

PoE power magnetics - options and trends

What is Power over Ethernet technology?

Ethernet enabled devices require both data connectivity and a power supply. Power over Ethernet (PoE) technology allows Ethernet devices to receive power as well as data over standard category 5 Ethernet cable (Figure 1). PoE is governed by the standard defined in IEEE802.3af. Specific details of the 802.3af standard are available from the Institute of Electrical and Electronic Engineers at www.ieee.org.

This article highlights an easy to use, low cost Eaton power magnetic selection. In short, the PoE port allows a powered device (PD) to draw up to 12.95 W from the power-sourcing equipment (PSE). PSE controls the PoE port and it identifies PDs via detection and classification before powering the port (Figure 2). The big advantage of PoE is the elimination of the nuisance “wall wart” power converters. In this case, the need to install additional AC power outlets and connect electrical wires to each terminal is eliminated. Only one cable is needed for your appliance. PoE promises to create a new world of network appliances by saving space, lower cost, easier maintenance and flexible installation.

What is Power over Ethernet application?

PoE is gaining in popularity and manufacturers already have products on the market such as VoIP (Voice over Internet Protocol) telephones, UPS, Wireless LAN access points, Bluetooth access points, Network cameras, Building access systems, Time and attendance systems, Retail point-of-information systems, Battery chargers for mobile phones and tablets, Vending machines and Gaming machines.

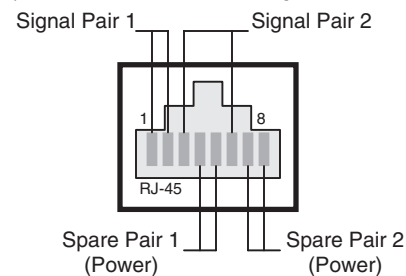


Figure 1. RJ-45 Ethernet connector

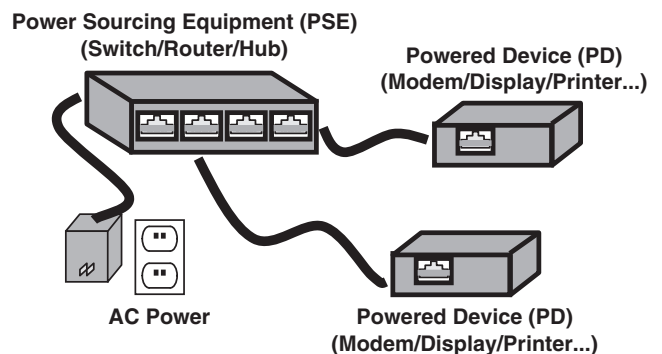


Figure 2. PSE and PD application example

Eaton's Power over Ethernet transformer characteristics.

In order to comply with IEEE802.3af PoE standard, Powered Device (PD) must meet the isolation requirement. Dc-Dc converters solve the isolation problem. Forward and Flyback switcher topologies can use Eaton's PoE transformers to isolate the PD's PoE interface from the rest of its circuitry while stepping down the PoE input voltage to power the PD circuitry.

Eaton's PoE transformers support 1500 VAC isolation in the power converter with feedback voltage of 11 V at 0.1 A. Available in 4 W, 7 W and 13 W, the transformers accept input voltage range from 29.5 V to 60 V using a nominal 250 kHz switching frequency.

An EFD15 core is used in 4 W and 7 W transformers while an EFD17 core is used in the 13 W transformers. The EFD17 is a core developed by Eaton to fit in between the EFD15 and EFD20 core sizes, and allows a smaller solution than most competitive devices for the same output power. These components operate in ambient temperatures between -40 °C and +85 °C. Due to the size, Eaton's PoE transformers can handle DC current of PoE and are rated for operating temperatures up to +125 °C.

Eaton's PoE transformers feature split primary and secondary windings to minimize leakage inductance – minimizing the result of imperfect magnetic linking of one winding to another. These components allow multiple output variations. 3.3 V and 5 V PoE transformers support three outputs while 12 V transformers support two outputs. Each of them has same output current and voltage. Alternately, the isolated windings can be combined in series to produce additional voltage combinations.

PoE13W3VERS has three different outputs, 7 V, 3.3 V and 1.8 V respectively. These outputs can be connected in series to produce a converter with 1.8 V, 5.1 V and 12.1 V from the same transformer. The series configuration produces optimal cross regulation between outputs. PoE13W2VERS has two different outputs, 5 V and 3.3 V.

VERS refers to the Eaton product lines that offer more than 500 usable inductor or transformer configurations. The same concept has been used in the PoE transformer family. Connecting the windings in parallel will increase the current carrying capability while connecting in series will increase the output voltage. These components provide flexibility in the design to connect the winding in series or parallel, and thereby achieving higher voltage or current.

Future trend- High power over Ethernet (HPoE).

The current IEEE802.3af standard is restricted to low power devices but the demand to standardize high power PoE is increasing. A standard capable with double the power limit of 13 W on a 48 V input was proposed. High Power over Ethernet needs same level of safety, reliability and should be backwards compatibility with the IEEE 802.3af standard.

Eaton has also introduced a 26 W HPoE transformers. Due to power and efficiency requirements, Forward converters with synchronous rectification are used. A gate drive winding will be provided on the secondary side. The operating frequency is 300 kHz - available in 3.3 V and 5 V outputs. The new standard delivers power to laptops, advanced network cameras, videophone, flat screen monitor and other high power consumption Ethernet devices.

Conclusion

With the introduction of the IEEE Power over Ethernet standard, the advantages of easy installation and robustness of a powered network has quickly lead to the introduction of many new network appliances. Higher power devices demand the same advantage, since reducing cost is always a driver for implementing new technology. As a key player manufacturing power magnetics, Eaton offers a series of standard PoE products suitable to use in Dc-Dc converters. Samples are available upon request at tools.eatonelectronics.com/request-form and the datasheets are available on the website: www.eaton.com/electronics.

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