

# Galatea RTL8211E Gigabit Ethernet Expansion Module User Guide

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## Introduction

The heart of the Galatea RTL8211E Gigabit Ethernet Expansion module is RTL8211E-VB, a highly integrated Ethernet transceiver that comply with 10BASE-T, 100BASE-TX and 1000Base-T IEEE 802.3 standards. RTL8211E-VB supports communication with Ethernet MAC layer via standard RGMII interface, thus providing an alternative to the IEEE802.3z GMII interface. The main objective in using RGMII interface over GMII interface is to reduce the number of IOs for interconnecting MAC and PHY. RTL8211E-VB implements auto-negotiation to automatically determine the best possible speed and mode of operation. HP Auto-MDIX support allows the use of direct connect or cross-over LAN cables. Galatea RTL8211E Gigabit Ethernet Expansion Module also has Microchip 24AA02E48 2Kbit EEPROM with built in unique MAC address. This MAC address can be read from the EEPROM and used for the Ethernet interface.

## Applications

- Product Prototype Development
- Network appliance development
- Embedded Telecom Applications
- Digital Media Adapters /Servers
- Development and testing of custom Projects

## Board features

- Three 2×6 pin Expansion connectors
- High-Performance 10/100/1000T Ethernet Transceiver
- Single-Chip Ethernet Physical Layer Transceiver (PHY)
- 2 Kbit Electrically Erasable PROM (24AA02E48) with MAC Address
- Dimension: 58.5mm X 67mm

## How to use the module

The following section describes how to use this module.

### Components/Tools required

Along with the module, you may need the items in the list below for easy and fast installation.

1. Galatea PCI Express Spartan 6 FPGA Development Board.
2. A device supporting 1Gbps Data Transfer Rate (Switch/Router or PC).

### Connection Diagram

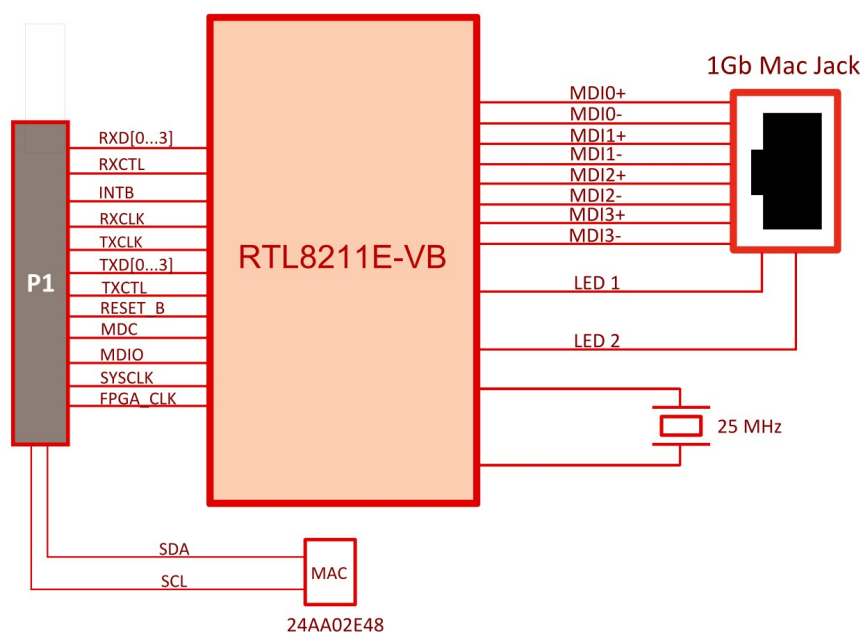


Figure 1

This diagram should be used as a reference only. For detailed information, see the schematics at the end of this document. Details of individual connectors are as below.

**Important!** This product is designed for and compatible with [Galatea PCI Express Spartan 6 FPGA Development Board](#).

## Connection Details

### Header P1

SL No.	Pin Details	Header Pin No.	Trace Length (mm)
1	RXD0	99	39.459
2	RXD1	98	39.564
3	RXD2	96	39.408
4	RXD3	95	39.450
5	RXCLK	28	39.511
6	TXCLK	29	39.361
7	TXD0	31	39.394
8	TXD1	32	39.408
9	TXD2	34	39.397
10	TXD3	35	39.421
11	SYSCLK	84	39.355
12	FPGA_CLK	83	-
13	TXCTL	46	-
14	RXCTL	101	-
15	INTB	52	-
16	MDC	53	-
17	MDIO	55	-
18	RESET_B	47	-
19	MAC_SCL	105	-
20	MAC_SDA	104	-

For more information, refer the schematics at the end of this document.

## Generating bit file and Application Project

Galatea RTL8211E Gigabit Ethernet Expansion Module is been tested and functionality is verified with Numato Lab's Galatea PCI Express Spartan 6 FPGA Development Board.

Below are the step-by-step procedure to build the project using Xilinx EDK for Galatea RTL8211E Gigabit Ethernet Expansion Module. The procedure assumes the use of Numato Lab's Galatea PCI Express Spartan 6 FPGA Development Board. This procedure below is not a tutorial rather just guidelines and it expects that you have reasonable expertise on working with EDK.

Below is the list of software and hardware required.

1. Galatea RTL8211E Gigabit Ethernet Expansion Module.
2. Galatea PCI Express Spartan 6 FPGA Development Board.
3. Xilinx EDK & SDK (License required).
4. Galatea BSB for EDK (Download from Galatea's product page at [www.numato.com](http://www.numato.com)).
5. Serial Terminal Emulation Software (Hyper terminal, PUTTY etc..).

### Steps to generate bit file using Xilinx EDK

**Step 1:** Download the BSB for Galatea and place it in the directory where Xilinx is installed in your system (Eg: C:\Xilinx\14.7\ISE\_DS\EDK\board).

**Step 2:** Open Xilinx Platform Studio and press Ctrl + Shift + B. Create a folder on your desktop, and give a name to the project, save and press next. In a drop down menu select Numato Lab and Galatea board and press next. If the choice doesn't appear verify the BSB downloaded is placed in proper destination as mentioned in Step 1.

**Step 3:** Select the peripheral as shown in the Figure 2. Also enable the interrupt of Ethernet\_IIC and axi\_timer. Once done press finish.

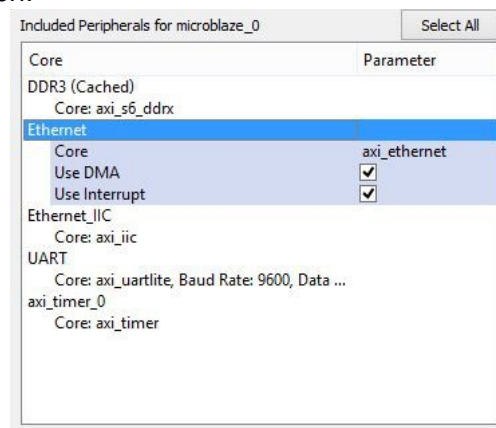


Figure 2

**Step 4:** In the window which appear go to Port tab and verify whether the Ethernet IOs are connected has external port. If not then connect it to external port by selecting “Make Ports External” as shown in Figure 3.

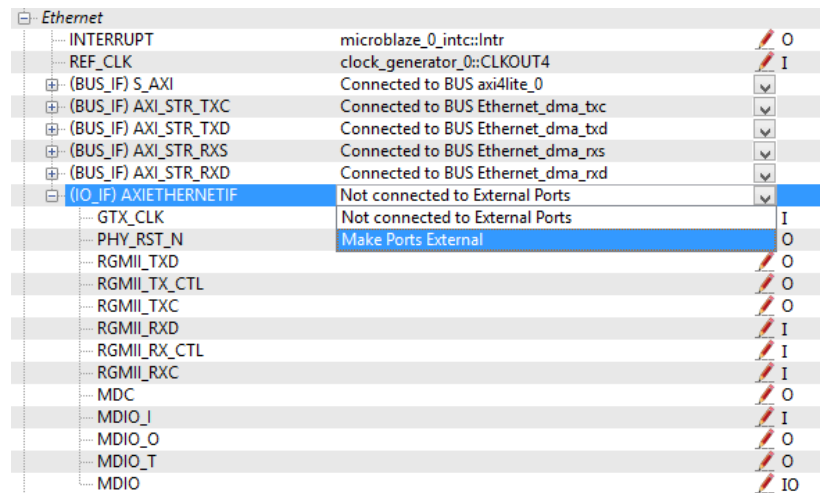


Figure 3

**Step 5:** Generate Netlist and BitStream with the help of the icons on left pane. Once the bit stream is generated export the design to SDK with the help of icon on left pane. A window like in the Figure 4 should appear, select Export & Launch SDK.



Figure 4

## Steps to develop application project using Xilinx SDK

**Step 1:** When SDK launches, select an appropriate folder to store the workspace. Close the Welcome tab and open Application Project in File menu. Give a name to the project press next. Select lwIP Echo Server and press finish.

**Step 2:** Xilinx lwIP Echo Server Application is originally written to work with a different Ethernet PHY. To make it work with RTL8211E, go to directory where Xilinx tools are installed and move to following path

Xilinx\14.x\ISE\_DS\EDK\sw\ThirdParty\sw\_services\lwip140\_v1\_0x\_a\src\contrib\ports\xilinx\netif and open xaxiemacif\_physpeed.c file in your preferred editor and update the following lines as shown below.

```
#define MARVEL_PHY_IDENTIFIER          0x1C
#define MARVEL_PHY_88E1116R_MODEL     0x110
```

\*Directly editing files in libraries is not recommended. If possible, you should copy those files in to your project and then edit.

**Step 3:** In main.c change IP address, Subnet and Gateway as required. Save and Rebuild the project and verify that .elf executable file is generated.

**Step 4:** Connect serial terminal with, Baud Rate: 9600 bps, Data bits: 8, Parity: None, Stop bits: 1.

**Step 5:** Make sure Galatea RTL8211E Gigabit Ethernet Expansion Module is connected to appropriate header of Galatea PCI Express Spartan 6 FPGA Development Board.

**Step 6:** Set-up the connection between Galatea RTL8211E Gigabit Ethernet Expansion Module and a device supporting 1Gbps Data Transfer Rate.

**Step 7:** Program FPGA and run the application. The terminal window should display that the board have auto-negotiated at 100/1000 Mbps along with Board IP and MAC id. Try to ping the board with Board's IP.

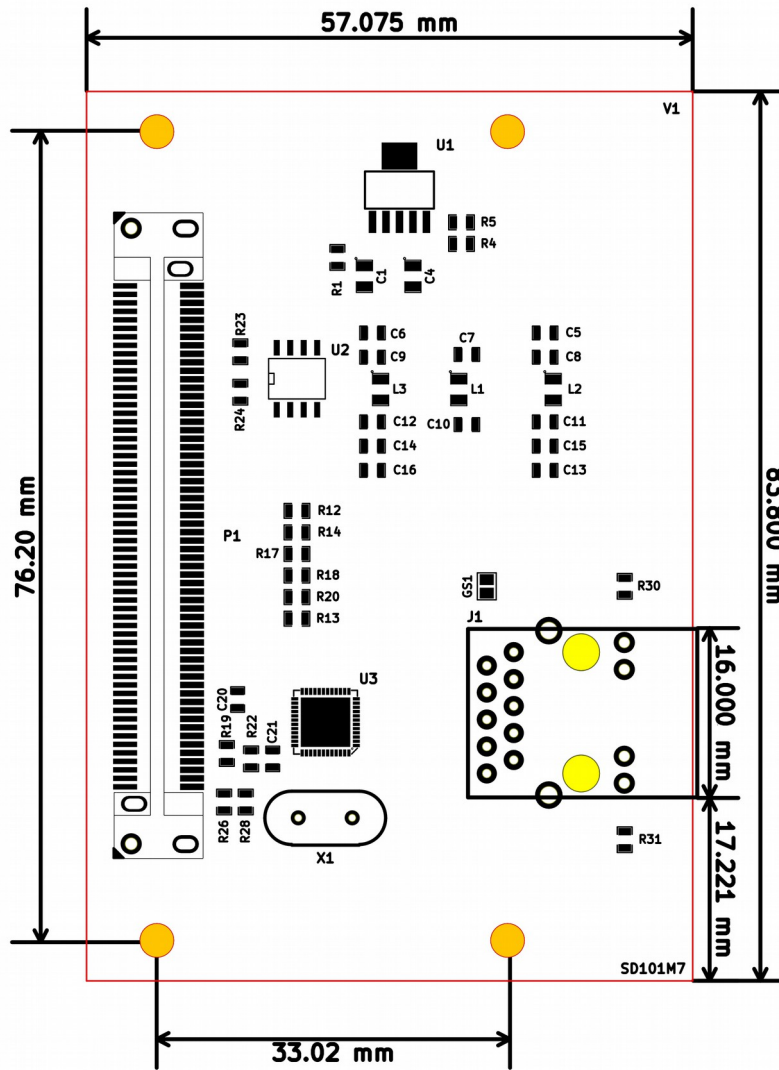


## Technical Specifications

Parameter *	Value	Unit
<b>Basic Specifications</b>		
Power supply voltage	3.3	V
Current drawn by the circuit		mA
<b>RTL8211E-VB</b>		
Supply Voltage (AVDD10,AVDD33,DVDD10,DVDD33)	3.3	V
Current Consumption		mA

\* All parameters considered nominal. Numato Systems Pvt Ltd reserve the right to modify products without notice.

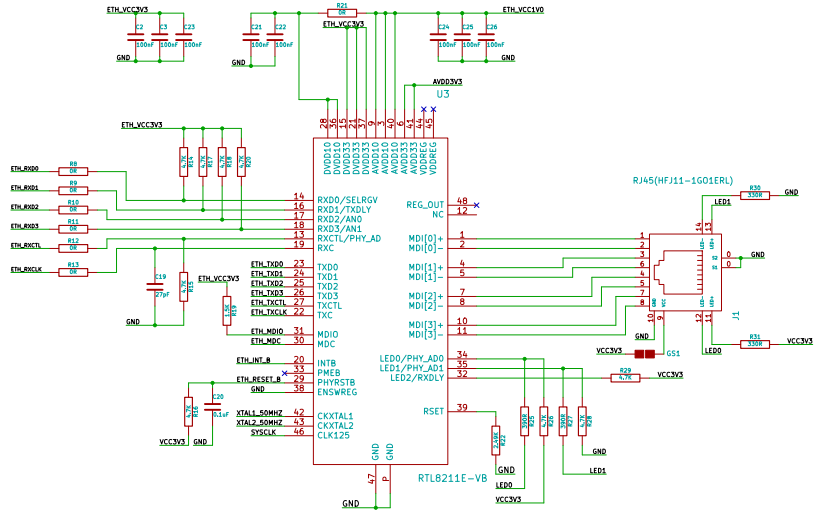
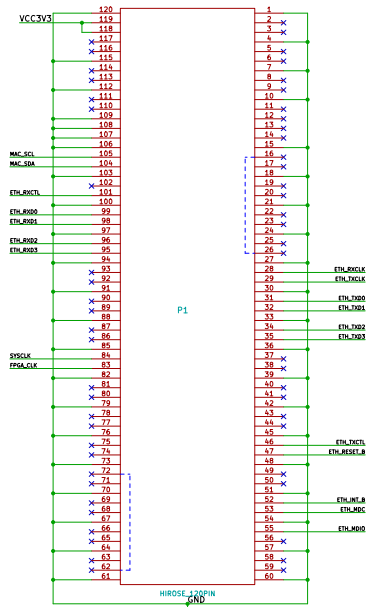
## Physical Dimensions



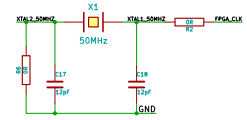
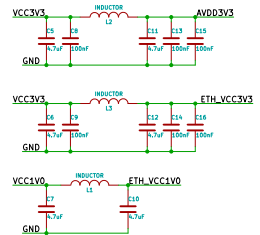
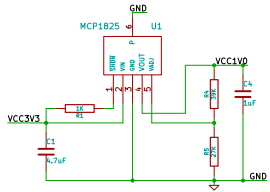
L x W x H : 83.800 mm x 57.075 mm x 14 mm  
 Mechanical Hole Diameter- 3.25 mm

## Schematics

See next page.



**VCC1V0**



**EEPROM**

