

SANYO Semiconductors DATA SHEET

An ON Semiconductor Company

LV8762T — Forward/Reverse H-bridge Driver

Overview

The LV8762T is an 1ch H-bridge driver that can control four operation modes (forward, reverse, brake, and standby) of a motor. The 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
- Built-in thermal protection circuit
- Single power supply

- $I_{Omax} = 1A$
- Current limit mask function
- Alert signal output
- Built-in short-circuit protection function (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		36	V
Output peak current	I _O peak	tw ≤ 10ms, duty 20%	1.5	Α
Output continuous current	I _O max		1.0	Α
Logic input voltage	V _{IN} max		-0.3 to +6	V
EMO pin input voltage	V _{EMO}		-0.3 to +6	V
Allowable power dissipation	Pd max	Mounted on a specified board. *	1.4	W
Operating temperature	Topr		-20 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

^{*} Specified circuit board : 57mm×57mm×1.6mm, glass epoxy both-type board.

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LV8762T

Allowable Operating Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage range	VM		9 to 32	V
VREF input voltage	VREF		0 to 3	V
Logic input voltage	VIN		0 to 5.5	V

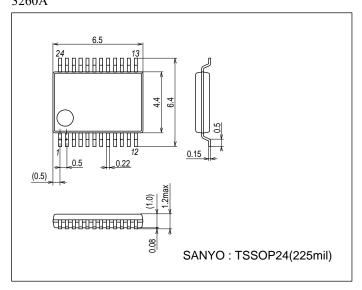
Electrical Characteristics at Ta = 25°C, VM = 24V, VREF = 1.5V

Dozometez	Symbol Conditions		Ratings			Linit
Parameter			min	typ	max	Unit
General						
Standby mode current drain	IMst	ST = "L"		100	400	μΑ
Operating mode current drain	IM	ST = "H", IN1 = "H", IN2 = "L", with no load		3	5	mA
REG5 output voltage	VREG	I _O = -1mA	4.5	5	5.5	V
Thermal shutdown temperature	TSD	Design guarantee *	150	180	200	°C
Thermal hysteresis width	ΔTSD	Design guarantee *		40		°C
Output block						
Output on resistance	RonU	I _O = 1A, upper side ON resistance		0.75	0.97	Ω
	RonD	I _O = -1A, under side ON resistance		0.5	0.65	Ω
Output leakage current	l _O leak	V _O = 32V			50	μА
Diode forward voltage	VD	ID = -1A		1.2	1.4	V
Rising time	tr	10% to 90%		100	200	ns
Falling time	tf	90% to 10%		100	200	ns
Input output delay time	tpLH	IN1 to OUTA, IN2 to OUTB (L \rightarrow H)		550	750	ns
	tpHL	IN1 to OUTA, IN2 to OUTB (H \rightarrow L)		550	750	ns
Control system input block	•					
Logic pin input H-level voltage	V _{IN} H		2.0			V
Logic pin input L-level voltage	V _{IN} L				0.8	V
Logic pin input current 1	I _{IN} L	V _{IN} = 0.8V	4	8	12	μА
	I _{IN} H	V _{IN} = 5V	30	50	70	μΑ
VREF input current	IREF	VREF = 1.5V	-0.5			μА
Current limit comparator threshold voltage	Vtlim	VREF = 1.5V	0.291	0.3	0.309	V
CHOP pin charge current	ICHOP		-6.5	-5	-3.5	μА
CHOP pin threshold voltage	VtCHOP		0.8	1	1.2	V
CMK pin charge current	ICMK		-32.5	-25	-17.5	μА
CMK pin threshold voltage	VtCMK		1.2	1.5	1.8	V
Charge pump block						
Step-up voltage	VGH	VM = 24V	27.7	28.7	29.7	V
Rising time	tONG	VG = 0.1μF		250	550	μS
Oscillation frequency	Fcp		90	125	155	kHz
Short-circuit protection block	•		. "	·		
FMO to to to the first live of						
EMO output saturation voltage	V _{EMO}	I _{EMO} = 1mA			0.4	V
SCP pin charge current	V _{EMO}	I _{EMO} = 1mA SCP = 0V	-6.5	-5	0.4 -3.5	V μA

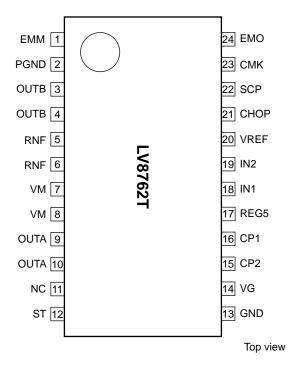
^{*} Design guarantee value and no measurement is made.

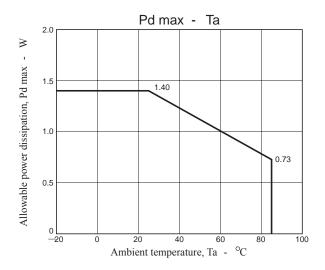
Package Dimensions

unit : mm (typ) 3260A



Pin Assignment

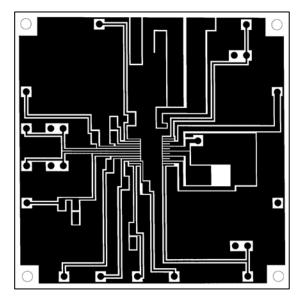


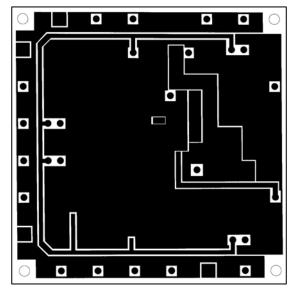


Substrate Specifications (Substrate recommended for operation of LV8762T)

Size : $57\text{mm} \times 57\text{mm} \times 1.6\text{mm}$ (two-layer substrate)

Material : Glass epoxy both-type board





L1 : Copper wiring pattern diagram

L2 : Copper wiring pattern diagram

Cautions

1) 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.

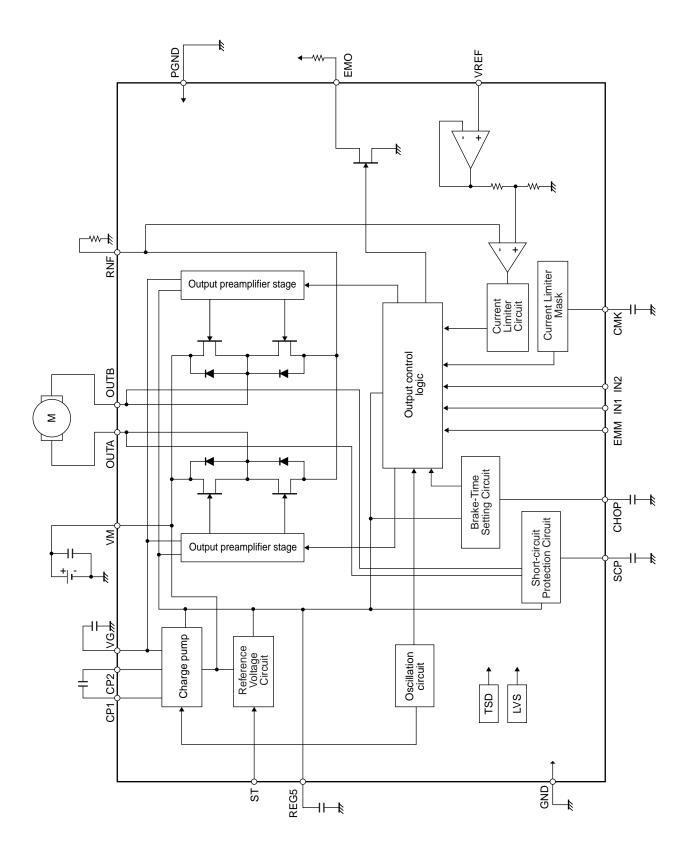
The guideline for ordinary derating is shown below:

- (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

2) 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



LV8762T

Pin Functions

Pin No. Pin Name Pin Function Equivalent Circuit	Pin Fun	ictions		
18	Pin No.	Pin Name	Pin Functtion	Equivalent Circuit
19 IN2 EMM Shart protection mode setting. 12 ST Standby mode setting 13 A OUTB 7, 8 VM 5, 6 RNF 2 PRND 2 PRND Current sense resistor connection pin. Power ground. 14 VG Charge pump capacitor connection pin. Current sense resistor connection pin. Charge pump capacitor connection pin.				
12 ST Standby mode setting 9, 10 3, 4 OUTB 7, 8 WR 5, 6 RNF 2 PGND 14 VS 8 VM 16 CP1 15 CP2 Charge pump capacitor connection pin. Charge pump				VREG5 ○ •
12 ST Standby mode setting VREGS 0 VREGS 0 VREGS 0 VREGS 0 VREGS 0 Substituting the setting of the setti				│
9, 10 OUTA 3, 4 OUTB 7, 8 WM 5, 6 RNF 2 PGND Charge pump capacitor connection pin. Power ground. Charge pump capacitor connection pin.	'	EIVIIVI	Short protection mode setting.	<u></u>
9, 10 OUTA 3, 4 OUTB 7, 8 WM 5, 6 RNF 2 PGND Charge pump capacitor connection pin. Power ground. Charge pump capacitor connection pin.				
12 ST Standby mode setting VREG5 0 9, 10 OUTA 3, 4 OUTB 7, 8 VM 5, 6 RNF 2 PGND Charge pump capacitor connection pin. Power ground. Charge pump capacitor connection pin.				
12 ST Standby mode setting VREG5 0 9, 10 OUTA 3, 4 OUTB 7, 8 VM 5, 6 RNF 2 PGND Charge pump capacitor connection pin. Power ground. Charge pump capacitor connection pin.				10kΩ
9, 10 OUTA 3, 4 OUTB 7, 8 VM 5, 6 RNF 2 PGND Charge pump capacitor connection pin. Power ground. Charge pump capacitor connection pin. Charge p				(19)(18)(1)
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ST Standby mode setting VREGS 0 12 ST Standby mode setting VREGS 0 10 VRE				↓
112 ST Standby mode setting VREGS 0 9,10 OUTA 3, 4 OUTB 7, 8 VM Motor power-supply connection pin. Current sense resistor connection pin. Power ground. 14 VG Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.				\$ 100K22 .
112 ST Standby mode setting VREGS 0 9,10 OUTA 3, 4 OUTB 7, 8 VM Motor power-supply connection pin. Current sense resistor connection pin. Power ground. 14 VG Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.				
ST Standby mode setting VREGS 0 VREGS 0 OUTA OUTA OUTB OUTB output pin. OUTB output pin. OUTB owner supply connection pin. Current sense resistor connection pin. Power ground. OUTB OUTB owner supply connection pin. Outget pin. Outget power supply connection pin. Power ground. OUTB OUT				
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9, 10 OUTA 3, 4 OUTB 7, 8 VM 5, 6 RNF 2 PGND Charge pump capacitor connection pin. Power ground. Charge pump capacitor connection pin.				
9, 10 OUTA 3, 4 OUTB 7, 8 VM 5, 6 RNF 2 PGND 14 VG 8 VM 16 CP1 15 CP2 Charge pump capacitor connection pin.				<u> </u>
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9, 10 3, 4 OUTB VM S, 6 PGND OUTA output pin. OUTB output pin. Motor power-supply connection pin. Current sense resistor connection pin. Power ground. OUTB output pin. Motor power-supply connection pin. Power ground. VG SND Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.				CNDO
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3, 4 7, 8 7, 8 Note that the second content of the second content	9, 10	OUTA	OUTA output pin.	
S, 6 2 PGND Current sense resistor connection pin. Power ground. Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.	3, 4	OUTB	OUTB output pin.	(78)
Power ground. Power ground. Power ground. Power ground. Order to pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.	7, 8	VM	Motor power-supply connection pin.	
14 VG Charge pump capacitor connection pin. 8 VM Motor power-supply connection pin. 16 CP1 Charge pump capacitor connection pin. 17 Charge pump capacitor connection pin. 18 CP2 Charge pump capacitor connection pin. 19 Charge pump capacitor connection pin. 10 Charge pump capacitor connection pin. 10 Charge pump capacitor connection pin.	5, 6	RNF	Current sense resistor connection pin.	
14 VG Solon	2	PGND	Power ground.	
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14 VG Solon				
14 VG Charge pump capacitor connection pin. 8 VM Motor power-supply connection pin. 16 CP1 Charge pump capacitor connection pin. 15 CP2 Charge pump capacitor connection pin. Charge pump capacitor connection pin.				$9^{10} \rightarrow 3^{4}$
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14 VG 8 VM Motor power-supply connection pin. Charge pump capacitor connection pin.				30052
14 VG Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.				$10k\Omega$ 500Ω
14 VG Solve Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.				
14 VG Solve Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.				
14 VG Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin.				
8 VM Motor power-supply connection pin. 16 CP1 Charge pump capacitor connection pin. 15 CP2 Charge pump capacitor connection pin.				GND ○
8 VM CP1 Charge pump capacitor connection pin. Charge pump capacitor connection pin. Charge pump capacitor connection pin.	14	VG	Charge pump capacitor connection pin	
16 CP1 Charge pump capacitor connection pin. 15 CP2 Charge pump capacitor connection pin.				VREG5 0—— (16) (8) (15) (14)
15 CP2 Charge pump capacitor connection pin.				
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GND				GND
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	om preceding p		
Pin No.	Pin Name	Pin Functtion	Equivalent Circuit
20	VREF	Reference voltage input pin for output current limit setting.	VREG5 Φ 500Ω GND Φ
17	REG5	Internal reference voltage output pin.	GND O O O O O O O O O O O O O O O O O O O
24	ЕМО	Alert signal output	VREG5 O
21	СНОР	Capacitor connection for current limit	VREG5 ○ ◆ ◆
22	SCP	break time setting Capacitor connection for short detection time setting	GND O (21)22
23	СМК	Capacitor connection for current limit mask setting	VREG5 Ο (3) 500Ω (5) (6) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1

DC Motor Driver

1.Standby function

This is can switch the standby – operation mode by setting the ST pin.

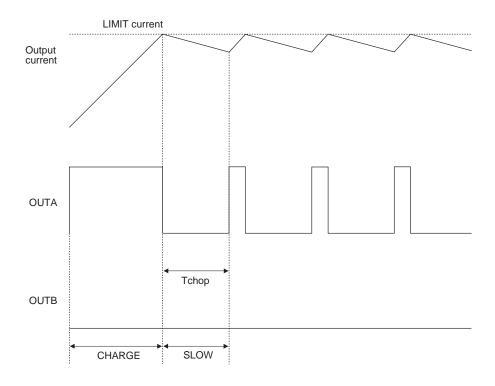
On standby-mode, all logic circuit is reset, internal regurator is off, internal charge-pump is off.

ST	mode	5V regurator	charge pump	
"L" or OPEN	standby mode	standby	standby	
"H"	operation mode	on	on	

2.DCM output control logic

Contol Input			Output		Mark	
ST	IN1	IN2	OUTA	OUTB	Mode	
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	

3. Current limit control timing chart



4. Setting the time of current limit brake value

This IC can set the time of the current limit break by connecting the capacitor with CHOP-GND. The value of the capacitor is decided according to the following expression.

brake time: T_{CHOP}
$$\approx$$
 C_{CHOP} \times Vt_{CHOP} \div I_{CHOP} [sec] Vt_{CHOP}:CHOP comparator threshold voltage. TYP=1.0[V] I_{CHOP}:CHOP charge current. TYP=5[μ A]

ex. Cchop=50[pF]
Tchop[sec] =
$$50[pF] \times 1.0[V] \div 5[\mu A] = 10[\mu s]$$

5. 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]
$$\approx$$
 (VREF [V] \div 5) \div RNF [Ω])

Assuming VREF = 1.5V, RNF =
$$1\Omega$$
, the current limit is : Ilimit = $1.5V \div 5 \div 1\Omega = 0.3A$

6. Setting the mask of current limit

CMK mask of current limit	
"L"	no operation
"H" or OPEN	operation

This function can be switched by CMK pin.

This function can prevent the current limit from working by the motor start-up current when the current limit value is set low.

7. Setting the time of the mask of current limit

This IC can set the time of the mask of current limit by connection the capacitor with CMK-GND.

The value of the capacitor is decided according to the following expression.

$$\label{eq:total_total_total_total_total_total_total} \begin{split} & \text{Time of mask:T}_{CMK} \approx C_{CMK} \times Vt_{CMK} \div I_{CMK} \text{ [sec]} \\ & Vt_{CMK:CMK} \text{ comparator threshold voltage. TYP=1.0[V]} \\ & I_{CMK:CMK} \text{ charge current. TYP=25[μA]} \end{split}$$

ex.
$$C_{CMK}$$
=0.1[μ F]
 T_{CMK} [sec] = 0.1[μ F] x 1.5[V] ÷ 25[μ A] = 6[ms]

Output short-circuit protection function

Thils IC incorporates an output short-circuit protection circuit. It turns the output off to prevent destruction of the IC if a problem such as an output pin being shorted to the motor power supply or ground occurs.

Then short-circuit detected, alart signal is assert to EMO pin.

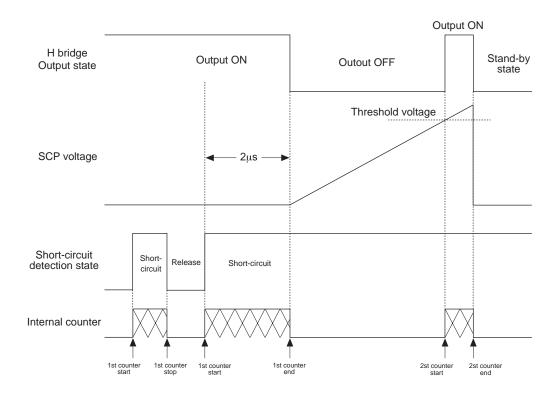
1. Output short protect mode

This function can be switched by EMM pin. EMM pin is L or OPEN then latch method, H then auto-retry method.

EMM Pin	Method
"L" or OPEN	Latch
"H"	Auto retry

2. 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 ($\approx 2\mu s$), 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 (TSCP) 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 ST to L.



3. Protection function operation (Auto retry method)

In this mode, short-protection function try repeatedly to detecting short-circuit.

The short-circuit detection circuit operates when a short output is detected as well as the latch method. The output is switched to the standby mode when the operation of the short-circuit detection circuit exceeds time (T_{SCP}) of the timer latch, and it returns to the turning on mode again after 2ms(typ). At this time, the switching mode is repeated when is still in the overcurrent mode until the overcurrent mode is made clear.

4. Unusual Condition Warning Output Pin (EMO)

The LV8762T is provided with the EMO 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 if abnormality is detected, the EMO output becomes (EMO=L) of on.

The EMO 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.

5. Timer latch-up (TSCP)

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

Timer latch-up : T_{SCP} $T_{SCP} \approx C_{SCP} \times Vt_{SCP} \div I_{SCP}$ [sec]

Vt_{SCP}: Comparator threshold voltage (1V typical)

ISCP : SCP charge current (5µA typical)

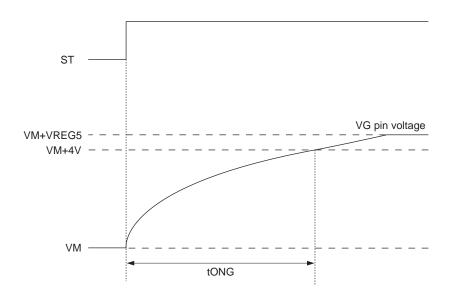
Thermal protection circuit

This IC incorporates an thermal protection circuit, and the output is turned off when junction temperature Tj exceeds 180°C, and the abnormal state output (EMO pin) is turned on at the same time. The output is driven again when temperature hysteresis falling (automatic restoration). The overheating protection circuit doesn't guarantee protection and the destruction prevention of the set because it becomes operation by the area where ratings Tjmax=150°C of the junction temperature were exceeded.

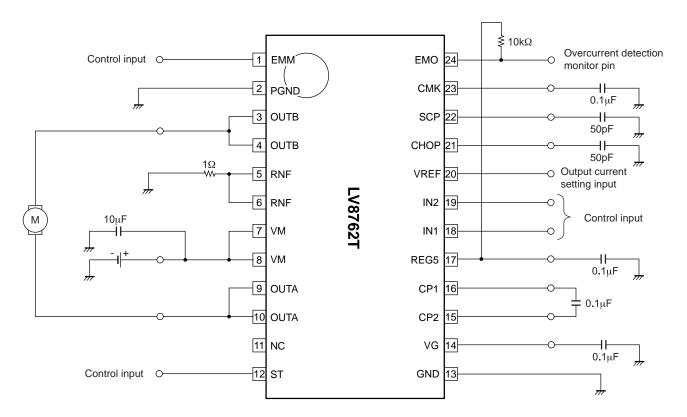
TSD =
$$180^{\circ}$$
C (typical)
 Δ TSD = 40° C (typical)

Charge pump

This IC makes "H" ST pin, and operate the charge pump circuit, and VG pin voltage step-up VM voltage to VM+REG5 voltage. Use it after the time of tONG or more passes when drives the motor. If it is not so, on-resistance cannot be secured.



Application Circuit Example



Current limit value

When VREF = 1.5V,
Ilimit = Vref
$$\div$$
 5 \div RNF
= 1.5V \div 5 \div 1 Ω = 0.3A

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

$$T_{SCP} \approx C_{SCP} \times Vt_{SCP} \div I_{SCP}$$

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

Setting at current limit mask time

$$\begin{split} T_{CMK} &\approx C_{CMK} \times Vt_{CMK} \div I_{CMK} \\ &= 0.1 \mu F \times 1.5 V \div 25 \mu A = 6 ms \end{split}$$

Setting at current limit brake time

$$\begin{split} &T_{CHOP}\approx C_{CHOP}\times Vt_{CHOP} \div I_{CHOP}\\ &=50 pF\times 1V\div 5\mu A=10\mu s \end{split}$$

^{*} The external part constant is a reference value.

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- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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