

SIEMENS

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

TLE 4904; TLE 4934;
TLE 4944

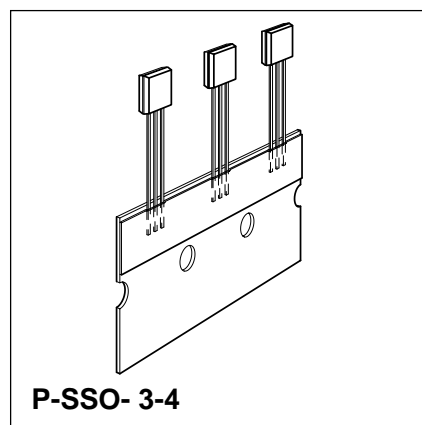
Highly Accurate, Protected Hall-Effect IC

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 performance



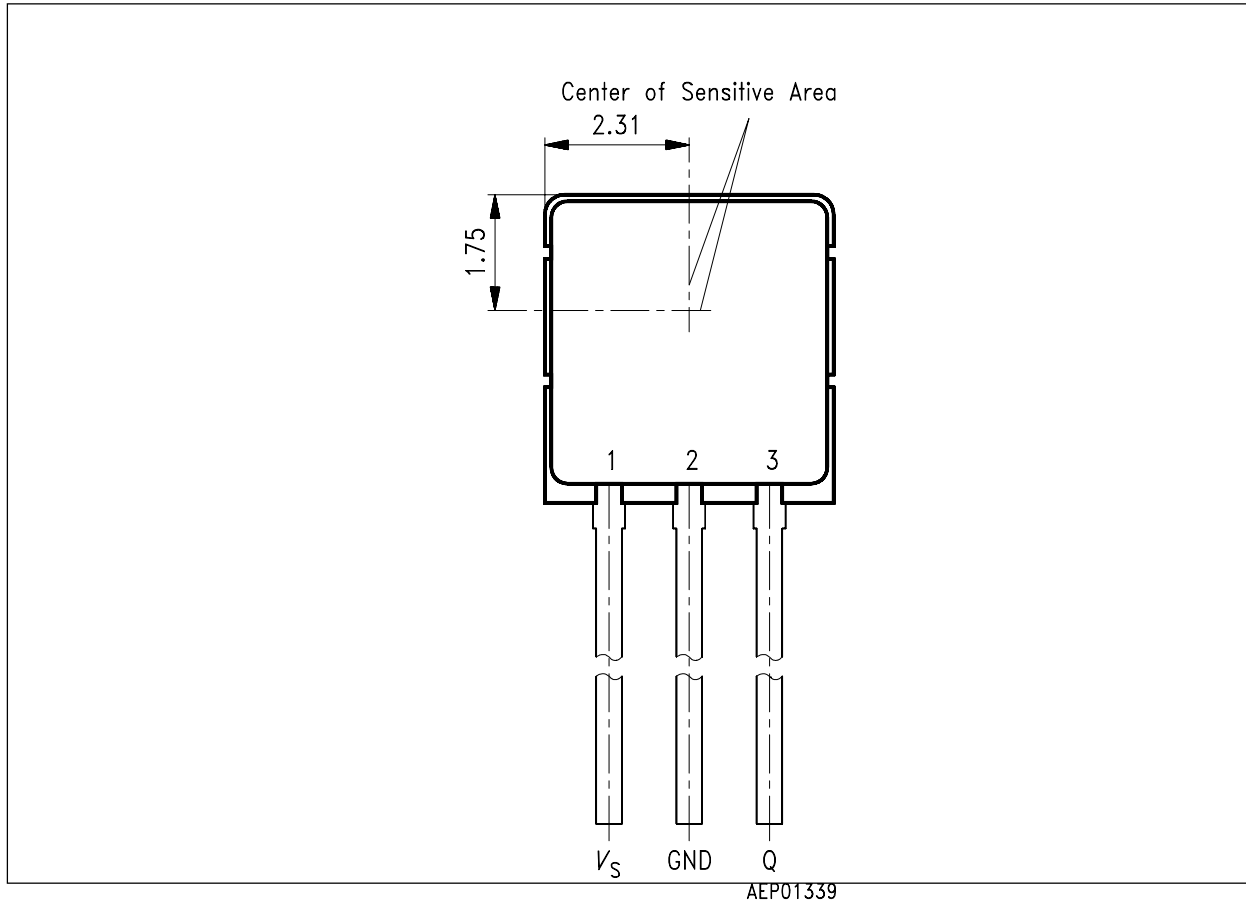
| Type | Ordering Code | Package |
|------------|---------------|-----------|
| ▼ TLE 4904 | Q67006-A9011 | P-SSO-3-4 |
| ▼ TLE 4934 | Q67006-A9027 | P-SSO-3-4 |
| ▼ TLE 4944 | Q67006-A9028 | P-SSO-3-4 |

▼ 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 comparator 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.

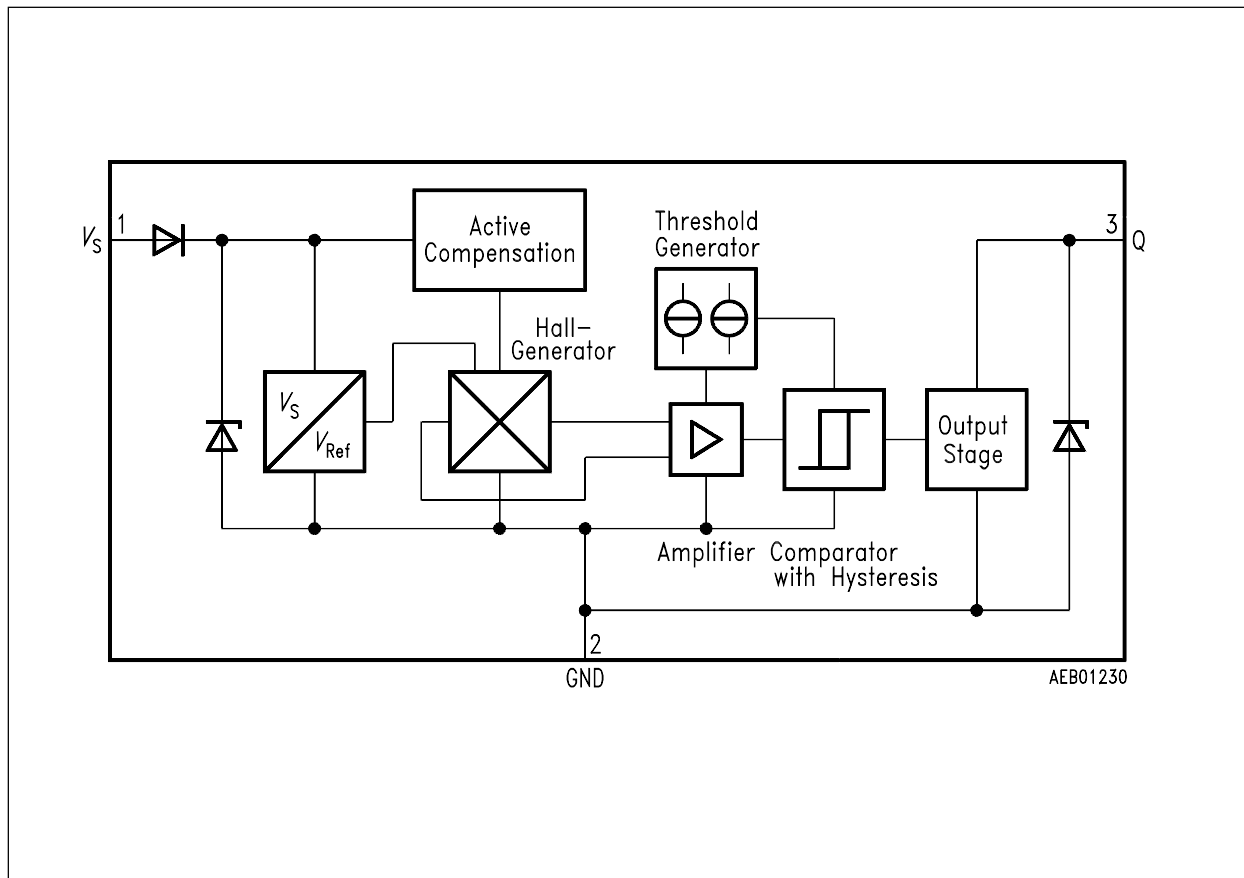


Figure 1
Block Diagram

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.

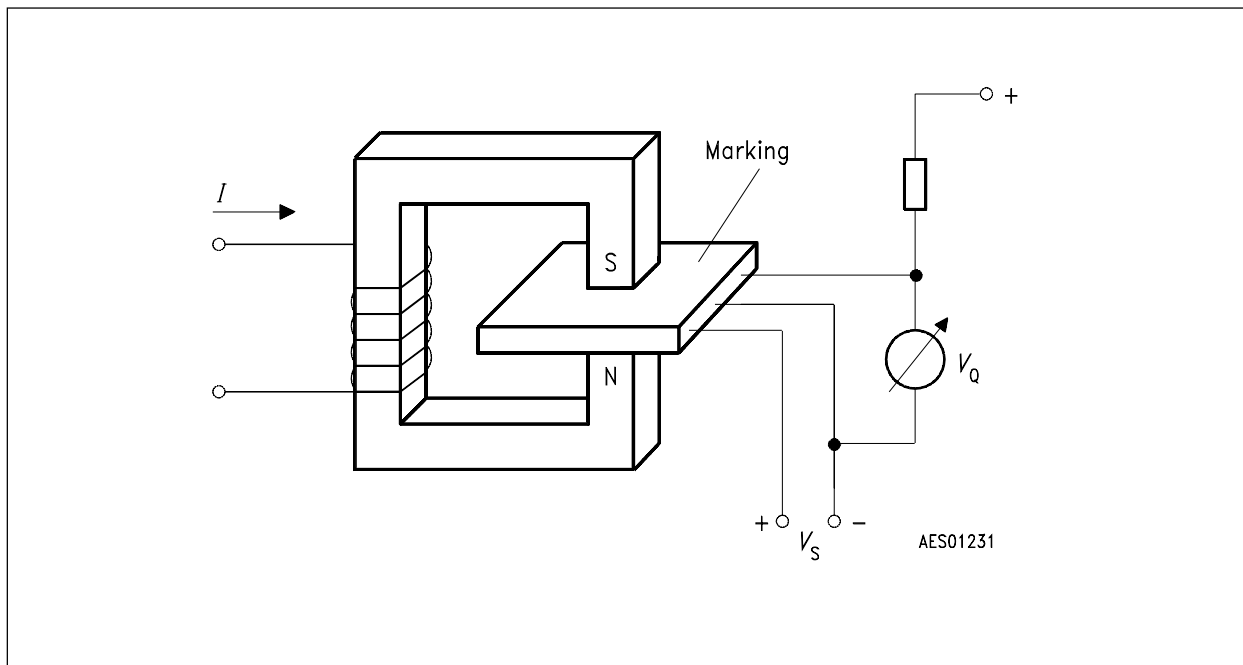


Figure 2
Sensor/Magnetic-Field Configuration

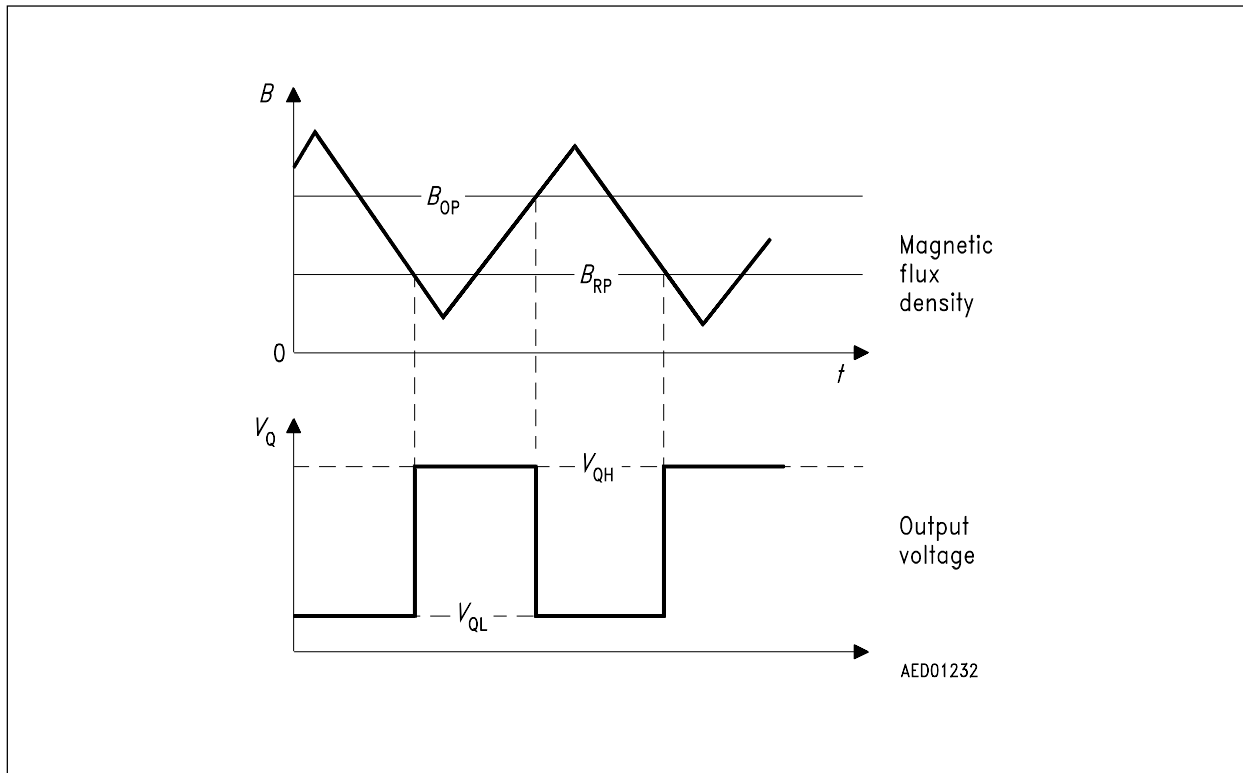


Figure 3
Switching Characteristics TLE 4904

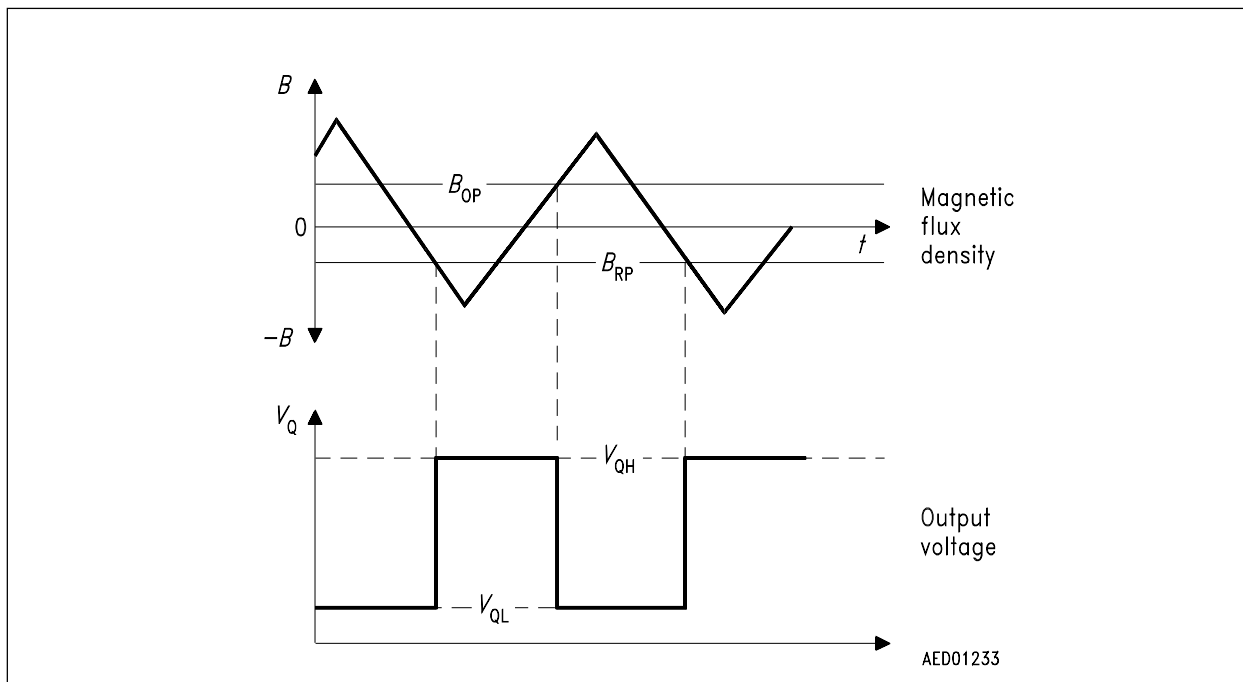


Figure 4
Switching Characteristics TLE 4934, TLE 4944

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_{jOFF} | 170 | 200 | °C | - |
| | T_{jON} | 135 | 165 | °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

$4.5 \text{ V} \leq V_{\text{DD}} \leq 24 \text{ V}$; $-40 \text{ }^\circ\text{C} \leq T_{\text{j}} \leq 150 \text{ }^\circ\text{C}$

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

Magnetic Characteristics

$3.8 \text{ V} \leq V_{\text{DD}} \leq 24 \text{ V}$

| Parameter | Symbol | Limit Values | | | | | | | | | Unit |
|--|-----------------|--------------|-------|-------|-------|-------|------|--------|------|------|------|
| | | -40 °C | | | 25 °C | | | 150 °C | | | |
| | | min. | typ. | max. | min. | typ. | max. | min. | typ. | max. | |
| TLE 4904 $T_{\text{C}} = -0.04 \text{ }^\circ\text{C}$ | 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 $T_{\text{C}} = -0.2 \text{ }^\circ\text{C}$ | 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 $T_{\text{C}} = -0.2 \text{ }^\circ\text{C}$ | 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 |

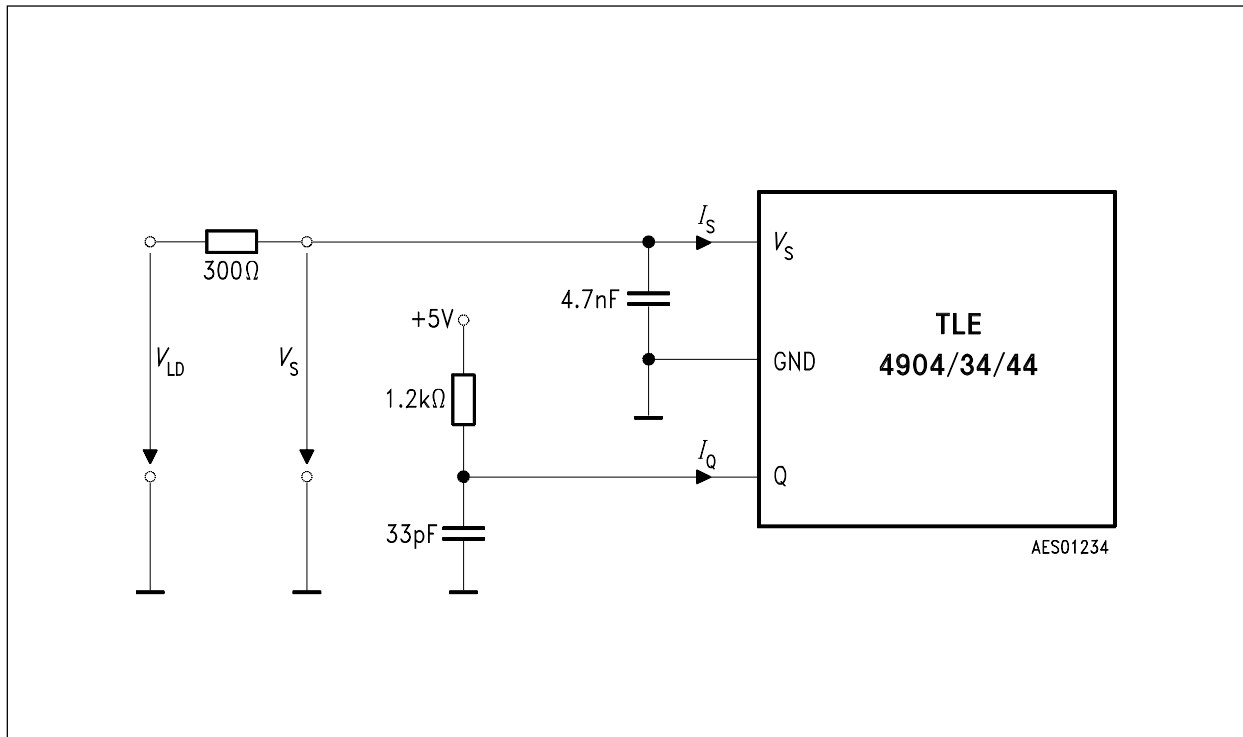


Figure 5
Test Circuit 1

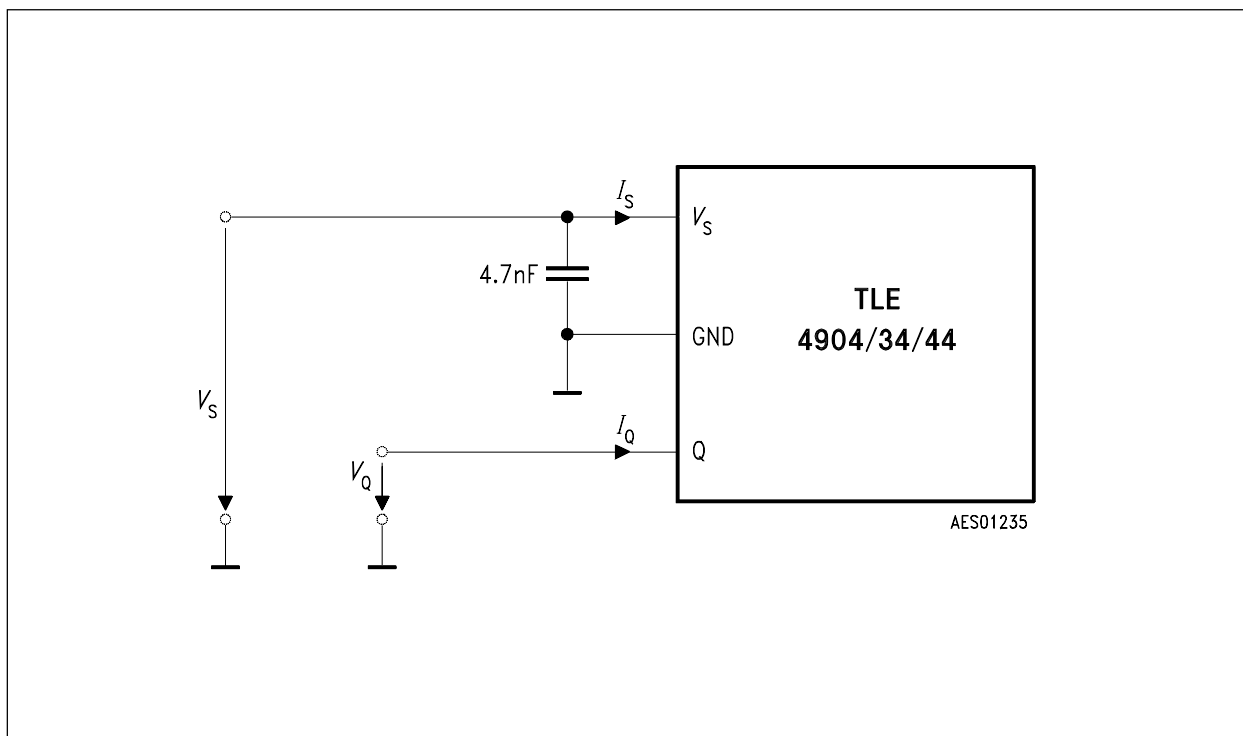


Figure 6
Test Circuit 2

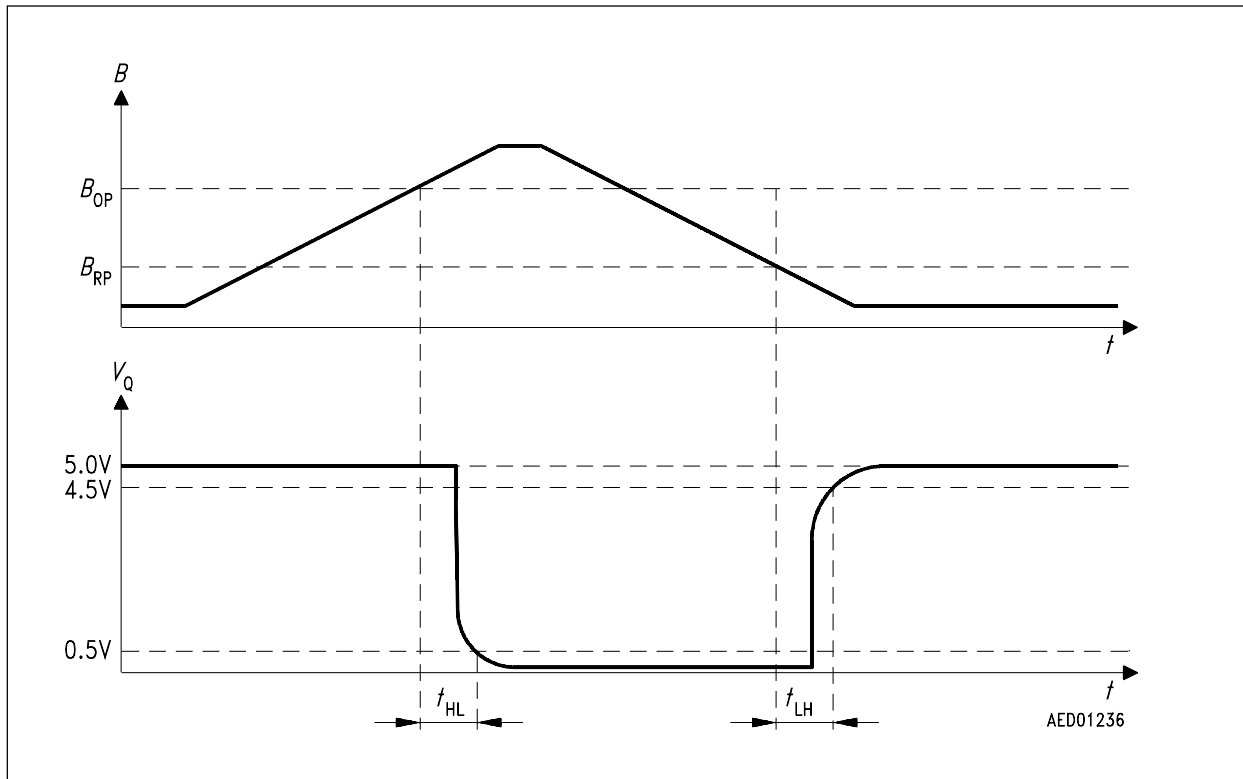


Figure 7
Diagram

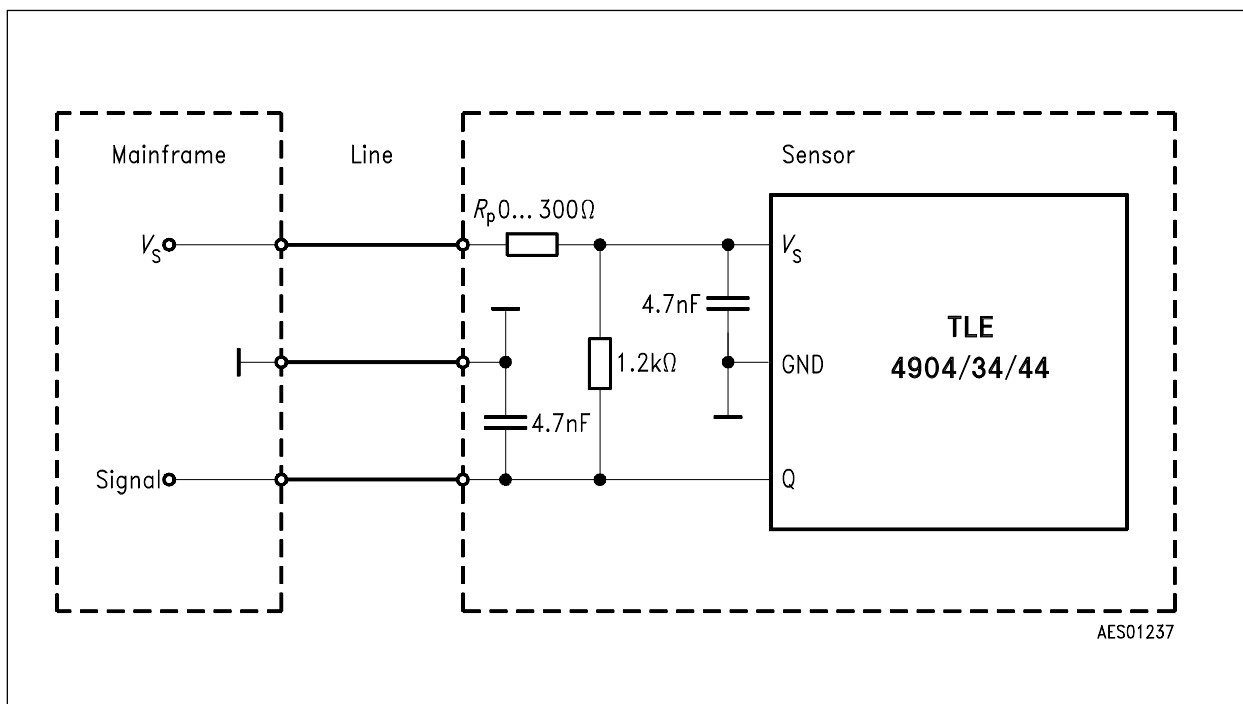


Figure 8
Application Circuit