DS26334DK/DS26324DK
3.3V, 16-Channel, E1/T1/J1 Short-/Long-Haul LIU Design Kit

www.maxim-ic.com

GENERAL DESCRIPTION

The DS26334DK/DS26324DK is a fully integrated design kit for the DS26334 and DS26324 3.3V, 16-channel, E1/T1/J1 line interface units (LIUs). This design kit contains all the necessary circuitry to evaluate the DS26334 and DS26324 in all modes of operation. The design kit also includes an on-board microprocessor to run real-time code for further part evaluation.

DESIGN KIT CONTENTS

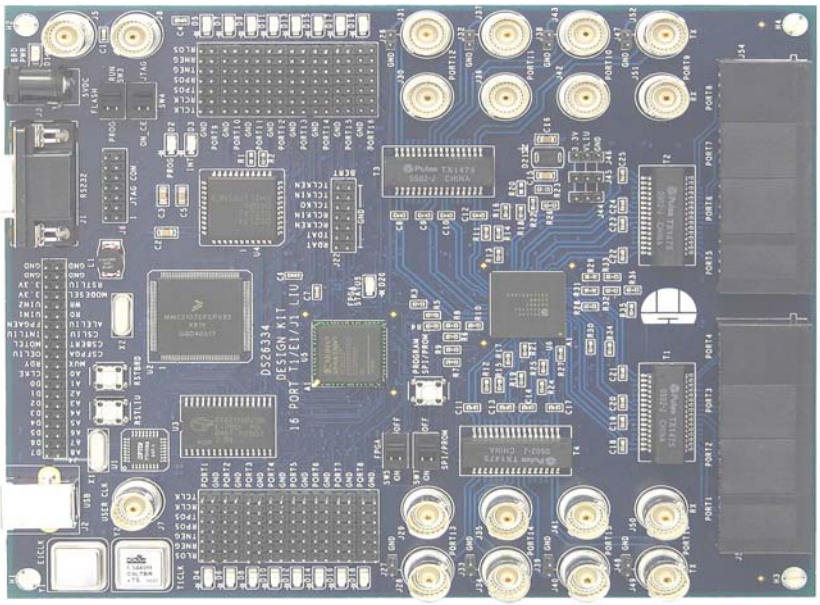
DS26334DK Board with a DS26324 or DS26334
5V AC/DC Adapter
3ft USB Cable
Download:
- ChipView Software
- DS26334DK/DS26324DK.def Definition File
- DS26334DK/DS26324DK Data Sheet

ORDERING INFORMATION

PART	DESCRIPTION
DS26334DK	Design Kit Board for DS26334
DS26324DK	Design Kit Board for DS26324

FEATURES

- **Expedites New Designs by Eliminating First-Pass Prototyping**
- **Demonstrates Key Functions of the DS26334/DS26324**
- **Includes DS26334/DS26324 x 16-Port LIU, Transformers, 75Ω BNC Connectors, RJ-48 Connectors, and Termination Passives**
- **Communicates Directly with any PC with a USB or RS-232 Serial Interface**
- **High-Level Windows®-Based Software Provides Visual Access to All Registers**
- **Software-Controlled (Register) Mapped Configuration Switches Facilitate Real-Time Clock and Signal Routing**
- **Precision Test Points for All Clocks and Signals**
- **On-Board T1 and E1 Crystal Oscillators for Stable Clock Generation**
- **On-Board BERT for Testing and Pattern Generation**



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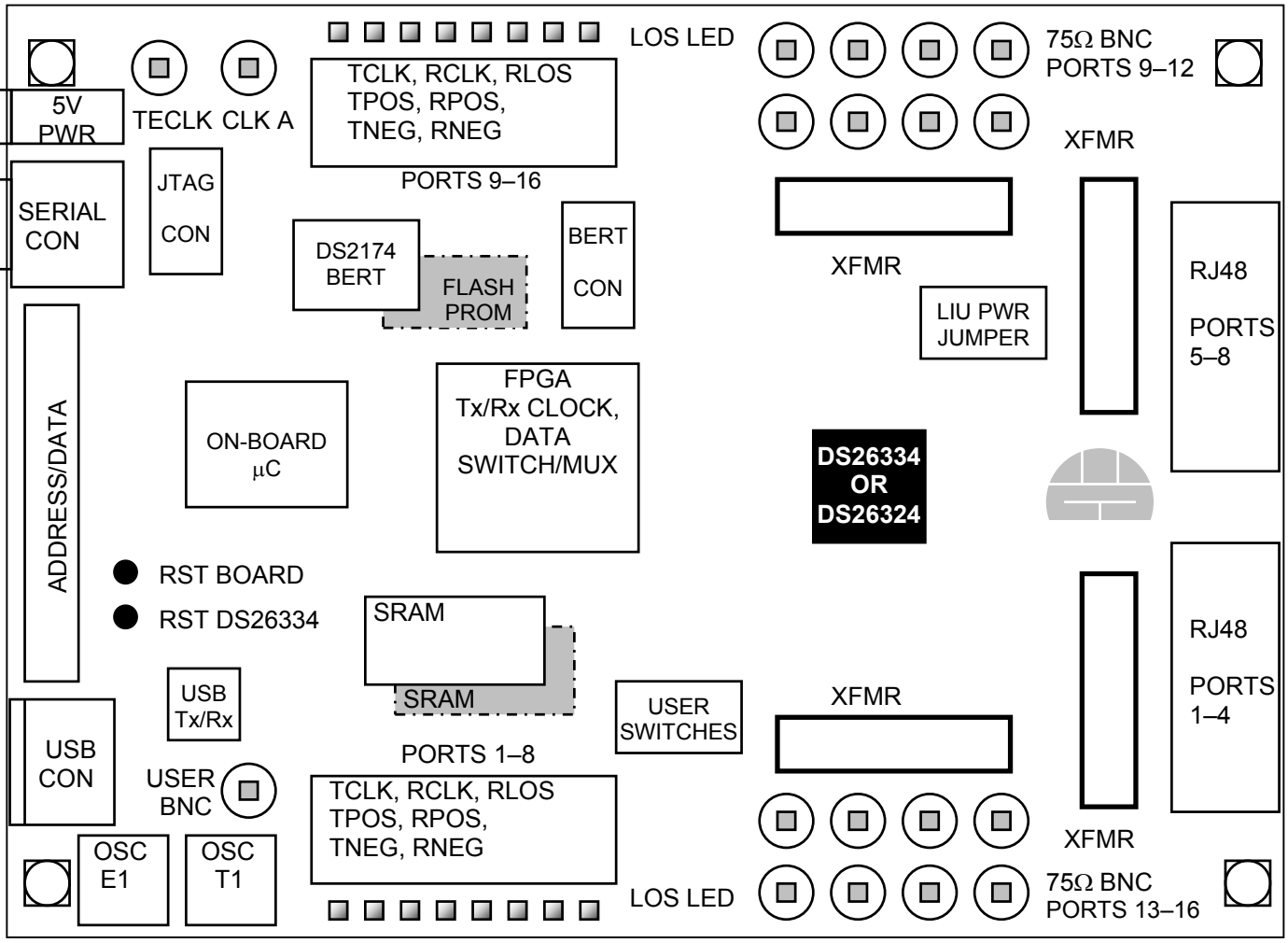
COMPONENT LIST

DESIGNATION	QTY	DESCRIPTION	SUPPLIER/ PART NUMBER
C1, C4, C6, C7, C31, C33–C41, C43–C46, C49, C51–C54, C56–C58, C61–C93, C95–C108	66	0.1µF ±20%, 16V X7R ceramic capacitors (0603)	AVX 0603YC104MAT
C2, C3, C27, C37, C42, C48, C50, C55, C59, C60	10	1µF ±10%, 16V ceramic capacitors (1206)	Panasonic ECJ-3YB1C105K
C5, C16, C26, C30, C34, C35, C94	7	10µF ±20%, 10V ceramic capacitors (1206)	Panasonic ECJ-3YB1A106M
C8–C14, C17–C25	16	470pF ±10%, 100V ceramic capacitors (0603)	Panasonic ECJ-1VB2A471K
C15	1	6.8µF ±10%, 6.3V X5R ceramic capacitors (1206)	Panasonic ECJ-3YB0J685K
C28, C29, C32, C109, C110	5	68µF ±20%, 16V tantalum capacitors (D case)	Panasonic ECS-T1CD686R
C36, C38, C47	3	22pF ±5%, 25V ceramic capacitors (0603)	AVX 06033A220JAT
C39, C40	2	10pF ±5%, 50V ceramic capacitors (1206) (tall case)	Phycomp 1206CG100J9B200
D1, D20	2	Green LEDs (SMD)	Panasonic LN1351C
D2–D19	18	Red LEDs (SMD)	Panasonic LN1251C
D21, D22, D23	3	1A, 40V Schottky diodes	International Rectifier 10BQ040
H1–H4	4	KIT, 4-40 hardware 0.75 nylon standoff and 0.25 nylon screw	Not applicable 4-40KIT2
J1	1	DB9 right-angle connector (short case)	AMP 788750-2
J2	1	Black, single right angle (Type B)	Molex Not applicable
J3	1	2.5mm connector Power jack, right-angle PC board mount	Switchcraft RAPC712
J4	1	40-pin terminal strip (dual row, vertical)	Samtec TSW-120-07-T-D
J5, J7, J8, J28–J31, J34–J37, J40–J43, J49–J52	19	5-pin, 75Ω BNC connectors (vertical)	Cambridge CP-BNCPC-004
J6, J9–J25	18	14-pin headers (dual row, vertical)	Samtec TSW-107-14-T-D
J26, J27, J32, J33, J38, J39, J47, J48	8	2-pin headers, 0.100in centers (vertical)	Samtec TSW-102-07-T-S
J44, J45, J46	3	100-mil 3-position jumpers	Samtec Not applicable
J53, J54	2	8-pin 4-port RJ45 jacks (right angle)	Molex 43223-8140
L1	1	1.0µH ±20%, 2-pin SMT inductor	Coiltronics UP1B-1R0
R1, R20, R61, R90, R138	5	Resistors (0603) **DO NOT POPULATE**	—

DESIGNATION	QTY	DESCRIPTION	SUPPLIER/ PART NUMBER
R2, R23, R37, R38, R39, R42, R45, R47–R50, R52, R53, R55, R57–R60, R66–R69, R71, R72, R74–R76, R79, R80, R85, R88, R89, R91, R99, R103, R104, R105, R110	38	10kΩ ±5%, 1/16W resistors (0603)	Panasonic ERJ-3GEYJ103V
R3–R19, R21, R22, R24–R36, R41, R44, R46, R51, R63, R64, R65, R81, R82, R102, R109, R116, R120, R121, R122, R126, R130, R131, R132, R134–R137, R139, R140, R148, R151, R153	60	33Ω ±5%, 1/16W resistors (0603)	Panasonic ERJ-3GEYJ330V
R40, R70, R73, R77, R78, R83, R84, R86, R87, R92, R93, R95–R98, R100, R101, R106, R107, R108	20	330Ω ±5%, 1/16W resistors (0603)	Panasonic ERJ-3GEYJ331V
R43, R62	2	15kΩ ±5%, 1/16W resistors (0603)	Panasonic ERJ-3GEYJ153V
R54	1	Resistor (1206) **DO NOT POPULATE**	—
R56	1	470Ω ±5%, 1/16W resistor (0603)	Panasonic ERJ-3GEYJ471V
R94	1	51Ω ±5%, 1/16W resistor (0603)	Panasonic ERJ-3GEYJ510V
R111–R115, R117, R118, R119, R123, R124, R125, R127, R128, R129, R133, R141–R144, R146, R147, R149, R150, R152, R154–R161	32	60.4Ω ±1%, 1/16W resistors (0603)	Panasonic ERJ-3EKF60R4V
R145	1	22kΩ ±5%, 1/16W resistor (0603)	Panasonic ERJ-3GEYJ223V
SW1, SW2, SW6	3	4-pin single-pole switch	Panasonic EVQPAE04M
SW3, SW4, SW5, SW7	4	6-pin slide switches (DPDT, through hole)	Tyco Electronics SSA22
T1–T4	4	32-pin transmit/receive SMT transformers (1:2 and 1:1)	Pulse Engineering TX1475
U1	1	8-bit FIFO USB UART (32-pin LQFP)	FTDI FT245BM
U2	1	MCORE Microcontroller (144-pin LQFP)	Motorola MMC2107PV
U3, U10	2	128k x 8 SRAM (32-pin SO)	Cypress CY62128VL-70SC

DESIGNATION	QTY	DESCRIPTION	SUPPLIER/ PART NUMBER
U4	1	DS2174 EBERT (44-pin PLCC, 0°C to +70°C)	Dallas Semiconductor DS2174Q
U5	1	Spartan-II 2.5V FPGA, 200k gate (256-pin BGA)	Xilinx XC2S200-5FG256C
U6	1	3.3V, 16-channel, E1/T1/J1 long-haul LIU (256-pin BGA, 0°C to +70°C)	Dallas Semiconductor DS26334
U7	1	Dual RS-232 transmitter/receiver (150-mil, 16-pin SO)	Dallas Semiconductor DS232AR
U8, U11	2	High-speed buffers	Fairchild Semiconductor NC7SZ86
U9, U20	2	1.5W, 3.3V or adj, 1A linear regulators (16-pin TSSOP-EP)	Maxim MAX1793EUE-33
U12	1	PROM for FPGA (44-pin TQFP)	Xilinx XC18V02VQ44C
U13, U14, U18	3	Hex inverters (14-pin SO)	Toshiba TC74HC04AFN
U15	1	2.5V or adj linear regulator (8-pin μMAX/SO)	Maxim MAX1792EUA25
U16	1	Platform flash in-system programmable configuration PROM (2Mb, 20-pin TSSOP)	Xilinx XCF02SVO20C
U17	1	Quad 2-input NAND gate (14-pin SO)	Toshiba TC74HC00AFN
U19	1	Switch debouncer (4-pin SOT143)	Maxim MAX6816EUS-T
X1	1	6.00MHz low-profile crystal	Pletronics LP49-26-6.00M
X2	1	8.000MHz low-profile crystal	Ecliptek Corp. EC1-8.000M
Y1	1	Oscillator, crystal clock 5V, 2.048MHz	SaRonix NTH039A-2.0480
Y2	1	Oscillator, crystal clock 5V, 1.544MHz	SaRonix NTH039A-1.5440

BOARD FLOORPLAN



BASIC OPERATION

This design kit relies upon several supporting files, which are available for downloading on our website at www.maxim-ic.com/DS26334DK.

The support files are used with an evaluation program called ChipView, which is available for download at www.maxim-ic.com/telecom.

HARDWARE CONFIGURATION

Quick Start (Hardware Settings—Single Power Supply)

- For single power-supply operation, short jumpers J44, J45, and J46 between the 3.3V pin and the VLIU pin. This connects VDD of the DS26334/DS26324 to the 3.3V supply on the design kit.
- Ensure that the FLASH switch (SW3) is in the *RUN* position.
- Ensure that the FPGA switch (SW5) is in the *ON* position.
- Ensure that the SPI/PROM switch (SW7) is in the *OFF* position.
- If using the serial port, connect an RS-232 serial cable from DS26334DK (J1) to the PC.
- If using the USB port, connect a USB cable from DS26334DK (J2) to the PC.
- Connect AC/DC adapter with an AC power source and the DS26334DK (J3). PWR LED should be on.

JTAG Configuration

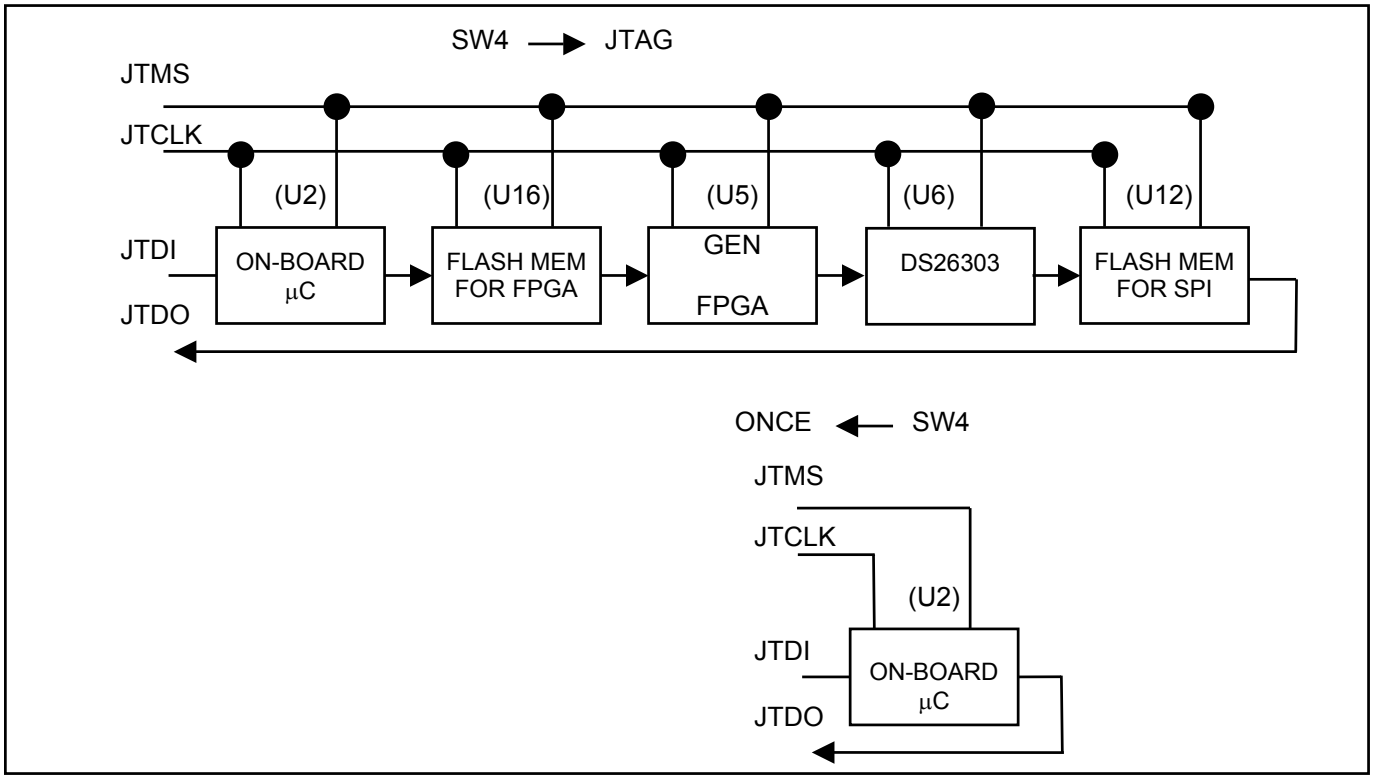
The JTAG chain is controlled by the connector JTAG CON (J6) and two on-board switches: FLASH (SW3) and ONCE/JTAG (SW4). Depending on the function, such as programming the internal microcontroller flash or performing boundary scan operations, the JTAG CON connector can be used and the switches can be configured to accomplish the desired task. For information on programming the internal flash of the on-board microcontroller, refer to the MMC2107 microcontroller user manual and board schematic.

For most purposes, having the complete JTAG chain is sufficient. Figure 1 shows the complete chain as well as what order the devices appear during boundary scan. Table 1 shows the pinout of the JTAG connector. Connect any JTAG cable to the connector to perform all operations. Note the JTAG chain changes depending on the switch SW4. The ONCE location of SW4 is used for programming the on-board microcontroller only.

Table 1. JTAG Connector (J6) Pinout

PIN	NAME
1	JTDI
2, 4, 6, 7	GND
3	JTDO
5	JTCLK
8	ALIGN KEY
9	BRD RST
10	JTMS
11	BRD V3.3
12	JDE
13	N.C.
14	JTRST

Figure 1. DS26334DK JTAG Chain



Address/Data Bus Connector

The DS26334DK has a connector (J4) to monitor all local bus activity for the design kit. All the signals can be captured with a high-impedance probe and displayed on an oscilloscope or logic analyzer. **Note:** If the FPGA switch (SW5) is in the "OFF" position, the on-board microcontroller will no longer drive any data onto the local bus. Therefore, the user can now connect the local bus of the DS26334/DS26324 into another system without making any modifications to the hardware. See Table 2 for specific pin information for connector J4.

Table 2. Address/Data Connector Pinout

PIN	NAME	FUNCTION		PIN	NAME	FUNCTION
1	A8	Local Address Bit 8		2	D0	Local Data Bit 0
3	A7	Local Address Bit 7		4	D1	Local Data Bit 1
5	A6	Local Address Bit 6		6	D2	Local Data Bit 2
7	A5	Local Address Bit 5		8	D3	Local Data Bit 3
9	A4	Local Address Bit 4		10	D4	Local Data Bit 4
11	A3	Local Address Bit 3		12	D5	Local Data Bit 5
13	A2	Local Address Bit 2		14	D6	Local Data Bit 6
15	A1	Local Address Bit 1		16	D7	Local Data Bit 7
17	A0	Local Address Bit 0		18	CLKE	SPI Clock Edge Select
19	MUX	Mux		20	RDY	Ready Handshake from LIU
21	CSFPGA	Chip Select FPGA		22	OE	Output Enable LIU
23	CSBERT	Chip Select DS2174		24	MOTEL	Motorola/Intel Select
25	CSLIU	Chip Select DS26334/DS26324		26	INT	Interrupt for DS26334/DS26324
27	ALELIU	Address Latch Enable		28	FPGAEN	FPGA Enable Pin
29	RD	Read Signal		30	UIN1	User Input 1
31	WR	Write Signal		32	UIN2	User Input 2
33	MODESEL	Mode Select		34, 36	3.3V	Board 3.3V
35	RSTLIU	Reset DS26334/DS26324		37–40	GND	Ground

Telecom Clock and Data Test Points

The DS26334DK has high-impedance test points for all the telecom signals that are related to the LIU. These signals are split up by port number and marked with easy to read silkscreen labels. Table 3 shows the telecom connector for port 1. The pinout for this connector is repeated for all 16 ports.

Table 3. Telecom Connector Pinout

PIN	NAME	FUNCTION
1	TCLK	Transmit Clock Input
2, 4, 6, 8, 10, 12, 14	GND	Ground
3	RCLK	Receive Clock Output
5	TPOS	Transmit Positive Data Input
7	RPOS	Receive Positive Data Output
9	TNEG	Transmit Negative Data Input
11	RNEG	Receive Positive Data Output
13	RLOS	Receive Loss-of-Signal Output

Note that the input signals in the telecom connector go from the connector to the on-board FPGA, then to the DS26334/DS26324. The FPGA was designed to perform specific signal routing functions such as looping back RPOS to TPOS on a particular port or transferring data from the on-board BERT. If you are using user-defined data and drive the signal on the connector, be sure to tri-state the input signal in the FPGA. **FAILURE TO DO SO COULD CAUSE DAMAGE TO THE FPGA**!

On-Board Bit Error-Rate Tester (BERT)

The DS26334DK has an on-board bit error-rate tester (BERT) to generate and detect errors in either pseudorandom or user-defined patterns. The BERT on the DS26334DK is the DS2174. A header for the relevant signals related to the BERT is located on the board (J22). See Table 4 for the pinout of the BERT connector. The BERT signals are routed into the FPGA and can be muxed into any of the 16 DS26334/DS26324 LIU ports under software control. For all questions concerning the operation of the on-board BERT, refer to the device data sheet available online at www.maxim-ic.com/telecom. If you are using user-defined data and driver the signal on the connector, be sure to tri-state the input signal in the FPGA. **FAILURE TO DO SO COULD CAUSE DAMAGE TO THE FPGA!**

Table 4. BERT Connector Pinout

PIN	NAME	FUNCTION
1	TCLK_EN	BERT TCLK Enable
2, 4, 6, 8, 10, 12, 14	GND	Ground
3	TCLKIN	BERT TCLK Input
5	TCLKO	BERT TCLK Output
7	RCLKIN	BERT RCLK Input
9	RCLKEN	BERT RCLK Enable
11	TDAT	BERT TDAT Output
13	RDAT	BERT RDAT Input

PROM SPI Configuration

In software mode, it is possible to configure the DS26334/DS26324 using a parallel interface or a serial peripheral interface (SPI). Most advanced microcontrollers have both a parallel interface and SPI interface such as the microcontroller on the DS26334DK. The command you send to the microcontroller through either the USB or serial port determines if that data is placed on the parallel or SPI bus. Refer to the data sheet for ChipView on the particular commands required to switch data ports.

A unique feature with the SPI port is that a PROM can be used to provide the LIU with the specific data needed for configuration. If the data in the PROM is formatted a certain way, it can seem as the PROM is acting like a controller with a SPI interface in master mode.

The most common PROMs to use for this type of application are those with an internal address accumulator. This feature for the PROM is important because the device must automatically jump to the next available address in the configuration memory. The Xilinx XC18V00 device family is a byte-wide nonvolatile memory with an autoincrement address function. The family of devices is available in 1Mb, 2Mb, and 4Mb densities. The PROM is also useful because the device can perform in-circuit programming with the JTAG port. Refer the data sheet for the XC18V00 for the JTAG codes for programming the configuration memory.

Figure 2 shows a general relationship of the timing for a SPI bus. For this case, all data is clocked into the slave device on the rising edge of SCLK. This feature can be configurable on the DS26334/DS26324.

Figure 2. SPI Timing Diagram

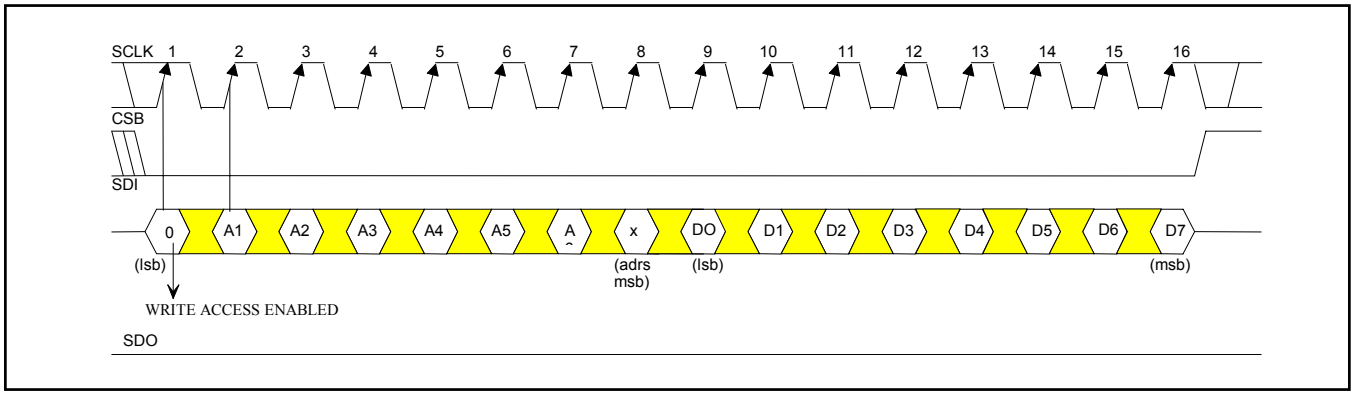


Figure 3 shows a simplified diagram of the XC18V00 device and the DS26334/DS26324 in SPI (serial) mode. Notice a few key points about this diagram. First, the CLK for the XC18V00 is the MCLK for the LIU, but this is not the SCLK for the SPI interface. The SCLK can be programmed as needed. See Table 5 for an example of the memory map. Second, the programming for this device begins when OE on the XC18V00 goes high. Therefore, consideration must be taken if some delay is necessary. Generally, it is sufficient for the OE pin to be connected to some power-up delay device. The OE delay is not necessary on this DK.

Figure 3. SPI Configuration with PROM

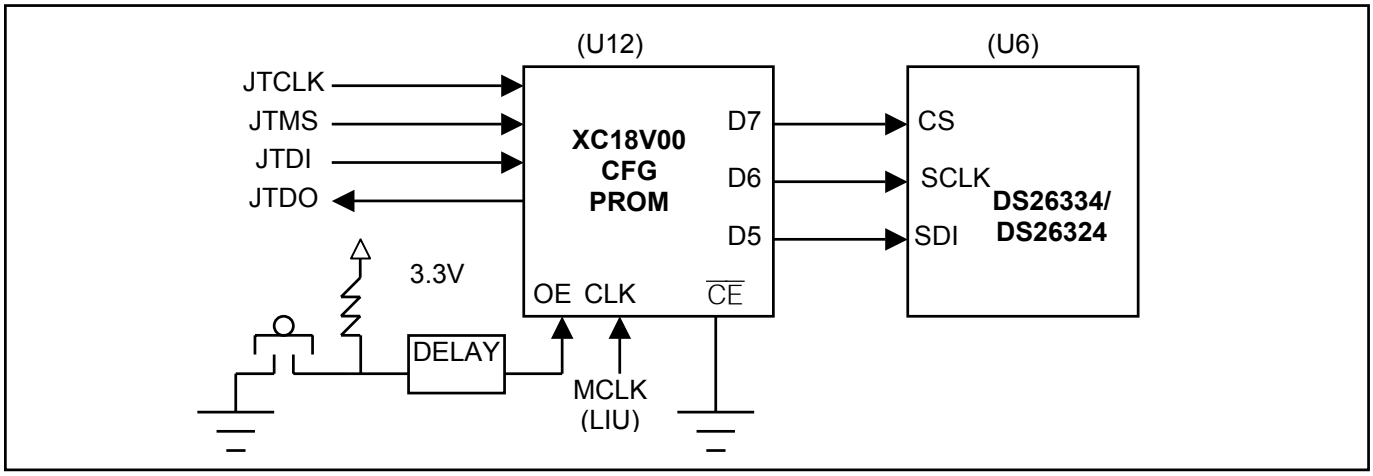


Table 5. Configuration Memory

ADDRESS	D7	D6	D5	D4	D3	D2	D1	D0
	CSB	SCLK	SDI	X	X	X	X	X
0x00	1	0	0	Start of Write Cycle				
0x01	0	0	0	Bit A0 (Always a "0" for a write)				
0x02	0	1	0					
0x03	0	0	1	Bit A1				
0x04	0	1	1					
0x05	0	0	0	Bit A2				
0x06	0	1	0					
0x07	0	0	0	Bit A3				
0x08	0	1	0					
0x09	0	0	0	Bit A4				
0x0A	0	1	0					
0x0B	0	0	0	Bit A5				
0x0C	0	1	0					
0x0D	0	0	0	Bit A6				
0x0E	0	1	0					
0x0F	0	0	0	Bit A7				
0x10	0	1	0					
0x11	0	0	0	Bit D0 (LSB)				
0x12	0	1	0					
0x13	0	0	1	Bit D1				
0x14	0	1	1					
0x15	0	0	1	Bit D2				
0x16	0	1	1					
0x17	0	0	0	Bit D3				
0x18	0	1	0					
0x19	0	0	0	Bit D4				
0x1A	0	1	0					
0x1B	0	0	1	Bit D5				
0x1C	0	1	1					
0x1D	0	0	1	Bit D6				
0x1E	0	1	1					
0x1F	0	0	0	Bit D7				
0x20	0	1	0					
0x21	1	0	X	End of Write Cycle				
0x22	1	X	X					

SOFTWARE CONFIGURATION

Quick Start (Software—ChipView)

- Perform steps in the Quick Start (Hardware Configuration).
- Load ChipView software.
- Select COM port.
- Select Register View.
- From the Programs menu, launch the host application named ChipView.exe. If the default installation options were used, click the Start button on the Windows toolbar and select Programs -> ChipView -> ChipView.
- Load the DS26334DK.def file.
- Make sure that all the register settings are correct for the proper function desired for the DS26334DK.
- Refer to the DS26334 and DS26324 data sheets for all questions pertaining to device functionality.

MEMORY MAP

The on-board microcontroller is configured to start the user address space at 0x81000000. All offsets given below are relative to the beginning of the user address space.

Table 6. DS26334DK Relative Address Map

REF DES	DEVICE	OFFSET
U5	General-Purpose FPGA Tx/Rx Clock, Data Switch/Mux	0x0000
U4	DS2174 BERT	0x1000
U6	DS26334/DS26324 16-Port T1/E1/J1 LIUs	0x2000

All device registers can be easily modified using the ChipView.exe host-based user-interface software.

Table 7. General-Purpose FPGA Memory Map

OFFSET	REGISTER NAME	TYPE	DESCRIPTION
0x00	BRDID	Read-Only	Board ID
0x02	DSIDH	Read-Only	Dallas Extended ID Upper Nibble
0x03	DSIDM	Read-Only	Dallas Extended ID Middle Nibble
0x04	DSIDL	Read-Only	Dallas Extended ID Lower Nibble
0x05	BRDREV	Read-Only	Board Rev
0x06	ASMREV	Read-Only	Assembly Rev
0x07	FPGAREV	Read-Only	FPGA Firmware Rev
0x08	CTRL1	Control	Control Register 1
0x0A	ABSP	Control	Address Bank Select Pointer
0x0B	BTCLK	Control	BERT TCLK Input
0x0C	BRCLK	Control	BERT RCLK Input
0x0D	BRDAT	Control	BERT RDAT Input
0x10	TCLK	Control	Indirect Register for TCLK Source Control
0x11	TPOS	Control	Indirect Register for TPOS Source Control
0x12	TNEG	Control	Indirect Register for TPOS Source Control

ID REGISTERS

BID: BOARD ID (Offset = 0X0000)

BID is read-only with a value of 0xD.

XBIDH: HIGH NIBBLE EXTENDED BOARD ID (Offset = 0X0002)

XBIDH is read-only with a value of 0x0.

XBIDM: MIDDLE NIBBLE EXTENDED BOARD ID (Offset = 0X0003)

XBIDM is read-only with a value of 0x1.

XBIDL: LOW NIBBLE EXTENDED BOARD ID (Offset = 0X0004)

XBIDL is read-only with a value of 0x6.

BREV: BOARD FAB REVISION (Offset = 0X0005)

BREV is read-only and displays the current fab revision.

AREV: BOARD ASSEMBLY REVISION (Offset = 0X0006)

AREV is read-only and displays the current assembly revision.

PREV: FPGA REVISION (Offset = 0X0007)

PREV is read-only and displays the current PLD firmware revision.

CONTROL REGISTERS

Register Name: **CTRL_1**
Register Description: **DS26334DK FPGA CONTROL REGISTER 1**
Register Offset: **0x08**

Bit #	7	6	5	4	3	2	1	0
Name	ENRLOS16	ENRLOS15	CLKE	SPI_SWAP	SPI	OE	MCLK1	MCLK0

Bit 7: ENRLOS16. This bit enables the RLOS16 LED. This should not be enabled when driving TECLK from the DS26334/DS26324.

If ENRLOS16 = LOW, the RLOS16 LED is not enabled.
If ENRLOS16 = HIGH, the RLOS16 LED is enabled and lights when RLOS16 is high.

Bit 6: ENRLOS15. This bit enables the RLOS15 LED. This should not be enabled when driving CLKA from the DS26334/DS26324.

If ENRLOS15 = LOW, the RLOS15 LED is not enabled.
If ENRLOS15 = HIGH, the RLOS15 LED is enabled and lights when RLOS15 is high.

Bit 5: CLKE. This bit sets the CLKE pin on the DS26334/DS26324. This is only active when SPI (Bit 0) is HIGH. If SPI (Bit 0) is low, CLKE is always low.

If CLKE = LOW, SDO is clocked out on the rising edge of SCLK.
If CLKE = HIGH, SDO is clocked out on the falling edge of SCLK.

Bit 4: SPI_SWAP. This bit sets the BSWP/A5 pin on the DS26334/DS26324. This is only active when SPI (Bit 0) is HIGH.

If SPI_SWAP = LOW, the SPI bus is LSB first.
If SPI_SWAP = HIGH, the SPI bus is MSB first.

Bit 3: SPI. This bit sets up the FPGA to use serial mode. This bit also changes the mode pin on the DS26334/DS26324.

If SPI = LOW, the parallel bus is used for all read/write access. This also sets the MODE pin on the DS26334/DS26324 to logic 1.
If SPI = HIGH, the SPI bus is used for all read/write access. This also sets the MODE pin on the DS26334/DS26324 to logic 0.

Bit 2: OE. This bit controls the OE pin to the DS26334.

Bits 1 and 0: MCLK1 and MCLK0. These bits control the MCLK pin to the DS26334/DS26324.

MCLK1	MCLK0	DESCRIPTION OF MCLK
0	0	MCLK = high-impedance mode
0	1	MCLK = on-board T1 oscillator
1	0	MCLK = on-board E1 oscillator
1	1	MCLK = user clock input

Register Name: **ABSP**
Register Description: **ADDRESS BANK SWAP POINTER**
Register Offset: **0x0A**

Bit #	7	6	5	4	3	2	1	0
Name	D7	D6	D5	D4	D3	D2	D1	D0

Bits 7 to 0: D7 to D0. These bits control the address bank for address 0x10 (TCLK N), 0x11 (TPOS), and 0x12 (TNEG).

ABSP	DESCRIPTION
0x00	Bank Address Value for Port 1
0x01	Bank Address Value for Port 2
0x02	Bank Address Value for Port 3
0x03	Bank Address Value for Port 4
0x04	Bank Address Value for Port 5
0x05	Bank Address Value for Port 6
0x06	Bank Address Value for Port 7
0x07	Bank Address Value for Port 8
0x08	Bank Address Value for Port 9
0x09	Bank Address Value for Port 10
0x0A	Bank Address Value for Port 11
0x0B	Bank Address Value for Port 12
0x0C	Bank Address Value for Port 13
0x0D	Bank Address Value for Port 14
0x0E	Bank Address Value for Port 15
0x0F	Bank Address Value for Port 16

Register Name: **BTCLK**
Register Description: **BERT TCLK SOURCE**
Register Offset: **0x0B**

Bit #	7	6	5	4	3	2	1	0
Name	D7	D6	D5	D4	D3	D2	D1	D0

Bits 7 to 0: D7 to D0. These bits control the source of the TCLK for the BERT.

BTCLK	DESCRIPTION
0x00	RCLK Port 1
0x01	RCLK Port 2
0x02	RCLK Port 3
0x03	RCLK Port 4
0x04	RCLK Port 5
0x05	RCLK Port 6
0x06	RCLK Port 7
0x07	RCLK Port 8
0x08	RCLK Port 9
0x09	RCLK Port 10
0x0A	RCLK Port 11
0x0B	RCLK Port 12
0x0C	RCLK Port 13
0x0D	RCLK Port 14
0x0E	RCLK Port 15
0x0F	RCLK Port 16
0x10	1.544MHz On-board oscillator
0x11	2.048MHz On-board oscillator
0x12	User clock
0x13	CLKA DS26334
0x14	TECLK DS26334
0x15	TCLKBERT OUT
0x16–0xFF	HI-Z

Register Name: **BRCLK**
Register Description: **BERT RCLK SOURCE**
Register Offset: **0x0C**

Bit #	7	6	5	4	3	2	1	0
Name	D7	D6	D5	D4	D3	D2	D1	D0

Bits 7 to 0: D7 to D0. These bits control the source of the RCLK for the BERT.

BTCLK	DESCRIPTION
0x00	RCLK Port 1
0x01	RCLK Port 2
0x02	RCLK Port 3
0x03	RCLK Port 4
0x04	RCLK Port 5
0x05	RCLK Port 6
0x06	RCLK Port 7
0x07	RCLK Port 8
0x08	RCLK Port 9
0x09	RCLK Port 10
0x0A	RCLK Port 11
0x0B	RCLK Port 12
0x0C	RCLK Port 13
0x0D	RCLK Port 14
0x0E	RCLK Port 15
0x0F	RCLK Port 16
0x10	1.544MHz On-board oscillator
0x11	2.048MHz On-board oscillator
0x12	User clock
0x13	CLKA DS26334/DS26324
0x14	TECLK DS26334/DS26324
0x15	TCLKBERT OUT
0x16–0xFF	HI-Z

Register Name: **BRDAT**
Register Description: **BERT RDAT SOURCE**
Register Offset: **0x0D**

Bit #	7	6	5	4	3	2	1	0
Name	D7	D6	D5	D4	D3	D2	D1	D0

Bits 7 to 0: D7 to D0. These bits control the source of the RDAT for the BERT. Note that the DS26334/DS26324 must be in single-rail mode for BERT to function properly.

BRDAT	DESCRIPTION
0x00	RPOS Port 1
0x01	RPOS Port 2
0x02	RPOS Port 3
0x03	RPOS Port 4
0x04	RPOS Port 5
0x05	RPOS Port 6
0x06	RPOS Port 7
0x07	RPOS Port 8
0x08	RPOS Port 9
0x09	RPOS Port 10
0x0A	RPOS Port 11
0x0B	RPOS Port 12
0x0C	RPOS Port 13
0x0D	RPOS Port 14
0x0E	RPOS Port 15
0x0F	RPOS Port 16
0x10	1.544MHz On-board oscillator
0x11	2.048MHz On-board oscillator
0x12	User clock
0x13	CLKA DS26334/DS26324
0x14	TECLK DS26334/DS26324
0x15	TCLKBERT OUT
0x16–0xFF	HI-Z

Register Name: **TCLK**
Register Description: **PORT TCLK SOURCE**
Register Offset: **0x10**

Bit #	7	6	5	4	3	2	1	0
Name	D7	D6	D5	D4	D3	D2	D1	D0

Note: *This is an indirect register that is related to ABSP (0x0A). See register description.*

Bits 7 to 0: D7 to D0. These bits control the source of the port TCLK for the DS26334/DS26324.

TCLK	DESCRIPTION
0x00	RCLK Port 1
0x01	RCLK Port 2
0x02	RCLK Port 3
0x03	RCLK Port 4
0x04	RCLK Port 5
0x05	RCLK Port 6
0x06	RCLK Port 7
0x07	RCLK Port 8
0x08	RCLK Port 9
0x09	RCLK Port 10
0x0A	RCLK Port 11
0x0B	RCLK Port 12
0x0C	RCLK Port 13
0x0D	RCLK Port 14
0x0E	RCLK Port 15
0x0F	RCLK Port 16
0x10	1.544MHz On-board oscillator
0x11	2.048MHz On-board oscillator
0x12	User clock
0x13	CLKA DS26334/DS26324
0x14	TECLK DS26334/DS26324
0x15	TCLKBERT OUT
0x16–0xFF	HI-Z

Register Name: **TPOS**
Register Description: **PORT TPOS SOURCE**
Register Offset: **0x11**

Bit #	7	6	5	4	3	2	1	0
Name	D7	D6	D5	D4	D3	D2	D1	D0

Note: *This is an indirect register that is related to ABSP (0x0A). See register description.*

Bits 7 to 0: D7 to D0. These bits control the source of the port TPOS for the DS26334/DS26324.

TPOS	DESCRIPTION
0x00	RPOS Port 1
0x01	RPOS Port 2
0x02	RPOS Port 3
0x03	RPOS Port 4
0x04	RPOS Port 5
0x05	RPOS Port 6
0x06	RPOS Port 7
0x07	RPOS Port 8
0x08	RPOS Port 9
0x09	RPOS Port 10
0x0A	RPOS Port 11
0x0B	RPOS Port 12
0x0C	RPOS Port 13
0x0D	RPOS Port 14
0x0E	RPOS Port 15
0x0F	RPOS Port 16
0x10	1.544MHz On-board oscillator
0x11	2.048MHz On-board oscillator
0x12	User clock
0x13	CLKA DS26334/DS26324
0x14	TECLK DS26334/DS26324
0x15	TDATBERT OUT
0x16–0xFF	HI-Z

Register Name: **TNEG**
Register Description: **PORT TNEG SOURCE**
Register Offset: **0x12**

Bit #	7	6	5	4	3	2	1	0
Name	D7	D6	D5	D4	D3	D2	D1	D0

Note: *This is an indirect register that is related to ABSP (0x0A). See register description.*

Bits 7 to 0: D7 to D0. These bits control the source of the port TNEG for the DS26334/DS26324.

TNEG	DESCRIPTION
0x00	RNEG Port 1
0x01	RNEG Port 2
0x02	RNEG Port 3
0x03	RNEG Port 4
0x04	RNEG Port 5
0x05	RNEG Port 6
0x06	RNEG Port 7
0x07	RNEG Port 8
0x08	RNEG Port 9
0x09	RNEG Port 10
0x0A	RNEG Port 11
0x0B	RNEG Port 12
0x0C	RNEG Port 13
0x0D	RNEG Port 14
0x0E	RNEG Port 15
0x0F	RNEG Port 16
0x10	1.544MHz On-board oscillator
0x11	2.048MHz On-board oscillator
0x12	User clock
0x13	CLKA DS26334/DS26324
0x14	TECLK DS26334/DS26324
0x15	Drive Logic “0”
0x16-0xFF	HI-Z

DS26334 INFORMATION

For more information about the DS26334, refer to the DS26334 data sheet available on our website at www.maxim-ic.com/DS26334.

DS26324 INFORMATION

For more information about the DS26324, refer to the DS26324 data sheet available on our website at www.maxim-ic.com/DS26324.

DS26334DK/DS26324DK INFORMATION

For more information about the DS26334DK/DS26324DK including software downloads, go to www.maxim-ic.com/DS26334DK.

TECHNICAL SUPPORT

For additional technical support, go to www.maxim-ic.com/support.

ERRATA

On page 18 of the schematic, EB0 and EB1 were swapped in the design on U3 and U10, respectively. These changes have been made to the board using jumper wires.

SCHEMATICS

The DS26334DK/DS26324DK schematics are featured in the following 25 pages.

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DS26334 DESIGN KIT
SCHEMATIC
DALLAS SEMICONDUCTOR / MAXIM
MAY 2005

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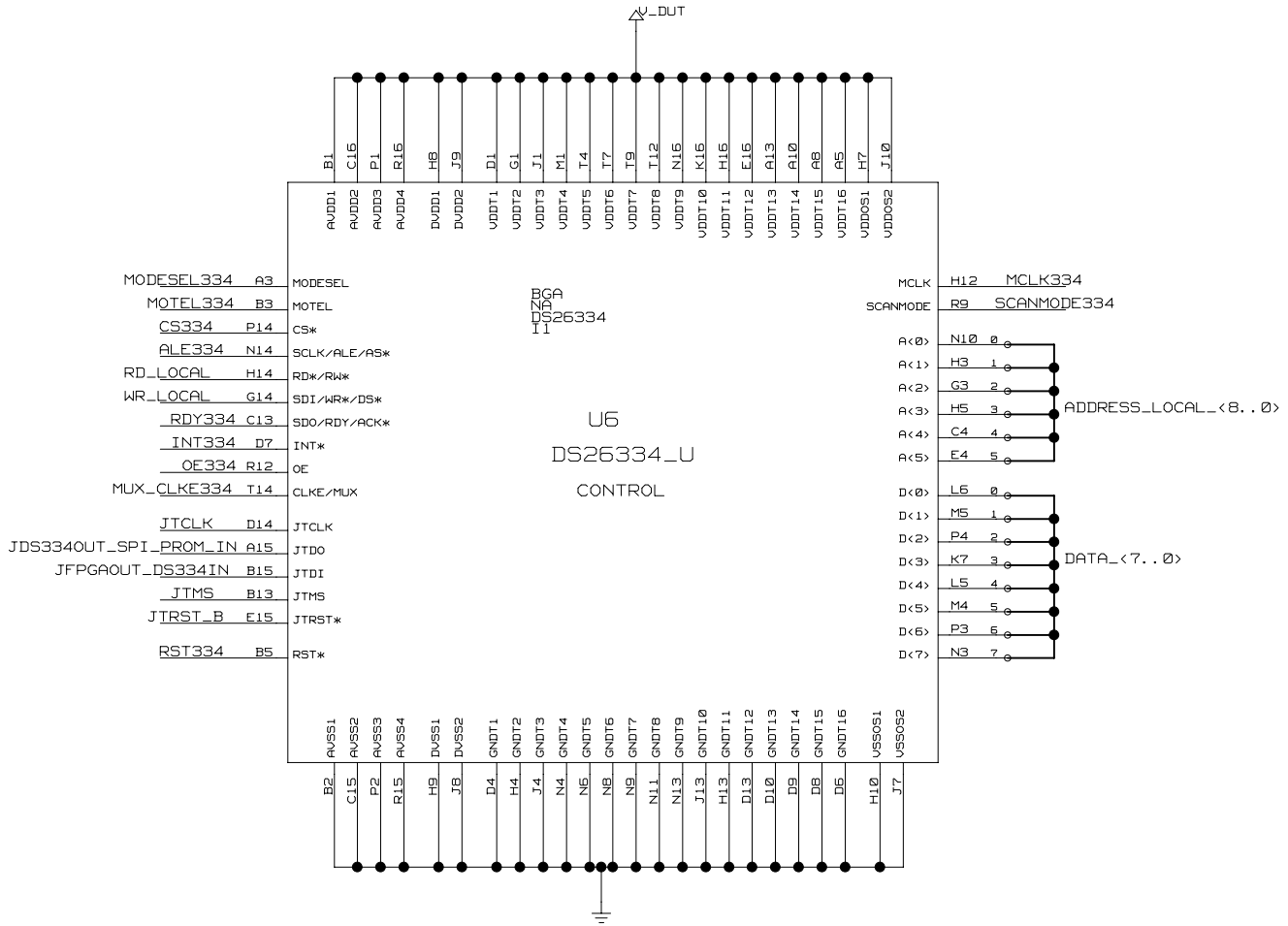
LIU POWER (V_DUT) IS
ISOLATED FROM
BOARD SUPPLY (V3_3)



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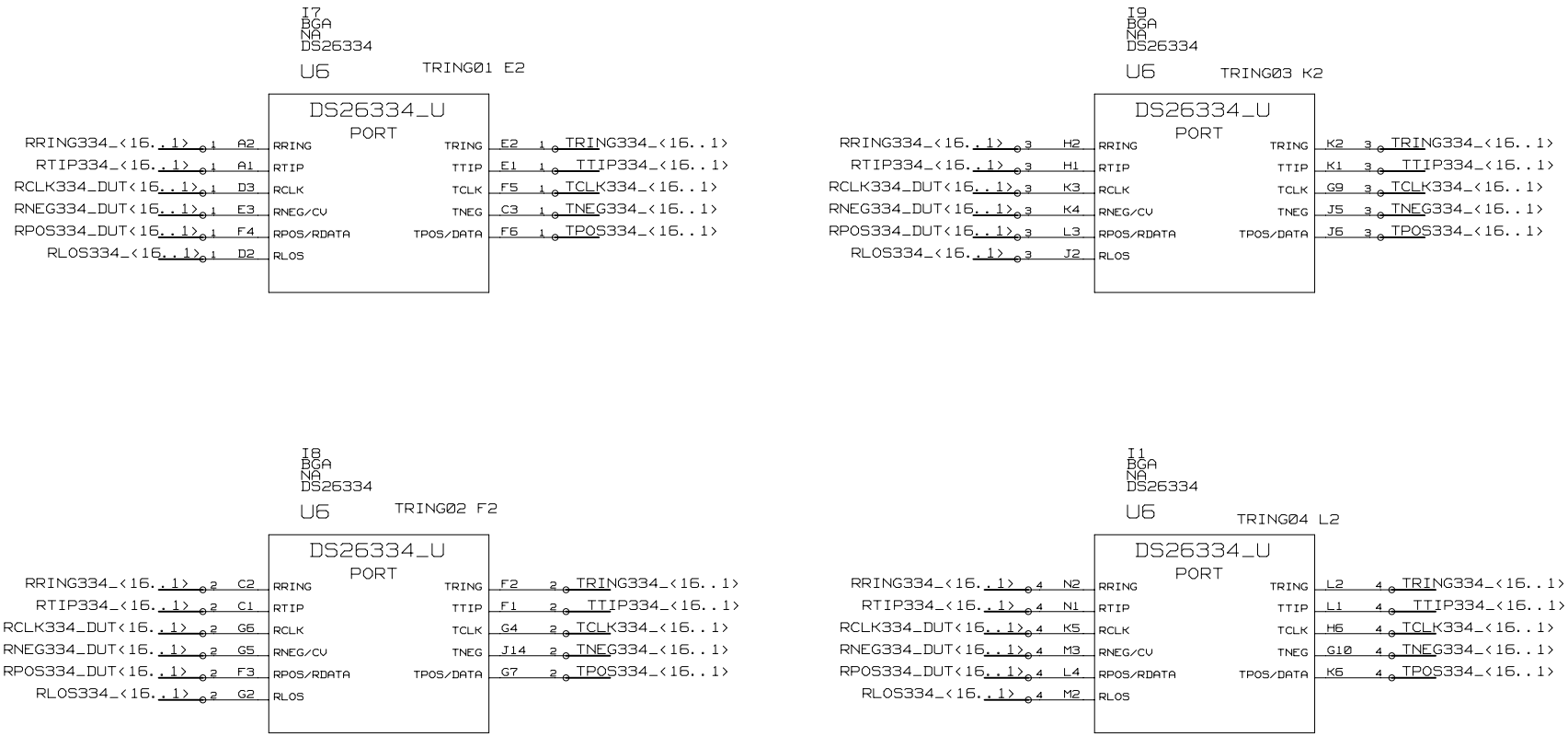
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E3
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TPOS/DATA
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K1
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RPOS334_DUT<16..1>
RLOS334_<16..1>
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M3
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RPOS/RDATA
RLOS
TRING
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TNEG
TPOS/DATA
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L1
H6
G10
K6
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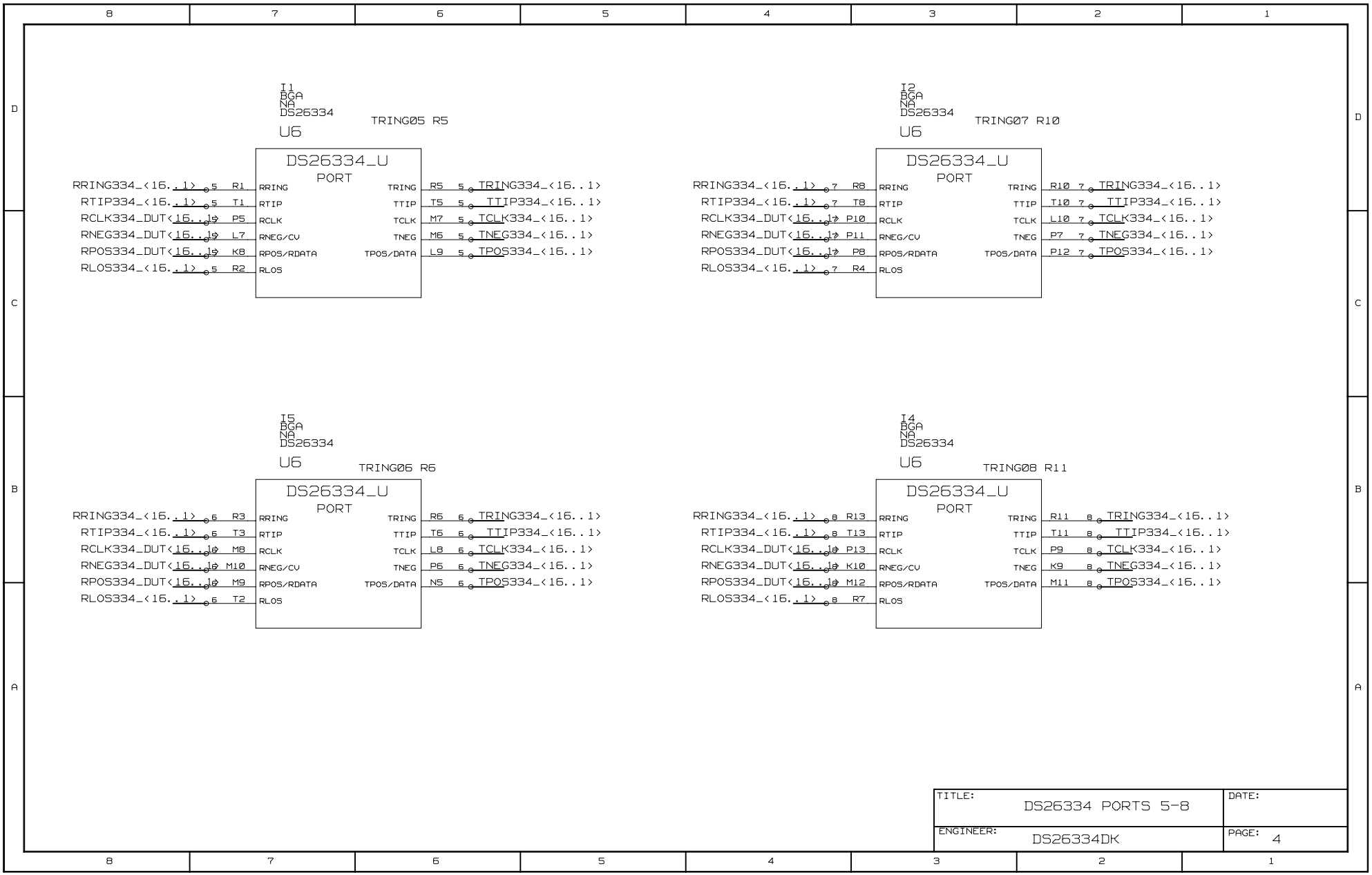
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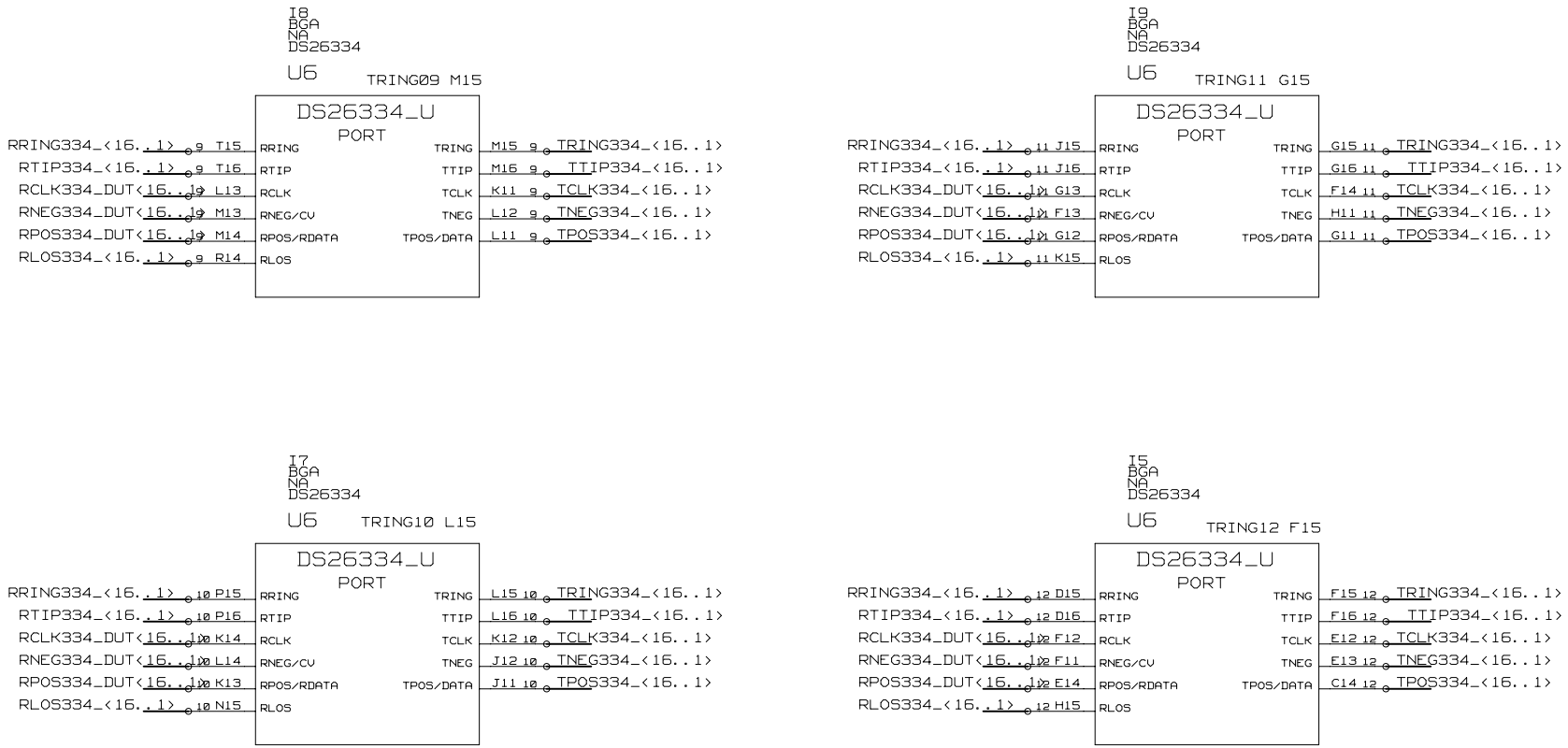

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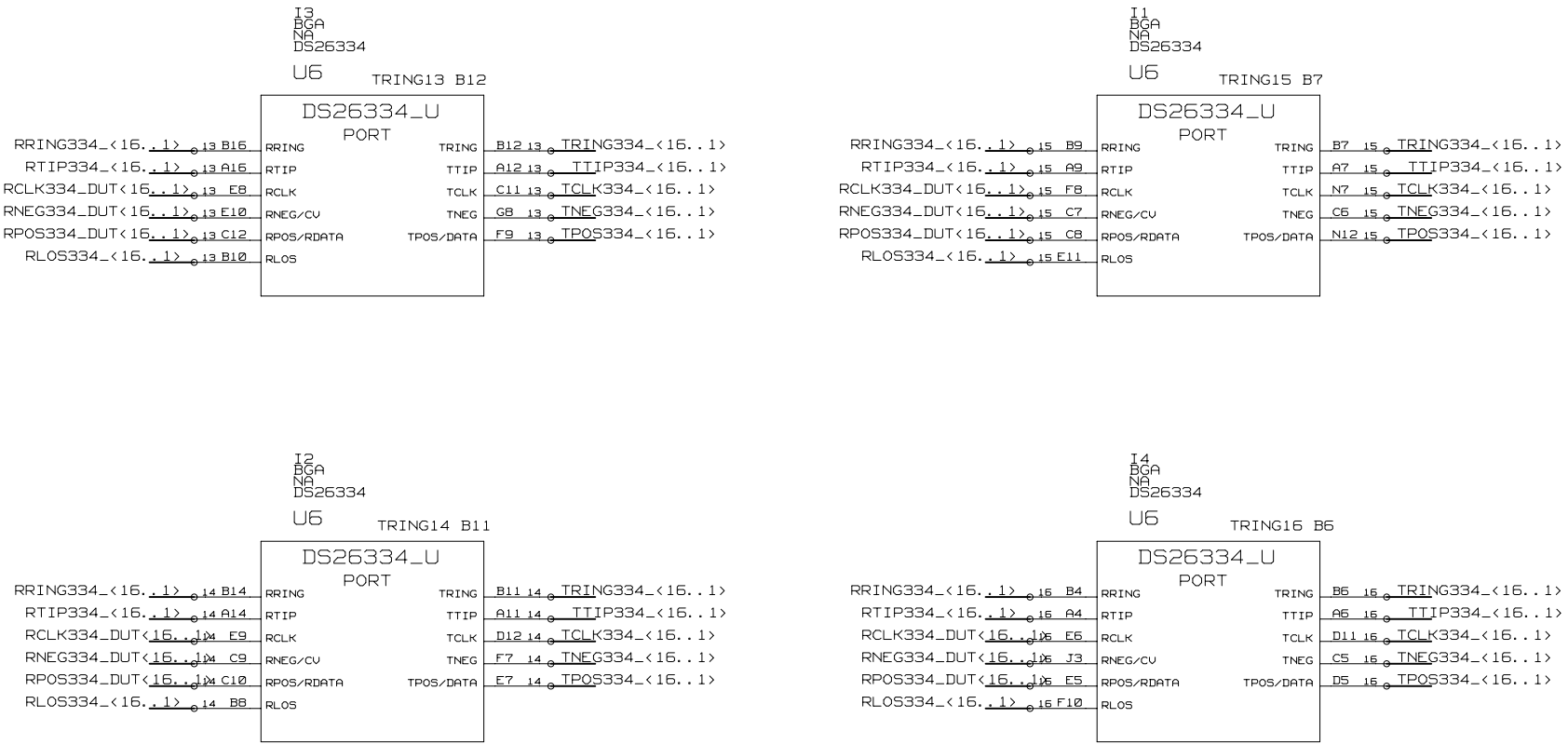

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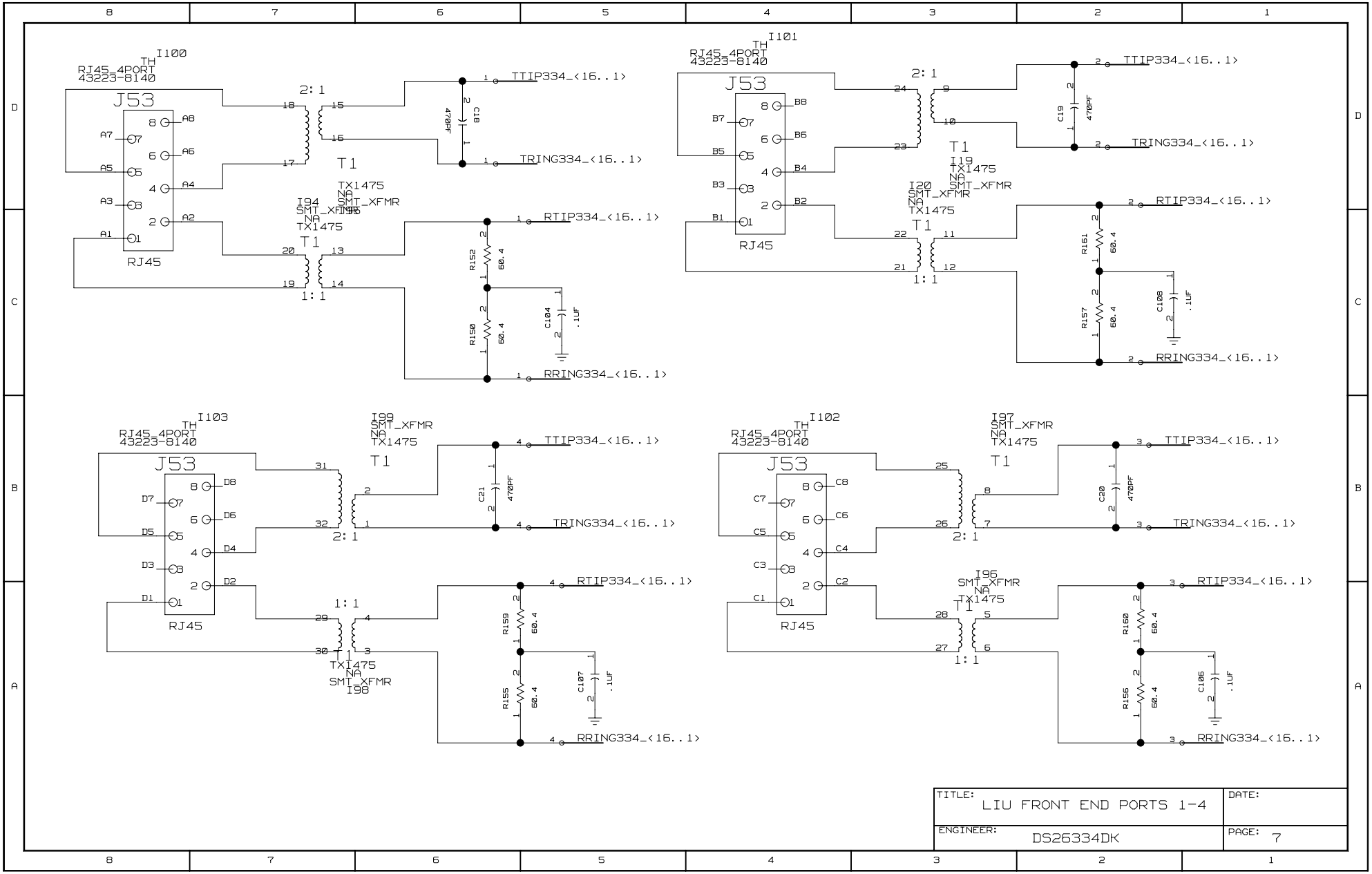

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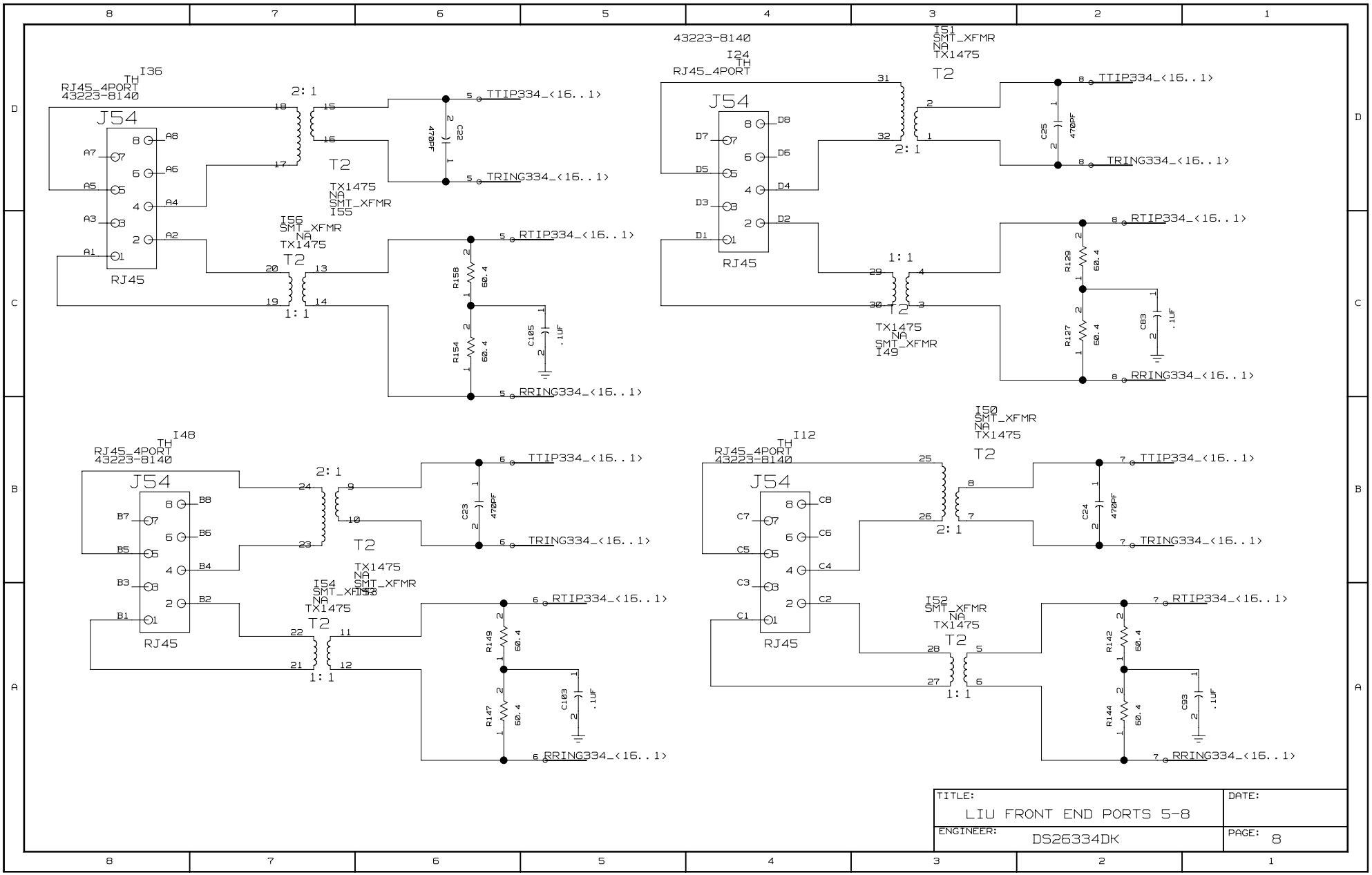

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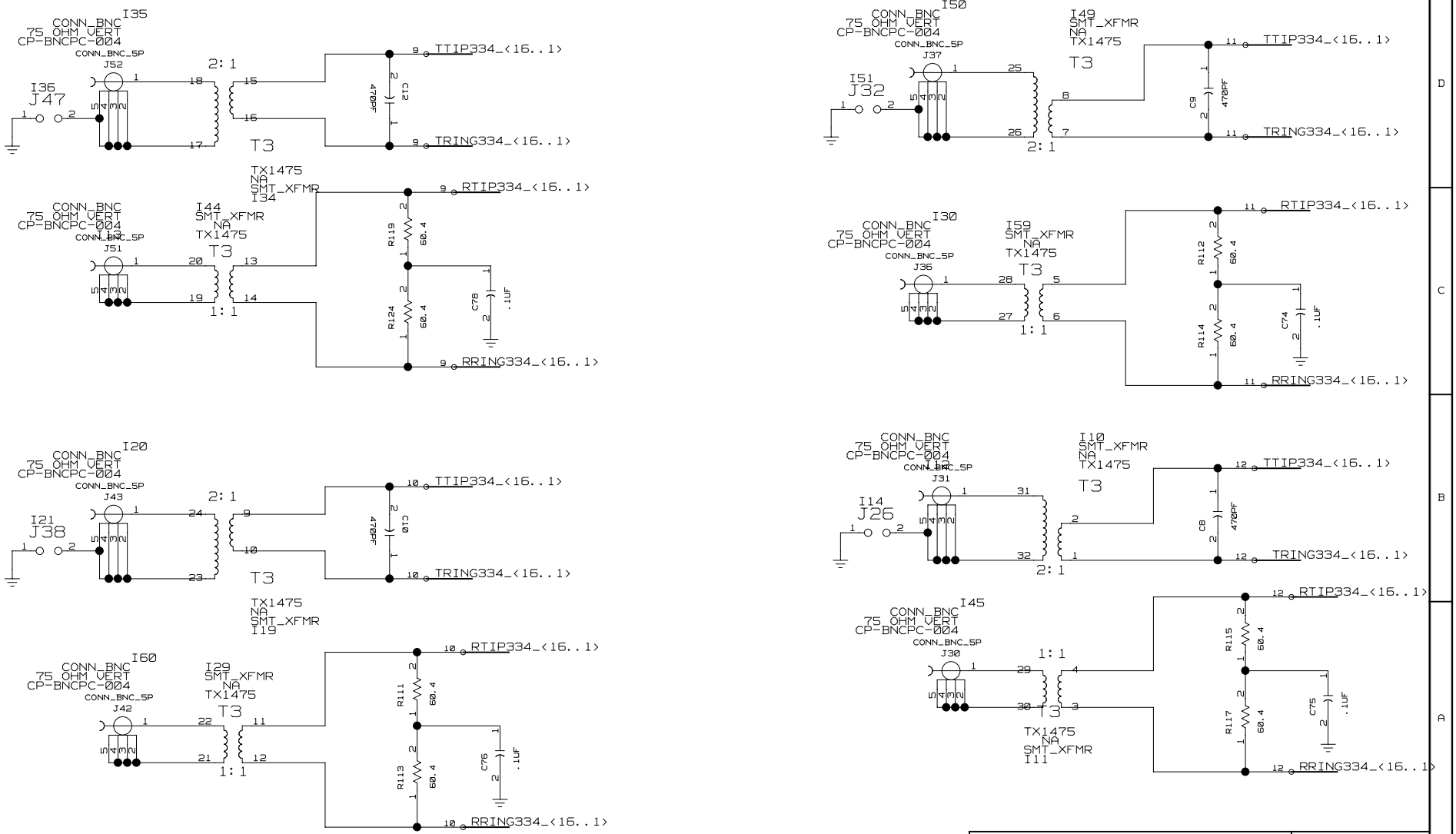

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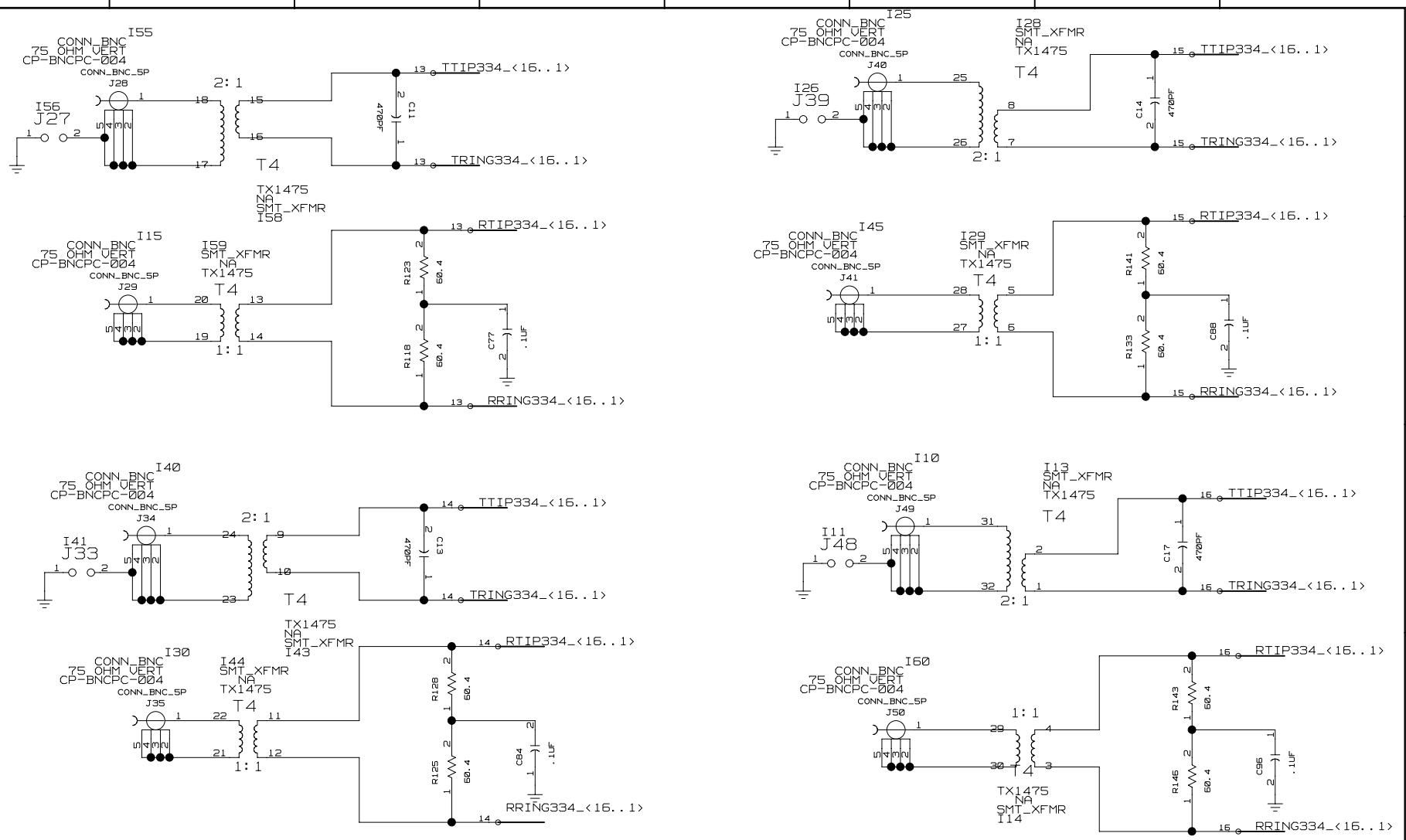
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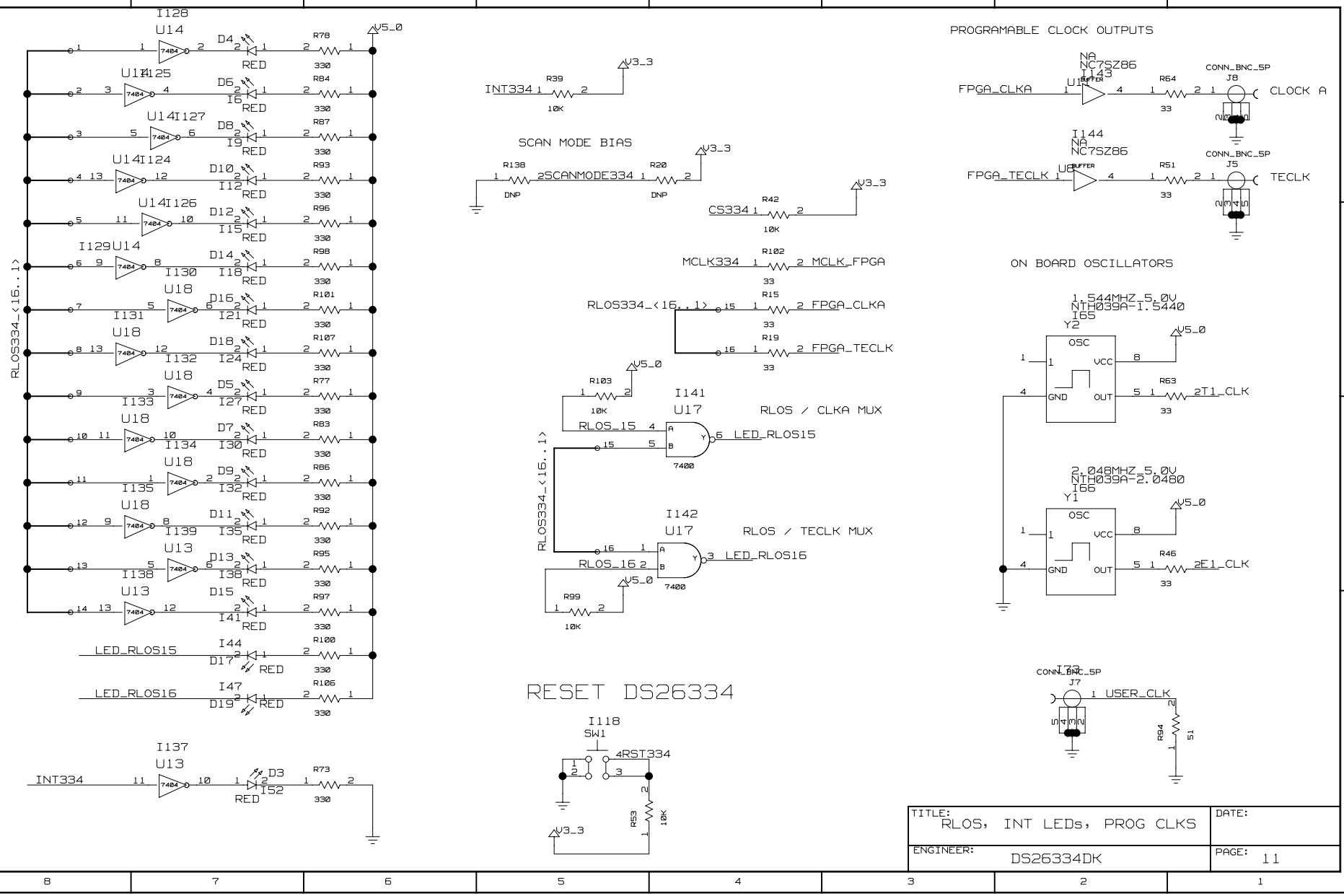
C96
.1UF
RTIP334_<16..1>
RRING334_<16..1>
TITLE:
LIU FRONT END PORTS 13-16
DATE:
ENGINEER:
DS26334DK
PAGE:
10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I128
U14
U14I125
U14I127
U14I124
U14I126
I129U14
U18
U18
U18
U18
U13
U13
D4
D6
D8
D10
D12
D14
D16
D18
D5
D7
D9
D11
D13
D15
I44
D17
I47
D19
RED
R78
R84
R87
R93
R96
R98
R101
R107
R77
R83
R86
R92
R95
R97
R100
R105
330
LED_RLOS15
LED_RLOS16
V5_0
I137
U13
INT334
D3
I52
R73
INT334
R39
10K
V3_3
SCAN MODE BIAS
R138
2SCANMODE334
R20
DNP
R42
CS334
MCLK334
R102
MCLK_FPGA
RLOS334_<16..1>
R15
FPGA_CLKA
R19
FPGA_TECLK
R103
I141
U17
RLOS / CLKA MUX
RLOS_15
LED_RLOS15
7400
I142
RLOS / TECLK MUX
RLOS_16
LED_RLOS16
R99
RESET DS26334
I118
SW1
4RST334
R53
PROGRAMABLE CLOCK OUTPUTS
NA
NC7SZ86
I143
I144
FPGA_CLKA
FPGA_TECLK
R64
R51
CONN_BNC_5P
J8
J5
CLOCK A
TECLK
ON BOARD OSCILLATORS
1.544MHZ_5.0V
NTH039A-1.5440
I65
Y2
2.048MHZ_5.0V
NTH039A-2.0480
I66
Y1
OSC
VCC
GND
OUT
R63
R46
2T1_CLK
2E1_CLK
I39
J7
USER_CLK
R94
51
TITLE:
RLOS, INT LEDs, PROG CLKS
DATE:
ENGINEER:
DS26334DK
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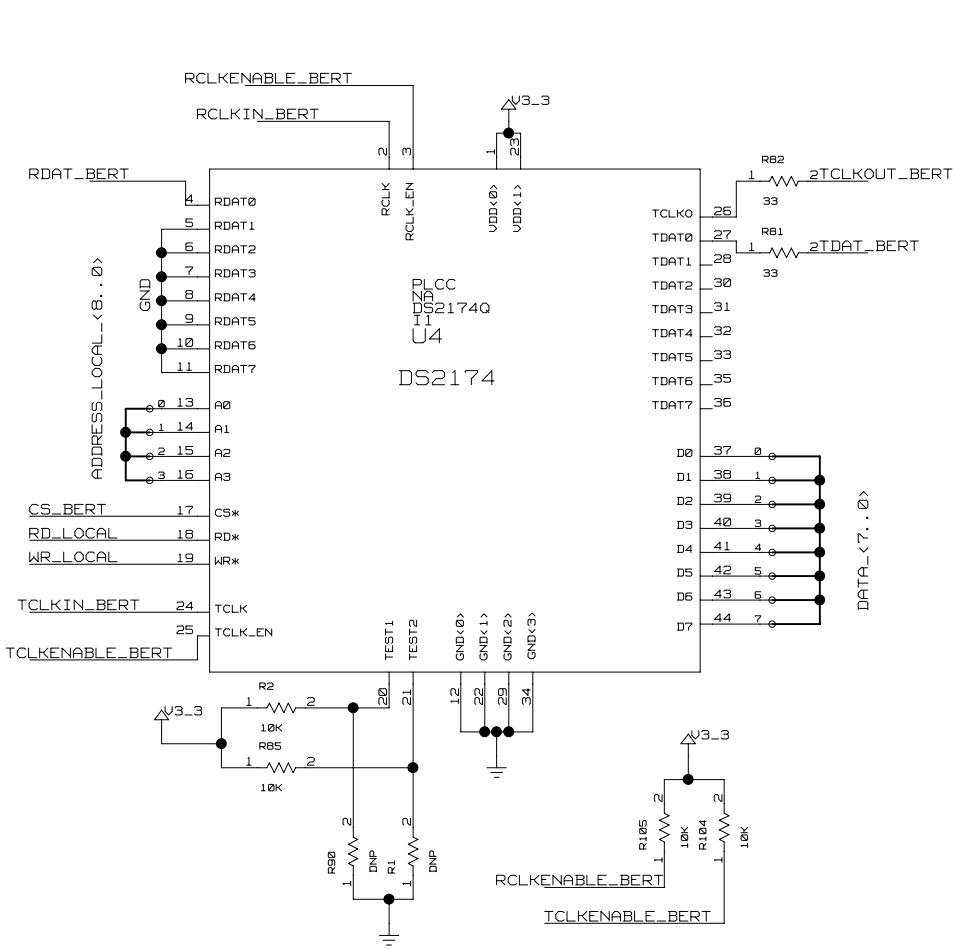
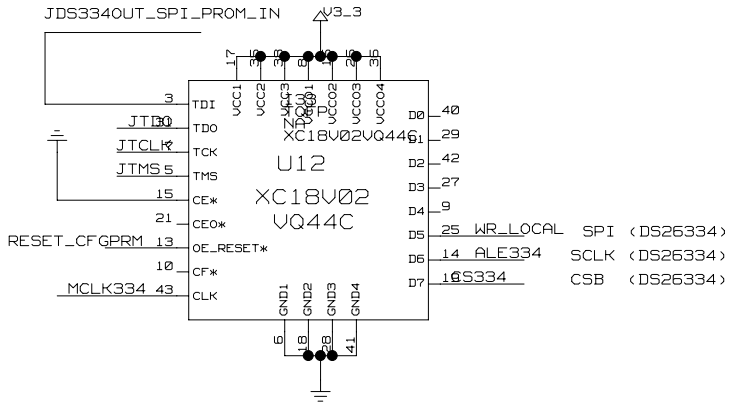
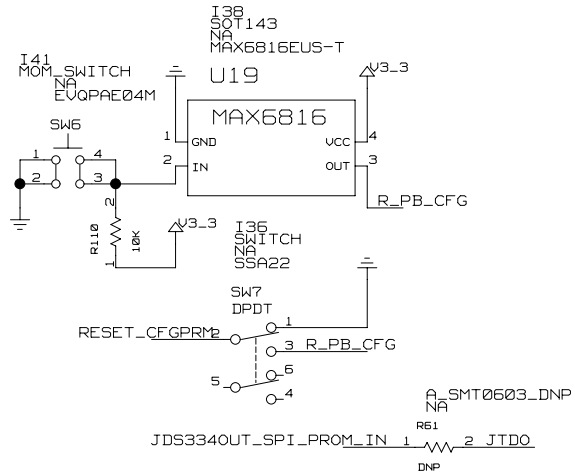
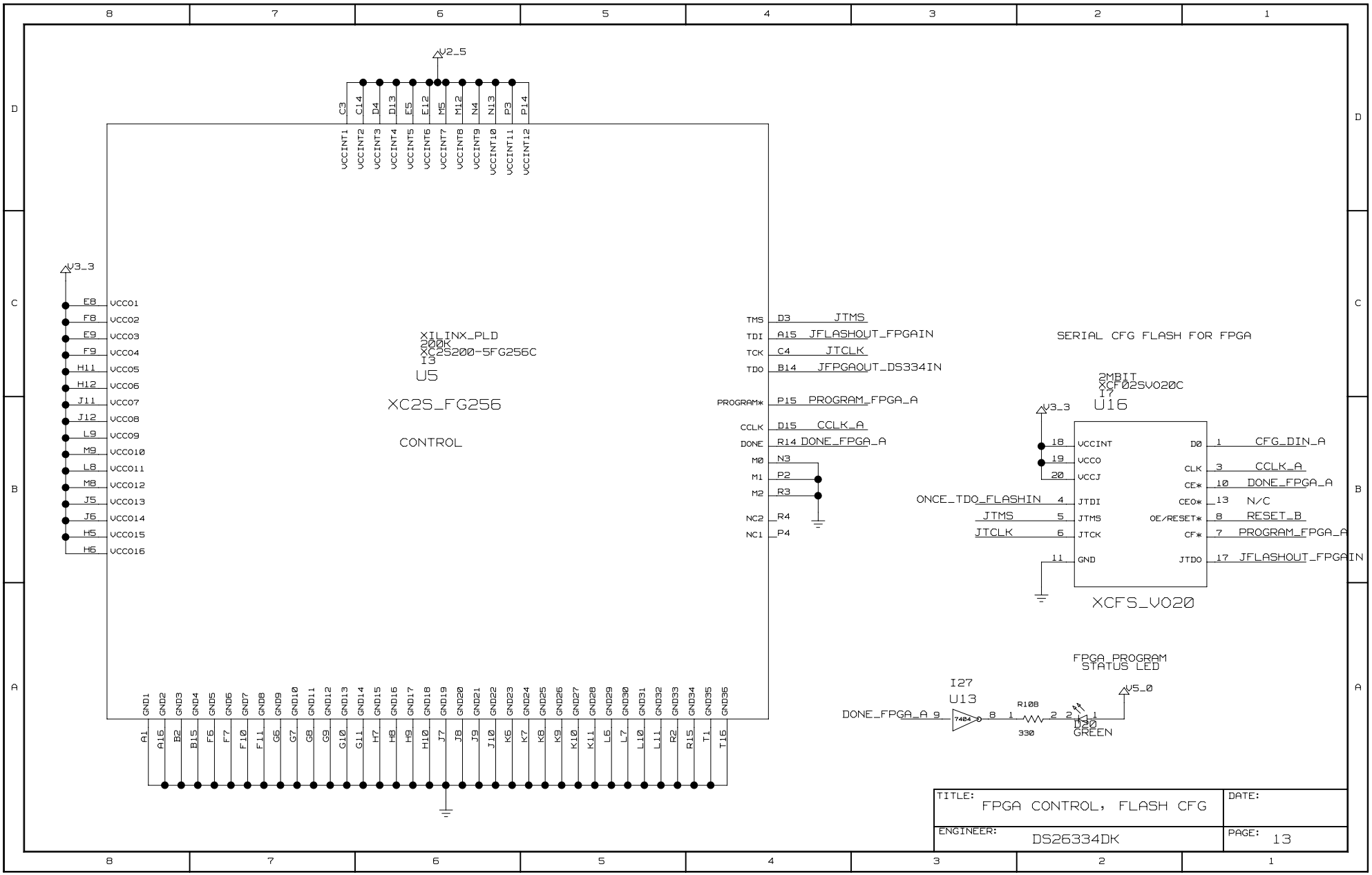
11



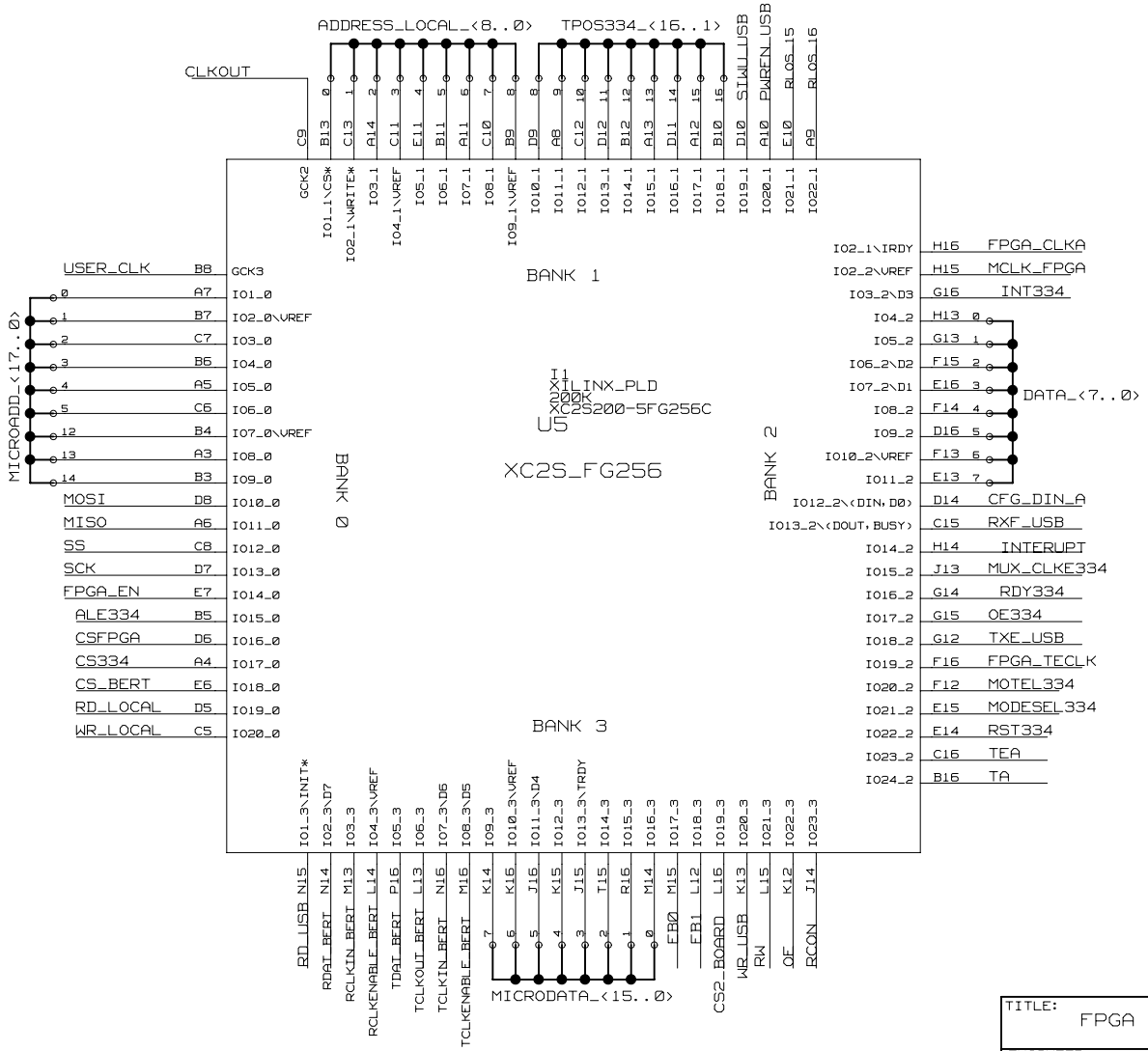




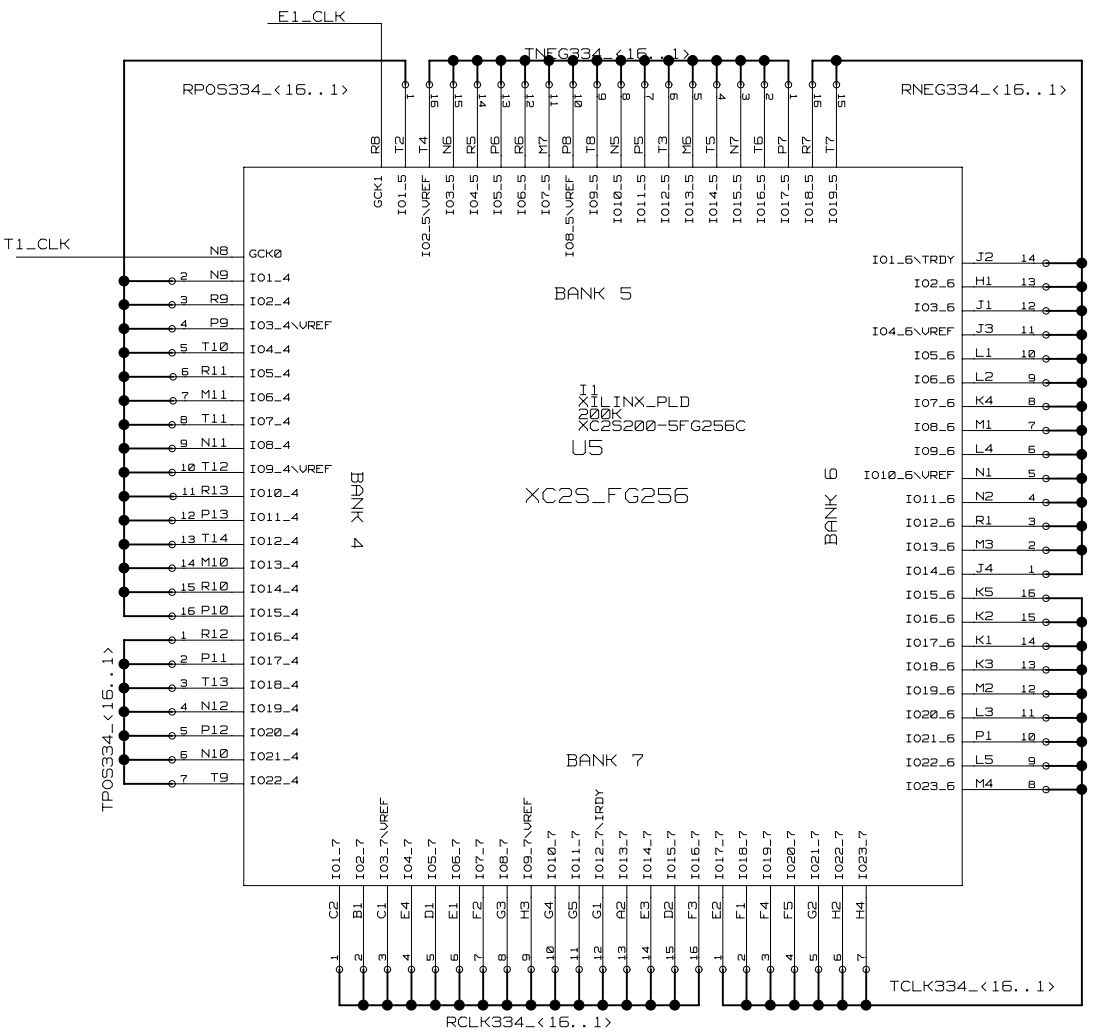
TITLE: EBERT x 1 / SPI PROM	DATE:
ENGINEER: DS26334DK	PAGE: 12



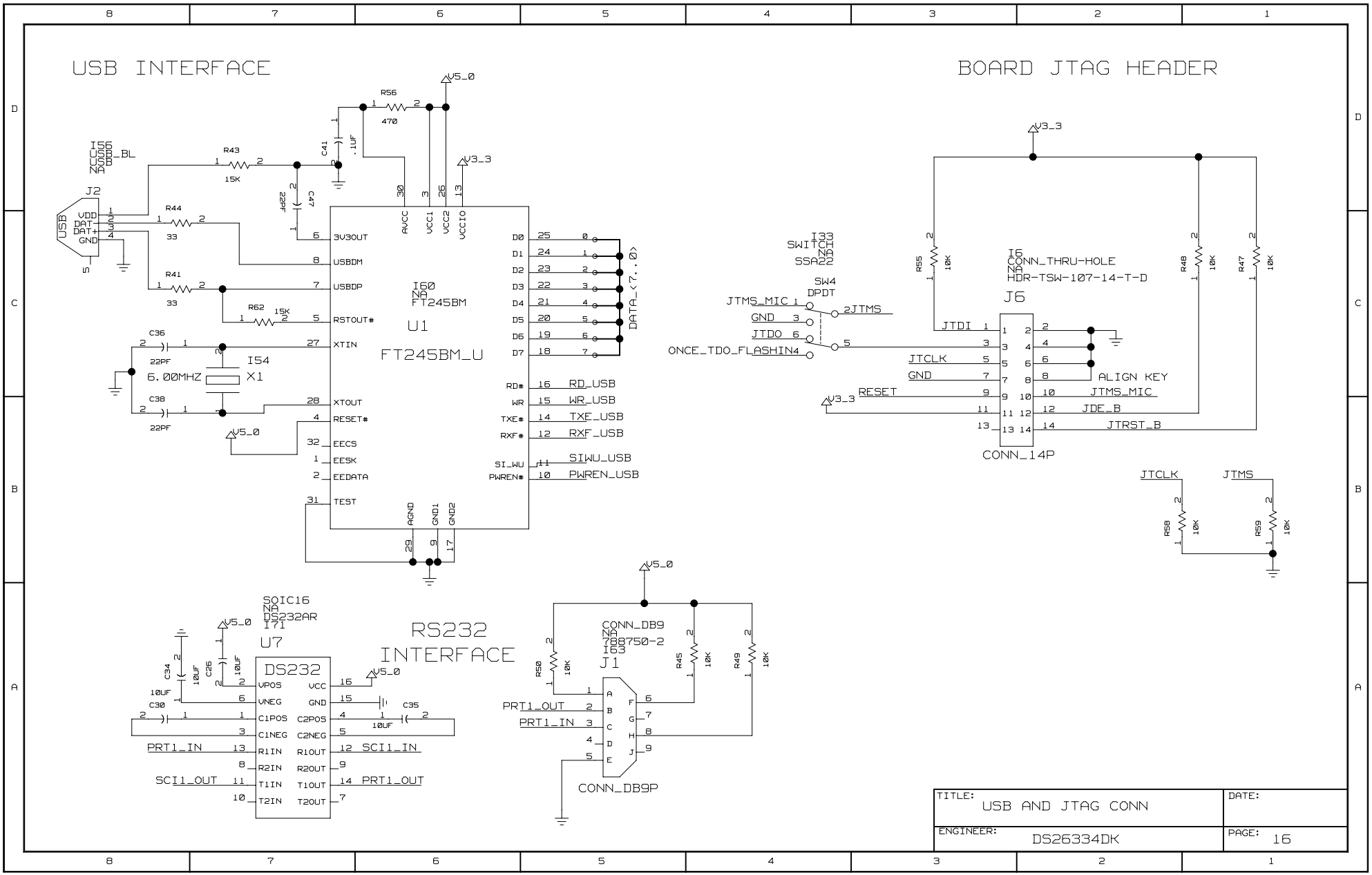
TITLE: FPGA CONTROL, FLASH CFG	DATE:
ENGINEER: DS26334DK	PAGE: 13



TITLE: FPGA BANK 1	DATE:
ENGINEER: DS26334DK	PAGE: 14



TITLE: FPGA BANK 2	DATE:
ENGINEER: DS26334DK	PAGE: 15


USB INTERFACE
BOARD JTAG HEADER
RS232 INTERFACE
USB
J2
VDD
DAT-
DAT+
GND
R44
33
R41
33
R43
15K
R56
470
C41
.1UF
C47
22PF
R62
15K
C36
22PF
C38
22PF
I54
6.00MHZ
X1
U1
FT245BM_U
I60
FT245BM
3V3OUT
USBDM
USBDP
RSTOUT#
XTIN
XTOUT
RESET#
EECS
EESK
EEDATA
TEST
AVCC
VCC1
VCC2
VCC10
AGND
GND1
GND2
D0
D1
D2
D3
D4
D5
D6
D7
DATA_<7..0>
RD#
WR
TXE#
RXF#
SI_WU
PWREN#
RD_USB
WR_USB
TXE_USB
RXF_USB
SIWU_USB
PWREN_USB
V5_0
V3_3
I55
ZCC0603
DNI
DIODE_BL
SW4
DPDT
JTMS_MIC
GND
JTDO
ONCE_TDO_FLASHIN
2JTMS
5
R55
10K
R48
10K
R47
10K
I6
ZCC
NA
CONN_THRU-HOLE
HDR-TSW-107-14-T-D
J6
JTDI
JTCLK
GND
RESET
ALIGN KEY
JTMS_MIC
JDE_B
JTRST_B
CONN_14P
R58
10K
R59
10K
JTCLK
JTMS
U7
SOIC16
NA
DS232AR
I71
DS232
VPOS
VNEG
C1POS
C1NEG
C2POS
C2NEG
R1IN
R2IN
T1IN
T2IN
R1OUT
R2OUT
T1OUT
T2OUT
VCC
GND
C34
C26
C30
C35
10UF
PRT1_IN
SCI1_OUT
SCI1_IN
PRT1_OUT
R50
10K
R45
10K
R49
10K
J1
CONN_DB9
NA
788750-2
163
CONN_DB9P
TITLE:
USB AND JTAG CONN
DATE:
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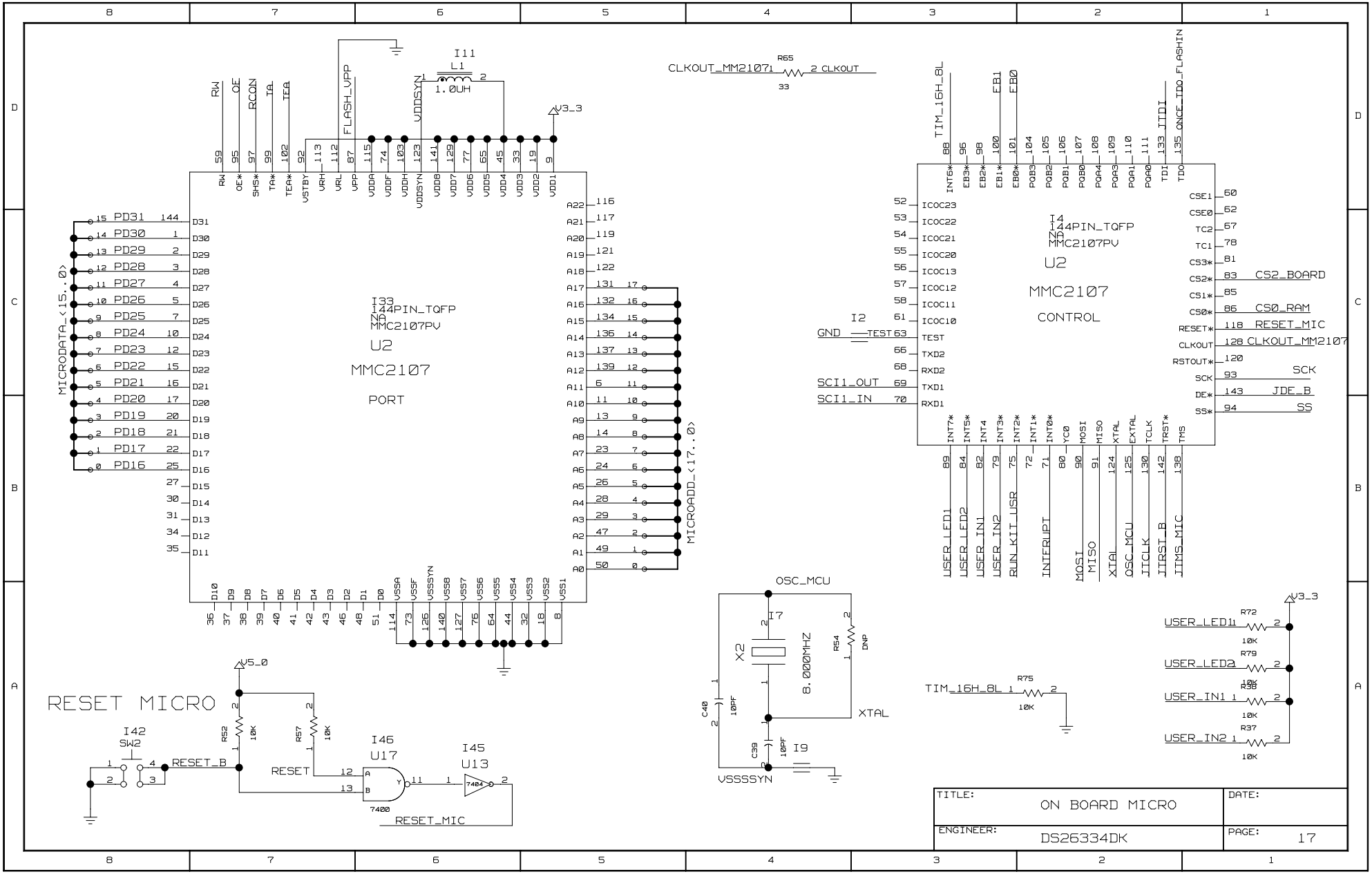
I33
144PIN_TQFP
MMC2107PV
U2
MMC2107
PORT
I4
144PIN_TQFP
MMC2107PV
U2
MMC2107
CONTROL
I2
I11
L1
1.0UH
R65
33
CLKOUT_MM2107
2 CLKOUT
MICRODATA_<15..0>
MICROADD_<17..0>
RESET MICRO
I42
SW2
RESET_B
R52
10K
R57
10K
RESET
I46
U17
7400
I45
U13
7404
RESET_MIC
OSC_MCU
X2
8.000MHZ
I7
I9
C40
10PF
C39
10PF
R54
DNP
XTAL
VSSSSYN
TIM_16H_8L
R75
10K
USER_LED1
USER_LED2
USER_IN1
USER_IN2
R72
R79
R38
R37
10K
CS2_BOARD
CS0_RAM
RESET_MIC
CLKOUT_MM2107
SCK
JDE_B
SS
SCI1_OUT
SCI1_IN
INTERRUPT
MOSI
MISO
XTAL
OSC_MCU
JTCLK
JTRST_B
JTMS_MIC
TITLE:
ON BOARD MICRO
DATE:
ENGINEER:
DS26334DK
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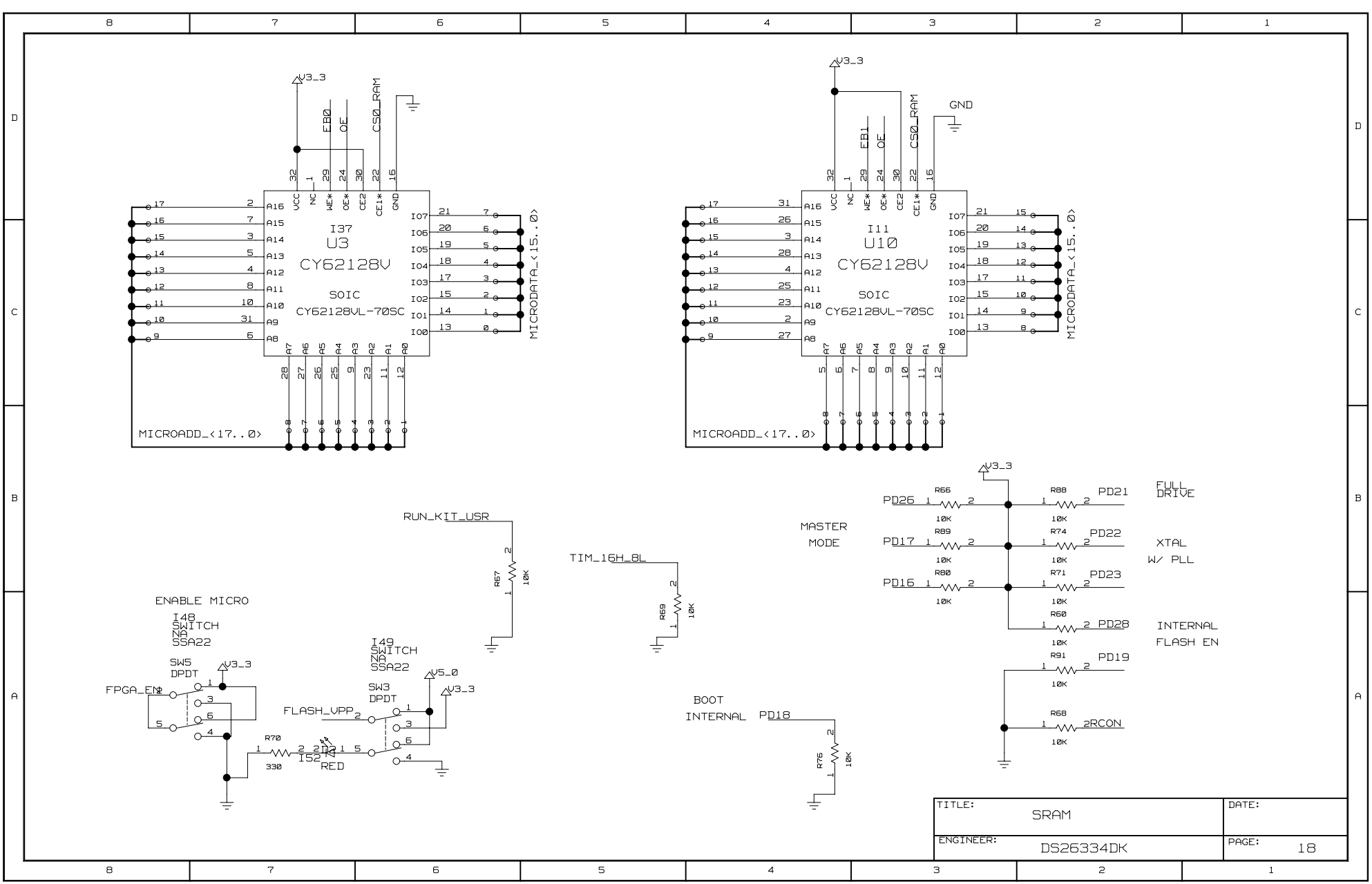
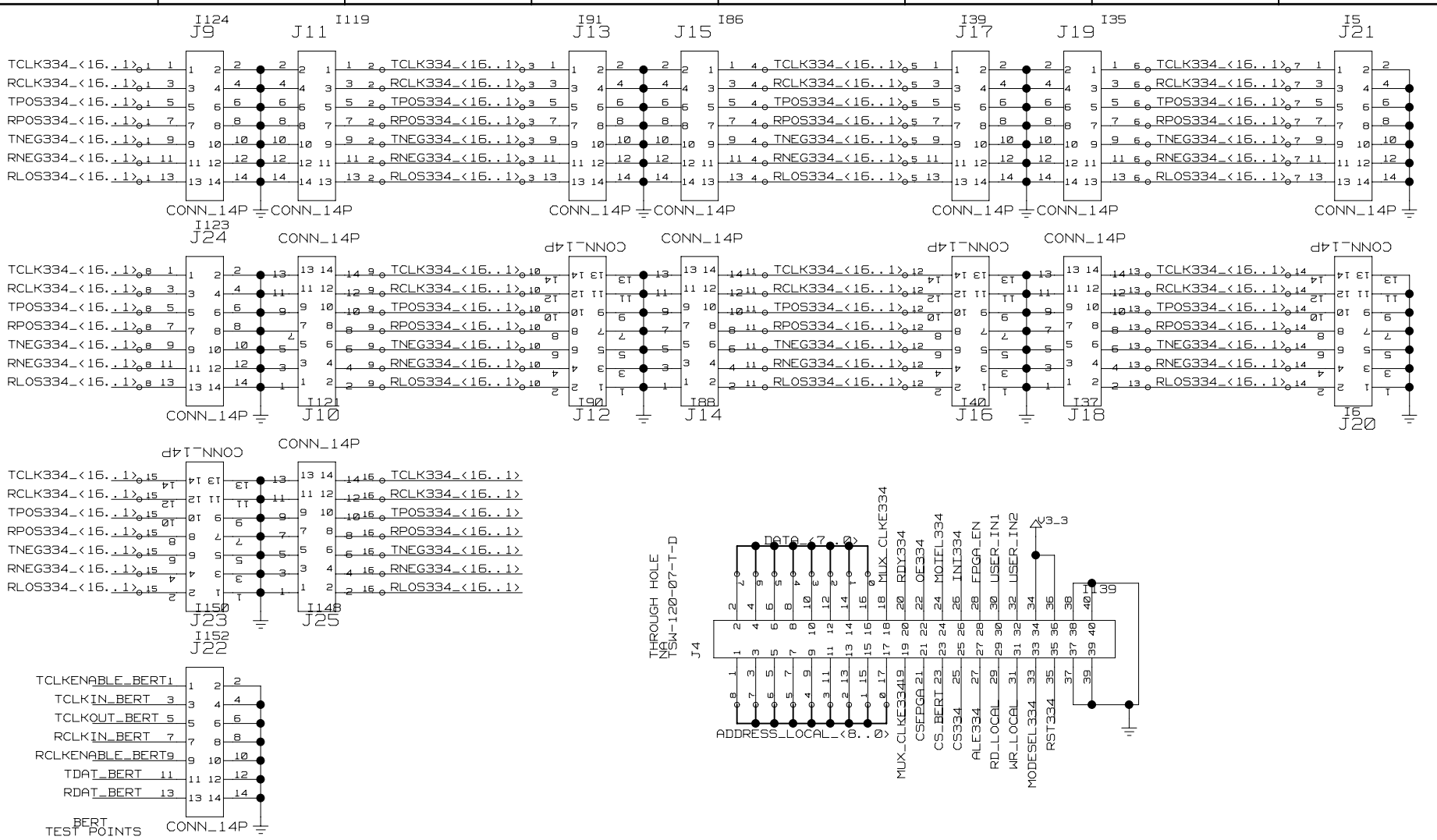
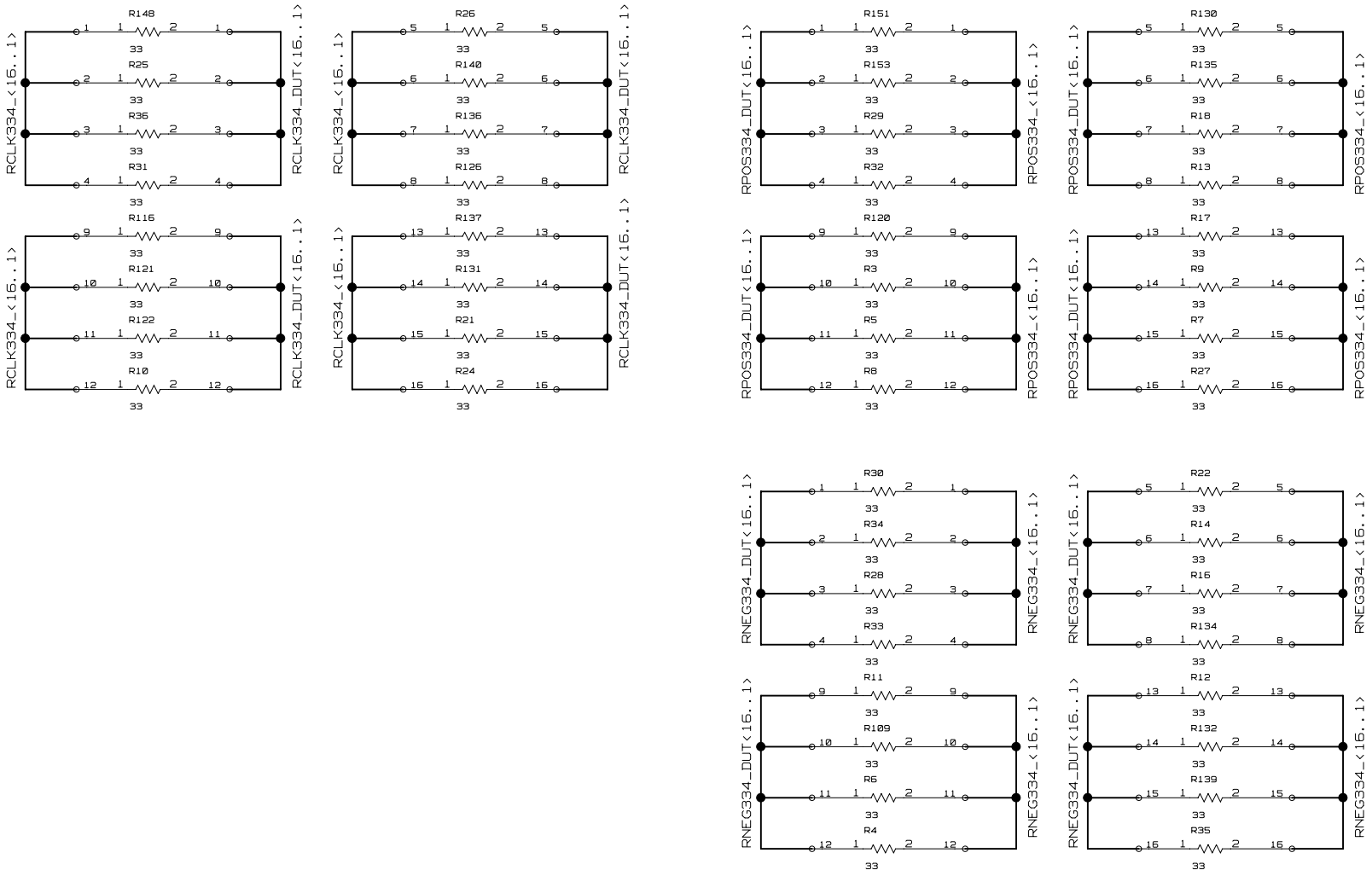


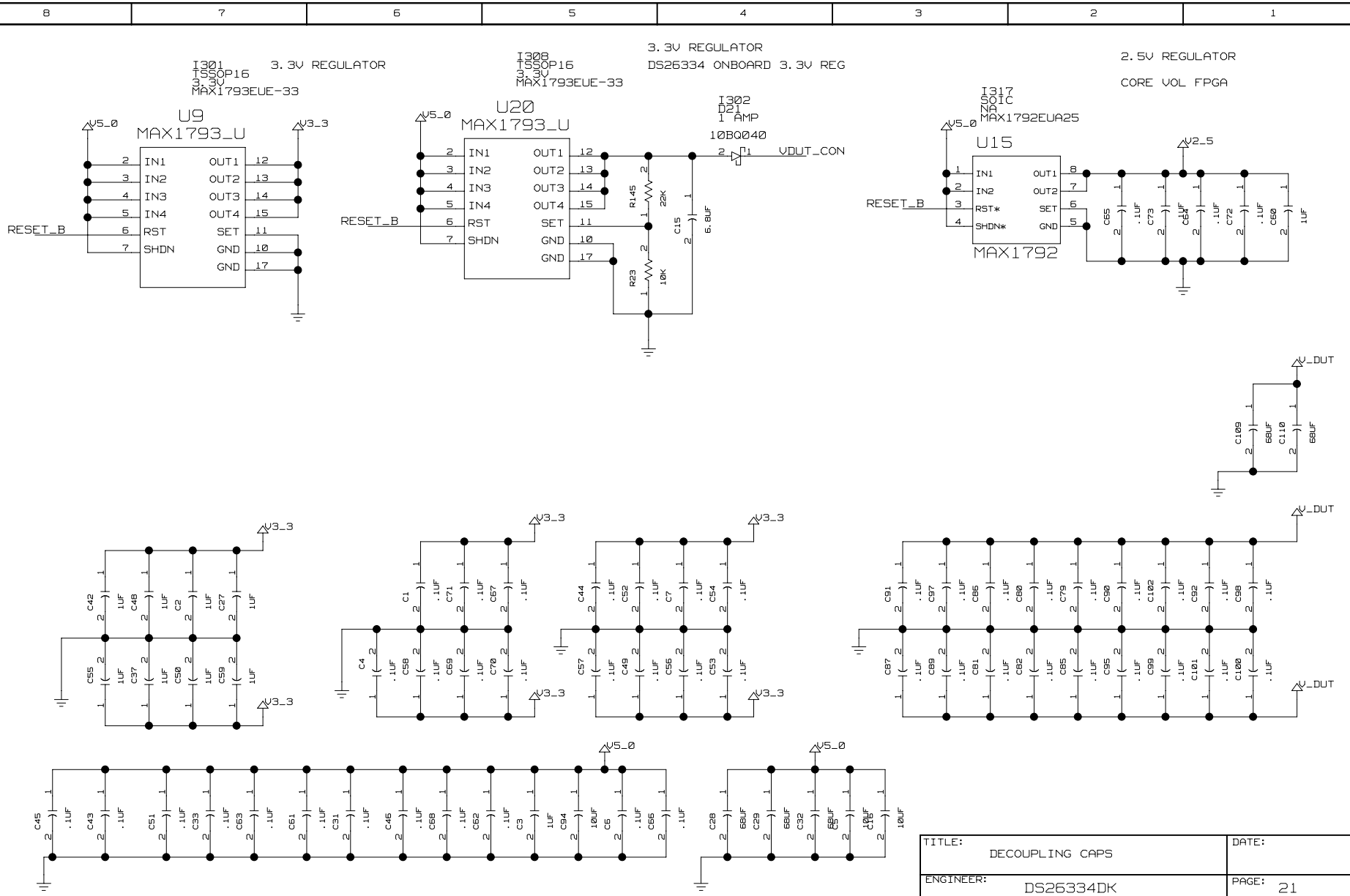
TITLE: SRAM	DATE:
ENGINEER: DS26334DK	PAGE: 18



TITLE:	TEST POINTS	DATE:	
ENGINEER:	DS26334DK	PAGE:	19

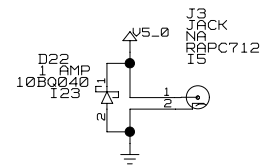


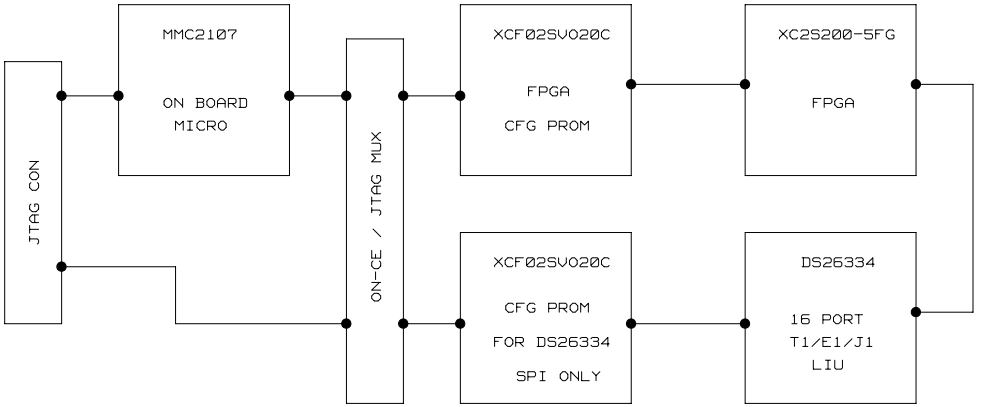
TITLE: LIU SERIES TERMINATION	DATE:
ENGINEER: DS26334DK	PAGE: 20

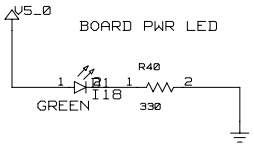


TITLE: DECOUPLING CAPS	DATE:
ENGINEER: DS26334DK	PAGE: 21

5V DC POWER SUPPLY
REVERSE BIAS PROTECTION

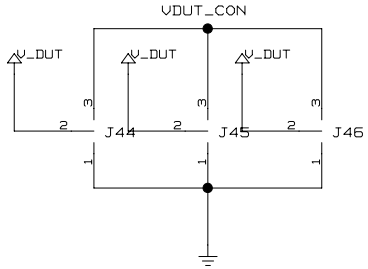




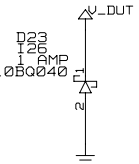


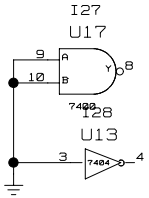
JTAG NOTES

SPLIT BOARD POWER SUPPLY
AND DUT POWER SUPPLY (V_DUT)



REVERSE BIAS PROTECTION





I1
0L_HARDWARE
.75STANDOFF_.25SCR
4-40KIT2

H1

I2
0L_HARDWARE
.75STANDOFF_.25SCR
4-40KIT2

H2

I3
0L_HARDWARE
.75STANDOFF_.25SCR
4-40KIT2

H3

I4
0L_HARDWARE
.75STANDOFF_.25SCR
4-40KIT2

H4

TITLE:	DATE:
ENGINEER: DS26334DK	PAGE: 22

*** Signal Cross-Reference for the entire design ***

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ALE334                12C1> 14B7<> 19A3<> 2C7<
CCLK_A                13B3<> 13B1<
CFG_DIN_A             13B1> 14B3<>
CLKOUT                14D7< 17D3<
CLKOUT_MM2107         17C1<> 17D4<
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CS2_BOARD             14A4<> 17C1<>
CS334                 12C1> 14B7<> 19A3<> 2C7< 11C4<
CSFPGA                14B7<> 19A3<>
CS_BERT               14B7<> 19A3<> 12B8<
DATA_<7..0>           2B3 12B5 14C3 16C5 19B4
DONE_FPGA_A           13B3<> 13A3< 13B1<
E1_CLK                11B1< 15D6<
EB0                   14A4<> 17D3<> 18D7<
EB1                   14A4<> 17D3<> 18D3<
FLASH_VPP             18A7<> 17D7<
FPGA_CLKA             11D3<> 14C3<> 11C3<
FPGA_EN               14B7<> 18A8<> 19B3<>
FPGA_TECLK            11D3<> 14B3<> 11C3<
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INTERUPT              14B3<> 17B2<>
JDE_B                 16B2<> 17B1<>
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JFPGAOUT_DS334IN      13C3> 2B7<
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                      13C3< 16B2<
JTDI                  16C3<> 17D2<>
JTDO                  12D3> 16C4<> 12A1<
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JTRST_B               16B2<> 17B2<> 2B7<
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LED_RLOS16            11A8<> 11B4>
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MCLK_FPGA             14C3<> 11C3<
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MICRODATA_<15..0>     14A5 17B8 18C2 18C5
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MODESEL334            14B3<> 19A3<> 2C7<
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MOTEL334              14B3<> 19B3<> 2C7<
MUX_CLKE334           14B3<> 19A4<> 19B4<> 2B7<
OE                    14A4<> 17D7<> 18D3< 18D7<
OE334                 14B3<> 19B3<> 2B7<
ONCE_TDO_FLASHIN      16C4<> 17D2<> 13B3<
OSC_MCU               17B2<> 17B4<>
PD16                  17B8<> 18B3<
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PD19                  17B8<> 18A2<
PD20                  17B8<>
PD21                  17C8<> 18B2<
PD22                  17C8<> 18B2<
PD23                  17C8<> 18B2<
PD24                  17C8<>
PD25                  17C8<>
PD26                  17C8<> 18B3<
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PD30                  17C8<>
PD31                  17C8<>
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PRT1_IN               16A6<> 16A8<
PRT1_OUT              16A6<> 16A6>
PWREN_USB             14D4<> 16B5>
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                 19C8< 19D2 19D4 19D6 19D8< 20C6 20C6
                 20C8 20C8
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```

```
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RCLKIN_BERT      14A6<> 19A8<> 12D7<
RCON             14A4<> 17D7<> 18A2<
RDAT_BERT        14A6<> 19A8<> 12D8<
RDY334           2B7> 14B3<> 19B4<>
RD_LOCAL         14B7<> 19A3<> 2C7< 12B8<
RD_USB           14A6<> 16C5>
RESET            16B3<> 17A7<
RESET_B          13B1<> 17A8<> 21C6> 21C8> 21D3>
RESET_CFGPRM     12A3<> 12C3<>
RESET_MIC        17A6> 17C1<>
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                 6A4< 6A8< 6C4< 6C8< 11B5 11C5 11C8
                 19B8< 19C2 19C4 19C6 19C8< 19D2 19D4
                 19D6 19D8<
RLOS_15          14D4<> 11B5<
RLOS_16          14D4<> 11B5<
RNEG334_<16..1>  19B6> 15D4 19B8< 19C2 19C4 19C6
                 19C8< 19D2 19D4 19D6 19D8< 20A1 20A3
                 20B1 20B3
RNEG334_DUT<16..1>  3B5< 3B8< 3C5< 3C8< 4B4< 4B8<
                 4C4< 4C8< 5B4< 5B8< 5C4< 5C8< 6B4<
                 6B8< 6C5< 6C8< 20A3 20A4 20B3 20B4
RPOS334_<16..1>  19B6> 15D7 19B8< 19C2 19C4 19C6
                 19C8< 19D2 19D4 19D6 19D8< 20C1 20C1
                 20C3 20C3
RPOS334_DUT<16..1>  3B5< 3B8< 3C5< 3C8< 4B4< 4B8<
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                 6B8< 6C5< 6C8< 20C3 20C3 20C4 20C4
RRING334_<16..1>  7A1> 7A4> 7C1> 7C5> 8A1> 8A5>
                 8B5> 8C1> 9A1> 9A5> 9C1> 9C5> 10A1>
                 10A5> 10C1> 10C5> 3B4< 3B8< 3D5<
                 3D8< 4B4< 4B8< 4D4< 4D8< 5B4< 5B8<
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RST334           11A5<> 14A3<> 19A3<> 2B7<
RTIP334_<16..1>  7B1> 7B4> 7C1> 7C5> 8A1> 8A5> 8C1>
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                 10C1> 10C5> 3B4< 3B8< 3C4< 3C8< 4B4<
                 4B8< 4C4< 4C8< 5B4< 5B8< 5C4< 5C8<
                 6B4< 6B8< 6C4< 6C8<
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RW               14A4<> 17D7<>
RXF_USB          14B3<> 16B5>
R_PB_CFG         12A2<> 12B2>
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SCI1_OUT         17C4<> 16A8<
SCK              14B7<> 17C1<>
SIWU_USB         14D4<> 16B5>
SS               14B7<> 17B1<>
T1_CLK           11B1< 15C7<
TA               14A3<> 17D7<>
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                 6C1> 6C5> 19B6> 15A4 19B8< 19C2 19C4
                 19C6 19C8< 19D2 19D4 19D6 19D8<
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TCLKIN_BERT      14A5<> 19A8<> 12B8<
TCLKOUT_BERT     14A6<> 19A8<> 12D5<
TDAT_BERT        14A6<> 19A8<> 12C5<
TEA              14A3<> 17D7<>
TEST             17C3<>
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                 6C1> 6C5> 19B6> 15D5 19B8< 19C2 19C4
                 19C6 19C8< 19D2 19D4 19D6 19D8<
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                 19C4 19C6 19C8< 19D2 19D4 19D6 19D8<
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USER_IN2            17B3<> 19B3<> 17A2<
USER_LED1           17B3<> 17A2<
USER_LED2           17B3<> 17A2<
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VDUT_CON            21D4<> 22A7<>
VSSSSYN             17A4<
WR_LOCAL            12C1> 14A7<> 19A3<> 2B7< 12B8<
WR_USB              14A4<> 16B5>
XTAL                17A3<> 17B2<>
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C3	CAP1	21A5
C4	CAP1	21A6
C5	CAP1	21A3
C6	CAP1	21A5
C7	CAP1	21B4
C8	CAP1	9B2
C9	CAP1	9D2
C10	CAP1	9B6
C11	CAP1	10D6
C12	CAP1	9D6
C13	CAP1	10B6
C14	CAP1	10D2
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C16	CAP1	21A3
C17	CAP1	10B2
C18	CAP1	7D6
C19	CAP1	7D2
C20	CAP1	7B2
C21	CAP1	7B6
C22	CAP1	8D6
C23	CAP1	8B6
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C106	CAP1	7A1
C107	CAP1	7A5
C108	CAP1	7C2
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C110	CAP1	21B1
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D4	LED	11D7
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D6	LED	11D7
D7	LED	11B7
D8	LED	11D7
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D11	LED	11B7
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D14	LED	11C7
D15	LED	11B7
D16	LED	11C7
D17	LED	11A7
D18	LED	11C7
D19	LED	11A7
D20	LED	13A2
D21	SCHOTTKYDIODE1	21D4
D22	SCHOTTKYDIODE1	22D8
D23	SCHOTTKYDIODE1	22A6
H1	4_40_HDWR	22B1
H2	4_40_HDWR	22B1
H3	4_40_HDWR	22A1
H4	4_40_HDWR	22A1
J1	CONN_DB9P	16A5
J2	USB_BCON_U	16D8
J3	POWER_JACK	22D8
J4	CONN_40P	19A5
J5	CONN_BNC_5P	11D1
J6	CONN_14P	16C3
J7	CONN_BNC_5P	11A2
J8	CONN_BNC_5P	11D1
J9	CONN_14P	19D7
J10	CONN_14P	19C7
J11	CONN_14P	19D7
J12	CONN_14P	19C5
J13	CONN_14P	19D5
J14	CONN_14P	19C5
J15	CONN_14P	19D5
J16	CONN_14P	19C3
J17	CONN_14P	19D3
J18	CONN_14P	19C3
J19	CONN_14P	19D2
J20	CONN_14P	19B1
J21	CONN_14P	19D1
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J23	CONN_14P	19B7
J24	CONN_14P	19C7
J25	CONN_14P	19B7
J26	JMP_OPEN_2P	9B4
J27	JMP_OPEN_2P	10D8
J28	CONN_BNC_5P	10D7
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J31	CONN_BNC_5P	9B3
J32	JMP_OPEN_2P	9D4
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J35	CONN_BNC_5P	10A7
J36	CONN_BNC_5P	9C3
J37	CONN_BNC_5P	9D3
J38	JMP_OPEN_2P	9B8
J39	JMP_OPEN_2P	10D4
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J42	CONN_BNC_5P	9A8
J43	CONN_BNC_5P	9B8
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J45	JMP3	22A7
J46	JMP3	22A7
J47	JMP_OPEN_2P	9D8
J48	JMP_OPEN_2P	10B4
J49	CONN_BNC_5P	10B3
J50	CONN_BNC_5P	10A3
J51	CONN_BNC_5P	9C8
J52	CONN_BNC_5P	9D8
J53	RJ45_8	7B4 7B7 7D4 7D8
J54	RJ45_8	8B4 8B8 8D4 8D8
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R2	RES1	12B7
R3	RES1	20C4
R4	RES1	20A4
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R6	RES1	20A4
R7	RES1	20C2
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R106	RES1	11A6
R107	RES1	11C5
R108	RES1	13A2
R109	RES1	20A4
R110	RES1	12A3
R111	RES1	9A6
R112	RES1	9C2
R113	RES1	9A6
R114	RES1	9C2

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R116  RES1      20C7
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R159  RES1      7A6
R160  RES1      7A2
R161  RES1      7C2
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SW2   PUSHBUTTON 17A8
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SW4   SWITCH_DPDT_SLIDE_6P 16C4
SW5   SWITCH_DPDT_SLIDE_6P 18A8
SW6   PUSHBUTTON 12B3
SW7   SWITCH_DPDT_SLIDE_6P 12A2
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            7D3 7D7
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            8D3 8D7
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            9D2 9D7
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            10C7 10D3 10D7
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U3    CY6212BV_2 18C7
U4    DS2174    12C7
U5    XC2S_FG256 13C6 14C5 15C5
U6    DS26334_U 2B5 3B3 3B7 3D3 3D7 4B3 4B7 4D3 4D7
            5B3 5B7 5D3 5D7 6B3 6B7 6D3 6D7
U7    DS232     16A7
U8    NC7SZ86_U 11D2
U9    MAX1793_U 21D7
U10   CY6212BV_2 18C3
U11   NC7SZ86_U 11D2
U12   XC18V02VQ44C 12D3
U13   74_04_U   11A7 11B7 11B8 13A3 17A6 22A2
U14   74_04_U   11C7 11C8 11D7 11D8
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U18   74_04_U   11B7 11B8 11B8 11C7 11C7 11C8
U19   MAX6816_2 12B2
U20   MAX1793_U 21D5
X1    XTAL_U    16C7
X2    XTAL      17A4
Y1    OSC2      11B2
Y2    OSC2      11C2
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