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# LV8714TA

## Advance Information

Monolithic Linear IC

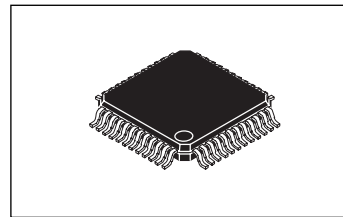
# PWM Constant-Current Control Stepper Motor Driver

## Overview

LV8714TA is a 4-channel H-bridge driver IC. It is ideally suited for driving stepping motors used in CCTV and POS printer.

## Function

- 4ch PWM current control H-bridge driver incorporated
- BiCDMOS process IC
- Low on resistance (Upper: 0.6Ω, Lower: 0.3 Ω , Total of upper and lower: 0.9Ω; Ta=25°C, Io=1.5A)
- Available constant current control less RF resistance
- Built-in thermal shutdown circuit
- Built-in Output short-circuit protection circuit



TQFP48 EP 7×7

## Specifications

### Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Condition	Rating	Unit
Motor supply voltage	VMmax	VM1, VM2, VM3, VM4	18	V
Logic input voltage	VINmax	PS, ENA1, IN1, ENA2, IN2, ENA3, IN3, ENA4, IN4	6	V
Output peak current	Iopeak	Each 1ch, tw≤10m, duty 20%	1.75	A
Output current	Iomax	Each 1ch	1.5	A
Allowable power dissipation	Pd max	*	4.86	W
Operating temperature	Topr		-20 to 85	°C
Storage temperature	Tstg		-55 to 150	°C

\* Specified circuit board : 90mm×90mm×1.6mm, glass epoxy 4-layer board, with backside mounting.

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

**Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details**

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

## ORDERING INFORMATION

See detailed ordering and shipping information on page 13 of this data sheet.

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## Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Condition	Rating	Unit
Motor supply voltage range	VM	VM1, VM2, VM3, VM4	4 to 16.5	V
Logic input voltage range	VIN	PS, ENA1, IN1, ENA2, IN2, ENA3, IN3, ENA4, IN4	-0.3 to 5.5	V
VREF input voltage range	VREF		0 to 1.5	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## Electrical Characteristics at Ta = 25°C, VM = 12V, VREF = 0.6V

Parameter	Symbol	Conditions	Ratings			Unit	
			min	typ	max		
Standby mode current	IMstn	I(VM1)+I(VM2)+I(VM3)+I(VM4) PS="L", No load		0	1	μA	
Supply current	IM	I(VM1)+I(VM2)+I(VM3)+I(VM4) PS="H", No load		3.2	4.2	mA	
Thermal shutdown temperature	TSD	Design guarantee	150	180		°C	
Thermal hysteresis width	ΔTSD	Design guarantee		40		°C	
<b>Regulator</b>							
REG3 output voltage	VREG3		3	3.3	3.6	V	
<b>Output</b>							
Output on resistance	RonU	Io=-1.5A, Source-side		0.6	0.85	Ω	
	RonD	Io=1.5A, Sink-side		0.3	0.5	Ω	
Output leakage current	Ioleak	Vo=16.5V			10	μA	
Diode forward voltage	VD	ID=-1.5A		1.2	1.6	V	
<b>Logic input</b>							
Logic pin input current	IinL	PS, ENA1, IN1, ENA2, IN2, ENA3, IN3, ENA4, IN4, VIN=0.8V	4.8	8	13.3	μA	
	IinH	VIN=3.3V	20	33	55	μA	
Logic input voltage	High	VinH	PS, ENA1, IN1, ENA2, IN2, ENA3, IN3, ENA4, IN4	2.0		5.5	V
	Low	VinL		0		0.8	V
<b>PWM current control</b>							
VREF pin input current	IREF	VREF1, VREF2, VREF3, VREF4 VREF=1.5V	-0.5			μA	
Current detection reference voltage	VREF	VREF1, VREF2, VREF3, VREF4 VREF=0.6V	0.18	0.2	0.22	V	
Chopping frequency	Fchop		100	125	150	kHz	
Output current detection current	Ircs	RCS1, RCS2, RCS3, RCS4 Io=0.5A, RSC=0V	115	125	137	μA	

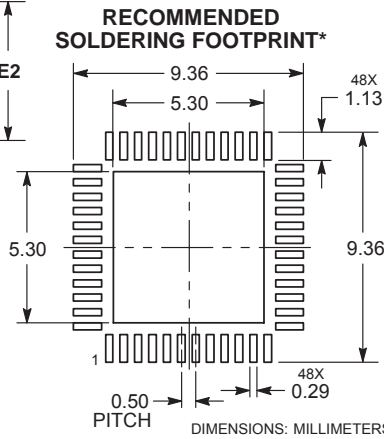
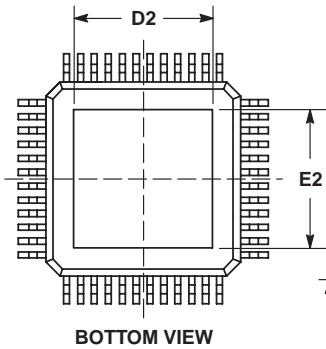
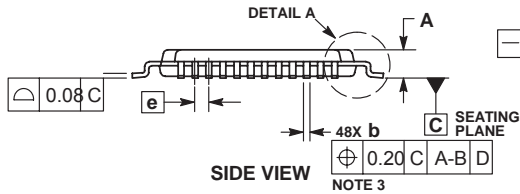
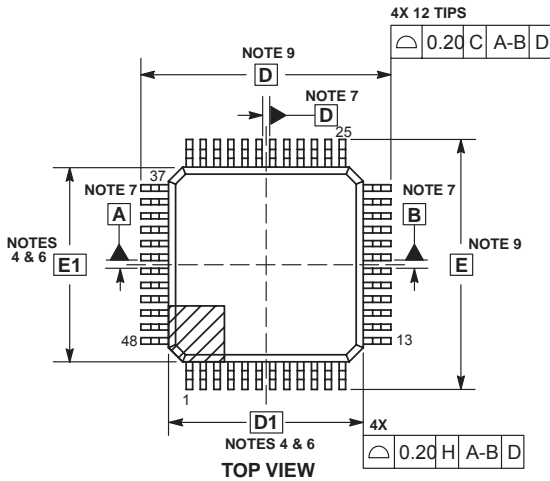
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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## Package Dimensions

unit : mm

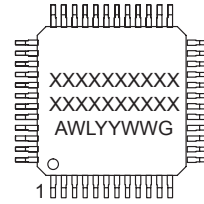
TQFP48 EP 7x7, 0.5P  
CASE 932F  
ISSUE C



- NOTES:
1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL BE 0.08 MAX. AT MMC. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD IS 0.07.
  4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.25 PER SIDE. DIMENSIONS D1 AND E1 ARE MAXIMUM PLASTIC BODY SIZE INCLUDING MOLD MISMATCH.
  5. THE TOP PACKAGE BODY SIZE MAY BE SMALLER THAN THE BOTTOM PACKAGE SIZE BY AS MUCH AS 0.15.
  6. DATUMS A-B AND D ARE DETERMINED AT DATUM PLANE H.
  7. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
  8. DIMENSIONS D AND E TO BE DETERMINED AT DATUM PLANE C.

MILLIMETERS		
DIM	MIN	MAX
A	0.95	1.25
A1	0.05	0.15
A2	0.90	1.20
b	0.17	0.27
D	9.00 BSC	
D1	7.00 BSC	
D2	4.90	5.10
E	9.00 BSC	
E1	7.00 BSC	
E2	4.90	5.10
e	0.50 BSC	
L	0.45	0.75
L2	0.25 BSC	
M	0°	7°

### GENERIC MARKING DIAGRAM\*



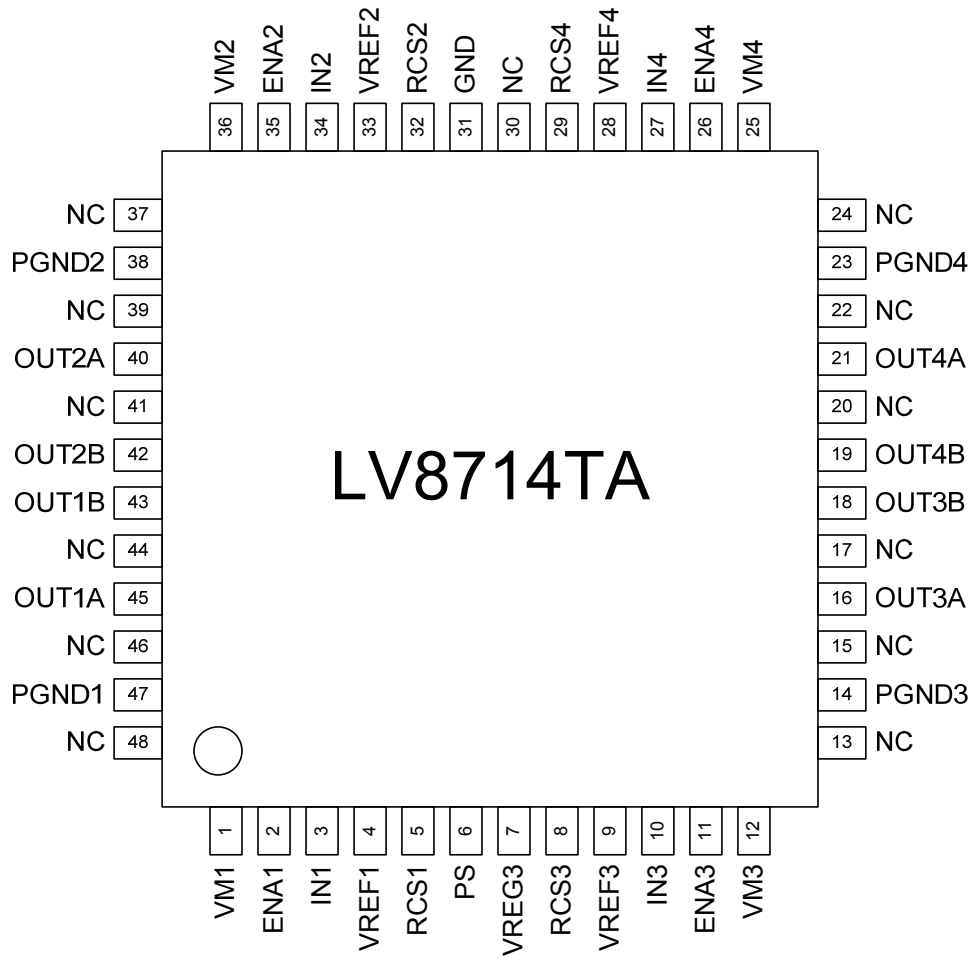
- XXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- YY = Year
- WW = Work Week
- G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present.

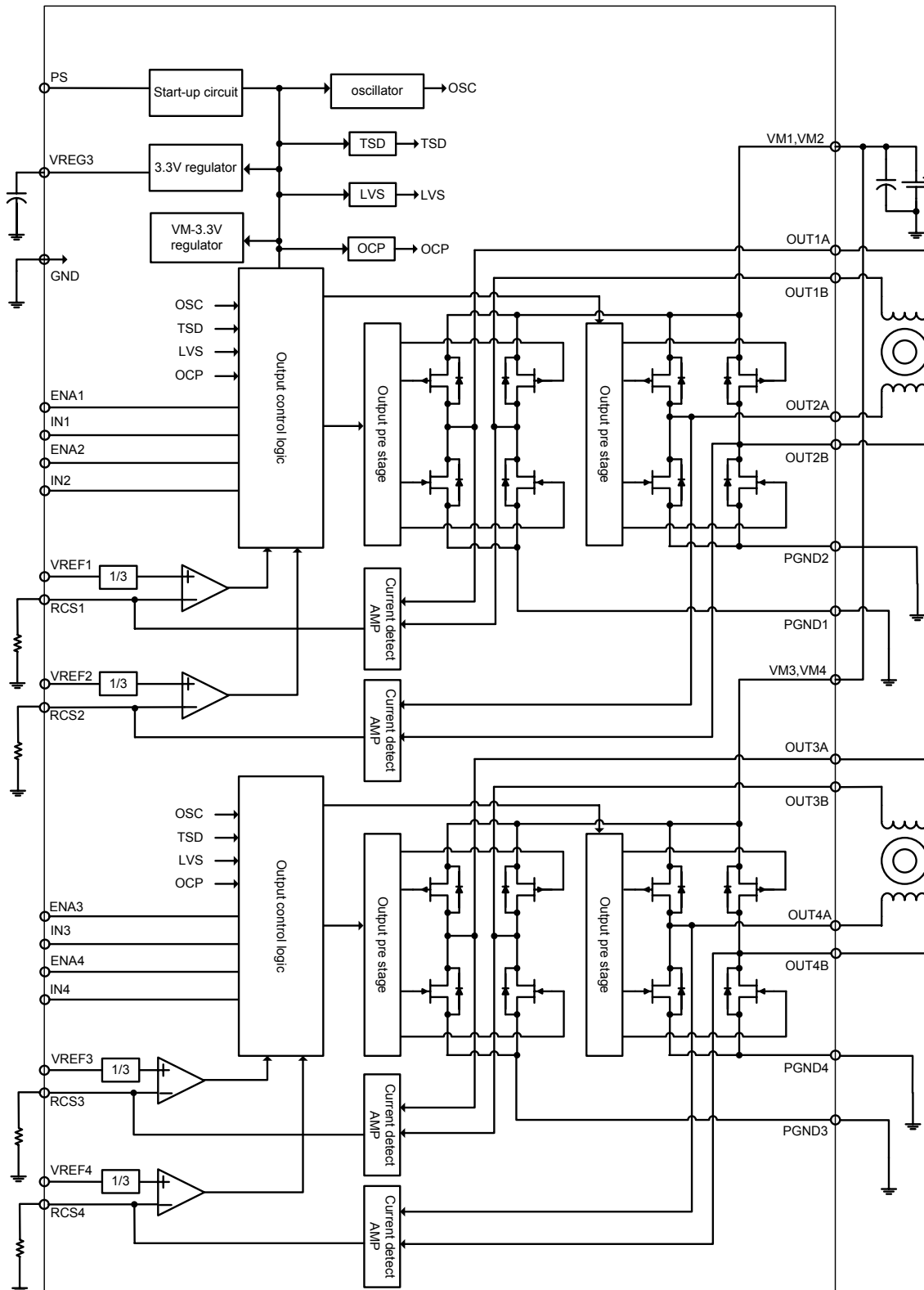
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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## Pin Assignment



Block Diagram



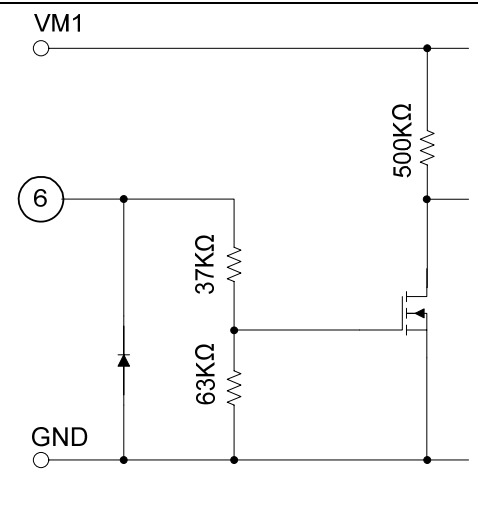
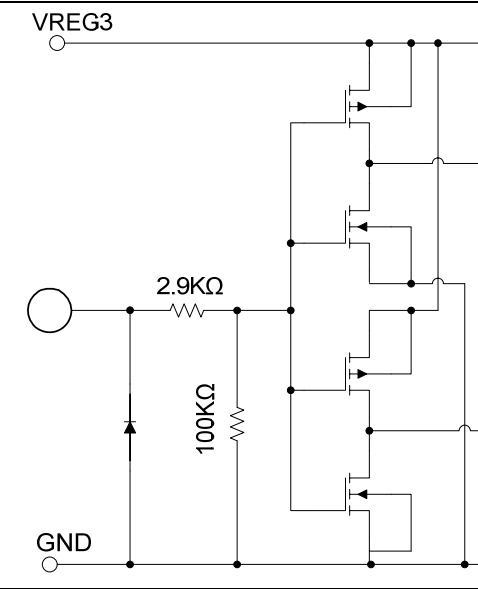
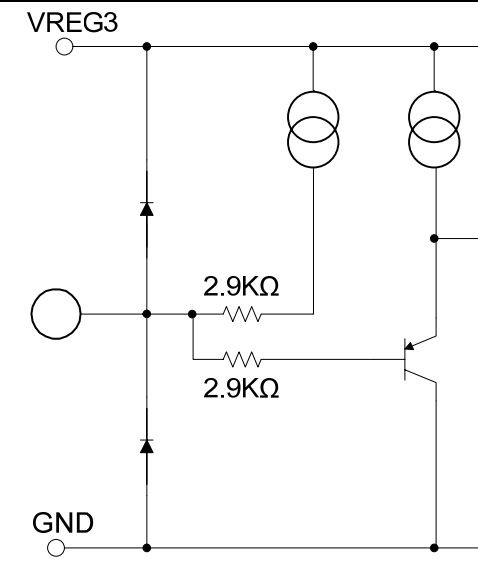
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## Pin Functions

Pin No.	Pin name	Description
6	PS	Power save signal input pin
2	ENA1	Channel1 Control signal input pin
3	IN1	
35	ENA2	Channel2 Control signal input pin
34	IN2	
11	ENA3	Channel3 Control signal input pin
10	IN3	
26	ENA4	Channel4 Control signal input pin
27	IN4	
4	VREF1	Channel1 current setting reference voltage input pin
33	VREF2	Channel2 current setting reference voltage input pin
9	VREF3	Channel3 current setting reference voltage input pin
28	VREF4	Channel4 current setting reference voltage input pin
5	RCS1	Channel1 output current detecting resistor connection pin
32	RCS2	Channel2 output current detecting resistor connection pin
8	RCS3	Channel3 output current detecting resistor connection pin
29	RCS4	Channel4 output current detecting resistor connection pin
7	VREG3	Internal power supply capacitor connection pin.
31	GND	Ground
1	VM1	Motor power supply pin
36	VM2	Motor power supply pin
12	VM3	Motor power supply pin
25	VM4	Motor power supply pin
45	OUT1A	Channel1 OUTA output pin
43	OUT1B	Channel1 OUTB output pin
40	OUT2A	Channel2 OUTA output pin
42	OUT2B	Channel2 OUTB output pin
16	OUT3A	Channel3 OUTA output pin
18	OUT3B	Channel3 OUTB output pin
21	OUT4A	Channel4 OUTA output pin
19	OUT4B	Channel4 OUTB output pin
47	PGND1	Channel1 power system GND
38	PGND2	Channel2 power system GND
14	PGND3	Channel3 power system GND
23	PGND4	Channel4 power system GND
13,15,17,20,2 2,24,37,39,41 ,44,46,48	NC	No Connect (No internal connection to the IC)

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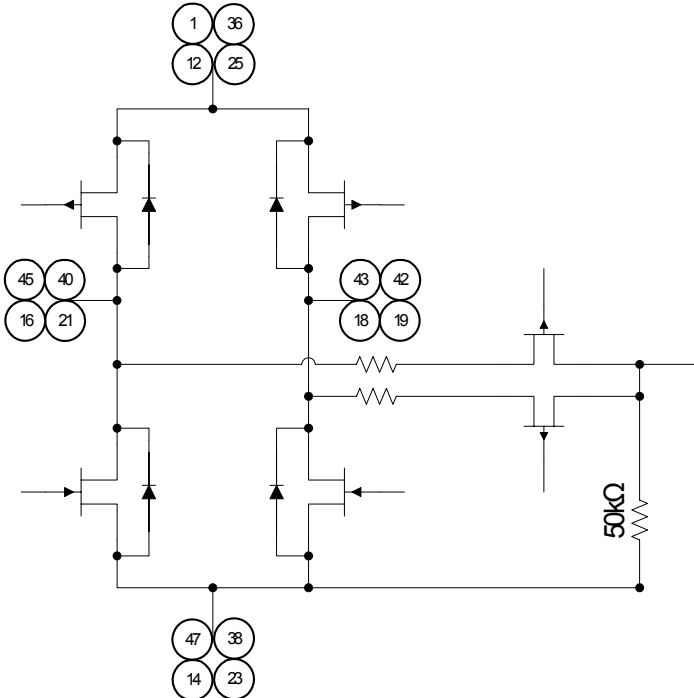
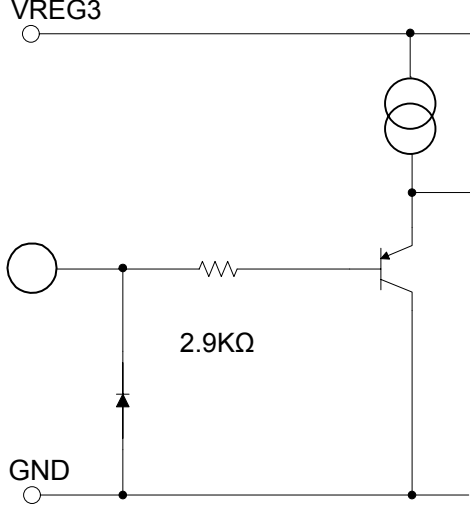
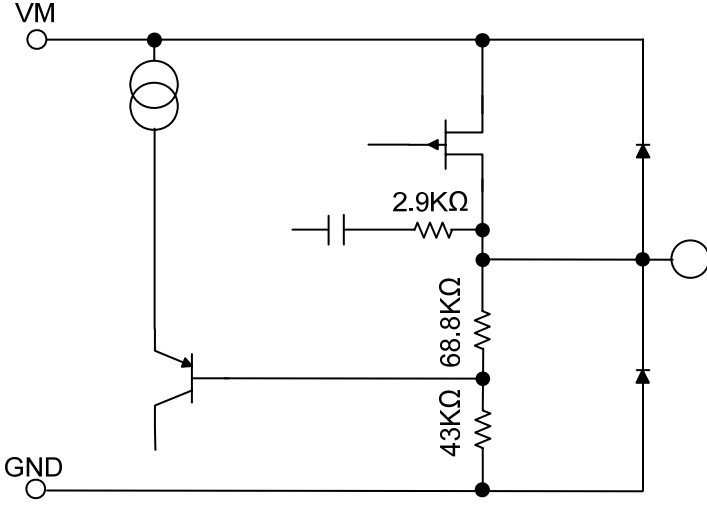
## Equivalent Circuit

Pin No.	Pin symbol	Equivalent Circuit
6	PS	
2 3 35 34 11 10 26 27	ENA1 IN1 ENA2 IN2 ENA3 IN3 ENA4 IN4	
5 32 8 29	RCS1 RCS2 RCS3 RCS4	

Continued on next page.

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Continued from preceding page.

Pin No.	Pin symbol	Equivalent Circuit
1 47 45 43 36 38 40 42 12 14 16 18 25 23 21 19	VM1 PGND1 OUT1A OUT1B VM2 PGND2 OUT2A OUT2B VM3 PGND3 OUT3A OUT3B VM4 PGND4 OUT4A OUT4B	
4 33 9 28	VREF1 VREF2 VREF3 VREF4	
7	VREG3	



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## Description of operation

### 1. Input pin function

#### (1-1) Chip enable function

This IC is switched between standby and operating mode by setting the PS pin. In standby mode, the IC is set to power-save mode and all logic is reset. In addition, the internal regulator circuit do not operate in standby mode.

PS	Mode	Internal regulator
L or Open	Standby mode	Standby
H	Operating mode	Operating

#### (1-2) Output control signal logic

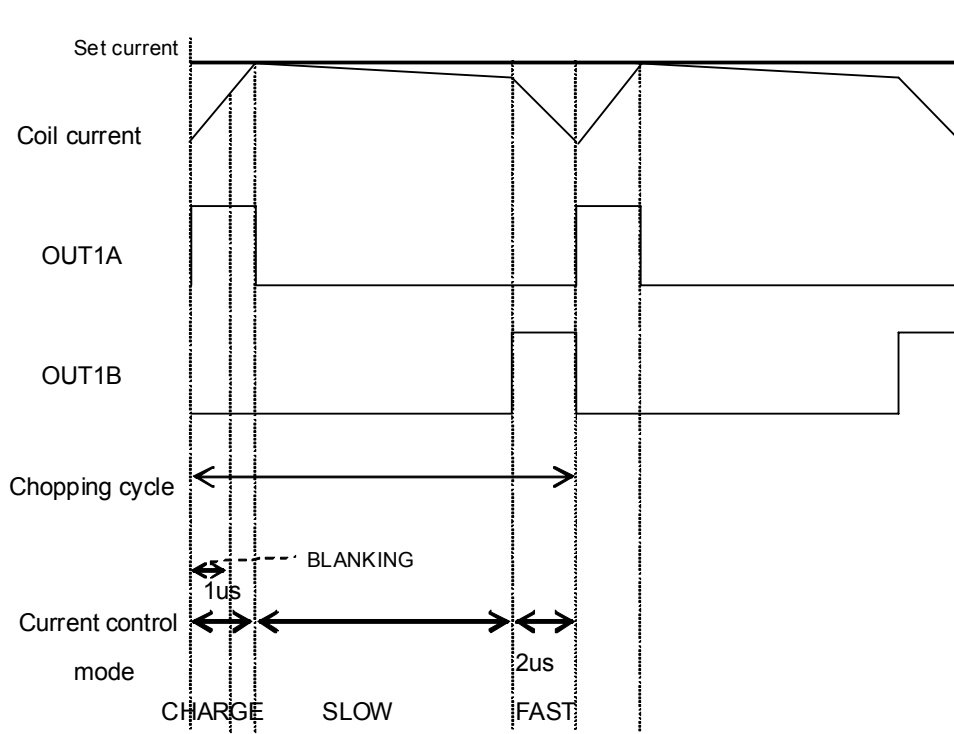
Input signal		Output		Function
ENA*	IN*	OUT*A	OUT*B	
L	–	Off	Off	*ch Stanby
H	L	High	Low	*ch CW (Forward)
H	H	Low	High	*ch CCW (Reverse)

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## 2. PWM constant-current control

LV8714TA performs constant current control of coil current by PWM chopping of the output pin, as opposed to the output detection current set up by connecting external resistance to RCS pin.

### (2-1) Constant-current control time chart



### (2-2) Detection current setting method

Based on the voltage input to the VREF pin and the resistance connected between RCS and GND, the output current that is subject to the constant-current control is set using the calculation formula below:

$$I_{out} = (V_{REF}/3)/RCS \times 4000$$

e.g.  $V_{REF} = 0.6V, RCS = 1k\Omega$

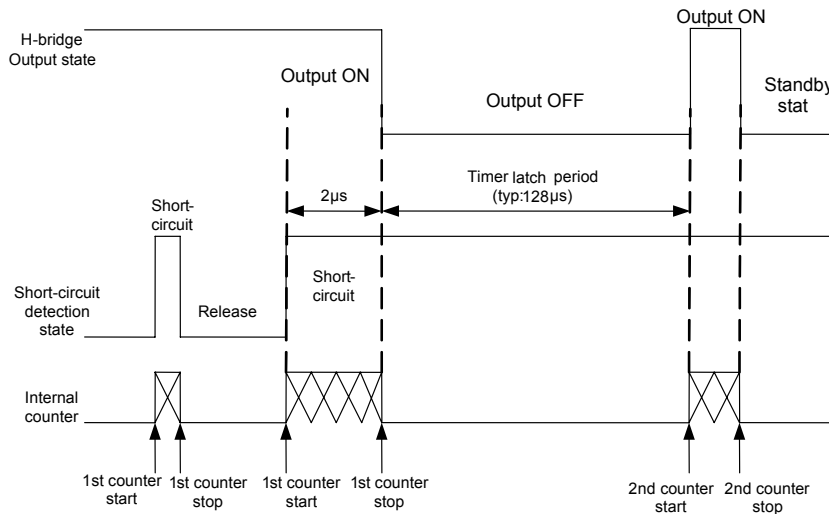
$$I_{out} = (0.6V/3) / 1k\Omega \times 4000 = 0.8A$$

**3. Output short-circuit protection current**

Built-in output short-circuit protection circuit makes output to enter in stand-by mode. This function prevents the IC from damaging when the output shorts circuit by a voltage short or a ground short, etc.

When output short state is detected for  $2\mu\text{s}$ , short-circuit detection circuit state the operating and output is once turned OFF. Subsequently, the output is turned ON again after the timer latch period (typ.  $128\mu\text{s}$ ). If the output remains in the short-circuit state, turn OFF the output, fix the output to the wait mode.

When output is fixed in stand-by mode by output short protection circuit, output is released the latch by setting PS = "L".



The output short-circuit protection circuit doesn't secure protection and the destruction prevention of the set because it becomes operation by the area where ratings  $I_{\text{omax}}=1.5\text{A}$  of the output current was exceeded.

**4. Thermal shutdown circuit function**

The Thermal shutdown circuit is built into, and the output is turned off when junction temperature  $T_j$  exceeds  $180^\circ\text{C}$ . The value of hysteresis and when it falls, the temperature drives the output again (automatic restoration).

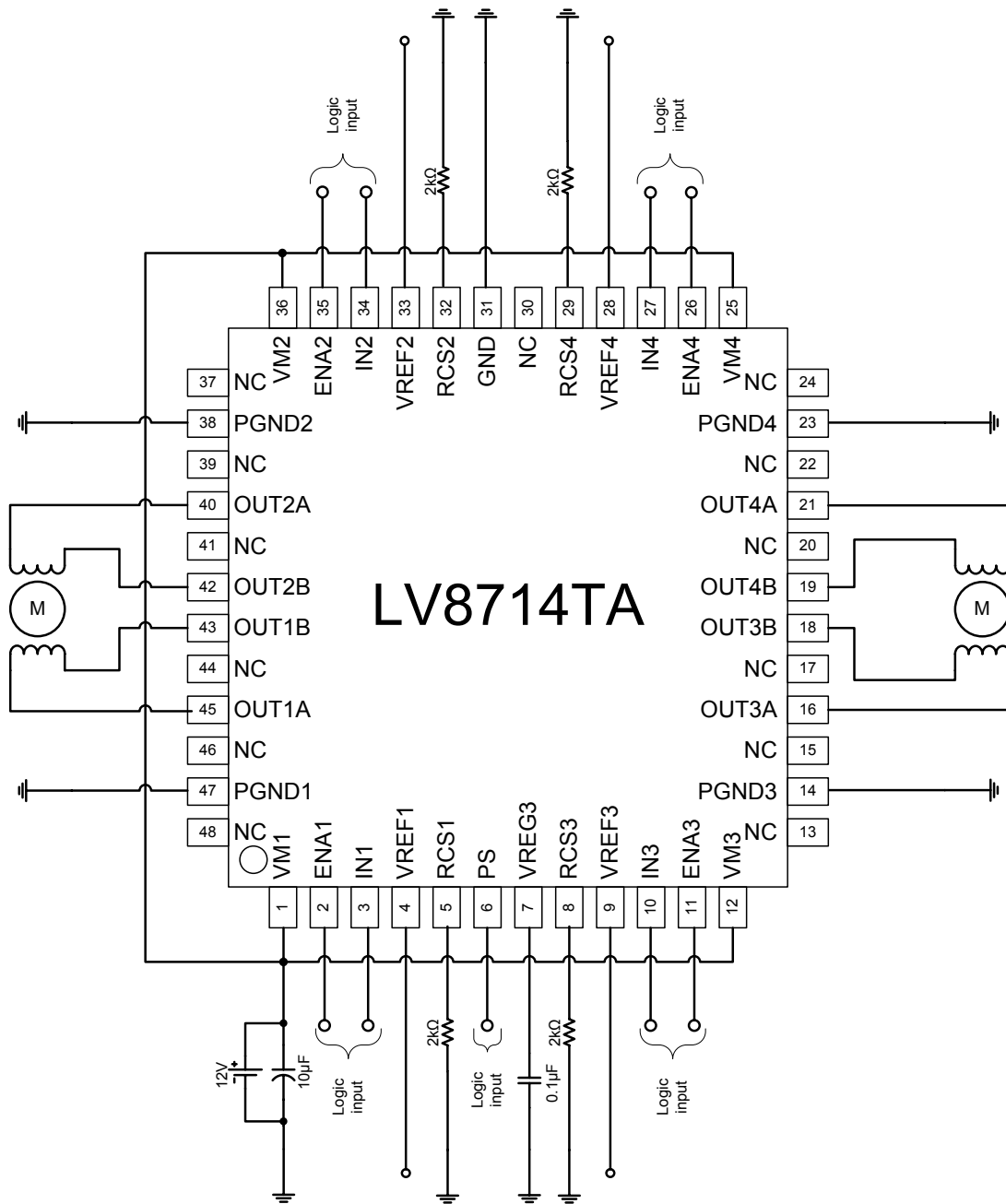
The overheating protection circuit doesn't secure protection and the destruction prevention of the set because it becomes operation by the area where ratings  $T_{j\text{max}}=150^\circ\text{C}$  of the junction temperature was exceeded.

TSD =  $180^\circ\text{C}$  (typ)

$\Delta\text{TSD} = 40^\circ\text{C}$  (typ)

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## Application Circuit Example



Setting of constant current

When  $V_{REF} = 0.9V$ ,  $R_{CS} = 2k\Omega$

$$I_{out} = (V_{REF}/3) / R_{CS} \times 4000$$

$$= (0.9V/3) / 2k\Omega \times 4000 = 0.6A$$

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## ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LV8714TA-AH	TQFP48 EP 7x7 (Pb-Free / Halogen Free)	1000 / Tape & Reel

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