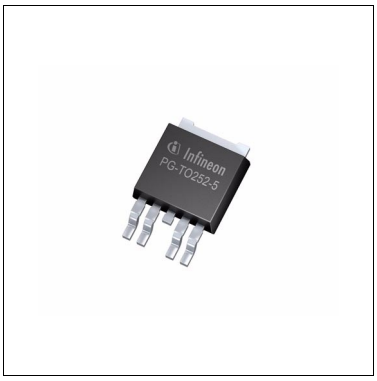
OPTIREG™ linear TLE4476D

Dual low-drop voltage regulator

AEC Qualified

RoHS



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)

Potential applications

General automotive applications.

Product validation

Qualified for automotive applications. Product validation according to AEC-Q100.

Description

The TLE4476D 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. Output 2 can be switched ON/OFF via the enable input EN. The device is available in the PG-TO252-5 (DPAK) package.

The TLE4476D 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	Marking
TLE4476D	PG-TO252-5	4476D

Table of Contents

1 Block diagram

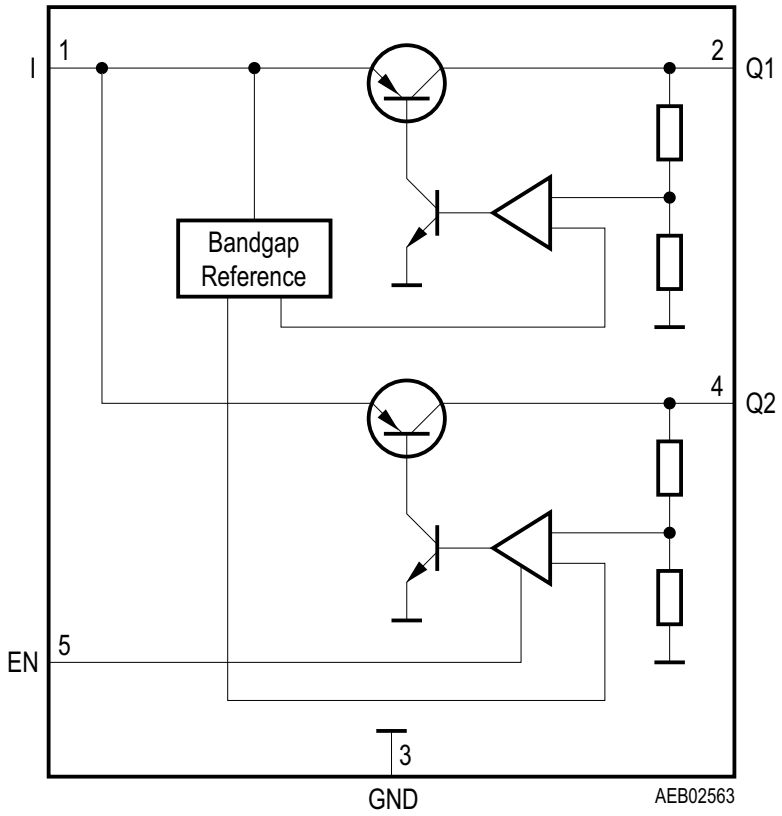


Figure 1 Block diagram

2 Pin configuration

2.1 Pin assignment PG-TO252-5

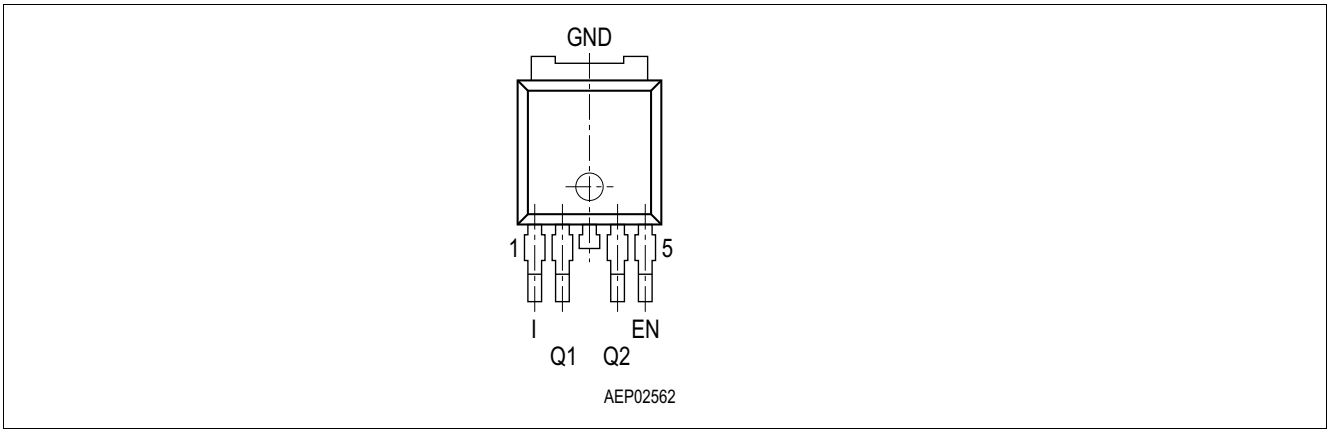


Figure 2

2.2 Pin definitions and functions PG-TO252-5

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 $C_{Q1} \geq 10$ µF , ESR < 2 Ω at 10 kHz
3	GND	**Ground**
4	Q2	**5 V output** Block to GND with a capacitor $C_{Q2} \geq 10$ µF , ESR < 3 Ω at 10 kHz
5	EN	**Enable input** Switch Q2 ON (high signal) or OFF (low signal)

3 General product characteristics

3.1 Absolute maximum ratings

Table 2 Absolute maximum ratings

T_j = -40°C to +170°C

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Input I							
Voltage	V_I	-42	–	42	V	–	P_3.1.1
Voltage	V_I	–	–	65	V	t < 400 ms	P_3.1.2
Current	I_I	–	–	–	mA	Internally limited	P_3.1.3
3.3 V output Q1							
Voltage	V_{Q1}	-1	–	36	V	–	P_3.1.4
Current	I_{Q1}	–	–	–	mA	Internally limited	P_3.1.5
5 V output Q2							
Voltage	V_{Q2}	-1	–	36	V	–	P_3.1.6
Current	I_{Q2}	–	–	–	mA	Internally limited	P_3.1.7
Inhibit EN							
Voltage	V_{EN}	-42	–	42	V	–	P_3.1.8
Voltage	V_{EN}	–	–	65	V	t < 400 ms	P_3.1.9
Current	I_{EN}	–	–	–	mA	Internally limited	P_3.1.10
Temperatures							
Junction temperature	T_j	-50	–	170	°C	–	P_3.1.11
Storage temperature	T_{stg}	-50	–	150	°C	–	P_3.1.12

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.*

3.2 Functional range

Table 3 Functional range

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Output 1 input voltage	V_{I1}	4.5	–	42	V	[1]	P_3.2.1
Output 2 input voltage	V_{I1}	5.7	–	42	V	[2]	P_3.2.2
3.3 V regulator output current	I_{O1}	0	–	350	mA	–	P_3.2.3

Table 3 Functional range (cont'd)

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
5 V regulator output current	I_{O2}	0	–	430	mA	–	P_3.2.4
Junction temperature	T_j	-40	–	170	°C	3)	P_3.2.5
Thermal resistances							
Junction case	$R_{th,j\text{-}case}$	–	–	3	K/W	–	P_3.2.6
Junction ambient	$R_{th,j\text{-}a}$	–	–	80	K/W	4)	P_3.2.7

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 statistical 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.

4 Electrical characteristics

Table 4 Electrical Characteristics

V_I = 13.5 V; $V_{EN} > V_{ENH}$; T_j = -40°C to +170°C; unless otherwise specified.

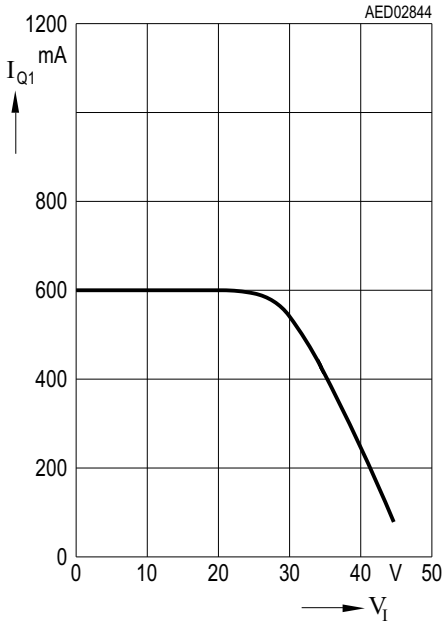
Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
3.3 V output Q1							
Output voltage	V_{Q1}	3.17	3.3	3.43	V	1 mA < I_{Q1} < 250 mA	P_4.0.1
Output current limitation	I_{Q1}	350	–	900	mA	1)	P_4.0.2
Load regulation	ΔV_{Q1}	–	–	30	mV	1 mA < I_{Q1} < 250 mA	P_4.0.3
Line regulation	ΔV_{Q1}	–	–	20	mV	I_{Q1} = 5 mA; 6 V < V_I < 28 V	P_4.0.4
Power supply ripple rejection	*PSRR*	–	60	–	dB	2) 20 Hz < f_r < 20 kHz; V_r = 5 V_{pp}	P_4.0.5
Output capacitor	C_{Q1}	10	–	–	µF	–	P_4.0.6
ESR of output capacitor	R_{ESRQ1}	–	–	2	Ω	At 10 kHz	P_4.0.7
5 V output Q2							
Output voltage	V_{Q2}	4.8	5.0	5.2	V	1 mA < I_{Q2} < 330 mA	P_4.0.8
Output current limitation	I_{Q2}	430	–	900	mA	1)	P_4.0.9
Drop voltage; $V_{DRQ2} = V_I - V_{Q2}$	V_{DRQ2}	–	0.3	0.7	V	1) I_{Q2} = 330 mA	P_4.0.10
Load regulation	ΔV_{Q2}	–	–	50	mV	5 mA < I_{Q2} < 330 mA	P_4.0.11
Line regulation	ΔV_{Q2}	–	–	50	mV	I_{Q2} = 5 mA; 6 V < V_I < 28 V	P_4.0.12
Power supply ripple rejection	*PSRR*	–	60	–	dB	2) 20 Hz < f_r < 20 kHz; V_r = 5 V_{pp}	P_4.0.13
Output capacitor	C_{Q2}	10	–	–	µF	–	P_4.0.14
ESR of output capacitor	R_{ESRQ2}	–	–	3	Ω	At 10 kHz	P_4.0.15
Current consumption							
Quiescent current; $I_q = I_I - I_{Q1}$	I_q	–	100	150	µA	T_j < 85°C; V_{EN} = 0 V	P_4.0.16
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	P_4.0.17
Quiescent current; $I_q = I_I - I_{Q1} - I_{Q2}$	I_q	–	2.5	10	mA	I_{Q1} = 150 mA; I_{Q2} = 300 µA	P_4.0.18
Quiescent current; $I_q = I_I - I_{Q2} - I_{Q1}$	I_q	–	5	13	mA	I_{Q1} = 300 µA; I_{Q2} = 250 mA	P_4.0.19
Enable input EN							
EN ON voltage	$V_{EN\ ON}$	1.8	–	–	V	V_{Q2} ON	P_4.0.20
EN OFF voltage	$V_{EN\ OFF}$	–	–	1.0	V	V_{Q2} OFF	P_4.0.21
Input current	V_{EN}	–	20	30	µA	V_{EN} = 13 V	P_4.0.22

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

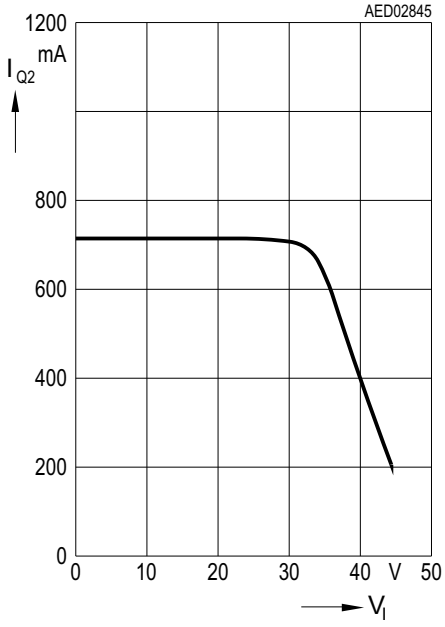
2) Guaranteed by design.

4.1 Typical performance characteristics

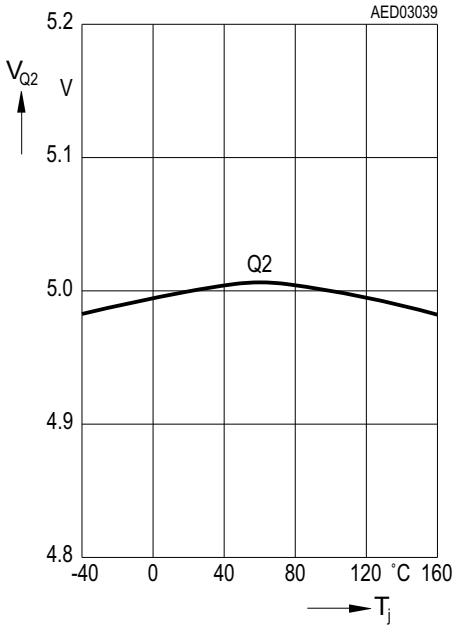
Output current I_{Q1} versus input voltage V_I



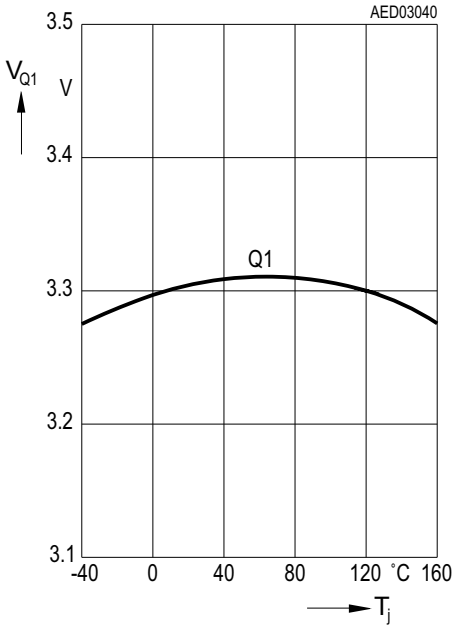
Output current I_{Q2} versus input voltage V_I enable ON



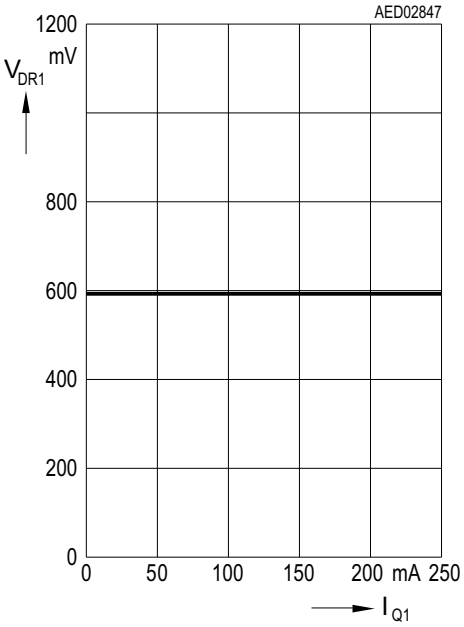
Output voltage V_{Q2} versus temperature T_j



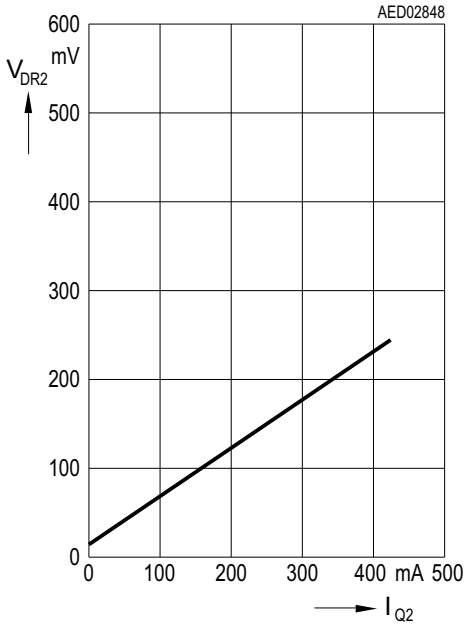
Output voltage V_{Q1} versus temperature T_j



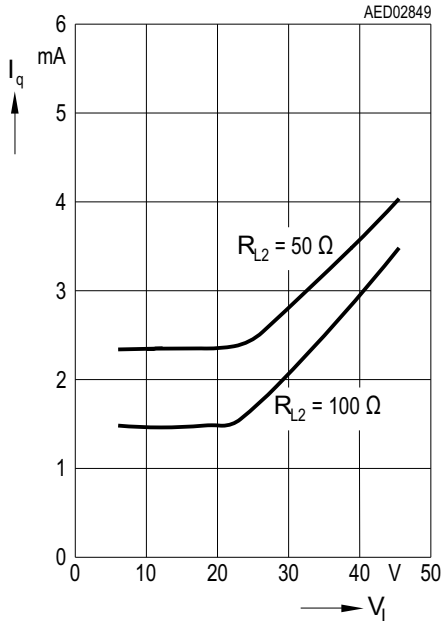
Drop voltage V_{DR1} versus output current I_{Q1}



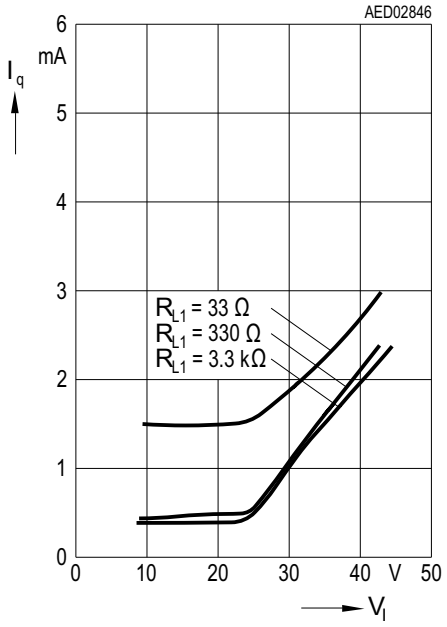
Drop voltage V_{DR2} versus output current I_{Q2} EN ON



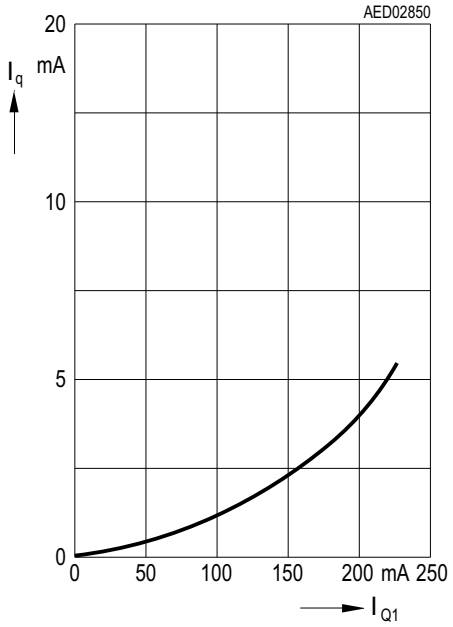
Current consumption I_q versus input voltage V_I



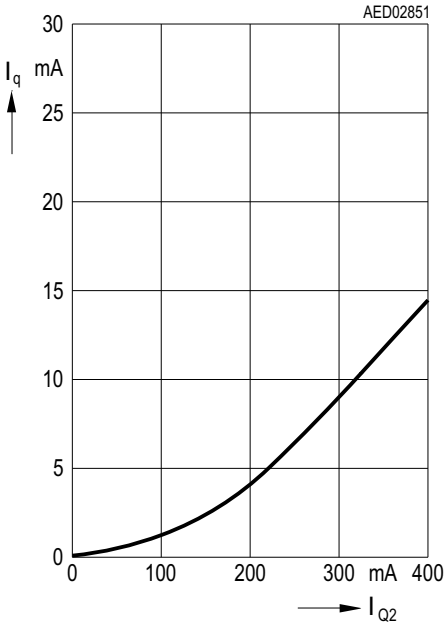
Current consumption I_q versus input voltage V_I



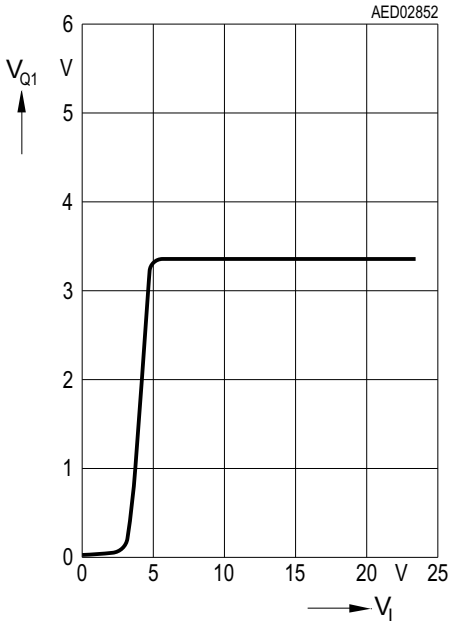
Current consumption I_q versus output current I_{Q1}



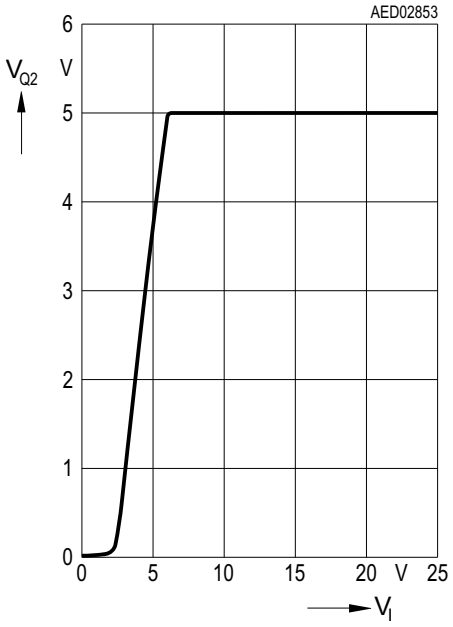
Current consumption I_q versus output current I_{Q2}



Output voltage V_{Q1} versus input voltage V_I



Output voltage V_{Q2} versus input voltage V_I



5 Application information

Note: The following information is given as a hint for the implementation of the device only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device.

5.1 Application diagram

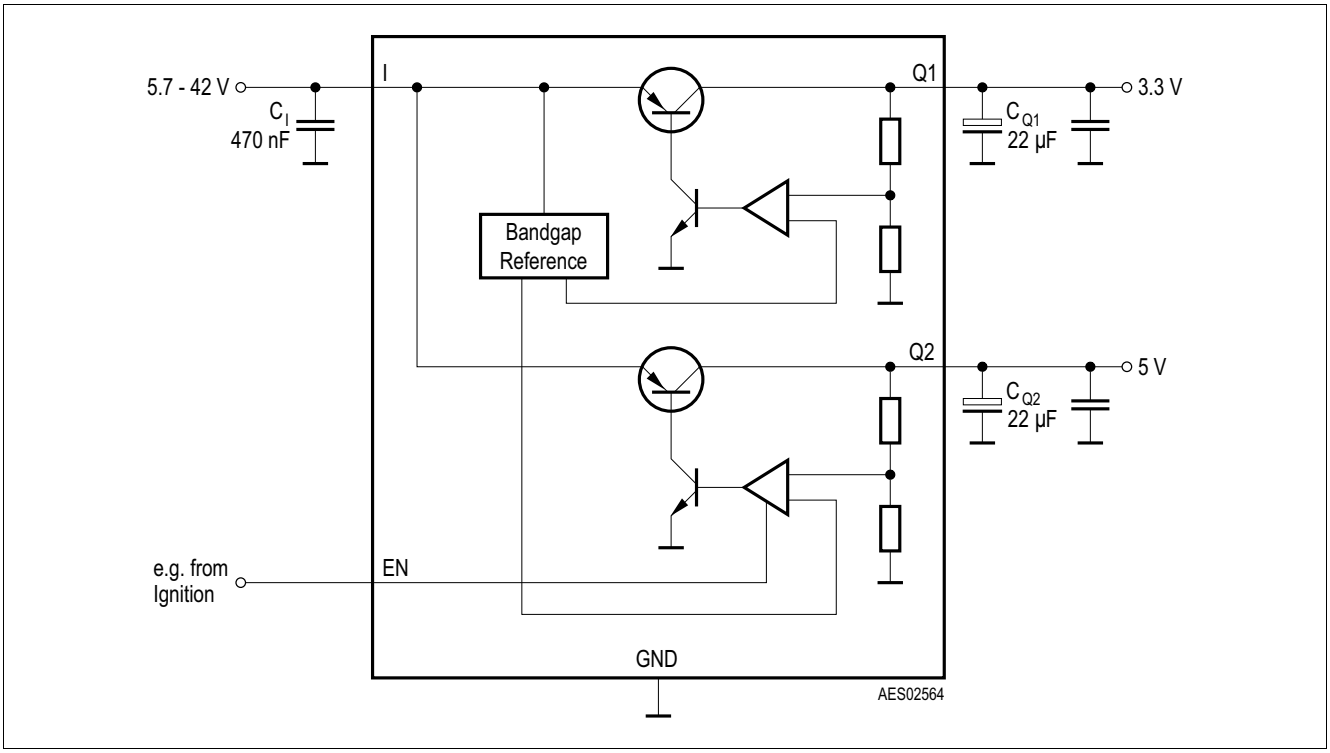


Figure 3 Application diagram

5.2 Selection of external components

5.2.1 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} ≥ 10 µF (ESR ≤ 2 Ω) and C_{Q2} ≥ 10 µF (ESR ≤ 3 Ω) within the operating temperature range.

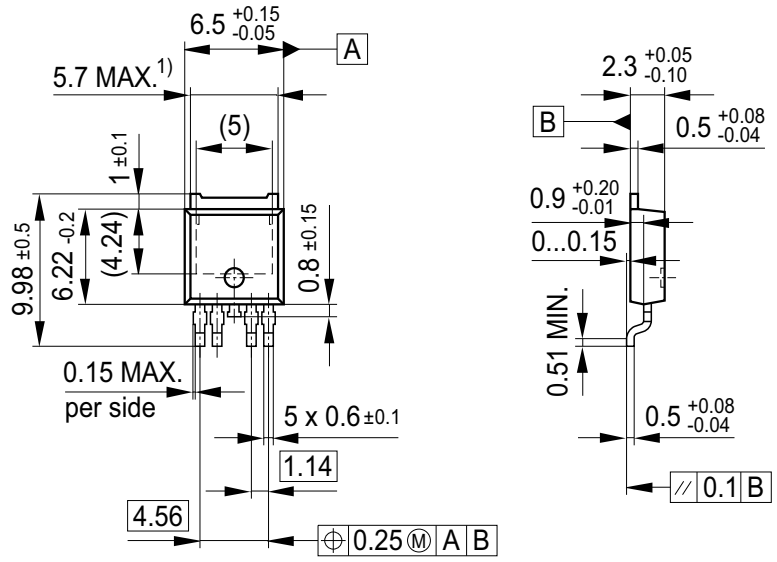
5.2.2 Enable

Using the enable feature 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.

5.3 Further application information

For further information you may contact **https://www.infineon.com**.

6 Package information



1) Includes mold flashes on each side.
All metal surfaces tin plated, except area of cut.

Figure 4 PG-TO252-5[1)]

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 (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

7 Revision history

Revision	Date	Changes
Rev. 2.6	2023-08-07	Update template, layout, and structure Editorial changes
Rev. 2.5	2007-03-20	Initial version of RoHS-compliant derivate of TLE4476D 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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