DESCRIPTION

Demonstration circuit 781 is a Telecom DC/DC converter featuring the LTC3803ES6 constant frequency current mode flyback controller. The DC781 converts 36V to 72V input to 3.3V or 5V output and provides 2A of output current. The 200kHz constant frequency operation is maintained down to zero load which prevents low frequency noise that occurs when power converters operate in pulse skipping mode. The converter provides high output voltage accuracy (typically ±2%) over wide load range with no minimum load requirement.

The DC781 can be easily modified to generate different output voltages. The output current is limited by total output power to 10W. Higher output voltages and currents can be achieved by changing the MOSFET, transformer and output capacitors. Please consult LTC factory for details.

The DC781 has a small circuit footprint. It is a high performance and cost effective solution for Telecom, Automotive and Power Over Ethernet applications.

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 2A	3.3V ±3% or 5V ±3%
Typical Output Ripple V_{OUT}	V_{IN} = 36V to 72V, I_{OUT} = 0A to 2A	$50mV_{P-P}$
Nominal Switching Frequency		200kHz

QUICK START PROCEDURE

Demonstration circuit 781 is easy to set up to evaluate the performance of the LTC3803ES6. For proper measurement equipment setup refer to Figure 1 and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to minimize the length of oscilloscope probe ground lead. Measure the input or output voltage ripple by connecting the probe tip directly across the VIN or VOUT and GND terminals as shown in Figure 2.

1. With power off, connect the input power supply to +VIN and GND.
2. Check the output voltage-setting jumper JP1. Move it into desired position if necessary.
3. Turn the input power source on and slowly increase the input voltage. Be careful not to exceed 72V.

   NOTE: Make sure that the input voltage VIN does not exceed 72V. If higher operating voltage is required,

power components with higher voltage ratings should be used.

4. Check the proper output voltage of 3.3V or 5V.

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

5. Once the proper output voltage is established, adjust the load within the 2A range and observe the output voltage regulation, ripple voltage, efficiency and other parameters

EFFICIENCY

The efficiency of DC781 is shown in Figure 3 and 4.

When DC781 is set for 3.3V output the bias voltage V_{B1} is 7V. However, when converter is set for 5V output the bias voltage V_{B1} is 9V. Due to higher bias voltage V_{B1}, the efficiency of 5V output is about 1% lower than the maximum achievable efficiency shown in Figure 4.

Note that the efficiency of 5V output shown in figure 4 was taken with 1.62k bias resistor R1. The bias resistor R1 is used to provide current limiting and to reduce the gate drive voltage, In this case, the resistor R1 lowers bias voltage V_{B1} from 9V to 7V, which produces about 1% higher efficiency.

Alternatively, for 5V output, reduce the transformer winding that generates V_{B1} by 20%.

PRE-REGULATOR Q3

The pre-regulator circuit Q3, D4 and R9 can be used to provide quick circuit startup. When enabled by installing a 0 ohm resistor at R10, the bias voltage for U1 is quickly pulled to 7.5V which reduces the startup delay.

Also, in this case, the bias voltage V_{B1} does not have to come up quickly, thus allowing startup to be independent of output load capacitance. Without the Q3 circuit, the output voltage must reach regulation before C1 voltage drops down to U1 Turn-Off voltage of 5.7V. Therefore, without the Q3 circuit, if a larger output cap is used, the value of C1 must be increased as well.

CHANGING SYNCHRONOUS RECTIFIER MOSFET

The synchronous rectifier MOSFET Q2 is selected to provide the appropriate gate drive threshold in respect to Q1. If a different MOSFET is used, additional MOSFET gate turn ON delays may be required. The turn ON delay can be increased by increasing the values of resistors R2 and R5.

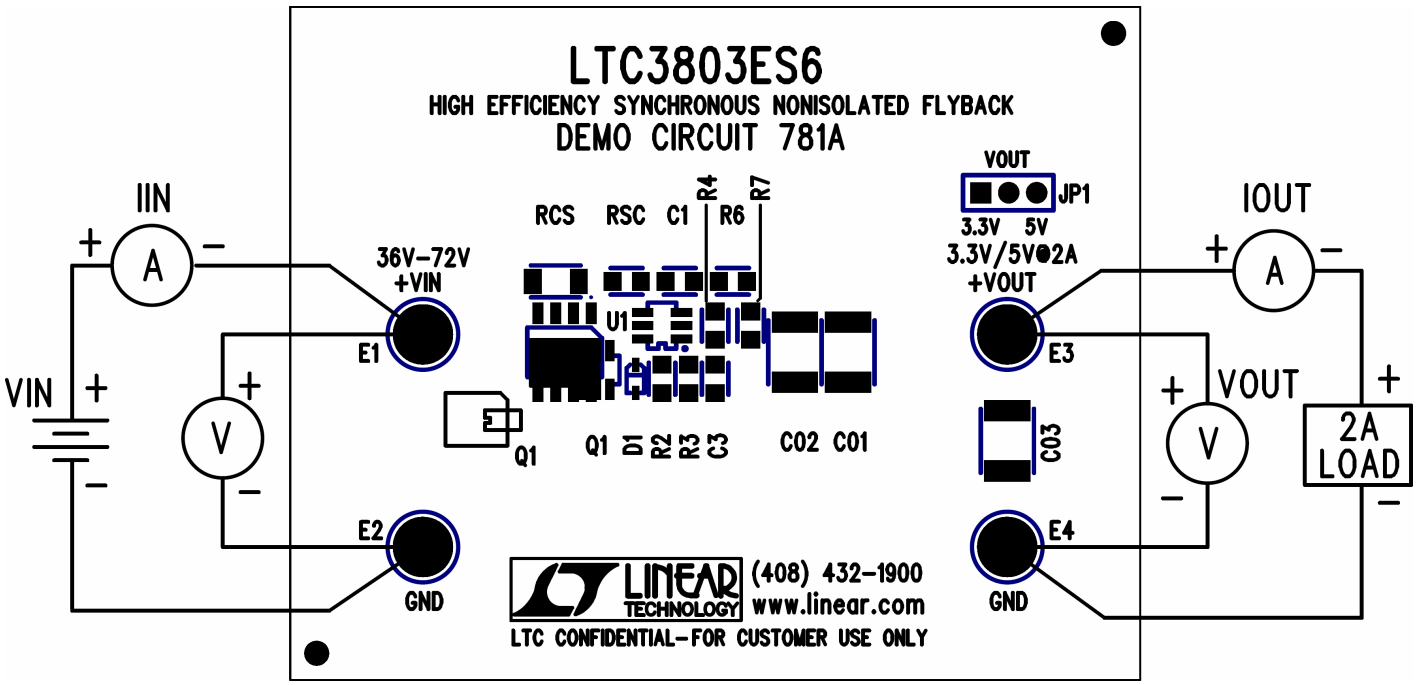


Figure 1. Proper Measurement Equipment Setup

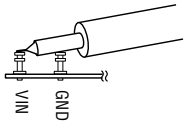


Figure 2. Measuring Input or Output Ripple

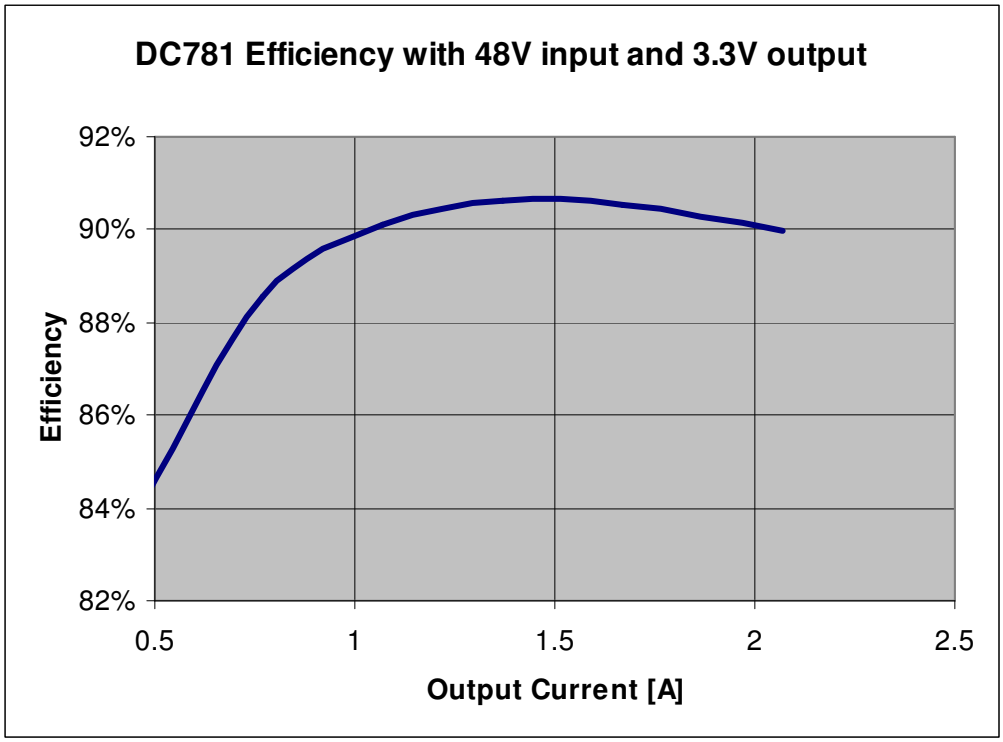


Figure 3. High efficiency of DC781 power converter is possible thanks to synchronous rectifier Q2

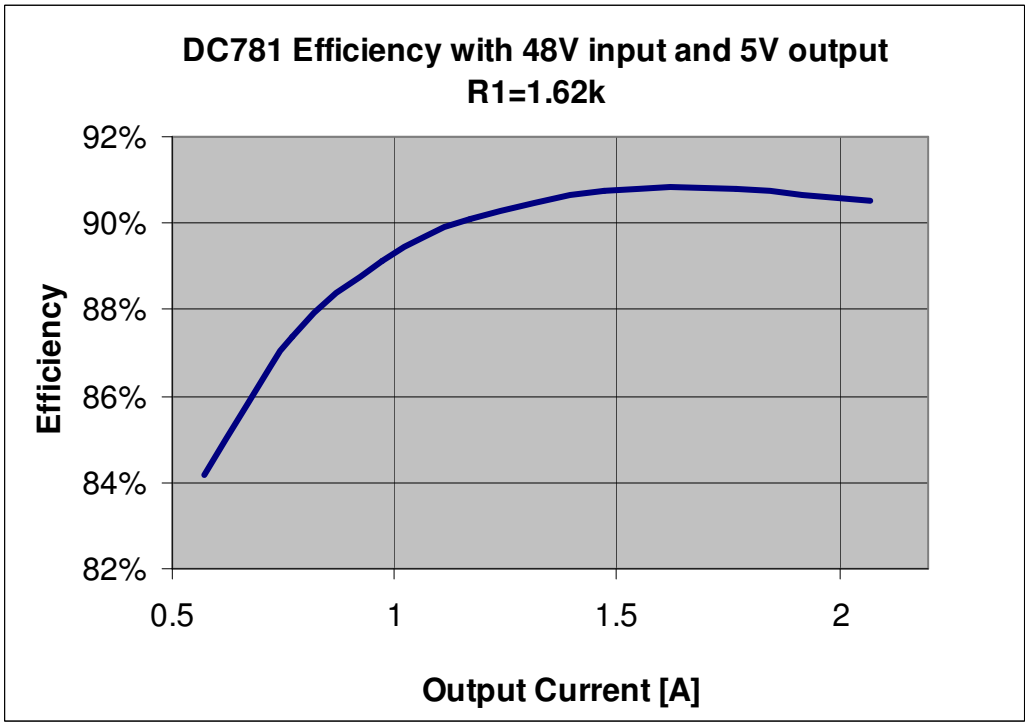
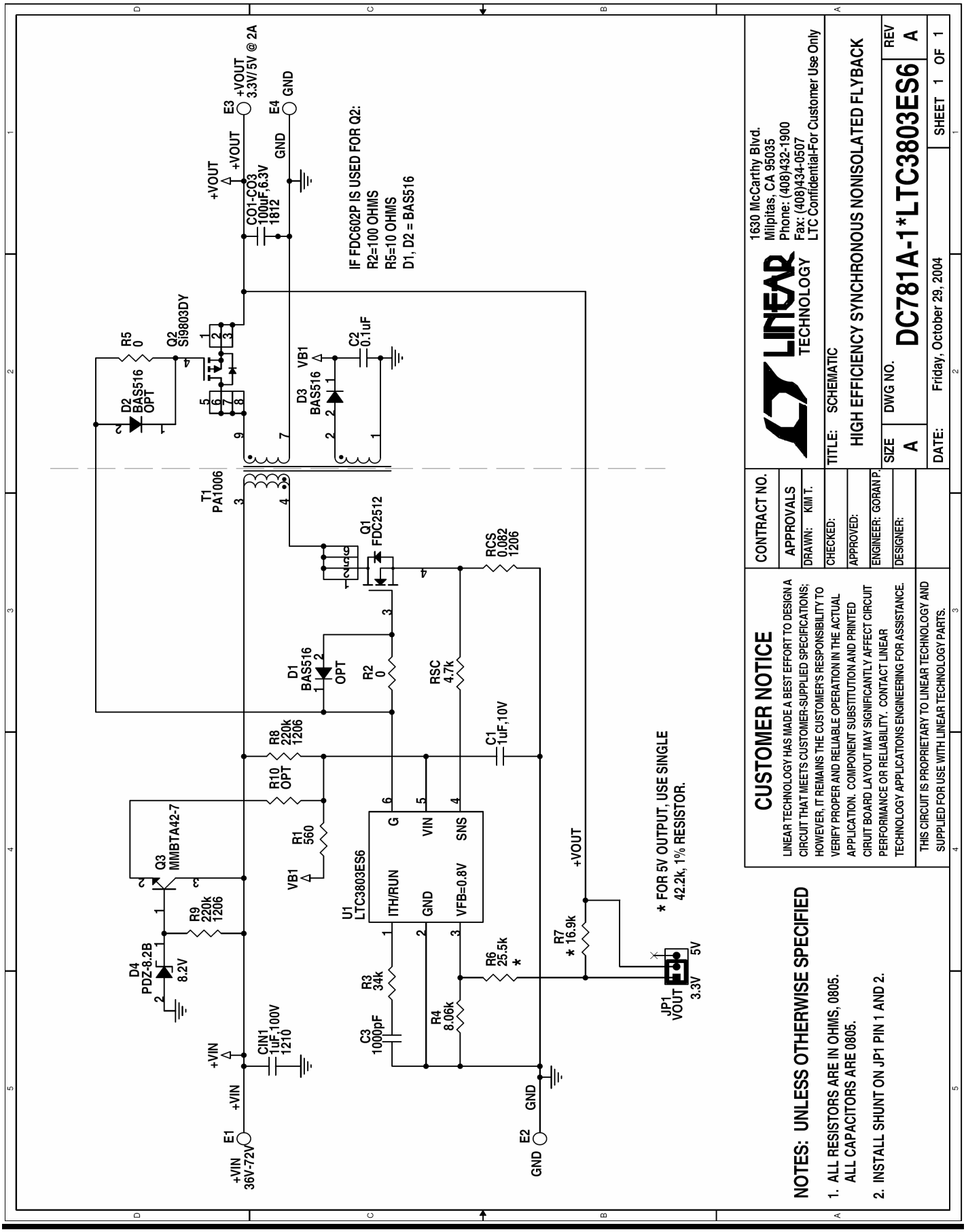


Figure 4. To achieve maximum efficiency with 5V output change R1 to 1.62k.



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THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

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TITLE: SCHEMATIC
HIGH EFFICIENCY SYNCHRONOUS NONISOLATED FLYBACK

SIZE: A
DWG NO.: DC781A-1*LTC3803ES6
REV: A
DATE: Friday, October 29, 2004
SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS, 0805.
   ALL CAPACITORS ARE 0805.
2. INSTALL SHUNT ON JP1 PIN 1 AND 2.