Ordering number : ENA1134A

# LV8014T

#### **Bi-CMOS LSI**

## Forward/Reverse Motor Driver



http://onsemi.com

#### Overview

LV8014T 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
- Built-in charge pump circuit
- Compact TSSOP-24 package
- Possible to respond to 3V control voltage and 6V motor voltage device
- Low ON resistance  $1.2\Omega$
- Built-in low voltage reset and thermal shutdown circuit
- Four mode function forward/reverse, brake, stop.

#### **Specifications**

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage (For load)	VM1, 2 max		-0.5 to 7.5	V
Supply voltage (For control)	V <sub>CC</sub> max		-0.5 to 6.0	V
Output current	I <sub>O</sub> max	t ≤ 100ms	1.4	Α
Output peak current	I <sub>O</sub> max2	t ≤ 10ms	2.5	Α
Input voltage	V <sub>IN</sub> max		-0.5 to V <sub>CC</sub> +0.5	V
Allowable dissipation	Pd max	* Mounted on a substrate	800	mW
Operating temperature	Topr		-20 to +75	°C
Storage temperature	Tstg		-55 to +150	°C

<sup>\*:</sup> Mounted on a substrate: 30×50×1.6mm³, 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 Ratings at Ta = 25°C, SGND = PGND = 0V

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage (VM Pin)	VM		2.0 to 7.0	V
Supply voltage (V <sub>CC</sub> Pin)	Vcc		2.7 to 5.5	V
Input signal voltage	V <sub>IN</sub>		0 to V <sub>CC</sub>	V
Input signal frequenc	f max		100	kHz
Capacitor for charge pump	C1, C2, C3		0.001 to 0.1	μF

#### **Electrical Characteristics** at Ta = 25°C, V<sub>CC</sub> = VM1 = VM2 = 5.0V, SGND = PGND = 0V, unless especially specified.

Parameter	Cumphal	O a malikia ma	Remarks	Ratings			1.1
Parameter	Symbol	Conditions		min	typ	max	Unit
Supply current for load at standby	IMO	EN = 0V	1			1.0	μΑ
Supply current for control at	ICO	EN = 0V,	2			1.0	μΑ
standby		IN1 = IN2 = IN3 = IN4 = 0V					
Current drain during operation	IC1	EN = 5V, VG at no load	3		0.7	1.2	mA
H-level input voltage	$V_{IH}$	2.7V ≤ V <sub>CC</sub> ≤ 5.5V		0.6×V <sub>CC</sub>		Vcc	٧
L-level input voltage	$V_{IL}$	$2.7V \le V_{CC} \le 5.5V$		0		0.2×V <sub>CC</sub>	٧
H-level input current (IN1, IN2, IN3, IN4)	İΗ		4			1.0	μА
L-level input current (IN1, IN2, IN3, IN4)	Iμ		4	-1.0			μА
Pull-down resistance (EN1, 2)	RUP			100	200	400	kΩ

#### $Ta = 25^{\circ}C, V_{CC} = VM = 5.0V, SGND = PGND = 0V$

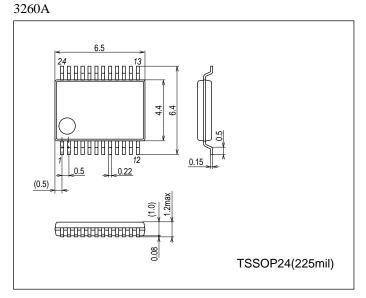
Parameter		Complete al	O and distance	Remarks	Ratings			11-2
		Symbol	Conditions		min	typ	max	Unit
Output ON resi	Output ON resistance		Sum of ON resistances at top and	5		0.75	1.2	Ω
			bottom					
Charge pump v	voltage	VG		6	8.5		10.5	V
Low-voltage de	tection operation	VCS		7	2.15	2.30	2.45	V
voltage	voltage							
Thermal shutdown operation		Tth		8		180		°C
temperature								
Charge pump capacity		VGLOAD		9	8	9		V
$(IG = 500\mu A)$								
IG current dissipation (Fin = 20kHz)		IG		10			350	μΑ
Charge pump start time		TVG	CVG = 0.1µF	11			1.0	ms
Output block	Turn on time	TPLH		12		0.2	0.4	μs
	Turn off time	TPHL		12		0.2	0.4	μs

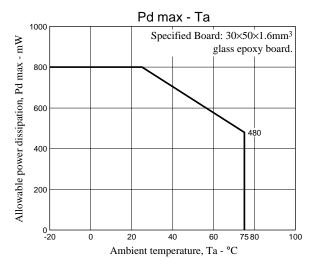
#### Remarks

- 1. It shows current dissipation of VM1, VM2 pin in output OFF state.
- 2. It shows current dissipation of V<sub>CC</sub> pin in stand-by state. (The standard current depends on EN pin pull-down resistance.)
- 3. It shows current dissipation of  $V_{CC}$  pin in state of EN = 5V (stand-by), including current dissipation of  $V_{CC}$  pin.
- 4. For IN1, IN2, IN3 and IN4 pins, no pull-down and pull-up resistance is needed. (High impedance pin)
- 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) =  $500\mu$ A
- 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  $0.1\mu F$  and  $V_{CC}$  is 5V).
- 12. It specifies 10% to 90% for start-up and 90% to 10% for shut-down.

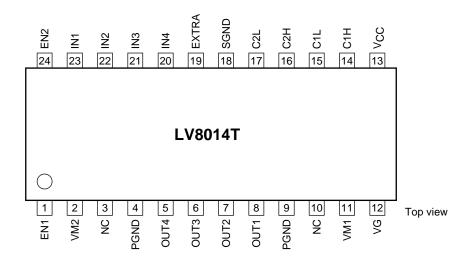
#### **Package Dimensions**

unit: mm (typ)

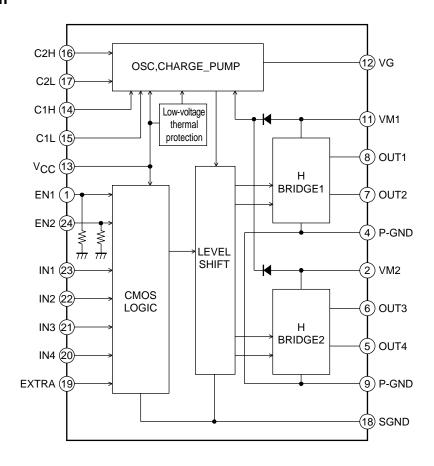




## **Pin Assignment**



## **Block Diagram**



### **Truth table**

	•						
EXTRA	EN1 (EN2)	IN1 (IN3)	IN2 (IN4)	OUT1 (OUT3)	OUT2 (OUT4)	Circuit of Charge Pump	Mode
L	Н	Н	Н	Z	Z	ON	Standby
		Н	L	L	Н		Reverse
		L	Н	Н	L		Forward
		L	L	L	L		Brake
	L	-	-	L	L	OFF	Standby
Н	Н	Н	-	L	Н	ON	Reverse
		L	-	Н	L		Forward
	L	-	-	L	L		Brake

-: Don't care Z: High-Impedance

<sup>\*</sup> Current drain becomes zero in the standby mode.

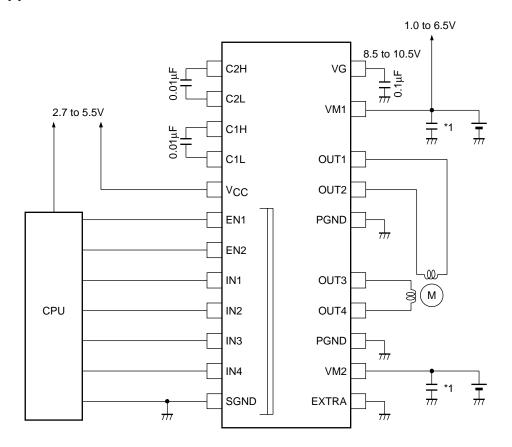
<sup>\*</sup> The output side becomes OFF, with motor drive stopped, during voltage reduction and thermal protection.

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#### **Pin Functions**

Pin Fun			
Pin No.	Pin name	Function	Equivalent Circuit
15	C1L	Voltage raising capacitor connection pin	Vcc
17	C2L		· · · · · · · · · · · · · · · · · · ·
			<b>*</b>
			$\frac{m}{}$
14	C1H	Voltage raising capacitor connection pin	
16	C2H		- □ VG
			C1H
			C2H O
23	IN1	Driver output changeover	VCC
22	IN2		<u> </u>
21 20	IN3 IN4		<b>*</b>
19	EXTRA		
19	EAIRA		
			Ţ,
			$\pi$
1	EN1	Logic enable pin	V <sub>CC</sub>
24	EN2	TOUT output control pin	<u> </u>
		(Pull-down resistor incorporated)	<b>*</b>
			<b>★</b> ₹200kO
			* 200kΩ
-	OUT4	Bi a di di	
8 7	OUT1 OUT2	Driver output pin	VM
6	OUT3		$\bigcirc$
5	OUT4		
	PGND		
			<b>→ ★ ★ →</b>
			OUT
			PGND
	1/140	Materia	
2 11	VM2 VM1	Motor power supply	
13	V <sub>CC</sub>	Logic power supply	
12	VG	Driver drive circuit power supply	VG
			VG
			\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\
			C2H
			0.01μF 🛨 📡 揃
			C2L \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
			\\ \frac{2}{111}
10	201:-	L OND	···
18	SGND	Logic GND	
9	PGND	Driver GND	
4	PGND	(both terminals to be connected)	
	I OND	(2011 IOITIMIAIS IO DE COMMECTEU)	1

#### **Sample Application Circuit**



\*1 : Connect a kickback absorption capacitor directly near IC. Coil kickback 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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