



# Transtek Magnetics

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*White Paper – DRAFT*

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## PoEJack™

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*Confidential and Proprietary*

### **PoE-enabled RJ45 Technology**

- Low Cost
- Compact





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**GENERAL DESCRIPTION**

The PoEJack™ -series is a family of products designed to be used in Power over Ethernet (PoE) Powered-device (PD) applications such as Voice over IP (VoIP) phones, Wireless LAN Access Points, security and web cameras, Analog Telephone Adapters (ATA), and Point of Sales terminals.

The POEJACK™-series includes the TMIC1113 device for 802.3af specification power levels and the TMIC1124 device for either 802.3af or 802.3at pre-specification power levels. The POEJACK™-series provides the functionality required for PoE PD applications. By using innovative silicon solutions built with standard CMOS technology. This enables its customers to bring to market higher performance PoE PD products with low cost and small footprint. The POEJACK™-series high level of integration includes rectification and protection circuitry, PD controller, and DC-DC converter. This high level of integration provides significant reliability and protection advantages as well as simplifies the PoE PD design.

**WHITE PAPER INTRODUCTION**

This white paper details the PoEJack™ design concept which utilizes the TMIC1113 IC to add PoE functionality into an integrated RJ45 connector.

**POEJACK™ CONCEPT**

The PoEJack™ is an integration of an Ethernet line transformer, plus the TMIC1113 IC for integrated diode bridge, PoE PD, and DC-DC converter into an RJ45 connector. This allows for the smallest PoE solution on the market. Figure 1 shows a block diagram of the integrated elements. The switching MOSFET is not integrated since the type of MOSFET used depends upon the amount of current required in the end system and the DC-DC converter topology required by the end system.

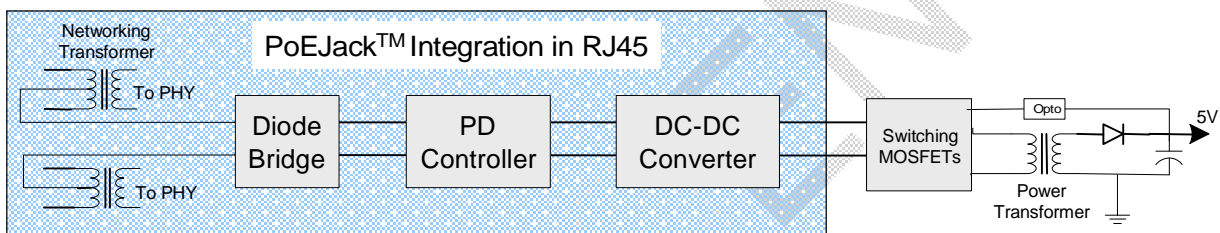


Figure 1 System Integration

The TMIC1113 integrates the Diode Bridge, PD controller and DC-DC converter into a single IC. The PoEJack™ design incorporates a small PCB which holds the TMIC1113 and a few configuration discretes. This PCB is placed in a RJ45 connector along with the Ethernet line transformer magnetics.

Figure 2 shows a cross-section representation of the PoEJack™. The PCB is placed upside down to allow for heat dissipation off the bottom of the PCB and for creation of a ground path. The TMIC1113's QFN thermal pad doubles as a ground pad. This "paddle" needs an electrical as well as a thermal path to the PCB from the PoEJack™. A Metal slug and connective paste is required to create this path. The RJ45 should also have a magnetic shield to improve this connection.

If the system requires that the PoEJack™ be isolated, non conductive thermal paste should be used but then a ground pin must be added to the PoEJack™.

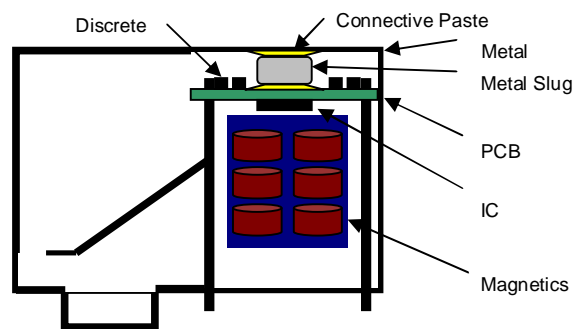


Figure 2 Cross Section View

**DESIGN CONSIDERATIONS**

**THERMAL PATH**

Since approximately 1W is dissipated within the TMIC1113's diode bridge, there is an estimated 50°C rise from the IC to the bottom of the board under full 802.3af load (13W@37V), which may vary based on application variables. This heat must be dissipated from the small PCB. It must be removed through radiation from the metal case of the PoEJack™ or via conduction into the ground plane of the system PCB.

Typically the PCB is enclosed in plastic, resulting in no airflow over the PCB. Thermal conductivity through a metal slug to the outer shell of the RJ45 is the only heat dissipation method, so it is recommended that the outside of the RJ45 be made of metal. Figure 3 shows the thermal path of the PoEJack™.

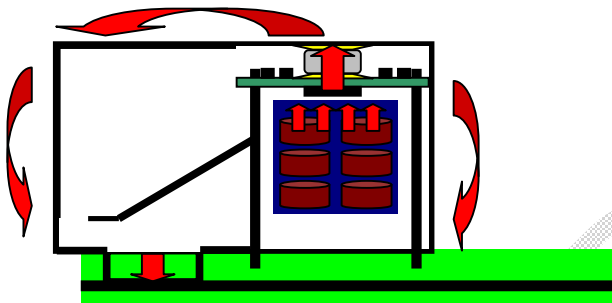


Figure 3 Thermal Path

**GROUND PATH**

The TMIC1113's thermal pad, or "paddle," is also its ground path to the DC-DC transformer in the system. Therefore an electrical path must be made to the system PCB to ensure that there is a common ground in the circuit.

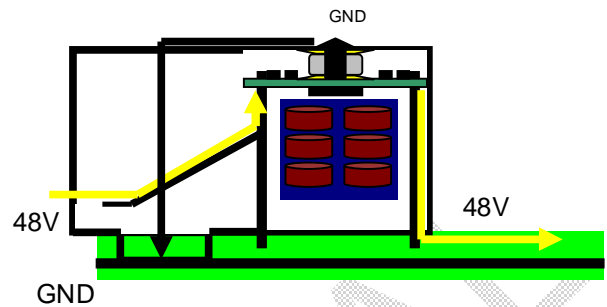


Figure 4 Electrical & Ground Path

Figure 4 shows this connection to the board's ground plane being accomplished using electrically conductive paste inside the PoEJack™ and using the case as the ground connection for non-isolated design implementations.

**10/100M VERSUS GIGABIT ETHERNET**

The only difference between 10/100M and Gigabit Ethernet in the design of the PoEJack™ is the number of line transformers in the device.

In a 10/100M design RJ1, 2, 3, and 6 are attached to the line transformer and CT1 and CT2 pins of the TMIC1113 are attached to the center taps of the line transformer. RJ 4 and 5 are tied together to TMIC1113 pin SP1. RJ 7 and 8 are tied together to TMIC1113 pin SP2.

In a Gigabit Ethernet system all eight Ethernet lines are tied to line transformers with their equivalent center taps tied to CT1, CT2, SP1, and SP2. The rest of the design is not affected by the type of traffic that the PoEJack™ is required to support.

**VAUX**

VAUX is a pin used to allow the PoEJack™ to be powered by a wall jack or local power. This may not be needed depending upon the requirements of the PoEJack™ design.

**LEDS**

LEDS can be integrated into the PoEJack™ design and are required by the IEEE802.3af specification if compliance is required.



SAMPLE BILL OF MATERIALS

Bill Of Materials    February 2,2007    10:25:41				
Item	Quantity	Reference	Part Description	Footprint
1	2	C1,C2	0.1uF	0402
2	1	C3	82nF	0402
3	2	C5,C11	100nF	0402
4	2	C9,C13	330nF	0402
5	3	C10,C12	1nF	0402
6	1	C14	3.3nF	0603
7	1	R1	24.7K	0603
8	2	R2	20K	0603
9	1	U4	TMIC1113 Integrated PD	QFN20

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**CONTACT INFORMATION**

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