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# LV8405V

## Bi-CMOS IC 2ch Forward/Reverse Motor Driver

### Overview

LV8405T is a 2ch forward/reverse motor driver IC using D-MOS FET for output stage. As MOS circuit is used, it supports the PWM input. Its features are that the on resistance ( $0.75\Omega$  typ) and current dissipation are low. It also provides protection functions such as heat protection circuit and reduced voltage detection and is optimal for the motors that need high-current.

### Functions

- 2ch forward/reverse motor driver.
- Low power consumption.
- Low ON resistance  $0.75\Omega$ .
- Built-in low voltage reset and thermal shutdown circuit.
- Four mode function forward/reverse, brake, stop.
- Built-in charge pump.

### Specifications

**Maximum Ratings** at  $T_a = 25^\circ\text{C}$ ,  $\text{SGND} = \text{PGND} = 0\text{V}$

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage (for load)	$V_M$ max		-0.5 to 16.0	V
Power supply voltage (for control)	$V_{CC}$ max		-0.5 to 6.0	V
Output current	$I_O$ max		1.4	A
Output peak current	$I_O$ peak	$t \leq 10\text{ms}$	2.5	A
Input voltage	$V_{IN}$ max		-0.5 to $V_{CC}+0.5$	V
Allowable power dissipation	$P_d$ max	Mounted on a specified board*	800	mW
Operating temperature	$T_{opr}$		-30 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

\* Specified board :  $114.3\text{mm} \times 76.1\text{mm} \times 1.6\text{mm}$ , glass epoxy board.

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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## Allowable Operating Conditions at $T_a = 25^\circ\text{C}$ , $\text{SGND} = \text{PGND} = 0\text{V}$

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage (VM pin)	VM		1.5 to 15.0	V
Power supply voltage ( $V_{\text{CC}}$ pin)	$V_{\text{CC}}$		2.8 to 5.5	V
Input signal voltage	$V_{\text{IN}}$		0 to $V_{\text{CC}}$	V
Input signal frequency	f max		200	kHz

## Electrical Characteristics $T_a = 25^\circ\text{C}$ , $V_{\text{CC}} = 3.0\text{V}$ , $\text{VM} = 6.0\text{V}$ , $\text{SGND} = \text{PGND} = 0\text{V}$ , unless otherwise specified.

Parameter	Symbol	Conditions	Remarks	Ratings			Unit
				min	typ	max	
Standby load current drain	IMO	$V_{\text{CC}} = 0\text{V}$ , $\text{VM} = 6\text{V}$	1			1.0	$\mu\text{A}$
Operating control current drain	IC1	When $V_{\text{CC}}$ is applied, with no load	2		0.85	1.2	mA
High-level input voltage	$V_{\text{IH}}$	$2.7 \leq V_{\text{CC}} \leq 5.5\text{V}$		$0.6 \times V_{\text{CC}}$		$V_{\text{CC}}$	V
Low-level input voltage	$V_{\text{IL}}$	$2.7 \leq V_{\text{CC}} \leq 5.5\text{V}$		0		$0.2 \times V_{\text{CC}}$	V
High-level input current (IN1, IN2, IN3, IN4)	$I_{\text{IH}}$	IN1, IN2, IN3, IN4 = 3V	3		15	25	$\mu\text{A}$
Low-level input current (IN1, IN2, IN3, IN4)	$I_{\text{IL}}$	IN1, IN2, IN3, IN4 = 0V	3	-1.0			$\mu\text{A}$
Pull-down resistance value (IN1-4)	RPD1			100	200	400	k $\Omega$
Charge pump voltage	VG	$V_{\text{CC}} + \text{VM}$		8.5	9.0	9.5	V
Output ON resistance 1	RON1	Sum of top and bottom sides ON resistance.	4		0.75	1.2	$\Omega$
Output ON resistance 2	RON2	Sum of top and bottom sides ON resistance. $V_{\text{CC}} = 2.8\text{V}$	4		1.0	1.5	$\Omega$
Low-voltage detection voltage	VCS	$V_{\text{CC}}$ pin voltage is monitored	5	2.15	2.30	2.45	V
Thermal shutdown temperature	Tth	Design guarantee value *	6	150	180	210	$^\circ\text{C}$
Output block	Turn-on time	TPLH	7		0.2	0.4	$\mu\text{S}$
	Turn-off time	TPHL	7		0.2	0.4	$\mu\text{S}$

\* : Design guarantee value and no measurement is performed.

### Remarks

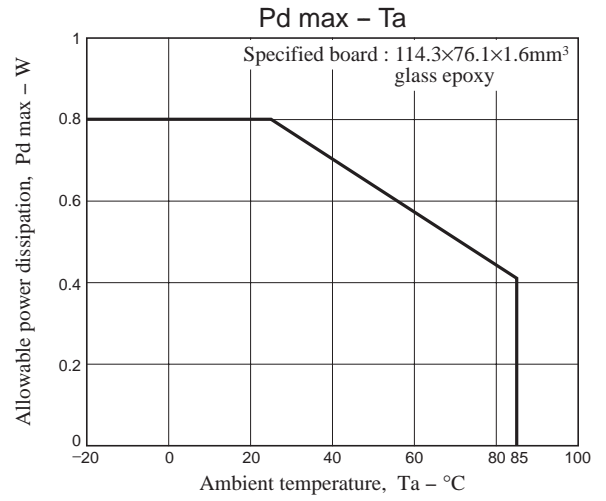
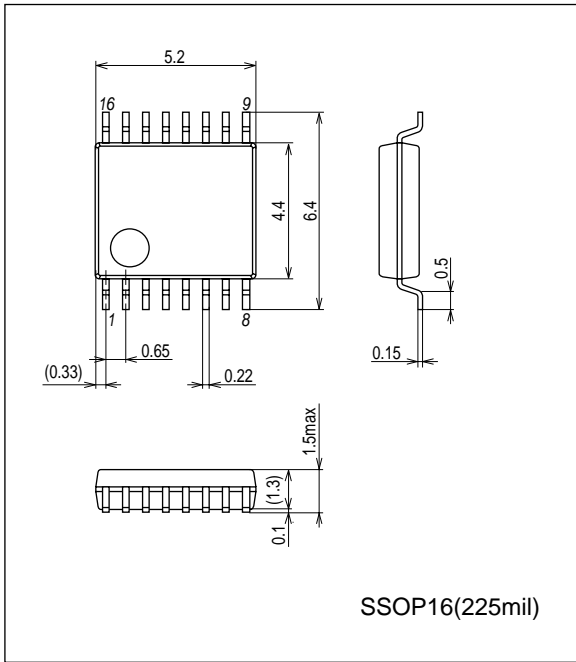
1. Current consumption when output at the VM pin is off.
2. Current consumption at the  $V_{\text{CC}}$  pin when  $V_{\text{CC}}$  is 3V and IN1 to IN4 are all 0V (standby mode).
3. Pins IN 1, 2, 3, and 4 are all pulled down.
4. Sum of upper and lower saturation voltages of OUT pin divided by the current.
5. All power transistors are turned off if a low  $V_{\text{CC}}$  condition is detected.
6. All output transistors are turned off if the thermal protection circuit is activated. They are turned on again as the temperature goes down.
7. Rising time from 10 to 90% and falling time from 90 to 10% are specified.

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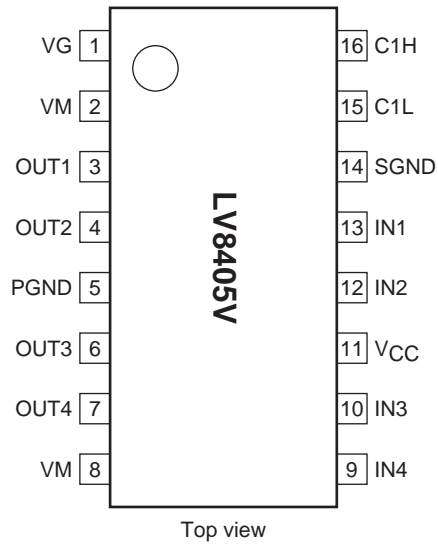
## Package Dimensions

unit : mm (typ)

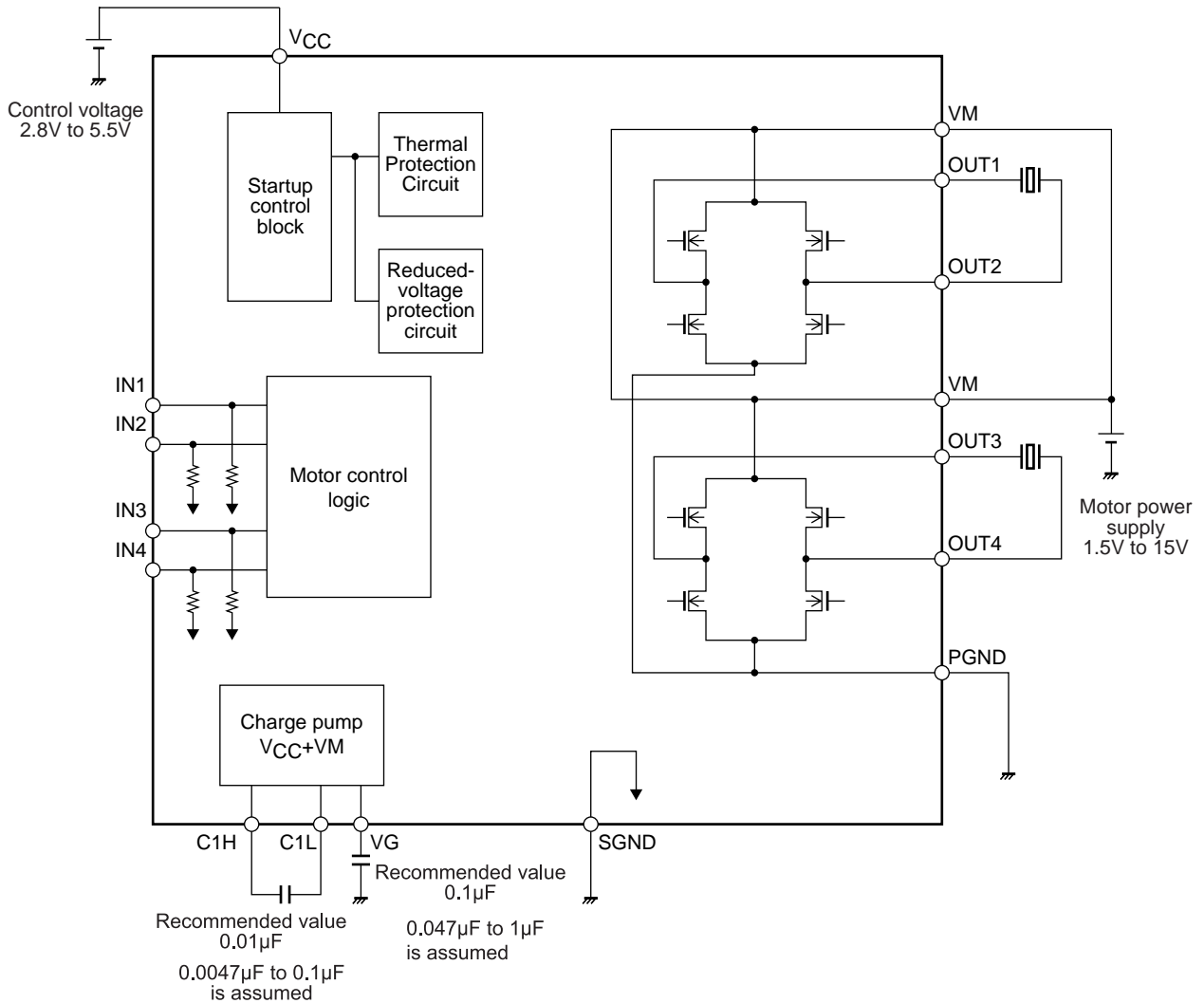
3178B



## Pin Assignment



Block Diagram



\* Connect a kickback absorption capacitor as near as possible to the IC. Coil kickback may cause increase in VM line voltage, and a voltage exceeding the maximum rating may be applied momentarily to the IC, which results in deterioration or damage of the IC

Truth Table

IN1 (IN3)	IN2 (IN4)	OUT1 (OUT3)	OUT2 (OUT4)	Charge pump	Mode
H	H	Z	Z	ON	Standby
H	L	L	H		Reverse
L	H	H	L		Forward
L	L	L	L		Brake

- : denotes a don't care value. Z : High-impedance

- The charge pump is always activated as long as V<sub>CC</sub> is applied.
- \* All power transistors turn off and the motor stops driving when the IC is detected in low voltage or thermal protection mode.

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## Pin Functions

Pin No.	Pin name	Description	Equivalent circuit
16 1	C1H VG	Step-up capacitor connection pin.	
13 12 10 9	IN1 IN2 IN3 IN4	Driver output switching. (Pull-down resistor incorporated)	
3 4 6 7	OUT1 OUT2 OUT3 OUT4	Driver output.	
2 8	VM	Motor block power supply.	
11	V <sub>CC</sub>	Logic block power supply.	
14	SGND	Control block ground.	
5	PGND	Driver block ground.	

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