

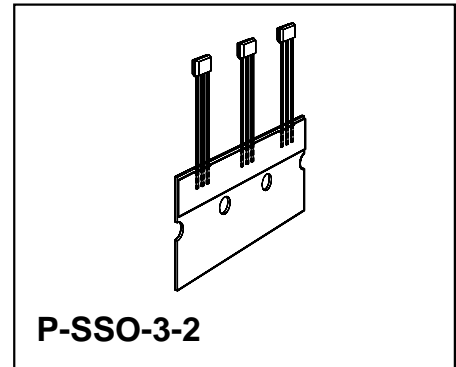
## Uni- and Bipolar Hall IC Switches for Magnetic Field Applications

TLE 4905 L; TLE 4935 L;  
TLE 4935-2 L; TLE 4945 L;  
TLE 4945-2L

### Bipolar IC

#### Features

- Temperature compensated magnetic performance
- Digital output signal
- For unipolar and alternating magnetic fields
- Large temperature range
- Protection against reversed polarity
- Output protection against electrical disturbances



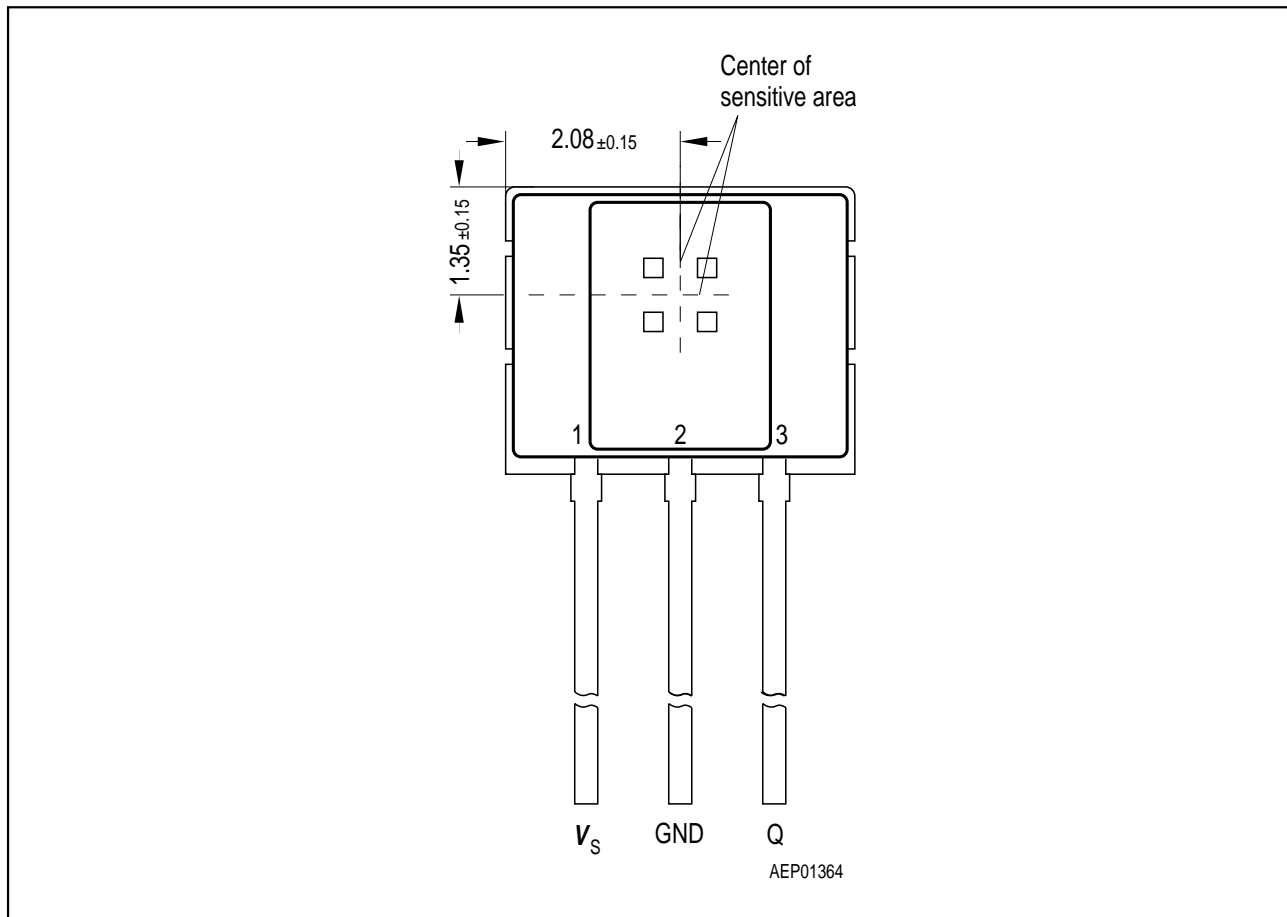
| Type         | Ordering Code | Package   |
|--------------|---------------|-----------|
| TLE 4905 L   | Q67006-A9120  | P-SSO-3-2 |
| TLE 4935 L   | Q67006-A9112  | P-SSO-3-2 |
| TLE 4935-2 L | Q67006-A9143  | P-SSO-3-2 |
| TLE 4945 L   | Q67006-A9163  | P-SSO-3-2 |
| TLE 4945-2L  | on request    | P-SSO-3-2 |

TLE 4905/35/35-2/45 L (Unipolar/Bipolar Magnetic Field Switches) have been designed specifically for automotive and industrial applications. Reverse polarity protection is included on-chip as is output protection against negative voltage transients.

Typical applications are position/proximity indicators, brushless DC motor commutation, rotational indexing etc.

## Pin Configuration

(view on branded side of component)



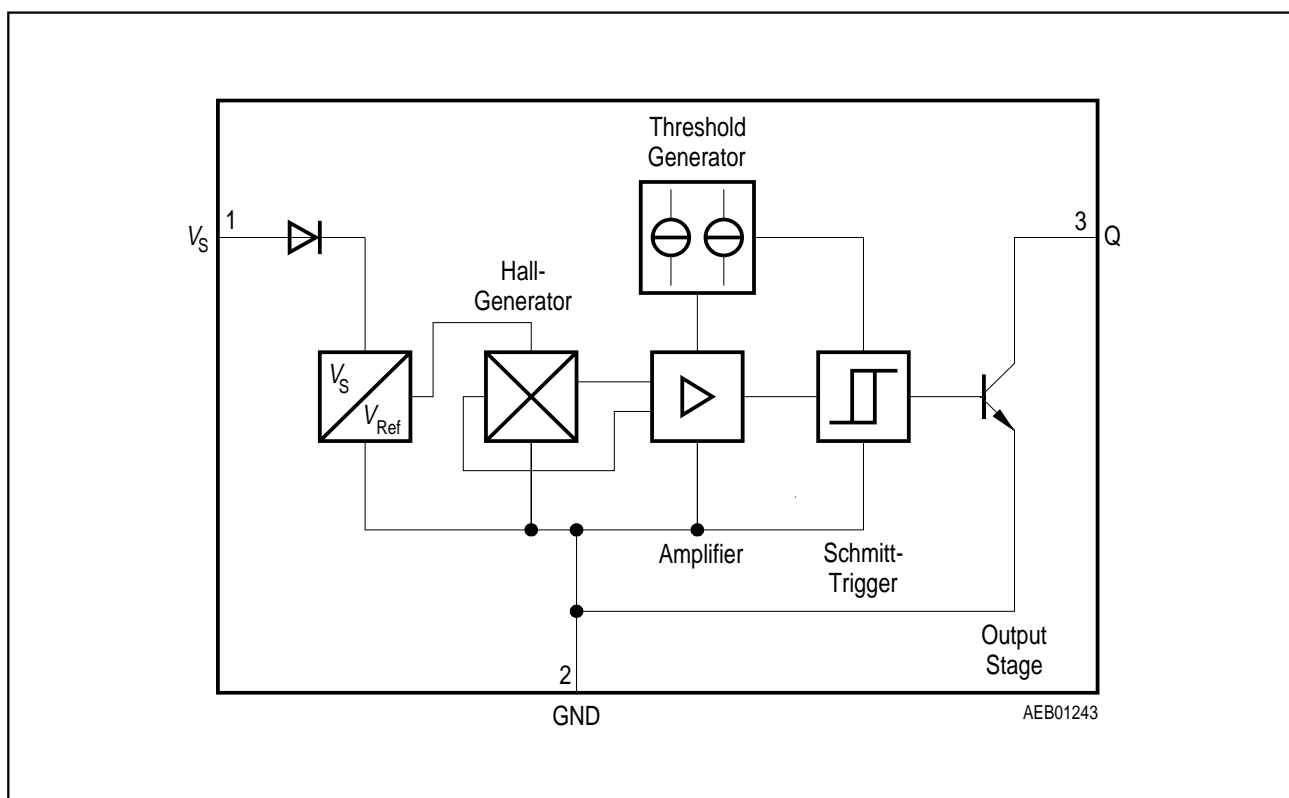
**Figure 1**

## Pin Definitions and Functions

| Pin No. | Symbol | Function       |
|---------|--------|----------------|
| 1       | $V_S$  | Supply voltage |
| 2       | GND    | Ground         |
| 3       | Q      | Output         |

## Circuit Description

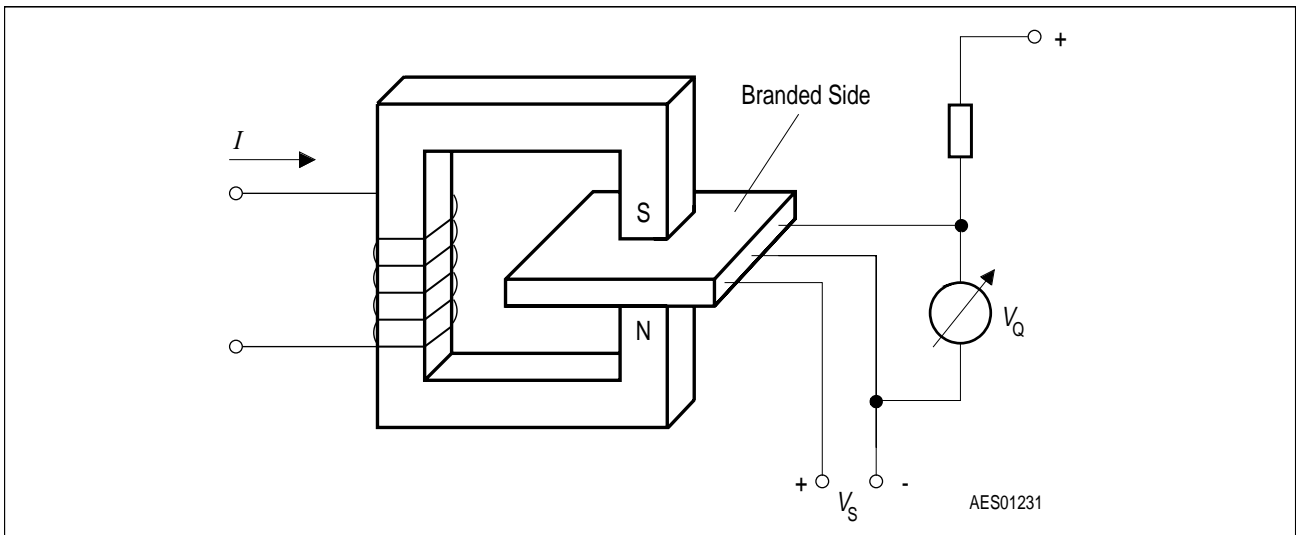
The circuit includes Hall generator, amplifier and Schmitt-Trigger on one chip. The internal reference provides the supply voltage for the components. A magnetic field perpendicular to the chip surface induces a voltage at the hall probe. This voltage is amplified and switches a Schmitt-trigger with open-collector output. A protection diode against reverse power supply is integrated. The output is protected against electrical disturbances.



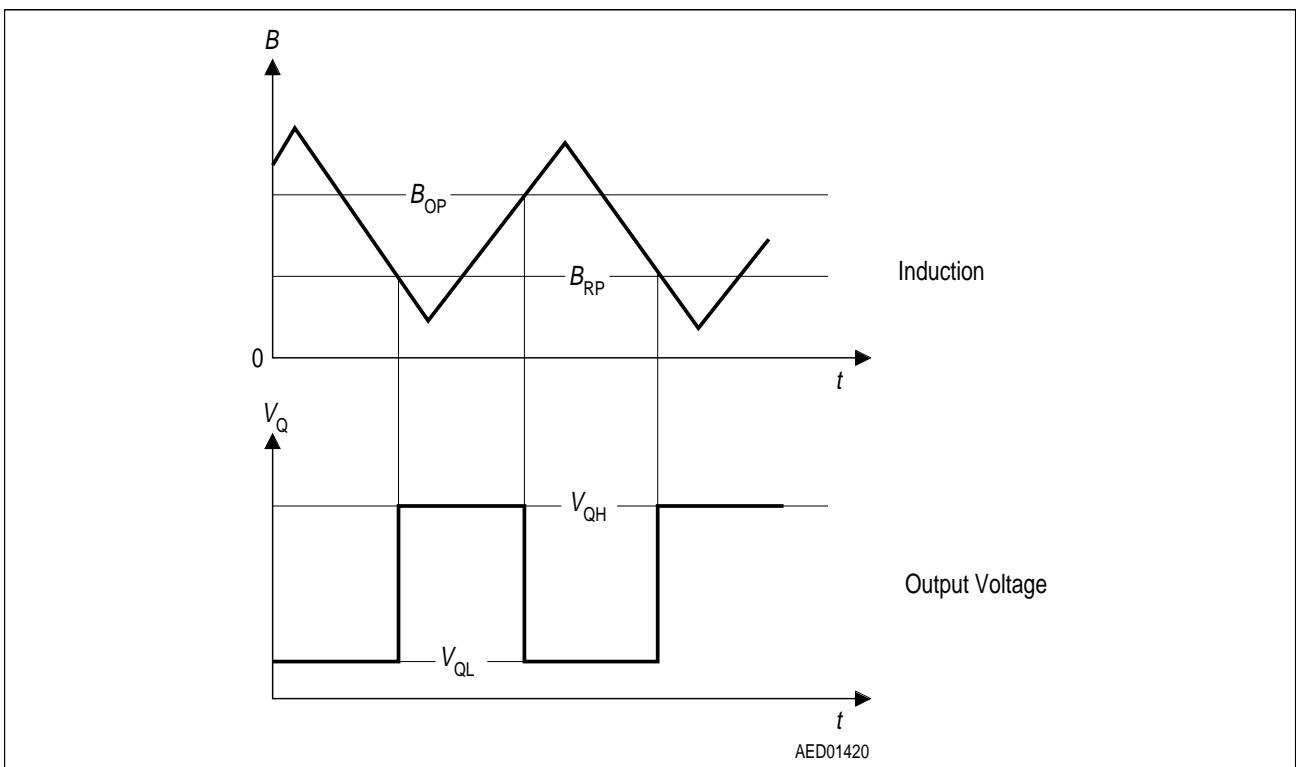
**Figure 2**  
**Block Diagram**

**Functional Description Unipolar Type TLE 4905 (figure 3 and 4)**

When a positive magnetic field is applied in the indicated direction (**figure 3**) 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, the output of the IC turns off (Release Point; **figure 4**).



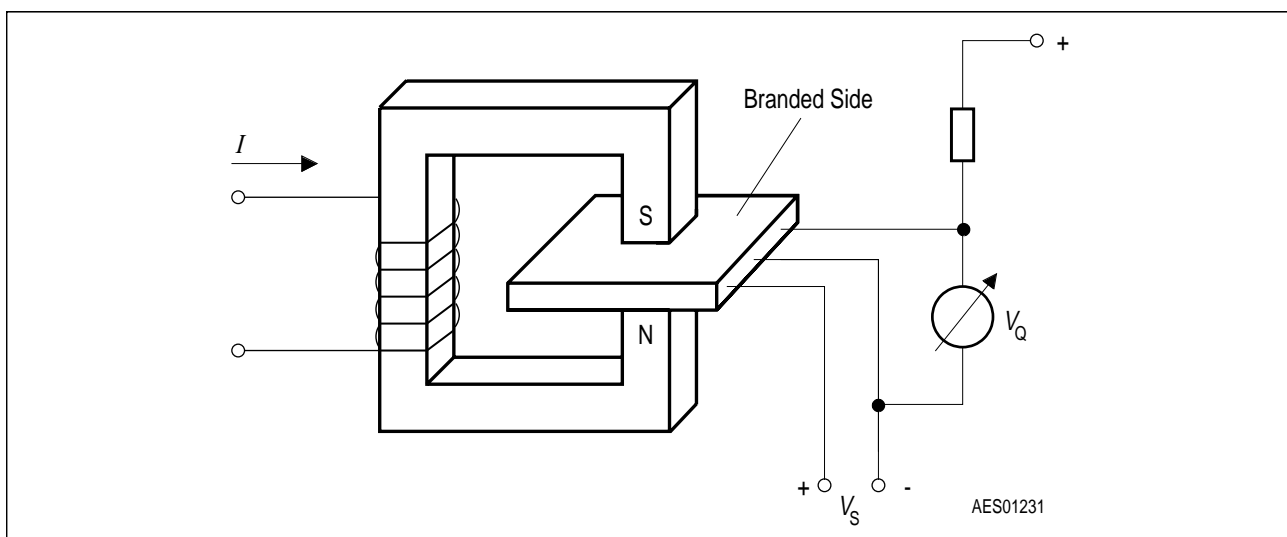
**Figure 3  
Sensor/Magnetic-Field Configuration**



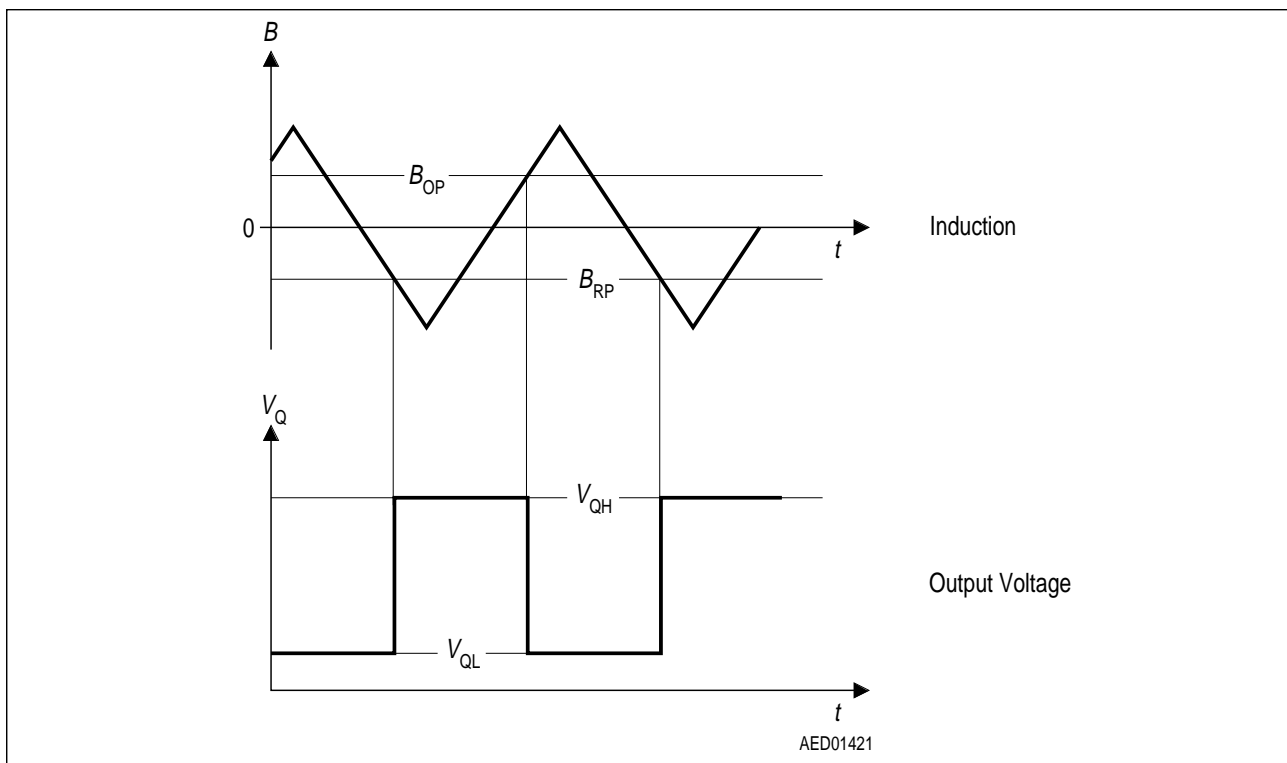
**Figure 4  
Switching Characteristics Unipolar Type**

**Functional Description Bipolar Type TLE 4935/35-2/45 (figure 5 and 6)**

When a positive magnetic field is applied in the indicated direction (**figure 5**) and the turn-on magnetic induction  $B_{OP}$  is exceeded, the output of the Hall-effect IC will conduct (Operate Point). When a reverse magnetic field is generated, the output of the IC turns off (Release Point; **figure 6**).



**Figure 5**  
**Sensor/Magnetic-Field Configuration**



**Figure 6**  
**Switching Characteristics Bipolar Type**

## Absolute Maximum Ratings

$T_j = -40$  to  $150$  °C

| Parameter              | Symbol      | Limit Values |      | Unit | Remarks                 |
|------------------------|-------------|--------------|------|------|-------------------------|
|                        |             | min.         | max. |      |                         |
| Supply voltage         | $V_S$       | -40          | 32   | V    | –                       |
| Supply voltage         | $V_S$       | –            | 40   | V    | $t < 400$ ms; $v = 0.1$ |
| Output voltage         | $V_Q$       | –            | 32   | V    | –                       |
| Output current         | $I_Q$       | –            | 100  | mA   | –                       |
| Output reverse current | $-I_Q$      | –            | 100  | mA   | –                       |
| 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    | $T_{stg}$   | -50          | 150  | °C   | –                       |
| Thermal resistance     | $R_{th JA}$ | –            | 190  | K/W  | –                       |

*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.*

## Operating Range

| Parameter            | Symbol | Limit Values |      | Unit | Remarks                          |
|----------------------|--------|--------------|------|------|----------------------------------|
|                      |        | min.         | max. |      |                                  |
| Supply voltage       | $V_S$  | 3.8          | 24   | V    | –                                |
| Junction temperature | $T_j$  | -40          | 150  | °C   | –                                |
| Junction temperature | $T_j$  | -40          | 170  | °C   | thresholds may exceed the limits |

*Note: In the operating range the functions given in the circuit description are fulfilled.*

## AC/DC Characteristics

$3.8 \text{ V} \leq V_S \leq 24 \text{ V}; -40 \text{ }^\circ\text{C} \leq T_j \leq 150 \text{ }^\circ\text{C}$

| Parameter                 | Symbol             | Limit Values |      |      | Unit          | Test Condition  | Test Circuit |
|---------------------------|--------------------|--------------|------|------|---------------|---|--------------|
|                           |                    | min.         | typ. | max. |               |   |              |
| Supply current            | $I_{\text{SHigh}}$ | –            | 3    | 7    | mA            | $B < B_{\text{RP}}$                                     | 1            |
|                           | $I_{\text{SLow}}$  | –            | 4    | 8    | mA            | $B > B_{\text{OP}}$                                     | 1            |
| Output saturation voltage | $V_{\text{QSat}}$  | –            | 0.25 | 0.5  | V             | $I_{\text{Q}} = 40 \text{ mA}$                          | 1            |
| Output leakage current    | $I_{\text{QL}}$    | –            | –    | 10   | $\mu\text{A}$ | $V_{\text{Q}} = 24 \text{ V}$                           | 1            |
| Rise/fall time            | $t_r / t_f$        | –            | –    | 1    | $\mu\text{s}$ | $R_L = 1.2 \text{ k}\Omega$<br>$C_L \leq 33 \text{ pF}$ | 1            |

*Note: The listed characteristics are ensured over the operating range of the integrated circuit. Typical characteristics specify mean values expected over the production spread. If not otherwise specified, typical characteristics apply at  $T_j = 25^\circ\text{C}$  and the given supply voltage.*

## Magnetic Characteristics

$3.8\text{ V} \leq V_S \leq 24\text{ V}$

| Parameter | Symbol | Limit Values      |      |                        |      |                          |      |                        |      |                          |      | Unit |
|-----------|--------|-------------------|------|------------------------|------|--------------------------|------|------------------------|------|--------------------------|------|------|
|           |        | TLE 4905 unipolar |      | TLE 4935 bipolar latch |      | TLE 4935-2 bipolar latch |      | TLE 4945 bipolar latch |      | TLE 4945-2 bipolar latch |      |      |
|           |        | min.              | max. | min.                   | max. | min.                     | max. | min.                   | max. | min.                     | max. |      |

### Junction Temperature $T_j = -40\text{ °C}$

|                                |                 |     |     |     |     |     |     |     |    |    |   |    |
|--------------------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|----|----|---|----|
| Turn-ON induction              | $B_{OP}$        | 7.5 | 19  | 10  | 20  | 15  | 27  | -6  | 10 | -3 | 6 | mT |
| Turn-OFF induction             | $B_{RP}$        | 5.5 | 17  | -20 | -10 | -27 | -15 | -10 | 6  | -6 | 3 | mT |
| Hysteresis ( $B_{OP}-B_{RP}$ ) | $\Delta B_{HY}$ | 2   | 6.5 | 20  | 40  | 30  | 54  | 2   | 10 | 1  | 5 | mT |

### Junction Temperature $T_j = 25\text{ °C}$

|                                |                 |   |    |     |     |     |     |     |    |    |   |    |
|--------------------------------|-----------------|---|----|-----|-----|-----|-----|-----|----|----|---|----|
| Turn-ON induction              | $B_{OP}$        | 7 | 18 | 10  | 18  | 14  | 26  | -6  | 10 | -3 | 6 | mT |
| Turn-OFF induction             | $B_{RP}$        | 5 | 16 | -18 | -10 | -26 | -14 | -10 | 6  | -6 | 3 | mT |
| Hysteresis ( $B_{OP}-B_{RP}$ ) | $\Delta B_{HY}$ | 2 | 6  | 20  | 36  | 28  | 52  | 2   | 10 | 1  | 5 | mT |

### Junction Temperature $T_j = 85\text{ °C}$

|                                |                 |     |      |     |    |     |     |     |    |    |   |    |
|--------------------------------|-----------------|-----|------|-----|----|-----|-----|-----|----|----|---|----|
| Turn-ON induction              | $B_{OP}$        | 6.5 | 17.5 | 9   | 18 | 13  | 26  | -6  | 10 | -3 | 6 | mT |
| Turn-OFF induction             | $B_{RP}$        | 4.5 | 15   | -18 | -9 | -26 | -13 | -10 | 6  | -6 | 3 | mT |
| Hysteresis ( $B_{OP}-B_{RP}$ ) | $\Delta B_{HY}$ | 2   | 5.5  | 18  | 36 | 26  | 52  | 2   | 10 | 1  | 5 | mT |



## Magnetic Characteristics (cont'd)

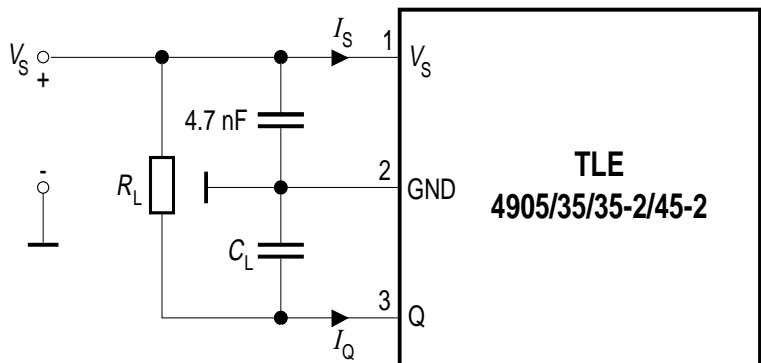
$$3.8 \text{ V} \leq V_S \leq 24 \text{ V}$$

| Parameter | Symbol | Limit Values      |      |                        |      |                          |      |                        |      |                          |      | Unit |
|-----------|--------|-------------------|------|------------------------|------|--------------------------|------|------------------------|------|--------------------------|------|------|
|           |        | TLE 4905 unipolar |      | TLE 4935 bipolar latch |      | TLE 4935-2 bipolar latch |      | TLE 4945 bipolar latch |      | TLE 4945-2 bipolar latch |      |      |
|           |        | min.              | max. | min.                   | max. | min.                     | max. | min.                   | max. | min.                     | max. |      |

## Junction Temperature $T_j = 150 \text{ }^\circ\text{C}$

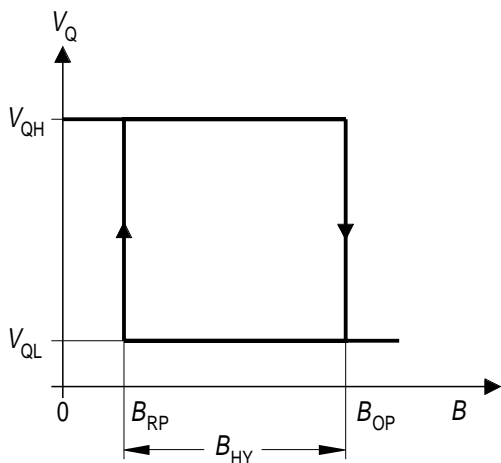
|                                |                 |   |    |     |    |     |     |     |    |    |   |    |
|--------------------------------|-----------------|---|----|-----|----|-----|-----|-----|----|----|---|----|
| Turn-ON induction              | $B_{OP}$        | 6 | 17 | 7   | 18 | 12  | 25  | -6  | 10 | -3 | 6 | mT |
| Turn-OFF induction             | $B_{RP}$        | 4 | 14 | -18 | -7 | -25 | -12 | -10 | 6  | -6 | 3 | mT |
| Hysteresis ( $B_{OP}-B_{RP}$ ) | $\Delta B_{HY}$ | 2 | 5  | 14  | 36 | 24  | 50  | 2   | 10 | 1  | 5 | mT |

*Note: The listed characteristics are ensured over the operating range of the integrated circuit. Typical characteristics specify mean values expected over the production spread. If not otherwise specified, typical characteristics apply at  $T_j = 25^\circ\text{C}$  and the given supply voltage.*

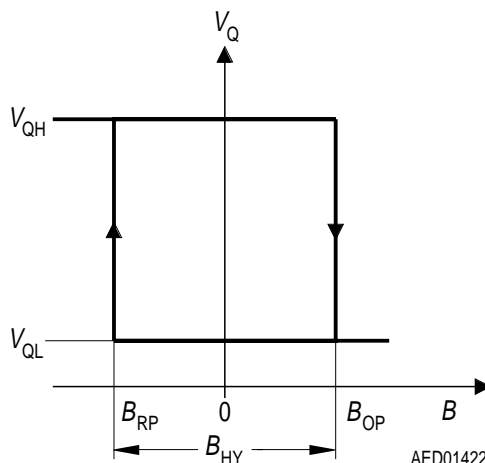


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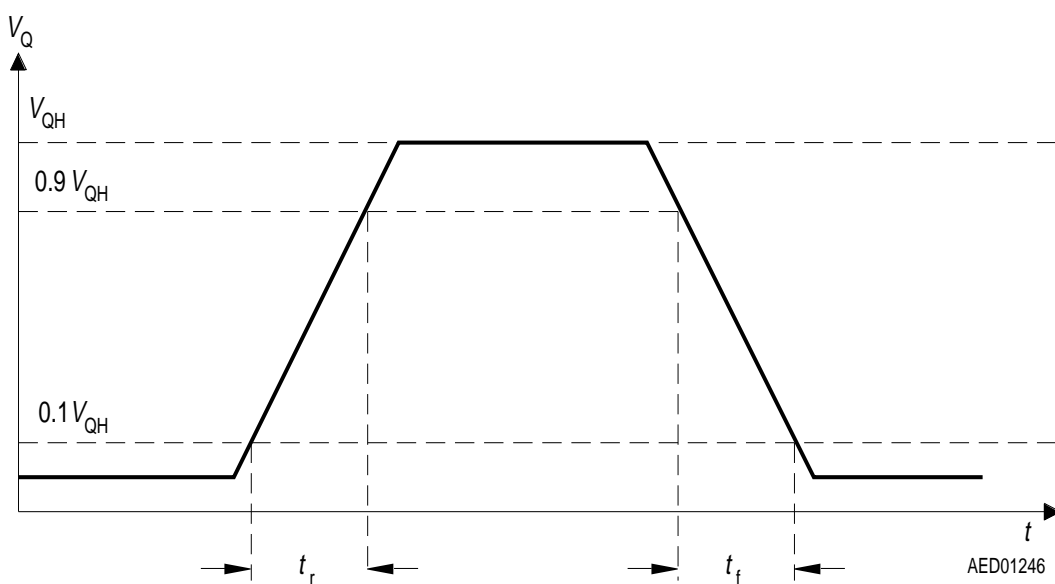
**Unipolar Type TLE 4905**



**Bipolar Type TLE 4935**

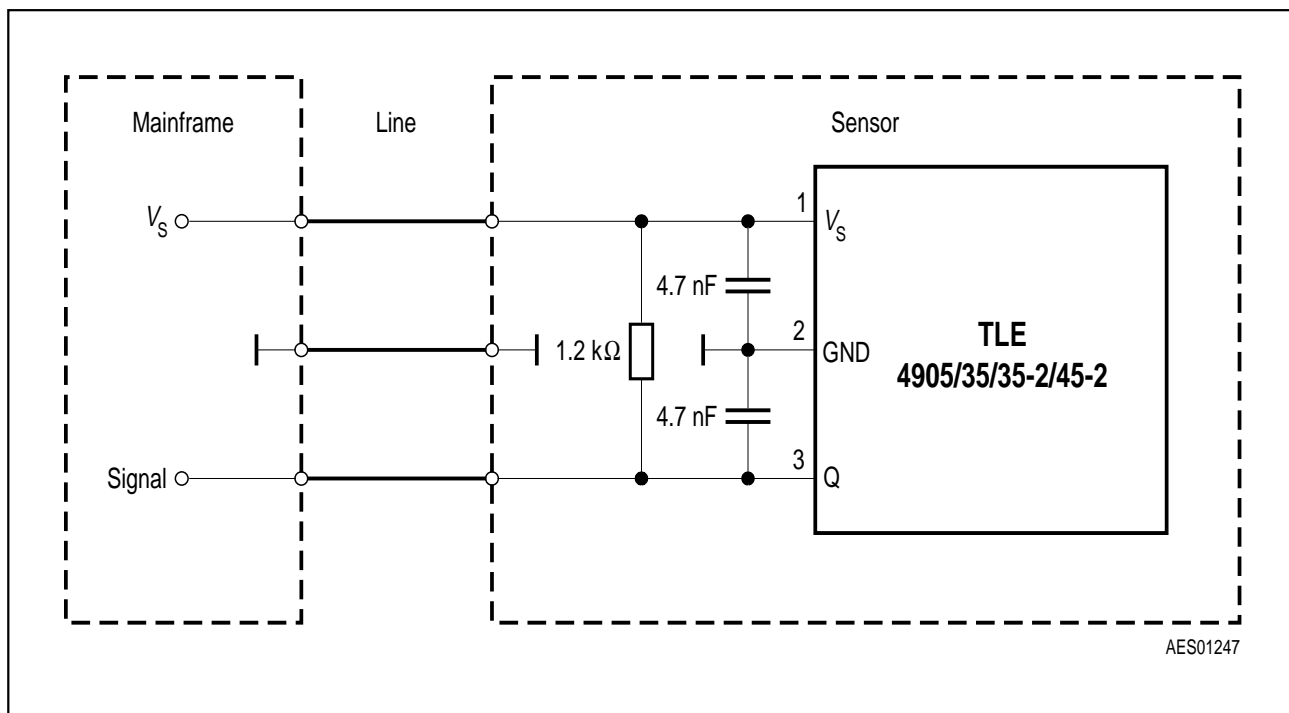


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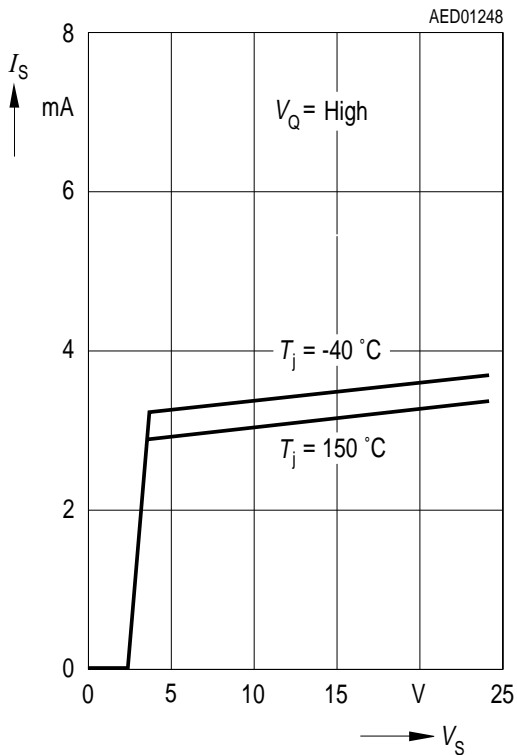
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**Figure 7  
Test Circuit 1**

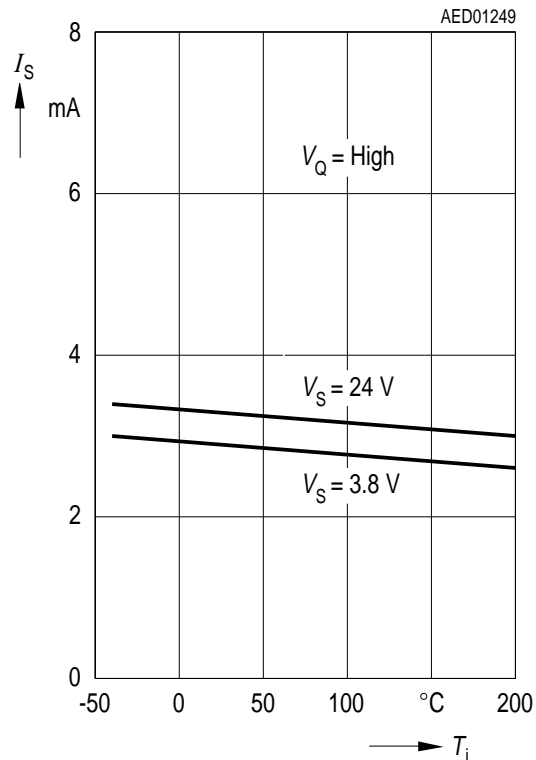


**Figure 8**  
**Application Circuit**

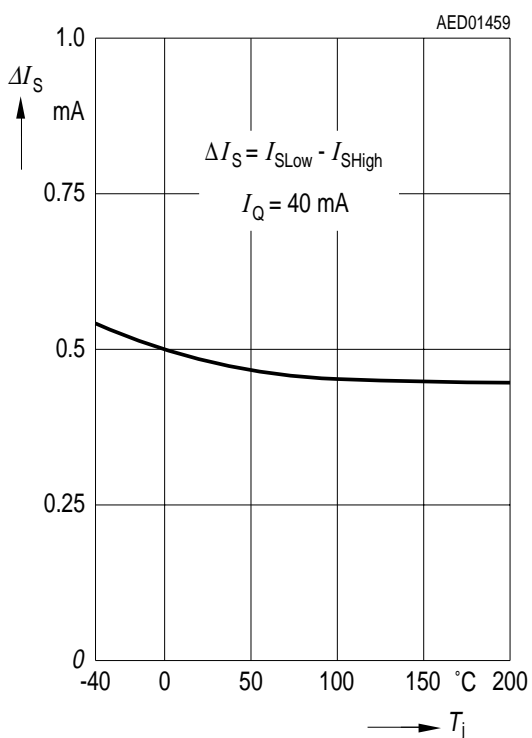
**Quiescent Current versus Supply Voltage**



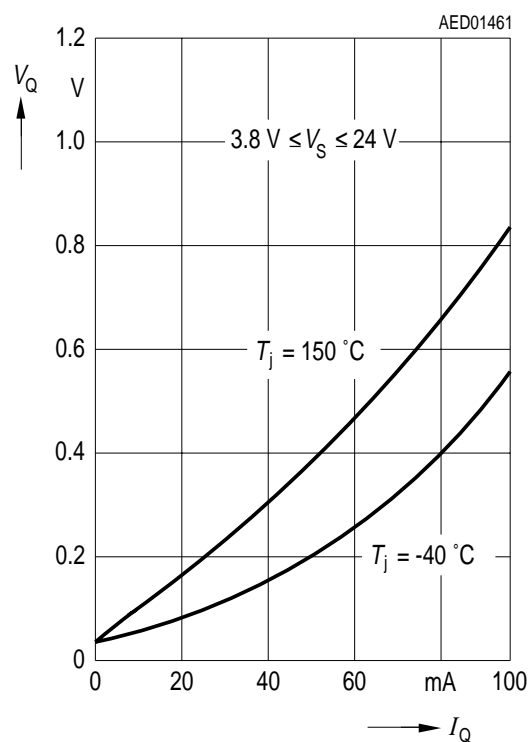
**Quiescent Current versus Junction Temperature**



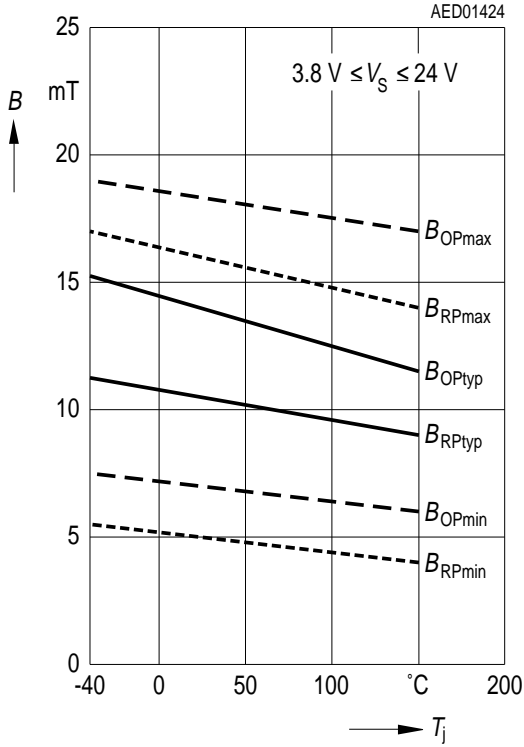
**Quiescent Current Difference versus Temperature**



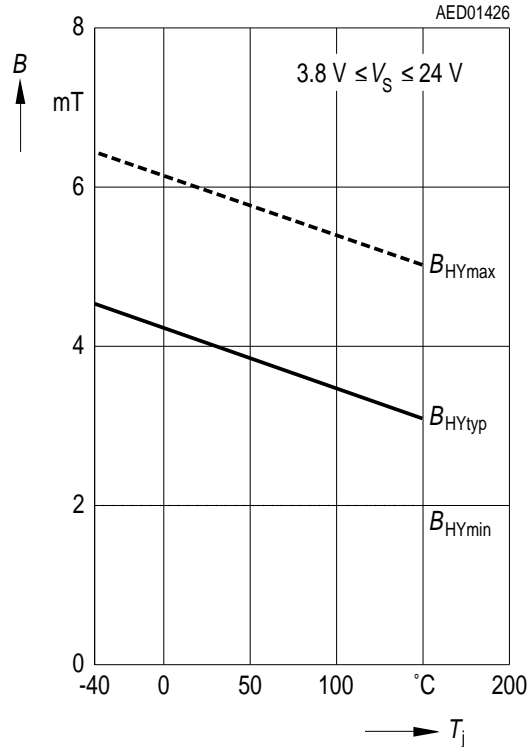
**Saturation Voltage versus Output Current**



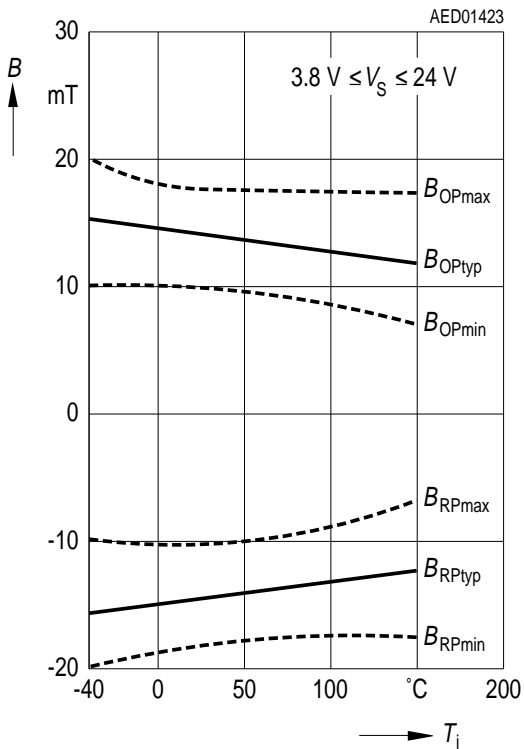
### TLE 4905 Operate-and Release-Point versus Junction Temperature



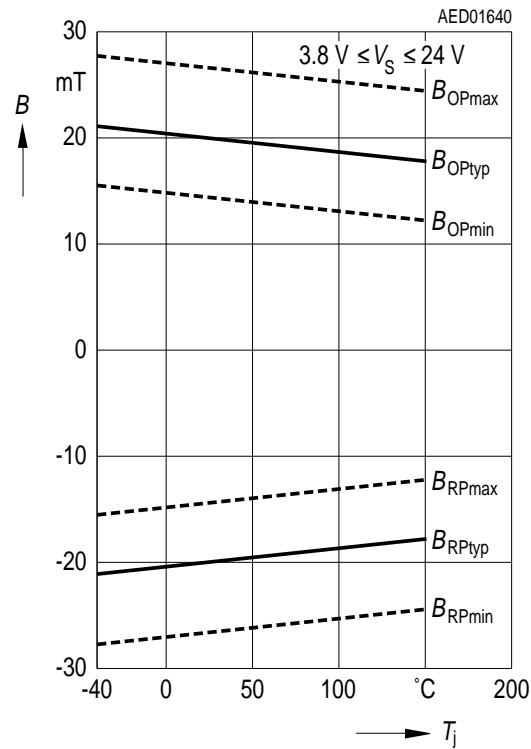
### TLE 4905 Hysteresis versus Junction Temperature



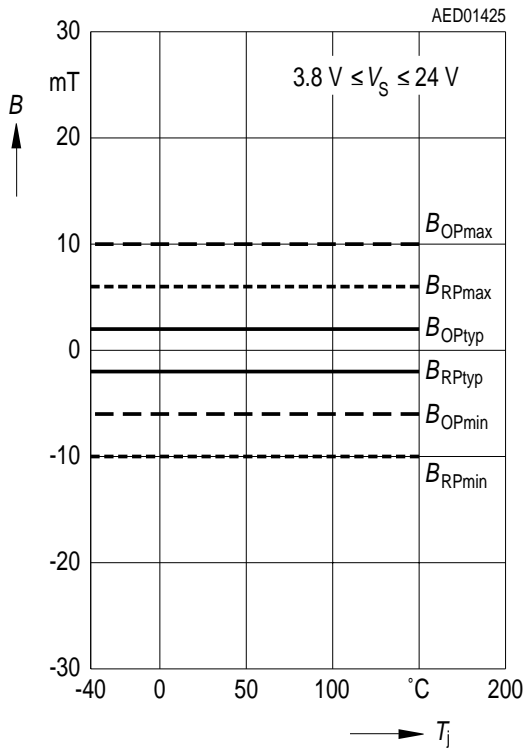
### TLE 4935 Operate-and Release-Point versus Junction Temperature



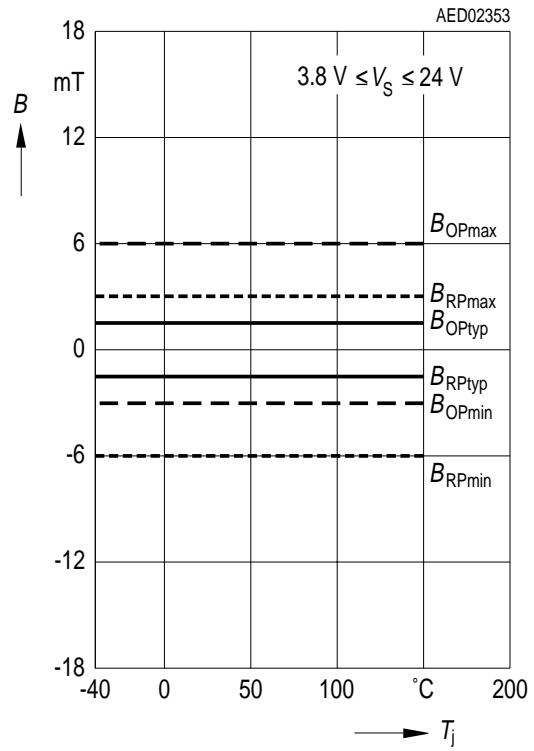
### TLE 4935-2 Operate-and Release-Point versus Junction Temperature



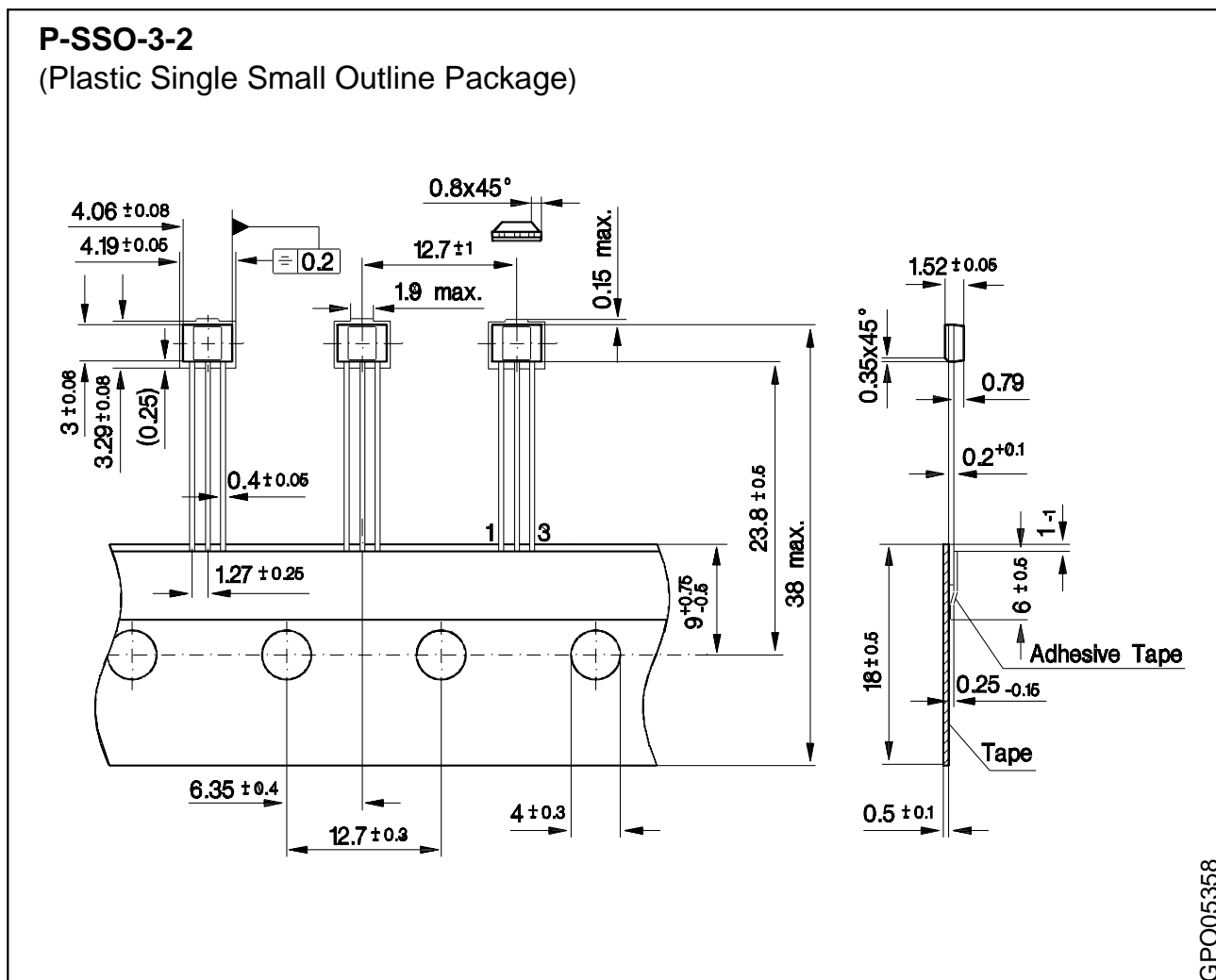
**TLE 4945 Operate-and Release-Point versus Junction Temperature**



**TLE 4945-2 Operate-and Release-Point versus Junction Temperature**



## Package Outline



GPO05358

### Exterior Packaging

I.e. tubes, trays, boxes are shown in our Data Book "Package Information". Dimensions in mm