LTM8005
38V$_{IN}$, 38V$_{OUT}$ Boost μModule LED Driver with 40V Switch

DESCRIPTION

Demonstration circuit 2257A features the LTM®8005 – a 38V$_{IN}$, 38V$_{OUT}$ boost μModule® LED driver that can disconnect the output to protect against faults and provides spread spectrum switching to simplify emissions compliance. DC2257A is an LED driver with an input range for normal operation from 6V to 27V. OVLO becomes active for inputs above 29V and the maximum input voltage is 38V. The LED current is 1.2A and the base switching frequency is 350kHz. The efficiency is 92% when the input is 12V with a 35V LED load. 35V is the maximum LED voltage.

The demo circuit requires application of an external voltage to the PWM terminal for operation. The external voltage can be a DC level or an appropriate PWM dimming signal. Common frequencies for PWM dimming are 100Hz or higher. Analog dimming is achieved using the CTRL inputs.

DC2257A allows adjustments to output voltage, output current, input current, switching frequency, frequency modulation rate including disable, feedback loop compensation, EN/UVLO threshold, OVLO threshold, soft-start period, and fault latch-off or hiccup. In most cases, adjustment is made by modifying the appropriate resistor or capacitor component(s).

DC2257A provides outputs for input and output current monitoring and fault status for short and open LEDs.

The demo circuit is designed to be easily reconfigured to buck mode, buck-boost mode and SEPIC topologies. There are placeholders to mount optional LC input filter components.

The LTM8005 data sheet must be read in conjunction with this demo manual to properly use or modify DC2257A.

Design files for this circuit board are available at http://www.linear.com/demo/DC2257A

BOARD PHOTO
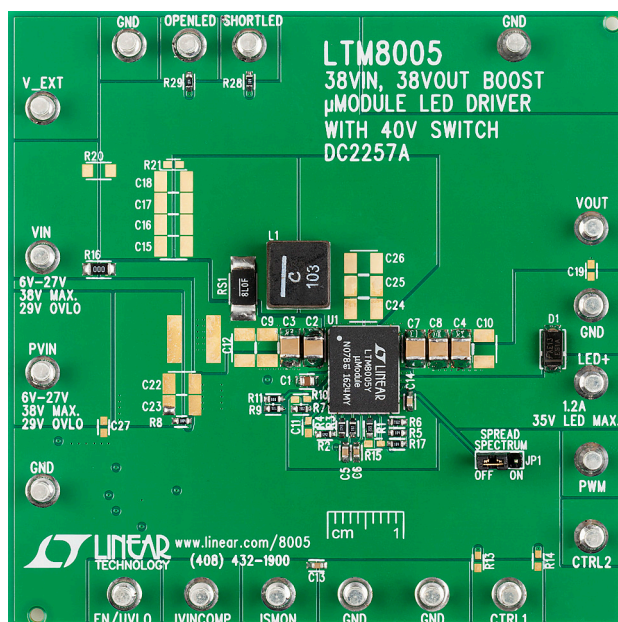
PERFORMANCE SUMMARY   Specifications are at $T_A = 25°C$

PARAMETER	CONDITIONS	MIN	TYP	MAX
Minimum Input Voltage, V_{PVIN}				6V
Maximum Input Voltage – Switching, V_{PVIN}		27V		
Maximum Input Voltage – Not Switching, V_{PVIN}	$V_{OVLO} \geq 1.25$	38V		
Maximum LED Voltage, V_{LED}		35V		
LED Current, I_{LED}	R5 = 100k, R6 = 73.2k		1.2A	
Input Turn-On Voltage, $V_{PVIN(EN)}$	R7 = 19.1k, R8 = 1M, R9 = 93.1k, V_{PVIN} Rising		5.9V	
Input Turn-Off Voltage, $V_{PVIN(UVLO)}$	R7 = 19.1k, R8 =1M, R9 = 93.1k, V_{PVIN} Falling		4.9V	
Input OVLO Turn-Off Voltage, $V_{PVIN(OVLO\_TURN-OFF)}$	R7 = 19.1k, R8 = 1M, R9 = 93.1k, V_{PVIN} Rising		29.1V	
Input OVLO Turn-On Voltage, $V_{PVIN(OVLO\_TURN-ON)}$	R7 = 19.1k, R8 = 1M, R9 = 93.1k, V_{PVIN} Falling		28.4V	
Efficiency	V_{PVIN} = 12V, V_{LED} = 35V, I_{LED} = 1.2A		92%	
Switching Frequency	R1 = 23.2k, Spread Spectrum = OFF		350kHz	
Input Current Limit	RS1 = 0.008Ω		7.5A Peak	

QUICK START PROCEDURE

To use DC2257A to evaluate the performance of the LTM8005, refer to Figure 1 for the proper measurement equipment setup and then follow the procedure below.

NOTE: PWM must be pulled high to work. If PWM is not used, connect the PWM terminal to a 2V to 5V source or connect the PWM pin to V_{REF} on the PCB using R18.

1. Connect a string of LEDs with a forward voltage of 35V or less, but greater than the PVIN voltage, to the LED⁺ and GND terminals on the PCB as shown in Figure 1.

2. Connect the EN/UVLO terminal to ground with a clip-on lead.

3. With the power off, connect the input power supply to the PVIN and GND terminals within the voltage range specified on the PCB. Make sure that the input power supply voltage does not exceed the forward voltage of the LED string. OVLO becomes active to inhibit switching for an input voltage of greater than 29V.

4. Connect an input to the PWM terminal. If PWM is not used, connect PWM to a 2V to 5V DC source or to V_{REF} on the PCB using resistor R18. PWM must be pulled high to work. For PWM dimming, connect a 100Hz or higher PWM signal to the PWM terminal.

5. Turn the PVIN power supply on.

6. Release the EN/UVLO to GND connection.

7. Observe the LED string running at the programmed LED current; or, observe the reduction of brightness in the LED string with PWM dimming.
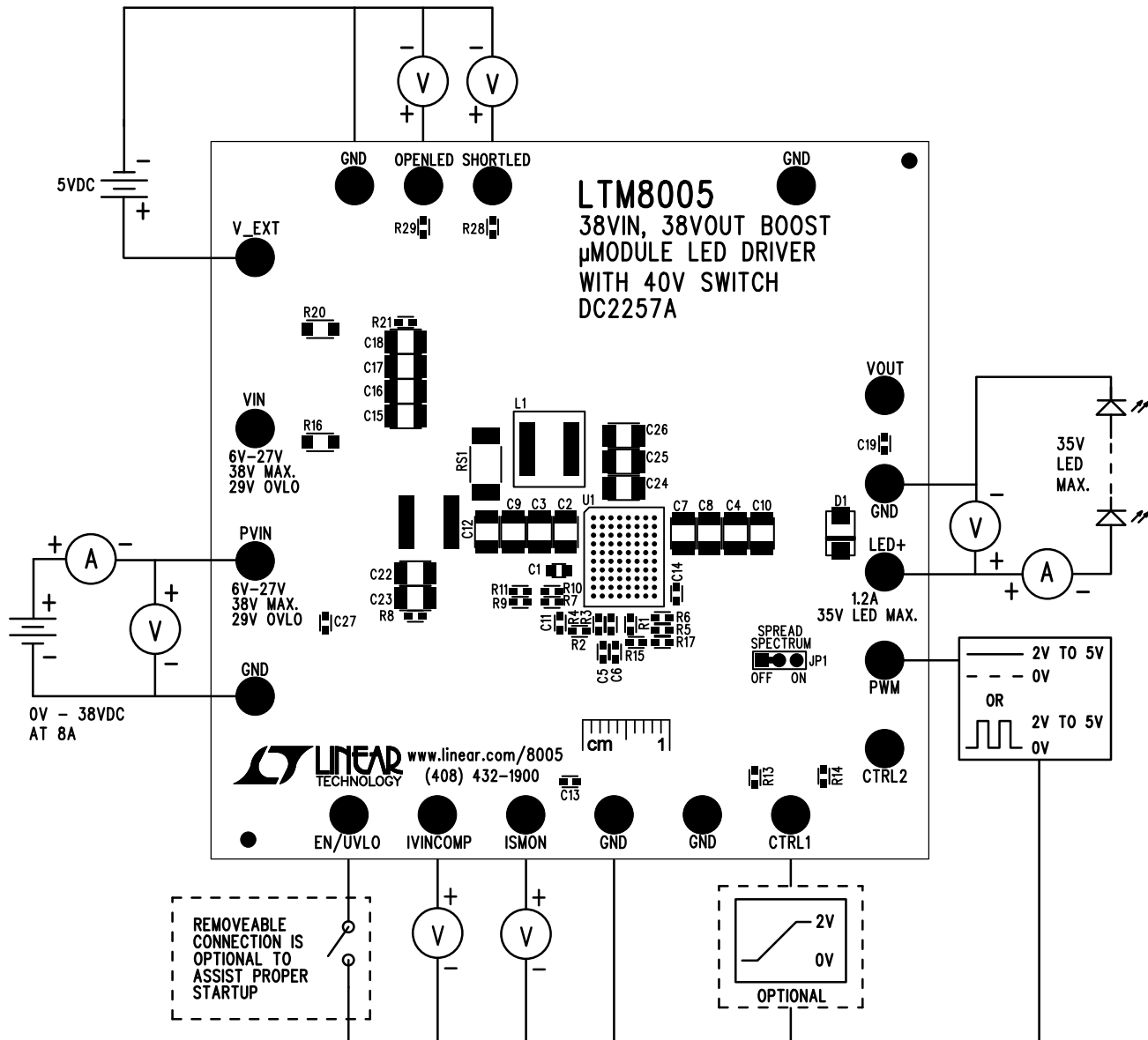
dc2257af

QUICK START PROCEDURE

Figure 1. Proper Measurement Equipment Setup
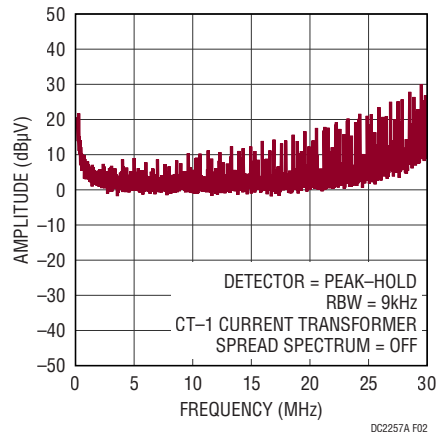
QUICK START PROCEDURE

Figure 2. Output Current Noise Spectrum with Spread Spectrum = OFF, V_{IN} = 12V, P_{OUT} = 42W, CT-1 Current Transformer
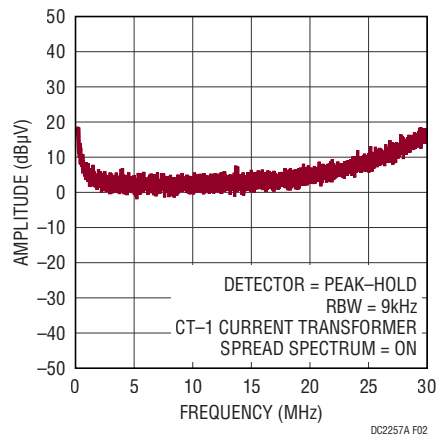

Figure 3. Output Current Noise Spectrum with Spread Spectrum = ON, V_{IN} = 12V, P_{OUT} = 42W, CT-1 Current Transformer

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., X7R, 1µF, 50V, 10%, 0805	MURATA, GRM21BR71H105KA12L
2	5	C2, C3, C4, C7, C8	CAP., X7R, 4.7µF, 50V, 10%, 1210	MURATA, GRM32ER71H475KA88L
3	1	C5	CAP., X7R, 0.022µF, 16V, 10%, 0603	MURATA, GRM188R71C223KA01D
4	1	C6	CAP., X7R, 0.1µF, 25V, 10%, 0603	AVX, 06033C104KAT2A
5	1	L1	INDUCTOR, 10µH	COILCRAFT, XAL8080-103ME
6	1	R1	RES, CHIP, 23.2k, 1/10W, 1%, 0603	VISHAY, CRCW060323K2FKEA
7	1	R2	RES, CHIP, 12.4k, 1/10W, 1%, 0603	VISHAY, CRCW060312K4FKEA
8	1	R3	RES, CHIP, 1.5k, 1/10W, 5%, 0603	VISHAY, CRCW06031K50JNEA
9	1	R4	RES, CHIP, 374k, 1/10W, 1%, 0603	VISHAY, CRCW0603374KFKEA
10	1	R5	RES, CHIP, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
11	1	R6	RES, CHIP, 73.2k, 1/10W, 1%, 0603	VISHAY, CRCW060373K2FKEA
12	1	U1	I.C., µMODULE LED DRIVER, 80-BGA	LINEAR TECH, LTM8005EY#PBF
Optional Demo Circuit Components				
1	1	C13	CAP., X7R, 0.1µF, 25V, 10%, 0603	AVX, 06033C104KAT2A
2	0	C11, C19, C27 (OPT)	CAP., 0603	
3	0	C9, C10, C12, C15-C18, C22-C26 (OPT)	CAP., 1210	
4	1	C14	CAP., X7R, 6.8nF, 16V, 10%, 0603	AVX, 0603YC682KAT2A
5	0	C21 (OPT)	CAP., ALUM, OPT, 10mm DIA.	
6	1	D1	DIODE, SMA	FAIRCHILD SEMI.,ES1A
7	0	L2 (OPT)	INDUCTOR, OPT, 8mm × 8mm	
8	0	M1 (OPT)	MOSFET, SOT23	
9	0	Q1 (OPT)	TRANS, SOT23	
10	1	RS1	RES, CHIP, .008Ω, 1W, 1%, 2512	VISHAY, WSL25128L000FEA
11	0	RS2 (OPT)	RES, 2010	
12	1	R7	RES, CHIP, 19.1k, 1/10W, 1%, 0603	VISHAY, CRCW060319K1FKEA
13	1	R8	RES, CHIP, 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
14	1	R9	RES, CHIP, 93.1k, 1/10W, 1%, 0603	VISHAY, CRCW060393K1FKEA
15	0	R10, R12-R15, R18, R19, R21-R27, R30 (OPT)	RES, 0603	
16	1	R11	RES, CHIP, 0, 1/10W, 1%, 0603	VISHAY, CRCW06030000Z0EA
17	1	R16	RES, CHIP, 0, 1/4W, 1%, 1206	VISHAY, CRCW12060000Z0EAHP
18	0	R20 (OPT)	RES, 1206	
19	3	R17, R28, R29	RES, CHIP, 100k, 1/10W, 5%, 0603	VISHAY, CRCW0603100KJNEA
Hardware				
1	19	E1-E19	TESTPOINT, TURRET, .094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	HEADER 3-PIN 0.079 SINGLE ROW	WURTH, 620 003 111 21
3	1	XJP1	SHUNT, .079" CENTER	WURTH, 608 002 134 21

SCHEMATIC DIAGRAM

NOTE: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTORS 5%, 0603.
2. ALL CAPACITORS 0603.

U1
LTM8005EY

dc2257af

LINEAR
TECHNOLOGY

SCHEMATIC DIAGRAM

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

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

dc2257af

LT 1016 • PRINTED IN USA

LINEAR
TECHNOLOGY

© LINEAR TECHNOLOGY CORPORATION 2016