

**SANYO****LB1851M****3-Phase Brushless Motor Driver****Overview**

The LB1851M is a 3-phase brushless motor drive IC ideally suited for use in VCR capstan motor driver, drum motor driver, and DAT motor driver applications.

**Features**

- 120°C voltage linear type.
- Less power dissipation because of speed control based on motor voltage control (suitable for use in portable sets).
- Torque ripple compensation circuit on chip.
- Small capacitance of external capacitor because of soft switching method (clip capacitor).
- Thermal shutdown circuit on chip.
- FG amplifier on chip.

**Specifications****Absolute Maximum Ratings at Ta = 25°C**

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage1	V <sub>CC1</sub> max		7	V
Maximum supply voltage2	V <sub>CC2</sub> max		16	V
Maximum supply voltage3	V <sub>S</sub> max		V <sub>CC2</sub>	V
Output supply voltage	V <sub>O</sub> max		V <sub>S</sub> +2V	V
Output Current	I <sub>O</sub> max		1.5	A
Allowable power dissipation	P <sub>d</sub> max		1.0	W
Operating temperature	T <sub>opr</sub>		-20 to +75	°C
Storage temperature	T <sub>stg</sub>		-55 to +125	°C

**Absolute Operating Conditions at Ta = 25°C**

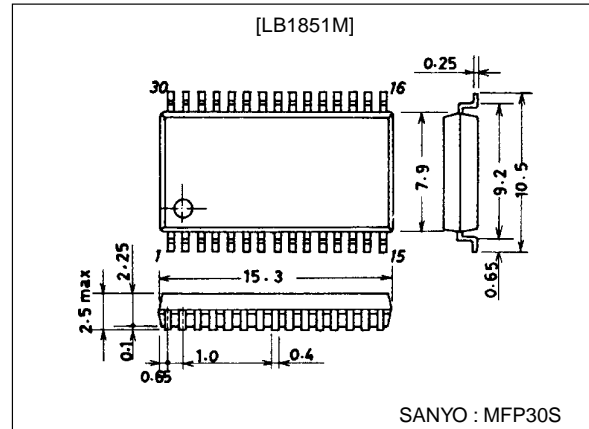
Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage1	V <sub>CC1</sub>		4.0 to 6.0	V
Supply voltage2	V <sub>CC2</sub>		4 to 14	V
Supply voltage3	V <sub>S</sub>		up to V <sub>CC2</sub>	V

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO 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 products described or contained herein.

**Package Dimensions**

unit:mm

**3073A-MFP30S****SANYO Electric Co.,Ltd. Semiconductor Business Headquarters**

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

73098HA (KT)/9050TA (KOTO) No.3659-1/6

# LB1851M

## Electrical Characteristics at Ta = 25°C, VCC1=5V, VCC2=7V, VS=3V

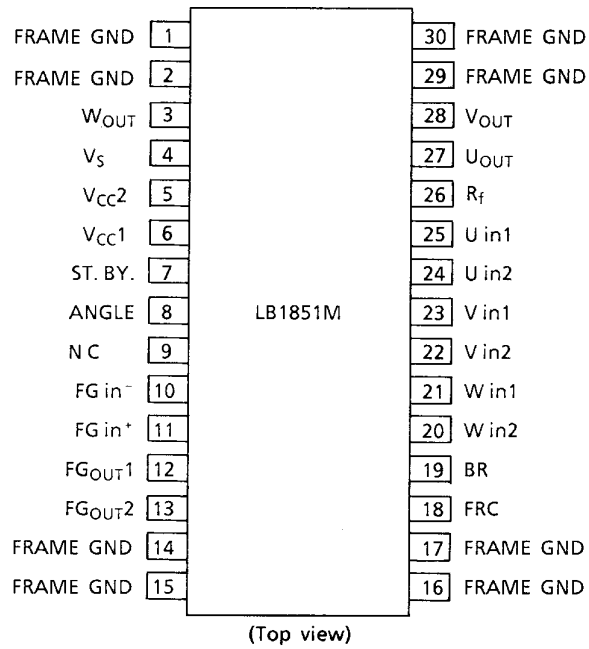
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current 1	ICC1	VBR=5V		4.5	6.5	mA
Supply current 2	ICC2	VBR=5V		15	20	mA
Supply current 3	IS	VBR=5V, RL=∞		6.5	9.0	mA
Output standby current 1	ICCOQ	VSTBY=0V			180	μA
Output standby current 2	ISOQ	VSTBY=0V, RL=∞			150	μA
Output saturation voltage	VO(sat)	IOUT=1.0A, sink+source			2.3	V
Output TRS voltage	VO(sus)	IOUT=20mA	16			V*
Output standby voltage	VOQ	IBR=5V	1.4	1.5	1.6	V
Hall amplifier input Offset voltage	VH offset		-5		+5	mV*
Hall amplifier common-mode Input voltage range	VHCOM		1.4		2.8	V
Hall input-output Voltage gain	GVHO	Rangle=8.2kΩ	31.5	34.5	37.5	dB
Brake pin 'H'-level voltage			2.0			V
Brake pin 'L'-level voltage					0.8	V
Brake pin input current					100	μA
Brake pin leakage current					-30	μA
FRC pin 'H'-level voltage			2.8			V
FRC pin 'L'-level voltage					1.2	V
FRC pin input current					100	μA
FRC pin leakage current					-30	μA
Upper residual voltage	VXH	IOUT=100mA, VCC2=6V, VS=2V	0.38		0.55	V
Lower residual voltage	VXL	IOUT=100mA, VCC2=6V, VS=2V	0.41		0.5	V
Residual voltage inflection point				2.0		V
Overlap amount		VCC2=6V, VS=3V	60	70	80	%
Standby ON voltage			-0.2		+0.1	V
Standby OFF voltage		Open : standby off (note1)	2		5	V
Standby pin bias current		Pin GND			10	μA
Operating temperature of thermal shutdown circuit			150	180	210	°C*
Hysteresis of thermal shutdown circuit				15		°C*
[FG Amplifier]						
FG amplifier input offset voltage	VFG offset		-8		+8	mV
Open loop voltage gain	GVFG	f=1kHz		60		dB
Source side output saturation voltage	VFG OUT	IQ=-2mA	3.7			V
Sink side output saturation voltage	VFG OD	IQ=2mA			1.3	V
Common-mode signal rejection	CHR			80		dB*
FG ampilier common-mode input voltage range	VFG CH		0		3.5	V
Phase margin				20		°C*
Schmitt amplifier threshold voltage		VFG in+=2.5V, VFGOUT2 at H to L	2.45	2.50	2.55	V
Schmitt amplifier hysteresis		VFG in+=2.5V	20	40	60	mV

Note1 : When standby pin is left open, standby operation is turned to off.

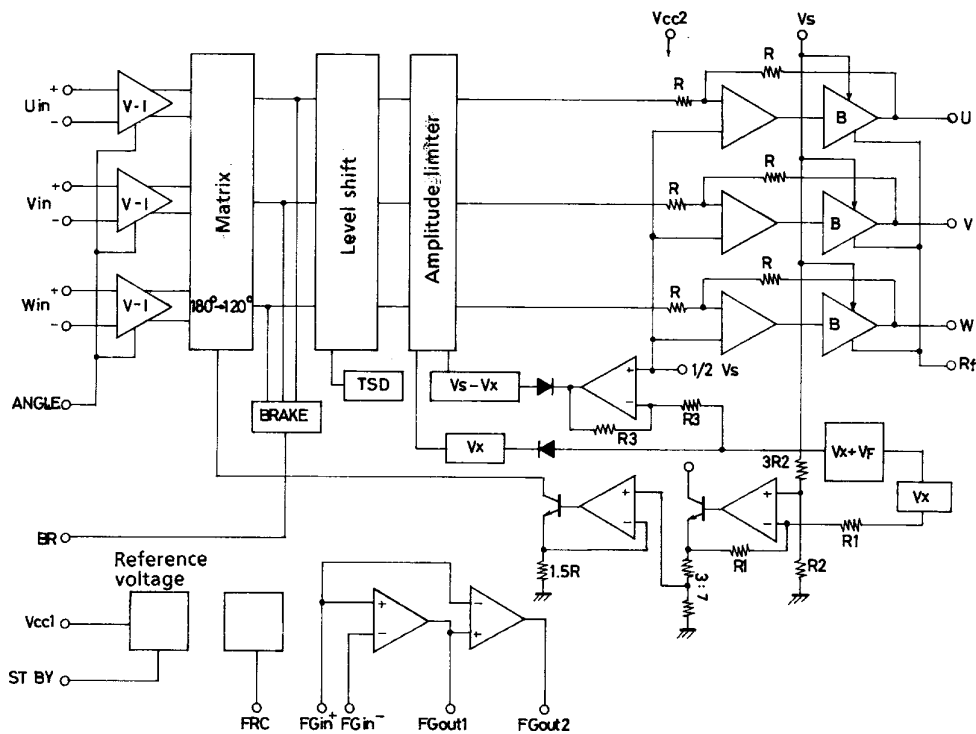
Note2\*: Values shown are design targets only. No measurements have been taken. Overlap spec. are regarded as test specification.

# LB1851M

## Pin Assignment

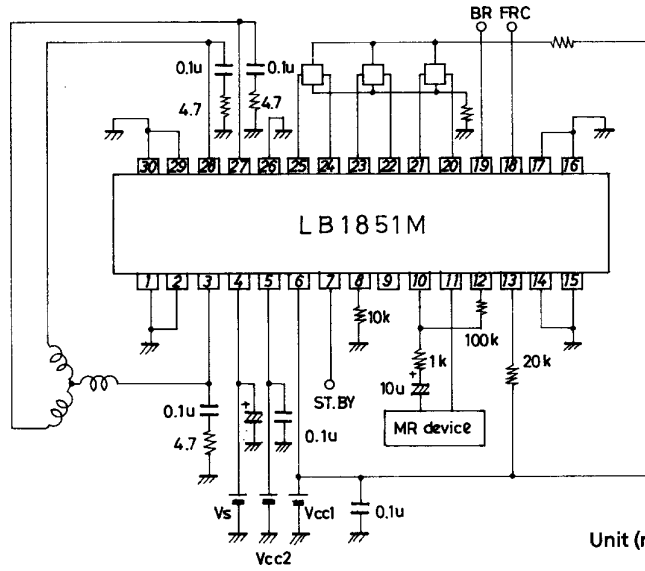


## Block Diagram



# LB1851M

## Sample Application Circuit



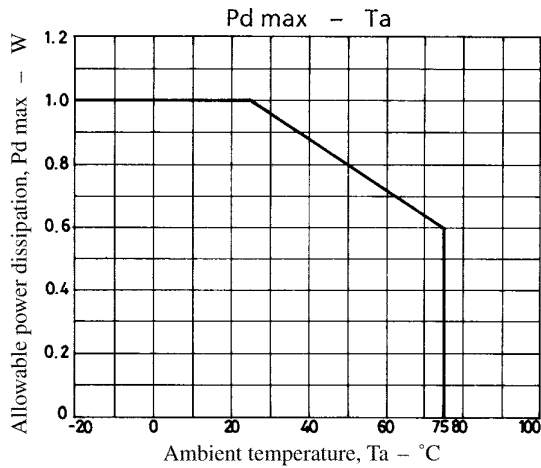
Unit (resistance: Ω, capacitance: F)

## Truth Table

Mode	Source	Sink	Input			Forward/Reverse Control
			U	V	W	
1	W phase → V phase		H	H	L	L
	V phase → W phase		H	H	L	H
2	W phase → U phase		H	L	L	L
	U phase → W phase		H	L	L	H
3	V phase → W phase		L	L	H	L
	W phase → V phase		L	L	H	H
4	U phase → V phase		L	H	L	L
	V phase → U phase		L	H	L	H
5	V phase → U phase		H	L	H	L
	U phase → V phase		H	L	H	H
6	U phase → W phase		L	H	H	L
	W phase → U phase		L	H	H	H

Input : "H" : Input 1 of each phase is at a potential which is higher by more than 0.2V relative to input 2.  
 "L" : Input 1 of each phase is at a potential which is lower by more than 0.2V relative to input 2.

Forward/reverse control : "H" : 2.8V to V<sub>CC1</sub>  
 "L" : 0V to 1.2V



# LB1851M

## Pin Description

Unit (resistance :  $\Omega$ )

Pin No.	Symbol	Pin voltage	Equivalent circuit	Pin function
4	$V_S$	$<V_{CC2}$		Power supply pin for fixing the output amplitude. Must be lower than $V_{CC2}$ voltage.
5	$V_{CC2}$	4V to 14V		Power supply pin for amp circuit other than motor driver transistor. Power supply pin for supplying voltage to other than the control section whose supply voltage is $V_{CC1}$ .
6	$V_{CC1}$	4V to 6V		Power supply pin for supplying voltage to the hall amp, forward/reverse control, FG amp, thermal shutdown circuit.
7	ST.BY	L : 0.1V max H : 2.0V min (When $V_{CC1}=5V$ )		When this pin is grounded, all the circuitry stops operating. In this case, the supply current is approximately 100 $\mu$ A. In the normal operation mode, this pin is left open or made to be at a potential of more than 2V.
8	ANGLE			The hall input-output gain (slope of motor waveform) can be changed by changing the resistance connected across this pin and GND.
10 11	FG in <sup>-</sup> FG in <sup>+</sup>	min 0V max 3.5V (When $V_{CC1}=5V$ )		FG signal input pin.
12	FG <sub>OUT1</sub>			FG amp output pin.
13	FG <sub>OUT2</sub>			FG schmitt amp output pin.
18	FRC	L : 1.2V max H : 2.8V min (When $V_{CC1}=5V$ )		Pin for forward/reverse control of motor L level : Forward (Less than 1.2V : When $V_{CC1}=5V$ ) H level : Reverse (More than 2.8V : When $V_{CC1}=5V$ ).
19	BR	L : 0.8V max H : 2.0V min		Pin for stopping the motor L level : Motor drive (Less than 0.8V). H level : Motor stop (More than 2.0V).

# LB1851M

Continued from preceding page.

Unit (resistance :  $\Omega$ )

Pin No.	Symbol	Pin voltage	Equivalent circuit	Pin function
20	Win2	min 1.4V max 2.8V (When $V_{CC1}=5V$ )		W phase hall element input pin Logic "H" : Win1>Win2
21	Win1			V phase hall element input pin Logic "H" : Vin1>Vin2
22	Vin2			U phase hall element input pin Logic "H" : Uin1>Uin2
23	Vin1			
24	Uin2			
25	Uin1			
26	Rf			GND for output transistor.
27	U <sub>OUT</sub>			Output pin.
28	V <sub>OUT</sub>			
3	W <sub>OUT</sub>			
1,2 14,15 16,17 29,30	FRAME (GND)			GND for other than output.

- Specifications of any and all SANYO 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 Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or 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 and all SANYO products described or contained herein fall under strategic products (including services) controlled under the Foreign Exchange and Foreign Trade Control Law of Japan, such products must not be exported without obtaining export license from the Ministry of International Trade and Industry 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 permission of SANYO Electric 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 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. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of July, 1998. Specifications and information herein are subject to change without notice.