

High Power PoE PD Interface with Integrated Flyback Controller

Design Note 425

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Introduction

To this day, Power over Ethernet (PoE) continues to gain popularity in today's networking world. The 12.95W delivered to the Powered Device (PD) input supplied by the Power Sourcing Equipment (PSE) is a universal supply. Each PD provides its own DC/DC conversion from a nominal 48V supply, thus eliminating the need for a correct voltage wall adapter. However, higher power devices can not take advantage of standard PoE because of its power limitations, and must rely on a large wall adapter as their primary supply. The new LTC4268-1 breaks this power barrier by allowing for power of up to 35W for such power-hungry 2-pair PoE applications. The LTC4268-1 provides a complete solution by integrating a high power PD interface control with an isolated flyback controller.

PD Interface Controller

The PD interface controller provides the same 25k signature detection resistance defined in the standard PoE. An extended optional class can be read by a customized

PSE that looks for such a class. Once a PSE detects and classifies the PD, it fully powers on the device. The LTC4268-1 provides a low inrush current limit, allowing load capacitance to ramp up to the line voltage in a controlled manner without interference from the PSE current limit. After the load capacitance is charged up, the LTC4268-1 switches to the high input current limit and provides a power good signal to its switching regulator indicating that it can start its operation. During this time, the LTC4268-1 remains in its high current limit state allowing for up to 35W delivered to the load.

Synchronous Flyback Controller

Once power is switched over to the synchronous flyback controller, the LTC4268-1 regulates the output voltages by sensing the average of all the output voltages via a transformer winding during the flyback time. This allows for tight output regulation without the use of an

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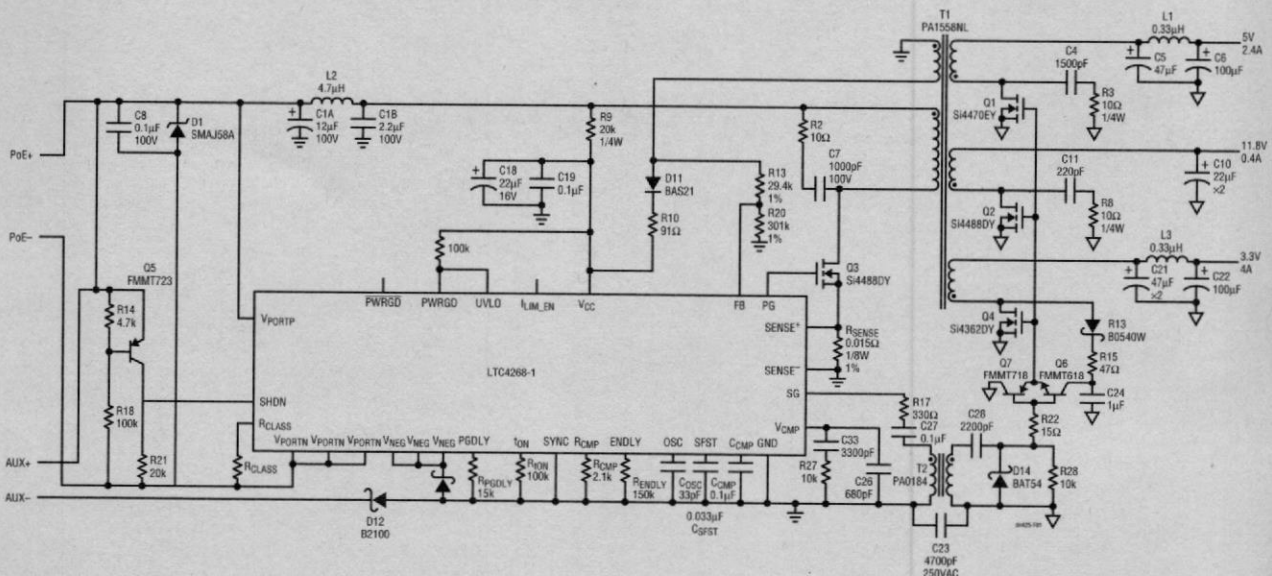


Figure 1. High Efficiency, Triple Output, High Power PD

optoisolator, providing improved dynamic response and reliability. Synchronous rectification increases the conversion efficiency and cross-regulation effectiveness above a conventional flyback topology. No external driver ICs or delay circuits are needed to achieve synchronous rectification; a single resistor is all that is needed to program the synchronous rectifier's timing.

High Efficiency, Triple Output, High Power PD

Figure 1 shows a design using the LTC4268-1 in a high power, triple output PD. A high power PSE connects through an Ethernet cable to the RJ45 connector. PSE detection and power is passed through the data pairs' high power Ethernet transformer or directly to the spare pairs in this 2-pair 10/100BaseT PoE system. The PSE power is then controlled by the LTC4268-1 PD interface and forwarded on to its switching regulator. An auxiliary supply option can also be connected to bypass and disable the PD interface which gives the auxiliary priority in power supply over PoE. Power conversion is then from the auxiliary supply down to the output voltages.

The small supply of the LTC4268-1 utilizes an isolated flyback topology with synchronous rectification that requires no optoisolator, lowering the parts count. This circuit gives efficiencies at full load of 83% when powered from a PSE and over 85% power sourced from an auxiliary supply.

PSE and Auxiliary Supplies

Standard PSEs are capable of providing as low as 15.4W at the port output. This would not be sufficient power for a high power PD operating at full load. Here, a customized PSE capable of delivering higher power must be used, or a PSE controller designed for high power such as an LTC4263-1 single port PSE controller. In cases where a high power PSE is not available, an auxiliary supply can be used.

2-Pair vs 4-Pair PD

2-pair power is used today in IEEE 802.3af systems. One pair of conductors is used to deliver the current and a

second pair is used for the return while two conductor pairs are not powered. This architecture offers the simplest implementation method but suffers from higher cable loss than an equivalent 4-pair system.

4-pair power delivers current to the PD via two conductor pairs in parallel allowing for an even higher level of power. This lowers the cable resistance but raises the issue of current balance between each conductor pair. Differences in resistance of the transformer, cable and connectors along with differences in diode bridge forward voltage in the PD can cause an imbalance in the currents flowing through each pair. Using two independent LTC4268-1s (Figure 2) allows for interfacing and power from two independent PSEs, and independent DC/DC converters resolve the current imbalance.

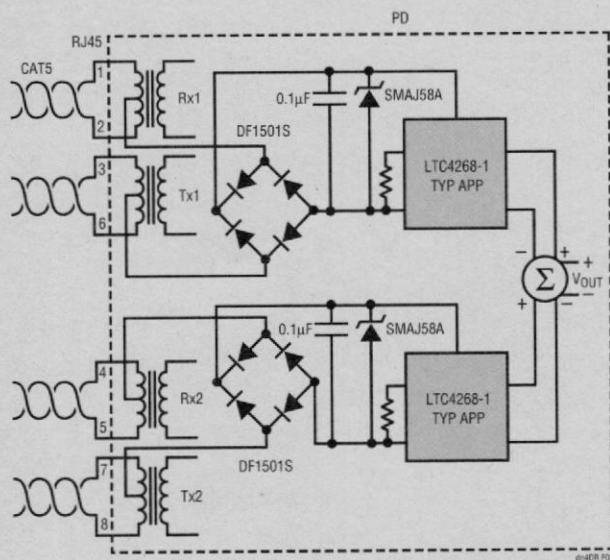


Figure 2. 4-Pair, High Power PD Diagram

Conclusion

The LTC4268-1 is a highly integrated solution for the next generation of PD products. It offers PoE PD functionality with control for efficient high power delivery to the output load.

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