

LB1930M

BIP monolithic IC Low-Voltage, Low-Saturation Bidirectional Motor Driver

Features and Benefits

- The low saturation voltage reduces IC internal heating and allows a high voltage to be applied to the motor. Thus this device can be used even in environments with a high operating ambient temperature.
 - Output saturation voltage: $V_{sat1} = 0.25V$ typical ($I_O = 0.2A$)
 - (High side + low side): $V_{sat2} = 0.55V$ typical ($I_O = 0.5A$)
 - Operating temperature range: $T_a = -30$ to $+85^\circ C$
- The LB1930M features the wide operating voltage range of 2.2 to 10.8V and the low standby current drain of $0.1\mu A$, and therefore can easily be used in battery operated systems.
- To minimize through currents, the LB1930M internal logic passes through an internal standby state when switched by the input signals between forward/reverse and brake, or between forward and reverse.
- There are no constraints on the relationship between the input voltage and the supply voltage. For example, the LB1930M can be used with $V_{CC} = 3V$, and $V_{IN} = 5V$.
- If the IC chip exceeds $180^\circ C$ due to an output short causing a large current flow, the built-in thermal protection circuit suppresses the drive current to prevent fires or destruction of the IC.
- MFP-10S miniature package. Also, the LB1930M features the high allowable power dissipation of $P_d = 800mW$.

Description

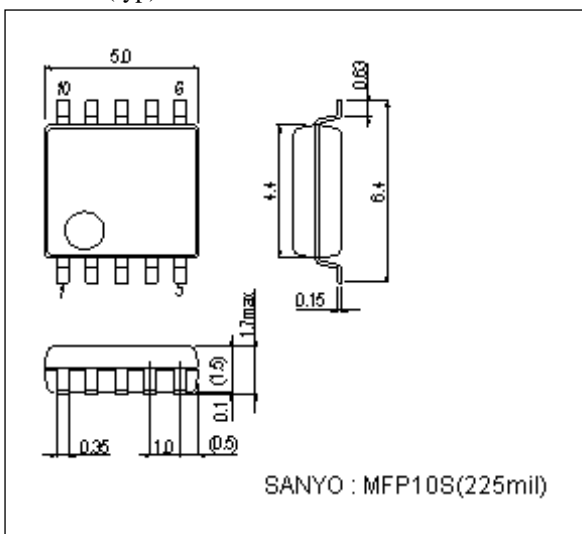
The LB1930M is a low saturation voltage single-channel H-bridge bidirectional motor driver that supports low-voltage drive.

Application include:

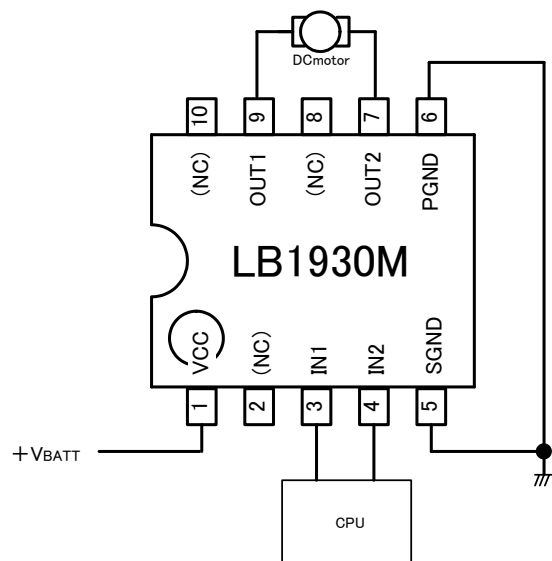
- CD, MD, and cassette player loading motors.
- Camera lens/shutter/lens barrier control
- Battery powered toys and games
- Robotic actuators and pumps
- Portable printers/scanners

Package Dimensions

unit : mm (typ)

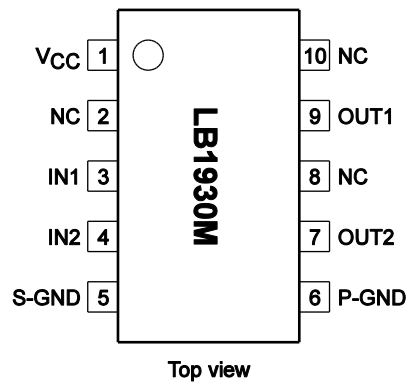


Typical Application

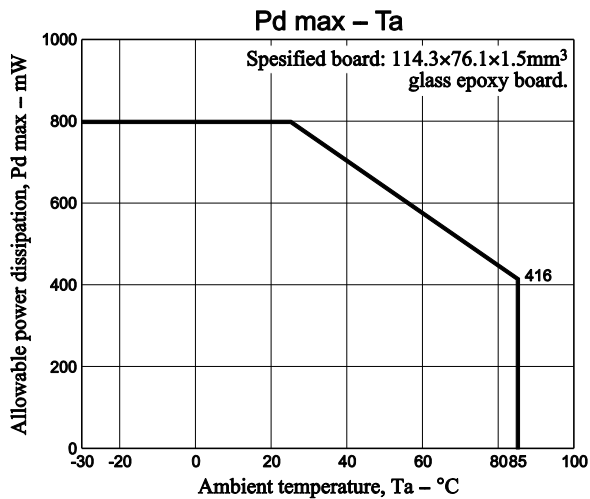
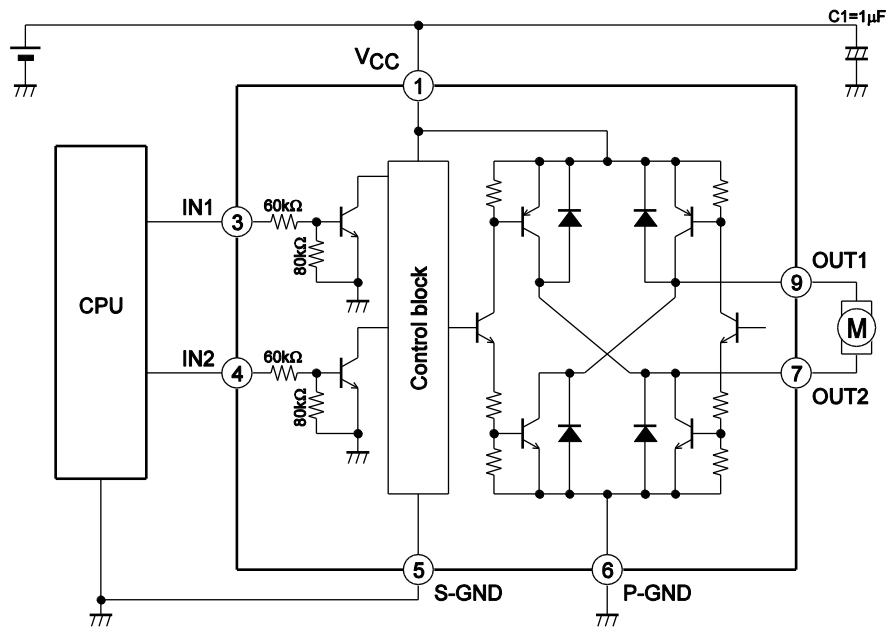


LB1930M

Pin Assignment



Block Diagram and Application Circuit Example



Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC} max		11	V
Output current	I_{OUT} max		1000	mA
Output voltage handling	V_{OUT} max		$V_{CC} + V_{SF}$	V
Applied input voltage	I_H max		10.5	V
Allowable power dissipation	P_d max	Mounted on a specified board *	800	mW
Operating temperature	T_{opr}		-30 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

* Specified board: 114.3mm × 76.1mm × 1.5mm, glass epoxy board.

Allowable Operating Ranges at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		2.2 to 10.8	V
High-level input voltage	V_{IH}		2.0 to 10	V
Low-level input voltage	V_{IL}		-0.3 to +0.3	V

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC1}	Standby mode		0.1	5	μA
	I_{CC2}	Forward or reverse drive operation		15	21	mA
	I_{CC3}	Braking		22	31	mA
Output saturation voltage	$V_O(\text{sat})1$	Forward or reverse drive: High side + low side, $I_O = 200\text{mA}$		0.25	0.35	V
	$V_O(\text{sat})2$	Forward or reverse drive: High side + low side, $I_O = 500\text{mA}$		0.55	0.75	V
	$V_O(\text{sat})3$	Forward or reverse drive: High side only, $I_O = 200\text{mA}$		0.15	0.25	V
Input current	I_{IN}	$V_{IN} = 5\text{V}$		70	95	μA
Thermal detection operating temperature	THD	Design guarantee value*	150	180	200	$^\circ\text{C}$
Spark killer diode						
Forward voltage	V_{SF}	$I_O = 200\text{mA}$		0.9	1.7	V
Reverse current	I_{RS}	$V_{OUT} = 10\text{V}$		0.1	5	μA

* Design guarantee value, Do not measurement.

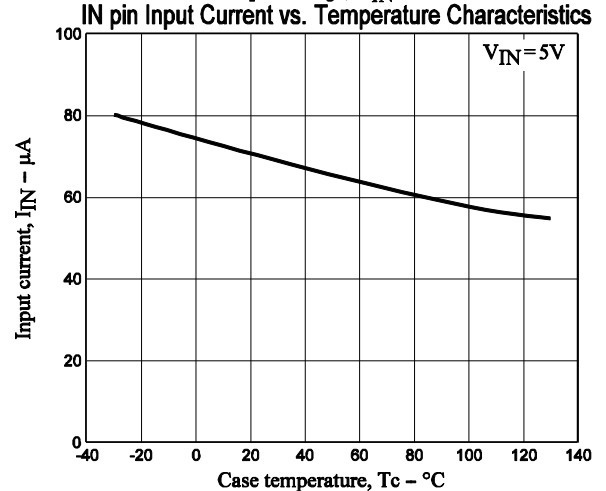
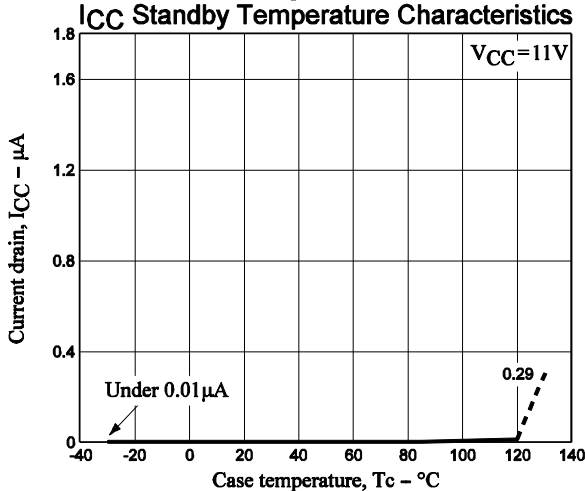
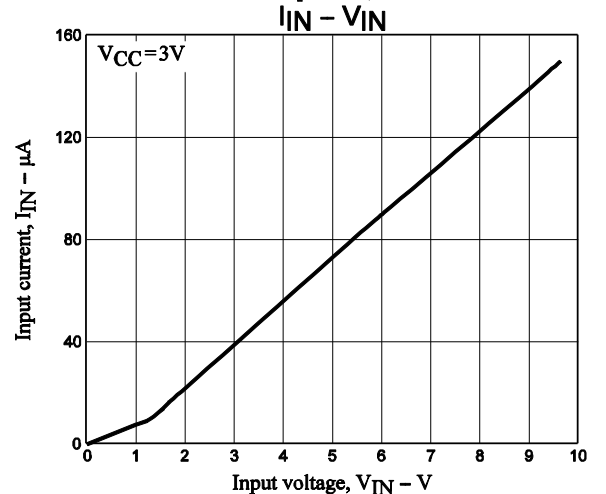
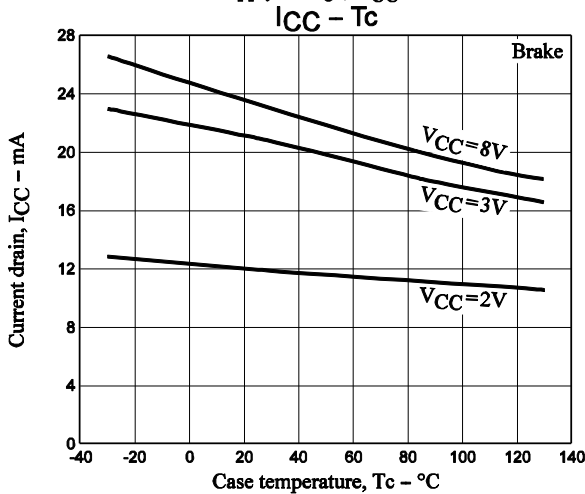
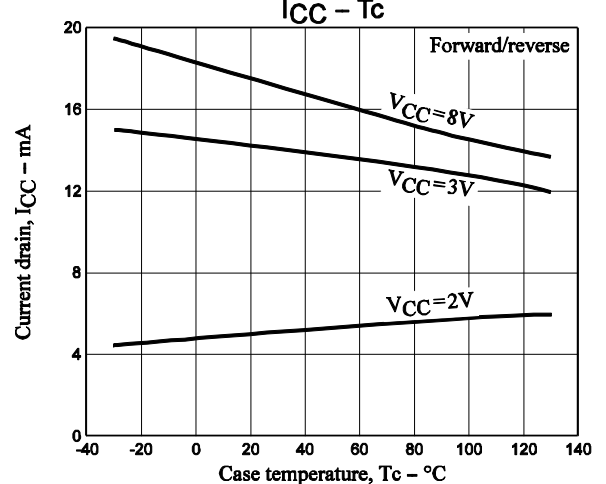
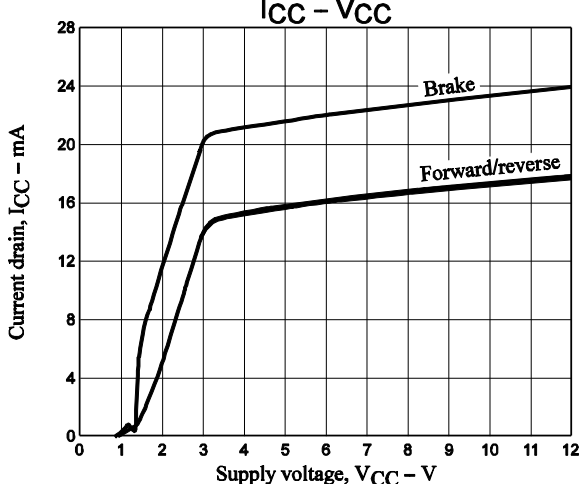
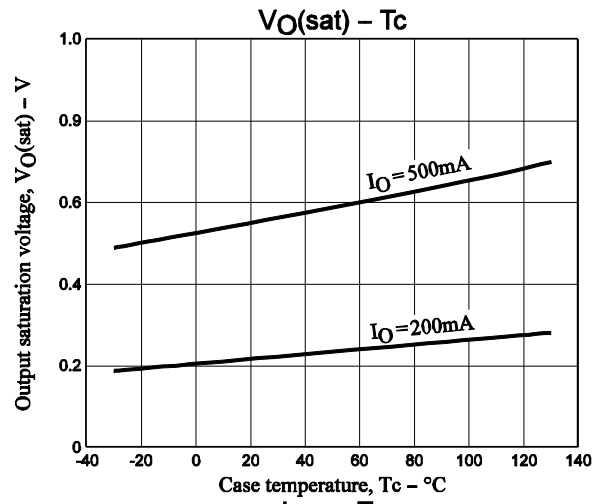
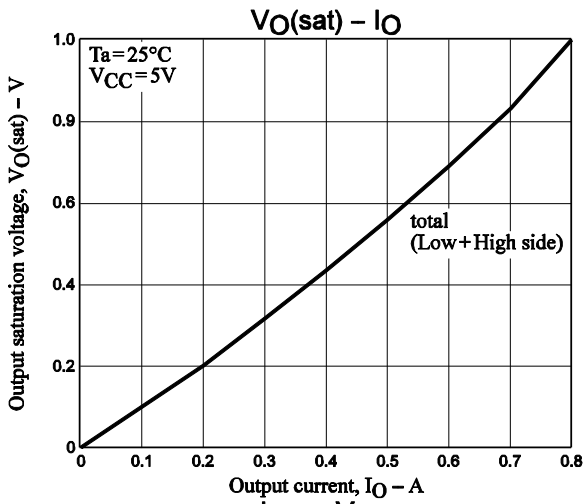
Truth Table

IN1	IN2	OUT1	OUT2	Mode
L	L	OFF	OFF	Standby
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	H	H	Brake

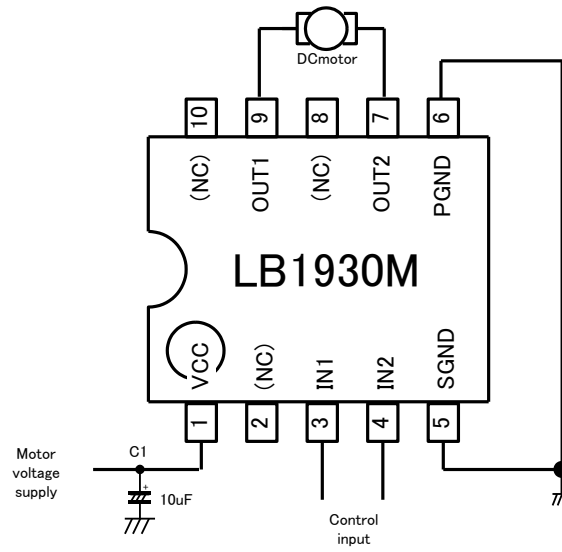
Usage Notes

Oscillation may occur in the V_{CC} and P-GND lines, since these lines carry a wide range of currents. The following may help if this is a problem.

- (1) Lower the inductance of the wiring by making lines wider and shorter.
- (2) Insert capacitors with good frequency characteristics close to the IC.
- (3) Consider adopting the following methods if the CPU and this IC are mounted on different printed circuit boards that could easily have different ground potentials.
 - Connect S-GND to the CPU ground and connect P-GND to the power system ground.
 - Insert resistors of about 10k Ω in series between the controller outputs and the inputs on this IC.



Motor connecting figure



Electrostatic capacitor C1 is used to stabilize power.

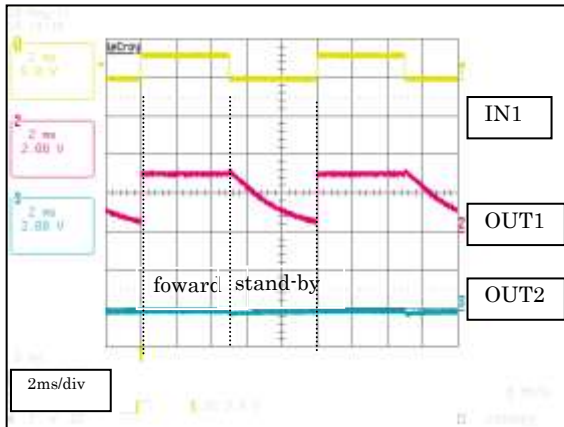
Requirement for capacitance value varies depends on substrate wiring, motor, and power.

The recommendation range of C1 is approximately $0.1 \mu\text{F}$ to $10 \mu\text{F}$.

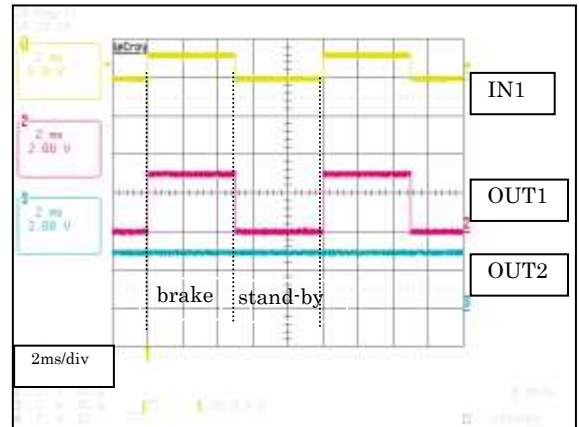
Please check supply voltage waveform when motor is under operation and use a capacitor for stable operation.

Waveform example

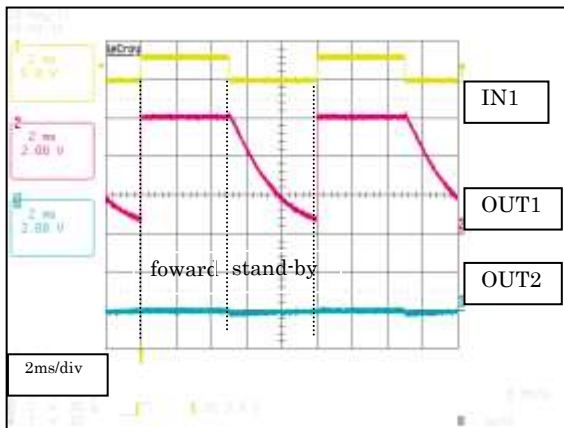
No load VCC=3V IN2="L"



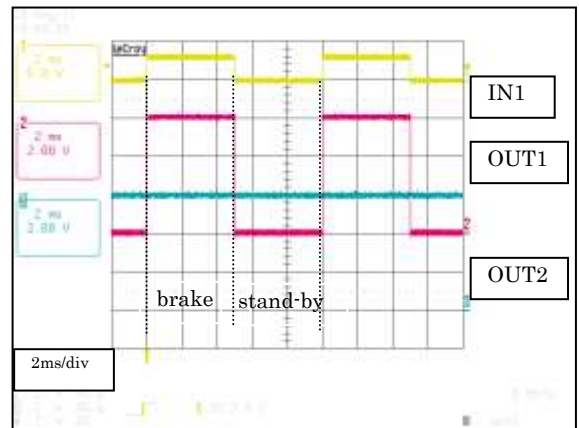
No load VCC=3V IN2="H"



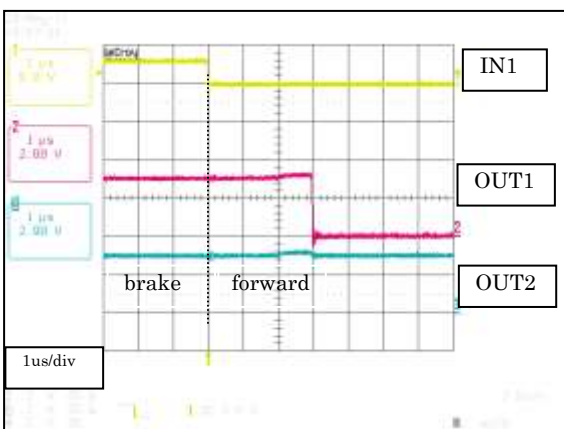
No load VCC=6V IN2="L"



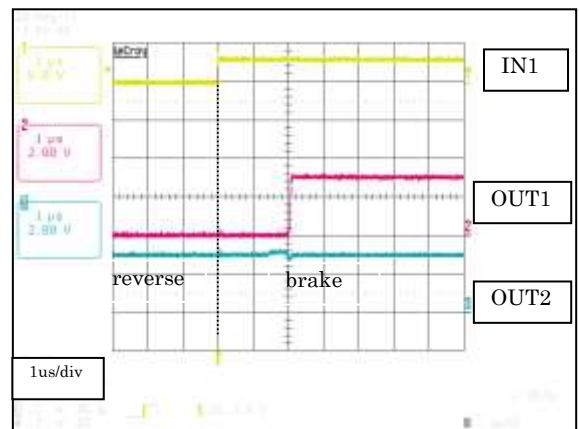
No load VCC=6V IN2="H"



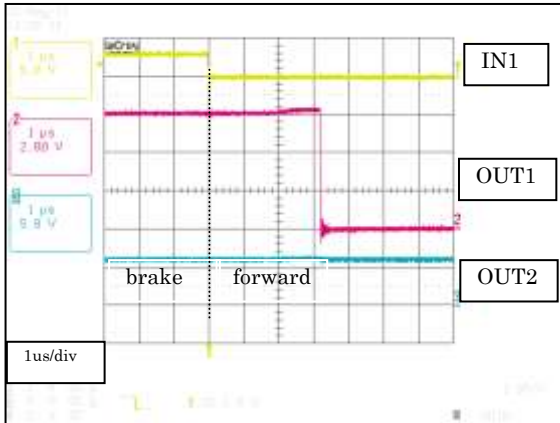
No load VCC=3V IN2="H"
Time scale expansion "fall time"



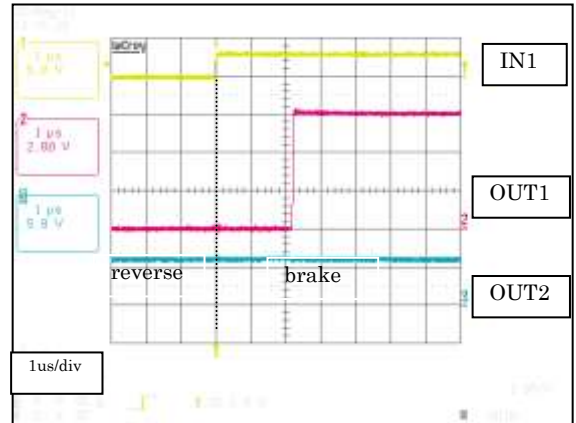
No load VCC=3V IN2="H"
Time scale expansion "rise time"



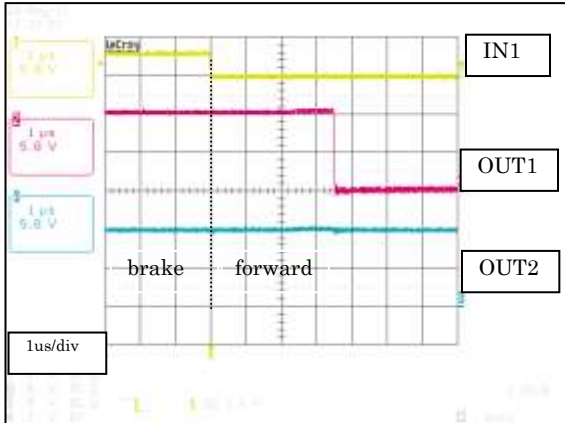
No load VCC=6V IN2="H"
Time scale expansion "fall time"



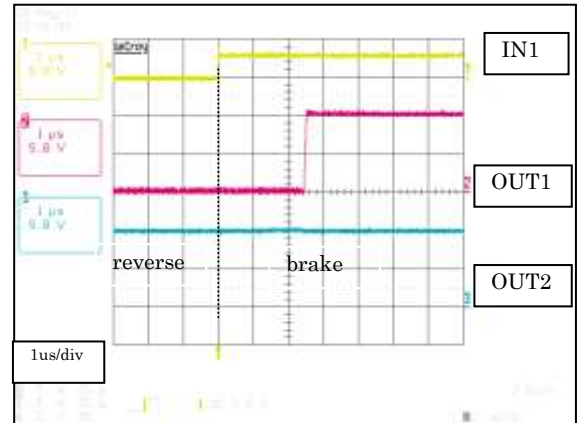
No load VCC=6V IN2="H"
Time scale expansion "rise time"



No load VCC=10V IN2="H"
Time scale expansion "fall time"

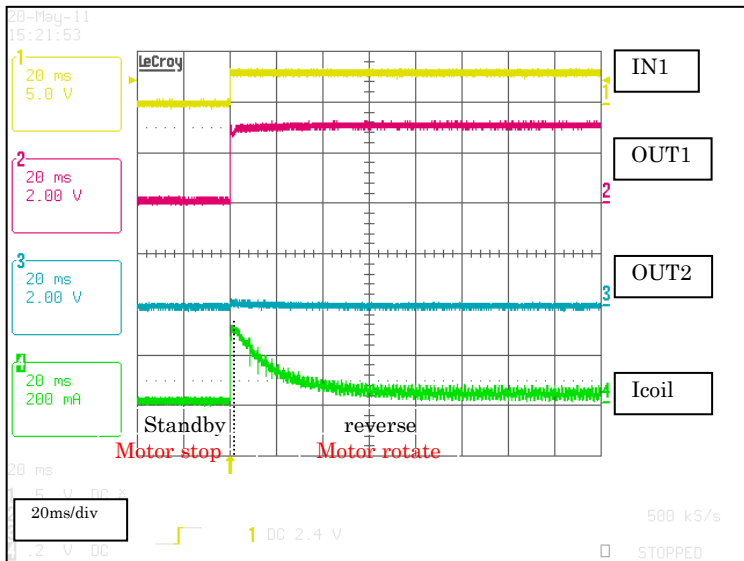


No load VCC=10V IN2="H"
Time scale expansion "rise time"



DC motor load VCC=3V IN2="L"

Current waveform example "motor start"



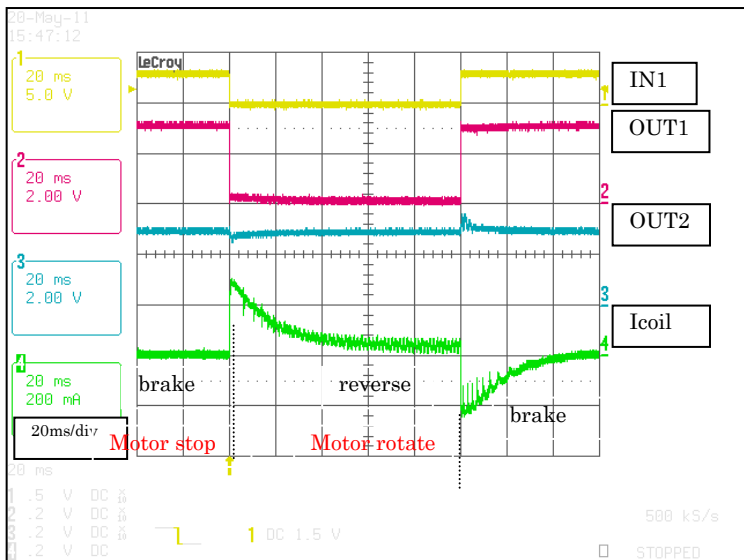
When DC motor starts up, the current value becomes high. However, rotation of DC motor starts, induced voltage E_a is generated, and current decreases according to the rotation frequency.

If a coil resistance is set to R_{coil} and motor voltage is set to V_m , then motor current is obtained as follows:

$$I_m = (V_m - E_a) / R_{coil}$$

DC motor load VCC=3V IN2="H"

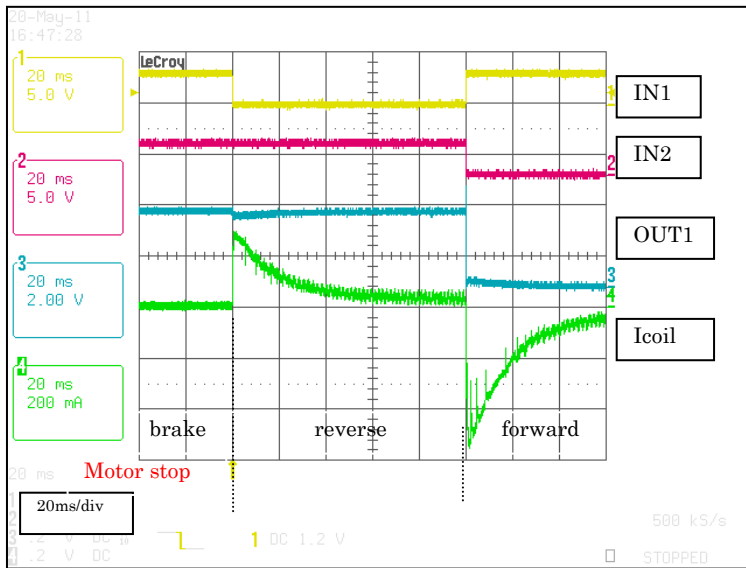
Current waveform example "brake current"



When DC motor is under rotation, if brake mode is set, then DC motor becomes short-brake status, and speed falls rapidly. In this case, current I_m ($I_m = E_a / R_{coil}$) flows to the opposite direction by the induced voltage E_a generated during motor rotation. If DC motor stops rotation, then $E_a = 0$, and current becomes 0.

DC motor load VCC =3V

Current waveform example “active reverse brake current”

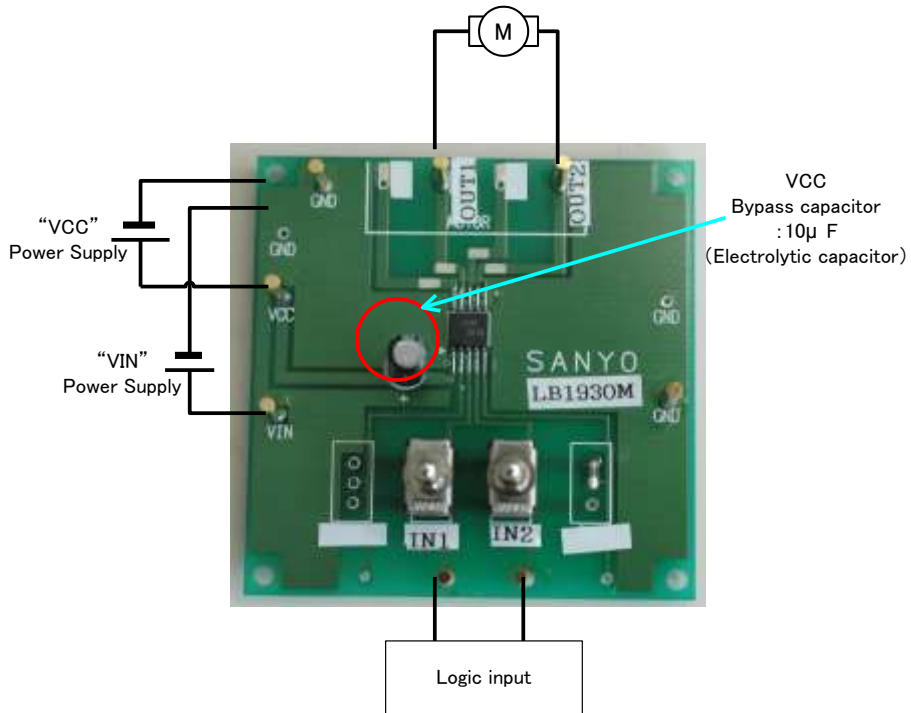
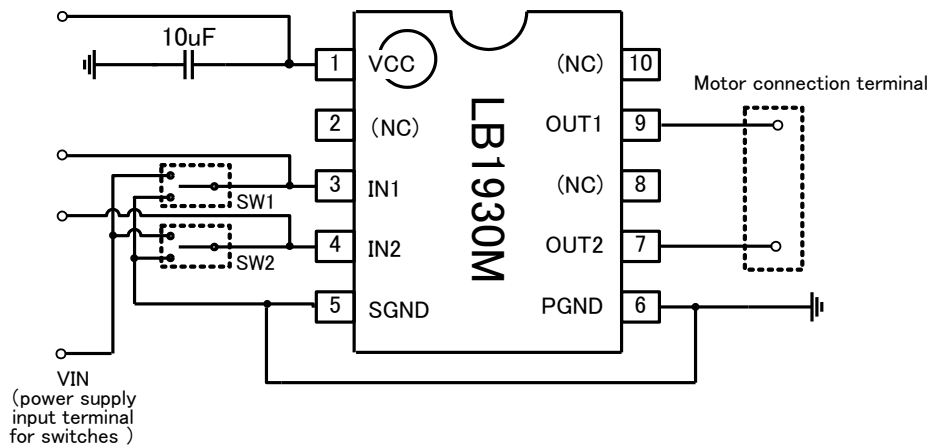


If rotation direction is switched while DC motor is rotating, then torque of reverse-rotation is generated, the speed of motor rotation becomes slow and reverse rotation is performed.

In this case, since voltage of VM is added to induced voltage Ea generated during motor rotation, the motor current flows into the motor coil which is obtained as follows: $I_m = (V_M + E_a) / R_{coil}$.

When you switch from forward to reverse, if the current exceeds I_{max}, make sure to set brake mode until the induced voltage is reduced between forward and reverse.

Evaluation board description



* VIN terminal is a power supply input terminal for switches.

5V are to impress it and can perform the setting that is in a state by the switch operation and logic input.

○ Operation method

Power supply injection order : VCC → VIN

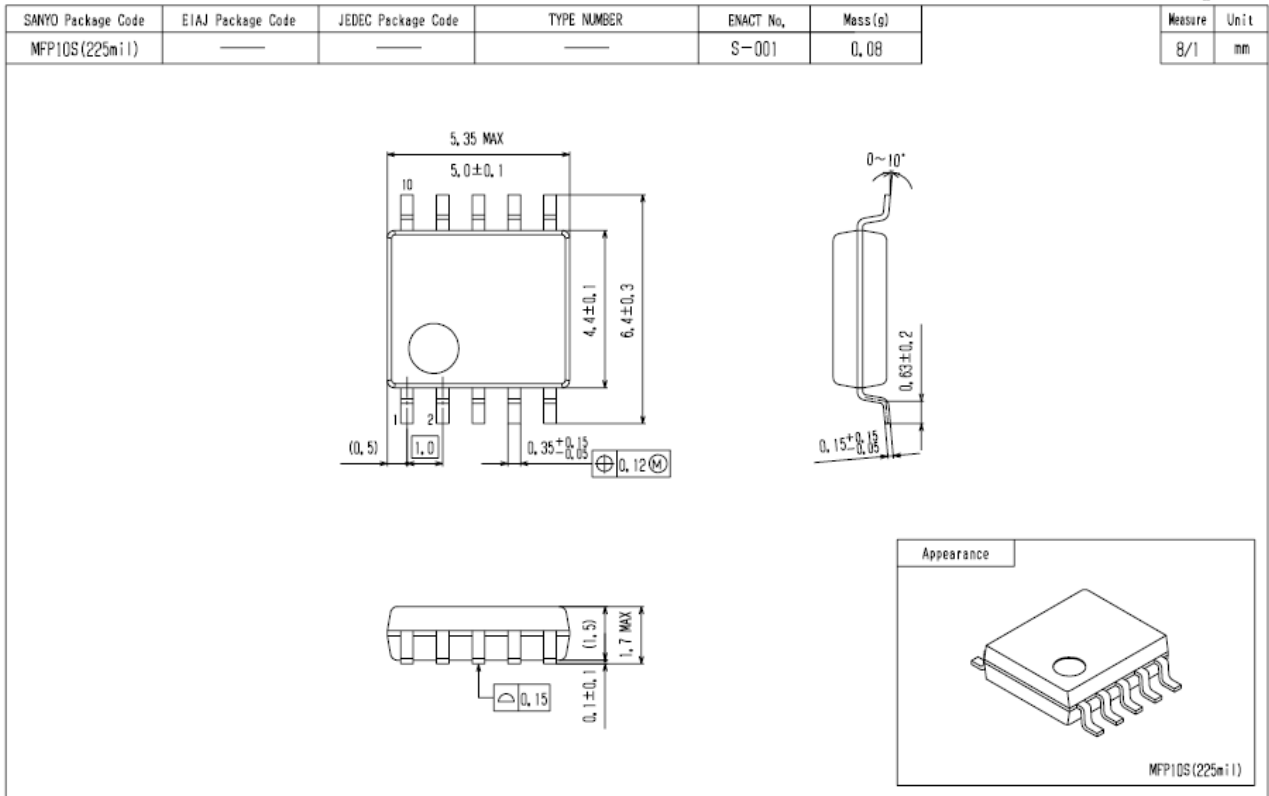
○ Truth value table

IN1	IN2	OUT1	OUT2	Mode
L	L	OFF	OFF	Standby
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	H	H	Brake

LB1930M

OUTLINE DRAWING

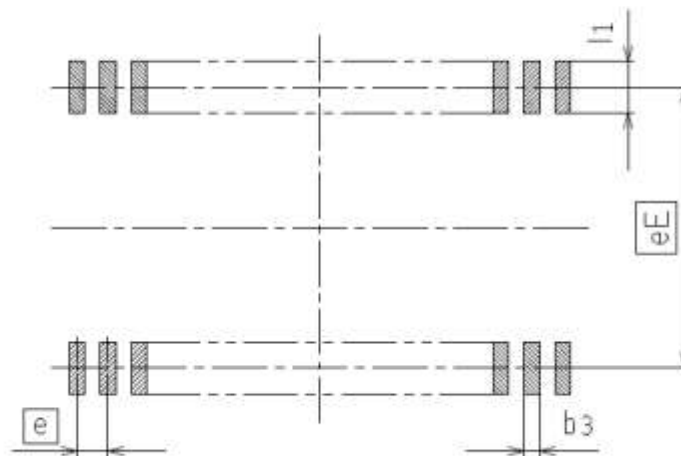
SANYO



REVISION : 2

SANYO : Shrink Small Outline Package 10Pin Plastic

Mounting Pad Sketch



MFP-S

Reference symbol	Packages name			
	MFP10S/14S(225mil)	MFP24S(300mil)	MFP30S/SD/SLF(375mil)	MFP30SDJ(375mil)
eE	5,70	6,87	9,75	9,75
e	1,00	1,00	1,00	1,00
b ₃	0,47	0,47	0,55	0,50
l ₁	1,10	1,13	1,15	1,15

- Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment (home appliances, AV equipment, communication device, office equipment, industrial equipment etc.). The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for applications outside the standard applications of our customer who is considering such use and/or outside the scope of our intended standard applications, please consult with us prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.
- Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Semiconductor Co.,Ltd. assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of June, 2011. Specifications and information herein are subject to change without notice.