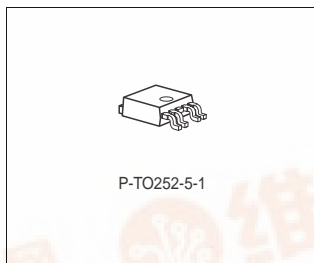


## 5-V Low Drop Voltage Regulator

## TLE 7270

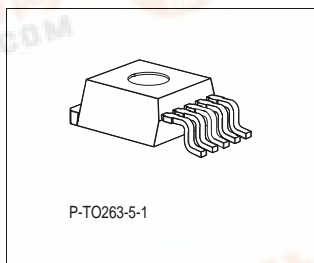
### Features

- Output voltage 5 V  $\pm 2\%$
- Ultra low current consumption: typ. 20  $\mu$ A
- 300 mA current capability
- Reset Feature
- Very low-drop voltage
- Short-circuit-proof
- Suitable for use in automotive electronics

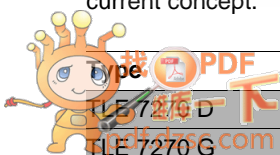


### Functional Description

The TLE 7270 is a monolithic integrated low-drop voltage regulator which can supply loads up to 300 mA. An input voltage up to 42 V is regulated to  $V_{Q,nom} = 5.0$  V with a precision of  $\pm 2\%$ . Due to its integrated reset circuitry featuring a 2-step adjustable power on timing and output voltage monitoring the IC is well suited for  $\mu$ -controller supplies. The sophisticated design allows to achieve stable operation even with ceramic output capacitors down to 470 nF. The device is designed for the harsh environment of automotive applications. Therefore it is protected against overload, short circuit and overtemperature conditions. Of course the TLE 7270 can be used also in all other applications, where a stabilized 5 V voltage is required. Due to its ultra low current consumption the TLE 7270 is dedicated for use in applications permanently connected to  $V_{BAT}$ . An integrated output sink current circuitry keeps the voltage at the Output pin Q below 5.5 V even when reverse currents are applied. Thus connected devices are protected from overvoltage damage. For applications requiring extremely low noise levels the Infineon voltage regulator family TLE 42XY and TLE 44XY is more suited than the TLE 7270. A mV-range output noise on the TLE 7270 caused by the charge pump operation is unavoidable due to the ultra low quiescent current concept.

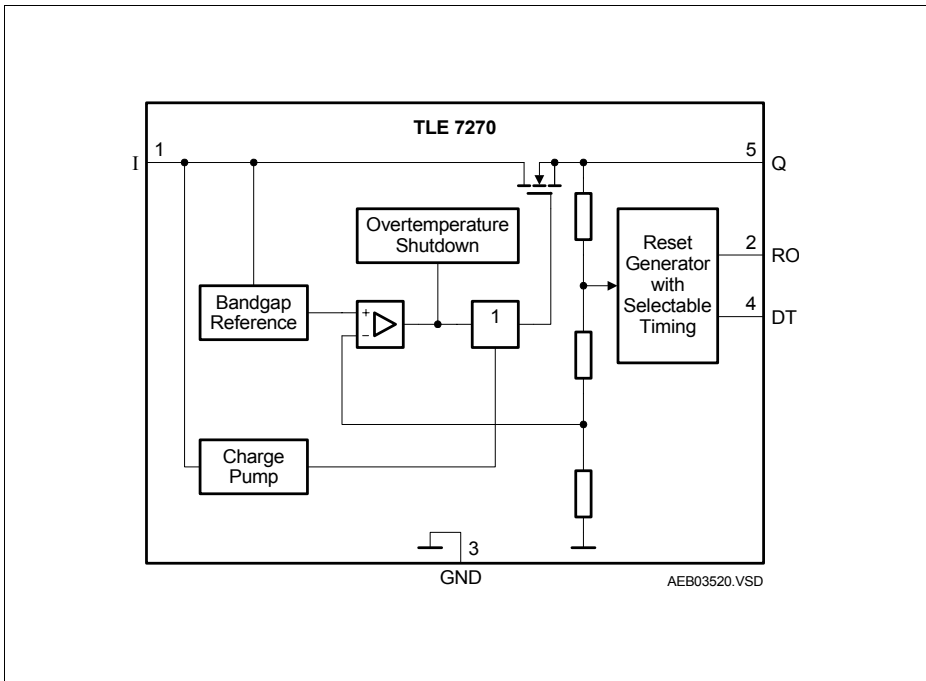


| Type       | Ordering Code | Package     |
|------------|---------------|-------------|
| TLE 7270 G | Q67006-A9670  | P-T0252-5-1 |
| TLE 7270 G | on request    | P-T0263-5-1 |

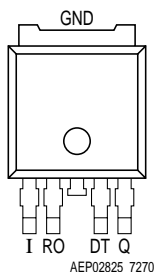


## Reset

The Reset pin informs e.g. the microcontroller in case the output voltage has fallen below the lower threshold  $V_{RT}$  of typ. 4.65 V. The hysteresis is typically 100mV. Connecting the regulator to a battery voltage at first the reset signal remains LOW. When the output voltage has reached the reset threshold  $V_{RT}$  the reset output RO remains still LOW for the reset delay time  $t_{rd}$  adjustable in 2 steps via the DT Pin. Afterwards the reset output turns HIGH.



**Figure 1**      **Block Diagram**



**Figure 2** Pin Configuration P-TO252-5-1 (D-PAK), P-TO263-5-1 (top view)

**Table 1** Pin Definitions and Functions

| Pin No. | Symbol | Function   |
|---------|--------|--|
| 1       | I      | <b>Input;</b> block to ground directly at the IC with a ceramic capacitor.   |
| 2       | RO     | <b>Reset Output.</b> Open Collector Output with integrated pull-up resistor of typically 30k $\Omega$ . Optional external pull-up resistor of $\geq 10\text{ k}\Omega$ to pin Q. |
| 3       | GND    | <b>Ground;</b> Pin 3 internally connected to heatsink.   |
| 4       | DT     | <b>Delay Time;</b> connect to Q or GND to choose reset delay time.   |
| 5       | Q      | <b>Output;</b> block to ground with a ceramic capacitor, $C \geq 470\text{ nF}$ .  |

**Table 2 Absolute Maximum Ratings**

| Parameter            | Symbol           | Limit Values |      | Unit | Test Condition         |
|----------------------|------------------|--------------|------|------|------------------------|
|                      |                  | Min.         | Max. |      |                        |
| Input I              |                  |              |      |      |                        |
| Voltage              | $V_I$            | -0.3         | 45   | V    | –                      |
| Current              | $I_I$            | -1           | –    | mA   | –                      |
| Output Q             |                  |              |      |      |                        |
| Voltage              | $V_Q$            | -0.3         | 5.5  | V    | –                      |
| Voltage              | $V_Q$            | -0.3         | 6.2  | V    | $t < 10\text{ s}^{1)}$ |
| Current              | $I_Q$            | -1           | –    | mA   | –                      |
| Reset Output RO      |                  |              |      |      |                        |
| Voltage              | $V_{RO}$         | -0.3         | 5.5  | V    | –                      |
| Voltage              | $V_{RO}$         | -0.3         | 6.2  | V    | $t < 10\text{ s}^{1)}$ |
| Current              | $I_{RO}$         | -1           | 1    | mA   | –                      |
| Delay Time DT        |                  |              |      |      |                        |
| Voltage              | $V_{DT}$         | -0.3         | 5.5  | V    | –                      |
| Voltage              | $V_{DT}$         | -0.3         | 6.2  | V    | $t < 10\text{ s}^{1)}$ |
| Current              | $I_{DT}$         | -1           | 1    | mA   | –                      |
| Temperature          |                  |              |      |      |                        |
| Junction temperature | $T_j$            | -40          | 150  | °C   | –                      |
| Storage temperature  | $T_{\text{sta}}$ | -50          | 150  | °C   | –                      |

1) Exposure to these absolute maximum ratings for extended periods ( $t > 10 \text{ s}$ ) may affect device reliability.

*Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

**Table 3 Operating Range**

| Parameter            | Symbol | Limit Values |      | Unit | Remarks |
|----------------------|--------|--------------|------|------|---------|
|                      |        | Min.         | Max. |      |         |
| Input voltage        | $V_I$  | 5.5          | 42   | V    | –       |
| Junction temperature | $T_j$  | -40          | 150  | °C   | –       |

*Note: In the operating range, the functions given in the circuit description are fulfilled.*

**Table 4 Thermal Resistance**

| Parameter        | Symbol      | Limit Values |                  | Unit | Remarks             |
|------------------|-------------|--------------|------------------|------|---------------------|
|                  |             | Min.         | Max.             |      |                     |
| Junction case    | $R_{thj-c}$ | –            | 10 <sup>1)</sup> | K/W  | –                   |
| Junction ambient | $R_{thj-a}$ | –            | 80 <sup>1)</sup> | K/W  | TO252 <sup>2)</sup> |
| Junction ambient | $R_{thj-a}$ | –            | 55 <sup>1)</sup> | K/W  | TO263 <sup>3)</sup> |

1) Target values need to be verified

2) Worst case, regarding peak temperature; zero airflow; mounted on a PCB FR4, 80 × 80 × 1.5 mm<sup>3</sup>, heat sink area 300 mm<sup>2</sup>

3) Worst case, regarding peak temperature; zero airflow; mounted on a PCB FR4, 80 × 80 × 1.5 mm<sup>3</sup>, heat sink area 300 mm<sup>2</sup>

**Table 5 Electrical Characteristics**

$V_I = 13.5 \text{ V}$ ;  $-40 \text{ }^{\circ}\text{C} < T_j < 150 \text{ }^{\circ}\text{C}$  (unless otherwise specified)

| Parameter                                 | Symbol             | Limit Values |      |      | Unit | Measuring Condition  |
|---|--------------------|--------------|------|------|------|--|
|   |                    | Min.         | Typ. | Max. |      |  |
| Output Q                                  |                    |              |      |      |      |  |
| Output voltage                            | $V_Q$              | 4.9          | 5.0  | 5.1  | V    | 0.1 mA< $I_Q$ <300 mA;<br>6 V < $V_I$ < 16 V                       |
| Output voltage                            | $V_Q$              | 4.9          | 5.0  | 5.1  | V    | 0.1 mA< $I_Q$ <100 mA;<br>6 V < $V_I$ < 40 V                       |
| Output current limitation                 | $I_Q$              | 320          | —    | —    | mA   | <sup>1)</sup>  |
| Output current limitation                 | $I_Q$              |              |      | 800  | mA   | $V_Q$ =0V  |
| Current consumption;<br>$I_q = I_I - I_Q$ | $I_q$              | —            | 20   | 30   | μA   | $I_Q = 0.1 \text{ mA}$ ;<br>$T_j = 25 \text{ }^{\circ}\text{C}$    |
| Current consumption;<br>$I_q = I_I - I_Q$ | $I_q$              | —            | —    | 40   | μA   | $I_Q = 0.1 \text{ mA}$ ;<br>$T_j \leq 80 \text{ }^{\circ}\text{C}$ |
| Drop voltage                              | $V_{dr}$           | —            | 200  | 500  | mV   | $I_Q = 200 \text{ mA}$<br>$V_{dr} = V_I - V_Q$ <sup>1)</sup>       |
| Load regulation                           | $\Delta V_{Q, lo}$ | — 40         | 15   | 40   | mV   | $I_Q = 5 \text{ mA}$ to 250 mA                                     |
| Line regulation                           | $\Delta V_{Q, li}$ | — 20         | 5    | 20   | mV   | $V_I = 10 \text{ V}$ to 32 V;<br>$I_Q = 5 \text{ mA}$              |

| Parameter                        | Symbol            | Limit Values |      |      | Unit | Measuring Condition                                 |
|----------------------------------|-------------------|--------------|------|------|------|---|
|                                  |                   | Min.         | Typ. | Max. |      |   |
| Power supply ripple rejection    | $PSRR$            | –            | 60   | –    | dB   | $f_r = 100 \text{ Hz}$ ;<br>$V_r = 0.5 \text{ Vpp}$ |
| Temperature output voltage drift | $\frac{dV_Q}{dT}$ | –            | 0.5  | –    | mV/K | –   |
| Output Capacitor                 | $C_Q$             | 470          | –    | –    | nF   | ESR < 3 $\Omega$                                    |

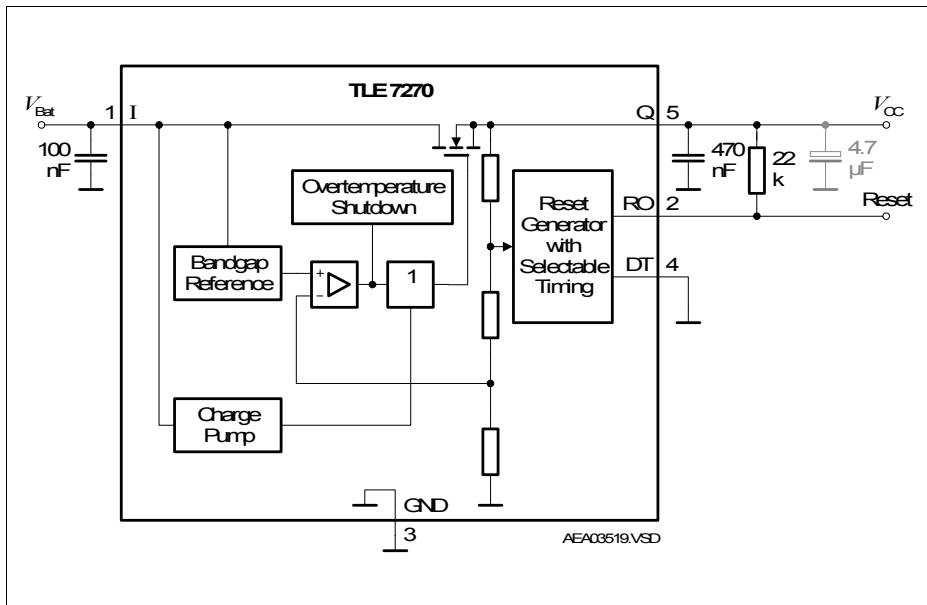
### Reset Output RO

|                                 |             |      |      |               |               |  |
|---------------------------------|-------------|------|------|---------------|---------------|--|
| Reset switching threshold       | $V_{RT}$    | 4.50 | 4.65 | 4.80          | V             | $V_Q$ decreasing<br>$V_i = 6\text{V}$                  |
| Reset output low voltage        | $V_{ROL}$   | –    | 0.2  | 0.4           | V             | $R_{RO} = 10 \text{ k}\Omega$ ;<br>$V_Q > 1 \text{ V}$ |
| Internal reset pull up resistor | $R_{R,int}$ | 15   | 30   | 45            | k $\Omega$    |  |
| External reset pull up resistor | $R_{R,ext}$ | 10   |      | $\infty^{2)}$ | k $\Omega$    | see Fig. 3   |
| Reset delay time                | $t_{rd}$    | 10   | 16   | 22            | ms            | DT connected to GND                                    |
| Reset delay time                | $t_{rd}$    | 80   | 128  | 176           | ms            | DT connected to Q                                      |
| Reset reaction time             | $t_{rr}$    | –    | –    | 12            | $\mu\text{s}$ | –  |

1) Measured when the output voltage  $V_Q$  has dropped 100 mV from the nominal value obtained at  $V_i = 13.5 \text{ V}$ .

2) An external reset pull up resistor is not required.

## Application Information



**Figure 3** Application Diagram

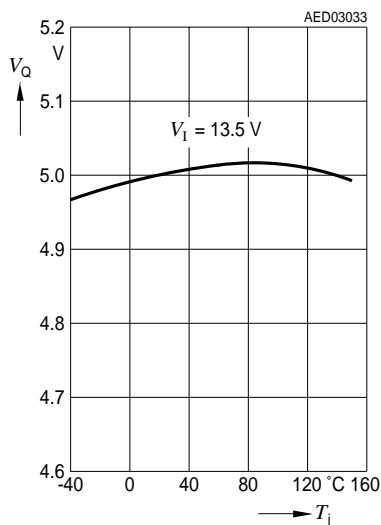
### Input, Output

An input capacitor is necessary for damping line influences. A resistor of approx.  $1 \Omega$  in series with  $C_I$ , can damp the LC of the input inductivity and the input capacitor.

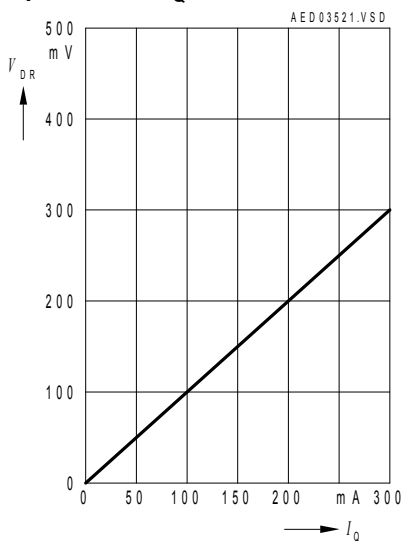
The TLE 7270 requires a ceramic output capacitor of at least 470 nF to assure stability of the regulation loop. In order to damp influences resulting from load current surges it is recommended to add an additional electrolytic capacitor of  $4.7 \mu\text{F}$  to  $47 \mu\text{F}$  at the output as shown in [Figure 3](#).

## Typical Performance Characteristics

### Output Voltage $V_Q$ versus Temperature $T_j$

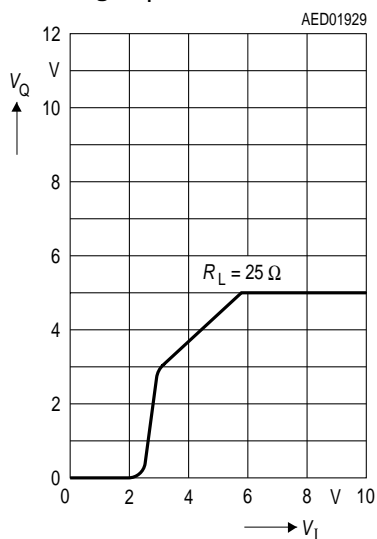


### Drop Voltage $V_{DR}$ versus Output Current $I_Q$

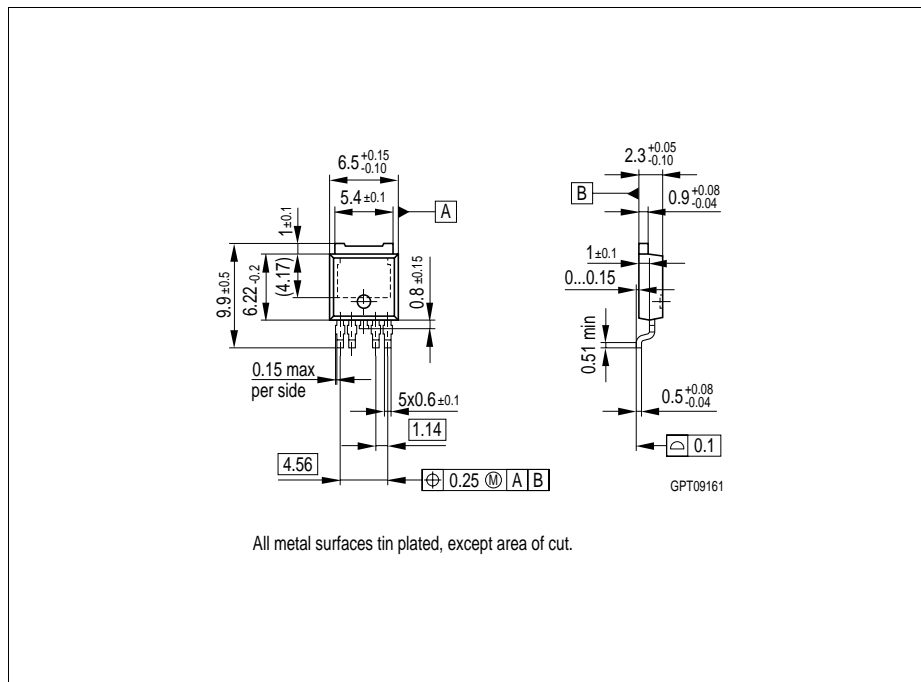




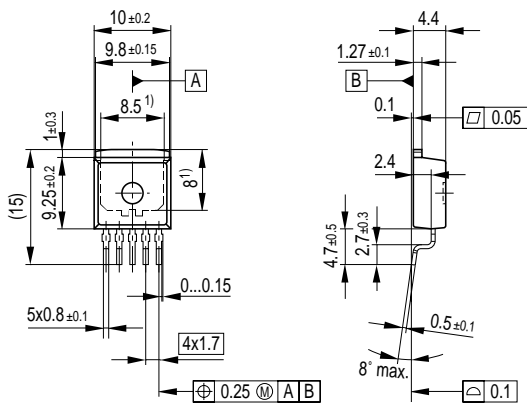
# Output Voltage $V_Q$ versus Input Voltage $V_I$



## Package Outlines



**Figure 4** P-T0252-5-1 (Plastic Transistor Single Outline)



<sup>1)</sup> Typical

All metal surfaces tin plated, except area of cut.

GPT09113

**Figure 5**      **P-T0263-5-1 (Plastic Transistor Single Outline)**



**Edition 2004-10-14**

**Published by Infineon Technologies AG,  
St.-Martin-Strasse 53,  
81669 München, Germany**

**© Infineon Technologies AG 2004.  
All Rights Reserved.**

**Attention please!**

The information herein is given to describe certain components and shall not be considered as a guarantee of characteristics.

Terms of delivery and rights to technical change reserved.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

**Information**

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office ([www.infineon.com](http://www.infineon.com)).

**Warnings**

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may

