# 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.

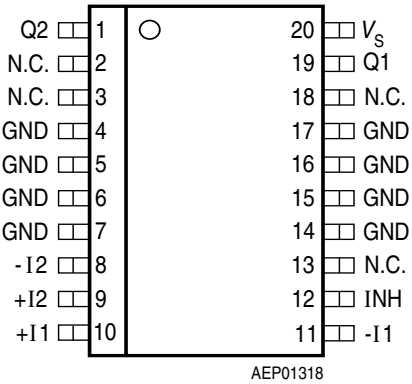



**Figure 1 Pin Configuration** (top view)

**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. |

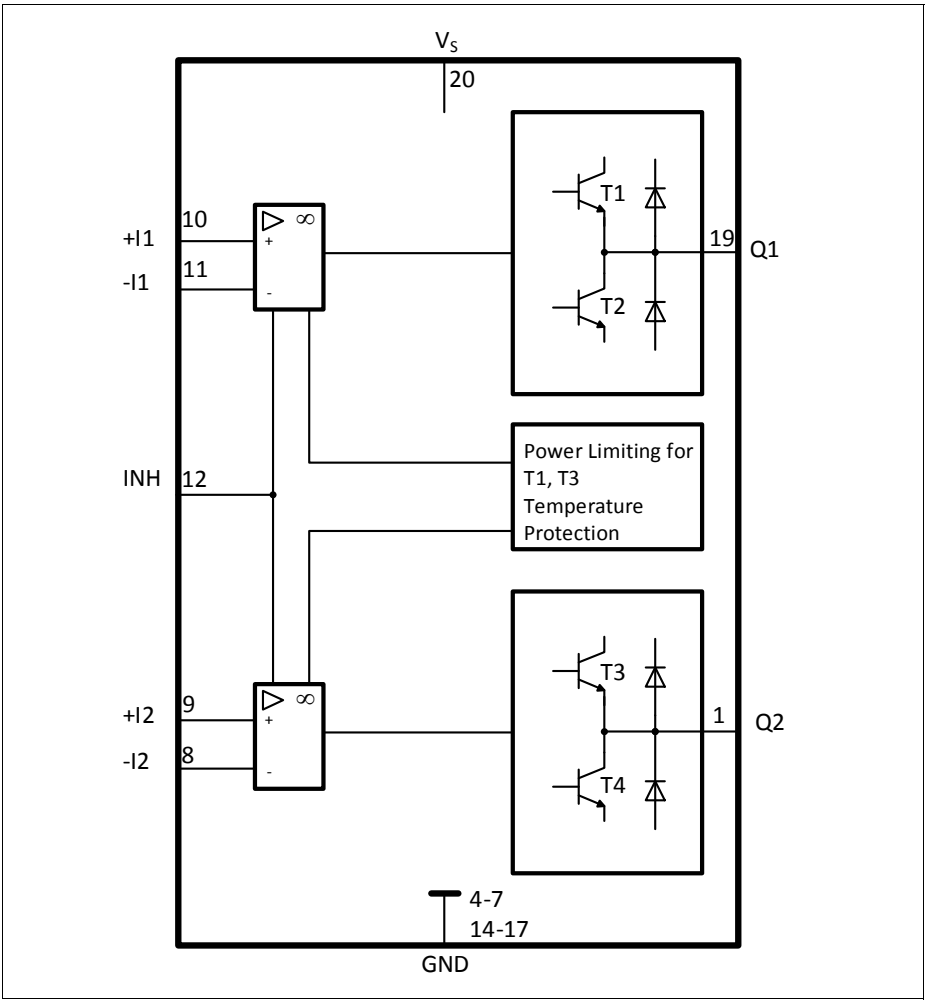



**Figure 2 Block Diagram**

## 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.

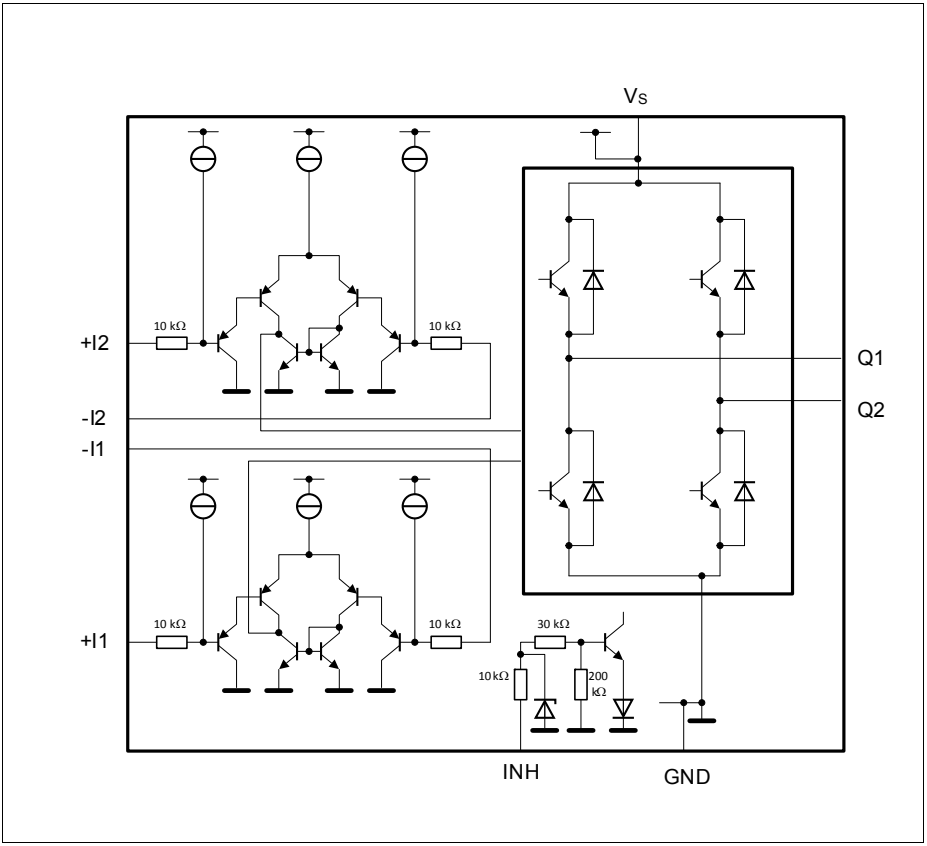



**Figure 3 Circuit Diagram**

## 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<br>junction - ambient<br>junction - case | <br>$R_{th\ JA}$<br>$R_{th\ JC}$ | <br>–<br>– | <br>65<br>20 | <br>K/W<br>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

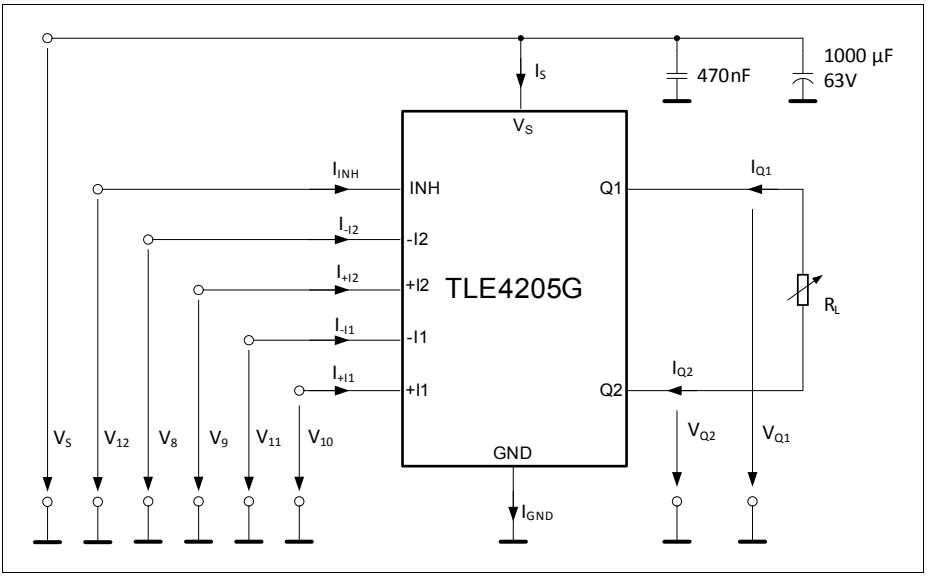



**Figure 4 Test Circuit**

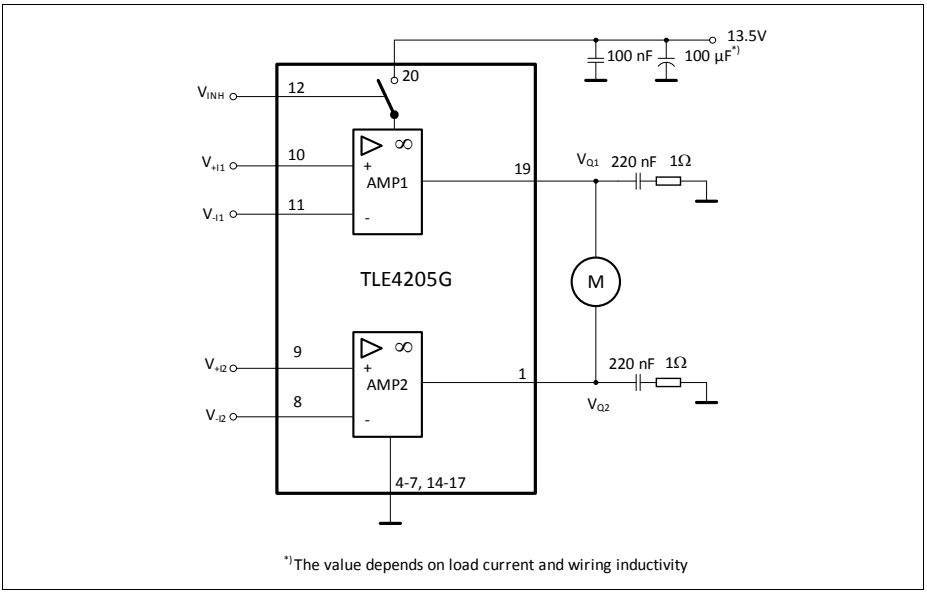
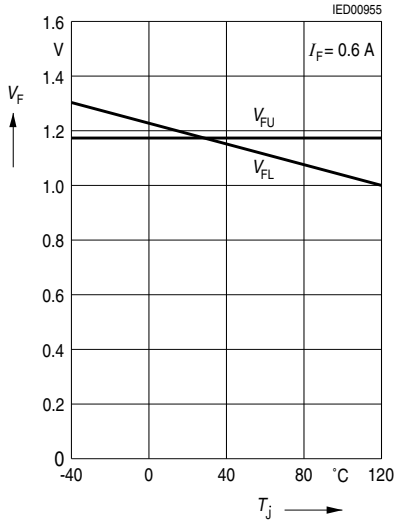
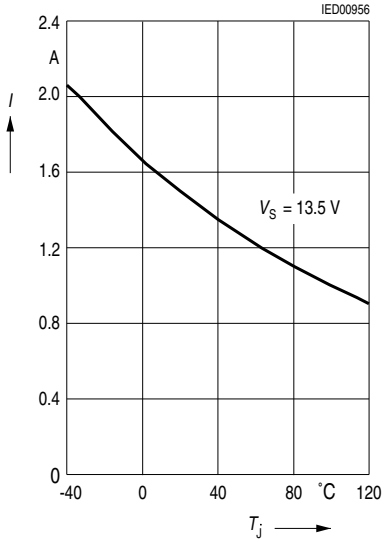



**Figure 5 Application Circuit**

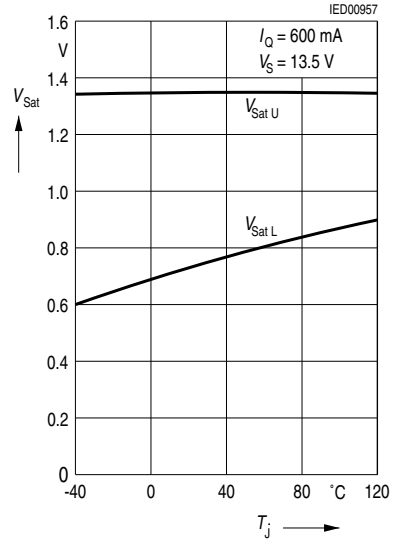
### Forward Voltage of the Free-Wheeling Diodes versus Junction Temperature



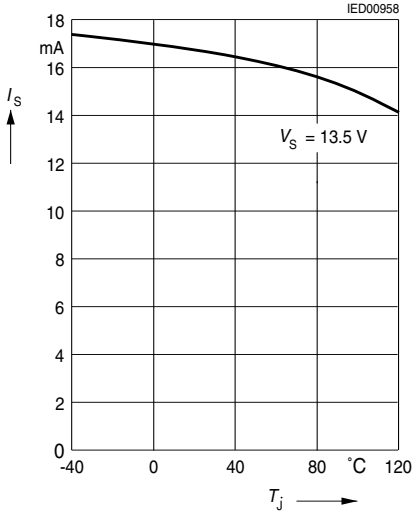

### Start Point of the SOA-Protection Circuit versus Junction Temperature




### Saturation Voltage versus Junction Temperature




### Current Consumption versus Junction Temperature



## Package Outlines

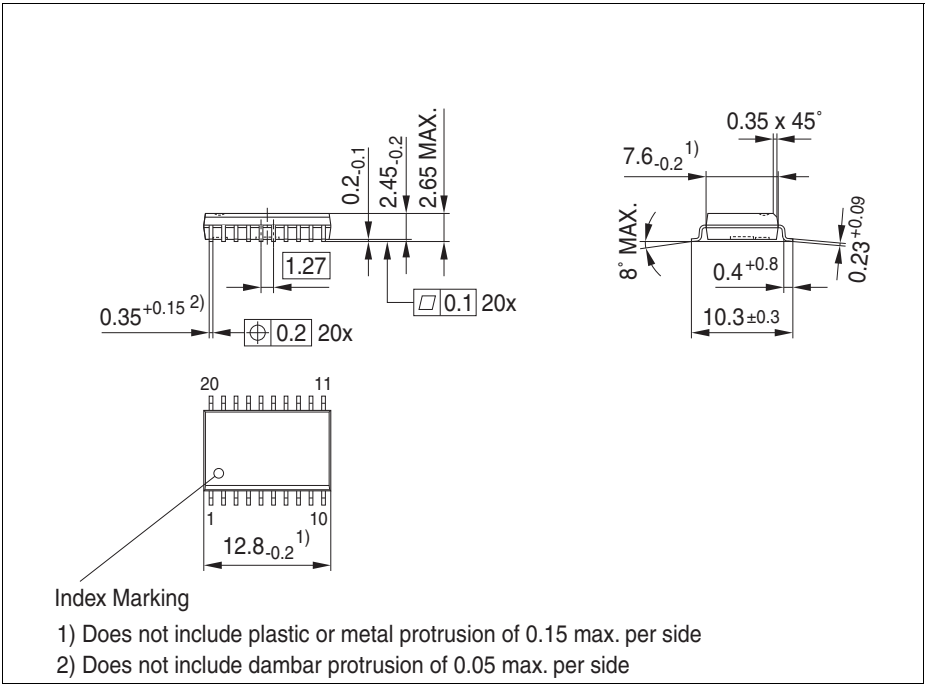



**Figure 6 PG-DSO-20 (Plastic Dual Small Outline)**

**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).

You can find all of our packages, sorts of packing and others in our Infineon Internet Page “Products”: **http://www.infineon.com/products**.

Dimensions in mm

## Revision History

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

**Edition 2015-01-19**

**Published by**
**Infineon Technologies AG**
**81726 Munich, Germany**



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