Ordering number : ENA1157B

SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

LV8760T — Bi-CMOS LSI Forward/Reverse H-bridge Driver

Overview

The LV8760T 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 efficnet 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

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	A
Output continuous current	I_O max		3	A
Logic input voltage	V_{IN}		-0.3 to V_{CC}+0.3	V
Allowable power dissipation	Pd max	Mounted on a specified board. *	3.3	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.

Allowable Operating Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage range	VM		9 to 35	V
	V_{CC}		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

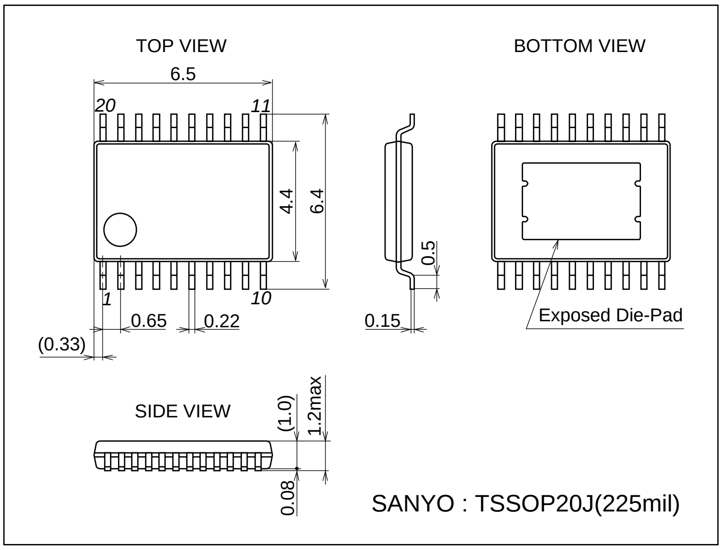
Electrical Characteristics at Ta = 25°C, VM = 24V, V_{CC} = 5V, VREF = 1.5V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
General						
Standby mode current drain 1	IMst	PS = “L”			1	μA
Standby mode current drain 2	I_{CC}st	PS = “L”			1	μA
Operating mode current drain 1	IM	PS = “H”, IN1 = “H”, with no load		1	1.3	mA
Operating mode current drain 2	I_{CC}	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						
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	$I_O$leak	V_O = 35V			50	μA
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 → H)		550	700	ns
	tpHL	IN1 or IN2 to OUTA or OUTB (H → L)		550	700	ns
Charge pump block						
Step-up voltage	VGH	VM = 24V	28.0	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	μA
	I_{IN}H	V_{IN} = 5V adaptive pin : PS	56	80	104	μA
Logic pin input current 2	I_{IN}L	V_{IN} = 0.8V adaptive pin : IN1, IN2	5.6	8	10.4	μA
	I_{IN}H	V_{IN} = 5V adaptive pin : IN1, IN2	35	50	65	μA
Logic pin input H-level voltage	V_{IN}H	adaptive pin : PS, IN1, IN2	2.0			V
Logic pin input L-level voltage	V_{IN}L	adaptive pin : PS, IN1, IN2			0.8	V
Current limiter block						
VREF input current	IREF		-0.5			μA
Current limit comparator threshold voltage	Vthlim	VREF = 1.5V	0.285	0.3	0.315	V
Blanking time	Tblk		1.6	2.0	2.4	μs
Short-circuit protection block						
SCP pin charge current	Iscp	SCP = 0V	3.5	5	6.5	μA
Comparator threshold voltage	Vthscp		0.8	1	1.2	V

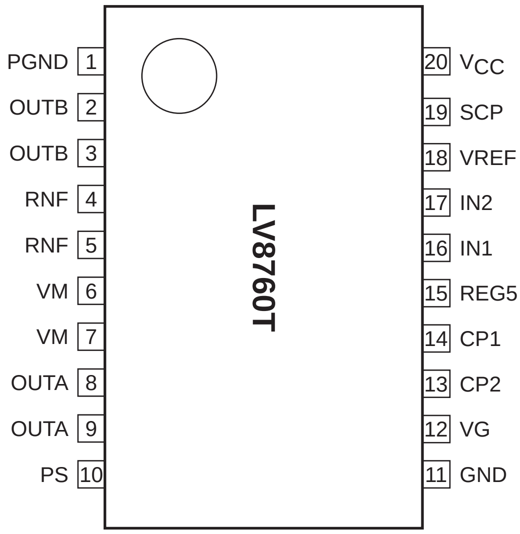
* Design guarantee value and no measurement is made.

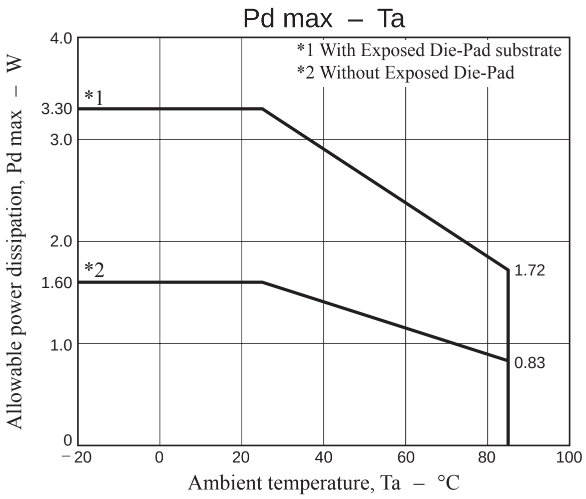
Package Dimensions

unit : mm (typ)
3279



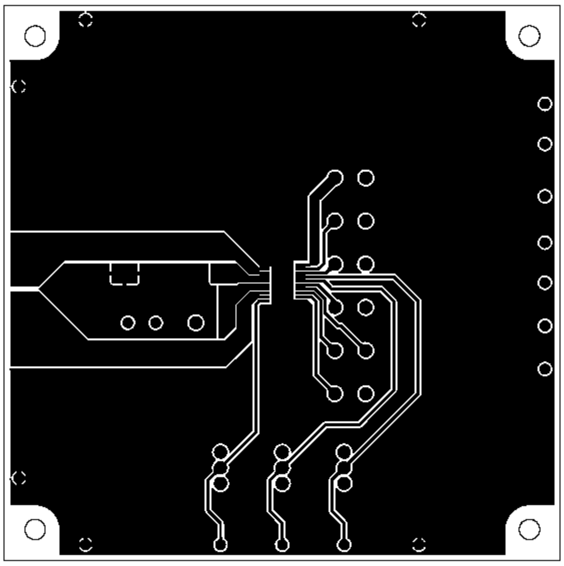
Pin Assignment



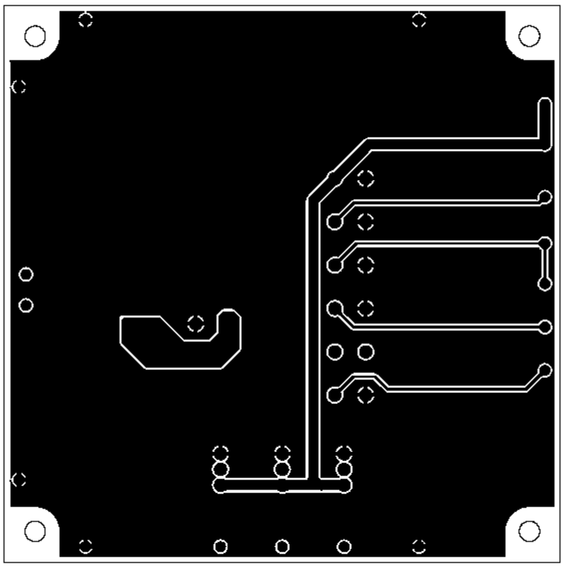


Substrate Specifications (Substrate recommended for operation of LV8760T)

Size : 90mm × 90mm × 1.6mm (two-layer substrate [2S0P])
Material : Glass epoxy
Copper wiring density : L1 = 95% / L2 = 95%



L1 : Copper wiring pattern diagram



L2 : Copper wiring pattern diagram

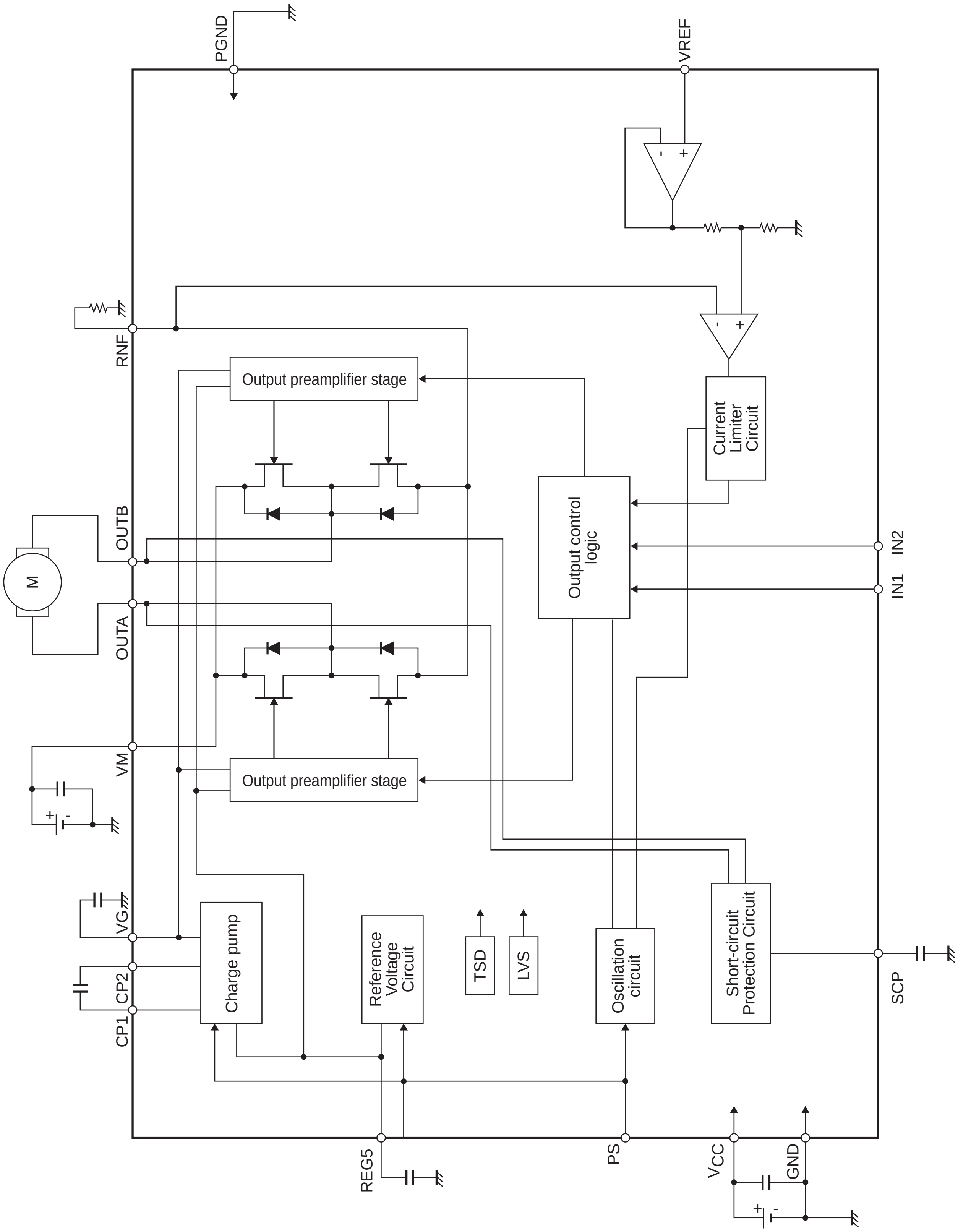
Cautions

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.

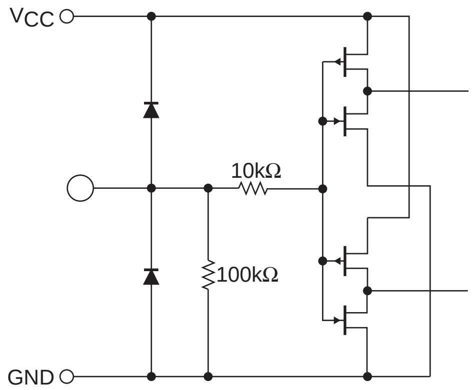
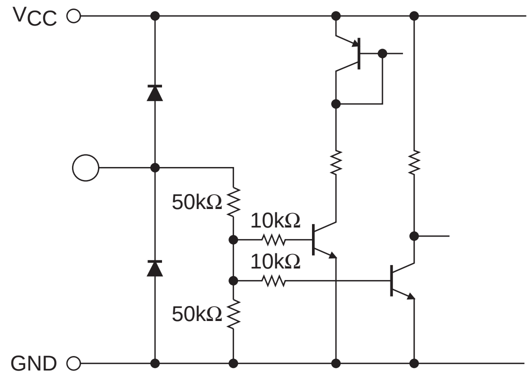
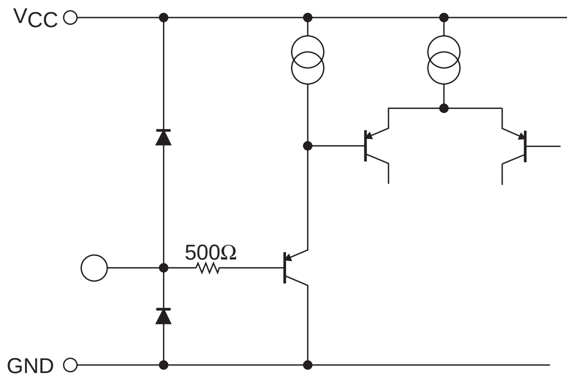
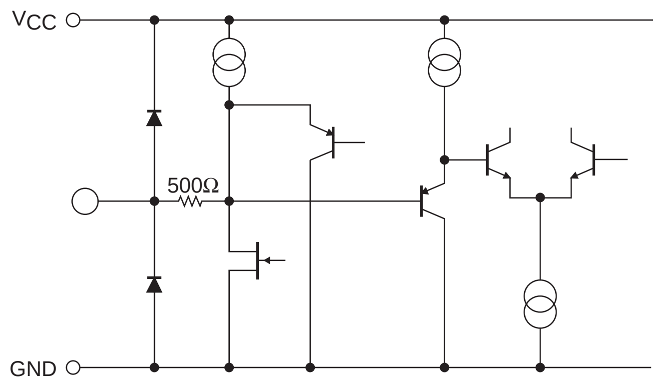
2) For the set design, employ the derating design with sufficient margin.
Stresses to be derated include the voltage, current, junction temperature, power loss, and mechanical stresses such as vibration, impact, and tension.
Accordingly, the design must ensure these stresses to be as low or small as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



Pin Functions

Pin No.	Pin Name	Pin Functtion	Equivalent Circuit
16 17	IN1 IN2	Output control signal input pin 1. Output control signal input pin 2.	
10	PS	Power save signal input pin.	
18	VREF	Reference voltage input pin for output current limit setting.	
19	SCP	Short-circiut protection circuit, detection time setting capacitor connection pin.	
20	V_{CC}	Power supply connection pin for control block.	

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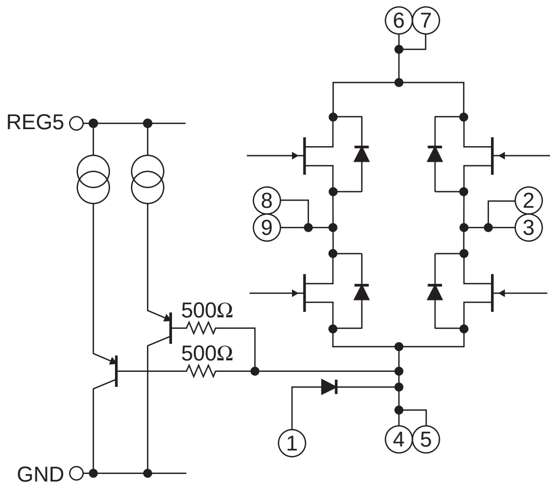
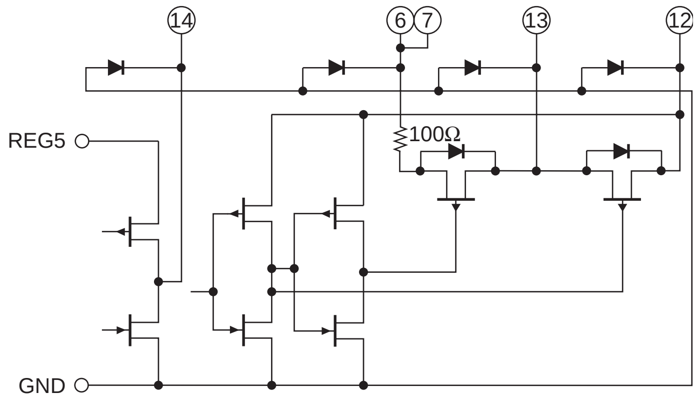
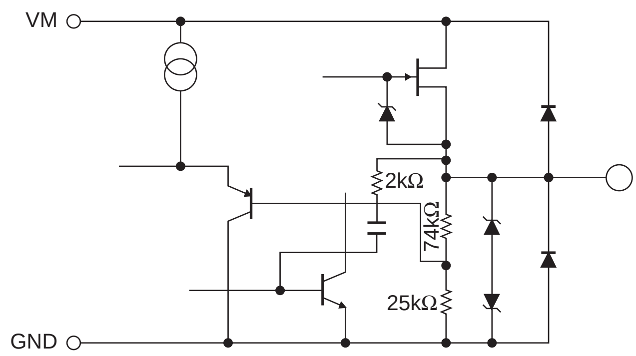
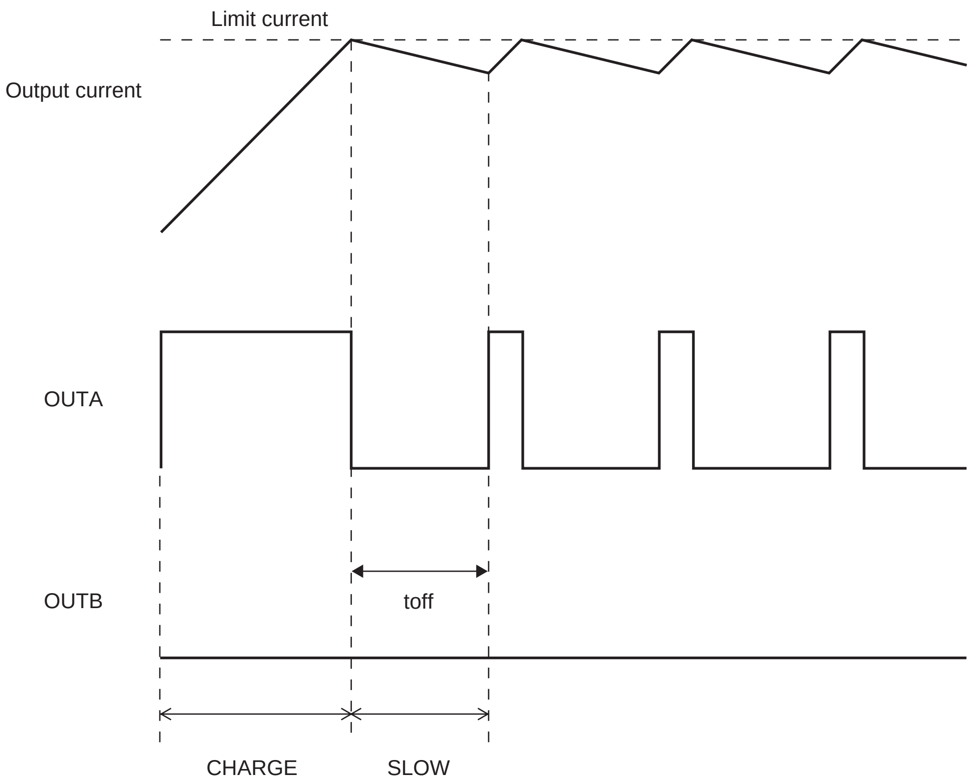
Pin No.	Pin Name	Pin Functtion	Equivalent Circuit
6, 7	VM	Motor power-supply connection pin.	
8, 9	OUTA	OUTA output pin.	
4, 5	RNF	Current sense resistor connection pin.	
2, 3	OUTB	OUTB output pin.	
1	PGND	Power ground.	
14	CP1	Charge pump capacitor connection pin.	
13	CP2	Charge pump capacitor connection pin.	
12	VG	Charge pump capacitor connection pin.	
15	REG5	Internal reference voltage output pin.	
11	GND	Ground.	

DC Motor Driver

1.DCM output control logic

Contol Input			Output		Mode
PS	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

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 settinig 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 [Ω])

Assuming VREF = 1.5V, RNF = 0.2Ω, the current limit is :

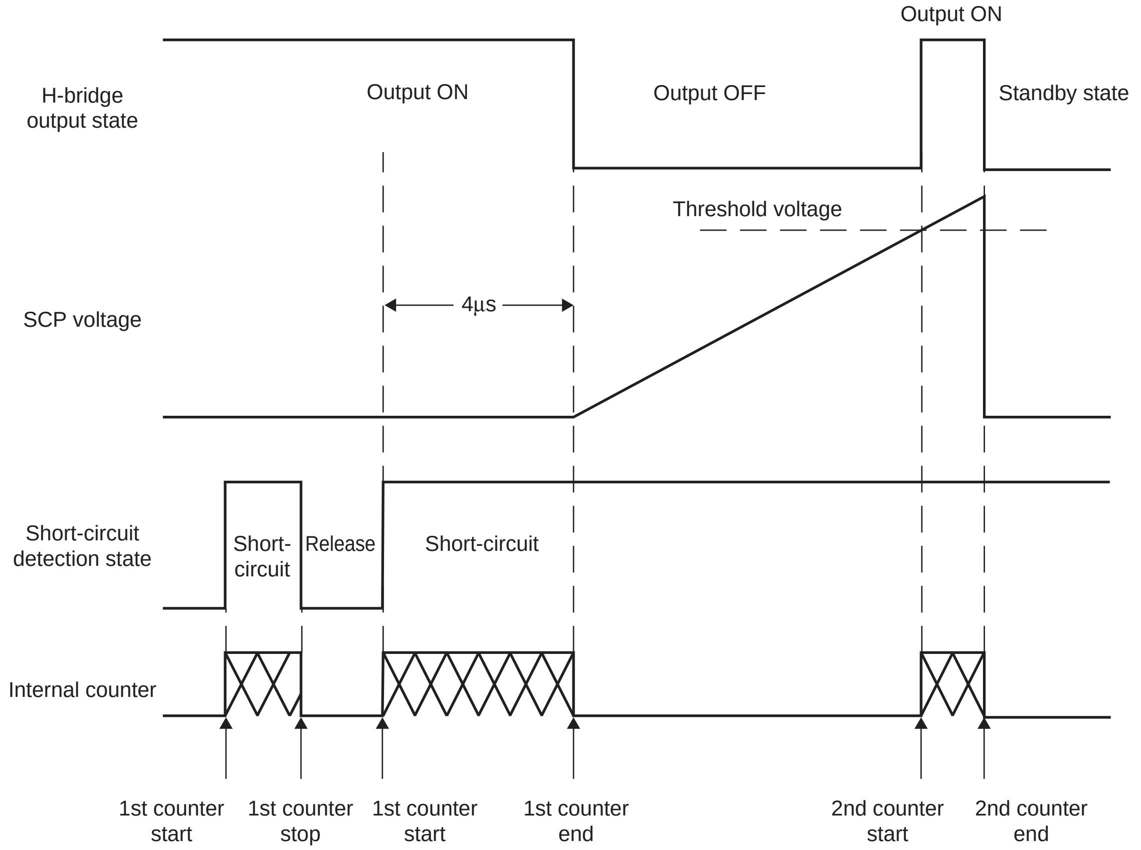
Ilimit = 1.5V/5/0.2Ω = 1.5A

Output short-circuit protection function

The LV8760T incorporates an output short-circuit protection circuit. It turns the ouputs 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.

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 (≈ 4μs), 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 ≈ C × V/I [s]

V : Comparator threshold voltage (1V typical)

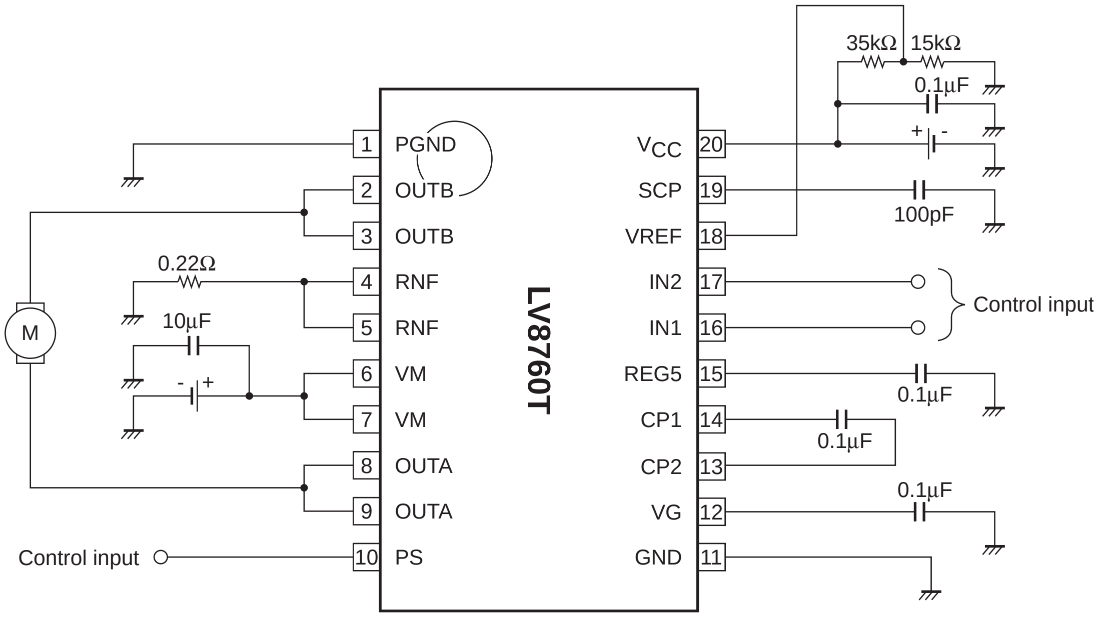
I : SCP charge current (5μA typical)

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 × 1V/5μA = 10μs

Application Circuit Example

(When you use the current limit function)



Setting the current limit value

When V_{CC} = 5V,

Vref = 1.5V

Ilimit = Vref/5/RNF

= 1.5V/5/0.22Ω = 1.36A

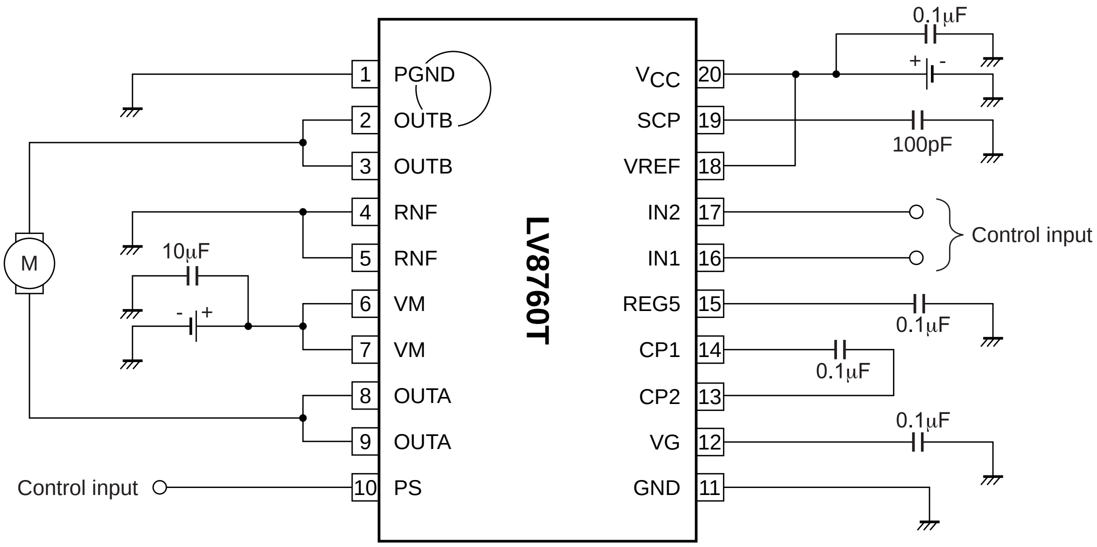
Setting the current limit regeneration time and short-circuit detection time

Tscp ≈ C × V/I

= 100pF × 1V/5μA

= 20μs

(When you do not use the current limit function)



Setting at short-circuit state detection time

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

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

$= 20\mu s$

*Do the following processing when you do not use the current limit function.

· It is short between RNF-GND.

· The terminal VREF is hung on suitable potential of V_{CC} or less.

This catalog provides information as of August, 2011. Specifications and information herein are subject to change without notice.