



Reference Manual

Mpression USB 3.0 Type-C PD Card

Revision 1.0

2017/09/01

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1. Read This First

1.1 Important Information

READ FIRST:

- **READ** this Reference Manual before using this product.
- **Keep** this manual so you can refer to it when necessary.
- **Do not attempt** to use the board until you fully understand its mechanisms.

Purpose of the Product:

- This product is intended for evaluation and verification of systems that used Power Delivery and USB 3.0 Type-C interfaces with evaluation boards equipped with FPGA from Intel. It provides support for verification of both software and hardware. Be sure to use this product correctly for this purpose.

For Users of This Product:

- This product should be used only by individuals who have carefully read and understand these materials and the Getting Started manual. Use of this product requires a basic knowledge of FPGAs, logic circuits, electronic circuits, and microcomputers.

Precautions to be taken when using This Product:

- This product is to be used for development of a program, and the evaluation stage. **You cannot install the board in your product** and cannot use the board for mass-production. When mass-producing a program you have finished developing, be sure to decide at your own responsibility whether it can be put to practical use by performing integration test, evaluation, or some other experiment.
- In no event shall Macnica Inc. be liable for any consequence arising from the use of this product.
- Macnica Inc. shall make effort to provide a workaround or fix for failures of this product, with or without charge. This does not mean, however, that Macnica Inc. guarantees to provide a workaround or fix under all circumstances.
- Macnica Inc. cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this reference manual and on the product are therefore not all-inclusive. Use this product correctly and safely at your own responsibility.
- Even if a device installed on this product has a failure, it cannot be replaced.
- The USB 3.0 Type-C interface is not guaranteed to connect to all hosts or devices.
- Remodeling or damages caused by the customer is not guaranteed.
- This product is a lead-free mounting product.
- Generally, the brand names carried in this reference manual each constitute a maker's trademark or registered trademark.

Improvement Policy:

- Macnica Inc. pursues a policy of continuous improvement in design, performance, and safety of the product.
Macnica Inc. reserves the right to change, wholly or partially, specifications, design, reference manual, and other documentation at any time without notice.

Warranty:

- Macnica Inc. offers exchange of this product free of charge only in a set range of cases of initial trouble for this product, and within 30 days from when the customer received delivery of the Board.
Macnica Inc. cannot exchange products in cases where breakdown is caused for the following reasons:
 - (1) Misuse, abuse of the product or use under abnormal conditions
 - (2) Remodeling or repair
 - (3) A fire, earthquake, fall or other accidents

Figures:

- Some figures in this reference manual may differ from your system as purchased.

1.2 Developer Information

The Developer of this product is:

Macnica Inc.

1-6-3 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8561 JAPAN

1.3 Inquires

In case you have any inquiries about the use this product, please contact your local Macnica company or make inquiries through the contact form in the following web site:

<http://www.m-pression.com/contact>




Macnica companies:

- | | | |
|------------------|-----------------------|---|
| • China & HK: | Cytech Technology | http://www.cytech.com/ |
| • ASEAN & India: | Cytech Global | http://www.cytechglobal.com/ |
| • Taiwan: | Galaxy Far East Corp. | http://www.gfec.com.tw/ |
| • North America: | Macnica Americas | http://www.macnica-na.com/ |
| • Brazil: | Macnica DHW | http://www.macnicadhw.com.br/en/ |
| • Japan: | Macnica Altima | http://www.alt.macnica.co.jp |
| | Elsena | http://www.elsena.co.jp |



2. For Ensuring Safe Use



Be sure to follow the precautions given here, which are intended to prevent harm to the user and others as well as material damage.


2.1 Legend

 Danger	Indicates an imminent hazardous situation which if not avoided will result in death or serious injury.
 Warning	Indicates a potentially hazardous situation which if not avoided could result in death or serious injury.
 Caution	Indicates a potentially hazardous situation which if not avoided may result in minor or moderate injury or in property damage.

2.2 Cautions

 Danger	When an AC adapter is required, be sure to use the AC adapter included in the package or one that meets the specifications described in this Manual. Using an AC adapter not meeting the specifications described in this Manual may cause the kit to emit heat, explode, or ignite.
 Warning	Do not apply strong impacts or blows to the kit. Doing so may cause the kit to emit heat, explode, or ignite, or the equipment in the kit to fail or malfunction. This may also cause fire.
	Do not put the main unit or the AC adapter in cooking appliances such as microwave ovens, or high-pressure containers. Doing so might cause the main unit or AC adapter to emit heat, explode, ignite, or emit smoke, or its parts to break or warp.
	Do not wrap the main unit that is in use with cloth or other materials that are likely to allow heat to build up inside the wrapping. This will cause heat to build up inside the wrapping which may cause the main unit to ignite or malfunction.
	When disposing of the main unit, do not dispose of it along with general household waste. Throwing the main unit into fire may cause it to explode. Dispose of the main unit following the laws, regulations, and ordinances governing waste disposal.
	Do not pull the power supply cable with excessive force or place heavy items on it. Do not damage, break, bundle, or tamper with the power supply cable. Damaged parts of the power supply cable might cause a short circuit resulting in fire or accidents involving electrical shock.
	Do not plug or unplug the power plug with wet or moist hands. This might cause injuries or equipment malfunctions or failures due to electrical shock.
	Plug the power plug securely into the outlet. If the power plug is not securely plugged into the outlet, it may cause accidents involving electrical shock or fire due to the heat that is emitted.

 Warning (Continued from previous page)	<p>Do not connect many electrical cords to a single socket or connect an AC adapter to an outlet that is not rated for the specified voltage. Doing so may cause the equipment to malfunction or fail, or lead to accidents involving electrical shock or fire due to the heat that is emitted.</p> <p>Periodically remove any dust accumulated on the power plug and around the outlet (socket). Do not use a power plug with dust accumulated on it because doing so will lead to insulation failure due to moisture which may lead to fire. Remove any dust on the power plug and around the outlet with dried cloth.</p> <p>Do not place any containers such as cups or vases filled with water or other liquid on this Board. If this Board is exposed to water or other liquids it may cause the Board to malfunction or lead to accidents involving electrical shock. If you spilled water or other liquid on this Board, immediately stop using the Board, turn off the power, and unplug the power plug. If you have any requests for repairs or technical consultation, please contact the local Macnica company or Mpression inquiry URL.</p> <p>Keep this board and accessories out of reach of children. Failure to do so may lead to injuries.</p>
 Caution	<p>Do not place the kit on unstable places such as shaky stands or tilted locations. Doing so may cause injuries or cause this Board to malfunction if the Board should fall.</p> <p>Do not attempt to use or leave the kit in places subject to strong direct sunlight or other places subject to high temperatures such as in cars in hot weather. Doing so might cause the kit to emit heat, break, ignite, run out of control, warp, or malfunction. Also, some parts of the equipment might emit heat causing burn injuries.</p> <p>Do not use the kit in places subject to extremely high or low temperatures or severe temperature changes. Doing so may cause the kit to fail or to malfunction. Always be sure to use the kit within a temperature range of 5°C to 35°C and a humidity range of 0% to 85%.</p> <p>Unplug the power supply cable when carrying out maintenance of devices in which the main unit is embedded. Failure to do so may lead to accidents involving electrical shock.</p> <p>Do not place the board in locations where excessive force may be applied to it. Doing so may cause the PC board to warp, leading to breakage of the PC board, missing parts or malfunctioning parts.</p> <p>When using the kit together with expansion boards or other peripheral devices, be sure to carefully read each of their manuals and to use them correctly. Developer does not guarantee the operation of specific expansion boards or peripheral devices when used in conjunction with this Board unless they are specifically mentioned in this Manual or their successful operation with this Board has been confirmed in separate documents.</p> <p>Be sure to turn off the power switch when moving this Board to connect to other devices. Failure to do so may cause this Board to fail or lead to accidents involving electrical shock.</p>

 <p>Caution (Continued from previous page)</p>	<p>Do not clean this Board by using a rag containing chemicals such as benzine or thinner.</p> <p>Failure to do so will likely to cause this Board to deteriorate. When using a chemical cloth be sure to comply with any directions or warnings.</p>
	<p>Do not immediately turn on the power if you find that water or moisture had condensed onto the main unit after removing the board from the package.</p> <p>Condensation might occur on this Board when taking it out of the box, if the board is cool yet the room temperature is warm.</p> <p>Do not apply power to the Board while water or moisture has condensed on it because the moisture may cause the Board to break or may shorten the service life of the parts.</p> <p>When you first take this Board out of the box be sure to leave it at room temperature for a while before using it. If condensation or moisture has occurred on this Board, first wait for the moisture to fully evaporate before installing or connecting the Board to other devices.</p>
	<p>Do not disassemble, dismantle, modify, alter, or recycle parts unless they are clearly described as customizable in this Manual.</p> <p>Although this kit is customizable, overall product operation cannot be guaranteed if parts needed for basic operations which are not specified in this Manual as customizable are modified in any way. Please contact the local Macnica company or Mpression inquiry URL beforehand if you wish to customize or modify any parts that are not described in this Manual as customizable.</p>

3. Unboxing

When unpacking the product, make sure that everything is included and that nothing is damaged. If something is missing, or if you discover physical damage, contact your sales representative within 30 days after the product was delivered to you.

USB 3.0 Type-C PD Card: 1 pc	
AC adapter 24 V/4.2 A: 1 pc	
Spacers for board mounting: 6 sets	
Guide for Developers	
Circuit Diagram	Download these files from the website at the URL noted in “Packing List and Precautions”.
Reference Manual	
Getting Started	
Reference Designs	

4. Board Functions and Features

4.1 Main Features

This board is a daughter board that is compatible with Intel's High-Speed Mezzanine Card (HSMC). By inserting this daughter board for function expansion into a board for evaluating an FPGA equipped with an HSMC, you can use various types of FPGAs and their functions to do various verifications of USB 3.0, Power Delivery, and DisplayPort interfaces.

The verified FPGA evaluation board is a Macnica Mpression Sodja board with an on-board Intel Cyclone® V Series FPGA.

For more detailed information and other related information, visit the link below.

- Cyclone® V Device Family Information
[Documentation: Cyclone V Devices](#)
- Specifications for High-Speed Mezzanine Card (HSMC)
[High-Speed Mezzanine Card \(HSMC\)](#)
- Mpression Sodja Board Documentation
[Mpression Sodja board](#)

4.2 Key Components

Table 1 shows the board's product specifications.

Table 1 USB 3.0 Type-C PD Card Product Specifications

Key Components	ALTHSMCUSB3PD
External Dimensions	147.5 mm x 78.105 mm
Board Specifications	8-layer FR4
HSMC connector	Samtec ASP-122952-01
Power	24 VDC/4.2 A from power jack
Push switch	x 3
DIP switch	x 3
Power switch	x 1
Power status LED	x 9
Interface	USB 3.0 Type-C
	USB 2.0 Micro-B x 2
	5-pin header for CCG3 program
	20-pin header for FX3 JATG
Operating Conditions	Temperature: 5°C to 35°C, Humidity: 0% to 85%

4.4 Board Specifications

Figure 4-2 and Figure 4-3 show the board's layout.

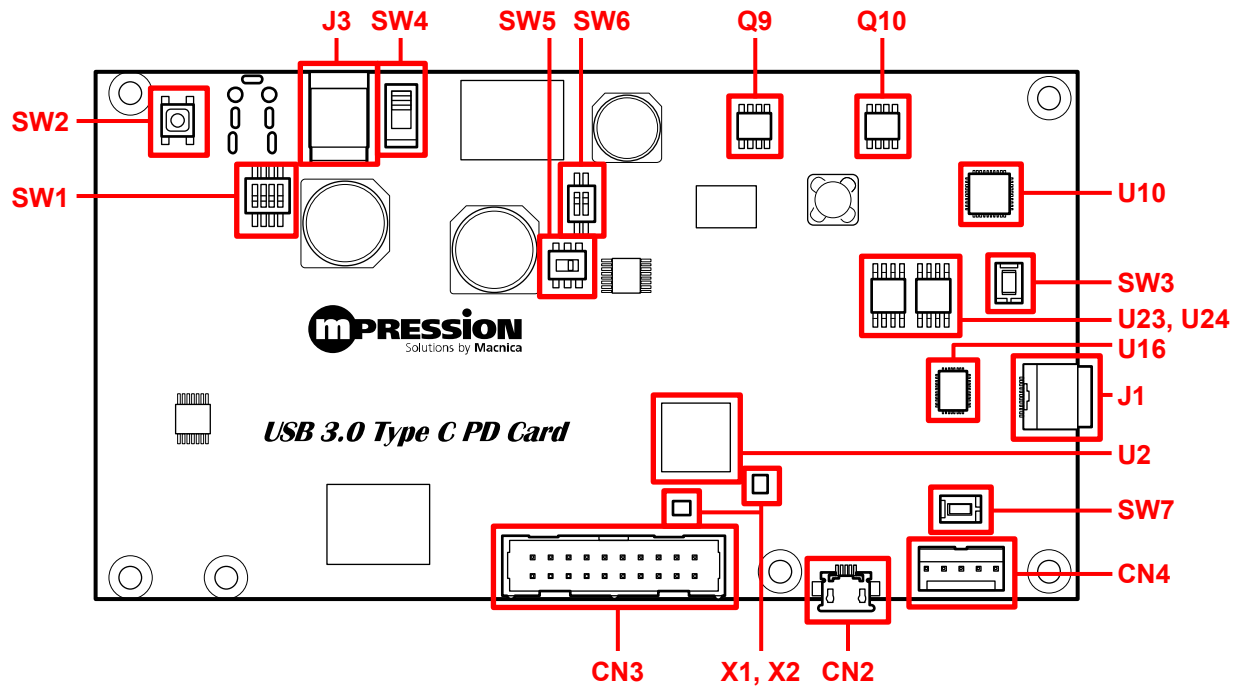


Figure 4-2 USB 3.0 Type-C PD Card Layout (Top View)

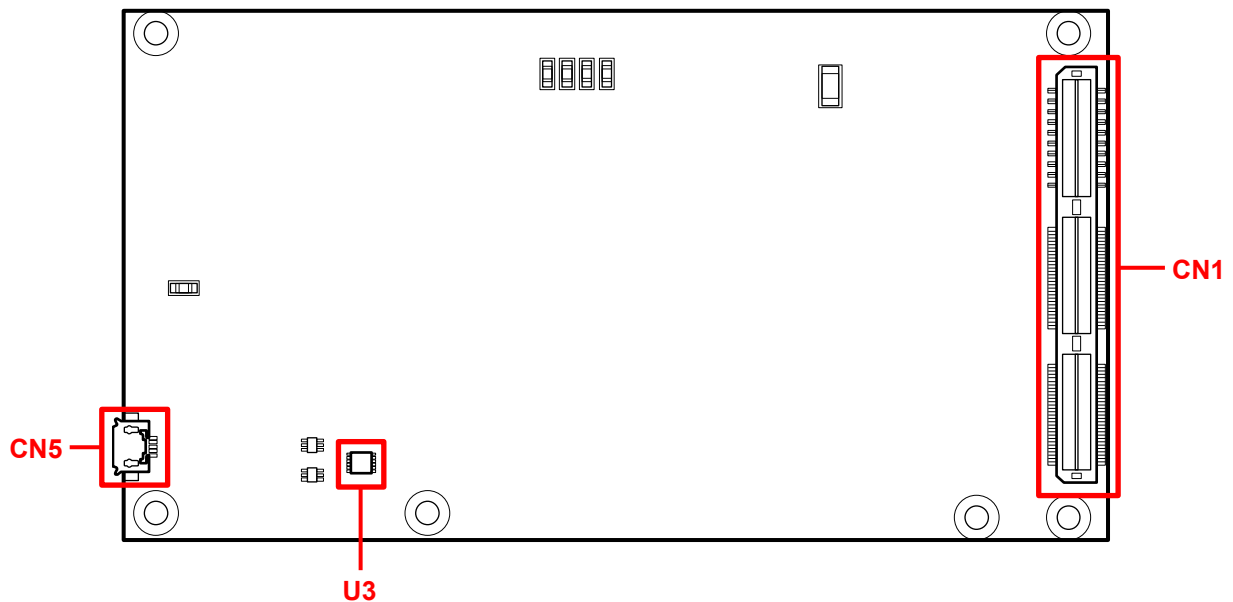


Figure 4-3 USB 3.0 Type-C PD Card Layout (Bottom View)

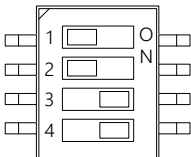
	Reference	Function	Details
Device			
1	U2	Cypress EZ-USB®FX3	SuperSpeed USB controller
2	U10	Cypress EZ-PD™ CCG3	USB Type-C port controller
3	U16	PARADE PS8742	USB device/USB Type-C redriver switch for DisplayPort sinking
4	Q9, Q10	N channel MOSFET	For controlling USB PD
5	U3	USB to UART bridge	USB to UART bridge chip
6	U23, U24	EEPROM	EEPROM for FX3 FW
7	X1, X2	19.2 MHZ liquid crystal oscillator, 32.768 KHZ liquid crystal oscillator	Clock for FX3
Interface			
8	J1	USB Type-C connector	USB Type-C connector
9	J3	DC jack	24 VDC power input
11	CN1	HSMC connector	Connector for FPGA main board
10	CN2	USB Micro-B connector	Connector for FX3 UART
11	CN3	JTAG connector	Connector for FX3 JTAG
12	CN4	All-purpose connector	Connector for CCG3 program
13	CN5	USB Micro-B connector	Connector for CCG3 debugging
14	SW1	FX3 boot mode selection switch	Boot mode can be selected by setting of SW1 [3:1]
15	SW2	FX3 reset push switch	FX3 reset
16	SW3	CCG3 reset push switch	CCG3 reset
17	SW4	Power switch	
18	SW5	Switch for selecting VBUS output	Can switch from automatic control to manual control via the CCG3
19	SW6	Switch for manual control of VBUS output	Can control output voltage to VBUS via SW6[2:1] if the SW5 setting is set to manual control
20	SW7	Push switch for CCG3 interruption	External interruption switch for CCG3
21	LD1, LD10	HSMC 3.3 V status LED	LEDs for hot plug status of DisplayPort Sink and 3.3 V from HSMC: Lights when operating normally
22	LD3, LD4, LD5, LD6, LD7, LD8, LD9	Power status LED	FX3's 1.2V, 2.5 V, 3.3 V, 5 V, USB_P_PWR (USB provide power), other (Except FX3's) 3.3 V, 5 V power statuses: Lights when operating normally

5. Components of the Board

5.1 Switch Functions

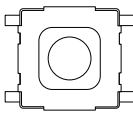
5.1.1 SW1

SW1 are the DIP switches for selecting hardware reset route and EZ-USB FX3 boot options for the board.

Function name	Initial values	Function
Select PMODE/RESET	SW1[4:1] => OFF, OFF, ON, ON  EZ-USB FX3 reset control cannot be done from FPGA while in USB Boot mode	SW1[3:1] = PMODE[2:0]: OFF, ON, ON: USB Boot ON, OFF, OFF: I2C only SW1[4] = H/W RESET connection selection: ON: Possible to control hardware reset to EZ-USB FX3 from the FPGA by connecting signal from FPGA to RESET_N terminal on EZ-USB FX3. OFF: Cannot control EZ-USB FX3 reset from FPGA because the reset signal from FPGA is not connected.

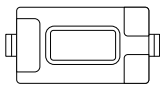
5.1.2 SW2

SW2 is a push switch for hardware reset input to EZ-USB FX3 on the board. Pushing the switch resets the EZ-USB FX3 hardware.

Function name	Initial values	Function
EZ-USB FX3 hardware reset	— 	Pushing the switch resets the EZ-USB FX3 and returning the switch returns it to normal.

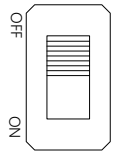
5.1.3 SW3


SW3 is a push switch for hardware reset input to EZ-PD CCG3 on the board. Pushing the switch resets the EZ-PD CCG3 hardware.

Function name	Initial values	Function
EZ-PD CCG3 hardware reset	— 	Pushing the switch resets the EZ-PD CCG3 and returning the switch returns it to normal.

5.1.4 SW4

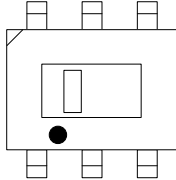
SW4 is the power switch to the board. It is possible to turn the power on or off only when the board is inserted into the HSMC connector on the FPGA evaluation board and the power on the FPGA evaluation board is on.


Function name	Initial values	Function
Power switch	OFF 	When the power is on, 24 VDC is supplied to the board from the AC adapter connected to J3.

 Warning	Operation of the board is not guaranteed if you use an AC adapter other than the one provided with the board. Always use the AC adapter provided.
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5.1.5 SW5

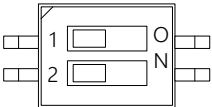
SW5 is a switch that switches whether EZ-PD CCG3 controls the power output to the VBUS of the USB Type-C connector or whether it is manually controlled by SW6. The user cannot select this because “Control by EZ-PD CCG3” is set at the factory.

Function name	Initial values	Function
Switch for selecting VBUS output power	Fixed on left side 	Left side: Control by EZ-PD CCG3 Right side: Manual control by SW6

 Warning	Operating SW5 while the power to the board is on and an external device is connected to the USB Type-C connector may damage or break the board and the device connected via USB. In addition, operating SW5 while evaluating firmware on EZ-PD CCG3 may cause unexpected problems to occur. Do not use SW5 to set “Manual control by SW6”.
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5.1.6 SW6


SW6 is a DIP switch that manually controls power output to the VBUS on the USB Type-C connector. It is used in combination with SW5, but the user does not need to set it.

Function name	Initial values	Function
Switch for manual control of VBUS output	SW6[2:1]: OFF OFF (00) 	SW6[2:1]: OFF OFF: 5 V OFF ON: 9 V ON OFF: 15 V ON ON: 20 V

5.1.7 SW7

SW7 connects the all-purpose port P2.0 terminal on the EZ-PD CCG3 on the board. SW7 can be used as an interrupt switch by setting the all-purpose port P2.0 terminal (15 pin) on the EZ-PD CCG3 as an interrupt terminal.

However, the P2.0 cannot be used as an all-purpose port if a debug kit, such as a MiniProg3 USB dongle for PSoC Programmer Software, is connected to CN4.

Function name	Initial values	Function
Switch for input to EZ-PD CCG3 all-purpose port	— 	Pushing this switch sets the P2.0 terminal (15 pin) on the EZ-PD CCG3 to low and returning the switch sets it to high.

5.2 Connector Pin Assignments

Figure 5-1 and Figure 5-2 show the positions of the connectors.

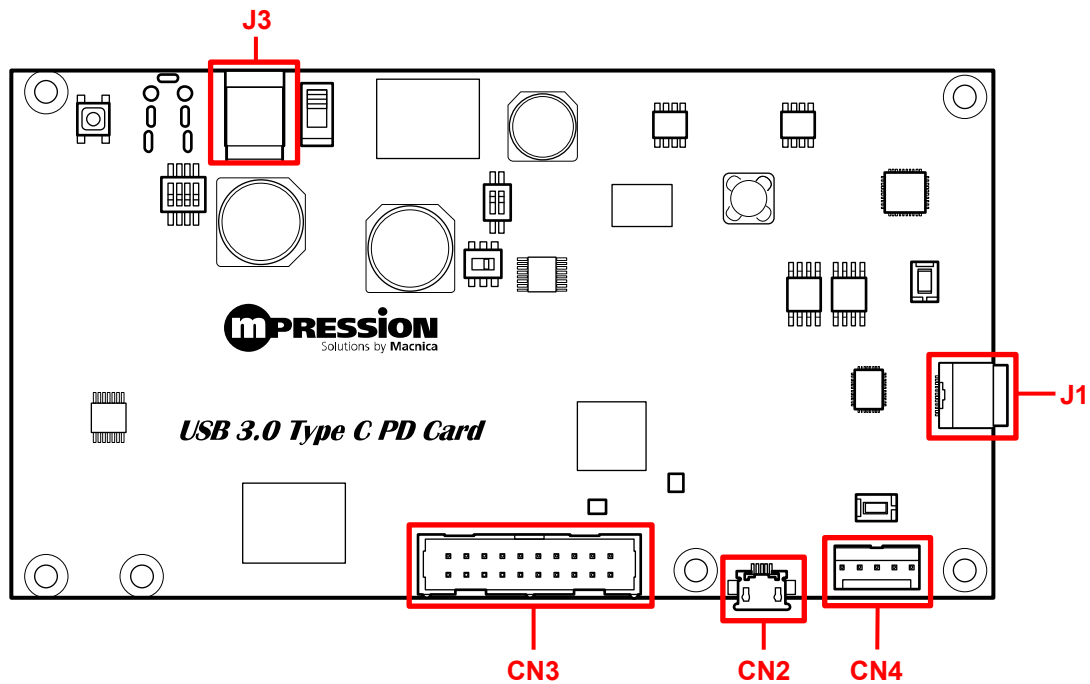


Figure 5-1 USB 3.0 Type-C PD Card Connector Positions (Top View)

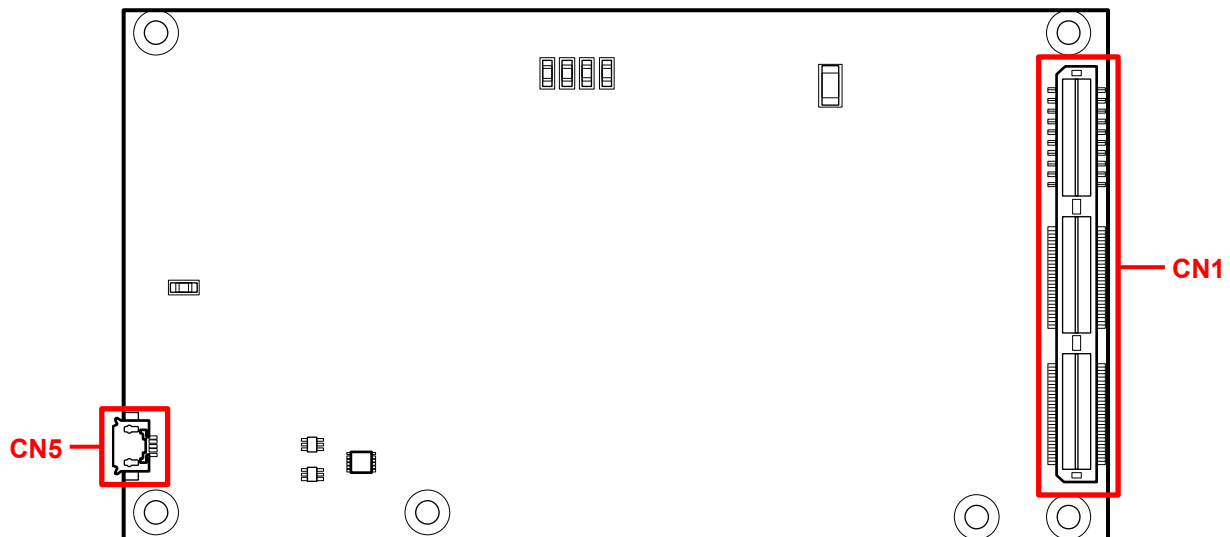
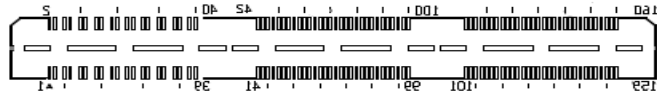


Figure 5-2 USB 3.0 Type-C PD Card Connector Positions (Bottom View)

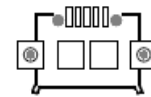
5.2.1 CN1 (HSMC)



CN1 is an HSMC connector for connecting this board to the HSMC connector mounted on the FPGA evaluation board. Always turn off the power to the FPGA evaluation board when inserting or removing this board.

Pin	Name of Signal	Pin	Name of Signal	Pin	Name of Signal	Pin	Name of Signal
1		46		91		136	
2		47	DQ4	92	DP_SNK_AUX_n	137	I2C_SCL
3		48	DQ5	93		138	
4		49	DQ6	94		139	I2C_SDA
5		50	DQ7	95		140	
6		51		96	GND	141	
7		52		97		142	
8		53	DQ8	98	GND	143	PCLK
9		54	DQ9	99		144	I2S_MCLK
10		55	DQ10	100		145	
11		56	DQ11	101	CTL0	146	
12		57		102	CTL1	147	
13		58		103	CTL2	148	
14		59	DQ12	104	CTL3	149	I2C_INTR
15		60	DQ13	105		150	DP_SNK_HPD
16		61	DQ14	106		151	
17		62	DQ15	107	CTL4	152	
18	DP_SNK_ML_LANE_p[3]	63		108	CTL5	153	3.3V
19		64		109	CTL6	154	
20	DP_SNK_ML_LANE_n[3]	65	DQ16	110	CTL7	155	
21		66	DQ17	111		156	GND
22	DP_SNK_ML_LANE_p[2]	67	DQ18	112		157	
23		68	DQ19	113	CTL8	158	GND
24	DP_SNK_ML_LANE_n[2]	69		114	CTL9	159	3.3V
25		70		115	CTL10	160	GND
26	DP_SNK_ML_LANE_p[1]	71	DQ20	116	CTL11	161	GND
27		72	DQ21	117		162	GND
28	DP_SNK_ML_LANE_n[1]	73	DQ22	118		163	GND
29		74	DQ23	119	CTL12	164	GND
30	DP_SNK_ML_LANE_p[0]	75		120		165	GND
31		76		121		166	GND
32	DP_SNK_ML_LANE_n[0]	77	DQ24	122		167	GND
33		78	DQ25	123		168	GND
34		79	DQ26	124		169	GND
35		80	DQ27	125	INT_N_CTL15	170	GND
36		81		126	RESET_N_1	171	GND
37		82		127		172	GND
38		83	DQ28	128		173	
39		84	DQ29	129		174	
40	GND	85	DQ30	130		175	
41	DQ0	86	DQ31	131	I2S_WP	176	
42	DQ1	87		132	I2S_SD	177	
43	DQ2	88		133	I2S_CLK	178	
44	DQ3	89		134		179	
45		90	DP_SNK_AUX_p	135		180	

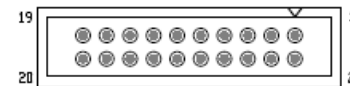
5.2.2 CN2 (USB 2.0 Micro-B for FX3)



CN2 is a serial console connector for EZ-USB FX3. It can be used for a serial console when evaluating EZ-USB FX3. To connect to a PC, insert a USB Micro-B type cable connector into CN2.

Pin	Name of Signal
1	VBUS
2	D-
3	D+
4	ID(NC)
5	GND
6	SHIELD

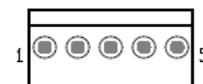
5.2.3 CN3 (JTAG for FX3)



CN3 is a JTAG connector for EZ-USB FX3. You can connect a JTAG debugger, such as J-Link.

Pin	Name of Signal	Pin	Name of Signal
1	2.5V	2	2.5V
3	TRST_N	4	GND
5	TDI	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	RTCK(GND)	12	GND
13	TDO	14	GND
15	N_SRST(NC)	16	GND
17	DBGREQ(NC)	18	GND
19	DBGACK(NC)	20	GND

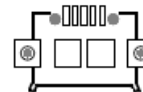
5.2.4 CN4 (SWD for CCG3)



CN4 is a debugging connector for EZ-PD CCG3. You can connect a debugger, such as a MiniProg3 USB dongle for PSoC Programmer Software.

Pin	Name of Signal
1	3.3V
2	GND
3	XRES
4	SWD_CLK
5	SWD_IO

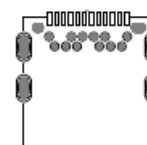
5.2.5 CN5 (USB Micro-B for CCG3)



CN5 is a serial console connector for EZ-PD CCG3. It can be used for a serial console when evaluating EZ-PD CCG3. To connect to a PC, insert a USB Micro-B type cable connector into CN5.

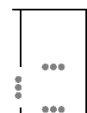
Pin	Name of Signal
1	VBUS
2	D-
3	D+
4	ID(NC)
5	GND
6	SHIELD

5.2.6 J1 (USB Type-C)



J1 is a USB Type-C connector. By inserting a USB Type-C cable that supports Power Delivery into J1, it is possible to evaluate USB 3.0/2.0, DisplayPort (input: sink), and Power Delivery (5 V, 9 V, 15 V, and 20 V).

Pin	Name of Signal	Pin	Name of Signal
A1	GND	B1	GND
A2	TX1+	B2	TX2+
A3	TX1-	B3	TX2-
A4	VBUS	B4	VBUS
A5	CC1	B5	CC2
A6	D+	B6	D+
A7	D-	B7	D-
A8	SBU1	B8	SBU2
A9	VBUS	B9	VBUS
A10	RX2-	B10	RX1-
A11	RX2+	B11	RX1+
A12	GND	B12	GND



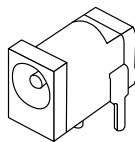

5.2.7 J3 (24 VDC IN/Jack)

The board has a maximum rating of 24 V for input voltage. The product operates on the 24 V from the AC adapter provided as a power supply. Insert the AC adapter into the board and then slide SW4 to turn on the power.

The input specifications for the DC jack (J4) for the power supply are shown below.

Pin	Name of Signal	Pin	Name of Signal
1	24V DC INPUT	2	GND
3	GND		

Table Input Specifications for DC Power Jack (J3)

Item	Specifications
Plug	Φ 2.1 mm 
Plug polarity	Center positive 
Input voltage	24 V
Supplied current	Maximum 4.2 A



Warning

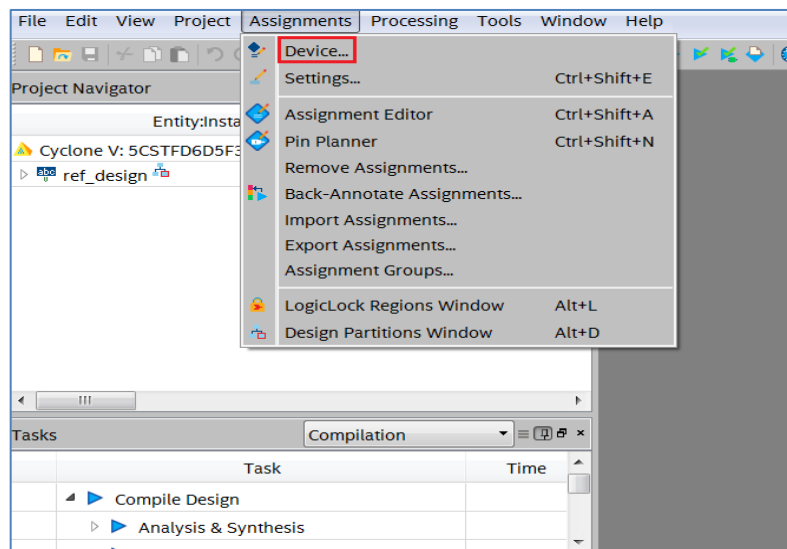
Operation of the board is not guaranteed if you use an AC adapter other than the one provided with the board.
 Always use the AC adapter provided.

6. Precautions During Use

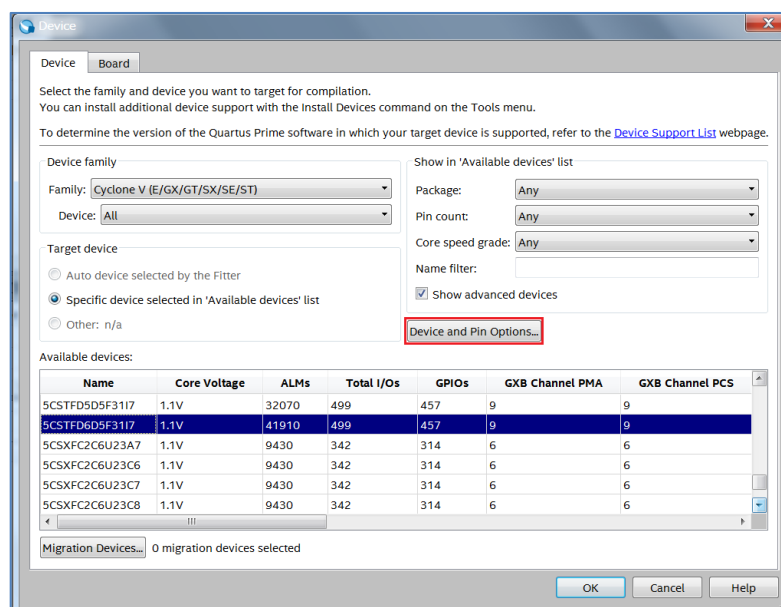
6.1 Mode Selection for Unused Pins

We recommend setting pins that are not used (unused pins) in the FPGA hardware design to the tristate mode to prevent misoperation. The procedure to set unused pins using the Quartus Prime development software is shown below.

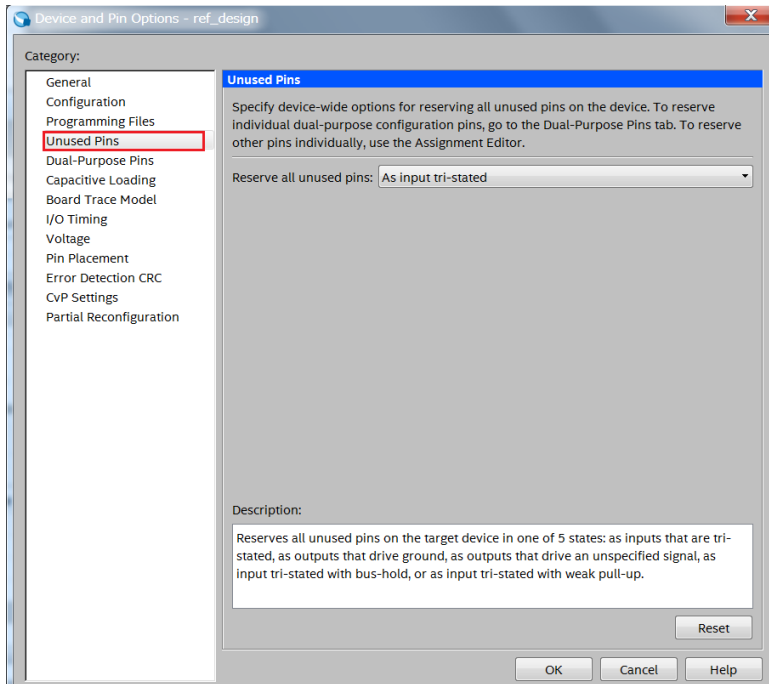
- 1) Select Assignments menu > [Device].



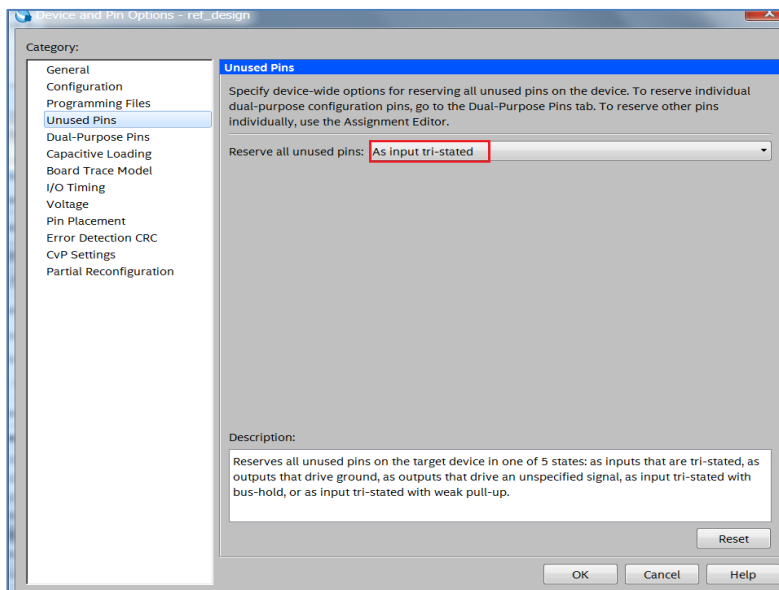
- 2) Click the [Device and Pin Options] button.
The [Device and Pin Options] window opens.



3) Select [Unused Pins].



4) In the Reserve all unused pins item, select [As input tri-stated].



5) Click the [OK] button.

6) Click the [OK] button to close the Device window.

6.2 Inserting the Board into an HSMC Connector

Always turn off the power to the FPGA evaluation board when inserting or removing this board into the HSMC connector on the FPGA evaluation board.

Note that, if you insert or remove the board while power to the FPGA evaluation board is on, it might damage or break the device.

Take sufficient static electricity prevention measures also, because touching the board while carrying a static charge could damage or break the device.

7. Document Revision History

Date	Revision	Changes
Sep 1, 2017	1.00	<ul style="list-style-type: none">• Document created