

**Power Charge Pump Circuit Features**

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

**Very Low Drop Voltage Regulator Features**

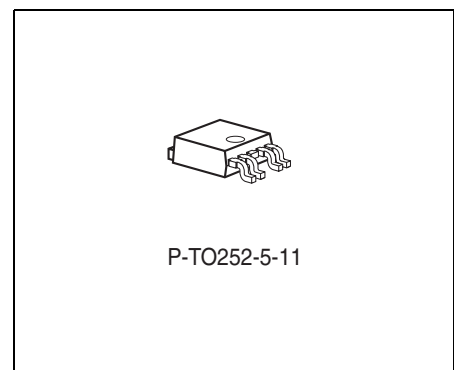
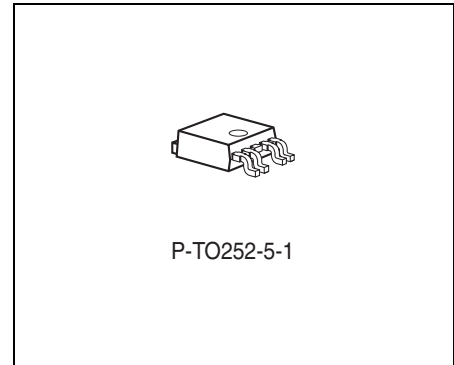
- 3.3 V or 3.8 V output voltage
- Low Output Voltage Tolerance
- High Current Capability 800 mA
- Short Circuit Protection
- Overtemperature Protection

**General Features**

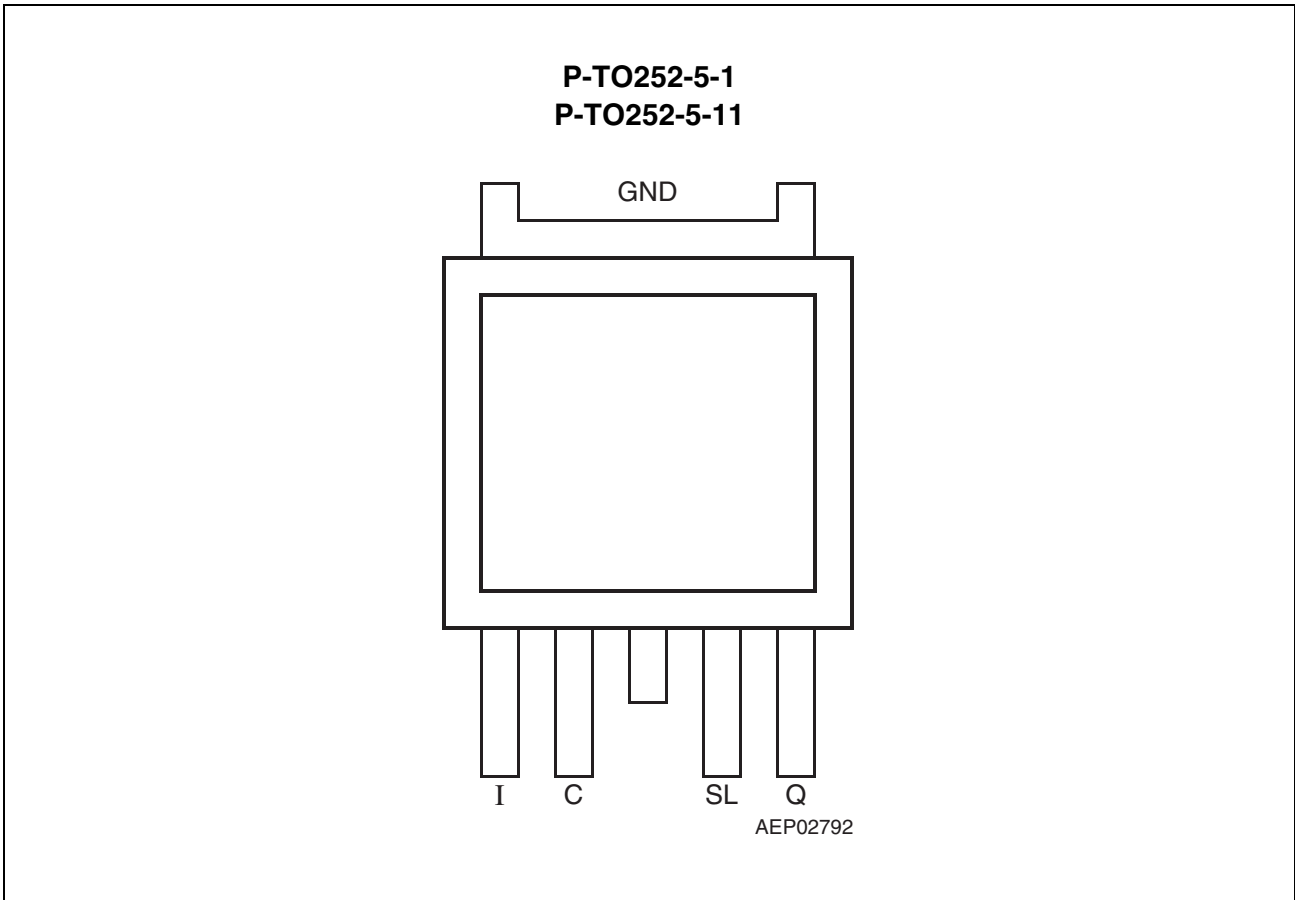
- Optimized SMD Package
- Industrial type

**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.



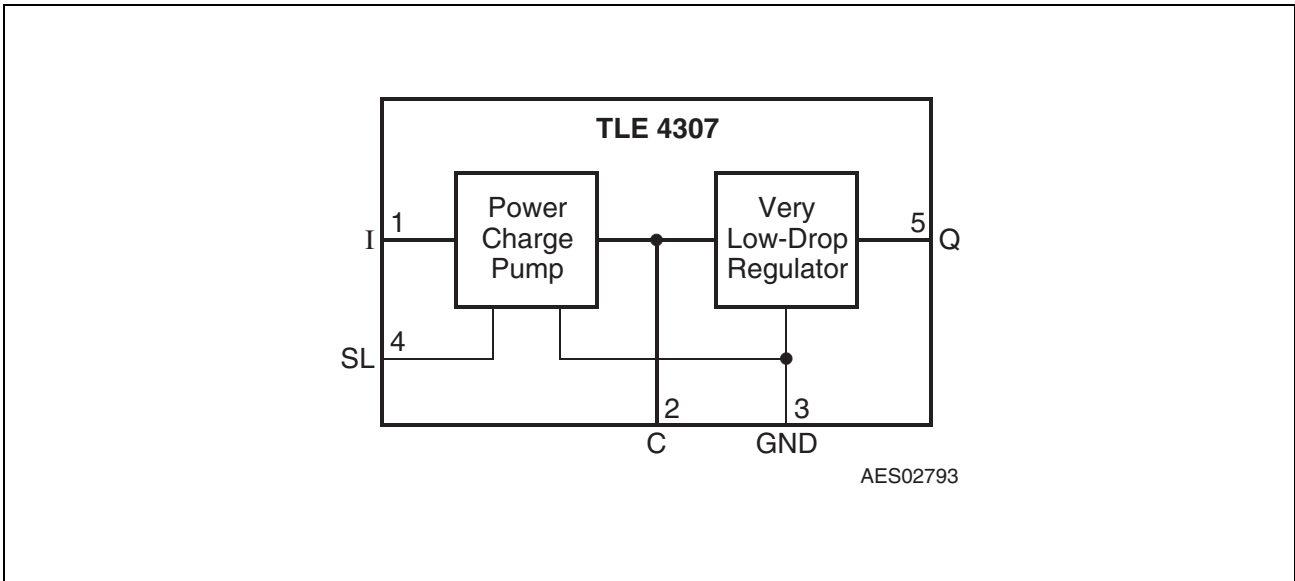
Type	Ordering Code	Package
TLE 4307 DV33	Q67006-A9444	P-TO252-5-1, P-TO252-5-11
TLE 4307 DV38	Q67006-A9415	P-TO252-5-1, P-TO252-5-11



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

**Table 1** Pin Definitions and Functions

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



**Figure 2 Block Diagram**

### Circuit Description

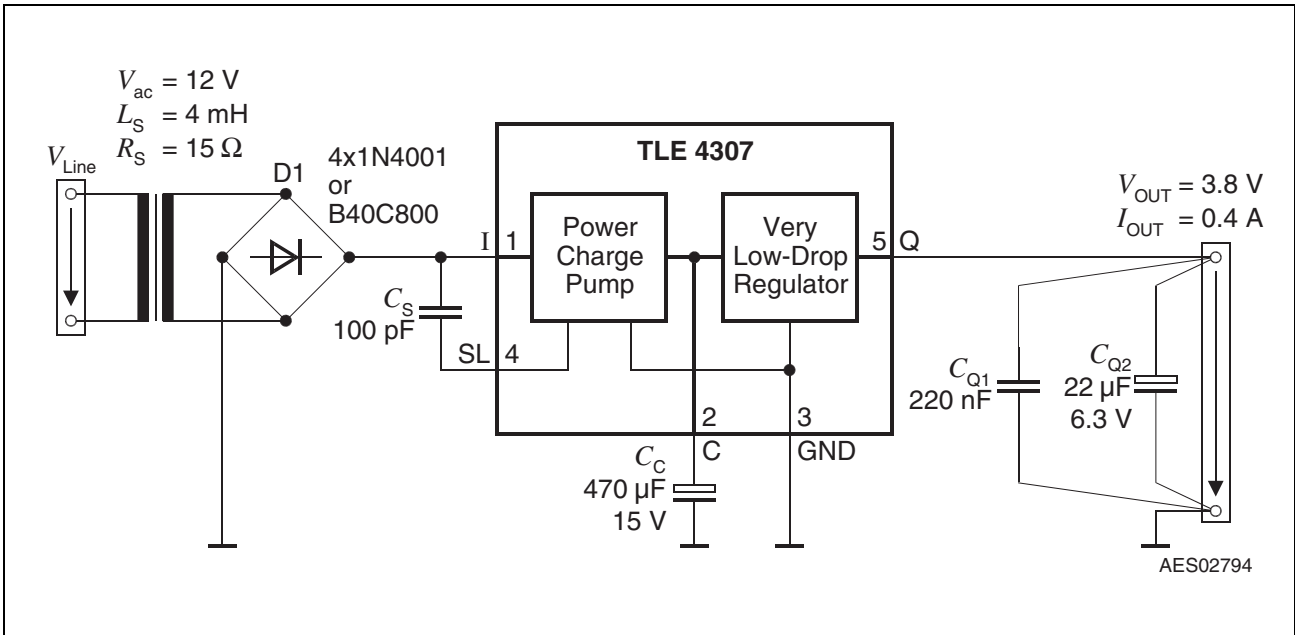
The TLE 4307 consists of 2 stages, the charge pump and the very low drop voltage regulator.

### 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  $\mu$ F and an ESR  $\leq 1 \Omega$  within the operating temperature range.

**Table 2 Absolute Maximum Ratings**

Parameter	Symbol	Limit Values		Unit	Notes
		Min.	Max.		
<b>Input</b>					
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%
<b>Charge-Pump Output</b>					
Voltage	$V_C$	-0.3	20	V	–
Current	$I_C$	–	–	mA	internally limited
<b>Slewrate Input</b>					
Voltage	$V_{SL}$	-0.3	4.0	V	–
Current	$I_{SL}$	-0.5	0.5	mA	–
<b>Regulator Output</b>					
Voltage	$V_Q$	-0.3	25	V	–
Current	$I_Q$	–	–	mA	internally limited
<b>Temperature</b>					
Junction temperature	$T_j$	-40	150	°C	–
Storage temperature	$T_{Stg}$	-50	150	°C	–
<b>Thermal Data</b>					
Junction-ambient	$R_{thj-a}$	–	70	K/W	–
	$R_{thj-c}$	–	4	K/W	–
<b>ESD</b>					
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**

$V_I = 12\text{ V}$ ;  $40\text{ }^\circ\text{C} < T_j < 150\text{ }^\circ\text{C}$ , 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.		
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	$\Delta V_{QLO}$	–	20	40	mV	$200\text{ mA} < I_Q < 600\text{ mA}$
Line regulation	$\Delta V_{QLI}$	–	–	20	mV	$5\text{ V} < V_C < 8.7\text{ V}$ ; $I_Q = 10\text{ mA}$

**Table 4 Electrical Characteristics (cont'd)**

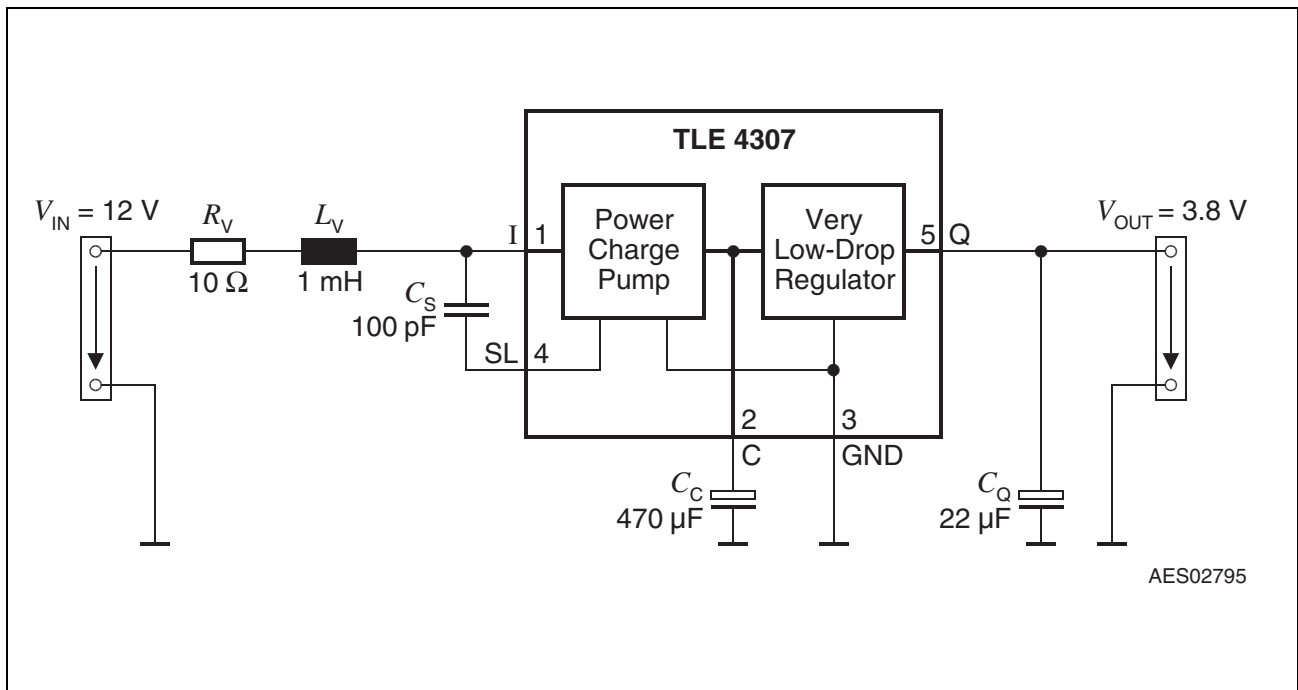
$V_i = 12\text{ V}$ ;  $40\text{ }^\circ\text{C} < T_j < 150\text{ }^\circ\text{C}$ , all voltages with respect to ground; positive current defined flowing into the pin; unless otherwise specified.

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	–	–	$\mu\text{F}$	$\text{ESR} < 1\ \Omega$

**Slewrate Input**

Input Resistance	$R_{SL}$	60	120	200	$\text{k}\Omega$	$V_{SL} = 0.2\text{ V}$
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1) Drop Voltage measured when the output voltage has dropped 100 mV from the nominal value.



**Figure 4 Measurement Circuit**

Package Outlines

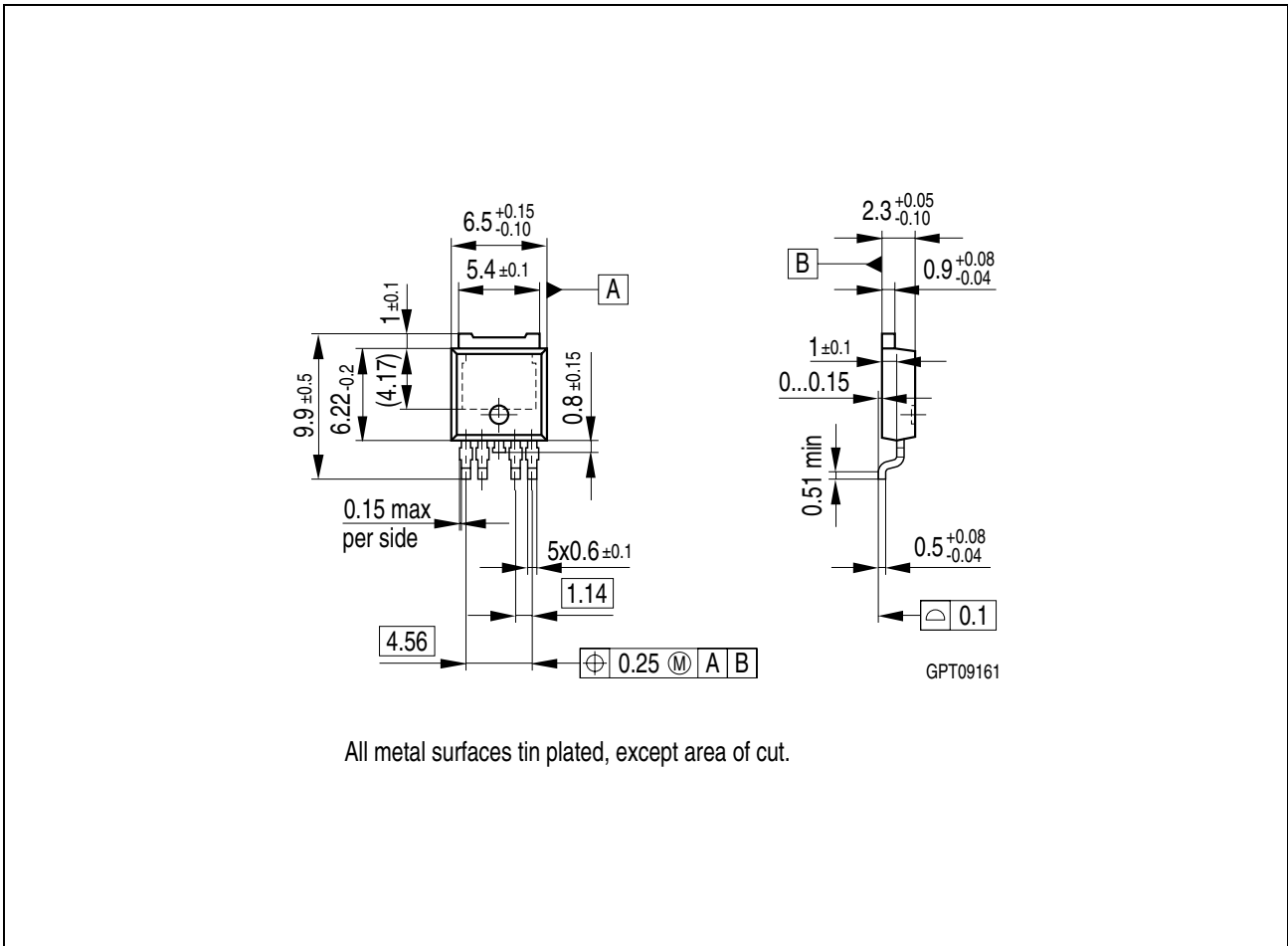
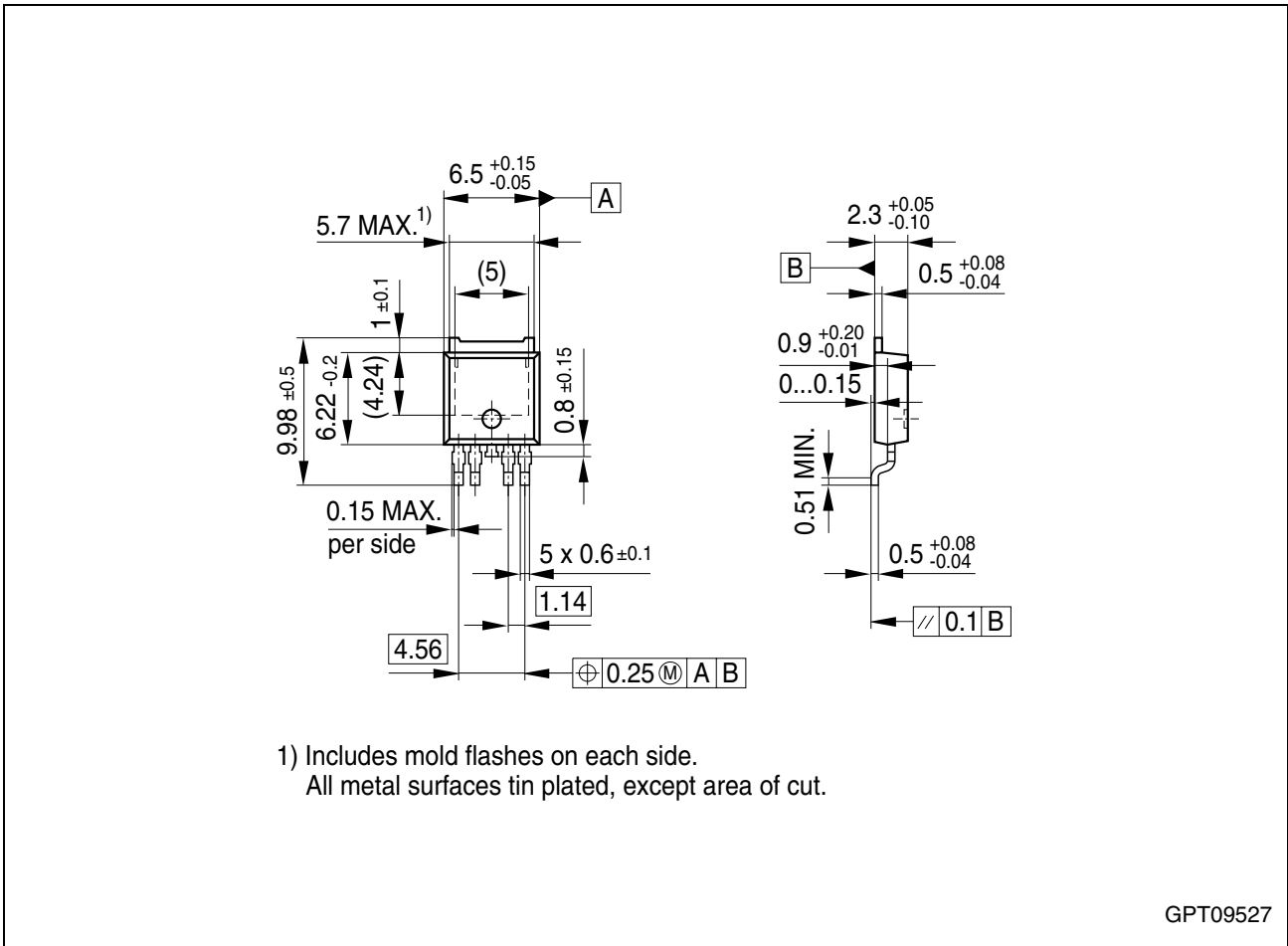


Figure 5 P-T0252-5-1 (Plastic Transistor Single Outline)

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SMD = Surface Mounted Device

Dimensions in mm



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

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SMD = Surface Mounted Device

Dimensions in mm

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