Ordering number: ENA0907B

LV8013T

Bi-CMOS IC

Forward/Reverse Motor Driver

ON Semiconductor®

http://onsemi.com

Overview

LV8013T is a 1ch 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 (0.3Ω 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

- 1ch forward/reverse motor driver
- Low power consumption
- Built-in charge pump circuit
- Four mode function forward/reverse, brake, stop.
- Possible to respond to 3V control voltage and 6V motor voltage device
- Low ON resistance 0.5Ω
- Built-in low voltage reset and thermal shutdown circuit

Specifications

Maximum Ratings at Ta = 25°C, SGND = PGND = 0V

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage (For load)	VM max		-0.5 to 16	V
Supply voltage (For control)	V_{CC} max		-0.5 to 6.0	V
Output current	I_O max	DC	1.2	A
	I_O peak1	t ≤ 100ms, f = 5Hz	2.0	A
	I_O peak2	t ≤ 10ms, f = 5Hz	3.8	A
Input voltage	V_{IN} max		-0.5 to V_{CC}+0.5	V
Allowable power dissipation	Pd max	Mounted on a specified board *	800	mW
Operating temperature	Topr		-20 to +75	°C
Storage temperature	Tstg		-55 to +150	°C

*Specified board: 30mm × 50mm × 1.6mm, 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.

May, 2013

Allowable Operating Conditions at Ta = 25°C, SGND = PGND = 0V

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage (For load)	VM		2.0 to 15.0	V
Supply voltage (For control)	V_{CC}		2.7 to 5.5	V
Input signal voltage	V_{IN}		0 to V_{CC}	V
Input signal frequency	f max	Duty = 50%	200	kHz
Capacitor for charge pump	C1, C2, CVG1, CVG2		0.001 to 0.1	μF

Electrical Characteristics at Ta = 25°C, V_{CC} = 5.0V, VM = 12.0V, SGND = PGND = 0V, unless especially specified.

Parameter		Symbol	Conditions	Re-marks	Ratings			Unit
					min	typ	max	
Supply current for load at standby 1		IM1	EN = 0V	1			1.0	μA
Supply current for load at standby 2		IM2	V_{CC} = 0V, Each input = 0V	1			1.0	μA
Supply current for control at standby		ICO	EN = 0V, IN1 = IN2 = 0V	2	12.5	25	50	μA
Current drain during operation 1		IC1	V_{CC} = 3.3V, EN = 3.3V, VG at no load	3		0.6	1.0	mA
Current drain during operation 2		IC2	V_{CC} = 5.0V, EN = 5V, VG at no load	3		0.7	1.2	mA
H-level input voltage		V_{IH}	2.7V ≤ V_{CC} ≤ 5.5V		0.6×V_{CC}		V_{CC}	V
L-level input voltage		V_{IL}	2.7V ≤ V_{CC} ≤ 5.5V		0		0.2×V_{CC}	V
H-level input current (IN1, IN2, TIN)		I_{IH}	V_{IN} = 5V	4	12.5	25	50	μA
L-level input current (IN1, IN2, TIN)		I_{IL}	V_{IN} = 0V	4	-1.0			μA
Pull-up resistance (EN)		RUP		4	100	200	400	kΩ
Pull-down resistance (EN)		RDN		4	100	200	400	kΩ
Output ON resistance		RON	Sum of ON resistances at top and bottom	5		0.3	0.5	Ω
Charge pump voltage1		VG1	V_{CC}×2 - 5.4V CLAMP circuit	6	5.15	5.4	5.65	V
Charge pump voltage2		VG2	VM + VG1 Voltage raising circuit	6	17.1	17.4	17.6	V
Low-voltage detection operation voltage		VCS	V_{CC} voltage	7	2.1	2.25	2.4	V
Thermal shutdown operation temperature		Tth	Design guarantee	8	150	180	210	°C
Charge pump capacity 1		VG1LOAD	IG1 = 500μA	9	5.0	5.3		V
Charge pump capacity 2		VG2LOAD	IG2 = 500μA	9	16.0	16.5		V
IG current dissipation (Fin = 20kHz)		IG		10			350	μA
Charge pump start time		TVG	CVG = 0.1μF	11			1.0	ms
Output block	Turn on time	TPLH		12		0.5	1.0	μs
	Turn off time	TPHL		12		0.5	1.0	μs
TOUT	Turn on time	TON	C = 500pF	12		0.5	20	μs
	Turn off time	TOFF	C = 500pF	12		0.5	20	μs
TOUT output voltage H		TOH	C = 500pF		VG2-0.1	VG2		V
TOUT output voltage L		TOL	C = 500pF			0.05	0.1	V

* Design guarantee : This characteristics is not measured.
Refer to next page for remarks.

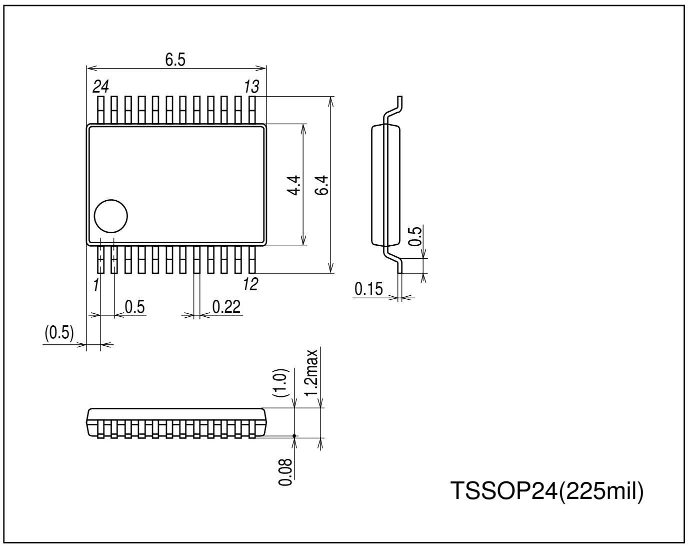
Remarks

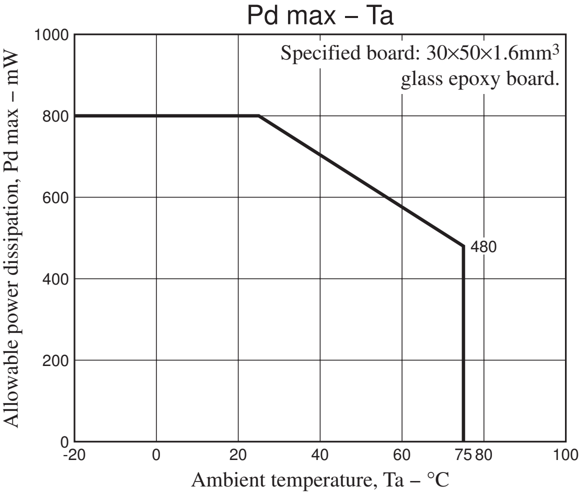
1. It shows current dissipation of VM pin in output OFF state.
2. It shows current dissipation of V_{CC} pin in stand-by state.
   (The standard current depends on EN pin pull-down resistor.)
3. It shows current dissipation of V_{CC} pin in state of EN = 5V (stand-by), including current dissipation of VG pin.
4. IN1, IN2 and TIN pin are built-in pull-down resistor, EN pin is built-in pull-up resistor.
5. It shows sum of upper and lower saturation voltages of OUT pin.
6. It controls charge-pump oscillation and makes specified voltage.
7. When low voltage is detected, the lower output is turned OFF.
8. When thermal protection circuit is activated, the lower output is turned OFF.
   When the heat temperature is fallen, it is turned ON again.
9. IG (VG pin load current) = 500µA
10. It shows VG pin current dissipation in state of PWM input for IN pin.
11. It specifies start-up time from 10% to 90% when VG is in non-load state
    (when setting the capacitor between VG and GND to 0.1µF and V_{CC} is 5V).
12. It specifies 10% to 90% for start-up and 90% to 10% for shut-down.

Package Dimensions

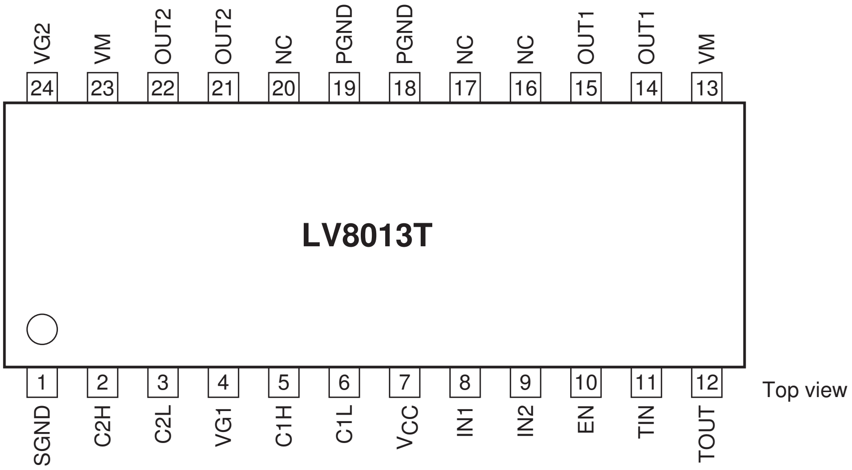
unit : mm (typ)

3260A

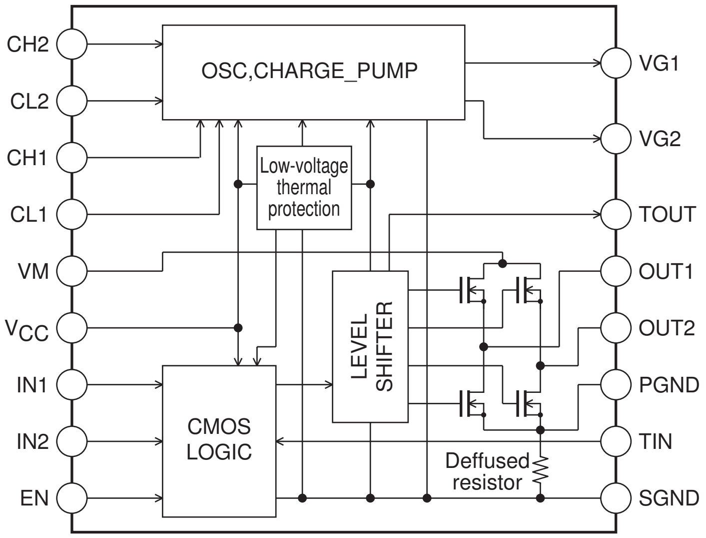




Pin Assignment



Block Diagram



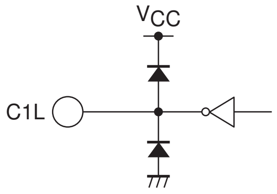
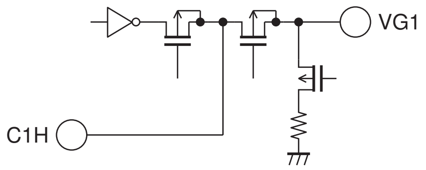
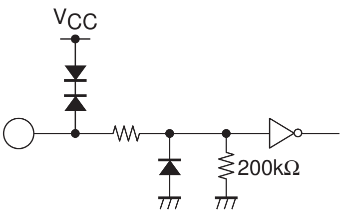
Truth Table

EN	IN1	IN2	TIN	OUT1	OUT2	TOUT	Charge Pump	Mode
H	H	H	-	L	L	-	ON	Brake
	H	L	-	H	L	-		Forward
	L	H	-	L	H	-		Reverse
	L	L	-	Z	Z	-		Standby
	-	-	L	-	-	L		Tr-OFF
	-	-	H	-	-	H		Tr-ON
L	-	-	-	L	L	L	OFF	Standby

- : Don't care, Z : High-Impedance

- Current drain becomes zero in the standby mode. (Leak current from EN pin is excluded)
- The output side becomes OFF, with motor drive stopped, during voltage reduction and thermal protection. Also, the charge of VG2 is discharged with an internal circuit at decreasing voltage.

Pin Function

Pin No.	Pin name	Function	Equivalent circuit
6	C1L	Voltage raising capacitor connection pin.	
5	C1H	Voltage raising capacitor connection pin.	
8 9 11	IN1 IN2 TIN	· Driver output changeover. · TOUT output control pin. (Built-in pull-down resistor)	

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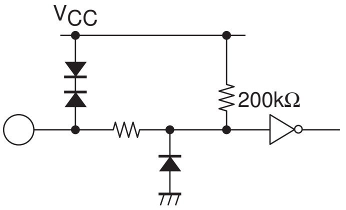
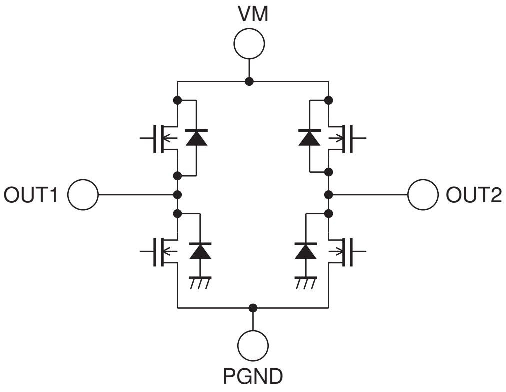
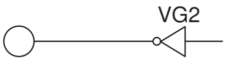
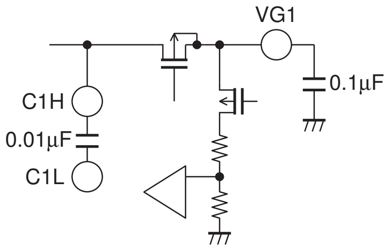
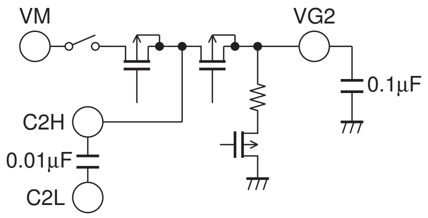
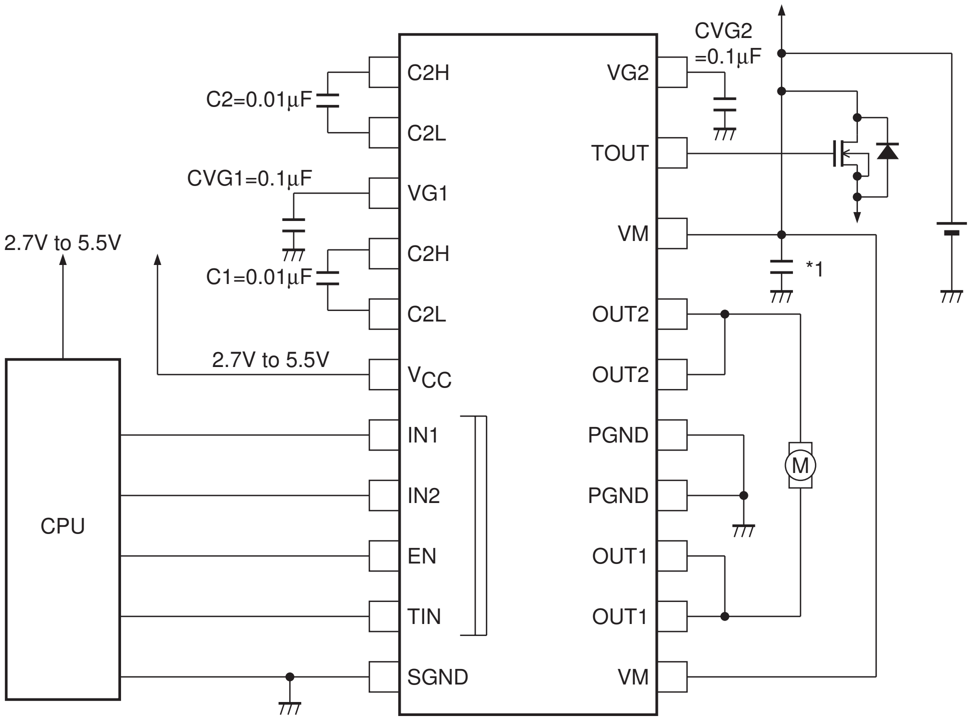
Pin No.	Pin name	Function	Equivalent circuit
10	EN	Logic enable pin. (Built-in pull-up resistor)	
14 15 21 22 18 19	OUT1 OUT1 OUT2 OUT2 PGND PGND	Driver output pin.	
12	TOUT	Voltage raising output pin.	
13 23	VM VM	Motor power supply. (both terminals to be connected)	
7	V_{CC}	Logic power supply.	
4	VG1	Voltage raising circuit 1. V_{CC} × 2 Clamped to 5.4V	
24 2 3	VG2 C2H C2L	· Voltage raising circuit 2. VM + VG1 · Voltage raising capacitor connection pin. VG2 is discharged in abnormal.	
1	SGND	Logic GND	
18 19	PGND PGND	Driver GND (both terminals to be connected)	

Application Circuit Example



*1 : Connect a kickback absorption capacitor directly near IC. Coil kick-back may cause rise of the voltage of VM line, and the voltage exceeding the maximum rating may be applied momentarily, resulting in deterioration or damage of IC.

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