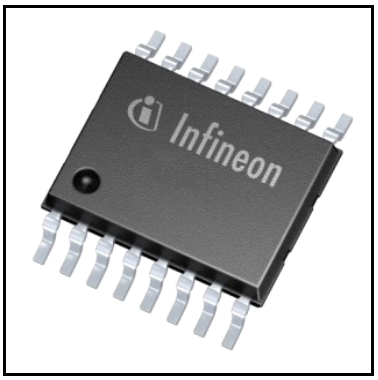
TLE5014SP16D



Preface

This document is an addendum to the TLE5014SP datasheet and describes the TLE5014SP16D dual die angle sensor. For all parameters which are not specified here, the TLE5014SP datasheet is valid.

Features

- Fast SSC interface up to 8MHz
- **G**iant **M**agneto **R**esistance (GMR)-based principle
- Two identical dies in one package (providing channel 1 and channel 2 output)
- Fully redundant 2-channel solution for highest functional safety requirements
- 360° angle measurement
- EEPROM for storage of configuration (e.g. zero angle) and customer specific ID
- 15 bit representation of absolute angle value on the output
- Max. 1° angle error over lifetime and temperature range
- Developed according to ISO26262 with process complying to ASIL-D
- Internal safety mechanisms with diagnostic coverage >97% for each channel
- 32 point look-up table to correct for systematic angle errors (e.g. magnetic circuit)
- 112 bit customer ID (programmable)
- Automotive qualified Q100, Grade 1: -40°C to 125°C (ambient temperature)
- ESD: 4 kV (HBM) on V_{DD} and 2kV (HBM) on output pins
- RoHS compliant and halogen free package

Functional Safety

- Safety Manual and Safety Analysis Summary Report available on request

Applications

The TLE5014SP GMR-based angle sensor is designed for angular position sensing in automotive applications. Fully redundancy of two chips in one package supporting highest functional safety requirements.

Description

Table 0-1 Derivative Ordering code

Product Type	Marking	Ordering Code	Package	Comment
TLE5014SP16D E0002	014SPD02	SP004531452	PG-TDSO-16	SSC interface

Table of Contents

1 Pin Configuration

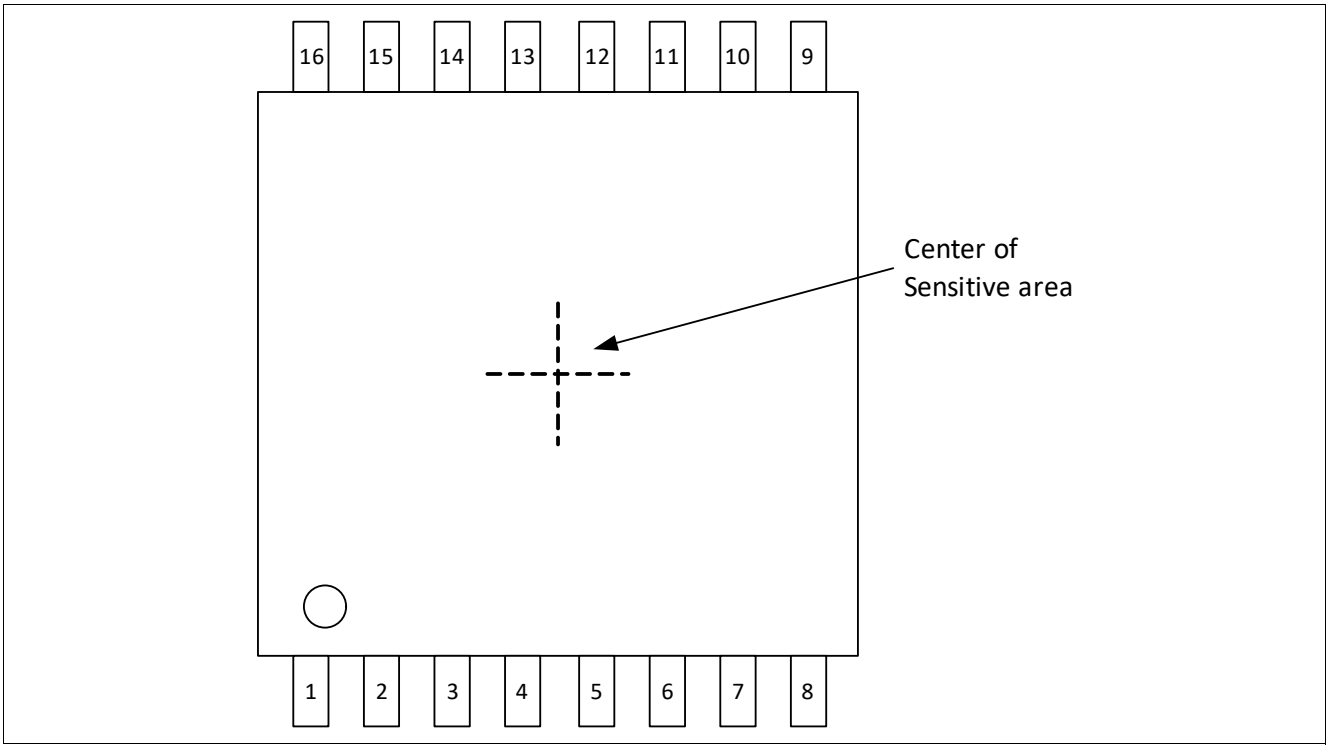


Figure 1-1 Pin configuration (top view)

1.1 Pin Description

The following table describes the pin-out of the chip. Pins 1-8 correspond to channel 1 of the sensor (top IC in the package). Pins 9-16 correspond to channel 2 (bottom IC in the package). The two sensors are galvanically decoupled.

Table 1-1 Pin Description

Pin No.	Symbol	In/Out	Function
1	IF1-1	I/O	DATA (MOSI/MISO)
2	IF2-1	I	SCK (SSC clock)
3	IF3-1	I	CSQ (chip select)
4	VDD-1	–	Supply voltage, positive
5	GND-1	–	Supply voltage, ground
6	IFA-1	–	Connect to GND
7	IFB-1	–	Connect via pull-up to V_{DD}
8	IFC-1	–	Keep open
9	IFC-2	–	Keep open
10	IFB-2	–	Connect via pull-up to V_{DD}
11	IFA-2	–	Connect to GND
12	GND-2	–	Supply voltage, ground
13	VDD-2	–	Supply voltage, positive

Table 1-1 Pin Description (cont'd)

Pin No.	Symbol	In/Out	Function
14	IF3-2	I	CSQ (chip select)
15	IF2-2	I	SCK (SSC clock)
16	IF1-2	I/O	DATA (MOSI/MISO)

2 Dual Sensor Angle Output

The bottom sensor element of the Product_Short is flipped relative to the orientation of the top sensor element Therefore the rotation direction sensed by the bottom element is opposite to the top element. This is advantageous for safety critical applications, as the two sensor elements do generally not output the same angle. **Figure 2-1** shows the output of the two sensor ICs for a given external magnetic field orientation.

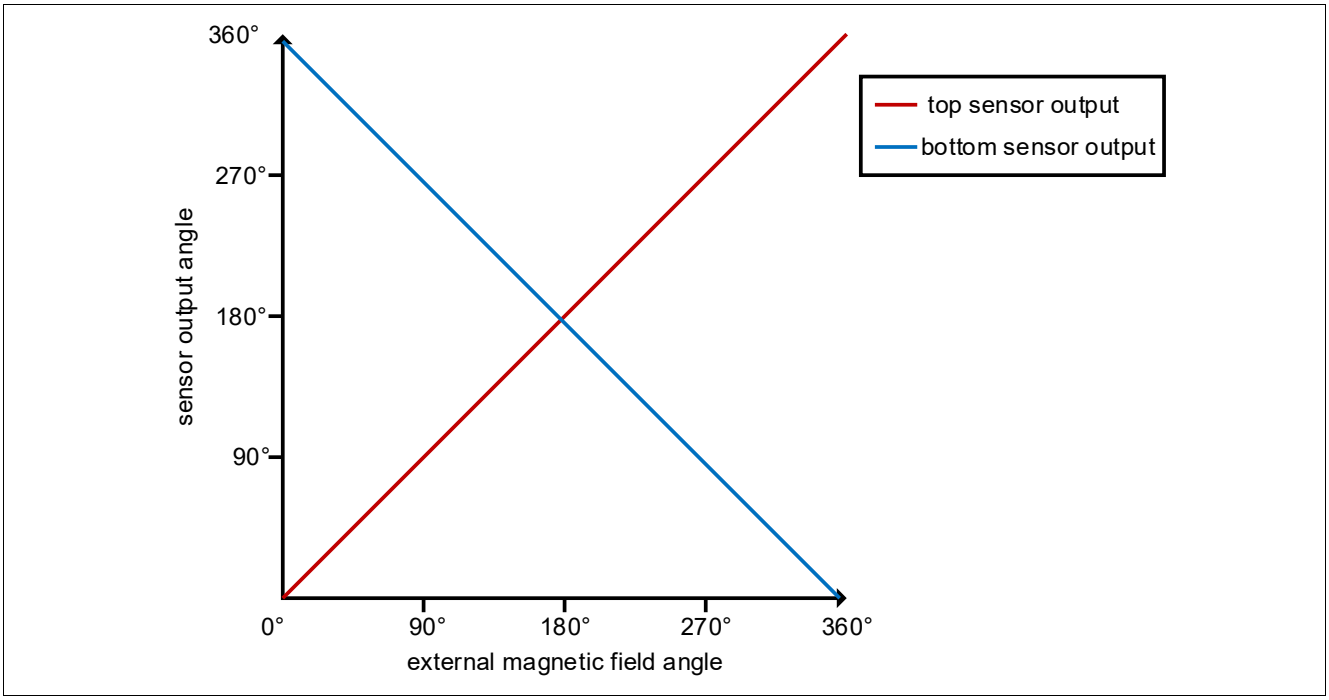


Figure 2-1 Dual die angle output

For applications where an identical angle output of both ICs is desired, the rotation direction and angle offset of one sensor IC can be reconfigured by changing the settings in the ANG_BASE register of the EEPROM.

3 Absolute Maximum Ratings

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 device.***

Table 3-1 ESD protection

Parameter	Symbol	Values		Unit	Notes
		Min.	Max.		
Electro-Static-Discharge voltage (HBM), according to ANSI/ESDA/JEDEC JS-001	V_{HBM}		±4.0	kV	HBM contact discharge for pins VDD, GND, IFB; ground pins connected
	V_{HBM}		±2.0	kV	HBM contact discharge for all pins, ground pins not connected
Electro-Static-Discharge voltage (CDM), according to JESD22-C101	V_{CDM}		±0.5	kV	for all pins except corner pins
			±0.75	kV	for corner pins only

4 Package Information

The device is qualified with a MSL level of 3. It is halogen free, lead free and RoHS compliant.

4.1 Package Parameters

Table 4-1 Package Parameters

Parameter	Symbol	Limit Values			Unit	Notes
		Min.	Typ.	Max.		
Thermal resistance	R_{thJA}			120	K/W	Junction to air[1], only one chip is active
				100	K/W	Junction to air[1], both chips are active
	R_{thJC}			45	K/W	Junction to case
	R_{thJL}			70	K/W	Junction to lead
Moisture Sensitively Level	MSL 3					260°C[2]
Lead Frame	Cu					
Plating	Sn 100%					> 7 µm

1) according to Jedec JESD51-7

2) suitable for reflow soldering with soldering profiles according to JEDEC J-STD-020E (December 2014)

Table 4-2 Position of the die in the package

Parameter	Symbol	Limit Values			Unit	Notes
		Min.	Typ.	Max.		
Tilt				±3	°	in respect to the z-axis and reference plane (see **Figure 4-1**),
Rotational displacement				±3	°	in respect to the reference axis (see **Figure 4-1**)
Placement tolerance in package				±100	µm	in x and y direction, for each die in the package

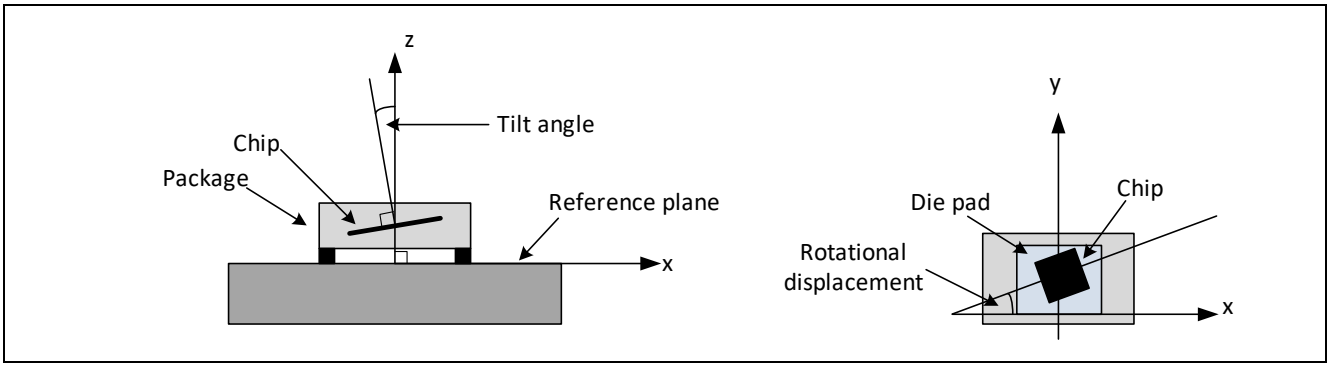


Figure 4-1 Tolerance of the die in the package

4.2 Package Outline

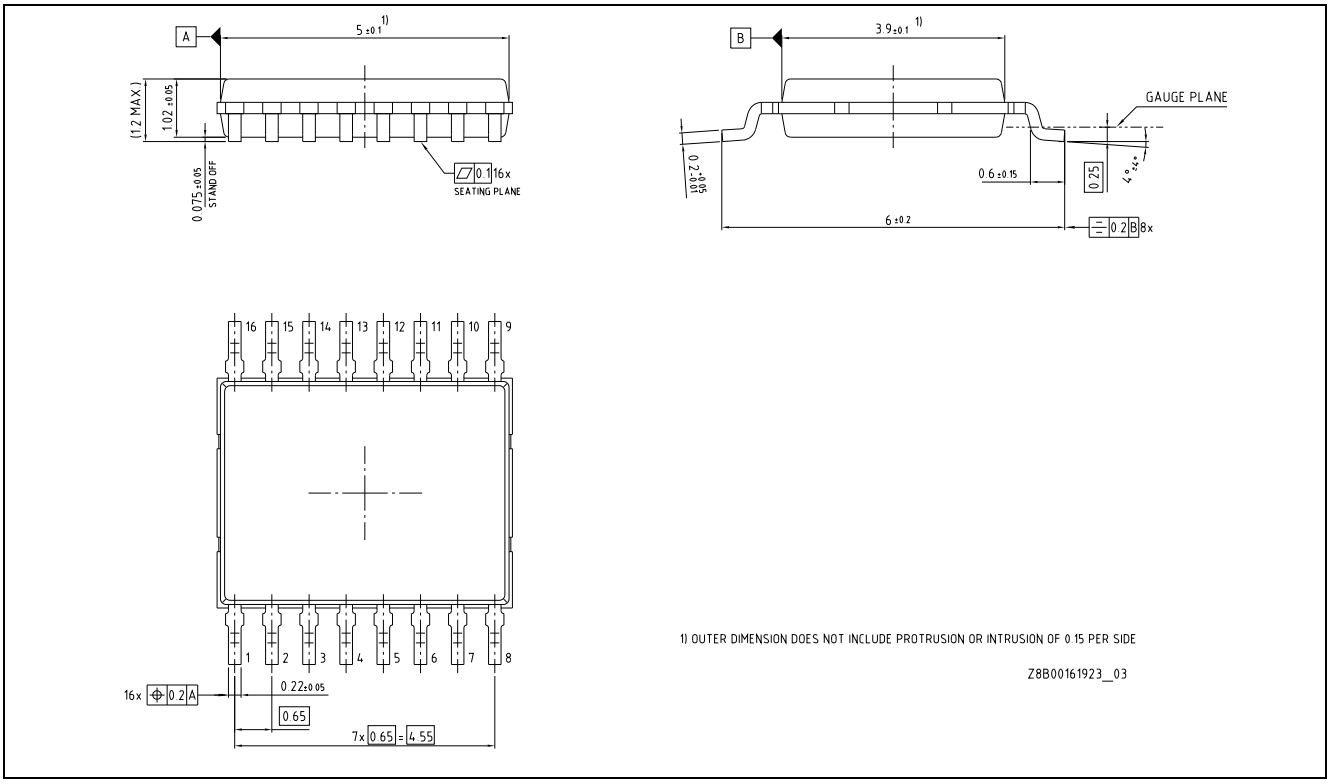


Figure 4-2 PG-TDSO-16 package dimension

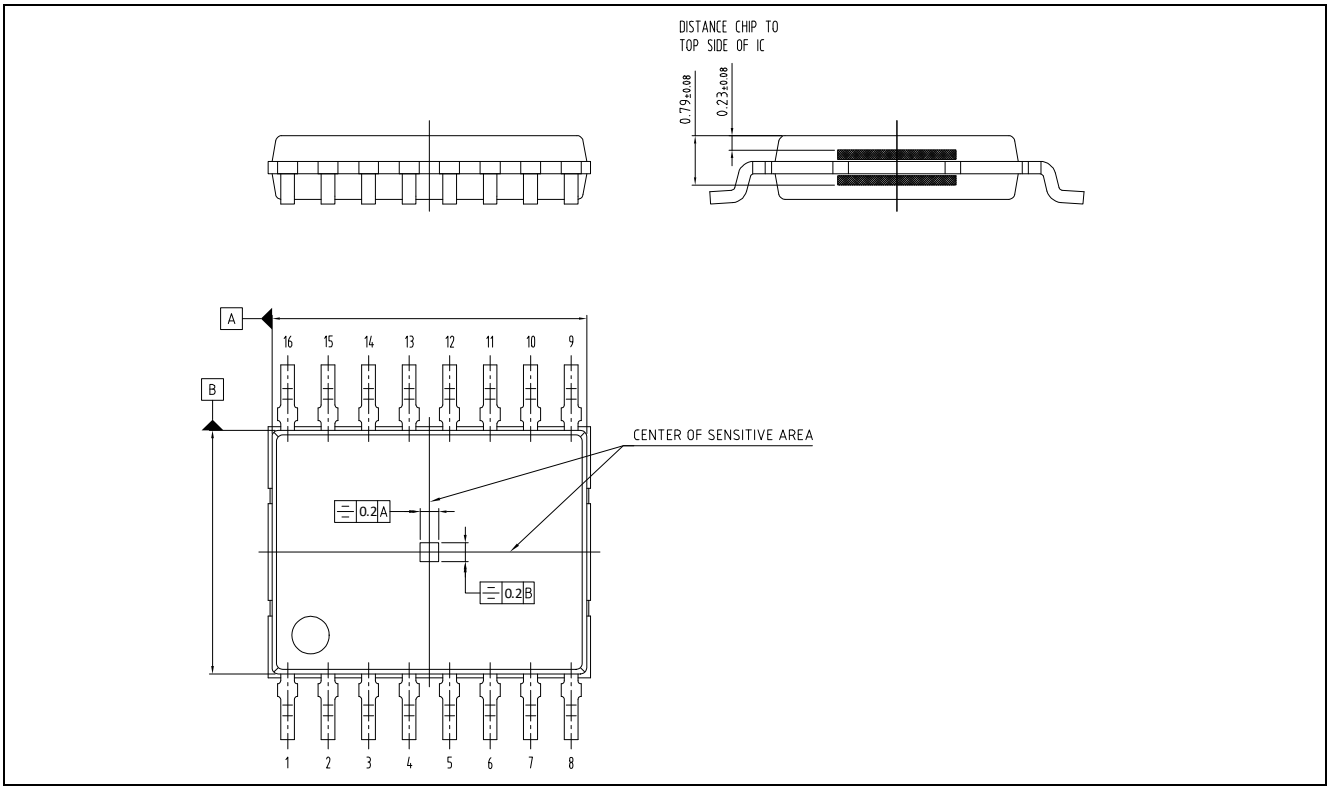


Figure 4-3 Position of sensing element

4.3 Footprint

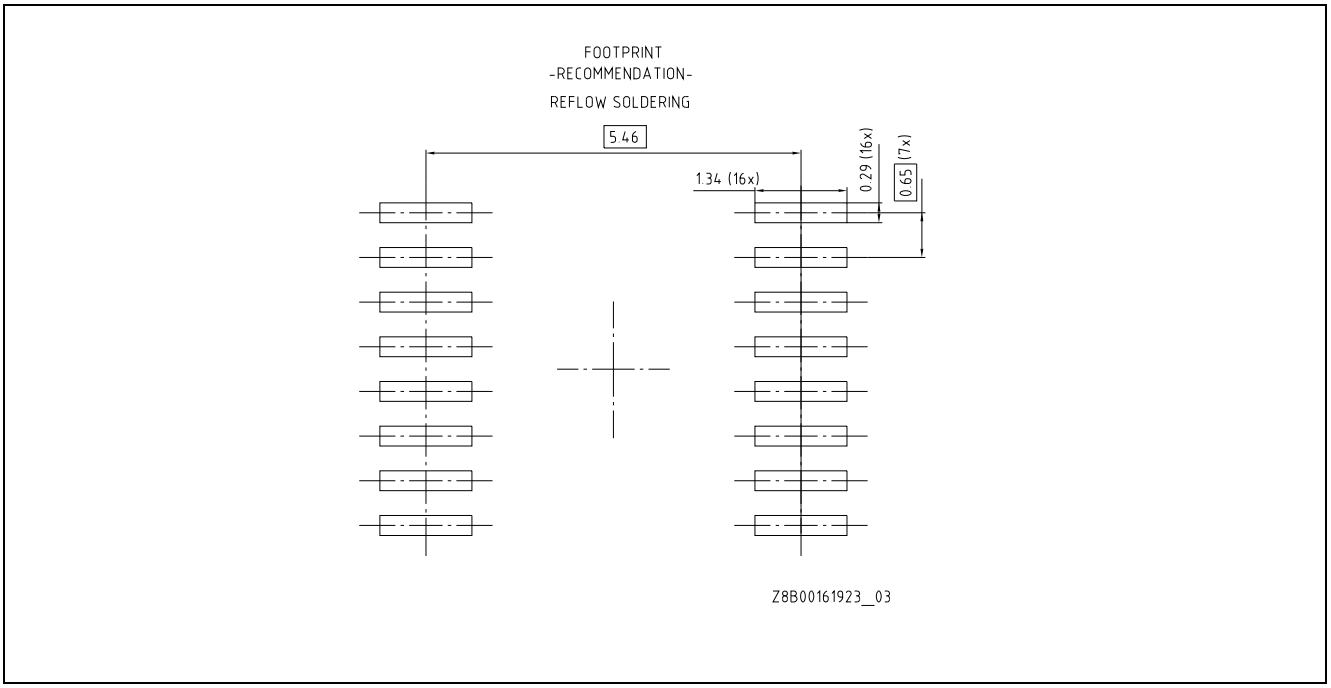


Figure 4-4 Footprint of PG TDSO-16

4.4 Packing

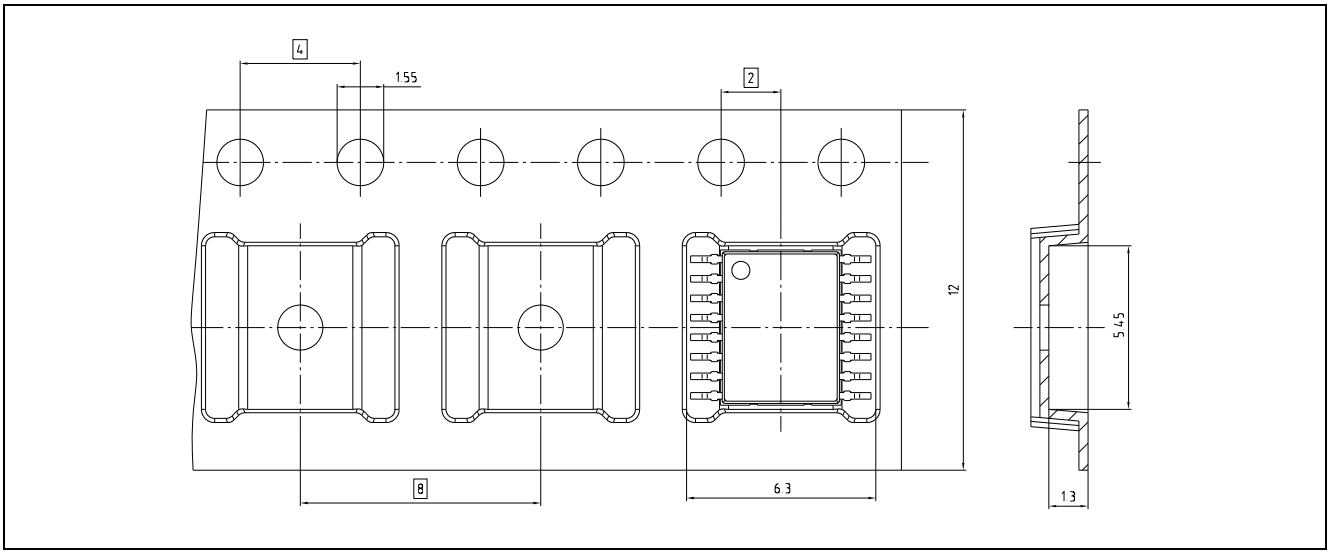


Figure 4-5 Tape and Reel

4.5 Marking

Position	Marking	Description
1st Line	Gxxxx	G..green, 4-digit..date code
2nd Line	xxxxxxxx	Interface type and version (see **Table 0-1**, Marking)
3rd Line	xxx	Lot code

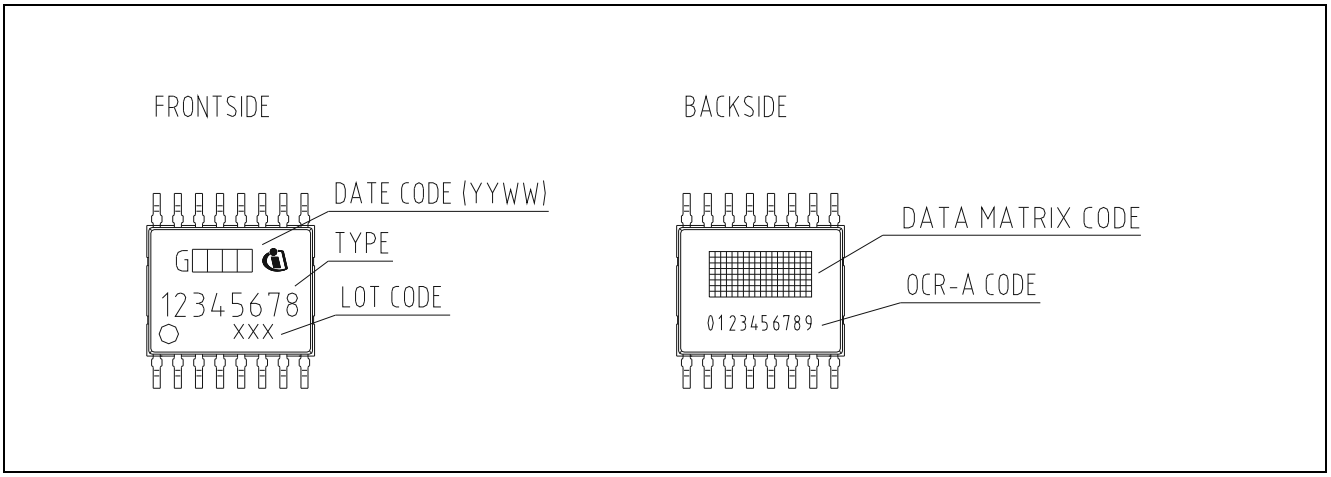


Figure 4-6 Marking of PG-TDSO-16

5 Revision History

Revision	Date	Changes
1.0	2019-05-09	initial version

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