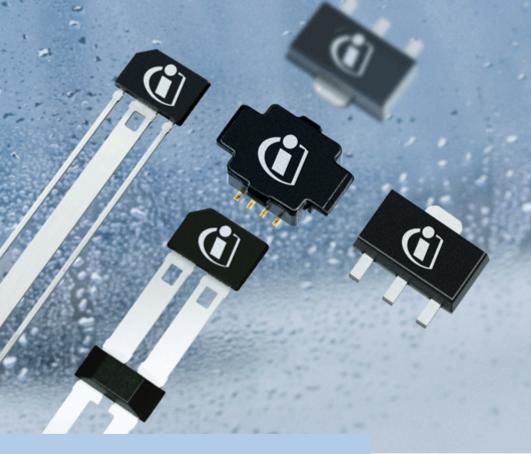
TLE4946K

High Precision Bipolar Hall-Effect Latch



Sensors



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Previous	Version:					
Page Subjects (major changes since last revision)						
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TLE4946K

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TLE4946K



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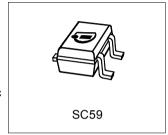
High Precision Bipolar Hall-Effect Latch

TLE4946K

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 μs)
- High ESD performance (± 6 kV HBM)
- · Digital output signal
- SMD package SC59 (SOT23 compatible)



1.2 Functional Description

The TLE4946K is a 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.

Туре	Package
TLE4946K	SC59



Overview

1.3 Pin Configuration (top view)

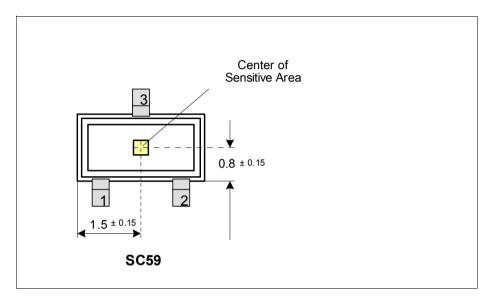


Figure 1 Pin Definition and Center of Sensitive Area

Table 1 Pin Definitions and Functions SC59

Pin No.	Symbol	Function
1	V_{S}	Supply voltage
2	Q	Output
3	GND	Ground



General

2 General

2.1 Block Diagram

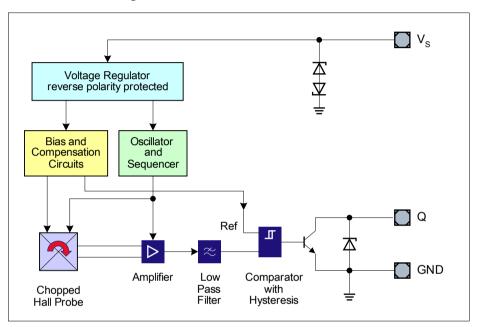


Figure 2 Block Diagram

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.



Maximum Ratings

3 Maximum Ratings

Table 2 Absolute Maximum Ratings

 $T_{\rm i} = -40^{\circ}{\rm C} \text{ to } 150^{\circ}{\rm C}$

Parameter	Symbol	Limit Values		Unit	Conditions
		min.	max.		
Supply voltage	V_{S}	- 18 - 18 - 18	18 24 26	V	for 1 h, $R_{\rm s} \ge 200~\Omega$ for 5 min, $R_{\rm s} \ge 200~\Omega$
Supply current through protection device	$I_{\mathbb{S}}$	- 50	+ 50	mA	
Output voltage	V_{Q}	- 0.7 - 0.7	18 26	V	for 5 min @ 1.2 kΩ pull up
Continuous output current	I_{Q}	- 50	+ 50	mA	
Junction temperature	T_{j}	- - -	155 165 175 195	°C	for 2000 h (not additive) for 1000 h (not additive) for 168 h (not additive) for 3 x 1 h (additive)
Storage temperature	$T_{\mathbb{S}}$	- 40	150	°C	
Magnetic flux density	В	-	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 1)

Parameter	Symbol	Limit \	Values	Unit	Notes		
		min.	max.				
ESD voltage	V _{ESD}	_	± 6	kV	HBM, R = 1.5 kΩ, C = 100 pF $T_{\rm A}$ = 25°C		

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



Operating Range

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

Electrical and Magnetic Parameters 5

Electrical Characteristics 1). Table 5

Parameter	Symbol	Limit Values			Unit	Conditions	
		min. typ.		max.			
Supply current	I_{S}	2	4	6	mA	V _S = 2.7 V 18 V	
Reverse current	I_{SR}	0	0.2	1	mA	V _S = -18 V	
Output saturation voltage	V_{QSAT}	_	0.3	0.6	V	$I_{\rm Q}$ = 20 mA	
Output leakage current	I_{QLEAK}	_	0.05	10	μΑ	for $V_{\rm Q}$ = 18 V	
Output fall time	t_{f}	-	0.02	1	μs	$R_{\rm L}$ = 1.2 k Ω ; $C_{\rm L}$ = 50 pF	
Output rise time	t_{r}	_	0.4	1	μs	see: Figure 3 "Timing Definition" on Page 9	
Chopper frequency	$f_{\sf OSC}$	_	320	-	kHz		
Switching frequency	$f_{\sf SW}$	0	_	15 ²⁾	kHz		
Delay time 3)	$t_{\sf d}$	-	13	_	μs		
Output jitter 4)	$t_{\rm QJ}$	_	1	-	μs _{RMS}	Typical value for square wave signal 1 kHz	
Power-on time 5)	t_{PON}	-	13	_	μs	$V_{\rm S} \ge 2.7 \text{ V}$	
Thermal resistance 6)	R_{thJA}	_	100	_	K/W	SC59	

- 1) over operating range, unless otherwise specified. Typical values correspond to $V_{\rm S}$ =12 V and $T_{\rm A}$ = 25°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 $V_S \ge 2.7 \text{ V}$ 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 $V_{\rm S}$ = 12.0 V, $I_{\rm Styp}$ = 4 mA, $V_{\rm QSATtyp}$ = 0.3 V and $I_{\rm Q}$ = 20 mA :

Power Dissipation: $P_{\rm DIS}$ = 54.0 mW. In $T_{\rm A}$ = $T_{\rm j}$ – ($R_{\rm thJA}$ × $P_{\rm DIS}$) = 175°C – (100 K / W × 0.054 W)

Resulting max. ambient temperature: T_A = 169.6°C

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



Electrical and Magnetic Parameters

Table 6 Magnetic Characteristics TLE4946K 1)

Parameter	Symbol	$T_{\rm j}$ [°C]	Li	imit Valu	ies	Unit	Notes
			min.	typ.	max.		
Operate point	B_{OP}	- 40 25 150	11.8 11.0 6.1	15.8 14.0 9.6	19.2 17.0 13.7	mT	
Release point	B_{RP}	- 40 25 150	- 19.2 - 17.0 - 13.7	- 15.8 - 14.0 - 9.6	- 11.8 - 11.0 - 6.1	mT	
Hysteresis	B _{HYS}	- 40 25 150	- 22.0 -	- 28.0 -	- 34.0 -	mT	
Magnetic Offset	B_{OFF}	- 40 25 150	- - 3.0 -	- - -	- 3.0 -	mT	2)
Temperature compensation of magn. thresholds	TC	-	_	- 2000	_	ppm/°C	
Repeatability of magnetic thresholds 3)	B_{REP}		-	20	-	μT _{RMS}	Typ. value for $\Delta B / \Delta t$ > 12 mT/ms

¹⁾ over operating range, unless otherwise specified. Typical values correspond to $V_{\rm S}$ = 12 V.

Field Direction Definion

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

²⁾ $B_{OFF} = (B_{OP} + B_{RP}) / 2$

³⁾ B_{RFP} is equivalent to the noise constant



Timing Diagram

6 Timing Diagram

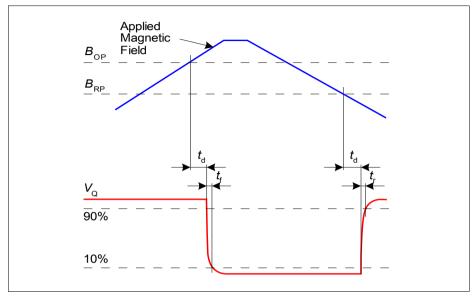


Figure 3 Timing Definition



Package Information

7 Package Information

7.1 Package Marking

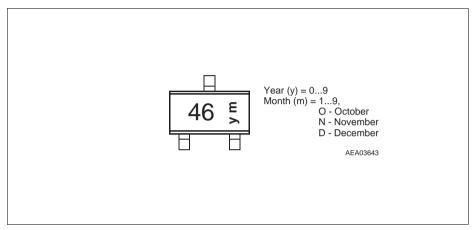


Figure 4 Marking TLE4946K



Package Information

7.2 Distance between Chip and Package Surface

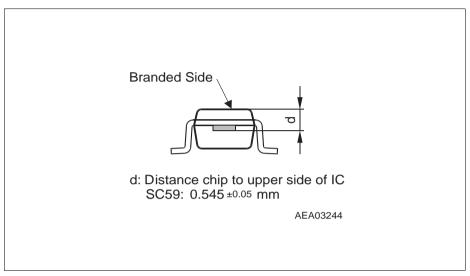


Figure 5 Distance Chip SC59 to Upper Side of IC

7.3 Package Outlines

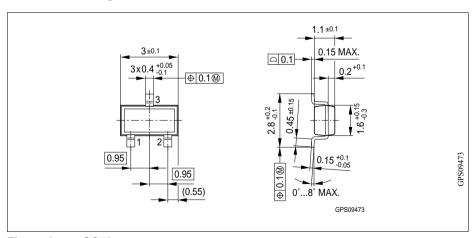


Figure 6 SC59



Package Information

PCB Footprint for SC59

The following picture shows a recommendation for the PCB layout.

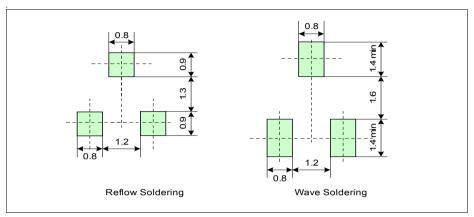


Figure 7 Footprint SC59 (SOT23 compatible)

Note: You can find all of our packages, sorts of packing and others in our Infineon Internet Page "Products": http://www.infineon.com/products.

Dimensions in mm



Notes



Notes



Notes

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