STRUCTURE Silicon monolithic integrated circuits

PRODUCT SERIES Bipolar stepping motor driver

TYPE **BD6389FM**

FUNCTION
- PWM constant current controllable two H bridge driver
- Built-in translator circuit for CLK-IN control
- Full, Half, Quarter step
- Mixed Decay control
- Parallel IN control

○Absolute maximum ratings(Ta=25℃)

Item	Symbol	Limit	Unit
Supply voltage	$V_{CC0,1,2}$	-0.2～+36.0	V
Power dissipation	Pd	2.8※1	W
		5.2※2	W
Input voltage for control pin	V_{IN}	-0.2～+5.5	V
RNF maximum voltage	V_{RNF}	0.5	V
Maximum output current	I_{OUT}	2.2※3	A/phase
Operating temperature range	T_{opr}	-25～+75	℃
Storage temperature range	T_{stg}	-55～+150	℃
Junction temperature	T_{jmax}	150	℃

※1 70mm×70mm×1.6mm glass epoxy board. Derating in done at 22.4mW/℃ for operating above Ta=25℃.
※2 4-layer recommended board. Derating in done at 41.6mW/℃ for operating above Ta=25℃.
※3 Do not, however exceed Pd, ASO and Tjmax=150℃.

○Operating conditions (Ta=-25～+75℃)

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	$V_{CC0,1,2}$	10	24	28	V
Output current	I_{OUT}	-	1.7	1.9※4	A/phase

※4 Do not, however exceed Pd, ASO.

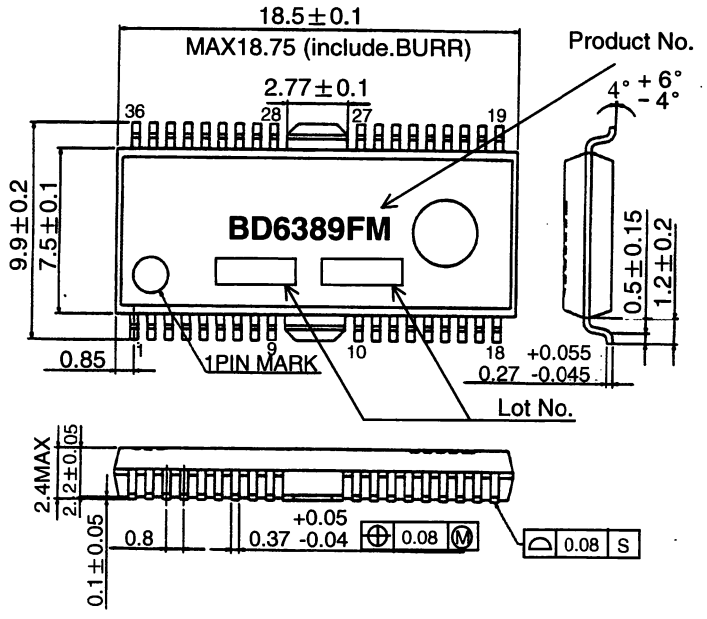
This product isn't designed for protection against radioactive rays.

Status of this document
The Japanese version of this document is the formal specification.
A customer may use this translation version only for a reference to help reading the formal version.
If there are any differences in translation version of this document, formal version takes priority.

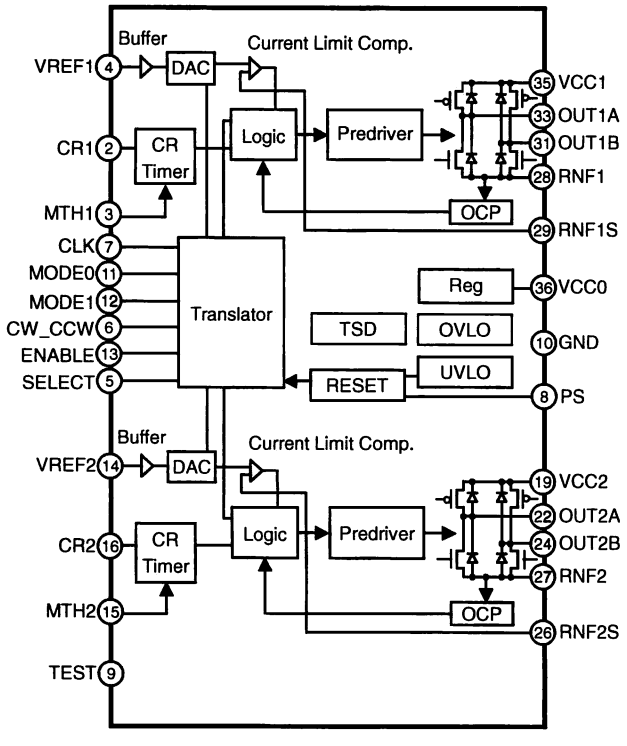
○Electrical characteristics (Unless otherwise specified Ta=25℃, VCC0,1,2=24V)

Item	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
Whole						
Circuit current at standby	I_{CCST}	-	1.0	3.0	mA	PS=L
Circuit current	I_{CC}	-	4.5	10	mA	PS=H, VREFX=2V
Control input (SELECT, CW_CCW, CLK, PS, MODE0, MODE1, ENABLE)						
H level input voltage	V_{INH}	2.0	-	-	V	
L level input voltage	V_{INL}	-	-	0.8	V	
H level input current	I_{INH}	35	50	85	μA	V_{IN}=5V
L level input current	I_{INL}	-10	0	-	μA	V_{IN}=0V
Output (OUT1A, OUT1B, OUT2A, OUT2B)						
Output ON resistance	R_{ON}	-	0.7	0.91	Ω	I_{OUT}=1.7A, Sum of upper and lower
Output leak current	I_{LEAK}	-	-	10	μA	
Current control						
RNFXS input current	I_{RNFS}	-2.0	-0.2	-	μA	RNFXS =0V
RNFX input current	I_{RNF}	-40	-20	-	μA	RNFX=0V
VREFX input current	I_{VREF}	-2.0	-0.1	-	μA	VREFX=0V
VREFX input voltage range	V_{REF}	0	-	2.0	V	
MTHX input current	I_{MTH}	-2.0	-0.1	-	μA	MTHX=0V
MTHX input voltage range	V_{MTH}	0	-	3.5	V	
Comparator threshold	V_{CTH}	0.36	0.40	0.44	V	VREFX=2V
Minimum on time	t_{ONMIN}	0.3	0.7	1.2	μs	R=39kΩ,C=1000pF

○Package outline



○Block diagram



○Pin No. / Pin name

Pin No.	Pin name	Pin No.	Pin name
1	N.C	19	VCC2
2	CR1	20	N.C
3	MTH1	21	N.C
4	VREF1	22	OUT2A
5	SELECT	23	N.C
6	CW_CCW	24	OUT2B
7	CLK	25	N.C.
8	PS	26	RNF2S
9	TEST	27	RNF2
FIN	FIN	FIN	FIN
10	GND	28	RNF1
11	MODE0	29	RNF1S
12	MODE1	30	N.C.
13	ENABLE	31	OUT1B
14	VREF2	32	N.C
15	MTH2	33	OUT1A
16	CR2	34	N.C
17	N.C	35	VCC1
18	N.C	36	VCC0

NC : Non Connection

FIN : Connect to GND

○Operation Notes

(1) Absolute maximum ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

(2) Power supply lines

As return of current regenerated by back EMF of motor happens, take steps such as putting capacitor between power supply and GND as an electric pathway for the regenerated current. Be sure that there is no problem with each property such as emptied capacity at lower temperature regarding electrolytic capacitor to decide capacity value. If the connected power supply does not have sufficient current absorption capacity, regenerative current will cause the voltage on the power supply line to rise, which combined with the product and its peripheral circuitry may exceed the absolute maximum ratings. It is recommended to implement a physical safety measure such as the insertion of a voltage clamp diode between the power supply and GND pins.

(3) GND potential

The potential of GND pin must be minimum potential in all operating conditions.

(4) Thermal design

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions. This IC is equipped with FIN heat dissipation terminals, but dissipation efficiency can be improved by applying heat dissipation treatment in this area. It is important to consider actual usage conditions and to take as large a dissipation pattern as possible.

(5) Actions in strong electromagnetic field

Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

(6) ASO

When using the IC, set the output transistor so that it does not exceed absolute maximum ratings or ASO.

(7) Thermal shutdown circuit

The IC has a built-in thermal shutdown circuit (TSD circuit). If the chip temperature becomes Tjmax=150℃, and higher, coil output to the motor will be open. The TSD circuit is designed only to shut the IC off to prevent runaway thermal operation. It is not designed to protect or indemnify peripheral equipment. Do not use the TSD function to protect peripheral equipment.

(8) Ground Wiring Pattern

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the ground potential of application so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

(9) TEST pin

Be sure to connect TEST pin to GND.

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