

SANYO

No.3323

LB1619M**3-Phase Brushless Motor Driver****Applications**

The LB1619M is a 3-phase brushless motor driver IC ideally suited for use in VTR capstan motor driver, drum motor driver applications.

Features

- 120° voltage linear type
- Speed control based on motor voltage control
- Soft switching type eliminating noises caused by current switching and making the values of external capacitors smaller (comparable to those of chip capacitors)
- On-chip torque ripple compensation circuit
- On-chip thermal shutdown circuit

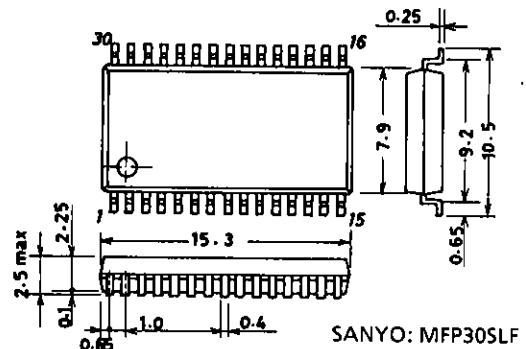
Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

			unit
Maximum Supply Voltage	V_{CC} max	16	V
Maximum Supply Voltage	V_S max	V_{CC}	V
Output Current	I_O	1.5	A
Hall Supply Current	I_H	20	mA
Allowable Power Dissipation	P_d max	1.0	W
Operating Temperature	T_{opr}	-20 to +75	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to +125	$^\circ\text{C}$

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

			unit
Supply Voltage	V_{CC}	6 to 16	V

(Design Notes) It should be noted that dielectric breakdown is liable to occur between pin 11 and other pins.

Package Dimensions 3073A-M30IC
(unit: mm)

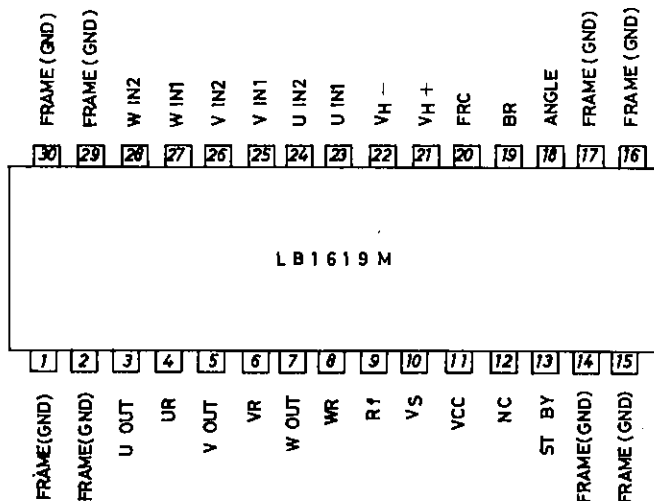
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Electrical Characteristics at Ta = 25°C, VCC = 12V, VS = 3V				min	typ	max	unit
Supply Current 1	ICC	VBR = 5V			18	23	mA
Supply Current 2	IS	VBR = 5V			5.0	7.0	mA
Supply Standby Current	ICCOQ	VSTBY = 0V				180	µA
Output Saturation Voltage	VO(sat)	IOUT = 1.0A, sink + source				2.3	V
Output Transistor	VO(sus)	IOUT = 20mA*		16			V
Breakdown Voltage							
Output Standby Voltage	VOQ	VBR = 5V		1.43	1.53	1.63	V
Hall Amp Input Offset Voltage	VHOFFset	*		-5		+5	mV
Hall Amp Common-Mode	VHCOM			1.4		2.8	V
Input Voltage Range							
Hall Input-Output Voltage Gain	GVHO	Under specified circuit conditions		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 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	VH	IH = 10mA VH(+)-VH(-)		0.8	1.0	1.5	V
Upper Residual Voltage	VXH	IOUT = 100mA		0.40	0.6	0.75	V
Lower Residual Voltage	VXL	IOUT = 100mA		0.5	0.6	0.7	V
Residual Voltage Inflection Point						2.0	V
Overlap Amount		VCC = 12V, VS = 3.5V		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
VS OFF-State IC Flow-out/in Current		Number of revolutions : 1260rpm				0.8	A

Note) * : Values shown are design targets only. No measurements have been taken.
 Overlap amount : Value measured at the time of shipment

Pin Assignment



Note : All FRAME pins are connected to GND.

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:

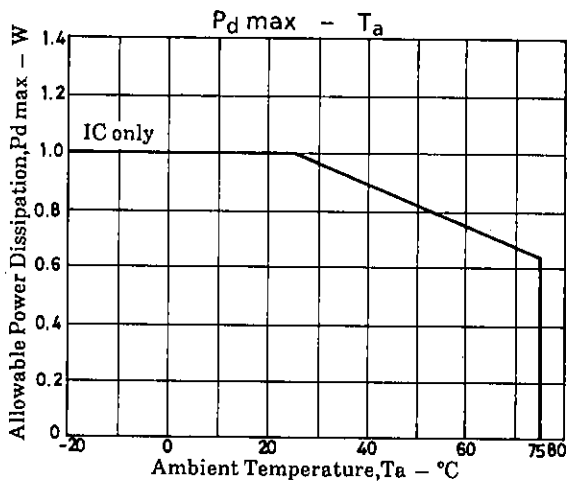
H: High level. One of the inputs should have a potential at least 0.2V higher than the other.

L: Low level. One of the inputs should have a potential at least 0.2V lower than the other.

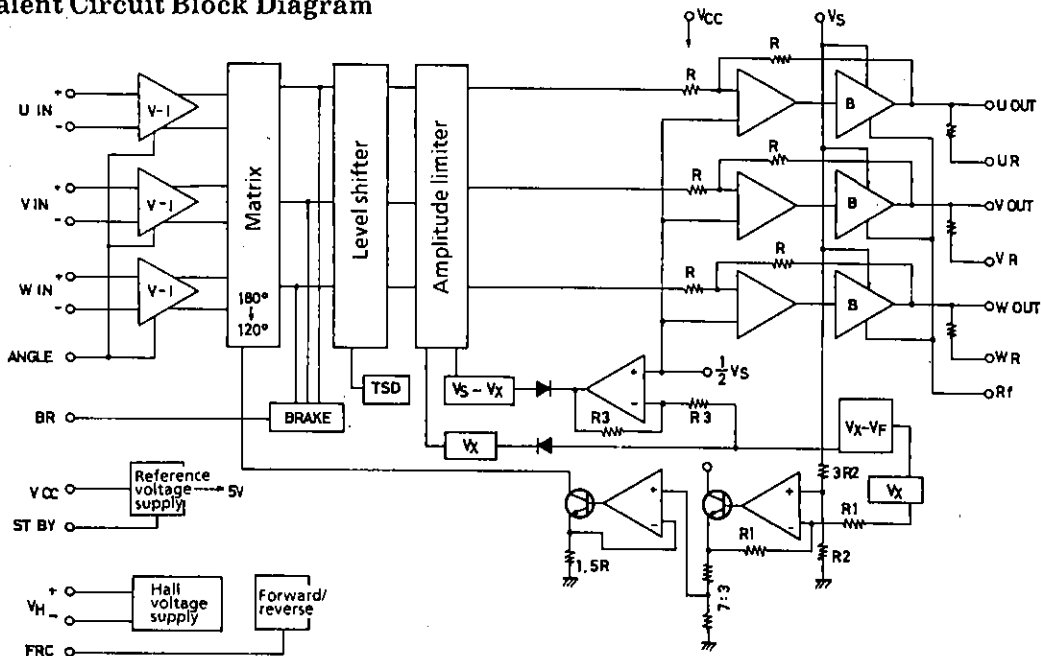
Forward/reverse control:

H: 2.8 to 5V

L: 0 to 1.2V



Equivalent Circuit Block Diagram



Pin Description

Unit (resistance: Ω)

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
3 5 7	U_{out} V_{out} W_{out}			Output pins
4 6 8	U_R V_R W_R			Output pins with resistor of 2Ω
9	R_f			GND for output transistor
10	V_S	$< V_{CC2}$		Power supply pin for fixing the output amplitude. Must be lower than V_{CC2} voltage.
11	V_{CC}			Power supply pin for power amp circuit other than motor driver transistor.
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 $100\mu A$. 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. $\approx 10k\Omega$
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)

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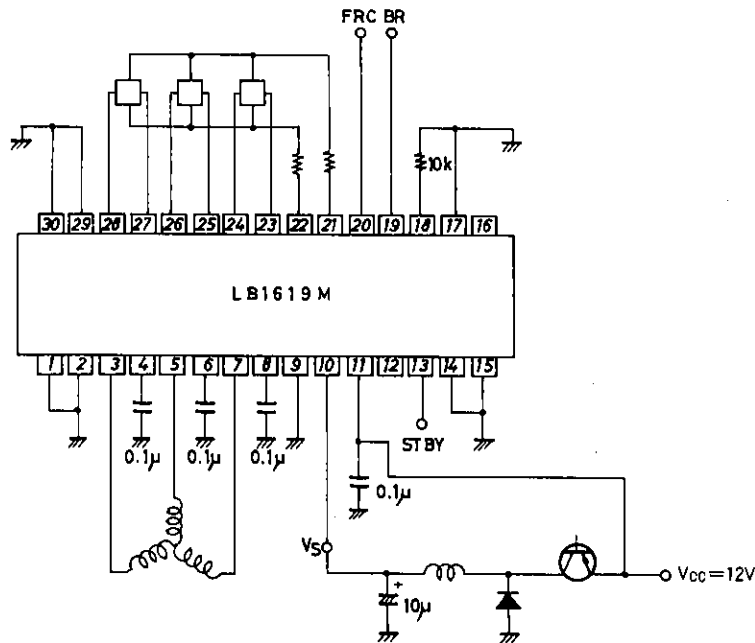
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Unit (resistance: Ω)

Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit	Pin Function
20	FRC	H: 2.8V min L: 1.2V max		Pin for forward/reverse control of motor L level : Forward (Less than 1.2V) H level : Reverse (More than 2.8V)
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_{IN1} U_{IN2} V_{IN1} V_{IN2} W_{IN1} W_{IN2}	1.4V min 2.8V max		U phase hall element input pin Logic "H" : $U_{IN1} > U_{IN2}$ V phase hall element input pin Logic "H" : $V_{IN1} > V_{IN2}$ W phase hall element input pin Logic "H" : $W_{IN1} > W_{IN2}$

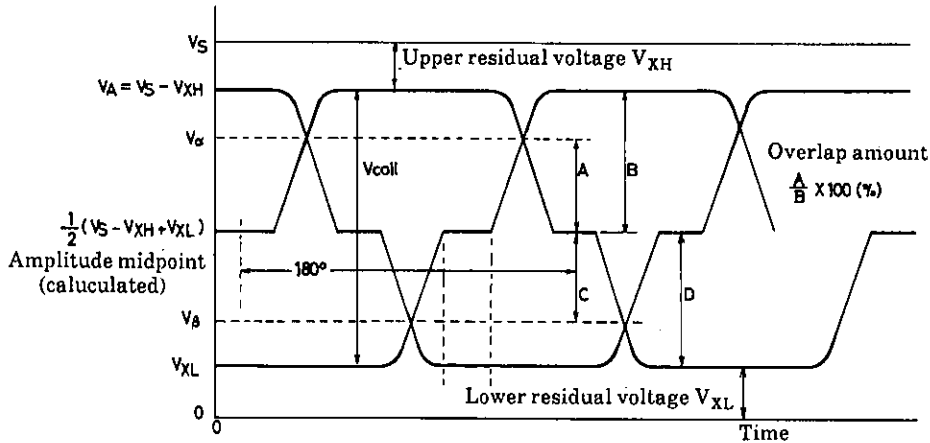
Note) Pin 12 (NC pin) must be left open.

Sample Application Circuit



Unit (resistance: Ω , capacitance: F)

Output Voltage Waveform



$$\text{Upper overlap} = (2V_{\alpha} - V_A - V_{XL}) / (V_A - V_{XL}) \times 100[\%]$$

$$\text{Lower overlap} = (V_A + V_{XL} - 2V_{\beta}) / (V_A - V_{XL}) \times 100[\%]$$

1. Upper overlap

DC voltage of upper amplitude : $V_S - V_{XH} = V_A$

DC voltage of lower amplitude : V_{XL}

Let the DC voltage at the intersection of two phases of the upper waveform be V_{α} :

From the drawing shown above

At upper overlap amount = $A/B \times 100[\%]$

$$A = V_{\alpha} - 1/2 (V_S - V_{XH} + V_{XL}) = V_{\alpha} - 1/2 (V_A + V_{XL})$$

$$B = (V_S - V_{XH}) - 1/2 (V_S - V_{XH} + V_{XL}) = 1/2 (V_A + V_{XL})$$

※ Upper overlap

$$= (2V_{\alpha} - V_A - V_{XL}) / (V_A - V_{XL}) \times 100[\%]$$

2. Lower overlap

DC voltage of upper amplitude : $V_S - V_{XH} = V_A$

DC voltage of lower amplitude : V_{XL}

Let the DC voltage at the intersection of two phases of the upper waveform be V_{β} :

From the drawing shown above

At lower overlap amount = $C/D \times 100[\%]$

$$C = 1/2 (V_S - V_{XH} + V_{XL}) - V_{\beta} = 1/2 (V_A + V_{XL}) - V_{\beta}$$

$$D = 1/2 (V_S - V_{XH} + V_{XL}) - V_{XL} = 1/2 (V_A - V_{XL})$$

※ Lower overlap

$$= (V_A + V_{XL} - 2V_{\beta}) / (V_A - V_{XL}) \times 100[\%]$$

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