# DEMO CIRCUIT 1038A-A
# QUICK START GUIDE

## LT3837
## Isolated Flyback Converter with Synchronous Rectification

## DESCRIPTION

Demonstration circuit 1038A-A is a 33 Watt Isolated Flyback Converter with Synchronous Rectification and Primary-Side Regulation featuring the LT3837.

This circuit was designed to demonstrate the high levels of performance, efficiency, and small solution size attainable using this part in a flyback power supply. It operates at 200kHz and produces a regulated 3.3V, 10A output from an input voltage range of 9 to 36V: suitable for automotive, industrial, and other applications. It has a footprint area that is less than an eighth-brick. Synchronous rectification helps to attain efficiency exceeding 88%. Isolation voltage is 1500VDC.

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



## PERFORMANCE SUMMARY

**Specifications are at TA = 25°C**

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Supply Range | | 9 | | 36 | V |
| $V_{OUT}$ | Output Voltage | | | 3.3 | | V |
| $I_{OUT}$ | Output Current Range | $V_{IN}$ = 9 –36V | 0 | | 10 | A |
| $F_{SW}$ | Switching (Clock) Frequency | | | 200 | | kHz |
| $V_{OUT\ P-P}$ | Output Ripple | $V_{IN}$ = 18V, $I_{OUT}$ = 10A (20MHz BW) | | 20 | | $mV_{P-P}$ |
| $I_{REG}$ | Output Regulation | Line and Load (9-36V, 0-10A) | | ±1.2 | | % |
| $P_{OUT}/P_{IN}$ | Efficiency (see Figure 2) | $V_{IN}$ =18V, $I_{OUT}$ = 10A | | 88 | | % |

## OPERATING PRINCIPLES

The LT3837 Synchronous Flyback PWM Controller is used on the primary and drives a secondary-side MOSFET through a pulse transformer to provide a synchronous rectified output.

When an input voltage is applied, an undervoltage circuit keeps the LT3837 in its quiescent state while a current source charges Cvcc (C8) to 8.2V. The controller is then enabled, and start-up commences. The primary circuit operates from the charge stored in Cvcc until the housekeeping winding of T1 starts to support Vcc. When a heavy overload or short-circuit prevents T1 supporting Vcc, the converter operates in 'burp-mode', cutting off when Vcc declines to 7.0V, maintaining low power dissipation in the circuit. The LT3837 provides a synchronous rectifier gate drive signal which is passed to the secondary through T2 and subsequently buffered.

Regulation is attained by observing the voltage on the housekeeping winding of T1 during the Flyback time, and Pulse Width Modulating (PWM) the Primary Gate drive (PG) and Synchronous Gate drive (SG). The LT3837 is programmed to compensate for circuit resistance that is outside of the control loop.

Optional LC filter stages on the input and output facilitate low noise.

## QUICK START PROCEDURE

Demonstration circuit 1038 is easy to set up to evaluate the performance of the LT3837. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

**NOTE.** When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the last ceramic output capacitor as shown in Figure 1.

1. Set an input power supply that is capable of 9V to 36V to 18V. Then turn off the supply.
2. Direct an airflow of 200lfm across the unit for sustained operation at full load.
3. With power off, connect the supply to the input terminals +Vin and –Vin.
   a. Input voltages lower than 9V can keep the converter from turning on due to the undervoltage lockout feature of the LT3837.
   b. If efficiency measurements are desired, an ammeter capable of measuring 5Adc or a resistor shunt can be put in series with the input supply in order to measure the DC1038A's input current.
   c. A voltmeter with a capability of measuring at least 36V can be placed across the input terminals in order to get an accurate input voltage measurement.
4. Turn on the power at the input.

**NOTE.** Make sure that the input voltage never exceeds 36V.

5. Check for the proper output voltage of 3.3V. Turn off the power at the input.
6. Once the proper output voltages are established, connect a variable load capable of sinking 10A at 3.3V to the output terminals +Vout and –Vout. Set the current for 0A.
   a. If efficiency measurements are desired, an ammeter or a resistor shunt that is capable of handling 10Adc can be put in series with the output load in order to measure the DC1038A's output current.
   b. A voltmeter with a capability of measuring at least 3.3V can be placed across the output terminals in order to get an accurate output voltage measurement.
7. Turn on the power at the input.

   **NOTE.** If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
8. Once the proper output voltage is again established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other desired parameters.

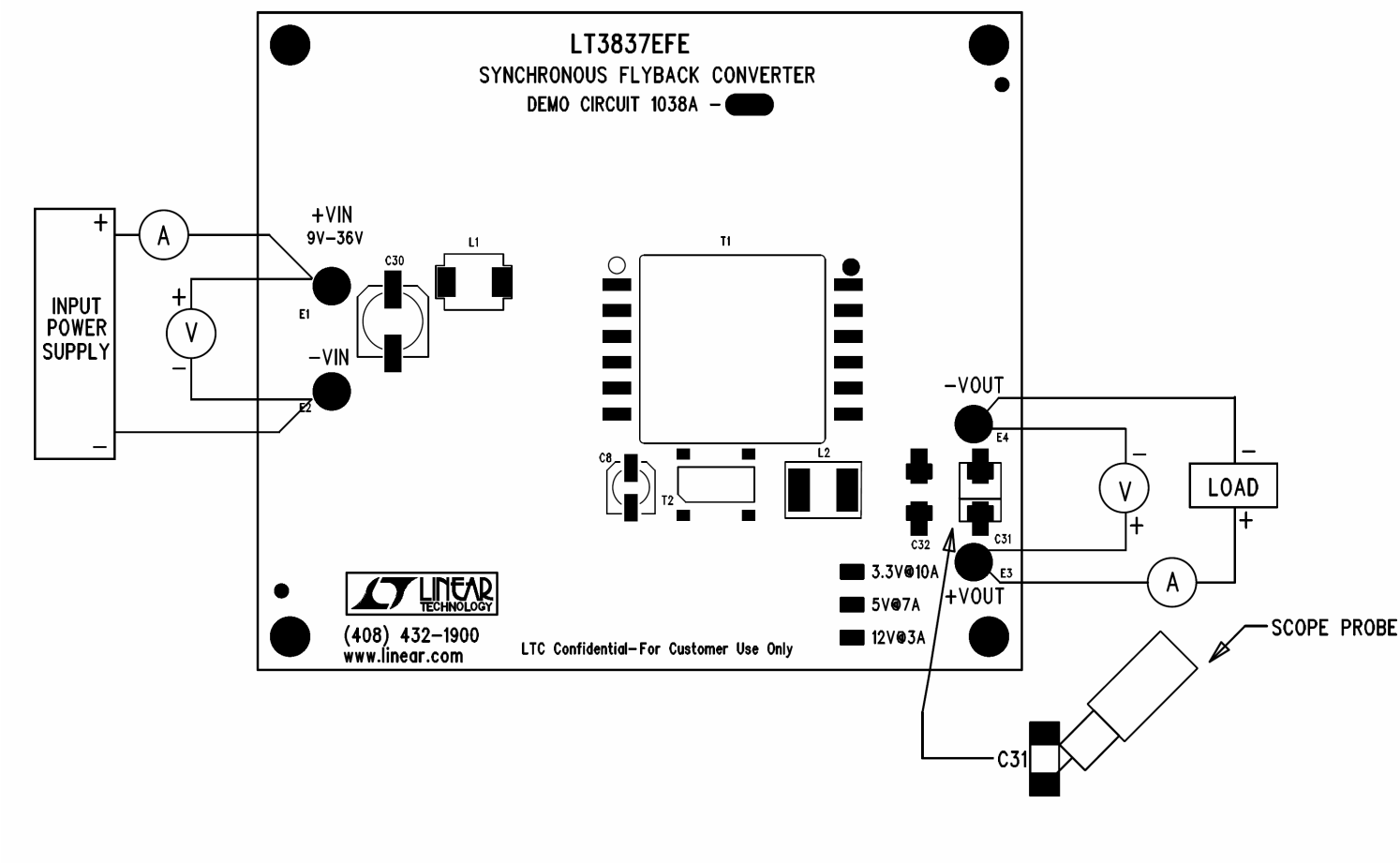


**Figure 1. Proper Measurement Equipment Setup**

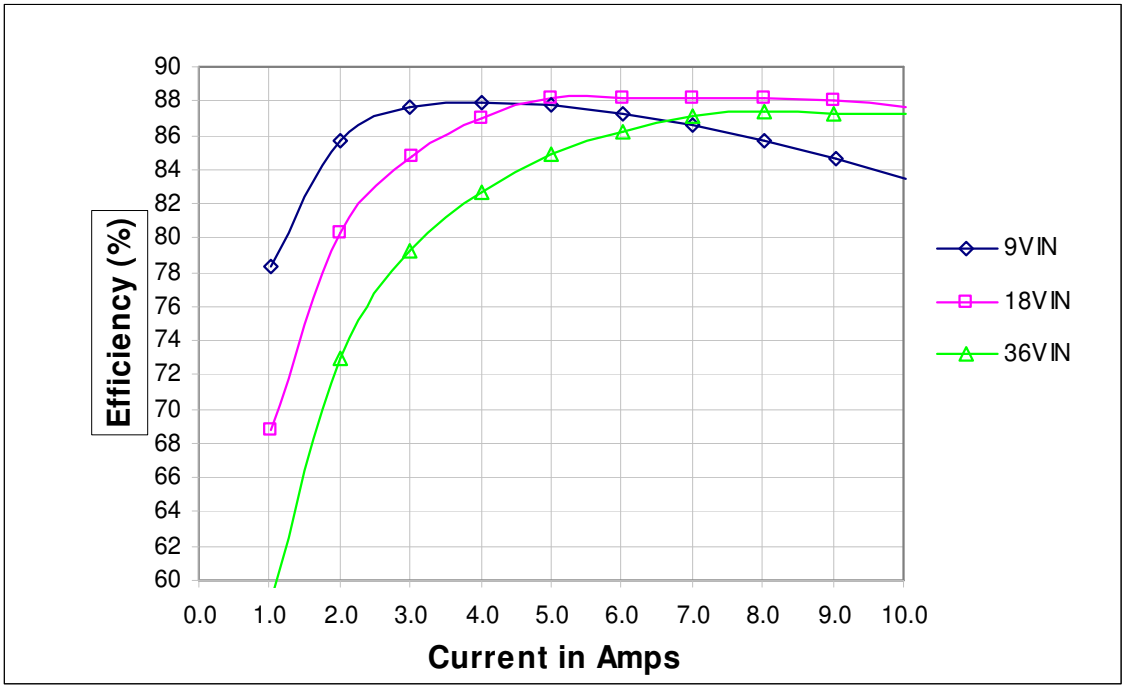


**Figure 2. Efficiency**

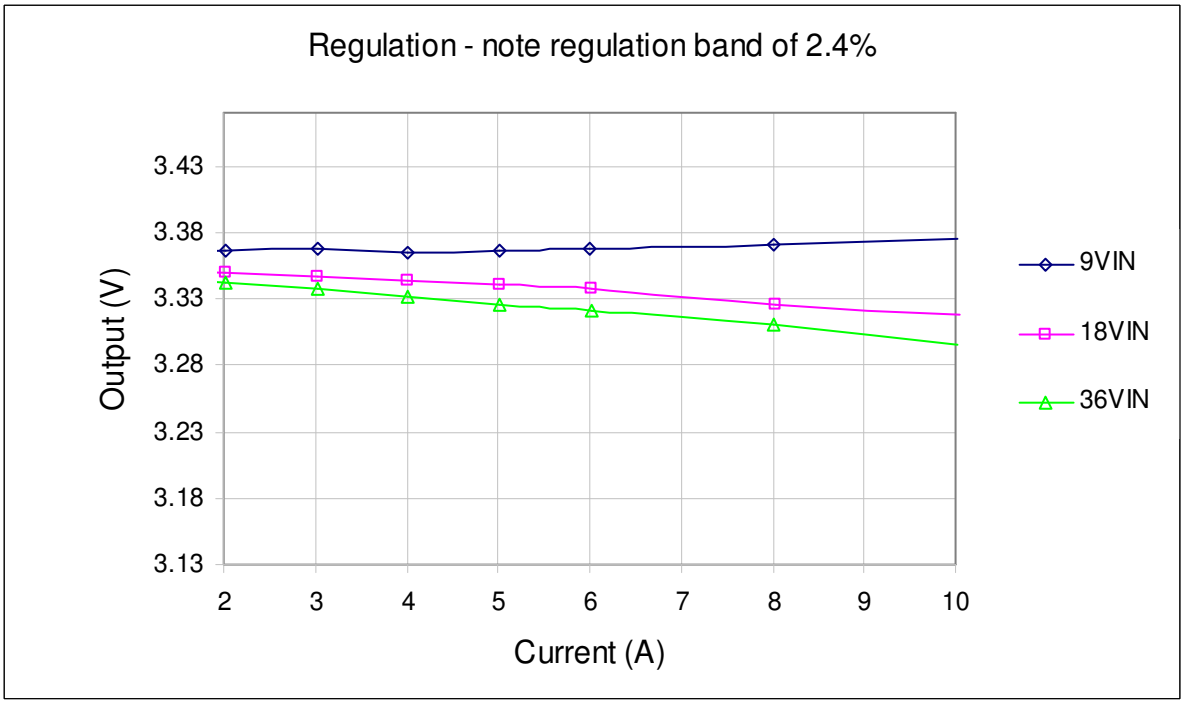


**Figure 3. Regulation**

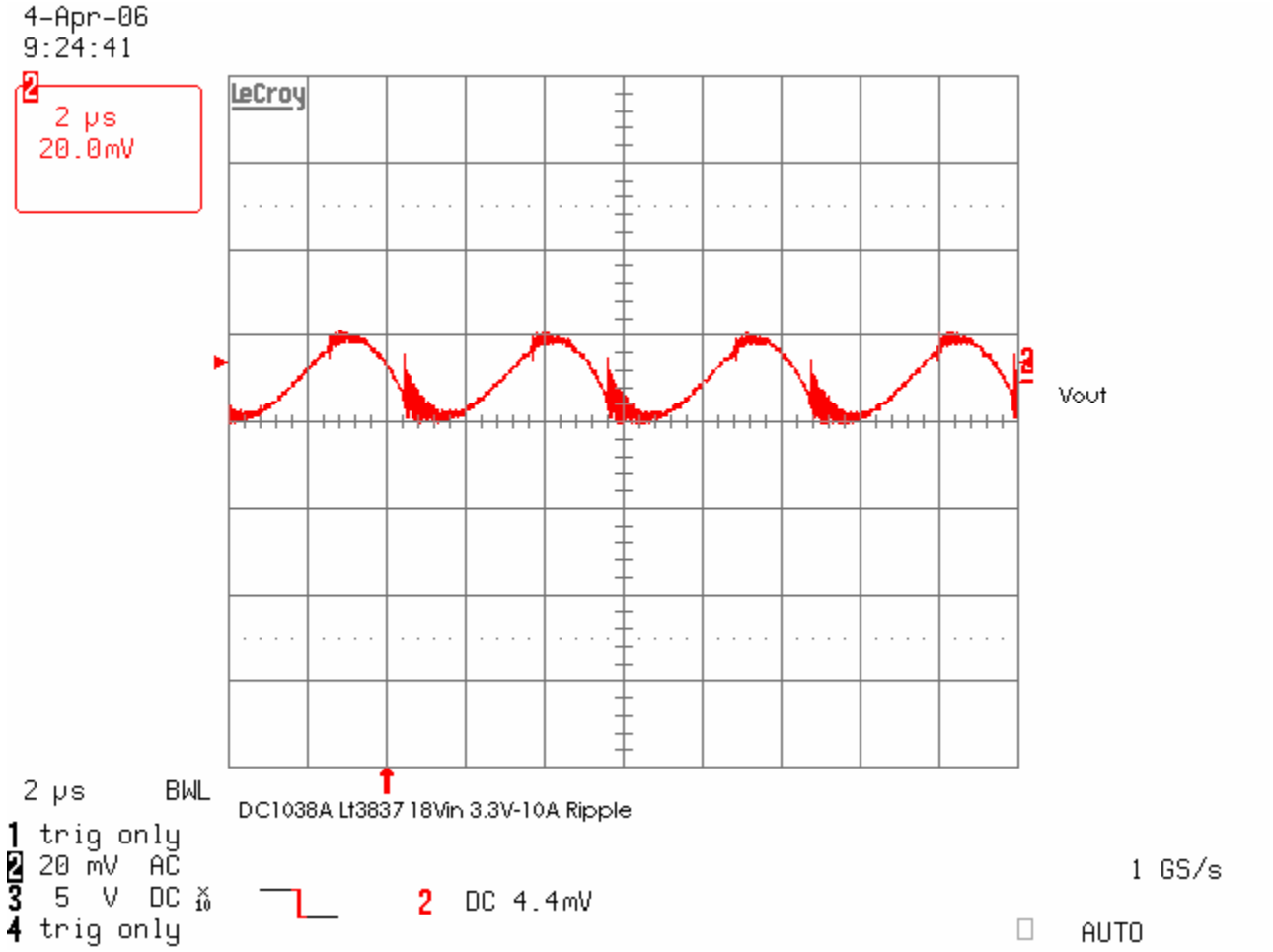


**Figure 4. Output Ripple at 18Vin and 10Aout (20MHz)**

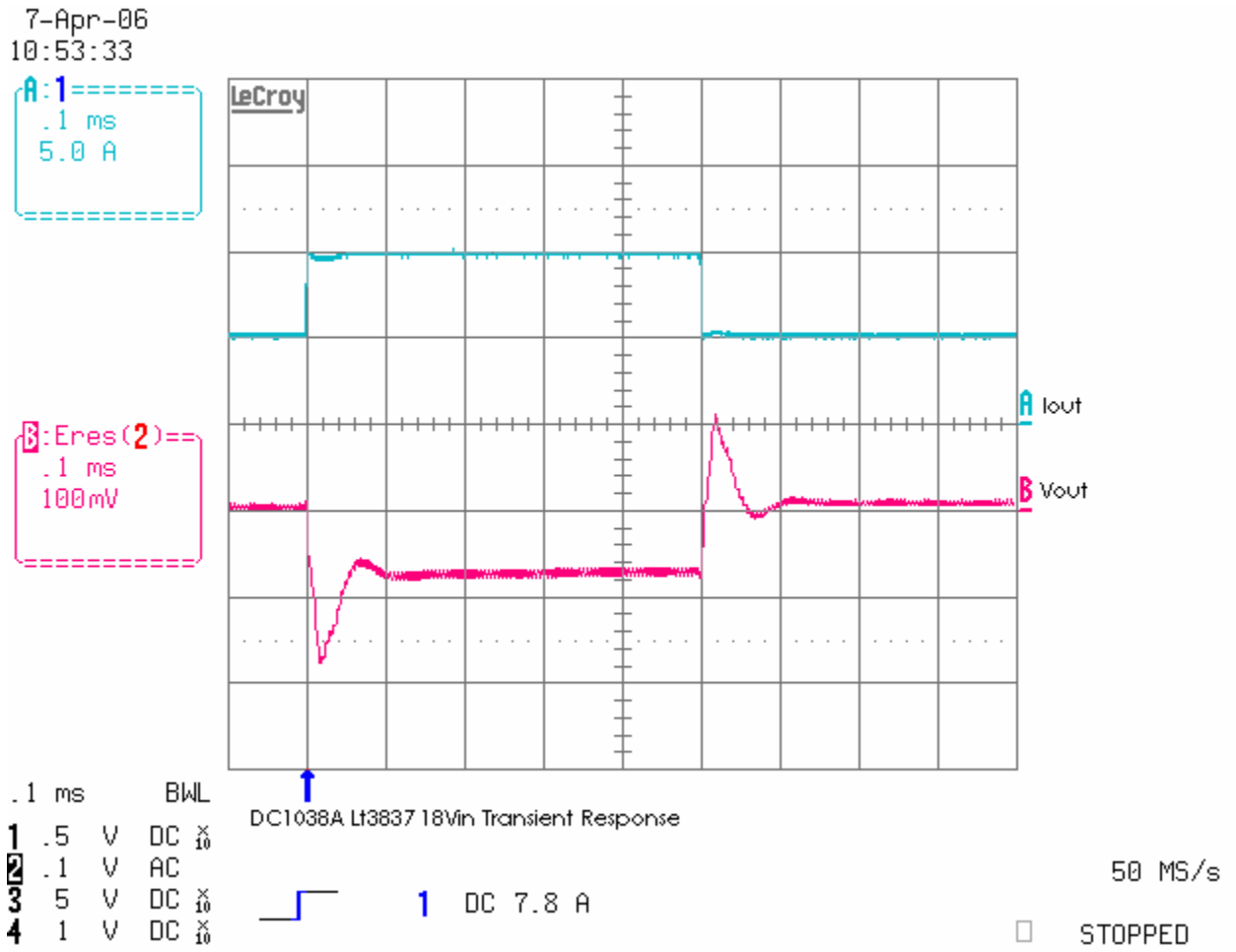


**Figure 5. Transient Response Waveform at 18Vin and 5 - 10Aout**

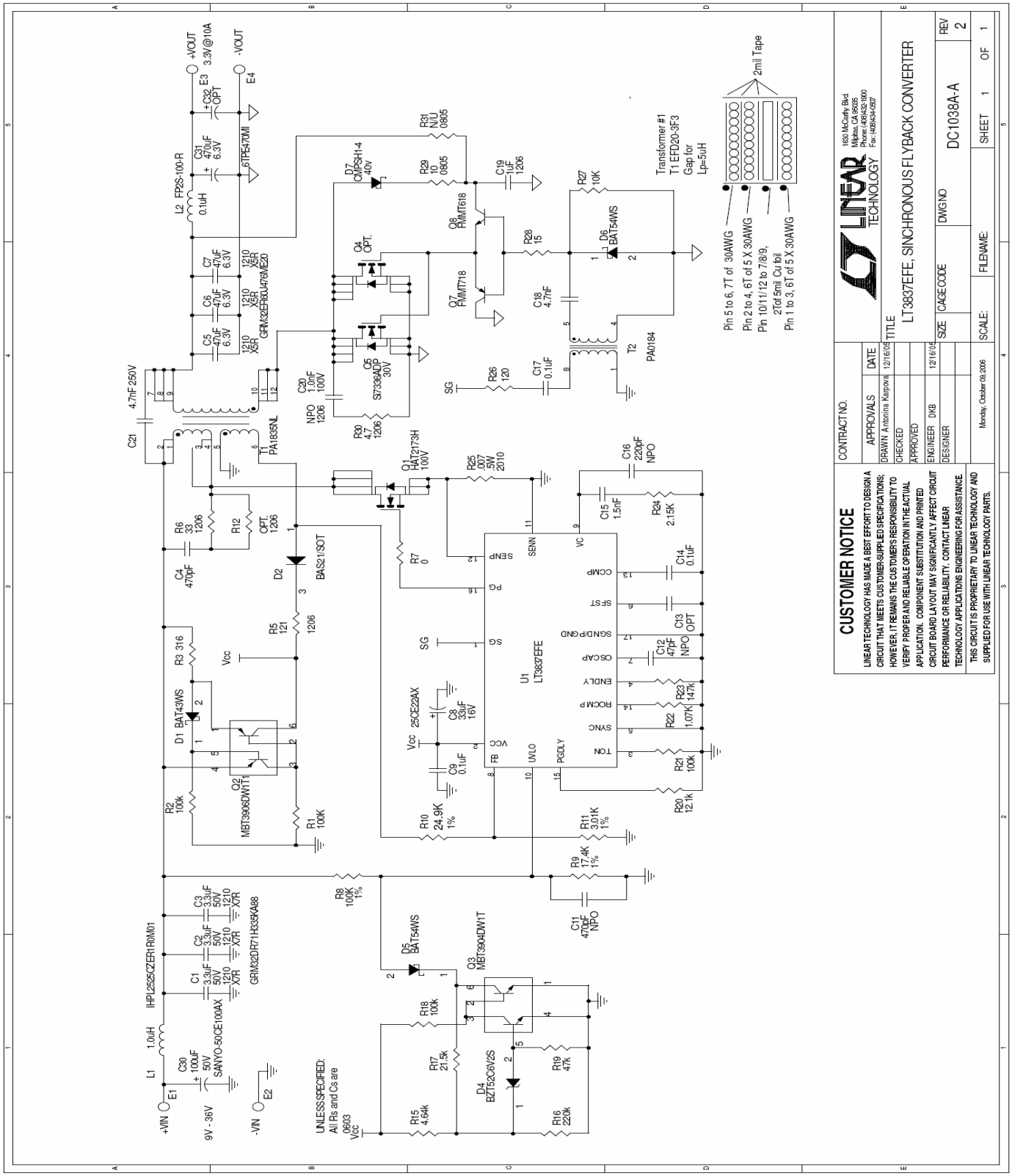


**Figure 6. Complete Board Schematic**