Reference Manual

SMP FMC Card

Revision

B

2017/10/23

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Contents

1. Read This First

1.1 Important Information

READ FIRST:
- Before using this card, be sure to read this Reference Manual.
- Keep this Reference Manual so you can refer to it when necessary.
- You should sufficiently understand the card's configuration before you use it.

Card Application:
- This card is an FPGA Mezzanine Connector (hereafter FMC) daughter card that can be connected to and used with any FMC that complies with FMC ALTERA LPC+ standard. Combining with an FPGA evaluation board (hereafter Evaluation board), this card supports the development and verification of software and hardware for SMP I/O interfaces. Use this card correctly in line with the application.

People Who Are Expected to Use This Card:
- Only people who carefully read and understood this manual and the Getting Started manual should use this card. You need a fundamental understanding of FPGA, logic circuits, electronic circuits, and micro-computers to use this card.

Precautions When Using This Card:
- This card is a development support card used for the purpose of your hardware and software development and evaluation. This card cannot be used in your mass production products. Furthermore, when you want to use the card's sample designs for your products, please be sure to confirm if it withstands practical use at your own risk by doing necessary and sufficient tests and evaluations.
- Macnica Incorporated (hereafter Macnica Inc.) has no liability for any results arising from the use of the card.
- Macnica Inc. will attempt to provide either free or paid support to handle repair of faults or workarounds for faults with the card. 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 and precautions in this Reference Manual and on the card are therefore not all-inclusive. You are responsible for using the card correctly and safely.
- Even if there are faults with devices that are mounted on the card, Macnica Inc. will not replace it with a fault-fixed device.
- Each interface is not guaranteed to connect with all products.
- The card will not be replaced if you damaged or modified the card.
- The card uses lead-free parts.
- The rights to the trademarks and registered trademarks of the vendors noted in this manual belong to their respective vendors.

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, designs, this Reference Manual, and other documentation at any time, without prior notice to customers.

Warranty:

- Macnica Inc. offers to exchange this card free of charge only in case of initial malfunction noticed by you within 30 days from the delivery.
  Macnica Inc. cannot exchange cards in cases where the malfunction is caused by the following reasons:
  (1) Misuse, abuse of the card or use under abnormal conditions
  (2) Remodeling or repair
  (3) A fire, earthquake, fall or other accidents

Figures:

- Some figures in this manual may differ from your purchased card.

1.2 Developer Information

The Developer of this card is:
Macnica Inc.
1-6-3 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8561 JAPAN

1.3 Inquiries

In case you have any inquiries about the use of this card, please contact sales office you purchased or make inquiries through the contact form on the following web site.

Inquiries page:
　　http://www.m-pression.com/contact/inquiry
Inquiries to:
　　Macnica Inc.
　　Sales and Planning Advanced Technology
　　1-5-5 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8563 JAPAN
　　TEL: +81-45-470-9838

2. For Ensuring Safe Use

Be sure to follow the instructions given in this Manual 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**	If an AC adapter is needed, be sure to use the AC adapter provided 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 card to emit heat, explode, or ignite.
⚠️	**Warning**	Do not apply strong impacts or blows to the card. Doing so may cause the card to emit heat, explode, or ignite, or the equipment in the card to fail or malfunction. This may also cause fire.
		Do not put this card or the AC adapter in cooking appliances such as microwave ovens, or high-pressure containers. Doing so might cause this card or AC adapter to emit heat, explode, ignite, or emit smoke, or its parts to break or warp.
		Do not cover or wrap this card 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 this card to ignite or malfunction.
		When disposing of this card, do not dispose of it along with general household waste. Throwing this card into fire may cause it to explode. Dispose of this card 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 heat emitted.
	Warning (Continued from previous page)	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 heat emitted.
		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 a dry cloth.
		Do not place any containers, such as cups or vases, filled with water or other liquids on the card. If the card is exposed to water or other liquids, it will cause a malfunction or electric shock. If you spilled water or other liquid on this card, immediately stop using the card, turn off the power, and unplug the power plug. If you have any requests for repairs or technical consultation, please contact the sales office you purchased or Mpression inquiry URL.
		Keep the card and accessories out of the reach of children. Failure to do so may lead to injuries.
	Caution	Do not place the card on unstable places such as shaky stands or tilted locations. Doing so may cause injuries or cause this card to malfunction if the card should fall.
		Do not attempt to use or leave the card 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 card to emit heat, break, ignite, run out of control, warp, or malfunction. Also, some parts of the equipment might emit heat, causing burn injuries.
		Do not use the card in places subject to extremely high or low temperatures or severe temperature changes. Doing so may cause the card to fail or to malfunction. Always be sure to use the card within a temperature range of 5°C to 35°C and a humidity range of 0% to 85%.
		Unplug the power supply when doing maintenance on equipment in which the card is embedded. Failure to do so may lead to accidents involving electrical shock.
		Do not place the card in locations where excessive force might be applied to it. Doing so may cause the printed circuit board to warp, leading to breakage of the printed circuit board, missing parts or malfunctioning parts.

⚠️	**Caution** (Continued from previous page)	When using the card together with expansion boards or other peripheral equipment, 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 card unless they are specifically mentioned in this Manual or their successful operation with this card has been confirmed in separate documents.
		Turn off the power switch when moving or connecting the card. Failure to do so may cause this card to fail or lead to accidents involving electrical shock.
		Do not clean this card by using a rag containing chemicals such as benzine or thinner. Doing so could degrade the card. When using a chemically treated cloth, comply with its directions and warnings.
		Do not immediately turn on the power if you find that moisture has condensed onto this card after removing it from the box. Condensation may form if the card is cold when moved from the box into a warm room. Turning on the power while there is moisture on the card may cause it to malfunction or shorten the service life of the parts. Allow the card to reach room temperature when you first take it out of the box. If condensation or moisture has occurred on this card, first wait for the moisture to fully evaporate before installing or connecting the card to other equipment.
		Operation of the card cannot be guaranteed if it has been disassembled, dismantled, altered, modified, or rebuilt.

3. Unpacking

During unpacking, check to make sure that all required items are included, and that nothing is damaged.
If something is missing or visibly damaged, contact your sales agent within 30 days after receiving your purchase.

SMP FMC card: 1	
SMP-SMP cable: 2	
37-mm spacer: 2	
10-mm spacer: 2	
Pan-head screw: 4	
Packing list/precautions(Japanese): 1	
Packing list/precautions(English): 1	
Circuit diagram	To download these files, go to the URL noted on the "Packing List and Precautions".
Reference Manual	
Getting Started	
Reference Design	

4. Functions and Features of the Card

4.1 Main Features

This card is an FPGA Mezzanine Connector (FMC) daughter card that complies with HPC standard. By inserting this card into an FPGA evaluation board, you can evaluate high-speed serial transceivers of the FPGA by utilizing a variety of FPGA functions.

The evaluation board which has been verified to connect with this card so far is the Altera Arria® 10 GX FPGA development kit.
Refer to the following links for more detailed information and related details.

- Information for the Arria® 10 device family
  Documentation: Arria® 10 Devices
- Materials related to the Arria® 10 GX FPGA Development Kit
  Arria® 10 GX FPGA Development Kit

4.2 Product Specifications

The product specifications for this card are shown below.

Product Specifications	SMP FMC CARD	
External Dimensions	69 mm x 115 mm	
Printed circuit board	8-layer MEGTRON6	
FMC	Samtec ASP-134488-01	
Power Supply	3.3 V from FMC	
Interface	SMP connector	Input x 10 pairs
		Output x 10 pairs
	Clock input	SMA x 2 pairs

4.3   Block Diagram

Figure 4-1 shows the block diagram of this card.
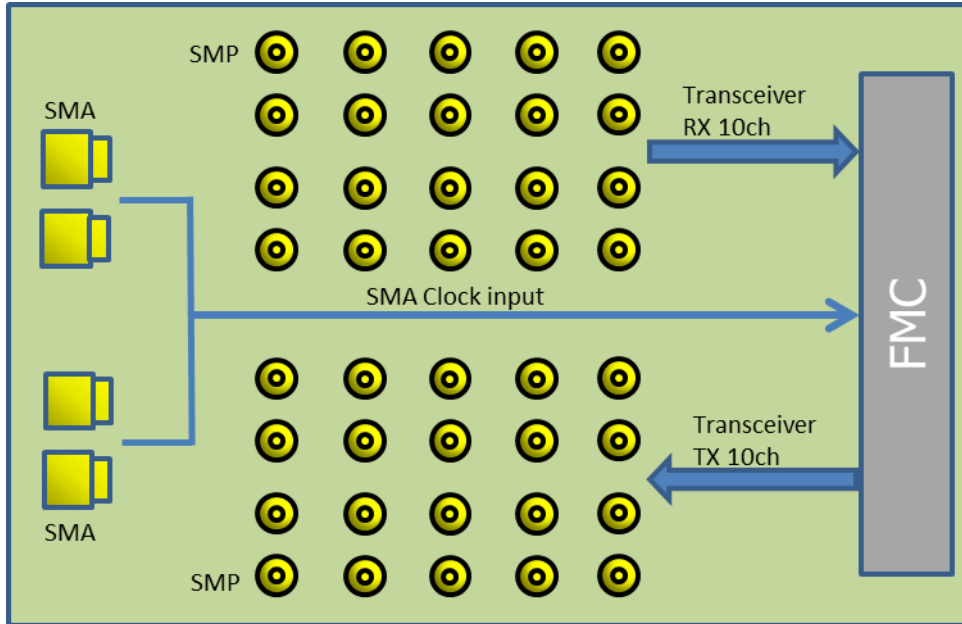
Figure 4-1 SMP FMC Card Block Diagram

4.4   Card Layout

Figure 4-2 and Figure 4-3 show the layout of the card.
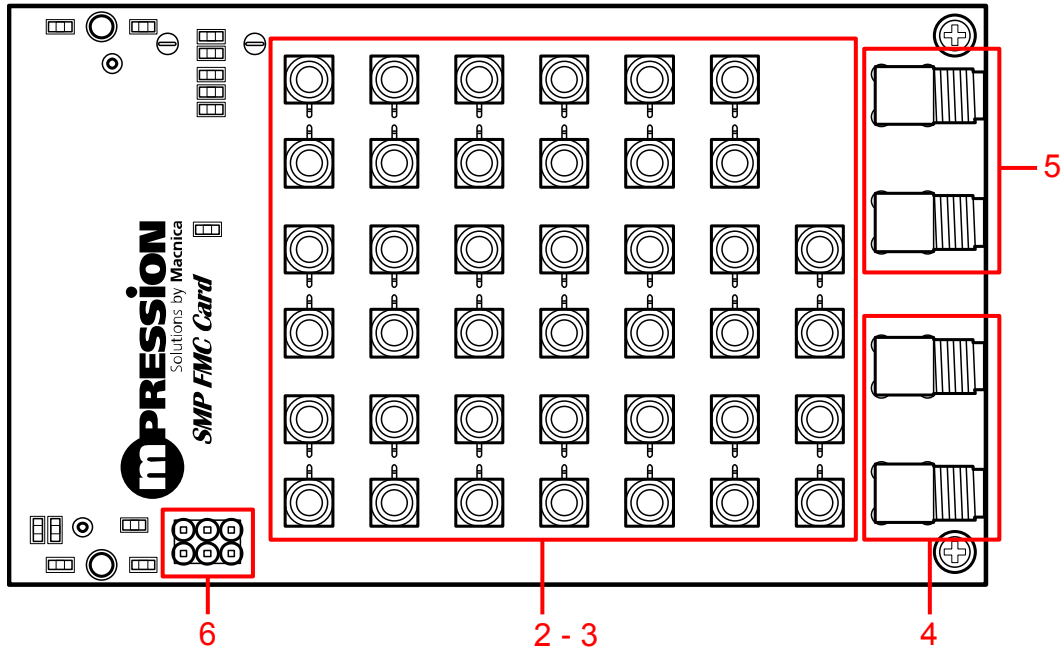
Figure 4-2 SMP FMC Card Layout (Front)
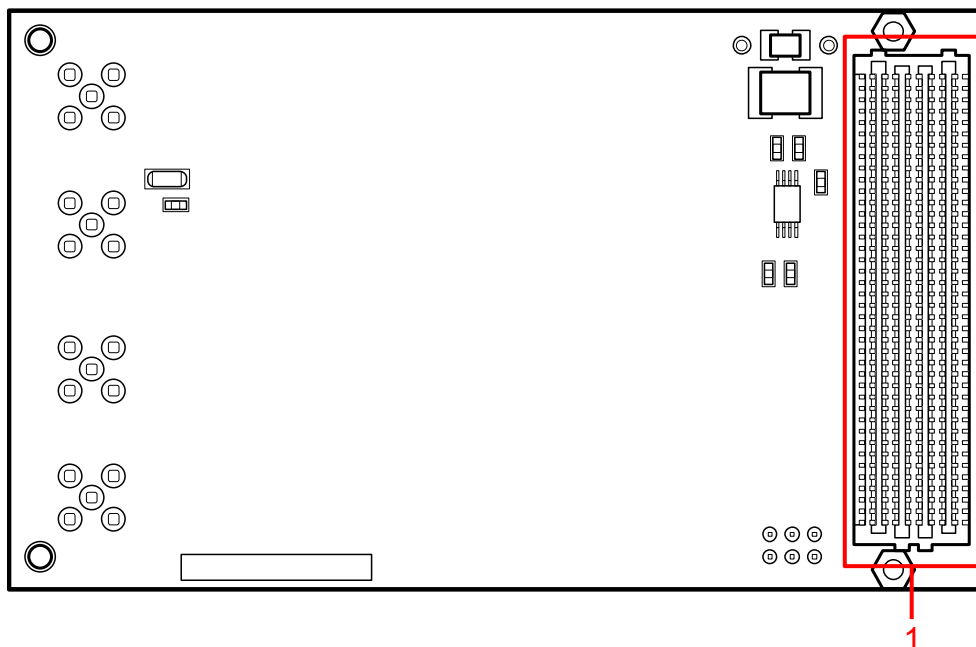
Figure 4-3 SMP FMC Card Layout (Back)

	Reference	Functions	Details
1	CN1	FMC	ALTERA FPGA Development Board Interface (FMC HPC)
2	CN2-CN21	SMP pairs for Input	Mezzanine to Carrier High-Speed Differential Signals
3	CN22-CN41	SMP pairs for Output	Carrier to Mezzanine High-Speed Differential Signals
4	CN42, 43	SMA pair for Clock input	For FPGA Transceiver Clock
5	CN44, 45	SMA pair for Clock input	For FPGA Transceiver Clock
6	CN46, CN47	GPIO connector	Mezzanine to Carrier

5. Components on the Card

5.1 Connector Pin Assignments

CN1 (FMC) Connector Pin Assignments

FMC Pin#	Signal Name	Interface on FMC card	Arria® 10 GX FPGA Development Kit FPGA Pin#	
			FMCA	FMCB
A2	M2C_05_P	CN4	BA7	W3
A3	M2C_05_N	CN5	BA8	W4
A6	M2C_07_p	CN6	AY5	Y5
A7	M2C_07_n	CN7	AY6	Y6
A10	M2C_10_p	CN8	AV5	V5
A11	M2C_10_n	CN9	AV6	V6
A14	M2C_02_p	CN10	AT5	U3
A15	M2C_02_n	CN11	AT6	U4
A18	M2C_04_p	CN12	AP5	T5
A19	M2C_04_n	CN13	AP6	T6
A22	C2M_07_p	CN24	BD5	Y1
A23	C2M_07_n	CN25	BD6	Y2
A26	C2M_09_p	CN26	BB5	V1
A27	C2M_09_n	CN27	BB6	V2
A30	C2M_02_p	CN28	BC3	T1
A31	C2M_02_n	CN29	BC4	T2
A34	C2M_04_p	CN30	BB1	P1
A35	C2M_04_n	CN31	BB2	P2
A38	C2M_06_p	CN32	BA3	M1
A39	C2M_06_n	CN33	BA4	M2
B4	M2C_06_p	CN20	AK5	M5
B5	M2C_06_n	CN21	AK6	M6
B8	M2C_09_p	CN18	AL3	N3
B9	M2C_09_n	CN19	AL4	N4
B12	M2C_01_p	CN16	AM5	P5
B13	M2C_01_n	CN17	AM6	P6
B16	M2C_03_p	CN14	AN3	R3
B17	M2C_03_n	CN15	AN4	R4
B20	GBTCLK1_M2C_p	CN44	AJ8	U8
B21	GBTCLK1_M2C_n	CN45	AJ7	U7
B24	C2M_08_p	CN40	AU3	G3
B25	C2M_08_n	CN41	AU4	G4
B28	C2M_01_p	CN38	AV1	H1
B29	C2M_01_n	CN39	AV2	H2
B32	C2M_03_p	CN36	AW3	J3
B33	C2M_03_n	CN37	AW4	J4
B36	C2M_05_p	CN34	AY1	K1
B37	C2M_05_n	CN35	AY2	K2
C2	C2M_10_p	CN22	BC7	AB1
C3	C2M_10_n	CN23	BC8	AB2
C6	M2C_08_p	CN2	AW7	AA3
C7	M2C_08_n	CN3	AW8	AA4
C30	SCL	-	AU10	J17
C31	SDA	-	AV10	J16
C34	GA0	-	BC16	K22
D4	GBTCLK0_M2C_p	CN42	AL8	W8
D5	GBTCLK0_M2C_n	CN43	AL7	W7
D23	GPIO0	CN46.1	AU18	H13
D24	GPIO1	CN46.2	AT18	J13
D26	GPIO2	CN47.1	AT19	M15
D27	GPIO3	CN47.2	AT20	L15
D35	GA1	-	BD16	L22

CN1 FMC pin assignment

	K	J	H	G	F	E	D	C	B	A
1	NC	GND	NC	GND	GND	GND	NC	GND	NC	GND
2	GND	NC	GND	NC	GND	NC	GND	C2M_10_p	GND	M2C_05_P
3	GND	NC	GND	NC	GND	NC	GND	C2M_10_n	GND	M2C_05_N
4	NC	GND	NC	GND	NC	GND	GBTCLK0_M2C_p	GND	M2C_06_p	GND
5	NC	GND	NC	GND	NC	GND	GBTCLK0_M2C_n	GND	M2C_06_n	GND
6	GND	NC	GND	NC	GND	NC	GND	M2C_08_p	GND	M2C_07_p
7	NC	NC	NC	NC	NC	NC	GND	M2C_08_n	GND	M2C_07_n
8	NC	GND	NC	GND	NC	GND	NC	GND	M2C_09_p	GND
9	GND	NC	GND	NC	GND	NC	NC	GND	M2C_09_n	GND
10	NC	NC	NC	NC	NC	NC	GND	NC	GND	M2C_10_p
11	NC	GND	NC	GND	NC	GND	NC	NC	GND	M2C_10_n
12	GND	NC	GND	NC	GND	NC	NC	GND	M2C_01_p	GND
13	NC	NC	NC	NC	NC	NC	GND	GND	M2C_01_n	GND
14	NC	GND	NC	GND	NC	GND	NC	NC	GND	M2C_02_p
15	GND	NC	GND	NC	GND	NC	NC	NC	GND	M2C_02_n
16	NC	NC	NC	NC	NC	NC	GND	GND	M2C_03_p	GND
17	NC	GND	NC	GND	NC	GND	NC	GND	M2C_03_n	GND
18	GND	NC	GND	NC	GND	NC	NC	NC	GND	M2C_04_p
19	NC	NC	NC	NC	NC	NC	GND	NC	GND	M2C_04_n
20	NC	GND	NC	GND	NC	GND	NC	GND	GBTCLK1_M2C_p	GND
21	GND	NC	GND	NC	GND	NC	NC	GND	GBTCLK1_M2C_n	GND
22	NC	NC	NC	NC	NC	NC	GND	NC	GND	C2M_07_p
23	NC	GND	NC	GND	NC	GND	GPIO0	NC	GND	C2M_07_n
24	GND	NC	GND	NC	GND	NC	GPIO1	GND	C2M_03_p	GND
25	NC	NC	NC	NC	NC	NC	GND	GND	C2M_03_n	GND
26	NC	GND	NC	GND	NC	GND	GPIO2	NC	GND	C2M_09_p
27	GND	NC	GND	NC	GND	NC	GPIO3	NC	GND	C2M_09_n
28	NC	NC	NC	NC	NC	NC	GND	GND	C2M_01_p	GND
29	NC	GND	NC	GND	NC	GND	NC	GND	C2M_01_n	GND
30	GND	NC	GND	NC	GND	NC	JTAG_TDI	SCL	GND	C2M_02_p
31	NC	NC	NC	NC	NC	NC	JTAG_TDO	SDA	GND	C2M_02_n
32	NC	GND	NC	GND	NC	GND	3P3VAUX	GND	C2M_03_p	GND
33	GND	NC	GND	NC	GND	NC	NC	GND	C2M_03_n	GND
34	NC	NC	NC	NC	NC	NC	NC	GA0	GND	C2M_04_p
35	NC	GND	NC	GND	NC	GND	GA1	NC	GND	C2M_04_n
36	GND	NC	GND	NC	GND	NC	3P3V	GND	C2M_05_p	GND
37	NC	NC	NC	NC	NC	NC	GND	NC	C2M_05_n	GND
38	NC	GND	NC	GND	NC	GND	3P3V	GND	GND	C2M_06_p
39	GND	NC	GND	NC	GND	NC	GND	3P3V	GND	C2M_06_n
40	NC	GND	NC	GND	NC	GND	3P3V	GND	NC	GND

FMC transceiver channel and SMP connector correspondence table

FMC Transceiver Channel	Signal Name (C2M)	SMP CN# (P/N)		Signal Name (M2C)	SMP CN# (P/N)
DP0	C2M_10_p/_n	CN22 / CN23		M2C_08_p/_n	CN2 / CN3
DP1	C2M_07_p/_n	CN24 / CN25		M2C_05_p/_n	CN4 / CN5
DP2	C2M_09_p/_n	CN26 / CN27		M2C_07_p/_n	CN6 / CN7
DP3	C2M_02_p/_n	CN28 / CN29		M2C_10_p/_n	CN8 / CN9
DP4	C2M_04_p/_n	CN30 / CN31		M2C_02_p/_n	CN10 / CN11
DP5	C2M_06_p/_n	CN32 / CN33		M2C_04_p/_n	CN12 / CN13
DP6	C2M_05_p/_n	CN34 / CN35		M2C_03_p/_n	CN14 / CN15
DP7	C2M_03_p/_n	CN36 / CN37		M2C_01_p/_n	CN16 / CN17
DP8	C2M_01_p/_n	CN38 / CN39		M2C_09_p/_n	CN18 / CN19
DP9	C2M_08_p/_n	CN40 / CN41		M2C_06_p/_n	CN20 / CN21

CN46 (GPIO0_CONN)

Pin#	Signal Name
1	GPIO0
2	GPIO1
3	3P3V

CN47 (GPIO1_CONN)

Pin#	Signal Name
1	GPIO2
2	GPIO3
3	GND

6. Handling Precautions

6.1 Insertion into / Removal from FMC

Always turn off the power to the evaluation board when inserting the card into or removing it from the FMC connector on the evaluation board.
Note that inserting or removing the card while the power is on may result in damage to or destruction of the device.
You need to arrange sufficient anti-static prevention measures because the act of contacting the card with a person or any object carrying a static charge may also result in damage to or destruction of the device.

6.2 Mode Selection of Unused Pins

We recommend that pins of FPGA that are not used (unused pins) in the design or hardware to be set in tri-state mode to prevent malfunction. The following shows how to set the unused pins using Quartus Prime development software.
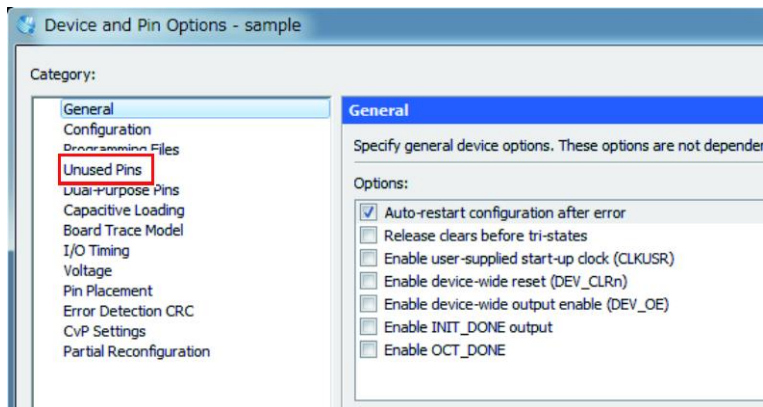
1)   Select the [Assignments] menu > [Device].
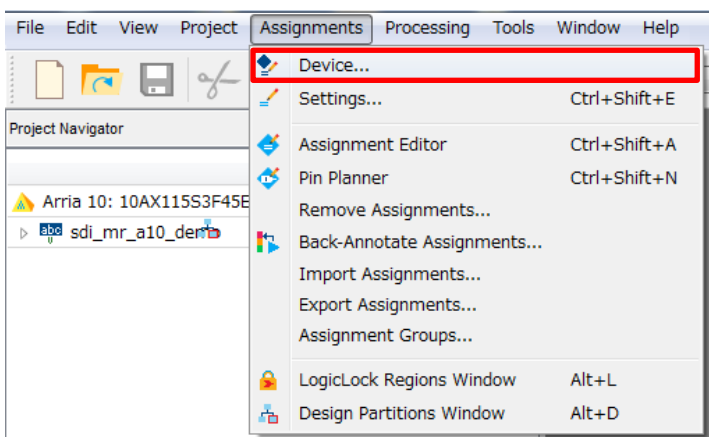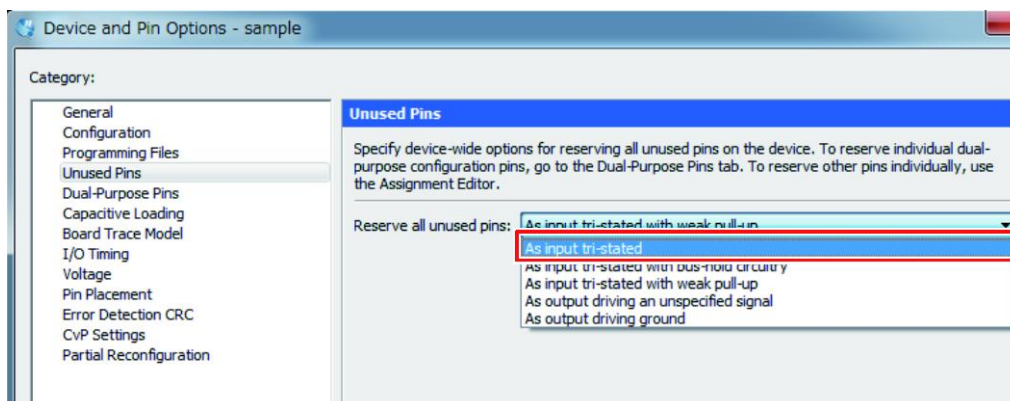
2) Click the [Device and Pin Options] button.
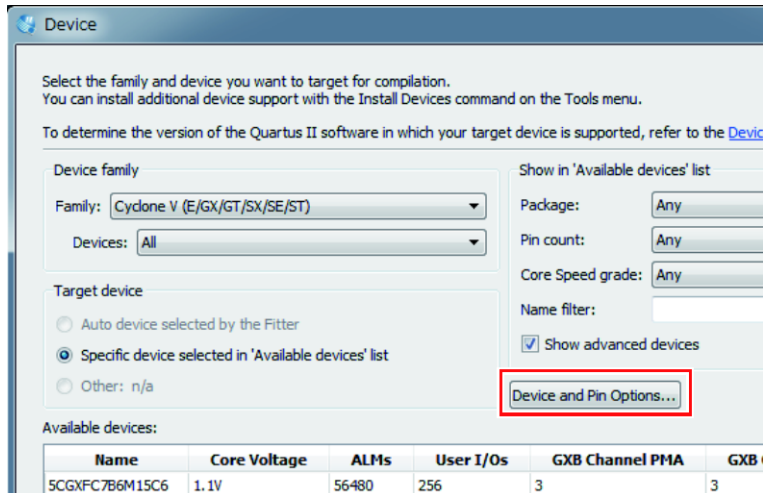
The [Device and Pin Options] window opens.

3) Select [Unused Pins].

4) For 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.

7. Document Revision History

Date	Revision	Changes
January 27, 2017	A	• First Edition
October 23, 2017	B	• Change URL

Reference Manual - SMP FMC Card

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