Panasonic

High torque and High spinning

PWM System Motor Drive IC for Optical Disk
AN41101A

Overview

AN41101A is the spindle motor drive IC for Optical disk which achieves low vibration and low power consumption by adopting phase control system which combines high torque and rotation and Direct PWM (pulse-duration modulation) drive system for low vibration.

Features

- Phase control system
- Raised 50% rotation number by High torque motor when leading power factor operation (Compared to our previous product)
- Achieved low noise and low vibration drive by adopting high efficiency of PWM.
- Built-in Gain switching, PWM frequency switching, Chip temperature detecting terminal and Reverse detecting terminal.
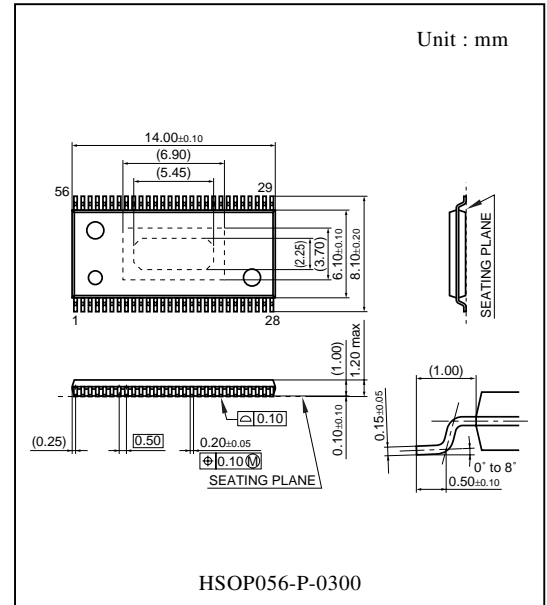- Adopted small and slim packages

Unit : mm

HSOP056-P-0300

Application

Covering all ReWriteable disks such as DVD-RAM or CD-RW DVD-RAM.

Block Diagram
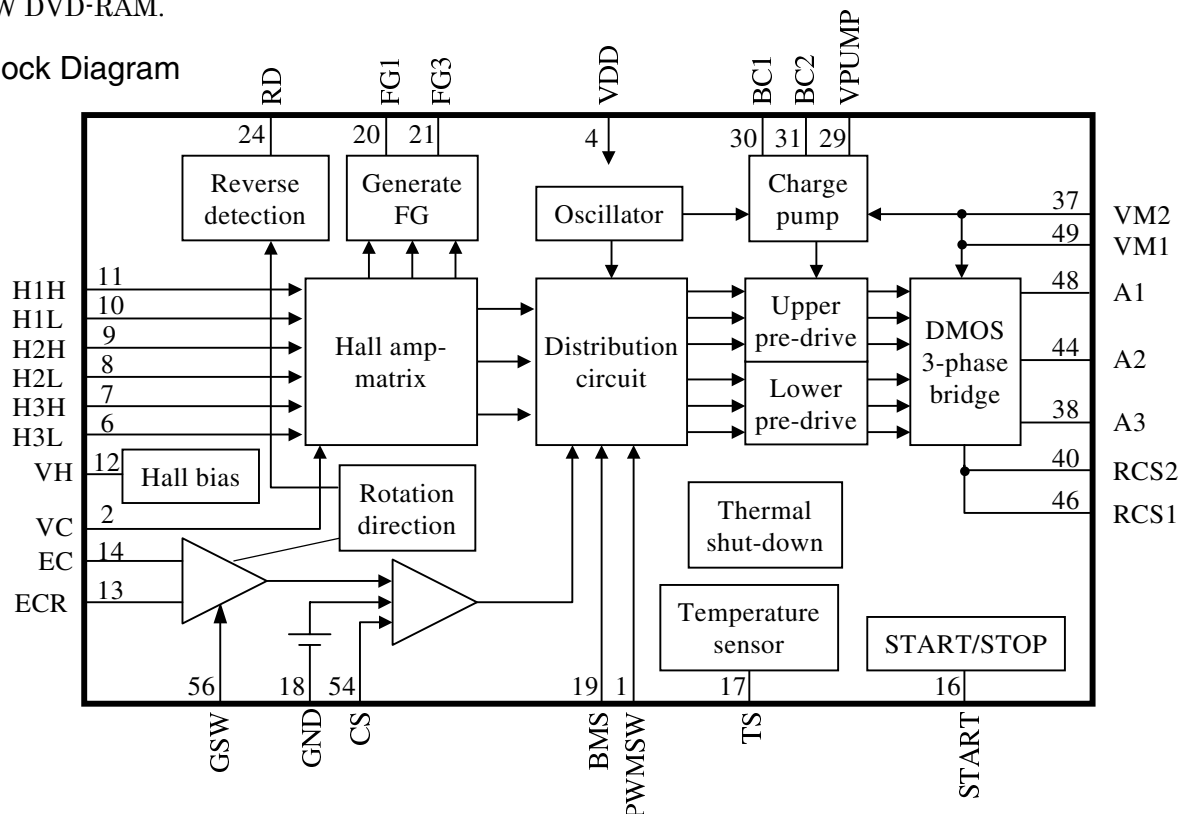
Semiconductor Company,   Matsushita Electric Industrial Co., Ltd.

Terminal descriptions

No	Brevity Code	Terminal Name	No	Brevity Code	Terminal Name
1	PWMSW	PWM frequency switching terminal	29	VPUMP	Charge pump set-up output
2	VC	Phase shift control terminal	30	BC1	Charge pump capacity connecting terminal1
3	N.C	N.C	31	BC2	Charge pump capacity connecting terminal2
4	VDD	Power supply	32	N.C	N.C
5	N.C	N.C	33	N.C	N.C
6	H3L	Hall elements 3 negative input terminal	34	N.C	N.C
7	H3H	Hall elements 3 positive input terminal	35	N.C	N.C
8	H2L	Hall element 2 negative input terminal	36	N.C	N.C
9	H2H	Hall element positive input terminal2	37	VM2	Motor power terminal 2
10	H1L	Hall element 1 minus input terminal	38	A3	Drive output 3
11	H1H	Hall element 1 plus input terminal	39	N.C	N.C
12	VH	Hall Bias terminal	40	RCS2	Current detecting terminal 2(Force)
13	ECR	Torque standard order input terminal	41	N.C	N.C
14	EC	Torque order input terminal	42	N.C	N.C
15	N.C	N.C	43	N.C	N.C
16	START	START/STOP switching terminal	44	A2	Drive output 2
17	TS	Chip temperature detecting terminal (O. C)	45	N.C	N.C
18	GND	GND terminal	46	RCS1	Current detecting terminal 1(Force)
19	BMS	Break-mode switching terminal	47	N.C	N.C
20	FG1	FG signal output terminal (O. C)	48	A1	Drive output 1
21	FG3	×3 FG signal input terminal (O. C)	49	VM1	Motor power terminal 1
22	N.C	N.C	50	N.C	N.C
23	N.C	N.C	51	N.C	N.C
24	RD	Reverse detecting terminal (O. C)	52	N.C	N.C
25	N.C	N.C	53	N.C	N.C
26	N.C	N.C	54	CS	Current detecting terminal (Sense)
27	N.C	N.C	55	N.C	N.C
28	N.C	N.C	56	GSW	Torque control Gain switching terminal

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit	Note
Storage temperature	Tstg	−55 to 150	°C	1
Operating ambient temperature	Topr	−30 to 85	°C	1
Supply voltage	VDD	6.0	V	
	VM1	14	V	2
	VM2			
Supply current	IDD	30	mA	
Power dissipation	Pd	448	mW	3
Drive output voltage	I (o)	± 1500	mA	Note) 4 o=38,40,46,48
Drive output voltage	V (m)	15	V	m=38,44,48
Control signal input voltage	V (n)	0 to VDD	V	n=1,2,13,14,16,19,56
Hall bias current	IHB(I)	30	mA	I=6,7,8,9,10,11,12

Note 1) Except for the operating ambient temperature and storage temperature, all ratings are for Ta=25°C.
Note 2) The supply voltage of pressurization circuit will be more than Supply voltage. Refer to sheet No.5
Note 3) Refer to sheet No.6
Note 4) Refer to sheet No.7

Operating Supply Voltage Range

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	VDD	4.5	5.0	5.5	V
	VM1	10.8	12.0	13.4	V
	VM2				

Electric Characteristics (If not specifically mentioned, operating ambient temperature is 25°C± 2°C,VDD=5.0V,VM1=VM2=12.0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Entire						
Circuit current 1	I_{DD1}	START=0V	—	0	0.1	mA
Circuit current 2	I_{DD2}	START=5V	—	6	12	mA
Start/Stop						
Start voltage	V_{START}	Voltage to make circuit turns ON by L→H	2.2	—	—	V
Stop voltage	V_{STOP}	Voltage to make circuit turns OFF by L→H	—	—	0.7	V
Hall Bias						
Hall bias voltage	V_{HB}	I_{HB}=20mA	0.7	1.0	1.3	V
Hall amplifier						
Input bias Current	I_{BH}		—	—	5.0	μA
In-phase input voltage range	V_{HBR}		1.5	—	4.0	V
Minimum input level	V_{INH}	Determined by difference input	50	—	—	mVp-p
Torque control						
In-phase input voltage range	EC		0.5	—	3.9	V
Offset voltage	EC_{OF}		100	—	100	mV
Dead zone	EC_{DZ}		50	—	200	mV
Input current	EC_{IN}	EC=ECR=2.5V	−5	—	—	μA
Input/Output Gain 1	A_{CS1}	GSW=0V,R_{CS}=0.22Ω	0.64	0.86	1.07	A/V
Input/Output Gain 2	A_{CS2}	GSW=5V,R_{CS}=0.22Ω	0.32	0.43	0.53	A/V
Torque limit current	I_{TL}	GSW=0V,R_{CS}=0.22Ω	720	900	1080	mA
Output						
Upper side ON resistance	R_{ONU}	I_O=−500mA	—	0.22	0.45	Ω
Upper side ON resistance	R_{ONL}	I_O= 500mA	—	0.28	0.55	Ω
FG						
FG1 output High level	$FG1_H$	IFG1= −0.01mA	4.5	—	—	V
FG1 output Low level	$FG1_L$	IFG1= 0.01mA	—	—	0.6	V
FG2 output High level	$FG2_H$	IFG3= −0.01mA	4.5	—	—	V
FG2 output Low level	$FG2_L$	IFG3= 0.01mA	—	—	0.6	V
BMS						
Short break voltage	V_{SBM}	Short mode voltage	2.2	—	—	V
Reverse break voltage	V_{RBM}	Reverse mode voltage	—	—	0.7	V

Electric Characteristics (If not specifically mentioned, operating ambient temperature is 25°C± 2°C,VDD=5.0V,VM1=VM2=12.0V)
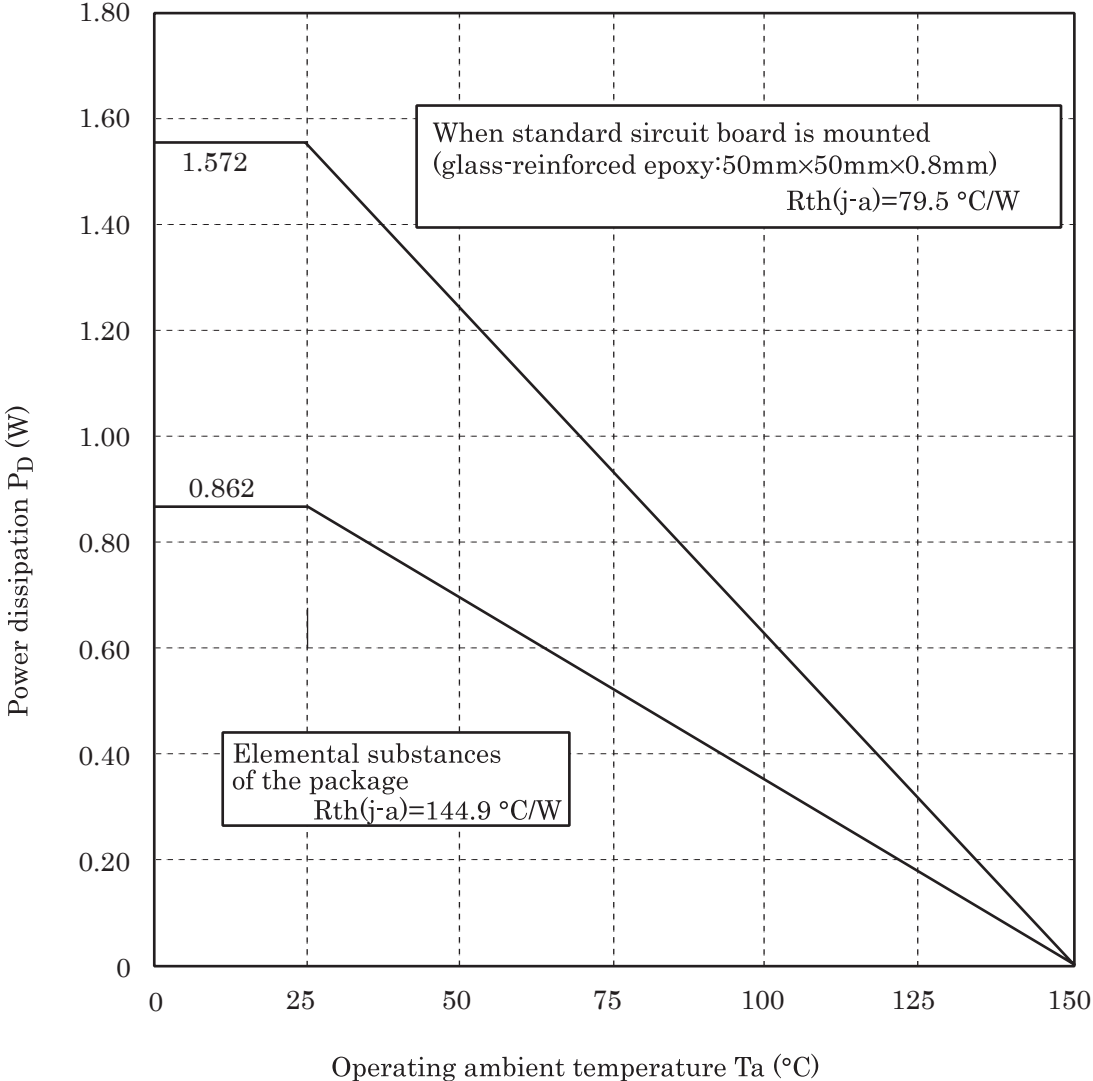
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
[Charge pump circuit]						
Charge pump voltage	V_{PUMP}		14.0	—	20.0	V
[Switching PWM oscillation]						
Input High level	PWM_H		2.2	—	—	V
Input Low level	PWM_L		—	—	0.7	V
[Reverse rotation detection]						
Normal rotation output voltage	V_{FD}	$I_{RD}=-0.01mA$	4.5	—	—	V
Reverse rotation output voltage	V_{RD}	$I_{RD}= 0.01mA$	—	—	0.6	V

(Design reference data)

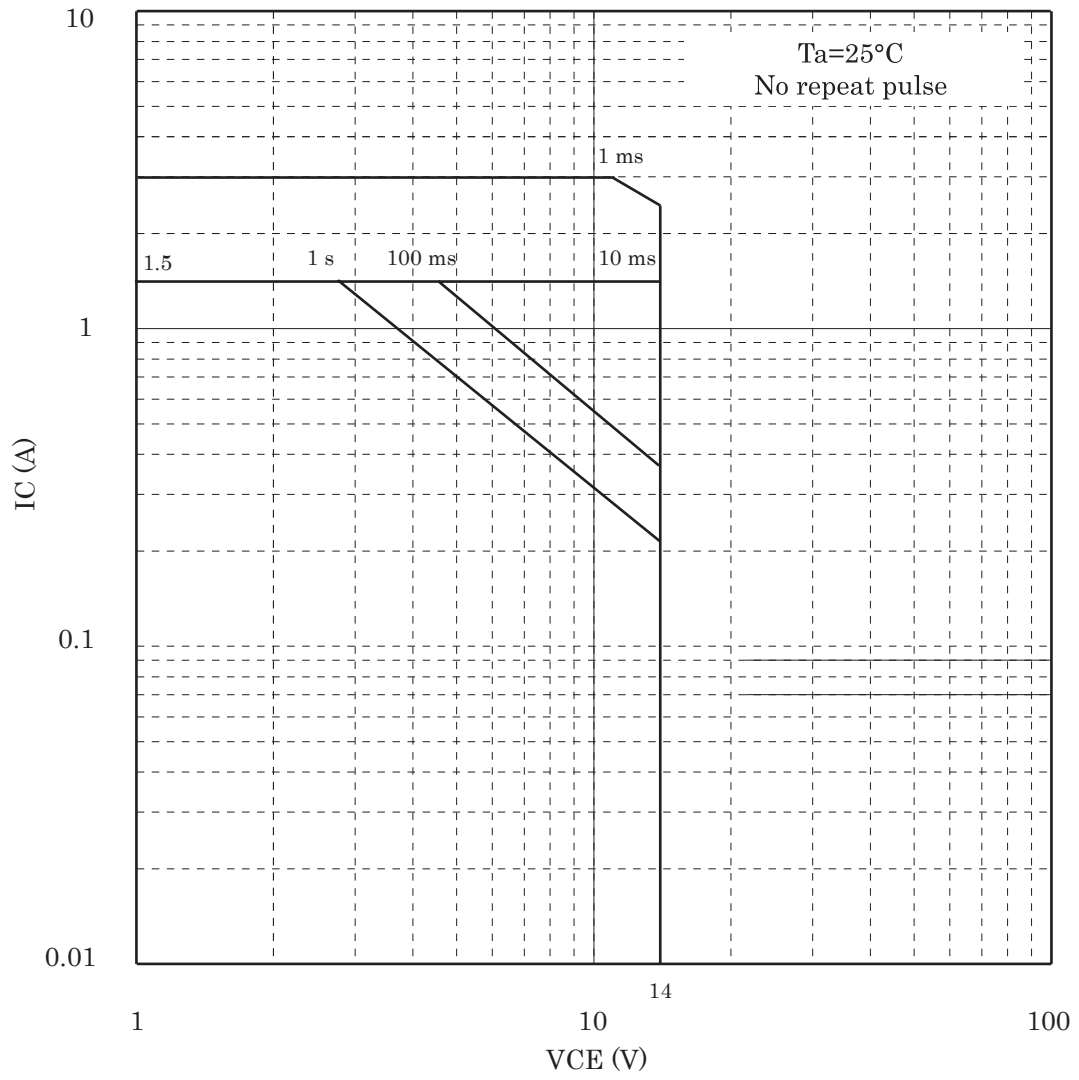| Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
[Thermal protection]						
Thermal protection operating temperature	TSD_{ON}		—	160	—	°C
Thermal protecting maximum hysteresis error	ΔTSD		—	45	—	V
[Temperature sensor]						
Output voltage	V_{TS}	ITS=2mA	—	0.9	—	V
[Hall signal phase shift]						
Phase shift angle	H_{θ}	VC=3V	—	60	—	Deg.
[PWM frequency]						
Oscillation frequency 1	fPWMH	PWMSW=5V	—	120	—	kHz
Oscillation frequency 2	fPWML	PWMSW=0V	—	60	—	kHz

Note   The characteristics listed above are reference value based on the IC design and are not guaranteed.

Package power dissipation

Package power dissipation graph. X-axis: Operating ambient temperature Ta (°C) from 0 to 150. Y-axis: Power dissipation P_D (W) from 0 to 1.80.

- Upper curve: "When standard sircuit board is mounted (glass-reinforced epoxy:50mm×50mm×0.8mm) Rth(j-a)=79.5 °C/W" — starts at 1.572, flat until 25°C, then decreasing to 0 at 150°C.
- Lower curve: "Elemental substances of the package Rth(j-a)=144.9 °C/W" — starts at 0.862, flat until 25°C, then decreasing to 0 at 150°C.

Area of safety operation

Area of safety operation graph. X-axis: VCE (V) from 1 to 100. Y-axis: IC (A) from 0.01 to 10. Curves labeled 1 ms, 10 ms, 100 ms, 1 s, 1.5. Conditions: Ta=25°C, No repeat pulse. Vertical reference line at 14.

Phase condition of hall input and output voltage
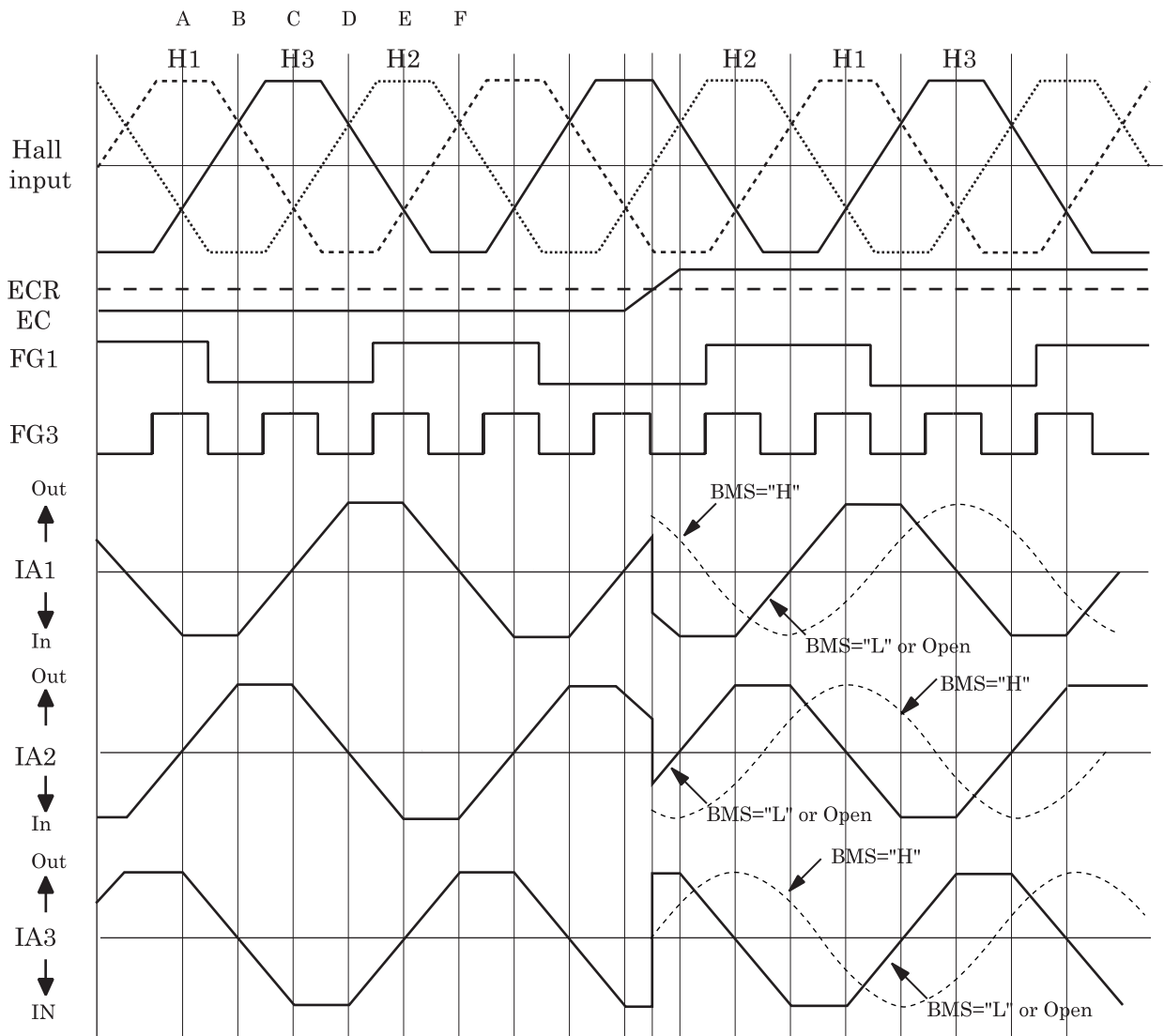
	H1	H2	H3
Hall input			
A	H	ML	ML
B	MH	L	MH
C	ML	ML	H
D	L	MH	MH
E	ML	H	ML
F	MH	MH	L

BMS="H" : Short
BMS="L" : Reverse