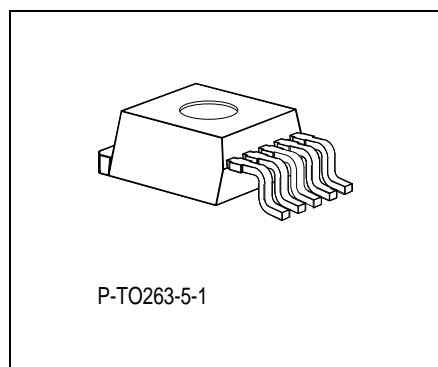
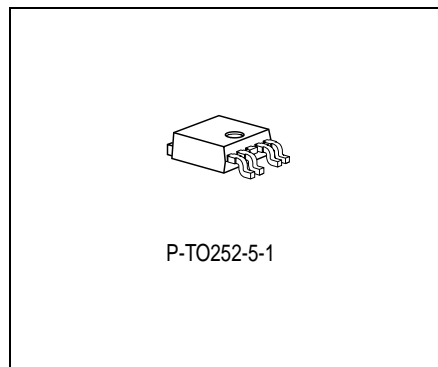


Features

- Output tracking tolerance $\leq \pm 0.2\%$
- 400 mA output current capability
- Enable Function
- Very low current consumption in OFF mode
- Wide operation range: up to 40 V
- Wide temperature range: $-40\text{ }^{\circ}\text{C} \leq T_j \leq 150\text{ }^{\circ}\text{C}$
- Output protected against short circuit
- Overtemperature protection
- Reverse polarity proof

| Type | Ordering Code | Package |
|------------|---------------|-------------|
| TLE 4251 D | Q67006-A9439 | P-TO252-5-1 |
| TLE 4251 G | Q67006-A9529 | P-TO263-5-1 |



Functional Description

The **TLE 4251** is a monolithic integrated low-drop voltage tracker in the very small SMD package P-TO252-5-1. It is designed to supply e.g. sensors under the severe conditions of automotive applications. Therefore the device is equipped with additional protection functions against over load, short circuit and reverse polarity.

Supply voltages up to 40 V are tracked to a reference voltage given to the adjust input via an external resistor.

The output is able to drive loads up to 400 mA while it follows e.g. the 5 V output of a main voltage regulator within an accuracy of 0.5%. For loads up to 300 mA the tracking accuracy is 0.2%.

The **TLE 4251** can be switched in stand-by mode via the enable EN input which causes the current consumption to drop to very low values. This feature makes the IC suitable for low power battery applications.

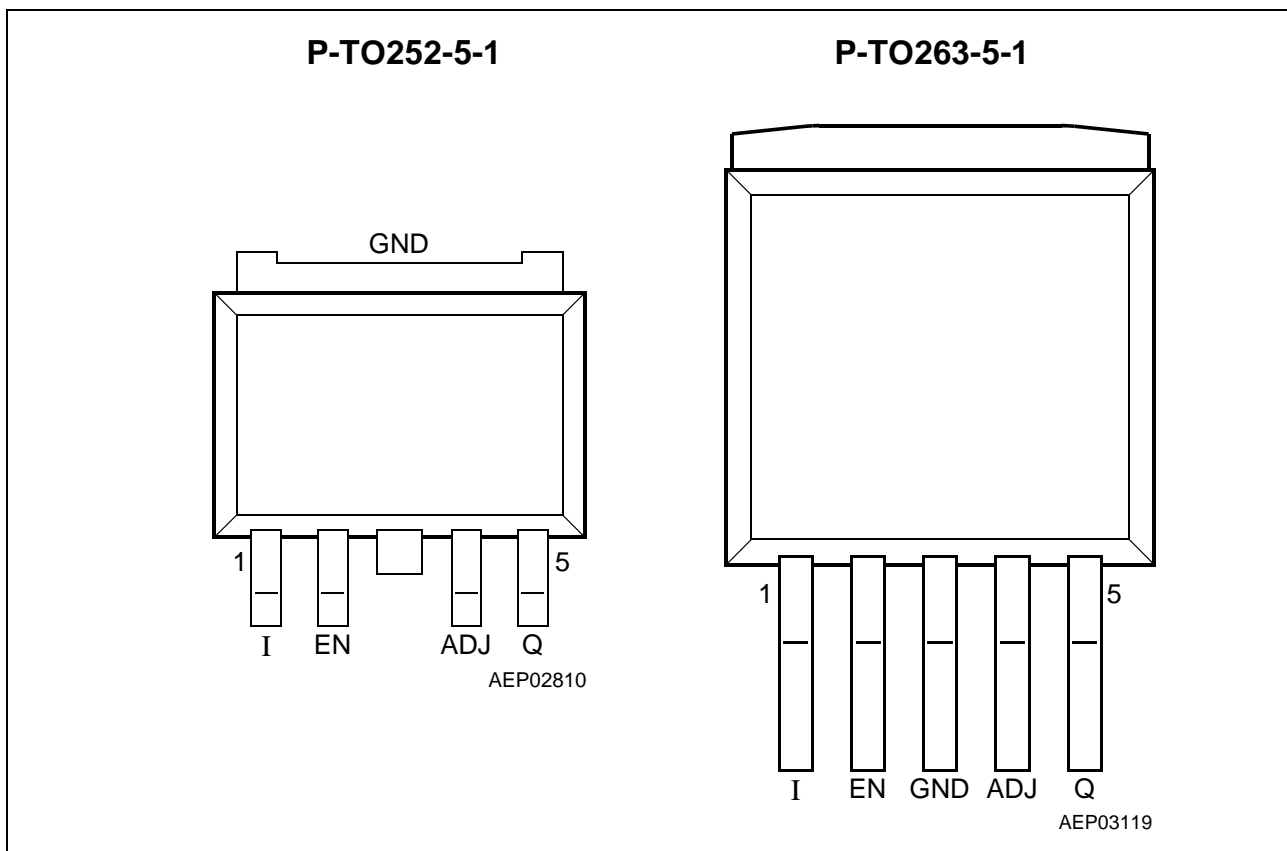


Figure 1 Pin Configuration (top view)

| Pin No. | Symbol | Function |
|---------|--------|---|
| 1 | I | Input voltage |
| 2 | EN | Enable , high-active input |
| 3 | GND | Ground |
| 4 | ADJ | Adjust ; connect to the reference voltage via ext. resistor or micro-controller port |
| 5 | Q | Output voltage ; must be blocked by a capacitor $C_Q \geq 22 \mu\text{F}$, $\text{ESR} \leq 3 \Omega$ to GND |

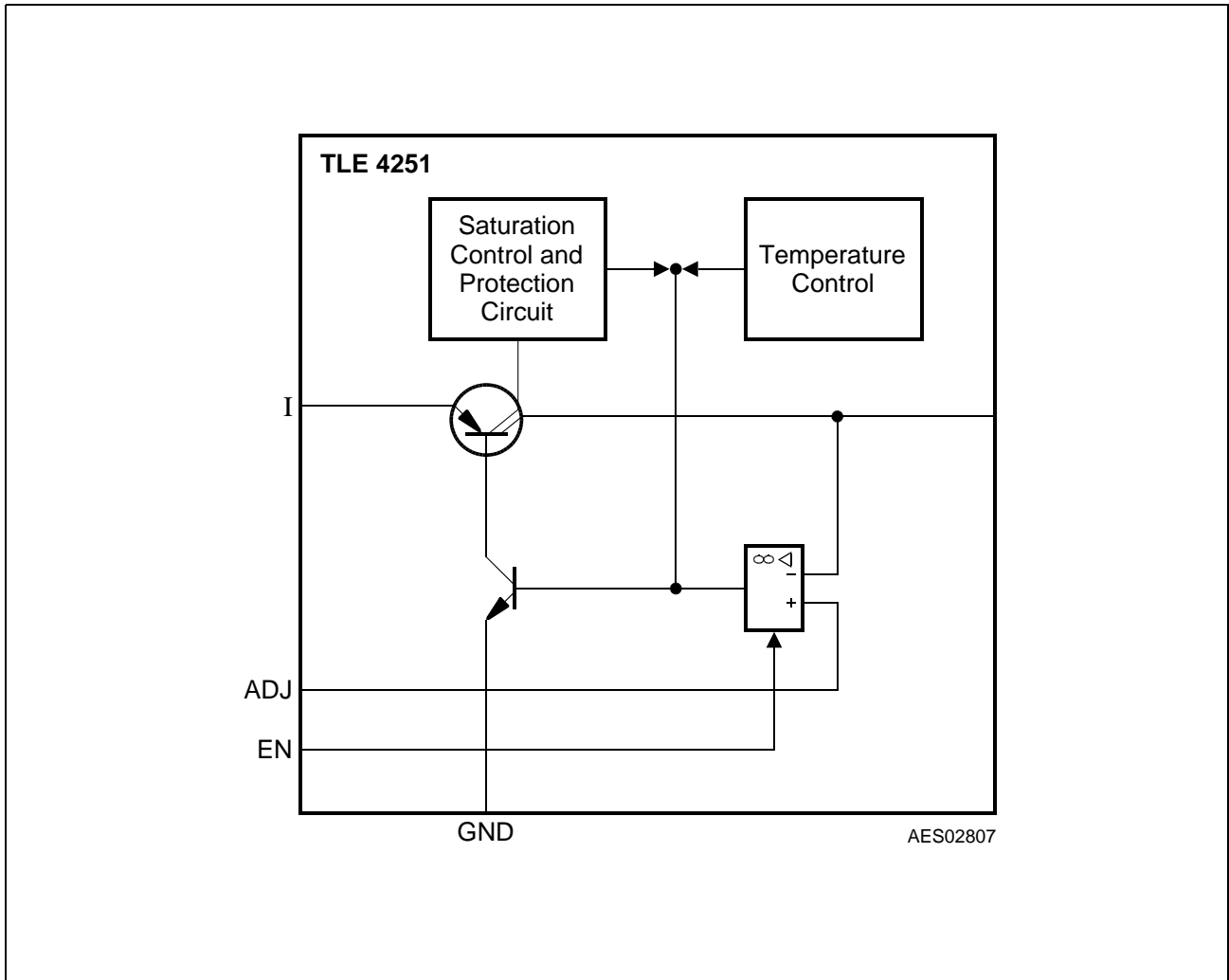


Figure 2 **Block Diagram**

Absolute Maximum Ratings

$$-40\text{ °C} < T_j < 150\text{ °C}$$

| Parameter | Symbol | Limit Values | | Unit | Remarks |
|-----------|--------|--------------|------|------|---------|
| | | min. | max. | | |

Input

| | | | | | |
|---------|-------|------|----|----|--------------------|
| Voltage | V_I | - 42 | 45 | V | - |
| Current | I_I | - | - | mA | internally limited |

Output

| | | | | | |
|---------|-------|-----|----|----|--------------------|
| Voltage | V_Q | - 2 | 45 | V | - |
| Current | I_Q | - | - | mA | internally limited |

Adjust

| | | | | | |
|---------|-----------|------|----|---------|--------------------|
| Voltage | V_{ADJ} | - 42 | 45 | V | - |
| Current | I_{ADJ} | - | - | μ A | internally limited |

Enable

| | | | | | |
|---------|----------|------|----|---------|--------------------|
| Voltage | V_{EN} | - 42 | 45 | V | - |
| Current | I_{EN} | - | - | μ A | internally limited |

Temperatures

| | | | | | |
|----------------------|-----------|------|-----|----|---|
| Junction temperature | T_j | - 40 | 150 | °C | - |
| Storage temperature | T_{stg} | - 50 | 150 | °C | - |

Thermal Resistances

| | | | | | |
|------------------|------------|---|----|-----|--------------------------|
| Junction case | R_{thjc} | - | 4 | K/W | TLE 4251 D |
| Junction ambient | R_{thja} | - | 78 | K/W | TLE 4251 D ¹⁾ |
| Junction case | R_{thjc} | - | 3 | K/W | TLE 4251 G |
| Junction ambient | R_{thja} | - | 52 | K/W | TLE 4251 G ¹⁾ |

¹⁾ Worst case, regarding peak temperature; zero airflow; mounted on a PCB 80 × 80 × 1.5 mm³, heat sink area 300 mm².

Note: Maximum ratings are absolute ratings; exceeding any one of these values may cause irreversible damage to the integrated circuit.

Operating Range

| Parameter | Symbol | Limit Values | | Unit | Remarks |
|----------------------|-----------|-----------------|------|------|---------------------------------|
| | | min. | max. | | |
| Input voltage | V_I | 4 ¹⁾ | 40 | V | – |
| Adjust input voltage | V_{ADJ} | 2.5 | 40 | V | – |
| Adjust input voltage | V_{ADJ} | 0 | 2.5 | V | $V_Q \leq V_{ADJ} + \Delta V_Q$ |
| Enable input voltage | V_{EN} | 0 | 40 | V | – |
| Junction temperature | T_j | – 40 | 150 | °C | – |

1) $V_I > V_{ADJ} + V_{DR}$

Electrical Characteristics

$V_I = 13.5 \text{ V}$; $2.5 \text{ V} \leq V_{ADJ} \leq V_I - 0.5 \text{ V}$; $-40 \text{ °C} < T_j < 150 \text{ °C}$; unless otherwise specified

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
| | | min. | typ. | max. | | |

Output

| | | | | | | |
|--|--------------|------|-----|-----|----|--|
| Output voltage tracking accuracy $\Delta V_Q = V_{ADJ} - V_Q$ | ΔV_Q | – 10 | – | 10 | mV | $V_I < 13.5 \text{ V}$; $-40 \text{ °C} < T_j < 125 \text{ °C}$; $1 \text{ mA} < I_Q < 300 \text{ mA}$ |
| Output voltage tracking accuracy | ΔV_Q | – 10 | – | 10 | mV | $6 \text{ V} < V_I < 40 \text{ V}$ $5 \text{ mA} < I_Q < 200 \text{ mA}$ |
| Output voltage tracking accuracy | ΔV_Q | – 25 | – | 25 | mV | $6 \text{ V} < V_I < 28 \text{ V}$ $1 \text{ mA} < I_Q < 300 \text{ mA}$ |
| Drop voltage | V_{dr} | – | 280 | 520 | mV | $I_Q = 300 \text{ mA}$; $V_{ADJ} > 4 \text{ V}$; Enable ON; ¹⁾ |
| Output current | I_Q | 400 | 450 | 800 | mA | $T_j \leq 125 \text{ °C}$ ¹⁾ |
| Output capacitor | C_Q | 22 | – | – | μF | $\text{ESR} \leq 3 \text{ } \Omega$ at 10 kHz |
| Current consumption $I_q = I_I - I_Q$ | I_q | – | 10 | 20 | mA | $I_Q = 300 \text{ mA}$ |
| Current consumption $I_q = I_I - I_Q$ | I_q | – | 230 | 300 | μA | $I_Q < 1 \text{ mA}$ $T_j < 85 \text{ °C}$ V_{EN} in ON state |

Electrical Characteristics (cont'd)
 $V_I = 13.5 \text{ V}; 2.5 \text{ V} \leq V_{ADJ} \leq V_I - 0.5 \text{ V}; -40 \text{ }^\circ\text{C} < T_j < 150 \text{ }^\circ\text{C};$ unless otherwise specified

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|--|--------|--------------|------|------|---------------|---|
| | | min. | typ. | max. | | |
| Quiescent current (stand-by) $I_q = I_I - I_Q$ | I_q | – | 0 | 10 | μA | $V_{EN} = 0 \text{ V}$ $T_j < 85 \text{ }^\circ\text{C}$ |

Regulator Performance

| | | | | | | |
|-------------------------------|--------------|------|----------|----|----|--|
| Load regulation | ΔV_Q | – 35 | ± 5 | 35 | mV | $5 \text{ mA} < I_Q < 300 \text{ mA};$ $V_I = 6 \text{ V}, V_{ADJ} = 5 \text{ V}$ |
| Line regulation | ΔV_Q | – 25 | ± 10 | 25 | mV | $12 \text{ V} < V_I < 32 \text{ V}$ $I_Q = 5 \text{ mA}$ |
| Power-Supply-Ripple-Rejection | $PSRR$ | 60 | – | – | dB | $f_r = 100 \text{ Hz};$ $V_r = 5 \text{ V}_{PP}$ |

Adjust Input

| | | | | | | |
|-----------------------|-----------|---|-----|-----|---------------|-------------------------|
| Input biasing current | I_{ADJ} | – | 0.1 | 0.5 | μA | $V_{ADJ} = 5 \text{ V}$ |
|-----------------------|-----------|---|-----|-----|---------------|-------------------------|

Enable

| | | | | | | |
|--------------------------|--------------|---|----|-----|---------------|--------------------------|
| Enable on voltage range | $V_{EN ON}$ | 2 | – | – | V | $V_Q ON$ |
| Enable off voltage range | $V_{EN OFF}$ | – | – | 0.5 | V | $V_Q \leq 0.1 \text{ V}$ |
| Input current | I_{EN} | 5 | 40 | 70 | μA | $V_{EN} = 5 \text{ V}$ |

¹⁾ Measured when the output voltage V_Q has dropped 100 mV from the nominal value.

Application Information

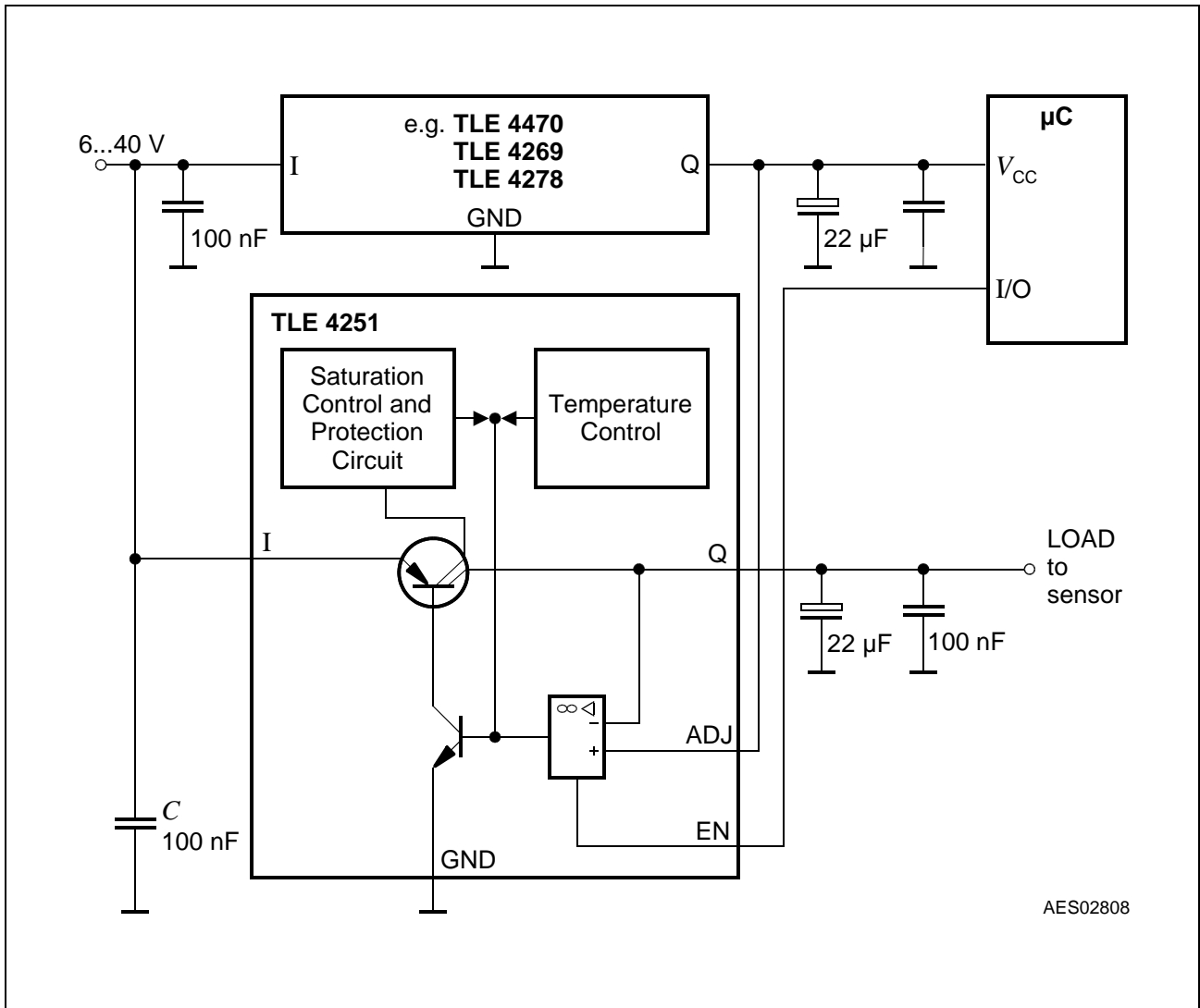
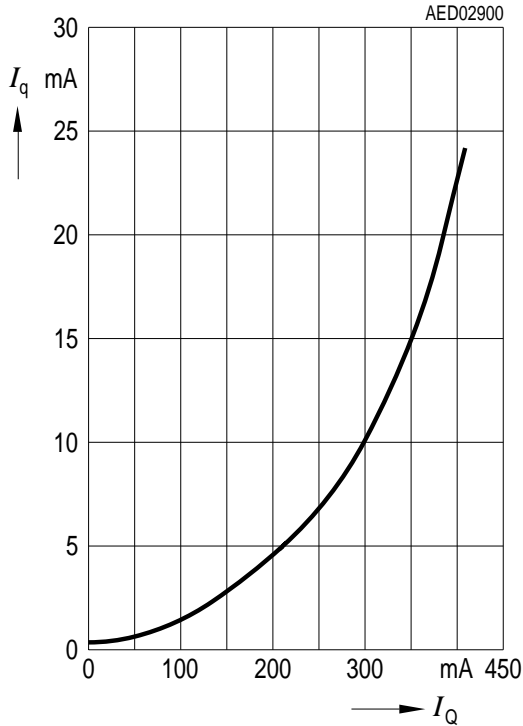
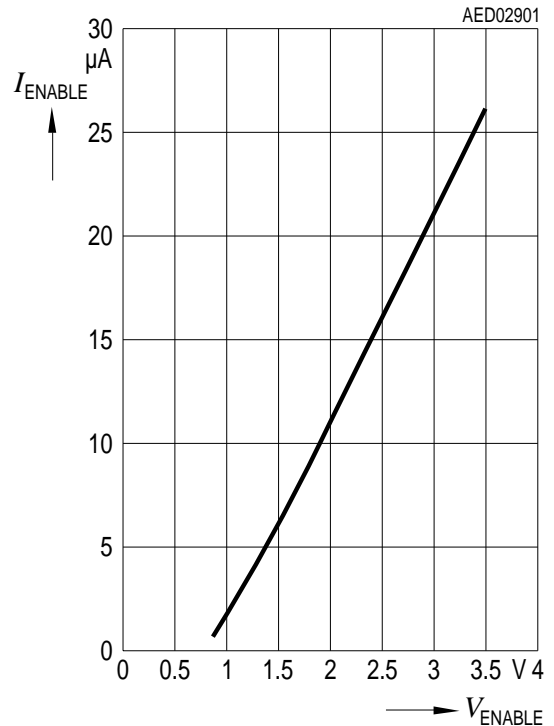


Figure 3 Application Circuit

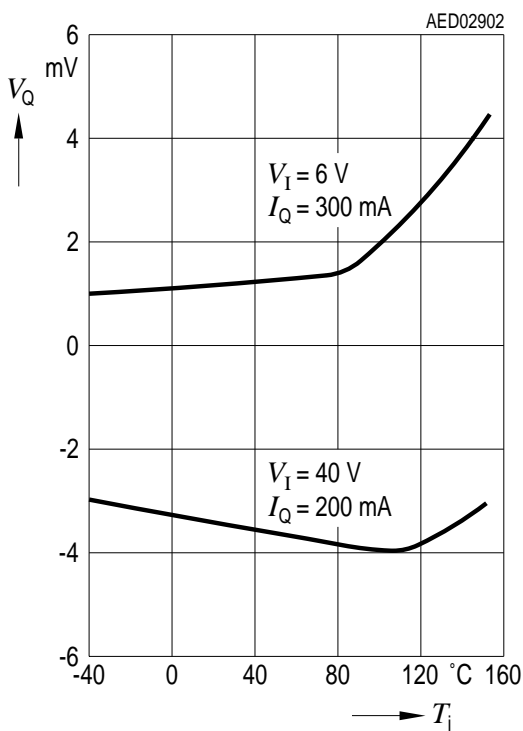
Quiescent Current I_q versus Output Current I_Q



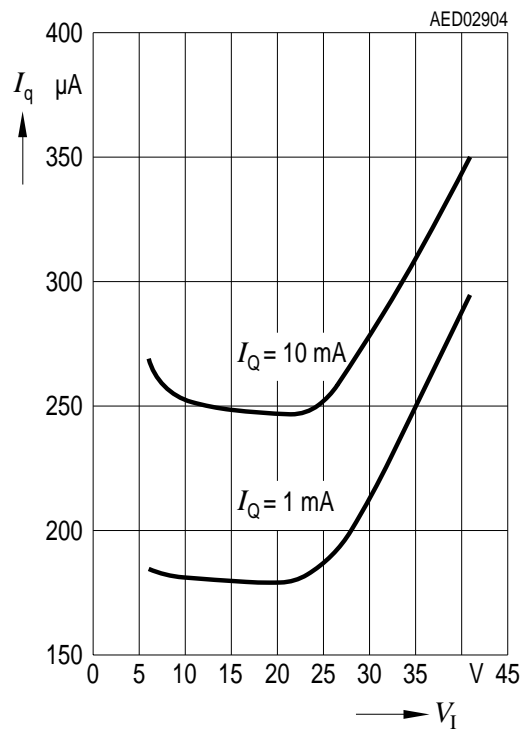
Enable Current I_{EN} versus Enable Voltage V_{EN}



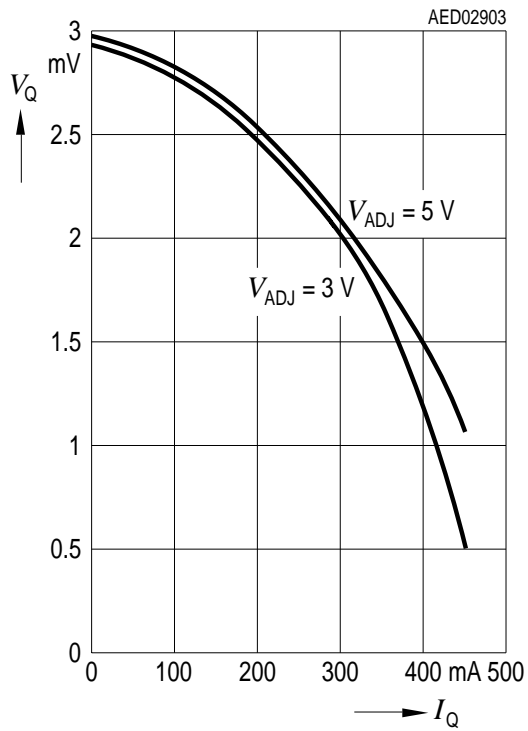
Tracking Accuracy ΔV_Q versus Temperature T_j , $V_{ADJ} = 5 V$



Current Consumption I_q versus Input Voltage V_I , $V_{ADJ} = 5 V$

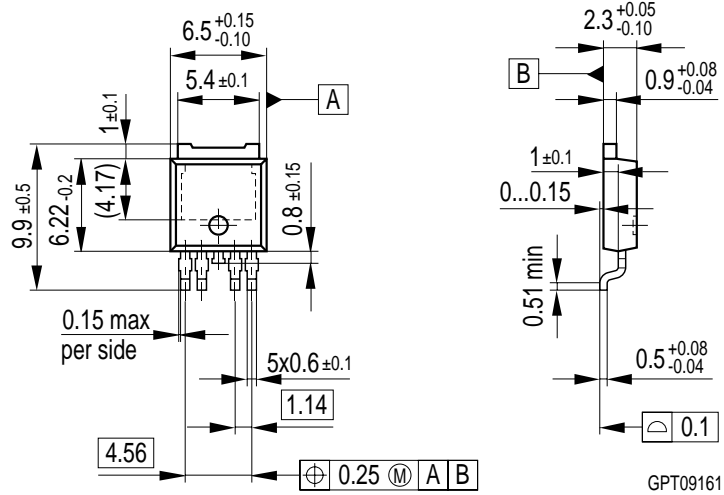


Tracking Accuracy ΔV_Q versus Output Current I_Q



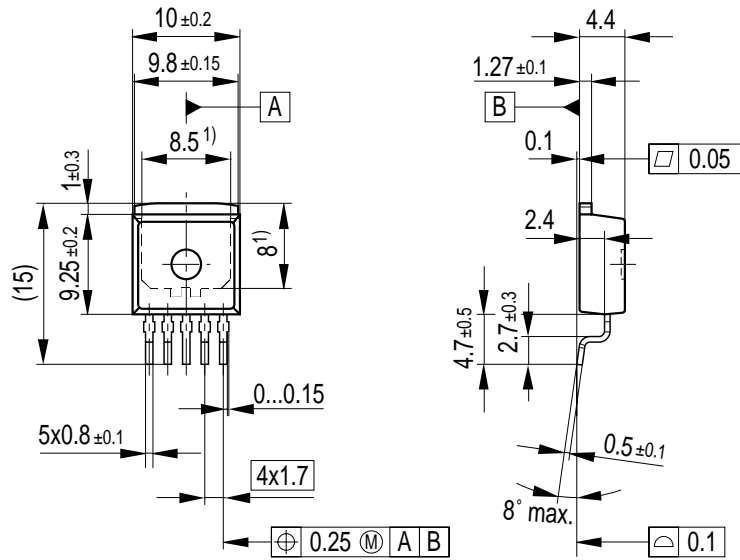
Package Outlines

P-TO252-5-1
(Plastic Transistor Single Outline)



All metal surfaces tin plated, except area of cut.

P-TO263-5-1
(Plastic Transistor Single Outline)



1) Typical
All metal surfaces tin plated, except area of cut.

GPT09113

Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm

Edition 2001-05-07

**Published by Infineon Technologies AG,
St.-Martin-Strasse 53,
D-81541 München**

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