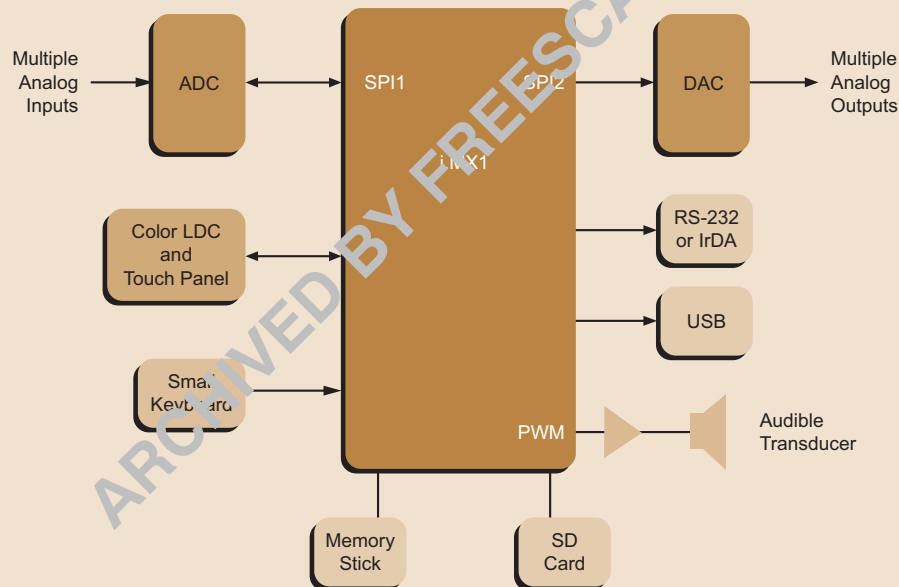# Industrial Control and Instrumentation

Overview

The industrial control and instrumentation markets continue to move toward products with color displays, touch screen user interfaces, wired links to systems, and analog data acquisition. Also, wireless short-range connectivity is coming on-line. New portable products are continually striving for longer battery life, improved ergonomic form factors, and lighter weight.

Freescale Semiconductor's i.MX family of highly integrated applications processors based on ARM® core technology addresses the product requirements for these markets. The i.MXS, i.MXL, i.MX1, and i.MX21 processors provide high performance, low power consumption, and on-chip integration such as LCD controller and USB, making them appropriate for a wide variety of applications.

Key Benefits

> ARM® core technology increases available software

> High level system-on-chip integration

> Power management optimizes battery life

> Broad base of OS support

> Family of products: speed, performance, and temperature options

> I^2C and SPI allow direct interface to external ADCs and DACs

> Partitioned chip allows simultaneous multi-voltage operation: 1.7 to 3.3 V

INDUSTRIAL CONTROL AND INSTRUMENTATION BLOCK DIAGRAM

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Design Challenges

Instrumentation presents a variety of design challenges. They are often placed in harsh environments where extreme temperatures, moisture, and dust are encountered. To complicate matters, circuits can be exposed to error-inducing high voltages and current surges. Handy touch screens may be required with special GUIs (graphical user interfaces) as well as audio feedback when limits are detected. Analog data acquisition and/or remote cameras may be necessary to monitor processes. Interfacing to networks may also be needed.

Industrial control presents similar set of design challenges. Harsh environments with extreme temperatures, moisture, and dust may be encountered. Circuits can be exposed to error-inducing high voltages and current surges. Handy touch screens may be required with special GUIs (graphical user interfaces) and audio feedback. Analog-to-digital and digital-to-analog conversion is usually required. Remote cameras and interfacing to networks may be needed.

Freescale Semiconductor Solution

The i.MX family of applications processors has the performance and features to suit a range of industrial control and instrumentation products. The power dissipation is low enough to allow sealed cases for end products, which helps cope with harsh or flammable environments. On-chip power management allows extended run times between battery charging. Also, weight is reduced because small batteries can be

used. The designer can select from three temperature grades of i.MX devices, with the top-of-the-line being 40 to 85ºC.

i.MX applications processors have general purpose outputs with ability to directly drive optical isolators for operation in noisy electrical environments. On-chip LCD controllers help with implementing the human interface along with pulse width modulation (PWM) for audible tones and alarms, even from audio files. A touch screen interface is provided in the line up. Most devices in the i.MX series have a camera interface that connects directly to CMOS sensors.

Serial interfaces, such as I^2C and SPI, facilitate connection to analog-to-digital and digital-to-analog converters. Infrared communication is accommodated along with several types of wired communication.

The i.MX family offers support for all the major open operating systems, including Linux, PalmOS, Microsoft Windows CE.NET, Microsoft PocketPC, and Symbian.

i.MXS

The lowest-cost member of the family is the i.MXS which has an ARM920T™ core that can operate up to 100 MHz. This 0.18 μm chip's internal bus can run up to 96 MHz. There is an on-chip LCD controller and USB (client). Both an I^2C and SPI are provided for interfacing to external analog devices. The i.MXS is applicable to products that do not require a camera interface, compact flash, or Memory Stick®.

i.MXL

The i.MXL applications processor is based on the ARM920T core available in two speed grades, 150 and 200 MHz. This 0.18 μm chip's internal bus can run up to 96 MHz and there is an on-chip LCD controller. In addition to the i.MXS features, the i.MXL accommodates a camera interface and a Memory Stick. In addition, there are two SPI ports and a secure digital controller.

i.MX1

The i.MX1 multimedia applications processor is based on the ARM920T core available in two speed grades, 150 and 200 MHz. This 0.18 μm chip's internal bus can run up to 96 MHz and there is an on-chip LCD controller. In addition to the i.MXL features, the i.MX1 processor allows direct interface to a touch screen and has 128 KB on-chip RAM. A smartcard interface module is included.

i.MX21

The i.MX21 multimedia applications processor is based on the ARM926EJ-S™ core operating up to 266 MHz. This 0.13 μm chip's internal bus can run up to 133 MHz. There is an on-chip standard LCD controller. i.MX21 comes with a smart LCD interface, too. Other features include a Smart Speed switch to reduce processor overhead, USB On-The-Go, and accommodation of PCMCIA® and compact flash. A 1-Wire® interface is added along with three SPI circuit blocks for interfacing to external analog devices.

Development Tools[NOTE]

Associated Device	Tool	Vendor	Additional Information
i.MXS	M9328MXLADS/B*	Freescale Semiconductor	www.freescale.com/imx
i.MXL	M9328MXLADS/B	Freescale Semiconductor	
i.MX1	M9328MX1ADS/B	Freescale Semiconductor	
i.MX21	M9328MX21ADS	Freescale Semiconductor	

Note: Search on associated device.
*The i.MXL ADS is used to develop applications for the i.MXS processor. See applications notes AN2908 for guidelines at
http://www.freescale.com/files/32bit/doc/app_note/AN2908.pdf.

Notes

Learn More: Contact the Technical Information Center at +1-800-521-6274 or +1-480-768-2130.

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