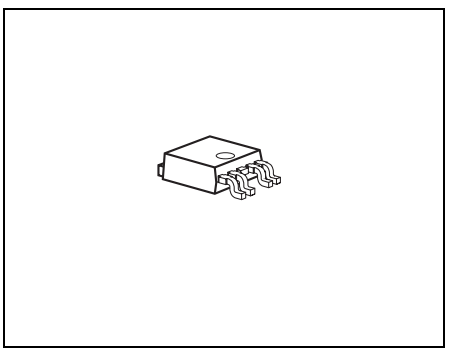
Low Drop Voltage Tracker

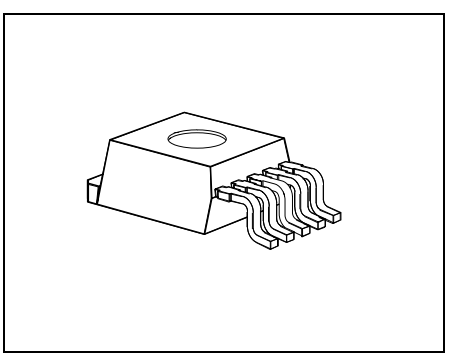
TLE 4251

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

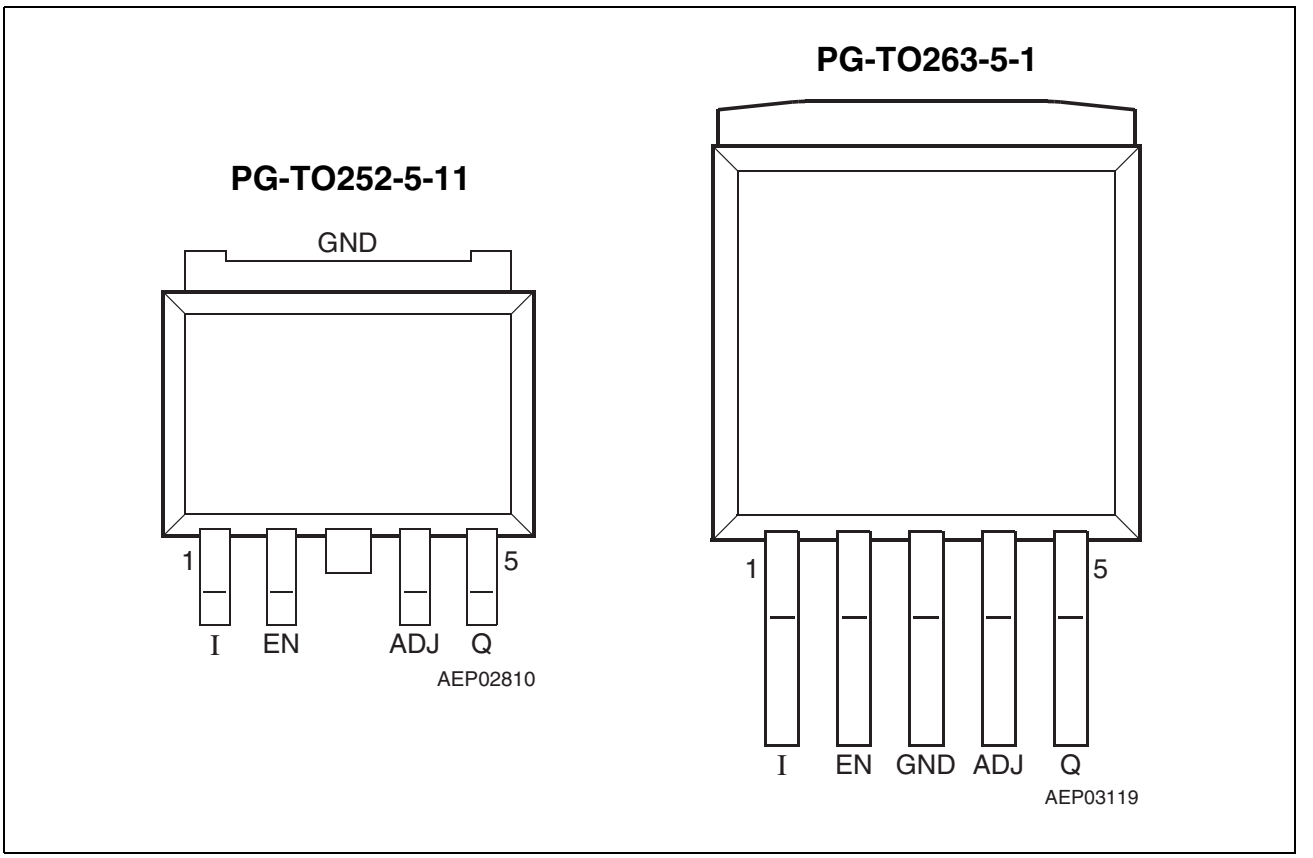


Figure 1 **Pin Configuration** (top view)

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

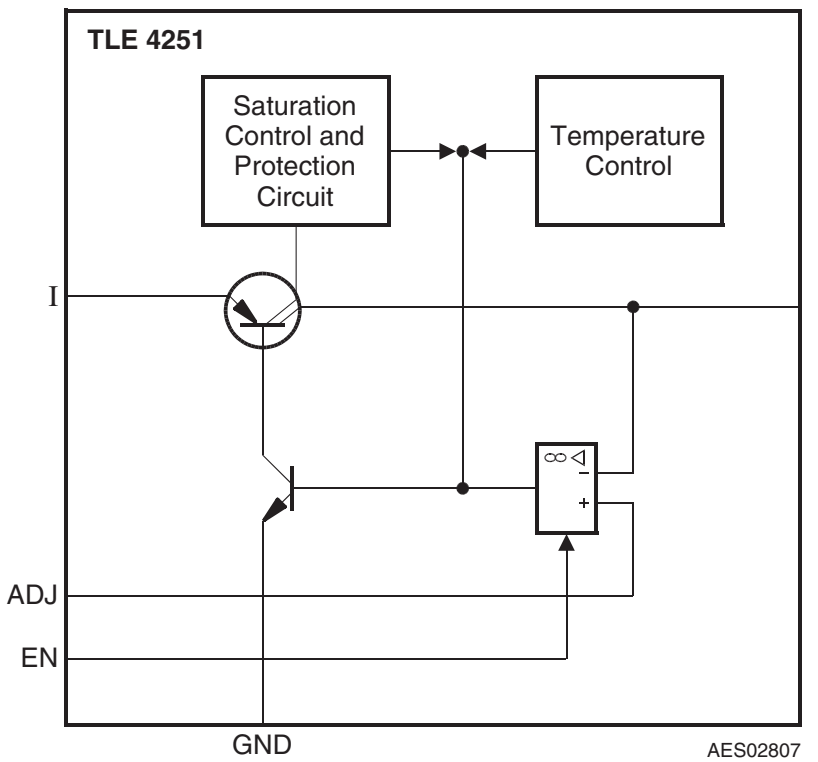


Figure 2 Block Diagram

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 $\Delta V_Q = V_{ADJ} - V_Q$	ΔV_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	ΔV_Q	-10	–	10	mV	6 V < V_I < 40 V; 5 mA < I_Q < 200 mA
Output voltage tracking accuracy	ΔV_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	ΔV_Q	-35	±5	35	mV	5 mA < I_Q < 300 mA; V_I = 6 V; V_{ADJ} = 5 V
Line regulation	ΔV_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

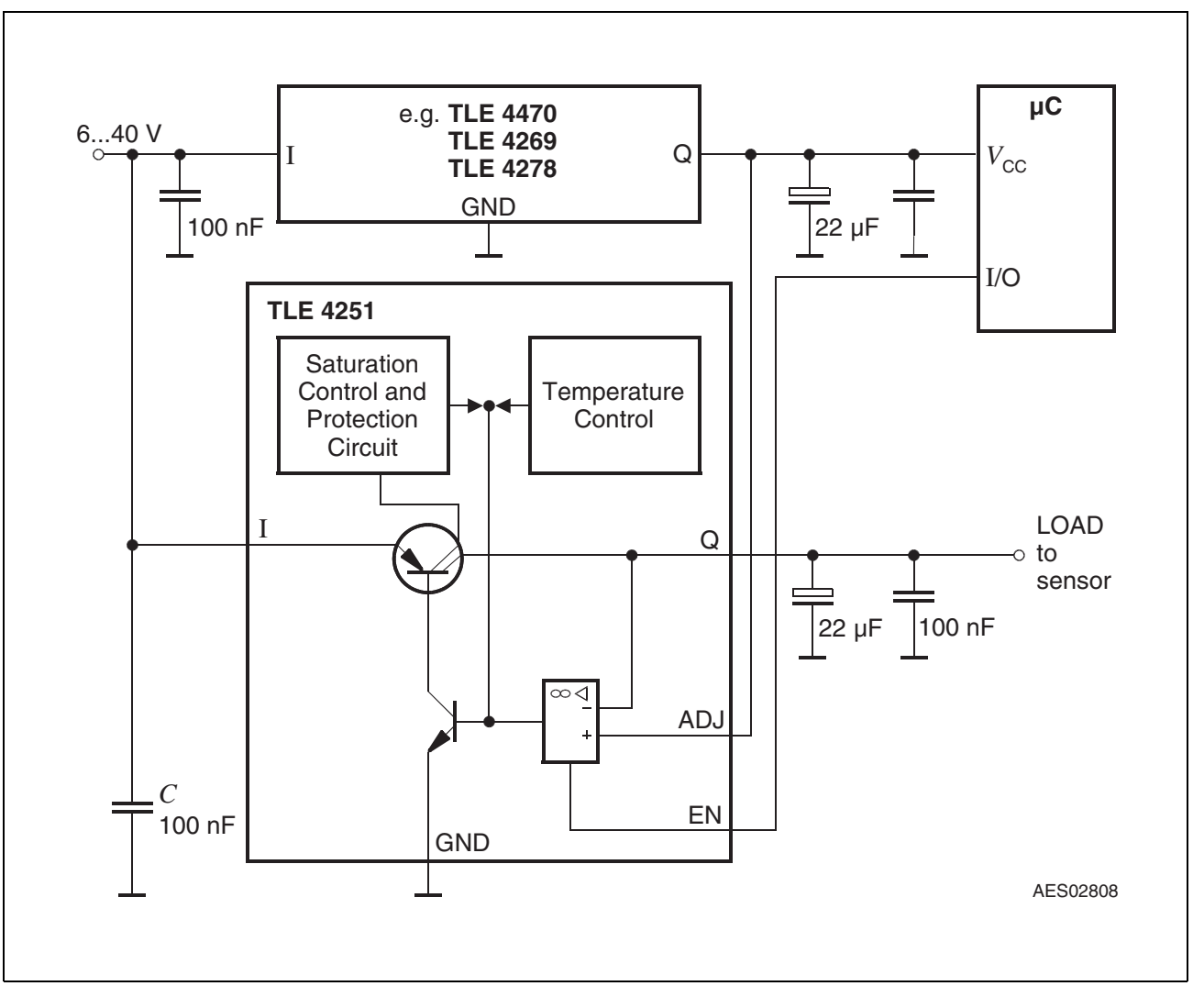
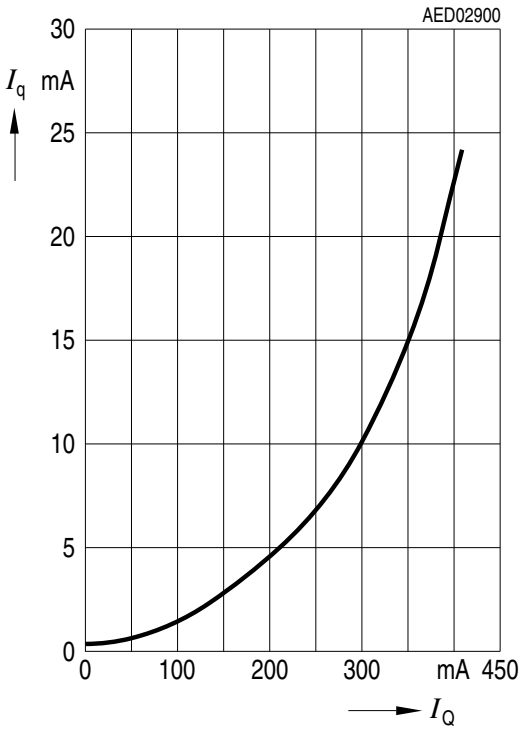
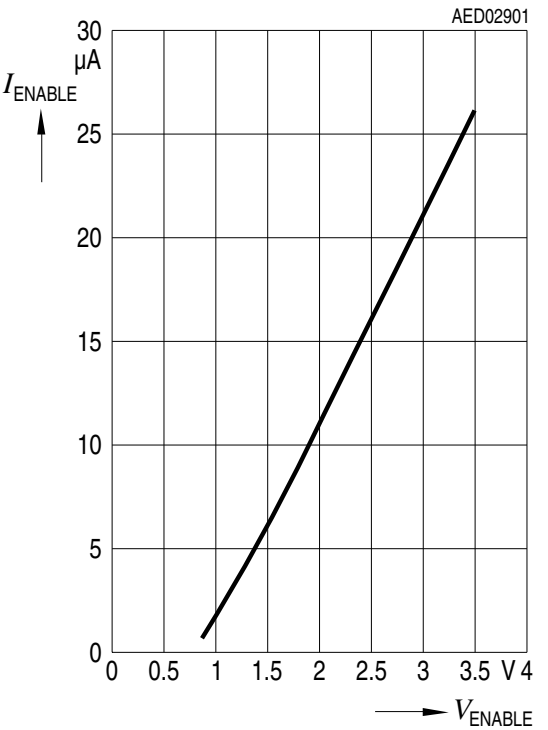


Figure 3 Application Circuit

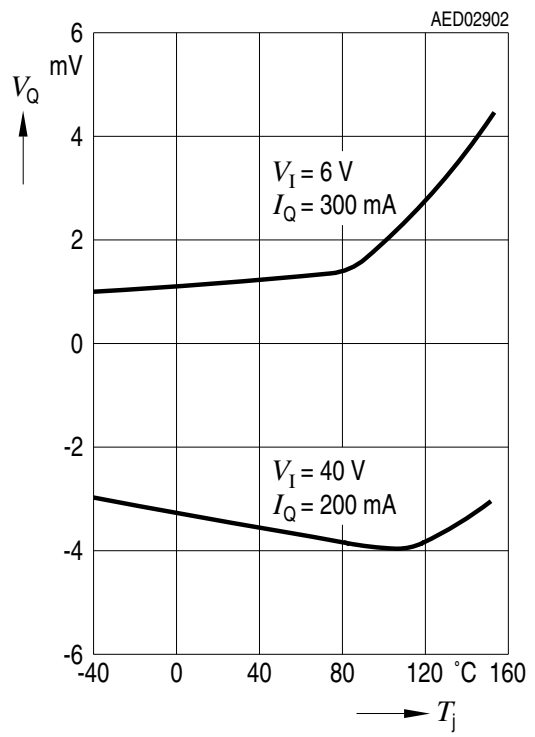
Quiescent Current I_q versus Output Current I_Q



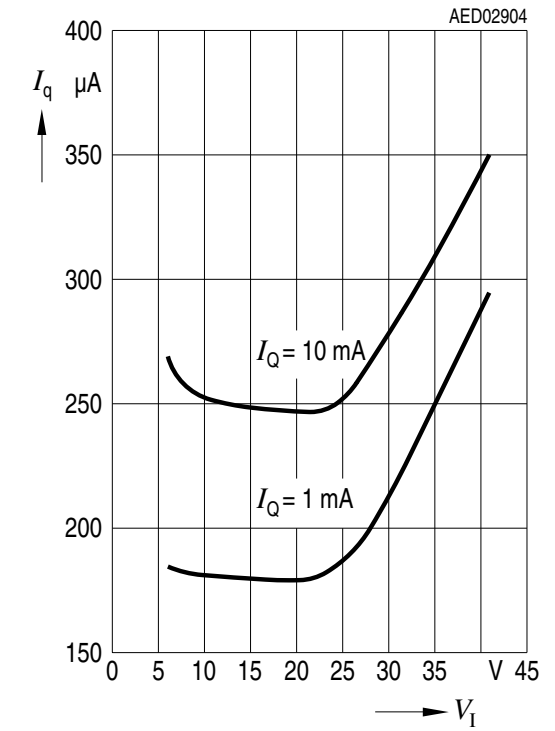
Enable Current I_{EN} versus Enable Voltage V_{EN}



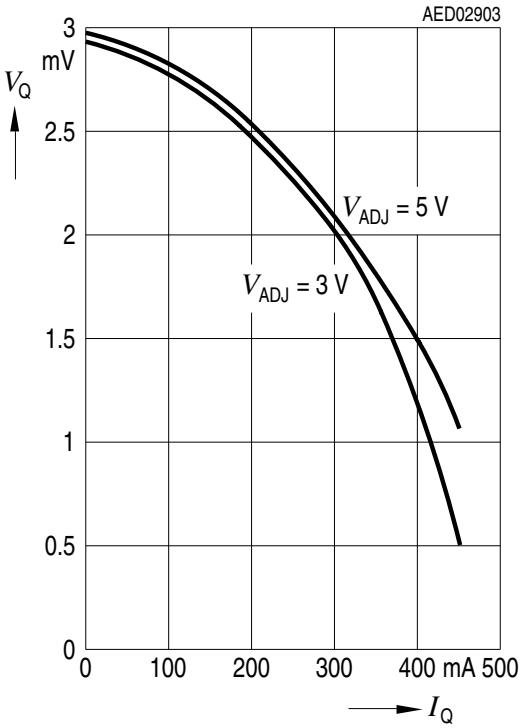
Tracking Accuracy ΔV_Q versus Temperature T_j, V_{ADJ} = 5 V



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



Tracking Accuracy ΔV_Q versus Output Current I_Q



Package Outlines

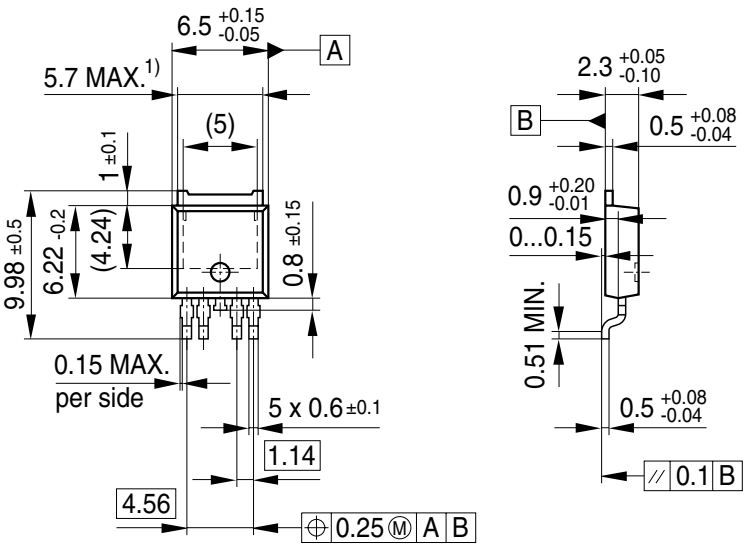


Figure 4 **PG-TO252-5-11** (Plastic Transistor Single Outline)

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

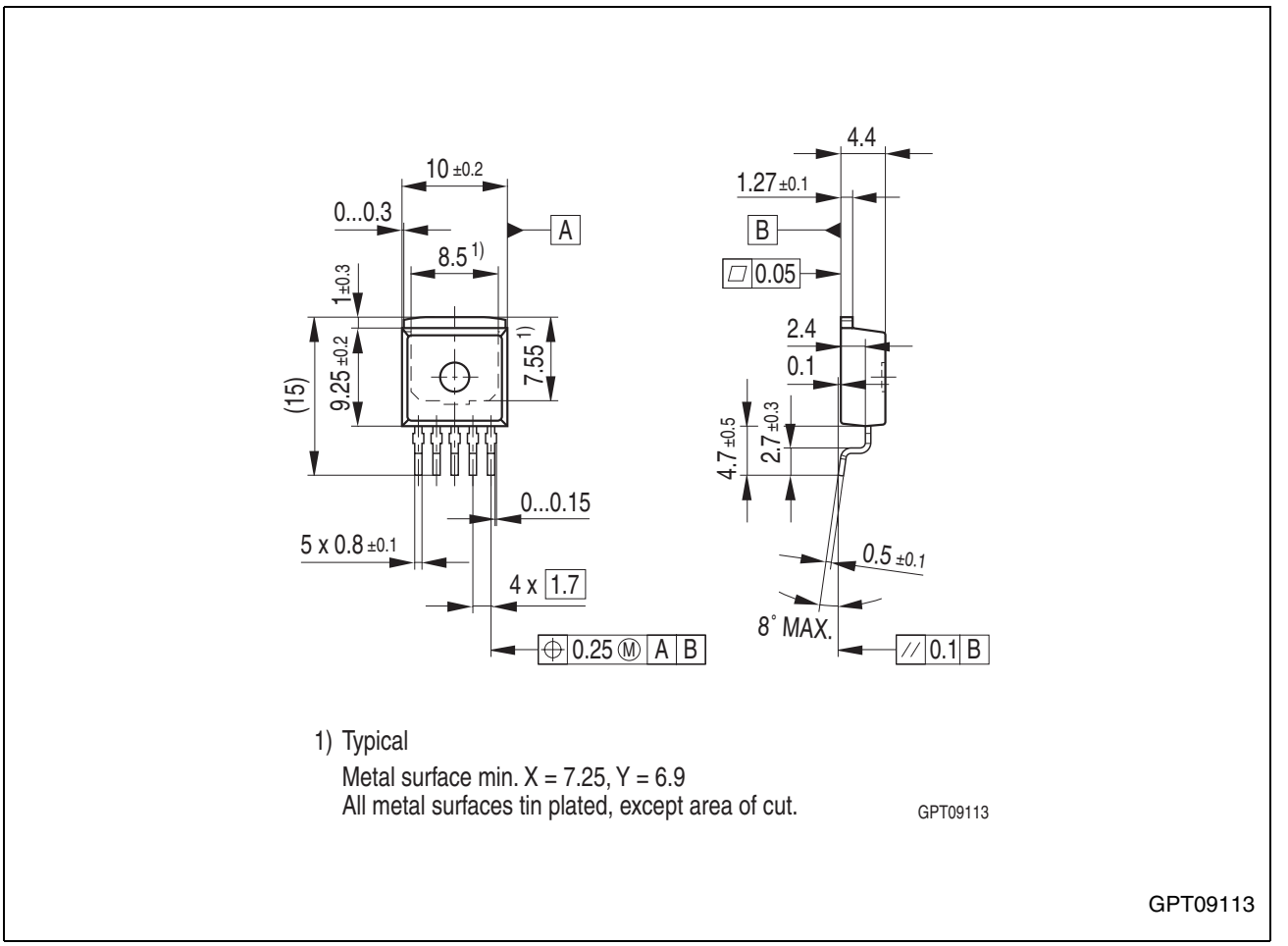

Figure 5 **PG-TO263-5-1** (Plastic Transistor Single Outline)

Green Product (RoHS compliant)

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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 **Page 1**: AEC certified statement added **Page 1** and **Page 10**: RoHS compliance statement and Green product feature added **Page 1** and **Page 10**: Package changed to RoHS compliant version Legal Disclaimer updated

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