

**SANYO**

No.3659

LB1851M

**3-Phase Brushless Motor Driver**

The LB1851M is a 3-phase brushless motor driver 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 (chip capacitor)
- Thermal shutdown circuit on chip
- FG amp on chip

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

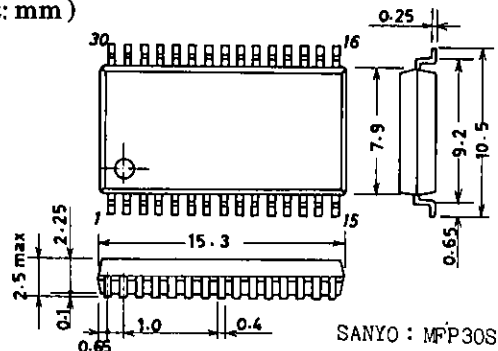
			unit
Maximum Supply Voltage1	V <sub>CC1</sub> max	7	V
Maximum Supply Voltage2	V <sub>CC2</sub> max	16	V
Maximum Supply Voltage3	V <sub>S</sub> max	V <sub>CC2</sub>	V
Output Supply Voltage	V <sub>O</sub> max	V <sub>S</sub> + 2V	V
Output Current	I <sub>O</sub> max	1.5	A
Allowable Power Dissipation	P <sub>d</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

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

			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

**Package Dimensions 3073A-M30IC**

(unit: mm)



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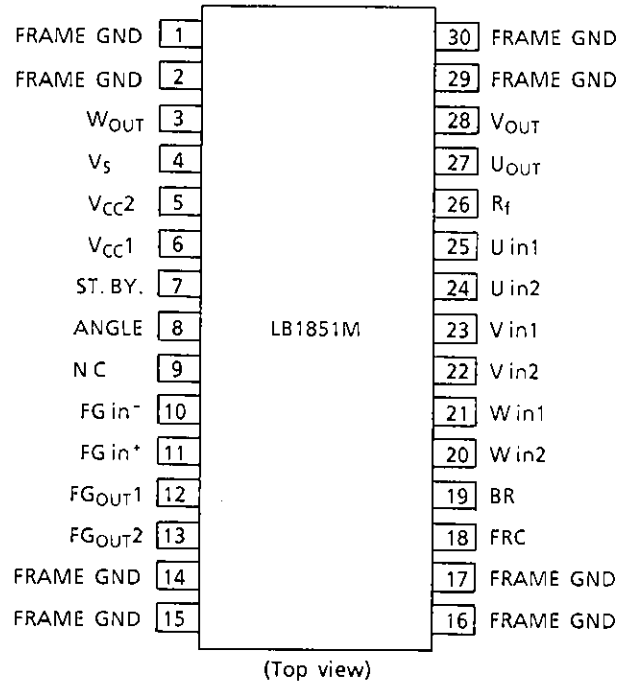
Electrical Characteristics at Ta=25°C, V <sub>CC1</sub> =5V, V <sub>CC2</sub> =7V, V <sub>S</sub> =3V			min	typ	max	unit	Note
Supply Current 1	I <sub>CC1</sub>	V <sub>BR</sub> =5V		4.5	6.5	mA	
Supply Current 2	I <sub>CC2</sub>	V <sub>BR</sub> =5V		15	20	mA	
Supply Current 3	I <sub>S</sub>	V <sub>BR</sub> =5V, R <sub>L</sub> =∞		6.5	9.0	mA	
Output Standby Current 1	I <sub>CCOQ</sub>	V <sub>STBY</sub> =0V			180	μA	
Output Standby Current 2	I <sub>SOQ</sub>	V <sub>STBY</sub> =0V, R <sub>L</sub> =∞			150	μA	
Output Saturation Voltage	V <sub>O</sub> (sat)	I <sub>OUT</sub> =1.0A, sink + source			2.3	V	
Output TRS Voltage	V <sub>O</sub> (sus)	I <sub>OUT</sub> =20mA	16			V	※
Output Standby Voltage	V <sub>OQ</sub>	I <sub>BR</sub> =5V	1.4	1.5	1.6	V	
Hall Amp Input Offset Voltage	V <sub>H off set</sub>		-5		+5	mV	※
Hall Amp Common-Mode Input Voltage Range	V <sub>HCOM</sub>		1.4		2.8	V	
Hall Input-Output Voltage Gain	G <sub>VHO</sub>	R <sub>angle</sub> =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	V <sub>XH</sub>	I <sub>OUT</sub> =100mA, V <sub>CC2</sub> =6V, V <sub>S</sub> =2V	0.38		0.55	V	
Lower Residual Voltage	V <sub>XL</sub>	I <sub>OUT</sub> =100mA, V <sub>CC2</sub> =6V, V <sub>S</sub> =2V	0.41		0.5	V	
Residual Voltage Inflection Point				2.0		V	
Overlap Amount		V <sub>CC2</sub> =6V, V <sub>S</sub> =3V	60	70	80	%	
Standby ON Voltage			-0.2		+0.1	V	
Standby OFF Voltage		Open : Standby Off (Note 1)	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 [FG Amp]				15		°C	※
FG Amp Input Offset Voltage	V <sub>FG off set</sub>		-8		+8	mV	
Open Loop Voltage Gain	G <sub>VFG</sub>	f=1kHz		60		dB	
Source Side Output Saturation Voltage	V <sub>FG OUT</sub>	I <sub>O</sub> =-2mA	3.7			V	
Sink Side Output Saturation Voltage	V <sub>FG OD</sub>	I <sub>O</sub> =2mA			1.3	V	
Common-Mode Signal Rejection	CHR			80		dB	※
FG Amp Common-Mode Input Voltage Range	V <sub>FG CH</sub>		0		3.5	V	
Phase Margin				20		°C	※
Schmitt Amp Threshold Voltage		V <sub>FGin+</sub> =2.5V, V <sub>FGOUT2</sub> at H to L	2.45	2.50	2.55	V	
Schmitt Amp Hysteresis		V <sub>FGin+</sub> =2.5V	20	40	60	mV	

Note 1 : When standby pin is left open, standby operation is turned to off.

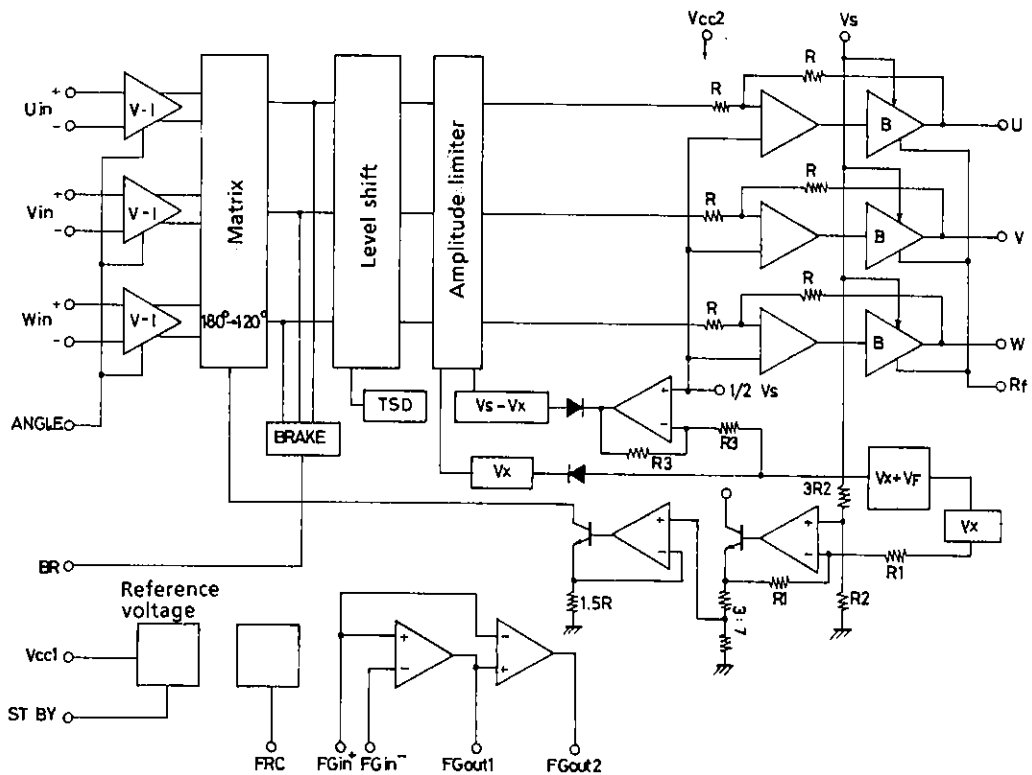
Note 2 ※ : Values shown are design targets only. No measurements have been taken. Overlap spec. are regarded as test spec.

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## Pin Assignment

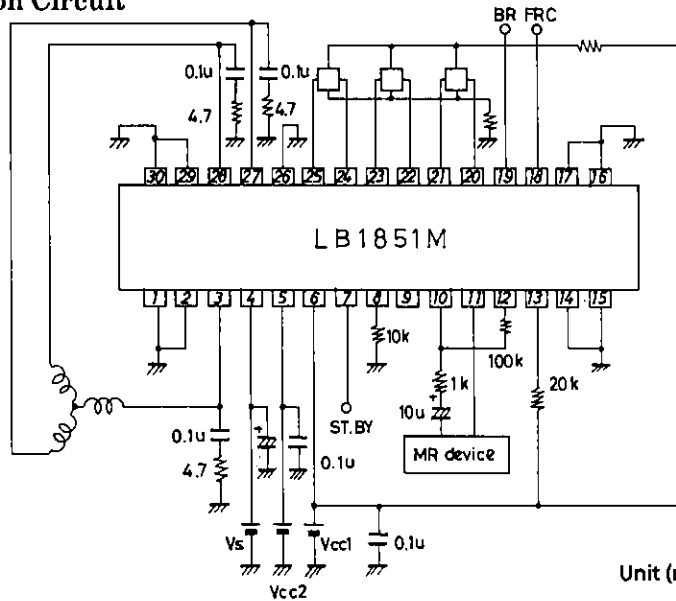


## Block Diagram



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## Sample Application Circuit



Unit (resistance:  $\Omega$ , capacitance: F)

## Truth Table

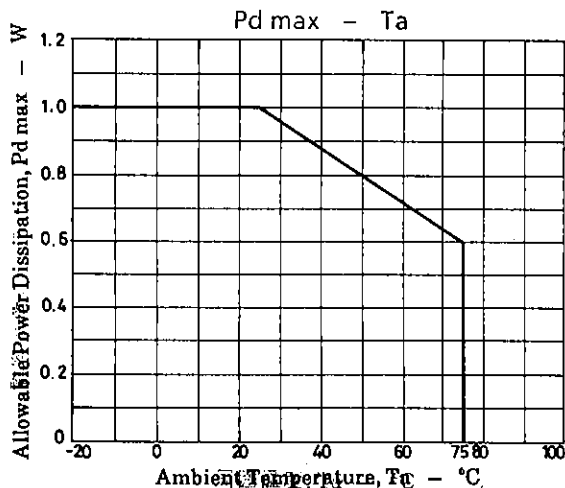
Mode	Source Sink	Input			Forward/Reverse Control
		U	V	W	
1	W phase $\rightarrow$ V phase	H	H	L	L
	V phase $\rightarrow$ W phase	H	H	L	H
2	W phase $\rightarrow$ U phase	H	L	L	L
	U phase $\rightarrow$ W phase	H	L	L	H
3	V phase $\rightarrow$ W phase	L	L	H	L
	W phase $\rightarrow$ V phase	L	L	H	H
4	U phase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

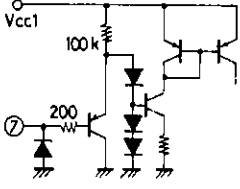
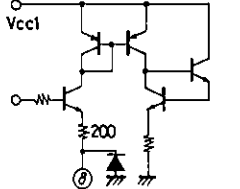
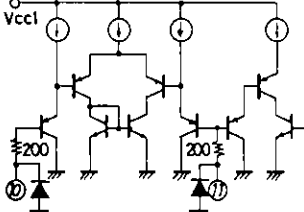
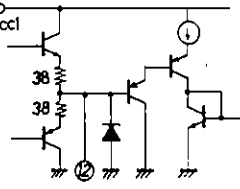
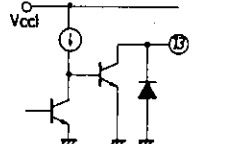
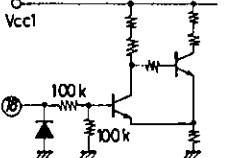
"L": Input 1 of each phase is at a potential which is lower by more than 0.2V relative to input 2.

Forward/reverse control: "H": 2.8V to  $V_{CC1}$

"L": 0V to 1.2V



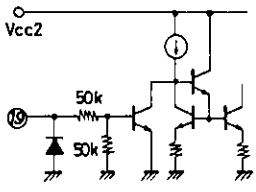
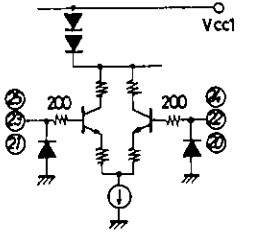
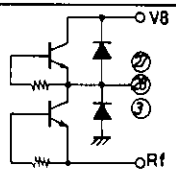
Pin Description

Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit	Pin Function
4	V <sub>s</sub>	< V <sub>CC2</sub>		Power supply pin for fixing the output amplitude. Must be lower than V <sub>CC2</sub> voltage.
5	V <sub>CC2</sub>	4V to 14V		Power supply pin for power amp circuit other than motor driver transistor. Power supply pin for supplying voltage to other than the control section whose supply voltage is V <sub>CC1</sub> .
6	V <sub>CC1</sub>	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 <sub>CC1</sub> = 5V)		When this pin is grounded, all the circuitry stops operating. In this case, the supply current is approximately 100μA. 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	FG in <sup>-</sup>	min 0V max 3.5V (When V <sub>CC1</sub> = 5V)		FG signal input pin
11	FG in <sup>+</sup>			
12	FG <sub>OUT1</sub>			FG amp output pin
13	FG <sub>OUT2</sub>			FG schmitt amp output pin
18	FRC	H: 2.8V min L: 1.2V max (When V <sub>CC1</sub> = 5V)		Pin for forward/reverse control of motor L level: Forward (Less than 1.2V: When V <sub>CC1</sub> = 5V) H level: Reverse (More than 2.8V: When V <sub>CC1</sub> = 5V)

Unit (resistance: Ω)

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Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit	Pin Function
19	BR	H : 2.0V min L : 0.8V max		Pin for stopping the motor L level : Motor drive (Less than 0.8V) H level : Motor stop (More than 2.0V)
20	Win2	min 1.4V max 2.8V (When V <sub>CC1</sub> = 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

Unit (resistance: Ω)

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