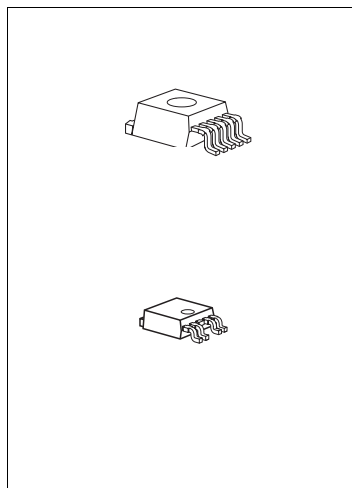




## Features

- 5 V or variable output voltage
- Output voltage tolerance  $\leq \pm 2\%$
- 400 mA current capability
- Low-drop voltage
- Inhibit input
- Very low current consumption
- Short-circuit-proof
- Reverse polarity proof
- Suitable for use in automotive electronics
- Green Product (RoHS compliant)
- AEC Qualified



Type	Package	Marking
TLE 4276-2 GV50	PG-TO263-5	4276-2V5
TLE 4276-2 GV	PG-TO263-5	4276-2V
TLE 4276-2 DV50	PG-TO252-5	4276-2V5
TLE 4276-2 DV	PG-TO252-5	4276-2V

## Functional Description

The TLE 4276-2 is a low-drop voltage regulator in a TO package. The IC regulates an input voltage up to 40 V to  $V_{Q,nom} = 5.0$  V (V50) or adjustable voltage (V). The maximum output current is 400 mA. The IC can be switched off via the inhibit input, which causes the current consumption to drop below 10  $\mu$ A. The IC is short-circuit-proof and includes temperature protection which turns off the device at overtemperature.

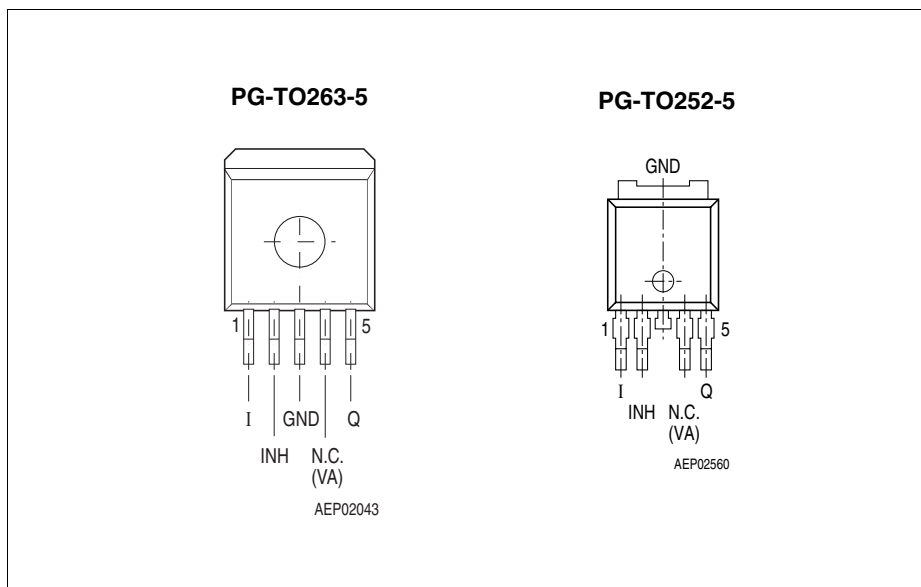
## Dimensioning Information on External Components

The input capacitor  $C_I$  is necessary for compensation of line influences. Using a resistor of approx. 1  $\Omega$  in series with  $C_I$ , the oscillating of input inductivity and input capacitance can be damped. The output capacitor  $C_O$  is necessary for the stability of the regulation circuit. Stability is guaranteed at values  $C_O \geq 22$   $\mu$ F and an ESR of  $\leq 3$   $\Omega$  within the operating temperature range.

## Circuit Description

The control amplifier compares a reference voltage to a voltage that is proportional to the output voltage and drives the base of the series transistor via a buffer. Saturation control as a function of the load current prevents any oversaturation of the power element. The IC also incorporates a number of internal circuits for protection against:

- Overload
- Overtemperature
- Reverse polarity



**Figure 1**      **Pin Configuration** (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	INH	<b>Inhibit</b> ; low-active input.
3	GND	<b>Ground</b>
4	N.C. VA	<b>Not connected</b> for V50 <b>Voltage Adjust Input</b> ; only for adjustable version. Connect an external voltage divider to determine the output voltage.
5	Q	<b>Output</b> ; block to GND with a $\geq 22 \mu\text{F}$ capacitor, $\text{ESR} \leq 3 \Omega$ at 10 kHz
Heat Tab		Connect to GND.



**Table 2 Absolute Maximum Ratings**

Parameter	Symbol	Limit Values		Unit	Test Condition
		Min.	Max.		
Input I					
Voltage	$V_I$	-42	45	V	—
Current	$I_I$	—	—	—	Internally limited
Inhibit INH					
Voltage	$V_{INH}$	-42	45	V	—
Voltage Adjust Input VA					
Voltage	$V_{VA}$	-0.3	10	V	—
Output Q					
Voltage	$V_Q$	-1.0	40	V	—
Current	$I_Q$	—	—	—	Internally limited
Ground GND					
Current	$I_{GND}$	—	100	mA	—
Temperature					
Junction temperature	$T_j$	-40	150	°C	—
Storage temperature	$T_{stg}$	-50	150	°C	—

*Note: Maximum ratings are absolute ratings; exceeding any one of these values may cause irreversible damage to the integrated circuit.*

**Table 3 ESD Rating**

Parameter	Symbol	Limit Values		Unit	Notes
		Min.	Max.		
ESD Capability	$V_{ESD,HBM}$	-2	2	kV	Human Body Model

**Table 4 Operating Range**

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
Input voltage	$V_I$	$V_Q + 0.5$	40	V	Fixed voltage device V50
Input voltage	$V_I$	$V_Q + 0.5$	40	V	Variable device V
Input voltage	$V_I$	4.5 V	40	V	Variable device V, $V_Q < 4$ V
Junction temperature	$T_j$	-40	150	°C	–

**Table 5 Thermal Resistance**

Parameter	Symbol	Limit Value			Unit	Conditions
		Min.	Typ.	Max.		
Junction to Case <sup>1)</sup>	$R_{thJC}$	–	3.0	–	K/W	–
Junction to Ambient <sup>1)</sup>	$R_{thJA}$	–	78	–	K/W	PG-TO252-5 300mm <sup>2</sup> heatsink area on PCB <sup>2)</sup>
Junction to Ambient <sup>1)</sup>	$R_{thJA}$	–	53	–	K/W	PG-TO263-5 300mm <sup>2</sup> heatsink area on PCB <sup>2)</sup>

1) not subject to production test, specified by design

2) EIA/JESD 52\_2, FR4, 80 × 80 × 1.5 mm; 35μ Cu, 5μ Sn

**Table 6 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	Measuring Circuit
		Min.	Typ.	Max.			
Output voltage	$V_Q$	4.9	5.0	5.1	V	V50-Version $5 \text{ mA} < I_Q < 300 \text{ mA}$ $6 \text{ V} < V_I < 28 \text{ V}$	1
Output voltage	$V_Q$	4.8	5.0	5.2	V	V50-Version $5 \text{ mA} < I_Q < 400 \text{ mA}$ $6 \text{ V} < V_I < 28 \text{ V}$	1
Output voltage	$V_Q$	4.8	5.0	5.2	V	V50-Version $5 \text{ mA} < I_Q < 200 \text{ mA}$ $6 \text{ V} < V_I < 40 \text{ V}$	1
Output voltage tolerance	$\Delta V_Q$	-2	—	2	%	V-Version $R_2 < 50 \text{ k}\Omega$ $V_Q + 1 \text{ V} \leq V_I \leq 28 \text{ V}$ $V_I > 4.5 \text{ V}$ $5 \text{ mA} \leq I_Q \leq 300 \text{ mA}$	1
Output voltage tolerance	$\Delta V_Q$	-4	—	4	%	V-Version $R_2 < 50 \text{ k}\Omega$ $V_Q + 1 \text{ V} \leq V_I \leq 40 \text{ V}$ $V_I > 4.5 \text{ V}$ $5 \text{ mA} \leq I_Q \leq 400 \text{ mA}$	1
Output current limitation <sup>1)</sup>	$I_Q$	400	600	1100	mA	—	1
Current consumption; $I_q = I_I - I_Q$	$I_q$	—	—	10	$\mu\text{A}$	$V_{\text{INH}} = 0 \text{ V};$ $T_j \leq 100 \text{ }^{\circ}\text{C}$	1
Current consumption; $I_q = I_I - I_Q$	$I_q$	—	100	220	$\mu\text{A}$	$I_Q = 1 \text{ mA}$	1
Current consumption; $I_q = I_I - I_Q$	$I_q$	—	5	10	mA	$I_Q = 250 \text{ mA}$	1
Current consumption; $I_q = I_I - I_Q$	$I_q$	—	15	25	mA	$I_Q = 400 \text{ mA}$	1

**Table 6 Characteristics (cont'd)**
 $V_I = 13.5 \text{ V}$ ;  $-40 \text{ }^\circ\text{C} < T_J < 150 \text{ }^\circ\text{C}$  (unless otherwise specified)

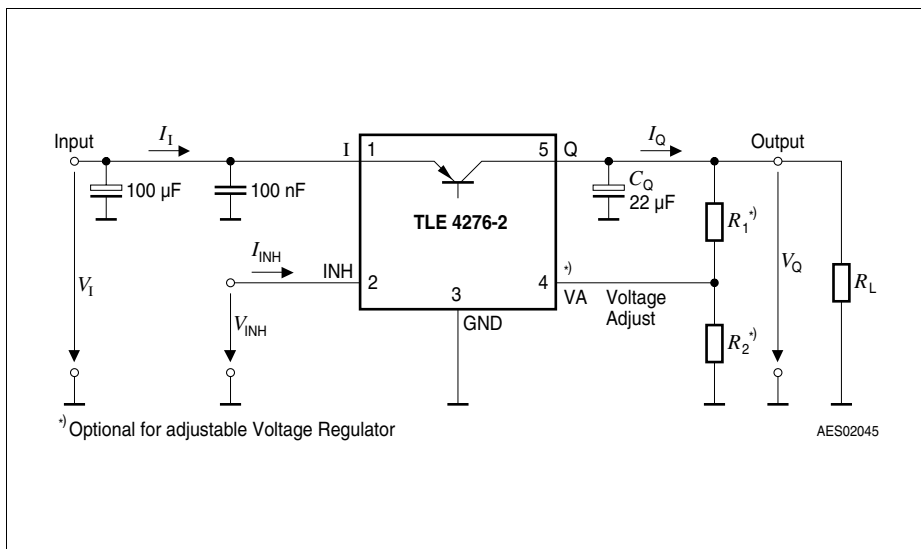
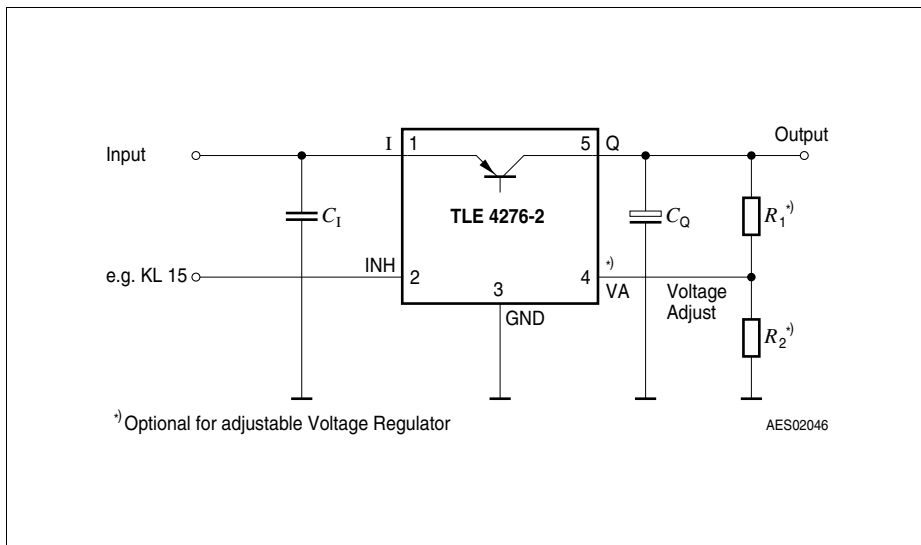
Parameter	Symbol	Limit Values			Unit	Measuring Condition	Measuring Circuit
		Min.	Typ.	Max.			
Drop voltage <sup>1)</sup>	$V_{DR}$	–	250	500	mV	V50 $I_Q = 250 \text{ mA}$ $V_{DR} = V_I - V_Q$	1
Drop voltage <sup>1)</sup>	$V_{DR}$	–	250	500	mV	variable devices $I_Q = 250 \text{ mA}$ $V_I > 4.5 \text{ V}$ $V_{DR} = V_I - V_Q$	1
Load regulation	$\Delta V_{Q,Lo}$	–	5	35	mV	$I_Q = 5 \text{ mA to } 400 \text{ mA}$	1
Line regulation	$\Delta V_{Q,Li}$	–	15	25	mV	$\Delta V_I = 12 \text{ V to } 32 \text{ V}$ $I_Q = 5 \text{ mA}$	1
Power supply ripple rejection	$PSRR$	–	54	–	dB	$f_r = 100 \text{ Hz}$ ; $V_r = 0.5 \text{ Vpp}$	1
Temperature output voltage drift	$dV_Q/dT$	–	0.5	–	–	–	mV/K

**Inhibit**

Inhibit on voltage	$V_{INH}$	–	2	3.5	V	$V_Q \geq 4.9 \text{ V}$	1
Inhibit off voltage	$V_{INH}$	0.5	1.7	–	V	$V_Q \leq 0.1 \text{ V}$	1
Input current	$I_{INH}$	5	10	20	$\mu\text{A}$	$V_{INH} = 5 \text{ V}$	1

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

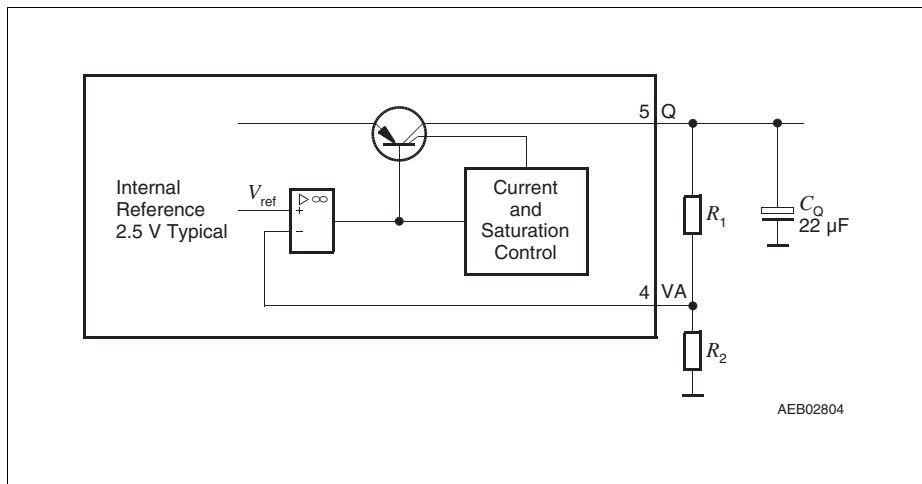



**Figure 3 Measuring Circuit**

**Figure 4 Application Circuit**

## Application Information for Variable Output Regulator TLE 4276-2 DV, GV

The output voltage of the TLE 4276-2 DV, GV can be adjusted between 2.5 V and 20 V by an external output voltage divider, closing the control loop to the voltage adjust pin VA.

The voltage at pin VA is compared to the internal reference of typical 2.5 V in an error amplifier. It controls the output voltage.



**Figure 5 Application Detail External Components at Output for Variable Voltage Regulator**

The output voltage is calculated according to [Equation \(1\)](#):

$$V_Q = (R_1 + R_2)/R_2 \times V_{ref}, \text{ neglecting } I_{VA} \quad (1)$$

$V_{ref}$  is typically 2.5 V.

To avoid errors caused by leakage current  $I_{VA}$ , we recommend to choose the resistor value  $R_2$  according to [Equation \(2\)](#):

$$R_2 < 50 \text{ k}\Omega \quad (2)$$

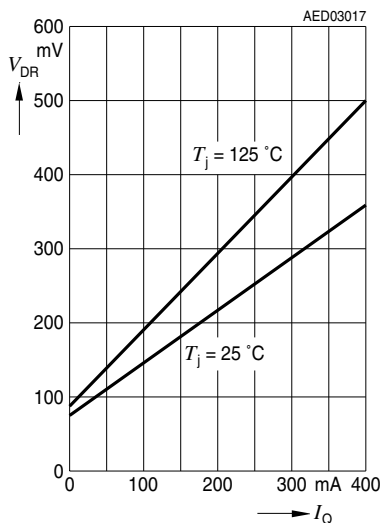
For a 2.5 V output voltage the output pin Q is directly connected to the adjust pin VA.

The accuracy of the resistors  $R_1$  and  $R_2$  add an additional error to the output voltage tolerance.

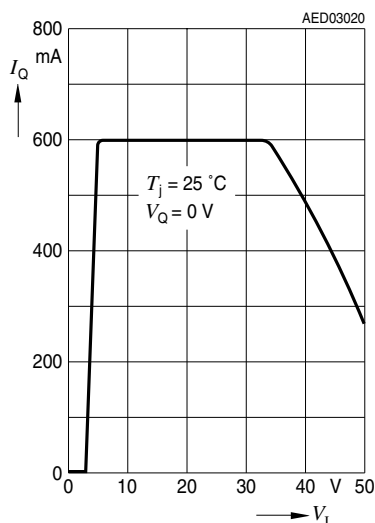
The operation range of the variable TLE 4276-2 DV, GV is  $V_Q + 0.5 \text{ V}$  to 40 V. For internal biasing a minimum input voltage of 4.3 V is required. For output voltages below 4 V the voltage drop is  $4.3 \text{ V} - V_Q$

# Typical Performance Characteristics V50:

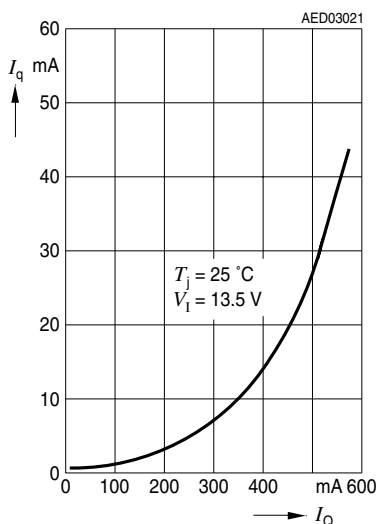
**Voltage  $V_{DR}$  versus Output Current  $I_Q$**



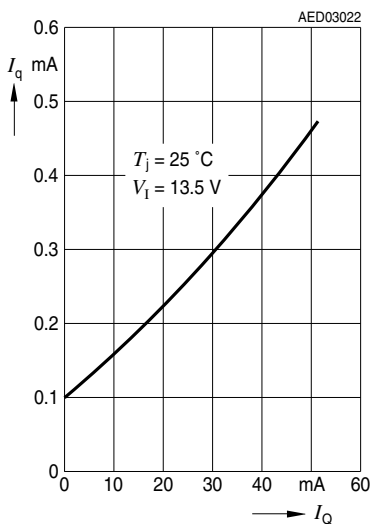
**Max. Output Current  $I_Q$  versus Input Voltage  $V_I$**



**Current Consumption  $I_q$  versus Output Current  $I_Q$  (high load)**

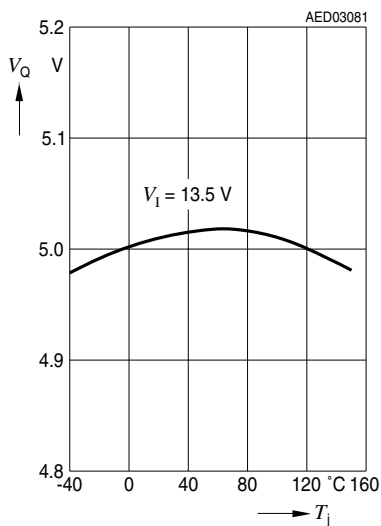


**Current Consumption  $I_q$  versus Output Current  $I_Q$  (low load)**

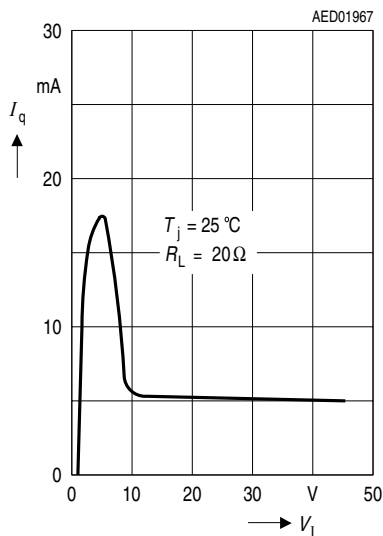


# Typical Performance Characteristics for V50:

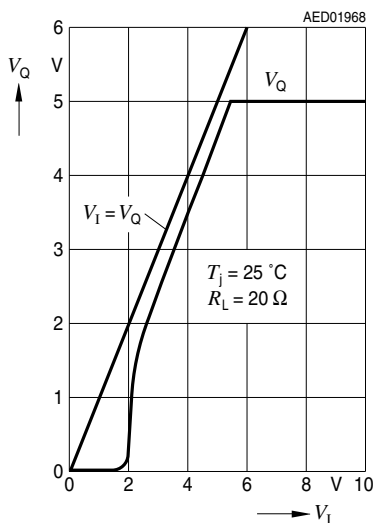
**Output Voltage  $V_Q$  versus Temperature  $T_j$**



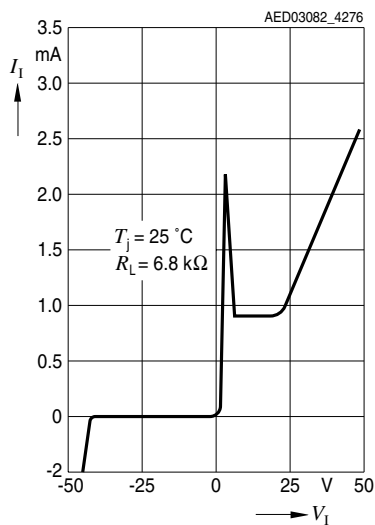
**Current Consumption  $I_q$  versus Input Voltage  $V_I$**



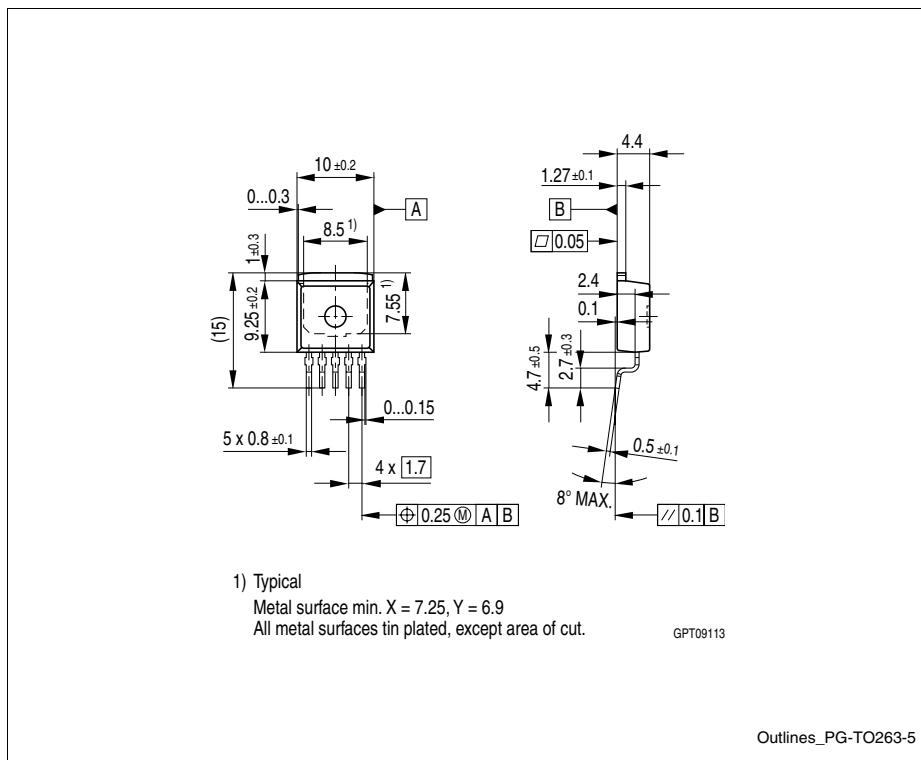
## Low Voltage Behavior



## High Voltage Behavior



## Package Outlines



**Figure 6 PG-TO263-5 (Plastic Green Transistor Single Outline)**

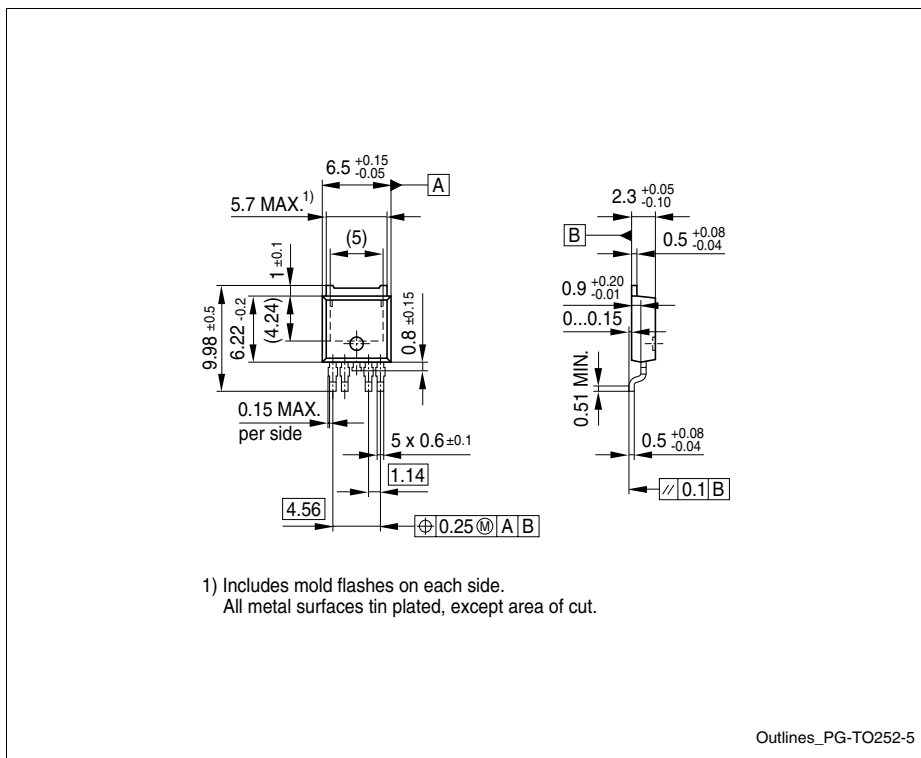
### Green Product (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-Compliant (i.e Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

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 7 PG-TO252-5 (Plastic Green Transistor Single Outline)**

### Green Product (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-Compliant (i.e Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

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

---

**Revision History**

Version	Date	Changes
Rev. 1.0	2007-08-07	First Version Data Sheet
Rev. 1.1	2007-09-21	Second Version Data Sheet

**Edition 2007-09-21**

**Published by  
Infineon Technologies AG  
81726 Munich, Germany**

**© 2007 Infineon Technologies AG  
All Rights Reserved.**

#### **Legal Disclaimer**

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.

#### **Information**

For further information on technology, delivery terms and conditions and prices, please contact the 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 the nearest Infineon Technologies Office.

Infineon Technologies components may be used in life-support devices or systems only 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.