DESIGN NOTES

Fully Autonomous IEEE 802.3af Power over Ethernet Midspan PSE Requires No Microcontroller – Design Note 350

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Introduction

The IEEE802.3af Power over Ethernet (PoE) standard defines how power will be delivered over CAT5 lines. Despite the differences between legacy devices and those that adhere to the new standard, there is no need to completely replace existing systems. The nominal 48V required by powered devices (PDs) can be delivered by midspan power sourcing equipment (PSE), which is connected to the front end in series with legacy routers and switches. The LTC®4259A is a quad PSE controller designed for both endpoint and midspan PSEs that integrates PD signature detection, power level classification, AC and DC disconnect detection and current limit without the need for a microcontroller.

A PSE's Duties

The responsibilities of the PSE are to correctly detect if a compliant PD has been connected to a port, optionally classify the PD and properly apply power to the PD while protecting the port from fault conditions. Once a PD is powered on, the PSE monitors a PD's presence and switches off power when the device is removed. A PSE must also provide overcurrent protection to prevent damage to the PSE and PD.

Traditional PSE solutions use a microcontroller to perform the detection measurements and calculations and control additional circuitry that switches power to

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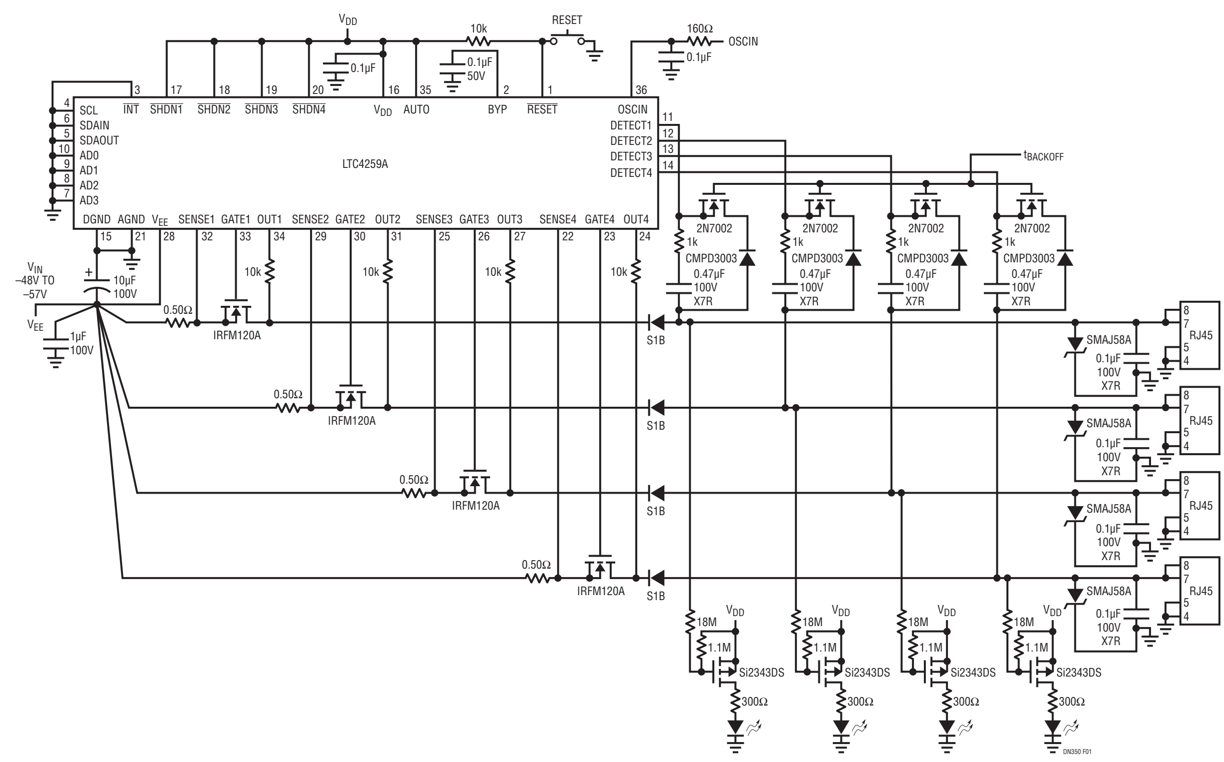

Figure 1. Autonomous 4-Port Power over Ethernet Midspan PSE

a PD. The LTC4259A in Figure 1, by contrast, requires no microcontroller and runs autonomously carrying out signature detection. It automatically interprets the loading conditions and powers on a valid PD.

The midspan PSE also must not interfere with an endpoint's operation. An endpoint PSE applies power on either the signal pairs or the spare pairs of the CAT5 cable, while the midspan PSE must apply power to only the spare pairs. To avoid conflict if the two were to be connected at the same time, the circuit in Figure 2 implements an LTC1726 watchdog timer to periodically disable the LTC4259A's detection scheme for two seconds. Midspan devices are required to have a back off capability after a failed attempt of detection to allow for a potentially present endpoint PSE to detect and power on a port.

After the back off interval is complete, LTC4259A detection is re-enabled for at least one full detection cycle. If a midspan or endpoint PSE is able to detect a valid signature 25kΩ (R_{SIG}) and power up the PD, a compliant PD would no longer display the R_{SIG} to prevent any further good signature detects and power ups from a second PSE. Hardware implementation of the back off timer eliminates the need for a microcontroller software timing routine.

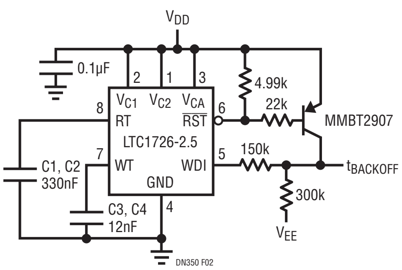

Figure 2. Midspan PSE Backoff Timer

Disconnect Detection

When a PD is unplugged from a powered port, the IEEE standards specify that a PSE must implement at least one of two power disconnect detections modes for port power removal: DC disconnect and/or AC disconnect.

DC disconnect measures a minimum current drawn from a port to determine if a PD is present and requires power. While this is easier to implement, AC disconnect is considered a more accurate detection of a PD's presence. AC disconnect measures the PD impedance and would keep a port powered even for PDs that idle at low power.

The LTC4259A auto mode uses the AC disconnect method by default. The LT®1498 in Figure 3 is a dual rail-to-rail op amp used to output a sine wave to drive OSCIN of the LTC4259A. The LTC4259A applies the AC signal to the lines and detects its presence when a PD has been removed and the port power is to be switched off.

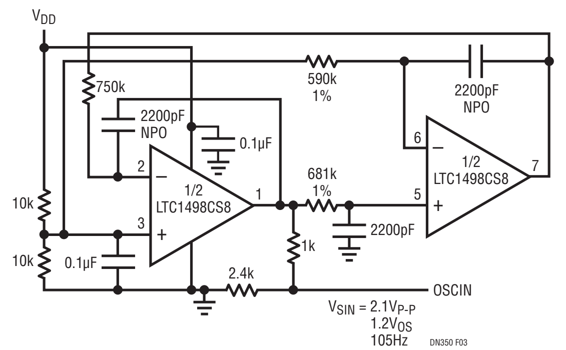

Figure 3. Sinewave Circuit for AC Disconnect

Supplying 3.3V from –48V

A 3.3V supply powers the digital portion of the LTC4259A. The LTC3803 circuit in Figure 4 converts –48V to 3.3V eliminating the need for a second power supply. This boost regulator circuit achieves a tight 2% regulation and outputs 400mA, enough for up to twelve LTC4259As and port indicator LEDs in a 48-port application.

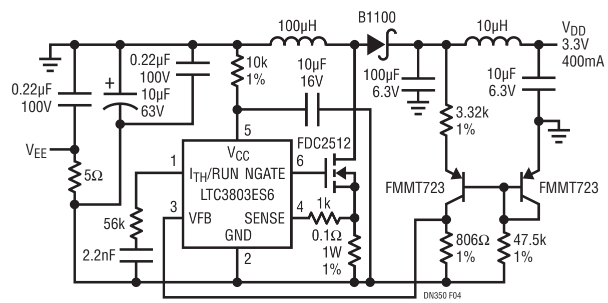

Figure 4. –48V to 3.3V Boost Converter

LTC4259A Options

The LTC4259A also allows flexibility when designing an endpoint or midspan PSE. Internal registers can be accessed via I^2C for additional control and settings, including the option of DC disconnect. The LTC4259A aids in IEEE-compliant power management by providing PD classification—a better method than guessing via monitoring current—of devices that present a class, such as an LTC4257 PD Interface Controller.

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