

# LTM8042, LTM8042-1 1A, 350mA $\mu$ Module LED Driver

## DESCRIPTION

Demonstration circuits 1511A-A and 1511A-B feature the LTM<sup>®</sup>8042 and the LTM8042-1, which are respectively complete 1A and 350mA  $\mu$ Module LED drivers. The demonstration circuits are assembled as boost topologies, accepting an input voltage from 3V to 30V and supporting an output up to 32V (see Table 1). The default switching frequency is 600kHz for DC1511A-A and 950kHz for DC1511A-B, but can be adjusted by changing the value of RT.

DC1511A is easily configured to support other features, including PWM dimming, analog dimming, buck-boost mode and buck mode (step-down). DC1511A includes a

P-channel MOSFET that is necessary for PWM dimming. The R<sub>ADJ</sub> pin/terminal voltage controls the output current. Voltage is either applied directly to the terminal or set by a divider that includes resistor R<sub>ADJ</sub> and the LTM8042's internal 2V reference and divider resistor. Open LED over-voltage protection is also included. Consult the LTM8042/LTM8042-1 datasheet for further information on how to properly use or modify the circuit.

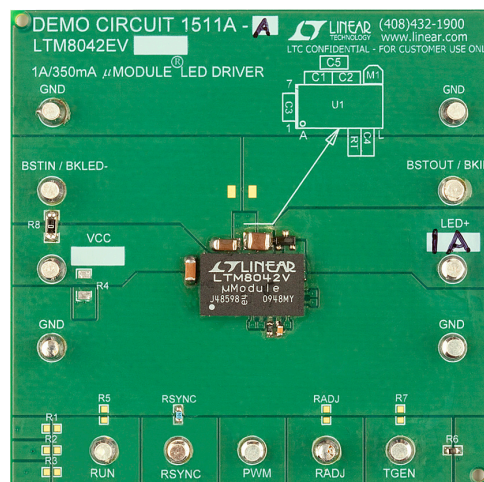
**Design files for this circuit board are available at <http://www.linear.com/demo>**

LT, LT, LTC, LTM,  $\mu$ Module, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

## PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

PARAMETER	CONDITIONS/NOTES	VALUE
Input Voltage Range, V <sub>IN</sub> (BSTIN)		3V to 30V (See Table 1)
I <sub>LED</sub>	DC1511A-A (LTM8042) DC1511A-B (LTM8042-1) Current Derating May Be Necessary Under Certain V <sub>IN</sub> , V <sub>OUT</sub> , Frequency and Thermal Conditions	1A 350mA
Switching Frequency	RT = 30.1k (DC1511A-A) RT = 16.9k (DC1511A-B)	600kHz 950kHz
Maximum Output Voltage (Open LED Voltage)		36V
Efficiency	V <sub>IN</sub> = 12V, V <sub>LED</sub> = 16.7V, I <sub>LED</sub> = 1A V <sub>IN</sub> = 12V, V <sub>LED</sub> = 24.8V, I <sub>LED</sub> = 350mA	91.5% (See Figure 2) 89% (See Figure 3)

## BOARD PHOTO



## QUICK START PROCEDURE

Demonstration circuit 1511A is easy to set up to evaluate the performance of the LTM8042EV/LTM8042EV-1. Refer to Figure 1 for the proper measurement equipment set-up and follow the procedure below for a boost (step-up) topology.

1. Connect a string of LEDs with forward voltage 32V or less, but greater than the input voltage, to the LED<sup>+</sup> (LED anode) and GND (LED cathode) terminals on the PCB, as shown in Figure 1.
2. With the power off, connect the input power supply to the BSTIN/BKLED<sup>-</sup> and GND terminals within the ranges specified in Table 1. Preset the DC input voltage within the recommended input voltage range for the appropriate forward voltage of the LED string.

**Table 1. Input Range for Proper Operation (Refer to the LTM8042/LTM8042-1 Datasheet)**

DC1511A-A LTM8042		DC1511A-B LTM8042-1	
INPUT VOLTAGE (BSTIN/BKLED <sup>-</sup> TO GND)	LED STRING VOLTAGE (LED <sup>+</sup> TO GND)	INPUT VOLTAGE (BSTIN/BKLED <sup>-</sup> TO GND)	LED STRING VOLTAGE (LED <sup>+</sup> TO GND)
5V to 5.8V	6V to 9V	3.2V to 7V	8V to 12V
6.4V to 7.7V	8V to 12V	4.1V to 10V	12V to 16V
8.6V to 11.3V	12V to 16V	4.8V to 12.3V	15V to 21V
11.3V to 13.8V	15V to 21V	5.8V to 15V	18V to 24V
13.4V to 16.5V	18V to 24V	8.5V to 20.8V	24V to 32V
20.5V to 22.5V	24V to 32V		

3. Connect the PWM terminal. If PWM is not used, connect PWM to a 5V source or to the input voltage. PWM must be pulled high or the LEDs will remain off.
4. Turn the input power supply on.
5. Observe the LED string running at the programmed LED current.
6. For PWM dimming, connect a PWM 100Hz or higher frequency signal to the PWM terminal.
7. Observe the reduction of brightness in the LED string by varying the duty cycle of the PWM signal.

To use the DC1511A in a buck-boost mode topology, make the following modifications to the procedure.

1. At step 1, connect the cathode of the LED string to the BSTIN/BKLED<sup>-</sup> terminal. The LED forward voltage may be greater than the input voltage for buck-boost mode.
2. At step 2, refer to the datasheet buck-boost mode applications information table. Preset the DC input voltage within the recommended input voltage range for the appropriate forward voltage and current of the LED string.

To use the DC1511A in a buck mode (step-down) topology, make the following modifications to the procedure.

1. Remove the 0Ω jumper at location R8 and instead install the jumper at location R4. This shorts the V<sub>CC</sub>, TGEN and RUN pins/terminals to BSTOUT/BKIN instead of BSTIN/BKLED<sup>-</sup>.
2. At step 1, connect the cathode of the LED string to the BSTIN/BKLED<sup>-</sup> terminal. The LED forward voltage must be less than the input voltage for buck mode.
3. At step 2, connect the input power supply to BSTOUT/BKIN and GND. Refer to the datasheet buck mode applications information table. Preset the DC input voltage within the recommended input voltage range for the appropriate forward voltage and current of the LED string.

## QUICK START PROCEDURE

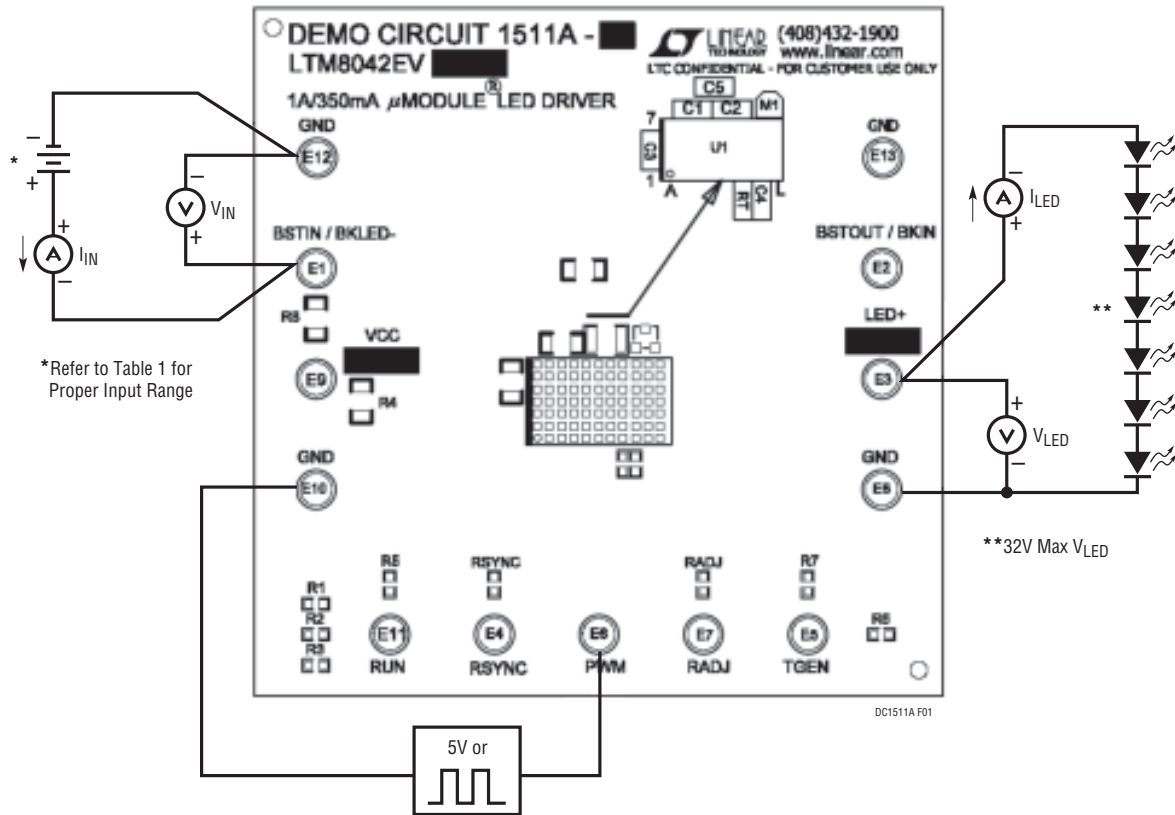


Figure 1. Proper Measurement Equipment Set-Up (Boost Topology)

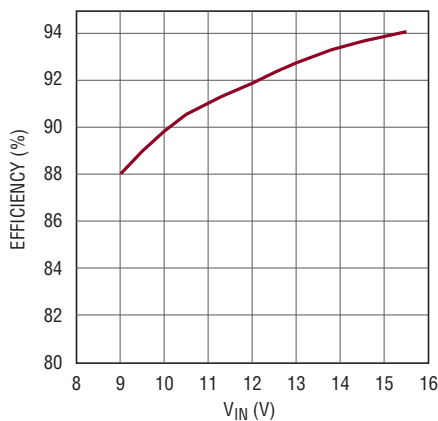


Figure 2. DC1511A-A Efficiency vs  $V_{IN}$  Boost Operation, 16.7V at 1A LED String

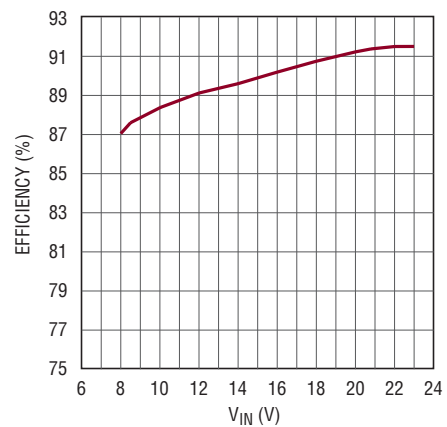


Figure 3. DC1511A-B Efficiency vs  $V_{IN}$  Boost Operation, 24.8V at 350mA LED String

# DEMO MANUAL DC1511A

## PARTS LIST

### LTM8042EV

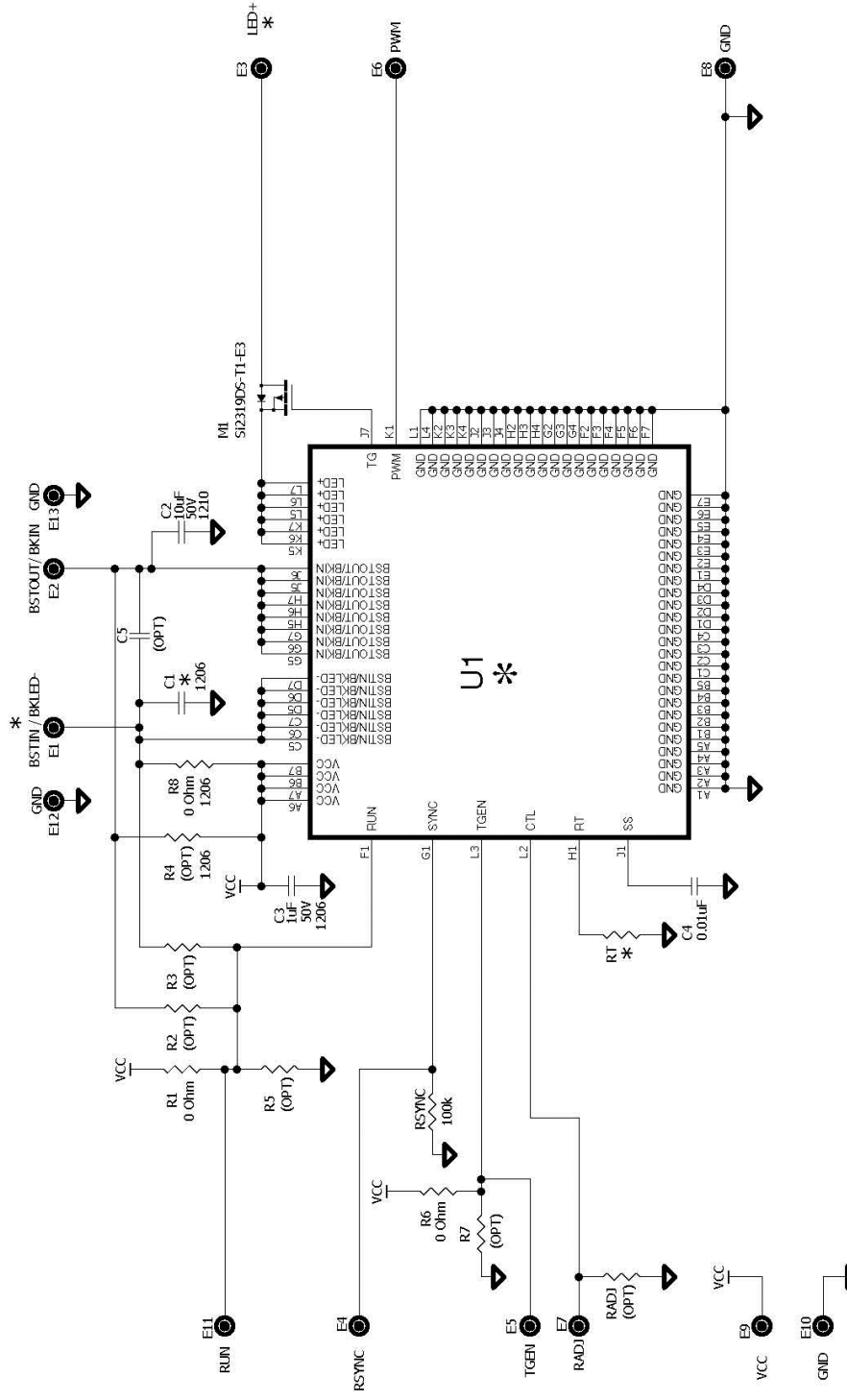
ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	C1	Cap., X5R, 4.7 $\mu$ F, 50V, 20%, 1206	Taiyo Yuden UMK316BJ475ML-T
2	1	C2	Cap., X5R, 10 $\mu$ F, 50V, 20%, 1210	Taiyo Yuden UMK325BJ106MM-T
3	1	C4	Cap., X7R, 0.01 $\mu$ F, 25V, 10%, 0603	AVX 06033C103KAT2A
4	1	RT	Res., Chip, 30.1k, 0.06W, 1%, 0603	NIC NRC06F3012TRF
5	1	U1	I.C., LED Driver, LGA (77), 15mm $\times$ 9mm $\times$ 4.32mm	Linear Technology Corporation LTM8042EV
<b>Additional Demo Board Circuit Components</b>				
1	1	C3	Cap., X5R, 1 $\mu$ F, 50V, 20%, 1206	TDK C3216X5R1H105M
2	0	C5 (OPT)	Cap., 1206	
3	0	R <sub>ADJ</sub> , R2, R3, R5, R7 (OPT)	Res., 0603	
4	1	R <sub>SYNC</sub>	Res., Chip, 100k, 0.06W, 5%, 0603	NIC NRC06J104TRF
5	2	R1, R6	Res./Jumper, Chip, 0 $\Omega$ , 1/16W, 1A, 0603	Vishay CRCW06030000Z0EA
6	0	R4 (OPT)	Res., 1206	
7	1	R8	Res./Jumper, Chip, 0 $\Omega$ , 1/4W, 1A, 1206	Vishay CRCW12060000Z0EA
8	1	M1	P-Channel MOSFET, 40V, SOT-23	Vishay Si2319DS-T1-E3 #PBF
<b>Hardware, for Demo Board Only</b>				
1	13	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13	Turret, Testpoint 0.094"	Mill-Max 2501-2-00-80-00-00-07-0

### LTM8042EV-1

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	C1	Cap., X5R, 2.2 $\mu$ F, 50V, 20%, 1206	Taiyo Yuden UMK316BJ225MD-T
2	1	C2	Cap., X5R, 10 $\mu$ F, 50V, 20%, 1210	Taiyo Yuden UMK325BJ106MM-T
3	1	C4	Cap., X7R, 0.01 $\mu$ F, 25V, 10%, 0603	AVX 06033C103KAT2A
4	1	RT	Res., Chip, 16.9k, 0.06W, 1%, 0603	Vishay CRCW060316K9FKEA
5	1	U1	I.C., LED Driver, LGA (77), 15mm $\times$ 9mm $\times$ 4.32mm	Linear Technology Corporation LTM8042EV-1
<b>Additional Demo Board Circuit Components</b>				
1	1	C3	Cap., X5R, 1 $\mu$ F, 50V, 20%, 1206	TDK C3216X5R1H105M
2	0	C5 (OPT)	Cap., 1206	
3	0	R <sub>ADJ</sub> , R2, R3, R5, R7 (OPT)	Res., 0603	
4	1	R <sub>SYNC</sub>	Res., Chip, 100k, 0.06W, 5%, 0603	NIC NRC06J104TRF
5	2	R1, R6	Res./Jumper, Chip, 0 $\Omega$ , 1/16W, 1A, 0603	Vishay CRCW06030000Z0EA
6	0	R4 (OPT)	Res., 1206	
7	0	R8	Res./Jumper, Chip, 0 $\Omega$ , 1/4W, 1A, 1206	Vishay CRCW12060000Z0EA
8	1	M1	P-Channel MOSFET, 40V, SOT-23	Vishay Si2319DS-T1-E3 #PBF
<b>Hardware, for Demo Board Only</b>				
1	13	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13	Turret, Testpoint, 0.094"	Mill-Max 2501-2-00-80-00-00-07-0

**SCHEMATIC DIAGRAM**

REVISION HISTORY				
ECO	REV	DESCRIPTION	APPROVED	DATE
-	2	PRODUCTION	KEITH S.	05-12-10



ASSY	U1	BSTIN / BKLED-	ILED	RT	C1
-A	LTM8042EV	SEE QUICK START GUIDE FOR INPUT RANGE	1A	30.1k	4.7uF
-B	LTM8042EV-1		350mA	16.9k	2.2uF

**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.  
C:\PADS\PROJECTS\1511A\SCH\1511A\_00\_REV3.DSN  
 THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

**APPROVALS**

PCB DES	KEITH S.
APP ENG	KEITH S.

**LINEAR TECHNOLOGY**  
 1630 McCarthy Blvd.  
 Milpitas, CA 95035 www.linear.com  
 Phone: (408)432-1900  
 Fax: (408)434-0507  
LTC CONFIDENTIAL - FOR CUSTOMER USE ONLY

**1A/350mA μMODULE LED DRIVER**

SIZE	IC NO.	REV.
N/A	LTM8042EV/LTM8042EV-1	3

**DEMO CIRCUIT 1511A**

Friday, August 06, 2010

SCALE = NONE	SHEET 1 OF 1
--------------	--------------

- NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTORS ARE IN OHMS, 0603.
  2. ALL CAPACITORS ARE IN MICROFARAD, 0603.



Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

# DEMO MANUAL DC1511A

---

## DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

**Please read the DEMO BOARD manual prior to handling the product.** Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation