TLE4208G

Quad Half-Bridge Driver IC

Data Sheet

Rev. 1.3, 2014-02-10

Automotive Power

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TLE4208G

1-A Quad Half-Bridge Driver IC

1 Overview


PG-DSO-28

Features

- Driver for up to 3 motors
- Delivers up to 0.8 A continuous
- Optimized for DC motor management applications
- Very low current consumption in stand-by (Inhibit) mode
- Low saturation voltage; typ.1.2 V total @ 25 °C; 0.4 A
- Output protected against short circuit
- Error flag diagnosis
- Overvoltage lockout and diagnosis
- Undervoltage lockout
- CMOS/TTL compatible inputs with hysteresis
- No crossover current
- Internal clamp diodes
- Overtemperature protection with hysteresis and diagnosis
- Enhanced power DSO-Package
- Green Product (RoHS compliant)
- AEC Qualified

Description

The TLE4208G is a protected Quad-Half-Bridge-Driver designed specially for automotive and industrial motion control applications. The part is built using Infineons bipolar high voltage power technology DOPL.

In a cascade configuration up to three actuators (DC motors) can be connected between the four half-bridges. These four half-bridges are configured as 2 dual-half-bridges, which are supplied and controlled separately. Operation modes forward (cw), reverse (ccw), brake and high impedance are invoked from a standard interface.

The standard enhanced power PG-DSO-28 package meets the application requirements and saves PCB-board space and costs. Moreover the package is RoHS compliant.

Furthermore the built-in features like diagnosis, over- and undervoltage-lockout, short-circuit protection, over-temperature protection and the very low quiescent current in stand-by mode will open a wide range of automotive and industrial applications.

Type	Package	Marking
TLE4208G	PG-DSO-28	TLE4208G

2 Block Diagram

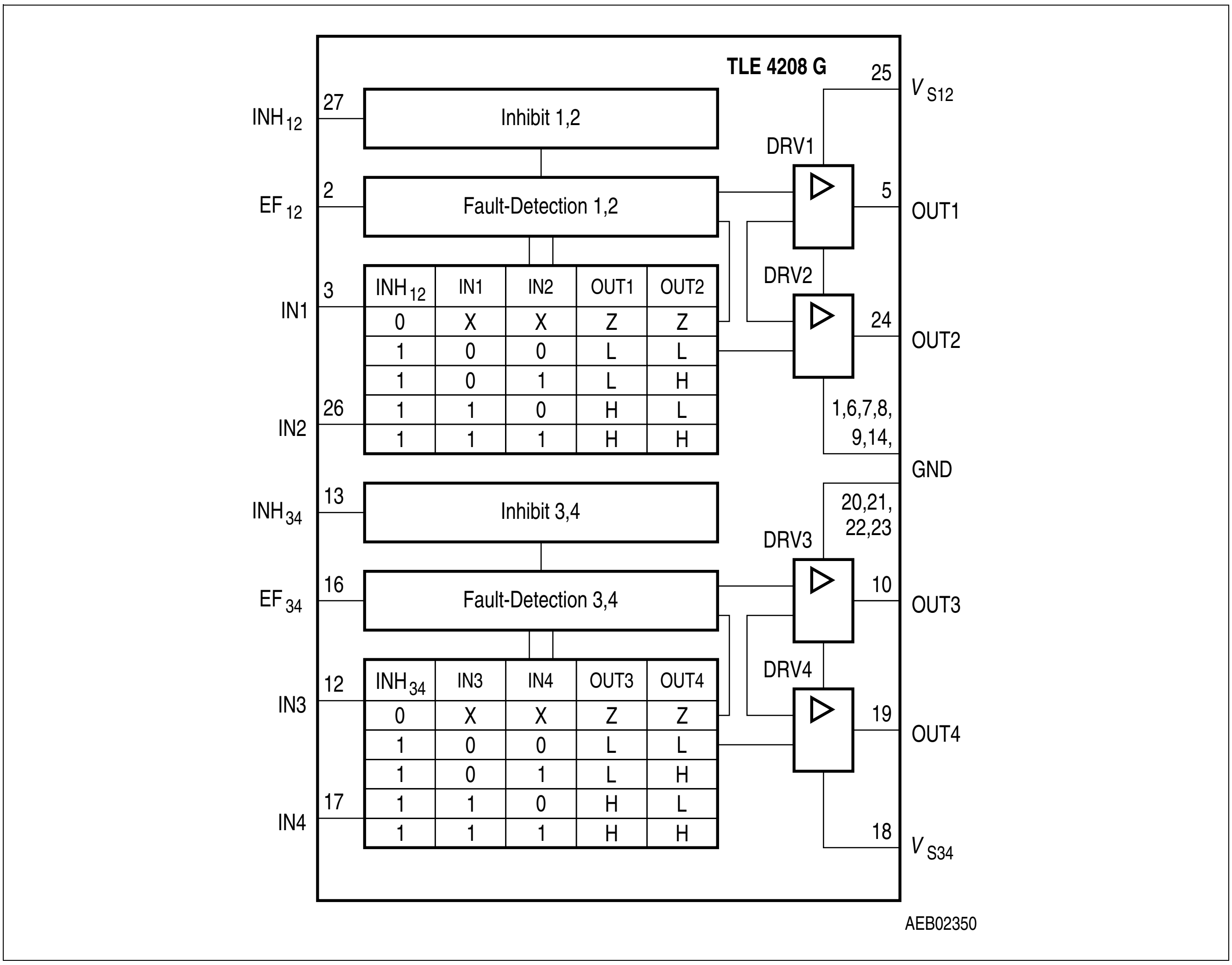


Figure 1 Block Diagram

Input Logic

Table 1 Functional Truth Table of Halfbridge 1 and 2

INH_{12}	**IN1**	**IN2**	**OUT1**	**OUT2**	**MODE**
0	**X**	**X**	**Z**	**Z**	**Stand-by**
1	0	0	L	L	Brake LL
1	0	1	L	H	CW
1	1	0	H	L	CCW
1	1	1	H	H	Brake HH

Note: Half-Bridge 1 and 2 connected to a full-bridge

Table 2 Functinal Truth Table of Halfbridge 3 and 4

INH_{34}	IN3	IN4	OUT3	OUT4	MODE
0	**X**	**X**	**Z**	**Z**	**Stand-by**
1	0	0	L	L	Brake LL
1	0	1	L	H	CW
1	1	0	H	L	CCW
1	1	1	H	H	Brake HH

IN:

0 = Logic LOW

1 = Logic HIGH

X = Don't Care

OUT:

Z = Output in tristate condition

L = Output in sink condition

X = Output in source condition

Note: Half-Bridge 3 and 4 connected to a full-bridge

Table 3 Diagnosis

EF_{12}	EF_{34}	Error
1	1	no error
0	1	over temperature of half-bridge 1 and 2 OR
0	1	over voltage of half-bridge 1 and 2
1	0	over temperature of half-bridge 3 and 4 OR
1	0	over voltage of half-bridge 3 and 4
0	0	over temperature of all half-bridges OR
0	0	over voltage of all half-bridge

3 Pin Configuration

3.1 Pin Assignment

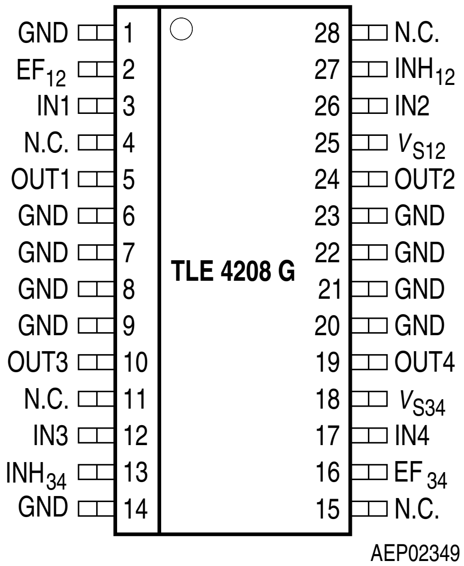


Figure 2 Pin Configuration

3.2 Pin Definitions and Functions

Pin	Symbol	Function
1, 6, 7, 8, 9, 14, 20, 21, 22, 23	GND	**Ground;** negative reference potential for blocking capacitor
2	EF_{12}	**Error Flag output of half-bridges 1 and 2**; open collector; low = error
3	IN1	**Input channel of half-bridge 1**; controls OUT 1
4, 11, 15, 28	N.C.	**Not Connected**
5	OUT 1	**Power output of half-bridge 1;** short circuit protected; with integrated clamp diodes
10	OUT 3	**Power output of half-bridge 3;** short circuit protected; with integrated clamp diodes
12	IN3	**Input channel of half-bridge 3**; controls OUT 3
13	INH_{34}	**Inhibit input of half-bridges 3 and 4**; low = half-bridges 3 and 4 in stand-by

Pin	Symbol	Function
16	EF_{34}	**Error Flag output of half-bridges 3 and 4**; open collector; low = error
17	IN4	**Input channel of half-bridge 4**; controls OUT 4
18	V_{S34}	**Power supply voltage of half-bridges 3 and 4**; positive reference potential for blocking capacitor
19	OUT 4	**Power output of half-bridge 4**; short circuit protected; with integrated clamp diodes
24	OUT 2	**Power-output of half-bridge 2**; short circuit protected; with integrated clamp diodes
25	V_{S12}	**Power supply voltage of half-bridges 1 and 2**; positive reference potential for blocking capacitor
26	IN4	**Input channel of half-bridge 4**; controls OUT 2
27	INH_{12}	**Inhibit input of half-bridges 1 and 2**; low = half-bridges 1 and 2in stand-by

4 General Product Characteristics

4.1 Absolute Maximum Ratings

Table 4 Absolute Maximum Ratings

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Voltages						
Supply Voltage	V_{S12}, V_{S34}	-0.3	–	45	V	–
Supply Voltage	V_{S12}, V_{S34}	-1	–	–	V	t < 0.5s; I_{S12}, I_{S34} > -2A
Logic input voltages (IN1; IN2; INH_{12}; IN3; IN4; INH_{34})	V_I	-5	–	20	V	0V $<$ V_{S12}, V_{S34} $<$ 45V
Logic output voltage (EF_{12}; EF_{34})	V_{EF12}, V_{EF34}	–0.3	–	20	V	0V $<$ V_{S12}, V_{S34} $<$ 45V
Currents						
Output Current (cont.)	I_{OUT1-4}	–	–	–	A	internally limited
Output Current (peak)	I_{OUT1-4}	–	–	–	A	internally limited
Output Current (diode)	I_{OUT1-4}	-1	–	1	A	–
Output Current (EF)	$I_{EF12-34}$	-2	–	5	mA	–
Temperatures						
Junction Temperature	T_j	-40	–	150	°C	–
Storage Temperature	T_{stg}	-50	–	150	°C	–
Thermal Resistances						
Junction pin	$R_{thj-pin}$	–	–	25	K/W	measured to pin 7
Junction ambient	R_{thjA}	–	–	65	kV	–

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.*

4.2 Functional Range

Table 5 Functional Range

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{S12}, V_{S34}	V_{UV_OFF}	–	18	V	After V_{S12}, V_{S34} rising above V_{UV_ON}
Extended Supply Voltage Range for Operation	V_{S12}, V_{S34}	-0.3	–	V_{UV_ON}	V	Outputs in tristate
Supply Voltage transients slew rate	V_{S12}, V_{S34}	-0.3	–	V_{UV_OFF}	V/µs	Outputs in tristate
Logic input voltages (IN1; IN2; INH12; IN3; IN4; INH34)	V_{I}	-2	–	18	V	–
Junction Temperature	T_{j}	-40	–	150	°C	–

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.

4.3 General Electrical Characteristics

4.3.1 Electrical Characteristics

Table 6 Electrical Characteristics

V_{S1} = V_{S2} = 8 V to 18 V, INH_{12} = INH_{34} = HIGH; I_{OUT1-4} = 0A; T_j = -40°C to +150°, all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Current Consumption INH_{12} = INH_{34} = LOW						
Quiescent current	I_S	–	–	100	µA	$I_S = I_{S12} + I_{S34}$
Quiescent current	I_S	–	20	40	µA	$I_S = I_{S12} + I_{S34}$; $V_{S12} = V_{S34}$ = 13.2V; T_j = 25 °C
INH_{12} = HIGH and INH_{34} = LOW or INH_{12} = LOW and INH_{34} = HIGH						
Supply current	I_{S12}, I_{S34}	–	10	20	mA	–
Supply current	I_{S12}, I_{S34}	–	–	30	mA	$I_{OUT1/3}$ = 0.4A $I_{OUT2/4}$ = -0.4A
Supply current	I_{S12}, I_{S34}	–	–	50	mA	$I_{OUT1/3}$ = 0.8A $I_{OUT2/4}$ = -0.8A
Over- and Under Voltage Lockout						
UV Switch ON voltage	$V_{UV\ ON}$	–	6.5	7.5	V	V_{S12},V_{S34} increasing
UV Switch OFF voltage	V_{UV_OFF}	5	6	–	V	V_{S12},V_{S34} decreasing
UV ON/ OFF hysteresis	V_{UV_HY}	–	0.5	–	V	$V_{UV\ ON}$ - $V_{UV\ OFF}$
OV Switch ON voltage	$V_{OV\ ON}$	–	20	24	V	V_{S12},V_{S34} increasing
OV Switch OFF voltage	V_{OV_OFF}	18	19.5	–	V	V_{S12},V_{S34} decreasing
OV ON/ OFF hysteresis	V_{OV_HY}	–	0.5	–	V	$V_{OV\ OFF}$ - $V_{OV\ ON}$
Outputs OUT1; OUT2; OUT3; OUT4 Saturation Voltages						
Source (upper) I_{OUT12}, I_{OUT34} = – 0.2 A	V_{SAT_U}	–	0.85	1.15	V	T_j= 25°C
Source (upper) I_{OUT12}, I_{OUT34} = – 0.4 A	V_{SAT_U}	–	0.90	1.20	V	T_j= 25°C
Sink (upper) I_{OUT12}, I_{OUT34} = – 0.8 A	V_{SAT_U}	–	1.10	1.50	V	T_j= 25°C
Sink (lower) I_{OUT12}, I_{OUT34} = 0.2 A	V_{SAT_L}	–	0.15	0.23	V	T_j= 25°C
Sink (lower) I_{OUT12}, I_{OUT34} = 0.4 A	V_{SAT_L}	–	0.25	0.40	V	T_j= 25°C
Sink (lower) I_{OUT12}, I_{OUT34} = 0.8 A	V_{SAT_L}	–	0.45	0.75	V	T_j= 25°C
Total Drop I_{OUT12}, I_{OUT34} = 0.2 A	V_{SAT}	–	1	1.4	V	$V_{SAT} = V_{SAT\_U} + V_{SAT\_L}$

Table 6 Electrical Characteristics

V_{S1} = V_{S2} = 8 V to 18 V, INH_{12} = INH_{34} = HIGH; I_{OUT1-4} = 0A; T_j = -40°C to +150°, all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Total Drop I_{OUT12}, I_{OUT34} = 0.4 A	V_{SAT}	–	1.2	1.7	V	$V_{SAT} = V_{SAT\_U}+V_{SAT\_L}$
Total Drop I_{OUT12}, I_{OUT34} = 0.8 A	V_{SAT}	–	1.6	2.5	V	$V_{SAT} = V_{SAT\_U}+V_{SAT\_L}$
Clamp Diodes						
Forward voltage; upper	V_{FU}	–	1	1.5	V	I_F = 0.4A
Upper leakage current	I_{LKU}	–	–	5	mA	I_F = 0.4A[1)]
Forward voltage; lower	V_{FL}	–	0.9	1.4	V	I_F = 0.4A
Input Interface **Logic Inputs IN1; IN2; IN3; IN4**						
H-input voltage	V_{IH}	–	2.0	3.0	V	–
L-input voltage	V_{IL}	1.0	1.5	–	V	–
Hysteresis of input voltage	V_{IHY}	–	0.5	–	V	–
H-input current	I_{IH}	-2	–	10	µA	V_I = 5V
L-input current	I_{IL}	-100	-20	-5	µA	V_I = 0V
Logic Inputs INH_{12}; INH_{34}						
H-input voltage	V_{IH}	–	2.7	3.5	V	–
L-input voltage	V_{IL}	1.0	2.0	–	V	–
Hysteresis of input voltage	V_{IHY}	–	0.7	–	V	–
H-input current	I_{IH}	–	100	250	µA	V_{INH} = 5V
L-input current	I_{IL}	-10	–	10	µA	V_{INH} = 0V
Error Flags EF_{12}; EF_{34}						
L-output voltage level	V_{EFL}	–	0.2	0.4	V	I_{EF} = 2 mA
Leakage current	I_{EFLK}	–	–	10	µA	0V < V_{EF} < 7V
Thermal Shutdown						
Thermal shutdown junction temperature	T_{jSD}	150	175	200	°C	–
Thermal switch-on junction temperature	T_{jSO}	120	–	170	°C	–
Temperature hysteresis	ΔT	–	30	–	K	–

1) Not subject to production test, specified by design

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.

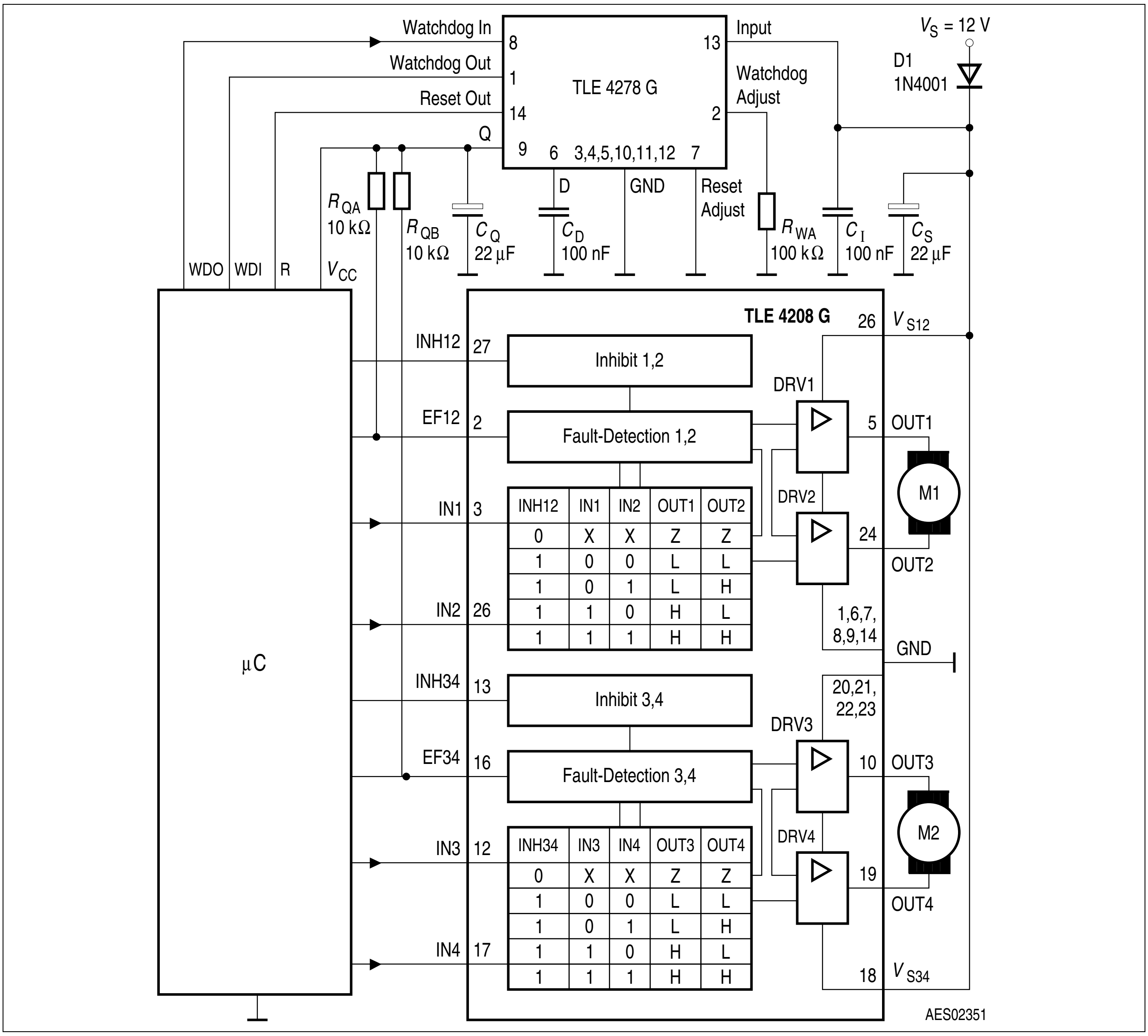
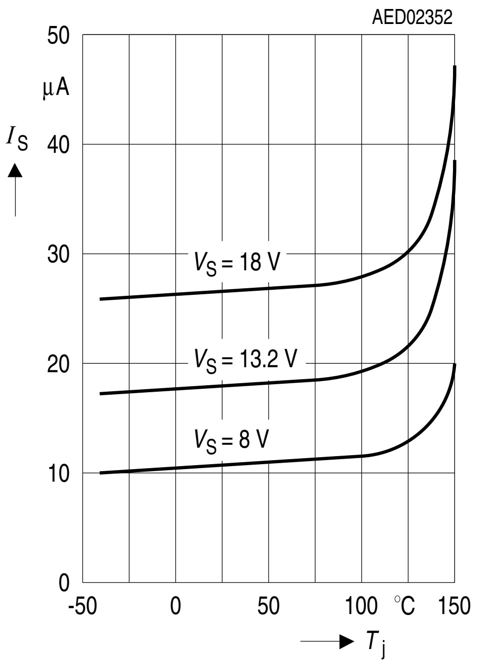


Figure 3 Application Circuit 1 (Device is used as Dual-Full-Bridge-Driver)

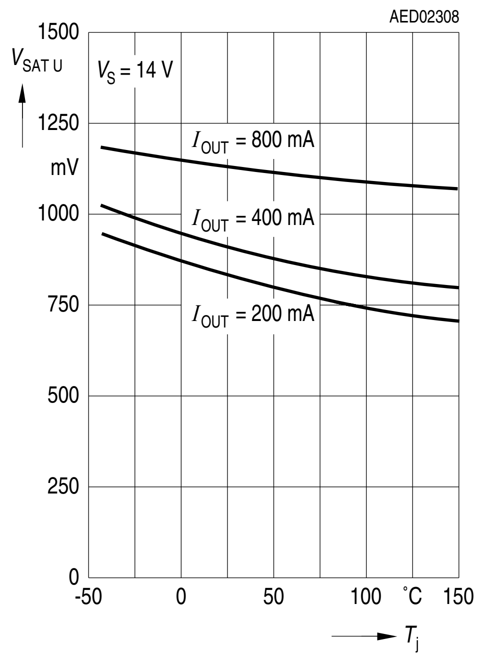
Note: This is a very simplified example of an application circuit. The function must be verified in the real application.

Diagrams

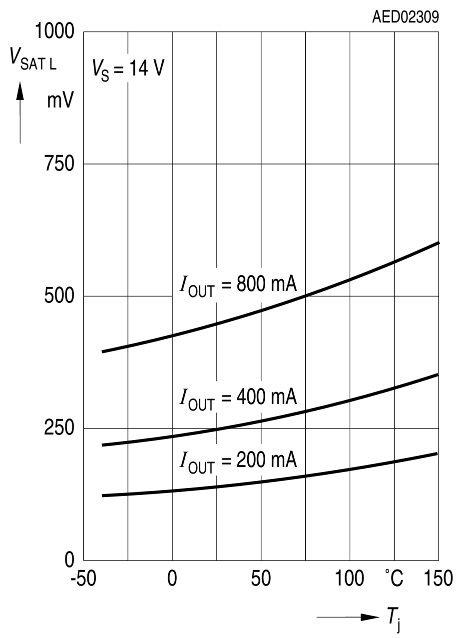
Quiescent current I_S over Temperature



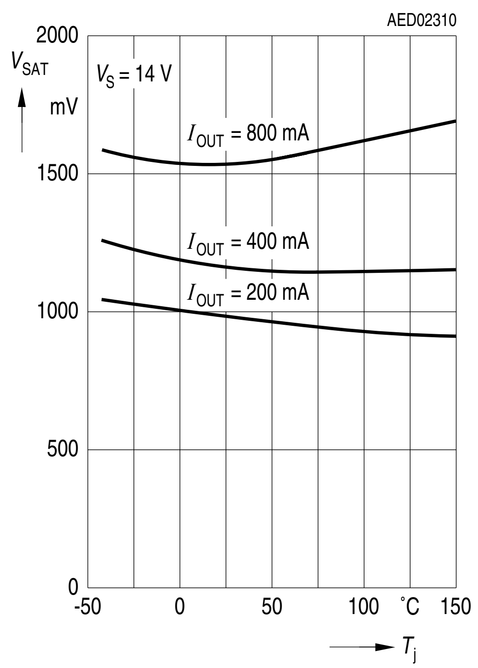
Saturation Voltage of Source $V_{SAT\,U}$ over Temperature



Saturation Voltage of Sink $V_{SAT\,L}$ over Temperature



Total Drop at outputs V_{SAT} over Temperature



6 Package Outlines

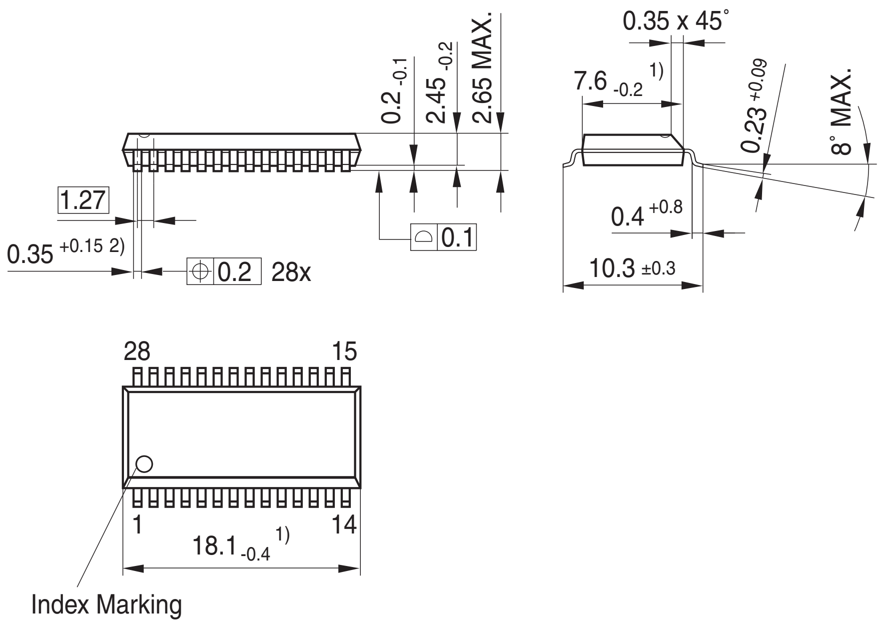


Figure 4 **PG-DSO-28** (Please Insert Package Long Name!)

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).

For further information on alternative packages, please visit our website:
http://www.infineon.com/packages.

Dimensions in mm

7 Revision History

Revision	Date	Changes
Rev. 1.3	2014-02-10	Updated package designation and to latest data sheet formatting
Rev. 1.2	2011-04-11	Updated package designation to reflect various production sites.
Rev. 1.1	2008-02-04	Initial version of RoHS-compliant derivate of TLE4208G Page 1: added AEC certified statement Page 1 and 13: added RoHS compliance statement and Green product feature Page 1 and 3: Editorial change: deleted "fully" (The term "fully protected" often leads to misunderstandings as it is unclear with respect to which parameters). Page 1 and 14: Package changed to RoHS compliant version Page 15: added Revision History, updated Legal Disclaimer

Edition 2014-02-10

Published by
Infineon Technologies AG
81726 Munich, Germany

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