BCR430U

Low Voltage Drop LED Driver IC

Feature list

- Supply voltage from 6 V to 42 V
- Controls up to 100 mA LED current
- Typ. 135 mV saturation voltage at 50 mA
- LED current precision ±5 % at 95 mA
- 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
BCR430U	PG-SOT23-6

Description

BCR430U 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 100 mA connecting a high ohmic resistor Rset to pin RS. The maximum voltage drop at the integrated LED driver stage is 200 mV at 50 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 BCR430U is very high.

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1 Application circuit

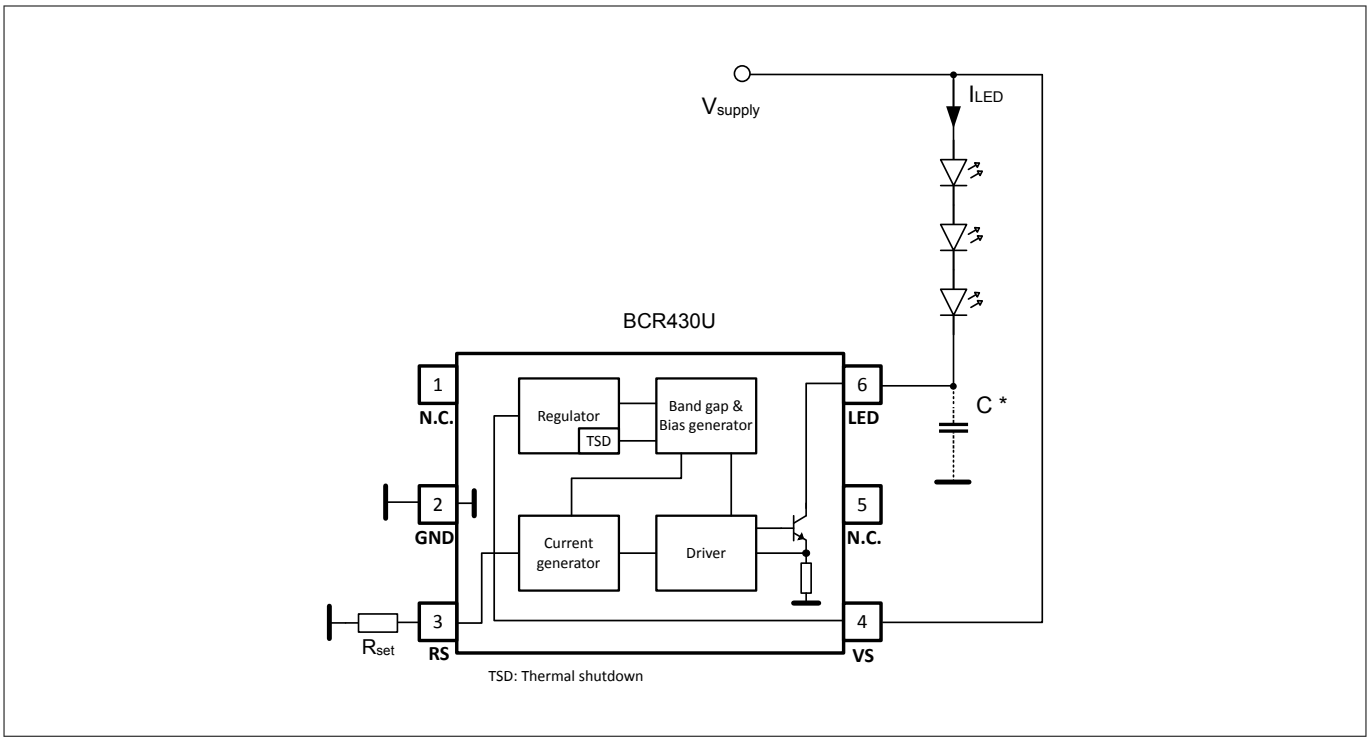

Figure 1 Typical Application Circuit of BCR430U

* 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

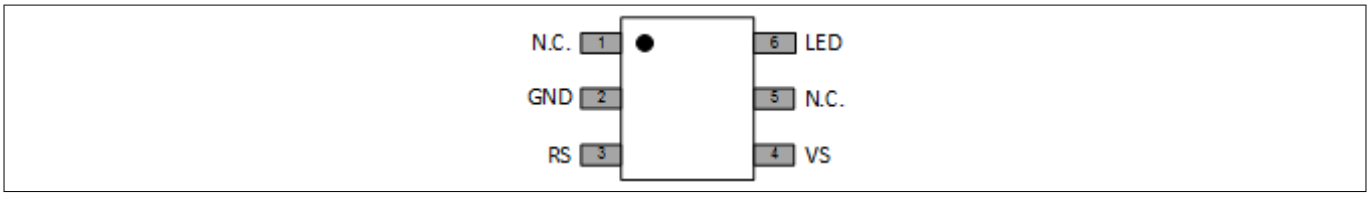

Figure 2 Pinout BCR430U

3 Functional description

LED current configuration

The LED current is configured by the external resistor Rset at pin RS. The current flowing into pin LED is proportional to the current flowing out of pin RS by a ratio of about 520:1. Therefore, the LED current depends on the value of Rset.

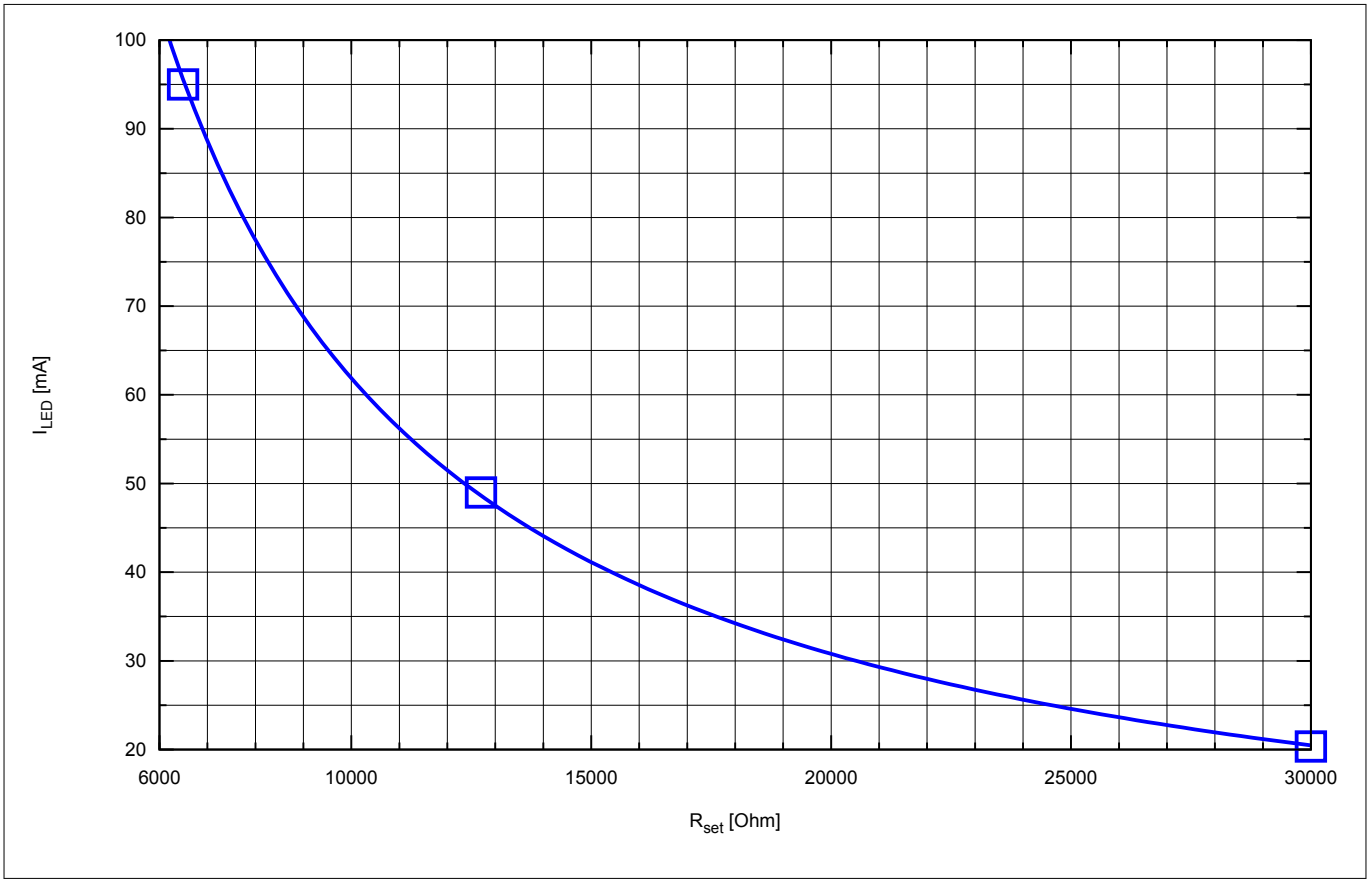

Figure 3 Relation between I_{LED} and R_{set}

Smart over temperature protection function

BCR430U 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.

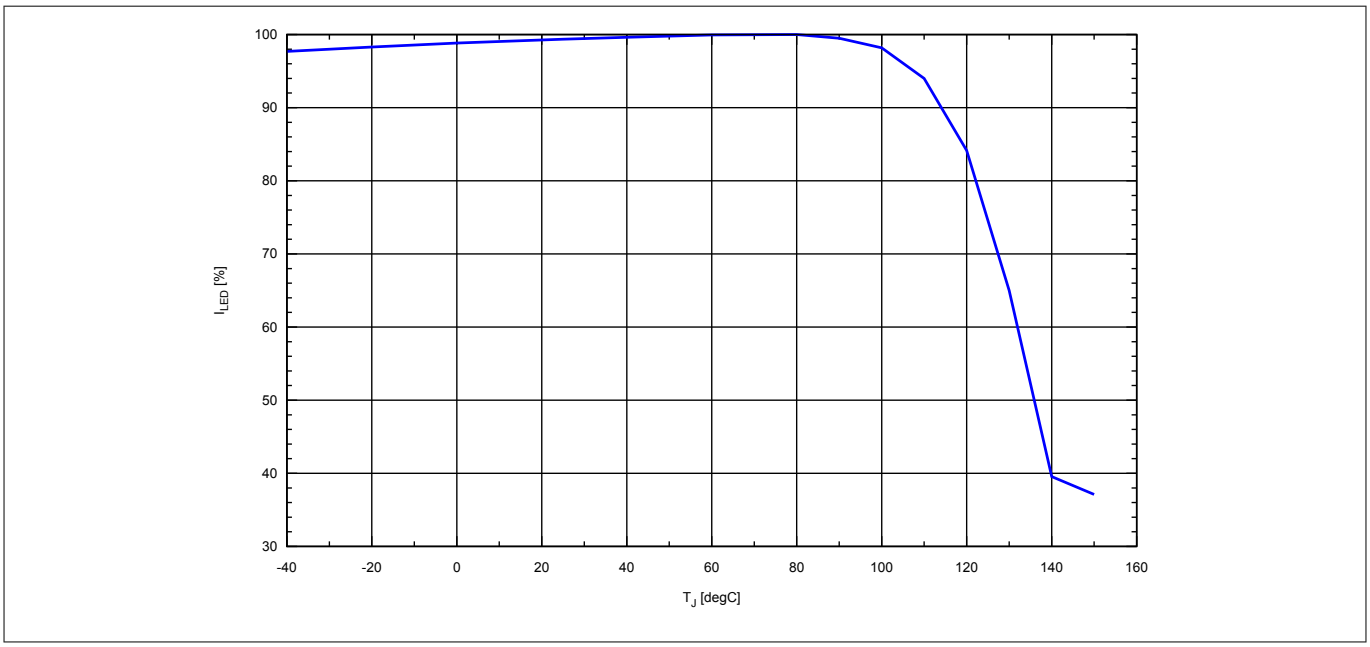

Figure 4 Relative reduction of LED current versus junction temperature of BCR430U

Maximum Permitted Power Dissipation

To avoid damage of the IC the power dissipation of BCR430U must be reduced with increasing ambient temperature according to ***Figure 5***.

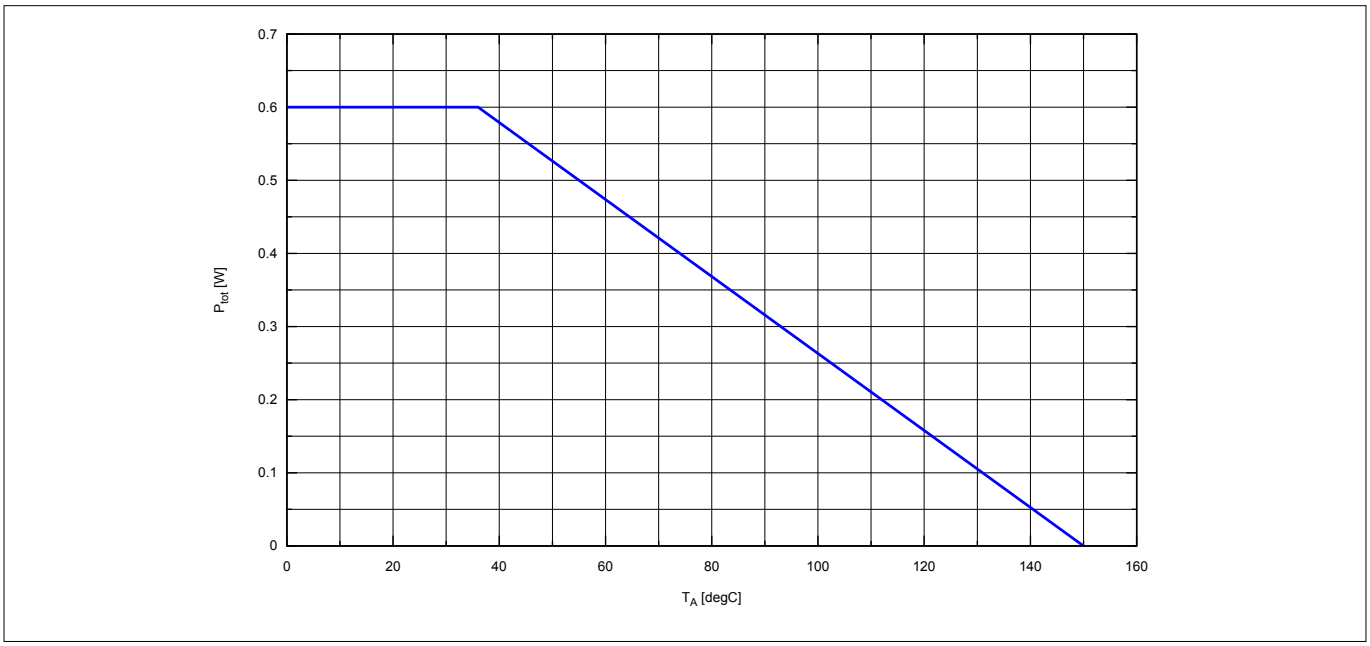

Figure 5 Maximum permitted total power dissipation of BCR430U on a JESD 51-7 board

4 Electrical characteristics and parameters

Table 1 Maximum Ratings at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Junction temperature	T_J	-40	-	150	°C	
Supply voltage	V_S	0	-	45	V	
Voltage at LED pin	V_{LED}	0	-	20	V	
Driver LED current	I_{LED}	0	-	100	mA	
RS maximum voltage	V_{RS}	0	-	5	V	
RS output current	I_{RS}	0	-	0.3	mA	
Power dissipation	P_{tot}	-	-	600	mW	JESD 51-7 test board, $T_A \leq 36$ °C
ESD robustness	$V_{ESD,HBM}$	-	-	1	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.

1. *For the supply pin VS, ESD protection vs. GND is performed with a snapback device, that will pull the VS voltage back to voltages around 20V if triggered. Usually this will happen if VS exceeds a trigger voltage (a typical value is 59V at room temperature in an ESD time range), e.g. by hot-plugging the LED driver with a power supply without proper system protection to limit the VS voltage. Then, the protection device would remain active until the voltage at this pin is reduced to a level sufficiently below the snapback voltage. So, if such a scenario cannot be excluded, an application would have to deactivate any snapback in due time to avoid damage by thermal overload.*

2. *For all other pins ESD protections is triggered without snapback, once the connected voltage signal exceeds a threshold higher than the maximum voltage rating specified.*

Table 2 Thermal Resistance at T_A = 25 °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 °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
Supply current	I_S	1.2	1.7	2.2	mA	I_{LED} = 50 mA, V_S = 6 V, V_{LED} = 1 V
		1.3	1.8	2.3		I_{LED} = 50 mA, V_S = 42 V, V_{LED} = 1 V
Driver LED capability	I_{LED}	20	-	100	mA	V_{LED} = 1 V, V_S =24 V
Driver LED current by R_{set}	I_{LED}	18.0	20.4	22.7	mA	R_{set} = 30 kΩ, V_{LED} =1 V, V_S =24 V
		45.7	49	52.3		R_{set} = 12.7 kΩ, V_{LED} = 1 V, V_S =24 V
		90	95	100		R_{set} = 6.49 kΩ, V_{LED} = 1 V, V_S =24 V
Driver saturation voltage	$V_{LED,sat}$	-	-	200	mV	I_{LED} = 50 mA, V_S =24 V
RS pin voltage	V_{RS}	1.16	1.20	1.24	V	I_{RS} = 0 µA, V_S = 24 V
		1.15	1.19	1.23		I_{RS} = 200 µA, V_S = 24 V

5 ESD protection

When a high voltage surge is applied to the VS pin, the internal ESD structure starts conducting at 59 V. It stops conducting when the voltage drops to 20 V. If the supplied voltage is higher than 20 V, like 24 V for example, the internal ESD structure might not stop conduction, which could cause damage.

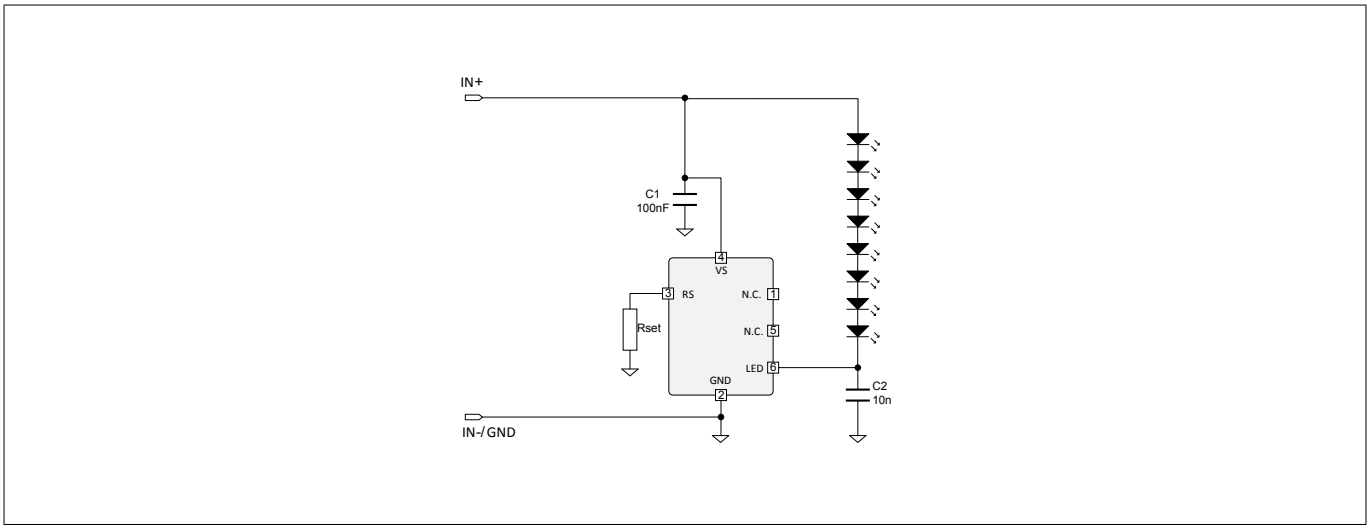

Figure 6 ESD surge protection on system level

To avoid such an effect it is recommended to limit ESD surge using external components such as a ceramic capacitor from 10 to 100 nF on the VS pin, as shown in ***Figure 6***. This solution may protect the system in a typical 24 V application from around 1.5 to 2 kV.

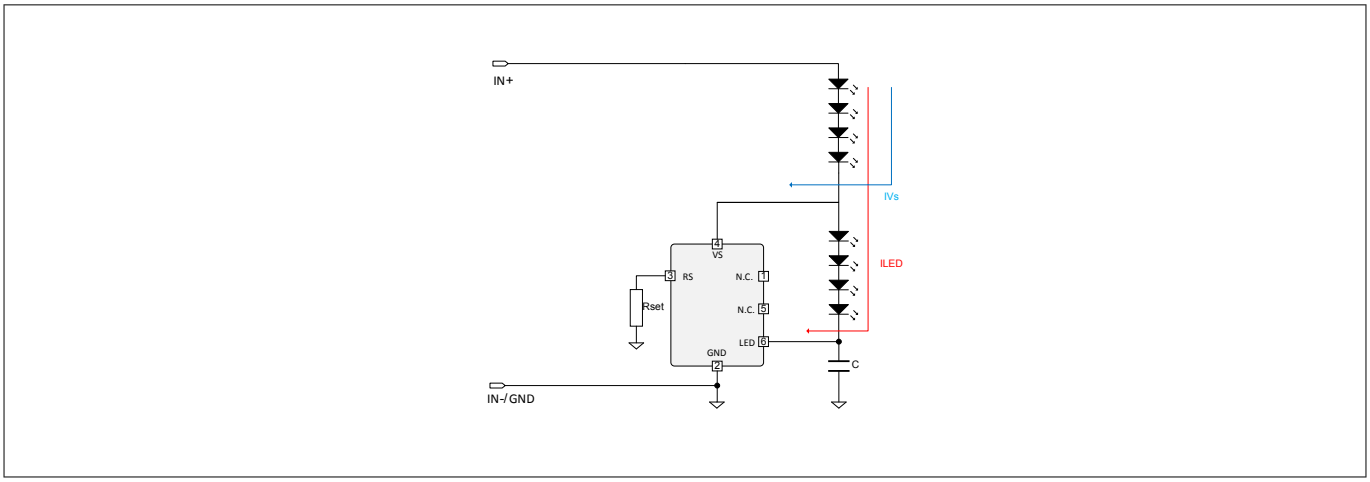

Figure 7 ESD protection divided LED strip by two

There is an optional protection, as shown in ***Figure 7***. When the LED strip is divided in two, the VS voltage is always less than 20 V. The forward voltage drop on the LEDs limits the VS voltage. With this protection the difference between currents in both strips will be up to 2 mA, which is the VS supply current.

6 Package dimensions

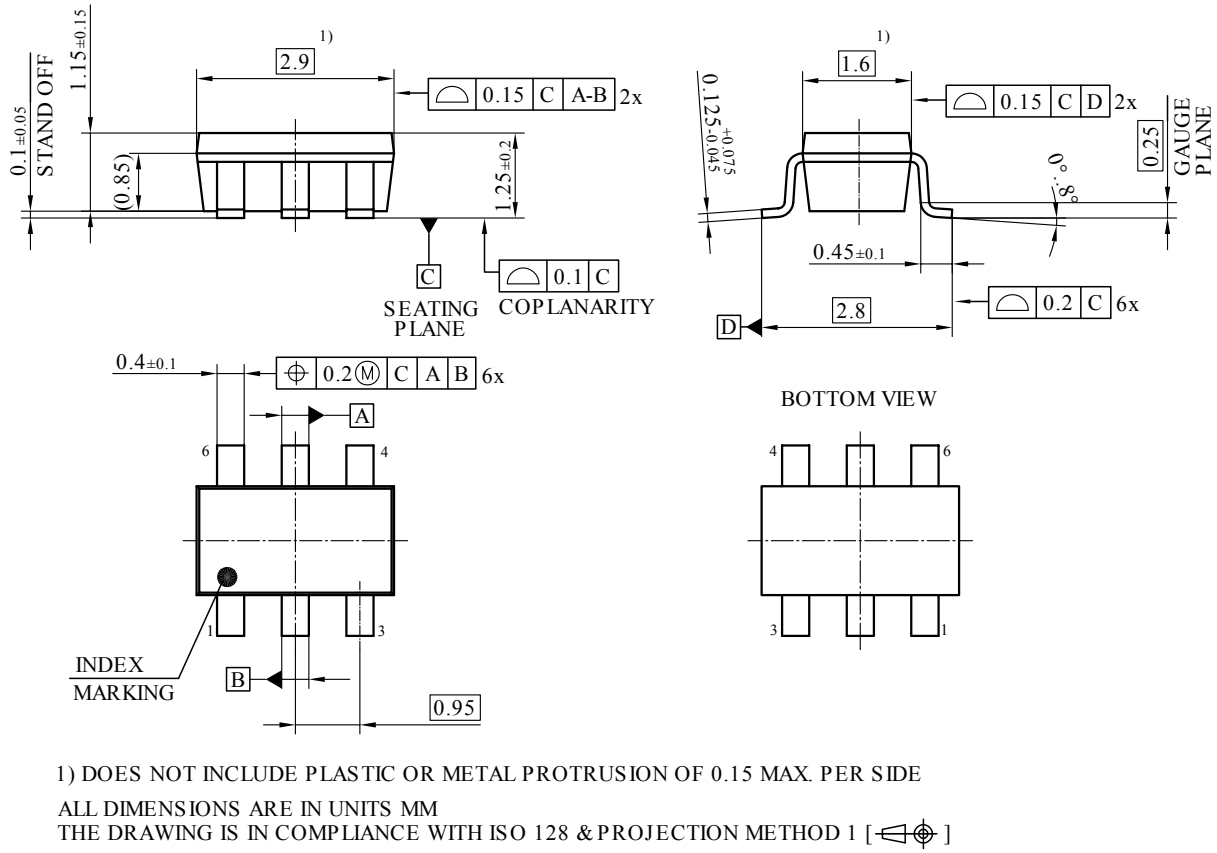

Figure 8 Package outline PG-SOT23-6

Package dimensions

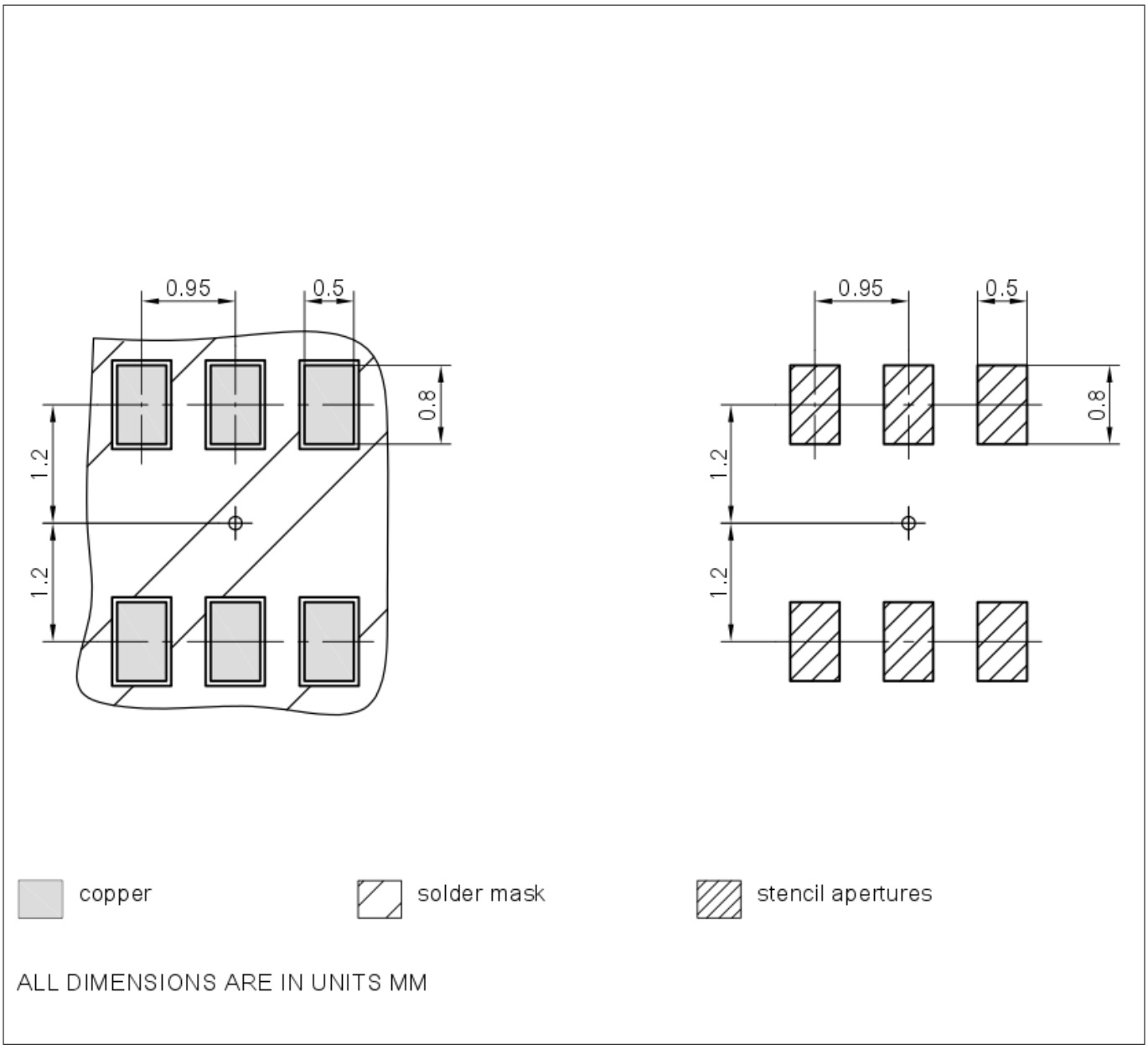

Figure 9 Footprint PG-SOT23-6

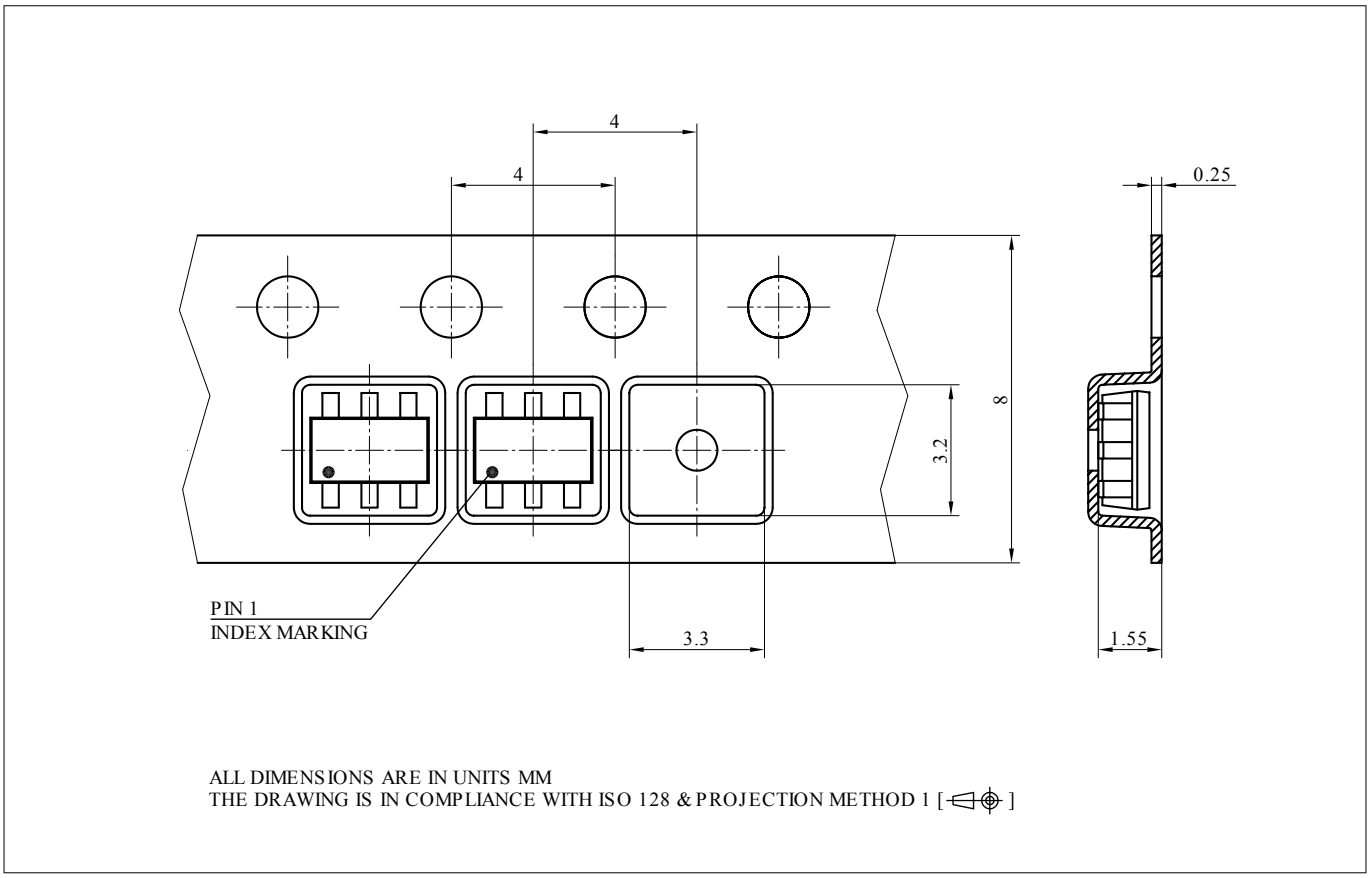

Figure 10 Tape & Reel PG-SOT23-6

7 References

Revision history

Document version	Date of release	Description of changes
1.0	2017-10-09	First version of data sheet
1.1	2019-01-21	ESD note added, electrical characteristics updated
1.2	2020-03-03	ESD protection information added, electrical characteristics updated

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Do you have a question about any aspect of this document?

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