

DESCRIPTION

Demonstration circuit 677 is an isolated input to high current output converter featuring the LT[®]1952 switching controller. The DC677 converts isolated 36V to 75V input to 3.3V output and provides over 50A of output current. The converter operates at 300kHz with high efficiency of 92%. The DC677 can be easily modified to generate output voltages in the range from 0.6V to 28V. The output currents are limited by total output power of up to 200W.

Demonstration circuit 677 can generate output currents as high as 60A with some airflow. Changing the MOSFETs, power transformer, output inductor and output capacitors can also change the output voltage to any value between 0.6V and 28V. Please consult LTC factory for details.

The DC677 circuit features soft-start which prevents output voltage overshoot on startup or when recovering from an overload condition.

The DC677 has a precise over-current protection circuit that allows for continuous operation under short circuit conditions. The low power dissipation under short circuit conditions insures high reliability even during short circuits.

The LT1952 can be synchronized to an external clock of up to 400kHz. Please refer to the LT1952 data sheet for design details and applications information.

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

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Table 1. Performance Summary

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		36V
Maximum Input Voltage		75V
V _{OUT}	V _{IN} = 36V to 72V, I _{OUT} = 0A to 50A	3.3V ±3%
Typical Output Ripple V _{OUT}	V _{IN} = 36V to 72V, I _{OUT} = 0A to 50A	50mV _{P-P}
Nominal Switching Frequency		300kHz

QUICK START PROCEDURE

Demonstration circuit 677 is easy to set up to evaluate the performance of the LT1952. 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 power off, connect the input power supply to Vin and GND. Make sure that the input power

supply has sufficient current rating at minimum input voltage for the required output load.

2. Turn on the power at the input.

NOTE: Make sure that the input voltage does not exceed 75V.

3. Check for the proper output voltage.

V_{out} = 3.3V.

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

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48V IN TO 3.3V, 50A ISOLATED DC/DC CONVERTER

- Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
- The DC677 is equipped with an output capacitor CSYS (470uF) that approximates typical system rail capacitance. If the system board already has capacitance of similar value, CSYS can be removed.

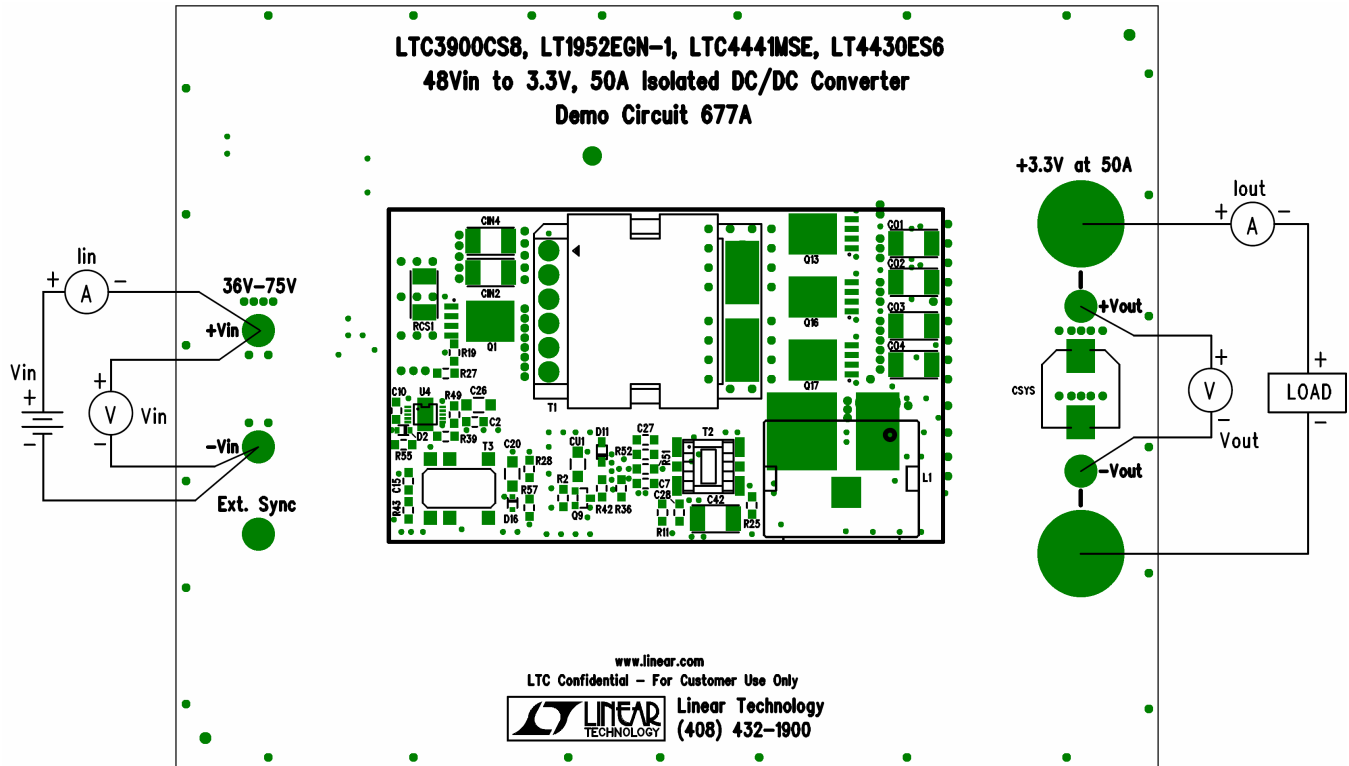


Figure 1. Proper Measurement Equipment Setup

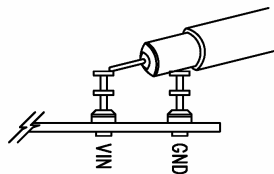


Figure 2. Scope Probe Placement for Measuring Input or Output Ripple

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CHANGING THE OUTPUT VOLTAGE

1. To set the output voltage lower than 3.3V, change the bottom voltage divider resistor connected to LT4430 Vfb pin (R26).
2. To get higher than 3.3V output voltages, a transformer with higher turns ratio will be required. Also, output MOSFETs with higher voltage ratings may be required. Please contact LTC factory for details.

OPTIONAL CIRCUITS

Demonstration circuit 677 is equipped with optional biasing, buffer and MOSFET circuits.

Biasing circuit (Option 1) can be used with a transformer that utilizes auxiliary bias winding. Please see Demonstration Circuit 759 or DC830 for details on how to use this circuit.

The MOSFET driver circuit LTC4441 can be replaced by simpler lower performance circuit (Option 2). Please note that the decrease in efficiency due to weaker gate drive of Option 2 may require more air flow or even heat-sinking for power MOSFETs.

The Option 3 circuit allows one more MOSFET to be added on the primary side for either higher power or higher input current applications.

USING MOSFET BUFFERS

The MOSFET buffers Q20 and Q21 are used to increase the converter efficiency and can be disabled by shorting resistors R16 and R17. To test the performance with the buffers disabled perform the following steps.

1. Turn the power off.
2. Change the base-emitter resistors R16 and R17 to zero ohm.
3. Turn the power on.
4. Measure the efficiency.

The efficiency of DC677 demo board with MOSFET buffers enabled is shown in Figure 3.

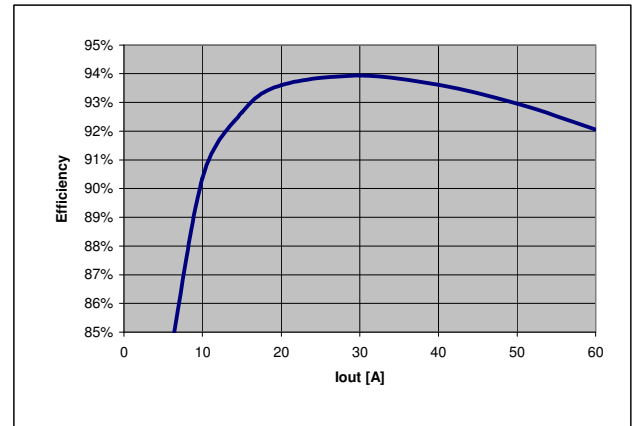


Figure 3. High efficiency of DC677 allows the board to be used in thermally critical applications

OUTPUT LOAD STEP RESPONSE

The load step response of DC677 is very fast even though a relatively small amount of output capacitance is present (300uF ceramic and 470uF electrolytic). This is due to the fast error amplifier of LT4430, optimal amount of current slope compensation of the LT1952, fast opto coupler and fast error amplifier of the LT1952. If higher load steps need to be handled more output capacitance can be added in order to keep the voltage transients at desired levels. The load step transients are shown in Figure 4.

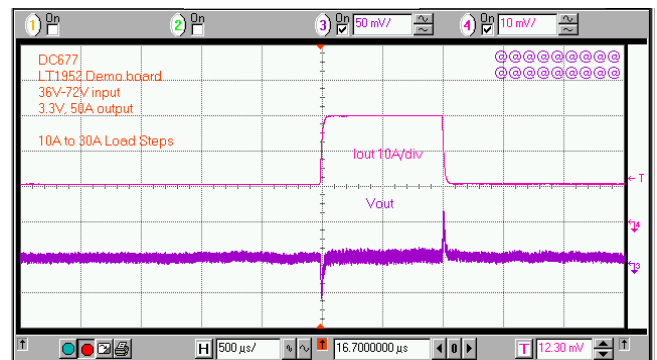


Figure 4. Fast transient response of DC677 is superior to many competing power modules without additional output capacitors

SOFT START FUNCTION

The DC677 features LT4430 opto coupler driver that has soft start function which produces the monotonic startup ramp shown in Figure 5. The rise time of the output voltage is controlled by capacitor C13 which is connected to OC (overshoot control) pin of LT4430.

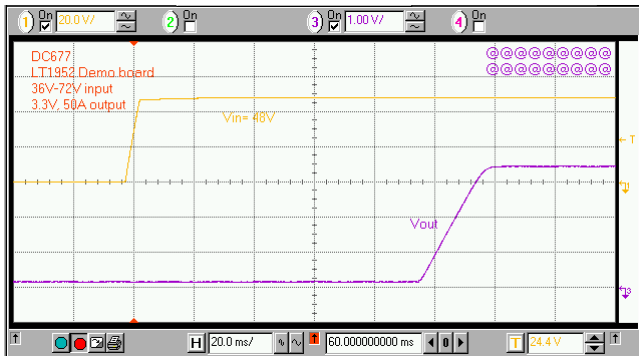


Figure 5. The LT4430 opto coupler driver produces monotonic output voltage rise at startup without output voltage overshoot.

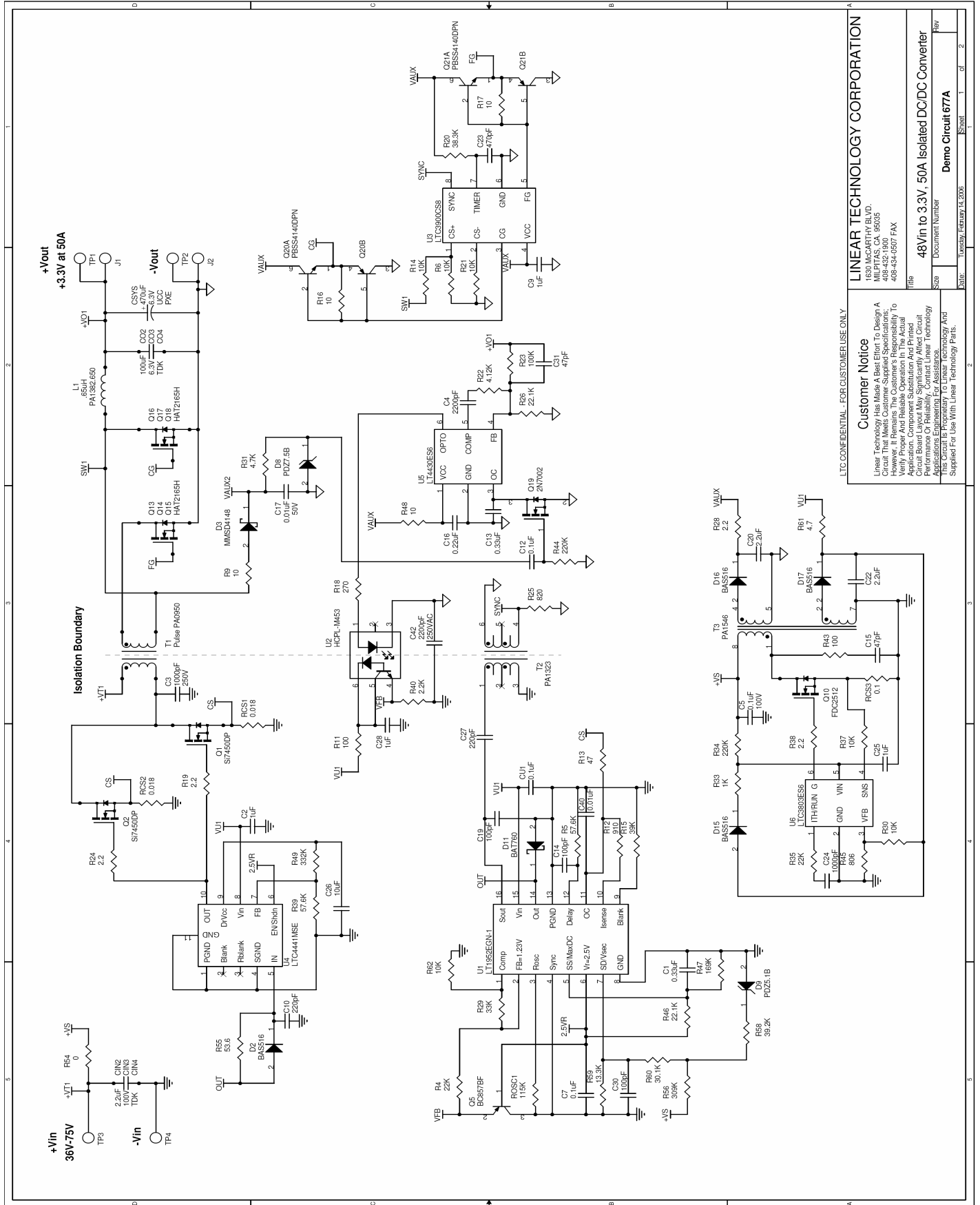
DEBUGGING AND TESTING

The DC677 can easily be tested and debugged by powering the bias circuit separately from the main power circuit. To place DC677 into debug mode, remove the resistor R54 and connect a 48V, 100mA power source to the +Vs node (right side of R54). By doing this, the bias power circuit of the LTC3803 will start running and it will power up the primary PWM controller of the LT1952 and the secondary MOSFET driver LTC3900.

Once the primary and secondary controllers are running, the MOSFET gate timing can be checked. The main power input can be applied to +Vin. If the MOSFET gate timing is correct (the delay from turn on of FG and GDO should be in the range from -100ns to +100ns). While slowly increasing the +Vin from 0V to 48V, monitor the output voltage and input current. The input current should not exceed 100mA without the output load. If one of the MOSFETs is damaged, the input current will exceed 100mA.

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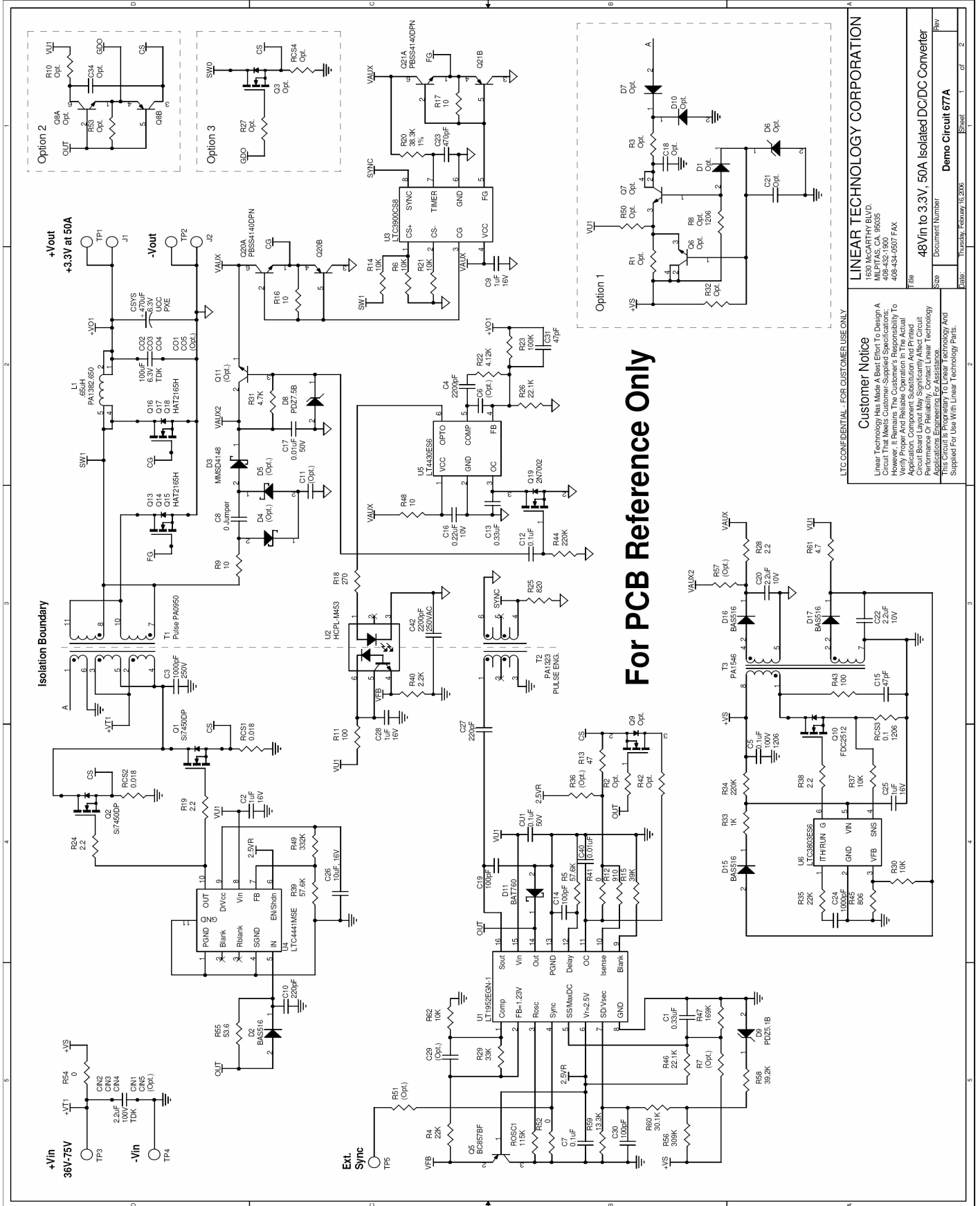
48Vin to 3.3V, 50A Isolated DC/DC Converter

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