SANYO

Monolithic Digital IC

3-Phase Brushless Motor Driver

The LB1617M is a 3-phase brushless motor driver IC ideally suited for use in movie VTR capstan motor driver, drum motor driver, and DAT motor driver applications.

Features
- 120° 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

Absolute Maximum Ratings at Ta = 25°C

				unit
Maximum Supply Voltage	$V_{CC}2, V_{CC}3$ max		16	V
	$V_{CC}1$ max		7	V
Supply Voltage	V_S	$V_S < V_{CC}2$	12	V
Output Current	I_O		1.5	A
Hall Supply Current	I_H		20	mA
Allowable Power Dissipation	Pd max	30-pin MFP	1.0	W
Operating Temperature	Topg		−20 to +75	°C
Storage Temperature	Tstg		−55 to +125	°C

Allowable Operating Conditions at Ta = 25°C

Case	$V_{CC}1$ (Reg)	$V_{CC}2$ (Un-Reg)	$V_{CC}3$
1	4 to 7V	4 to 16V	Shorted with $V_{CC}1$
2	Open	6 to 16V	Shorted with $V_{CC}2$

Electrical Characteristics at Ta = 25°C, $V_{CC}2 = V_{CC}3 = 7.0V$, $V_S = 3V$

			min	typ	max	unit
Supply Current 1	$I_{CC}1 + 3$	$V_{CC}1 = V_{CC}3 = 5V$, $V_{BR} = 5V$		10	12	mA
Supply Current 2	$I_{CC}2$	$V_{BR} = 5V$		18	23	mA
Supply Current 3	I_S	$V_{BR} = 5V$		5.0	7.0	mA
Supply Standby Current	$I_{CC}0Q$	$V_{STBY} = 0V$			180	μA

Case Outline 3073A-M30IC
(unit : mm)
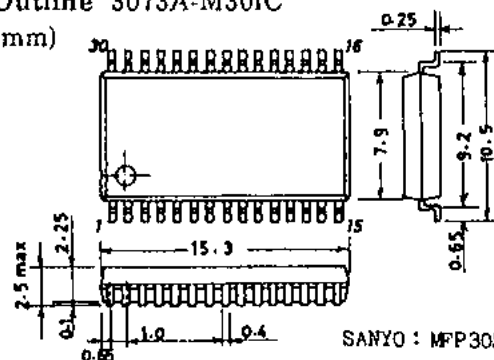
SANYO : MFP30S

Specifications and information herein are subject to change without notice.

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			min	typ	max	unit
Output Saturation Voltage	$V_{O(sat)}$	$I_{OUT}=1.0A$ sink + source			2.3	V
Output Transistor Breakdown Voltage	$V_{O(sus)}$	$I_{OUT}=20mA$	16			V
Output Standby Voltage	V_{OQ}	$V_{BR}=5V$	1.43	1.53	1.63	V
Hall Amp Input Offset Voltage	$V_{HOFFSET}$		-5		+5	mV
Hall Amp Common-Mode Input Voltage Range	V_{HCOM}		1.4		2.8	V
Hall Input-Output Voltage Gain	G_{VHO}	Under specified circuit conditions	33	36	39	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 Leak 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 Leak Current					-30	μA
Hall Supply Voltage	V_H	$I_H=10mA$ $V_H{}^{(+)}-V_H{}^{(-)}$	0.8	1.0	1.5	V
Upper Residual Voltage	V_{XH}	$I_{OUT}=100mA, V_{CC}2=6V, V_S=2V$	0.33		0.5	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	%
Operating Temperature of Thermal Shutdown Circuit			150	180	210	°C
Hysteresis of Thermal Shutdown Circuit				15		°C
Standby Operating Voltage					0.1	V
Standby Bias Current		Pin GND			10	μA

Design Notes
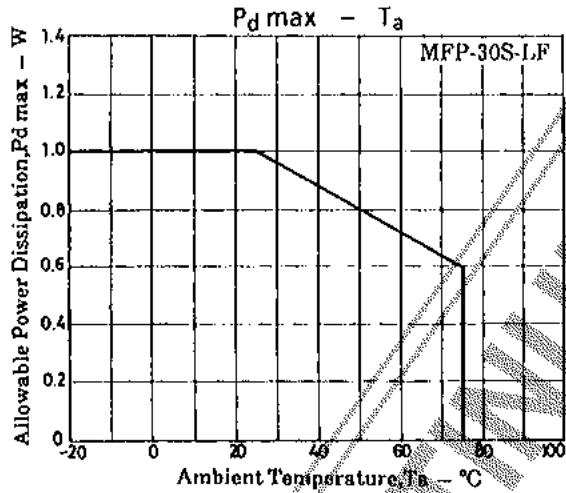   It should be noted that dielectric breakdown is liable to occur between pin 10 and other pins.
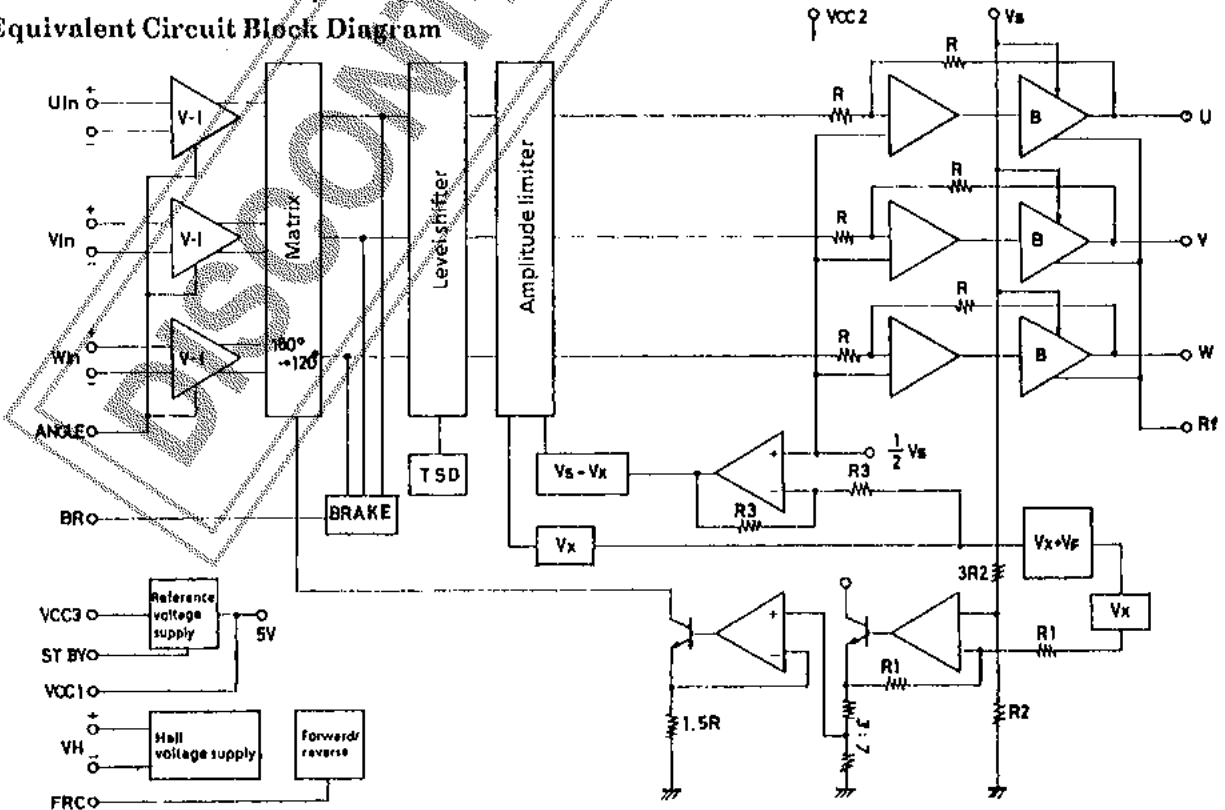
Pin Assignment

LB1617M
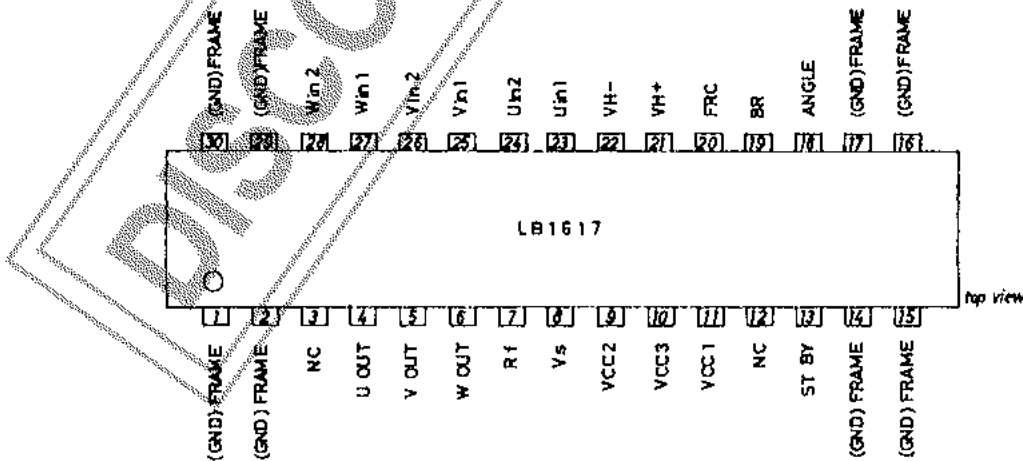
Truth Table

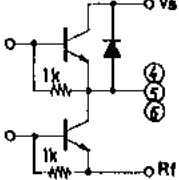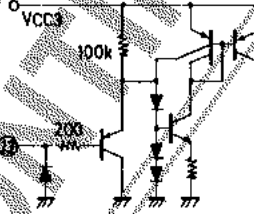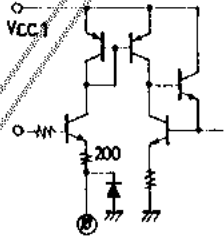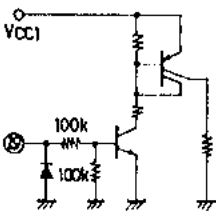|	Source	Sink	Input			Forward/Reverse Control
			U	V	W	
1	W phase → V phase		H	H	L	L
	V phase → W phase					H
2	W phase → U phase		H	L	L	L
	U phase → W phase					H
3	V phase → W phase		L	L	H	L
	W phase → V phase					H
4	U phase → V phase		L	H	L	L
	V phase → U phase					H
5	V phase → U phase		H	L	H	L
	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":2.8 to $V_{CC}2$
"L":0 to 1.2V

P_d max – T_a

MFP-30S-LF

Allowable Power Dissipation, P_d max – W

Ambient Temperature, T_a – °C

Equivalent Circuit Block Diagram

Pin Description

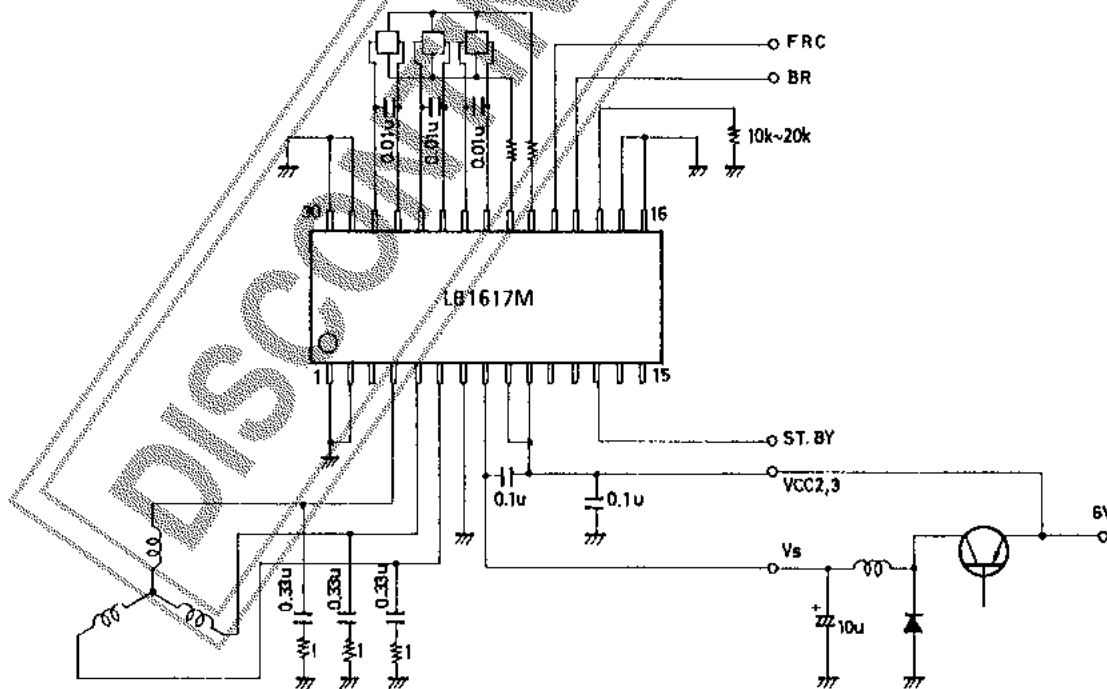| Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit	Pin Function
1,2 14,15 16,17 29,30	FRAME (GND)			GND for other than output
4 5 6	U_out V_out W_out			Output pins
7	R_f			GND for output transistor
8	V_S	$<V_{CC}2$		Power supply pin for fixing the output amplitude. Must be lower than $V_{CC}2$ voltage.
9	$V_{CC}2$			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 $V_{CC}1$, $V_{CC}3$.
10	$V_{CC}3$			Power supply pin for hall bias power supply, 1.2V reference voltage, $V_{CC}1$ internal power supply.
11	$V_{CC}1$			Power supply pin for supplying voltage to the hall amp, forward/reverse control, thermal shutdown circuit. When this pin is left open, a voltage of approximately 5V is supplied internally.
13	ST.BY	L: 0.1V max H: 2.0V min		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.
18	ANGLE			The hall input-output gain (slope of motor waveform) can be changed by changing the resistance connected across this pin and GND. $\fallingdotseq 10k\Omega$
19	BR	H: 2.0V min L: 0.8V max (When $V_{CC}1 = 5V$)		Pin for stopping the motor L level : Motor drive (Less than 0.8V : When $V_{CC}1 = 5V$) H level : Motor stop (More than 2.0V : When $V_{CC}1 = 5V$)

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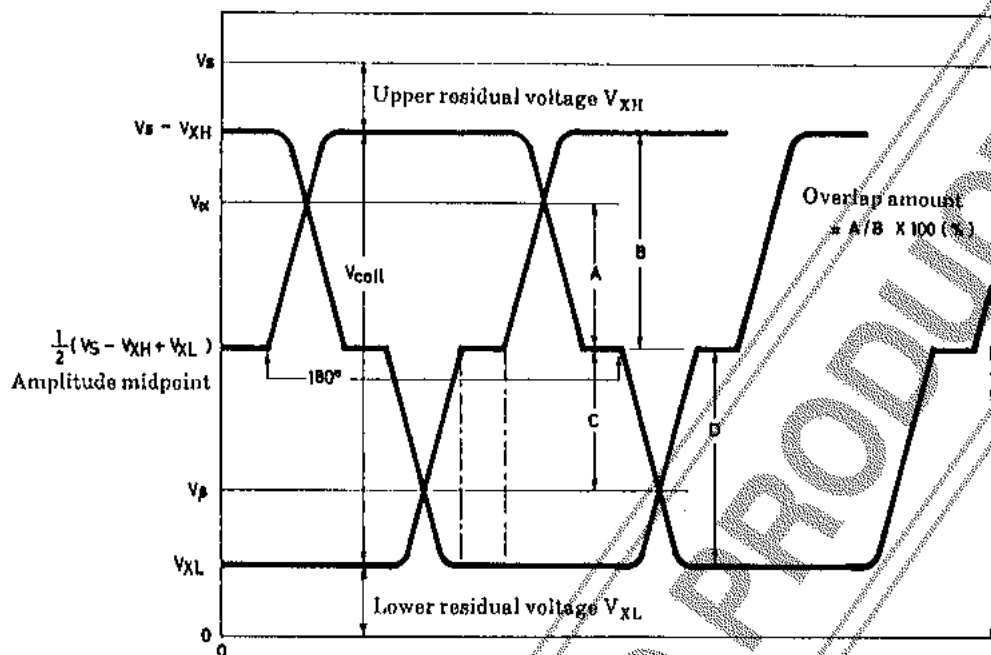| Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit	Pin Function
20	FRC	H:1.2V min L: 2.8V max (When $V_{CC}1=5V$)		Pin for forward/reverse control of motor L level : Forward (Less than 1.2V : When $V_{CC}1=5V$) H level : Reverse (More than 2.8V : When $V_{CC}1=5V$)
21 22	$V_H{}^+$ $V_H{}^-$			Pin for supplying the hall bias current A voltage of approximately 1V is developed across ($V_H{}^+$) and ($V_H{}^-$).
23 24 25 26 27 28	$U_{in}1$ $U_{in}2$ $V_{in}1$ $V_{in}2$ $W_{in}1$ $W_{in}2$	1.4V min 2.8V max (When $V_{CC}1=5V$)		U phase hall element input pin Logic "H": $U_{in}1 > U_{in}2$ V phase hall element input pin Logic "H": $V_{in}1 > V_{in}2$ W phase hall element input pin Logic "H": $W_{in}1 > W_{in}2$

Note) Pin 12 (NC pin) must be left open.

Sample Application Circuit

Output Voltage Waveform

Vs

Vs − V$_{XH}$

Upper residual voltage V$_{XH}$

V$_{α}$

Overlap amount = A/B × 100 (%)

V$_{coil}$

A

B

$\frac{1}{2}$(Vs − V$_{XH}$ + V$_{XL}$)
Amplitude midpoint

180°

C

D

V$_{β}$

V$_{XL}$

Lower residual voltage V$_{XL}$

0

0

Upper overlap = A/B = (2V$_{α}$ − V$_{A}$ − V$_{XL}$) / (V$_{A}$ − V$_{XL}$) × 100[%]

Lower overlap = C/D = (V$_{A}$ + V$_{XL}$ − 2V$_{β}$) / (V$_{A}$ − V$_{XL}$) × 100[%]