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)

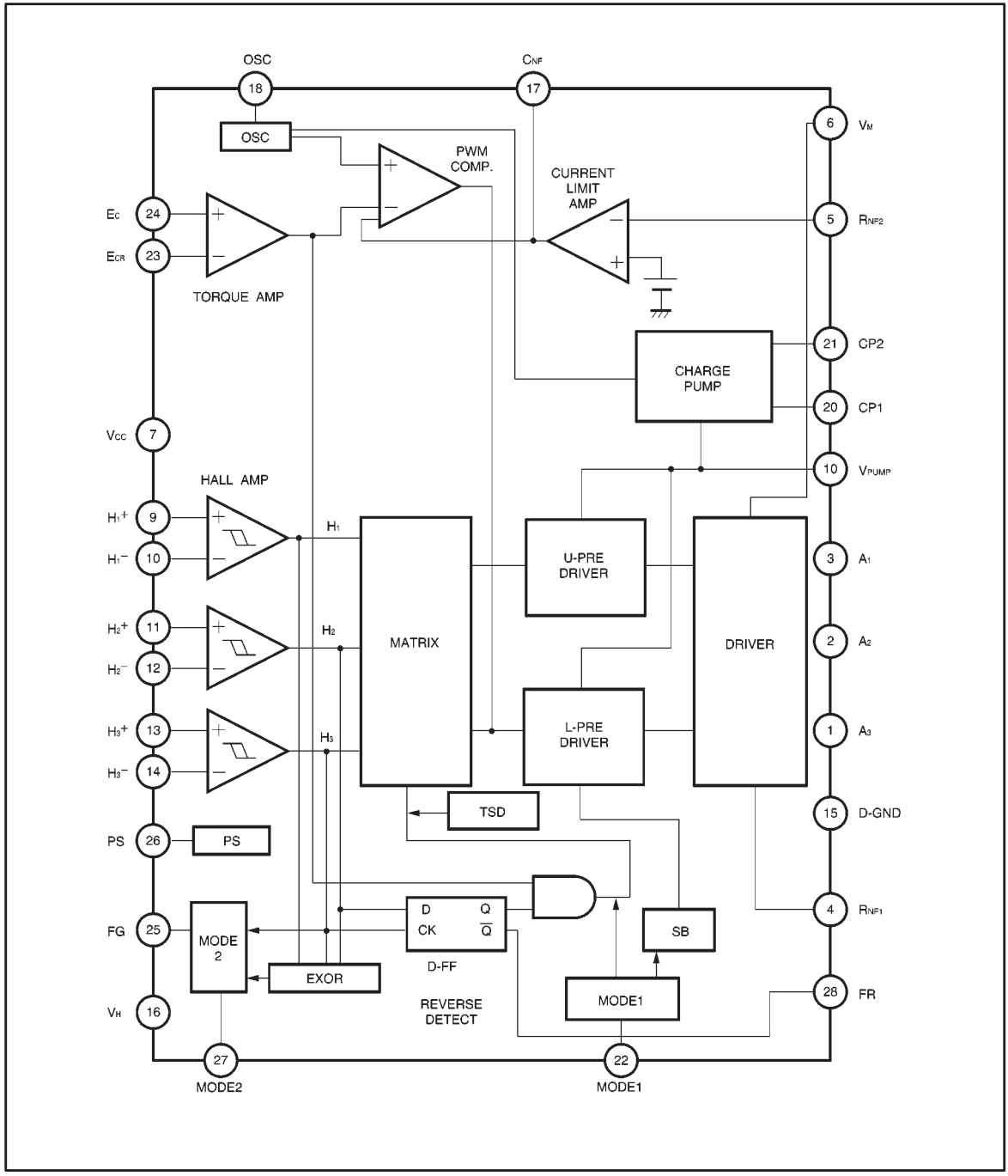
Parameter	Symbol	Limits	Unit
Applid voltage	V_{CC}	7	V
Applid voltage	V_M	7	V
Power dissipation	Pd	1020*1	mW
Operating temperature	Topr	−20～+75	℃
Storage temperature	Tstg	−55～+150	℃
Output current	I_{OMAX}	1000*2	mA

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

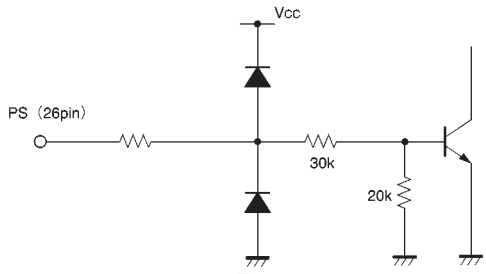


Fig.1

(2) Torque amplifier

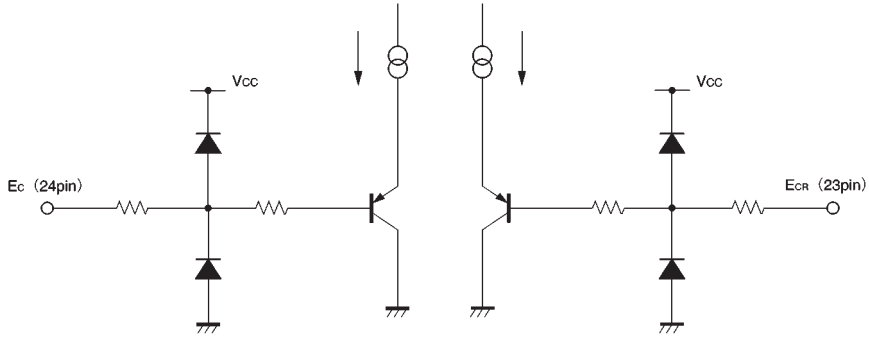


Fig.2

(3) MODE1

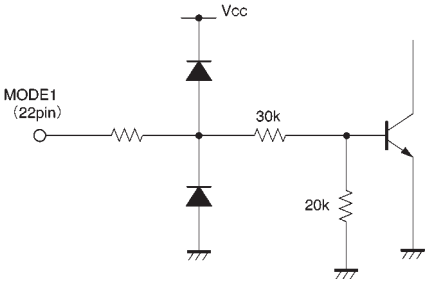
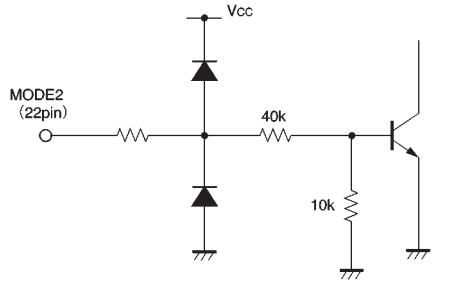


Fig.3

(4) MODE2



※Resistor values are typical values.

Fig.4

(5) Output pin

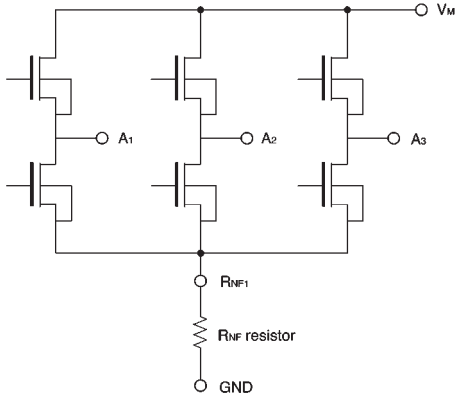


Fig.5

(6) Hall bias pin

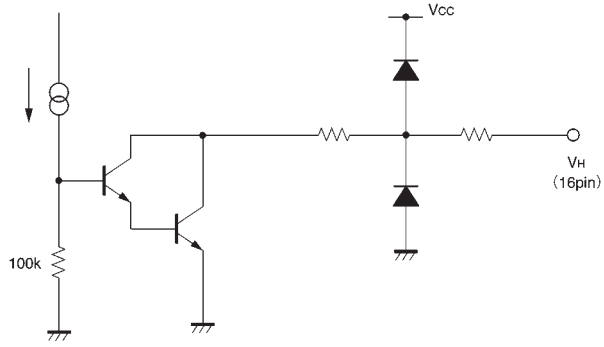


Fig.6

(7) FG output / CP_1 output / FR output

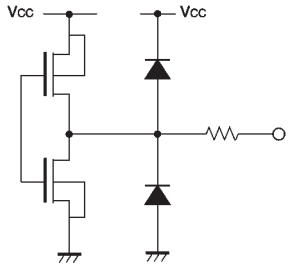


Fig.7

(8) CP_2 / V_{PUMP} output

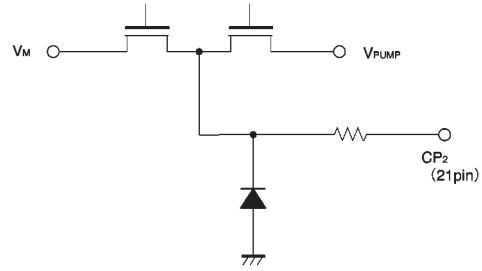


Fig.8

●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 (+)	Ecof+	20	50	80	mV	—
Offset voltage (−)	Ecof−	−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

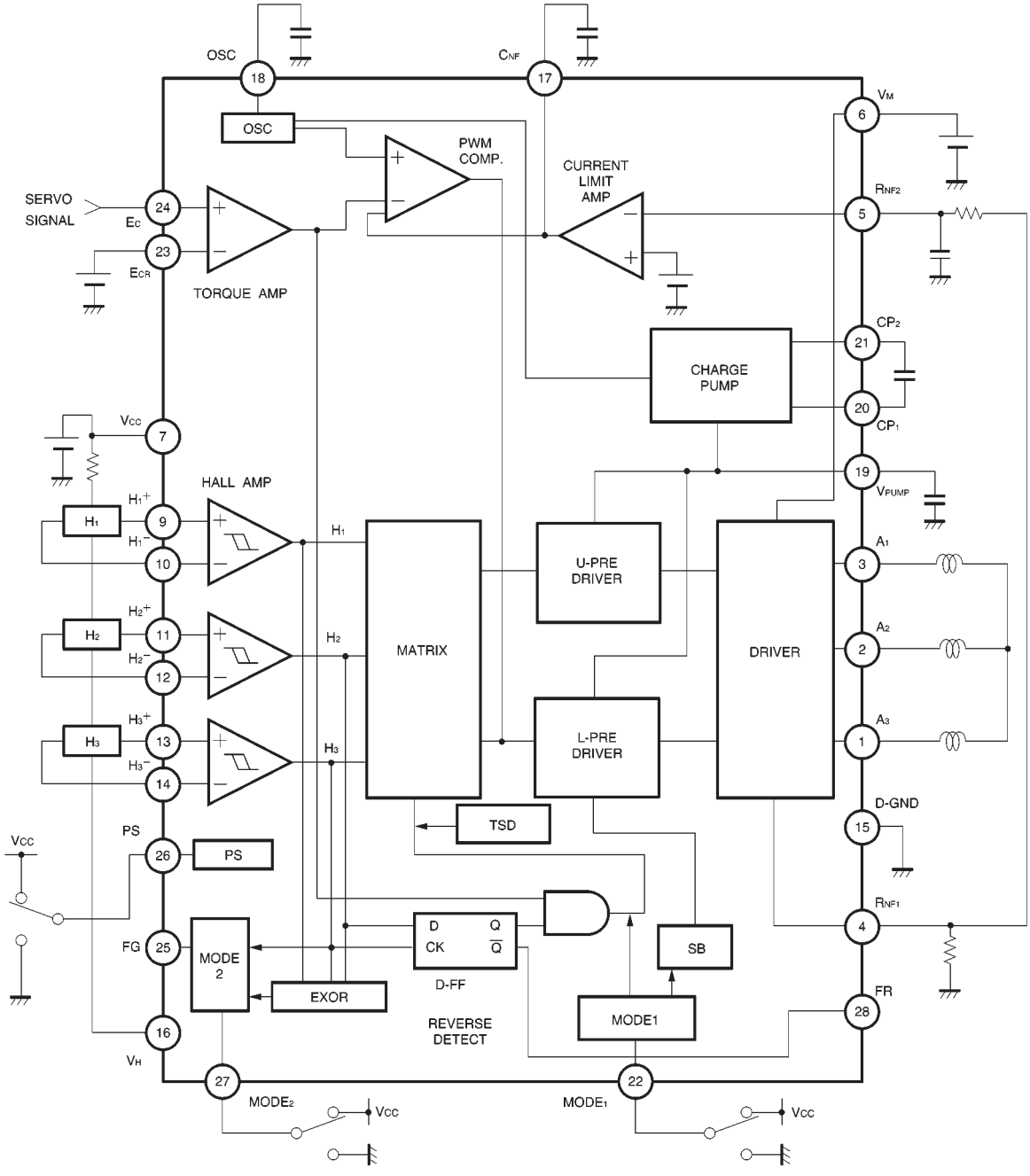


Fig.9

●Operation notes

(1) Brake mode (MODE1) logic

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

Table-1

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.

Table-2

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

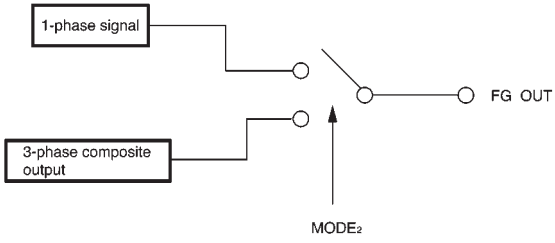


Fig.10

(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)

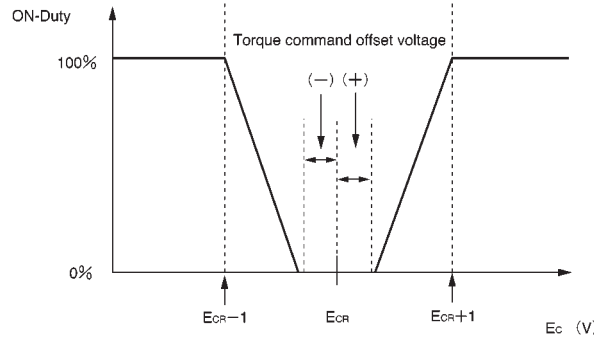


Fig.11

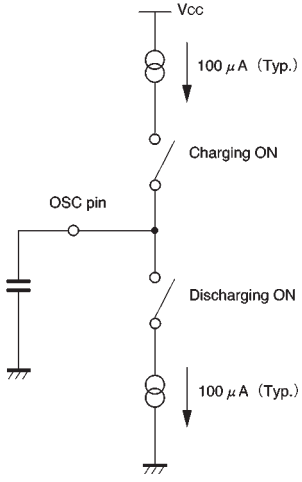
(4) Current limiter operation

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_{omax} is limited to:

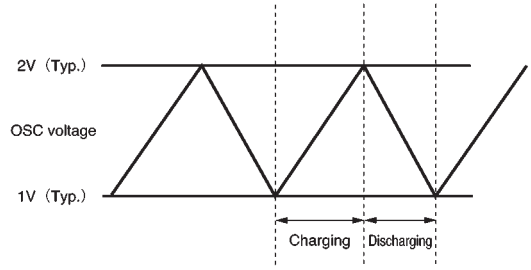
$I_{omax} \fallingdotseq$ approx. $0.2 / R_{NF}$

(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



Triangular wave

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

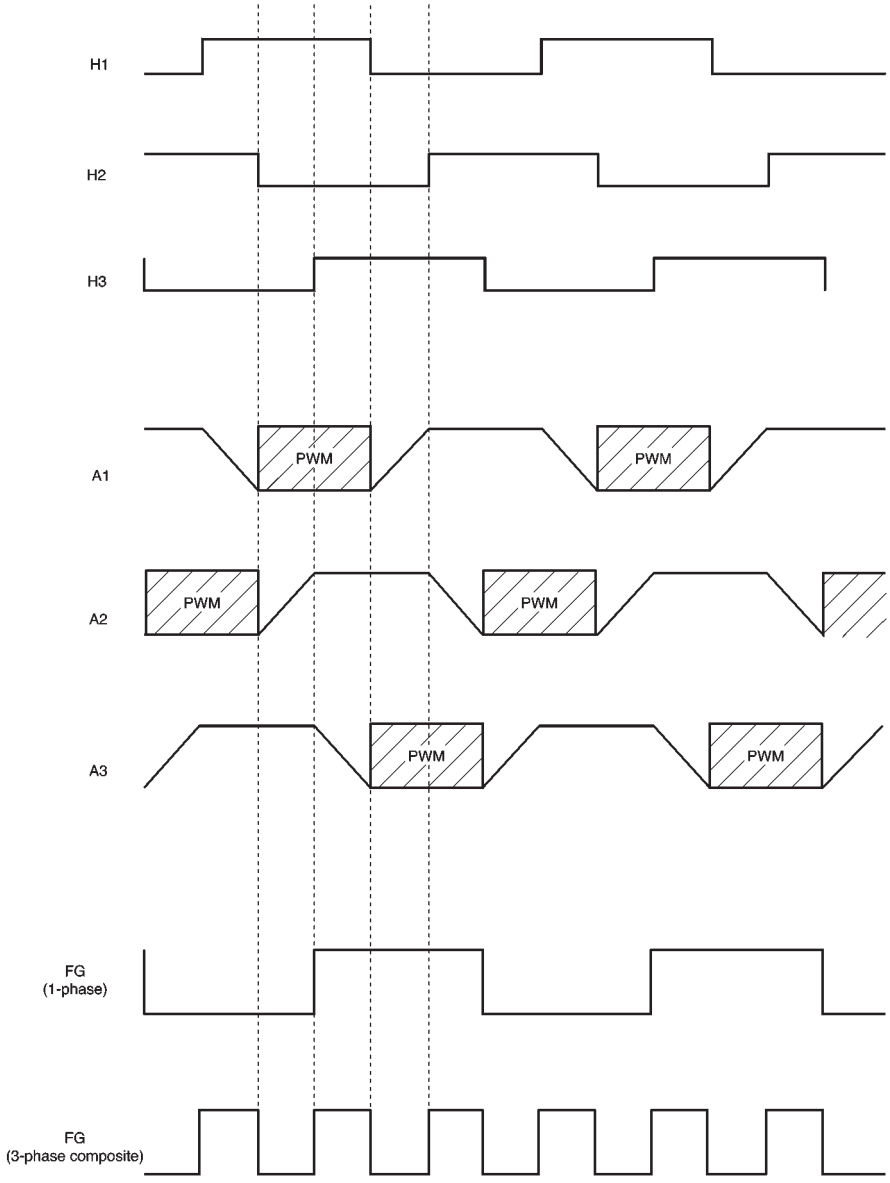
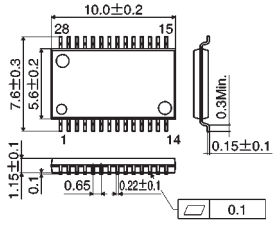


Fig.13

●External dimensions (Units: mm)



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