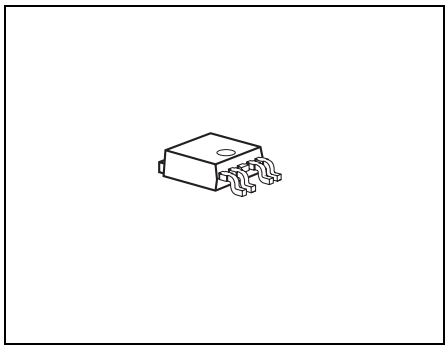
# Low Drop Voltage Tracker

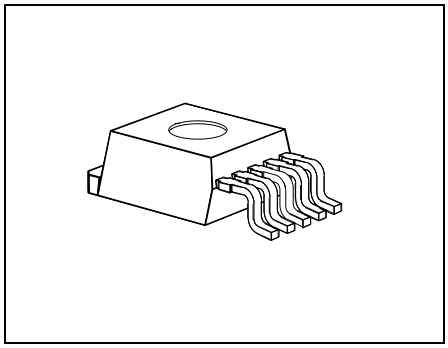
# TLE 4251

AEC Qualified

RoHS

## Features





- Output tracking tolerance ≤ ±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 °C ≤ $T_j$ ≤ 150 °C
- Output protected against short circuit
- Overtemperature protection
- Reverse polarity proof
- Green Product (RoHS compliant)
- AEC Qualified

## Functional Description

The **TLE 4251** is a monolithic integrated low drop voltage tracker in the very small SMD package PG-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 overload, 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.

| Type | Package |
|---|---|
| TLE 4251 D | PG-TO252-5-11 |
| TLE 4251 G | PG-TO263-5-1 |

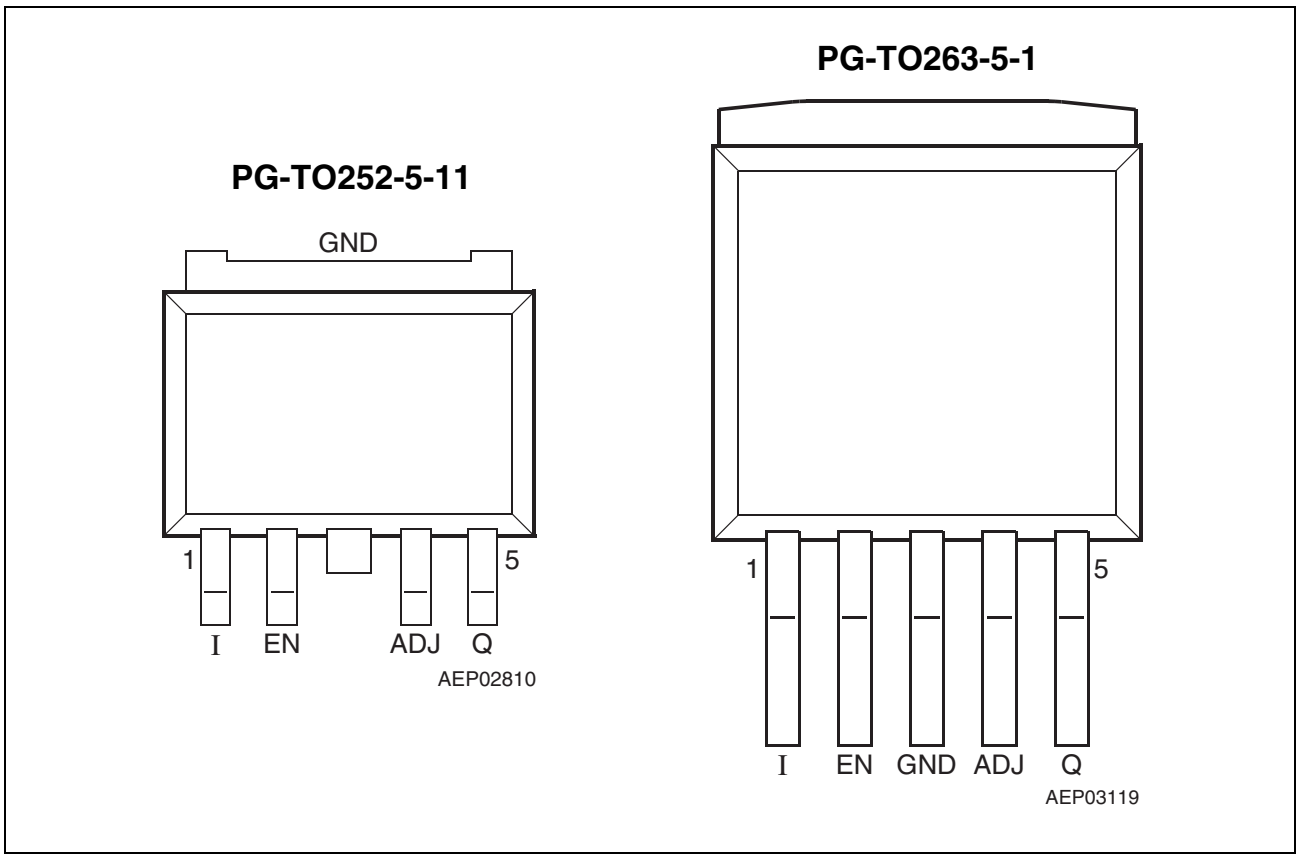



**Figure 1** **Pin Configuration** (top view)

**Table 1** **Pin Definitions and Functions**

| Pin No. | Symbol | Function |
|---|---|---|
| 1 | I | **Input voltage** |
| 2 | EN | **Enable;** high-active input |
| 3 | GND | **Ground** |
| 4 | ADJ | **Adjust;** connect directly to the reference or with a voltage divider to the reference (for reference-proportional output voltages, VQ<Vref)….. |
| 5 | Q | **Output voltage;** must be blocked by a capacitor $C_Q \geq 22\ \mu F$, ESR $\leq 3\ \Omega$ to GND |

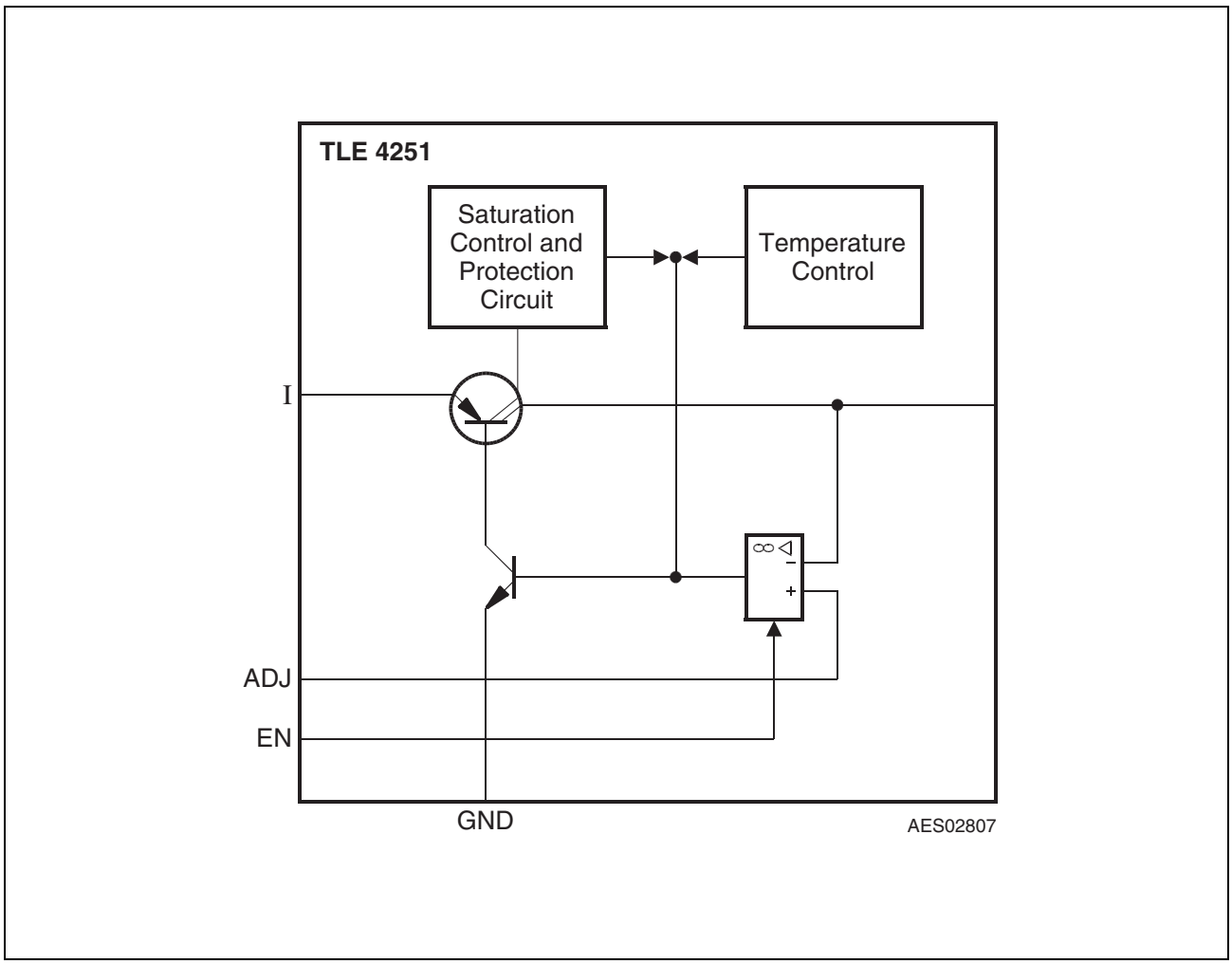



**Figure 2 Block Diagram**

**Table 2 Absolute Maximum Ratings**

-40 °C < $T_j$ < 150 °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 | $I_{ADJ}$ | – | – | µA | internally limited |
| **Enable** | | | | | |
| Voltage | $V_{EN}$ | -42 | 45 | V | – |
| Current | $I_{EN}$ | – | – | µA | 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 an a PCB 80 × 80 × 1.5 $mm^3$, heat sink area 300 $mm^2$.

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

**Table 3 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) $V_I > V_{ADJ} + V_{DR}$

**Table 4 Electrical Characteristics**

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

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| **Output** | | | | | | |
| Output voltage tracking accuracy $\Delta V_Q = V_{ADJ} - V_Q$ | $\Delta V_Q$ | -10 | – | 10 | mV | $V_I$ < 13.5 V; -40 °C < $T_j$ < 125 °C; 1 mA < $I_Q$ < 300 mA |
| Output voltage tracking accuracy | $\Delta V_Q$ | -10 | – | 10 | mV | 6 V < $V_I$ < 40 V; 5 mA < $I_Q$ < 200 mA |
| Output voltage tracking accuracy | $\Delta V_Q$ | -25 | – | 25 | mV | 6 V < $V_I$ < 28 V; 1 mA < $I_Q$ < 300 mA |
| Drop voltage | $V_{dr}$ | – | 280 | 520 | mV | $I_Q$ = 300 mA; $V_{ADJ}$ > 4 V; Enable ON[1)] |
| Output current | $I_Q$ | 400 | 450 | 800 | mA | $T_j$ ≤ 125 °C[1)] |
| Output capacitor | $C_Q$ | 22 | – | – | µF | ESR ≤ 3 Ω at 10 kHz |
| Current consumption $I_q = I_I - I_Q$ | $I_q$ | – | 10 | 20 | mA | $I_Q$ = 300 mA |
| Current consumption $I_q = I_I - I_Q$ | $I_q$ | – | 230 | 300 | µA | $I_Q$ < 1 mA; $T_j$ < 85 °C; $V_{EN}$ in ON state |
| Quiescent current (stand-by) $I_q = I_I - I_Q$ | $I_q$ | – | 0 | 2 | µA | $V_{EN}$ = 0 V; $T_j$ < 85 °C |
| **Regulator Performance** | | | | | | |
| Load regulation | $\Delta V_Q$ | -35 | ±5 | 35 | mV | 5 mA < $I_Q$ < 300 mA; $V_I$ = 6 V; $V_{ADJ}$ = 5 V |
| Line regulation | $\Delta V_Q$ | -25 | ±10 | 25 | mV | 12 V < $V_I$ < 32 V; $I_Q$ = 5 mA |
| Power Supply Ripple Rejection | $PSRR$ | 60 | – | – | dB | $f_r$ = 100 Hz; $V_r$ = 0.5 Vpp; $V_{ADJ}$ = 5 V; $C_Q$ = 22 µF Tantalum |
| **Adjust Input** | | | | | | |
| Input biasing current | $I_{ADJ}$ | – | 0.1 | 0.5 | µA | $V_{ADJ}$ = 5 V |

**Table 4 Electrical Characteristics** (cont'd)

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

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| **Enable** | | | | | | |
| Enable on voltage range | $V_{EN\ ON}$ | 2 | – | – | V | $V_Q$ ON |
| Enable off voltage range | $V_{EN\ OFF}$ | – | – | 0.5 | V | $V_Q$ ≤ 0.1 V |
| Input current | $I_{EN}$ | 5 | 40 | 70 | µA | $V_{EN}$ = 5 V |

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

## Application Information

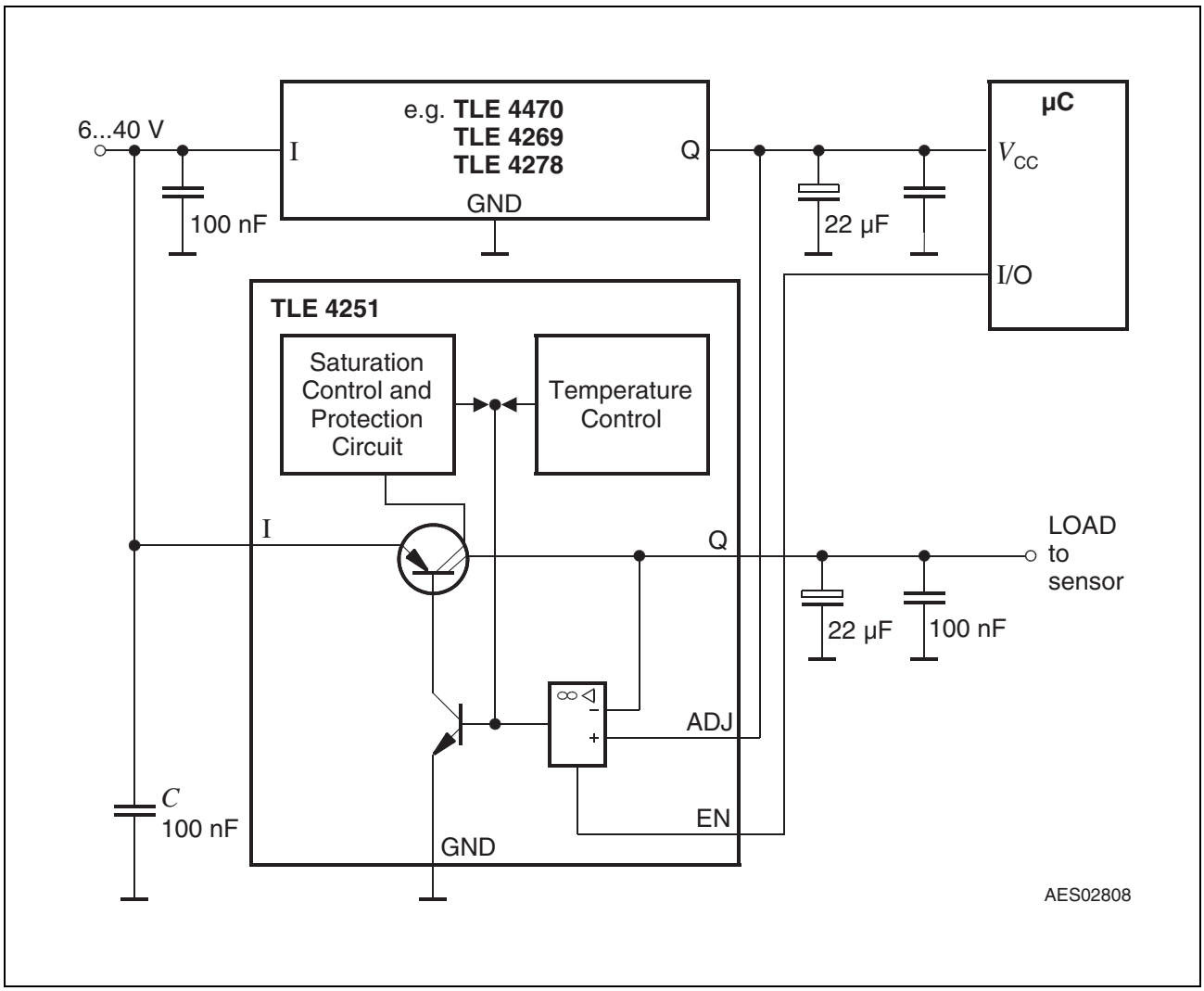
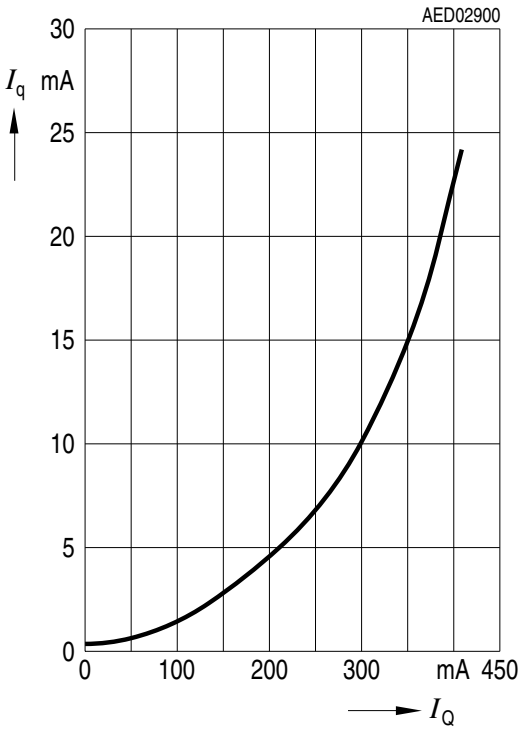
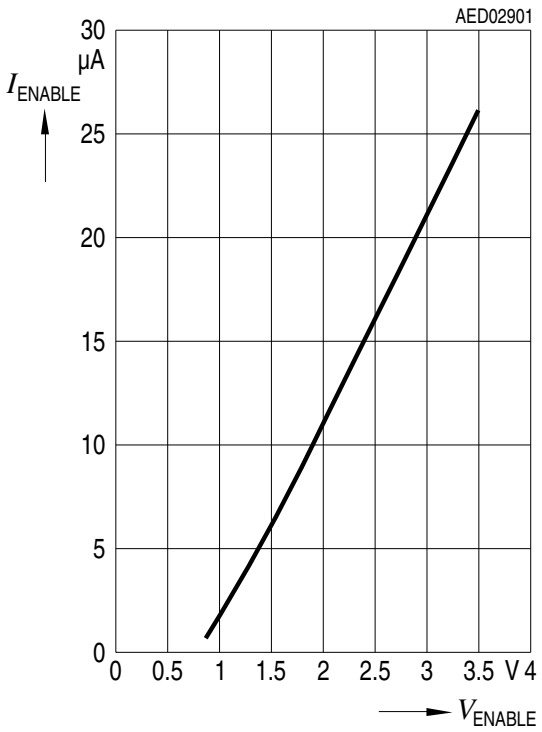



**Figure 3 Application Circuit**

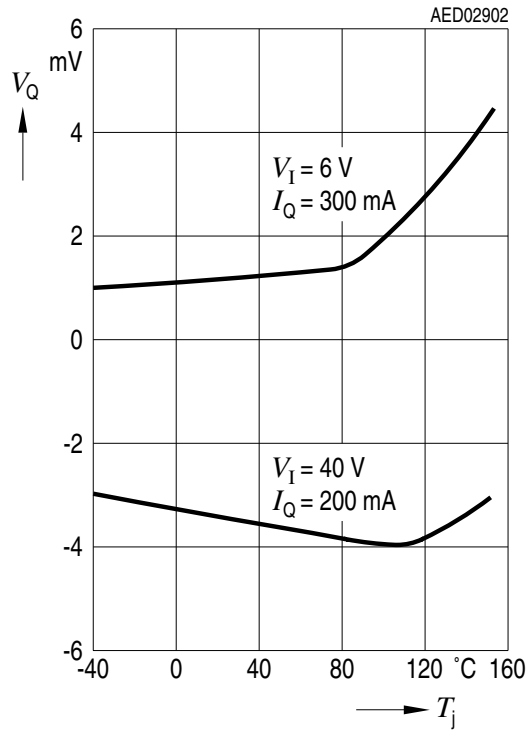
### Quiescent Current $I_q$ versus Output Current $I_Q$



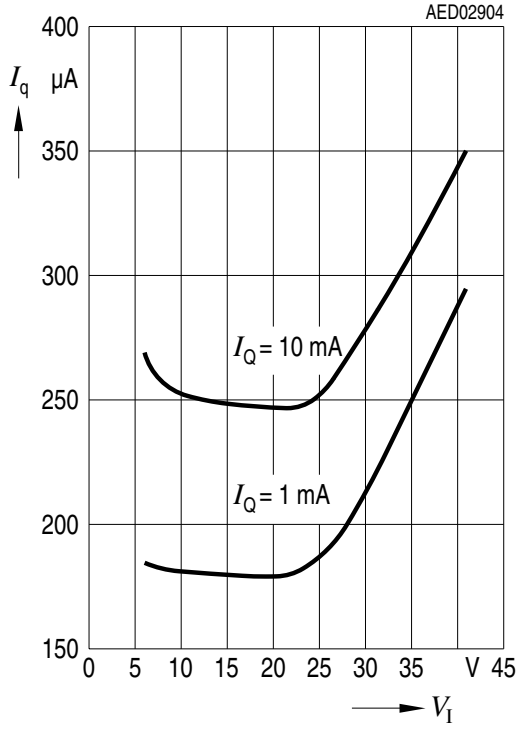

### Enable Current $I_{EN}$ versus Enable Voltage $V_{EN}$



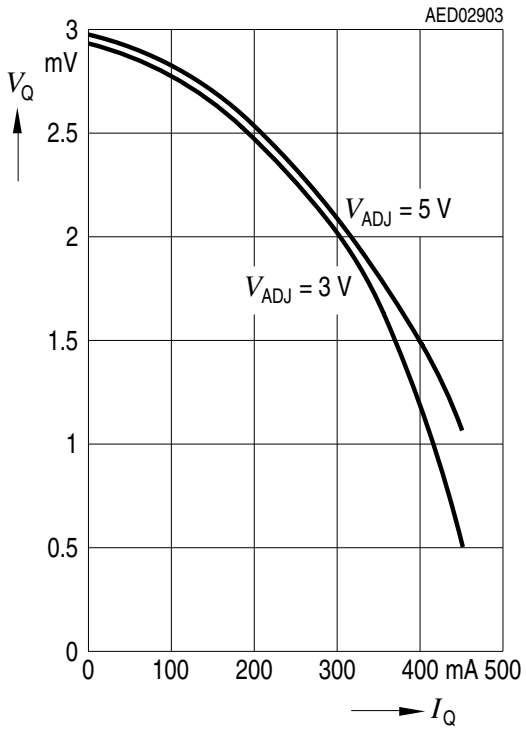

### Tracking Accuracy $\Delta V_Q$ versus Temperature $T_j$, $V_{ADJ}$ = 5 V




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



## Tracking Accuracy $\Delta V_Q$ versus Output Current $I_Q$



## Package Outlines

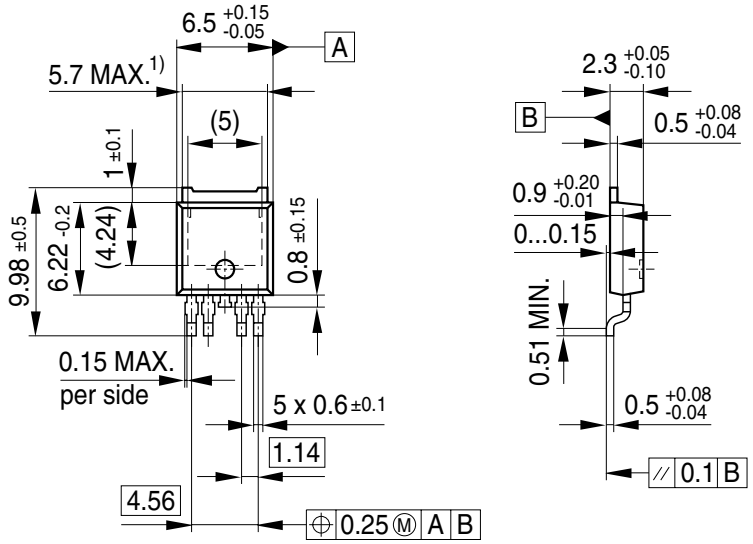



**Figure 4** **PG-TO252-5-11** (Plastic Transistor Single Outline)

**Green Product** (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-Compliant (i.e Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

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SMD = Surface Mounted Device

Dimensions in mm

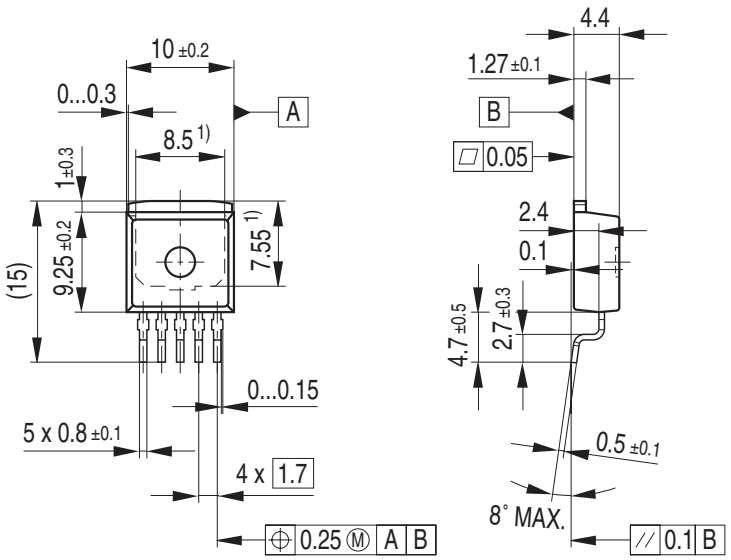


**Figure 5** **PG-TO263-5-1** (Plastic Transistor Single Outline)

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SMD = Surface Mounted Device

Dimensions in mm

## Revision History

| Version | Date | Changes |
|---|---|---|
| Rev. 2.9 | 2007-03-20 | Initial version of RoHS-compliant derivate of TLE 4251<br>**Page 1**: AEC certified statement added<br>**Page 1** and **Page 10**: RoHS compliance statement and Green product feature added<br>**Page 1** and **Page 10**: Package changed to RoHS compliant version<br>Legal Disclaimer updated |
| | | |

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