Ordering number : ENA1926

SANYO Semiconductors
DATA SHEET

An ON Semiconductor Company

LV8762T — Bi-CMOS LSI 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
- Built-in short-circuit protection function (selectable from latch-type or auto reset-type).
- $I_O$max = 1A
- Current limit mask function
- Alert signal output

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	A
Output continuous current	I_O max		1.0	A
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.

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	V_{IN}		0 to 5.5	V

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

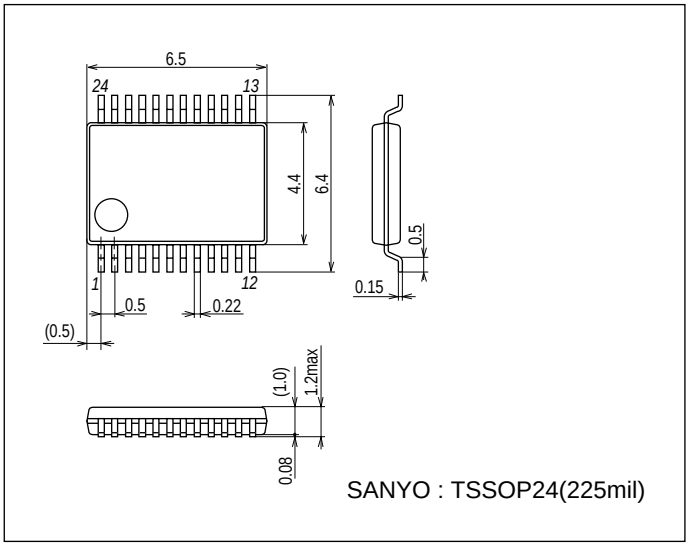
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
General						
Standby mode current drain	IMst	ST = "L"		100	400	μA
Operating mode current drain	IM	ST = "H", IN1 = "H", IN2 = "L", with no load		3	5	mA
REG5 output voltage	VREG	I_O = -1mA	4.5	5	5.5	V
Thermal shutdown temperature	TSD	Design guarantee *	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	$I_O$leak	V_O = 32V			50	μA
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 → H)		550	750	ns
	tpHL	IN1 to OUTA, IN2 to OUTB (H → 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	μA
	I_{IN}H	V_{IN} = 5V	30	50	70	μA
VREF input current	IREF	VREF = 1.5V	-0.5			μA
Current limit comparator threshold voltage	Vtlim	VREF = 1.5V	0.291	0.3	0.309	V
CHOP pin charge current	I_{CHOP}		-6.5	-5	-3.5	μA
CHOP pin threshold voltage	Vt_{CHOP}		0.8	1	1.2	V
CMK pin charge current	I_{CMK}		-32.5	-25	-17.5	μA
CMK pin threshold voltage	Vt_{CMK}		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						
EMO output saturation voltage	V_{EMO}	I_{EMO} = 1mA			0.4	V
SCP pin charge current	I_{SCP}	SCP = 0V	-6.5	-5	-3.5	μA
Comparator threshold voltage	Vt_{SCP}		0.8	1	1.2	V

* Design guarantee value and no measurement is made.

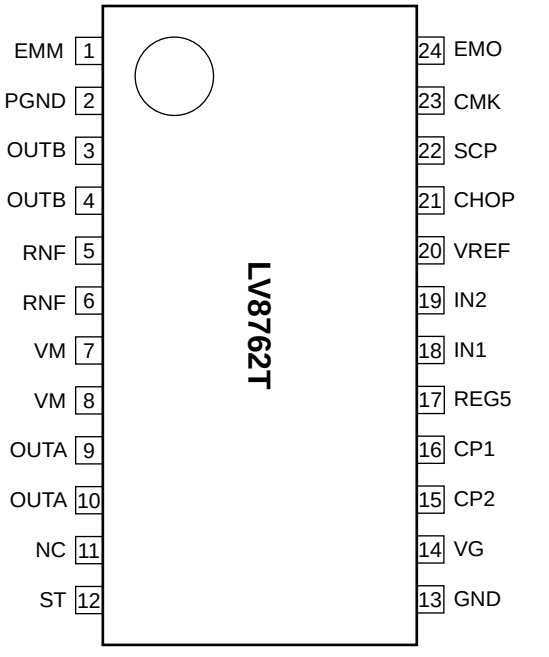
Package Dimensions

unit : mm (typ)

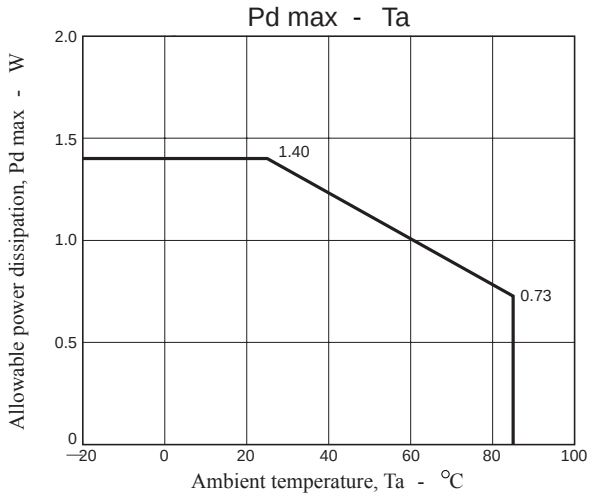
3260A



Pin Assignment

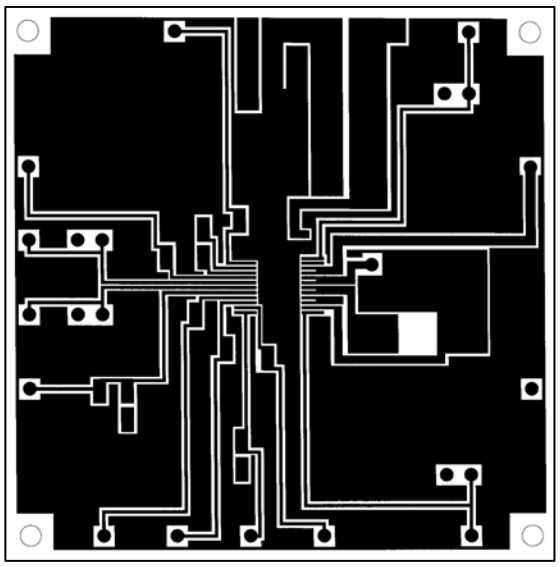


Top view

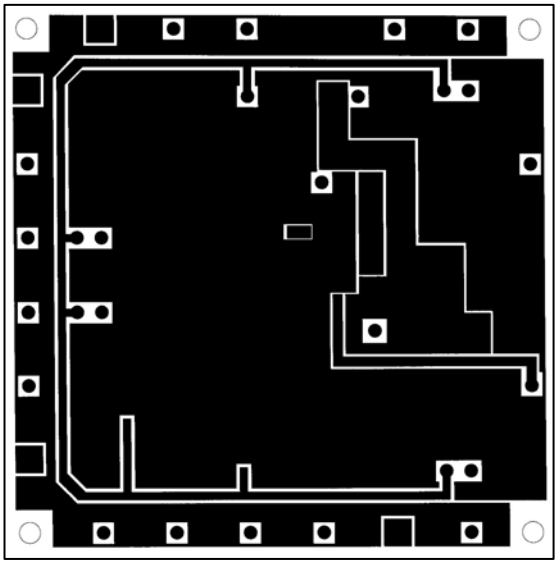


Substrate Specifications (Substrate recommended for operation of LV8762T)

Size : 57mm × 57mm × 1.6mm (two-layer substrate)
Material : Glass epoxy both-type board



L1 : Copper wiring pattern diagram



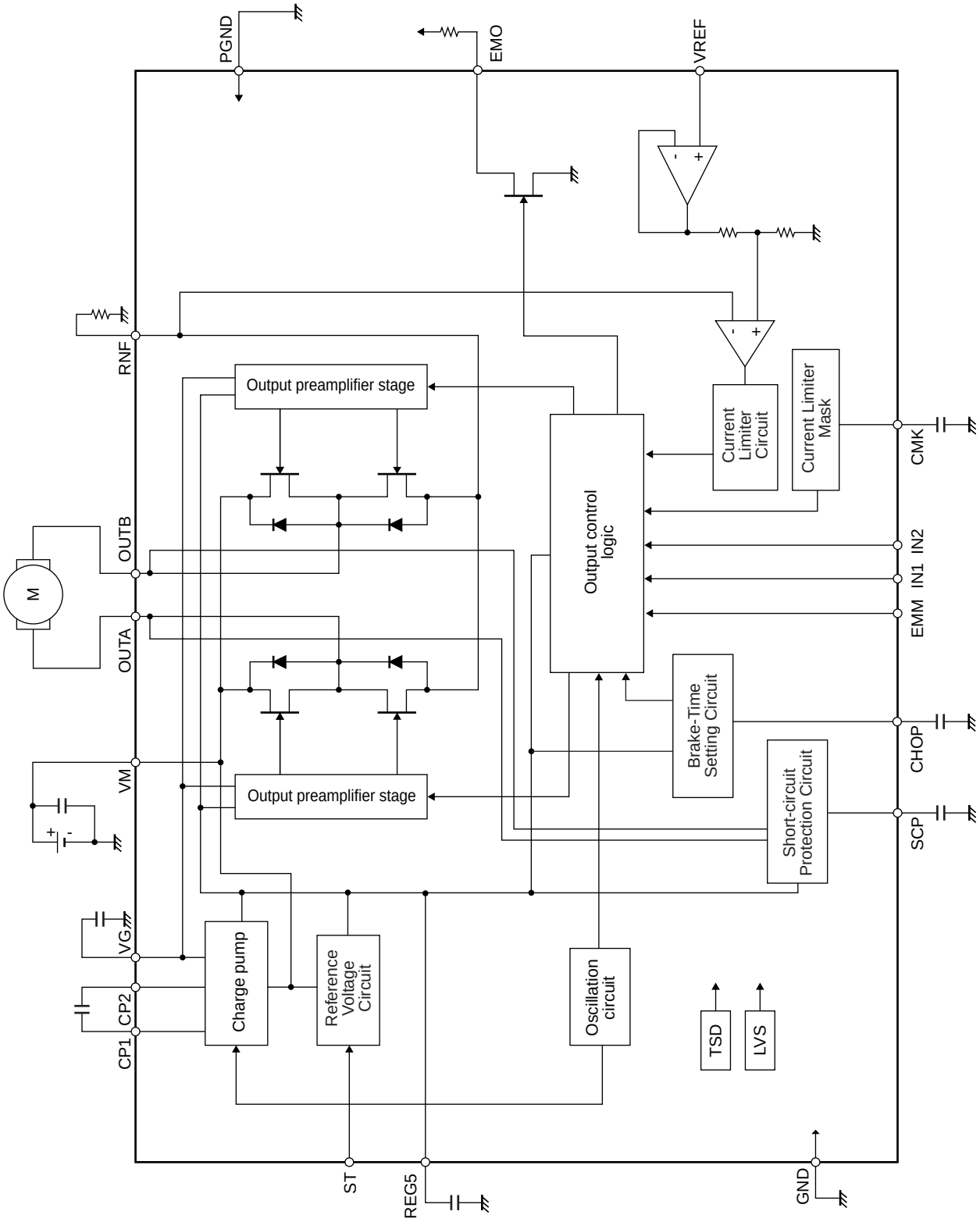
L2 : Copper wiring pattern diagram

Cautions

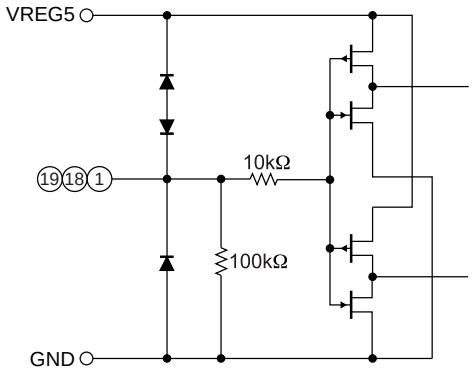
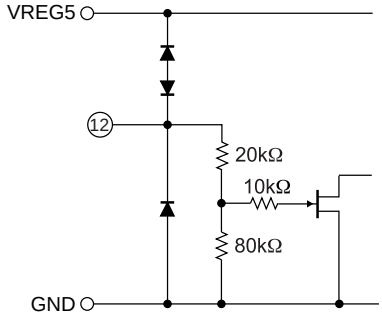
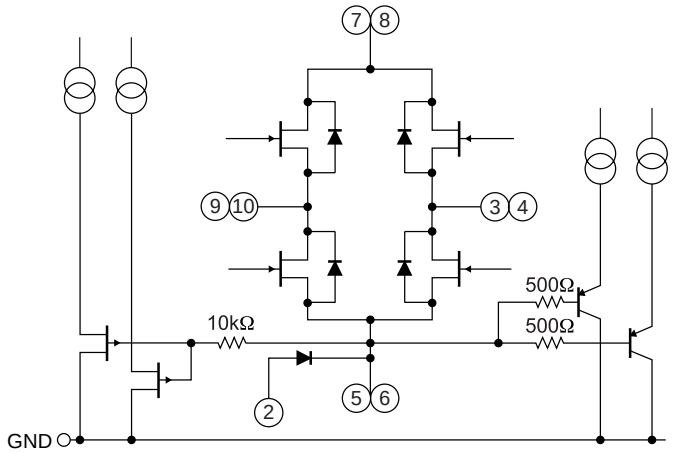
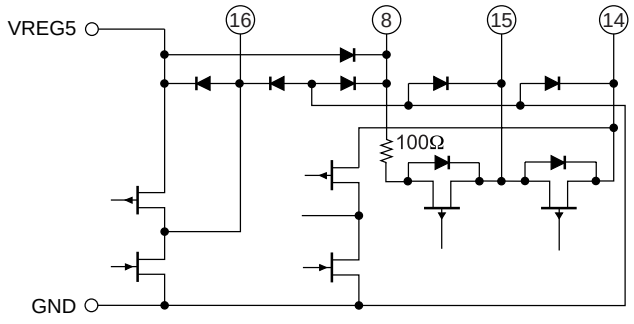
1) For the set design, employ the derating design with sufficient margin.
Stresses to be derated include the voltage, current, junction temperature, power loss, and mechanical stresses such as vibration, impact, and tension.
Accordingly, the design must ensure these stresses to be as low or small as 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



Pin Functions

Pin No.	Pin Name	Pin Functtion	Equivalent Circuit
18 19 1	IN1 IN2 EMM	Output control signal input pin 1. Output control signal input pin 2. Short protection mode setting.	
12	ST	Standby mode setting	
9, 10 3, 4 7, 8 5, 6 2	OUTA OUTB VM RNF PGND	OUTA output pin. OUTB output pin. Motor power-supply connection pin. Current sense resistor connection pin. Power ground.	
14 8 16 15	VG VM CP1 CP2	Charge pump capacitor connection pin. Motor power-supply connection pin. Charge pump capacitor connection pin. Charge pump capacitor connection pin.	

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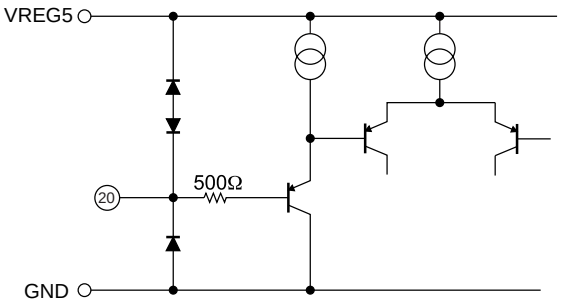
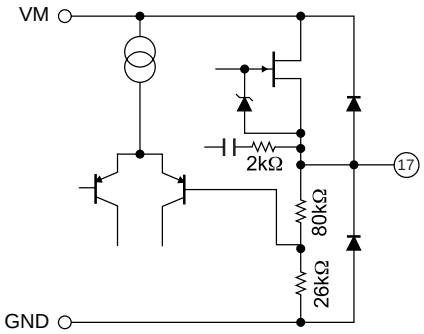
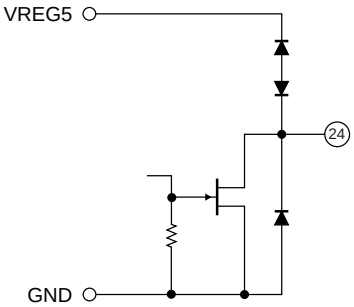
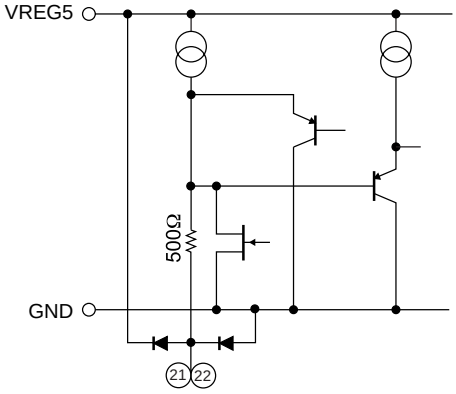
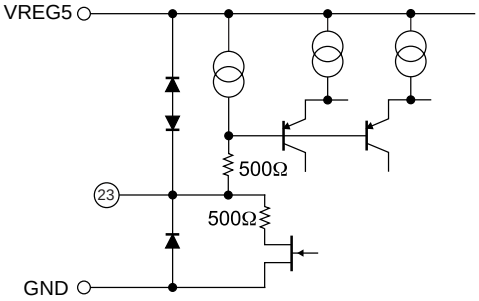
Pin No.	Pin Name	Pin Functtion	Equivalent Circuit
20	VREF	Reference voltage input pin for output current limit setting.	
17	REG5	Internal reference voltage output pin.	
24	EMO	Alert signal output	
21 22	CHOP SCP	Capacitor connection for current limit break time setting Capacitor connection for short detection time setting	
23	CMK	Capacitor connection for current limit mask setting	

DC Motor Driver

1.Standby function

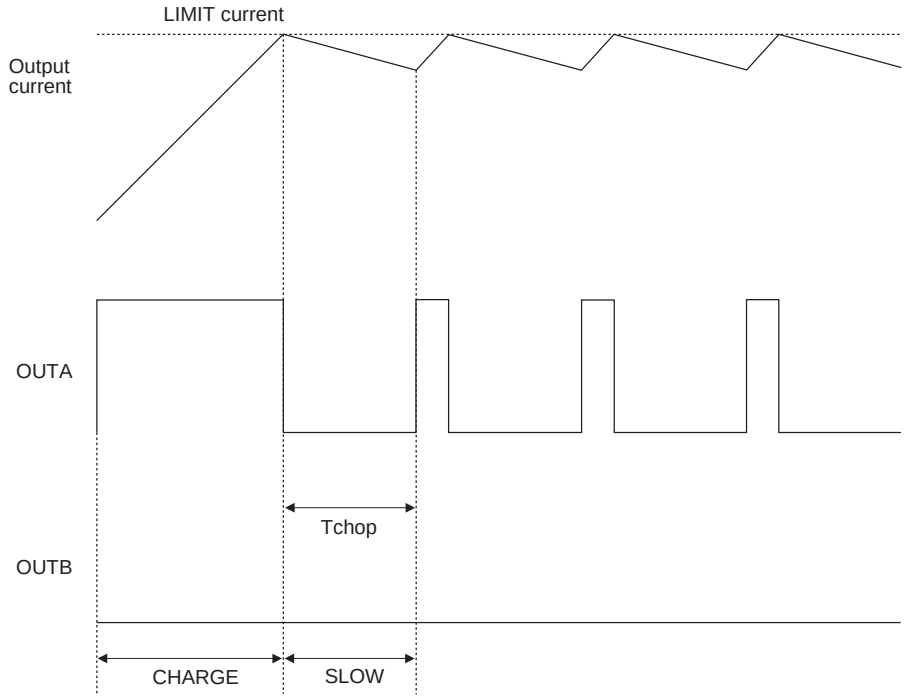
This is can switch the standby – operation mode by setting the ST pin.
On standby-mode, all logic circuit is reset, internal regurator is off, internal charge-pump is off.

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		Mode
ST	IN1	IN2	OUTA	OUTB	
L	*	*	OFF	OFF	Standby
H	L	L	OFF	OFF	Output OFF
H	H	L	H	L	CW (forward)
H	L	H	L	H	CCW (reverse)
H	H	H	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[μA]

ex. Cchop=50[pF]
Tchop[sec] = 50[pF] × 1.0[V] ÷ 5[μA] = 10[μs]

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 :

$$Ilimit\ [A] \approx (VREF\ [V] \div 5) \div RNF\ [\Omega])$$

Assuming VREF = 1.5V, RNF = 1Ω, 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.

Time of mask: $T_{CMK} \approx C_{CMK} \times Vt_{CMK} \div I_{CMK}$ [sec]

Vt_{CMK}:CMK comparator threshold voltage. TYP=1.0[V]

I_{CMK}:CMK charge current. TYP=25[μA]

ex. C_{CMK}=0.1[μF]

T_{CMK}[sec] = 0.1[μF] x 1.5[V] ÷ 25[μA] = 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.

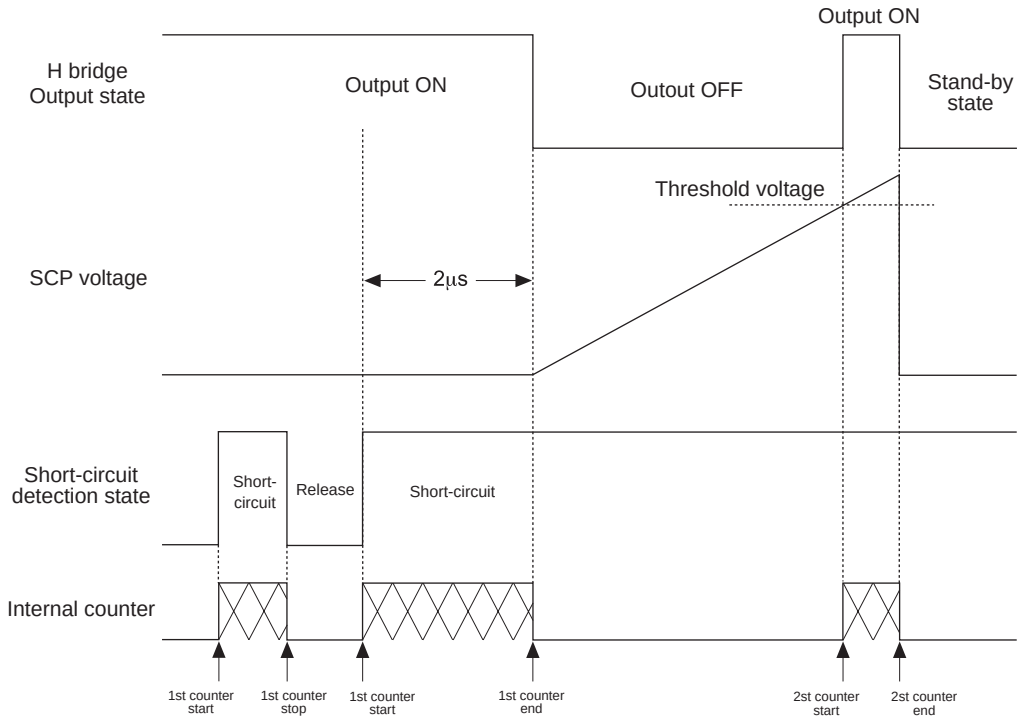
1. Output short protect mode

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 (≈ 2μs), 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 (T_{SCP}) 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 (T_{SCP})

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)

I_{SCP} : SCP charge current (5μA typical)

Thermal protection circuit

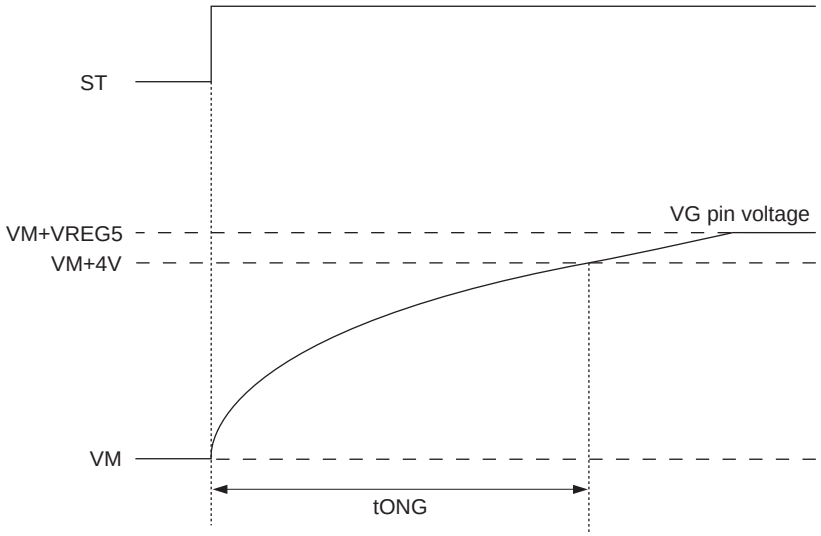
This IC incorporates an thermal protection circuit, and the output is turned off when junction temperature Tj exceeds 180°C, and the abnormal state output (EMO pin) is turned on at the same time. The output is driven again when temperature hysteresis falling (automatic restoration). The overheating protection 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°C (typical)

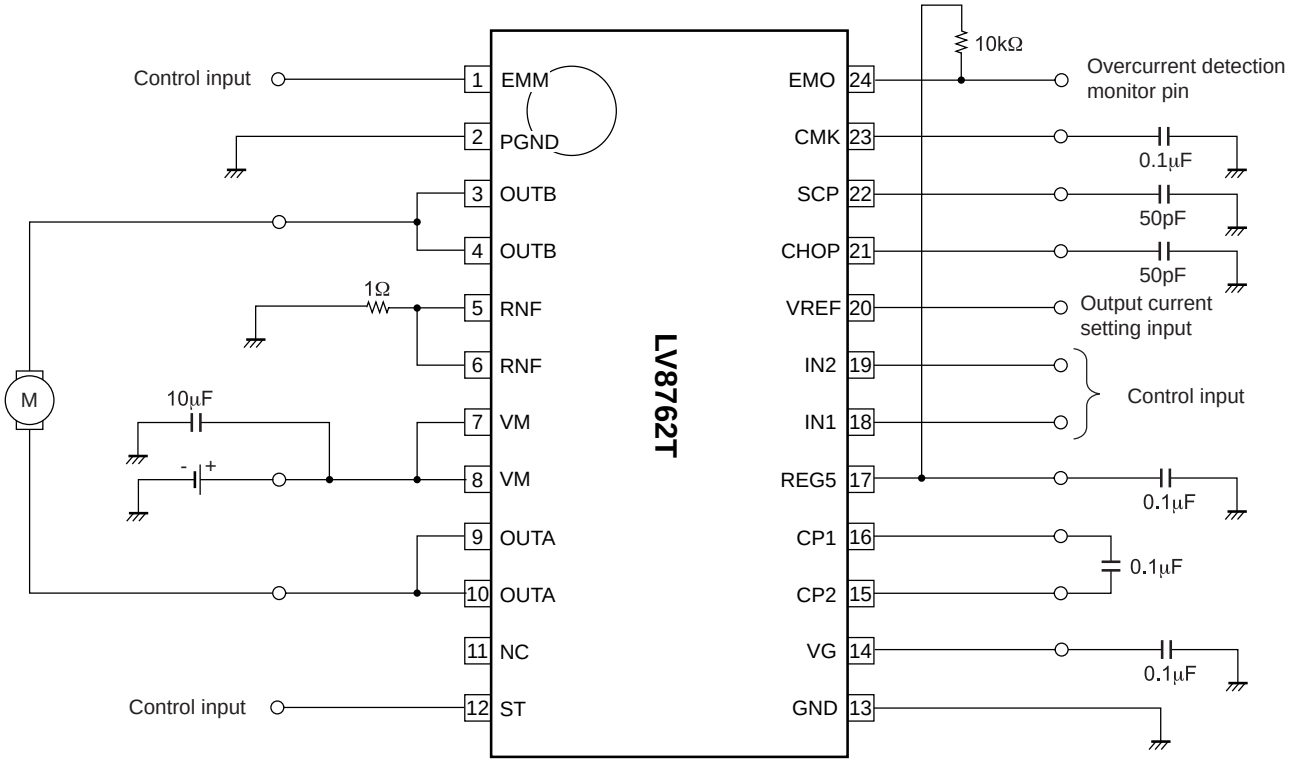
ΔTSD = 40°C (typical)

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 ÷ 5 ÷ RNF

= 1.5V ÷ 5 ÷ 1Ω = 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 × 1V ÷ 5μA = 10μs

Setting at current limit mask time

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

= 0.1μF × 1.5V ÷ 25μA = 6ms

Setting at current limit brake time

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

= 50pF × 1V ÷ 5μA = 10μs

* The external part constant is a reference value.

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Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А