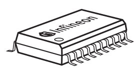
5-V Low Drop Fixed Voltage Regulator TLE 4268

Features

- Output voltage tolerance ≤ ±2%
- Very low current consumption
- Low-drop voltage
- Watchdog
- Settable reset threshold
- Overtemperature protection
- Reverse polarity protection
- Short-circuit proof
- Suitable for use in automotive electronics
- Wide temperature range
- Green Product (RoHS compliant)
- AEC Qualified



Functional Description

This device is a 5-V low-drop fixed-voltage regulator. The maximum input voltage is 45 V. It can deliver an output current of at least 180 mA. The IC is short-circuit proof and features temperature protection that disables the circuit in the event of impermissibly high temperatures. The watchdog function is disabled as a function of the load, so that a controller is not interrupted during sleep mode by a watchdog reset.

Application Description

The IC regulates an input voltage V_I in the range 5.5 V < V_I < 45 V to $V_{Q,nom}$ = 5.0 V. In the event of an output voltage V_Q < V_{RT}, a reset signal is generated. The wiring of the reset switching threshold input enables the value of V_{RT} to be reduced. The reset delay time can be adjusted using an external capacitor. The integrated watchdog monitors the connected active controller. If there is no rising edge at the watchdog input, the reset

Type	Package
TLE 4268 GS	PG-DSO-8
TLE 4268 G	PG-DSO-20

output is set to low. The reset delay capacitor provides a wide adjustment range for the pulse repetition time. The watchdog function is only activated if the load exceeds 8 mA. This ensures that a microcontroller is not activated during power-down and the current drain is not increased. The IC is protected against overload and overtemperature.

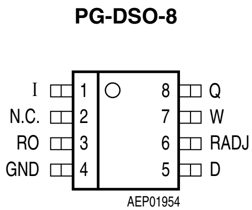


Figure 1 Pin Configuration (top view)

Table 1 Pin Definitions and Functions

Pin	Symbol	Function
1	I	Input voltage
2	N.C.	Not connected
3	RO	Reset output
4	GND	Ground
5	D	Reset delay
6	RADJ	Reset switching threshold
7	W	Watchdog input
8	Q	5 V output voltage

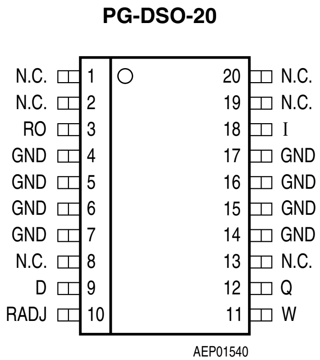


Figure 2 **Pin Configuration** (top view)

Table 2 **Pin Definitions and Functions**

Pin	Symbol	Function
1, 2, 8, 13, 19, 20	N.C.	Not connected.
3	RO	**Reset output;** the open collector output is connected to the 5-V output via an integrated resistor of 30 kΩ.
4 … 7, 14 … 17	GND	**Ground**
9	D	**Reset delay;** connect a capacitor to ground for delay time adjustment.
10	RADJ	**Reset switching threshold;** for setting the switching threshold, output to ground with voltage divider. If this input is connected to ground, the reset is triggered at an output voltage of 4.5 V.
11	W	**Watchdog input;** positive-edge-triggered input for monitoring a microcontroller.
12	Q	**5-V output voltage;** block to ground with 22 µF capacitor, ESR < 3 Ω.
18	I	**Input voltage;** block to ground directly on the IC with ceramic capacitor.

Circuit Description

The control amplifier compares a reference voltage, which is kept highly accurate by resistance adjustment, to a voltage that is proportional to the output voltage and drives the base of the series transistor via a buffer. Saturation control as a function of the load current prevents any over-saturation of the power element. If the externally scaled down output voltage at the reset threshold input drops below 1.35 V, the external reset delay capacitor is discharged by the reset generator. If the voltage on the capacitor reaches the lower threshold V_{DRL}, a reset signal is generated on the reset output and not cancelled again until the upper threshold voltage is exceeded. If the reset threshold input is connected to GND, reset is triggered at an output voltage of 4.5 V. A connected microcontroller is monitored by the watchdog logic. If pulses are missing, the rest output is set to low. The pulse sequence time can be set within a wide range with the reset delay capacitor. The IC also incorporates internal circuits for protection against:

- Overload
- Overtemperature
- Reverse polarity

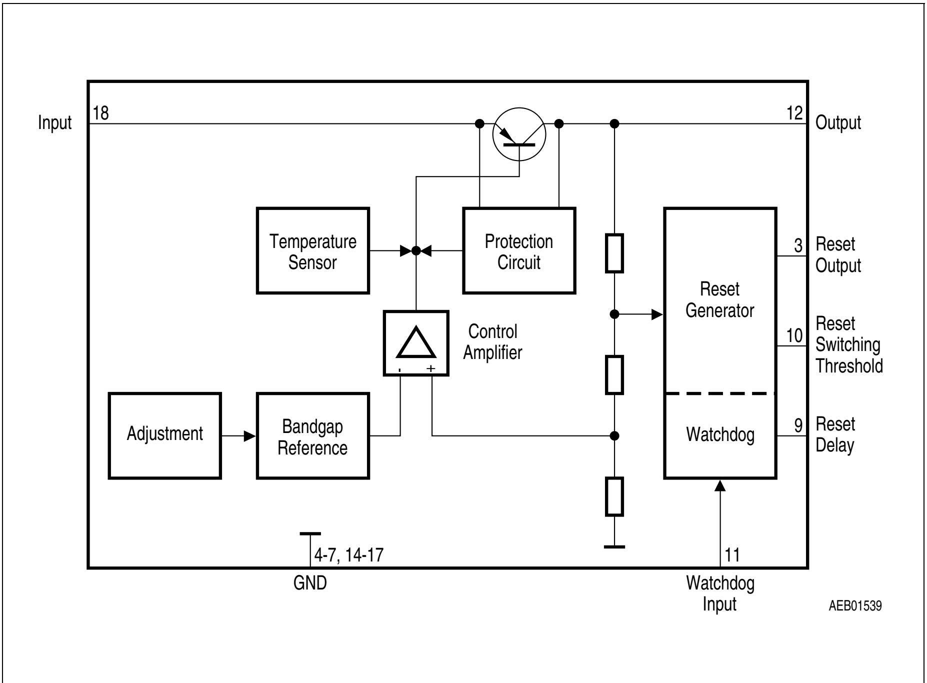


Figure 3 Block Diagram TLE 4268 G (PG-DSO-20)

Table 3 Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Notes
		Min.	Max.		
Input I					
Input voltage Input current	V_I I_I	-30 –	45 –	V –	– Internally limited
Reset Output RO					
Voltage Current	V_R I_R	-0.3 –	7 –	V –	– Internally limited
Reset Delay D					
Voltage Current	V_D I_D	-0.3 –	7 –	V –	– Internally limited
Watchdog W					
Watchdog input	V_W	-0.3	7	V	–
Reset Switching Threshold RADJ					
Reset threshold	V_{RADJ}	-0.3	7	V	–
Output Q					
Output voltage Output current	V_Q I_Q	-0.3 –	7 –	V –	– Internally limited
Ground GND					
Current	I_{GND}	-100	50	mA	–
Temperatures					
Junction temperature Storage temperature	T_j T_S	-40 -50	150 150	°C °C	– –

Table 4 Operating Range

Parameter	Symbol	Limit Values		Unit	Notes
		Min.	Max.		
Input voltage	V_I	–	45	V	–
Junction temperature	T_j	-40	150	°C	–
Thermal Resistance					
Junction ambient (soldered)	R_{thj-a} R_{thj-a}	– –	185 100	K/W K/W	PG-DSO-8[1)] PG-DSO-20[1)]
Junction pin	$R_{thj-pin}$ $R_{thj-pin}$	– –	72 23	K/W K/W	PG-DSO-8[2)] PG-DSO-20[3)]

1) Package mounted on PCB 80 × 80 × 1.5 mm³; 35µ Cu; 5µ Sn; Footprint only; zero airflow.
2) Measured to pin 2.
3) Measured to pin 5.

Optimum reliability and life time are guaranteed if the junction temperature does not exceed 125 °C in operating mode. Operation at up to the maximum junction temperature of 150 °C is possible in principle. Note, however, operation at the maximum permitted ratings could affect the reliability of the device.

Table 5 Characteristics

V_I = 13.5 V; -40 °C ≤ T_j ≤ 125 °C (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
Output voltage	V_Q	4.90	5.00	5.10	V	5 mA ≤ I_Q ≤ 150 mA; 6 V ≤ V_I ≤ 28 V
Output current limiting	I_Q	180	250	–	mA	–
Current consumption $I_q = I_I - I_Q$	I_q	–	300	450	µA	I_Q = 0 mA
Current consumption $I_q = I_I - I_Q$	I_q	–	13	20	mA	I_Q = 150 mA
Drop voltage	V_{DR}	–	0.25	0.50	V	I_Q = 150 mA[1)]
Load regulation	$\Delta V_{Q,Lo}$	–	10	30	mV	I_Q = 5 to 150 mA
Line regulation	$\Delta V_{Q,Li}$	–	10	30	mV	V_I = 6 to 28 V I_Q = 150 mA
Reset Generator						
Reset threshold	$V_{Q,rt}$	4.2	4.5	4.8	V	–
Reset adjust threshold	V_{RADJ}	1.28	1.35	1.45	V	–
Reset low voltage	$V_{RO,l}$	–	0.2	0.5	V	1 mA external
Saturation voltage	V_D	–	30	100	mV	$V_Q < V_{RT}$
Charging current	$I_{D,c}$	5	12	18	µA	V_D = 1.0 V
Upper reset timing threshold	V_{DU}	1.4	1.8	2.2	V	–
Reset delay time	t_{rd}	10	15	25	ms	C_D = 100 nF
Reset reaction time	t_{rr}	–	2	–	µs	C_D = 100 nF
Pull-up	R_{RO}	18	30	46	kΩ	with resp. to V_Q
Lower reset timing threshold	V_{DRL}	0.2	0.4	0.55	V	–

Table 5 Characteristics (cont'd)

V_I = 13.5 V; -40 °C ≤ T_j ≤ 125 °C (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		Min.	Typ.	Max.		
Watchdog						
Discharge current	$I_{D,d}$	1.5	3.5	5.2	μA	V_D = 1.0 V
Charging current	$I_{D,c}$	5	12	18	μA	V_D = 1.0 V
Upper timing threshold	V_{DU}	1.4	1.8	2.2	V	–
Lower timing threshold	V_{DWL}	0.2	0.4	0.55	V	–
Watchdog period	T_{WP}	30	55	75	ms	C_D = 100 nF
Watchdog trigger time	T_{WT}	25	40	60	ms	C_D = 100 nF
Activating current	I_Q	2	8	15	mA	Activates watchdog
Slew rate	dV_W/dt	5	–	–	V/μs	from 20% up to 80% V_Q [2)]

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)

2) Watchdog pulse recognition tested with 10 kHz max. pulse frequency

Note: The reset output is low in range from V_Q = 1 V to $V_{Q,rt}$.

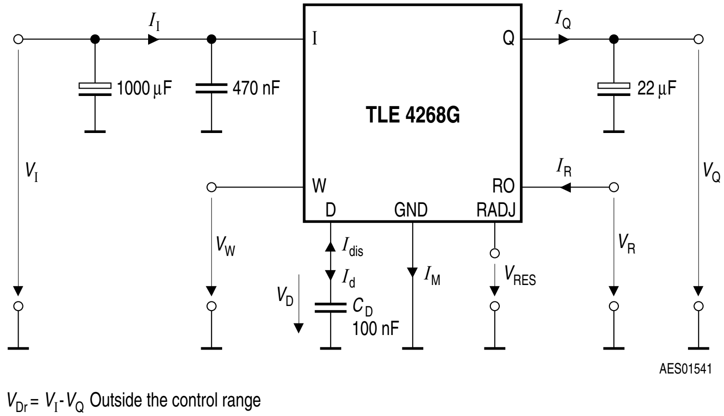


Figure 4 Test Circuit

Reset Timing

The power-on reset delay time is defined by the charging time of an external capacitor C_D which can be calculated as follows:

$$C_D = (\Delta t_{rd} \times I_{D,c})/\Delta V \quad (1)$$

Definitions:

- C_D = delay capacitor
- Δt_{rd} = delay time
- $I_{D,c}$ = charge current, typical 12 μA
- $\Delta V = V_{DU}$, typical 1.8 V
- V_{DU} = upper delay switching threshold at C_D for reset delay time

The reset reaction time t_{rr} is the time it takes the voltage regulator to set the reset out LOW after the output voltage has dropped below the reset threshold. It is typically 1 μs for delay capacitor of 47 nF. For other values for C_D the reaction time can be estimated using the following equation:

$$t_{rr} \approx 20 \text{ s/F} \times C_D \quad (2)$$

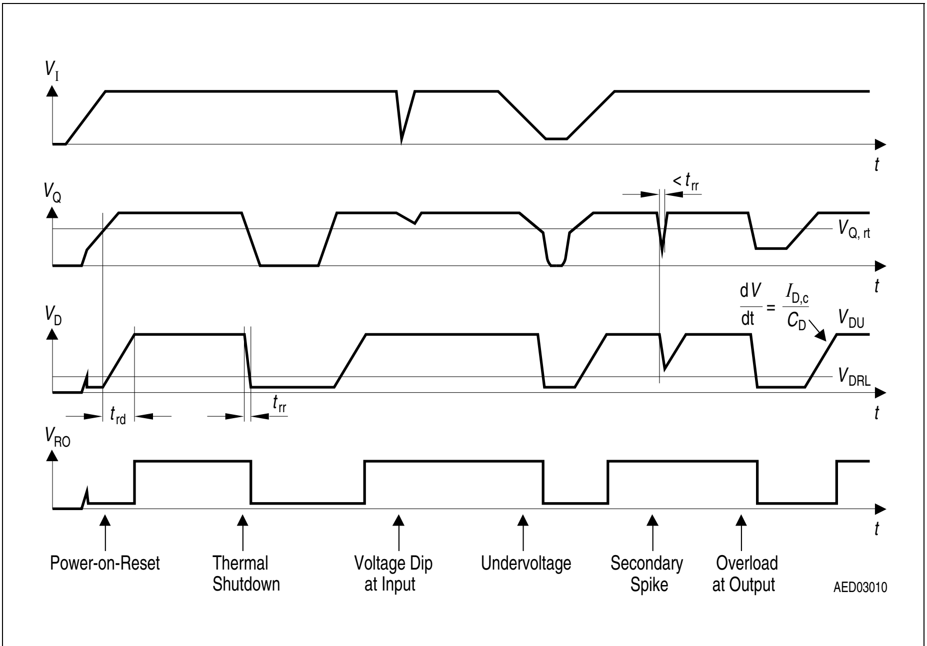
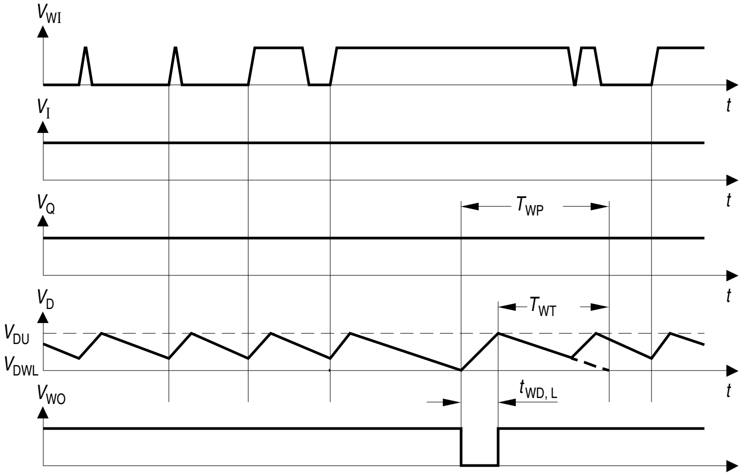


Figure 5 Timing (Watchdog disabled)



$$T_{WT} = \frac{(V_{DU} - V_{DWL})}{I_{D,d}} C_D; \quad T_{WP} = \frac{(V_{DU} - V_{DWL})(I_{D,c} + I_{D,d})}{I_{D,c} \times I_{D,d}} C_D; \quad t_{WD,L} = \frac{(V_{DU} - V_{DWL})}{I_{D,c}} C_D$$

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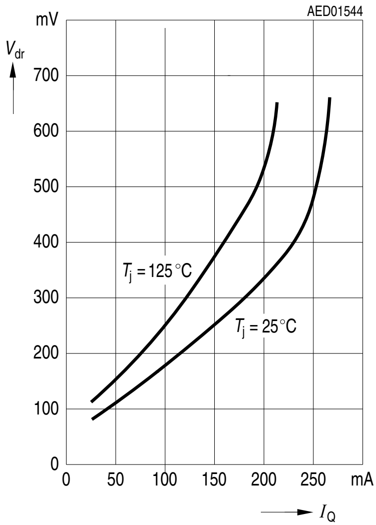
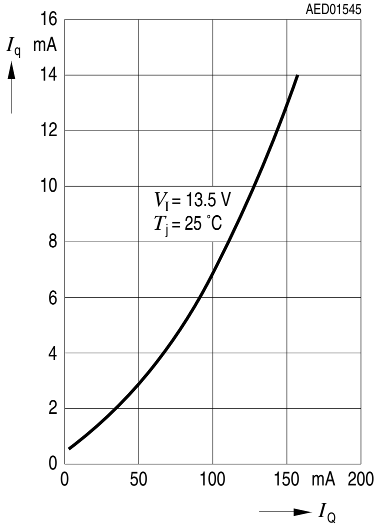
Figure 6 Timing of the Watchdog Function

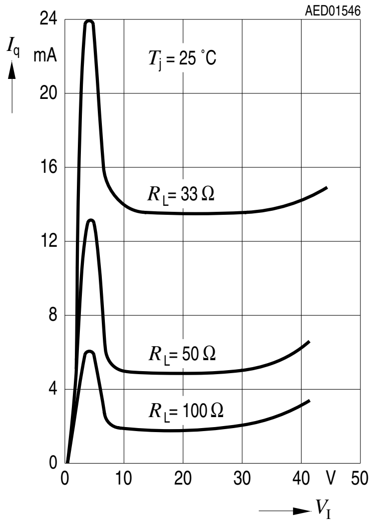
Drop Voltage V_{DR} versus Output Current I_Q



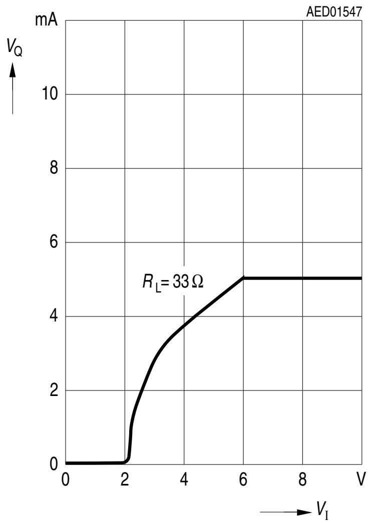
Current Consumption I_q versus Output Current I_Q



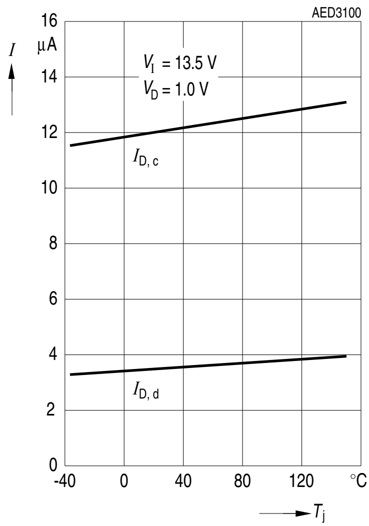
Current Consumption I_q versus Input Voltage V_I



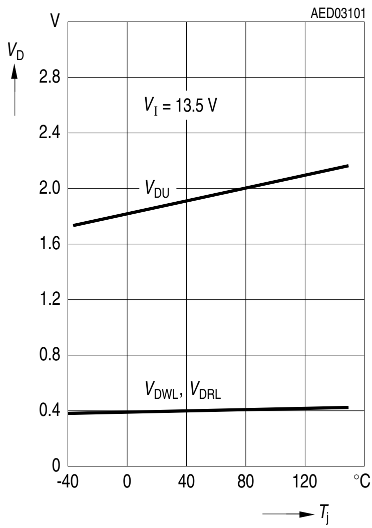
Output Voltage versus Input Voltage V_I



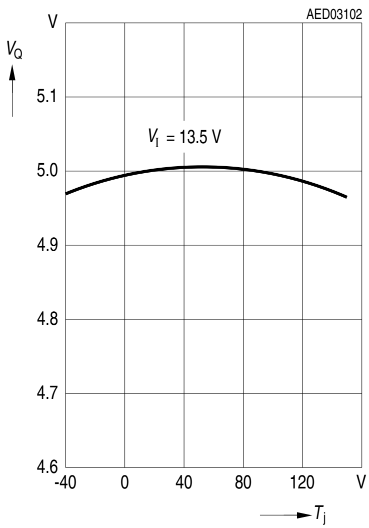
Charge Current $I_{D,c}$ and Discharge Current $I_{D,d}$ versus Temperature T_j



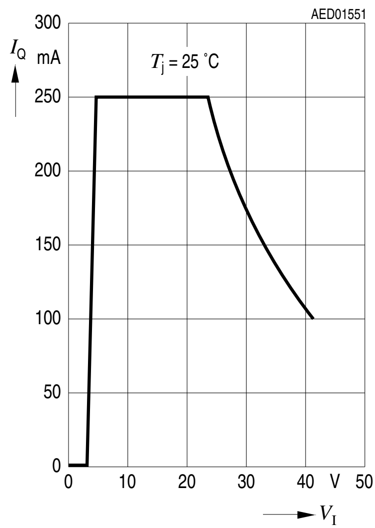
Timing Threshold V_{DU}, V_{DWL}, V_{DRL} versus Temperature T_j



Output Voltage V_Q versus Temperature T_j



Output Current I_Q versus Input Voltage V_I



Package Outlines

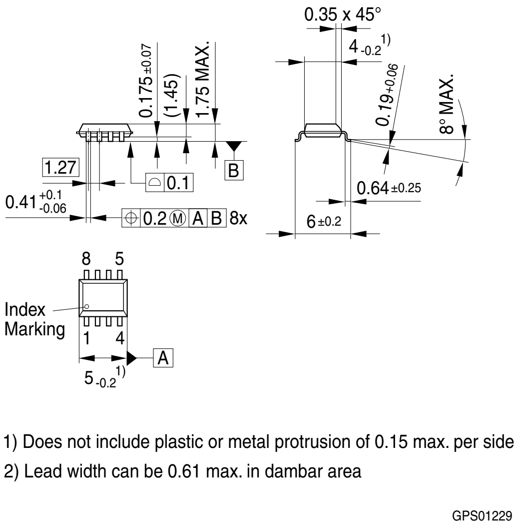


Figure 7 **PG-DSO-8** (Plastic Dual Small Outline)

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

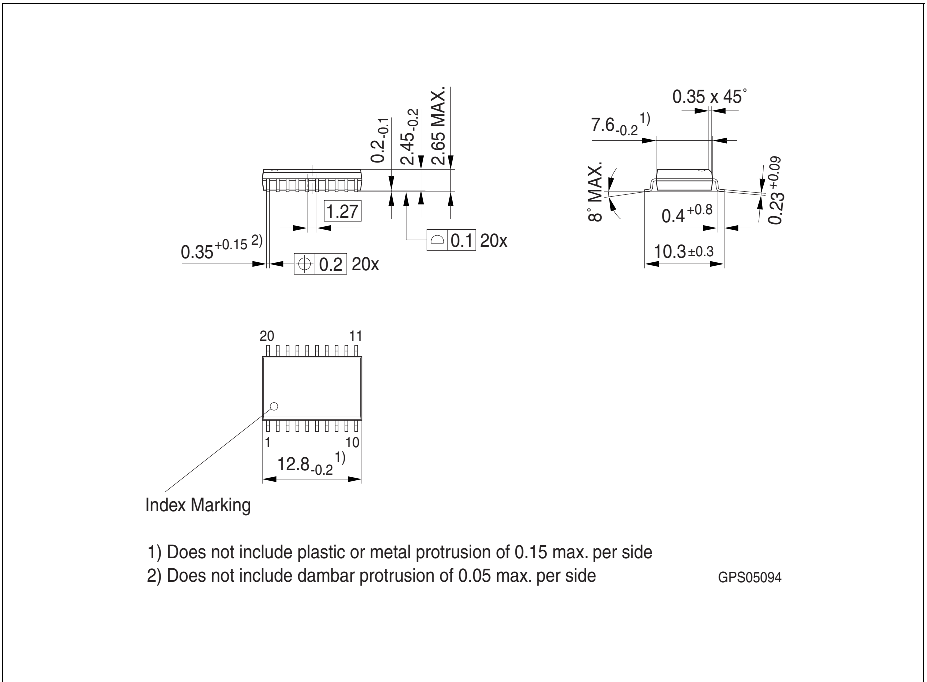

Figure 8 **PG-DSO-20** (Plastic Dual Small Outline)

Green Product (RoHS compliant)

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SMD = Surface Mounted Device

Dimensions in mm

Version	Date	Changes
Rev. 1.6	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
Rev. 1.5	2007-03-20	Initial version of RoHS-compliant derivate of TLE 4268 **Page 1**: AEC certified statement added **Page 1** and **Page 14** ff: RoHS compliance statement and Green product feature added **Page 1** and **Page 14** ff: Package changed to RoHS compliant version Legal Disclaimer updated

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