

BCR431U Low Voltage Drop LED Driver IC

Features

- Supply voltage from 6 V to 42 V
- Controls up to 36.5 mA LED current
- Max. 200 mV saturation voltage at 32.8 mA
- LED current precision $\pm 10\%$
- Smart over temperature protection function

Advantages with respect to discrete solutions

- Low BOM count
- Lower assembly cost
- Smaller form factor
- Higher reliability due to less parts and soldering joints

Potential Applications

- LED strips
- LED displays and channel letters
- Architectural and landscape lighting
- Retail lighting

Product Validation

- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

| Product Name | Package |
|--------------|------------|
| BCR431U | PG-SOT23-6 |

Description

BCR431U is a linear LED driver IC in a small PG-SOT23-6 package regulating the LED current in standalone operation without any external power transistor. The IC supply voltage range is from 6 V up to 42 V. The LED current level can be adjusted up to 36.5 mA connecting a high ohmic resistor R_{set} to pin RS. The maximum voltage drop at the integrated LED driver stage is 200 mV at 32.8 mA improving the overall system efficiency and providing extra voltage headroom to compensate for tolerances of LED forward voltage or supply voltage. The smart over temperature protection function reduces the LED current when junction temperature of BCR431U is very high.

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Application circuit

1 Application circuit

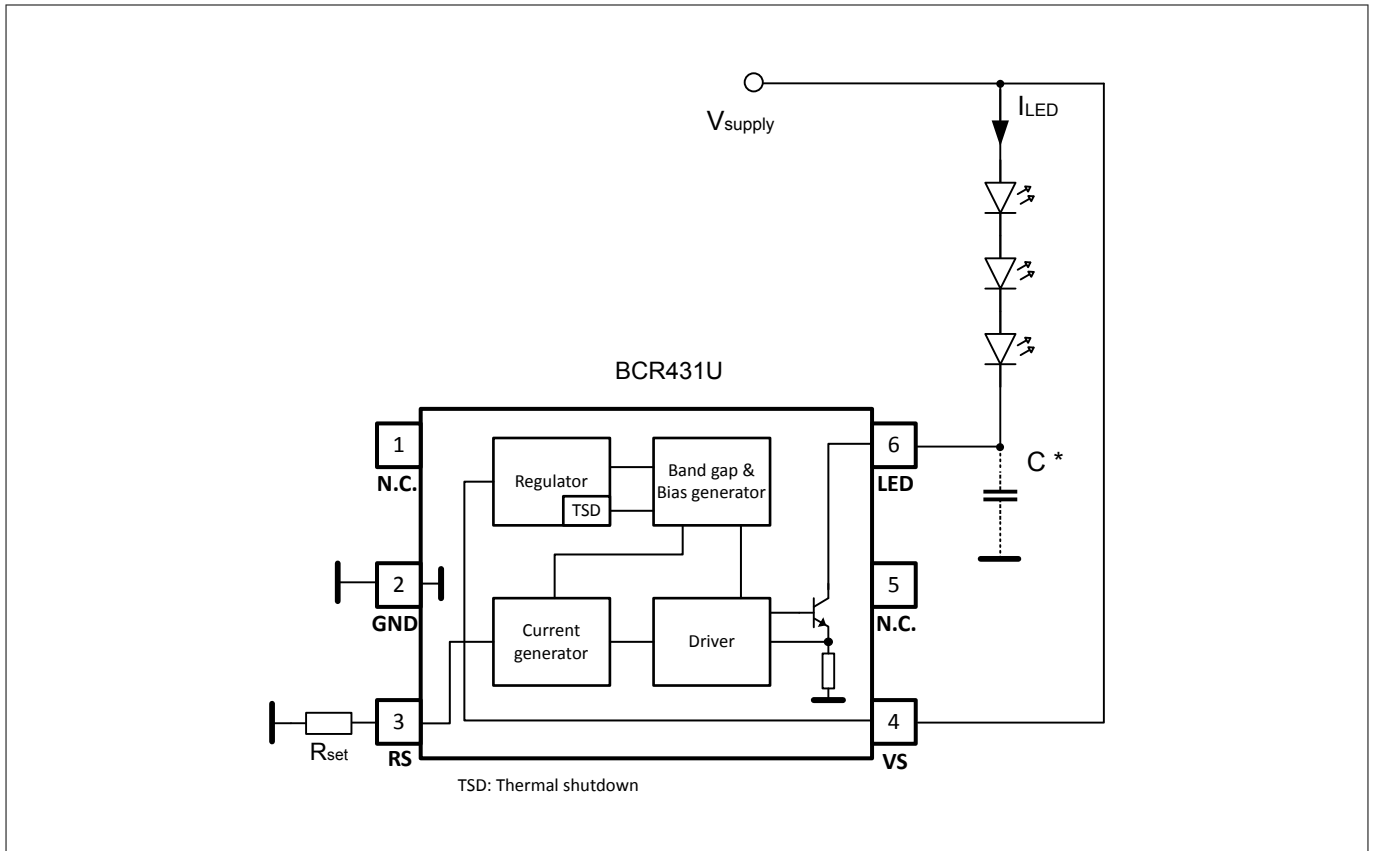


Figure 1 Typical Application Circuit of BCR431U

* A ceramic capacitor of 10nF in parallel to LED pin needed for a long line to compensate parasitic line inductance.

2 Pin configuration

| Pin No. | Pin Name | Pin Type | Function |
|---------|----------|----------|--|
| 1 | N.C. | - | Not connected |
| 2 | GND | GND | IC ground & thermal connection to heat spreader on PCB |
| 3 | RS | Output | Connection of Rset resistor |
| 4 | VS | Input | Supply voltage |
| 5 | N.C. | - | Not connected |
| 6 | LED | Input | Driver pin to control the LED current |

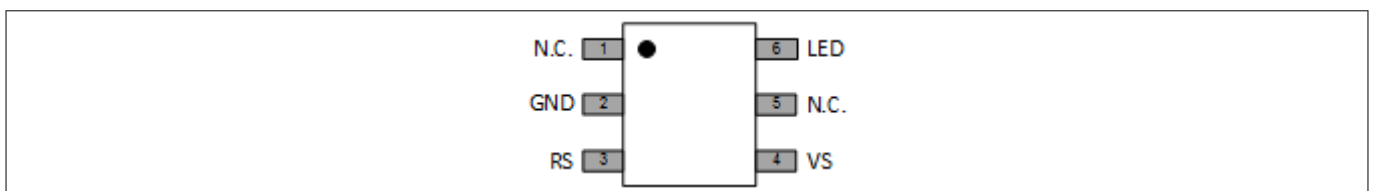


Figure 2 Pinout BCR431U

Functional description

3 Functional description

LED current configuration

The LED current is configured by the external resistor R_{set} at pin RS. The current flowing into pin LED is proportional to the current flowing out of pin RS by a ratio of about 760:1. Therefore, the LED current depends on the value of R_{set} .

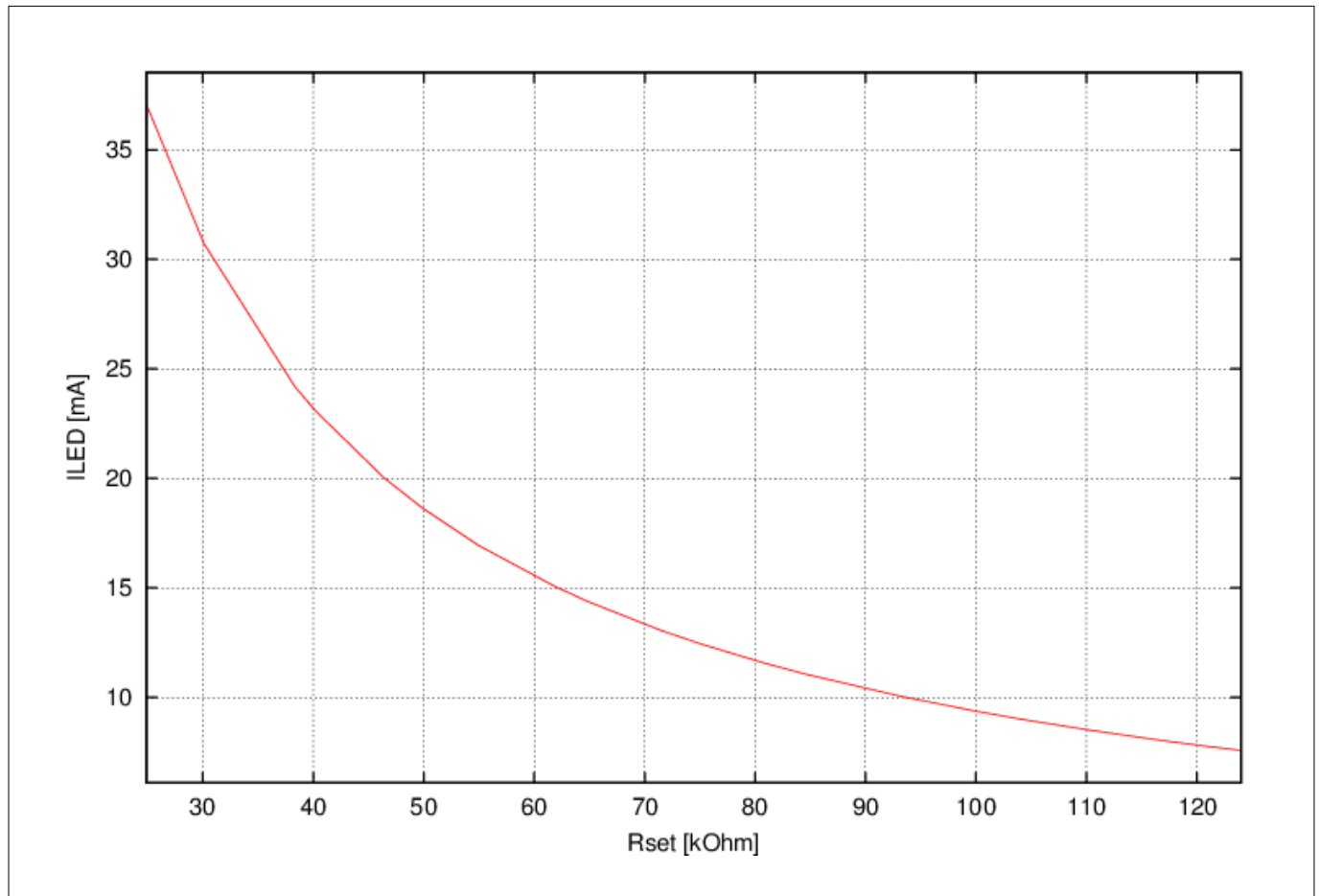


Figure 3 Relation between I_{LED} and R_{set}

Functional description

Smart over temperature protection function

BCR431U reduces the LED current with increasing junction temperature by reducing the voltage at pin RS. The reduced voltage of pin RS drives less current through the external resistor Rset, causing the current into pin LED to reduce. The LED current is never turned off fully.

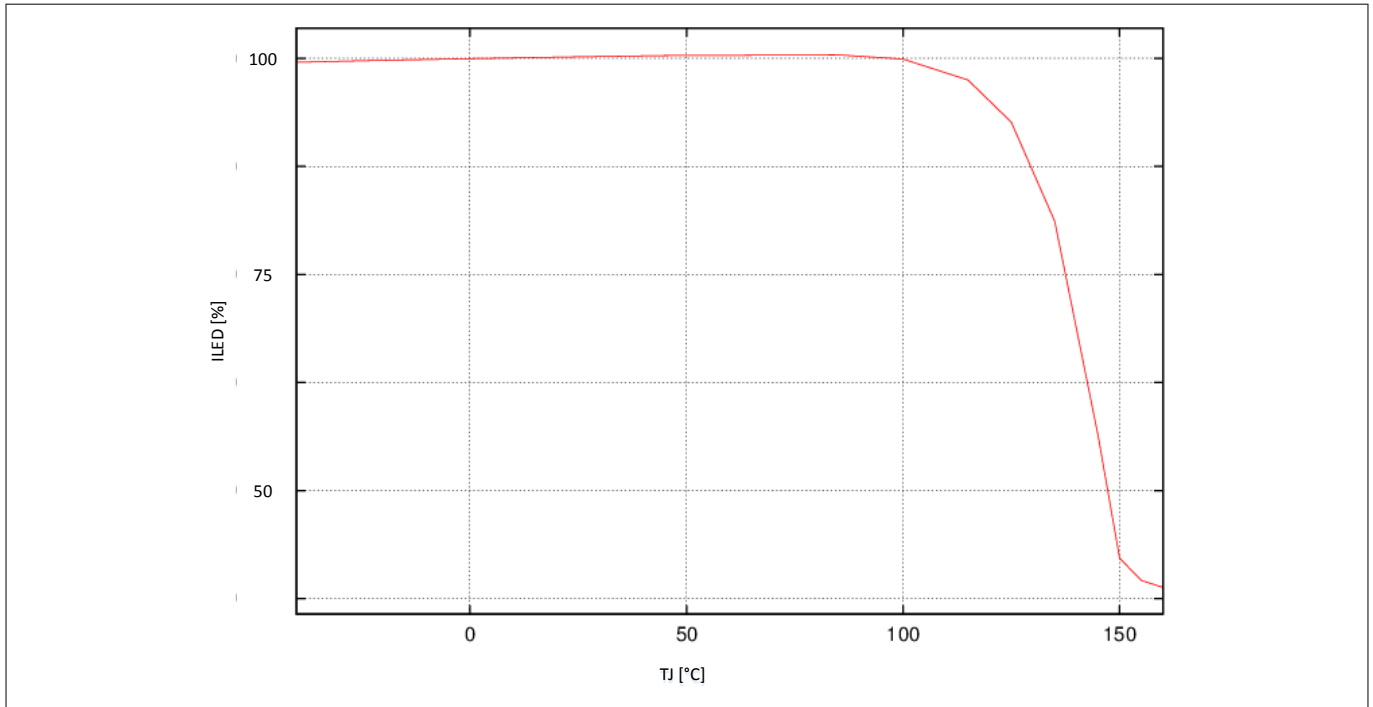


Figure 4 Relative reduction of LED current versus junction temperature of BCR431U

Maximum Permitted Power Dissipation

To avoid damage of the IC the power dissipation of BCR431U must be reduced with increasing ambient temperature according to [Figure 5](#).

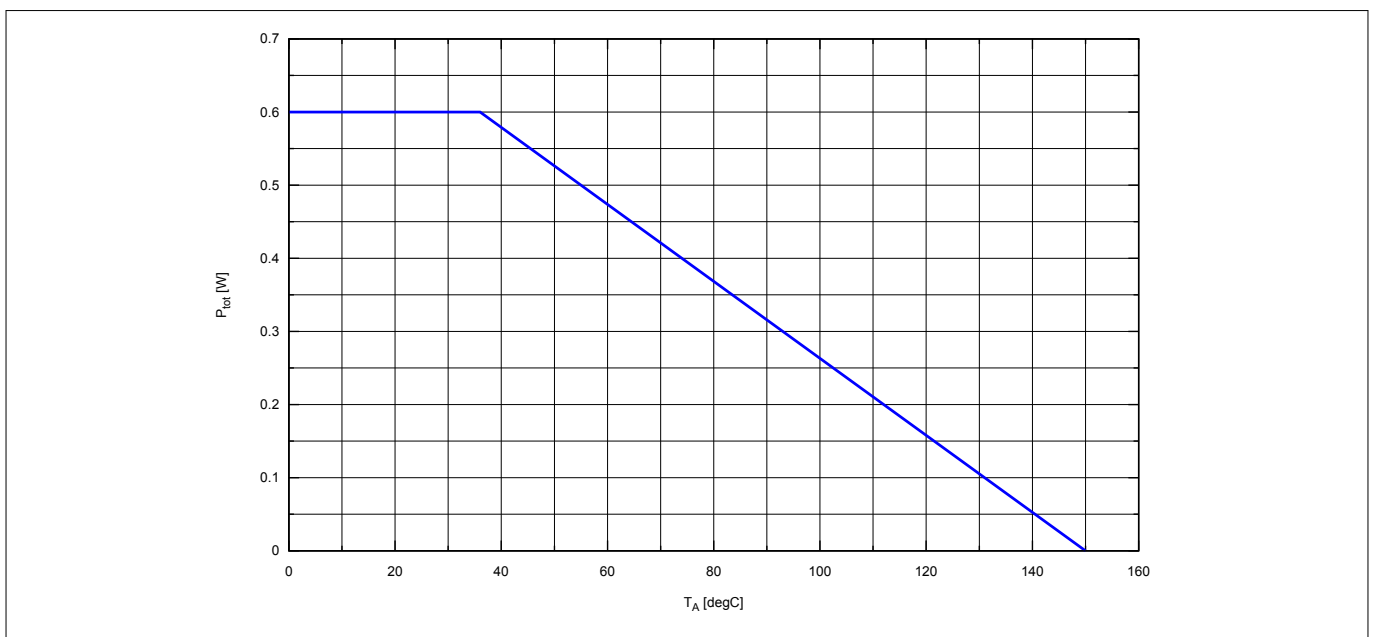


Figure 5 Maximum permitted total power dissipation of BCR431U on a JESD 51-7 board

Electrical characteristics and parameters

4 Electrical characteristics and parameters

Table 1 Maximum Ratings at $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|----------------------|---------------|--------|------|------|------------------|---|
| | | Min. | Typ. | Max. | | |
| Junction temperature | T_J | -40 | - | 150 | $^\circ\text{C}$ | |
| Supply voltage | V_S | 0 | - | 45 | V | |
| Voltage at LED pin | V_{LED} | 0 | - | 15 | V | |
| Driver LED current | I_{LED} | 0 | - | 42 | mA | |
| RS maximum voltage | V_{RS} | 0 | - | 5 | V | |
| RS output current | I_{RS} | 0 | - | 60 | μA | |
| Power dissipation | P_{tot} | - | - | 600 | mW | JESD 51-7 test board, $T_A \leq 36\text{ }^\circ\text{C}$ |
| ESD robustness | $V_{ESD,HBM}$ | 6 | - | - | kV | HBM according to JEDEC JS-001 |

Attention: Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit. These values are not tested, only production test.

Table 2 Thermal Resistance at $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note or Test Condition |
|---|---------------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Thermal resistance junction to ambient | $R_{thJA,1s0p,0}$ | - | - | 288 | K/W | JEDEC 1s0p (JESD 51-3) footprint w/o extra cooling area |
| | $R_{thJA,1s0p,300}$ | - | - | 182 | K/W | JEDEC 1s0p (JESD 51-3) with 300 mm ² cooling area connected to GND pin |
| | $R_{thJA,2s2p}$ | - | - | 190 | K/W | JEDEC 2s2p (JESD 51-7) |
| Thermal resistance junction to soldering pint | R_{thJS} | - | 70 | - | K/W | |

Table 3 Electrical Characteristics at $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note or Test Condition |
|----------------|--------|--------|------|------|------|---------------------------|
| | | Min. | Typ. | Max. | | |
| Supply voltage | V_S | 6 | - | 42 | V | Operational voltage range |

Electrical characteristics and parameters
Table 3 Electrical Characteristics at $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified (continued)

| Parameter | Symbol | Values | | | Unit | Note or Test Condition |
|---------------------------------|--------------------|--------|-------|------|---------------|--|
| | | Min. | Typ. | Max. | | |
| Supply current | I_S | - | - | 1.8 | mA | $V_{LED} = 1\text{ V}$, $R_{set} = 24.9\text{ k}\Omega$, $V_S = 6\text{ V}$ |
| | | - | - | 2 | | $V_{LED} = 1\text{ V}$, $R_{set} = 24.9\text{ k}\Omega$, $V_S = 42\text{ V}$ |
| Driver LED capability | I_{LED} | 32.8 | - | - | mA | $V_{LED} = 1\text{ V}$, $R_{set} = 24.9\text{ k}\Omega$ |
| Driver LED current by R_{set} | I_{LED} | - | 8 | - | mA | $R_{set} = 114\text{ k}\Omega$, $V_{LED} = 1\text{ V}$, $V_S = 24\text{ V}$ |
| | | - | 10 | - | | $R_{set} = 90.9\text{ k}\Omega$, $V_{LED} = 1\text{ V}$, $V_S = 24\text{ V}$ |
| | | - | 15 | - | | $R_{set} = 60.4\text{ k}\Omega$, $V_{LED} = 1\text{ V}$, $V_S = 24\text{ V}$ |
| | | - | 20 | - | | $R_{set} = 45.3\text{ k}\Omega$, $V_{LED} = 1\text{ V}$, $V_S = 24\text{ V}$ |
| | | - | 24 | - | | $R_{set} = 36.5\text{ k}\Omega$, $V_{LED} = 1\text{ V}$, $V_S = 24\text{ V}$ |
| | | - | 36.5 | - | | $R_{set} = 24.9\text{ k}\Omega$, $V_{LED} = 1\text{ V}$, $V_S = 24\text{ V}$ |
| Driver saturation voltage | $V_{LED,sat}$ | - | - | 200 | mV | $I_{LED} = 32.8\text{ mA}$, $R_{set} = 24.9\text{ k}\Omega$, $V_S = 6\text{ V}$ |
| Driver saturation voltage | $V_{LED,sat}$ | - | - | 200 | mV | $I_{LED} = 32.8\text{ mA}$, $R_{set} = 24.9\text{ k}\Omega$, $V_S = 24\text{ V}$ |
| RS pin voltage | V_{RS} | 1.172 | 1.197 | 1.22 | V | $R_{set} = 45.3\text{ k}\Omega$, $V_{LED} = 1\text{ V}$, $V_S = 24\text{ V}$ |
| V_{LED} pin leakage current | $I_{V_{LED},leak}$ | - | - | 350 | μA | R_{set} opened, $V_{LED} = 15\text{ V}$, $V_S = 42\text{ V}$ |

Package dimensions

5 Package dimensions

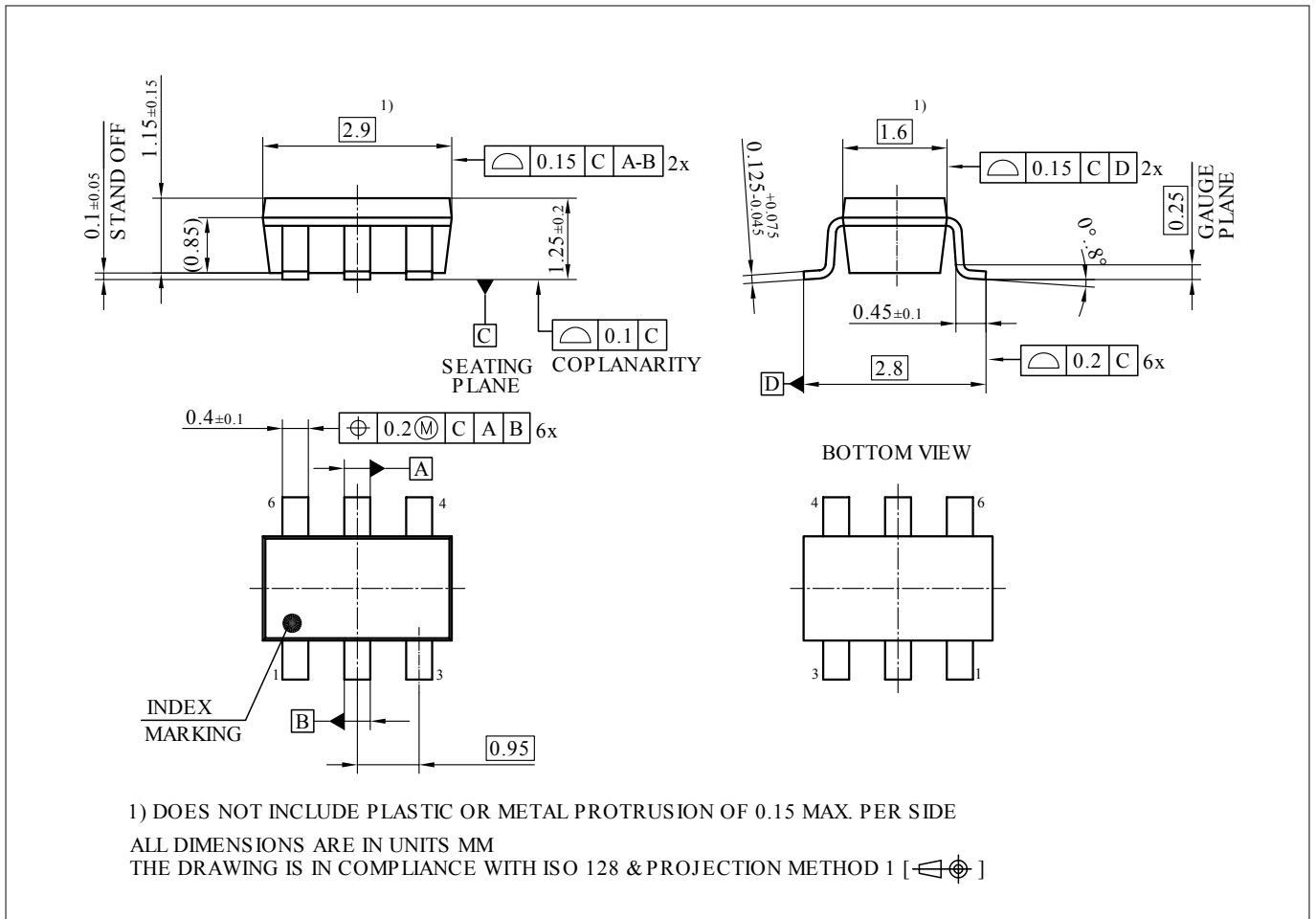


Figure 6 Package outline PG-SOT23-6

Package dimensions

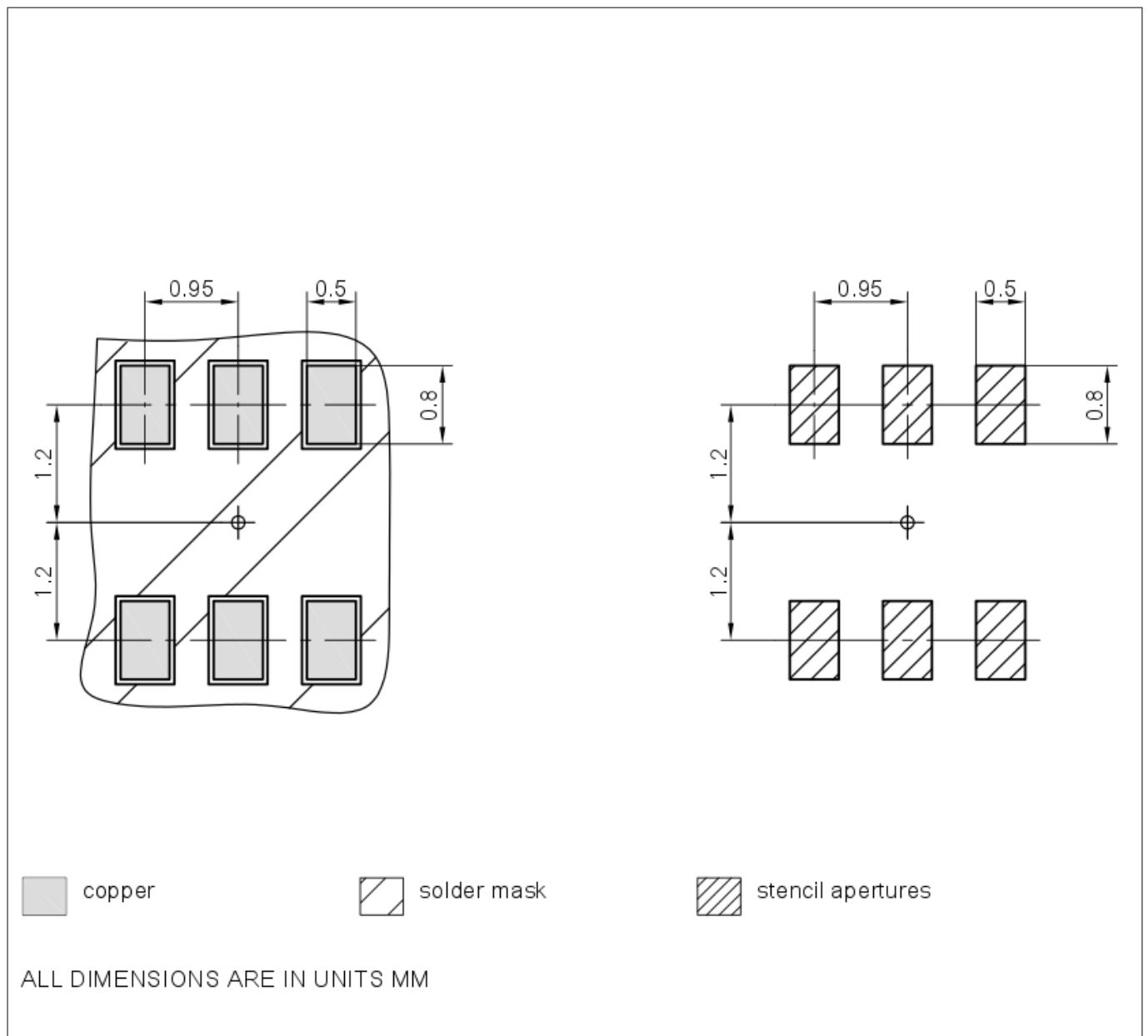


Figure 7 Footprint PG-SOT23-6

References

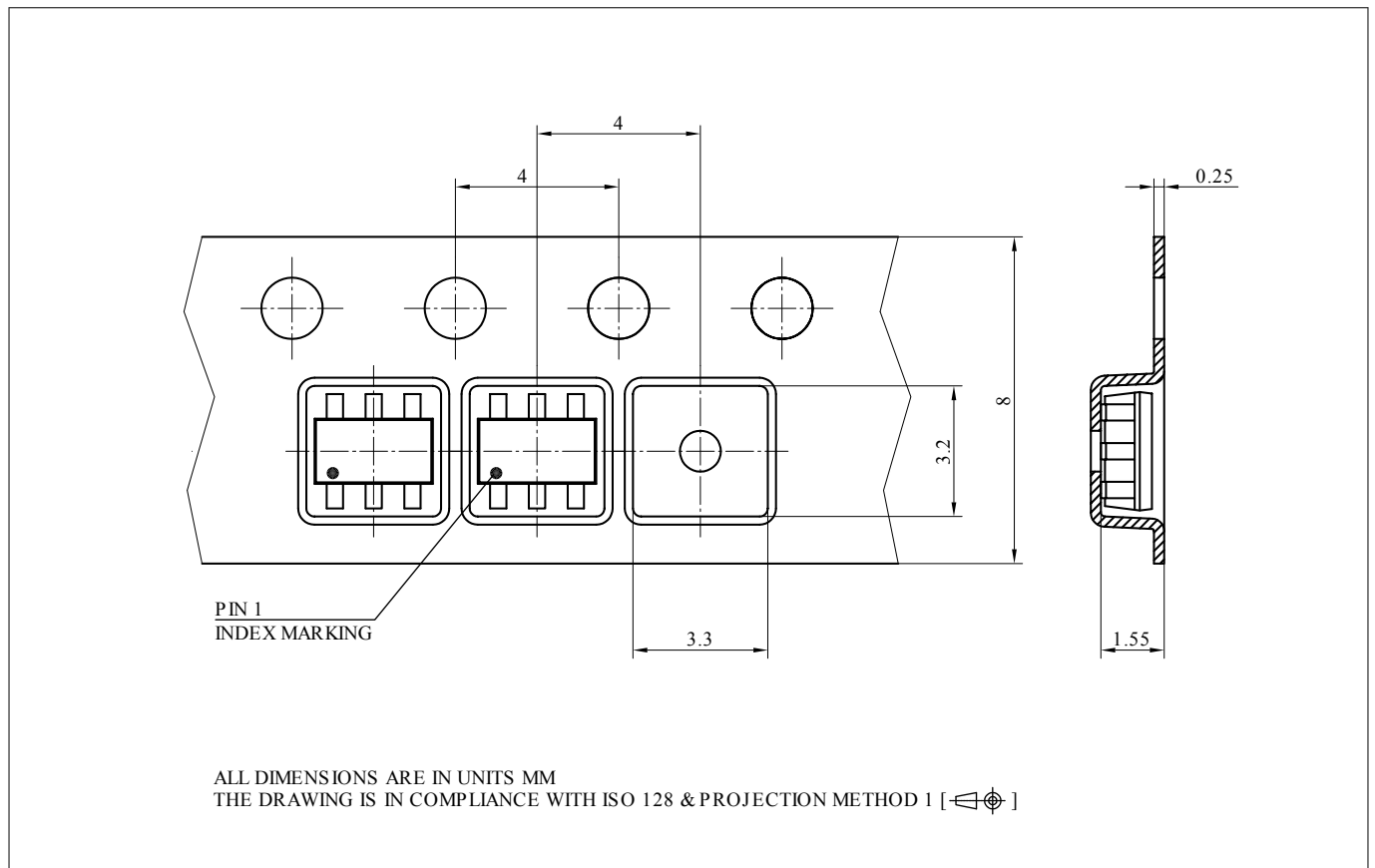


Figure 8 Tape & Reel PG-SOT23-6

6 References

Revision history

| Document version | Date of release | Description of changes |
|------------------|-----------------|--------------------------|
| 1.0 | 2020-03-03 | First data sheet release |