TOSHIBA BiCD Integrated Circuit Silicon Monolithic

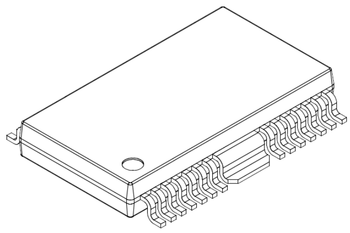
TB62214AFG

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

The TB62214AFG is a two-phase bipolar stepping motor driver using a PWM chopper controlled by clock input.

Fabricated with the BiCD process, the TB62214AFG is rated at 40 V/2.0 A .

The on-chip voltage regulator allows control of a stepping motor with a single VM power supply.



HSOP28-P-0450-0.80

Weight: 0.79 g (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/2.0 A (absolute maximum ratings)
- Thermal shutdown (TSD), overcurrent shutdown (ISD), and power-on-resets (PORs)
- Packages: HSOP28-P-0450-0.80

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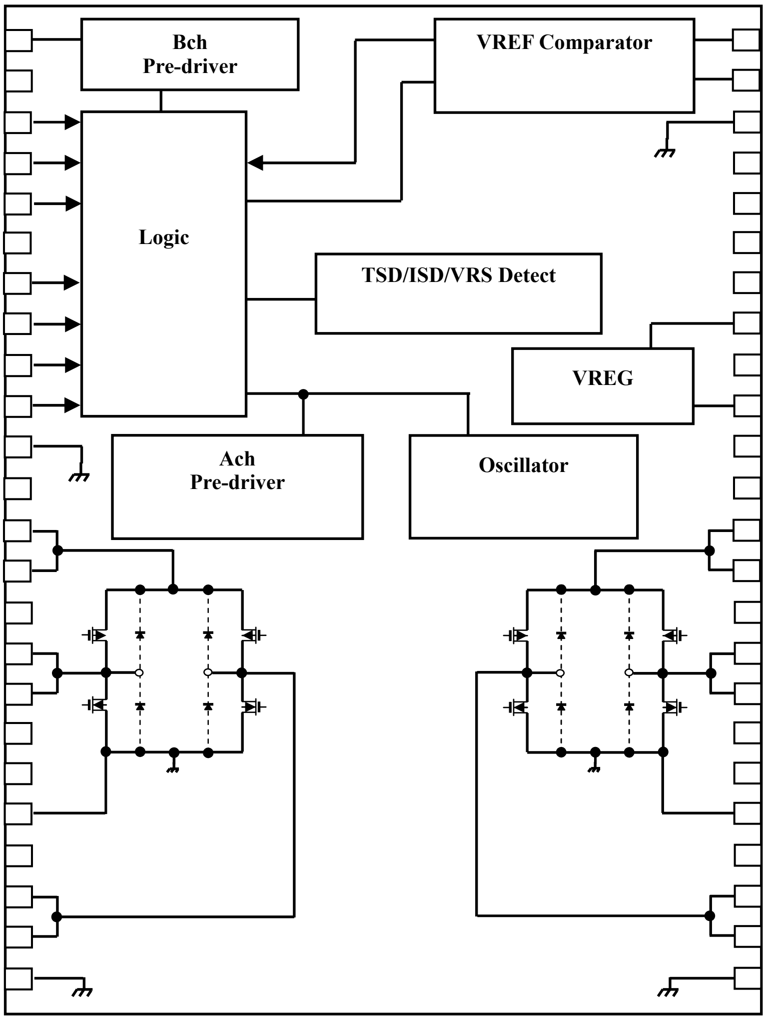
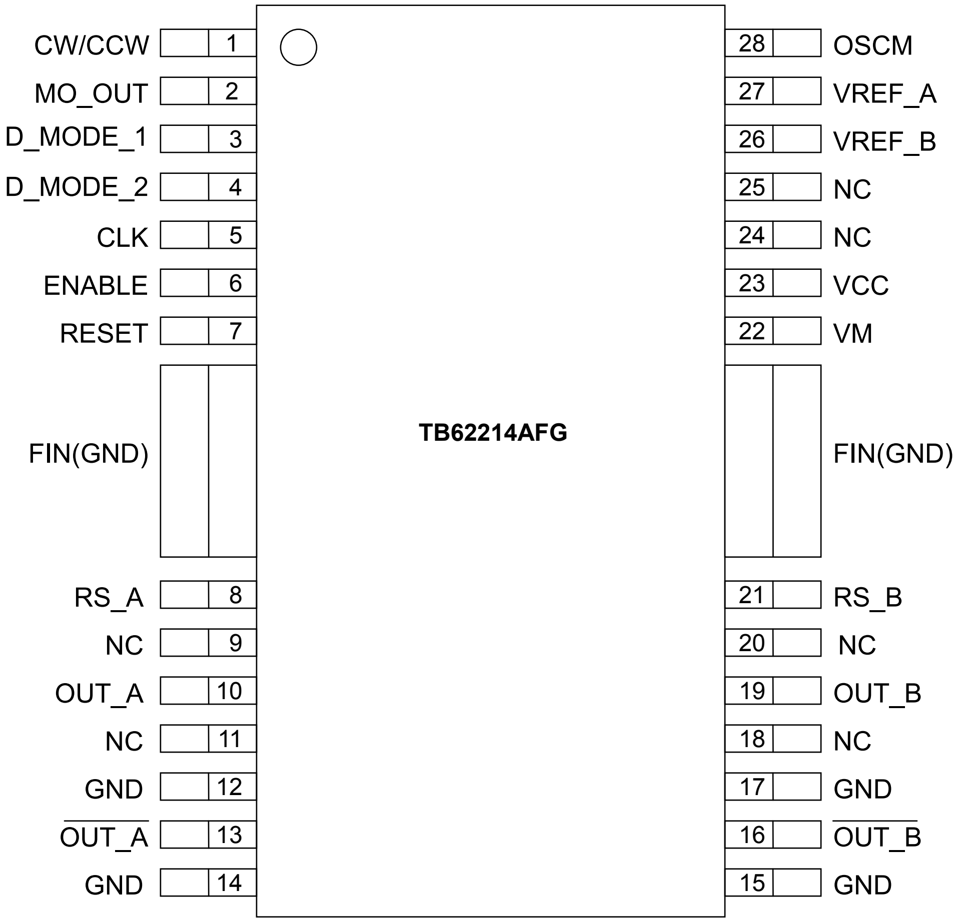
Block Diagram



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

Pin Assignment

TB62214AFG



Pin Function

Pin No.	Pin Name	Function
1	CW/CCW	Motor rotation: forward/reverse
2	MO_OUT	Electric angle monitor
3	D_MODE_1	Excitation mode control
4	D_MODE_2	Excitation mode control
5	CLK	An electrical angle leads on the rising edge of the clock input. A motor rotation count depends on the input frequency.
6	ENABLE	A-/B-channel output enable
7	RESET	Electric angle reset
8	RS_A	The sink current sensing of A-phase motor coil
9	NC	No-connect
10	OUT_A	A-phase positive driver output
11	NC	No-connect
12	GND	Motor power ground
13	$\overline{\text{OUT\_A}}$	A-phase negative driver output
14	GND	Motor power ground
15	GND	Motor power ground
16	$\overline{\text{OUT\_B}}$	B-phase negative driver output
17	GND	Motor power ground
18	NC	No-connect
19	OUT_B	B-phase positive driver output
20	NC	No-connect
21	RS_B	The sink current sensing of B-phase motor coil
22	VM	Power supply
23	VCC	Smoothing filter for logic power supply
24	NC	No-connect
25	NC	No-connect
26	VREF_B	Tunes the current level for B-phase motor drive.
27	VREF_A	Tunes the current level for A-phase motor drive.
28	OSCM	Oscillator pin for PWM chopper

CLK Function

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

ENABLE Function

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

CW/CCW Function

CW/CCW Input	Function
H	Forward (CW)
L	Reverse (CCW)

Excitation Mode Select Function

D_MODE_1	D_MODE_2	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

RESET Function

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

Excitation Mode	A-phase Current	B-phase Current
2 Phase	100%	100%
1 – 2 Phase	100%	100%
W1-2 Phase	71%	71%

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}	2.0	A
Digital input voltage	V_{IN}	-0.5 to 6.0	V
Vref standard voltage	V_{ref}	5.0	V
MO output voltage	V_{MO}	6.0	V
MO output sink current	I_{MO}	30.0	mA
Power dissipation	P_D	1.15	W
Operating temperature	T_{opr}	−20 to 85	°C
Storage temperature	T_{stg}	−55 to 150	°C
Junction temperature	$T_{j\ (MAX)}$	150	°C

Operating Ranges (Ta=0 to 85°C)

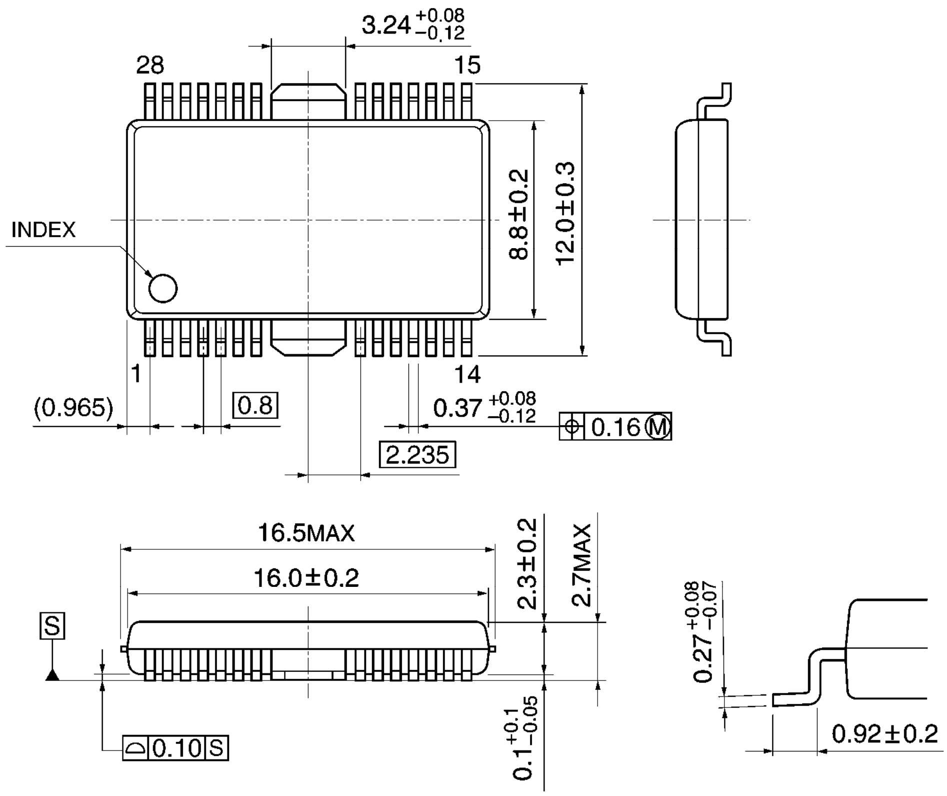
Characteristics	Symbol	Min	Typ.	Max	Unit
Motor power supply	V_M	10.0	24.0	38.0	V
Motor output current	I_{OUT}	−	1.4	2.0	A
Digital input voltage	$V_{IN\ (H)}$	2.0	−	5.5	V
	$V_{IN\ (L)}$	-0.4	−	1.0	V
MO output voltage	V_{MO}	−	3.3	5.5	V
Clock input frequency	f_{CLK}	−	−	100	kHz
Chopper frequency	f_{chop}	40.0	100.0	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 1 (Ta = 25°C, VM = 24 V, unless otherwise specified)

Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input hysteresis voltage		$V_{IN\ (HIS)}$	DC	Digital input pins	100	200	300	mV
Digital input current	High	$I_{IN\ (H)}$	DC	V_{IN} = 5 V at the digital input pins under test	35	50	75	μA
	Low	$I_{IN\ (L)}$	DC	V_{IN} = 0 V at the digital input pins under test	−	−	1	μA
MO output voltage	High	$V_{OH\ (MO)}$	−	I_{OH} = -24 mA when the output is High	2.4	−	−	V
	Low	$V_{OL\ (MO)}$	−	I_{OL} = 24 mA when the output is Low	−	−	0.5	V
Supply current		I_{M1}	DC	Outputs open, In standby mode	−	2	3	mA
		I_{M2}	DC	Outputs open, ENABLE = Low	−	3.5	5	mA
		I_{M3}	DC	Outputs open (two-phase excitation)	−	5	7	mA
Output leakage current	High-side	I_{OH}	DC	V_{RS} = VM = 40 V, V_{OUT} = 0 V	−	−	1	μA
	Low-side	I_{OL}	DC	V_{RS} = VM = V_{OUT} = 40 V	1	−	−	μA
Channel-to-channel differential		ΔI_{OUT1}	DC	Channel-to-channel error	−5	0	5	%
Output current error relative to the predetermined value		ΔI_{OUT2}	DC	I_{OUT} = 1 A	−5	0	5	%
R_S pin current		I_{RS}	DC	V_{RS} = VM = 24 V	0	−	10	μA
Drain-source ON-resistance of the output transistors (upper and lower sum)		$R_{ON\ (D-S)}$	DC	I_{OUT} = 2.0 A, T_j = 25°C	−	1.0	1.5	Ω

Package Dimensions

HSOP28-P-450-0.80 Unit: mm



Notes on Contents

Block Diagrams

Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purposes.

IC Usage Considerations

Notes on handling of ICs

(1) 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 the device breakdown, damage or deterioration, and may result injury by explosion or combustion.

(2) Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current 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 smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.

(3) 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.

(4) Do not insert devices incorrectly or in the wrong orientation.
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 breakdown, damage or deterioration of the device, and may result in injury by explosion or combustion.
In addition, do not use any device that has had current applied to it while inserted incorrectly or in the wrong orientation even once.

(5) Carefully select power amp, regulator, or other external components (such as inputs and negative feedback capacitors) and load components (such as speakers).
If there is a large amount of leakage current such as input or negative feedback capacitors, 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 can cause smoke or ignition. (The over current can 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 on 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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