

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 _{cc}	18	V
Power dissipation	P _d	1.45*1	W
Operating temperature	T _{opr}	-35~+85	°C
Storage temperature	T _{stg}	-55~+150	°C

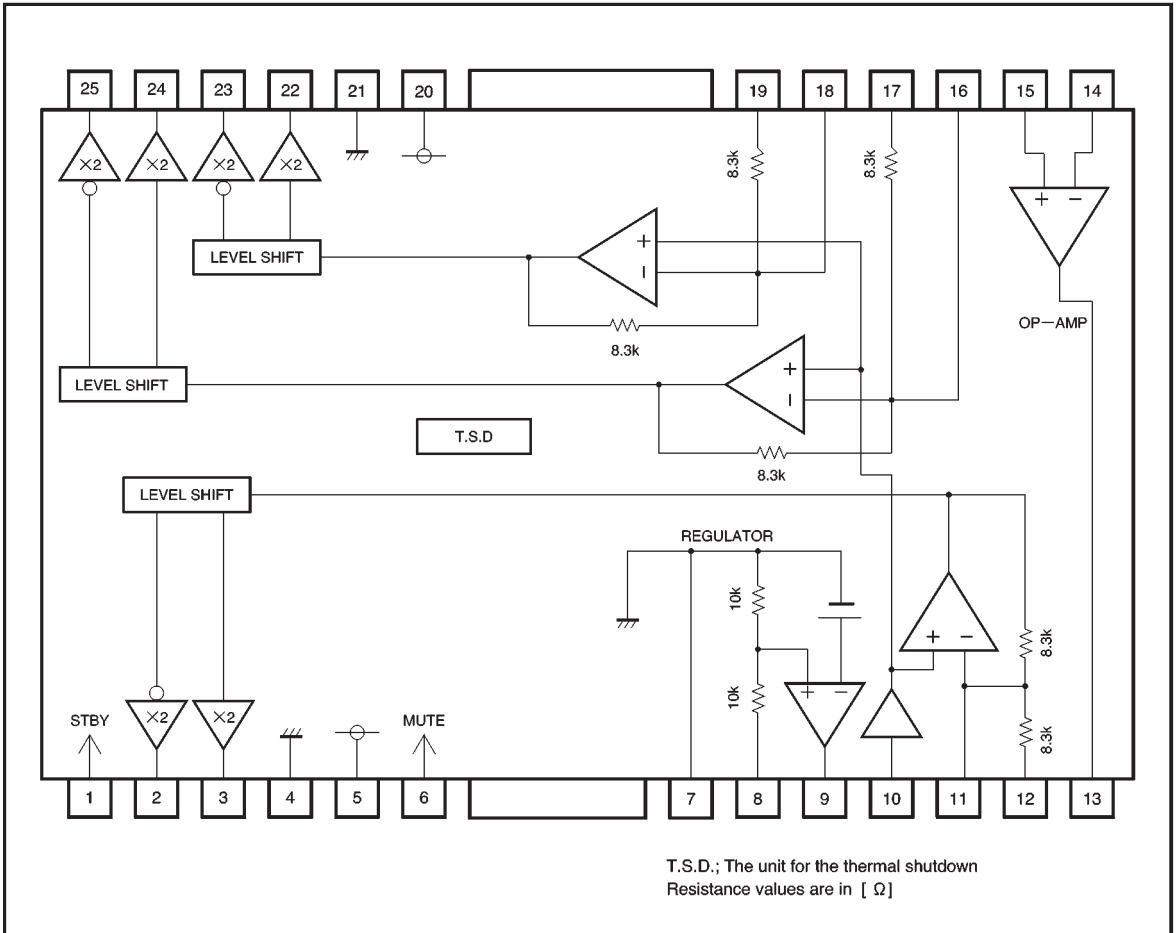
*1 When mounted on a 70 × 70 × 1.5 mm glass epoxy board with less than 3% copper foil.
Reduced by 11.6 mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Power supply voltage	V _{cc}	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

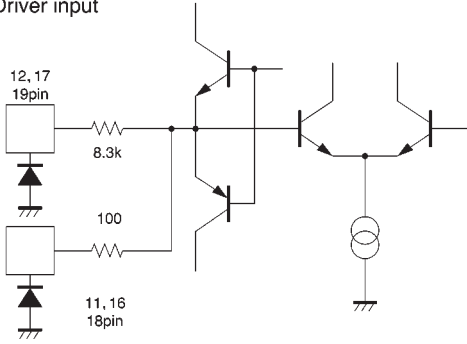
Pin No.	Pin name	Function
1	STBY	Standby mode switch
2	OUT1+	Channel 1 positive output
3	OUT1-	Channel 1 negative output
4	GND	Ground
5	V _{CC}	V _{CC}
6	MUTE	Mute
7	GND	Substrate ground
8	REG_OUT	Constant voltage output (collector for the attached transistor)
9	REG_B	Connect to the base of the attached 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 _{CC}	V _{CC}
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

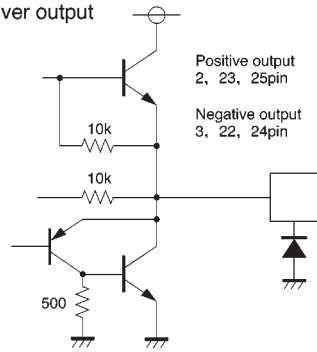
* Positive and negative output is relative to the polarity of the input pins.

● Pin equivalent circuit diagrams

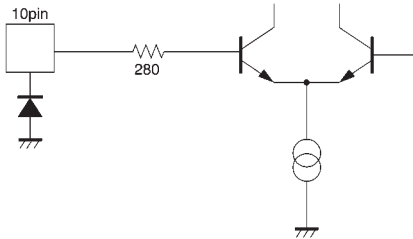
Driver input



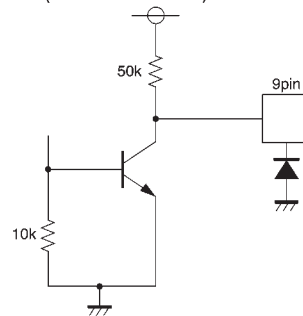
Driver output



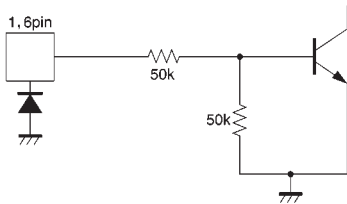
Bias



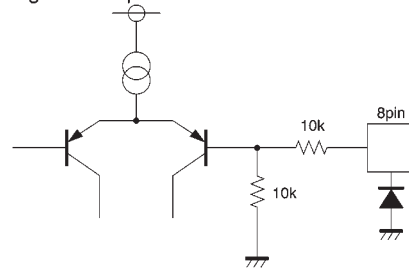
Regulator (base connection)



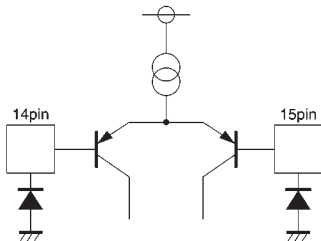
Standby switch muting



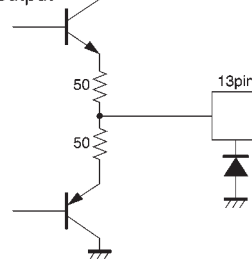
Regulator output



Operational amplifier input



Operational amplifier output



●Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $\text{BIAS} = 2.5\text{V}$, $R_L = 8\Omega$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current dissipation	I_{CC}	—	7.0	10.0	mA	No load
Standby current dissipation	I_{SCC}	—	0	100	μA	No load
Output voltage, offset	V_{OO}	-50	—	50	mV	—
Maximum output amplitude	V_{OM}	2.5	3.0	—	V	—
Closed loop voltage gain	G_{VC}	10.5	12.0	13.5	dB	$V_{IN} = \pm 0.3\text{V}$
Ripple rejection	RR	—	60	—	dB	RIPPLE IN=0.1Vrms, 100Hz
Slew rate	SR	—	2.0	—	V/ μs	100 kHz square wave, 2 V_{P-P} output
Mute On voltage	V_{MON}	—	—	0.5	V	—
Mute Off voltage	V_{MOFF}	2.0	—	—	V	—
Standby On voltage	V_{SON}	—	—	0.5	V	—
Standby Off voltage	V_{SOFF}	2.0	—	—	V	—

<5 V regulator>

Output voltage	V_{REG}	4.75	5.00	5.25	V	$V_{CC} = 8\text{V}$ $I_L = 100\text{mA}$
Output load differential	ΔV_{RL}	-50	0	10	mV	$V_{CC} = 8\text{V}$ $I_L = 0 \sim 200\text{mA}$
Power supply voltage differential	ΔV_{VCC}	-8	0	25	mV	($V_{CC} = 6 \sim 9\text{V}$) $I_L = 100\text{mA}$

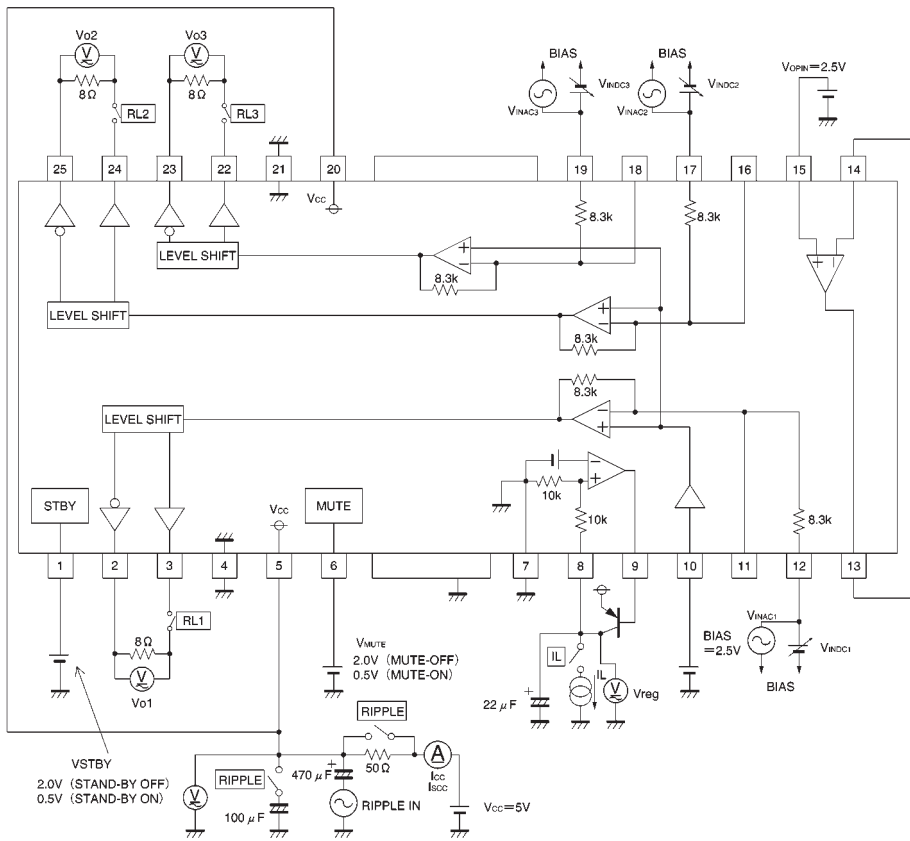
<Operational amplifier>

Offset voltage	V_{OFOP}	-5	0	5	mV	—
Input bias current	V_{BOP}	—	—	300	nA	—
Output high level voltage	V_{OHOP}	3.9	—	—	V	—
Output low level voltage	V_{OLOP}	—	—	1.1	V	—
Output drive current (sink)	I_{SINK}	10	30	—	mA	V_{CC} at 50 Ω
Output drive current (source)	I_{SOURCE}	10	25	—	mA	50 Ω at ground
Open loop voltage gain	G_{VO}	—	78	—	dB	$V_{IN} = -75\text{dBV}$, 1kHz
Slew rate	S_{ROP}	—	1	—	V/ μs	100 kHz square wave, 2 V_{P-P} output
Ripple rejection	RR _{OP}	—	65	—	dB	$V_{IN} = -20\text{dBV}$, 100Hz
Common mode rejection ratio	C_{MRR}	—	84	—	dB	$V_{IN} = -20\text{dBV}$, 1kHz

©Not designed for radiation resistance.

● Measurement circuit

〈Driver〉



〈Operational amplifier〉

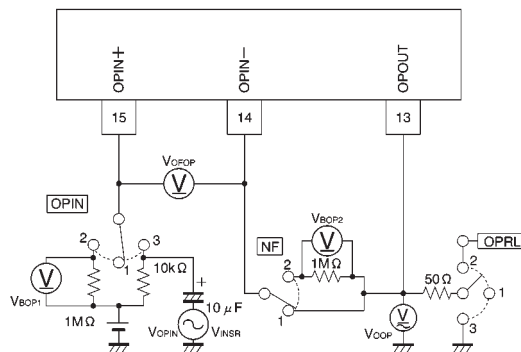


Fig. 1

● Application example

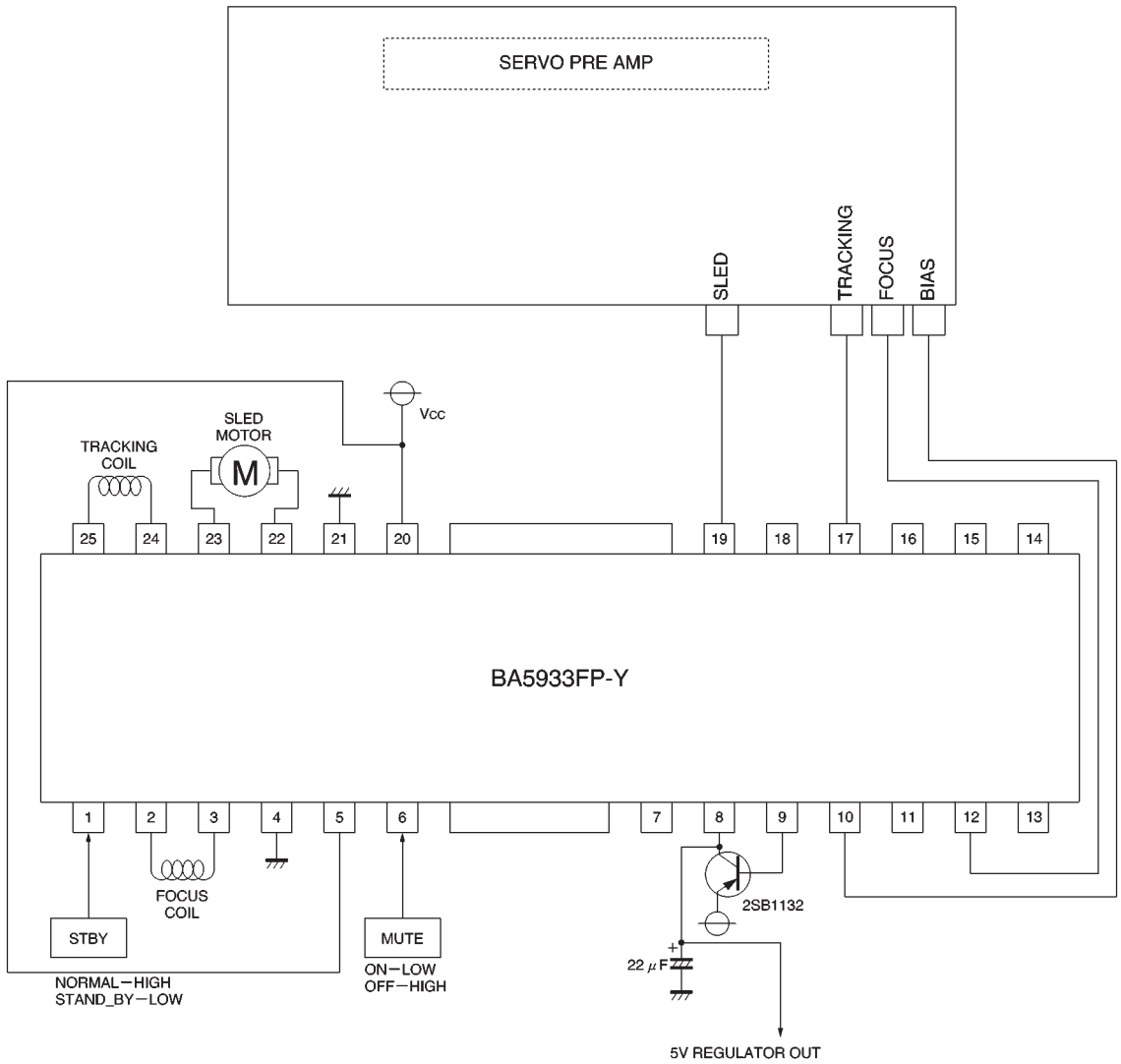


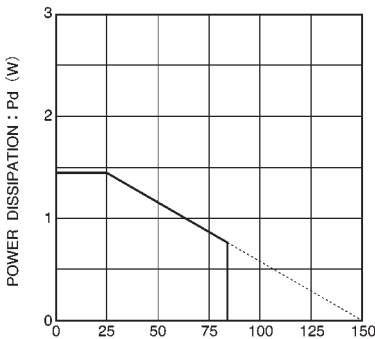
Fig. 2

● 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



AMBIENT TEMPERATURE : T_a (°C)
When mounted to a 70 x 70 x 1.5 mm glass epoxy board with less than 3% copper foil.

Fig. 3 Thermal derating curve

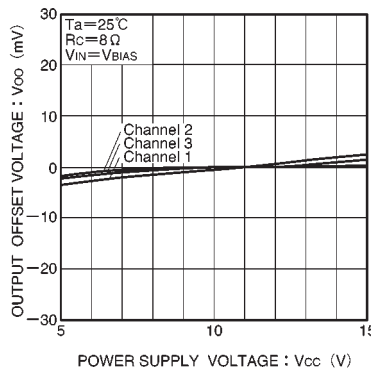


Fig. 4 Output offset voltage vs. power supply voltage

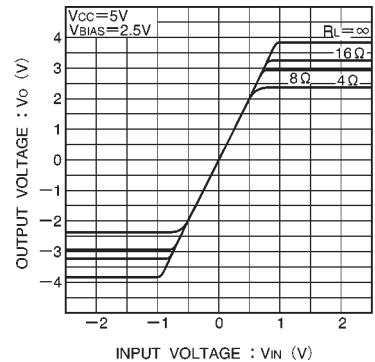


Fig. 5 I/O characteristics ($V_{cc} = 5\text{ V}$, variable load)

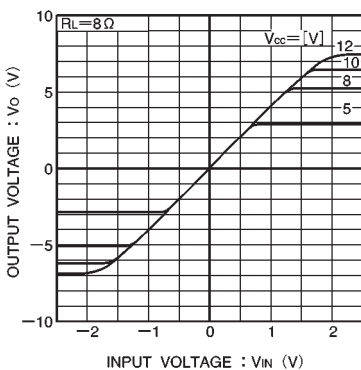


Fig. 5 I/O characteristics (variable V_{cc})

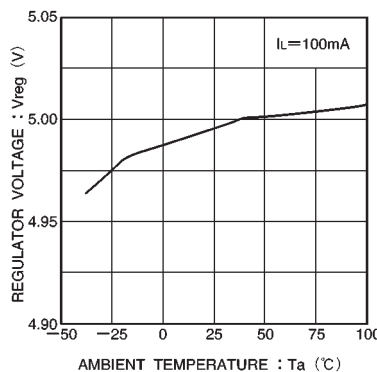


Fig. 7 Regulator voltage vs. temperature

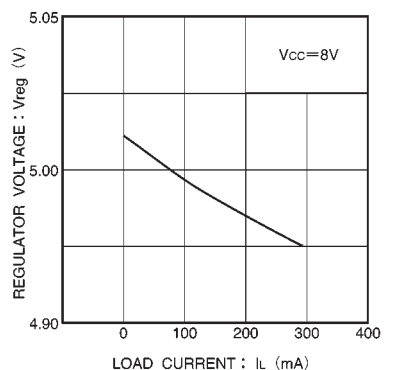


Fig. 8 Load current vs. regulator voltage

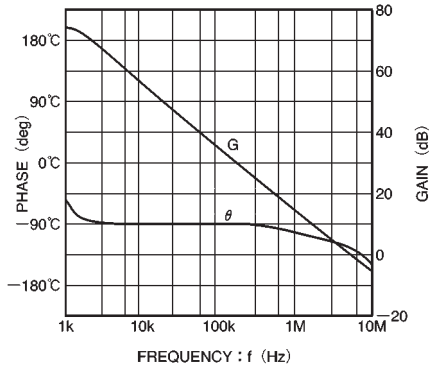


Fig. 9 Operational amplifier v.s. open loop characteristics

● External dimensions (Units: mm)

