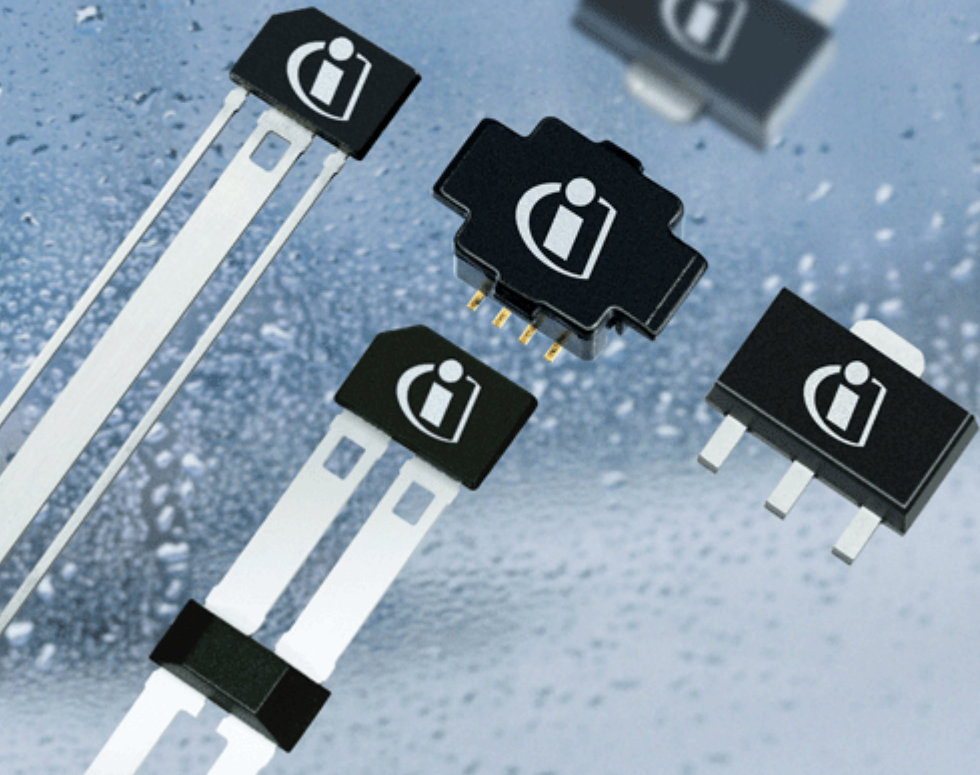


# TLE4946-1L

High Precision Bipolar Hall-Effect Latch



Sensors



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Rev 1.2

Previous Version:        1.1

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Page	Subjects (major changes since last revision)
	TLE4946H version removed (transferred to own datasheet)

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## 1 Overview

### 1.1 Features

- 2.7 V to 24 V supply voltage operation
- Operation from unregulated power supply
- High sensitivity and high stability of the magnetic switching points
- High resistance to mechanical stress by Active Error Compensation
- Reverse battery protection (– 18 V)
- Superior temperature stability
- Peak temperatures up to 195°C without damage
- Low jitter (typ. 1  $\mu$ s)
- High ESD performance ( $\pm$  6 kV HBM)
- Digital output signal
- Leaded package PG-SSO-3-2



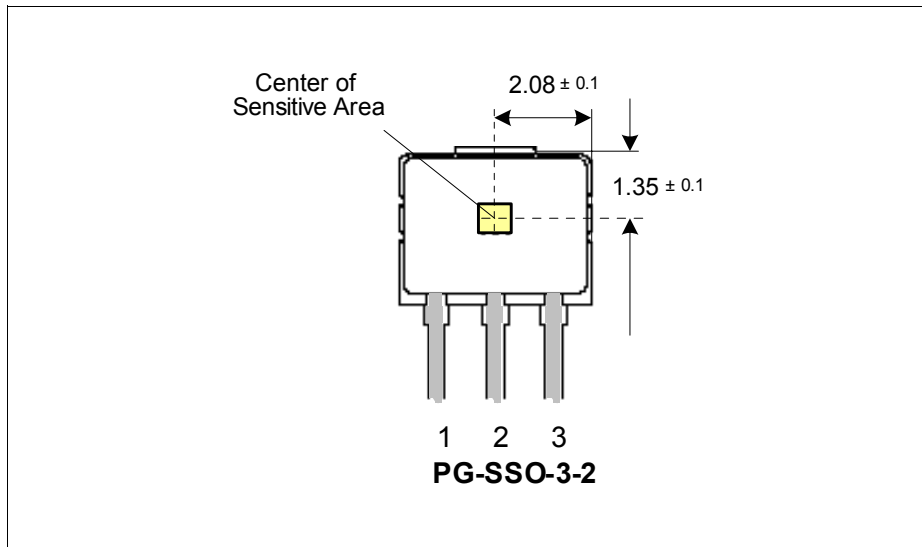
### 1.2 Functional Description

The TLE4946-1L is an integrated circuit Hall-effect sensor designed specifically for highly accurate applications.

Precise magnetic switching points and high temperature stability are achieved by active compensation circuits and chopper techniques on chip.

Type	Package
TLE4946-1L	PG-SSO-3-2

### 1.3 Pin Configuration (top view)



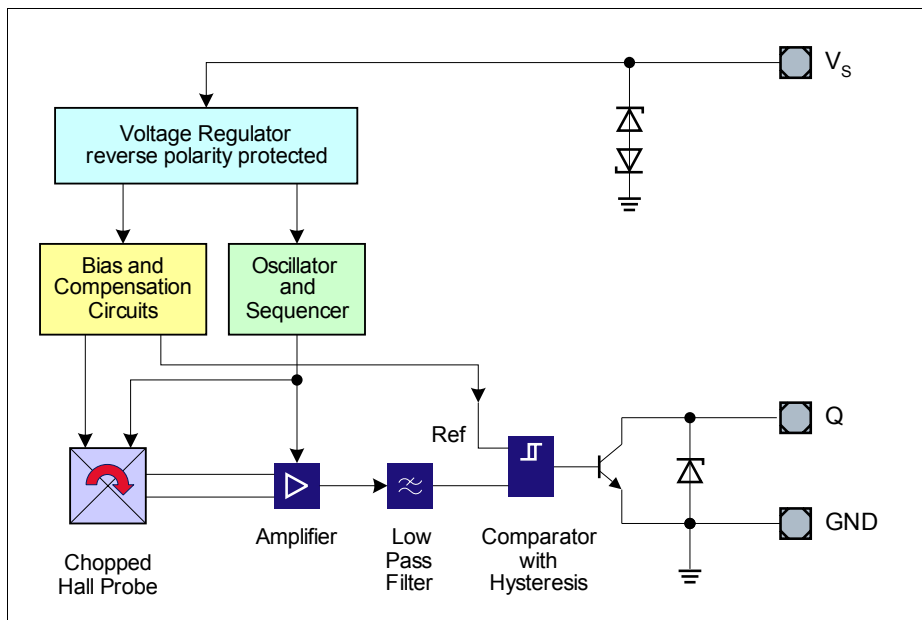
**Figure 1 Pin Definition and Center of Sensitive Area**

**Table 1 Pin Definitions and Functions PG-SSO-3-2**

Pin No.	Symbol	Function
1	$V_S$	Supply voltage
2	GND	Ground
3	Q	Output

## 2 General

### 2.1 Block Diagram



**Figure 2** Block Diagram

### 2.2 Circuit Description

The chopped Hall IC Switch comprises a Hall probe, bias generator, compensation circuits, oscillator, and output transistor.

The bias generator provides currents for the Hall probe and the active circuits. Compensation circuits stabilize the temperature behavior and reduce technology variations.

The Active Error Compensation rejects offsets in signal stages and the influence of mechanical stress to the Hall probe caused by molding and soldering processes and other thermal stresses in the package.

This chopper technique together with the threshold generator and the comparator ensure high accurate magnetic switching points.

### 3 Maximum Ratings

**Table 2 Absolute Maximum Ratings**
 $T_j = -40^{\circ}\text{C to } 150^{\circ}\text{C}$ 

Parameter	Symbol	Limit Values		Unit	Conditions
		min.	max.		
Supply voltage	$V_S$	- 18 - 18 - 18	18 24 26	V	for 1 h, $R_s \geq 200 \Omega$ for 5 min, $R_s \geq 200 \Omega$
Supply current through protection device	$I_S$	- 50	+ 50	mA	
Output voltage	$V_Q$	- 0.7 - 0.7	18 26	V	for 5 min @ 1.2 k $\Omega$ pull up
Continuous output current	$I_Q$	- 50	+ 50	mA	
Junction temperature	$T_j$	- - - -	155 165 175 195	$^{\circ}\text{C}$	for 2000 h (not additive) for 1000 h (not additive) for 168 h (not additive) for 3 x 1 h (additive)
Storage temperature	$T_S$	- 40	150	$^{\circ}\text{C}$	
Magnetic flux density	B	-	unlimited	mT	

*Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

**Table 3 ESD Protection <sup>1)</sup>**

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
ESD voltage	$V_{\text{ESD}}$	-	$\pm 6$	kV	HBM, $R = 1.5 \text{ k}\Omega$ , $C = 100 \text{ pF}$ $T_A = 25^{\circ}\text{C}$

<sup>1)</sup> Human Body Model (HBM) tests according to: EOS/ESD Association Standard S5.1-1993 and Mil. Std. 883D method 3015.7



## 4 Operating Range

Table 4 Operating Range

Parameter	Symbol	Limit Values			Unit	Conditions
		min.	typ.	max.		
Supply voltage	$V_S$	2.7	–	18	V	
Output voltage	$V_Q$	– 0.7	–	18	V	
Junction temperature	$T_j$	– 40	–	150	°C	
Output current	$I_Q$	0	–	20	mA	

## Electrical and Magnetic Parameters

**5 Electrical and Magnetic Parameters**
**Table 5 Electrical Characteristics <sup>1)</sup>.**

Parameter	Symbol	Limit Values			Unit	Conditions
		min.	typ.	max.		
Supply current	$I_S$	2	4	6	mA	$V_S = 2.7 \text{ V} \dots 18 \text{ V}$
Reverse current	$I_{SR}$	0	0.2	1	mA	$V_S = -18 \text{ V}$
Output saturation voltage	$V_{QSAT}$	–	0.3	0.6	V	$I_Q = 20 \text{ mA}$
Output leakage current	$I_{QLEAK}$	–	0.05	10	$\mu\text{A}$	for $V_Q = 18 \text{ V}$
Output fall time	$t_f$	–	0.02	1	$\mu\text{s}$	$R_L = 1.2 \text{ k}\Omega$ ; $C_L = 50 \text{ pF}$ see: <b>Figure 3 “Timing Definition” on Page 9</b>
Output rise time	$t_r$	–	0.4	1	$\mu\text{s}$	
Chopper frequency	$f_{OSC}$	–	320	–	kHz	
Switching frequency	$f_{SW}$	0	–	15 <sup>2)</sup>	kHz	
Delay time <sup>3)</sup>	$t_d$	–	13	–	$\mu\text{s}$	
Output jitter <sup>4)</sup>	$t_{QJ}$	–	1	–	$\mu\text{s}_{RMS}$	Typical value for square wave signal 1 kHz
Power-on time <sup>5)</sup>	$t_{PON}$	–	13	–	$\mu\text{s}$	$V_S \geq 2.7 \text{ V}$
Thermal resistance <sup>6)</sup>	$R_{thJA}$	–	–	190	K/W	PG-SSO-3-2

1) over operating range, unless otherwise specified. Typical values correspond to  $V_S = 12 \text{ V}$  and  $T_A = 25^\circ\text{C}$

2) To operate the sensor at the max. switching frequency, the value of the magnetic signal amplitude must be 1.4 times higher than for static fields.

This is due to the - 3 dB corner frequency of the low pass filter in the signal path.

3) Systematic delay between magnetic threshold reached and output switching

4) Jitter is the unpredictable deviation of the output switching delay

5) Time from applying  $V_S \geq 2.7 \text{ V}$  to the sensor until the output state is valid

6) Thermal resistance from junction to ambient

*Note: Typical characteristics specify mean values expected over the production spread.*

**Electrical and Magnetic Parameters**
**Table 6 Magnetic Characteristics TLE4946-1L <sup>1)</sup>**

Parameter	Symbol	$T_j$ [°C]	Limit Values			Unit	Notes
			min.	typ.	max.		
Operate point	$B_{OP}$	- 40	11.3	15.4	19.5	mT	
		25	11.0	15.0	19.0		
		150	10.5	14.3	18.1		
Release point	$B_{RP}$	- 40	- 19.5	- 15.4	- 11.3	mT	
		25	- 19.0	- 15.0	- 11.0		
		150	- 18.1	- 14.3	- 10.5		
Hysteresis	$B_{HYS}$	- 40	-	-	-	mT	
		25	22.0	30.0	38.0		
		150	-	-	-		
Magnetic Offset	$B_{OFF}$	- 40	-	-	-	mT	<sup>2)</sup>
		25	- 2.0	-	2.0		
		150	-	-	-		
Temperature compensation of magn. thresholds	TC	-	-	- 350	-	ppm/°C	
Repeatability of magnetic thresholds <sup>3)</sup>	$B_{REP}$		-	20	-	$\mu T_{RMS}$	Typ. value for $\Delta B / \Delta t > 12$ mT/ms

1) over operating range, unless otherwise specified. Typical values correspond to  $V_S = 12$  V.

2)  $B_{OFF} = (B_{OP} + B_{RP}) / 2$

3)  $B_{REP}$  is equivalent to the noise constant

**Field Direction Definition**

Positive magnetic fields related with south pole of magnet to the branded side of package.

## 6 Timing Diagram

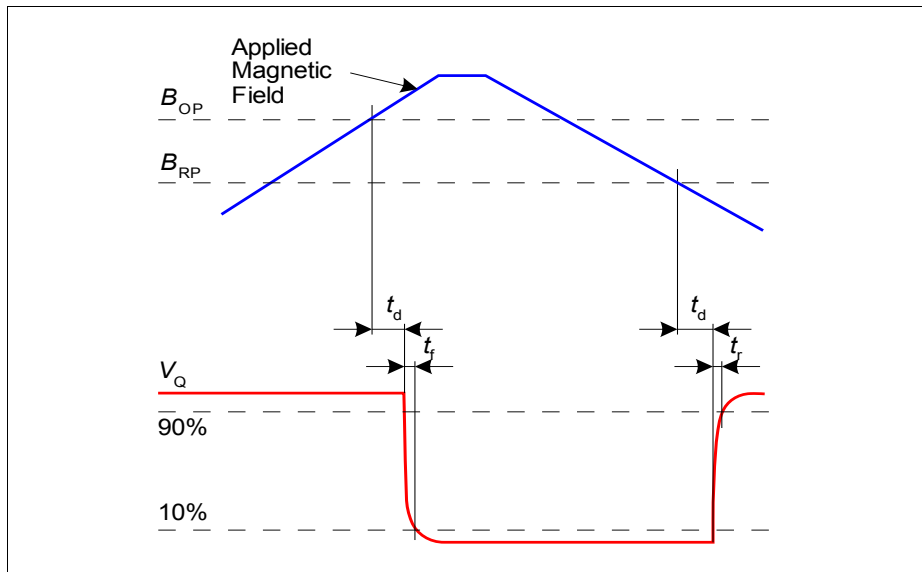
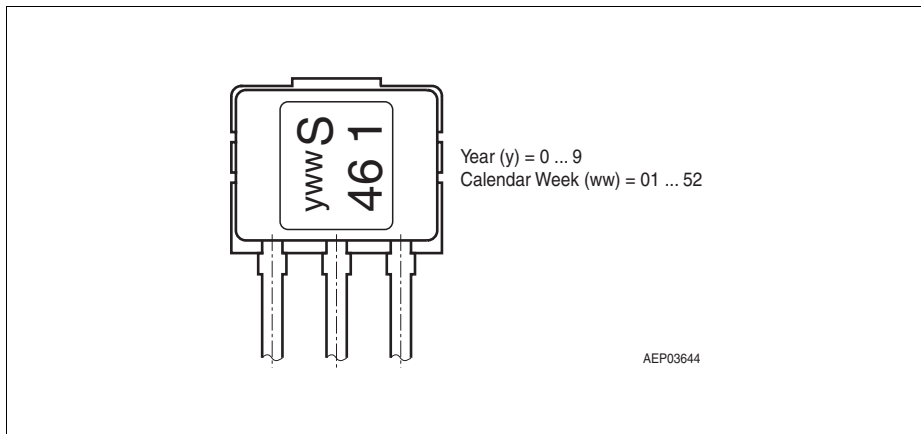


Figure 3 Timing Definition

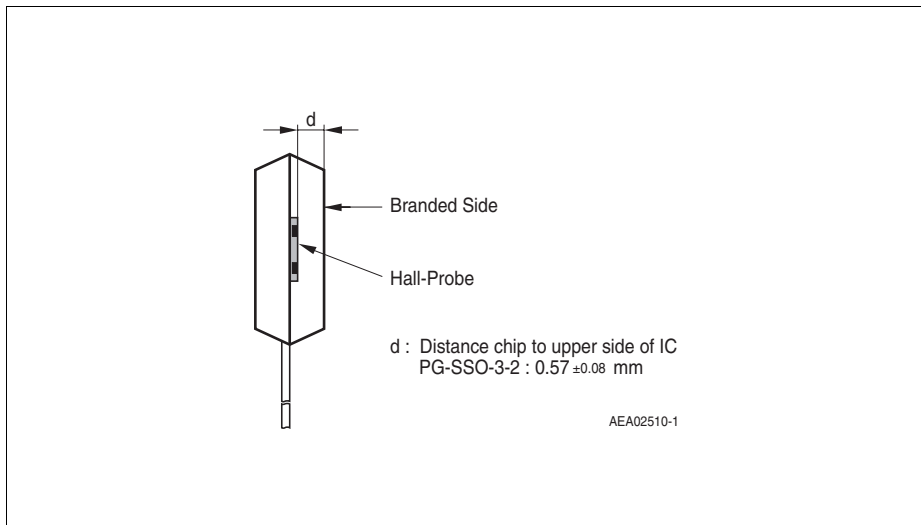
## 7 Package Information

### 7.1 Package Marking



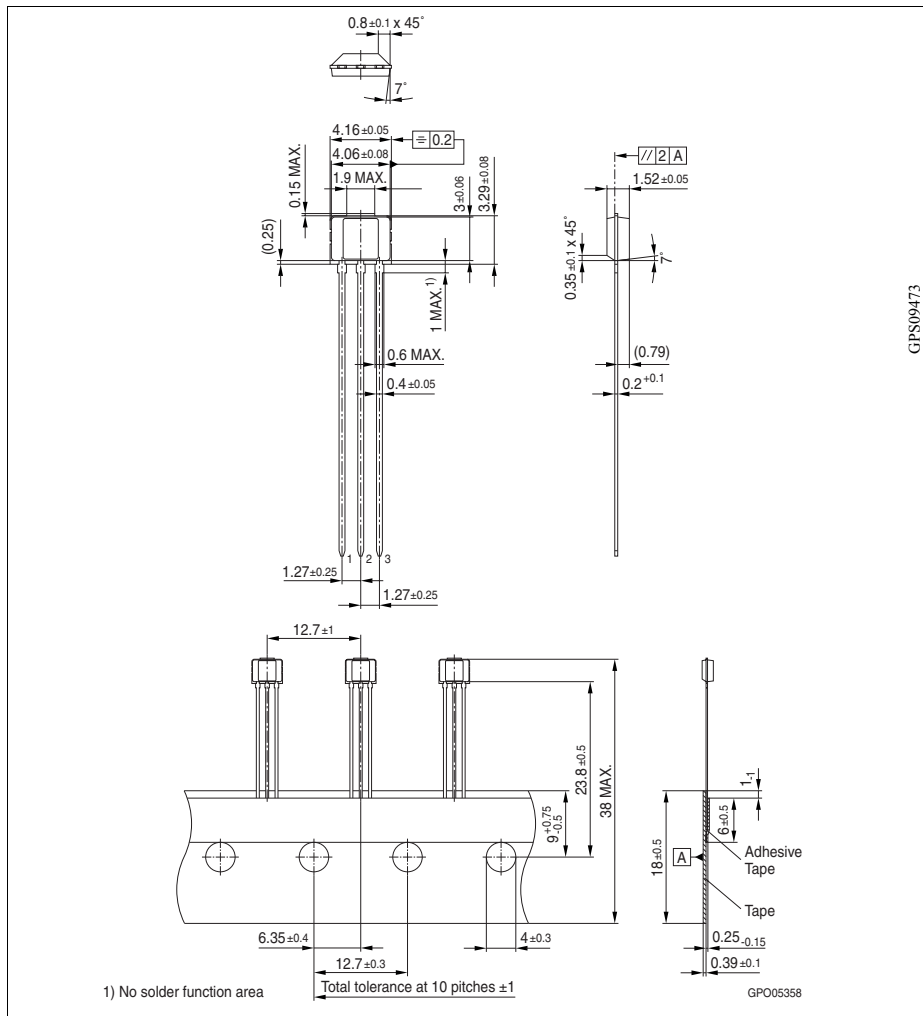
**Figure 4** Marking TLE4946-1L

## 7.2 Distance between Chip and Package Surface



**Figure 5 Distance Chip PG-SSO-3-2 to Upper Side of IC**

7.3 Package Outlines



GPS09473

Figure 6 PG-SSO-3-2

Note: You can find all of our packages, sort of packing and others on our Infineon Internet page "Products": <http://www.infineon.com/products>





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