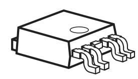
Dual Low Drop Voltage Regulator **TLE 4476**

Features

- Output 1: 350 mA; 3.3 V ± 4%
- Output 2: 430 mA; 5.0 V ± 4%
- Enable input for output 2
- Low quiescent current in OFF state
- Wide operation range: up to 42 V
- Reverse battery protection: up to 42 V
- Output protected against short circuit
- Wide temperature range: -40 °C to 170 °C
- Overvoltage protection up to 65 V (< 400 ms)
- Overtemperature protection
- Overload protection
- Green Product (RoHS compliant)
- AEC Qualified



Functional Description

The TLE 4476 is a monolithic integrated voltage regulator providing two output voltages, Q1 is a 3.3 V output for loads up to 350 mA and Q2 is a 5 V output providing 430 mA. The device is available in the PG-TO252-5-11 (D-Pak) package. Output 2 can be switched ON/OFF via the Enable input EN.

The TLE 4476 is designed to supply microprocessor systems under the severe conditions of automotive applications and is therefore equipped with additional protection functions against overload, short circuit and overtemperature.

Type	Package
TLE 4476 D	PG-TO252-5-11

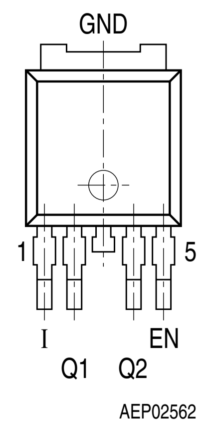


Figure 1 Pin Configuration (top view)

Table 1 Pin Definitions and Functions

Pin No.	Symbol	Function
1	I	**Input voltage;** block to GND directly at the IC with a ceramic capacitor
2	Q1	**3.3 V output;** block to GND with a capacitor $C_{Q1} \geq 10\ \mu F$, ESR < 2 Ω at 10 kHz
3	GND	**Ground**
4	Q2	**5.0 V output;** block to GND with a capacitor $C_{Q2} \geq 10\ \mu F$, ESR < 3 Ω at 10 kHz
5	EN	**Enable input;** to switch ON and OFF Q2, ON with high signal

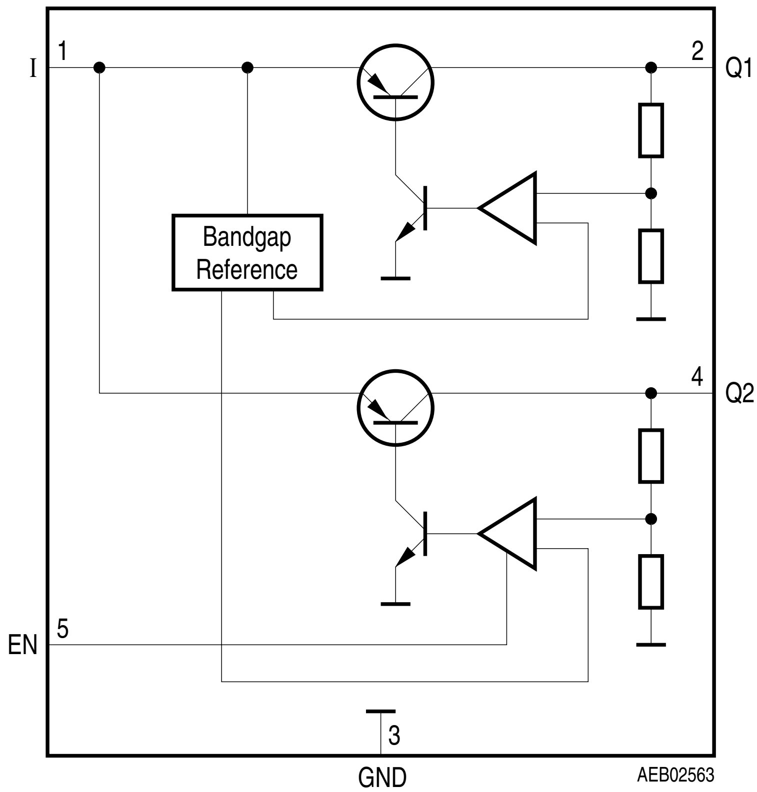


Figure 2 Block Diagram

Table 2 Absolute Maximum Ratings

-40 °C < T_j < 170 °C

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
Input I					
Voltage	V_I	-42 –	42 65	V V	– t < 400 ms
Current	I_I	–	–	mA	Internally limited
3.3 V Output Q1					
Voltage	V_{Q1}	-1	36	V	–
Current	I_{Q1}	–	–	mA	Internally limited
5.5 V Output Q2					
Voltage	V_{Q2}	-1	36	V	–
Current	I_{Q2}	–	–	mA	Internally limited
Inhibit EN					
Voltage	V_{EN}	-42 –	42 65	V V	– t < 400 ms
Current	I_{EN}	–	–	mA	Internally limited
Temperatures					
Junction temperature	T_j	-50	170	°C	–
Storage temperature	T_{stg}	-50	150	°C	–

Notes

1. *ESD-Protection according to MIL Std. 883: ±2 kV.*
2. *Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

Table 3 Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		Min.	Max.		
Output 1 input voltage	V_{I1}	4.5	42	V	1)
Output 2 input voltage	V_{I1}	5.7	42	V	2)
3.3 V regulator output current	I_{O1}	0	350	mA	–
5 V regulator output current	I_{O2}	0	430	mA	–
Junction temperature	T_j	-40	170	°C	3)
Thermal Resistances					
Junction case	$R_{th,j\text{-}case}$	–	3	K/W	–
Junction ambient	$R_{th,j\text{-}a}$	–	80	K/W	4)

1) Input voltage V_I required for operation of output Q1

2) Input voltage V_I required for operation of output Q2

3) The overtemperature protection is set to > 170 °C. The voltage regulator may not be operated continuously at 170 °C as device reliability will be reduced to 500 h statistic lifetime.

4) Worst case regarding peak temperature, zero airflow; mounted on a PCB 80 × 80 × 1.5 mm^3, 35 µm Cu, 5 µm Sn, heat sink area 300 mm^2.

Note: In the operating range the functions given in the circuit description are fulfilled.

Table 4 Electrical Characteristics

V_I = 13.5 V; V_{EN} > V_{ENH}; -40 °C < T_j < 150 °C; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
3.3 V Output Q1						
Output voltage	V_{Q1}	3.17	3.3	3.43	V	1 mA < I_{Q1} < 250 mA
Output current limitation	I_{Q1}	350	–	900	mA	[1)]
Load regulation	ΔV_{Q1}	–	–	30	mV	1 mA < I_{Q1} < 250 mA
Line regulation	ΔV_{Q1}	–	–	20	mV	I_{Q1} = 5 mA; 6 V < V_I < 28 V
Power Supply Ripple Rejection	$PSRR$	–	60	–	dB	20 Hz < f_r < 20 kHz[2)]; V_r = 5 Vpp
Output capacitor	C_{Q1}	10	–	–	µF	–
ESR of output capacitor	R_{ESRQ1}	–	–	2	Ω	at 10 kHz
5.0 V Output Q2						
Output voltage	V_{Q2}	4.8	5.0	5.2	V	1 mA < I_{Q2} < 330 mA
Output current limitation	I_{Q2}	430	–	900	mA	[1)]
Drop voltage; $V_{DRQ2} = V_I - V_{Q2}$	V_{DRQ2}	–	0.3	0.7	V	I_{Q2} = 330 mA[1)]
Load regulation	ΔV_{Q2}	–	–	50	mV	5 mA < I_{Q2} < 330 mA
Line regulation	ΔV_{Q2}	–	–	50	mV	I_{Q2} = 5 mA; 6 V < V_I < 28 V
Power Supply Ripple Rejection	$PSRR$	–	60	–	dB	20 Hz < f_r < 20 kHz[2)]; V_r = 5 Vpp
Output capacitor	C_{Q2}	10	–	–	µF	–
ESR of output capacitor	R_{ESRQ2}	–	–	3	Ω	at 10 kHz

Table 4 Electrical Characteristics (cont'd)

V_I = 13.5 V; V_{EN} > V_{ENH}; -40 °C < T_j < 150 °C; unless otherwise specified.

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
Current Consumption						
Quiescent current; $I_q = I_I - I_{Q1}$	I_q	–	100	150	µA	T_j < 85 °C; V_{EN} = 0 V
Quiescent current; $I_q = I_I - I_{Q1} - I_{Q2}$	I_q	–	300	400	µA	$I_{Q1} = I_{Q2}$ = 300 µA; T_j < 85 °C
Quiescent current; $I_q = I_I - I_{Q1} - I_{Q2}$	I_q	–	2.5	10	mA	I_{Q1} = 150 mA; I_{Q2} = 300 µA
Quiescent current; $I_q = I_I - I_{Q2} - I_{Q1}$	I_q	–	5	13	mA	I_{Q1} = 300 µA; I_{Q2} = 250 mA
Enable Input EN						
EN ON voltage	$V_{EN\ ON}$	1.8	–	–	V	V_{Q2} ON
EN OFF voltage	$V_{EN\ OFF}$	–	–	1.0	V	V_{Q2} OFF
Input current	V_{EN}	–	20	30	µA	V_{EN} = 13 V

1) Measured when the output voltage V_Q has dropped 100 mV from the nominal value.

2) Guaranteed by design.

Application Information

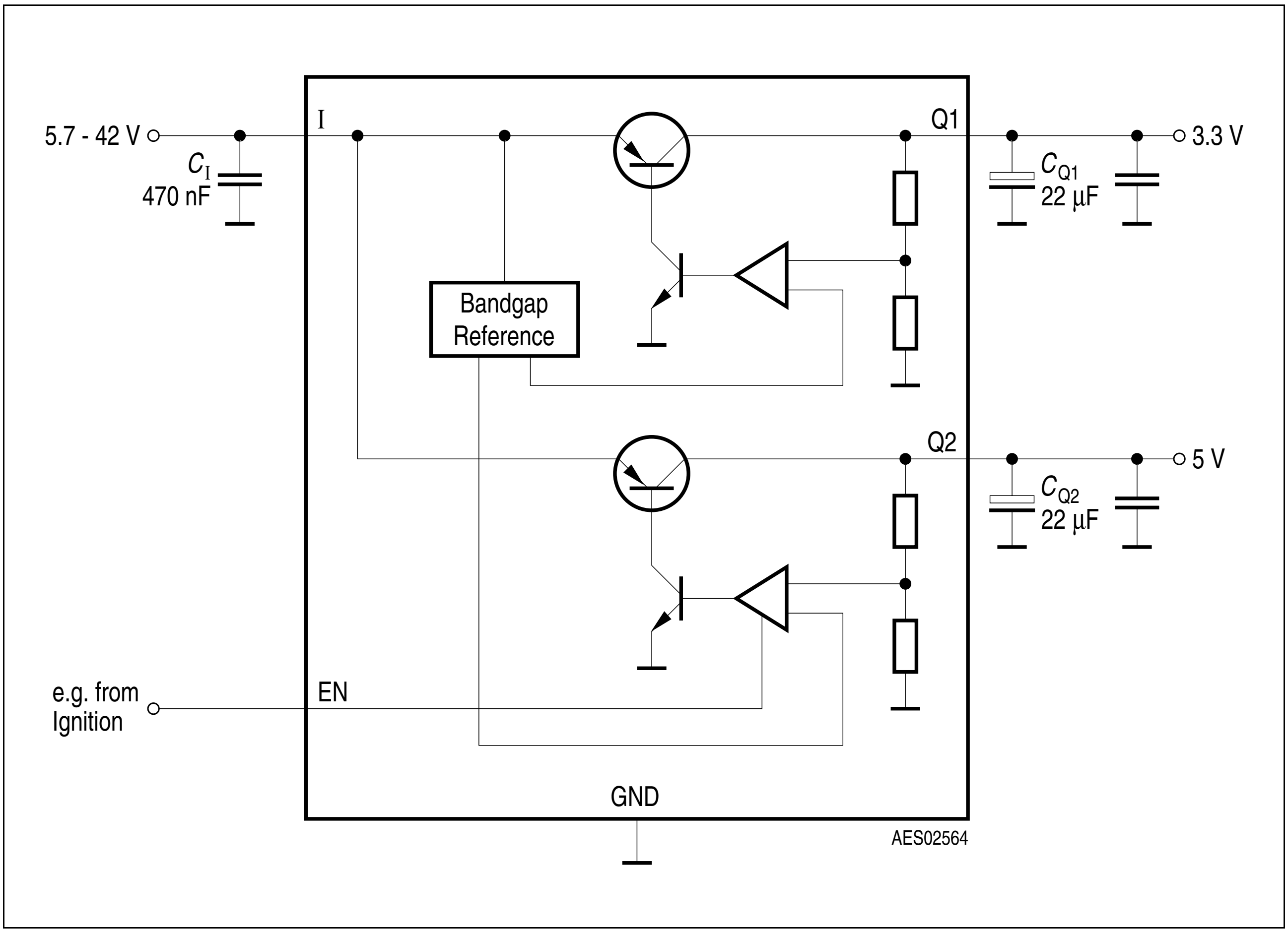


Figure 3 Application Circuit

Input, Output

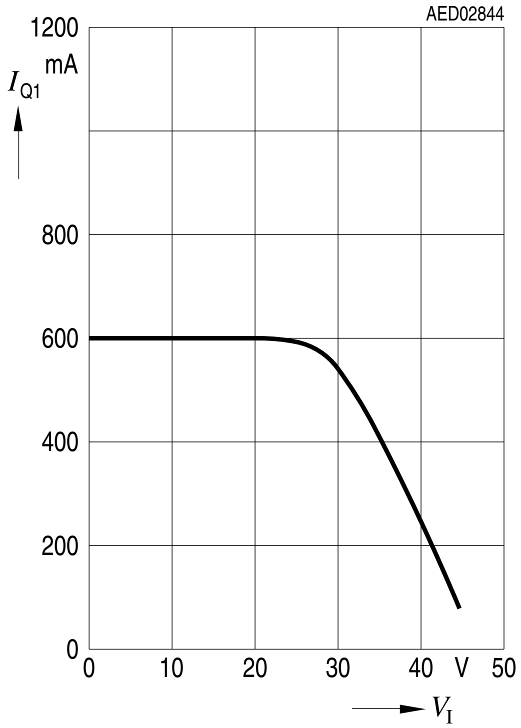
The input capacitor C_I is necessary for compensating line influences. Using a resistor of approx. 1 Ω in series with C_I, the LC circuit of input inductivity and input capacitance can be damped. To stabilize the regulation circuits of the stand-by and main regulator, output capacitors C_{Q1} and C_{Q2} are necessary. Stability is guaranteed at values $C_{Q1} \geq 10\ \mu F$ (ESR $\leq 2\ \Omega$) and $C_{Q2} \geq 10\ \mu F$ (ESR $\leq 3\ \Omega$) within the operating temperature range.

Enable

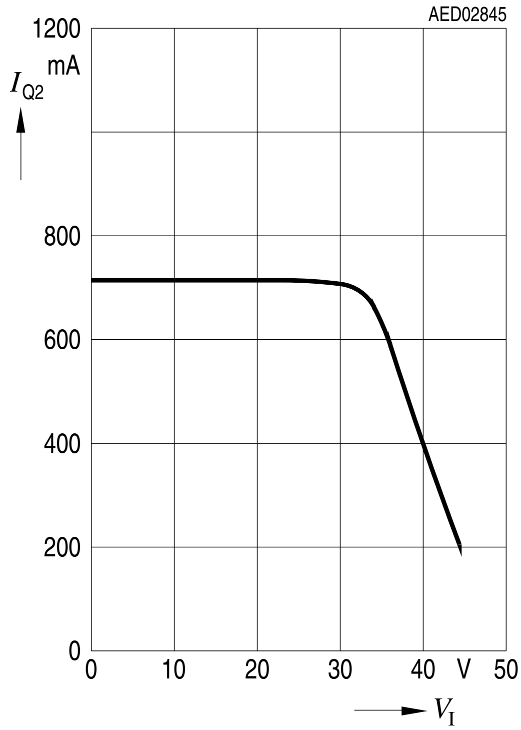
Using the enable feature the output 2 (5 V output) can be switched ON or OFF. The enable input can be connected directly to terminal 30 (battery line) or 15 (ignition line). It is also possible to control the output 2 via the microcontroller.

Typical Performance Characteristics

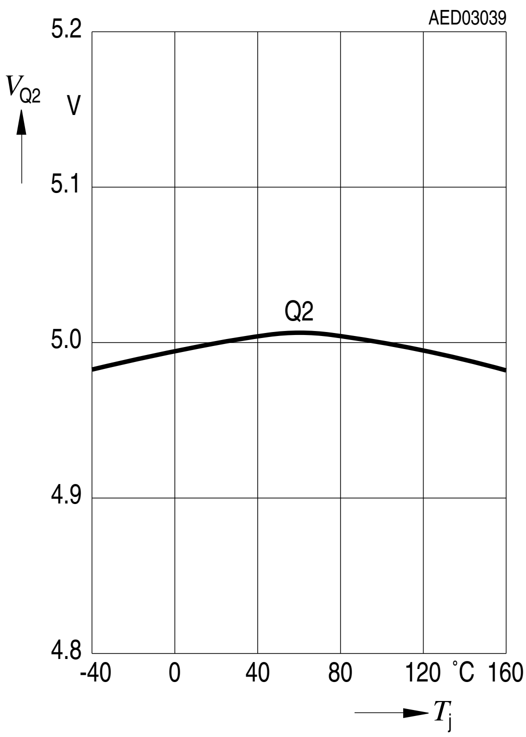
Output Current I_{Q1} versus Input Voltage V_I



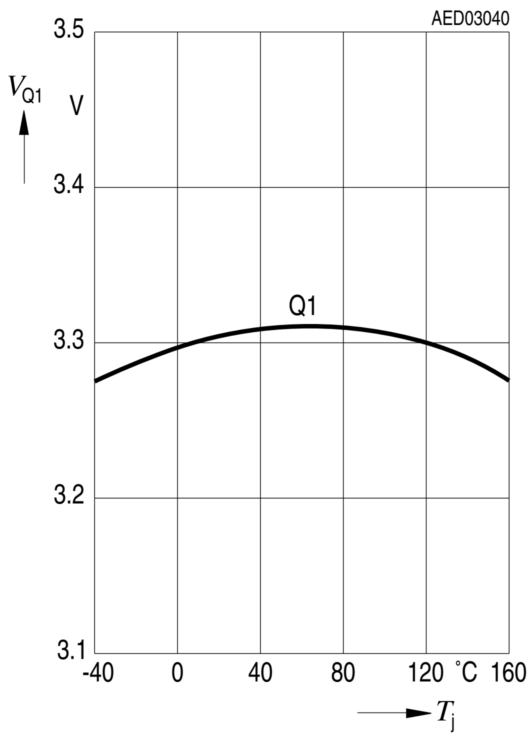
Output Current I_{Q2} versus Input Voltage V_I Enable ON



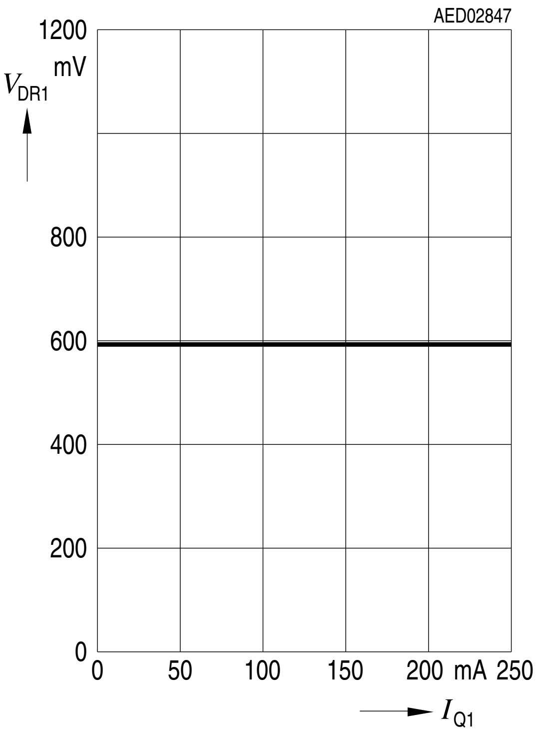
Output Voltage V_{Q2} versus Temperature T_j



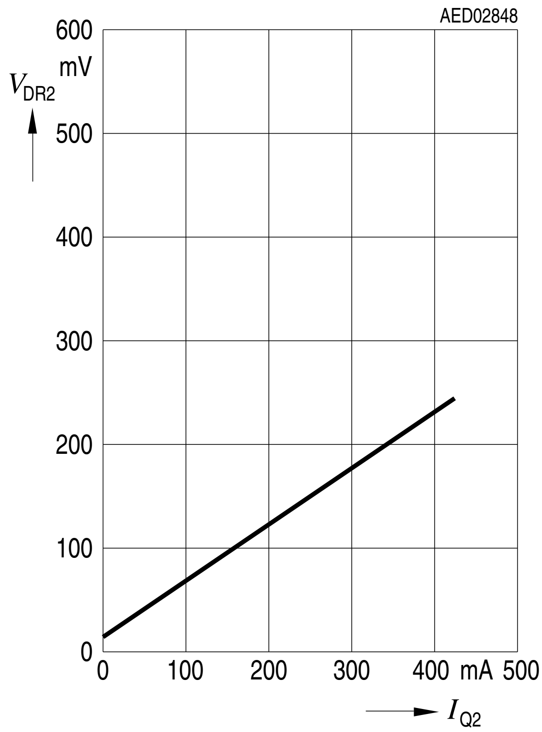
Output Voltage V_{Q1} versus Temperature T_j



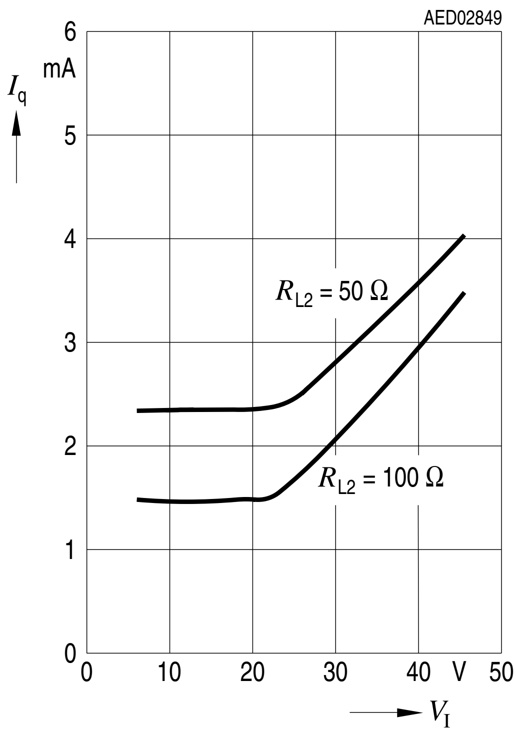
Drop Voltage V_{DR1} versus Output Current I_{Q1}



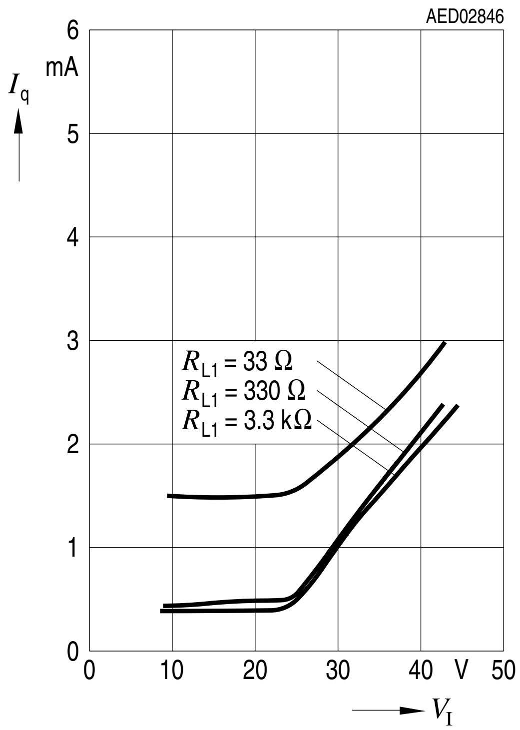
Drop Voltage V_{DR2} versus Output Current I_{Q2} EN ON



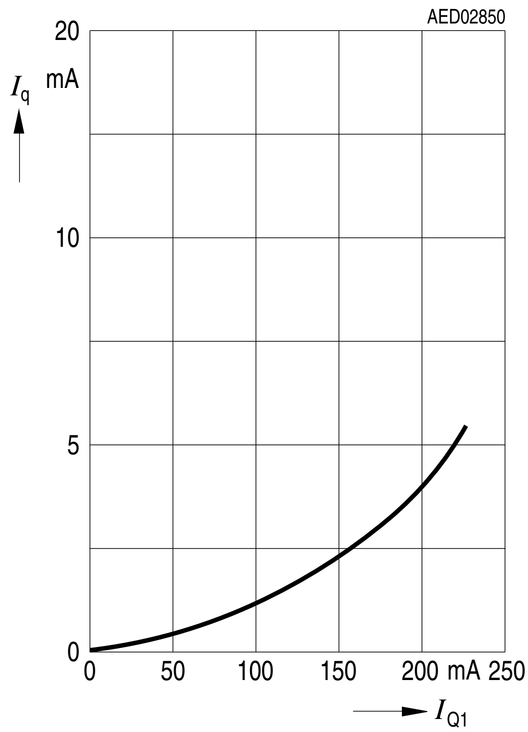
Current Consumption I_q versus Input Voltage V_I



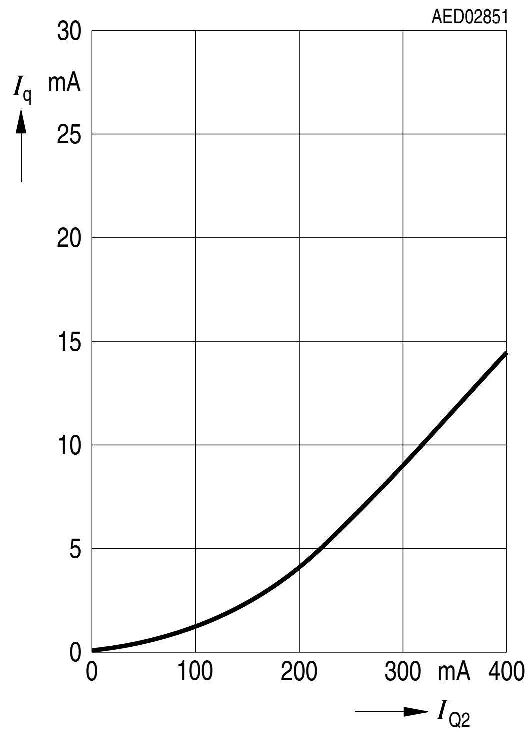
Current Consumption I_q versus Input Voltage V_I



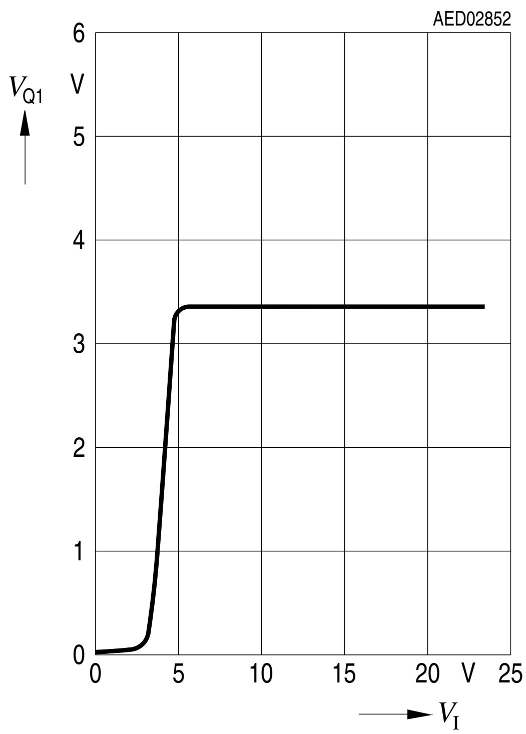
Current Consumption I_q versus Output Current I_{Q1}



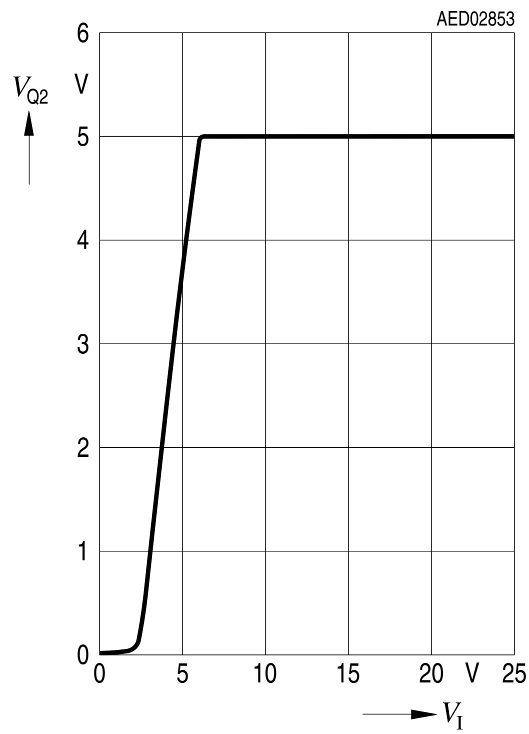
Current Consumption I_q versus Output Current I_{Q2}



Output Voltage V_{Q1} versus Input Voltage V_I



Output Voltage V_{Q2} versus Input Voltage V_I



Package Outlines

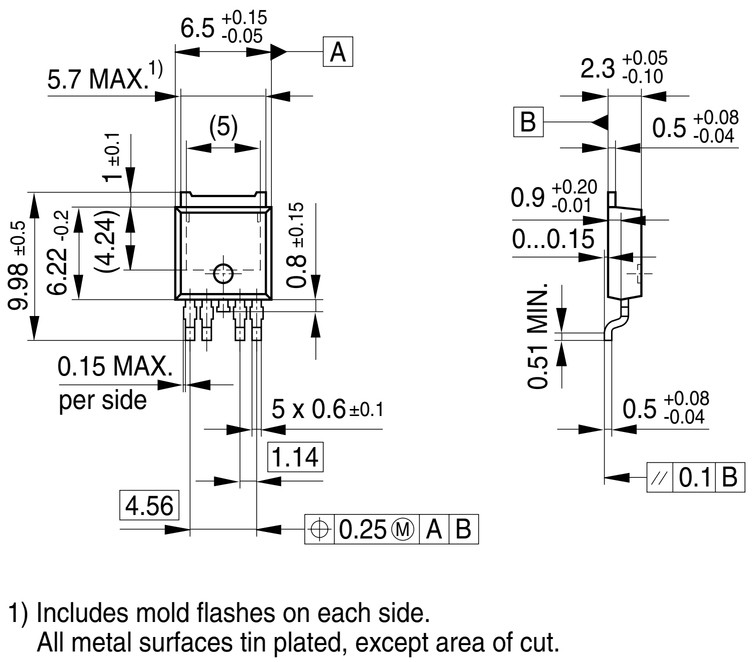


Figure 4 **PG-TO252-5-11** (Plastic Transistor Single Outline)

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).

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

Version	Date	Changes
Rev. 2.5	2007-03-20	Initial version of RoHS-compliant derivate of TLE 4476 **Page 1**: AEC certified statement added **Page 1** and **Page 12**: RoHS compliance statement and Green product feature added **Page 1** and **Page 12**: Package changed to RoHS compliant version Legal Disclaimer updated

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