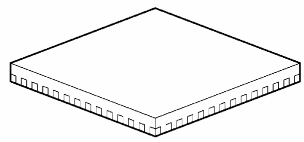
BiCD Integrated Circuit Silicon Monolithic

TB62215AFTG

PWM Method Clock In Bipolar Stepping Motor Driver IC

The TB62215AFTG is a two-phase bipolar stepping motor driver using a PWM chopper.
Fabricated with the BiCD process, the TB62215AFTG 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.



QFN48-P-0707-0.50A

Weight: 0.14g(typ.)

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/3.0A (absolute maximum ratings)
- Thermal shutdown (TSD), overcurrent shutdown (ISD), and power-on-resets (PORs)

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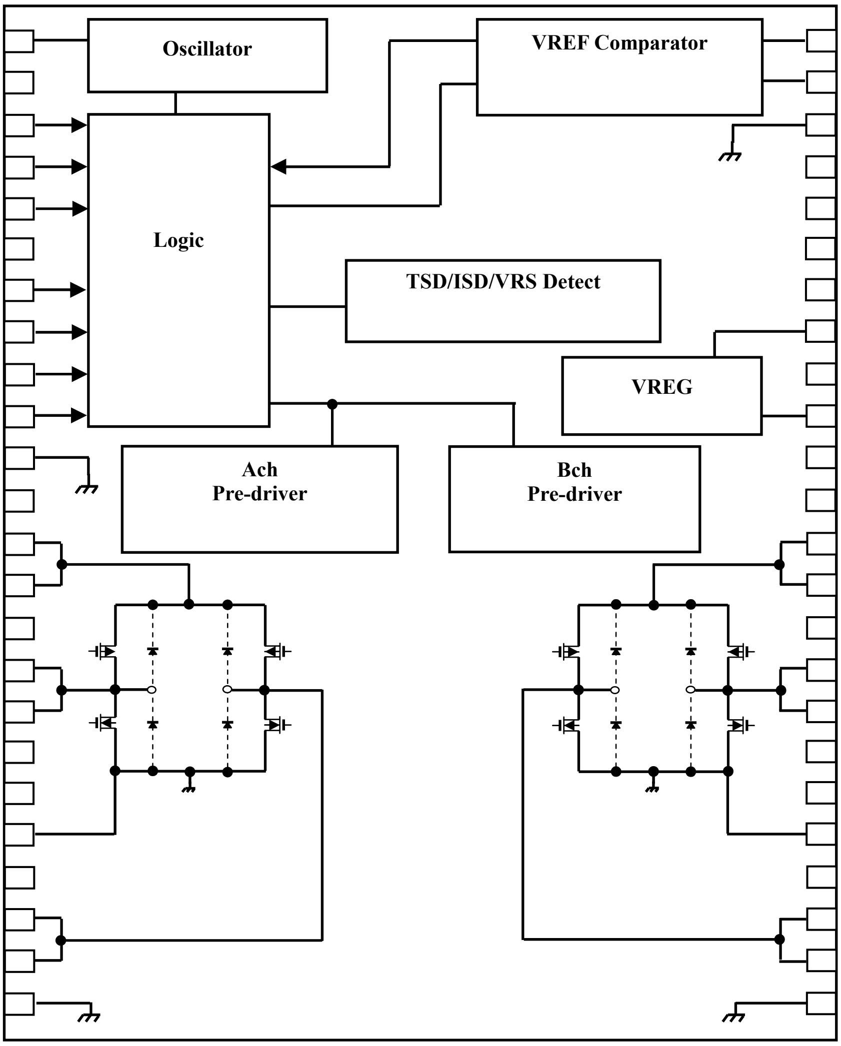
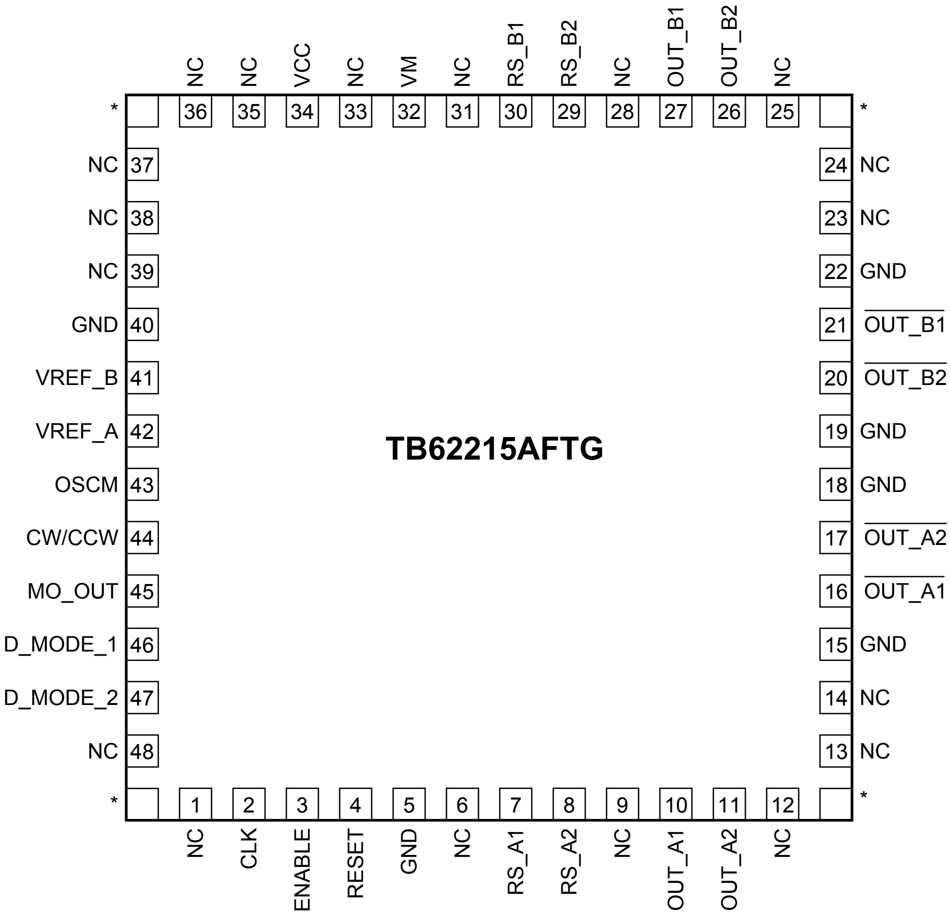
Block Diagram



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

Pin assignment



Pin function

Pin No.	Pin Name	Function	Pin No.	Pin Name	Function
1	NC	No-connect	25	NC	No-connect
2	CLK	An electrical angle leads on the rising edge of the clock input. A motor rotation count depends on the input frequency.	26	OUT_B2	B-phase positive driver output
3	ENABLE	A-/B-channel output enable	27	OUT_B1	
4	RESET	Electric angle reset	28	NC	No-connect
5	GND	Logic ground	29	RS_B2	Power supply of B-phase motor coil and the sink current sensing of B-phase motor coil
6	NC	No-connect	30	RS_B1	
7	RS_A1	Power supply of A-phase motor coil and the sink current sensing of A-phase motor coil	31	NC	No-connect
8	RS_A2		32	VM	Power supply
9	NC	No-connect	33	NC	No-connect
10	OUT_A1	A-phase positive driver output	34	VCC	Smoothing filter for logic power supply
11	OUT_A2		35	NC	No-connect
12	NC	No-connect	36	NC	No-connect
13	NC	No-connect	37	NC	No-connect
14	NC	No-connect	38	NC	No-connect
15	GND	Motor power ground	39	NC	No-connect
16	$\overline{\text{OUT\_A1}}$	A-phase negative driver output	40	GND	Logic ground
17	$\overline{\text{OUT\_A2}}$		41	VREF_B	Tunes the current level for B-phase motor drive.
18	GND	Motor power ground	42	VREF_A	Tunes the current level for A-phase motor drive.
19	GND	Motor power ground	43	OSCM	Oscillator pin for PWM chopper
20	$\overline{\text{OUT\_B2}}$	B-phase negative driver output	44	CW/CCW	Motor rotation: forward/reverse
21	$\overline{\text{OUT\_B1}}$		45	MO_OUT	Electric angle monitor
22	GND	Motor power ground	46	D_MODE_1	Excitation mode control
23	NC	No-connect	47	D_MODE_2	Excitation mode control
24	NC	No-connect	48	NC	No-connect

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_S}	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

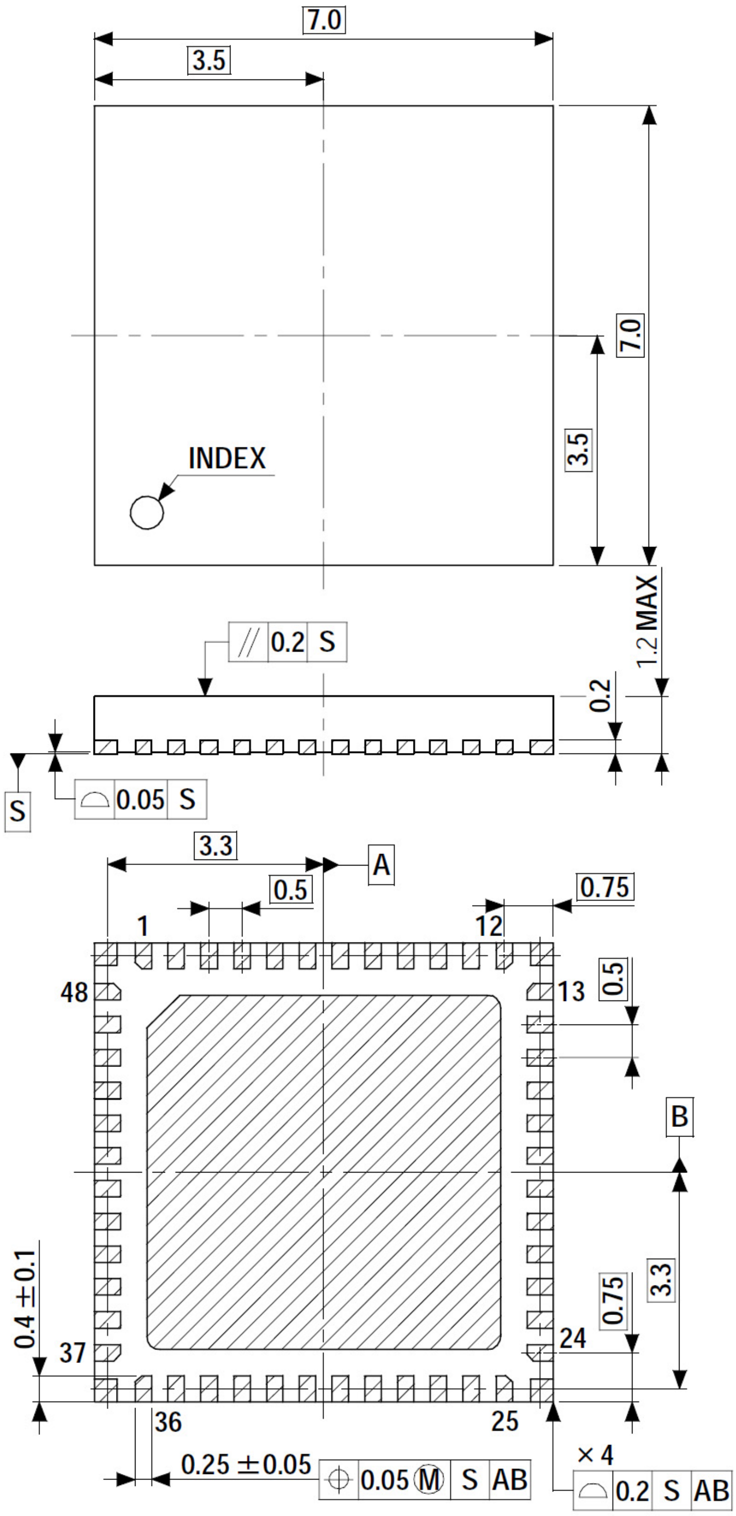
This document is for reference only. Please contact us for sample datasheets.

・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	ΔI_{OUT1}	I_{OUT} = 2.0A	-5	0	5	%
Output current error relative to the predetermined value	ΔI_{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,Tj = 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

QFN48-P-0707-0.50A "Unit : mm"



Weight: 0.14g (typ.)

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 (TJ) 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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