

## DESCRIPTION

Demonstration circuit DC659 is a four-output flyback regulator based on the LTC3806 control IC. Input voltages between 25 and 60 volts are stepped down to 12V, 5V, 3.3V and 2.5V. Total load power is 22W. Thanks to the use of synchronous rectification, efficiency and cross regulation are significantly improved versus a conventional flyback regulator. This demo circuit is suitable for powered Ethernet or 42V automotive applications.

**Design files for this circuit board are available. Call the LTC factory.**

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**Table 1. Performance Summary ( $T_A = 25^\circ\text{C}$ )**

PARAMETER	CONDITION	VALUE
Output Voltage $V_{OUT1}$	$V_{IN} = 25\text{V to } 60\text{V}$ , $I_{OUT} = 40\text{mA to } 400\text{mA}$	$12\text{V} \pm 10\%$
Output Voltage $V_{OUT2}$	$V_{IN} = 25\text{V to } 60\text{V}$ , $I_{OUT} = 0\text{mA to } 400\text{mA}$	$5\text{V} \pm 5\%$
Output Voltage $V_{OUT3}$	$V_{IN} = 25\text{V to } 60\text{V}$ , $I_{OUT} = 0\text{A to } 3.0\text{A}$	$3.3\text{V} \pm 5\%$
Output Voltage $V_{OUT4}$	$V_{IN} = 25\text{V to } 60\text{V}$ , $I_{OUT} = 0\text{A to } 2.0\text{A}$	$2.5\text{V} \pm 5\%$
Nominal Switching Frequency		250kHz
Efficiency	$V_{IN} = 44\text{V}$ , Full load	89% Typical
On/Off Control	Logic Low Voltage-Off	0.6V MAX
	Logic High Voltage-On	1V MIN

## OPERATING PRINCIPLES

DC659 steps a high input voltage down to multiple low voltage outputs with high efficiency. The demo circuit features the LTC3806 synchronous flyback controller. The synchronous flyback topology replaces the normal output diode of the flyback converter with a MOSFET. The MOSFET has a lower forward voltage drop than the diode it replaces, which improves efficiency particularly at low and very low output voltages. The second benefit achieved by synchronous rectification is that unlike a diode, the MOSFET synchronous switch will allow current to flow in both directions. Therefore, during the ON time of the secondary side switches, all of the outputs

are able to share power. This improves the cross regulation of the outputs so that output voltage regulation is maintained even when one output is lightly loaded and the other outputs are heavily loaded. Normally with diode rectification, the lightly loaded output rises, as its output capacitor is peak charged with voltage spikes caused by transformer leakage inductance. This effect can still be seen on the diode derived (non-synchronous) 12V output on the demo circuit. This output will rise in the event that its load is relatively small compared to the other output loads. This output has a correspondingly loose output accuracy specification.

### QUICK START PROCEDURE

Demonstration circuit 659 is easy to set up to evaluate the performance of the LTC3806. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

**NOTE:** When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the Vin or Vout and GND terminals. See Figure 2 for proper scope probe technique.

1. With the power off connect the input power supply and the output loads as shown in Fig.1

2. Turn on the power at the input.
3. Check for the proper output voltages. Vout1 = 12V , Vout2 = 5V Vout3=3.3V Vout4=2.5V

**NOTE:** If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

4. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

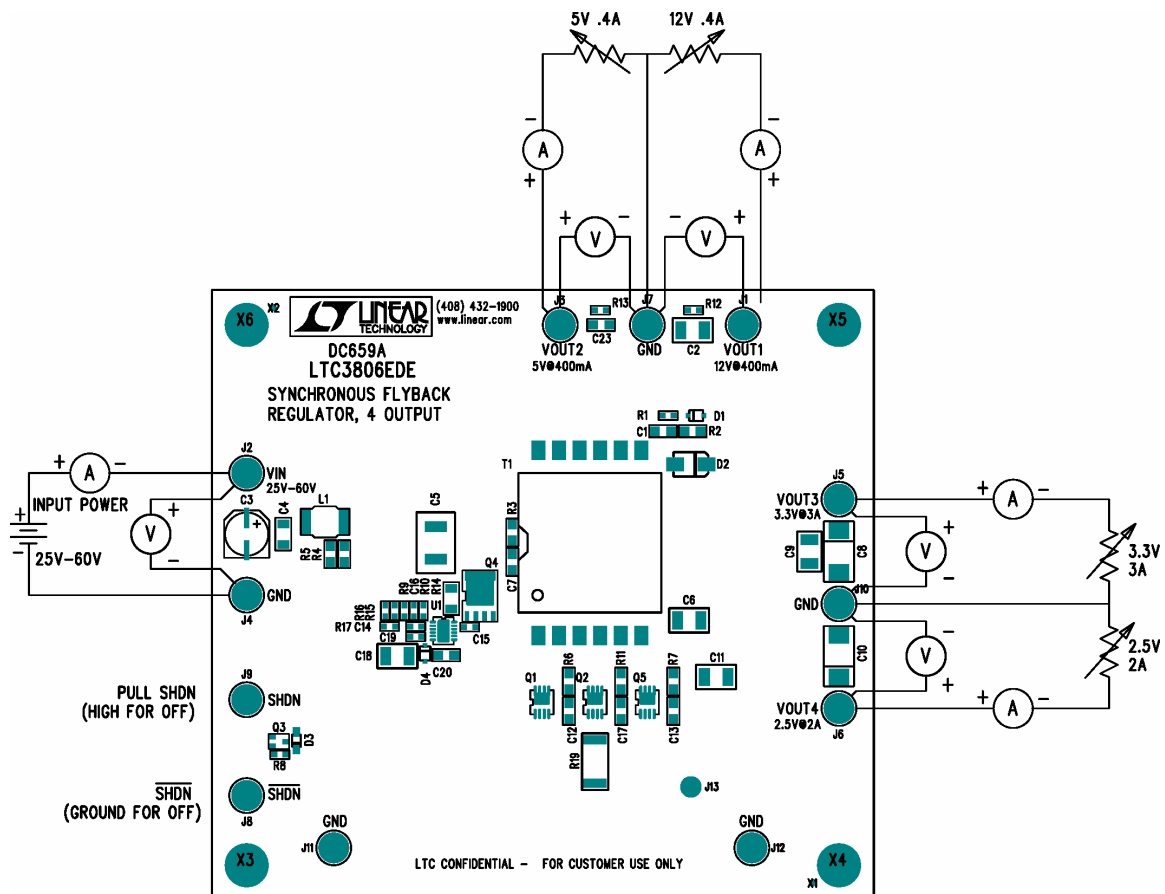
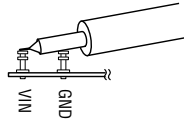


Figure 1. Proper Measurement Equipment Setup

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 659

## SYNCHRONOUS FLYBACK REGULATOR 4 OUTPUT

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**Figure 2. Measuring Input or Output Ripple**

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## SYNCHRONOUS FLYBACK REGULATOR 4 OUTPUT

