3-phase motor driver for CD-ROMs

BA6849FP / BA6849FP-Y / BA6849FM / BA6849FS

The BA6849 series are ICs developed for CD-ROM spindle motor drives. These ICs possess a short brake and reverse-rotation brake for two types of brake functions, and also contain FG output and rotation direction detection (FR) circuits, making them high-functionality and high-performance ICs.

●Applications
CD-ROM, CD-R, CD-RW, DVD-ROM, and DVD-RAM

●Features
1) Three-phase, full-wave, pseudo-linear drive system.
2) Built-in power save and thermal shutdown functions.
3) Built-in current limiter and Hall bias circuits.
4) Built-in FG output.
5) Built-in rotation direction detector.
6) Built-in reverse rotation prevention circuit.
7) Built-in short brake pin.

●Absolute maximum ratings (Ta = 25°C)

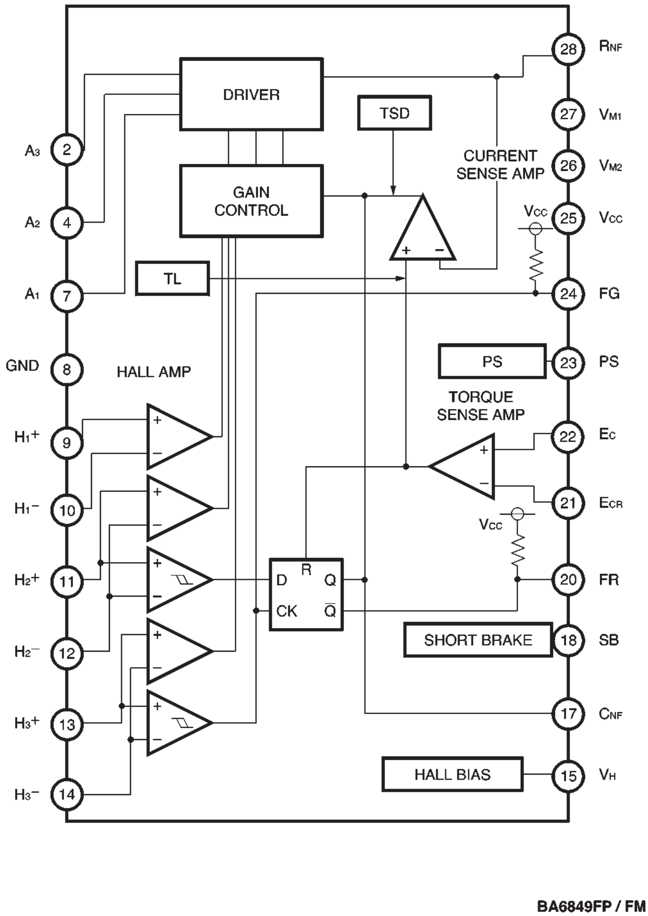
Parameter		Symbol	Limits	Unit
Applied voltage (with 5V power supply)		V_{CC}	7	V
Applied voltage (motor power supply1)		V_{M1}	16	V
Applied voltage (motor power supply2)		V_{M2}	16	V
Power dissipation	BA6849FM	Pd	2200*1	mW
	BA6849FP		1700*2	mW
	BA6849FP-Y		1450*3	mW
	BA6849FS		1000*4	mW
Operating temperature		Topr	−20～+75	℃
Storage temperature		Tstg	−55～+150*5	℃
Output current		I_{OUT}	1300*6	mA

*1 Reduced by 17.6mW for each increase in Ta of 1℃ over 25℃.
*2 When mounted on a 70mm×70mm×1.6mm glass epoxy board.
Reduced by 13.6mW for each increase in Ta of 1℃ over 25℃.
*3 Reduced by 11.6mW for each increase in Ta of 1℃ over 25℃.
*4 Reduced by 8.0mW for each increase in Ta of 1℃ over 25℃.
*5 Tj should not exceed 150℃.
*6 Should not exceed Pd or ASO values.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	4.25~5.5	V
	V_{M1}	3.0~15	V
	V_{M2}	3.0~15	V

●Block diagram



ROHM

● Pin descriptions

BA6849FP / BA6849FM

Pin No.	Pin Name	Functiom
2	A_3	Output
4	A_2	Output
7	A_1	Output
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	V_H	Hall bias
17	C_{NF}	For connection of phase compensation capacitor
18	SB	Short brake
20	FR	Rotation direction detection
21	E_{CR}	Output voltage control reference
22	E_C	Output voltage control
23	PS	Power save
24	FG	FG signal output
25	V_{CC}	Power supply
26	V_{M2}	Motor power supply 2
27	V_{M1}	Motor power supply 1
28	R_{NF}	For connection of output current detection resistor
FIN	—	SUB GND

＊ ＊ Missing pin numbers are N.C.

BA6849FP-Y

Pin No.	Pin name	Function
1	—	SUB GND
2	A_3	Output
3	A_2	Output
5	A_1	Output
6	GND	GND
7	H_1+	Hall signal input
8	H_1-	Hall signal input
9	H_2+	Hall signal input
10	H_2-	Hall signal input
11	H_3+	Hall signal input
12	H_3-	Hall signal input
13	V_H	Hall bias
15	C_{NF}	For connection of phase compensation capacitor
16	SB	Short brake
17	FR	Rotation direction detection
18	E_{CR}	Torque control reference
19	E_C	Torque control
20	PS	Power save
21	FG	FG signal output
22	V_{CC}	Power supply
23＊	V_{M2}	Motor power supply 2
23＊	V_{M1}	Motor power supply 1
24	R_{NF}	For connection of output current detection resistor

＊ Connected within the IC.
Note) Missing pin numbers are N.C.

MA6849FS

Pin No.	Pin name	Function
1	—	SUB GND
2	A_3	Output
3	A_2	Output
5	A_1	Output
6	GND	GND
7	H_1^+	Hall signal input
8	H_1^-	Hall signal input
9	H_2^+	Hall signal input
10	H_2^-	Hall signal input
11	H_3^+	Hall signal input
12	H_3^-	Hall signal input
13	V_H	Hall bias
15	C_{NF}	For connection of phase compensation capacitor
16	SB	Short brake
17	FR	Rotation direction detection
18	E_{CR}	Torque control reference
19	E_C	Torque control
20	PS	Power save
21	FG	FG signal output
22	V_{CC}	Power supply
23*	V_{M2}	Motor power supply 2
23*	V_{M1}	Motor power supply 1
24	R_{NF}	For connection of output current detection resistor

* Connected within the IC.

Note) Missing pin numbers are N.C.

●Input / output circuits

(1) Power save

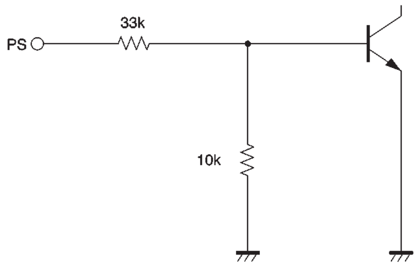


Fig.1

(2) Torque command input

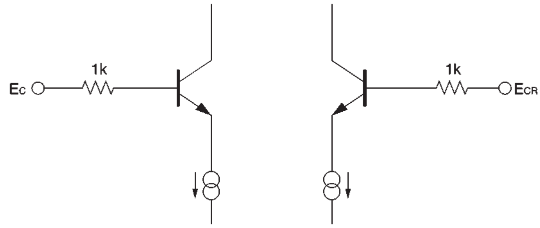


Fig.2

(3) Torque output (A_1, A_2, and A_3)

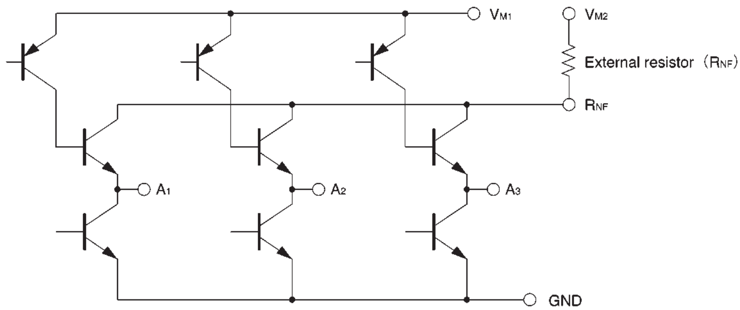


Fig.3

(4) Hall input (H_1^+, H_1^-, H_2^+, H_2^-, H_3^+, H_3^-)

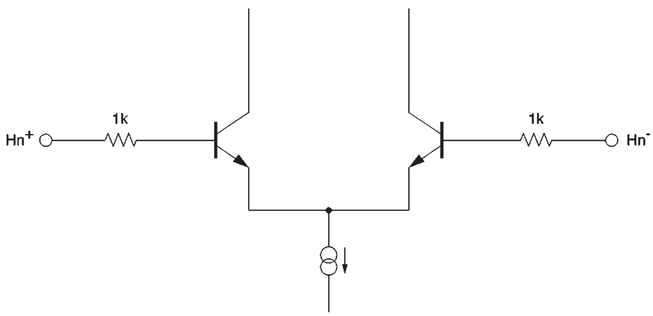


Fig.4

Note: Resistance values are typical values.

(5) Hall bias

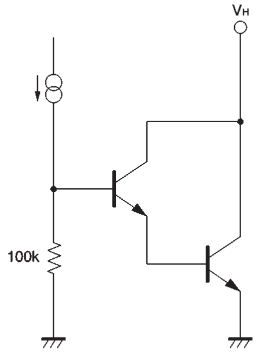


Fig.5

(6) FG output

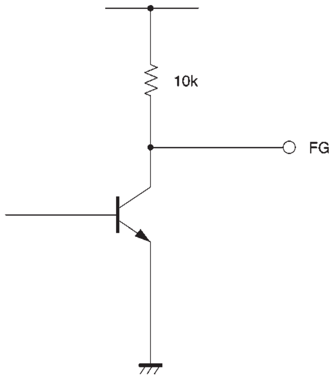


Fig.6

(7) FR Output

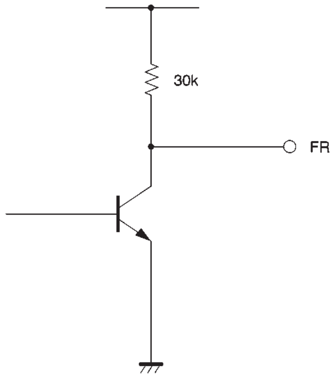


Fig.7

(8) Short brake

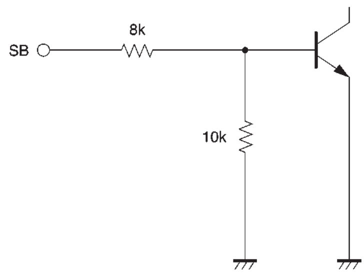


Fig.8

Note: Resistance values are typical values.

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 5V, V_{M1} = 12V, V_{M2} = 12V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈Total device〉						
Circuit current 1	I_{CC1}	—	0	0.2	mA	In the power save ON state
Circuit current 2	I_{CC2}	—	4.1	6.5	mA	In the power save OFF state
〈Power save〉						
ON voltage range	V_{PSON}	—	—	1.5	V	—
OFF voltage range	V_{PSOFF}	3.5	—	—	V	—
〈Hall bias〉						
Hall bias voltage	V_{HB}	0.5	0.9	1.5	V	I_{HB}=10mA
〈Hall amplifier〉						
Input bias current	I_{HA}	—	0.7	3.0	μA	—
Same phase input voltage range	V_{HAR}	1.5	—	4.0	V	—
Minimum input level	V_{INH}	50	—	—	mV_{P-P}	—
H3 hysteresis level	V_{HYS}	10	20	40	mV	—
〈Torque command〉						
Input voltage range	E_C	1.0	—	4.0	V	—
"−" offset voltage	$E_{COFF}-$	−80	−50	−20	mV	E_{CR}=2.5V
"+" offset voltage	$E_{COFF}+$	20	50	80	mV	E_{CR}=2.5V
Input bias current	E_{CIN}	—	0.5	2.0	μA	E_C=E_{CR}
I / O gain	G_{EC}	0.41	0.51	0.61	A / V	E_C=1.5V, 2.0V
〈FG〉						
FG output high level voltage	V_{FGH}	4.5	4.8	—	V	I_{FG}=−20μA
FG output low level voltage	V_{FGL}	0	0.25	0.4	V	I_{FG}=3mA
DUTY (reference value)	DU	—	50	—	%	—
〈Rotation detection〉						
FR output high level voltage	V_{FRH}	4.1	4.4	—	V	I_{FR}=−20μA
FR output low level voltage	V_{FRL}	0	0.25	0.4	V	I_{FR}=3mA
〈Output〉						
Output saturation high level voltage	V_{OH}	—	1.0	1.5	V	I_O=−600mA
Output saturation low level voltage	V_{OL}	—	0.4	0.8	V	I_O=600mA
Pre-drive current	I_{VML}	—	35	70	mA	E_C=0V output open
Output limit current	I_{TL}	560	700	840	mA	—
〈Short brake〉						
ON voltage range	V_{SBON}	3.5	—	—	V	—
OFF voltage range	V_{SBOFF}	—	—	1.5	V	—

◎Not designed forradiation resistance.

●Circuit operation

(1) Hall input to coil output

The phase relationship between the Hall input signals and the output current and voltage is shown in Fig.9. The motor position data input via the Hall pins is amplified by the Hall amplifier, and formed into waveforms by the matrix block.These signals are input to the output driver that supplies the drive current to the motor coils.

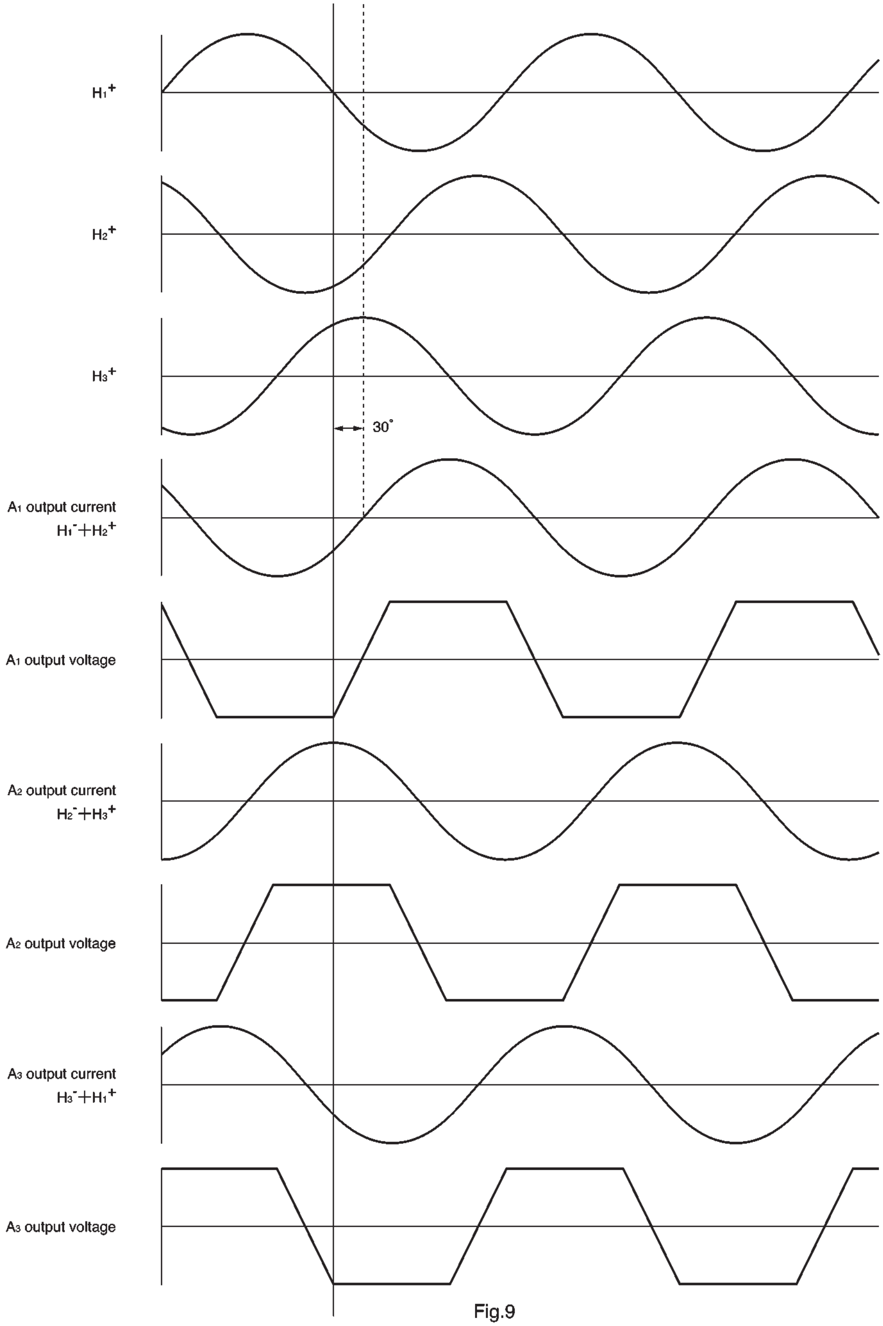


Fig.9

(2) Torque command

The R_{NF} pin voltage with respect to the torque command (E_C) is as follows:

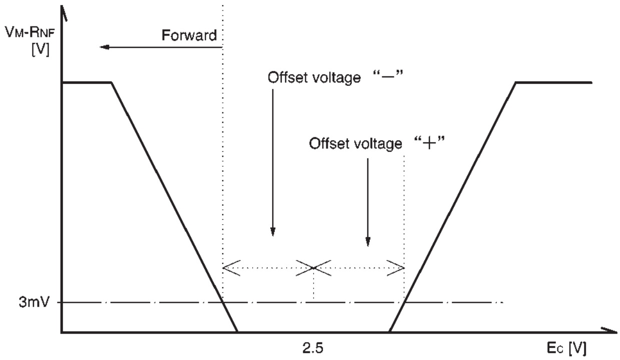


Fig.10

	Rotation direction
$E_C < E_{CR}$	Forward
$E_C > E_{CR}$	Reverse*

* Stops after detecting reverse.

The I / O gain (G_{EC}) from the E_C pin to the R_{NF} pin (output current) is determined by the R_{NF} detector resistor.

$G_{EC} = 0.255 / R_{NF}$ [A / V]

The torque limit current I_{TL} is given by:

$I_{TL} = 0.35 / R_{NF}$ [A]

(3) Reverse rotation detection function

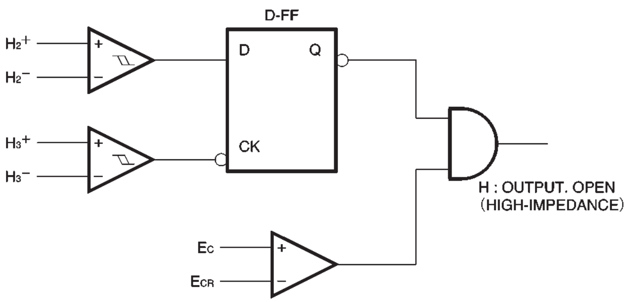


Fig.11

The reverse detection circuit construction is shown in Fig.11.

1) Forward ($E_C < E_{CR}$)

The phase relationship between the Hall input signals $H2^+$ and $H3^+$ becomes as shown in Fig.9, and the reverse rotation detection circuit does not operate.

2) Reverse ($E_C > E_{CR}$)

The phase relationship between the signals H_2^+ and H_3^+ is opposite that for forward operation, and the reverse rotation detection circuit operates. The output goes OFF, and becomes open circuit.

	FR signal output pin
Forward	L
Reverse	H

(4) Short brake

When 3.5V or more is applied to the short brake pin, the upper-side output transistors of all go off, and the lower-side output transistors go on. Short braking operates regardless of the torque command signal.

(5) Other circuits

When 3.5V or more is applied to the power save pin, all circuits are on. When 1.5V or less is applied, the IC enters power save mode. Also, the Hall bias pins turn on and off with the power save pin.

●Application example

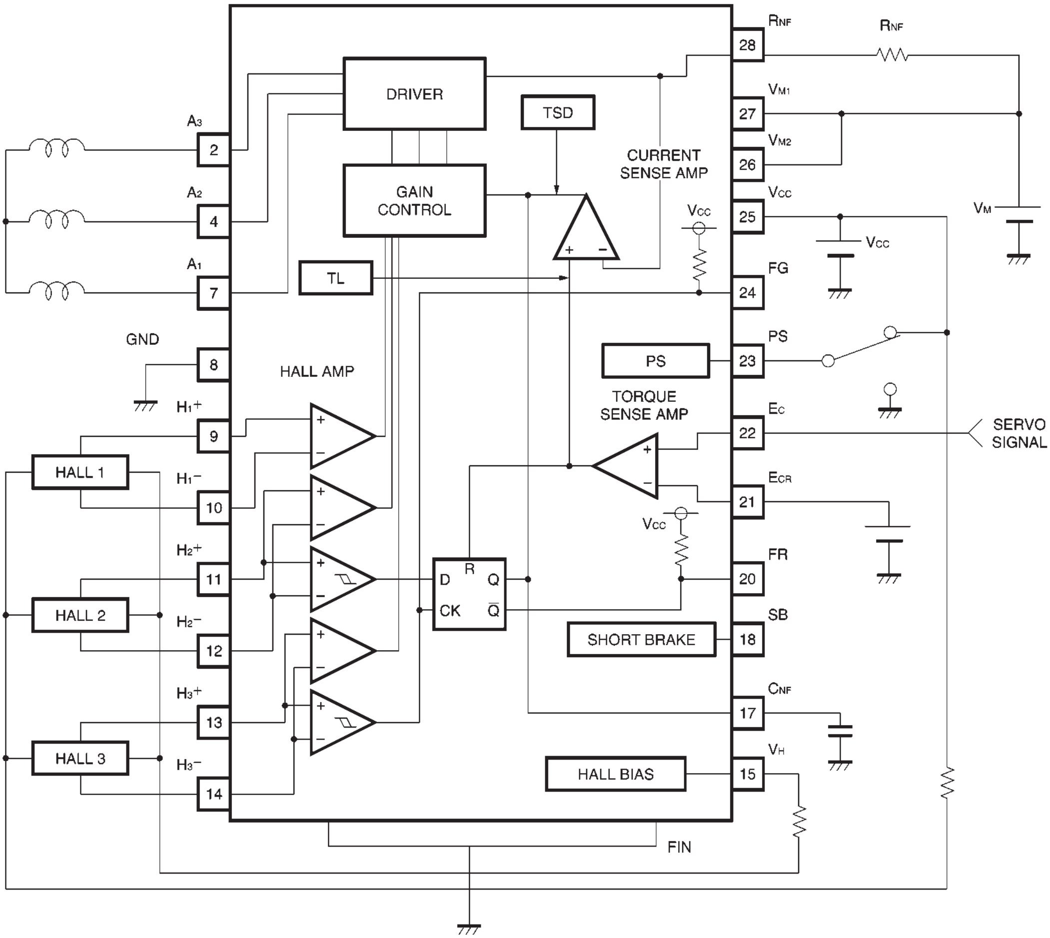


Fig.12

●Operation notes

(1) Power save

The power save input is an I / O circuit like the own shown in Fig.1.

The thermal derating characteristics of the power save pin is –8mV / °C, and the resistance will fluctuate between ±30% so be careful of the input voltage range.

(2) Hall input

The input circuit shown in Fig.4 is used for the Hall inputs. The Hall elements can be connected either in series or in parallel.

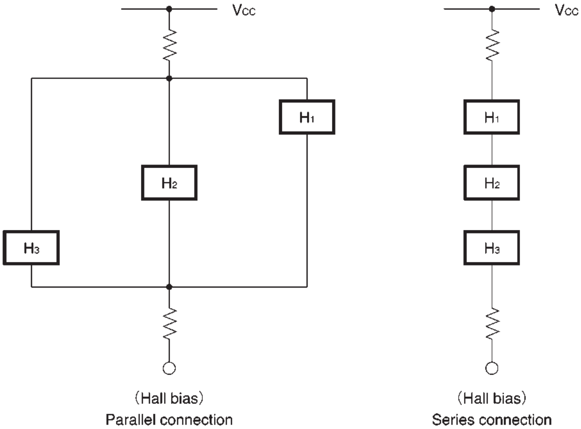


Fig.13

(3) Thermal shutdown (TSD)

When the junction temperature reaches 175°C, the A_1, A_2, and A_3 coil outputs go open circuit. The thermal shutdown has approximately 15°C of hysteresis.

●Electrical characteristics curves

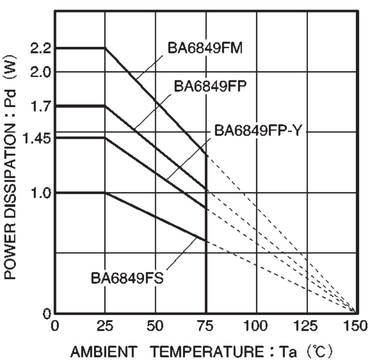


Fig.14 Package derating characteristics

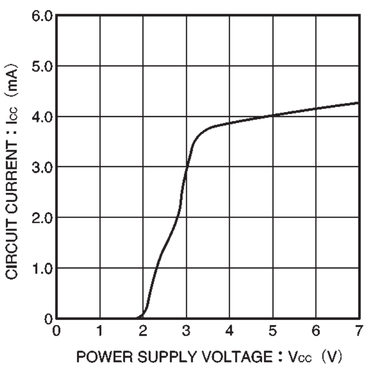


Fig.15 Power supply current vs. power supply voltage

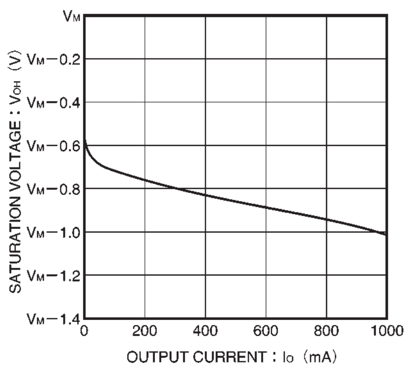


Fig.16 Upper-side output saturation voltage vs. output current

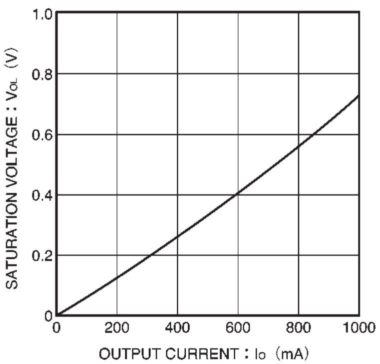
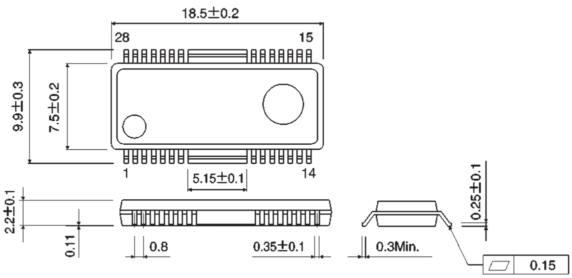


Fig.17 Lower-side output saturation voltage vs. output current

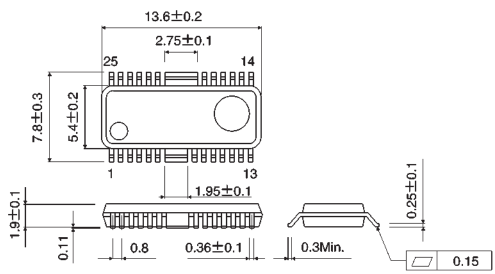
●External dimensions (Units: mm)

BA6849FP



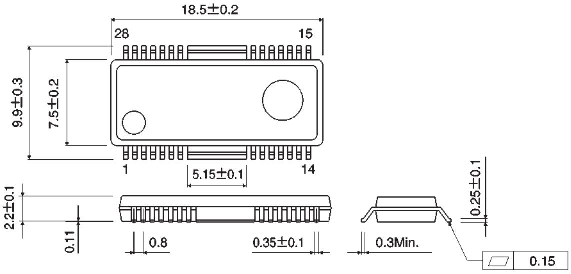
HSOP-28

BA6849FP-Y



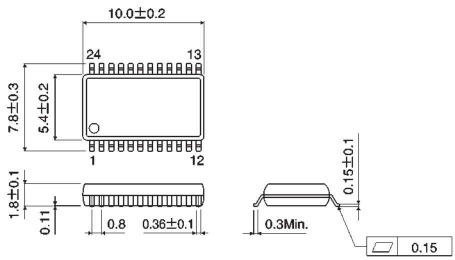
HSOP-25

BA6849FM



HSOP-M28

BA6849FS



SSOP-24