



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 $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage1	$V_{CC1 \text{ max}}$		7	V
Maximum supply voltage2	$V_{CC2 \text{ max}}$		16	V
Maximum supply voltage3	$V_S \text{ max}$		V_{CC2}	V
Output supply voltage	$V_O \text{ max}$		$V_S + 2V$	V
Output Current	$I_O \text{ max}$		1.5	A
Allowable power dissipation	$P_d \text{ max}$		1.0	W
Operating temperature	T_{opr}		-20 to +75	°C
Storage temperature	T_{stg}		-55 to +125	°C

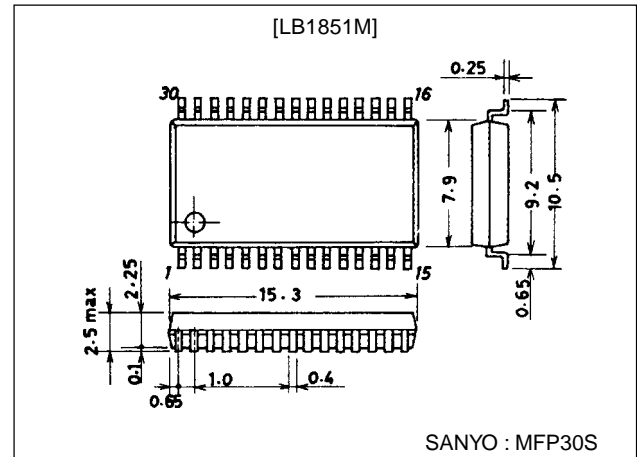
Absolute Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage1	V_{CC1}		4.0 to 6.0	V
Supply voltage2	V_{CC2}		4 to 14	V
Supply voltage3	V_S		up to V_{CC2}	V

Package Dimensions

unit:mm

3073A-MFP30S



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

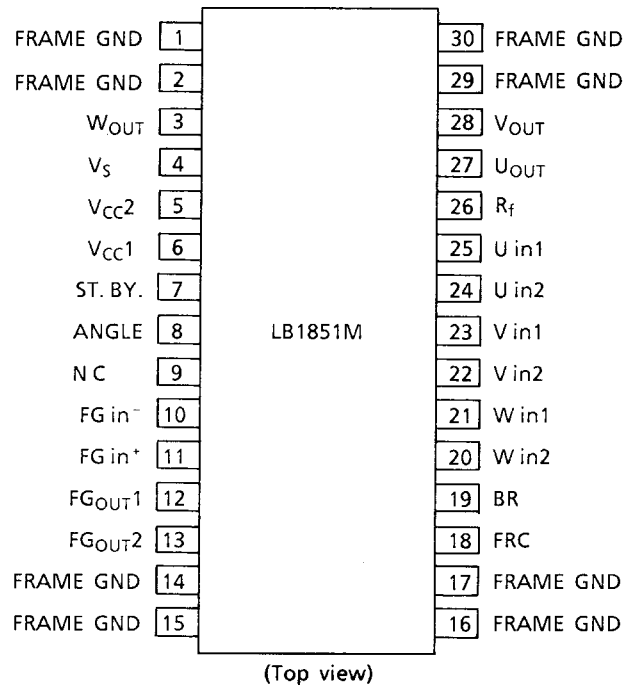
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current 1	I _{CC1}	V _{BR} =5V		4.5	6.5	mA
Supply current 2	I _{CC2}	V _{BR} =5V		15	20	mA
Supply current 3	I _S	V _{BR} =5V, R _L =∞		6.5	9.0	mA
Output standby current 1	I _{CCOQ}	V _{STBY} =0V			180	μA
Output standby current 2	I _{SOQ}	V _{STBY} =0V, R _L =∞			150	μA
Output saturation voltage	V _{O(sat)}	I _{OUT} =1.0A, sink+source			2.3	V
Output TRS voltage	V _{O(sus)}	I _{OUT} =20mA	16			V*
Output standby voltage	V _{OQ}	I _{BR} =5V	1.4	1.5	1.6	V
Hall amplifier input Offset vottage	V _{H offset}		-5		+5	mV*
Hall amplifier common-mode Input voltage range	V _{HCOM}		1.4		2.8	V
Hall input-output Voltage gain	G _{VHO}	R _{angle} =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 _{XH}	I _{OUT} =100mA, V _{CC2} =6V, V _S =2V	0.38		0.55	V
Lower residual voltage	V _{XL}	I _{OUT} =100mA, V _{CC2} =6V, V _S =2V	0.41		0.5	V
Residual voltage inflection point				2.0		V
Overlap amount		V _{CC2} =6V, V _S =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	V _{FG offset}		-8		+8	mV
Open loop voltage gain	G _{VFG}	f=1kHz		60		dB
Source side output saturation voltage	V _{FG OUT}	I _O =-2mA	3.7			V
Sink side output saturation voltage	V _{FG OD}	I _O =2mA			1.3	V
Common-mode signal rejection	CHR			80		dB*
FG ampilier common-mode input voltage range	V _{FG CH}		0		3.5	V
Phase margin				20		°C*
Schmitt amplifier threshold voltage		V _{FG in+} =2.5V, V _{FGOUT2} at H to L	2.45	2.50	2.55	V
Schmitt amplifier hysteresis		V _{FG in+} =2.5V	20	40	60	mV

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

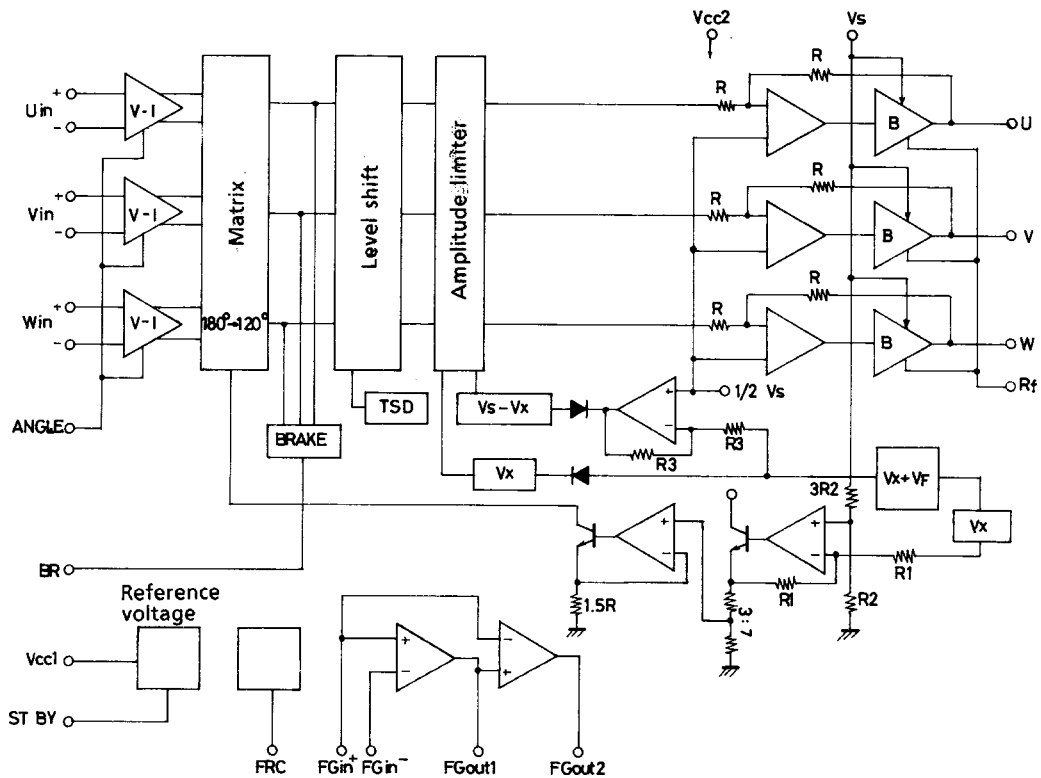
Note2*: Values shown are design targets only. No measurements have been taken. Overlap spec. are regarded as test specification.

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Pin Assignment

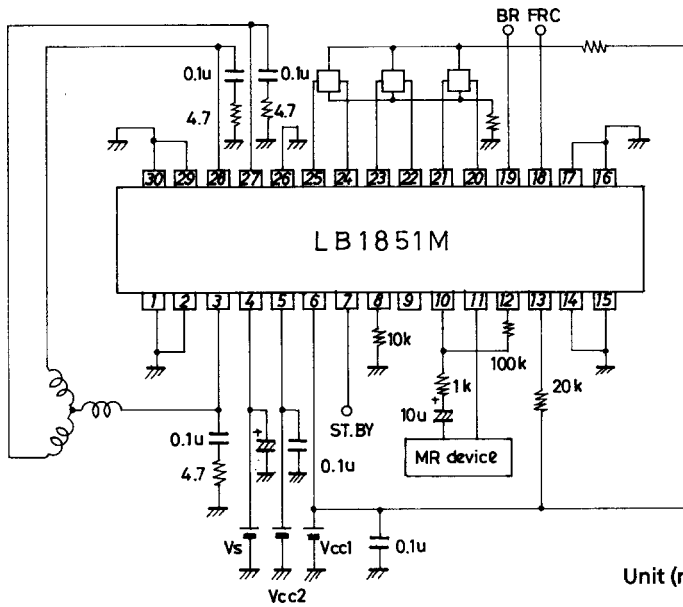


Block Diagram



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Sample Application Circuit



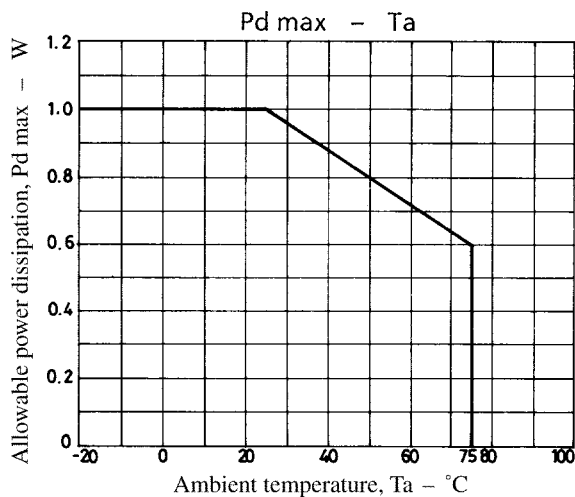
Unit (resistance: Ω , capacitance: F)

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.

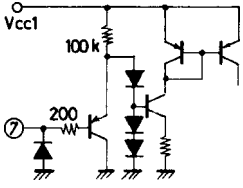
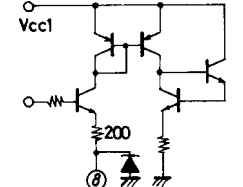
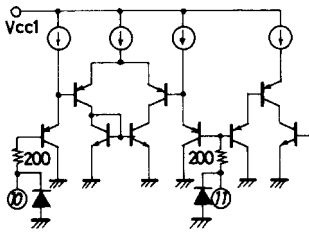
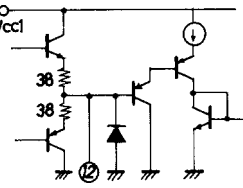
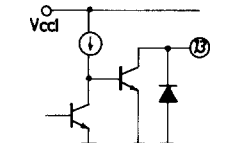
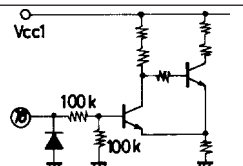
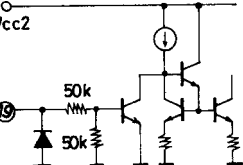
Forward/reverse control : "H" : 2.8V to V_{CC1}
 "L" : 0V to 1.2V



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Pin Description

Unit (resistance : Ω)

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 μ 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 ⁻ FG in ⁺	min 0V max 3.5V (When $V_{CC1}=5V$)		FG signal input pin.
12	FG _{OUT1}			FG amp output pin.
13	FG _{OUT2}			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).

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Continued from preceding page.

Unit (resistance : Ω)

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 _{OUT}			Output pin.
28	V _{OUT}			
3	W _{OUT}			
1,2 14,15 16,17 29,30	FRAME (GND)			GND for other than output.

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