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|--------------|---------------------------------------|----------------|
| SANYO | No.3348 | LB1689M |
| | 3-Phase Brushless Motor Driver | |

Applications

The LB1689M is a 3-phase brushless motor driver IC ideally suited for use in VTR capstan motor, drum motor drive applications, etc.

Features and Functions

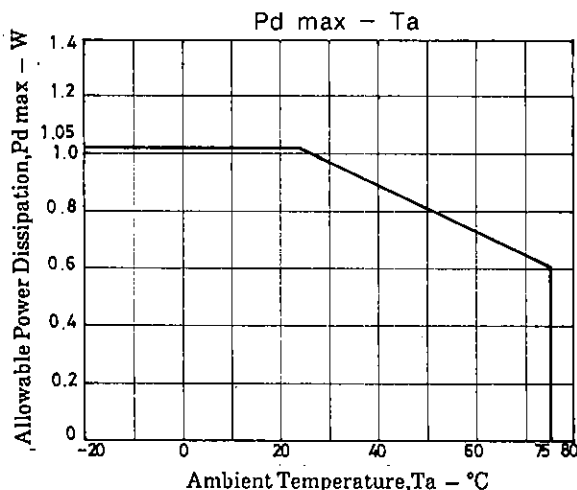
- (1) 120° voltage linear type
- (2) Soft switching type eliminating noises caused by current switching and making the values of external capacitors smaller (comparable to those of chip capacitors)
- (3) On-chip FG amplifier
- (4) On-chip thermal shutdown circuit
- (5) The FG signal can be used to detect the rotational speed of a motor so that the hall amp gain is changed in two steps, thus reducing torque ripple and noise.

Absolute Maximum Ratings at Ta = 25°C

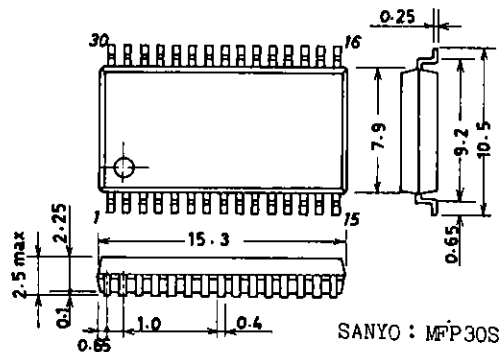
| | | | unit |
|-----------------------------|-----------------------|---------------|------|
| Maximum Supply Voltage | V _{CC} max1 | 20 | V |
| | V _{CC} max2 | 7.0 | V |
| Output Supply Voltage | V _{OUT.V.W.} | 22 | V |
| Output Current | I _{OUT} | 1.5 | A |
| Allowable Power Dissipation | P _d max | 1.05 | W |
| Operating Temperature | T _{opr} | - 20 to + 75 | °C |
| Storage Temperature | T _{stg} | - 55 to + 125 | °C |

Allowable Operating Conditions at Ta = 25°C

| | | | unit |
|----------------|------------------|------------|------|
| Supply Voltage | V _{CC1} | 8.5 to 18 | V |
| | V _{CC2} | 4.3 to 6.5 | V |



Package Dimensions 3073A
(unit: mm)



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| Electrical Characteristics at Ta = 25°C, V _{CC1} = 12V, V _{CC2} = 5V | | | | min | typ | max | unit |
|--|------------------------|---|------|-----|------|-----|------|
| [Power Supply] | | | | | | | |
| Supply Current 1 | I _{CC1} | V _C = 0, R _L = ∞ | | 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 _O = 0.5A, sink + source | | 1.6 | 2.2 | | V |
| | V _{O(sat)2} | I _O = 1.0A, sink + source | | 2.0 | 3.0 | | V |
| Output TRS Voltage | V _{O(sus)} | I _O = 20mA (See note.) | 20 | | | | V |
| Output Quiescent Voltage | V _{OQ} | V _C = 0 | 5.8 | 6.1 | 6.4 | | V |
| [Hall Input-Output] | | | | | | | |
| Hall Amp Input Offset Voltage | V _H offset | | -5 | | +5 | | mV |
| Hall Amp Input Bias Current | I _H bias | | | 1 | 5 | | μA |
| Hall Amp Common-Mode | V _H ch | | 1.3 | | 3.7 | | V |
| Input Voltage Range | | | | | | | |
| Hall Input-Output Voltage Gain | G _{VHO1} | | | 56 | | | dB |
| | G _{VHO2} | | | 43 | | | dB |
| [Control-Output] | | | | | | | |
| Control-Output Voltage Gain | G _{VCO} | | 38 | 41 | 44 | | dB |
| Control-Output Voltage Gain | ΔG _{VCO} | | -2 | | +2 | | dB |
| CH Difference | | | | | | | |
| [FG Amplifier] | | | | | | | |
| FG Amp Input Offset Voltage | V _{FG} offset | | -8 | | +8 | | mV |
| Open Loop Voltage Gain | G _{VFG} | f = 1kHz | | 60 | | | dB |
| Source Output Saturation Voltage | V _{FG} OU | I _O = 2mA | 3.7 | | | | V |
| Sink Output Saturation Voltage | V _{FG} OD | I _O = -2mA | | | 1.3 | | V |
| Common-Mode Signal | CHR | (See note.) | | 80 | | | dB |
| Rejection Ratio | | | | | | | |
| FG Amp Common-Mode | V _{FG} CH | | 0 | | 3.5 | | V |
| Input Voltage Range | | | | | | | |
| Phase Margin | | (See note.) | | 30 | | | deg. |
| [Motor Detection] | | | | | | | |
| Motor Detection Amp | | | 35 | 50 | 65 | | mV |
| Hysteresis Width | | | | | | | |
| CR Pin Threshold Voltage | | V _{CR} changes from LOW to HIGH. | 2.35 | 2.5 | 2.65 | | V |
| [Thermal Shutdown] | | | | | | | |
| Thermal Shutdown Temperature | T _{SD} | (See note.) | 150 | 180 | 210 | | °C |
| Thermal Shutdown Hysteresis | ΔT _{SD} | (See note.) | | 15 | | | °C |

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

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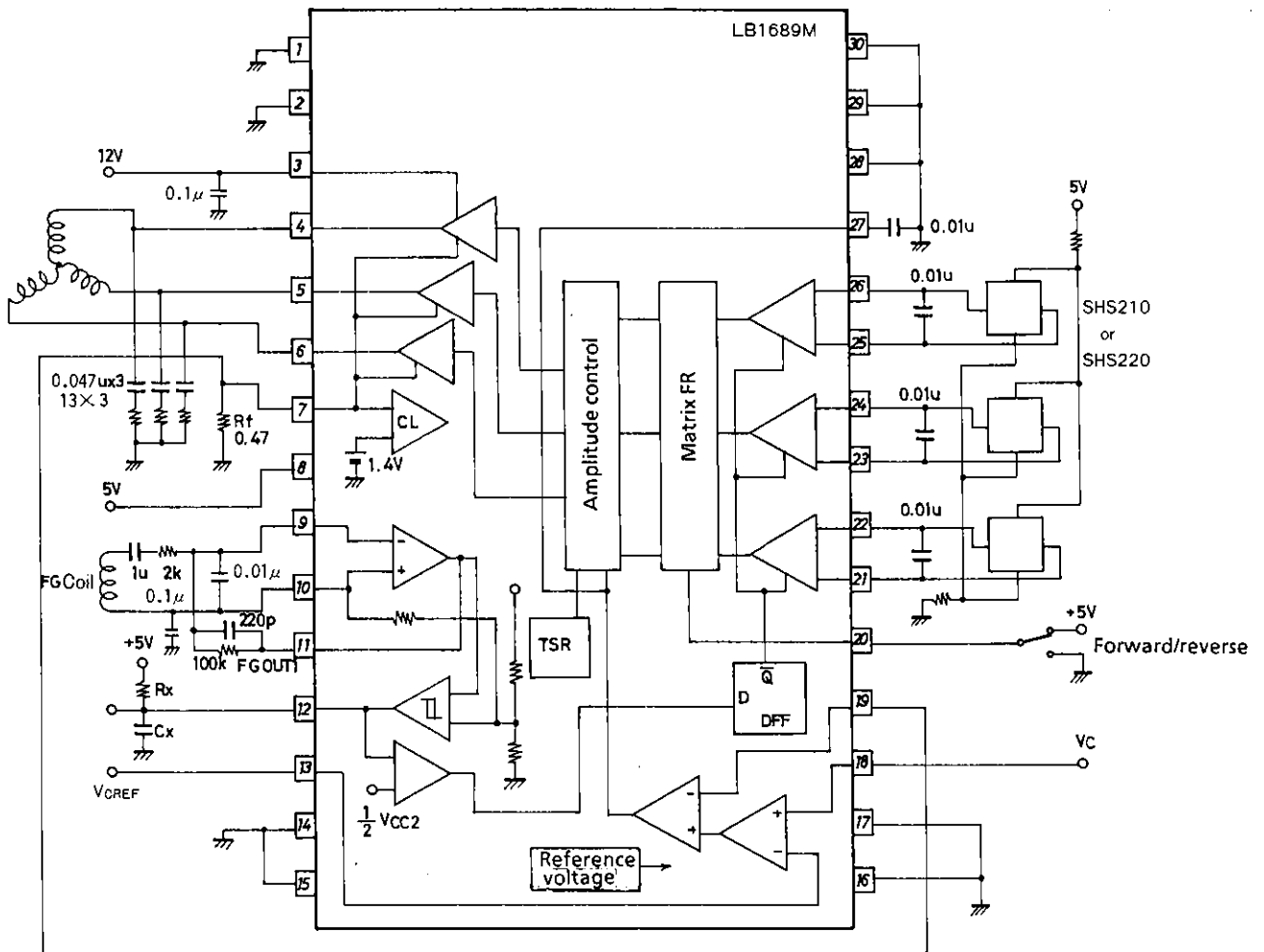
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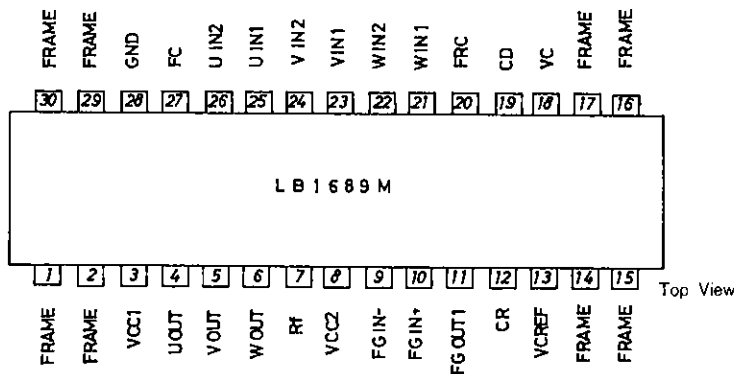
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Equivalent Circuit Block Diagram



Unit (resistance: Ω , capacitance: F)

Pin Assignment



Note: All FRAME pins are connected to GND.

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Pin Description

| Pin Name | Pin No. | Description |
|---|----------------------------|--|
| U _{IN1} , U _{IN2} V _{IN1} , V _{IN2} W _{IN1} , W _{IN2} | 25, 26 23, 24 21, 22 | U phase hall element input pin. 'H' of logic : V _{IN1} > V _{IN2} V phase hall element input pin. 'H' of logic : V _{IN1} > V _{IN2} W phase hall element input pin. 'H' of logic : V _{IN1} > V _{IN2} |
| U _{OUT} V _{OUT} W _{OUT} | 4 5 6 | U phase output pin V phase output pin W phase output pin |
| V _{CC1} | 3 | Power supply pin for applying output |
| V _{CC2} | 8 | Power supply pin for applying voltage to each section other than output section. This voltage must be stabilized to be free from ripple, noise, etc. |
| R _f | 7 | Output current detect pin. By connecting R _f across this pin and GND pin, output current is detected as voltage. The result is used to control the overcurrent protection circuit. |
| CD | 19 | Pin for fetching current (voltage) detected with R _f . To take feedback for R _f , the control-output voltage gain can be reduced. Ground when not in use. |
| FC | 27 | Frequency characteristic correction |
| V _C | 18 | Speed-phase control pin Control is of voltage-controlled type that controls output voltage. |
| V _{CREF} | 13 | Control reference voltage |
| GND | 28 | GND for other than output Minimum potential of output transistor is at R _f pin. |
| F/RC | 20 | Forward/reverse control pin By setting this pin to 'H' (more than 2.0V)/'L' (less than 0.3V), truth value is changed to perform forward/reverse rotation. |
| FG _{in-} , FG _{in+} | 9, 10 | FG signal input pin |
| FG _{OUT} | 11 | FG amp output pin |
| CR | 12 | This pin voltage can be used to change the hall input-output gain. Connection of an external resistor and capacitor makes it possible to detect the rotational speed of a motor and change the hall input-output voltage gain in two steps. |

Truth Table

| | Source | Input | | | Forward/Reverse Control F/RC |
|---|-------------------|-------|---|---|---------------------------------|
| | | 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 : Each phase input 1 is more than 0.2V higher than each phase input 2.

L : Each phase input 1 is more than 0.2V lower than each phase input 2.

Forward/reverse control :

H : 2.0 to V_{CC2}

L : 0 to 0.3V