edge of clock to enable slave devices and then begin a SPI transfer at the rising edge of the master clock (MCBSPx.CLKX).

**Figure 5–22. McBSP Timing as SPI Master or Slave: CLKSTP = 10b, CLKXP = 1**

**Table 5–22. McBSP as SPI Master or Slave Timing Requirements (CLKSTP = 11b, CLKXP = 1)<sup>†‡</sup>**

| NO. | MIN                        |                                                    | MASTER |     | SLAVE  |     | UNIT |
|-----|----------------------------|----------------------------------------------------|--------|-----|--------|-----|------|
|     |                            |                                                    | MIN    | MAX | MIN    | MAX |      |
| M58 | t <sub>su</sub> (DRV-CKXL) | Setup time, MCBSPx.DR valid before MCBSPx.CLKX low | 15     |     | 2 – 6P |     | ns   |
| M59 | t <sub>h</sub> (CKXL-DRV)  | Hold time, MCBSPx.DR valid after MCBSPx.CLKX low   | 2      |     | 6 + 6P |     | ns   |
| M60 | t <sub>su</sub> (FXL-CKXL) | Setup time, MCBSPx.FSX low before MCBSPx.CLKX low  | McBSP1 |     | 21     |     | ns   |
|     |                            |                                                    | McBSP2 |     | 5      |     |      |
|     |                            |                                                    | McBSP3 |     | 10     |     |      |
| M61 | t <sub>c</sub> (CKX)       | Cycle time, MCBSPx.CLKX                            | 2P     |     | 16P    |     | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the internal reference clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CLK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

**Table 5–23. McBSP as SPI Master or Slave Switching Characteristics (CLKSTP = 11b, CLKXP = 1)<sup>†‡</sup>**

| NO. | PARAMETER                 |                                                               | MASTER <sup>§</sup> |       | SLAVE   |         | UNIT |
|-----|---------------------------|---------------------------------------------------------------|---------------------|-------|---------|---------|------|
|     |                           |                                                               | MIN                 | MAX   | MIN     | MAX     |      |
| M53 | t <sub>h</sub> (CKXH-FXL) | Hold time, MCBSPx.FSX low after MCBSPx.CLKX high <sup>¶</sup> | 0.45D               | 0.55D |         |         | ns   |
| M54 | t <sub>d</sub> (FXL-CKXL) | Delay time, MCBSPx.FSX low to MCBSPx.CLKX low <sup>#</sup>    | 0.45T               | 0.55T |         |         | ns   |
| M55 | t <sub>d</sub> (CKXH-DXV) | Delay time, MCBSPx.CLKX high to MCBSPx.DX valid               | –1                  | 7     | 3P + 2  | 5P + 18 | ns   |
| M57 | t <sub>d</sub> (FXL-DXV)  | Delay time, MCBSPx.FSX low to MCBSPx.DX valid                 | C + 20              |       | 4P + 18 |         | ns   |

<sup>†</sup> For all SPI slave modes, CLKG is programmed as 1/2 of the internal reference clock by setting CLKSM = CLKGDV = 1.

<sup>‡</sup> P = 1/(Base frequency) for McBSP 1 and 3, or 1/(ARMPER\_CLK clock frequency) in ns for McBSP 2. Base frequency is 12 or 13 MHz.

<sup>§</sup> T = CLKX period = (1 + CLKGDV) \* P

C = CLKX low pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2) \* P when CLKGDV is even

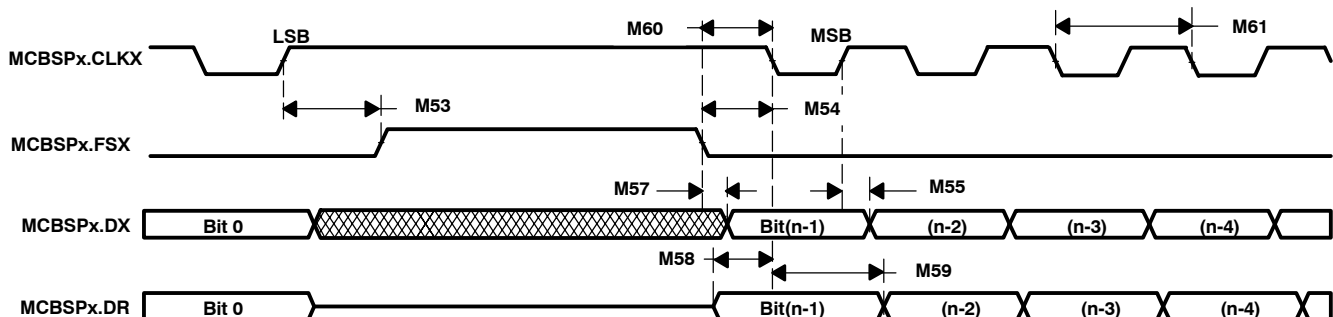
D = CLKX high pulse width = T/2 when CLKGDV is odd or zero and = (CLKGDV/2 + 1) \* P when CLKGDV is even

<sup>¶</sup> FSRP = FSXP = 1. As a SPI master, MCBSPx.FSX is inverted to provide active-low slave-enable output. As a slave, the active-low signal input on MCBSPx.FSX and MCBSPx.FSR is inverted before being used internally.

CLKXM = FSXM = 1, CLKRM = FSRM = 0 for master McBSP

CLKXM = CLKRM = FSXM = FSRM = 0 for slave McBSP

<sup>#</sup> MCBSPx.FSX should be low before the rising edge of clock to enable slave devices and then begin a SPI transfer at the rising edge of the master clock (MCBSPx.CLKX).

**Figure 5–23. McBSP Timing as SPI Master or Slave: CLKSTP = 11b, CLKXP = 1**

## 5.10 Multichannel Serial Interface (MCSI)

Table 5–24 and Table 5–25 assume testing over recommended operating conditions (see Figure 5–24 and Figure 5–25).

**Table 5–24. MCSI Timing Requirements**

| NO.  |                    |                                                           |        | MIN               | MAX               | UNIT |
|------|--------------------|-----------------------------------------------------------|--------|-------------------|-------------------|------|
| MC11 | $f_{op}(CLK)$      | Operating frequency, MCSIx.CLK                            | Slave  |                   | $B^{\dagger}$     | MHz  |
| MC12 | $t_w(CLKH)$        | Pulse duration, MCSIx.CLK high                            | Slave  | $0.45P^{\dagger}$ | $0.55P^{\dagger}$ | ns   |
| MC13 | $t_w(CLKL)$        | Pulse duration, MCSIx.CLK low                             | Slave  | $0.45P^{\dagger}$ | $0.55P^{\dagger}$ | ns   |
| MC14 | $t_r(CLK)$         | Rise time, MCSIx.CLK                                      | Slave  |                   | 12                | ns   |
| MC15 | $t_f(CLK)$         | Fall time, MCSIx.CLK                                      | Slave  |                   | 12                | ns   |
| MC16 | $t_{su}(FSH-CLKL)$ | Setup time, external MCSIx.SYNC high before MCSIx.CLK low | Slave  | 18                |                   | ns   |
| MC17 | $t_h(CLKL-FSH)$    | Hold time, external MCSIx.SYNC high after MCSIx.CLK low   | Slave  | 6                 |                   | ns   |
| MC18 | $t_{su}(DIV-CLKL)$ | Setup time, MCSIx.DIN valid before MCSIx.CLK low          | Master | 27                |                   | ns   |
|      |                    |                                                           | Slave  | 18                |                   |      |
| MC19 | $t_h(CLKL-DIV)$    | Hold time, MCSIx.DIN valid after MCSIx.CLK low            | Master | 0                 |                   | ns   |
|      |                    |                                                           | Slave  | 6                 |                   |      |

$^{\dagger} P$  = MCSIx.CLK period [ $t_c(CLK)$ ] in nanoseconds.

$^{\ddagger} B$  = Base frequency for OMAP5910 (12 or 13 MHz).

**Table 5–25. MCSI Switching Characteristics**

| NO. | PARAMETER         |                                                     |        | MIN               | MAX               | UNIT |
|-----|-------------------|-----------------------------------------------------|--------|-------------------|-------------------|------|
| MC1 | $f_{op}(CLK)$     | Operating frequency, MCSIx.CLK                      | Master |                   | $0.5B^{\ddagger}$ | MHz  |
| MC2 | $t_w(CLKH)$       | Pulse duration, MCSIx.CLK high                      | Master | $0.45P^{\dagger}$ | $0.55P^{\dagger}$ | ns   |
| MC3 | $t_w(CLKL)$       | Pulse duration, MCSIx.CLK low                       | Master | $0.45P^{\dagger}$ | $0.55P^{\dagger}$ | ns   |
| MC4 | $t_d(CLKH-FS)$    | Delay time, MCSIx.CLK high to MCSIx.SYNC transition | Master | 0                 | 5                 | ns   |
| MC7 | $t_d(CLKH-DOV)$   | Delay time, MCSIx.CLK high to MCSIx.DOUT valid      | Master | 0                 | 5                 | ns   |
|     |                   |                                                     | Slave  | 2                 | 30                |      |
| MC8 | $t_{en}(CLKH-DO)$ | Enable time, MCSIx.DOUT driven from MCSIx.CLK high  | Master | 0                 |                   | ns   |
|     |                   |                                                     | Slave  | 2                 |                   |      |

$^{\dagger} P$  = MCSIx.CLK period [ $t_c(CLK)$ ] in nanoseconds.

$^{\ddagger} B$  = Base frequency for OMAP5910 (12 or 13 MHz).

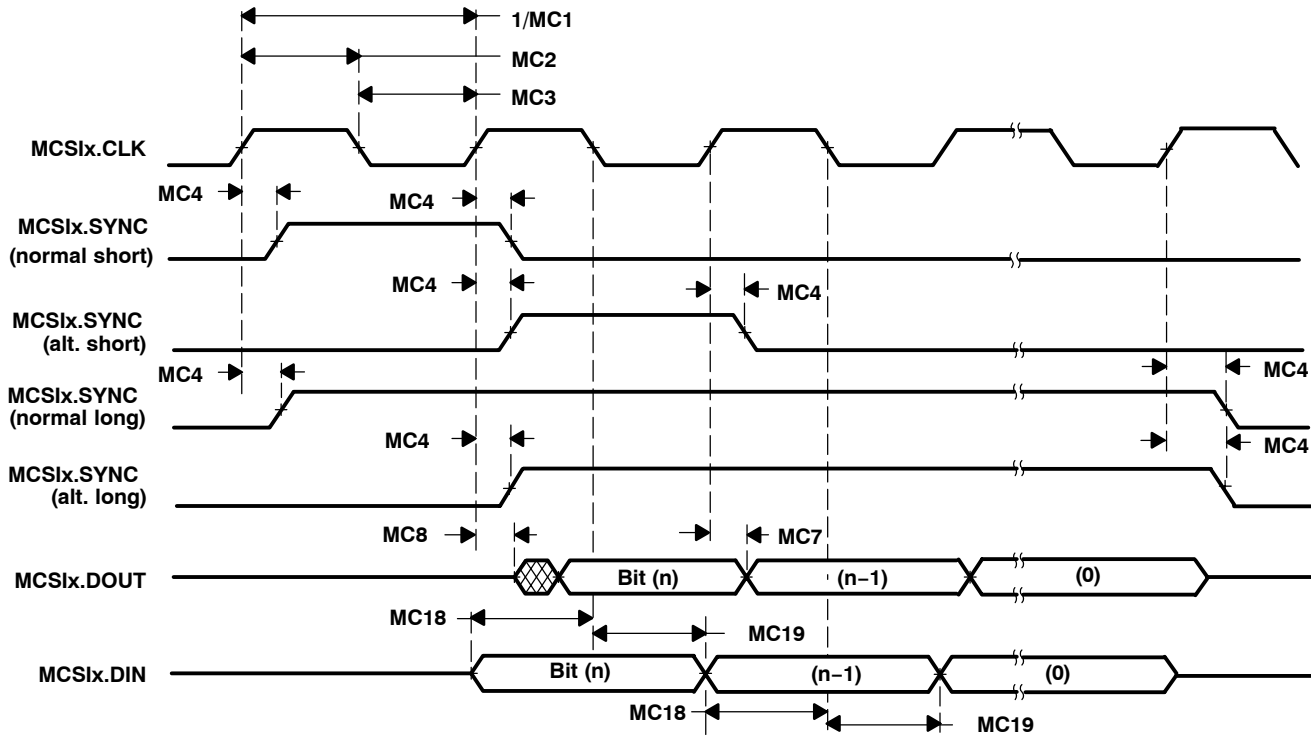


Figure 5-24. MCSI Master Mode Timings

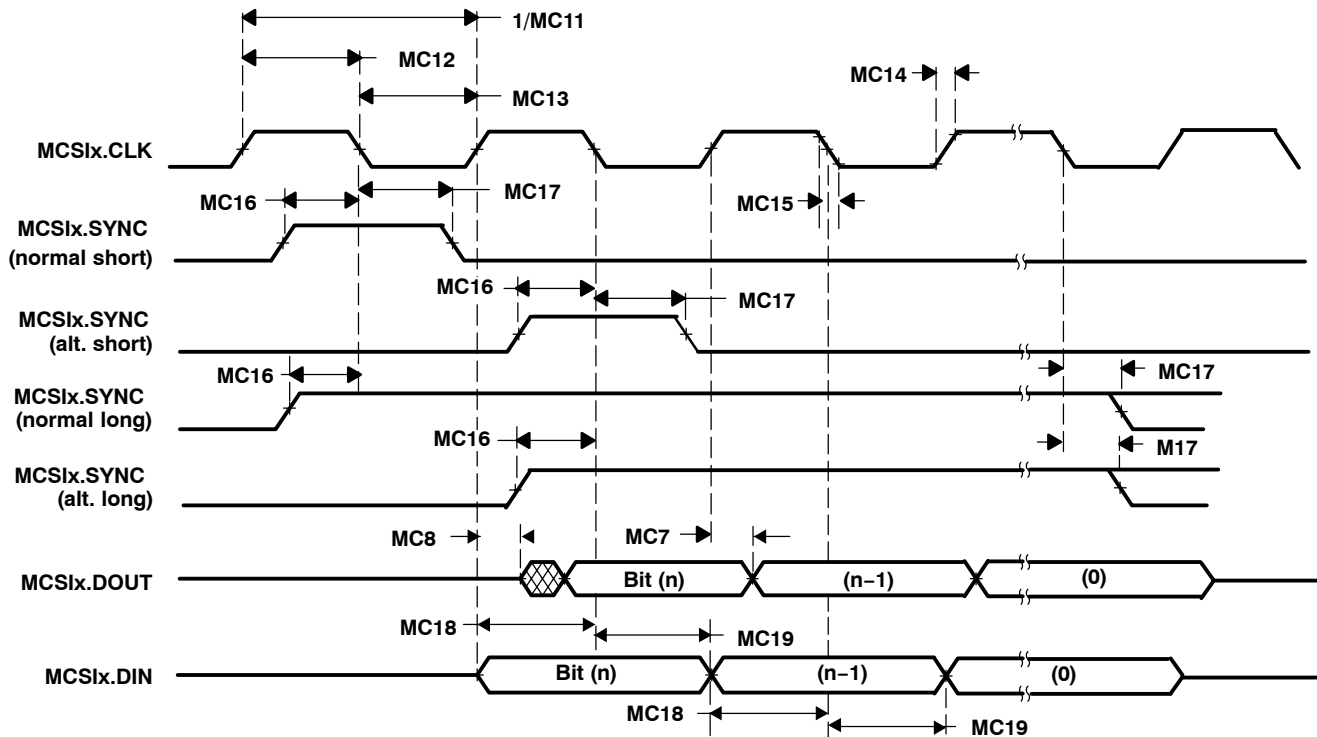


Figure 5-25. MCSI Slave Mode Timings

## 5.11 Camera Interface Timings

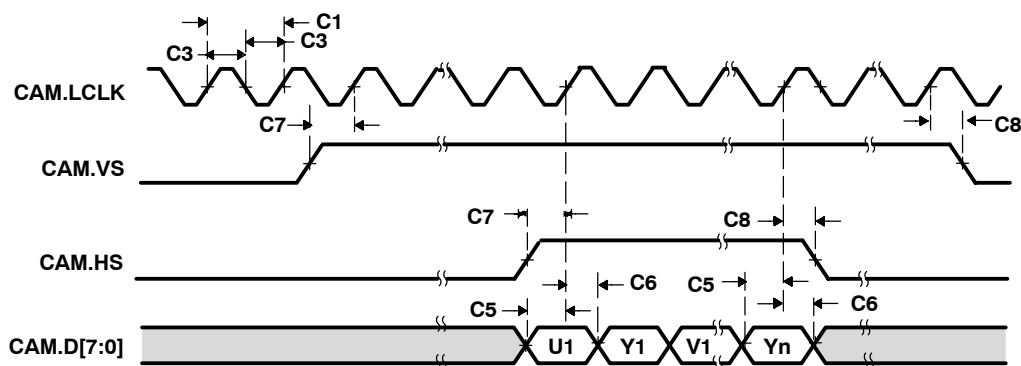
Table 5–26 assumes testing over recommended operating conditions (see Figure 5–26).

**Table 5–26. Camera Interface Timing Requirements**

| NO. |                                                                          | MIN                | MAX                | UNIT |
|-----|--------------------------------------------------------------------------|--------------------|--------------------|------|
| C1  | $1 / [t_{c(LCKH-HSV)}]$ Operating frequency, CAM.LCLK                    |                    | 13                 | MHz  |
| C2  | $1 / [t_{c(XCKH-HSV)}]$ Operating frequency, CAM.EXCLK                   |                    | 24                 | MHz  |
| C3  | $t_{w(LCK)}$ Pulse duration, CAM.LCLK high or low                        | 0.45P <sup>†</sup> | 0.55P <sup>†</sup> | ns   |
| C5  | $t_{su(LCKH-DV)}$ Setup time, CAM.D[7:0] data valid before CAM.LCLK high | 1 <sup>‡</sup>     |                    | ns   |
| C6  | $t_{h(DV-LCKH)}$ Hold time, CAM.D[7:0] data valid after CAM.LCLK high    | 9 <sup>‡</sup>     |                    | ns   |
| C7  | $t_{su(LCKH-DV)}$ Setup time, CAM.VS/CAM.HS active before CAM.LCLK high  | 1 <sup>‡</sup>     |                    | ns   |
| C8  | $t_{h(DV-CLKH)}$ Hold time, CAM.VS/CAM.HS active after CAM.LCLK high     | 9 <sup>‡</sup>     |                    | ns   |

<sup>†</sup> P = period of CAM.LCLK in nanoseconds (ns).

<sup>‡</sup> Polarity of CAM.LCLK is selectable via the POLCLK bit in the CTRLCLOCK register. Although data is latched on rising CAM.LCLK in the timing diagrams, these timing parameters also apply to falling CAM.LCLK when POLCLK = 1.



**Figure 5–26. Camera Interface Timings**

## 5.12 LCD Controller Timings

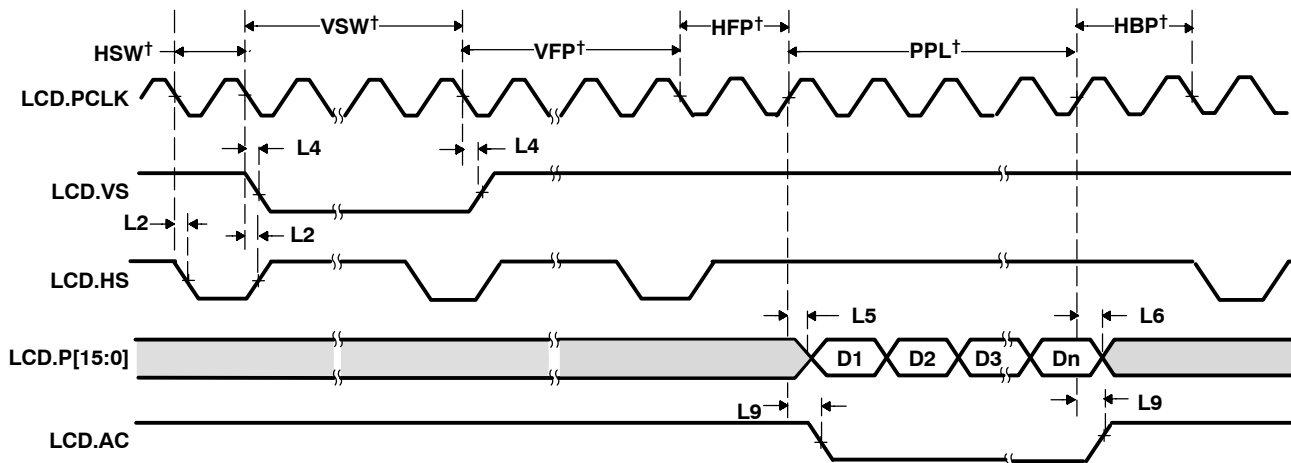
Table 5–27 assumes testing over recommended operating conditions (see Figure 5–27 and Figure 5–28).

**Table 5–27. LCD Controller Switching Characteristics <sup>†</sup>**

| NO. | PARAMETER         |                                                               | MIN | MAX              | UNIT |
|-----|-------------------|---------------------------------------------------------------|-----|------------------|------|
| L1  | $t_{d(CLKH-HSV)}$ | Delay time, LCD.PCLK high to LCD.HS transition                | 1   | 11               | ns   |
| L2  | $t_{d(CLKL-HSV)}$ | Delay time, LCD.PCLK low to LCD.HS transition                 | 1   | 11               | ns   |
| L3  | $t_{d(CLKH-VSV)}$ | Delay time, LCD.PCLK high to LCD.VS transition                | 1   | 11               | ns   |
| L4  | $t_{d(CLKL-VSV)}$ | Delay time, LCD.PCLK low to LCD.VS transition                 | 1   | 11               | ns   |
| L5  | $t_{d(CLKH-PV)}$  | Delay time, LCD.PCLK high to pixel data valid (LCD.P[15:0])   |     | 11               | ns   |
| L6  | $t_{d(CLKH-PIV)}$ | Delay time, LCD.PCLK high to pixel data invalid (LCD.P[15:0]) | 1   |                  | ns   |
| L7  | $t_{d(CLKL-PV)}$  | Delay time, LCD.PCLK low to pixel data valid (LCD.P[15:0])    |     | 11               | ns   |
| L8  | $t_{d(CLKL-PIV)}$ | Delay time, LCD.PCLK low to pixel data invalid (LCD.P[15:0])  | 1   |                  | ns   |
| L9  | $t_{d(CLKL-ACV)}$ | Delay time, LCD.PCLK high to LCD.AC transition                | 1   | $5+P^{\ddagger}$ | ns   |
| L10 | $t_{d(CLKL-ACV)}$ | Delay time, LCD.PCLK low to LCD.AC transition                 | 1   | $5+P^{\ddagger}$ | ns   |

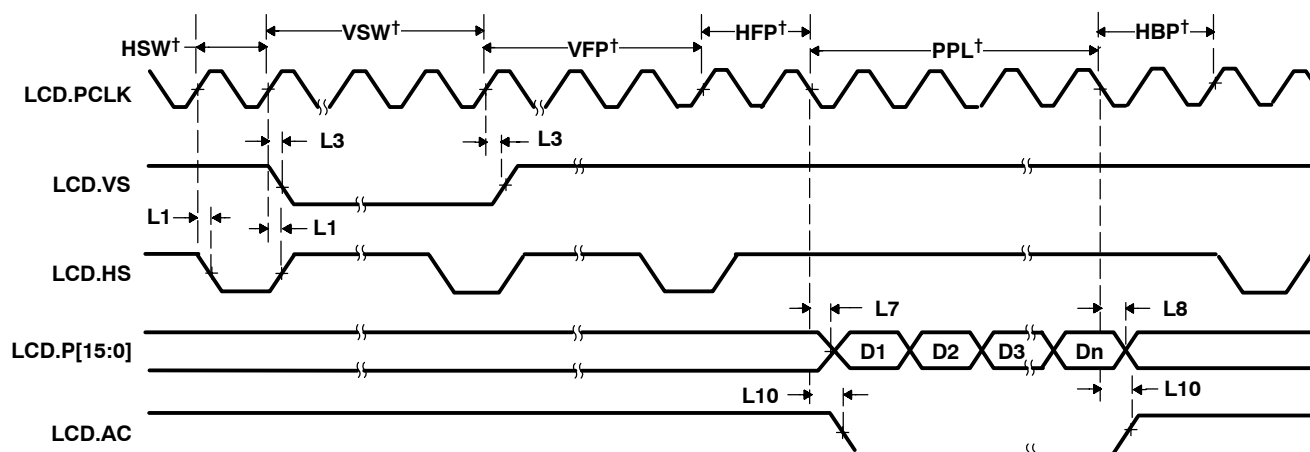
<sup>†</sup> Although timing diagrams illustrate the logical function of the TFT mode, static timings apply to all supported modes of operation. Likewise, LCD.HS, LCD.VS, and LCD.AC are shown as active-low, but each may optionally be configured as active-high.

<sup>‡</sup> P = period of internal undivided pixel clock



<sup>†</sup> Delays for HSW (LCD.HS Width), VSW (LCD.VS Width), VFP (Vertical Front Porch), HFP (Horizontal Front Porch), HBP (Horizontal Back Porch) and PPL (Pixels per Line) are programmable in number of LCD.PCLK cycles via the LCD configuration registers.

**Figure 5–27. TFT Mode (LCD.HS/LCD.VS on Falling and LCD.Px on Rising LCD.PCLK)**



† Delays for HSW (LCD.HS Width), VSW (LCD.VS Width), VFP (Vertical Front Porch), HFP (Horizontal Front Porch), HBP (Horizontal Back Porch) and PPL (Pixels per Line) are programmable in number of LCD.PCLK cycles via the LCD configuration registers.

**Figure 5–28. TFT Mode (LCD.HS/LCD.VS on Rising and LCD.Px on Falling LCD.PCLK)**

### 5.13 Multimedia Card/Secure Digital (MMC/SD) Timings

Table 5–28 and Table 5–29 assume testing over recommended operating conditions (see Figure 5–29 through Figure 5–32).

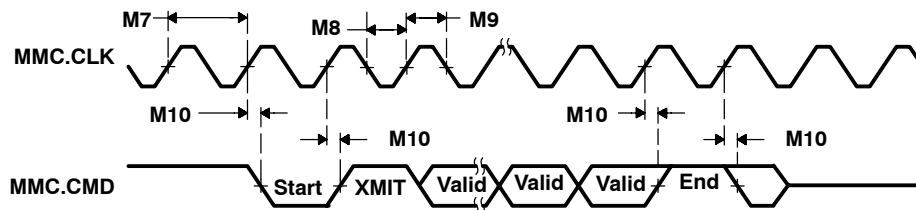
**Table 5–28. MMC/SD Timing Requirements**

| NO. |                                                                    | MIN | MAX | UNIT |
|-----|--------------------------------------------------------------------|-----|-----|------|
| M1  | $t_{su}(CMDV-CLKH)$ Setup time, MMC.CMD valid before MMC.CLK high  | 12  |     | ns   |
| M2  | $t_h(CLKH-CMDV)$ Hold time, MMC.CMD invalid after MMC.CLK high     | 2   |     | ns   |
| M3  | $t_{su}(DATV-CLKH)$ Setup time, MMC.DATx valid before MMC.CLK high | 12  |     | ns   |
| M4  | $t_h(CLKH-DATV)$ Hold time, MMC.DATx invalid after MMC.CLK high    | 2   |     | ns   |

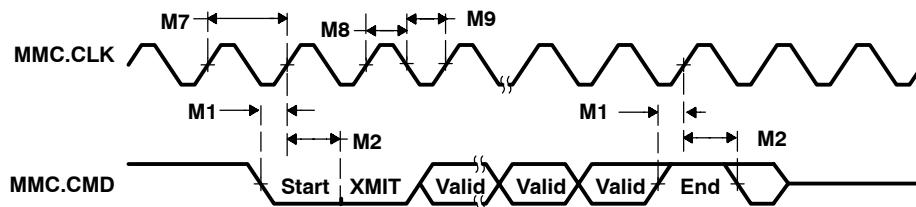
**Table 5–29. MMC/SD Switching Characteristics**

| NO. | PARAMETER                                                       | MIN             | MAX  | UNIT |
|-----|-----------------------------------------------------------------|-----------------|------|------|
| M7  | $t_c(CLK)$ Cycle time, MMC.CLK                                  | 41.7            |      | ns   |
|     |                                                                 |                 | 5.31 | us   |
| M8  | $t_w(CLKH)$ Pulse Duration, MMC.CLK high                        | 20 <sup>†</sup> |      | ns   |
| M9  | $t_w(CLKL)$ Pulse Duration, MMC.CLK low                         | 20 <sup>†</sup> |      | ns   |
| M10 | $t_d(CLKH-CMD)$ Delay time, MMC.CLK high to MMC.CMD transition  | 4               | 48   | ns   |
| M11 | $t_d(CLKH-DAT)$ Delay time, MMC.CLK high to MMC.DATx transition | 4               | 48   | ns   |

<sup>†</sup> MMC.CLK period and pulse duration depends upon software configuration.



**Figure 5–29. MMC/SD Host Command Timings**



**Figure 5–30. MMC/SD Card Response Timings**

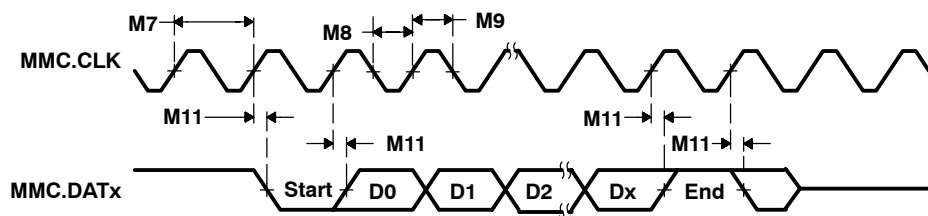


Figure 5–31. MMC/SD Host Write Timings

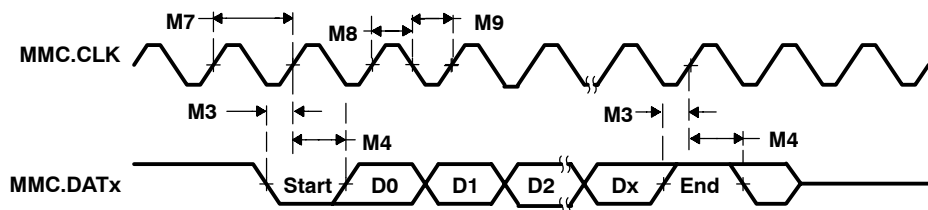


Figure 5–32. MMC/SD Host Read and Card CRC Status Timings

## 5.14 I<sup>2</sup>C Timings

Table 5–30 assumes testing over recommended operating conditions (see Figure 5–33).

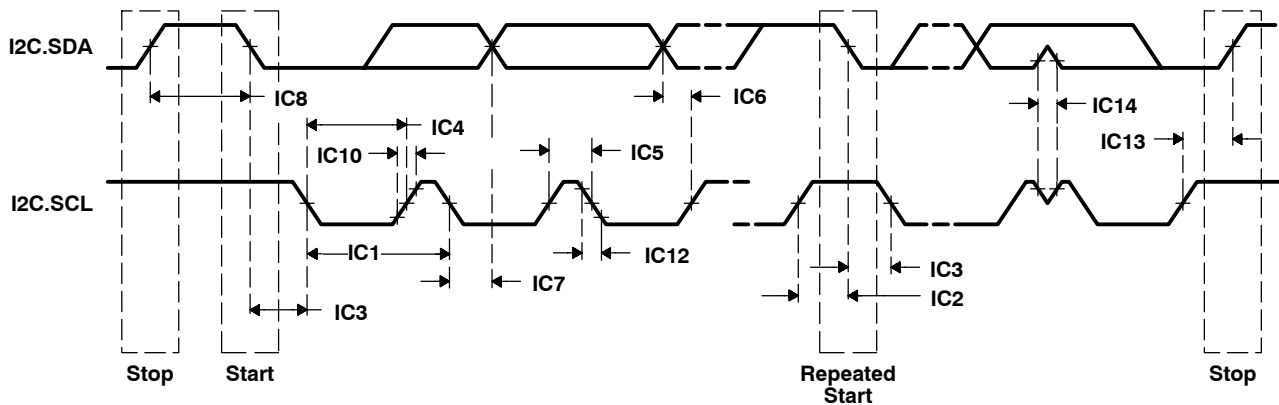
**Table 5–30. I<sup>2</sup>C Signals (I2C.SDA and I2C.SCL) Switching Characteristics**

| NO.  | PARAMETER                                                                                        | STANDARD MODE   |      | FAST MODE |     | UNIT |
|------|--------------------------------------------------------------------------------------------------|-----------------|------|-----------|-----|------|
|      |                                                                                                  | MIN             | MAX  | MIN       | MAX |      |
| IC1  | $t_{c(SCL)}$ Cycle time, I2C.SCL                                                                 | 10 <sup>†</sup> |      | 2.5       |     | μs   |
| IC2  | $t_{su(SCLH-SDAL)}$ Setup time, I2C.SCL high before I2C.SDA low (for a repeated START condition) | 4.7             |      | 0.6       |     | μs   |
| IC3  | $t_{h(SCLL-SDAL)}$ Hold time, I2C.SCL low after I2C.SDA low (for a repeated START condition)     | 4               |      | 0.6       |     | μs   |
| IC4  | $t_{w(SCLL)}$ Pulse duration, I2C.SCL low                                                        | 4.7             |      | 1.3       |     | μs   |
| IC5  | $t_{w(SCLH)}$ Pulse duration, I2C.SCL high                                                       | 4               |      | 0.6       |     | μs   |
| IC6  | $t_{su(SDA-SDLH)}$ Setup time, I2C.SDA valid before I2C.SCL high                                 | 250             | ‡    | 100       |     | ns   |
| IC7  | $t_{h(SDA-SDLL)}$ Hold time, I2C.SDA valid after I2C.SCL low (for I <sup>2</sup> C bus devices)  | 0               |      | 0         | 0.9 | μs   |
| IC8  | $t_{w(SDAH)}$ Pulse duration, I2C.SDA high between STOP and START conditions                     | 4.7             |      | 1.3       |     | μs   |
| IC9  | $t_r(SDA)$ Rise time, I2C.SDA                                                                    |                 | 1000 |           | 300 | ns   |
| IC10 | $t_r(SCL)$ Rise time, I2C.SCL                                                                    |                 | 1000 |           | 300 |      |
| IC11 | $t_f(SDA)$ Fall time, I2C.SDA                                                                    |                 | 300  |           | 300 | ns   |
| IC12 | $t_f(SCL)$ Fall time, I2C.SCL                                                                    |                 | 300  |           | 300 |      |
| IC13 | $t_{su(SCLH-SDAH)}$ Setup time, I2C.SCL high before I2C.SDA high (for STOP condition)            | 4.0             |      | 0.6       |     | μs   |
| IC14 | $t_{w(SP)}$ Pulse duration, spike (must be suppressed)                                           |                 |      | 0         | 50  | ns   |
| IC15 | $C_b$ § Capacitive load for each bus line                                                        |                 | 400  |           | 400 | pF   |

<sup>†</sup> In the master-only I<sup>2</sup>C operating mode of OMAP5910, minimum cycle time for I2C.SCL is 12 μs.

<sup>‡</sup> The maximum  $t_{h(SCLL-SDAL)}$  has only to be met if the device does not stretch the low period ( $t_{w(SCLL)}$ ) of the I2C.SCL signal.

§  $C_b$  = The total capacitance of one bus line in pF.



- NOTES:
- A. A device must internally provide a hold time of at least 300 ns for the I2C.SDA signal (referred to the  $V_{IHmin}$  of the I2C.SCL signal) to bridge the undefined region of the falling edge of I2C.SCL.
  - B. The maximum  $t_{h(SCLL-SDAL)}$  has only to be met if the device does not stretch the LOW period ( $t_{w(SCLL)}$ ) of the I2C.SCL signal.
  - C. A Fast-mode I<sup>2</sup>C-bus device can be used in a standard-mode I<sup>2</sup>C-bus system, but the requirement  $t_{su(SDA-SDLH)} \bullet 250$  ns must then be met. This is automatically the case if the device does not stretch the LOW period of the I2C.SCL signal. If such a device does stretch the LOW period of the I2C.SCL signal, it must output the next data bit to the I2C.SDA line  $t_r \text{ max} + t_{su(SDA-SDLH)} = 1000 + 250 = 1250$  ns (according to the standard-mode I<sup>2</sup>C-bus specification) before the I2C.SCL line is released.
  - D.  $C_b$  = total capacitance of one bus line in pF. If mixed with fast-mode devices, faster fall times are allowed.

**Figure 5–33. I<sup>2</sup>C Timings**

## 5.15 Universal Serial Bus (USB) Timings

All OMAP5910 USB interfaces are compliant with the *Universal Serial Bus Specification, Revision 2.0*. Table 5–31 assumes testing over recommended operating conditions (see Figure 5–34).

**Table 5–31. USB Integrated Transceiver Interface Switching Characteristics**

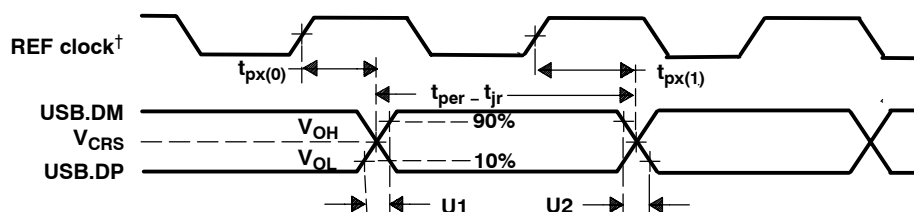
| NO. | PARAMETER                                               | LOW SPEED<br>1.5 Mbps |                  | FULL SPEED<br>12 Mbps |                     | UNIT |
|-----|---------------------------------------------------------|-----------------------|------------------|-----------------------|---------------------|------|
|     |                                                         | MIN                   | MAX              | MIN                   | MAX                 |      |
| U1  | $t_r$ Rise time, USB.DP and USB.DM signals <sup>†</sup> | 75 <sup>†</sup>       | 300 <sup>†</sup> | 4 <sup>†</sup>        | 20 <sup>†</sup>     | ns   |
| U2  | $t_f$ Fall time, USB.DP and USB.DM signals <sup>†</sup> | 75 <sup>†</sup>       | 300 <sup>†</sup> | 4 <sup>†</sup>        | 20 <sup>†</sup>     | ns   |
| U3  | $t_{RFM}$ Rise/Fall time matching <sup>‡</sup>          | 80 <sup>‡</sup>       | 125 <sup>‡</sup> | 90 <sup>‡</sup>       | 111.11 <sup>‡</sup> | %    |
| U4  | $V_{CRS}$ Output signal cross-over voltage <sup>†</sup> | 1.3 <sup>†</sup>      | 2.0 <sup>†</sup> | 1.3 <sup>†</sup>      | 2.0 <sup>†</sup>    | V    |
| U5  | $t_{jr}$ Differential propagation jitter <sup>§</sup>   | –25 <sup>§</sup>      | 25 <sup>§</sup>  | –2 <sup>§</sup>       | 2 <sup>§</sup>      | ns   |
| U6  | $f_{op}$ Operating frequency <sup>¶</sup>               | 1.5                   |                  | 12                    |                     | MHz  |

<sup>†</sup> Low Speed:  $C_L = 200$  pF, Full Speed:  $C_L = 50$  pF

<sup>‡</sup>  $t_{RFM} = (t_r/t_f) \times 100$

<sup>§</sup>  $t_{jr} = t_{px(1)} - t_{px(0)}$

<sup>¶</sup>  $f_{op} = 1/t_{per}$



<sup>†</sup> "REF clock" is not an actual device signal, but an ideal reference clock against which relative timings are specified. REF clock is assumed to be 12 MHz for full-speed mode or 1.5 MHz for low-speed mode).

**Figure 5–34. USB Integrated Transceiver Interface Timings**

## 5.16 MICROWIRE Interface Timings

Table 5–32 and Table 5–33 assume testing over recommended operating conditions (see Figure 5–35).

**Table 5–32. MICROWIRE Timing Requirements**

| NO. |                                                                                           | MIN | MAX | UNIT |
|-----|-------------------------------------------------------------------------------------------|-----|-----|------|
| W5  | $t_{su}(SDI-SCLK)$ Setup time, UWIRE.SDI valid before UWIRE.SCLK active edge <sup>†</sup> | 21  |     | ns   |
| W6  | $t_h(SCLK-SDI)$ Hold time, UWIRE.SDI invalid after UWIRE.SCLK active edge <sup>†</sup>    | 6   |     | ns   |

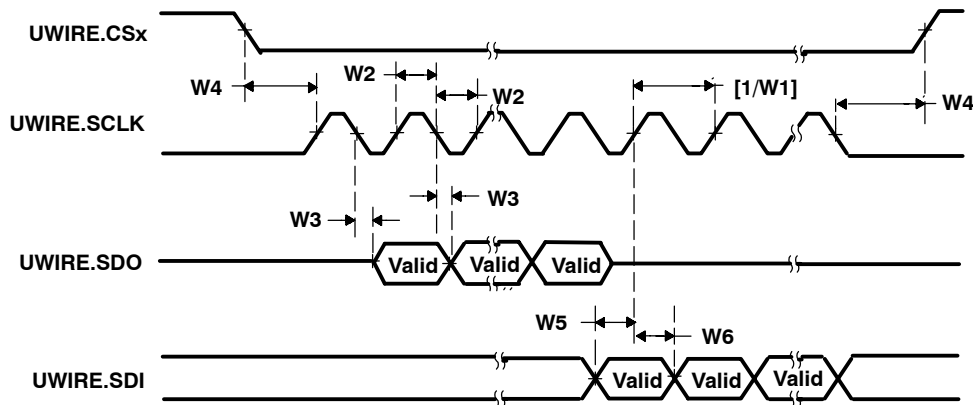
<sup>†</sup> Polarity of UWIRE.SCLK and the active clock edge (rising or falling) on which SDO data is driven and SDI data is latched is all software configurable. These timings apply to all configurations regardless of UWIRE.SCLK polarity and which clock edges are used to drive output data and capture input data.

**Table 5–33. MICROWIRE Switching Characteristics**

| NO. | PARAMETER                                                                               | MIN                | MAX                | UNIT |
|-----|-----------------------------------------------------------------------------------------|--------------------|--------------------|------|
| W1  | $f_{op}(SCLK)$ Operating Frequency, UWIRE.SCLK                                          |                    | 3                  | MHz  |
| W2  | $t_w(SCLK)$ Pulse Duration, UWIRE.SCLK high/low                                         | 0.45P <sup>‡</sup> | 0.55P <sup>‡</sup> | ns   |
| W3  | $t_d(SCLK-SDO)$ Delay time, UWIRE.SCLK active edge to UWIRE.SDO transition <sup>†</sup> | –3                 | 6                  | ns   |
| W4  | $t_d(CS-SCLK)$ Delay time, UWIRE.CSx active to UWIRE.SCLK active <sup>†</sup>           | 1.5P <sup>‡</sup>  |                    | ns   |

<sup>†</sup> Polarity of UWIRE.SCLK and the active clock edge (rising or falling) on which SDO data is driven and SDI data is latched is all software configurable. These timings apply to all configurations regardless of UWIRE.SCLK polarity and which clock edges are used to drive output data and capture input data.

<sup>‡</sup> P = UWIRE.SCLK cycle time in ns.



NOTE: The polarities of UWIRE.CSx and UWIRE.SCLK and the active UWIRE.SCLK edges on which SDO is driven and SDI is sampled are all software configurable.

**Figure 5–35. MICROWIRE Timings**

## 5.17 HDQ/1-Wire Interface Timings

Table 5–34 and Table 5–35 assume testing over recommended operating conditions (see Figure 5–36 through Figure 5–39).

**Table 5–34. HDQ/1-Wire Timing Requirements<sup>†</sup>**

|    |           |                                                      | MIN                              | MAX  | UNIT    |
|----|-----------|------------------------------------------------------|----------------------------------|------|---------|
| H1 | $t_c$     | Cycle time, master read                              | 190                              | 250  | $\mu s$ |
| H2 | $t_v$     | Read one data valid after HDQ low                    | 32                               | 50   | $\mu s$ |
| H3 | $t_v$     | Read zero data hold after HDQ low                    | 80                               | 145  | $\mu s$ |
| H4 | $t_v$     | Response time from HDQ slave device                  | OMAP5910 base frequency = 12 MHz |      | $\mu s$ |
|    |           |                                                      | OMAP5910 base frequency = 13 MHz |      | $\mu s$ |
| W1 | $t_c$     | Cycle time, master read                              | 190                              |      | $\mu s$ |
| W2 | $t_v$     | Read data valid after HDQ low (master sample window) | 12                               | 13.6 | $\mu s$ |
| W3 | $t_{dis}$ | Recovery time after slave device inactive            | 1                                |      | $\mu s$ |

<sup>†</sup> HDQ timing is OMAP5910 default. 1-Wire timing is selectable through software.

**Table 5–35. HDQ/1-Wire Switching Characteristics**

|    | PARAMETER |                                                | MIN                              | MAX | UNIT    |
|----|-----------|------------------------------------------------|----------------------------------|-----|---------|
| H5 | $t_c$     | Cycle time, master write                       | 190                              |     | $\mu s$ |
| H6 | $t_d$     | Write one data valid after HDQ low             | 32                               | 50  | $\mu s$ |
| H7 | $t_d$     | Write zero data hold after HDQ low             | OMAP5910 base frequency = 12 MHz |     | $\mu s$ |
|    |           |                                                | OMAP5910 base frequency = 13 MHz |     | $\mu s$ |
| H8 | $t_w$     | Pulse width, HDQ low for break pulse (reset)   | 190                              |     | $\mu s$ |
| H9 | $t_w$     | Pulse width, HDQ high for break pulse recovery | 40                               |     | $\mu s$ |
| W4 | $t_c$     | Cycle time, master write                       | 190                              |     | $\mu s$ |
| W5 | $t_d$     | Write zero master inactive after HDQ low       | 15                               | 90  | $\mu s$ |
| W6 | $t_d$     | Write one master inactive after HDQ low        | 1.1                              | 1.4 | $\mu s$ |
| W7 | $t_{dis}$ | Recovery time after master inactive            | 1                                |     | $\mu s$ |

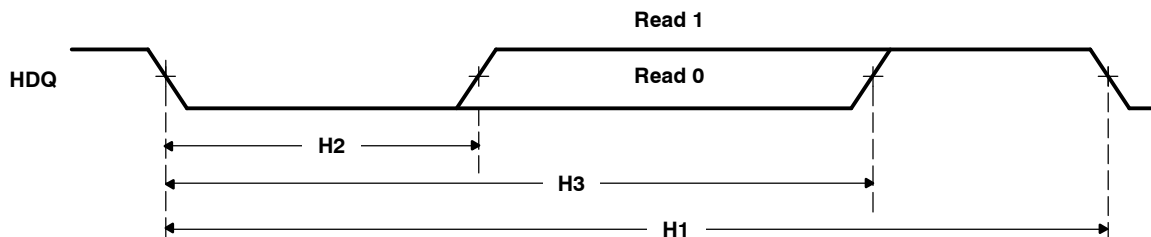


Figure 5–36. OMAP5910 HDQ Interface Reading From HDQ Slave Device

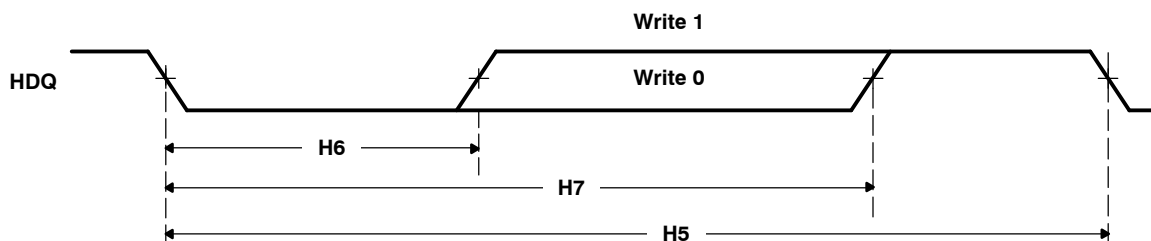


Figure 5–37. OMAP5910 HDQ Interface Writing to HDQ Slave Device

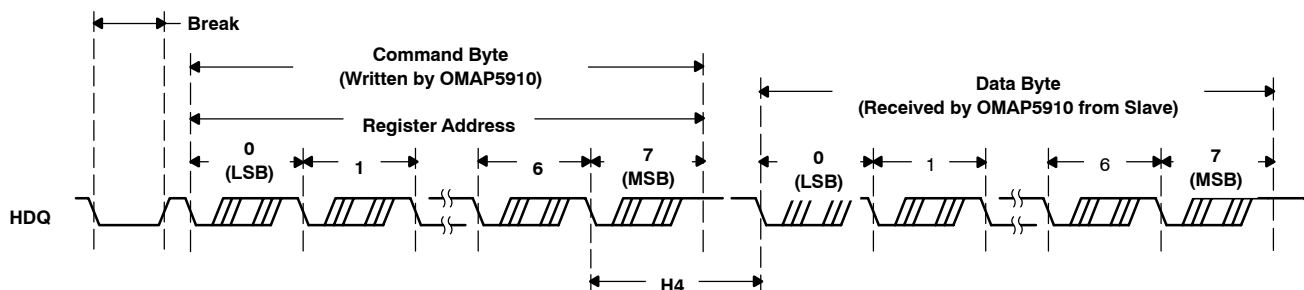


Figure 5–38. Typical Communication Between OMAP5910 HDQ and HDQ Slave



Figure 5–39. HDQ/1-Wire Break (Reset) Timing

## 6 Glossary

| ACRONYM | DEFINITION                                                    |
|---------|---------------------------------------------------------------|
| 1-wire  | a serial protocol defined by Dallas Semiconductor Corporation |
| AAC     | Advanced Audio Coding (standard) (ISO/IEC 13818-7)            |
| AC97    | Interface Standard for Codecs                                 |
| ALU     | arithmetic/logic unit                                         |
| AMR     | Adaptive Multi-Rate                                           |
| ASRAM   | asynchronous static RAM                                       |
| AU      | address unit                                                  |
| BCD     | binary coded decimal                                          |
| BGA     | ball grid array                                               |
| CMOS    | complementary metal oxide semiconductor                       |
| CP15    | coprocessor 15                                                |
| CRC     | cyclic redundancy check                                       |
| CSL     | Chip Support Library                                          |
| CTS     | clear-to-send                                                 |
| DARAM   | dual-access RAM                                               |
| DCT     | discrete cosine transform                                     |
| DMA     | direct memory access                                          |
| DPLL    | digital phase-locked loop                                     |
| DSP     | digital signal processor                                      |
| DSPLIB  | DSP Library                                                   |
| DSR     | data-set-ready                                                |
| DTR     | data-terminal-ready                                           |
| DU      | data unit                                                     |
| EMIFF   | external memory interface fast                                |
| EMIFS   | external memory interface slow                                |
| EP      | endpoint                                                      |
| ESD     | electrostatic discharge                                       |
| ETM     |                                                               |
| FAC     | frame adjustment counter                                      |
| FFT     | Fast Fourier Transform                                        |
| FIFO    | first-in first out                                            |
| FIQ     | fast interrupt request                                        |
| GPRS    | General Packet Radio Service                                  |
| GSM     | Global System for Mobile Communications                       |
| H.26x   | an ITU-TSS standard                                           |
| HBM     | Human Body Model                                              |
| HBP     | Horizontal Back Porch                                         |

| ACRONYM          | DEFINITION                                                                    |
|------------------|-------------------------------------------------------------------------------|
| HDQ              | a single-wire serial interface protocol defined by Benchmarq™ Controls Inc.   |
| HFP              | Horizontal Front Porch                                                        |
| HOM              | host-only mode                                                                |
| HS               | high-speed                                                                    |
| I-cache          | instruction cache                                                             |
| I <sup>2</sup> C | Inter-integrated circuit                                                      |
| I <sup>2</sup> S | Inter-IC Sound (specification)                                                |
| iDCT             | Inverse Discrete Cosine Transform                                             |
| I/F              | interface                                                                     |
| IFR              | Interrupt Flag Register                                                       |
| IMGLIB           | Image/Video Processing Library                                                |
| IMIF             | internal memory interface                                                     |
| IMR              | Interrupt Mask Register                                                       |
| IOM-2            | ISDN Oriented Modular Interface Revision 2                                    |
| IrDA             | infrared data adapter                                                         |
| IRQ              | low-priority interrupt request                                                |
| IU               | instruction unit                                                              |
| JPEG             | Joint Photographic Experts Group – standard for compressed still-picture data |
| LB               | local bus                                                                     |
| LCD              | liquid crystal display                                                        |
| LPG              | LED pulse generator                                                           |
| LSB              | least significant bit                                                         |
| LVC MOS          | low-voltage CMOS                                                              |
| MAC              | multiply-accumulate                                                           |
| MCSI             | multichannel serial interface                                                 |
| McBSP            | multichannel buffered serial port                                             |
| MMC              | multimedia card                                                               |
| MMC/SD           | multimedia card/secure digital                                                |
| MMU              | memory management unit                                                        |
| MPEG             | Moving Picture Experts Group – proposed standard for compressed video data    |
| MPU              | microprocessor unit                                                           |
| MPUI             | microprocessor unit interface                                                 |
| MPUIO            | microprocessor unit I/O                                                       |
| MSB              | most significant bit                                                          |
| MVIP             | multi-vendor integration protocol                                             |
| ODM              | original design manufacturer                                                  |
| OEM              | original equipment manufacturer                                               |
| OHCI             | Open Host Controller Interface                                                |
| OS               | operating system                                                              |

Benchmarq is a trademark of Texas Instruments.

| ACRONYM | DEFINITION                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PPL     | pixels per line                                                                                                                                                                                                                                                                                                                                                                                                                             |
| PU      | program unit                                                                                                                                                                                                                                                                                                                                                                                                                                |
| PWL     | pulse-width light                                                                                                                                                                                                                                                                                                                                                                                                                           |
| PWT     | pulse-width tone                                                                                                                                                                                                                                                                                                                                                                                                                            |
| RISC    | reduced instruction set computer                                                                                                                                                                                                                                                                                                                                                                                                            |
| RTC     | real-time clock                                                                                                                                                                                                                                                                                                                                                                                                                             |
| RTS     | request-to-send                                                                                                                                                                                                                                                                                                                                                                                                                             |
| SAM     | shared-access mode                                                                                                                                                                                                                                                                                                                                                                                                                          |
| SARAM   | single-access RAM                                                                                                                                                                                                                                                                                                                                                                                                                           |
| SD      | secure digital                                                                                                                                                                                                                                                                                                                                                                                                                              |
| SDRAM   | synchronous dynamic RAM                                                                                                                                                                                                                                                                                                                                                                                                                     |
| SDW     | short distance wireless                                                                                                                                                                                                                                                                                                                                                                                                                     |
| SIR     | slow infrared                                                                                                                                                                                                                                                                                                                                                                                                                               |
| SPI     | serial peripheral interface                                                                                                                                                                                                                                                                                                                                                                                                                 |
| SRAM    | static RAM                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| SRG     | Sample Rate Generator                                                                                                                                                                                                                                                                                                                                                                                                                       |
| STN     | super twisted nematic                                                                                                                                                                                                                                                                                                                                                                                                                       |
| T1/E1   | T1 is a digital transmission link with a capacity of 1.544 Mbps. It uses two pairs of normal twisted-wires and can handle 24-voice conversations, each digitized using mu-law coding at 64 kbps. T1 is used in USA, Canada, Hong Kong, and Japan. E1 is a digital transmission link with a capacity of 2.048 Mbps. It is the European equivalent of T1. It can handle 30-voice conversations, each digitized using A-law coding at 64 kbps. |
| TAP     | test access port                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TC      | traffic controller                                                                                                                                                                                                                                                                                                                                                                                                                          |
| TFT     | thin-film transistor                                                                                                                                                                                                                                                                                                                                                                                                                        |
| TI      | Texas Instruments                                                                                                                                                                                                                                                                                                                                                                                                                           |
| TIPB    | TI peripheral bus                                                                                                                                                                                                                                                                                                                                                                                                                           |
| TLB     | Translation Look-Aside Buffer                                                                                                                                                                                                                                                                                                                                                                                                               |
| TTB     | Translation Table Base                                                                                                                                                                                                                                                                                                                                                                                                                      |
| UART    | universal asynchronous receiver/transmitter                                                                                                                                                                                                                                                                                                                                                                                                 |
| ULPD    | ultra low-power device                                                                                                                                                                                                                                                                                                                                                                                                                      |
| URL     | uniform resource locator                                                                                                                                                                                                                                                                                                                                                                                                                    |
| USB     | universal serial bus                                                                                                                                                                                                                                                                                                                                                                                                                        |
| USB2.0  | Universal Serial Bus Specification Revision 2.0                                                                                                                                                                                                                                                                                                                                                                                             |
| VFP     | Vertical Front Porch                                                                                                                                                                                                                                                                                                                                                                                                                        |
| VIVT    | virtual index virtual tag                                                                                                                                                                                                                                                                                                                                                                                                                   |
| WB      | write buffer                                                                                                                                                                                                                                                                                                                                                                                                                                |
| WDT     | watchdog timer                                                                                                                                                                                                                                                                                                                                                                                                                              |
| WMA     | Windows Media Audio                                                                                                                                                                                                                                                                                                                                                                                                                         |
| WMV     | Windows Media Video                                                                                                                                                                                                                                                                                                                                                                                                                         |

## **7 Mechanical Data**

The following mechanical package diagram(s) reflect the most current released mechanical data available for the designated device(s).

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type   | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|----------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| OMAP5910GGZG2    | OBSOLETE              | BGA            | GZG             | 289  |             | TBD                     | Call TI          | Call TI                      |
| OMAP5910JGDY2    | ACTIVE                | BGA            | GDY             | 289  | 84          | TBD                     | SNPB             | Level-3-220C-168HR           |
| OMAP5910JGZG2    | ACTIVE                | BGA            | GZG             | 289  | 160         | TBD                     | SNPB             | Level-4-220C-72HR            |
| OMAP5910JZDY2    | ACTIVE                | BGA            | ZDY             | 289  | 84          | Pb-Free (RoHS)          | SNAGCU           | Level-3-260C-168HR           |
| OMAP5910JZZG2    | ACTIVE                | BGA MI CROSTAR | ZZG             | 289  | 160         | Green (RoHS & no Sb/Br) | SNAGCU           | Level-4-260C-72HR            |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

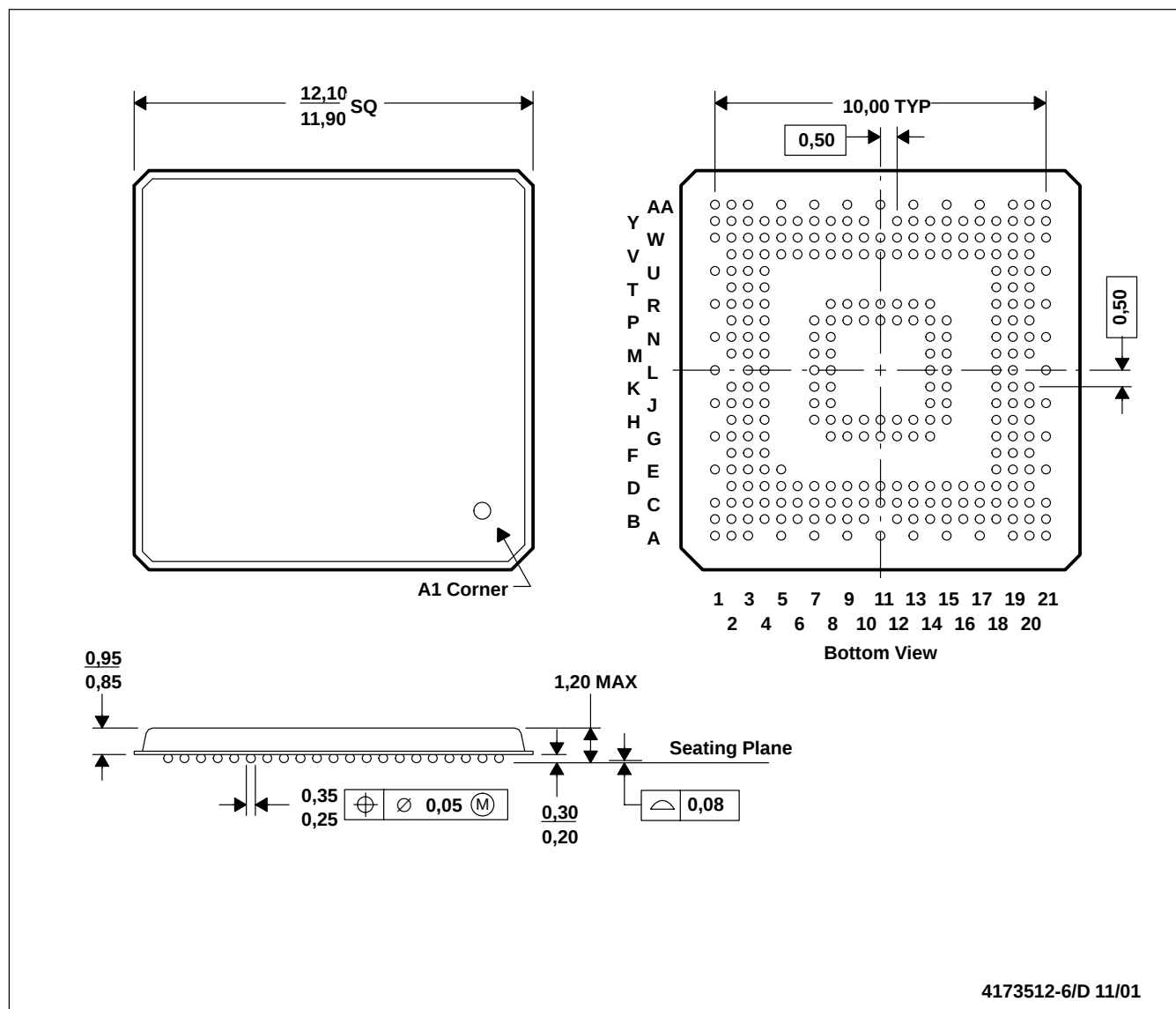
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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## GZG (S-PBGA-N289)

## PLASTIC BALL GRID ARRAY

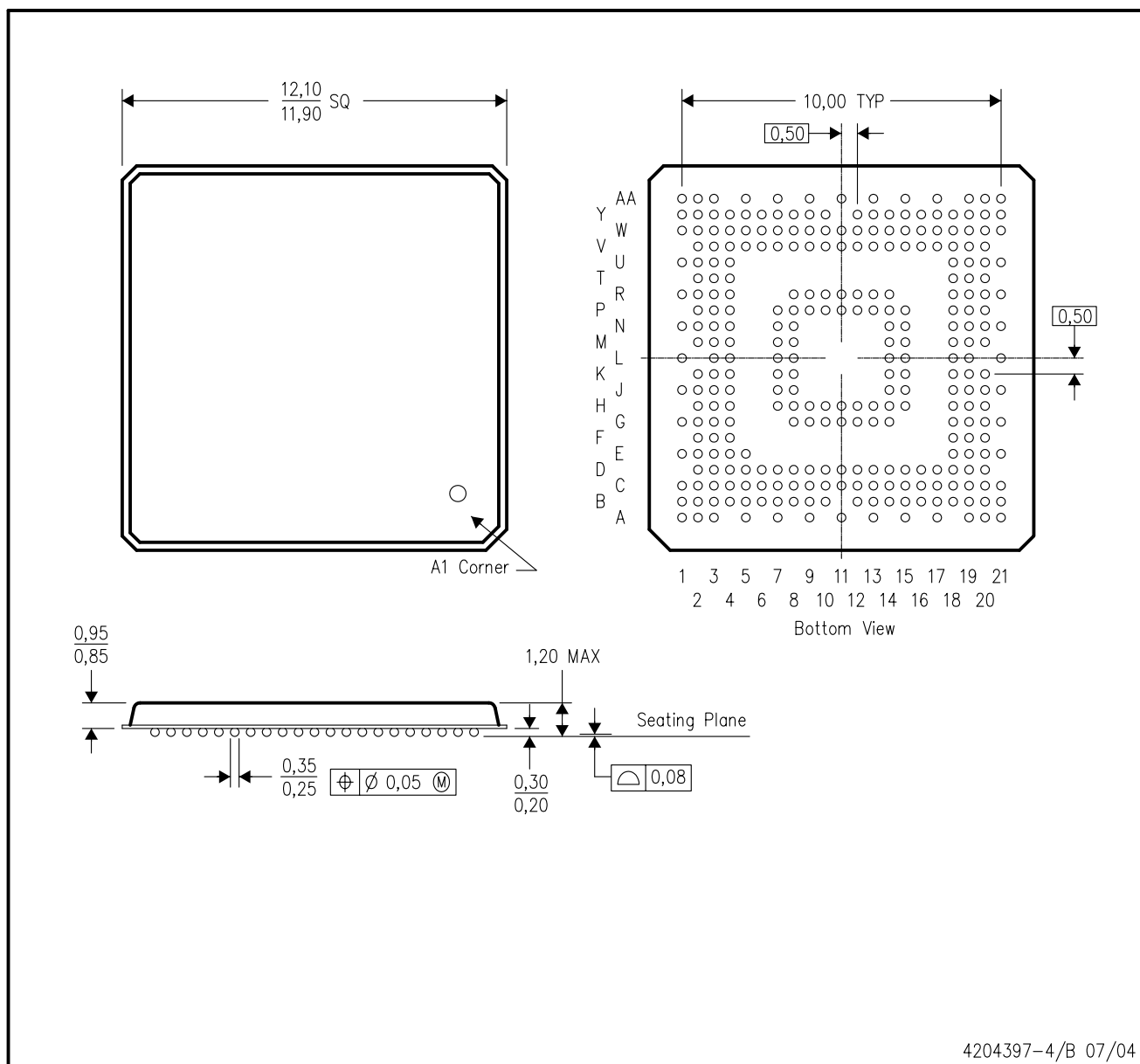


- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. MicroStar BGA™ configuration

MicroStar BGA is a trademark of Texas Instruments.

## ZZG (S-PBGA-N289)

## PLASTIC BALL GRID ARRAY

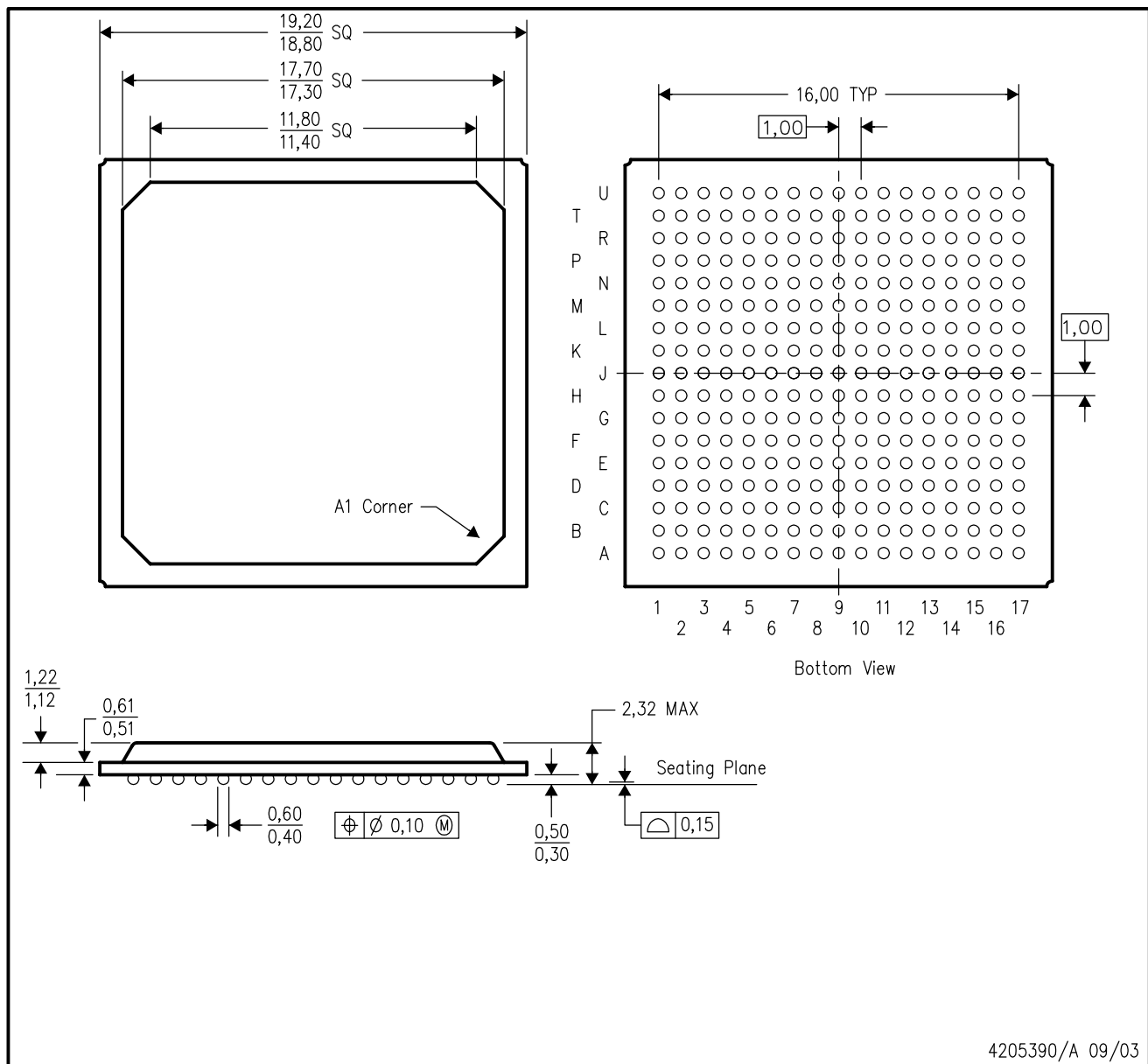


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. MicroStar BGA configuration
  - D. This package is lead-free.



## ZDY (S-PBGA-N289)

## PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. This package is lead free.