LT3760
8-Channel 100mA High Voltage LED Driver

DESCRIPTION

DC1573A is an 8-Channel 100mA High Voltage LED Driver featuring the LT®3760. The LT3760 drives up to 100mA per string and has a maximum LED string voltage of 45V. DC1573A is set at 1MHz switching frequency for smallest inductor and capacitor size as well as maximum PWM dimming performance. Overvoltage protection is set at 55V in case the LEDs are removed from the circuit. If the LEDs are opened, the $\overline{FAULT}$ terminal output flag goes low and reports the fault condition. The V_{IN} terminal is powered from 10V to 14V input separated from the 24V PV_{IN} supply for best thermal performance. If one or more of the 8 LED channels is not used, its LED pin or terminal should be tied to LED+ to disable it. Multiple channels can be used in parallel for higher LED current by tying their LED1-8 pins together.

The LT3760 data sheet gives a complete description of the part, operation and applications information. The data sheet must be read in conjunction with this demo manual for demonstration circuit 1573A. The LT3760 is assembled in a small 28-lead FE (4.4mm TSSOP) package with a thermally enhanced ground pad. Proper board layout is essential for maximum thermal performance. See the Layout Considerations section in the data sheet.

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

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITION	VALUE (TYPICAL)
PV_{IN} Power Input Voltage Range	Operating	20V to 28V
V_{IN} Pin Input Voltage Range	Operating	8V to 14V
Switching Frequency	R_T = 39.2k	1MHz
LED String Current $I_{LED(1-8)}$	R14 = 5.76k	100mA
OVP Open LED Voltage	R8 = 11k, R7 = 20k	55V
Efficiency	PV_{IN} = 24V, V_{IN} = 10V, V_{LED} = 45V, I_{LED1-8} = 100mA	92%
Undervoltage Lockout	R1 = 499k, R4 = 40.2k	20.1V
Low Voltage Turn-On (UVLO + V_{HYST})	R1 = 499k, R4 = 40.2k	21.4V
Peak Switch Current Limit	R_{S1} = 0.015Ω	3.3A

QUICK START PROCEDURE

Demonstration circuit 1573A is easy to set up to evaluate the performance of the LT3760. Follow the procedure below:

Note: PWM must be pulled high to work. If PWM is not used, tie PWM high or connect to REF on the PCB using resistor R9.

1. Connect strings of LEDs with forward voltage less than 45V, but greater than the PV_{IN} voltage, to the LED+ and LED1-8 terminals on the PCB as shown in Figure 1. Tie any unused LED1-8 pins directly to V_{OUT} (LED+) before power-up to disable that channel.
2. Connect the $\overline{SHDN}$ terminal to GND.
3. With power off, connect the PV_{IN} power supply to the PV_{IN} and GND terminals within the range specified on the PCB. Make sure that the PV_{IN} DC input voltage does not exceed the forward voltage of the LED string.
4. With power off, connect the V_{IN} power supply to the V_{IN} and GND terminals within the range specified on the PCB.
5. Connect the PWM terminal. If PWM is not used, tie PWM high or connect to REF on the PCB using resistor R9. PWM must be pulled high to work.
6. Turn the PV_{IN} power supply on.
7. Turn the V_{IN} power supply on after PV_{IN}.
8. Release the $\overline{SHDN}$-to-GND connection.
9. Observe the LED strings running at the programmed LED current.

Note: For PWM dimming, connect a PWM (100Hz or higher) signal to the PWM terminal and observe the reduction of brightness in the LED string when PWM dimming.

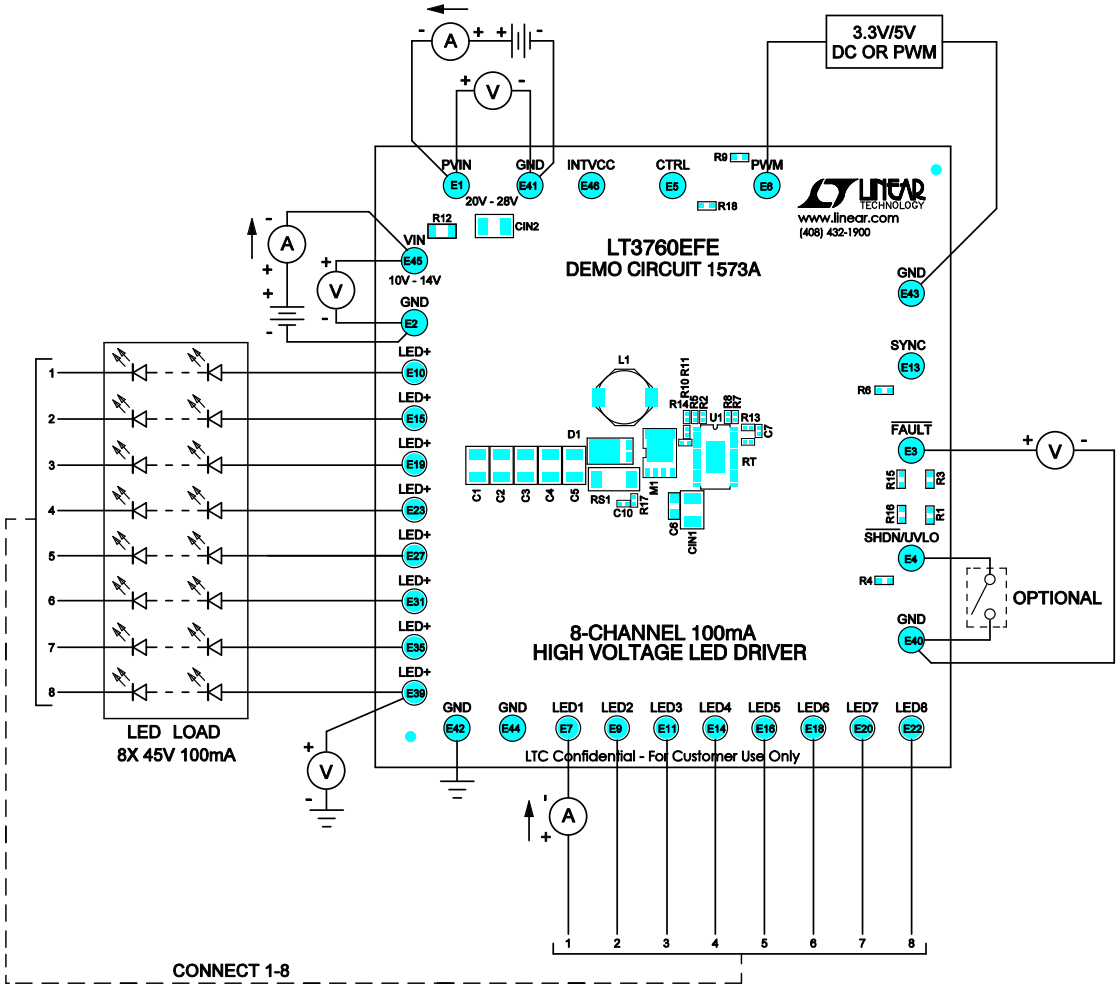


Figure 1. Proper Measurement Setup Drawing

TERMINAL OPTIONS

$\overline{\text{FAULT}}$: The $\overline{\text{FAULT}}$ terminal is tied directly to the $\overline{\text{FAULT}}$ pin. If there is a fault condition, the $\overline{\text{FAULT}}$ terminal is pulled low. When there is no fault, the terminal is pulled up to V_{IN}. This terminal can be monitored with a voltage meter, tied to the input of another device, or left floating.

$\overline{\text{SHDN}}$/UVLO: This terminal is tied directly to the $\overline{\text{SHDN}}$/UVLO pin. A resistor divider from PV_{IN} to GND sets the voltage on this terminal/pin. These resistors can be easily adjusted for both the UVLO level and the amount of rising hysteresis. See the data sheet for details. The terminal can also be used to shut the IC down and turn off the LEDs. Tie the terminal directly to GND in order to place the IC in shutdown and turn off the LEDs.

CTRL: This terminal is tied directly to the CTRL pin. As assembled, there is a 1M resistor pulling the CTRL pin up to REF. The CTRL pin voltage can be adjusted for analog dimming as shown in the data sheet. Either a voltage on the CTRL terminal can be driven to dim the LEDs or a resistor divider (R2 and R5) from PV_{IN} to GND can be added to reduce the CTRL voltage as PV_{IN} drops too low. Pulling the CTRL pin to GND turns the LEDs off.

PWM: This terminal is tied directly to the PWM pin. As shown in the data sheet, an input PWM waveform turns the LEDs ON and OFF. Dimming frequency and dimming range are discussed in the data sheet. When PWM dimming is not being used, tie PWM to REF with a 0Ω resistor (R9) or place a 3.3V or 5V DC source on the PWM terminal.

SYNC: This terminal is tied directly to the SYNC pin. As assembled, SYNC is disabled and tied directly to GND with a 0Ω resistor (R6). For SYNC to be used, R6 must be removed and a SYNC signal must be applied to this terminal.

$INTV_{CC}$: This terminal is tied directly to the $INTV_{CC}$ pin. This terminal is provided to be able to monitor the voltage on the $INTV_{CC}$ regulator or to provide an external $INTV_{CC}$ source to the IC. In some low voltage applications, $INTV_{CC}$ can be tied directly to PV_{IN} or V_{IN}. See the data sheet for details. For normal operation, leave this terminal floating.

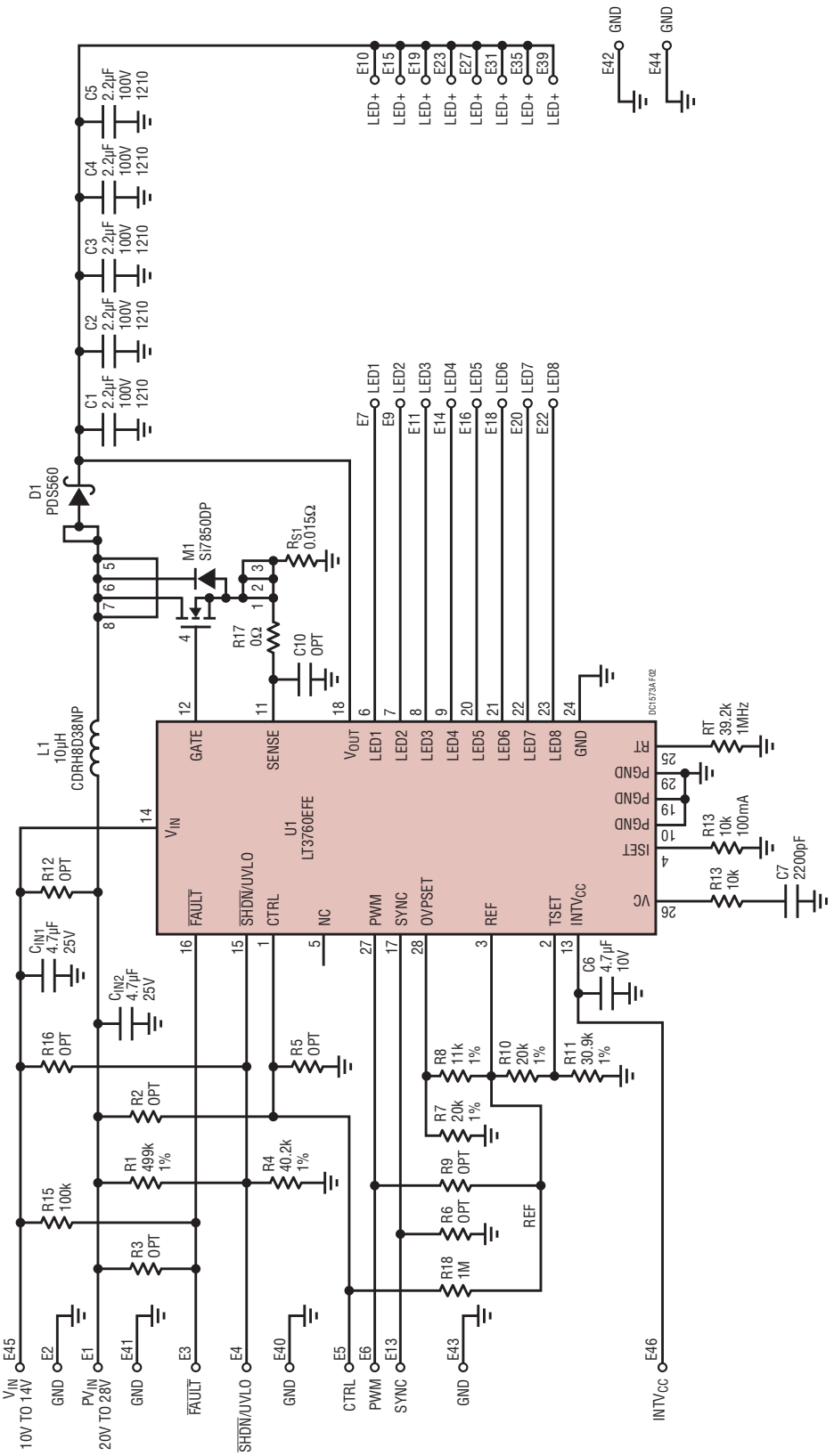
LED+ and LED1-8: The eight LED+ terminals are the output voltage of the boost regulator and they are all tied together on the PCB. The anodes of the LED strings should be tied to these terminals and the cathodes to LED1-8 terminals. If an LED1-8 terminal is not used, it should be tied directly to LED+. If all LED+ to LED1-8 connections are left floating or are opened during operation, DC1573A powers the output to 55V as programmed by OVPSET. It is okay to connect LEDs to the LED+ and LED1-8 terminals when it is powered to OVP. See data sheet for details.

LED1-8 terminals can be tied together to get more than 100mA per LED string. Pairs of LED1-8 terminals can be tied together for 4× 200mA LED strings as an example. Individually, each LED1-8 pin can source a maximum of 100mA, but they can be tied together for more.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	Capacitor, 1210 4.7µF 20% 25V X7R	TDK C3225X7R1E475M
2	1	CIN2	Capacitor, 1210 4.7µF 10% 50V X7R	AVX 12105C475KAT2A
3	5	C1, C2, C3, C4, C5	Capacitor, 1210 2.2µF 10% 100V X7R	Murata GRM32ER72A225KA35L
4	1	C6	Capacitor, 0805 4.7µF 10% 10V X5R	Taiyo Yuden LMK212BJ475KG-T
5	1	C7	Capacitor, 0402 2200pF 5% 50V X7R	AVX 04025C222JAT2A
6	1	D1	Diode, Schottky	Diodes Inc. PDS560
7	1	L1	Inductor, 10µH	Sumida CDRH8D38NP-100NC
8	1	M1	MOSFET N-channel 60V	Vishay Si7850DP-T1-E3
9	1	RS1	Resistor, 2010 0.015Ω 1% 1W	IRC LRF2010LF-01-R015-F
10	1	RT	Resistor, 0402 39.2kΩ 1% 1/16W	Panasonic ERJ-2RKF3922X
11	1	R1	Resistor, 0603 499kΩ 1% 1/10W	NIC NRC06F4993TRF
12	1	R4	Resistor, 0603 40.2kΩ 1% 1/10W	NIC NRC06F4022TRF
13	2	R7, R10	Resistor, 0402 20kΩ 1% 1/16W	NIC NRC04F2002TRF
14	1	R8	Resistor, 0402 11kΩ 1% 1/16W	NIC NRC04F1102TRF
15	1	R11	Resistor, 0402 30.9kΩ 1% 1/16W	NIC NRC04F3092TRF
16	1	R13	Resistor, 0402 10kΩ 5% 1/16W	NIC NRC04J103TRF
17	1	R14	Resistor, 0402 5.76kΩ 1% 1/16W	NIC NRC04F5761TRF
18	1	R18	Resistor, 0603 1MΩ 5% 1/10W	Vishay CRCW06031M00JNEA
19	1	U1	IC, 8-Channel LED Driver	Linear Technology LT3760EFE
Optional Electrical Components				
1	0	C10	Do Not Stuff	Option
2	0	R2, R3, R5, R16	Resistor, 0603 Option	Option
3	1	R6	Resistor 0603 0Ω Jumper	NIC NR06Z0TRF
4	0	R9, R12	Do Not Stuff	Option
5	1	R15	Resistor, 0603 100kΩ 5% 1/10W	NIC NRC06J104TRF
6	1	R17	Resistor, 0402 0Ω Jumper	Vishay CRCW04020000Z0ED
Hardware				
1	14	E1-E6, E13, E40-E46	Turret	MILL MAX 2501-2-00-80-00-00-07-0
2	16	E7, E9-E11, E14-E16, E18-E20, E22, E23, E27, E31, E35, E39	Turret	MILL MAX 2308-2-00-80-00-00-07-0

SCHEMATIC DIAGRAM



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