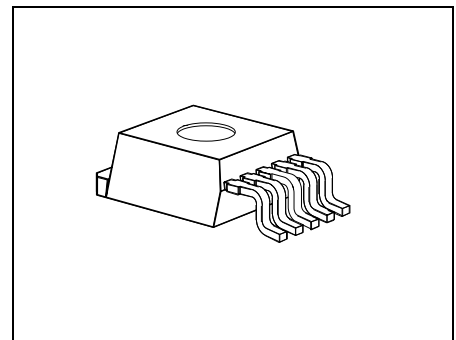
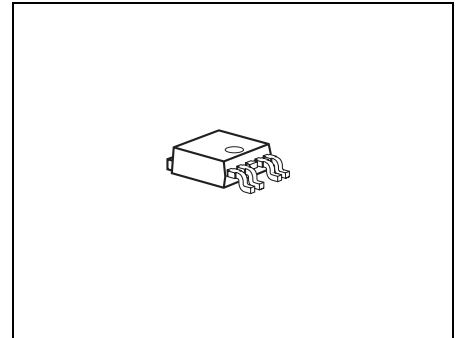




## Features

- 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
- Green Product (RoHS compliant)
- AEC Qualified



## Functional Description

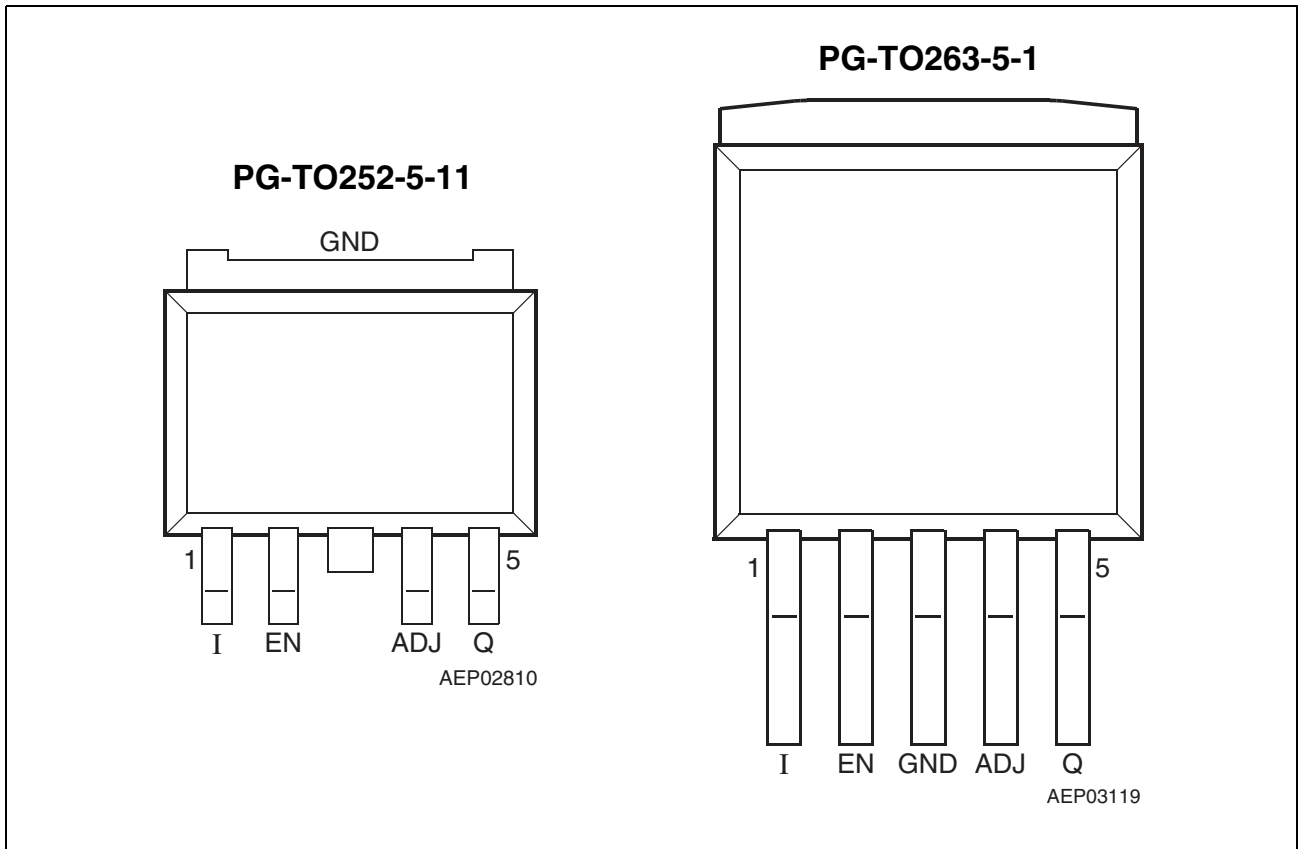
The **TLE 4251** is a monolithic integrated low drop voltage tracker in the very small SMD package PG-TO252-5-1. It is designed to supply e.g. sensors under the severe conditions of automotive applications. Therefore the device is equipped with additional protection functions against overload, short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

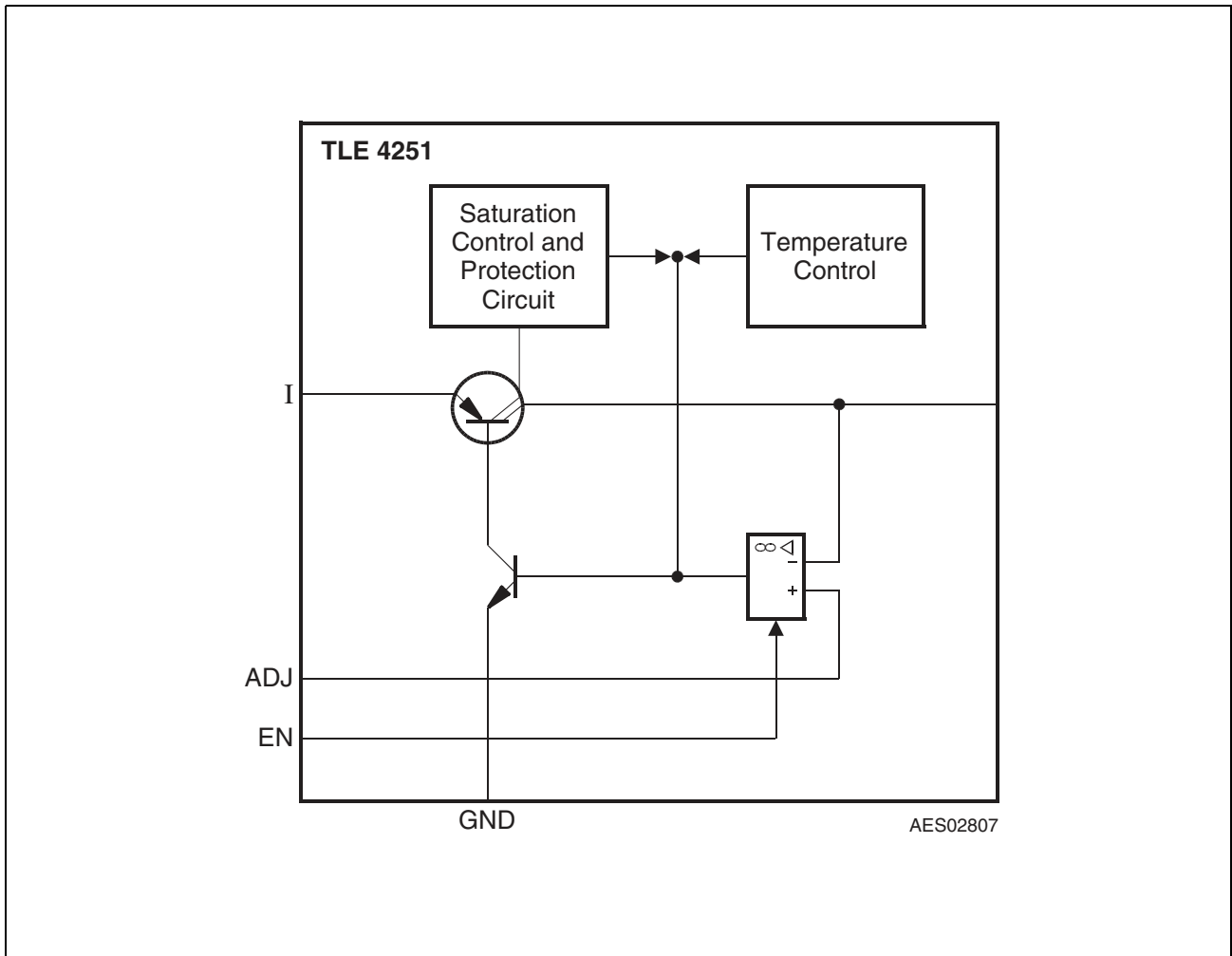
Type	Package
TLE 4251 D	PG-TO252-5-11
TLE 4251 G	PG-TO263-5-1



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

**Table 1** Pin Definitions and Functions

Pin No.	Symbol	Function
1	I	<b>Input voltage</b>
2	EN	<b>Enable;</b> high-active input
3	GND	<b>Ground</b>
4	ADJ	<b>Adjust;</b> connect directly to the reference or with a voltage divider to the reference (for reference-proportional output voltages, $V_Q < V_{ref}$ ).....
5	Q	<b>Output voltage;</b> 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**

$-40\text{ °C} < T_j < 150\text{ °C}$

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
<b>Input</b>					
Voltage	$V_I$	-42	45	V	–
Current	$I_I$	–	–	mA	internally limited
<b>Output</b>					
Voltage	$V_Q$	-2	45	V	–
Current	$I_Q$	–	–	mA	internally limited
<b>Adjust</b>					
Voltage	$V_{ADJ}$	-42	45	V	–
Current	$I_{ADJ}$	–	–	$\mu\text{A}$	internally limited
<b>Enable</b>					
Voltage	$V_{EN}$	-42	45	V	–
Current	$I_{EN}$	–	–	$\mu\text{A}$	internally limited
<b>Temperatures</b>					
Junction temperature	$T_j$	-40	150	$^{\circ}\text{C}$	–
Storage temperature	$T_{stg}$	-50	150	$^{\circ}\text{C}$	–
<b>Thermal Resistances</b>					
Junction case	$R_{thjc}$	–	4	K/W	TLE 4251 D
Junction ambient	$R_{thja}$	–	78	K/W	TLE 4251 D <sup>1)</sup>
Junction case	$R_{thjc}$	–	3	K/W	TLE 4251 G
Junction ambient	$R_{thja}$	–	52	K/W	TLE 4251 G <sup>1)</sup>

1) Worst case, regarding peak temperature; zero airflow; mounted on a PCB  $80 \times 80 \times 1.5\text{ mm}^3$ , heat sink area  $300\text{ mm}^2$ .

*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 <sup>1)</sup>	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**
 $V_I = 13.5 \text{ V}; 2.5 \text{ V} \leq V_{\text{ADJ}} \leq V_I - 0.5 \text{ V}; -40 \text{ }^\circ\text{C} < T_j < 150 \text{ }^\circ\text{C};$  unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
<b>Output</b>						
Output voltage tracking accuracy $\Delta V_Q = V_{\text{ADJ}} - V_Q$	$\Delta V_Q$	-10	–	10	mV	$V_I < 13.5 \text{ V};$ $-40 \text{ }^\circ\text{C} < T_j < 125 \text{ }^\circ\text{C};$ $1 \text{ mA} < I_Q < 300 \text{ mA}$
Output voltage tracking accuracy	$\Delta V_Q$	-10	–	10	mV	$6 \text{ V} < V_I < 40 \text{ V};$ $5 \text{ mA} < I_Q < 200 \text{ mA}$
Output voltage tracking accuracy	$\Delta V_Q$	-25	–	25	mV	$6 \text{ V} < V_I < 28 \text{ V};$ $1 \text{ mA} < I_Q < 300 \text{ mA}$
Drop voltage	$V_{\text{dr}}$	–	280	520	mV	$I_Q = 300 \text{ mA};$ $V_{\text{ADJ}} > 4 \text{ V};$ Enable ON <sup>1)</sup>
Output current	$I_Q$	400	450	800	mA	$T_j \leq 125 \text{ }^\circ\text{C}^{1)}$
Output capacitor	$C_Q$	22	–	–	$\mu\text{F}$	$\text{ESR} \leq 3 \Omega$ 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	$\mu\text{A}$	$I_Q < 1 \text{ mA}; T_j < 85 \text{ }^\circ\text{C};$ $V_{\text{EN}}$ in ON state
Quiescent current (stand-by) $I_q = I_I - I_Q$	$I_q$	–	0	2	$\mu\text{A}$	$V_{\text{EN}} = 0 \text{ V}; T_j < 85 \text{ }^\circ\text{C}$
<b>Regulator Performance</b>						
Load regulation	$\Delta V_Q$	-35	$\pm 5$	35	mV	$5 \text{ mA} < I_Q < 300 \text{ mA};$ $V_I = 6 \text{ V}; V_{\text{ADJ}} = 5 \text{ V}$
Line regulation	$\Delta V_Q$	-25	$\pm 10$	25	mV	$12 \text{ V} < V_I < 32 \text{ V};$ $I_Q = 5 \text{ mA}$
Power Supply Ripple Rejection	$PSRR$	60	–	–	dB	$f_r = 100 \text{ Hz};$ $V_r = 0.5 \text{ Vpp};$ $V_{\text{ADJ}} = 5 \text{ V};$ $C_Q = 22 \mu\text{F}$ Tantalum
<b>Adjust Input</b>						
Input biasing current	$I_{\text{ADJ}}$	–	0.1	0.5	$\mu\text{A}$	$V_{\text{ADJ}} = 5 \text{ V}$

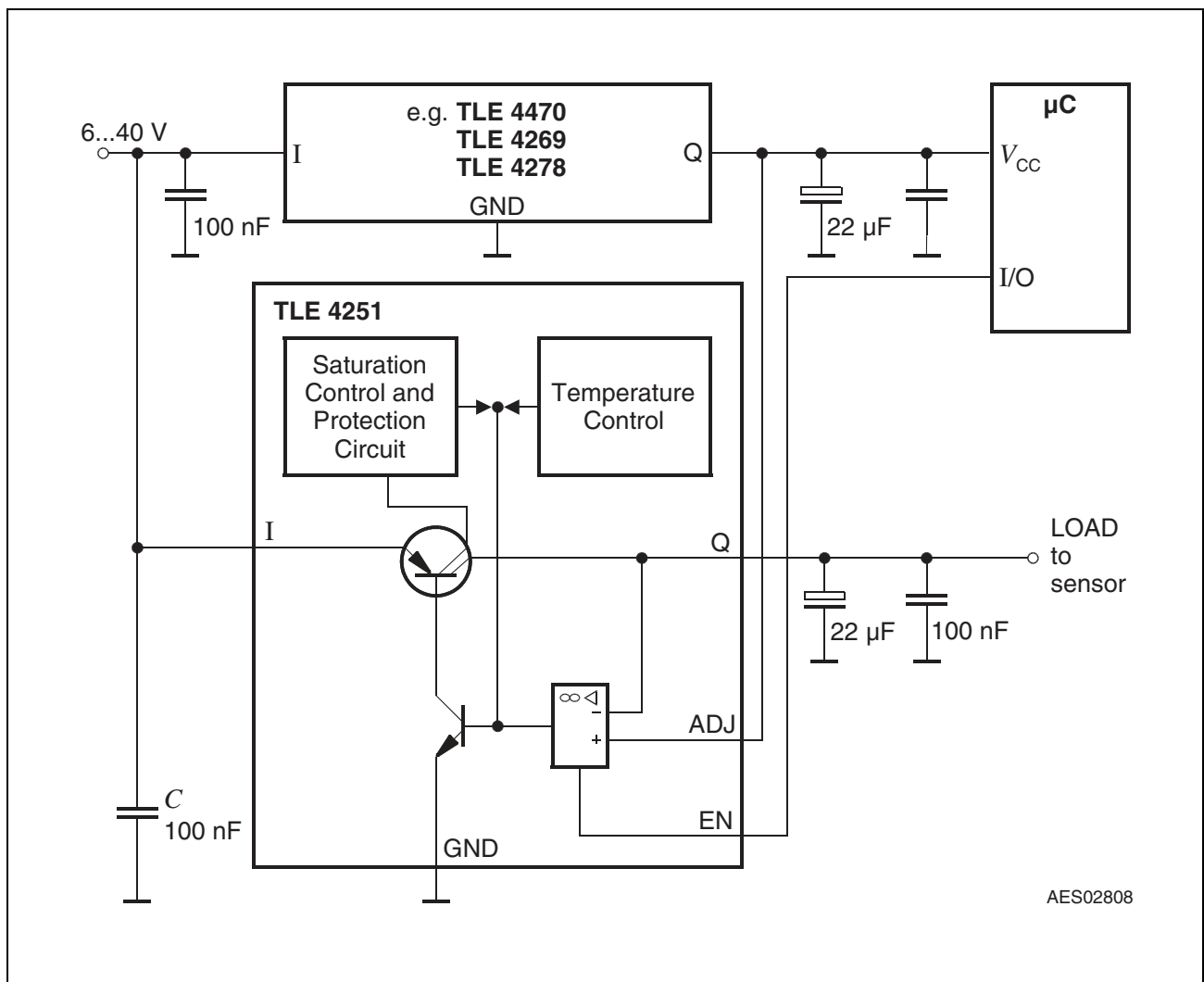
**Table 4 Electrical Characteristics (cont'd)**

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

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
<b>Enable</b>						
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	$\mu\text{A}$	$V_{EN} = 5\text{ V}$

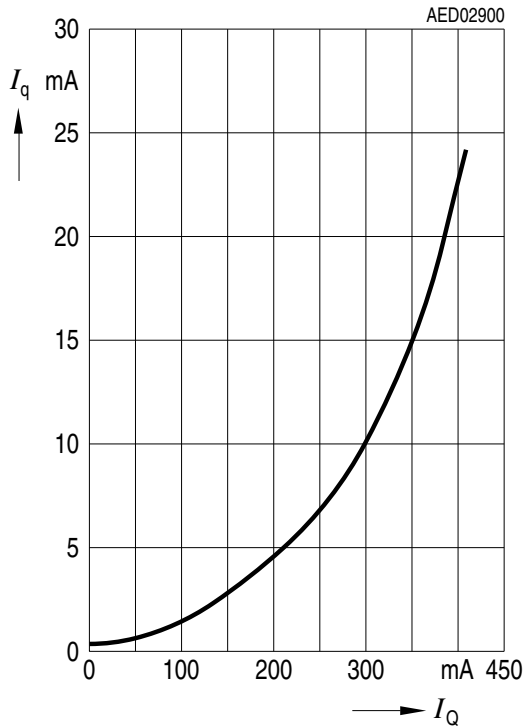
1) Measured when the output voltage  $V_Q$  has dropped 100 mV from the nominal value.

**Application Information**

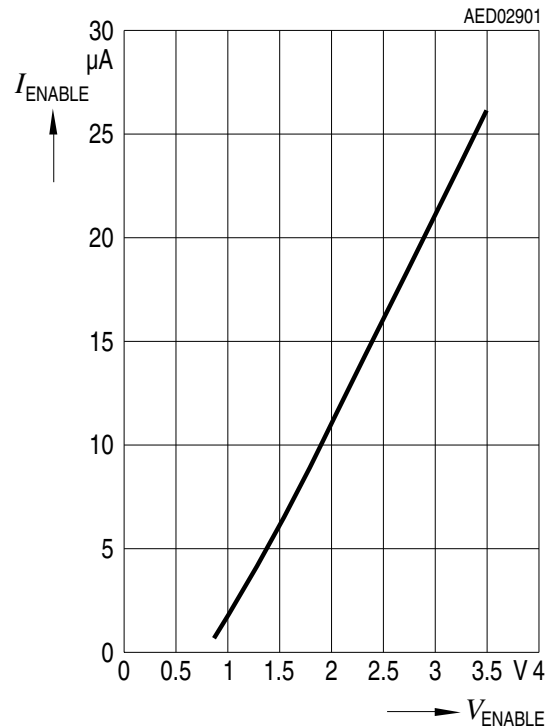


**Figure 3 Application Circuit**

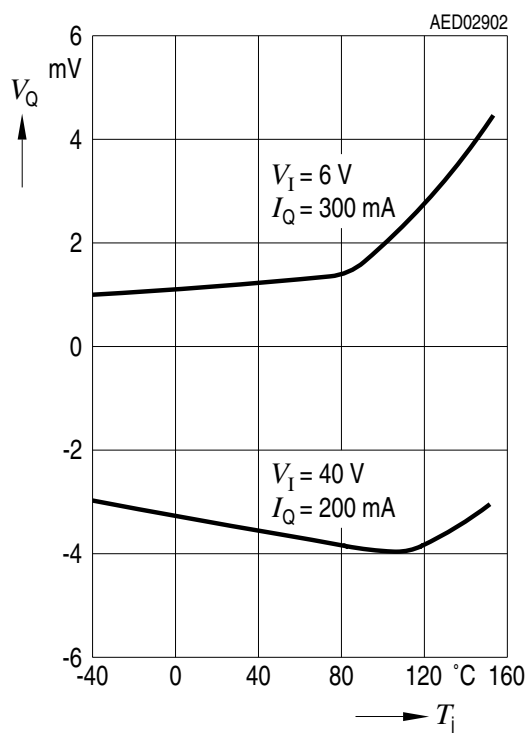
**Quiescent Current  $I_q$  versus Output Current  $I_Q$**



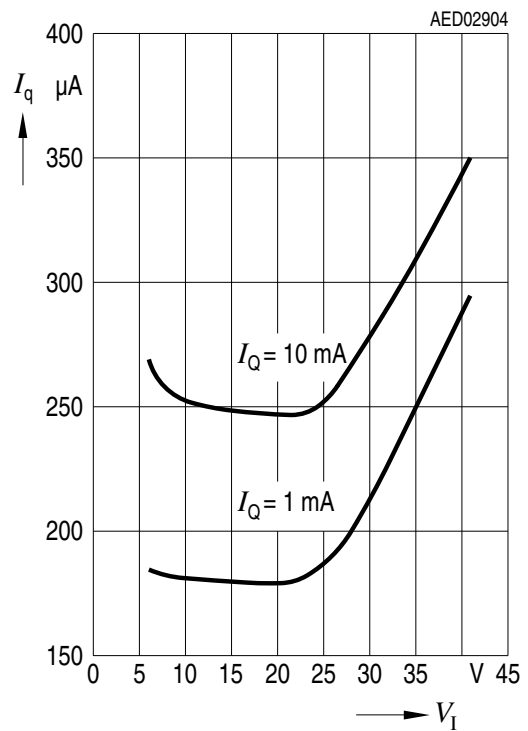
**Enable Current  $I_{EN}$  versus Enable Voltage  $V_{EN}$**



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

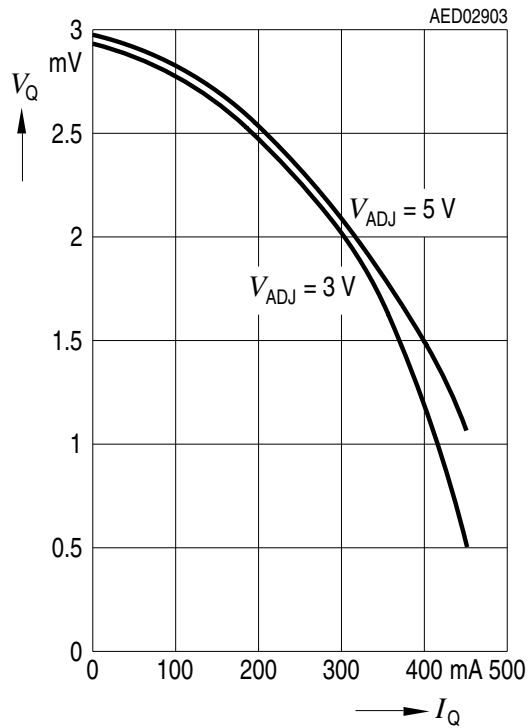


**Current Consumption  $I_q$  versus Input Voltage  $V_I$ ,  $V_{ADJ} = 5 V$**





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



Package Outlines

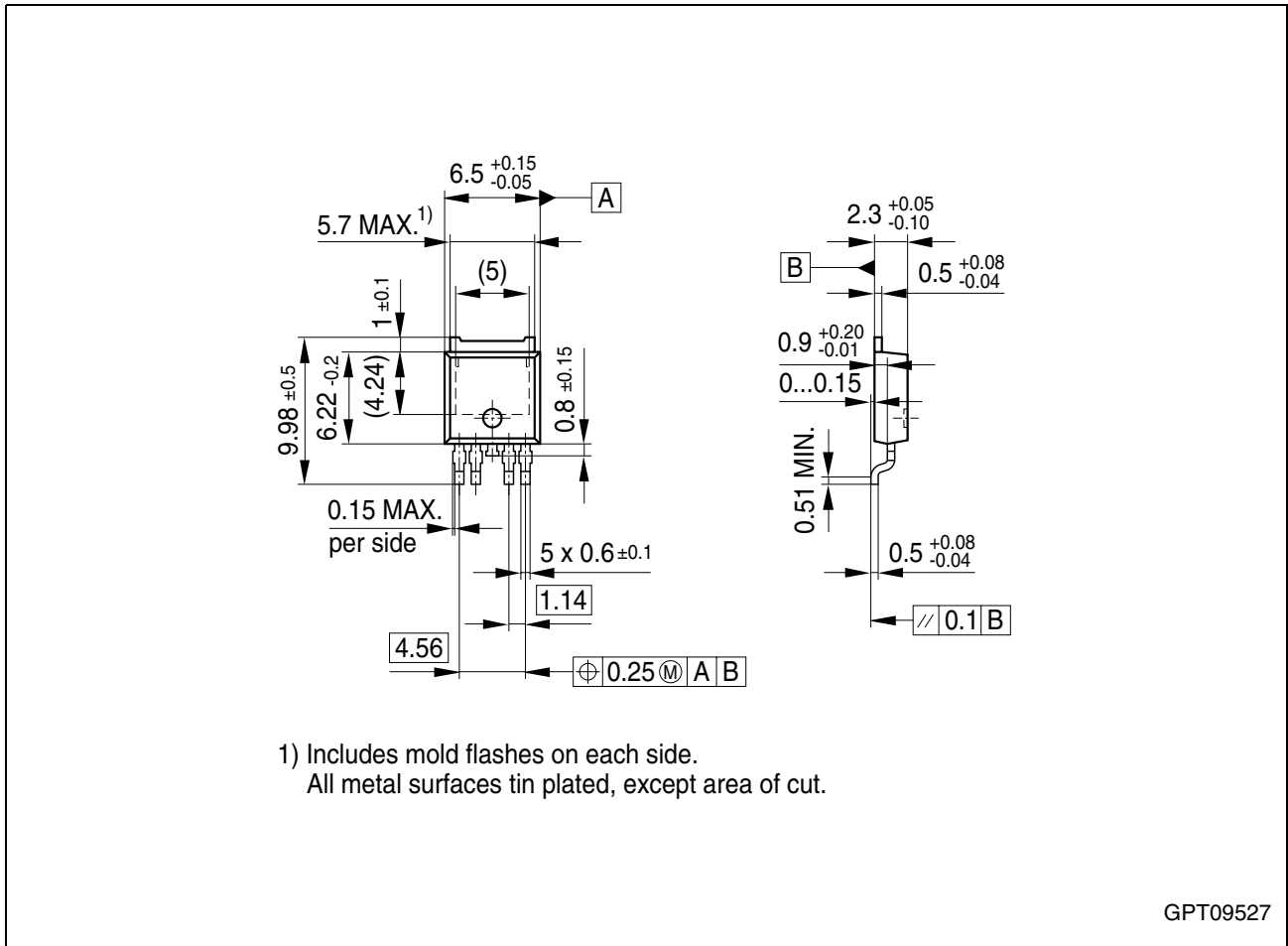


Figure 4 PG-TO252-5-11 (Plastic Transistor Single Outline)

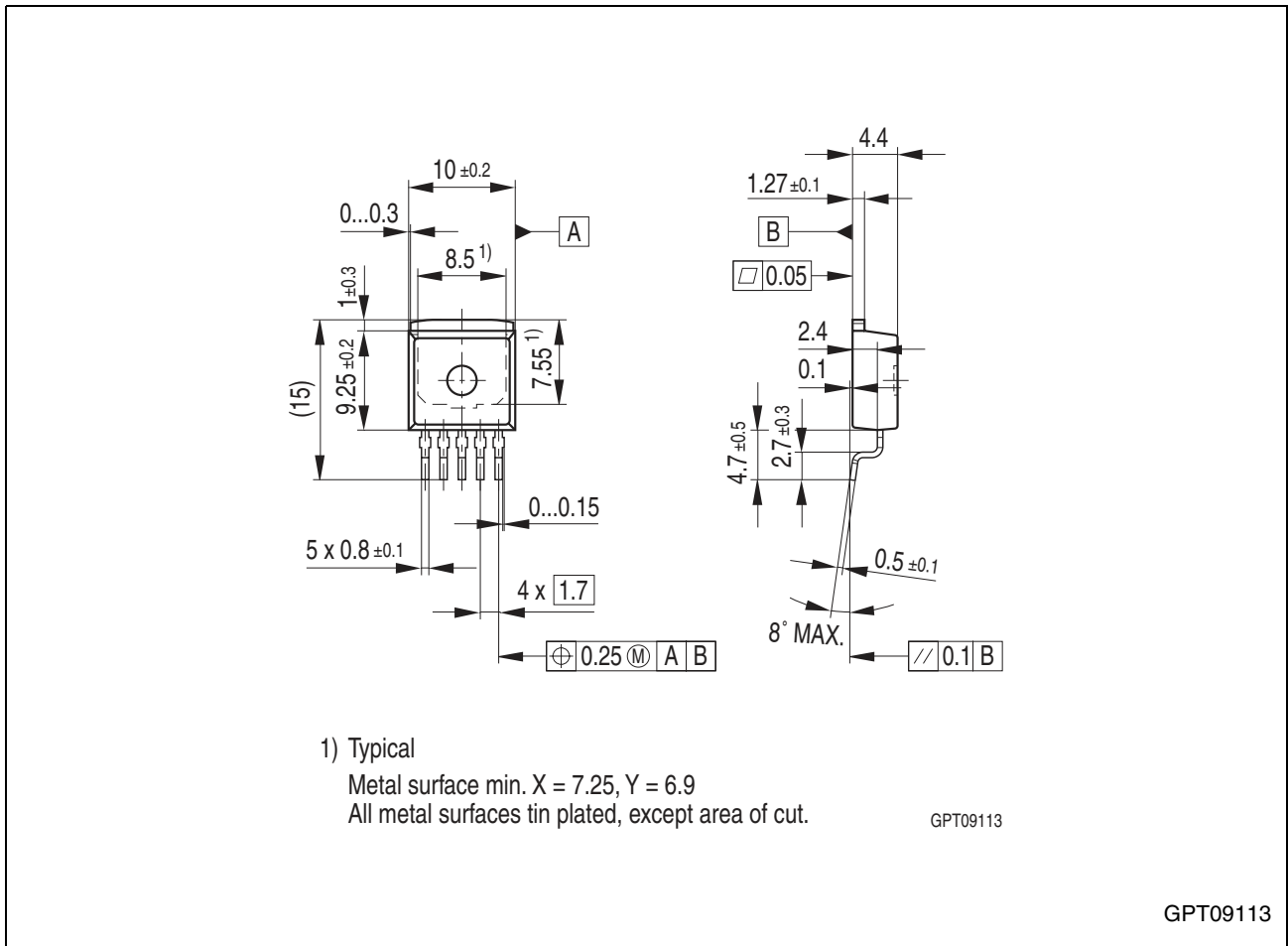
Green Product (RoHS compliant)

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)**

**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

## Revision History

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

**Edition 2007-03-20**

**Published by  
Infineon Technologies AG  
81726 Munich, Germany**

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