

SANYO

No. 4476A

LB1854M**Three-Phase Brushless Motor Driver IC****Overview**

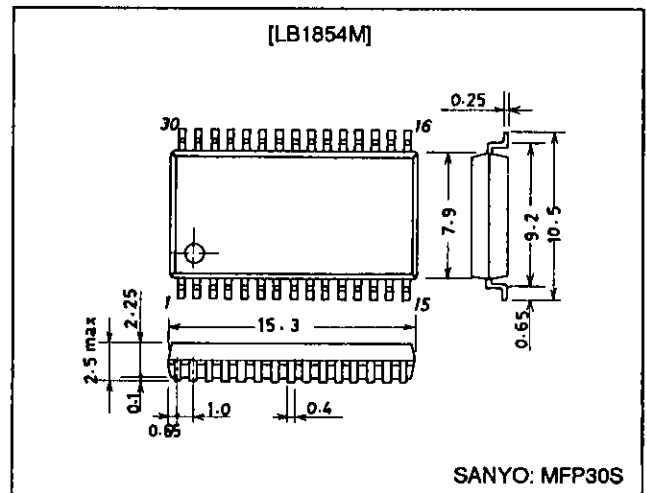
The LB1854M is a three-phase brushless motor driver IC and is optimal, in particular, for driving VCR capstan and drum motors.

Features

- 120° voltage linear drive technique
- The LB1854M soft switching scheme allows smaller external capacitors to be used (e.g., chip capacitors).
- Built-in thermal-shutdown function
- Built-in overcurrent protection circuit
- Built-in FG amplifiers (operational amplifier and Schmitt amplifier)
- Control start voltage set by an external voltage
- The output current feedback level can be changed by changing the control gain to one of two levels.

Package Dimensions

unit: mm

3073A-MFP30S

Note: The package dimensions are the same for the domestic Japanese products and the import access products.

The mark "MT" is displayed on the package of import access products for identification.

Specifications**Absolute Maximum Ratings at Ta = 25°C**

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|-----------------------|------------|-------------|------|
| Maximum supply voltage | V _{CC1} max | | 20 | V |
| | V _{CC2} max | | 7.0 | V |
| Applied output voltage | V _{OU, v, w} | | 22 | V |
| Maximum output current | I _{OUT} max | | 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 +150 | °C |

Allowable Operating Ranges at Ta = 25°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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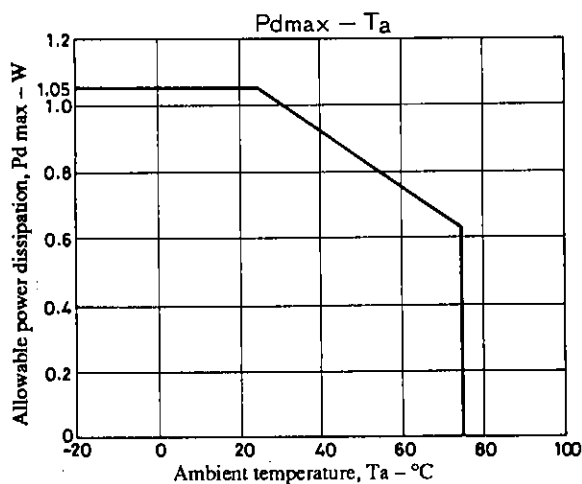
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LB1854M

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

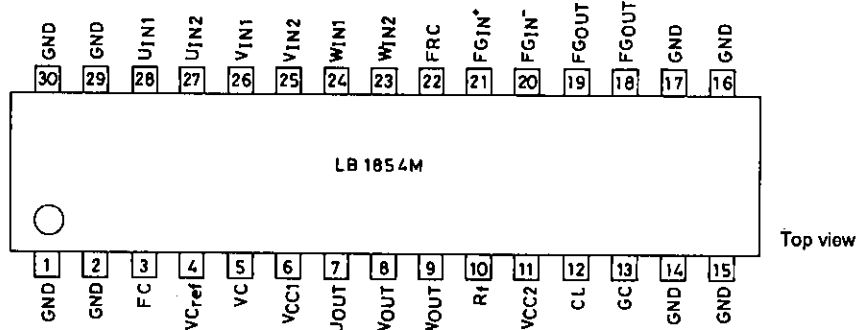
| Parameter | Symbol | Conditions | min | typ | max | Unit | Note |
|--|-------------------------|--|-----|-----|-----|------------------|------|
| Current drain | I_{CC1} | $V_C = 0\text{ V}$, $R_L = \infty$ | | 17 | 30 | mA | |
| | I_{CC2} | $V_C = 0\text{ V}$ | | 6.5 | 9.5 | mA | |
| [Drive Block] | | | | | | | |
| Output saturation voltage | $V_O(\text{sat}) 1$ | $I_{OUT} = 0.5\text{ A}$, sink + source | | 1.6 | 2.2 | V | |
| | $V_O(\text{sat}) 2$ | $I_{OUT} = 1.0\text{ A}$, sink + source | | 2.0 | 3.0 | V | |
| Output TRS breakdown voltage | $V_O(\text{sus})$ | $I_{OUT} = 20\text{ mA}$ | 20 | | | V | * |
| Output resting potential | V_{OQ} | $V_C = 0\text{ V}$ | 5.7 | 6.0 | 6.3 | V | |
| Hall amplifier input offset voltage | $V_H \text{ offset}$ | | -5 | | +5 | mV | |
| Hall amplifier input bias current | $I_H \text{ bias}$ | | | 1 | 5 | μA | |
| Hall amplifier common mode input voltage range | $V_H \text{ ch}$ | | 1.3 | | 2.2 | V | |
| Hall input/output voltage gain | GV_{HO} | | 43 | 46 | 49 | dB | |
| [Control Block] | | | | | | | |
| Control output drive gain | GV_{CO1} | High gain | 37 | 40 | 43 | dB | |
| | GV_{CO2} | Low gain | 31 | 34 | 37 | dB | |
| Control output CH difference | ΔGV_{CO} | | -2 | | +2 | dB | |
| Control start voltage | V_{CTH} | When $V_{OUTP-P} = 2\text{ V}$ | | 2.5 | | V | |
| Gain control switching high level | | | 4 | | 5 | V | |
| Gain control switching middle level | | Middle level when the input is open | 2 | | 3 | V | |
| Gain control switching low level | | | 0 | | 1 | V | |
| [FG Amplifier] | | | | | | | |
| FG amplifier input offset voltage | $V_{FG} \text{ offset}$ | | -8 | | +8 | mV | |
| Open-loop voltage gain | GV_{FG} | $f = 1\text{ kHz}$ | | 60 | | dB | |
| Source output saturation voltage | $V_{FG \text{ OU}}$ | $I_O = 2\text{ mA}$ | 37 | | | V | |
| Sink output saturation voltage | $V_{FG \text{ OD}}$ | $I_O = -2\text{ mA}$ | | | 1.3 | V | |
| Common-mode signal rejection ratio | CHR | | | 80 | | dB | * |
| FG amplifier common-mode input voltage range | $V_{FG \text{ CH}}$ | | 0 | | 3.5 | V | |
| Phase margin | | | | 20 | | Deg | * |
| Schmitt hysteresis | ΔV_{sh1} | FG_{OUT2} : High to low | | 22 | | mV | |
| | ΔV_{sh2} | FG_{OUT2} : Low to high | | 22 | | mV | |
| Schmitt input voltage range | V_{shCH} | | 0.7 | | 3.5 | V | |
| [Thermal Shutdown] | | | | | | | |
| Operating temperature | TSD | | 150 | 180 | 210 | $^\circ\text{C}$ | * |
| Hysteresis | ΔTSD | | | 15 | | $^\circ\text{C}$ | * |

Note: * Items marked with an asterisk are design target values and are not measured.

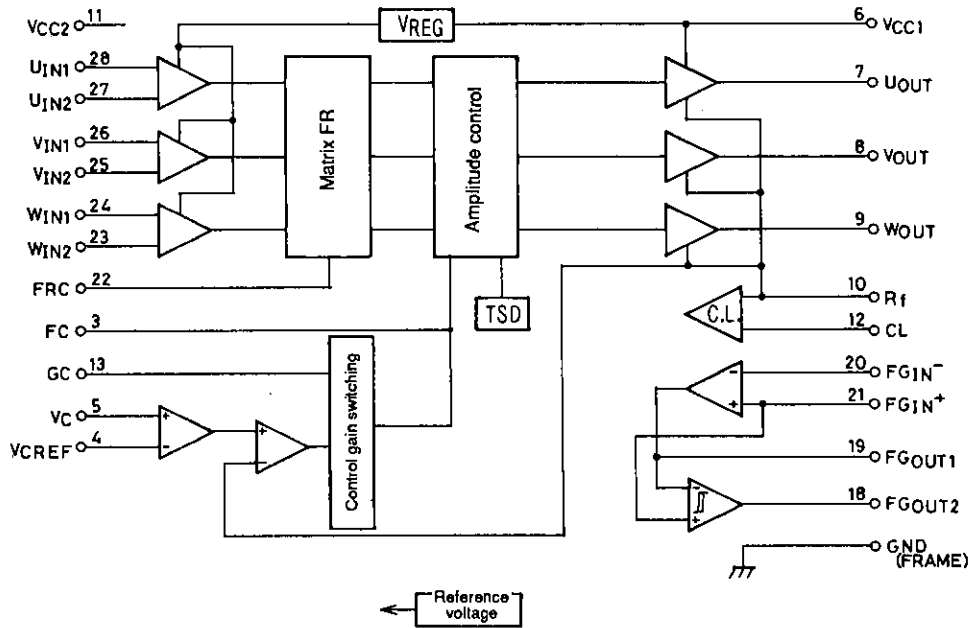


LB1854M

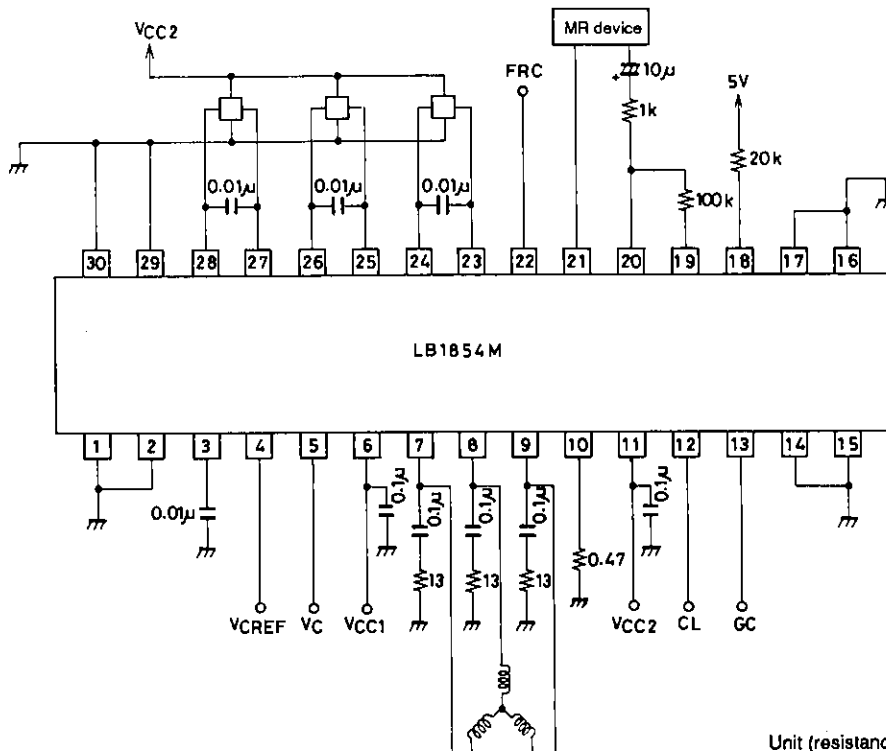
Pin Assignment



Block Diagram



Sample Application Circuit



LB1854M

Truth Table

| | Source | Sink | Input | | | Forward and 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 high: Phase 1 is 0.2 V or more higher than the corresponding phase 2 for each phase input.

Low: Phase 1 is 0.2 V or more lower than the corresponding phase 2 for each phase input.

Forward and reverse control high: 2.3 V to V_{CC1}

Low: 0 V to 0.7 V

Pin Functions

Unit (resistance: Ω)

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Function |
|---------------------------------------|---------------------|--|--------------------|--|
| 1, 2, 14, 15, 16, 17, 29, 30 | FRAME (GND) | | | Ground for all circuits except the outputs |
| 3 | FC | | | The gain frequency characteristics can be lowered by connecting a capacitor between this pin and ground to prevent oscillation. |
| 4 5 | V_{CREF} V_C | 1.5 V min V_{CC2} max 0 V min V_{CC2} max | | Speed control The LB1854M implements a voltage control scheme in which the output voltage is controlled by the pin 5 voltage. The pin 4 voltage determines the control start voltage. |
| 6 | V_{CC1} | 5 to 18 V | | Power supply that provides the drive outputs |

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LB1854M

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Unit (resistance: Ω)

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Function |
|-------------|-------------------------------------|--------------------------|--------------------|--|
| 7 8 9 | U_{OUT} V_{OUT} W_{OUT} | | | Output pins |
| 10 | R_f | | | <p>Output transistor ground</p> <p>Feedback can be applied to the control amplifier by inserting resistor between this pin and GND and detecting the output current as a voltage. The overcurrent protection circuit (current limiter) operates by detecting the voltage on this pin.</p> |
| 11 | V_{CC2} | 4.3 to 6.5 V | | <p>Power supply provided to all blocks other than the output block</p> <p>This voltage must be stabilized so that no ripple or other noise is present.</p> |
| 12 | CL | 0 V min V_{CC2} max | | <p>The current limiter operates when the R_f pin reaches the same potential as pin 12. The pin 12 potential is set up externally.</p> |
| 13 | GC | 0 V min V_{CC2} max | | <p>Control input to output gain switching pin</p> <p>High level (4 to 5 V): 34 dB Middle level (2 to 3 V) or open: 40 dB (low speed); 34 dB (high speed) Low level (0 to 1 V): 40 dB</p> <p>However, note that this applies when V_{CC2} is 5 V.</p> |
| 18 | FG_{OUT2} | | | FG Schmitt amplifier output |
| 19 | FG_{OUT1} | | | FG amplifier output |

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LB1854M

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Unit (resistance: Ω)

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Function |
|----------------------------------|--|--|--------------------|---|
| 20 21 | FG _{IN-} FG _{IN+} | 0 V min 3.5 V max (when V _{CC2} is 5 V) | | FG signal input |
| 22 | FRC | High: 2.3 V min Low: 0.7 V max | | Motor forward/reverse control pin Low level (0.7 V or lower): forward High level (2.3 V or higher): reverse |
| 23 24 25 26 27 28 | W _{IN2} W _{IN1} V _{IN2} V _{IN1} U _{IN2} U _{IN1} | 1.4 V min 2.0 V max | | W phase Hall sensor input Logic high is the W _{IN1} > W _{IN2} state. V phase Hall sensor input Logic high is the V _{IN1} > V _{IN2} state. U phase Hall sensor input Logic high is the U _{IN1} > U _{IN2} state. |

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