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## Adding an External Ethernet RJ-45 Connector and PCB Layout Guidelines for NetBurner -200 Version Modules

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### Introduction

Specific NetBurner modules are available in two build configurations:

- With a RJ-45 Ethernet connector that has integrated magnetics and LEDs.
- With a 10-pin header that provides the Ethernet and LED signals from the Ethernet PHY. This enables you to locate the RJ-45 elsewhere in your final product design, and also provides a lower height dimension for the module itself.

The purpose of this application note is to provide some design guidelines to assist you in adding an external Ethernet RJ-45 and magnetics to a NetBurner based design with the 10-pin header format.

### Hardware Compatibility

Module	Ethernet PHY	Ethernet Jack Type
MOD5234-200IR	Microchip KSZ8721BLI	1
MOD5270-200IR	Microchip KSZ8721BLI	1
MOD5282-200IR	Microchip KS8721BL	1
MOD54415-200IR	Microchip KSZ8041NLI	1
MOD54417-200IR	Microchip KSZ8081RNAIA	2
SB70LC-200IR	Microchip KSZ8721BLI	1
SBL2E-200IR	Internal	1

#### Compatible RJ-45 Jacks with Integrated Magnetics

Ethernet jacks are available for purchase from NetBurner

##### Type 1

Halo Electronics: HFJ11-E2450E-L11  
Yuan Dean Scientific: 13F-641GGDP2NL

##### Type 2

Abracrom: ARJ-177  
Yuan Dean Scientific: 62F-1204GYD2Z2NL

## Hardware Design

Example design schematics are shown on following pages. No additional components are required if you are using one of the compatible RJ-45 Ethernet jacks with integrated magnetics and LEDs.

You may also use discrete magnetics if you prefer, as long as they are compatible with the Ethernet PHY on the module. **If you do decide to use alternate components, we strongly recommend contacting NetBurner Support for the latest revision information before you begin your design.**

## PCB Layout Considerations

There are many considerations that can affect the layout of high frequency signals. The following are useful guidelines in most situations.

1. Avoid using cables or discrete wires, all signals should be routed on the PCB.
2. The trace distance between the module's 10-pin header and Ethernet magnetics should be kept as short as possible, and must be less than 3 inches.
3. A RJ-45 with integrated magnetics is preferred, but if using discrete magnetics the trace distance between the magnetics and the RJ-45 should be less than 1 inch.
4. The RX+/RX- and TX+/TX- signals should be routed in pairs and the traces of each differential pair should be of equal length. Separate the TX/RX differential pairs with a ground trace or plane, and route them far enough apart to avoid coupling. Otherwise an outgoing signal on the TX pair may create noise and false data in the RX pair.
5. Avoid any right angle trace bends, use at least a 45 degree angle or a curved trace. Do not vary the trace widths. Individual trace impedance should be kept below 50 ohms.

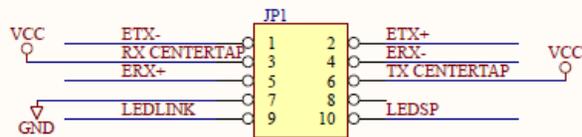
## Power Considerations

Noise from the power supply will show up on the Ethernet signals. The 3.3VDC power supplied to your NetBurner module should be within +/-5%.

## Design Notes

Unlike most PHY transceiver designs that have a single signal pin providing link and activity status, the SBL2e PHY has link and activity on separate pins. The result is that on the SBL2e, one LED indicates 10/100 speed, and the other LED indicates link only, not activity.

# Example Design for MOD5234, MOD5270, MOD5282, MOD54415

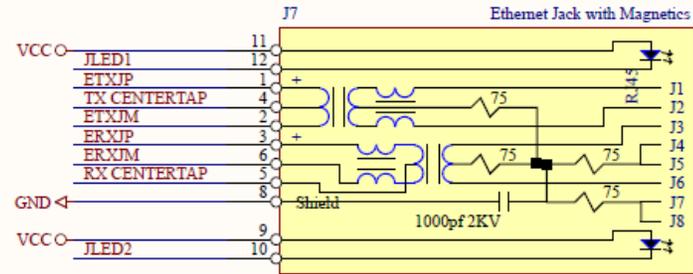


Module Ethernet Header

For JP1 Header Orientation Please Refer To The Mechanical Documentation Found on the Product Web Page

VCC power is as listed below:

Compatible Modules	TX/RX Center Tap Connections
MOD5234-200IR	2.5V Power
MOD5270-200IR	2.5V Power
MOD5282-200IR	2.5V Power
MOD54415-200IR	3.3V Power



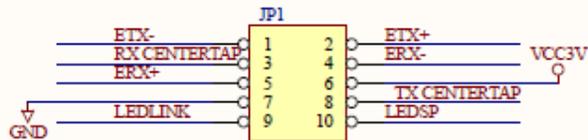
If using one of the approved RJ-45 Connectors listed below no additional parts are required  
Otherwise, Magnetics required on jack to match specifications on these parts

### Tested RJ-45 Connectors

HALO  
HFJ11-2450E-L11

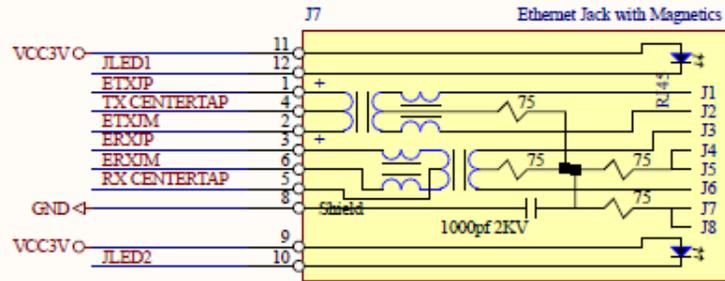
Yuan Dean Scientific  
13F-641GGDP2NL

# Example Design for MOD54417



Module Ethernet Header

For JP1 Header Orientation Please Refer To The Mechanical Documentation Found on the Product Web Page



If using one of the approved RJ-45 Connectors listed below no additional parts are required  
Otherwise, Magnetics required on jack to match specifications on these parts

**Tested RJ-45 Connectors**

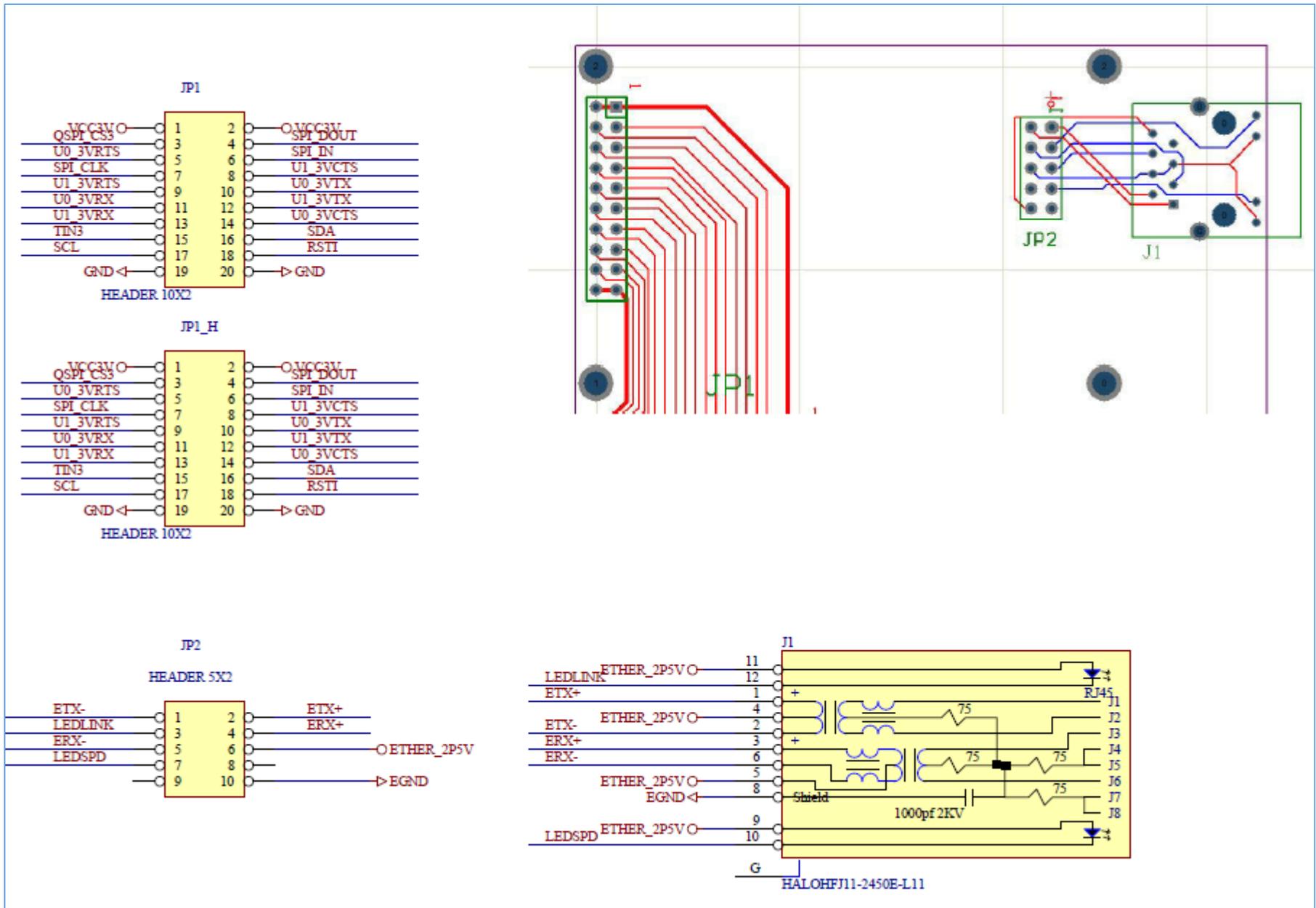
HALO  
HFJ11-2450E-L11

Yuan Dean Scientific  
13F-641GGDP2NL

**MOD54417 Dual Jacks**

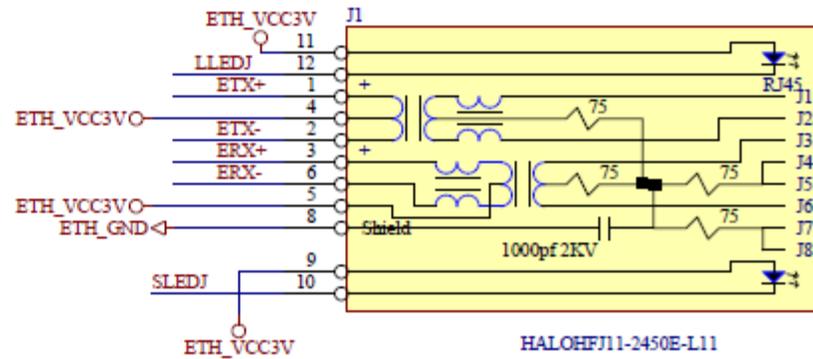
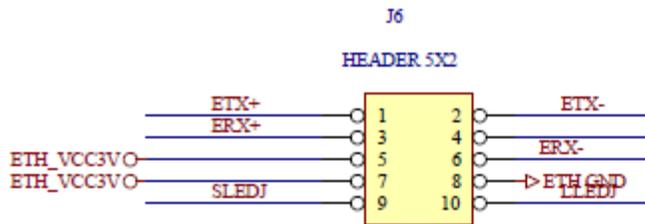
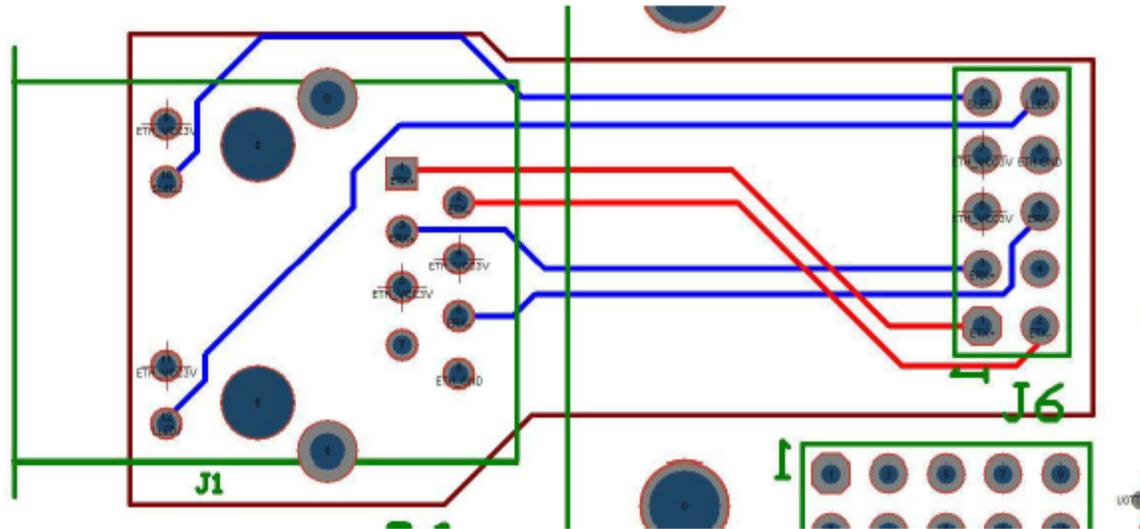
Abracon  
ARJ-177  
Oupiin  
8949-M1882-06SC1B01A-2I22

# Example Design for SB70LC



# Example Design for SBL2e

## Top View of PCB



## Revision History

4/2/2010	1.0	Initial release
4/28/2010	1.1	Added Design Notes section
11/10/2016	1.2	Added MOD54417