OPTIREG™ linear TLE4296G

Low drop voltage regulator



Features

- Two output voltage versions: 3.3 V, 5.0 V
- Output voltage tolerance ≤ ±4%
- Very low drop voltage
- Output current: 30 mA
- Inhibit function
- Low quiescent current consumption
- Input voltage up to 45 V
- Wide temperature range: T_j = -40°C to +150°C
- Output protected against short circuit
- Overtemperature protection
- Reverse polarity proof
- Very small and thermally enhanced package
- Green Product (RoHS compliant)

Potential applications

General automotive applications

Product validation

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

Description

The OPTIREG™ linear TLE4296G is a monolithic integrated low drop voltage regulator in very small SMD package PG-SCT595-5. It is designed to supply various loads (e.g. microcontrollers, sensors, or as stand-by supply, etc.) under severe conditions. Therefore the device is equipped with additional protection functions against overload, short circuit and reverse polarity. In case of an overtemperature condition the regulator is automatically turned off by the integrated thermal protection circuit.

Input voltages up to 40 V are regulated to $V_{Q,nom}$ = 3.3 V (V33 version) or 5.0 V (V50 version). The output is able to drive a load of 30 mA while it regulates the output voltage within a 4% accuracy. To save energy the device can be switched to stand-by mode via an inhibit input which causes the current consumption to drop below 5 µA.

Type	Package	Marking
TLE4296GV33	PG-SCT595-5	C2
TLE4296GV50	PG-SCT595-5	C1

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1 Block diagram

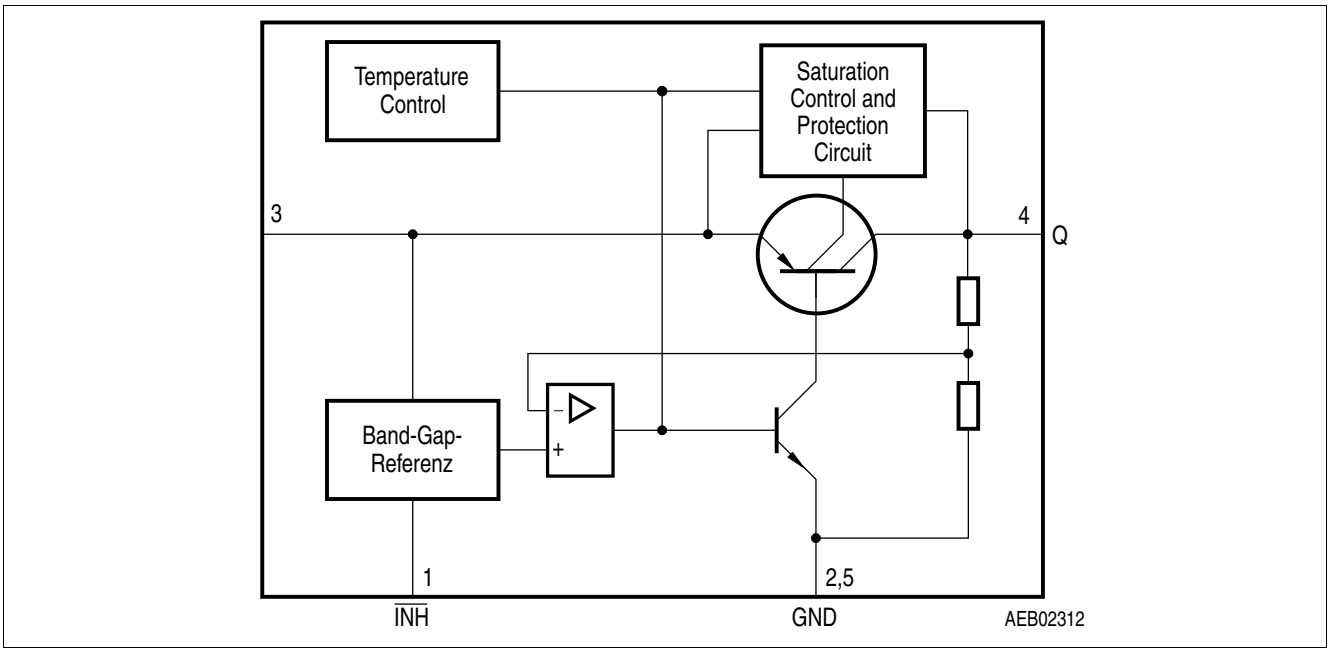


Figure 1 Block diagram

2 Pin configuration

2.1 Pin assignment

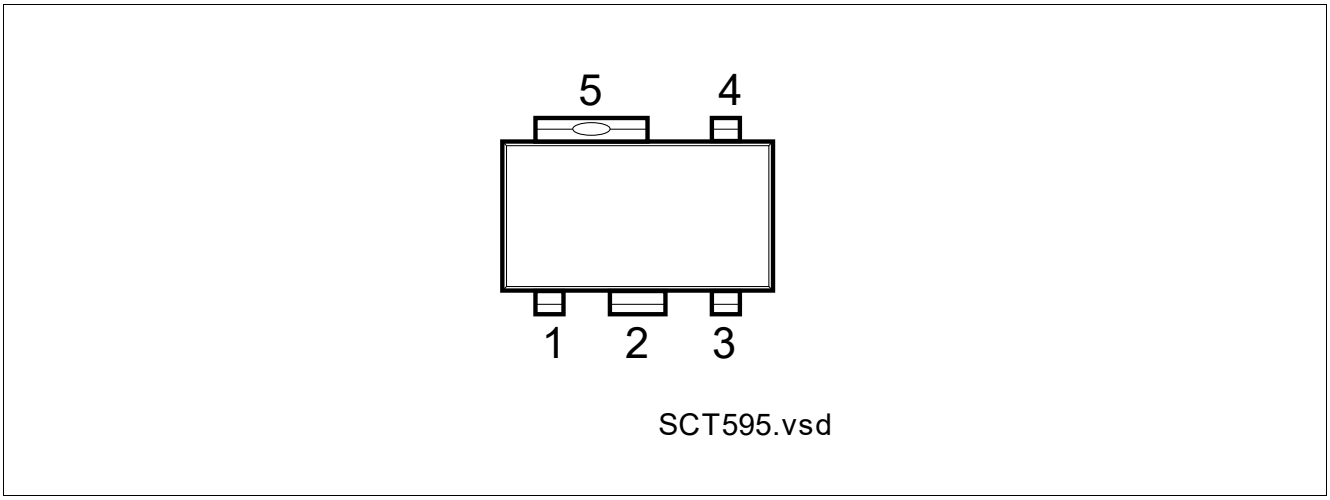


Figure 2 Pin configuration (top view)

2.2 Pin definitions and functions

Table 1 Pin definitions and functions

Pin	Symbol	Function
1	$\overline{\text{INH}}$	**Inhibit input** High level to turn on the IC.
2	GND	**Ground** Connected to pin 5.
3	I	**Input voltage**
4	Q	**Output voltage** Must be blocked with a capacitor $C_Q \geq 2.2$ µF, ESR 3 Ω to 10 Ω.
5	GND	**Ground** Connected to pin 2.

3 General product characteristics

3.1 Absolute maximum ratings

Table 2 Absolute maximum ratings[1)]

T_j = -40°C to 150°C; all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Input							
Voltage	V_I	-42	–	45	V	–	P_3.1.1
Current	I_I	–	–	–		2)	
Output							
Voltage	V_Q	-6	–	30	V	–	P_3.1.2
Current	I_I	–	–	–		2)	
Inhibit							
Voltage	$V_{\overline{INH}}$	-42	–	45	V	–	P_3.1.3
Current	$I_{\overline{INH}}$	-500	–	2)	µA	–	P_3.1.4
		-5	–	5	mA	-0.3 V ≤ V_I ≤ 45 V; t_p < 1 ms	P_3.1.5
Temperatures							
Junction temperature	T_j	-40	–	150	°C	–	P_3.1.6
Storage temperature	T_{stg}	-50	–	150	°C	–	P_3.1.7

1) Not subject to production test, specified by design.
2) Internally limited.

Notes

1. *Stresses above the ones listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*
2. *Integrated protection functions are designed to prevent IC destruction under fault conditions described in the data sheet. Fault conditions are considered as “outside” normal operating range. Protection functions are not designed for continuous repetitive operation.*

3.2 Functional range

Table 3 Functional range

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Input voltage	V_I	4.0	–	45	V	TLE4296GV33	P_3.2.1
		5.5	–	45	V	TLE4296GV50	P_3.2.2
Inhibit voltage	$V_{\overline{INH}}$	-0.3	–	40	V	–	P_3.2.3
Junction temperature	T_j	-40	–	150	°C	–	P_3.2.4

Note: Within the functional or operating range, the IC operates as described in the circuit description. The electrical characteristics are specified within the conditions given in the electrical characteristics table.

3.3 Thermal resistance

*Note: This thermal data was generated in accordance with JEDEC JESD51 standards. For more information, go to **www.jedec.org**.*

Table 4 Thermal resistance

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Junction to ambient	R_{thJA}	–	179	–	K/W	Zero airflow zero heat sink area[1)]	P_3.4.1
Junction to soldering point	R_{thJSP}	–	30	–	K/W	measured to Pin 5	P_3.4.2

1) Worst case regarding peak temperature.

4 Electrical characteristics

4.1 Electrical characteristics voltage regulator

Table 5 Electrical characteristics voltage regulator

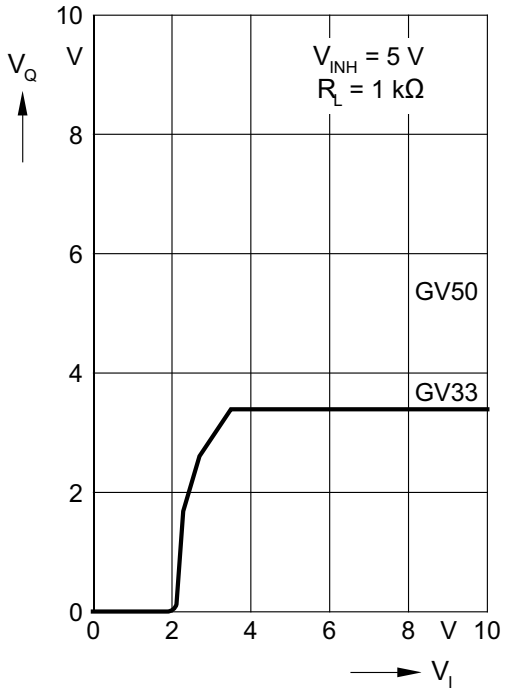
V_I = 13.5 V; $V_{\overline{INH}}$ > 2.5 V; T_j = -40°C to +150°C; all voltages with respect to ground (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Output voltage TLE4296GV33	V_Q	3.17	3.30	3.43	V	1 mA ≤ I_Q ≤ 30 mA V_I = 13.5 V	P_5.1.1
		3.17	3.30	3.43	V	I_Q = 10 mA; 4.3 V ≤ V_I ≤ 40 V	P_5.1.2
Output voltage TLE4296GV50	V_Q	4.80	5.00	5.20	V	1 mA ≤ I_Q ≤ 30 mA V_I = 13.5 V	P_5.1.18
		4.80	5.00	5.20	V	I_Q = 10 mA; 6 V ≤ V_I ≤ 40 V	P_5.1.19
Output current limitation	I_Q	30	–	–	mA	1)	P_5.1.3
Dropout voltage	V_{dr}	–	250	300	mV	I_Q = 20 mA	P_5.1.4
Output capacitor	C_Q	2.2	–	–	µF	ESR 3 Ω to 10 Ω at 100 kHz	P_5.1.5
Current consumption $I_q = I_I - I_Q$	I_q	–	2	4.5	mA	I_Q < 30 mA	P_5.1.6
		–	110	170	µA	I_Q < 1 mA; T_j < 85°C	P_5.1.7
Quiescent current (stand-by) $I_q = I_I - I_Q$	I_q	–	–	1	µA	$V_{\overline{INH}}$ = 0.4 V; T_j < 85°C	P_5.1.8
		–	–	5	µA	$V_{\overline{INH}}$ = 0.4 V	P_5.1.9
Load regulation	ΔV_Q	–	10	20	mV	1 mA < I_Q < 25 mA; T_j = 25°C;	P_5.1.10
Line regulation	ΔV_Q	–	5	20	mV	V_I = ($V_{Q,nom}$ + 0.5 V) to 36 V; I_Q = 5 mA; T_j = 25°C	P_5.1.12
Power supply ripple rejection	PSRR	–	60	–	dB	f_r = 100 Hz; V_r = 0.5 V_{pp}	P_5.1.13
Logic Inhibit input							
Inhibit, turn-on voltage	$V_{\overline{INH},high}$	–	–	2.2	V	V_Q > 0.95 × $V_{Q,nom}$	P_5.1.14
Inhibit, turn-off voltage	$V_{\overline{INH},low}$	0.4	–	–	V	V_Q < 0.1 V	P_5.1.15
H-input current	$V_{\overline{INH},high}$	–	8	12	µA	$V_{\overline{INH}}$ = 5 V	P_5.1.16
L-input current	$V_{\overline{INH},low}$	-2	–	2	µA	$V_{\overline{INH}}$ = 0 V	P_5.1.17

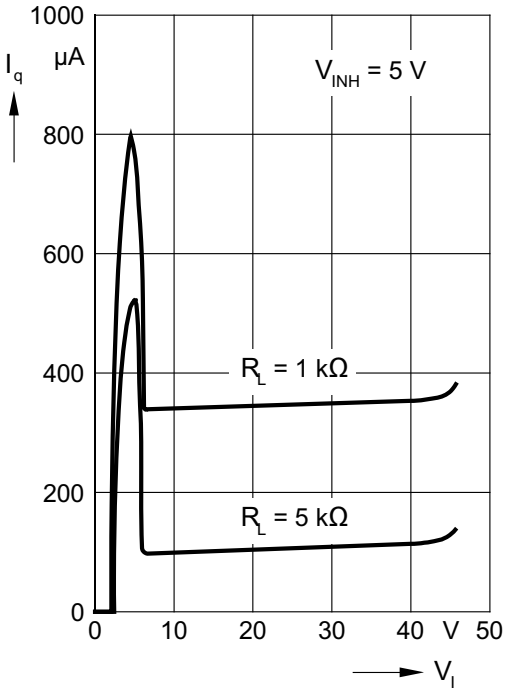
1) Measured when the output voltage V_Q has dropped 100 mV from the nominal value.

4.2 Typical performance characteristics voltage regulator

Output voltage V_Q vs. input voltage V_I



Current consumption I_q vs. 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.

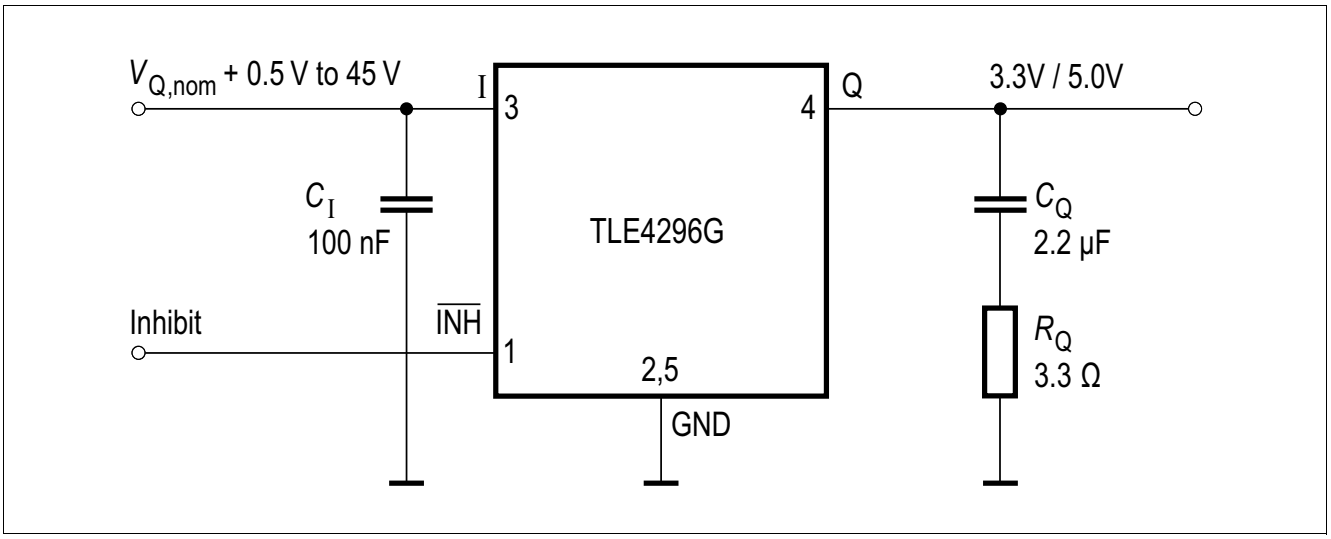


Figure 3 Application diagram

The output voltage of the TLE4296G is divided and compared to an internal reference of 2.5 V typical. A regulation loop controls the output to achieve a stabilized output voltage.

Figure 3 shows a typical application circuit. In order to maintain the stability of the control loop the TLE4296G output requires an output capacitor C_Q of at least 2.2 µF with a minimum required ESR of 3 Ω and a maximum allowed ESR of 10 Ω. It is recommended to use for C_Q a suitable tantalum capacitor (e.g. the EPCOS 3.3 µF / 16V B45196P3335M209 or 4.7 µF / 10V B45196-P247M109) or a multilayer ceramic capacitor with a sufficiently dimensioned series resistor in order to cover the required ESR range over the full operating temperature range of T_j = -40°C to +150°C.

At the input of the regulator a capacitor is required for compensating line influences (100 nF ceramic capacitor recommended). A resistor of approximately 1 Ω in series with the input capacitor C_I can dampen oscillations that could occur due to the input line inductance and the input capacitor.

6 Package information

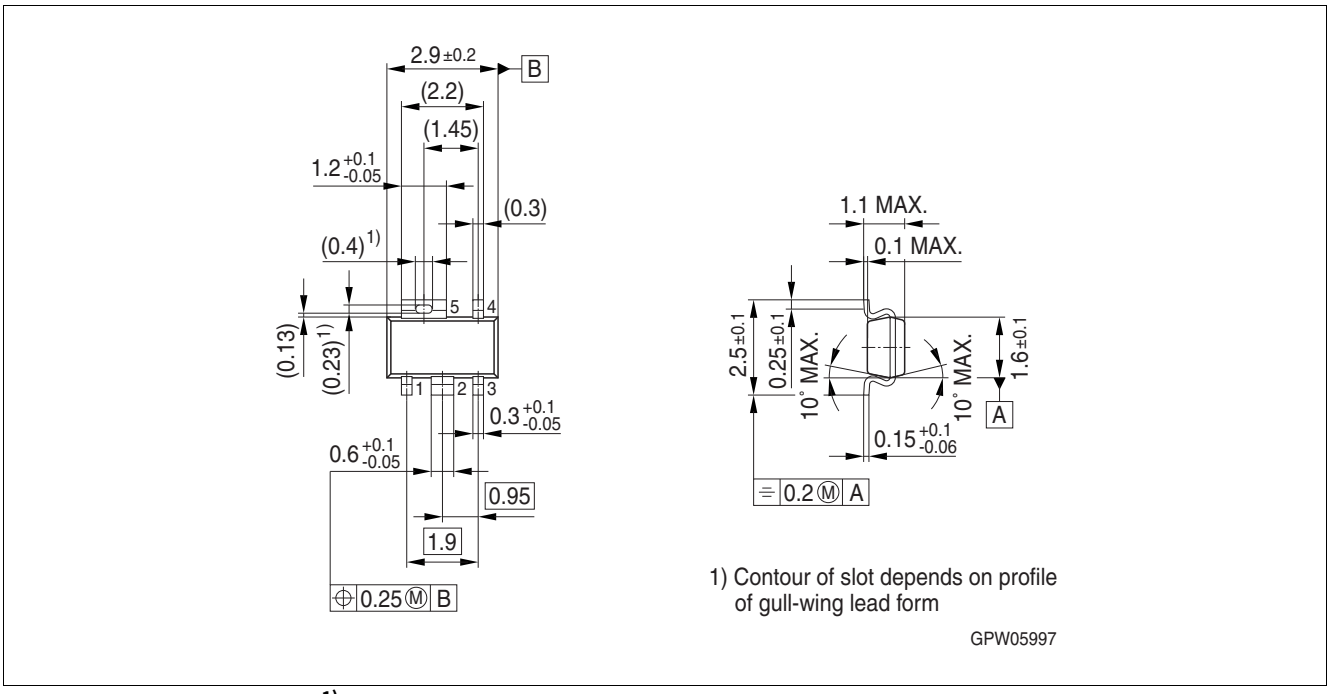


Figure 4 PG-SCT595-5[1)]

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 (i.e. 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
1.21	2023-05-10	Editorial change
1.2	2021-05-05	Updated layout and structure Deleted 3.0 V version Editorial changes Added TOC
1.1	2008-04-21	Initial version of RoHS-compliant derivate of TLE4296 Page 1: AEC certified statement and Marking information added Chapter 6: RoHS compliance and Green product feature added Further editorial changes
1.0	2004-01-01	Initial release

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Edition 2023-05-10
Published by
Infineon Technologies AG
81726 Munich, Germany

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Document reference
Z8F55167454

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