

Power Charge Pump Circuit Features

- High Current Capability
- Short Circuit Protection
- Overtemperature Protection
- Active Zener Circuit

Very Low Drop Voltage Regulator Features

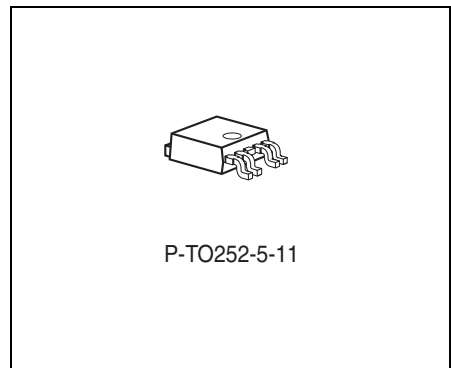
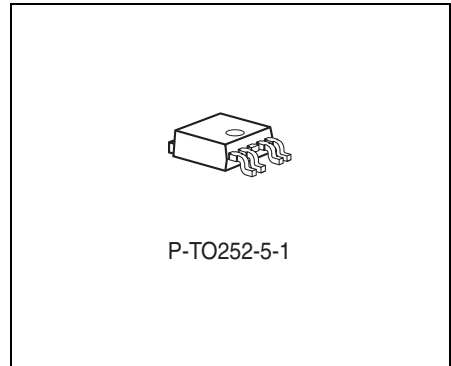
- 3.3 V or 3.8 V output voltage
- Low Output Voltage Tolerance
- High Current Capability 800 mA
- Short Circuit Protection
- Overtemperature Protection

General Features

- Optimized SMD Package
- Industrial type

Functional Description

The TLE 4307 is a monolithic integrated power charge pump with a Low Drop Voltage Regulator. The power charge pump loads an energy storage capacitor at pin C. The voltage regulator supplies 3.3 V or 3.8 V out of this storage capacitor with up to 800 mA output current. The TLE 4307 is intended for use with DC supplies for consumer or industrial applications.



| Type | Ordering Code | Package |
|---------------|---------------|---------------------------|
| TLE 4307 DV33 | Q67006-A9444 | P-TO252-5-1, P-TO252-5-11 |
| TLE 4307 DV38 | Q67006-A9415 | P-TO252-5-1, P-TO252-5-11 |

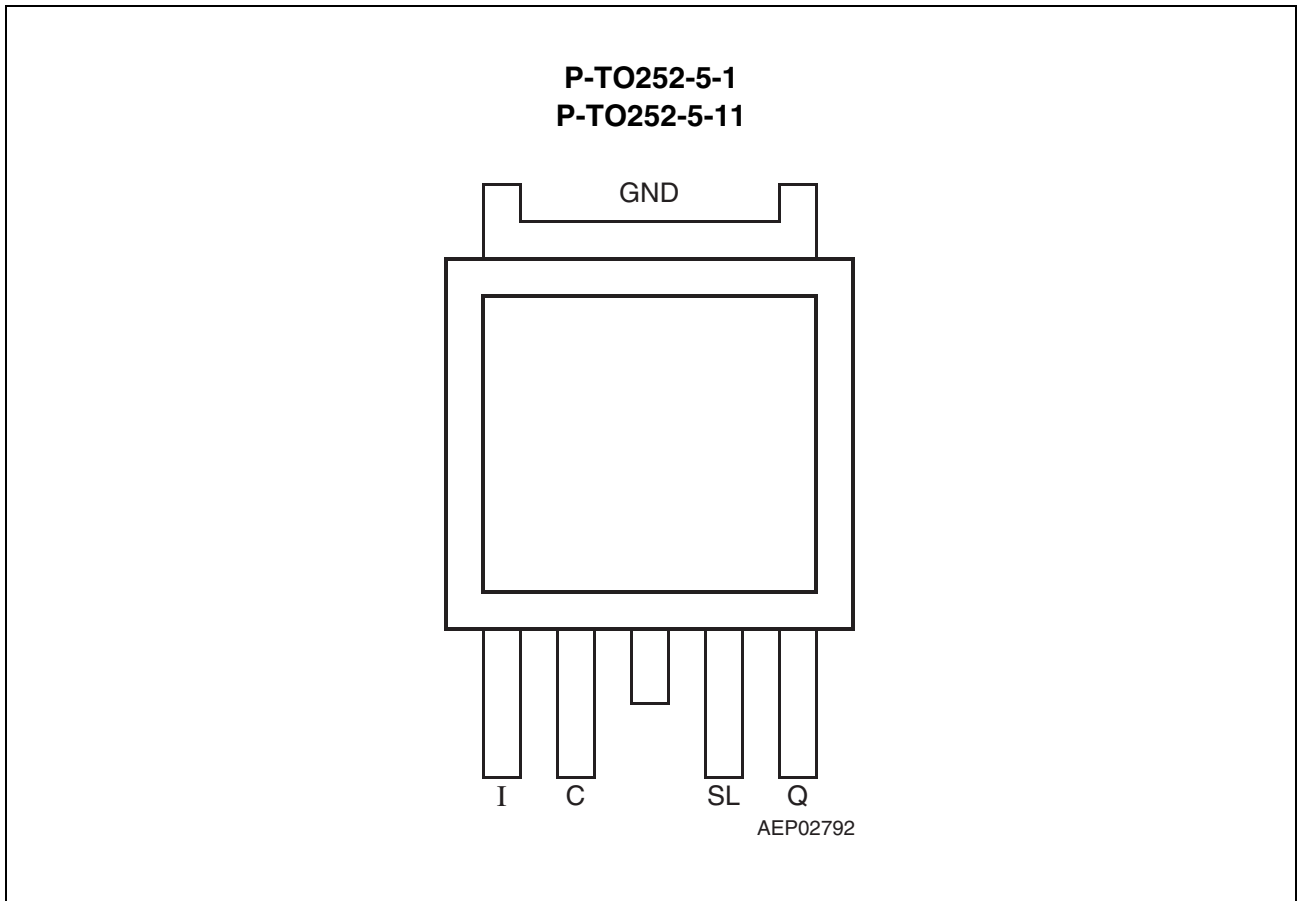


Figure 1 Pin Configuration (top view)

Table 1 Pin Definitions and Functions

| Pin No. | Symbol | Function |
|---------|--------|--|
| 1 | I | Input; Connect to the input voltage source |
| 2 | C | Charge-Pump Output; Connect to the energy reservoir capacitor to GND |
| 3 | GND | Ground |
| 4 | SL | Slewrate Control Input; a capacitor from this pin to the Input pin I controls the slewrate during recirculation |
| 5 | Q | Regulator Output; connect to GND with a capacitor as specified for C_Q |

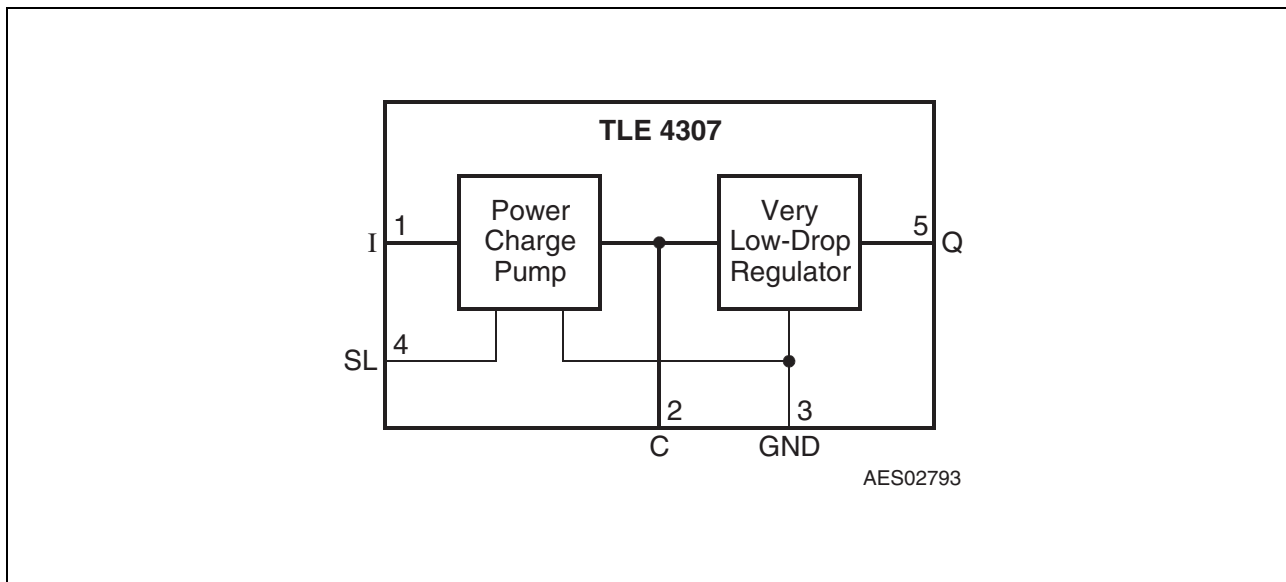


Figure 2 Block Diagram

Circuit Description

The TLE 4307 consists of 2 stages, the charge pump and the very low drop voltage regulator.

Charge Pump

The power stage is used as a switching element, that is driven by a buffer. A current source keeps the power stage on. When the output C of the charge pump reaches $V_{C,off}$, the power stage is switched off. It is active clamped, when the input I reaches $V_{I,cl}$. Optional, an external capacity can be connected between pin SL and I to limit the slew rate at the input, when an inductive load drives the IC. Saturation control as a function of the load current prevents any oversaturation of the power element. The regulator is additionally protected against overload and overtemperature.

Very Low Drop Regulator

The control amplifier compares a reference voltage, made highly accurate by resistance balancing, with a voltage proportional to the output voltage and drives the base of the series PNP transistor via a buffer. Saturation control as a function of the load current prevents any oversaturation of the power element. The regulator is additionally protected against overload and overtemperature.

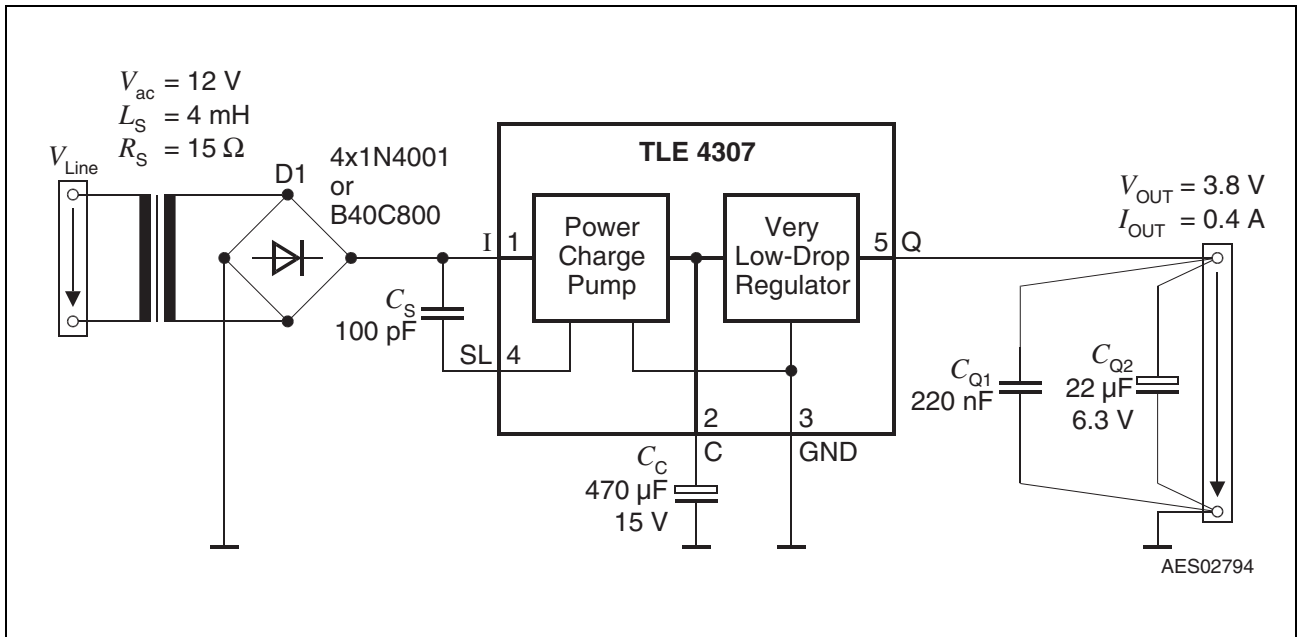


Figure 3 Application Example

Application Description

The IC is meant to be used with a DC power supply. The power charge pump limits the energy that is needed to drive the load at the output Q of the IC. The energy is stored to a capacity C_C , connected to pin C. When pin C reaches $V_{C,off}$, the power charge pump is switched off. Since the power supply consists of the inductance and a parasitic series resistance, the remaining available energy is dissipated in the external power supply and therefore does not stress the IC with this dispensable energy. The very low drop regulator is provided with the energy, stored in C_C . The regulator requires an output capacitor C_Q for the stability of the regulating circuit. Stability is guaranteed at values above $22 \mu\text{F}$ and an $\text{ESR} \leq 1 \Omega$ within the operating temperature range.

Table 2 Absolute Maximum Ratings

| Parameter | Symbol | Limit Values | | Unit | Notes |
|---|-------------|--------------|-----------|------|---------------------------------|
| | | Min. | Max. | | |
| Input | | | | | |
| Input voltage | V_I | -0.3 | V_{ICL} | V | V_{ICL} = Zener clamp voltage |
| Input current (during pump cycle) | I_I | -5 | – | mA | internally limited |
| Input current (during active Zener operation) | I_I | -5 | 1000 | mA | $t_p < 1$ ms; duty cycle 10% |
| Charge-Pump Output | | | | | |
| Voltage | V_C | -0.3 | 20 | V | – |
| Current | I_C | – | – | mA | internally limited |
| Slewrate Input | | | | | |
| Voltage | V_{SL} | -0.3 | 4.0 | V | – |
| Current | I_{SL} | -0.5 | 0.5 | mA | – |
| Regulator Output | | | | | |
| Voltage | V_Q | -0.3 | 25 | V | – |
| Current | I_Q | – | – | mA | internally limited |
| Temperature | | | | | |
| Junction temperature | T_j | -40 | 150 | °C | – |
| Storage temperature | T_{Stg} | -50 | 150 | °C | – |
| Thermal Data | | | | | |
| Junction-ambient | R_{thj-a} | – | 70 | K/W | – |
| | R_{thj-c} | – | 4 | K/W | – |
| ESD | | | | | |
| All pins to GND | V_{ESD} | -2 | 2 | kV | HBM Model |

Table 3 Operating Range

| Parameter | Symbol | Limit Values | | Unit | Notes |
|----------------------|--------|--------------|-----------|------|-------|
| | | Min. | Max. | | |
| Input voltage | V_I | 0 | V_{ICL} | V | – |
| Output current | I_I | 0 | 600 | mA | – |
| Junction temperature | T_j | -40 | 150 | °C | – |

Table 4 Electrical Characteristics

$V_I = 12\text{ V}$; $40\text{ °C} < T_j < 150\text{ °C}$, all voltages with respect to ground; positive current defined flowing into the pin; unless otherwise specified.

| Parameter | Symbol | Limit Values | | | Unit | Measuring Condition |
|---|-------------|--------------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Current consumption; $I_q = I_I - I_Q$ | I_q | – | 1.2 | 2.5 | mA | $I_Q = 0\text{ mA}$; $V_I = 6\text{ V}$ |
| Current consumption; $I_q = I_I - I_Q$ | $I_{q,10}$ | – | 1.4 | 3.0 | mA | $I_Q = 10\text{ mA}$; $V_I = 6\text{ V}$ |
| Current consumption; $I_q = I_I - I_Q$ | $I_{q,250}$ | – | 4 | 10 | mA | $I_Q = 250\text{ mA}$; $V_I = 6\text{ V}$ |

Charge Pump

| | | | | | | |
|---------------------------|-------------|-----|-----|-----|---|-----------------------|
| Switch off threshold | $V_{C,off}$ | 7.7 | 8.2 | 8.7 | V | – |
| Input Clamp Voltage | $V_{I,cl}$ | 21 | 23 | 25 | V | $I_I = 250\text{ mA}$ |
| Current limit | $I_{C,max}$ | 0.7 | 1.2 | 1.6 | A | $V_C = 5\text{ V}$ |
| Drop voltage; $V_I - V_C$ | V_{DR025} | – | 0.8 | 1.1 | V | $I_C = 0.25\text{ A}$ |
| Drop voltage; $V_I - V_C$ | V_{DR06} | – | 1.2 | 1.5 | V | $I_C = 0.6\text{ A}$ |
| Drop voltage; $V_I - V_C$ | V_{DR07} | – | 1.4 | 2.0 | V | $I_C = 0.7\text{ A}$ |

Main-Regulator

| | | | | | | |
|---------------------------------------|------------------|-----|-----|-----|----|---|
| Output voltage | V_Q | 3.7 | 3.8 | 3.9 | V | $0 < I_Q < 250\text{ mA}$; TLE 4307 DV38 |
| Output voltage | V_Q | 3.2 | 3.3 | 3.4 | V | $0 < I_Q < 250\text{ mA}$; TLE 4307 DV33 |
| Current limit | $I_{Q,max}$ | 0.8 | 1.2 | 1.6 | A | – |
| Drop voltage; $V_C - V_Q$ | V_{DR025} | – | 0.2 | 0.4 | V | $I_Q = 0,25\text{ A}^{1)}$ |
| Drop voltage; $V_C - V_Q$ | V_{DR06} | – | 0.4 | 0.7 | V | $I_Q = 0.6\text{ A}^{1)}$ |
| Drop voltage; $V_C - V_Q$ | V_{DR08} | – | 1.0 | 2.0 | V | $I_Q = 0.8\text{ A}^{1)}$ |
| Over all Drop voltage; $V_I - V_Q$ | V_{DR} | – | 1.1 | 1.3 | V | $I_Q = 0.25\text{ A}^{1)}$ |
| Load regulation | ΔV_{QLO} | – | 20 | 40 | mV | $200\text{ mA} < I_Q < 600\text{ mA}$ |
| Line regulation | ΔV_{QLI} | – | – | 20 | mV | $5\text{ V} < V_C < 8.7\text{ V}$; $I_Q = 10\text{ mA}$ |

Table 4 Electrical Characteristics (cont'd)

$V_I = 12\text{ V}$; $40\text{ }^\circ\text{C} < T_j < 150\text{ }^\circ\text{C}$, all voltages with respect to ground; positive current defined flowing into the pin; unless otherwise specified.

| Parameter | Symbol | Limit Values | | | Unit | Measuring Condition |
|-------------------------------|--------|--------------|------|------|---------------|---|
| | | Min. | Typ. | Max. | | |
| Power Supply Ripple rejection | $PSRR$ | -40 | – | – | dB | $f_r = 100\text{ Hz}$; $V_r = 0.5\text{ Vpp}$ |
| Output Capacitor | C_Q | 22 | – | – | μF | $\text{ESR} < 1\ \Omega$ |

Slewrate Input

| | | | | | | |
|------------------|----------|----|-----|-----|------------------|-------------------------|
| Input Resistance | R_{SL} | 60 | 120 | 200 | $\text{k}\Omega$ | $V_{SL} = 0.2\text{ V}$ |
|------------------|----------|----|-----|-----|------------------|-------------------------|

1) Drop Voltage measured when the output voltage has dropped 100 mV from the nominal value.

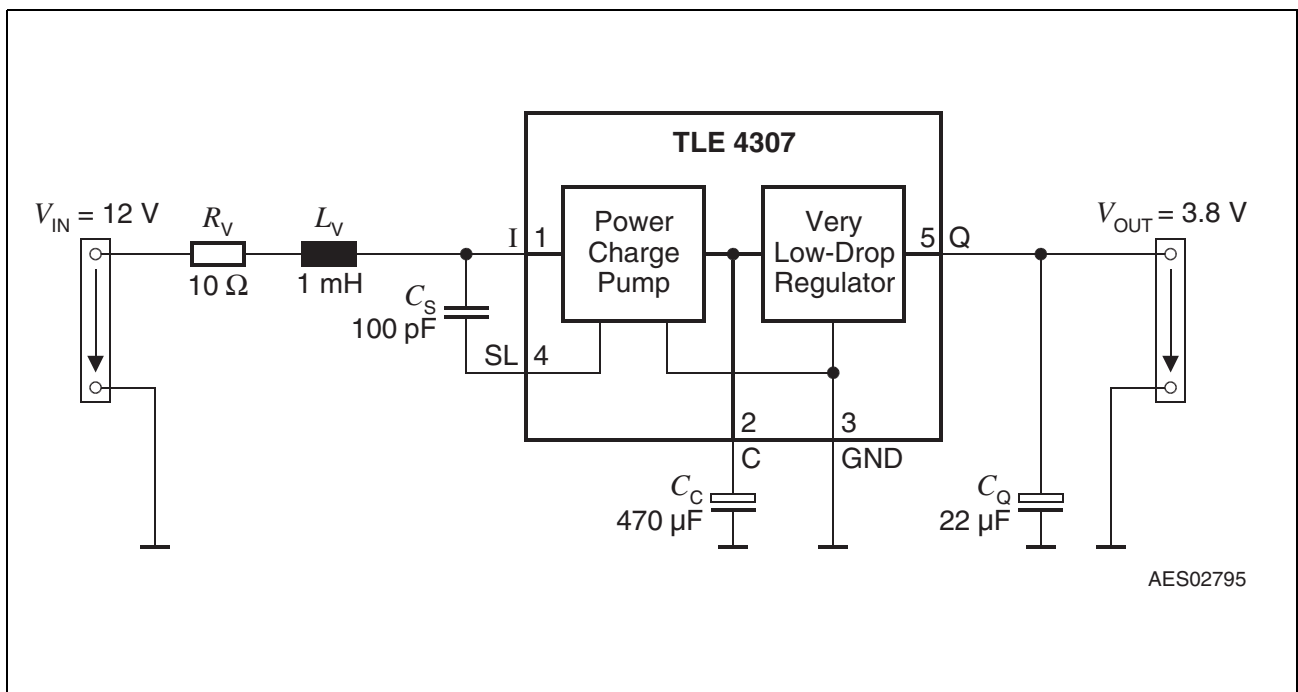


Figure 4 Measurement Circuit

Package Outlines

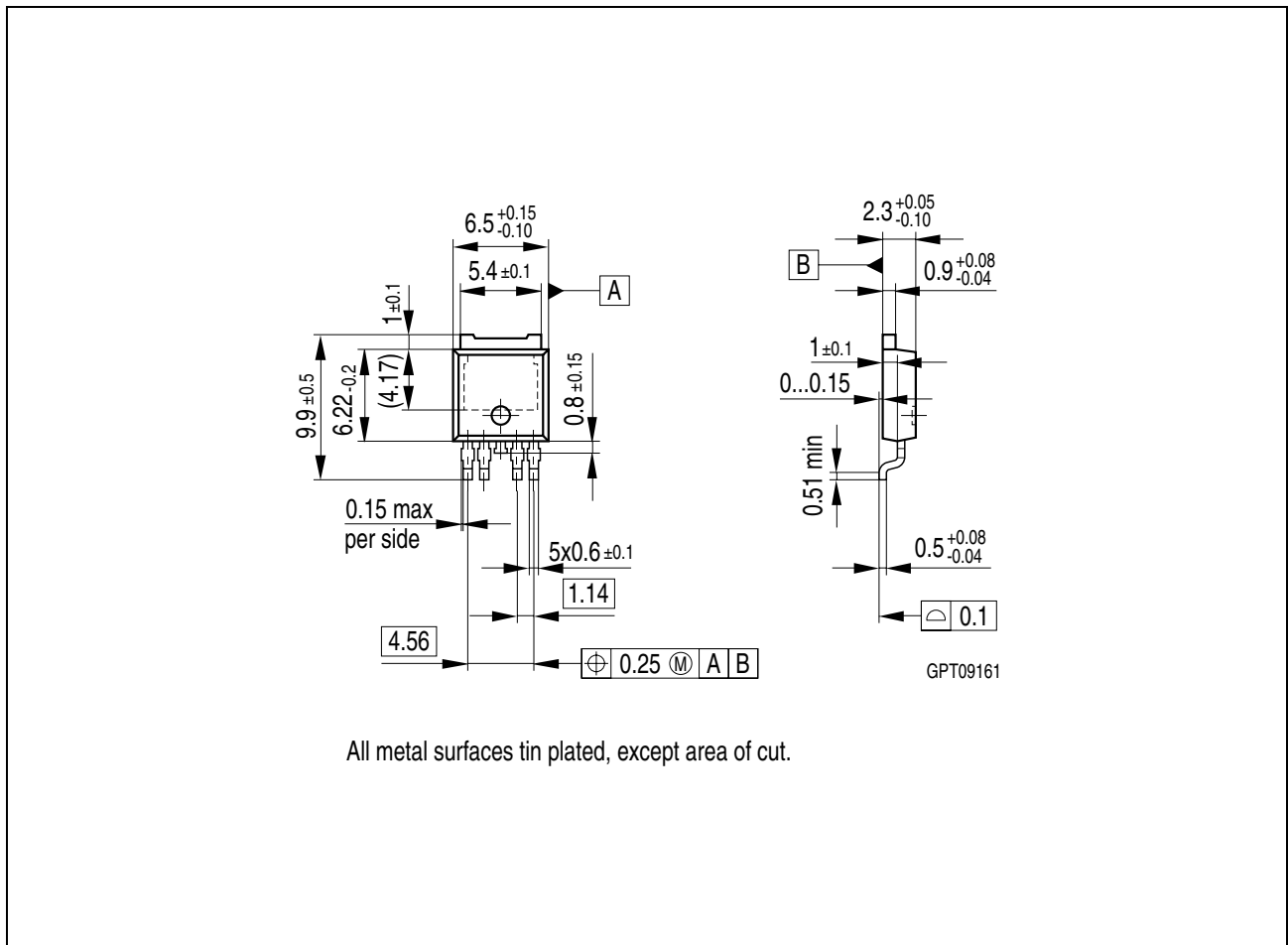


Figure 5 P-TO252-5-1 (Plastic Transistor Single Outline)

You can find all of our packages, sorts of packing and others in our Infineon Internet Page "Products": <http://www.infineon.com/products>.

SMD = Surface Mounted Device

Dimensions in mm

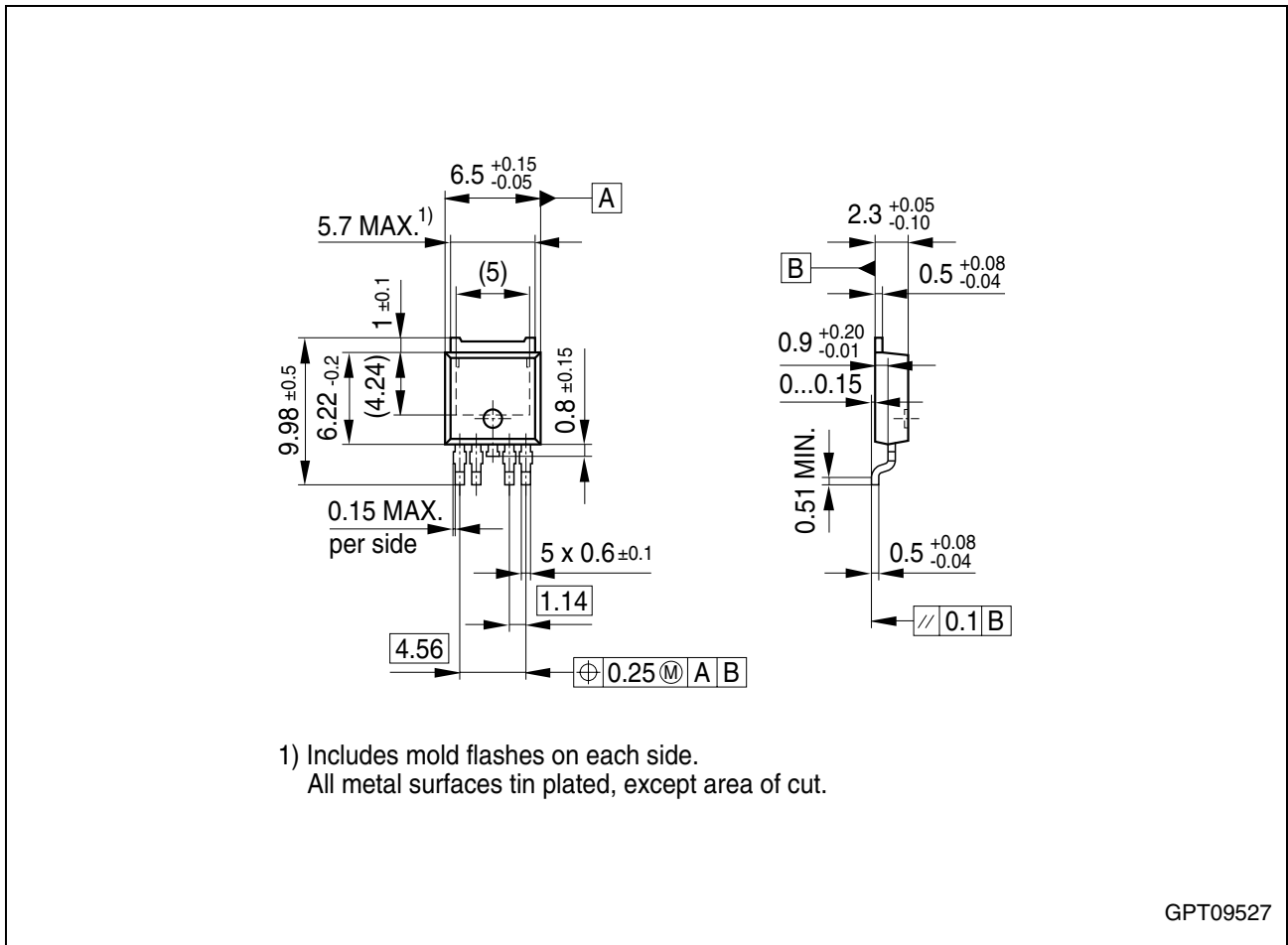


Figure 6 P-TO252-5-11 (Plastic Transistor Single Outline)

You can find all of our packages, sorts of packing and others in our Infineon Internet Page "Products": <http://www.infineon.com/products>.

SMD = Surface Mounted Device

Dimensions in mm

Edition 2004-01-01

**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).

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 be endangered.