



Getting Started

TI GE PHY HSMC CARD

Revision

A

2019/10/25

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1. Read This First

1.1 Important Information

READ FIRST:

- Before using this card, be sure to read this Getting Started manual.
- Keep this Getting Started 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 Reference 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 Getting Started 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 Getting Started 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 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. Advance Preparation

3.1 About This Manual

This manual describes how to use the reference design that this card is used in. The following information is also included.

- Basic specifications of the card
- Reference design for implementation using this card and Intel Cyclone® V GT FPGA development kit.

3.2 Advance Preparation

A. Preparation of reference design

The following items are included in the reference design that is provided.

- Reference design (sof files and elf files)
- Board information

The following item is included in the board information.

- Circuit diagram

To download these files, go to the URL noted on the “Packing List and Precautions”.

B. Preparation of materials

Prepare the following materials to execute all the functions of this design.

- This card : 1
- Cyclone® V GT FPGA development kit : 1
- LAN cable (CAT5e or better) : 1
- Computer for evaluations

C. Preparation of tools

Prepare the following tools before operating this design.

- Intel Quartus Prime 17.1 Standard Edition
- NiosII EDS 17.1

4. Reference Design

4.1 About Reference Design

4.1.1 Ping Test from Evaluation Computer

Input the ping command from the evaluation computer and then confirm the response from the Cyclone V GT FPGA development kit via the TI GE PHY HSMC CARD.

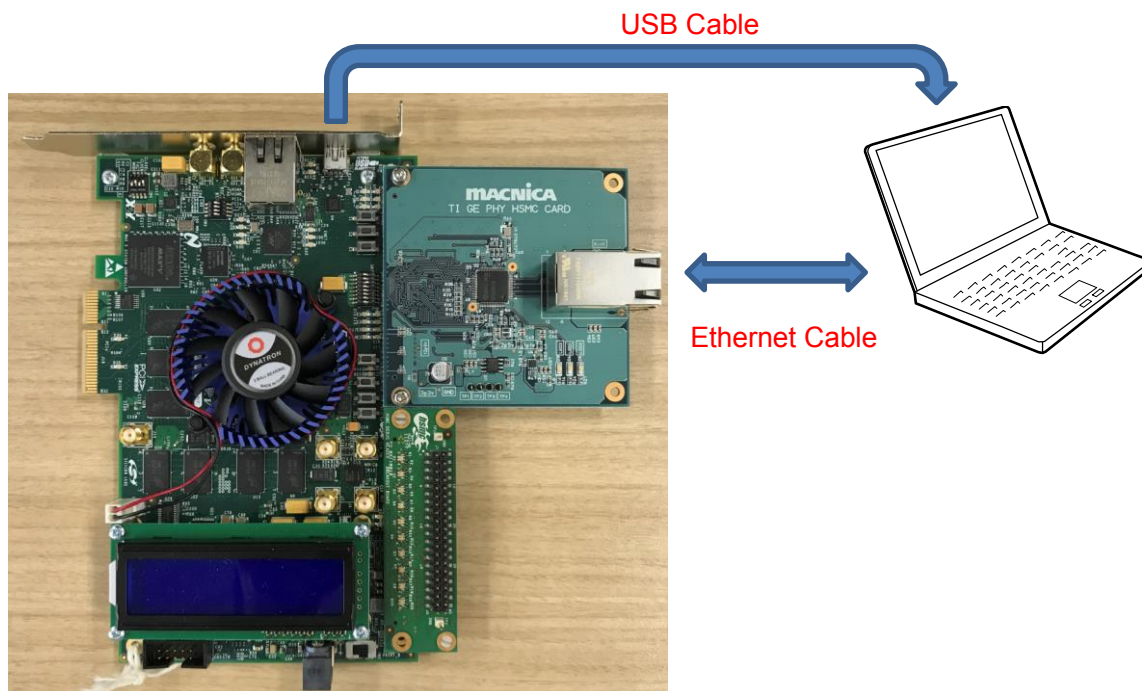


Figure 4-1 Connection Diagram for TI GE PHY HSMC CARD and evaluation computer.

Table 4-1 Reference Design for TI GE HSMC CARD Ping Test

| File name | Description | Ping test target |
|-------------------|------------------------------|--------------------|
| gt_top.sof | HW design for FPGA | Ethernet ping test |
| SSS.elf | FW design for Nios | |
| 1sof_download.bat | Script file for sof download | - |
| 2nios_download.ba | Script file for elf download | - |

5. Setup

5.1 Card Layout

This section explains the card layout and major components.

Figure 5-1 and Figure 5-2 show the layout of the card.

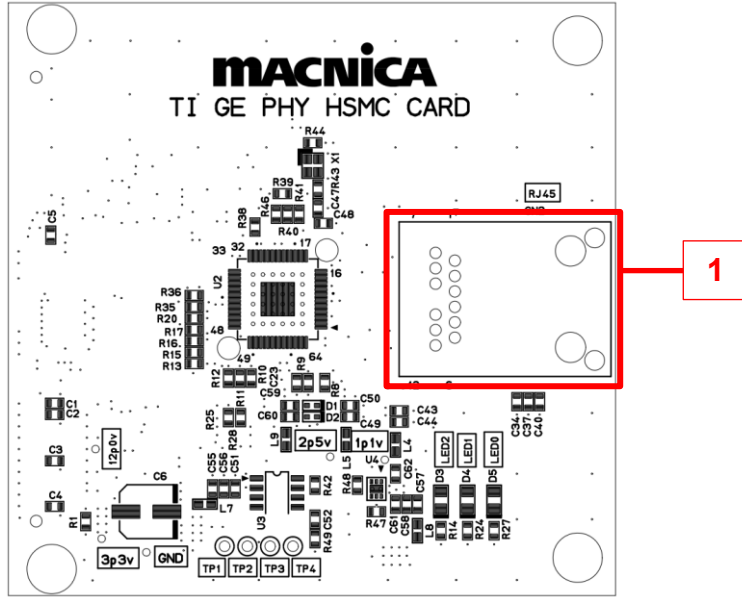


Figure 5-1 TI GE PHY HSMC CARD Layout (Front)

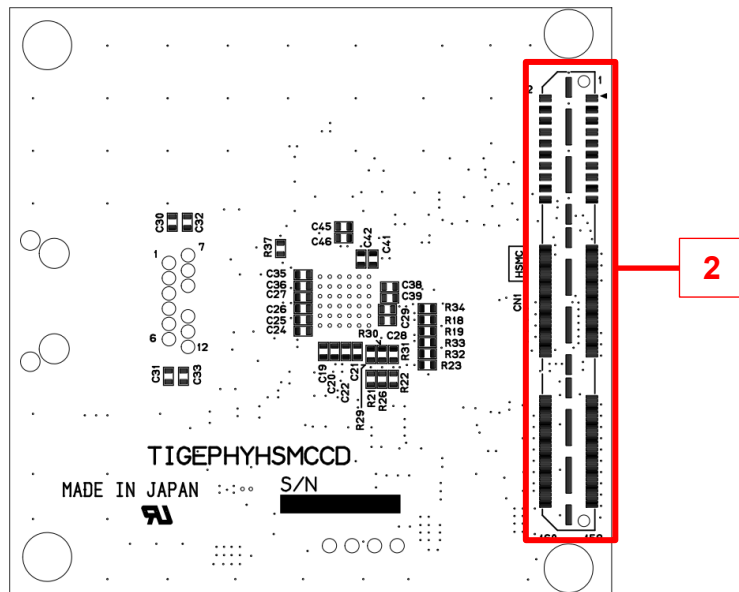


Figure 5-2 TI GE PHY HSMC CARD Layout (Back)

Table 5-1 TI GE PHY HSMC CARD Connectors

| No. | Reference | Functions | Details |
|-----|-----------|--|----------------------------------|
| 1 | CN2 | Ethernet port RJ45 | Wurth Electronics 7499111000A |
| 2 | CN1 | Interface for Intel FPGA Development Board High Speed Mezzanine Card (HSMC) connector | Samtec ASP-122952-01 |

5.2 Card Setup and Ping Test

Before startup, set up the card, Evaluation board and the evaluation computer as shown below.

5.2.1 Network Settings on the Evaluation Computer

Do the network settings on the evaluation computer. (*The settings may vary according to the computer's environment.)

Once you implement these settings, you don't have to follow this procedure again until the PC is rebooted.

- 1) Input the following command in Command Prompt.

```
> netsh interface ipv4 show interface
```

The following information is displayed.

| Idx | Met | MTU | State | Name |
|-----|-----|------------|--------------|------------------------------|
| 1 | 50 | 4294967295 | connected | Loopback Pseudo-Interface 1 |
| 12 | 25 | 1500 | connected | Wireless Network Connection |
| 11 | 30 | 1500 | connected | Local Area Connection |
| 14 | 50 | 1500 | disconnected | Bluetooth Network Connection |
| 15 | 5 | 1400 | disconnected | Local Area Connection* 11 |

The name of the interface being used at this time appears in "Idx11:Local Area Connection". (LAN port of computer)

- 2) Input one of the following commands.

```
> netsh interface ipv4 set neighbors 11 192.168.1.234 00-07-ed-ff-e1-ae
```

or

```
> netsh interface ipv4 set neighbors Local Area Connection 192.168.1.234 00-07-ed-ff-e1-ae
```

* 192.168.1.234 is the IP address of the target (TI GE PHY HSMC CARD), 00-07-ed-ff-e1-ae is the MAC address of the target.

- 3) To confirm, execute the following command.

```
> arp -a
```

The following information is displayed.

| Interface: 192.168.1.10 --- 0xb | | | |
|---------------------------------|-------------------|--------|--|
| Internet Address | Physical Address | Type | |
| 192.168.1.234 | 00-07-ed-ff-e1-ae | static | <= Confirm that this information is displayed. |
| 192.168.1.255 | ff-ff-ff-ff-ff | static | |
| 224.0.0.22 | 01-00-5e-00-00-16 | static | |
| 224.0.0.251 | 01-00-5e-00-00-fb | static | |
| 224.0.0.252 | 01-00-5e-00-00-fc | static | |

The network setup is completed.

5.2.2 Ping Test

- 1) Turn on the power to the Cyclone V GT FPGA Development kit.
- 2) Open Command Prompt in the evaluation computer.
- 3) Execute the “1sof_download.bat”(*1) file and then configure a test design on the FPGA.
(*1. Edit the bat file according to the installation environment of the NiosII EDS 17.1.)

```
Info: *****
Info: Running Quartus Prime Programmer
Info: Command: quartus_pgm --no_banner --mode=jtag -o p;gt_top.sof
Info (213045): Using programming cable "USB-BlasterII [USB-1]"
Info (213011): Using programming file gt_top.sof with checksum 0x0C643AC4 for de
vice 5CGTFD9E5F35@1
Info (209060): Started Programmer operation at Fri Oct 11 14:34:20 2019
Info (209016): Configuring device index 1
Info (209017): Device 1 contains JTAG ID code 0x02B040DD
Info (209007): Configuration succeeded -- 1 device(s) configured
Info (209011): Successfully performed operation(s)
Info (209061): Ended Programmer operation at Fri Oct 11 14:34:25 2019
Info: Quartus Prime Programmer was successful. 0 errors, 1 warning
Info: Peak virtual memory: 327 megabytes
Info: Processing ended: Fri Oct 11 14:34:25 2019
Info: Elapsed time: 00:00:13
Info: Total CPU time (on all processors): 00:00:03
```

4) Execute the “2nios_download_ch0.bat”(*/) file and then execute the test program.

```

Using cable "USB-BlasterII [USB-1]", device 1, instance 0x00
Pausing target processor: OK
Initializing CPU cache (if present)
OK
Downloaded 317KB in 0.5s (634.0KB/s)
Verified OK
Starting processor at address 0x1000023C
nios2-terminal: connected to hardware target using JTAG UART on cable
nios2-terminal: "USB-BlasterII [USB-1]", device 1, instance 0
nios2-terminal: (Use the IDE stop button or Ctrl-C to terminate)

InterNiche Portable TCP/IP, v3.1

Copyright 1996-2008 by InterNiche Technologies. All rights reserved.
prep_tse_mac 0
Your Ethernet MAC address is 00:07:ed:ff:e1:ae
Static IP Address is 192.168.1.234
prepped 1 interface, initializing...
[tse_mac_init]
List of PHY profiles supported (Total profiles = 7)...
Profile No. 0   :
PHY Name       : Marvell 88E1111
PHY OUI        : 0x005043
PHY Model Num. : 0x0c
PHY Rev. Num.  : 0x02
Status Register : 0x11
Speed Bit      : 14
Duplex Bit     : 13
Link Bit       : 10

.....(omitted)

Profile No. 6   :
PHY Name       : TI DP83867IR
PHY OUI        : 0x080028
PHY Model Num. : 0x23
PHY Rev. Num.  : 0x01
Status Register : 0x11
Speed Bit      : 14
Duplex Bit     : 13
Link Bit       : 2

(next)
    
```


(before)

```
INFO : TSE MAC 0 found at address 0x20102000
INFO : Multi Channel          = No
INFO : MDIO Shared           = No
INFO : MAC Type               = 10/100/1000 Ethernet MAC
INFO : MAC Address            = 0x20102000
INFO : MAC Device             = tse_mac_device[0]Created "Inet main" task (Prio: 2)
```

INFO : PHY TI DP83867IR found at PHY address 0x00 of MAC Group[0]

```
INFO : PHY OUI                 = 0x080028
INFO : PHY Model Number       = 0x23
INFO : PHY Revision Number    = 0x1
INFO : PHY[0.0] - Automatically mapped to tse_mac_device[0]
INFO : PHY[0.0] - Advertisement of 1000 Base-T Full Duplex set to 1
INFO : PHY[0.0] - Advertisement of 1000 Base-T Half Duplex set to 1
INFO : PHY[0.0] - Advertisement of 100 Base-T4 set to 0
INFO : PHY[0.0] - Advertisement of 100 Base-TX Full Duplex set to 1
INFO : PHY[0.0] - Advertisement of 100 Base-TX Half Duplex set to 1
INFO : PHY[0.0] - Advertisement of 10 Base-TX Full Duplex set to 1
INFO : PHY[0.0] - Advertisement of 10 Base-TX Half Duplex set to 1
INFO : PHY[0.0] - Restart Auto-Negotiation, checking PHY link...
```

INFO : PHY[0.0] - Auto-Negotiation PASSED

```
INFO : Applying additional user PHY configuration
TI : Enable GMII Timing Control
```

```
INFO : PHY[0.0] - Checking link...
INFO : PHY[0.0] - Link established
```

INFO : PHY[0.0] - Speed = 1000, Duplex = Full

```
OK, x=0, CMD_CONFIG=0x00000000
```

```
MAC post-initialization: CMD_CONFIG=0x0000821b
[tse_sgdma_read_init] RX descriptor chain desc (1 depth) created
mctest init called
```

```
IP address of et1 : 192.168.1.234
```

```
Created "clock tick" task (Prio: 3)
```

Simple Socket Server starting up

```
[sss_task] Simple Socket Server listening on port 30
```

```
Created "simple socket server" task (Prio: 4)
```

- 5) Execute the following command and confirm that a ping is returned from the TI GE PHY HSMC CARD.

```
C:\>ping 192.168.1.234
```

Operations are normal if the response is similar to the following.

```
Pinging 192.168.1.234 with 32 bytes of data:  
Reply from 192.168.1.234: bytes =32 time =1ms TTL=64  
Reply from 192.168.1.234: bytes =32 time <1ms TTL=64  
Reply from 192.168.1.234: bytes =32 time <1ms TTL=64  
Reply from 192.168.1.234: bytes =32 time <1ms TTL=64  
  
Ping statistics for 192.168.1.234:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round-trip times in milli-seconds:  
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

The operation check of this board is complete.

6. Document Revision History

| Date | Revision | Changes |
|------------------|----------|---|
| October 25, 2019 | A | <ul style="list-style-type: none">• First Edition |