

LB1848MC



ON Semiconductor®

<http://onsemi.com>

Monolithic Digital IC

Low-Voltage/Low Saturation Voltage Type Bidirectional Motor Driver Application Note

Overview

The LB1848MC is a 2-channel low-voltage, low saturation voltage type bidirectional motor driver IC that is optimal for use as 2-phase stepping motor driver in printers, floppy disk drives, cameras and other portable equipments. The output circuits are of the bipolar type, with pnp transistors in the upper side and npn transistors in the lower side, and they achieve low saturation output and low power characteristics despite being provided in a miniature package.

The LB1848MC can directly control a motor from signals from a microcontroller. The LB1848M is optimal for 2-phase excitation drive for 2-phase stepping motors using 3-input logic (ENA, IN1, and IN2).

The LB1848MC has a built-in thermal shutdown circuit to protect itself from operating at exceedingly high temperature even if the IC outputs are shorted. Additionally, the MFP-10S miniature package used supports reduced-space mounting.

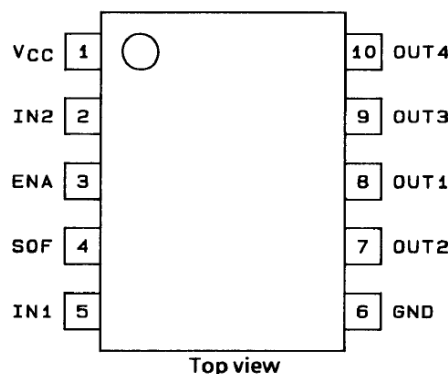
Function

- Optimal for 2 phase excitation drive for 2-phase stepping motor
- Low saturation voltage. $V_{O(sat)} = 0.55\text{ V}$ typical at $I_O = 400\text{ mA}$
- Standby current: zero
- Thermal shutdown circuit
- Miniature package: MFP-10S (6.5 x 5.1 mm²)
- Through-current prevention circuit
- "Soft off" function that reduces power supply line noise when switching from drive to standby modes. (Requires the use of one external capacitor.)
- No limitations on the magnitude relationship between the power supply voltage (VCC) and the input voltage (VIN)

Typical Applications

- Blu-ray pickup lens
- CCTV
- POS printer
- Security camera
- DSC

Pin Assignment

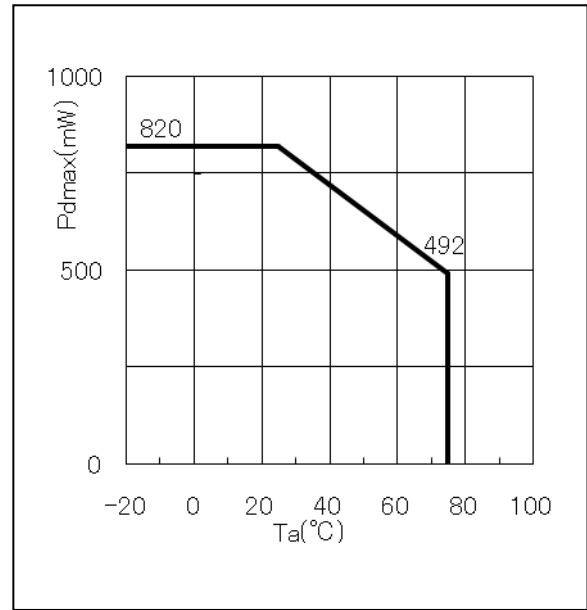
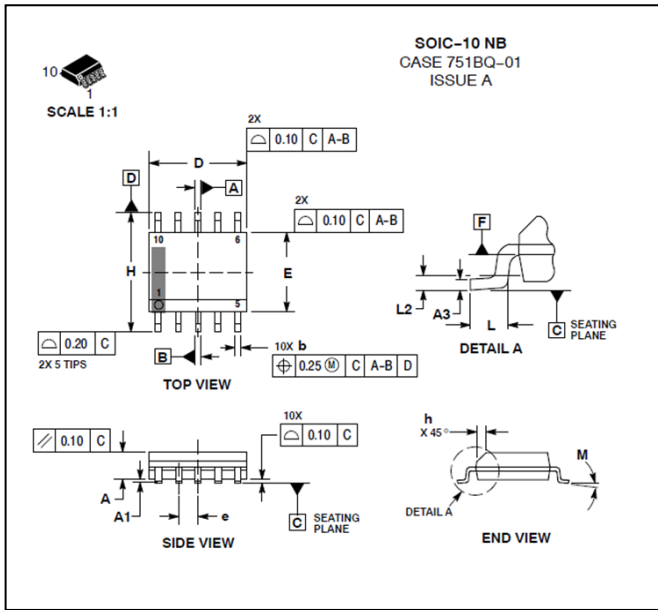


LB1848MC Application Note

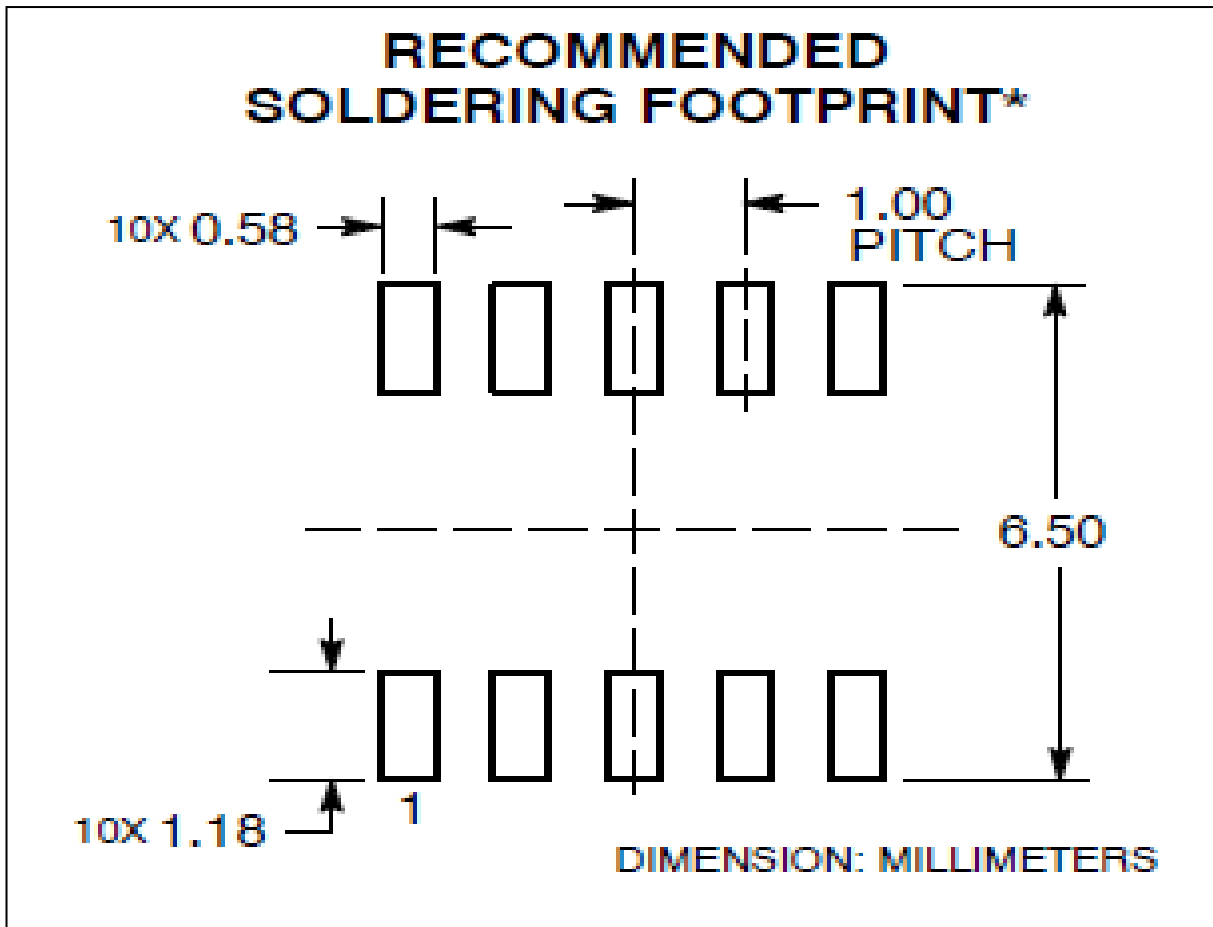
Package Dimensions

unit : mm (typ)

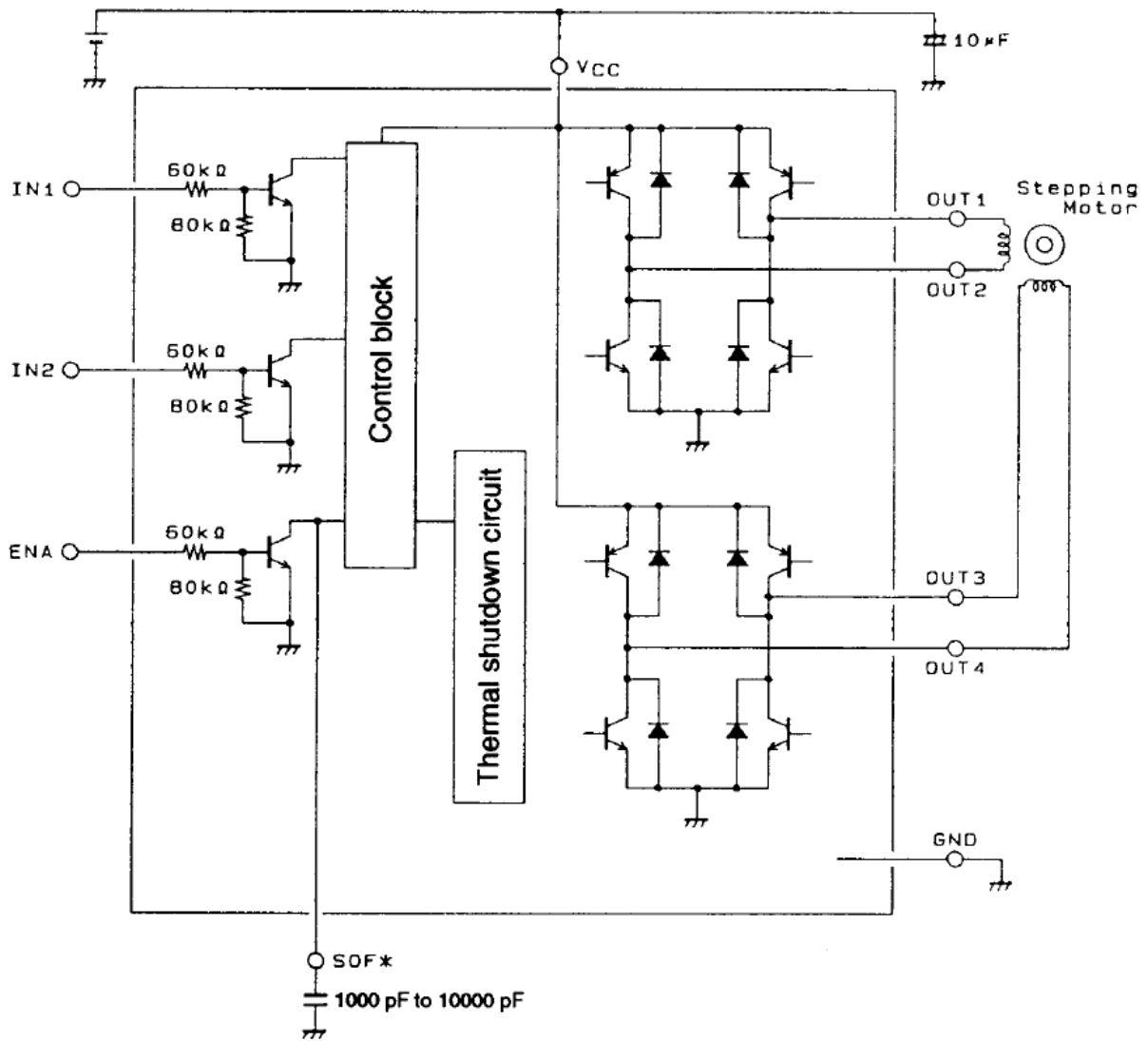
Pdmax-Ta



Recommended Soldering Footprint



Block Diagram



Note: When the "soft off" function is used, a capacitor must be connected to the SOF pin. If this function is not used, this pin must be left open with absolutely no signals or lines connected.

Notes on Wiring and Lines

Since large currents flow in the VCC and ground lines, oscillations may occur on these lines. The following points should be observed if such oscillations occur.

- (1) Lower the line impedances by making them shorter and thicker.
- (2) Attach capacitors close to the IC.
- (3) If the controller (CPU) is mounted on a separate printed circuit board, insert series resistors (of about 10kohm) between the controller outputs and this IC.

LB1848MC Application Note

Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$		-0.3 to +8.0	V
Output voltage	V_{OUT}		$V_{CC}+V_{SF}$	V
Input voltage	V_{IN}		-0.3 to +8.0	V
Ground pin outflow current	I_{GND}	Per channel	800	mA
Allowable power dissipation	$P_d\text{ max1}$	Independent IC	350	mW
	$P_d\text{ max2}$	When mounted.*	870	mW
Operating temperature	T_{opr}		-20 to +75	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +150	$^\circ\text{C}$

Note: * On the specified circuit board (114.3mm×76.2mm×1.5mm, glass epoxy printed circuit board)

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.

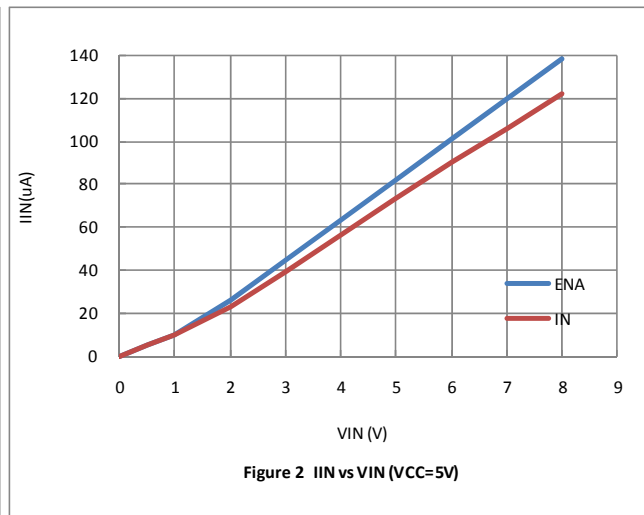
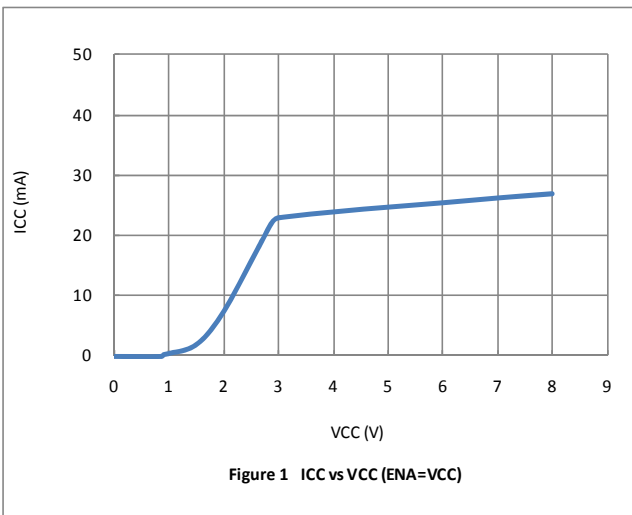
Recommended Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply voltage	V_{CC}		2.5		7.5	V
Input high-level voltage	V_{IH}		2.0		7.5	V
Input low-level voltage	V_{IL}		-0.3		+0.7	V

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC0}	ENA = 0V, $V_{IN} = 3\text{V}$ or 0V		0.1	10	μA
	I_{CC1}	ENA = 3V, $V_{IN} = 3\text{V}$ or 0V		25	35	mA
Output saturation voltage	V_{OUT1}	ENA = 3V, $V_{IN} = 3\text{V}$ or 0V, $V_{CC} = 3$ to 7.5V, $I_{OUT} = 200\text{mA}$		0.27	0.4	V
	V_{OUT2}	ENA = 3V, $V_{IN} = 3\text{V}$ or 0V, $V_{CC} = 4$ to 7.5V, $I_{OUT} = 400\text{mA}$		0.55	0.8	V
Input current 1	I_{IN}	$V_{IN} = 5\text{V}$		75	100	μA
Input current 2	I_{ENA}	ENA = 5V		85	110	μA
Spark killer Diode						
Reverse current	$I_S(\text{leak})$				30	μA
Forward voltage	V_{SF}	$I_{OUT} = 400\text{mA}$			1.7	V

Note: The thermal shutdown circuit function values are design guarantees, and are not tested.



LB1848MC Application Note

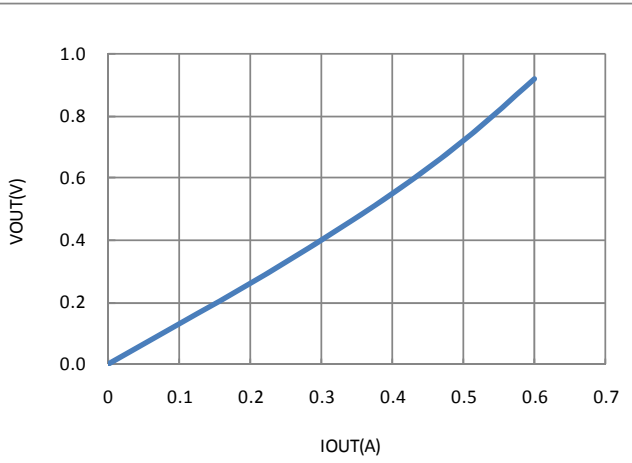


Figure 3 VOUT vs IOU (VCC=VIN=4V)

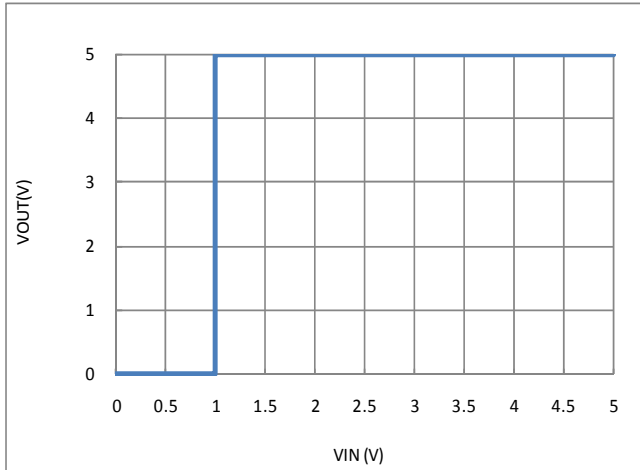


Figure 4 VOUT vs VIN (VCC=3.3V, VM=5V)

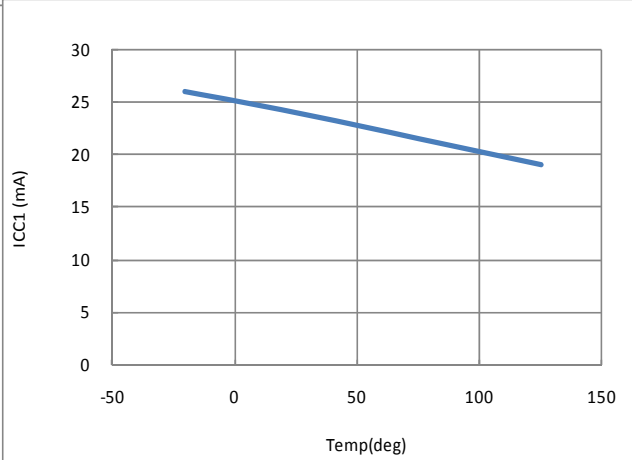


Figure 5 ICC1 vs Temperature (VCC=ENA=5V)

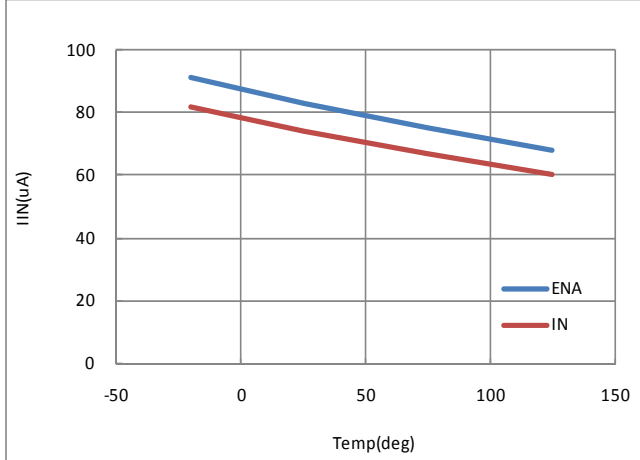


Figure 6 IIN vs Temperature (VCC=VIN=5V)

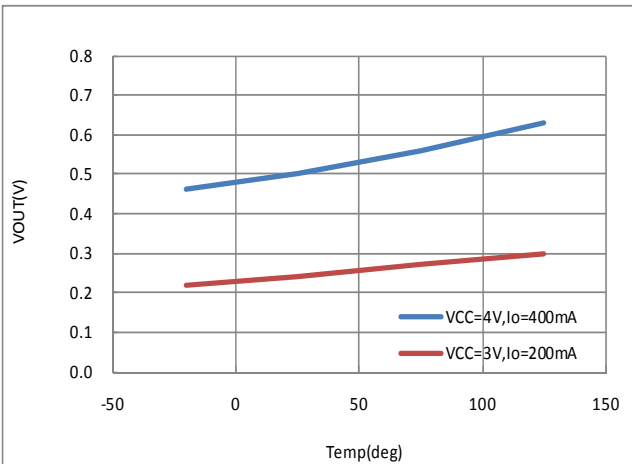


Figure 7 VOUT vs Temperature (VCC=VIN)

LB1848MC Application Note

Pin Functions

Pin No.	Pin name	Pin Function	Equivalent Circuit
3	ENA	Control signal input pin	
5 2	IN1 IN2	Control signal input pin Control signal input pin	
4	SOF	Capacitor connection pin	
8 7 9 10	OUT1 OUT2 OUT3 OUT4	Outpin Outpin Outpin Outpin	
1	VCC	Power supply voltage pin	
6	GND	Ground pin	

LB1848MC Application Note

Truth Table

ENA	IN1	IN2	OUT1	OUT2	OUT3	OUT4	Notes
L	-	-	OFF	OFF	OFF	OFF	Standby
H	L	L	H	L	H	L	2-phase excitation
	L	H	H	L	L	H	
	H	H	L	H	L	H	
	H	L	L	H	H	L	

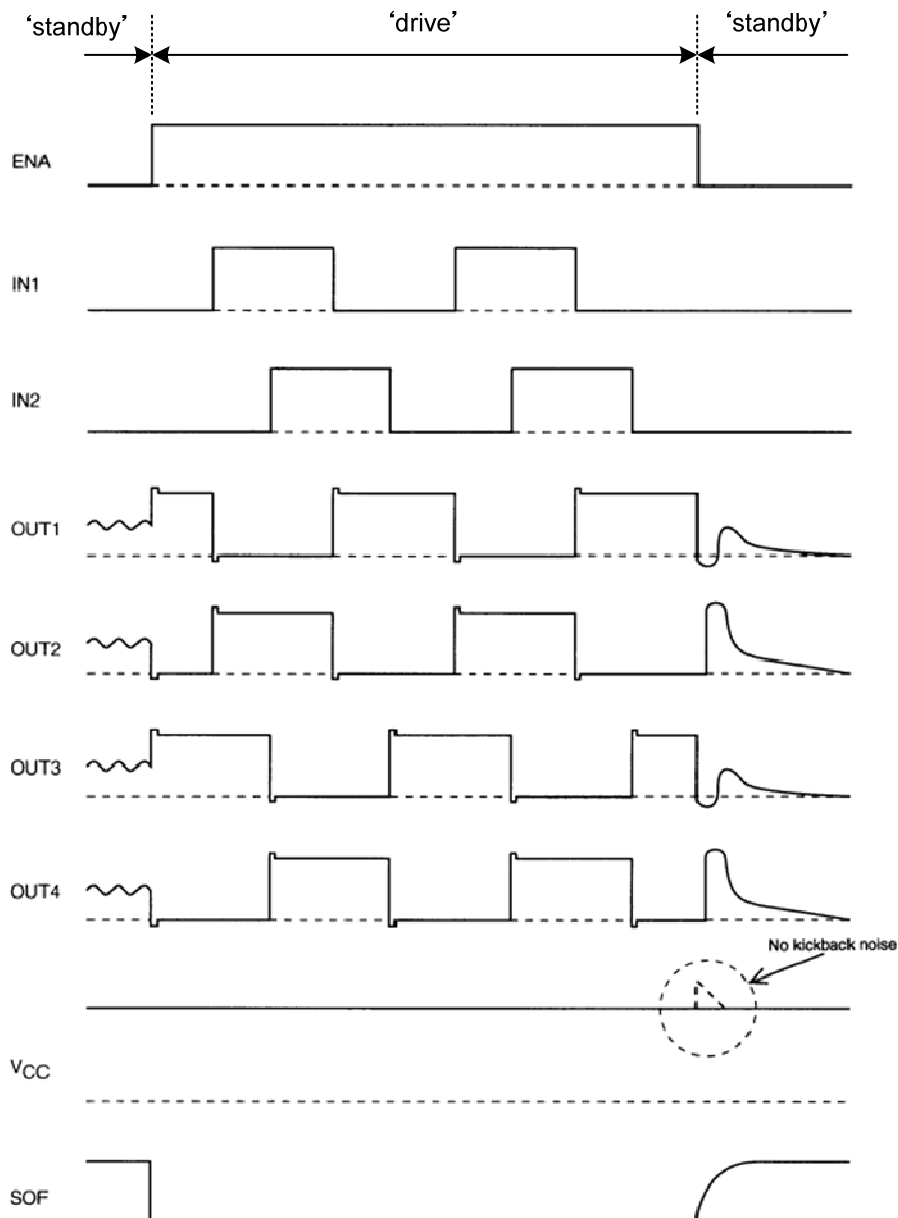
Note: "-" indicates a "don't care" input.

SOF Pin ("Soft Off" Function) Operation

The soft off function reduces power supply line noise due to the kickback current generated when the stepping motor drive mode is switched from drive to standby. The "soft off" function provided by this IC operates when a capacitor (0.001 to 0.01 μF) is connected between the SOF pin and ground. (Leave the SOF pin open to disable the soft off function.)

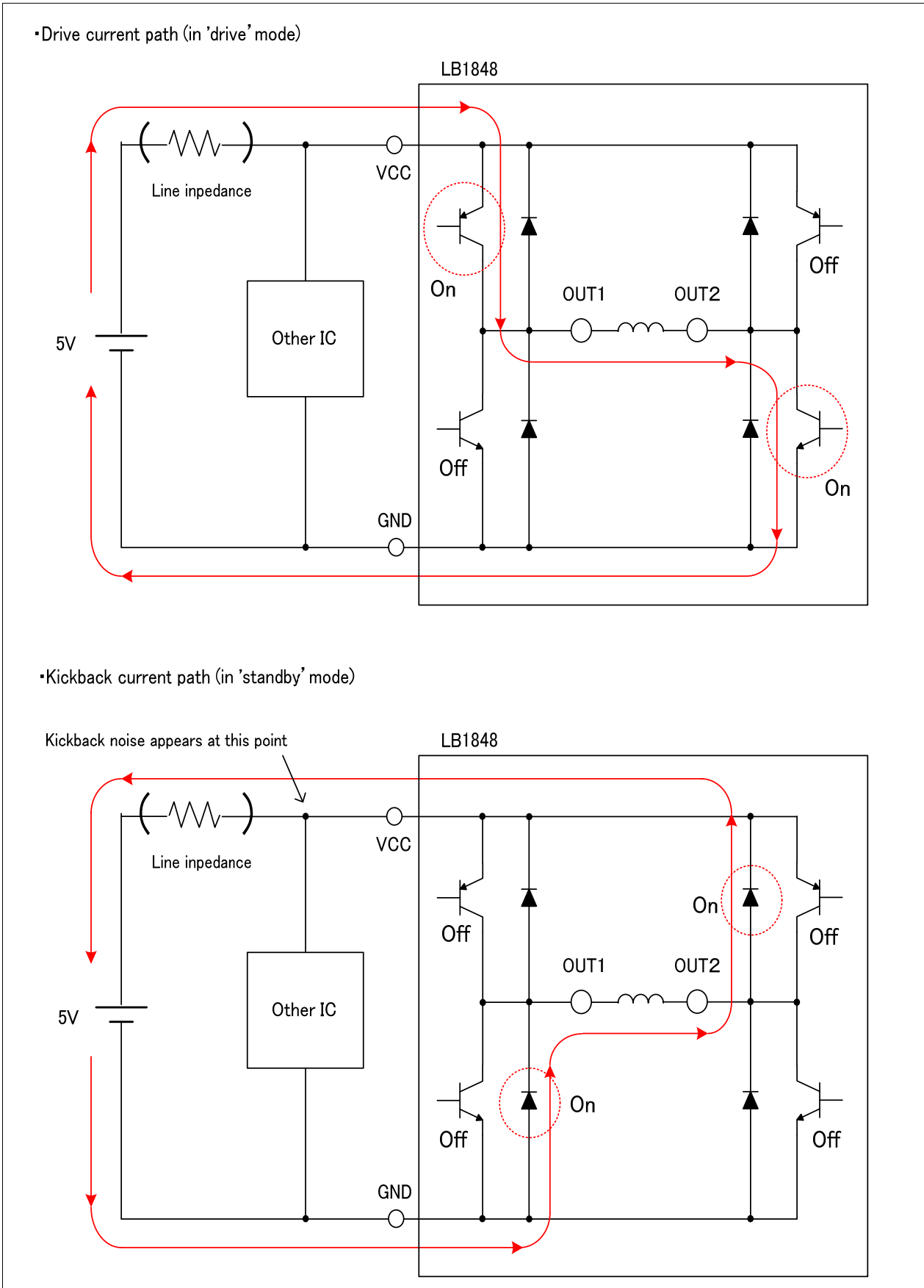
The waveforms for each pin are shown below.

- Timing chart for stepping motor 2phase excitation



LB1848MC Application Note

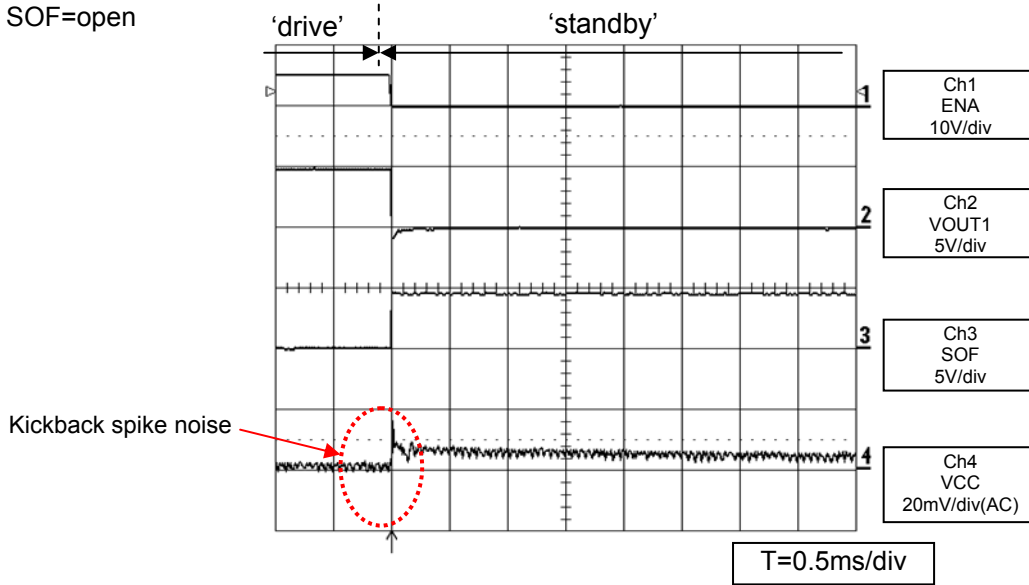
*Mechanism of the kickback noise generation



LB1848MC Application Note

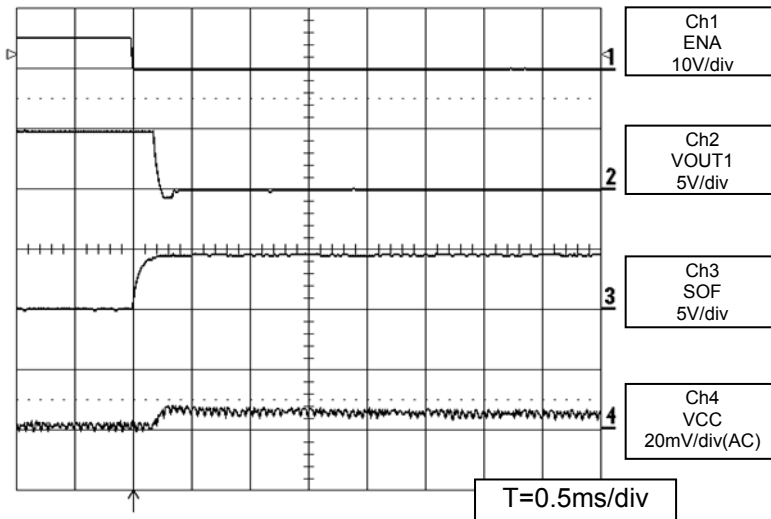
*) Effect of the SOF function

- SOF=open

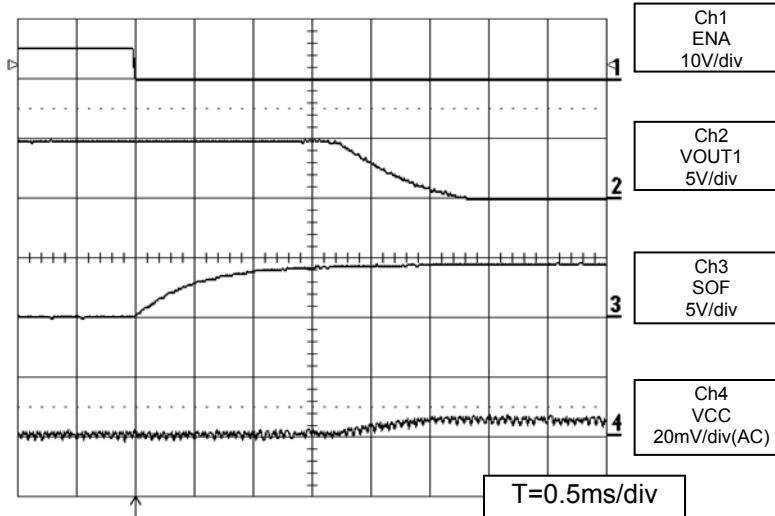


VCC=5V, 2phase excitation

- SOF-GND: 0.01uF



- SOF-GND: 0.1uF



LB1848MC Application Note

Operation explanation

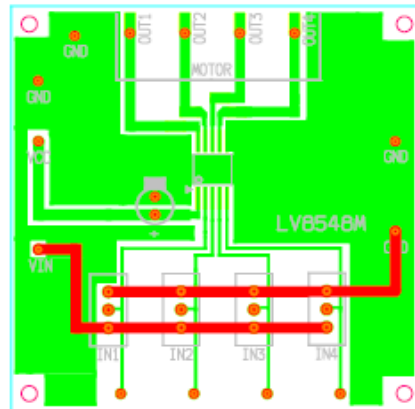
- Overheating protection function (Thermal Shutdown circuit)
The device has a built-in overheating protection circuit that turns-off when the junction temperature (T_j) exceeds 180°C. Once the temperature decreases below 140°C, the device is turned on again (automatic restoration). The overheating protection circuit hysteresis is 40°C.

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

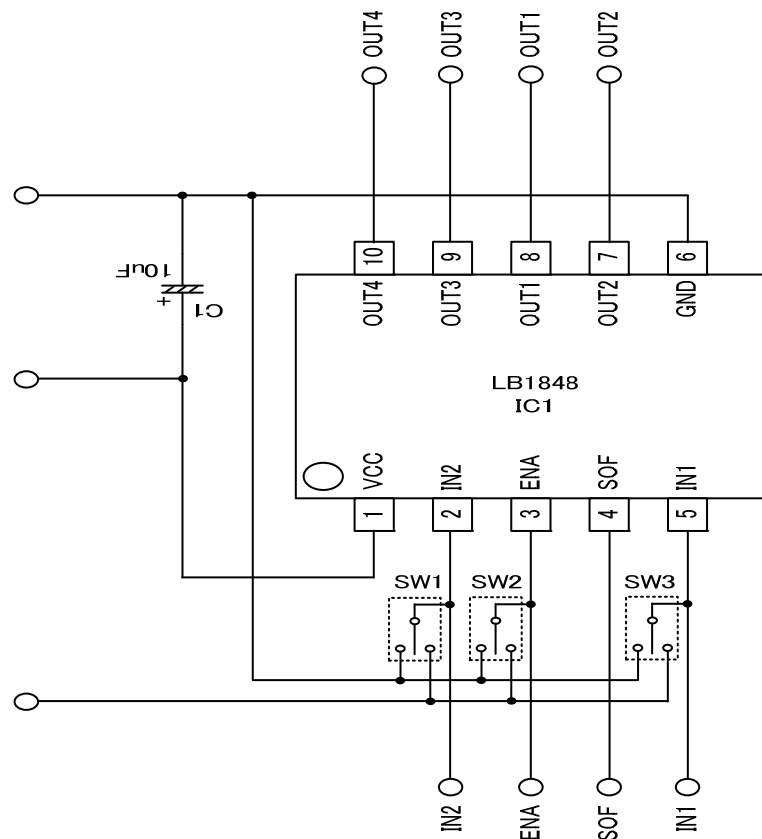
$TSD = 180^\circ\text{C}$ (typ)
 $\Delta TSD = 40^\circ\text{C}$ (typ)

Evaluation board manual

- Overview



- Circuit diagram

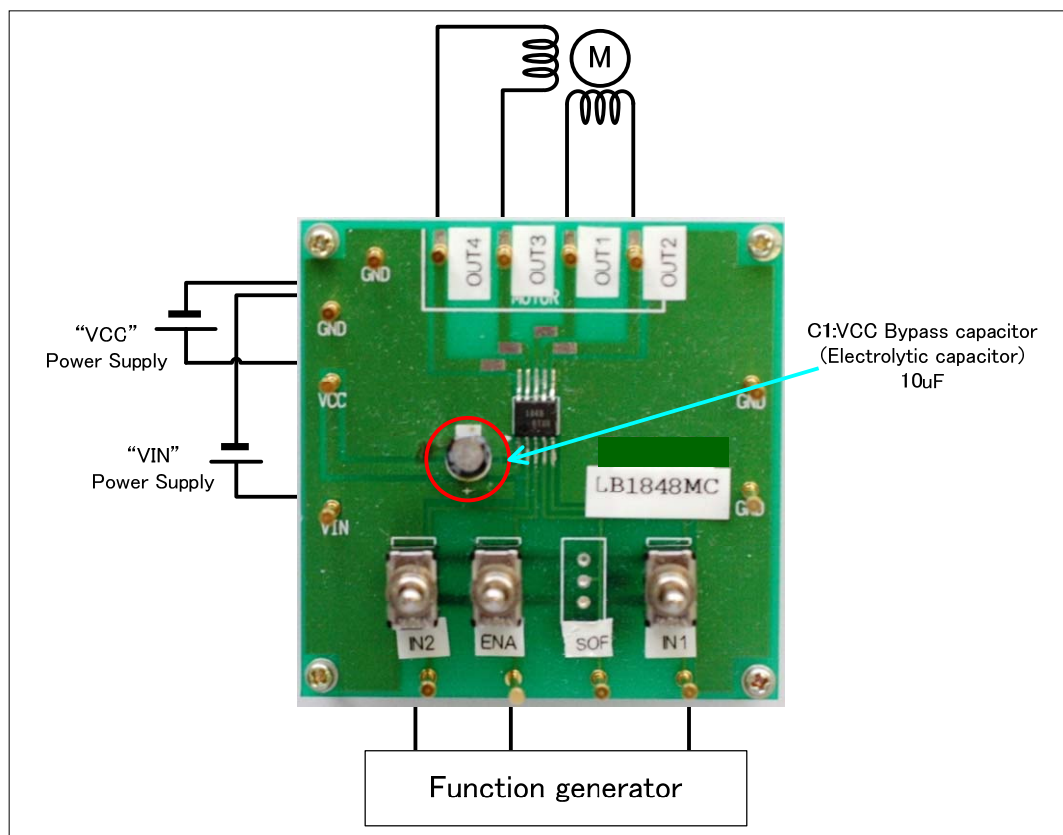


LB1848MC Application Note

Bill of Materials for LB1848MC Evaluation Board

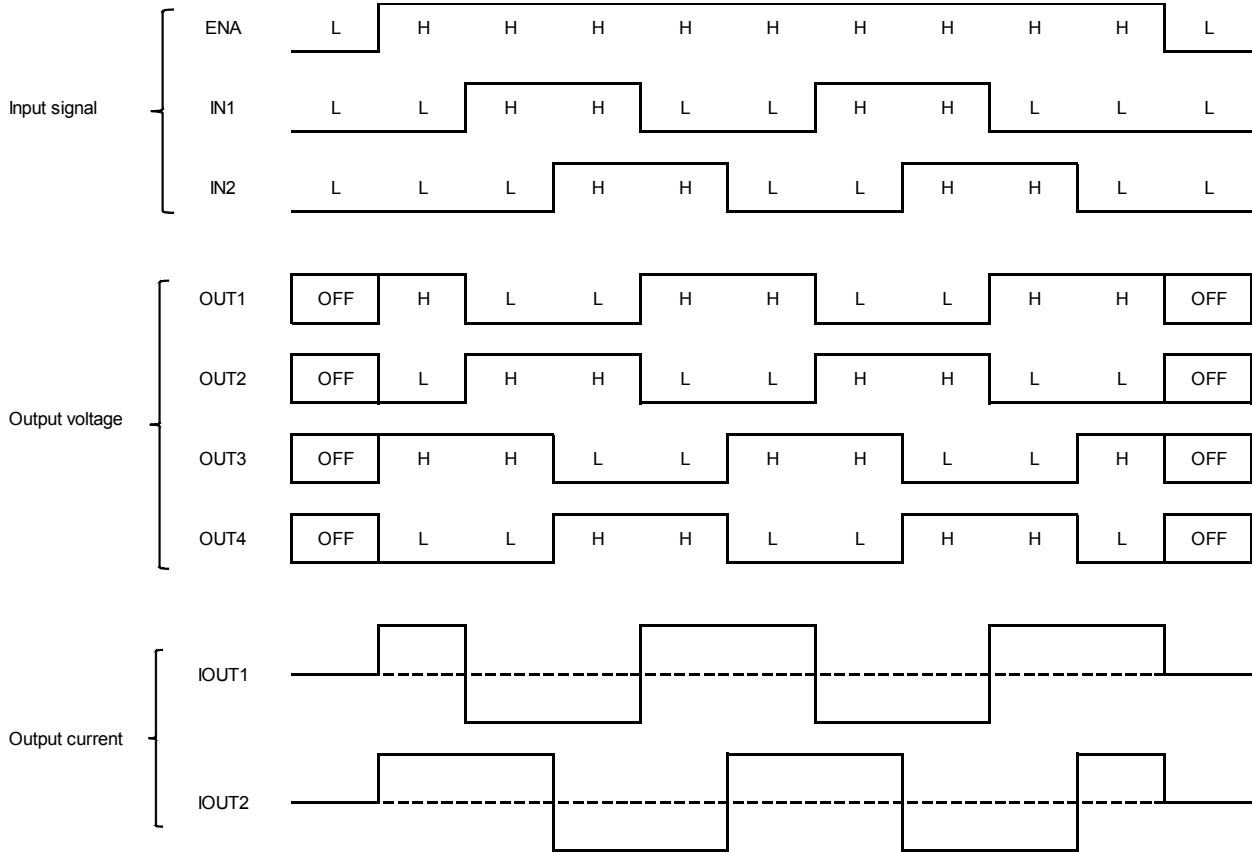
Designator	Qty	Description	Value	Tol	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed	Lead Free
IC1	1	Motor Driver			MFP10S (225mil)	ON semiconductor	LB1848MC	No	Yes
C1	1	VCC Bypass capacitor	10 μ F 50V	\pm 20%		SUN Electronic Industries	50ME10HC	Yes	Yes
SW1-SW3	3	Switch				MIYAMA Electric	MS-621C-A01	Yes	Yes
TP1-TP11	11	Test points				MAC8	ST-1-3	Yes	Yes

- Stepping motor driving method

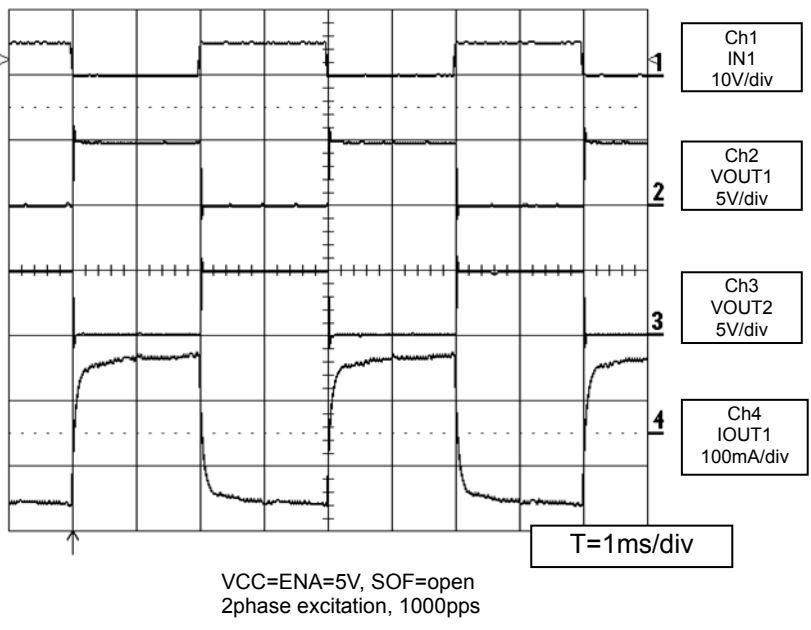


- Connect a stepping motor with OUT1, OUT2, OUT3 and OUT4.
- Connect the motor power supply with the terminal VCC, the control power supply with the terminal VIN. Connect the GND line with the terminal GND.
- The Stepping motor is driven in 2-phase excitation by inputting signals into ENA, IN1 and IN2(Refer to the waveform diagram below)
- Check the stepping motor is rotating.
- Check the waveform of the output voltage and current. (Please refer to the following waveform example.)

LB1848MC Application Note



- Stepping motor driving waveform example



LB1848MC Application Note

ON Semiconductor and the ON logo are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.