

ZC706 Evaluation Board for the Zynq-7000 XC7Z045 SoC

User Guide

UG954 (v1.8) August 6, 2019



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Revision History

The following table shows the revision history for this document.

Date	Version	Revision
10/08/2012	1.0	Initial Xilinx release.
11/21/2012	1.1	Added additional user LED in ZC706 Evaluation Board Features section, Table 1-1 , User I/O section, Figure 1-26 , and Table 1-28 . In Table 1-1 , added fan sink information and updated notes for 10/100/1000 Ethernet PHY, user pushbuttons, user DIP switch, and FPGA PROG pushbutton. Added Encryption Key Backup Circuit section. Updated second paragraph in DDR3 SODIMM Memory (PL) section. Updated second paragraph in SD Card Interface section. Updated Table 1-11 . Added U53 information to first paragraph in HDMI Video Output section. Added fourth bullet to Real Time Clock (RTC) section. Updated Figure 1-24 . Added pin A17 to Table 1-28 . Updated Figure 1-33 . Replaced UCF in Appendix C . Added additional reference to Additional Resources .

Date	Version	Revision
04/24/2013	1.2	<p>Chapter 1, ZC706 Evaluation Board Features: Table 1-1 feature descriptions are now linked to their respective sections in the book. Figure 1-3, Figure 1-34, and Figure 1-35 were replaced. Table 1-2 was removed because it was a duplicate of Table 1-11. Table 1-2: Switch SW11 Configuration Option Settings was added. FMC Connector JTAG Bypass, page 35 was updated. Default lane size information below Figure 1-18 was changed. Figure 1-19 PCI Express Lane Size Select Jumper J19 was added. The names of pins 18 and 19 changed in Table 1-17. The address of I²C bus PMBUS_DATA/CLOCK changed in Table 1-25. Reference designator DS35 was added to Table 1-27. Callout numbers in the User I/O, page 59 section are now linked to Table 1-1. SW13 information was added to the section User Pushbuttons, page 61. In Table 1-33, J5 pin H22 changed to XC7Z045 (U1) pin AH26 and H23 changed to AH27. The section ZC706 Board Power System, page 74 was added. Voltage levels were changed in VADJ Voltage Control, page 81. Table 1-37 was modified and Table 1-38 was added.</p> <p>Appendix A, Default Switch and Jumper Settings: The SW11 selection in Table A-1 changed.</p> <p>Appendix F, Regulatory and Compliance Information: A link to the master answer record was added.</p>
07/31/2013	1.3	Updated Table 1-22 . Replaced the master User Constraints File (UCF) list in Appendix C, Xilinx Constraints File with the master Xilinx Design Constraints (XDC) list. Updated references throughout the document.
04/28/2015	1.4	Updated "LMZ22000 Family Regulator Description" to LMZ31500 and LMZ31700 Family Regulator Description . Updated Table 1-4 , Table 1-7 , Table 1-13 , Table 1-23 , Table 1-28 through Table 1-30 , Table 1-32 through Table 1-34 , Table 1-36 , and Table A-2 . Added Figure A-1 . Updated Appendix C, Xilinx Constraints File .
09/10/2015	1.5	Updated J48 header jumper setting (third row in Table 1-7).
03/29/2016	1.6	Updated value of C6 in Figure 1-33 from 270 pF to 5600 pF.
07/01/2018	1.7	Editorial updates only. No technical content updates.
08/06/2019	1.8	Updated Figure 1-27 from VADJ to VCC1V5_PL. Appendix F, Regulatory and Compliance Information : An updated link to the master answer record was added.

Table of Contents

Revision History	2
Chapter 1: ZC706 Evaluation Board Features	
Overview	7
ZC706 Evaluation Board Features	7
Block Diagram	10
Board Layout	10
Discharge Caution	11
Feature Descriptions	15
Zynq-7000 XC7Z045 SoC	15
Device Configuration	16
Encryption Key Backup Circuit	17
I/O Voltage Rails	18
DDR3 SODIMM Memory (PL)	19
DDR3 Component Memory (PS)	23
Quad-SPI Flash Memory	26
USB 2.0 ULP/I Transceiver	29
SD Card Interface	31
Programmable Logic JTAG Programming Options	33
Programmable Logic JTAG Select Switch	33
FMC Connector JTAG Bypass	35
Clock Generation	35
System Clock	36
Programmable User Clock	37
User SMA Clock Source	38
Processing System Clock Source	39
GTX SMA Clock (SMA_MGT_REFCLK_P and SMA_MGT_REFCLK_N)	39
Jitter Attenuated Clock	40
GTX Transceivers	41
PCI Express Endpoint Connectivity	46
SFP/SFP+ Module Connector	48
10/100/1000 Mb/s Tri-Speed Ethernet PHY (PS)	49
Ethernet PHY Clock Source	50
USB-to-UART Bridge	51
HDMI Video Output	52
I2C Bus	55
Real Time Clock (RTC)	57
Status and User LEDs	58
Ethernet PHY User LEDs	59
User I/O	59
User LEDs	60
User Pushbuttons	61
GPIO DIP Switch	62

User PMOD GPIO Headers	62
Switches	64
Power On/Off Slide Switch	64
Program_B Pushbutton	65
PS Power-On and System Reset Pushbuttons	66
FPGA Mezzanine (FMC) Card Interface	67
HPC Connector J37	67
LPC Connector J5	71
ZC706 Board Power System	74
UCD90120A Description	74
LMZ31500 and LMZ31700 Family Regulator Description	74
XADC Power System Measurement	77
Power Management	79
VADJ Voltage Control	81
SoC Programmable Logic (PL) Voltage Control	82
Monitoring Voltage and Current	82
Cooling Fan	84
XADC Analog-to-Digital Converter	85

Appendix A: Default Switch and Jumper Settings

Switches	88
Jumpers	89

Appendix B: VITA 57.1 FMC Connector Pinouts

Appendix C: Xilinx Constraints File

Appendix D: Board Setup

Installing the ZC706 Board in a PC Chassis	95
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Appendix E: Board Specifications

Dimensions	97
Environmental	97
Temperature	97
Humidity	97
Operating Voltage	97

Appendix F: Regulatory and Compliance Information

Overview	98
Declaration of Conformity	98
CE Directives	98
CE Standards	98
Electromagnetic Compatibility	99
Safety	99
Markings	99

Appendix G: Additional Resources

Xilinx Resources	101
Solution Centers.....	101
References	101

ZC706 Evaluation Board Features

Overview

The ZC706 evaluation board for the XC7Z045 SoC provides a hardware environment for developing and evaluating designs targeting the Zynq®-7000 XC7Z045-2FFG900C SoC. The ZC706 evaluation board provides features common to many embedded processing systems, including DDR3 SODIMM and component memory, a four-lane PCI Express® interface, an Ethernet PHY, general purpose I/O, and two UART interfaces. Other features can be supported using VITA-57 FPGA mezzanine cards (FMC) attached to the low pin count (LPC) FMC and high pin count (HPC) FMC connectors.

ZC706 Evaluation Board Features

The ZC706 evaluation board features are listed in here. Detailed information for each feature is provided in [Feature Descriptions](#) starting on [page 15](#).

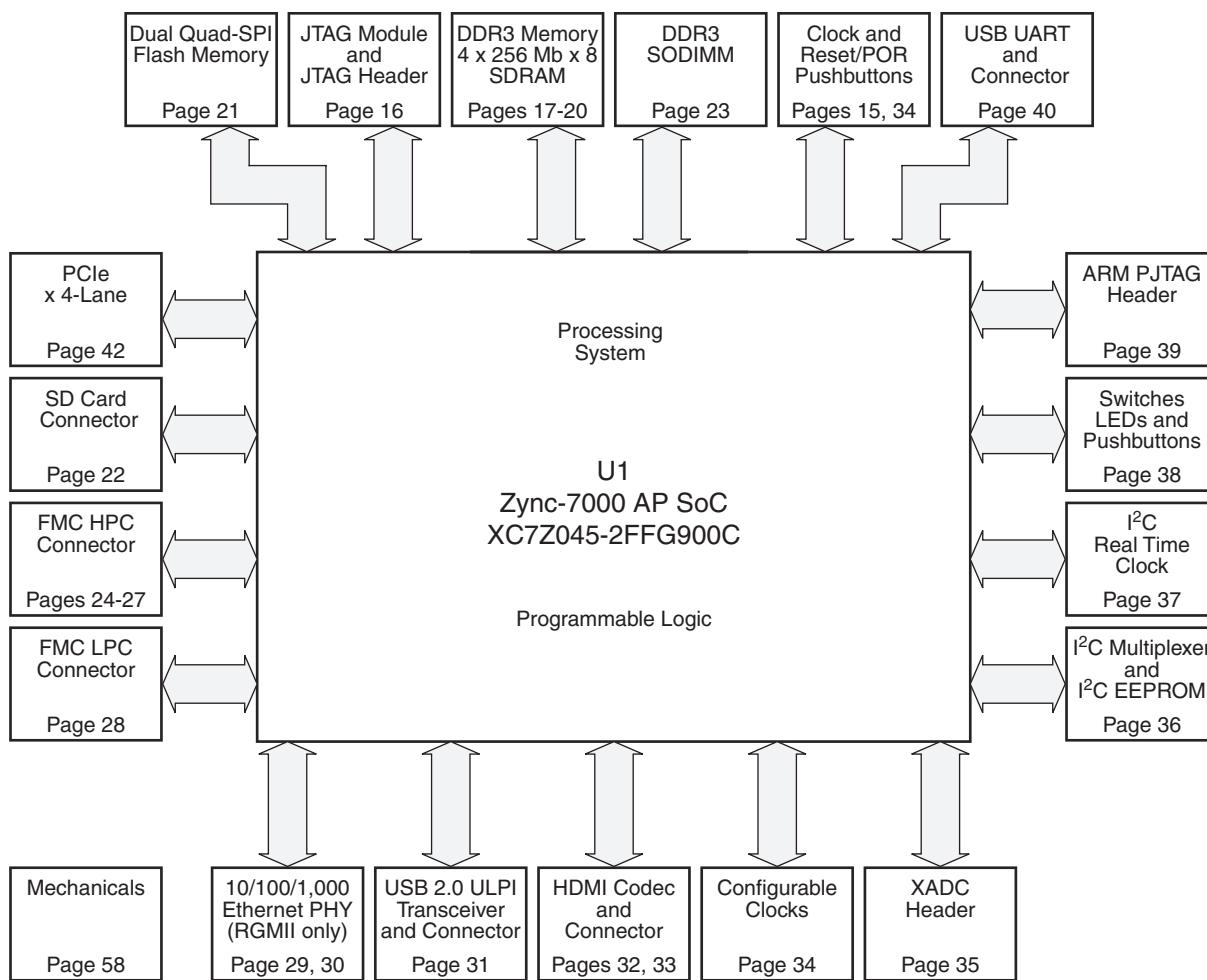
- Zynq-7000 XC7Z045-2FFG900C SoC
- 1 GB DDR3 memory SODIMM on the programmable logic (PL) side
- 1 GB DDR3 component memory (four [256 Mb x 8] devices) on the processing system (PS) side
- Two 128 Mb Quad-SPI (QSPI) flash memory (Dual Quad-SPI)
- USB 2.0 ULPI (UTMI+ low pin interface) transceiver with micro-B USB connector
- Secure Digital (SD) connector
- USB JTAG interface via Digilent module with micro-B USB connector
- Clock sources:
 - Fixed 200 MHz LVDS oscillator (differential)
 - I²C programmable LVDS oscillator (differential)
 - Fixed 33.33 MHz LVCMOS oscillator (single-ended)
 - Subminiature version A (SMA) connectors (differential)
 - SMA connectors for GTX transceiver clocking (differential)

- GTX transceivers
 - FMC HPC connector (eight GTX transceivers)
 - FMC LPC connector (one GTX transceiver)
 - SMA connectors (one pair each for TX, RX and REFCLK)
 - PCI Express (four lanes)
 - Small form-factor pluggable plus (SFP+) connector
 - Ethernet PHY RGMII interface
- PCI Express endpoint connectivity
 - Gen1 4-lane (x4)
 - Gen2 4-lane (x4)
- SFP+ Connector
- Ethernet PHY RGMII interface with RJ-45 connector
- USB-to-UART bridge with mini-B USB connector
- HDMI codec with HDMI connector
- I²C bus
- I²C bus multiplexed to:
 - Si570 user clock
 - ADV7511 HDMI codec
 - M24C08 EEPROM (1 kB)
 - 1-to-16 TCA6416APWR port expander
 - DDR3 SODIMM
 - RTC-8564JE real time clock
 - FMC HPC connector
 - FMC LPC connector
 - PMBUS data/clock
- Status LEDs:
 - Ethernet status
 - TI Power Good
 - Linear Power Good
 - PS DDR3 Component V_{tt} Good
 - PL DDR3 SODIMM V_{tt} Good

- FMC Power Good
- 12V Input Power On
- FPGA INIT
- FPGA DONE
- User I/O:
 - Four (PL) user LEDs
 - Three (PL) user pushbuttons
 - One (PL) user DIP switch (4-pole)
 - Two Dual row Pmod GPIO headers
- SoC PS Reset Pushbuttons:
 - SRST_B PS reset button
 - POR_B PS reset button
- VITA 57.1 FMC HPC connector
- VITA 57.1 FMC LPC connector
- Power on/off slide switch
- Program_B pushbutton
- Power management with PMBus voltage and current monitoring through TI power controller
- Dual 12-bit 1 MSPS XADC analog-to-digital front end
- Configuration options:
 - Dual Quad-SPI flash memory
 - USB JTAG configuration port (Digilent module)
 - Platform cable header JTAG configuration port
 - 20-pin PL PJTAG header

Block Diagram

The ZC706 evaluation board block diagram is shown in [Figure 1-1](#).



Note: Page numbers reference the page number of schematic 0381513.

UG954_c1_01_1002012

Figure 1-1: ZC706 Evaluation Board Block Diagram

Board Layout

[Figure 1-3](#) shows the ZC706 evaluation board. Each numbered feature that is referenced in [Figure 1-3](#) is described in [Table 1-1](#) with a link to detailed information provided under [Feature Descriptions](#) starting on [page 15](#).

Note: The image in [Figure 1-3](#) is for reference only and might not reflect the current revision of the board.

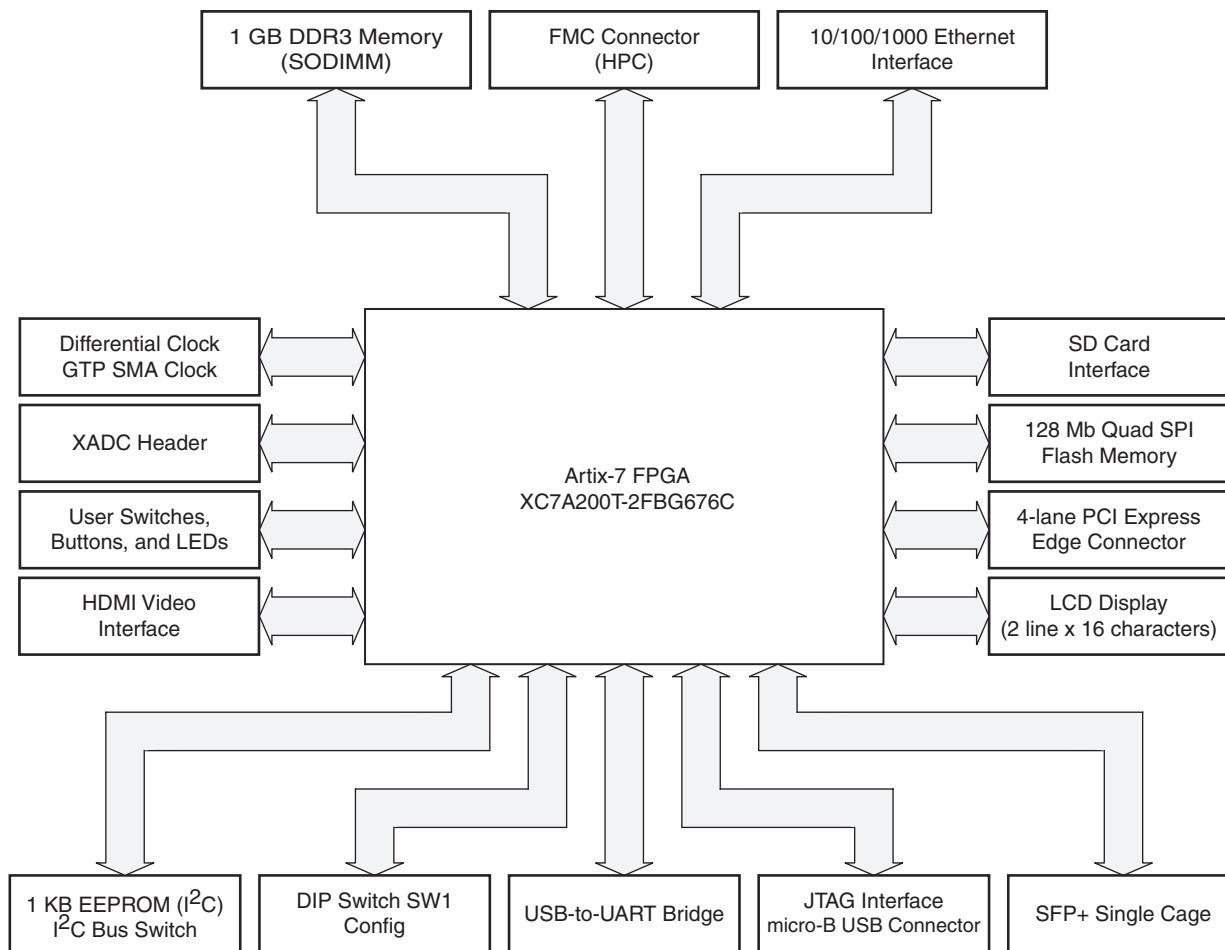
Discharge Caution



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.*

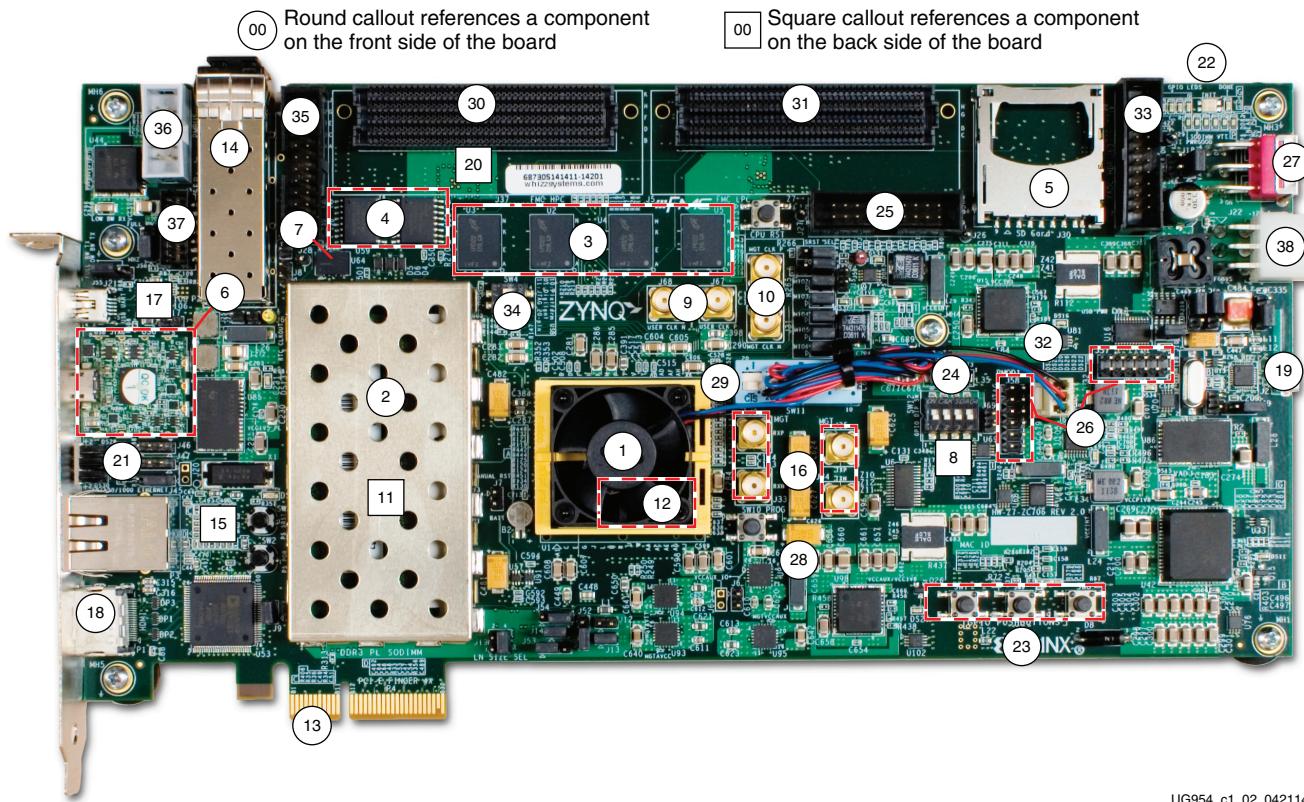
To prevent ESD damage:

- 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.
- If a wrist strap is not available, ground yourself by touching the metal chassis before handling the adapter or any other part of the computer/server.



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Figure 1-2: AC701 Board Block Diagram



UG954_c1_02_042114

Figure 1-3: ZC706 Evaluation Board Component Locations

Table 1-1: ZC706 Evaluation Board Component Descriptions

Callout	Feature	Notes	Schematic 0381513 Page Number
1	Zynq-7000 XC7Z045 SoC, page 15 Zynq-7000 SoC with fan sink	XC7Z045T-2FFG900C with Radian INC3001-7_1.5BU_LI98 fan sink	
2	DDR3 SODIMM Memory (PL), page 19 DDR3 SODIMM Memory Socket (J1)	Micron MT8JTF12864HZ-1G6G1	23
3	DDR3 Component Memory (PS), page 23 DDR3 Memory 1GB (4x256M U2-U5)	Micron MT41J256M8HX-15E	17-20
4	Quad-SPI Flash Memory, page 26 Dual Quad-SPI Flash (128Mb) (U58-U59)	Spansion S25FL128SAGMFIR01	21
5	SD Card Interface, page 31 SD Card Interface Connector (J30)	Molex 67840-8001	22
6	USB 2.0 ULPI Transceiver, page 29 USB JTAG Interface w/Micro-B Connector (U30)	Digilent USB JTAG Module	16
7	System Clock, page 36 System Clock, 2.5V LVDS (U64)	SiTime SIT9102-243N25E200.0000	34

Table 1-1: ZC706 Evaluation Board Component Descriptions (Cont'd)

Callout	Feature	Notes	Schematic 0381513 Page Number
8	Programmable User Clock, page 37 I ² C Prog. User Clock 3.3V LVDS (U37, bottom of board)	Silicon Labs SI570BAB0000544DG, default 156.250 MHz	34
9	User SMA Clock Source, page 38 User Differential SMA Clock P/N (J67/J68)	Rosenberger 32K10K-400L5	44
10	GTX SMA Clock (SMA_MGT_REFCLK_P and SMA_MGT_REFCLK_N), page 39 GTX Differential SMA Clock P/N (J36/J31)	Rosenberger 32K10K-400L5	44
11	Jitter Attenuated Clock, page 40 Jitter Attenuated Clock (U60, bottom of board)	Silicon Labs SI5324C-C-GM	43
12	GTX Transceivers, page 41 GTX Transceivers	Embedded within SoC U1	8
13	PCI Express Endpoint Connectivity, page 46 PCI Express Connector (P4)	4-lane card edge connector	42
14	SFP/SFP+ Module Connector, page 48 SFP/SFP+ Module Connector (P2)	Molex 74441-0010	41
15	10/100/1000 Mb/s Tri-Speed Ethernet PHY (PS), page 49 RGMII only 10/100/1000 Mb/s Ethernet PHY w/RJ45 (U51, P3)	Marvell 88E1116RA0-NNC1C000	29
16	GTX Differential SMA TX and RX P/N (J35/J34and J32/J33)	Rosenberger 32K10K-400L5	44
17	USB-to-UART Bridge, page 51 USB-to-UART Bridge with Mini-B Connector (U52, J21)	Silicon Labs CP2103GM bridge	40
18	HDMI Video Output, page 52 HDMI Controller (U53), HDMI Video Connector (P1)	Analog Devices ADV7511KSTZ-P, Molex 500254-1927,	32, 33
19	USB 2.0 ULPI Transceiver, page 29 USB 2.0 ULPI Controller w/ Micro-B Connector (U12, J2)	SMSC USB3320C-EZK	31
20	I²C Bus, page 55 I ² C Bus MUX (U65, bottom of board)	TI PCA9548ARGER	36
21	Ethernet PHY User LEDs, page 59 Ethernet PHY Status LEDs (DS28-DS30)	EPHY status LED, GREEN single-stack	29
22	User LEDs, page 60 User LEDs (DS8-DS10, DS35)	GPIO LEDs, GREEN 0603	38
23	User Pushbuttons, page 61 User pushbuttons, active-High (SW7, 9, 8)	E-Switch TL3301EF100QG in Left, Center, Right pattern	38

Table 1-1: ZC706 Evaluation Board Component Descriptions (Cont'd)

Callout	Feature	Notes	Schematic 0381513 Page Number
24	GPIO DIP Switch, page 62 GPIO DIP Switch (SW12)	4-pole C&K SDA04H1SBD	38
25	ARM® core PJTAG Header (J64)	2x10 0.1inch male header, Samtec TST-110-01-G-D	39
26	User PMOD GPIO Headers, page 62 PMOD Headers (J57, J58)	2x6 0.1 inch male header	37, 39
27	Power On/Off Slide Switch, page 64 Power On/Off Switch (SW1)	C&K 1201M2S3AQE2	48
28	Program_B Pushbutton, page 65 FPGA PROG pushbutton (SW10)	E-Switch TL3301EF100QG	38
29	SoC MIO Config. DIP Switch (SW11)	5-pole DPDT CTS 206-125	15
30	HPC Connector J37, page 67 FMC HPC connector (J37)	Samtec ASP_134486_01	24-27
31	LPC Connector J5, page 71 FMC LPC connector (J5)	Samtec ASP_134603_01	28
32	Power Management, page 79 Power Management System (top and bottom of board)	TI UCD90120ARGC in conjunction w/variou	48-57
33	XADC Analog-to-Digital Converter, page 85 XADC Connector (J63)	2x10 0.1inch male header, Samtec TST-110-01-G-D	35
34	Programmable Logic JTAG Select Switch, page 33 JTAG Configuration DIP Switch (SW4)	2-pole C&K SDA02H1SBD	16
35	JTAG Flying Lead Header (J62)	2x10 0.1inch male header, Samtec TST-110-01-G-D	16
36	2x5 shrouded PMBus connector J4	ASSMAN HW10G-0202	48
37	2x7 2mm shrouded JTAG cable connector J3	MOLEX 87832-1420	16
38	12V power input 2x6 connector J22	MOLEX-39-30-1060	48

Notes:

1. Jumper header locations are identified in [Appendix A, Default Switch and Jumper Settings](#).

Feature Descriptions

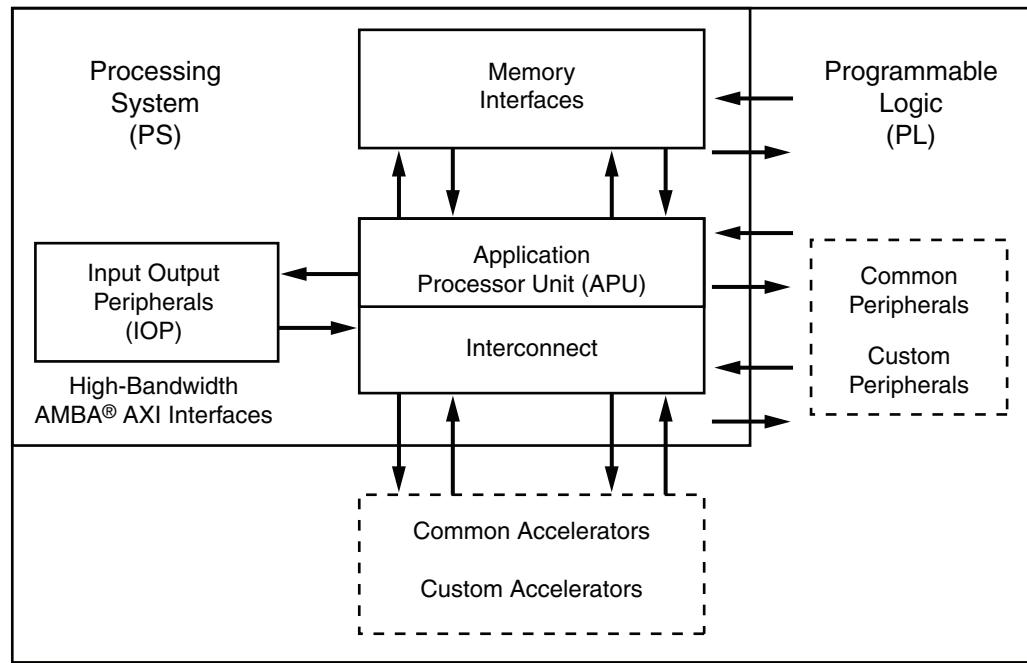
Detailed information for each feature shown in [Figure 1-3](#) and listed in [Table 1-1](#) is provided in this section.

Zynq-7000 XC7Z045 SoC

[[Figure 1-3](#), callout 1]

The ZC706 evaluation board is populated with the Zynq-7000 XC7Z045-2FFG900C SoC.

The XC7Z045 SoC consists of an integrated processing system (PS) and programmable logic (PL), on a single die. The high-level block diagram is shown in [Figure 1-4](#).

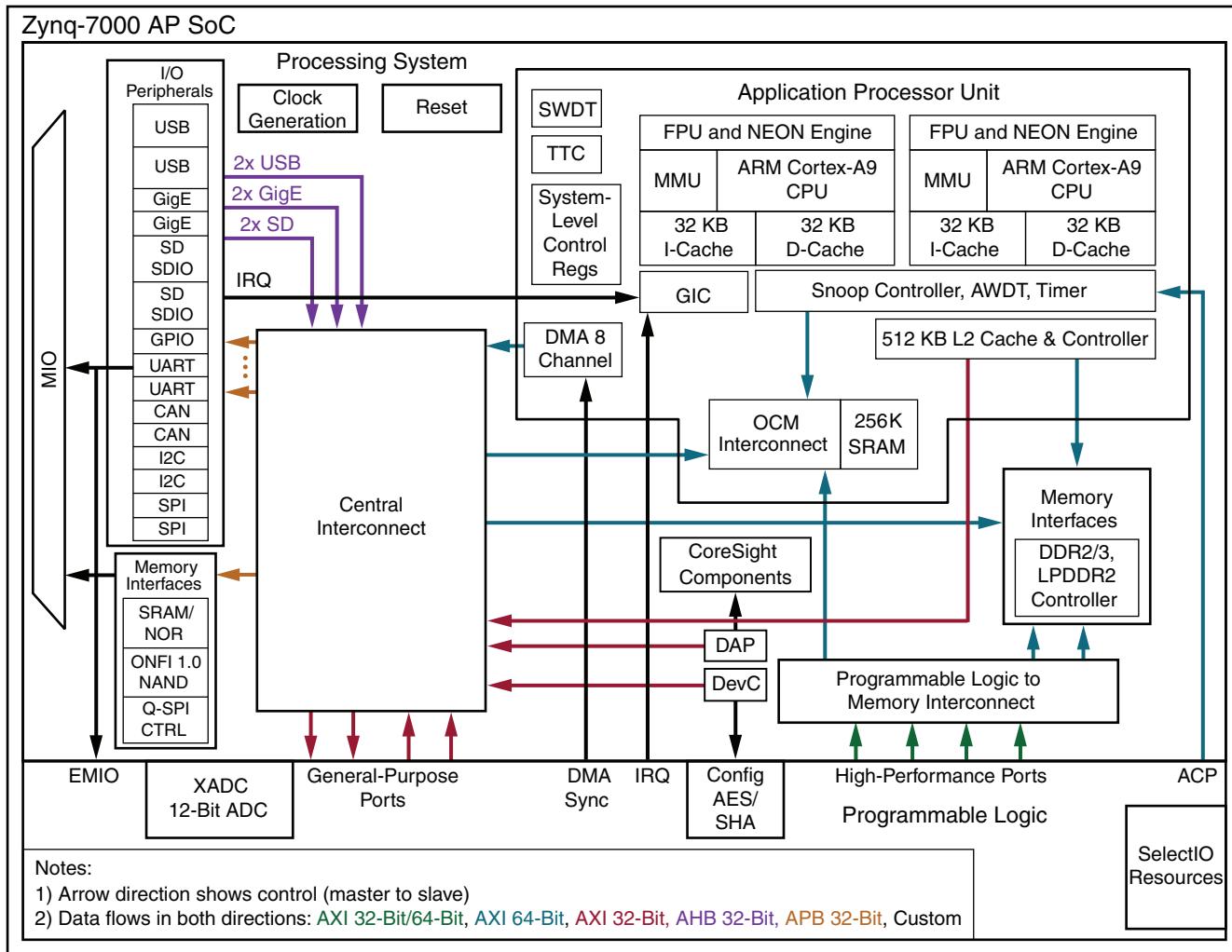


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Figure 1-4: High-Level Block Diagram

The PS integrates two ARM® Cortex™-A9 MPCore™ application processors, AMBA® interconnect, internal memories, external memory interfaces, and peripherals including USB, Ethernet, SPI, SD/SDIO, I²C, CAN, UART, and GPIO. The PS runs independently of the PL and boots at power-up or reset.

A system level block diagram is shown in [Figure 1-5](#).



UG954_c1_04_100112

Figure 1-5: Zynq-7000 Block Diagram

For additional information on Zynq-7000 SoC devices, see *Zynq-7000 SoC Overview (DS190)* and *Zynq-7000 SoC Technical Reference Manual (UG585)*.

Device Configuration

the Zynq-7000 XC7Z045 SoC uses a multi-stage boot process that supports both a non-secure and a secure boot. The PS is the master of the boot and configuration process. For a secure boot, the PL must be powered on to enable the use of the security block located within the PL, which provides 256-bit AES and SHA decryption/authentication.

The ZC706 evaluation board supports these configuration options:

- PS Configuration: Quad-SPI flash memory
- PS Configuration: Processor System Boot from SD Card (J30)

- PL Configuration: USB JTAG configuration port (Digilent module U30)
- PL Configuration: Platform cable header J3 and flying lead header J62 JTAG configuration ports



TIP: Designs using serial configuration based on Quad-SPI flash memory can take advantage of low-cost commodity SPI flash memory.

The JTAG configuration option is selected by setting SW11 (PS) as shown in [Table 1-2](#) and SW4 (PL) as described in [Programmable Logic JTAG Programming Options, page 33](#). SW11 is callout [29](#) in [Figure 1-3](#).

Table 1-2: Switch SW11 Configuration Option Settings

Boot Mode	SW11.1	SW11.2	SW11.3	SW11.4	SW11.5
JTAG mode ⁽¹⁾	0	0	0	0	0
Independent JTAG mode	1	0	0	0	0
QSPI mode	0	0	0	1	0
SD mode	0	0	1	1	0
MIO configuration pin	MIO2	MIO3	MIO4	MIO5	MIO6

Notes:

1. Default switch setting

For more information about Zynq-7000 SoC configuration settings, see [Zynq-7000 SoC Technical Reference Manual \(UG585\)](#).

Encryption Key Backup Circuit

The XC7Z045 SoC U1 implements bitstream encryption key technology. The ZC706 board provides the encryption key backup battery circuit shown in [Figure 1-6](#). The Seiko TS518FE rechargeable 1.5V lithium button-type battery B2 is soldered to the board with the positive output connected to the XC7Z045 SoC U1 VCCBATT pin P9. The battery supply current IBATT specification is 150 nA max when board power is off. B2 is charged from the VCCAUX 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.

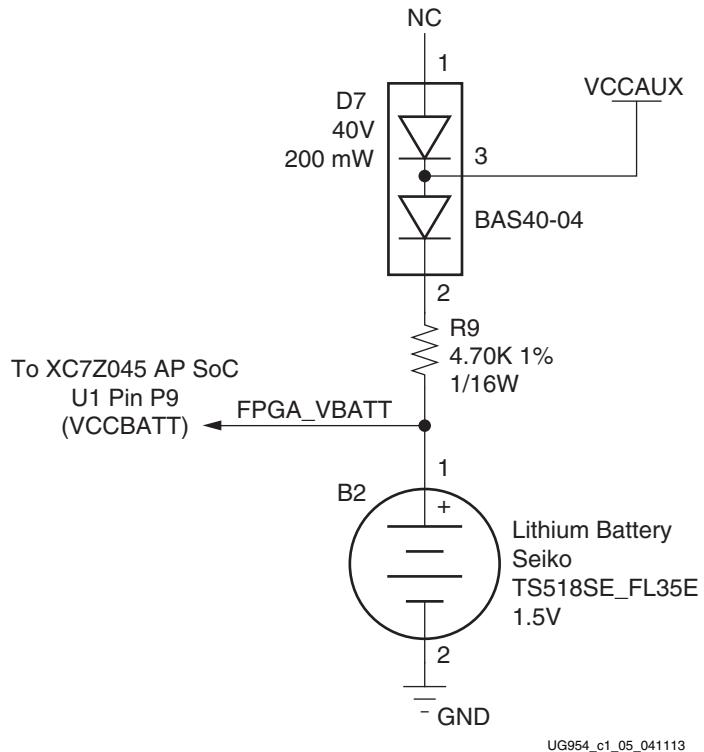


Figure 1-6: Encryption Key Backup Circuit

I/O Voltage Rails

There are eleven I/O banks available on the XC7Z045 SoC. The voltages applied to the XC7Z045 SoC I/O banks used by the ZC706 evaluation board are listed in [Table 1-3](#).

Table 1-3: I/O Voltage Rails

XC7Z045 (U1) Bank	Net Name	Voltage	Connected To
PL Bank 0	VCC3V3_FPGA	3.3V	SoC Configuration Bank 0
PL Bank 9	VADJ_FPGA	2.5V	PMOD, USER_SMA_CLOCK, SM_FAN, REC_CLOCK, SFP_TX_DISABLE
PL Bank 10			FMC_LPC, PL_JTAG, GPIO
PL Bank 11			FMC_HPC, GPIO_LED, HDMI
PL Bank 12			FMC_LPC, HDMI
PL Bank 13			FMC_HPC, HDMI
PL Bank 33			PL_DDR3_D[31:0]
PL Bank 34	VCC1V5_PL	1.5V	PL_DDR3_A, SYSCLK
PL Bank 35			PL_DDR3_D[63:32], XADC

Table 1-3: I/O Voltage Rails (Cont'd)

XC7Z045 (U1) Bank	Net Name	Voltage	Connected To
PS Bank 500	VCCP1V8	1.8V	QSPI0,QSPI1
PS Bank 501			PHY_IF,SDIO_IF,USB_IF
PS Bank 502			PS_DDR3_IF

Notes:

1. The ZC706 evaluation board is shipped with V_{ADJ} set to 2.5V.

DDR3 SODIMM Memory (PL)

[Figure 1-3, callout 2]

The memory module at J1 is a 1 GB DDR3 small outline dual-inline memory module (SODIMM). It provides volatile synchronous dynamic random access memory (SDRAM) for storing user code and data.

- Part number: MT8JTF12864HZ-1G6G1 (Micron Technology)
- Supply voltage: 1.5V
- Datapath width: 64 bits
- Data rate: Up to 1,600 MT/s

The ZC706 XC7Z045 SoC PL DDR interface performance is documented in the Zynq-7000 SoC (Z-7030, 035, 045, and Z-7100): DC and AC Switching Characteristics Data Sheet (DS191)[Ref 2].

The DDR3 interface is implemented across the PL-side I/O banks. Bank 33 and bank 35 have a dedicated DCI VRP/N resistor connection. An external 0.75V reference VTTREF_SODIMM is provided for data interface banks. Any interface connected to these banks that requires the VTTREF voltage must use this FPGA voltage reference. The connections between the DDR3 memory and the SoC are listed in Table 1-4.

Table 1-4: DDR3 SODIMM Socket J1 Connections to the XC7Z045 SoC

XC7Z045 (U1) Pin	Net Name	I/O Standard	DDR3 SODIMM Memory J1	
			Pin Number	Pin Name
E10	PL_DDR3_A0	SSTL15	98	A0
B9	PL_DDR3_A1	SSTL15	97	A1
E11	PL_DDR3_A2	SSTL15	96	A2
A9	PL_DDR3_A3	SSTL15	95	A3
D11	PL_DDR3_A4	SSTL15	92	A4
B6	PL_DDR3_A5	SSTL15	91	A5
F9	PL_DDR3_A6	SSTL15	90	A6

Table 1-4: DDR3 SODIMM Socket J1 Connections to the XC7Z045 SoC (Cont'd)

XC7Z045 (U1) Pin	Net Name	I/O Standard	DDR3 SODIMM Memory J1	
			Pin Number	Pin Name
E8	PL_DDR3_A7	SSTL15	86	A7
B10	PL_DDR3_A8	SSTL15	89	A8
J8	PL_DDR3_A9	SSTL15	85	A9
D6	PL_DDR3_A10	SSTL15	107	A10/AP
B7	PL_DDR3_A11	SSTL15	84	A11
H12	PL_DDR3_A12	SSTL15	83	A12_BC_N
A10	PL_DDR3_A13	SSTL15	119	A13
G11	PL_DDR3_A14	SSTL15	80	A14
C6	PL_DDR3_A15	SSTL15	78	A15
F8	PL_DDR3_BA0	SSTL15	109	BA0
H7	PL_DDR3_BA1	SSTL15	108	BA1
A7	PL_DDR3_BA2	SSTL15	79	BA2
L1	PL_DDR3_D0	SSTL15	5	DQ0
L2	PL_DDR3_D1	SSTL15	7	DQ1
K5	PL_DDR3_D2	SSTL15	15	DQ2
J4	PL_DDR3_D3	SSTL15	17	DQ3
K1	PL_DDR3_D4	SSTL15	4	DQ4
L3	PL_DDR3_D5	SSTL15	6	DQ5
J5	PL_DDR3_D6	SSTL15	16	DQ6
K6	PL_DDR3_D7	SSTL15	18	DQ7
G6	PL_DDR3_D8	SSTL15	21	DQ8
H4	PL_DDR3_D9	SSTL15	23	DQ9
H6	PL_DDR3_D10	SSTL15	33	DQ10
H3	PL_DDR3_D11	SSTL15	35	DQ11
G1	PL_DDR3_D12	SSTL15	22	DQ12
H2	PL_DDR3_D13	SSTL15	24	DQ13
G5	PL_DDR3_D14	SSTL15	34	DQ14
G4	PL_DDR3_D15	SSTL15	36	DQ15
E2	PL_DDR3_D16	SSTL15	39	DQ16
E3	PL_DDR3_D17	SSTL15	41	DQ17
D4	PL_DDR3_D18	SSTL15	51	DQ18
E5	PL_DDR3_D19	SSTL15	53	DQ19
F4	PL_DDR3_D20	SSTL15	40	DQ20
F3	PL_DDR3_D21	SSTL15	42	DQ21
D1	PL_DDR3_D22	SSTL15	50	DQ22

Table 1-4: DDR3 SODIMM Socket J1 Connections to the XC7Z045 SoC (Cont'd)

XC7Z045 (U1) Pin	Net Name	I/O Standard	DDR3 SODIMM Memory J1	
			Pin Number	Pin Name
D3	PL_DDR3_D23	SSTL15	52	DQ23
A2	PL_DDR3_D24	SSTL15	57	DQ24
B2	PL_DDR3_D25	SSTL15	59	DQ25
B4	PL_DDR3_D26	SSTL15	67	DQ26
B5	PL_DDR3_D27	SSTL15	69	DQ27
A3	PL_DDR3_D28	SSTL15	56	DQ28
B1	PL_DDR3_D29	SSTL15	58	DQ29
C1	PL_DDR3_D30	SSTL15	68	DQ30
C4	PL_DDR3_D31	SSTL15	70	DQ31
K10	PL_DDR3_D32	SSTL15	129	DQ32
L9	PL_DDR3_D33	SSTL15	131	DQ33
K12	PL_DDR3_D34	SSTL15	141	DQ34
J9	PL_DDR3_D35	SSTL15	143	DQ35
K11	PL_DDR3_D36	SSTL15	130	DQ36
L10	PL_DDR3_D37	SSTL15	132	DQ37
J10	PL_DDR3_D38	SSTL15	140	DQ38
L7	PL_DDR3_D39	SSTL15	142	DQ39
F14	PL_DDR3_D40	SSTL15	147	DQ40
F15	PL_DDR3_D41	SSTL15	149	DQ41
F13	PL_DDR3_D42	SSTL15	157	DQ42
G16	PL_DDR3_D43	SSTL15	159	DQ43
G15	PL_DDR3_D44	SSTL15	146	DQ44
E12	PL_DDR3_D45	SSTL15	148	DQ45
D13	PL_DDR3_D46	SSTL15	158	DQ46
E13	PL_DDR3_D47	SSTL15	160	DQ47
D15	PL_DDR3_D48	SSTL15	163	DQ48
E15	PL_DDR3_D49	SSTL15	165	DQ49
D16	PL_DDR3_D50	SSTL15	175	DQ50
E16	PL_DDR3_D51	SSTL15	177	DQ51
C17	PL_DDR3_D52	SSTL15	164	DQ52
B16	PL_DDR3_D53	SSTL15	166	DQ53
D14	PL_DDR3_D54	SSTL15	174	DQ54
B17	PL_DDR3_D55	SSTL15	176	DQ55
B12	PL_DDR3_D56	SSTL15	181	DQ56
C12	PL_DDR3_D57	SSTL15	183	DQ57

Table 1-4: DDR3 SODIMM Socket J1 Connections to the XC7Z045 SoC (Cont'd)

XC7Z045 (U1) Pin	Net Name	I/O Standard	DDR3 SODIMM Memory J1	
			Pin Number	Pin Name
A12	PL_DDR3_D58	SSTL15	191	DQ58
A14	PL_DDR3_D59	SSTL15	193	DQ59
A13	PL_DDR3_D60	SSTL15	180	DQ60
B11	PL_DDR3_D61	SSTL15	182	DQ61
C14	PL_DDR3_D62	SSTL15	192	DQ62
B14	PL_DDR3_D63	SSTL15	194	DQ63
J3	PL_DDR3_DM0	SSTL15	11	DM0
F2	PL_DDR3_DM1	SSTL15	28	DM1
E1	PL_DDR3_DM2	SSTL15	46	DM2
C2	PL_DDR3_DM3	SSTL15	63	DM3
L12	PL_DDR3_DM4	SSTL15	136	DM4
G14	PL_DDR3_DM5	SSTL15	153	DM5
C16	PL_DDR3_DM6	SSTL15	170	DM6
C11	PL_DDR3_DM7	SSTL15	187	DM7
K2	PL_DDR3_DQS0_N	DIFF_SSTL15	10	DQS0_N
K3	PL_DDR3_DQS0_P	DIFF_SSTL15	12	DQS0_P
H1	PL_DDR3_DQS1_N	DIFF_SSTL15	27	DQS1_N
J1	PL_DDR3_DQS1_P	DIFF_SSTL15	29	DQS1_P
D5	PL_DDR3_DQS2_N	DIFF_SSTL15	45	DQS2_N
E6	PL_DDR3_DQS2_P	DIFF_SSTL15	47	DQS2_P
A4	PL_DDR3_DQS3_N	DIFF_SSTL15	62	DQS3_N
A5	PL_DDR3_DQS3_P	DIFF_SSTL15	64	DQS3_P
K8	PL_DDR3_DQS4_N	DIFF_SSTL15	135	DQS4_N
L8	PL_DDR3_DQS4_P	DIFF_SSTL15	137	DQS4_P
F12	PL_DDR3_DQS5_N	DIFF_SSTL15	152	DQS5_N
G12	PL_DDR3_DQS5_P	DIFF_SSTL15	154	DQS5_P
E17	PL_DDR3_DQS6_N	DIFF_SSTL15	169	DQS6_N
F17	PL_DDR3_DQS6_P	DIFF_SSTL15	171	DQS6_P
A15	PL_DDR3_DQS7_N	DIFF_SSTL15	186	DQS7_N
B15	PL_DDR3_DQS7_P	DIFF_SSTL15	188	DQS7_P
G7	PL_DDR3_ODT0	SSTL15	116	ODT0
C9	PL_DDR3_ODT1	SSTL15	120	ODT1
G17	PL_DDR3_RESET_B	SSTL15	30	RESET_B
J11	PL_DDR3_S0_B	SSTL15	114	S0_B
H8	PL_DDR3_S1_B	SSTL15	121	S1_B

Table 1-4: DDR3 SODIMM Socket J1 Connections to the XC7Z045 SoC (Cont'd)

XC7Z045 (U1) Pin	Net Name	I/O Standard	DDR3 SODIMM Memory J1	
			Pin Number	Pin Name
M10	PL_DDR3_TEMP_EVE NT	SSTL15	198	EVENT_B
F7	PL_DDR3_WE_B	SSTL15	113	WE_B
E7	PL_DDR3_CAS_B	SSTL15	115	CAS_B
H11	PL_DDR3_RAS_B	SSTL15	110	RAS_B
D10	PL_DDR3_CKE0	SSTL15	73	CKE0
C7	PL_DDR3_CKE1	SSTL15	74	CKE1
F10	PL_DDR3_CLK0_N	DIFF_SSTL15	103	CK0_N
G10	PL_DDR3_CLK0_P	DIFF_SSTL15	101	CK0_P
D8	PL_DDR3_CLK1_N	DIFF_SSTL15	104	CK1_N
D9	PL_DDR3_CLK1_P	DIFF_SSTL15	102	CK1_P

The ZC706 DDR3 SODIMM interface adheres to the constraints guidelines documented in the "Dynamic Memory" section of the *Zynq-7000 SoC PCB Design and Pin Planning Guide* ([UG933](#)). The ZC706 DDR3 SODIMM interface is a 40Ω impedance implementation. For more details, see the MT8JTF12864HZ-1G6G1 data sheet [\[Ref 35\]](#).

DDR3 Component Memory (PS)

[Figure 1-3, callout 3]

The 1 GB, 32-bit wide DDR3 component memory system is comprised of four SDRAMs at U2-U5. This memory system is connected to the XC7Z045 SoC Processing System (PS) memory interface bank 502.

- Part number: MT41J256M8HX-15E (Micron Technology)
- Configuration: 2Gb: 256 Mb x 8
- Supply voltage: 1.5V
- Datapath width: 32 bits
- Data rate: Up to 1,333 MT/s

The ZC706 XC7Z045 SoC PS DDR Bank 502 interface performance is documented in the Zynq-7000 SoC (Z-7030, 035, 045, and Z-7100): DC and AC Switching Characteristics Data Sheet (DS191) [\[Ref 2\]](#).

The DDR3 0.75V VTT termination voltage is sourced from linear regulator U27. The connections between the DDR3 component memory and XC7Z045 SoC bank 502 are listed in [Table 1-5](#).

Table 1-5: DDR3 Component Memory Connections to the XC7Z045 SoC

XC7Z045 (U1) Pin	Net Name	Component Memory		
		Pin Number	Pin Name	Ref. Des.
E26	PS_DDR3_DQ0	B3	DQ0	U2
A25	PS_DDR3_DQ1	C7	DQ1	U2
E27	PS_DDR3_DQ2	C2	DQ2	U2
E25	PS_DDR3_DQ3	C8	DQ3	U2
D26	PS_DDR3_DQ4	E3	DQ4	U2
B25	PS_DDR3_DQ5	E8	DQ5	U2
D25	PS_DDR3_DQ6	D2	DQ6	U2
B27	PS_DDR3_DQ7	E7	DQ7	U2
A27	PS_DDR3_DQ8	B3	DQ8	U3
A28	PS_DDR3_DQ9	C7	DQ9	U3
A29	PS_DDR3_DQ10	C2	DQ10	U3
C28	PS_DDR3_DQ11	C8	DQ11	U3
D30	PS_DDR3_DQ12	E3	DQ12	U3
A30	PS_DDR3_DQ13	E8	DQ13	U3
D29	PS_DDR3_DQ14	D2	DQ14	U3
D28	PS_DDR3_DQ15	E7	DQ15	U3
H27	PS_DDR3_DQ16	B3	DQ16	U4
G27	PS_DDR3_DQ17	C7	DQ17	U4
H28	PS_DDR3_DQ18	C2	DQ18	U4
E28	PS_DDR3_DQ19	C8	DQ19	U4
E30	PS_DDR3_DQ20	E3	DQ20	U4
F28	PS_DDR3_DQ21	E8	DQ21	U4
G30	PS_DDR3_DQ22	D2	DQ22	U4
F30	PS_DDR3_DQ23	E7	DQ23	U4
K27	PS_DDR3_DQ24	B3	DQ24	U5
J30	PS_DDR3_DQ25	C7	DQ25	U5
J28	PS_DDR3_DQ26	C2	DQ26	U5
J29	PS_DDR3_DQ27	C8	DQ27	U5
K30	PS_DDR3_DQ28	E3	DQ28	U5
M29	PS_DDR3_DQ29	E8	DQ29	U5
L30	PS_DDR3_DQ30	D2	DQ30	U5
M30	PS_DDR3_DQ31	E7	DQ31	U5
C27	PS_DDR3_DM0	B7	DM0	U2
C26	PS_DDR3_DQS0_P	C3	DQS0_P	U2

Table 1-5: DDR3 Component Memory Connections to the XC7Z045 SoC (Cont'd)

XC7Z045 (U1) Pin	Net Name	Component Memory		
		Pin Number	Pin Name	Ref. Des.
B26	PS_DDR3_DQS0_N	D3	DQS0_N	U2
B30	PS_DDR3_DM1	B7	DM1	U3
C29	PS_DDR3_DQS1_P	C3	DQS1_P	U3
B29	PS_DDR3_DQS1_N	D3	DQS1_N	U3
H29	PS_DDR3_DM2	B7	DM2	U4
G29	PS_DDR3_DQS2_P	C3	DQS2_P	U4
F29	PS_DDR3_DQS2_N	D3	DQS2_N	U4
K28	PS_DDR3_DM3	B7	DM3	U5
L28	PS_DDR3_DQS3_P	C3	DQS3_P	U5
L29	PS_DDR3_DQS3_N	D3	DQS3_N	U5
L25	PS_DDR3_A0	K3	A0	U2, U3, U4, U5
K26	PS_DDR3_A1	L7	A1	U2, U3, U4, U5
L27	PS_DDR3_A2	L3	A2	U2, U3, U4, U5
G25	PS_DDR3_A3	K2	A3	U2, U3, U4, U5
J26	PS_DDR3_A4	L8	A4	U2, U3, U4, U5
G24	PS_DDR3_A5	L2	A5	U2, U3, U4, U5
H26	PS_DDR3_A6	M8	A6	U2, U3, U4, U5
K22	PS_DDR3_A7	M2	A7	U2, U3, U4, U5
F27	PS_DDR3_A8	N8	A8	U2, U3, U4, U5
J23	PS_DDR3_A9	M3	A9	U2, U3, U4, U5
G26	PS_DDR3_A10	H7	A10	U2, U3, U4, U5
H24	PS_DDR3_A11	M7	A11	U2, U3, U4, U5
K23	PS_DDR3_A12	K7	A12	U2, U3, U4, U5
H23	PS_DDR3_A13	N3	A13	U2, U3, U4, U5
J24	PS_DDR3_A14	N7	A14	U2, U3, U4, U5
M27	PS_DDR3_BA0	J2	BA0	U2, U3, U4, U5
M26	PS_DDR3_BA1	K8	BA1	U2, U3, U4, U5
M25	PS_DDR3_BA2	J3	BA2	U2, U3, U4, U5
K25	PS_DDR3_CLK_P	F7	CK	U2, U3, U4, U5
J25	PS_DDR3_CLK_N	G7	CK_B	U2, U3, U4, U5
M22	PS_DDR3_CKE	G9	CKE	U2, U3, U4, U5
N23	PS_DDR3_WE_B	H3	WE_B	U2, U3, U4, U5
M24	PS_DDR3_CAS_B	G3	CAS_B	U2, U3, U4, U5
N24	PS_DDR3_RAS_B	F3	RAS_B	U2, U3, U4, U5
F25	PS_DDR3_RESET_B	N2	RESET_B	U2, U3, U4, U5

Table 1-5: DDR3 Component Memory Connections to the XC7Z045 SoC (Cont'd)

XC7Z045 (U1) Pin	Net Name	Component Memory		
		Pin Number	Pin Name	Ref. Des.
N22	PS_DDR3_CS_B	H2	CS_B	U2, U3, U4, U5
L23	PS_DDR3_ODT	G1	ODT	U2, U3, U4, U5
N21	PS_VRN			
M21	PS_VRP			
L22	VTTVREF_PS			
L24	VTTVREF_PS			

The ZC706 DDR3 component interface adheres to the constraints guidelines documented in the *DDR3 Design Guidelines* section of *Zynq-7000 SoC PCB Design and Pin Planning Guide* ([UG933](#)). The ZC706 DDR3 component interface is a 40Ω impedance implementation. For more details, see the MT41J256M8HX-15E data sheet [[Ref 35](#)].

Quad-SPI Flash Memory

[Figure 1-3, callout 4]

The Quad-SPI flash memory located at U58 and U59 provides 2×128 Mb of nonvolatile storage that can be used for configuration and data storage.

- Part number: S25FL128SAGMFIR01 (Spansion)
- Supply voltage: 1.8V
- Datapath width: 4 bits
- Data rate: Various depending on Single/Dual/Quad mode

The connections between the SPI flash memory and the XC7Z045 SoC are listed in [Table 1-6](#).

Table 1-6: Quad-SPI Flash Memory Connections to the XC7Z045 SoC

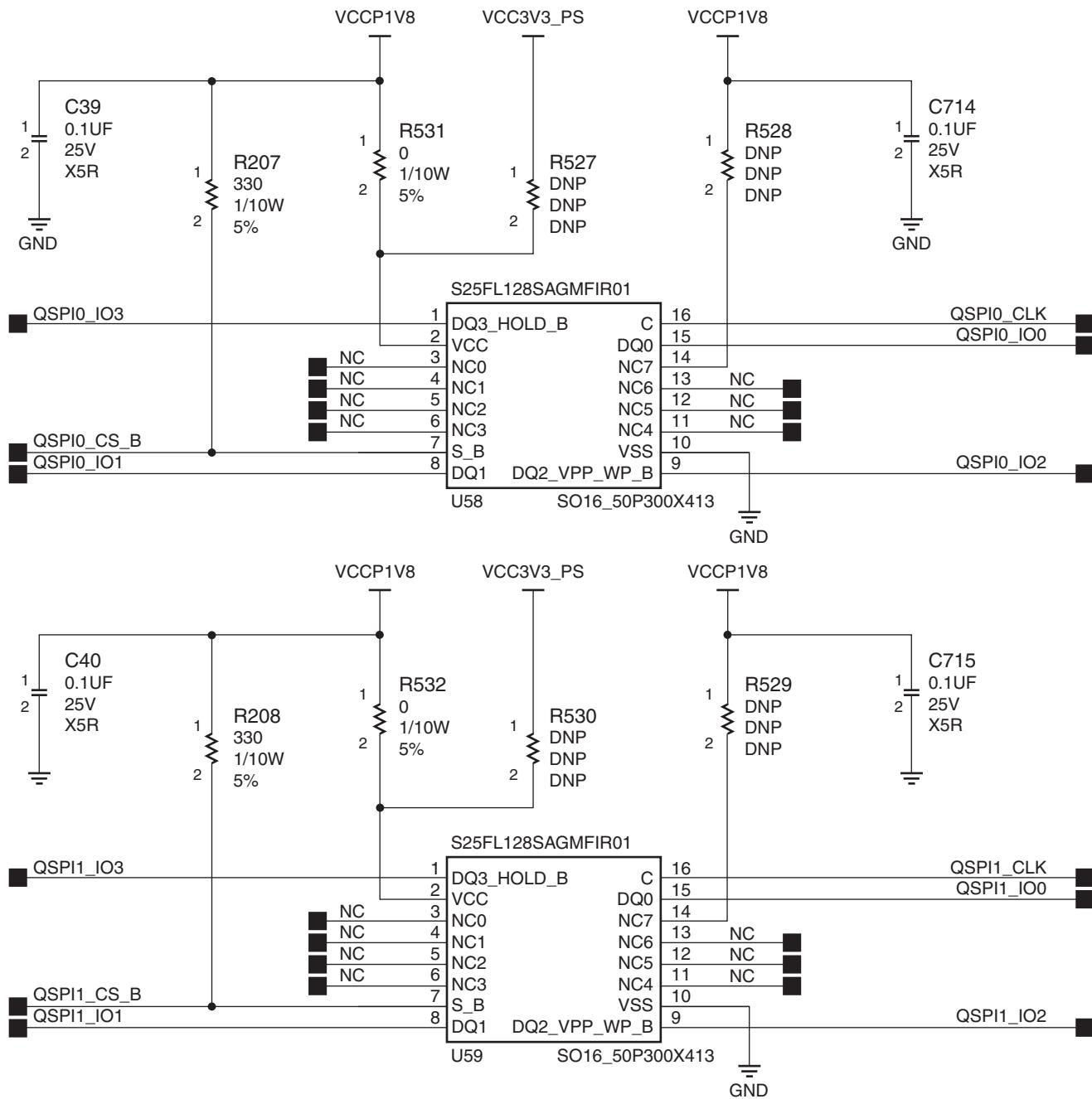
XC7Z045 (U1)			Schematic Net Name	Quad-SPI Flash Memory		QSPI Device	MIO Select Header
Pin Name	Bank	Pin Number		Pin Number	Pin Name		
PS_MIO6	500	D24	QSPI0_CLK	16	C	U58	J74.2
PS_MIO5	500	C24	QSPI0_IO3	1	DQ3_HOLD_B	U58	J73.2
PS_MIO4	500	E23	QSPI0_IO2	9	WP_B	U58	J72.2
PS_MIO3	500	C23	QSPI0_IO1	8	DQ1	U58	J71.2
PS_MIO2	500	F23	QSPI0_IO0	15	DQ0	U58	J70.2
PS_MIO1	500	D23	QSPI0_CS_B	7	S_B	U58	N/A
PS_MIO9	500	A24	QSPI1_CLK	16	C	U59	N/A

Table 1-6: Quad-SPI Flash Memory Connections to the XC7Z045 SoC (Cont'd)

XC7Z045 (U1)			Schematic Net Name	Quad-SPI Flash Memory		QSPI Device	MIO Select Header
Pin Name	Bank	Pin Number		Pin Number	Pin Name	Ref. Des.	
PS_MIO13	500	F22	QSPI1_IO3	1	DQ3_HOLD_B	U59	N/A
PS_MIO12	500	E21	QSPI1_IO2	9	WP_B	U59	N/A
PS_MIO11	500	A23	QSPI1_IO1	8	DQ1	U59	N/A
PS_MIO10	500	E22	QSPI1_IO0	15	DQ0	U59	N/A
PS_MIO0	500	F24	QSPI1_CS_B	7	S_B	U59	N/A

The configuration section of the *Zynq-7000 SoC Technical Reference Manual* [UG585](#), provides details on using the Quad-SPI flash memory.

[Figure 1-7](#) shows the connections of the linear Quad-SPI flash memory on the ZC706 evaluation board. For more details, see the Spansion S25FL128SAGMFIR01 data sheet [\[Ref 17\]](#).



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Figure 1-7: 128 Mb Quad-SPI Flash Memory

USB 2.0 ULPI Transceiver

[Figure 1-3, callout 19]

The ZC706 evaluation board uses a Standard Microsystems Corporation USB3320 USB 2.0 ULPI Transceiver at U12 to support a USB connection to the host computer. A USB cable is supplied in the ZC706 evaluation kit (Standard-A connector to host computer, Micro-B connector to ZC706 evaluation board connector J2). The USB3320 is a high-speed USB 2.0 PHY supporting the UTMI+ low pin interface (ULPI) interface standard. The ULPI standard defines the interface between the USB controller IP and the PHY device which drives the physical USB bus. Use of the ULPI standard reduces the interface pin count between the USB controller IP and the PHY device.

The USB3320 is clocked by a 24 MHz crystal. Consult the SMSC USB3320 data sheet for clocking mode details [\[Ref 18\]](#).

The interface to the USB3320 transceiver is implemented through the IP in the XC7Z045 SoC Processor System.

[Table 1-7](#) describes the jumper settings for the USB 2.0 circuit. Bold text identifies the default OTG mode settings.

Table 1-7: USB Jumper Settings

Header	Function	Shunt Position	Notes
J11	USB PHY reset	Shunt ON = USB PHY reset Shunt OFF = USB PHY normal operation	Clean reset requires external debouncing
J10	V _{BUS} 5V Supply	Shunt ON = Host or OTG mode Shunt OFF = Device mode	
J48	RVBUS select	Position 1-2 = Device mode only (10 KΩ) Position 2-3 = OTG or Host mode (1 KΩ)	Oversupply protection
J50	CVBUS select	Position 1-2 = OTG and Device mode 1 μF Position 2-3 = Host mode 120 μF	V _{BUS} load capacitance
J49	Cable ID select	Position 1-2 = A/B cable detect Position 2-3 = ID not used	Used in OTG mode
J51	USB Micro-B	Position 1-2 = Shield connected to GND Position 2-3 = Shield floating	

The connections between the USB Micro-B connector at J2 and the PHY at U12 are listed in [Table 1-8](#).

Table 1-8: USB Connector Pin Assignments and Signal Definitions Between J2 and U12

USB Connector J1		Net Name	Description	USB3320 (U12) Pin
Pin	Name			
1	VBUS	USB_VBUS_SEL	+5V from host system	22
2	D_N	USB_D_N	Bidirectional differential serial data (N-side)	19
3	D_P	USB_D_P	Bidirectional differential serial data (P-side)	18
5	GND	GND	Signal ground	33

The connections between the USB 2.0 PHY at U12 and the XC7Z045 SoC are listed in [Table 1-9](#).

Table 1-9: USB 2.0 ULPI Transceiver Connections to the XC7Z045 SoC

XC7Z045 (U1)			Schematic Net Name	USB3320 (U12) Pin
Pin Name	Bank	Pin Number		
PS_MIO36	501	H17	USB_CLKOUT	1
PS_MIO31	501	H21	USB_NXT	2
PS_MIO32	501	K17	USB_DATA0	3
PS_MIO33	501	G22	USB_DATA1	4
PS_MIO34	501	K18	USB_DATA2	5
PS_MIO35	501	G21	USB_DATA3	6
PS_MIO28	501	L17	USB_DATA4	7
PS_MIO37	501	B21	USB_DATA5	9
PS_MIO38	501	A20	USB_DATA6	10
PS_MIO39	501	F18	USB_DATA7	13
PS_MIO30	501	L18	USB_STP	29
PS_MIO29	501	E8	USB_DIR	31
PS_MIO7	500	D5	USB_RESET_B_AND	27 (via AND gate U13)

For additional information on the Zynq-7000 SoC device USB controllers, see [Zynq-7000 SoC Overview \(DS190\)](#) and [Zynq-7000 SoC Technical Reference Manual \(UG585\)](#).

Figure 1-8 shows the USB 2.0 ULPI transceiver circuitry. Note that the shield for the USB Micro-B connector (J2) can be tied to GND by a jumper on header J51 pins 1–2 (default). The USB shield can optionally be connected through a capacitor to GND by installing a capacitor (body size 0402) at location C335 and jumping pins 2–3 on header J51.

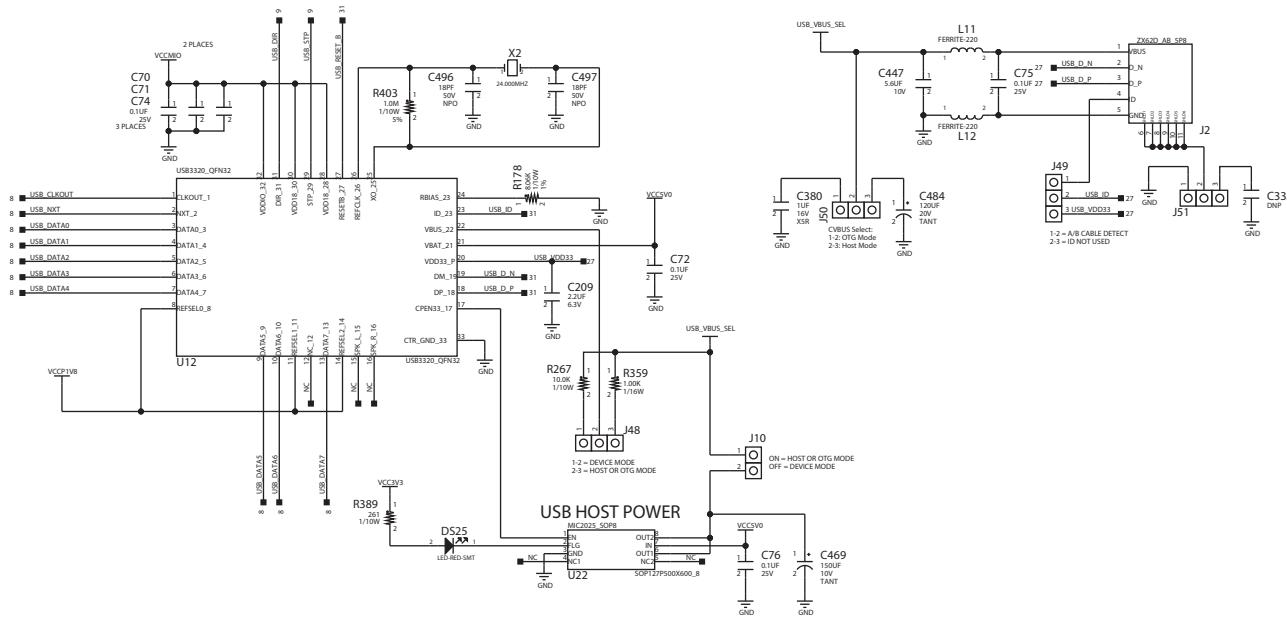
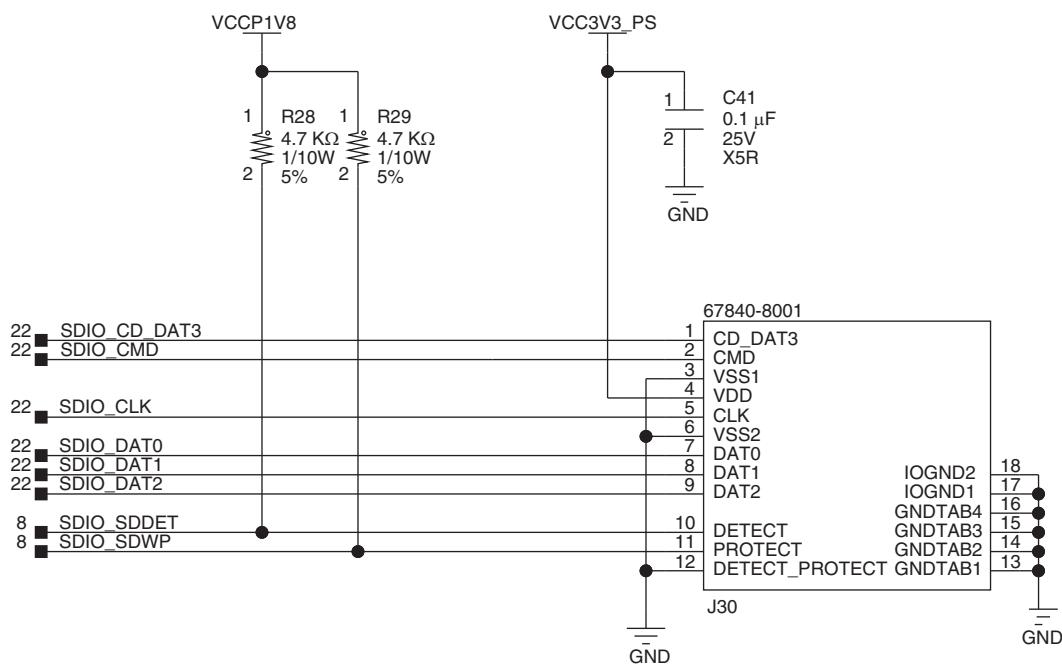


Figure 1-9 shows the connections of the SD card interface on the ZC706 evaluation board.



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Figure 1-9: SD Card Interface

Table 1-10 lists the SD card interface connections to the XC7Z045 SoC

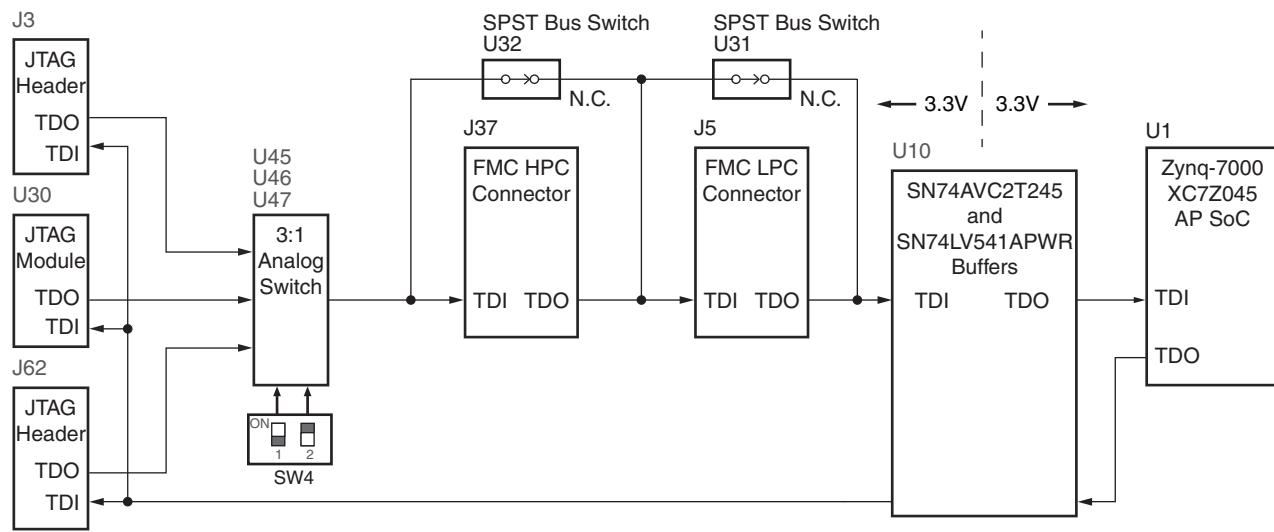
Table 1-10: SDIO Connections to the XC7Z045 SoC

XC7Z045 (U1) Pin			Schematic Net Name	Level Shifter (U11)		SDIO Connector (J30)	
Pin Name	Bank	Pin Number		1.8V Side Pin	3.3V Side Pin	Pin Number	Pin Name
PS_MIO15	500	C22	SDIO_SDWP	N/A	N/A	11	PROTECT
PS_MIO14	500	B22	SDIO_SDDET	N/A	N/A	10	DETECT
PS_MIO41	501	J18	SDIO_CMD_LS	4	20	2	CMD
PS_MIO40	501	B20	SDIO_CLK_LS	9	19	5	CLK
PS_MIO44	501	E20	SDIO_DAT2_LS	1	23	9	DAT2
PS_MIO43	501	E18	SDIO_DAT1_LS	7	16	8	DAT1
PS_MIO42	501	D20	SDIO_DAT0_LS	6	18	7	DAT0
PS_MIO45	501	H18	SDIO_CD_DAT3_LS	3	22	1	CD_DAT3

Programmable Logic JTAG Programming Options

[Figure 1-3, callout 6]

The ZC706 evaluation board JTAG chain is shown in [Figure 1-10](#).



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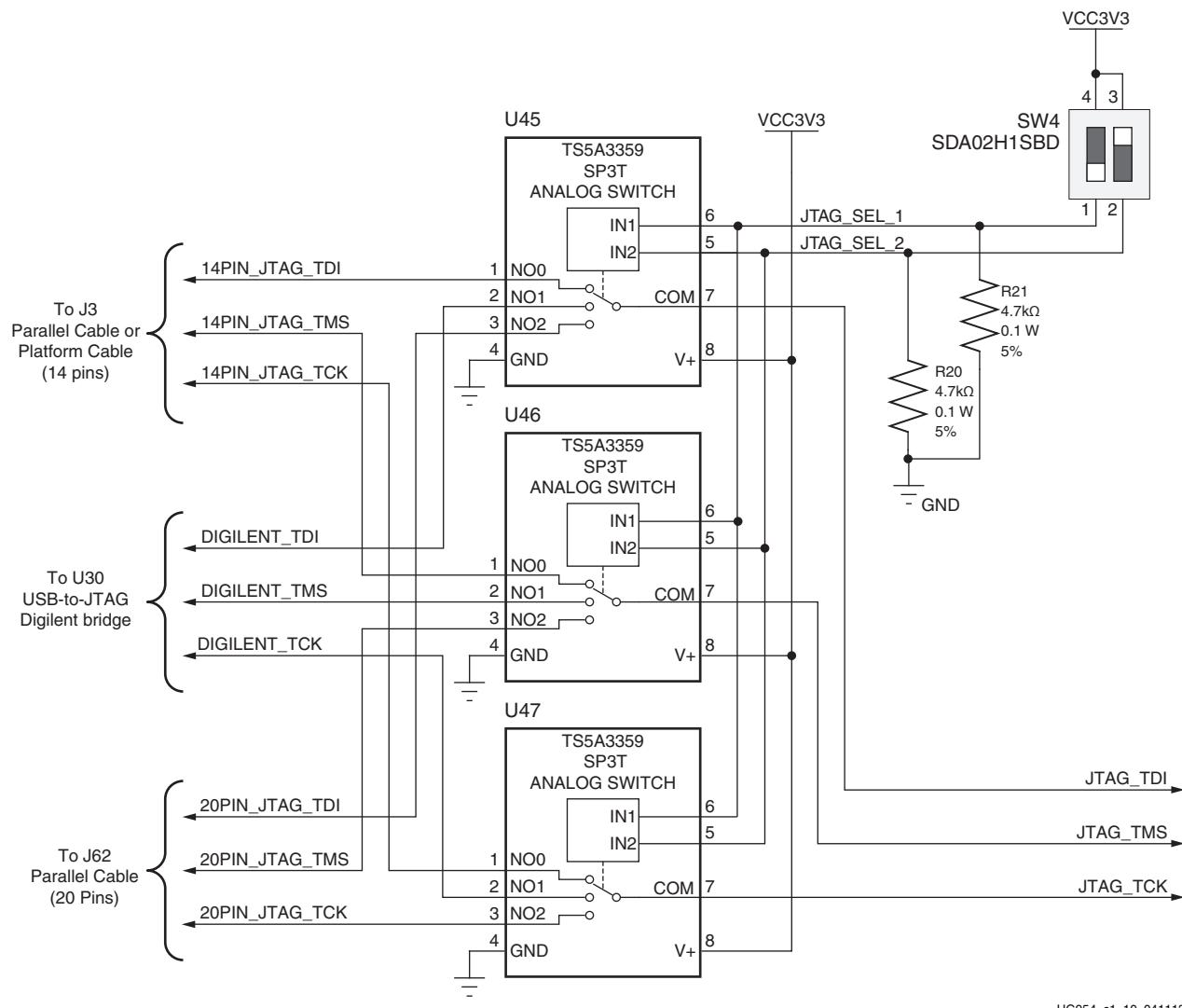
Figure 1-10: JTAG Chain Block Diagram

Programmable Logic JTAG Select Switch

[Figure 1-3, callout 35]

The PL JTAG chain can be programmed by three different methods made available through a 3-to-1 analog switch (U45, U46, and U47) controlled by a 2-position DIP switch at SW4.

[Figure 1-11](#) shows the JTAG analog switches and DIP switch SW4.



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Figure 1-11: PL JTAG Programming Source Analog Switch

DIP switch SW4[1:2] setting 10 selects the 14-pin header J3 for configuration using either a Parallel Cable IV (PC4) or Platform Cable USB II. DIP switch SW4 setting 01 selects the USB-to-JTAG Digilent bridge U30 for configuration over a Standard-A to Micro-B USB cable. DIP switch SW4 setting 11 selects the JTAG 20-pin header at J62. The four JTAG signals TDI, TDO, TCK, and TMS would be connected to J62 through flying leads from a JTAG cable. The 3-to-1 analog switch settings are shown in [Table 1-11](#).

Table 1-11: Switch SW4 Configuration Option Settings

Configuration Source	DIP Switch SW4	
	Switch 1 ⁽¹⁾ JTAG_SEL_1	Switch 2 ⁽¹⁾ JTAG_SEL_2
None	0	0
Cable Connector J3 ⁽²⁾	1	0
Digilent USB-to-JTAG interface U30	0	1
JTAG (flying lead) Header J62	1	1

Notes:

1. 0 = open, 1 = closed
2. Default switch setting

FMC Connector JTAG Bypass

When an FPGA mezzanine card (FMC) is attached to HPC J37 or LPC J5 it is automatically added to the JTAG chain through electronically controlled single-pole single-throw (SPST) switches U32 and U31 respectively. The SPST switches are normally closed and transition to an open state when an FMC is attached. Switch U32 adds an attached FMC to the JTAG chain as determined by the FMC_HPC_PRSNT_M2C_B signal. Switch U31 adds an attached FMC to the JTAG chain as determined by the FMC_LPC_PRSNT_M2C_B signal. The attached FMC card must implement a TDI-to-TDO connection through a device or bypass jumper for the JTAG chain to be completed to the SoC U1.

The JTAG connectivity on the ZC706 board allows a host computer to download bitstreams to the SoC using the Xilinx® iMPACT software. In addition, the JTAG connector allows debug tools such as the Vivado serial I/O analyzer or a software debugger to access the SoC. The iMPACT software tool can also indirectly program the linear QSPI flash memory. To accomplish this, the iMPACT software configures the SoC with a temporary design to access and program the QSPI memory device.

Clock Generation

[Figure 1-3, callouts 7, 8, and 9]

The ZC706 evaluation board provides four clock sources for the XC7Z045 SoC. Table 1-12 lists the source devices for each clock.

Table 1-12: ZC706 Evaluation Board Clock Sources

Clock Name	Clock Source	Description
System Clock	U64	SiT9102 2.5V LVDS 200 MHz fixed-frequency oscillator (SiTime). See System Clock, page 36 .
User Clock	U37	Si570 3.3V LVDS I ² C programmable oscillator, 156.250 MHz default (Silicon Labs). See Programmable User Clock, page 37 .
User SMA Clock	J67(P), J68(N)	User clock input SMAs, limit input swing voltage to VADJ_FPGA setting (1.8V, 2.5V, 3.3V). See User SMA Clock Source, page 38 .
PS Clock	U24	SIT8103 1.8V single-ended CMOS 33.3333 MHz fixed frequency oscillator (SiTime). See Processing System Clock Source, page 39 .
GTX SMA REF Clock	J36(P), J31(N)	User clock input SMAs. See GTX SMA Clock (SMA_MGT_REFCLK_P and SMA_MGT_REFCLK_N), page 39 .
Jitter Attenuated Clock	U60	Si5324C LVDS precision clock multiplier/jitter attenuator (Silicon Labs). See Jitter Attenuated Clock, page 40 .

[Table 1-13](#) lists the pin-to-pin connections from each clock source to the XC7Z045 SoC.

Table 1-13: Clock Connections, Source to XC7Z045 SoC

Clock Source Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin
U64.5	SYSCLK_N	LVDS	G9
U64.4	SYSCLK_P	LVDS	H9
U37.5	USRCLK_N	LVDS_25	AG14
U37.4	USRCLK_P	LVDS_25	AF14
J67.1	USER_SMA_CLOCK_P	LVDS_25	AD18
J68.1	USER_SMA_CLOCK_N	LVDS_25	AD19
J24.3	PS_CLK	NA(1)	A22 (Bank 500)
J36.1	SMA_MGT_REFCLK_P	NA(1)	W8
J31.1	SMA_MGT_REFCLK_N	NA(1)	W7
U60.29	SI5324_OUT_C_N	NA(1)	AC7
U60.28	SI5324_OUT_C_P	NA(1)	AC8
U60.17	REC_CLOCK_C_N	LVDS_25	AE20
U60.16	REC_CLOCK_C_P	LVDS_25	AD20
U60.3	SI5324_INT_ALM_LS	LVCMOS25	AJ25
U60.1	SI5324_RST_LS	LVCMOS25	W23

Notes:

1. PS-side and GTX nets do not have an assigned I/O standard.

System Clock

[[Figure 1-3](#), callout 7]

The system clock source is an LVDS 200 MHz oscillator at U64. It is wired to a multi-region clock capable (MRCC) input on programmable logic (PL) bank 34. The signal pair is named SYSCLK_P and SYSCLK_N and each signal is connected to U1 (pins H9 and G9, respectively) on the XC7Z045 SoC.

- Oscillator: SiTime SiT9102AI-243N25E200.00000 (200 MHz)
- Frequency tolerance: 50 ppm
- LVDS Differential Output

The system clock circuit is shown in [Figure 1-12](#).

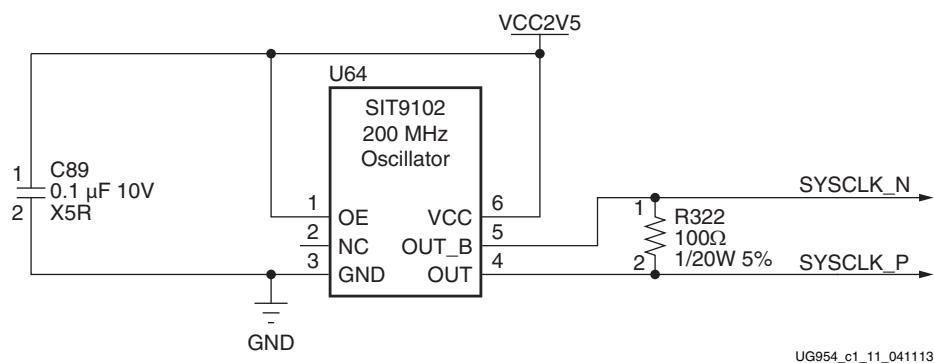


Figure 1-12: System Clock Source

For more details, see the SiTime SiT9102 data sheet [\[Ref 21\]](#).

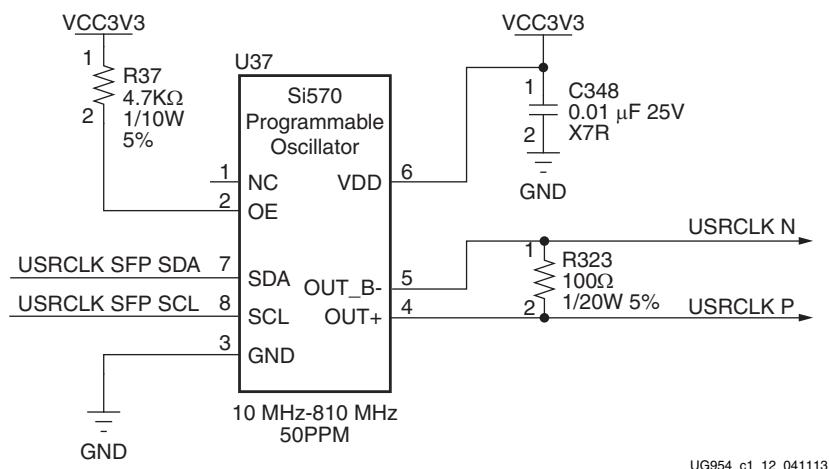
Programmable User Clock

[[Figure 1-3](#), callout 8]

The ZC706 evaluation board has a programmable low-jitter 3.3V LVDS differential oscillator (U37) connected to the MRCC inputs of bank 10. This USRCLK_P and USRCLK_N clock signal pair is connected to XC7Z045 SoC U1 pins AF14 and AG14, respectively. On power-up the user clock defaults to an output frequency of 156.250 MHz. User applications can change the output frequency within the range of 10 MHz to 810 MHz through an I²C interface. Power cycling the ZC706 evaluation board reverts the user clock to the default frequency of 156.250 MHz.

- Programmable Oscillator: Silicon Labs Si570BAB0000544DG (10 MHz–810 MHz)
- Frequency tolerance: 50 ppm
- LVDS Differential Output

The user clock circuit is shown in [Figure 1-13](#).



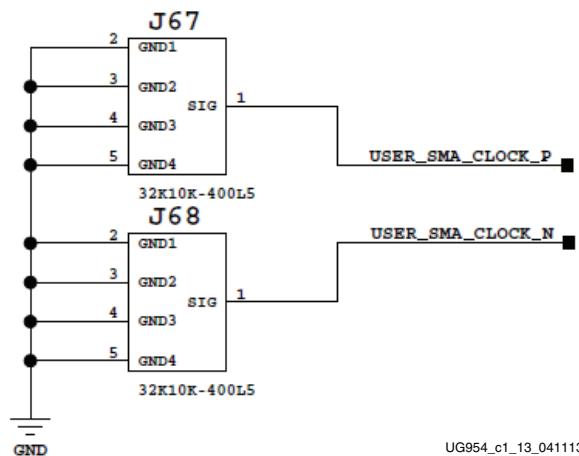
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Figure 1-13: User Clock Source

See the Silicon Labs Si570 data sheet [[Ref 22](#)].

User SMA Clock Source

The ZC706 board provides a pair of SMAs for differential user clock input into PL Bank 9 (see [Figure 1-14](#)). The P-side SMA J67 signal USER_SMA_CLOCK_P is connected to U1 pin AD18, with the N-side SMA J68 signal USER_SMA_CLOCK_N connected to U1 pin AD19. Bank 9 V_{cco} is VADJ_FPGA, a variable voltage (1.8V, 2.5V, 3.3V) depending on the ZC706 FMC interface banks voltage. The USER_SMA_CLOCK input voltage swing should not exceed the board VADJ_FPGA voltage setting.



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Figure 1-14: User SMA Clock

Processing System Clock Source

The Processing System (PS) clock source is a 1.8V LVC MOS single-ended fixed 33.33333 MHz oscillator at U24. It is wired to PS bank 500, pin A22 (PS_CLK), on the XC7Z045 SoC.

- Oscillator: SiTime SiT8103AC-23-18E-33.33333 (33.3 MHz)
- Frequency tolerance: 50 ppm
- Single-ended output

The system clock circuit is shown in [Figure 1-15](#).

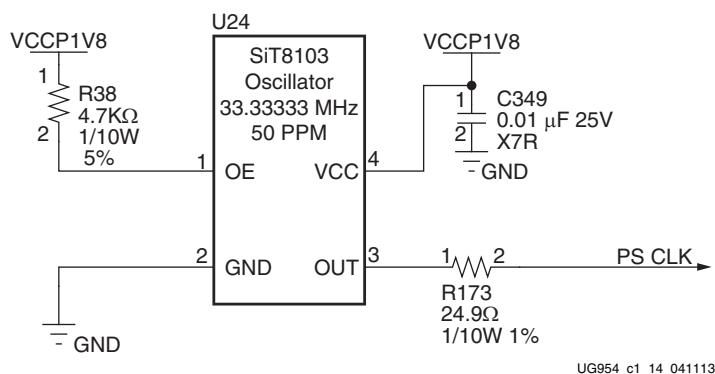


Figure 1-15: Processing System Clock Source

For more details, see the SiTime SiT8103 data sheet [\[Ref 21\]](#).

GTX SMA Clock (SMA_MGT_REFCLK_P and SMA_MGT_REFCLK_N)

[[Figure 1-3](#), callout 10]

The ZC706 board includes a pair of SMA connectors for a GTX clock wired to GTX Quad bank 111. This differential clock has signal names SMA_MGT_REFCLK_P and SMA_MGT_REFCLK_N, which are connected to SoC U1 pins W8 and W7 respectively.

- External user-provided GTX reference clock on SMA input connectors
- Differential Input

Figure 1-16 shows this AC-coupled clock circuit.

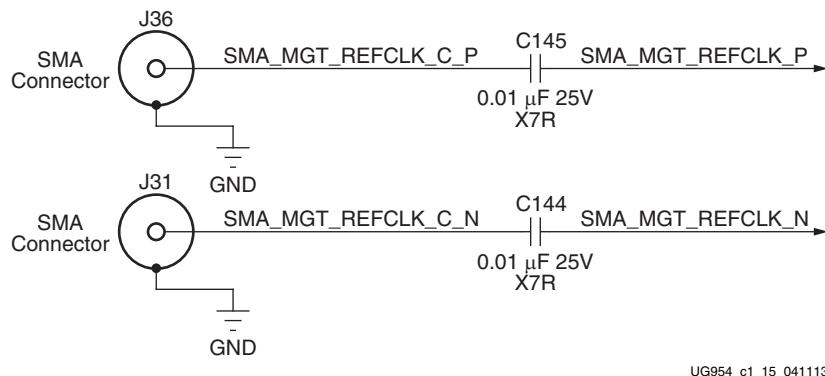


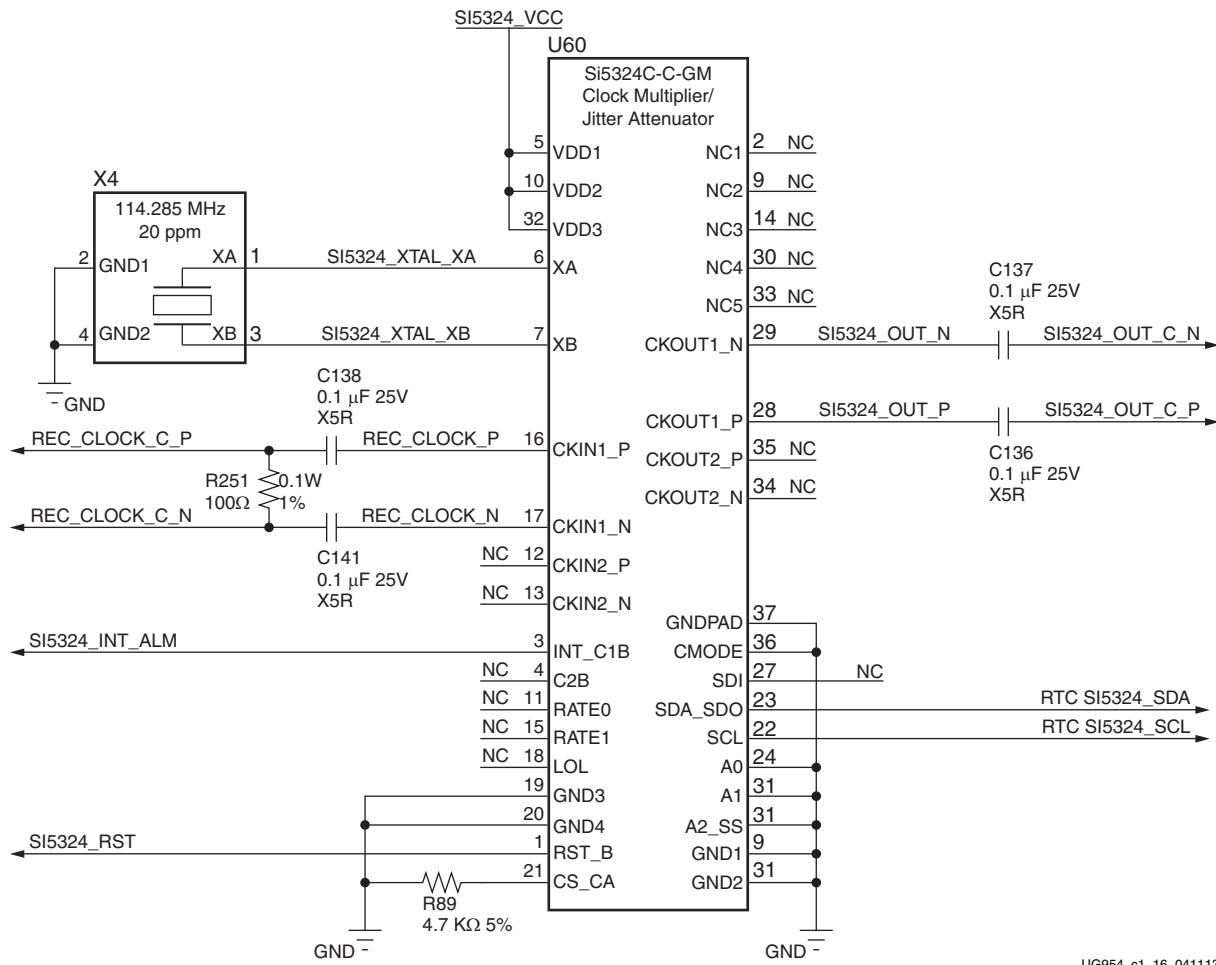
Figure 1-16: GTX SMA Clock Source

Jitter Attenuated Clock

[Figure 1-3, callout 11]

The ZC706 board includes a Silicon Labs Si5324 jitter attenuator U60 on the back side of the board. SoC user logic can implement a clock recovery circuit and then output this clock to a differential I/O pair on I/O bank 9 (REC_CLOCK_C_P, SoC U1 pin AD20 and REC_CLOCK_C_N, SoC U1 pin AE20) for jitter attenuation. The jitter attenuated clock (Si5324_OUT_C_P, Si5324_OUT_C_N) is then routed as a reference clock to GTX Quad 110 inputs MGTRREFCLK1P (SoC U1 pin AC8) and MGTRREFCLK1N (SoC U1 pin AC7).

The primary purpose of this clock is to support CPRI/OBSAI applications that perform clock recovery from a user-supplied SFP/SFP+ module and use the jitter attenuated recovered clock to drive the reference clock inputs of a GTX transceiver. The jitter attenuated clock circuit is shown in Figure 1-17.



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Figure 1-17: Jitter Attenuated Clock

See the Silicon Labs Si5324 data sheet [Ref 22].

GTX Transceivers

[Figure 1-3, callout 12]

The ZC706 board provides access to 16 GTX transceivers:

- Four of the GTX transceivers are wired to the PCI Express x4 endpoint edge connector (P4) fingers
- Eight of the GTX transceivers are wired to the FMC HPC connector (J37)
- One GTX transceiver is wired to the FMC LPC connector (J5)
- One GTX transceiver is wired to SMA connectors (RX: J32, J33 TX: J35, J34)
- One GTX transceiver is wired to the SFP/SFP+ Module connector (P2)

- One GTX transceiver is unused and is wired in a capacitively coupled TX-to-RX loopback configuration

The GTX transceivers in Zynq-7000 series SoCs are grouped into four channels described as Quads. The reference clock for a Quad can be sourced from the Quad above or Quad below the GTX Quad of interest. There are four GTX Quads on the ZC706 board with connectivity as shown here:

- Quad 109:
 - MGTREFCLK0 - FMC_HPC_GBTCLK0_M2C clock
 - MGTREFCLK1 - not connected
 - Contains 4 GTX transceivers allocated to FMC_HPC_DP[3:0]_C2M_P/N
- Quad 110:
 - MGTREFCLK0 - FMC_HPC_GBTCLK1_M2C clock
 - MGTREFCLK1 - SI5324_OUT_C_P/N jitter attenuator clock
 - Contains 4 GTX transceivers allocated to FMC_HPC_DP[7:4]_C2M_P/N
- Quad 111:
 - MGTREFCLK0 - FMC_LPC_GBTCLK0_M2C_C_P/N
 - MGTREFCLK1 - SMA_MGT_REFCLK_P/N SMA GTX clock input
 - Contains 1 GTX transceiver allocated to FMC_LPC_DP0_C2M_P/N
 - Contains 1 GTX transceiver allocated to SMA_MGT_TX_P/N and RX_P/N SMA connectors
 - Contains 1 GTX transceiver allocated to SFP_TX and _RX_P/N SFP/SFP+ connector
 - Contains 1 GTX transceiver which is unused and is wired in TX-to-RX loopback configuration
- Quad 112:
 - MGTREFCLK0 - PCIE_CLK_Q0_P/N PCIe edge connector clock
 - MGTREFCLK1 - not connected
 - Contains 4 GTX transceivers allocated to PCIe lanes 0-3

Table 1-15 lists the GTX Banks 109 and 110 interface connections between the SoC U1 and FMC HPC connector J37.

Table 1-14: SoC GTX Banks 109 and 110 Interface Connections to FMC HPC J37

Transceiver Bank	SoC U1 Pin Number	SoC U1 Pin Name	Schematic Net Name	Connected Pin	Connected Device
GTX_BANK_109	AK10	MGTPTXP0_109	FMC_HPC_DP0_C2M_P	C2	FMC HPC J37
	AK9	MGTPTXN0_109	FMC_HPC_DP0_C2M_N	C3	
	AH10	MGTPRXP0_109	FMC_HPC_DP0_M2C_P	C6	
	AH9	MGTPRXN0_109	FMC_HPC_DP0_M2C_N	C7	
	AK6	MGTPTXP1_109	FMC_HPC_DP1_C2M_P	A22	
	AK5	MGTPTXN1_109	FMC_HPC_DP1_C2M_N	A23	
	AJ8	MGTPRXP1_109	FMC_HPC_DP1_M2C_P	A2	
	AJ7	MGTPRXN1_109	FMC_HPC_DP1_M2C_N	A3	
	AJ4	MGTPTXP2_109	FMC_HPC_DP2_C2M_P	A26	
	AJ3	MGTPTXN2_109	FMC_HPC_DP2_C2M_N	A27	
	AG8	MGTPRXP2_109	FMC_HPC_DP2_M2C_P	A6	
	AG7	MGTPRXN2_109	FMC_HPC_DP2_M2C_N	A7	
	AK2	MGTPTXP3_109	FMC_HPC_DP3_C2M_P	A30	
	AK1	MGTPTXN3_109	FMC_HPC_DP3_C2M_N	A31	
	AE8	MGTPRXP3_109	FMC_HPC_DP3_M2C_P	A10	
	AE7	MGTPRXN3_109	FMC_HPC_DP3_M2C_N	A11	
	AD10	MGTREFCLK0P_109	FMC_HPC_GBTCLK0_M2C_C_P ⁽¹⁾	D4	
	AD9	MGTREFCLK0N_109	FMC_HPC_GBTCLK0_M2C_C_N ⁽¹⁾	D5	
	AF10	MGTREFCLK1P_109	NC	NA	NA
	AF9	MGTREFCLK1N_109	NC	NA	NA

Table 1-14: SoC GTX Banks 109 and 110 Interface Connections to FMC HPC J37 (Cont'd)

Transceiver Bank	SoC U1 Pin Number	SoC U1 Pin Name	Schematic Net Name	Connected Pin	Connected Device
GTX_BANK_110	AH2	MGTPTXP0_110	FMC_HPC_DP4_C2M_P	A34	FMC HPC J37
	AH1	MGTPTXN0_110	FMC_HPC_DP4_C2M_N	A35	
	AH6	MGTPRXP0_110	FMC_HPC_DP4_M2C_P	A14	
	AH5	MGTPRXN0_110	FMC_HPC_DP4_M2C_N	A15	
	AF2	MGTPTXP1_110	FMC_HPC_DP5_C2M_P	A38	
	AF1	MGTPTXN1_110	FMC_HPC_DP5_C2M_N	A39	
	AG4	MGTPRXP1_110	FMC_HPC_DP5_M2C_P	A18	
	AG3	MGTPRXN1_110	FMC_HPC_DP5_M2C_N	A19	
	AE4	MGTPTXP2_110	FMC_HPC_DP6_C2M_P	B36	
	AE3	MGTPTXN2_110	FMC_HPC_DP6_C2M_N	B37	
	AF6	MGTPRXP2_110	FMC_HPC_DP6_M2C_P	B16	
	AF5	MGTPRXN2_110	FMC_HPC_DP6_M2C_N	B17	
	AD2	MGTPTXP3_110	FMC_HPC_DP7_C2M_P	B32	
	AD1	MGTPTXN3_110	FMC_HPC_DP7_C2M_N	B33	
	AD6	MGTPRXP3_110	FMC_HPC_DP7_M2C_P	B12	
	AD5	MGTPRXN3_110	FMC_HPC_DP7_M2C_N	B13	
	AA8	MGTREFCLK0P_110	FMC_HPC_GBTCLK1_M2C_P ⁽¹⁾	B20	
	AA7	MGTREFCLK0N_110	FMC_HPC_GBTCLK1_M2C_N ⁽¹⁾	B21	
	AC8	MGTREFCLK1P_110	SI5324_OUT_C_P ⁽²⁾	28	SI5324C U60
	AC7	MGTREFCLK1N_110	SI5324_OUT_C_N ⁽²⁾	29	

Notes:

1. SoC U1 GTX input clock nets are capacitively coupled to the FMC HPC J37 pins.
2. SoC U1 GTX input clock nets are capacitively coupled to the SI5324C Recovery Clock U60 output pins.

[Table 1-15](#) lists the GTX Bank interface connections between the SoC U1 and FMC LPC connector J5.

Table 1-15: SoC GTX Bank 111 Interface Connections to FMC LPC J5

Transceiver Bank	SoC U1 Pin Number	SoC U1 Pin Name	Schematic Net Name	Connected Pin	Connected Device
GTX_BANK_111	AB2	MGTPTXP0_111	FMC_LPC_DP0_C2M_P	C2	FMC LPC J5
	AB1	MGTPTXN0_111	FMC_LPC_DP0_C2M_N	C3	
	AC4	MGTPRXP0_111	FMC_LPC_DP0_M2C_P	C6	
	AC3	MGTPRXN0_111	FMC_LPC_DP0_M2C_N	C7	
	Y2	MGTPTXP1_111	SMA_MGT_TX_P	J35.1	GTX TX/RX SMA
	Y1	MGTPTXN1_111	SMA_MGT_TX_N	J34.1	
	AB6	MGTPRXP1_111	SMA_MGT_RX_P ⁽²⁾	J32.1	
	AB5	MGTPRXN1_111	SMA_MGT_RX_N ⁽²⁾	J33.1	
	W4	MGTPTXP2_111	SFP_TX_P	18	SFP+ Conn. P2
	W3	MGTPTXN2_111	SFP_TX_N	19	
	Y6	MGTPRXP2_111	SFP_RX_P	13	
	Y5	MGTPRXN2_111	SFP_RX_N	12	
	V2	MGTPTXP3_111	(capacitively coupled to AA4)	U1.AA4	SoC U1 GTX Loopback
	V1	MGTPTXN3_111	(Cooperatively coupled to AA3)	U1.AA3	
	AA4	MGTPRXP3_111	See Pin V2 loopback	U1.V2	
	AA3	MGTPRXN3_111	See Pin V1 loopback	U1.V1	
	U8	MGTREFCLK0P_111	FMC_LPC_GBTCLK0_M2C_C_P ⁽¹⁾	D4	FMC LPC J5
	U7	MGTREFCLK0N_111	FMC_LPC_GBTCLK0_M2C_C_N ⁽¹⁾	D5	
	W8	MGTREFCLK1P_111	SMA_MGT_REFCLK_P ⁽²⁾	J36.1	GTX REFCLK SMA
	W7	MGTREFCLK1N_111	SMA_MGT_REFCLK_N ⁽²⁾	J31.1	

Notes:

1. SoC U1 GTX input clock nets are capacitively coupled to the FMC LPC J5 pins.
2. SoC U1 GTX input nets are capacitively coupled to the RX and MGT_REFCLK SMA pins.

For additional information on Zynq-7000 GTX transceivers, see *7 Series FPGAs GTX/GTH Transceivers User Guide* ([UG476](#)).

PCI Express Endpoint Connectivity

[Figure 1-3, callout 13]

The 4-lane PCI Express edge connector performs data transfers at the rate of 2.5 GT/s for a Gen1 application and 5.0 GT/s for a Gen2 application. The PCIe transmit and receive signal data paths have a characteristic impedance of $85\Omega \pm 10\%$. The PCIe clock is routed as a 100Ω differential pair.

The XC7Z045-2FFG900C SoC (-2 speed grade) included with the ZC706 board supports up to Gen2 x4.

The PCIe clock is input from the edge connector. It is AC coupled to the SoC through the MGTREFCLK0 pins of Quad 112. PCIE_CLK_Q0_P is connected to SoC U1 pin N8, and the _N net is connected to pin N7. The PCIe clock circuit is shown in Figure 1-18.

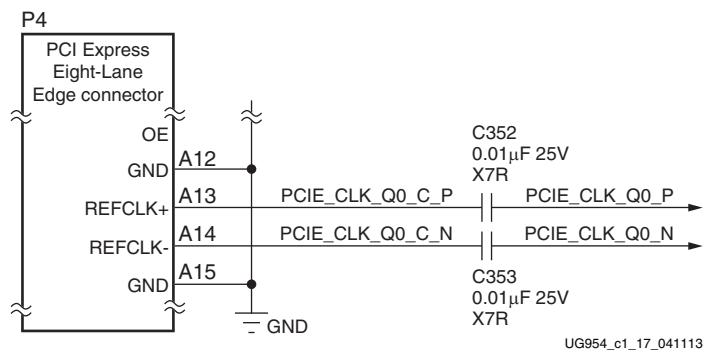


Figure 1-18: PCIe Clock

PCIe lane width/size is selected by jumper J19 (Figure 1-18). The default lane size selection is 4-lane (J19 pins 3 and 4 jumpered).

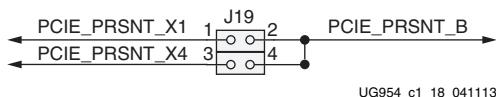


Figure 1-19: PCIe Lane Size Select Jumper J19

Table 1-18 lists the GTX Bank 112 interface connections between the SoC U1 and PCIe 4-lane connector P4.

Table 1-16: SoC GTX Bank 112 Interface Connections to PCIe 4-Lane Connector P4

Transceiver Bank	SoC U1 Pin Number	SoC U1 Pin Name	Schematic Net Name	PCIe 4-Lane Conn. P4 Pin Number
GTX_BANK_112	T2	MGTPTXP0_112	PCIE_TX3_P	A29 (1)
	T1	MGTPTXN0_112	PCIE_TX3_N	A30 (1)
	V6	MGTPRXP0_112	PCIE_RX3_P	B27
	V5	MGTPRXN0_112	PCIE_RX3_N	B28
	R4	MGTPTXP1_112	PCIE_TX2_P	A25 (1)
	R3	MGTPTXN1_112	PCIE_TX2_N	A26 (1)
	U4	MGTPRXP1_112	PCIE_RX2_P	B23
	U3	MGTPRXN1_112	PCIE_RX2_N	B24
	P2	MGTPTXP2_112	PCIE_TX1_P	A21 (1)
	P1	MGTPTXN2_112	PCIE_TX1_N	A22 (1)
	T6	MGTPRXP2_112	PCIE_RX1_P	B19
	T5	MGTPRXN2_112	PCIE_RX1_N	B20
	N4	MGTPTXP3_112	PCIE_TX0_P	A16 (1)
	N3	MGTPTXN3_112	PCIE_TX0_N	A17 (1)
	P6	MGTPRXP3_112	PCIE_RX0_P	B14
	P5	MGTPRXN3_112	PCIE_RX0_N	B15
	N8	MGTREFCLK0P_112	PCIE_CLK_Q0_P	A13 (1)
	N7	MGTREFCLK0N_112	PCIE_CLK_Q0_N	A14 (1)
	R8	MGTREFCLK1P_112	NC	NA
	R7	MGTREFCLK1N_112	NC	NA

Notes:

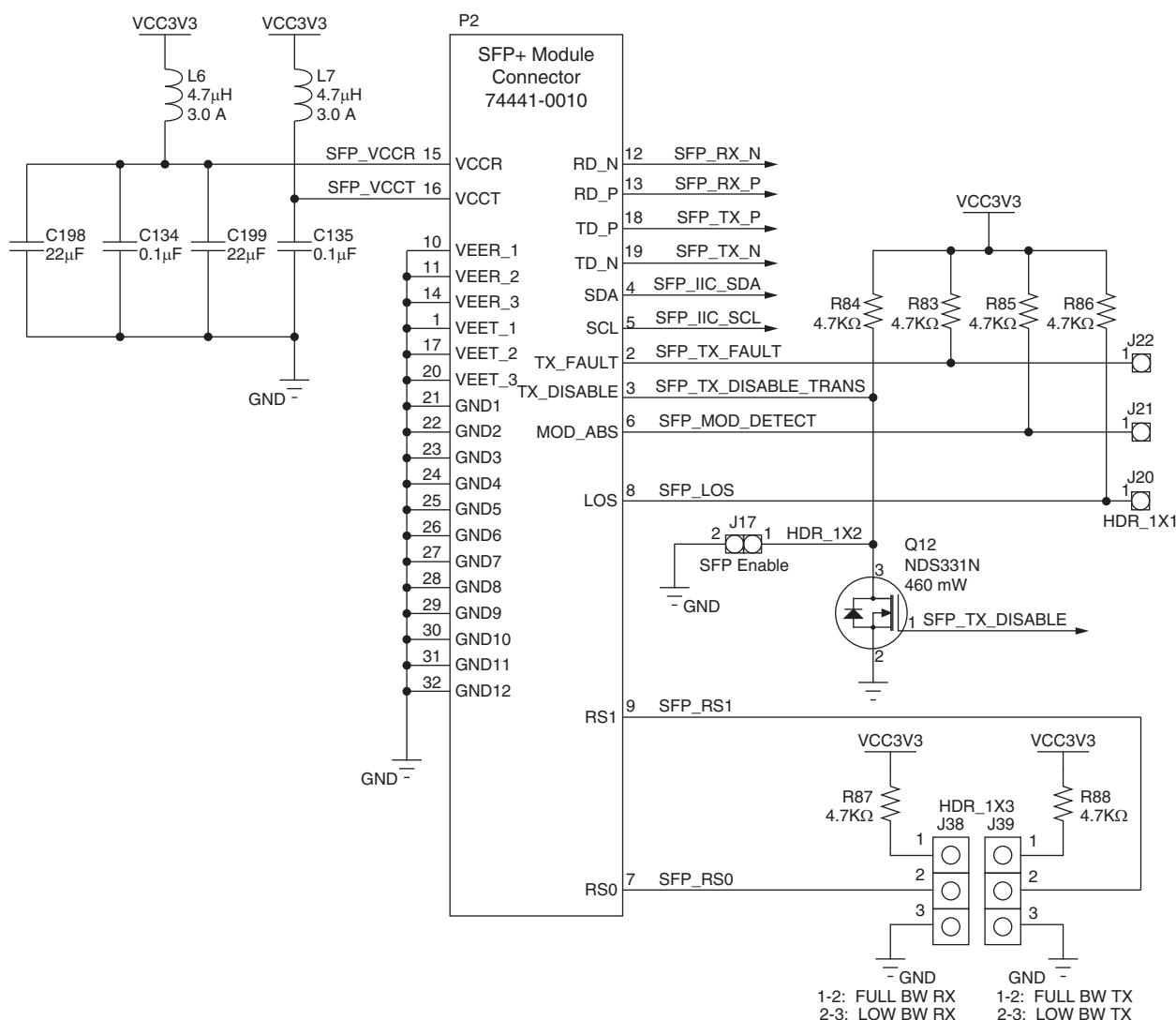
1. PCIE_TXn_P/N and PCIE_CLK_Q0_P/N are capacitively coupled to the PCIe edge connector P4.

For additional information about Zynq-7000 PCIe functionality, see *7 Series FPGAs Integrated Block for PCI Express Product Guide for Vivado Design Suite* ([PG054](#)). Additional information about the PCI Express standard is available [\[Ref 23\]](#).

SFP/SFP+ Module Connector

[Figure 1-3, callout 14]

The ZC706 board contains a small form-factor pluggable (SFP/SFP+) connector and cage assembly P2 that accepts SFP or SFP+ modules. Figure 1-20 shows the SFP/SFP+ module connector circuitry.



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Figure 1-20: SFP+ Module Connector

Table 1-17 lists the SFP+ module RX and TX connections to the SoC.

Table 1-17: SoC U1 to SFP+ Module Connections

SoC (U1) Pin	Schematic Net name	SFP+ Module (P2)	
		Pin	Name
Y5	SFP_RX_N	12	RD_N
Y6	SFP_RX_P	13	RD_P
W4	SFP_TX_P	18	TD_P
W3	SFP_TX_N	19	TD_N
AA18	SFP_TX_DISABLE_TRANS	3	TX_DISABLE

Table 1-18 lists the SFP+ module control and status connections to the SoC.

Table 1-18: SFP+ Module Control and Status Connections

SFP Control/ Status Signal	Board Connection	
SFP_TX_FAULT	Test Point J23	High = Fault
		Low = Normal operation
SFP_TX_DISABLE	Jumper 17	Off = SFP Disabled
		On = SFP enabled
SFP_MOD_DETECT	Test Point J24	High = Module not present
		Low = Module present
SFP_RS0	Jumper 56	Jumper pins 1-2 = Full RX bandwidth
		Jumper pins 2-3 = Reduced RX bandwidth
SFP_RS1	Jumper 55	Jumper pins 1-2 = Full TX bandwidth
		Jumper pins 2-3 = Reduced TX bandwidth
SFP_LOS	Test Point J25	High = Loss of receiver signal
		Low = Normal operation

For additional information about the enhanced Small Form Factor Pluggable (SFP+) module, see the SFF-8431 specification [\[Ref 24\]](#).

10/100/1000 Mb/s Tri-Speed Ethernet PHY (PS)

[Figure 1-3, callout 15]

The ZC706 evaluation board uses the Marvell Alaska PHY device (88E1116R) at U51 for Ethernet communications at 10 Mb/s, 100 Mb/s, or 1000 Mb/s. The board supports RGMII mode only. The PHY connection to a user-provided Ethernet cable is through a Halo HFJ11-1G01E RJ-45 connector (P3) with built-in magnetics.

On power-up, or on reset, the PHY is configured to operate in RGMII mode with PHY address 0b00111 using the settings shown in [Table 1-19](#). These settings can be overwritten via software commands passed over the MDIO interface.

Table 1-19: Board Connections for PHY Configuration Pins

U51 Pin	Setting	Configuration	
CONFIG (64)	VCCP1V8	PHYAD[1]=1	PHYAD[0]=1
CONFIG1 (1)	PHY_LED0	PHYAD[3]=0	PHYAD[2]=1
CONFIG2 (2)	GND	ENA_XC=0	PHYAD[4]=0
	PHY_LED0	ENA_XC=0	PHYAD[4]=1
	VCCP1V8	ENA_XC=1	PHYAD[4]=1
CONFIG3 (3)	GND	RGMII_TX=0	RGMII_RX=0
	PHY_LED0	RGMII_TX=0	RGMII_RX=1
	PHY_LED1	RGMII_TX=1	RGMII_RX=0
	VCCP1V8	RGMII_TX=1	RGMII_RX=1

The Ethernet connections from the XC7Z045 SoC at U1 to the 88E1116R PHY device at U51 are listed in [Table 1-20](#).

Table 1-20: Ethernet Connections, XC7Z045 SoC to the PHY Device

XC7Z045 (U1) Pin			Schematic Net Name	M88E1116R PHY U51	
Pin Name	Bank	Pin Number		Pin	Name
PS_MIO53	501	C18	PHY_MDIO	45	MDIO
PS_MIO52	501	D19	PHY_MDC	48	MDC
PS_MIO16	501	L19	PHY_TX_CLK	60	TX_CLK
PS_MIO21	501	J19	PHY_TX_CTRL	63	TX_CTRL
PS_MIO20	501	M20	PHY_TXD3	62	TXD3
PS_MIO19	501	J20	PHY_TXD2	61	TXD2
PS_MIO18	501	K20	PHY_TXD1	59	TXD1
PS_MIO17	501	K21	PHY_TXD0	58	TXD0
PS_MIO22	501	L20	PHY_RX_CLK	53	RX_CLK
PS_MIO27	501	G20	PHY_RX_CTRL	49	RX_CTRL
PS_MIO26	501	M17	PHY_RXD3	55	RXD3
PS_MIO25	501	G19	PHY_RXD2	54	RXD2
PS_MIO24	501	M19	PHY_RXD1	51	RXD1
PS_MIO23	501	J21	PHY_RXD0	50	RXD0

Ethernet PHY Clock Source

A 25.00 MHz 50 ppm crystal at X1 is the clock source for the 881116R PHY at U51. [Figure 1-21](#) shows the clock source.

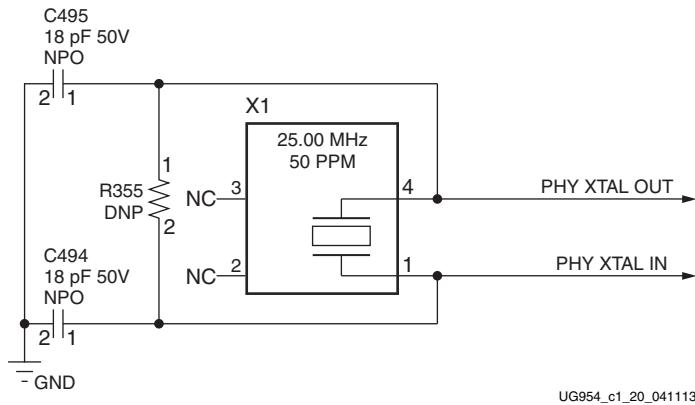


Figure 1-21: Ethernet PHY Clock Source

The data sheet can be obtained under NDA with Marvell. Contact information can be found at their website [\[Ref 25\]](#).

For additional information on the Zynq-7000 SoC device gigabit Ethernet controller, see *Zynq-7000 SoC Overview* ([DS190](#)) and *Zynq-7000 SoC Technical Reference Manual* ([UG585](#)).

USB-to-UART Bridge

[[Figure 1-3](#), callout 17]

The ZC706 evaluation board contains a Silicon Labs CP2103GM USB-to-UART bridge device (U52) which allows a connection to a host computer with a USB port. The USB cable is supplied in the ZC706 evaluation kit (Standard-A end to host computer, Type Mini-B end to ZC706 evaluation board connector J21). The CP2103GM is powered by the USB 5V provided by the host PC when the USB cable is plugged into the USB port on the ZC706 evaluation board.

The CP2013GM TX and RX pins are wired to the UART_1 IP block within the XC7Z045 SoC PS I/O Peripherals set. The XC7Z045 SoC supports the USB-to-UART bridge using two signal pins: Transmit (TX) and Receive (RX).

Silicon Labs provides royalty-free Virtual COM Port (VCP) drivers for the host computer. These drivers permit the CP2103GM USB-to-UART bridge to appear as a COM port to communications application software (for example, TeraTerm 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 ZC706 evaluation board.

The USB Connector pin assignments and signal definitions between J21 and U52 are listed in [Table 1-21](#).

Table 1-21: USB Connector J21 Pin Assignments and Signal Definitions

USB Connector (J21)		Net Name	Description	CP2103GM (U52)	
Pin	Name			Pin	Name
1	VBUS	USB_UART_VBUS	+5V VBUS Powered	7	REGIN
				8	VBUS
2	D_N	USB_UART_D_N	Bidirectional differential serial data (N-side)	4	D -
3	D_P	USB_UART_D_P	Bidirectional differential serial data (P-side)	3	D +
5	GND	USB_UART_GND	Signal ground	2	GND1
				29	CNR_GND

Table 1-22 lists the USB connections between the XC7Z045 SoC PS Bank 501 and the CP2103 UART bridge.

Table 1-22: XC7Z045 SoC to CP2103 Connections

XC7045 SoC (U1)						Schematic Net Name	CP2103GM Device (U52)		
Pin Name	Bank	PIN	Function	Direction	IOSTANDARD		PIN	Function	Direction
PS_MIO48	501	C19	TX	Output	LVCMOS18	USB_UART_RX	24	RXD	Input
PS_MIO49	501	D18	RX	Input	LVCMOS18	USB_UART_TX	25	TXD	Output

Refer to the Silicon Labs website for technical information on the CP2103GM and the VCP drivers [Ref 22].

For additional information on the Zynq-7000 SoC device UART controller, see *Zynq-7000 SoC Overview (DS190)* and *Zynq-7000 SoC Technical Reference Manual (UG585)*.

HDMI Video Output

[Figure 1-3, callout 18]

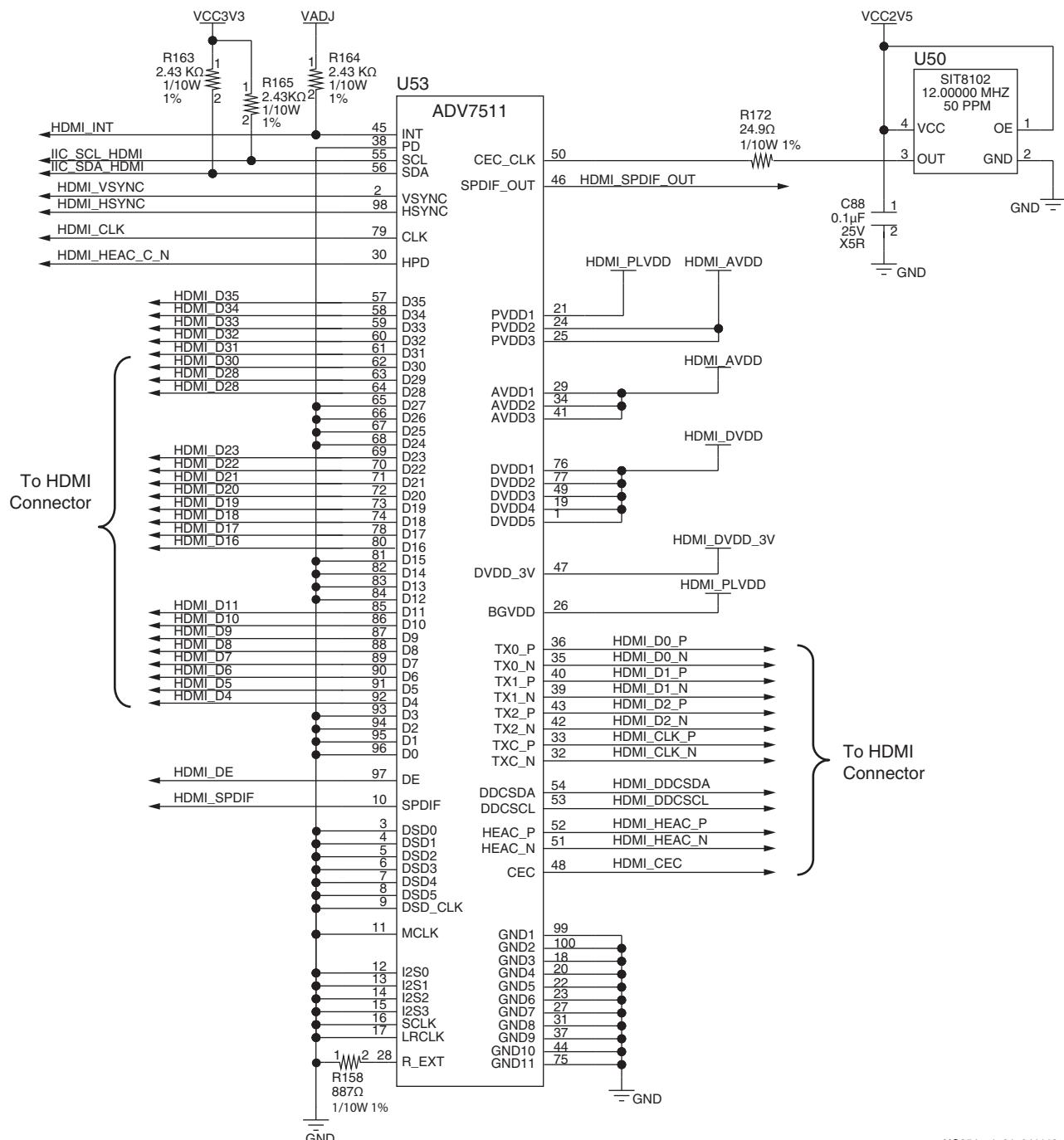
The ZC706 evaluation board provides a high-definition multimedia interface (HDMI®) video output using an Analog Devices ADV7511KSTZ-P HDMI transmitter at U53. The HDMI transmitter U53 is connected to the XC7Z045 SoC PL-side banks 12 and 13 and its output is provided on a Molex 500254-1927 HDMI type-A receptacle at P1. The ADV7511 supports 1080P 60Hz, YCbCr 4:4:4 encoding via 24-bit input data mapping.

The ZC706 evaluation board supports the following HDMI device interfaces:

- 24 data lines
- Independent VSYNC, HSYNC
- Single-ended input CLK
- Interrupt Out pin to XC7Z045 SoC

- I²C
- SPDIF

Figure 1-22 shows the HDMI codec circuit.



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Figure 1-22: HDMI Codec Circuit

Table 1-23 lists the connections between the codec and the XC7Z045 SoC.

Table 1-23: XC7Z045 SoC U1 to HDMI Codec Connections (ADV7511)

XC7Z045 (U1) Pin	Net Name	I/O Standard	ADV7511 (U53)	
			Pin Number	Pin Name
U24	HDMI_R_D4	LVCMOS25	92	D4
T22	HDMI_R_D5	LVCMOS25	91	D5
R23	HDMI_R_D6	LVCMOS25	90	D6
AA25	HDMI_R_D7	LVCMOS25	89	D7
AE28	HDMI_R_D8	LVCMOS25	88	D8
T23	HDMI_R_D9	LVCMOS25	87	D9
AB25	HDMI_R_D10	LVCMOS25	86	D10
T27	HDMI_R_D11	LVCMOS25	85	D11
AD26	HDMI_R_D16	LVCMOS25	80	D16
AB26	HDMI_R_D17	LVCMOS25	78	D17
AA28	HDMI_R_D18	LVCMOS25	74	D18
AC26	HDMI_R_D19	LVCMOS25	73	D19
AE30	HDMI_R_D20	LVCMOS25	72	D20
Y25	HDMI_R_D21	LVCMOS25	71	D21
AA29	HDMI_R_D22	LVCMOS25	70	D22
AD30	HDMI_R_D23	LVCMOS25	69	D23
Y28	HDMI_R_D28	LVCMOS25	64	D28
AF28	HDMI_R_D29	LVCMOS25	63	D29
V22	HDMI_R_D30	LVCMOS25	62	D30
AA27	HDMI_R_D31	LVCMOS25	61	D31
U22	HDMI_R_D32	LVCMOS25	60	D32
N28	HDMI_R_D33	LVCMOS25	59	D33
V21	HDMI_R_D34	LVCMOS25	58	D34
AC22	HDMI_R_D35	LVCMOS25	57	D35
V24	HDMI_R_DE	LVCMOS25	97	DE
R22	HDMI_R_HSYNC	LVCMOS25	98	HSYNC
U21	HDMI_R_VSYNC	LVCMOS25	2	VSYNC
P28	HDMI_R_CLK	LVCMOS25	79	CLK
AC23	HDMI_INT	LVCMOS25	45	INT
AC21	HDMI_R_SPDIF	LVCMOS25	10	SPDIF
AB22	HDMI_SPDIF_OUT_LS	LVCMOS25	46	SPDIF_OUT

Table 1-24 lists the connections between the codec and the HDMI receptacle P1.

Table 1-24: ADV7511 to HDMI Receptacle Connections

ADV7511 (U53)	Net Name	HDMI Receptacle P1 Pin
36	HDMI_D0_P	7
35	HDMI_D0_N	9
40	HDMI_D1_P	4
39	HDMI_D1_N	6
43	HDMI_D2_P	1
42	HDMI_D2_N	3
33	HDMI_CLK_P	10
32	HDMI_CLK_N	12
54	HDMI_DDCSDA	16
53	HDMI_DDCSCL	15
52	HDMI_HEAC_P	14
51	HDMI_HEAC_N	19
48	HDMI_CEC	13

Information about the ADV7511KSTZ-P is available on the Analog Devices website [Ref 26].

For additional information about HDMI IP options, see the *LogiCORE IP DisplayPort Product Guide for Vivado Design Suite* ([PG064](#)).

I²C Bus

[Figure 1-3, callout 20]

The ZC706 evaluation board implements two I²C ports on the XC7Z045 SoC. The PL-side I²C port (IIC_SDA and _SCL_MAIN) is routed to level shifter U87. The PS-side I²C port (PS_SDA and _SCL_MAIN) is routed to level shifter U88. The "output" side of the two level shifters are wired to the common I²C bus IIC_SDA and _SCL_MAIN which is connected to TI Semiconductor PCA9548 1-to-8 channel I²C bus switch (U65). The bus switch can operate at speeds up to 400 kHz.



IMPORTANT: The PCA9548 U65 RESET_B pin 24 is connected to FPGA U1 bank 501 pin F20 via level-shifter U25. FPGA pin F20 net IIC_MUX_RESET_B_LS must be driven High to enable I²C bus transactions with the devices connected to U65.

The ZC706 evaluation board I²C bus topology is shown in [Figure 1-23](#).

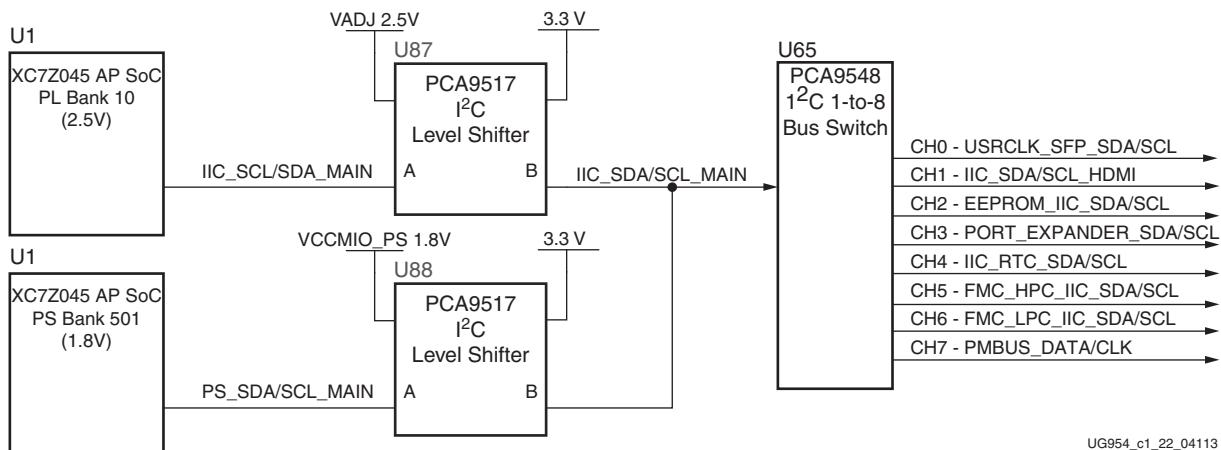


Figure 1-23: I²C Bus Topology

User applications that communicate with devices on one of the downstream I²C buses must first set up a path to the desired bus through the U65 bus switch at I²C address 0x74 (0b01110100). [Table 1-25](#) lists the address for each bus.

Table 1-25: I²C Bus Addresses

Device	I ² C Switch Position	I ² C Address	Device
PCA9548 8-Channel bus switch	NA	0b1110100	PCA9548 U65
Si570 clock	0	0b1011101	Si570 U37
		0b1010000	SFP+ Conn. P2
ADV7511 HDMI	1	0b0111001	ADV7511 U53
I ² C EEPROM	2	0b1010100	M24C08 U9
I ² C port expander and DDR3 SODIMM	3	0b0100001	Port Expander U16
		0b1010000	DDR3 SODIMM J1
		0b0011000	
I ² C real time clock and Si5324 clock	4	0b1010001	RTC8564JE U26
		0b1101000	SI5324 U60
FMC HPC	5	0bxxxxxx00	FMC HPC J37
FMC LPC	6	0bxxxxxx00	FMC LPC J5
UCD90120A pmbus	7	0b1100101	UCD90120A U48

Information about the PCA9548 is available on the TI Semiconductor website at [\[Ref 27\]](#).

For additional information on the Zynq-7000 SoC device I²C controller, see *Zynq-7000 SoC Overview* ([DS190](#)) and *Zynq-7000 SoC Technical Reference Manual* ([UG585](#)).

Real Time Clock (RTC)

The Epson RTC-8564JE (U26) is an I²C bus interface real-time clock that has a built-in 32.768 KHz oscillator with these features:

- Frequency output options: 32.768 KHz, 1,024 Hz, 32 Hz or 1 Hz
- Calendar output functions: Year, month, day, weekday, hour, minute and second
- Clock counter, alarm and fixed-cycle timer interrupt functions
- Back-up battery B3 Panasonic ML621S/DN, 3.0V rechargeable cell

Programming information for the RTC-8564JE is available in the *RTC-8564JE/NB Application Manual* [Ref 30].

Figure 1-24 shows the real time clock circuit.

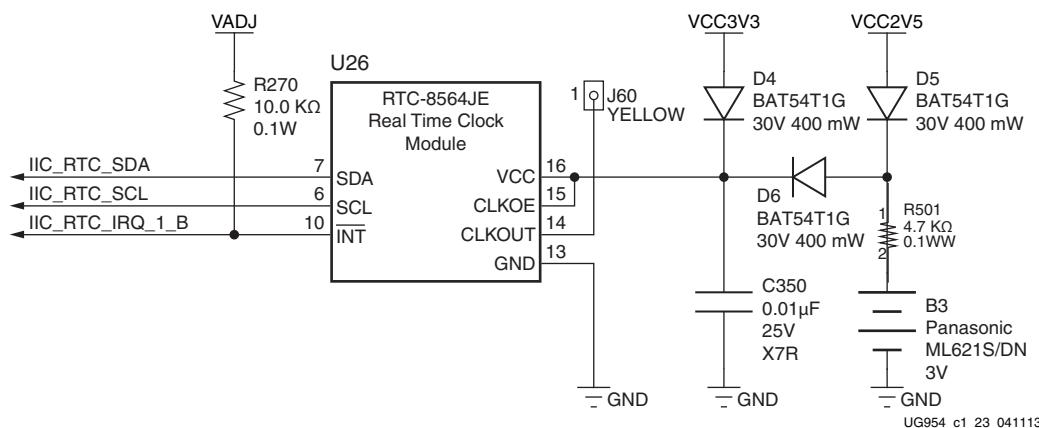


Figure 1-24: Real Time Clock Circuit

Real time clock connections to the XC7Z045 SoC and the PCA9548 8-Channel bus switch are listed in Table 1-26. Refer to Table 1-25 for the RTC I²C address.

Table 1-26: Real Time Clock Connections

RTC-8564JE (U16) Pin	Net Name	Connects To
6	IIC_RTC_SCL	U65.11 (PCA9548 SC4)
7	IIC_RTC_SDA	U65.10 (PCA9548 SD4)
10	IIC_RTC_IRQ_1_B	U1.AA17 (XC7Z045 SoC PL BANK 10)

Information about the RTC-8564JE is available at the Epson Electronics America website [Ref 31].

Status and User LEDs

Table 1-27 defines the status and user LEDs.

Table 1-27: Status LEDs

Reference Designator	Net Name	LED Color	Description
DS1	POR	RED	Processor System Power-ON reset is active
DS2	FPGA_INIT_B	GRN/RED	Green: FPGA initialization was successful Red: FPGA initialization is in progress
DS3	DONE	GRN	FPGA bit file download is complete
DS8	GPIO_LED_LEFT	GRN	Geographically LEFT located user LED
DS9	GPIO_LED_CENTER	GRN	Geographically CENTER located user LED
DS10	GPIO_LED_RIGHT	GRN	Geographically RIGHT located user LED
DS11	VCCINT	GRN	VCCINT voltage on indicator
DS13	VCC1V5_PL	GRN	VCC1V5_PL voltage on indicator
DS15	VADJ_FPGA	GRN	VADJ_FPGA voltage on indicator
DS16	VCC3V3_FPGA	GRN	VCC3V3 voltage on indicator
DS20	PS_DDR_LINEAR_PG	GRN	VTTDDR_PS voltage on indicator
DS21	SODIMM_DDR_LINEAR_PG	GRN	VTTDDR_SODIMM voltage on indicator
DS22	VCC12_P	GRN	VCC12_P voltage on indicator
DS23	PWRCTL1_FMC_PG_C2M	GRN	FMC power good INDICATOR
DS24	CTRL1_PWRGOOD	GRN	Power Controller controlled voltage regulator outputs are all \geq their minimum "good" threshold
DS25	U22_FLG	RED	USB 2.0 MOSFET power switch fault
DS26	LINEAR_POWER_GOOD	GRN	MGTAVCC, MGTAVTT, MGTVCVAUX voltage regulator outputs are all \geq their minimum "good" threshold
DS27	VCCAUX	GRN	VCCAUX voltage on indicator
DS28	PHY_LED0	GRN	Ethernet PHY LED0
DS29	PHY_LED1	GRN	Ethernet PHY LED1
DS30	PHY_LED2	GRN	Ethernet PHY LED2
DS35	GPIO_LED_0	GRN	General Purpose user LED

Ethernet PHY User LEDs

[Figure 1-3, callout 21]

The three Ethernet PHY user LEDs shown in Figure 1-25 are located near the RJ45 Ethernet jack P3. The on/off state for each LED is software dependent and has no specific meaning at Ethernet PHY power on.

Refer to the Marvell 881116R Alaska Gigabit Ethernet transceiver data sheet for details concerning the use of the Ethernet PHY user LEDs. They are referred to in the data sheet as LED0, LED1, and LED2. See the data sheet and other product information for the Marvell 881116R Alaska Gigabit Ethernet Transceiver [Ref 25].

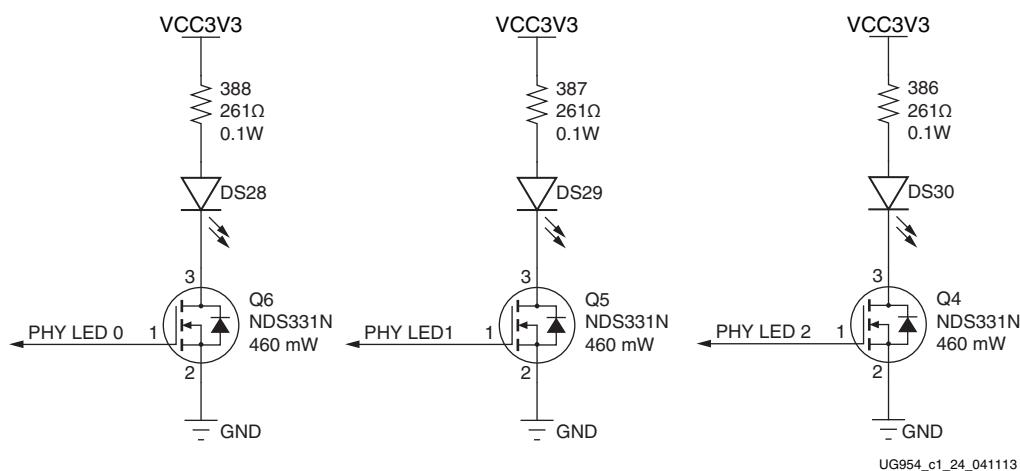


Figure 1-25: Ethernet PHY User LEDs

User I/O

[Figure 1-3, callout 22–24]

The ZC706 evaluation board provides the following user and general purpose I/O capabilities:

- Four user LEDs (callout 22)
 - GPIO_LED_LEFT DS8, GPIO_LED_CENTER DS9, GPIO_LED_RIGHT DS10, GPIO_LED_0 DS35
- Three user pushbuttons (callout 23)
 - GPIO_SW_LEFT SW7, GPIO_SW_CENTER SW9, GPIO_SW_RIGHT SW8
- PL CPU reset pushbutton
 - PL_CPU_RESET SW13
- 4-position user DIP Switch (callout 24)

- GPIO_DIP_SW[3:0] SW12
- Two user GPIO male pin headers (callout 26)
- 2 x 6 0.1 in. pitch PMOD1 J57
- 2 x 6 0.1 in. pitch PMOD2 J58

User LEDs

[Figure 1-3, callout 22]

The ZC706 evaluation board supports four user LEDs connected to XC7Z045 SoC Banks 11, 33, and 35. Figure 1-26 shows the user LED circuits.

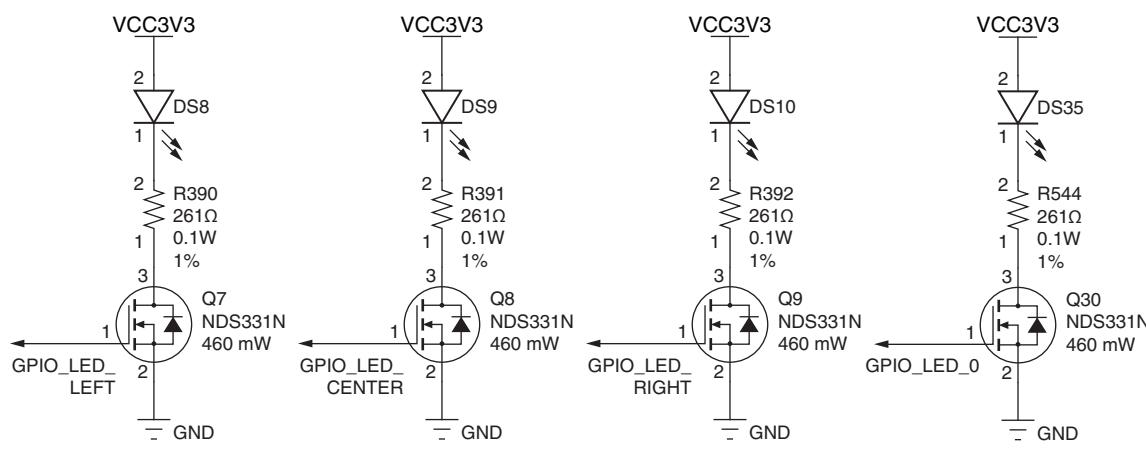


Figure 1-26: User LEDs

Table 1-28 lists the user LED connections to XC7Z045 SoC U1.

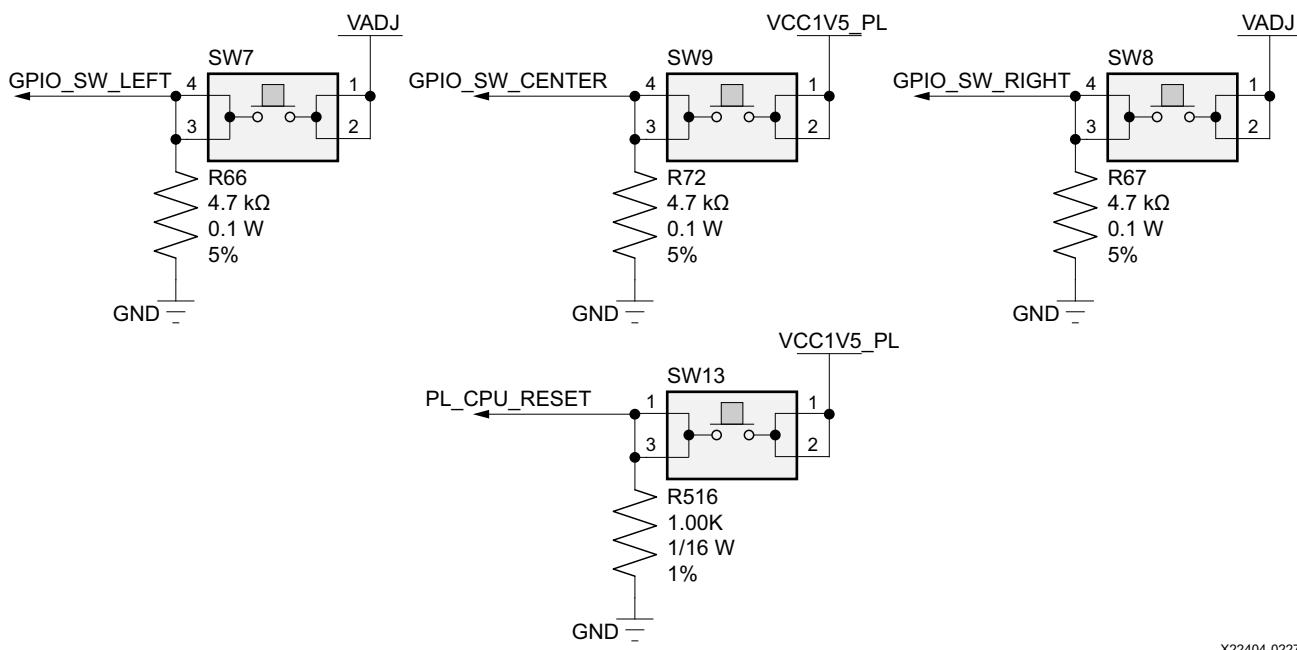
Table 1-28: User LED Connections to XC7Z045 SoC U1

XC7Z045 SoC (U1) Pin	Net Name	I/O Standard	LED Reference
Y21	GPIO_LED_LEFT	LVCMS25	DS8
G2	GPIO_LED_CENTER	LVCMS25	DS9
W21	GPIO_LED_RIGHT	LVCMS25	DS10
A17	GPIO_LED_0	LVCMS25	DS35

User Pushbuttons

[Figure 1-3, callout 23]

Figure 1-27 shows the user pushbutton circuits.



X22404-022719

Figure 1-27: User Pushbuttons

Table 1-29 lists the user pushbutton connections to XC7Z045 SoC U1.

Table 1-29: User Pushbutton Connections to XC7Z045 SoC U1

XC7Z045 SoC (U1) Pin	Net Name	I/O Standard	Pushbutton Reference
AK25	GPIO_SW_LEFT	LVCMS25	SW7
K15	GPIO_SW_CENTER	LVCMS15	SW9
R27	GPIO_SW_RIGHT	LVCMS25	SW8
A8	PL_CPU_RESET	LVCMS15	SW13

GPIO DIP Switch

Figure 1-28 shows the GPIO DIP switch circuit.

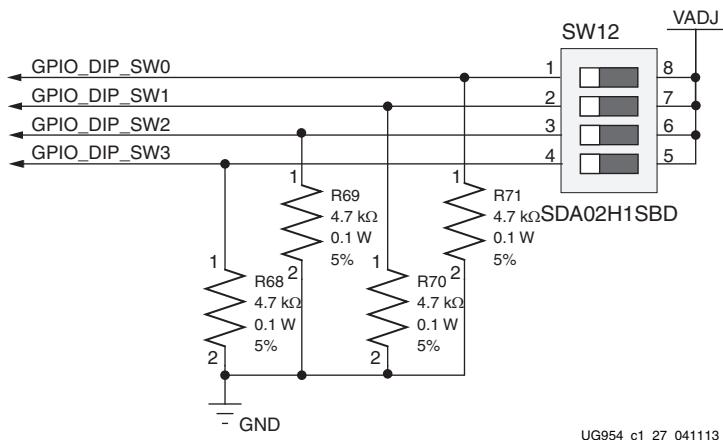


Figure 1-28: **GPIO DIP Switch**

Table 1-30 lists the GPIO DIP switch connections to XC7Z045 SoC U1.

Table 1-30: **GPIO DIP Switch Connections to XC7Z045 SoC at U1**

XC7Z045 SOC (U1) Pin	Net Name	I/O Standard	DIP Switch SW12 Pin
AB17	GPIO_DIP_SW0	LVCMOS25	1
AC16	GPIO_DIP_SW1	LVCMOS25	2
AC17	GPIO_DIP_SW2	LVCMOS25	3
AJ13	GPIO_DIP_SW3	LVCMOS25	4

User PMOD GPIO Headers

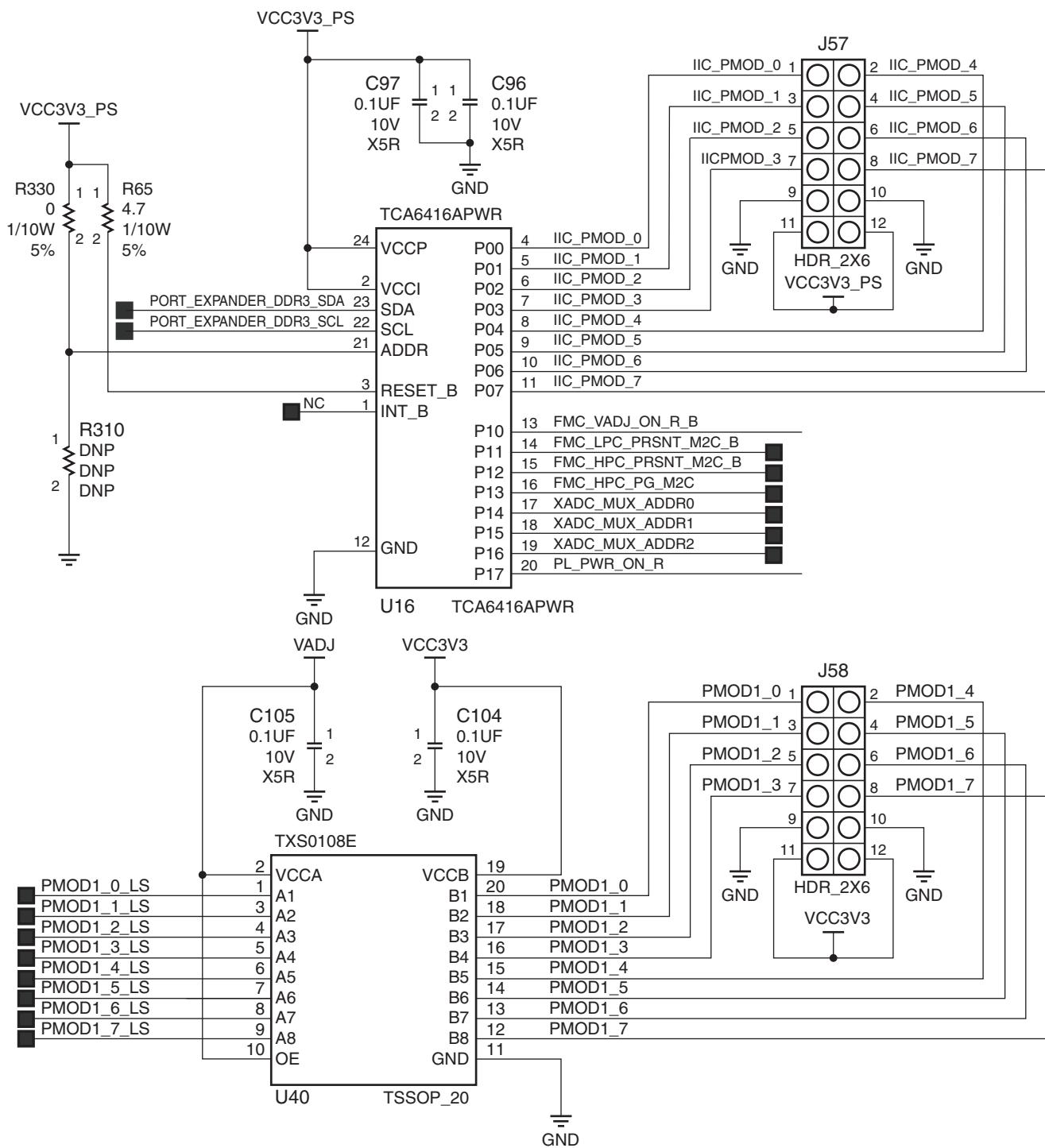
[Figure 1-3, callout 26]

The ZC706 evaluation board GPIO 2 x 6 male headers J57 and J58 support Digilent Pmod Peripheral Modules. J57 pins (IIC_PMOD_[0:7]) are connected to the TI TCA6416APWR I2C expansion port device U16. J58 pins (PMOD1_[0:7]) are connected to the TI TXS0108E 3.3V-to-VADJ level-shifter U40.

See the Digilent website for information on Digilent Pmod Peripheral Modules [Ref 36].

Information about the TCA641APWR and TXS0108E devices is available at the Texas Instruments website [Ref 27].

Figure 1-29 shows the user GPIO male pin header circuits.



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Figure 1-29: User GPIO Headers

[Table 1-31](#) lists the GPIO Header connections to XC7Z045 SoC U1.

Table 1-31: GPIO Header Connections to XC7Z045 SoC at U1

TCA6416APWR (U16) PORT: Pin	Net Name	GPIO Header J57 Pin
P00:4	IIC_PMOD_0	J57.1
P01:5	IIC_PMOD_1	J57.3
P02:6	IIC_PMOD_2	J57.5
P03:7	IIC_PMOD_3	J57.7
P04:8	IIC_PMOD_4	J57.2
P05:9	IIC_PMOD_5	J57.4
P06:10	IIC_PMOD_6	J57.6
P07:11	IIC_PMOD_7	J57.8
XC7Z045 SoC (U1) Pin	Net Name	GPIO Header J58 Pin
AJ21	PMOD1_0	J58.1
AK21	PMOD1_1	J58.3
AB21	PMOD1_2	J58.5
AB16	PMOD1_3	J58.7
Y20	PMOD1_4	J58.2
AA20	PMOD1_5	J58.4
AC18	PMOD1_6	J58.6
AC19	PMOD1_7	J58.8

See *Zynq-7000 SoC Technical Reference Manual* ([UG585](#)) for information about the PS PJTAG functionality.

Switches

The ZC706 evaluation board includes a power and a configuration (PL PROG_B) switch:

- Power On/Off slide switch SW1 (callout [27](#))
- SW10 (FPGA_PROG_B), active-Low pushbutton (callout [28](#))
- PS System Reset Pushbuttons

Power On/Off Slide Switch

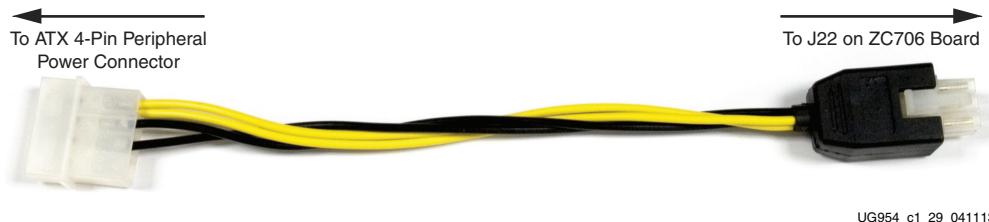
[[Figure 1-3](#), callout 27]

The ZC706 evaluation board power switch is SW1. Sliding the switch actuator from the Off to On position applies 12V power from J22 a 6-pin mini-fit connector. Green LED DS22 illuminates when the ZC706 evaluation board power is on. See [Power Management](#) for details on the onboard power system.



CAUTION! Do NOT plug a PC ATX power supply 6-pin connector into J22 on the ZC706 Evaluation Board. The ATX 6-pin connector has a different pinout than J22. Connecting an ATX 6-pin connector into J22 will damage the ZC706 Evaluation Board and void the board warranty.

The ZC706 evaluation kit provides the adapter cable shown in [Figure 1-30](#) for powering the ZC706 board from the ATX power supply 4-pin peripheral connector. The Xilinx part number for this cable is 2600304, and is equivalent to Sourcegate Technologies part number AZCBL-WH-1109-RA4. For information on ordering this cable, see [\[Ref 37\]](#).



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Figure 1-30: ATX Power Supply Adapter Cable

[Figure 1-31](#) shows the power connector J22, power switch SW1 and indicator LED DS22.

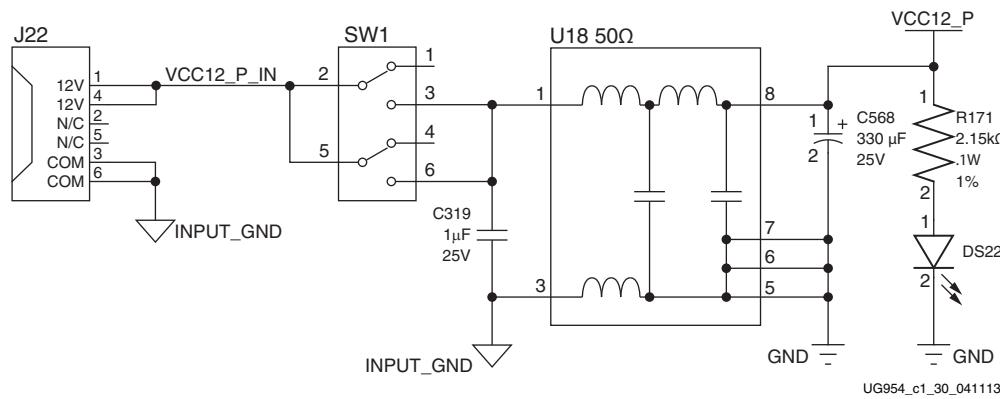


Figure 1-31: Power On/Off Switch SW1

Program_B Pushbutton

[[Figure 1-3](#), callout 28]

Switch SW10 grounds the XC7Z045 SoC PROG_B pin when pressed. This action clears the programmable logic configuration. The FPGA_PROG_B signal is connected to XC7Z045 SoC U1 pin Y9.

See *7 Series FPGAs Configuration User Guide*, ([UG470](#)) for further details on configuring the 7 series FPGAs.

Figure 1-32 shows SW10.

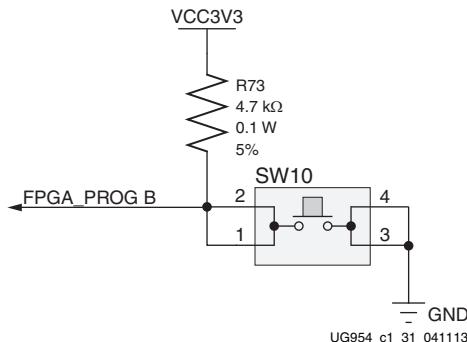
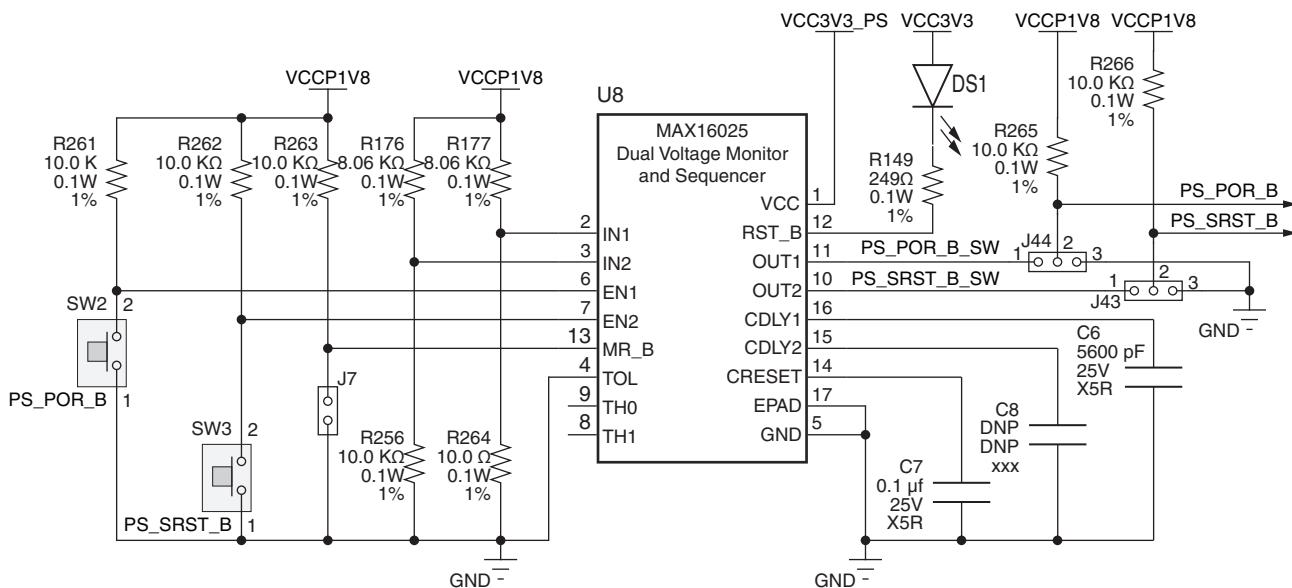


Figure 1-32: PROG_B Pushbutton SW10

PS Power-On and System Reset Pushbuttons

Figure 1-33 shows the reset circuitry for the processing system.



C8 = DNP, SRST delay = 35 µS
C6 = 5600 pF, POR delay = 22.4 mS

UG954_c1_32_032916

Figure 1-33: PS Power On and System Reset Circuitry

Depressing and then releasing pushbutton SW1 causes PS_POR_B_SW to strobe low.

PS_POR_B: This reset is used to hold the PS in reset until all PS power supplies are at the required voltage levels. It must be held Low through PS power-up. PS_POR_B should be generated by the power supply *power-good* signal.

Depressing and then releasing pushbutton SW3 causes PS_SRST_B_SW (connected to the XC7Z045 SoC U1 dedicated PS Bank 500 pin D21) to strobe low.

PS_SRST_B: This reset is used to force a system reset. It can be tied or pulled High, and can be High during the PS supply power ramps.

See *Zynq-7000 SoC Technical Reference Manual* ([UG585](#)) for information concerning the resets.

FPGA Mezzanine (FMC) Card Interface

[[Figure 1-3](#), callout 30 and 31]

The ZC706 evaluation board supports the VITA 57.1 FPGA Mezzanine Card (FMC) specification by providing subset implementations of the high pin count (HPC) connector at J37 and low pin count (LPC) version at J5. Both connectors use a 10 x 40 form factor. The HPC connector is populated with 400 pins, while the LPC connector is partially populated with 160 pins. The connectors are keyed so that a mezzanine card, when installed in either of these FMC connectors on the ZC706 evaluation board, faces away from the ZC706 board.

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 32](#)]. More information about the VITA 57.1 FMC specification is available at the VITA FMC Marketing Alliance website [[Ref 38](#)].

HPC Connector J37

[[Figure 1-3](#), callout 30]

The 400-pin HPC connector defined by the FMC specification ([Figure B-2, page 93](#)) provides connectivity for up to:

- 160 single-ended or 80 differential user-defined signals
- 10 GTX transceivers
- 2 GTX clocks
- 4 differential clocks
- 159 ground and 15 power connections

The connections between the HPC connector at J37 and SoC U1 ([Table 1-32](#)) implements a subset of this connectivity:

- 34 differential user-defined pairs (34 LA pairs, LA00–LA33)

- 8 GTX transceivers
- 2 GTX clocks
- 2 differential clocks
- 159 ground and 15 power connections

The ZC706 board V_{ADJ} voltage for the J37 and J5 connectors is determined by the FMC V_{ADJ} power sequencing logic described in the [Power Management, page 79](#).

Note: HPC FMC (J37) GA0 = GA1 = 0 = GND.

[Table 1-32](#) shows the J37 HPC FMC to SoC U1 connections.

Table 1-32: J37 HPC FMC Connections to XC7Z045 SoC U1

J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin	J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin
A2	FMC_HPC_DP1_M2C_P	(1)	AJ8	B1	NC	N/A	N/A
A3	FMC_HPC_DP1_M2C_N	(1)	AJ7	B4	NC	N/A	N/A
A6	FMC_HPC_DP2_M2C_P	(1)	AG8	B5	NC	N/A	N/A
A7	FMC_HPC_DP2_M2C_N	(1)	AG7	B8	NC	N/A	N/A
A10	FMC_HPC_DP3_M2C_P	(1)	AE8	B9	NC	N/A	N/A
A11	FMC_HPC_DP3_M2C_N	(1)	AE7	B12	FMC_HPC_DP7_M2C_P	(1)	AD6
A14	FMC_HPC_DP4_M2C_P	(1)	AH6	B13	FMC_HPC_DP7_M2C_N	(1)	AD5
A15	FMC_HPC_DP4_M2C_N	(1)	AH5	B16	FMC_HPC_DP6_M2C_P	(1)	AF6
A18	FMC_HPC_DP5_M2C_P	(1)	AG4	B17	FMC_HPC_DP6_M2C_N	(1)	AF5
A19	FMC_HPC_DP5_M2C_N	(1)	AG3	B20	FMC_HPC_GBTCLK1_M2C_P	(1)	AA8
A22	FMC_HPC_DP1_C2M_P	(1)	AK6	B21	FMC_HPC_GBTCLK1_M2C_N	(1)	AA7
A23	FMC_HPC_DP1_C2M_N	(1)	AK5	B24	NC	N/A	N/A
A26	FMC_HPC_DP2_C2M_P	(1)	AJ4	B25	NC	N/A	N/A
A27	FMC_HPC_DP2_C2M_N	(1)	AJ3	B28	NC	N/A	N/A
A30	FMC_HPC_DP3_C2M_P	(1)	AK2	B29	NC	N/A	N/A
A31	FMC_HPC_DP3_C2M_N	(1)	AK1	B32	FMC_HPC_DP7_C2M_P	(1)	AD2
A34	FMC_HPC_DP4_C2M_P	(1)	AH2	B33	FMC_HPC_DP7_C2M_N	(1)	AD1
A35	FMC_HPC_DP4_C2M_N	(1)	AH1	B36	FMC_HPC_DP6_C2M_P	(1)	AE4
A38	FMC_HPC_DP5_C2M_P	(1)	AF2	B37	FMC_HPC_DP6_C2M_N	(1)	AE3
A39	FMC_HPC_DP5_C2M_N	(1)	AF1	B40	NC	N/A	N/A
C2	FMC_HPC_DP0_C2M_P	(1)	AK10	D1	PWRCTL1_FMC_PG_C2M	LVCMOS25	AB20
C3	FMC_HPC_DP0_C2M_N	(1)	AK9	D4	FMC_HPC_GBTCLK0_M2C_P	(1)	AD10
C6	FMC_HPC_DP0_M2C_P	(1)	AH10	D5	FMC_HPC_GBTCLK0_M2C_N	(1)	AD9
C7	FMC_HPC_DP0_M2C_N	(1)	AH9	D8	FMC_HPC_LA01_CC_P	LVCMOS25	AG21
C10	FMC_HPC_LA06_P	LVCMOS25	AG22	D9	FMC_HPC_LA01_CC_N	LVCMOS25	AH21
C11	FMC_HPC_LA06_N	LVCMOS25	AH22	D11	FMC_HPC_LA05_P	LVCMOS25	AH23

Table 1-32: J37 HPC FMC Connections to XC7Z045 SoC U1 (Cont'd)

J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin	J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin
C14	FMC_HPC_LA10_P	LVCMOS25	AG24	D12	FMC_HPC_LA05_N	LVCMOS25	AH24
C15	FMC_HPC_LA10_N	LVCMOS25	AG25	D14	FMC_HPC_LA09_P	LVCMOS25	AD21
C18	FMC_HPC_LA14_P	LVCMOS25	AC24	D15	FMC_HPC_LA09_N	LVCMOS25	AE21
C19	FMC_HPC_LA14_N	LVCMOS25	AD24	D17	FMC_HPC_LA13_P	LVCMOS25	AA22
C22	FMC_HPC_LA18_CC_P	LVCMOS25	W25	D18	FMC_HPC_LA13_N	LVCMOS25	AA23
C23	FMC_HPC_LA18_CC_N	LVCMOS25	W26	D20	FMC_HPC_LA17_CC_P	LVCMOS25	V23
C26	FMC_HPC_LA27_P	LVCMOS25	V28	D21	FMC_HPC_LA17_CC_N	LVCMOS25	W24
C27	FMC_HPC_LA27_N	LVCMOS25	V29	D23	FMC_HPC_LA23_P	LVCMOS25	P25
C30	FMC_HPC_IIC_SCL	N/A	U65.13	D24	FMC_HPC_LA23_N	LVCMOS25	P26
C31	FMC_HPC_IIC_SDA	N/A	U65.12	D26	FMC_HPC_LA26_P	LVCMOS25	R28
C34	GA0 = 0 = GND	N/A	N/A	D27	FMC_HPC_LA26_N	LVCMOS25	T28
C35	VCC12_P	N/A	N/A	D29	FMC_HPC_TCK_BUF	N/A	U23.15
C37	VCC12_P	N/A	N/A	D30	FMC_TDI_BUF	N/A	U23.18
C39	VCC3V3	N/A	N/A	D31	FMC_HPC_TDO_FMC_LPC_TDI	N/A	U32.2
				D32	VCC3V3	N/A	N/A
				D33	FMC_HPC_TMS_BUF	N/A	U23.17
				D34	NC	N/A	N/A
				D35	GA1 = 0 = GND	N/A	N/A
				D36	VCC3V3	N/A	N/A
				D38	VCC3V3	N/A	N/A
				D40	VCC3V3	N/A	N/A
E2	NC	N/A	N/A	F1	FMC_HPC_PG_M2C	N/A	U16.16
E3	NC	N/A	N/A	F4	NC	N/A	N/A
E6	NC	N/A	N/A	F5	NC	N/A	N/A
E7	NC	N/A	N/A	F7	NC	N/A	N/A
E9	NC	N/A	N/A	F8	NC	N/A	N/A
E10	NC	N/A	N/A	F10	NC	N/A	N/A
E12	NC	N/A	N/A	F11	NC	N/A	N/A
E13	NC	N/A	N/A	F13	NC	N/A	N/A
E15	NC	N/A	N/A	F14	NC	N/A	N/A
E16	NC	N/A	N/A	F16	NC	N/A	N/A
E18	NC	N/A	N/A	F17	NC	N/A	N/A
E19	NC	N/A	N/A	F19	NC	N/A	N/A
E21	NC	N/A	N/A	F20	NC	N/A	N/A
E22	NC	N/A	N/A	F22	NC	N/A	N/A
E24	NC	N/A	N/A	F23	NC	N/A	N/A
E25	NC	N/A	N/A	F25	NC	N/A	N/A

Table 1-32: J37 HPC FMC Connections to XC7Z045 SoC U1 (Cont'd)

J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin	J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin
E27	NC	N/A	N/A	F26	NC	N/A	N/A
E28	NC	N/A	N/A	F28	NC	N/A	N/A
E30	NC	N/A	N/A	F29	NC	N/A	N/A
E31	NC	N/A	N/A	F31	NC	N/A	N/A
E33	NC	N/A	N/A	F32	NC	N/A	N/A
E34	NC	N/A	N/A	F34	NC	N/A	N/A
E36	NC	N/A	N/A	F35	NC	N/A	N/A
E37	NC	N/A	N/A	F37	NC	N/A	N/A
E39	VADJ	N/A	N/A	F38	NC	N/A	N/A
				F40	VADJ	N/A	N/A
G2	FMC_HPC_CLK1_M2C_P	LVCMOS25	U26	H1	NC	N/A	N/A
G3	FMC_HPC_CLK1_M2C_N	LVCMOS25	U27	H2	FMC_HPC_PRSNT_M2C_B	N/A	U16.15
G6	FMC_HPC_LA00_CC_P	LVCMOS25	AF20	H4	FMC_HPC_CLK0_M2C_P	LVCMOS25	AE22
G7	FMC_HPC_LA00_CC_N	LVCMOS25	AG20	H5	FMC_HPC_CLK0_M2C_N	LVCMOS25	AF22
G9	FMC_HPC_LA03_P	LVCMOS25	AH19	H7	FMC_HPC_LA02_P	LVCMOS25	AK17
G10	FMC_HPC_LA03_N	LVCMOS25	AJ19	H8	FMC_HPC_LA02_N	LVCMOS25	AK18
G12	FMC_HPC_LA08_P	LVCMOS25	AF19	H10	FMC_HPC_LA04_P	LVCMOS25	AJ20
G13	FMC_HPC_LA08_N	LVCMOS25	AG19	H11	FMC_HPC_LA04_N	LVCMOS25	AK20
G15	FMC_HPC_LA12_P	LVCMOS25	AF23	H13	FMC_HPC_LA07_P	LVCMOS25	AJ23
G16	FMC_HPC_LA12_N	LVCMOS25	AF24	H14	FMC_HPC_LA07_N	LVCMOS25	AJ24
G18	FMC_HPC_LA16_P	LVCMOS25	AA24	H16	FMC_HPC_LA11_P	LVCMOS25	AD23
G19	FMC_HPC_LA16_N	LVCMOS25	AB24	H17	FMC_HPC_LA11_N	LVCMOS25	AE23
G21	FMC_HPC_LA20_P	LVCMOS25	U25	H19	FMC_HPC_LA15_P	LVCMOS25	Y22
G22	FMC_HPC_LA20_N	LVCMOS25	V26	H20	FMC_HPC_LA15_N	LVCMOS25	Y23
G24	FMC_HPC_LA22_P	LVCMOS25	V27	H22	FMC_HPC_LA19_P	LVCMOS25	T24
G25	FMC_HPC_LA22_N	LVCMOS25	W28	H23	FMC_HPC_LA19_N	LVCMOS25	T25
G27	FMC_HPC_LA25_P	LVCMOS25	T29	H25	FMC_HPC_LA21_P	LVCMOS25	W29
G28	FMC_HPC_LA25_N	LVCMOS25	U29	H26	FMC_HPC_LA21_N	LVCMOS25	W30
G30	FMC_HPC_LA29_P	LVCMOS25	R25	H28	FMC_HPC_LA24_P	LVCMOS25	T30
G31	FMC_HPC_LA29_N	LVCMOS25	R26	H29	FMC_HPC_LA24_N	LVCMOS25	U30
G33	FMC_HPC_LA31_P	LVCMOS25	N29	H31	FMC_HPC_LA28_P	LVCMOS25	P30
G34	FMC_HPC_LA31_N	LVCMOS25	P29	H32	FMC_HPC_LA28_N	LVCMOS25	R30
G36	FMC_HPC_LA33_P	LVCMOS25	N26	H34	FMC_HPC_LA30_P	LVCMOS25	P23
G37	FMC_HPC_LA33_N	LVCMOS25	N27	H35	FMC_HPC_LA30_N	LVCMOS25	P24
G39	VADJ	N/A	N/A	H37	FMC_HPC_LA32_P	LVCMOS25	P21
				H38	FMC_HPC_LA32_N	LVCMOS25	R21
				H40	VADJ	N/A	N/A

Table 1-32: J37 HPC FMC Connections to XC7Z045 SoC U1 (Cont'd)

J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin	J37 FMC HPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin
<hr/>							
J2	NC	N/A	N/A	K1	NC	N/A	N/A
J3	NC	N/A	N/A	K4	NC	N/A	N/A
J6	NC	N/A	N/A	K5	NC	N/A	N/A
J7	NC	N/A	N/A	K7	NC	N/A	N/A
J9	NC	N/A	N/A	K8	NC	N/A	N/A
J10	NC	N/A	N/A	K10	NC	N/A	N/A
J12	NC	N/A	N/A	K11	NC	N/A	N/A
J13	NC	N/A	N/A	K13	NC	N/A	N/A
J15	NC	N/A	N/A	K14	NC	N/A	N/A
J16	NC	N/A	N/A	K16	NC	N/A	N/A
J18	NC	N/A	N/A	K17	NC	N/A	N/A
J19	NC	N/A	N/A	K19	NC	N/A	N/A
J21	NC	N/A	N/A	K20	NC	N/A	N/A
J22	NC	N/A	N/A	K22	NC	N/A	N/A
J24	NC	N/A	N/A	K23	NC	N/A	N/A
J25	NC	N/A	N/A	K25	NC	N/A	N/A
J27	NC	N/A	N/A	K26	NC	N/A	N/A
J28	NC	N/A	N/A	K28	NC	N/A	N/A
J30	NC	N/A	N/A	K29	NC	N/A	N/A
J31	NC	N/A	N/A	K31	NC	N/A	N/A
J33	NC	N/A	N/A	K32	NC	N/A	N/A
J34	NC	N/A	N/A	K34	NC	N/A	N/A
J36	NC	N/A	N/A	K35	NC	N/A	N/A
J37	NC	N/A	N/A	K37	NC	N/A	N/A
J39	NC	N/A	N/A	K38	NC	N/A	N/A
				K40	NC	N/A	N/A

Notes:

1. No I/O standards are associated with MGT connections.

LPC Connector J5

[Figure 1-3, callout 31]

The 160-pin LPC connector defined by the FMC specification (Figure B-1, page 92) provides connectivity for up to:

- 68 single-ended or 34 differential user-defined signals
- 1 GTX transceiver

- 1 GTX clock
- 2 differential clocks
- 61 ground and 10 power connections

The connections between the HPC connector at J5 and SoC U1 implements a subset of this connectivity:

- 34 differential user-defined pairs (34 LA pairs, LA00–LA33)
- 1 GTX transceiver
- 1 GTX clock
- 2 differential clocks
- 61 ground and 9 power connections

Note: LPC FMC (J5) GA0 = GA1 = 0 = GND.

Table 1-33 shows the FMC LPC connections between J5 and XC7Z045 SoC U1.

Table 1-33: J5 LPC FMC Connections to SoC U1

J5 FMC LPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin	J5 FMC LPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin
C2	FMC_LPC_DP0_C2M_P	(1)	AB2	D1	PWRCTL1_FMC_PG_C2M	LVCMOS25	AB20
C3	FMC_LPC_DP0_C2M_N	(1)	AB1	D4	FMC_LPC_GBTCLK0_M2C_P	(1)	U8
C6	FMC_LPC_DP0_M2C_P	(1)	AC4	D5	FMC_LPC_GBTCLK0_M2C_N	(1)	U7
C7	FMC_LPC_DP0_M2C_N	(1)	AC3	D8	FMC_LPC_LA01_CC_P	LVCMOS25	AF15
C10	FMC_LPC_LA06_P	LVCMOS25	AB12	D9	FMC_LPC_LA01_CC_N	LVCMOS25	AG15
C11	FMC_LPC_LA06_N	LVCMOS25	AC12	D11	FMC_LPC_LA05_P	LVCMOS25	AE16
C14	FMC_LPC_LA10_P	LVCMOS25	AC14	D12	FMC_LPC_LA05_N	LVCMOS25	AE15
C15	FMC_LPC_LA10_N	LVCMOS25	AC13	D14	FMC_LPC_LA09_P	LVCMOS25	AH14
C18	FMC_LPC_LA14_P	LVCMOS25	AF18	D15	FMC_LPC_LA09_N	LVCMOS25	AH13
C19	FMC_LPC_LA14_N	LVCMOS25	AF17	D17	FMC_LPC_LA13_P	LVCMOS25	AH17
C22	FMC_LPC_LA18_CC_P	LVCMOS25	AE27	D18	FMC_LPC_LA13_N	LVCMOS25	AH16
C23	FMC_LPC_LA18_CC_N	LVCMOS25	AF27	D20	FMC_LPC_LA17_CC_P	LVCMOS25	AB27
C26	FMC_LPC_LA27_P	LVCMOS25	AJ28	D21	FMC_LPC_LA17_CC_N	LVCMOS25	AC27
C27	FMC_LPC_LA27_N	LVCMOS25	AJ29	D23	FMC_LPC_LA23_P	LVCMOS25	AJ26
C30	FMC_LPC_IIC_SCL	N/A	U65.15	D24	FMC_LPC_LA23_N	LVCMOS25	AK26
C31	FMC_LPC_IIC_SDA	N/A	U65.14	D26	FMC_LPC_LA26_P	LVCMOS25	AJ30
C34	GA0 = 0 = GND	N/A	N/A	D27	FMC_LPC_LA26_N	LVCMOS25	AK30
C35	VCC12_P	N/A	N/A	D29	FMC_LPC_TCK_BUF	N/A	U23.14
C37	VCC12_P	N/A	N/A	D30	FMC_HPC_TDO_FMC_LPC_TDI	N/A	U31.1
C39	VCC3V3	N/A	N/A	D31	FMC_LPC_TDO_FPGA_TDI	N/A	U31.2

Table 1-33: J5 LPC FMC Connections to SoC U1 (Cont'd)

J5 FMC LPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin	J5 FMC LPC Pin	Net Name	I/O Standard	XC7Z045 (U1) Pin
				D32	VCC3V3	N/A	N/A
				D33	FMC_LPC_TMS_BUF	N/A	U23.16
				D34	NC	N/A	N/A
				D35	GA1 = 0 = GND	N/A	N/A
				D36	VCC3V3	N/A	N/A
				D38	VCC3V3	N/A	N/A
				D40	VCC3V3	N/A	N/A
G2	FMC_LPC_CLK1_M2C_P	LVCMOS25	AC28	H1	NC	LVCMOS25	
G3	FMC_LPC_CLK1_M2C_N	LVCMOS25	AD28	H2	FMC_LPC_PRSNT_M2C_B	LVCMOS25	U16.14
G6	FMC_LPC_LA00_CC_P	LVCMOS25	AE13	H4	FMC_LPC_CLK0_M2C_P	LVCMOS25	AG17
G7	FMC_LPC_LA00_CC_N	LVCMOS25	AF13	H5	FMC_LPC_CLK0_M2C_N	LVCMOS25	AG16
G9	FMC_LPC_LA03_P	LVCMOS25	AG12	H7	FMC_LPC_LA02_P	LVCMOS25	AE12
G10	FMC_LPC_LA03_N	LVCMOS25	AH12	H8	FMC_LPC_LA02_N	LVCMOS25	AF12
G12	FMC_LPC_LA08_P	LVCMOS25	AD14	H10	FMC_LPC_LA04_P	LVCMOS25	AJ15
G13	FMC_LPC_LA08_N	LVCMOS25	AD13	H11	FMC_LPC_LA04_N	LVCMOS25	AK15
G15	FMC_LPC_LA12_P	LVCMOS25	AD16	H13	FMC_LPC_LA07_P	LVCMOS25	AA15
G16	FMC_LPC_LA12_N	LVCMOS25	AD15	H14	FMC_LPC_LA07_N	LVCMOS25	AA14
G18	FMC_LPC_LA16_P	LVCMOS25	AE18	H16	FMC_LPC_LA11_P	LVCMOS25	AJ16
G19	FMC_LPC_LA16_N	LVCMOS25	AE17	H17	FMC_LPC_LA11_N	LVCMOS25	AK16
G21	FMC_LPC_LA20_P	LVCMOS25	AG26	H19	FMC_LPC_LA15_P	LVCMOS25	AB15
G22	FMC_LPC_LA20_N	LVCMOS25	AG27	H20	FMC_LPC_LA15_N	LVCMOS25	AB14
G24	FMC_LPC_LA22_P	LVCMOS25	AK27	H22	FMC_LPC_LA19_P	LVCMOS25	AH26
G25	FMC_LPC_LA22_N	LVCMOS25	AK28	H23	FMC_LPC_LA19_N	LVCMOS25	AH27
G27	FMC_LPC_LA25_P	LVCMOS25	AF29	H25	FMC_LPC_LA21_P	LVCMOS25	AH28
G28	FMC_LPC_LA25_N	LVCMOS25	AG29	H26	FMC_LPC_LA21_N	LVCMOS25	AH29
G30	FMC_LPC_LA29_P	LVCMOS25	AE25	H28	FMC_LPC_LA24_P	LVCMOS25	AF30
G31	FMC_LPC_LA29_N	LVCMOS25	AF25	H29	FMC_LPC_LA24_N	LVCMOS25	AG30
G33	FMC_LPC_LA31_P	LVCMOS25	AC29	H31	FMC_LPC_LA28_P	LVCMOS25	AD25
G34	FMC_LPC_LA31_N	LVCMOS25	AD29	H32	FMC_LPC_LA28_N	LVCMOS25	AE26
G36	FMC_LPC_LA33_P	LVCMOS25	Y30	H34	FMC_LPC_LA30_P	LVCMOS25	AB29
G37	FMC_LPC_LA33_N	LVCMOS25	AA30	H35	FMC_LPC_LA30_N	LVCMOS25	AB30
G39	VADJ	N/A	N/A	H37	FMC_LPC_LA32_P	LVCMOS25	Y26
				H38	FMC_LPC_LA32_N	LVCMOS25	Y27
				H40	VADJ	N/A	N/A

Notes:

- No I/O standards are associated with MGT connections.

ZC706 Board Power System

The ZC706 board hosts a power system based on the Texas Instruments (TI) UCD90120A power supply sequencer and monitor, and the LMZ31500 and LMZ31700 family voltage regulators.

UCD90120A Description

The UCD90120A is a 12-rail PMBus/I²C addressable power-supply sequencer and monitor. The device integrates a 12-bit ADC for monitoring up to 12 power-supply voltage inputs. Twenty-six GPIO pins can be used for power supply enables, power-on reset signals, external interrupts, cascading, or other system functions. Twelve of these pins offer pulse width modulation (PWM) functionality. Using these pins, the UCD90120A offers support for margining and general purpose PWM functions.

The TI Fusion Digital Power™ designer software is provided for device configuration. This PC-based graphical user interface (GUI) offers an intuitive interface for configuring, storing, and monitoring all system operating parameters.

LMZ31500 and LMZ31700 Family Regulator Description

The LMZ31520 SIMPLE SWITCHER® power module is a step-down DC-DC solution capable of driving up to 20A load. The LMZ31520 module can accept an input voltage rail between 3V and 14.5V and deliver an adjustable and highly accurate output voltage as low as 0.6V.

The LMZ31506 SIMPLE SWITCHER® power module is a step-down DC-DC solution capable of driving up to 6A load. The LMZ31506 module can accept an input voltage rail between 3V and 14.5V and deliver an adjustable and highly accurate output voltage as low as 0.6V. In older documentation this regulator was known as the TI TPS84621.

The LMZ31710 SIMPLE SWITCHER® power module is a step-down DC-DC solution capable of driving up to 10A load. The LMZ31710 module can accept an input voltage rail between 4.5V and 17V and deliver an adjustable and highly accurate output voltage as low as 0.6V.

These modules only requires two external resistors plus external capacitors to provide a complete power solution. These modules offer the following protection features: thermal shutdown, programmable input under-voltage lockout, output over-voltage protection, short-circuits protection, output current limit, and each allows startup into a pre-biased output.

The LMZ31710 sync input allows synchronization over the 200 kHz to 1,200 kHz switching frequency range and up to six modules can be connected in parallel for higher load currents.

Table 1-34 shows the ZC706 board TI power system configuration for controller U48.

Table 1-34: ZC706 TI Controller U48 Power System Configuration

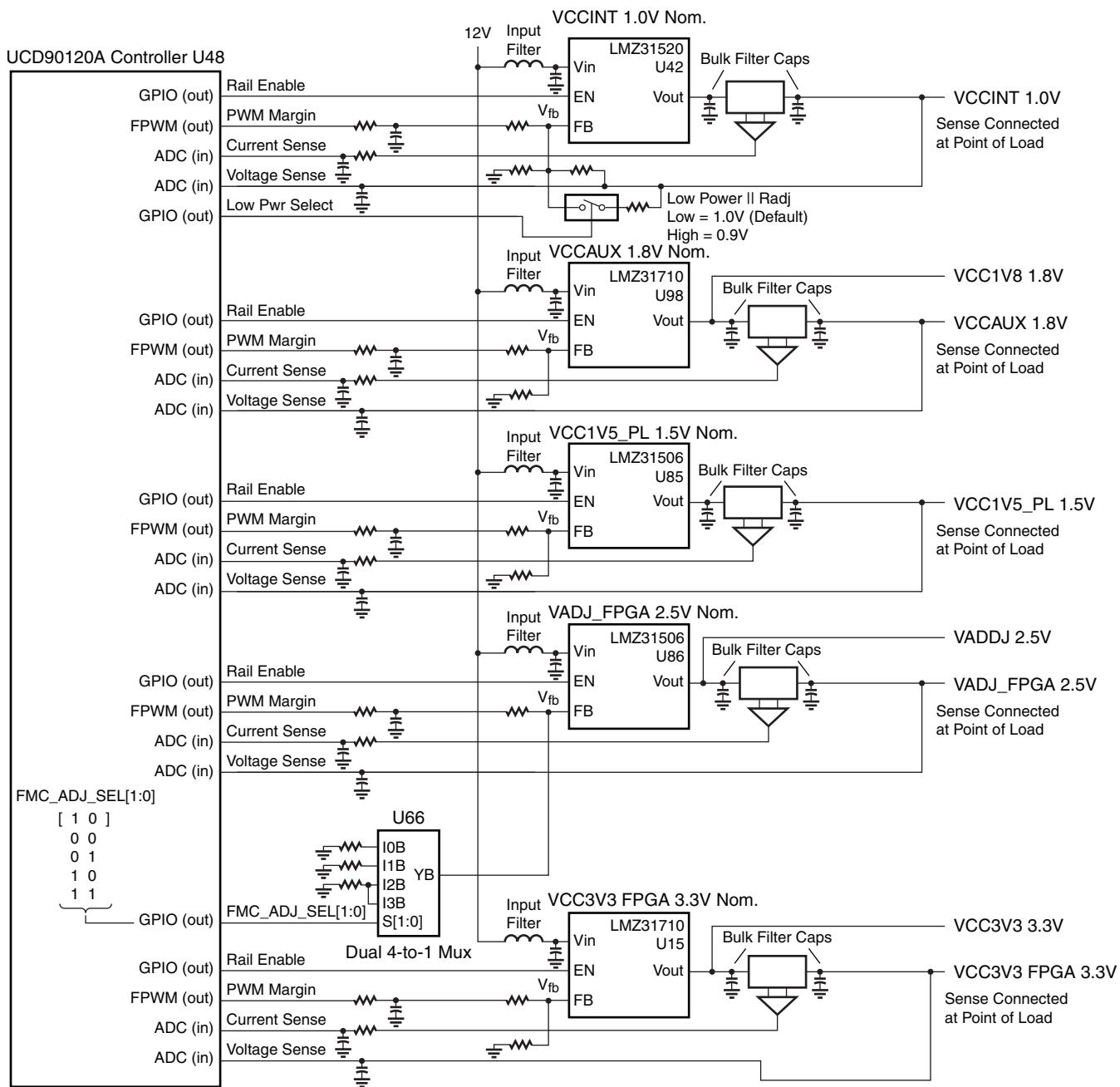
Sequencer	Schematic Page			Regulator Type, U#	Voltage	Current
	Page	Contents	Net Name			
U48 PMBus Addr 101 5 Rails	49	UCD90120A				
	50	Addr 101, Rail 1	VCCINT	LMZ31520 U42 ⁽¹⁾	1.0V	16A
	51	Addr 101, Rail 2	VCCAUX, VCC1V8	LMZ31710 U98 ⁽²⁾	1.8V	10A
	52	Addr 101, Rail 3	VCC1V5_PL	LMZ31506 U85 ⁽³⁾	1.5V	6A
	53	Addr 101, Rail 4	VADJ_FPGA,VADJ	LMZ31506 U86 ⁽²⁾	2.5V	6A
	54	Addr 101, Rail 5	VCC3V3_FPGA,VCC3V3	LMZ31710 U15 ⁽⁴⁾	3.3V	10A

Notes:

ZC706 boards prior to Rev. 2.0 implemented different voltage regulators for VCCINT, VCCAUX/VCC1V8, VCC1V5_PL, VADJ_FPGA/VADJ and VCC3V3_FPGA/VCC3V3. Refer to UG954 v1.3 and earlier, and to the schematic for the particular version of the ZC706 board prior to Rev. 2.0. Notes on ZC706 boards prior to Rev. 2.0:

1. VCCINT is implemented utilizing 2xLMZ22008 8A components (U42, U43) in parallel which provides 16A capability.
2. The 1.8V rails are supplied from a LMZ22010 10A component (U98).
3. VCC1V5_PL and the 2.5V rails are supplied from TPS84621 6A components (U85, U86).
4. The 3.3V rails are supplied from a LMZ22010 10A component (U15).

Figure 1-34 shows the power system for UCD90120A U48 controller.



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Figure 1-34: ZC706 TI UCD90120A Controller U48 Power System

The LMZ31520, LMZ31506, and LMZ31710 adjustable voltage regulators have their output voltage set through an external resistor. The regulator topology on the ZC706 board permits the TI UCD90120A module to monitor rail voltage and current. Voltage margining at +5% and -5% is also implemented.

Each voltage regulator's external V_{OUT} setting resistor is calculated and implemented as if the regulator is stand-alone. The TI UCD90120A module has two ADC inputs allocated per voltage rail, one input for the remote voltage sense connection, the other for the current sense resistor op amp output voltage connection. The TI UCD90120A ADC full scale input is 2.5V. The remote voltage feedback is scaled to approximately 2V if it exceeds 2V, that is, the V_{CCO_VADJ} rail for the 2.5V and 3.3V modes, and the $FPGA_3V3$ rail also at 3.3V are resistor-attenuated to scale the remotely sensed voltage at a ratio of 0.606 to give approximately 2V at the ADC input pin for a 3.3V remote sense value. Rails below 2V are not scaled.

Each rail's current sense op amp has its gain set to provide approximately 2V maximum at the TI UCD90120A ADC input pin when the rail current is at its expected maximum current level, as can be seen in the U48 controller power system figure ([Figure 1-34](#)).

The TI UCD90120A module has an assignable group of GPIO pins with PWM capability. Each controller "channel" has a PWM GPIO pin wired to the associated voltage regulator V_{ADJ} pin. The external V_{OUT} setting resistor is also wired to this pin. The PWM GPIO pin is configured in 3-state mode. This pin is not driven unless a Margin command is executed. The Margin command is available within the TI Fusion Digital Power™ designer software.

During the margin-High or Low operation, the PWM GPIO pin drives a voltage into the voltage regulator V_{ADJ} pin, which causes a slight voltage change resulting in the regulator V_{OUT} moving to the margin +5% or -5% voltage commanded.

XADC Power System Measurement

The ZC706 board XADC interface includes power system voltage and current measuring capability. The V_{CCINT} and V_{CCAUX} rail voltages are measured using the XADC internal voltage measurement capability. Other rails are measured through an external Analog Devices ADG707BRU multiplexer U6. Each rail has a separate TI INA333 op amp strapped across its series current sense resistor Kelvin terminals. This op amp has its gain adjusted to give approximately 1V at the expected full scale current value for the rail.

Figure 1-35 shows the XADC external MUX block diagram.

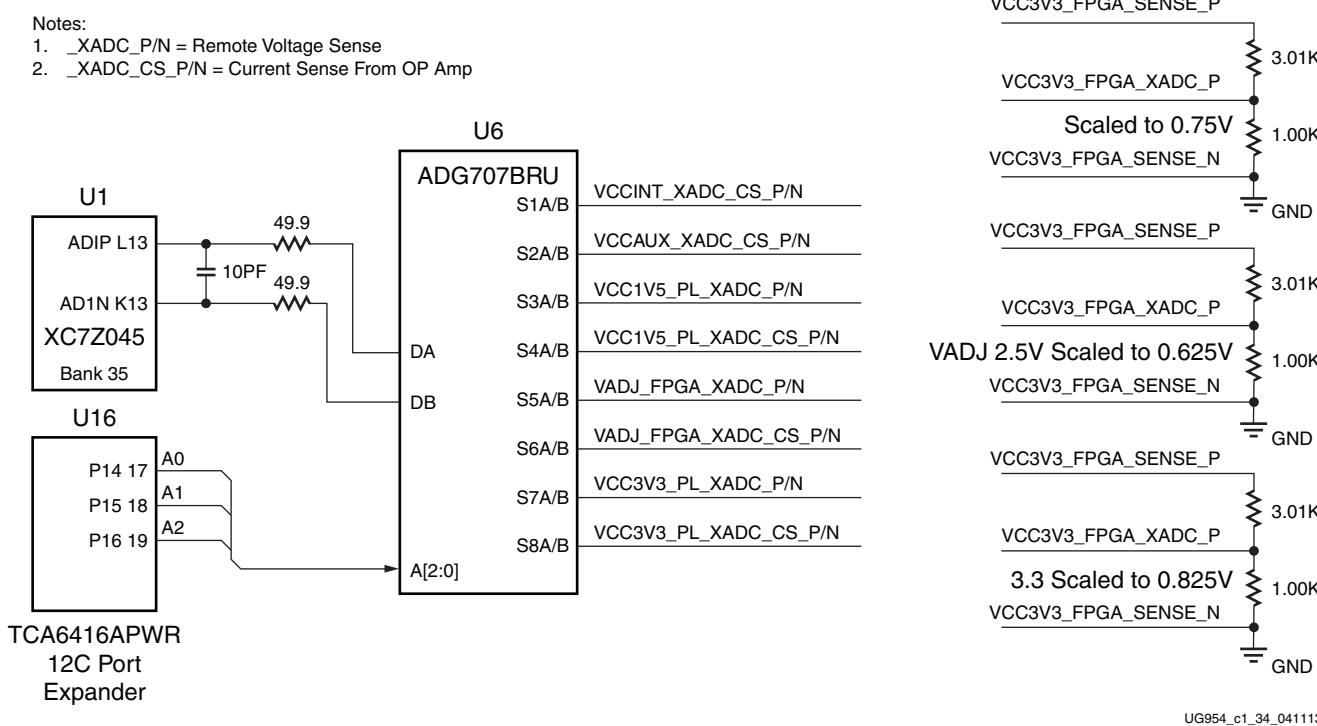


Figure 1-35: XADC External MUX Block Diagram

See Table 1-35 which lists the ZC706 XADC power system voltage and current measurement details for the external MUX U6.

Table 1-35: XADC Measurements through MUX U6

Meas. Type	Rail Name	Current Range	Isense Op Amp			Schematic Net Name	8-to-1 MUX U6		MUX A[2:0]		
			Reference Designator	Gain	Vo Range		Pin Num	Pin Name			
V	VCCINT	NA	NA	NA	NA	XADC INTERNAL	NA	NA	NA		
I	VCCINT CS	0A-8A	U69	20	0V-0.8V	VCCINT_XADC_CS_P	19	S1A	000		
						VCCINT_XADC_CS_N	11	S1B			
V	VCCAUX	NA	NA	NA	NA	XADC INTERNAL	NA	NA	NA		
I	VCCAUX CS	0A-4A	U68	50	0V-1V	VCCAUX_XADC_CS_P	20	S2A	001		
						VCCAUX_XADC_CS_N	10	S2B			
V	VCC1V5_PL	NA	VCC1V5_PL REMOTE SENSE DIVIDED TO DELIVER 0.75V ON VCC1V5_PL_XADC_P			VCC1V5_PL_XADC_P	21	S3A	010		
						VCC1V5_PL_SENSE_N	9	S3B			
I	VCC1V5_PL CS	0A-2A	U67	100	0V-1V	VCC1V5_PL_XADC_CS_P	22	S4A	011		
						VCC1V5_PL_XADC_CS_N	8	S4B			

Table 1-35: XADC Measurements through MUX U6 (Cont'd)

Meas. Type	Rail Name	Current Range	Isense Op Amp			Schematic Net Name	8-to-1 MUX U6		MUX A[2:0]
			Reference Designator	Gain	Vo Range		Pin Num	Pin Name	
V	VADJ_FPGA	NA	VADJ_FPGA 2.5V REMOTE SENSE DIVIDED TO DELIVER 0.625V ON VADJ_FPGA_XADC_P			VADJ_FPGA_XADC_P	23	S5A	100
						VADJ_FPGA_SENSE_N	7	S5B	
I	VADJ_FPGA CS	0A-2A	U70	100	0V-1V	VADJ_FPGA_XADC_CS_P	24	S6A	101
						VADJ_FPGA_XADC_CS_N	6	S6B	
V	VCC3V3_FPGA	NA	VCC3V3_FPGA REMOTE SENSE DIVIDED TO DELIVER 0.825V ON VCC3V3_FPGA_XADC_P			VCC3V3_FPGA_XADC_P	25	S7A	110
						VCC3V3_FPGA_SENSE_N	5	S7B	
I	VCC3V3_FPGA CS	0A-2A	U97	100	0V-1V	VCC3V3_FPGA_XADC_CS_P	26	S8A	111
						VCC3V3_FPGA_XADC_CS_N	4	S8B	

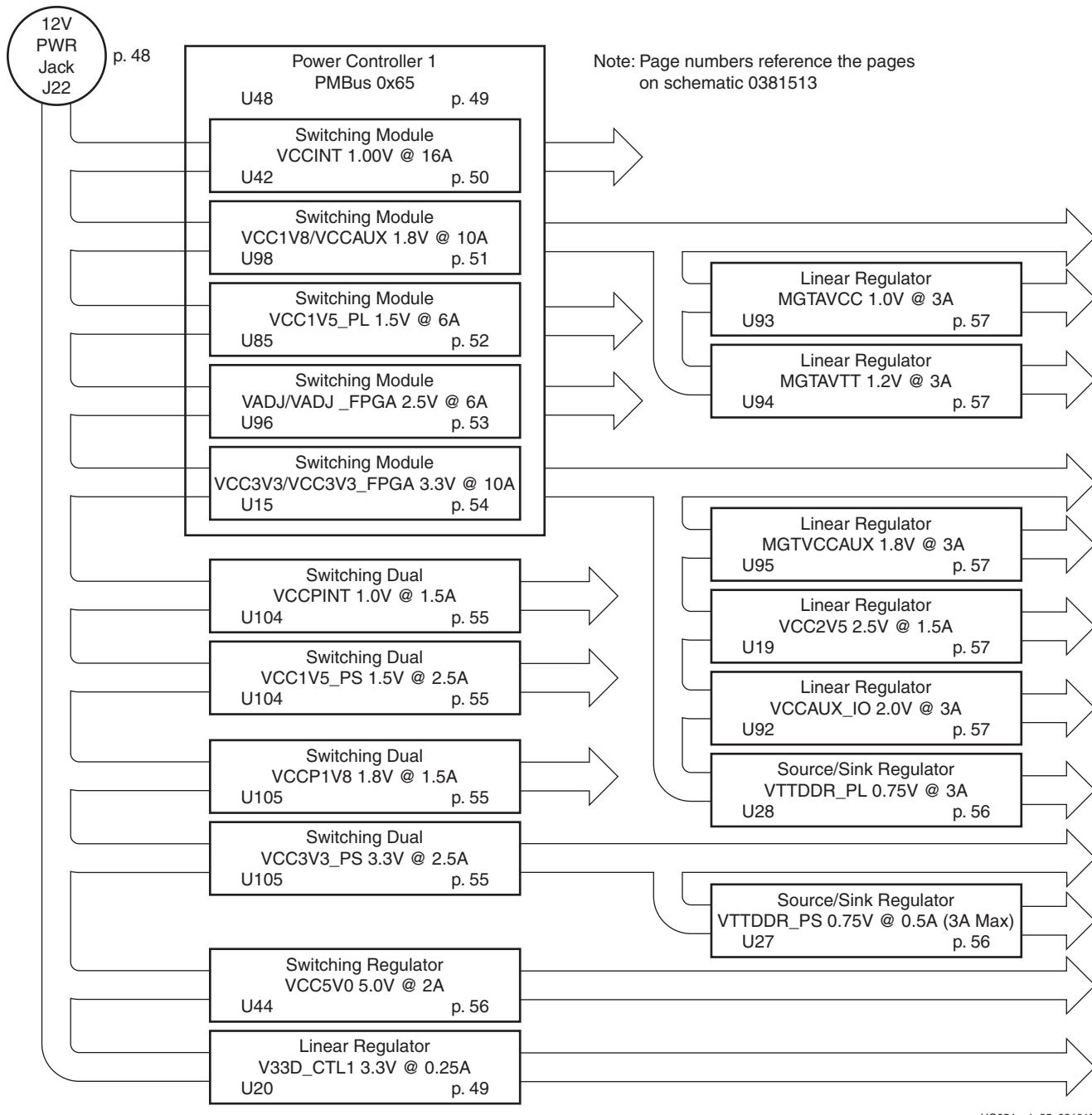
Power Management

[Figure 1-3, callout 32]

The ZC706 board uses power regulators and a PMBus-compliant system controller from Texas Instruments to supply core and auxiliary voltages. The Texas Instruments Fusion Digital Power graphical user interface is used to monitor the voltage and current levels of the board power modules.

The PCB layout and power system design meet the recommended criteria described in *Zynq-7000 SoC PCB Design and Pin Planning Guide* ([UG933](#)).

The ZC706 evaluation board power distribution diagram is shown in [Figure 1-36](#).



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Figure 1-36: Onboard Power Regulators

The ZC706 evaluation board uses power regulators and PMBus compliant PWM system controllers from Texas Instruments to supply the core and auxiliary voltages listed in [Table 1-36](#).

Table 1-36: Onboard Power System Devices

Device Type	Reference Designator	Description	Power Rail Net Name	Power Rail Voltage	Schematic Page
UCD90120A	U48	PMBus Controller, PMBus Addr = 101			49
LMZ31520RLG ⁽¹⁾⁽⁶⁾	U42	16A 0.6 - 3.6V Adj. Switching Regulator	VCCINT ⁽²⁾	1.00V	50
LMZ31710RVQ ⁽⁷⁾	U98	10A 0.6V - 5.5V Adj. Switching Regulator	VCCAUX ⁽³⁾	1.80V	51
LMZ31506RUQ	U85	6A 0.6V - 5.5V Adj. Switching Regulator	VCC1V5_PL	1.50V	52
LMZ31506RUQ	U86	6A 0.6V - 5.5V Adj. Switching Regulator	VADJ_FPGA ⁽⁴⁾	2.50V	53
LMZ31710RVQ ⁽⁷⁾	U15	10A 0.6V - 5.5V Adj. Switching Regulator	VCC3V3_FPGA ⁽⁵⁾	3.30V	54
<hr/>					
TPS54291PWP (Dual Output)	U104	2.5A 0.8V - 10V Adj. Switching Regulator	VCCPINT	1.00V	55
		2.5A 0.8V - 10V Adj. Switching Regulator	VCC1V5_PS	1.50V	55
TPS54291PWP (Dual Output)	U105	2.5A 0.8V - 10V Adj. Switching Regulator	VCCP1V8	1.80V	55
		2.5A 0.8V - 10V Adj. Switching Regulator	VCC3V3_PS	3.30V	55
TPS51200DR	U27	3A Push/Pull Tracking Regulator	VTTDDR_PS	0.75V	56
TPS51200DR	U28	3A Push/Pull Tracking Regulator	VTTDDR_SODIMM	0.75V	56
TPS74901RGW	U92	3A 0.8V - 3.6V Adj. Linear Regulator	VCCAUX_IO	2.00V	57
TPS74901RGW	U93	3A 0.8V - 3.6V Adj. Linear Regulator	MGTAVCC	1.00V	57
TPS74901RGW	U94	3A 0.8V - 3.6V Adj. Linear Regulator	MGTAVTT	1.20V	57
TPS74901RGW	U95	3A 0.8V - 3.6V Adj. Linear Regulator	MGTVCXAUX	1.80V	57
TL1963A	U19	1.5A 1.21V - 3.3V Adj. Linear Regulator	VCC2V5	2.50V	57
TPS79433	U20	0.25A 3.3V Fixed Linear Regulator	V33D_CTL1	3.30V	49
LMZ31704RVQ ⁽⁸⁾	U44	2A 0.6V - 5.5V Adj. Switching Regulator	VCC5V0	5.00V	56

Notes:

1. VCCINT max. current is 16A
2. VCCBRAM 1.0V is also sourced from the Vccint rail
3. VCC1V8 1.80V is also sourced from the Vccaux rail
4. VADJ (1.80V/2.50V/3.30V) for the FMC connectors is also sourced from the Vadj_fpga rail
5. VCC3V3 3.30V is also sourced from the Vcc3v3_fpga rail
6. Paralleled dual LMZ22008TZ (U42/U43) 8A 0.8V - 6V Adj. Switching Regulators on ZC706 board versions prior to Rev. 2.0
7. LMZ22010TZ (U98 VCCAUX, U15 VCC3V3_FPGA) 10A 0.8 - 6V Adj. Switching Regulators on ZC706 board versions prior to Rev. 2.0
8. LMZ12002TZ U44 2A 0.8 - 6V Adj. Switching Regulator on ZC706 board versions prior to Rev. 2.0

VADJ Voltage Control

The V_{ADJ} rail is set to 2.5V. When the ZC706 evaluation board is powered on, the state of the `FMC_VADJ_ON_B` signal wired to header J18 is sampled by the TI UCD90120A controller U48. If a jumper is installed on J18 signal `FMC_VADJ_ON_B` is held Low, and the TI controller U48 energizes the V_{ADJ} rail at power on.

Because the rail turn on decision is made at power on time based on the presence of the J18 jumper, removing the jumper at J18 after the board is powered up does not affect the 2.5V power delivered to the V_{ADJ} rail and it remains on.

A jumper installed at J18 is the default setting.

In this mode the user can control when to turn on V_{ADJ} and to which voltage level (1.8V, 2.5V, 3.3V). With V_{ADJ} off the XC7Z045 SoC still configures and has access to the TI controller PMBUS along with the FMC_VADJ_ON_B signal. The combination of these allows the user to develop code to command the V_{ADJ} rail to be set to something other than the default setting of 2.5V. Once the new V_{ADJ} voltage level has been programmed into TI controller U48, the FMC_VADJ_ON_B signal can be driven low by the user logic and the V_{ADJ} rail comes up at the new V_{ADJ} voltage level. Installing a jumper at J18 after a ZC706 board powers up in the V_{ADJ} off (no jumper on J18 at ZC706 power up) mode turns on the V_{ADJ} rail.

The FMC_VADJ_ON_B signal is connected to the TCA6416APWR I²C port expander U16 pin 13 (see [Figure 1-29](#)). The XC7Z045 SoC is thus able to drive the FMC_VADJ_ON_B signal by writing to the I²C port expander U16.

The I²C port expander IIC_PORT_EXPANDER SDA/SCL bus is wired to the PCA9548ARGER I²C U65 bus switch (see [I²C Bus, page 55](#)).

Documentation describing PMBUS programming for the UCD90120A power controller is available at the website [\[Ref 27\]](#).

SoC Programmable Logic (PL) Voltage Control

All PL and PS power rails are enabled by default. When the ZC706 board is powered on, the state of the PL_PWR_ON signal wired to 2-pin header J66 is sampled by the TI UCD90120A controller U48. If a jumper is not installed on J66, signal PL_PWR_ON is held high, and the TI controller U48 energizes all the PL and PS power rails.

Because the rail turn on decision is made at power on time based on the presence of the J66 jumper, installing the jumper at J66 after the board is powered up does not affect power delivered to the any PS or PL rails, all rails remain on.

A jumper not installed at J66 is the default setting.

If a jumper is installed on J66 when the ZC706 board is powered on, signal PL_PWR_ON is held low, and the ZC706 board does not energize the PL side power rails at power on.

Monitoring Voltage and Current

Voltage and current monitoring and control are available for selected power rails through Texas Instruments' Fusion Digital Power Designer graphical user interface. The onboard TI power controller (U48 at address 101) is accessed through the PMBus connector J4, which is provided for use with the TI USB Interface Adapter PMBus pod (TI part number EVM_USB-TO-GPIO), which can be ordered from the Texas Instruments website [\[Ref 28\]](#) and

associated TI Fusion Digital Power Designer GUI (downloadable from the TI site [\[Ref 29\]](#)). This is the simplest and most convenient way to monitor the voltage and current values for the power rails listed in [Table 1-37](#).

In the table, the Power Good (PG) On Threshold is the setpoint at or above which the particular rail is deemed "good". The PG Off Threshold is the setpoint at or below which the particular rail is no longer deemed "good". The controller internally OR's these per rail PG conditions together and drives an output PG pin high only if all active rail PG states are "good". The On and Off Delay and parameters are relative to when the board power on-off slide switch SW12 is turned on and off.

[Table 1-37](#) Power Rail Specifications for UCD90120A PMBus controller at Address 101 defines the voltage and current values for each power rail controlled by the UCD90120A U48.



IMPORTANT: In [Table 1-37](#), the values defined in the Shutdown columns are the voltage and current thresholds that cause the regulator to shut down if the value is exceeded.

Table 1-37: Power Rail Specifications for UCD90120A PMBus Controller at Address 101

Device	Address	Rail	Nominal Voltage	Power Good On	Power Good Off	Turn On Delay (ms) ⁽²⁾	Turn Off Delay (ms)	Shutdown ⁽¹⁾		
								Over Voltage	Over Current	
UCD90120A U48	101d	1	VCCINT	1.000	0.900	0.850	0.0	25.0	1.150	11.50
		2	VCCAUX	1.800	1.620	1.530	5.0	20.0	2.070	6.91
		3	VCC1V5_PL	1.500	1.350	1.275	5.0	10.0	1.725	3.50
		4	VADJ_FPGA	2.500	2.250	2.125	5.0	5.0	2.875	3.50
		5	VCC3V3_FPGA	3.300	2.970	2.805	5.0	15.0	3.795	6.91

Notes:

1. The values defined in these columns are the voltage and current thresholds that cause the regulator to shut down if the value is exceeded.
2. See [Table 1-39](#) for rail turn on dependency details.

The ZC706 power system rail turn on timing is not strictly controlled through the Turn On Delay shown in [Table 1-37](#). The [Table 1-37](#) Turn On Delay values are applied after the preceding rail has reached 90% of its nominal voltage. See [Table 1-38](#) for rail turn on dependency details.

Table 1-38: Power Rail Sequence On Dependencies for UCD90120A PMBus Controller at Address 101

Device	Address	Rail	Nominal Voltage	Turn On Order	Turn On Timing
UCD90120A	101d	1 VCCINT	1.000	1	Turn on at board power-on
		2 VCCAUX	1.800	2	5ms after VCCINT hits 90%
		5 VCC3V3_FPGA	3.300	3	5ms after VCCAUX hits 90%
		3 VCC1V5_PL	1.500	4	5ms after VCC3V3 hits 90%
		4 VADJ_FPGA	2.500	5	5ms after VCC1V5_PL hits 90%

Cooling Fan

The XC7Z045 SoC cooling fan connector is shown in [Figure 1-37](#).

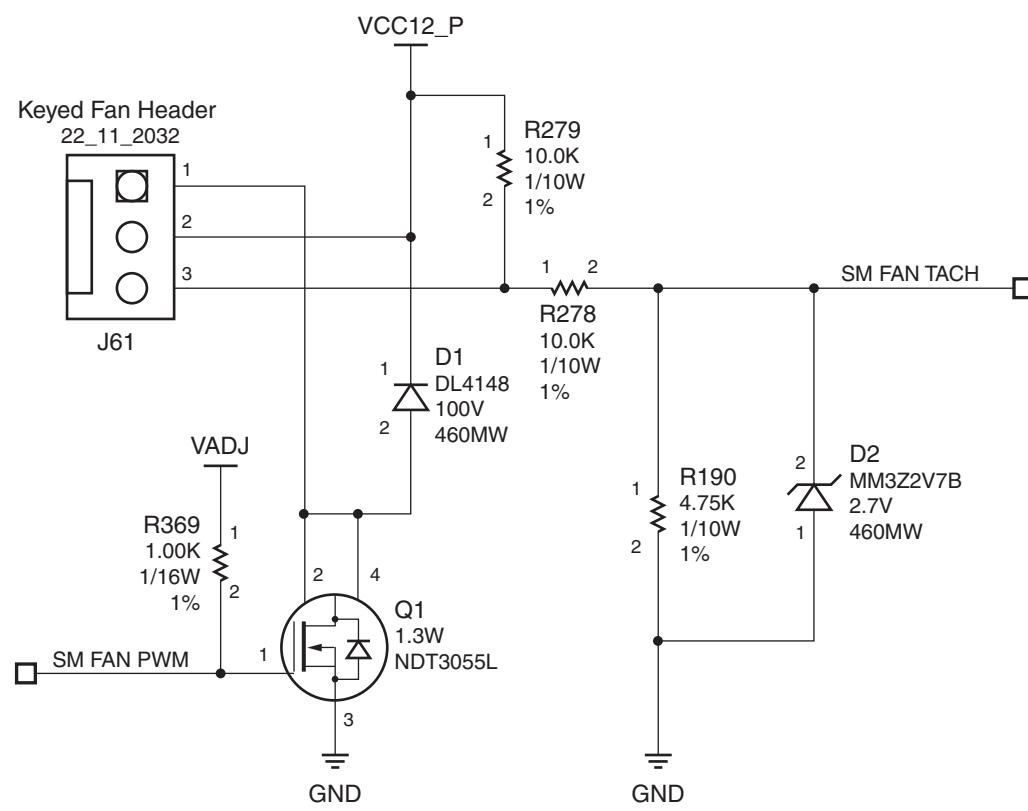


Figure 1-37: Cooling Fan Circuit

When V_{ADJ} is modified from a default of 2.5V to 1.8V or a lower V_{ADJ} setting, the SoC U1 cooling fan turns off. Transistor Q1 is used to switch on the fan and has a max VGS of 2V, hence the fan is not guaranteed to work at 1.8V or lower V_{ADJ} setting. See [\[Ref 16\]](#).

The fan turns on when the ZC706 is powered up due to pull-up resistor R369. The SM_FAN_PWM and SM_FAN_TACH signals are wired to XC7Z045 SoC U1 pins AB19 and

AA19 respectively, enabling the user to implement their own fan speed control IP in the SoC PL logic.

More information about the power system components used by the ZC706 evaluation board are available from the Texas Instruments digital power website [\[Ref 33\]](#).

XADC Analog-to-Digital Converter

[Figure 1-3, callout 33]

The XC7Z045 SoC provides an Analog Front End XADC block. The XADC block includes a dual 12-bit, 1 MSPS Analog-to-Digital Convertor (ADC) and on-chip sensors. See *7 Series FPGAs and Zynq-7000 SoC XADC Dual 12-Bit 1 MSPS Analog-to-Digital Converter User Guide* ([UG480](#)) for details on the capabilities of the analog front end. [Figure 1-38](#) shows the XADC block diagram.

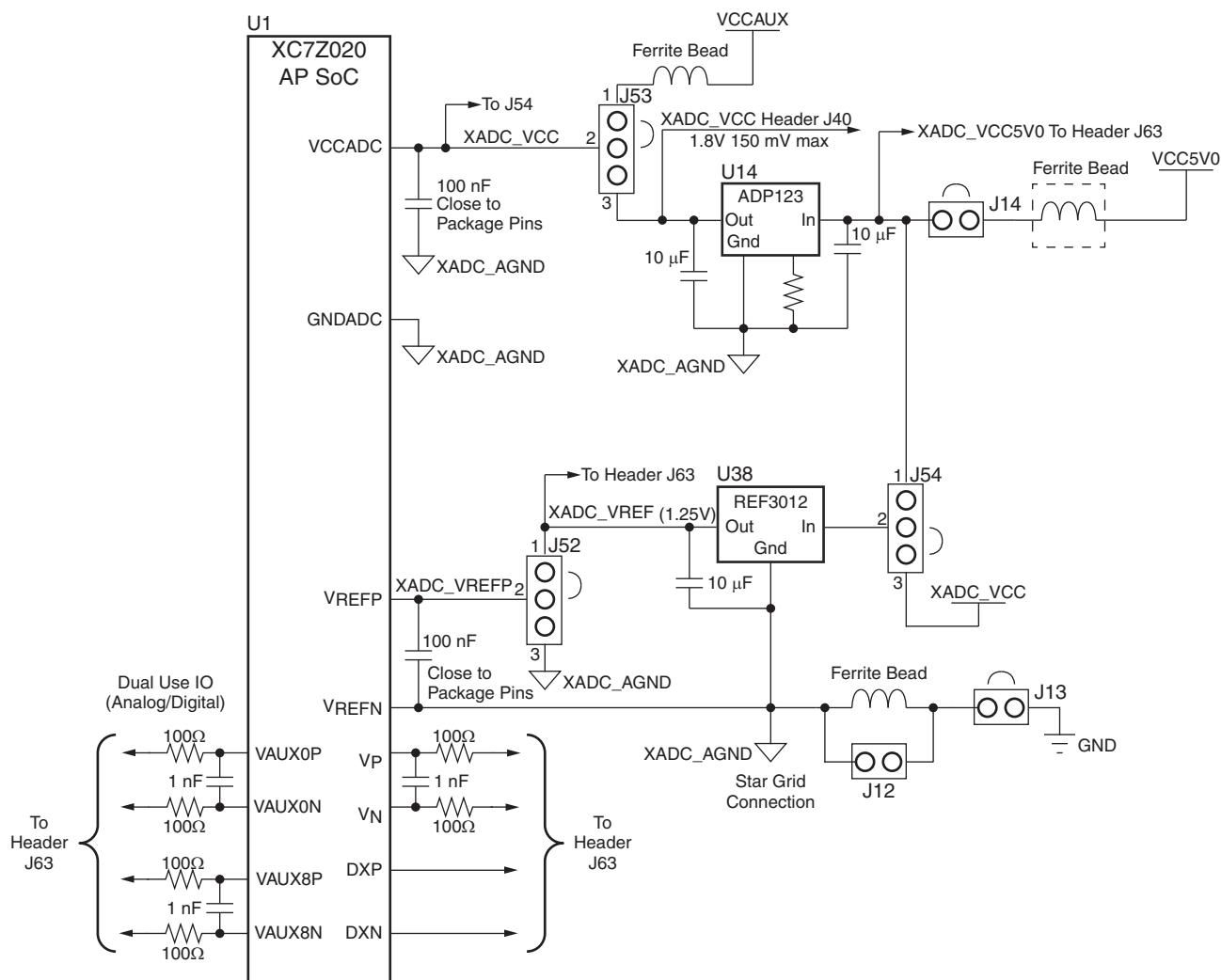


Figure 1-38: XADC Block Diagram

The ZC706 evaluation board supports both the internal XC7Z045 SoC sensor measurements and the external measurement capabilities of the XADC. Internal measurements of the die temperature, VCCINT, VCCAUX, and VCCBRAM are available.

Jumper J52 can be used to select either an external voltage reference (VREF) or on-chip voltage reference for the analog-to-digital converter.

For external measurements an XADC header (J63) is provided. This header can be used to provide analog inputs to the XC7Z045 SoC's dedicated VP/VN channel, and to the VAUXP[0]/VAUXN[0], VAUXP[8]/VAUXN[8] auxiliary analog input channels. Simultaneous sampling of Channel 0 and Channel 8 is supported.

A user-provided analog signal multiplexer card can be used to sample additional external analog inputs using the 4 GPIO pins available on the XADC header as multiplexer address lines. [Figure 1-39](#) shows the XADC header connections.

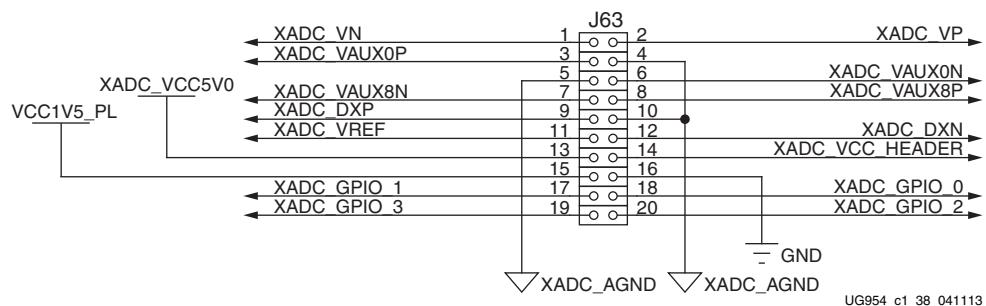


Figure 1-39: XADC Header (J63)

[Table 1-39](#) describes the XADC header J40 pin functions.

Table 1-39: XADC Header J63 Pinout

Net Name	J63 Pin Number	Description
VN, VP	1, 2	Dedicated analog input channel for the XADC.
XADC_VAUX0P, N	3, 6	Auxiliary analog input channel 0. Also supports use as I/O inputs when anti alias capacitor is not present.
XADC_VAUX8N, P	7, 8	Auxiliary analog input channel 8. Also supports use as I/O inputs when anti alias capacitor is not present.
DXP, DXN	9, 12	Access to thermal diode.
XADC_AGND	4, 5, 10	Analog ground reference.
XADC_VREF	11	1.25V reference from the board.
XADC_VCC5V0	13	Filtered 5V supply from board.
XADC_VCC_HEADER	14	Analog 1.8V supply for XADC.
VCC1V5_PL	15	VCCO supply for bank which is the source of DIO pins.

Table 1-39: XADC Header J63 Pinout (Cont'd)

Net Name	J63 Pin Number	Description
GND	16	Digital Ground (board) Reference
XADC_GPIO_3, 2, 1, 0	19, 20, 17, 18	Digital I/O. These pins should come from the same bank. These IOs should not be shared with other functions because they are required to support three-state operation.

Default Switch and Jumper Settings

The default switch and jumper settings for the ZC706 evaluation board are provided in this appendix.

Switches

[Figure 1-3, callout 24]

Default switch settings are listed in [Table A-1](#). The locations of the ZC706 jumper headers called out in [Table A-2](#) are shown in [Figure A-1](#).

Table A-1: Default Switch Settings

Switch	Function	Default	Selects	Figure 1-3 Callout
SW1	Board main power On-Off Slide Switch	OFF	Delivered in OFF position	27
SW4	2-pole SPST DIP Switch, JTAG mode select signals JTAG_SEL_[1:2]	10	JTAG = cable connector J3	34
SW11	5-pole DPDT DIP Switch, PS Boot Mode select signals MIO[6:2]_SELECT	All Down	JTAG flat cable header J3	29
SW12	4-pole SPST DIP Switch, user signals GPIO_DIP_SW[0:3], poles [1:4]	All OFF	All = 0 (4.7K p/d to GND)	24

Jumpers

[Figure 1-3, callout 24]

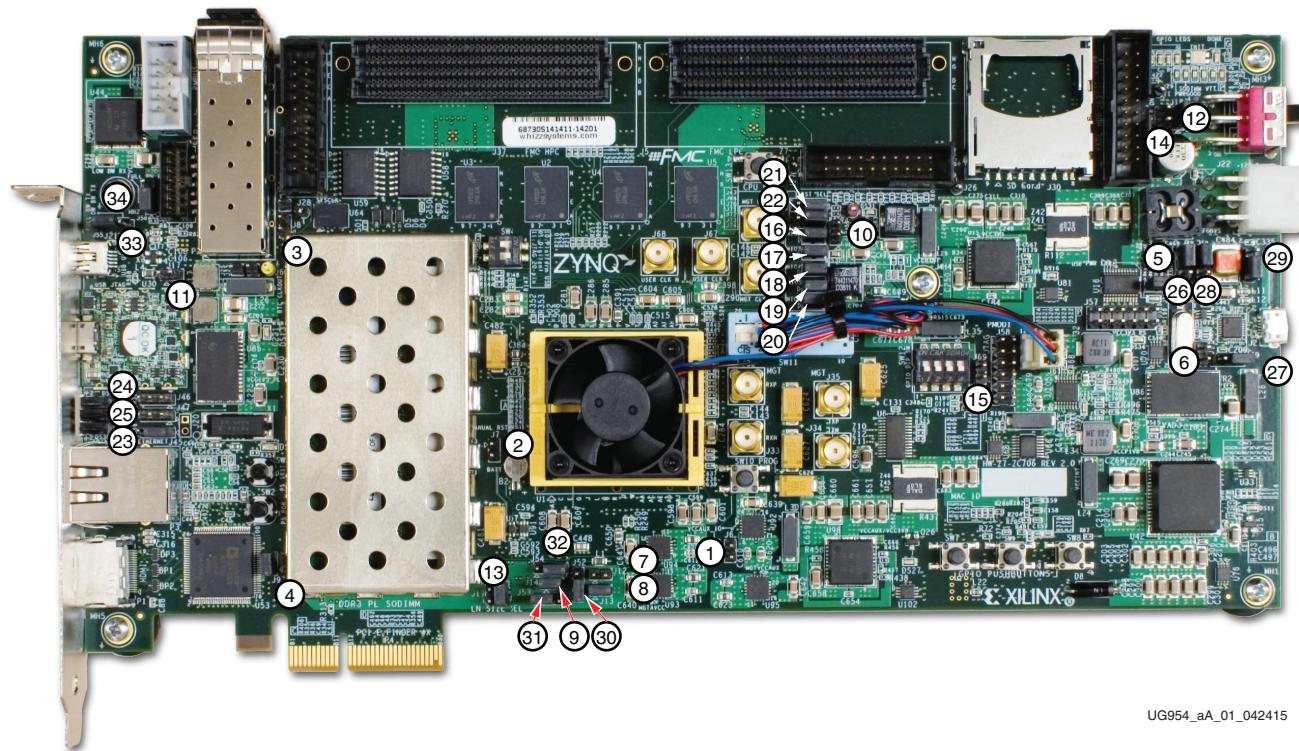
Default jumper positions are listed in [Table A-2](#).

Table A-2: Default Jumper Settings

Jumper Callout	Jumper	Function	Default Jumper Position	Option Selected	Schematic 0381513 Page
HDR_1 X 2					
1	J6 J65	SoC U1 Bank 0 CFGBVS pin V9 logic 0/1 Select (call out #1 applies to this, too): J65 is an INIT_B (pin 1) and DONE (pin 2) test header	OPEN OPEN	CFGBVS pin V9 = 1 N/A	3 3
2	J7	U8 MAX16025 POR Device Reset MR_B pin 13 logic 0/1 Select	OPEN	U8 MR_B pin 13 = 1	15
3	J8	JTAG Header J62 pin 2 can be connected to 3.3V	OPEN	J62 pin 2 is NC	16
4	J9	U51 Ethernet PHY CONFIG2 pin 2 1K pull-down to logic 0 (GND)	1-2	U51 pin 2 CONFIG2 = 0	
5	J10	U12 USB3320 2.0 Host/OTG or Device Select Header	1-2	HOST source VBUS power (from U22)	31
6	J11	U12 USB3320 2.0 RESET Header	OPEN	U12 not held in RESET	31
7	J12	U38 REF3012 VREF XADC_AGND-to-GND L3 inductor bypass	OPEN	L3 not bypassed	35
8	J13	U38 REF3012 VREF XADC_AGND-to-GND Select Header	1-2	XADC_AGND connected to GND	35
9	J14	XADC circuit VCC5V0 sources XADC_VCC5V0 Select Header	1-2	XADC_VCC5V0 = filtered (L1) VCC5V0	35
10	J15	ARM PJTAG Header J64 pin 2 can be connected to VADJ	OPEN	J64 pin 2 is NC	39
11	J17	SPF+ P2 pin 3 SFP_TX_DISABLE_TRANS logic 0/1 Select Header	OPEN	SPF+ P2 SFP TX is enabled (P2 pin 3 = 1)	41
12	J18	FMC_VADJ_ON_B Select Header	1-2	FMC VADJ enabled (U48 UCD90120A pin 37 = logic 0)	49
13	J19	PCIe® Lane Width Select Header	3-4	4-Lane PCIe selected	42
14	J66	PL_PWR_ON Header	OPEN	PL Power enabled (U48 UCD90120A pin 24 = logic 1)	49
15	J69	XADC Power System Vccint CS OpAmp U69 Gain Select Header	OPEN	U69 Current Sense OpAmp Gain = 10	45
16	J70	MIO Select Header MIO2 (Note: DIP SW11 pole 1 affects this signal)	1-2	QSPI0_IO0 = MIO2_SELECT	15
17	J71	MIO Select Header MIO3 (Note: DIP SW11 pole 2 affects this signal)	1-2	QSPI0_IO1 = MIO3_SELECT	15

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

Jumper Callout	Jumper	Function	Default Jumper Position	Option Selected	Schematic 0381513 Page
18	J72	MIO Select Header MIO4 (Note: DIP SW11 pole 3 affects this signal)	1-2	QSPI0_IO4 = MIO2_SELECT	15
19	J73	MIO Select Header MIO5 (Note: DIP SW11 pole 4 affects this signal)	1-2	QSPI0_IO5 = MIO2_SELECT	15
20	J74	MIO Select Header MIO6 (Note: DIP SW11 pole 5 affects this signal)	1-2	QSPI0_CLK = MIO6_SELECT	15
HDR_1 X 3					
21	J43	PS_SRST_B Select Header	1-2	PS_SRST_B = PS_SRST_B_SW (MAX16025 U8 pin 10)	15
22	J44	PS_POR_B Select Header	1-2	PS_POR_B = PS_POR_B_SW (MAX16025 U8 pin 11)	15
23	J45	U51 Ethernet PHY CONFIG3 pin 3 1K pull-up to 1.8V or 1 KΩ pull-down to GND Select Header	1-2	U51 pin 3 CONFIG3 = 1 (p/u to 1.8V)	29
24	J46	U51 Ethernet PHY CONFIG2 pin 2 tie to 1.8V or LED0 Select Header	OPEN	J9 sets U51 pin 2 CONFIG2 condition	29
25	J47	U51 Ethernet PHY CONFIG3 pin 3 LED1 or LED0 Select Header	OPEN	No connection to LED0 or LED1, J45 sets U51 pin 3 CONFIG3 condition	29
26	J48	U12 USB3320 2.0 MODE Select Header	2-3	HOST/OTG Mode selected	31
27	J49	USB 2.0 Micro-B connector J2 ID pin 4 function Select Header	1-2	J2 ID pin 4 connected to USB3320 U12 pin 23 ID	31
28	J50	USB_VBUS_SEL 1uF/120 uF capacitor to GND Select Header	2-3	USB_VBUS_SEL net has 120 uF to GND	31
29	J51	USB 2.0 Micro-B connector J2 ID shield pins connection Select Header	1-2	J2 shield pins to GND	31
30	J52	XADC_VREFP source Select Header	1-2	XADC_VREFP = XADC_VREF	35
31	J53	XADC_VCC source Select Header	1-2	XADC_VCC = VCCAUX 1.8V	35
32	J54	U38 REF3012 VREF Vin Select Header	2-3	U38 powered by XADC_VCC (U14 1.85V)	35
33	J55	SPF+ P2 SFP_RS1 BW Select Header	2-3	LOW BW TX selected	41
34	J56	SPF+ P2 SFP_RS0 BW Select Header	2-3	LOW BW RX selected	41



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Figure A-1: ZC706 Jumper Header Locations

VITA 57.1 FMC Connector Pinouts

[Figure B-1](#) shows the pinout of the FPGA mezzanine card (FMC) low pin count (LPC) connector defined by the VITA 57.1 FMC specification. For a description of how the ZC706 evaluation board implements the FMC specification, see [FPGA Mezzanine \(FMC\) Card Interface, page 67](#) and [LPC Connector J5, page 71](#).

	K	J	H	G	F	E	D	C	B	A
1	NC	NC	VREF_A_M2C	GND	NC	NC	PG_C2M	GND	NC	NC
2	NC	NC	PRSNT_M2C_L	CLK1_M2C_P	NC	NC	GND	DP0_C2M_P	NC	NC
3	NC	NC	GND	CLK1_M2C_N	NC	NC	GND	DP0_C2M_N	NC	NC
4	NC	NC	CLK0_M2C_P	GND	NC	NC	GBTCLK0_M2C_P	GND	NC	NC
5	NC	NC	CLK0_M2C_N	GND	NC	NC	GBTCLK0_M2C_N	GND	NC	NC
6	NC	NC	GND	LA00_P_CC	NC	NC	GND	DP0_M2C_P	NC	NC
7	NC	NC	LA02_P	LA00_N_CC	NC	NC	GND	DP0_M2C_N	NC	NC
8	NC	NC	LA02_N	GND	NC	NC	LA01_P_CC	GND	NC	NC
9	NC	NC	GND	LA03_P	NC	NC	LA01_N_CC	GND	NC	NC
10	NC	NC	LA04_P	LA03_N	NC	NC	GND	LA06_P	NC	NC
11	NC	NC	LA04_N	GND	NC	NC	LA05_P	LA06_N	NC	NC
12	NC	NC	GND	LA08_P	NC	NC	LA05_N	GND	NC	NC
13	NC	NC	LA07_P	LA08_N	NC	NC	GND	GND	NC	NC
14	NC	NC	LA07_N	GND	NC	NC	LA09_P	LA10_P	NC	NC
15	NC	NC	GND	LA12_P	NC	NC	LA09_N	LA10_N	NC	NC
16	NC	NC	LA11_P	LA12_N	NC	NC	GND	GND	NC	NC
17	NC	NC	LA11_N	GND	NC	NC	LA13_P	GND	NC	NC
18	NC	NC	GND	LA16_P	NC	NC	LA13_N	LA14_P	NC	NC
19	NC	NC	LA15_P	LA16_N	NC	NC	GND	LA14_N	NC	NC
20	NC	NC	LA15_N	GND	NC	NC	LA17_P_CC	GND	NC	NC
21	NC	NC	GND	LA20_P	NC	NC	LA17_N_CC	GND	NC	NC
22	NC	NC	LA19_P	LA20_N	NC	NC	GND	LA18_P_CC	NC	NC
23	NC	NC	LA19_N	GND	NC	NC	LA23_P	LA18_N_CC	NC	NC
24	NC	NC	GND	LA22_P	NC	NC	LA23_N	GND	NC	NC
25	NC	NC	LA21_P	LA22_N	NC	NC	GND	GND	NC	NC
26	NC	NC	LA21_N	GND	NC	NC	LA26_P	LA27_P	NC	NC
27	NC	NC	GND	LA25_P	NC	NC	LA26_N	LA27_N	NC	NC
28	NC	NC	LA24_P	LA25_N	NC	NC	GND	GND	NC	NC
29	NC	NC	LA24_N	GND	NC	NC	TCK	GND	NC	NC
30	NC	NC	GND	LA29_P	NC	NC	TDI	SCL	NC	NC
31	NC	NC	LA28_P	LA29_N	NC	NC	TDO	SDA	NC	NC
32	NC	NC	LA28_N	GND	NC	NC	3P3VAUX	GND	NC	NC
33	NC	NC	GND	LA31_P	NC	NC	TMS	GND	NC	NC
34	NC	NC	LA30_P	LA31_N	NC	NC	TRST_L	GA0	NC	NC
35	NC	NC	LA30_N	GND	NC	NC	GA1	12P0V	NC	NC
36	NC	NC	GND	LA33_P	NC	NC	3P3V	GND	NC	NC
37	NC	NC	LA32_P	LA33_N	NC	NC	GND	12P0V	NC	NC
38	NC	NC	LA32_N	GND	NC	NC	3P3V	GND	NC	NC
39	NC	NC	GND	VADJ	NC	NC	GND	3P3V	NC	NC
40	NC	NC	VADJ	GND	NC	NC	3P3V	GND	NC	NC

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Figure B-1: FMC LPC Connector Pinout

[Figure B-2](#) shows the pinout of the FPGA mezzanine card (FMC) high pin count (HPC) connector defined by the VITA 57.1 FMC specification. For a description of how the ZC706 evaluation board implements the FMC specification, see [FPGA Mezzanine \(FMC\) Card Interface, page 67](#) and [HPC Connector J37, page 67](#).

	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_M2C_P	PRSNT_M2C_L	CLK1_M2C_P	GND	HA01_P_CC	GND	DP0_C2M_P	GND	DP1_M2C_P
3	GND	CLK3_M2C_N	GND	CLK1_M2C_N	GND	HA01_N_CC	GND	DP0_C2M_N	GND	DP1_M2C_N
4	CLK2_M2C_P	GND	CLK0_M2C_P	GND	HA00_P_CC	GND	GBTCLK0_M2C_P	GND	DP9_M2C_P	GND
5	CLK2_M2C_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	LA04_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 B-2: FMC HPC Connector Pinout

Xilinx Constraints File

The Xilinx Design Constraints (XDC) template for the ZC706 board provides for designs targeting the ZC706 evaluation board. Net names in the constraints correlate with net names on the latest ZC706 evaluation board schematic. Users must identify the appropriate pins and replace the net names with net names in the user RTL. See *Vivado Design Suite User Guide: Using Constraints* ([UG903](#)) for more information.

The FMC connectors J37 and J5 are connected to 2.5V V_{ADJ} banks. Because different FMC cards implement different circuitry, the FMC bank I/O standards must be uniquely defined by each customer.

Note: Refer to the Board Files area of the documentation tab on the Xilinx Zynq-7000 SoC ZC706 Evaluation Kit product page (www.xilinx.com/zc706) for the latest xdc constraints file.

Refer to the Zynq-7000 SoC ZC706 Evaluation Kit - Known Issues and Release Notes Master Answer Record concerning the CE requirements for the PC Test Environment:

[Zynq-7000 SoC ZC706 Master Answer Record 51899](#)

Board Setup

Installing the ZC706 Board in a PC Chassis

Installation of the ZC706 board inside a computer chassis is required when developing or testing PCI Express® functionality.

When the ZC706 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 shown in [Figure D-1](#) to J22 on the ZC706 board. The Xilinx part number for this cable is 2600304, and is equivalent to Sourcegate Technologies part number AZCBL-WH-1109-RA4. For information on ordering this cable, see [\[Ref 37\]](#).



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Figure D-1: ATX Power Supply Adapter Cable

To install the ZC706 board in a PC chassis:

1. On the ZC706 board, remove all six rubber feet and standoffs and the PCIe bracket. The standoffs and feet are affixed to the board by screws on the top side of the board. Remove all six screws.
2. Re-attach the PCIe bracket to the ZC706 board using two of the previously removed screws.
3. Power down the host computer and remove the power cord from the PC.
4. Open the PC chassis following the instructions provided with the PC.
5. 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.
6. Plug the ZC706 board into the PCIe connector at this slot and secure its PCIe bracket to the chassis with a screw at the top of the bracket.

7. The ZC706 board is taller than standard PCIe cards. Ensure that the height of the card is free of obstructions.
8. Connect the ATX power supply to the ZC706 board using the ATX power supply adapter cable as shown in [Figure D-1](#):
 - a. Plug the 6-pin 2 x 3 Molex connector on the adapter cable into J22 on the ZC706 board.
 - b. Plug the 4-pin 1 x 4 peripheral power connector from the ATX power supply into the 4-pin adapter cable connector.
9. Slide the ZC706 board power switch SW1 to the ON position. The PC can now be powered on.

Board Specifications

Dimensions

Height 5.5 inch (14.0 cm)

Length 10.5 inch (26.7 cm)

Note: The ZC706 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}

Regulatory and Compliance Information

Overview

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

Refer to the Zynq-7000 SoC ZC706 Evaluation Kit - Known Issues and Release Notes Master Answer Record concerning the CE requirements for the PC Test Environment:

[Zynq-7000 SoC ZC706 Master Answer Record 51899](#)

Declaration of Conformity

The Zynq-7000 SoC ZC706 Evaluation Kit CE [Declaration of Conformity](#) is online.

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

In August of 2005, the European Union (EU) implemented the EU WEEE Directive 2002/96/EC and later the WEEE Recast Directive 2012/19/EU requiring Producers of electronic and electrical equipment (EEE) to manage and finance the collection, reuse, recycling and to appropriately treat WEEE that the Producer places on the EU market after August 13, 2005. The goal of this directive is to minimize the volume of electrical and electronic waste disposal and to encourage re-use and recycling at the end of life.



Xilinx has met its national obligations to the EU WEEE Directive by registering in those countries to which Xilinx is an importer. Xilinx has also elected to join WEEE Compliance Schemes in some countries to help manage customer returns at end-of-life.



If you have purchased Xilinx-branded electrical or electronic products in the EU and are intending to discard these products at the end of their useful life, please do not dispose of them with your other household or municipal waste. Xilinx has labeled its branded electronic products with the WEEE Symbol to alert our customers that products bearing this label should not be disposed of in a landfill or with municipal or household waste in the EU.



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



In August of 2005, the European Union (EU) implemented the EU WEEE Directive 2002/96/EC and later the WEEE Recast Directive 2012/19/EU requiring Producers of electronic and electrical equipment (EEE) to manage and finance the collection, reuse, recycling and to appropriately treat WEEE that the Producer places on the EU market after August 13, 2005. The goal of this directive is to minimize the volume of electrical and electronic waste disposal and to encourage re-use and recycling at the end of life.

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If you have purchased Xilinx-branded electrical or electronic products in the EU and are intending to discard these products at the end of their useful life, please do not dispose of them with your other household or municipal waste. Xilinx has labeled its branded electronic products with the WEEE Symbol to alert our customers that products bearing this label should not be disposed of in a landfill or with municipal or household waste in the EU.



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

Additional Resources

Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see the [Xilinx Support website](#).

For continual updates, add the Answer Record to your [myAlerts](#).

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.

References

The most up to date information related to the ZC706 board, its documentation, and schematics, are available on the following websites.

The Xilinx Zynq-7000 SoC ZC706 Evaluation Kit product page:

www.xilinx.com/zc706

The Zynq-7000 SoC ZC706 Evaluation Kit - Known Issues and Release Notes Master Answer Record is [Zynq-7000 SoC ZC706 Master Answer Record 51899](#).

These Xilinx documents provide supplemental material useful with this guide:

1. *Zynq-7000 SoC Overview* ([DS190](#))
2. *Zynq-7000 SoC (Z-7030, 035, 045, and Z-7100): DC and AC Switching Characteristics* ([DS191](#))
3. *LogiCORE IP DisplayPort Product Guide for Vivado Design Suite* ([PG064](#))

4. LogiCORE IP Tri-Mode Ethernet MAC Product Guide for Vivado Design Suite ([PG051](#))
5. 7 Series FPGAs Memory Resources User Guide ([UG473](#))
6. 7 Series FPGAs Configuration User Guide ([UG470](#))
7. 7 Series FPGAs GTX/GTH Transceivers User Guide ([UG476](#))
8. 7 Series FPGAs Integrated Block for PCI Express Product Guide for Vivado Design Suite ([PG054](#))
9. 7 Series FPGAs and Zynq-7000 SoC XADC Dual 12-Bit 1 MSPS Analog-to-Digital Converter User Guide ([UG480](#))
10. Zynq-7000 SoC Technical Reference Manual ([UG585](#))
11. 7 Series FPGAs Memory Interface Solutions User Guide ([UG586](#))
12. Zynq-7000 SoC Packaging and Pinout Product Specification ([UG865](#))
13. AMS101 Evaluation Card User Guide ([UG886](#))
14. Vivado Design Suite User Guide: Using Constraints ([UG903](#))
15. Zynq-7000 SoC PCB Design and Pin Planning Guide ([UG933](#))
16. Answer Record [AR#61712](#)

Other documents associated with Xilinx devices, design tools, intellectual property, boards, and kits are available at the Xilinx documentation website at:

www.xilinx.com/support/documentation/index

Documents associated with other devices used by the ZC706 evaluation board are available at these vendor websites:

17. Spansion Inc.: www.spansion.com
(S25FL128SAGMFIR01)
18. Standard Microsystems Corporation: www.smsc.com/
(USB3320)
19. SanDisk: www.sandisk.com
20. SD Association: www.sdcard.org.
21. SiTime: www.sitime.com
(SiT9102)
22. Silicon Labs: www.silabs.com
(Si570, Si5324C)
23. PCI Express® standard: www.pcisig.com/specifications
24. SFF-8431 specification: ftp.seagate.com/sff
25. Marvell Semiconductor: www.marvell.com, www.marvell.com/transceivers/alaska-gbe

26. Analog Devices: www.analog.com/en/index.html
(ADP 123, ADV7511KSTZ-P)
27. Texas Instruments: www.ti.com, www.ti.com/fusiondocs
(UCD90120A, LMZ31506, LMZ31520, LMZ31710, LMZ31704, TPS54291PWP,
TPS51200DR, PCA9548, TCA641APWR, TXS0108E)
28. Texas Instruments: www.ti.com/xilinx_usb
(to order EVM USB-TO-GPIO)
29. Texas Instruments: www.ti.com/fusion-gui
(to download FUSION_DIGITAL_POWER_DESIGNER)
30. *RTC-8564JE/NB Application Manual:*
www.epsondevice.com/docs/qd/en/DownloadServlet?id=ID000498
31. Epson Electronics America: www.eea.epson.com.
(RTC-8564JE)
32. Samtec: www.samtec.com.
(SEAF series connectors)
33. Texas Instruments digital power: www.ti.com/ww/en/analog/digital-power/index.html
34. Maxim Integrated: www.maximintegrated.com
(Maxim MAX13035E)
35. Micron Technology: www.micron.com (MT8JTF12864HZ-1G6G1, MT41J256M8HX-15E).
36. Digilent: www.digilentinc.com
(Pmod Peripheral Modules)
37. Sourcegate Technologies: www.sourcegate.net. To order the custom Sourcegate cable,
contact Sourcegate at, +65 6483 2878 for price and availability.

Note: 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. This is a custom cable and cannot be ordered from the Sourcegate website.

38. VITA FMC Marketing Alliance: www.vita.com (FPGA Mezzanine Card (FMC) VITA 57.1 specification)