

# 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 <sub>CC</sub>	7	V
Applied voltage	V <sub>M</sub>	7	V
Power dissipation	P <sub>d</sub>	1020*1	mW
Operating temperature	T <sub>opr</sub>	-20~+75	°C
Storage temperature	T <sub>stg</sub>	-55~+150	°C
Output current	I <sub>OMAX</sub>	1000*2	mA

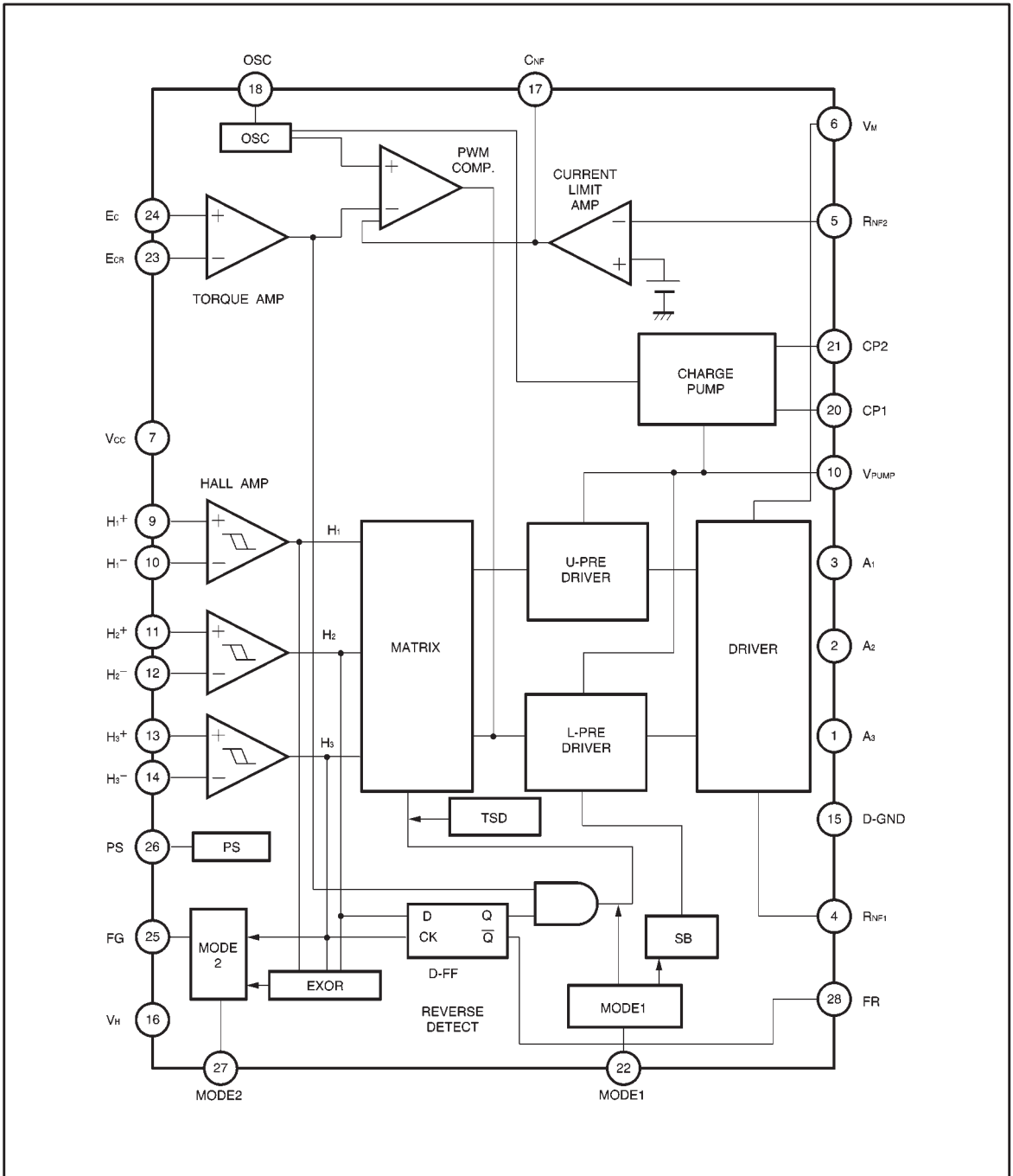
\*1 When mounted on a 70mm×70mm×1.6mm glass epoxy board.  
Reduced by 8.16mW for each increase in Ta of 1°C over 25°C.

\*2 Should not exceed Pd or ASO values.

### ●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Operating power supply voltage	V <sub>CC</sub>	4.5~5.5	V
	V <sub>M</sub>	3~6.5	V
	V <sub>PUMP</sub>	14	V

●Block diagram

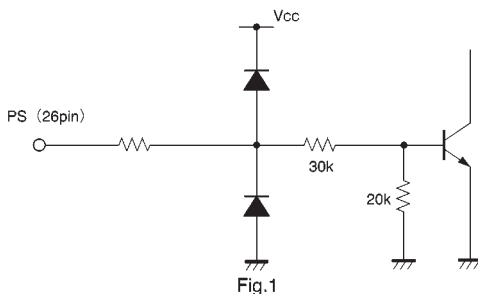


● Pin descriptions

Pin No.	Pin name	Function
1	A <sub>3</sub>	Output
2	A <sub>2</sub>	Output
3	A <sub>1</sub>	Output
4	R <sub>NF1</sub>	For connection of resistor for output current detection
5	R <sub>NF2</sub>	For connection of resistor for output current detection
6	V <sub>M</sub>	Motor power supply
7	V <sub>CC</sub>	Power supply
8	GND	GND
9	H <sub>1</sub> <sup>+</sup>	Hall signal input
10	H <sub>1</sub> <sup>-</sup>	Hall signal input
11	H <sub>2</sub> <sup>+</sup>	Hall signal input
12	H <sub>2</sub> <sup>-</sup>	Hall signal input
13	H <sub>3</sub> <sup>+</sup>	Hall signal input
14	H <sub>3</sub> <sup>-</sup>	Hall signal input
15	D—GND	Digital—GND
16	V <sub>H</sub>	Hall bias
17	C <sub>NF</sub>	For connection of capacitor for phase compensation
18	OSC	For connection of capacitor for oscillator
19	V <sub>PUMP</sub>	Charge pump output
20	CP <sub>1</sub>	For connection of capacitor 1 for charge pump
21	CP <sub>2</sub>	For connection of capacitor 2 for charge pump
22	MODE1	Brake mode switch
23	E <sub>CR</sub>	Output voltage control reference
24	E <sub>c</sub>	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

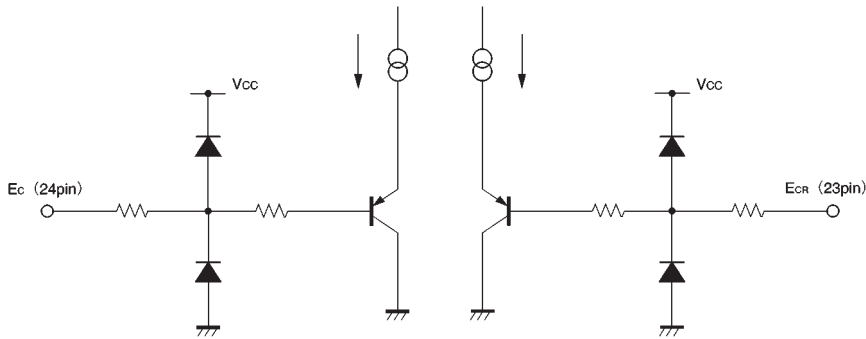


Fig.2

(3) MODE1

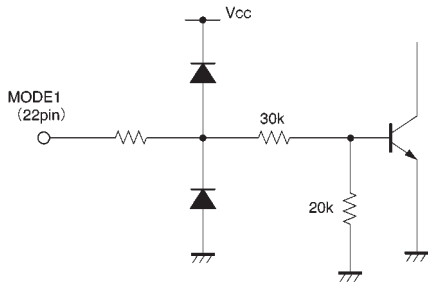
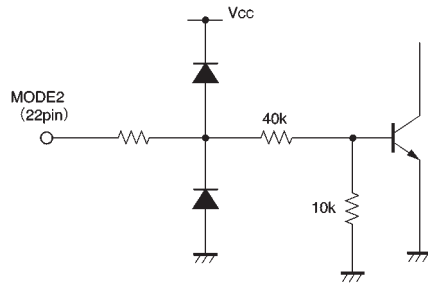


Fig.3

(4) MODE2



※ Resistor values are typical values.

Fig.4

(5) Output pin

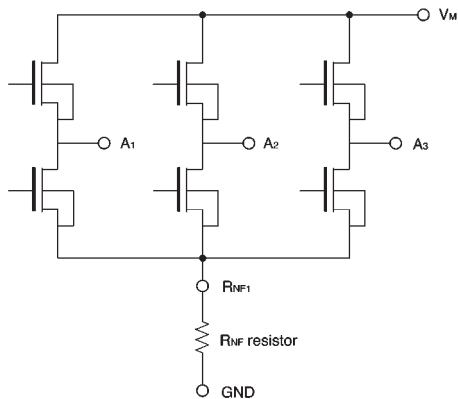


Fig.5

(6) Hall bias pin

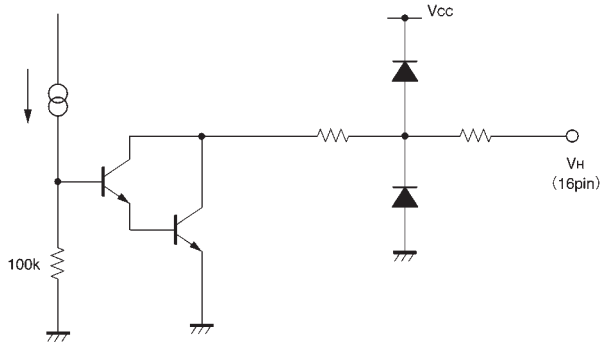


Fig.6

(7) FG output / CP<sub>1</sub> output / FR output

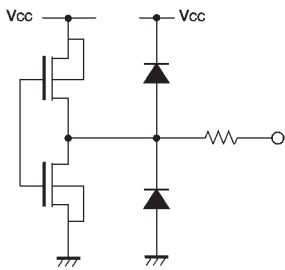


Fig.7

(8) CP<sub>2</sub> / V<sub>PUMP</sub> output

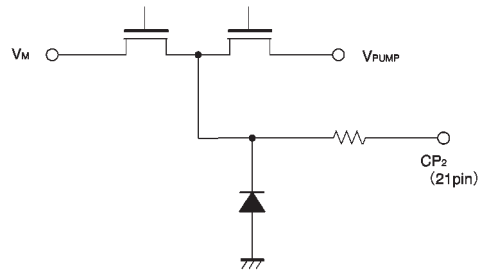


Fig.8

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V<sub>CC</sub> = 5V, V<sub>M</sub> = 5V)

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

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

● Application example

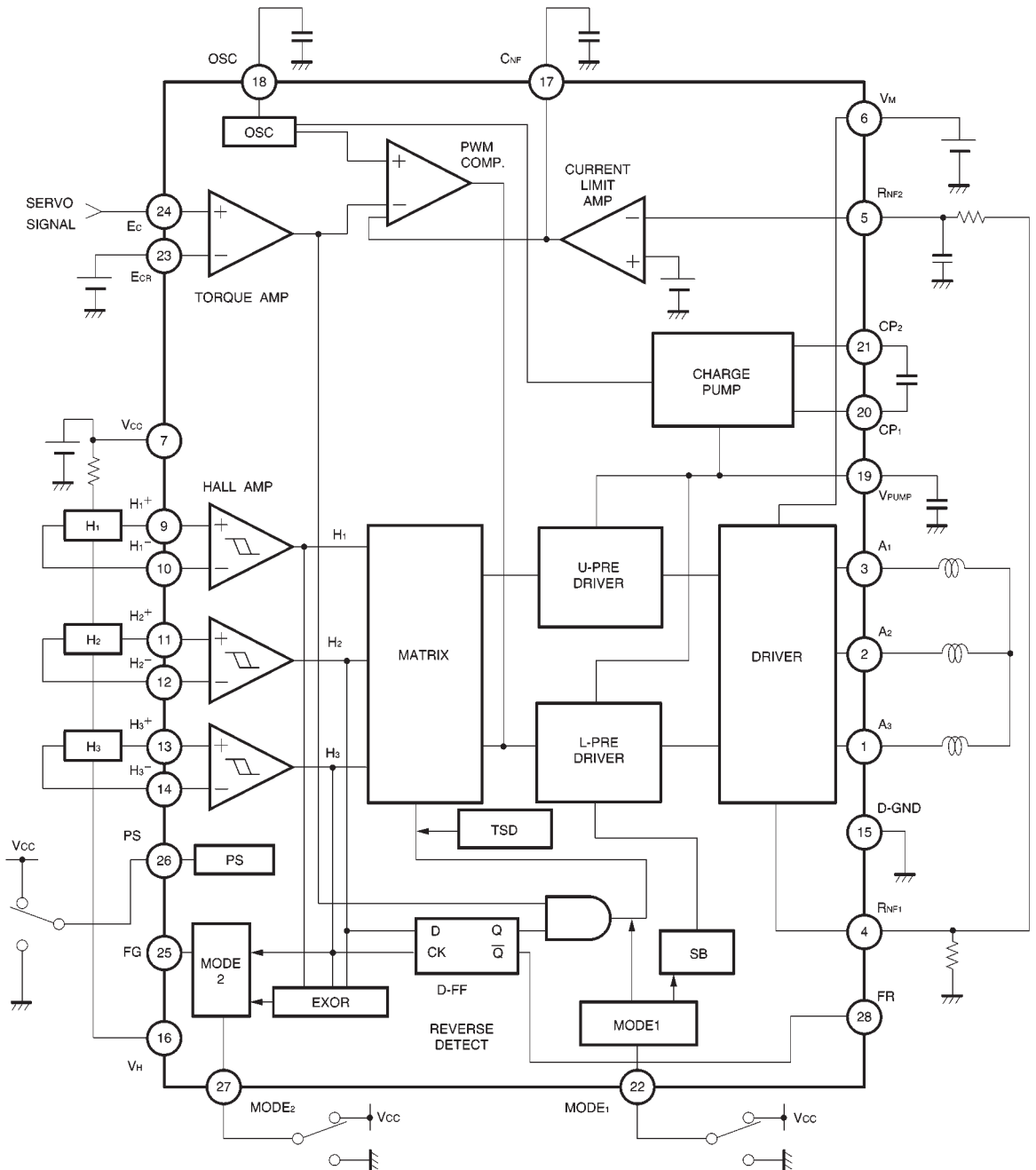


Fig.9



● 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

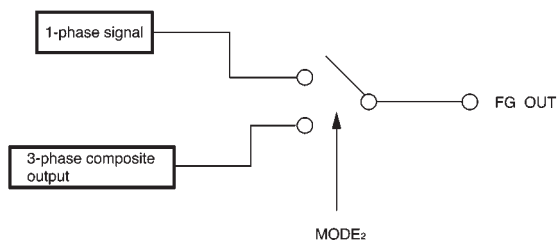


Fig.10

(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. ( $E_{cR} = 1.65V$ )

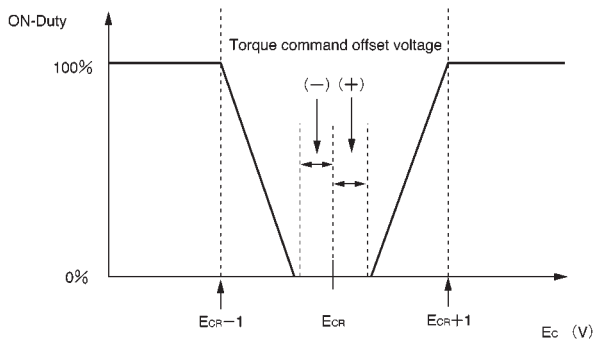


Fig.11

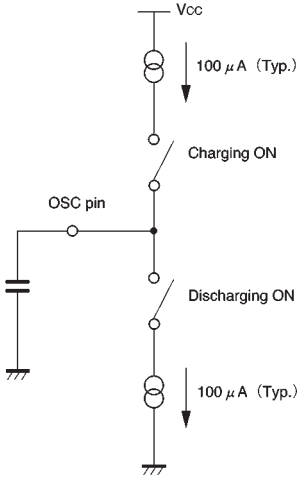
(4) Current limiter operation

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

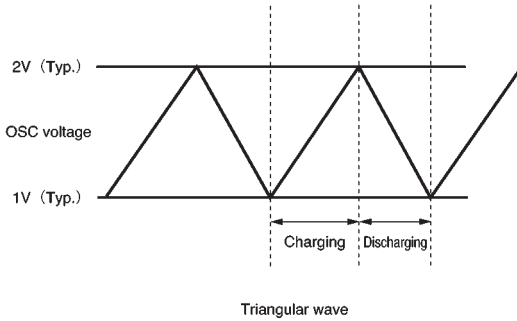


Fig.12

(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

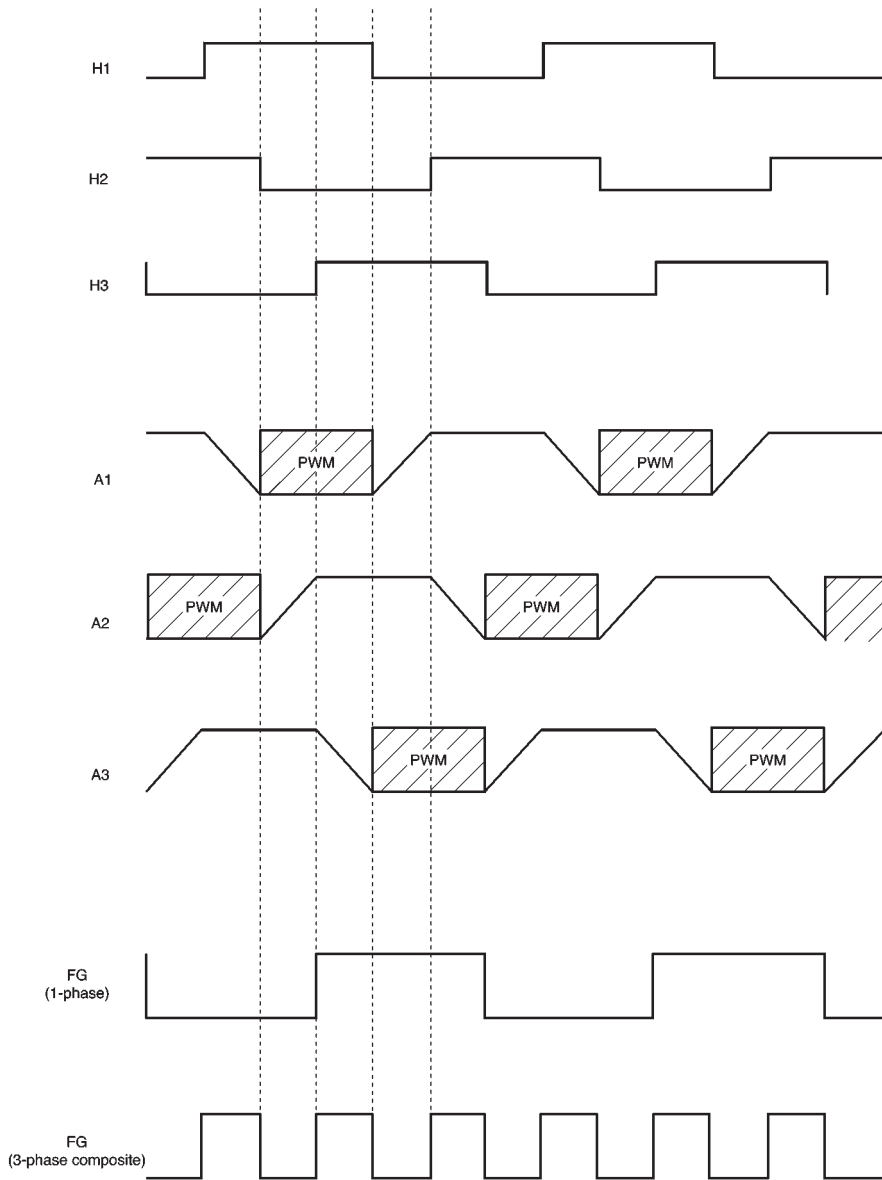


Fig.13

● External dimensions (Units: mm)

