

Structure : Silicon Monolithic Integrated Circuit
Product Name : Power Driver For CD Players

Device Name : **BA5984FP**

- Features :
- 5-ch driver comprising of 4 channels for BTL drivers and 1 channel for reversible drivers
 - Use of the HSOP-28PIN power package allows downsizing of the set.
 - A built-in thermal shutdown circuit installed.
 - A wide dynamic range ($V_{CC}=8V$, $6.0V$ (Typ.) when $R_L=8\Omega$)
- <BTL Driver>
- A general op-amp connected to the input terminal allows a differential input and the addition of signals.
- <Loading Driver>
- A built-in brake function installed
 - A built-in diode for protecting against over-voltage caused by a counter electromotive force

○ ABSOLUTE MAXIMUM RATINGS ($T_a=25^\circ C$)

Parameter	Symbol	Limits	Unit
Power Supply Voltage	V_{CC}	13.5	V
Power Dissipation	P_d	1.7 ^{*1}	W
Operating Temperature Range	T_{opr}	-40 to 85	$^\circ C$
Storage Temperature Range	T_{stg}	-55 to 150	$^\circ C$

*1 When mounted on the glass/epoxy board with the size: 70 mm×70 mm, the thickness: 1.6 mm, and the rate of copper foil occupancy area: 3% or less.
Over $T_a=25^\circ C$, derating at the rate of $13.6mW/^\circ C$.

○ RECOMMENDED OPERATING CONDITIONS (To determine a power supply voltage, the power dissipation must be taken into consideration.)

V_{CC}	4.3 to 13.2V
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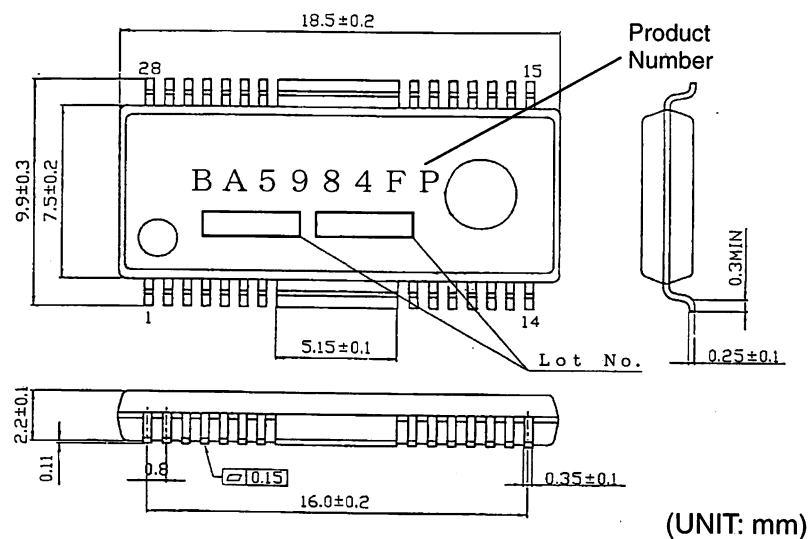
Not designed for radiation resistance.

○ ELECTRIC CHARACTERISTICS

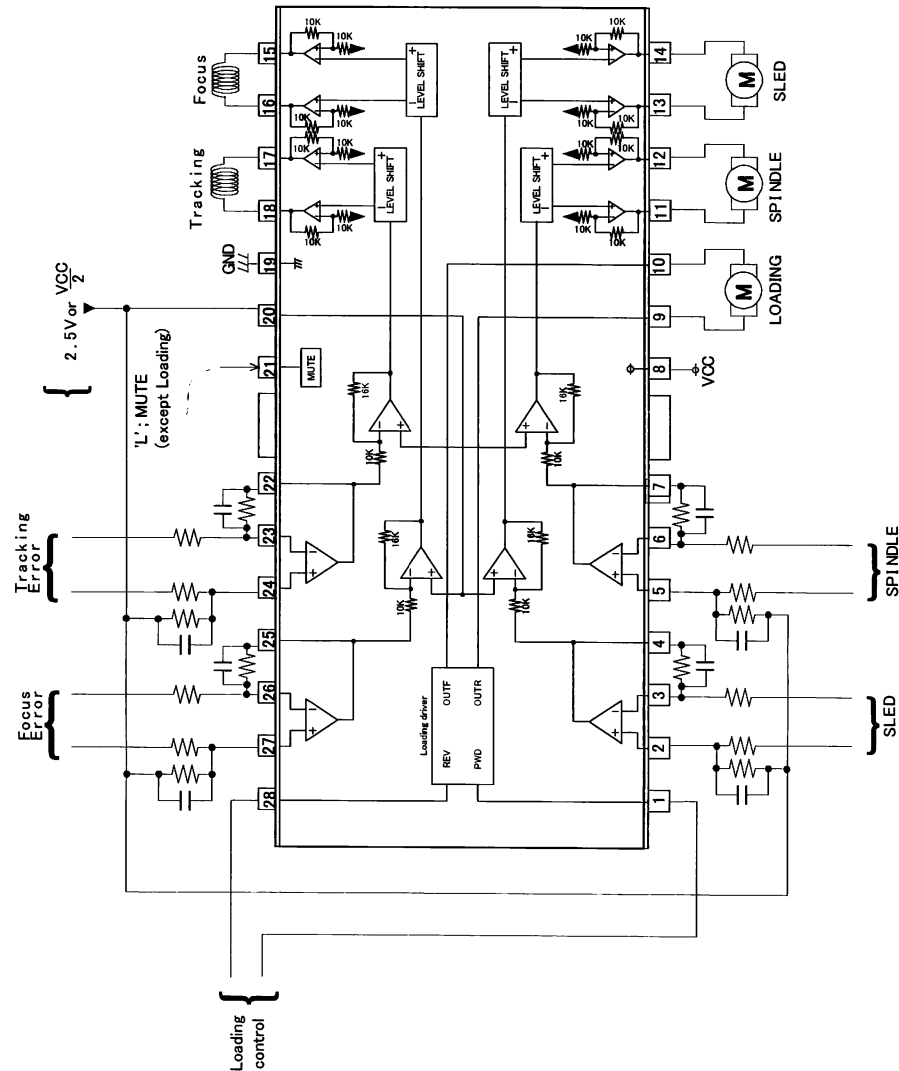
(Ta=25°C, Vcc=8V, BIAS=2.5V, RL=8Ω, unless otherwise noted.)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Quiescent Circuit Current	ICC	-	24	34	mA	No load applied
<BTL Driver>						
Output Offset Voltage	VOO	-50	0	50	mV	
Maximum Output Amplitude	VOM	5.4	6.0	-	V	
Voltage Gain	GVC	14.0	16.1	18.0	dB	
Mute ON Voltage	VMTON	-	-	0.5	V	
Mute OFF Voltage	VMTOFF	1.5	-	-	V	
Mute Terminal Input Current	IMUTE	-	180	270	μA	VMUTE = 5V
Bias Terminal Input Current	IBIAS	-	75	120	μA	VBIAS = 2.5V
<Pre-stage Operational Amplifier>						
Common Mode Input Range	VICM	0.5	-	6.8	V	
Input Offset Voltage	VOFOP	-6	0	6	mV	
Input Bias Current	IBOP	-	-	300	nA	
High-level Output Voltage	VOHOP	7.5	-	-	V	
Low-level Output Voltage	VOLOP	-	-	0.5	V	
Output Driving Current Sink	ISIN	1	-	-	mA	Vcc with 50Ω attached
Output Driving Current Source	ISOU	1	-	-	mA	GND with 50Ω
Slew Rate	SROP	-	1	-	V/us	100KHz square wave, 2Vp-p output
<Loading Driver>						
Output Saturation Voltage 1	VSAT1	0.7	1.1	1.6	V	Sum of upper side + lower side, IL=200mA
Output Saturation Voltage 1 F/R Difference	ΔVSAT1	-	-	0.1	V	F/R Difference of Output Saturation Voltage 1
Output Saturation Voltage 2	VSAT2	1.0	1.55	2.3	V	Sum of upper side + lower side, IL=500mA
<Loading Logic Input>						
Input High-level Voltage	VIHLD	1.5	-	VCC	V	
Input Low-level Voltage	VILLD	-0.3	-	0.5	V	
Input High-level Current	IIHLD	-	180	270	μA	VFWD=VREV=5V

○ OUTLINE DIMENSIONS, SYMBOLS



○ APPLICATION CIRCUIT DIAGRAM



Resistance unit : [Ω]

○ PIN NUMBERS, PIN NAMES

No.	Pin name	Description	No.	Pin name	Description
1	FWD	Loading driver FWD input terminal	15	VO4(+)	Driver CH4 positive output
2	OPIN1(+)	CH1 pre-stage amp non-inverted input terminal	16	VO4(-)	Driver CH4 negative output
3	OPIN1(-)	CH1 pre-stage amp inverted input terminal	17	VO3(+)	Driver CH3 positive output
4	OPOUT1	CH1 pre-stage amp output terminal	18	VO3(-)	Driver CH3 negative output
5	OPIN2(+)	CH2 pre-stage amp non-inverted input terminal	19	GND	Ground terminal
6	OPIN2(-)	CH2 pre-stage amp inverted input terminal	20	BIAS	Bias input terminal
7	OPOUT2	CH2 pre-stage amp output terminal	21	MUTE	Mute control terminal
8	VCC	Power supply terminal	22	OPOUT3	CH3 pre-stage amp output terminal
9	VOL(-)	Loading driver negative output	23	OPIN3(-)	CH3 pre-stage amp inverted input terminal
10	VOL(+)	Loading driver positive output	24	OPIN3(+)	CH3 pre-stage amp non-inverted input terminal
11	VO2(-)	Driver CH2 negative output	25	OPOUT4	CH4 pre-stage amp output terminal
12	VO2(+)	Driver CH2 positive output	26	OPIN4(-)	CH4 pre-stage amp inverted input terminal
13	VO1(-)	Driver CH1 negative output	27	OPIN4(+)	CH4 pre-stage amp non-inverted input terminal
14	VO1(+)	Driver CH1 positive output	28	REV	Loading driver REV input terminal

Note) The positive or negative polarity of driver outputs is determined by the input polarity.
(For example, when the voltage on the pin 4 is HIGH, the output voltage on the pin 14 becomes HIGH.)

○ CAUTIONS ON USE

- (1) Setting the voltage on the Mute terminal to open or 0.5V or less will activate a mute function for the output current. Under conditions of normal use, the Mute terminal should be pulled-up to 1.5V or above.
- (2) When the voltage applied on the Bias terminal (pin 20) has dropped to 0.7V (Typ.) or less, the mute function will be activated. Under conditions of normal use, it should be set to 1.1V or above.
- (3) When the power supply voltage drops to 3.8V (Typ.) or less, the mute function will be activated and, when recovering to 4.0V (Typ.) or above, the circuit will startup again.
- (4) Thermal shutdown (TSD) or power supply voltage drop will activate the mute functions on all drivers, while mute ON or bias terminal voltage drop will on the BTL drivers except loading drivers. The pre-stage OP-amps cannot be muted in any cases described above. While muting, the output terminals of the BTL driver are set to the value of the internal bias voltage ((VCC-0.7)/2V).
- (5) Loading Driver - Logic Input Truth Table

FWD (1pin)	REV (28pin)	VOL (+) (10pin)	VOL (-) (9pin)	Function
L	L	OPEN	OPEN	Open mode
L	H	L	H	Reverse mode
H	L	H	L	Forward mode
H	H	L	L	Brake mode

- (6) Even though a radiating fin is connected to the GND inside of the package, it must be connected to the external GND.
- (7) Basically, applying a voltage below the IC sub-potential to any terminals must be avoided. Due to a counter electromotive force of the load, if the output on each driver has dropped to the IC sub-potential (GND) or less, an operation margin must be considered and examined.
- (8) About absolute maximum ratings
Exceeding the absolute maximum ratings, such as the applied voltage or the operating temperature range, may cause permanent device damage. As these cases cannot be limited to the broken short mode or the open mode, if a special mode where the absolute maximum ratings may be exceeded is assumed, it is recommended to take mechanical safety measures such as attaching fuses.
- (9) About power supply lines
As a measure against the back current regenerated by a counter electromotive force of the motor, a capacitor to be used as a regenerated-current path can be installed between the power supply and GND and its capacitance value should be determined after careful check that any problems, for example, a leak capacitance of the electrolytic capacitor at low temperature, are not found in various characteristics.
- (10) About GND potential
The electric potential of the GND terminal must be kept lowest in the circuitry at any operation states.
- (11) About thermal design
With consideration of the power dissipation (Pd) under conditions of actual use, a thermal design provided with an enough margin should be done.
- (12) About operations in a strong electric field
When used in a strong electric field, note that a malfunction may occur.
- (13) ASO
When using this IC, the output Tr must be set not to exceed the values specified in the absolute maximum ratings and ASO.
- (14) Thermal shutdown circuit (Thermal shutdown: TSD)
This IC incorporates a thermal shutdown circuit (TSD circuit). When the chip temperature reaches the value shown below, the coil output to the motor will be set to open.
The thermal shutdown circuit is designed only to shut off the IC from a thermal runaway and not intended to protect or guarantee the entire IC functions.
Therefore, users cannot assume that the TSD circuit once activated can be used continuously in the subsequent operations.

TSD ON Temperature [°C] (typ.)	Hysteresis Temperature [°C] (typ.)
175	25

(15) About earth wiring patterns

When a small signal GND and a large current GND are provided, it is recommended that the large current GND pattern and the small signal GND pattern should be separated and grounded at a single point of the reference point of the set in order to prevent the voltage of the small signal GND from being affected by a voltage change caused by the resistance of the pattern wiring and the large current.

Make sure that the GND wiring patterns of the external components will not change, too.

(16) This IC is a monolithic IC which has a P⁺ isolations and P substrate to isolate elements each other.

This P layer and an N layer in each element form a PN junction to construct various parasitic elements. Due to the IC structure, the parasitic elements are inevitably created by the potential relationship.

Activation of the parasitic elements can cause interference between circuits and may result in a malfunction or, consequently, a fatal damage. Therefore, make sure that the IC must not be used under conditions that may activate the parasitic elements, for example, applying the lower voltage than the ground level (GND, P substrate) to the input terminals.

In addition, do not apply the voltage to input terminals without applying the power supply voltage to the IC. Also while applying the power supply voltage, the voltage of each input terminal must not be over the power supply voltage, or within the guaranteed values in the electric characteristics.

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Japan /
(Internal Sales)

Tokyo	2-1-1, Yaesu, Chuo-ku, Tokyo 104-0082	
	TEL : +81(3)5203-0321	FAX : +81(3)5203-0300
Yokohama	2-4-8, Shin Yokohama, Kohoku-ku, Yokohama, Kanagawa 222-8575	
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Nagoya	Dainagayo Building 9F 3-28-12, Meieki, Nakamura-ku, Nagoya, Aichi 450-0002	
	TEL : +81(52)581-8521	FAX : +81(52)561-2173
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	TEL : +81(75)311-2121	FAX : +81(75)314-6559

(Contact address for overseas customers in Japan)

Yokohama	TEL : +81(45)476-9270	FAX : +81(045)476-9271
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