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

Device Name : **BA5814FM**

Features :
- 5-ch BTL driver
- Use of an HSOP-M28 power package can achieve downsizing of the set.
- A built-in thermal shutdown circuit is installed.
- A wide dynamic range (6.0V(typ.) when Vcc=8V and RL=8Ω)
- Incorporate variable regulators for 2 channels. (External PNP Tr. must be 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	-40 to 85	°C
Storage Temperature Range	Tstg	-55 to 150	°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 Ta=25°C, derating at the rate of 17.6mW/°C.

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

Vcc	4.3 to 13.2 V

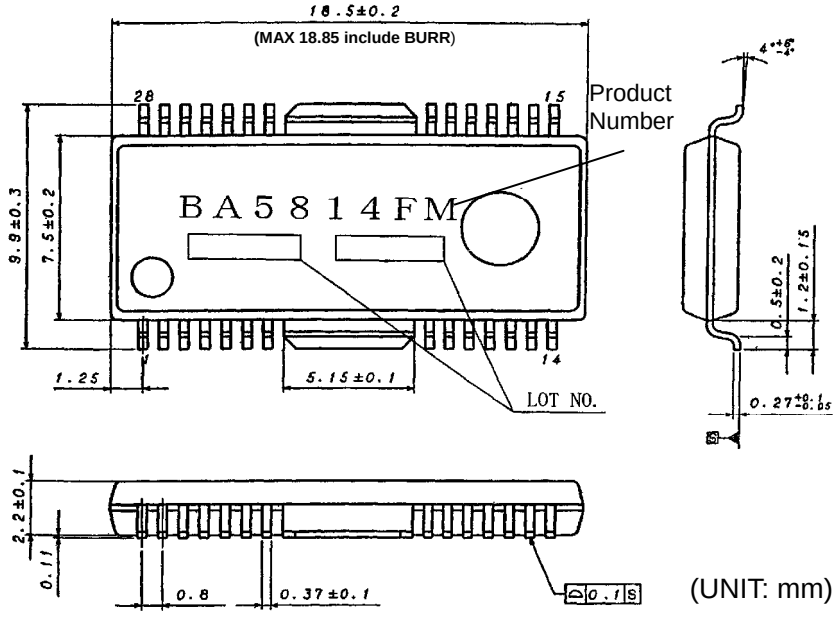
This product has not been checked for the strategic materials (or service) defined in the Foreign Exchange and Foreign Trade Control Low of Japan so that a verification work is required before exporting it.
Not designed for radiation resistance.

○ ELECTRIC CHARACTERISTICS

(Ta=25°C, Vcc=8V, PVcc45=5V, BIAS=2.5V, R_L=8Ω, unless otherwise noted.)

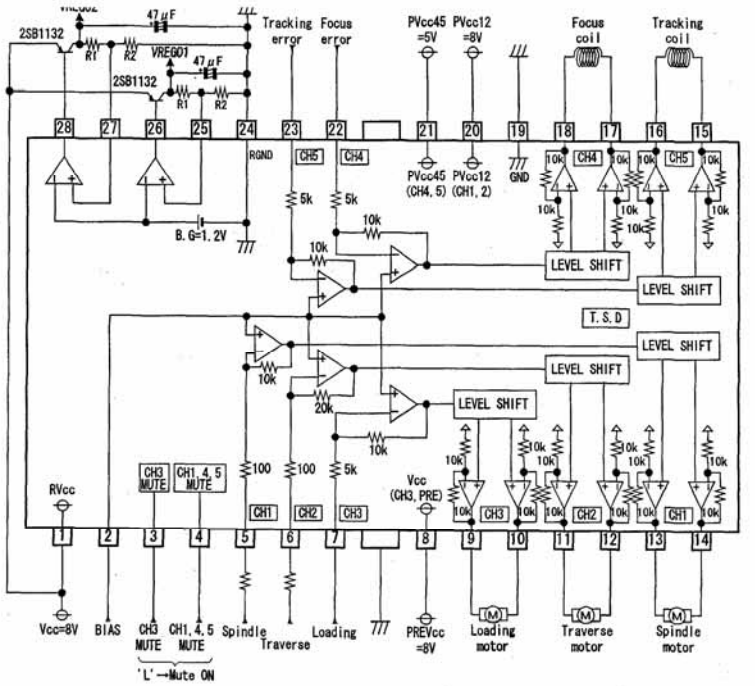
Parameter	Symbol	MIN	TYP	MAX	Unit	Condition
Circuit Current (at no signal)	ICC	-	20	30	MA	No load applied
<BTL Driver>						
Output Offset Voltage	VOOF	-50	0	50	MV	
Maximum Output Amplitude 1	VOM1	5.4	6.0	-	V	CH1, 2, 3
Maximum Output Amplitude 2	VOM2	3.6	4.0	-	V	CH4, 5
Voltage Gain 1	GVC1	9.5	12.0	14.5	dB	CH1 RIN=10kΩ
Voltage Gain 2	GVC2	15.5	18.0	20.5	dB	CH2 RIN=10kΩ
Voltage Gain 3	GVC3	16.5	18.0	19.5	dB	CH3, 4, 5
Mute ON Voltage	VMTON	-	-	0.5	V	
Mute OFF Voltage	VMTOFF	2.0	-	-	V	
Mute Terminal Input Current	IMUTE	-	90	140	μA	VMUTE=5V
Bias Terminal Input Current	IBIAS	-	75	120	μA	
<Regulator>						
RE_I Terminal Threshold Voltage	VREITH	1.14	1.2	1.26	V	
RE_O Terminal Output Sink Current	ISIN	10	50	-	mA	
RE_I Terminal Bias Input Current	IBOP	-	20	300	nA	

○ OUTLINE DIMENSIONS, SYMBOLS



(UNIT: mm)

○ APPLICATION CIRCUIT DIAGRAM



T.S.D : (Thermal shutdown)
Resistance unit : [Ω]

○ PIN NUMBERS, PIN NAMES

No.	Pin Name	Description	No.	Pin Name	Description
1	RVcc	Power supply voltage terminal (REG part)	15	VO5(+)	Driver CH5 positive output
2	BIAS	Bias input terminal	16	VO5(-)	Driver CH5 negative output
3	MUTE1	CH3 mute control terminal	17	VO4(+)	Driver CH4 positive output
4	MUTE2	CH1, 4, 5 mute control terminal	18	VO4(-)	Driver CH4 negative output
5	VIN1	CH1 input terminal	19	GND	Ground terminal (PRE part, POWER part)
6	VIN2	CH2 input terminal	20	PVcc12	Power supply terminal (CH1, 2 POWER part)
7	VIN3	CH3 input terminal	21	PVcc45	Power supply terminal (CH4, 5 POWER part)
8	VCC	Power supply terminal (PRE part, CH3 POWER part)	22	VIN4	CH4 input terminal
9	VO3(-)	Driver CH3 negative output	23	VIN5	CH5 input terminal
10	VO3(+)	Driver CH3 positive output	24	RGND	Ground terminal (REG part)
11	VO2(-)	Driver CH2 negative output	25	RE_I1	Regulator 1 output feedback terminal
12	VO2(+)	Driver CH2 positive output	26	RE_O1	Regulator 1 external Tr base connection terminal
13	VO1(-)	Driver CH1 negative output	27	RE_I2	Regulator 2 output feedback terminal
14	VO1(+)	Driver CH1 positive output	28	RE_O2	Regulator 2 external Tr base connection terminal

Note: The positive or negative polarity of driver outputs is determined by the input polarity.
(For example, when the voltage on the pin 5 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.
(The pin 3 will mute CH3 while the pin 4 will mute CH1, 4, 5.)
(2) On the Bias terminal (pin 2), the applied voltage of 0.7V (Typ.) or less will activate a mute function.
Under conditions of normal use, it should be set to 1.1V or above.
(3) When the power supply voltage drops to 3.7V (Typ.) or less, the internal circuit will turn OFF and, when recovering to 3.9V (Typ.) or above, the internal circuit will startup.
(4) Thermal shutdown (TSD), a low power supply voltage, or a low bias terminal voltage will activate the mute functions on all drivers.
While muting, the output voltage of the BTL driver equals to the internal bias voltage (VCC/2).
(5) Because an internal resistance of the driver input part is generated at the rate of +1200ppm/°C (Typ.), using an external input resistance to control the gain will result in a change of the gain value corresponding to the temperature.
(6) The regulator output voltage: VREGO will be the value including the RE_I terminal threshold voltage: VREITH and a variation of the external resistance.
Affected by the RE_I terminal input bias current:: IBOP, VREGO is described as the following, where the high-precision external resistance must be selected after careful consideration of IBOP.

$$V_{REGO}=V_{REITH} * \left(\frac{R_1}{R_2}+1\right) - R_1 \times I_{BOP}$$

(As for R_1 and R_2, refer to the application circuit diagram.)

(7) The capacitor installed between the regulator output and GND also serves as an anti-oscillation capacitor and therefore, it must show high performance in the temperature characteristics.
(8) The power supply and GND terminals of the regulator (pin 1 and 24) also serve as the power supply and GND of the internal constant current source and therefore, they must be connected to the external power supply and GND even when the regulator is not in use.
(9) Even though a radiating fin is connected to the GND inside of the package, it must be connected to the external GND.
(10) 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.
(11) Short-circuit between output-power supply, output-GND, or output terminals
Short-circuits between output pin-VCC, output pin-GND, or output terminals (load short) must be avoided. Make sure that the ICs are installed on the board in proper directions.
Mounting the ICs in improper directions may damage them or produce smoke.
(12) 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.
(13) 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.
(14) About GND potential
The electric potential of the GND terminal must be kept lowest in the circuitry at any operation states.
(15) 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.
(16) About operations in a strong electric field
When used in a strong electric field, note that a malfunction may occur.
(17) ASO
When using this IC, the output Tr must be set not to exceed the values specified in the absolute maximum ratings and ASO.

(18) 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.)
175	25

(19) 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.

(20) 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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