

APPLICATION NOTE 4984

High-Efficiency, Low Cost Flyback Converter Uses No Optocoupler Feedback

Abstract: This reference design is for a highly efficient, flyback, 12V, Class 3 powered device (PD). The design features the MAX5969B as its controller. The design also uses the MAX5974A, which controls current-mode PWM converters and provides frequency foldback for PoE applications. Using these devices, this reference design is IEEE® 802.3af/at compliant and is a high-performance, compact, and cost efficient solution for a Class 3 PD. The design can also be customized to 12V/2A Class 4 PD.

General Description

This reference design is for a highly efficient, flyback, 12V/1A Class 3 powered device (PD) that is IEEE 802.3af/3at compliant and cost effective. The reference design can be customized to a 12V/2A Class 4 PD.

The design features the [MAX5969B](#) and [MAX5974A](#). The MAX5969B controller is fully compliant with the IEEE 802.3af/at standard in a power-over-Ethernet (PoE) system. The device can also get power from a wall adapter (WAD). The MAX5974A controls wide-input-voltage, active-clamped, inductive feedback, current-mode PWM converters and provides frequency foldback for PoE applications. Using these devices, this reference design is IEEE 802.3af/at compliant. It is also a high-performance, compact, and economical solution for a Class 3 PD or a Class 4 PD.

Specifications

The 12V/1A PD meets the following specifications:

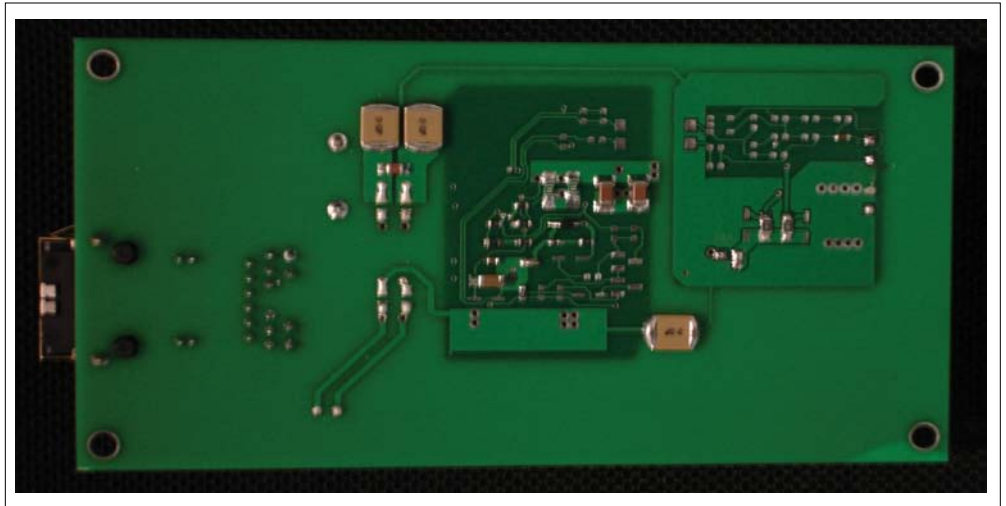
- Input voltage: 36V to 57V
- WAD input voltage: 36V to 57V (10V to 57V with a different transformer)
- V_{OUT1} : 12V/1A (up to 2A by optimizing the switching frequency)
- Output ripple: $\pm 2.5\%$ (can be reduced by adding more output ceramic capacitors or disabling the frequency foldback, FFB)
- Load transient V_{P-P} : $\pm 3\%$ (25% step-load)
- Line and load regulation: $\pm 2\%$
- Switching frequency: 300kHz (150kHz in FFB mode)
- Total efficiency with a load of 2A at 3V and 48V input: 90.3%, including input LAN transformer and diode bridge (93.3%, not including input LAN transformer and diode bridge)

Design Features

- Inductive feedback: no optocoupler or shunt-regulator, so costs are lowered
- Self-driving input voltage: achieves synchronous rectifier, provides high efficiency and good load regulation
- Frequency foldback: 150kHz switching frequency when load is about 1W, provides high efficiency at light loads

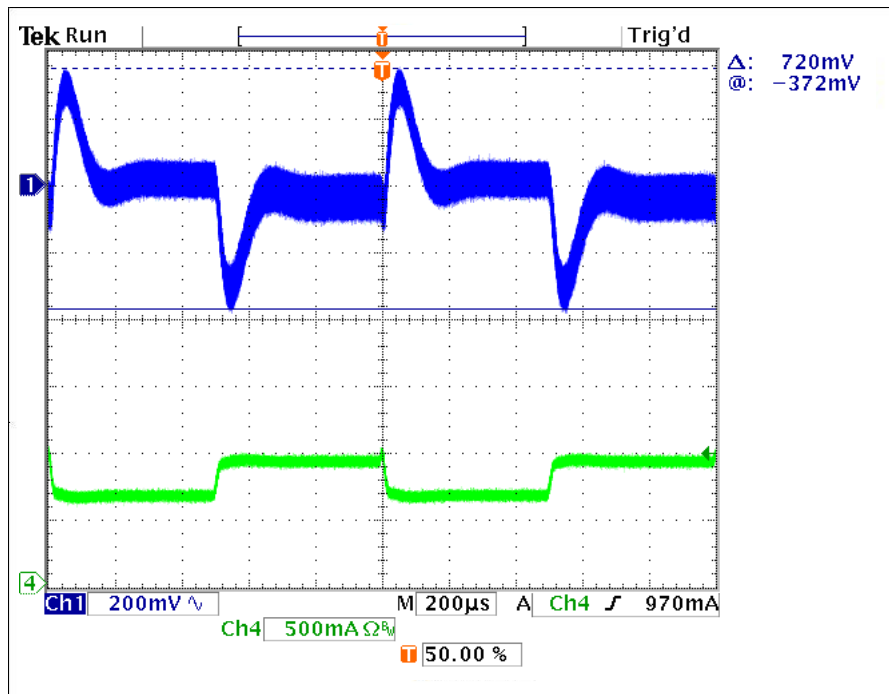
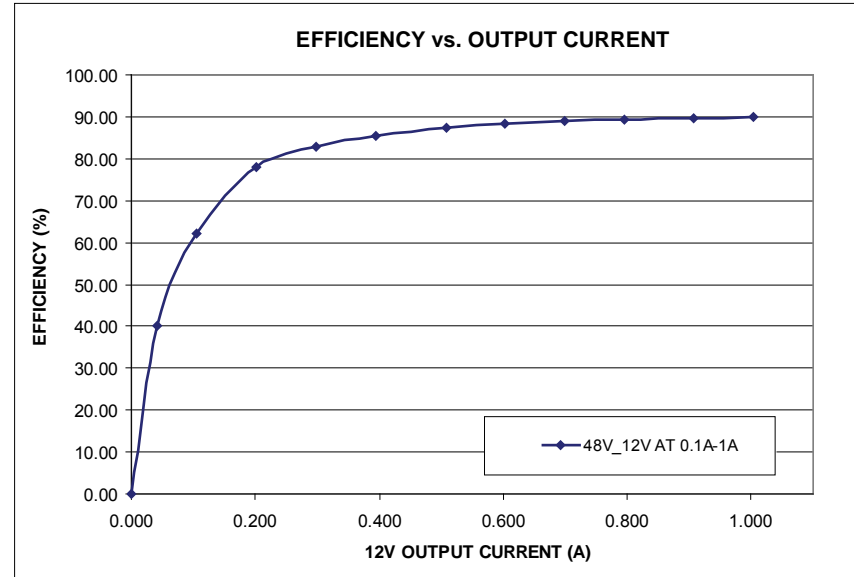
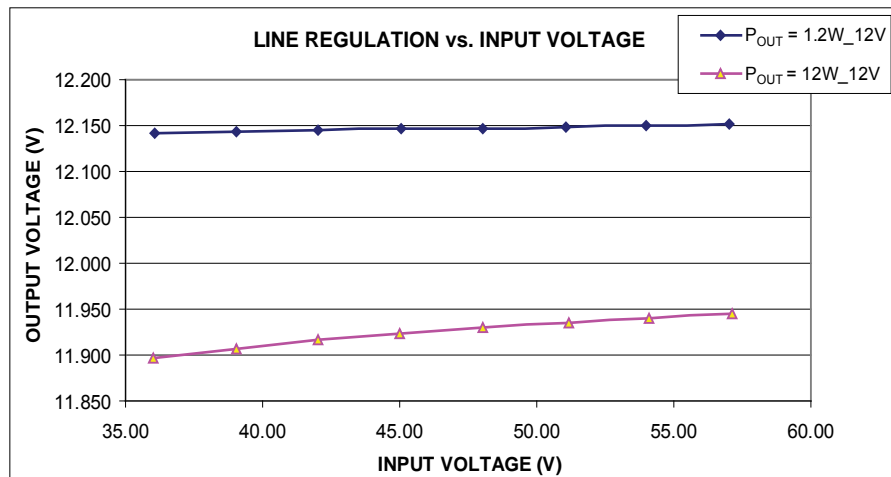


Top view of the reference design.



Bottom view of the reference design.

Performance Data



Transient Response

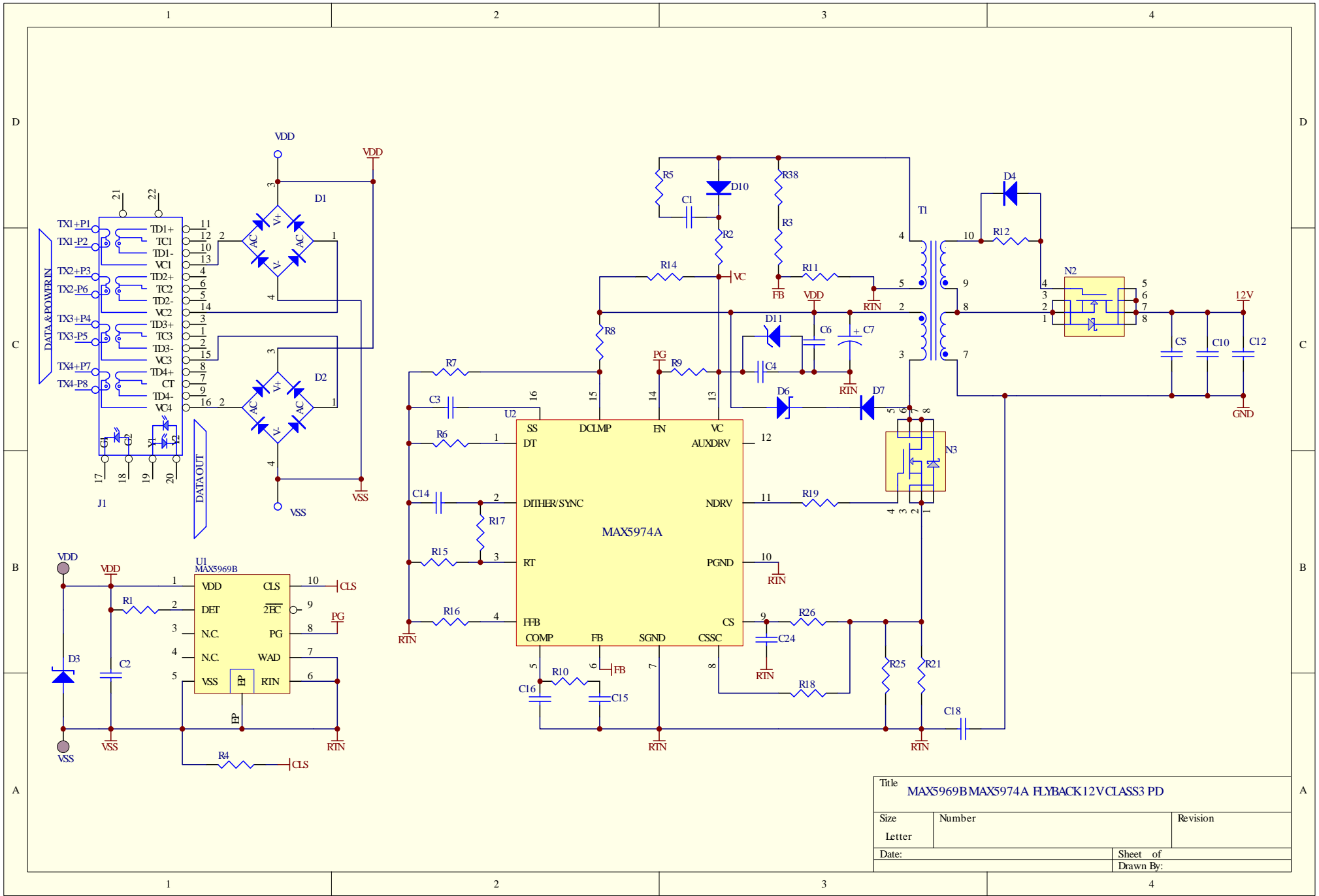
$$V_{IN} = 36V$$

$$V_{OUT} = 12V/0.6A-0.9A-0.6A$$

CH1: 200mV/div, 12V output voltage

CH4: 500mA/div, output current

Time base: 200µs/div



Title MAX5969B MAX5974A FLYBACK 12V CLASS3 PD		
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Related Parts

[MAX5969B](#) IEEE 802.3af/at-Compliant, Powered Device Interface Controllers with Integrated Power MOSFET

[MAX5974A](#) Active-Clamped, Spread-Spectrum, Current-Mode PWM Controllers

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