IS32LT3140B SINGLE CHANNEL LED DRIVER WITH THERMAL SHUNT RESISTOR

DESCRIPTION

The IS32LT3140B is an automotive-grade high-side programmable current regulator consisting of a single output channel capable of 450mA. An external resistor sets the current level for the single-channel current source. An optional thermal shunt resistor can be used to significantly optimize IC power dissipation. It features an EN pin to enable or shutdown the device. It supports either PWM dimming via a PWM pin or power supply modulation (PSM). A resistor divider circuit can be used on the UV pin to set an external VCC under-voltage lockout threshold for LED string open fault detection. In addition, the IS32LT3140B integrates fault protection for LED string open/short, output overcurrent (not reported), 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 active low open drain signal. Multiple devices can have their FAULTB pins connected to create a “one-fail-all-fail” condition.

The IS32LT3140B 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. The device is offered in a small thermally enhanced SOP-8-EP package.

FEATURES

- Wide input voltage range, 4.5V to 40V
- Single-channel sources up to 450mA
- High-side external resister sets source current
- ±5% current accuracy over -40°C ~ +150°C
- Low headroom voltage, max 700mV at 150mA
- Low operating current of 350μA and 5μA in shutdown
- Optional thermal shunt resistor to optimize IC power dissipation
- Support for both PWM or PSM dimming
- Programmable VIN under-voltage lockout at PWM pin
- Fault protection with open-drain flag output:
  - LED string open/short
  - Output overcurrent (not reported)
  - Thermal shutdown
- Shared fault flag for multiple device operation to comply with “one-fail-all-fail” function
- AEC-Q100 Qualified

RECOMMENDED EQUIPMENT

- 12V, 1A DC power supply or 12V Battery

ABSOLUTE MAXIMUM RATINGS

- ≤ 40V power supply

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

QUICK START

Figure 1: Photo of IS32LT3140B Evaluation Board

ORDERING INFORMATION

Part No.	Temperature Range	Package
IS32LT3140B-GRLA3-EB	-40°C to +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.

PROCEDURE

The IS32LT3140B 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 GND of the power supply to the GND terminal of the evaluation board and the VCC of the power supply to the VIN terminal of the evaluation board.
2) The jumper JP1 is used to enable/shutdown the device. The JP1 is default connected to upper side to enable the device. Connecting JP1 to downside will force the device into the shutdown mode with an ultralow standby current.
   Note: In shutdown mode the thermal shunt resistors (R4A~R4C) will provide a current path to the LEDs. To support a complete shutdown, JP7 must also be opened.
3) The default for Jumper JP6 is closed. This will connect the PWM (pin3) to VIN via a resistor divider which sets the UVLO for a VIN of 8.5V (programmable by the resistor divider, R5 and R6). Please refer to the "UNDER VOLTAGE LOCKOUT (UVLO)" description of the datasheet for more detail. For PWM dimming, JP6 must be opened to disconnect the PWM pin from the VIN pullup (R6) and the thermal shunt resistors (R4A~R4C) must be disconnected by removing jumper JP7. Apply an external PWM signal on PWM terminal to dim the output.
   Note: If JP6 is not opened, the external PWM source may be damaged by a high voltage.
4) The jumper JP8 is used to enable/disable the LED open and single LED short detection. Closing JP8 enables both fault detections when VIN>9.2V (programmable by the resistor divider, R1 and R2). Opening JP8 will disable both fault detections.
5) There is an onboard LED string which can be adjusted from 1 to 3 LEDs by jumpers, JP3~JP5. Close the jumper to short the corresponding LED. Remove all jumpers (JP3~5) to enable all the LEDs. JP2 is used to connect the IC OUT pin to the onboard LED string (LED1~LED3).
6) R7, R8, D2 and ZD1 are used for the fault reporting indicator LED (D2) which will turn on during a fault detection.
   Note: This circuit is not necessary in the actual application.
7) Turn on the power supply to light up the LED string.
8) Test points for UV, PWM (input), FAULTB (output), OUT (output), SDH and SDL are available for external monitoring and control.

Table 1 Fault Action Description for "One Fail All Fail"

UV Pin	Fault Type	Fault Condition	Output State	FAULTB Pin (with input function)	Recovery
$<V_{UV\_IL}$	LED string open or OUT short to VIN	Disabled			
	LED string short or OUT short to GND	$V_{OUT}<V_{SCD\_F}$	Ignores the PWM input, outputs I_{RTR} for recovery detection	Pull low (If the FAULTB pins of multiple devices are connected together, all devices will be off)	$V_{OUT}>V_{SCD\_R}$
	Over temperature	$T_J>T_{SD}$	Off		$T_J<(T_{SD}-T_{HY})$
$>V_{UV\_IH}$	LED string open or OUT short to VIN	$(V_{VICC}-V_{OUT})<V_{OD\_R}$	Ignores the PWM input, outputs I_{RTR} for recovery detection		$(V_{VICC}-V_{OUT})>V_{OD\_F}$
	LED string short or OUT short to GND	$V_{OUT}<V_{SCD\_F}$	Ignores the PWM input, outputs I_{RTR} for recovery detection		$V_{OUT}>V_{SCD\_R}$
	Over temperature	$T_J>T_{SD}$	Off		$T_J<(T_{SD}-T_{HY})$

JUMPER SETTING TABLE

Table 2 Jumper Setting Table

Jumper	Function	Setting
JP1	Enable/shutdown device	Upper side: enable device Down side: shutdown device
JP2	Enable/disable the onboard LED string	Closed: connect output to the onboard LED string Open: disconnect output to the onboard LED string
JP3~JP5	LED string configuration	Closed: short the corresponding LED Open: enable the corresponding LED
JP6	Enable/disable external PWM dimming	Closed: set 8.5V UVLO function for VIN Open: external PWM signal on the PWM pin to dim the output
JP7	External thermal shunt resistors connection	Closed: connect external power resistors Open: disconnect external power resistors
JP8	Enable/disable LED open and single LED short detection	Closed: enable LED open and single LED short detection Open: disable LED open and single LED short detection

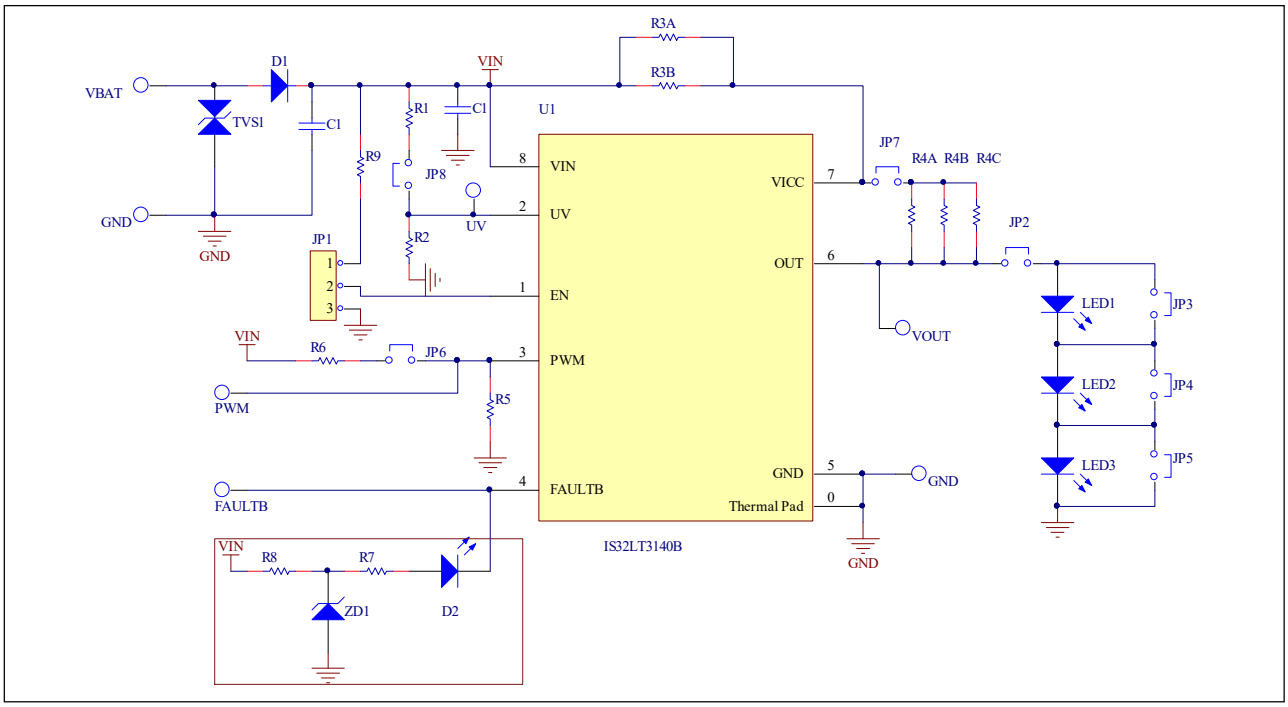

Figure 2: IS32LT3140B Application Schematic

BILL OF MATERIALS

Name	Symbol	Description	Qty	Supplier	Part No.
LED Driver	U1	1CH Constant current LED driver	1	Lumissil	IS32LT3140B
Capacitor	C1	CAP,1μF,50V,±10%,SMD	1	Yageo	AC1206KRX7R9BB105
Capacitor	C2	CAP,100nF,50V,±10%,SMD	1	Yageo	AC1206KRX7R9BB104
Resistor	R3A, R3B	RES,1R, 0805,±1%,SMD	2	Yageo	AC0805FR-071RL
Resistor	R4A, R4B, R4C	RES,240R,2512,±5%,SMD	3	Yageo	AC2512JK-07240RL
Resistor	R1	RES,120k, 0603,±1%,SMD	1	Yageo	AC0603FR-07120KL
Resistor	R2	RES,18k, 0603,±1%,SMD	1	Yageo	AC0603FR-0718KL
Resistor	R5	RES,15k, 0603,±1%,SMD	1	Yageo	AC0603JR-0715kL
Resistor	R6	RES,91k, 0603,±1%,SMD	1	Yageo	AC0603JR-0791kL
Resistor	R7	RES,1k, 0603,±5%,SMD	1	Yageo	AC0603JR-071K0L
Resistor	R8	RES,5.1k, 0603,±5%,SMD	1	Yageo	AC0603JR-075K1L
Resistor	R9	RES,100k, 0603,±1%,SMD	1	Yageo	AC0603FR-07100KL
Schottky	D1	SS16,1A,60V, SMB	1	ONsemi	NRVBSS16T3G
Zener	ZD1	ZMM5.1V,0.5W, LL-34	1		
LED	LED1~LED3	White LED, 350mA, V_F=2.7V~2.9V	3		
LED	D2	Red LED,20mA, V_F=1.8V,	1		
Header	JP1	3 pin headers	1		
Header	JP2~JP7	2 pin headers	6		

Bill of materials, refer to Figure 2 above.

PCB LAYOUT

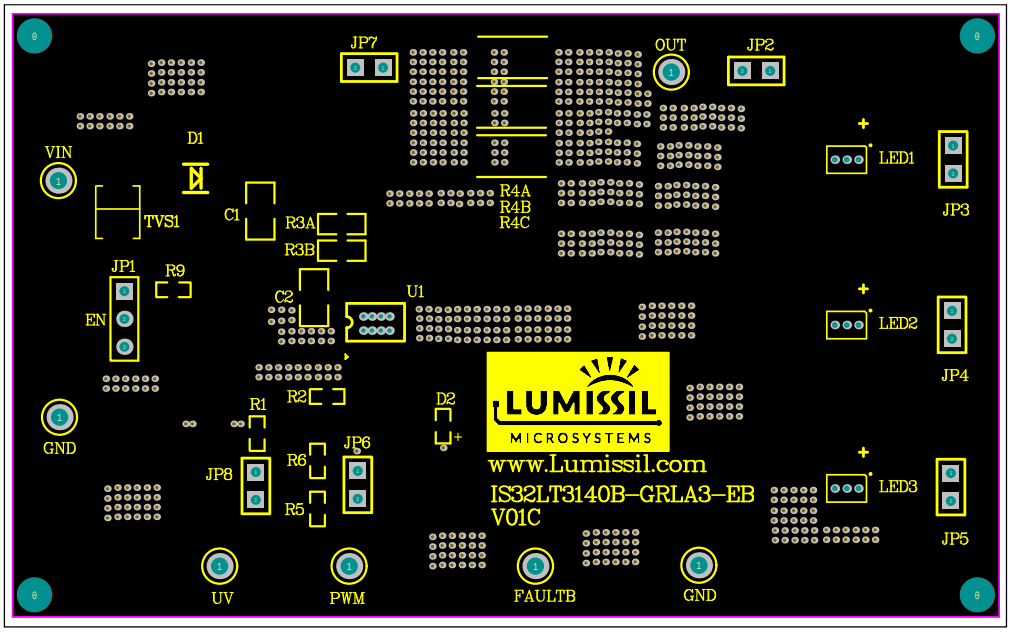

Figure 3: Board Component Placement - Top Layer

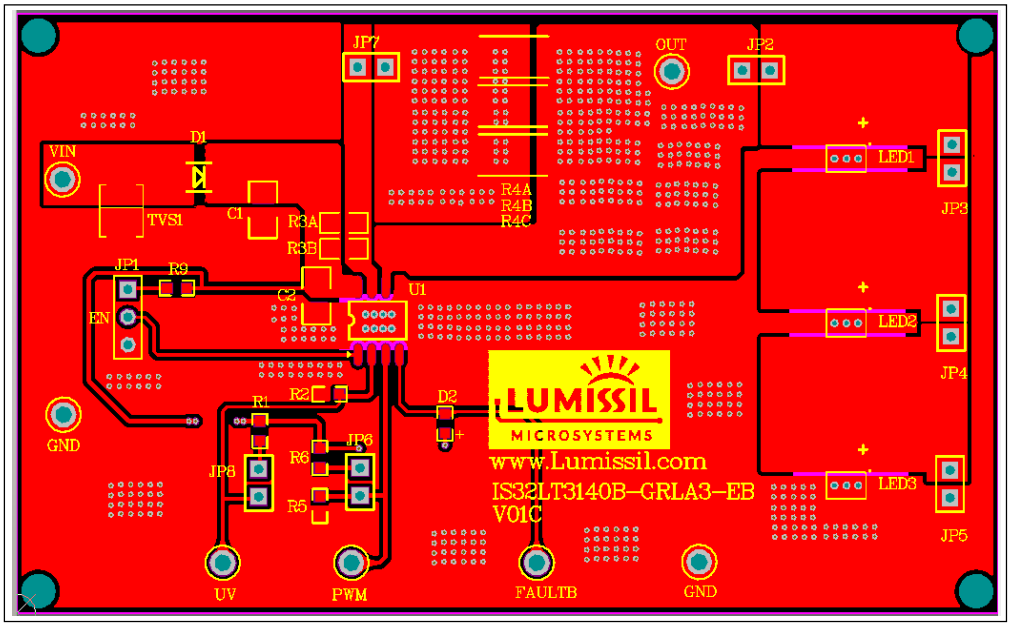

Figure 4: Board PCB Layout - Top Layer

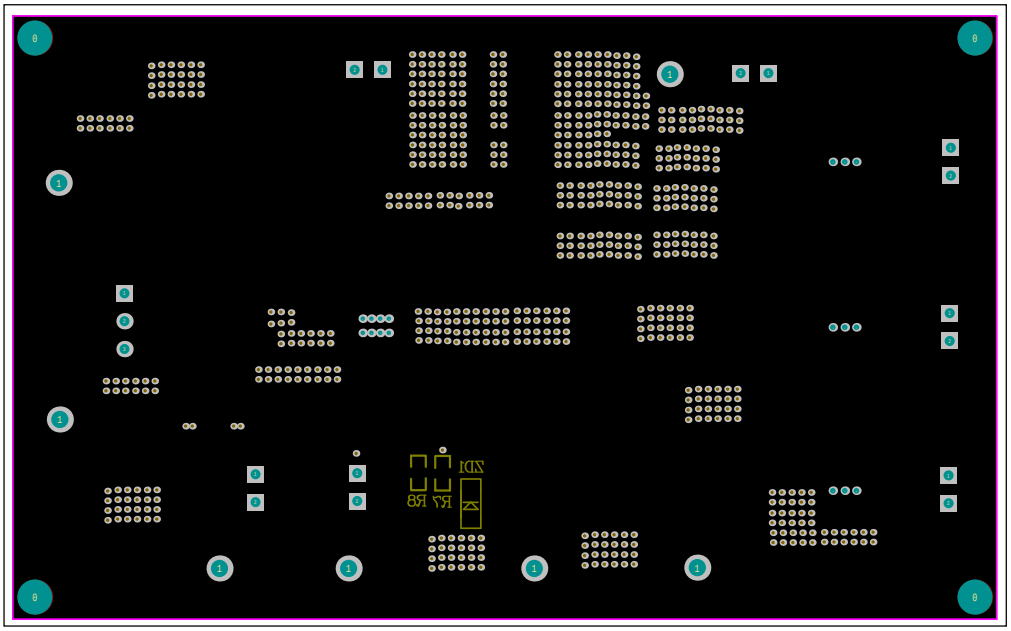

Figure 5: Board Component Placement - Bottom Layer

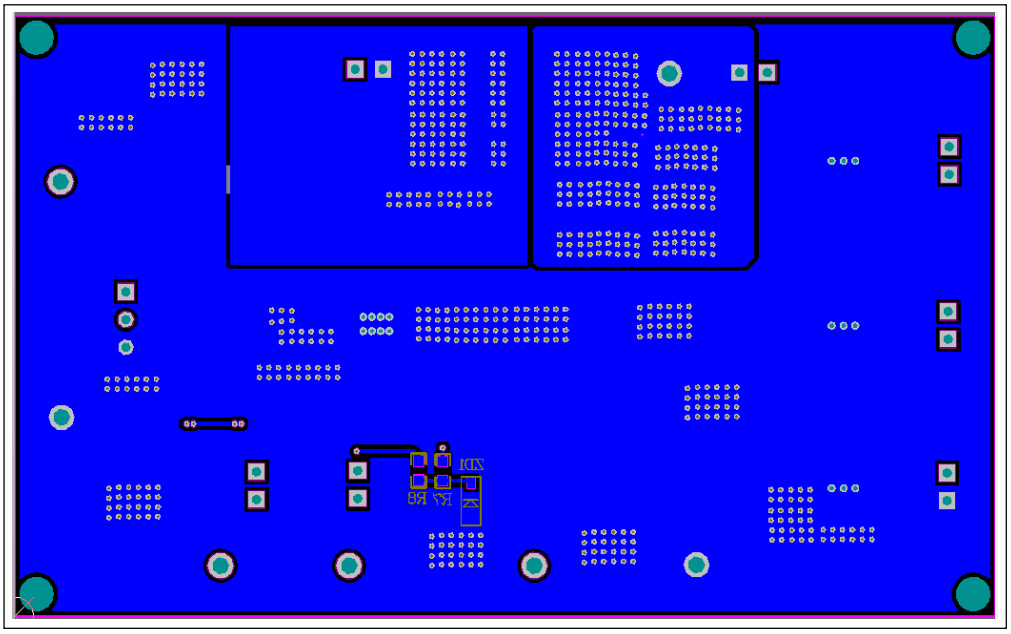

Figure 6: Board PCB Layout-Bottom Layer

REVISION HISTORY

Revision	Detail Information	Data
A	Initial Release	2021.04.10
B	Update Features information	2021.07.28