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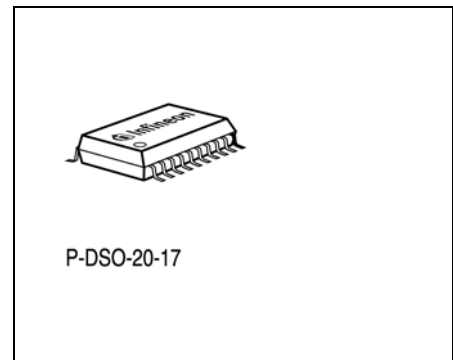
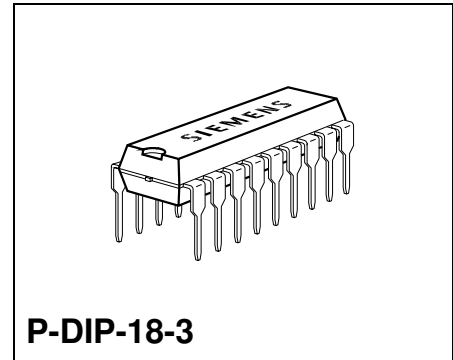


Overview

Bipolar IC

Features

- Max. driver current 1 A
- Integrated free-wheeling diodes
- Short-circuit proof to ground
- Inhibit
- ESD protected inputs
- Temperature range $-40\text{ °C} \leq T_j \leq 150\text{ °C}$



| Type | Ordering Code | Package |
|------------|---------------|-------------|
| TLE 4205 | Q67000-A9025 | P-DIP-18-3 |
| TLE 4205 G | Q67006-A9114 | P-DSO-20-17 |

Description

TLE 4205 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.

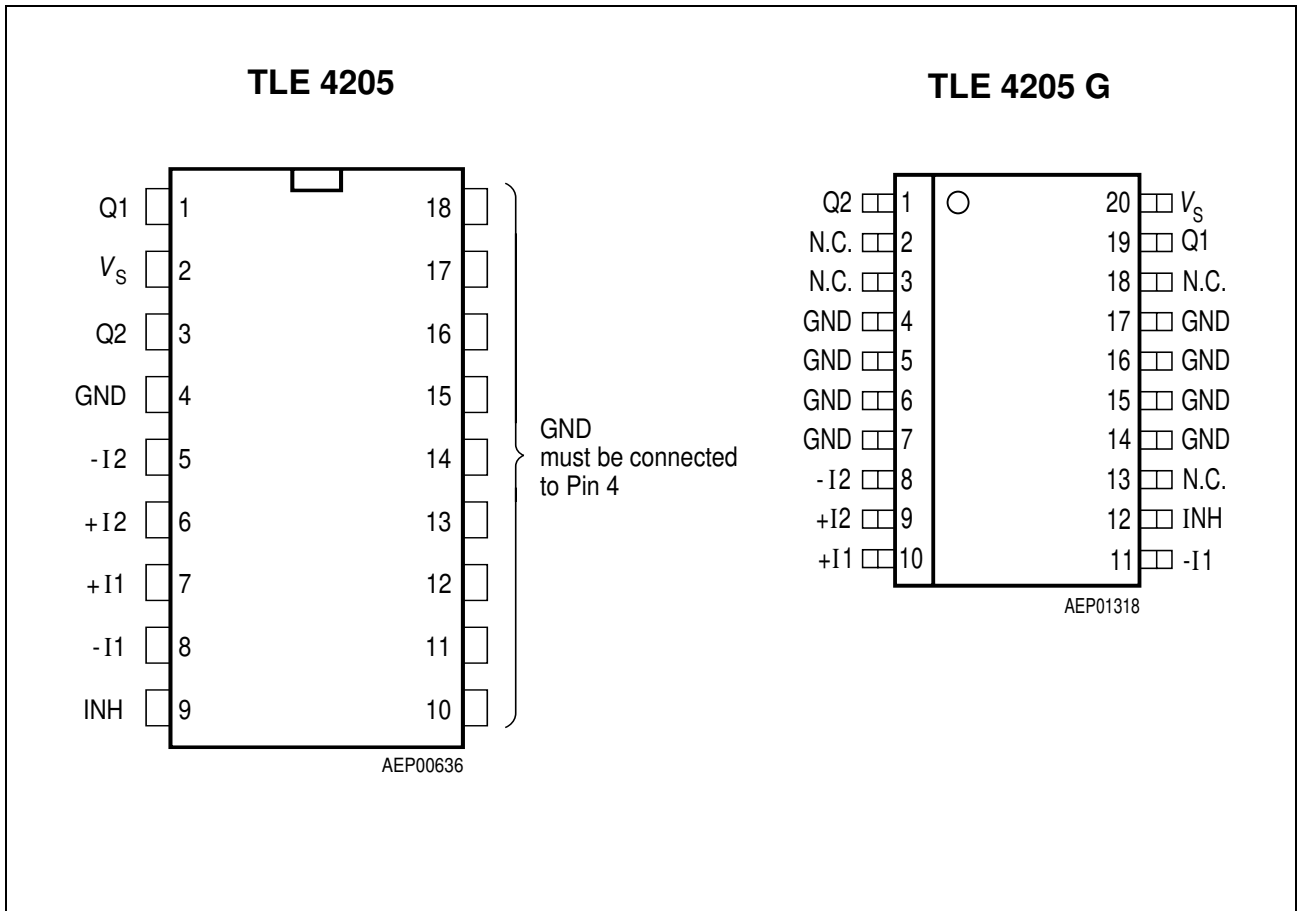


Figure 1 Pin Configuration (top view)

Pin Definitions and Functions

| Pin No. | Symbol | Function |
|---------|--------|--|
| 1 | Q1 | Output Q1 of channel 1 ; push-pull B output with DC short-circuit protection to ground. Integrated free-wheeling diodes to ground and the supply voltage. |
| 2 | V_S | Supply voltage V_S ; must be blocked to ground with a ceramic capacitor of at least 100 nF directly on the pins of the IC. |
| 3 | Q2 | Output Q2 of channel 2 ; see pin 1. |
| 4 | GND | Ground |
| 5 | - I2 | Inverting input channel 2 ; to be wired according to general rules. |
| 6 | + I2 | Non-inverting input channel 2 ; to be wired according to general rules. |
| 7 | + I1 | Non-inverting input channel 1 ; see pin 6. |
| 8 | - I1 | Inverting input channel 1 ; see pin 5. |
| 9 | INH | Inhibit ; the IC is passive when this pin is open or connected to ground. |
| 10-18 | GND | Ground ; must be connected to pin 4. |

Pin Definitions and Functions (TLE 4205 G)

| 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. |

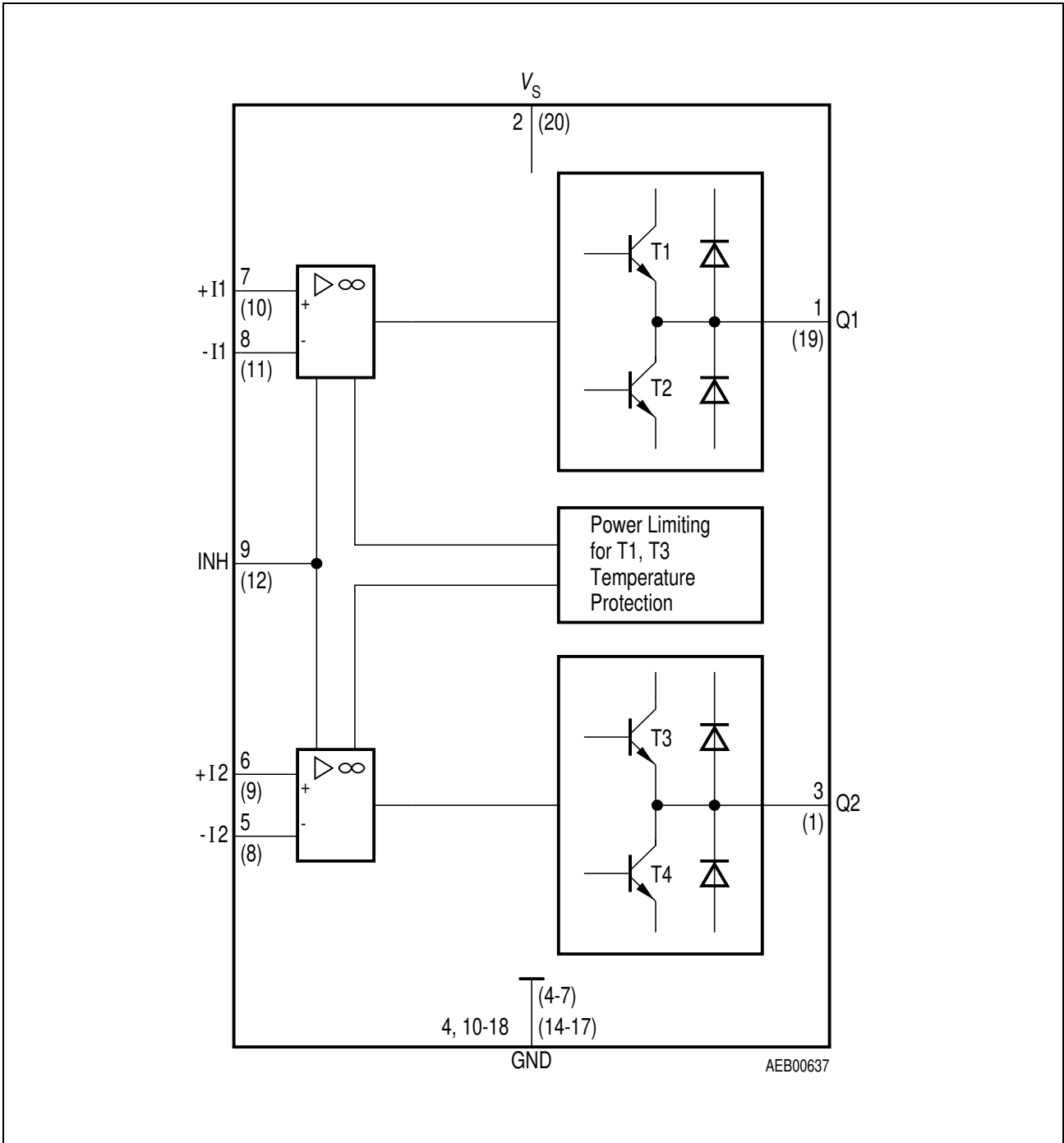


Figure 2 Block Diagram

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.

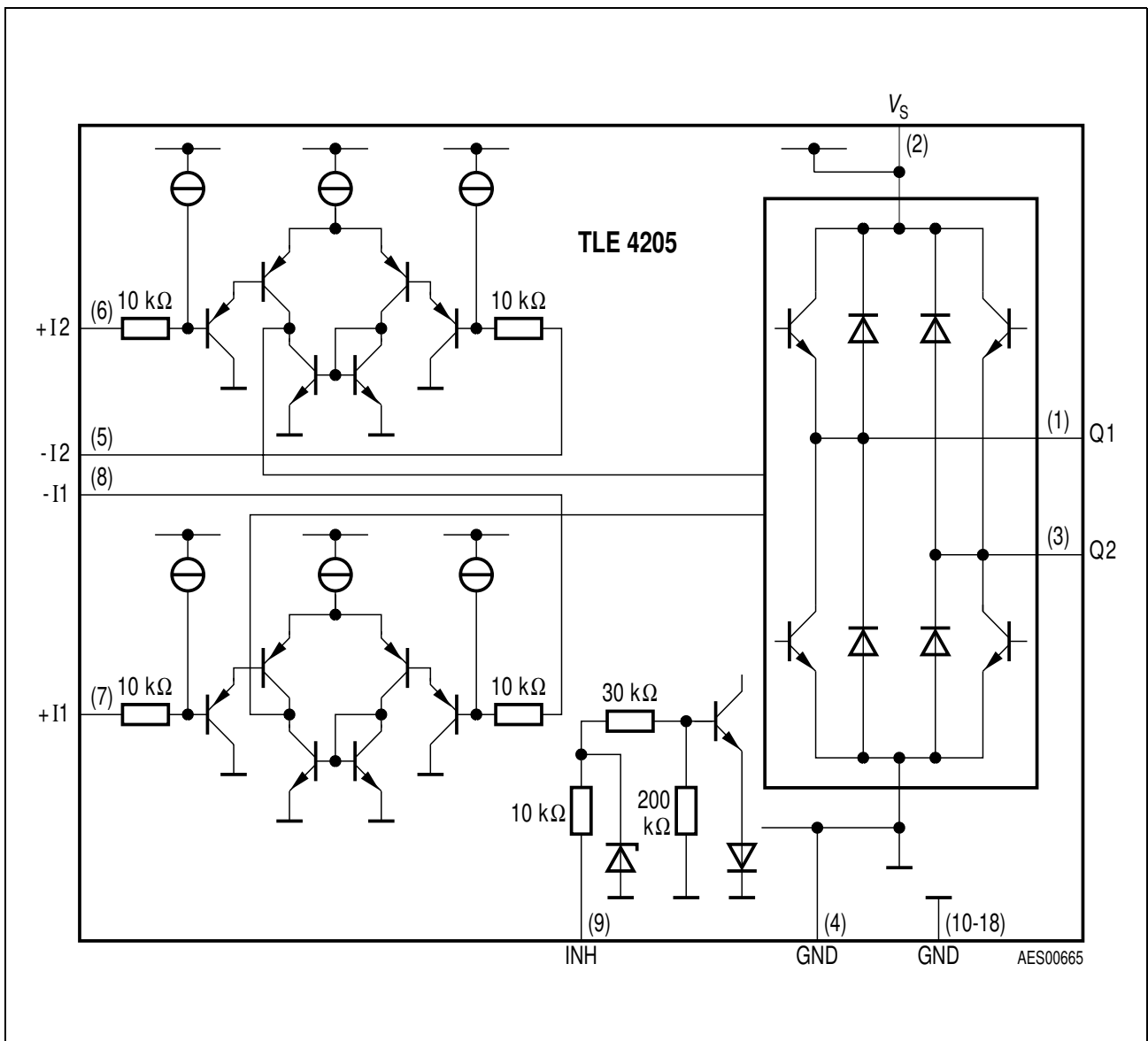


Figure 3 Circuit Diagram

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 | ΔV_{6-5} or ΔV_{7-8} TLE 4205 ΔV_{8-9} or ΔV_{10-11} TLE 4205 G |
| 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 | $V_5; V_6; V_7; V_8$ TLE 4205 $V_8; V_9; V_{10}; V_{11}$ TLE 4205 G |
| Inhibit input | V_{Inh} | - 15 | V_S | V | V_9 TLE 4205 V_{12} TLE 4205G |
| 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 | 105 | °C | $P_{Dmax} = 3$ W; DIP |
| Case temperature | T_C | - 40 | 95 | °C | $P_{Dmax} = 3$ W; SO |
| Thermal resistance junction - ambient | $R_{th JA}$ | - | 60 | K/W | TLE 4205 |
| junction - case | $R_{th JC}$ | - | 15 | K/W | TLE 4205 |
| Thermal resistance junction - ambient | $R_{th JA}$ | - | 65 | K/W | TLE 4205 G |
| junction - case | $R_{th JC}$ | - | 20 | K/W | TLE 4205 G |

Outputs pin 1 (19) and pin 3 (1) short-circuit proof to GND at $V_S \leq 18$ V for TLE 4205 (TLE 4205G)

Characteristics
 $6\text{ V} < V_S < 18\text{ V}; -40\text{ }^\circ\text{C} < T_j < 150\text{ }^\circ\text{C}$

| 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 $V_{9\text{ OFF/ON}}$ | $t_{d\text{ ON}}$ | – | 10 | 20 | μs | $ I_{1,3} < 1\text{ A}$ TLE 4205 $ I_{1,19} < 1\text{ A}$ TLE 4205 G |
| Turn-OFF dead time ref. to $V_{9\text{ OFF/ON}}$ | $t_{d\text{ OFF}}$ | – | 10 | 20 | μs | $ I_{1,3} < 1\text{ A}$ TLE 4205 $ I_{1,19} < 1\text{ A}$ TLE 4205 G |
| Open-loop gain | G_{VO} | 50 | 80 | – | dB | $f = 500\text{ Hz}$ |

Inputs

| | | | | | | |
|-----------------------------------|--------------------------|-------|----|-----------|-----------------|-----------------------------|
| Input zero voltage | V_{IO} | – 7.5 | – | 7.5 | mV | $R_S = 10\text{ k}\Omega$; |
| Input-voltage drift | $\Delta V_{IO}/\Delta T$ | – | 20 | 30 | $\mu\text{V/K}$ | – |
| 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 | $\mu\text{V/V}$ | $R_S = 10\text{ k}\Omega$; |
| Common-mode rejection ratio | $CMRR$ | 70 | 80 | – | dB | – |

Characteristics (cont'd)
 $6\text{ V} < V_S < 18\text{ V}; -40\text{ }^\circ\text{C} < T_j < 150\text{ }^\circ\text{C}$

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
| | | min. | typ. | max. | | |

Outputs

| | | | | | | |
|--|--------------------|---|------|-----|------------------|-----------------------|
| Saturation voltage | $V_{\text{Sat U}}$ | – | 1.35 | 1.5 | V | $I_Q = -0.6\text{ A}$ |
| Saturation voltage | $V_{\text{Sat L}}$ | – | 0.8 | 1.2 | V | $I_Q = 0.6\text{ A}$ |
| Forward voltage of free-wheeling diode | V_{FU} | – | 1 | 1.5 | V | $I_F = 0.6\text{ A}$ |
| Forward voltage of free-wheeling diode | V_{FL} | – | 1 | 1.5 | V | $I_F = 0.6\text{ A};$ |
| 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 | $V_9 = 5\text{ V}$ |
| L-input current | I_{IH} | – | 0 | – | μA | $V_9 = 0\text{ V}$ |

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

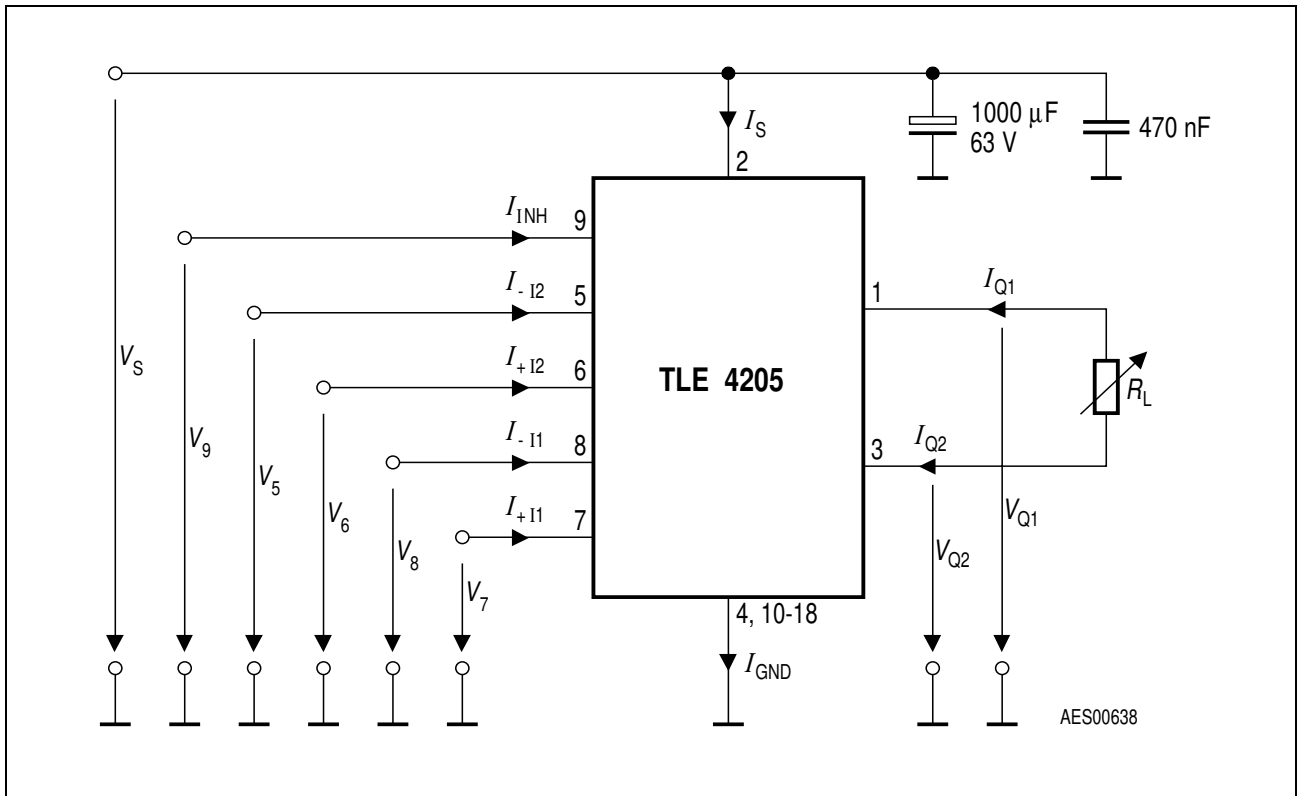


Figure 4 Test Circuit

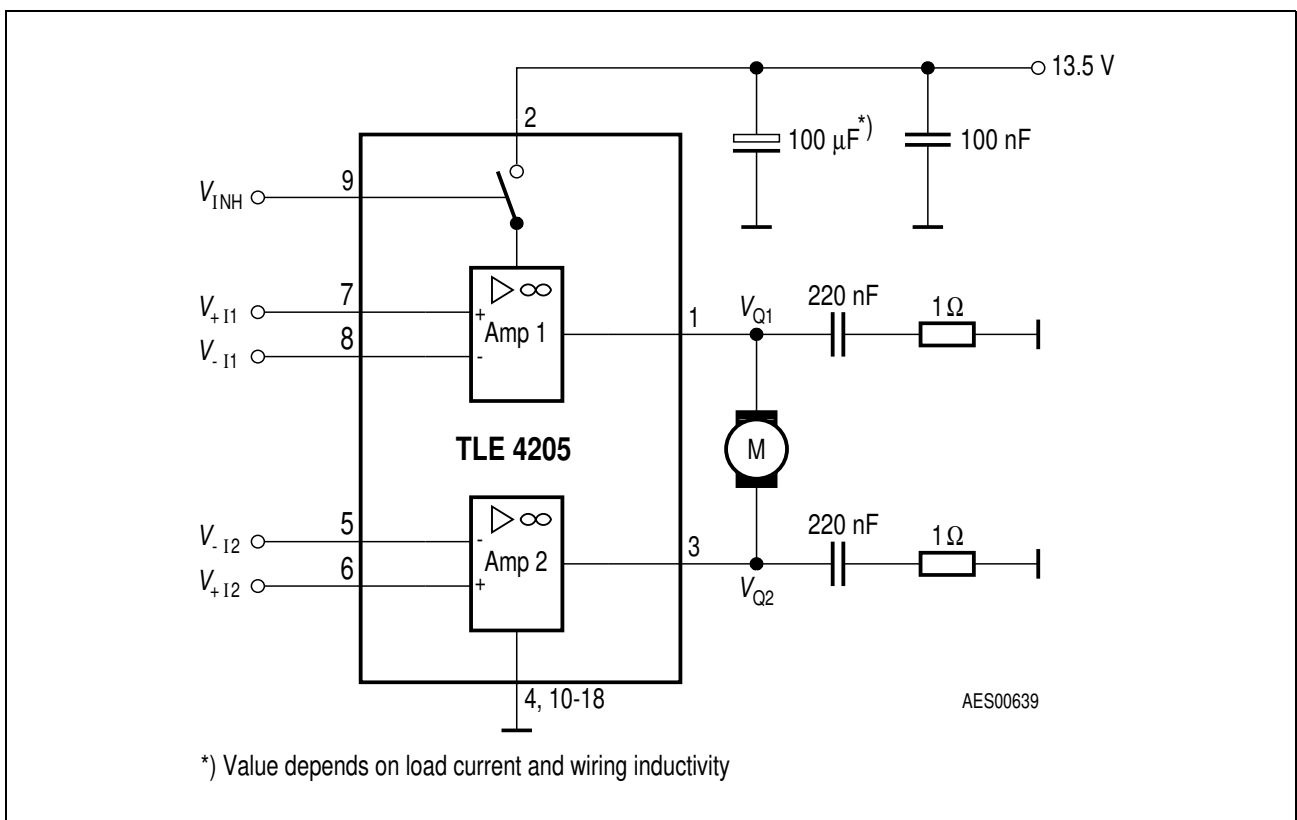
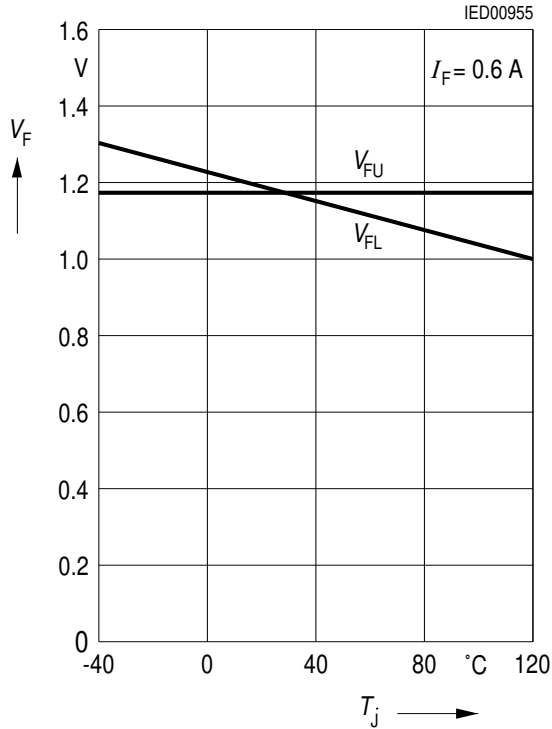
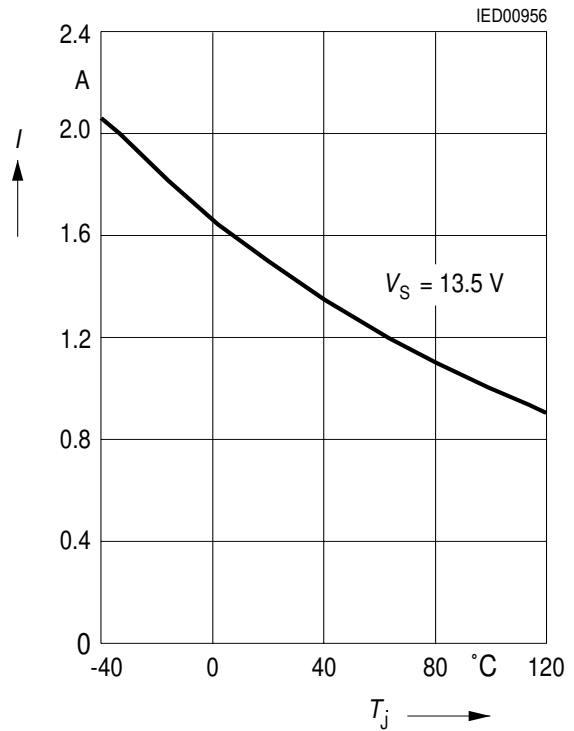


Figure 5 Application Circuit

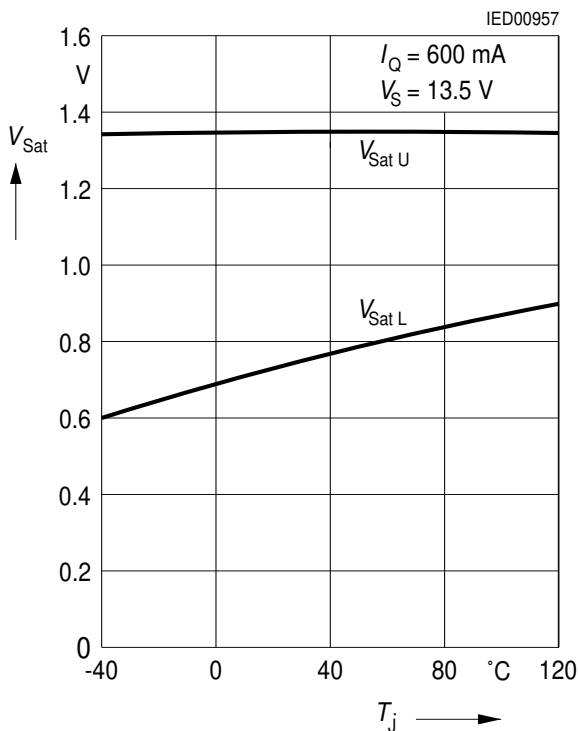
Forward Voltage of the Free-Wheeling Diodes versus Junction Temperature



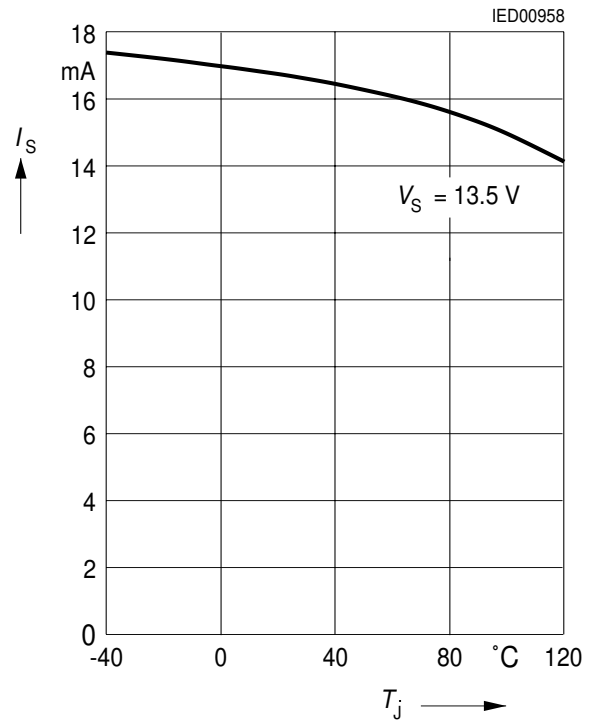
Start Point of the SOA-Protection Circuit versus Junction Temperature



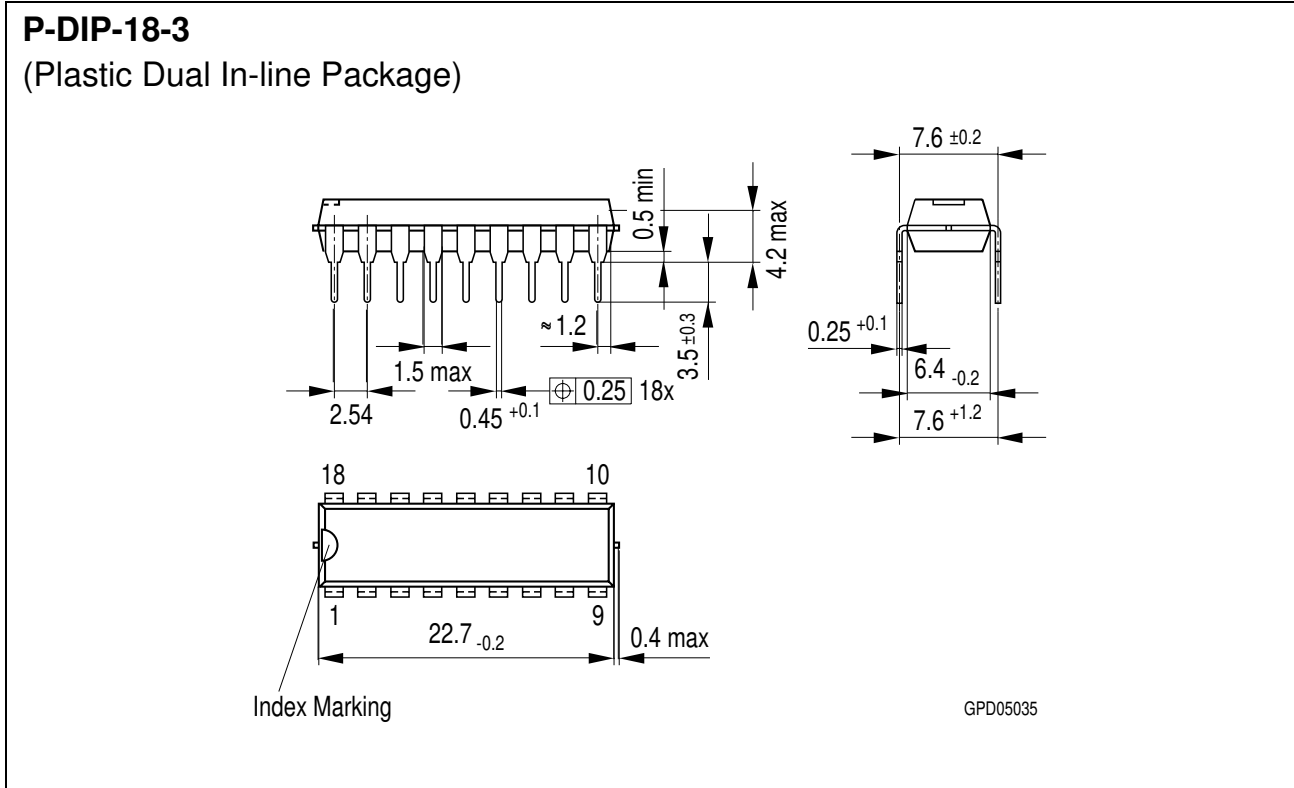
Saturation Voltage versus Junction Temperature



Current Consumption versus Junction Temperature



Package Outlines

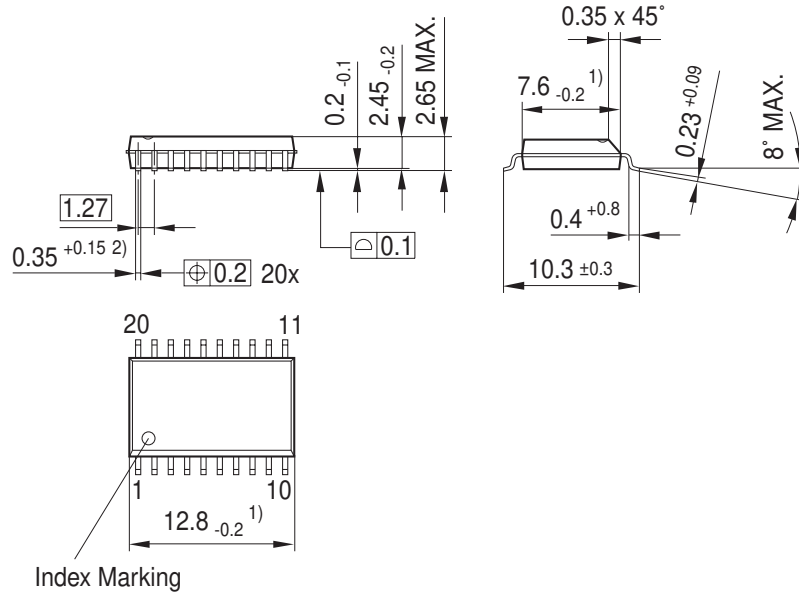


Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

Dimensions in mm

P-DSO-20-17
(Plastic Dual Small Outline Package)



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

Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm