

Reference Manual

IEEE1588 GE Card

Revision B 2017/10/23

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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 a High Speed Mezzanine Card (hereafter HSMC) daughter card that can be connected to and used with any HSMC that complies with HSMC standard. Combining with an FPGA evaluation board (hereafter Evaluation board), this card supports the development and verification of hardware and software for 2 ports of Gigabit Ethernet i/o interface. 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.
Ń	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 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.
	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).
Warning	Do not use a power plug with dust accumulated on it because doing so will lead
(Continued from	to insulation failure due to moisture which may lead to fire.
previous page)	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.
	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.
Caution	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.
	France and source, messing parts of manufactoring parts.



		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
	Caution	thinner.
	(Continued from	Doing so could degrade the card. When using a chemically treated cloth, comply
	previous page)	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.
L		dismanifica, alterea, mounica, 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.

IEEE1588 GE Card: 1	
5-mm spacer: 2	
Washer: 2	
Nut: 2	
4-mm pan-head screw: 2	
Packing list/precautions: 1	
Packing list/precautions (English): 1	
Circuit diagram	To download these files, go to the URL
Reference Manual	noted on the "Packing List and
Getting Started	Precautions".
Reference Design	

4. Functions and Features of the Card

4.1 Main Features

This card is a daughter card for expanding functions, that complies with High-Speed Mezzanine Card (hereafter HSMC) specifications. By inserting this card into an evaluation board, you can use a variety of FPGA functions to evaluate Gigabit Ethernet.

The evaluation board which has been verified to connect with this card so far is Macnica's Nitro – Cyclone® V GX I/O expansion base board.

Refer to the following links for more detailed information and related details.

- Information for the Cyclone® V device family <u>Documentation: Cyclone®V Devices</u>
- Documentation for Nitro Cyclone® V GX I/O expansion base board <u>Nitro – Cyclone® V GX I/O Expansion Base Board</u>

4.2 **Product Specifications**

The product specifications for this card are shown below.

Product Specifications	IEEE1588 GE Card
External Dimensions	$78.105 \text{ mm} \times 100.00 \text{ mm}$
Printed circuit board	6-layer FR4
HSMC	1
Power Supply	3.3 V, 2.5 V, 1.8 V, 1.0 V
Gigabit Ethernet PHY	MARVELL 88E1512 x 2
IDT clock	IDT 8T49N285
Interface	RJ45 x 2



4.3 Block Diagram

Figure 4-1 shows the block diagram of this card.

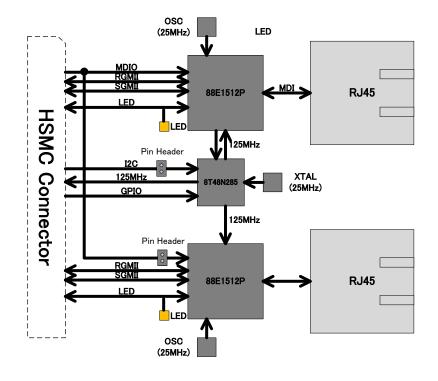


Figure 4-1 IEEE1588 GE Card Block Diagram

4.4 Card Layout

Figure 4-2 and Figure 4-3 show the layout of the card.

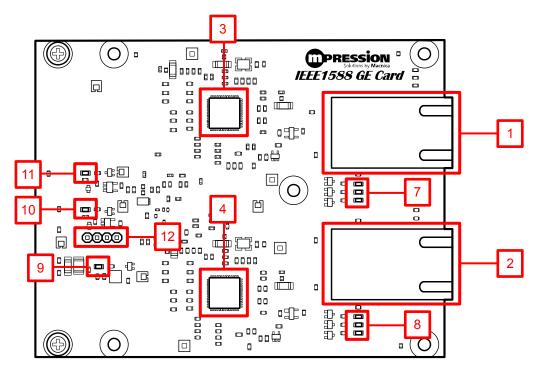


Figure 4-2 IEEE1588 GE Card Layout (Front)

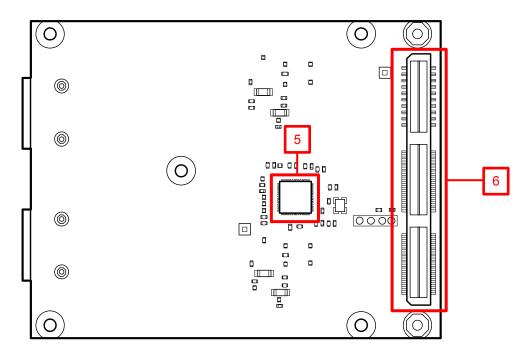


Figure 4-3 IEEE1588 GE Card Layout (Back)



No.	Reference	Functions	Details
1	CN3	Ethernet port 0 RJ45	Belfuse 0826-1G1T-43-F
2	CN5	Ethernet port 1 RJ45	Belfuse 0826-1G1T-43-F
3	U1	Gigabit Ethernet PHY port 0	MARVELL 88E1512
4	U5	Gigabit Ethernet PHY port 1	MARVELL 88E1512
5	U7	Clock Generator	IDT 8T49N285
6	CN1	Interface for ALTERA FPGA Development Board High Speed Mezzanine Card (HSMC) connector	Samtec ASP-122952-01
7	LED1-3	PH1 CH1 LED status indicators	88E1512#LED[0]-[2] status
8	LED4-6	PH1 CH2 LED status indicators	88E1512#LED[0]-[2] status
9	LED7	2.5 V power source status indicator	LED on: Normal, LED off: Abnormal
10	LED8	1.8 V power source status indicator	LED on: Normal, LED off: Abnormal
11	LED9	1.0 V power source status indicator	LED on: Normal, LED off: Abnormal
12	CN6	Configuration connector for U7 Clock Generator	I2C interface

5. Components on the Card

5.1 Connector Pin Assignments

Table 5-1 CN1 HSMC Pin Assignments

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Image: Construction of the sector o							
Image: Constraint of the							
Image: Constraint of the second sec			()		(8)		
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Image: Constraint of the second sec			(11)		(12)		
Image: Constraint of the second sec			(12)		(14)		
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NET I, S, TX, N HSMC, TX, N0 (31) (32) HSMC, RX, N0 NET I, S, RX, N HSMC, SDA (33) (34) HSMC, SGL (34) HSMC, SGL NETO TX, CLK HSMC, GLK, OUTO (37) (38) (38) (38) NETO TX, CTRL HSMC, D2 (41) HSMC, D1 NETO RX, CTRL NETO TX, CTRL HSMC, D2 (42) HSMC, D1 NETO RX, CTRL NETO TX, CTRL HSMC, D2 (43) HSMC, D1 NETO RX, D1 NETO RX, D1 NETO TXD(D) HSMC, TX, D P0 (53) 12V 12V NETO RXD(D) NETO TXD(D) HSMC, TX, D P0 (53) 12V 12V 12V NETO TXD(D) HSMC, TX, D P0 (53) 12V 12V 12V NETO RESET, N HSMC, TX, D P2 (53) 12V 12V 12V ASW 33V 33V (70) 12V 12V 12V MSMC, TX, D P3 (71) (72) 18M HSMC, TX, D P3 (76) 12V	NET1 S TY D	HEMO TY DO	(20)		(20)	HEMC BY DO	NET1 S DV D
HSMC_SDA (33) NETO TX_CLK HSMC_CLK_OUTO (35) NETO TX_CLK HSMC_CLK_OUTO (39) NETO TX_CLK HSMC_DQ (41) NETO TX_CLK HSMC_DQ (41) NETO TX_CLC HSMC_DQ (42) NETO TX_CLC HSMC_DQ (44) NETO TX_CLC HSMC_DQ (44) NETO TX_CLC HSMC_DQ (44) NETO TX_DD HSMC_DQ (44) NETO TX_DD HSMC_TX_D P0 (50) NETO TX_DD HSMC_TX_D P1 (50) NETO TX_DD HSMC_TX_D P1 (51) S3V 33V (55) HSMC_TX_D P2 (55) HSMC_RX_D P1 HSMC_TX_D P2 (56) HSMC_RX_D P1 HSMC_TX_D P2 (56) HSMC_RX_D P2 1S3V 33V (32) (32) 33V 33V (33) (34) HSMC_TX_D P3 (71) (72) HSMC_RX_D P3 HSMC_TX_D P4 (72) (72) <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>							
(35) (36) NETO TX, CLK HSMC CLK OUTO (37) NETO TX, CLK HSMC CLK (37) NETO TX, CLK HSMC CD2 (43) 33V 33V (45) NETO TX, CLK HSMC CD2 (44) HSMC CD3 33V 33V (45) NETO TXD(1) HSMC TX D. P0 (53) NETO TXD(2) HSMC TX D. P0 (53) NETO TXD(2) HSMC TX D. P0 (53) NETO TXD(2) HSMC TX D. P0 (53) NETO TXD(3) HSMC TX D. P1 (59) NETO TXD(3) HSMC TX D. P1 (59) NETO TXD(2) HSMC TX D. P1 (59) NETO TXD(3) HSMC TX D. P3 (71) 33V 33V (63) NETO TXD(3) HSMC TX D. P3 (71) 33V 33V (63) HSMC TX D. P3 (71) F6 HSMC TX D. P3 (71) F6 HSMC TX D. P4 (72) HSMC TX D. P4 HSMC TX D. P							
Image: Construct of the system of		HSMC_SDA				HSMC_SCL	
INTO TX CLK HSMC CLK OUTD (39) (40) HSMC CLK IND NETO RX CLK NETO TX CTRL HSMC D0 (41) (42) HSMC D1 NETO RX CLK NETO TX CTRL HSMC D2 (43) (44) HSMC D3 (44) 33V 33V (45) (46) 12V 12V NETO TXD[1] HSMC D2 (46) HSMC D5 NETO RXD[1] NETO TXD[2] HSMC TX D, P0 (55) HSMC RXD P0 NETO RXD[1] NETO TXD[2] HSMC TX D, P0 (55) (56) HSMC RXD P0 NETO RXD[2] NETO TXD[2] HSMC TX D, P1 (59) 12V 12V 12V NETO RESET N HSMC TX D, P2 (56) HSMC RXD P1 NETO INTD 3.3V 3.3V (33) (66) HSMC RXD P2 (66) HSMC RXD P2 1 HSMC TX D, P3 (33) (33) (33) (33) (32) 12V 12V 1 HSMC TX D, P3 (33) (33) (33) (33) <td< td=""><td></td><td><u> </u></td><td>(35)</td><td></td><td>(36)</td><td></td><td></td></td<>		<u> </u>	(35)		(36)		
NC NC NETO TX CTR. HSMC D2 (41) HSMC D2 (42) HSMC D1 NETO TXO[0] HSMC D4 (47) NETO TXD[1] HSMC D4 (47) NETO TXD[2] HSMC TX D P0 (53) NETO TXD[2] HSMC TX D P0 (53) NETO TXD[3] HSMC TX D P0 (53) NETO TXD[3] HSMC TX D P0 (53) NETO TXD[2] HSMC TX D P1 (59) NETO TXD[3] HSMC TX D P1 (59) NETO TXD[3] HSMC TX D P1 (51) 3.3V 3.3V (63) HSMC TX D P2 (61) (62) HSMC RX D P1 HSMC TX D P3 (71) (62) HSMC RX D P2 (72) HSMC TX D P3 (71) (74) HSMC RX D P3 (72) HSMC TX D P4 (77) (68) HSMC RX D P4 (72) HSMC TX D P6 (83) (84) HSMC RX D P5 (86) 3.3V 3.3V (37) (86) HSMC RX D							
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HSMC D2 (43) 33V 64) NET0 TXD[0] HSMC D4 NET0 TXD[1] HSMC D4 33V 63V 33V 63V NET0 TXD[1] HSMC TX D P0 33V 63V NET0 TXD[2] HSMC TX D P0 NET0 TXD[3] HSMC TX D P0 33V 33V 33V 33V 33V 33V HSMC TX D P1 650 HSMC TX D P2 650 HSMC TX D P3 671 HSMC TX D P4 670 HSMC TX D P4 670 HSMC TX D P4 670 HSMC TX D P3 711 HSMC TX D P4 670 HSMC TX D P4 670 HSMC TX D P4 671 HSMC TX D P4 671 HSMC TX D P4 672 HSMC TX D P4 672 HSMC TX D P6 680 HSMC TX D P6 681 HSMC TX D P6 681 HSMC TX D P6 <td< th=""><th>NET0 TX CTRL</th><th></th><th>(41)</th><th></th><th>(42)</th><th></th><th>NETO RX CTRL</th></td<>	NET0 TX CTRL		(41)		(42)		NETO RX CTRL
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Instruction	0.011	HSMC_TX_D_N11	(127)	B	(128)	HSMC_RX_D_N11	1011
Instruction				NK			
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NET1_RESET_N HSMC_TX_D_P15 (149) (150) HSMC_RX_D_P15 NET1_INTn HSMC_TX_D_N15 (151) (152) HSMC_RX_D_P15 NET1_INTn 3.3V 3.3V (153) (154) 12V 12V NET1_TX_CLK HSMC_CLK_OUT_P2 (155) HSMC_CLK_OUT_P2 NET1_RX_CLK HSMC_CLK_OUT_N2 (157) (158) HSMC_CLK IN N2 157)							
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NET1_TX_CLK HSMC_CLK_OUT_P2 (155) (156) HSMC_CLK_IN_P2 NET1_RX_CLK HSMC_CLK_OUT_N2 (157) (158) HSMC_CLK_IN_N2 NET1_RX_CLK		HSMC_TX_D_N15	(151)	1	(152)	HSMC_RX_D_N15	NET1_EVREQ_TRG
HSMC_CLK_OUT_N2 (157) (158) HSMC_CLK_IN_N2							
	NETT_TX_CLK						NETT_RX_CLK
	3.3V			1			GND



Pin#	Signal name
1	SCL
2	SDA
3	$2.5\mathrm{V}$
4	GND

Table 5-2 CN6 PLL_I2C Pin Assignments

6. Handling Precautions

6.1 Connecting/disconnecting to the HSMC

Always turn off the power to the evaluation board when connecting or disconnecting the card to the HSMC connector on the evaluation board.

Note that connecting or disconnecting 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 Using the Mounted IC

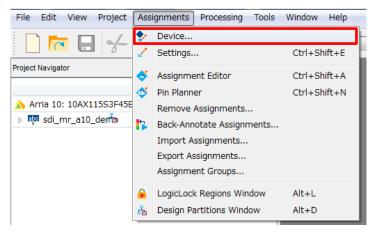
Refer to the following site and data sheet to use the IC that is mounted on the card. It should not be used in nonstandard ways.

IC	Model	Link
Gigabit Ethernet PHY	88E1512	http://www.marvell.com/
		<u>88E1512</u>
Clock Generator	8T49N285	https://www.idt.com/
		<u>8T49N285</u>

6.3 Mode Selection of Unused Pins

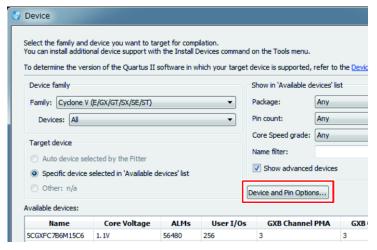
We recommend that pins of FPGA that are not used (unused pins) in the design or hardware to be set in tri-state mode to prevent malfunction. The following shows how to set the unused pins using Quartus Prime development software.

1) Select the [Assignments] menu > [Device].





2) Click the [Device and Pin Options] button.

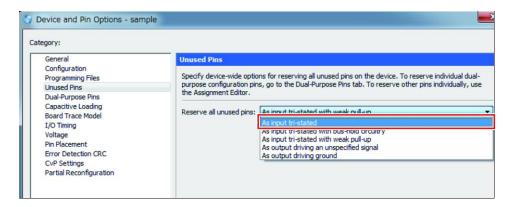


The [Device and Pin Options] window opens.

3) Select [Unused Pins].

General	General
	General
Configuration Programming Files	Specify general device options. These options are not depend
Unused Pins	
vual-rurpose Pins	Options:
Capacitive Loading	Auto-restart configuration after error
Board Trace Model	Release clears before tri-states
I/O Timing	Enable user-supplied start-up clock (CLKUSR)
Voltage	Enable device-wide reset (DEV_CLRn)
Pin Placement	Enable device-wide output enable (DEV_OE)
Error Detection CRC CvP Settings	Enable INIT DONE output
Partial Reconfiguration	

4) Select [As input tri-stated] for the [Reserve all unused pins] item.



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

7. Document Revision History

Date	Revision	Changes
January 31, 2017	A	• First Edition
October 23, 2017	В	Change URL

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