

**LB1687****3-Phase Brushless Motor Driver****Applications**

The LB1687 is a 3-phase brushless motor driver IC ideally suited for use in VCR capstan motor, drum motor drive applications.

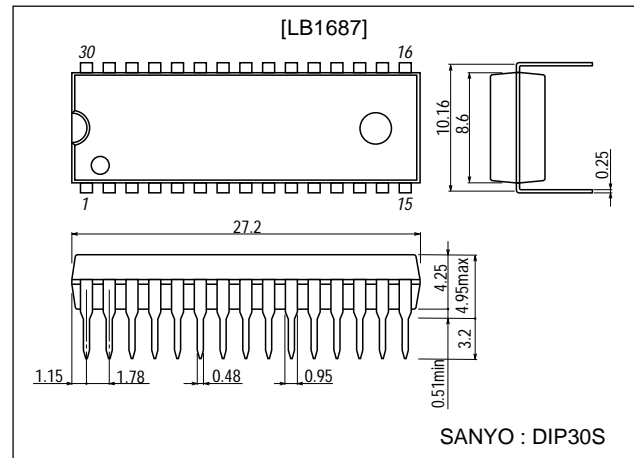
**Features and Functions**

- 120° voltage linear type.
- 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 FG amplifier.
- On-chip thermal shutdown circuit.
- The FG signal can be used to detect the rotational speed of a motor so that the hall amplifier gain is changed in two steps, thus reducing torque ripple and noise.
- Motor drivable at voltage down to motor supply voltage 5V.

**Package Dimensions**

unit:mm

3061-DIP30S

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\ max1}$		20	V
	$V_{CC\ max2}$		7.0	V
Output supply voltage	$V_{OUT.V.W}$		22	V
Output current	$I_{OUT}$		1.5	A
Allowable power dissipation	$P_d\ max$		2.1	W
Operating temperature	$T_{opr}$		-20 to +75	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +125	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	$V_{CC1}$		5 to 18	V
	$V_{CC2}$		4.3 to 6.5	V

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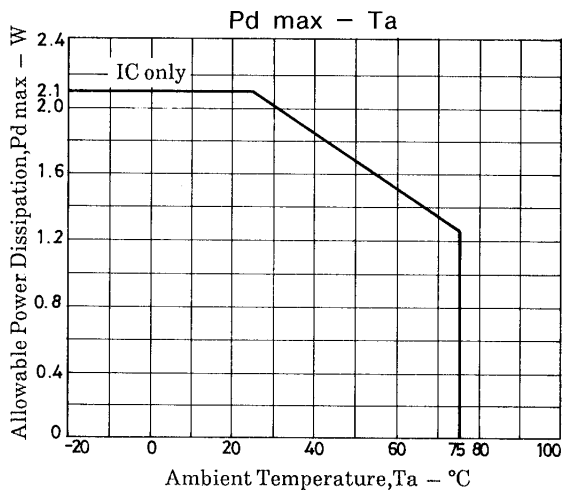
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

# LB1687

## Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC1}=12\text{V}$ , $V_{CC2}=5\text{V}$

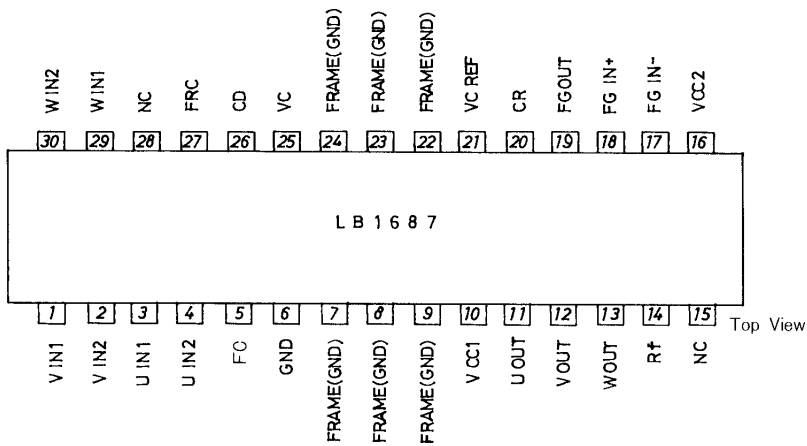
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Power supply]						
Supply current 1	$I_{CC1}$	$V_C=0, R_L=\infty$		17	30	mA
Supply current 2	$I_{CC2}$	$V_C=0$		6.5	9.5	mA
[Output]						
Output saturation voltage	$V_{O(sat)1}$	$I_{OUT}=0.5\text{A}$ , sink+source		1.6	2.2	V
	$V_{O(sat)2}$	$I_{OUT}=1.0\text{A}$ , sink+source		2.0	3.0	V
Output TRS voltage	$V_{O(sus)}$	$I_{OUT}=20\text{mA}$ (See note.)	20			V
Output quiescent voltage	$V_{OQ}$	$V_C=0$	5.8	6.1	6.4	V
[Hall input-output]						
Hall amplifier input offset voltage	$V_H$ offset		-5		+5	mV
Hall amplifier input bias current	$I_H$ bias			1	5	$\mu\text{A}$
Hall amplifier common-mode input voltage range	$V_H$ ch		1.3		3.7	V
Hall input-output voltage gain	$G_{VHO1}$			56		dB
	$G_{VHO2}$			43		dB
[Control-output]						
Control-output drive gain	$G_{VCO}$		38	41	44	dB
Control-output CH difference	$\Delta G_{VCO}$		-2		+2	dB
[FG amplifier]						
FG amplifier input offset voltage	VFG offset		-8		+8	mV
Open-loop voltage gain	$G_{VFG}$	$f=1\text{kHz}$		60		dB
Source output saturation voltage	$V_{FG\ OU}$	$I_O=2\text{mA}$	3.7			V
Sink output saturation voltage	$V_{FG\ OD}$	$I_O=-2\text{mA}$			1.3	V
Common-mode signal rejection ratio	CHR	(See note.)		80		dB
FG amplifier common-mode input voltage range	$V_{FG\ CH}$		0		3.5	V
Phase margin		(See note.)		20		deg.
[Motor detection]						
Motor detection amplifier hysteresis width			35	50	65	mV
CR pin threshold voltage		VCR changes from LOW to HIGH.	2.35	2.5	2.65	V
Thermal shutdown temperature	$T_{SD}$	(See note.)	150	180	210	$^\circ\text{C}$
Thermal shutdown hysteresis	$\Delta T_{SD}$	(See note.)		15		$^\circ\text{C}$

Note : Values shown are design targets only. No measurements have been taken.



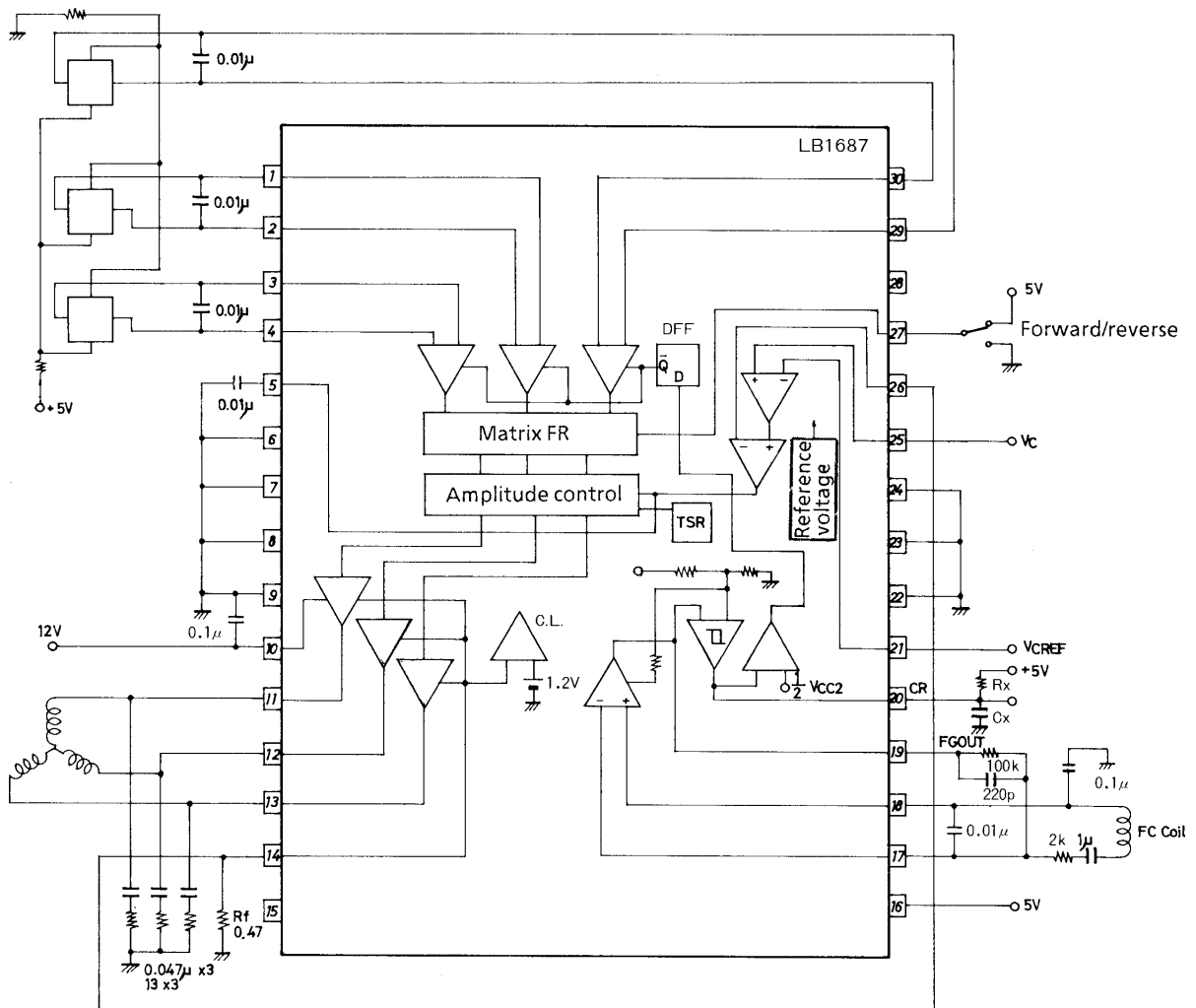
# LB1687

## Pin Assignment



## Equivalent Circuit Block Diagram

Unit (resistance:  $\Omega$ , capacitance: F)



**Truth Table**

	Source sink	Input			Forward/Reverse Control F/RC
		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 : 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 : 2.0 to  $V_{CC2}$

L : 0 to 0.3V

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