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TLI4966G

High Precision Hall-Effect Switch with Direction Detection

Sensors

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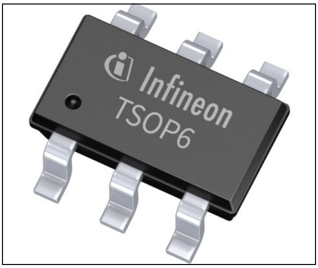
High Precision Hall-Effect Switch with Direction Detection **TLI4966G**

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 125°C without damage
- Low jitter (typ. 1 µs)
- Digital output signals
- Bipolar version
- Excellent matching between the 2 Hall probes
- Hall plate distance 1.45 mm
- Direction & speed information
- Direction signal switches before the speed signal
- SMD package PG-TSOP6-6-9

1.2 Functional Description

The TLI4966G is an integrated circuit double Hall-effect sensor designed specifically for industrial applications. Precise magnetic switching points and high temperature stability are achieved by active compensation circuits and chopper techniques on chip. They provide a speed signal at Q2 for every magnetic pole pair and a direction information at Q1, which is provided before the speed signal.

Type	Ordering Code	Package
TLI4966G	SP003330332	PG-TSOP6-6-9

1.3 Pin Configuration (top view)

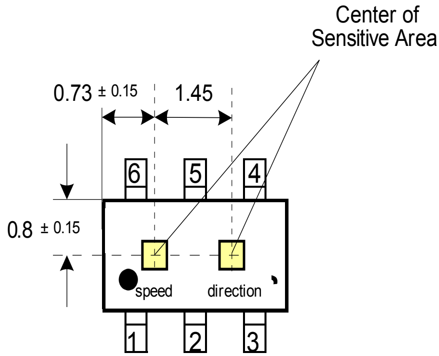


Figure 1 Pin Definition and Center of Sensitive Area

Table 1 Pin Definitions and Functions PG-TSOP6-6-9

Pin No.	Symbol	Function
1	Q2	Speed
2	GND	Recommended connection to GND
3	Q1	Direction
4	V_S	Supply voltage
5	GND	Recommended connection to GND
6	GND	Ground

2 General

2.1 Block Diagram

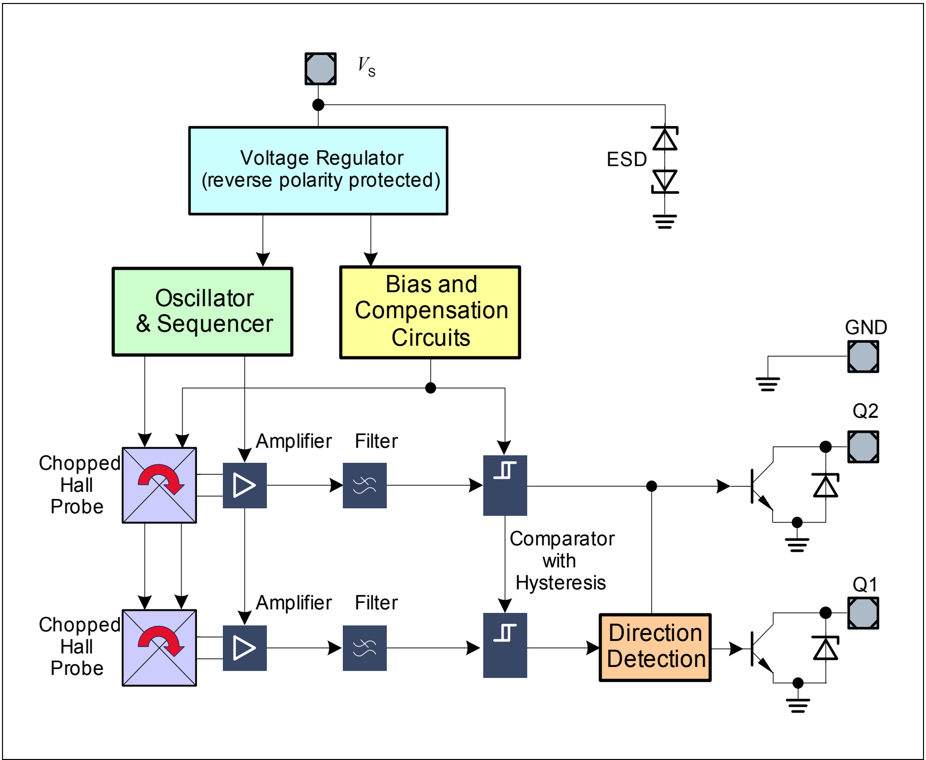


Figure 2 Block Diagram

2.2 Circuit Description

The chopped Double Hall Switch comprises two Hall probes, bias generator, compensation circuits, oscillator, and output transistors.

The bias generator provides currents for the Hall probes 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 probes caused by molding and soldering processes and other thermal stresses in the package. This chopper technique together with the threshold generator and the comparator ensures high accurate magnetic switching points.

3 Maximum Ratings

Table 2 Absolute Maximum Ratings

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 kΩ pull up
Continuous output current	I_Q	-50	50	mA	
Junction temperature	T_J	-40	125	°C	
Storage temperature	T_S	-40	150	°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 [1)]

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
ESD voltage	V_{ESD}	–	±4	kV	HBM, R = 1.5 kΩ, C = 100 pF T_A = 25°C

1) 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 24 26	V	 1 h with $R_S \geq 200\ \Omega$ for 5 min $R_S \geq 200\ \Omega$
Output voltage	V_Q	-0.7	–	18	V	
Ambient temperature	T_A	-40		115	°C	
Output current	I_Q	0	–	10	mA	

5 Electrical and Magnetic Parameters

Table 5 Electrical Characteristics [1]

Parameter	Symbol	Limit Values			Unit	Conditions
		min.	typ.	max.		
Supply current	I_S	4	5.2	7	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_Q = 10 mA
Output leakage current	I_{QLEAK}	–	0.05	10	µA	for V_Q = 18 V
Output fall time	t_f	–	0.2	1	µs	R_L = 1.2 kΩ; C_L < 50 pF see: Figure 3 on Page 13
Output rise time	t_r	–	0.2	1	µs	
Chopper frequency	f_{OSC}	–	320	–	kHz	
Switching frequency	f_{SW}	0	–	15 [2]	kHz	
Delay time [3]	t_d	–	13	–	µs	
Count Signal Delay	t_{dc}	50	200	1000	ns	
Output jitter [4]	t_{QJ}	–	1	–	μs_{RMS}	Typ. value for square-wave signal 1 kHz
Repeatability of magnetic thresholds [5]	B_{REP}	–	40	–	μT_{RMS}	Typ. value for $\Delta B/\Delta t$ > 12 mT/ms
Power-on time [6]	t_{PON}	–	13	–	µs	$V_S \geq$ 2.7 V
Distance of hall plates	d_{HALL}	–	1.45	–	mm	
Thermal resistance [7]	R_{thJA}	–	100	–	K/W	PG-TSOP6-6-9

1) over operating range, unless otherwise specified. Typical values correspond to V_S = 12 V and T_A = 25°C
2) To operate the sensor at the max. switching frequency, 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) B_{REP} is equivalent to the noise constant
6) Time from applying $V_S \geq$ 2.7 V to the sensor until the output state is valid
7) Thermal resistance from junction to ambient

Calculation of the junction temperature (PG-TSOP6-6-9 example)

e.g. for V_S = 12.0 V, I_{Smax} = 7.0 mA, $V_{QSATtyp}$ = 0.3 V and 2 x I_Q = 10 mA :
Power Dissipation: P_{DIS} = 90.0 mW.
In $T_J = T_A + (R_{thJA} \times P_{DIS})$ / for T_A = 115°C + (100 K / W × 0.09 W)
Resulting max. junction temperature: T_J = 124.0°C

Table 6 Magnetic Characteristics [1].

Parameter	Symbol	T_j [°C]	Limit Values			Unit	Conditions
			min.	typ.	max.		
Operate point	B_{OP}	-40 25 125	5.2 5.0 4.7	7.7 7.5 7.1	10.3 10.0 9.5	mT	
Release point	B_{RP}	-40 25 125	-10.3 -10.0 -9.5	-7.7 -7.5 -7.1	-5.2 -5.0 -4.7	mT	
Hysteresis	B_{HYS}	-40 25 125	– 10.0 –	– 15.0 –	– 20.0 –	mT	
Magnetic matching	B_{MATCH}	-40 25 125	– -2.0 –	– 0 –	– 2.0 –	mT	Valid for B_{OP1} - B_{OP2} and B_{RP1} - B_{RP2}
Magnetic offset	B_{OFF}	-40 25 125	– -2.0 –	– 0 –	– 2.0 –	mT	$(B_{OP} + B_{RP})/2$
Temperature compensation of magnetic thresholds	TC	–	–	-350	–	ppm/°C	

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

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

Field Direction Definition

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

6 Timing Diagrams for the Speed and Direction Outputs

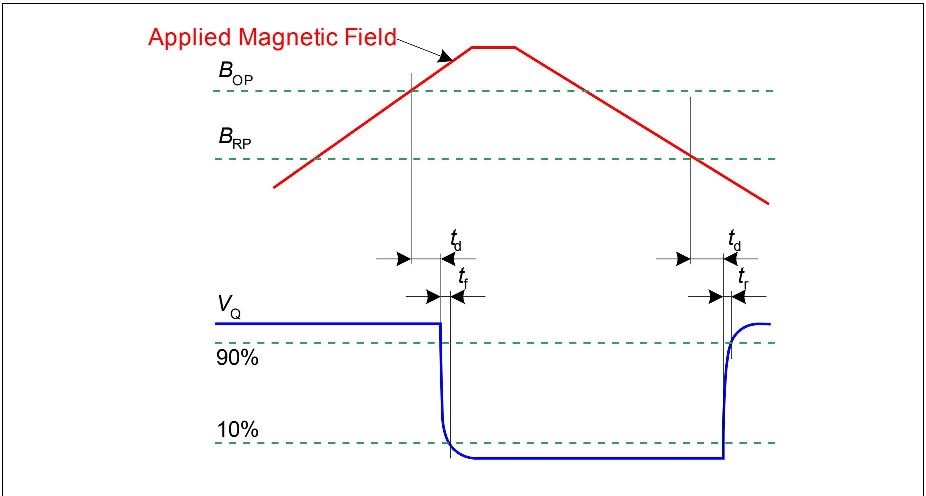


Figure 3 Timing Definition of the Speed Signal

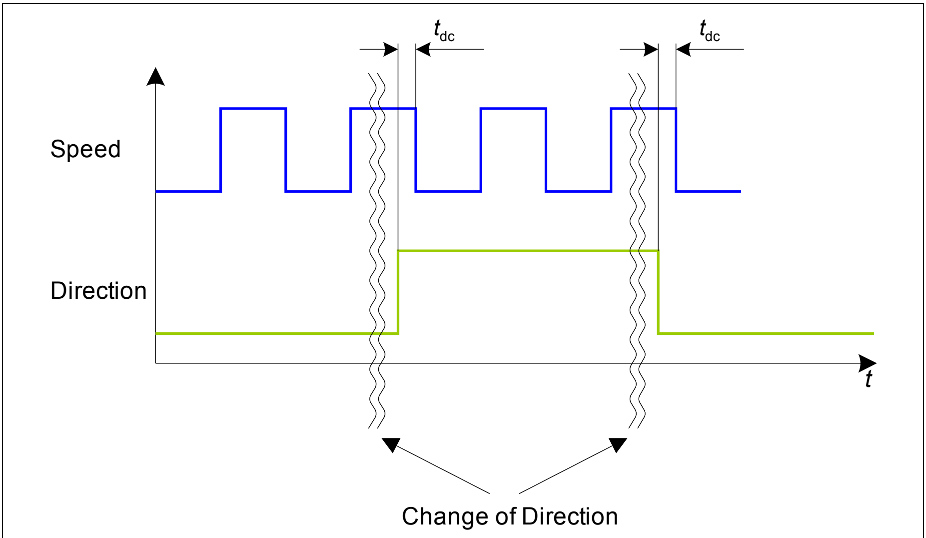


Figure 4 Timing Definition of the Direction Signal

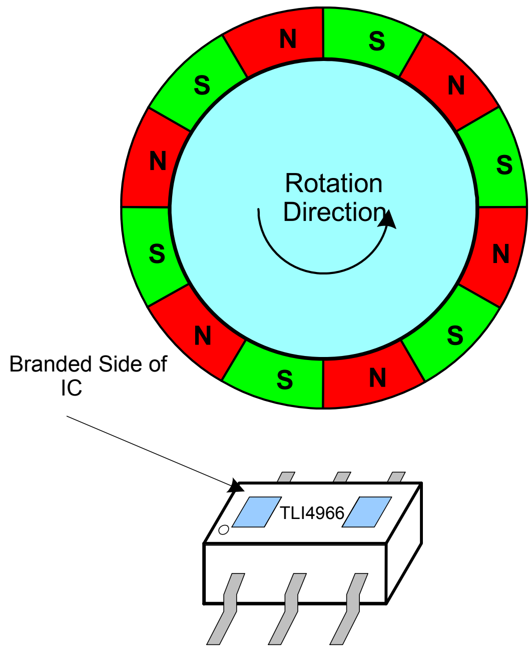


Figure 5 Definition of the Direction Signal

Rotation Direction	State of Direction Output V_{Q1}
Left to right	Low
Right to left	High

7 Package Information

7.1 Package Marking

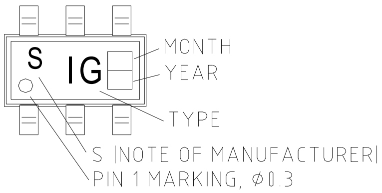


Figure 6 Marking PG-TSOP6-6-9

7.2 Distance between Chip and Package Surface

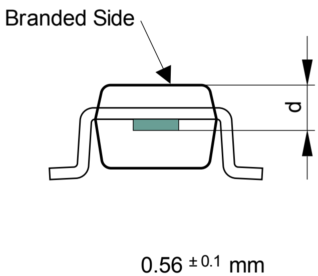


Figure 7 Distance Chip to Upper Side of IC

7.3 Package Outlines

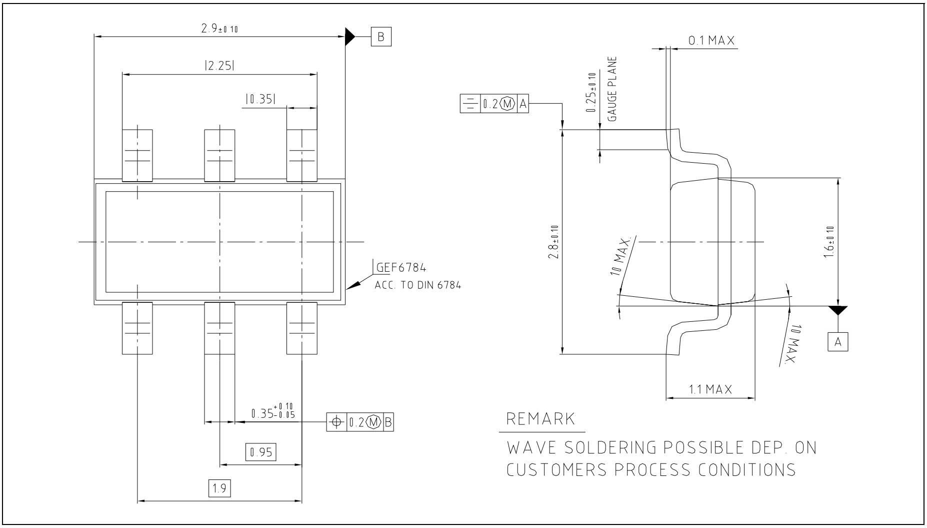


Figure 8 **PG-TSOP6-6-9** (Plastic Thin Small Outline Package)

PCB Footprint for PG-TSOP6-6-9

The following picture shows a recommendation for the PCB layout.

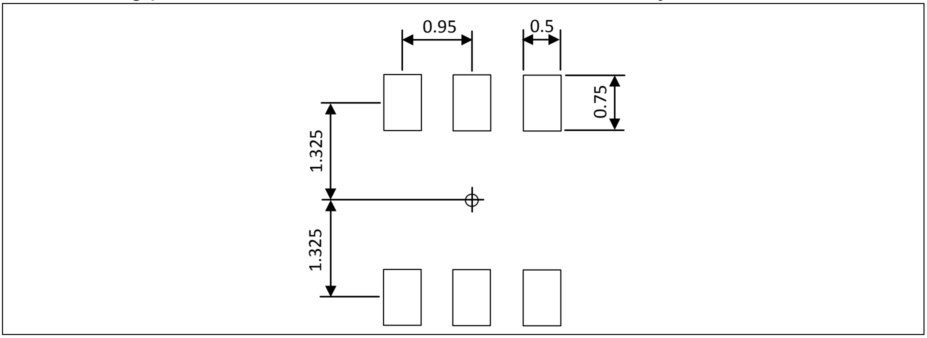


Figure 9 **Footprint PG-TSOP6-6-9**

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

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