# LTM8042, LTM8042-1
# 1A, 350mA µModule LED Driver

## DESCRIPTION

Demonstration circuits 1511A-A and 1511A-B feature the LTM®8042 and the LTM8042-1, which are respectively complete 1A and 350mA µModule 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 RADJ pin/terminal voltage controls the output current. Voltage is either applied directly to the terminal or set by a divider that includes resistor RADJ and the LTM8042's internal 2V reference and divider resistor. Open LED overvoltage 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**

## PERFORMANCE SUMMARY Specifications are at $T_A$ = 25°C

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

## BOARD PHOTO



dc1511af
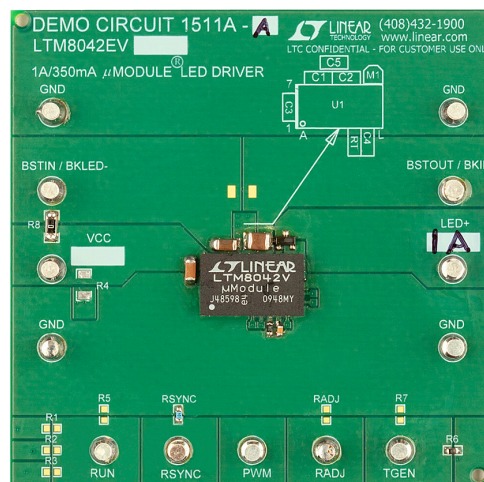
# QUICK START PROCEDURE

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+ (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− 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− TO GND) | LED STRING VOLTAGE (LED+ TO GND) | INPUT VOLTAGE (BSTIN/BKLED− TO GND) | LED STRING VOLTAGE (LED+ 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− 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 $V_{CC}$, TGEN and RUN pins/terminals to BSTOUT/BKIN instead of BSTIN/BKLED−.

2. At step 1, connect the cathode of the LED string to the BSTIN/BKLED− 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.
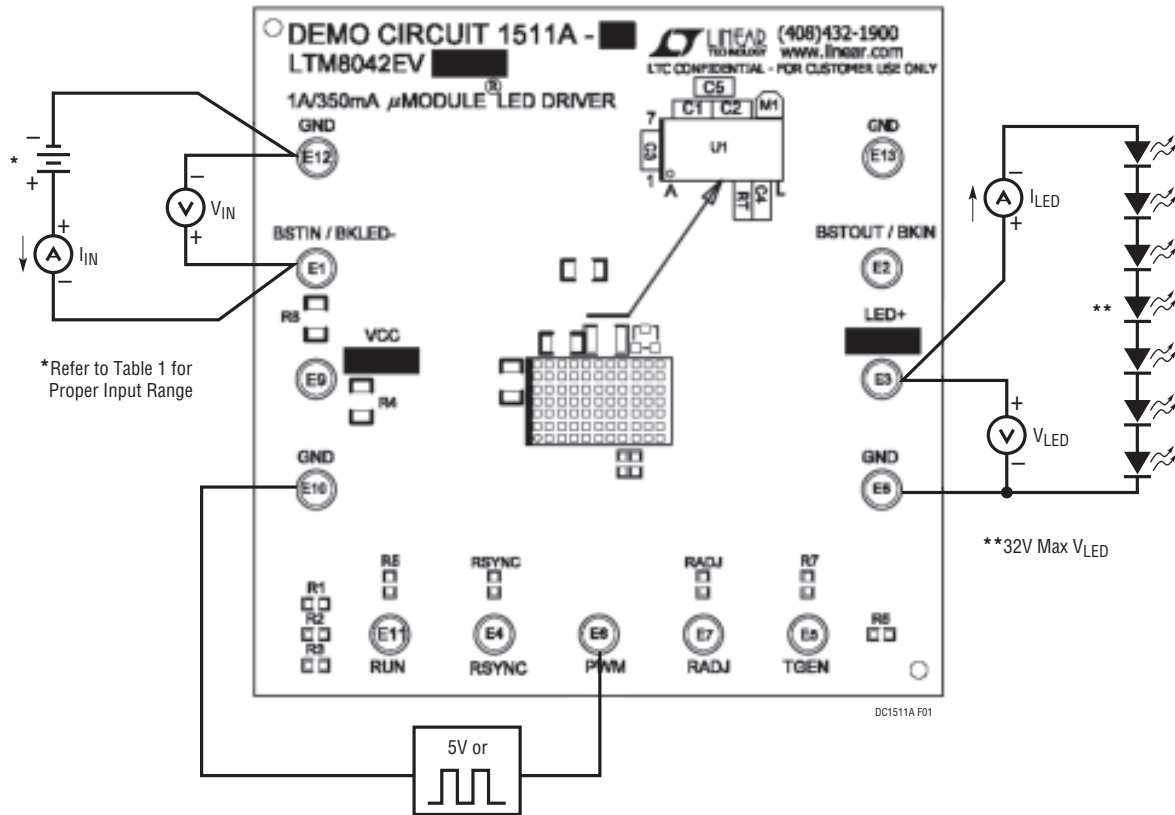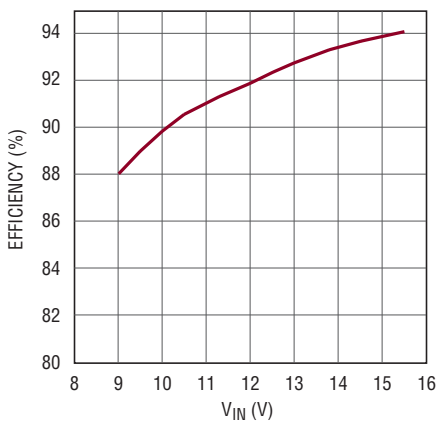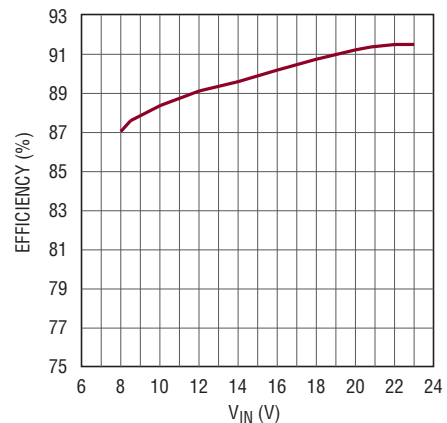
# QUICK START PROCEDURE



**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**

## PARTS LIST

**LTM8042EV**

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|------|-----|-----------|------------------|--------------------------|
| **Required Circuit Components** | | | | |
| 1 | 1 | C1 | Cap., X5R, 4.7µF, 50V, 20%, 1206 | Taiyo Yuden UMK316BJ475ML-T |
| 2 | 1 | C2 | Cap., X5R, 10µF, 50V, 20%, 1210 | Taiyo Yuden UMK325BJ106MM-T |
| 3 | 1 | C4 | Cap., X7R, 0.01µF, 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 × 9mm × 4.32mm | Linear Technology Corporation LTM8042EV |
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 1 | C3 | Cap., X5R, 1µF, 50V, 20%, 1206 | TDK C3216X5R1H105M |
| 2 | 0 | C5 (OPT) | Cap., 1206 | |
| 3 | 0 | $R_{ADJ}$, R2, R3, R5, R7 (OPT) | Res., 0603 | |
| 4 | 1 | $R_{SYNC}$ | Res., Chip, 100k, 0.06W, 5%, 0603 | NIC NRC06J104TRF |
| 5 | 2 | R1, R6 | Res./Jumper, Chip, 0Ω, 1/16W, 1A, 0603 | Vishay CRCW06030000Z0EA |
| 6 | 0 | R4 (OPT) | Res., 1206 | |
| 7 | 1 | R8 | Res./Jumper, Chip, 0Ω, 1/4W, 1A, 1206 | Vishay CRCW12060000Z0EA |
| 8 | 1 | M1 | P-Channel MOSFET, 40V, SOT-23 | Vishay Si2319DS-T1-E3 #PBF |
| **Hardware, for Demo Board Only** | | | | |
| 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 |
|------|-----|-----------|------------------|--------------------------|
| **Required Circuit Components** | | | | |
| 1 | 1 | C1 | Cap., X5R, 2.2µF, 50V, 20%, 1206 | Taiyo Yuden UMK316BJ225MD-T |
| 2 | 1 | C2 | Cap., X5R, 10µF, 50V, 20%, 1210 | Taiyo Yuden UMK325BJ106MM-T |
| 3 | 1 | C4 | Cap., X7R, 0.01µF, 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 × 9mm × 4.32mm | Linear Technology Corporation LTM8042EV-1 |
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 1 | C3 | Cap., X5R, 1µF, 50V, 20%, 1206 | TDK C3216X5R1H105M |
| 2 | 0 | C5 (OPT) | Cap., 1206 | |
| 3 | 0 | $R_{ADJ}$, R2, R3, R5, R7 (OPT) | Res., 0603 | |
| 4 | 1 | $R_{SYNC}$ | Res., Chip, 100k, 0.06W, 5%, 0603 | NIC NRC06J104TRF |
| 5 | 2 | R1, R6 | Res./Jumper, Chip, 0Ω, 1/16W, 1A, 0603 | Vishay CRCW06030000Z0EA |
| 6 | 0 | R4 (OPT) | Res., 1206 | |
| 7 | 0 | R8 | Res./Jumper, Chip, 0Ω, 1/4W, 1A, 1206 | Vishay CRCW12060000Z0EA |
| 8 | 1 | M1 | P-Channel MOSFET, 40V, SOT-23 | Vishay Si2319DS-T1-E3 #PBF |
| **Hardware, for Demo Board Only** | | | | |
| 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



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

| ASSY | U1 | BSTIN / BKLED- | | |
|------|-----|-----|-----|-----|
| | | SEE QUICK START GUIDE FOR INPUT RANGE | | |
| -A | LTM8042EV | | | |
| -B | LTM8042EV-1 | | | |

| | ILED | RT | C1 |
|---|------|-----|-----|
| | 1A | 30.1k | 4.7uF |
| | 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.

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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

1A/350mA μ MODULE® LED DRIVER

IC NO. LTM8042EV/LTM8042EV-1 DEMO CIRCUIT 1511A

REV. 3

SIZE N/A

SHEET 1 OF 1

DATE: Friday, August 06, 2010

| APPROVALS | |
|-----------|---|
| PCB DES. | RB |
| APP ENG. | KEITH S. |

SCALE = NONE

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

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