

Motor driver for CD-ROMs

BA6665FM

The BA6665FM is a CD-ROM spindle motor driver supporting reverse-rotation preventing circuit. It incorporates power save circuit, thermal shut down circuit, FG output, hall bias, etc. The 3-phasefull-wave pseudo linear driving system achieves high-performance and multi-function.

●Applications

CD-ROM / RW, DVD-ROM

●Features

- 1) 3-phase, full-wave pseudo linear driving system
- 2) Built in power save
- 3) Built in thermal shut down circuit
- 4) Built in current limit circuit
- 5) Built in Hall Bias circuit
- 6) Built in FG-output (3 phase parallel output)
- 7) With switching function of regular / reverse rotations

●Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits	Unit
Supply voltage	V _{CC}	7	V
Supply voltage	V _M	15	V
Power dissipation	P _d	2200*1	mW
Operate.temp.range	T _{opr}	-20~+75	°C
Strage.temp.range	T _{stg}	-55~+150	°C
Junction temp.	T _{jmax}	150	°C
Maximum o.current	I _{OUT}	1300*2	mA

70mm×70mm×1.6mm glass epoxy board.

*1 Derating in done at 17.6mW / °C for operating above Ta=25°C.

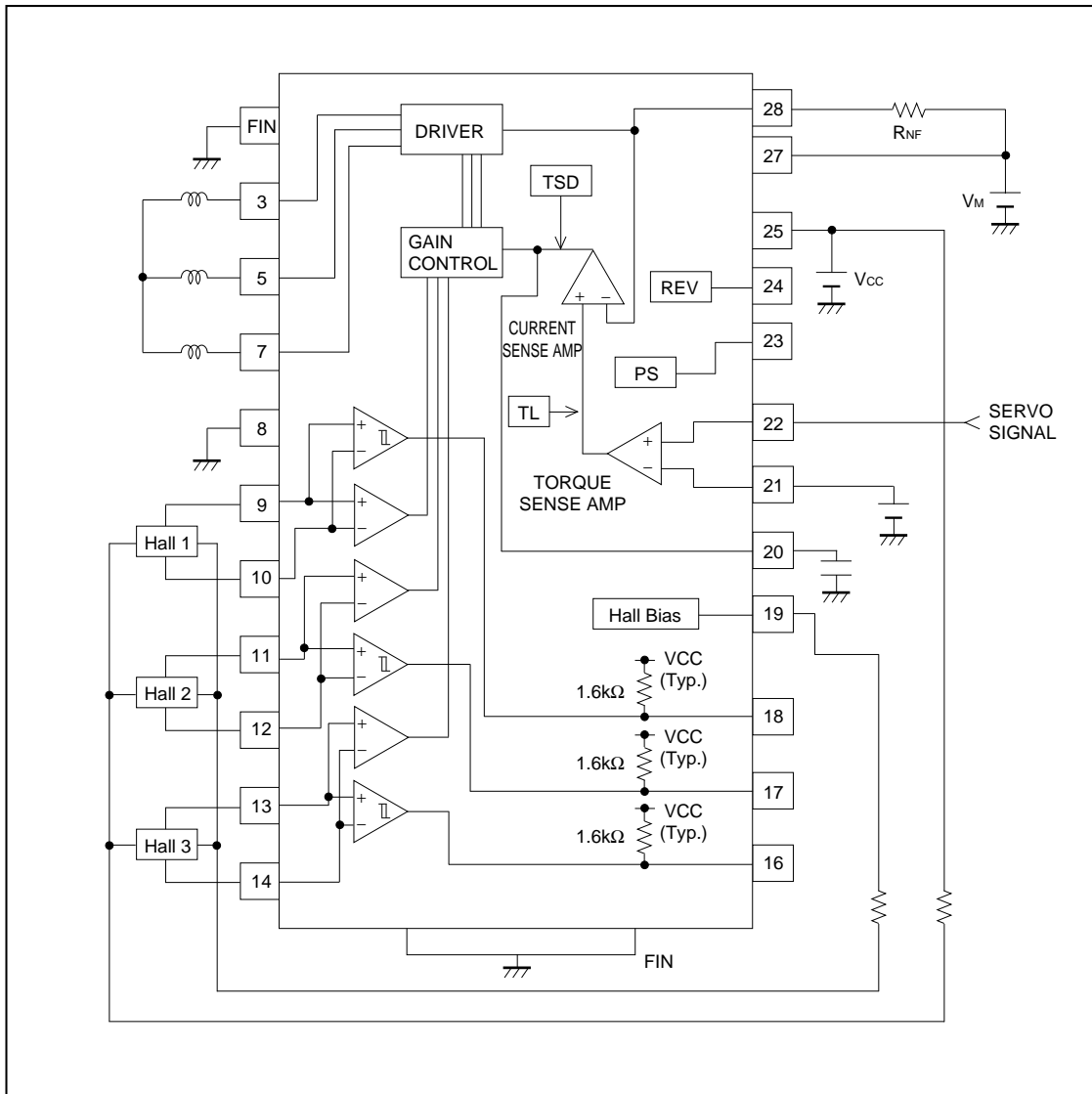
*2 Do not, however exceed Pd, ASO and T_j=150°C.

●Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating supply voltage range	V _{CC}	4.5	–	5.5	V
	V _M	3.0	–	14.0	

Optical disc ICs

●Block diagram



Optical disc ICs

●Pin descriptions

Pin No.	Pin Name	Function
1	N.C.	N.C.
2	N.C.	N.C.
3	A ₃	Output3 for motor
4	N.C.	N.C.
5	A ₂	Output2 for motor
6	N.C.	N.C.
7	A ₁	Output1 for motor
8	GND	GND
9	H ₁ ⁺	Hall input Amp1. positive input
10	H ₁ ⁻	Hall input Amp1. negative input
11	H ₂ ⁺	Hall input Amp2. positive input
12	H ₂ ⁻	Hall input Amp2. negative input
13	H ₃ ⁺	Hall input Amp3. positive input
14	H ₃ ⁻	Hall input Amp3. negative input
15	N.C.	N.C.
16	FG3	FG3 signal output terminal
17	FG2	FG2 signal output terminal
18	FG1	FG1 signal output terminal
19	V _H	Hall bias
20	C _{NF}	Capacitor connection pin for phase compensation
21	E _{CR}	Torque control standard voltage input terminal
22	E _C	Torque control voltage input terminal
23	PS	START / STOP switch
24	R _{EV}	Reverse terminal
25	V _{CC}	Power supply for signal division
26	N.C.	N.C.
27	V _M	Power supply for driver
28	R _{NF}	Terminal connection for current sensing resistor
FIN	FIN	GND

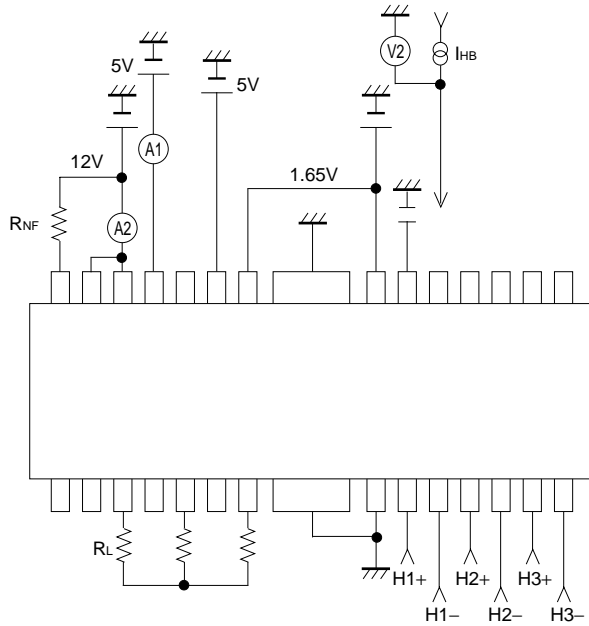
Optical disc ICs

●Electrical characteristics (unless otherwise noted, Ta=25°C, Vcc=5V, VM=12V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Test Circuit
〈TOTAL〉							
Circuit current1	Icc1	–	0	0.2	mA	At power save ON	Fig.1
Circuit current2	Icc2	–	4.7	7.1	mA	At power save OFF	Fig.1
〈POWER SAVE〉							
ON voltage range	V _{PSON}	2.5	–	–	V		Fig.2
OFF voltage range	V _{PSOFF}	–	–	1.0	V		Fig.2
〈HALL BIAS〉							
Hall bias voltage	V _{HB}	0.5	0.9	1.5	V	I _{HB} =10mA	
〈HALL AMP〉							
Input bias current	I _{HA}	–	0.7	3.0	μA		Fig.3
In-phase input voltage range	V _{HAR}	1.5	–	4.0	V		Fig.3
Minimum input level	V _{INH}	50	–	–	mVpp		Fig.3
H ₃ hysteresis level	V _{HYS}	10	20	40	mV		Fig.6
〈TORQUE CONTROL〉							
Input voltage range	E _c , E _{CR}	0	–	5	V	E _c , E _{CR} =0.5V~3.3V	
Offset voltage –	E _{COFF –}	–70	–40	–10	mV	E _{CR} =1.65V	Fig.5
Offset voltage +	E _{COFF +}	10	40	70	mV	E _{CR} =1.65V	Fig.5
Input current	E _{CIN}	–	0.5	2.0	μA	E _c =E _{CR} =1.65V	
Input-output Gain	G _{EC}	0.56	0.7	0.84	A / V	E _c =1.3, 1.5V 1.8, 2.0V R _{NF} =0.5Ω	Fig.5
〈FG〉							
FG output voltage H	V _{FGH}	4.5	4.9	5.0	V	I _{FG} =–20μA	Fig.6
FG output voltage L	V _{FGL}	0	0.25	0.4	V	I _{FG} =3mA	Fig.6
〈OUTPUT〉							
Saturation voltage H	V _{OH}	–	1.0	1.5	V	I _o =–600mA	Fig.4
Saturation voltage L	V _{OL}	–	0.4	0.8	V	I _o =600mA	Fig.4
Pre-drive current	I _{VMP}	–	35	70	mA	E _c =5V output open	Fig.6
Torque limit current	I _{TL}	560	700	840	mA	R _{NF} =0.5Ω	Fig.2
〈REVERSE〉							
ON voltage range	V _{RSON}	2.5	–	–	V		
OFF voltage range	V _{RSOFF}	–	–	1.0	V		

Optical disc ICs

● Measurement circuit

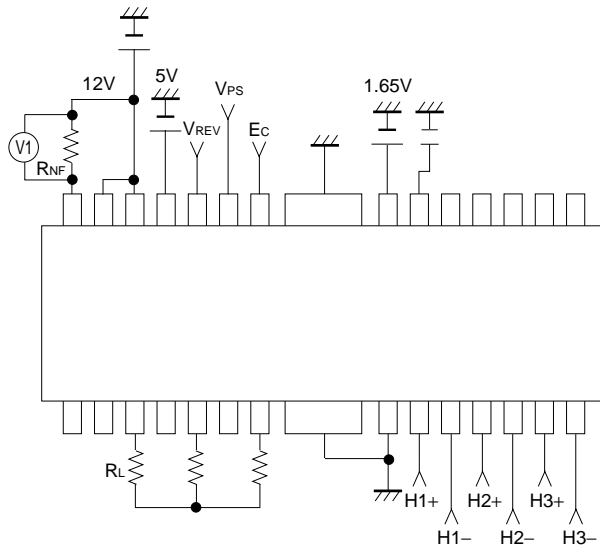


ICC1 : Value of 'A1'
 VPS=0 [V]
 $H1+ \sim H3+ = (1/2) \times VCC + 0.1$ [V]
 $H1- \sim H3- = (1/2) \times VCC$ [V]

ICC2 : Value of 'A2'
 VPS=5 [V]
 $H1+ \sim H3+ = (1/2) \times VCC + 0.1$ [V]
 $H1- \sim H3- = (1/2) \times VCC$ [V]

VHB : Value of 'V2'
 VPS=5 [V]
 IHB=10 [mA]

Fig.1 Circuit current Hall bias voltage) Test Circuit



VPSON : Range of 'VPS' that output pins become input-output table. (Input condition 1-6)

VPSONOFF : Range of 'VPS' that output pins become open. (Input condition 1-6)

VRSON : Range of 'VREV' that output pins become input-output table. (Input condition 1-6)
 VPS=5 [V] EC=0 [V]

VRSONOFF : Range of 'VREV' that output pins become open. (Input condition 1-6)
 VPS=5 [V] EC=0 [V]

ITL : (Value of 'V1') / 0.5
 VPS=5 [V] EC=0 [V]
 (Input condition 1-6)

PS ON/OFF range REV ON/OFF range) Test Circuit
 Torque limit current

Optical disc ICs

Input-output table

Pin No.	Input conditions						Output						Test point (Regular)
							Regular			Reverse			
	9	10	11	12	13	14	7	5	3	7	5	3	
	H1+	H1-	H2+	H2-	H3+	H3-	A1	A2	A3	A1	A2	A3	
Condition 1	L	M	H	M	M	M	H	L	L	L	H	H	7pin HI
Condition 2	H	M	L	M	M	M	L	H	H	H	L	L	7pin Low
Condition 3	M	M	L	M	H	M	L	H	L	H	L	H	5pin HI
Condition 4	M	M	H	M	L	M	H	L	H	L	H	L	5pin Low
Condition 5	H	M	M	M	L	M	L	L	H	H	H	L	3pin HI
Condition 6	L	M	M	M	H	M	H	H	L	L	L	H	3pin Low

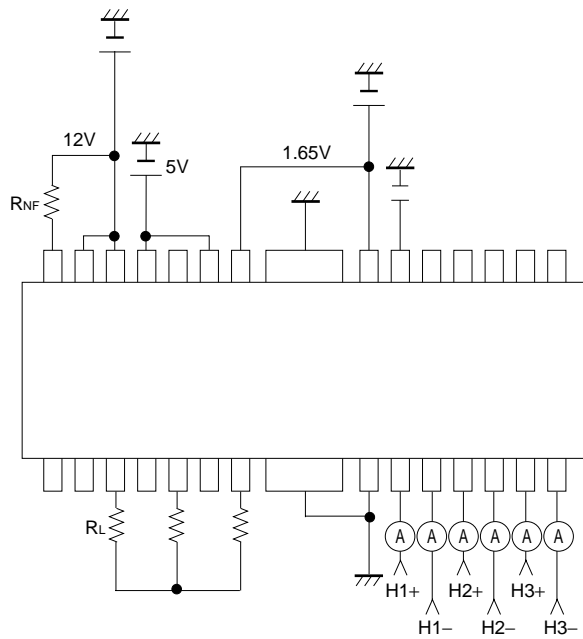
Cautions 1 : Regular EC<ECR REV = L, EC>ECR REV=H

Reverse EC<ECR REV = L,

Input voltage : Hi = 2.6V

Mid = 2.5V

Low = 2.4V



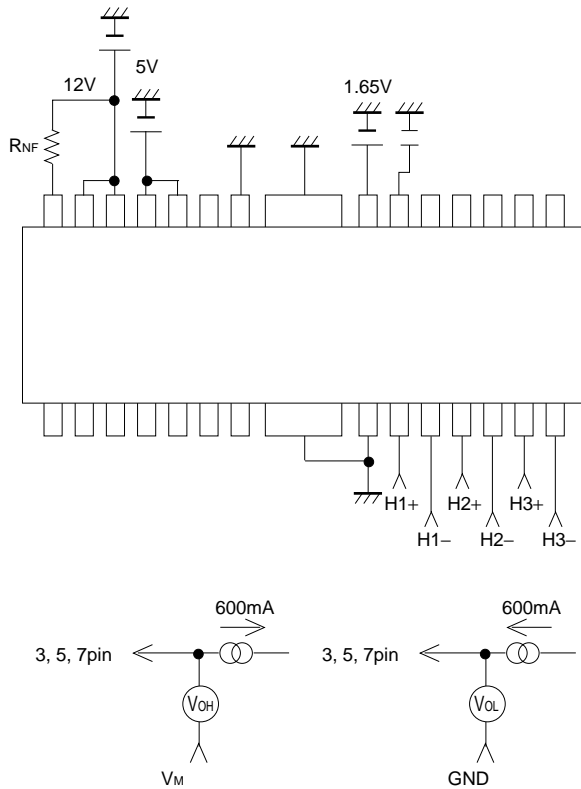
IHA : Value of 'A1' ($Hn^+=4.0V, Hn^-=2.5V$)
 Value of 'A2' ($Hn^+=2.5V, Hn^-=4.0V$)
 $n=1, 2, 3$

VHAR : Hall voltage range that output pins become input-output table.

VINH : Hall input level that output pins become input-output table.
 $|Hn^+ - Hn^-| \quad Hn^-=2.5V \quad (n=1, 2, 3)$

Fig.3 Input bias current
 In-phase input voltage range
 Hall minimum input level) Test Circuit

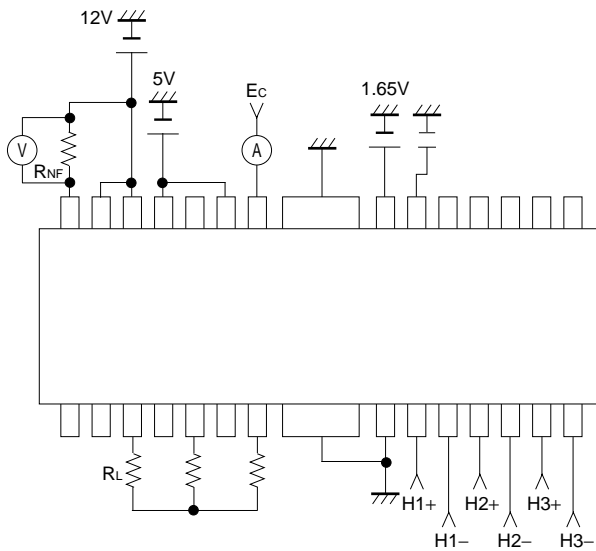
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VOH : In case output measurement pin='H'
by input condition and IO=-600mA,
value of 'VOH'. (VM-RNF short)

VOL : In case output measurement pin='L'
by input condition and IO=600mA,
value of 'VOL'.

Fig.4 Output saturation voltage H) Test Circuit
Output saturation voltage L)



EC : Torque control operating. range.

ECOFF+, ECOFF- : Offset voltage at ECR=1.65V that
value of 'V' become 3mV.

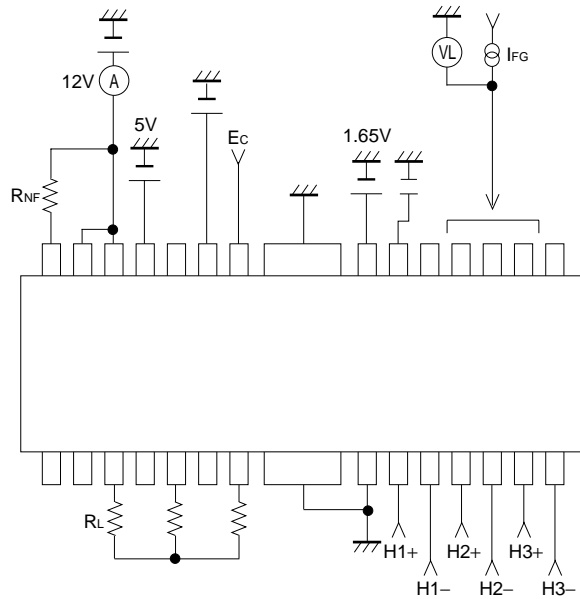
ECIN : Value of 'A' at EC=ECR=2.5V

GEC : Value of 'V' at EC=1.3V→V1
Value of 'V' at EC=1.5V→V2
Value of 'V' at EC=1.8V→V3
Value of 'V' at EC=2.0V→V4

$GEC = \frac{(V1 - V2)}{(1.5 - 1.3)} / RNF$
 $GEC = \frac{(V4 - V3)}{(2.0 - 1.8)} / RNF$
RNF=0.5Ω

Fig.5 Torque offset voltage) Test Circuit
Input-output gain)

Optical disc ICs



VHYS : Difference H_n^+ from H_n^- that
 FG1 / FG2 / FG3 voltage change. (n=1, 2, 3)
 EC=ECR=1.65V

IVMp : value of 'A'
 Output open
 (Input condition 1-6)
 EC=5V, ECR=2.5V

VFGL : Value of 'FG-OUTPUT-VOLTAGE'
 at IFG=3mA ($H_n^+=L$)

VFGH : Value of 'FG-OUTPUT-VOLTAGE'
 at IFG=-20 μ A ($H_n^+=H$)

Fig.6 Hall hysteresis level
 Pre-drive current
 FG output voltage H
 FG output voltage L) Test Circuit

●Electrical characteristic curves

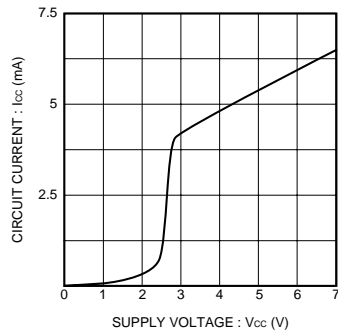


Fig.7 Circuit Current

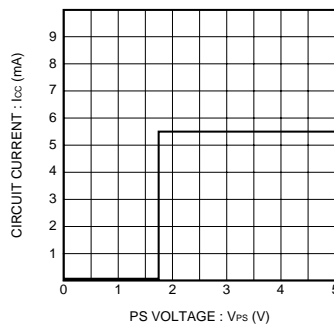


Fig.8 PS Threshold voltage

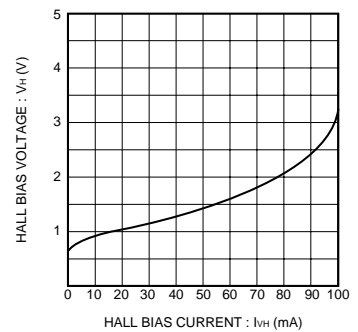


Fig.9 Hall Bias voltage

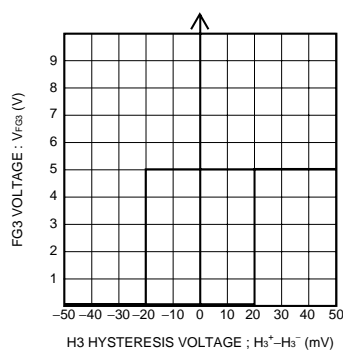


Fig.10 H3 Hysteresis Level

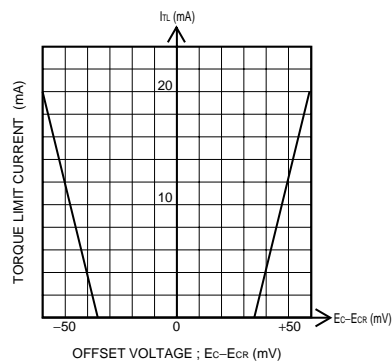


Fig.11 Torque Control Offset voltage

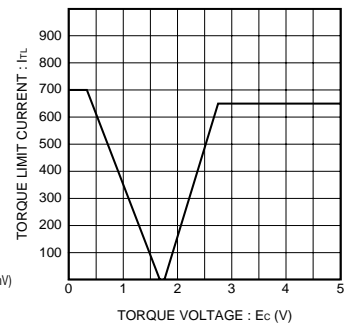


Fig.12 Torque Limit Current

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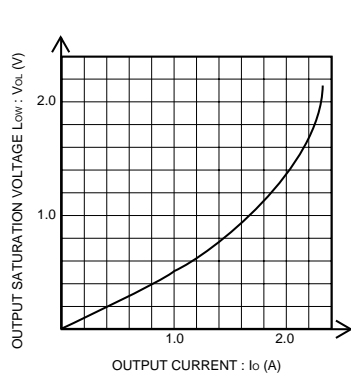


Fig.14 Output Saturation voltage Low

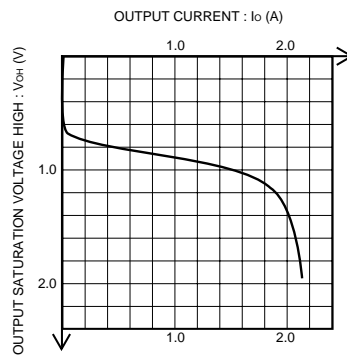


Fig.13 Output Saturation voltage HI

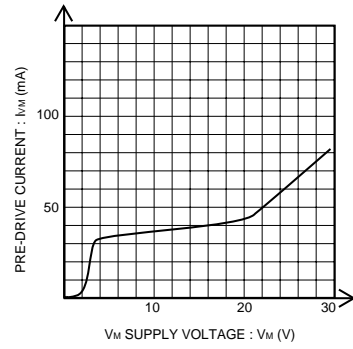


Fig.15 Pre-drive Current

●External dimensions (Units : mm)

