DEMO CIRCUIT 1470
QUICK START GUIDE

LT3743

High Current Synchronous Step-Down LED Driver with Three-State Control

DESCRIPTION

Demonstration circuit 1470 is a High Current Synchronous Step-Down LED Driver with Three-State Control featuring the LT3743EUFD. The demo board is optimized for 20A output from a 12V input. Being an LED driver, the output current is being regulated until the output voltage reaches a programmed voltage limit. This voltage limit on this demo board is set to around 6V by R5 and R6. The 6V is chosen because of the 6.3V voltage rating of the output capacitors. The ideal load to be used with this demo board is a single LED, such as PT120 from Luminus Devices. Smaller LEDs may not be able to handle the high current, even for a short period of time. At 20A, the demo circuit can operate continuously. However, it is necessary to mount the LED load on a proper heat sink and possibly with a fan to avoid exceed its maximum temperate rating. Note: the demo board 1470 will drive a LED with its cathode grounded. Grounding cathode of the LED allows customers to use positive input supply.

The input voltage range of the LT3743 itself is 6V to 36V. However, the demo board utilizes 30V Mosfets to demonstrate best efficiency so the maximum recommended input voltage is 24V for the demo board. When input is above 20V during PWM dimming, a slightly larger inductance may be needed. The typical efficiency of the demo board is 94% from a 12V input to 5V, 20A load. The lower the input voltage, the higher the efficiency tends to be with a given load. At output power level of 100W, a couple of percent of efficiency improvement is a huge advantage in minimizing temperature rise. If an efficiency measurement is needed in an application, the output voltage must be measured at the output capacitors instead of at the LED load. This prevents cable loss from being counted as a loss of the board. If efficiency measurement is required during PWM dimming, the average current and voltage values should be measured with proper equipments. All LT3743 circuits turn off unnecessary circuits during PWM off period to minimize power losses. As a result, efficiency in many PWM dimming applications is almost the same as efficiency of the constant current applications.

The demo circuit DC1470A uses a split output capacitor configuration to achieve <2us current rise time from 0A to 20A. To see the real rise time, connecting wires between the LED and the board should be minimized to no more than 2 inches total to minimize the wire inductance. 1 inch is even better. The cathode of the LED should return to LED- with R25 populated with a resistor in a few mΩ. It is recommended to measure the voltage on R25 with a short 50Ω coax cable directly into a BNC connector on the oscilloscope. The current can then be calculated from the measured voltage. To get accurate current, R25 should be measured before it is mounted on the board. A current probe adds more delays to the rise time so using a current probe is not recommended. If fast rise time measurement is not necessary, the cathode of the LED can be connected to GND as shown in Figure 1.

R27 can be used to slow down the gate drive. Slower gate drive helps to reduce ringing on the SW node without noticeable effect on the efficiency. A 10Ω is usually more then enough to completely damp any ringing.

R15, R16 and C15 help filtering out voltage spikes seen on the SENSE+ or SENSE- pin. It is critical to have those components on a board.

LT3743 has a three-state control. It can change output current among zero, a low level and a high level, all in a few us. The low current level of the demo board is set to around 5A. The high current level is 20A. Both levels can be adjusted by changing the voltage dividers on CTRL_H and CTRL_L. Applying a PWM signal to CTRL_SEL will toggle the output between 5A to 20A. While applying a PWM signal to the PWM pin will toggle the output between either 0 to 5A or 0 to 20A depending on the CTRL_SEL level.

The LT3743 datasheet gives a complete description of the part, operation and application information. The datasheet must be read in conjunction with this quick start guide for demo circuit 1470A.

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
PV_{IN}*	Input Supply Range. PV_{IN}=V_{IN}	L1 is Optimized for 12V.		12	26.4	V
V_{OUT}*	Output Voltage	With ONE PT120 LED. 6V is the over voltage limit.		4.5	6	V
I_{OUT}	Output Current	CTRL_SEL>1V	18.8	20	21.2	A
F_{SW}	Switching Frequency		400	430	460	kHz
I_{RISE}	Current Rise Time	Following a PWM rising edge		2		us
EFF	Efficiency at DC	V_{IN} = 12V, V_{OUT}=5V, I_{OUT}=20A		94		%

*: PV_{IN} and V_{IN} of the demo circuit are limited to 24V typical by the selection of Mosfets. The LT3743 input range is 6V to 36V. VOUT maximum of the demo circuit is limited to 6V due to the selection of the output capacitors.

QUICK START PROCEDURE

Demonstration circuit 1470A is easy to set up to evaluate the performance of the LT3743. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to PV_{IN} and GND. The input power supply should have a current limit of 10A or more.
2. With power off, connect a LED between VOUT and GND or between VOUT and LED- if fast rise time is to be verified. When returning LED to LED-, R25 needs to be populated. To check voltage across R25, the best set up is to solder a short 50Ω coax cable across R25. Connect the other end of the cable directly into a BNC connector on an oscilloscope. A less perfect but easier set up is to touch the probe tip directly across the IS+ and IS- terminals with out the probe ground wire. See Figure 2 for setup. The latter set up tends to have more noise but is ok for non-critical measurements. The LED connecting wires should be as short as possible, 1 inch total being ideal.
3. Turn on the power at the input.
4. At this time, the output current will be slightly below 5A. If no output current is observed, turn off PV_{IN} and check the connections.
5. To increase the load current to 20A, turn off PV_{IN}. Pull CTRL_SEL high either by populating R21 or by using an external voltage source. Make sure the load can handle 20A continuously and the load voltage is not too high for the board. Then turn on PV_{IN}.
6. Both the low current level, 5A and the high current level 20A can be adjusted by changing the voltage on CTRL_L and CTRL_H terminals between 0V and 2V.
7. To evaluate the transient between 0A and a non-zero current level, apply a PWM signal to the PWM terminal. The non-zero current level is dictated by the CTRL_SEL and CTRL_H or CTRL_L voltages.
8. To evaluate the transient between two non-zero current levels, apply a PWM signal to the CTRL_SEL terminal.
9. To modify the demo board for other applications, please contact Linear Applications Group for help.

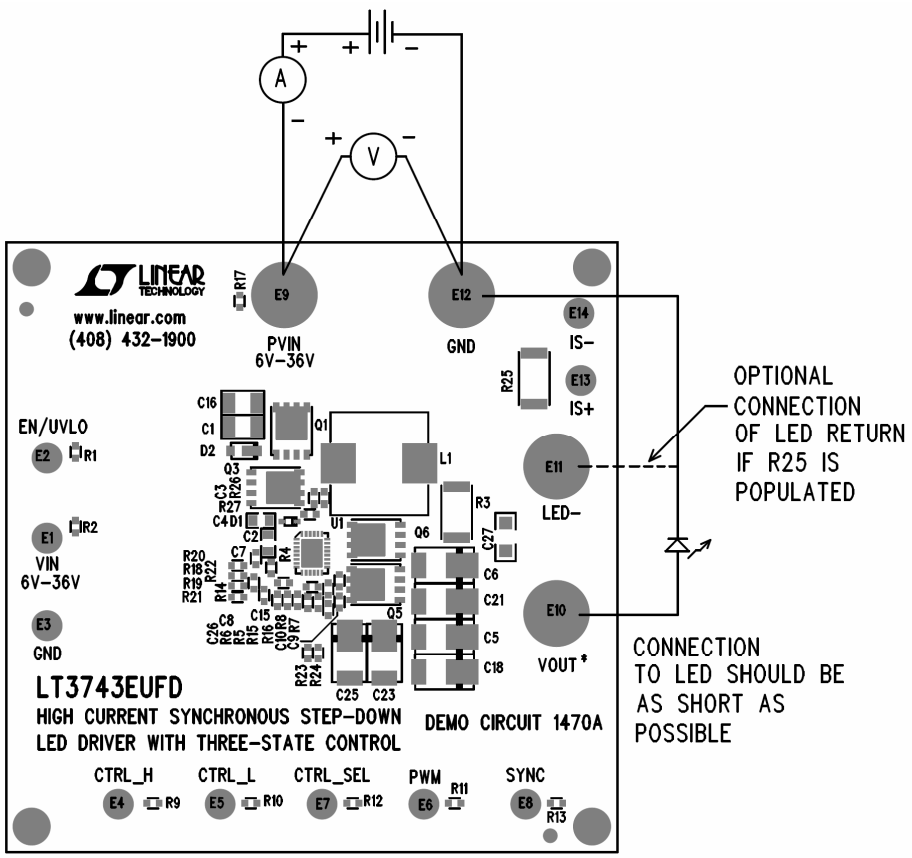


Figure 1. Proper Measurement Equipment Setup

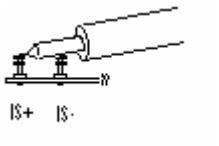
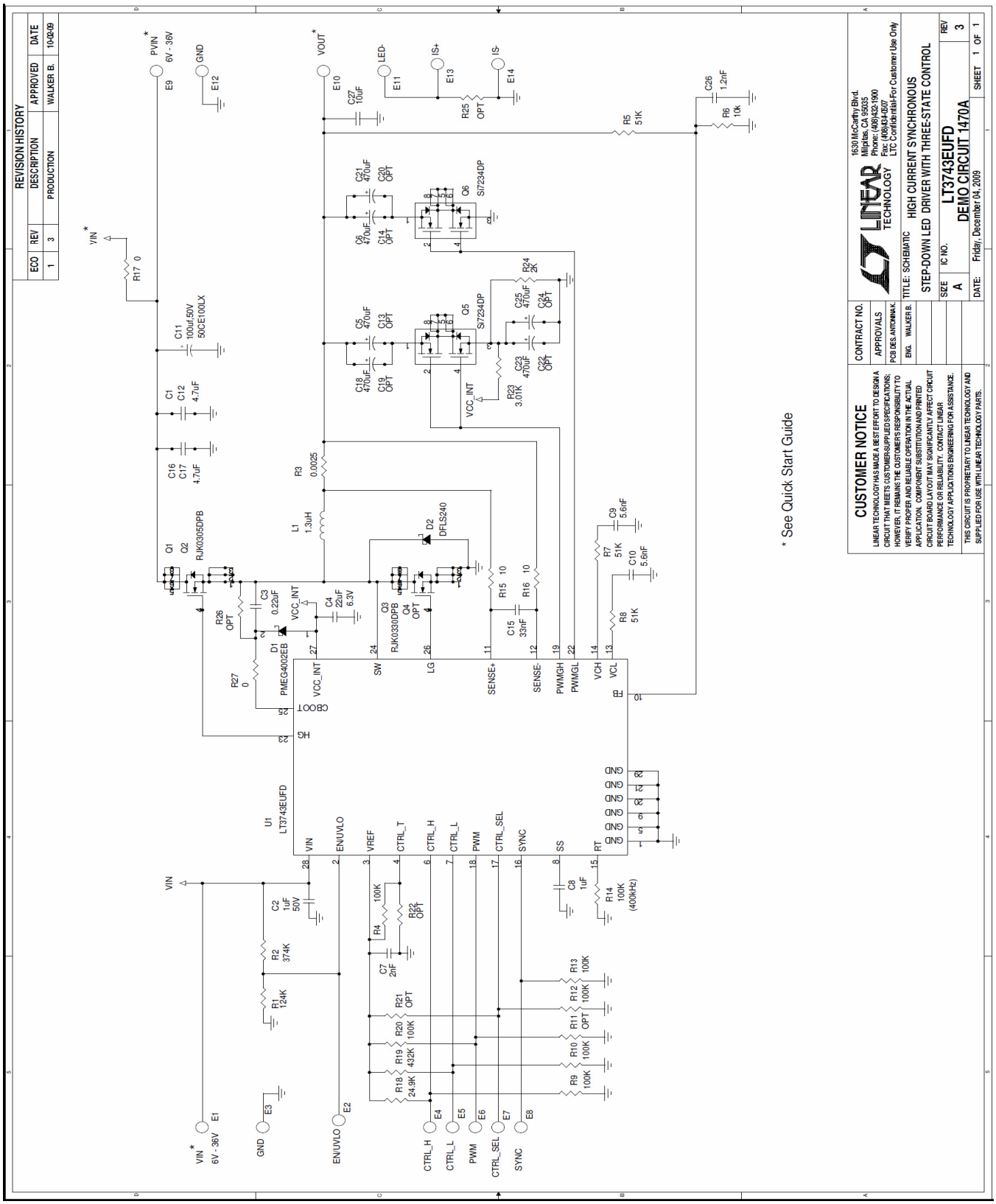


Figure 2. Measuring Voltage Across R25


REVISION HISTORY
ECO REV DESCRIPTION APPROVED DATE
1 3 PRODUCTION WALKER B. 10/02/09
* See Quick Start Guide
CUSTOMER NOTICE
LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.
THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.
CONTRACT NO.
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LTC Confidential-For Customer Use Only
TITLE: SCHEMATIC
HIGH CURRENT SYNCHRONOUS
STEP-DOWN LED DRIVER WITH THREE-STATE CONTROL
SIZE
A
IC NO.
LT3743EUFD
DEMO CIRCUIT 1470A
REV
3
DATE:
Friday, December 04, 2009
SHEET 1 OF 1
U1
LT3743EUFD
VIN
ENUVLO
VREF
CTRL_T
CTRL_H
CTRL_L
PWM
CTRL_SEL
SYNC
SS
RT
GND
HG
CBOOT
SW
LG
SENSE+
SENSE-
PWMGH
PWMGL
VCH
VCL
FB
VCC_INT
PVIN*
6V - 36V
VOUT*
LED-
IS+
IS-
VIN*
GND
CTRL_H
CTRL_L
PWM
CTRL_SEL
SYNC
ENUVLO
RJK0305DPB
RJK0330DPB
PMEG4002EB
DFLS240
Si7234DP
R1 124K
R2 374K
R3 0.0025
R4 100K
R5 51K
R6 10k
R7 51K
R8 51K
R9 100K
R10 100K
R11 OPT
R12 100K
R13 100K
R14 100K (400kHz)
R15 10
R16 10
R17 0
R18 24.9K
R19 432K
R20 100K
R21 OPT
R22 OPT
R23 3.01K
R24 2K
R25 OPT
R26 OPT
R27 0
C1 C12 4.7uF
C2 1uF 50V
C3 0.22uF
C4 22uF 6.3V
C5 470uF
C6 470uF
C7 2nF
C8 1uF
C9 5.6nF
C10 5.6nF
C11 100uf,50V 50CE100LX
C15 33nF
C16 C17 4.7uF
C18 470uF
C21 470uF
C23 470uF
C25 470uF
C26 1.2nF
C27 10uF
L1 1.3uH