

3-phase motor driver for CD-ROMs

BD6660FV

The BD6660FV is low power consumption CD-ROM spindle driver that uses MOS transistor in the output. To meet the requirements for notebook computers, the thin power package SSOP-B28 is used and a PWM drive with a MOS processor output stage achieves an extremely low power consumption.

●Applications

Portable CD-ROMs, DVDs

●Features

- 1) Direct PWM drive.
- 2) Built-in power save circuit.
- 3) Built-in current limiter circuit.
- 4) Built-in FG output.
- 5) Built-in Hall biasing.
- 6) Built-in reverse-rotation prevention circuit.
- 7) Built-in short brake.
- 8) Low power consumption with the output MOSFET.
- 9) Built-in brake mode switching circuit.
- 10) Built-in rotation detection pin.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Applied voltage	V _{CC}	7	V
Applied voltage	V _M	7	V
Power dissipation	P _d	1020*1	mW
Operating temperature	T _{opr}	-20~+75	°C
Storage temperature	T _{stg}	-55~+150	°C
Output current	I _{OMAX}	1000*2	mA

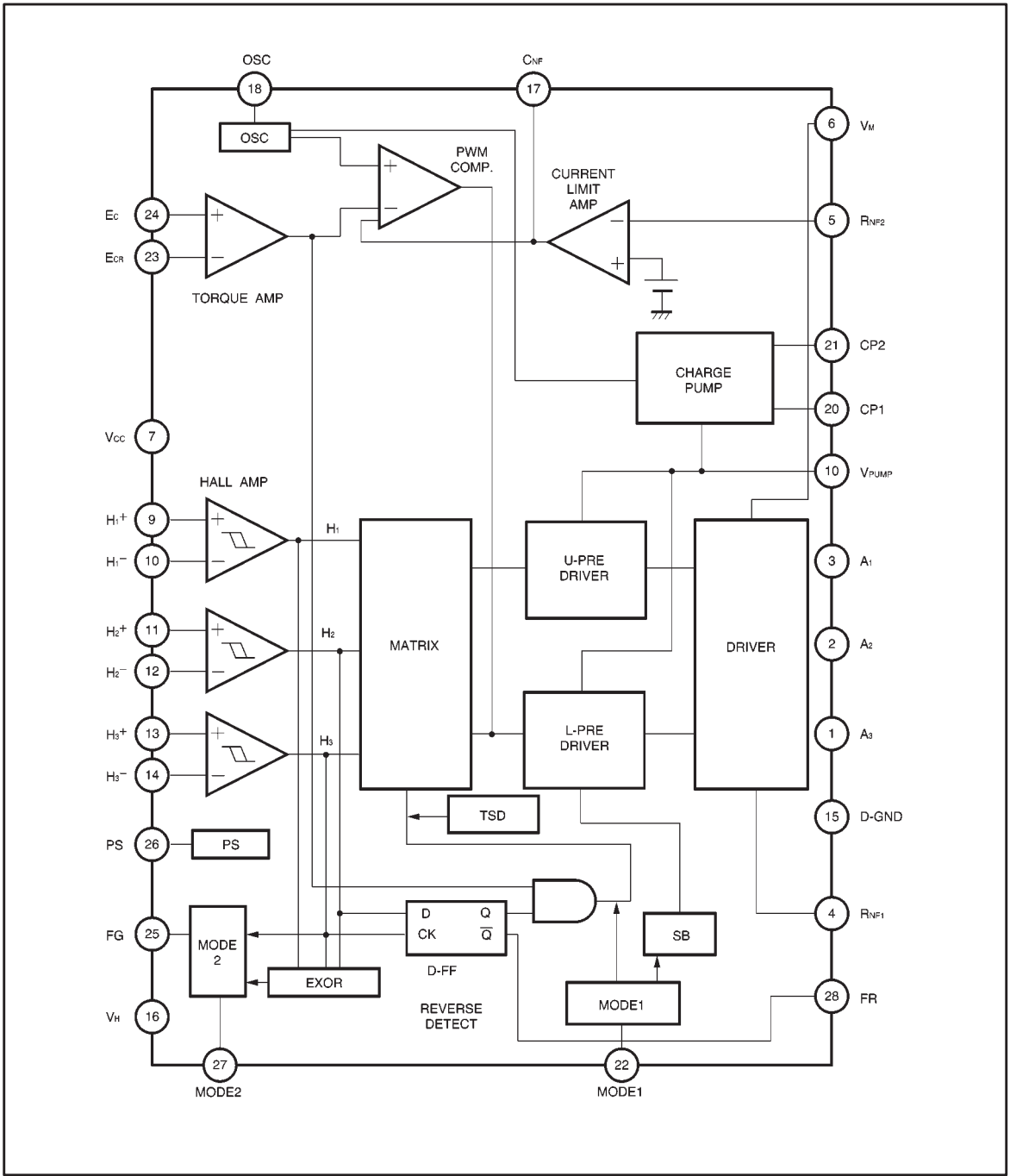
*1 When mounted on a 70mm×70mm×1.6mm glass epoxy board.
Reduced by 8.16mW for each increase in Ta of 1°C over 25°C.

*2 Should not exceed Pd or ASO values.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Operating power supply voltage	V _{CC}	4.5~5.5	V
	V _M	3~6.5	V
	V _{PUMP}	14	V

●Block diagram

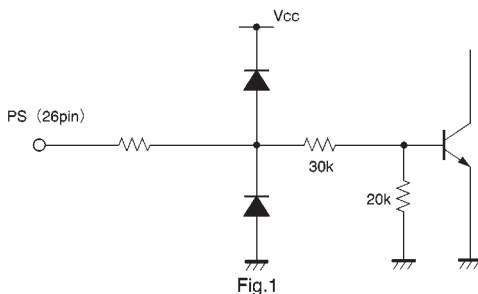


● Pin descriptions

Pin No.	Pin name	Function
1	A ₃	Output
2	A ₂	Output
3	A ₁	Output
4	R _{NF1}	For connection of resistor for output current detection
5	R _{NF2}	For connection of resistor for output current detection
6	V _M	Motor power supply
7	V _{CC}	Power supply
8	GND	GND
9	H ₁ ⁺	Hall signal input
10	H ₁ ⁻	Hall signal input
11	H ₂ ⁺	Hall signal input
12	H ₂ ⁻	Hall signal input
13	H ₃ ⁺	Hall signal input
14	H ₃ ⁻	Hall signal input
15	D—GND	Digital—GND
16	V _H	Hall bias
17	C _{NF}	For connection of capacitor for phase compensation
18	OSC	For connection of capacitor for oscillator
19	V _{PUMP}	Charge pump output
20	CP ₁	For connection of capacitor 1 for charge pump
21	CP ₂	For connection of capacitor 2 for charge pump
22	MODE1	Brake mode switch
23	E _{CR}	Output voltage control reference
24	E _c	Output voltage control
25	FG	FG output
26	PS	Power save
27	MODE2	FG output switching
28	FR	Rotation direction sensor

● Input and output circuits

(1) Power save



(2) Torque amplifier

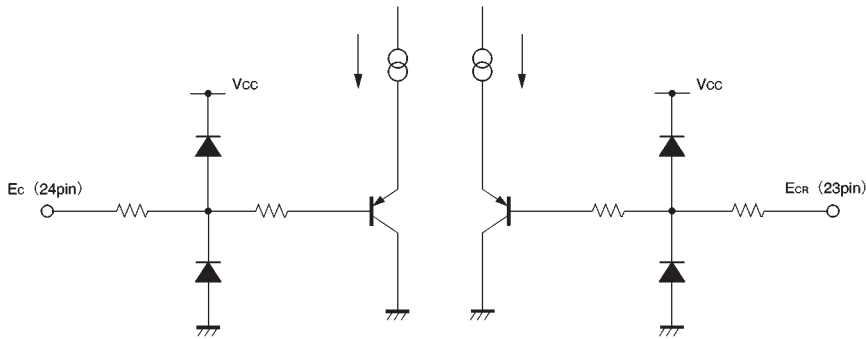


Fig.2

(3) MODE1

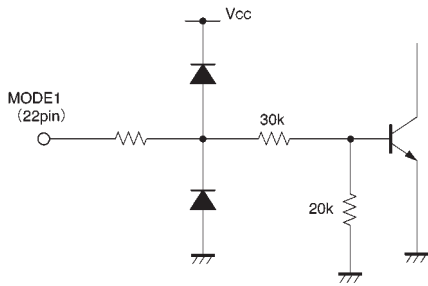
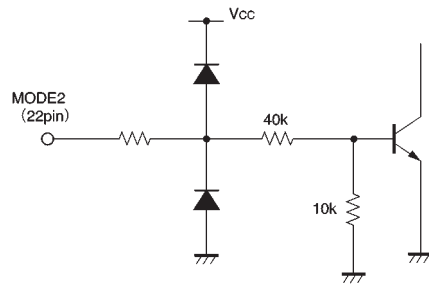


Fig.3

(4) MODE2



※ Resistor values are typical values.

Fig.4

(5) Output pin

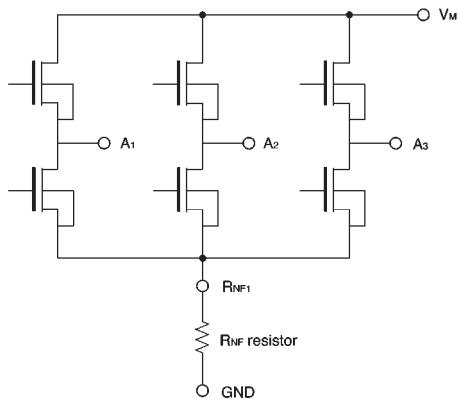


Fig.5

(6) Hall bias pin

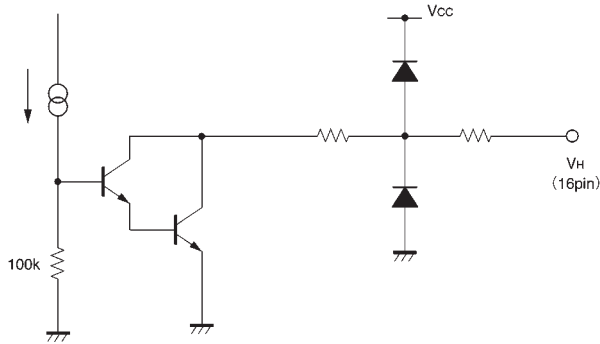


Fig.6

(7) FG output / CP₁ output / FR output

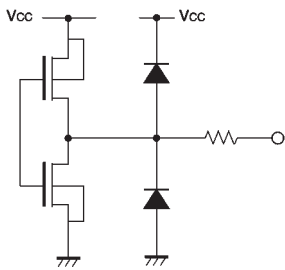


Fig.7

(8) CP₂ / V_{PUMP} output

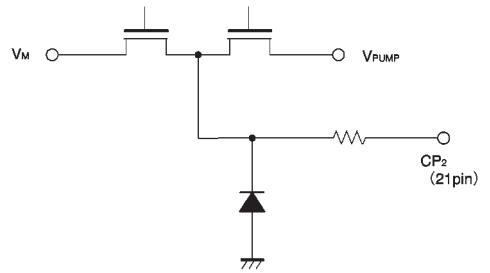


Fig.8

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 5V, V_M = 5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈Overall〉						
Circuit current 1	I _{CC1}	—	—	0.4	mA	Standby mode
Circuit current 2	I _{CC2}	—	4.2	—	mA	—
〈Power save〉						
ON voltage range	V _{PSON}	—	—	1.0	V	Standby mode
OFF voltage range	V _{PSOFF}	2.5	—	—	V	—
〈Hall bias〉						
Hall bias voltage	V _{HB}	—	0.9	1.5	V	I _{HB} =10mA
〈Hall amplifier〉						
Input bias current	I _{HA}	—	0.0	—	μA	—
Common phase input voltage	V _{HAR}	1.5	—	4.0	V	—
Minimum input level	V _{INH}	50	—	—	mV _{P-P}	—
Hall hysteresis level	V _{HYS}	—	20	—	mV	—
〈Torque command〉						
Input voltage	E _C , E _{CR}	0.5	—	3.3	V	—
Offset voltage (+)	E _{cof+}	20	50	80	mV	—
Offset voltage (—)	E _{cof—}	—80	—50	—20	mV	—
Input current	E _{CIN}	—3.0	—1.0	—	μA	E _C =E _{CR} =1.65V
PWM high level control range	V _{PWMH}	—	E _{CR} +1	—	V	E _{CR} =1.65V
PWM low level control range	V _{PWML}	—	E _{CR} —1	—	V	E _{CR} =1.65V
〈Brake mode switching〉						
ON voltage range	V _{MODE1ON}	2.5	—	—	V	Short brake
OFF voltage range	V _{MODE1OFF}	—	—	1.0	V	Reverse rotation brake
〈Output〉						
Output on resistance	R _{ON}	—	0.7	—	Ω	I _o =±600mA
Output limit voltage	V _{TL}	—	0.2	—	V	With R _{NF} =0.33Ω
〈OSC oscillator〉						
Output high level voltage	V _{HPOSC}	—	2.0	—	V	—
Output low level voltage	V _{LPOSC}	—	1.0	—	V	—
Oscillation frequency (reference value)	F _{OSC}	—	100	—	kHz	With C = 470pF
〈Voltage booster〉						
Charge pump output voltage	V _{PUMP}	—	10	—	V	With V _M = V _{CC} = 5V
〈FG output switching〉						
ON voltage range	V _{MODE2ON}	2.5	—	—	V	Single-phase output
OFF voltage range	V _{MODE2OFF}	—	—	1.0	V	Three-phase composite output

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈FG output〉						
Output high level voltage	V _{FGH}	4.6	—	—	V	I _{FG} =-100 μA
Output low level voltage	V _{FGL}	—	—	0.4	V	I _{FG} =100 μA
〈FR output〉						
Output high level voltage	V _{FRH}	4.6	—	—	V	I _{FR} =-100 μA
Output low level voltage	V _{FRL}	—	—	0.4	V	I _{FR} =100 μA
〈CP1 output〉						
High level saturation voltage	V _{CP1H}	—	0.5	—	V	I _{CP1} =-7mA
Low level saturation voltage	V _{CP1L}	—	0.5	—	V	I _{CP1} =7mA
〈CP2 output〉						
High level saturation voltage	V _{CP2H}	—	0.5	—	V	I _{FR} =-7mA
Low level saturation voltage	V _{CP2L}	—	0.5	—	V	I _{FR} =7mA

● Application example

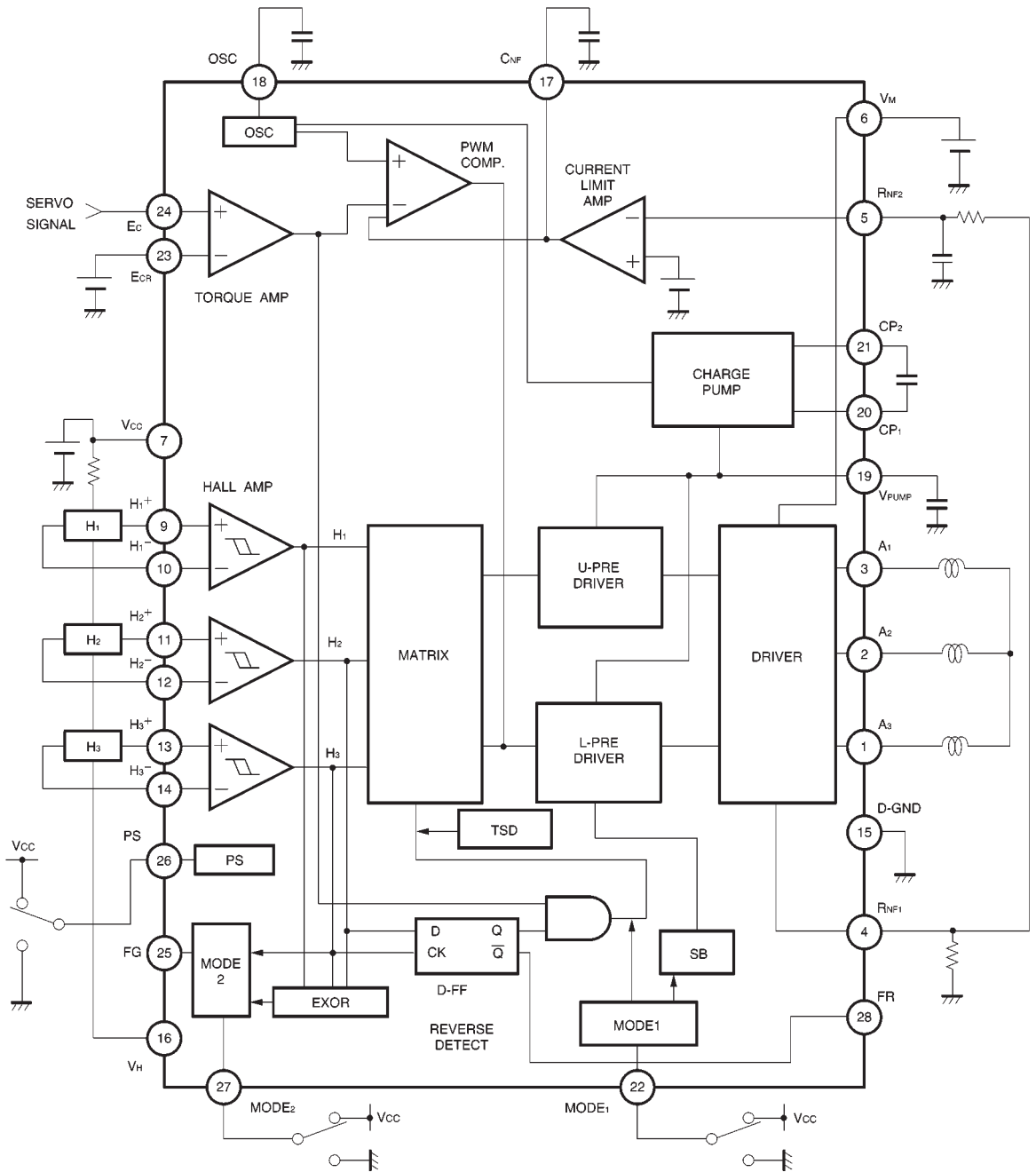


Fig.9

● Operation notes

(1) Brake mode (MODE1) logic

The brake mode is switched by MODE1 pin and the operation is shown in Table-1 below.

MODE1	Operation
L	Reverse rotation brake
H	Short brake

(When $E_c > E_{cR}$)

(2) MODE2 logic

The FG output is switched by MODE2 pin and the operation is shown in Table-2 below.

MODE2	FG output
L	3-phase composite output
H	1-phase output

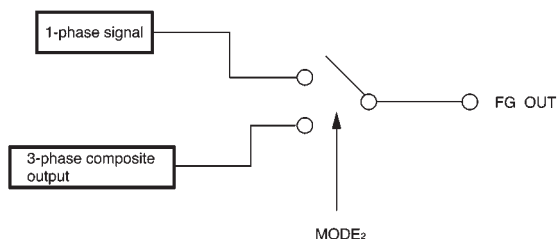


Fig.10

(3) PWM operation

By the voltage potential difference between E_c and E_{cR} , the ON duty when switching the low level output transistor changes as shown in Fig. 11 below. ($E_{cR} = 1.65V$)

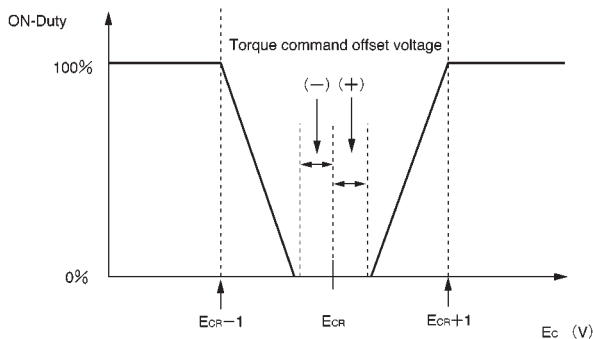


Fig.11

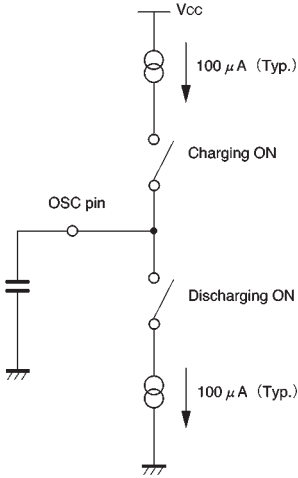
(4) Current limiter operation

When the R_{NF} voltage becomes 0.2V (Typ.), the current limiter circuit activates and limits the PWM ON duty. At this time the output current I_{max} is limited to:

$$I_{max} \approx \text{approx. } 0.2 / R_{NF}$$

(5) OSC oscillator circuit

By connecting a capacitor to the OSC pin, the charging and discharging of the capacitor generates a triangular wave as that shown in Fig. 12. (C = 470pF and f = 100kHz (Typ.))



Internal circuit for OSC pin

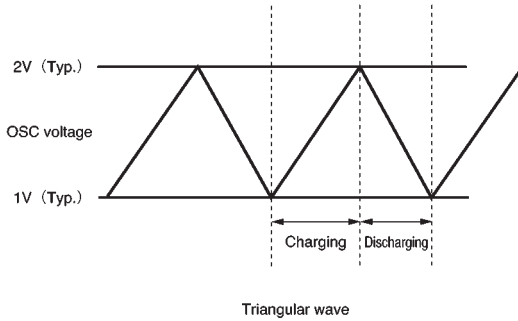


Fig.12

(6) Charge pump

The boost voltage (V_{PUMP}) is $V_M + V_{CC}$. Therefore, to prevent ($V_M + V_{CC}$) from increasing much over ratings, set the V_M and V_{CC} voltages.

(7) Timing chart

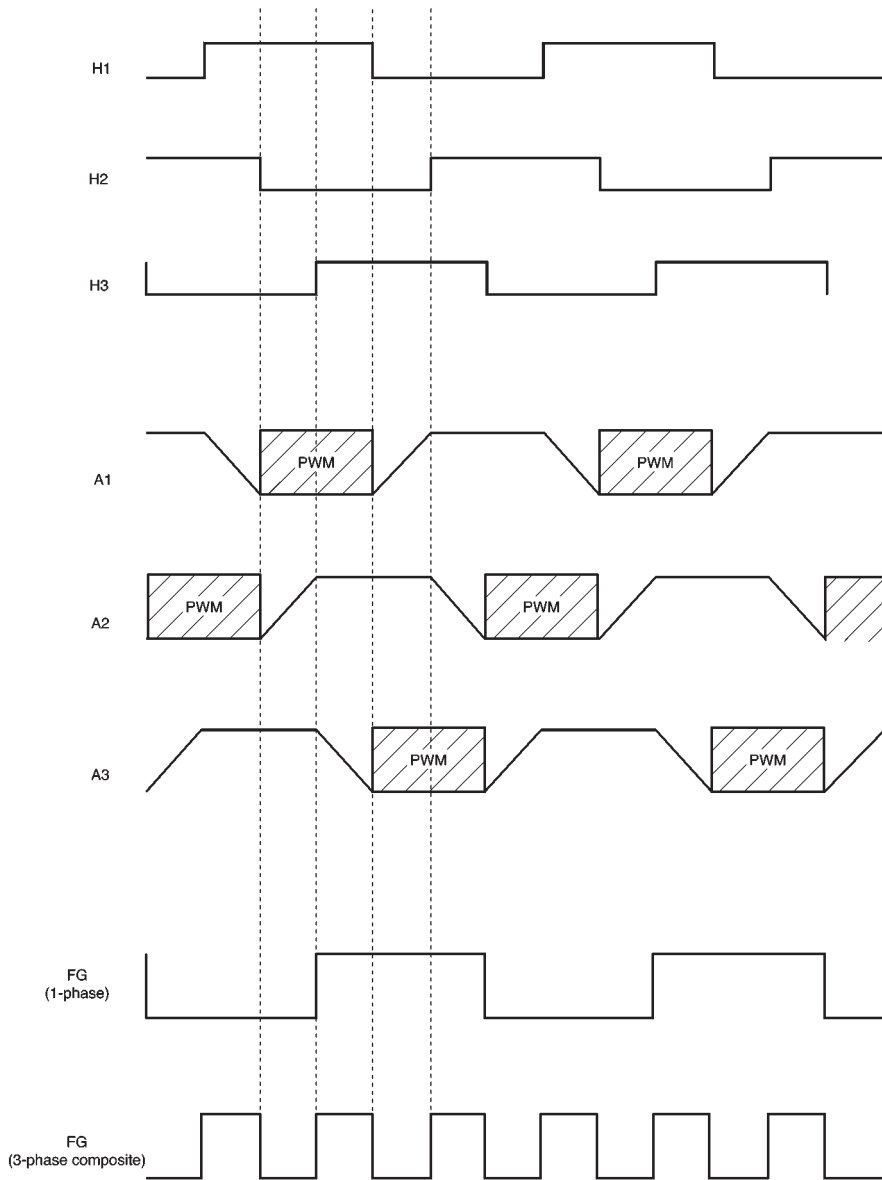


Fig.13

● External dimensions (Units: mm)

