

# 4-channel BTL driver for CD players

## BA6197FP

The BA6197FP, an IC for CD players, has a 4-channel BTL driver, 5V regulator (attached PNP transistor required), standard operational amplifier, and internal reset output linked to an internal thermal shutdown circuit. The driver has gain adjustment input pins for each channel, allowing gain to be set to the desired value. Also, the internal level shift circuit helps reduce the number of attached components.

### ●Applications

CD players, CD-ROM drives and other optical disc devices

### ●Features

- 1) 4-channel BTL driver on a HSOP 28-pin power package, allowing for application miniaturization.
- 2) Gain is adjustable with an attached resistor.
- 3) Internal thermal shutdown circuit with hysteresis capabilities.
- 4) Internal 5V regulator. (required attached PNP transistor)
- 5) Internal standard operational amplifier.
- 6) Reset output pin.

### ●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>	1700 *1	mW
Operating temperature	T <sub>opr</sub>	-35~+85	°C
Storage temperature	T <sub>stg</sub>	-55~+150	°C

\*1 16-pin DIP only. Reduced by 13.6 mW for each increase in Ta of 1°C over 25°C.

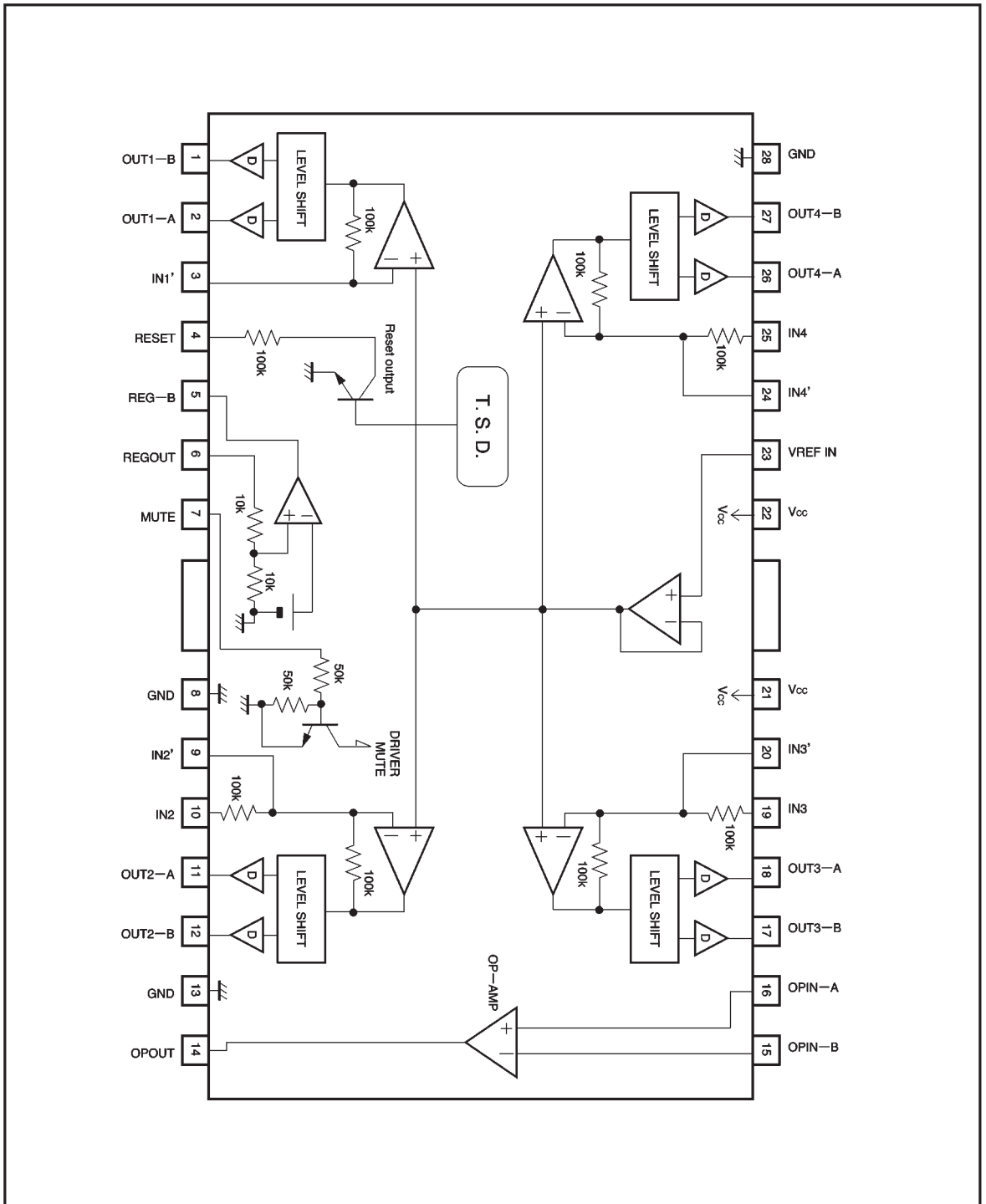
### ●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V <sub>CC</sub>	6.0	—	10.0	V
		5.5	—	10.0	V *2

\*2 Without regulator



● Block diagram

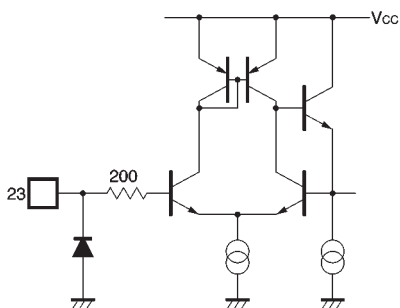
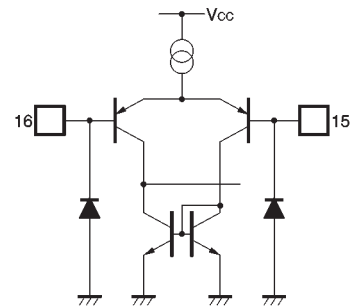
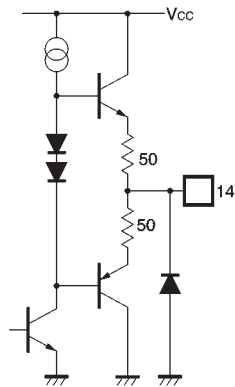
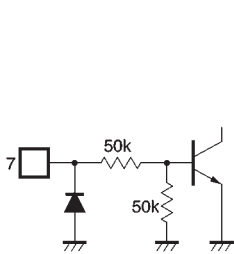
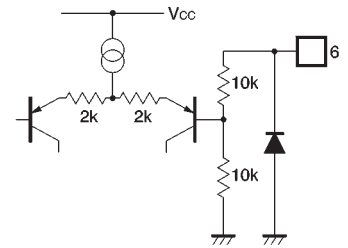
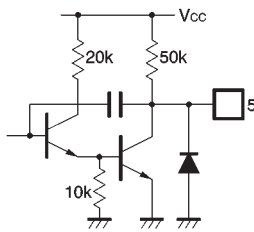
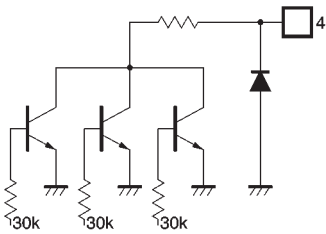
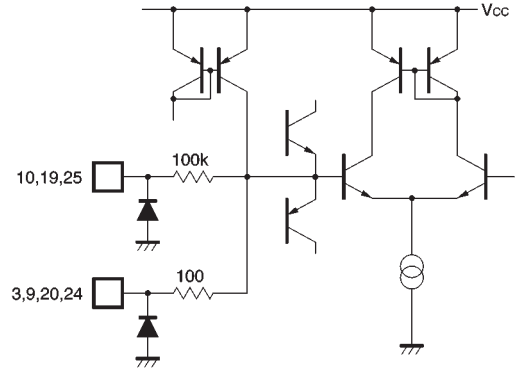
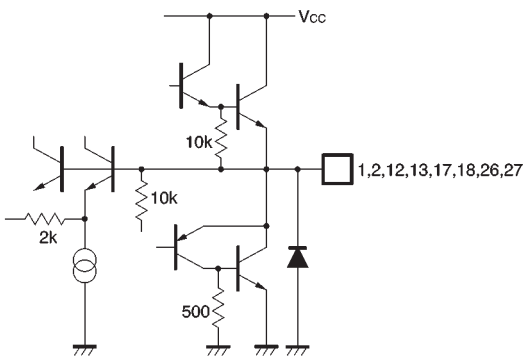


## ● Pin descriptions

Pin No.	Pin name	Function
1	OUT1—B	Channel 1 negative output
2	OUT1—A	Channel 1 positive output
3	IN1'	Input for adjusting channel 1 gain
4	RESET	Reset output
5	REG—B	Connect to base of attached regulator transistor
6	REGOUT	Connect the base of attached regulator transistor (output)
7	MUTE	Mute control
8	GND	Ground
9	IN2'	Input for adjusting channel 2 gain
10	IN2	Channel 2 input
11	OUT2—A	Channel 2 positive output
12	OUT2—B	Channel 2 negative output
13	GND	Substrate ground
14	OPOUT	Operational amplifier output
15	OPIN—B	Operational amplifier input (negative)
16	OPIN—A	Operational amplifier input (positive)
17	OUT3—B	Channel 3 negative output
18	OUT3—A	Channel 3 positive output
19	IN3	Channel 3 input
20	IN3'	Input for adjusting channel 3 gain
21	Vcc	Power supply
22	Vcc	Power supply
23	VREFIN	Reference amplifier input (bias)
24	IN4'	Input for adjusting channel 4 gain
25	IN4	Channel 4 input
26	OUT4—A	Channel 4 positive output
27	OUT4—B	Channel 4 negative output
28	GND	Substrate ground

\*Positive and negative output is relative to the polarity of the input pins.  
HIGH input → positive output (HIGH), negative output (LOW).

● Input / output circuits



● Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 8\text{V}$ ,  $f = 1\text{kHz}$ ,  $R_L = 8\Omega$ )

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
Quiescent current dissipation	$I_{CC}$	6.0	10.0	14.0	mA	No load	Fig.1
Output voltage, offset	$V_{OO}$	-50	—	50	mV		Fig.1
Maximum output amplitude	$V_{OD}$	3.65	4.30	—	V		Fig.1
Driver input resistance	$R_{IN}$	75	100	125	k $\Omega$	(Channel 1 except)	Fig.1
Closed loop voltage gain1	$G_{VC}$	4.5	6.0	7.5	dB	$V_{IN}=0.1\text{V}$ (Channel 1 except)	Fig.1
Closed loop voltage gain 2	$G_{VC}$	4.0	6.0	8.0	dB	$V_{IN}=0.1\text{V}$ (Channel 1, input 100k $\Omega$ attached)	Fig.1
Ripple rejection ratio	RR	—	60	—	dB	$V_{IN}=0.1\text{V}_{\text{rms}}$ , 100Hz	Fig.1
Slew rate	SR	—	2.0	—	V/ $\mu\text{s}$	100 kHz square wave, 3 $V_{P-P}$ output	Fig.1
MUTE OFF voltage	$V_{MOFF}$	2.0	—	—	V		Fig.1
〈5 V regulator〉							
Output voltage	$V_{REG}$	4.75	5.00	5.25	V	$I_L=100\text{mA}$	Fig.1
Output load differential	$\Delta V_{RL}$	-50	0	10	mV	$I_L=0\sim 200\text{mA}$	Fig.1
Power supply voltage differential	$\Delta V_{VCC}$	-10	0	25	mV	( $V_{CC}=6\sim 9\text{V}$ ) $I_L=100\text{mA}$	Fig.1
〈OP-AMP〉							
Offset voltage	$V_{OFOP}$	-5	0	5	mV		Fig.1
Input bias current	$I_{BIAS}$	—	—	300	nA		Fig.1
Output high level voltage	$V_{OHOP}$	6.0	—	—	V		Fig.1
Output low level voltage	$V_{OLOP}$	—	—	1.1	V		Fig.1
Output drive current (source)	$I_{SOU}$	10	40	—	mA	50 $\Omega$ at GND	Fig.1
Output drive current (sink)	$I_{SIN}$	10	50	—	mA	50 $\Omega$ at $V_{CC}$	Fig.1
(Open loop) voltage gain	$G_{VO}$	—	78	—	dB	$V_{IN}=-75\text{dBV}$ , 1kHz	Fig.1
Slew rate	$SR_{OP}$	—	1	—	V/ $\mu\text{s}$	100 kHz square wave, 3 $V_{P-P}$ output	Fig.1
Ripple rejection ratio	$RR_{OP}$	50	65	—	dB	$V_{IN}=-20\text{dBV}$ , 100Hz	Fig.1
Common mode rejection ratio	$CMRR$	70	84	—	dB	$V_{IN}=-20\text{dBV}$ , 1kHz	Fig.1

© Not designed for radiation resistance.

● Measurement circuit

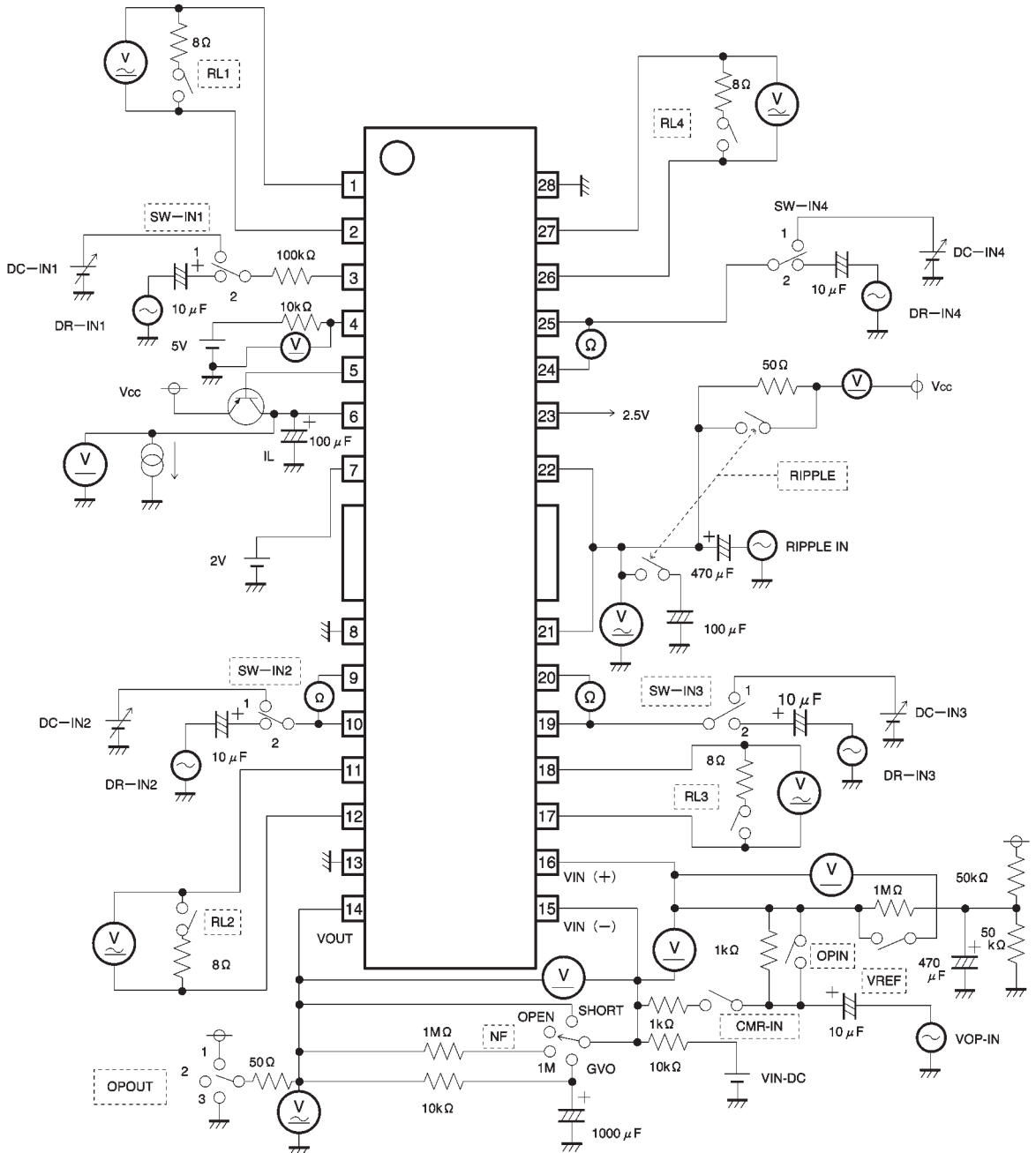


Fig.1

## ● Measurement circuit switch table

Parameter	Switch								Input					Condition
	RIP PLE	RL	OPIN	VREF	CMR -IN	NF	OP OUT	SW -IN	DR -IN	DC -IN	RIPPLE IN	VOP IN	VIN DC	
Quiescent current dissipation	ON	OFF	ON	ON	OFF	SHORT	2	2	0	0	0	0	OFF	
Output voltage, offset	↓	ON	↓	↓	↓	↓	↓	1	↓	2.5V	↓	↓	↓	
Maximum output	↓	↓	↓	↓	↓	↓	↓	2	↓	2.0 Vrms	↓	↓	↓	Only one chan- nel on at a time
Closed loop voltage gain	↓	↓	↓	↓	↓	↓	↓	↓	0.1 Vrms	0	↓	↓	↓	
Ripple rejection ratio	OFF	↓	↓	↓	↓	↓	↓	1	0	2.5V	0.1 Vrms	↓	↓	
Slew rate	ON	↓	↓	↓	↓	↓	↓	2	⌋	0	0	↓	↓	
〈Regulator〉														
Output voltage	↓	OFF	↓	↓	↓	↓	↓	↓	0	↓	↓	↓	↓	
Output load variation	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
Supply voltage variation	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
〈Operational amplifier〉														
Offset voltage	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
Input bias current	↓	↓	↓	OFF	↓	1M	↓	↓	↓	↓	↓	↓	↓	
Output high level voltage	↓	↓	↓	ON	↓	OPEN	↓	↓	↓	↓	↓	↓	2V	
Output low level voltage	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	6V	
Output driver current (sink)	↓	↓	↓	↓	↓	SHORT	1	↓	↓	↓	↓	↓	OFF	
Output driver current (source)	↓	↓	↓	↓	↓	↓	3	↓	↓	↓	↓	↓	↓	
(Open loop) voltage gain	↓	↓	↓	↓	↓	GVO	2	↓	↓	↓	↓	-75 dBV	↓	
Slew rate	↓	↓	↓	↓	↓	SHORT	↓	↓	↓	↓	↓	⌋	↓	
Ripple rejection ratio	OFF	↓	↓	↓	↓	↓	↓	↓	↓	↓	0.1 Vrms	0	↓	
Synchronous signal ratio	ON	↓	OFF	ON	ON	1M	↓	↓	↓	↓	0	0.1 Vrms	↓	

●Application example

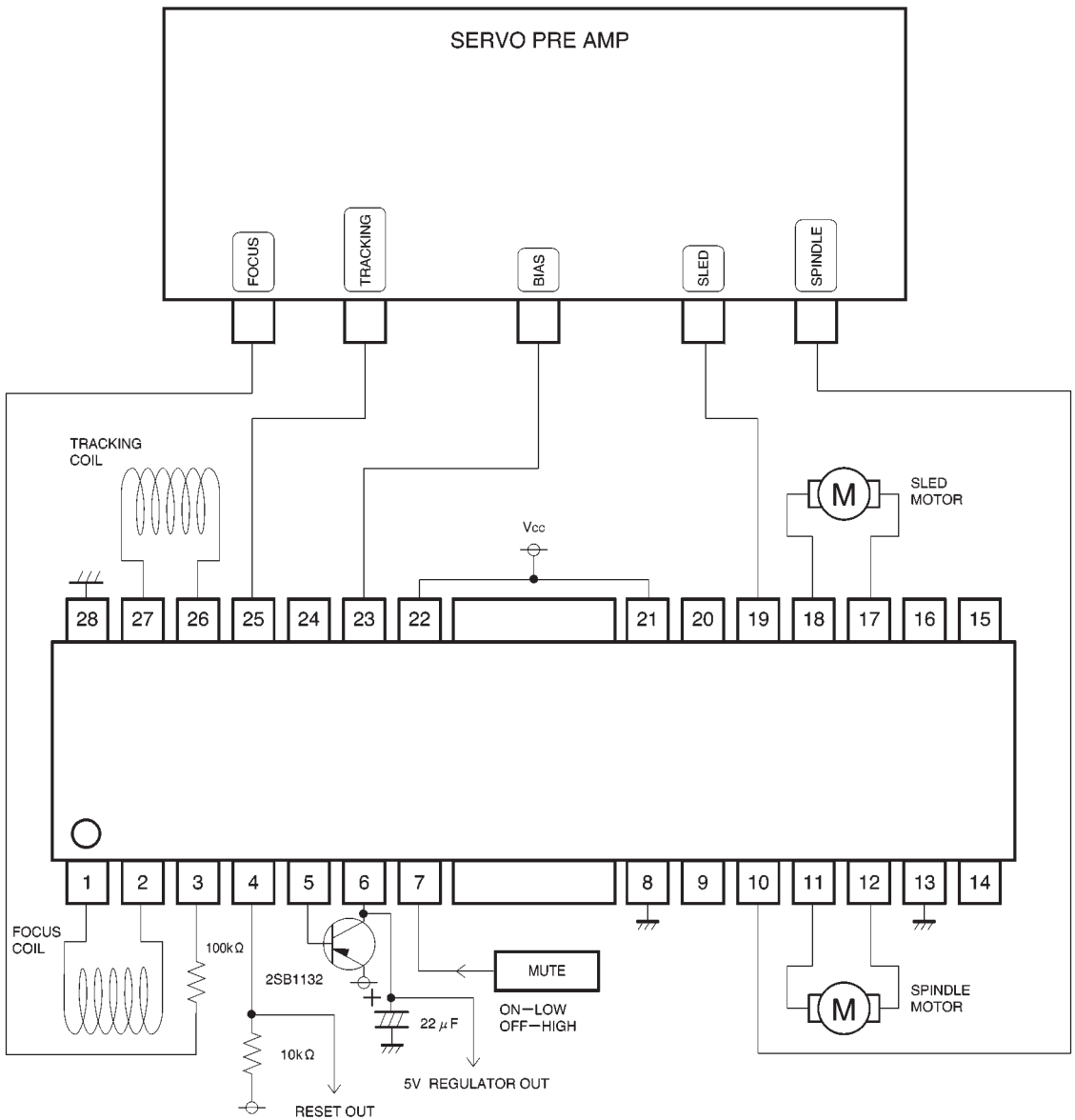


Fig.2



● Operation notes

(1) Muting and resetting

Function	Mute	Reset	Operational conditions*1(typ.)	Operational conditions*2(typ.)	Hysteresis width (typ.)
Thermal shutdown	○	○	$T_j \geq 175^\circ\text{C}$ *3	$T_j \leq 150^\circ\text{C}$	$25^\circ\text{C}$ *4
External muting*5	○		$V_{\text{MUTE}} \leq 1.4\text{V}$ or open	$V_{\text{MUTE}} \geq 1.4\text{V}$	none

\*1 Condition for mute = ON, reset output = LOW

\*2 Condition for mute = OFF, reset output = HIGH

\*3 Allow for variation of approximately  $\pm 25^\circ\text{C}$

\*4 Allow for variation of approximately  $\pm 5^\circ\text{C}$

\*5 Should be below 0.5 V (mute ON) and above 2.0 V (mute OFF)

(2) The circuit is muted during thermal shutdown and during the mute-on state. In each case, only the drivers are muted. During muting, the output pins remain at the internal bias voltage, roughly  $(V_{\text{CC}} - V_F) / 2$ .

(3) When using an attached resistor to change the gain, the temperature characteristics of the internal feedback resistors results in temperature variation in the gain (relative to the typical value) of +4600ppm per degree. There is virtually no temperature variation in error due to resistance variation.

(4) Be sure to connect the IC to a 0.1 $\mu\text{F}$  bypass capacitor to the power supply, at the base of the IC.

(5) The radiating fin is connected to the packages internal GND, but should also be connected to an external ground.

(6) The capacitor between regulator output (pin 6) and GND also serves to prevent oscillation of the IC, so select one with good temperature characteristics.

(7) Pins 5 and 6 may be left open when the regulator is not used.

(8) Pins 14, 15 and 16 may be left open when the operational amplifier is not used.

● Electrical characteristic curves

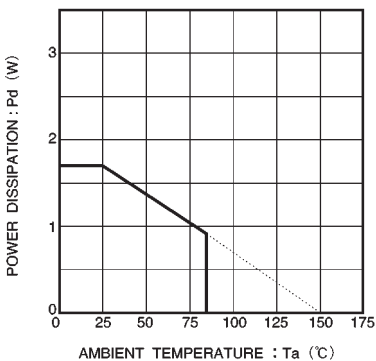


Fig. 3 Thermal derating curve

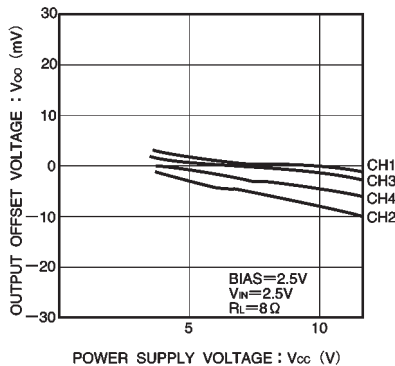


Fig. 4 Power supply voltage vs. driver output offset voltage

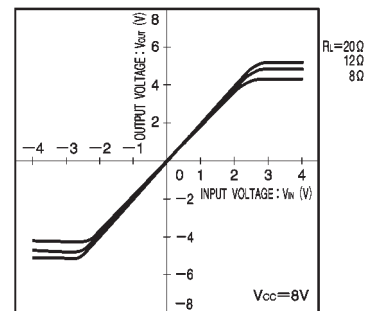


Fig. 5 Driver I / O characteristics (variable load)

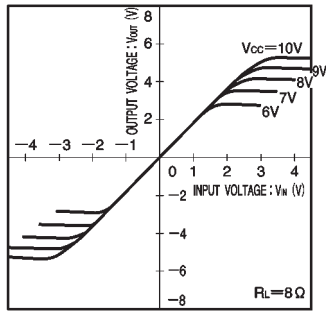


Fig. 6 Driver I/O characteristics (variable supply voltage)

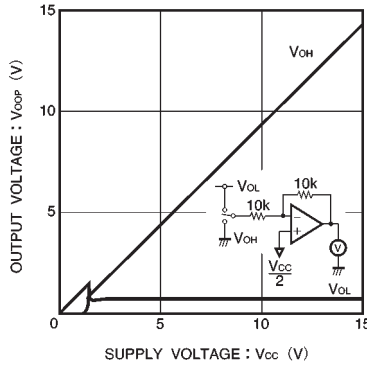


Fig. 7 Operational amplifier output voltage (high and low level)

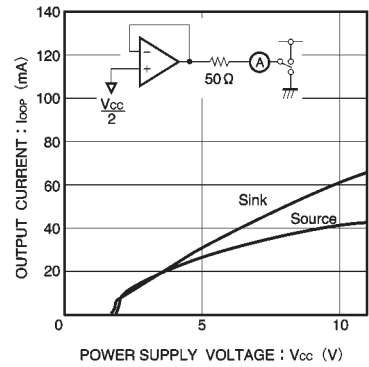


Fig. 8 Power supply voltage vs. operational amplifier drive voltage

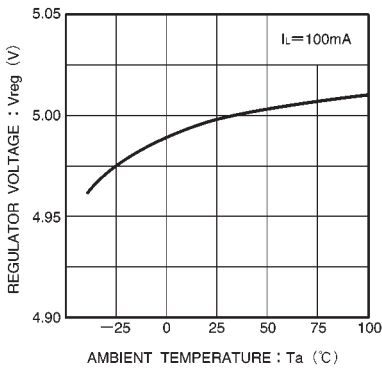


Fig. 9 Regulator voltage vs. temperature characteristics

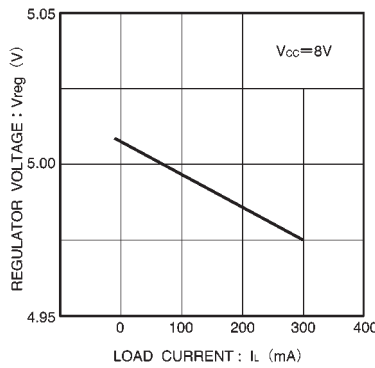


Fig. 10 Load current vs. regulator voltage

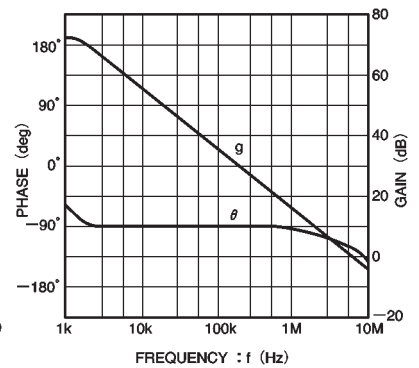
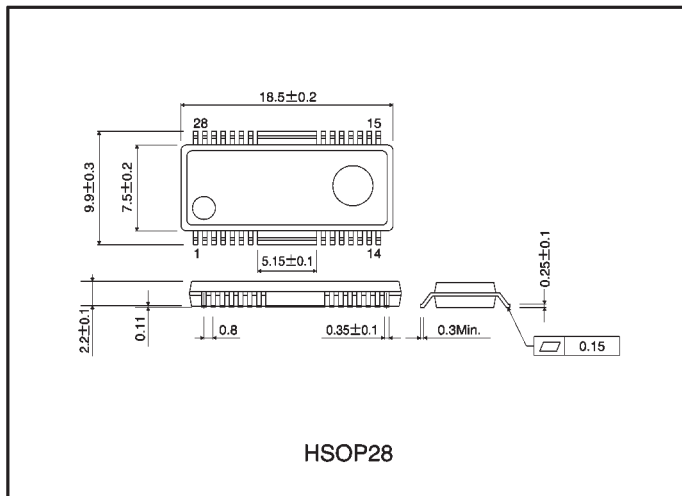


Fig. 11 Operational amplifier vs. open loop

● External dimensions (Units: mm)



HSOP28