

Power driver for CD and MD applications

BH6514AFS

The BH6514AFS is a PWM driver for CD and MD motors and actuators.

In addition to a two-channel "H" bridge for the actuators, the IC includes a three-phase driver for spindle motor drive, and a single-channel half bridge for synchronous rectification of the spindle drive V_M .

● Applications

Power drive for CD and MD players

● Features

- 1) Compatible with PWM input.
- 2) Charge pump circuit to increase V_G .
- 3) Charge pump circuit has free-running oscillator.
- 4) Each "H" bridge power supply can be supplied independently for efficient application.
- 5) Low on-resistance.
- 6) Low power consumption.
- 7) Compact SSOP-A32 package.

● Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Limits | Unit |
|--------------------------------------|--|-----------------|------------------|
| H-bridge power supply voltage | V_M | 9 | V |
| Control circuit power supply voltage | VDD | 9 | V |
| Pre-driver power supply voltage | V_G (18pin) | 12 | V |
| Driver output current | I_o (ch3, U, V, Wch) I_o (ch1, ch2) | 500 300*1 | mA |
| Power dissipation | P_d | 850*2 | mW |
| Operating temperature | T_{opr} | $-20 \sim +85$ | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | $-55 \sim +150$ | $^\circ\text{C}$ |

*1 500msec.

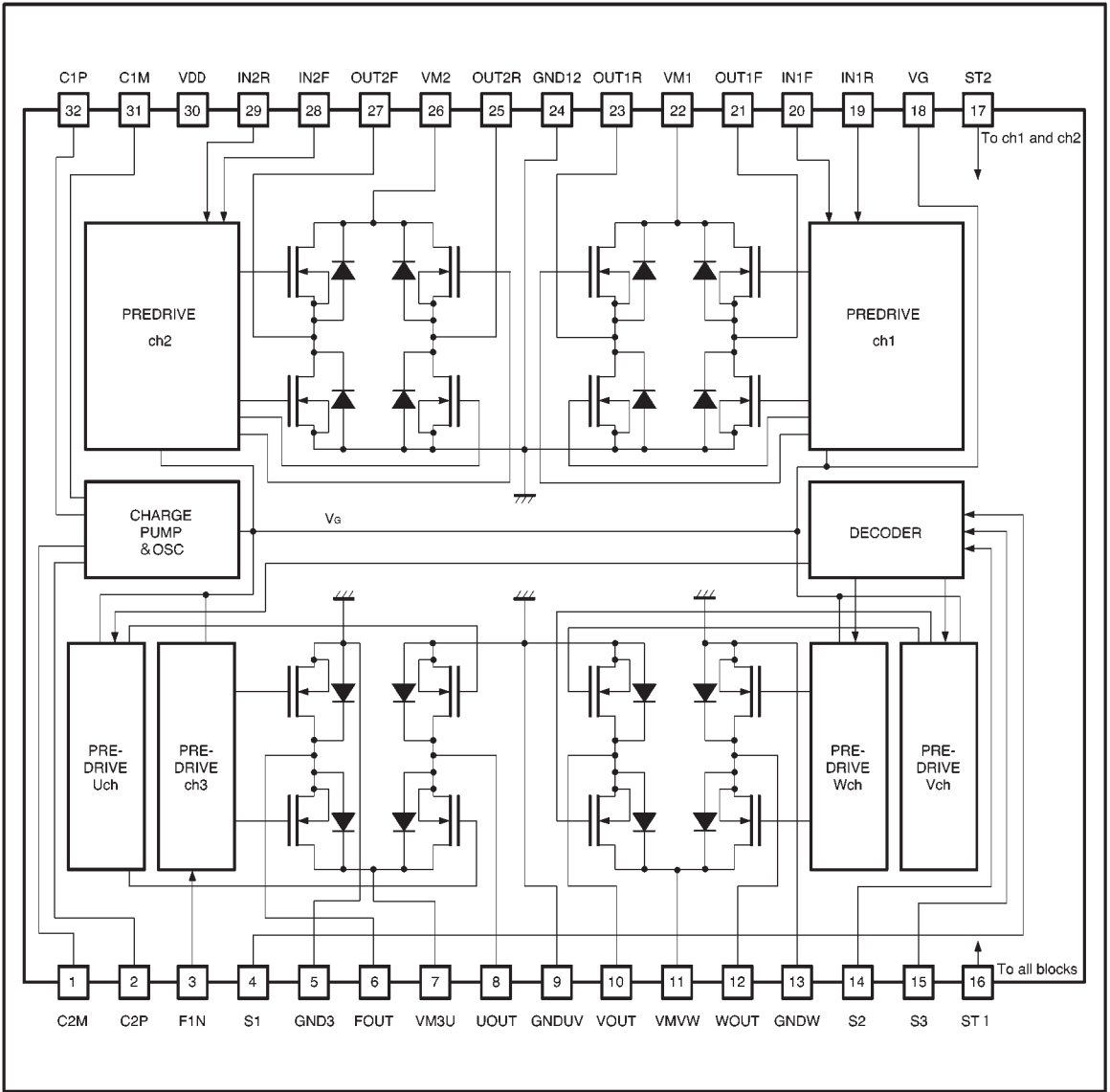
*2 Reduced by 6.8mW for each increase in T_a of 1°C over 25°C .

● Recommended operating conditions ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------------------|---------------|-------------|-------|------|------|
| H-bridge power supply voltage | V_M | 1.6 | 2.5 | 5.5 | V |
| Control circuit power supply voltage | VDD | 2.4*3 | 3.0 | 5.5 | V |
| Pre-driver power supply voltage | V_G (18pin) | $V_M + 3.0$ | 9 | 11.5 | V |
| Pulse input frequency | f_{123IN} | — | 176.4 | 200 | kHz |
| | F_{UVWMIN} | — | — | 400 | Hz |

*3 When the ambient temperature is in the range -20°C to 85°C .

●Block diagram



● Pin descriptions

| Pin No. | Pin name | Function | Pin No. | Pin name | Function |
|---------|----------|--|---------|----------|--|
| 1 | C2M | Negative connection terminal for charge pump capacitor 2 | 32 | C1P | Positive connection terminal for charge pump capacitor 1 |
| 2 | C2P | Positive connection terminal for charge pump capacitor 2 | 31 | C1M | Negative connection terminal for charge pump capacitor 1 |
| 3 | FIN | Brushless motor power supply input | 30 | VDD | Pre block power supply |
| 4 | S1 | Stepping motor input | 29 | IN2R | Channel 2 reverse input |
| 5 | GND3 | Channel 3 power GND | 28 | IN2F | Channel 2 forward input |
| 6 | FOUT | Brushless motor power supply output | 27 | OUT2F | Channel 2 forward output |
| 7 | VM3U | Channel 3, U channel power block power supply | 26 | VM2 | Channel 2 power block power supply |
| 8 | UOUT | Stepping motor output (U phase) | 25 | OUT2R | Channel 2 reverse output |
| 9 | GNDUV | U channel, V channel power GND | 24 | GND12 | Channel 1,2 power GND |
| 10 | VOUT | Stepping motor output (V phase) | 23 | OUT1R | Channel 1 reverse output |
| 11 | VMVW | V channel, W channel power block power supply | 22 | VM1 | Channel 1 power block power supply |
| 12 | WOOUT | Stepping motor output (W phase) | 21 | OUT1F | Channel 1 forward output |
| 13 | GNDW | W channel power GND | 20 | IN1F | Channel 1 forward input |
| 14 | S2 | Stepping motor input | 19 | IN1R | Channel 1 reverse input |
| 15 | S3 | Stepping motor input | 18 | VG | Charge pump output |
| 16 | ST1 | Standby | 17 | ST2 | Channels 1 and 2 mute |

● Input / output circuits

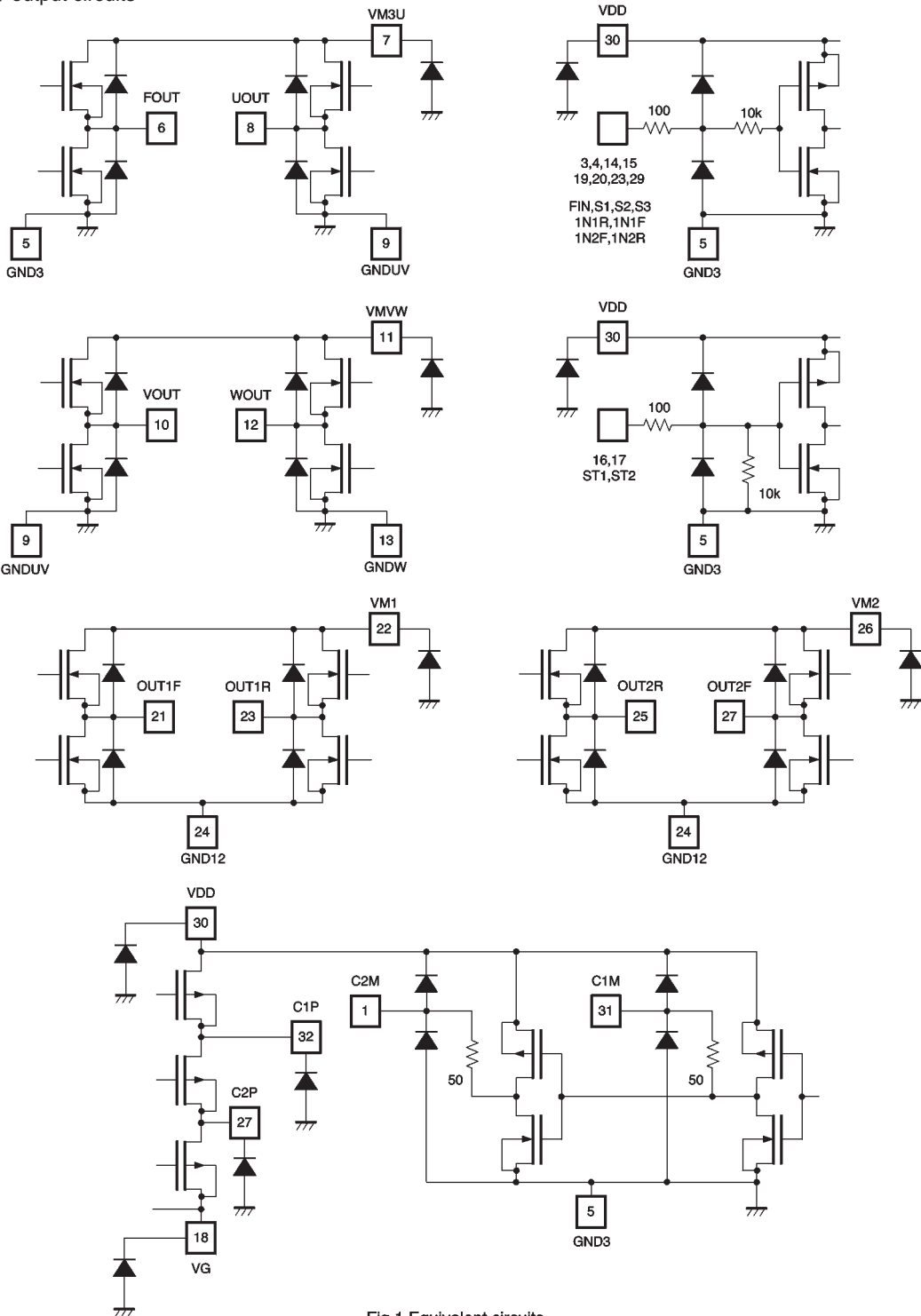


Fig.1 Equivalent circuits

- Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_M = 2.5\text{V}$, $V_{DD} = 3\text{V}$,
 VG is the internally pumped output, $f_{123\text{IN}} = 176\text{kHz}$, $f_{UVWIN} = 1\text{kHz}$, and $R_L = 8\Omega\text{--}47\mu\text{H}$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|--|--------------|--------------|------|------|-----------------|--|
| 〈H-bridge power supply current〉 | | | | | | |
| No input | I_{MST} | — | — | 1 | μA | — |
| 〈Control circuit power supply current〉 | | | | | | |
| Standby | I_{DDST} | — | — | 1 | μA | ST1=L |
| No signal | I_{DDO} | — | 0.6 | 1 | mA | ST2=low level, all inputs low level |
| Operation | I_{DDA} | — | 3.1 | 6.5 | mA | ST1 and ST2=high level, all channels driven together |
| 〈Pre-drive power supply voltage〉 | | | | | | |
| No input | I_{G1} | 7.5 | 8.9 | 10 | V | ST1 and ST2=high level, all inputs low level |
| Operation | I_{G2} | 6.0 | 7.6 | 9.5 | V | ST1 and ST2=high level, all channels driven together |
| 〈Logic input characteristics〉 | | | | | | |
| Input high level voltage | V_{IH} | $V_{DD}-0.6$ | — | — | V | — |
| Input low level voltage | V_{IL} | — | — | 0.6 | V | — |
| Input high level current 1 | I_{IH1} | — | — | 1 | μA | $V_{IN}=3\text{V}$, each driver input |
| Input low level current 1 | I_{IL1} | -1 | — | — | μA | $V_{IN}=0\text{V}$, each driver input |
| Input high level current 2 | I_{IH2} | — | 300 | 600 | μA | $V_{IN}=3\text{V}$, ST1 and ST2 pins |
| Input low level current 2 | I_{IL2} | -1 | — | — | μA | $V_{IN}=0\text{V}$, ST1 and ST2 pins |
| Output on-resistance | R_{ON3UVW} | — | 0.8 | 1.2 | Ω | Sum of top and bottom resistors |
| | R_{ON12} | — | 1.2 | 2.0 | Ω | VG=10V |
| Output transmission delay time 1 | t_{RISE} | — | 0.2 | 1 | μsec | ch1, ch2, ch3 |
| | t_{FALL} | — | 0.2 | 1 | μsec | |
| Output transmission delay time 2 | t_{EDGE} | — | 0.3 | 20 | μsec | Uch, Vch, Wch |
| Minimum input pulse width | t_{min} | 200 | — | — | nsec | Output pulse width 2 / 3 t_{Min} . or more |
| 〈Oscillator circuit〉 | | | | | | |
| Free-running frequency | f_{osc} | 150 | 300 | 400 | kHz | Pin 32 waveform monitor |

©Not designed for radiation resistance.

● Measurement circuit

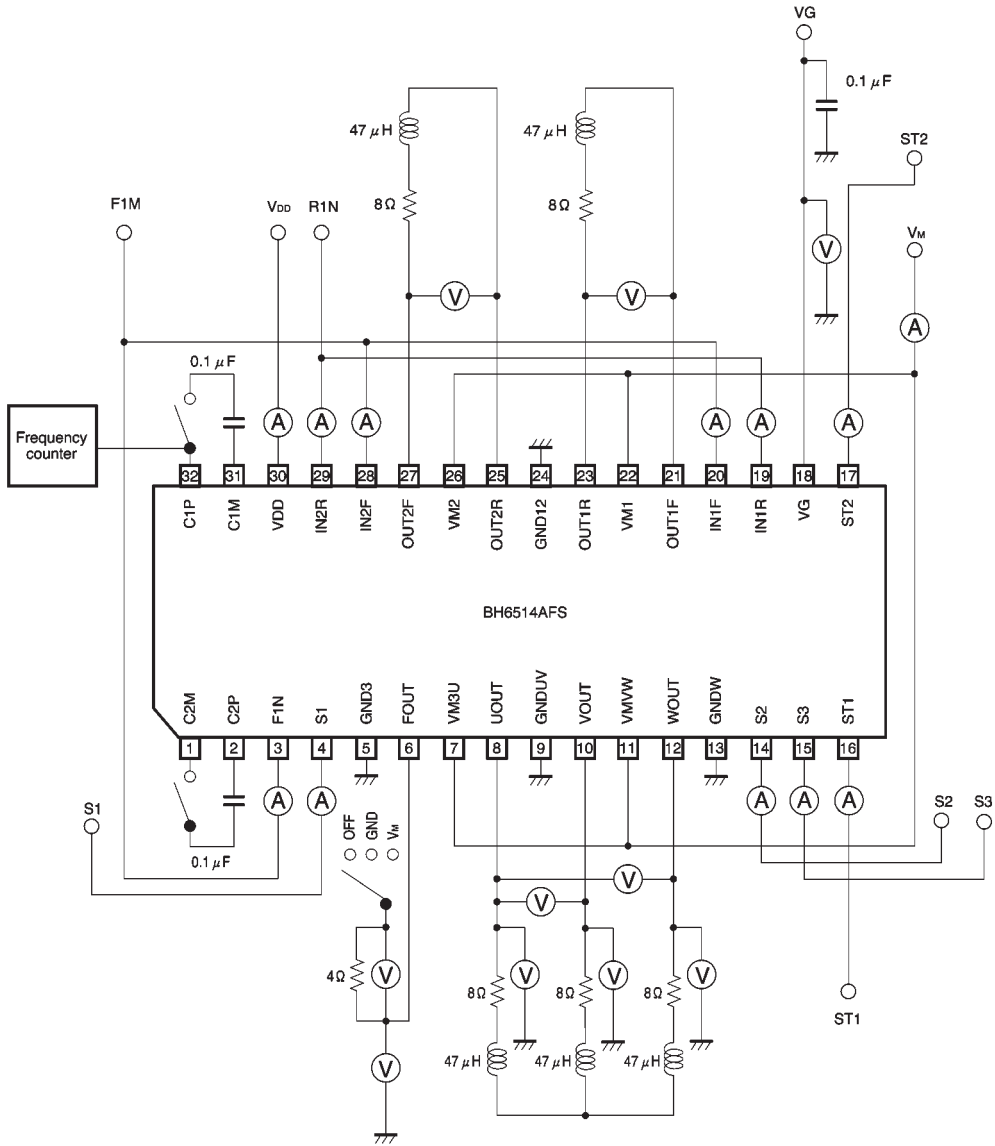


Fig.2

● Circuit operation

Driver truth table

Focus / tracking coil

| ST1 | ST2 | IN1, 2F | IN1, 2R | OUT1, 2F | OUT1, 2R |
|-----|-----|---------|---------|----------|----------|
| H | H | L | L | L | L |
| H | H | L | H | L | H |
| H | H | H | L | H | L |
| H | H | H | H | L | L |
| L | X | X | X | Z | Z |
| X | L | X | X | Z | Z |

Brushless motor power supply

| ST1 | ST2 | FIN | Fout |
|-----|-----|-----|------|
| H | X | L | L |
| H | X | H | H |
| L | X | X | Z |

Stepping motor

| ST1 | ST2 | S3 | S2 | S1 | Uout | Vout | Wout |
|-----|-----|----|----|----|------|------|------|
| H | X | L | L | L | H | L | Z |
| H | X | L | L | H | H | Z | L |
| H | X | L | H | L | Z | H | L |
| H | X | L | H | H | L | H | Z |
| H | X | H | L | L | L | Z | H |
| H | X | H | L | H | Z | L | H |
| H | X | H | H | X | Z | Z | Z |
| L | X | X | X | X | Z | Z | Z |

●Application example

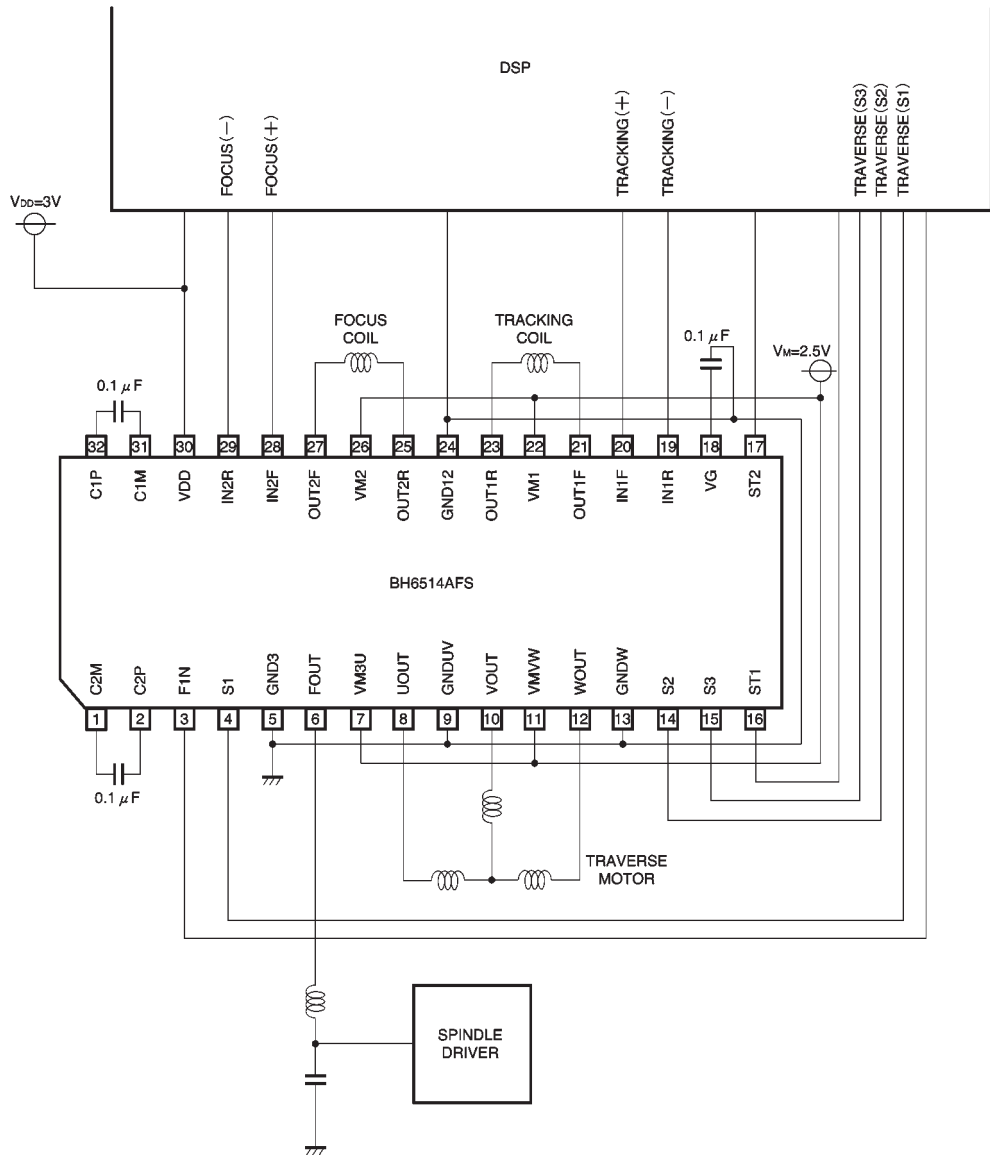


Fig.3

● Operation notes

- (1) The charge pump circuit is a x3 multiplier that uses the voltage on pin 30 as its reference. Therefore, set the voltage (V_{DD}) on pin 30 so that the VG does not exceed its rating.
- (2) If you will use an externally-supplied VG, disconnect the capacitors between pins 31 and 32 and pins 1 and 2.

● External dimensions (Units: mm)

