

**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

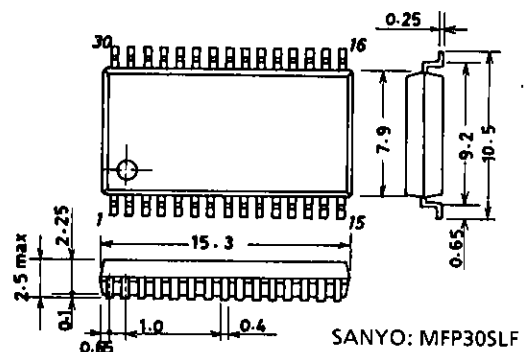
**Absolute Maximum Ratings at  $T_a = 25^\circ\text{C}$** 

			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.

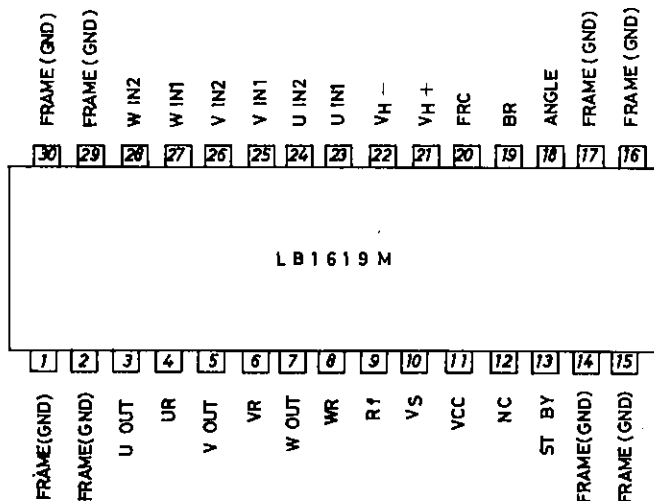
**Package Dimensions 3073A-M30IC**  
(unit: mm)

## LB1619M

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:

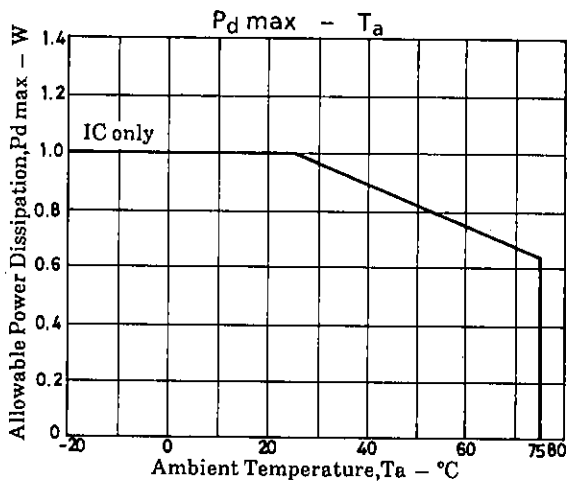
H: High level. One of the inputs should have a potential at least 0.2V higher than the other.

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

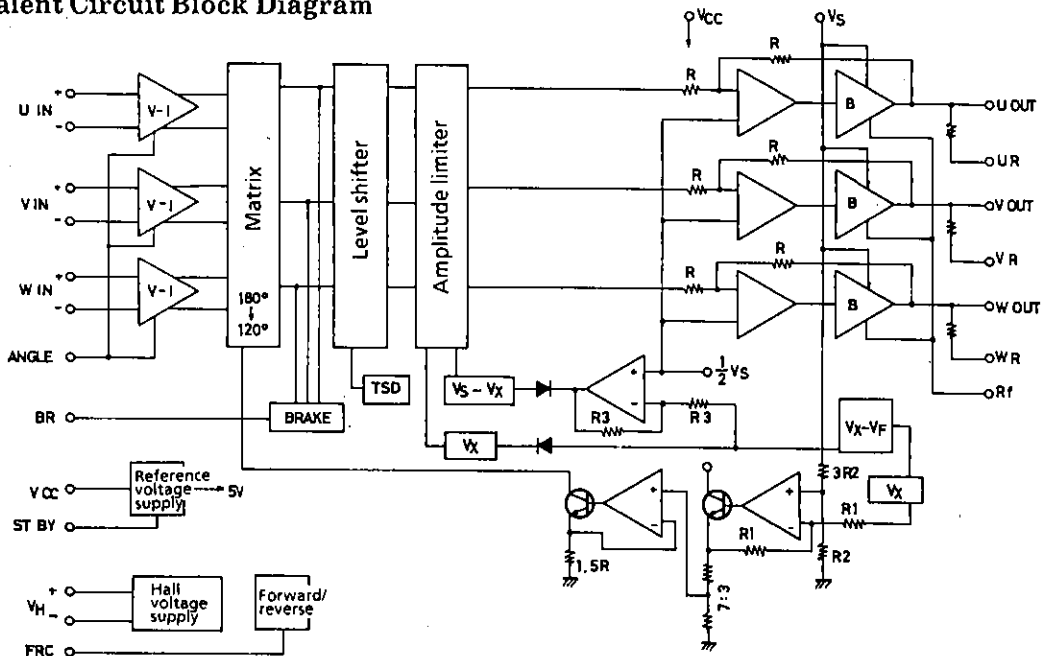
Forward/reverse control:

H: 2.8 to 5V

L: 0 to 1.2V



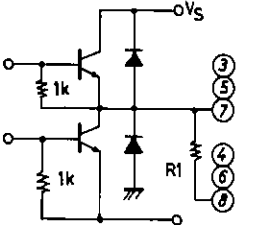
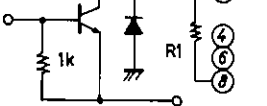
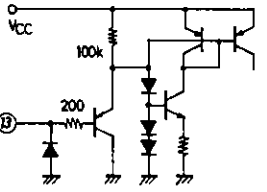
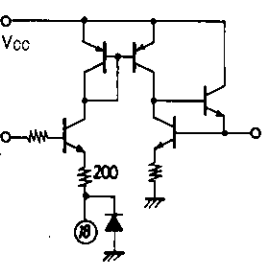
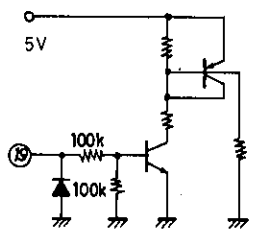
Equivalent Circuit Block Diagram



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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 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. $\approx 10k\Omega$
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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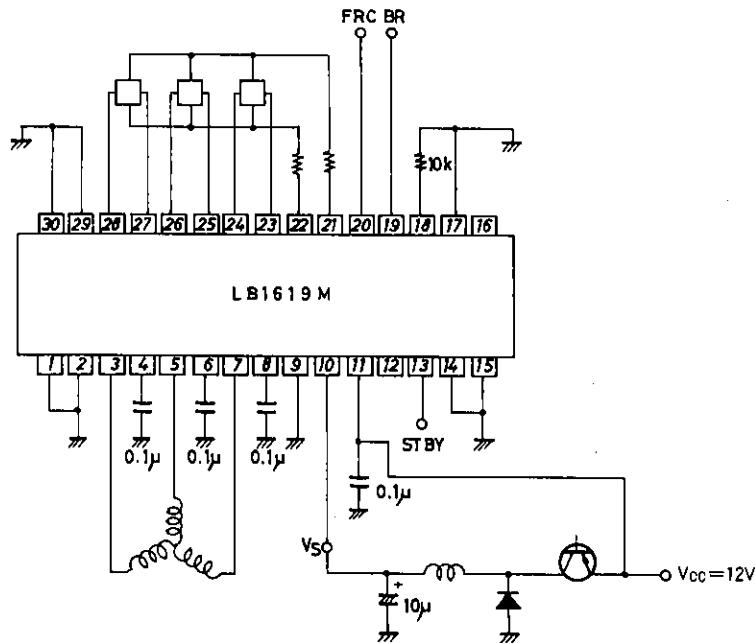
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Unit (resistance:  $\Omega$ )

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" : $W_{IN1} > W_{IN2}$

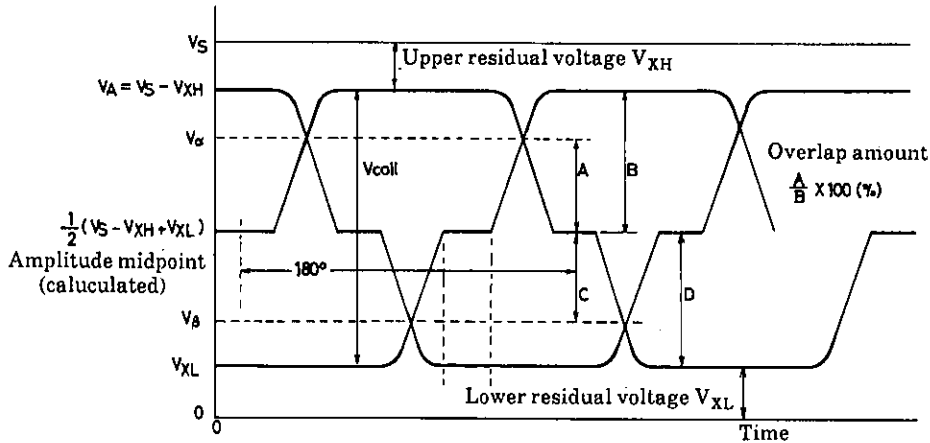
Note) Pin 12 (NC pin) must be left open.

Sample Application Circuit



Unit (resistance:  $\Omega$ , 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  $V_{\alpha}$  :

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  $V_{\beta}$  :

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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