SIEMENS

Ψ-Hall-Effect IC; (PSI: Protected-Precision-Siemens-Hall-IC)

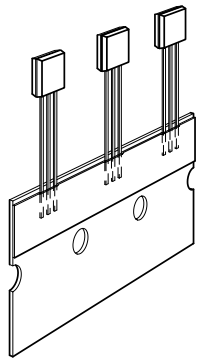
TLE 4904; TLE 4934; TLE 4944

Highly Accurate, Protected Hall-Effect IC

Preliminary Data **Bipolar-IC**

Features

- Active Piezo compensation
- Digital output signal
- For unipolar and bipolar magnetic fields
- Large temperature range
- High temperature stability
- High switching accuracy
- Protection against overvoltage and short circuit
- Protection against reversed polarity
- Output protection against electrical disturbances
- Temperature compensated magnetic perfomance



P-SSO- 3-4

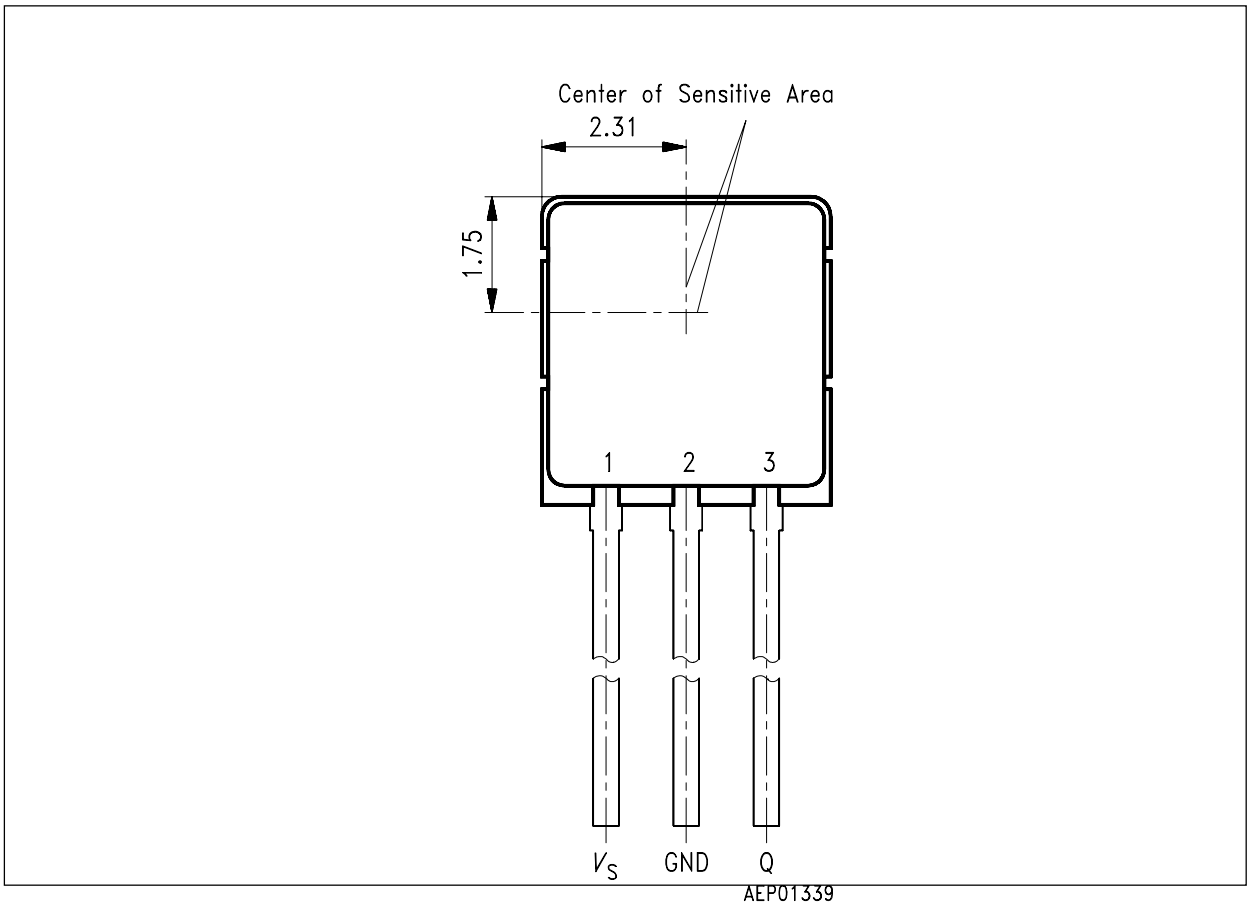
	Type	Ordering Code	Package
▼	TLE 4904	Q67006-A9011	P-SSO-3-4
▼	TLE 4934	Q67006-A9027	P-SSO-3-4
▼	TLE 4944	Q67006-A9028	P-SSO-3-4

▼ New type

TLE 4904 (Unipolar Magnetic Fields - Switch) and the TLE 4934, TLE 4944 (Bipolar Magnetic Fields-Latch/Switch) are integrated circuit Hall sensors designed specifically for high end automotive and industrial electronics. Precise switching points and high temperature stability are achieved by adjustment temperature and active compensation on chip.

These Hall effect integrated circuits include protection for overvoltage, reversed polarity and electrical overstress such as load dump, etc., in accordance with ISO-TR 7637 (DIN 40 839) and short circuit of the output.

Pin Configuration
(top view)



Pin Definition and Functions

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

Circuit Description

The circuit includes Hall generator, amplifier and comperator with hysteresis on one chip.

The internal reference provides the supply voltage for the components. A magnetic field perpendicular to the chip surface induces a voltage at the hall probe. This voltage is amplified and switches a comparator with open-drain output.

The switching points are adjusted to achieve high accuracy. The active offset compensation eliminates internal and external offsets (mechanical stress) by switching of the hall element. The built-in temperature compensation fits to regular magnet system.

Protection is provided at the input/supply (pin 1) for overvoltage and reverse polarity, against overstress such as load dump, etc., in accordance with ISO-TR 7637 (DIN 40839). The output (pin 3) is protected against voltage peaks and short circuit.

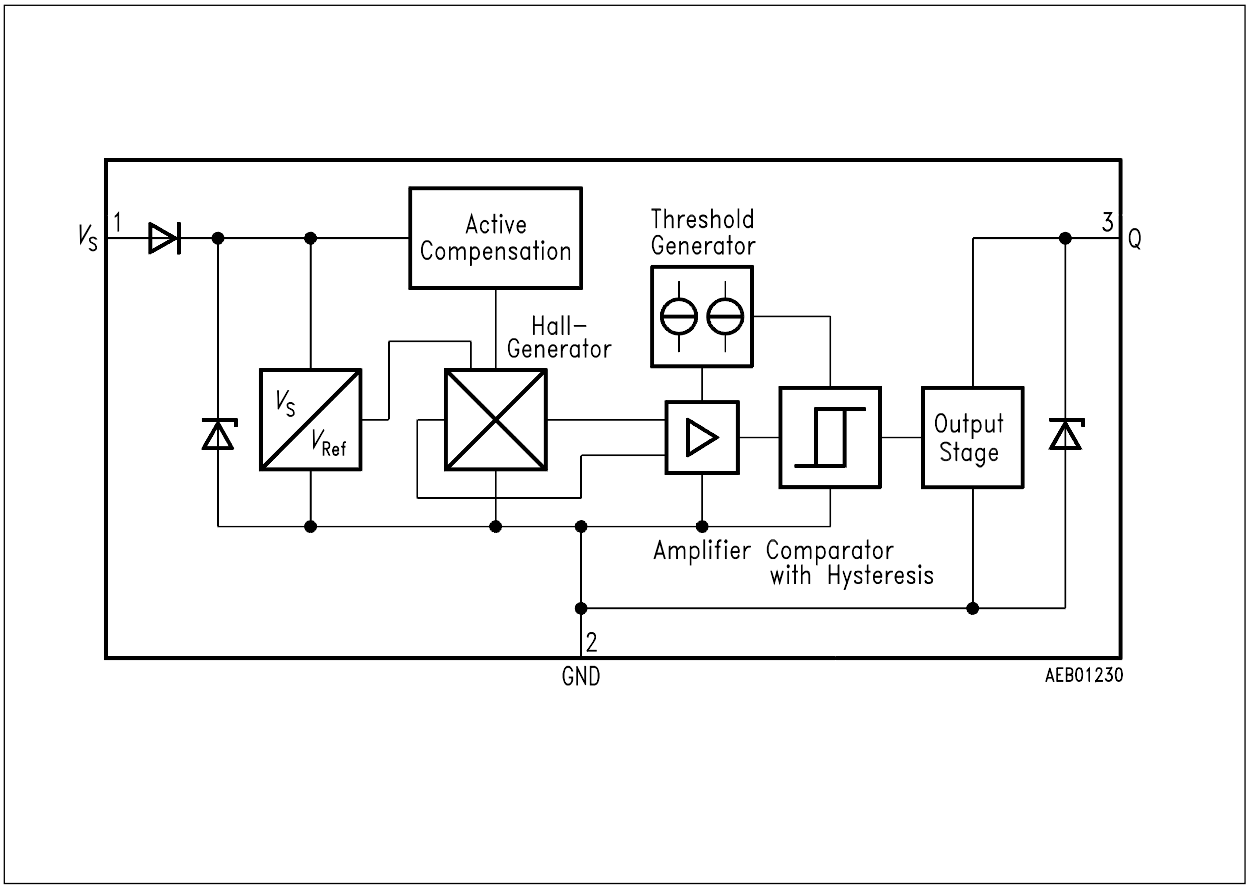


Figure 1
Block Diagram

Functional Description

When a positive magnetic field is applied in the indicated direction (**figure 2**) and the turn-ON magnetic induction B_{OP} is exceeded, the output of the Hall-effect IC will conduct (Operate Point). When the current is reduced (TLE 4904) or a reverse magnetic field is generated (TLE 4934, TLE 4944), the output of the IC turns OFF (Release Point) (**figures 3 and 4**).

B_{RP} and B_{OP} are the critical parameters in most unipolar and bipolar Hall-switch applications. For this reason the switching points are adjusted.

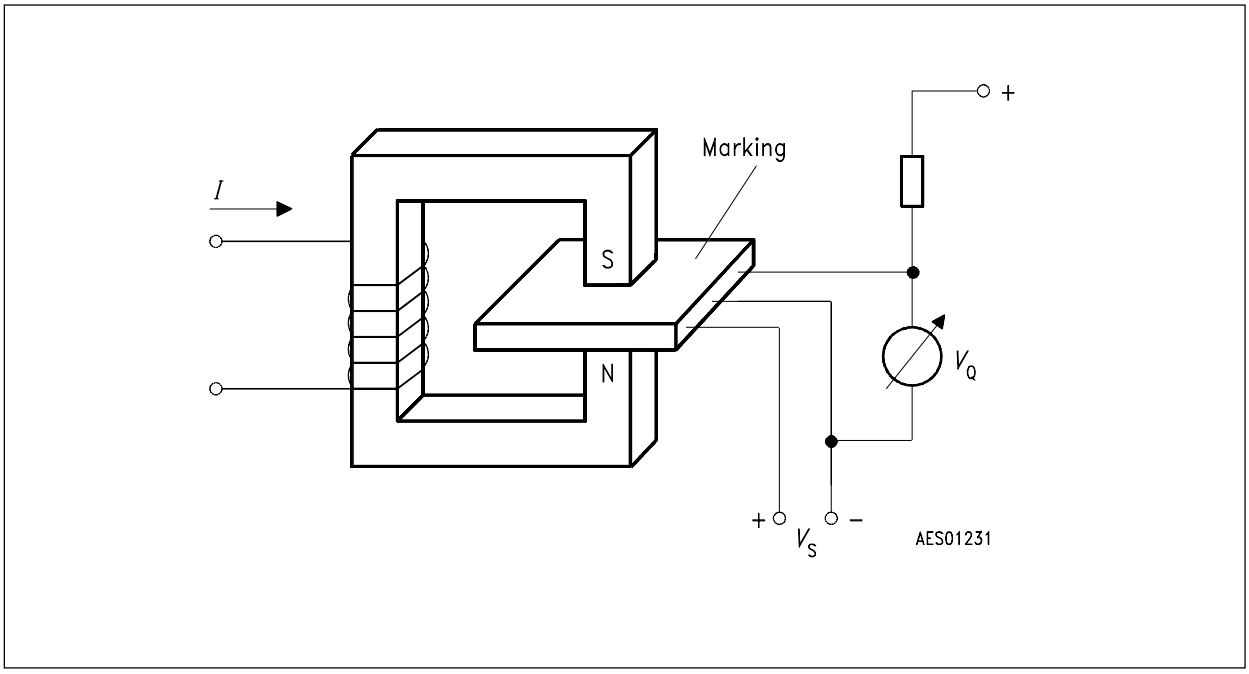


Figure 2
Sensor/Magnetic-Field Configuration

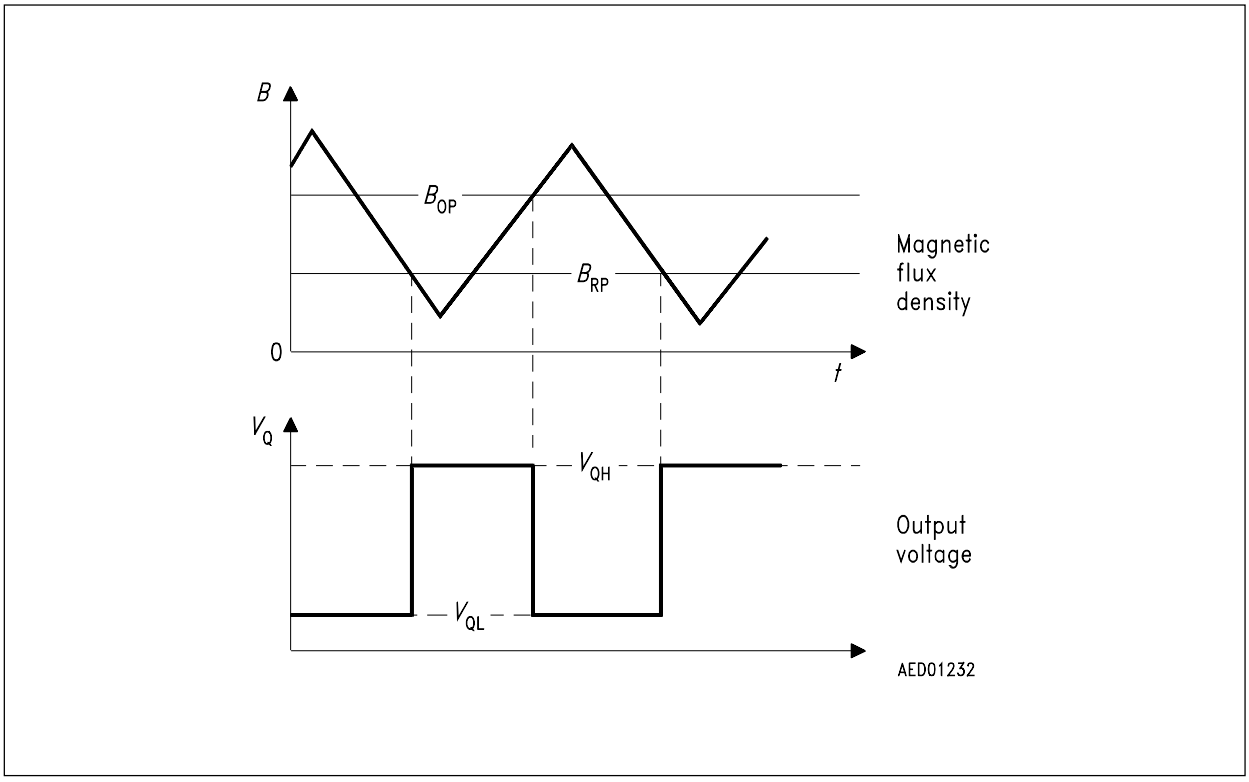


Figure 3
Switching Characteristics TLE 4904

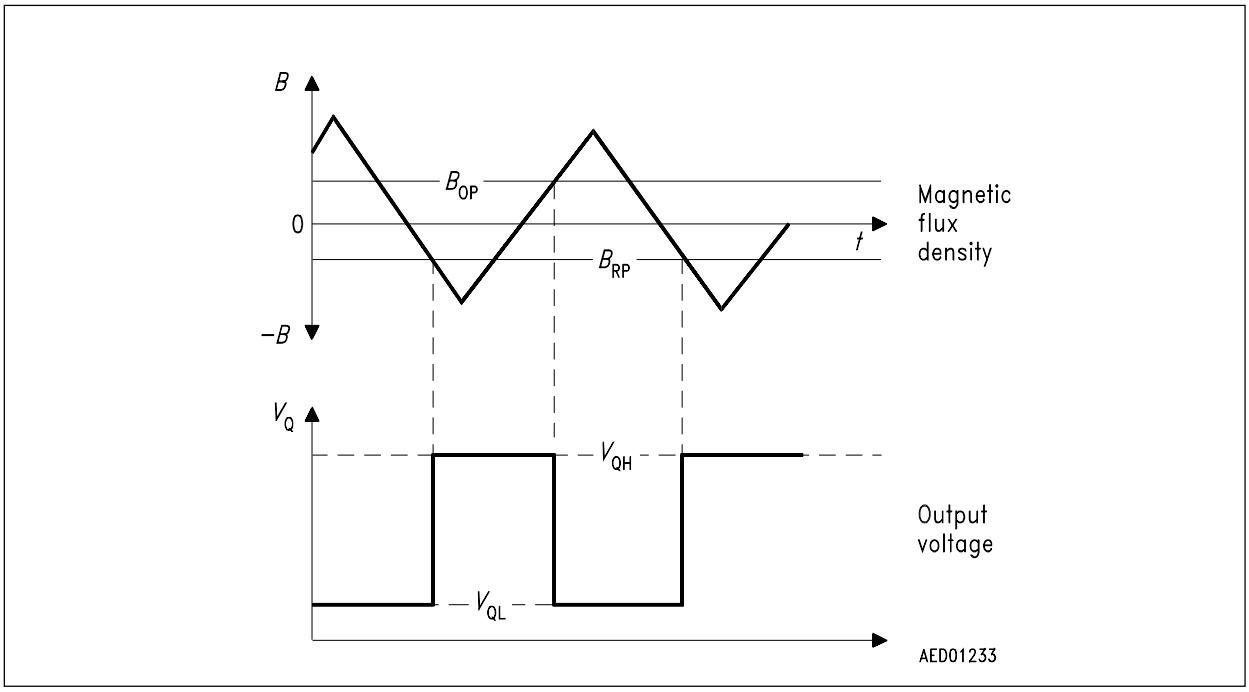


Figure 4
Switching Characteristics TLE 4934, TLE 4944

Absolute Maximum Ratings

T_A = – 40 to 125 ˚C

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_{DD}	– 40	28	V	–
Output voltage	V_Q	–	28	V	–
Output short circuit current	I_Q	–	150	mA	–
Output thermal protection	$T_{j\,OFF}$ $T_{j\,ON}$	170 135	200 165	°C °C	–
Junction temperature	T_j	– 40	150	°C	–
Junction temperature	T_j	–	170	°C	1000 h
Junction temperature	T_j	–	210	°C	40 h
Storage temperature	T_{stg}	– 40	150	°C	–
Thermal resistance	$R_{th\,JA}$	–	190	K/W	–
Current through input-protection device	I_{DDZ}	– 200	200	mA	t < 2 ms; v = 0.1
Current through output-protection device	I_{QZ}	– 200	200	mA	t < 2 ms; v = 0.1

Operating Range

Supply voltage	V_S	3.8	24	V	–
Junction temperature	T_j	– 40	150	°C	–
Junction temperature	T_j	– 40	170	°C	threshold may exceed the limits

AC/DC Characteristics

4.5 V ≤ V_{DD} ≤ 24 V; – 40 ˚C ≤ T_j ≤ 150 ˚C

Parameter	Symbol	Limit Values			Unit	Test Condition	Test Circuit
		min.	typ.	max.			
Supply current	I_S	–	1.5	3	mA	B < B_{RP}	1
	I_S	–	1.5	3	mA	B > B_{OP}	1
Output saturation voltage	V_{QSat}	–	0.25	0.6	V	I_Q = 40 mA	2
Output leakage current	I_{QL}	–	–	10	µA	V_Q = 24 V	2
Overvoltage protection							
–at supply voltage	V_{SZ}	28	31	–	V	I_S = 10 mA, 25 °C	2
–at output	V_{QZ}	28	31	–	V	I_Q = 10 mA, 25 °C	2
Delay time	t_{dHL} / t_{dLH}	–	50	75	µs	–	1

Magnetic Characteristics

3.8 V ≤ V_{DD} ≤ 24 V

Parameter	Symbol	Limit Values									Unit
		-40 ˚C			25 ˚C			150 ˚C			
		min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	
TLE 4904 T_C = – 0.04 %/˚C											
	B_{OP}	9.2	10.8	12.3	9	10.5	12	8.5	10	11.4	mT
	B_{RP}	5.1	6.2	7.2	5	6	7	4.7	5.7	6.7	mT
	B_{Hy}	4.1	4.6	5.1	4	4.5	5	3.8	4.3	4.8	mT
TLE 4934 T_C = – 0.2 %/˚C											
	B_{OP}	11.9	11.9	13.6	9	10.5	12	6.7	7.9	9	mT
	B_{RP}	-13.6	-11.9	-10.2	-12	-10.5	-9	-9	-7.9	-6.7	mT
	B_{Hy}	21.4	23.8	26.2	19	21	23	14.2	15.8	17.4	mT
TLE 4944 T_C = – 0.2 %/˚C											
	B_{OP}	3.9	5.1	6.2	3.5	4.5	5.5	2.6	3.4	4.1	mT
	B_{RP}	-6.2	-5.1	-3.9	-5.5	-4.5	-3.5	-4.1	-3.4	-2.6	mT
	B_{Hy}	9.2	10.2	11.2	8	9	10	6.1	6.8	7.5	mT

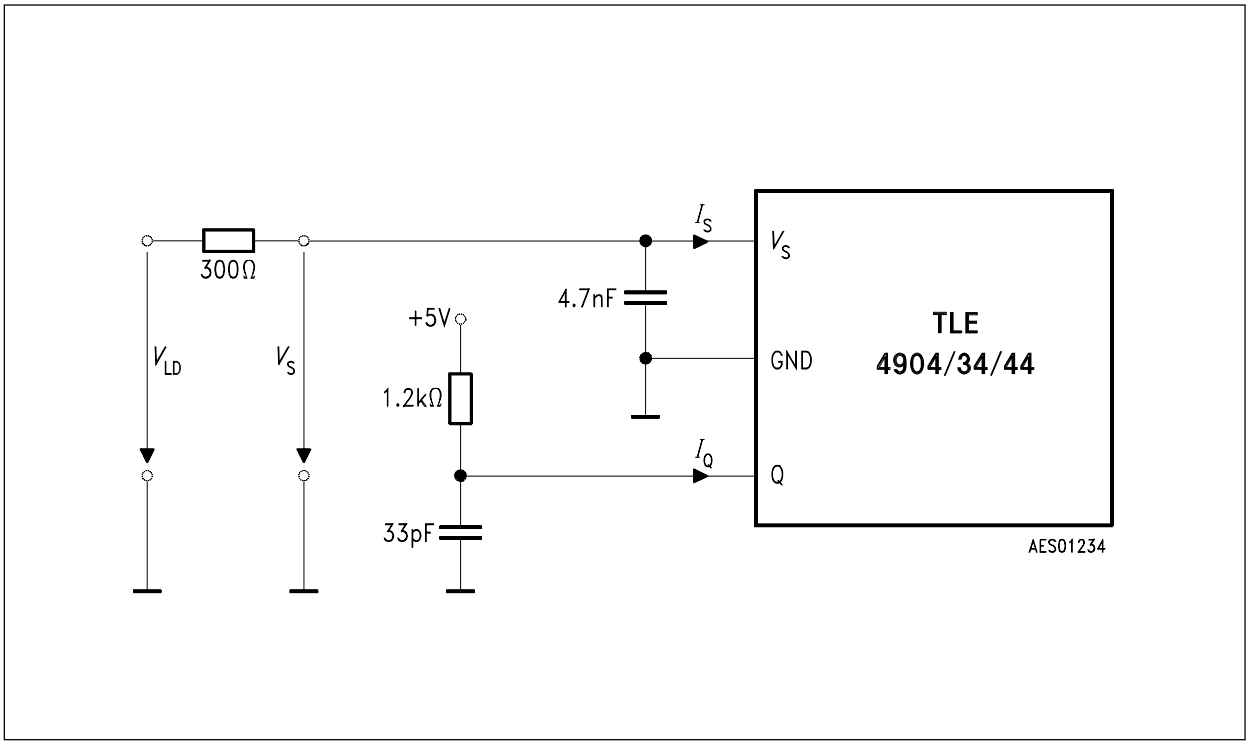


Figure 5
Test Circuit 1

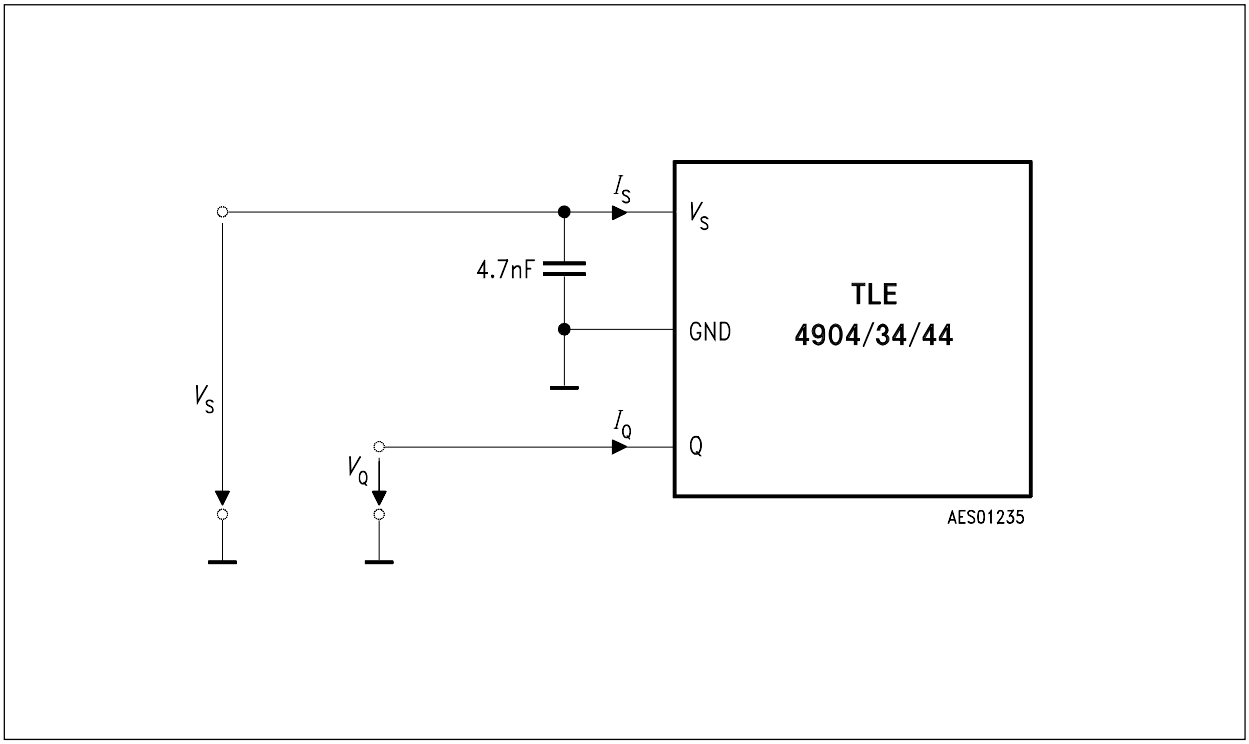


Figure 6
Test Circuit 2

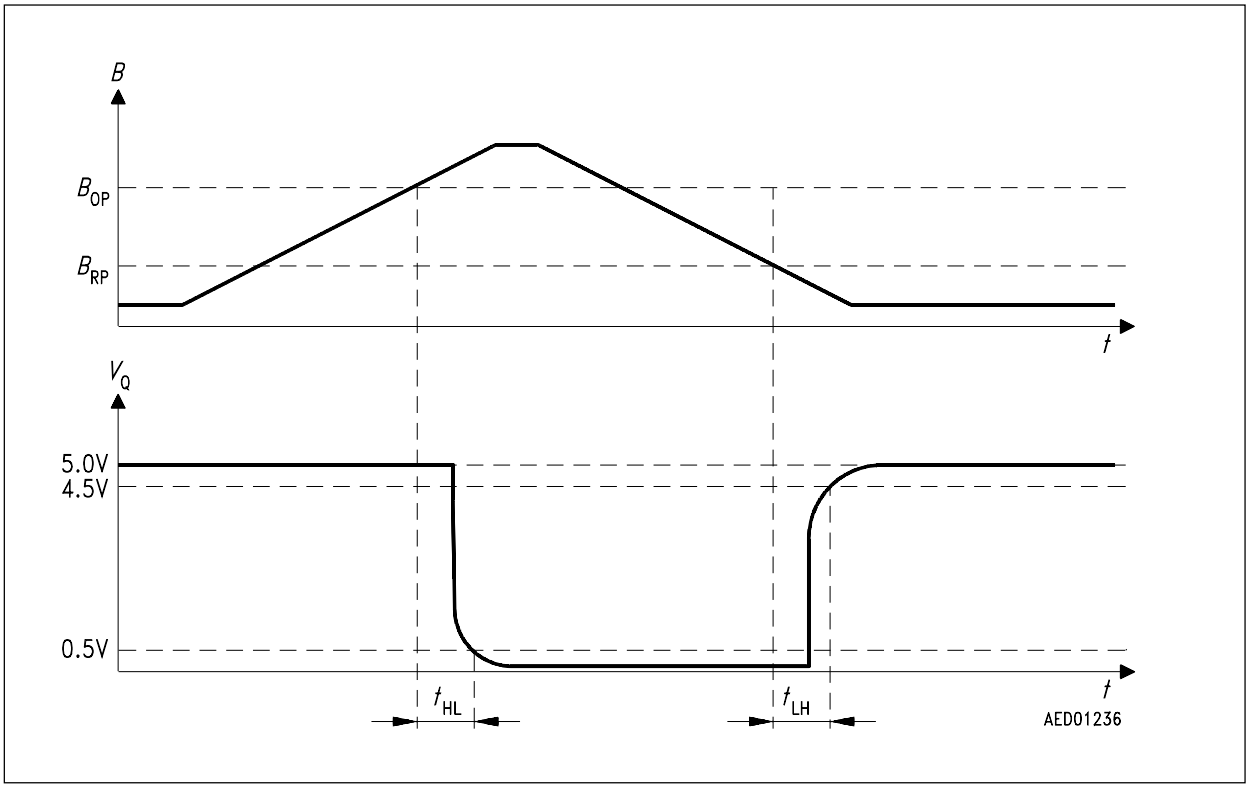


Figure 7
Diagram

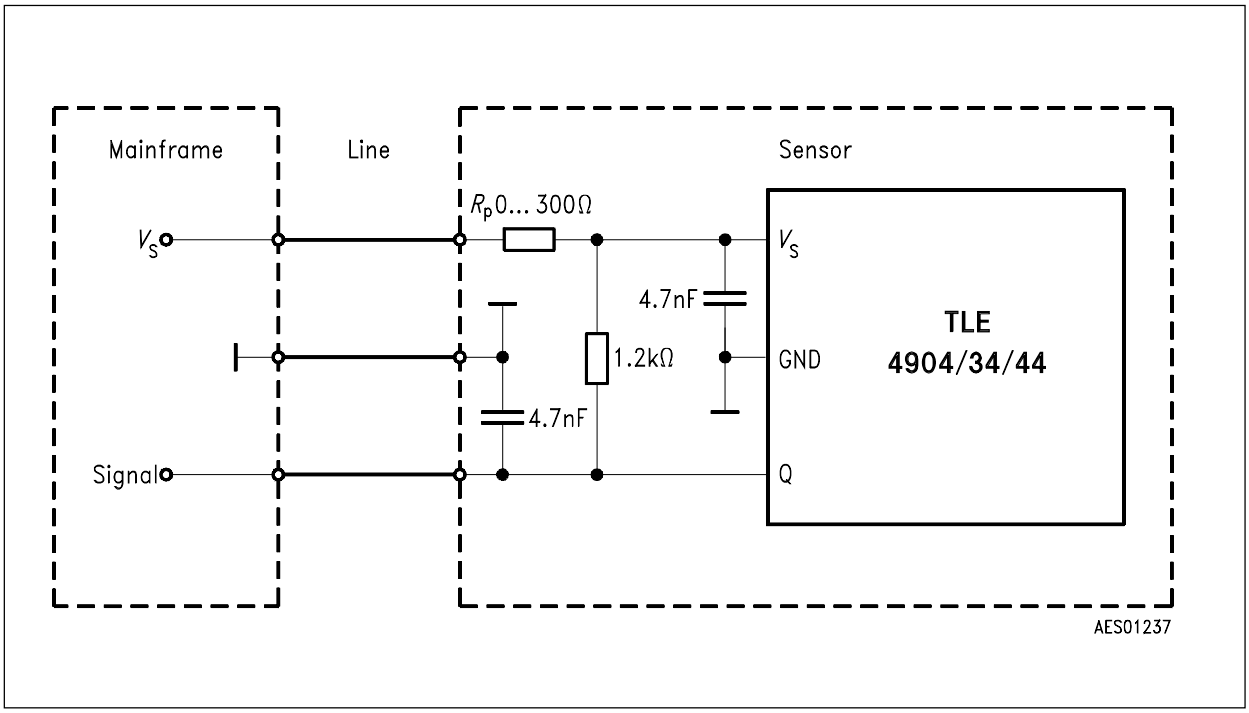


Figure 8
Application Circuit