

RTL8211E Gigabit Ethernet Expansion Module User Guide

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Mailing Address

Numato Systems Pvt Ltd
1st Floor, #56C Wipro Avenue
Phase 1 - Electronic City
Bangalore, KA-560100, India

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Introduction

The heart of the 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 I/Os 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. 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. Any FPGA/Micro-controller board featuring 2x6 pin Expansion connectors
2. A device supporting 1Gbps Data Transfer Rate (Switch/Router or PC).
3. Power Supply 3.3V @500mA

Connection Diagram

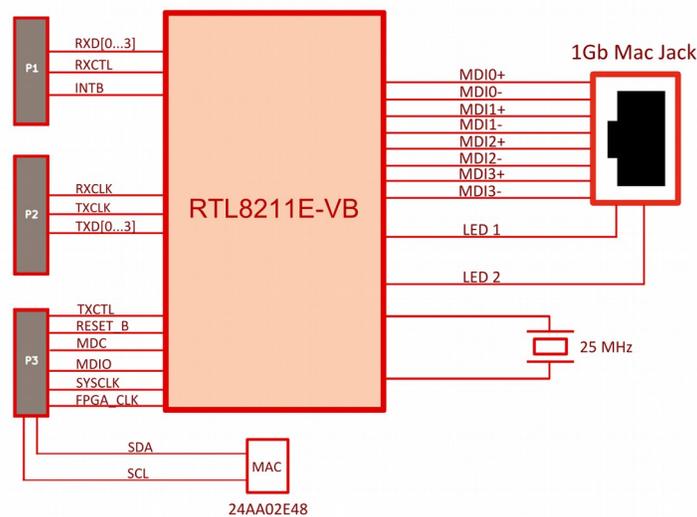


Figure 1

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.

To use this module, directly attach the 2x6 expansion connectors to the FPGA/Micro-controller development board where corresponding female headers are available. If 2x6 female headers are not available, manually make the connections as per the connection details below (Not recommended for fast links).

Connection Details

Header P1

Header Pin No.	Pin Details	Trace Length (mm)
1	NC	-
2	NC	-
3	RXD0	44.745
4	RXCTL	44.745
5	RXD2	44.742
6	RXD1	44.808
7	INTB	-
8	RXD3	44.811
9	GND	-
10	GND	-
11	VCC3V3	-
12	VCC3V3	-

Header P2

Header Pin No.	Pin Details	Trace Length (mm)
1	NC	-
2	NC	-
3	RXCLK	44.853
4	TXCLK	44.718
5	TXD0	44.697
6	TXD1	44.747
7	TXD2	44.726
8	TXD3	44.767
9	GND	-
10	GND	-
11	VCC3V3	-
12	VCC3V3	-

Header P3

Header Pin No.	Pin Details	Trace Length (mm)
1	TXCTL	44.752
2	RESET_B	-
3	MDC	-
4	MDIO	-
5	MAC_SCL	-
6	MAC_SDA	-
7	SYSCLK	44.811
8	FPGA_CLK	44.737
9	GND	-
10	GND	-
11	VCC3V3	-
12	VCC3V3	-

For more information, refer the schematics below.

Generating bit file and Developing Application Project

RTL8211E Gigabit Ethernet Expansion Module is been tested and functionality is verified with Numato Lab's Saturn Spartan 6 LX45 Development Board. This module may be used with any other FPGA board as long as the board can provide enough number of IOs and FPGA resources. It is also important that the traces to the connector are length matched too.

Below are the step-by-step procedure to build the project using Xilinx EDK for RTL8211E Gigabit Ethernet Expansion Module. The procedure assumes the use of Numato Lab's Saturn Spartan 6 LX45 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. RTL8211E Gigabit Ethernet Expansion Module
2. Saturn Spartan 6 LX45 Development Board or compatible
3. Xilinx EDK
4. Saturn BSB for EDK (Download from saturn's product page at 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 Saturn and place it in the directory where Xilinx EDK 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 Saturn LX45 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.

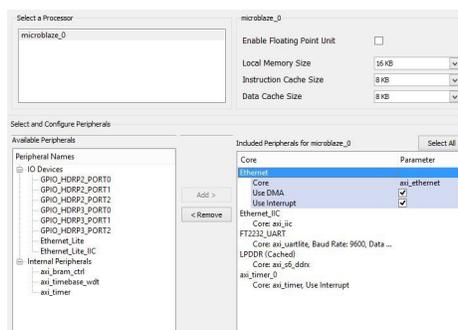


Figure 2

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.

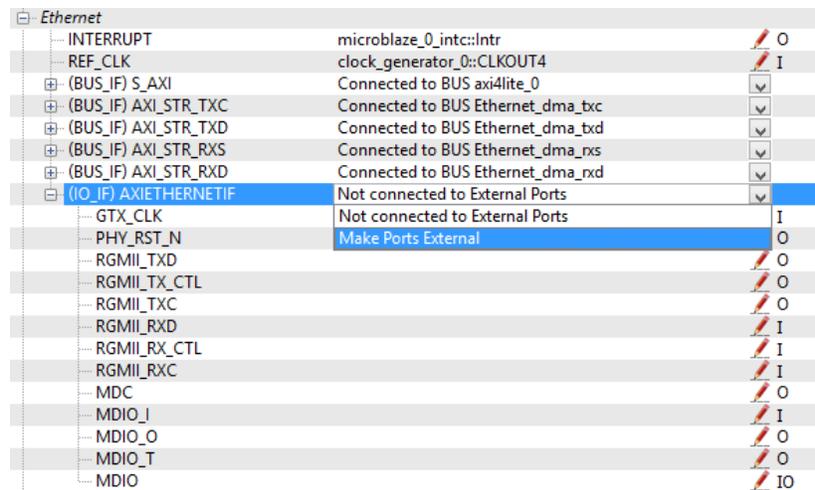


Figure 3

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 image below 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 xaxiemaif_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 RTL8211E Gigabit Ethernet Expansion Module is connected to P8 – P10 – P9 headers of Saturn Expansion Breakout board and the Saturn Expansion Breakout board is attached to header P2 of Saturn LX45 module. And also connect the Ethernet module to another device with Gigabit port.

Step 5: Program FPGA and run the application.

Step 6: 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.

DHCP can be enabled by updating system.mss with the following changes and rebuilding the project.

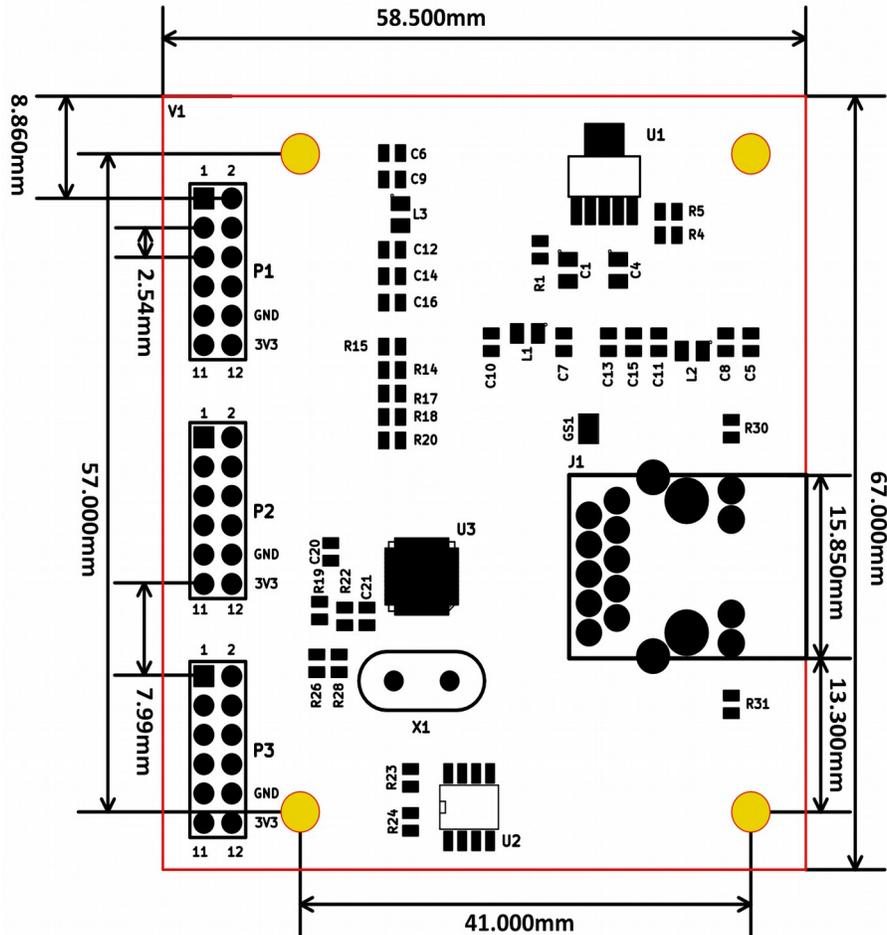
```
PARAMETER LWIP_DHCP = true
PARAMETER DHCP_DOES_ARP_CHECK = true
```

Technical Specifications

Parameter *	Value	Unit
Basic Specifications		
Power supply voltage	3.3	V
Current drawn by the circuit	250-500	mA

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

Physical Dimensions



L x W x H : 67.00 mm x 58.500 mm x 17 mm
Mechanical Hole Diameter : 3.2 mm

Schematics

See next page.

