BTL driver for CD-ROMs

BA5972FP

The BA5972FP is a 4-channel BTL driver developed for use with CD-ROMs. A multi-purpose operational amplifier is equipped in each channel to allow use in a variety of applications. Also, by applying independent power supplies for both the pre-stage and power-stage, with the power-stage power supply further split into two so one power supply handles two channels each, a highly efficient driver has been realized.

●Applications

CD-ROM, DVD-ROM, MD, and optical discs

●Features

1) Wide dynamic range (V_{OUT} = 4V [Typ.] when $PreV_{CC}$ = 8V, $PowV_{CC}$ = 5V, and R_L = 8Ω).
2) Internal thermal shutdown circuit.
3) Internal mute functions.
4) Internal standby functions.

●Absolute maximum ratings (Ta = 25°C)

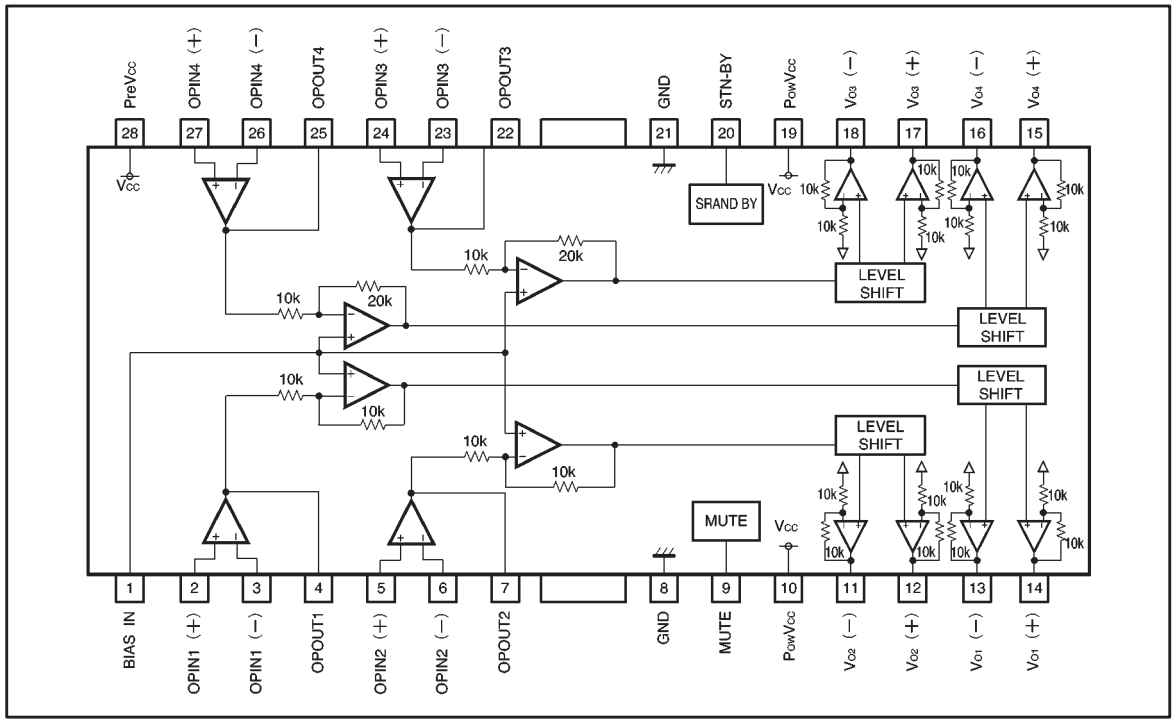
Parameter	Symbol	Limits	Unit
Power supply voltage	$PreV_{CC}$, $PowV_{CC}$	13.5	V
Power dissipation	Pd	1.7*1	W
Operating temperature	Topr	−35～+85	℃
Storage temperature	Tstg	−55～+150	℃

*1 When mounted on a 70mm × 70mm × 1.6mm glass epoxy board with copper foil coverage of less than 3%. Reduced by 13.6mW for each increase in Ta of 1℃ over 25℃.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	$PreV_{CC}$	4.5～13.2	V
	$PowV_{CC}$	4.5～$PreV_{CC}$	V

●Block diagram



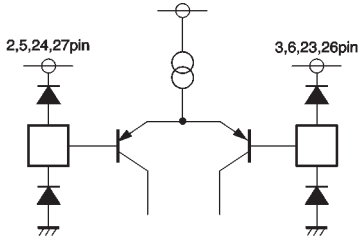
●Pin descriptions

Pin No.	Pin name	Function	Pin No.	Pin name	Function
1	BIAS IN	Bias amplifier input	15	V_{O4} (+)	Driver channel 4 positive output
2	OPIN1 (+)	Channel 1 pre-amplifier non-inverse input	16	V_{O4} (−)	Driver channel 4 negative output
3	OPIN1 (−)	Channel 1 pre-amplifier inverse input	17	V_{O3} (+)	Driver channel 3 positive output
4	OPOUT1	Channel 1 pre-amplifier output	18	V_{O3} (−)	Driver channel 3 negative output
5	OPIN2 (+)	Channel 2 pre-amplifier non-inverse input	19	PowVcc	PowVcc (channels 3 and 4)
6	OPIN2 (−)	Channel 2 pre-amplifier inverse input	20	STN-BY	Standby
7	OPOUT2	Channel 2 pre-amplifier output pin	21	GND	GND
8	GND	GND	22	OPOUT3	Channel 3 pre-amplifier output
9	MUTE	Mute control for all channels	23	OPIN3 (−)	Channel 3 pre-amplifier inverse input
10	PowVcc	PowVcc (channels 1 and 2)	24	OPIN3 (+)	Channel 3 pre-amplifier non-inverse input
11	V_{O2} (−)	Driver channel 2 negative output	25	OPOUT4	Channel 4 pre-amplifier output
12	V_{O2} (+)	Driver channel 2 positive output	26	OPIN4 (−)	Channel 4 pre-amplifier inverse input
13	V_{O1} (−)	Driver channel 1 negative output	27	OPIN4 (+)	Channel 4 pre-amplifier non-inverse input
14	V_{O1} (+)	Driver channel 1 positive output	28	PreVcc	PreVcc

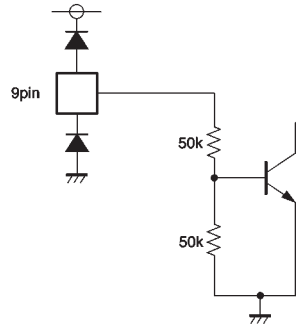
Note: Positive output and negative output are the polarities with respect to the input.
(For example, if pin 4 voltage is high, then pin 14 voltage becomes high.)

●Input / output circuits

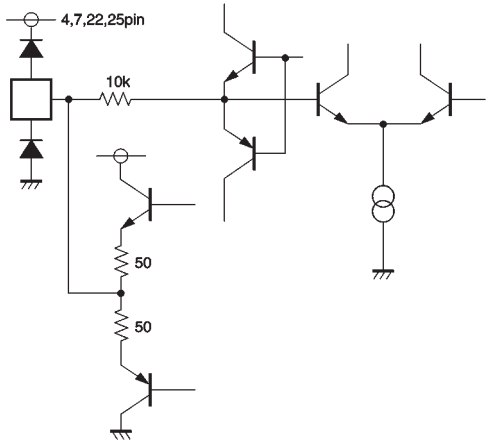
Pre-amplifier input



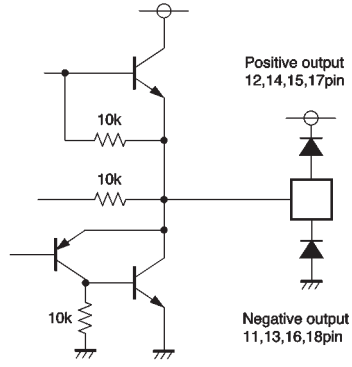
Mute



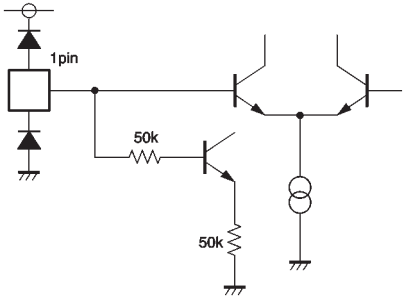
Pre-amplifier output (driver input)



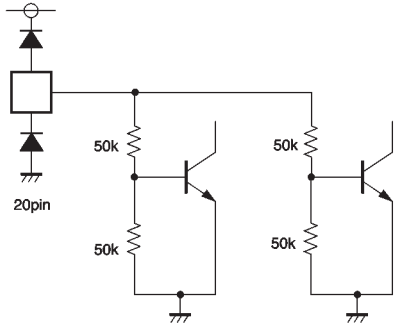
Driver output



Bias



Standby



Units for resistance is〔Ω〕

●Electrical characteristics (unless otherwise noted, Ta = 25°C, $PreV_{CC}$ = 8V, $PowV_{CC}1$ = 5V, $PowV_{CC}2$ = 8V, BIAS = 2.5V, R_L = 8Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I_Q	—	20	30	mA	No load
Circuit current during standby	I_{ST}	—	—	1	mA	No load
Standby on voltage	V_{STON}	—	—	0.5	V	
Standby off voltage	V_{STOFF}	2.0	—	—	V	
〈Driver〉						
Output offset voltage 1	V_{OO1}	−70	0	70	mV	channel 1, 2
Output offset voltage 2	V_{OO2}	−90	0	90	mV	channel 3, 4
Maximum output amplitude 1	V_{OM1}	3.6	4.0	—	V	channel 1, 2, V_{IN}=±2.0V
Maximum output amplitude 2	V_{OM2}	5.4	6.0	—	V	channel 3, 4, V_{IN}=±2.0V
Voltage gain 1	G_{VC1}	10	12	14	dB	V_{IN}=±0.5V
Voltage gain 2	G_{VC2}	16	18	20	dB	V_{IN}=±0.5V
Mute on voltage	V_{MTON}	2.0	—	—	V	
Mute off voltage	V_{MTOFF}	—	—	0.5	V	
〈Pre-stage operational amplifier〉						
Common-mode input voltage	V_{ICM}	−0.3	—	6.8	V	
Input offset voltage	V_{OFOP}	−6	0	6	mV	
Input bias current	V_{BOP}	—	—	300	nA	
Output high level voltage	V_{OHOP}	6.9	7.35	—	V	
Output low level voltage	V_{OLOP}	—	0.75	1.1	V	
Output drive current sink	I_{SI}	1	—	—	mA	50Ω at V_{CC}
Output drive current source	I_{SO}	1	—	—	mA	50Ω at GND
Slew rate	SR_{OP}	—	1	—	V/μs	100kHz rectangular wave, $2V_{P-P}$ output

◎Not designed for radiation resistance.

●Measurement circuit

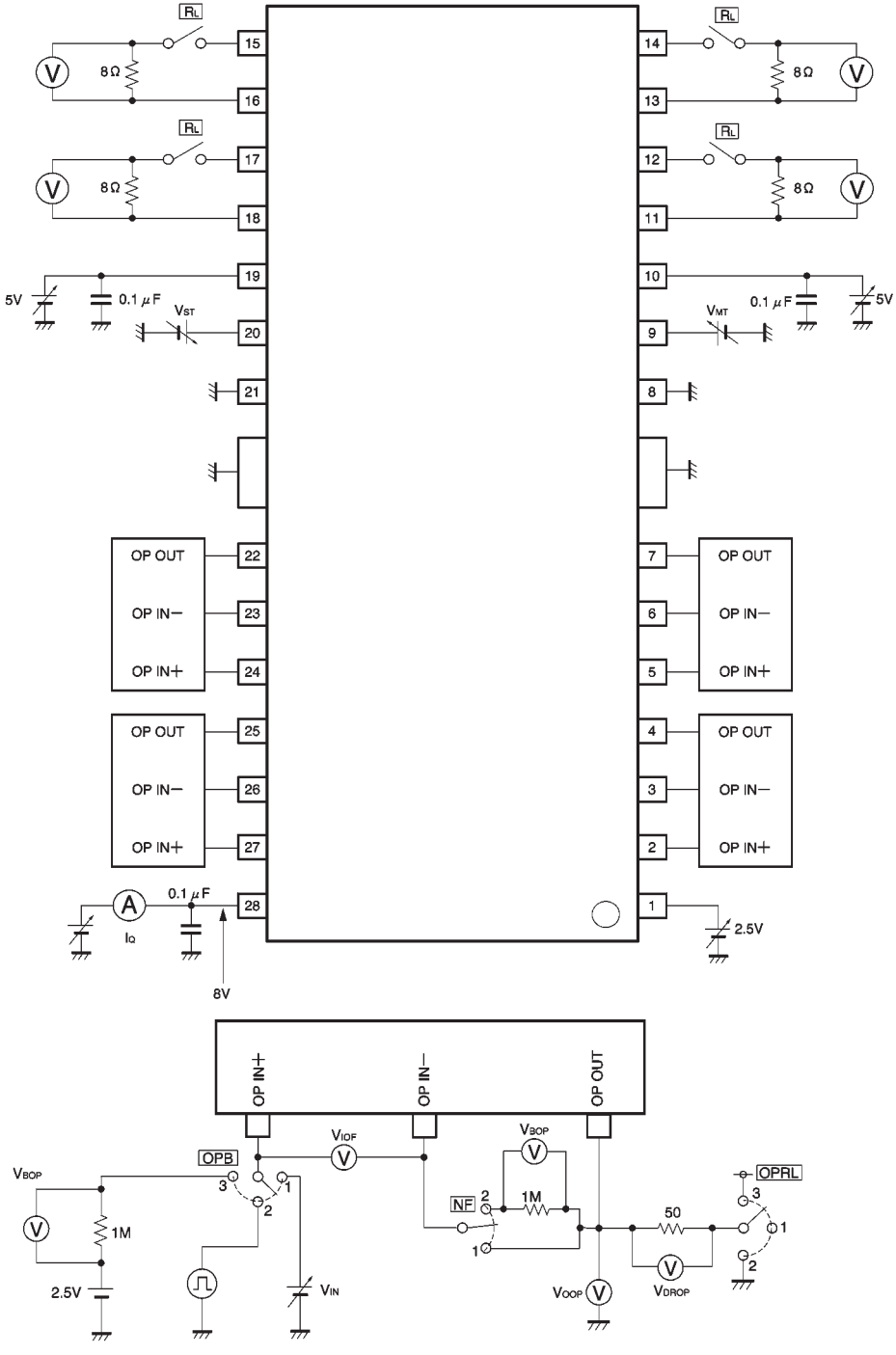


Fig.1

●Measurement circuit switch table

(1) Circuit current and standby (V_{MT} = 0V, V_{IN} = 2.5V, R_L → OFF, OPB → 1, NF → 1, OPRL → 1)

Symbol	Input	Remarks	Measurement point
	V_{ST}		
I_O	5V	—	I_Q
I_{ST}	0V	—	I_Q
V_{STON}	0.5V	—	I_Q
V_{STOFF}	2.0V	—	I_Q

(2) Driver block (V_{ST} = 5V, R_L → ON, OPB → 1, NF → 1, OPRL → 1)

Symbol	Input		Remarks	Measurement point
	V_{IN}	V_{MT}		
V_{OO1}	2.5V	0.5V	—	V_O (channel 1, 2)
V_{OO2}	2.5V	0.5V	—	V_O (channel 3, 4)
V_{OOM1}	±2.0V	0.5V	V_{IN}=0.5V and 4.5V	V_O (channel 1, 2)
V_{OOM2}	±2.0V	0.5V	V_{IN}=0.5V and 4.5V	V_O (channel 3, 4)
G_{VC1}	±0.5V	0.5V	V_{IN}=2.0V and 3.0V	V_O (channel 1, 2)
G_{VC2}	±0.5V	0.5V	V_{IN}=2.0V and 3.0V	V_O (channel 3, 4)
V_{MTON}	3.0V	2.0V	Verify output voltage is muted	V_O
V_{MTOFF}	3.0V	0.5V	Verify output voltage is muted	V_O

(3) Pre-stage operational amplifier block (V_{ST} = 5V, V_{MT} = 0V, R_L → OFF)

Symbol	Switch			Input	Remarks	Measurement point
	OPB	NF	OPRL	V_{IN}		
V_{OFOP}	1	1	1	2.5V	—	V_{IOF}
V_{BOP}	3	2	1	2.5V	—	V_{BOP}/1MΩ
V_{OHOP}	1	1	1	5V	—	V_{OOP}
V_{OLOP}	1	1	1	0V	—	V_{OOP}
I_{SI}	1	1	3	2.5V	—	V_{DROP}/50Ω
I_{SO}	1	1	2	2.5V	—	V_{DROP}/50Ω
SR_{OP}	2	1	1	±1V	100kHz rectangular wave, 2.5±1V input	V_{OOP}

●Application example

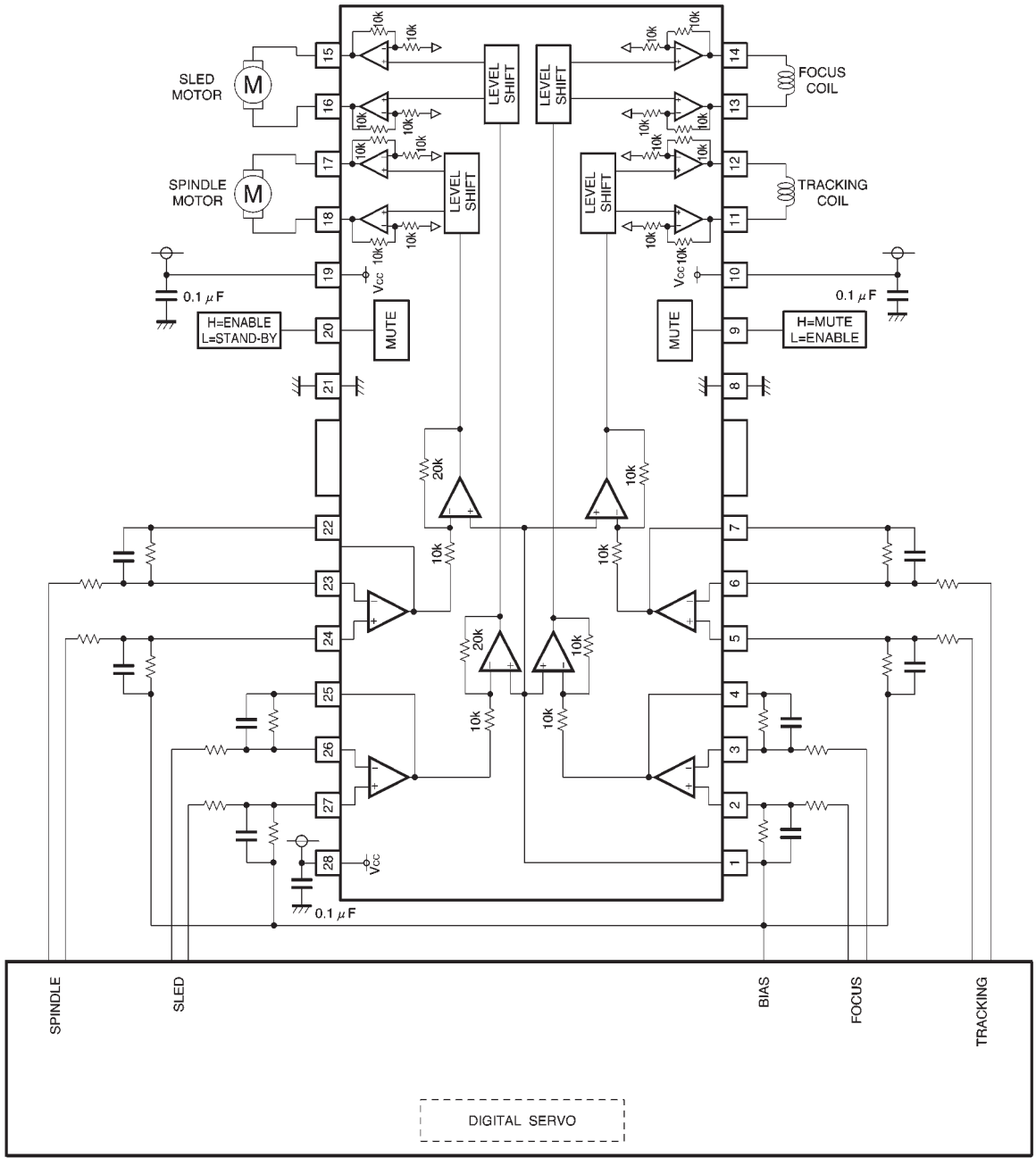


Fig.2

●Operation notes

(1) The BA5972FP contains a thermal shutdown circuit.
When the chip temperature reaches 175°C (Typ.), the output current is muted. If the chip temperature then drops below 150°C (Typ.), then the mute is released.

(2) By having the mute pin (pin 7) voltage pulled up to 2.0V or greater, you can mute the output current for channels 1 and 4. For normal conditions, have pin 7 open or at 0.5V or below.

(3) If the voltage of the bias pin (pin 1) drops below 1.4V (Typ.), outputs are muted.
For normal conditions, have the voltage above 1.7V.

(4) If the power supply voltage drops below 3.8V (Typ.), internal circuits turn off. If the power supply voltage then rises to 4.0V (Typ.), the circuits turn on.

(5) If the voltage of the thermal shutdown, mute ON, or bias pin drops, or if the power supply voltage drops, the mute is activated; however, in these situations, only the drivers are muted.
Also, the output pin voltage becomes the internal bias voltage (approx. $V_{CC}/2$).

(6) If the standby pin voltage is open or 0.5V or below, the circuit current enters the standby condition.
For normal operation, have the standby pin voltage pulled up to 2.0V or greater.

(7) Connect a bypass capacitor (approx. 0.1μF) between the bases of the power supply pins of this IC.

(8) Even though the radiation fins are connected to ground within the package, be sure to also connect them to a ground externally as well.

(9) The application example will assure excellent results, but nevertheless, be sure to carefully check all characteristics during use. During use with constants in the external circuitry modified, be sure to leave a sufficient margin in order to take into consideration fluctuations in the static and transient characteristics of the external components and this IC.
Also, be aware that ROHM has not sufficiently performed all confirmations regarding patent rights.

●Electrical characteristic curves

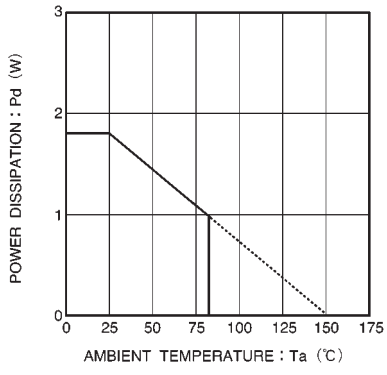


Fig.3 Thermal derating curve

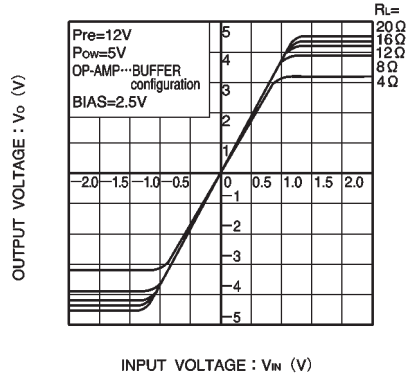


Fig.4 I / O characteristics (channels 1 and 2)

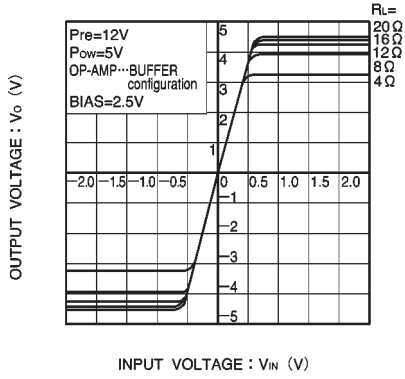


Fig.5 I / O characteristics (channels 3 and 4)

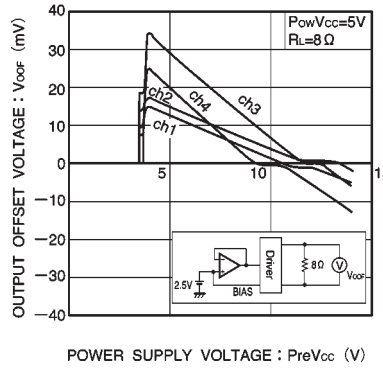


Fig.6 Driver output offset characteristics

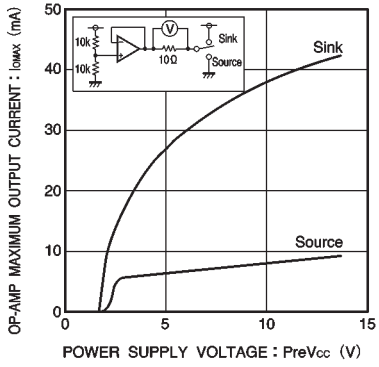


Fig.7 Op-amp maximum output current characteristics

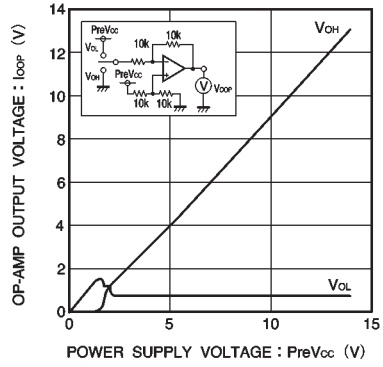


Fig.8 Op-amp saturation voltage characteristics

●External dimensions (Units: mm)