IS32LT3125/IS32LT3125A SINGLE CHANNEL LINEAR CURRENT LED DRIVER

DESCRIPTION

The IS32LT3125/3125A is a linear programmable current regulator consisting of a single output channel capable of 250mA. It features an EN pin to enable and disable the output channel's current source. It supports PWM dimming via EN pin or power supply modulation (PSM). The UV pin can be used to set external VCC undervoltage lockout threshold via a resistor divider. An external resistor programs the current level for the channel current source. In addition, IS32LT3125/3125A integrates fault protection for LED open/short, ISET pin open/short and over temperature condition for robust operation. Detection of these failures is reported by the FAULTB pin. When a fault is detected the device will disable itself and output an open drain low signal. Multiple devices can have their FAULTB pins connected to create a "one-fail-all-fail" condition. Under a fault condition, the IS32LT3125 will sink 30mA I_{CC} current, while the IS32LT3125A will sink a lower 2mA (Max.) I_{CC}.

The IS32LT3125/3125A is targeted at the automotive market with end applications to include interior and exterior lighting. For 12V automotive applications the low dropout driver can support one to several LEDs on the output channel.

Both devices are offered in a small thermally enhanced SOP-8-EP package.

FEATURES

- Single channel, sources up to 250mA
- 5.0V to 28V input supply voltage range
  - Withstand 42V load dump
- External resister sets source current
- Programmable VCC undervoltage lockout to match the LED stack for High Side PWM operation
- Shared fault flag for multiple devices operation
- Fault protection with flag output:
  - LED string open/short
  - OUT pin short to VCC/GND
  - ISET pin open/short
  - Thermal shutdown
- I_{CC} set to 30mA under fault condition (IS32LT3125 only)
- External C_{STOR} capacitor keeps fault status during start/stop operation
- SOP-8-EP package
- AEC-Q100 Qualified
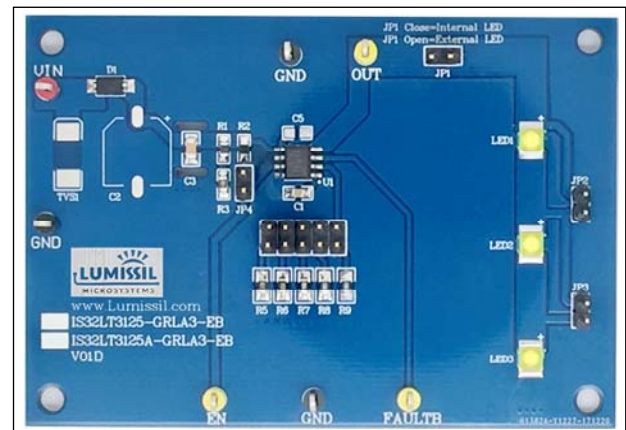- Operating temperature range from -40°C ~ +125°C

QUICK START

Figure 1: Photo of IS32LT3125/IS32LT3125A Evaluation Board

RECOMMENDED EQUIPMENT

- 12V,1A DC power supply

ABSOLUTE MAXIMUM RATINGS

- ≤ 42V power supply

Caution: Do not exceed the conditions listed above, otherwise the board will be damaged.

PROCEDURE

The IS32LT3125/IS32LT3125A evaluation board is fully assembled and tested. Follow the steps listed below to verify board operation.

Caution: Do not turn on the power supply until all connections are completed.

1) Connect the ground terminal of the power supply to the GND and the positive terminal to the Vin.
2) The evaluation board supports several current levels, selected by R5, R6, R7, R8, R9 see table below. The final resistance can be measured with an ohm meter across ISET and GND pins. For jumpers (R5~R9) Closed=1 and Open=0.

R5	R6	R7	R8	R9	R_{ISET} (kΩ)	I_{OUT}(mA)
0	0	0	0	0	-	0
1	0	0	0	0	8	250
0	1	0	0	0	13	153
0	0	1	0	0	20	100
0	0	0	1	0	39	51
0	0	0	0	1	82	24

3) There is one LED string on board and can be adjusted from 1 to 3 LEDs by jumpers, JP2 and

JP3. Open JP1 to disable the LED string on board.

4) If external LED string is used, please make sure JP1 is open. Connect the anode of the external LED string to OUT and cathode to GND.

Note: Connecting an external LED string without removing the onboard JP1 jumper header will drive both on board and external LED strings in parallel resulting in lower current drive to the LED string.

5) To support PWM dimming, open JP4 and apply an external PWM signal on EN test point.

Note: JP4 connects EN pin to VCC via R2 resistor. If JP4 is not opened, the external PWM source may be damaged by high voltage.

6) FAULTB terminal is fault reporting pin. In the event of LED string open/short, ISET pin open/short or thermal shutdown fault condition, the FAULTB will pull low for reporting. Once the fault condition is removed, the FAULTB pin goes back high.

ORDERING INFORMATION

Part No.	Temperature Range	Package
IS32LT3125 -GRLA3-EB IS32LT3125A-GRLA3-EB	-40°C ~ +125°C (Automotive)	SOP-8-EP, Lead-free

Table 1: Ordering Information

For pricing, delivery, and ordering information, please contact Lumissil's analog marketing team at analog@Lumissil.com or (408) 969-6600.

EVALUATION BOARD OPERATION

IS32LT3125/IS32LT3125A evaluation board drives one string of WLEDs (default is 3 LED in series). It can be dimmed via PWM on power line or by digitally driving the EN pin. The output current is set by a single reference resistor (R_{ISET}) and capable of 250mA.

OUTPUT CURRENT SETTING

A single resistor (R_{ISET}) controls the maximum output current for the channel. The resistor value for a specific current level is calculated using the following Equation (1):

$$R_{ISET} = \frac{2000}{I_{SET}} \quad (1)$$

(8kΩ≤R_{ISET}≤80kΩ)

R_{ISET} need to be chosen 1% accuracy resistor with good temperature characteristic to ensure stable output current.

The device is protected from an output overcurrent condition caused by a too low value R_{ISET}, by internally limiting the maximum current to 300mA (Typ.). If ISET pin is open, the output will be off and FAULTB will be pulled low.

POWER SUPPLY MODULATION DIMMING

The IS32LT3125/IS32LT3125A can operate with Power Supply Modulation (PSM) where the device's power supply is pulse width modulated to achieve LED dimming. The IS32LT3125/IS32LT3125A stability is not affected by operation with PSM. To get better dimming linearity, the recommended PSM frequency can be in the range of 100Hz to 300Hz, (200Hz Typ.) and input capacitor, C_{VCC}, should be low value (0.1uF typical) to ensure rapid discharge during PSM low period.

CSTOR OPERATION

To keep the IC operating normally during condition of PSM when V_{CC} goes to zero, C_{STOR} capacitor provides the keep-alive current needed to power the digital counter and the fault flag circuits. A capacitor value of 2.2μF is recommended. The keep-alive time could be roughly calculated by the following Equation (2):

$$t_{alive} = \frac{2.5V \times C_{STOR}}{I_{CST}} \quad (2)$$

EN PIN OPERATION

The voltage at the EN pin must be higher than V_{EN} to enable the IC and below (V_{EN}-V_{ENHY}) to disable the IC. The EN pin of the IS32LT3125/IS32LT3125A can accept a PWM signal to implement LED dimming. LED average current may be computed using the following Equation (3).

$$I_{LED} = I_{MAX} \times D_{PWM} \quad (3)$$

I_{MAX} is computed using Equation (1) and D_{PWM} is the duty cycle. To guarantee a reasonably good dimming effect, recommend PWM frequency in the range of 100Hz ~ 1kHz. Driving the EN pin with a PWM signal can effectively adjust the LED intensity. The PWM signal voltage levels must meet the EN pin input voltage levels, V_{EN}. Pull up to VCC via a 10KΩ resister when EN pin is unused; do not leave it floating.
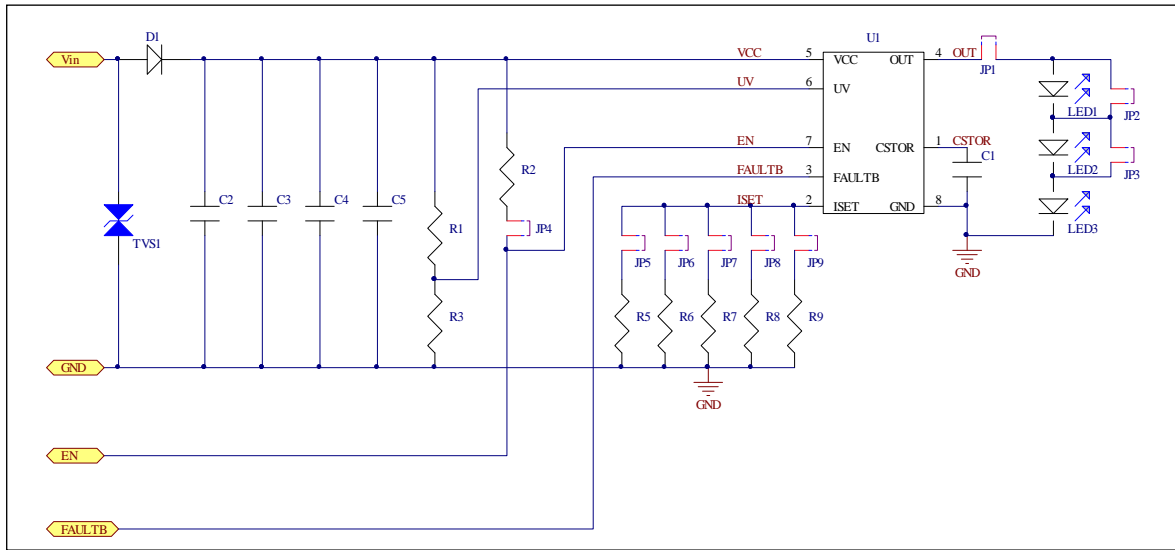
Figure 2: IS32LT3125/IS32LT3125A Application Schematic

BILL OF MATERIALS

Name	Symbol	Description	Qty	Supplier	Part No.
	C2,C3,C4,TVS1	NC	4		
LED Driver	U1	LED Driver	1	Lumissil	IS32LT3125/ IS32LT3125A
Resistor	R1	RES,51k,1/8W,±5%,SMD	1	YAGEO	RC0805JR-0751KL
Resistor	R3,R2	RES,10k,1/8W,±1%,SMD	2	YAGEO	RC0805FR-0710KL
Resistor	R5	RES,8k,1/8W,±1%,SMD	1	YAGEO	RC0805FR-078KL
Resistor	R6	RES,13k,1/8W,±1%,SMD	1	YAGEO	RC0805FR-0713KL
Resistor	R7	RES,20k,1/8W,±1%,SMD	1	YAGEO	RC0805FR-0720KL
Resistor	R8	RES,39k,1/8W,±1%,SMD	1	YAGEO	RC0805FR-0739KL
Resistor	R9	RES,82k,1/8W,±1%,SMD	1	YAGEO	RC0805FR-0782KL
Capacitor	C1	CAP,2.2µF,50V,±10%,SMD	1	YAGEO	CC0805KKX7R8BB225
Capacitor	C5	CAP,0.1µF,50V,±10%,SMD	1	YAGEO	CC0805KKX7R8BB104
Diode	D1	1A,60V, DO-214AC,SMA SS16	1	Fairchild	SS16
LED	LED1~LED3	350mA,V_F=3.0V,Warm White	3		

Bill of materials, refer to Figure 2 above.
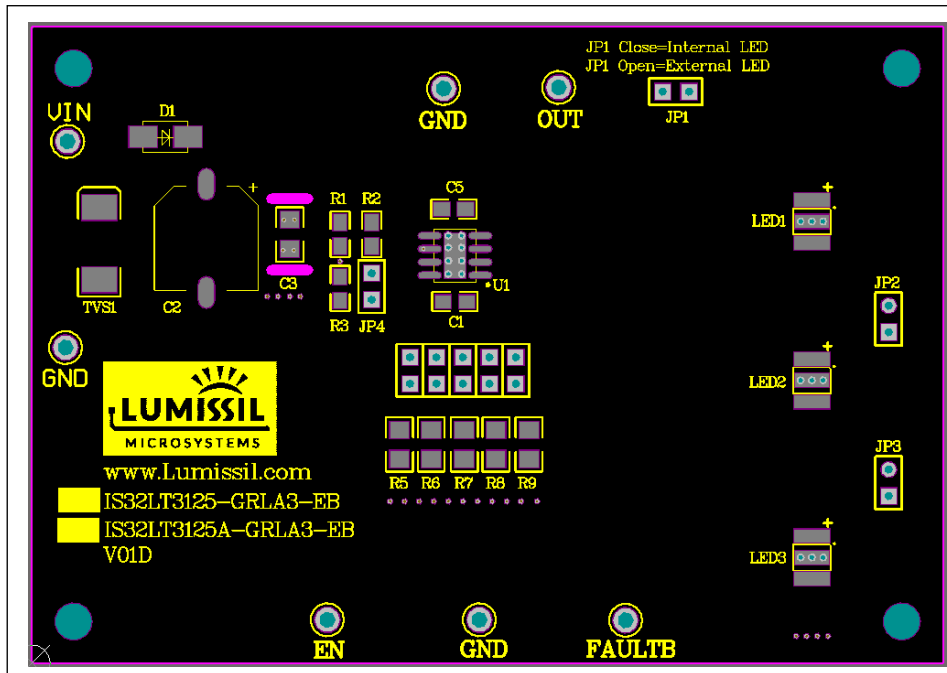
Figure 3: Board Component Placement Guide - Top Layer
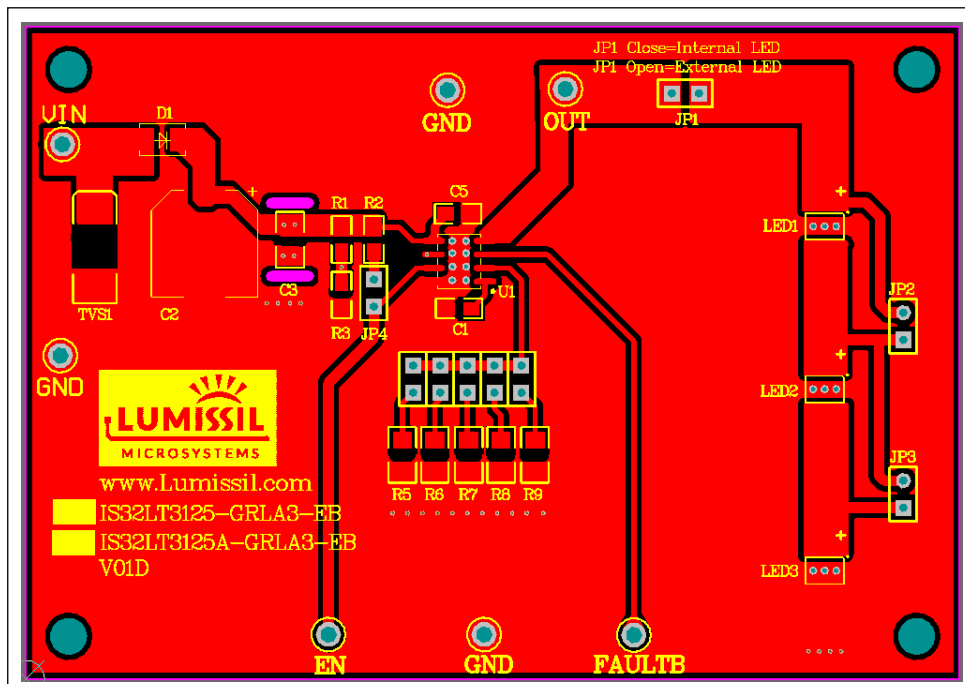
Figure 4: Board PCB Layout - Top Layer
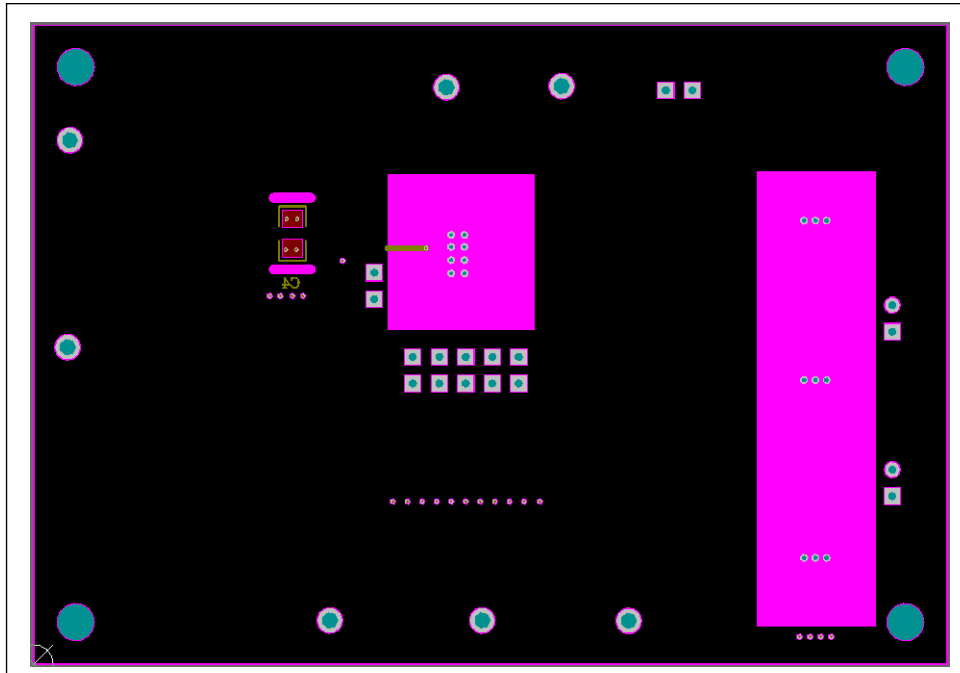
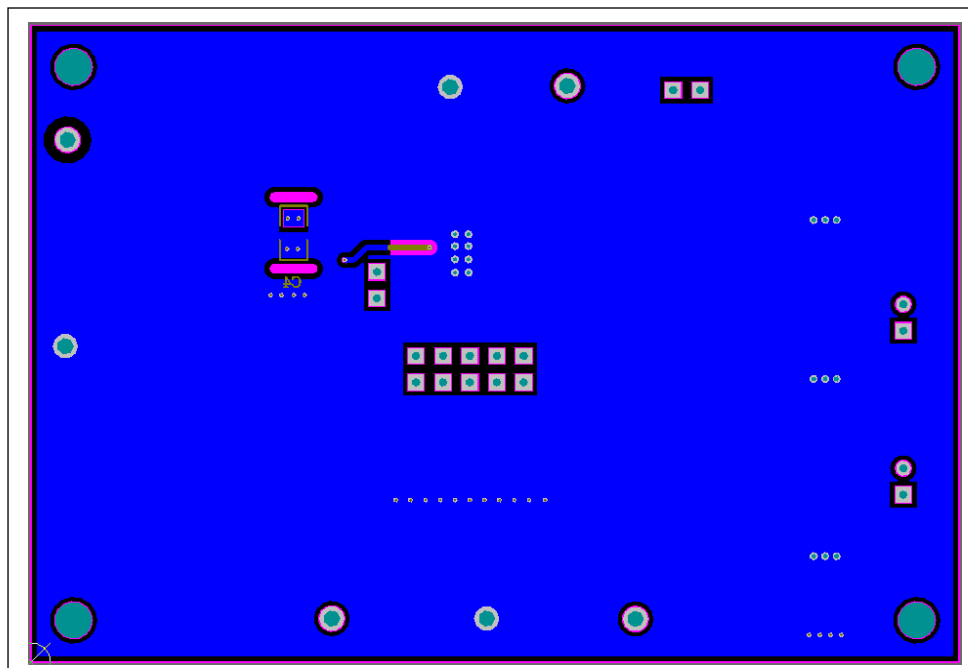*Figure 5: Board Component Placement Guide - Bottom Layer*

Figure 6: Board PCB Layout - Bottom Layer

REVISION HISTORY

Revision	Detail Information	Date
A	Initial release	2020.07.07