LV8760T

Allowable Operating Ratings at $Ta = 25^{\circ}C$

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	VIN		0 to V _{CC}	V

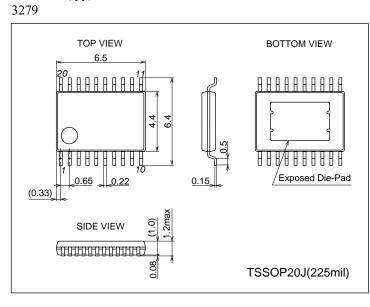
Electrical Characteristics at $Ta = 25^{\circ}C$, VM = 24V, $V_{CC} = 5V$, VREF = 1.5V

Parameter	Symbol	Conditions	Ratings			Unit	
	Symbol		min	typ	max	Unit	
General	1	T		r			
Standby mode current drain 1	IMst	PS = "L"			1	μΑ	
Standby mode current drain 2	ICCst	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	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							
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	lOleak	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 \rightarrow H)		550	700	ns	
	tpHL	IN1 or IN2 to OUTA or OUTB (H \rightarrow L)		550	700	ns	
Charge pump block	1	•			1		
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	1	•			1		
Logic pin input current 1	IINL	V _{IN} = 0.8V adaptive pin : PS	5.6	8	10.4	μA	
	IINH	V _{IN} = 5V adaptive pin : PS	56	80	104	μA	
Logic pin input current 2	IINL	VIN = 0.8V adaptive pin : IN1, IN2	5.6	8	10.4	μΑ	
	IINH	V _{IN} = 5V adaptive pin : IN1, IN2	35	50	65	μA	
Logic pin input H-level voltage	VINH	VIN = 5V adaptive pin : IN1, IN2 35 50 adaptive pin : PS, IN1, IN2 2.0				V	
Logic pin input L-level voltage	VINL	adaptive pin : PS, IN1, IN2			0.8	V	
Current limiter block	1	•					
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		I		2.0		μo	
SCP pin charge current	Iscp	SCP = 0V	3.5	5	6.5	μA	
	1300		0.0	1	0.0	μ. 	

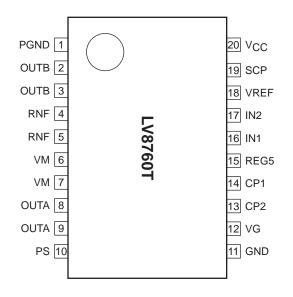
 * Design guarantee value and no measurement is made.

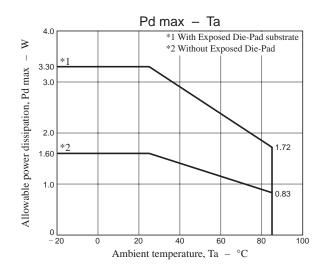
Package Dimensions

unit : mm (typ)



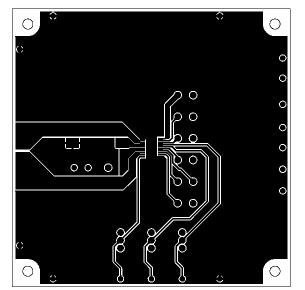
Pin Assignment



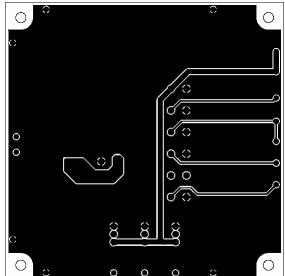


Substrate Specifications (Substrate recommended for operation of LV8760T)

Size: $90\text{mm} \times 90\text{mm} \times 1.6\text{mm}$ (two-layer substrate [2S0P])Material: Glass epoxyCopper wiring density: L1 = 95% / L2 = 95%



L1 : Copper wiring pattern diagram



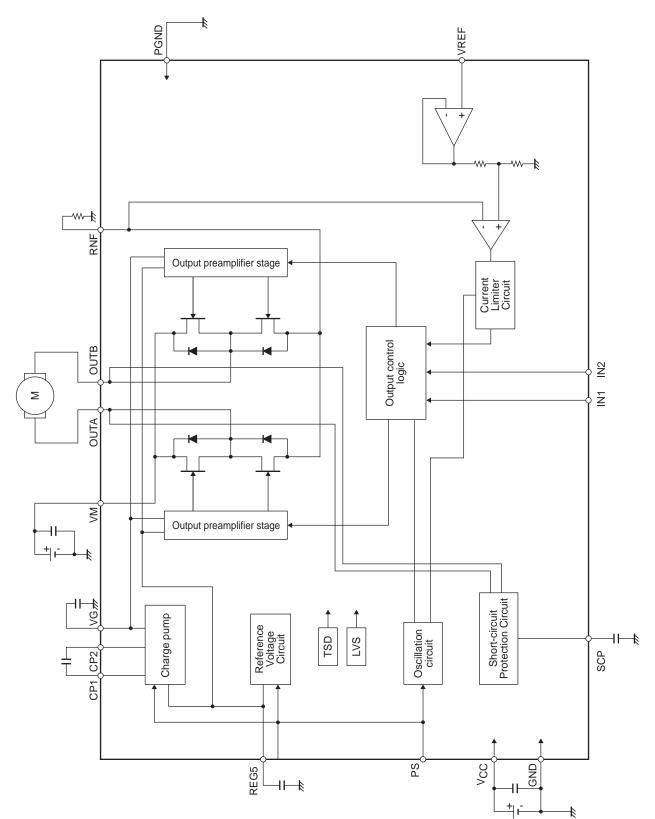
L2 : Copper wiring pattern diagram

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 No. Pin Name Pin Function Equivalent Circuit 16 IN1 Output control signal input pin 1. Output control signal input pin 2. VCC 0 17 IN2 Output control signal input pin 2. VCC 0 Image: Control signal input pin 2. 10 PS Power save signal input pin. VCC 0 Image: Control signal input pin. 10 PS Power save signal input pin. VCC 0 10 PS Power save signal input pin. VCC 0 Input pin. VCC 0 Image: Control signal input pin.	
17 IN2 Output control signal input pin 2. VCC 0 Image: signal input pin 2. 10 PS Power save signal input pin. VCC 0 Image: signal input pin. Soko: signal input pin. Vcc 0 Image: signal input pin. Image: signal input pin. Image: signal input pin. Vcc 0 Image: signal input pin. Image: signal input pin. Image: signal input pin. Image: signal input pin. Image: signal input pin. Image: signal input pin. Image: signal input pin. Image: signa	
18 VREF Reference voltage input pin for output current limit setting. VCC 0 0 500Ω 0 GND 0 0	-
19 SCP Short-circiut protection circuit, detection time setting capacitor connection pin.	
20 V _{CC} Power supply connection pin for control block.	

Continued on next page.

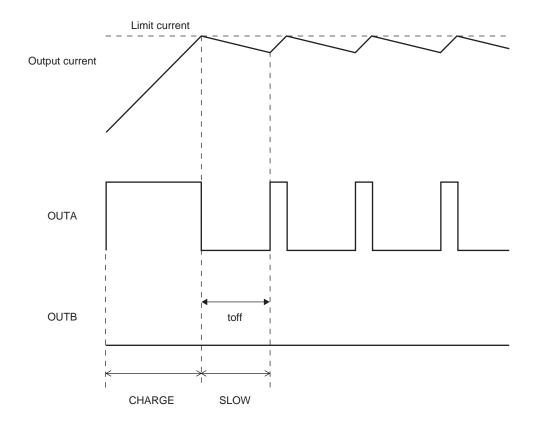
Pin No. Pin Name Pin Function Equivalent Circuit 6,7 VM Motor power-supply connection pin. OUTA output pin. OUTA output pin. 2,3 OUTB OUTB output pin. Current sense resistor connection pin. OUTB output pin. 1 PGND Power ground. REG5 Image: Constant output pin. 1 PGND Power ground. Image: Constant output pin. REG5 1 PGND Charge pump capacitor connection pin. Image: Constant output pin. Image: Constant output pin. 14 CP1 Charge pump capacitor connection pin. Image: Constant output pin. Image: Constant output pin. 12 VG Charge pump capacitor connection pin. Image: Constant output pin. Image: Constant output pin. 12 VG Charge pump capacitor connection pin. Image: Constant output pin. Image: Constant output pin. 12 VG Charge pump capacitor connection pin. Image: Constant output pin. Image: Constant output pin.		page.	rom preceding p	Continued fi
6,7 VM Motor power-supply connection pin. 8,9 OUTA OUTA output pin. 2,3 OUTB OUTB output pin. 1 PGND Power ground. REG5 Image: state sta	Equivalent Circuit			
14 CP1 Charge pump capacitor connection pin. 13 CP2 12 VG Charge pump capacitor connection pin. Charge pump capacitor connection pin.	REG5 0	Motor power-supply connection pin. OUTA output pin. Current sense resistor connection pin. OUTB output pin.	VM OUTA RNF OUTB	6, 7 8, 9 4, 5 2, 3
	REG5 O		VG	12
15 REG5 Internal reference voltage output pin. VM ο Internal reference voltage output pin. VM ο Internal reference voltage output pin. GND ο Internal reference voltage output pin.		Internal reference voltage output pin.	REG5	15
11 GND Ground.	 +	Ground.	GND	11

DC Motor Driver

1.DCM output control logic

Contol Input			Output		Maria	
PS	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	

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

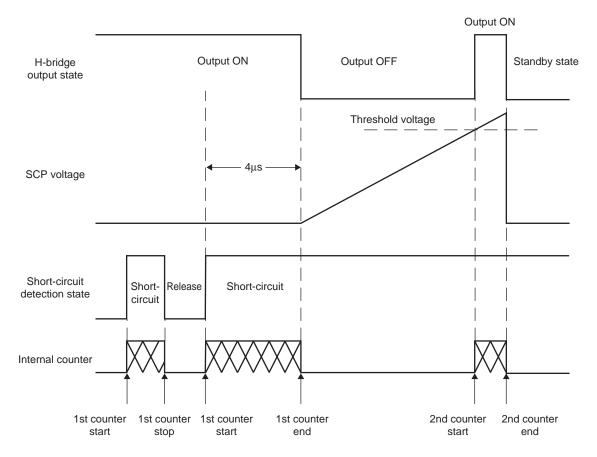
Assuming VREF = 1.5V, RNF = 0.2Ω , the current limit is : Ilimit = $1.5V/5/0.2\Omega = 1.5A$

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 ($\approx 4\mu s$), 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	

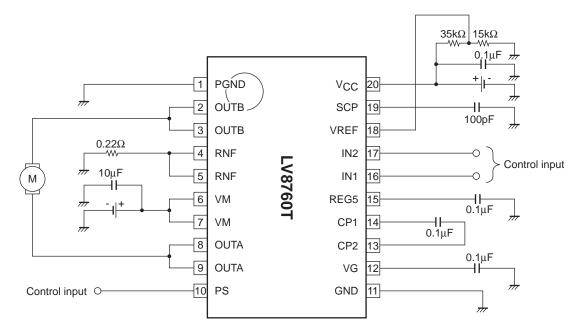
Tocp \approx C × V/I [s] V : Comparator threshold voltage (1V typical) I : SCP charge current (5µA typical)

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

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

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 $= 1.5V/5/0.22\Omega = 1.36A$

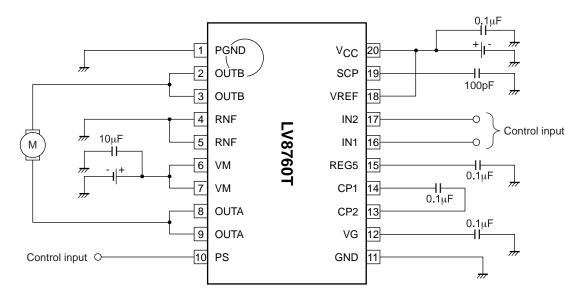
Setting the current limit regeneration time and short-circuit detection time

 $Tscp \approx C \times V/I$

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

 $= 20 \mu s$

(When you do not use the current limit function)



Setting at short-circuit state detection time

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

=100pF \cdot 1V/5 μ A

=20µs

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

· It is short between RNF-GND.

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

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