5-V Low Drop Fixed Voltage Regulator

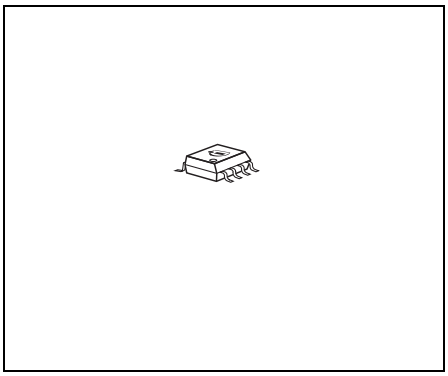
TLE 4279

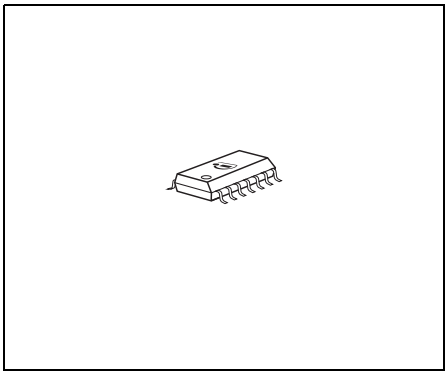
AEC Qualified

RoHS

Features

- Output voltage tolerance ≤ ±2%
- 150 mA current capability
- Very low current consumption
- Early warning
- Reset output low down to V_Q = 1 V
- Overtemperature protection
- Reverse polarity proof
- Adjustable reset threshold
- Very low-drop voltage
- Wide temperature range
- Green Product (RoHS compliant)
- AEC Qualified





Functional Description

This device is an automotive suited voltage regulator with a fixed 5-V output, e.g. in a PG-DSO-8-16 package. The maximum operating voltage is 45 V. The output is able to drive 150 mA load. It is short circuit protected and the thermal shutdown switches the output off if the junction temperature is in excess of 150 °C. A reset signal is generated for an output voltage of V_Q < 4.65 V. The reset threshold voltage can be decreased by external connection of a voltage divider. The reset delay time can be set by an external capacitor. If the application requires pull-up resistors at the logic outputs (Reset, Sense Out) the TLE 4269 with integrated resistors can be used. It is also possible to supervise the input voltage by using an integrated comparator to give a low voltage warning.

Type	Package
TLE 4279 G	PG-DSO-8-16
TLE 4279 GM	PG-DSO-14-30

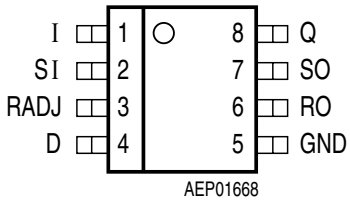


Figure 1 **Pin Configuration** (top view)

Table 1 **Pin Definitions and Functions (TLE 4279 G)**

Pin No.	Symbol	Function
1	I	**Input;** block to GND directly at the IC with a ceramic capacitor
2	SI	**Sense input;** if not needed connect to Q
3	RADJ	**Reset threshold adjust;** if not needed connect to ground
4	D	**Reset delay;** to select the delay time, connect to GND via external capacitor
5	GND	**Ground**
6	RO	**Reset output;** open-collector output. Keep open, if not needed
7	SO	**Sense output;** open-collector output. Keep open, if not needed
8	Q	**5-V output;** connect to GND with a 10 µF capacitor, ESR < 10 Ω

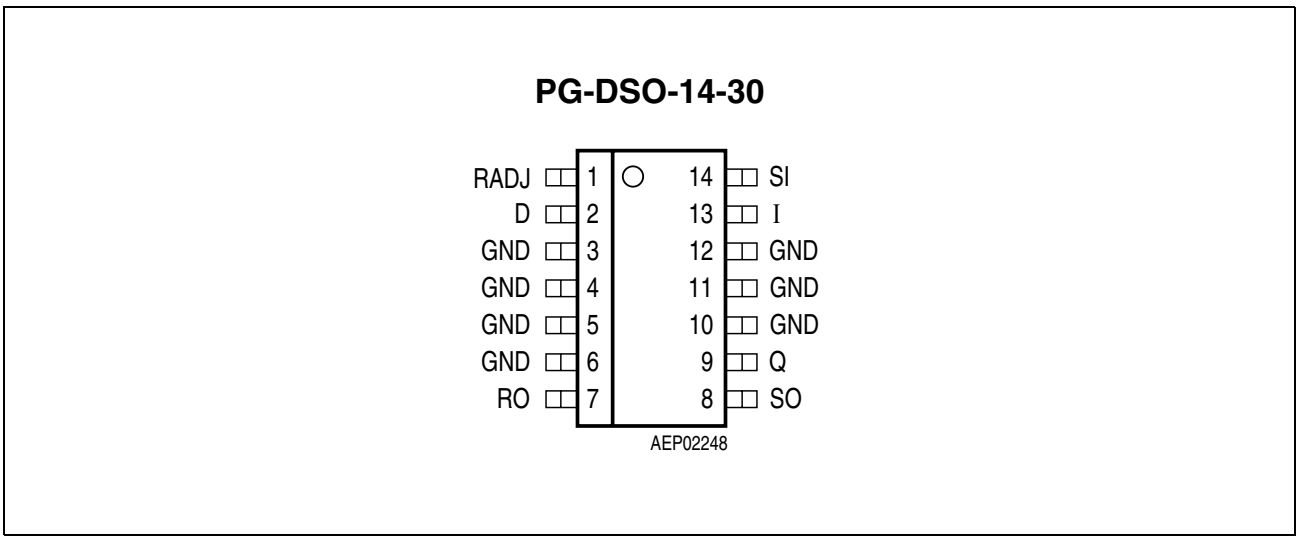


Figure 2 **Pin Configuration** (top view)

Table 2 **Pin Definitions and Functions (TLE 4279 GM)**

Pin No.	Symbol	Function
1	RADJ	**Reset threshold adjust;** if not needed connect to GND
2	D	**Reset delay;** connect to GND via external delay capacitor for setting delay time
3, 4, 5, 6	GND	**Ground**
7	RO	**Reset output;** open-collector output. Keep open, if not needed
8	SO	**Sense output;** open-collector output. Keep open, if not needed
9	Q	**5-V output;** connect to GND via 10 µF capacitor, ESR < 10 Ω
10, 11, 12	GND	**Ground**
13	I	**Input;** block to GND directly at the IC by a ceramic capacitor
14	SI	**Sense input;** if not needed connect to Q

Circuit 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 (see **Figure 4**) according to:

$$V_{THRES} = V_{RADJ,TH} \times (R_{RADJ1} + R_{RADJ2}) / R_{RADJ2}, \quad (1)$$

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 Description

The input capacitor C_I is necessary for compensating line influences. Using a resistor of approx. 1 Ω 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 ≥ 10 µF and an ESR ≤ 10 Ω within the operating temperature range. Both reset output and sense output are open collector outputs and have to be connected to 5 V output via external pull-up resistors ≥ 10 kΩ. For small tolerances of the reset delay the spread of the capacitance of the delay capacitor and its temperature coefficient should be noted.

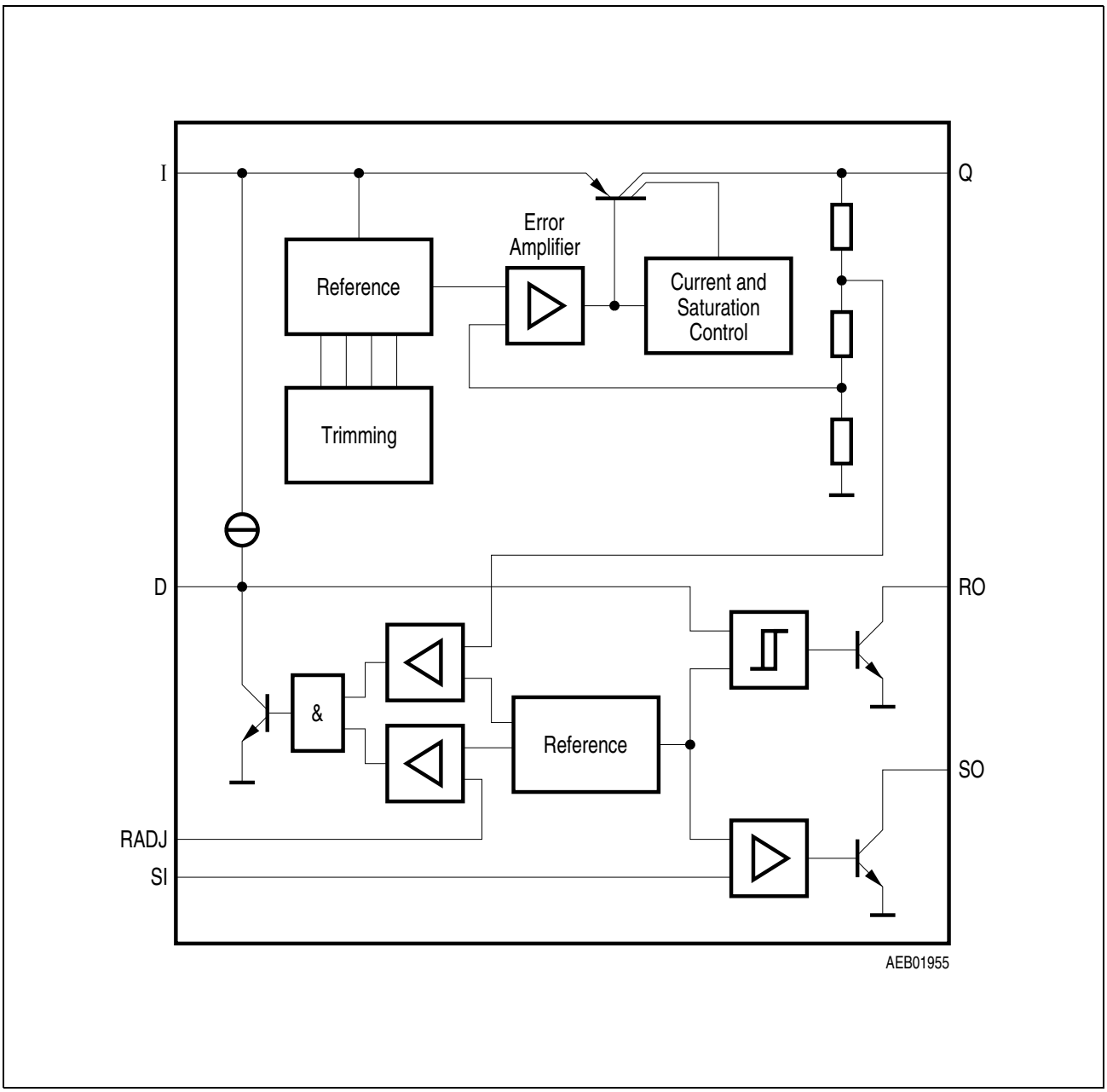


Figure 3 Block Diagram

Table 3 Absolute Maximum Ratings

T_j = -40 to 150 °C

Parameter	Symbol	Limit Values		Unit	Notes
		Min.	Max.		
Input					
Input voltage	V_I	-40	45	V	–
Input current	I_I	–	–	–	internal limited
Sense Input					
Input voltage	V_{SI}	-40	45	V	–
Input current	I_{SI}	1	1	mA	–
Reset Threshold					
Voltage	V_{RADJ}	-40	7	V	–
Current	I_{RADJ}	-10	10	mA	–
Reset Delay					
Voltage	V_D	-0.3	7	V	–
Current	I_D	–	–	–	internal limited
Ground					
Current	I_{GND}	50	–	mA	–
Reset Output					
Voltage	V_R	-0.3	7	V	–
Current	I_R	–	–	–	internal limited
Sense Output					
Voltage	V_{SO}	-0.3	7	V	–
Current	I_{SO}	–	–	–	internal limited
5-V Output					
Output voltage	V_Q	-0.5	7	V	–
Output current	I_Q	-10	–	mA	–
Temperature					
Junction temperature	T_j	–	150	°C	–
Storage temperature	T_{Stg}	-50	150	°C	–

Table 3 Absolute Maximum Ratings (cont'd)

T_j = -40 to 150 °C

Parameter	Symbol	Limit Values		Unit	Notes
		Min.	Max.		
Operating Range					
Input voltage	V_I	–	45	V	–
Junction temperature	T_j	-40	150	°C	–
Thermal Data					
Junction-ambient	R_{thja}	– –	200 70	K/W K/W	PG-DSO-8-16 PG-DSO-14-30
Junction-pin	R_{thjp}	–	30	K/W	PG-DSO-14-30 1)

1) measured to Pin 4

Table 4 Characteristics

V_I = 13.5 V; T_j = -40 °C < T_j < 125 °C

Parameter	Symbol	Limit Values			Unit	Measuring Condition
		Min.	Typ.	Max.		
Output voltage	V_Q	4.90	5.00	5.10	V	1 mA ≤ I_Q ≤ 100 mA 6 V ≤ V_I ≤ 16 V
Current limit	I_Q	150	200	500	mA	–
Current consumption; $I_q = I_I - I_Q$	I_q	–	150	300	µA	I_Q ≤ 1 mA, T_j < 85 °C
Current consumption; $I_q = I_I - I_Q$	I_q	–	250	700	µA	I_Q = 10 mA
Current consumption; $I_q = I_I - I_Q$	I_q	–	2	8	mA	I_Q = 50 mA
Drop voltage	V_{dr}	–	0.25	0.5	V	I_Q = 100 mA[1)]
Load regulation	ΔV_Q	–	10	30	mV	I_Q = 5 mA to 100 mA
Line regulation	ΔV_Q	–	10	40	mV	V_I = 6 V to 26 V I_Q = 1 mA
Reset Generator						
Switching threshold	V_{RT}	4.50	4.65	4.80	V	–
Reset adjust switching voltage	$V_{RADJ,TH}$	1.26	1.35	1.44	V	V_Q > 3.5 V
Reset low voltage	$V_{RO,SAT}$	–	0.1	0.4	V	R_{extern} = 20 kΩ
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	–
Reset delay low voltage	$V_{D,SAT}$	–	–	0.1	V	V_Q < V_{RT}
Charge current	I_D	3.0	6.5	9.5	µA	V_D = 1 V
Delay time L → H	t_d	17	28	–	ms	C_D = 100 nF
Delay time H → L	t_t	–	1	–	µs	C_D = 100 nF

Table 4 Characteristics (cont'd)

V_I = 13.5 V; T_j = -40 °C < T_j < 125 °C

Parameter	Symbol	Limit Values			Unit	Measuring Condition
		Min.	Typ.	Max.		
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 V; V_Q > 3 V; R_{extern} = 20 kΩ
Sense input current	I_{SI}	-1	0.1	1	µA	–

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.)

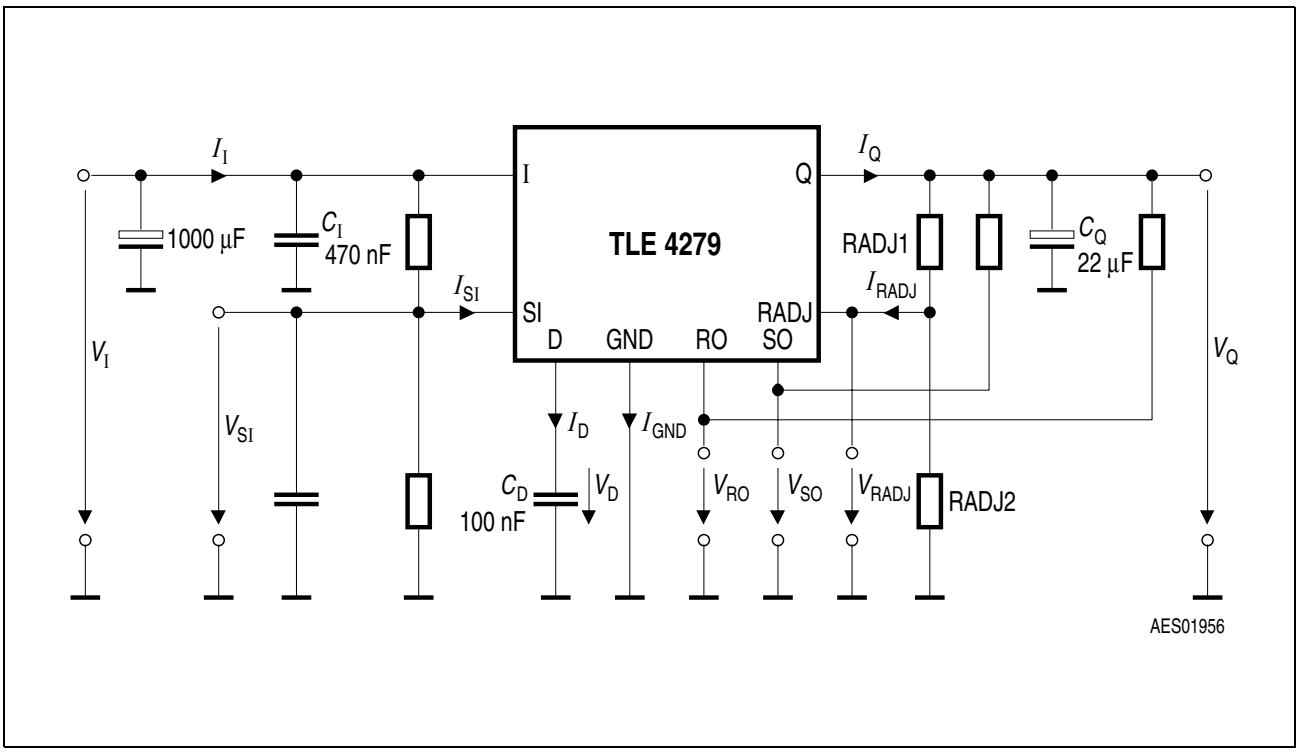


Figure 4 Measuring Circuit

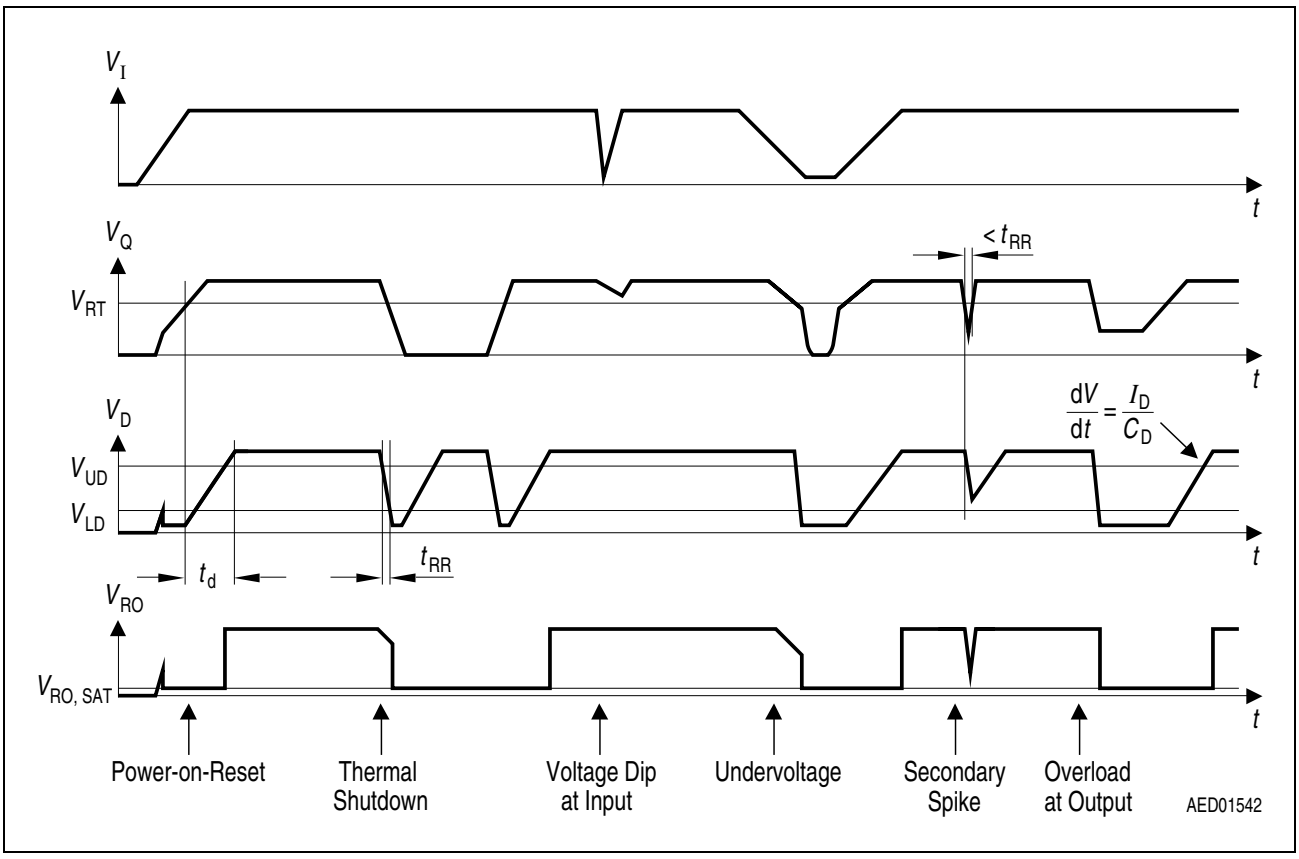


Figure 5 Reset Timing Diagram

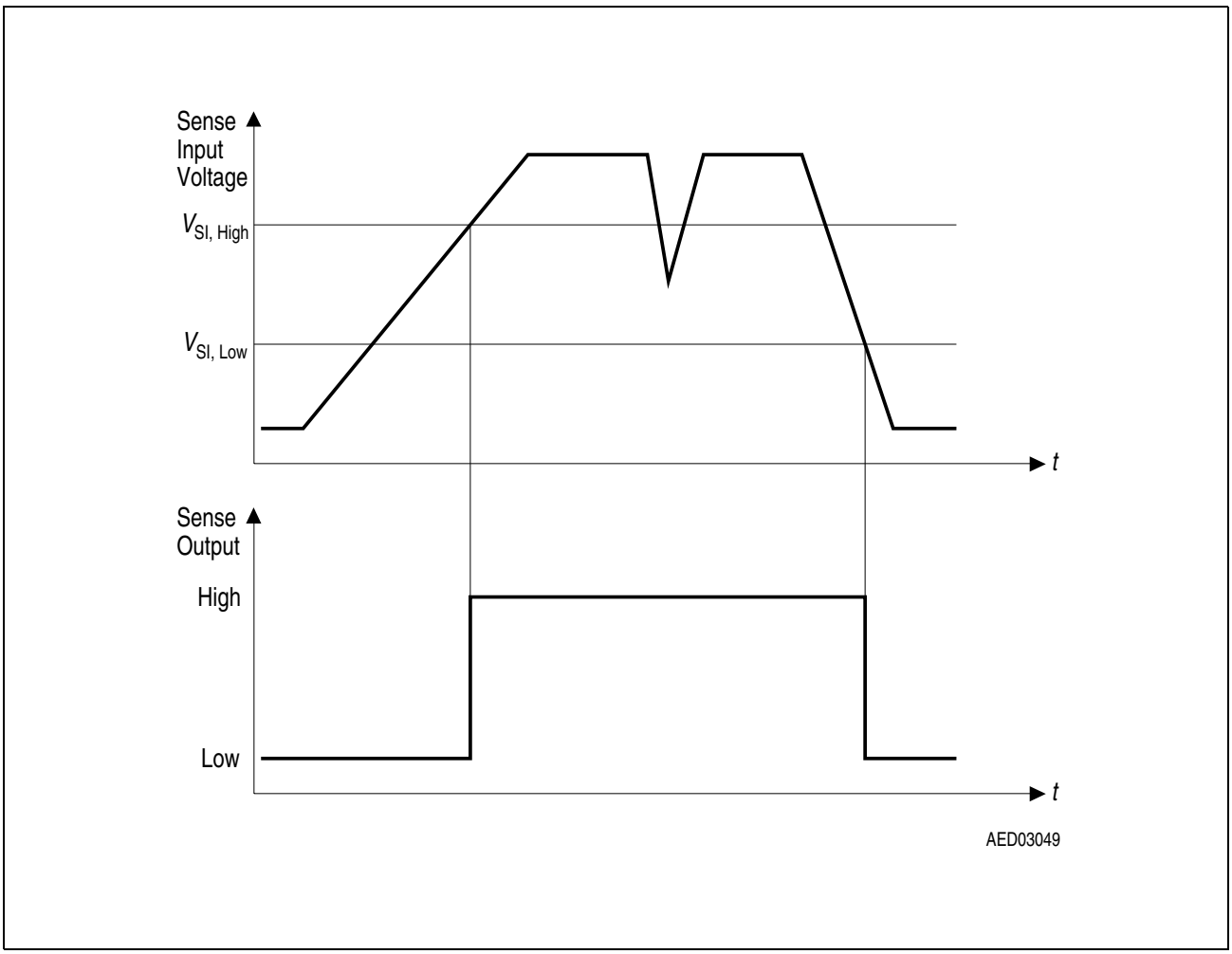
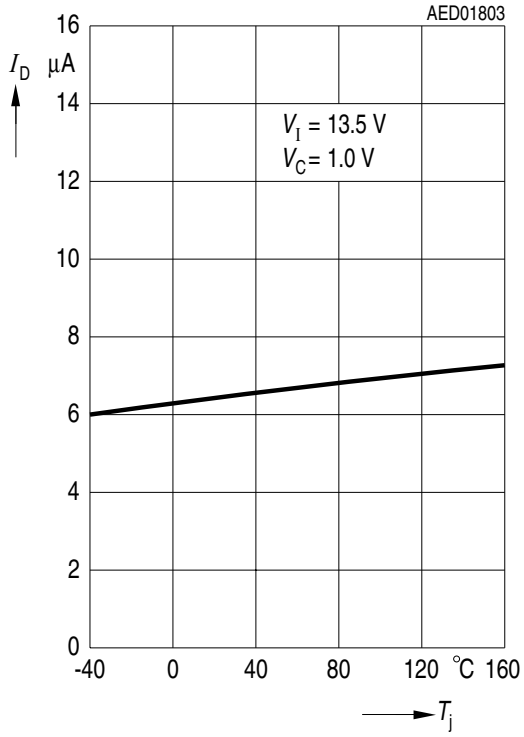
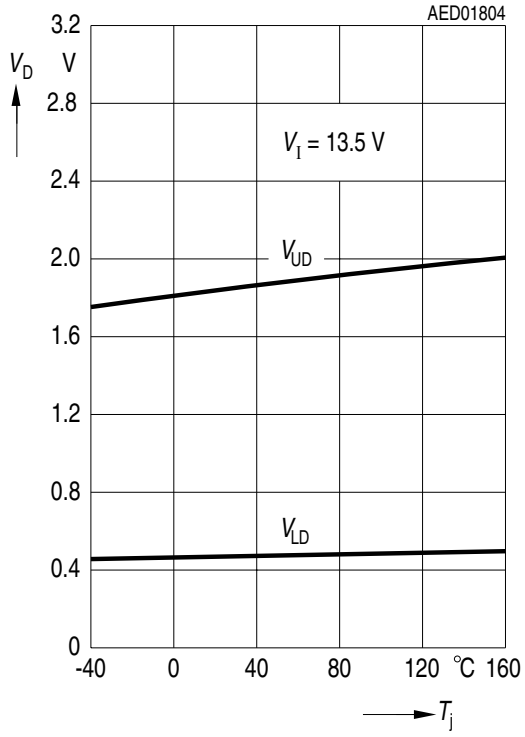


Figure 6 Sense Input Timing Diagram

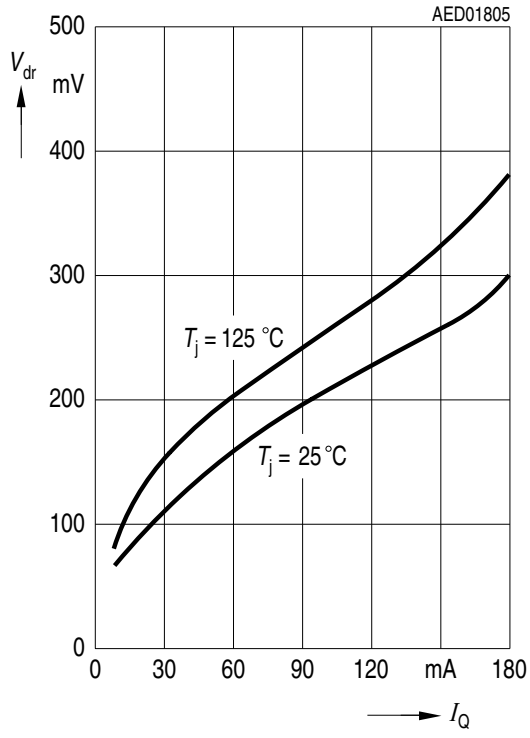
Charge Current I_D versus Temperature T_j



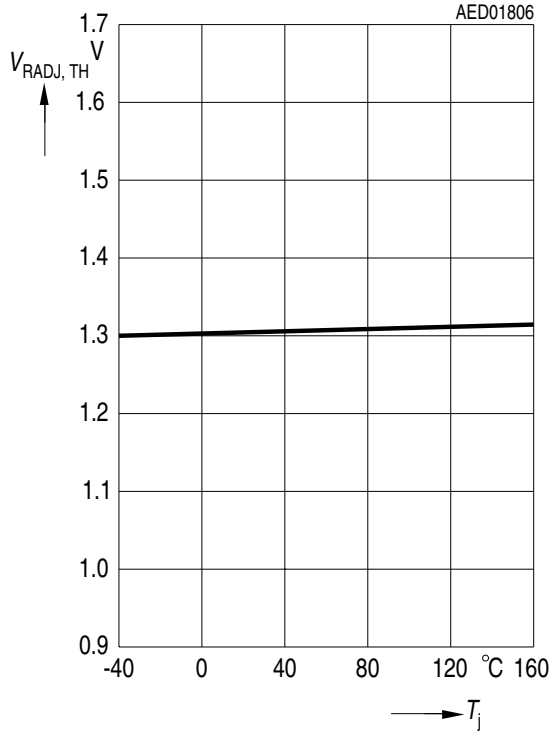
Switching Voltage V_{UD} and V_{LD} versus Temperature T_j



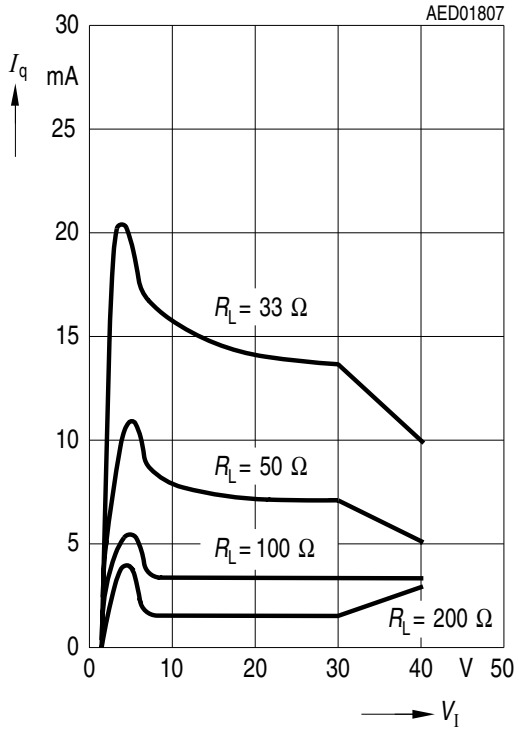
Drop Voltage V_{dr} versus Output Current I_Q



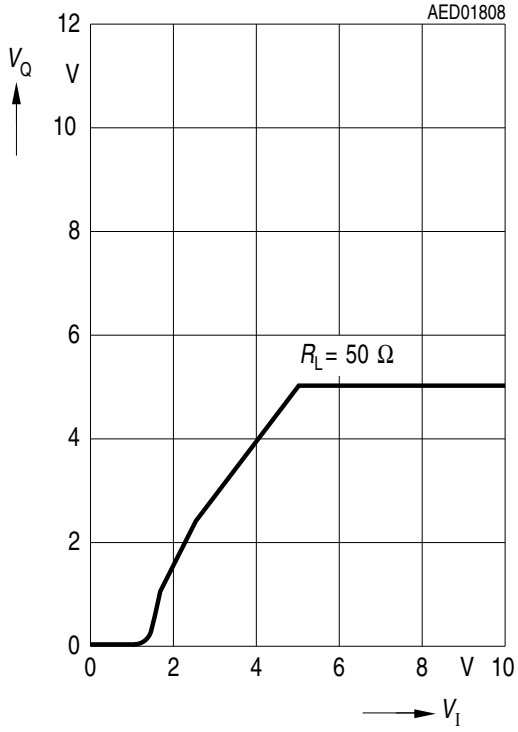
Reset Adjust Switching Threshold $V_{RADJ,TH}$ versus Temperature T_j



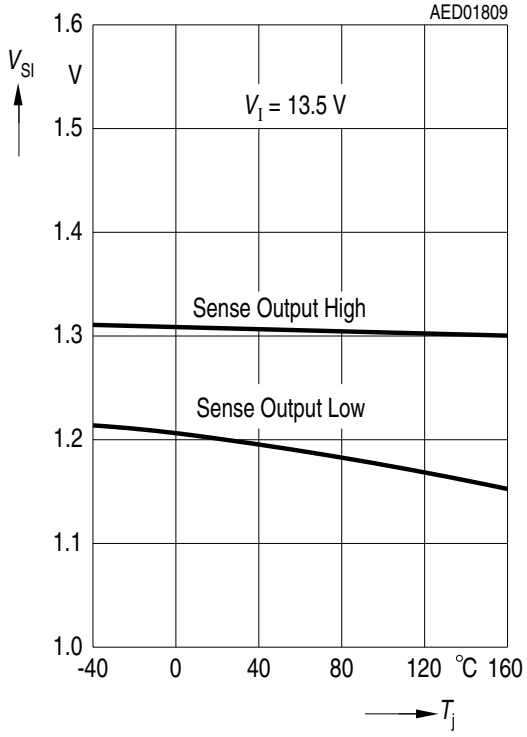
Current Consumption I_Q versus Input Voltage V_I



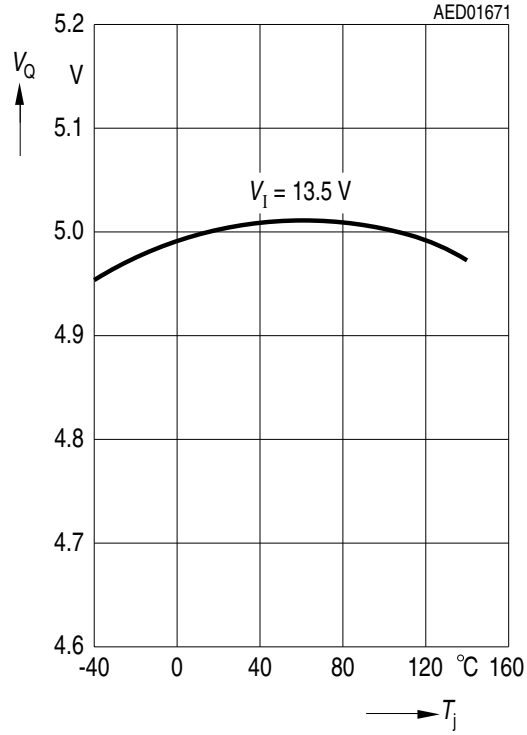
Output Voltage V_Q versus Input Voltage V_I



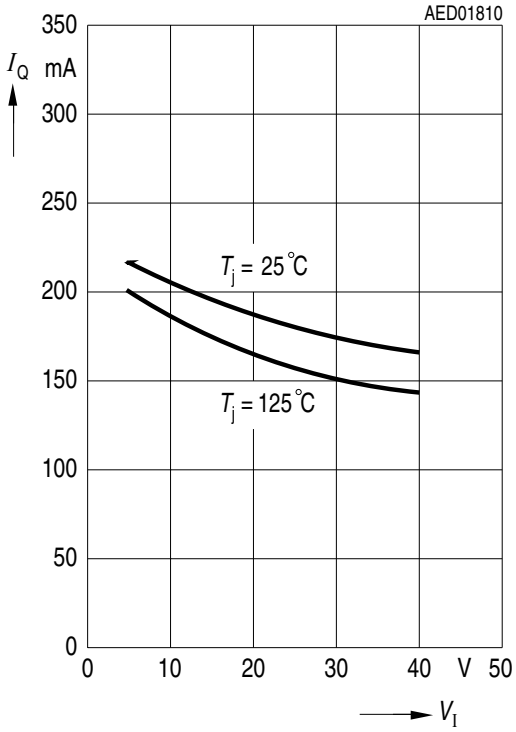
Sense Threshold V_{SI} versus Temperature T_j



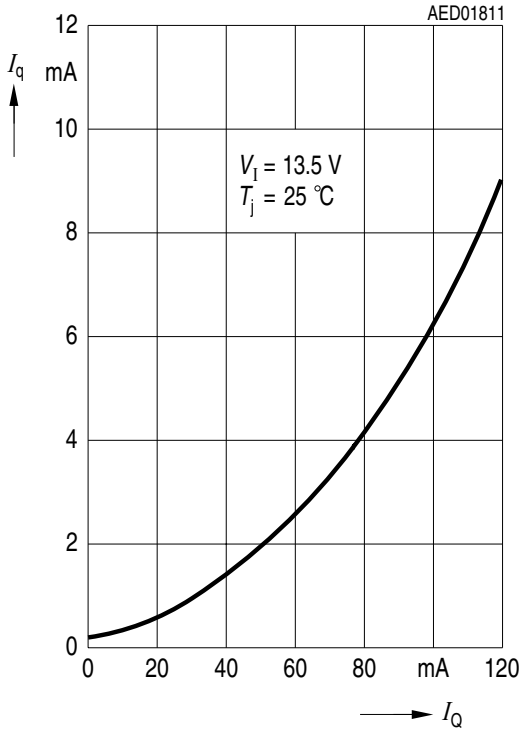
Output Voltage V_Q versus Temperature T_j



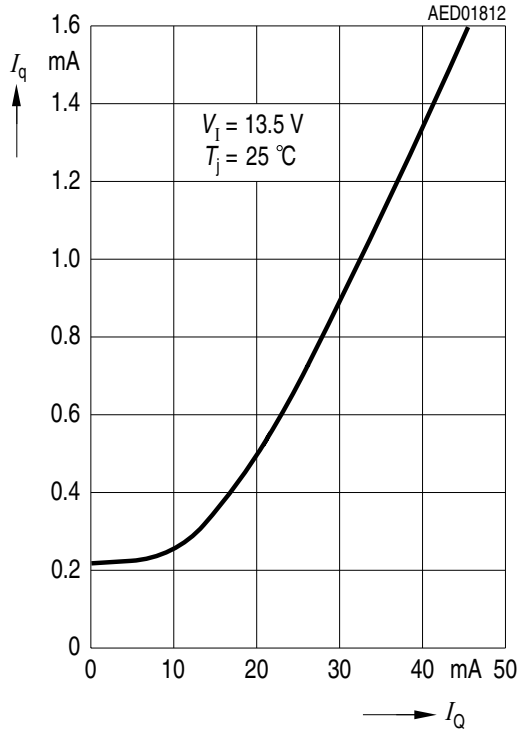
Output Current I_Q versus Input Voltage V_I



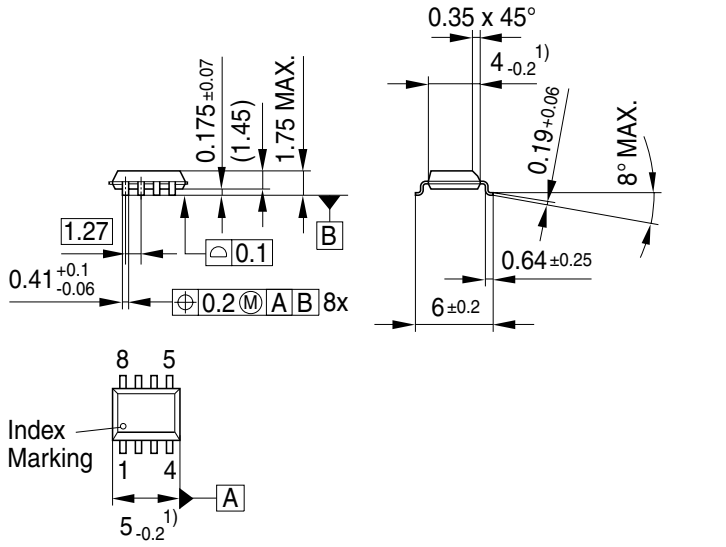
Current Consumption I_q versus Output Current I_Q



Current Consumption I_q versus Output Current I_Q



Package Outlines



1) Does not include plastic or metal protrusion of 0.15 max. per side

2) Lead width can be 0.61 max. in dambar area

GPS01229

Figure 7 **PG-DSO-8-16** (Plastic Dual Small 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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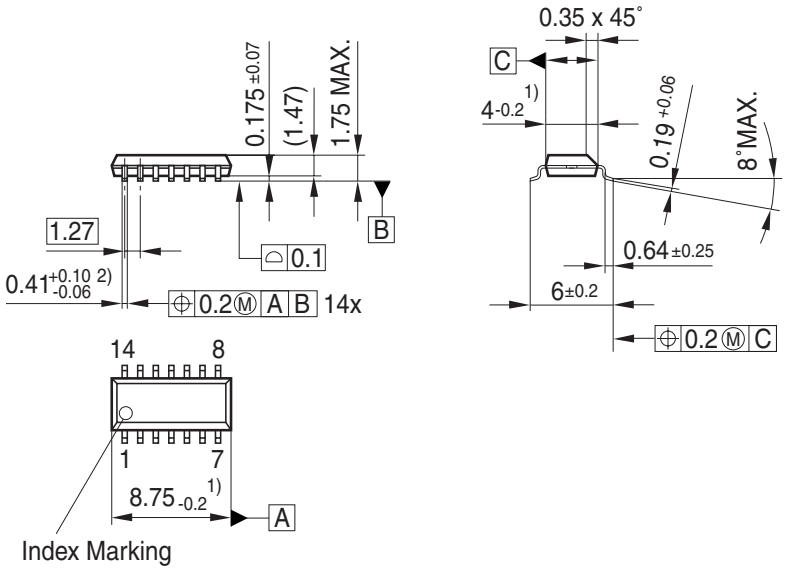
SMD = Surface Mounted Device

Dimensions in mm



1) Does not include plastic or metal protrusion of 0.15 max. per side

2) Lead width can be 0.61 max. in dambar area

GPS01230

Figure 8 **PG-DSO-14-30** (Plastic Dual Small 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

Revision History

Version	Date	Changes
Rev. 2.4	2007-03-20	Initial version of RoHS-compliant derivate of TLE 4279 **Page 1**: AEC certified statement added **Page 1** and **Page 15**f: RoHS compliance statement and Green product feature added **Page 1** and **Page 15**f: Packages changed to RoHS compliant version Legal Disclaimer updated

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