Ordering number:EN3659

Monolithic Digital IC

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

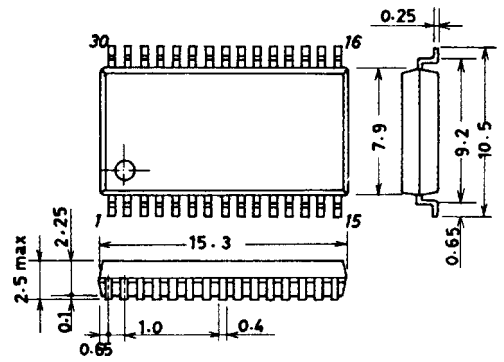
- 120˚C voltage linear type.
- Less power dissipation because of speed control based on motor voltage control (suitable for use in portable sets).
- Torque ripple compensation circuit on chip.
- Small capacitance of external capacitor because of soft switching method (clip capacitor).
- Thermal shutdown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

Package Dimensions

unit:mm

3073A-MFP30S

[LB1851M]



SANYO : MFP30S

Specifications

Absolute Maximum Ratings at Ta = 25˚C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage1	$V_{CC}1$ max		7	V
Maximum supply voltage2	$V_{CC}2$ max		16	V
Maximum supply voltage3	V_S max		$V_{CC}2$	V
Output supply voltage	V_O max		V_S+2V	V
Output Current	I_O max		1.5	A
Allowable power dissipation	Pd max		1.0	W
Operating temperature	Topr		–20 to +75	˚C
Storage temperature	Tstg		–55 to +125	˚C

Absolute Operating Conditions at Ta = 25˚C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage1	$V_{CC}1$		4.0 to 6.0	V
Supply voltage2	$V_{CC}2$		4 to 14	V
Supply voltage3	V_S		up to $V_{CC}2$	V

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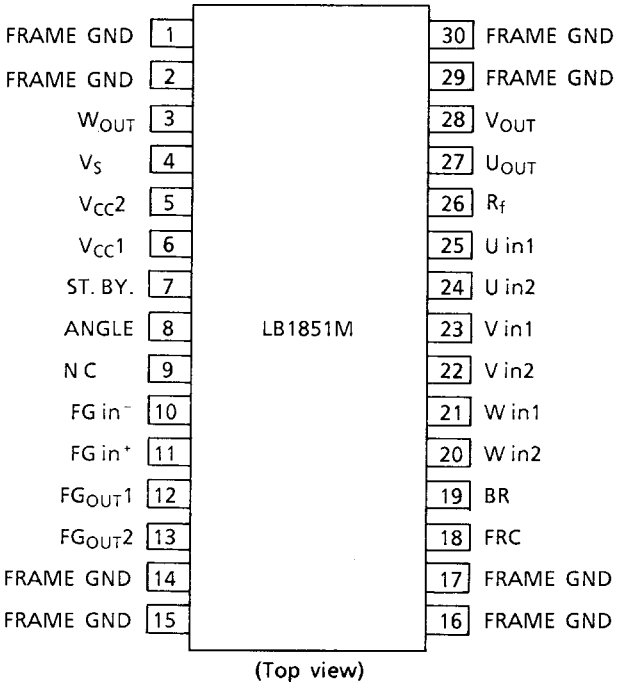
Electrical Characteristics at Ta = 25˚C, $V_{CC}1$=5V, $V_{CC}2$=7V, V_S=3V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current 1	$I_{CC}1$	V_{BR}=5V		4.5	6.5	mA
Supply current 2	$I_{CC}2$	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 votlage	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}	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	V_{XH}	I_{OUT}=100mA, $V_{CC}2$=6V, V_S=2V	0.38		0.55	V
Lower residual voltage	V_{XL}	I_{OUT}=100mA, $V_{CC}2$=6V, V_S=2V	0.41		0.5	V
Residual voltage inflection point				2.0		V
Overlap amount		$V_{CC}2$=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, $V_{FGOUT}2$ at H to L	2.45	2.50	2.55	V
Schmitt amplifier hysteresis		$V_{FG\ in}$+=2.5V	20	40	60	mV

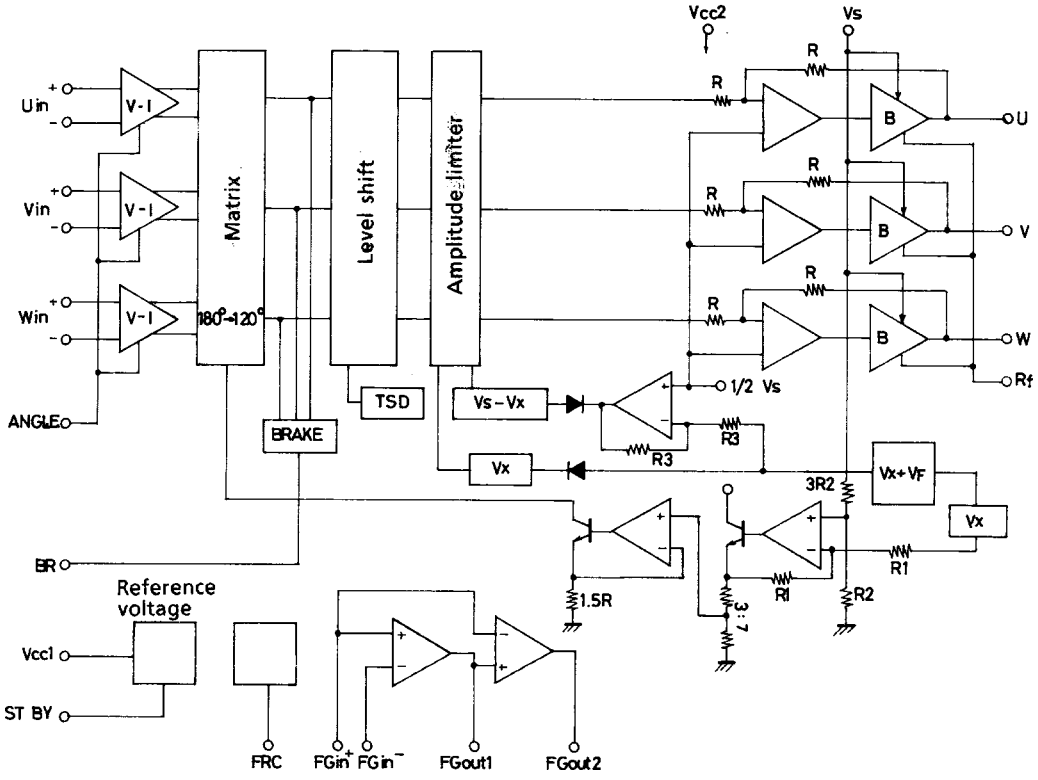
Note1 : When standby pin is left open, standby operation is turned to off.
Note2*: Values shown are design targets only. No measurements have been taken. Overlap spec. are regarded as test specification.

Pin Assignment

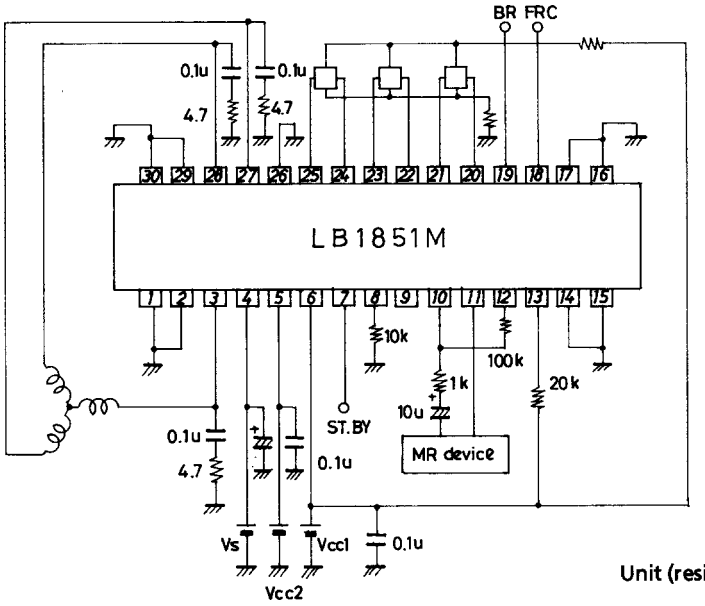


(Top view)

Block Diagram



Sample Application Circuit



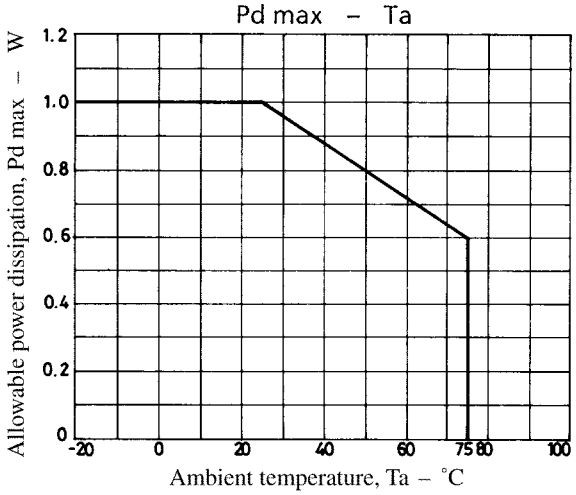
Unit (resistance: Ω, capacitance: F)

Truth Table

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

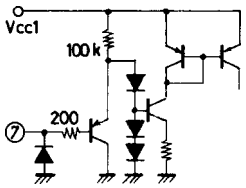
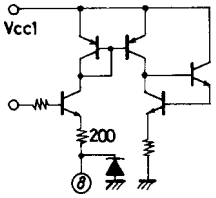
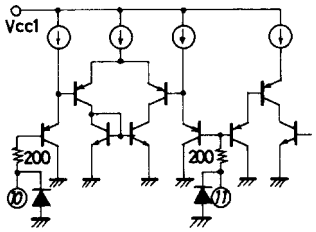
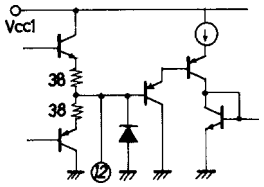
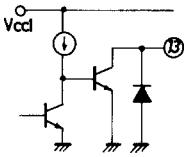
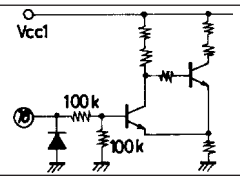
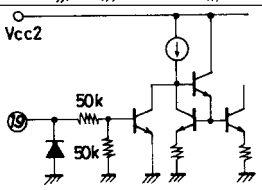
Input : "H" : Input 1 of each phase is at a potential which is higher by more than 0.2V relative to input 2.
"L" : Input 1 of each phase is at a potential which is lower by more than 0.2V relative to input 2.

Forward/reverse control : "H" :2.8V to $V_{CC}1$
"L" : 0V to 1.2V



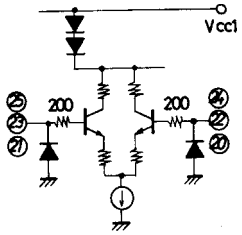
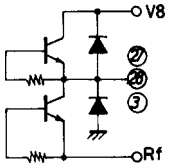
Pin Description

Unit (resistance : Ω)

Pin No.	Symbol	Pin voltage	Equivalent circuit	Pin function
4	V_S	$<V_{CC}2$		Power supply pin for fixing the output amplitude. Must be lower than $V_{CC}2$ voltage.
5	$V_{CC}2$	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 $V_{CC}1$.
6	$V_{CC}1$	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 $V_{CC}1$=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 11	FG in^- FG in^+	min 0V max 3.5V (When $V_{CC}1$=5V)		FG signal input pin.
12	$FG_{OUT}1$			FG amp output pin.
13	$FG_{OUT}2$			FG schmitt amp output pin.
18	FRC	L : 1.2V max H : 2.8V min (When $V_{CC}1$=5V)		Pin for forward/reverse control of motor L level : Forward (Less than 1.2V : When $V_{CC}1$=5V) H level : Reverse (More than 2.8V : When $V_{CC}1$=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).

Continued from preceding page.

Unit (resistance : Ω)

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