SIEMENS

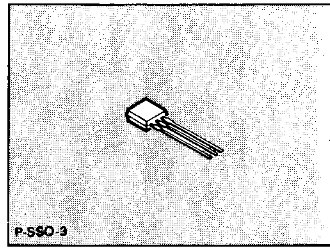
Integrated Hall-Effect Switch for Alternating Magnetic Fields

TLE 4901 F

Preliminary Data **Bipolar IC**

Features

- Low switching thresholds with good-long-term stability
- High interference immunity
- Overvoltage protection
- Extended temperature range −40 to 135 °C
- Insensitive to mechanical stress
- Plastic package: P-SSO-3



Type	Ordering Code	Package
S TLE 4901 F	Q67000–A2518	P-SSO-3

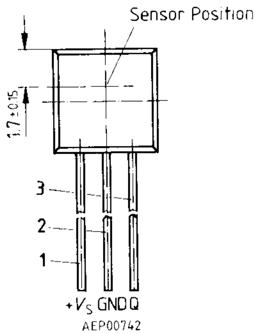
The Hall-effect IC TLE 4901 is a static contactless switch operated by an alternating magnetic field. The output is switched to the conducting state by the south pole of the magnetic field and blocked by its north pole.

The IC is provided with an integrated overvoltage protection against most of the transients occuring in automotive and industrial applications.

The IC is particularly intended as an rpm sensor or an angle indicator.

Multiple-pole ring magnets are especially suited for switching the IC.

Pin Configuration
TLE 4901 F



Pin Definitions and Functions

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

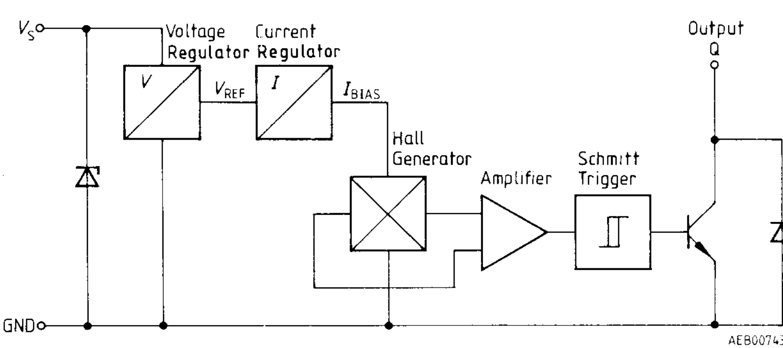
Circuit Description

The circuit includes a Hall generator, amplifier and a Schmitt trigger. The supply and the output terminals have protection circuits with Z characteristics to prevent overvoltage.

A magnetic field perpendicular to the chip surface induces a voltage at the sensor contacts of the integrated Hall generator. This voltage is amplified, Schmitt-triggered, and used to control an NPN transistor with a collector output. The output-stage transistor conducts when the applied flux density exceeds the switching level. If the flux density is reduced by the hysteresis flux density, the output stops conducting.

To minimize the effects of supply voltage and temperature fluctuations on the switching level, the Hall sensor is supplied by a stabilized current source, which is in turn derived from a reference voltage.

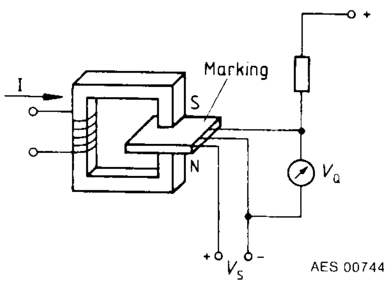
Block Diagram



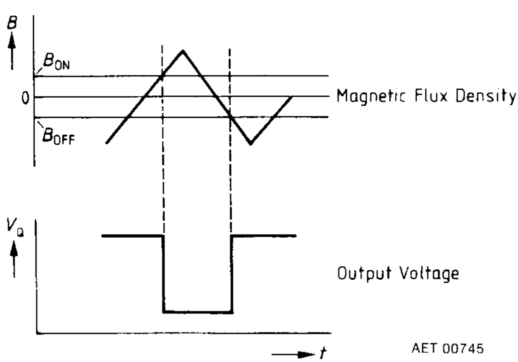
Functional Description

When a magnetic field is applied in the direction shown, and the turn-on flux density is exceeded, the IC's output conducts.

Reversal of the current direction in the electromagnet (i.e. reversal of the magnetic field) and falling below the turn-off flux density, leaves the output non-conducting.



Switching Characteristics



Absolute Maximum Ratings

$T_A = -40$ to 135 °C

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Supply voltage	V_S	−1.2	30	V
Output voltage, output off-state	V_Q		30	V
Output current, output on-state	I_Q		40	mA
Flux density range	B	unlimited		T
Junction temperature[1]), $t < 70000$ h	T_j		150	°C
Storage temperature, $t < 70000$ h	T_{stg}	−55	150	°C
Thermal resistance, system – air	$R_{th\ SA}$		250	K/W
Overvoltage limits Current through protection devices $t < 2$ ms	I_Z	−200	200	mA

Operating Range

Supply voltage	V_S	4.5	30	V
Ambient temperature	T_A	−40	135	°C

Characteristics

$V_S = 6$ to 16 V; $T_A = -30$ to 125 °C

Parameter	Symbol	Limit Values			Unit	Test Circuits
		min.	typ.	max.		
Supply current $B \leqq B_{OFF}$ $B \leqq B_{ON}$	I_S	2 3		8 13	mA mA	2 2
Flux density for "ON" ($T_A = 25$ °C)	B_{ON}			10	mT	2
Flux density for "OFF" ($T_A = 25$ °C)	B_{OFF}	−10			mT	2
Flux density for "ON" ($T_A = -25$ to 85 °C)	B_{ON}			12	mT	2
Flux density for "OFF" ($T_A = -25$ to 85 °C)	B_{OFF}	−12			mT	2
Hysteresis ($T_A = -25$ to 85 °C)	B_{Hy}	3		14	mT	2
Output leakage current ($B \leqq B_{Off}$)	I_{QH}			10	µA	2
Output voltage ($I_{QL} = 16$ mA; $B \geqq B_{ON}$)	V_{QL}			0.4	V	2
Transition times of output Fall time Rise time	 t_{HL} t_{LH}		 0.3 0.5	 1 1	 µs µs	 1 1

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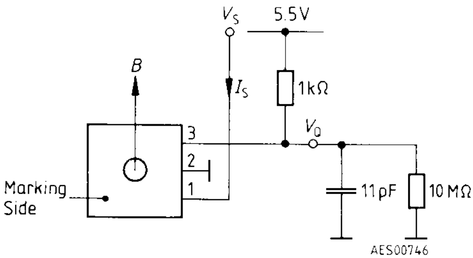
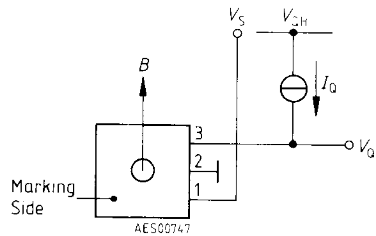
[1]) An optimal reliability and life time of the IC are assured as long as the junction temperature does not exceed 125 °C. Though operation of the IC at the given max. junction temperature of 150 °C is possible, continuous operation at this rating could however impair the reliability of the IC considerably.

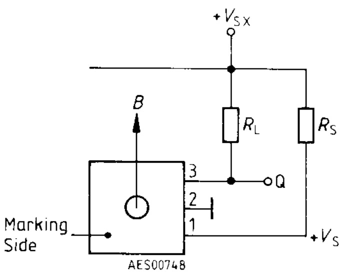
Test Circuit 1



Test Circuit 2



Application Circuit



For optimum protection against destruction, R_s is required to be as high as possible.
Dimensioning:

$$R_s = \frac{V_{SX\,min} - V_{S\,min}}{I_{S\,max}}$$

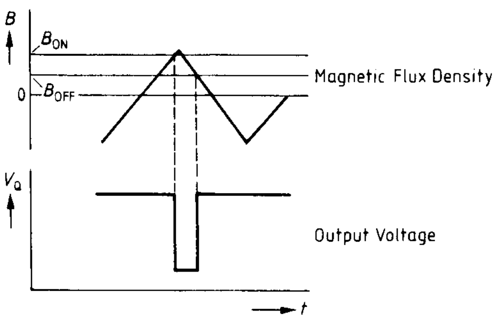
$V_{SX\,min}$ is the minimum supply voltage in each application.

Pulse Diagrams

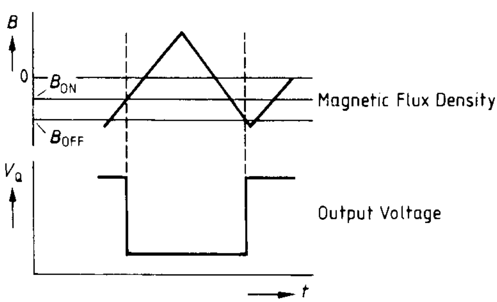
Flux density	Q
$B > B_{ON}$	L
$B < B_{OFF}$	H

The characteristics include the following extreme cases:

$B_{ON} = B_{ON\ max}$



$B_{OFF} = B_{OFF\ min}$



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