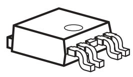
Tracking Regulator | **TLE 4252**

Features

- Output tracking tolerance to reference ≤ ±0.2%
- Output voltage adjust down to 1.5 V
- 250 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 to GND and Battery
- Overtemperature protection
- Reverse polarity proof



P-TO252-5-1

Short Functional Description

The **TLE 4252** is a monolithic integrated low-drop voltage tracking regulator in a very small SMD package P-TO252-5-1. It is designed to supply off-board systems, e.g. sensors in engine management systems under the severe conditions of automotive applications. Therefore the device is equipped with additional protection functions against reverse polarity and short circuit to GND and battery.

With supply voltages up to 40 V the output voltage follows a reference voltage applied at the adjust input with high accuracy. The reference voltage applied directly to the adjust input or by an e.g. external resistor divider can be 1.5 V at minimum.

The output is able to drive loads up to 250 mA at minimum while they follow e.g. the 5 V output of a main voltage regulator as reference with high accuracy.

The **TLE 4252** tracker can be switched into stand-by mode to reduce the current consumption to very low values. This feature makes the IC suitable for low power battery applications.

Type	Ordering Code	Package
TLE 4252 D	Q67006-A9669	P-TO252-5-1

Block Diagram

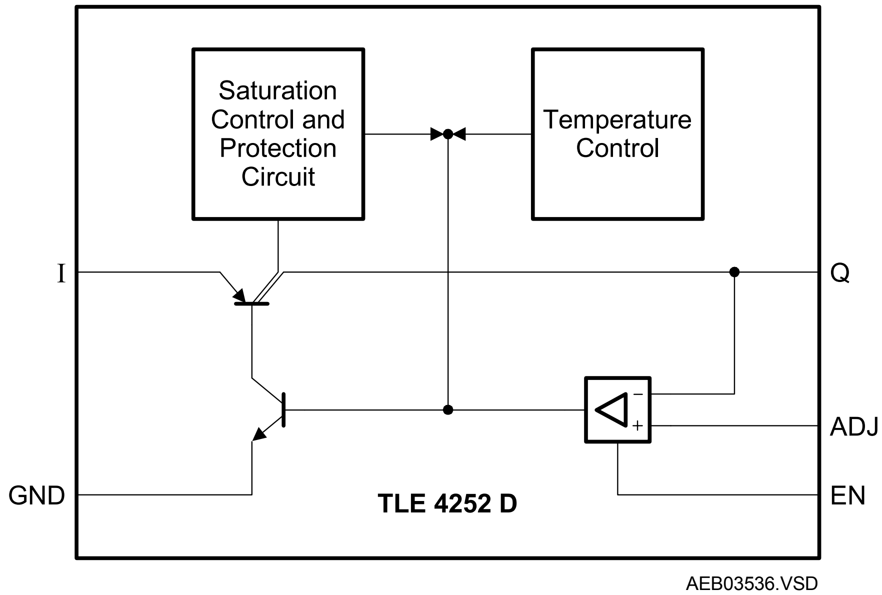


Figure 1 Internal Circuit Blocks

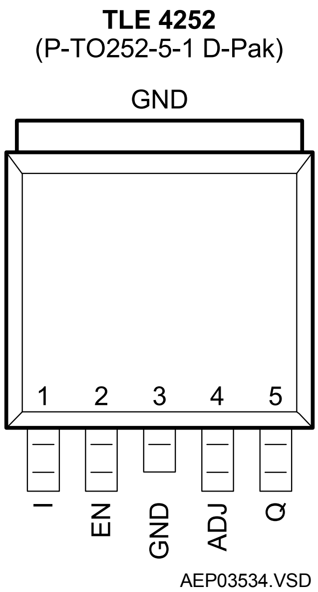


Figure 2 **Pin Configuration** (Draft, subject to alternation!)

Table 1 **Pin Definitions and Functions** (draft, subject to alternation)

Pin No.	Symbol	Function
1	I	**Supply voltage input;** Input for battery or a pre-regulated voltage of a e.g. DC to DC converter.
2	EN	**Enable input for tracker;** An active high signal turns on the device, with active low the tracker is turned off.
3	GND	**Ground;** Connected to the heatsink of the package.
4	ADJ	**Adjust input for tracker;** Input for the reference voltage which can be connected directly or by voltage divider to the reference (see **Application Information**).
5	Q	**Output voltage of tracker;** For a stable operation to avoid ringing at the output connect a capacitor of $C_Q \geq 10\ \mu F$ and $0 \leq ESR \leq 5\ \Omega$ to GND.

Table 2 Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
Supply Voltage Input I					
Voltage	V_I	-42	45	V	–
Current	I_I	–	–	A	Limited internally
Enable Input EN					
Voltage	V_{EN}	-42	45	V	–
Current	I_{EN}	–	–	A	Limited internally
Adjust Input ADJ					
Voltage	V_{ADJ}	-42	45	V	–
Current	I_{ADJ}	–	–	A	Limited internally
Output Q					
Voltage	V_Q	-2	45	V	–
Current	I_Q	–	–	A	Limited internally
Temperature					
Junction temperature	T_j	-40	150	°C	–
Storage temperature	T_{stg}	-50	150	°C	–
ESD-Protection					
Voltage	V_{ESD}	-2	2	kV	Human Body Model (HBM)

Note: Maximum ratings are absolute ratings, exceeding one of these values may cause irreversible damage to the integrated circuit!

Table 3 Operating Range

Parameter	Symbol	Limit Values			Unit	Remarks
		Min.	Typ.	Max.		
In- and Output Voltage						
Supply voltage	V_I	3.5	–	40	V	$V_I > V_{ADJ} + V_{dr}$
Enable input voltage	V_{EN}	0	–	40	V	–
Adjust input voltage	V_{ADJ}	1.5	–	40	V	–
Adjust input voltage	V_{ADJ}	0	–	1.5	V	$V_Q \le V_{ADJ} + \Delta V_Q$
Error amplifier common mode range	CMR	1.5	–	V_I - 0.5	V	$V_Q \le V_{ADJ} + \Delta V_Q$ with $V_{FB} = V_Q$
Temperature						
Junction temperature	T_j	-40	–	150	°C	–
Thermal Resistance P-TO252-5-1						
Junction to ambient	R_{thj-a}	–	–	144	K/W	Footprint only[1)]
Junction to ambient	R_{thj-a}	–	–	78	K/W	Heat sink area 300 mm^2 [1)]
Junction to ambient	R_{thj-a}	–	–	55	K/W	Heat sink area 600 mm^2 [1)]
Junction to case	R_{thj-c}	–	–	2	K/W	–

1) Worst case regarding peak temperature; zero airflow; mounted on FR4; 80 × 80 × 1.5 mm^3; 35 µ Cu; 5 µ Sn

Note: Within this operating range the IC is functional. The electrical characteristics, however, are not guaranteed over this full range given above.

Table 4 Electrical Characteristics

V_I = 13.5 V; 1.5 V ≤ V_{ADJ} ≤ V_I - 0.6 V; -40 °C < T_j < 150 °C; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
Regulator Performance, Tracker Output Q						
Output voltage tracking accuracy $\Delta V_Q = V_{ADJ} - V_Q$	ΔV_Q	-10	–	10	mV	4.5 V < V_I < 26 V; 1 mA < I_Q < 200 mA;
Output voltage tracking accuracy $\Delta V_Q = V_{ADJ} - V_Q$	ΔV_Q	-10	–	10	mV	3.5 V < V_I < 32 V; 10 mA < I_Q < 100 mA;
		-25	–	25	mV	3.5 V < V_I < 4.5 V; 1 mA < I_Q < 200 mA;
Drop voltage	V_{dr}	–	280	600	mV	I_Q = 200 mA; V_{ADJ} > 3.5 V; $V_{EN} = V_{EN, on}$ [1)]
Output current	I_Q	250	350	500	mA	V_Q = 5.0 V[2)]
Output capacitor	C_Q	10	–	–	µF	0 ≤ ESR ≤ 5 Ω at 10 kHz
Current consumption $I_q = I_I - I_Q$	I_q	–	10	25	mA	I_Q = 200 mA; V_Q = 5 V
Current consumption $I_q = I_I - I_Q$	I_q	–	100	150	µA	I_Q < 100 µA; T_j < 85 °C; V_{EN} = 5 V
Quiescent current (stand-by) $I_q = I_I - I_Q$	I_q	–	0	2	µA	V_{EN} = 0 V; $V_{EN/ADJ}$ = 0 V; T_j < 85 °C
Reverse current	I_r	–	0.5	5	mA	V_Q = 16 V; V_I = 0 V
Load regulation	ΔV_Q	–	–	10	mV	1 mA < I_Q < 200 mA
Line regulation	ΔV_Q	–	–	10	mV	5 V < V_I < 32 V; I_Q = 5 mA
Power supply ripple rejection	*PSSR*	–	60	–	dB	$f_{I, ripple}$ = 100 Hz; $V_{I, ripple}$ = 0.5 Vpp[3)]

Table 4 Electrical Characteristics (cont'd)

V_I = 13.5 V; 1.5 V ≤ V_{ADJ} ≤ V_I - 0.6 V; -40 °C < T_j < 150 °C; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
Adjust Input ADJ						
Input biasing current	I_{ADJ}	–	0.1	0.5	µA	V_{ADJ} = 5 V
Enable Input EN						
Device on voltage range	$V_{EN, on}$	2.0	–	40	V	V_Q settled
Device off voltage range	$V_{EN, off}$	0	–	0.8	V	V_Q < 0.1 V
Input current	I_{EN}	-1	2	5	µA	V_{EN} = 5 V
EN pull-down resistor	R_{EN}	–	1.5	–	MΩ	–

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

2) The current limit depends also on the input voltage, see graph output current vs. input voltage in the diagrams section.

3) Specified by design. Not subject to production test.

Application Information

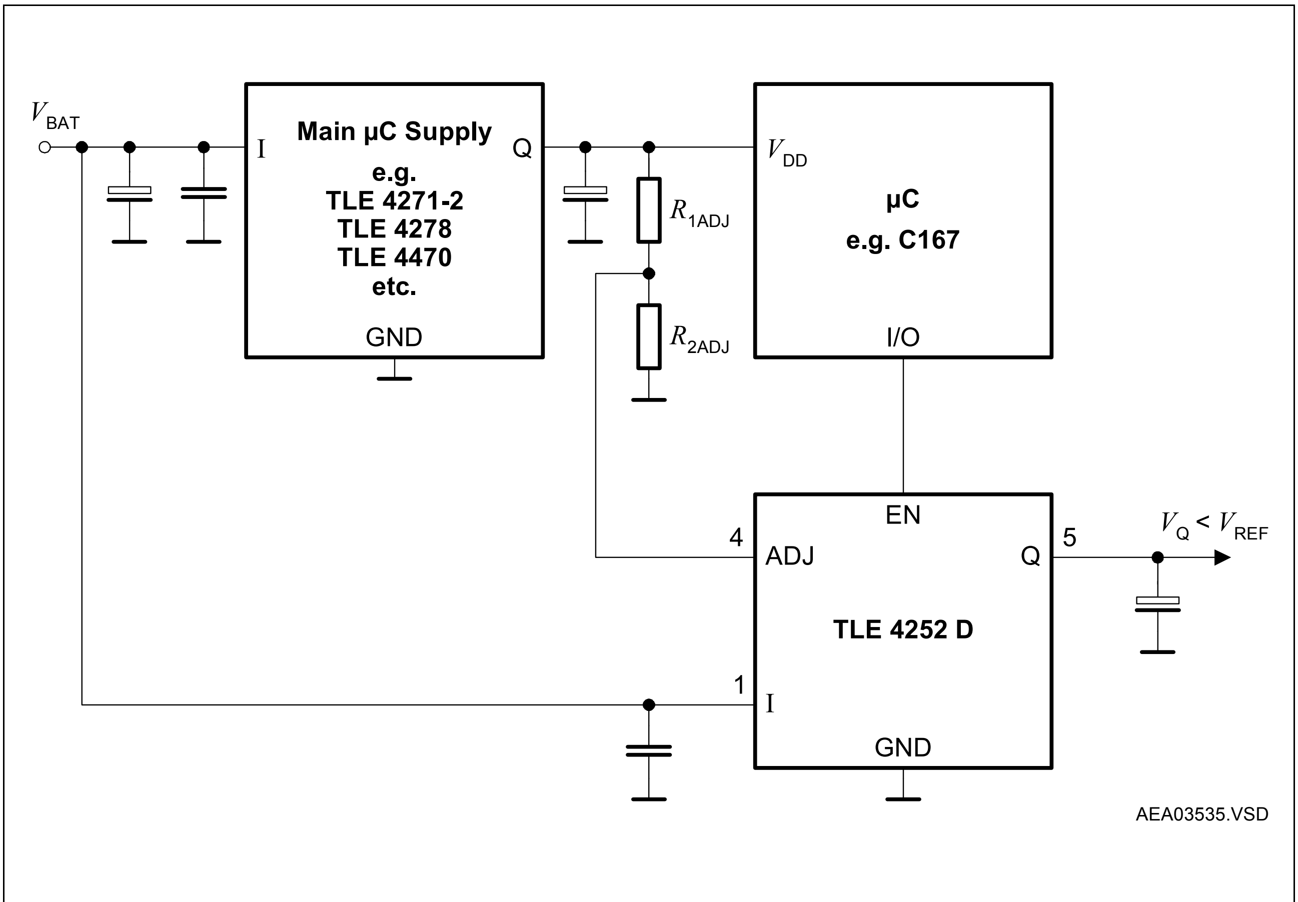


Figure 3 Application Circuit: Output Voltage < Reference Voltage

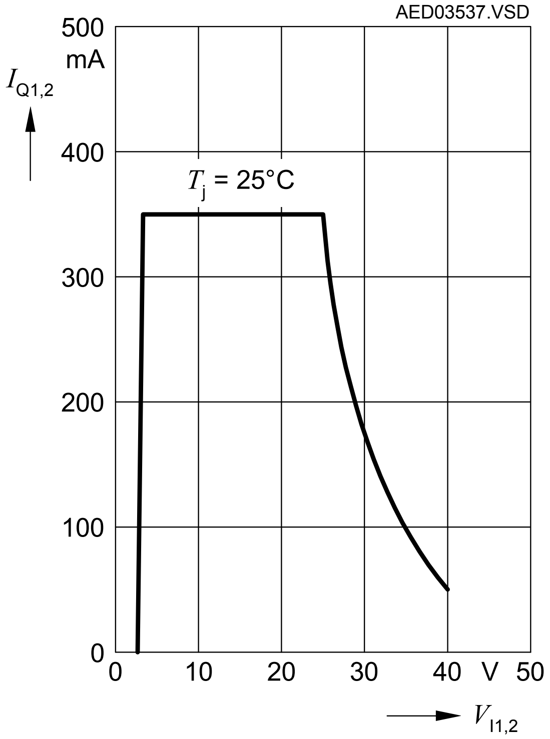
Figure 3 shows a typical application circuit with $V_Q < V_{REF}$. Of course, also $V_Q = V_{REF}$ is feasible by directly connecting the reference pin of the TLE 4252 D to the appropriate voltage level without voltage divider.

The output voltage calculates to:

$$V_Q = V_{REF} \times \left(\frac{R_{2ADJ}}{R_{1ADJ} + R_{2ADJ}} \right) \quad (1)$$

Diagrams

Output Current Limit I_Q versus Input Voltage V_I



Package Outlines

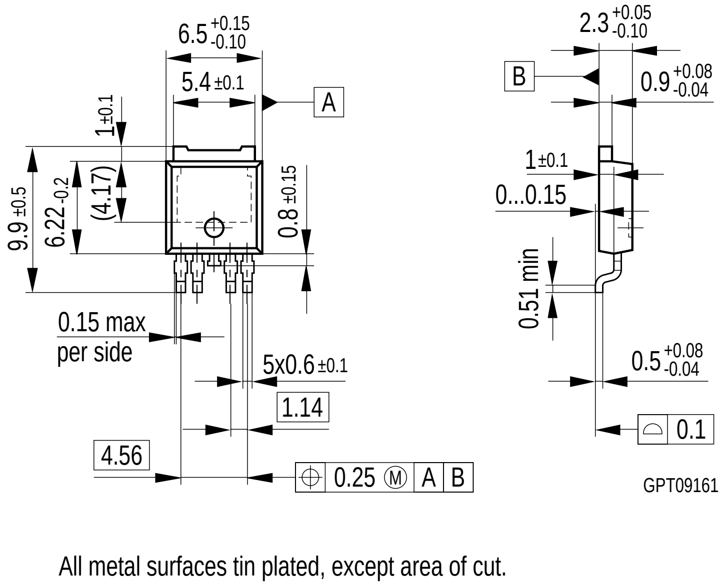


Figure 4 **P-TO252-5-1** (Plastic Transistor Single Outline)

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SMD = Surface Mounted Device

Dimensions in mm

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