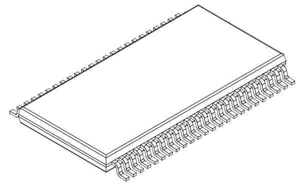
TOSHIBA BiCD Integrated Circuit   Silicon Monolithic

TB62213AFNG

BiCD Constant-Current Two-Phase Bipolar Stepping Motor Driver IC

The TB62213AFNG is a two-phase bipolar stepping motor driver using a PWM chopper.
Fabricated with the BiCD process, the TB62213AFNG is rated at 40 V/3.0 A .
The on-chip voltage regulator allows control of a stepping motor with a single V_M power supply.



HTSSOP48-P-300-0.50

Weight   0.20g(typ.)

Features

- Bipolar stepping motor driver
- PWM constant-current drive
- 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)

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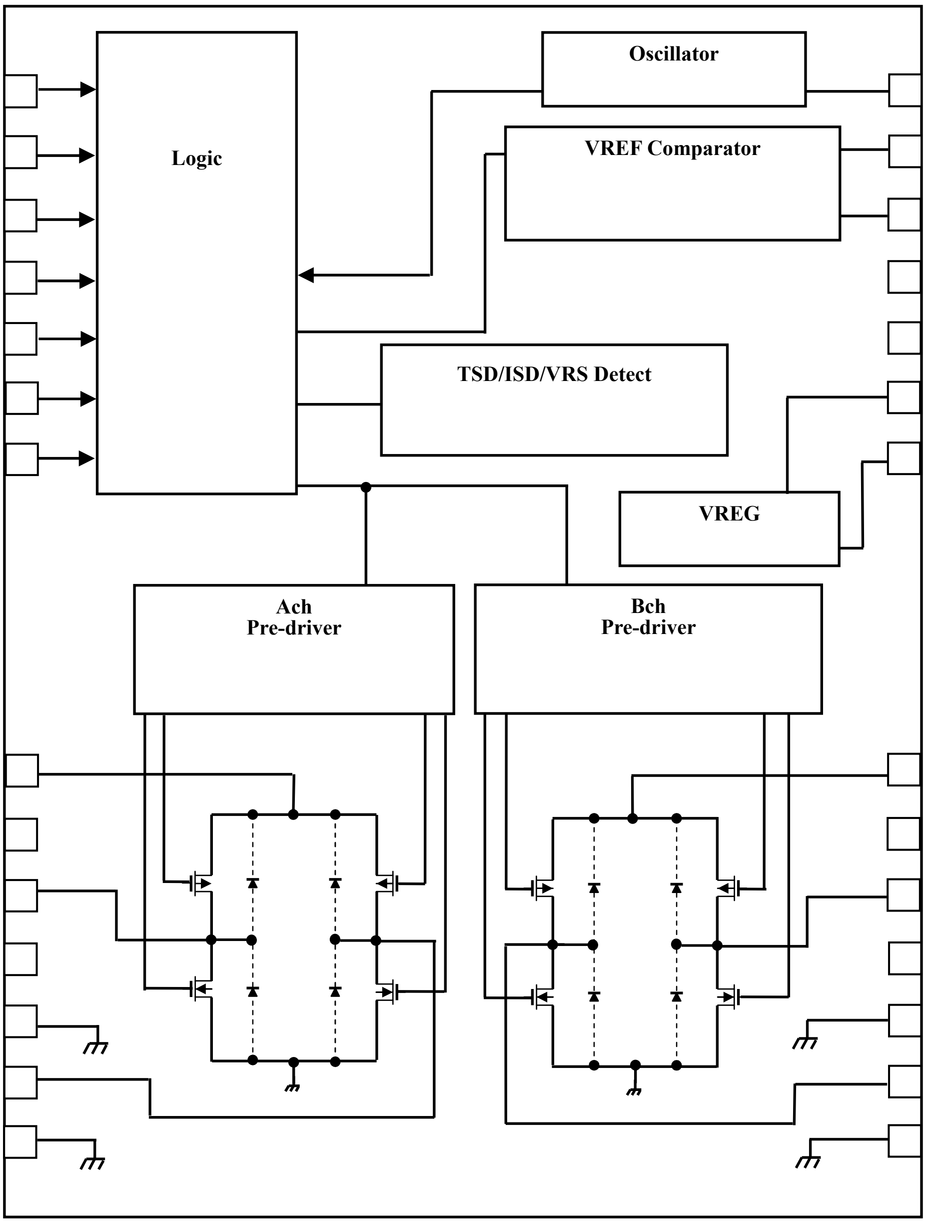
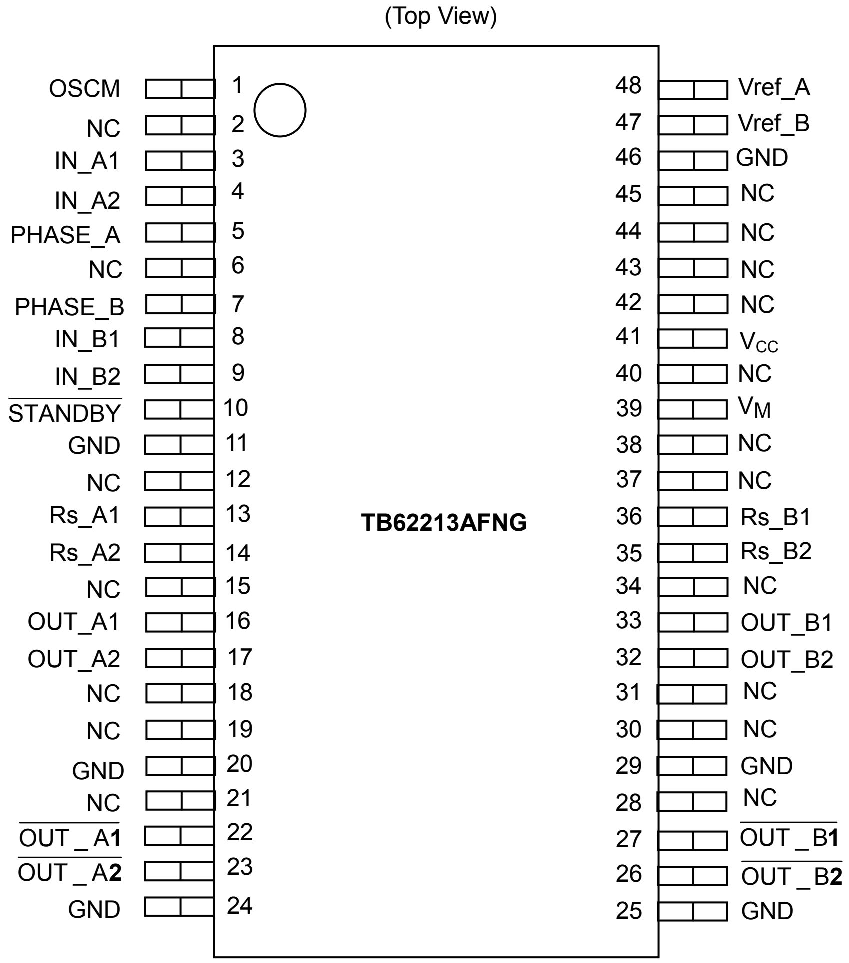
Block Diagram



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	OSCM	Oscillator pin for PWM choppers	25	GND	Motor power ground
2	NC	No-connect	26	$\overline{\text{OUT\_B2}}$	B-phase negative driver output
3	IN_A1	A-phase excitation control input	27	$\overline{\text{OUT\_B1}}$	
4	IN_A2	A-phase excitation control input	28	NC	No-connect
5	PHASE_A	Current direction signal input for A phase	29	GND	Motor power ground
6	NC	No-connect	30	NC	No-connect
7	PHASE_B	Current direction signal input for B phase	31	NC	No-connect
8	IN_B1	B-phase excitation control input	32	OUT_B2	B-phase positive driver output
9	IN_B2	B-phase excitation control input	33	OUT_B1	
10	$\overline{\text{STAND BY}}$	High: Normal operation mode Low: Standby mode	34	NC	No-connect
11	GND	Logic ground	35	Rs_B2	Power supply pin 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 pin 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	V_M	Power supply
16	OUT_A1	A-phase positive driver output	40	NC	No-connect
17	OUT_A2		41	V_{CC}	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 B-phase motor drive.
24	GND	Motor power ground	48	Vref_A	Tunes the current level for A-phase motor drive.

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
V_{ref} reference voltage	V_{ref}	5.0	V
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
PHASE signal input frequency	f_{PHASE}	-	1.0	-	400	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

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	IM	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

Operation explanation

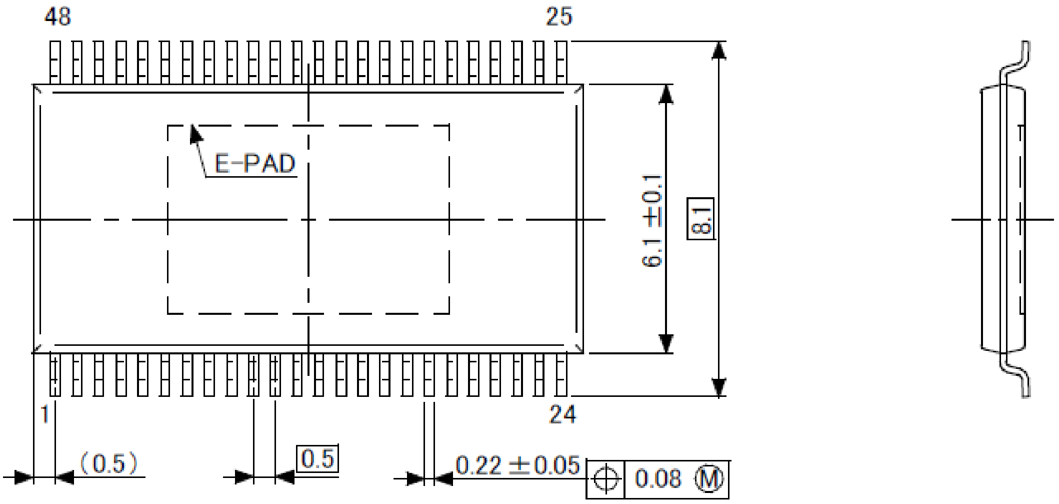
Pin Name	H	L	Notes
IN_X	Outputs enabled	Outputs disabled	When IN_X is deasserted Low (where a letter X that indicates a phase), its outputs assume the high-impedance state, regardless of the state of that phase.
PHASE_X	OUT_X: H	OUT_X (-): H	When PHASE_X is High, a current normally flows from OUT_X to OUT_X (-).
$\overline{\text{STANDBY}}$	Normal operation mode	Standby mode	When $\overline{\text{STANDBY}}$ is Low, both the oscillator and output drivers are disabled. The TB62213AFNG can not drive a motor.

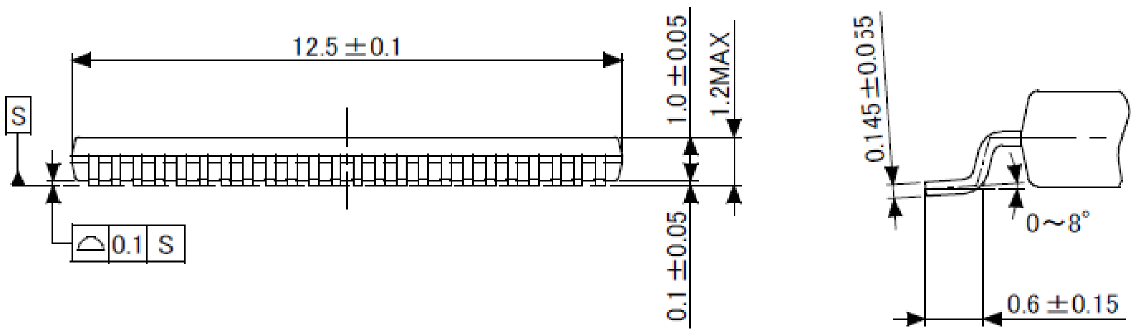
W1-2 phase

PHASE	IN_1	IN_2	Output I_{OUT}(A)
L	L	L	0%
	L	H	-38%
	H	L	-71%
	H	H	-100%
H	L	L	0%
	L	H	38%
	H	L	71%
	H	H	100%

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 (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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