

# 3-channel BTL driver for CD players

## BA5933FP-Y

The BA5933FP-Y is a 3-channel BTL driver for CD player actuators and motors. This IC has an internal 5V regulator and a standard operational amplifier, and comes in a HSOP 25-pin package, allowing for application miniaturization.

### ●Applications

CD players and CD-ROM drives

### ●Features

- 1) 3-channel BTL driver.
- 2) HSOP 25-pin power package allows for application miniaturization.
- 3) Internal standby function.
- 4) Internal thermal shutdown circuit.
- 5) Gain is adjustable with an attached resistor.
- 6) Internal 5V regulator.  
(requires attached PNP transistor)
- 7) Internal standard operational amplifier.

### ●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>CC</sub>	18	V
Power dissipation	P <sub>d</sub>	1.45*1	W
Operating temperature	T <sub>opr</sub>	−35~+85	°C
Storage temperature	T <sub>stg</sub>	−55~+150	°C

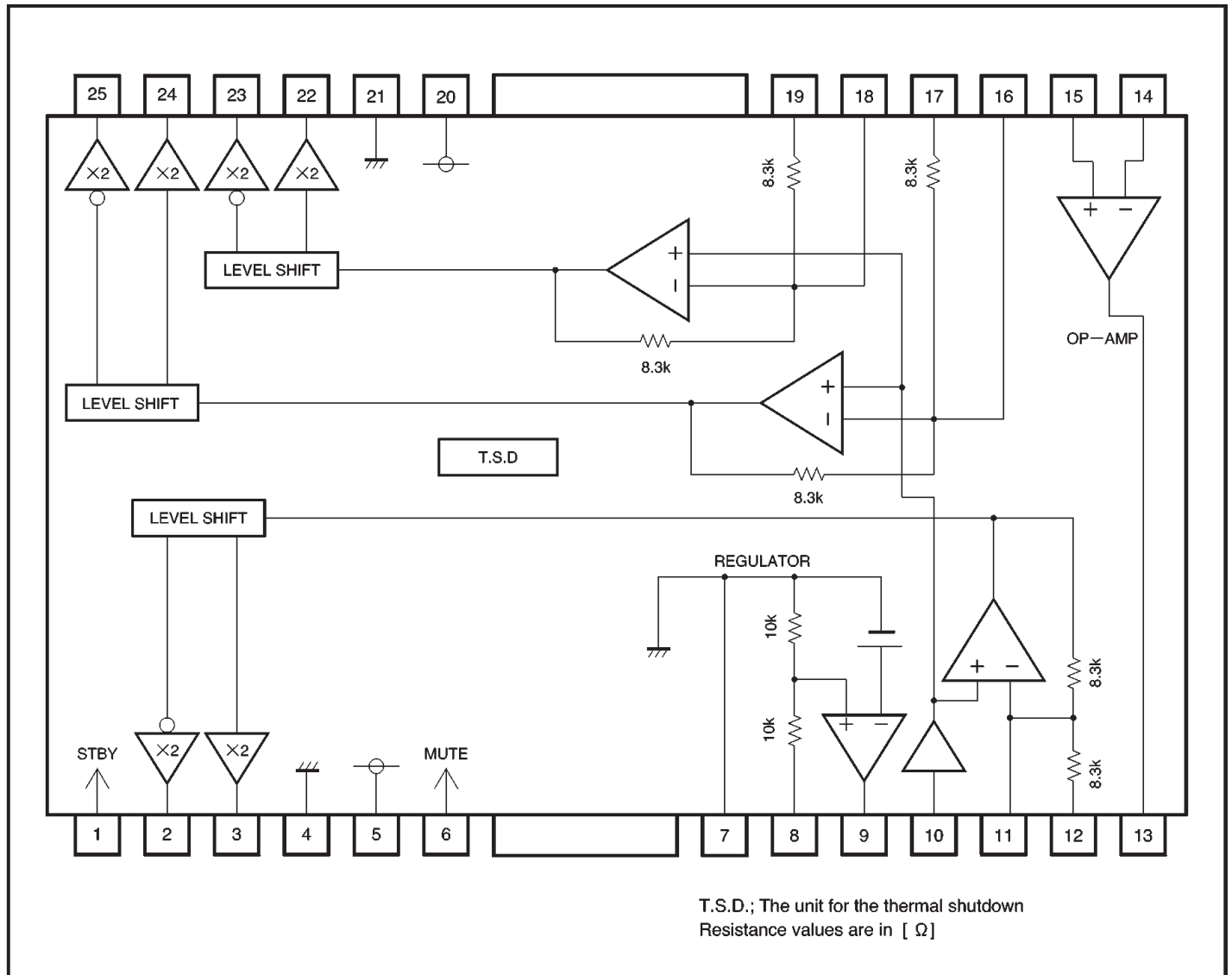
\*1 When mounted on a 70 × 70 × 1.5 mm glass epoxy board with less than 3% copper foil.  
Reduced by 11.6 mW for each increase in Ta of 1°C over 25°C.

### ●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Power supply voltage	V <sub>CC</sub>	6	—	13.2	V	
		4.5	—	13.2	V	Without regulator*2

\*2 Pins 8 and 9 may be left open without regulator.

## ●Block diagram



## ●Pin descriptions

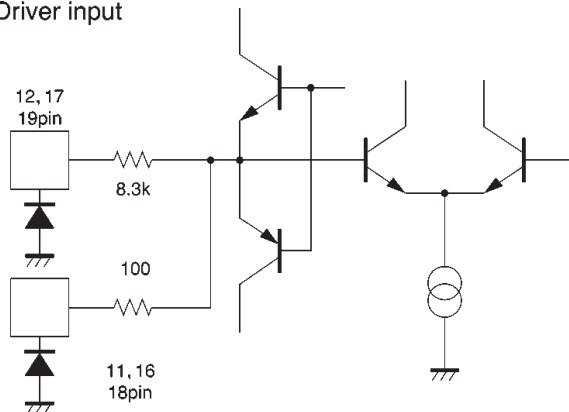
Pin No.	Pin name	Function
1	STBY	Standby mode switch
2	OUT1+	Channel 1 positive output
3	OUT1—	Channel 1 negative output
4	GND	Ground
5	V <sub>CC</sub>	V <sub>CC</sub>
6	MUTE	Mute
7	GND	Substrate ground
8	REG_OUT	Constant voltage output (collector for the attached transistor)
9	REG_B	Connect to the base of the attached transistor
10	BIAS	Bias input
11	IN1'	Channel 1 gain adjustment input
12	IN1	Channel 1 fixed input
13	OP_OUT	Operational amplifier output

Pin No.	Pin name	Function
14	OP_IN (—)	Operational amplifier negative input
15	OP_IN (+)	Operational amplifier positive input
16	IN2'	Channel 2 gain adjustment input
17	IN2	Channel 2 gain fixed input
18	IN3'	Channel 3 gain adjustment input
19	IN3	Channel 3 gain fixed input
20	V <sub>CC</sub>	V <sub>CC</sub>
21	GND	Ground
22	OUT3—	Channel 3 negative output
23	OUT3+	Channel 3 positive output
24	OUT2—	Channel 2 negative output
25	OUT2+	Channel 2 positive output

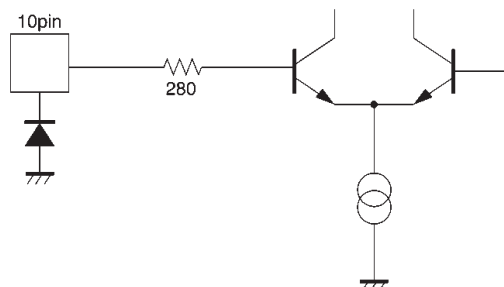
\* Positive and negative output is relative to the polarity of the input pins.

## ● Pin equivalent circuit diagrams

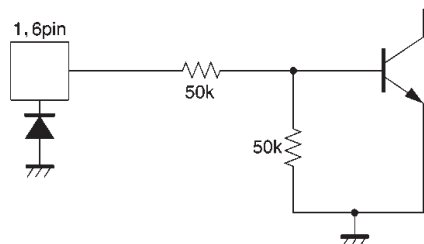
Driver input



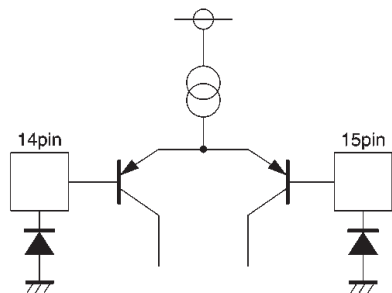
Bias



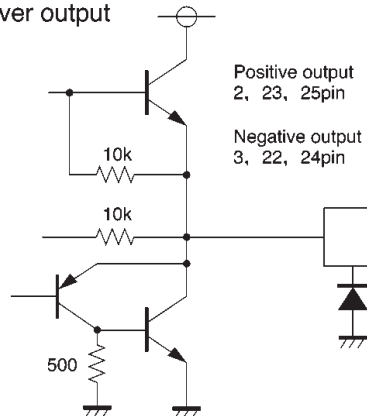
Standby switch muting



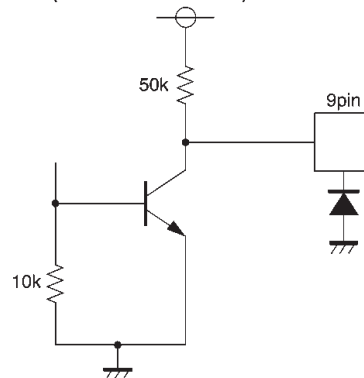
Operational amplifier input



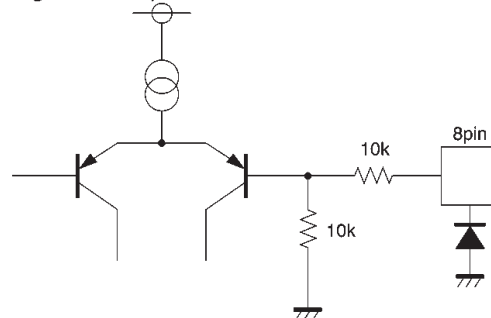
Driver output



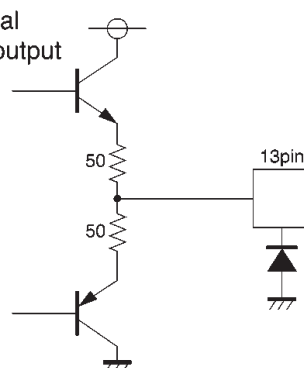
Regulator (base connection)



Regulator output



Operational amplifier output



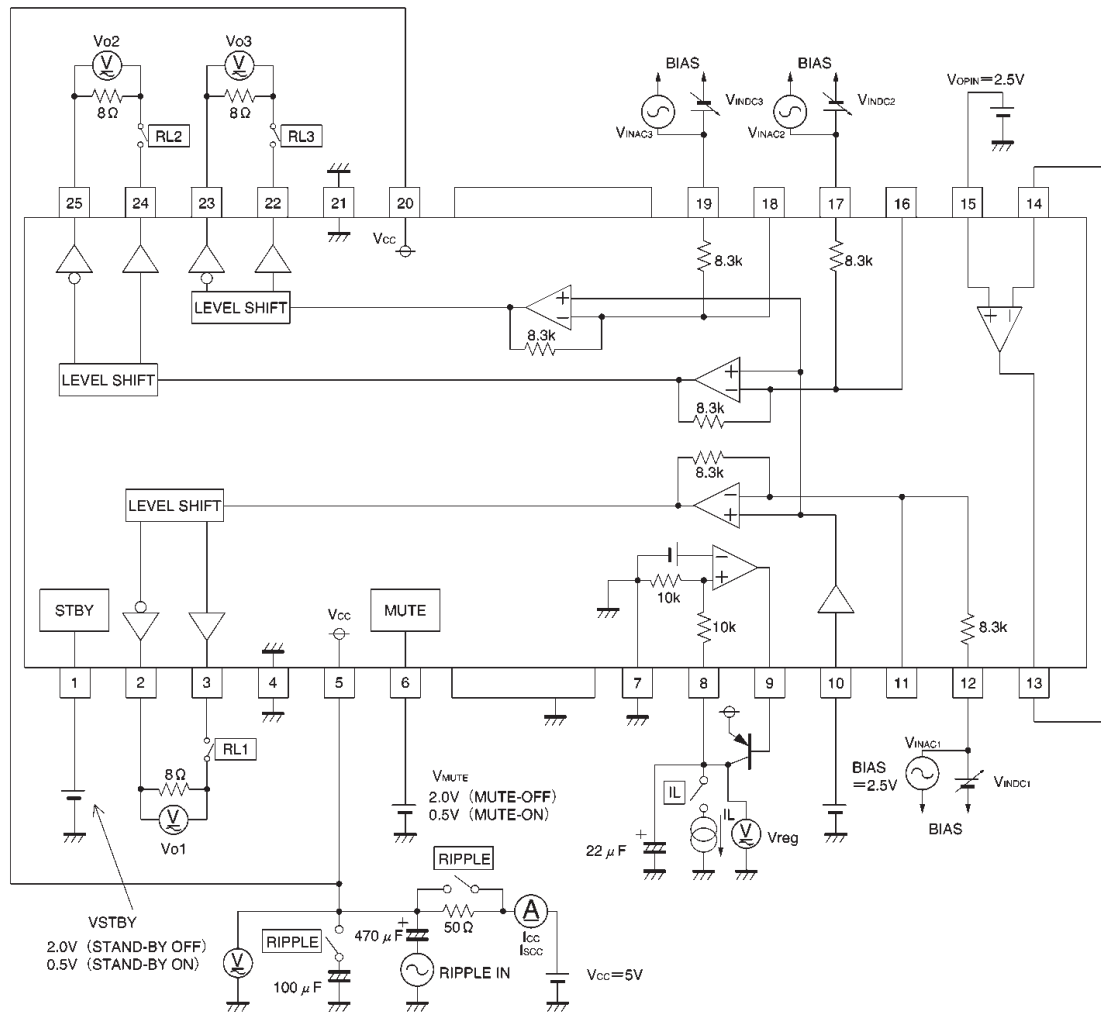
●Electrical characteristics (unless otherwise noted, Ta = 25°C, V<sub>CC</sub> = 5V, BIAS = 2.5V, R<sub>L</sub> = 8Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current dissipation	I <sub>CC</sub>	—	7.0	10.0	mA	No load
Standby current dissipation	I <sub>SCC</sub>	—	0	100	μA	No load
Output voltage, offset	V <sub>OO</sub>	—50	—	50	mV	—
Maximum output amplitude	V <sub>OM</sub>	2.5	3.0	—	V	—
Closed loop voltage gain	G <sub>VC</sub>	10.5	12.0	13.5	dB	V <sub>IN</sub> = ±0.3V
Ripple rejection	RR	—	60	—	dB	RIPPLE IN = 0.1Vrms, 100Hz
Slew rate	SR	—	2.0	—	V/μs	100 kHz square wave, 2 V <sub>P-P</sub> output
Mute On voltage	V <sub>MON</sub>	—	—	0.5	V	—
Mute Off voltage	V <sub>MOFF</sub>	2.0	—	—	V	—
Standby On voltage	V <sub>SON</sub>	—	—	0.5	V	—
Standby Off voltage	V <sub>SOFF</sub>	2.0	—	—	V	—
〈5 V regulator〉						
Output voltage	V <sub>reg</sub>	4.75	5.00	5.25	V	V <sub>CC</sub> = 8V I <sub>L</sub> = 100mA
Output load differential	ΔV <sub>RL</sub>	—50	0	10	mV	V <sub>CC</sub> = 8V I <sub>L</sub> = 0~200mA
Power supply voltage differential	ΔV <sub>VCC</sub>	—8	0	25	mV	(V <sub>CC</sub> = 6~9V) I <sub>L</sub> = 100mA
〈Operational amplifier〉						
Offset voltage	V <sub>OFOP</sub>	—5	0	5	mV	—
Input bias current	V <sub>BOP</sub>	—	—	300	nA	—
Output high level voltage	V <sub>OHOP</sub>	3.9	—	—	V	—
Output low level voltage	V <sub>LOP</sub>	—	—	1.1	V	—
Output drive current (sink)	I <sub>SINK</sub>	10	30	—	mA	V <sub>CC</sub> at 50 Ω
Output drive current (source)	I <sub>SOURCE</sub>	10	25	—	mA	50 Ω at ground
Open loop voltage gain	G <sub>VO</sub>	—	78	—	dB	V <sub>IN</sub> = —75dBV, 1kHz
Slew rate	S <sub>ROP</sub>	—	1	—	V/μs	100 kHz square wave, 2 V <sub>P-P</sub> output
Ripple rejection	RR <sub>OP</sub>	—	65	—	dB	V <sub>IN</sub> = —20dBV, 100Hz
Common mode rejection ratio	C <sub>MRR</sub>	—	84	—	dB	V <sub>IN</sub> = —20dBV, 1kHz

◎Not designed for radiation resistance.

## ● Measurement circuit

〈Driver〉



〈Operational amplifier〉

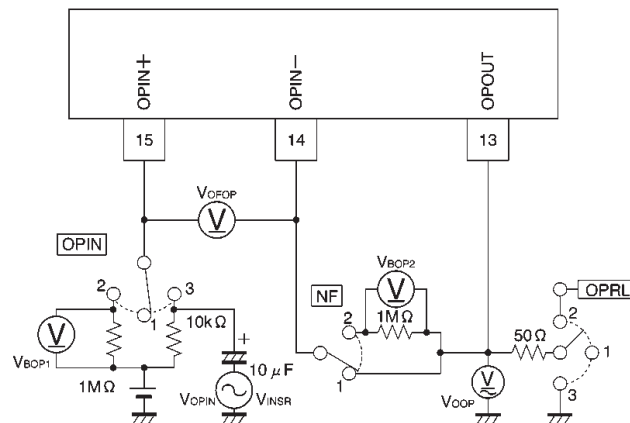


Fig. 1

●Application example

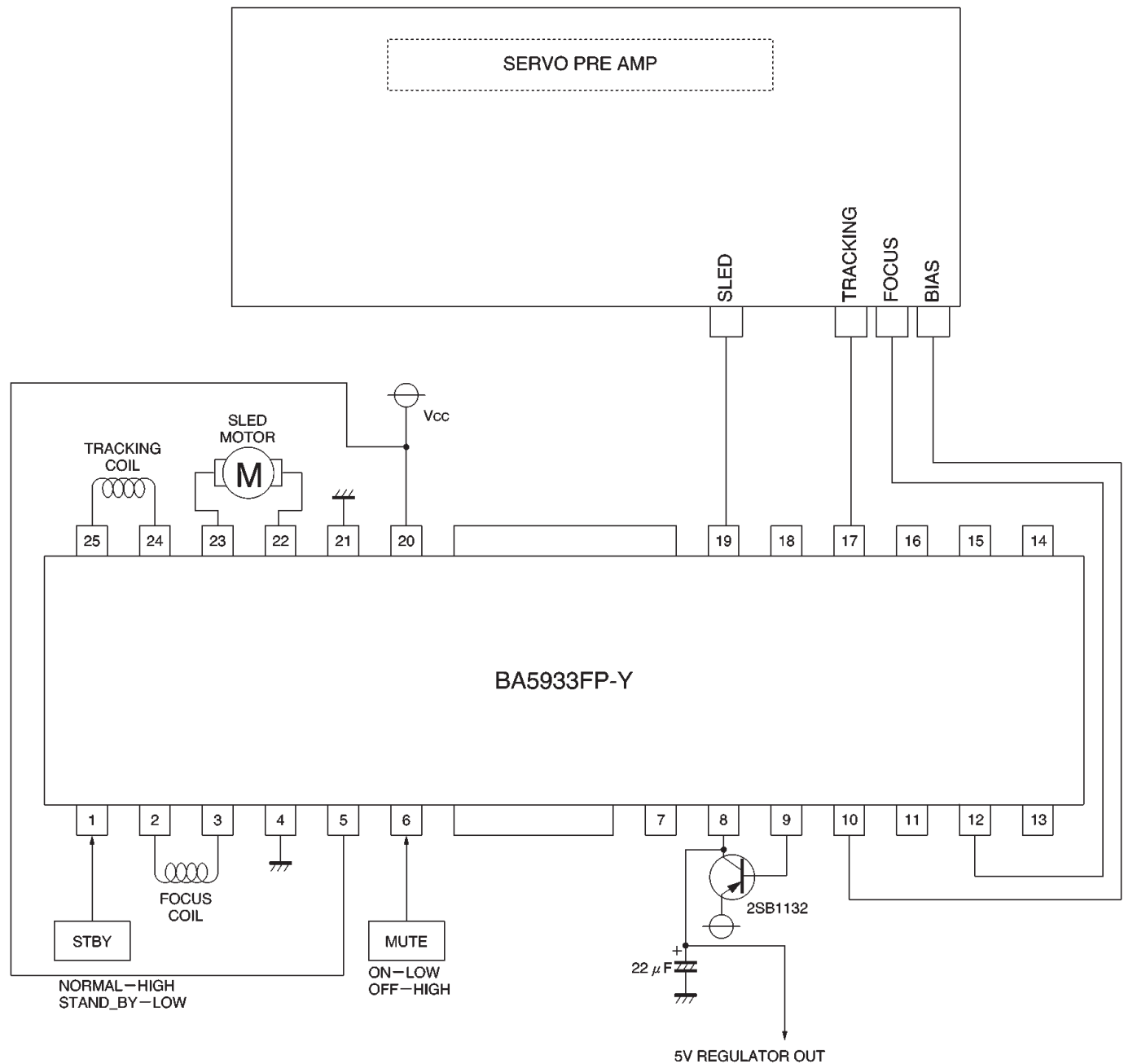


Fig. 2

### ●Operation notes

- (1) The BA5933FP-Y has a thermal shutdown circuit. The output current is muted when the chip temperature rises above 175°C (typically). When the chip temperature falls to 150°C (typically), the driver circuit starts up again.
- (2) The output current can be muted by opening the mute pin (pin 6) voltage or lowering it below 0.5V. During normal use, pin 6 should be pulled up above 2.0V.
- (3) The bias pin (pin10) is muted when lowered below 1.4V (typically). Make sure it stays above 1.6V during normal use.
- (4) Muting occurs during thermal shutdown, mute-on operations or a drop in the bias pin voltage. In each case, only the drivers are muted. During muting, the output pins

remain at the internal bias voltage, roughly ( $V_{CC}/2$ ).

- (5) Connect the IC to a 0.1μF bypass capacitor between power supplies, at the base of the IC.

- (6) The radiating fin is connected to the package's internal GND, but should also be connected to an external GND.

- (7) The capacitor between regulator output (pin 8) and GND also serves to prevent oscillation of the IC, so select one with good temperature characteristics.

- (8) The IC can be switched to the standby mode by opening the standby mode switch (pin 1) voltage, or lowering it below 0.5V. During normal use, pin 1 should be pulled up above 2.0V.

### ●Electrical characteristic curves

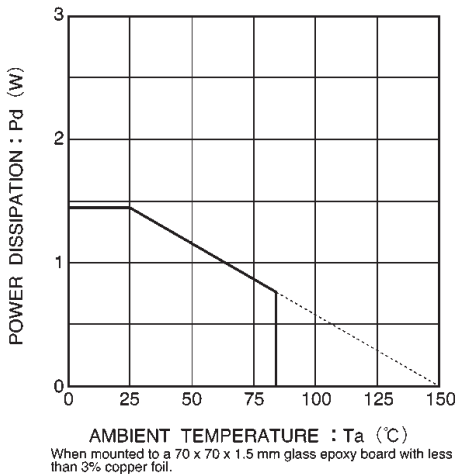


Fig. 3 Thermal derating curve

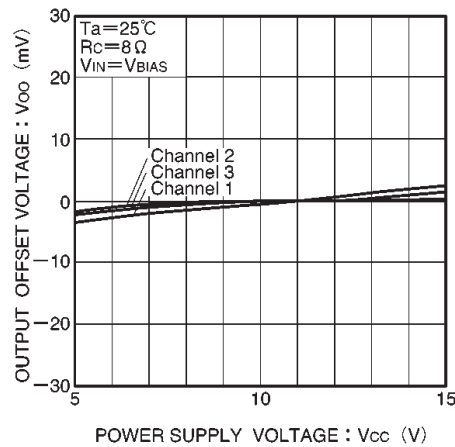


Fig. 4 Output offset voltage vs. power supply voltage

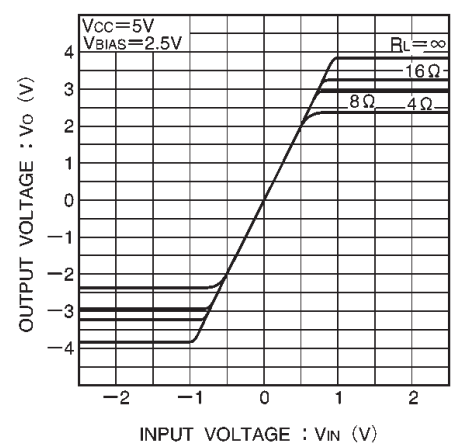


Fig. 5 I/O characteristics (Vcc = 5 V, variable load)

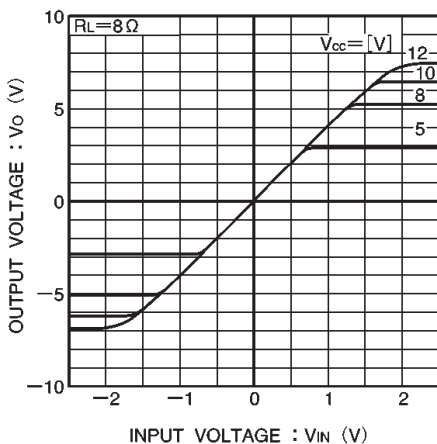


Fig. 5 I/O characteristics (variable Vcc)

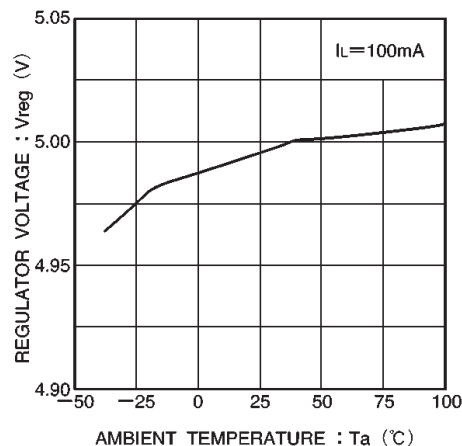


Fig. 7 Regulator voltage vs. temperature

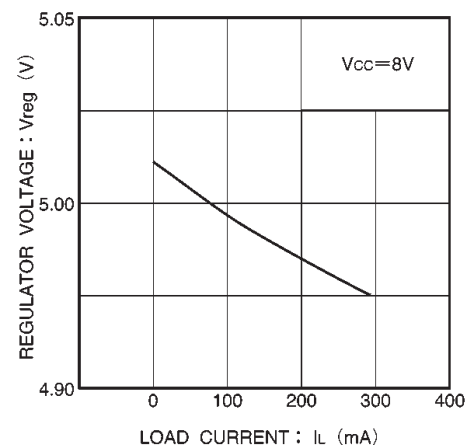


Fig. 8 Load current vs. regulator voltage



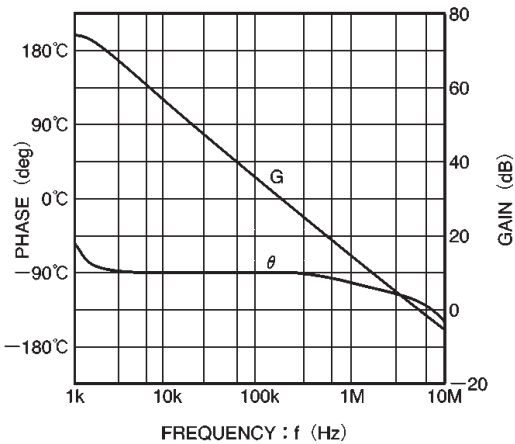


Fig. 9 Operational amplifier v.s. open loop characteristics

●External dimensions (Units: mm)

