

# 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  $-40\text{ °C} \leq T_j \leq 150\text{ °C}$
- Green Product (RoHS compliant)
- AEC Qualified

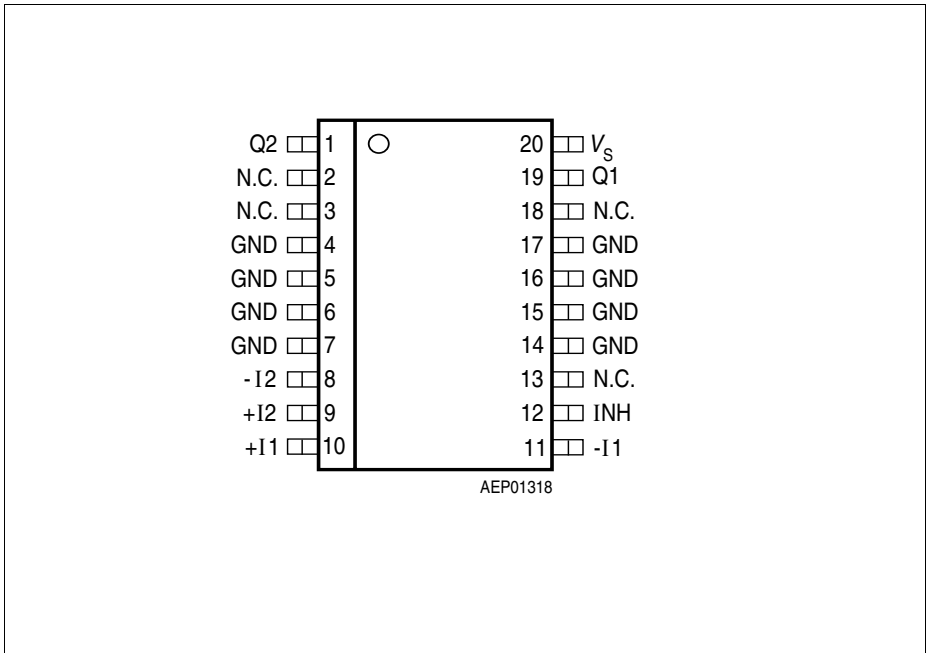


PG-DSO-20

Type	Marking	Package
TLE4205G	TLE4205G	PG-DSO-20

### Description

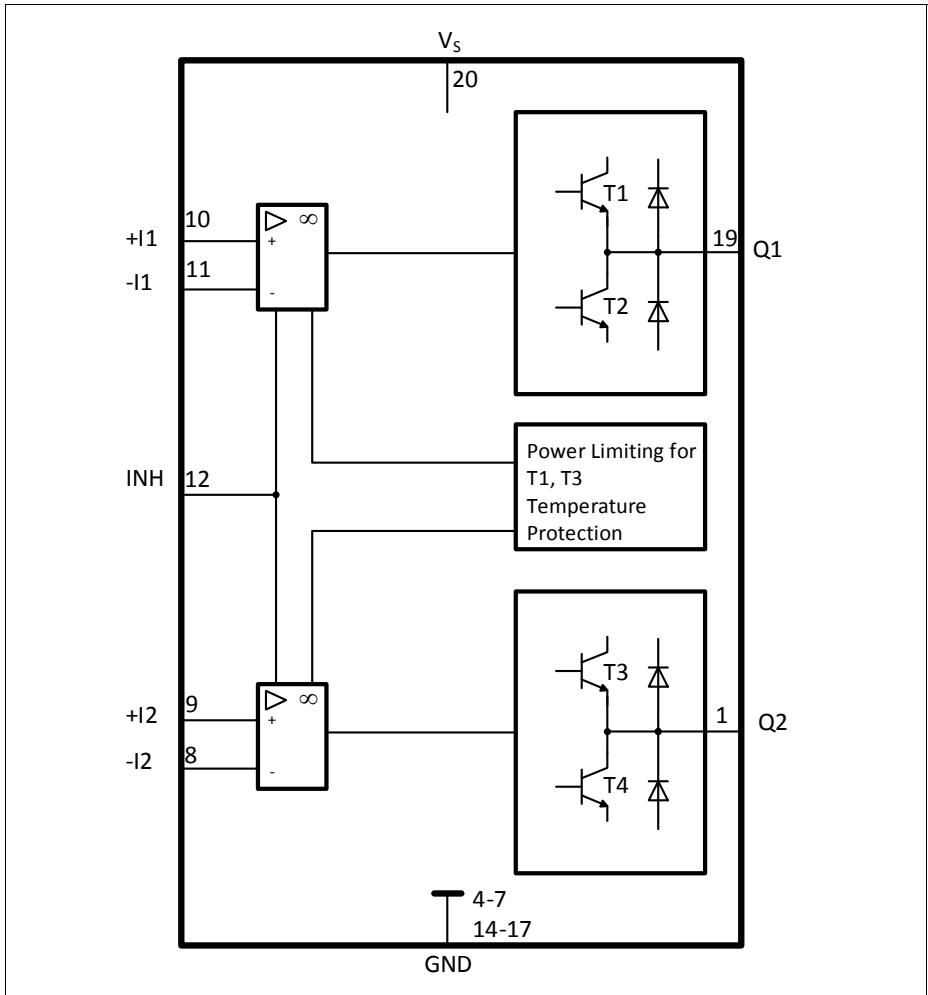
TLE 4205G is an integrated power full-bridge DC-motor driver for a wide temperature range, as required in automotive applications for example. The circuit contains two power comparators that can be combined to a full-bridge circuit. For inductive loads there are integrated free-wheeling diodes to  $+V_S$  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	<b>Output 2 of channel 2;</b> 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	<b>Inverting input channel 2;</b> to be wired according to general rules.
9	+ I2	<b>Non-inverting input channel 2;</b> to be wired according to general rules.
10	+ I1	<b>Non-inverting input channel 1;</b> see pin 9.
11	– I1	<b>Inverting input channel 1;</b> see pin 8.
12	INH	<b>Inhibit;</b> 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	$V_s$	<b>Supply voltage <math>V_s</math>;</b> must be blocked with a ceramic capacitor of at least 100 nF directly on the pins of the IC.

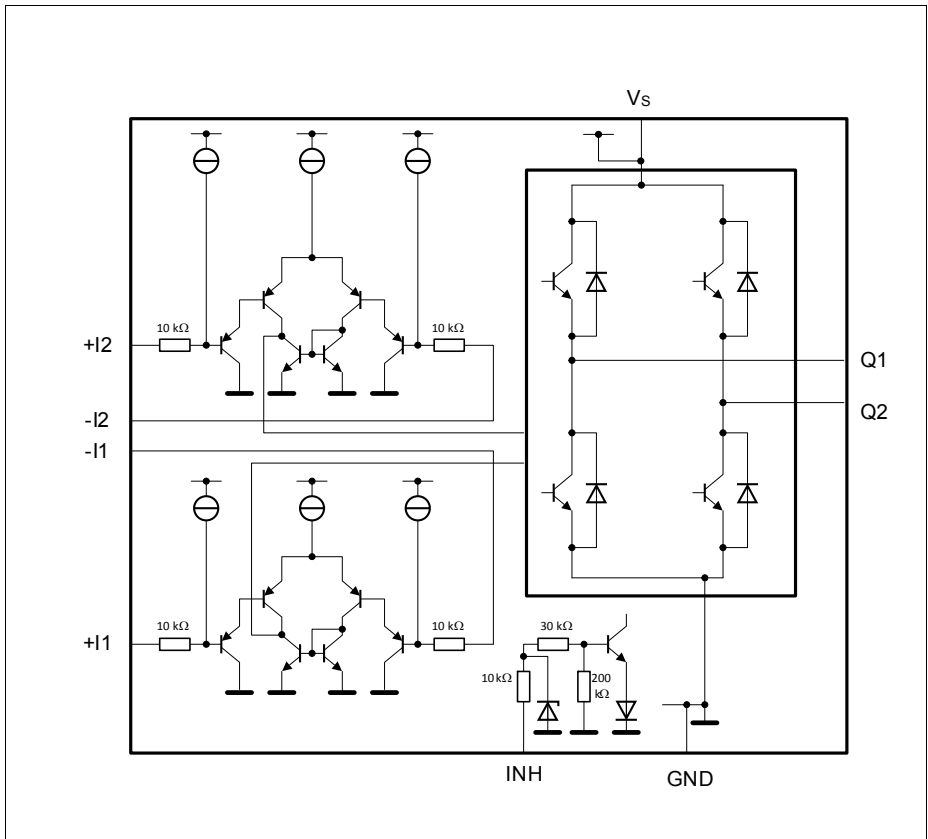


**Figure 2** Block Diagram

**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	$\Delta V_{8-9}$ or $\Delta V_{10-11}$
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	$R_{thJA}$	-	65	K/W	
junction - case	$R_{thJC}$	-	20	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	$ I_{1,19}  < 1$ A
Turn-OFF dead time ref. to $V_{12\ OFF/ON}$	$t_{d\ OFF}$	-	10	20	μs	$ I_{1,19}  < 1$ A

**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.		
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.		

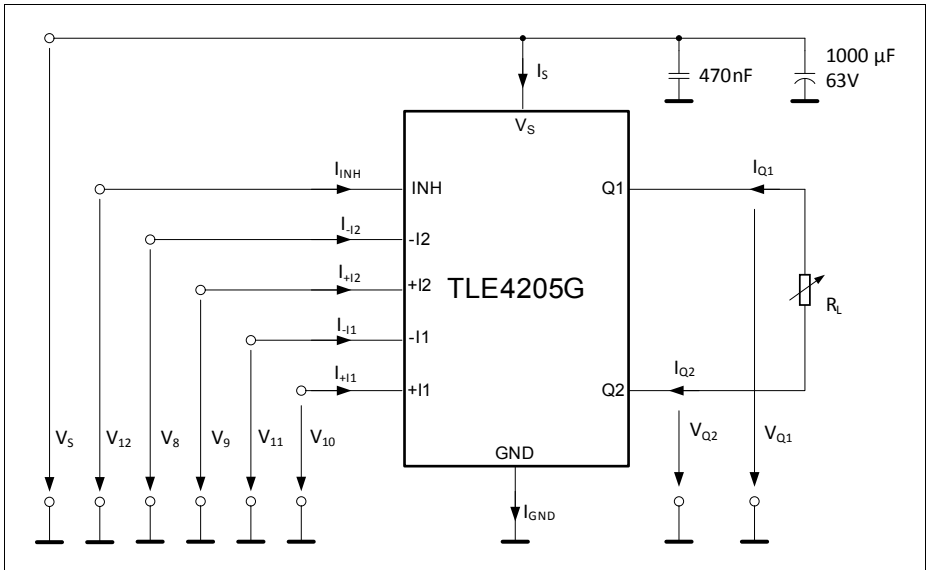
**Outputs**

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	$V_{\text{FU}}$	–	1	1.5	V	$I_F = 0.6\text{ A}$
Forward voltage of free-wheeling diode	$V_{\text{FL}}$	–	1	1.5	V	$I_F = 0.6\text{ A}$
Slew rate of $V_Q$	$dV_q/dt_r$	–	0.5	–	V/ $\mu\text{s}$	–

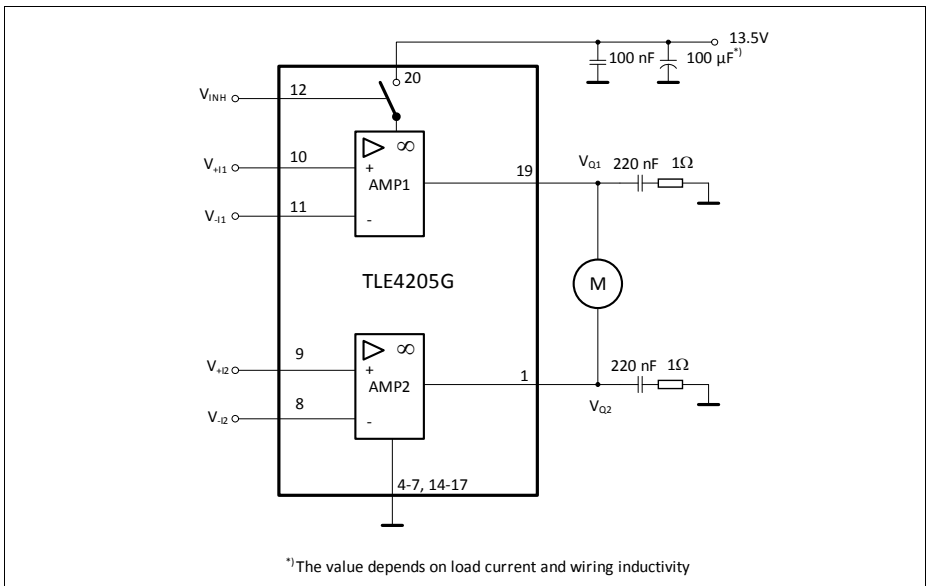
**Inhibit Input**

Switching threshold high	$V_{\text{IH}}$	2	–	–	V	–
Switching threshold low	$V_{\text{IL}}$	–	–	0.8	V	–
H-input current	$I_{\text{IH}}$	–	100	–	$\mu\text{A}$	$V_{12} = 5\text{ V}$
L-input current	$I_{\text{IH}}$	–	0	–	$\mu\text{A}$	$V_{12} = 0\text{ V}$

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



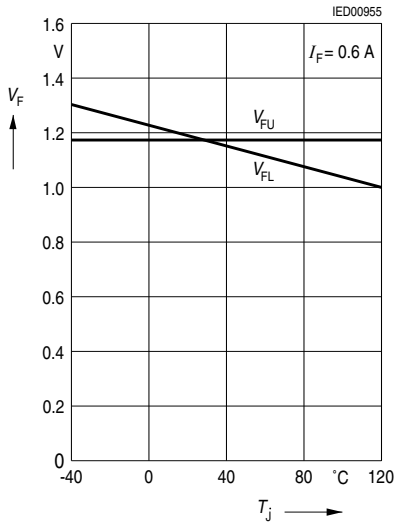
**Figure 4 Test Circuit**



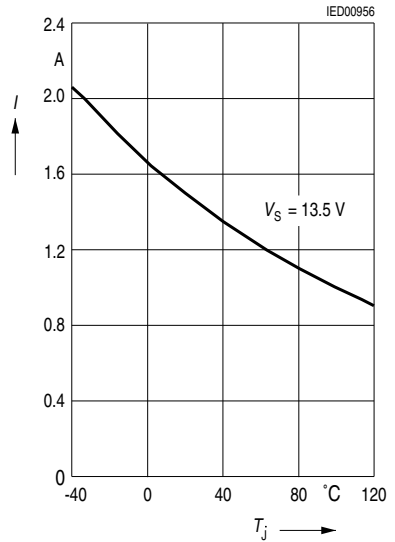
<sup>1)</sup>The value depends on load current and wiring inductivity

**Figure 5 Application Circuit**

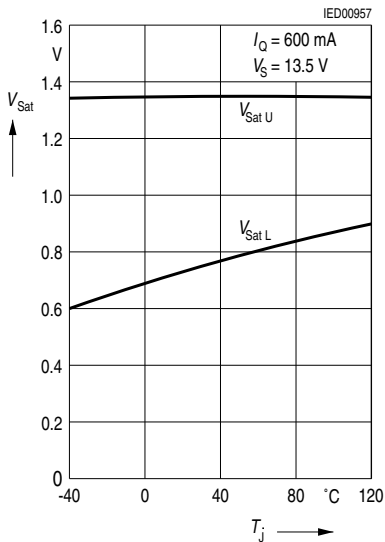
**Forward Voltage of the Free-Wheeling Diodes versus Junction Temperature**



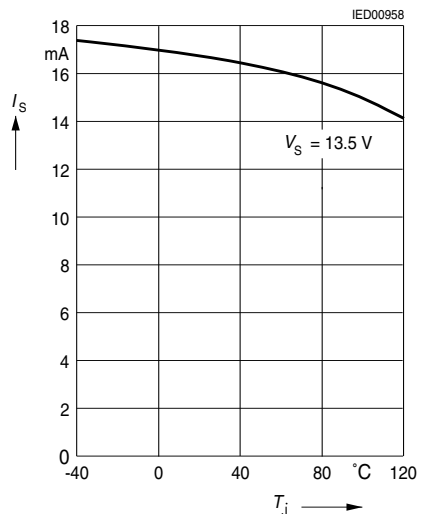
**Start Point of the SOA-Protection Circuit versus Junction Temperature**



**Saturation Voltage versus Junction Temperature**



**Current Consumption versus Junction Temperature**



Package Outlines

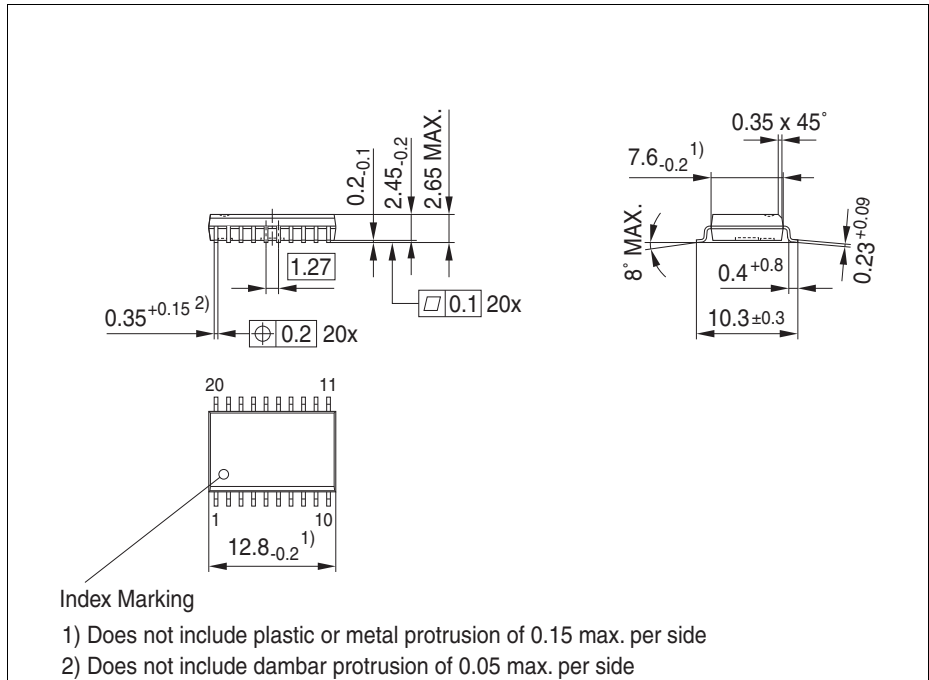


Figure 6 PG-DSO-20 (Plastic Dual Small Outline)

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).

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Dimensions in mm

## Revision History

Revision	Date	Changes
1.1	2015-01-19	<p>Initial version of RoHS-compliant derivate of TLE 4205G</p> <ul style="list-style-type: none"><li>• Page 1: Added Coverpage,</li><li>• All pages: Infineon logo updated</li><li>• 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</li><li>• Page 12: Package name changed to RoHS compliant versions, “Green Product” description added</li><li>• Page 13: added Revision History</li><li>• Page 14: added Legal Disclaimer</li><li>• Page 7, Page 9: V9 designating the voltage at INH pin renamed V12</li></ul>

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