Ordering number : ENN5339A

Monolithic Digital IC

LB1846M, 1848M

Low-Voltage/Low Saturation Voltage Type Bidirectional Motor Driver

An ON Semiconductor Company

Overview

The LB1846M and LB1848M are 2-channel low-voltage, low saturation voltage type bidirectional motor driver ICs that are optimal for use as 2-phase stepping motor drivers in printers, floppy disk drives, and cameras and other portable equipment. 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.

Both of these IC products can directly control a motor from signals from a microcontroller. The LB1846M is optimal for 1-2 phase excitation drive for 2-phase stepping motors using 4-input logic (IN1, IN2, IN3, and IN4) and the LB1848M is optimal for 2-phase excitation drive for 2-phase stepping motors using 3-input logic (ENA, IN1, and IN2).

Another point is that these ICs include built-in thermal shutdown circuits so that IC scorching or burning is prevented in advance even if the IC outputs are shorted. Additionally, the MFP-10S miniature package used supports reduced-space mounting.

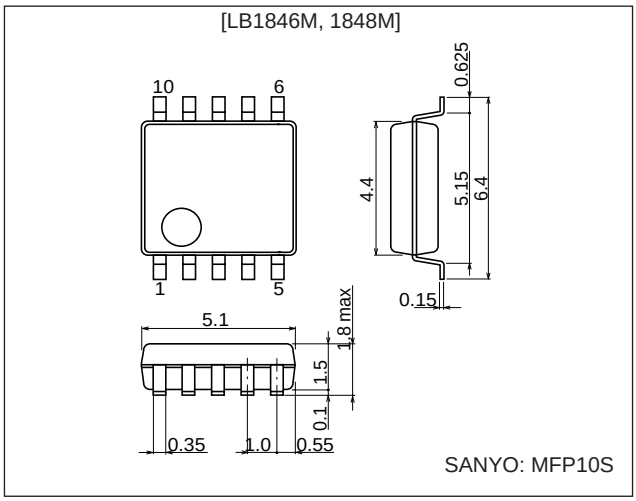
Features

- Optimal for 1-2 phase excitation drive for 2-phase stepping motors (LB1846M)
- Optimal for 2 phase excitation drive for 2-phase stepping motors (LB1848M)
- Low saturation voltage. V_O(sat) = 0.55 V typical at I_O = 400 mA
- Standby current: zero
- Thermal shutdown circuit
- Miniature package: MFP-10S (6.5 × 5.1 mm²)
- Through-current prevention circuit (LB1848M only)
- "Soft off" function that reduces power supply line noise when switching from drive to standby modes. (Requires the use of one external capacitor.) (LB1848M only)
- No limitations on the magnitude relationship between the power supply voltage (V_{CC}) and the input voltage (V_{IN})

Package Dimensions

unit: mm

3086A-MFP10S



Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} 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	Pd max1	Independent IC	350	mW
	Pd max2	When mounted*	870	mW
Operating temperature	Topr		–20 to +75	°C
Storage temperature	Tstg		–40 to +150	°C

Note: *On the specified circuit board (a 114.3 × 76.2 × 1.5-mm^3 glass-epoxy printed circuit board)

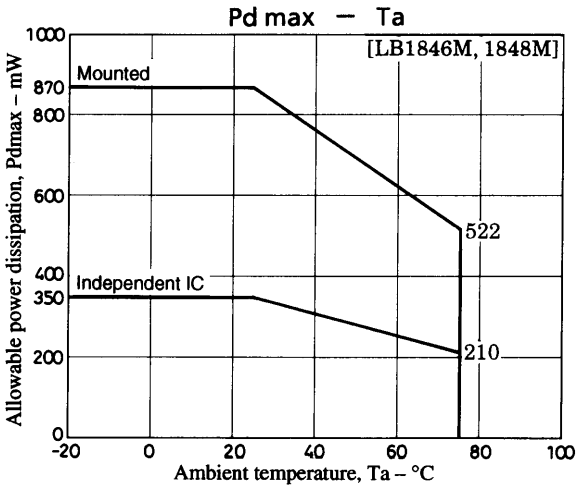
Allowable Operating Ranges at Ta = 25°C

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

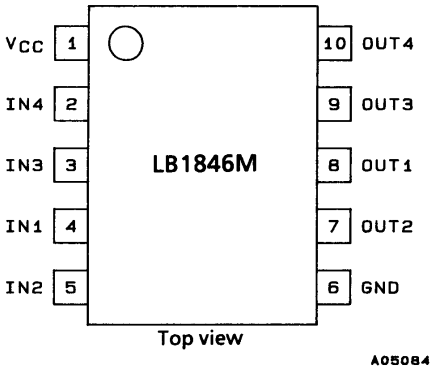
Electrical Characteristics at Ta = 25°C, V_{CC} = 5.0 V

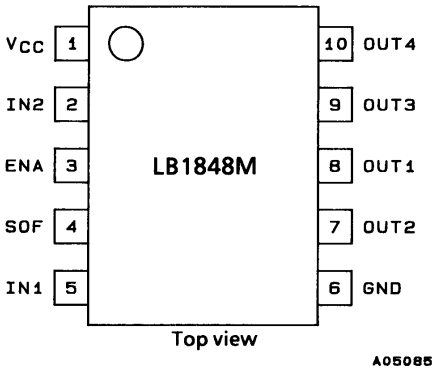
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[LB1846M]						
Current drain	$I_{CC}0$	IN1, 2, 3, 4 = 0 V		0.1	10	µA
	$I_{CC}1$	IN1, 3 = 3 V, IN2, 4 = 0 V		30	40	mA
Output saturation voltage	$V_{OUT}1$	V_{IN} = 3 V or 0 V, V_{CC} = 3 to 7.5 V, I_{OUT} = 200 mA		0.27	0.4	V
	$V_{OUT}2$	V_{IN} = 3 V or 0 V, V_{CC} = 4 to 7.5 V, I_{OUT} = 400 mA		0.55	0.8	V
Input current	I_{IN}	V_{IN} = 5 V		150	200	µA
[Spark Killer Diode]						
Reverse current	I_S(leak)				30	µA
Forward voltage	V_{SF}	I_{OUT} = 400 mA			1.7	V
[LB1848M]						
Current drain	$I_{CC}0$	ENA = 0 V, V_{IN} = 3 V or 0 V		0.1	10	µA
	$I_{CC}1$	ENA = 3 V, V_{IN} = 3 V or 0 V		25	35	mA
Output saturation voltage	$V_{OUT}1$	ENA = 3 V, V_{IN} = 3 V or 0 V, V_{CC} = 3 to 7.5 V, I_{OUT} = 200 mA		0.27	0.4	V
	$V_{OUT}2$	ENA = 3 V, V_{IN} = 3 V or 0 V, V_{CC} = 4 to 7.5 V, I_{OUT} = 400 mA		0.55	0.8	V
Input current 1	I_{IN}	V_{IN} = 5 V		75	100	µA
Input current 2	I_{ENA}	ENA = 5 V		85	110	µA
[Spark Killer Diode]						
Reverse current	I_S(leak)				30	µA
Forward voltage	V_{SF}	I_{OUT} = 400 mA			1.7	V

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



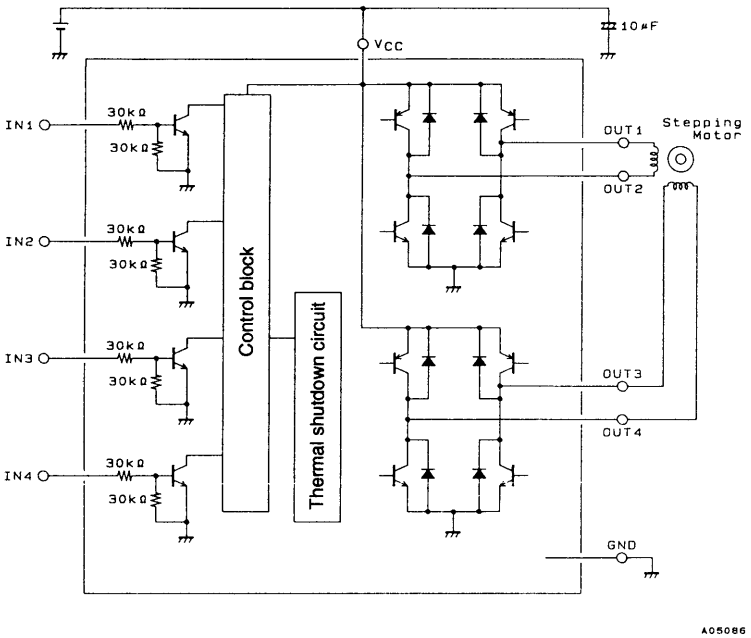
Pin Assignments



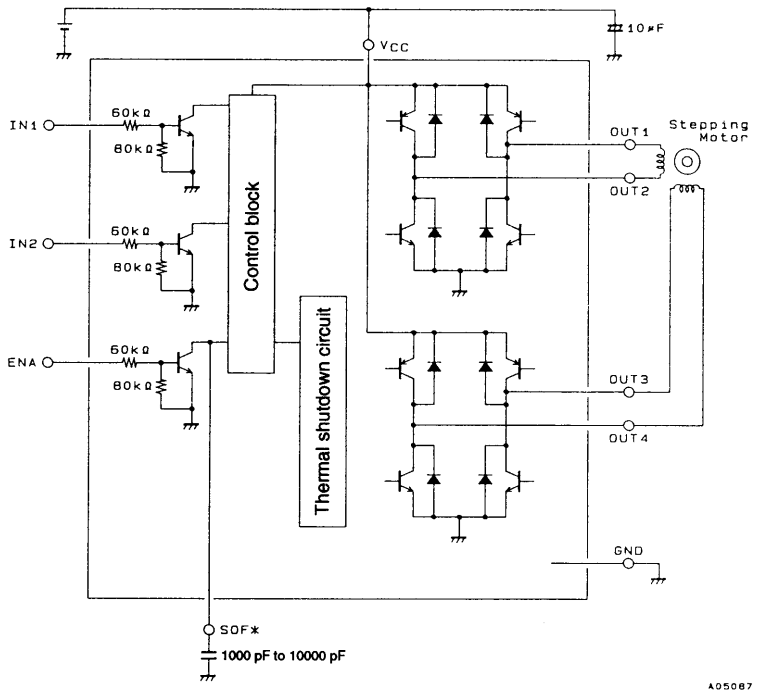


Block Diagrams

[LB1846M]



[LB1848M]



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 V_{CC} 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 10 kΩ) between the controller outputs and this IC.

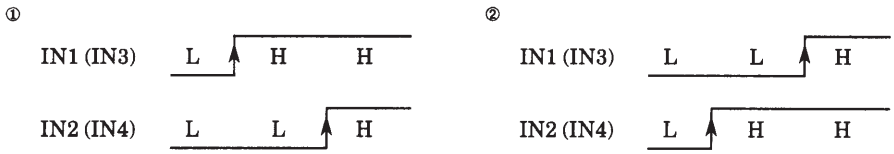
Truth Tables

[LB1846M]

IN1	IN2	IN3	IN4	OUT1	OUT2	OUT3	OUT4	Notes
L	L	L	L	OFF	OFF	OFF	OFF	Standby
H	L	L	L	H	L	OFF	OFF	1-2 phase excitation
H	L	H	L	H	L	H	L	
L	L	H	L	OFF	OFF	H	L	
L	H	H	L	L	H	H	L	
L	H	L	L	L	H	OFF	OFF	
L	H	L	H	L	H	L	H	
L	L	L	H	OFF	OFF	L	H	
H	L	L	H	H	L	L	H	
H	H	—	—	The logic output for the first high-level input is produced. *2				
—	—	H	H					

Note: 1. "—" indicates a "don't care" input.

2. If two high levels (H/H) are input to the IN1/IN2 pins with the timing shown in ① in the figure below, then the IN2 input that arrived later will be ignored and the IC will function as though an H/L combination is applied to the IN1/IN2 pins. Similarly, the timing shown in ② results in a L/H combination on the IN1/IN2 pins.



[LB1848M]

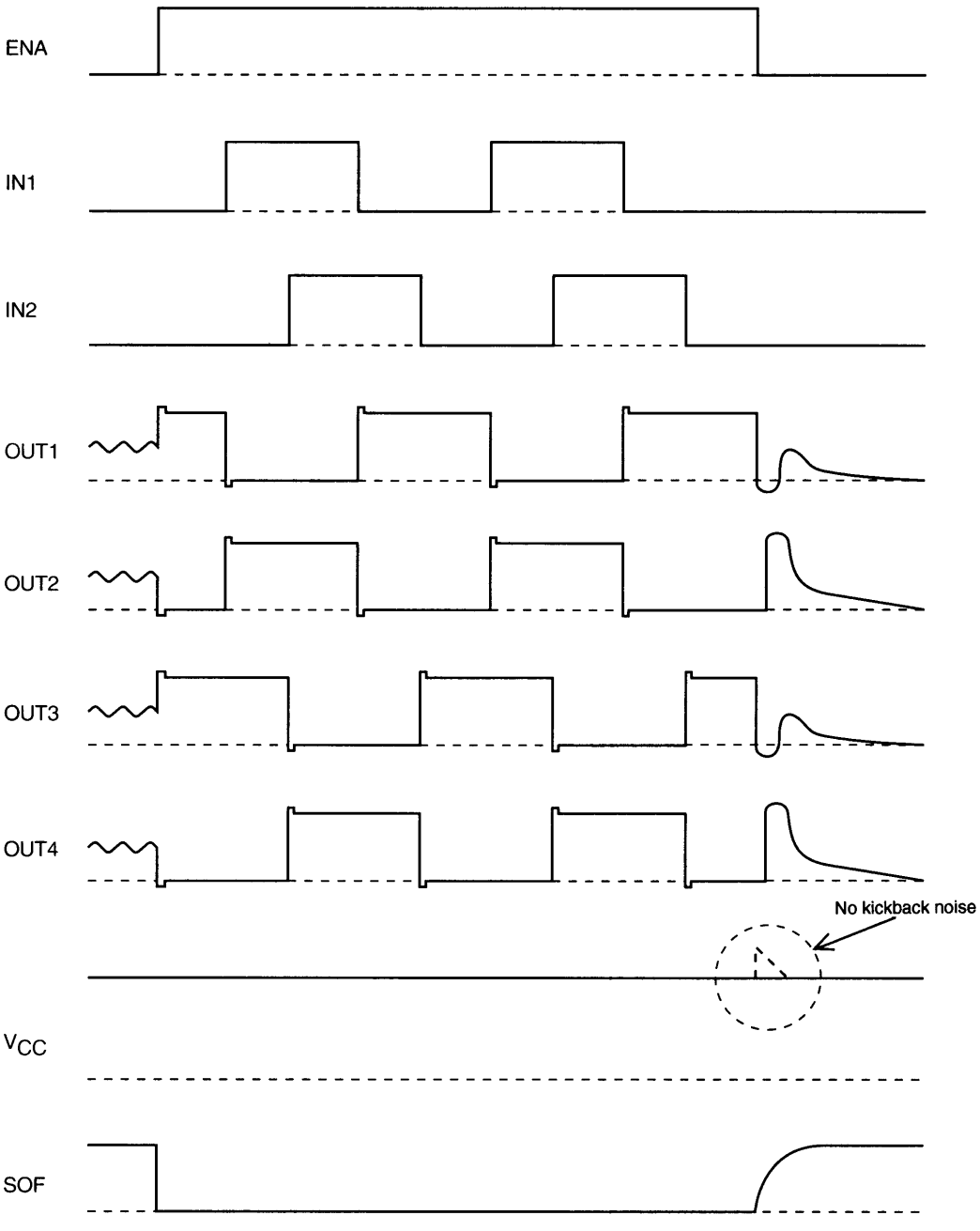
ENA	IN1	IN2	OUT1	OUT2	OUT3	OUT4	Notes
L	—	—	OFF	OFF	OFF	OFF	Standby
H	L	L	H	L	H	L	2-phase excitation
	L	H	H	L	L	H	
	H	H	L	H	L	H	
	H	L	L	H	H	L	

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

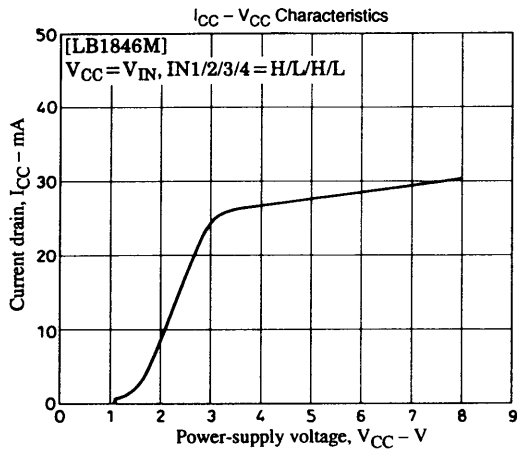
SOF Pin ("Soft Off" Function) Operation [LB1848M only]

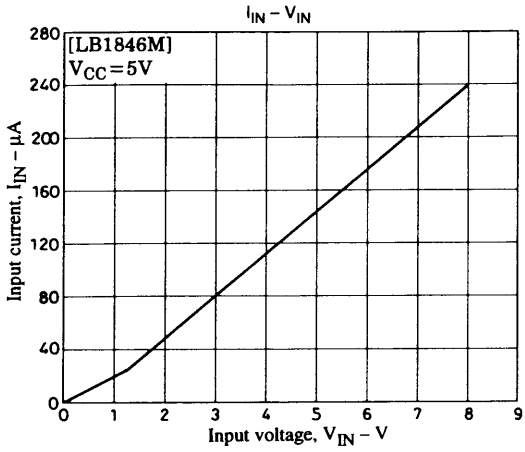
The soft off function reduces power supply line noise due to the kickback current generated when the stepping motor drive mode is switched from drive to standby. The "soft off" function provided by this IC operates when a capacitor (0.001 to 0.01 μF) is connected between the SOF pin and ground. (Leave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

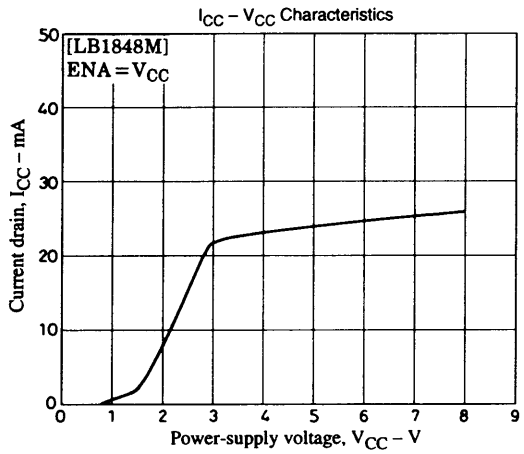
The waveforms for each pin are shown below.

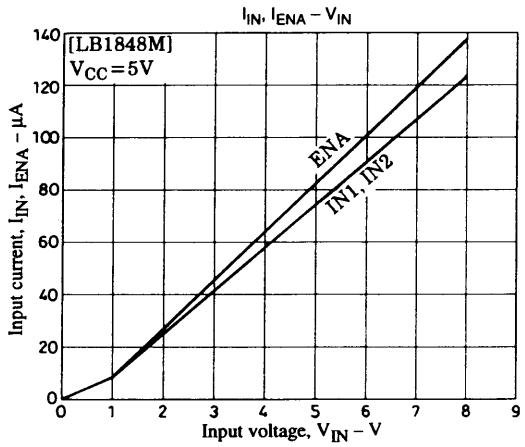


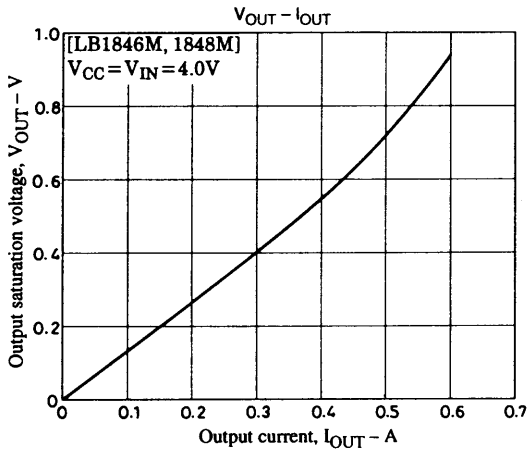
Timing Chart for Stepping Motor 2-Phase Excitation


I_{CC} – V_{CC} Characteristics
[LB1846M]
V_{CC} = V_{IN}, IN1/2/3/4 = H/L/H/L
Current drain, I_{CC} – mA
Power-supply voltage, V_{CC} – V


I_{IN} – V_{IN}
[LB1846M]
V_{CC} = 5V
Input current, I_{IN} – µA
Input voltage, V_{IN} – V


I_{CC} – V_{CC} Characteristics
[LB1848M]
ENA = V_{CC}
Current drain, I_{CC} – mA
Power-supply voltage, V_{CC} – V


I_{IN}, I_{ENA} – V_{IN}
[LB1848M]
V_{CC} = 5V
ENA
IN1, IN2
Input current, I_{IN}, I_{ENA} – µA
Input voltage, V_{IN} – V


V_{OUT} – I_{OUT}
[LB1846M, 1848M]
V_{CC} = V_{IN} = 4.0V
Output saturation voltage, V_{OUT} – V
Output current, I_{OUT} – A