DESCRIPTION

Demonstration circuit 850A is a 3V-14.4Vin, Boost LED Driver featuring the LTC3783 – a high PWM dimming ratio capable, LED driver controller. This circuit was designed to attain a highly efficient, output current regulating power supply from a wide input voltage range while achieving an unprecedented dimming ratio of greater than 1000:1. This circuit also incorporates an output over voltage protection feature to limit output voltage to less than 27V if the LED string is inadvertently disconnected.

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

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Table 1. Performance Summary (T_A = 25°C)

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		3V
Maximum Input Voltage		14.4V
Output Voltage V_{OUT}	V_{IN} = 3V to 14.4V	$V_{IN} < V_{OUT} < 25V$
Typical Output Ripple V_{OUT}	V_{IN} = 8V	$65mV_{P-P}$
Maximum Output Current		360mA
Output Current Regulation	Over line and load	±2.0%
Nominal Switching Frequency		290kHz
Efficiency	V_{IN} = 8V, V_{OUT} = 20V	91.5% Typical
Run Control	Falling Voltage-Off	1.223V Min
	Rising Voltage-On	1.348V Typical
SYNC Control	Logic Low Voltage-Off	0.5V MAX
	Logic High Voltage-On	1.2V Min
PWM Dimming Control	Logic Low Voltage-Off	0.8V Typical
	Logic High Voltage-On	1.6V Typical
PWM Dimming Ratio		1000:1

OPERATING PRINCIPLES

The LTC3783 LED controller will operate when an input voltage of 3V to 14.4V is applied. The exception is when the RUN terminal, E6, is tied to GND, E7. This inhibits the LTC3783's switching and puts it into shutdown. (This can be accomplished via an open collector/drain configuration with a transistor or a mechanical switch.) When the LTC3783 is taken out of shutdown, it begins a controlled soft-start increase of the output current.

If the PWMIN pin, E4, is high or left floating, R9 will conduct the LED current. This current develops a voltage across R9 that is fed to the FBN pin. This voltage is compared to the voltage on the FBP pin which is developed from the resistor divider, R5 and

R6, from the reference voltage, VREF. When the voltages at the FBP and FBN pins are equal, the controller is in output current regulation.

If for any reason the impedance at the LED terminals gets higher than design limits (i.e. disconnected LEDs), the LTC3783 will limit the output voltage to its over voltage point (OVP) of 27V. This ensures no damage to the circuit components.

PWM dimming is carried out by applying a PWM signal to the PWMIN terminal, E4. This signal is then buffered and used to drive the PWM FET, Q3. This FET interrupts the current through the LEDs, thus effecting PWM dimming of the LED string. High dimming ratios are achievable due to the output current state being saved by the controller each time that the PWM FET is turned off.

The LTC3783 can be synchronized to an external clock that is faster than the free-running frequency via the SYNC pin, E5. As always, see the LTC3783 datasheet for more detailed information on all of the above features.

Depending on system ripple requirements, fewer/lower value input and output capacitors can be used. This demo board is shipped with a mere 65mVpp of output and 85mVpp of input ripple!

QUICK START PROCEDURE

Demonstration circuit 850A is easy to set up to evaluate the performance of the LTC3783. 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 output (or input) voltage ripple by touching the probe tip and probe ground directly across the VOUT/LED+ (E3) and GND (E9) terminals. See Figure 2 for proper scope probe measurement technique.

1. Set an input power supply that is capable of 3V to 15V at 3A to a voltage of 8V. Then turn off the supply.
2. With power off, connect the supply to the input terminals VIN (E1) and GND (E2).
   a. Input voltages lower than 3V can result in too much power dissipation due to the larger currents needed to sustain regulation.
   b. If efficiency measurements are desired, an ammeter capable of measuring at last 3Adc can be put in series with the input supply in order to measure the DC850's input current.
   c. A voltmeter with a capability of measuring at least 15V can be placed across the input terminals in order to get an accurate input voltage measurement.
3. Connect a string of LEDs that will yield < 25V at 360mA between the output terminals VOUT/LED+ (E3) to LED- (E8).
4. Turn on the power to the input power supply.

   NOTE: Make sure that the input voltage never exceeds 15V – electrical overstresses can occur.
5. Check for the proper output current of 360mA ± 2%. If the output current is < 360mA ± 2% and the output voltage is ≥ 25V, the OVP may be activated. Check connections and LED string voltage and make adjustments as necessary.
   a. If efficiency measurements are desired, an ammeter that is capable of handling 500mA can be put in series with the output LED string in order to measure the DC850's output current.
   b. A voltmeter with a capability of measuring at least 30V can be placed across the output terminals VOUT/LED+ (E3) and GND (E9) in order to get an accurate output voltage measurement.

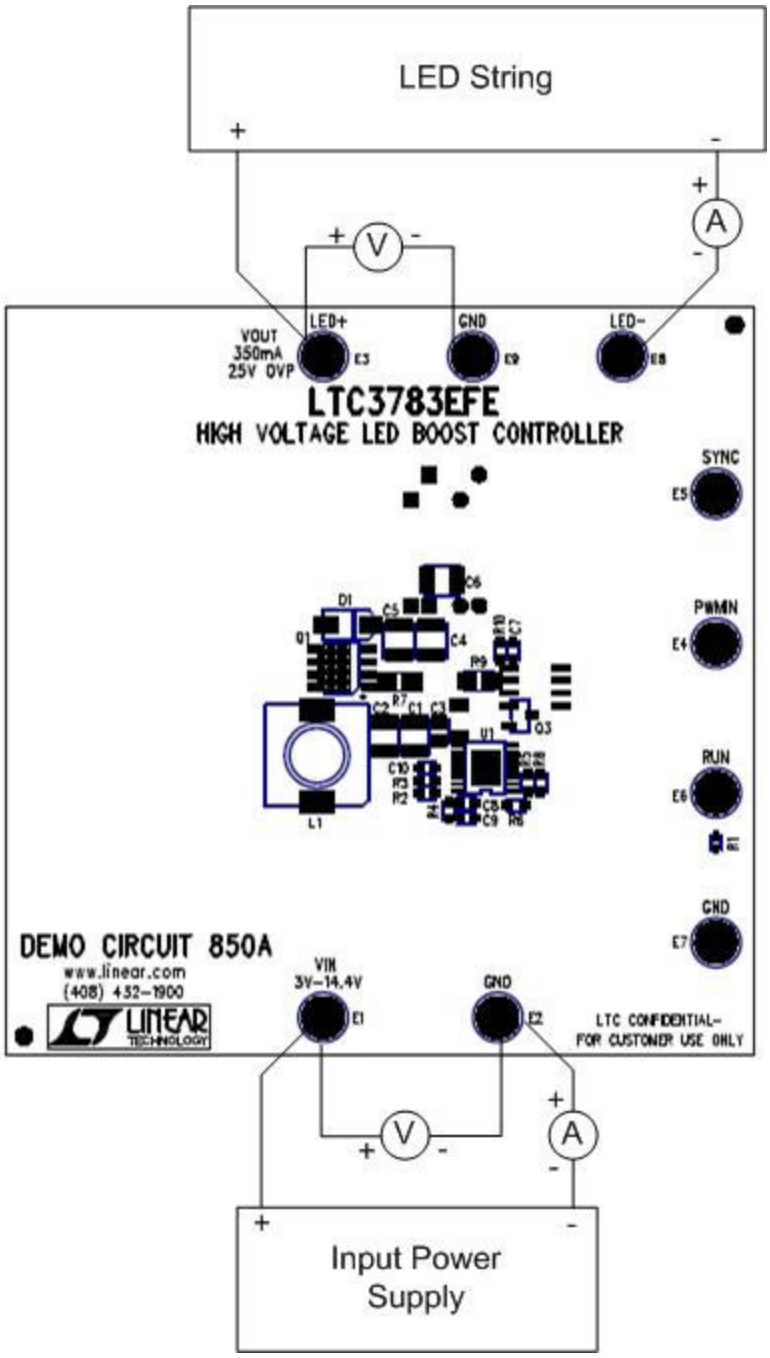


Figure 1. Proper Measurement Equipment Setup

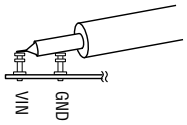


Figure 2. Measuring Input or Output Ripple

MEASURED DATA

Figure 3 shows efficiency data for a typical DC850A.

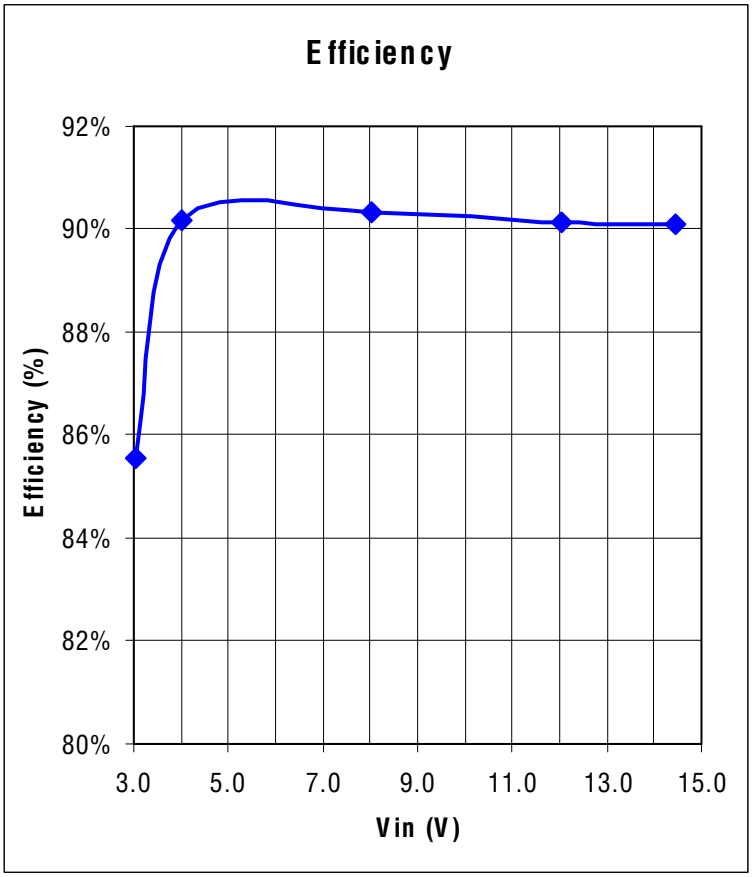
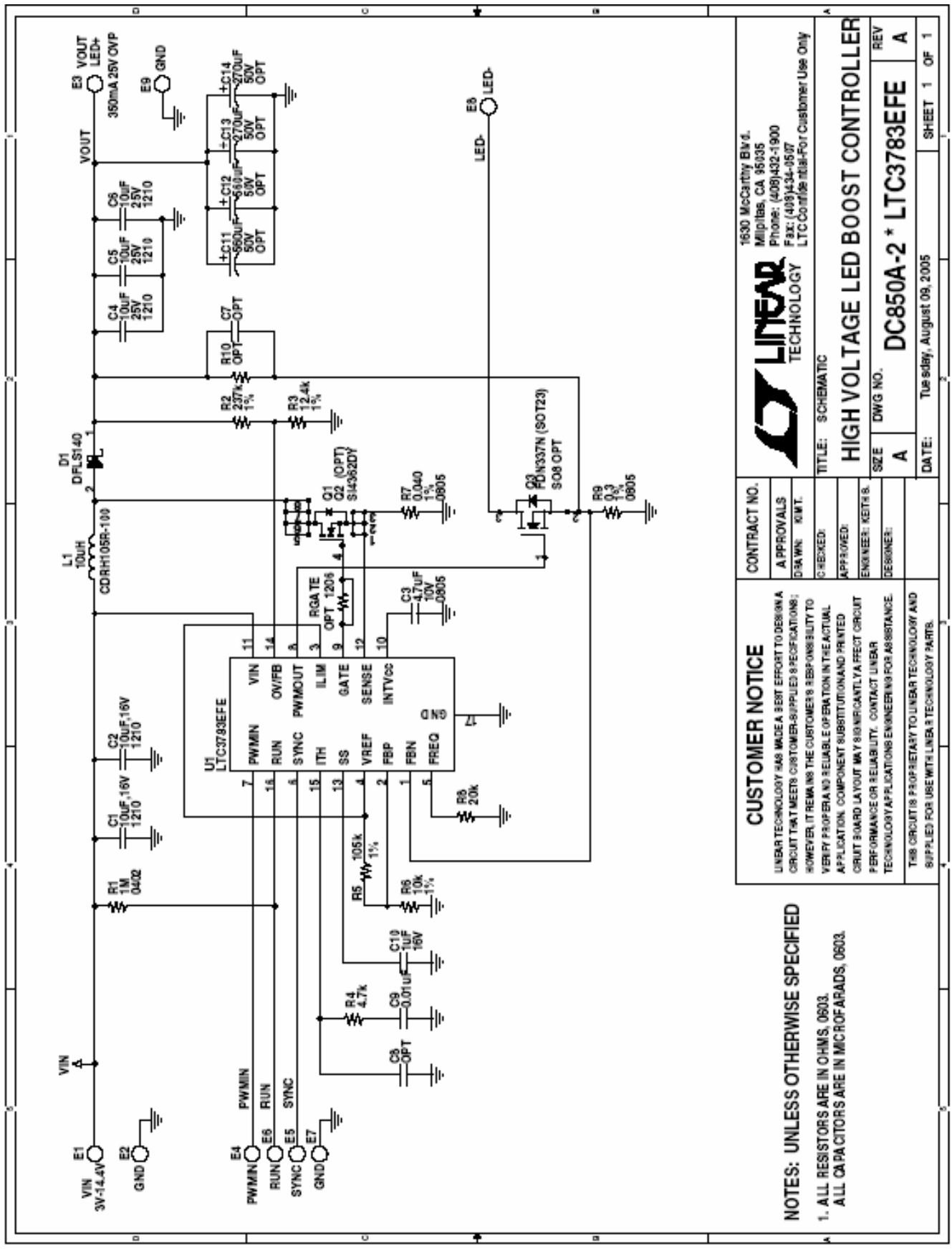


Figure 3. Efficiency with VLED of 16V.


HIGH VOLTAGE LED BOOST CONTROLLER
DC850A-2 * LTC3783EFE
LINEAR TECHNOLOGY
1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408)432-1900
Fax: (408)434-0507
LTC Confidential-For Customer Use Only
CUSTOMER NOTICE
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 0603.
ALL CAPACITORS ARE IN MICROFARADS, 0603.
U1 LTC3783EFE
D1 DFLS140
L1 10UH CDRH105R-100
Q1 Q2 (OPT) SI4362DY
Q3 FDN337N (SOT23) SOB OPT
VIN 3V-14.4V
VOUT 350mA 25V OVP
LED-
GND
PWMIN
RUN
SYNC
R1 1M 0402
R2 237k 1%
R3 12.4k 1%
R4 4.7k
R5 105k 1%
R6 10k 1%
R7 0.040 1% 0805
R8 20k
R9 0.3 1% 0805
R10 OPT
C1 10uF,16V 1210
C2 10uF,16V 1210
C3 4.7uF 10V 0805
C4 10uF 25V 1210
C5 10uF 25V 1210
C6 10uF 25V 1210
C7 OPT
C9 0.01uF
C9 OPT
C10 1uF 16V
C11 560uF 50V OPT
C12 560uF 50V OPT
C13 270uF 50V OPT
C14 270uF 50V OPT
RGATE OPT 1206
CONTRACT NO.
APPROVALS
DRAWN: KMT.
CHECKED:
APPROVED:
ENGINEER: KEITH B.
DESIGNER:
TITLE: SCHEMATIC
SIZE A
DWG NO.
DATE: Tuesday, August 09, 2005
REV A
SHEET 1 OF 1