January 2009

TLE4906K / TLE4906L

High Precision Hall Effect Switch

Data Sheet

V 2.0

Sensors



Never stop thinking

Edition 2009-01

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TLE4906K / TLE4906L High Precision Hall Effect Switch

Revision History: 2009-01, V 2.0

s Version: 1.1							
Subjects (major changes since last revision)							
Package type "H" changed to "K"							
General layout changed							

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High Precision Hall-Effect Switch

TLE4906K TLE4906L

1 **Product Description**

1.1 Overview

The TLE4906 is a high precision Hall effect switch with highly accurate switching thresholds for operating temperatures up to 150°C.

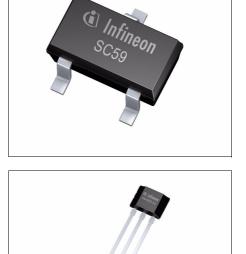
1.2 Features

- 2.7V to 24V supply voltage
- 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 (-18V)
- Superior temperature stability
- Peak temperatures up to 195°C without damage
- Low jitter (typ. 1µs)
- High ESD performance (± 6kV HBM)
- Digital output signal
- SMD package SC59 (SOT23 compatible) (TLE4906K))
- Leaded package PG-SSO-3-2 (TLE4906L)

1.3 Target Applications

Target applications for TLE4906 are all automotive applications which require a high precision Hall switch for position sensing with a operating temperature range from -40°C to +150°C.

Product Name	Product Type	Ordering Code	Package
Hall Effect Switch	TLE4906K	SP000475028	SC59
Hall Effect Switch	TLE4906L	SP000012949	PG-SSO-3-2





Functional Description

2 Functional Description

2.1 General

The TLE4906K and the TLE4906L are integrated circuit Hall-effect sensors 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.

2.2 Pin Configuration (top view)

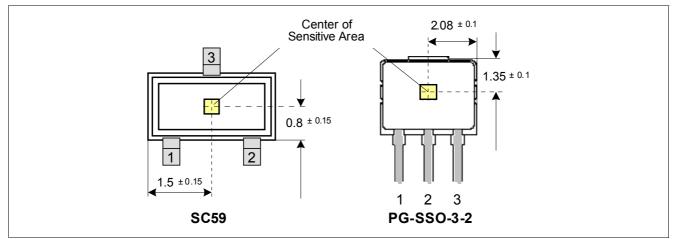


Figure 1 Pin Configuration and Center of Sensitive Area

2.3 Pin Description

Table 1Pin Description SC59

Pin No.	Symbol	Function	Comment
1	Vs	Supply voltage	
2	Q	Output	
3	GND	Ground	

Table 2 Pin Description PG-SSO-3-2

Pin No.	Symbol	Function	Comment
1	Vs	Supply voltage	
2	GND	Ground	
3	Q	Output	



Functional Description

2.4 Block Diagram

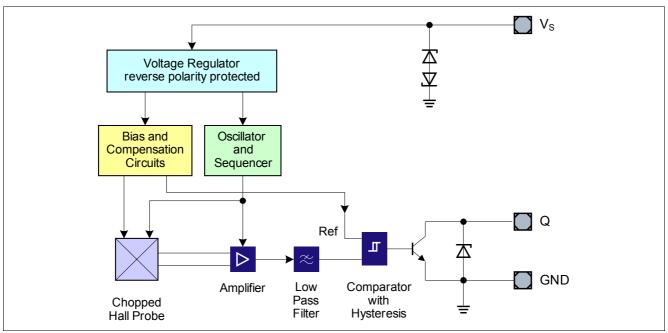


Figure 2 Functional Block Diagram

2.5 Functional Block Description

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

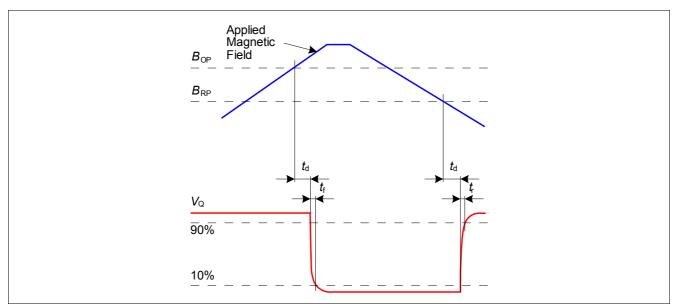
The bias generator provides currents for the Hall probe and the active circuits. Compensation circuits stabilize the temperature behavior and reduce technology variations.

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.



Functional Description





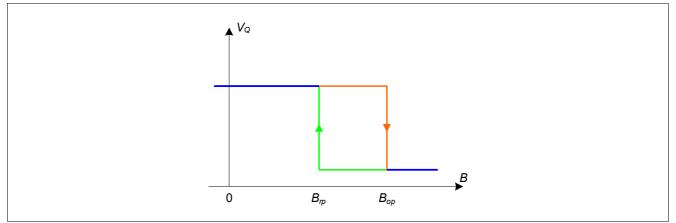


Figure 4 Output Signal



3.1 Absolute Maximum Ratings

Table 3 Absolute Maximum Rating Parameters

T_i = -40°C to 150°C

Parameter	Symbol	Lim	it Values	Unit	Note / Test Condition	
		Min.	Max.			
Supply voltage	Vs	-18	18	V		
		-18	24		for 1h, $R_S \ge 200\Omega$	
		-18	26		for 5min, $R_S \ge 200\Omega$	
Supply current through	I _S	-50	50	mA		
protection device						
Output voltage	V _Q	-0.7	18	V		
		-0.7	26		for 5min @ 1.2k Ω pull up	
Continuous output current	Ι _Q	-50	50	mA		
Junction temperature	Tj	_	155	°C	for 2000h (not additive)	
	,	—	165		for 1000h (not additive)	
		—	175		for 168h (not additive)	
		-	195		for 3 x 1h (additive)	
Storage temperature	T _s	-40	150	°C		
Magnetic flux density	В	_	unlimited	mT		

Note: 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.

Table 4ESD Protection¹⁾

Parameter	Symbol	Lim	it Values	Unit	Note / Test Condition	
		Min.	Max.			
ESD Voltage	V _{ESD}		±6	kV	HBM, R = $1.5k\Omega$, C = $100pF$ T _A = $25^{\circ}C$	

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



3.2 Operating Range

The following operating conditions must not be exceeded in order to ensure correct operation of the TLE4906K / TLE4906L.

All parameters specified in the following sections refer to these operating conditions unless otherwise mentioned.

Table 5 Operating Conditions Parameters

Parameter	Symbol Values			S	Unit	Note / Test Condition	
		Min.	Тур.	Max.			
Supply voltage	Vs	2.7		18	V		
Output voltage	V _Q	-0.7		18	V		
Junction temperature	Tj	-40		150	°C		
Output current	l _Q	0		20	mA		



3.3 Electrical and Magnetic Characteristics

Product characteristics involve the spread of values guaranteed within the specified voltage and ambient temperature range. Typical characteristics are the median of the production.

Parameter	Symbol Values				Unit	Note / Test Condition
		Min.	Тур.	Max.		
Supply current	I _S	2	4	6	mA	V _S = 2.7V 18V
Reverse current	I _{SR}	0	0.2	1	mA	V _S = -18V
Output saturation voltage	V _{QSAT}	-	0.3	0.6	V	I _Q = 20mA
Output leakage current	I _{QLEAK}	-	0.05	10	μA	for $V_Q = 18V$
Output fall time	t _f	-	0.02	1	μs	R_{L} = 1.2kΩ; C_{L} = 50pF
Output rise time	t _r	-	0.4	1	μs	see Figure 3
Chopper frequency	f _{osc}	-	320	-	kHz	
Switching frequency	f _{sw}	0	-	15 ²⁾	kHz	
Delay time ³⁾	t _d	-	13	-	μs	
Output jitter ⁴⁾	t _{QJ}	-	1	-	μs _{RMS}	typical value for square wave signal with 1kHz
Power-on time ⁵⁾	t _{PON}	-	13	-	μs	$V_{\rm S} \ge 2.7 V$
Thermal resistance ⁶⁾	R _{thJA}	-	100	-	K/W	SC59
		-	-	190		PG-SSO-3-2

 Table 6
 General Electrical Characteristics¹⁾

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

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 -3dB 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 $V_S \ge 2.7V$ to the sensor until the output state is valid.

6) Thermal resistance from junction to ambient.

Calculation of the ambient temperature (SC59 example)

e.g. for V_S = 12.0V, I_{Styp} = 4mA, V_{QSATtyp} = 0.3V and I_Q = 20mA Power dissipation P_{DIS} = 54.0mW In T_A = T_j - (R_{thJA} x P_{DIS}) = 175°C - (100K/W x 0.054W)

Resulting max. ambient temperature: $T_A = 169.6^{\circ}C$



Parameter	Symbol	Tj[°C]	Values			Unit	Note / Test Condition
			Min.	Тур.	Max.		
Operating point	B _{OP}	-40	6.7	10.3	13.9	mT	
		25	6.5	10.0	13.5		
		150	6.2	9.5	12.9		
Release point	B _{RP}	-40	5.2	8.7	12.3	mT	
		25	5.0	8.5	12.0		
		150	4.7	8.1	11.4		
Hysteresis	B _{HYS}	-40	-	-	-	mT	
-		25	0.7	1.5	3.0		
		150	-	-	-		
Temperature compensation of magnetic thresholds	T _C		-	-350	-	ppm/°C	
Repeatability of magnetic thresholds ²⁾	B _{REP}		-	20	-	μT_{RMS}	typ. value for $\Delta B/\Delta t > 12mT/ms$

Table 7Magnetic Characteristics1)

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

2) B_{REP} is equivalent to the noise constant

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

Field Direction Definition

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

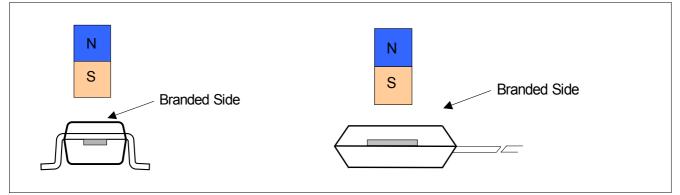


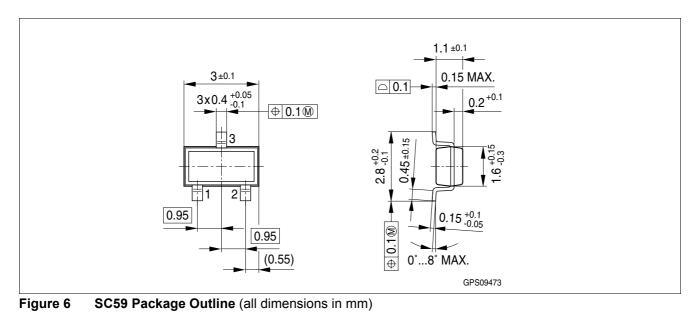
Figure 5 Definition of magnetic field direction (left: SC59, right: PG-SSO-3-2)



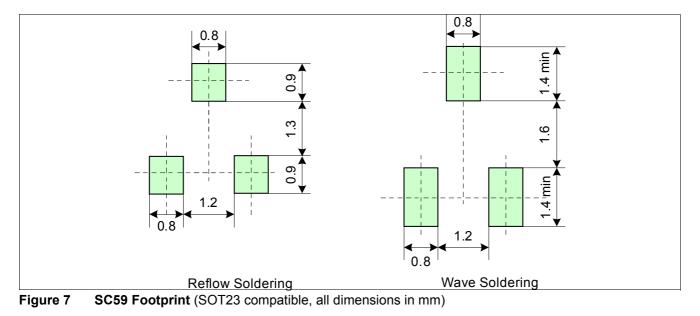
Package Information

4 Package Information

4.1 Package Outline



The following picture shows a recommendation for the PCB layout.





TLE4906K TLE4906L

Package Information

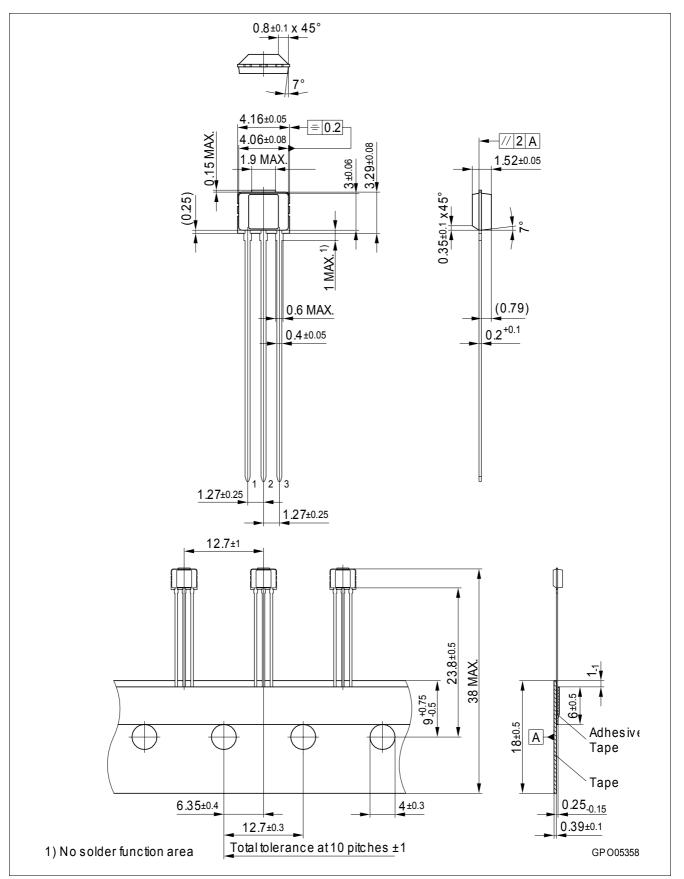


Figure 8 PG-SSO-3-2 Package Outline (All dimensions in mm)



Package Information

4.2 Distance between Chip and Package

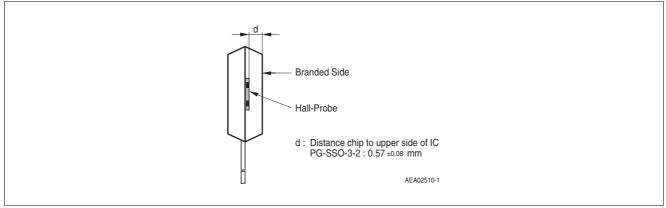


Figure 9 Distance between chip and package PG-SSO-3-2

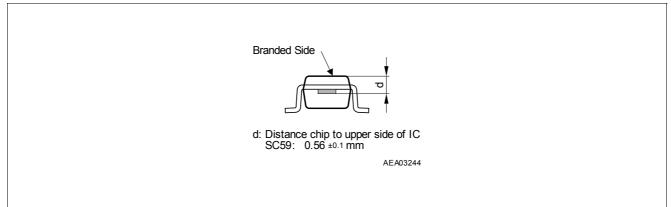


Figure 10 Distance between chip and package SC59

4.3 Package Marking

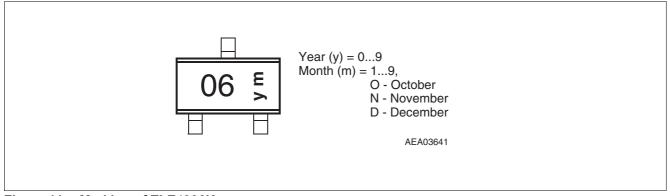


Figure 11 Marking of TLE4906K



TLE4906K TLE4906L

Package Information

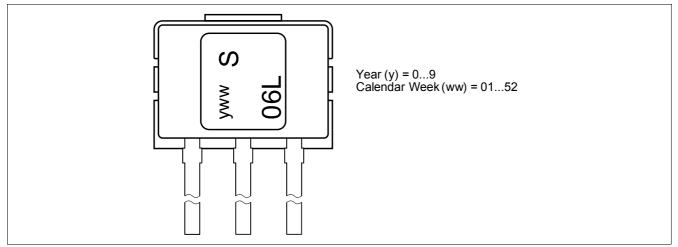


Figure 12 Marking of TLE4906L

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