TLE4924x

Dynamic Differential Hall Effect Sensor

TLE4924C-2 E6547
TLE4924CB-2 E6547

Product Information

2013-10-04

Sense & Control

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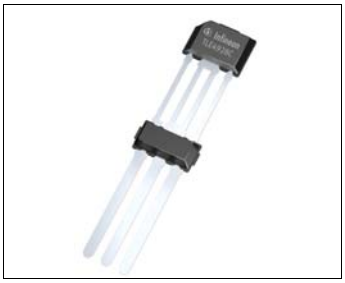
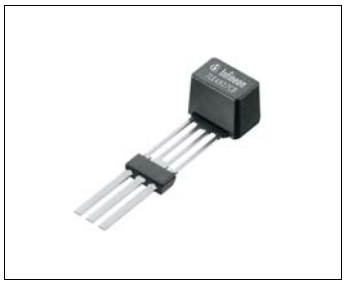
1 General





1.1 Target Application

The TLE4924 is an active Hall sensor suited to detecting the motion and position of ferromagnetic or permanent magnet targets. An additional self-calibration module is implemented to achieve optimum accuracy during normal running operation. The device comes in a 3-pin package providing pins for the supply voltage and an open drain output. Infineon also offers customers the possibility to purchase sensors with already attached back bias magnets (TLE4924CB-2 E6547).

1.2 Features

- High sensitivity
- Single chip solution
- Symmetrical thresholds
- High resistance to Piezo effects
- South and north pole pre-induction possible
- Low cut-off frequency
- Digital output signal
- Advanced performance through dynamic self calibration principle
- Wide operating temperature range
- Fast start-up time
- Large operating air gaps
- Reverse voltage protection on V_S pin
- Short-circuit and overtemperature protection of output
- Digital output signal (voltage interface)
- Integrated back bias magnet as an option
- Module style package with two integrated capacitors:
  - 4.7 nF between Q and GND
  - 47 nF between V_S and GND: Needed for micro cuts in power supply

Type	Order Code	Marking	Package
TLE4924C-2 E6547	SP000718250	24D82	PG-SSO-3-92
TLE4924CB-2 E6547	SP000913548	924D00	PG-SSOM-3-11

2 Functional Description

2.1 General

The differential Hall sensor IC detects the motion and position of ferromagnetic and permanent magnet structures by measuring the differential flux density of the magnetic field. To detect ferromagnetic objects the magnetic field must be provided by a back biasing permanent magnet (south or north pole of the magnet attached to the rear unmarked side of the IC package).

Offset cancellation is achieved by advanced digital signal processing. Immediately after power-on, motion is detected (start-up mode). After a few transitions, the sensor has finished self-calibration and switches to a high accuracy mode (running mode). In running mode, switching occurs at the zero crossing points of the magnetic signal. This zero crossing is found by calculating the arithmetic mean of the maximum and minimum value of the magnetic differential signal (ΔB). ΔB is defined as the field difference between Hall plate 1 and Hall plate 2. See Figure 2-2.

2.2 Sensor assembly

Sensor and back bias magnet can be applied in the following ways:

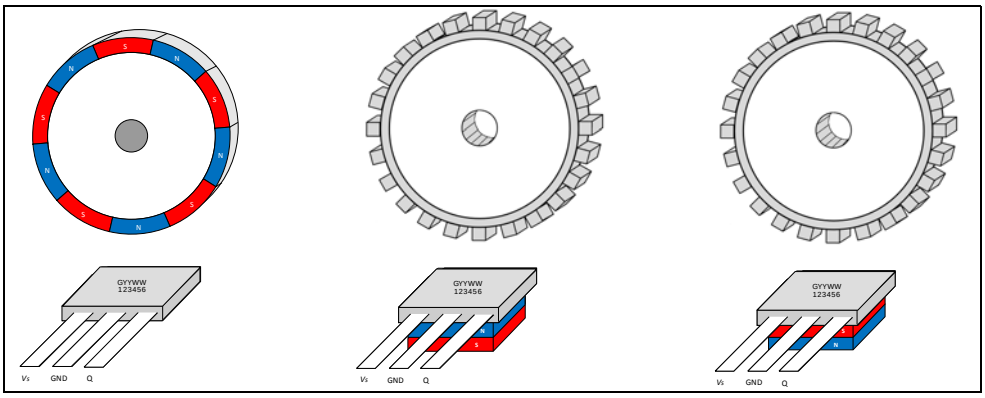


Figure 2-1 Sensor assembly

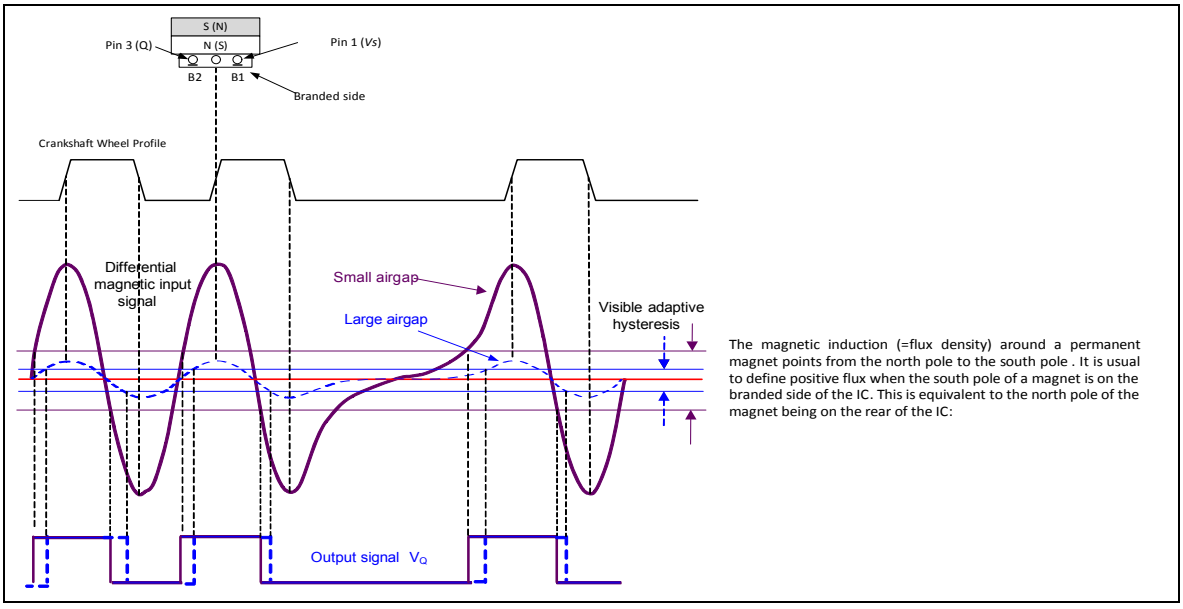


Figure 2-2 System operation with visible adaptive hysteresis

3 Specification

3.1 Operating Range

Table 3-1 Operating Range

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_S	3.2		26	V	time limited with $R_{Series} \geq 200\ \Omega$
Continuous output OFF voltage	V_Q			18	V	time limited
Continuos output ON current	I_Q			20	mA	V_{Qmax} = 0.6 V
Operation junction temperature	T_j	-40		175	°C	time limited

3.2 Electrical Characteristics

Table 3-2 Electrical Characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply current	I_S		6.8		mA	–
Output saturation voltage	V_{Qsat}		0.25		V	I_Q = 20 mA
Output rise time	t_r		12		µs	V_{Load}= 4.5 to 24 V R_{Load} = 1.2 kΩ C_{Load} = 4.7 nF included in package.
Output fall time	t_f		0.9		µs	V_{Load}= 5 V R_{Load} = 1.2 kΩ C_{Load} = 4.7 nF included in package.
Delay time	t_d		12.5		µs	
Frequency range	f		–	8	kHz	

3.3 ESD Protection

Table 3-3 ESD Protection

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
ESD Protection PG-SSO-3-92	V_{ESD}	–	–	±6	kV	According to standard EIA/JESD22-A114-B Human Body Model (HBM 1500 Ω / 100 pF).

3.4 Magnetic Characteristics

Table 3-4 Magnetic Characteristics in Running Mode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Minimum signal amplitude	$\lvert\Delta B_{min}\rvert$		0.75		mT	

3.5 Operating Characertistics

Table 3-5 Operating Characteristics - TLE4924CB-2 E6547

Parameter	Symbol	Values			Unit	Remarks
		min	typ	max		
Operational airgap	AG	0.5			mm	Valid in running mode, measured from sensor housing (branded side) to target tooth. Valid at 25°C & 0h. No missing output pulses.
Phase jitter	φjitter	0.35		1.35	°crank	Output falling edge 360° repeatability, 1000 rotations, 3 sigma value, min. input signal size 10 mT_{pp}

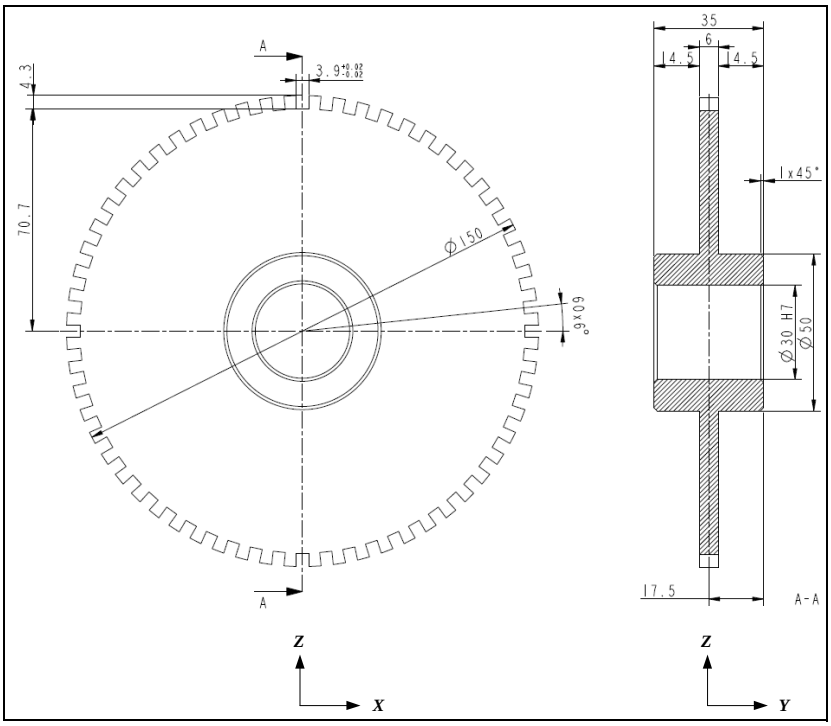


Figure 3-1 Reference target wheel - TLE4924CB-2 E6547

Table 3-6 Reference target wheel geometry - TLE4924CB-2 E6547

Parameter	Symbol	Typ value	Unit	Remarks
Outside diameter	d	150	mm	
Number of teeth	Z	60	-	
Pitch Ratio		50:50	%	
Material	ST37			

4 Package Information

4.1 Application Example

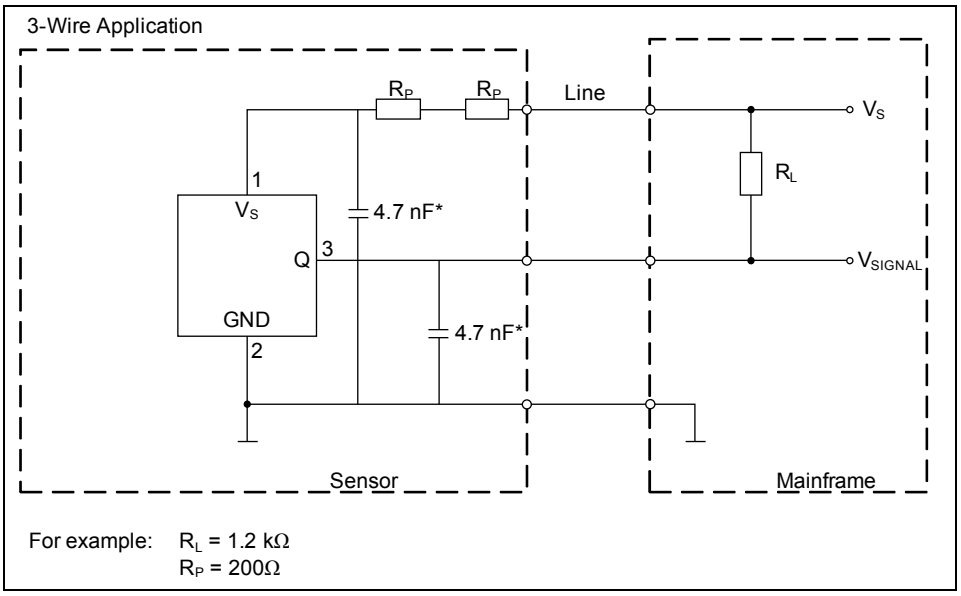


Figure 4-1 TLE4924 Application Circuits (*capacitors included in package)

4.2 Gear Tooth Sensing

In the case of ferromagnetic toothed wheel applications, the IC must be biased by the south or north pole of a permanent magnet which should cover both Hall probes (e.g. a SmCO5 magnet (Vacuumschmelze VX145) with dimensions 8 mm x 5 mm x 3 mm).

The maximum air gap depends on:

- The magnetic field strength (magnet used; pre-induction).
- The toothed wheel that is used (dimensions, material, etc.; resulting differential field).

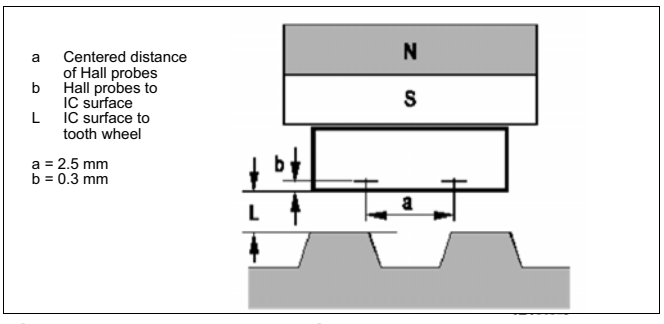


Figure 4-2 Sensor Spacing

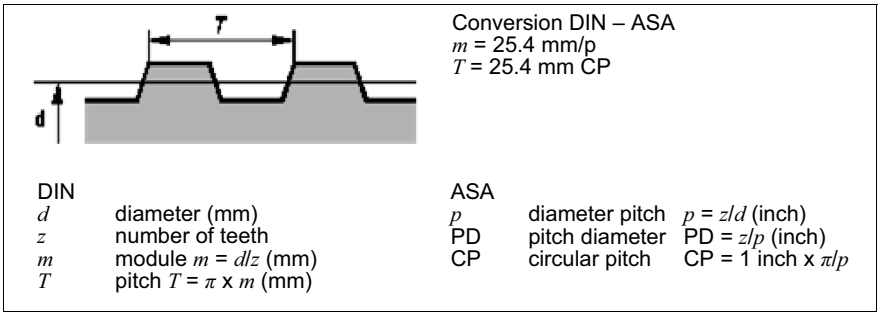


Figure 4-3 Toothed Wheel Dimensions

4.3 Package Information

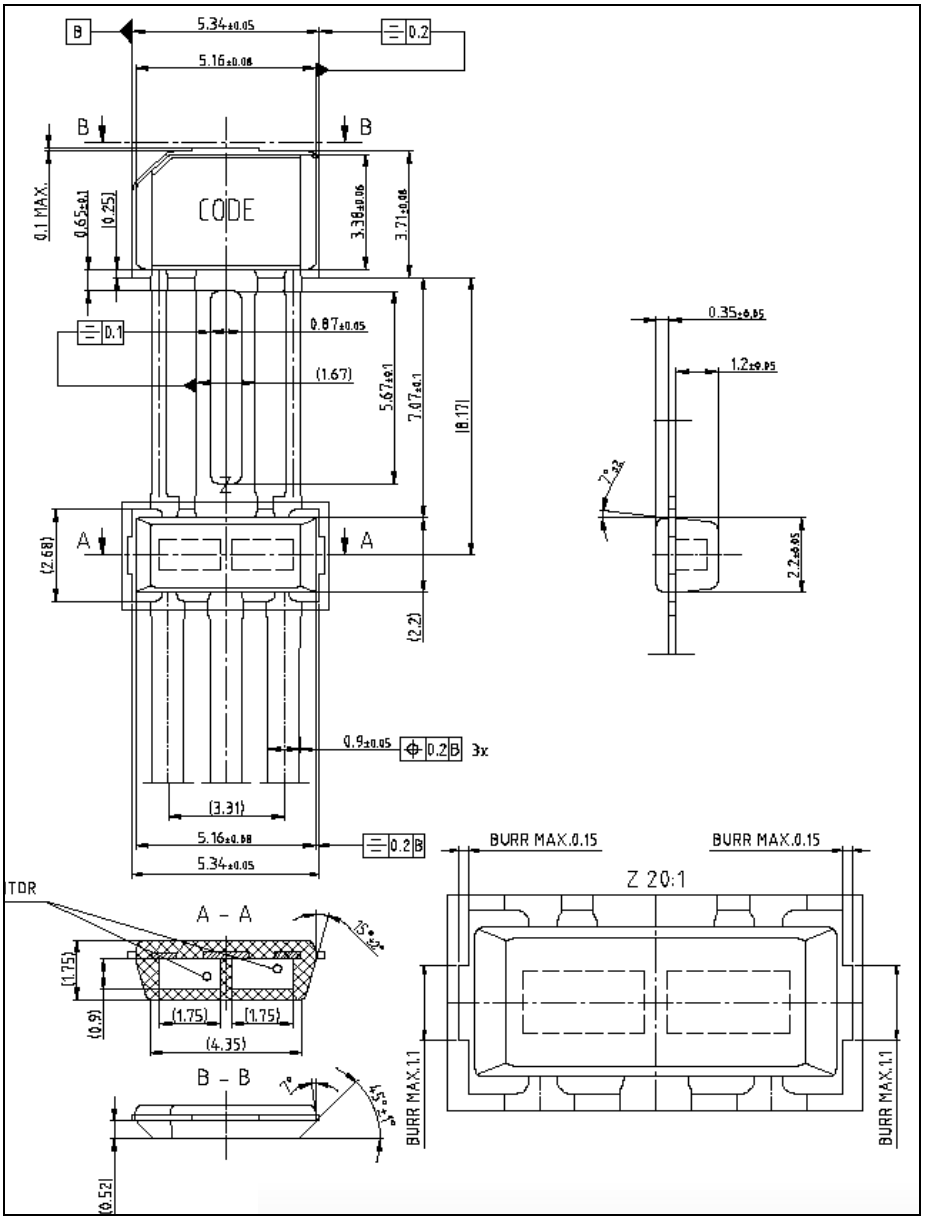


Figure 4-4 Package Dimensions of PG-SSOM-3-11 (Plastic Green Single Small Outline)

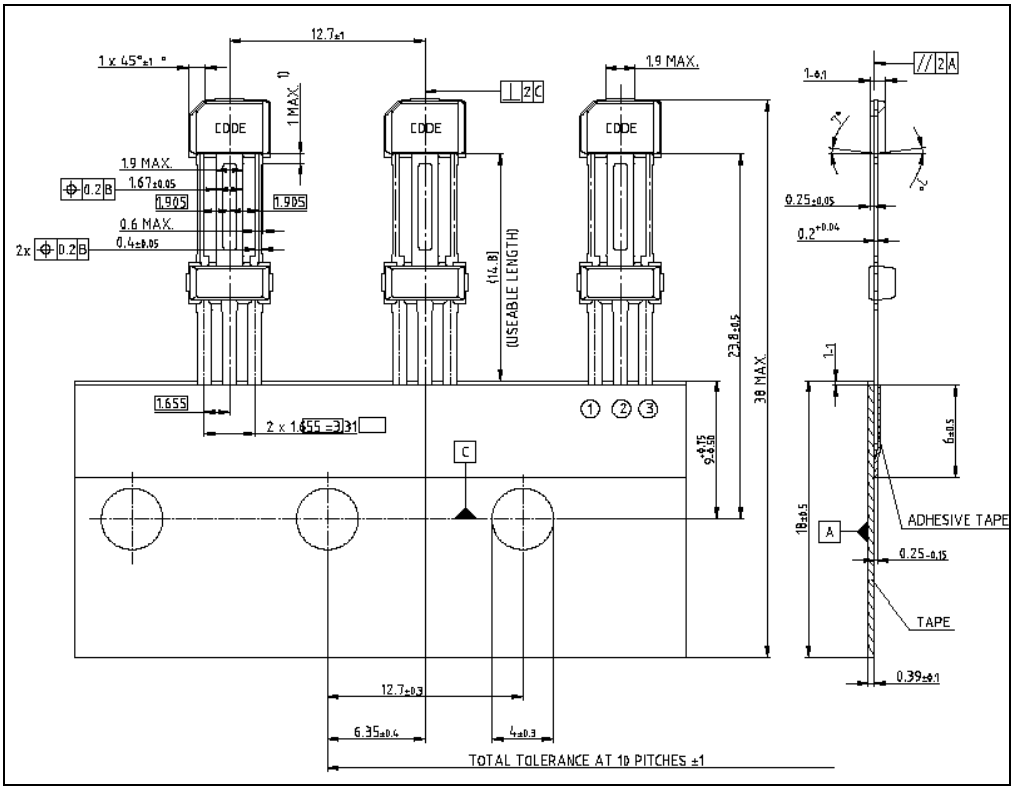


Figure 4-5 Tape Loading Orientation in PG-SSOM-3-11 Package

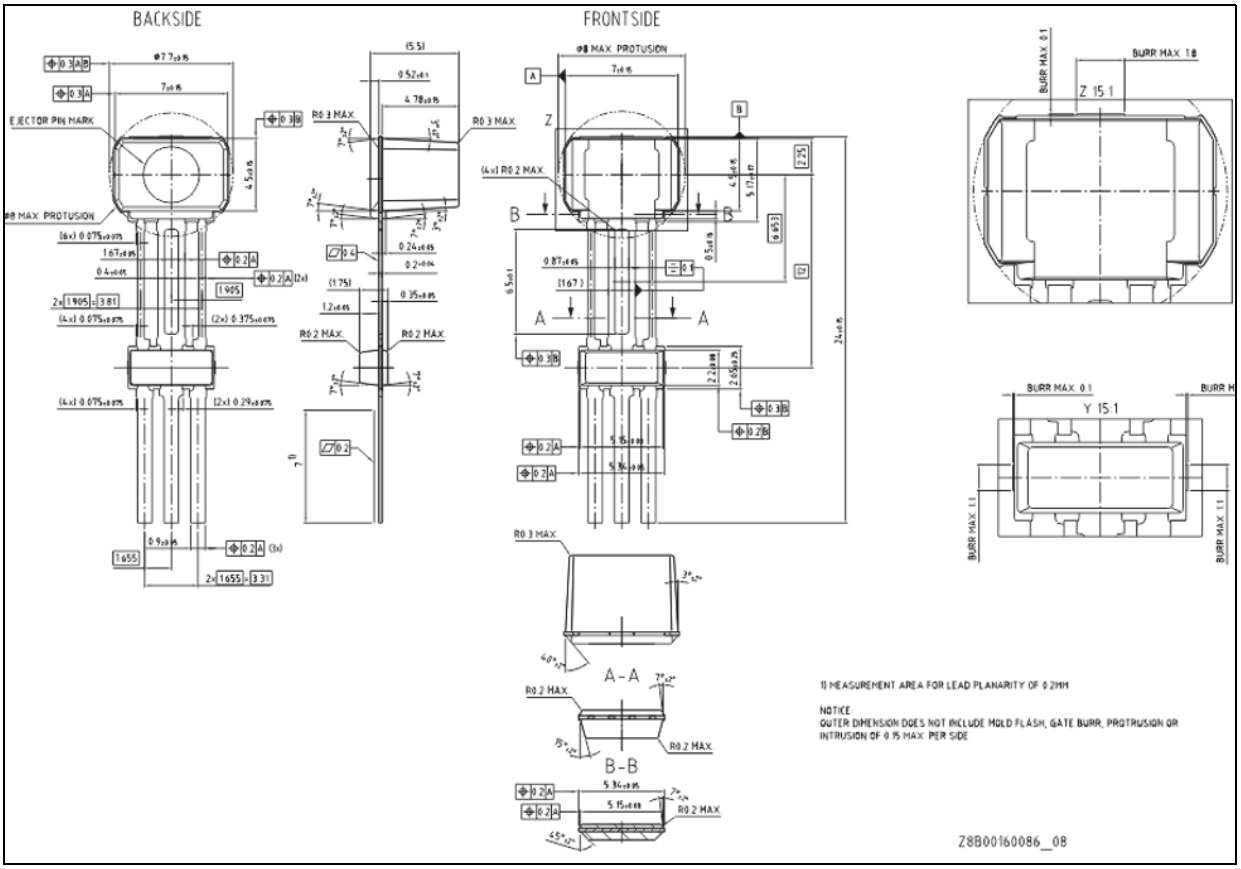


Figure 4-6 PG-SSOM-3-11 package outline - TLE4924CB-2 E6547

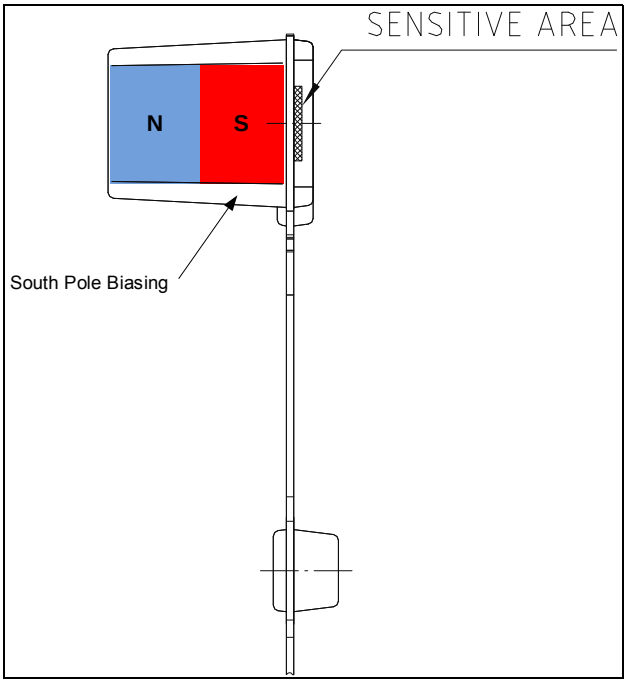


Figure 4-7 Back-bias field orientation - TLE4924CB-2 E6547

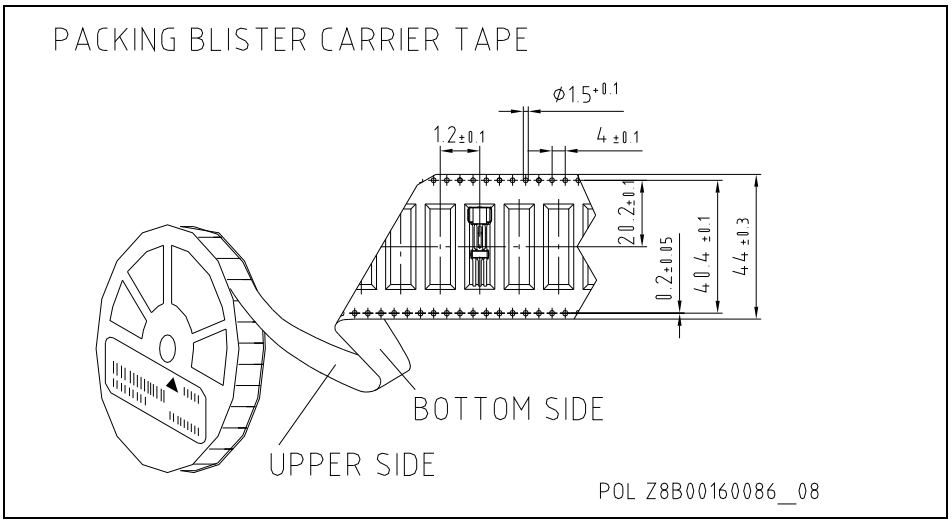


Figure 4-8 PG-SSOM-3-11 blister tape packing information -TLE4924CB-2 E6547

For additional packages information, sort of packing and others, please see Infineon internet web page: http://www.infineon.com/products

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