

Low-Drop Voltage Regulator

TLE 4276

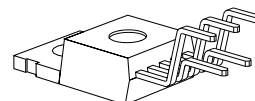
Features

- 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

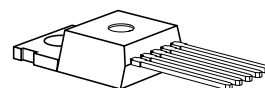
Type	Ordering Code	Package
TLE 4276 V50	Q67000-A9262	P-TO220-5-3
TLE 4276 V85	Q67000-A9263	P-TO220-5-3
TLE 4276 V10	Q67000-A9264	P-TO220-5-3
TLE 4276 V	Q67000-A9265	P-TO220-5-3
TLE 4276 S V50	Q67000-A9267	P-TO220-5-43
TLE 4276 S V85	Q67000-A9269	P-TO220-5-43
TLE 4276 S V10	Q67000-A9271	P-TO220-5-43
TLE 4276 SV	Q67000-A9273	P-TO220-5-43
TLE 4276 G V50	Q67006-A9266	P-TO220-5-122
TLE 4276 G V85	Q67006-A9268	P-TO220-5-122
TLE 4276 G V10	Q67006-A9270	P-TO220-5-122
TLE 4276 GV	Q67006-A9272	P-TO220-5-122
• TLE 4276 D V50	Q67006-A9369	P-TO252-5-1
• TLE 4276 DV	Q67006-A9361	P-TO252-5-1

■ SMD = Surface Mounted Device

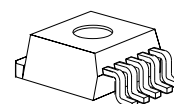
- New type



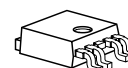
P-TO220-5-3



P-TO-220-5-43



P-TO 220-5-122
(TO-220 AB/5, Option E3122)



P-TO252-5-1

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 $V_{Q,nom} = 5.0\text{ V (V50)}$, 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 $10\text{ }\mu\text{A}$. 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. $1\text{ }\Omega$ 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 $C_Q \geq 22\text{ }\mu\text{F}$ and an ESR of $\leq 3\text{ }\Omega$ 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

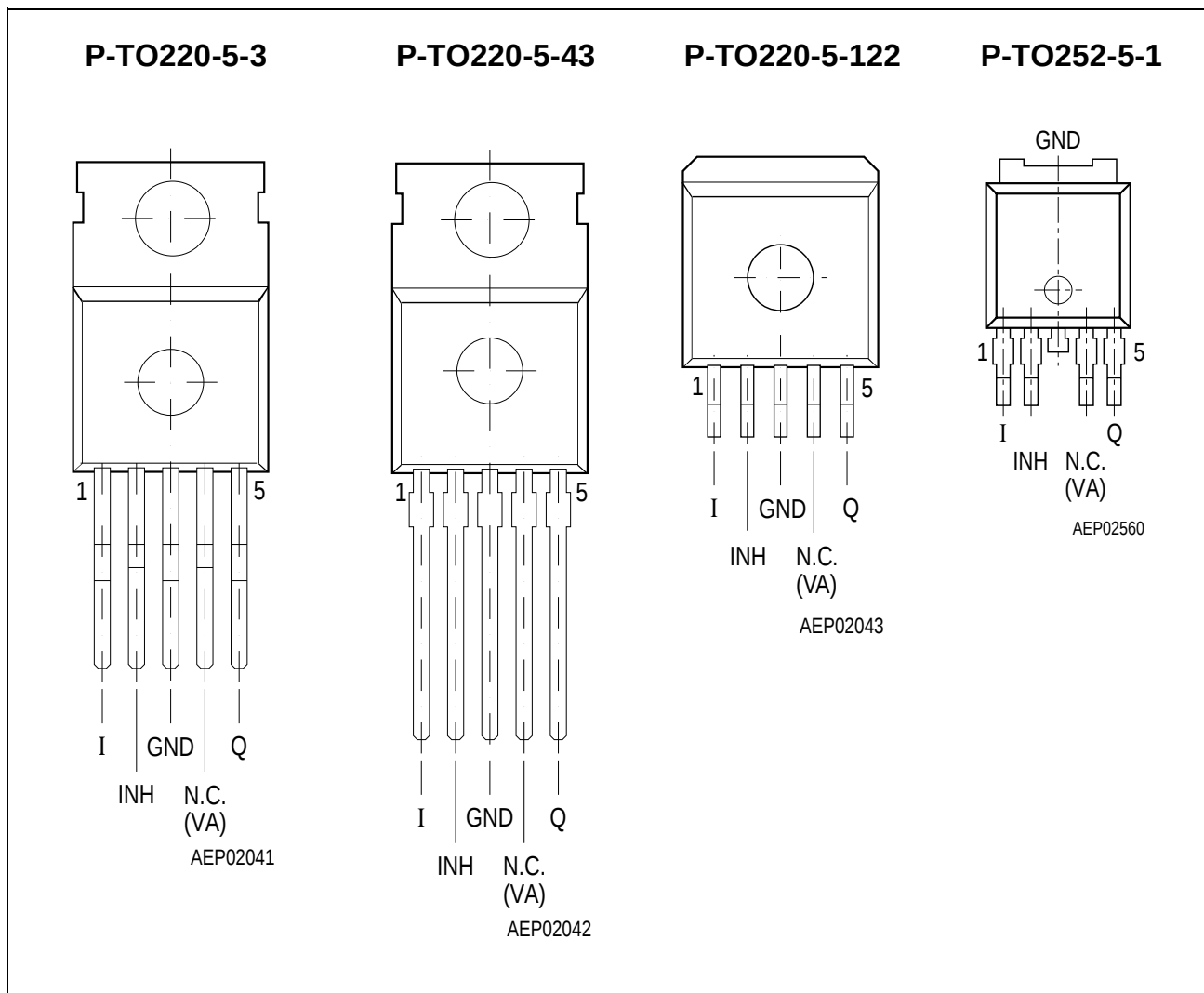
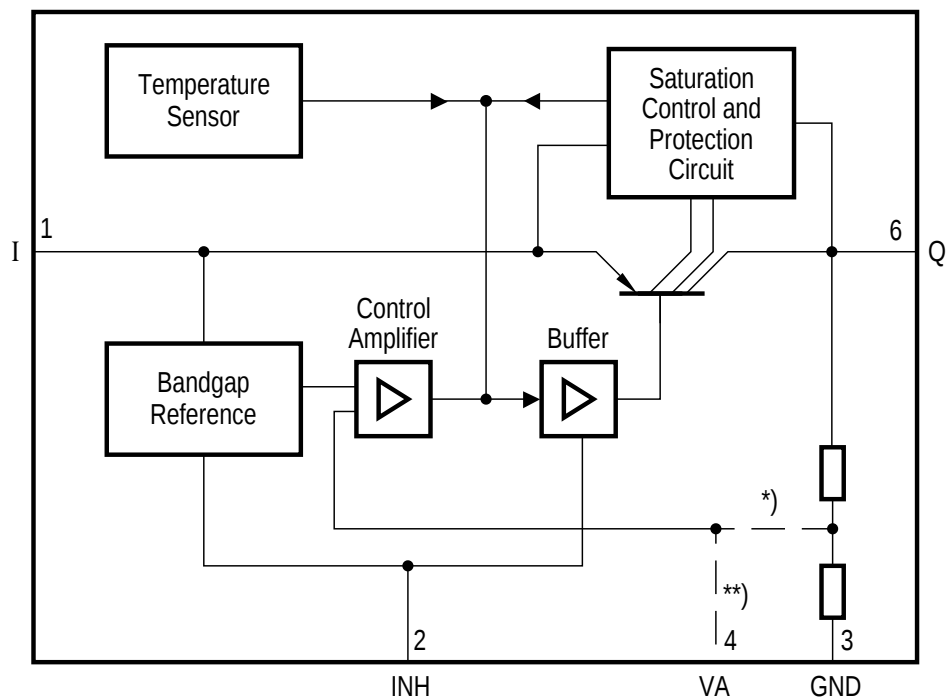


Figure 1 Pin Configuration (top view)

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 ground with a capacitor of $C \geq 22 \mu\text{F}$, $\text{ESR} \geq 3 \Omega$ at 10 kHz.



- *) For fixed Voltage Regulator only
 **) For adjustable Voltage Regulator only

AEB02044

Figure 2 **Block Diagram**

Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Test Condition
		min.	max.		

Voltage Regulator

Input I

Voltage	V_I	– 42	45	V	–
Current	I_I	–	–	–	Internally limited

Inhibit INH

Voltage	V_{INH}	– 42	45	V	–
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Voltage Adjust Input VA

Voltage	V_{VA}	– 0.3	10	V	–
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Output Q

Voltage	V_Q	– 1.0	40	V	–
Current	I_Q	–	–	–	Internally limited

Ground GND

Current	I_{GND}	–	100	mA	–
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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.

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.

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	4.8	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	V_Q	8.16	8.50	8.84	V	V85-Version $5 \text{ mA} < I_Q < 400 \text{ mA}$ $9.5 \text{ V} < V_i < 28 \text{ V}$	1
Output voltage	V_Q	8.16	8.50	8.84	V	V85-Version $5 \text{ mA} < I_Q < 200 \text{ mA}$ $9.5 \text{ V} < V_i < 40 \text{ V}$	1
Output voltage	V_Q	9.6	10.0	10.4	V	V10-Version $5 \text{ mA} < I_Q < 400 \text{ mA}$ $11 \text{ V} < V_i < 28 \text{ V}$	1
Output voltage	V_Q	9.6	10.0	10.4	V	V10-Version $5 \text{ mA} < I_Q < 200 \text{ mA}$ $11 \text{ V} < V_i < 40 \text{ V}$	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	$V_{\text{INH}} = 0 \text{ V}$; $T_j \leq 100 \text{ }^{\circ}\text{C}$	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

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.			
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 mA	1
Line regulation	$\Delta V_{Q,Li}$	–	15	25	mV	$\Delta V_I = 12 \text{ V}$ to 32V $I_Q = 5 \text{ mA}$	1
Power supply ripple rejection	$PSRR$	–	54	–	dB	$f_r = 100 \text{ Hz}$; $V_r = 0.5 V_{SS}$	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 $V_I = 13.5 \text{ V}$.

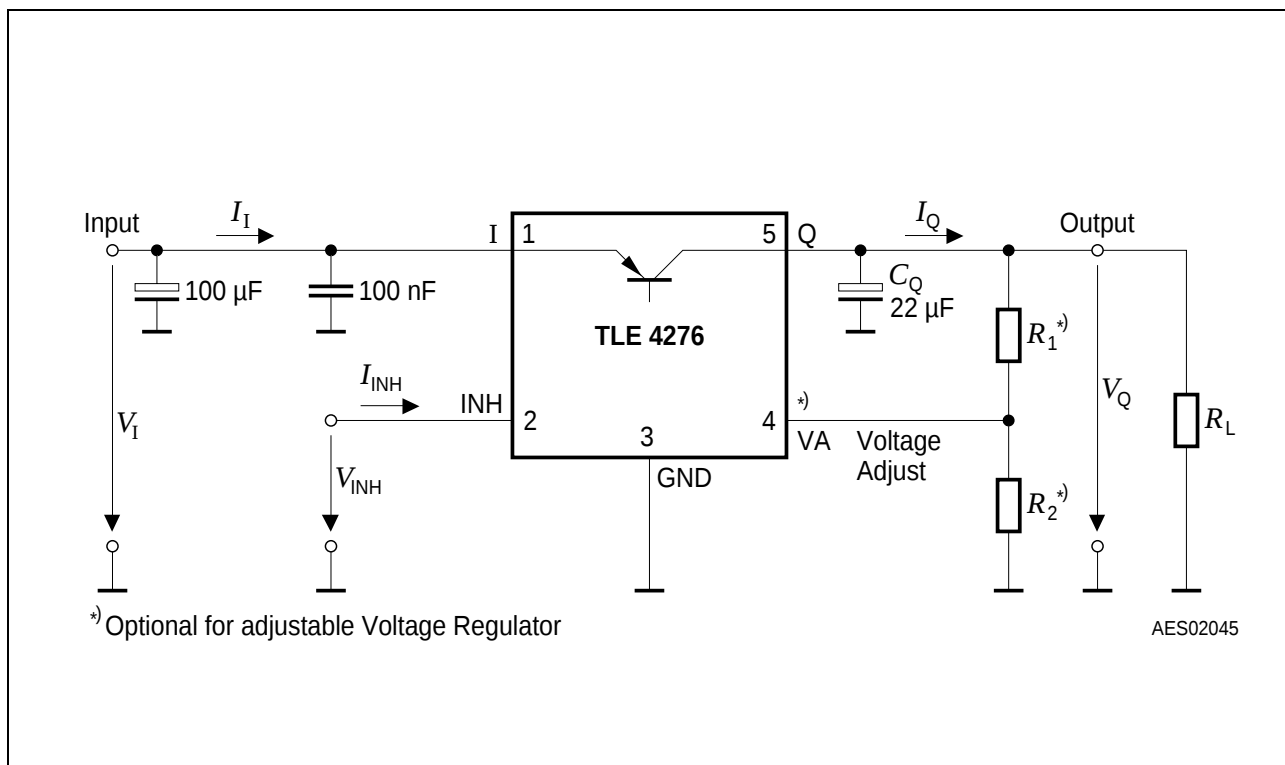


Figure 3 Measuring Circuit

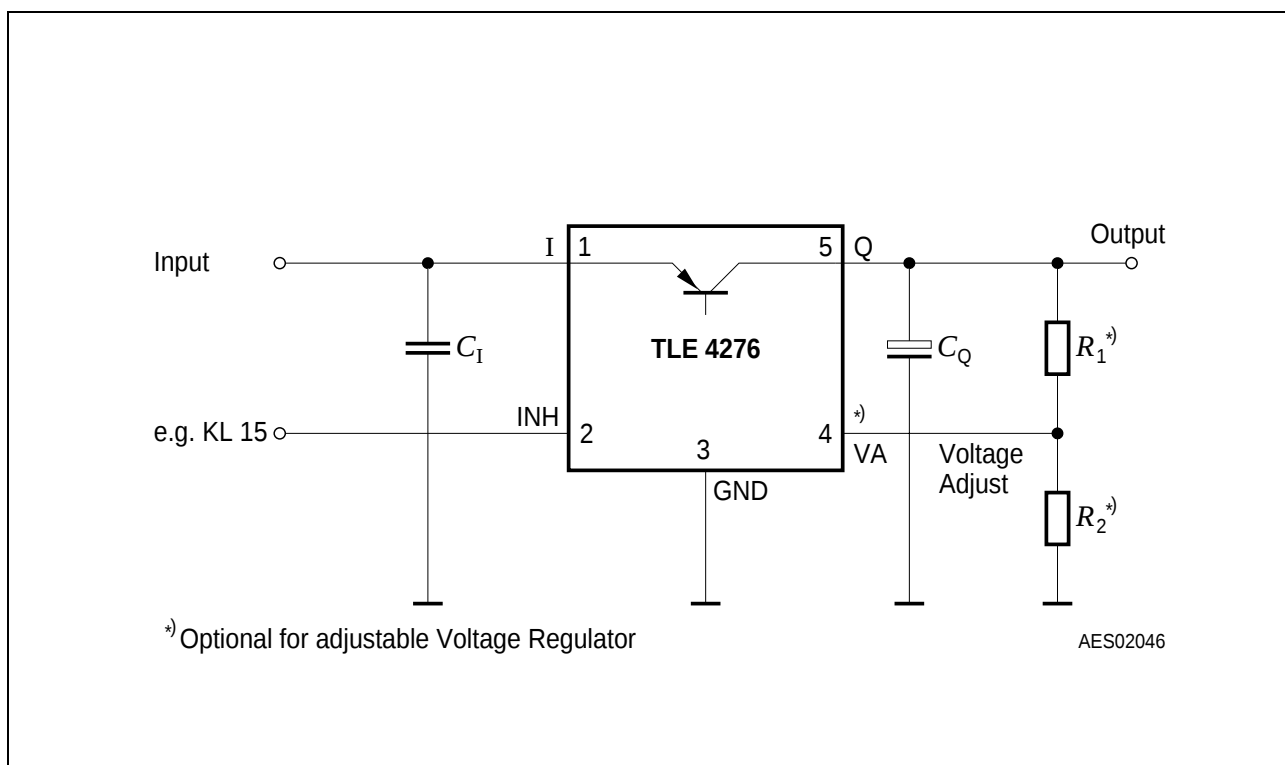


Figure 4 Application Circuit

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.

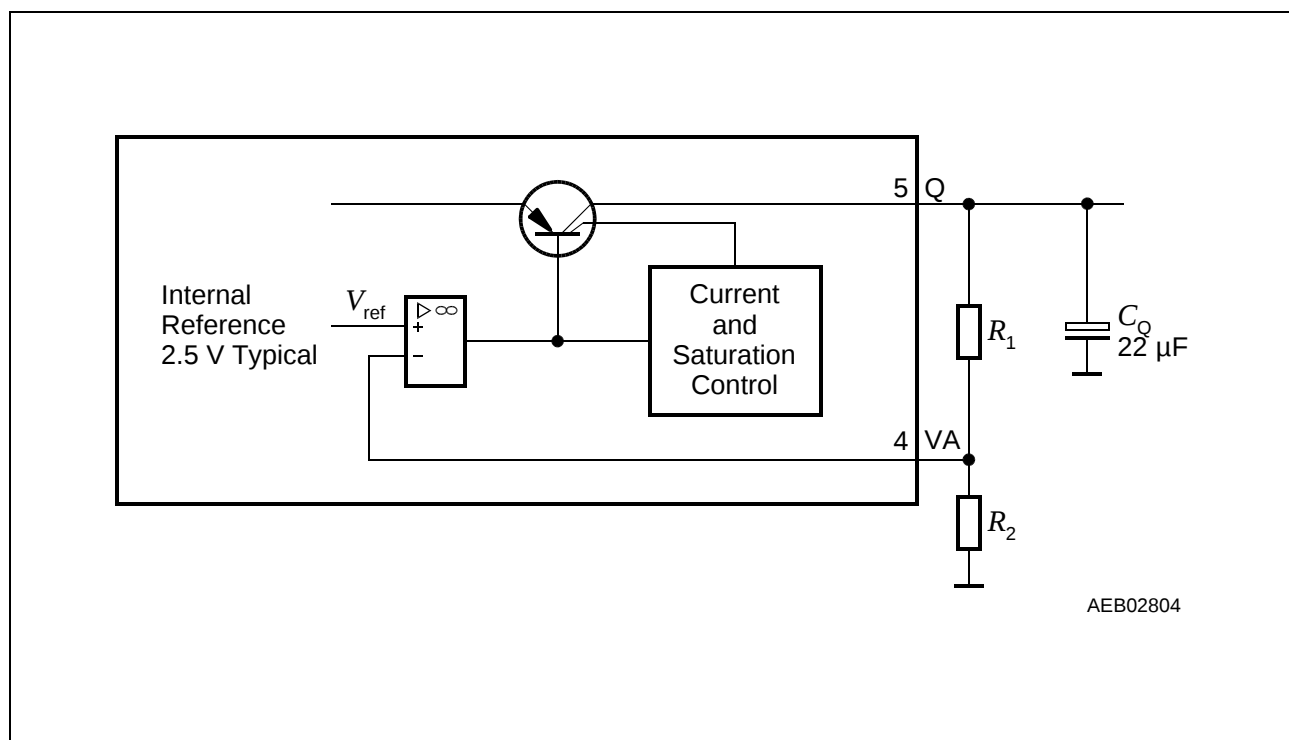


Figure 5 Application Detail External Components at Output for Variable Voltage Regulator

The output voltage is calculated according to **Equation 1**:

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

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**:

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

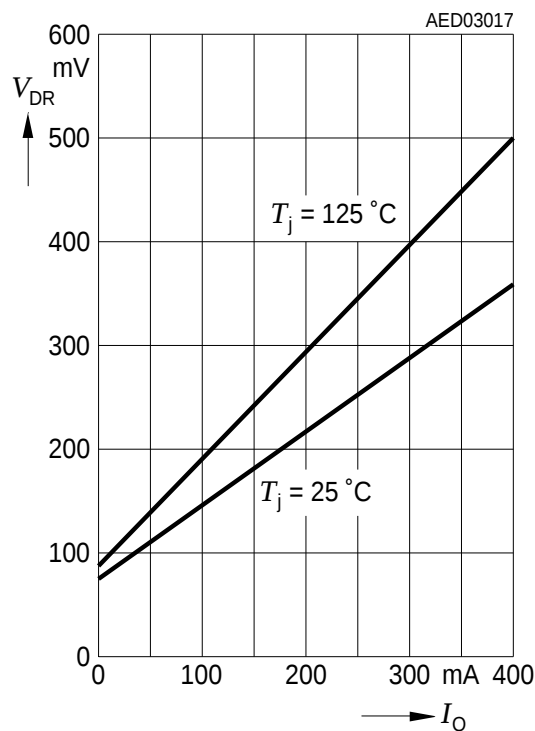
For a 2.5 V output voltage the output pin Q is directly connected to the adjust pin VA.

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

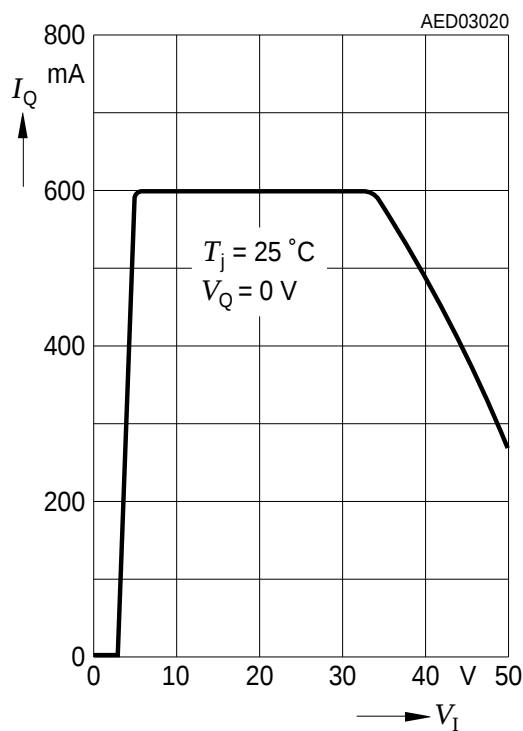
The operation range of the variable TLE 4276 V is $V_Q + 0.5 \text{ V}$ to 40 V. For internal biasing a minimum input voltage of 4.3 V is required. For output voltages below 4 V the voltage drop is $4.3 \text{ V} - V_Q$

Typical Performance Characteristics (V50, V85 and V10):

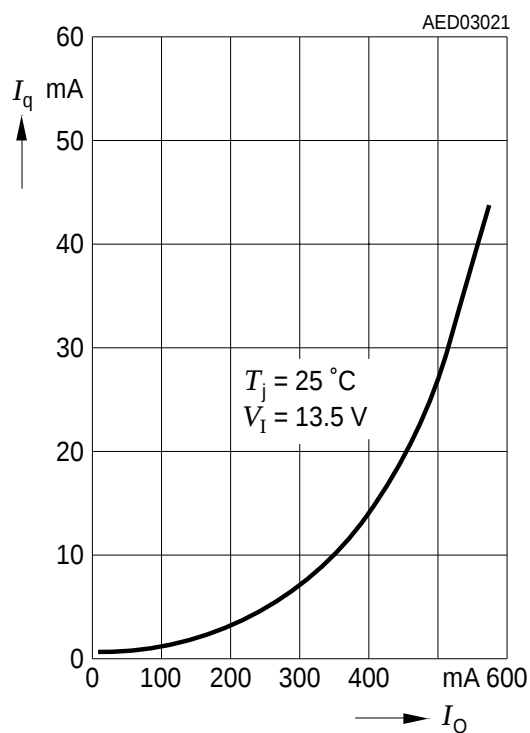
Voltage V_{DR} versus Output Current I_Q



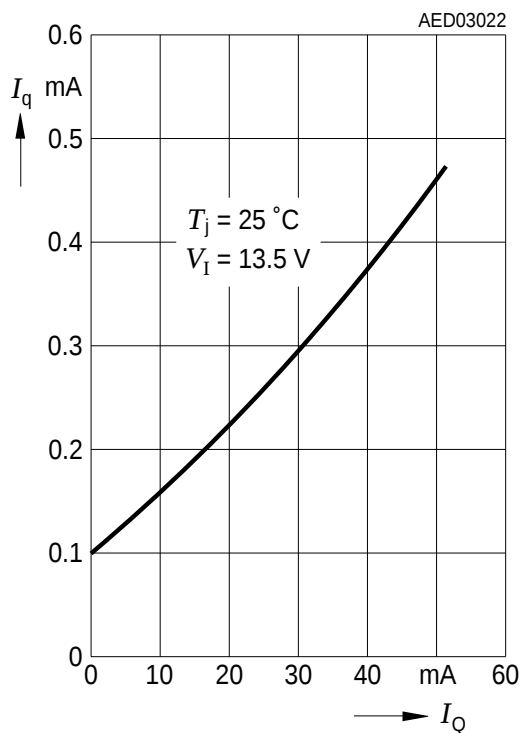
Max. Output Current I_Q versus Input Voltage V_I



Current Consumption I_q versus Output Current I_Q (high load)

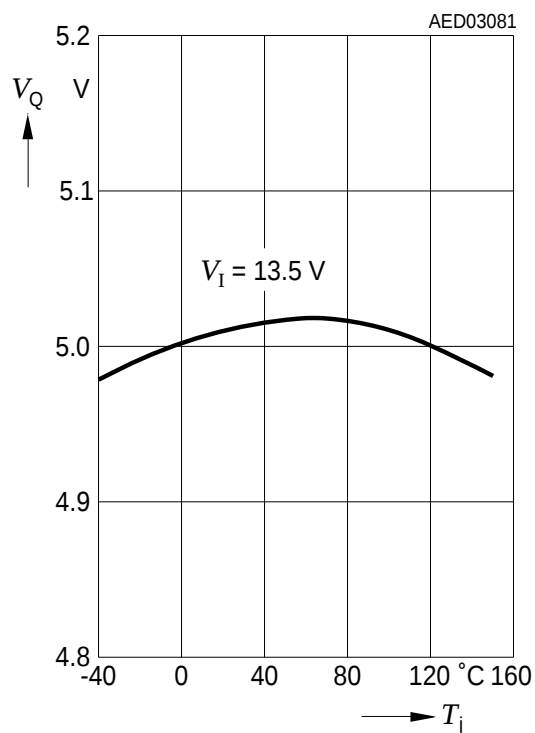


Current Consumption I_q versus Output Current I_Q (low load)

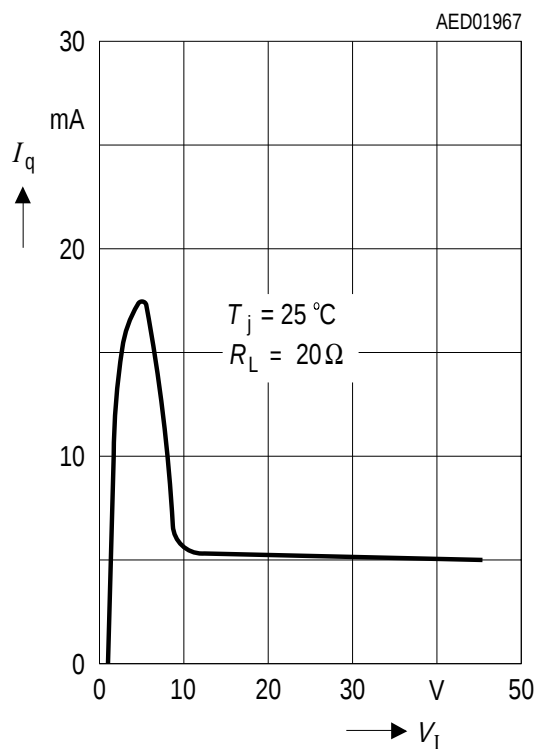


Typical Performance Characteristics for V50:

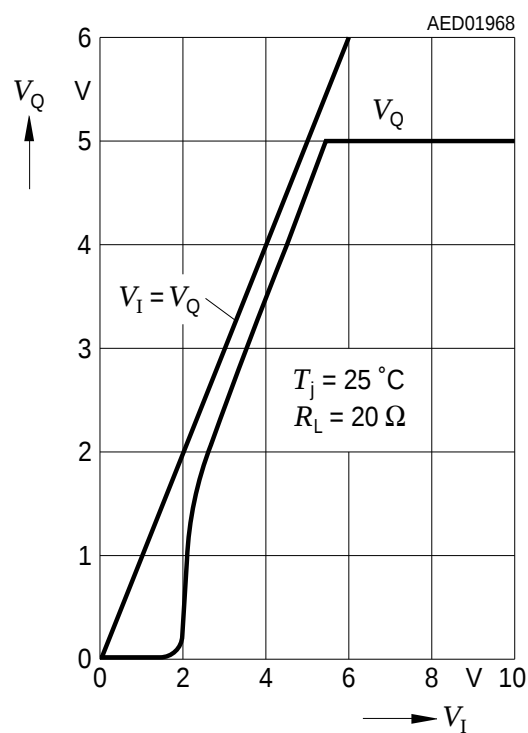
Output Voltage V_Q versus Temperature T_j



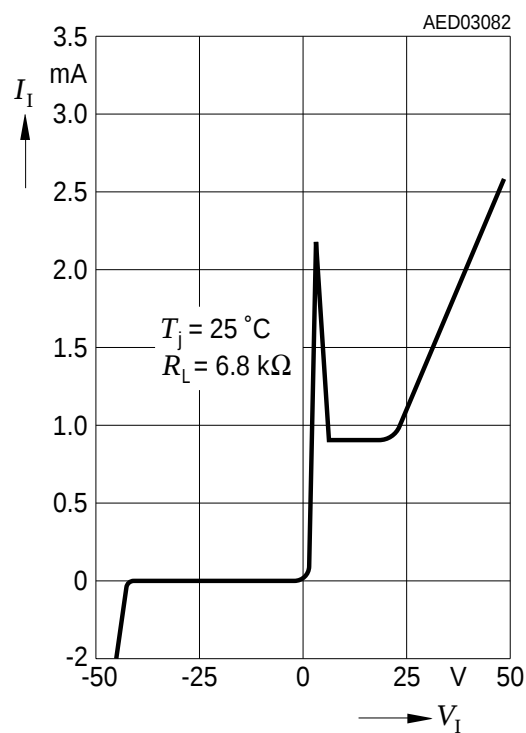
Current Consumption I_q versus Input Voltage V_I



Low Voltage Behavior

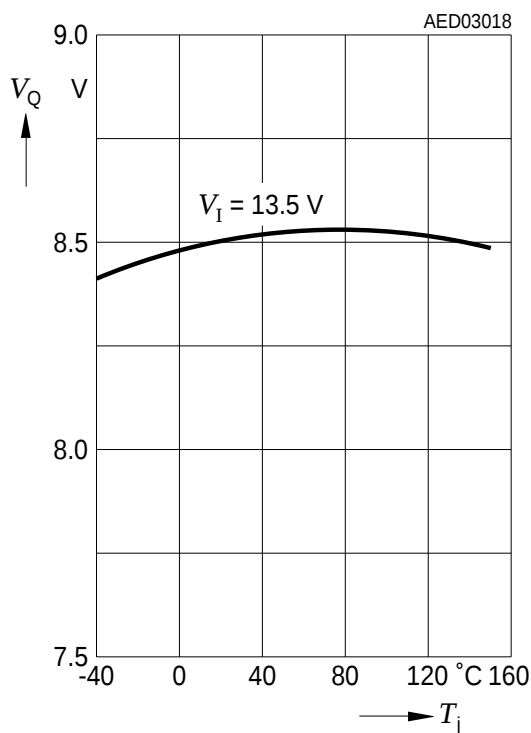


High Voltage Behavior

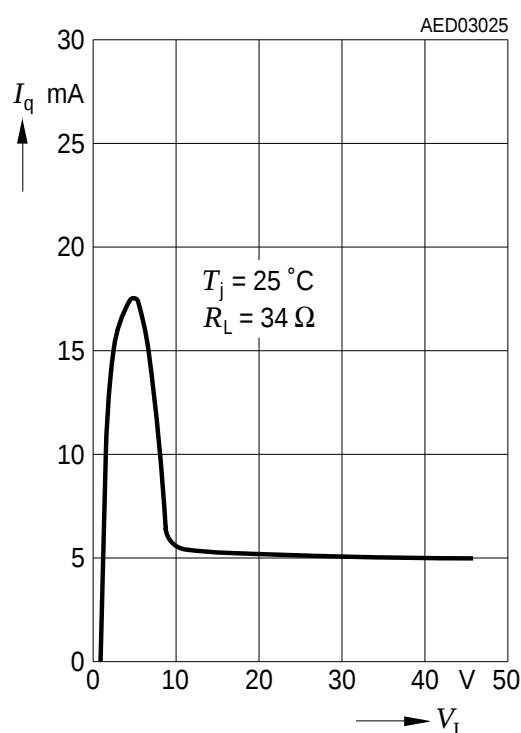


Typical Performance Characteristics for V85:

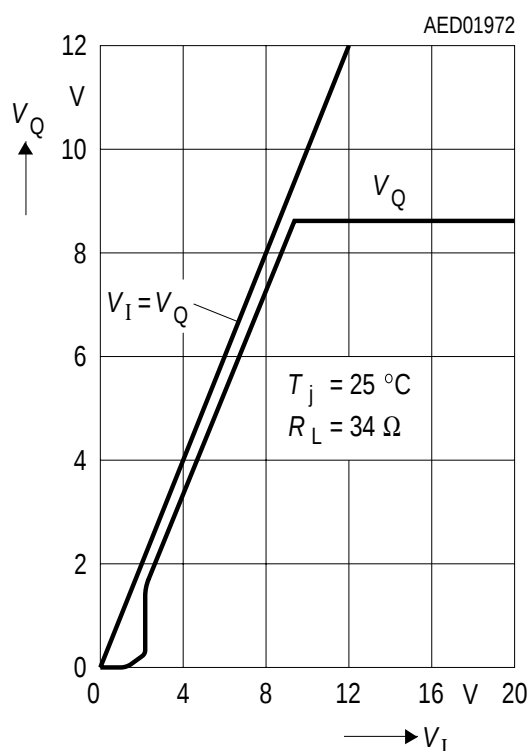
Output Voltage V_Q versus Temperature T_j



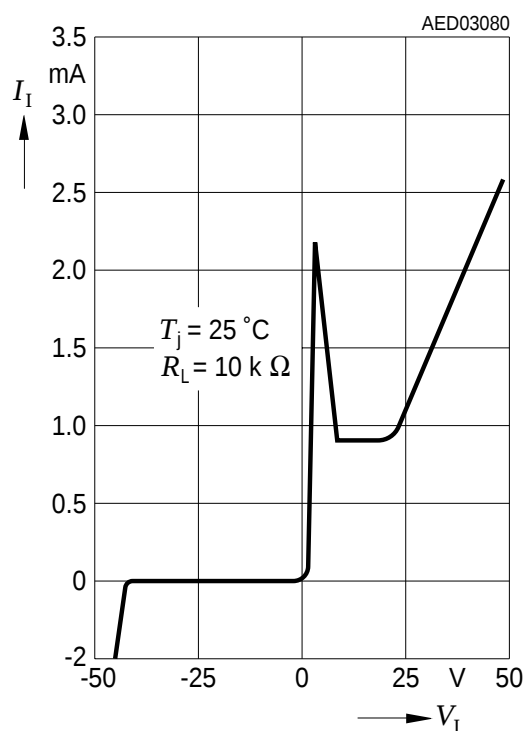
Current Consumption I_q versus Input Voltage V_I



Low Voltage Behavior

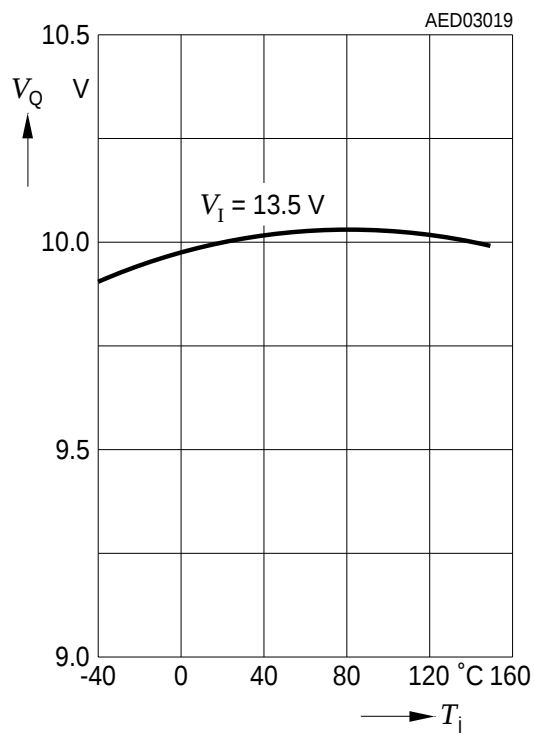


High Voltage Behavior

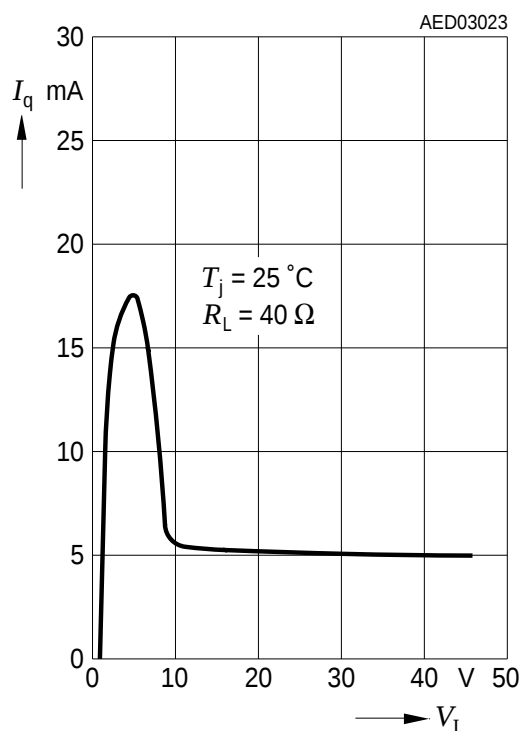


Typical Performance Characteristics for V10:

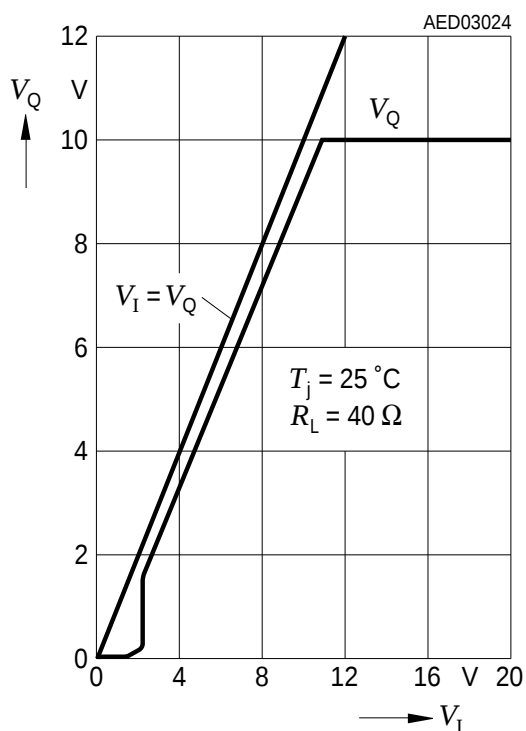
Output Voltage V_Q versus Temperature T_j



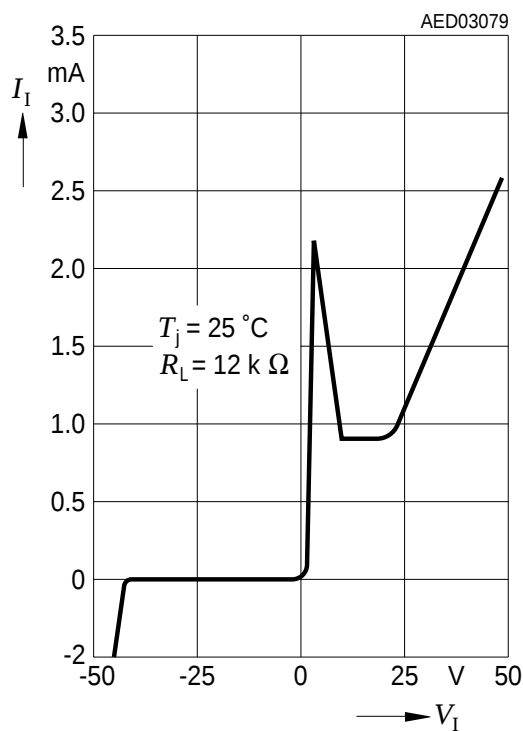
Current Consumption I_q versus Input Voltage V_I



Low Voltage Behavior



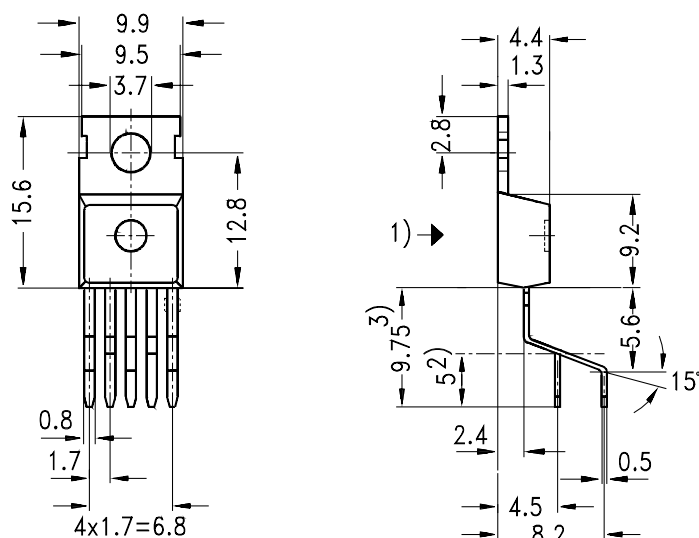
High Voltage Behavior



Package Outlines

P-TO220-5-3

(Plastic Transistor Single Outline)



GPT05165

- 1) shear and punch direction no burrs this surface
- 2) min. length by tinning
- 3) max. 11 mm allowable by tinning

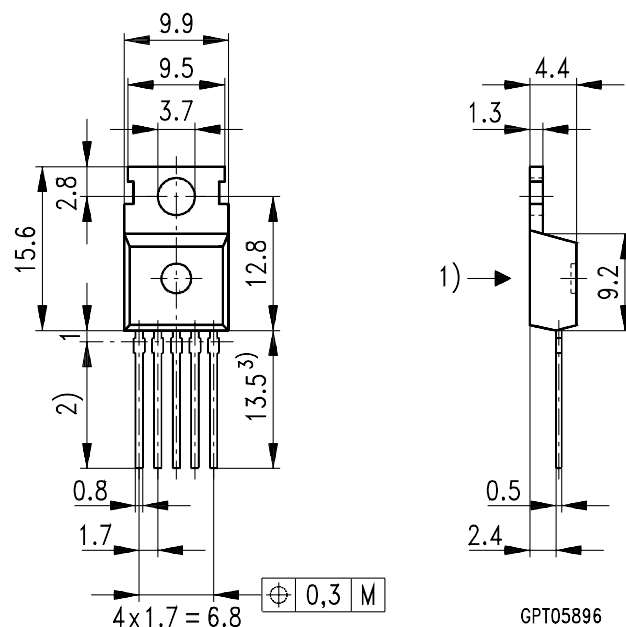
Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information"

Dimensions in mm

P-TO220-5-43

(Plastic Transistor Single Outline)



- 1) Punch direction, burr max. 0.04
- 2) Dip tinning
- 3) Max. 14.5 by dip tinning press burr
max. 0.05 radii not dimensioned max. 0.2

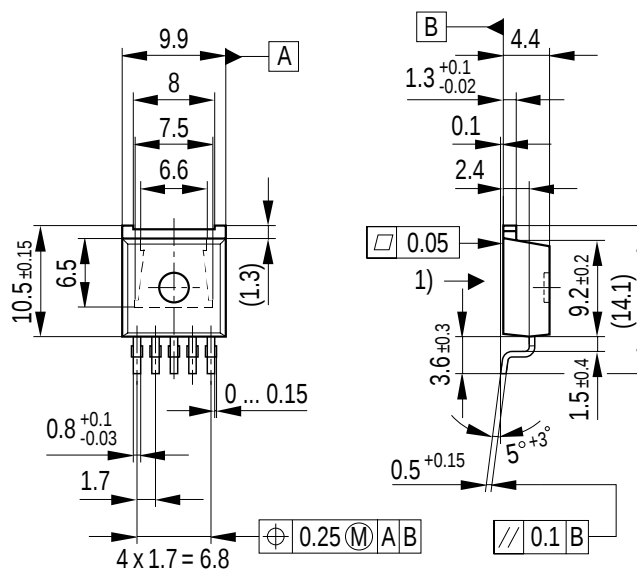
Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information"

Dimensions in mm

P-TO220-5-122

(Plastic Transistor Single Outline)



1) Shear and punch direction no burrs this surface

--- Back side, heatsink contour

All metal surfaces tin plated, except area of cut

GPT05259

Sorts of Packing

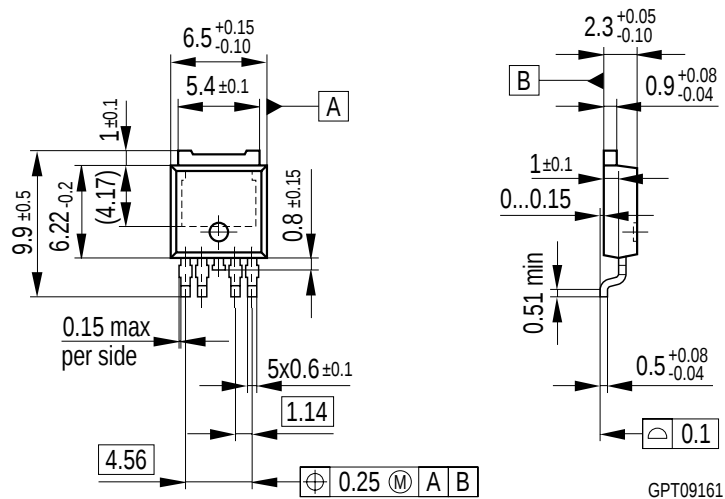
Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm

P-TO252-5-1

(Plastic Transistor Single Outline)



All metal surfaces tin plated, except area of cut.

Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm

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