

# DESIGN NOTES

## Flyback Controller Simplifies Design of Low Input Voltage DC/DC Converters – Design Note 1016

David Burgoon

### Introduction

Small, high efficiency DC/DC converters are critical to the design of leading-edge electronics. Achieving high accuracy and efficiency traditionally means adding extra components, complexity, and size. Not so with the LT3837. This flyback controller serves 10W to 60W isolated applications with high performance, simplicity, small size, and a minimum component count.

### High-Efficiency Controller Capabilities

The LT<sup>®</sup>3837 operates from a 4.5V to 20V input, but the converter input range can be extended upwards by using a  $V_{CC}$  regulator and/or a bias winding on the transformer. It also provides a synchronous rectifier output with adjustable timing to optimize efficiency and enhance cross-regulation in multiple-output supplies.

The LT3837 eliminates the need for the traditional secondary-side reference, error amplifier, and optoisolator circuits by sampling the flyback voltage on a primary-side winding. Accuracy is enhanced with output resistance compensation. Current mode control with leading edge

blanking yields a high performance loop that is easy to compensate.

The operating frequency is adjustable from 50kHz to 250kHz or can be synchronized to an external clock. Soft-start provides well controlled start-up with limited inrush current. Protection features include current limit with soft-start cycling for severe overloads, undervoltage lockout, and thermal shutdown.

### 3.3V, 10A Converter Operates from a 9V to 18V Source

The circuit shown in Figure 1 is a flyback design for a 3.3V, 10A output from a 9V to 18V input with a minimum of external components. The LT3837 samples the voltage on the primary winding during the flyback interval to provide superb regulation. Figure 2 shows ruler-flat regulation at 9V input, and a tight regulation window of  $\pm 0.7\%$  over line and load. Synchronous rectification with adjustable

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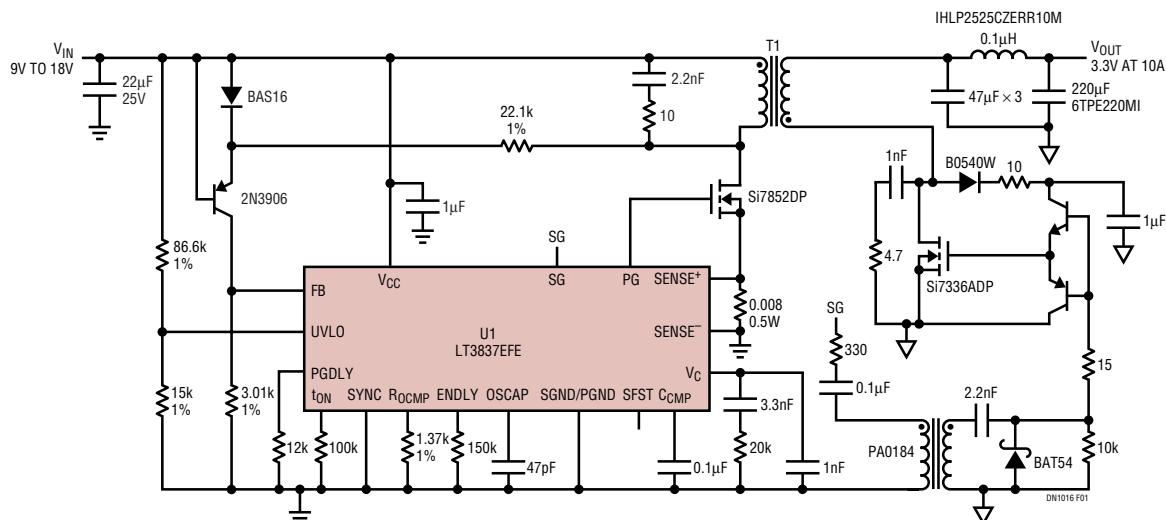


Figure 1. Low Parts Count, 9V to 18V Input to 3.3V/10A Output Isolated Flyback Converter with  $\pm 0.7\%$  Regulation

timing yields excellent efficiency—88% over a wide range of operating conditions—as shown in Figure 3.

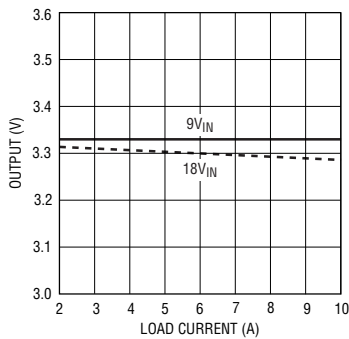
### 3.3V, 10A Converter Operates from a 9V to 36V Source

Figure 4 shows an enhanced circuit that extends the input operating range of the LT3837 to 9V to 36V. Operation is converted to hysteretic start-up for efficient wide-range operation. Q1 provides a low-drop current source for start-up, and Q2 creates a suitable undervoltage circuit for  $V_{CC}$ . These circuits, together with the  $V_{CC}$  winding on the transformer, result in low  $V_{CC}$  power at higher input voltages and low dissipation cycling when operating into a short circuit. This circuit is implemented in a

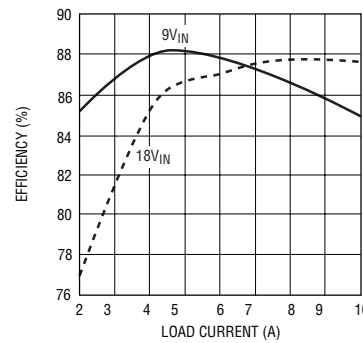
1.5in<sup>2</sup> footprint. This circuit exhibits excellent regulation of  $\pm 1.2\%$  over line and load, and efficiency of 88% over much of its operating range.

### Conclusion

The LT3837 is part of a new class of flyback controllers developed by Linear Technology to satisfy the demand for economical, high performance power converters. It provides synchronous rectifier drive and eliminates the need for secondary regulation circuits and optoisolators. The LT3837 makes it easy to implement high performance Flyback designs that are cost effective, small and efficient.



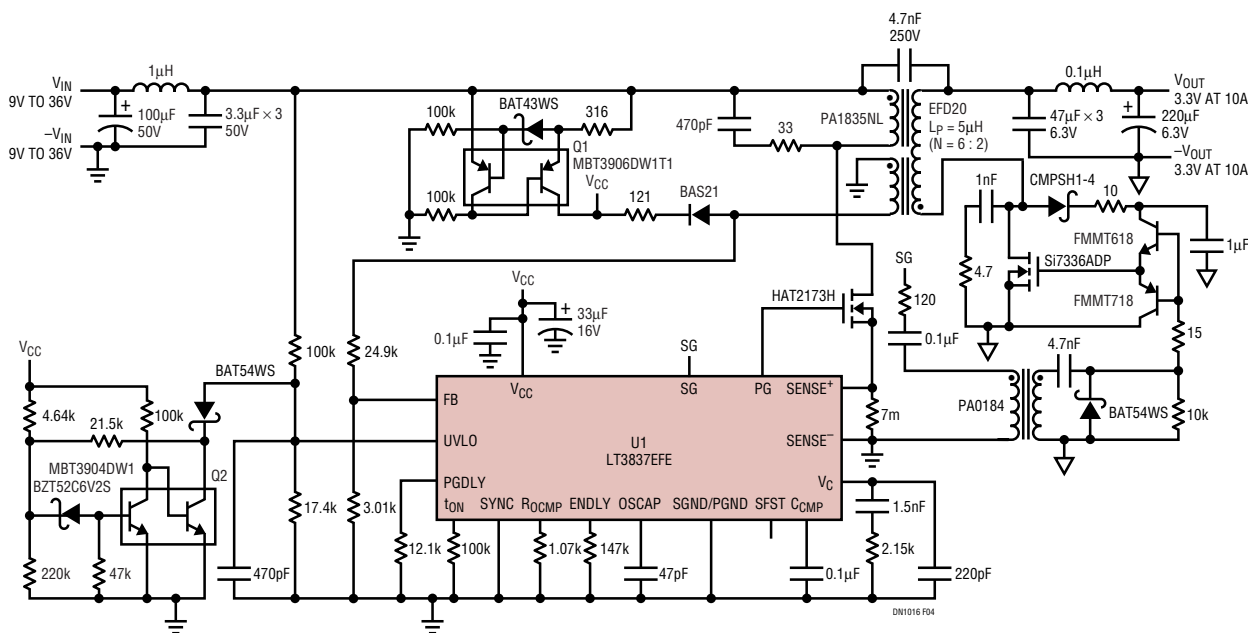
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Figure 2. Regulation of the Converter in Figure 1

Figure 3. Efficiency of the Converter in Figure 1



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Figure 4. Wide Range, 9V to 36V to 3.3V/10A Isolated Flyback Converter with  $\pm 1.2\%$  Regulation

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