



## Target Specification

### 2-Wire High Precision Hall-Effect Switch

**TLE4976L**

Version 1.6

## Features

- 2-wire current interface 6/14 mA
- 3.0V to 26V 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. 1µs)
- High ESD performance (±8kV HBM)
- Digital output signal
- Unipolar version
- Leaded package P-SSO-3-2

Type	Ordering Code	Package
TLE4976L	t.b.d.	P-SSO-3-2

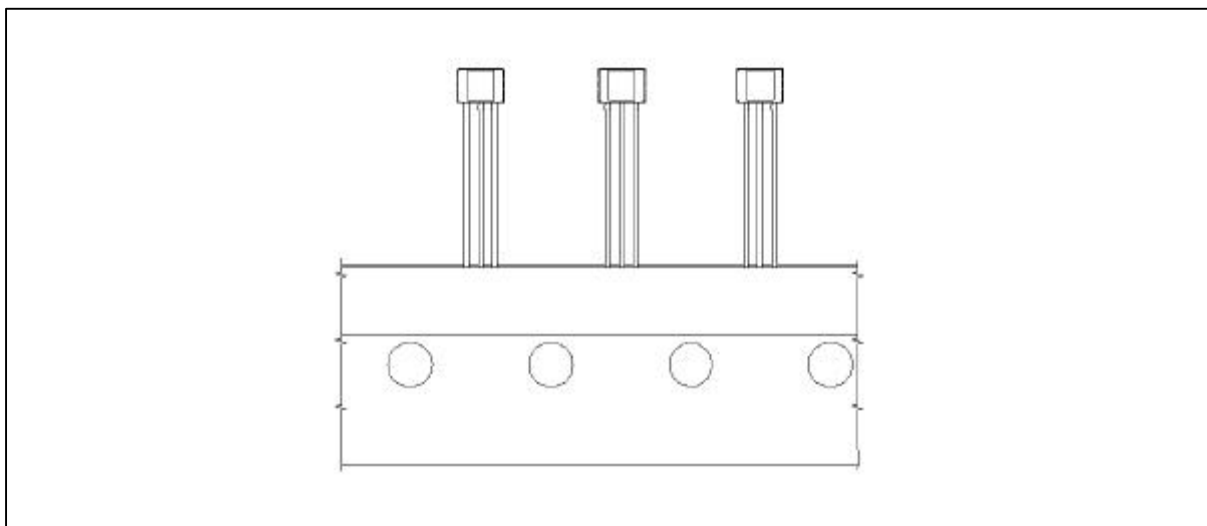


Figure 1: P-SSO-3-2

## Functional Description

The TLE4976L is an integrated circuit Hall-effect sensor designed specifically for highly accurate applications with a current interface. 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 a current output.

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.

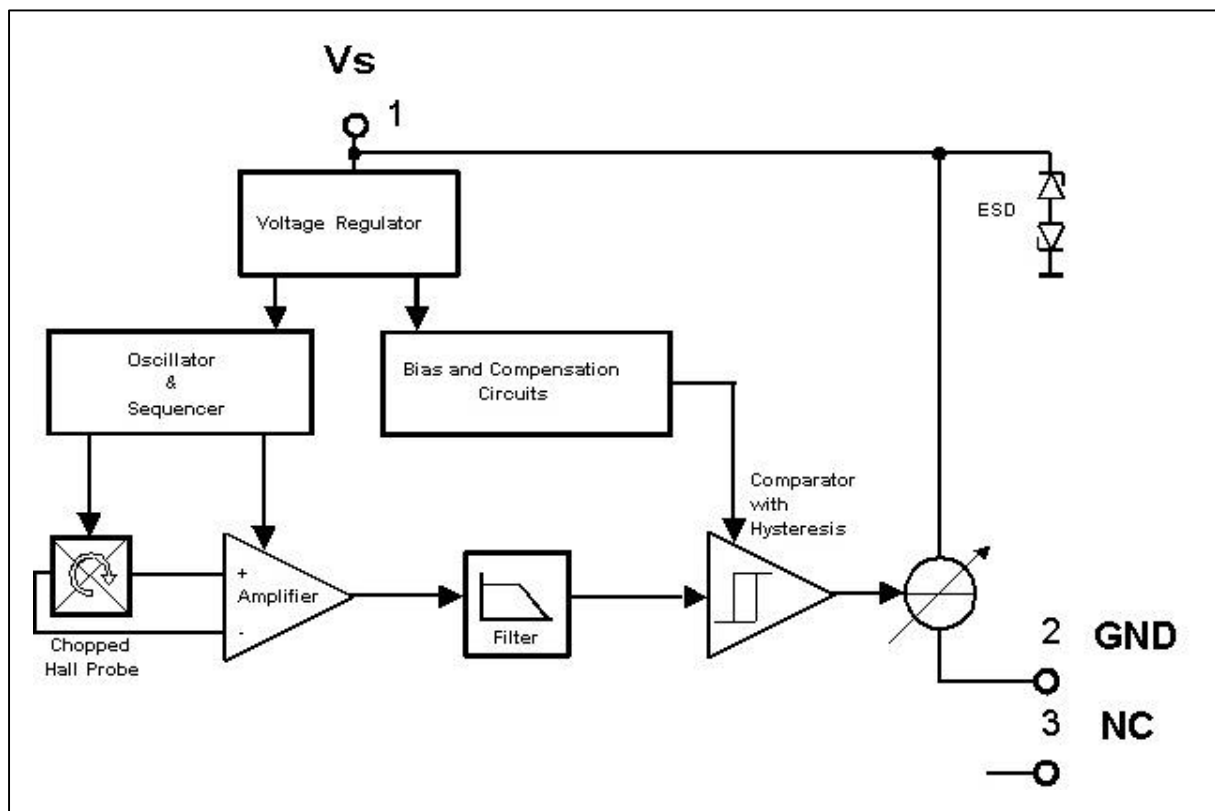


Figure 2 Block Diagram TLE4976L

## Pin Configuration

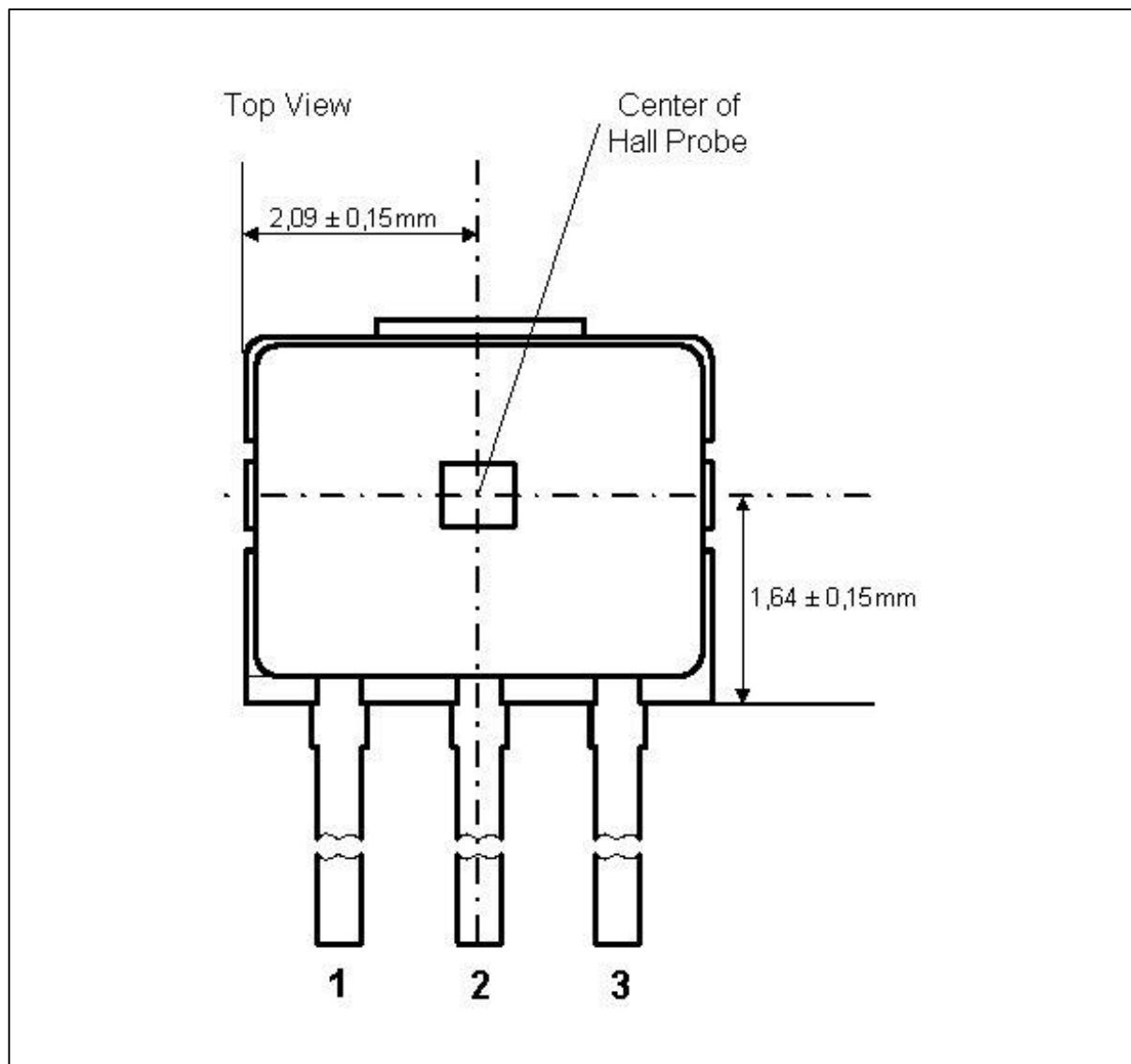


Figure 3: Pin Configuration TLE4976L

## Pin Definition and Functions

Pin	Symbol	Function
1	$V_S$	Supply voltage
2	GND	Ground
3	NC	No internal connection



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### Absolute Maximum Ratings

T<sub>j</sub> = -40 to 150°C

Parameter	Symbol	min.	max.	Unit	Conditions
Supply Voltage	V <sub>S</sub>	-18 -18 -18	18 24 26	V	for 1h (R <sub>S</sub> +R <sub>L</sub> > 75 Ohm) for 5min (R <sub>S</sub> +R <sub>L</sub> > 75 Ohm)
Supply Current through protection device	I <sub>S</sub>	-50	+50	mA	
Junction Temperature	T <sub>j</sub>	-	155 165 175 195	°C	for 2000 h (not additive) for 1000 h (not additive) for 168 h (not additive) for 3x1 h (additive)
Storage Temperature	T <sub>S</sub>	-40	150	°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	U <sub>ESD</sub>	± 8	kV	HBM, R= 1.500 Ohm, C= 100pF; T <sub>A</sub> = 25°C

### Operating Range

Parameter	Symbol	min.	typ.	max.	Unit	Conditions
Supply Voltage	V <sub>S</sub>	3.0 3.0	-	18 26	V	for 5min (R <sub>S</sub> +R <sub>L</sub> > 100 Ohm)
Junction Temperature	T <sub>j</sub>	-40	-	150 175	°C	for 168 h

## 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 low	$I_{Slow}$	5	6	7	mA	$B > B_{rp}$ ; $V_S = 3.0V \dots 18V$
Supply Current high	$I_{Shigh}$	12	14	17	mA	$B < B_{op}$ ; $V_S = 3.0V \dots 18V$
Reverse Current	$I_{SR}$	0	-	0.2	mA	$V_S = -18V$
Output Fall Time	$t_f$		0.4	1.6	$\mu s$	$R_S = 100 \text{ Ohm}$
Output Rise Time	$t_r$		0.4	1.6	$\mu s$	$R_S = 100 \text{ Ohm}$
Chopper Frequency	$f_{OSC}$	-	320	-	kHz	
Switching Frequency	$f_{SW}$	-	-	30 t.b.d.	kHz	Typ. value for $B_{pp}=1.5 \cdot B_{HYS}$
Delay Time <sup>1)</sup>	$t_d$	-	13	20 t.b.d.	$\mu s$	
Output Jitter <sup>2)</sup>	$T_{QJ}$	-	1	-	$\mu s_{RMS}$	Typ. Value for Square-Wave Signal 1kHz
Repeatability of magnetic thresholds <sup>3)</sup>	$B_{REP}$	-	40	-	$\mu T_{RMS}$	Typ. Value for $\Delta B/\Delta t > 12 \text{ mT/ms}$
Power-On Time <sup>4)</sup>	$t_{PON}$	-	13	30 t.b.d.	$\mu s$	$V_S \geq 3.5V$
Thermal Resistance <sup>5)</sup> P-SSO-3-2	$R_{thJA}$	-	-	190	K/W	

<sup>1)</sup> Systematic delay between magnetic threshold reached and output switching.

<sup>2)</sup> Jitter is the unpredictable deviation of the output switching delay.

<sup>3)</sup>  $B_{REP}$  is equivalent to the noise constant.

<sup>4)</sup> Time from applying  $V_S \geq 3.5V$  to the sensor until the output state is valid.

<sup>5)</sup> Thermal resistance from junction to ambient.

e.g. for  $V_S=13.5V$ ,  $R_S=100 \text{ Ohms}$  and  $I_{Shigh}=14 \text{ mA} \Rightarrow$  Power Dissipation  $P_{dis}=169.4 \text{ mW}$ .

In  $T_A = T_j - (R_{thJA} \cdot P_{dis}) = 175^\circ C - (190 \text{ K/W} \cdot 0.1694 \text{ W}) \Rightarrow T_A = 142.8^\circ C$

## 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 TLE4976L	$B_{OP}$	-40 25 150	1.1 1.0 0.9	4.1 4.0 3.8	6.1 6.0 5.8	mT	
Release Point TLE4976L	$B_{RP}$	-40 25 150	3.1 3.0 2.9	6.1 6.0 5.8	8.2 8.0 7.7	mT	
Hysteresis TLE4976L	$B_{HYS}$	-40 25 150	- 0.5 -	- 2.0 -	- 3.5 -	mT	
Temperature Compensation of Magnetic Thresholds	TC		-	-200	-	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

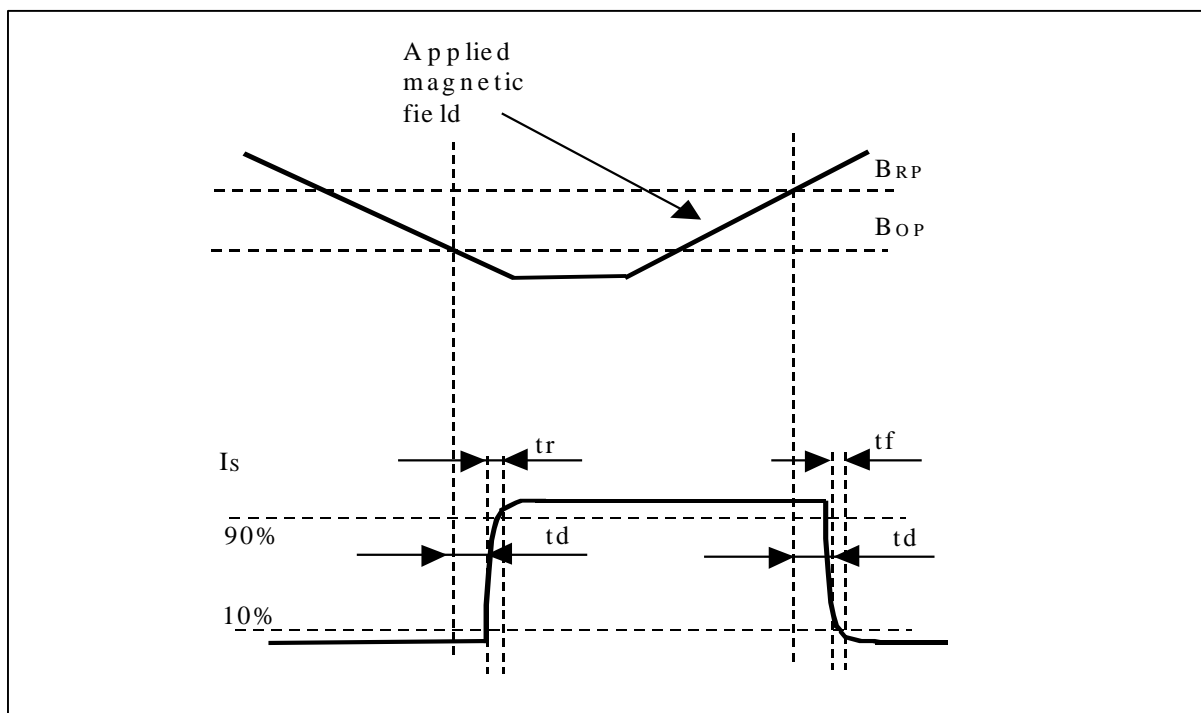


Figure 4: Timing definition of TLE4976L

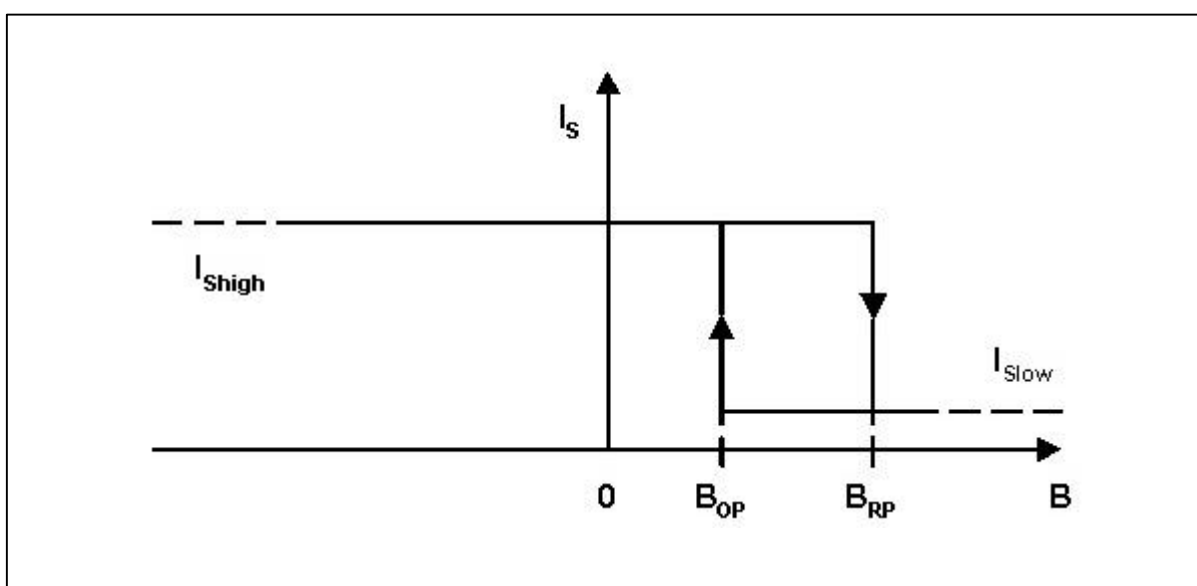


Figure 5: Output Signal of TLE4976L

## Package Dimensions

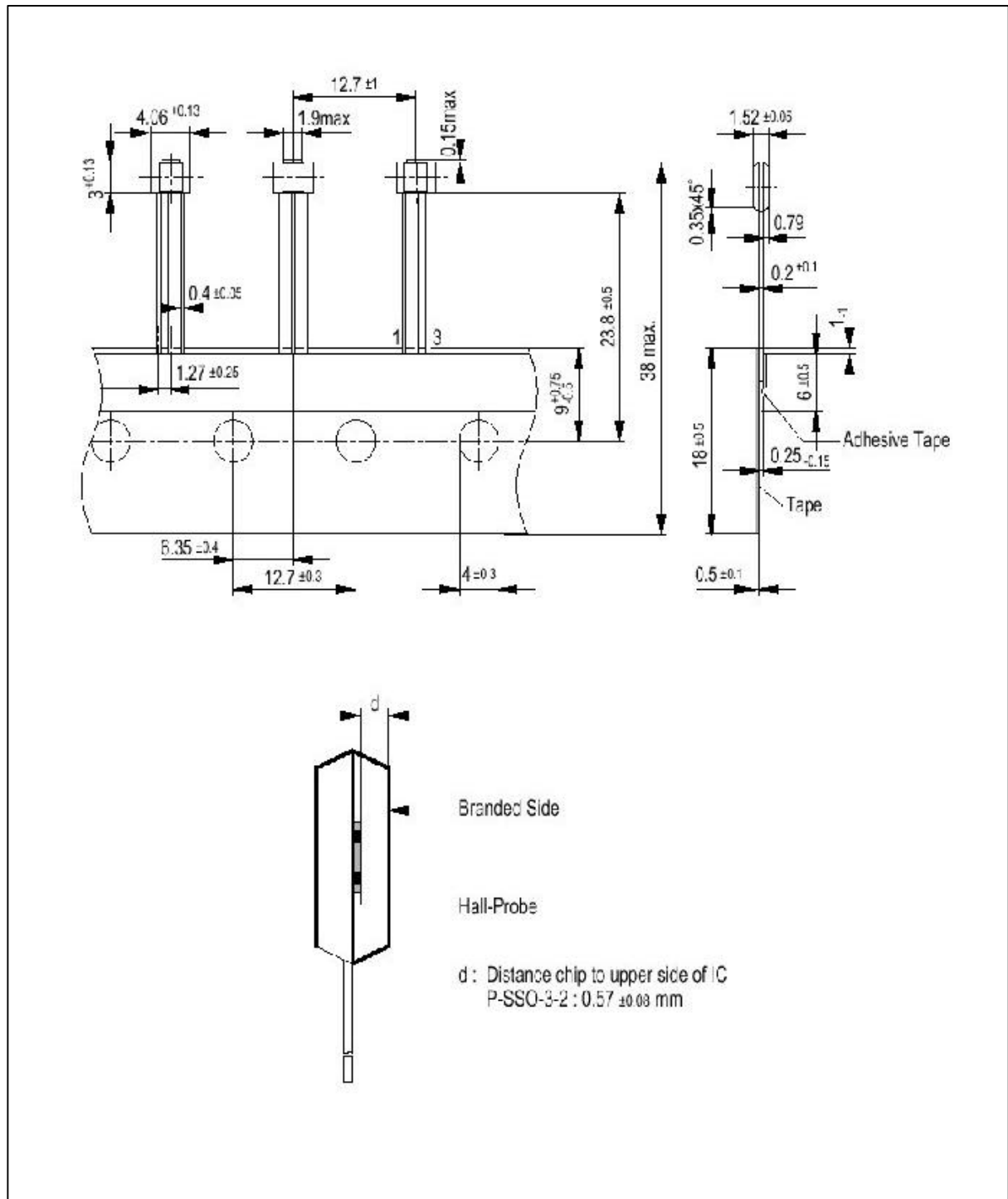



Figure 6: Package dimension TLE4976L



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<b>TLE4976L</b>	
<b>Revision History: 2003-02-21</b>	
Previous Version:	
Page	Subjects (major changes since last revision)

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