SIEMENS

1-A DC Motor Driver

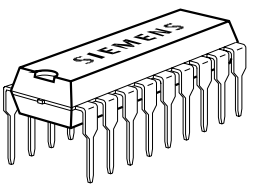
TLE 4205

Overview

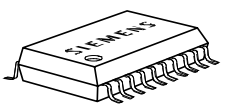
Bipolar IC

Features

- Max. driver current 1 A
- Integrated free-wheeling diodes
- Short-circuit proof to ground
- Inhibit
- ESD protected inputs
- Temperature range – 40 °C ≤ T_j ≤ 150 °C



P-DIP-18-3



P-DSO-20-6

Type	Ordering Code	Package
TLE 4205	Q67000-A9025	P-DIP-18-3
TLE 4205 G	Q67006-A9114	P-DSO-20-6

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.

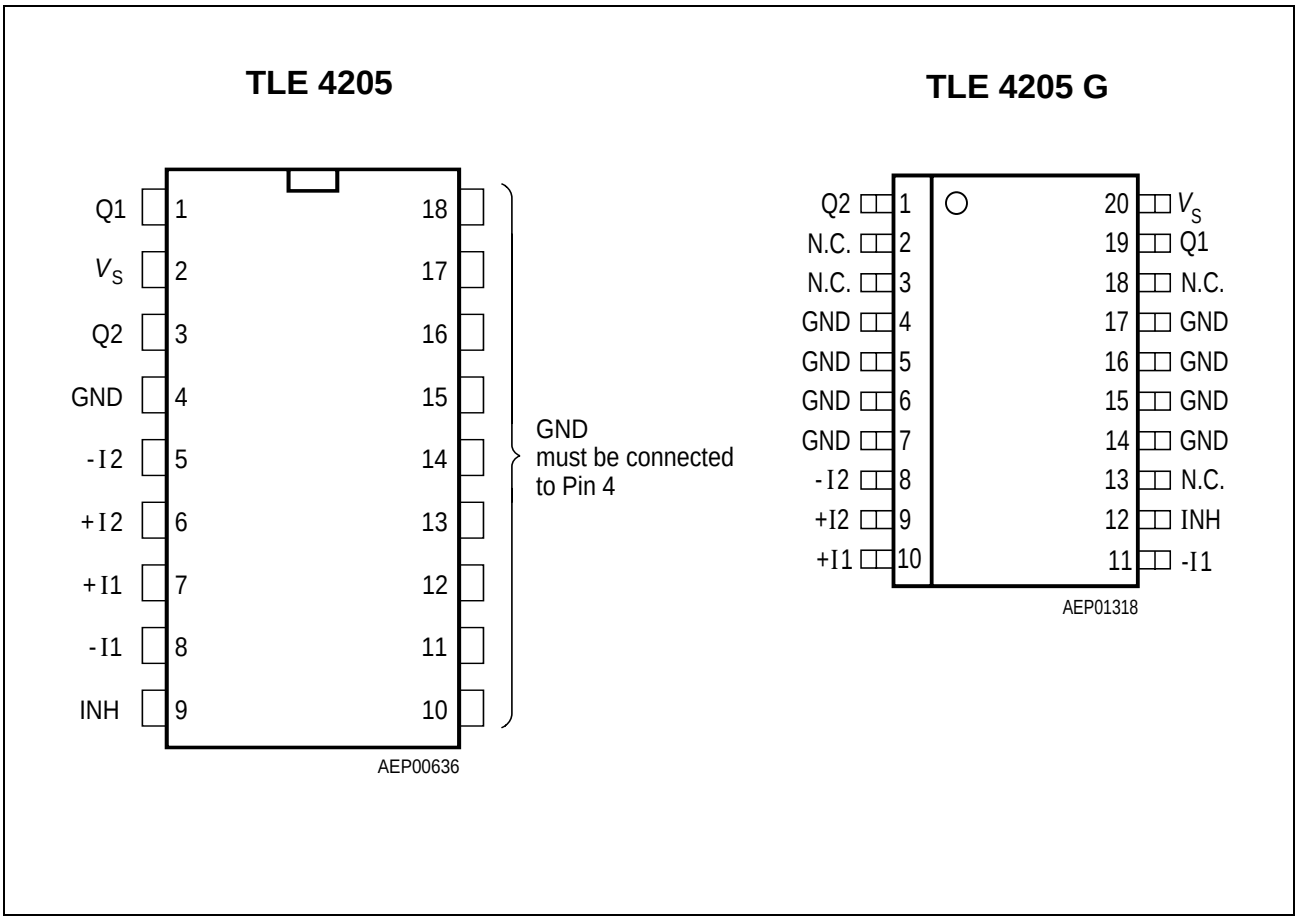


Figure 1 Pin Configuration (top view)

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.

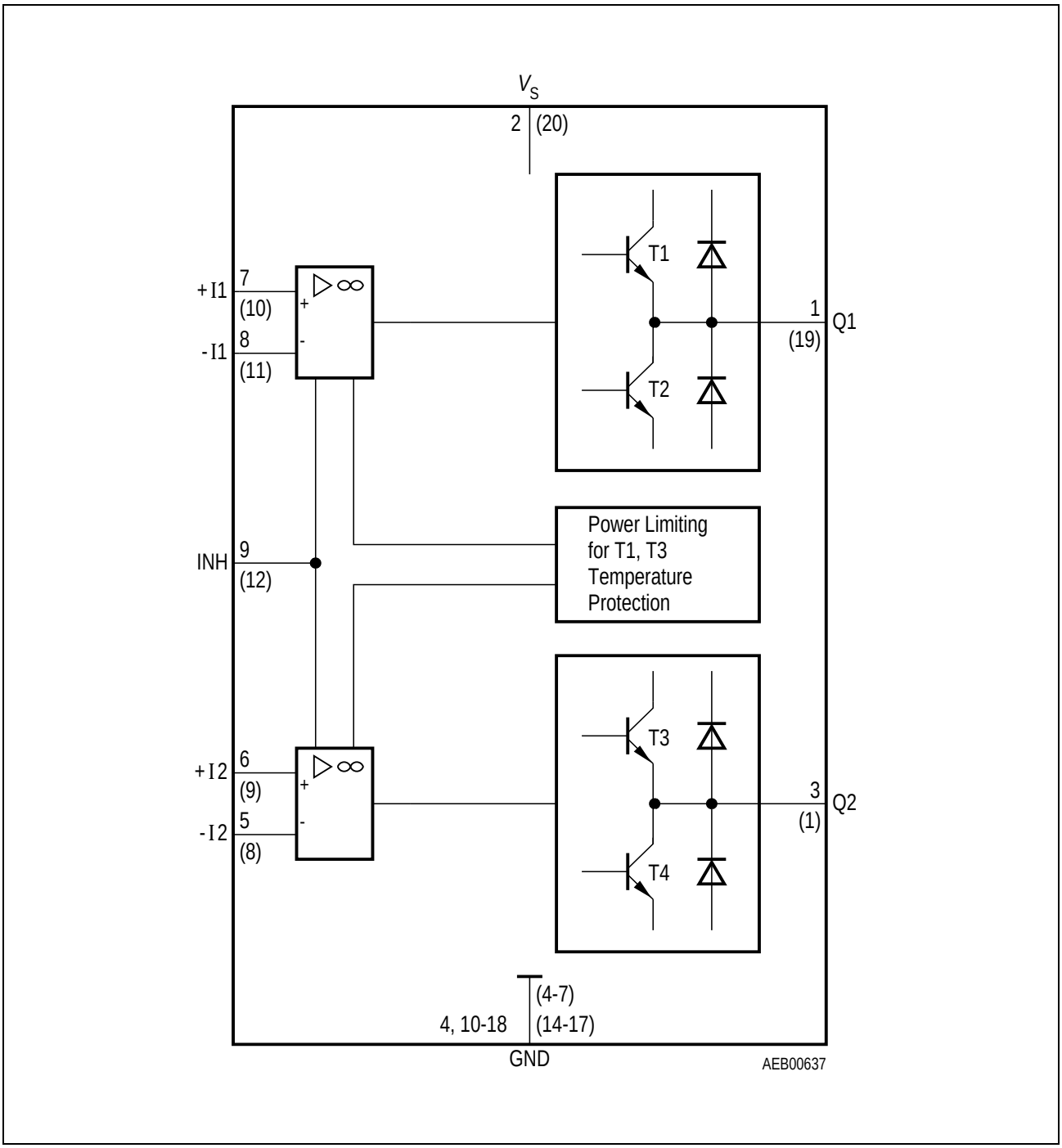


Figure 2 Block Diagram

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.

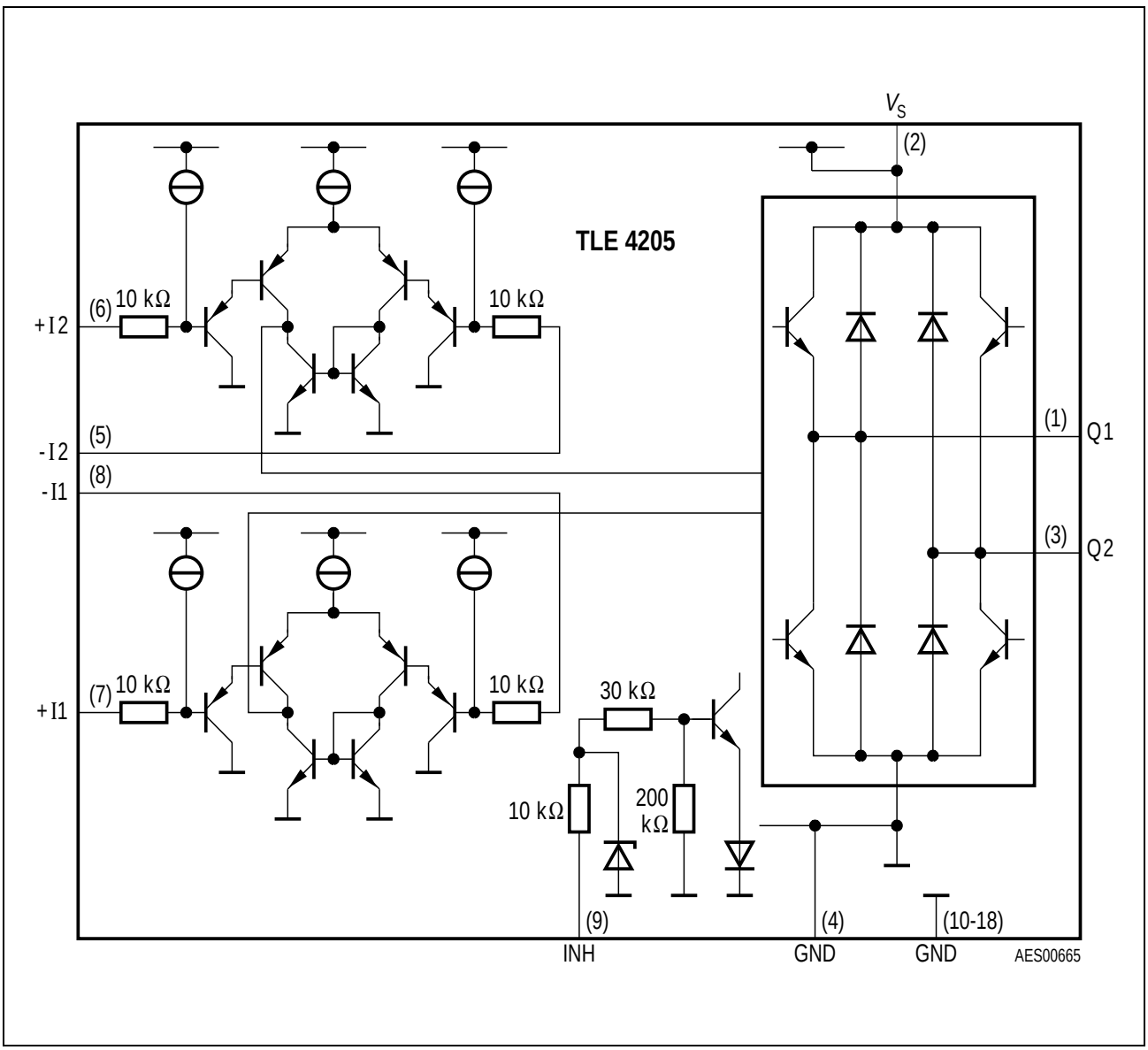


Figure 3 Circuit Diagram

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	$\Delta V_{6\text{-}5}$ or $\Delta V_{7\text{-}8}$ TLE 4205 $\Delta V_{8\text{-}9}$ or $\Delta V_{10\text{-}11}$ 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 junction - case	 $R_{th\ JA}$ $R_{th\ JC}$	 – –	 60 15	 K/W K/W	 TLE 4205 TLE 4205
Thermal resistance junction - ambient junction - case	 $R_{th\ JA}$ $R_{th\ JC}$	 – –	 65 20	 K/W K/W	 TLE 4205 G 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 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 $V_{9\ OFF/ON}$	$t_{d\ ON}$	–	10	20	µs	$\|I_{1,3}\|$ < 1 A TLE 4205 $\|I_{1,19}\|$ < 1 A TLE 4205 G
Turn-OFF dead time ref. to $V_{9\ OFF/ON}$	$t_{d\ OFF}$	–	10	20	µs	$\|I_{1,3}\|$ < 1 A TLE 4205 $\|I_{1,19}\|$ < 1 A TLE 4205 G
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_9 = 5 V
L-input current	I_{IH}	–	0	–	µA	V_9 = 0 V

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

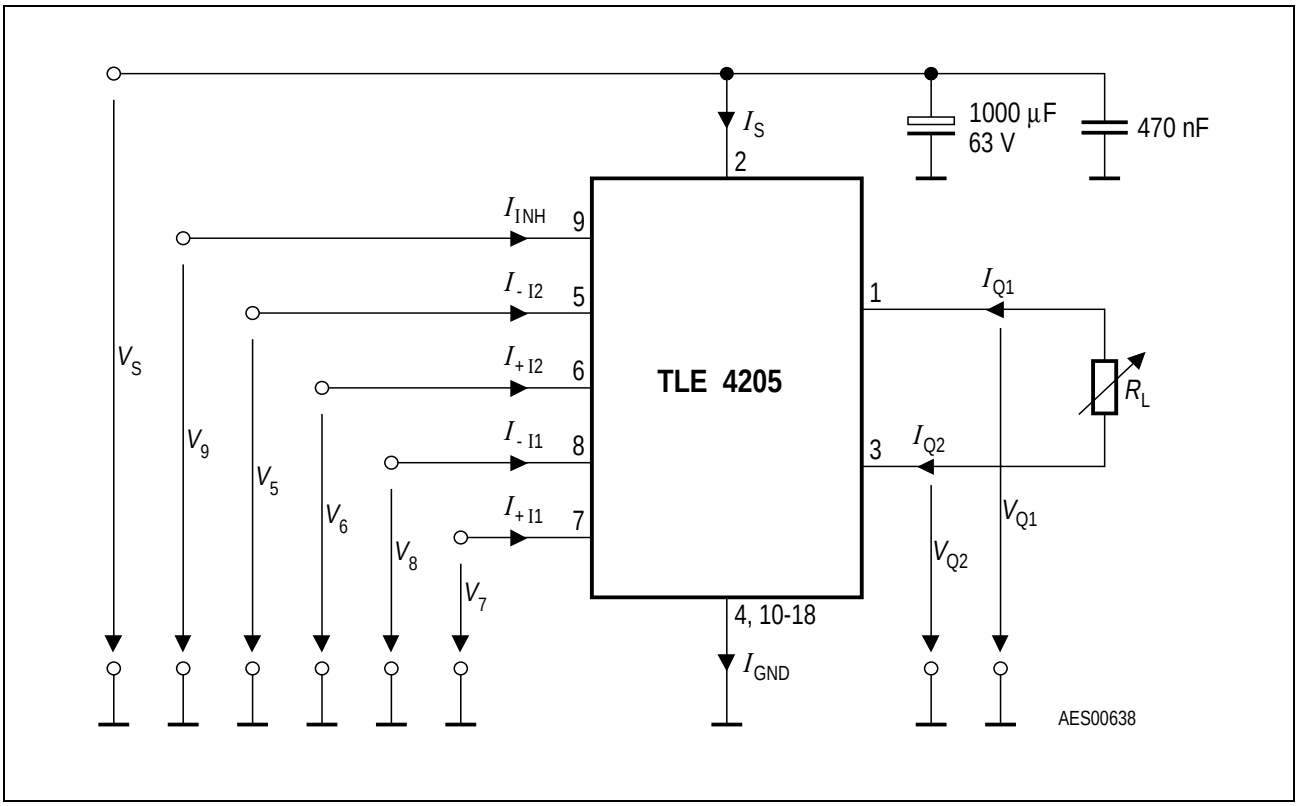


Figure 4 Test Circuit

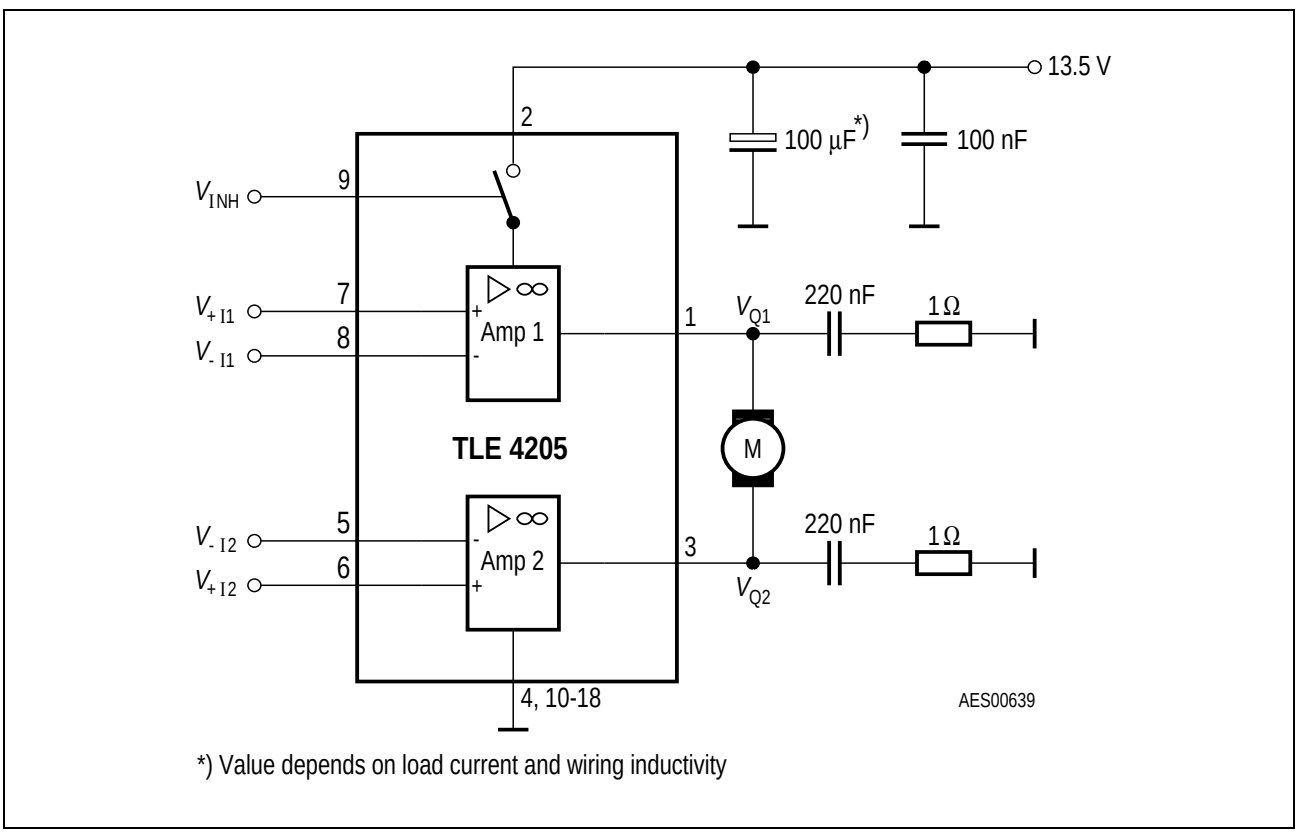
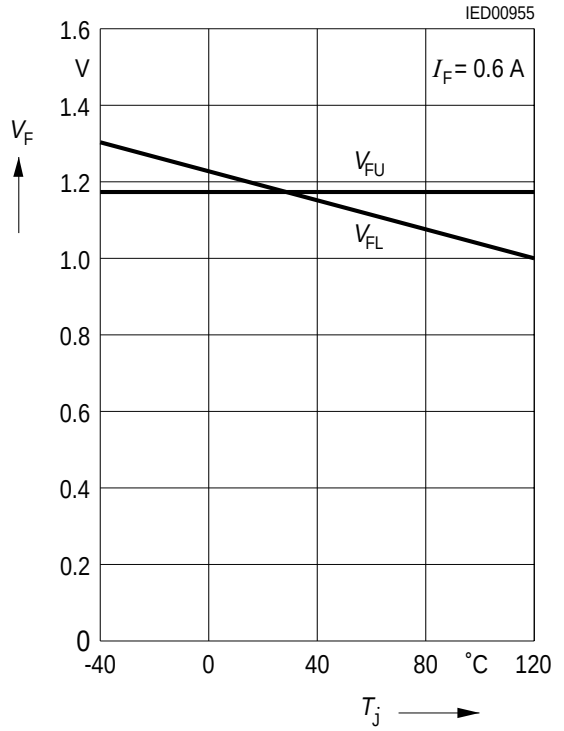
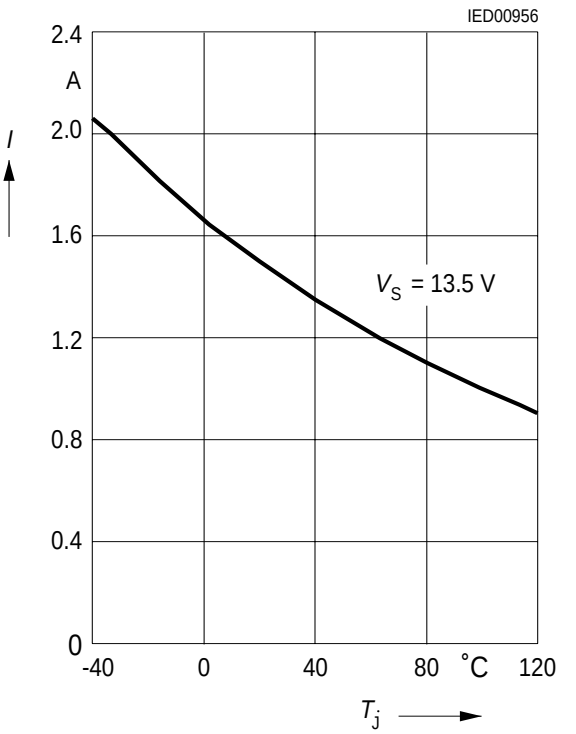


Figure 5 Application Circuit

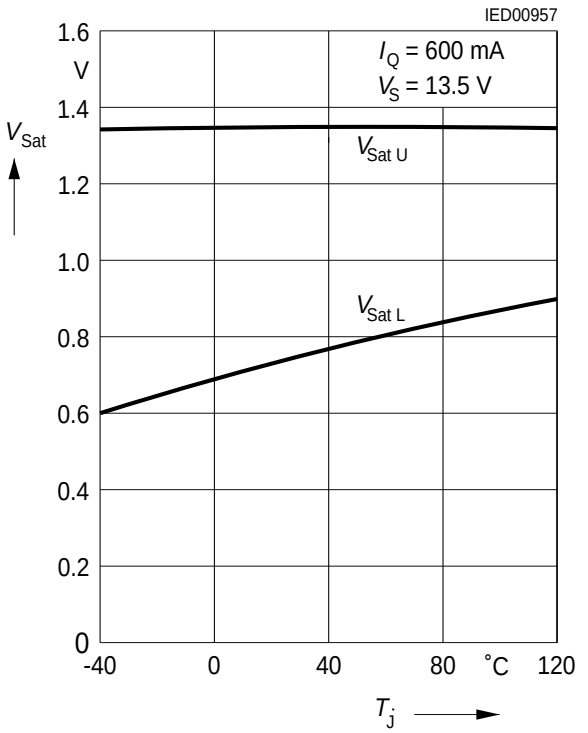
Forward Voltage of the Free-Wheeling Diodes versus Junction Temperature



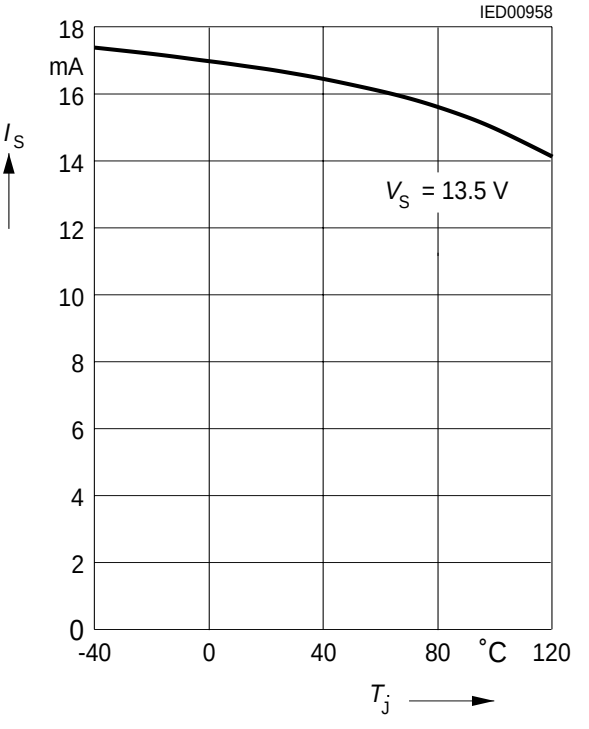
Start Point of the SOA-Protection Circuit versus Junction Temperature



Saturation Voltage versus Junction Temperature

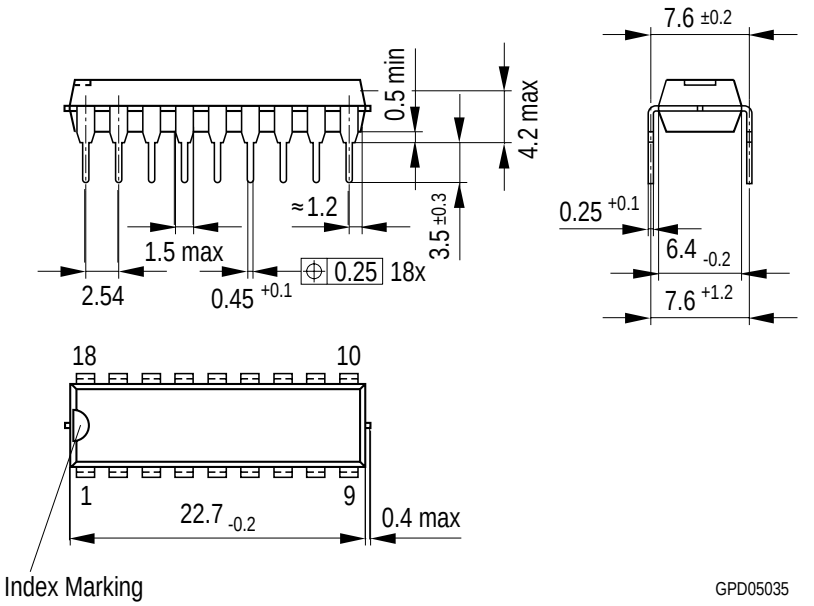


Current Consumption versus Junction Temperature



Package Outlines

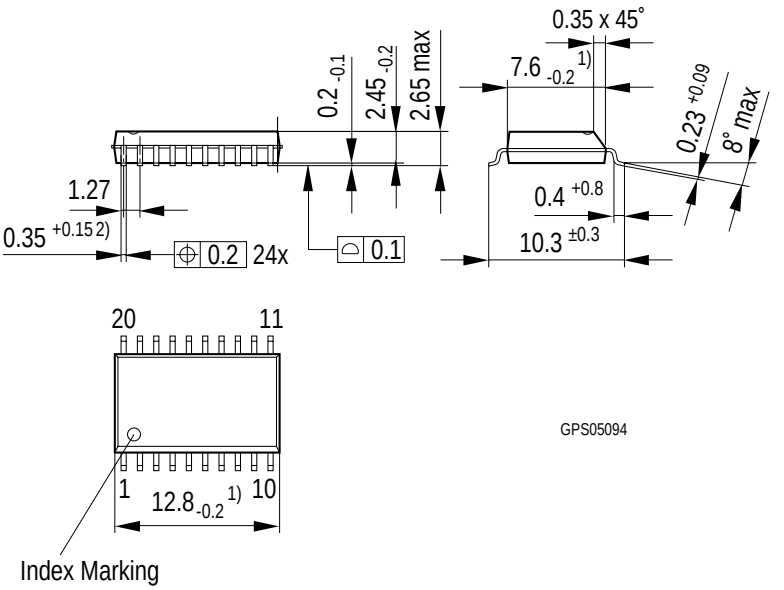
P-DIP-18-3
(Plastic Dual In-line Package)



Sorts of Packing
Package outlines for tubes, trays etc. are contained in our Data Book “Package Information”.

Dimensions in mm

P-DSO-20-6
(Plastic Dual Small Outline Package)



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

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SMD = Surface Mounted Device

Dimensions in mm