



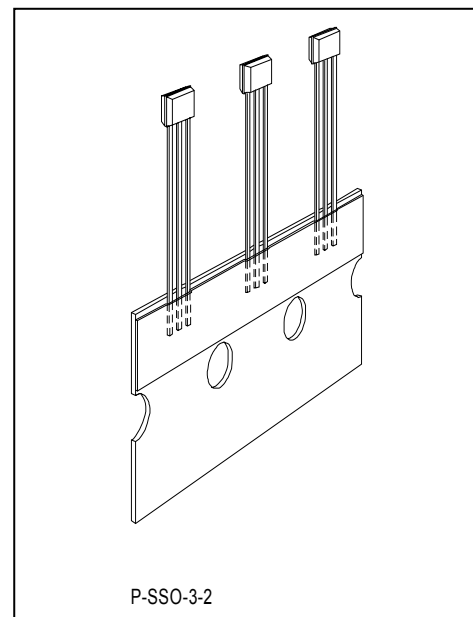
## High Precision Hall-Effect Switch

**TLE4906L**

Data Sheet Version 1.0  
2003-11-20

### Features

- 2.7V to 24V 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 (-18V)
- Superior temperature stability
- Peak temperatures up to 195°C without damage
- Low jitter (typ. 1 $\mu$ s)
- High ESD performance ( $\pm$ 6kV HBM)
- Digital output signal
- Unipolar version
- Leaded package P-SSO-3-2



Type	Ordering Code	Package
TLE4906L	Q62705-K694	P-SSO-3-2

### Functional Description

The TLE4906L is an integrated circuit Hall-effect sensor designed specifically for highly accurate automotive and industrial applications. Precise magnetic switching points and high temperature stability are achieved by active compensation circuits and chopper techniques on chip.

**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.

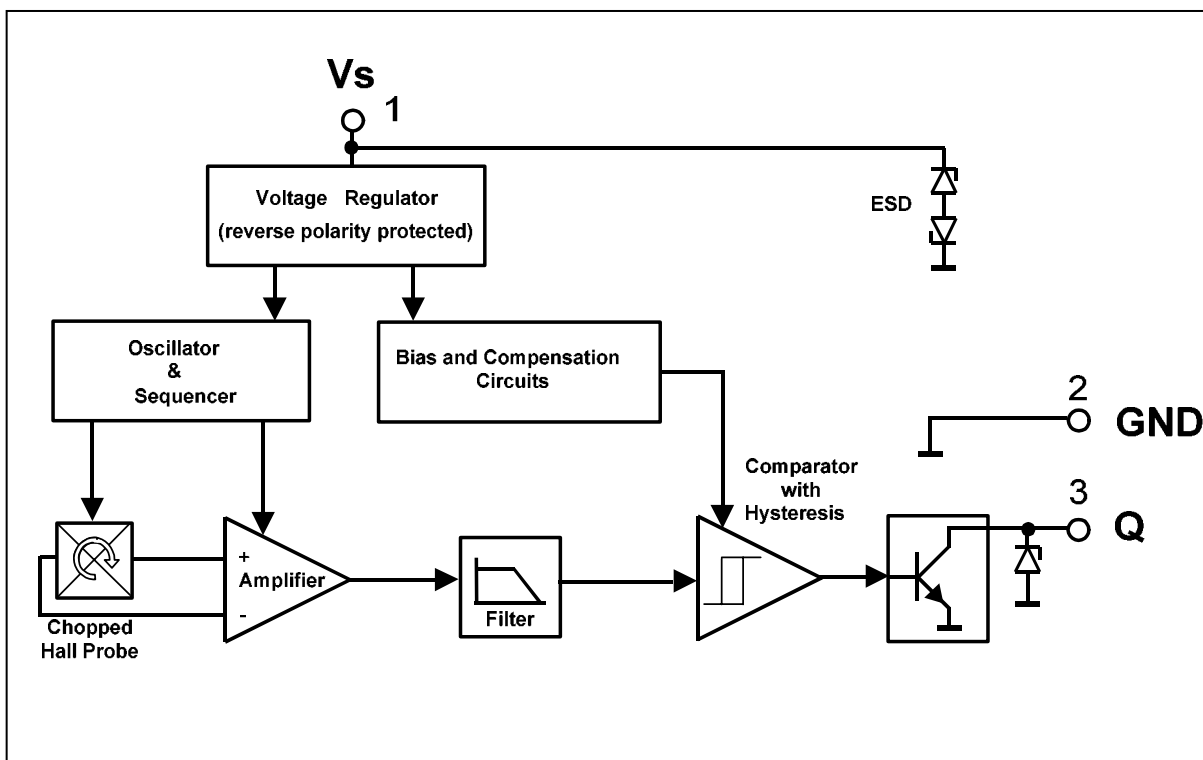


Figure 1: Block Diagram

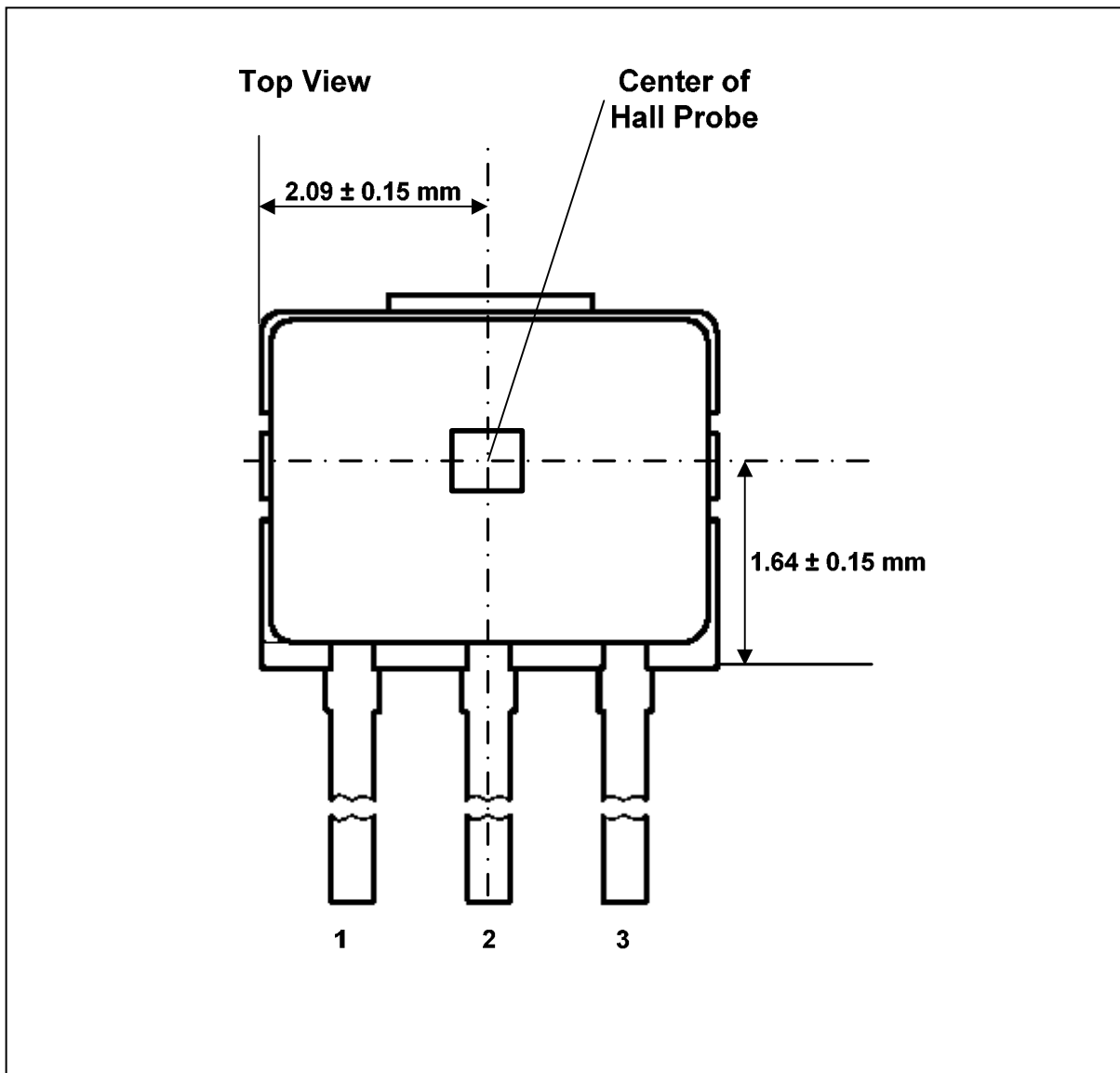
**Pin Configurations**


Figure 2: Pin Configuration

**Pin Definition and Functions**

Pin	Symbol	Function
1	$V_s$	Supply voltage
2	GND	Ground
3	Q	Output

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

Parameter	Symbol	min.	max.	Unit	Conditions
Supply Voltage	$V_S$	-18 -18 -18	18 24 26	V	for 1h, $R_S \geq 200$ Ohm for 5min, $R_S \geq 200$ Ohm
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 kOhm 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 3x1 h (additive)
Storage Temperature	$T_S$	-40	150	$^\circ\text{C}$	
Magnetic Flux Density	B	-	unlimit.	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.

**ESD Protection**

Human Body Model (HBM) tests according to:

EOS/ESD Association Standard S5.1-1993 and Mil. Std. 883D method 3015.7

Parameter	Symbol	max.	Unit	Conditions
ESD Voltage	$V_{\text{ESD}}$	$\pm 6$	kV	HBM, $R = 1.500$ Ohm, $C = 100$ pF; $T_A = 25^\circ\text{C}$

**Operating Range**

Parameter	Symbol	min.	typ.	max.	Unit	Conditions
Supply Voltage	$V_S$	2.7	-	18 24 26	V	1h with $R_S \geq 200$ Ohm for 5min $R_S \geq 200$ Ohm
Output Voltage	$V_Q$	-0.7	-	18	V	
Junction Temperature	$T_j$	-40	-	150 175	$^\circ\text{C}$	for 168 h
Output Current	$I_Q$	0	-	20	mA	

### AC/DC Characteristics

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

Parameter	Symbol	min.	typ.	max.	Unit	Conditions
Supply Current	$I_S$	2	4	6	mA	$V_S = 2.7V \dots 18V$
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	$\mu A$	for $V_Q=18V$
Output Fall Time	$t_f$	-	0.02	1	$\mu s$	$R_L = 1.2 k\Omega ; C_L = 50pF$
Output Rise Time	$t_r$	-	0.4	1	$\mu s$	$R_L = 1.2 k\Omega ; C_L = 50pF$
Chopper Frequency	$f_{OSC}$	-	320	-	kHz	
Switching Frequency	$f_{SW}$	0	-	15 <sup>1)</sup>	kHz	
Delay Time <sup>2)</sup>	$t_d$	-	13	-	$\mu s$	
Output Jitter <sup>3)</sup>	$t_{QJ}$	-	1	-	$\mu s_{RMS}$	B = Square-Wave Signal 1kHz
Repeatability of magnetic thresholds <sup>4)</sup>	$B_{REP}$	-	20	-	$\mu T_{RMS}$	$\Delta B/\Delta t > 12mT/ms$
Power-On Time <sup>5)</sup>	$t_{PON}$	-	13	-	$\mu s$	$V_S \geq 2.7V$
Thermal Resistance <sup>6)</sup> P-SSO-3-2	$R_{thJA}$	-	-	190	K/W	

<sup>1)</sup> 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.

<sup>2)</sup> Systematic delay between magnetic threshold reached and output switching.

<sup>3)</sup> Jitter is the unpredictable deviation of the output switching delay.

<sup>4)</sup>  $B_{REP}$  is equivalent to the noise constant.

<sup>5)</sup> Time from applying  $V_S \geq 2.7V$  to the sensor until the output state is valid.

<sup>6)</sup> Thermal resistance from junction to ambient.

e.g.:  $V_S=12.0V$ ,  $I_{S\_typ}=4mA$ ,  $V_{QSAT\_typ}=0.3V$ ,  $I_Q=20mA \Rightarrow$  Power Dissipation  $P_{dis}=54.0mW$ .

In  $T_A = T_j - (R_{thJA} * P_{dis}) = 175^\circ C - (190 K/W * 0.054 W) \Rightarrow T_A = 164.7^\circ C$

### Magnetic Characteristics

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

Parameter	Symbol	$T_j$ [ $^\circ C$ ]	min.	typ.	max.	Unit	Conditions
Operate Point TLE4906L	$B_{OP}$	-40	6.7	10.3	13.9	mT	
		25	6.5	10.0	13.5		
		150	6.2	9.5	12.9		
Release Point TLE4906L	$B_{RP}$	-40	5.2	8.7	12.3	mT	
		25	5.0	8.5	12.0		
		150	4.7	8.1	11.4		
Hysteresis TLE4906L	$B_{HYS}$	-40	-	-	-	mT	
		25	0.7	1.5	3.0		
		150	-	-	-		
Temperature Compensation of Magnetic Thresholds	TC	-	-	-350	-	ppm/ $^\circ C$	

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

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

Timing Diagram

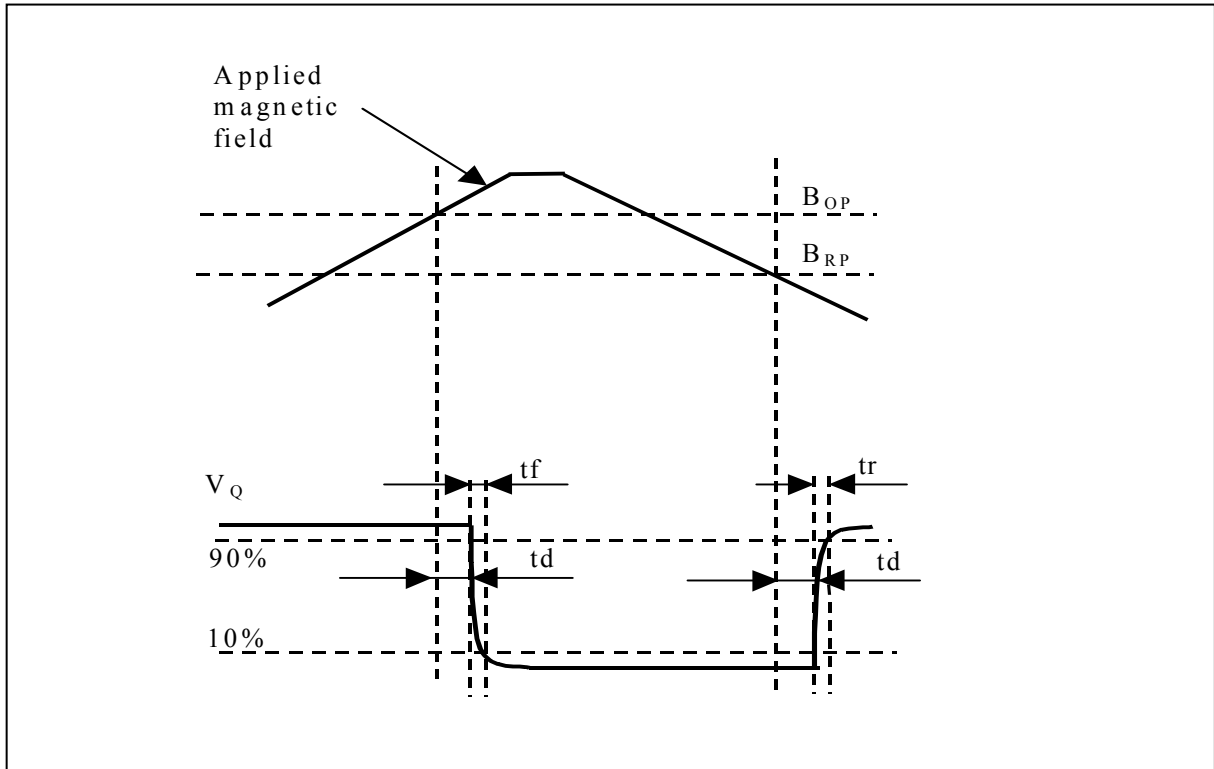


Figure 3: Timing Definition

Package Dimension P-SSO-3-2

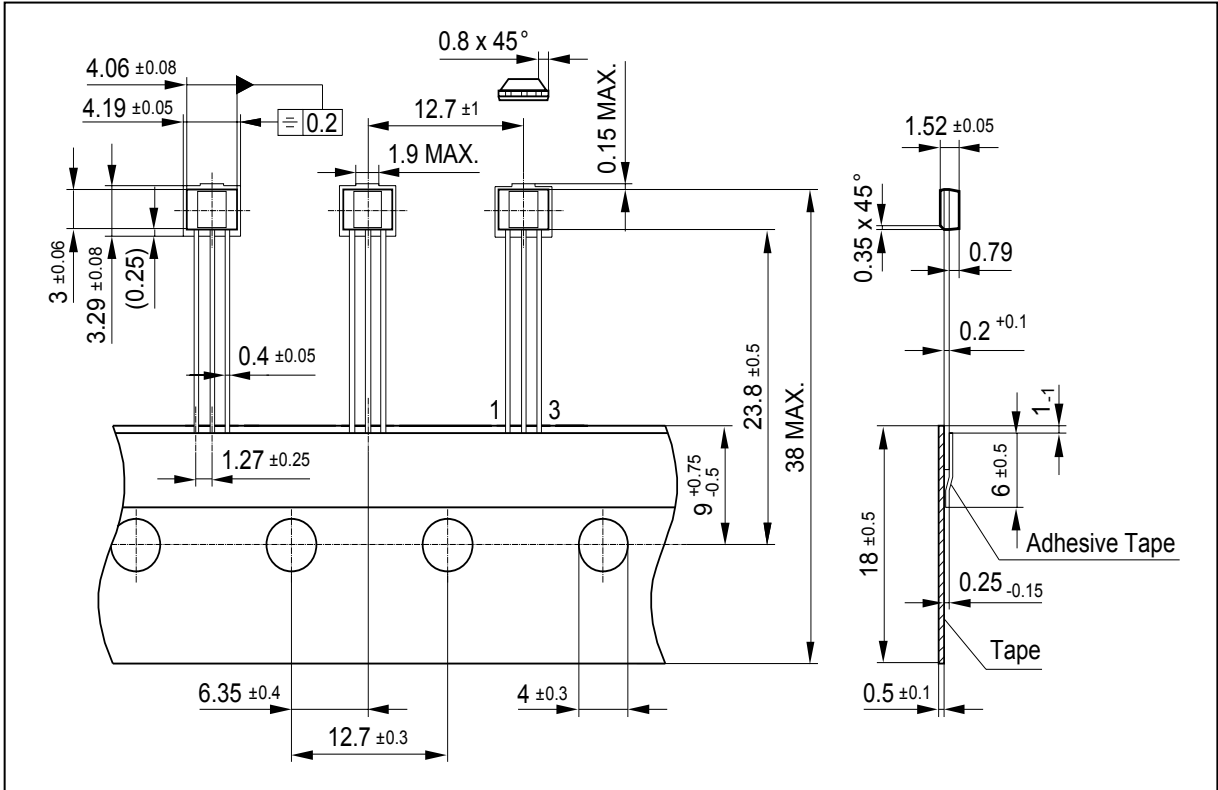


Figure 4: Package Dimension

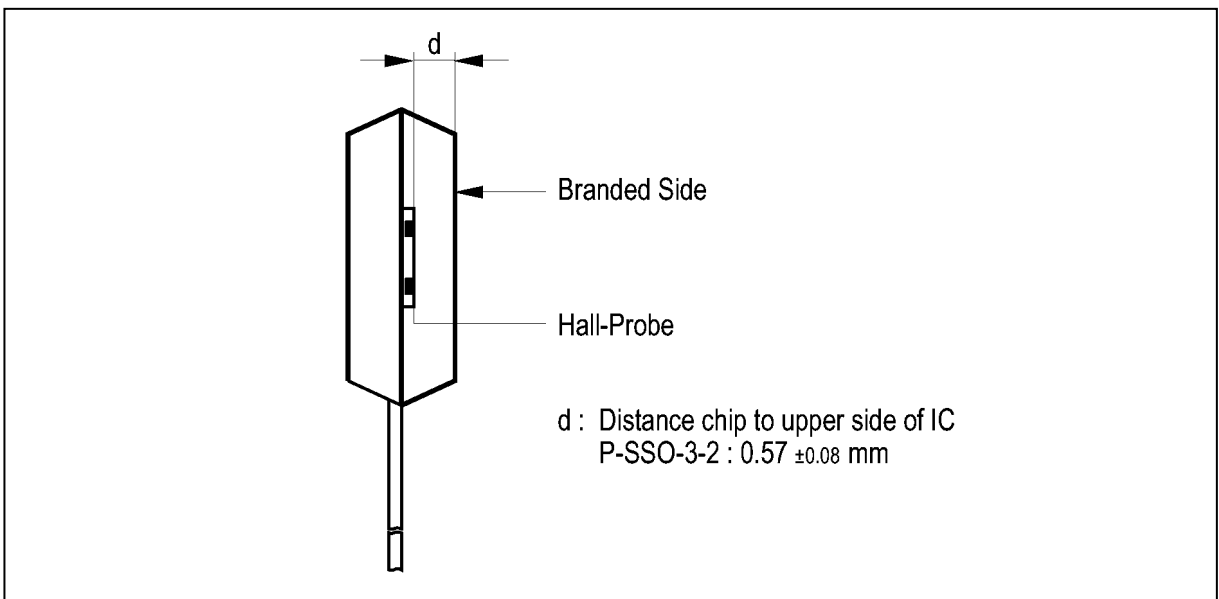


Figure 5: Distance Chip to Upper Side of IC

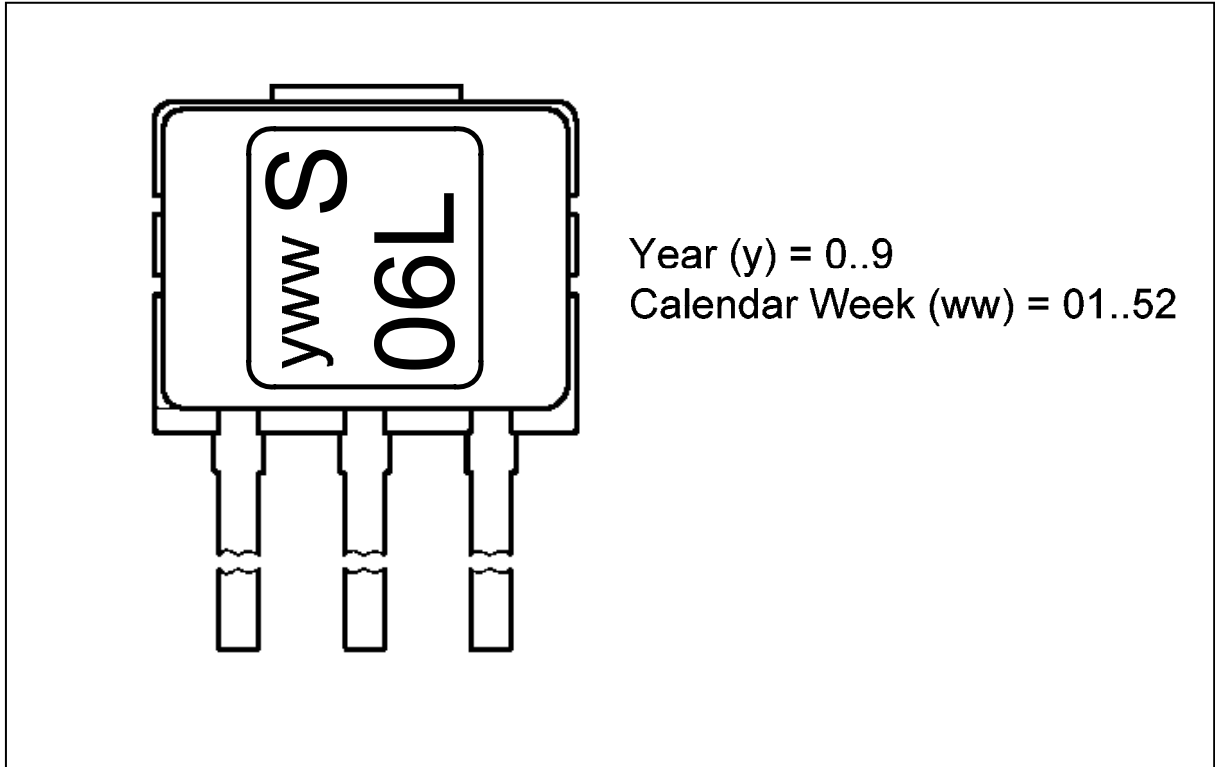


Figure 6: Marking



<b>TLE4906L</b>	
<b>Revision History:</b>	<b>Version 1.0</b> <span style="float: right;"><b>2003-11-20</b></span>
Previous Version:	
Page	Subjects (major changes since last revision)

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