Ordering number : ENA1385A

LV8400V

Bi-CMOS IC
Forward/Reverse Motor Driver

ON Semiconductor®

http://onsemi.com

Overview

The LV8400V is a 1-channel motor driver IC using D-MOS FET for output stage and operates in one of the four modes under program control: forward, reverse, brake, and standby.

As the P/N-channel structure is used in the H-bridge output stage, the LV8400V features minimal number of external component and low on-resistance (0.33Ω typical). This IC is optimal for driving motors that need large-current.

Functions

- 1-channel forward/reverse motor driver
- Low power consumption
- Low output ON resistance 0.33Ω
- Built-in constant current output circuit
- Built-in low voltage reset and thermal shutdown circuit
- Four mode function forward/reverse, brake, standby.

Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage (for load)	VM 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	DC	1.2	A
	I_O peak1	t ≤ 100ms, f = 5Hz	2.0	A
	I_O peak2	t ≤ 10ms, f = 5Hz	3.8	A
	I_{OUT} max	DC	30	mA
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 +85	°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.

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.

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

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage (for load)	VM		4.0 to 15.0	V
Power 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

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

Parameter	Symbol	Conditions	Remarks	Ratings			Unit
				min	typ	max	
Standby load current drain 1	IMO1	EN = 0V	1			1.0	μA
Standby load current drain 2	IMO2	EN = 0V, V_{CC} = 0V, Each input pin = 0V	1			1.0	μA
Standby control current drain	ICO	EN = 0V, IN1 = IN2 = 0V	2			1.0	μA
Operating load current drain 1	IM1	V_{CC} = 3.3V, EN = 3.3V	3		0.35	0.70	mA
Operating load current drain 2	IM2	V_{CC} = 5.0V, EN = 5.0V	3		0.35	0.70	mA
Operating current consumption 1	IC1	V_{CC} = 3.3V, EN = 3.3V	4		0.6	1.2	mA
Operating current consumption 2	IC2	V_{CC} = 5.0V, EN = 5.0V	4		0.8	1.6	mA
High-level input voltage	V_{IH}	2.7 ≤ V_{CC} ≤ 5.5V		0.6×V_{CC}		V_{CC}	V
Low-level input voltage	V_{IL}	2.7 ≤ V_{CC} ≤ 5.5V		0		0.2×V_{CC}	V
High-level input current (EN,IN1, IN2, ICTRL)	I_{IH}	V_{IN} = 5V	5	12.5	25	50	μA
Low-level input current (EN,IN1, IN2, ICTRL)	I_{IL}	V_{IN} = 0V	5	-1.0			μA
Pull-down resistance value (EN,IN1, IN2, ICTRL)	R_{DN}			100	200	400	kΩ
Output ON resistance	R_{ON}	Sum of top and bottom sides ON resistance. 2.7V ≤ V_{CC} ≤ 5.5V	6		0.33	0.5	Ω
Constant current output leakage current	I_OLEAK	EN = 0V	7			1.0	μA
Output constant current	I_{OUT}	RSET = 40Ω, Internal reference = 0.2V	8	4.65	5.00	5.35	mA
ISET pin voltage	V_{ISET}	RSET = 40Ω	9	0.186	0.20	0.214	V
Constant current output ON resistance	R_{ON}IO	RSET = 0Ω, I_O = 5mA	10		20	30	Ω
Low-voltage detection voltage	VCS	V_{CC} voltage	11	2.10	2.25	2.40	V
Thermal shutdown temperature	Tth	Design guarantee *	12	150	180	210	°C
Output block Turn-on time	TPLH		13		0.5	1.0	μs
Output block Turn-off time	TPHL		13		0.5	1.0	μs

* Design guarantee value and no measurement is performed.

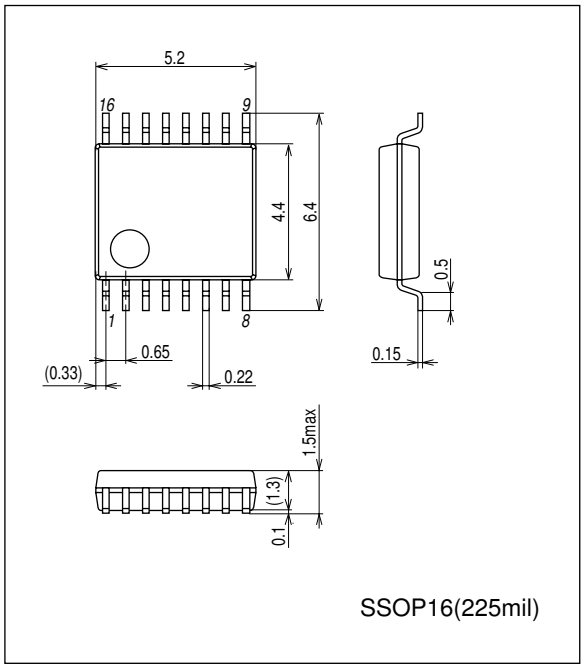
Remarks

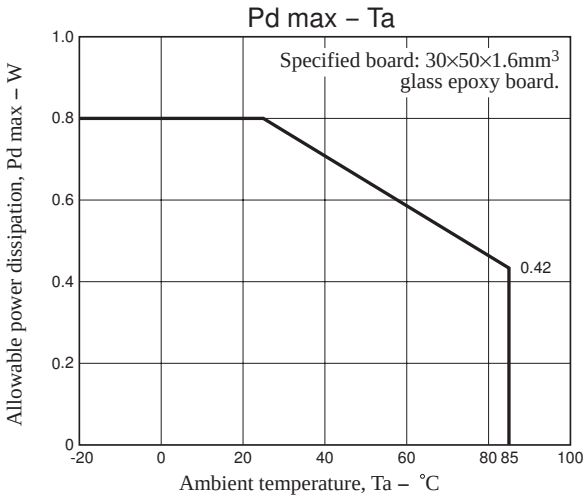
1. Current consumption when output at the VM pin is off.
2. Current consumption at the V_{CC} pin when in all function stop.
3. Current consumption at the VM pin when EN is high.
4. Current consumption at the V_{CC} pin when EN is high.
5. These input pins (EN, IN1, IN2, and ICTRL) have an internal pull-down resistor.
6. Sum of the top and bottom side output on resistance.
7. Leakage current when the constant current output is off.
8. Current value that is determined by dividing the internal reference voltage (0.2V) by RSET.
9. ISET pin voltage when the constant current output block is active.
10. ON resistance value of the constant current output block.
11. All output transistors are turned off if a low-voltage is detected.
12. All output transistors are turned off if the thermal protection circuit is activated. They are turned on again as the temperature goes down.
13. Rising time from 10 to 90% and falling time from 90 to 10% are specified.

Package Dimensions

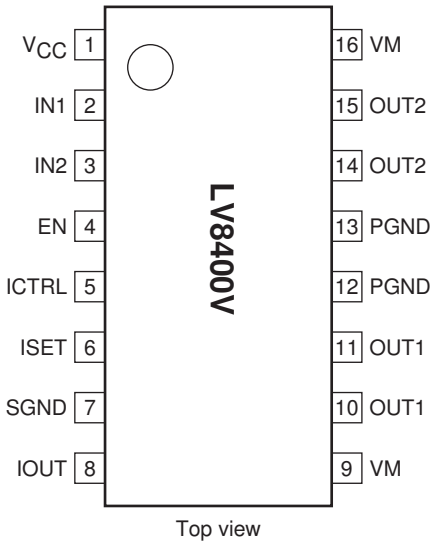
unit : mm (typ)

3178B

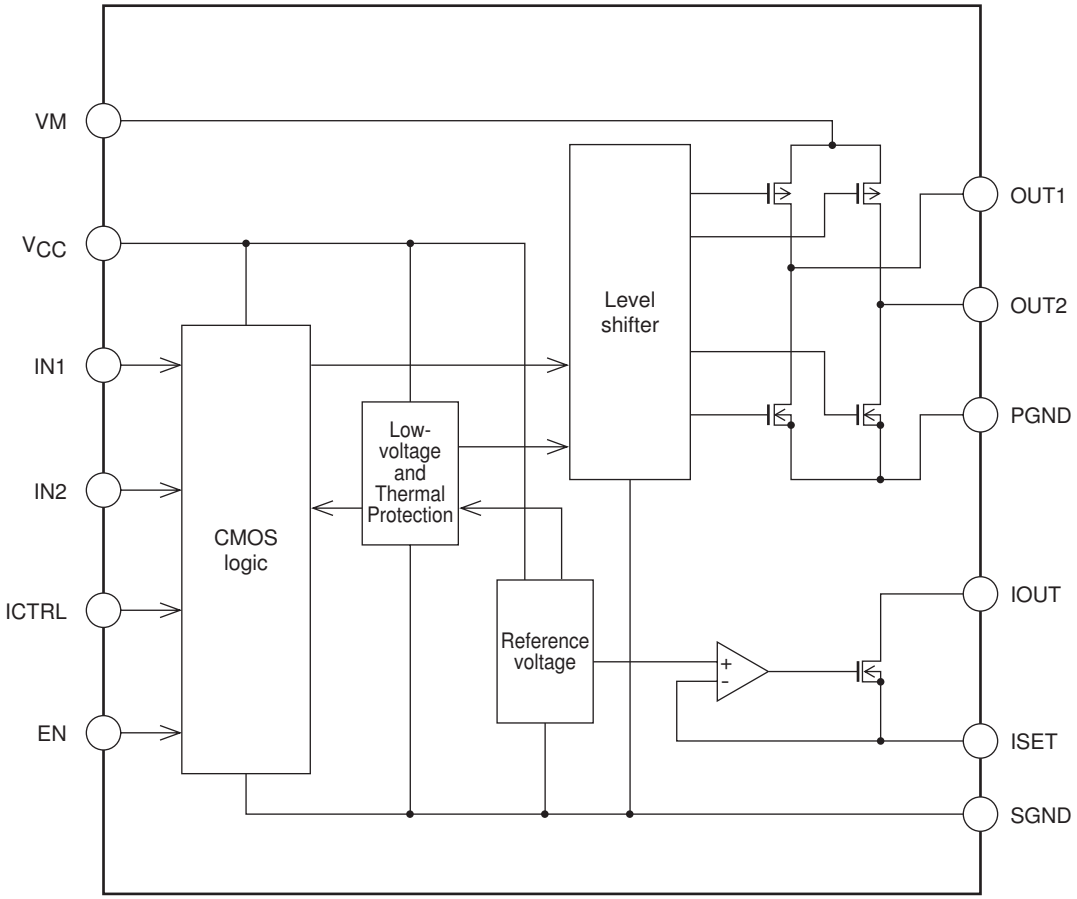




Pin Assignment



Block Diagram



Truth Table

EN	IN1	IN2	OUT1	OUT2	Mode
H	H	H	L	L	Brake
	H	L	H	L	Forward
	L	H	L	H	Reverse
	L	L	Z	Z	Standby
L	-	-	Z	Z	All function stop

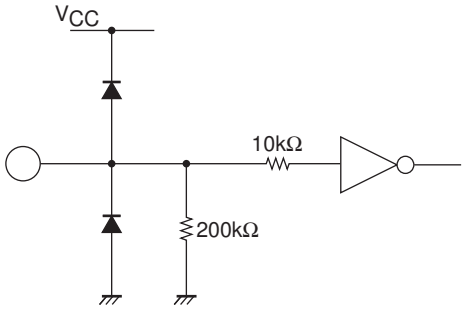
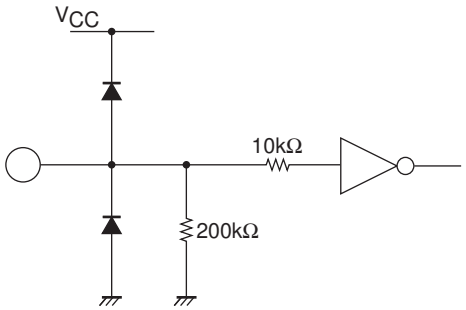
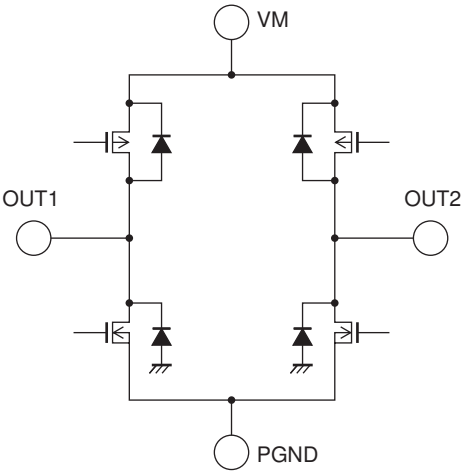
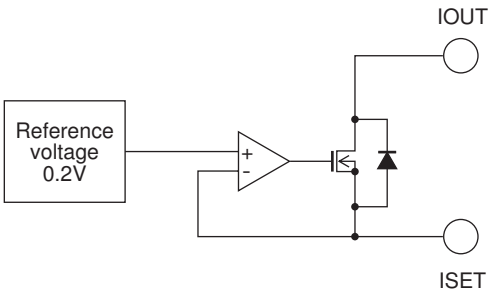
EN	ICTRL	IOUT	Mode
H	H	ON	Constant current ON
	L	Z	Constant current OFF
L	-	Z	All function stop

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

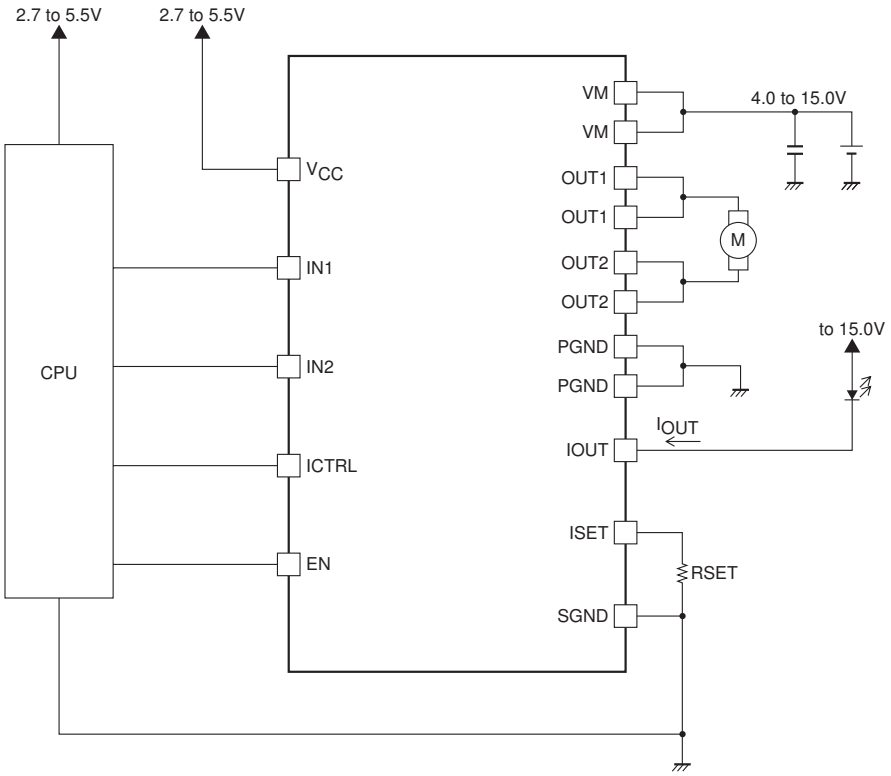
• Current drain is zero in all function stop mode. (excluding the current that flows out of the EN pin)

* All power transistors turn off and the motor stops driving when the IC is detected in low voltage or thermal protection mode.

Pin Functions

Pin No.	Pin name	Description	Equivalent circuit
9 16	VM	Motor block power supply. (Both pins must be connected)	
1	V_{CC}	Logic block power supply.	
4	EN	Logic enable pin. (Pull-down resistor incorporated)	
2 3 5	IN1 IN2 ICTRL	Driver output switching. (Pull-down resistor incorporated)	
10 11 14 15	OUT1 OUT2 	Driver output.	
6 8	ISET IOUT	Constant current output.	
7	SGND	Logic block ground.	
12 13	PGND	Driver block ground. (Both pins must be connected)	

Sample Application Circuit



*1 : Connect a kickback absorbing capacitor as close as possible to the IC. Characteristics deterioration of the IC or damage may result if an instantaneous voltage surge exceeding the maximum rated value is applied to the VM line due to coil kickback or other causes.

*2 : The output constant current (I_{OUT}) is determined by the internal reference voltage and the sense resistor between the ISET and SGND pins.

I_{OUT} = Internal reference voltage (0.2V) ÷ Sense resistor (RSET)

From the formula above, I_{OUT} = 5mA when a sense resistor of 40Ω is connected between the ISET and SGND.