

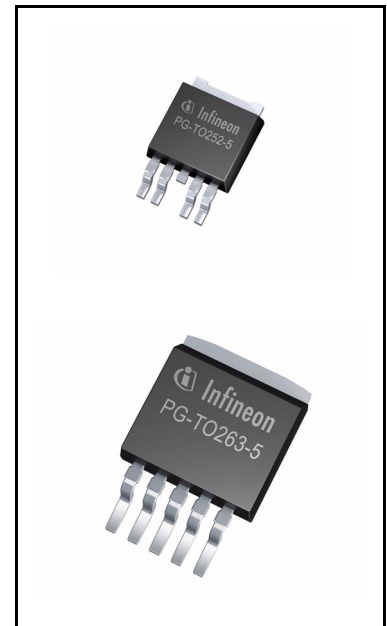
# TLE4251

## Low drop voltage tracker



### 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:  $-40\text{ °C} \leq T_j \leq 150\text{ °C}$
- Output protected against short circuit
- Overtemperature protection
- Reverse polarity proof
- Available in standard PG-TO252-5 and PG-TO263-5 packages
- Green Product (RoHS compliant)



### Potential applications

- General automotive applications

### Product validation

Qualified for automotive applications. Product validation according to AEC-Q100.

### Description

The TLE4251 is a monolithic integrated low drop voltage tracker. 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 TLE4251 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.

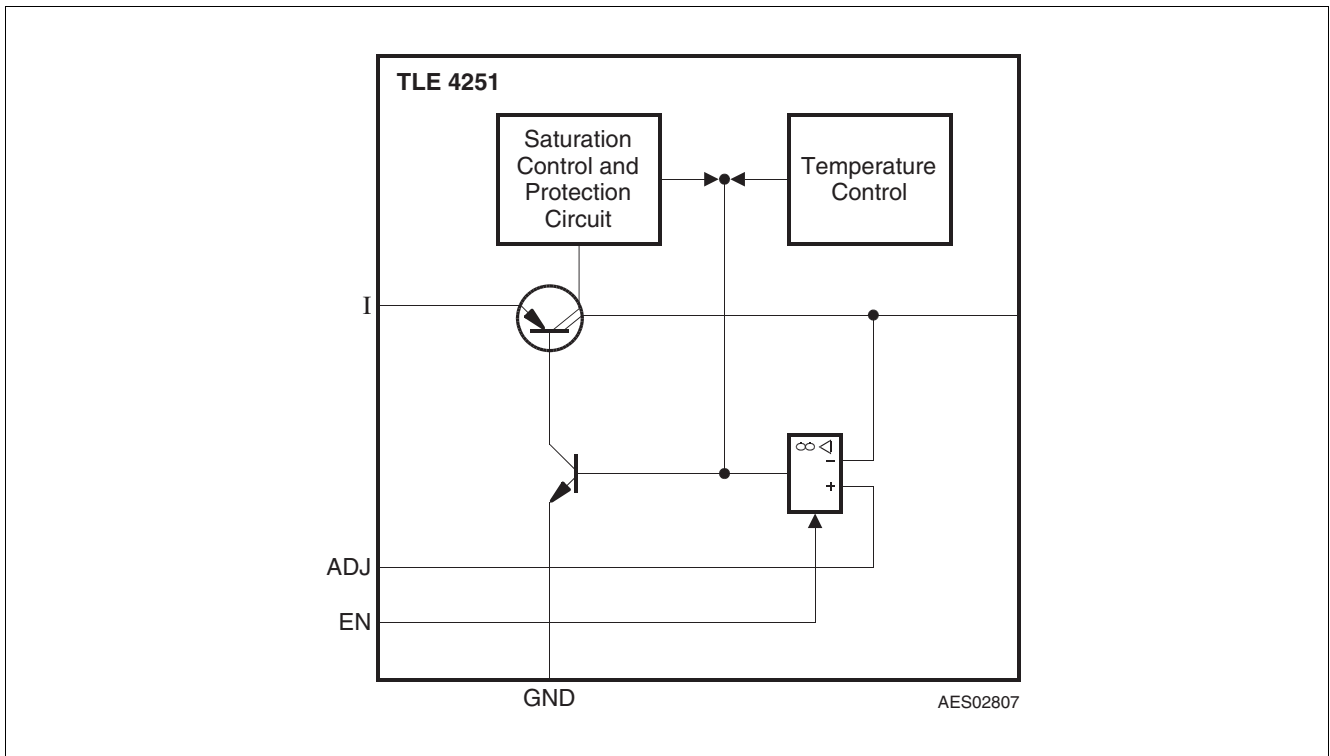
Type	Package	Marking
TLE4251D	PG-TO252-5	4251D
TLE4251G	PG-TO263-5	4251G

## Table of Contents

<b>1</b>	<b>Block diagram</b> .....	<b>3</b>
<b>2</b>	<b>Pin configuration</b> .....	<b>4</b>
2.1	Pin assignment .....	4
2.2	Pin definitions and functions .....	4
<b>3</b>	<b>General product characteristics</b> .....	<b>5</b>
3.1	Absolute maximum ratings .....	5
3.2	Functional range .....	6
3.3	Thermal resistance .....	6
<b>4</b>	<b>Electrical characteristics</b> .....	<b>7</b>
4.1	Electrical characteristics .....	7
4.1.1	Typical performance graphs .....	8
<b>5</b>	<b>Application information</b> .....	<b>10</b>
5.1	Further application information .....	10
<b>6</b>	<b>Package information</b> .....	<b>11</b>
<b>7</b>	<b>Revision history</b> .....	<b>12</b>

**Block diagram**

**1 Block diagram**

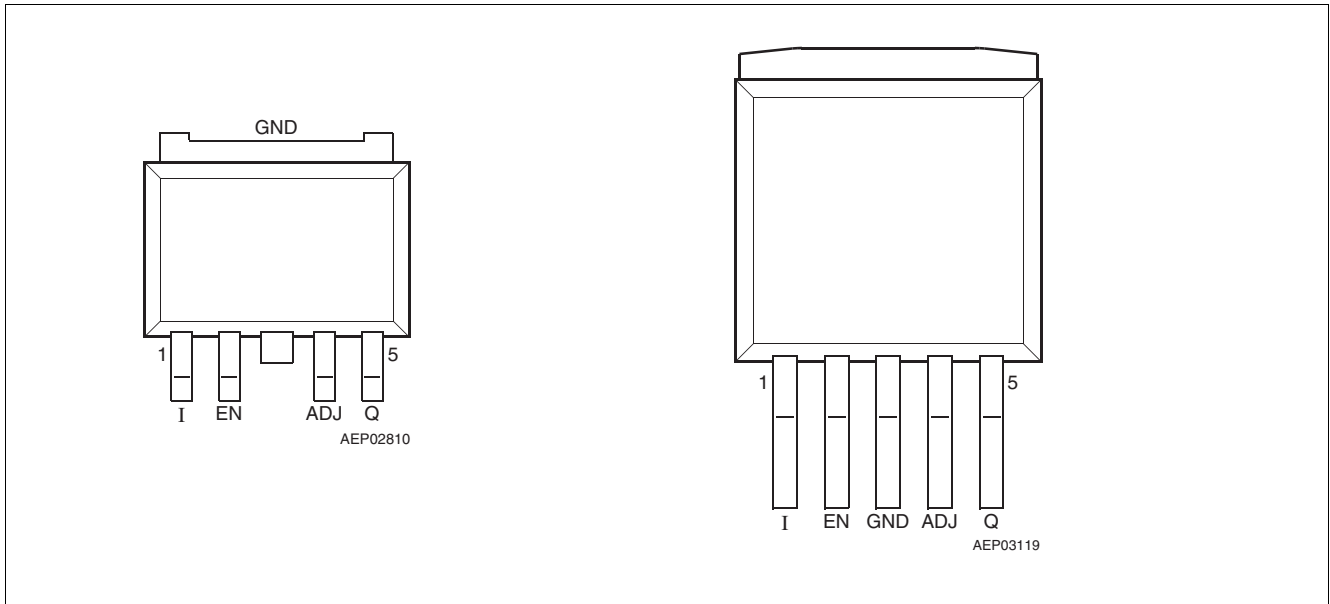


**Figure 1 Block diagram**

**Pin configuration**

**2 Pin configuration**

**2.1 Pin assignment**



**Figure 2 Pin configuration**

**2.2 Pin definitions and functions**

Pin	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 $C_Q \geq 22 \mu\text{F}$ , $\text{ESR} \leq 3 \Omega$ to GND

### 3 General product characteristics

#### 3.1 Absolute maximum ratings

**Table 1** Absolute maximum ratings<sup>1)</sup>

$T_j = -40^\circ\text{C}$  to  $150^\circ\text{C}$ ; all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
<b>Input</b>							
Voltage	$V_I$	-42	–	45	V	–	P_3.1.1
Current	$I_I$	–	–	–	mA	internally limited	P_3.1.2
<b>Output</b>							
Voltage	$V_Q$	-2	–	45	V	–	P_3.1.3
Current	$I_Q$	–	–	–	mA	internally limited	P_3.1.4
<b>Adjust</b>							
Voltage	$V_{ADJ}$	-42	–	45	V	–	P_3.1.5
Current	$I_{ADJ}$	–	–	–	$\mu\text{A}$	internally limited	P_3.1.6
<b>Enable</b>							
Voltage	$V_{EN}$	-42	–	45	V	–	P_3.1.7
Current	$I_{EN}$	–	–	–	$\mu\text{A}$	internally limited	P_3.1.8
<b>Temperatures</b>							
Junction temperature	$T_j$	-40	–	150	$^\circ\text{C}$	–	P_3.1.9
Storage temperature	$T_{stg}$	-50	–	150	$^\circ\text{C}$	–	P_3.1.10

1) Not subject to production test, specified by design.

#### Notes

1. Stresses above the ones listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. Integrated protection functions are designed to prevent IC destruction under fault conditions described in the data sheet. Fault conditions are considered as outside normal operating range. Protection functions are not designed for continuous repetitive operation.

**General product characteristics**

**3.2 Functional range**

**Table 2 Functional range**

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Input voltage	$V_I$	4 <sup>1)</sup>	–	40	V	–	P_3.2.1
Adjust input voltage	$V_{ADJ}$	2.5	–	40	V	–	P_3.2.2
Adjust input voltage	$V_{ADJ}$	0	–	2.5	V	$V_Q \leq V_{ADJ} + \Delta V_Q$	P_3.2.3
Enable input voltage	$V_{EN}$	0	–	40	V	–	P_3.2.4
Junction temperature	$T_j$	-40	–	150	°C	–	P_3.2.5

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

*Note:* Within the functional or operating range, the IC operates as described in the circuit description. The electrical characteristics are specified within the conditions given in the electrical characteristics table.

**3.3 Thermal resistance**

*Note:* This thermal data was generated in accordance with JEDEC JESD51 standards. For further information visit <https://www.jedec.org>.

**Table 3 Thermal resistance**

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Junction to case	$R_{thJC}$	–	4	–	K/W	TLE4251D	P_3.3.1
Junction to ambient	$R_{thJA}$	–	78	–	K/W	TLE4251D <sup>1)</sup>	P_3.3.2
Junction to case	$R_{thJC}$	–	3	–	K/W	TLE4251G	P_3.3.3
Junction to ambient	$R_{thJA}$	–	52	–	K/W	TLE4251G <sup>1)</sup>	P_3.3.4

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

**Electrical characteristics**

**4 Electrical characteristics**

**4.1 Electrical characteristics**

**Table 4 Electrical characteristics**

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

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
<b>Output</b>							
Output voltage tracking accuracy $\Delta V_Q = V_{ADJ} - V_Q$	$\Delta V_Q$	-10	-	10	mV	$V_I < 13.5\text{ V}$ ; $-40^\circ\text{C} < T_j < 125^\circ\text{C}$ ; $1\text{ mA} < I_Q < 300\text{ mA}$	P_4.1.1
Output voltage tracking accuracy	$\Delta V_Q$	-10	-	10	mV	$6\text{ V} < V_I < 40\text{ V}$ ; $5\text{ mA} < I_Q < 200\text{ mA}$	P_4.1.2
Output voltage tracking accuracy	$\Delta V_Q$	-25	-	25	mV	$6\text{ V} < V_I < 28\text{ V}$ ; $1\text{ mA} < I_Q < 300\text{ mA}$	P_4.1.3
Drop voltage	$V_{dr}$	-	280	520	mV	$I_Q = 300\text{ mA}$ ; $V_{ADJ} > 4\text{ V}$ ; Enable ON <sup>1)</sup>	P_4.1.4
Output current	$I_Q$	400	450	800	mA	$T_j \leq 125^\circ\text{C}$ <sup>1)</sup>	P_4.1.5
Output capacitor	$C_Q$	22	-	-	$\mu\text{F}$	$\text{ESR} \leq 3\ \Omega$ at 10 kHz	P_4.1.6
Current consumption $I_q = I_I - I_Q$	$I_q$	-	10	20	mA	$I_Q = 300\text{ mA}$	P_4.1.7
Current consumption $I_q = I_I - I_Q$	$I_q$	-	230	300	$\mu\text{A}$	$I_Q < 1\text{ mA}$ ; $T_j < 85^\circ\text{C}$ ; $V_{EN}$ in ON state	P_4.1.8
Quiescent current (stand-by) $I_q = I_I - I_Q$	$I_q$	-	0	2	$\mu\text{A}$	$V_{EN} = 0\text{ V}$ ; $T_j < 85^\circ\text{C}$	P_4.1.9
<b>Regulator Performance</b>							
Load regulation	$\Delta V_Q$	-35	$\pm 5$	35	mV	$5\text{ mA} < I_Q < 300\text{ mA}$ ; $V_I = 6\text{ V}$ ; $V_{ADJ} = 5\text{ V}$	P_4.1.10
Line regulation	$\Delta V_Q$	-25	$\pm 10$	25	mV	$12\text{ V} < V_I < 32\text{ V}$ ; $I_Q = 5\text{ mA}$	P_4.1.11
Power Supply Ripple Rejection	$PSRR$	60	-	-	dB	$f_r = 100\text{ Hz}$ ; $V_r = 0.5\text{ Vpp}$ ; $V_{ADJ} = 5\text{ V}$ ; $C_Q = 22\ \mu\text{F}$ Tantalum	P_4.1.12
<b>Adjust Input</b>							
Input biasing current	$I_{ADJ}$	-	0.1	0.5	$\mu\text{A}$	$V_{ADJ} = 5\text{ V}$	P_4.1.13
<b>Enable</b>							
Enable on voltage range	$V_{EN\ ON}$	2	-	-	V	$V_Q$ ON	P_4.1.14

**Electrical characteristics**

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

$V_1 = 13.5\text{ V}$ ;  $2.5\text{ V} \leq V_{ADJ} \leq V_1 - 0.5\text{ V}$ ;  $T_j = -40^\circ\text{C}$  to  $150^\circ\text{C}$ ; unless otherwise specified

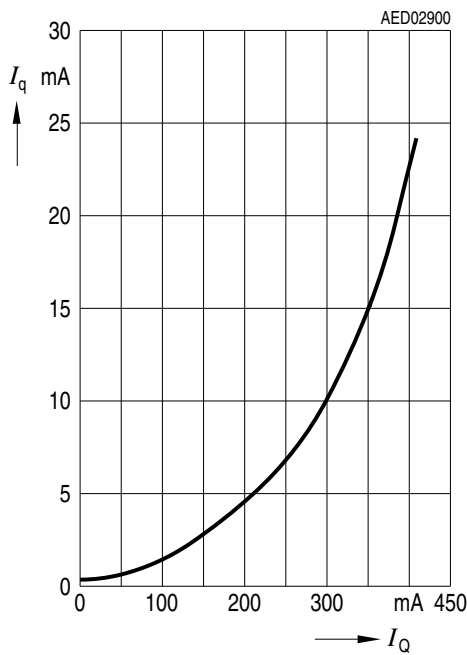
Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Enable off voltage range	$V_{EN\ OFF}$	–	–	0.5	V	$V_Q \leq 0.1\text{ V}$	P_4.1.15
Input current	$I_{EN}$	5	40	70	$\mu\text{A}$	$V_{EN} = 5\text{ V}$	P_4.1.16

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

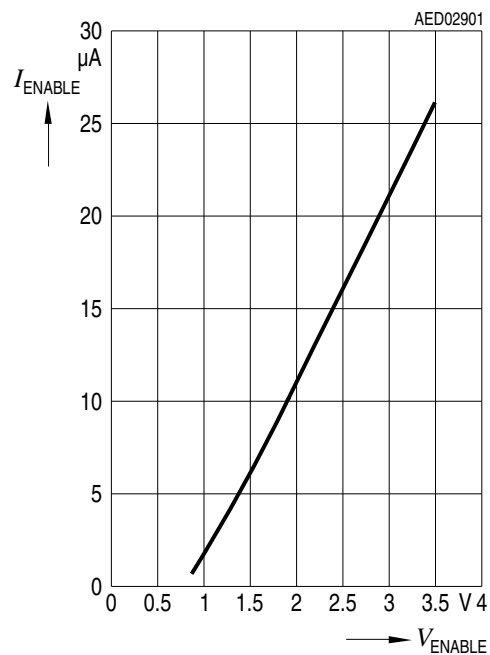
**4.1.1 Typical performance graphs**

**Typical performance characteristics**

**Quiescent current  $I_q$  versus output current  $I_Q$**



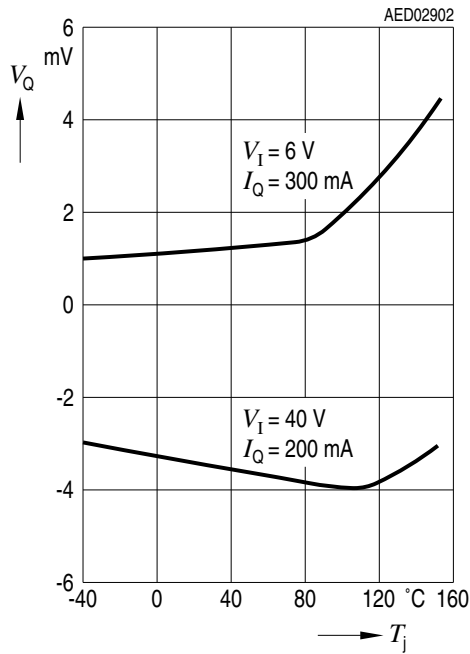
**Enable current  $I_{EN}$  versus enable voltage  $V_{EN}$**



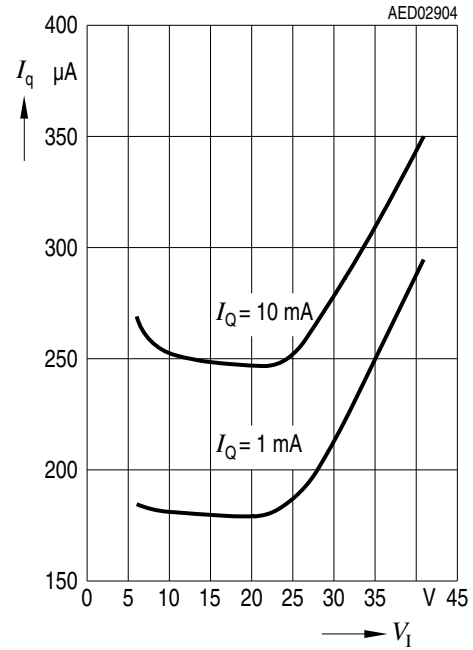


**Electrical characteristics**

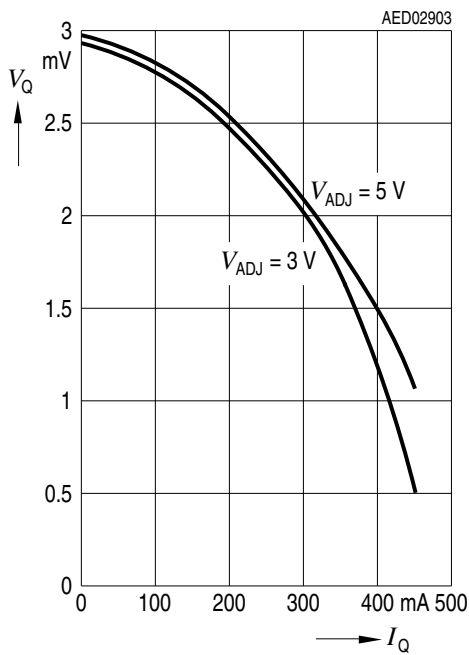
**Tracking accuracy  $\Delta V_Q$  versus junction temperature  $T_J$ ,  $V_{ADJ} = 5V$**



**Current consumption  $I_q$  versus input voltage  $V_I$ ,  $V_{ADJ} = 5V$**

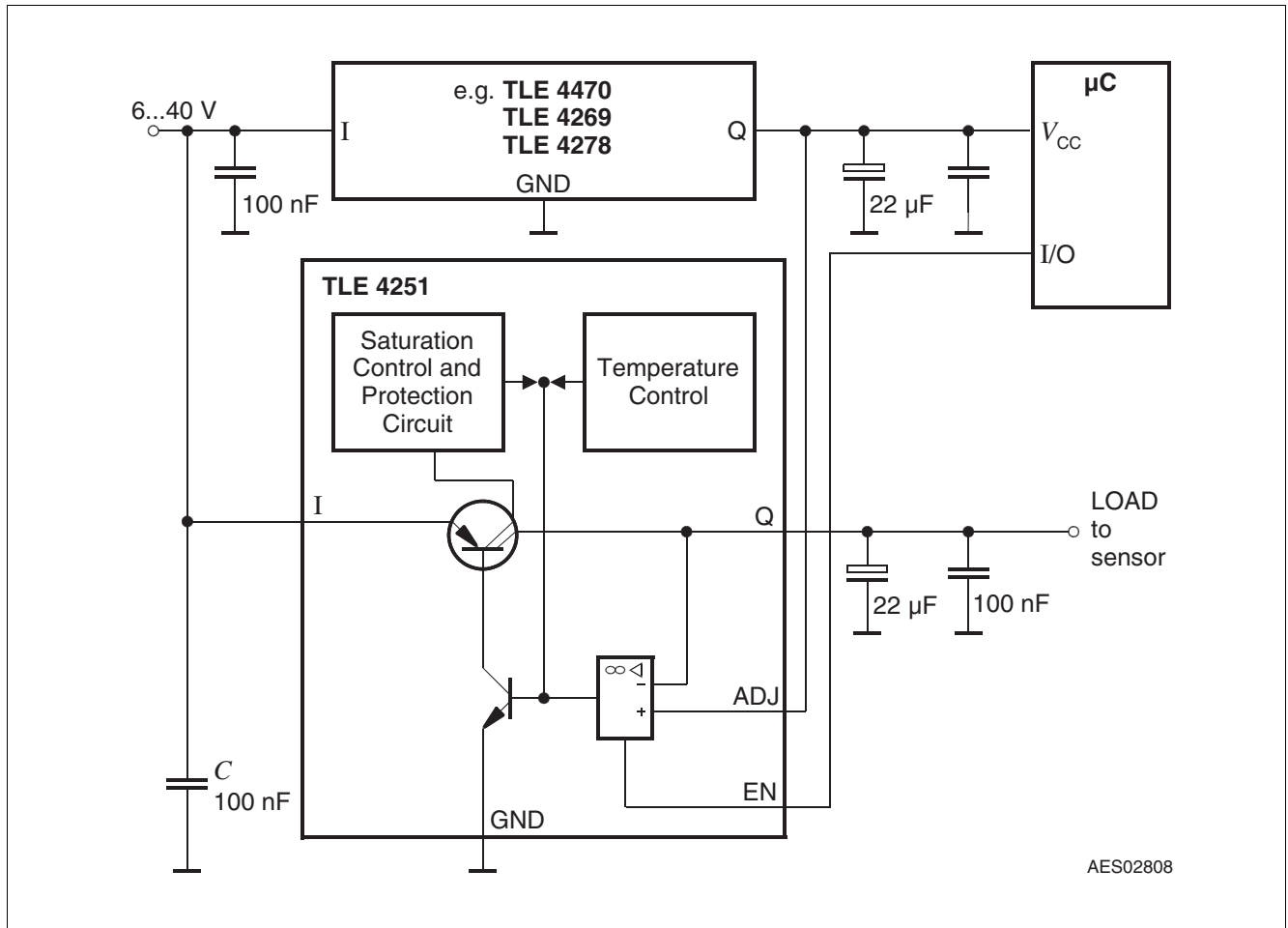


**Tracking accuracy  $\Delta V_Q$  versus output current  $I_Q$**



## 5 Application information

*Note: The following information is given as a hint for the implementation of the device only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device.*



**Figure 3 Application diagram**

*Note: This is a very simplified example of an application circuit. The function must be verified in the real application.*

### 5.1 Further application information

- Please contact us for information regarding the FMEA pin
- Existing Application Note (Title)
- For further information you may contact <https://www.infineon.com>

## 6 Package information

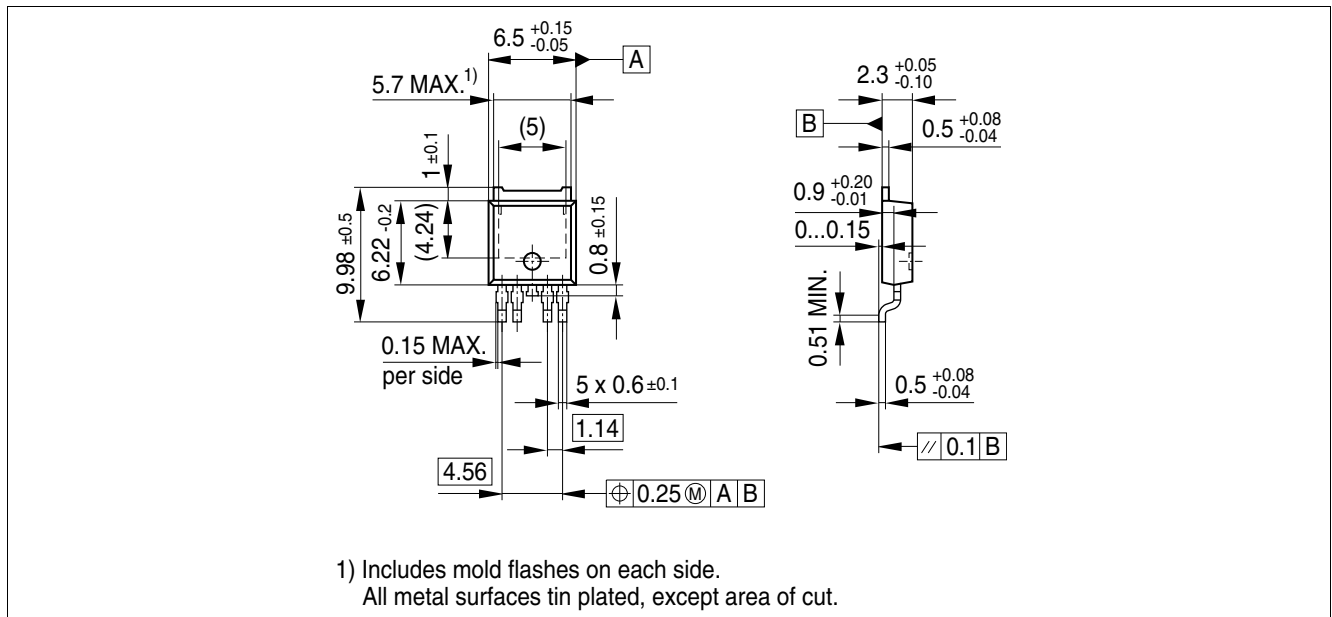


Figure 4 PG-T0252-5<sup>1)</sup>(Plastic transistor single outline)

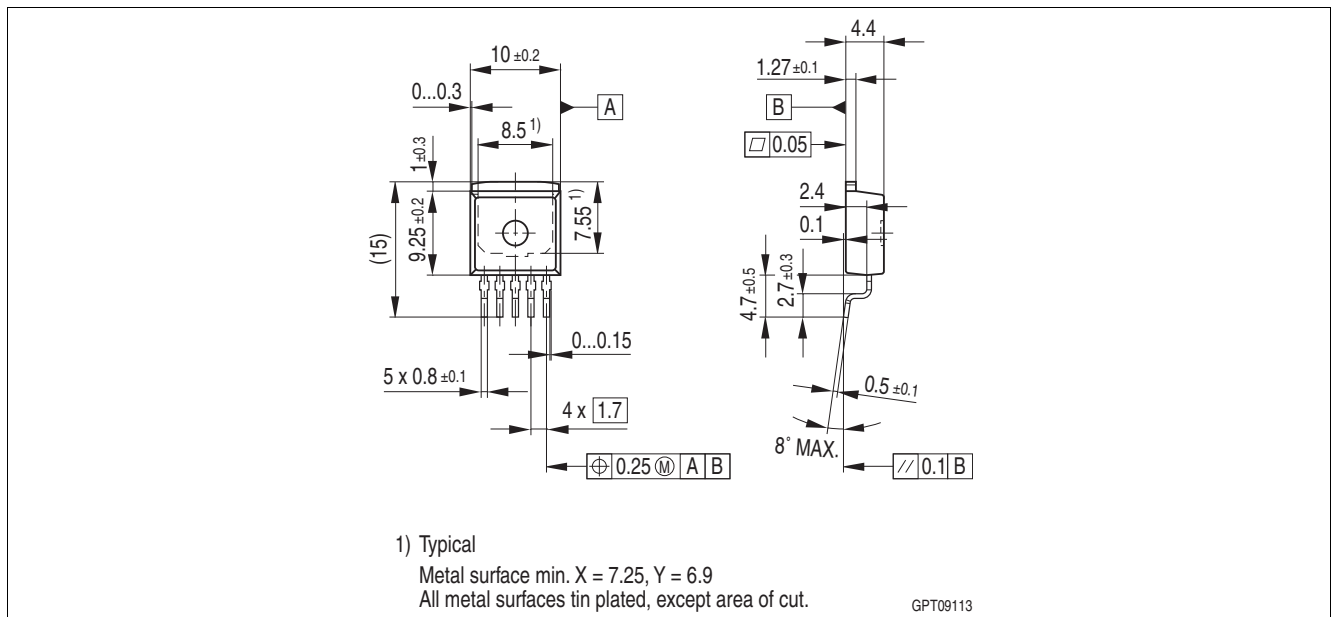


Figure 5 PG-T0263-5<sup>1)</sup>(Plastic transistor single outline)

### 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).

### Further information on packages

<https://www.infineon.com/packages>

1) Dimensions in mm

**Revision history**

## **7 Revision history**

<b>Revision</b>	<b>Date</b>	<b>Changes</b>
Rev. 3.0	2022-05-31	Updated layout and template Editorial changes
Rev. 2.9	2007-03-20	Initial version of RoHS-compliant derivate of TLE4251 Page 1: AEC certified statement added Page 1 and page 11: RoHS compliance statement and Green product feature added Page 1 and page 11: Package changed to RoHS compliant version Legal Disclaimer updated

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**Edition 2022-05-31**

**Published by**

**Infineon Technologies AG**

**81726 Munich, Germany**

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