

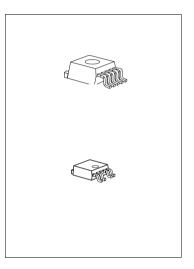
Low Drop Voltage Regulator

TLE 4276-2



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



Туре	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 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 $C_{\rm l}$ is necessary for compensation of line influences. Using a resistor of approx. 1 Ω in series with $C_{\rm l}$, the oscillating of input inductivity and input capacitance can be damped. The output capacitor $C_{\rm Q}$ is necessary for the stability of the regulation circuit. Stability is guaranteed at values $C_{\rm Q} \ge 22 \ \mu\text{F}$ and an ESR of $\le 3 \ \Omega$ 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



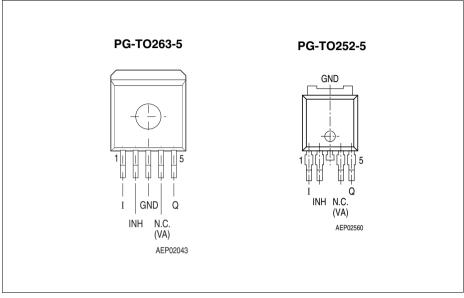
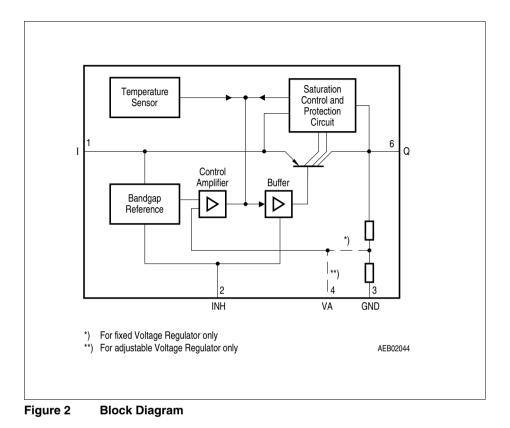


Figure 1 Pin Configuration (top view)

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 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 \ge 22 μ F capacitor, ESR \le 3 Ω at 10 kHz
Heat Tab		Connect to GND.







Parameter	Symbol	Limi	t Values	Unit	Test Condition	
		Min.	Max.			
Input I	I		P			
Voltage	$V_{\rm I}$	-42	45	V	-	
Current	I	-	-	-	Internally limited	
Inhibit INH						
Voltage	V_{INH}	-42	45	V	-	
Voltage Adjust Inp	ut VA		t			
Voltage	$V_{\sf VA}$	-0.3	10	V	-	
Output Q						
Voltage	V_{Q}	-1.0	40	V	-	
Current	IQ	-	-	-	Internally limited	
Ground GND						
Current	I _{GND}	-	100	mA	-	

Table 2 Absolute Maximum Ratings

Temperature

Junction temperature	Tj	-40	150	°C	-
Storage temperature	$T_{\rm stg}$	-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	$V_{\rm ESD,HBM}$	-2	2	kV	Human Body Model



Table 4Operating Range

Parameter	Symbol	Limit	Values	Unit	Remarks	
		Min.	Max.			
Input voltage	VI	V _Q + 0.5	40	V	Fixed voltage device V50	
Input voltage	$V_{\rm I}$	$V_{\rm Q}$ + 0.5	40	V	Variable device V	
Input voltage	VI	4.5 V	40	V	Variable device V, $V_{\rm Q}$ < 4 V	
Junction temperature	Tj	-40	150	°C	-	

Table 5 Thermal Resistance

Parameter	ameter Symbol Limit Value		Unit	Conditions		
		Min.	Тур.	Max.		
Junction to Case ¹⁾	R_{thJC}	-	3.0	-	K/W	-
Junction to Ambient ¹⁾	R _{thJA}	-	78	-	K/W	PG-TO252-5 300mm ² heatsink area on PCB ²⁾
Junction to Ambient ¹⁾	R _{thJA}	-	53	-	K/W	PG-TO263-5 300mm ² heatsink area on PCB ²⁾

1) not subject to production test, specified by design

2) EIA/JESD 52_2, FR4, $80\times80\times1.5$ mm; 35 μ Cu, 5 μ Sn



Table 6 Characteristics

 $V_{\rm l}$ = 13.5 V; -40 $^{\circ}{\rm C}$ < $T_{\rm j}$ < 150 $^{\circ}{\rm C}$ (unless otherwise specified)

Parameter	Sym-	Limit Values			Unit	Measuring	Measuring
	bol	Min.	Тур.	Max.	1	Condition	Circuit
Output voltage	V _Q	4.9	5.0	5.1	V	V50-Version 5 mA < I_{Q} < 300 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 < 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 tolerance	ΔV_{Q}	-2	-	2	%		1
Output voltage tolerance	ΔV_{Q}	-4	_	4	%	$V-Version \\ R_2 < 50 \text{ k}\Omega \\ V_Q + 1 \text{ V} \le V_1 \le 40 \text{ V} \\ V_1 > 4.5 \text{ V} \\ 5 \text{ mA} \le I_Q \le 400 \text{ mA} \\ \end{cases}$	1
Output current limitation ¹⁾	IQ	400	600	1100	mA	-	1
Current consumption; $I_q = I_l - I_Q$	I _q	-	-	10	μA	$V_{\text{INH}} = 0 \text{ V};$ $T_{\text{j}} \leq 100 \text{ °C}$	1
Current consumption; $I_q = I_l - I_Q$	Iq	-	100	220	μA	<i>I</i> _Q = 1 mA	1
Current consumption; $I_q = I_l - I_Q$	Iq	-	5	10	mA	<i>I</i> _Q = 250 mA	1
Current consumption; $I_q = I_1 - I_Q$	Iq	-	15	25	mA	<i>I</i> _Q = 400 mA	1



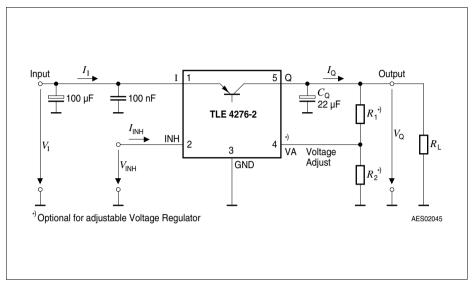
Table 6 Characteristics (cont'd)

 $V_{\rm I}$ = 13.5 V; -40 °C < $T_{\rm I}$ < 150 °C (unless otherwise specified)

Parameter	Sym-	Lir	nit Val	ues	Unit	Measuring	Measuring Circuit
	bol	Min.	Тур.	Max.		Condition	
Drop voltage ¹⁾	V _{DR}	-	250	500	mV	V50 $I_{\rm Q}$ = 250 mA $V_{\rm DR}$ = $V_{\rm I}$ - $V_{\rm Q}$	1
Drop voltage ¹⁾	V _{DR}	_	250	500	mV	variable devices $I_{\rm Q}$ = 250 mA $V_{\rm I}$ > 4.5 V $V_{\rm DR}$ = $V_{\rm I}$ - $V_{\rm Q}$	1
Load regulation	$\Delta V_{\rm Q,Lo}$	-	5	35	mV	$I_{\rm Q}$ = 5 mA to 400 mA	1
Line regulation	$\Delta V_{\rm Q,Li}$	-	15	25	mV	$\Delta V_{\rm I}$ = 12 V to 32 V $I_{\rm Q}$ = 5 mA	1
Power supply ripple rejection	PSRR	-	54	-	dB	$f_{\rm r}$ = 100 Hz; $V_{\rm r}$ = 0.5 Vpp	1
Temperature output voltage drift	dV_Q/dT	-	0.5	_	-	-	mV/K
Inhibit							
Inhibit on voltage	$V_{\rm INH}$	-	2	3.5	V	$V_{\rm Q} \ge 4.9 \ {\rm V}$	1
Inhibit off voltage	$V_{\rm INH}$	0.5	1.7	-	V	$V_{\rm Q} \leq 0.1 \ {\rm V}$	1
Input current	I _{INH}	5	10	20	μA	$V_{\rm INH} = 5 \rm V$	1

Image: Substraining the second sec







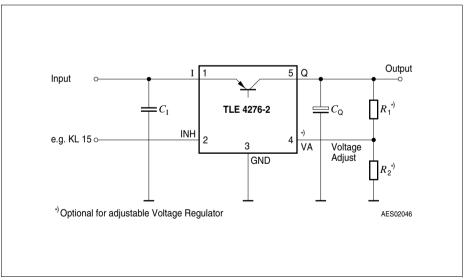


Figure 4 Application Circuit



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.

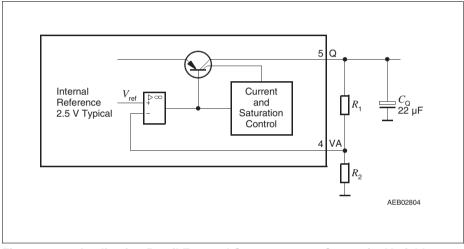


Figure 5 Application Detail External Components at Output for Variable Voltage Regulator

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

$$V_{\rm Q} = (R_1 + R_2)/R_2 \times V_{\rm ref}$$
, neglecting $I_{\rm VA}$

 $V_{\rm ref}$ 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):

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

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.

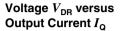
The operation range of the variable TLE 4276-2 DV, GV is V_Q + 0.5 V to 40 V. For internal biasing a minimum input voltage of 4.3 V is required. For output voltages below 4 V the voltage drop is 4.3 V - V_Q

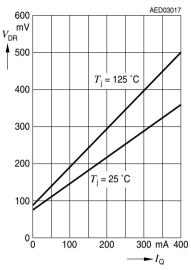
(1)

(2)

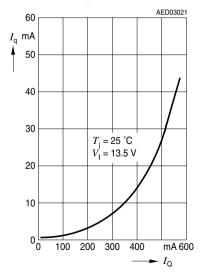


Typical Performance Characteristics V50:

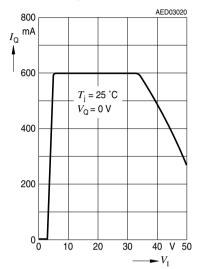




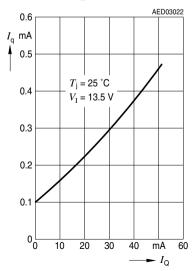
Current Consumption I_q versus Output Current I_Q (high load)



Max. Output Current I_{Q} versus Input Voltage V_{I}

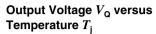


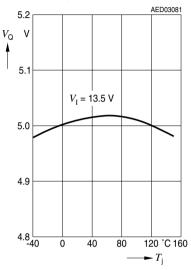
Current Consumption I_q versus Output Current I_Q (low load)



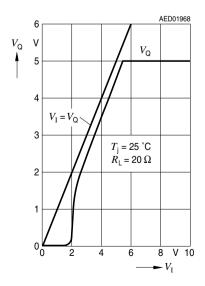


Typical Performance Characteristics for V50:

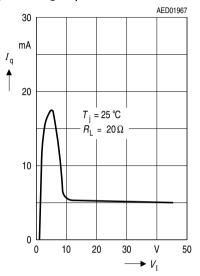




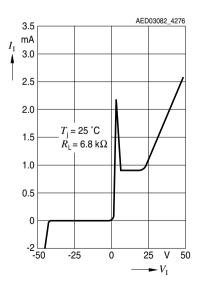
Low Voltage Behavior



Current Consumption I_q versus Input Voltage V_l



High Voltage Behavior





Package Outlines

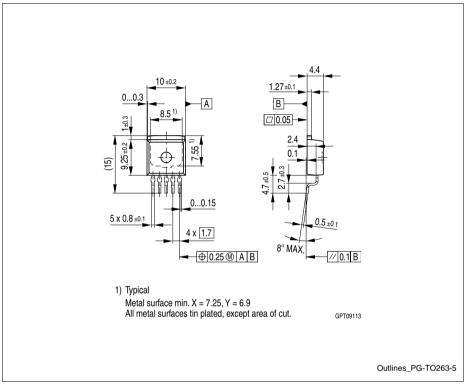


Figure 6 PG-TO263-5 (Plastic Green Transistor Single Outline)

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).

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SMD = Surface Mounted Device

Dimensions in mm



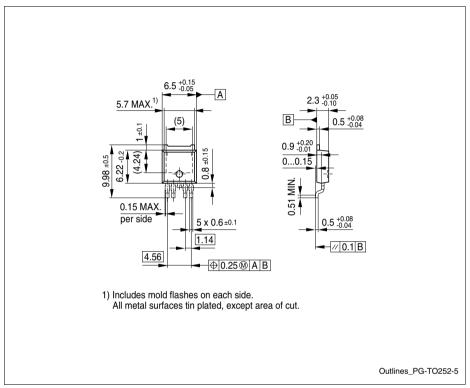


Figure 7 PG-T0252-5 (Plastic Green Transistor Single Outline)

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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

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