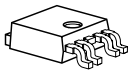
Low Drop Voltage Tracker

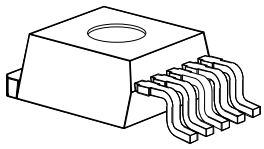
TLE 4251

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



P-TO252-5-1



P-TO263-5-1

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.

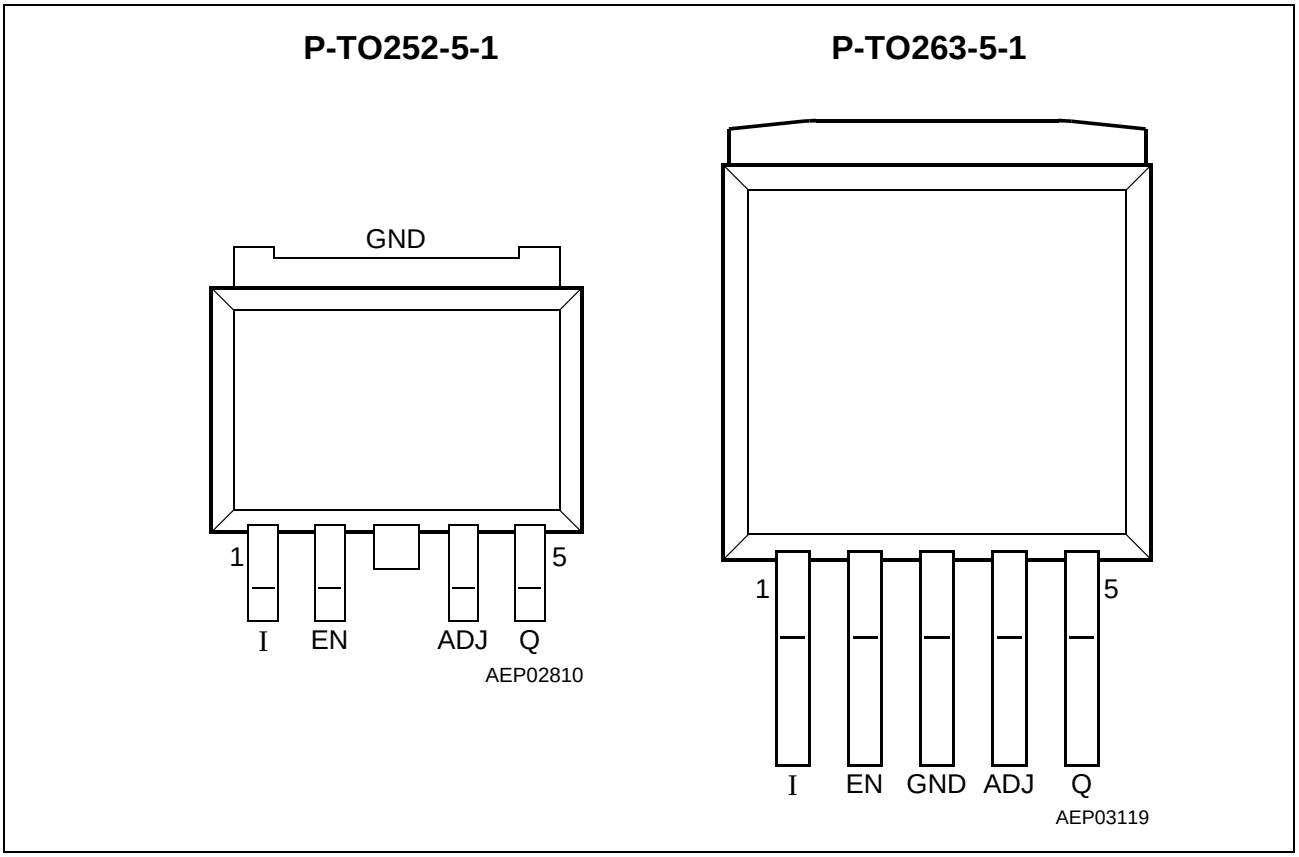


Figure 1 **Pin Configuration** (top view)

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 $C_Q \geq 22\ \mu F$, ESR $\leq 3\ \Omega$ to GND

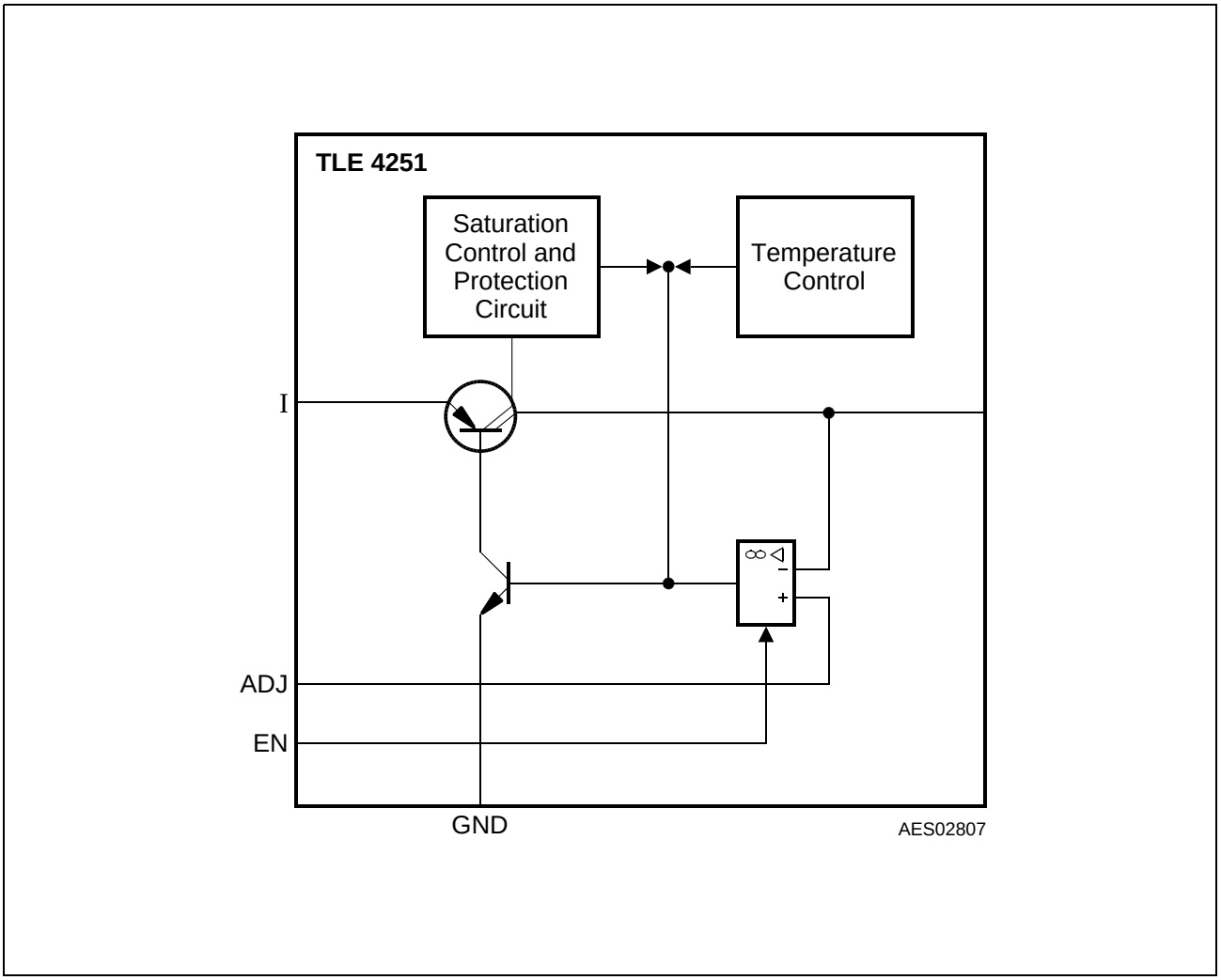


Figure 2 Block Diagram

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 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 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	$T_j \leq$ 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

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.		
Quiescent current (stand-by) $I_q = I_I - I_Q$	I_q	–	0	10	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 = 5 V_{PP}
Adjust Input						
Input biasing current	I_{ADJ}	–	0.1	0.5	µA	V_{ADJ} = 5 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 ≤ 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

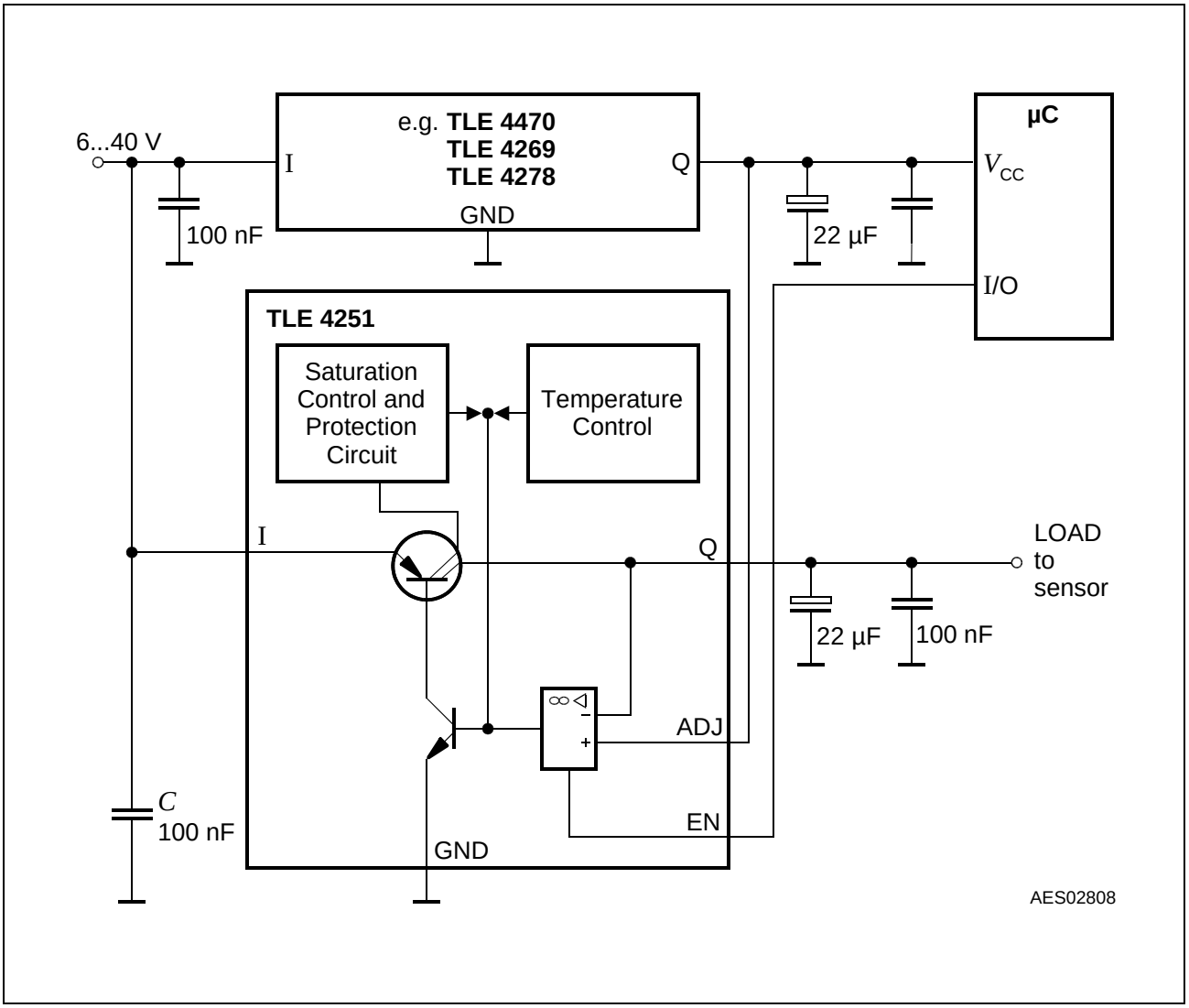
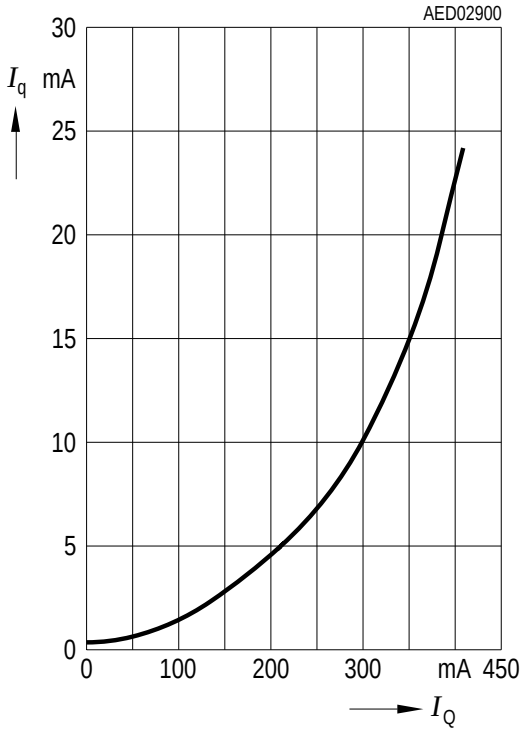
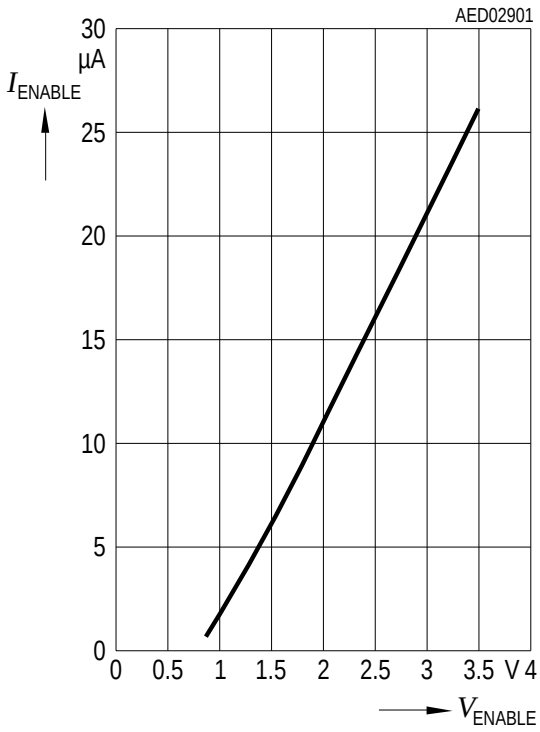


Figure 3 Application Circuit

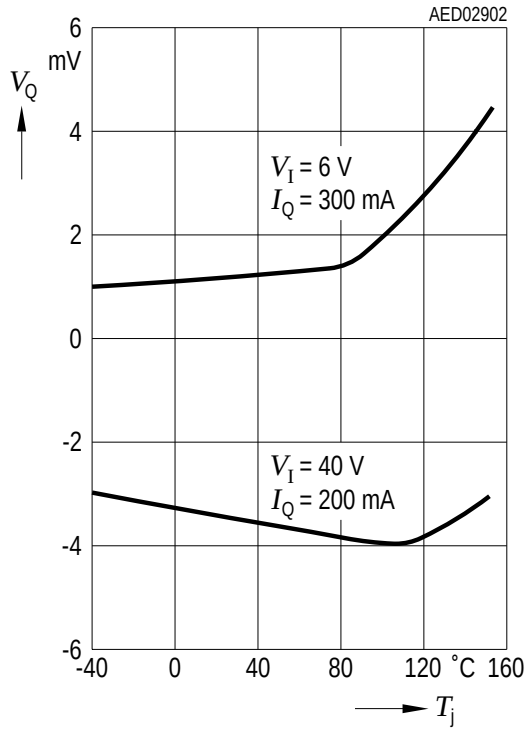
Quiescent Current I_q versus Output Current I_Q



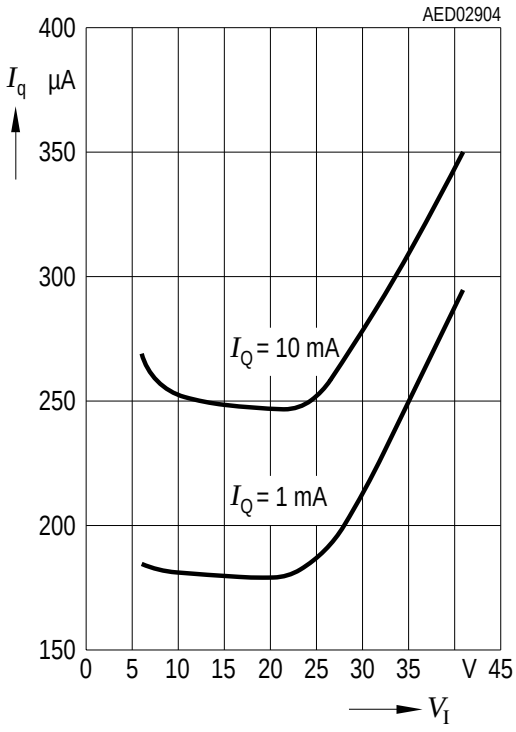
Enable Current I_{EN} versus Enable Voltage V_{EN}



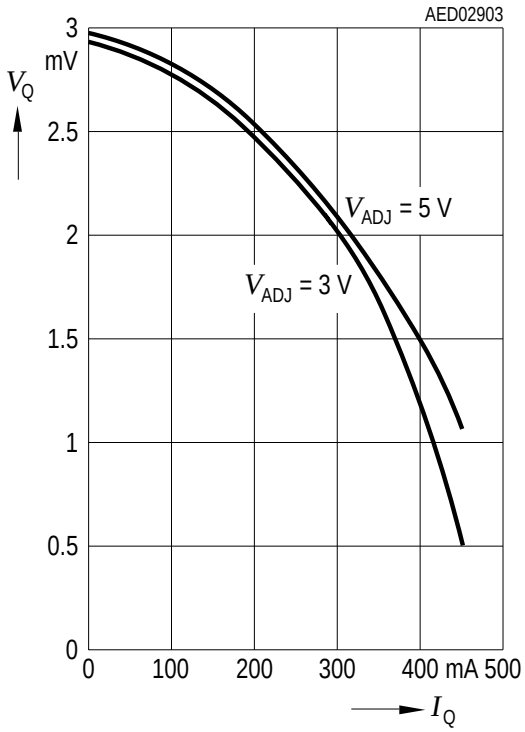
Tracking Accuracy ΔV_Q versus Temperature T_j, V_{ADJ} = 5 V



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

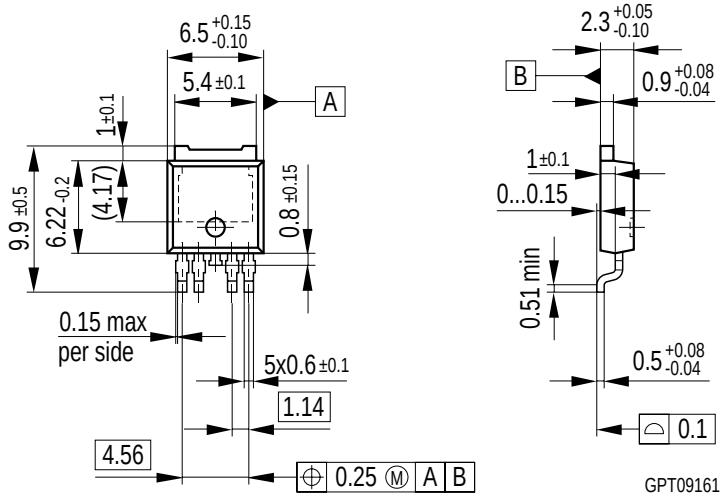


Tracking Accuracy ΔV_Q versus Output Current I_Q



Package Outlines

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



All metal surfaces tin plated, except area of cut.

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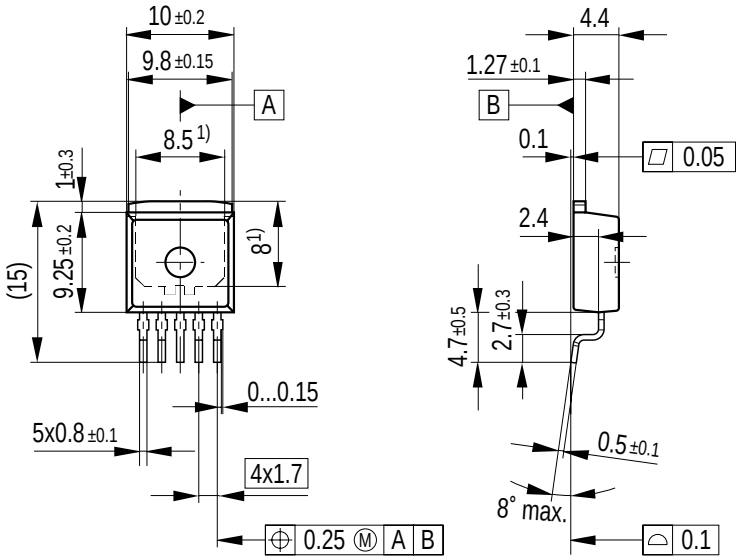

1) Typical

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

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