

OPTIREG™ Linear TLE4276

Low Drop Voltage Regulator

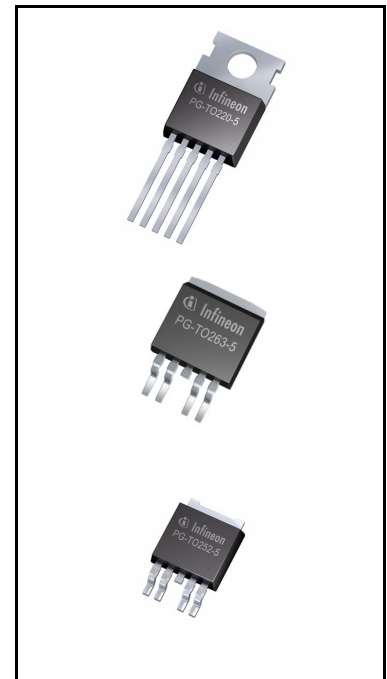


Features

- 5 V, and variable output voltage
- Output voltage tolerance $\leq \pm 4\%$
- 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)

Potential applications

Automotive applications especially with tight space constraints.



Product validation

Qualified for Automotive Applications. Product Validation according to AEC-Q100/101.

Description

The OPTIREG™ Linear TLE4276 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), and 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 μ A. The IC is short-circuit-proof and includes temperature protection which turns off the device at overtemperature.

Type	Package	Marking
TLE4276SV	PG-TO220-5	4276V
TLE4276GV50	PG-TO263-5	4276V50
TLE4276GV	PG-TO263-5	4276V
TLE4276DV50	PG-TO252-5	4276V50
TLE4276DV	PG-TO252-5	4276V

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Block Diagram

1 Block Diagram

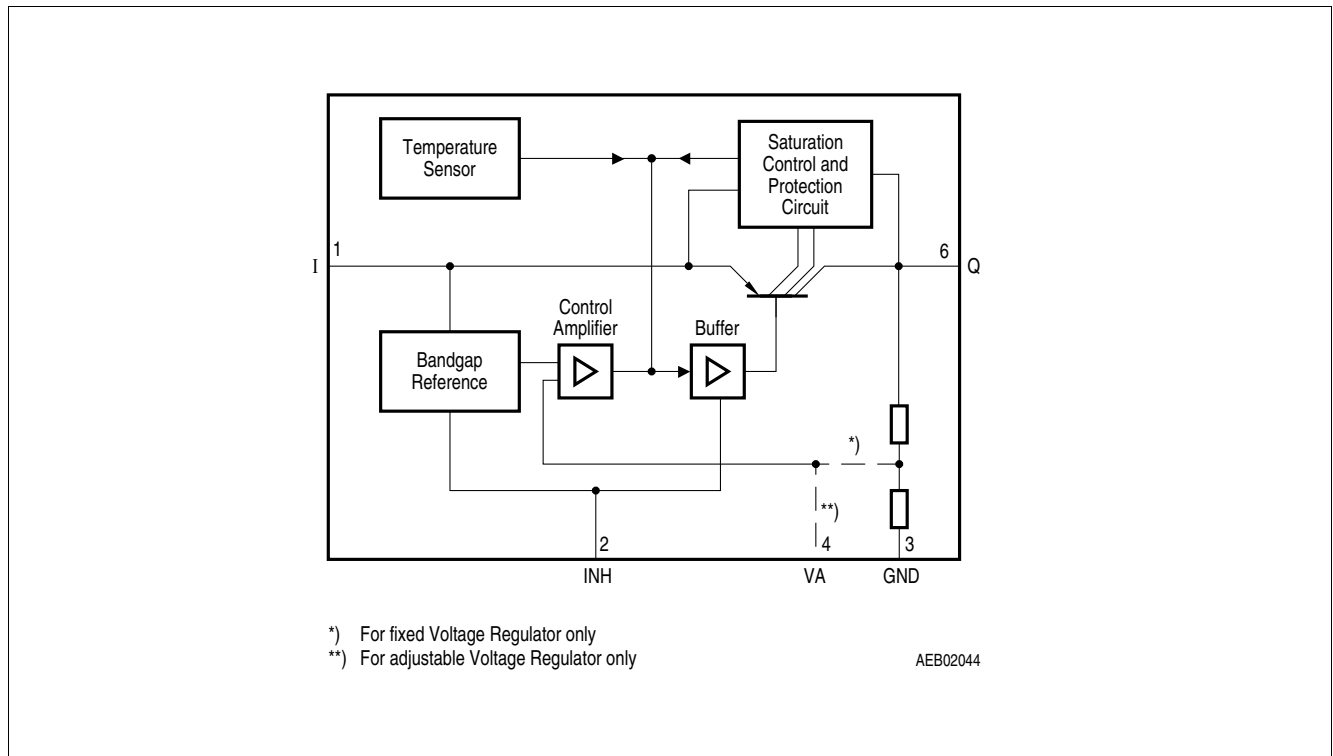


Figure 1 Block Diagram

Pin Configuration

2 Pin Configuration

2.1 Pin Assignments

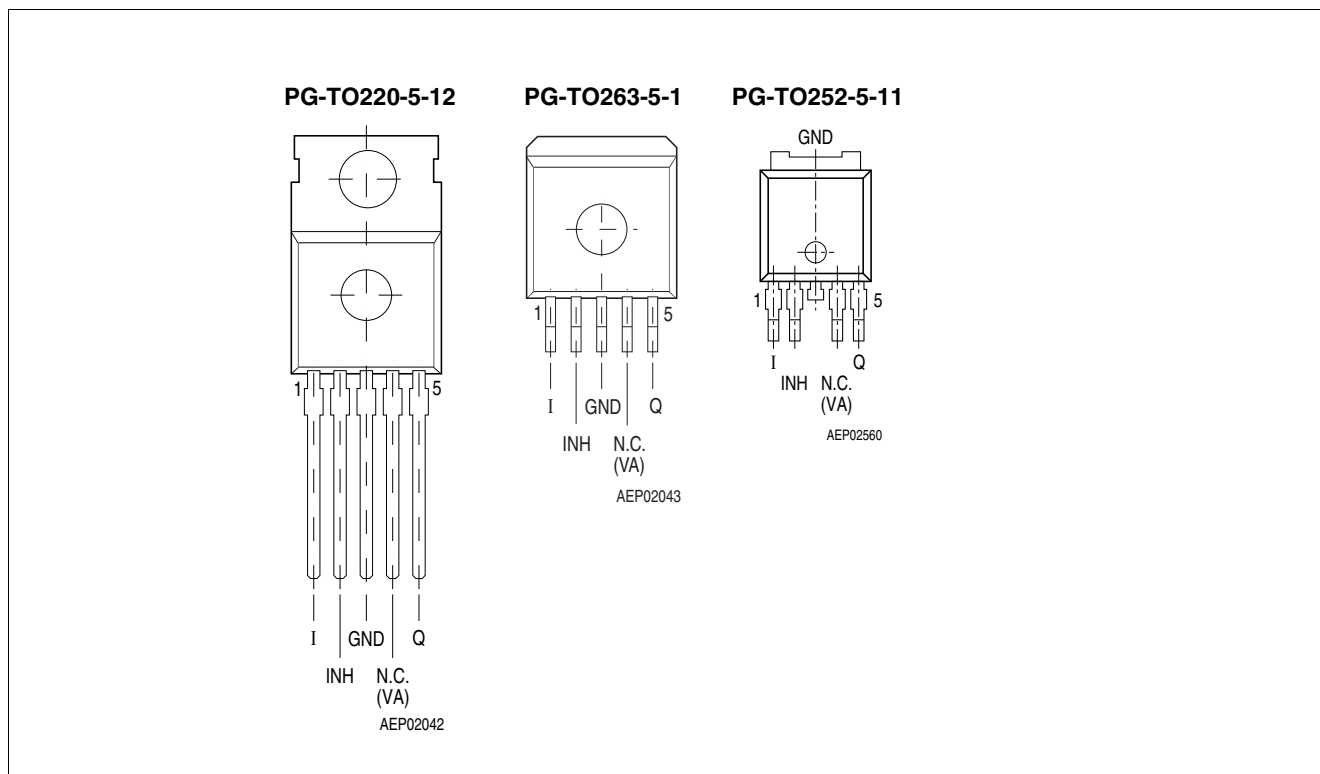


Figure 2 Pin Configuration (top view)

Table 1 Pin Definitions and Functions

Pin No.	Symbol	Function
1	I	Input; block to ground directly at the IC with a ceramic capacitor.
2	INH	Inhibit; low-active input.
3	GND	Ground
4	N.C. VA	Not connected for V50 Voltage Adjust Input; only for adjustable version. Connect an external voltage divider to determine the output voltage.
5	Q	Output; block to GND with a $\geq 22 \mu\text{F}$ capacitor, $\text{ESR} \leq 3 \Omega$ at 10 kHz
Heatsink		Connect to GND.

3 Functional Description

Functional Description

The OPTIREG™ Linear TLE4276 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), and 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 μ 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 Ω 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 $C_O \geq 22$ μ F and an ESR of ≤ 3 Ω 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

Functional Description

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	$V_{ESD,HBM}$	2000	-	V	Human Body Model

Functional Description

Table 4 Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
Input voltage	V_I	$V_Q + 0.5$	40	V	Fixed voltage devices 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	-

Thermal Resistance

Junction ambient	R_{thj-a}	-	65	K/W	TO220
Junction ambient	R_{thj-a}	-	80	K/W	TO252, TO263 ¹⁾
Junction case	R_{thj-c}	-	4	K/W	-

1) Package mounted on PCB 80 × 80 × 1.5 mm ; 35μ Cu; 5μ Sn; Footprint only; zero airflow.

Functional Description

Table 5 Characteristics

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

Parameter	Symbol	Limit Values			Unit	Measuring Condition	Measuring Circuit
		Min.	Typ.	Max.			
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	ΔV_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 ¹⁾	I_Q	400	600	1100	mA	-	1
Current consumption; $I_q = I_I - I_Q$	I_q	-	-	10	μA	$V_{\text{INH}} = 0 \text{ V}$; $T_j \leq 100 \text{ °C}$	1
Current consumption; $I_q = I_I - I_Q$	I_q	-	100	220	μA	$I_Q = 1 \text{ mA}$	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
Drop voltage ¹⁾	V_{DR}	-	250	500	mV	V50 $I_Q = 250 \text{ mA}$ $V_{\text{DR}} = V_I - V_Q$	1
Drop voltage ¹⁾	V_{DR}	-	250	500	mV	variable devices $I_Q = 250 \text{ mA}$ $V_I > 4.5 \text{ V}$ $V_{\text{DR}} = V_I - V_Q$	1
Load regulation	$\Delta V_{Q,\text{Lo}}$	-	5	35	mV	$I_Q = 5 \text{ mA to } 400 \text{ mA}$	1
Line regulation	$\Delta V_{Q,\text{Li}}$	-	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	$\Delta V_Q/dT$	-	0.5	-	-	-	mV/K

Functional Description

Table 5 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.			
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	μA	$V_{INH} = 5\text{ V}$	1

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

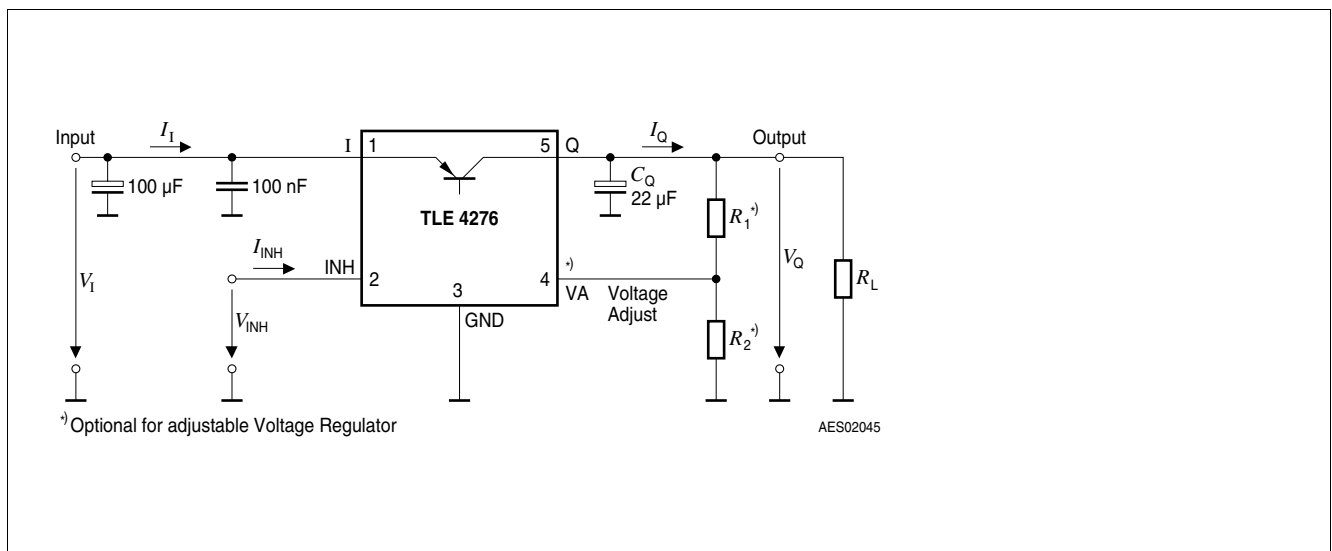


Figure 3 Measuring Circuit

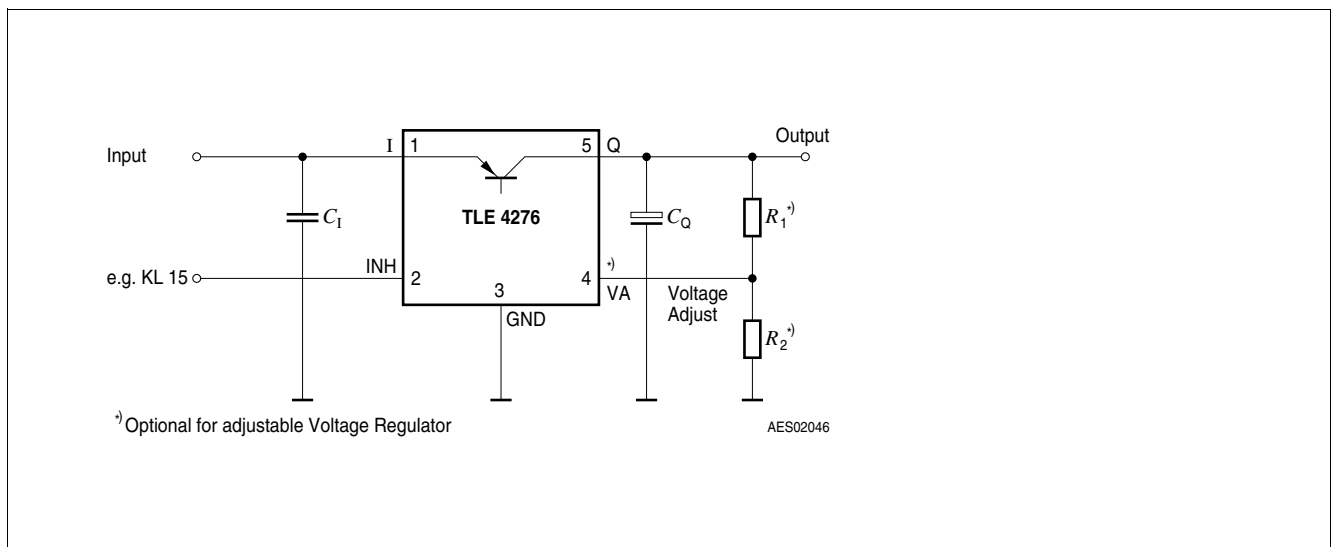


Figure 4 Application Circuit

Functional Description

Application Information for Variable Output Regulator TLE 4276 V

The output voltage of the TLE 4276 V 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.

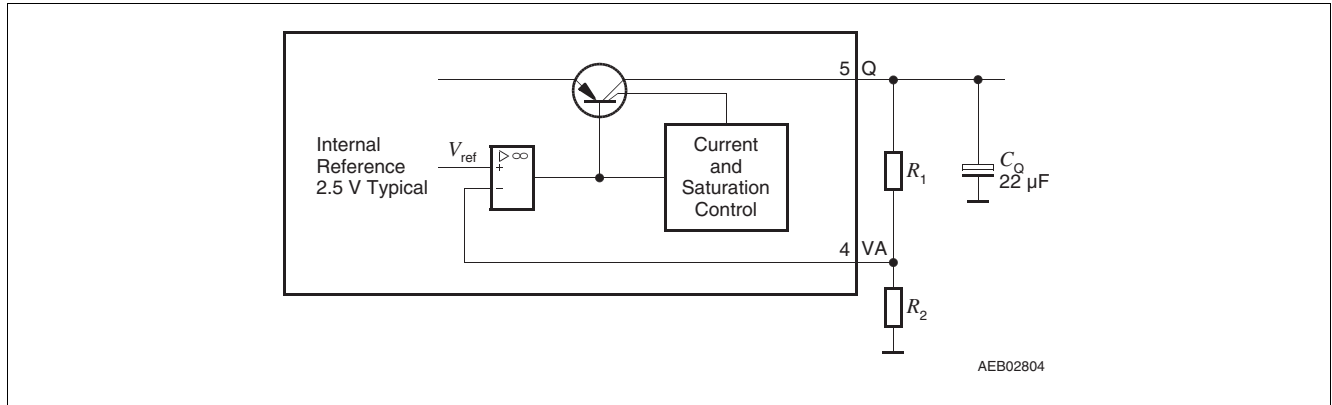


Figure 5 Application Detail External Components at Output for Variable Voltage Regulator

The output voltage is calculated according to **Equation (3.1)**:

$$V_Q = (R_1 + R_2) / R_2 \times V_{ref}, \text{ neglecting } I_{VA} \tag{3.1}$$

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 (3.2)**:

$$R_2 < 50 \text{ k}\Omega \tag{3.2}$$

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.

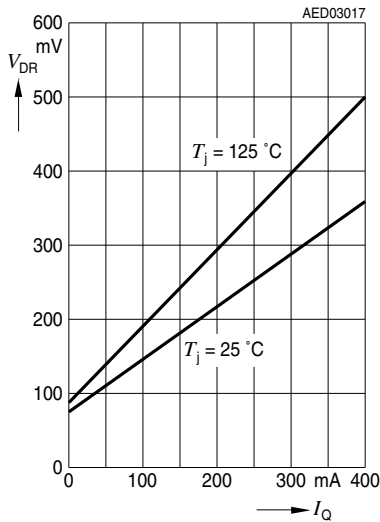
The operation range of the variable TLE 4276 V is $V_Q + 0.5 \text{ V}$ to 40 V. For internal biasing a minimum input voltage of 4.3 V is required. For output voltages below 4 V the voltage drop is $4.3 \text{ V} - V_Q$

Functional Description

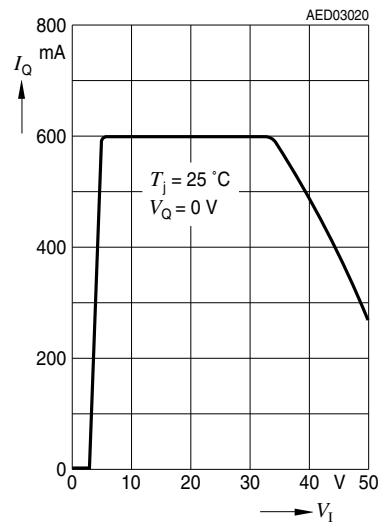
3.1 Typical Performance Graphs

Typical Performance Characteristics V50

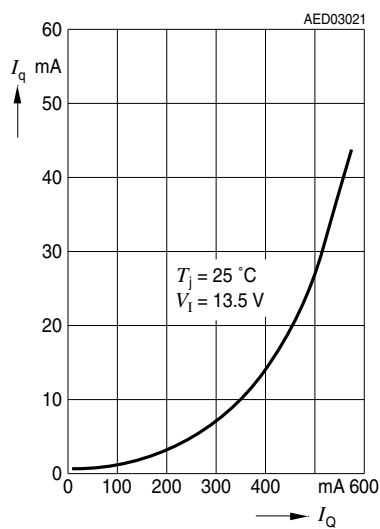
Voltage V_{DR} versus Output Current I_Q



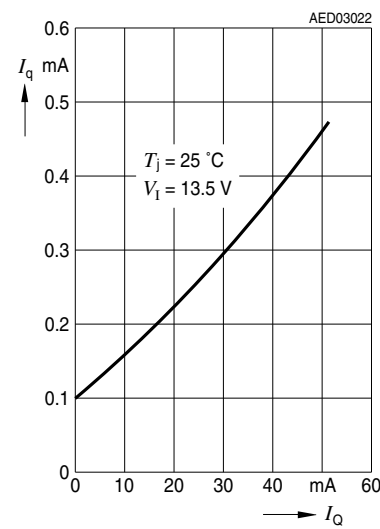
Current Consumption I_q versus Output Current I_Q (high load)



Max. Output Current I_Q versus Input Voltage V_I

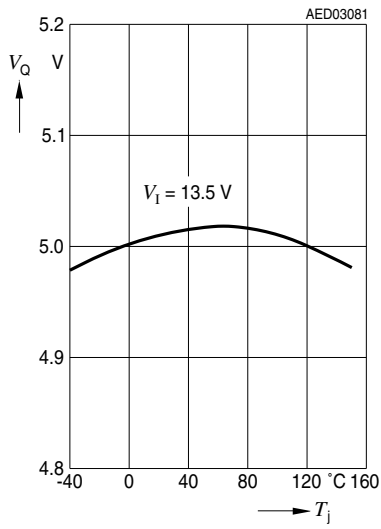


Current Consumption I_q versus Output Current I_Q (low load)

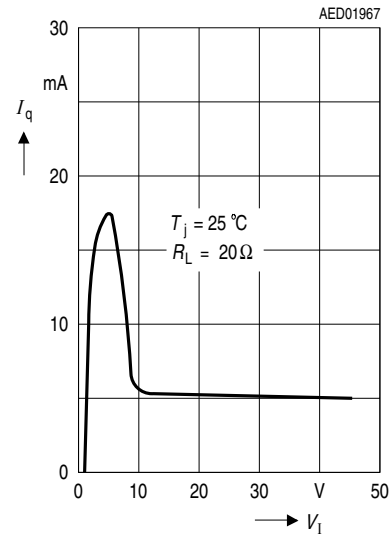


Functional Description

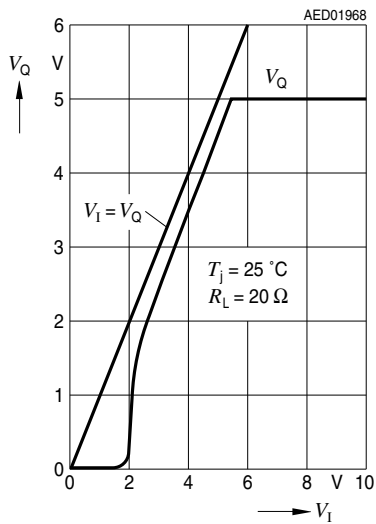
Output Voltage V_Q versus Temperature T_j



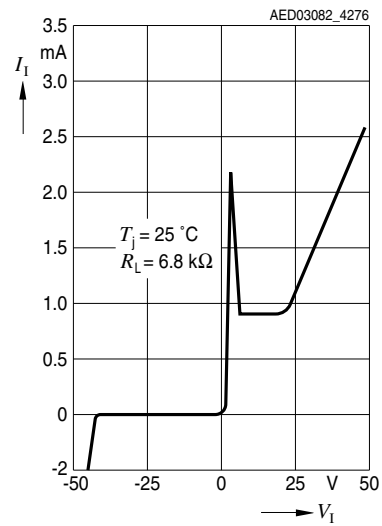
Current Consumption I_q versus Input Voltage V_I



Low Voltage Behavior



High Voltage Behavior



Package information

4 Package information

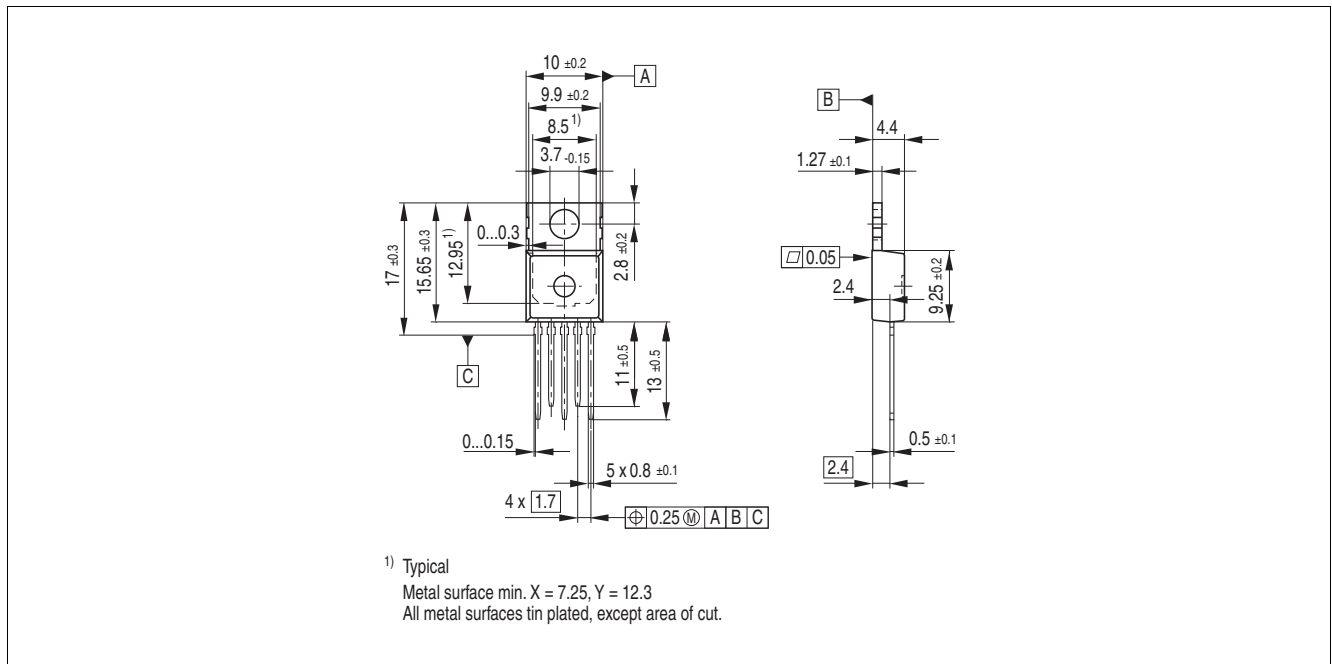


Figure 6 PG-TO220-5¹⁾

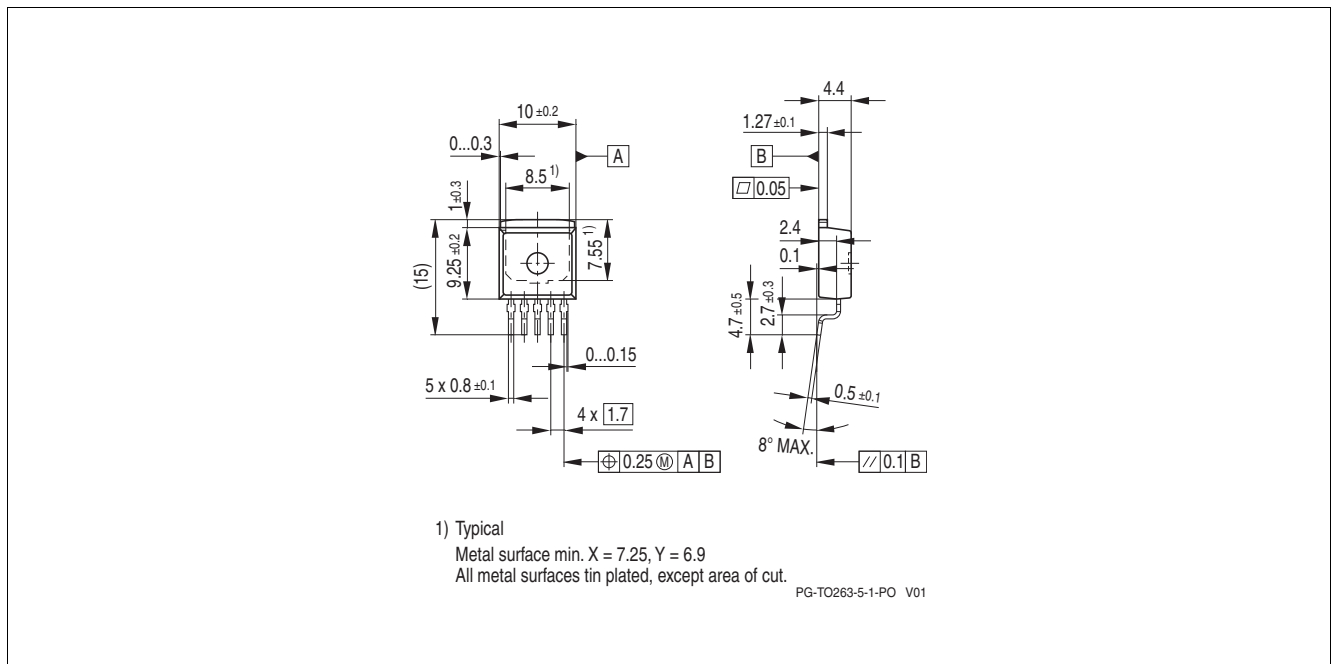


Figure 7 PG-TO263-5¹⁾

1) Dimensions in mm

Package information

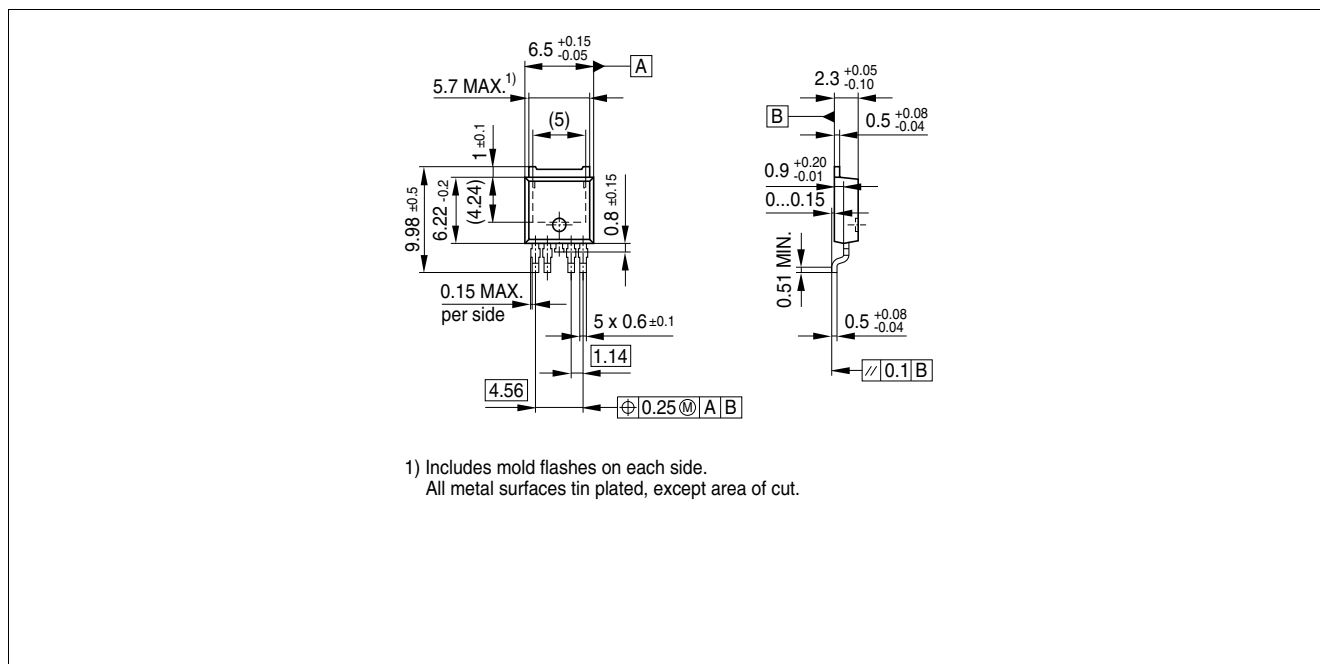


Figure 8 PG-T0252-5¹⁾

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).

Further information on packages

<https://www.infineon.com/packages>

1) Dimensions in mm

Revision History

5 Revision History

Revision	Date	Changes
2.81	2019-05-22	Updated layout (OPTIREG)
2.80	2018-01-10	Deleted obsolete products: TLE4276V50, TLE4276V85, TLE4276V10, TLE4276SV50, TLE4276SV85, TLE4276GV85 and TLE4276GV10 Updated Template

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