

# LV8549MC



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Bi-CMOS integrated circuit  
**12V Low Saturation Voltage Drive  
Stepper Motor Driver  
Application Note**

## Overview

The LV8549MC is a 2-channel low saturation voltage stepper motor driver IC. It is optimal for Full step motor drive in 12V system products.

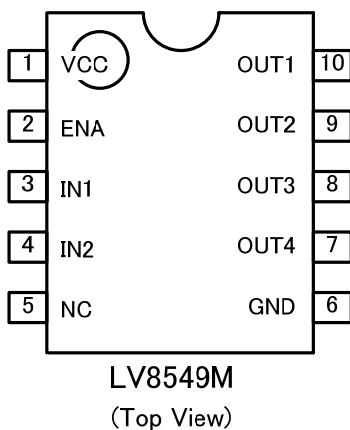
## Function

- DMOS output transistor adoption (Upper and lower total  $R_{ON}=1\Omega$  typ)
- The compact package (SOIC10) is adopted.
- $V_{CC}$  max=20v,  $I_O$  max=1A
- For one power supply (The control system power supply is unnecessary.)
- Current consumption 0 when standing by

## Typical Applications

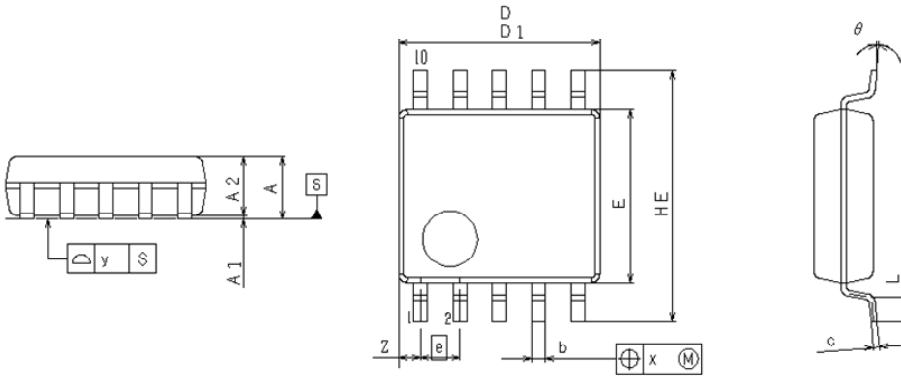
- Refrigerators
- Time Recorder
- Label Printer
- Vacuum cleaner
- POS Printer
- TOY

## Pin Assignment

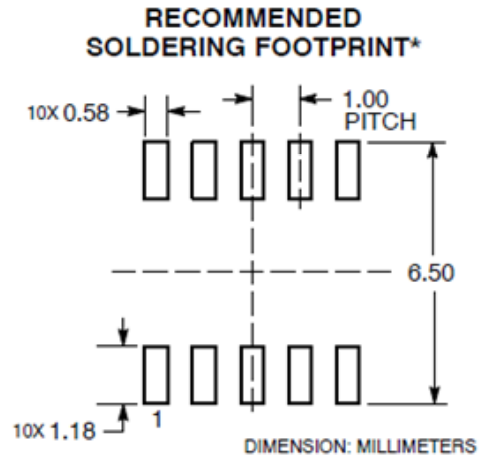


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## Package Dimensions



symbol	SOIC10		
	MIN.	NOM.	MAX.
D			
D1	4.80	<4.90>	5.00
A			1.75
A1	0.10	<0.175>	0.25
A2	1.25		1.75
e		1.00	
L	0.40	<0.835>	1.27
b	0.31	<0.41>	0.51
c	0.17	<0.21>	0.25
x		0.25	
y		0.10	
HE	5.80	<6.00>	6.20
E	3.80	<3.90>	4.00
θ	0.00		8.00
Z			



Caution: The package dimension is a reference value, which is not a guaranteed value.

## Block Diagram

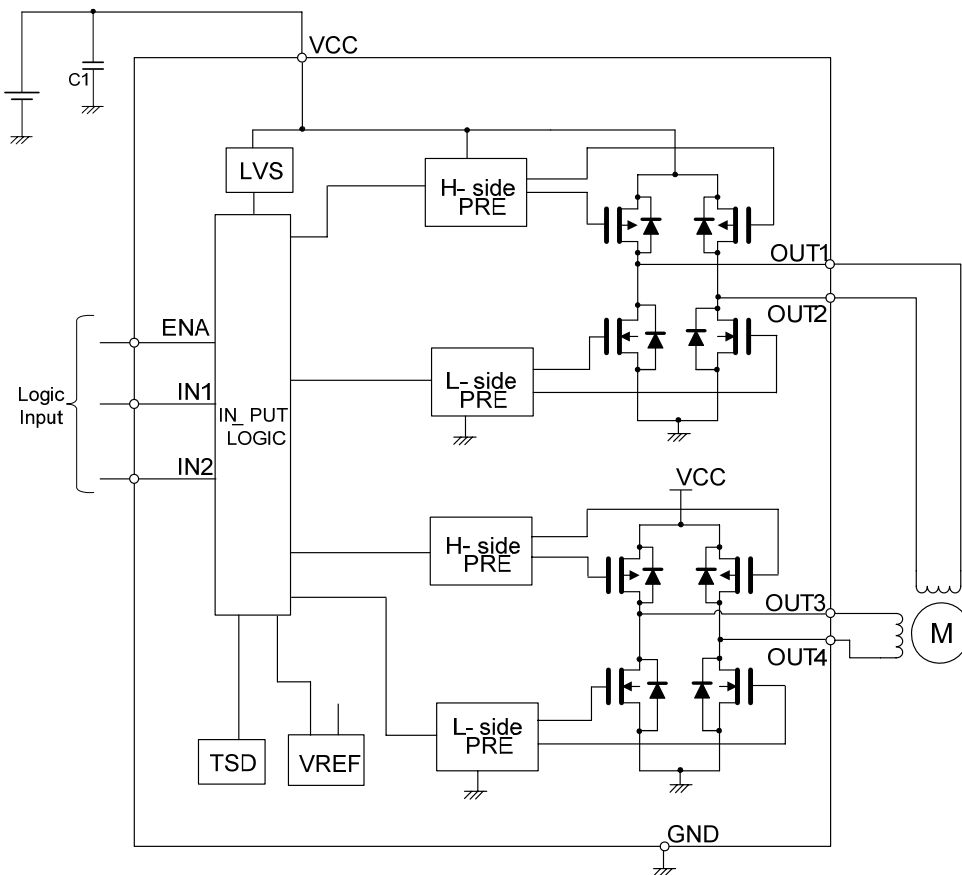


Figure1 One stepper motor drive

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## Specifications

### Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	V <sub>CC</sub> max		-0.3 to +20	V
Output impression voltage	V <sub>OUT</sub>		-0.3 to +20	V
Input impression voltage	V <sub>IN</sub>		-0.3 to +6	V
GND pin outflow current	I <sub>GND</sub>	For ch	1.0	A
Allowable Power dissipation	P <sub>d</sub> max	*	1.05	W
Operating temperature	T <sub>opr</sub>		-30 to +85	°C
Storage temperature	T <sub>stg</sub>		-40 to +150	°C

\*: When mounted on the specified printed circuit board (57.0mm × 57.0mm × 1.6mm), glass epoxy, both sides

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 Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

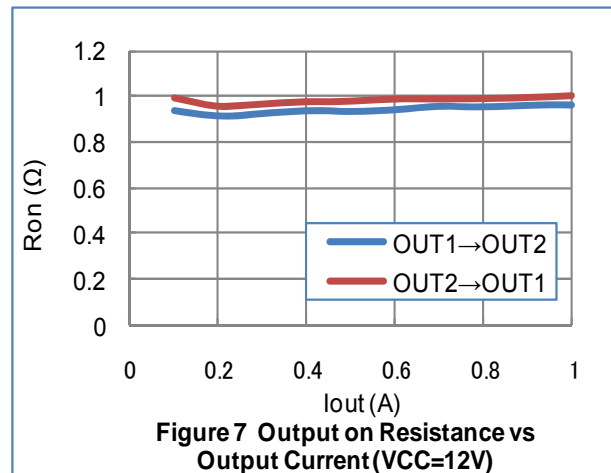
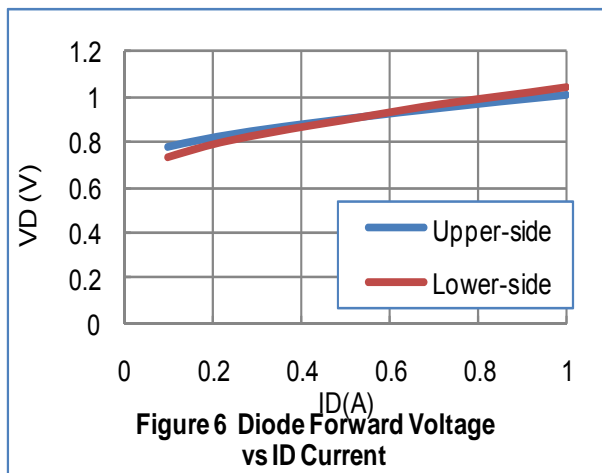
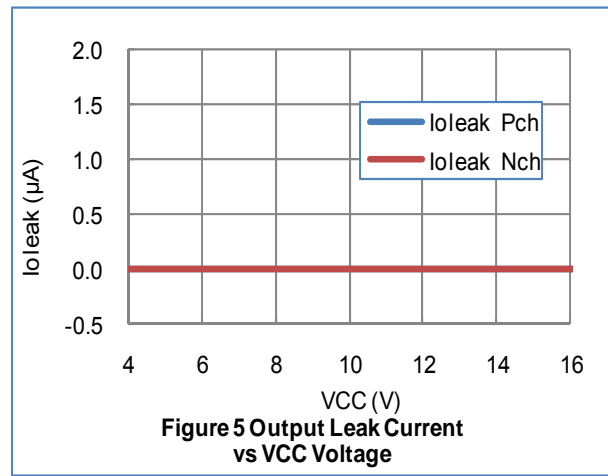
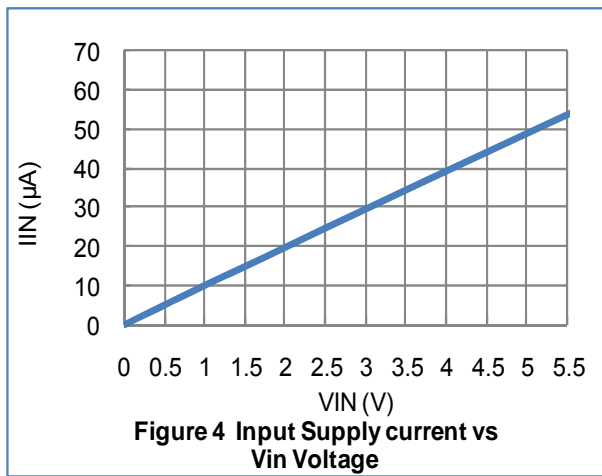
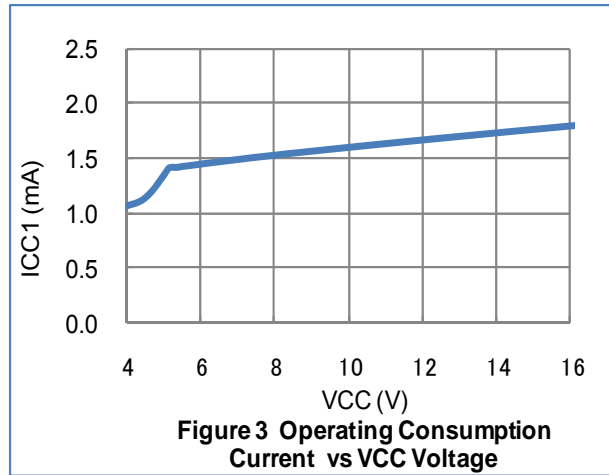
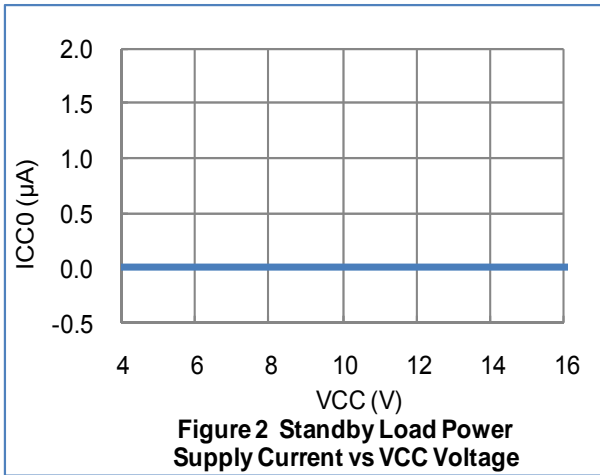
### Recommended Operating Condition at Ta = 25°C

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply voltage	V <sub>CC</sub>		4		16	V
Input "H" level voltage	V <sub>INH</sub>		+1.8		+5.5	V
Input "L" level voltage	V <sub>INL</sub>		-0.3		+0.7	V

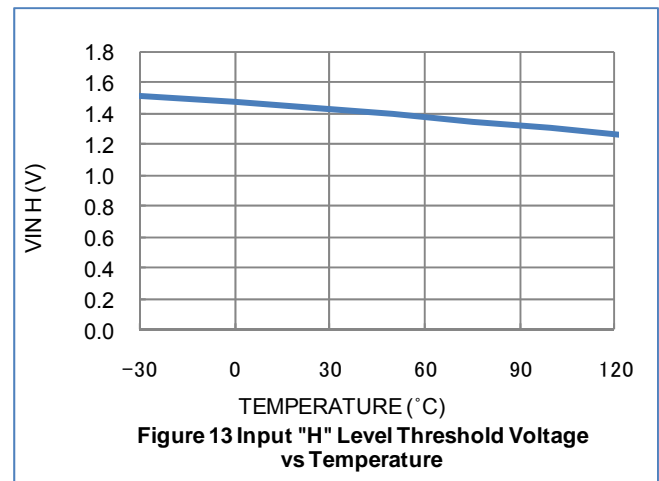
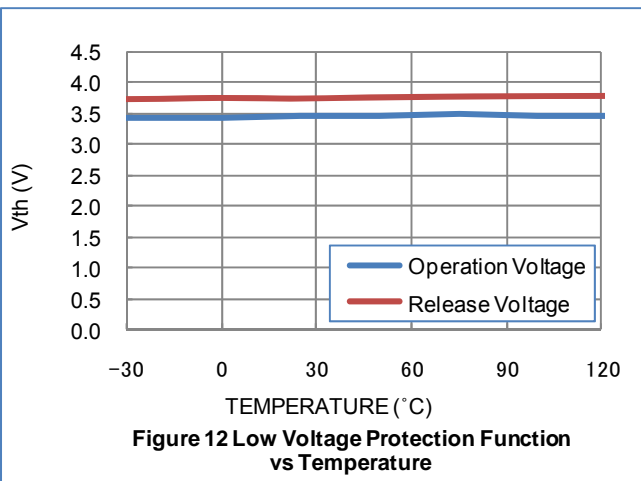
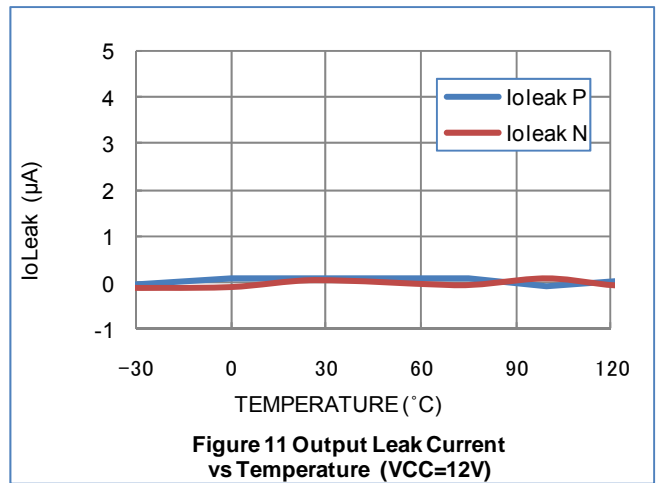
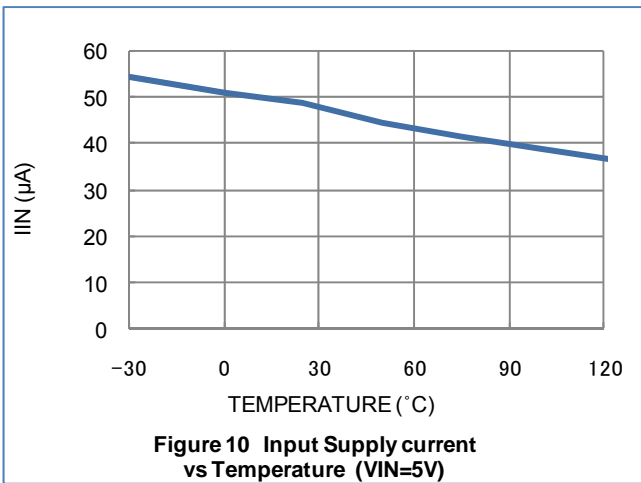
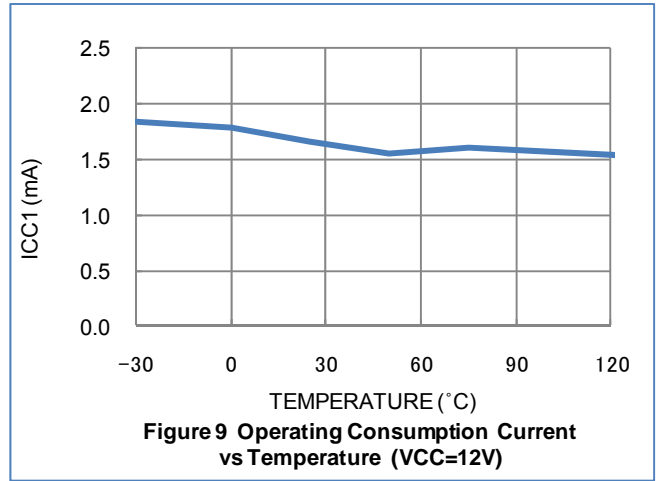
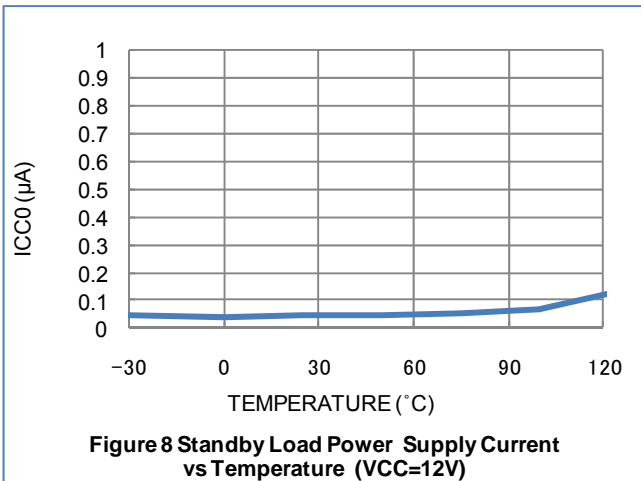
### Electrical Characteristics at Ta = 25°C, V<sub>CC</sub> = 12V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply voltage	I <sub>CC0</sub>	Standby mode ENA=L			1	μA
	I <sub>CC1</sub>	ENA=H		1.7	2.3	mA
Input current	I <sub>IN</sub>	V <sub>IN</sub> =5V	30	50	65	μA
Thermal shutdown operating temperature	T <sub>tsd</sub>	Design certification	150	180	210	°C
Width of temperature hysteria	ΔT <sub>tsd</sub>	Design certification		40		°C
Low voltage protection function operation voltage	V <sub>th</sub> V <sub>CC</sub>		3.3	3.5	3.65	V
Release voltage	V <sub>thret</sub>		3.55	3.8	3.95	V
Output ON resistance (Upper and lower total)	R <sub>ON</sub>	I <sub>OUT</sub> =1.0A	0.7	1	1.25	Ω
Output leak current	I <sub>Oleak</sub>	V <sub>O</sub> =16V			10	μA
Diode forward voltage	V <sub>D</sub>	I <sub>D</sub> =1.0A		1.0	1.2	V

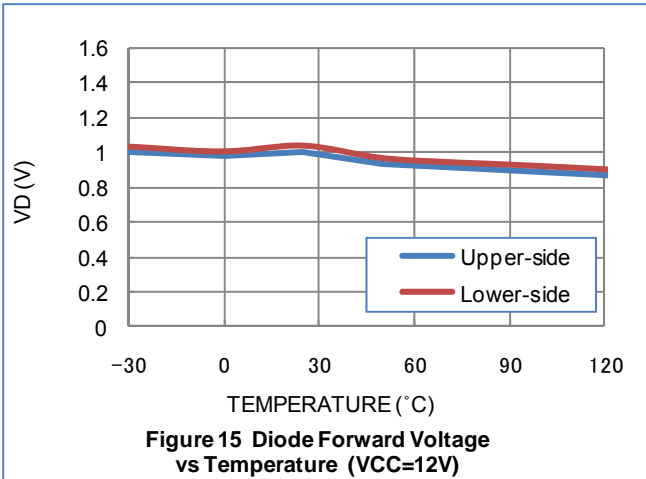
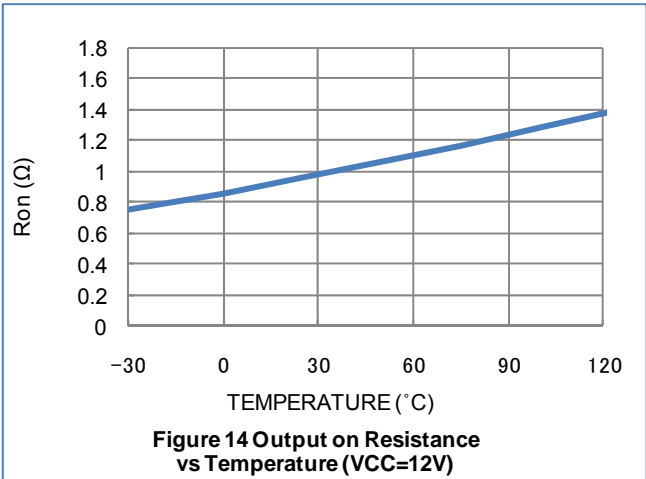
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## Pin function

Pin No.	Pin name	Pin function	Equivalent Circuit
1	VCC	Power-supply voltage pin. VCC voltage is impressed. The permissible operation voltage is from 4.0 to 16.0(V). The capacitor is connected for stabilization for GND pin (6pin).	
2	ENA	Motor drive control input pin. It shifts from the stand-by state to a prescribed output operation corresponding to the state of the input when the ENA pin becomes a standby mode by L, the circuit current can be adjusted to 0, and it makes it to H. It is a digital input, and the range of L level input is 0 to 0.7(V) and the range of H level input are 1.8 to 5.5(V). PWM can be input. Pull-down resistance 100(kΩ) is built into in the terminal.	
3	IN1	Motor drive control input pin. Driving control input pin of OUT1 (10pin) and OUT2 (9pin). PWM can be input. With built-in pull-down resistance.	
4	IN2	Motor drive control input pin. Driving control input pin of OUT3 (8pin) and OUT4 (7pin). PWM can be input. With built-in pull-down resistance.	
5	NC		
6	GND	Ground pin.	
7	OUT4	Driving output pin. The motor coil is connected between terminal OUT3 (8pin).	
8	OUT3	Driving output pin. The motor coil is connected between terminal OUT4 (7pin).	
9	OUT2	Driving output pin. The motor coil is connected between terminal OUT1 (10pin).	
10	OUT1	Driving output pin. The motor coil is connected between terminal OUT2 (9pin).	

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## Operation explanation

### 1. STM output control logic

Input			Output				Function
ENA	IN1	IN2	OUT1	OUT2	OUT3	OUT4	
L	-	-	OFF	OFF	OFF	OFF	Standby
H	L	L	H	L	H	L	Step 1
	H	L	L	H	H	L	Step 2
	H	H	L	H	L	H	Step 3
	L	H	H	L	L	H	Step 4

### 2. About the switch time from the stand-by to the operation

When ENA pin are "L", this IC has completely stopped operating. After the time of reset (about 7 $\mu$ s of an internal setting) it shifts to a prescribed output status corresponding to the state of the input when the signal enters the ENA pin.

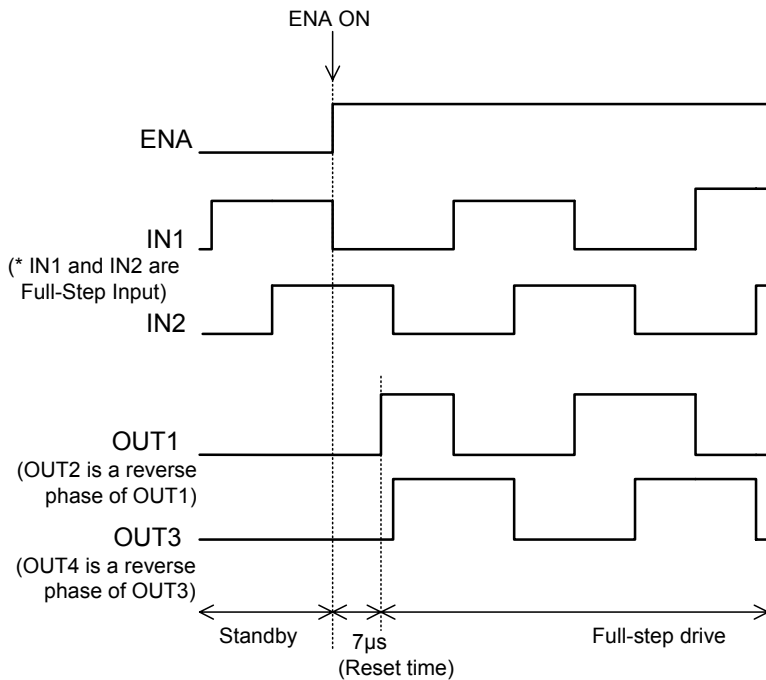


Figure16 Switch time from the stand-by to the operation

### 3. Thermal shutdown function

The thermal shutdown circuit is incorporated and the output is turned off when junction temperature  $T_j$  exceeds 180 $^{\circ}$ C. As the temperature falls by hysteresis, the output turned on again (automatic restoration). The thermal shutdown circuit does not guarantee the protection of the final product because it operates when the temperature exceed the junction temperature of  $T_{jmax}=150^{\circ}$ C.

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

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

### 4. Low voltage protection function

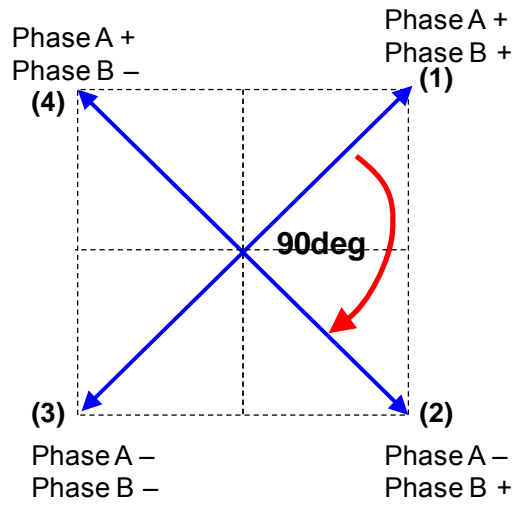
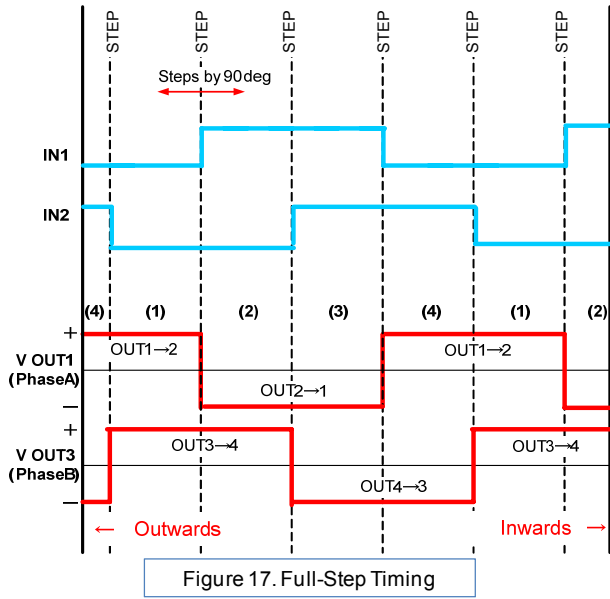
When the power supply voltage is as follows typical 3.5V, the output does OFF.  
When the power supply voltage is as above typical 3.8V, the IC outputs a set state.



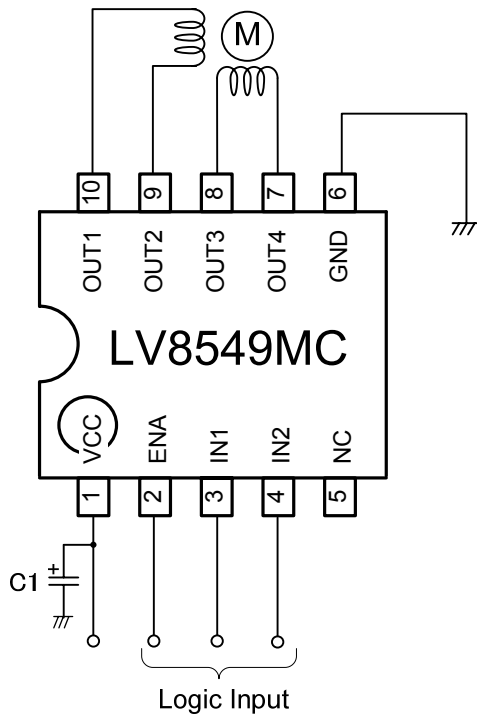
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## Operation principal

- Full-Step Drive  
Motor advances 90 degree by inputting 1 step.



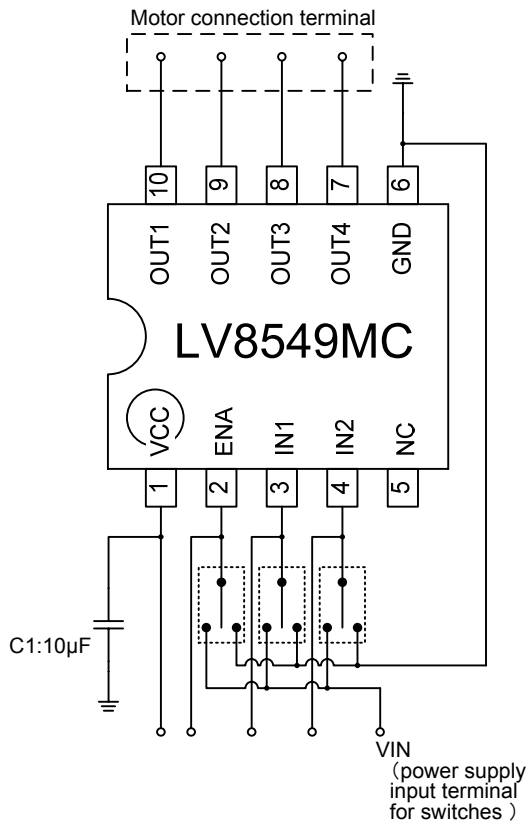
## Application Circuit Example



\* Bypass capacitor (C1) connected between VCC-GND of all examples of applied circuit recommends the electric field capacitor of 0.1μA to 10μA.  
Confirm there is no problem in operation in the state of the motor load including the temperature property about the value of the capacitor.  
Mount the position where the capacitor is mounted on nearest IC.

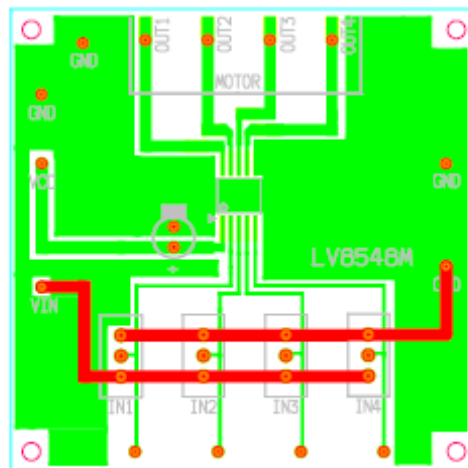
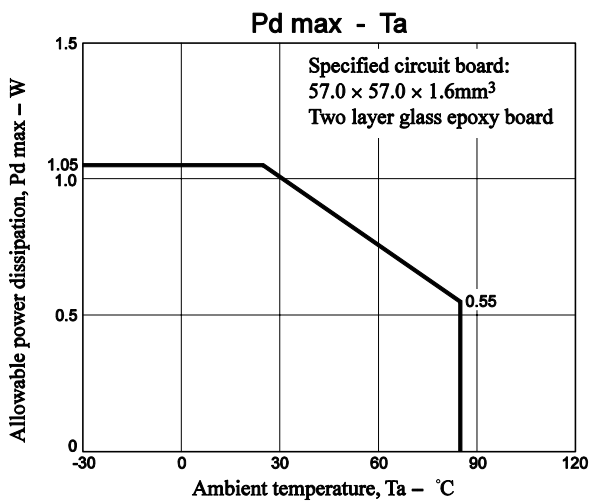
## Eva-Board Manual

### 1. Eva-Board circuit diagram



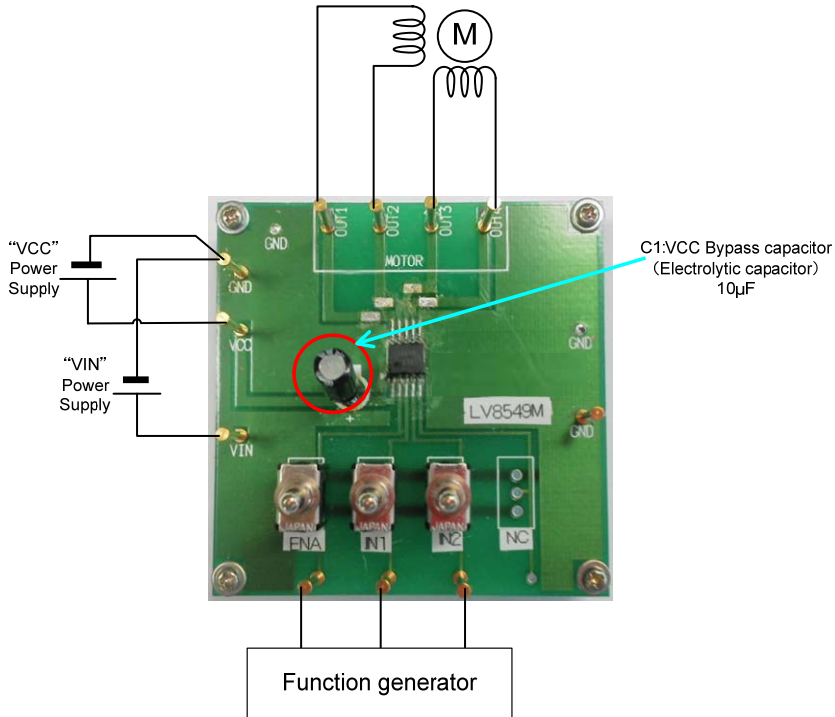
### Bill of Materials for LV8549MC Evaluation Board

Designator	Qty	Description	Value	Tol	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed	Lead Free
IC1	1	Motor Driver			SOIC10	ON semiconductor	LV8549MC	No	Yes
C1	1	VCC Bypass capacitor	10µF 50V	±20%		SUN Electronic Industries	50ME10HC	Yes	Yes
SW1-SW4	3	Switch				MIYAMA	MS-621-A01	Yes	Yes
TP1-TP11	11	Test points				MAC8	ST-1-3	Yes	Yes



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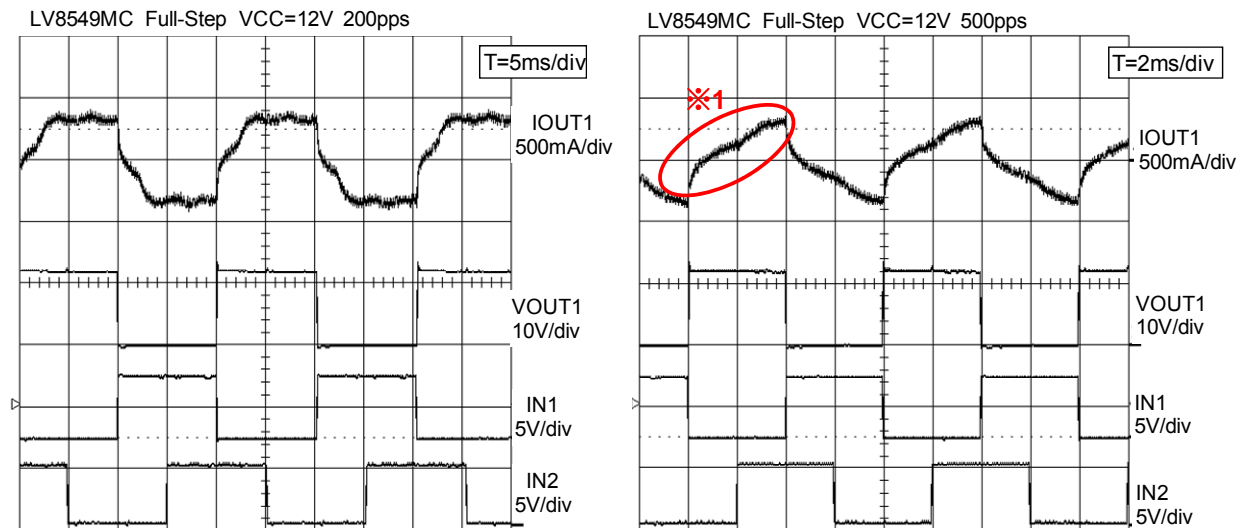
## 2. One stepper motor drive



- Connect a stepper motor with OUT1, OUT2, OUT3 and OUT4.
- Connect the motor power supply with the terminal VCC, the control power supply with the terminal VIN. Connect the GND line with the terminal GND.
- STP motor drives it in a Full step, by inputting an input signal such as follows into IN1/IN2.
- For input signal to function generator, refer to p.9.  
To reverse motor rotation, make sure to input signal to outward direction.

### Waveform of LV8549MC evaluation board when driving stepper motor

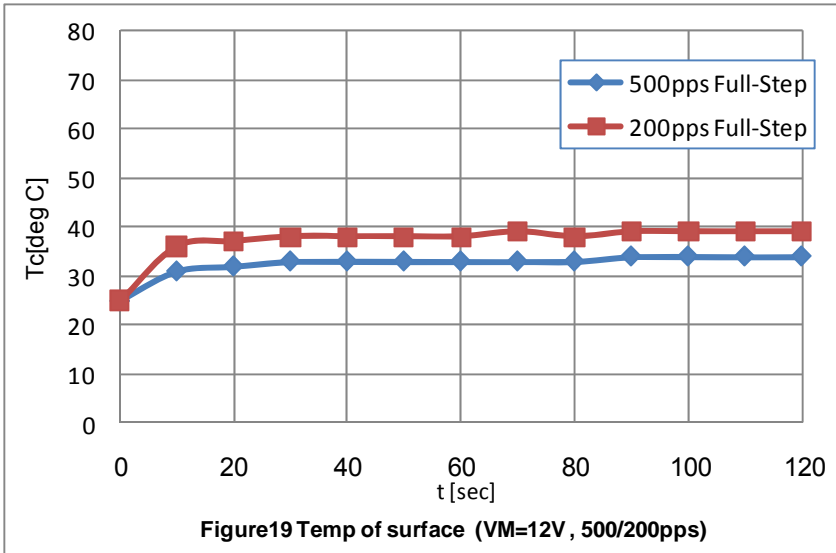
- Full-Step Drive



\*1. When the motor rotation is at a high speed, current gradient increases by the inductance of motor (L).

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- IC surface temperature when a motor is in operation (reference)



[Stepper motor driven by LV8549MC]  
Motor diameter: 20.5mm  
Coil resistance: 30.8Ω

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