TLE4205G

1-A DC Motor Driver

Datasheet

Rev. 1.1, 2015-01-15

Automotive Power

1-A DC Motor Driver
Overview

Features

- Max. driver current 1 A
- Integrated free-wheeling diodes
- Short-circuit proof to ground
- Inhibit
- ESD protected inputs
- Temperature range – 40 °C ≤ T_j ≤ 150 °C
- Green Product (RoHS compliant)
- AEC Qualified

PG-DSO-20

Type	Marking	Package
TLE4205G	TLE4205G	PG-DSO-20

Description

TLE 4205G is an integrated power full-bridge DC-motor driver for a wide temperature range, as required in automotive applications for example. The circuit contains two power comparators that can be combined to a full-bridge circuit. For inductive loads there are integrated free-wheeling diodes to + V_S and ground. The outputs are short-circuit proof up to 18 V supply voltage to ground and turn off when overtemperature occurs. This IC is especially suitable for headlight-beam adjustment in automobiles.

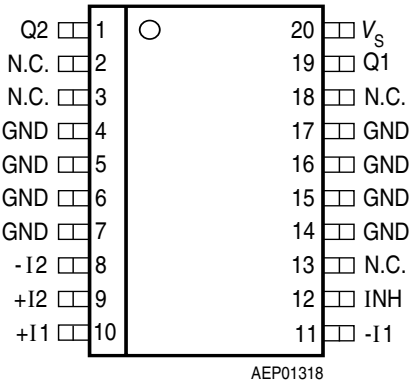


Figure 1 Pin Configuration (top view)

Pin Definitions and Functions

Pin No.	Symbol	Function
1	Q2	**Output 2 of channel 2;** push-pull B output with DC short-circuit protection to ground. Integrated free-wheeling diodes to ground and the supply voltage.
2	N.C.	Not connected
3	N.C.	Not connected
4-7	GND	Ground
8	– I2	**Inverting input channel 2;** to be wired according to general rules.
9	+ I2	**Non-inverting input channel 2;** to be wired according to general rules.
10	+ I1	**Non-inverting input channel 1;** see pin 9.
11	– I1	**Inverting input channel 1;** see pin 8.
12	INH	**Inhibit;** the IC is passive when this pin is open or connected to ground.
13	N.C.	Not connected
14-17	GND	Ground
18	N.C.	Not connected
19	Q1	Output Q1 of channel 1, see pin 1.
20	V_S	**Supply voltage V_S;** must be blocked with a ceramic capacitor of at least 100 nF directly on the pins of the IC.

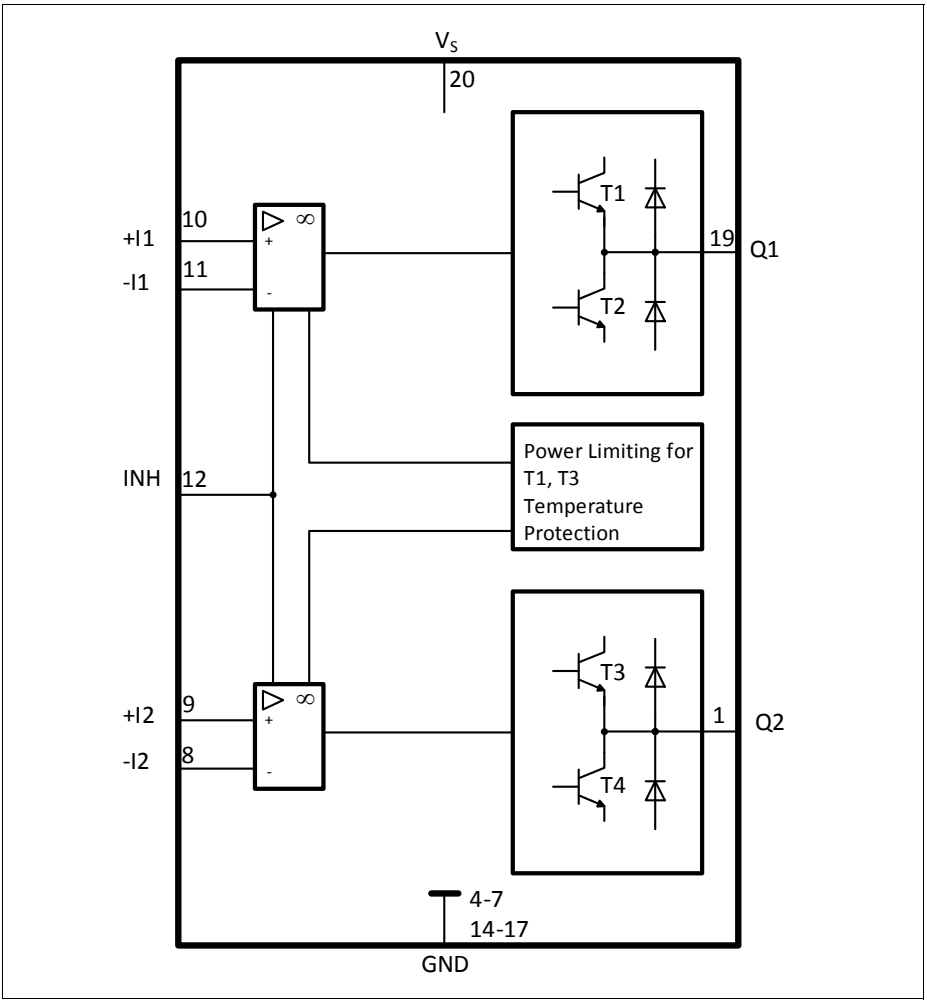


Figure 2 Block Diagram

Circuit Description

The IC contains two amplifiers with typical open-loop gain of 80 dB at 500 Hz.

The input stages consist of PNP-differential amplifiers. This produces a common-mode input range of 0 V to nearly V_S and a maximum differential input voltage of V_S. The IC is guarded against ground shorts by an SOA-protective circuit. The output transistors are turned off if the chip temperature exceeds approx. 160 °C. The IC can be turned off by an inhibit input, which very much reduces current consumption.

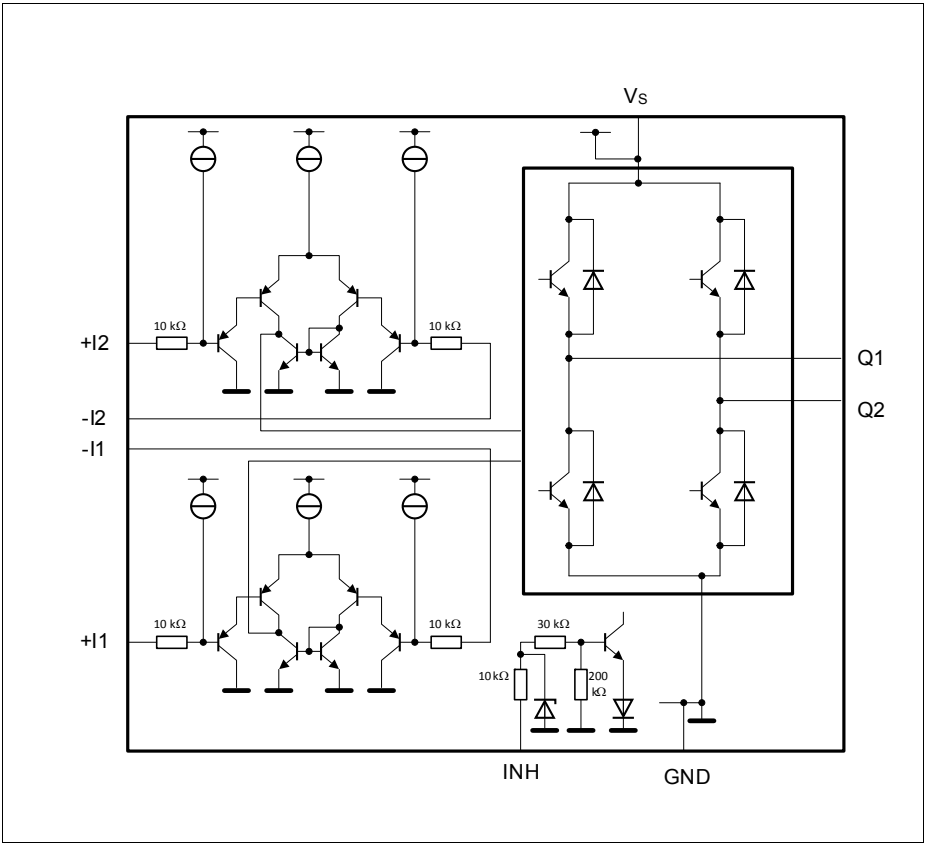


Figure 3 Circuit Diagram

Absolute Maximum Ratings

T_j = – 40 to 150 °C

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_S	– 0.3	45	V	–
Differential input voltage	V_{ID}	–	$\pm V_S$	V	$\Delta V_{8\text{-}9}$ or $\Delta V_{10\text{-}11}$
Output current	I_Q	– 1	1	A	–
Supply current	I_S	2.5	3	A	–
Ground current	I_{GND}	– 3	2.5	A	I2
Input voltage	V_I	– 15	V_S	V	V_8; V_9; V_{10}; V_{11}
Inhibit input	V_{Inh}	– 15	V_S	V	V_{12}
Junction temperature	T_j	–	150	°C	–
Storage temperature	T_{stg}	– 50	150	°C	–

Operating Range

Supply voltage	V_S	6	32	V	–
Case temperature	T_C	– 40	95	°C	P_{Dmax} = 3 W
Thermal resistance junction - ambient junction - case	 $R_{th\ JA}$ $R_{th\ JC}$	 – –	 65 20	 K/W K/W	

Outputs pin 1 and pin 19 short-circuit proof to GND at $V_S \leq 18$ V

Characteristics

6 V < V_S < 18 V; – 40 °C < T_j < 150 °C

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
General						
Open-circuit current consumption	I_S	–	10	30	mA	active, both outputs high
Open-circuit current consumption	I_S	–	10	100	µA	inhibit
Turn-ON dead time ref. to $V_{12\ OFF/ON}$	$t_{d\ ON}$	–	10	20	µs	$\lvert I_{1,19}\rvert$ < 1 A
Turn-OFF dead time ref. to $V_{12\ OFF/ON}$	$t_{d\ OFF}$	–	10	20	µs	$\lvert I_{1,19}\rvert$ < 1 A

Characteristics (cont'd)
6 V < V_S < 18 V; – 40 °C < T_j < 150 °C

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Open-loop gain	G_{VO}	50	80	–	dB	f = 500 Hz
Inputs						
Input zero voltage	V_{IO}	– 7.5	–	7.5	mV	R_S = 10 kΩ;
Input-voltage drift	$\Delta V_{IO}/\Delta T$	–	20	30	µV/K	–
Input zero current	I_{IO}	– 75	–	75	mA	–
Input current	I_I	– 300	–	300	nA	–
Input-current drift	$\Delta I_I/\Delta T$	–	–	5	nA/K	–
Input common-mode range, positive	V_{IC}	–	–	V_S – 2	V	–
Input common-mode range, negative	V_{IC}	–	–	– 0.5	V	–
Power-supply rejection ratio	$PSSR$	–	–	200	µV/V	R_S = 10 kΩ;
Common-mode rejection ratio	$CMRR$	70	80	–	dB	–

Characteristics (cont'd)
6 V < V_S < 18 V; – 40 °C < T_j < 150 °C

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Outputs						
Saturation voltage	$V_{Sat\ U}$	–	1.35	1.5	V	I_Q = – 0.6 A
Saturation voltage	$V_{Sat\ L}$	–	0.8	1.2	V	I_Q = 0.6 A
Forward voltage of free-wheeling diode	V_{FU}	–	1	1.5	V	I_F = 0.6 A
Forward voltage of free-wheeling diode	V_{FL}	–	1	1.5	V	I_F = 0.6 A
Slew rate of V_Q	$dV_q dt_r$	–	0.5	–	V/µs	–
Inhibit Input						
Switching threshold high	V_{IH}	2	–	–	V	–
Switching threshold low	V_{IL}	–	–	0.8	V	–
H-input current	I_{IH}	–	100	–	µA	V_{12} = 5 V
L-input current	I_{IH}	–	0	–	µA	V_{12} = 0 V

Note: $V_{Sat\ U}$ = upper
$V_{Sat\ L}$ = lower

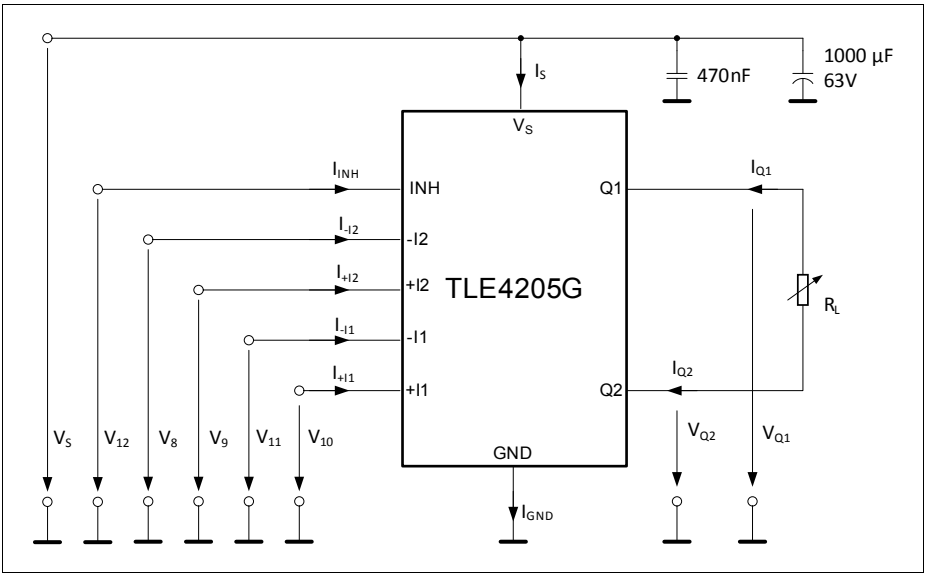


Figure 4 Test Circuit

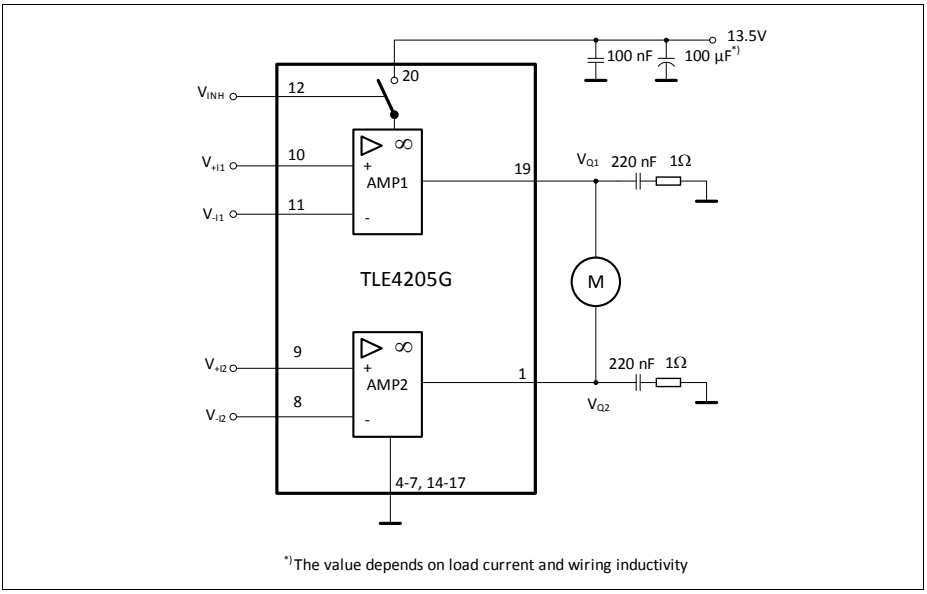
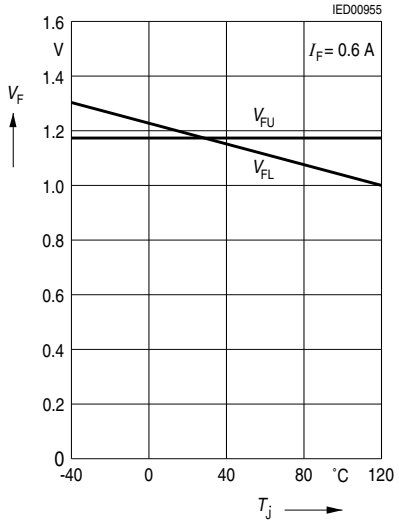
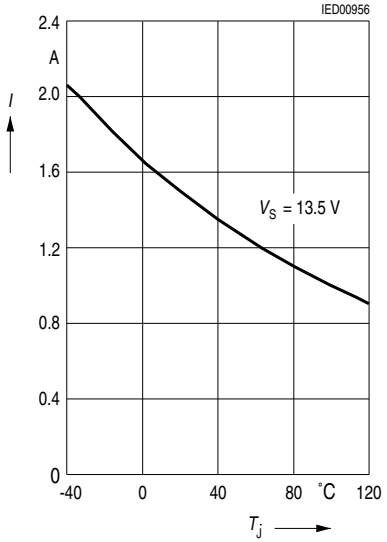


Figure 5 Application Circuit

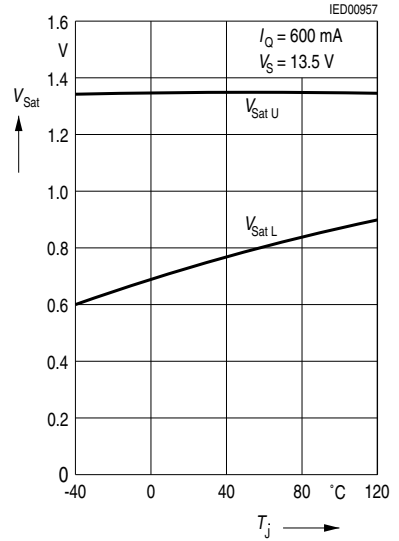
Forward Voltage of the Free-Wheeling Diodes versus Junction Temperature



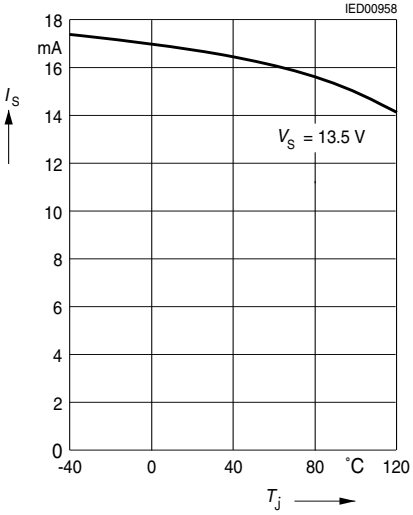
Start Point of the SOA-Protection Circuit versus Junction Temperature



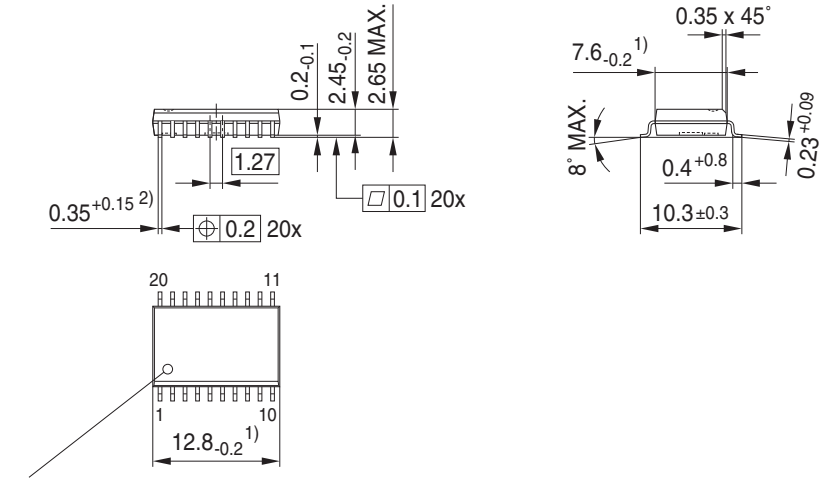
Saturation Voltage versus Junction Temperature



Current Consumption versus Junction Temperature



Package Outlines



1) Does not include plastic or metal protrusion of 0.15 max. per side
2) Does not include dambar protrusion of 0.05 max. per side

Figure 6 PG-DSO-20 (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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Dimensions in mm

Revision History

Revision	Date	Changes
1.1	2015-01-19	Initial version of RoHS-compliant derivate of TLE 4205G • Page 1: Added Coverpage, • All pages: Infineon logo updated • Page 2: “added AEC qualified” and “RoHS” logo, “Green Product (RoHS compliant)” and “AEC qualified” statement added to feature list, package name changed to RoHS compliant versions, package picture updated • Page 12: Package name changed to RoHS compliant versions, “Green Product” description added • Page 13: added Revision History • Page 14: added Legal Disclaimer • Page 7, Page 9: V9 designating the voltage at INH pin renamed V12

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