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-phasefall-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)

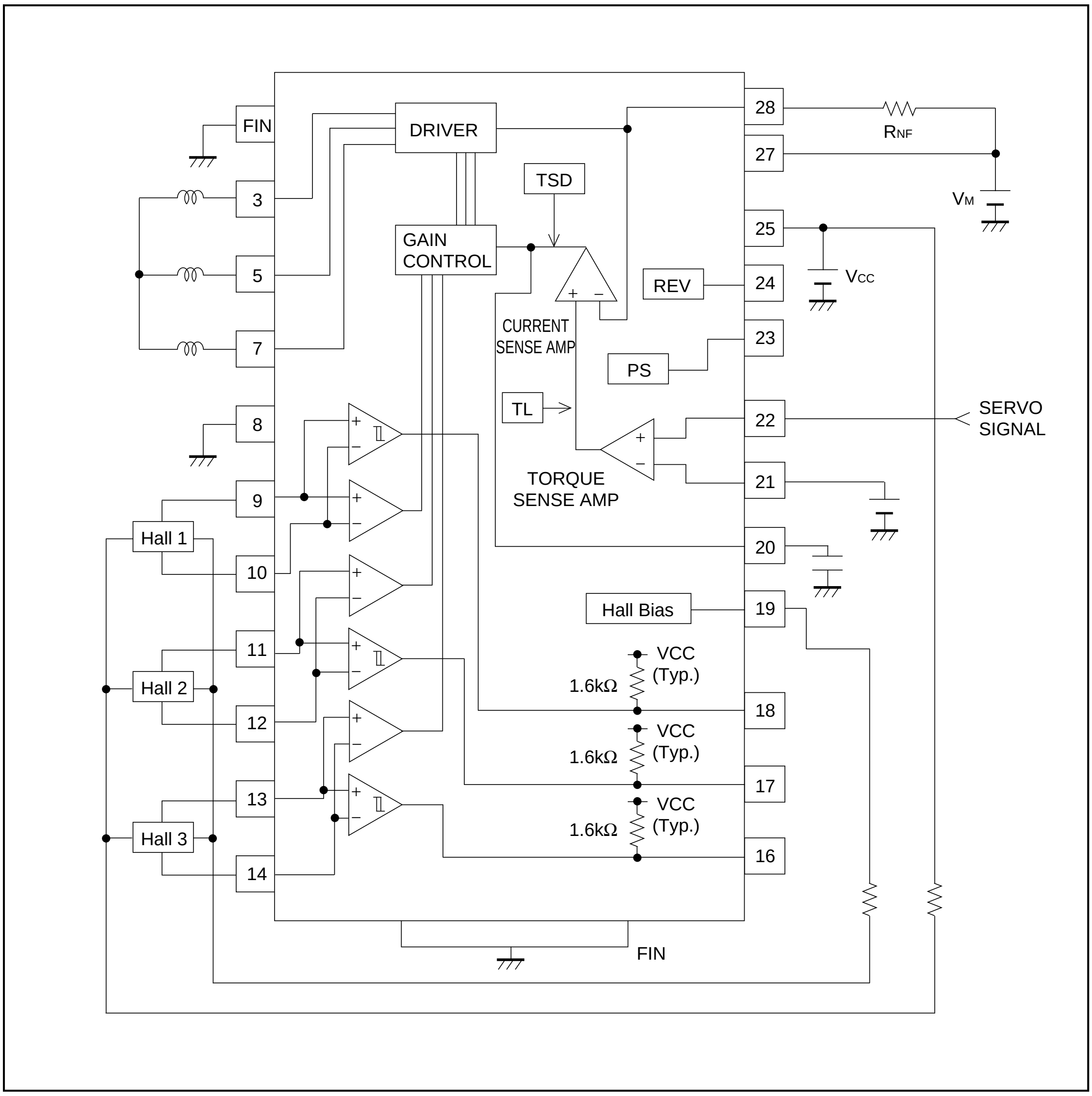
Parameter	Symbol	Limits	Unit
Supply voltage	V_{CC}	7	V
Supply voltage	V_M	15	V
Power dissipation	Pd	2200∗1	mW
Operate.temp.range	Topr	–20~+75	˚C
Strage.temp.range	Tstg	–55~+150	˚C
Juncition temp.	Tjmax	150	˚C
Maximum o.current	I_{OUT}	1300∗2	mA

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 Tj=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	

●**Block diagram**



● **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

● **Electrical characteristics** (unless otherwise noted, Ta=25°C, V_{CC}=5V, V_M=12V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Test Circuit
〈TOTAL〉							
Circuit current1	$I_{CC}1$	–	0	0.2	mA	At power save ON	Fig.1
Circuit current2	$I_{CC}2$	–	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 RNF=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		

● **Measurement circuit**

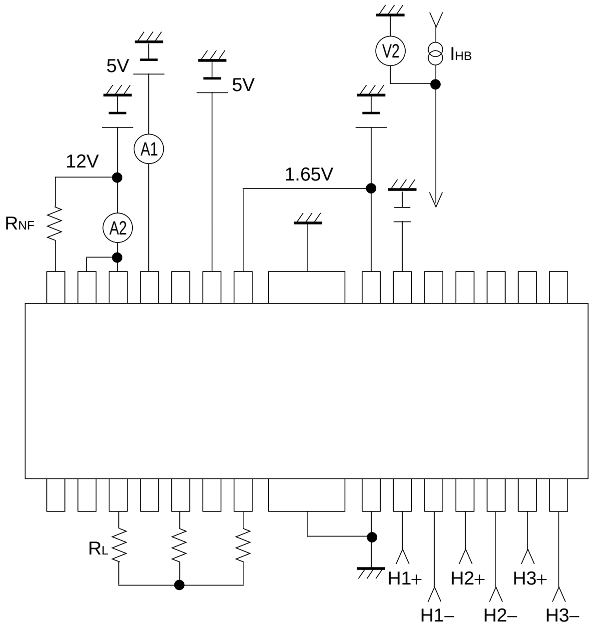


Fig.1 Circuit current / Hall bias voltage) Test Circuit

ICC1 : Value of 'A1'
VPS=0 [V]
H1+~H3+=(1/2)×VCC+0.1 [V]
H1–~H3–=(1/2)×VCC [V]

ICC2 : Value of 'A1'
VPS=5 [V]
H1+~H3+=(1/2)×VCC+0.1 [V]
H1–~H3–=(1/2)×VCC [V]

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

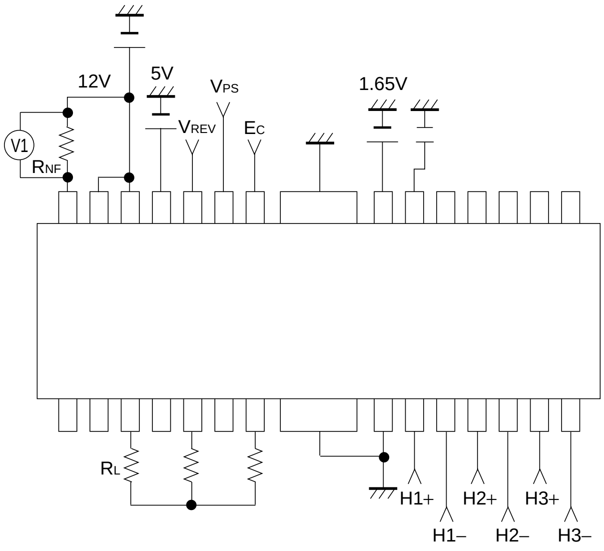


Fig.2 PS ON/OFF range / REV ON/OFF range / Torque limit current) Test Circuit

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

VPSOFF : 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]

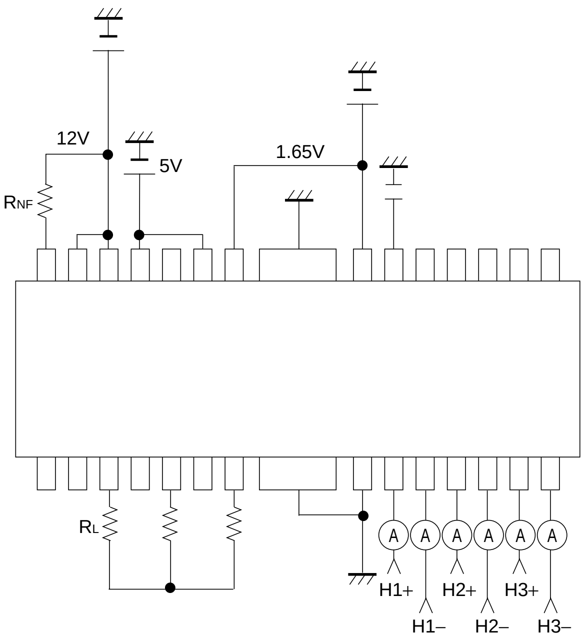
VRSOFF : Range of 'VREV' that output pins become open.
(Input condition 1~6)
VPS=5 [V] EC=0 [V]

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

Input-output table

Input conditions							Output						Test point (Regular)
							Regular			Reverse			
Pin No.	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

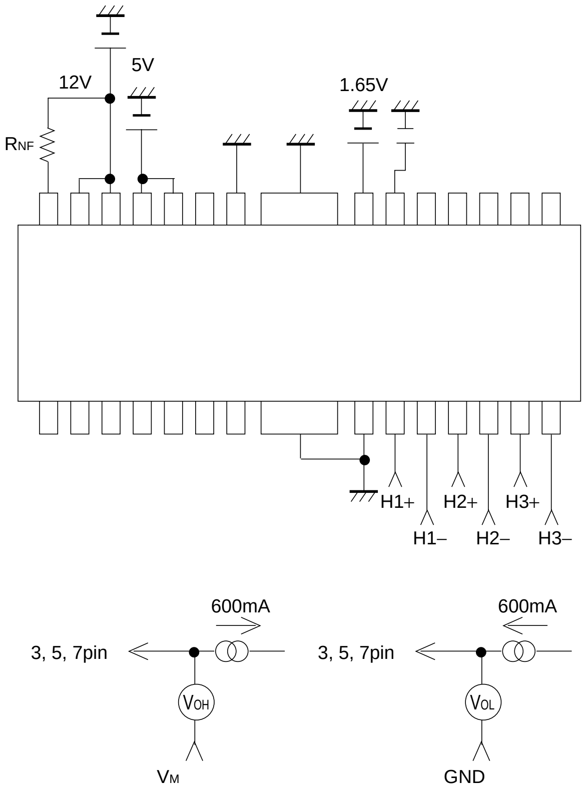


IHA : Value of 'A1' (Hn^{+}=4.0V, Hn^{-}=2.5V)
Value of 'A2' (Hn^{+}=2.5V, Hn^{-}=4.0V)
n=1, 2, 3

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

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

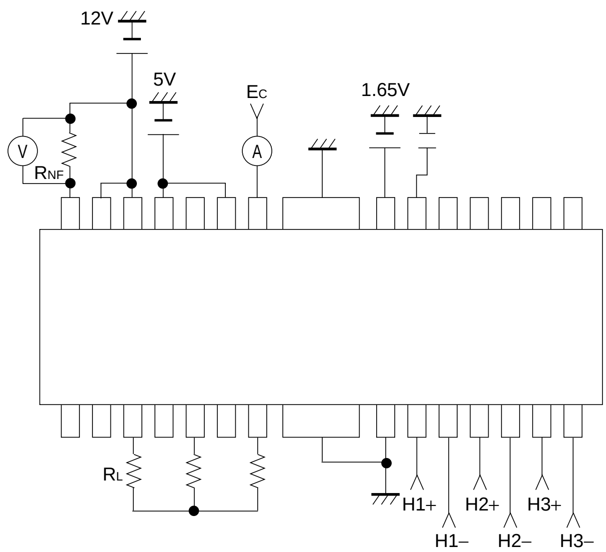
Fig.3 Input bias current / In-phase input voltage range / Hall minimum input level) Test Circuit



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 / Output saturation voltage L) Test Circuit



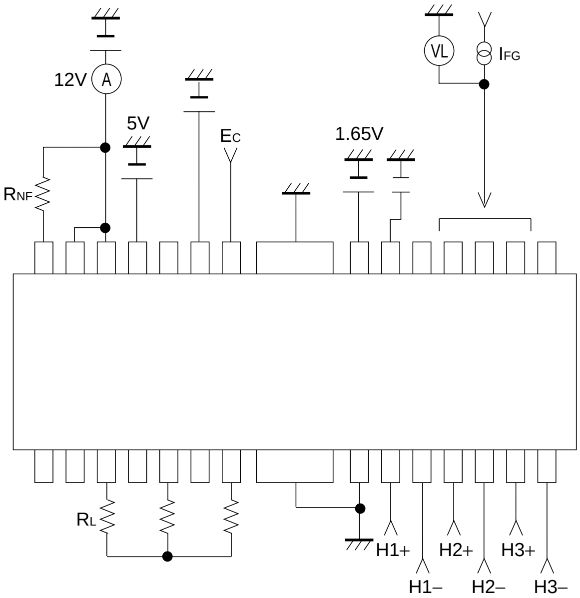
EC : Torque control operating. range.

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={(V1–V2) / (1.5–1.3)} / RNF
GEC={(V4–V3) / (2.0–1.8)} / RNF
RNF=0.5Ω

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



VHYS : Difference Hn+ from Hn– 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 (Hn+=L)

VFGH : Value of 'FG-OUTPUT-VOLTAGE' at IFG=–20µA (Hn+=H)

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

●Electrical characteristic curves

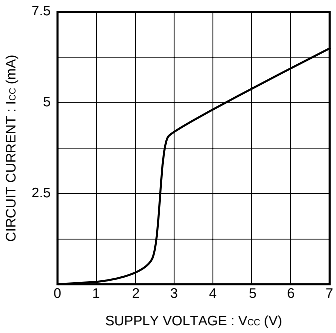


Fig.7 Circuit Current

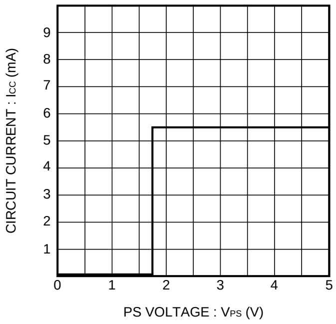


Fig.8 PS Threshold voltage

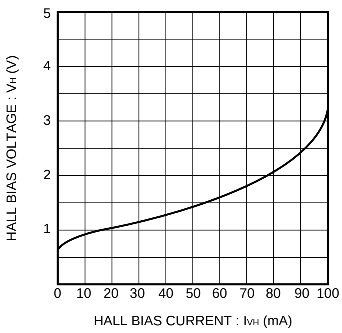


Fig.9 Hall Bias voltage

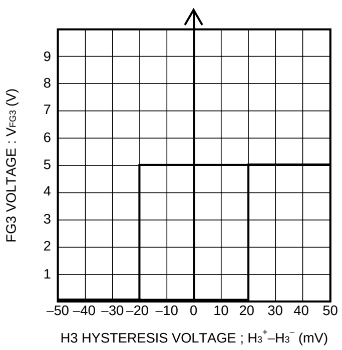


Fig.10 H3 Hysteresis Level

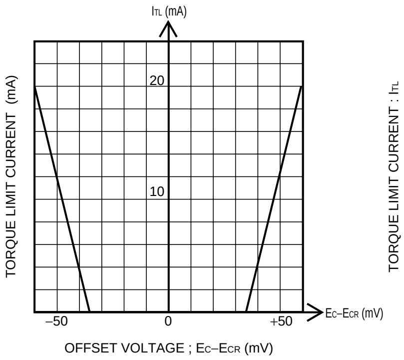


Fig.11 Torque Control Offset voltage

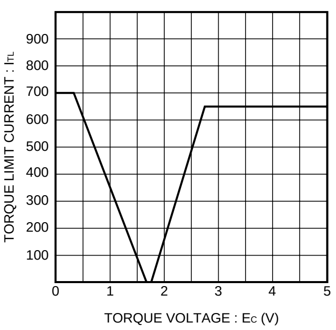


Fig.12 Torque Limit Current

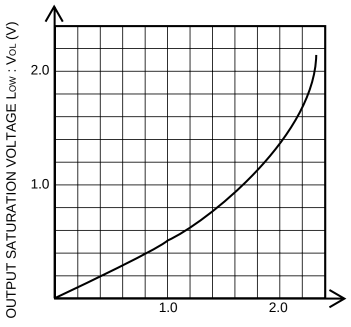


Fig.14 Output Saturation voltage Low

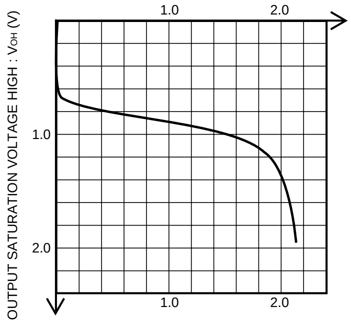


Fig.13 Output Saturation voltage HI

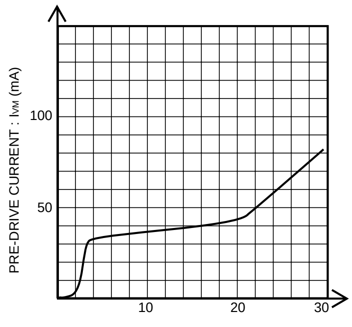
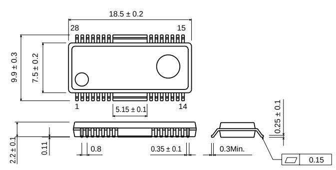


Fig.15 Predrive Current

● **External dimensions** (Units : mm)



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