

High Isolation Converter Uses Off-the-Shelf Magnetics


by Mitchell Lee

Isolated flyback converters usually evoke thoughts (or bitter memories) of custom transformers, slipped delivery schedules and agency approval problems. Off-the-shelf flyback transformers are available from several vendors, but these carry isolation ratings of only 300V–500V, and, rarely, of up to 1kV. Flyback transformers with isolation ratings of 3750V_{RMS} are impossible to find, and if an application requires this level of isolation, an expensive, custom design is likely the only solution.

Gate-drive transformers, designed to couple switching regulator controllers to MOSFET gates, are readily available from stock with high isolation ratings and low cost. These are wound on ungapped cores and have very high inductance (500μH to 2mH), and will quickly saturate in a normal flyback converter circuit. It is possible to use a gate-drive transformer in a forward converter, but an optoisolator or a tertiary winding is needed for feedback. Another topology that can utilize a gate drive transformer is the uncoupled SEPIC.

Figure 1 shows a complete schematic for a converter based on the uncoupled SEPIC. The converter operates from a 12V battery-backed input supply and outputs 24V at 200mA. The key feature is that the second coil is not a coil at all, but rather an off-the-shelf gate drive transformer. This component offers 3750V_{RMS} isolation and full VDE approval, and functions flawlessly in SEPIC service.

Feedback is derived from the primary winding, through D3. R1 acts to filter the leakage-inductance spike at

switch turn-off, and C4 smooths the recovered feedback voltage. Note that the transformer is wound 1:1; C4 peak detects a voltage roughly equal to the output. Sizing R1 and C4 is a trade-off between minimum load and load regulation. As shown, a minimum load of 3600Ω is recommended. Output regulation is shown in Figure 2. Line regulation from 10V to 20V input at full load is 0.13%/V. 

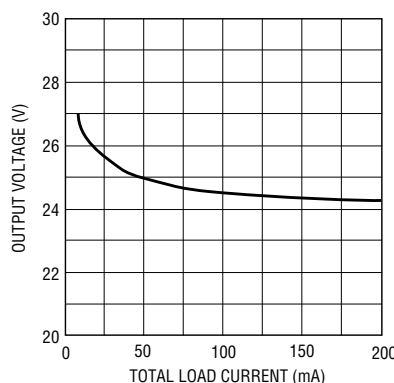


Figure 2. Output regulation for Figure 1's circuit

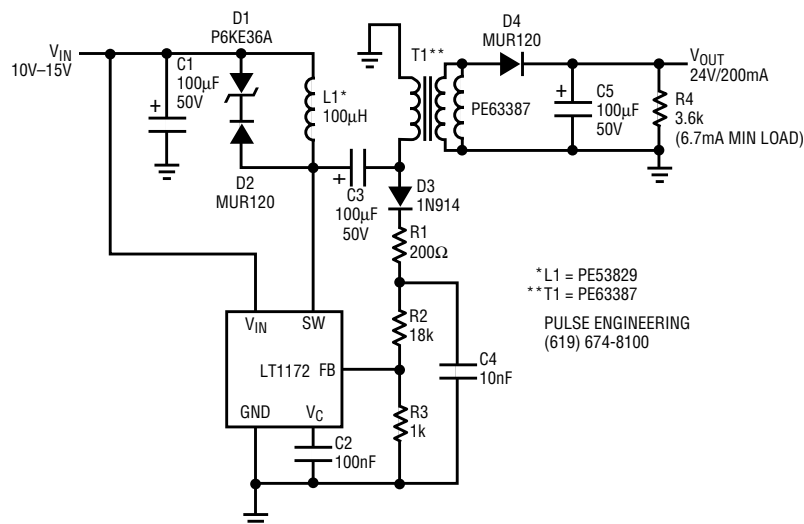


Figure 1. 24V/200mA bulk supply with 3750V_{RMS} isolation

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