

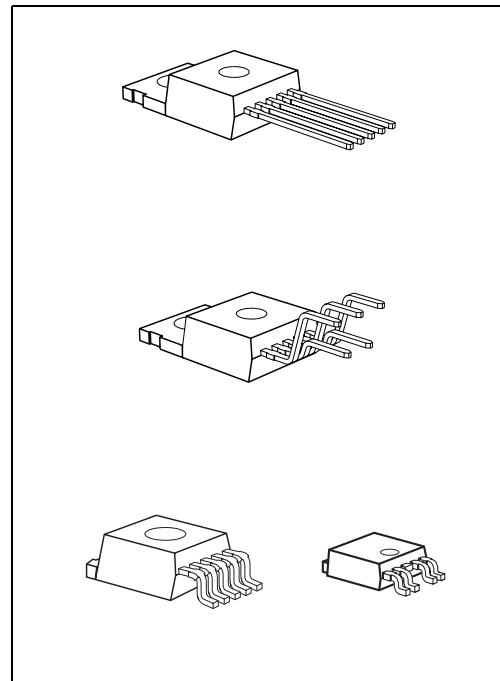
Low Drop Voltage Regulator

TLE 4276



Features

- 5 V, 8.5 V, 10 V or 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)
- AEC Qualified



Type	Package	Type	Package
TLE 4276 V50	PG-T0220-5-11	TLE 4276 GV50	PG-T0263-5-1
TLE 4276 V85	PG-T0220-5-11	TLE 4276 GV85	PG-T0263-5-1
TLE 4276 V10	PG-T0220-5-11	TLE 4276 GV10	PG-T0263-5-1
TLE 4276 V	PG-T0220-5-11	TLE 4276 GV	PG-T0263-5-1
TLE 4276 SV50	PG-T0220-5-12	TLE 4276 DV50	PG-T0252-5-11
TLE 4276 SV85	PG-T0220-5-12	TLE 4276 DV	PG-T0252-5-11
TLE 4276 SV	PG-T0220-5-12		

Functional Description

The TLE 4276 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), 8.5 V (V85), 10 V (V10) 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_Q is necessary for the stability of the regulation circuit. Stability is guaranteed at values $C_Q \geq 22 \mu$ 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

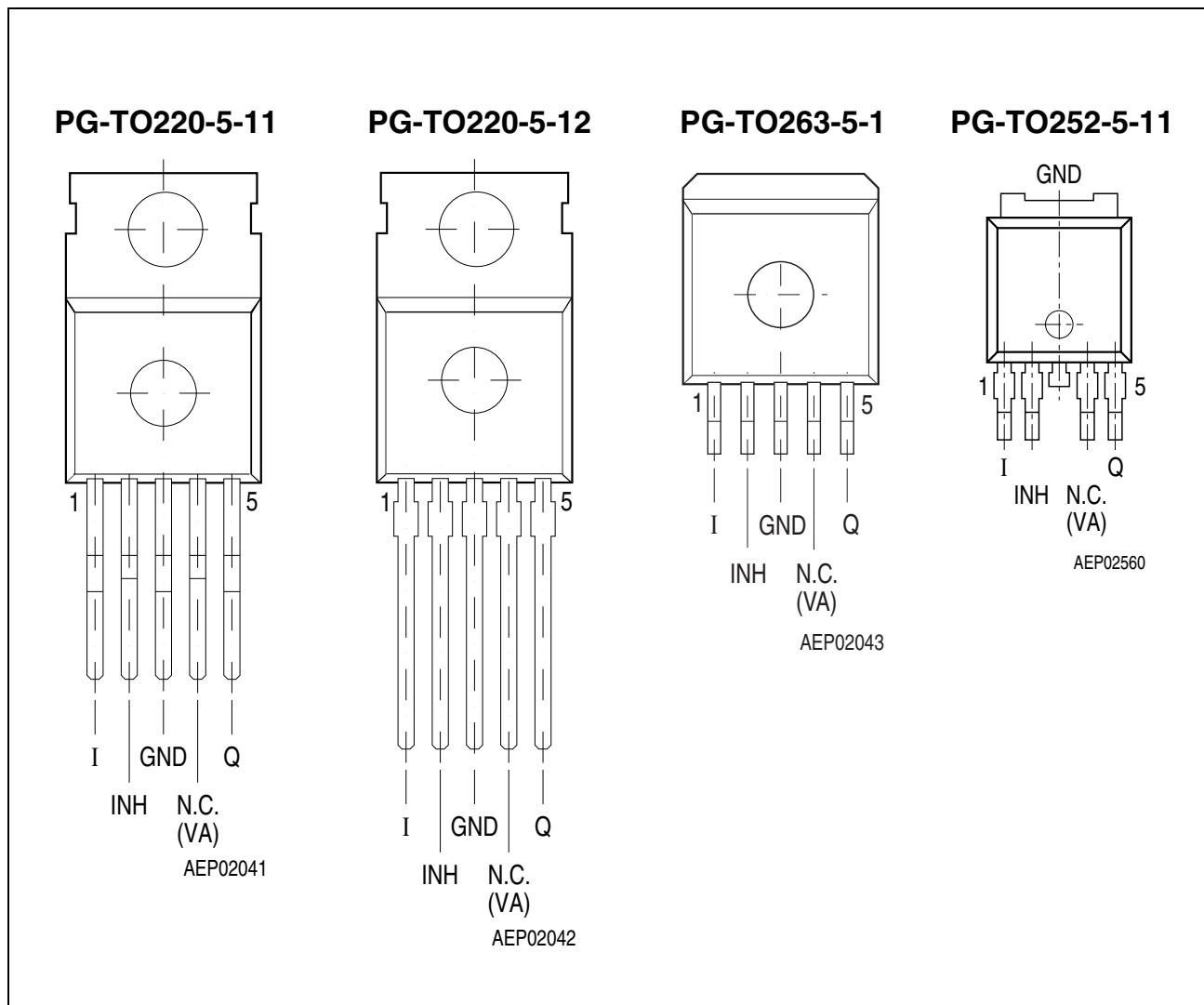
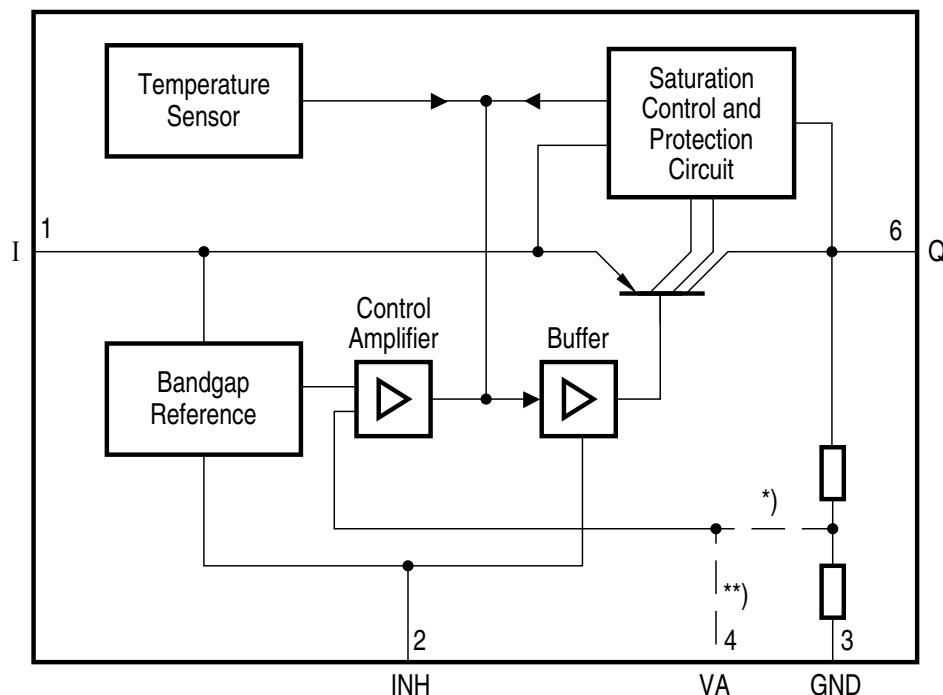


Figure 1 Pin Configuration (top view)

Table 1 Pin Definitions and Functions

Pin No.	Symbol	Function
1	I	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, V85, V10 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.



*) For fixed Voltage Regulator only

**) For adjustable Voltage Regulator only

AEB02044

Figure 2 Block Diagram

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

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, V85, V10
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 × 1.5mm³; 35µ Cu; 5µ Sn; Footprint only; zero airflow.

Table 5 Characteristics
 $V_I = 13.5 \text{ V}$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$ (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 mA < I_Q < 400 mA 6 V < V_I < 28 V	1
Output voltage	V_Q	4.8	5.0	5.2	V	V50-Version 5 mA < I_Q < 200 mA 6 V < V_I < 40 V	1
Output voltage	V_Q	8.16	8.50	8.84	V	V85-Version 5 mA < I_Q < 400 mA 9.5 V < V_I < 28 V	1
Output voltage	V_Q	8.16	8.50	8.84	V	V85-Version 5 mA < I_Q < 200 mA 9.5 V < V_I < 40 V	1
Output voltage	V_Q	9.6	10.0	10.4	V	V10-Version 5 mA < I_Q < 400 mA 11 V < V_I < 28 V	1
Output voltage	V_Q	9.6	10.0	10.4	V	V10-Version 5 mA < I_Q < 200 mA 11 V < V_I < 40 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 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	$V_{\text{INH}} = 0 \text{ V}$; $T_j \leq 100^\circ\text{C}$	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

Table 5 Characteristics (cont'd)
 $V_I = 13.5 \text{ V}$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Measuring Condition	Measuring Circuit
		Min.	Typ.	Max.			
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	$V50, V85, V10$ $I_Q = 250 \text{ mA}$ $V_{DR} = V_I - V_Q$	1
Drop voltage ¹⁾	V_{DR}	—	250	500	mV	variable devices $I_Q = 250 \text{ mA}$ $V_I > 4.5 \text{ V}$ $V_{DR} = V_I - V_Q$	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	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 $V_I = 13.5 \text{ V}$.

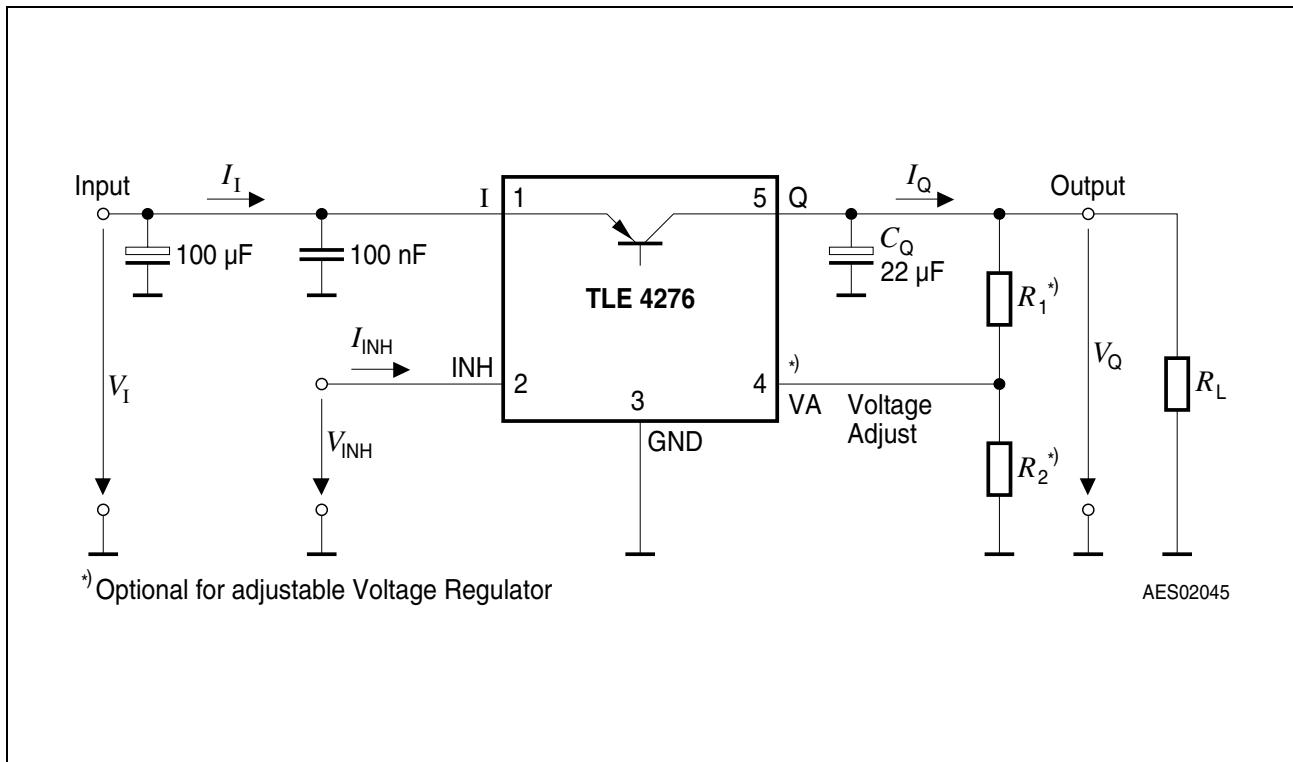


Figure 3 Measuring Circuit

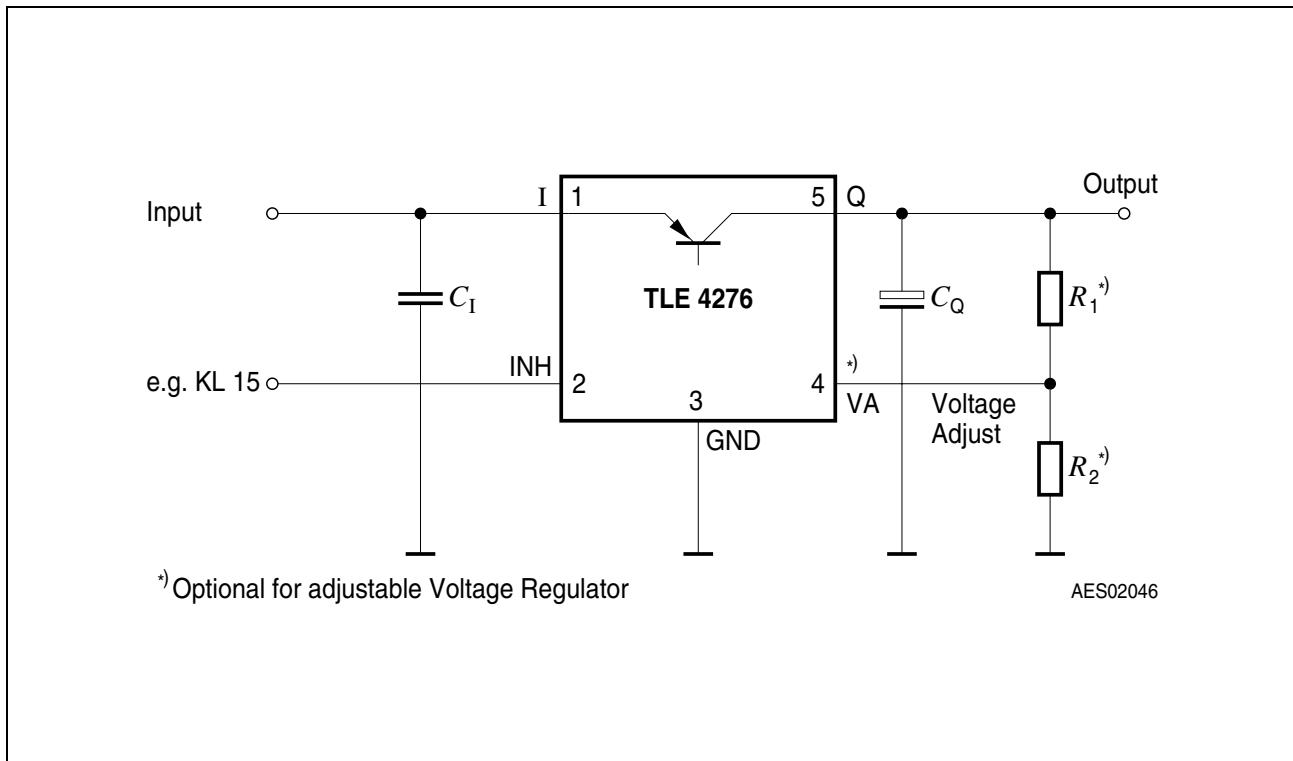


Figure 4 Application Circuit

Application Information for Variable Output Regulator TLE 4276 V, SV, DV, GV

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.

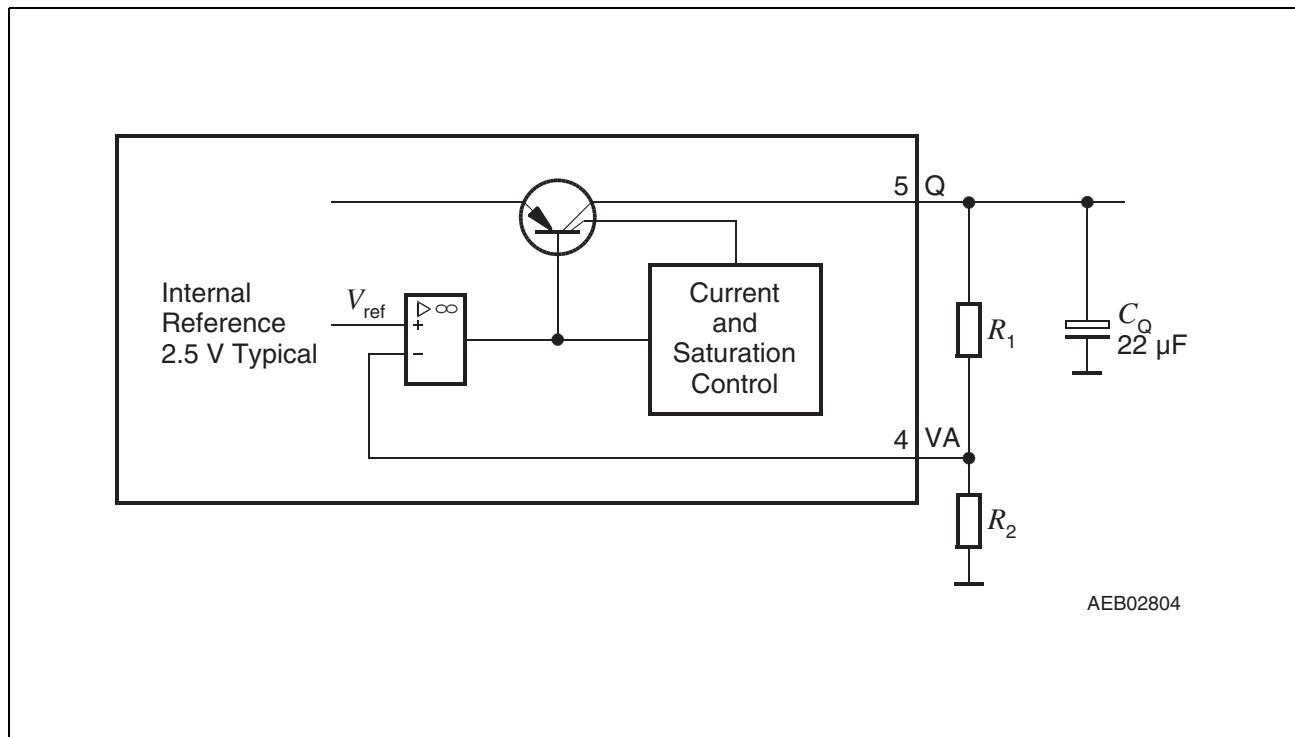


Figure 5 Application Detail External Components at Output for Variable Voltage Regulator

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

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

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 \(2\)](#):

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

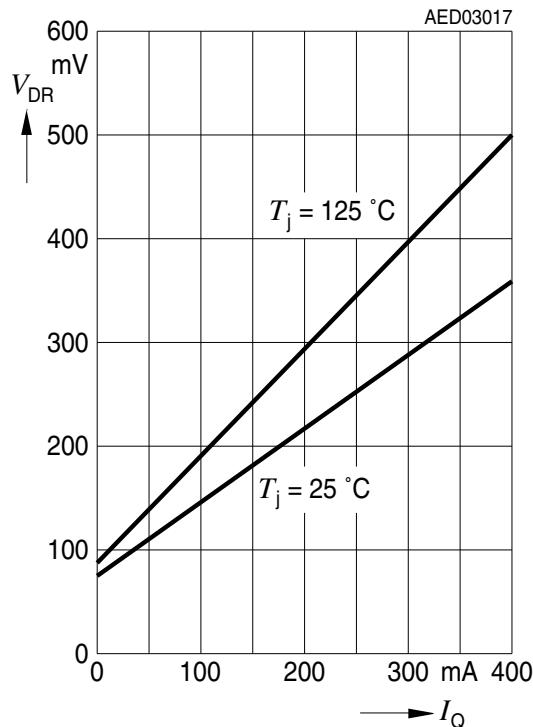
For a 2.5 V output voltage the output pin Q is directly connected to the adjust pin VA.

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

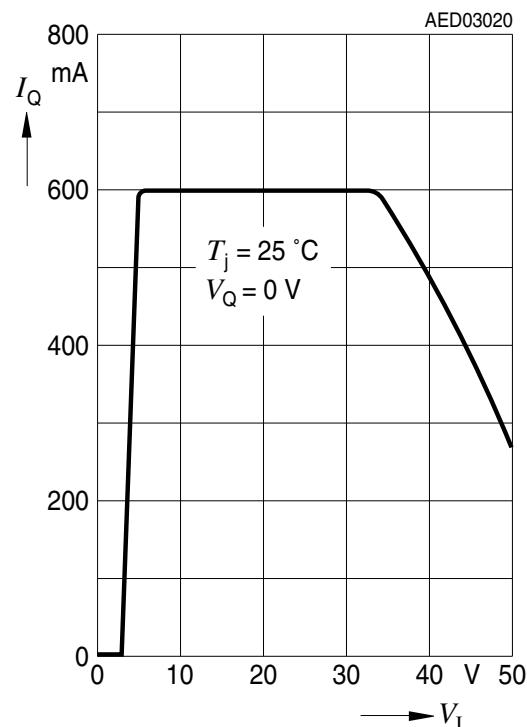
The operation range of the variable TLE 4276 V is $V_Q + 0.5 \text{ V}$ to 40 V. For internal biasing a minimum input voltage of 4.3 V is required. For output voltages below 4 V the voltage drop is 4.3 V - V_Q .

Typical Performance Characteristics (V50, V85 and V10):

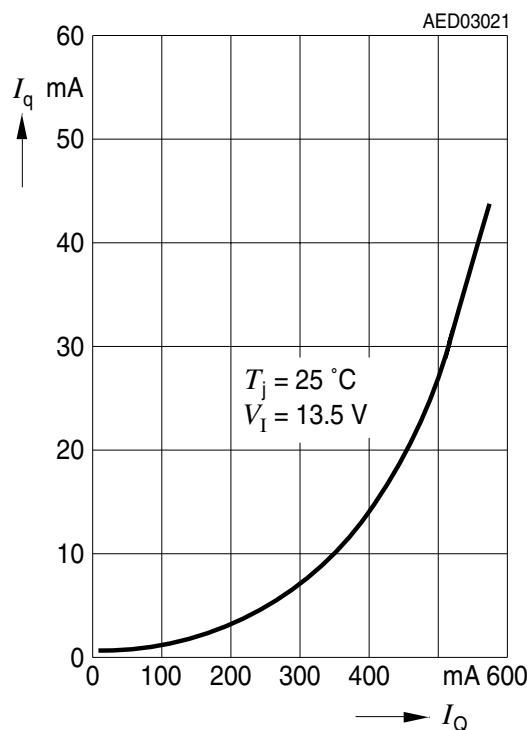
Voltage V_{DR} versus Output Current I_Q



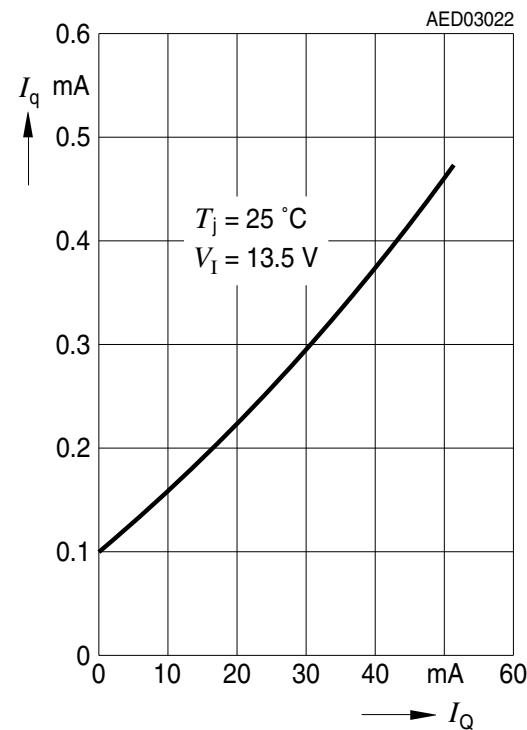
Max. Output Current I_Q versus Input Voltage V_I

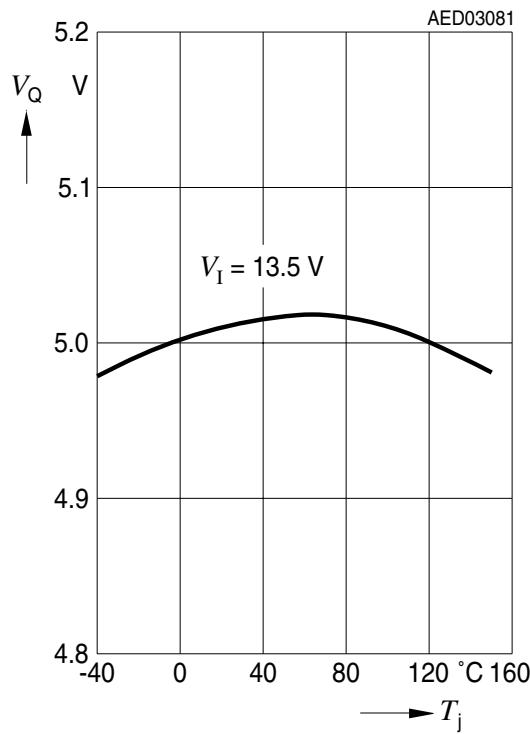
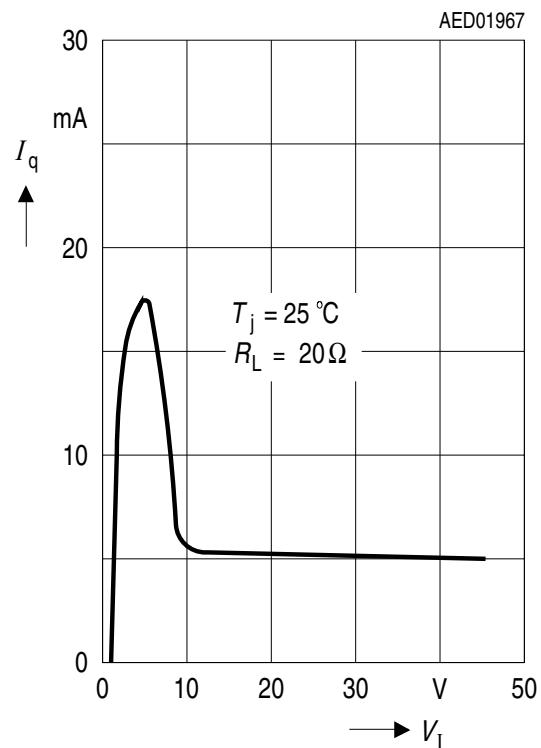
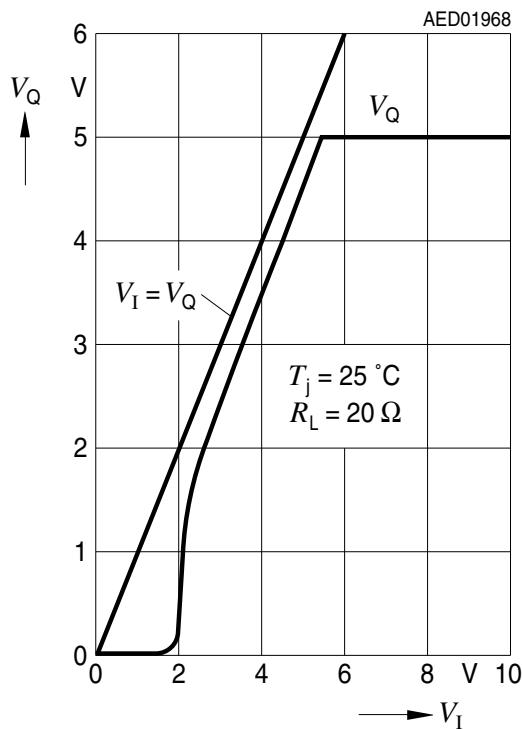
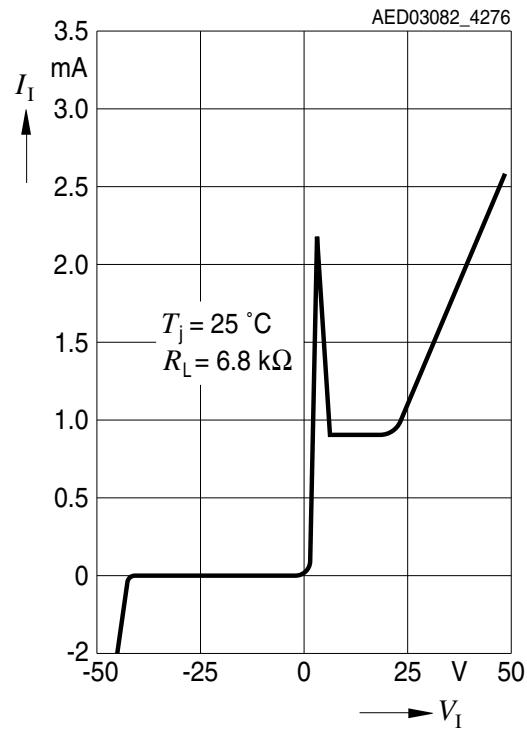


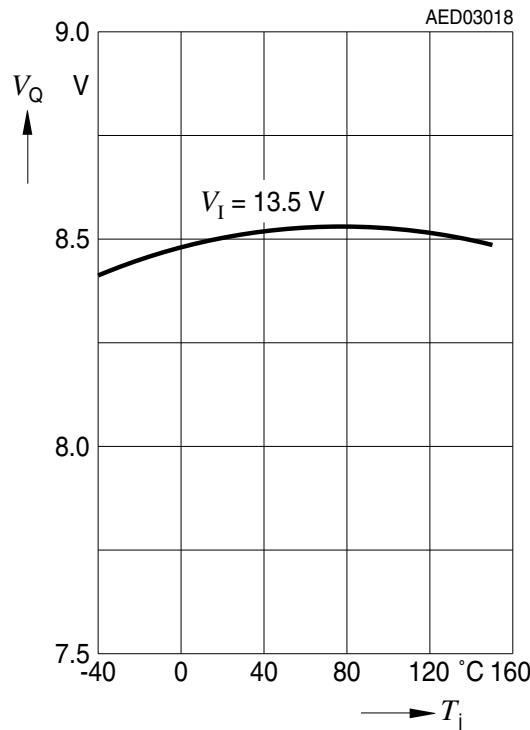
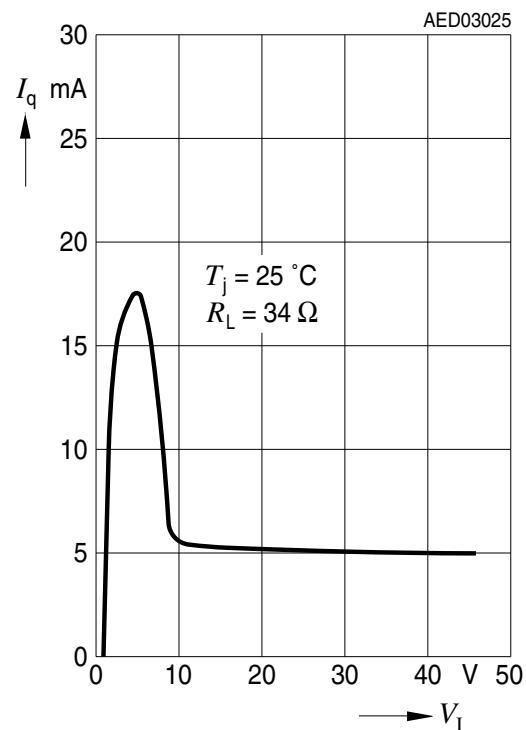
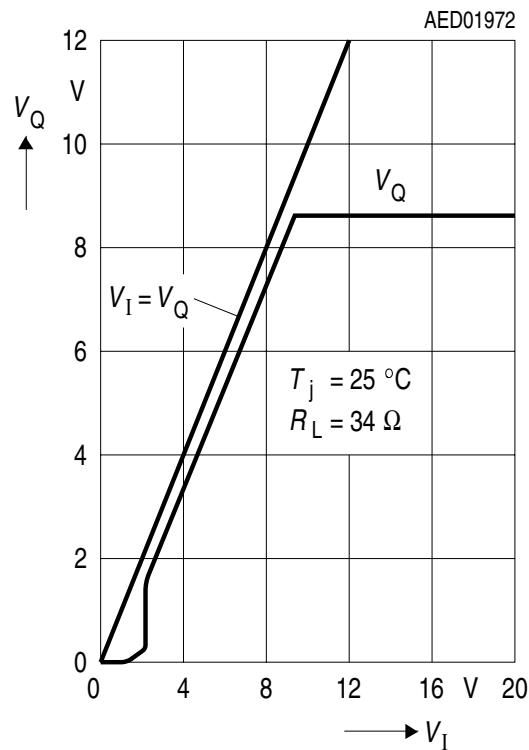
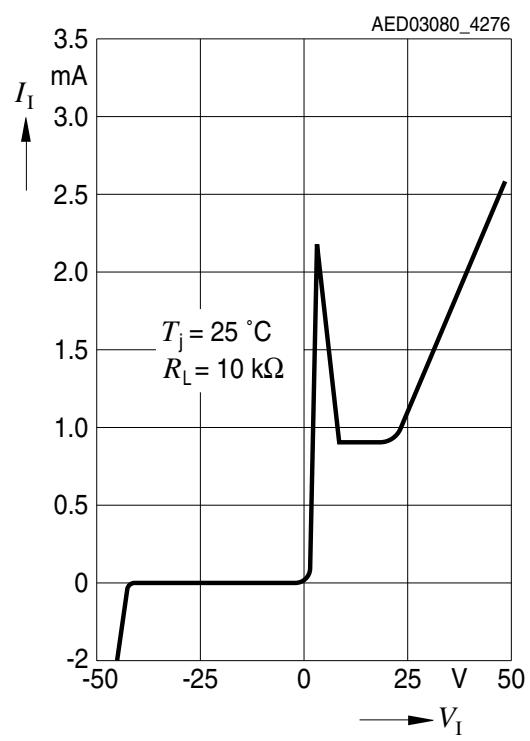
Current Consumption I_q versus Output Current I_Q (high load)

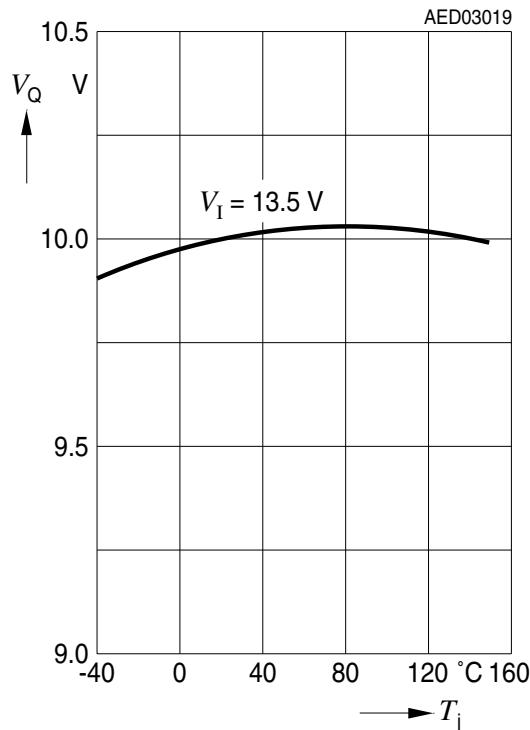
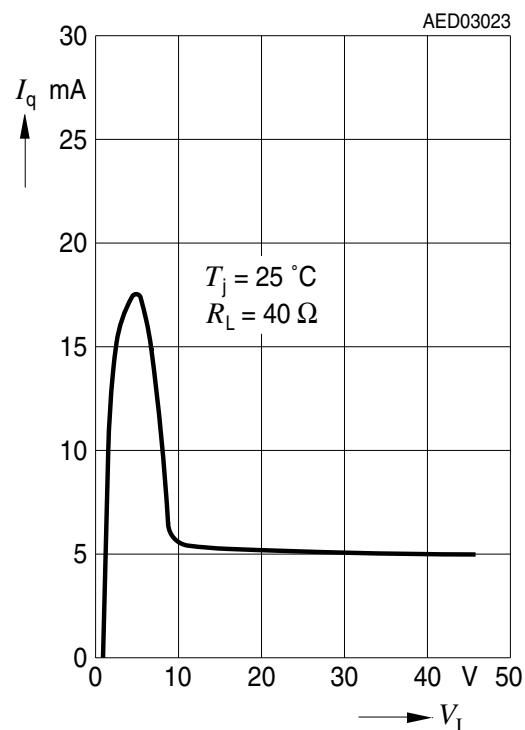
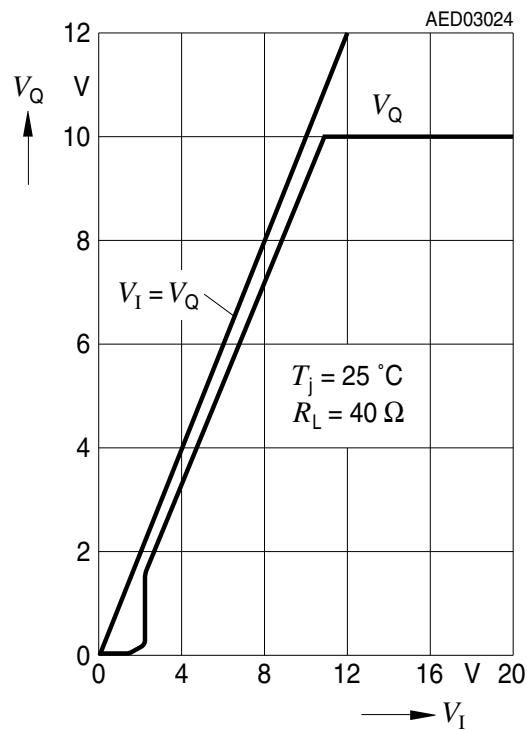
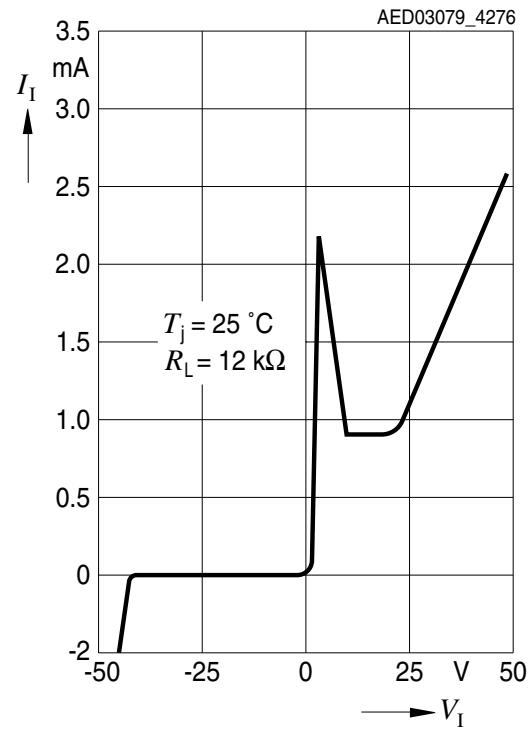


Current Consumption I_q versus Output Current I_Q (low load)

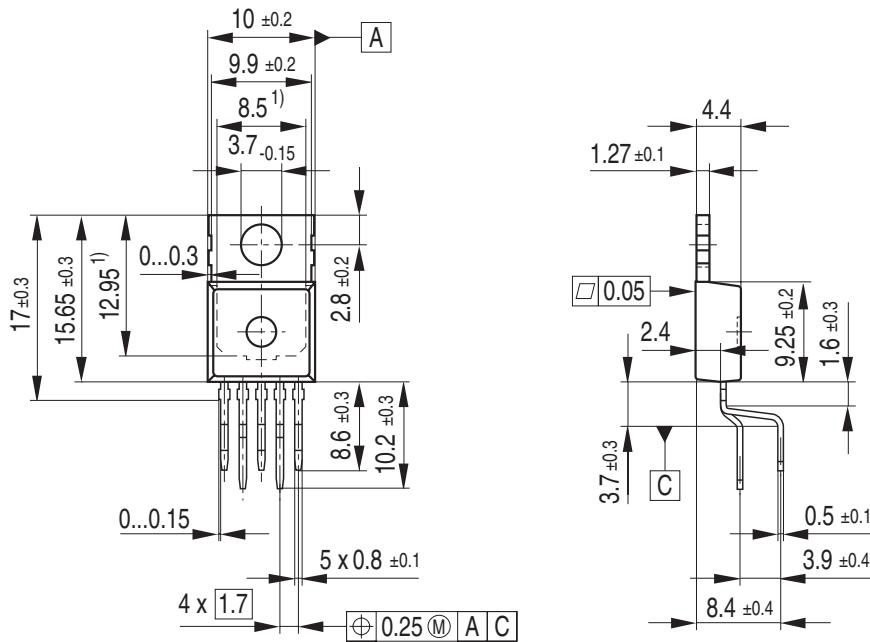


Typical Performance Characteristics for V50:
Output Voltage V_Q versus Temperature T_j

Current Consumption I_q versus Input Voltage V_I

Low Voltage Behavior

High Voltage Behavior


Typical Performance Characteristics for V85:
**Output Voltage V_Q versus
Temperature T_j**

**Current Consumption I_q versus
Input Voltage V_I**

Low Voltage Behavior

High Voltage Behavior


Typical Performance Characteristics for V10:
**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



1) Typical
All metal surfaces tin plated, except area of cut.

GPT09064

Figure 6 PG-TO220-5-11 (Plastic Transistor Single Outline)

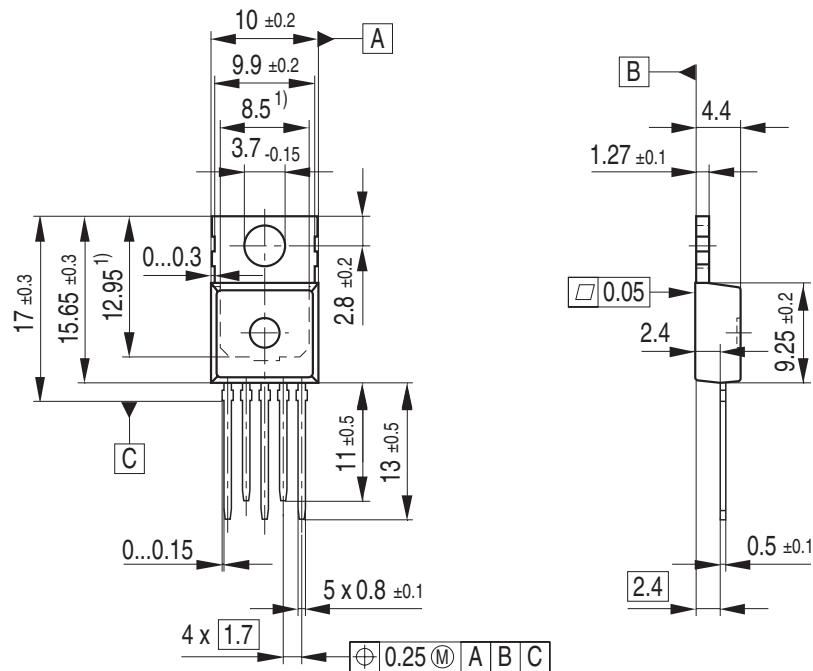
Green Product (RoHS compliant)

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).

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SMD = Surface Mounted Device

Dimensions in mm



¹⁾ Typical
Metal surface min. X = 7.25, Y = 12.3
All metal surfaces tin plated, except area of cut.

GPT09065

Figure 7 PG-T0220-5-12 (Plastic Transistor Single Outline)

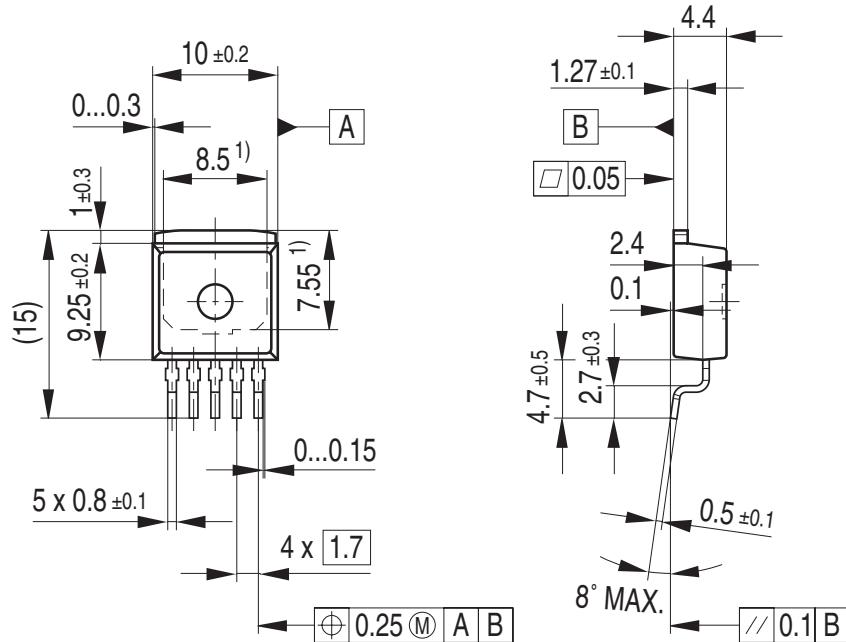
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SMD = Surface Mounted Device

Dimensions in mm



1) Typical

Metal surface min. X = 7.25, Y = 6.9

All metal surfaces tin plated, except area of cut.

GPT09113

Figure 8 PG-T0263-5-1 (Plastic Transistor Single Outline)

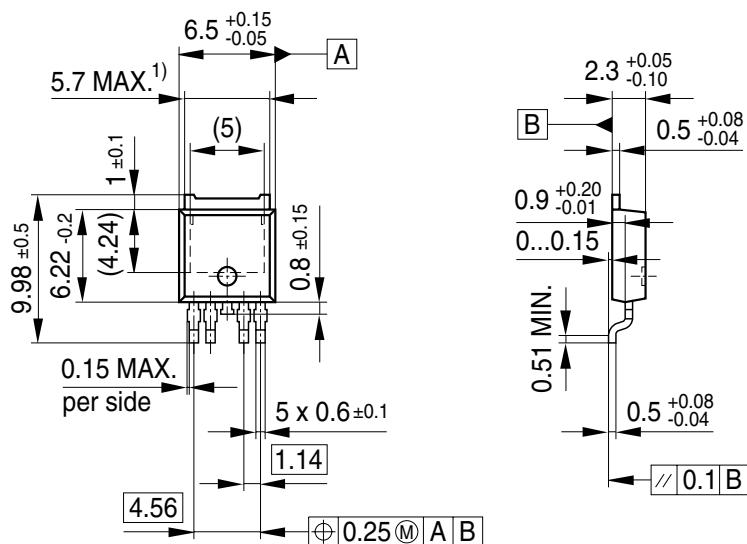
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SMD = Surface Mounted Device

Dimensions in mm



GPT09527

Figure 9 PG-T0252-5-11 (Plastic Transistor Single Outline)

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SMD = Surface Mounted Device

Dimensions in mm

Revision History

Version	Date	Changes
Rev. 2.7	2007-10-23	Page 17 : Corrected package outline drawing of PG-T0263-5-1
Rev. 2.6	2007-03-20	Initial version of RoHS-compliant derivate of TLE 4276 Page 1 : AEC certified statement added Page 1 and Page 15 : RoHS compliance statement and Green product feature added Page 1 and Page 15 : Package changed to RoHS compliant version Legal Disclaimer updated
Rev. 2.5	2004-12-23	Added ESD capability information in table “Maximum Ratings”.

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