



Reference Manual

TI GE PHY HSMC CARD

Revision

A

2019/10/31

© 2019 Macnica, Inc.

Disclaimer

The information in this document (hereinafter called “Information”) is subject to change without notice.

Macnica Inc. (Developer) makes no warranty of any kind regarding this document, or of any liability arising out of the application or use of information in this document, and assumes no responsibility for any errors that may appear in this document.

This document is distributed without any charge and reselling or copying without written authorization by Developer is restricted.

IN NO EVENT WILL DEVELOPER BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, EXEMPLARY, SPECIAL, OR INCIDENTAL DAMAGES, INCLUDING ANY LOST DATA AND LOST PROFITS, ARISING FROM OR RELATING TO YOUR USE OF THE INFORMATION, EVEN IF YOU HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE TOTAL CUMULATIVE LIABILITY OF DEVELOPER IN CONNECTION WITH YOUR USE OF THE INFORMATION IN THIS DOCUMENT, WHETHER IN CONTRACT OR TORT OR OTHERWISE, WILL IN NO EVENT EXCEED THE AMOUNT OF FEES PAID BY YOU TO DEVELOPER HEREUNDER FOR USE OF THE INFORMATION. YOU ACKNOWLEDGE THAT THE FEES, IF ANY, REFLECT THE ALLOCATION OF RISK SET FORTH IN THIS AGREEMENT AND THAT DEVELOPER WOULD NOT MAKE AVAILABLE THE INFORMATION TO YOU WITHOUT THESE LIMITATIONS OF LIABILITY.

The Information is not intended for use in the development of on-line control equipment in hazardous environments requiring failsafe controls, such as in the operation of nuclear facilities, aircraft navigation or communications systems, air traffic control, life support, or weapons systems (“High-Risk Applications”). Developer specifically disclaims any express or implied warranties of fitness for such High-Risk Applications. You represent that use of the Information in such High-Risk Applications is fully at your risk.

Contents

- 1. Read This First** _____ **4**
 - 1.1 Important Information 4
 - 1.2 Developer Information..... 5
 - 1.3 Inquiries 5
- 2. For Ensuring Safe Use** _____ **6**
 - 2.1 Legend..... 6
 - 2.2 Cautions 6
- 3. Unpacking** _____ **9**
- 4. Functions and Features of the Card** _____ **10**
 - 4.1 Main Features 10
 - 4.2 Product Specifications..... 10
 - 4.3 Block Diagram 11
 - 4.4 Card Layout 11
- 5. Components on the Card** _____ **13**
 - 5.1 Connector Pin Assignments 13
- 6. Handling Precautions** _____ **15**
 - 6.1 Connecting/disconnecting to the HSMC..... 15
 - 6.2 Using the Mounted IC 15
- 7. Document Revision History** _____ **16**

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 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 reference design 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	<p>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.</p>
 Warning	<p>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.</p>
	<p>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.</p>
	<p>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.</p>
	<p>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.</p>
	<p>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.</p>
	<p>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.</p>

<div style="text-align: center;">  <p>Warning (Continued from previous page)</p> </div>	<p>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.</p> <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 heat 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 a dry cloth.</p> <p>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.</p> <p>Keep the card and accessories out of the reach of children. Failure to do so may lead to injuries.</p>
<div style="text-align: center;">  <p>Caution</p> </div>	<p>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.</p> <p>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.</p> <p>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%.</p> <p>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.</p> <p>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.</p>

 <p>Caution (Continued from previous page)</p>	<p>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.</p> <p>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.</p>
	<p>Turn off the power switch when moving or connecting the card.</p> <p>Failure to do so may cause this card to fail or lead to accidents involving electrical shock.</p>
	<p>Do not clean this card by using a rag containing chemicals such as benzine or thinner.</p> <p>Doing so could degrade the card. When using a chemically treated cloth, comply with its directions and warnings.</p>
	<p>Do not immediately turn on the power if you find that moisture has condensed onto this card after removing it from the box.</p> <p>Condensation may form if the card is cold when moved from the box into a warm room.</p> <p>Turning on the power while there is moisture on the card may cause it to malfunction or shorten the service life of the parts.</p> <p>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.</p>
	<p>Operation of the card cannot be guaranteed if it has been disassembled, dismantled, altered, modified, or rebuilt.</p>

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.

TI GE PHY HSMC CARD : 1 set	
5mm Spacer : 2 sets	
32mm Spacer : 2 sets	
Nut : 2 sets	
4mm Pan Head Screw : 4 sets	
Packing list/precautions: 1 set	
Packing list/precautions (English): 1 set	
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 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 Intel Cyclone® V GT FPGA development kit.

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

- Information for the Cyclone V device family
[Documentation: Cyclone V Devices](#)
- Documentation for Intel Cyclone V GT FPGA development kit
[Cyclone V GT FPGA Development Kit](#)

4.2 Product Specifications

The product specifications for this card are shown below.

Table 4-1 Product specifications

Product Specifications	TI GE PHY HSMC CARD
External Dimensions	78.105 mm × 80.00 mm
Printed circuit board	4-layer FR4
HSMC	1
Power Supply	12 V, 3.3 V, 2.5 V, 1.1 V
Gigabit Ethernet PHY	Texas Instruments DP83867IR
IDT clock	Texas Instruments DP83867IR
Interface	RJ45

4.3 Block Diagram

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

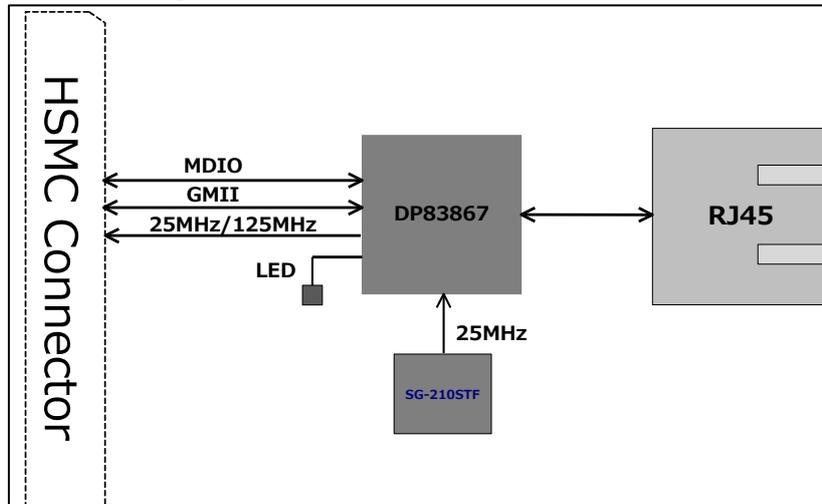


Figure 4-1 TI GE PHY HSMC CARD Block Diagram

4.4 Card Layout

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

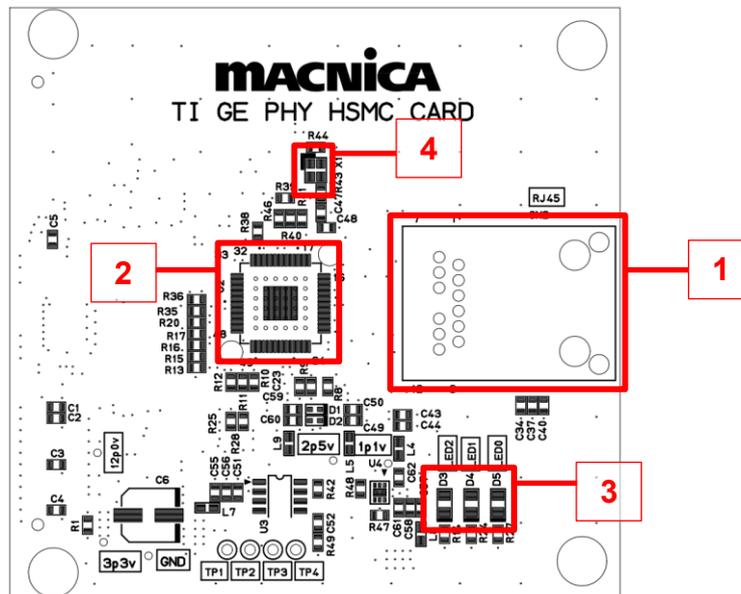


Figure 4-2 TI GE PHY HSMC CARD Layout (Front)

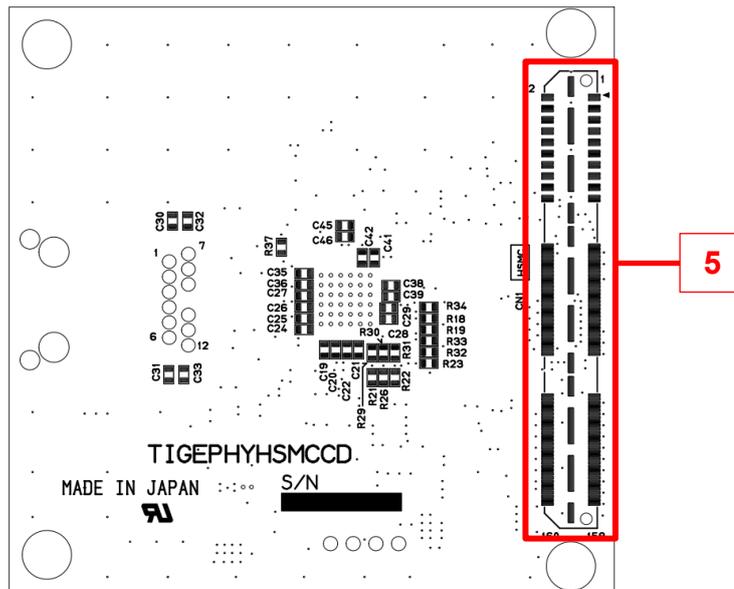


Figure 4-3 TI GE PHY HSMC CARD Layout (Back)

Table 4-2 CN1 HSMC Pin Assignments

No.	Reference	Functions	Details
1	CN2	Ethernet port RJ45	Würth Electronics 7499111000A
2	U2	Gigabit Ethernet PHY	Texas Instruments DP83867IR
3	LED1 LED2 LED3	PHY status indicators	Default status LED1 on: Link establish LED2 on: 1000BASE-T link LED3 on: Receiving or sending
4	X1	Clock oscillator	Epson SG-210STF 25MHz
5	CN1	Interface for Intel FPGA Development Kit High Speed Mezzanine Card (HSMC) connector	Samtec ASP-122952-01

5. Components on the Card

5.1 Connector Pin Assignments

Table 5-1 CN1 HSMC Pin Assignments

Board	HSMC	Pin#	BANK	Pin#	HSMC	Board
		1	BANK A	2		
		3		4		
		5		6		
		7		8		
		9		10		
		11		12		
		13		14		
		15		16		
	HSMC_TX_P3	17		18	HSMC_RX_P3	
	HSMC_TX_N3	19		20	HSMC_RX_N3	
	HSMC_TX_P2	21		22	HSMC_RX_P2	
	HSMC_TX_N2	23		24	HSMC_RX_N2	
	HSMC_TX_P1	25		26	HSMC_RX_P1	
	HSMC_TX_N1	27		28	HSMC_RX_N1	
	HSMC_TX_P0	29		30	HSMC_RX_P0	
	HSMC_TX_N0	31		32	HSMC_RX_N0	
	HSMC_SDA	33	34	HSMC_SCL		
		35	36			
		37	38			
	HSMC_CLK_OUT0	39	40	HSMC_CLK_IN0	TX_CLK	
	HSMC_D0	41	42	HSMC_D1		
	HSMC_D2	43	44	HSMC_D3		
3.3V	3.3V	45	46	12V	12V	
	HSMC_TX_D_P0	47	48	HSMC_RX_D_P0		
	HSMC_TX_D_N0	49	50	HSMC_RX_D_N0		
3.3V	3.3V	51	52	12V	12V	
PHY_RESET_N	HSMC_TX_D_P1	53	54	HSMC_RX_D_P1	RX_DV	
	HSMC_TX_D_N1	55	56	HSMC_RX_D_N1	COL	
3.3V	3.3V	57	58	12V	12V	
TX_EN	HSMC_TX_D_P2	59	60	HSMC_RX_D_P2	CRS	
TX_ERR	HSMC_TX_D_N2	61	62	HSMC_RX_D_N2	RX_ERR	
3.3V	3.3V	63	64	12V	12V	
PWRDOWN_INT_N	HSMC_TX_D_P3	65	66	HSMC_RX_D_P3	MDIO	
	HSMC_TX_D_N3	67	68	HSMC_RX_D_N3	MDC	
3.3V	3.3V	69	70	12V	12V	
TX0	HSMC_TX_D_P4	71	72	HSMC_RX_D_P4	RX0	
TX1	HSMC_TX_D_N4	73	74	HSMC_RX_D_N4	RX1	
3.3V	3.3V	75	76	12V	12V	
TX2	HSMC_TX_D_P5	77	78	HSMC_RX_D_P5	RX2	
TX3	HSMC_TX_D_N5	79	80	HSMC_RX_D_N5	RX3	
3.3V	3.3V	81	82	12V	12V	
TX4	HSMC_TX_D_P6	83	84	HSMC_RX_D_P6	RX4	
TX5	HSMC_TX_D_N6	85	86	HSMC_RX_D_N6	RX5	
3.3V	3.3V	87	88	12V	12V	
TX6	HSMC_TX_D_P7	89	90	HSMC_RX_D_P7	RX6	
TX7	HSMC_TX_D_N7	91	92	HSMC_RX_D_N7	RX7	
3.3V	3.3V	93	94	12V	12V	
GTX_CLK	HSMC_CLK_OUT_P1	95	96	HSMC_CLK_IN_P1	RX_CLK	
	HSMC_CLK_OUT_N1	97	98	HSMC_CLK_IN_N1	GND	
3.3V	3.3V	99	100	12V	12V	
	HSMC_TX_D_P8	101	102	HSMC_RX_D_P8		
	HSMC_TX_D_N8	103	104	HSMC_RX_D_N8		
3.3V	3.3V	105	106	12V	12V	
	HSMC_TX_D_P9	107	108	HSMC_RX_D_P9		
	HSMC_TX_D_N9	109	110	HSMC_RX_D_N9		
3.3V	3.3V	111	112	12V	12V	
	HSMC_TX_D_P10	113	114	HSMC_RX_D_P10		
	HSMC_TX_D_N10	115	116	HSMC_RX_D_N10		

Board	HSMC	Pin#	BANK	Pin#	HSMC	Board
3.3V	3.3V	117		118	12V	12V
	HSMC_TX_D_P11	119		120	HSMC_RX_D_P11	
	HSMC_TX_D_N11	121		122	HSMC_RX_D_N11	
3.3V	3.3V	123		124	12V	12V
	HSMC_TX_D_P12	125		126	HSMC_RX_D_P12	
	HSMC_TX_D_N12	127		128	HSMC_RX_D_N12	
3.3V	3.3V	129		130	12V	12V
	HSMC_TX_D_P13	131		132	HSMC_RX_D_P13	
	HSMC_TX_D_N13	133		134	HSMC_RX_D_N13	
3.3V	3.3V	135		136	12V	12V
	HSMC_TX_D_P14	137		138	HSMC_RX_D_P14	
	HSMC_TX_D_N14	139		140	HSMC_RX_D_N14	
3.3V	3.3V	141		142	12V	12V
	HSMC_TX_D_P15	143		144	HSMC_RX_D_P15	
	HSMC_TX_D_N15	145		146	HSMC_RX_D_N15	
3.3V	3.3V	147		148	12V	12V
TP2	HSMC_TX_D_P16	149		150	HSMC_RX_D_P16	TP3
TP1	HSMC_TX_D_N16	151		152	HSMC_RX_D_N16	TP4
3.3V	3.3V	153		154	12V	12V
	HSMC_CLK_OUT_P2	155		156	HSMC_CLK_IN_P2	CLK_FR_PHY
	HSMC_CLK_OUT_N2	157		158	HSMC_CLK_IN_N2	GND
3.3V	3.3V	159		160	HSMC_PRSTn	GND

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	DP83867IR	http://www.ti.com/lit/ds/symlink/dp83867ir.pdf

7. Document Revision History

Date	Revision	Changes
October 31, 2019	A	<ul style="list-style-type: none"> • First Edition