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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



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

Device Name : **BA5947FM**

- Features :
- 4-ch BTL driver
 - Use of an HSOP-M28 power package can achieve downsizing of the set.
 - 3 channels are directly connected to the PWM input. (with a built-in primary filter)
 - For CH4, the input terminal can be switched by the SW terminal.
 - A wide dynamic range (5.4V(typ.) when PreVcc=PowVcc=8V and RL=8Ω)
 - A built-in thermal shutdown circuit is installed.
 - PreVcc, PowVcc of CH1 and CH2, and PowVcc of CH3 and CH4 are provided with power supplies independently and an efficient power supply voltage design can be achieved.
 - Using an external mute terminal, the output current can be muted.
 - A built-in general operational amplifier installed.

○ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Parameter	Symbol	Limits	Unit
Power Supply Voltage	Vcc	13.5	V
Power Dissipation	Pd	2.2 *1	W
Operating Temperature Range	Topr	-35 to 85	°C
Storage Temperature Range	Tstg	-55 to 150	°C

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

PreVcc	6.0 to 13.2 V
PowVcc	6.0 to PreVcc

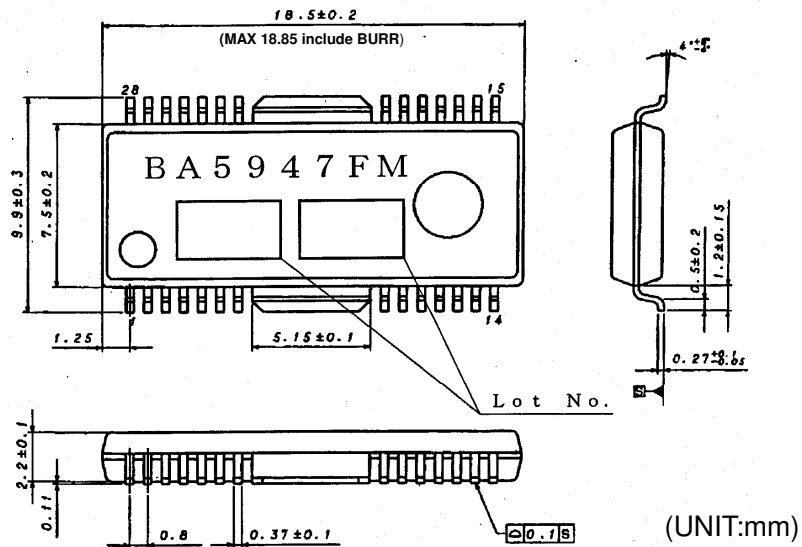
*1 When mounted on the glass/epoxy board with the size: 70 mm×70 mm, the thickness: 1.6 mm, and the rate of copper foil occupancy area: 3% or less.
 Over Ta=25°C, derating at the rate of 17.6mW/°C.

This product has not been checked for the strategic materials (or service) defined in the Foreign Exchange and Foreign Trade Control Law of Japan so that a verification work is required before exporting it.
 Not designed for radiation resistance.

○ ELECTRIC CHARACTERISTICS (Ta=25°C, Vcc=8V, RL=8Ω, Vb=VOP±1.75V, unless otherwise noted.)

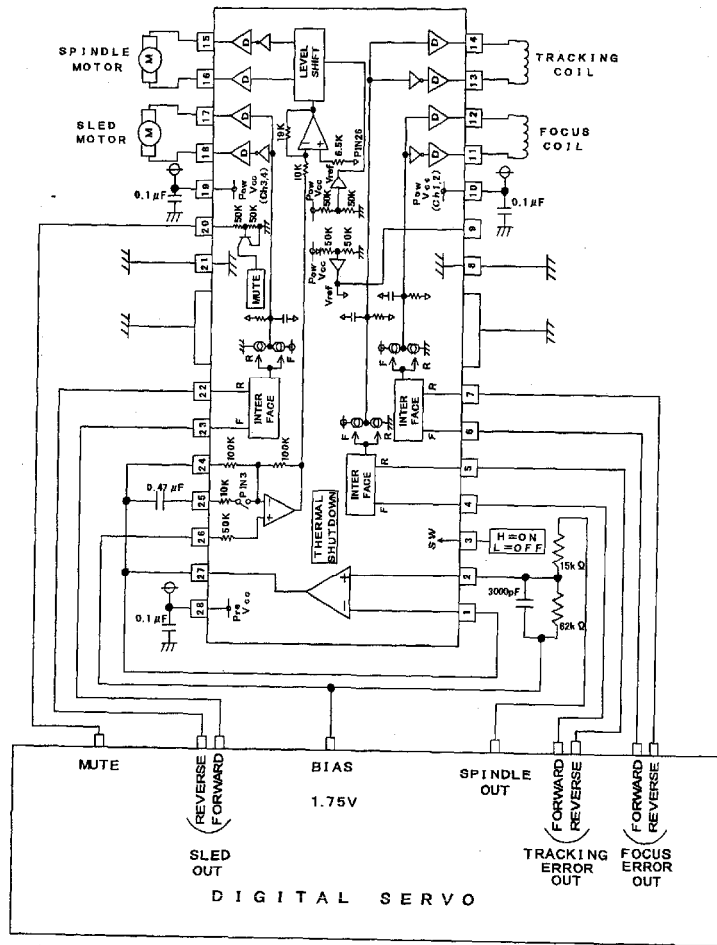
Parameter	Symbol	MIN	TYP	MAX	Unit	Condition
Consumption Current (at no signal)	IQ	-	17.0	25.0	mA	no load applied
Internal Vref Terminal Voltage	VREF	3.40	3.70	4.00	V	
Mute OFF Voltage	VMON	1.9	-	-	V	
Mute ON Voltage	VMOFF	-	-	0.5	V	
Drivers not a spindle type (CH1, 2, 3)						
Input High-level Voltage	VIH	1.9	-	VCC	V	
Input Low-level Voltage	VIL	-0.3	-	0.5	V	
Input High-level Current	IIH	170	310	450	μA	Vf=Vr=5V
Input Low-level Current F side	IILF	-10	-	0	μA	Vf=0V
Input Low-level Current R side	IILR	-50	-	0	μA	Vr=0V
Output Offset Voltage	VOO	-30	-	30	mV	
Maximum Output Amplitude	VOM	4.4	5.0	5.6	V	Vf=5V, Vr=0V
Spindle Drivers (CH4)						
Input Bias Current	IB	-	10	300	nA	
Output Offset	VOO4	-50	-	50	mV	VIN4=Vb
Maximum Output Amplitude	VOM	-	5.4	-	V	Vb=4V
Voltage Gain 1	GVC1	9.3	11.3	13.3	dB	PIN24 and PIN25 are shorted.
Voltage Gain 2	GVC2	27.8	31.3	34.8	dB	PIN24 and PIN25 are shorted.
Analog SW Input						
Input High-level Voltage	VIHSW	1.9	-	VCC	V	
Input Low-level Voltage	VILSW	-0.3	-	0.5	V	
Input High-level Current	IIHSW	-	60	90	μA	VSW=3.5V
Input Low-level Current	IILSW	-10	0	10	μA	VSW=0V
Operational Amplifier						
Offset Voltage	VOFOP	-5	0	5	mV	
Input Bias Current	IBOP	-	10	300	nA	
High-level Output Voltage	VOHOP	7.0	-	-	V	
Low-level Output Voltage	VOLOP	-	-	0.2	V	
Output Driving Current Sink	Isink	2.0	9.0	-	mA	
Output Driving Current Source	source	7.0	13.0	-	mA	
Open-loop Voltage Gain	GVO	-	65	-	dB	VIN=-60dBV, 1KHz
Slew Rate	SR	-	0.5	-	V/μs	f=50kHz, 2Vpp square wave, Vb=4V

○ OUTLINE DIMENSIONS, SYMBOLS



(UNIT:mm)

○ BLOCK DIAGRAM



○ PIN NUMBERS, PIN NAMES

No.	Pin Name	Description	No.	Pin Name	Description
1	OPIN-	operational amplifier negative input terminal	15	CH4OUTR	CH4 reverse output terminal
2	OPIN+	operational amplifier positive input terminal	16	CH4OUTF	CH4 forward output terminal
3	SW	CH4 input selecting switch terminal	17	CH3OUTF	CH3 forward output terminal
4	CH1FIN	CH1PWM forward input	18	CH3OUTR	CH3 reverse output terminal
5	CH1RIN	CH1PWM reverse input	19	POWVCC	power part power supply voltage (CH3, 4)
6	CH2FIN	CH2PWM forward input	20	MUTE	mute terminal
7	CH2RIN	CH2PWM reverse input	21	GND	GND
8	GND	GND	22	CH3RIN	CH3PWM reverse input
9	VREFIN	internal Vref voltage input terminal	23	CH3FIN	CH3PWM forward input
10	POWVCC	power part power supply voltage (CH1, 2)	24	CH4IN	CH4 input terminal
11	CH2OUTR	CH2 reverse output terminal	25	CH4CAPA	CH4 external CAPA connection terminal
12	CH2OUTF	CH2 forward output terminal	26	OUTVREF	CH4 external reference voltage input terminal
13	CH1OUTR	CH1 reverse output terminal	27	OPOUT	operational amplifier output terminal
14	CH1OUTF	CH1 forward output terminal	28	PREVCC	pre-stage power supply voltage

* Polarities for the F output and the R output. For CH4, when PIN24 is High, PIN16 outputs High.

○ CAUTIONS ON USE

- (1) Thermal shutdown or mute ON will activate the mute function only on the driver part.
- (2) Even though a radiating fin is connected to the GND inside of the package, it must be connected to the external GND.
- (3) 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.
- (4) 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.
- (5) About GND potential
The electric potential of the GND terminal must be kept lowest in the circuitry at any operation states.
- (6) 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.
- (7) About operations in a strong electric field
When used in a strong electric field, note that a malfunction may occur.
- (8) ASO
When using this IC, the output Tr must be set not to exceed the values specified in the absolute maximum ratings and ASO.
- (9) Thermal shutdown circuit
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.)
180	20

- (10) 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.
- (11) 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.
Note that, while not applying the power supply voltage to the IC, any voltage must not be applied 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, each input terminal must be the power supply voltage or less; or within the guaranteed values in the electric characteristics.

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