

BiCD Integrated Circuit Silicon Monolithic

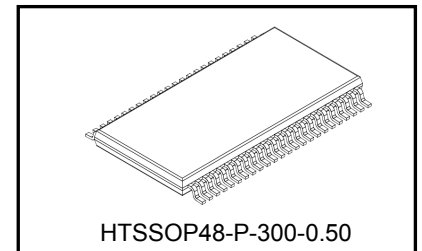
TB62215AFNG

PWM method clock Inn bipolar stepping motor driver

The TB62215AFNG is a two-phase bipolar stepping motor driver using a PWM chopper. Fabricated with the BiCD process, the TB62215AFNG is rated at 40 V/3.0 A. The on-chip voltage regulator allows control of a stepping motor with a single VM power supply.

Features

- Bipolar stepping motor driver
- PWM constant-current drive
- Clock input control
- Allows two-phase, 1-2-phase and W1-2-phase excitations.
- BiCD process: Uses DMOS FETs as output power transistors.
- High voltage and current: 40 V/3.0 A (absolute maximum ratings)
- Thermal shutdown (TSD), overcurrent shutdown (ISD), and power-on-resets (PORs)

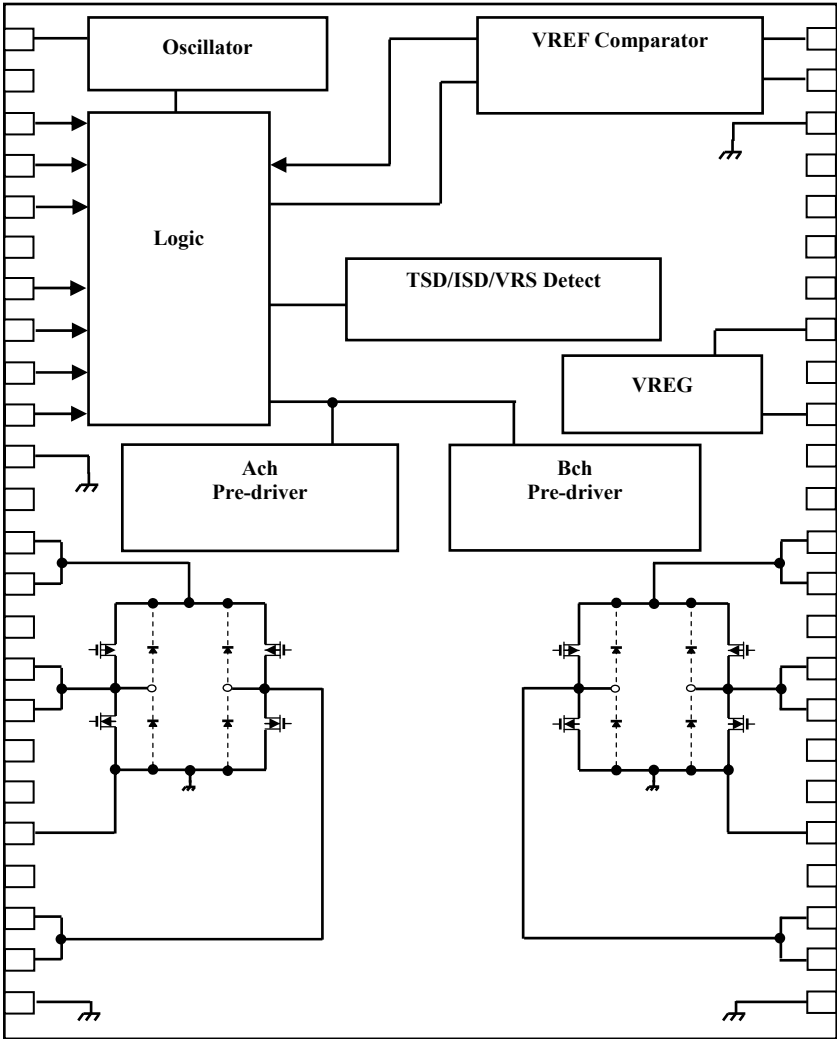


Weight 0.21g(typ.)

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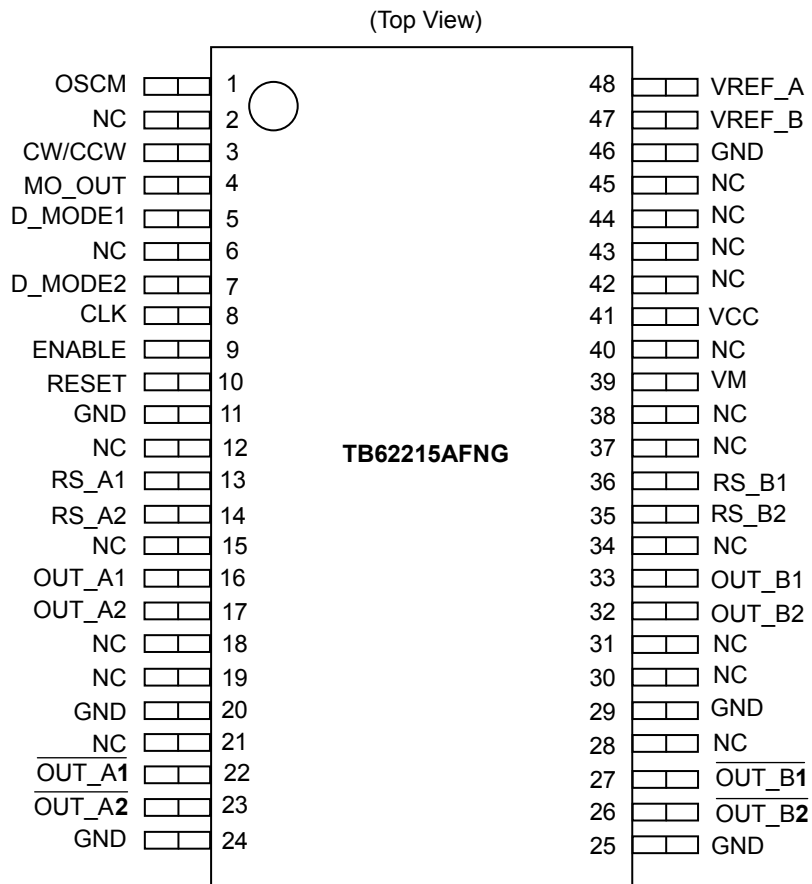
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Block Diagram



Functional blocks/circuits/constants in the block chart etc. may be omitted or simplified for explanatory purposes.

Pin assignment



Terminal function explanation

| Pin No. | Pin Name | Function | Pin No. | Pin Name | Function |
|---------|-----------------------------|---|---------|-----------------------------|---|
| 1 | OSCM | Oscillator pin for PWM chopper | 25 | GND | Motor power ground |
| 2 | NC | No connect | 26 | $\overline{\text{OUT_B2}}$ | B-phase negative driver output |
| 3 | CW/CCW | Motor rotation: forward/reverse | 27 | $\overline{\text{OUT_B1}}$ | |
| 4 | MO_OUT | Electric angle monitor | 28 | NC | No connect |
| 5 | D_MODE_1 | Excitation mode control 1 | 29 | GND | Motor power ground |
| 6 | NC | No connect | 30 | NC | No connect |
| 7 | D_MODE_2 | Excitation mode control 2 | 31 | NC | No connect |
| 8 | CLK | An electrical angle leads on the rising edge of the clock input. A motor rotation count depends on the input frequency. | 32 | OUT_B2 | B-phase positive driver output |
| 9 | ENABLE | A-/B-channel output enable | 33 | OUT_B1 | |
| 10 | RESET | Electric angle reset | 34 | NC | No connect |
| 11 | GND | Logic ground | 35 | RS_B2 | Power supply of B-phase motor coil and the sink current sensing of B-phase motor coil |
| 12 | NC | No connect | 36 | RS_B1 | |
| 13 | RS_A1 | Power supply of A-phase motor coil and the sink current sensing of A-phase motor coil | 37 | NC | No connect |
| 14 | RS_A2 | | 38 | NC | No connect |
| 15 | NC | No connect | 39 | VM | Power supply |
| 16 | OUT_A1 | A-phase positive driver output | 40 | NC | No-connect |
| 17 | OUT_A2 | | 41 | VCC | Smoothing filter for logic power supply |
| 18 | NC | No connect | 42 | NC | No connect |
| 19 | NC | No connect | 43 | NC | No connect |
| 20 | GND | Motor power ground | 44 | NC | No connect |
| 21 | NC | No connect | 45 | NC | No connect |
| 22 | $\overline{\text{OUT_A1}}$ | A-phase negative driver output | 46 | GND | Logic ground |
| 23 | $\overline{\text{OUT_A2}}$ | | 47 | VREF_B | Tunes the current level for A-phase motor drive. |
| 24 | GND | Motor power ground | 48 | VREF_A | Tunes the current level for A-phase motor drive. |

1. CLK

| CLK Input | Function |
|-----------|---|
| Rise | The electrical angle leads by one on the rising edge. |
| Fall | Remains at the same position. |

2. ENABLE

| ENABLE Input | Function |
|--------------|---|
| H | Output transistors are enabled (normal operation mode). |
| L | Output transistors are disabled (high impedance state). |

3. CW/CCW

| CW/CCW Input | Function | OUT (+) | OUT (-) |
|--------------|---------------|---------|---------|
| H | Forward (CW) | H | L |
| L | Reverse (CCW) | L | H |

4. DMODE

| D_MODE1 | D_MODE2 | Function |
|---------|---------|--|
| L | L | OSC_M, output transistors are disabled (in Standby mode) |
| L | H | Two-phase excitation |
| H | L | 1-2-phase excitation |
| H | H | W1-2-phase excitation |

5. RESET

| RESET Input | Function |
|-------------|--------------------------------|
| L | Normal operation mode |
| H | The electrical angle is reset. |

Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|------------------------|---------------------|------------|------|
| Motor power supply | V _M | 40 | V |
| Motor output voltage | V _{OUT} | 40 | V |
| Motor output current | I _{OUT} | 3.0 | A |
| Logic power supply | V _{CC} | 6 | V |
| Digital input voltage | V _{IN} | 6 | V |
| MO output voltage | V _{MO} | 6 | V |
| MO output sink current | I _{MO} | 30.0 | mA |
| Power dissipation | P _D | 1.3 | W |
| Operating temperature | T _{opr} | -20 to 85 | °C |
| Storage temperature | T _{str} | -55 to 150 | °C |
| Junction temperature | T _{j(Max)} | 150 | °C |

Operation Ranges

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--|--------------------|-------------------------------|------|------|------|------|
| Motor power supply | V _M | - | 10 | 24 | 38 | V |
| Motor output current | I _{OUT} | Ta=25°C, 1corresponding worth | - | 1.8 | 2.4 | A |
| Digital input voltage | V _{IN(H)} | H level of logic | 2.0 | - | 5.5 | V |
| | V _{IN(L)} | L level of logic | -0.4 | - | 1.0 | V |
| MO output voltage | V _{MO} | With a pull-up resistor | - | 3.3 | 5.5 | V |
| Clock input frequency | f _{CLK} | - | - | - | 100 | kHz |
| Chopper frequency | f _{chop} | - | 40 | 100 | 150 | kHz |
| V _{ref} reference voltage | V _{ref} | - | GND | - | 3.6 | V |
| Voltage across the current-sensing resistor pins | V _{RS} | - | 0.0 | ±1.0 | ±1.5 | V |

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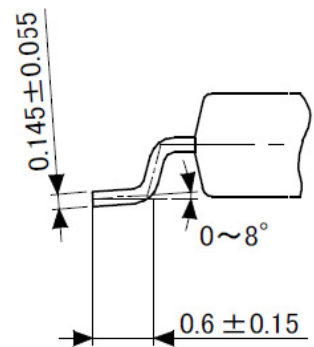
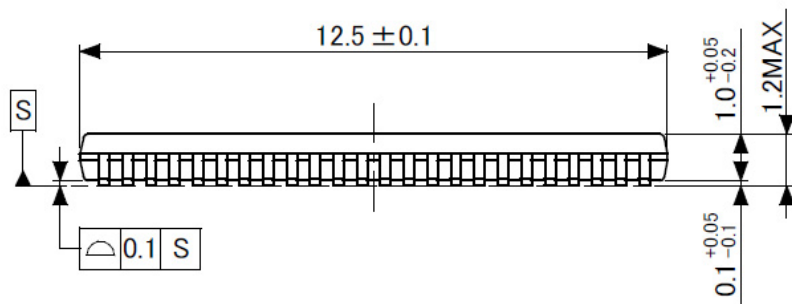
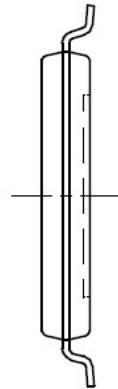
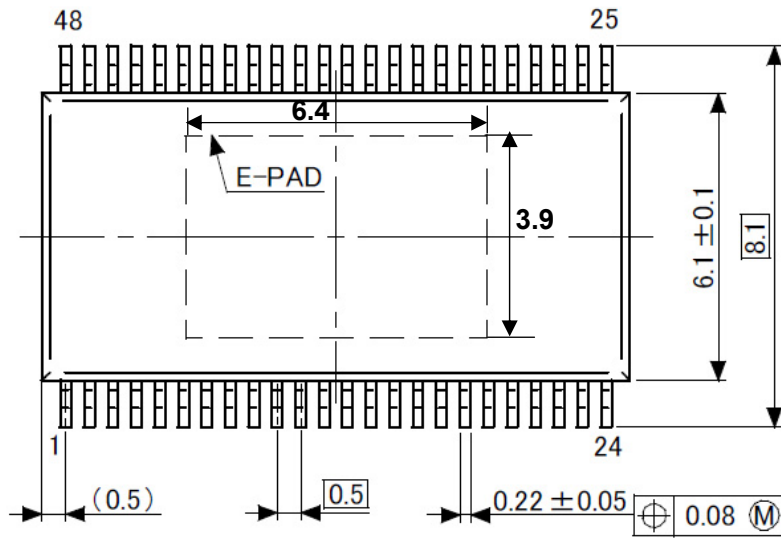
Electrical Characteristics (Ta = 25°C, V_M = 24 V, unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--|----------------------|--|------|------|------|------|
| Digital input voltage | V _{IH} | Digital input pins | 2.0 | 3.3 | 5.5 | V |
| | V _{IL} | | GND | - | 0.8 | |
| Supply current | I _M | Outputs open (two-phase excitation) | - | 5 | 7 | mA |
| Channel-to-channel differential | Δ I _{OUT1} | I _{OUT} = 2.0A | -5 | 0 | 5 | % |
| Output current error relative to the predetermined value | Δ I _{OUT2} | I _{OUT} = 2.0A | -5 | 0 | 5 | % |
| Drain-source ON-resistance of the output transistors (upper and lower sum) | R _{ON(D-S)} | I _{OUT} = 2.0A, T _j = 25°C | 0.4 | 0.6 | 0.8 | Ω |
| Power-supply voltage for internal circuit operation | V _{CC} | I _{CC} = 5.0mA | 4.75 | 5.00 | 5.25 | V |
| Power-supply current for internal circuit operation | I _{CC} | - | - | 2.5 | 5.0 | mA |
| V _M recovery voltage | V _{MR} | - | 7.0 | 8.0 | 9.0 | V |
| Overcurrent trip threshold | ISD | - | 3.0 | 4.0 | 5.0 | A |

Package Dimensions

HTSSOP48-P-300-0.50

Unit: mm



NOTES on Contents

Block Diagrams

Functional blocks/circuits/constants in the block chart etc. may be omitted or simplified for explanatory purposes.

IC Usage Considerations

Notes on handling of ICs

The absolute maximum ratings of a semiconductor device are a set of ratings that must not be exceeded, even for a moment. Do not exceed any of these ratings.

Exceeding the rating(s) may cause device breakdown, damage or deterioration, and may result in injury by explosion or combustion.

Use an appropriate power supply fuse to ensure that a large current does not continuously flow in the case of overcurrent and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead to smoke or ignition. To minimize the effects of the flow of a large current in the case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.

If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF. IC breakdown may cause injury, smoke or ignition.

Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition.

Do not insert devices in the wrong orientation or incorrectly.

Make sure that the positive and negative terminals of power supplies are connected properly.

Otherwise, the current or power consumption may exceed the absolute maximum rating, and exceeding the rating(s) may cause device breakdown, damage or deterioration, and may result in injury by explosion or combustion.

In addition, do not use any device inserted in the wrong orientation or incorrectly to which current is applied even just once.

Carefully select external components (such as inputs and negative feedback capacitors) and load components (such as speakers), for example, power amp and regulator.

If there is a large amount of leakage current such as from input or negative feedback condenser, the IC output DC voltage will increase. If this output voltage is connected to a speaker with low input withstand voltage, overcurrent or IC failure may cause smoke or ignition. (The overcurrent may cause smoke or ignition from the IC itself.) In particular, please pay attention when using a Bridge Tied Load (BTL) connection-type IC that inputs output DC voltage to a speaker directly.

Points to remember when handling of ICs**Overcurrent Protection Circuit**

Overcurrent protection circuits (referred to as current limiter circuits) do not necessarily protect ICs under all circumstances. If the overcurrent protection circuits operate against the overcurrent, clear the overcurrent status immediately.

Depending on the method of use and usage conditions, exceeding absolute maximum ratings may cause the overcurrent protection circuit to operate improperly or IC breakdown may occur before operation. In addition, depending on the method of use and usage conditions, if overcurrent continues to flow for a long time after operation, the IC may generate heat resulting in breakdown.

Thermal Shutdown Circuit

Thermal shutdown circuits do not necessarily protect ICs under all circumstances. If the thermal shutdown circuits operate against the over-temperature, clear the heat generation status immediately.

Depending on the method of use and usage conditions, exceeding absolute maximum ratings may cause the thermal shutdown circuit to operate improperly or IC breakdown to occur before operation.

Heat Radiation Design

When using an IC with large current flow such as power amp, regulator or driver, design the device so that heat is appropriately radiated, in order not to exceed the specified junction temperature (T_J) at any time or under any condition. These ICs generate heat even during normal use. An inadequate IC heat radiation design can lead to decrease in IC life, deterioration of IC characteristics or IC breakdown. In addition, when designing the device, take into consideration the effect of IC heat radiation with peripheral components.

Back-EMF

When a motor rotates in the reverse direction, stops or slows abruptly, current flows back to the motor's power supply owing to the effect of back-EMF. If the current sink capability of the power supply is small, the device's motor power supply and output pins might be exposed to conditions beyond the absolute maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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