DEMO CIRCUIT 1102
QUICK START GUIDE

LT3476 and LT3003
Quadruple High Power LED Driver with Ballaster in Buck Mode

WARNING!
DO NOT LOOK AT OPERATING LED.
This circuit produces light that can damage eyes.

DESCRIPTION

Demonstration circuit 1102 is a Quadruple High Power LED Driver with Ballaster in Buck Mode featuring the LT3476 and LT3003. The demo board steps down PVIN to a proper level in order to generate required current for LED loads. PVIN can be up to 33V. All the four LT3476 channels are independent. Each of the four channels can drive 3 LED strings using one LT3003. The total number of strings the demo circuit can drive is 12. The LT3003 is a three string LED current ballaster. It offers high efficiency and good current matching. VIN is for the LT3476 bias. To reduce power dissipation on the chip, use a low voltage, such as 3.3V, for VIN.

The demo circuit operates at 1MHz, offering good balance between small solution size and high efficiency. The number of LEDs the circuit can drive depends on the LED forward voltage and PVIN. At 1MHz, the circuit can drive up to 26V worth of LED string voltage at 1A per channel. If the LED current is low and the LT3476 operates at a low duty cycle, the circuit may skip pulses. Pulse skipping is not harmful in most cases. Populating C14-C17 with 1-10pF capacitors can usually prevent skipping pulses.

PWM dimming offers better LED color integrity than the DC dimming. At 100Hz PWM frequency, 1000:1 dimming ratio can be achieved with this demo circuit.

Other current levels and/or circuit configurations can be achieved with simple modifications. Please consult the datasheets or the factory for customization details.

The LT3476 and the LT3003 datasheets give complete description of the part, operation and application information. The datasheets must be read in conjunction with this quick start guide for working on or modifying the demo circuit 1102.

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

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
PVIN	Power Input Supply				33	V
VIN	Input Supply		3		16	V
Fs	Switching Frequency			1		MHz
M	Number of Channels			4		
N	Number of LED Strings per Channel			3		N/A
I_{OUT}	LED Current per String			333		mA
$I_{OUT\ TOTAL}$	Total LED Current per Channel			1000		mA
η	Efficiency	PVIN=33V, VIN=3.3V, 3 LED strings per channel, 8 white LEDs per string, 333mA/string		87		%

QUICK START PROCEDURE

Demonstration circuit 1102 is easy to set up to evaluate the performance of the LT3476 and LT3003. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. With power off, connect an input power supply to VIN and GND. The maximum rating is 16V. To achieve highest efficiency, a low voltage, such as 3.3V, is recommended.
2. With power off, connect a second input power supply to PVIN and GND. The maximum PVIN is 33V.
3. With power off, connect PWM1, PWM2, PWM3, and PWM4 to VIN. If an output *n* is not used, the PWM*n* should be grounded.
4. With power off, connect three LED strings to a channel interested. Connect all anodes of the LED strings to LED*n+*. Connect the cathodes of the three LED strings to the LED*n-x* respectively, where *x* is the LED string number. All four channels can operate simultaneously or individually.
5. Turn on PVIN power supply.
6. Turn on VIN power supply.
7. Check for the proper LED current and LED string voltage.

   NOTE. If there is no LED current, turn off the power supplies. Check all connections and LEDs.
8. Once the proper output current/voltage are established, adjust the parameters within the operating range and observe the output current regulation, efficiency and other parameters.
9. To observe PWM dimming, turn off all power supplies. Disconnect PWM*n* from VIN. Connect the PWM*n* to a pulse generator. Turn on all supplies. Then repeat step 7-8.

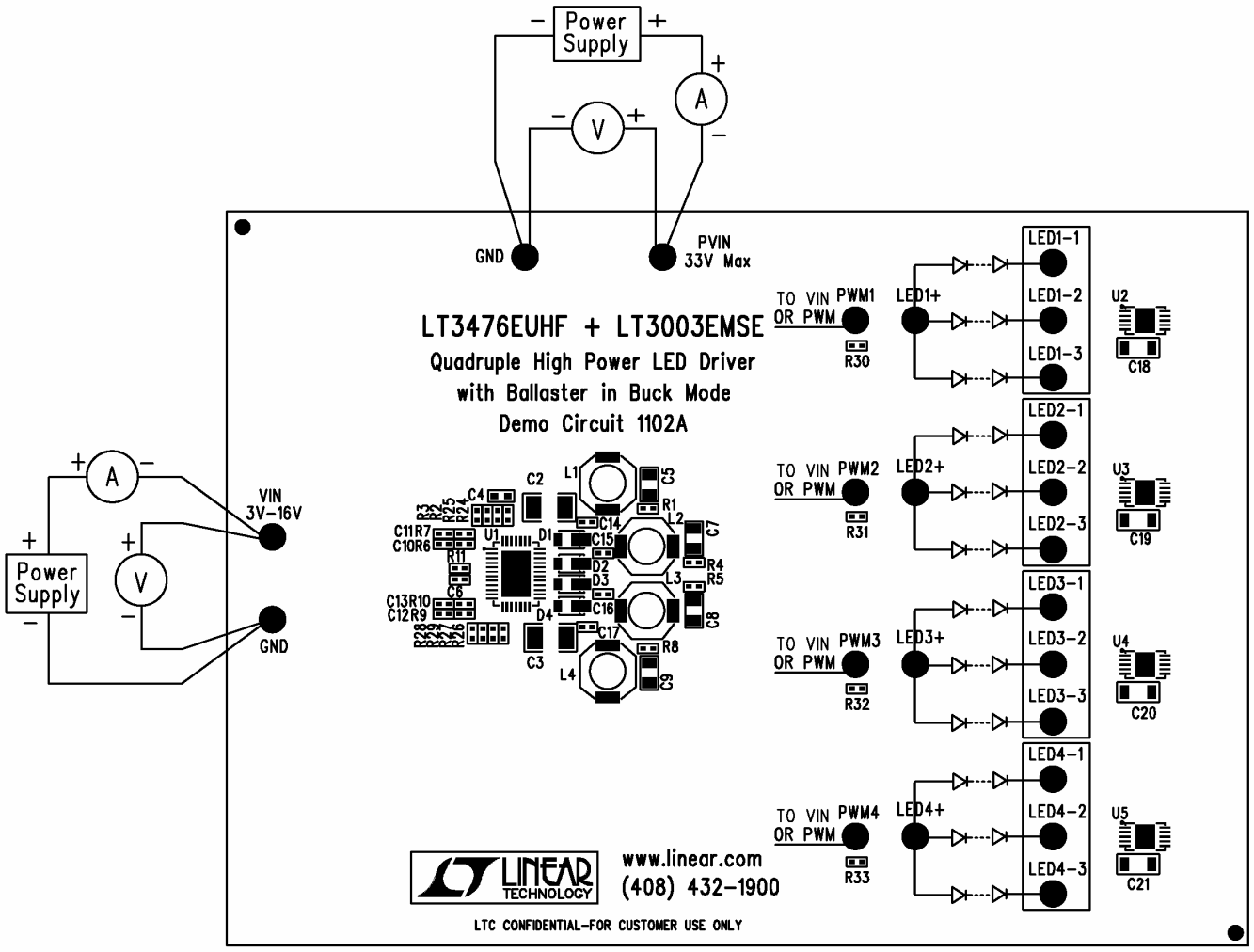
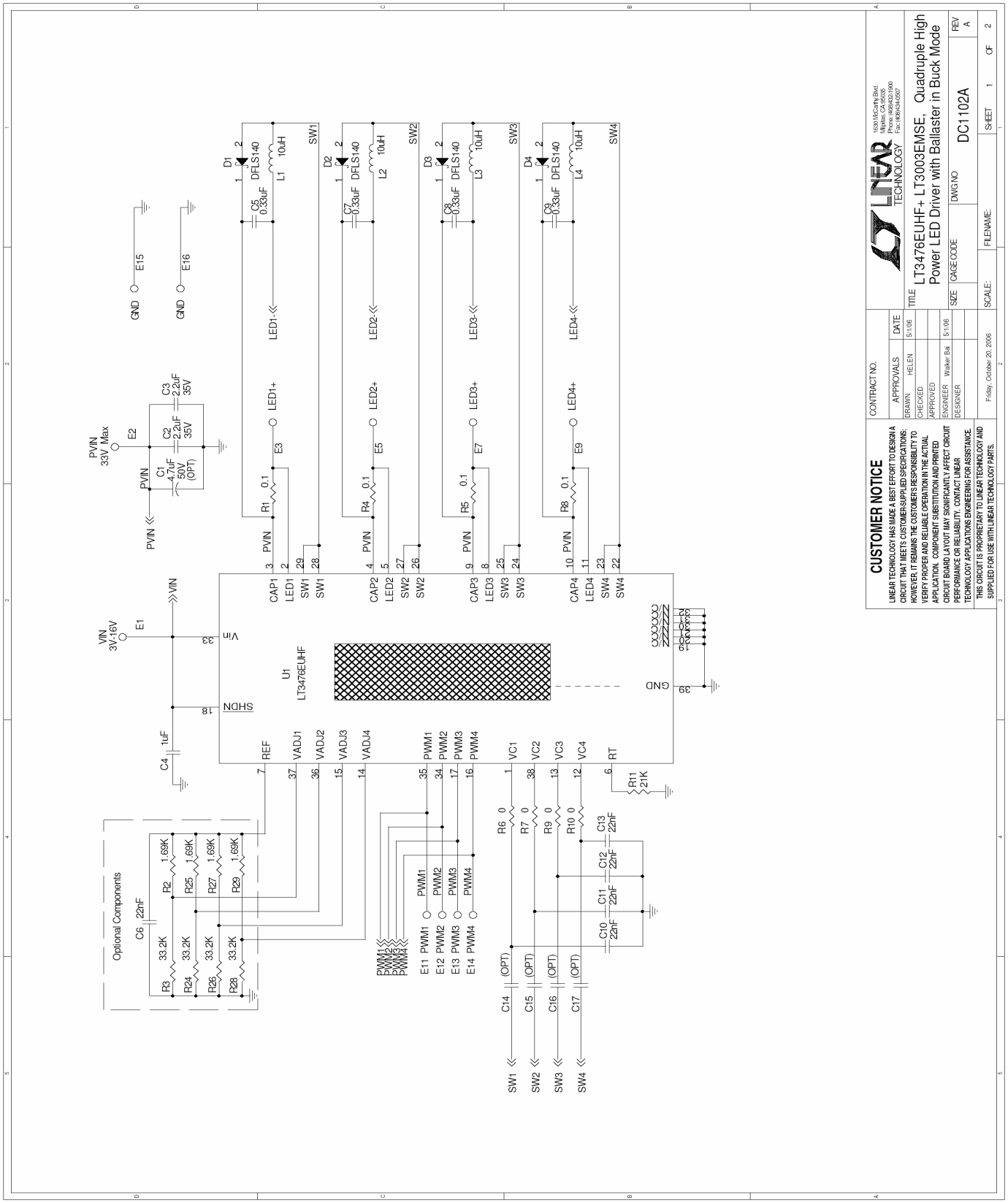
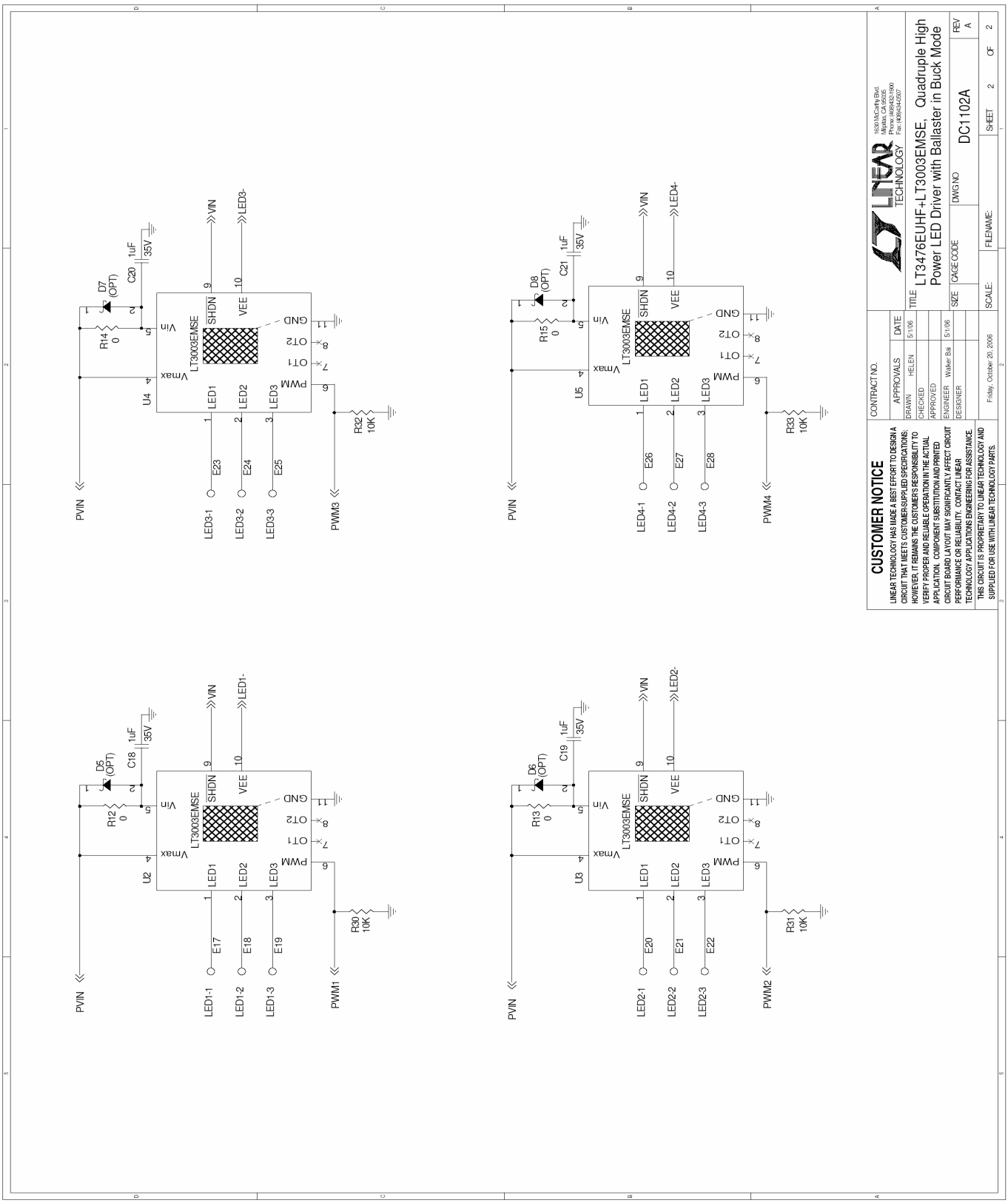


Figure 1. Proper Measurement Equipment Setup


LT3476EUHF+ LT3003EMSE, Quadruple High Power LED Driver with Ballaster in Buck Mode
DC1102A
LINEAR TECHNOLOGY
CUSTOMER NOTICE
Optional Components
U1
LT3476EUHF
PVIN 33V Max
VIN 3V-16V
GND
SHDN
REF
VADJ1
VADJ2
VADJ3
VADJ4
PWM1
PWM2
PWM3
PWM4
VC1
VC2
VC3
VC4
RT
CAP1
CAP2
CAP3
CAP4
LED1
LED2
LED3
LED4
SW1
SW2
SW3
SW4
LED1+
LED2+
LED3+
LED4+
LED1-
LED2-
LED3-
LED4-
DFLS140
10uH
0.33uF
4.7uF
2.2uF
1uF
22nF
1.69K
33.2K
21K
0.1


U4
U5
U2
U3
LT3003EMSE
Vmax
Vin
SHDN
VEE
GND
OT2
OT1
PWM
LED1
LED2
LED3
D7 (OPT)
D8 (OPT)
D5 (OPT)
D6 (OPT)
C20 1uF 35V
C21 1uF 35V
C18 1uF 35V
C19 1uF 35V
R14 0
R15 0
R12 0
R13 0
R32 10K
R33 10K
R30 10K
R31 10K
PVIN
VIN
LED3-
LED4+
LED1-
LED2-
LED3-1
LED3-2
LED3-3
LED4-1
LED4-2
LED4-3
LED1-1
LED1-2
LED1-3
LED2-1
LED2-2
LED2-3
E23
E24
E25
E26
E27
E28
E17
E18
E19
E20
E21
E22
PWM3
PWM4
PWM1
PWM2
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.
APPROVALS
DATE
DRAWN HELEN 5/1/06
CHECKED
APPROVED
ENGINEER Walker Bai 5/1/06
DESIGNER
SCALE:
Friday, October 20, 2006
TITLE
LT3476EUHF+LT3003EMSE, Quadruple High Power LED Driver with Ballaster in Buck Mode
SIZE
CAGE CODE
DWG NO
DC1102A
REV A
FILENAME:
SHEET 2 OF 2

Linear Technology Corporation

LT3476EUHF+LT3003EMSE

Bill Of Material
Demo Bd. # 1102A
11/7/2006

Item	*Qty*	*Reference*	*Part Description*	*Manufacturer / Part #*
		REQUIRED CIRCUIT COMPONENTS:		
1	2	C2,C3	Cap., X5R, 2.2uF, 35V, 10%, 1210	TAIYO YUDEN, GMK325BJ225KAT
2	1	C4	Cap., X7R, 1uF, 16V, 10%, 0603	TDK, C1608X7R1C105K
3	4	C5,C7,C8,C9	Cap., X5R, 0.33uF, 35V, 20%, 0805	TAIYO YUDEN, GMK212BJ334MG-T
4	5	C6, C10 -C13	CAP., X7R, 22nF, 16V, 10%, 0402	AVX, 0402YC223KAT
5	4	C18-C21	CAP., X7R, 1uF, 35V, 10%, 1206	TAIYO YUDEN, GMK316BJ105KL
6	4	D1,D2,D3,D4	SCHOTTKY DIODES, PowerDI123	DIODES INC, DFLS140-7
7	4	L1,L2,L3,L4	INDUCTOR.,10uH	TOKO, #A916CY-100M=P3
8	4	R1,R4,R5,R8	RES., CHIP, 0.1, 1/8W, 1% ,0402	PANASONIC, ERJ-2BSFR10X
9	4	R2,R25,R27,R29	RES., CHIP, 1.69K, 1/16W, 1% ,0402	VISHAY, CRCW04021k69FKED
10	4	R3,R24,R26,R28	RES., CHIP, 33.2K, 1/16W, 1% ,0402	AAC, CR05-3322FM
11	1	R11	RES., CHIP, 21K, 1/16W, 1% ,0402	AAC, CR05-2102FM
12	1	U1	I.C LT3476EUHF#PBF,5mmX7mm,QFN	LINEAR TECH., LT3476EUHF#PBF
13	4	U2-U5	I.C LT3003EMSE#PBF,10-lead, MSOP	LINEAR TECH., LT3003EMSE#PBF
		ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:		
1	1	C1	Cap., TANT, 4.7uF, 50V, 10%, 7343	AVX, TAJD475K050R
2	0	C14-C17 (OPT)	Cap., 0402	
3	8	R6,R7,R9,R10,R12-R15	RES., CHIP, 0, 1/16W, ,0402	AAC, CJ05-000M
4	4	D5-D8	Zener Voltage Regulator,500mW, SOD-123	ON SEMICONDUCTOR, MMSZ5245BT1
5	4	R30-R33	RES., CHIP, 10K, 1/16W, 1% ,0402	VISHAY, CRCW040210K0F
		HARDWARE-FOR DEMO BOARD ONLY:		
1	28	E1-E3, E5,E7,E9,E11-E28	TESTPOINT, TURRET, .065"	MILL-MAX, 2308-2-00-80-00-00-07-00