POWER DESIGN FAQs

Frequently Asked Questions:

PoE NETWORKS

Sam Davis, Contributing Editor

DISCRETE VERSUS IC-BASED PoE SYSTEMS

Function	Discrete PoE with dc-dc IC and internal switching MOSFET	IC-based PoE with external dc-dc switching MOSFET
DC-DC converter	Included	External
Power MOSFET switch	Internal	External
Switching compensation	Simplifies MOSFET switching and feedback compensation	Requires extensive design expertise for feedback compensation
Switching circuit layout	Simplified by inclusion of power MOSFET in dc-dc converter	Complicated by use of an external power MOSFET and longer circuit connections
Transient suppression	High-voltage MOSFET reduces the need for transient protection	May require transient-voltage suppressor (TVS)
Current limiting	Internal	External detector
UVLO	Internal	Internal
Signature and classification	Requires one external resistor	Includes internal resistance

What is the basis for Power over Ethernet (PoE)?

The IEEE 802.3af standard for PoE enables data terminal equipment (DTE) to receive power over the same cabling used for data in an Ethernet network. The standard specifies the protocol for delivery of a nominal 48 V dc over unshielded twisted-pair cables (such as CAT-5). This eliminates the need for a local power source.

What does IEEE802.3af cover?

The IEEE 802.3af standard presents the requirements for providing and receiving power over the existing Ethernet cabling. It involves power-sourcing equipment (PSE) that provides the power on the cable for the powered device (PD). The figure shows a simplified version of a typical PoE system.

What are some typical PDs employed in PoE?

PDs include VoIP phones, security systems, and point-of-sale terminals.

What is the communication protocol between the PSE and PD?

The PD responds to three sequential phases when interrogated by the PSE: detection, classification, and undervoltage lockout (UVLO) and pass-switch control. These phases result from the PSE's application of a 2.5- to 30-V ramp to the PD.

What is the detection phase?

Initially, the PSE interrogates the PD to determine if it is enabled for the PoE IEEE802.3af standard. The PSE does this by applying a 2.5- to 10-V ramp to the PD to see if it presents a characteristic impedance between 19.6 and 26.5 kΩ. (Often, 24.9 kΩ is selected to minimize power loss.) If the PSE does not detect the correct impedance, it assumes that the load is not PoE-enabled and shuts down its input to the PD. This system would then operate as a conventional Ethernet network.

What is the classification phase?

If the PSE verifies that the PD is PoE-enabled by detecting the correct classification impedance, it continues to increase the voltage applied to the PD. Between 14.5 and 20.5 V, the PD draws a classification current. This classification current determines the amount of power required by the PD during normal operation. The PSE sends information to a controller that monitors the system's power budget. The controller permits the PSE to power up the PD if sufficient power is available from the system budget.

What is the UVLO phase?

After classification, the PSE continues the ramp voltage to the PD until it reaches the operating threshold, which releases the system's undervoltage lockout, allowing the PD to start.

What are the power and current limitations in a PoE system?

The maximum current delivered to a PD is 350 mA. Accounting for power loss in the associated cables, the maximum power that can be delivered to each PD is 12.95 W.

How do discrete PoE with IC-based dc-dc PD-powered systems compare with an IC-based PoE and partially IC-based dc-dc (external MOSFET) approach?

Two approaches can be used to implement a PoE-enabled system: a discrete dc-dc converter IC with integrated power MOSFET switching transistor and a PoE IC with PoE functions and the driver plus controller elements of the dc-dc converter. The table compares the characteristics of these approaches. The optimum approach depends on a cost and performance comparison between an appropriate dc-dc converter with discrete PoE components and a PoE IC with a discrete dc-dc switching MOSFET.

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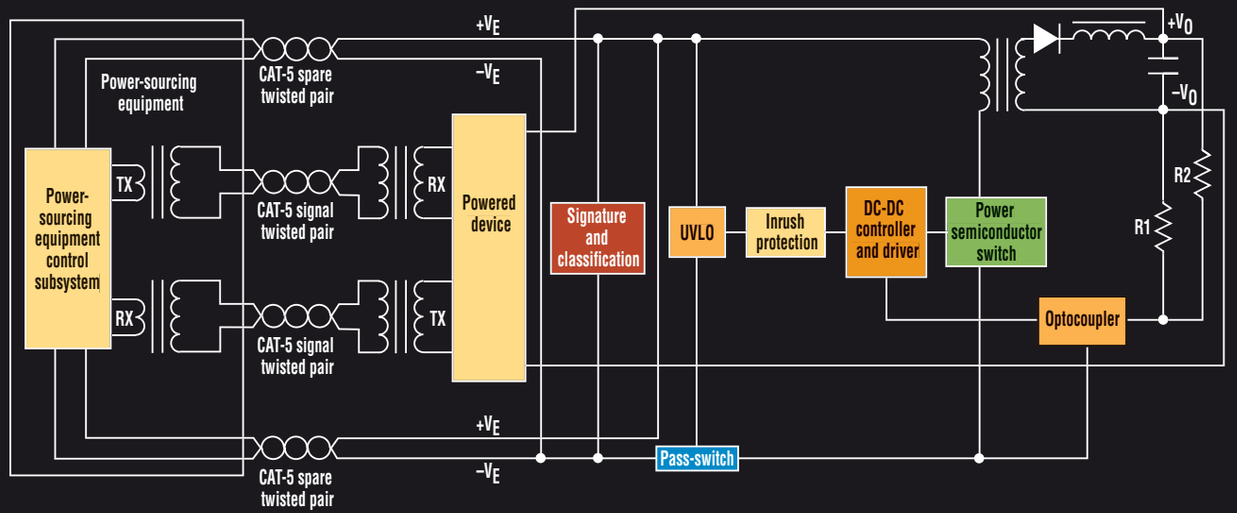

One node of a PoE-enabled system employs spare twisted-pair cables to provide controlled dc voltage for the powered device (PD), while the signal cables provide their data. This approach eliminates the need to supply dc power to the PD with an external ac-dc converter operating from the ac power line.