

# OPTIREG™ Linear TLE4269

## 5 V low drop fixed voltage regulator



### Features

- Output voltage tolerance  $\leq \pm 2\%$
- 150 mA current capability
- Very low current consumption
- Early warning
- Reset output low down to  $V_Q = 1\text{ V}$
- Overtemperature protection
- Reverse polarity proof
- Adjustable reset threshold
- Very low drop voltage
- Wide temperature range
- Integrated pull-up resistor at logic outputs
- Green Product (RoHS compliant)

### Potential applications

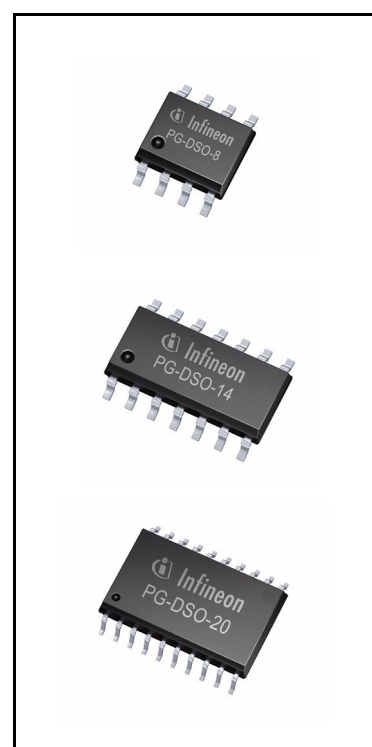
General automotive applications.

### Product validation

Qualified for automotive applications. Product validation according to AEC-Q100/101.

### Description

The OPTIREG™ Linear TLE4269 is an automotive voltage regulator with a 5 V fixed output. The maximum operating voltage is 45 V. The output is able to drive 150 mA load. The device features short-circuit protection. The thermal shutdown feature switches the output off when the junction temperature exceeds 150°C to ensure the device is not damaged by overheating. A reset signal is generated when the output voltage drops below  $V_Q < 4.65\text{ V}$ . The reset threshold voltage can be decreased by an external connection of a voltage divider. The reset delay time can be set by an external capacitor. Reset and sense output have integrated pull-up resistors. If the integrated resistors are not required, the TLE4279 can be used instead. It is also possible to supervise the input voltage by using an integrated comparator to give a low voltage warning.



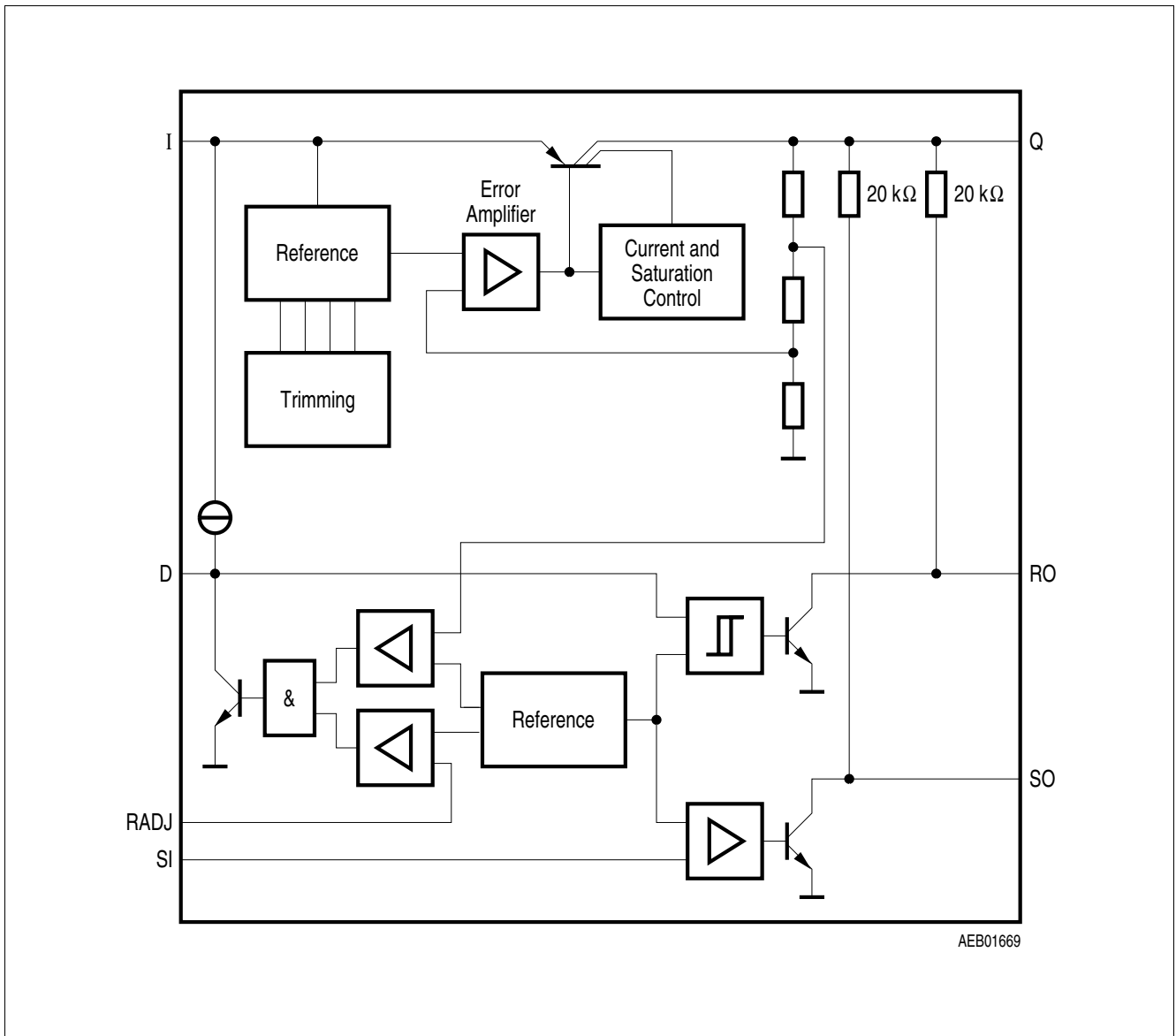
Type	Package	Marking
TLE4269G	PG-DSO-8	TLE 4269
TLE4269GM	PG-DSO-14	TLE 4269
TLE4269GL	PG-DSO-20	TLE 4269

## Table of contents

	<b>Features</b> .....	<b>1</b>
	<b>Potential applications</b> .....	<b>1</b>
	<b>Product validation</b> .....	<b>1</b>
	<b>Description</b> .....	<b>1</b>
	<b>Table of contents</b> .....	<b>2</b>
<b>1</b>	<b>Block diagram</b> .....	<b>3</b>
<b>2</b>	<b>Pin configuration</b> .....	<b>4</b>
<b>3</b>	<b>General product characteristics</b> .....	<b>7</b>
3.1	Absolute maximum ratings .....	7
3.2	Electrical characteristics .....	9
<b>4</b>	<b>Functional description</b> .....	<b>10</b>
<b>5</b>	<b>Application information</b> .....	<b>11</b>
5.1	Application diagram .....	11
5.2	Typical performance characteristics .....	13
<b>6</b>	<b>Package information</b> .....	<b>16</b>
<b>7</b>	<b>Revision history</b> .....	<b>18</b>

**Block diagram**

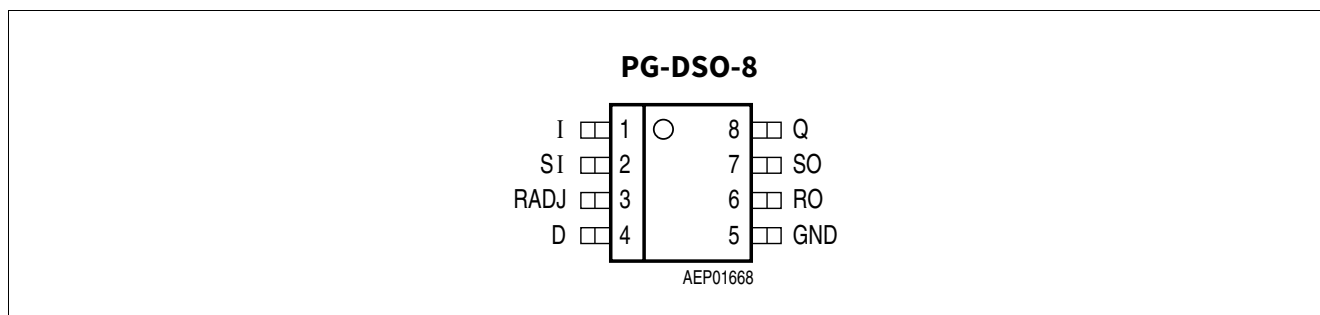
**1 Block diagram**



**Figure 1 Block diagram**

**Pin configuration**

**2 Pin configuration**

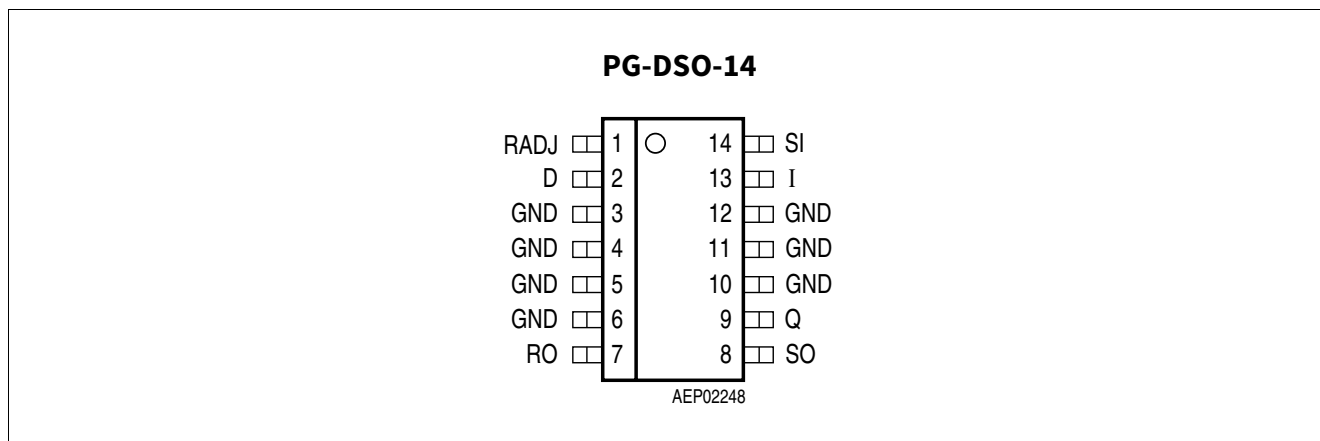


**Figure 2 Pin configuration PG-DSO-8 (top view)**

**Table 1 Pin definitions and functions (TLE4269G)**

Pin No.	Symbol	Function
1	I	<b>Input</b> connected with a ceramic capacitor to GND directly at the IC.
2	SI	<b>Sense input</b> if not needed connect to Q.
3	RADJ	<b>Reset threshold adjust</b> if not needed connect to GND.
4	D	<b>Reset delay</b> to select delay time, connect to GND via capacitor.
5	GND	<b>Ground</b>
6	RO	<b>Reset output</b> the open collector output is connected to the 5 V output via an integrated 20 kΩ pull-up resistor; leave open if the reset function is not needed
7	SO	<b>Sense output</b> the open collector output is connected to the 5 V output via an integrated 20 kΩ pull-up resistor; leave open if the sense comparator is not needed.
8	Q	<b>5 V output</b> connect to GND with a 10 μF capacitor, ESR < 10 Ω

**Pin configuration**

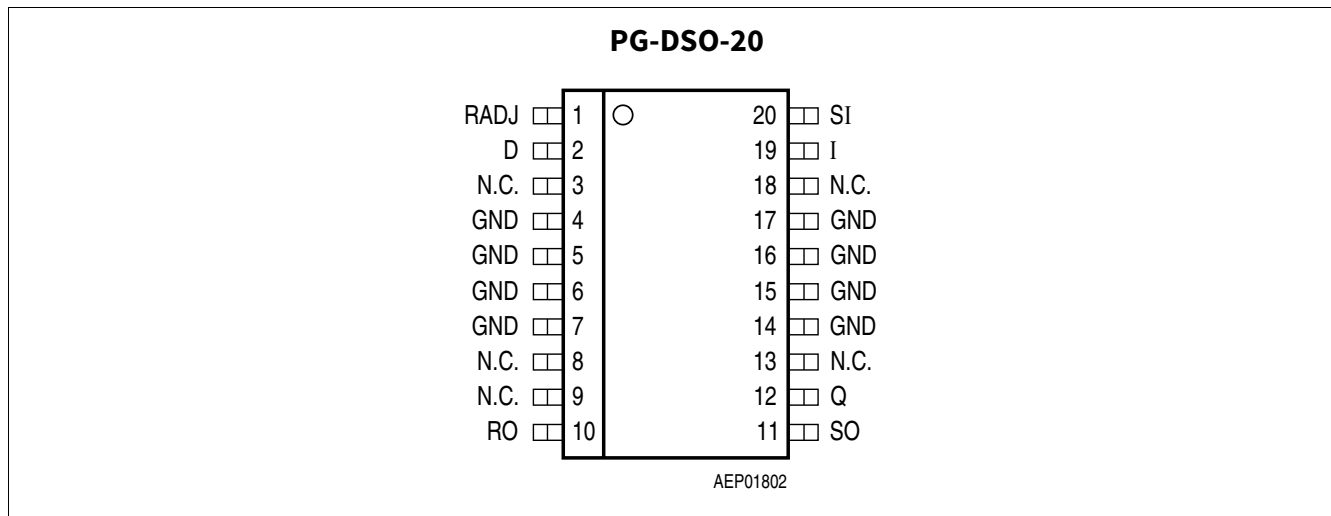


**Figure 3** Pin configuration PG-DSO-14 (top view)

**Table 2** Pin definitions and functions (TLE4269GM)

Pin No.	Symbol	Function
1	RADJ	<b>Reset threshold adjust</b> if not needed connect to GND.
2	D	<b>Reset delay</b> to select delay time; connect to GND via capacitor.
3, 4, 5, 6	GND	<b>Ground</b>
7	RO	<b>Reset output</b> the open collector output is connected to the 5 V output via an integrated 20 kΩ pull-up resistor; leave open if the reset function is not needed
8	SO	<b>Sense output</b> the open collector output is connected to the 5 V output via an integrated 20 kΩ pull-up resistor; leave open if the sense comparator is not needed.
9	Q	<b>5 V Output</b> connect to GND with a 10 μF capacitor, ESR < 10 Ω.
10, 11, 12	GND	<b>Ground</b>
13	I	<b>Input</b> connected with a ceramic capacitor to GND directly at the IC.
14	SI	<b>Sense input</b> if not needed connect to Q.

**Pin configuration**



**Figure 4** Pin configuration PG-DSO-20 (top view)

**Table 3** Pin definitions and functions (TLE4269GL)

Pin No.	Symbol	Function
1	RADJ	<b>Reset threshold adjust</b> if not needed connect to ground.
2	D	<b>Reset delay</b> to select delay time, connect to GND via external capacitor.
4 - 7, 14 - 17	GND	<b>Ground</b>
10	RO	<b>Reset output</b> the open collector output is connected to the 5 V output via an integrated 20 kΩ pull-up resistor; leave open if the reset function is not needed
11	SO	<b>Sense output</b> the open collector output is connected to the 5 V output via an integrated 20 kΩ pull-up resistor; leave open if the sense comparator is not needed.
12	Q	<b>Output</b> connect to GND with a 10 μF capacitor, ESR < 10 Ω.
19	I	<b>Input</b> connected with a ceramic capacitor to GND directly at the IC.
20	SI	<b>Sense input</b> if not needed connect to Q.

**General product characteristics**

**3 General product characteristics**

**3.1 Absolute maximum ratings**

**Table 4 Absolute maximum ratings**

$T_j = -40^\circ\text{C}$  to  $150^\circ\text{C}$

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
<b>Input</b>						
Input voltage	$V_I$	-40	-	45	V	-
Input current	$I_I$	-	-	-	-	Internal limited
<b>Sense input</b>						
Input voltage	$V_{SI}$	-40	-	45	V	-
Input current	$I_{SI}$	1	-	1	mA	-
<b>Reset threshold</b>						
Voltage	$V_{RADJ}$	-0.3	-	7	V	-
Current	$I_{RADJ}$	-10	-	10	mA	-
<b>Reset delay</b>						
Voltage	$V_D$	-0.3	-	7	V	-
Current	$I_D$	-	-	-	-	Internal limited
<b>Ground</b>						
Current	$I_{GND}$	50	-	-	mA	-
<b>Reset output</b>						
Voltage	$V_R$	-0.3	-	7	V	-
Current	$I_R$	-	-	-	-	Internal limited
<b>Sense output</b>						
Voltage	$V_{SO}$	-0.3	-	7	V	-
Current	$I_{SO}$	-	-	-	-	Internal limited
<b>5 V output</b>						
Output voltage	$V_Q$	-0.5	-	7	V	-
Output current	$I_Q$	-10	-	-	mA	-
<b>Temperature</b>						
Junction temperature	$T_j$	-	-	150	$^\circ\text{C}$	-
Storage temperature	$T_{Stg}$	-50	-	150	$^\circ\text{C}$	-
<b>Operating range</b>						
Input voltage	$V_I$	-	-	45	V	-
Junction temperature	$T_j$	-40	-	150	$^\circ\text{C}$	-

**General product characteristics**

**Table 4 Absolute maximum ratings (cont'd)**

$T_j = -40^\circ\text{C}$  to  $150^\circ\text{C}$

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
<b>Thermal data</b>						
Junction-ambient	$R_{thja}$	–	–	200	K/W	PG-DSO-8
		–	–	70	K/W	PG-DSO-14
		–	–	70	K/W	PG-DSO-20
Junction-pin	$R_{thjp}$	–	–	30	K/W	PG-DSO-8 <sup>1)</sup>
		–	–	30	K/W	PG-DSO-14 <sup>2)</sup>
		–	–	30	K/W	PG-DSO-20 <sup>2)</sup>

1) Measured to pin 5.

2) Measured to pin 4.



**General product characteristics**

**3.2 Electrical characteristics**

**Table 5 Electrical characteristics**

$V_I = 13.5 \text{ V}; -40^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
Output voltage	$V_Q$	4.90	5.00	5.10	V	$1 \text{ mA} \leq I_Q \leq 100 \text{ mA}$ , $6 \text{ V} \leq V_I \leq 16 \text{ V}$
Current limit	$I_Q$	150	200	500	mA	–
Current consumption; $I_q = I_I - I_Q$	$I_q$	–	240	300	$\mu\text{A}$	$I_Q \leq 1 \text{ mA}$ , $T_j < 85^\circ\text{C}$
Current consumption; $I_q = I_I - I_Q$	$I_q$	–	250	700	$\mu\text{A}$	$I_Q = 10 \text{ mA}$
Current consumption; $I_q = I_I - I_Q$	$I_q$	–	2	8	mA	$I_Q = 50 \text{ mA}$
Drop voltage	$V_{dr}$	–	0.25	0.5	V	$I_Q = 100 \text{ mA}^{1)}$
Load regulation	$\Delta V_Q$	–	10	30	mV	$I_Q = 5 \text{ mA}$ to $100 \text{ mA}$
Line regulation	$\Delta V_Q$	–	10	40	mV	$V_I = 6 \text{ V}$ to $26 \text{ V}$ , $I_Q = 1 \text{ mA}$

**Reset generator**

Switching threshold	$V_{RT}$	4.50	4.65	4.80	V	–
Reset adjust switching threshold	$V_{RADJ, TH}$	1.26	1.35	1.44	V	$V_Q > 3.5 \text{ V}$
Reset pull-up	–	10	20	40	k $\Omega$	–
Saturation voltage	$V_{RO, SAT}$	–	0.1	0.4	V	$R_{intern}$
Upper delay switching threshold	$V_{UD}$	1.4	1.8	2.2	V	–
Lower delay switching threshold	$V_{LD}$	0.3	0.45	0.60	V	–
Saturation voltage delay capacitor	$V_{D, SAT}$	–	–	0.1	V	$V_Q < V_{RT}$
Charge current	$I_D$	3.0	6.5	9.5	$\mu\text{A}$	$V_D = 1 \text{ V}$
Delay time L $\rightarrow$ H	$t_d$	17	28	–	ms	$C_D = 100 \text{ nF}$
Delay time H $\rightarrow$ L	$t_t$	–	1	–	$\mu\text{s}$	$C_D = 100 \text{ nF}$

**Input voltage sense**

Sense threshold high	$V_{SI, high}$	1.24	1.31	1.38	V	–
Sense threshold low	$V_{SI, low}$	1.16	1.20	1.28	V	–
Sense output low voltage	$V_{SO, low}$	–	0.1	0.4	V	$V_{SI} < 1.20 \text{ V}; V_Q > 3 \text{ V}, R_{intern}$
Sense pull-up	–	10	20	40	k $\Omega$	–
Sense input current	$I_{SI}$	-1	0.1	1	$\mu\text{A}$	–

1) Drop voltage =  $V_I - V_Q$  measured when the output voltage has dropped 100 mV from the nominal value obtained at 13.5 V input.

## Functional description

### 4 Functional description

The control amplifier compares a reference voltage, made highly accurate by resistance balancing, with a voltage proportional to the output voltage and drives the base of the series PNP transistor via a buffer. Saturation control as a function of the load current prevents any over-saturation of the power element.

The reset output RO is in high-state if the voltage on the delay capacitor  $C_D$  is greater or equal  $V_{UD}$ . The delay capacitor  $C_D$  is charged with the current  $I_D$  for output voltages greater than the reset threshold  $V_{RT}$ . If the output voltage gets lower than  $V_{RT}$  ('reset condition') a fast discharge of the delay capacitor  $C_D$  sets in and as soon as  $V_D$  gets lower than  $V_{LD}$  the reset output RO is set to low-level.

The time gap for the delay capacitor discharge is the reset reaction time  $t_{RR}$ .

The reset threshold  $V_{RT}$  can be decreased via an external voltage divider connected to the pin RADJ. In this case the reset condition is reached if  $V_Q < V_{RT}$  and  $V_{RADJ} < V_{RAQDJ, TH}$ . Dimensioning the voltage divider (**Figure 5**) according to:

(4.1)

$$V_{THRES} = \frac{V_{RAD(J, TH)} \times (R_{ADJ1} + R_{ADJ2})}{R_{ADJ2}}$$

the reset threshold can be decreased down to 3.5 V. If the reset-adjust-option is not needed the RADJ-pin should be connected to GND causing the reset threshold to go to its default value (typ. 4.65 V).

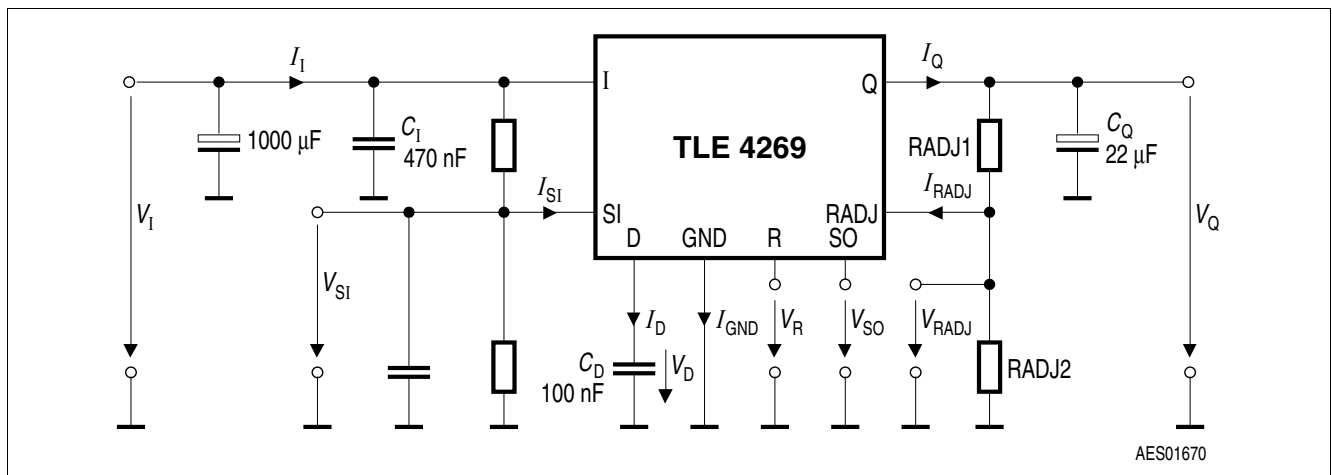
A built in comparator compares the signal of the pin SI, normally fed by a voltage divider from the input voltage, with the reference and gives an early warning on the pin SO. It is also possible to superwise another voltage e.g. of a second regulator, or to build a watchdog circuit with few external components.

**Application information**

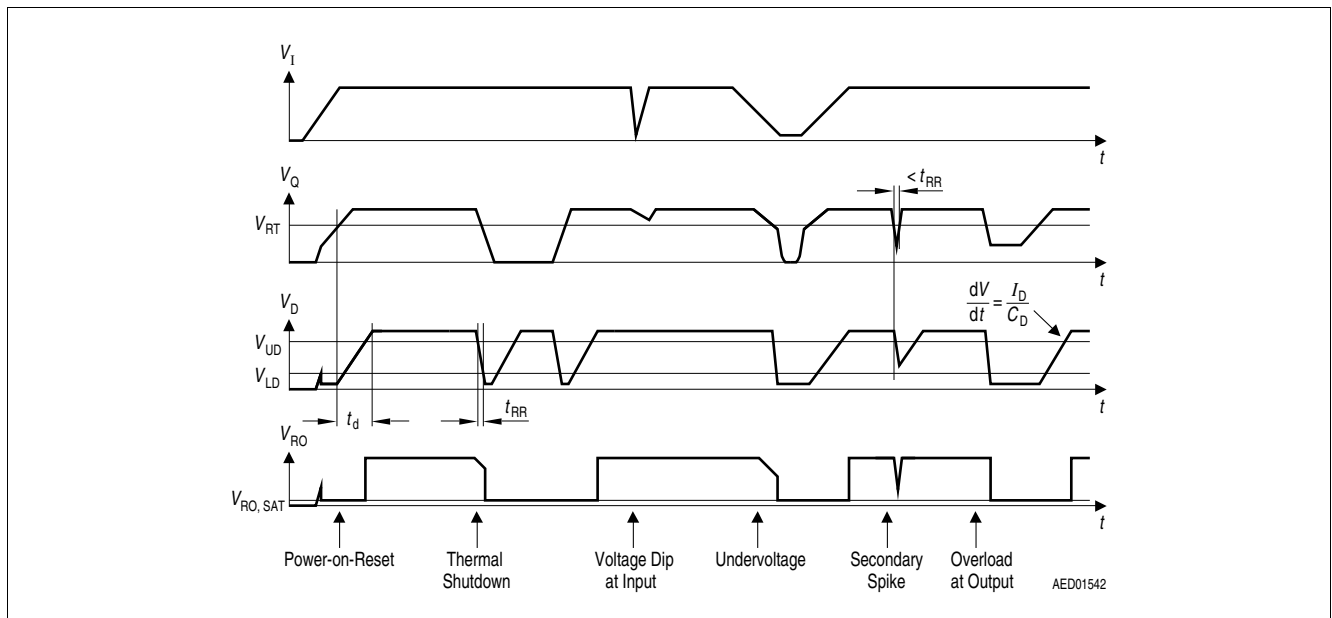
**5 Application information**

The input capacitor  $C_I$  is necessary for compensating line influences. Using a resistor of approx.  $1\ \Omega$  in series with  $C_I$ , the oscillating circuit consisting of input inductivity and input capacitance can be damped. The output capacitor  $C_Q$  is necessary for the stability of the regulating circuit. Stability is guaranteed at values  $\geq 10\ \mu\text{F}$  and an  $\text{ESR} \leq 10\ \Omega$  within the operating temperature range. For small tolerances of the reset delay the spread of the capacitance of the delay capacitor and its temperature coefficient should be noted.

**5.1 Application diagram**

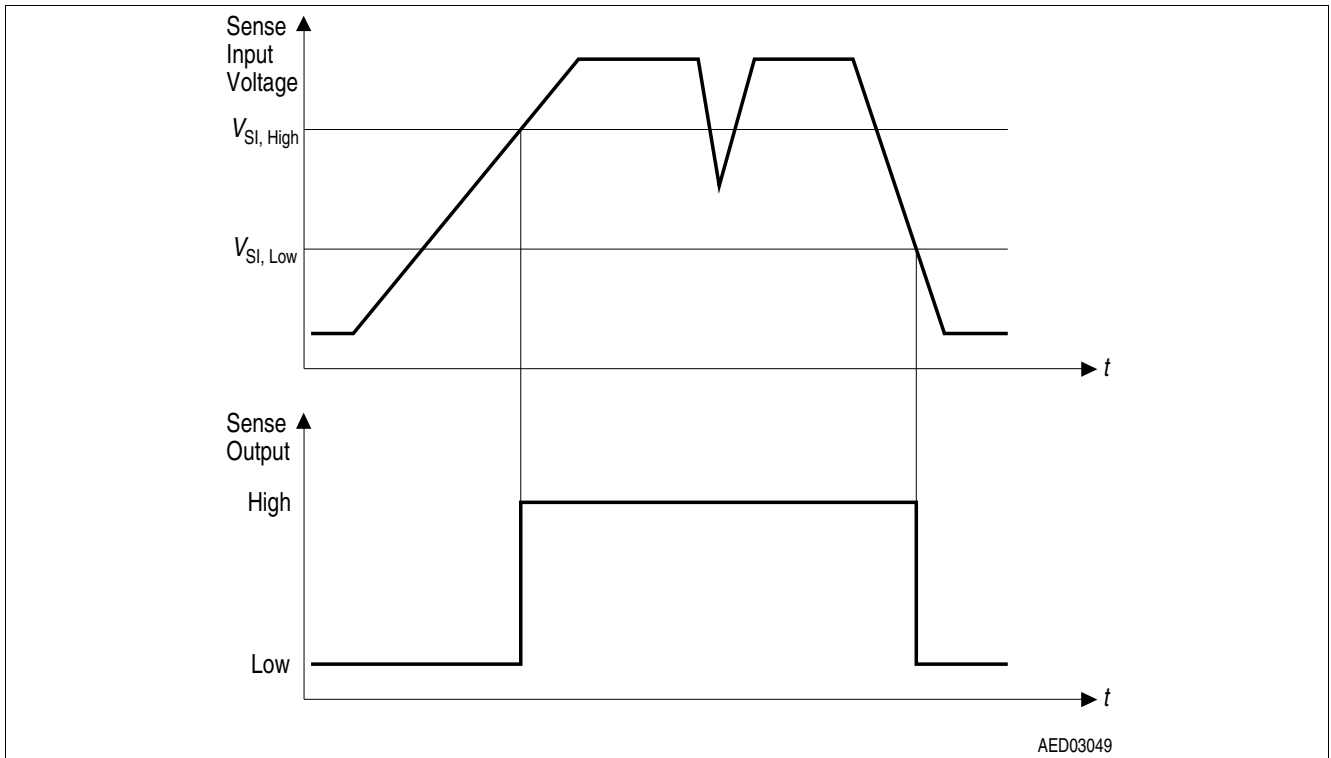


**Figure 5 Measuring circuit**



**Figure 6 Reset timing diagram**

**Application information**

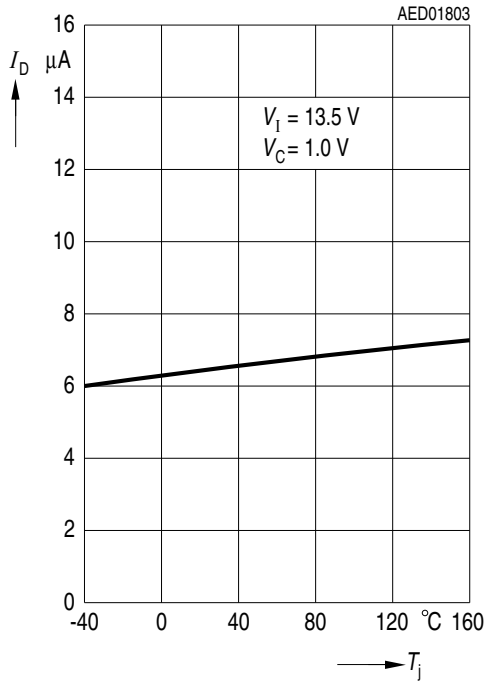


**Figure 7 Sense timing diagram**

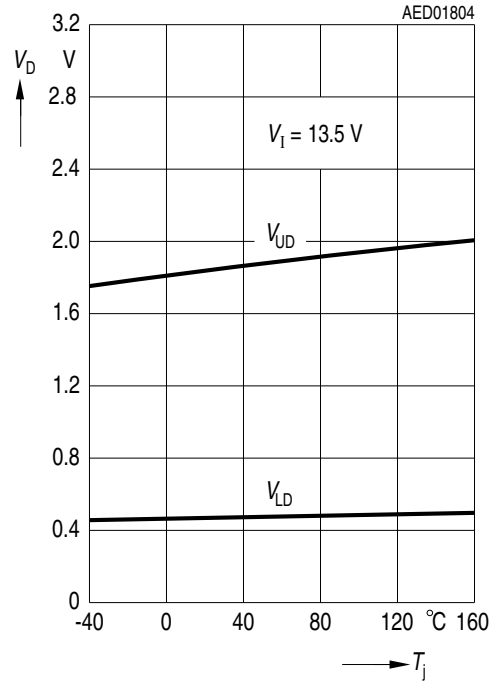
**Application information**

**5.2 Typical performance characteristics**

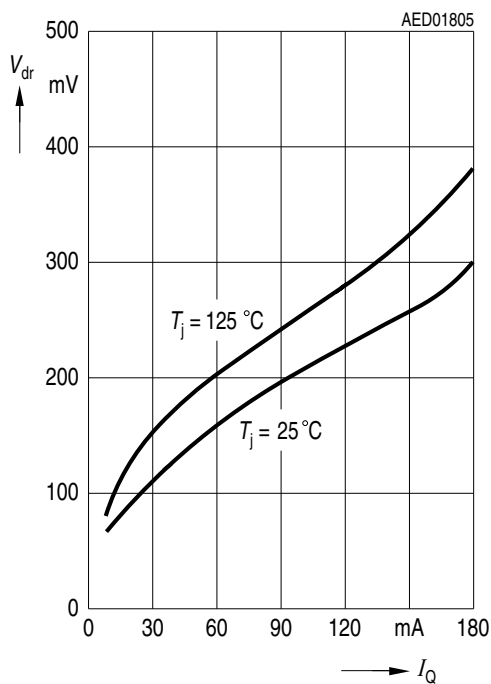
**Charge current  $I_D$  versus junction temperature  $T_j$**



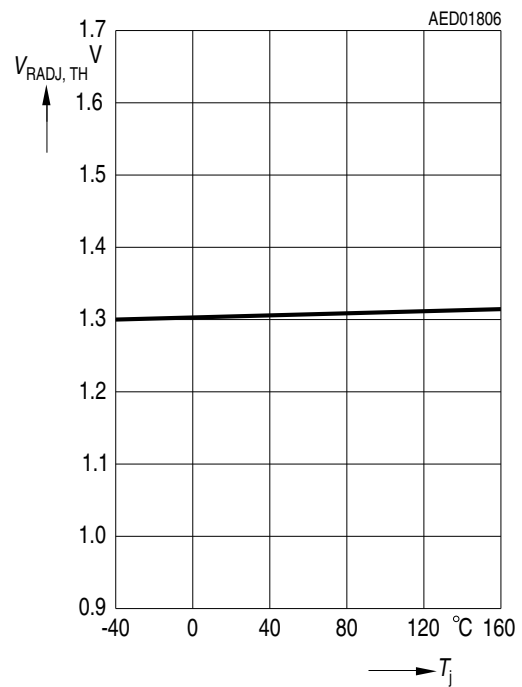
**Switching voltage  $V_{UD}$  and  $V_{LD}$  versus junction temperature  $T_j$**



**Drop voltage  $V_{dr}$  versus output current  $I_Q$**

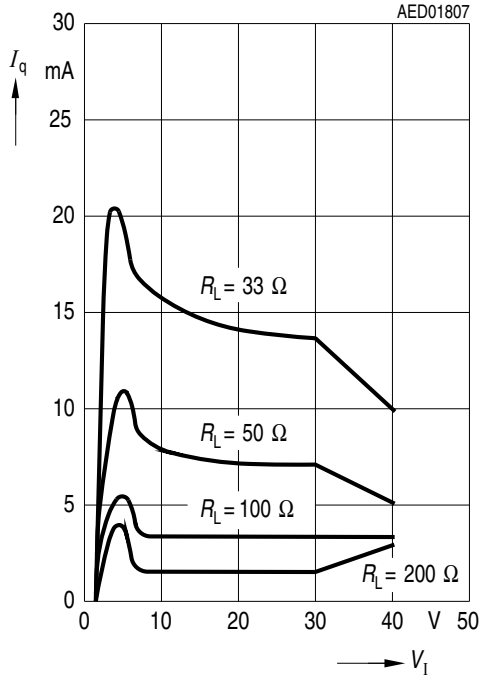


**Reset adjust switching threshold  $V_{RADJ,TH}$  versus junction temperature  $T_j$**

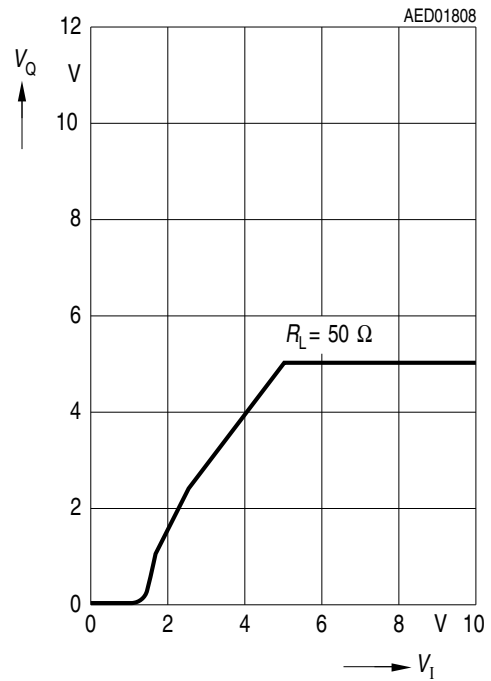


**Application information**

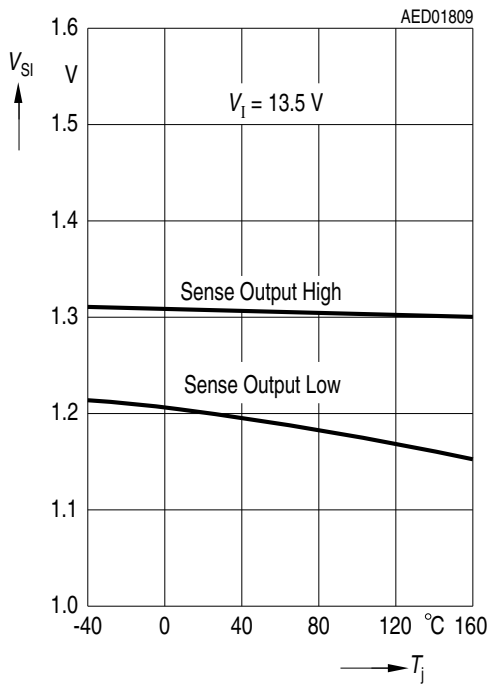
**Current consumption  $I_Q$  versus input voltage  $V_I$**



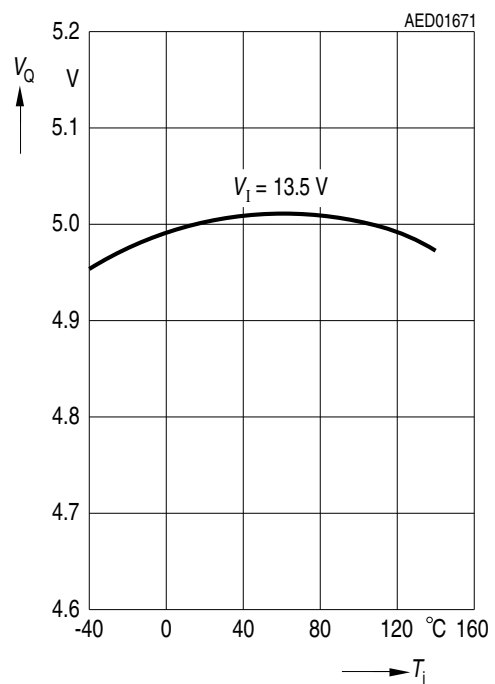
**Output voltage  $V_Q$  versus input voltage  $V_I$**



**Sense threshold  $V_{SI}$  versus junction temperature  $T_j$**

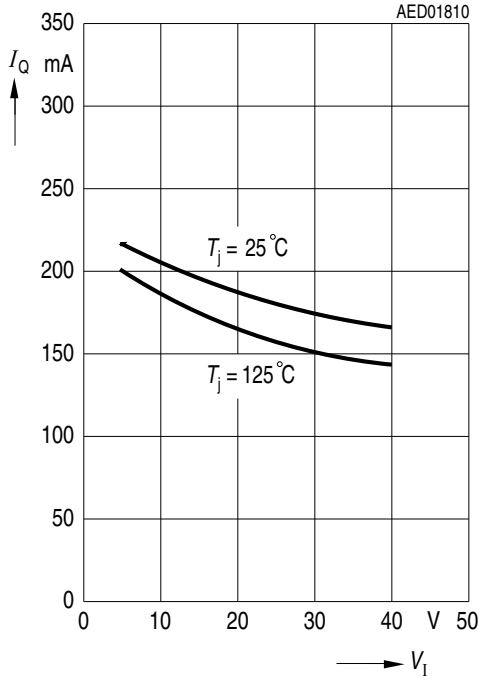


**Output voltage  $V_Q$  versus junction temperature  $T_j$**

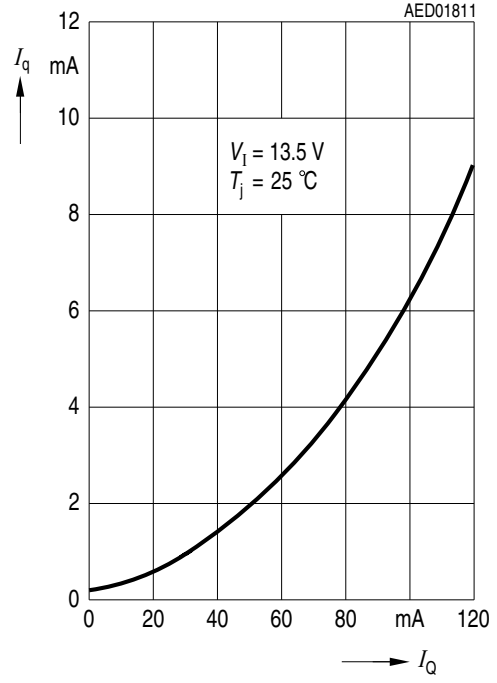


**Application information**

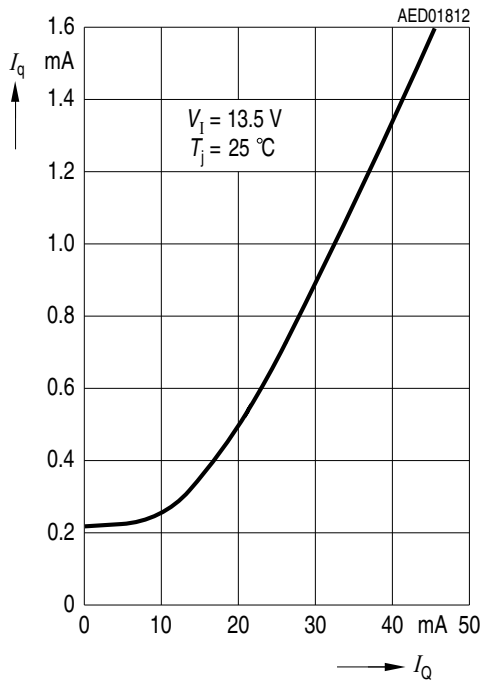
**Output current  $I_Q$  versus input voltage  $V_I$**



**Current consumption  $I_q$  versus output current  $I_Q$**

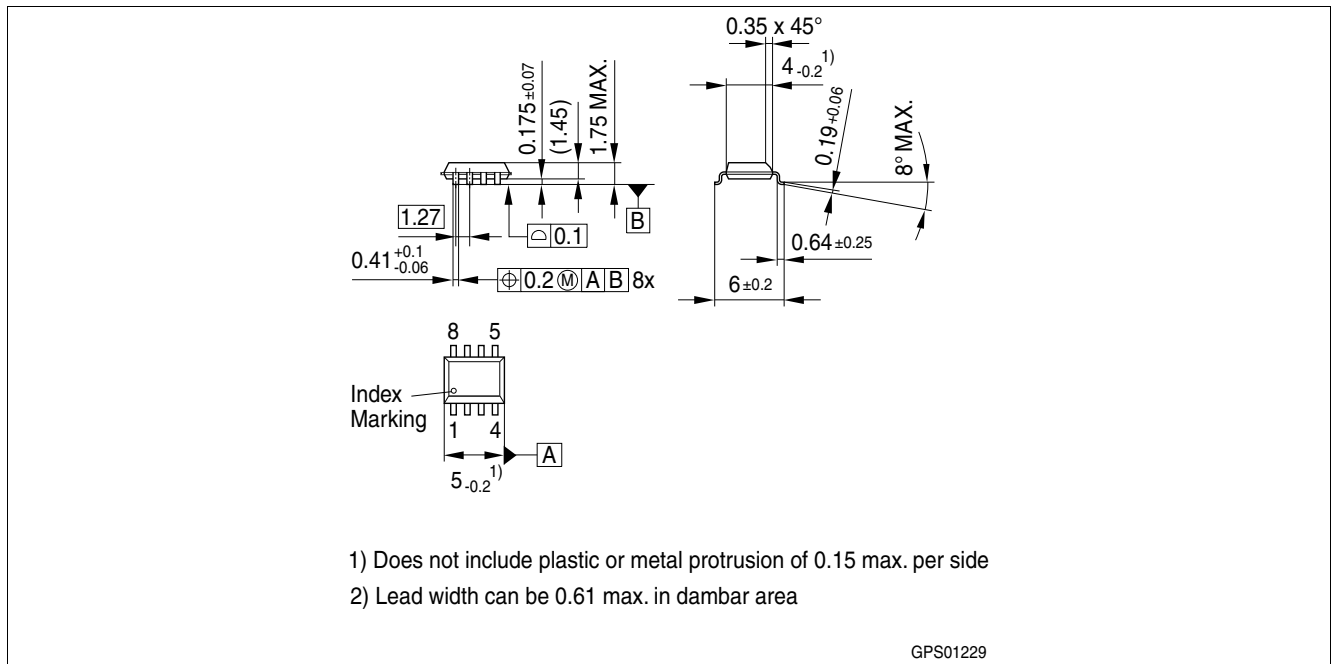


**Current consumption  $I_q$  versus output current  $I_Q$**

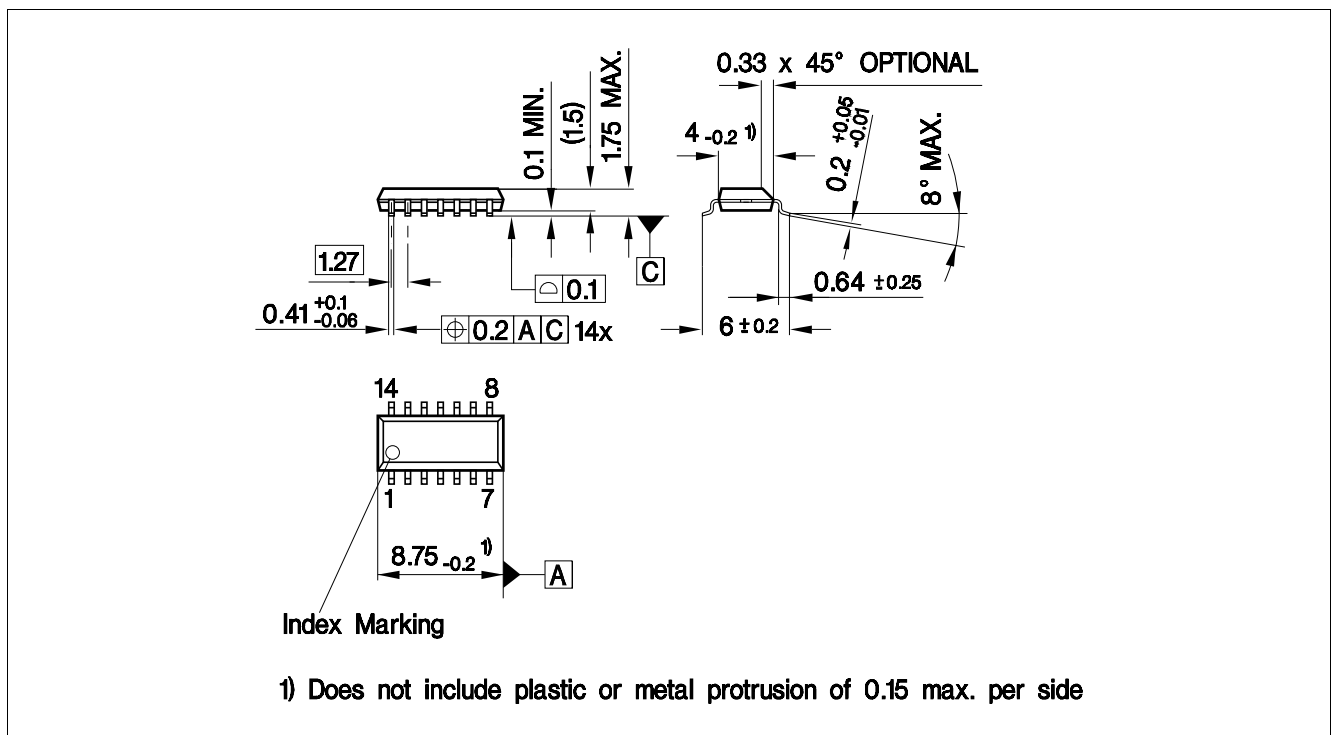


**Package information**

**6 Package information**



**Figure 8 PG-DSO-8<sup>1)</sup>**

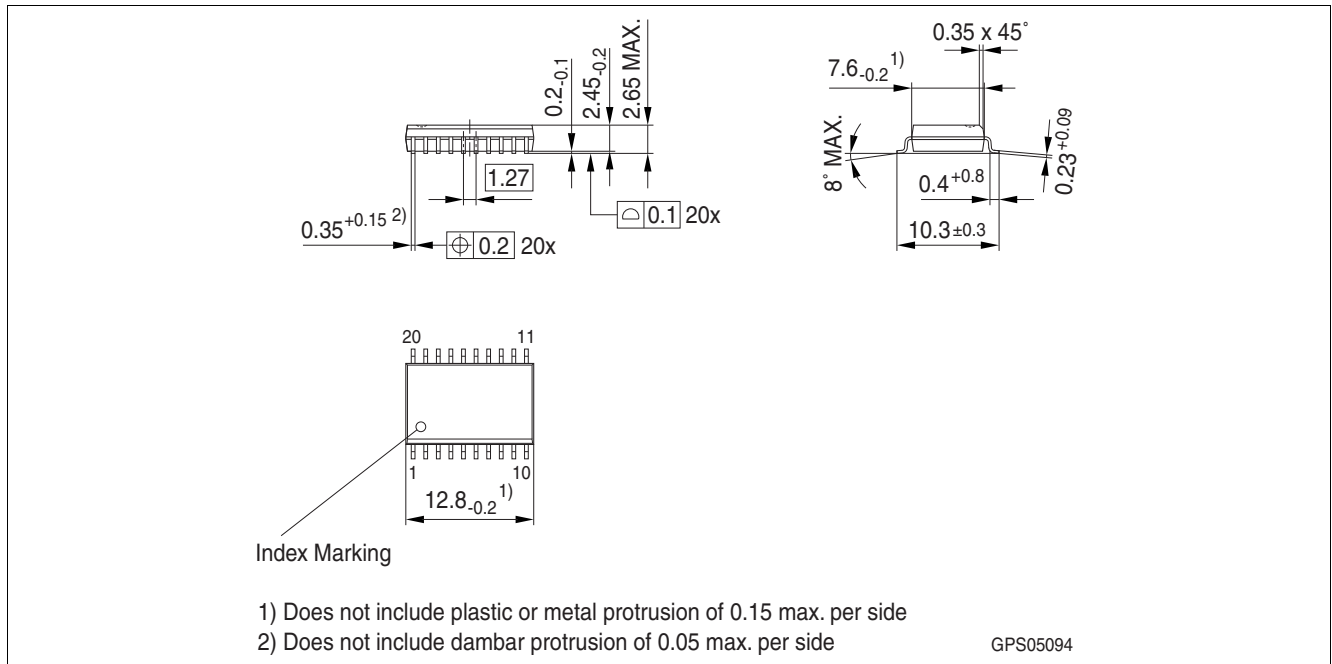


**Figure 9 PG-DSO-14<sup>1)</sup>**

1) Dimensions in mm



**Package information**



**Figure 10 PG-DSO-20<sup>1)</sup>**

**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

Revision history

## 7 Revision history

Revision	Date	Changes
2.6	2018-11-20	Update layout and structure Updated packaged drawing “PG-DSO-14” Editorial changes
2.5	2013-11-25	Package version changed: - PG-DSO-20-35 to PG-DSO-20 Package naming harmonized according to Infineon standards: - PG-DSO-8-16 to PG-DSO-8 - PG-DSO-14-30 to PG-DSO-14
2.4	2007-03-20	Initial version of RoHS-compliant derivate of TLE4269 <b>Page 1</b> : AEC certified statement added <b>Page 1</b> and <b>Page 16</b> : RoHS compliance statement and Green product feature added <b>Page 1</b> and <b>Page 16</b> : Package changed to RoHS compliant version Legal Disclaimer updated
2.3	2004-01-01	

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**Email: [erratum@infineon.com](mailto:erratum@infineon.com)**

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