

# IS31LT3178/IS32LT3178 10-TO-200mA CONSTANT-CURRENT LED DRIVER

## DESCRIPTION

The IS31LT3178 and IS32LT3178 are adjustable linear current devices with excellent temperature stability. A single resistor is all that is required to set the operating current from 10mA to 200mA. The devices can operate from an input voltage from 2.6V to 40V with a minimal voltage headroom of 1.0V (Typ.) at 150mA. Designed with a low dropout voltage; the device can drive LED strings close to the supply voltage without switch capacitors or inductors.

The EN Pin of the IS31LT3178/IS32LT3178 can function as the PWM signal input used for MCU PWM dimming.

As a current sink it is ideal for LED lighting applications or current limiter for power supplies.

The device is provided in a lead (Pb) free, SOT23-6 and SOP-8-EP packages.

## FEATURES

- Low-side current sink
  - Adjustable from 10mA to 150mA (SOT23-6)/200mA (SOP-8-EP) with external resistor selection
- Wide input voltage range from
  - 2.6V to 40V with a low dropout of typical 1.0V at 150mA
- Up to 1kHz PWM input
- ±5% current accuracy over -40°C ~ +125°C
- Protection features:
  - 0.6%/K current roll off at high temp over 145°C for thermal protection
- Up to 0.77W (SOT23-6)/2.32W (SOP-8-EP) power dissipation in a small package
- RoHS compliant (Pb-free) package
- AEC-Q100 qualification in progress (IS32LT3178)

## QUICK START

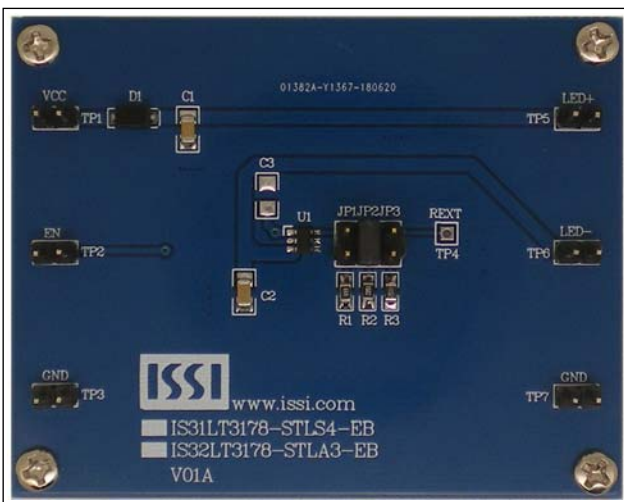


Figure 1: Photo of IS31LT3178-STLS4/IS32LT3178-STLA3 Evaluation Board

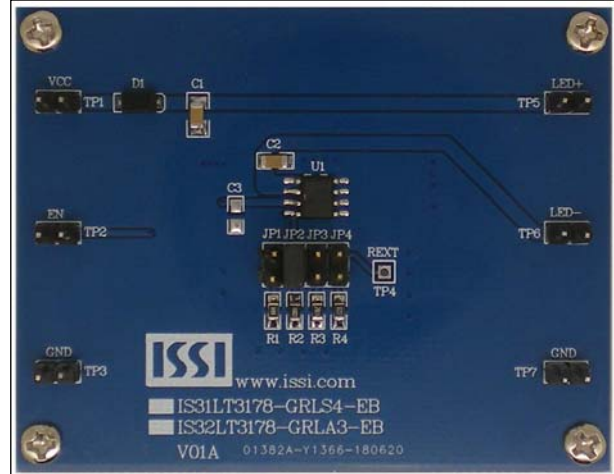


Figure 2: Photo of IS31LT3178-GRLS4/IS32LT3178-GRLA3 Evaluation Board

## RECOMMENDED EQUIPMENT

- 2.6V~40V, 1A DC variable power supply
- HBLEDs

## ABSOLUTE MAXIMUM RATINGS

- ≤ 40V input voltage

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

## PROCEDURE

The IS31LT3178/IS32LT3178 evaluation board are 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 (TP3) and the positive terminal to the VCC (TP1). Connect the Anode of an external LED string to LED+ (TP5) and its Cathode to LED- (TP6).
- 2) The evaluation board (IS31LT3178-STLS4/IS32LT3178-STLA3-EB) supports three current levels, selected by JP1, JP2, JP3 see the table below. The test point REXT can be used to add an external resistor. The final resistance can be measured with an ohm meter across REXT and GND (TP7) pins. For jumpers (JP1~JP3) Closed=1 and Open=0.

| JP1 | JP2 | JP3 | R <sub>EXT</sub> (kΩ) |
|-----|-----|-----|-----------------------|
| 1   | 0   | 0   | 33                    |
| 0   | 1   | 0   | 16                    |
| 0   | 0   | 1   | 11                    |

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3) The evaluation board (IS31LT3178-GRLS4 /IS32LT3178-GRLA3-EB) supports four current levels, selected by JP1, JP2, JP3, JP4 see the table on the right. The test point REXT can be used to add an external resistor. The final resistance can be measured with an ohm meter across REXT and GND (TP7) pins. For jumpers (JP1~JP4) Closed=1 and Open=0.

| JP1 | JP2 | JP3 | JP4 | R <sub>EXT</sub> (kΩ) |
|-----|-----|-----|-----|-----------------------|
| 1   | 0   | 0   | 0   | 33                    |
| 0   | 1   | 0   | 0   | 16                    |
| 0   | 0   | 1   | 0   | 11                    |
| 0   | 0   | 0   | 1   | 8.2                   |

## ORDERING INFORMATION

| Part No.            | Temperature Range           | Package             |
|---------------------|-----------------------------|---------------------|
| IS31LT3178-STLS4-EB | -40°C ~ +125°C (Industrial) | SOT-23-6, Lead-free |
| IS31LT3178-GRLS4-EB | -40°C ~ +125°C (Industrial) | SOP-8-EP, Lead-free |
| IS32LT3178-STLA3-EB | -40°C ~ +125°C (Automotive) | SOT-23-6, Lead-free |
| IS32LT3178-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](mailto:analog@lumissil.com) or (408) 969-6600

## EVALUATION BOARD OPERATION

IS31LT3178/IS32LT3178 evaluation board drives one string of HBLEDs.

output current. The device limits the maximum output current to I<sub>OUT\_LIMIT</sub> to protect itself from an output overcurrent condition caused by a low value. Do not leave ISET pin floating.

## OUTPUT CURRENT SETTING

IS31LT3178/IS32LT3178 provides an easy constant current source solution for LED lighting applications. It uses an external resistor to adjust the LED current from 10mA to 150mA (SOT23-6)/200mA (SOP-8-EP). The LED current can be determined by the external resistor R<sub>ISET</sub> as Equation (1):

$$R_{ISET} = \frac{V_{ISET} \times 1600}{I_{SET}} \quad (1)$$

10.6kΩ ≤ R<sub>ISET</sub> ≤ 160kΩ for SOT23-6 package, and 8kΩ ≤ R<sub>ISET</sub> ≤ 160kΩ for SOP-8-EP package.

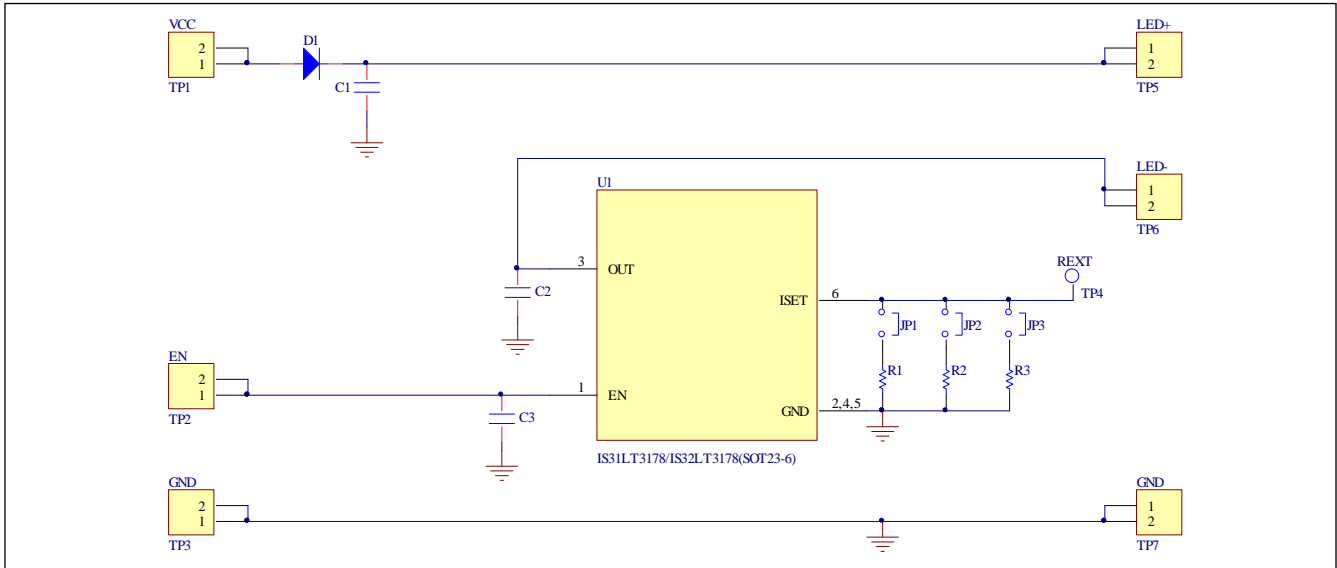
Where R<sub>ISET</sub> is in Ω, I<sub>SET</sub> is desired LED current in Amp and V<sub>ISET</sub> = 1.0V (Typ.)

R<sub>ISET</sub> must be a 1% accuracy resistor with good temperature characteristics in order to ensure stable

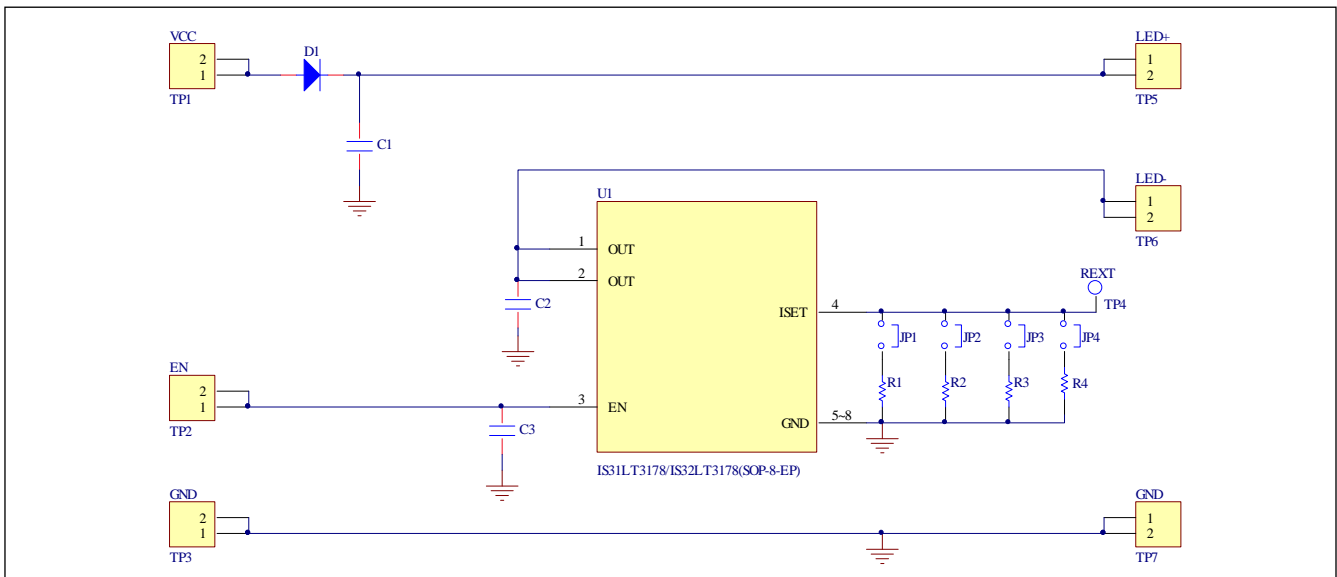
## THERMAL PROTECTION

The IS31LT3178/IS32LT3178 implements thermal roll off protection to reduce the LED current when the package's thermal dissipation is exceeded and prevent "thermal runaway". The thermal roll off begins from 145°C, and linearly decreases following the junction temp to 85% of the set current value at T<sub>SD</sub> (170°C). In the event that the junction temperature exceeds 170°C, the device will go into shutdown mode. At this point, the IC begins to cool off and will resume operation once the junction temperature goes below 140°C.

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**Figure 3: IS31LT3178/ IS32LT3178 (SOT23-6) Application Schematic**



**Figure 4: IS31LT3178/ IS32LT3178 (SOP-8-EP) Application Schematic**

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**BILL OF MATERIALS**

| Name          | Symbol  | Description                 | Qty | Supplier | Part No.                                   |
|---------------|---------|-----------------------------|-----|----------|--|
| LED Driver    | U1      | Constant-Current LED Driver | 1   | Lumissil | IS31LT3178-STLS4-TR<br>IS32LT3178-STLA3-TR |
| Resistor      | R1      | RES,33K,1/8W,±1%,SMD        | 1   | YAGEO    | RC0805FR-0733KL                            |
| Resistor      | R2      | RES,16K,1/8W,±1%,SMD        | 1   | YAGEO    | RC0805FR-0716KL                            |
| Resistor      | R3      | RES,11K,1/8W,±1%,SMD        | 1   | YAGEO    | RC0805FR-0711KL                            |
| Capacitor     | C1      | CAP, 0.1µF,50V,±10%,SMD     | 1   | YAGEO    | CC1206KRX7R9BB104                          |
| Capacitor     | C2      | CAP, 1nF,50V,±10%,SMD       | 1   | YAGEO    | CC1206KRX7R9BB102                          |
| Diode         | D1      | 1N4007,1A,1000V,SMA         | 1   | Diodes   | M7   |
| Capacitor     | C3      | NC                          | 1   |          |  |
| Jumper        | JP1~JP3 | Jumper                      | 3   |          |  |
| Test Terminal | TP1~TP7 | Test terminal               | 7   |          |  |

*Bill of materials, refer to Figure 3 above.*

| Name          | Symbol  | Description                 | Qty | Supplier | Part No.                                   |
|---------------|---------|-----------------------------|-----|----------|--|
| LED Driver    | U1      | Constant-Current LED Driver | 1   | Lumissil | IS31LT3178-GRLS4-TR<br>IS32LT3178-GRLA3-TR |
| Resistor      | R1      | RES,33K,1/8W,±1%,SMD        | 1   | YAGEO    | RC0805FR-0733KL                            |
| Resistor      | R2      | RES,16K,1/8W,±1%,SMD        | 1   | YAGEO    | RC0805FR-0716KL                            |
| Resistor      | R3      | RES,11K,1/8W,±1%,SMD        | 1   | YAGEO    | RC0805FR-0711KL                            |
| Resistor      | R4      | RES,8.2K,1/8W,±1%,SMD       | 1   | YAGEO    | RC0805FR-078K2L                            |
| Capacitor     | C1      | CAP, 0.1µF,50V,±10%,SMD     | 1   | YAGEO    | CC1206KRX7R9BB104                          |
| Capacitor     | C2      | CAP, 1nF,50V,±10%,SMD       | 1   | YAGEO    | CC1206KRX7R9BB102                          |
| Diode         | D1      | 1N4007,1A,1000V,SMA         | 1   | Diodes   | M7   |
| Capacitor     | C3      | NC                          | 1   |          |  |
| Jumper        | JP1~JP4 | Jumper                      | 4   |          |  |
| Test Terminal | TP1~TP7 | Test terminal               | 7   |          |  |

*Bill of materials, refer to Figure 4 above.*

# IS31LT3178/IS32LT3178 10-TO-200mA CONSTANT-CURRENT LED DRIVER

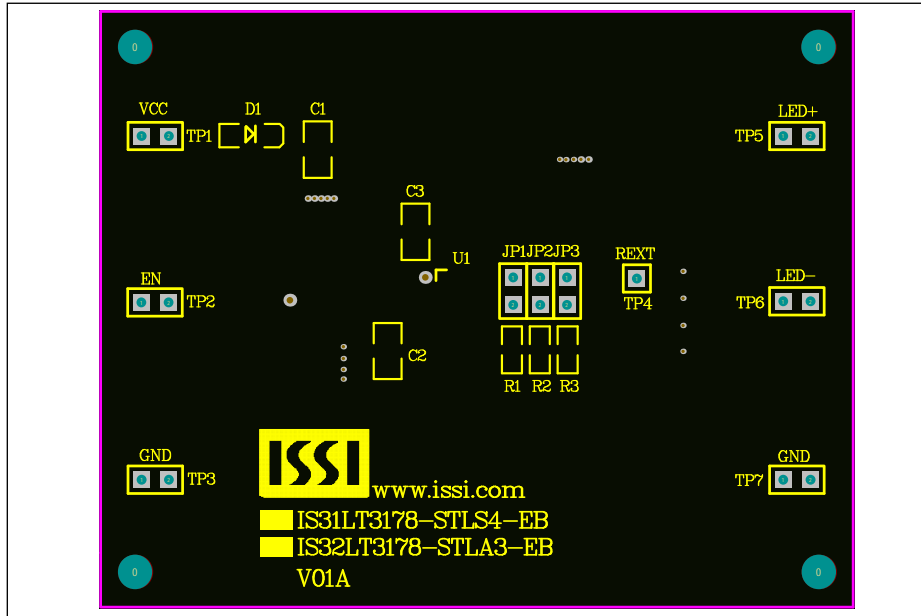


Figure 5: Board Component Placement Guide - Top Layer (SOT23-6)

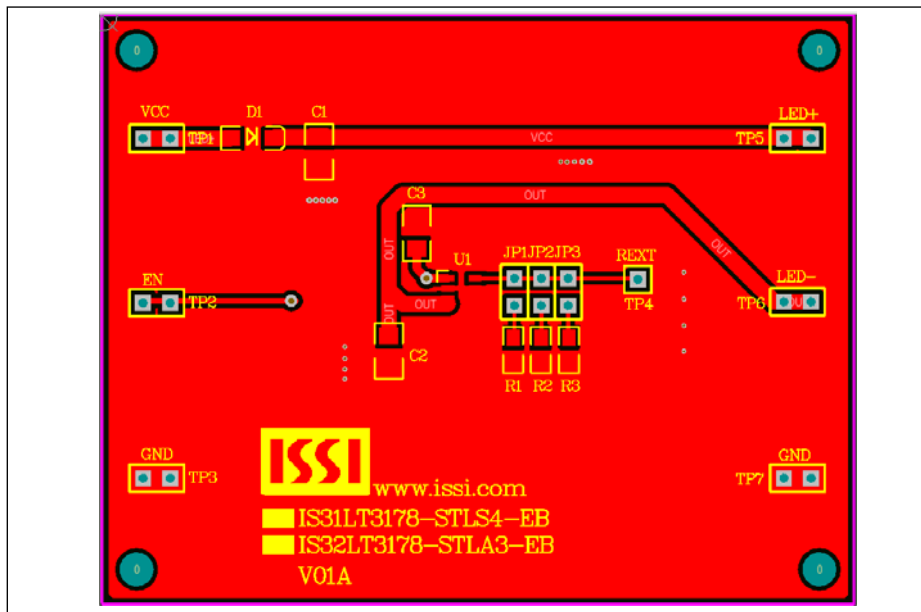


Figure 6: Board PCB Layout - Top Layer (SOT23-6)

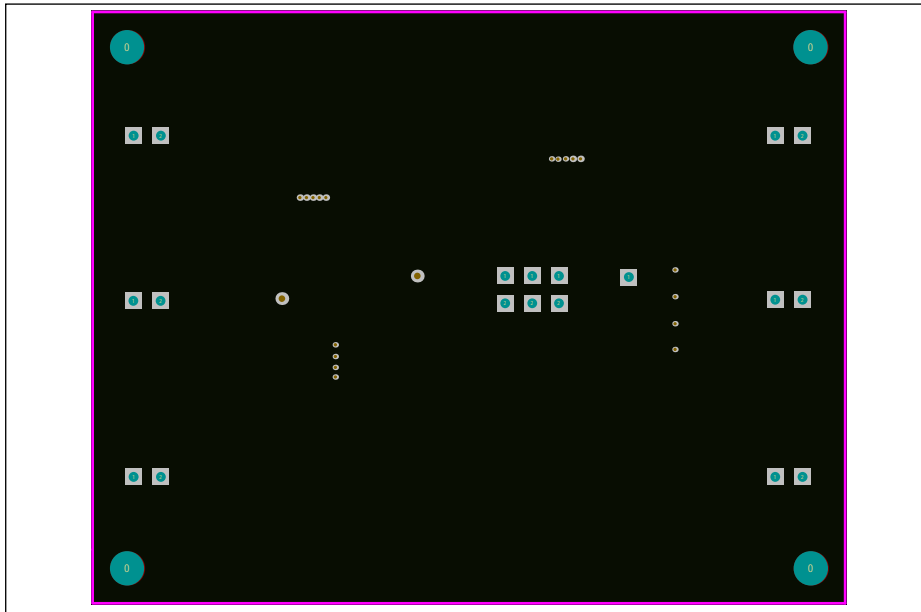


Figure 7: Board Component Placement Guide - Bottom Layer (SOT23-6)

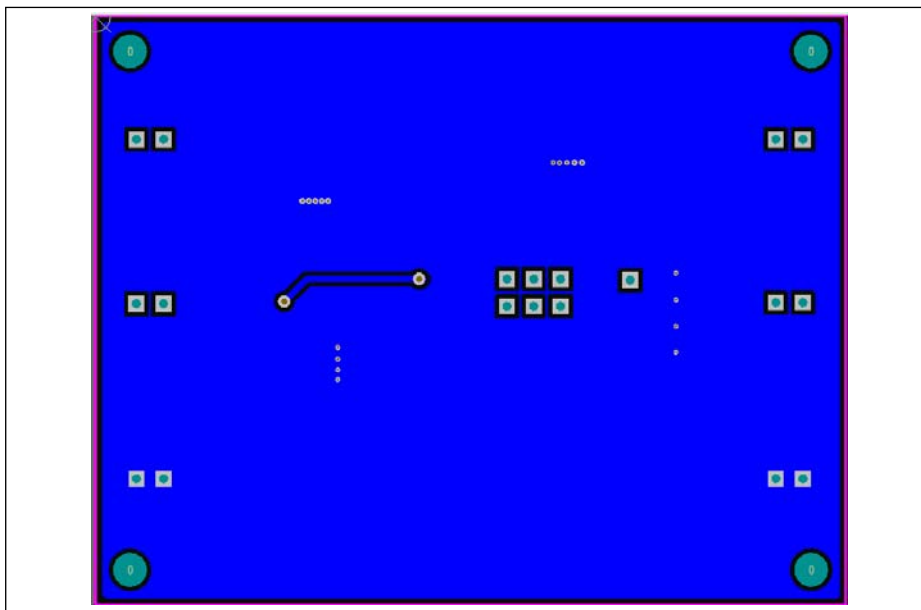


Figure 8: Board PCB Layout - Bottom Layer (SOT23-6)

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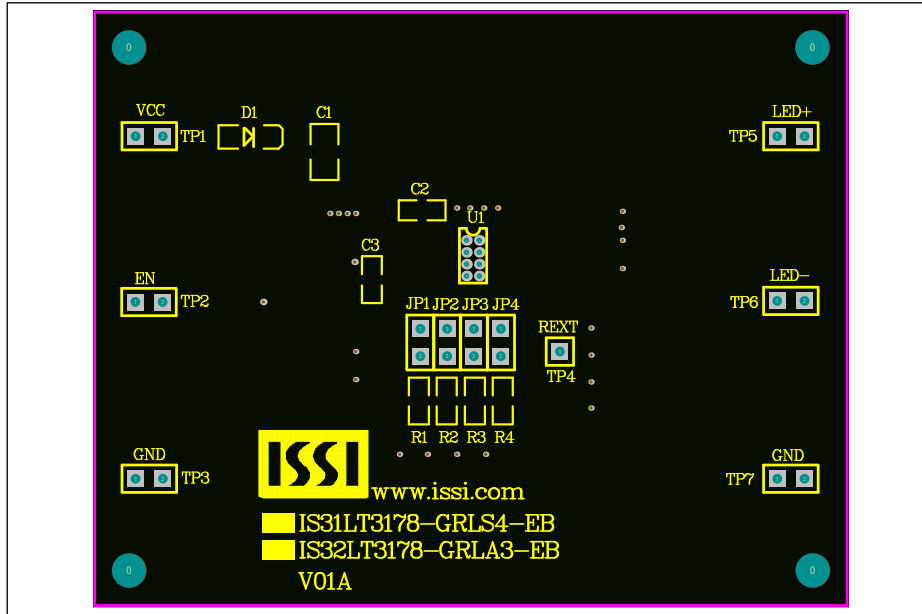


Figure 9: Board Component Placement Guide - Top Layer (SOP-8-EP)

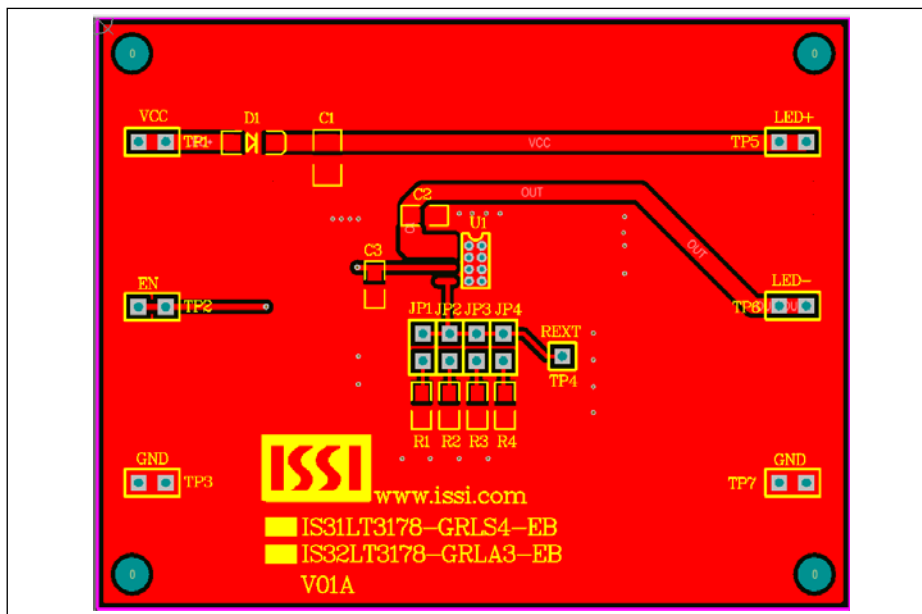


Figure 10: Board PCB Layout - Top Layer (SOP-8-EP)

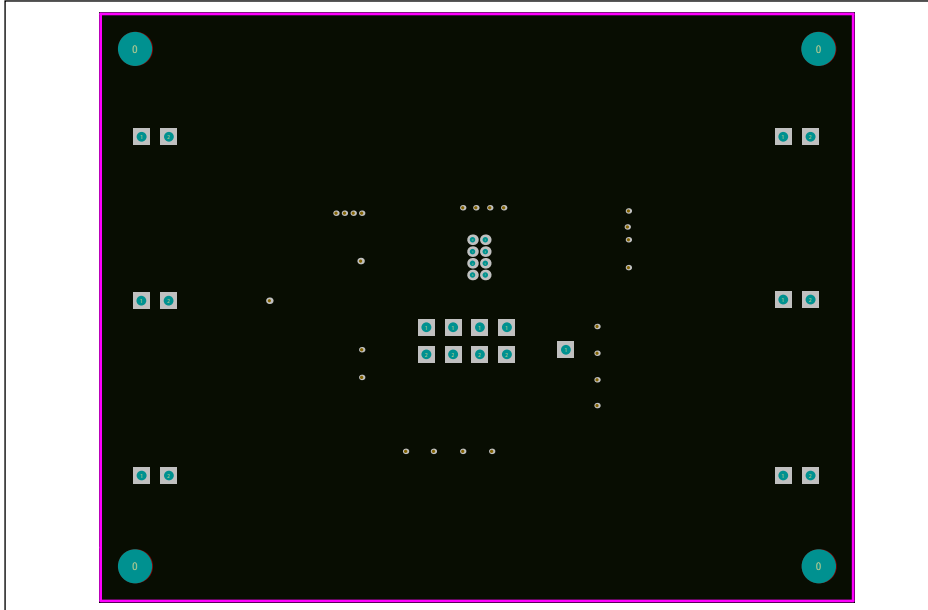


Figure 11: Board Component Placement Guide - Bottom Layer (SOP-8-EP)

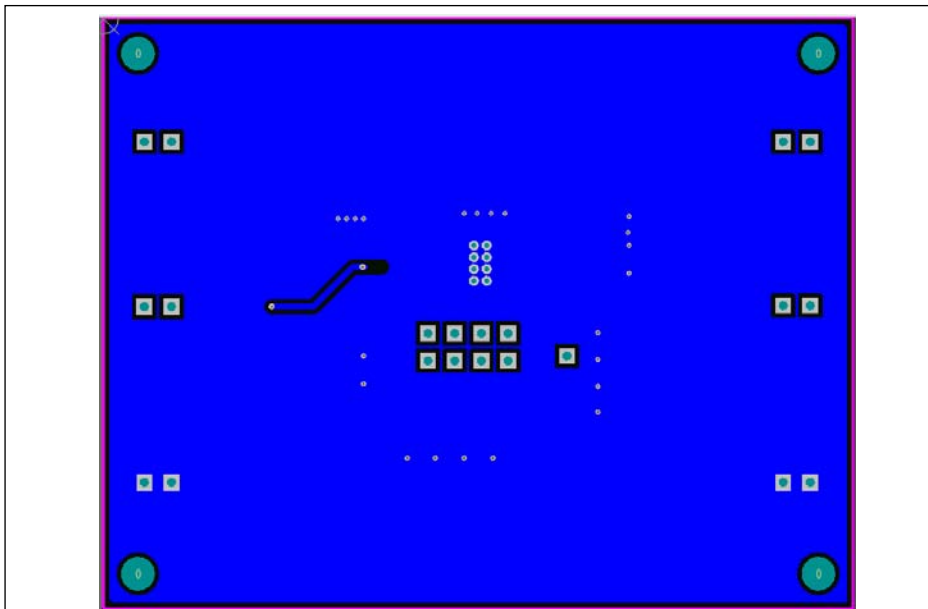


Figure 12: Board PCB Layout - Bottom Layer (SOP-8-EP)

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**REVISION HISTORY**

| <b>Revision</b> | <b>Detail Information</b> | <b>Date</b> |
|-----------------|---------------------------|-------------|
| A               | Initial release           | 2018.08.20  |
| B               | Update BOM list           | 2018.10.23  |