

SANYO Semiconductors DATA SHEET

An ON Semiconductor Company

LV8761V — Forward/Reverse H-bridge Driver

Overview

The LV8761V is an H-bridge driver that can control four operation modes (forward, reverse, brake, and standby) of a motor. The low on-resistance, zero standby current, highly efficient IC is optimal for use in driving brushed DC motors for office equipment.

Features

- Forward/reverse H-bridge motor driver: 1 channel
- Built-in current limiter circuit
- Built-in thermal protection circuit
- Built-in short-circuit protection function
- Unusual condition warning output pin
- Short-circuit protection circuit selectable from latch-type or auto reset-type

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	VM max		38	V
	V _{CC} max		6	V
Output peak current	I _O peak	tw ≤ 20ms, duty 5%	4	Α
Output continuous current	I _O max		3	А
Logic input voltage	V _{IN}		-0.3 to V _{CC} +0.3	V
Allowable power dissipation	Pd max	Mounted on a specified board. *	3.15	W
Operating temperature	Topr		-20 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

^{*} Specified circuit board: 90mm×90mm×1.6mm, glass epoxy 2-layer board (2S0P), with backside mounting.

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Allowable Operating Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage range	VM		9 to 35	V
	VCC		3 to 5.5	V
VREF input voltage	VREF		0 to V _{CC} -1.8	V
Logic input voltage	V _{IN}		0 to V _{CC}	V

Electrical Characteristics at Ta = 25°C, VM = 24V, $V_{CC} = 5V$, VREF = 1.5V

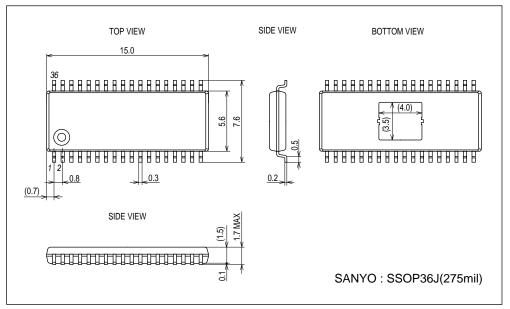
D	0	O a different	Ratings			1.1-4
Parameter	Symbol	Symbol Conditions		typ	max	Unit
General						
Standby mode current drain 1	IMst	PS = "L"			1	μΑ
Standby mode current drain 2	I _{CC} st	PS = "L"			1	μΑ
Operating mode current drain 1	IM	PS = "H", IN1 = "H", with no load		1	1.3	mA
Operating mode current drain 2	Icc	PS = "H", IN1 = "H", with no load		3	4	mA
VREG output voltage	VREG	I _O = -1mA	4.75	5	5.25	V
V _{CC} low-voltage cutoff voltage	VthV _{CC}		2.5	2.7	2.9	V
Low-voltage hysteresis voltage	VthHIS		120	150	180	mV
Thermal shutdown temperature	TSD	Design guarantee *	155	170	185	°C
Thermal hysteresis width	ΔTSD	Design guarantee *		40		°C
Output block	1	•		,		
Output on resistance	Ron1	I _O = 3A, sink side		0.2	0.25	Ω
	Ron2	I _O = -3A, source side		0.32	0.40	Ω
Output leakage current	l _O leak	V _O = 35V			50	μА
Rising time	tr	10% to 90%		200	500	ns
Falling time	tf	90% to 10%		200	500	ns
Input output delay time	tpLH	IN1 or IN2 to OUTA or OUTB (L \rightarrow H)		550	700	ns
	tpHL	IN1 or IN2 to OUTA or OUTB (H \rightarrow L)		550	700	ns
Charge pump block	· I			<u> </u>	<u> </u>	
Step-up voltage	VGH	VM = 24V 28.		28.7	29.8	V
Rising time	tONG	VG = 0.1μF		250	500	μS
Oscillation frequency	Fcp		115	140	165	kHz
Control system input block					•	
Logic pin input current 1	I _{IN} L	V _{IN} = 0.8V adaptive pin : PS	5.6	8	10.4	μΑ
	I _{IN} H	V _{IN} = 5V adaptive pin : PS	56	80	104	μΑ
Logic pin input current 2	I _{IN} L	V _{IN} = 0.8V adaptive pin : IN1, IN2, EMM	5.6	8	10.4	μА
	I _{IN} H	V _{IN} = 5V adaptive pin : IN1, IN2, EMM	35	50	65	μА
Logic pin input H-level voltage	V _{IN} H	adaptive pin : PS, IN1, IN2, EMM	2.0			V
Logic pin input L-level voltage	V _{IN} L	adaptive pin : PS, IN1, IN2, EMM			0.8	V
Current limiter block	· II			l.		
VREF input current	IREF		-0.5			μА
Current limit comparator Vthlim		VREF = 1.5V	0.285	0.3	0.315	V
threshold voltage						
Short-circuit protection block	1					
SCP pin charge current	Iscp	SCP = 0V	3.5	5	6.5	μΑ
Comparator threshold voltage	Vthscp		0.8	1	1.2	V
EMO output saturation voltage	Vemo	I _O = 500μA		0.3	0.4	V

^{*} Design guarantee value and no measurement is made.

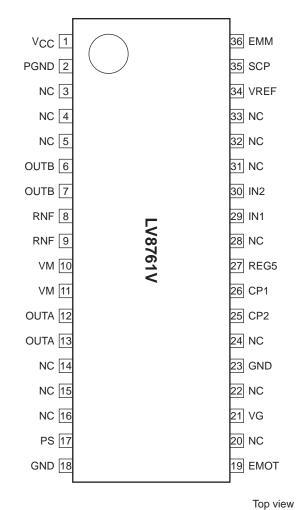
Package Dimensions

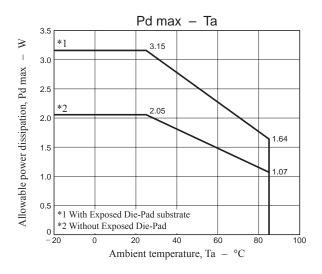
unit: mm (typ)

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Pin Assignment



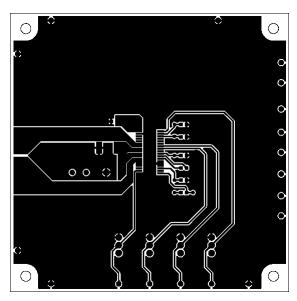


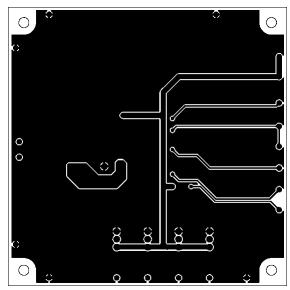
Substrate Specifications (Substrate recommended for operation of LV8761T)

Size : $90\text{mm} \times 90\text{mm} \times 1.6\text{mm}$ (two-layer substrate [2S0P])

Material : Glass epoxy

Copper wiring density : L1 = 95% / L2 = 95%





L1: Copper wiring pattern diagram

L2: Copper wiring pattern diagram

Cautions

- 1) The data for the case with the Exposed Die-Pad substrate mounted shows the values when 90% or more of the Exposed Die-Pad is wet.
- 2) For the set design, employ the derating design with sufficient margin.

Stresses to be derated include the voltage, current, junction temperature, power loss, and mechanical stresses such as vibration, impact, and tension.

Accordingly, the design must ensure these stresses to be as low or small as possible.

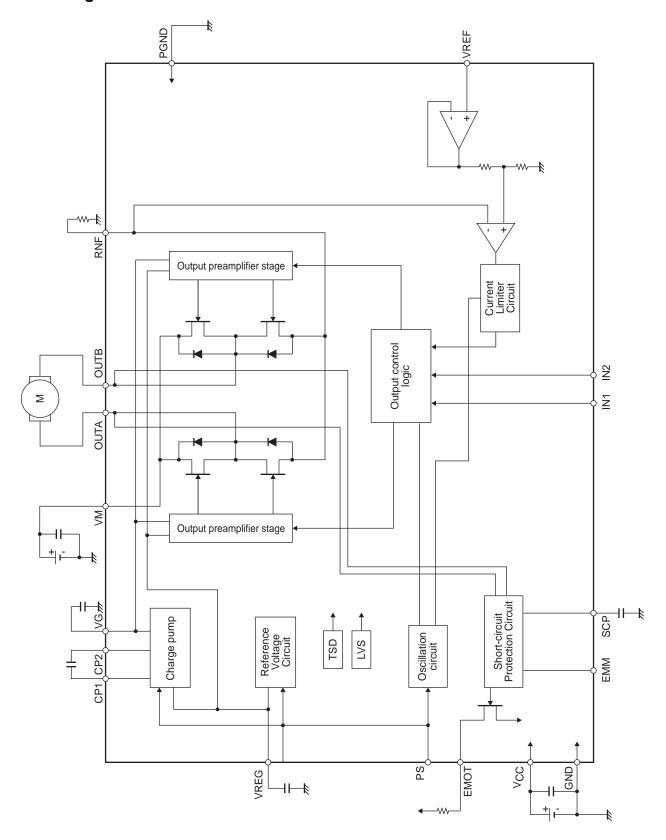
The guideline for ordinary derating is shown below:

- (1)Maximum value 80% or less for the voltage rating
- (2)Maximum value 80% or less for the current rating
- (3)Maximum value 80% or less for the temperature rating
- 3) After the set design, be sure to verify the design with the actual product.

Confirm the solder joint state and verify also the reliability of solder joint for the Exposed Die-Pad, etc.

Any void or deterioration, if observed in the solder joint of these parts, causes deteriorated thermal conduction, possibly resulting in thermal destruction of IC.

Block Diagram



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Pin Functions

Pin Fur	ictions		
Pin No.	Pin Name	Pin Functtion	Equivalent Circuit
29	IN1	Output control signal input pin 1.	
30	IN2	Output control signal input pin 2.	Vcc O +
36	EMM	Short-circuit protection circuit mode	
30	EIVIIVI		
		switching pin.	<u></u>
			↑
			10kΩ
			Δ \$100kΩ + -
			\$ 100K22 1
			GND O
17	PS	Power save signal input pin.	VCC O
			VCC 0-
]+
			1
			↑
			50kΩ ξ
			10kΩ
			1000
			10kΩ
			50kΩ \$
			30,423
			GND O
34	VREF	Reference voltage input pin for output	Vcc O
		current limit setting.	
			5000
			500Ω
			*
		I	
			GND O
35	SCP	Short-circuit protection circuit detection	
35	SCP	Short-circiut protection circuit, detection	GND O VCC O TOTAL CONTRACTOR OF THE PROPERTY O
35	SCP	Short-circiut protection circuit, detection time setting capacitor connection pin.	
35	SCP		Vcc o
35	SCP		
35	SCP		Vcc o
35	SCP		Vcc o
35	SCP		Vcc o
35	SCP		Vcc o
35	SCP		Vcc o
35	SCP		ν _{CC} ο
35	SCP		Vcc o
		time setting capacitor connection pin.	ν _{CC} ο
35	SCP		ν _{CC} ο

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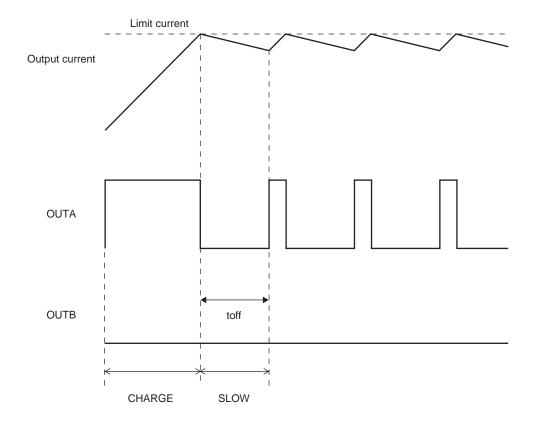
10, 11 V 12, 13 C 8, 9 R 6, 7 C	Pin Name /M DUTA RNF DUTB PGND	Pin Function Motor power-supply connection pin. OUTA output pin. Current sense resistor connection pin. OUTB output pin. Power ground.	REG5 0 12 16 6
12, 13 C 8, 9 R 6, 7 C	OUTA RNF OUTB	OUTA output pin. Current sense resistor connection pin. OUTB output pin.	
			13 500Ω 2 8 9
25 C	CP1 CP2 /G	Charge pump capacitor connection pin. Charge pump capacitor connection pin. Charge pump capacitor connection pin.	REG5 Ο 10(1) (25) (21) (10(1) (25) (25) (10(1) (25) (25) (25) (25) (25) (25) (25) (25
27 R	REG5	Internal reference voltage output pin.	$VM \circ$ $25k\Omega$ $25k\Omega$
19	EMOT	Unusual condition warning output pin.	V _{CC} Ο 500Ω W

DC Motor Driver

1.DCM output control logic

Contol Input			Output		Mode
PS	IN1	IN2	OUTA	OUTB	Wode
L	*	*	OFF	OFF	Standby
Н	L	L	OFF	OFF	Output OFF
Н	Н	L	Н	L	CW (forward)
Н	L	Н	L	Н	CCW (reverse)
Н	Н	Н	L	L	Brake

2. Current limit control timing chart



Braking operation time in current limit mode can be set by connecting a capacitor between SCP and GND pins. This setting is the same as the time setting required to turn off the outputs when an output short-circuit occurs as explained in the section entitled "Output Short-circuit Protection Function." See "Output Short-circuit Protection Function," for the setting procedure.

3. Setting the current limit value

The current limit value of the DCM driver is determined by the VREF voltage and the resistance (RNF) connected across the RNF and GND pins using the following formula:

Ilimit [A] =
$$(VREF [V] /5) /RNF [\Omega])$$

Assuming VREF = 1.5V, RNF = 0.2
$$\Omega$$
, the current limit is : Ilimit = 1.5V/5/0.2 Ω = 1.5A

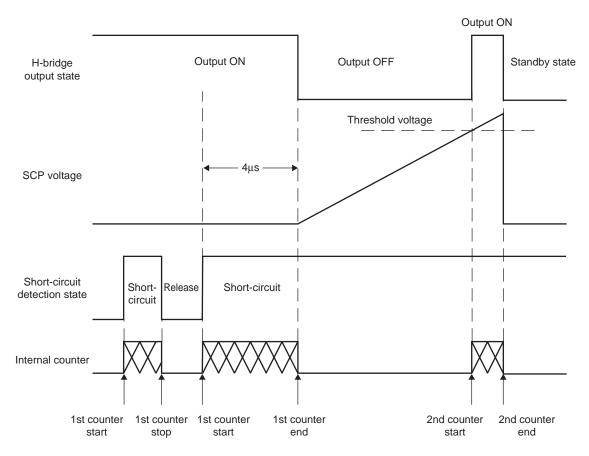
Output short-circuit protection function

The LV8761V incorporates an output short-circuit protection circuit that turns off the output to prevent the IC from fatal damage when the output is short-circuited due to short-to-power or short-to-ground fault. Either the "latch-type," in which the output off state is latched when the short-circuit protection circuit is activated, or "auto reset-type," in which the output on/off states are repeated when the short-circuit protection circuit is activated, can be selected.

EMM Pin	Short-circuit Protection Mode		
L	Latch type		
Н	Auto reset type		

1. Protection function operation (Latch method)

The short-circuit protection circuit is activated when it detects the output short-circuit state. If the short-circuit state continues for the internally preset period ($\approx 4\mu s$), the protection circuit turns off the output from which the short-circuit state has been detected. Then it turns the output on again after a lapse of the timer latch time described later. If the short-circuit state is still detected, it changes all the outputs to the standby mode and retains the state. The latched state is released by setting the PS to L.



2. How to set the SCP pin constant (timer latch-up setting)

The user can set the time at which the outputs are turned off when a short-circuit occurs by connecting a capacitor across the SCP and GND pins. The value of the capacitor can be determined by the following formula:

Timer latch-up : Tocp Tocp $\approx C \times V/I$ [s]

V : Comparator threshold voltage (1V typical)

I : SCP charge current (5μA typical)

When a capacitor with a capacitance of 50pF is connected across the SCP and GND pins, for example, Tscp is calculated as follows:

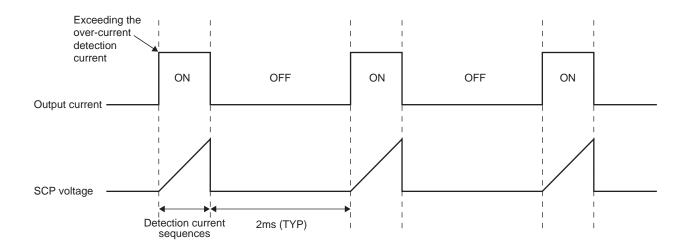
Tscp =
$$50pF \times 1V/5\mu A = 10\mu s$$

3. Auto Reset Type

The sequences up to the detection of an output short-circuit state are identical to those which are explained in Section 1, "Protection Function Operation (Latch Type).

After output is turned off on detection of an output short-circuit condition, the internal counter starts counting and repeats turning on and off the output as shown in the figure below.

This state continues until the overcurrent state is eliminated.



4. Unusual Condition Warning Output Pin (EMOT)

The LV8761V is provided with the EMOT pin which notifies the CPU of an unusual condition if the protection circuit operates by detecting an abnormal condition of the IC. This pin is of the open-drain output type and requires a pull-up resistor when to be used.

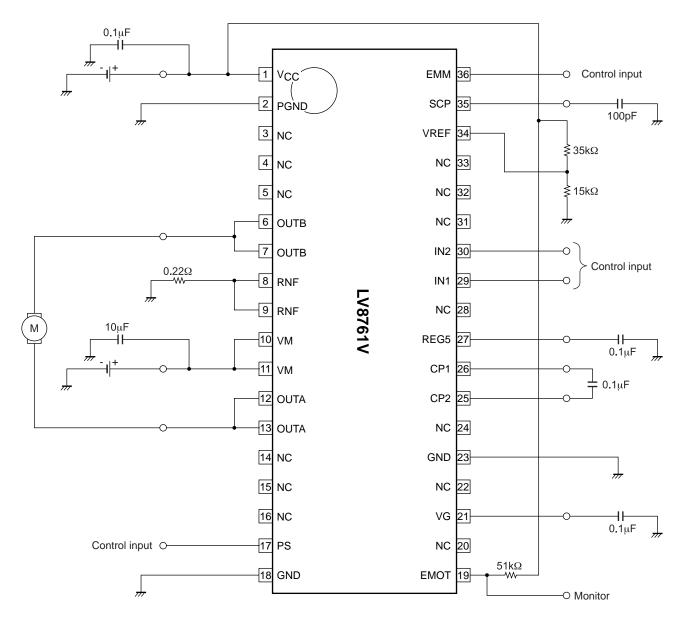
The EMOT pin is placed in the ON state when one of the following conditions occurs.

- 1. Shorting-to-power or shorting-to-ground occurs at the output pin and the output short-circuit protection circuit is activated.
- 2. The IC junction temperature rises and the thermal protection circuit is activated.

The EMOT pin is set to the OFF state when the relevant protection operation is eliminated.

Application Circuit Example

(When you use the current limit function)



Setting the current limit value

When
$$V_{CC} = 5V$$
,
 $V_{ref} = 1.5V$
 $Ilimit = V_{ref}/5/RNF$
 $= 1.5V/5/0.22\Omega = 1.36A$

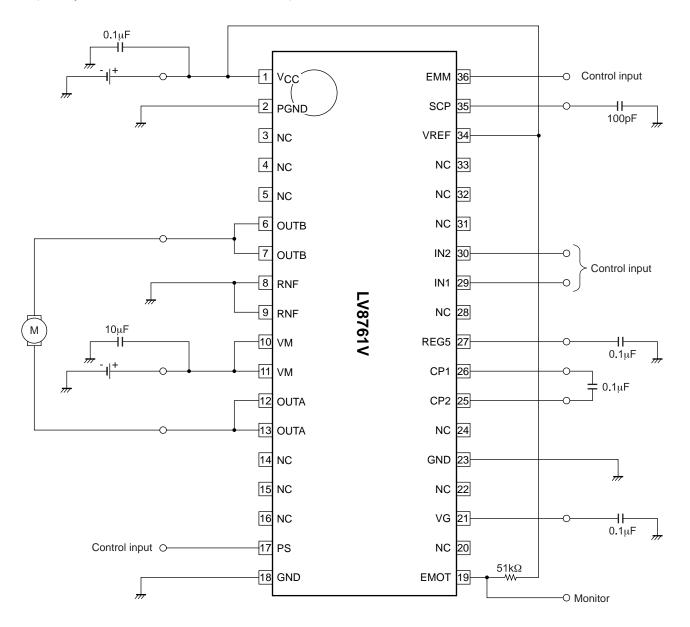
Setting the current limit regeneration time and short-circuit detection time

$$Tscp \approx C \times V/I$$

$$= 100pF \times 1V/5\mu A$$

$$= 20\mu s$$

(When you do not use the current limit function)



Setting at short-circuit state detection time

$$T_{SCP} = C \cdot V/I$$

=100pF·1V/5 μ A
=20 μ s

- · It is short between RNF-GND.
- · The terminal VREF is hung on suitable potential of VCC or less.

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