VCU118 Evaluation Board

User Guide

UG1224 (v1.4) October 17, 2018

XILINX

Revision History

The following table shows the revision history for this document.

Date	Version	Revision
10/17/2018	1.4	Updated the PCI Express endpoint connectivity list. Added the Electrostatic Discharge Caution section. Updated Callout 25 in Table 2-1. Updated SW16 in Table 2-2. Updated Jumper J7 in Table 2-3. Added Note 1 to Table 2-4. Updated the switch positions in Figure 2-4. Updated the Virtex UltraScale+ XCVU9P-L2FLGA2104 Device, DDR4 Component Memory, RLD3 Component Memory, and PCI Express Endpoint Connectivity descriptions. Updated the callout locations in the User I/O and CPU Reset Pushbutton sections. Updated the 4-pole DIP SW12 devices in Table 3-29. Revised Note 1 in Table 3-33. Updated the switch positions in Figure 3-30. In Appendix B, updated the Overview and deleted the *VCU118 Board Constraints File Listing* section. Updated Appendix D, Regulatory and Compliance Information.
5/09/2018	1.3	Added new information below Figure 2-4 and Table 3-25. Revised Table 3-24 notes. Updated Figure 3-18 and Table 3-27. Updated VCU118 Board Constraints File listing.
11/10/2017	1.2	Revised binary format for PMBus INA226AIDGS power monitor in Table 3-27.
10/31/2017	1.1	Updated Figure 1-1. Revised Board Features, Board Component Location, and FPGA Configuration. Added Quad SPI Flash Memory and Documentation Navigator and Design Hubs. Revised Appendix B, Master Constraints File Listing. Reorganized appendices to include a new Appendix C, BPI Flash Memory for VCU118 Boards Prior to Revision 2.0.
10/15/2016	1.0	Initial Xilinx release.

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Introduction

Overview

The VCU118 evaluation board for the Xilinx® Virtex® UltraScale+™ FPGA provides a hardware environment for developing and evaluating designs targeting the UltraScale+ XCVU9P-L2FLGA2104 device. The VCU118 evaluation board provides features common to many evaluation systems, including:

- DDR4 and RLD3 component memory
- Dual small form-factor pluggable (QSFP+) connector
- Sixteen-lane PCI Express® interface
- Ethernet PHY
- General purpose I/O
- Two UART interfaces
- FireFly™ Optical x4 28 G connector

Other features can be supported using modules compatible with the VITA-57.1 FPGA mezzanine card (FMC) and VITA-57.4 FPGA mezzanine card plus high serial pin (FMC+ HSPC) connectors on the VCU118 board.

Additional Resources

See Appendix E, Additional Resources and Legal Notices for references to documents, files, and resources relevant to the VCU118 evaluation board.

Block Diagram

A block diagram of the VCU118 evaluation board is shown in Figure 1-1.

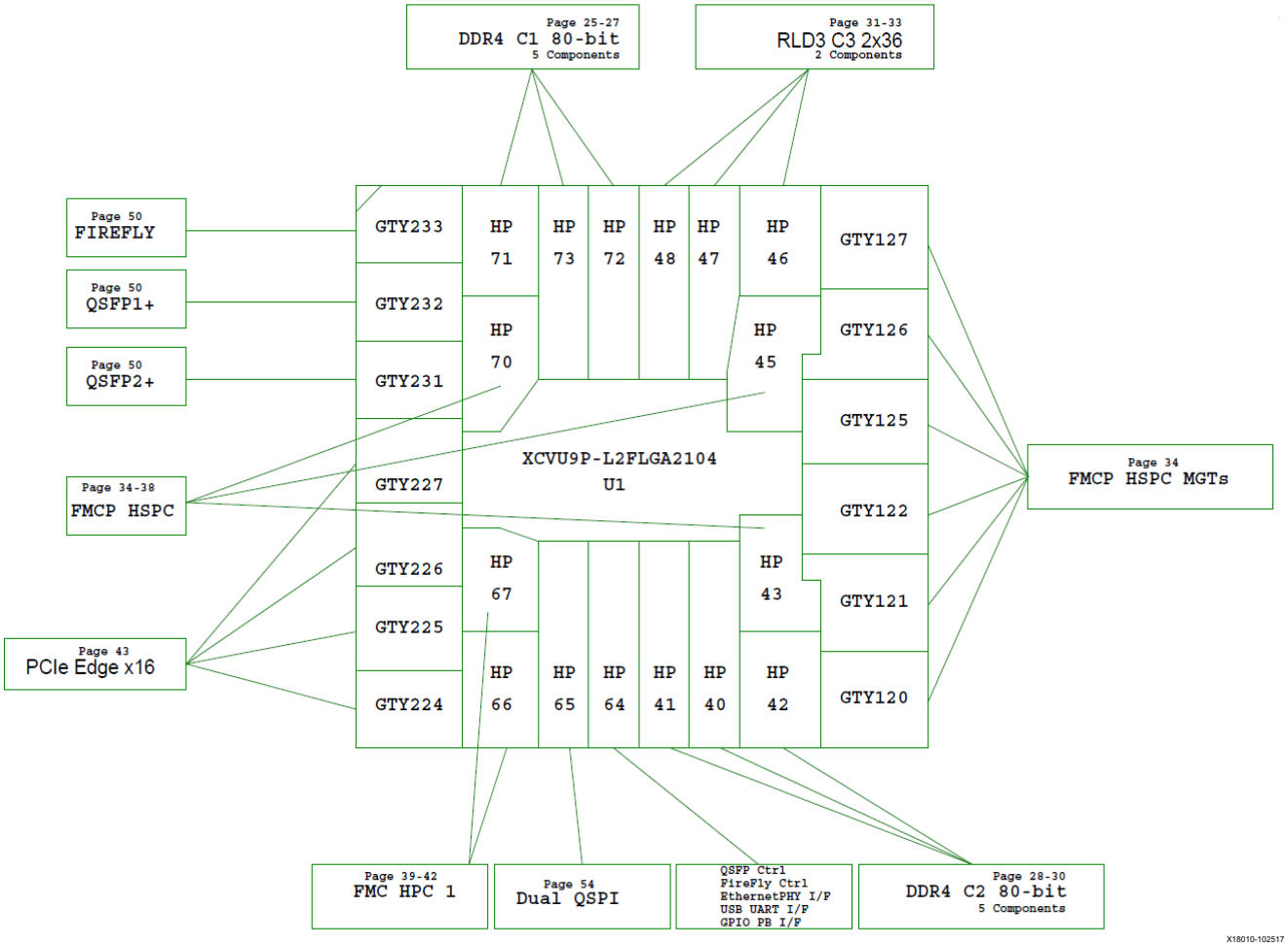

Figure 1-1: **VCU118 Evaluation Board Block Diagram**

Board Features

The VCU118 evaluation board features are listed here. Detailed information for each feature is provided in Component Descriptions in Chapter 3.

- Virtex UltraScale+ XCVU9P-L2FLGA2104 device
- Zynq®-7000 SoC XC7Z010 based system controller
- Two 2.5 GB DDR4 80-bit component memory interfaces (five [256 Mb x 16] devices each)
- 288 MB 72-bit RLD3 memory interface comprised of two 1.125 Gb 36-bit devices
- Dual 1 Gb Quad SPI flash memory (BPI flash on pre-Rev. 2.0 boards)
- USB JTAG interface using a Digilent module with separate micro-B USB connector
- Clock sources:
  - Si5335A quad clock generator
  - Three Si570 I^2C programmable LVDS clock generators
  - One SG5032 fixed 250 MHz LVDS clock generator
  - Si5328B clock multiplier and jitter attenuator for QSFP
  - Subminiature version A (SMA) connectors (differential)
- 52 GTY transceivers (13 Quads)
  - FMC+ HSPC connector (twenty-four GTY transceivers)
  - 2x28 Gb/s QSFP+ connectors (eight GTY transceivers)
  - Samtec Firefly connector (four GTY transceiver)
  - PCIe 16-lane edge connector (sixteen GTY transceivers)
- PCI Express endpoint connectivity
  - Gen1 16-lane (x16)
  - Gen2 16-lane (x16)
  - Gen3 8-lane (x8) (Pre-Rev. 2.0 VCU118 board V_{CCINT} = 0.72V)
  - Gen3 16-lane (x16) (VCU118 Rev. 2.0 and later V_{CCINT} = 0.85V
- Ethernet PHY SGMII interface with RJ-45 connector
- Dual USB-to-UART bridge with micro-B USB connector
- I^2C bus
- Status LEDs

- User I/O (4-pole DIP switch, 6 each push-button switches, 8 x LED)
- Two Pmod 2x6 connectors (one male pin header, one right-angle receptacle)
- VITA 57.4 FMC+ HSPC connector J22
- VITA 57.1 FMC HPC1 connector J2
- Power management with PMBus voltage monitoring through Maxim power controllers and GUI
- 10-bit 0.2 MSPS SYSMON analog-to-digital front end
- Configuration options:
  - Dual Quad SPI flash memory
  - Digilent USB configuration module
  - Platform cable USB II interface 2x7 2 mm connector

Board Specifications

Dimensions

Height: 6.927 inch (17.59 cm)

Thickness (±5%): 0.061 inch (0.1549 cm)

Length: 9.5 inch (24.13 cm)

Note: A 3D model of this board is not available.

IMPORTANT: *The VCU118 board height exceeds the standard 4.376 inch (11.15 cm) height of a PCI Express® card.*

Environmental

Temperature

Operating: 0°C to +45°C

Storage: -25°C to +60°C

Humidity

10% to 90% non-condensing

Operating Voltage

+12 V_{DC}

Board Setup and Configuration

Board Component Location

Figure 2-1 shows the VCU118 board component locations. Each numbered component shown in the figure is keyed to Table 2-1. Table 2-1 identifies the components, references the respective schematic page numbers, and links to a detailed functional description of the components and board features in Chapter 3.

IMPORTANT: *Figure 2-1 is for visual reference only and might not reflect the current revision of the board.*

CAUTION! *The VCU118 board can be damaged by electrostatic discharge (ESD). Follow standard ESD prevention measures when handling the board.*

Electrostatic Discharge Caution

CAUTION! *ESD can damage electronic components when they are improperly handled, and can result in total or intermittent failures. Always follow ESD-prevention procedures when removing and replacing components.*

To prevent ESD damage:

- Use an ESD wrist or ankle strap and ensure that it makes skin contact. Connect the equipment end of the strap to an unpainted metal surface on the chassis.
- Avoid touching the adapter against your clothing. The wrist strap protects components from ESD on the body only.
- Handle the adapter by its bracket or edges only. Avoid touching the printed circuit board or the connectors.
- Put the adapter down only on an antistatic surface such as the bag supplied in your kit.

• If you are returning the adapter to Xilinx Product Support, place it back in its antistatic bag immediately.

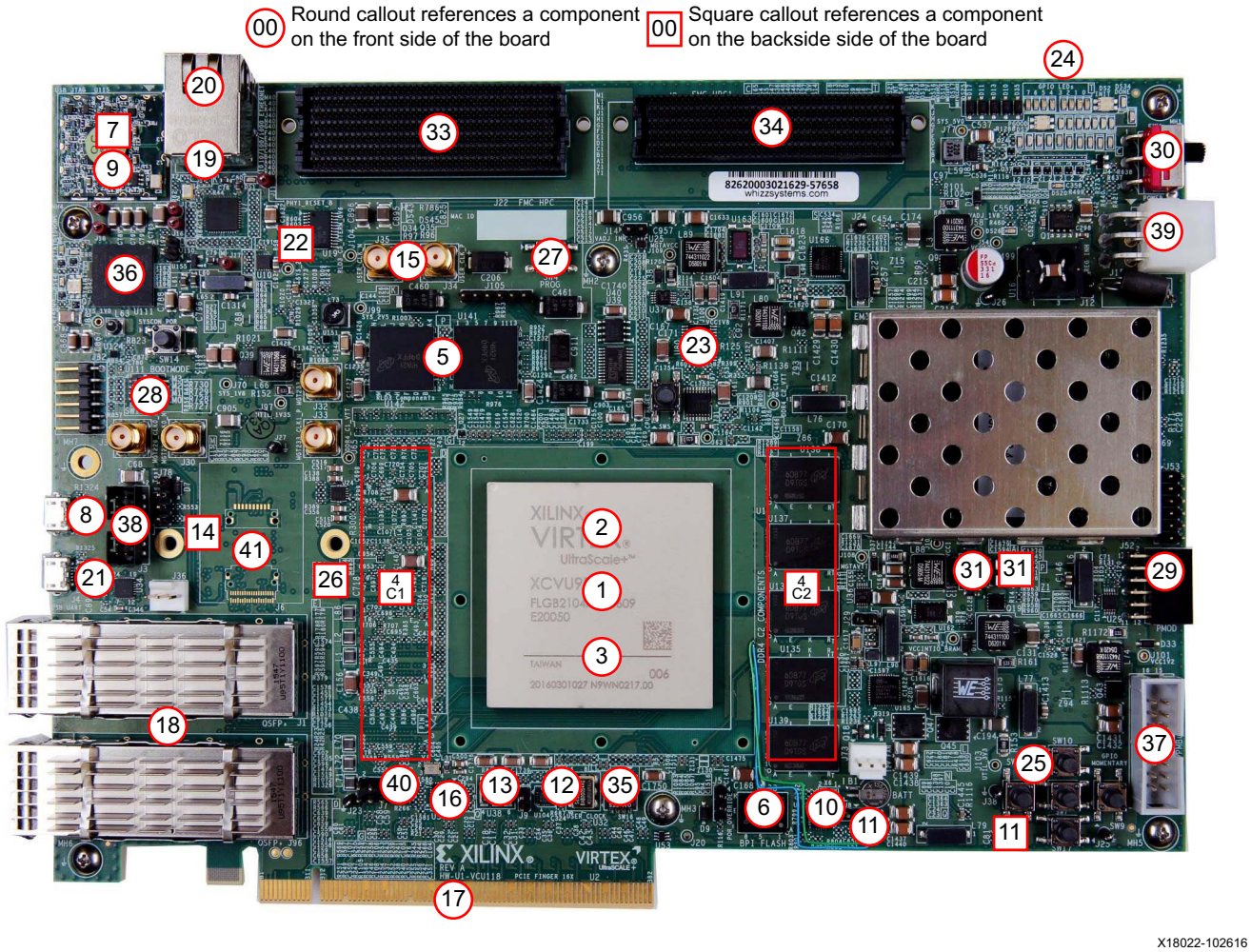

Figure 2-1: **VCU118 Evaluation Board Components**

Table 2-1: **VCU118 Board Component Descriptions**

Callout	Feature	Notes	Schematic Page Number
1	Virtex UltraScale+ XCVU9P-L2FLGA2104 Device, (with fan-sink on soldered FPGA)	XCVU9P-L2FLGA2104E Cofan 30-5530-03	
2	GTY transceivers, Right Side Quads (six quads)	Embedded within FPGA U1	14-15
3	GTY transceivers, Left Side Quads (seven quads)	Embedded within FPGA U1	16-17
4	DDR4 Component Memory, two 80-bit DDR4 component memory I/F, C1 (U60-U64) (bottom) and C2 (U135-U139) (top)	C1: 5 x Micron MT40A256M16GE-075E, C2: 5 x Micron MT40A256M16GE-075E	25-27, 28-30

Table 2-1: **VCU118 Board Component Descriptions *(Cont'd)***

Callout	Feature	Notes	Schematic Page Number
5	RLD3 Component Memory, RLD3 72-bit component memory I/F C3 (U141-U142)	Micron MT44K32M36RB-083F	31-32
6	VCU118 Rev. 2.0 board hosts dual clam-shelled Quad SPI Flash Memory: U133 (top), U43 (bottom)(1)	Micron MT25QU01GBBB8ESF-0SIT	54
7	System Controller Micro-SD Card Interface, (bottom) System Controller micro-SD card interface connector (J83)	Molex 5025700893	49
8	Digilent USB JTAG Module, USB JTAG micro-B connector (J106)	Hirose ZX62D-AB-5P8	24
9	Digilent USB JTAG Module (U115), with micro-B connector	Digilent JTAG-SMT2-NC	24
10	Clock Generation, multi-output clock generator, SYSCLK and other clocks, 1.8V LVDS (U122)	SI5335A-B02436-GM, 4 outputs: 300 MHz, 125 MHz, 90 MHz, 33.33 MHz	44
11	System Clock, programmable user clock Si570_0, I^2C programmable user clock, 3.3V LVDS (U18) (bottom) with 1-to-2 LVDS MUX/buffer (U157) (top)	Silicon Labs SI570BAB0000544DG (default 156.250 MHz) with Si53340 MUX/buffer	44
12	Programmable User Clock 1, programmable user clock Si570_1, I^2C programmable user clock, 3.3V LVDS (U32) with 1-to-2 LVDS MUX/buffer (U104)	Silicon Labs SI570BAB0000544DG (default 156.250 MHz) with Si53340 MUX/buffer	45
13	Programmable User Clock 2 (QSFP Clock), programmable user clock Si570_2, I^2C programmable user clock, 3.3V LVDS (U38)	Silicon Labs SI570BAB0000544DG (default 156.250 MHz)	45
14	250 MHz Clock, fixed SG5032 250 MHz user clock, 3.3V LVDS (U14) (bottom) with 1-to-2 LVDS MUX/buffer (U21) (bottom)	Epson SG5032VAN_250.000000M-KEGA3 with ICS85411AMLF 1-to-2 buffer	45
15	User SMA Clock pair J34(P)/J35(N)	Rosenberger 32K10K-400L5	45
16	Jitter Attenuated Clock, jitter attenuated QSFP clock (U57)	Silicon Labs SI5328B	51
17	PCI Express Endpoint Connectivity, PCI Express connector (P1)	8-lane card edge connector	43
18	Two 28 Gb/s QSFP+ Module Connectors, QSFP1 (U145), QSFP2 (U123)	Amphenol FS1-Z38-20Z6-10	50
19	10/100/1000 Mb/s Tri-Speed Ethernet PHY with RJ45, SGMII mode only, (U7, J10)	TI DP83867ISRGZ with Wurth 7499111221A RJ45 (with magnetics)	52
20	Ethernet PHY Status LEDs, LEDs are integrated into J10 bezel	Wurth 7499111221A RJ45 integrated status LEDs	52
21	Dual USB-to-UART Bridge, bridge device (U34) with mini-B connector (J4)	Silicon Labs CP2105-F01-GM bridge, Hirose ZX62D-AB-5P8 connector	53

Table 2-1: **VCU118 Board Component Descriptions *(Cont'd)***

Callout	Feature	Notes	Schematic Page Number
22	I2C Bus, Topology, and Switches, I^2C bus, I^2C bus MUX (U28) (bottom)	TI TCA9548APWR	58
23	I2C Bus, Topology, and Switches, I^2C bus, I^2C bus MUX (U80)	TI TCA9548APWR	58
24	User GPIO LEDs (DS6-DS10, DS12, DS13, DS18)	GPIO LEDs, green 0603 Lumex SML-LX0603GW-TR	55
25	User Pushbuttons, (SW10, SW17, SW9, SW6, SW7), CPU reset pushbutton (SW5 near Callout 23) all active-High	E-Switch TL3301EF100QG (north, south, east, west, center pattern)	55
26	GPIO DIP Switch, GPIO DIP switch (SW12) (bottom)	4-pole CTS 218-4LPSTRF	55
27	Program_B Pushbutton Switch, program_B pushbutton switch, FPGA PROG pushbutton (SW4)	E-Switch TL3301EF100QG	55
28	VCU118 XC7Z010 system controller, mode switch DIP, switch (SW15)	4-pole CTS 218-4LPSTRF	49
29	User Pmod GPIO Headers, (J52 right-angle receptacle, J53 male pin header) (top) with level shifters (U41,U42) (bottom)	J52 Sullins PPPC062LJBN-RC, J53 Sullins PBC36DAAN, NXP NVT2008PW	57
30	Switches, power on/off slide switch SW1	C&K 1201M2S3AQE2	59
31	VCU118 Board Power System, power management system (top and bottom)	Maxim MAX20751E and MAX15301 dig-ital P.O.L. controllers	60-75
32	Monitoring Voltage and Current, power management voltage and current sensing	TI Current and Power Monitor INA226AIDGS	60-67
33	GTY Transceivers, FMCP HSPC connector J22	Samtec ASP_184329_01	34-38
34	FMC HPC1 Connector J2	Samtec ASP_134486_01	39-42
35	Configuration Options, FPGA U1 configuration mode DIP switch, (SW16)	4-pole CTS 218-4LPSTRF	3
36	System Controller, VCU118 Zynq-7000 SoC XC7Z010CLG225 (U111)	XC7Z010CLG225	46-49
37	Monitoring Voltage and Current, VCU118 board power system 2x8 shrouded PMBus connector (J39)	ASSMAN AWHW16G-0202	59
38	Digilent USB JTAG Module, USB JTAG module, shrouded JTAG cable connector (J3)	2x7 2 mm Molex 87832-1420	24
39	Power On/Off Slide Switch SW1, power input connector (J15)	2x6 Molex-39-30-1060	59
41	FireFly Connector, signal and power pair (J6)	Samtec Signal: UEC5-019-2-H-D-RA-1, Samtec Power: UCC8-10-1-H-S-1-A	50

Table 2-1: **VCU118 Board Component Descriptions *(Cont'd)***

Callout	Feature	Notes	Schematic Page Number
40	PCI Express Endpoint Connectivity, lane width select header, (J7)	2x4 0.1 inch male header Sullins PBC36DAAN	43

Notes:

1. VCU118 boards earlier than Rev. 2.0 host a linear BPI 16-bit flash configuration memory, 1 Gb (U133) Micron MT28GU01GAAA1EGC-0SIT at location 6 and on their respective schematic page 54. See Appendix C, BPI Flash Memory for VCU118 Boards Prior to Revision 2.0.
2. The VCU118 board schematics are available for download. See the VCU118 Evaluation Kit.
3. The VCU118 board jumper header locations are shown in Figure 2-2.

Default Switch and Jumper Settings

Switches

Default switch settings are listed in Table 2-2. Switch locations are shown in Figure 2-1. Table 2-2 also references the respective schematic page numbers.

Table 2-2: **Default Switch Settings**

Switch	Function	Default	Comments	Figure 2-1 Callout	Schematic Page
SW1	SPST slide switch	OFF	Board shipped with power switch off	30	59
SW12	4-pole GPIO	0000	Positions 1-4, GPIO	26	55
SW15	4-pole configuration	0000	Positions 1-4, Zynq-7000 SoC System Controller U111	28	49
SW16	4-pole configuration (0 = Off/Open)	0001	Position 1, System Controller Enable Positions 2-4, FPGA U1 mode M[2:0] = Master SPI	35	3

Notes:

1. DIP switches are active-High (connected net is pulled High when DIP switch is closed).

Jumpers

Figure 2-2 shows the VCU118 board jumper header locations. Each numbered component shown in the figure is keyed to Table 2-3, which identifies the default jumper settings and references the respective schematic page numbers.

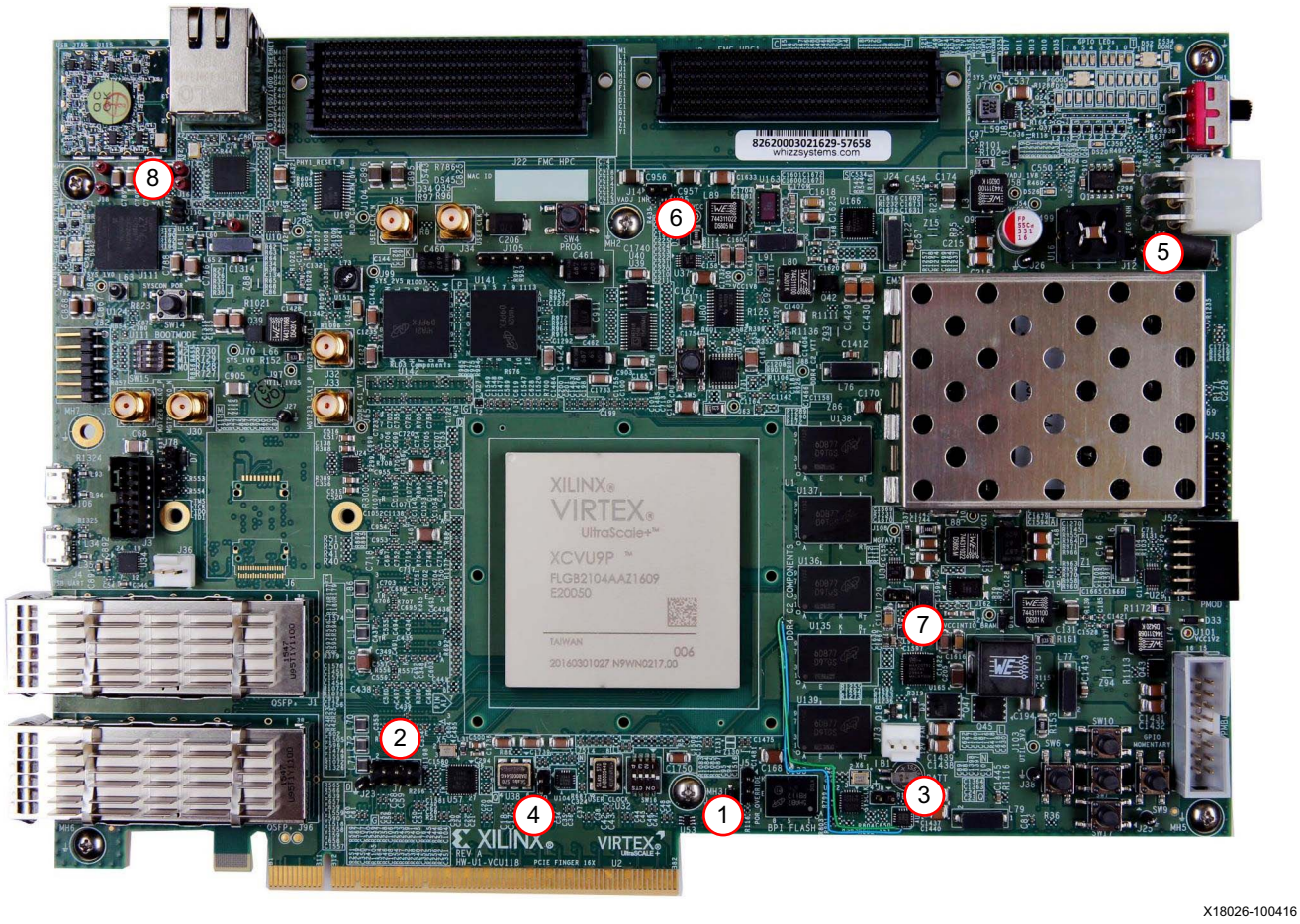

Figure 2-2: **VCU118 Board Header Jumper Locations**

Table 2-3: **Default Jumper Settings**

Jumper	Function	Default	Comments	Figure 2-2 Callout	Schematic Page
J5	Power on reset (POR) override	2-3	U1 POR_OVERRIDE pin AG12 to GND	1	3
J7	PCIe lane size select	7-8	16-lane	2	43
J8	SYSCLK source select	Off	SI5335A 300 MHz default	3	44
J9	USER/MGT_SI570 source select	Off	SI570 U32 156.250 MHz	4	45
J12	Maxim regulator inhibit	Off	Used when programming PWR. SYS.	5	59
J14	U30 VADJ_1V8 enable	Off	Input to U25 AND, VADJ_1V8 enabled	6	63

Table 2-3: **Default Jumper Settings *(Cont'd)***

Jumper	Function	Default	Comments	Figure 2-2 Callout	Schematic Page
J29[(1)]	BPI Flash A25 source select	1-2	A25 connected to FPGA U1 pin BE17	7	54
J110	Zynq-7000 SoC System Controller U111 QSPI_IO3	Off	QSPI_IO3 P/U w/20K (On = P/D to GND)	8	47

Notes:

1. Pre-Rev. 2.0 VCU118 boards only.

Installing the VCU118 Board in a PC Chassis

Installation of the VCU118 board inside a computer chassis is required when developing or testing PCI Express® functionality.

When the VCU118 board is used inside a computer chassis (that is, plugged in to the PCIe® slot), power is provided from the ATX power supply 4-pin peripheral connector through the ATX adapter cable (Figure 2-3) to J15 on the VCU118 board. The Xilinx part number for this cable is 2600304. See [Ref 29] for ordering information.

Figure 2-3: **ATX Power Supply Adapter Cable**

To install the VCU118 board in a PC chassis:

1. On the VCU118 board, remove the six screws retaining the six rubber feet with their standoffs, and the PCIe bracket. Reinstall the PCIe bracket using two of the previously removed screws.
2. Power down the host computer and remove the power cord from the PC.
3. Open the PC chassis following the instructions provided with the PC.
4. Select a vacant PCIe expansion slot and remove the expansion cover (at the back of the chassis) by removing the screws on the top and bottom of the cover.

5. The VCU118 board requires three adjacent PCIe slots. The VCU118 board has a large cooling fan that exceeds the PCIe top side component height restriction and has several spring loaded screws on the back side of the board. Ensure the slots closest to the front and back of the board are free of obstructions.
6. Plug the VCU118 board into the center of the three open slots.
7. Install the top mounting bracket screw into the PC expansion cover retainer bracket to secure the VCU118 board in its slot.
8. Connect the ATX power supply to the VCU118 board using the ATX power supply adapter cable as shown in Figure 2-3.
   a. Plug the 6-pin 2 x 3 Molex connector on the adapter cable into J15 on the VCU118 board.
   b. Plug the 4-pin 1 x 4 peripheral power connector from the ATX power supply into the 4-pin adapter cable connector.

CAUTION! *Do NOT plug a PC ATX power supply 6-pin connector into J15 on the VCU118 evaluation board. The ATX 6-pin connector has a different pin out than J15. Connecting an ATX 6-pin connector into J15 damages the VCU118 evaluation board and voids the board warranty.*

9. Slide the VCU118 board power switch SW1 to the ON position. The PC can now be powered on.

FPGA Configuration

VCU118 boards earlier than Rev. 2.0 host a linear BPI 16-bit flash configuration memory, 1 Gb (U133) Micron MT28GU01GAAA1EGC-0SIT. See Appendix C, BPI Flash Memory for VCU118 Boards Prior to Revision 2.0.

The VCU118 board supports two of the seven UltraScale FPGA configuration modes:

- Dual Quad SPI flash memory
- JTAG using:
  - USB JTAG configuration port (Digilent module U115)
  - Platform cable USB 2.0, 2 mm, keyed flat cable header (J3)

Each configuration interface corresponds to one or more configuration modes and bus widths, as listed in Table 2-4. The mode switches M2, M1, and M0 are on SW16 positions 2, 3, and 4, respectively. The FPGA default mode setting M[2:0] = **001** selects the master SPI configuration mode.

Table 2-4: **Configuration Modes**

Configuration Mode	SW16 DIP Switch Settings M[2:0] (1)	Bus Width	CCLK Direction
Master SPI	001	x1, x2, x4	Output
JTAG	101	x1	Not Applicable

Notes:
1. DIP SW16 is active-High (connected net is pulled High when DIP switch is closed).

For complete details on configuring the FPGA, see *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2].

Figure 2-4 shows the configuration mode DIP switch SW16 JTAG switch positions.

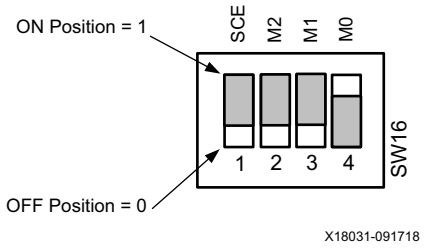

Figure 2-4: **SW16 JTAG Mode Settings**

See the *VCU118 Software Install and Board Setup Tutorial* (XTP449) [Ref 15] for more information.

See System Controller, page 112 for an overview of query and control of select programmable board features such as clocks, FMC functionality, and power systems. See the *VCU118 System Controller Tutorial* (XTP447) [Ref 14] for more information.

Board Component Descriptions

Overview

This chapter provides a detailed functional description of the board's components and features. Table 2-1, page 12 identifies the components, references the respective schematic page numbers, and links to the corresponding detailed functional description in this chapter. Component locations are shown in Figure 2-1, page 12.

Component Descriptions

Virtex UltraScale+ XCVU9P-L2FLGA2104 Device

[Figure 2-1, callout 1]

The VCU118 board is populated with the Virtex UltraScale+ XCVU9P-L2FLGA2104 device. For more information on Virtex UltraScale+ FPGAs, see *Virtex UltraScale+ FPGAs Data Sheet: DC and AC Switching Characteristics* (DS923) [Ref 1].

When creating FPGA designs for the VCU118, the correct V_{CCINT} must be chosen in the Xilinx Vivado tool. Choose the appropriate entry for the V_{CCINT} on your board:

- V_{CCINT} = 0.85V → xcvu9p-flga2104-2L-e
- V_{CCINT} = 0.72V → xcvu9p-flga2104-2LV-e

The V_{CCINT} value on your board can be found using the *VCU118 System Controller Tutorial* (XTP447) [Ref 14] or via the FPGA internal SYSMON function: after Vivado has discovered the XCVU9P in the JTAG chain, the SYSMON module is displayed on the upper left pane. Double-click on the SYSMON icon, which opens a parameter measurement pane. In the upper left of this pane, click on the + option and a list of available parameters will be displayed. Choose V_{CCINT}, and the voltage value will be displayed.

Encryption Key Battery Backup Circuit

The XCVU9P device U1 implements bitstream encryption key technology. The VCU118 board provides the encryption key backup battery circuit shown in Figure 3-1. The Seiko TS518FE rechargeable 1.5V lithium button-type battery B1 is soldered to the board with the positive output connected to the XCVU9P device U1 VBATT pin AT11. The battery supply current I_{BATT} specification is 150 nA maximum when the board power is off. B1 is charged from the SYS_1V8 1.8V rail through a series diode with a typical forward voltage drop of 0.38V and 4.7 KΩ current limit resistor. The nominal charging voltage is 1.42V.

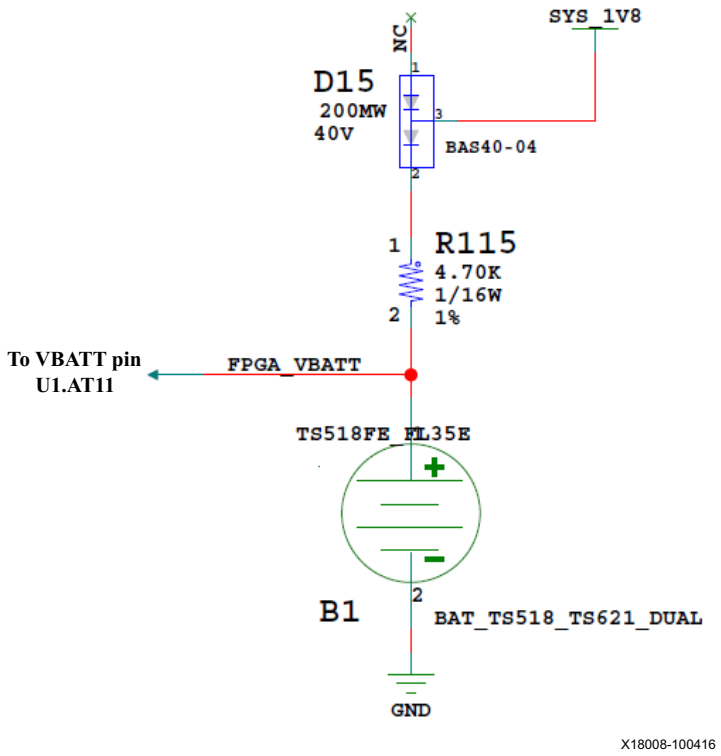

Figure 3-1: **Encryption Key Backup Circuit**

I/O Voltage Rails

There are 16 I/O banks available on the XCVU9P device and the VCU118 board. The voltages applied to the FPGA I/O banks used by the VCU118 board are listed in Table 3-1.

Table 3-1: **I/O Bank Voltage Rails**

FPGA (U1) Bank	Power Supply Rail Net Name	Voltage
Bank 0	VCC1V8_FPGA	1.8V
HP Bank 40	VCC1V2_FPGA	1.2V
HP Bank 41	VCC1V2_FPGA	1.2V
HP Bank 42	VCC1V2_FPGA	1.2V
HP Bank 43	VADJ_1V8_FPGA	1.8V
HP Bank 45	VADJ_1V8_FPGA	1.8V
HP Bank 46	VCC1V2_FPGA	1.2V
HP Bank 47	VCC1V2_FPGA	1.2V
HP Bank 48	VCC1V2_FPGA	1.2V
HP Bank 64	VCC1V8_FPGA	1.8V
HP Bank 65	VCC1V8_FPGA	1.8V
HP Bank 66	VADJ_1V8_FPGA	1.8V
HP Bank 67	VADJ_1V8_FPGA	1.8V
HP Bank 70	VADJ_1V8_FPGA	1.8V
HP Bank 71	VCC1V2_FPGA	1.2V
HP Bank 72	VCC1V2_FPGA	1.2V
HR Bank 73	VCC1V2_FPGA	1.2V

DDR4 Component Memory

[Figure 2-1, callout 4]

The DDR4 component memory system is comprised of two 2.5 GB sets of five 256 Mb x 16 (80-bit wide) DDR4 SDRAM devices, U60-U64 (C1) and U135-U139 (C2).

- Manufacturer: Micron
- Part Number: MT40A256M16GE-083E
- Description:
  - 4 Gb (256 Mb x 16)
  - 1.2V 96-ball TFBGA
  - DDR4-2400

The VCU118 XCVU9P DDR interface performance is documented in the *Virtex UltraScale+ FPGAs Data Sheet: DC and AC Switching Characteristics* (DS923) [Ref 1].

This dual memory system is connected in 80-bit wide interfaces to the U1 XCVU9P HP banks 71, 72, 73 (C1) and 40, 41, 42 (C2).

The DDR4 0.6V V_{TT} termination voltages (nets DDR4_C1_VTT and DDR4_C2_VTT) are sourced from the TI TPS51200DR linear regulators U24 and U134. The DDR4 memory interface bank VREF pins are not connected, which, coupled with an XDC set_property INTERNAL_VREF constraint, invoke the INTERNAL VREF mode. The connections between the C1 80-bit interface DDR4 component memories and XCVU9P banks 71, 72, and 73 are listed in Table 3-2.

Table 3-2: **DDR4 Memory 80-bit I/F C1 to FPGA U1 Banks 71, 72, and 73**

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
F11	DDR4_C1_DQ0	POD12_DCI	G2	DQL0	U60
E11	DDR4_C1_DQ1	POD12_DCI	F7	DQL1	U60
F10	DDR4_C1_DQ2	POD12_DCI	H3	DQL2	U60
F9	DDR4_C1_DQ3	POD12_DCI	H7	DQL3	U60
H12	DDR4_C1_DQ4	POD12_DCI	H2	DQL4	U60
G12	DDR4_C1_DQ5	POD12_DCI	H8	DQL5	U60
E9	DDR4_C1_DQ6	POD12_DCI	J3	DQL6	U60
D9	DDR4_C1_DQ7	POD12_DCI	J7	DQL7	U60
R19	DDR4_C1_DQ8	POD12_DCI	A3	DQU0	U60
P19	DDR4_C1_DQ9	POD12_DCI	B8	DQU1	U60
M18	DDR4_C1_DQ10	POD12_DCI	C3	DQU2	U60
M17	DDR4_C1_DQ11	POD12_DCI	C7	DQU3	U60

Table 3-2: **DDR4 Memory 80-bit I/F C1 to FPGA U1 Banks 71, 72, and 73 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
N19	DDR4_C1_DQ12	POD12_DCI	C2	DQU4	U60
N18	DDR4_C1_DQ13	POD12_DCI	C8	DQU5	U60
N17	DDR4_C1_DQ14	POD12_DCI	D3	DQU6	U60
M16	DDR4_C1_DQ15	POD12_DCI	D7	DQU7	U60
D11	DDR4_C1_DQS0_T	DIFF_POD12_DCI	G3	DQSL_T	U60
D10	DDR4_C1_DQS0_C	DIFF_POD12_DCI	F3	DQSL_C	U60
P17	DDR4_C1_DQS1_T	DIFF_POD12_DCI	B7	DQSU_T	U60
P16	DDR4_C1_DQS1_C	DIFF_POD12_DCI	A7	DQSU_C	U60
G11	DDR4_C1_DM0	POD12_DCI	E7	DML_B/DBIL_B	U60
R18	DDR4_C1_DM1	POD12_DCI	E2	DMU_B/DBIU_B	U60
L16	DDR4_C1_DQ16	POD12_DCI	G2	DQL0	U61
K16	DDR4_C1_DQ17	POD12_DCI	F7	DQL1	U61
L18	DDR4_C1_DQ18	POD12_DCI	H3	DQL2	U61
K18	DDR4_C1_DQ19	POD12_DCI	H7	DQL3	U61
J17	DDR4_C1_DQ20	POD12_DCI	H2	DQL4	U61
H17	DDR4_C1_DQ21	POD12_DCI	H8	DQL5	U61
H19	DDR4_C1_DQ22	POD12_DCI	J3	DQL6	U61
H18	DDR4_C1_DQ23	POD12_DCI	J7	DQL7	U61
F19	DDR4_C1_DQ24	POD12_DCI	A3	DQU0	U61
F18	DDR4_C1_DQ25	POD12_DCI	B8	DQU1	U61
E19	DDR4_C1_DQ26	POD12_DCI	C3	DQU2	U61
E18	DDR4_C1_DQ27	POD12_DCI	C7	DQU3	U61
G20	DDR4_C1_DQ28	POD12_DCI	C2	DQU4	U61
F20	DDR4_C1_DQ29	POD12_DCI	C8	DQU5	U61
E17	DDR4_C1_DQ30	POD12_DCI	D3	DQU6	U61
D16	DDR4_C1_DQ31	POD12_DCI	D7	DQU7	U61
K19	DDR4_C1_DQS2_T	DIFF_POD12_DCI	G3	DQSL_T	U61
J19	DDR4_C1_DQS2_C	DIFF_POD12_DCI	F3	DQSL_C	U61
F16	DDR4_C1_DQS3_T	DIFF_POD12_DCI	B7	DQSU_T	U61
E16	DDR4_C1_DQS3_C	DIFF_POD12_DCI	A7	DQSU_C	U61
K17	DDR4_C1_DM2	POD12_DCI	E7	DML_B/DBIL_B	U61
G18	DDR4_C1_DM3	POD12_DCI	E2	DMU_B/DBIU_B	U61
D17	DDR4_C1_DQ32	POD12_DCI	G2	DQL0	U62
C17	DDR4_C1_DQ33	POD12_DCI	F7	DQL1	U62

Table 3-2: **DDR4 Memory 80-bit I/F C1 to FPGA U1 Banks 71, 72, and 73 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
C19	DDR4_C1_DQ34	POD12_DCI	H3	DQL2	U62
C18	DDR4_C1_DQ35	POD12_DCI	H7	DQL3	U62
D20	DDR4_C1_DQ36	POD12_DCI	H2	DQL4	U62
D19	DDR4_C1_DQ37	POD12_DCI	H8	DQL5	U62
C20	DDR4_C1_DQ38	POD12_DCI	J3	DQL6	U62
B20	DDR4_C1_DQ39	POD12_DCI	J7	DQL7	U62
N23	DDR4_C1_DQ40	POD12_DCI	A3	DQU0	U62
M23	DDR4_C1_DQ41	POD12_DCI	B8	DQU1	U62
R21	DDR4_C1_DQ42	POD12_DCI	C3	DQU2	U62
P21	DDR4_C1_DQ43	POD12_DCI	C7	DQU3	U62
R22	DDR4_C1_DQ44	POD12_DCI	C2	DQU4	U62
P22	DDR4_C1_DQ45	POD12_DCI	C8	DQU5	U62
T23	DDR4_C1_DQ46	POD12_DCI	D3	DQU6	U62
R23	DDR4_C1_DQ47	POD12_DCI	D7	DQU7	U62
A19	DDR4_C1_DQS4_T	DIFF_POD12_DCI	G3	DQSL_T	U62
A18	DDR4_C1_DQS4_C	DIFF_POD12_DCI	F3	DQSL_C	U62
N22	DDR4_C1_DQS5_T	DIFF_POD12_DCI	B7	DQSU_T	U62
M22	DDR4_C1_DQS5_C	DIFF_POD12_DCI	A7	DQSU_C	U62
B18	DDR4_C1_DM4	POD12_DCI	E7	DML_B/DBIL_B	U62
P20	DDR4_C1_DM5	POD12_DCI	E2	DMU_B/DBIU_B	U62
K24	DDR4_C1_DQ48	POD12_DCI	G2	DQL0	U63
J24	DDR4_C1_DQ49	POD12_DCI	F7	DQL1	U63
M21	DDR4_C1_DQ50	POD12_DCI	H3	DQL2	U63
L21	DDR4_C1_DQ51	POD12_DCI	H7	DQL3	U63
K21	DDR4_C1_DQ52	POD12_DCI	H2	DQL4	U63
J21	DDR4_C1_DQ53	POD12_DCI	H8	DQL5	U63
K22	DDR4_C1_DQ54	POD12_DCI	J3	DQL6	U63
J22	DDR4_C1_DQ55	POD12_DCI	J7	DQL7	U63
H23	DDR4_C1_DQ56	POD12_DCI	A3	DQU0	U63
H22	DDR4_C1_DQ57	POD12_DCI	B8	DQU1	U63
E23	DDR4_C1_DQ58	POD12_DCI	C3	DQU2	U63
E22	DDR4_C1_DQ59	POD12_DCI	C7	DQU3	U63
F21	DDR4_C1_DQ60	POD12_DCI	C2	DQU4	U63
E21	DDR4_C1_DQ61	POD12_DCI	C8	DQU5	U63

Table 3-2: **DDR4 Memory 80-bit I/F C1 to FPGA U1 Banks 71, 72, and 73 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
F24	DDR4_C1_DQ62	POD12_DCI	D3	DQU6	U63
F23	DDR4_C1_DQ63	POD12_DCI	D7	DQU7	U63
M20	DDR4_C1_DQS6_T	DIFF_POD12_DCI	G3	DQSL_T	U63
L20	DDR4_C1_DQS6_C	DIFF_POD12_DCI	F3	DQSL_C	U63
H24	DDR4_C1_DQS7_T	DIFF_POD12_DCI	B7	DQSU_T	U63
G23	DDR4_C1_DQS7_C	DIFF_POD12_DCI	A7	DQSU_C	U63
L23	DDR4_C1_DM6	POD12_DCI	E7	DML_B/DBIL_B	U63
G22	DDR4_C1_DM7	POD12_DCI	E2	DMU_B/DBIU_B	U63
A24	DDR4_C1_DQ64	POD12_DCI	G2	DQL0	U64
A23	DDR4_C1_DQ65	POD12_DCI	F7	DQL1	U64
C24	DDR4_C1_DQ66	POD12_DCI	H3	DQL2	U64
C23	DDR4_C1_DQ67	POD12_DCI	H7	DQL3	U64
B23	DDR4_C1_DQ68	POD12_DCI	H2	DQL4	U64
B22	DDR4_C1_DQ69	POD12_DCI	H8	DQL5	U64
B21	DDR4_C1_DQ70	POD12_DCI	J3	DQL6	U64
A21	DDR4_C1_DQ71	POD12_DCI	J7	DQL7	U64
D7	DDR4_C1_DQ72	POD12_DCI	A3	DQU0	U64
C7	DDR4_C1_DQ73	POD12_DCI	B8	DQU1	U64
B8	DDR4_C1_DQ74	POD12_DCI	C3	DQU2	U64
B7	DDR4_C1_DQ75	POD12_DCI	C7	DQU3	U64
C10	DDR4_C1_DQ76	POD12_DCI	C2	DQU4	U64
B10	DDR4_C1_DQ77	POD12_DCI	C8	DQU5	U64
B11	DDR4_C1_DQ78	POD12_DCI	D3	DQU6	U64
A11	DDR4_C1_DQ79	POD12_DCI	D7	DQU7	U64
D22	DDR4_C1_DQS8_T	DIFF_POD12_DCI	G3	DQSL_T	U64
C22	DDR4_C1_DQS8_C	DIFF_POD12_DCI	F3	DQSL_C	U64
A9	DDR4_C1_DQS9_T	DIFF_POD12_DCI	B7	DQSU_T	U64
A8	DDR4_C1_DQS9_C	DIFF_POD12_DCI	A7	DQSU_C	U64
E24	DDR4_C1_DM8	POD12_DCI	E7	DML_B/DBIL_B	U64
C9	DDR4_C1_DM9	POD12_DCI	E2	DMU_B/DBIU_B	U64
D14	DDR4_C1_A0	SSTL12_DCI	P3	A0	U60-U64
B15	DDR4_C1_A1	SSTL12_DCI	P7	A1	U60-U64
B16	DDR4_C1_A2	SSTL12_DCI	R3	A2	U60-U64
C14	DDR4_C1_A3	SSTL12_DCI	N7	A3	U60-U64

Table 3-2: **DDR4 Memory 80-bit I/F C1 to FPGA U1 Banks 71, 72, and 73 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
C15	DDR4_C1_A4	SSTL12_DCI	N3	A4	U60-U64
A13	DDR4_C1_A5	SSTL12_DCI	P8	A5	U60-U64
A14	DDR4_C1_A6	SSTL12_DCI	P2	A6	U60-U64
A15	DDR4_C1_A7	SSTL12_DCI	R8	A7	U60-U64
A16	DDR4_C1_A8	SSTL12_DCI	R2	A8	U60-U64
B12	DDR4_C1_A9	SSTL12_DCI	R7	A9	U60-U64
C12	DDR4_C1_A10	SSTL12_DCI	M3	A10/AP	U60-U64
B13	DDR4_C1_A11	SSTL12_DCI	T2	A11	U60-U64
C13	DDR4_C1_A12	SSTL12_DCI	M7	A12/BC_B	U60-U64
D15	DDR4_C1_A13	SSTL12_DCI	T8	A13	U60-U64
G15	DDR4_C1_BA0	SSTL12_DCI	N2	BA0	U60-U64
G13	DDR4_C1_BA1	SSTL12_DCI	N8	BA1	U60-U64
H13	DDR4_C1_BG0	SSTL12_DCI	M2	BG0	U60-U64
H14	DDR4_C1_A14_WE_B	SSTL12_DCI	L2	WE_B/A14	U60-U64
H15	DDR4_C1_A15_CAS_B	SSTL12_DCI	M8	CAS_B_A15	U60-U64
F15	DDR4_C1_A16_RAS_B	SSTL12_DCI	L8	RAS_B/A16	U60-U64
F14	DDR4_C1_CK_T	DIFF_SSTL12_DCI	K7	CK_T	U60-U64
E14	DDR4_C1_CK_C	DIFF_SSTL12_DCI	K8	CK_C	U60-U64
A10	DDR4_C1_CKE	SSTL12_DCI	K2	CKE	U60-U64
E13	DDR4_C1_ACT_B	SSTL12_DCI	L3	ACT_B	U60-U64
G10	DDR4_C1_PAR	SSTL12_DCI	T3	PAR	U60-U64
C8	DDR4_C1_ODT	SSTL12_DCI	K3	ODT	U60-U64
F13	DDR4_C1_CS_B	SSTL12_DCI	L7	CS_B	U60-U64
R17	DDR4_C1_ALERT_B	SSTL12_DCI	P9	ALERT_B	U60-U64
N20	DDR4_C1_RESET_B	LVCMOS12	P1	RESET_B	U60-U64
A20	DDR4_C1_TEN	SSTL12_DCI	N9	TEN	U60-U64

The connections between the C2 80-bit interface DDR4 component memories (U135-U139) and XCVU9P banks 40, 41, and 42 are listed in Table 3-3.

Table 3-3: **DDR4 Memory 80-bit I/F C2 to FPGA U1 Banks 40, 41, and 42**

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
BD30	DDR4_C2_DQ0	POD12_DCI	G2	DQL0	U135
BE30	DDR4_C2_DQ1	POD12_DCI	F7	DQL1	U135
BD32	DDR4_C2_DQ2	POD12_DCI	H3	DQL2	U135
BE33	DDR4_C2_DQ3	POD12_DCI	H7	DQL3	U135
BC33	DDR4_C2_DQ4	POD12_DCI	H2	DQL4	U135
BD33	DDR4_C2_DQ5	POD12_DCI	H8	DQL5	U135
BC31	DDR4_C2_DQ6	POD12_DCI	J3	DQL6	U135
BD31	DDR4_C2_DQ7	POD12_DCI	J7	DQL7	U135
BA32	DDR4_C2_DQ8	POD12_DCI	A3	DQU0	U135
BB33	DDR4_C2_DQ9	POD12_DCI	B8	DQU1	U135
BA30	DDR4_C2_DQ10	POD12_DCI	C3	DQU2	U135
BA31	DDR4_C2_DQ11	POD12_DCI	C7	DQU3	U135
AW31	DDR4_C2_DQ12	POD12_DCI	C2	DQU4	U135
AW32	DDR4_C2_DQ13	POD12_DCI	C8	DQU5	U135
AY32	DDR4_C2_DQ14	POD12_DCI	D3	DQU6	U135
AY33	DDR4_C2_DQ15	POD12_DCI	D7	DQU7	U135
BF30	DDR4_C2_DQS0_T	DIFF_POD12_DCI	G3	DQSL_T	U135
BF31	DDR4_C2_DQS0_C	DIFF_POD12_DCI	F3	DQSL_C	U135
AY34	DDR4_C2_DQS1_T	DIFF_POD12_DCI	B7	DQSU_T	U135
BA34	DDR4_C2_DQS1_C	DIFF_POD12_DCI	A7	DQSU_C	U135
BE32	DDR4_C2_DM0	POD12_DCI	E7	DML_B/DBIL_B	U135
BB31	DDR4_C2_DM1	POD12_DCI	E2	DMU_B/DBIU_B	U135
AV30	DDR4_C2_DQ16	POD12_DCI	G2	DQL0	U136
AW30	DDR4_C2_DQ17	POD12_DCI	F7	DQL1	U136
AU33	DDR4_C2_DQ18	POD12_DCI	H3	DQL2	U136
AU34	DDR4_C2_DQ19	POD12_DCI	H7	DQL3	U136
AT31	DDR4_C2_DQ20	POD12_DCI	H2	DQL4	U136
AU32	DDR4_C2_DQ21	POD12_DCI	H8	DQL5	U136
AU31	DDR4_C2_DQ22	POD12_DCI	J3	DQL6	U136
AV31	DDR4_C2_DQ23	POD12_DCI	J7	DQL7	U136
AR33	DDR4_C2_DQ24	POD12_DCI	A3	DQU0	U136
AT34	DDR4_C2_DQ25	POD12_DCI	B8	DQU1	U136
AT29	DDR4_C2_DQ26	POD12_DCI	C3	DQU2	U136

Table 3-3: **DDR4 Memory 80-bit I/F C2 to FPGA U1 Banks 40, 41, and 42 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
AT30	DDR4_C2_DQ27	POD12_DCI	C7	DQU3	U136
AP30	DDR4_C2_DQ28	POD12_DCI	C2	DQU4	U136
AR30	DDR4_C2_DQ29	POD12_DCI	C8	DQU5	U136
AN30	DDR4_C2_DQ30	POD12_DCI	D3	DQU6	U136
AN31	DDR4_C2_DQ31	POD12_DCI	D7	DQU7	U136
AU29	DDR4_C2_DQS2_T	DIFF_POD12_DCI	G3	DQSL_C	U136
AV29	DDR4_C2_DQS2_C	DIFF_POD12_DCI	F3	DQSL_T	U136
AP31	DDR4_C2_DQS3_T	DIFF_POD12_DCI	B7	DQSU_C	U136
AP32	DDR4_C2_DQS3_C	DIFF_POD12_DCI	A7	DQSU_T	U136
AV33	DDR4_C2_DM2	POD12_DCI	E7	DML_B/DBIL_B	U136
AR32	DDR4_C2_DM3	POD12_DCI	E2	DMU_B/DBIU_B	U136
BE34	DDR4_C2_DQ32	POD12_DCI	G2	DQL0	U137
BF34	DDR4_C2_DQ33	POD12_DCI	F7	DQL1	U137
BC35	DDR4_C2_DQ34	POD12_DCI	H3	DQL2	U137
BC36	DDR4_C2_DQ35	POD12_DCI	H7	DQL3	U137
BD36	DDR4_C2_DQ36	POD12_DCI	H2	DQL4	U137
BE37	DDR4_C2_DQ37	POD12_DCI	H8	DQL5	U137
BF36	DDR4_C2_DQ38	POD12_DCI	J3	DQL6	U137
BF37	DDR4_C2_DQ39	POD12_DCI	J7	DQL7	U137
BD37	DDR4_C2_DQ40	POD12_DCI	A3	DQU0	U137
BE38	DDR4_C2_DQ41	POD12_DCI	B8	DQU1	U137
BC39	DDR4_C2_DQ42	POD12_DCI	C3	DQU2	U137
BD40	DDR4_C2_DQ43	POD12_DCI	C7	DQU3	U137
BB38	DDR4_C2_DQ44	POD12_DCI	C2	DQU4	U137
BB39	DDR4_C2_DQ45	POD12_DCI	C8	DQU5	U137
BC38	DDR4_C2_DQ46	POD12_DCI	D3	DQU6	U137
BD38	DDR4_C2_DQ47	POD12_DCI	D7	DQU7	U137
BE35	DDR4_C2_DQS4_T	DIFF_POD12_DCI	G3	DQSL_T	U137
BF35	DDR4_C2_DQS4_C	DIFF_POD12_DCI	F3	DQSL_C	U137
BE39	DDR4_C2_DQS5_T	DIFF_POD12_DCI	B7	DQSU_T	U137
BF39	DDR4_C2_DQS5_C	DIFF_POD12_DCI	A7	DQSU_C	U137
BC34	DDR4_C2_DM4	POD12_DCI	E7	DML_B/DBIL_B	U137
BE40	DDR4_C2_DM5	POD12_DCI	E2	DMU_B/DBIU_B	U137
BB36	DDR4_C2_DQ48	POD12_DCI	G2	DQL0	U138

Table 3-3: **DDR4 Memory 80-bit I/F C2 to FPGA U1 Banks 40, 41, and 42 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
BB37	DDR4_C2_DQ49	POD12_DCI	F7	DQL1	U138
BA39	DDR4_C2_DQ50	POD12_DCI	H3	DQL2	U138
BA40	DDR4_C2_DQ51	POD12_DCI	H7	DQL3	U138
AW40	DDR4_C2_DQ52	POD12_DCI	H2	DQL4	U138
AY40	DDR4_C2_DQ53	POD12_DCI	H8	DQL5	U138
AY38	DDR4_C2_DQ54	POD12_DCI	J3	DQL6	U138
AY39	DDR4_C2_DQ55	POD12_DCI	J7	DQL7	U138
AW35	DDR4_C2_DQ56	POD12_DCI	A3	DQU0	U138
AW36	DDR4_C2_DQ57	POD12_DCI	B8	DQU1	U138
AU40	DDR4_C2_DQ58	POD12_DCI	C3	DQU2	U138
AV40	DDR4_C2_DQ59	POD12_DCI	C7	DQU3	U138
AU38	DDR4_C2_DQ60	POD12_DCI	C2	DQU4	U138
AU39	DDR4_C2_DQ61	POD12_DCI	C8	DQU5	U138
AV38	DDR4_C2_DQ62	POD12_DCI	D3	DQU6	U138
AV39	DDR4_C2_DQ63	POD12_DCI	D7	DQU7	U138
BA35	DDR4_C2_DQS6_T	DIFF_POD12_DCI	G3	DQSL_C	U138
BA36	DDR4_C2_DQS6_C	DIFF_POD12_DCI	F3	DQSL_T	U138
AW37	DDR4_C2_DQS7_T	DIFF_POD12_DCI	B7	DQSU_C	U138
AW38	DDR4_C2_DQS7_C	DIFF_POD12_DCI	A7	DQSU_T	U138
AY37	DDR4_C2_DM6	POD12_DCI	E7	DML_B/DBIL_B	U138
AV35	DDR4_C2_DM7	POD12_DCI	E2	DMU_B/DBIU_B	U138
BF26	DDR4_C2_DQ64	POD12_DCI	G2	DQL0	U139
BF27	DDR4_C2_DQ65	POD12_DCI	F7	DQL1	U139
BD28	DDR4_C2_DQ66	POD12_DCI	H3	DQL2	U139
BE28	DDR4_C2_DQ67	POD12_DCI	H7	DQL3	U139
BD27	DDR4_C2_DQ68	POD12_DCI	H2	DQL4	U139
BE27	DDR4_C2_DQ69	POD12_DCI	H8	DQL5	U139
BD25	DDR4_C2_DQ70	POD12_DCI	J3	DQL6	U139
BD26	DDR4_C2_DQ71	POD12_DCI	J7	DQL7	U139
BC25	DDR4_C2_DQ72	POD12_DCI	A3	DQU0	U139
BC26	DDR4_C2_DQ73	POD12_DCI	B8	DQU1	U139
BB28	DDR4_C2_DQ74	POD12_DCI	C3	DQU2	U139
BC28	DDR4_C2_DQ75	POD12_DCI	C7	DQU3	U139
AY27	DDR4_C2_DQ76	POD12_DCI	C2	DQU4	U139

Table 3-3: **DDR4 Memory 80-bit I/F C2 to FPGA U1 Banks 40, 41, and 42 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
AY28	DDR4_C2_DQ77	POD12_DCI	C8	DQU5	U139
BA27	DDR4_C2_DQ78	POD12_DCI	D3	DQU6	U139
BB27	DDR4_C2_DQ79	POD12_DCI	D7	DQU7	U139
BE25	DDR4_C2_DQS8_T	DIFF_POD12_DCI	G3	DQSL_C	U139
BF25	DDR4_C2_DQS8_C	DIFF_POD12_DCI	F3	DQSL_T	U139
BA26	DDR4_C2_DQS9_T	DIFF_POD12_DCI	B7	DQSU_C	U139
BB26	DDR4_C2_DQS9_C	DIFF_POD12_DCI	A7	DQSU_T	U139
BE29	DDR4_C2_DM8	POD12_DCI	E7	DML_B/DBIL_B	U139
BA29	DDR4_C2_DM9	POD12_DCI	E2	DMU_B/DBIU_B	U139
AM27	DDR4_C2_A0	SSTL12_DCI	P3	A0	U135-U139
AL27	DDR4_C2_A1	SSTL12_DCI	P7	A1	U135-U139
AP26	DDR4_C2_A2	SSTL12_DCI	R3	A2	U135-U139
AP25	DDR4_C2_A3	SSTL12_DCI	N7	A3	U135-U139
AN28	DDR4_C2_A4	SSTL12_DCI	N3	A4	U135-U139
AM28	DDR4_C2_A5	SSTL12_DCI	P8	A5	U135-U139
AP28	DDR4_C2_A6	SSTL12_DCI	P2	A6	U135-U139
AP27	DDR4_C2_A7	SSTL12_DCI	R8	A7	U135-U139
AN26	DDR4_C2_A8	SSTL12_DCI	R2	A8	U135-U139
AM26	DDR4_C2_A9	SSTL12_DCI	R7	A9	U135-U139
AR28	DDR4_C2_A10	SSTL12_DCI	M3	A10/AP	U135-U139
AR27	DDR4_C2_A11	SSTL12_DCI	T2	A11	U135-U139
AV25	DDR4_C2_A12	SSTL12_DCI	M7	A12/BC_B	U135-U139
AT25	DDR4_C2_A13	SSTL12_DCI	T8	A13	U135-U139
AR25	DDR4_C2_BA0	SSTL12_DCI	N2	BA0	U135-U139
AU28	DDR4_C2_BA1	SSTL12_DCI	N8	BA1	U135-U139
AU27	DDR4_C2_BG0	SSTL12_DCI	M2	BG0	U135-U139
AV28	DDR4_C2_A14_WE_B	SSTL12_DCI	L2	WE_B/A14	U135-U139
AU26	DDR4_C2_A15_CAS_B	SSTL12_DCI	M8	CAS_B_A15	U135-U139
AV26	DDR4_C2_A16_RAS_B	SSTL12_DCI	L8	RAS_B/A16	U135-U139
AT26	DDR4_C2_CK_T	DIFF_SSTL12_DCI	K7	CK_T	U135-U139
AT27	DDR4_C2_CK_C	DIFF_SSTL12_DCI	K8	CK_C	U135-U139
AW28	DDR4_C2_CKE	SSTL12_DCI	K2	CKE	U135-U139
AN25	DDR4_C2_ACT_B	SSTL12_DCI	L3	ACT_B	U135-U139
BF29	DDR4_C2_PAR	SSTL12_DCI	P9	ALERT_B	U135-U139

Table 3-3: **DDR4 Memory 80-bit I/F C2 to FPGA U1 Banks 40, 41, and 42 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
BB29	DDR4_C2_ODT	SSTL12_DCI	T3	PAR	U135-U139
AY29	DDR4_C2_CS_B	SSTL12_DCI	K3	ODT	U135-U139
AR29	DDR4_C2_ALERT_B	SSTL12_DCI	L7	CS_B	U135-U139
BD35	DDR4_C2_RESET_B	LVCMOS12	P1	RESET_B	U135-U139
AY35	DDR4_C2_TEN	SSTL12_DCI	N9	TEN	U135-U139

The VCU118 dual DDR4 80-bit memory component interfaces adhere to the constraints guidelines documented in the "DDR3/DDR4 Design Guidelines" section of the *UltraScale Architecture-Based FPGAs Memory IP LogiCORE IP Product Guide* (PG150) [Ref 4]. The VCU118 board DDR4 memory component interface is a 40Ω impedance implementation.

For more information on the internal VREF, see the "Supply Voltages for the SelectIO Pins VREF" and the "Internal VREF" sections in the *UltraScale Architecture SelectIO Resources User Guide* (UG571) [Ref 3]. For more details about the Micron DDR4 component memory, see the Micron MT40A256M16GE data sheet at the Micron website [Ref 18].

RLD3 Component Memory

[Figure 2-1, callout 5]

The 288 MB RLD3 72-bit wide component memory system is comprised of two 36-bit 1.125 Gb RLDRAM3 devices located at U141-U142.

- Manufacturer: Micron
- Part Number: MT44K32M36RB-093E
- Description:
  - 1.125 Gb (32 Mb x 36 CIO)
  - 1.35V 168-ball BGA
  - RL3-2133 (1200 MHz DDR operation)

The VCU118 XCVU9P RLDRAM3 interface performance is documented in the *Virtex UltraScale+ FPGAs Data Sheet: DC and AC Switching Characteristics* (DS923) [Ref 1].

This memory system is connected to the XCVU9P HP banks 46, 47, and 48.

The RLD3 0.6V V_{TT} termination voltage (net RLD3_C3_VTT) is sourced from TI TPS51200DR linear regulator U143. The RLD3 memory interface bank VREF pins are not connected, which, coupled with an XDC set_property INTERNAL_VREF constraint, invoke the INTERNAL VREF mode. The connections between the RLD3 component memories and XCVU9P banks 46, 47, and 48 are listed in Table 3-4.

Table 3-4: **RLD3 Memory 72-bit I/F to FPGA U1 Banks 46, 47, and 48**

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
H39	RLD3_C3_72B_DQ0	SSTL12	D11	DQ0	U141
H40	RLD3_C3_72B_DQ1	SSTL12	E10	DQ1	U141
G40	RLD3_C3_72B_DQ2	SSTL12	C8	DQ2	U141
F40	RLD3_C3_72B_DQ3	SSTL12	C10	DQ3	U141
H38	RLD3_C3_72B_DQ4	SSTL12	C12	DQ4	U141
G38	RLD3_C3_72B_DQ5	SSTL12	B9	DQ5	U141
K37	RLD3_C3_72B_DQ6	SSTL12	B11	DQ6	U141
J37	RLD3_C3_72B_DQ7	SSTL12	A8	DQ7	U141
F38	RLD3_C3_72B_DQ8	SSTL12	A10	DQ8	U141
J35	RLD3_C3_72B_DQ9	SSTL12	J10	DQ9	U141
H35	RLD3_C3_72B_DQ10	SSTL12	K11	DQ10	U141
J36	RLD3_C3_72B_DQ11	SSTL12	K13	DQ11	U141
H37	RLD3_C3_72B_DQ12	SSTL12	L8	DQ12	U141
H34	RLD3_C3_72B_DQ13	SSTL12	L10	DQ13	U141
G35	RLD3_C3_72B_DQ14	SSTL12	L12	DQ14	U141
F35	RLD3_C3_72B_DQ15	SSTL12	M9	DQ15	U141
F36	RLD3_C3_72B_DQ16	SSTL12	M11	DQ16	U141
G36	RLD3_C3_72B_DQ17	SSTL12	N8	DQ17	U141
E37	RLD3_C3_72B_DQ18	SSTL12	D3	DQ18	U141
E38	RLD3_C3_72B_DQ19	SSTL12	E4	DQ19	U141
C39	RLD3_C3_72B_DQ20	SSTL12	C6	DQ20	U141
B40	RLD3_C3_72B_DQ21	SSTL12	C4	DQ21	U141
A39	RLD3_C3_72B_DQ22	SSTL12	C2	DQ22	U141
A40	RLD3_C3_72B_DQ23	SSTL12	B5	DQ23	U141
D40	RLD3_C3_72B_DQ24	SSTL12	B3	DQ24	U141
C40	RLD3_C3_72B_DQ25	SSTL12	A6	DQ25	U141
B38	RLD3_C3_72B_DQ26	SSTL12	A4	DQ26	U141
D35	RLD3_C3_72B_DQ27	SSTL12	J4	DQ27	U141
C35	RLD3_C3_72B_DQ28	SSTL12	K3	DQ28	U141
D34	RLD3_C3_72B_DQ29	SSTL12	K1	DQ29	U141
C34	RLD3_C3_72B_DQ30	SSTL12	L6	DQ30	U141
B36	RLD3_C3_72B_DQ31	SSTL12	L4	DQ31	U141
B37	RLD3_C3_72B_DQ32	SSTL12	L2	DQ32	U141

Table 3-4: **RLD3 Memory 72-bit I/F to FPGA U1 Banks 46, 47, and 48 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
B35	RLD3_C3_72B_DQ33	SSTL12	M5	DQ33	U141
A36	RLD3_C3_72B_DQ34	SSTL12	M3	DQ34	U141
A34	RLD3_C3_72B_DQ35	SSTL12	N6	DQ35	U141
F39	RLD3_C3_72B_DM0	SSTL12	B7	DM0	U141
A35	RLD3_C3_72B_DM1	SSTL12	M7	DM1	U141
J39	RLD3_C3_72B_QK0_P	DIFF_SSTL12	D9	QK0	U141
J40	RLD3_C3_72B_QK0_N	DIFF_SSTL12	E8	QK0_B	U141
F34	RLD3_C3_72B_QK1_P	DIFF_SSTL12	K9	QK1	U141
E34	RLD3_C3_72B_QK1_N	DIFF_SSTL12	J8	QK1_B	U141
E39	RLD3_C3_72B_QK2_P	DIFF_SSTL12	D5	QK2	U141
D39	RLD3_C3_72B_QK2_N	DIFF_SSTL12	E6	QK2_B	U141
D37	RLD3_C3_72B_QK3_P	DIFF_SSTL12	K5	QK3	U141
C37	RLD3_C3_72B_QK3_N	DIFF_SSTL12	J6	QK3_B	U141
G37	RLD3_C3_72B_QVLD0	SSTL12	J12	QVLD0	U141
A38	RLD3_C3_72B_QVLD1	SSTL12	J2	QVLD1	U141
T24	RLD3_C3_72B_DQ36	SSTL12	D11	DQ0	U142
R24	RLD3_C3_72B_DQ37	SSTL12	E10	DQ1	U142
R27	RLD3_C3_72B_DQ38	SSTL12	C8	DQ2	U142
P27	RLD3_C3_72B_DQ39	SSTL12	C10	DQ3	U142
P25	RLD3_C3_72B_DQ40	SSTL12	C12	DQ4	U142
N25	RLD3_C3_72B_DQ41	SSTL12	B9	DQ5	U142
P26	RLD3_C3_72B_DQ42	SSTL12	B11	DQ6	U142
N27	RLD3_C3_72B_DQ43	SSTL12	A8	DQ7	U142
P24	RLD3_C3_72B_DQ44	SSTL12	A10	DQ8	U142
M25	RLD3_C3_72B_DQ45	SSTL12	J10	DQ9	U142
L26	RLD3_C3_72B_DQ46	SSTL12	K11	DQ10	U142
L28	RLD3_C3_72B_DQ47	SSTL12	K13	DQ11	U142
K28	RLD3_C3_72B_DQ48	SSTL12	L8	DQ12	U142
L24	RLD3_C3_72B_DQ49	SSTL12	L10	DQ13	U142
L25	RLD3_C3_72B_DQ50	SSTL12	L12	DQ14	U142
K26	RLD3_C3_72B_DQ51	SSTL12	M9	DQ15	U142
J26	RLD3_C3_72B_DQ52	SSTL12	M11	DQ16	U142
K27	RLD3_C3_72B_DQ53	SSTL12	N8	DQ17	U142
H27	RLD3_C3_72B_DQ54	SSTL12	D3	DQ18	U142

Table 3-4: **RLD3 Memory 72-bit I/F to FPGA U1 Banks 46, 47, and 48 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
G27	RLD3_C3_72B_DQ55	SSTL12	E4	DQ19	U142
F28	RLD3_C3_72B_DQ56	SSTL12	C6	DQ20	U142
E28	RLD3_C3_72B_DQ57	SSTL12	C4	DQ21	U142
H28	RLD3_C3_72B_DQ58	SSTL12	C2	DQ22	U142
G28	RLD3_C3_72B_DQ59	SSTL12	B5	DQ23	U142
E26	RLD3_C3_72B_DQ60	SSTL12	B3	DQ24	U142
E27	RLD3_C3_72B_DQ61	SSTL12	A6	DQ25	U142
G25	RLD3_C3_72B_DQ62	SSTL12	A4	DQ26	U142
B28	RLD3_C3_72B_DQ63	SSTL12	J4	DQ27	U142
A28	RLD3_C3_72B_DQ64	SSTL12	K3	DQ28	U142
C27	RLD3_C3_72B_DQ65	SSTL12	K1	DQ29	U142
B27	RLD3_C3_72B_DQ66	SSTL12	L6	DQ30	U142
B26	RLD3_C3_72B_DQ67	SSTL12	L4	DQ31	U142
A26	RLD3_C3_72B_DQ68	SSTL12	L2	DQ32	U142
D25	RLD3_C3_72B_DQ69	SSTL12	M5	DQ33	U142
D26	RLD3_C3_72B_DQ70	SSTL12	M3	DQ34	U142
C25	RLD3_C3_72B_DQ71	SSTL12	N6	DQ35	U142
N24	RLD3_C3_72B_DM2	SSTL12	B7	DM0	U142
B25	RLD3_C3_72B_DM3	SSTL12	M7	DM1	U142
T26	RLD3_C3_72B_QK4_P	DIFF_SSTL12	D9	QK0	U142
R26	RLD3_C3_72B_QK4_N	DIFF_SSTL12	E8	QK0_B	U142
M27	RLD3_C3_72B_QK5_P	DIFF_SSTL12	K9	QK1	U142
M28	RLD3_C3_72B_QK5_N	DIFF_SSTL12	J8	QK1_B	U142
G26	RLD3_C3_72B_QK6_P	DIFF_SSTL12	D5	QK2	U142
F26	RLD3_C3_72B_QK6_N	DIFF_SSTL12	E6	QK2_B	U142
D27	RLD3_C3_72B_QK7_P	DIFF_SSTL12	K5	QK3	U142
C28	RLD3_C3_72B_QK7_N	DIFF_SSTL12	J6	QK3_B	U142
J27	RLD3_C3_72B_QVLD2	DIFF_SSTL12	J12	QVLD0	U142
F25	RLD3_C3_72B_QVLD3	DIFF_SSTL12	J2	QVLD1	U142
A29	RLD3_C3_72B_A0	SSTL12	E2	A0	U141-U142
C29	RLD3_C3_72B_A1	SSTL12	F5	A1	U141-U142
D29	RLD3_C3_72B_A2	SSTL12	F4	A2	U141-U142
B30	RLD3_C3_72B_A3	SSTL12	F9	A3	U141-U142
C30	RLD3_C3_72B_A4	SSTL12	F10	A4	U141-U142

Table 3-4: **RLD3 Memory 72-bit I/F to FPGA U1 Banks 46, 47, and 48 *(Cont'd)***

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Component Memory		
			Pin #	Pin Name	Ref. Des.
A31	RLD3_C3_72B_A5	SSTL12	F12	A5	U141-U142
A30	RLD3_C3_72B_A6	SSTL12	G3	A6	U141-U142
A33	RLD3_C3_72B_A7	SSTL12	F1	A7	U141-U142
B33	RLD3_C3_72B_A8	SSTL12	G11	A8	U141-U142
B32	RLD3_C3_72B_A9	SSTL12	F13	A9	U141-U142
B31	RLD3_C3_72B_A10	SSTL12	H13	A10	U141-U142
C33	RLD3_C3_72B_A11	SSTL12	D1	A11	U141-U142
C32	RLD3_C3_72B_A12	SSTL12	H11	A12	U141-U142
D30	RLD3_C3_72B_A13	SSTL12	D13	A13	U141-U142
E29	RLD3_C3_72B_A14	SSTL12	H3	A14	U141-U142
F29	RLD3_C3_72B_A15	SSTL12	G2	A15	U141-U142
D32	RLD3_C3_72B_A16	SSTL12	H4	A16	U141-U142
E32	RLD3_C3_72B_A17	SSTL12	H10	A17	U141-U142
D31	RLD3_C3_72B_A18	SSTL12	G12	A18	U141-U142
E31	RLD3_C3_72B_A19	SSTL12	H1	A19	U141-U142
R28	RLD3_C3_72B_A20	SSTL12	F2	NF_A20	U141-U142
E33	RLD3_C3_72B_BA0	SSTL12	G9	BA0	U141-U142
F33	RLD3_C3_72B_BA1	SSTL12	G5	BA1	U141-U142
F30	RLD3_C3_72B_BA2	SSTL12	H8	BA2	U141-U142
G30	RLD3_C3_72B_BA3	SSTL12	H6	BA3	U141-U142
K29	RLD3_C3_72B_WE_B	SSTL12	F6	WE_B	U141-U142
L30	RLD3_C3_72B_REF_B	SSTL12	F8	REF_B	U141-U142
H29	RLD3_C3_72B_CK_P	SSTL12	H7	CK	U141-U142
H30	RLD3_C3_72B_CK_N	SSTL12	G7	CK_B	U141-U142
L29	RLD3_C3_72B_RESET_B	SSTL12	A13	RESET_B	U141-U142
N29	RLD3_C3_72B_CS_B	SSTL12	E12	CS_B	U141-U142
K31	RLD3_C3_72B_DK0_P	DIFF_SSTL12	D7	DK0	U141
J31	RLD3_C3_72B_DK0_N	DIFF_SSTL12	C7	DK0_B	U141
K32	RLD3_C3_72B_DK1_P	DIFF_SSTL12	K7	DK1	U141
J32	RLD3_C3_72B_DK1_N	DIFF_SSTL12	L7	DK1_B	U141
J29	RLD3_C3_72B_DK2_P	DIFF_SSTL12	D7	DK0	U142
J30	RLD3_C3_72B_DK2_N	DIFF_SSTL12	C7	DK0_B	U142
H33	RLD3_C3_72B_DK3_P	DIFF_SSTL12	K7	DK1	U142
G33	RLD3_C3_72B_DK3_N	DIFF_SSTL12	L7	DK1_B	U142

The VCU118 RLD3 72-bit memory component interface adheres to the constraints guidelines documented in the RLD3 Design Guidelines section of *UltraScale Architecture-Based FPGAs Memory IP LogiCORE IP Product Guide* (PG150) [Ref 4]. The VCU118 RLD3 memory component interface is a 40Ω impedance implementation. For more information on the internal VREF, see the "Supply Voltages for the SelectIO Pins", "V_{REF}", and "Internal V_{REF}" sections in *UltraScale Architecture SelectIO Resources* (UG571) [Ref 3]. For more details about the Micron RLD3 component memory, see the Micron MT44K32M36RB-083E Data Sheet [Ref 18].

Quad SPI Flash Memory

VCU118 boards earlier than Rev. 2.0 host a linear BPI 16-bit flash configuration memory, 1 Gb (U133) Micron MT28GU01GAAA1EGC-0SIT. See Appendix C, BPI Flash Memory for VCU118 Boards Prior to Revision 2.0.

[Figure 2-1, callout 6]

The Micron dual MT25QU01GBB8ESF serial NOR flash Quad SPI flash memories are capable of holding the boot image for the XCVU9P FPGA. To achieve higher performance two Quad SPI flash memory devices are connected in parallel and provide an 8-bit data bus for booting and configuration. This interface supports the QSPI32 boot mode as defined in the *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2].

The dual Quad SPI flash memories located at U133 (QSPI0) and U43 (QSPI1) provide 1 Gb each of non-volatile storage that can be used for configuration and data storage.

- Part number: MT25QU01GBB8ESF-0SIT (Micron)
- Supply voltage: 1.8V
- Datapath width: 8 bits
- Data rate: various depending on single/dual/quad mode

The dual-QSPI circuitry is shown in Figure 3-2.

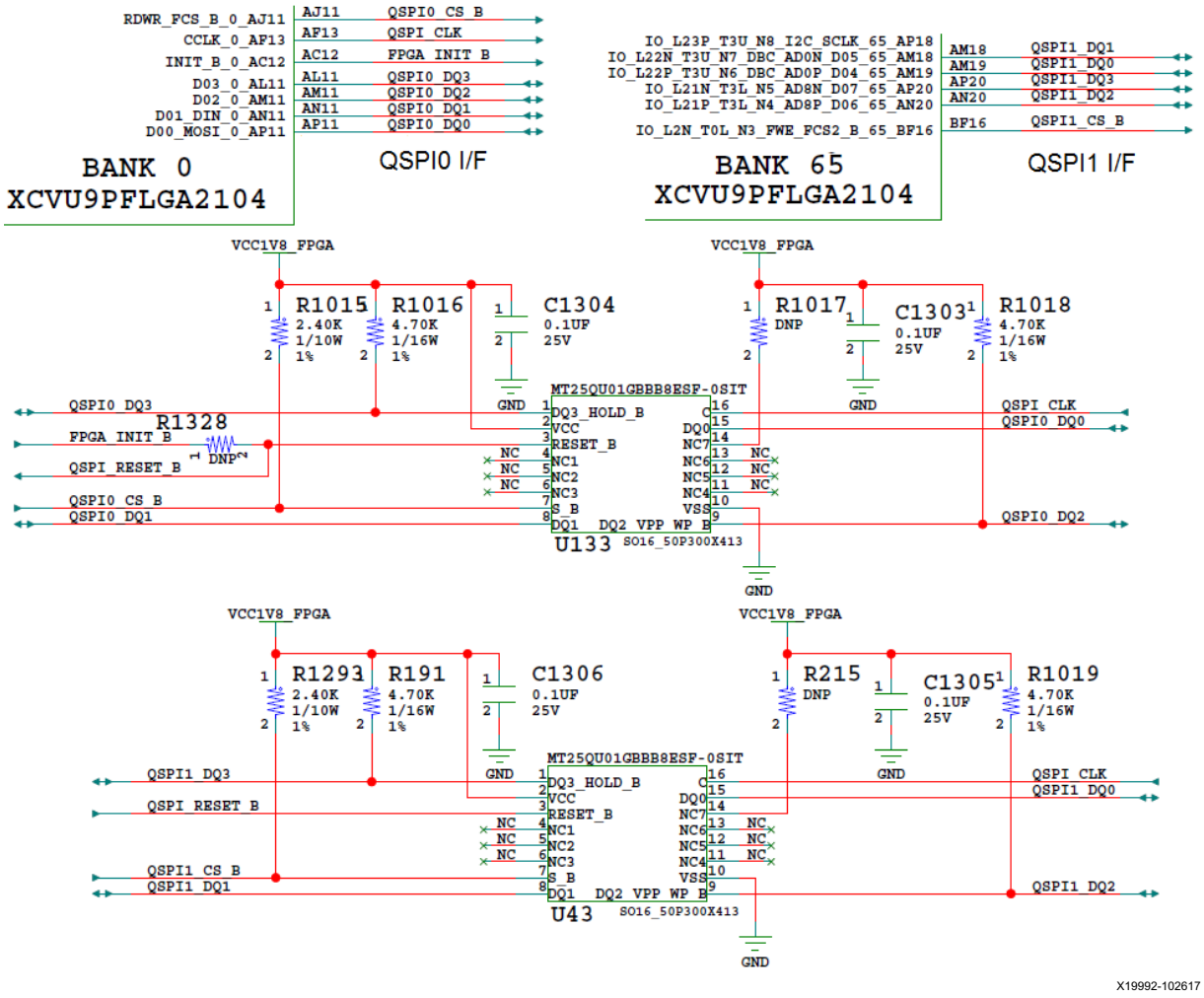

Figure 3-2: **Dual Quad SPI (2 Gbit) Flash Memory**

The connections between the dual-QSPI flash memory and the XCVU9P FPGA are listed in Table 3-5.

Table 3-5: **Quad-SPI Component Connections to FPGA U1**

XCVC9P (U1) Pin	Net Name	U133 (QSPI0), U43 (QSPI1)	
		Pin #	Pin Name
AP11	QSPI0_DQ0	15	DQ0
AN11	QSPI0_DQ1	8	DQ1
AM11	QSPI0_DQ2	9	DQ2_WP_B
AL11	QSPI0_DQ3	1	DQ3_RST_HOLD_B
AF13	QSPI _CLK	16	C
AJ11	QSPI0_CS_B	7	S_B
AM19	QSPI1_DQ0	15	DQ0
AM18	QSPI1_DQ1	8	DQ1
AN20	QSPI1_DQ2	9	DQ2_WP_B
AP20	QSPI1_DQ3	1	DQ3_RST_HOLD_B
AF13	QSPI _CLK	16	C
BF16	QSPI1_CS_B	7	S_B

The *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2] provides FPGA configuration details. For more Quad SPI component information, see the Micron MT25QU01GBB8ESF-0SIT data sheet at the Micron website [Ref 18].

System Controller Micro-SD Card Interface

[Figure 2-1, callout 7]

The VCU118 board includes a secure digital input/output (SDIO) interface allowing the U111 XC7Z010 Zynq-7000 SoC system controller access to general purpose nonvolatile micro-SD memory cards and peripherals. The micro-SD card slot is designed to support 50 MHz high speed micro-SD cards. The SD card is not accessible by the U1 XCVU9P FPGA and is not an FPGA configuration option.

Digilent USB JTAG Module

[Figure 2-1, callout 8, 9]

JTAG configuration is provided through a Digilent onboard USB-to-JTAG configuration logic module (U115) where a host computer accesses the VCU118 board JTAG chain through a type-A (host side) to micro-B (VCU118 board side J106) USB cable.

A 2 mm JTAG header (J3) is also provided in parallel for access by Xilinx download cables, such as the Platform Cable USB II. JTAG initiated configuration takes priority over the configuration method selected through the FPGA mode pins M[2:0], wired to SW16 positions [2:4]. The JTAG chain of the VCU118 board is illustrated in Figure 3-3.

For more details about the Digilent USB JTAG Module, see the Digilent website [Ref 21].

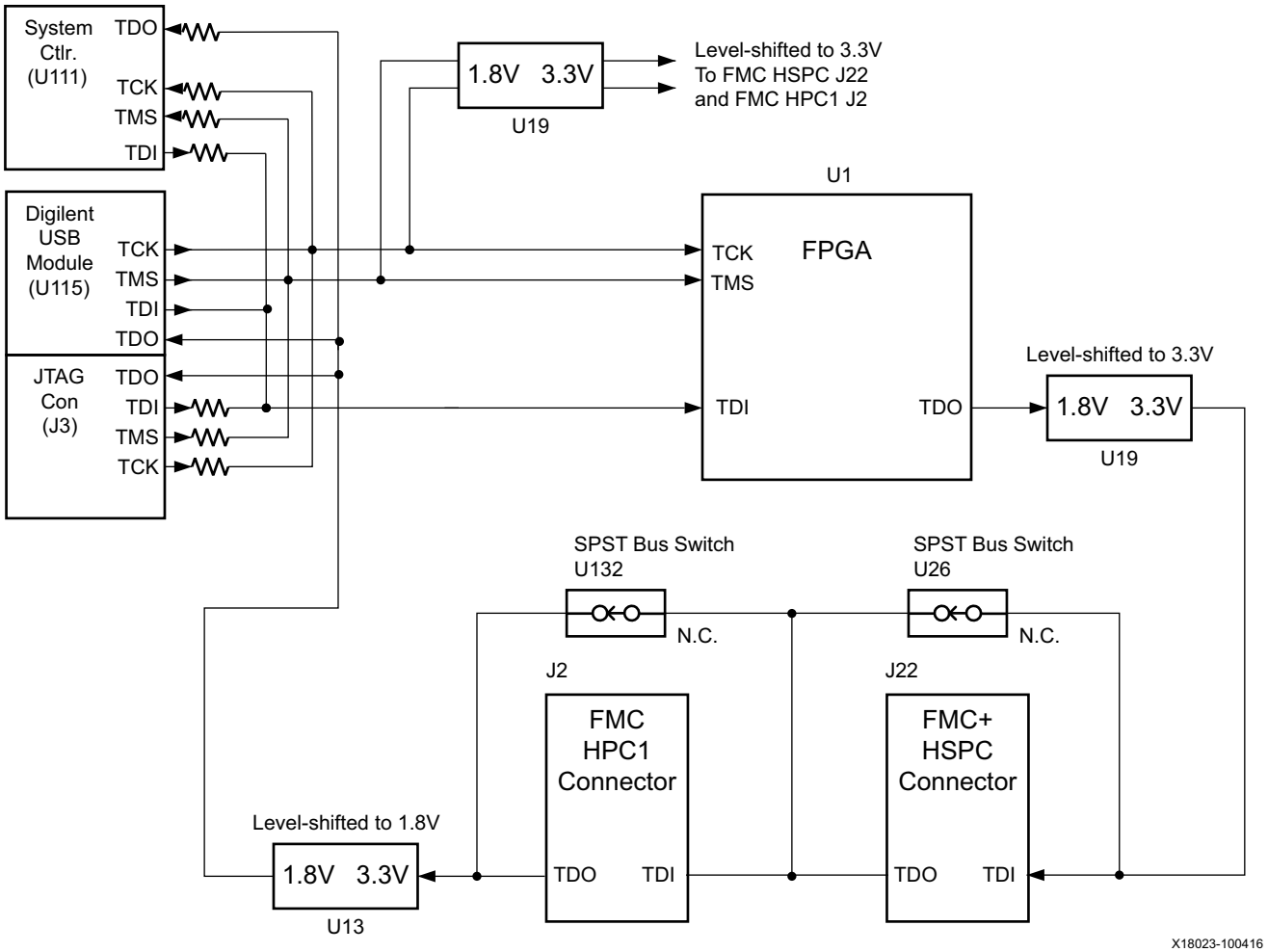

Figure 3-3: **JTAG Chain Block Diagram**

FMC Connector JTAG Bypass

When an FMC is attached to the VCU118 board, it is automatically added to the JTAG chain through electronically controlled single-pole single-throw (SPST) switches U26 (HSPC) and U132 (HPC1). The SPST switches are in a normally closed state and transition to an open state when the FMC is attached. Switch U26 adds an attached FMC to the FPGAs JTAG chain as determined by the FMC_HSPC_H_PRSNT_M2C_B signal. Switch U132 adds an attached FMC to the FPGAs JTAG chain as determined by the FMC_HPC1_PRSNT_M2C_B signal.

IMPORTANT: *The attached FMC must implement a TDI-to-TDO connection through a device or bypass jumper to ensure that the JTAG chain connects to the FPGA U1.*

The JTAG connectivity on the VCU118 board allows a host computer to download bitstreams to the FPGA using the Xilinx tools. In addition, the JTAG connector allows debug tools such as the Vivado serial I/O analyzer or a software debugger to access the FPGA. The Xilinx tools can also program the dual Quad SPI flash memory.

Clock Generation

[Figure 2-1, callout 10]

The VCU118 evaluation board provides multiple clock sources to the FPGA as listed in Table 3-6.

Table 3-6: **VCU118 Board Clock Sources**

Clock Name	Clock Ref. Des.	Description
System clock 300 MHz	U122/U157	Silicon Labs Si5335A 1.8V LVDS any frequency quad clock generator CLK0 drives U157 clock buffer. (SYSCLK1_300_P/N)
System clock 125 MHz	U122	Silicon Labs Si5335A 1.8V LVDS any frequency quad clock generator CLK1. (CLK_125 MHz)
EMC clock 90 MHz	U122	Silicon Labs Si5335A 1.8V LVCMOS single-ended any frequency quad clock generator CLK2. (FPGA_EMCCLK)
System control clock 33.333 MHz	U122	Silicon Labs Si5335A 1.8V LVCMOS single-ended any frequency quad clock generator CLK3. (SYSCTLR_CLK)
User clock 10 MHz-810 MHz	U32/U104	Silicon Labs Si570 3.3V LVDS I^2C programmable oscillator, 156.250 MHz default. U32 output Q0 drives U104 quad clock buffer. (US-ER_SI570_CLOCK_P/N and MGT_SI570_CLOCK1_P/N through MGT_SI570_CLOCK3_P/N)
QSFP1 Jitter attenuated clock	U57	Silicon Labs Si5328B LVDS precision clock multiplier/jitter attenuator. See Jitter Attenuated Clock (SI5328_OUT1_P/N)

Table 3-6: **VCU118 Board Clock Sources *(Cont'd)***

Clock Name	Clock Ref. Des.	Description
QSFP2 Jitter attenuated clock	U57	Silicon Labs Si5328B LVDS precision clock multiplier/jitter attenuator. See Jitter Attenuated Clock (SI5328_OUT2_P/N)
User SMA clock	J34(P), J35(N)	User clock input SMAs. See User SMA Clock (USER_SMA_CLOCK_P and USER_SMA_CLOCK_N).
QSFP clock 10 MHz-810 MHz	U38	Silicon Labs Si570 3.3V LVDS I^2C programmable oscillator, 156.250 MHz default. (QSFP_SI570_CLOCK_P/N)
Fixed 250 MHz	U14/U21	Epson SG5032 3.3V LVDS I^2C oscillator, fixed 250 MHz. U14 output drives U21 dual clock buffer. (250MHZ_CLK1_P/N and 250MHZ_CLK2_P/N)

Table 3-7 lists the VCU118 clock sources to FPGA U1 connections.

Table 3-7: **VCU118 Clock Sources to XCVU9P FPGA U1 Connections**

Clock Source Device/U#.Pin#	Schematic Net Name	I/O Standard	FPGA (U1) Pin
SI53340/U157.9	SYSCLK1_300_P	LVDS	G31
SI53340/U157.10	SYSCLK1_300_N	LVDS	F31
SI5335A/U122.18	CLK_125MHZ_P	LVDS	AY24
SI5335A/U122.17	CLK_125MHZ_N	LVDS	AY23
SI5335A/U122.14	FPGA_EMCCLK(2)	LVCMOS18	AL20
SI5335A/U122.10	SYSCTLR_CLK(2)	LVCMOS18	U111.C7
SI53340/U104.9	USER_SI570_CLOCK_P	LVDS	H32
SI53340/U104.10	USER_SI570_CLOCK_N	LVDS	G32
SI53340/U157.13	USER_SI570_CLOCK1_P	LVDS	AW23
SI53340/U157.14	USER_SI570_CLOCK1_N	LVDS	AW22
SI53340/U104.11	MGT_SI570_CLOCK1_P	NA(2)	AJ9
SI53340/U104.12	MGT_SI570_CLOCK1_N	NA(2)	AJ8
SI53340/U104.13	MGT_SI570_CLOCK2_P	NA(2)	R9
SI53340/U104.14	MGT_SI570_CLOCK2_N	NA(2)	R8
SI53340/U104.15	MGT_SI570_CLOCK3_P	NA(2)	L9
SI53340/U104.16	MGT_SI570_CLOCK3_N	NA(2)	L8
SI5328B/U57.28	SI5328_OUT1_P	NA(1)	U9
SI5328B/U57.29	SI5328_OUT1_N	NA(1)	U8
SI5328B/U57.28	SI5328_OUT2_P	NA(1)	N9
SI5328B/U57.29	SI5328_OUT2_N	NA(1)	N8
SMA/J34.1	USER_SMA_CLOCK_P	LVDS	R32

Table 3-7: **VCU118 Clock Sources to XCVU9P FPGA U1 Connections *(Cont'd)***

Clock Source Device/U#.Pin#	Schematic Net Name	I/O Standard	FPGA (U1) Pin
SMA/J35.1	USER_SMA_CLOCK_N	LVDS	P32
SMA/U38.4	QSFP_SI570_CLOCK_P	NA(2)	W9
SMA/U38.5	QSFP_SI570_CLOCK_N	NA(2)	W8
ICS85411A/U21.1	250MHZ_CLK1_P	LVDS	E12
ICS85411A/U21.2	250MHZ_CLK1_N	LVDS	D12
ICS85411A/U21.3	250MHZ_CLK2_P	LVDS	AW26
ICS85411A/U21.4	250MHZ_CLK2_N	LVDS	AW27

Notes:

1. Series capacitor coupled, MGT connections I/O standard is not applicable.
2. SI570 U32 SI570_OUTPUT_P/N nets are wired to quad clock buffer U104, (1) also applies.

System Clock

[Figure 2-1, callout 11]

The system clock source is a Silicon Labs SI5335A quad clock generator U122. The system clock (SYSCLK) is a LVDS 300 MHz clock sourced from the CLK0A output pair of U122.

SYSCLK is wired to SI53340 U157 clock MUX/quad-buffer input CLK0 P/N inputs (pins 6 (P) and 7 (N)).

The 3.3V SI53340 U157 has four LVDS output clock pairs:

- U157 output Q0 drives clock pair SYSCLK1_300_P/N, connected to XCVU9P FPGA U1 bank 47 global clock (GC) pins G31 and F31 (series capacitor coupled), respectively.
- U157 output Q1 drives clock pair SYSCLK2_300_P/N which is not connected to XCVU9P FPGA U1, it is wired to the SI53340 U104 CLK1 input.
- U157 output Q2 drives clock pair USER_SI570_CLOCK1_P/N, connected to XCVU9P FPGA U1 bank 64 global clock (GC) pins AW23 and AW22, respectively.
- U157 output Q3 is not connected.

Clock generator: U122 Silicon Labs SI5335A-B03426-GM (CLK0A 300 MHz)

- Low phase jitter of 0.7 pS RMS
- LVDS differential output
- Quad clock buffer: Silicon Labs SI53340-B-GM (SYSCLK1, SYSCLK2 300 MHz)
- Additive phase jitter of 43 fs RMS
- LVDS differential output

The 300 MHz system clock circuit (U122 upper right CLK0 branch) is shown in Figure 3-4.

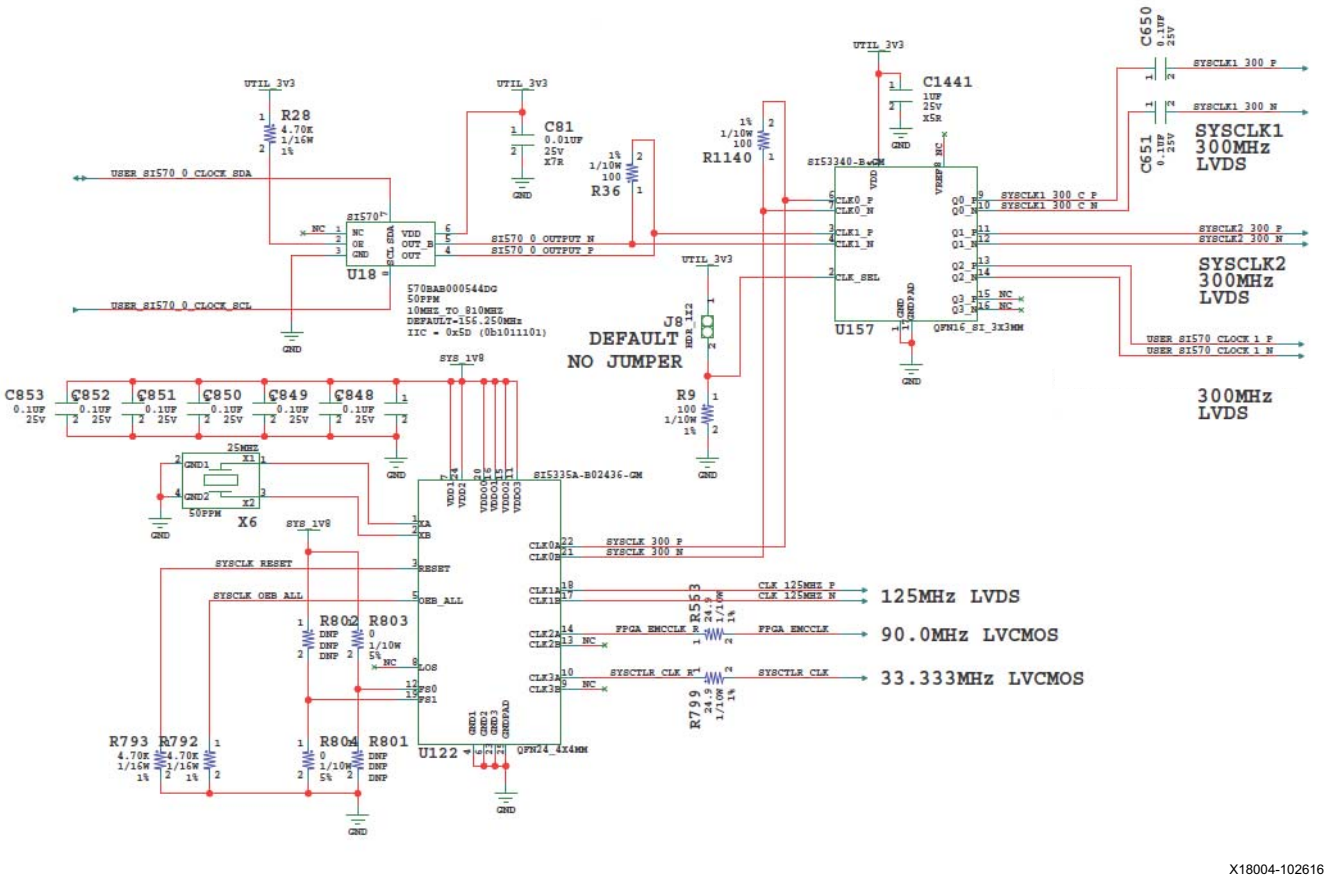

Figure 3-4: **VCU118 System Clock**

The VCU118 SYSCLKn_300 clocks have an optional clock oscillator source U18 as shown in Figure 3-4. SI570 I^{2}C programmable low-jitter 3.3V LVDS differential oscillator U18 is connected to the CLK1 P/N inputs (pins 3 (P) and 4 (N)) of clock MUX/quad buffer SI53340 U157.

The clock MUX input select pin 2 is wired to 2-pin header J8 and a pull-down resistor. The default J8 setting is jumper OFF, which allows the pull-down resistor to select U157 input CLK0, the SI5335A quad clock generator U122 CLK0 300 MHz fixed frequency output. SI570 U18 is selected as the U157 source clock when a jumper block is installed on J8, pulling the U157 select signal High and selecting the U157 CLK1 input. SI570 U18 can be programmed over the IIC_MAIN bus, either from the FPGA U1 fabric or the Zynq-7000 SoC system controller U111. See the I2C Bus, Topology, and Switches section for more details.

On power-up, the U18 SI570 user clock defaults to an output frequency of 156.250 MHz. The system controller and user applications can change the output frequency within the range of 10 MHz to 810 MHz. Power cycling the VCU118 evaluation board resets the user clock to the default frequency of 156.250 MHz.

- Programmable oscillator: Silicon Labs Si570BAB0000544DG (10 MHz-810 MHz)
- Frequency tolerance: 50 ppm
- 3.3V LVDS differential output

Three additional clocks are sourced from the SI5335A U122 quad clock generator:

- Output CLK1: 125 MHz LVDS signal pair CLK_125MHZ_P and CLK_125MHZ_N, connected to XCVU9P FPGA U1 bank 64 pins AY24 and AY23, respectively.
- Output CLK2: 90.0 MHz single-ended 1.8V LVCMOS, series resistor coupled FPGA_EMCCLK, connected to XCVU9P FPGA U1 bank 65 dedicated EMCCLK input pin AL20.
- Output CLK3: 33.3333 MHz single-ended 1.8V LVCMOS, series resistor coupled SYSCTLR_CLK, connected to system controller.

Programmable User Clock 1

[Figure 2-1, callout 12]

The VCU118 evaluation board has a SI570 programmable low-jitter 3.3V LVDS differential oscillator (U32) connected to the CLK0 P/N inputs (pins 6 (P) and 7 (N)) of clock MUX/quad-buffer SI53340 U104.

The 3.3V SI53340 U104 has four LVDS output clock pairs:

- U104 output Q0 drives clock pair USER_SI570_CLOCK_P/N, connected to XCVU9P FPGA U1 HP bank 47 GC pins H32 and G32, respectively.
- U104 output Q1 drives clock pair MGT_SI570_CLOCK1_P/N, connected to XCVU9P FPGA U1 GTY BANK 225 MGTREFCLK1 P/N pins AJ9 and AJ8 (series capacitor coupled), respectively.
- U104 output Q2 drives clock pair MGT_SI570_CLOCK2_P/N, connected to XCVU9P FPGA U1 GTY bank 232 MGTREFCLK0 P/N pins R9 and R8 (series capacitor coupled), respectively.
- U104 output Q3 drives clock pair MGT_SI570_CLOCK3_P/N, connected to XCVU9P FPGA U1 GTY BANK 233 MGTREFCLK0 P/N pins L9 and L8 (series capacitor coupled), respectively.

The U104 clock MUX input select pin 2 is wired to 2-pin header J9 and a pull-down resistor. The default J9 setting is jumper OFF, which allows the pull-down resistor to select U104 input CLK0, the SI570 U32. The SI5335A quad clock generator U122 CLK1 300 MHz fixed frequency output, wired to U104 input CLK1, is selected as the U104 source clock when a jumper block is installed on J9, pulling the U104 select signal High and selecting the U104 CLK1 input.

On power-up, the U32 SI570 user clock defaults to an output frequency of 156.250 MHz. The system controller and user applications can change the output frequency within the range of 10 MHz to 810 MHz through an I^2C interface. Power cycling the VCU118 evaluation board resets the user clock to the default frequency of 156.250 MHz.

- Programmable oscillator: Silicon Labs Si570BAB0000544DG (10 MHz-810 MHz)
- Frequency tolerance: 50 ppm
- 3.3V LVDS differential output

The I^2C programmable SI570 U32/SI53340 U104 clock buffer circuit is shown in Figure 3-5.

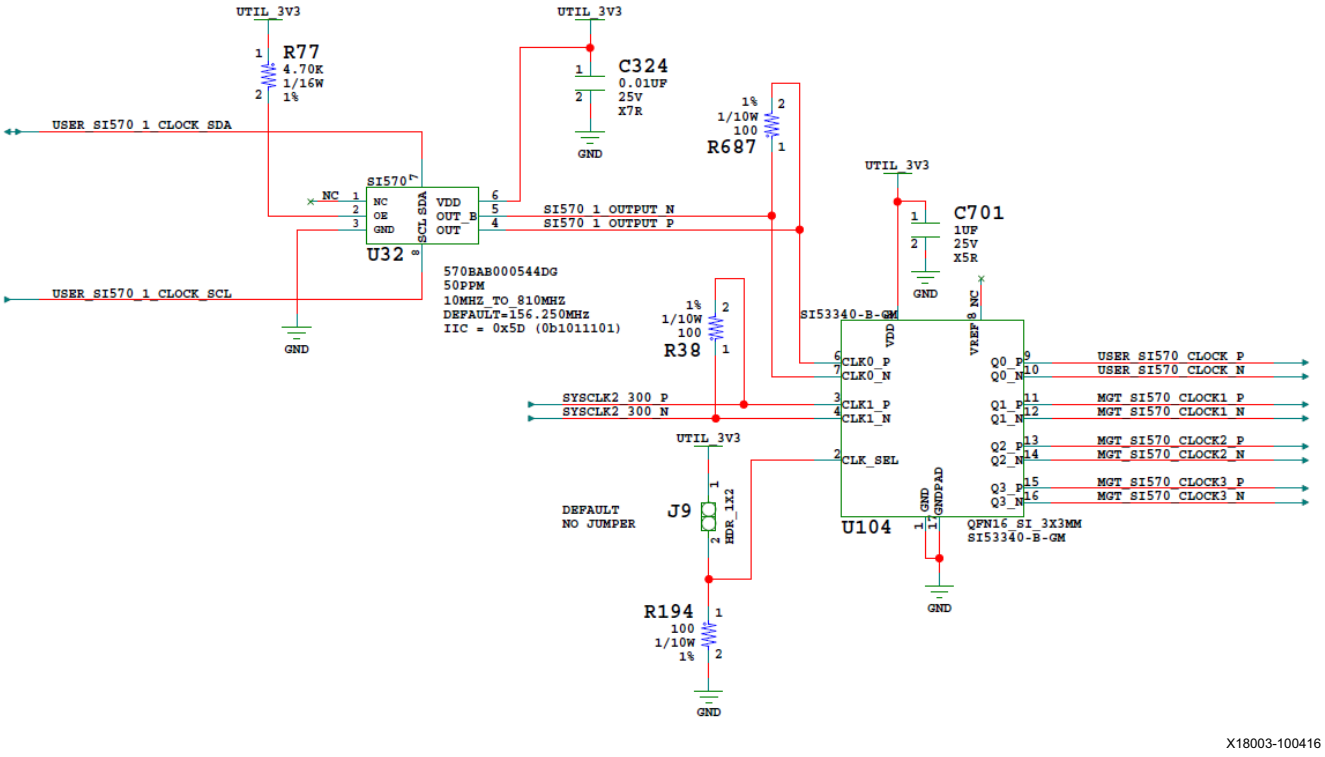

Figure 3-5: **VCU118 Board User and MGT Clocks**

Programmable User Clock 2 (QSFP Clock)

[Figure 2-1, callout 13]

The VCU118 evaluation board has a SI570 I²C programmable low-jitter 3.3V LVDS differential oscillator (U38) connected to FPGA U1 GTY bank 231 MGTREFCLK0 P/N pins W9 and W8 (series capacitor coupled), respectively.

On power-up, the U32 SI570 user clock defaults to an output frequency of 156.250 MHz. The Zynq-7000 SoC system controller or FPGA user IP can change the output frequency within the range of 10 MHz to 810 MHz through an I²C interface. Power cycling the VCU118 evaluation board resets the user clock to the default frequency of 156.250 MHz.

- Programmable oscillator: Silicon Labs Si570BAB0000544DG (10 MHz-810 MHz)
- Frequency tolerance: 50 ppm
- 3.3V LVDS differential output

The programmable clock circuit is shown in Figure 3-6.

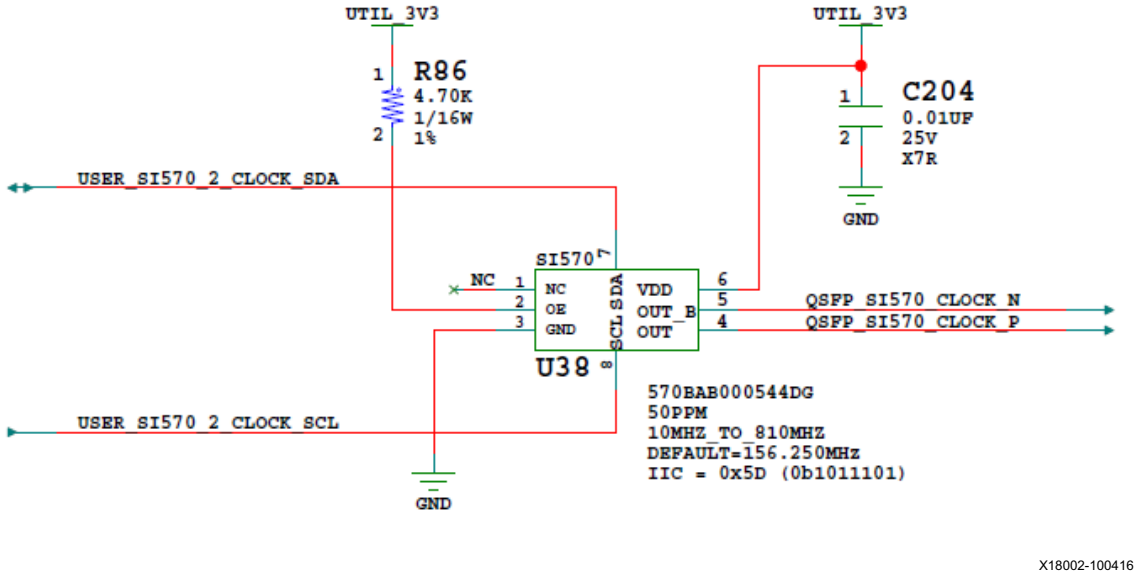

Figure 3-6: **VCU118 Board Programmable QSFP Clock**

250 MHz Clock

[Figure 2-1, callout 14]

The VCU118 evaluation board has an Epson SG5032 3.3V LVDS differential fixed 250 MHz oscillator (U14) connected to 1-to-2 ICS85411 clock buffer U21.

The 3.3V ICS85411 U21 has two LVDS output clock pairs:

- U21 output Q0 drives clock pair 250MHZ_CLK1_P/N, connected to XCVU9P FPGA U1 HP bank 71 GC pins E12 and D12, respectively.
- U21 output Q1 drives clock pair 250MHZ_CLK2_P/N, connected to XCVU9P FPGA U1 HP bank 41 GC pins AW26 and AW27, respectively.

The ICS85411 U21 oscillator is a fixed frequency device:

- Epson SG5032VAN_250.000000M-KEGA3
- Frequency tolerance: 50 ppm
- 3.3V LVDS differential output

The SG5032 U14/ICS85411A U14/U21 clock circuit is shown in Figure 3-7.

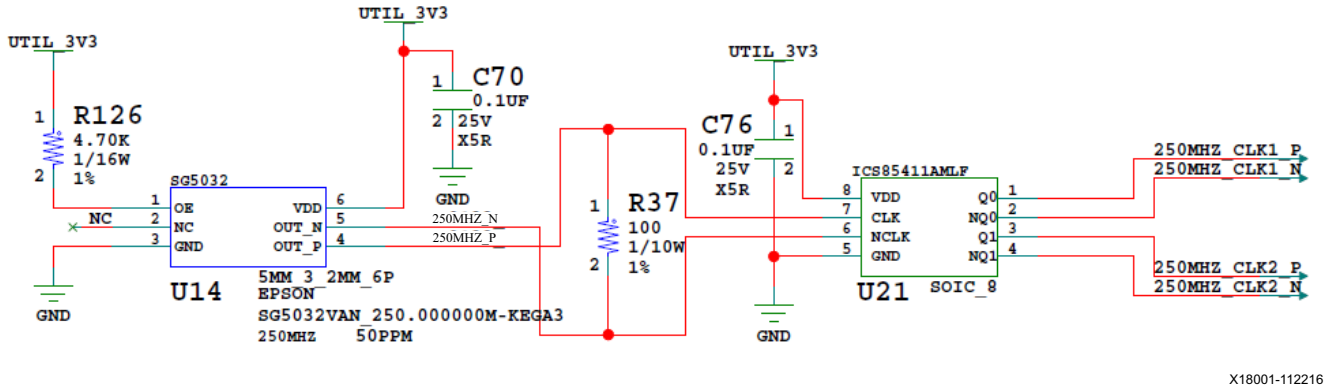

Figure 3-7: **VCU118 Board 250 MHz Clocks**

User SMA Clock

[Figure 2-1, callout 15]

The VCU118 board provides a pair of SMAs for differential user clock input into FPGA U1 HP bank 45. The P-side SMA J34 signal USER_SMA_CLOCK_P is connected to FPGA U1 HP bank 45 GC pin R32, with the N-side SMA J35 signal USER_SMA_CLOCK_N connected to U1 HP bank 45 GC pin P32. Bank 45 VADJ_1V8_FPGA VCCO is nominally 1.8V. The USER_SMA_CLOCK input voltage swing should not exceed the voltage setting on the VADJ_1V8_FPGA rail. Any signal connected to the USER_SMA_CLOCK connector inputs must be equal to or less than the VCCO for bank 45. Valid values for the VADJ rail VADJ_1V8_FPGA are 1.2V, 1.5V, and 1.8V. This value must be confirmed prior to applying signals to the USER_SMA_CLOCK connectors.

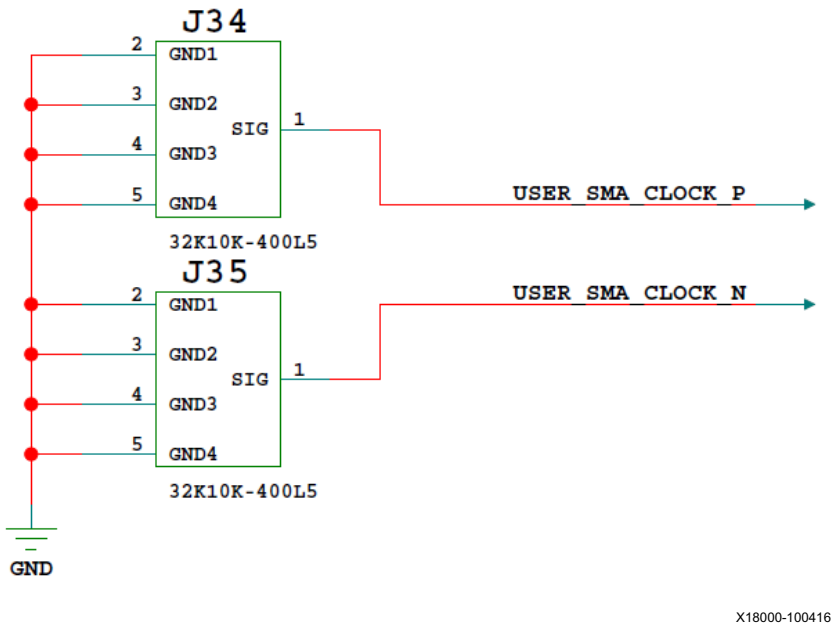

Figure 3-8: **User SMA Clock**

Jitter Attenuated Clock

[Figure 2-1, callout 16]

The VCU118 board includes a Silicon Labs Si5328B jitter attenuator U57 on the back side of the board. The FPGA U1 QSFP1/QSFP2 control interface bank 64 can output QSFP RX differential clocks (QSFP1_RECCLK_P, pin AM23 and QSFP1_RECCLK_N, pin AM22, and QSFP2_RECCLK_P, pin AP23 and QSFP2_RECCLK_N, pin AP22) for jitter attenuation. The jitter attenuated clock (SI5328_CLOCK1_C_P (U57 output pin 28), SI5328_CLOCK1_C_N (U57 output pin 29)) is routed as a reference clock to FPGA U1 GTY Quad 231 inputs MGTREFCLK1P (U1 pin U9) and MGTREFCLK1N (U1 pin U8). The jitter attenuated clock (SI5328_CLOCK2_C_P (U57 output pin 35), SI5328_CLOCK2_C_N (U57 output pin 34)) is routed as a reference clock to FPGA U1 GTY Quad 232 inputs MGTREFCLK1P (U1 pin N9) and MGTREFCLK1N (U1 pin N8).

The primary purpose of this clock is to support synchronous protocols, such as common packet radio interface (CPRI™) or open base station architecture initiative (OBSAI). These synchronous protocols perform clock recovery from user-supplied QSFP/QSFP+ modules, and use the jitter attenuated recovered clock to drive the reference clock inputs of a GTY transceiver.

The system controller configures SI5328B U57 in free-run mode or automatically switches over to one of two recovered clock inputs for synchronous operation. Enabling the jitter attenuation feature requires additional user programming from FPGA IP through the I^2C bus. The jitter attenuated clock circuit is shown in Figure 3-9.

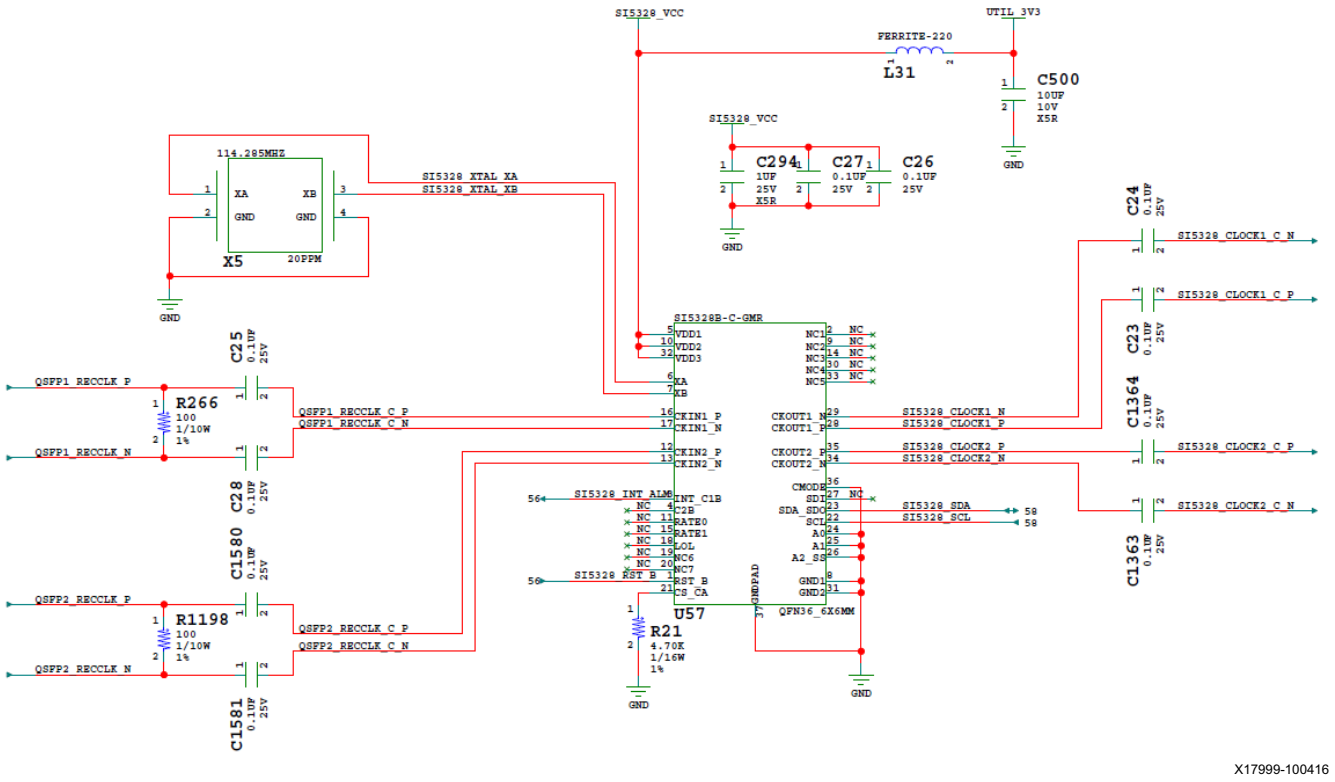

Figure 3-9: **VCU118 Board QSFP Jitter Attenuated Clock**

IMPORTANT: *The Silicon Labs Si5328 U57 pin 1 reset net SI5328_RST_B must be driven High to enable the device. U57 pin 1 net SI5328_RST_B is level-shifted to 1.8V by U3 and is connected to FPGA U1 bank 64 pin BC21.*

IMPORTANT: *The Silicon Labs Si5328 U57 component implements a 3-to-1 multiplexer. One of three input clocks (XA/B, CKIN1, or CKIN2) is selected via I²C programming.*

An active-Low input at U57 pin 1 RST_B performs an external hardware reset of this device. This resets all internal logic to a known state and forces the device registers to their default value. The clock outputs are disabled during reset. The part must be programmed after a reset or a power-on to get a clock output. The reset pin 1 has a weak internal pull-up.

For more details on the Silicon Labs SI5335A, SI570, SI53340, and SI5328B devices, see the Silicon Labs website [Ref 22].

For UltraScale FPGA clocking information, see *UltraScale Architecture Clocking Resources User Guide* (UG572) [Ref 5].

GTY Transceivers

The GTY transceivers in the XCVU9P are grouped into four channels or quads. The XCVU9P has seven GTY quads on the left side of the device and six GTY quads on the right side of the device.

The VCU118 board provides access to 52 of the 52 GTY transceivers:

- Four of the GTY transceivers are wired to Samtec Firefly Module Connector (J6)
- Four of the GTY transceivers are wired to QSFP1 module connector (U145)
- Four of the GTY transceivers are wired to QSFP2 module connector (U123)
- Sixteen of the GTY transceivers are wired to the PCIe 16-lane edge connector (U2)
- Twenty-four of the GTY transceivers are wired to FMC+ HSPC connector (J22)

The reference clock for a quad can be sourced from the quad above or quad below the GTY quad of interest.

Right Side Quads

The six GTY quads on the right side of the VCU118 board have connectivity as listed here:

Quad 120:

- MGTREFCLK0 - FMCP_HSPC_GBTCLK5_M2C_C_P/N (J22)
- MGTREFCLK1 - FMCP_HSPC_GBT1_5_P/N (U39)
- Four GTY transceivers allocated to FMC+ HSPC DP[20:23] (J22)

Quad 121:

- MGTREFCLK0 - FMCP_HSPC_GBT0_0_M2C_C_P/N (U40)
- MGTREFCLK1 - FMCP_HSPC_GBT1_0_M2C_C_P/N (U39)
- Four GTY transceivers allocated to FMC+ HSPC DP[0:3] (J22)

Quad 122:

- MGTREFCLK0 - FMCP_HSPC_GBTCLK2_M2C_C_P/N (J22)
- MGTREFCLK1 - FMCP_HSPC_GBT1_2_M2C_C_P/N (U39)
- Four GTY transceivers allocated to FMC+ HSPC DP[8:11] (J22)

Quad 125:

- MGTREFCLK0 - FMCP_HSPC_GBTCLK3_M2C_C_P/N (J22)
- MGTREFCLK1 - FMCP_HSPC_GBT1_3_M2C_C_P/N (U39)
- Four GTY transceivers allocated to FMC+ HSPC DP[12:15] (J22)

Quad 126:

- MGTREFCLK0 - FMCP_HSPC_GBT0_1_M2C_C_P/N (U40)
- MGTREFCLK1 - FMCP_HSPC_GBT1_1_M2C_C_P/N (U39)
- Four GTY transceivers allocated to FMC+ HSPC DP[4:7] (J22)

Quad 127:

- MGTREFCLK0 - FMCP_HSPC_GBTCLK4_M2C_C_P/N (J22)
- MGTREFCLK1 - FMCP_HSPC_GBT1_4_M2C_C_P/N (U39)
- Four GTY transceivers allocated to FMC+ HSPC DP[16:19] (J22)

Table 3-8 through Table 3-13 list the VCU118 FPGA U1 GTY transceiver bank 120, 122, 123, 125, 126, 127 connections, respectively.

Table 3-8: **VCU118 FPGA U1 GTY Transceiver Bank 120 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 120	BD42	MGTYTXP0_120	FMCP_HSPC_DP20_C2M_P	Z8	DP20_C2M_P	FMC+ HSPC J22
	BD43	MGTYTXN0_120	FMCP_HSPC_DP20_C2M_N	Z9	DP20_C2M_N	
	BC45	MGTYRXP0_120	FMCP_HSPC_DP20_M2C_P	M14	DP20_M2C_P	
	BC46	MGTYRXN0_120	FMCP_HSPC_DP20_M2C_N	M15	DP20_M2C_N	
	BB42	MGTYTXP1_120	FMCP_HSPC_DP21_C2M_P	Y6	DP21_C2M_P	
	BB43	MGTYTXN1_120	FMCP_HSPC_DP21_C2M_N	Y7	DP21_C2M_N	
	BA45	MGTYRXP1_120	FMCP_HSPC_DP21_M2C_P	M10	DP21_M2C_P	
	BA46	MGTYRXN1_120	FMCP_HSPC_DP21_M2C_N	M11	DP21_M2C_N	
	AY42	MGTYTXP2_120	FMCP_HSPC_DP22_C2M_P	Z4	DP22_C2M_P	
	AY43	MGTYTXN2_120	FMCP_HSPC_DP22_C2M_N	Z5	DP22_C2M_N	
	AW45	MGTYRXP2_120	FMCP_HSPC_DP22_M2C_P	M6	DP22_M2C_P	
	AW46	MGTYRXN2_120	FMCP_HSPC_DP22_M2C_N	M7	DP22_M2C_N	
	AV42	MGTYTXP3_120	FMCP_HSPC_DP23_C2M_P	Y2	DP23_C2M_P	
	AV43	MGTYTXN3_120	FMCP_HSPC_DP23_C2M_N	Y3	DP23_C2M_N	
	AU45	MGTYRXP3_120	FMCP_HSPC_DP23_M2C_P	M2	DP23_M2C_P	
	AU46	MGTYRXN3_120	FMCP_HSPC_DP23_M2C_N	M3	DP23_M2C_N	
	AN40	MGTREFCLK0P_120	FMCP_HSPC_GBTCLK5_M2C_P	Z20	GBTCLK5_M2C_P	
	AN41	MGTREFCLK0N_120	FMCP_HSPC_GBTCLK5_M2C_N	Z21	GBTCLK5_M2C_N	
	AM38	MGTREFCLK1P_120	FMCP_HSPC_GBT1_5_P	19	Q5_P	U39 ICS855S006I clock buffer
	AM39	MGTREFCLK1N_120	FMCP_HSPC_GBT1_5_N	20	Q5_N	

Table 3-9: **VCU118 FPGA U1 GTY Transceiver Bank 121 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 121	AT42	MGTYTXP0_121	FMCP_HSPC_DP0_C2M_P	C2	DP0_C2M_P	FMC+ HSPC J22
	AT43	MGTYTXN0_121	FMCP_HSPC_DP0_C2M_N	C3	DP0_C2M_N	
	AR45	MGTYRXP0_121	FMCP_HSPC_DP0_M2C_P	C6	DP0_M2C_P	
	AR46	MGTYRXN0_121	FMCP_HSPC_DP0_M2C_N	C7	DP0_M2C_N	
	AP42	MGTYTXP1_121	FMCP_HSPC_DP1_C2M_P	A22	DP1_C2M_P	
	AP43	MGTYTXN1_121	FMCP_HSPC_DP1_C2M_N	A23	DP1_C2M_N	
	AN45	MGTYRXP1_121	FMCP_HSPC_DP1_M2C_P	A2	DP1_M2C_P	
	AN46	MGTYRXN1_121	FMCP_HSPC_DP1_M2C_N	A3	DP1_M2C_N	
	AM42	MGTYTXP2_121	FMCP_HSPC_DP2_C2M_P	A26	DP2_C2M_P	
	AM43	MGTYTXN2_121	FMCP_HSPC_DP2_C2M_N	A27	DP2_C2M_N	
	AL45	MGTYRXP2_121	FMCP_HSPC_DP2_M2C_P	A6	DP2_M2C_P	
	AL46	MGTYRXN2_121	FMCP_HSPC_DP2_M2C_N	A7	DP2_M2C_N	
	AL40	MGTYTXP3_121	FMCP_HSPC_DP3_C2M_P	A30	DP3_C2M_P	
	AL41	MGTYTXN3_121	FMCP_HSPC_DP3_C2M_N	A31	DP3_C2M_N	
	AJ45	MGTYRXP3_121	FMCP_HSPC_DP3_M2C_P	A10	DP3_M2C_P	
	AJ46	MGTYRXN3_121	FMCP_HSPC_DP3_M2C_N	A11	DP3_M2C_N	
	AK38	MGTREFCLK0P_121	FMCP_HSPC_GBT0_0_P	1	Q0	U40 ICS85411A clock buffer
	AK39	MGTREFCLK0N_121	FMCP_HSPC_GBT0_0_N	2	NQ0	
	AH38	MGTREFCLK1P_121	FMCP_HSPC_GBT1_0_P	5	Q0_P	U39 ICS855S006I clock buffer
	AH39	MGTREFCLK1N_121	FMCP_HSPC_GBT1_0_N	6	Q0_N	
	BF43	MGTRREF_LS	MGTRREF_121	R175.1 100Ω 1% P/U to MGTAVTT_FPGA		
	BF42	MGTAVTTRCAL	MGTAVTT_FPGA	NA	NA	NA

Table 3-10: **VCU118 FPGA U1 GTY Transceiver Bank 122 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 122	AK42	MGTYTXP0_122	FMCP_HSPC_DP8_C2M_P	B28	DP8_C2M_P	FMC+ HSPC J22
	AK43	MGTYTXN0_122	FMCP_HSPC_DP8_C2M_N	B29	DP8_C2M_N	
	AG45	MGTYRXP0_122	FMCP_HSPC_DP8_M2C_P	B8	DP8_M2C_P	
	AG46	MGTYRXN0_122	FMCP_HSPC_DP8_M2C_N	B9	DP8_M2C_N	
	AJ40	MGTYTXP1_122	FMCP_HSPC_DP9_C2M_P	B24	DP9_C2M_P	
	AJ41	MGTYTXN1_122	FMCP_HSPC_DP9_C2M_N	B25	DP9_C2M_N	
	AF43	MGTYRXP1_122	FMCP_HSPC_DP9_M2C_P	B4	DP9_M2C_P	
	AF44	MGTYRXN1_122	FMCP_HSPC_DP9_M2C_N	B5	DP9_M2C_N	
	AG40	MGTYTXP2_122	FMCP_HSPC_DP10_C2M_P	Z24	DP10_C2M_P	
	AG41	MGTYTXN2_122	FMCP_HSPC_DP10_C2M_N	Z25	DP10_C2M_N	
	AE45	MGTYRXP2_122	FMCP_HSPC_DP10_M2C_P	Y10	DP10_M2C_P	
	AE46	MGTYRXN2_122	FMCP_HSPC_DP10_M2C_N	Y11	DP10_M2C_N	
	AE40	MGTYTXP3_122	FMCP_HSPC_DP11_C2M_P	Y26	DP11_C2M_P	
	AE41	MGTYTXN3_122	FMCP_HSPC_DP11_C2M_N	Y27	DP11_C2M_N	
	AD43	MGTYRXP3_122	FMCP_HSPC_DP11_M2C_P	Z12	DP11_M2C_P	
	AD44	MGTYRXN3_122	FMCP_HSPC_DP11_M2C_N	Z13	DP11_M2C_N	
	AF38	MGTREFCLK0P_122	FMCP_HSPC_GBTCLK2_M2C_P	L12	GBTCLK2_M2C_P	
	AF39	MGTREFCLK0N_122	FMCP_HSPC_GBTCLK2_M2C_N	L13	GBTCLK2_M2C_N	
	AD38	MGTREFCLK1P_122	FMCP_HSPC_GBT1_2_P	11	Q2_P	U39 ICS855S006I clock buffer
	AD39	MGTREFCLK1N_122	FMCP_HSPC_GBT1_2_N	12	Q2_N	

Table 3-11: **VCU118 FPGA U1 GTY Transceiver Bank 125 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 125	AC40	MGTYTXP0_125	FMCP_HSPC_DP12_C2M_P	Z28	DP12_C2M_P	FMC+ HSPC J22
	AC41	MGTYTXN0_125	FMCP_HSPC_DP12_C2M_N	Z29	DP12_C2M_N	
	AC45	MGTYRXP0_125	FMCP_HSPC_DP12_M2C_P	Y14	DP12_M2C_P	
	AC46	MGTYRXN0_125	FMCP_HSPC_DP12_M2C_N	Y15	DP12_M2C_N	
	AA40	MGTYTXP1_125	FMCP_HSPC_DP13_C2M_P	Y30	DP13_C2M_P	
	AA41	MGTYTXN1_125	FMCP_HSPC_DP13_C2M_N	Y31	DP13_C2M_N	
	AB43	MGTYRXP1_125	FMCP_HSPC_DP13_M2C_P	Z16	DP13_M2C_P	
	AB44	MGTYRXN1_125	FMCP_HSPC_DP13_M2C_N	Z17	DP13_M2C_N	
	W40	MGTYTXP2_125	FMCP_HSPC_DP14_C2M_P	M18	DP14_C2M_P	
	W41	MGTYTXN2_125	FMCP_HSPC_DP14_C2M_N	M19	DP14_C2M_N	
	AA45	MGTYRXP2_125	FMCP_HSPC_DP14_M2C_P	Y18	DP14_M2C_P	
	AA46	MGTYRXN2_125	FMCP_HSPC_DP14_M2C_N	Y19	DP14_M2C_N	
	U40	MGTYTXP3_125	FMCP_HSPC_DP15_C2M_P	M22	DP15_C2M_P	
	U41	MGTYTXN3_125	FMCP_HSPC_DP15_C2M_N	M23	DP15_C2M_N	
	Y43	MGTYRXP3_125	FMCP_HSPC_DP15_M2C_P	Y22	DP15_M2C_P	
	Y44	MGTYRXN3_125	FMCP_HSPC_DP15_M2C_N	Y23	DP15_M2C_N	
	AB38	MGTREFCLK0P_125	FMCP_HSPC_GBTCLK3_M2C_C_P	L8	GBTCLK3_M2C_P	
	AB39	MGTREFCLK0N_125	FMCP_HSPC_GBTCLK3_M2C_C_N	L9	GBTCLK3_M2C_N	
	Y38	MGTREFCLK1P_125	FMCP_HSPC_GBT1_3_P	13	Q3_P	U39 ICS855S006I clock buffer
	Y39	MGTREFCLK1N_125	FMCP_HSPC_GBT1_3_N	14	Q3_N	

Table 3-12: **VCU118 FPGA U1 GTY Transceiver Bank 126 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 126	T42	MGTYTXP0_126	FMCP_HSPC_DP4_C2M_P	A34	DP4_C2M_P	FMC+ HSPC J22
	T43	MGTYTXN0_126	FMCP_HSPC_DP4_C2M_N	A35	DP4_C2M_N	
	W45	MGTYRXP0_126	FMCP_HSPC_DP4_M2C_P	A14	DP4_M2C_P	
	W46	MGTYRXN0_126	FMCP_HSPC_DP4_M2C_N	A15	DP4_M2C_N	
	P42	MGTYTXP1_126	FMCP_HSPC_DP5_C2M_P	A38	DP5_C2M_P	
	P43	MGTYTXN1_126	FMCP_HSPC_DP5_C2M_N	A39	DP5_C2M_N	
	U45	MGTYRXP1_126	FMCP_HSPC_DP5_M2C_P	A18	DP5_M2C_P	
	U46	MGTYRXN1_126	FMCP_HSPC_DP5_M2C_N	A19	DP5_M2C_N	
	M42	MGTYTXP2_126	FMCP_HSPC_DP6_C2M_P	B36	DP6_C2M_P	
	M43	MGTYTXN2_126	FMCP_HSPC_DP6_C2M_N	B37	DP6_C2M_N	
	R45	MGTYRXP2_126	FMCP_HSPC_DP6_M2C_P	B16	DP6_M2C_P	
	R46	MGTYRXN2_126	FMCP_HSPC_DP6_M2C_N	B17	DP6_M2C_N	
	K42	MGTYTXP3_126	FMCP_HSPC_DP7_C2M_P	B32	DP7_C2M_P	
	K43	MGTYTXN3_126	FMCP_HSPC_DP7_C2M_N	B33	DP7_C2M_N	
	N45	MGTYRXP3_126	FMCP_HSPC_DP7_M2C_P	B12	DP7_M2C_P	
	N46	MGTYRXN3_126	FMCP_HSPC_DP7_M2C_N	B13	DP7_M2C_N	
	V38	MGTREFCLK0P_126	FMCP_HSPC_GBT0_1_P	3	Q1	U40 ICS85411A clock buffer
	V39	MGTREFCLK0N_126	FMCP_HSPC_GBT0_1_N	4	NQ1	
	T38	MGTREFCLK1P_126	FMCP_HSPC_GBT1_1_P	8	Q1_P	U39 ICS855S006I clock buffer
	T39	MGTREFCLK1N_126	FMCP_HSPC_GBT1_1_N	9	Q1_N	
	L41	MGTRREF_LN	MGTRREF_126	R176.1 100Ω 1% P/U to MGTAVTT_FPGA		
	L40	MGTAVTTRCAL_LN	MGTAVTT_FPGA	NA	NA	NA

Table 3-13: **VCU118 FPGA U1 GTY Transceiver Bank 127 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 127	H42	MGTYTXP0_127	FMCP_HSPC_DP16_C2M_P	M26	DP16_C2M_P	FMC+ HSPC J22
	H43	MGTYTXN0_127	FMCP_HSPC_DP16_C2M_N	M27	DP16_C2M_N	
	L45	MGTYRXP0_127	FMCP_HSPC_DP16_M2C_P	Z32	DP16_M2C_P	
	L46	MGTYRXN0_127	FMCP_HSPC_DP16_M2C_N	Z33	DP16_M2C_N	
	F42	MGTYTXP1_127	FMCP_HSPC_DP17_C2M_P	M30	DP17_C2M_P	
	F43	MGTYTXN1_127	FMCP_HSPC_DP17_C2M_N	M31	DP17_C2M_N	
	J45	MGTYRXP1_127	FMCP_HSPC_DP17_M2C_P	Y34	DP17_M2C_P	
	J46	MGTYRXN1_127	FMCP_HSPC_DP17_M2C_N	Y35	DP17_M2C_N	
	D42	MGTYTXP2_127	FMCP_HSPC_DP18_C2M_P	M34	DP18_C2M_P	
	D43	MGTYTXN2_127	FMCP_HSPC_DP18_C2M_N	M35	DP18_C2M_N	
	G45	MGTYRXP2_127	FMCP_HSPC_DP18_M2C_P	Z36	DP18_M2C_P	
	G46	MGTYRXN2_127	FMCP_HSPC_DP18_M2C_N	Z37	DP18_M2C_N	
	B42	MGTYTXP3_127	FMCP_HSPC_DP19_C2M_P	M38	DP19_C2M_P	
	B43	MGTYTXN3_127	FMCP_HSPC_DP19_C2M_N	M39	DP19_C2M_N	
	E45	MGTYRXP3_127	FMCP_HSPC_DP19_M2C_P	Y38	DP19_M2C_P	
	E46	MGTYRXN3_127	FMCP_HSPC_DP19_M2C_N	Y39	DP19_M2C_N	
	R40	MGTREFCLK0P_127	FMCP_HSPC_GBTCLK4_M2C_C_P	L4	GBTCLK4_M2C_P	
	R41	MGTREFCLK0N_127	FMCP_HSPC_GBTCLK4_M2C_C_N	L5	GBTCLK4_M2C_N	
	N40	MGTREFCLK1P_127	FMCP_HSPC_GBT1_4_P	16	Q4_P	U39 ICS855S006I clock buffer
	N41	MGTREFCLK1N_127	FMCP_HSPC_GBT1_4_N	17	Q4_N	

Left Side Quads

The seven GTY quads on the left side of the VCU118 board have connectivity as listed here:

Quad 224:

- MGTREFCLK0 - not connected
- MGTREFCLK1 - not connected
- Four GTY transceivers allocated to PCIe lanes 15:12

Quad 225:

- MGTREFCLK0 - PCIE_CLK1_P/N (U20)
- MGTREFCLK1 - MGT_SI570_CLOCK1_C_P/N (U104)
- Four GTY transceivers allocated to PCIe lanes 11:8

Quad 226:

- MGTREFCLK0 - MGT226_CLK0_P/N (SMA J31 P, J30 N)
- MGTREFCLK1 - not connected
- Four GTY transceivers allocated to PCIe lanes 7:4

Quad 227:

- MGTREFCLK0 - PCIE_CLK2_P/N (U20)
- MGTREFCLK1 - not connected
- Four GTY transceivers allocated to PCIe lanes 3:0

Quad 231:

- MGTREFCLK0 - QSFP_SI570_CLOCK_C_P/N (U38)
- MGTREFCLK1 - SI5328_CLOCK1_C_P/N (U57)
- Four GTY transceivers allocated to QSFP1 (U145)

Quad 232:

- MGTREFCLK0 - MGT_SI570_CLOCK2_C_P/N (U104)
- MGTREFCLK1 - SI5328_CLOCK2_C_P/N (U57)
- Four GTY transceivers allocated to QSFP2 (U123)

Quad 233:

- MGTREFCLK0 - MGT_SI570_CLOCK3_C_P/N (U104)
- MGTREFCLK1 - MGT233_CLK1_P/N (SMA J33 P, J32 N)
- Four GTY transceivers allocated to FIREFLY (J6)

Table 3-14 through Table 3-20 list the VCU118 FPGA U1 GTY transceiver bank 224, 225, 226, 227, 231, 232 and 233 connections, respectively.

Table 3-14: **VCU118 FPGA U1 GTY Transceiver Bank 224 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 224	BE5	MGTYTXP0_224	PCIE_TX15_P	A80	HSIP(15)	PCIe EDGE Conn. U2
	BE4	MGTYTXN0_224	PCIE_TX15_N	A81	HSIN(15)	
	BB2	MGTYRXP0_224	PCIE_RX15_P	B78	HSOP(15)	
	BB1	MGTYRXN0_224	PCIE_RX15_N	B79	HSON(15)	
	BC5	MGTYTXP1_224	PCIE_TX14_P	A76	HSIP(14)	
	BC4	MGTYTXN1_224	PCIE_TX14_N	A77	HSIN(14)	
	AY2	MGTYRXP1_224	PCIE_RX14_P	B74	HSOP(14)	
	AY1	MGTYRXN1_224	PCIE_RX14_N	B75	HSON(14)	
	BA5	MGTYTXP2_224	PCIE_TX13_P	A72	HSIP(13)	
	BA4	MGTYTXN2_224	PCIE_TX13_N	A73	HSIN(13)	
	AV2	MGTYRXP2_224	PCIE_RX13_P	B70	HSOP(13)	
	AV1	MGTYRXN2_224	PCIE_RX13_N	B71	HSON(13)	
	AW5	MGTYTXP3_224	PCIE_TX12_P	A68	HSIP(12)	
	AW4	MGTYTXN3_224	PCIE_TX12_N	A69	HSIN(12)	
	AT2	MGTYRXP3_224	PCIE_RX12_P	B66	HSOP(12)	
	AT1	MGTYRXN3_224	PCIE_RX12_N	B67	HSON(12)	
	AR9	MGTREFCLK0P_224	NC			
	AR8	MGTREFCLK0N_224	NC			
	AN9	MGTREFCLK1P_224	NC			
	AN8	MGTREFCLK1N_224	NC			

Table 3-15: **VCU118 FPGA U1 GTY Transceiver Bank 225 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 225	AU5	MGTYTXP0_225	PCIE_TX11_P	A64	HSIP(11)	PCIe EDGE Conn. U2
	AU4	MGTYTXN0_225	PCIE_TX11_N	A65	HSIN(11)	
	AP2	MGTYRXP0_225	PCIE_RX11_P	B62	HSOP(11)	
	AP1	MGTYRXN0_225	PCIE_RX11_N	B63	HSON(11)	
	AT7	MGTYTXP1_225	PCIE_TX10_P	A60	HSIP(10)	
	AT6	MGTYTXN1_225	PCIE_TX10_N	A61	HSIN(10)	
	AM2	MGTYRXP1_225	PCIE_RX10_P	B58	HSOP(10)	
	AM1	MGTYRXN1_225	PCIE_RX10_N	B59	HSON(10)	
	AR5	MGTYTXP2_225	PCIE_TX9_P	A56	HSIP(9)	
	AR4	MGTYTXN2_225	PCIE_TX9_N	A57	HSIN(9)	
	AK2	MGTYRXP2_225	PCIE_RX9_P	B54	HSOP(9)	
	AK1	MGTYRXN2_225	PCIE_RX9_N	B55	HSON(9)	
	AP7	MGTYTXP3_225	PCIE_TX8_P	A52	HSIP(8)	
	AP6	MGTYTXN3_225	PCIE_TX8_N	A53	HSIN(8)	
	AJ4	MGTYRXP3_225	PCIE_RX8_P	B50	HSOP(8)	
	AJ3	MGTYRXN3_225	PCIE_RX8_N	B51	HSON(8)	
	AL9	MGTREFCLK0P_225	PCIE_CLK1_P	1	Q0	U20 ICS85411A clock buffer
	AL8	MGTREFCLK0N_225	PCIE_CLK1_N	2	NQ0	
	AJ9	MGTREFCLK1P_225	MGT_SI570_CLOCK1_C_P	11	Q1_P	U104 SI53340 clock buffer
	AJ8	MGTREFCLK1N_225	MGT_SI570_CLOCK1_C_N	12	Q1_N	

Table 3-16: **VCU118 FPGA U1 GTY Transceiver Bank 226 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 226	AN5	MGTYTXP0_226	PCIE_TX7_P	A47	HSIP(7)	PCIe EDGE Conn. U2
	AN4	MGTYTXN0_226	PCIE_TX7_N	A48	HSIN(7)	
	AH2	MGTYRXP0_226	PCIE_RX7_P	B45	HSOP(7)	
	AH1	MGTYRXN0_226	PCIE_RX7_N	B46	HSON(7)	
	AM7	MGTYTXP1_226	PCIE_TX6_P	A43	HSIP(6)	
	AM6	MGTYTXN1_226	PCIE_TX6_N	A44	HSIN(6)	
	AG4	MGTYRXP1_226	PCIE_RX6_P	B41	HSOP(6)	
	AG3	MGTYRXN1_226	PCIE_RX6_N	B42	HSON(6)	
	AK7	MGTYTXP2_226	PCIE_TX5_P	A39	HSIP(5)	
	AK6	MGTYTXN2_226	PCIE_TX5_N	A40	HSIN(5)	
	AF2	MGTYRXP2_226	PCIE_RX5_P	B37	HSOP(5)	
	AF1	MGTYRXN2_226	PCIE_RX5_N	B38	HSON(5)	
	AH7	MGTYTXP3_226	PCIE_TX4_P	A35	HSIP(4)	
	AH6	MGTYTXN3_226	PCIE_TX4_N	A36	HSIN(4)	
	AE4	MGTYRXP3_226	PCIE_RX4_P	B33	HSOP(4)	
	AE3	MGTYRXN3_226	PCIE_RX4_N	B34	HSON(4)	
	AG9	MGTREFCLK0P_226	MGT226_CLK0_P(1)	J31	1	SMA Connectors J31(P), J30(N)
	AG8	MGTREFCLK0N_226	MGT226_CLK0_N(1)	J30	1	
	AE9	MGTREFCLK1P_226	NC			
	AE8	MGTREFCLK1N_226	NC			
	BD2	MGTRREF_RS	MGTRREF_226	R1088.1 100Ω 1% P/U to MGTAVTT_FPGA		
	BD3	MGTAVTTRCAL_RS	MGTAVTT_FPGA	NA	NA	NA

Notes:

1. Ensure that the GTY RefClock being sourced into the RefClock SMAs (J30, J31) is AC coupled for proper clocking operation of GTY transceivers. Use inline SMA DC blocking capacitors if frequency source output is not AC coupled.

Table 3-17: **VCU118 FPGA U1 GTY Transceiver Bank 227 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 227	AF7	MGTYTXP0_227	PCIE_TX3_P	A29	HSIN(3)	PCIe EDGE Conn. U2
	AF6	MGTYTXN0_227	PCIE_TX3_N	A30	HSIP(3)	
	AD2	MGTYRXP0_227	PCIE_RX3_P	B27	HSIN(3)	
	AD1	MGTYRXN0_227	PCIE_RX3_N	B28	HSIP(3)	
	AD7	MGTYTXP1_227	PCIE_TX2_P	A25	HSIN(2)	
	AD6	MGTYTXN1_227	PCIE_TX2_N	A26	HSIP(2)	
	AC4	MGTYRXP1_227	PCIE_RX2_P	B23	HSIN(2)	
	AC3	MGTYRXN1_227	PCIE_RX2_N	B24	HSIP(2)	
	AB7	MGTYTXP2_227	PCIE_TX1_P	A21	HSIN(1)	
	AB6	MGTYTXN2_227	PCIE_TX1_N	A22	HSIP(1)	
	AB2	MGTYRXP2_227	PCIE_RX1_P	B19	HSIN(1)	
	AB1	MGTYRXN2_227	PCIE_RX1_N	B20	HSIP(1)	
	Y7	MGTYTXP3_227	PCIE_TX0_P	A16	HSIN(0)	
	Y6	MGTYTXN3_227	PCIE_TX0_N	A17	HSIP(0)	
	AA4	MGTYRXP3_227	PCIE_RX0_P	B14	HSIN(0)	
	AA3	MGTYRXN3_227	PCIE_RX0_N	B15	HSIP(0)	
	AC9	MGTREFCLK0P_227	PCIE_CLK2_P	3	Q1	U20 ICS85411A clock buffer
	AC8	MGTREFCLK0N_227	PCIE_CLK2_N	4	NQ1	
	AA9	MGTREFCLK1P_227	NC			
	AA8	MGTREFCLK1N_227	NC			

Table 3-18: **VCU118 FPGA U1 GTY Transceiver Bank 231 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 231	V7	MGTYTXP0_231	QSFP1_TX1_P	36	TX1P	QSFP1 U145
	V6	MGTYTXN0_231	QSFP1_TX1_N	37	TX1N	
	Y2	MGTYRXP0_231	QSFP1_RX1_P	17	RX1P	
	Y1	MGTYRXN0_231	QSFP1_RX1_N	18	RX1N	
	T7	MGTYTXP1_231	QSFP1_TX2_P	3	TX2P	
	T6	MGTYTXN1_231	QSFP1_TX2_N	2	TX2N	
	W4	MGTYRXP1_231	QSFP1_RX2_P	22	RX2P	
	W3	MGTYRXN1_231	QSFP1_RX2_N	21	RX2N	
	P7	MGTYTXP2_231	QSFP1_TX3_P	33	TX3P	
	P6	MGTYTXN2_231	QSFP1_TX3_N	34	TX3N	
	V2	MGTYRXP2_231	QSFP1_RX3_P	14	RX3P	
	V1	MGTYRXN2_231	QSFP1_RX3_N	15	RX3N	
	M7	MGTYTXP3_231	QSFP1_TX4_P	6	TX4P	
	M6	MGTYTXN3_231	QSFP1_TX4_N	5	TX4N	
	U4	MGTYRXP3_231	QSFP1_RX4_P	25	RX4P	
	U3	MGTYRXN3_231	QSFP1_RX4_N	24	RX4N	
	W9	MGTREFCLK0P_231	QSFP_SI570_CLOCK_C_P	4	OUT	U38 SI570 I^2C prog. osc.
	W8	MGTREFCLK0N_231	QSFP_SI570_CLOCK_C_N	5	OUT_B	
	U9	MGTREFCLK1P_231	SI5328_CLOCK1_C_P	28	CLKOUT1_P	U57 SI5328B jitter atten.
	U8	MGTREFCLK1N_231	SI5328_CLOCK1_C_N	29	CLKOUT1_N	
	A4	MGTRREF_RN	MGTRREF_231	R1326.1 100Ω 1% P/U to MGTAVTT_FPGA		
	A5	MGTAVTTRCAL_RN	MGTAVTT_FPGA	NA	NA	NA

Table 3-19: **VCU118 FPGA U1 GTY Transceiver Bank 232 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 232	L5	MGTYTXP0_232	QSFP2_TX1_P	36	TX1P	QSFP2 U123
	L4	MGTYTXN0_232	QSFP2_TX1_N	37	TX1N	
	T2	MGTYRXP0_232	QSFP2_RX1_P	17	RX1P	
	T1	MGTYRXN0_232	QSFP2_RX1_N	18	RX1N	
	K7	MGTYTXP1_232	QSFP2_TX2_P	3	TX2P	
	K6	MGTYTXN1_232	QSFP2_TX2_N	2	TX2N	
	R4	MGTYRXP1_232	QSFP2_RX2_P	22	RX2P	
	R3	MGTYRXN1_232	QSFP2_RX2_N	21	RX2N	
	J5	MGTYTXP2_232	QSFP2_TX3_P	33	TX3P	
	J4	MGTYTXN2_232	QSFP2_TX3_N	34	TX3N	
	P2	MGTYRXP2_232	QSFP2_RX3_P	14	RX3P	
	P1	MGTYRXN2_232	QSFP2_RX3_N	15	RX3N	
	H7	MGTYTXP3_232	QSFP2_TX4_P	6	TX4P	
	H6	MGTYTXN3_232	QSFP2_TX4_N	5	TX4N	
	M2	MGTYRXP3_232	QSFP2_RX4_P	25	RX4P	
	M1	MGTYRXN3_232	QSFP2_RX4_N	24	RX4N	
	R9	MGTREFCLK0P_232	MGT_SI570_CLOCK2_C_P	13	Q2_P	U104 SI53340 clock buffer
	R8	MGTREFCLK0N_232	MGT_SI570_CLOCK2_C_N	14	Q2_N	
	N9	MGTREFCLK1P_232	SI5328_CLOCK2_C_P	35	CLKOUT2_P	U57 SI5328B jitter atten.
	N8	MGTREFCLK1N_232	SI5328_CLOCK2_C_N	34	CLKOUT2_N	

Table 3-20: **VCU118 FPGA U1 GTY Transceiver Bank 233 Connections**

MGT Bank	FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	Connected Pin	Connected Pin Name	Connected Device
GTY Bank 233	G5	MGTYTXP0_233	FIREFLY_TX1_P	A3	TX1P	QSFP2 U123
	G4	MGTYTXN0_233	FIREFLY_TX1_N	A2	TX1N	
	K2	MGTYRXP0_233	FIREFLY_RX1_P	B17	RX1P	
	K1	MGTYRXN0_233	FIREFLY_RX1_N	B18	RX1N	
	F7	MGTYTXP1_233	FIREFLY_TX2_P	B3	TX2P	
	F6	MGTYTXN1_233	FIREFLY_TX2_N	B2	TX2N	
	H2	MGTYRXP1_233	FIREFLY_RX2_P	A17	RX2P	
	H1	MGTYRXN1_233	FIREFLY_RX2_N	A18	RX2N	
	E5	MGTYTXP2_233	FIREFLY_TX3_P	A6	TX3P	
	E4	MGTYTXN2_233	FIREFLY_TX3_N	A5	TX3N	
	F2	MGTYRXP2_233	FIREFLY_RX3_P	B14	RX3P	
	F1	MGTYRXN2_233	FIREFLY_RX3_N	B15	RX3N	
	C5	MGTYTXP3_233	FIREFLY_TX4_P	B6	TX4P	
	C4	MGTYTXN3_233	FIREFLY_TX4_N	B5	TX4N	
	D2	MGTYRXP3_233	FIREFLY_RX4_P	A14	RX4P	
	D1	MGTYRXN3_233	FIREFLY_RX4_N	A15	RX4N	
	L9	MGTREFCLK0P_233	MGT_SI570_CLOCK3_C_P	15	Q3_P	U104 SI53340 clock buffer
	L8	MGTREFCLK0N_233	MGT_SI570_CLOCK3_C_N	16	Q3_N	
	J9	MGTREFCLK1P_233	MGT232_CLK1_P(1)	J33	1	SMA Connectors J33(P), J32(N)
	J8	MGTREFCLK1N_233	MGT232_CLK1_N(1)	J32	1	

Notes:

1. Ensure that the GTY RefClock being sourced into the RefClock SMAs (J32, J33) is AC coupled for proper clocking operation of GTY transceivers. Use inline SMA DC blocking capacitors if frequency source output is not AC coupled.

For additional information on GTY transceivers, see *UltraScale Architecture GTY Transceivers User Guide* (UG578) [Ref 6]. Also see *UltraScale FPGAs Transceivers Wizard LogiCORE IP Product Guide* (PG182) [Ref 7].

For additional information about the quad small form factor pluggable (28 Gb/s QSFP+) module, see the SFF-8663 specification for the 28 Gb/s QSFP+ at the SFF-8663 specification website [Ref 24].

PCI Express Endpoint Connectivity

[Figure 2-1, callout 17]

The 16-lane PCI Express edge connector U2 performs data transfers at the rate of 2.5 GT/s for Gen1 applications, 5.0 GT/s for Gen2 applications, and 8.0 GT/s for Gen3 applications. The PCIe transmit and receive signal data paths have a characteristic impedance of 85Ω ±10%. The PCIe clock is routed as a 100Ω differential pair.

The XCVU9P-L2FLGA2104 (-2 speed grade) is deployed on the VCU118 to support up to Gen3 x8 on VCU118 pre-Rev. 2.0 boards where V_{CCINT} = 0.72V. PCI Express Gen3 x16 operation is not supported when V_{CCINT} = 0.72V.

See the *Virtex UltraScale+ FPGAs Data Sheet: DC and AC Switching Characteristics* (DS923) [Ref 1]. On VCU118 Rev. 2.0 and later boards, V_{CCINT} = 0.85V and PCIe Gen 3 x16 is supported.

When creating FPGA designs for the VCU118, the correct V_{CCINT} must be chosen in the Xilinx Vivado tool. Choose the appropriate entry for the V_{CCINT} on your board:

V_{CCINT}: 0.85V → xcvu9p-flga2104-2L-e-es1

V_{CCINT}: 0.72V → xcvu9p-flga2104-2LV-e-es1

The V_{CCINT} value on your board can be found using the *VCU118 System Controller Tutorial* (XTP447) [Ref 14] or via the FPGA internal SYSMON function: after Vivado has discovered the XCVU9P in the JTAG chain, the SYSMON module is displayed on the upper left pane. Double-click on the SYSMON icon, which opens a parameter measurement pane. In the upper left of this pane, click on the + option and a list of available parameters will be displayed. Choose V_{CCINT}, and the voltage value will be displayed.

The PCIe reference clock input is from the U2 edge connector. It is AC coupled to FPGA U1 through the MGTREFCLK0 pins of Quad 225. PCIE_CLK_Q0_P is connected to U1 pin AL9, and the _N net is connected to pin AL8. The PCI Express clock connection is shown in Figure 3-10.

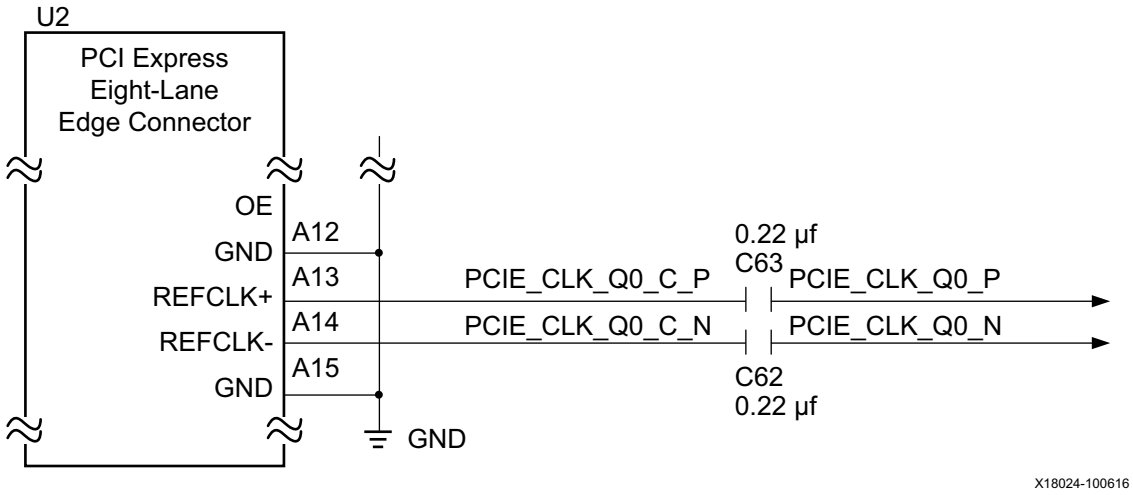

Figure 3-10: **PCIe Edge Connector Clock**

The PCIe clock is routed to a 1-to-2 ICS85411A clock buffer U20. The Q0 output of U20 is wired to the GTY225 MGTHREFCLK0 input (see Table 3-15). The Q1 output of U20 is wired to the GTY227 MGTHREFCLK0 input (see Table 3-17). The 1-to-2 U20 PCIe clock buffer circuit is shown in Figure 3-11.

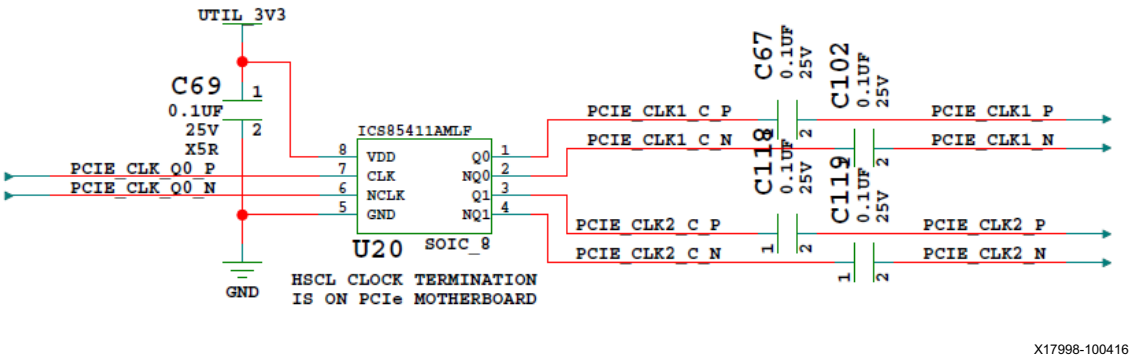

Figure 3-11: **PCIe Clock**

PCIe lane width/size is selected by jumper J7 shown in Figure 3-12. The default lane size selection is 16-lane (J7 pins 7 and 8 jumpered).

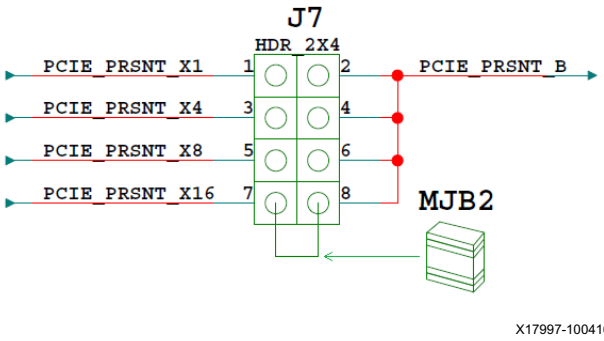

Figure 3-12: **PCI Express Lane Size Select Jumper J7**

Table 3-21 lists the PCIe U2 edge connector wiring to FPGA U1.

Table 3-21: **VCU118 Board FPGA U1 to PCIe Edge U2 Connections**

FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	PCIe Edge U2	
			Pin Num	Pin Name
Y7	MGTYTXP3_227	PCIE_TX0_P	A16	HSIN(0)
Y6	MGTYTXN3_227	PCIE_TX0_N	A17	HSIP(0)
AB7	MGTYTXP2_227	PCIE_TX1_P	A21	HSIN(1)
AB6	MGTYTXN2_227	PCIE_TX1_N	A22	HSIP(1)
AD7	MGTYTXP1_227	PCIE_TX2_P	A25	HSIN(2)
AD6	MGTYTXN1_227	PCIE_TX2_N	A26	HSIP(2)
AF7	MGTYTXP0_227	PCIE_TX3_P	A29	HSIN(3)
AF6	MGTYTXN0_227	PCIE_TX3_N	A30	HSIP(3)
AH7	MGTYTXP3_226	PCIE_TX4_P	A35	HSIP(4)
AH6	MGTYTXN3_226	PCIE_TX4_N	A36	HSIN(4)
AK7	MGTYTXP2_226	PCIE_TX5_P	A39	HSIP(5)
AK6	MGTYTXN2_226	PCIE_TX5_N	A40	HSIN(5)
AM7	MGTYTXP1_226	PCIE_TX6_P	A43	HSIP(6)
AM6	MGTYTXN1_226	PCIE_TX6_N	A44	HSIN(6)
AN5	MGTYTXP0_226	PCIE_TX7_P	A47	HSIP(7)
AN4	MGTYTXN0_226	PCIE_TX7_N	A48	HSIN(7)
AP7	MGTYTXP3_225	PCIE_TX8_P	A52	HSIP(8)
AP6	MGTYTXN3_225	PCIE_TX8_N	A53	HSIN(8)
AR5	MGTYTXP2_225	PCIE_TX9_P	A56	HSIP(9)
AR4	MGTYTXN2_225	PCIE_TX9_N	A57	HSIN(9)
AT7	MGTYTXP1_225	PCIE_TX10_P	A60	HSIP(10)
AT6	MGTYTXN1_225	PCIE_TX10_N	A61	HSIN(10)
AU5	MGTYTXP0_225	PCIE_TX11_P	A64	HSIP(11)
AU4	MGTYTXN0_225	PCIE_TX11_N	A65	HSIN(11)
AW5	MGTYTXP3_224	PCIE_TX12_P	A68	HSIP(12)
AW4	MGTYTXN3_224	PCIE_TX12_N	A69	HSIN(12)
BA5	MGTYTXP2_224	PCIE_TX13_P	A72	HSIP(13)
BA4	MGTYTXN2_224	PCIE_TX13_N	A73	HSIN(13)
BC5	MGTYTXP1_224	PCIE_TX14_P	A76	HSIP(14)
BC4	MGTYTXN1_224	PCIE_TX14_N	A77	HSIN(14)
BE5	MGTYTXP0_224	PCIE_TX15_P	A80	HSIP(15)
BE4	MGTYTXN0_224	PCIE_TX15_N	A81	HSIN(15)

Table 3-21: **VCU118 Board FPGA U1 to PCIe Edge U2 Connections *(Cont'd)***

FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	PCIe Edge U2	
			Pin Num	Pin Name
AA4	MGTYRXP3_227	PCIE_RX0_P	B14	HSIN(0)
AA3	MGTYRXN3_227	PCIE_RX0_N	B15	HSIP(0)
AB2	MGTYRXP2_227	PCIE_RX1_P	B19	HSIN(1)
AB1	MGTYRXN2_227	PCIE_RX1_N	B20	HSIP(1)
AC4	MGTYRXP1_227	PCIE_RX2_P	B23	HSIN(2)
AC3	MGTYRXN1_227	PCIE_RX2_N	B24	HSIP(2)
AD2	MGTYRXP0_227	PCIE_RX3_P	B27	HSIN(3)
AD1	MGTYRXN0_227	PCIE_RX3_N	B28	HSIP(3)
AE4	MGTYRXP3_226	PCIE_RX4_P	B33	HSOP(4)
AE3	MGTYRXN3_226	PCIE_RX4_N	B34	HSON(4)
AF2	MGTYRXP2_226	PCIE_RX5_P	B37	HSOP(5)
AF1	MGTYRXN2_226	PCIE_RX5_N	B38	HSON(5)
AG4	MGTYRXP1_226	PCIE_RX6_P	B41	HSOP(6)
AG3	MGTYRXN1_226	PCIE_RX6_N	B42	HSON(6)
AH2	MGTYRXP0_226	PCIE_RX7_P	B45	HSOP(7)
AH1	MGTYRXN0_226	PCIE_RX7_N	B46	HSON(7)
AJ4	MGTYRXP3_225	PCIE_RX8_P	B50	HSOP(8)
AJ3	MGTYRXN3_225	PCIE_RX8_N	B51	HSON(8)
AK2	MGTYRXP2_225	PCIE_RX9_P	B54	HSOP(9)
AK1	MGTYRXN2_225	PCIE_RX9_N	B55	HSON(9)
AM2	MGTYRXP1_225	PCIE_RX10_P	B58	HSOP(10)
AM1	MGTYRXN1_225	PCIE_RX10_N	B59	HSON(10)
AP2	MGTYRXP0_225	PCIE_RX11_P	B62	HSOP(11)
AP1	MGTYRXN0_225	PCIE_RX11_N	B63	HSON(11)
AT2	MGTYRXP3_224	PCIE_RX12_P	B66	HSOP(12)
AT1	MGTYRXN3_224	PCIE_RX12_N	B67	HSON(12)
AV2	MGTYRXP2_224	PCIE_RX13_P	B70	HSOP(13)
AV1	MGTYRXN2_224	PCIE_RX13_N	B71	HSON(13)
AY2	MGTYRXP1_224	PCIE_RX14_P	B74	HSOP(14)
AY1	MGTYRXN1_224	PCIE_RX14_N	B75	HSON(14)
BB2	MGTYRXP0_224	PCIE_RX15_P	B78	HSOP(15)
BB1	MGTYRXN0_224	PCIE_RX15_N	B79	HSON(15)

For additional information about UltraScale PCIe functionality, see *UltraScale Architecture Gen3 Integrated Block for PCI Express LogiCORE IP Product Guide* (PG156) [Ref 8]. Additional information about the PCI Express standard is available at the PCI Express® standard website [Ref 23].

28 Gb/s QSFP+ Module Connectors

[Figure 2-1, callout 18]

The VCU118 board contains two quad (4-channel) small form-factor pluggable (28 Gb/s QSFP+) connectors, QSFP1 U145 and QSFP2 U123, which accept 28 Gb/s QSFP+ optical modules. Each connector is housed within a single 28 Gb/s QSFP+ cage assembly. Figure 3-13 shows the 28 Gb/s QSFP+ module connector circuitry.

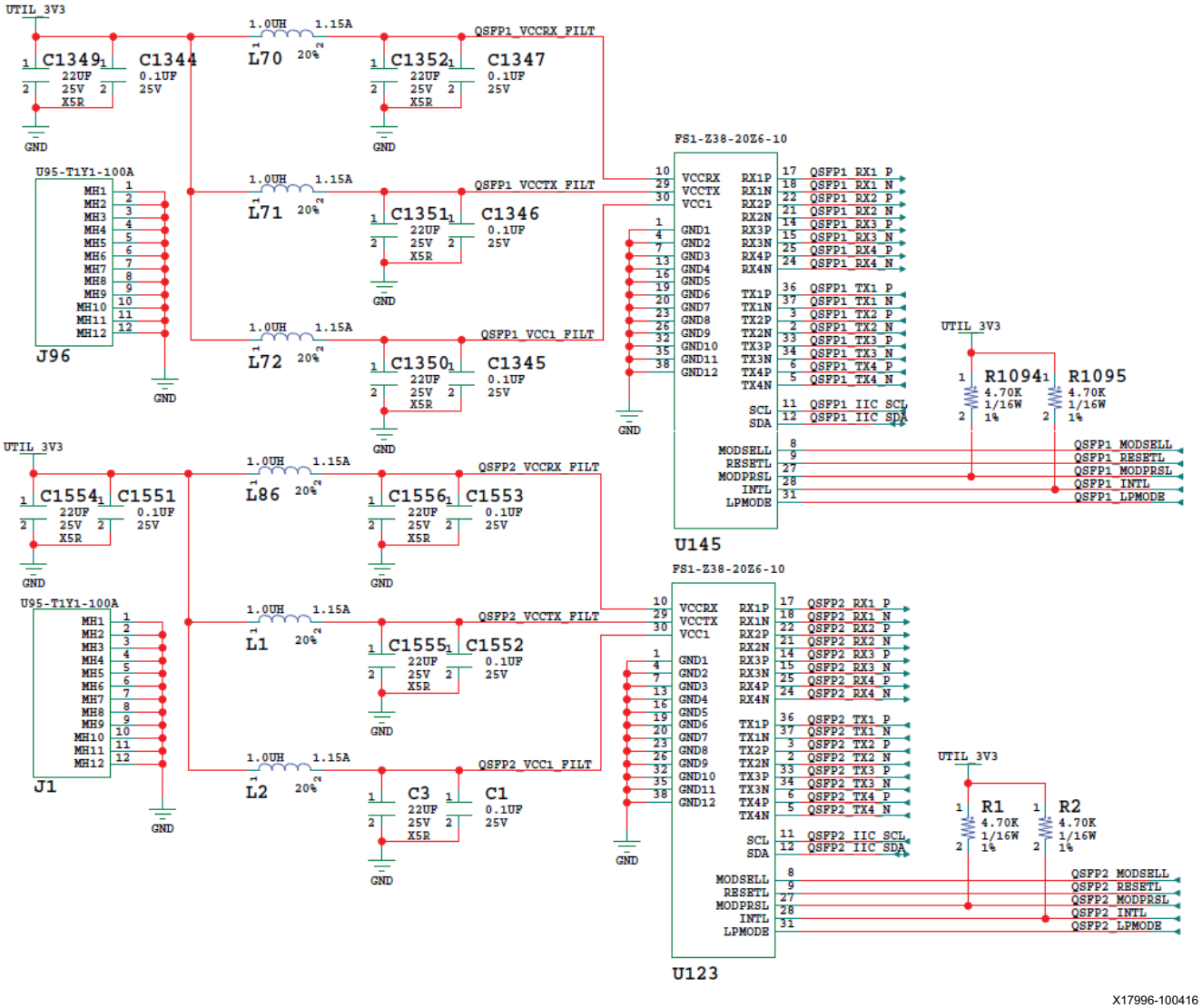

Figure 3-13: **28 Gb/s QSFP+ Module Connectors**

The connections between the 28 Gb/s QSFP+ module connector U145 and the FPGA are listed in Table 3-22.

Table 3-22: **VCU118 Board FPGA U1 to QSFP+ Module QSFP1 U145 Connections**

FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	FPGA (U1) Direction	QSFP1 U145	
				Pin Num	Pin Name
V7	MGTYTXP0_231	QSFP1_TX1_P	Output	36	TX1P
V6	MGTYTXN0_231	QSFP1_TX1_N	Output	37	TX1N
Y2	MGTYRXP0_231	QSFP1_RX1_P	Input	17	RX1P
Y1	MGTYRXN0_231	QSFP1_RX1_N	Input	18	RX1N
T7	MGTYTXP1_231	QSFP1_TX2_P	Output	3	TX2P
T6	MGTYTXN1_231	QSFP1_TX2_N	Output	2	TX2N
W4	MGTYRXP1_231	QSFP1_RX2_P	Input	22	RX2P
W3	MGTYRXN1_231	QSFP1_RX2_N	Input	21	RX2N
P7	MGTYTXP2_231	QSFP1_TX3_P	Output	33	TX3P
P6	MGTYTXN2_231	QSFP1_TX3_N	Output	34	TX3N
V2	MGTYRXP2_231	QSFP1_RX3_P	Input	14	RX3P
V1	MGTYRXN2_231	QSFP1_RX3_N	Input	15	RX3N
M7	MGTYTXP3_231	QSFP1_TX4_P	Output	6	TX4P
M6	MGTYTXN3_231	QSFP1_TX4_N	Output	5	TX4N
U4	MGTYRXP3_231	QSFP1_RX4_P	Input	25	RX4P
U3	MGTYRXN3_231	QSFP1_RX4_N	Input	24	RX4N
U28.9	SC2	QSFP1_IIC_SCL(1)	Output	11	SCL
U28.8	SD2	QSFP1_IIC_SDA(1)	BiDir	12	SDA
AM21	IO_L23N_T3U_N9_64	QSFP1_MODSELL(2)	Output	8	MODSELL
BA22	IO_L10N_T1U_N7_64	QSFP1_RESETL(2)	Output	9	RESETL
AL21	IO_L23P_T3U_N8_64	QSFP1_MODPRSL(2)	Output	27	MODPRSL
AP21	IO_L21N_T3L_N5_64	QSFP1_INTL(2)	Input	28	INTL
AN21	IO_L21P_T3L_N4_64	QSFP1_LPMODE(2)	Output	31	LPMODE

Notes:

1. The QSFP+ connectors U145 I^2C SCL/SDA are connected via I^2C switch U28 to the IIC_MAIN_SCL/SDA bus. See I2C Bus, Topology, and Switches.
2. The QSFP+ connector U145 QSFP1 control signals are level-shifted by U17.

Table 3-23: **VCU118 Board FPGA U1 to QSFP+ Module QSFP2 U123 Connections**

FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	FPGA (U1) Direction	QSFP2 U123	
				Pin Num	Pin Name
L5	MGTYTXP0_232	QSFP2_TX1_P	Output	36	TX1P
L4	MGTYTXN0_232	QSFP2_TX1_N	Output	37	TX1N
T2	MGTYRXP0_232	QSFP2_RX1_P	Input	17	RX1P
T1	MGTYRXN0_232	QSFP2_RX1_N	Input	18	RX1N
K7	MGTYTXP1_232	QSFP2_TX2_P	Output	3	TX2P
K6	MGTYTXN1_232	QSFP2_TX2_N	Output	2	TX2N
R4	MGTYRXP1_232	QSFP2_RX2_P	Input	22	RX2P
R3	MGTYRXN1_232	QSFP2_RX2_N	Input	21	RX2N
J5	MGTYTXP2_232	QSFP2_TX3_P	Output	33	TX3P
J4	MGTYTXN2_232	QSFP2_TX3_N	Output	34	TX3N
P2	MGTYRXP2_232	QSFP2_RX3_P	Input	14	RX3P
P1	MGTYRXN2_232	QSFP2_RX3_N	Input	15	RX3N
H7	MGTYTXP3_232	QSFP2_TX4_P	Output	6	TX4P
H6	MGTYTXN3_232	QSFP2_TX4_N	Output	5	TX4N
M2	MGTYRXP3_232	QSFP2_RX4_P	Input	25	RX4P
M1	MGTYRXN3_232	QSFP2_RX4_N	Input	24	RX4N
U28.11	SC3	QSFP2_IIC_SCL(1)	Output	11	SCL
U28.10	SD3	QSFP2_IIC_SDA(1)	BiDir	12	SDA
AN23	IO_L20N_T3L_N3_AD1N_64	QSFP2_MODSELL(2)	Output	8	MODSELL
AY22	IO_L10P_T1U_N6_QBC_AD4P_64	QSFP2_RESETL(2)	Output	9	RESETL
AN24	IO_L20P_T3L_N2_AD1P_64	QSFP2_MODPRSL(2)	Output	27	MODPRSL
AT21	IO_T2U_N12_64	QSFP2_INTL(2)	Input	28	INTL
AT24	IO_L18N_T2U_N11_AD2N_64	QSFP2_LPMODE(2)	Output	31	LPMODE

Notes:

1. The QSFP+ connector U123 I^2C SCL/SDA IS connected to the I^2C switch U28 to the IIC_MAIN_SCL/SDA bus. See I2C Bus, Topology, and Switches.
2. The QSFP+ connector U123 QSFP2 control signals are level-shifted by U3.

   For additional information about the quad small form factor pluggable (28 Gb/s QSFP+) module, see the SFF-8663 and SFF-8679 specifications for the 28 Gb/s QSFP+ at the SNIA Technology Affiliates website [Ref 24].

FireFly Connector

[Figure 2-1, callout 41]

The VCU118 board contains a 4x28 Gb/s FireFly composite connector pair J6. The FireFly connector system is a two part connector designed for applications up to 28 Gb/s. It is based on two connectors, a micro high-speed edge connector (UEC5 Series, shown rear left) with two rows of 19 positions providing 12 differential lanes and a 10-position positive latch control signal and power connector (UCC8 Series, shown front right). Figure 3-14 shows the connector pair.

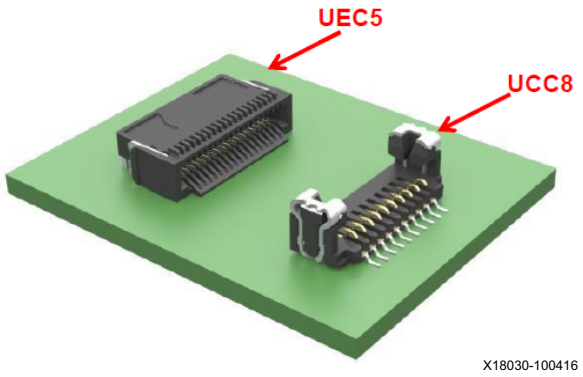

Figure 3-14: **FireFly Connector System**

Figure 3-15 shows the schematic representation.

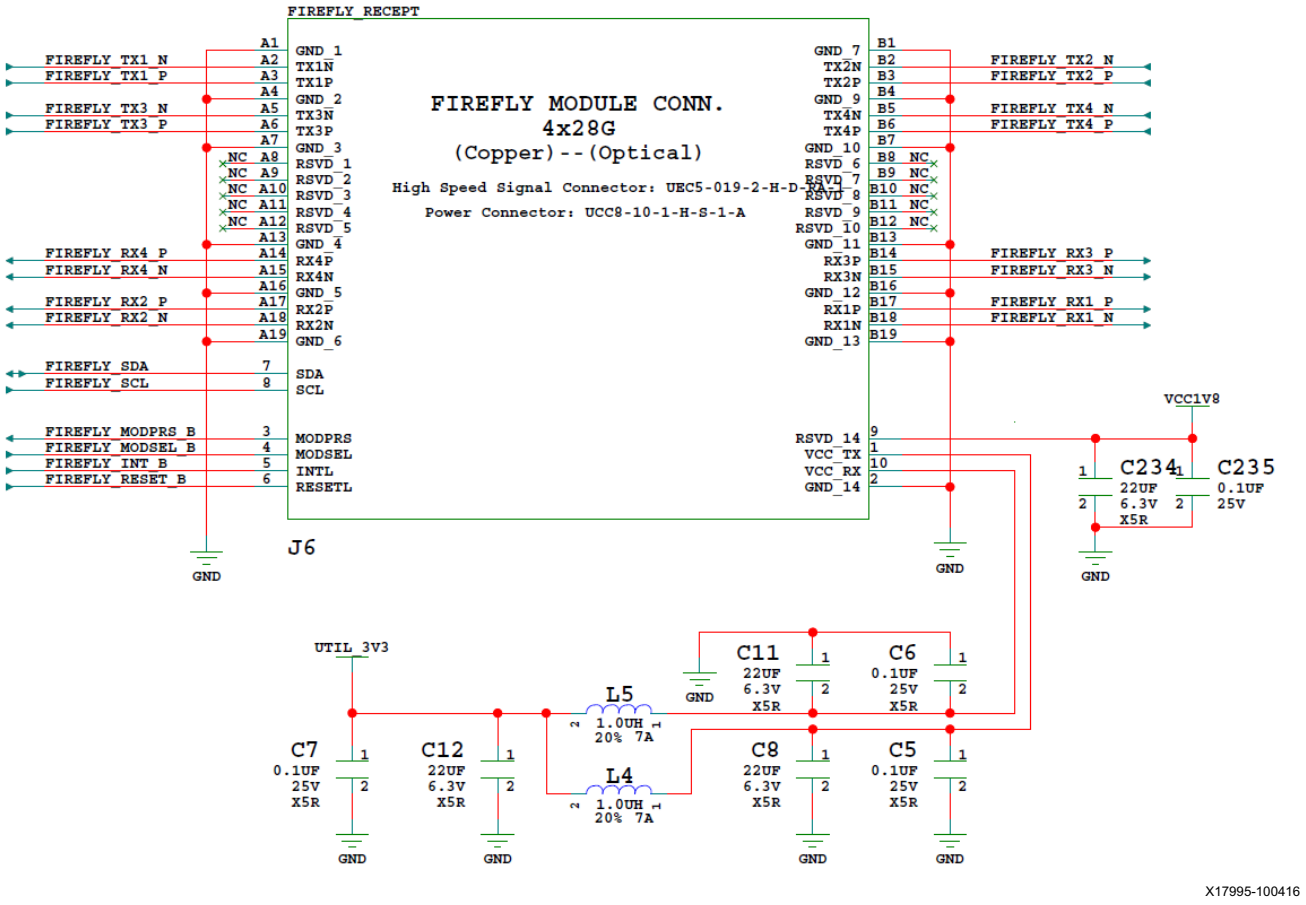

Figure 3-15: **FireFly Connector Schematic**

The connections between the J6 and the FPGA are listed in Table 3-24.

Table 3-24: **VCU118 Board FPGA U1 to FireFly J6 Connections**

FPGA (U1) Pin	FPGA (U1) Pin Name	Schematic Net Name	FPGA (U1) Direction	FireFly J6	
				Pin Num	Pin Name
G5	MGTYTXP0_233	FIREFLY_TX1_P	Output	A3	TX1P
G4	MGTYTXN0_233	FIREFLY_TX1_N	Output	A2	TX1N
K2	MGTYRXP0_233	FIREFLY_RX1_P	Input	B17	RX1P
K1	MGTYRXN0_233	FIREFLY_RX1_N	Input	B18	RX1N
F7	MGTYTXP1_233	FIREFLY_TX2_P	Output	B3	TX2P
F6	MGTYTXN1_233	FIREFLY_TX2_N	Output	B2	TX2N
H2	MGTYRXP1_233	FIREFLY_RX2_P	Input	A17	RX2P
H1	MGTYRXN1_233	FIREFLY_RX2_N	Input	A18	RX2N
E5	MGTYTXP2_233	FIREFLY_TX3_P	Output	A6	TX3P
E4	MGTYTXN2_233	FIREFLY_TX3_N	Output	A5	TX3N
F2	MGTYRXP2_233	FIREFLY_RX3_P	Input	B14	RX3P
F1	MGTYRXN2_233	FIREFLY_RX3_N	Input	B15	RX3N
C5	MGTYTXP3_233	FIREFLY_TX4_P	Output	B6	TX4P
C4	MGTYTXN3_233	FIREFLY_TX4_N	Output	B5	TX4N
D2	MGTYRXP3_233	FIREFLY_RX4_P	Input	A14	RX4P
D1	MGTYRXN3_233	FIREFLY_RX4_N	Input	A15	RX4N
U28.20	SCL	FIREFLY_SCL(1)	Output	8	SCL
U28.19	SDA	FIREFLY_SDA(1)	BiDir	7	SDA
AN23	IO_L20N_T3L_N3_AD1N_64	FIREFLY_MODSEL_B(1)	Output	4	MODSEL
AY22	IO_L10P_T1U_N6_QBC_AD4P_64	FIREFLY_RESET_B(1)	Output	6	RESETL
AN24	IO_L20P_T3L_N2_AD1P_64	FIREFLY_MODPRS_B(2)	Output	3	MODPRS
AT21	IO_T2U_N12_64	FIREFLY_INT_B(2)	Input	5	INTL
NA	NA	UTIL_3V3_L4	NA (power)	1	VCC_TX
NA	NA	GND	NA (power)	2	GND_14
NA	NA	VCC1V8	NA (power)	9	RSVD_14
NA	NA	UTIL_3V3_L5	NA (power)	10	VCC_RX

Notes:

1. Wired to bank 64 via level-shifter U33, I/O standard LVCMOS18. Level-shifted nets have LS in their names.
2. Wired to bank 64 via level-shifter U21, I/O standard LVCMOS18. Level-shifted nets have LS in their names.

For additional information about the FireFly connector, see the Samtec website [Ref 26].

10/100/1000 Mb/s Tri-Speed Ethernet PHY

[Figure 2-1, callout 19]

The VCU118 evaluation board uses the TI PHY device DP83867ISRGZ (U7) for Ethernet communications at 10 Mb/s, 100 Mb/s, or 1000 Mb/s. The board supports SGMII mode only. The PHY connection to a user-provided Ethernet cable is through RJ-45 connector J10, a Wurth 7499111221A with built-in magnetics and status LEDs.

On power-up, or on reset, the PHY is configured to operate in SGMII mode with PHY address[4:0] = **00011**.

Table 3-25 lists the FPGA U1 to U7 DP83867ISRGZ Ethernet PHY connections.

Table 3-25: **FPGA U1 to Ethernet PHY U7 Connections**

FPGA (U1) Pin	Net Name	I/O Standard	DP83867ISRGZ U7	
			Pin	Name
AR23	PHY1_MDIO	LVCMOS18	17	MDIO
AV23	PHY1_MDC	LVCMOS18	16	MDC
AR24	PHY1_PDWN_B_I_INT_B_O	LVCMOS18	44	INT_PWDN
AV21	PHY1_SGMII_IN_N	LVCMOS18	28	TX_D1_SGMII_SIP
AU21	PHY1_SGMII_IN_P	LVCMOS18	27	TX_D0_SGMII_SIN
AV24	PHY1_SGMII_OUT_N	LVCMOS18	36	RX_D3_SGMII_SON
AU24	PHY1_SGMII_OUT_P	LVCMOS18	35	RX_D2_SGMII_SOP
AU22	PHY1_SGMII_CLK_N	LVCMOS18	34	RX_D1_SGMII_CON
AT22	PHY1_SGMII_CLK_P	LVCMOS18	33	RX_D0_SGMII_COP
BA21	PHY1_RESET_B	LVCMOS18	43	RESET_B
AR22	PHY1_GPIO_0	LVCMOS18	39	GPIO_2
AU23	PHY1_CLKOUT	LVCMOS18	18	CLK_OUT

Table 3-25 shows the net names for the connections from the FPGA to the Ethernet PHY. PHY1_SGMII_IN correlates with the SGMII_TX ports in the FPGA design, and PHY1_SGMII_OUT correlates with the SGMII_RX ports.

Ethernet PHY Status LEDs

[Figure 2-1, callout 20]

Two Ethernet PHY status LEDs are integrated into the metal frame of the J10 RJ-45 connector. These LEDs are visible on the left edge of the VCU118 board when it is installed into a PCIe slot in a PC chassis. The two PHY status LEDs are visible within the frame of the RJ45 Ethernet jack as shown in Figure 3-16. As viewed from the front opening, the left green LED is the link activity indicator, the right green LED is the 1000BASE-T link mode indicator.

Figure 3-16: **VCU118 Ethernet PHY Status LEDs**

A separate discrete LED on top of the board (DS27) indicates link established.

Details about the tri-mode Ethernet MAC core are provided in *Tri-Mode Ethernet MAC LogiCORE IP Product Guide* (PG051) [Ref 9]. The TI DP83867ISRGZ data sheet can be found on the TI website [Ref 25].

Dual USB-to-UART Bridge

[Figure 2-1, callout 21]

The VCU118 evaluation board contains a Silicon Labs CP2105GM dual USB-to-UART bridge device (U34) that allows a connection to a host computer with a USB port. The USB cable is supplied in the VCU118 evaluation kit (standard type-A end to host computer, type micro-B end to VCU118 evaluation board connector J4). The CP2105GM is powered by the USB 5V provided by the host PC when the USB cable is plugged into the USB port on the VCU118 evaluation board.

The dual UART interface connections are split between two components:

- UART1 SCI 4-wire interface is connected to the XCVU9P U1 FPGA
- UART2 ECI 2-wire interface is connected to the system controller

Silicon Labs provides royalty-free virtual COM port (VCP) drivers for the host computer. These drivers permit the CP2105GM dual USB-to-UART Bridge to appear as a pair of COM ports to communications application software (for example, Tera Term or HyperTerm) that runs on the host computer. The VCP device drivers must be installed on the host PC prior to establishing communications with the VCU118 evaluation board. The COM port driver list will show an enhanced com port and a standard com port. The standard com port is connected to the FPGA and UART IP must be implemented in the FPGA for communications over this channel. The enhanced com port is connected to the system controller.

The Silicon Labs CP2105GM dual USB-to-UART bridge circuit is shown in Figure 3-17.

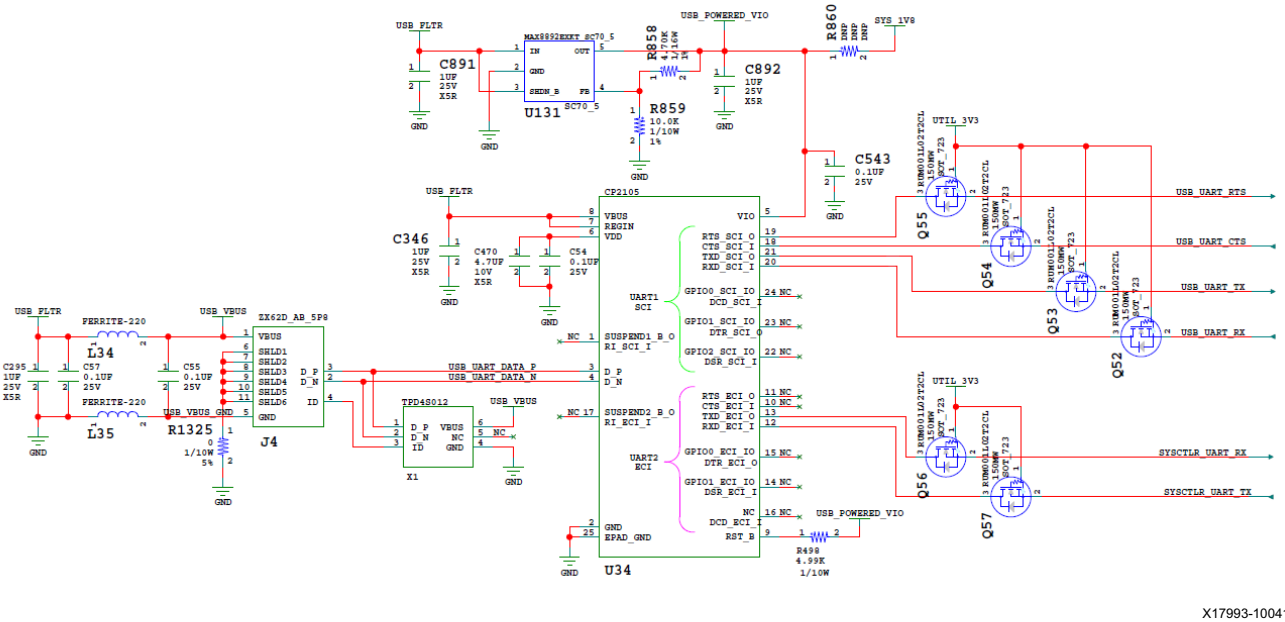

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Figure 3-17: **VCU118 Dual UART CP2105GM**

Table 3-26 lists the FPGA U1 connections to dual-UART U34.

Table 3-26: **FPGA U1 to CP2105GM U34 Connections**

FPGA (U1) Pin	Function	Direction	I/O Standard	Schematic Net Name	CP2105GM Device (U34)		
					Pin	Function	Direction
The USB UART signal nets are named from the perspective of the CP2105GM device (U34)							
AW25	RX	Input	LVCMOS18	USB_UART_TX	21	TXD	Output
BB21	TX	Output	LVCMOS18	USB_UART_RX	20	RXD	Input
AY25	CTS	Input	LVCMOS18	USB_UART_RTS	19	RTS	Output
BB22	RTS	Output	LVCMOS18	USB_UART_CTS	18	CTS	Input

For more technical information on the CP2105GM and the VCP drivers, see the Silicon Labs website [Ref 22].

Xilinx UART IP is expected to be implemented in the FPGA logic using IP. See the *AXI UART Lite LogiCORE IP Product Guide* (PG142) [Ref 10] for more information.

I2C Bus, Topology, and Switches

[Figure 2-1, callouts 22, 23]

The VCU118 evaluation board implements a 2-to-1 I^2C bus arrangement. The FPGA U1 HP bank 64 (VCCO VCC1V8_FPGA) and system controller U111 are wired to the same IIC_MAIN_SDA/SCL I^2C bus. The common I^2C bus is then routed to a pair of 1-to-8 channel TI TCA9548 bus switches U28 (address 0x74) and U80 (address 0x75). The bus switches can operate at speeds up to 400 kHz. The VCU118 evaluation board I^2C bus topology overview is shown in Figure 3-18.

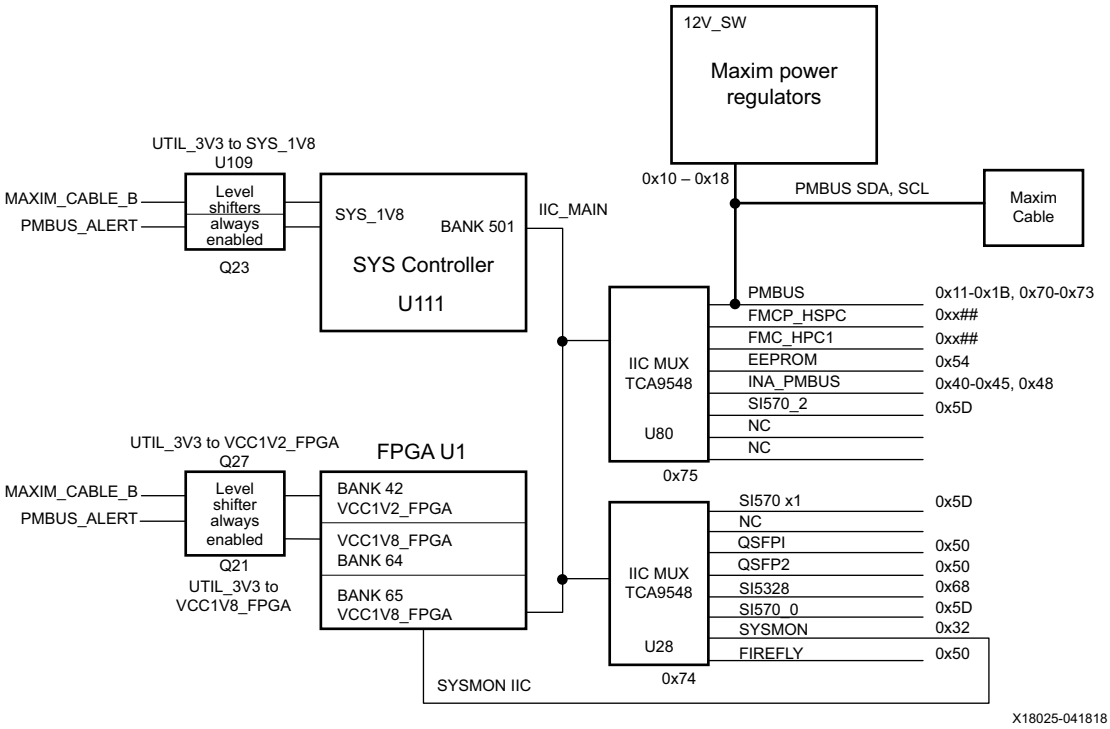

Figure 3-18: **VCU118 IIC Bus**

IMPORTANT: *The TCA9548 U28 and U80 RESET_B pin 3 is connected to FPGA U1 Bank 64 pin AL25. FPGA pin AL25 LVCMOS18 net IIC_MUX_RESET_B must be driven High to enable I²C bus transactions with the devices connected to U28 and U80.*

User applications that communicate with devices on one of the downstream I²C buses must first set up a path to the desired target bus through the U28 or U80 bus switch at I²C address 0x74 (**0b1110100**) or 0x75 (**0b111101**), respectively. Table 3-27 lists the address for each bus.

Table 3-27: **I²C Bus Addresses**

I²C Devices	I²C Switch Position	I²C Address		Device
		Binary Format	Hex Format	
TCA9548 8-Channel bus switch	N/A	**0b1110100**	**0x74**	U28 TCA9548
SI570_1 clock	0	**0b1011101**	**0x5D**	U32 SI570
Not used	1	N/A	N/A	N/A
QSFP1 module	2	**0b1010000**	**0x50**	U145 28 Gb/s QSFP+
QSFP2 module	3	**0b1010000**	**0x50**	U123 28 Gb/s QSFP+
SI5328 clock	4	**0b1101000**	**0x68**	U57 SI5328B
SI570_0 clock	5	**0b1011101**	**0x5D**	U18 SI570
FPGA SYSMON	6	**0b0110010**	**0x32**	U1 BANK 65
FireFly Connector	7	**0b1010000**	**0x50**	J6 UEC5, UCC8
TCA9548 8-Channel bus switch	N/A	**0b1110101**	**0x75**	U80 TCA9548
PMBus regulators	0	**0b0010001-0b0011011, 0b1110000-0b1110011**	**0x11-0x1B, 0x70-0x73**	Various Maxim Regulators.MAX15301:U4,U6,U9, U30,U150,U156; MAX20751EKX: U164,U165,U166
FMCP HSPC (FMC Plus)	1	**0bXXXXXXX**	**0x##**	J22 FMCP HSPC
FMC HPC1	2	**0bXXXXXXX**	**0x##**	J2 FMC HPC
I²C EEPROM	3	**0b1010100**	**0x54**	U12 M24C08
PMBus INA226AIDGS power monitor	4	**0b1000000-0b1001000**	**0x40-0x48**	U8,U23,U27,U29,U35,U36,U37
SI570_2 clock	5	**0b1011101**	**0x5D**	U38 SI570
Not used	6	N/A	N/A	N/A
Not used	7	N/A	N/A	N/A

Information about the TCA9548 is available on the TI Semiconductor website [Ref 25].

Status and User LEDs

[Figure 2-1, callouts 24]

Table 3-28 defines VCU118 board status and user LEDs.

Table 3-28: **VCU118 Board Status and User LEDs**

Reference Designator	Description
DS1	ENET PHY link
DS2	FPGA INIT
DS3	Combined power good
DS4	SYS_2V2 ON
DS5	VCCINTIO_BRAM On
DS6	GPIO_LED_1
DS7	GPIO_LED_0
DS8	GPIO_LED_2
DS9	GPIO_LED_5
DS10	GPIO_LED_4
DS12	GPIO_LED_5
DS13	GPIO_LED_6
DS14	UTIL_3V3 On
DS15	MGTAVCC On
DS16	VCC1V2 On
DS17	MGTAVTT On
DS18	GPIO_LED_7
DS19	VADJ_1V8 On
DS20	12V power available at power input jack J15
DS21	VCCINT On
DS24	VCC1V8 On
DS25	MGTVCCAUX On
DS26	12V On
DS27	SYS_2V5 On
DS28	SYS_1V8 On
DS31	GPIO_LED_7
DS32	GPIO_LED_6
DS33	GPIO_LED_5
DS34	FPGA done
DS36	DDR4 C1 VTT On

Table 3-28: **VCU118 Board Status and User LEDs *(Cont'd)***

Reference Designator	Description
DS40	SYS_5V0 On
DS42	SYSCTLR INIT
DS43	SYSCTLR status
DS44	SYSCTLR done
DS45	SYSCTLR error
DS46	SYS_1V0 On
DS47	DDR4 C2 VTT On
DS48	RLD3 C1 VTT On
DS49	UTIL_1V35 On
EPHY J10 RT. GREEN	ENET PHY LINK1000
EPHY J10 LFT. GREEN	ENET link activity

User I/O

[Figure 2-1, callouts 23, 24, 25, 26]

The VCU118 board provides these user and general purpose I/O capabilities:

- Eight user LEDs (callout 24)
  - GPIO_LED[7-0]: DS31, DS32, DS33, DS10, DS19, DS8, DS6, DS7
- Five user pushbuttons and CPU reset switch (callout 25)
  - GPIO_SW [NESWC]: SW10, SW9, SW8, SW6, SW7
  - CPU_RESET: SW5 (near callout 23)
- 4-position user DIP switch (callout 26)
  - GPIO_DIP_SW[3:0]: SW12

User GPIO LEDs

[Figure 2-1, callouts 24]

Figure 3-19 shows the GPIO LED circuit.

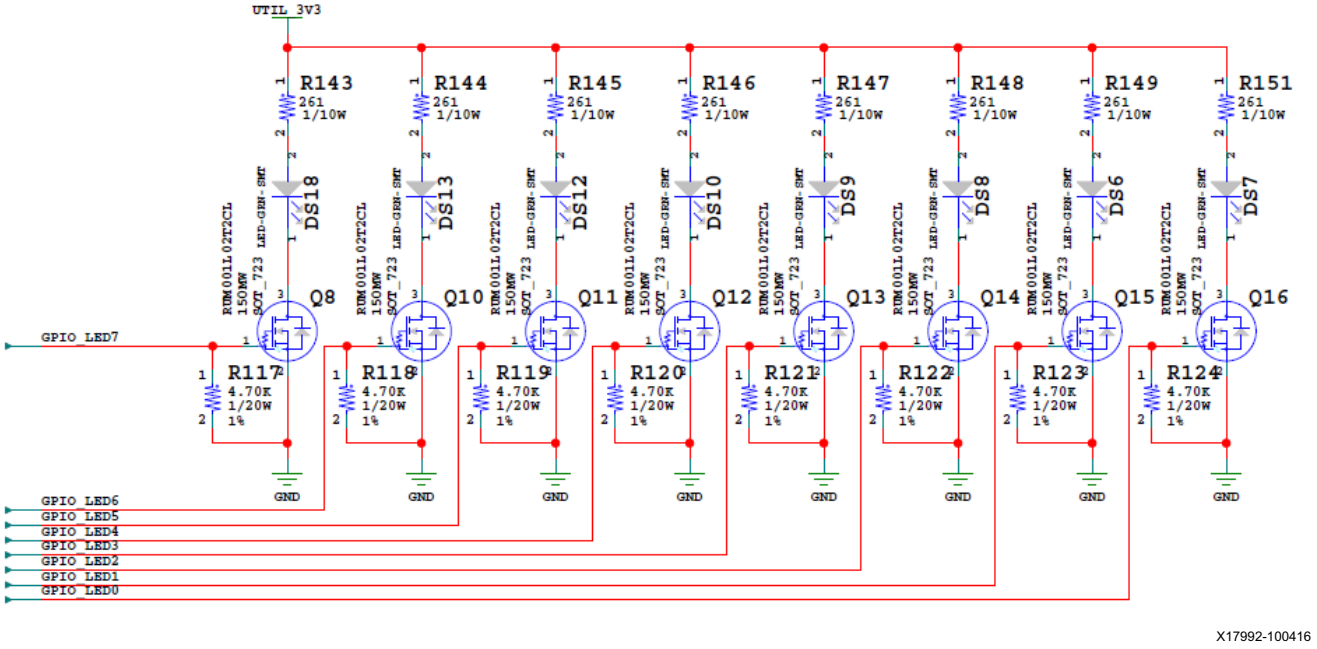

Figure 3-19: **User LEDs**

User Pushbuttons

[Figure 2-1, callout 25]

Figure 3-20 shows the user pushbuttons circuit.

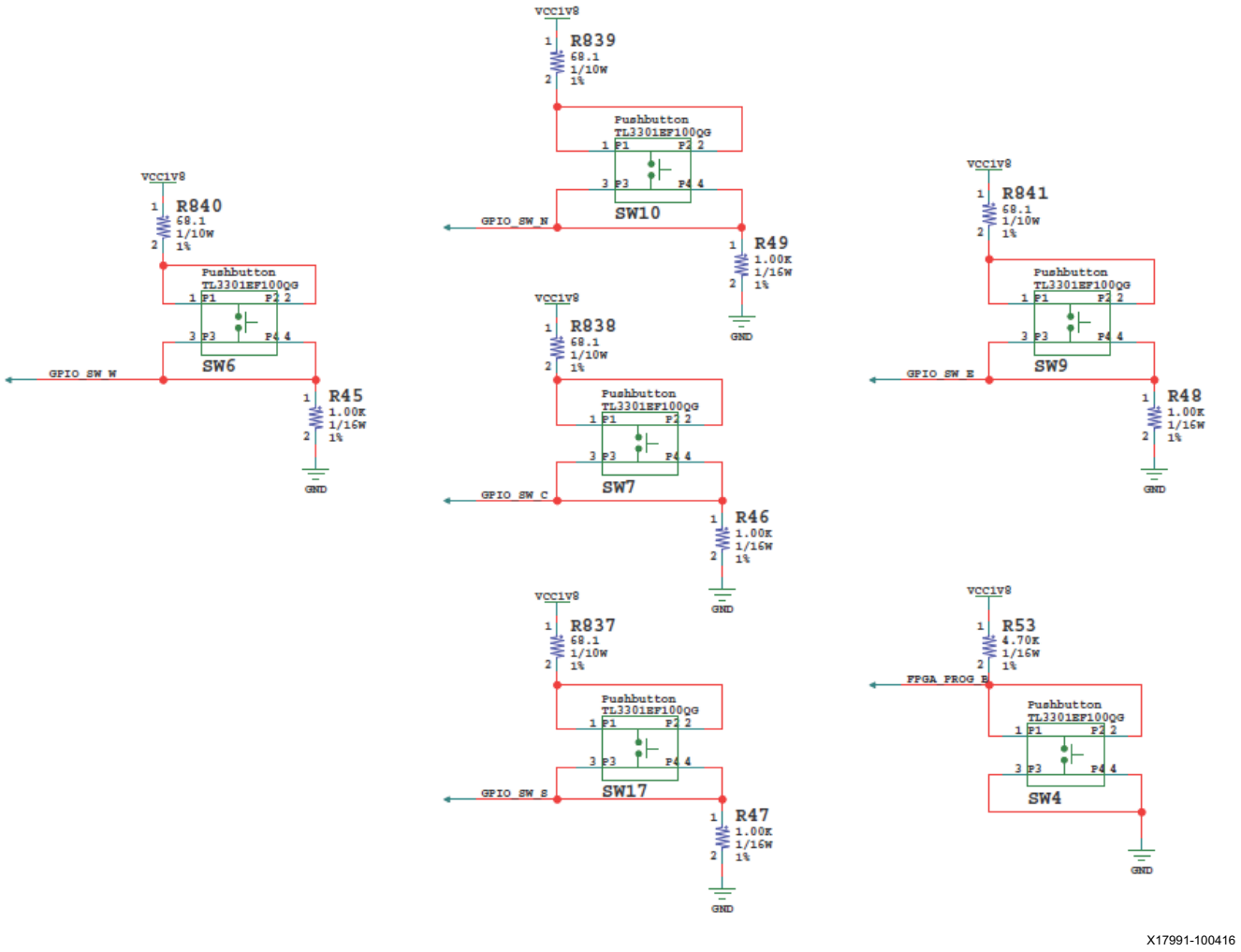

Figure 3-20: **User Pushbuttons**

CPU Reset Pushbutton

[Figure 2-1, near callout 23]

Figure 3-21 shows the CPU reset pushbutton circuit.

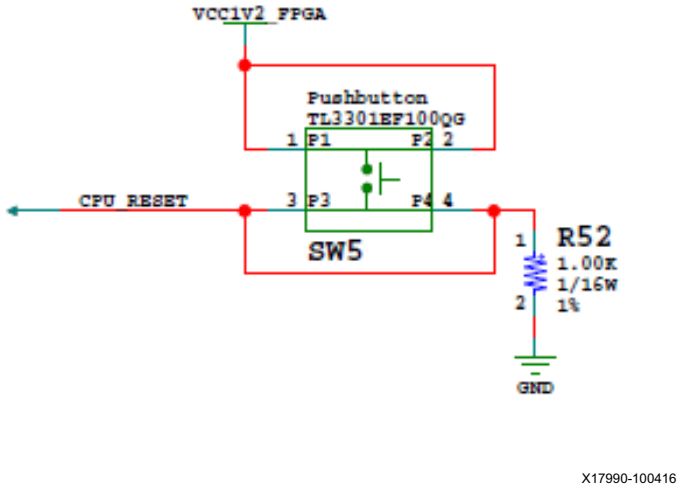

Figure 3-21: **CPU Reset Pushbutton**

GPIO DIP Switch

[Figure 2-1, callout 26]

Figure 3-22 shows the GPIO DIP switch circuit.

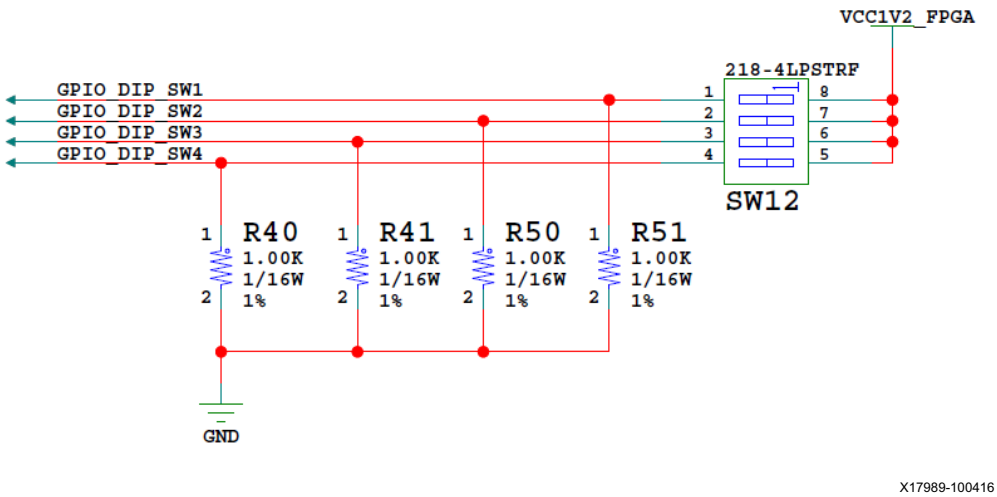

Figure 3-22: **GPIO DIP Switch**

Table 3-29 lists the GPIO connections to FPGA U1.

Table 3-29: **VCU118 GPIO Connections to FPGA U1**

FPGA (U1) Pin		Schematic Net Name	FPGA (U1) Direction	I/O Standard	Device
GPIO LEDs (Active-High) GPIO_LED signals are wired to FET LED drivers					
BANK 40	AT32	GPIO_LED_0	Output	LVCMOS12	DS7
BANK 40	AV34	GPIO_LED_1	Output	LVCMOS12	DS6
BANK 40	AY30	GPIO_LED_2	Output	LVCMOS12	DS8
BANK 40	BB32	GPIO_LED_3	Output	LVCMOS12	DS9
BANK 40	BF32	GPIO_LED_4	Output	LVCMOS12	DS10
BANK 42	AU37	GPIO_LED_5	Output	LVCMOS12	DS12
BANK 42	AV36	GPIO_LED_6	Output	LVCMOS12	DS13
BANK 42	BA37	GPIO_LED_7	Output	LVCMOS12	DS18
Directional pushbuttons (Active-High) are wired in parallel to FPGA BANK 64 and system controller U111 Bank 501					
BANK 64	BB24	GPIO_SW_N	Input	LVCMOS18	SW10.3
BANK 501 U111	A13				
BANK 64	BE23	GPIO_SW_E	Input	LVCMOS18	SW9.3
BANK 501 U111	B14				
BANK 64	BF22	GPIO_SW_W	Input	LVCMOS18	SW6.3
BANK 501 U111	D14				
BANK 64	BE22	GPIO_SW_S	Input	LVCMOS18	SW17.3
BANK 501 U111	C14				
BANK 64	BD23	GPIO_SW_C	Input	LVCMOS18	SW7.3
BANK 501 U111	B12				
CPU reset pushbutton (active-High)					
BANK 73	L19	CPU_RESET	Input	LVCMOS12	SW5.3
4-Pole DIP SW12 (active-High)					
BANK 73	B17	GPIO_DIP_SW1	Input	LVCMOS12	SW12.1
BANK 73	G16	GPIO_DIP_SW2	Input	LVCMOS12	SW12.2
BANK 73	J16	GPIO_DIP_SW3	Input	LVCMOS12	SW12.3
BANK 72	D21	GPIO_DIP_SW4	Input	LVCMOS12	SW12.4

User Pmod GPIO Headers

[Figure 2-1, callout 29]

The VCU118 evaluation board supports two Pmod GPIO headers J52 and J53. The Pmod nets connected to these headers are accessed using level shifters U41 (PMOD0 J52) and U42 (PMOD1 J53). The level shifters are wired to XCVU9P FPGA U1 banks 47 and 67.

Figure 3-23 shows the GPIO Pmod headers J52 (female right-angle) and J53 (male vertical).

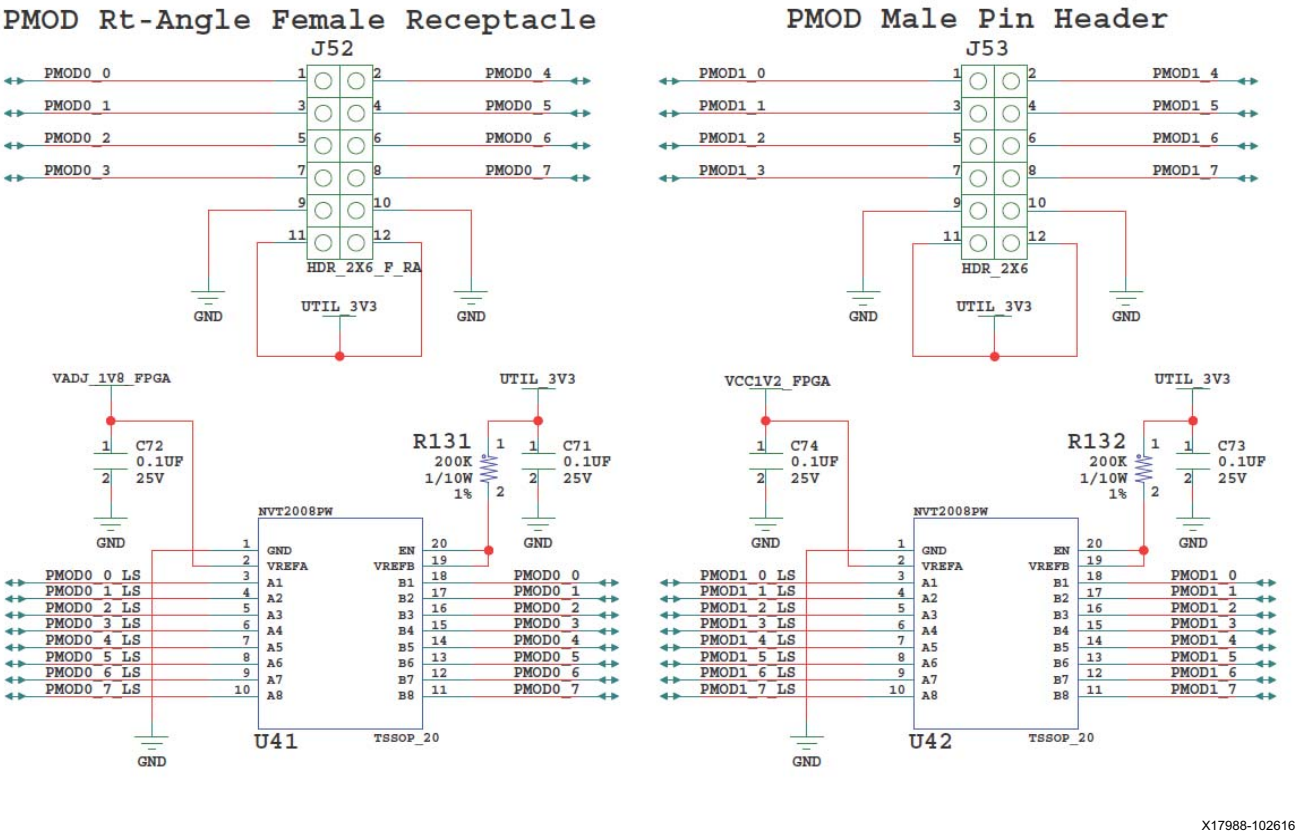

Figure 3-23: **Pmod Connectors J52 and J53 with Level Shifters U41 and U42**

Table 3-30 shows the level shifter U41 and U42 connections to FPGA U1

Table 3-30: **Pmod Connector J52, J53 Connections through Level Shifter U41, U42 to FPGA U1**

FPGA (U1) Pin	Schematic Net Name	I/O Standard	Level Shifter		Schematic Net Name	Pmod Connector Pin
			Side A 1.8V	**Side B 3.3V**		
AY14	PMOD0_0_LS	LVCMOS18	U41.3	U41.18	PMOD0_0	J52.1
AY15	PMOD0_1_LS	LVCMOS18	U41.4	U41.17	PMOD0_1	J52.3
AW15	PMOD0_2_LS	LVCMOS18	U41.5	U41.16	PMOD0_2	J52.5
AV15	PMOD0_3_LS	LVCMOS18	U41.6	U41.15	PMOD0_3	J52.7
AV16	PMOD0_4_LS	LVCMOS18	U41.7	U41.14	PMOD0_4	J52.2
AU16	PMOD0_5_LS	LVCMOS18	U41.8	U41.13	PMOD0_5	J52.4
AT15	PMOD0_6_LS	LVCMOS18	U41.9	U41.12	PMOD0_6	J52.6
AT16	PMOD0_7_LS	LVCMOS18	U41.10	U41.11	PMOD0_7	J52.8
			Side A 1.2V	**Side B 3.3V**		
N28	PMOD1_0_LS	LVCMOS12	U42.3	U42.18	PMOD1_0	J53.1
M30	PMOD1_1_LS	LVCMOS12	U42.4	U42.17	PMOD1_1	J53.3
N30	PMOD1_2_LS	LVCMOS12	U42.5	U42.16	PMOD1_2	J53.5
P30	PMOD1_3_LS	LVCMOS12	U42.6	U42.15	PMOD1_3	J53.7
P29	PMOD1_4_LS	LVCMOS12	U42.7	U42.14	PMOD1_4	J53.2
L31	PMOD1_5_LS	LVCMOS12	U42.8	U42.13	PMOD1_5	J53.4
M31	PMOD1_6_LS	LVCMOS12	U42.9	U42.12	PMOD1_6	J53.6
R29	PMOD1_7_LS	LVCMOS12	U42.10	U42.11	PMOD1_7	J53.8

For more information about Pmod connector compatible Pmod modules, see the Digilent website [Ref 21].

Switches

[Figure 2-1, callouts 27, 30]

The VCU118 evaluation board includes a power on/off slide switch and a configuration pushbutton switch:

- Power on/off slide switch SW1 (callout 30)
- FPGA Program_B SW4, active-Low (callout 27)

Power On/Off Slide Switch SW1

[Figure 2-1, callout 30]

The VCU118 board power switch is SW1. Sliding the switch actuator from the off to on position applies 12VDC power from the 6-pin mini-fit power input connector J15. Green LED DS20 illuminates when power is available at the VCU118 power connector J15, and DS26 illuminates when the VCU118 board power switch is on. See VCU118 Board Power System for details on the onboard power system.

CAUTION! *Do NOT plug a PC ATX power supply 6-pin connector into J15 on the VCU118 evaluation board. The ATX 6-pin connector has a different pinout than J15. Connecting an ATX 6-pin connector into J15 damages the VCU118 evaluation board and voids the board warranty.*

The VCU118 evaluation kit provides the adapter cable shown in Figure 3-24 for powering the VCU118 board from the ATX power supply 4-pin peripheral connector. The Xilinx part number for this cable is 2600304, and is equivalent to the Sourcegate Technologies part number AZCBL-WH-1109-RA4. See [Ref 29] for ordering information.

Figure 3-24: **ATX Power Supply Adapter Cable**

Figure 3-25 shows the power connector J15, power switch SW1, and indicator LED DS26.

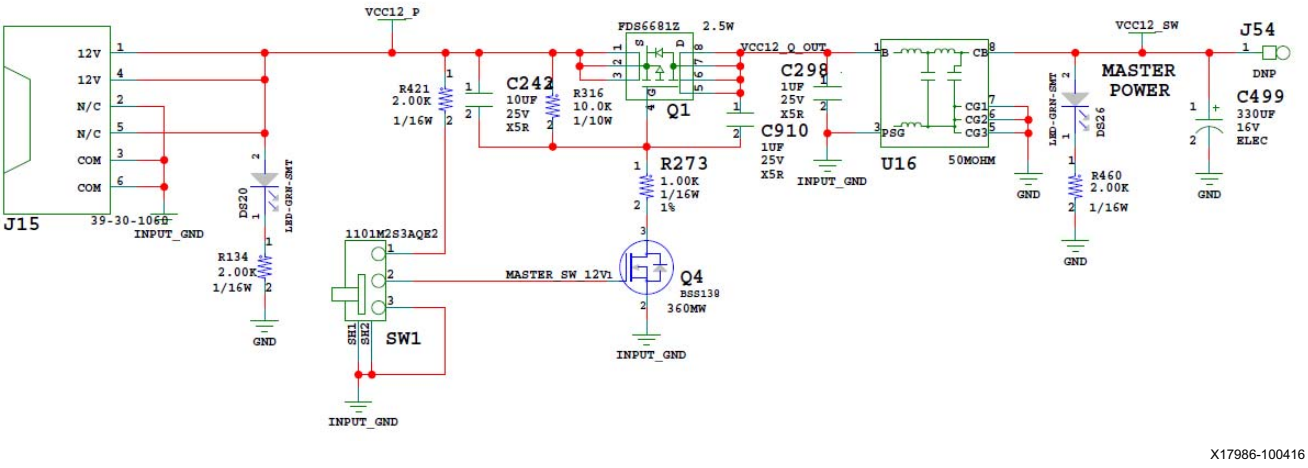

Figure 3-25: **Power On/Off Switch SW1**

Program_B Pushbutton Switch

[Figure 2-1, callout 27]

Switch SW4 grounds the XCVU9P FPGA U1 PROGRAM_B pin when pressed. This action clears the FPGA configuration. The FPGA_PROG_B signal is connected to XCVU9P FPGA U1 pin AH11. See *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2] for further configuration details.

Figure 3-26 shows SW4.

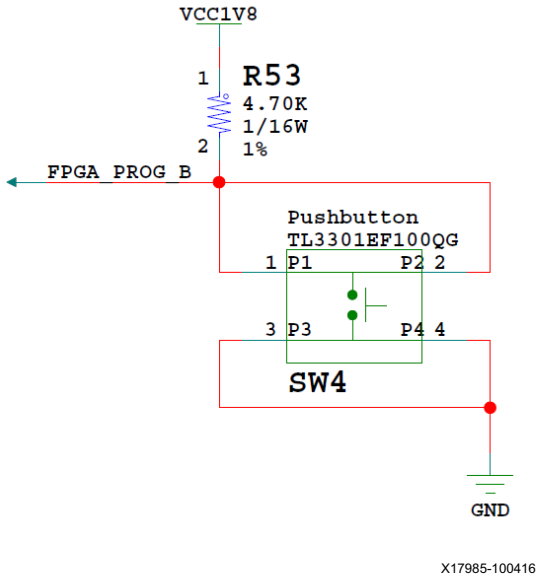

Figure 3-26: **Program_B Pushbutton Switch SW4**

FPGA Mezzanine Card Interface

[Figure 2-1, callouts 33, 34]

The VCU118 evaluation board supports the VITA 57.1 FPGA mezzanine card (FMC) specification by providing a subset implementation of the high pin count connector at J2 (HPC1). HPC connectors use a 10 x 40 form factor, populated with 400 pins. The connector is keyed so that a mezzanine card, when installed on the VCU118 evaluation board, faces away from the board.

In addition, the VCU118 evaluation board supports the VITA 57.4 FPGA mezzanine card plus (FMC+ or FMCP) specification by providing a subset implementation of the high pin count connector at J22 (HSPC). FMC+ connectors use a 14 x 40 form factor, populated with 560 pins. The connector is keyed so that a mezzanine card, when installed on the VCU118 evaluation board, faces away from the board.

J2 FMC Connector Type

- Samtec SEAF series, 1.27 mm (0.050 in) pitch. Mates with SEAM series connector. More information about SEAF series connectors is available at the Samtec website [Ref 26]. More information about the VITA 57.1 FMC specification is available at the VITA FMC Marketing Alliance website [Ref 27].
- The 400-pin HPC connector defined by the FMC specification (see Appendix A, VITA 57.1 and 57.4 FMC Connector Pinouts) provides connectivity for up to:
  - 160 single-ended or 80 differential user-defined signals
  - 10 transceiver differential pairs
  - 2 transceiver differential clocks
  - 4 differential clocks
  - 159 ground and 15 power connections

FMC HPC1 Connector J2

[Figure 2-1, callout 34]

The HPC connector at J2 implements a subset of the full FMC HPC connectivity:

- 68 single-ended or 34 differential user-defined pairs (34 LA pairs: LA[00:33])
- Two differential clocks
- 159 ground and 15 power connections

The HPC1 J2 connections to FPGA U1 are documented in Table 3-31. The net names shown in the table are as connected to FMC HPC1 J2 pins.

Table 3-31: **J2 VITA 57.1 FMC HPC1 Connections**

J2 FMC HPC1 Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin	J2 FMC HPC1 Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J2 Sections A/B are no connects (not connected to FPGA U1)							
J2 Sections C/D Connections to FPGA U1							
C2	NC	NA	NA	D1	VADJ_1V8_PGOOD (1)	LVCMOS18	AK35
C3	NC	NA	NA	D4	NC	NA	NA
C6	NC	NA	NA	D5	NC	NA	NA
C7	NC	NA	NA	D8	FMC_HPC1_LA01_CC_P	LVDS	BF10
C10	FMC_HPC1_LA06_P	LVDS	BD13	D9	FMC_HPC1_LA01_CC_N	LVDS	BF9
C11	FMC_HPC1_LA06_N	LVDS	BE13	D11	FMC_HPC1_LA05_P	LVDS	BE14
C14	FMC_HPC1_LA10_P	LVDS	BB13	D12	FMC_HPC1_LA05_N	LVDS	BF14
C15	FMC_HPC1_LA10_N	LVDS	BB12	D14	FMC_HPC1_LA09_P	LVDS	BA14
C18	FMC_HPC1_LA14_P	LVDS	AW8	D15	FMC_HPC1_LA09_N	LVDS	BB14
C19	FMC_HPC1_LA14_N	LVDS	AW7	D17	FMC_HPC1_LA13_P	LVDS	AY8
C22	FMC_HPC1_LA18_CC_P	LVDS	AP12	D18	FMC_HPC1_LA13_N	LVDS	AY7
C23	FMC_HPC1_LA18_CC_N	LVDS	AR12	D20	FMC_HPC1_LA17_CC_P	LVDS	AR14
C26	FMC_HPC1_LA27_P	LVDS	AL14	D21	FMC_HPC1_LA17_CC_N	LVDS	AT14
C27	FMC_HPC1_LA27_N	LVDS	AM14	D23	FMC_HPC1_LA23_P	LVDS	AN16
C30	FMC_HPC1_IIC_SCL (5)		U80.9	D24	FMC_HPC1_LA23_N	LVDS	AP16
C31	FMC_HPC1_IIC_SDA (5)		U80.8	D26	FMC_HPC1_LA26_P	LVDS	AK15
C34	GA0 = 0 = GND			D27	FMC_HPC1_LA26_N	LVDS	AL15
C35	VCC12_SW			D29	FMC_HPC1_TCK_BUF (2)		U19.16
C37	VCC12_SW			D30	FMCP_HSPC_TDO_HPC1_TDI (3)		U132.1,U26.2,J22.D31
C39	UTIL_3V3			D31	FMC_HPC1_TDO (3)		U132.2,U13.8
				D32	UTIL_3V3		
				D33	FMC_HPC1_TMS_BUF (2)		U19.19
				D34	NC		
				D35	GA1 = 0 = GND		
				D36	UTIL_3V3		
				D38	UTIL_3V3		
				D40	UTIL_3V3		

Table 3-31: **J2 VITA 57.1 FMC HPC1 Connections *(Cont'd)***

J2 FMC HPC1 Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin	J2 FMC HPC1 Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J2 Sections E/F have only the connections shown							
E39	VADJ_1V8_FPGA			F1	FMC_HPC1_PG_M2C (6)	LVCMOS18	BA7
				F40	VADJ_1V8_FPGA		
J2 Sections G/H Connections to FPGA U1							
G2	FMC_HPC1_CLK1_M2C_P	LVDS	AV14	H1	FMC_HPC1_VREF_A_M2C	LVCMOS18	
G3	FMC_HPC1_CLK1_M2C_N	LVDS	AV13	H2	FMC_HPC1_PRSNT_M2C_B (4)	LVCMOS18	BB7
G6	FMC_HPC1_LA00_CC_P	LVDS	AY9	H4	FMC_HPC1_CLK0_M2C_P	LVDS	BC9
G7	FMC_HPC1_LA00_CC_N	LVDS	BA9	H5	FMC_HPC1_CLK0_M2C_N	LVDS	BC8
G9	FMC_HPC1_LA03_P	LVDS	BD12	H7	FMC_HPC1_LA02_P	LVDS	BC11
G10	FMC_HPC1_LA03_N	LVDS	BE12	H8	FMC_HPC1_LA02_N	LVDS	BD11
G12	FMC_HPC1_LA08_P	LVDS	BE15	H10	FMC_HPC1_LA04_P	LVDS	BF12
G13	FMC_HPC1_LA08_N	LVDS	BF15	H11	FMC_HPC1_LA04_N	LVDS	BF11
G15	FMC_HPC1_LA12_P	LVDS	BC14	H13	FMC_HPC1_LA07_P	LVDS	BC15
G16	FMC_HPC1_LA12_N	LVDS	BC13	H14	FMC_HPC1_LA07_N	LVDS	BD15
G18	FMC_HPC1_LA16_P	LVDS	AV9	H16	FMC_HPC1_LA11_P	LVDS	BA16
G19	FMC_HPC1_LA16_N	LVDS	AV8	H17	FMC_HPC1_LA11_N	LVDS	BA15
G21	FMC_HPC1_LA20_P	LVDS	AW11	H19	FMC_HPC1_LA15_P	LVDS	BB16
G22	FMC_HPC1_LA20_N	LVDS	AY10	H20	FMC_HPC1_LA15_N	LVDS	BC16
G24	FMC_HPC1_LA22_P	LVDS	AW13	H22	FMC_HPC1_LA19_P	LVDS	AW12
G25	FMC_HPC1_LA22_N	LVDS	AY13	H23	FMC_HPC1_LA19_N	LVDS	AY12
G27	FMC_HPC1_LA25_P	LVDS	AT12	H25	FMC_HPC1_LA21_P	LVDS	AU11
G28	FMC_HPC1_LA25_N	LVDS	AU12	H26	FMC_HPC1_LA21_N	LVDS	AV11
G30	FMC_HPC1_LA29_P	LVDS	AN15	H28	FMC_HPC1_LA24_P	LVDS	AP13
G31	FMC_HPC1_LA29_N	LVDS	AP15	H29	FMC_HPC1_LA24_N	LVDS	AR13
G33	FMC_HPC1_LA31_P	LVDS	AM13	H31	FMC_HPC1_LA28_P	LVDS	AV10
G34	FMC_HPC1_LA31_N	LVDS	AM12	H32	FMC_HPC1_LA28_N	LVDS	AW10
G36	FMC_HPC1_LA33_P	LVDS	AK14	H34	FMC_HPC1_LA30_P	LVDS	AK12
G37	FMC_HPC1_LA33_N	LVDS	AK13	H35	FMC_HPC1_LA30_N	LVDS	AL12
G39	VADJ_1V8_FPGA			H37	FMC_HPC1_LA32_P	LVDS	AJ13
				H38	FMC_HPC1_LA32_N	LVDS	AJ12
				H40	VADJ_1V8_FPGA		
J2 Sections J/K are no connects (not connected to FPGA U1)							

Table 3-31: **J2 VITA 57.1 FMC HPC1 Connections *(Cont'd)***

J2 FMC HPC1 Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin	J2 FMC HPC1 Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin

Notes:

1. U30 MAX15301 VADJ_1V8_FPGA voltage regulator PGOOD level-shifted by U44.
2. FPGA U1 JTAG TCK, TMS pins AE13, AF15 are buffered by U19 SN74AVC8T245.
3. J2 HPC1 TDO-TDI connections to U132 HPC1 FMC JTAG bypass switch (N.C. normally closes/bypassing J2 until an FMC card is plugged into J2).
4. FMC_HPC1_PRSNT_M2C_B is the HPC1 FMC JTAG bypass switch U132.4 OE control signal and is also connected to the FPGA U1 pin BB7 via level shifter U44.
5. Connected to the FPGA U1 pins AL24/AM24 IIC_MAIN_SDA/SCL via IIC MUX U80.
6. HPC1 FMC signal FMC_HPC1_PG_M2C is connected to the FPGA U1 pin BA7 via level shifter U44.

The VCU118 evaluation board supports the VITA 57.4 FPGA mezzanine card plus (FMC+ or FMCP) specification by providing a subset implementations of the high pin count connectors at J22 (HSPC). FMC+ connectors use a 14 x 40 form factor, populated with 560 pins. The connector is keyed so that a mezzanine card, when installed on the VCU118 evaluation board, faces away from the board.

J22 FMC+ Connector Type

- Samtec SEAF series, 1.27 mm (0.050 in) pitch. Mates with SEAM series connector. More information about SEAF series connectors is available at the Samtec website [Ref 26]. More information about the VITA 57.4 FMC+ specification is available at the VITA FMC Marketing Alliance website [Ref 27].
- The 560-pin FMC+ connector defined by the FMC specification (see Appendix A, VITA 57.1 and 57.4 FMC Connector Pinouts) provides connectivity for up to:
  - 160 single-ended or 80 differential user-defined signals
  - 24 transceiver differential pairs
  - 6 transceiver differential clocks
  - 4 differential clocks
  - 239 ground and 19 power connections

FMCP Connector J22

[Figure 2-1, callout 33]

The HPC connector at J22 implements a subset of the full FMCP connectivity:

- 116 single-ended or 58 differential user-defined pairs (34 LA pairs: LA[00:33], 24 HA pairs: HA[00:23])
- 24 transceiver differential pairs
- 6 transceiver differential clocks
- 2 differential clocks
- 239 ground and 16 power connections

The FMCP J22 connections to FPGA U1 are documented in Table 3-32. The net names shown in the table are as connected to FMCP HSCP J22 pins.

Table 3-32: **J22 VITA 57.4 FMCP HSCP Connections**

J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin		J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J22 Sections A/B Connections to FPGA U1								
A2	FMCP_HSPC_DP1_M2C_P	LVDS	AN45		B1	NC	NA	NA
A3	FMCP_HSPC_DP1_M2C_N	LVDS	AN46		B4	FMCP_HSPC_DP9_M2C_P	LVDS	AF43
A6	FMCP_HSPC_DP2_M2C_P	LVDS	AL45		B5	FMCP_HSPC_DP9_M2C_N	LVDS	AF44
A7	FMCP_HSPC_DP2_M2C_N	LVDS	AL46		B8	FMCP_HSPC_DP8_M2C_P	LVDS	AG45
A10	FMCP_HSPC_DP3_M2C_P	LVDS	AJ45		B9	FMCP_HSPC_DP8_M2C_N	LVDS	AG46
A11	FMCP_HSPC_DP3_M2C_N	LVDS	AJ46		B12	FMCP_HSPC_DP7_M2C_P	LVDS	N45
A14	FMCP_HSPC_DP4_M2C_P	LVDS	W45		B13	FMCP_HSPC_DP7_M2C_N	LVDS	N46
A15	FMCP_HSPC_DP4_M2C_N	LVDS	W46		B16	FMCP_HSPC_DP6_M2C_P	LVDS	R45
A18	FMCP_HSPC_DP5_M2C_P	LVDS	U45		B17	FMCP_HSPC_DP6_M2C_N	LVDS	R46
A19	FMCP_HSPC_DP5_M2C_N	LVDS	U46		B20	FMCP_HSPC_GBTCLK1_M2C_P(5)	LVDS	U39.2
A22	FMCP_HSPC_DP1_C2M_P	LVDS	AP42		B21	FMCP_HSPC_GBTCLK1_M2C_N(5)	LVDS	U39.1
A23	FMCP_HSPC_DP1_C2M_N	LVDS	AP43		B24	FMCP_HSPC_DP9_C2M_P	LVDS	AJ40
A26	FMCP_HSPC_DP2_C2M_P	LVDS	AM42		B25	FMCP_HSPC_DP9_C2M_N	LVDS	AJ41
A27	FMCP_HSPC_DP2_C2M_N	LVDS	AM43		B28	FMCP_HSPC_DP8_C2M_P	LVDS	AK42
A30	FMCP_HSPC_DP3_C2M_P	LVDS	AL40		B29	FMCP_HSPC_DP8_C2M_N	LVDS	AK43
A31	FMCP_HSPC_DP3_C2M_N	LVDS	AL41		B32	FMCP_HSPC_DP7_C2M_P	LVDS	K42
A34	FMCP_HSPC_DP4_C2M_P	LVDS	T42		B33	FMCP_HSPC_DP7_C2M_N	LVDS	K43
A35	FMCP_HSPC_DP4_C2M_N	LVDS	T43		B36	FMCP_HSPC_DP6_C2M_P	LVDS	M42
A38	FMCP_HSPC_DP5_C2M_P	LVDS	P42		B37	FMCP_HSPC_DP6_C2M_N	LVDS	M43
A39	FMCP_HSPC_DP5_C2M_N	LVDS	P43		B40	NC	NA	NA

Table 3-32: **J22 VITA 57.4 FMCP HSCP Connections *(Cont'd)***

J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin	J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J22 Sections C/D Connections to FPGA U1							
C2	FMCP_HSPC_DP0_C2M_P	LVDS	AT42	D1	VADJ_1V8_PGOOD(1)	LVCMOS18	AK35
C3	FMCP_HSPC_DP0_C2M_N	LVDS	AT43	D4	FMCP_HSPC_GBTCLK0_M2C_P(5)	LVDS	U40.7
C6	FMCP_HSPC_DP0_M2C_P	LVDS	AR45	D5	FMCP_HSPC_GBTCLK0_M2C_N(5)	LVDS	U40.6
C7	FMCP_HSPC_DP0_M2C_N	LVDS	AR46	D8	FMCP_HSPC_LA01_CC_P	LVDS	AL30
C10	FMCP_HSPC_LA06_P	LVDS	AT35	D9	FMCP_HSPC_LA01_CC_N	LVDS	AL31
C11	FMCP_HSPC_LA06_N	LVDS	AT36	D11	FMCP_HSPC_LA05_P	LVDS	AP38
C14	FMCP_HSPC_LA10_P	LVDS	AP35	D12	FMCP_HSPC_LA05_N	LVDS	AR38
C15	FMCP_HSPC_LA10_N	LVDS	AR35	D14	FMCP_HSPC_LA09_P	LVDS	AJ33
C18	FMCP_HSPC_LA14_P	LVDS	AG31	D15	FMCP_HSPC_LA09_N	LVDS	AK33
C19	FMCP_HSPC_LA14_N	LVDS	AH31	D17	FMCP_HSPC_LA13_P	LVDS	AJ35
C22	FMCP_HSPC_LA18_CC_P	LVDS	R31	D18	FMCP_HSPC_LA13_N	LVDS	AJ36
C23	FMCP_HSPC_LA18_CC_N	LVDS	P31	D20	FMCP_HSPC_LA17_CC_P	LVDS	R34
C26	FMCP_HSPC_LA27_P	LVDS	V33	D21	FMCP_HSPC_LA17_CC_N	LVDS	P34
C27	FMCP_HSPC_LA27_N	LVDS	V34	D23	FMCP_HSPC_LA23_P	LVDS	Y32
C30	FMCP_HSPC_IIC_SCL			D24	FMCP_HSPC_LA23_N	LVDS	W32
C31	FMCP_HSPC_IIC_SDA			D26	FMCP_HSPC_LA26_P	LVDS	V32
C34	GA0 = 0 = GND			D27	FMCP_HSPC_LA26_N	LVDS	U33
C35	VCC12_SW			D29	FMCP_HSPC_TCK_BUF		
C37	VCC12_SW			D30	FPGA_TDO_FMC_TDI_BUF		
C39	UTIL_3V3			D31	FMCP_HSPC_TDO_HPC1_TDI		
				D32	UTIL_3V3		
				D33	FMCP_HSPC_TMS_BUF		
				D34	NC		
				D35	GA1 = 0 = GND		
				D36	UTIL_3V3		
				D38	UTIL_3V3		
				D40	UTIL_3V3		

Table 3-32: **J22 VITA 57.4 FMCP HSCP Connections *(Cont'd)***

J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin		J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J22 Sections E/F Connections to FPGA U1								
E2	FMCP_HSPC_HA01_CC_P	LVDS	V15		F1	FMCP_HSPC_PG_M2C(2)	LVCMOS18	AM34
E3	FMCP_HSPC_HA01_CC_N	LVDS	U15		F4	FMCP_HSPC_HA00_CC_P	LVDS	N14
E6	FMCP_HSPC_HA05_P	LVDS	R14		F5	FMCP_HSPC_HA00_CC_N	LVDS	N13
E7	FMCP_HSPC_HA05_N	LVDS	P14		F7	FMCP_HSPC_HA04_P	LVDS	AA13
E9	FMCP_HSPC_HA09_P	LVDS	W14		F8	FMCP_HSPC_HA04_N	LVDS	Y13
E10	FMCP_HSPC_HA09_N	LVDS	V14		F10	FMCP_HSPC_HA08_P	LVDS	U11
E12	FMCP_HSPC_HA13_P	LVDS	V13		F11	FMCP_HSPC_HA08_N	LVDS	T11
E13	FMCP_HSPC_HA13_N	LVDS	U12		F13	FMCP_HSPC_HA12_P	LVDS	T16
E15	FMCP_HSPC_HA16_P	LVDS	T14		F14	FMCP_HSPC_HA12_N	LVDS	T15
E16	FMCP_HSPC_HA16_N	LVDS	R13		F16	FMCP_HSPC_HA15_P	LVDS	M13
E18	FMCP_HSPC_HA20_P	LVDS	M15		F17	FMCP_HSPC_HA15_N	LVDS	M12
E19	FMCP_HSPC_HA20_N	LVDS	L15		F19	FMCP_HSPC_HA19_P	LVDS	L14
E21	NC	NA	NA		F20	FMCP_HSPC_HA19_N	LVDS	L13
E22	NC	NA	NA		F22	NC	NA	NA
E24	NC	NA	NA		F23	NC	NA	NA
E25	NC	NA	NA		F25	NC	NA	NA
E27	NC	NA	NA		F26	NC	NA	NA
E28	NC	NA	NA		F28	NC	NA	NA
E30	NC	NA	NA		F29	NC	NA	NA
E31	NC	NA	NA		F31	NC	NA	NA
E33	NC	NA	NA		F32	NC	NA	NA
E34	NC	NA	NA		F34	NC	NA	NA
E36	NC	NA	NA		F35	NC	NA	NA
E37	NC	NA	NA		F37	NC	NA	NA
E39	VADJ_1V8_FPGA				F38	NC	NA	NA
					F40	VADJ_1V8_FPGA		

Table 3-32: **J22 VITA 57.4 FMCP HSCP Connections *(Cont'd)***

J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin	J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J22 Sections G/H Connections to FPGA U1							
G2	FMCP_HSPC_CLK1_M2C_P	LVDS	P35	H1	FMCP_HSPC_VREF_A_M2C		
G3	FMCP_HSPC_CLK1_M2C_N	LVDS	P36	H2	FMCP_HSPC_H_PRSNT_M2C_B(3)	LVCMOS18	AM33
G6	FMCP_HSPC_LA00_CC_P	LVDS	AL35	H4	FMCP_HSPC_CLK0_M2C_P	LVDS	AL32
G7	FMCP_HSPC_LA00_CC_N	LVDS	AL36	H5	FMCP_HSPC_CLK0_M2C_N	LVDS	AM32
G9	FMCP_HSPC_LA03_P	LVDS	AT39	H7	FMCP_HSPC_LA02_P	LVDS	AJ32
G10	FMCP_HSPC_LA03_N	LVDS	AT40	H8	FMCP_HSPC_LA02_N	LVDS	AK32
G12	FMCP_HSPC_LA08_P	LVDS	AK29	H10	FMCP_HSPC_LA04_P	LVDS	AR37
G13	FMCP_HSPC_LA08_N	LVDS	AK30	H11	FMCP_HSPC_LA04_N	LVDS	AT37
G15	FMCP_HSPC_LA12_P	LVDS	AH33	H13	FMCP_HSPC_LA07_P	LVDS	AP36
G16	FMCP_HSPC_LA12_N	LVDS	AH34	H14	FMCP_HSPC_LA07_N	LVDS	AP37
G18	FMCP_HSPC_LA16_P	LVDS	AG34	H16	FMCP_HSPC_LA11_P	LVDS	AJ30
G19	FMCP_HSPC_LA16_N	LVDS	AH35	H17	FMCP_HSPC_LA11_N	LVDS	AJ31
G21	FMCP_HSPC_LA20_P	LVDS	N32	H19	FMCP_HSPC_LA15_P	LVDS	AG32
G22	FMCP_HSPC_LA20_N	LVDS	M32	H20	FMCP_HSPC_LA15_N	LVDS	AG33
G24	FMCP_HSPC_LA22_P	LVDS	N34	H22	FMCP_HSPC_LA19_P	LVDS	N33
G25	FMCP_HSPC_LA22_N	LVDS	N35	H23	FMCP_HSPC_LA19_N	LVDS	M33
G27	FMCP_HSPC_LA25_P	LVDS	Y34	H25	FMCP_HSPC_LA21_P	LVDS	M35
G28	FMCP_HSPC_LA25_N	LVDS	W34	H26	FMCP_HSPC_LA21_N	LVDS	L35
G30	FMCP_HSPC_LA29_P	LVDS	U35	H28	FMCP_HSPC_LA24_P	LVDS	T34
G31	FMCP_HSPC_LA29_N	LVDS	T36	H29	FMCP_HSPC_LA24_N	LVDS	T35
G33	FMCP_HSPC_LA31_P	LVDS	P37	H31	FMCP_HSPC_LA28_P	LVDS	M36
G34	FMCP_HSPC_LA31_N	LVDS	N37	H32	FMCP_HSPC_LA28_N	LVDS	L36
G36	FMCP_HSPC_LA33_P	LVDS	L34	H34	FMCP_HSPC_LA30_P	LVDS	N38
G37	FMCP_HSPC_LA33_N	LVDS	K34	H35	FMCP_HSPC_LA30_N	LVDS	M38
G39	VADJ_1V8_FPGA			H37	FMCP_HSPC_LA32_P	LVDS	L33
				H38	FMCP_HSPC_LA32_N	LVDS	K33
				H40	VADJ_1V8_FPGA		

Table 3-32: **J22 VITA 57.4 FMCP HSCP Connections *(Cont'd)***

J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin	J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J22 Sections J/K Connections to FPGA U1							
J2	NC	NA	NA	K1	NC	NA	NA
J3	NC	NA	NA	K4	NC	NA	NA
J6	FMCP_HSPC_HA03_P	LVDS	W12	K5	NC	NA	NA
J7	FMCP_HSPC_HA03_N	LVDS	V12	K7	FMCP_HSPC_HA02_P	LVDS	AA12
J9	FMCP_HSPC_HA07_P	LVDS	AA14	K8	FMCP_HSPC_HA02_N	LVDS	Y12
J10	FMCP_HSPC_HA07_N	LVDS	Y14	K10	FMCP_HSPC_HA06_P	LVDS	U13
J12	FMCP_HSPC_HA11_P	LVDS	R12	K11	FMCP_HSPC_HA06_N	LVDS	T13
J13	FMCP_HSPC_HA11_N	LVDS	P12	K13	FMCP_HSPC_HA10_P	LVDS	V16
J15	FMCP_HSPC_HA14_P	LVDS	M11	K14	FMCP_HSPC_HA10_N	LVDS	U16
J16	FMCP_HSPC_HA14_N	LVDS	L11	K16	FMCP_HSPC_HA17_CC_P	LVDS	R11
J18	FMCP_HSPC_HA18_P	LVDS	P15	K17	FMCP_HSPC_HA17_CC_N	LVDS	P11
J19	FMCP_HSPC_HA18_N	LVDS	N15	K19	FMCP_HSPC_HA21_P	LVDS	K14
J21	FMCP_HSPC_HA22_P	LVDS	K12	K20	FMCP_HSPC_HA21_N	LVDS	K13
J22	FMCP_HSPC_HA22_N	LVDS	J12	K22	FMCP_HSPC_HA23_P	LVDS	K11
J24	NC	NA	NA	K23	FMCP_HSPC_HA23_N	LVDS	J11
J25	NC	NA	NA	K25	NC	NA	NA
J27	NC	NA	NA	K26	NC	NA	NA
J28	NC	NA	NA	K28	NC	NA	NA
J30	NC	NA	NA	K29	NC	NA	NA
J31	NC	NA	NA	K31	NC	NA	NA
J33	NC	NA	NA	K32	NC	NA	NA
J34	NC	NA	NA	K34	NC	NA	NA
J36	NC	NA	NA	K35	NC	NA	NA
J37	NC	NA	NA	K37	NC	NA	NA
J39	NC	NA	NA	K38	NC	NA	NA
				K40	NC	NA	NA

Table 3-32: **J22 VITA 57.4 FMCP HSCP Connections *(Cont'd)***

J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin	J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J22 Sections L/M Connections to FPGA U1							
L1	NC			M2	FMCP_HSPC_DP23_M2C_P	LVDS	AU45
L4	FMCP_HSPC_GBTCLK4_M2C_P(5)	LVDS	R40	M3	FMCP_HSPC_DP23_M2C_N	LVDS	AU46
L5	FMCP_HSPC_GBTCLK4_M2C_N(5)	LVDS	R41	M6	FMCP_HSPC_DP22_M2C_P	LVDS	AW45
L8	FMCP_HSPC_GBTCLK3_M2C_P(5)	LVDS	AB38	M7	FMCP_HSPC_DP22_M2C_N	LVDS	AW46
L9	FMCP_HSPC_GBTCLK3_M2C_N(5)	LVDS	AB39	M10	FMCP_HSPC_DP21_M2C_P	LVDS	BA45
L12	FMCP_HSPC_GBTCLK2_M2C_P(5)	LVDS	AF38	M11	FMCP_HSPC_DP21_M2C_N	LVDS	BA46
L13	FMCP_HSPC_GBTCLK2_M2C_N(5)	LVDS	AF39	M14	FMCP_HSPC_DP20_M2C_P	LVDS	BC45
L16	FMCP_HSPC_SYNC_C2M_P	LVDS	AN34	M15	FMCP_HSPC_DP20_M2C_N	LVDS	BC46
L17	FMCP_HSPC_SYNC_C2M_N	LVDS	AN35	M18	FMCP_HSPC_DP14_C2M_P	LVDS	W40
L20	FMCP_HSPC_REFCLK_C2M_P	LVDS	AN33	M19	FMCP_HSPC_DP14_C2M_N	LVDS	W41
L21	FMCP_HSPC_REFCLK_C2M_N	LVDS	AP33	M22	FMCP_HSPC_DP15_C2M_P	LVDS	U40
L24	FMCP_HSPC_REFCLK_M2C_P	LVDS	AK34	M23	FMCP_HSPC_DP15_C2M_N	LVDS	U41
L25	FMCP_HSPC_REFCLK_M2C_N	LVDS	AL34	M26	FMCP_HSPC_DP16_C2M_P	LVDS	H42
L28	FMCP_HSPC_SYNC_M2C_P	LVDS	AM36	M27	FMCP_HSPC_DP16_C2M_N	LVDS	H43
L29	FMCP_HSPC_SYNC_M2C_N	LVDS	AN36	M30	FMCP_HSPC_DP17_C2M_P	LVDS	F42
L32	NC			M31	FMCP_HSPC_DP17_C2M_N	LVDS	F43
L33	NC			M34	FMCP_HSPC_DP18_C2M_P	LVDS	D42
L36	VCC12_SW			M35	FMCP_HSPC_DP18_C2M_N	LVDS	D43
L37	VCC12_SW			M38	FMCP_HSPC_DP19_C2M_P	LVDS	B42
L40	VCC12_SW			M39	FMCP_HSPC_DP19_C2M_N	LVDS	B43

Table 3-32: **J22 VITA 57.4 FMCP HSCP Connections *(Cont'd)***

J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin		J22 FMCP HSCP Pin	Schematic Net Name	I/O Standard	FPGA (U1) Pin
J22 Sections Y/Z Connections to FPGA U1								
Y2	FMCP_HSPC_DP23_C2M_P	LVDS	AV42		Z1	FMCP_HSPC_Z_PRSNT_M2C_B(4)	LVCMOS18	AM29
Y3	FMCP_HSPC_DP23_C2M_N	LVDS	AV43		Z4	FMCP_HSPC_DP22_C2M_P	LVDS	AY42
Y6	FMCP_HSPC_DP21_C2M_P	LVDS	BB42		Z5	FMCP_HSPC_DP22_C2M_N	LVDS	AY43
Y7	FMCP_HSPC_DP21_C2M_N	LVDS	BB43		Z8	FMCP_HSPC_DP20_C2M_P	LVDS	BD42
Y10	FMCP_HSPC_DP10_M2C_P	LVDS	AE45		Z9	FMCP_HSPC_DP20_C2M_N	LVDS	BD43
Y11	FMCP_HSPC_DP10_M2C_N	LVDS	AE46		Z12	FMCP_HSPC_DP11_M2C_P	LVDS	AD43
Y14	FMCP_HSPC_DP12_M2C_P	LVDS	AC45		Z13	FMCP_HSPC_DP11_M2C_N	LVDS	AD44
Y15	FMCP_HSPC_DP12_M2C_N	LVDS	AC46		Z16	FMCP_HSPC_DP13_M2C_P	LVDS	AB43
Y18	FMCP_HSPC_DP14_M2C_P	LVDS	AA45		Z17	FMCP_HSPC_DP13_M2C_N	LVDS	AB44
Y19	FMCP_HSPC_DP14_M2C_N	LVDS	AA46		Z20	FMCP_HSPC_GBTCLK5_M2C_P(5)	LVDS	AN40
Y22	FMCP_HSPC_DP15_M2C_P	LVDS	Y43		Z21	FMCP_HSPC_GBTCLK5_M2C_N (5)	LVDS	AN41
Y23	FMCP_HSPC_DP15_M2C_N	LVDS	Y44		Z24	FMCP_HSPC_DP10_C2M_P	LVDS	AG40
Y26	FMCP_HSPC_DP11_C2M_P	LVDS	AE40		Z25	FMCP_HSPC_DP10_C2M_N	LVDS	AG41
Y27	FMCP_HSPC_DP11_C2M_N	LVDS	AE41		Z28	FMCP_HSPC_DP12_C2M_P	LVDS	AC40
Y30	FMCP_HSPC_DP13_C2M_P	LVDS	AA40		Z29	FMCP_HSPC_DP12_C2M_N	LVDS	AC41
Y31	FMCP_HSPC_DP13_C2M_N	LVDS	AA41		Z32	FMCP_HSPC_DP16_M2C_P	LVDS	L45
Y34	FMCP_HSPC_DP17_M2C_P	LVDS	J45		Z33	FMCP_HSPC_DP16_M2C_N	LVDS	L46
Y35	FMCP_HSPC_DP17_M2C_N	LVDS	J46		Z36	FMCP_HSPC_DP18_M2C_P	LVDS	G45
Y38	FMCP_HSPC_DP19_M2C_P	LVDS	E45		Z37	FMCP_HSPC_DP18_M2C_N	LVDS	G46
Y39	FMCP_HSPC_DP19_M2C_N	LVDS	E46		Z40	UTIL_3V3		

Notes:

1. VADJ_1V8_PGOOD is level-shifted by U44 and is connected to FPGA pin U1.AK35.
2. FMCP_HSPC_PG_M2C is level-shifted by U44 and is connected to FPGA pin U1.AM34.
3. FMCP_HSPC_H_PRSNT_M2C_B is level-shifted by U44 and is connected to FPGA pin U1.AM33.
4. FMCP_HSPC_Z_PRSNT_M2C_B is level-shifted by U44 and is connected to FPGA pin U1.AM29.
5. FMCP_HSPC_GBTCLKn_M2C_P/N are series capacitor coupled, the nets connected to FPGA U1 are FMCP_HSPC_GBTCLKn_M2C_C_P/N.

VCU118 Board Power System

[Figure 2-1, callout 31]

The VCU118 hosts a Maxim PMBus based power system. Figure 3-27 shows the VCU118 power system block diagram.

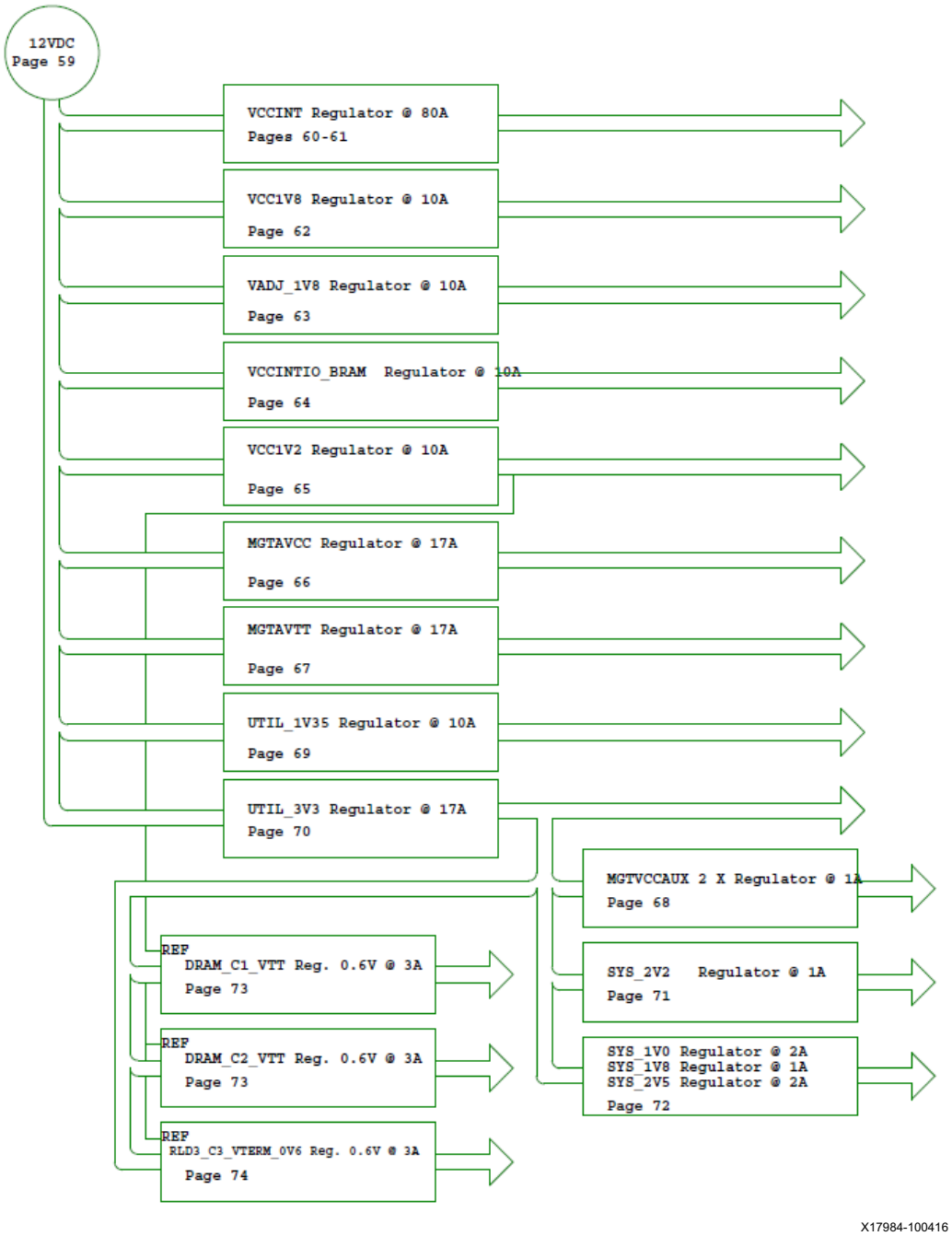

Figure 3-27: **VCU118 Power System Block Diagram**

The VCU118 evaluation board uses power regulators and PMBus compliant point of load (POL) controllers from Maxim Integrated Circuits to supply the core and auxiliary voltages listed in Table 3-33.

Table 3-33: **Onboard Power System Devices**

Device Type	Reference Designator	PMBus Address	Description	Power Rail Net Name	Voltage
MAX20751EKX	U164	0x70	Maxim multiphase master with smart slaves VT1697SBFQX 80A	VCCINT_FPGA	0.85V(1)
MAX15301	U9	0x11	Maxim InTune digital POL controller 10A	VCC1V8_FPGA	1.80V
MAX15301	U30	0x12	Maxim InTune digital POL controller 10A	VADJ_1V8_FPGA	1.80V
MAX15301	U6	0x15	Maxim InTune digital POL controller 10A	VCCINTIO_BRAM_FPGA	0.85V
MAX15301	U4	0x14	Maxim InTune digital POL controller 10A	VCC1V2_FPGA	1.20V
MAX20751EKX	U166	0x72	Maxim multiphase master with smart slave VT1697SBFQX 17A	MGTAVCC_FPGA	0.90V
MAX20751EKX	U165	0x73	Maxim multiphase master with smart slave VT1697SBFQX 17A	MGTAVTT_FPGA	1.20V
MAX8869EUE	U167	NA	Maxim fixed LDO 1A	MGTVCCAUX_L	1.80V
MAX8869EUE	U5	NA	Maxim fixed LDO 1A	MGTVCCAUX_R	1.80V
MAX15301	U150	0x1A	Maxim InTune digital POL controller 10A	UTIL_1V35	1.35V
MAX15301	U156	0x1B	Maxim InTune digital POL controller 17A	UTIL_3V3	3.30V
MAX15027	U10	NA	Maxim adjustable LDO 1A	SYS_2V2	2.20V
MAX15053	U124	NA	Maxim adjustable synchronous buck switcher 2A	SYS_1V0	1.00V
MAX15027	U125	NA	Maxim adjustable LDO 1A	SYS_1V8	1.80V
MAX15053	U151	NA	Maxim adjustable synchronous buck switcher 2A	SYS_2V5	2.50V
TPS51200	U24	NA	TI source-sink VTT regulator 3A	DDR4_C1_VTT	0.60V
TPS51200	U134	NA	TI source-sink VTT regulator 3A	DDR4_C2_VTT	0.60V
TPS51200	U143	NA	TI source-sink VTT regulator 3A	RLD3_C1_VTERM	0.60V

Notes:

1. Pre-Rev. 2.0 board V_{CCINT} = 0.72V. PCI Express Gen3 x16 operation is not supported when V_{CCINT} = 0.72V.

Documentation describing PMBus programming for the Maxim multiphase master and InTune power controllers is available at the Maxim website [Ref 28]. The PCB layout and power system design meet the recommended criteria described in the *UltraScale Architecture PCB Design User Guide* (UG583) [Ref 12].

FMC VADJ_1V8 Power Rail

The VCU118 evaluation board implements the ANSI/VITA 57.1 section 5.5.1 IPMI support functionality. The power control of the VADJ_1V8 power rail is significantly different from other Xilinx evaluation boards, and is managed by the U111 system controller. This rail powers both the FMCP HSPC (J22) and the FMC HPC1 (J2) VADJ pins, as well as the XCVU9P HP banks 43, 45, 66, 67, and 70 (see I/O Voltage Rails). The valid values of the VADJ_1V8 rail are 1.2V, 1.5V, and 1.8V.

At power on, the system controller detects if an FMC module is connected to each interface:

- If no cards are attached to the FMC ports, the VADJ voltage is set to 1.8V.
- When one FMC card is attached, its IIC EEPROM is read to find a VADJ voltage supported by both the VCU118 board and the FMC module, within the available choices of 1.2V, 1.5V, 1.8V, and 0.0V.
- When two FMC cards are attached with differing VADJ requirements, VADJ_1V8 is set to the lowest value compatible with the VCU118 board and the FMC modules, within the available choices of 1.2V, 1.5V, 1.8V, and 0.0V.
- If no valid information is found in the IIC EEPROMs, the VADJ_1V8 rail is set to 0.0V.

The system controller user interface allows the FMC IPMI routine to be overridden and an explicit value can be set for the VADJ_1V8_FPGA rail.

Monitoring Voltage and Current

[Figure 2-1, callouts 32, 37]

Voltage and current monitoring and control for the Maxim power system is available through either the VCU118 system controller or the Maxim PowerTool software GUI.

The VCU118 system controller is the simplest and most convenient way to monitor the voltage and current values for the power rails listed in Table 3-34.

The Maxim PMBus power controllers listed in Table 3-34 can also be accessed through the PMBus connector J39. Using this connector requires the Maxim PowerTool USB cable (Maxim part number MAXPOWERTOOL002#). This cable can be ordered from the Maxim Integrated website [Ref 28]. The associated Maxim PowerTool GUI can be downloaded from the Maxim website.

The Maxim PMBus controller and INA226 power monitor I²C bus mapping is shown in Table 3-34.

Table 3-34: **VCU118 Voltage Regulators and INA226 Power Monitors**

PMBus Regulators and INA226 Map								
Schematic Page	Rail	Regulator Type	U#	Vout (V)	Max Iout (A)	PMBus Address	INA226 U#	I²C Address
								INA_PMBUS
60	VCCINT_FPGA	MAX20751	U164	0.85V (1)	80	0X70	U35	0x40
62	VCC1V8_FPGA	MAX15301	U9	1.80	10	0x11	U23	0X41
63	VADJ_1V8_FPGA	MAX15301	U30	1.80	10	0x12	U27	0X42
64	VCCINTIO_BRAM_FPGA	MAX15301	U6	0.85	10	0x15	U8	0x48
65	VCC1V2_FPGA	MAX15301	U4	1.20	10	0x14	U29	0x43
66	MGTAVCC_FPGA	MAX20751	U166	0.90	17	0x72	U37	0x44
67	MGTAVTT_FPGA	MAX20751	U165	1.20	17	0x73	U36	0x45
69	UTIL_1V35	MAX15301	U150	1.35	10	0x1A	NA	NA
70	UTIL_3V3	MAX15301	U156	3.30	17	0x1B	NA	NA
Non-PMBus Regulators								
68	MGTVCCAUX_R	MAX8869EUE18	U5	1.80	1			
68	MGTVCCAUX_L	MAX8869EUE18	U167	1.80	1			
71	SYS_2V2	MAX15027	U10	2.20	1			
72	SYS_1V8	MAX15027	U125	1.80	1			
72	SYS_1V0	MAX15053	U124	1.00	2			
72	SYS_2V5	MAX15053	U151	2.50	2			
73	DDR4_C1_VTT	TPS51200DR	U24	0.60	3			
73	DDR4_C2_VTT	TPS51200DR	U134	0.60	3			

Notes:

1. Pre-Rev. 2.0 board V_{CCINT} = 0.72V.

Cooling Fan

The XCVU9P FPGA U1 cooling fan connector is shown in Figure 3-28.

The VCU118 fan circuit uses a Maxim MAX6643 fan controller that autonomously monitors the FPGA die temperature pins DXP and DXN. The fan circuit is set up to increase fan speed as the FPGA temperature increases.

Note: At initial power on, it is normal for the fan controller to energize at full speed for a few seconds.

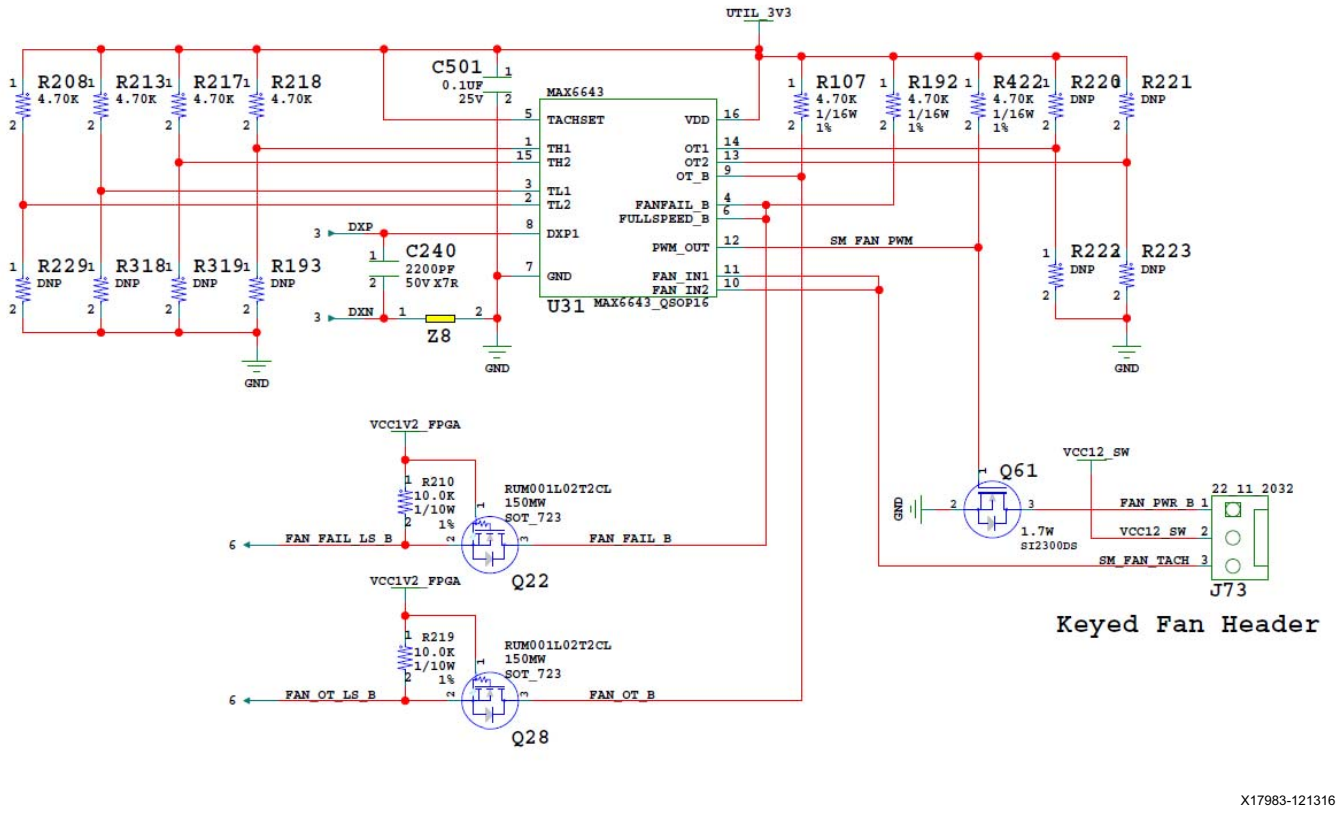

Figure 3-28: **Cooling Fan Circuit**

System Controller

[Figure 2-1, callout 36]

The VCU118 board includes an onboard Zynq-7000 SoC as the system controller. A host PC resident graphical user interface for the system controller (SCUI) is provided on the VCU118 website. The SCUI can be used to query and control select programmable features such as clocks, FMC functionality, and power systems. The VCU118 website also includes a *VCU118 System Controller Tutorial* (XTP447) [Ref 14] and *VCU118 Software Install and Board Setup Tutorial* (XTP449) [Ref 15]. A summary of the steps are:

1. Ensure the Silicon Labs VCP USB-UART drivers are installed on the host PC. See *Silicon Labs CP210x USB-to-UART Installation Guide* (UG1033) [Ref 13].
2. Download the SCUI host PC application.
3. Connect the micro-B USB cable between the VCU118 board USB-UART connector (J4) and the host PC.
4. Power-cycle the VCU118 board.
5. Launch SCUI.

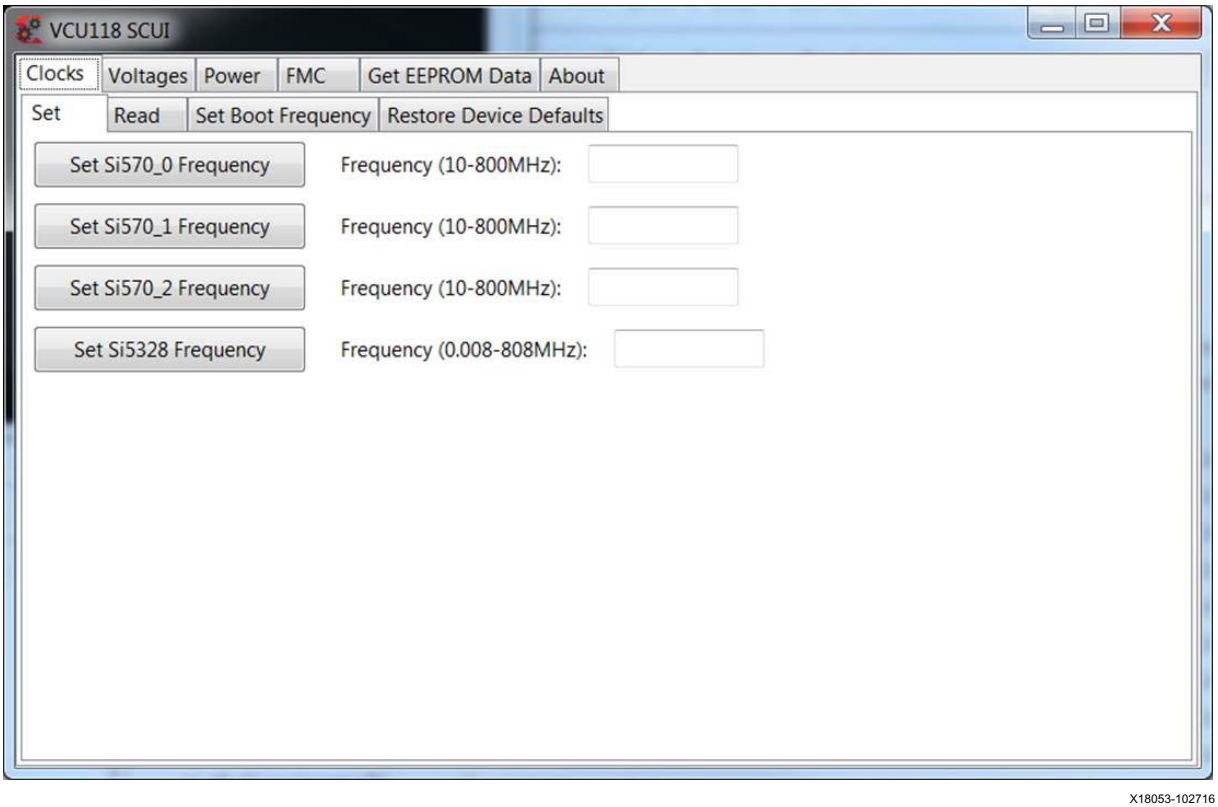

Figure 3-29: **VCU118 SCUI**

On first use of the SCUI, go to the **FMC** > **Set VADJ** > **Boot-up** tab and click **USE FMC EEPROM Voltage**. The SCUI buttons are grayed out during command execution and return to their original appearance when ready to accept a new command. See Figure 3-29.

See the *VCU118 System Controller Tutorial* (XTP447) and the VCU118 *Software Install and Board Setup Tutorial* (XTP449) for more information on installing and using the System Controller utility.

Configuration Options

[Figure 2-1, callout 35]

VCU118 boards earlier than Rev. 2.0 host a linear BPI 16-bit flash configuration memory, 1 Gb (U133) Micron MT28GU01GAAA1EGC-0SIT. See Appendix C, BPI Flash Memory for VCU118 Boards Prior to Revision 2.0.

The VCU118 board supports two of the seven UltraScale FPGA configuration modes:

- Master SPI using the onboard dual Quad SPI flash memory
- JTAG using:
  - USB JTAG configuration port (Digilent module U115)
  - Xilinx platform cable 2 mm, keyed flat cable header (J3)

See *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2] for further details on configuration modes.

Each configuration interface corresponds to one or more configuration modes and bus widths as listed in Table 3-35. The mode switches M2, M1, and M0 are on SW16 positions 2, 3, and 4, respectively. The FPGA default mode setting M[2:0] = 001, selecting the master SPI configuration mode.

Table 3-35: **VCU118 Board FPGA Configuration Modes**

Configuration Mode	SW16 DIP Switch Settings (M[2:0])	Bus Width	CCLK Direction
Master SPI	001	x1, x2, x4	Output
JTAG	101	x1	Not applicable

Figure 3-30 shows mode switch SW16.

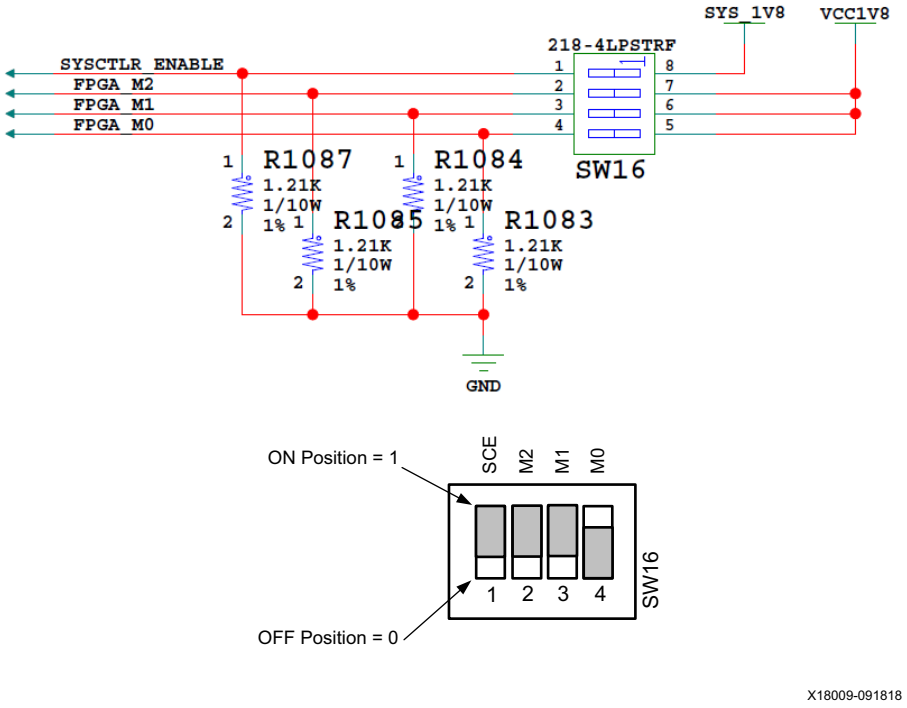

Figure 3-30: **SW16 JTAG Settings**

The mode pins settings on SW16 determine if the Quad SPI flash is used for configuring the FPGA. DIP switch SW16 also includes a system controller enable switch in position 1.

To obtain the fastest configuration speed, an external 90 MHz clock from the Silicon Labs Si5335A U122 is wired to the EMCCLK pin of the FPGA on bank 65 pin AL20. This allows the creation of bitstreams to configure the FPGA over the 8-bit datapath from the dual Quad SPI flash memory at a maximum synchronous read rate of 90 MHz.

VITA 57.1 and 57.4 FMC Connector Pinouts

Overview

Figure A-1 shows the pinout of the FPGA mezzanine card (FMC) high pin count (HPC) J2 defined by the VITA 57.1 FMC specification. For a description of how the VCU118 evaluation board implements the FMC specification, see FPGA Mezzanine Card Interface, page 95.

10 × 40	K	J	H	G	F	E	D	C	B	A
1	VREF_B_M2C	GND	VREF_A_M2C	GND	PG_M2C	GND	PG_C2M	GND	RES1	GND
2	GND	CLK3_BIDIR_P	PRSNT_M2C_L	CLK1_M2C_P	GND	HA01_P_CC	GND	DP0_C2M_P	GND	DP1_M2C_P
3	GND	CLK3_BIDIR_N	GND	CLK1_M2C_N	GND	HA01_N_CC	GND	DP0_C2M_N	GND	DP1_M2C_N
4	CLK2_BIDIR_P	GND	CLK0_M2C_P	GND	HA00_P_CC	GND	GBTCLK0_M2C_P	GND	DP9_M2C_P	GND
5	CLK2_BIDIR_N	GND	CLK0_M2C_N	GND	HA00_N_CC	GND	GBTCLK0_M2C_N	GND	DP9_M2C_N	GND
6	GND	HA03_P	GND	LA00_P_CC	GND	HA05_P	GND	DP0_M2C_P	GND	DP2_M2C_P
7	HA02_P	HA03_N	LA02_P	LA00_N_CC	HA04_P	HA05_N	GND	DP0_M2C_N	GND	DP2_M2C_N
8	HA02_N	GND	LA02_N	GND	HA04_N	GND	LA01_P_CC	GND	DP8_M2C_P	GND
9	GND	HA07_P	GND	LA03_P	GND	HA09_P	LA01_N_CC	GND	DP8_M2C_N	GND
10	HA06_P	HA07_N	LA04_P	LA03_N	HA08_P	HA09_N	GND	LA06_P	GND	DP3_M2C_P
11	HA06_N	GND	LA04_N	GND	HA08_N	GND	LA05_P	LA06_N	GND	DP3_M2C_N
12	GND	HA11_P	GND	LA08_P	GND	HA13_P	LA05_N	GND	DP7_M2C_P	GND
13	HA10_P	HA11_N	LA07_P	LA08_N	HA12_P	HA13_N	GND	GND	DP7_M2C_N	GND
14	HA10_N	GND	LA07_N	GND	HA12_N	GND	LA09_P	LA10_P	GND	DP4_M2C_P
15	GND	HA14_P	GND	LA12_P	GND	HA16_P	LA09_N	LA10_N	GND	DP4_M2C_N
16	HA17_P_CC	HA14_N	LA11_P	LA12_N	HA15_P	HA16_N	GND	GND	DP6_M2C_P	GND
17	HA17_N_CC	GND	LA11_N	GND	HA15_N	GND	LA13_P	GND	DP6_M2C_N	GND
18	GND	HA18_P	GND	LA16_P	GND	HA20_P	LA13_N	LA14_P	GND	DP5_M2C_P
19	HA21_P	HA18_N	LA15_P	LA16_N	HA19_P	HA20_N	GND	LA14_N	GND	DP5_M2C_N
20	HA21_N	GND	LA15_N	GND	HA19_N	GND	LA17_P_CC	GND	GBTCLK1_M2C_P	GND
21	GND	HA22_P	GND	LA20_P	GND	HB03_P	LA17_N_CC	GND	GBTCLK1_M2C_N	GND
22	HA23_P	HA22_N	LA19_P	LA20_N	HB02_P	HB03_N	GND	LA18_P_CC	GND	DP1_C2M_P
23	HA23_N	GND	LA19_N	GND	HB02_N	GND	LA23_P	LA18_N_CC	GND	DP1_C2M_N
24	GND	HB01_P	GND	LA22_P	GND	HB05_P	LA23_N	GND	DP9_C2M_P	GND
25	HB00_P_CC	HB01_N	LA21_P	LA22_N	HB04_P	HB05_N	GND	GND	DP9_C2M_N	GND
26	HB00_N_CC	GND	LA21_N	GND	HB04_N	GND	LA26_P	LA27_P	GND	DP2_C2M_P
27	GND	HB07_P	GND	LA25_P	GND	HB09_P	LA26_N	LA27_N	GND	DP2_C2M_N
28	HB06_P_CC	HB07_N	LA24_P	LA25_N	HB08_P	HB09_N	GND	GND	DP8_C2M_P	GND
29	HB06_N_CC	GND	LA24_N	GND	HB08_N	GND	TCK	GND	DP8_C2M_N	GND
30	GND	HB11_P	GND	LA29_P	GND	HB13_P	TDI	SCL	GND	DP3_C2M_P
31	HB10_P	HB11_N	LA28_P	LA29_N	HB12_P	HB13_N	TDO	SDA	GND	DP3_C2M_N
32	HB10_N	GND	LA28_N	GND	HB12_N	GND	3P3VAUX	GND	DP7_C2M_P	GND
33	GND	HB15_P	GND	LA31_P	GND	HB19_P	TMS	GND	DP7_C2M_N	GND
34	HB14_P	HB15_N	LA30_P	LA31_N	HB16_P	HB19_N	TRST_L	GA0	GND	DP4_C2M_P
35	HB14_N	GND	LA30_N	GND	HB16_N	GND	GA1	12P0V	GND	DP4_C2M_N
36	GND	HB18_P	GND	LA33_P	GND	HB21_P	3P3V	GND	DP6_C2M_P	GND
37	HB17_P_CC	HB18_N	LA32_P	LA33_N	HB20_P	HB21_N	GND	12P0V	DP6_C2M_N	GND
38	HB17_N_CC	GND	LA32_N	GND	HB20_N	GND	3P3V	GND	GND	DP5_C2M_P
39	GND	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	DP5_C2M_N
40	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	RES0	GND

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Figure A-1: **FMC Connector Pinouts**

Figure A-2 shows the pinout of the FPGA mezzanine card plus (FMCP) connector J22 defined by the VITA 57.4 FMC specification. For a description of how the VCU118 evaluation board implements the FMC specification, see FPGA Mezzanine Card Interface, page 95.

4 x 40	M	L	K	J	H	G	F	E	D	C	B	A	Z	Y
1	GND	RES1	VREF_B_M2C	GND	VREF_A_M2C	GND	PG_M2C	GND	PG_C2M	GND	CLK_DIR	GND	HSPC_PRSNT_M2C_L	GND
2	DP23_M2C_P	GND	GND	CLK3_BIDIR_P	PRSNT_M2C_L	CLK1_M2C_P	GND	HA01_P_CC	GND	DP0_C2M_P	GND	DP1_M2C_P	GND	DP23_C2M_P
3	DP23_M2C_N	GND	GND	CLK3_BIDIR_N	GND	CLK1_M2C_N	GND	HA01_N_CC	GND	DP0_C2M_N	GND	DP1_M2C_N	GND	DP23_C2M_N
4	GND	GBTCLK4_M2C_P	CLK2_BIDIR_P	GND	CLK0_M2C_P	GND	HA00_P_CC	GND	GBTCLK0_M2C_P	GND	DP9_M2C_P	GND	DP22_C2M_P	GND
5	GND	GBTCLK4_M2C_N	CLK2_BIDIR_N	GND	CLK0_M2C_N	GND	HA00_N_CC	GND	GBTCLK0_M2C_N	GND	DP9_M2C_N	GND	DP22_C2M_N	GND
6	DP22_M2C_P	GND	GND	HA03_P	GND	LA00_P_CC	GND	HA05_P	GND	DP0_M2C_P	GND	DP2_M2C_P	GND	DP21_C2M_P
7	DP22_M2C_N	GND	HA02_P	HA03_N	LA02_P	LA00_N_CC	HA04_P	HA05_N	GND	DP0_M2C_N	GND	DP2_M2C_N	GND	DP21_C2M_N
8	GND	GBTCLK3_M2C_P	HA02_N	GND	LA02_N	GND	HA04_N	GND	LA01_P_CC	GND	DP8_M2C_P	GND	DP20_C2M_P	GND
9	GND	GBTCLK3_M2C_N	GND	HA07_P	GND	LA03_P	GND	HA09_P	LA01_N_CC	GND	DP8_M2C_N	GND	DP20_C2M_N	GND
10	DP21_M2C_P	GND	HA06_P	HA07_N	LA04_P	LA03_N	HA08_P	HA09_N	GND	LA06_P	GND	DP3_M2C_P	GND	DP10_M2C_P
11	DP21_M2C_N	GND	HA06_N	GND	LA04_N	GND	HA08_N	GND	LA05_P	LA06_N	GND	DP3_M2C_N	GND	DP10_M2C_N
12	GND	GBTCLK2_M2C_P	GND	HA11_P	GND	LA08_P	GND	HA13_P	LA05_N	GND	DP7_M2C_P	GND	DP11_M2C_P	GND
13	GND	GBTCLK2_M2C_N	HA10_P	HA11_N	LA07_P	LA08_N	HA12_P	HA13_N	GND	GND	DP7_M2C_N	GND	DP11_M2C_N	GND
14	DP20_M2C_P	GND	HA10_N	GND	LA07_N	GND	HA12_N	GND	LA09_P	LA10_P	GND	DP4_M2C_P	GND	DP12_M2C_P
15	DP20_M2C_N	GND	GND	HA14_P	GND	LA12_P	GND	HA16_P	LA09_N	LA10_N	GND	DP4_M2C_N	GND	DP12_M2C_N
16	GND	SYNC_C2M_P	HA17_P_CC	HA14_N	LA11_P	LA12_N	HA15_P	HA16_N	GND	GND	DP6_M2C_P	GND	DP13_M2C_P	GND
17	GND	SYNC_C2M_N	HA17_N_CC	GND	LA11_N	GND	HA15_N	GND	LA13_P	GND	DP6_M2C_N	GND	DP13_M2C_N	GND
18	DP14_C2M_P	GND	GND	HA18_P	GND	LA16_P	GND	HA20_P	LA13_N	LA14_P	GND	DP5_M2C_P	GND	DP14_M2C_P
19	DP14_C2M_N	GND	HA21_P	HA18_N	LA15_P	LA16_N	HA19_P	HA20_N	GND	LA14_N	GND	DP5_M2C_N	GND	DP14_M2C_N
20	GND	REFCLK_C2M_P	HA21_N	GND	LA15_N	GND	HA19_N	GND	LA17_P_CC	GND	GBTCLK1_M2C_P	GND	GBTCLK5_M2C_P	GND
21	GND	REFCLK_C2M_N	GND	HA22_P	GND	LA20_P	GND	HB03_P	LA17_N_CC	GND	GBTCLK1_M2C_N	GND	GBTCLK5_M2C_N	GND
22	DP15_C2M_P	GND	HA23_P	HA22_N	LA19_P	LA20_N	HB02_P	HB03_N	GND	LA18_P_CC	GND	DP1_C2M_P	GND	DP15_M2C_P
23	DP15_C2M_N	GND	HA23_N	GND	LA19_N	GND	HB02_N	GND	LA23_P	LA18_N_CC	GND	DP1_C2M_N	GND	DP15_M2C_N
24	GND	REFCLK_M2C_P	GND	HB01_P	GND	LA22_P	GND	HB05_P	LA23_N	GND	DP9_C2M_P	GND	DP10_C2M_P	GND
25	GND	REFCLK_M2C_N	HB00_P_CC	HB01_N	LA21_P	LA22_N	HB04_P	HB05_N	GND	GND	DP9_C2M_N	GND	DP10_C2M_N	GND
26	DP16_C2M_P	GND	HB00_N_CC	GND	LA21_N	GND	HB04_N	GND	LA26_P	LA27_P	GND	DP2_C2M_P	GND	DP11_C2M_P
27	DP16_C2M_N	GND	GND	HB07_P	GND	LA25_P	GND	HB09_P	LA26_N	LA27_N	GND	DP2_C2M_N	GND	DP11_C2M_N
28	GND	SYNC_M2C_P	HB06_P_CC	HB07_N	LA24_P	LA25_N	HB08_P	HB09_N	GND	GND	DP8_C2M_P	GND	DP12_C2M_P	GND
29	GND	SYNC_M2C_N	HB06_N_CC	GND	LA24_N	GND	HB08_N	GND	TCK	GND	DP8_C2M_N	GND	DP12_C2M_N	GND
30	DP17_C2M_P	GND	GND	HB11_P	GND	LA29_P	GND	HB13_P	TDI	SCL	GND	DP3_C2M_P	GND	DP13_C2M_P
31	DP17_C2M_N	GND	HB10_P	HB11_N	LA28_P	LA29_N	HB12_P	HB13_N	TDO	SDA	GND	DP3_C2M_N	GND	DP13_C2M_N
32	GND	RES2	HB10_N	GND	LA28_N	GND	HB12_N	GND	3P3VAUX	GND	DP7_C2M_P	GND	DP16_M2C_P	GND
33	GND	RES3	GND	HB15_P	GND	LA31_P	GND	HB19_P	TMS	GND	DP7_C2M_N	GND	DP16_M2C_N	GND
34	DP18_C2M_P	GND	HB14_P	HB15_N	LA30_P	LA31_N	HB16_P	HB19_N	TRST_L	GA0	GND	DP4_C2M_P	GND	DP17_M2C_P
35	DP18_C2M_N	GND	HB14_N	GND	LA30_N	GND	HB16_N	GND	GA1	12P0V	GND	DP4_C2M_N	GND	DP17_M2C_N
36	GND	12P0V	GND	HB18_P	GND	LA33_P	GND	HB21_P	3P3V	GND	DP6_C2M_P	GND	DP18_M2C_P	GND
37	GND	12P0V	HB17_P_CC	HB18_N	LA32_P	LA33_N	HB20_P	HB21_N	GND	12P0V	DP6_C2M_N	GND	DP18_M2C_N	GND
38	DP19_C2M_P	GND	HB17_N_CC	GND	LA32_N	GND	HB20_N	GND	3P3V	GND	GND	DP5_C2M_P	GND	DP19_M2C_P
39	DP19_C2M_N	GND	GND	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	DP5_C2M_N	GND	DP19_M2C_N
40	GND	12P0V	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	RES0	GND	3P3V	GND

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Figure A-2: **FMCP Connector Pinouts**

Appendix B

Xilinx Constraints File

Overview

The Xilinx design constraints (XDC) file template for the VCU118 board provides for designs targeting the VCU118 evaluation board. Net names in the constraints correlate with net names on the latest VCU118 evaluation board schematic. Users must identify the appropriate pins and replace the net names with net names in the user RTL. See the *Vivado Design Suite User Guide: Using Constraints* (UG903) [Ref 11] for more information.

The FMC connectors J22 (FMCP) and J2 (FMC HPC1) are connected to 1.8V VADJ banks. Because different FMC cards implement different circuitry, the FMC bank I/O standards must be uniquely defined by each customer.

IMPORTANT: *The XDC file can be accessed on the* VCU118 Evaluation Kit website.

Appendix C

BPI Flash Memory for VCU118 Boards Prior to Revision 2.0

Configuration Options

[Figure 2-1, callout 35]

The VCU118 board supports two of the seven UltraScale FPGA configuration modes:

- Master BPI using the onboard linear BPI flash memory
- JTAG using:
  - USB JTAG configuration port (Digilent module U115)
  - Xilinx platform cable 2 mm, keyed flat cable header (J3)

See *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2] for further details on configuration modes.

Each configuration interface corresponds to one or more configuration modes and bus widths as listed in Table 3-35. The mode switches M2, M1, and M0 are on SW16 positions 2, 3, and 4, respectively. The FPGA default mode setting M[2:0] = 010, selecting the master BPI configuration mode.

Table C-1: **VCU118 Board FPGA Configuration Modes**

Configuration Mode	SW16 DIP Switch Settings (M[2:0])	Bus Width	CCLK Direction
Master BPI	010	x8, x16	Output
JTAG	101	x1	Not applicable

Figure C-1 shows mode switch SW16.

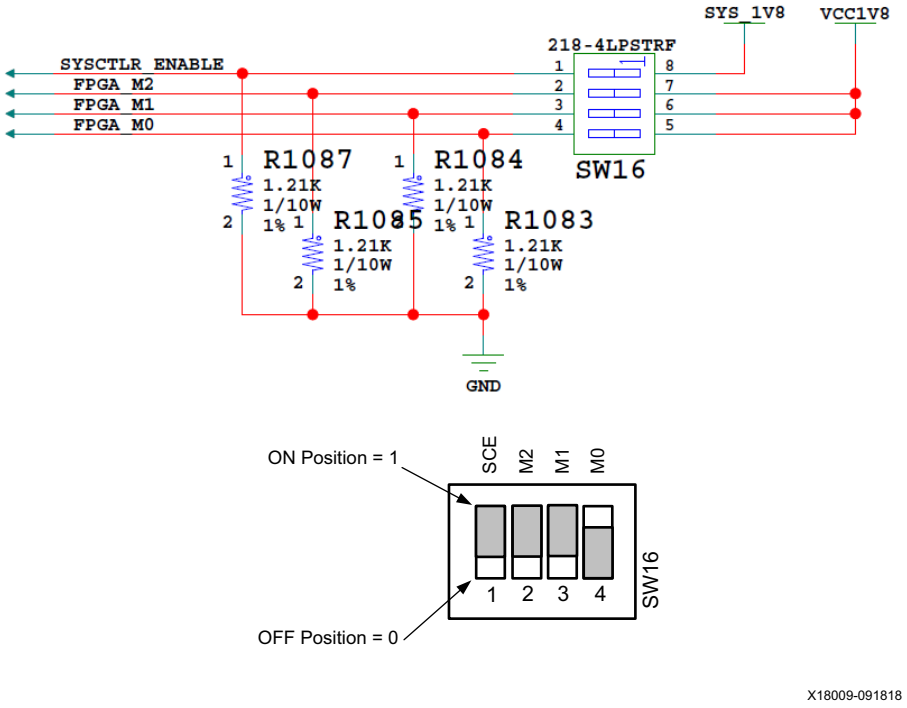

Figure C-1: **SW16 JTAG Mode Setting**

The mode pins settings on SW16 determine if the linear BPI flash is used for configuring the FPGA. DIP switch SW16 also includes a system controller enable switch in position 1.

To obtain the fastest configuration speed, an external 90 MHz clock from the Silicon Labs Si5335A U122 is wired to the EMCCLK pin of the FPGA on bank 65 pin AL20. This allows the creation of bitstreams to configure the FPGA over the 16-bit datapath from the linear BPI flash memory at a maximum synchronous read rate of 90 MHz.

Linear BPI Flash Memory

[Figure 2-1, callout 6]

The linear BPI flash memory located at U133 provides 128 MB (1 Gbit) of nonvolatile storage that can be used for configuration or software storage. The data, address, and control signals are connected to the U1 XCVU9P bank 65. The BPI flash memory device is packaged in a 64-pin BGA.

- Part number: MT28GU01GAAA1EGC-0SIT (Micron)
- Supply voltage: 1.8V
- Datapath width: 16 bits (with 26 address lines and 7 control signals)
- Data rate: up to 90 MHz

The linear BPI flash memory can synchronously configure the FPGA in master BPI mode at the 90 MHz data rate supported by the MT28GU01GAAA1EGC flash memory by using a configuration bitstream generated with BitGen options for synchronous configuration and for a configuration clock division of one. The fastest configuration method uses the external 90 MHz oscillator connected to the FPGA bank 65 EMCCLK pin AL20. By default, UltraScale FPGAs use the parallel NOR flash asynchronous read in the master BPI configuration mode.

A full XCVU9P 641,272,864-bit uncompressed bitstream requires 60% of the 1 Gbit linear BPI NOR flash size, so one XCVU9P bitstream is supported.

The BPI flash memory upper address A25 pin is wired to pull-up header J29 to allow one of two compressed bitstreams to be manually selected.

See the *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2] for more information.

Add these constraints for compression to designs targeted for the VCU118 board.

- When loading from the BPI flash memory:

```
set_property BITSTREAM.CONFIG.EXTMASTERCCLK_EN div-1 [current_design]
set_property BITSTREAM.CONFIG.BPI_SYNC_MODE Type1 [current_design]
set_property CONFIG_MODE BPI16 [current_design]
*set_property BITSTREAM.GENERAL.COMPRESS TRUE [current_design]
```

  Note: Compression is an optional setting that can improve indirect flash programming time.

- To match the VCU118 configuration of FPGA U1 bank 0:

```
set_property CFGBVS GND [current_design]
set_property CONFIG_VOLTAGE 1.8 [current_design]
```

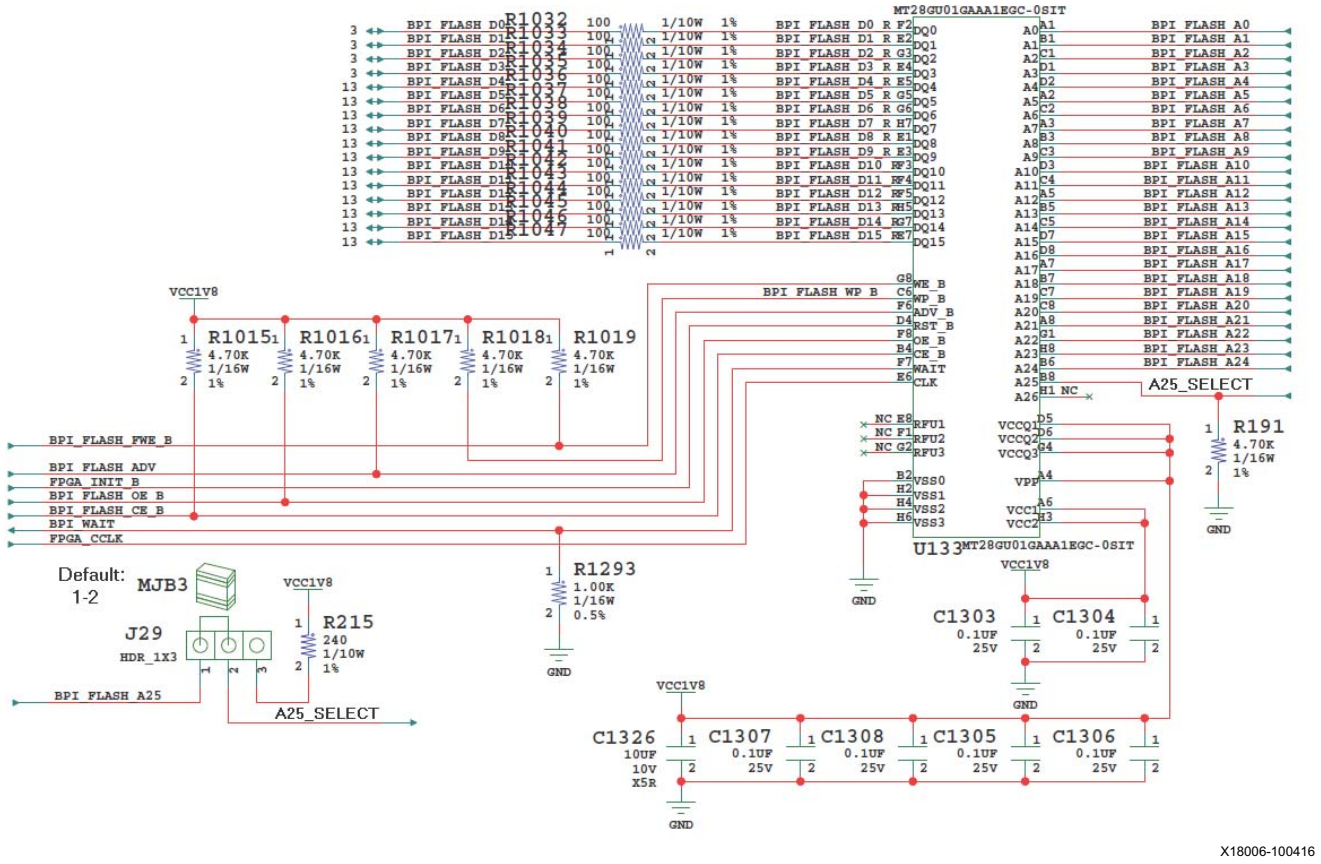

Figure C-2: **Linear BPI 128 MB (1 Gbit) Flash Memory**

The connections between the BPI flash memory and the FPGA are listed in Table C-2.

Table C-2: **BPI Flash Memory Connections to FPGA U1**

FPGA (U1) Pin	Net Name	I/O Standard	U58 BPI Flash Memory	
			Pin #	Pin Name
AP11	BPI_FLASH_D0	(NA BANK0)	F2	DQ0
AN11	BPI_FLASH_D1	(NA BANK0)	E2	DQ1
AM11	BPI_FLASH_D2	(NA BANK0)	G3	DQ2
AL11	BPI_FLASH_D3	(NA BANK0)	E4	DQ3
AM19	BPI_FLASH_D4	LVCMOS18	E5	DQ4
AM18	BPI_FLASH_D5	LVCMOS18	G5	DQ5
AN20	BPI_FLASH_D6	LVCMOS18	G6	DQ6
AP20	BPI_FLASH_D7	LVCMOS18	H7	DQ7
AN19	BPI_FLASH_D8	LVCMOS18	E1	DQ8
AN18	BPI_FLASH_D9	LVCMOS18	E3	DQ9
AR18	BPI_FLASH_D10	LVCMOS18	F3	DQ10
AR17	BPI_FLASH_D11	LVCMOS18	F4	DQ11
AT20	BPI_FLASH_D12	LVCMOS18	F5	DQ12
AT19	BPI_FLASH_D13	LVCMOS18	H5	DQ13
AT17	BPI_FLASH_D14	LVCMOS18	G7	DQ14
AU17	BPI_FLASH_D15	LVCMOS18	E7	DQ15
AR20	BPI_FLASH_A0	LVCMOS18	A1	A0
AR19	BPI_FLASH_A1	LVCMOS18	B1	A1
AV20	BPI_FLASH_A2	LVCMOS18	C1	A2
AW20	BPI_FLASH_A3	LVCMOS18	D1	A3
AU19	BPI_FLASH_A4	LVCMOS18	D2	A4
AU18	BPI_FLASH_A5	LVCMOS18	A2	A5
AV19	BPI_FLASH_A6	LVCMOS18	C2	A6
AV18	BPI_FLASH_A7	LVCMOS18	A3	A7
AW18	BPI_FLASH_A8	LVCMOS18	B3	A8
AY18	BPI_FLASH_A9	LVCMOS18	C3	A9
AY19	BPI_FLASH_A10	LVCMOS18	D3	A10
BA19	BPI_FLASH_A11	LVCMOS18	C4	A11
BA17	BPI_FLASH_A12	LVCMOS18	A5	A12
BB17	BPI_FLASH_A13	LVCMOS18	B5	A13
BB19	BPI_FLASH_A14	LVCMOS18	C5	A14
BC19	BPI_FLASH_A15	LVCMOS18	D7	A15

Table C-2: **BPI Flash Memory Connections to FPGA U1 *(Cont'd)***

FPGA (U1) Pin	Net Name	I/O Standard	U58 BPI Flash Memory	
			Pin #	Pin Name
BB18	BPI_FLASH_A16	LVCMOS18	D8	A16
BC18	BPI_FLASH_A17	LVCMOS18	A7	A17
AY20	BPI_FLASH_A18	LVCMOS18	B7	A18
BA20	BPI_FLASH_A19	LVCMOS18	C7	A19
BD18	BPI_FLASH_A20	LVCMOS18	C8	A20
BD17	BPI_FLASH_A21	LVCMOS18	A8	A21
BC20	BPI_FLASH_A22	LVCMOS18	G1	A22
BD20	BPI_FLASH_A23	LVCMOS18	H8	A23
BE18	BPI_FLASH_A24	LVCMOS18	B6	A24
BE17	BPI_FLASH_A25	LVCMOS18	B8	A25
NC	NC	NA	H1	A26
BF16	BPI_FLASH_FWE_B	LVCMOS18	G8	WE_B
p/u R1018	BPI_FLASH_WP_B	(NA BANK0)	C6	WP_B
AW17	BPI_FLASH_ADV	LVCMOS18	F6	ADV_B
AC12	FPGA_INIT_B	(NA BANK0)	D4	RST_B
BF17	BPI_FLASH_OE_B	LVCMOS18	F8	OE_B
AJ11	BPI_FLASH_CE_B	(NA BANK0)	B4	CE_B
AL19	BPI_WAIT	LVCMOS18	F7	WAIT
AL20	FPGA_CCLK	LVCMOS18	E6	CLK

Additional FPGA bitstreams can be stored and used for configuration by setting the warm boot start address (WBSTAR) register contained in UltraScale FPGAs. More information is available in the reconfiguration and multi-boot section in the *UltraScale Architecture Configuration User Guide* (UG570) [Ref 2]. The configuration section in this document provides details on the master BPI configuration mode. For more information about the Micron MT28GU01GAAA1EGC-0SIT, see the Micron Technology website [Ref 18].

BPI Flash Memory Constraints

```
# BPI FLASH
# BPI_FLASH_D[3:0] are wired to FPGA U1 Bank 0
# CONFIGURATION BITS D[3:0} ARE NOT USER ACCESSIBLE
# PACKAGE_PIN AP11 - BPI_FLASH_D0 Bank 0 - D00_MOSI_0
# PACKAGE_PIN AN11 - BPI_FLASH_D1 Bank 0 - D01_DIN_0
# PACKAGE_PIN AM11 - BPI_FLASH_D2 Bank 0 - D02_0
# PACKAGE_PIN AL11 - BPI_FLASH_D3 Bank 0 - D03_0
# PACKAGE_PIN AJ11 - BPI_FLASH_CE_B Bank 0 - RDWR_FCS_B_0

set_property PACKAGE_PIN       AM19              [get_ports "BPI_FLASH_D4"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D4"];
set_property PACKAGE_PIN       AM18              [get_ports "BPI_FLASH_D5"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D5"];
set_property PACKAGE_PIN       AN20              [get_ports "BPI_FLASH_D6"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D6"];
set_property PACKAGE_PIN       AP20              [get_ports "BPI_FLASH_D7"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D7"];
set_property PACKAGE_PIN       AN19              [get_ports "BPI_FLASH_D8"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D8"];
set_property PACKAGE_PIN       AN18              [get_ports "BPI_FLASH_D9"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D9"];
set_property PACKAGE_PIN       AR18              [get_ports "BPI_FLASH_D10"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D10"];
set_property PACKAGE_PIN       AR17              [get_ports "BPI_FLASH_D11"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D11"];
set_property PACKAGE_PIN       AT20              [get_ports "BPI_FLASH_D12"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D12"];
set_property PACKAGE_PIN       AT19              [get_ports "BPI_FLASH_D13"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D13"];
set_property PACKAGE_PIN       AT17              [get_ports "BPI_FLASH_D14"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D14"];
set_property PACKAGE_PIN       AU17              [get_ports "BPI_FLASH_D15"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_D15"];
set_property PACKAGE_PIN       AR20              [get_ports "BPI_FLASH_A0"];
set_property IOSTANDARD        LVCMOS18          [get_ports "BPI_FLASH_A0"];
set_property PACKAGE_PIN       AR19              [get_ports "BPI_FLASH_A1"];
```

```
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A1"];
set_property PACKAGE_PIN     AV20            [get_ports "BPI_FLASH_A2"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A2"];
set_property PACKAGE_PIN     AW20            [get_ports "BPI_FLASH_A3"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A3"];
set_property PACKAGE_PIN     AU19            [get_ports "BPI_FLASH_A4"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A4"];
set_property PACKAGE_PIN     AU18            [get_ports "BPI_FLASH_A5"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A5"];
set_property PACKAGE_PIN     AV19            [get_ports "BPI_FLASH_A6"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A6"];
set_property PACKAGE_PIN     AV18            [get_ports "BPI_FLASH_A7"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A7"];
set_property PACKAGE_PIN     AW18            [get_ports "BPI_FLASH_A8"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A8"];
set_property PACKAGE_PIN     AY18            [get_ports "BPI_FLASH_A9"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A9"];
set_property PACKAGE_PIN     AY19            [get_ports "BPI_FLASH_A10"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A10"];
set_property PACKAGE_PIN     BA19            [get_ports "BPI_FLASH_A11"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A11"];
set_property PACKAGE_PIN     BA17            [get_ports "BPI_FLASH_A12"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A12"];
set_property PACKAGE_PIN     BB17            [get_ports "BPI_FLASH_A13"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A13"];
set_property PACKAGE_PIN     BB19            [get_ports "BPI_FLASH_A14"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A14"];
set_property PACKAGE_PIN     BC19            [get_ports "BPI_FLASH_A15"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A15"];
set_property PACKAGE_PIN     BB18            [get_ports "BPI_FLASH_A16"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A16"];
set_property PACKAGE_PIN     BC18            [get_ports "BPI_FLASH_A17"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A17"];
set_property PACKAGE_PIN     AY20            [get_ports "BPI_FLASH_A18"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A18"];
set_property PACKAGE_PIN     BA20            [get_ports "BPI_FLASH_A19"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A19"];
set_property PACKAGE_PIN     BD18            [get_ports "BPI_FLASH_A20"];
```

```
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A20"];
set_property PACKAGE_PIN     BD17            [get_ports "BPI_FLASH_A21"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A21"];
set_property PACKAGE_PIN     BC20            [get_ports "BPI_FLASH_A22"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A22"];
set_property PACKAGE_PIN     BD20            [get_ports "BPI_FLASH_A23"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A23"];
set_property PACKAGE_PIN     BE18            [get_ports "BPI_FLASH_A24"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A24"];
set_property PACKAGE_PIN     BE17            [get_ports "BPI_FLASH_A25"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A25"];
set_property PACKAGE_PIN     BE20            [get_ports "BPI_FLASH_A26"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_A26"];
set_property PACKAGE_PIN     AW17            [get_ports "BPI_FLASH_ADV"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_ADV"];
set_property PACKAGE_PIN     BF16            [get_ports "BPI_FLASH_FWE_B"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_FWE_B"];
set_property PACKAGE_PIN     BF17            [get_ports "BPI_FLASH_OE_B"];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_FLASH_OE_B"];
set_property PACKAGE_PIN     AL19            [get_ports "BPI_WAIT "];
set_property IOSTANDARD      LVCMOS18        [get_ports "BPI_WAIT "];
```

Appendix D

Regulatory and Compliance Information

Overview

This product is designed and tested to conform to the European Union directives and standards described in this section.

VCU118 Evaluation Kit — Master Answer Record (AR 68268)

For Technical Support, open a Support Service Request.

CE Directives

2006/95/EC, *Low Voltage Directive (LVD)*

2004/108/EC, *Electromagnetic Compatibility (EMC) Directive*

CE Standards

EN standards are maintained by the European Committee for Electrotechnical Standardization (CENELEC). IEC standards are maintained by the International Electrotechnical Commission (IEC).

Electromagnetic Compatibility

EN 55022:2010, *Information Technology Equipment Radio Disturbance Characteristics – Limits and Methods of Measurement*

EN 55024:2010, *Information Technology Equipment Immunity Characteristics – Limits and Methods of Measurement*

This is a Class A product. In a domestic environment, this product can cause radio interference, in which case the user might be required to take adequate measures.

Safety

IEC 60950-1:2005, *Information technology equipment – Safety, Part 1: General requirements*

EN 60950-1:2006, *Information technology equipment – Safety, Part 1: General requirements*

Markings

This product complies with Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). The affixed product label indicates that the user must not discard this electrical or electronic product in domestic household waste.

This product complies with Directive 2002/95/EC on the restriction of hazardous substances (RoHS) in electrical and electronic equipment.

This product complies with CE Directives 2006/95/EC, *Low Voltage Directive (LVD)* and 2004/108/EC, *Electromagnetic Compatibility (EMC) Directive*.

Appendix E

Additional Resources and Legal Notices

Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see Xilinx Support.

Solution Centers

See the Xilinx Solution Centers for support on devices, software tools, and intellectual property at all stages of the design cycle. Topics include design assistance, advisories, and troubleshooting tips.

Documentation Navigator and Design Hubs

Xilinx® Documentation Navigator provides access to Xilinx documents, videos, and support resources, which you can filter and search to find information. To open the Xilinx Documentation Navigator (DocNav):

- From the Vivado® IDE, select **Help > Documentation and Tutorials**.
- On Windows, select **Start > All Programs > Xilinx Design Tools > DocNav**.
- At the Linux command prompt, enter `docnav`.

Xilinx Design Hubs provide links to documentation organized by design tasks and other topics, which you can use to learn key concepts and address frequently asked questions. To access the Design Hubs:

- In the Xilinx Documentation Navigator, click the **Design Hubs View** tab.
- On the Xilinx website, see the Design Hubs page.

Note: For more information on Documentation Navigator, see the Documentation Navigator page on the Xilinx website.

References

The most up to date information related to the VCU118 board and its documentation is available on the following websites.

VCU118 Evaluation Kit

VCU118 Evaluation Kit – Master Answer Record (AR 68268)

These Xilinx documents provide supplemental material useful with this guide:

1. *Virtex UltraScale+ FPGAs Data Sheet: DC and AC Switching Characteristics* (DS923)
2. *UltraScale Architecture Configuration User Guide* (UG570)
3. *UltraScale Architecture SelectIO Resources User Guide* (UG571)
4. *UltraScale Architecture-Based FPGAs Memory IP LogiCORE IP Product Guide* (PG150)
5. *UltraScale Architecture Clocking Resources User Guide* (UG572)
6. *UltraScale Architecture GTY Transceivers User Guide* (UG578)
7. *UltraScale FPGAs Transceivers Wizard Product Guide for Vivado Design Suite* (PG182)
8. *UltraScale Architecture Gen3 Integrated Block for PCI Express LogiCORE IP Product Guide* (PG156)
9. *Tri-Mode Ethernet MAC LogiCORE IP Product Guide* (PG051)
10. *AXI UART Lite LogiCORE IP Product Guide* (PG142)
11. *Vivado Design Suite User Guide: Using Constraints* (UG903)
12. *UltraScale Architecture PCB Design User Guide* (UG583)
13. *Silicon Labs CP210x USB-to-UART Installation Guide* (UG1033)
14. *VCU118 System Controller Tutorial* (XTP447)
15. *VCU118 Software Install and Board Setup Tutorial* (XTP449)
16. For additional documents associated with Xilinx devices, design tools, intellectual property, boards, and kits see the Xilinx documentation website.

The following websites provide supplemental material useful with this guide:

17. Xilinx, Inc: www.xilinx.com

    (XCVU9P-L2FLGA2104)

18. Micron Technology: www.micron.com

    (MT40A256M16HA-083E, N25Q256A11ESF40F)

19. SanDisk Corporation: www.sandisk.com
20. SD Association: www.sdcard.org
21. Digilent: www.digilentinc.com

    (USB JTAG Module, Pmod Peripheral Modules)

22. Silicon Labs: www.silabs.com

    (Si5335A, Si570, Si53340, Si5328B)

23. PCI Express® standard: www.pcisig.com/specifications
24. SFF-8663, SFF-8679: SNIA Technology Affiliates
25. Texas Instruments: www.ti.com

    (TCA9548, PCA9544)

26. Samtec, Inc.: www.samtec.com

    (SEAF series connectors)

27. VITA FMC Marketing Alliance: www.vita.com

    (FPGA Mezzanine Card (FMC) VITA 57.1 specification)

28. Maxim Integrated: http://www.maximintegrated.com/products/power/intune/ and http://www.maxim-ic.com/xilinx

    (Maxim power system devices, InTune™ Digital Power Solutions)

    InTune™ Digital PowerTool Software Version 1.08.02 is available. Users will have to create a Maxim account and login before they can see the link to download the GUI.

29. The Xilinx ATX cable part number 2600304 is manufactured by Sourcegate Technologies and is equivalent to the Sourcegate Technologies part number AZCBL-WH-11009. Sourcegate only manufactures the latest revision, which is currently A4. To order, contact Aries Ang, aries.ang@sourcegate.net, +65 6483 2878 for price and availability. This is a custom cable and cannot be ordered from the Sourcegate website.