



# DESIGN NOTES

## Secondary Side Dual Output Controller Tightly Regulates Two Isolated Outputs – Design Note 1000

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### Introduction

Many systems with dual output isolated power supplies require tight regulation on both outputs. The LT<sup>®</sup>3804 makes it possible to satisfy this requirement in a space saving and efficient circuit.

The LT3804 is a secondary side dual output controller. It contains an error amplifier and an optocoupler driver to regulate the first output. It also includes a complete PWM controller and dual N-channel MOSFET drivers for the second output. The power to the second output is transferred directly from the transformer secondary winding without going through the first output stage, thus minimizing the size of the output inductor and capacitor of the first output. Accurate output regulation for both outputs is assured—even if the power supply's outputs are far away from the actual loads—due to true differential remote sensing.

### Dual Output Isolated Power Supply

Figure 1 shows a dual output high efficiency isolated DC/DC power supply with 36V to 72V input range and two outputs of 3.3V/15A and 1.8V/15A. The basic power stage topology is a 2-switch forward converter with synchronous rectification. The primary side is controlled by the LT3781, a current mode 2-switch forward controller with built-in MOSFET drivers.

On the secondary side, the LT3804 provides voltage feedback for the 3.3V output and regulation for the 1.8V output. The 3.3V output is monitored by the LT3804 and fed to the LT3781 on the primary side via an optocoupler (MOC207) and the LT3804's built-in optocoupler driver. An LTC1693-1 high speed dual N-channel MOSFET driver

provides the gate drive for the synchronous MOSFETs at the 3.3V output stage.

The 1.8V output stage is a special synchronous buck converter whose input is a pulsed waveform instead of a DC voltage. The LT3804 precisely regulates the 1.8V output by further reducing and controlling the duty cycle of the switching waveform from the power transformer (T1) secondary winding.

The circuit provides 1500V input to output isolation and a switching frequency of 230kHz. The complete circuit fits easily on a standard half brick size PC board. With a 48V input, the overall efficiency is about 87% at full loads for both outputs.

### LT3804 Versatility

The LT3804 can be used to regulate the outputs of any buck derived single-ended or dual-ended isolated topologies, including forward, push-pull, half-bridge and full-bridge converters. The device's leading-edge modulation allows it to operate with either current mode or voltage mode primary controllers.

### Conclusion

The LT3804 is a high efficiency secondary side switching controller ideal for dual output isolated power supplies. Unlike a traditional auxiliary supply from the secondary circuits, an LT3804-based design can precisely regulate *both* outputs. Its true differential remote sensing and synchronous rectification features make it suitable for high current applications where the output voltage can be as low as 0.6V.

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