4-channel BTL driver for CD players

BA6898S / BA6898FP

The BA6898S / BA6898FP ICs contain a 4-channel BTL driver , 5V regulator (which requires an externally connected PNP transistor), multi-purpose operational amplifier, and reset output for use with CD players. Also equipped with an input pin for gain adjustment for all channels of the driver block so that the gain can be adjusted to the desired value for your application. Furthermore, a built-in level shift circuit exists to further reduce the amount of external components required.

●Applications

CD players, CD-ROM, and other optical disc equipment

●Features

1) 4-channel BTL driver.
2) Gain is adjustable with externally connected resistor.
3) Internal thermal shutdown circuit.
4) Internal 5V regulator (requires external PNP transistor).
5) Internal multi-purpose operational amplifier.
6) Equipped with reset output pin.

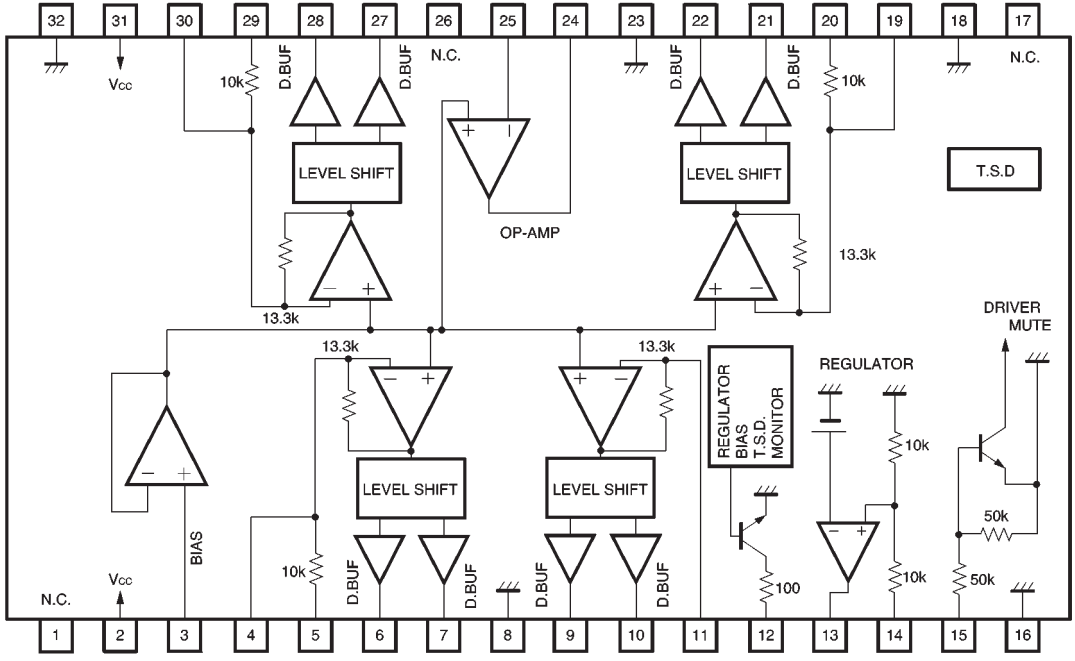
●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	13.5	V
Power dissipation	Pd	1.7*	W
Operating temperature	Topr	−35～+85	℃
Storage temperature	Tstg	−55～+150	℃

* 6V to 9V (driver block is operable up to 5.5V).
BA6898S: Values when IC is unmounted.
BA6898FP: 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℃.

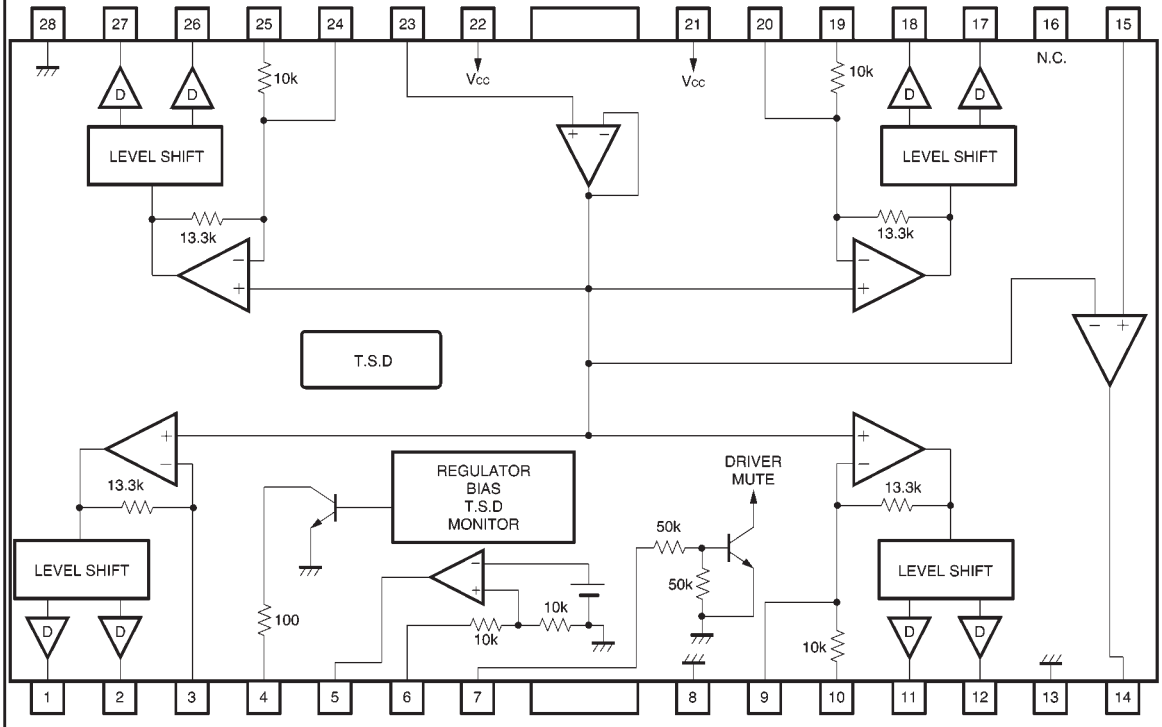
●Block diagram

BA6898S



T.S.D. : Thermal shutdown
D. BUF : Drive buffer
Resistor units: Ω

BA6898FP



T.S.D. : Thermal shutdown
D : Drive buffer
Resistor units: Ω

●Pin descriptions

BA6898S

Pin No.	Pin name	Function
1	N.C.	N.C.
2	Vcc	Power supply
3	BIAS IN	Bias amplifier input
4	VIN1'	Input for driver channel 1 gain adjustment
5	VIN1	Driver channel 1 input
6	VO1 (+)	Driver channel 1 positive output
7	VO1 (−)	Driver channel 1 negative output
8	GND	Substrate GND
9	VO2 (−)	Driver channel 2 negative output
10	VO2 (+)	Driver channel 2 positive output
11	VIN2'	Input for driver channel 2 gain adjustment
12	RESET	Reset output
13	REG-B	For connection of external transistor base for regulator
14	REG OUT	Constant voltage output (for connection of external transistor collector)
15	MUTE	Mute control
16	SUB	Substrate GND
17	N.C.	N.C.
18	GND	GND
19	VIN3'	Input for driver channel 3 gain adjustment
20	VIN3	Driver channel 3 input
21	VO3 (+)	Driver channel 3 positive output
22	VO3 (−)	Driver channel 3 negative output
23	GND	Substrate GND
24	OP OUT	Op-amp output
25	OP IN (−)	Op-amp negative input
26	N.C.	N.C.
27	VO4 (−)	Driver channel 4 negative output
28	VO4 (+)	Driver channel 4 positive output
29	VIN4	Driver channel 4 input
30	VIN4'	Input for driver channel 4 gain adjustment
31	Vcc	Power supply
32	SUB	Substrate GND

Note: Positive output and negative output are the polarities with respect to the input.

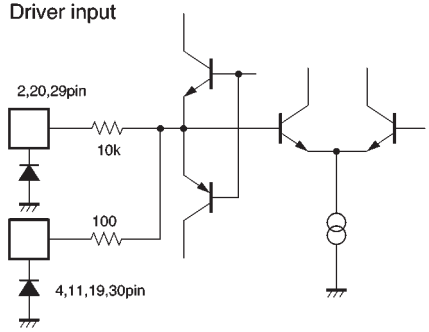
BA6898FP

Pin No.	Pin name	Function
1	OUT1-B	Channel 1 negative output
2	OUT1-A	Channel 1 positive output
3	IN1	Input for channel 1 gain adjustment
4	RESET	Reset output
5	REG-B	For connection of external transistor base for regulator
6	REGOUT	For connection of external transistor collector for regulator (output)
7	MUTE	Mute control
8	GND	GND
9	IN2'	Input for channel 2 gain adjustment
10	IN2	Channel 2 input
11	OUT2-A	Channel 2 positive output
12	OUT2-B	Channel 2 negative output
13	GND	Substrate GND
14	OPOUT	Op-amp out
15	OPIN-B	Op-amp negative input
16	N.C.	N.C.
17	OUT3-B	Channel 3 negative output
18	OUT3-A	Channel 3 positive output
19	IN3	Channel 3 input
20	IN3'	Input for channel 3 gain adjustment
21	Vcc	Vcc
22	Vcc	Vcc
23	VREFIN	Reference amplifier input (bias)
24	IN4'	Input for channel 4 gain adjustment
25	IN4	Channel 4 input
26	OUT4-A	Channel 4 positive output
27	OUT4-B	Channel 4 negative output
28	GND	Substrate GND

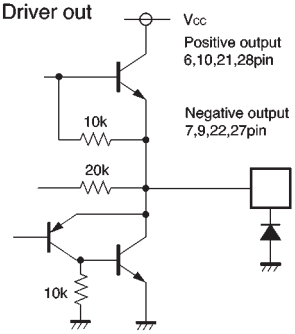
Note: Positive output and negative output are the polarities with respect to the input.
If the input pin is high, the negative output pin is low and the positive output pin is high.

●Input / output circuits

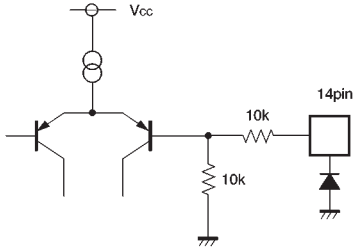
Driver input



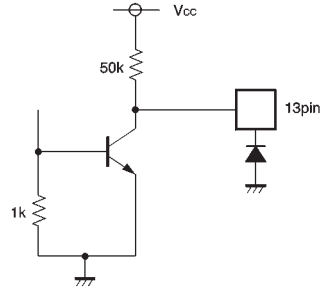
Driver out



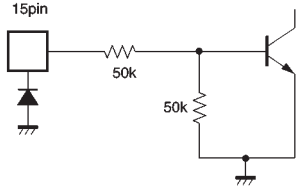
Regulator output



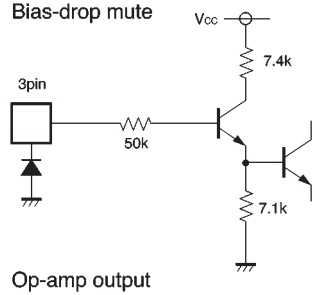
Regulator (base connection)



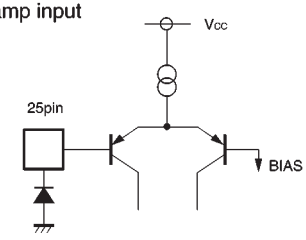
Mute



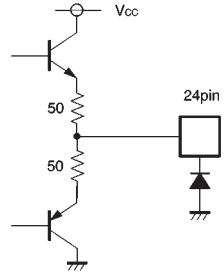
Bias-drop mute



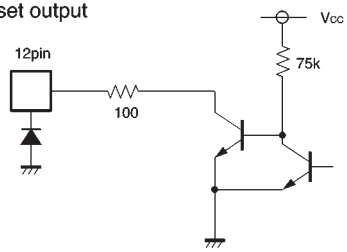
Op-amp input



Op-amp output



Reset output



Pin numbers are those for the BA6898S.

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 8V, f = 1kHz, R_L = 8Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Circuit current	I_{CC}	6.0	10.0	14.0	mA	No load
Output offset voltage	V_{OO}	−40	−	40	mV	−
Maximum output high level voltage	VOHD	5.6	6.0	−	V	−
Maximum output low level voltage	VOLD	−	1.2	1.45	V	−
Closed-loop voltage gain	GVC	7.4	8.4	9.4	dB	V_{IN}=0.1Vrms, 1kHz (excluding channel 2)
Ripple rejection	RR	−	60	−	dB	V_{IN}=0.1Vrms, 100Hz
Slew rate	SR	−	1.0	−	V/μs	100kHz rectangular wave, $3V_{P-P}$ output
Mute off voltage	VMOFF	2.0	−	−	V	−
〈5V regulator〉						
Output voltage	Vreg	4.75	5.00	5.25	C	I_L=100mA
Output load regulation	ΔVRL	−70	0	10	mV	I_L=0～200mA
Power supply voltage regulation	ΔV_{CC}	−10	0	35	mV	(V_{CC}=6～9V), I_L=100mA
〈OP-AMP〉						
Offset voltage	VOFOP	−5	0	5	mV	−
Input bias current	IBIAS	−	−	300	nA	−
Output high level voltage	VOHOP	7.0	−	−	V	−
Output low level voltage	VOLOP	−	−	1.1	V	−
Output drive current source	ISOU	10	40	−	mA	50Ω at GND
Output drive current sink	ISIN	10	50	−	mA	50Ω at V_{CC}
Open-loop voltage gain	GVO	−	78	−	dB	V_{IN}=−75dBV, 1kHz
Slew rate	SROP	−	1	−	V/μs	100kHz rectangular wave, $4V_{P-P}$ output
Ripple rejection	RROP	50	65	−	dB	V_{IN}=−20dBV, 100Hz
〈Reset output〉						
Reset on threshold voltage	VTHR	−	4.0	−	V	From regulator voltage
Reset on output voltage	VRON	−	−	0.5	V	Connect to 5V at 10kΩ

◎Not designed for radiation resistance.

●Measurement circuit

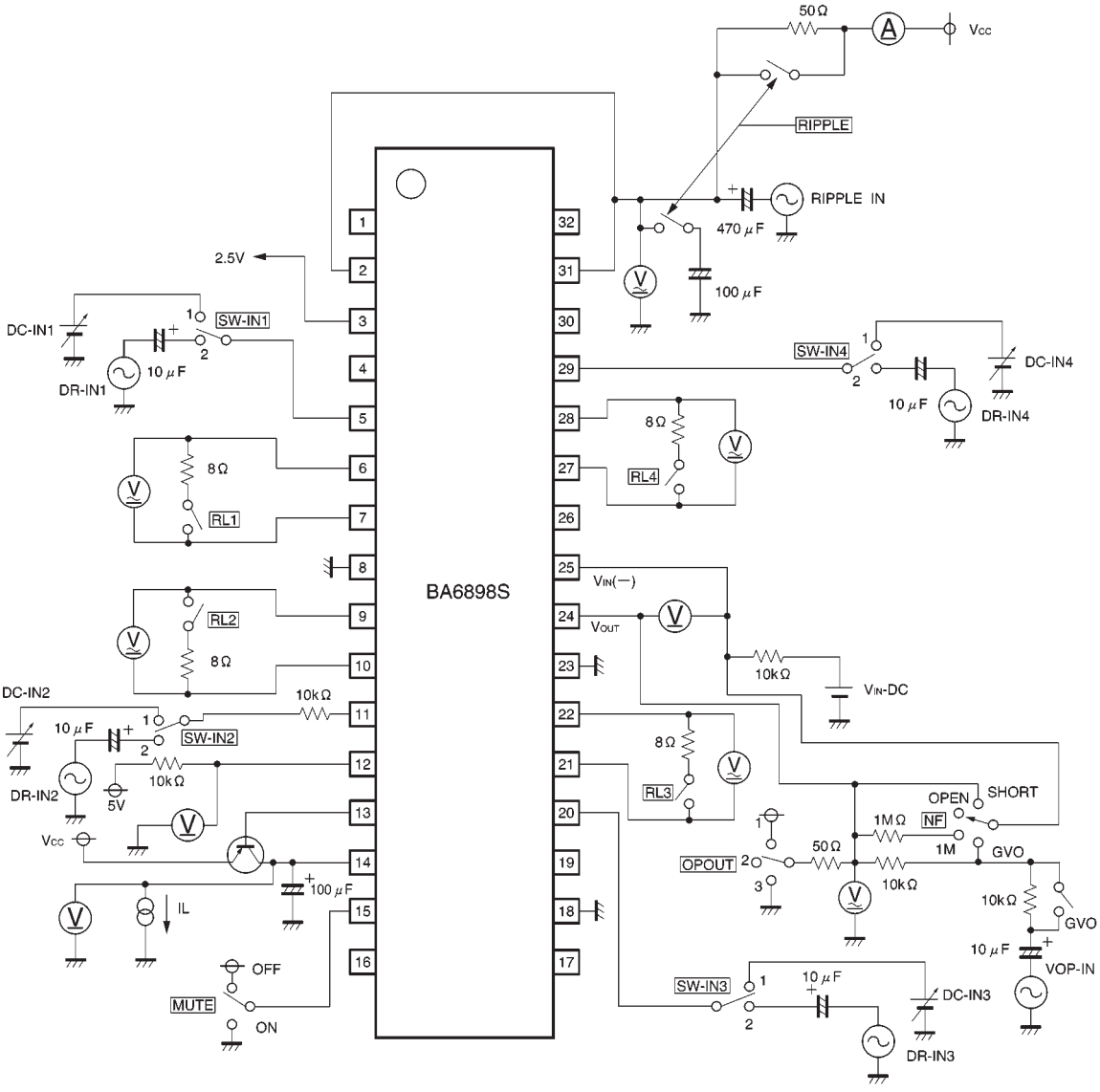


Fig.1

●Circuit operation

(1) Driver block

The input is the focus and tracking error signals from the servo pre-amplifier and the control signals for the motor system. The input signal is normally centered at 2.5V, and at the pre-amplifier, it undergoes V / I conversion to generate the current corresponding to the input voltage. This is then passed through a resistor and sent to the internal reference voltage block.

This results in the output from the pre-amplifier being the signal at the center of the internal reference voltage. Furthermore, at the V / I conversion, forward and reverse phases are generated and the BTL output is then gained through the driver buffer.

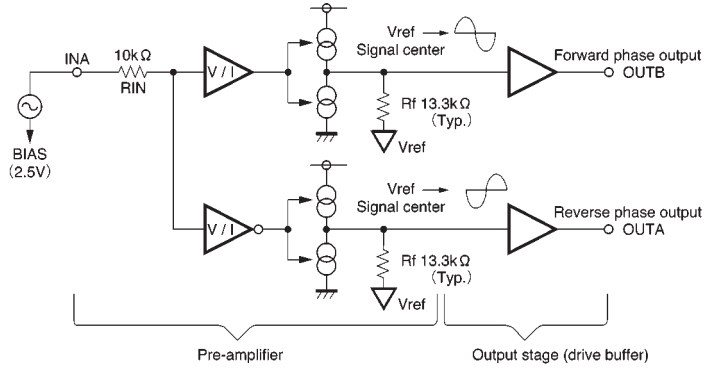


Fig.2

(2) Regulator block

The configuration is that of a normal series-type regulator and the reference voltage is provided internally. A PNP low-saturation transistor is connected externally.

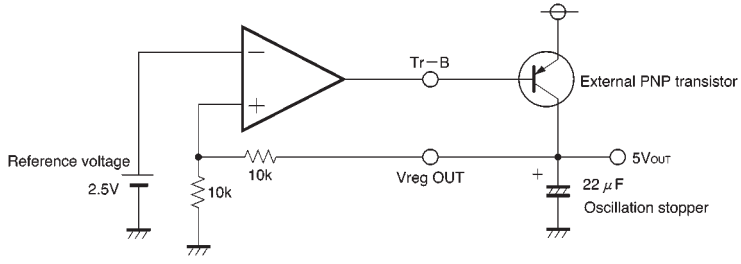


Fig.3

●Application example

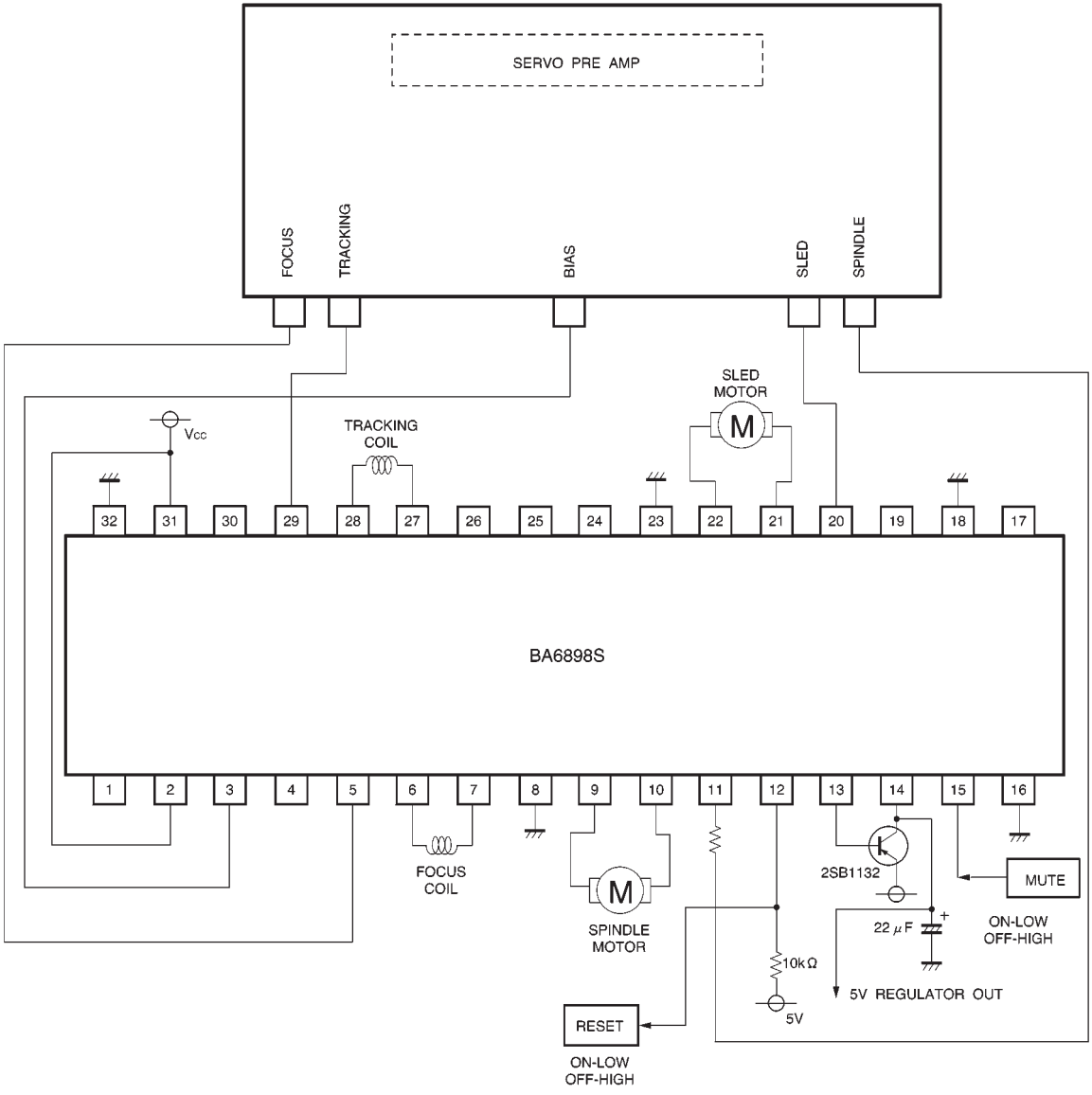


Fig.4

●Operation notes (pin Nos. are those for the BA6898S)

(1) Relationship between mute and reset output

Function	Mute operation	Reset output
Regulator voltage drop	Turns on for all conditions	"H" → "L"
Bias voltage drop		"H" → "L"
Thermal shutdown		"H" → "L"
Mute (pin 15)		No change

Regulator voltage drop ..... If the regulator voltage drops to 4.0V (Typ.) or below, the reset output turns low and the mute turns on. If the voltage then rises again to 4.2V (Typ.), the reset output turns high and the mute turns off.

Bias voltage drop ..... If the bias pin (pin 3) voltage lowers to 1.4V (Typ.) or below, the mute turns on and the reset output turns low. For normal operations, have the voltage at 1.6V or greater.

Thermal shutdown ..... When the chip temperature reaches 175°C (Typ.), the mute turns on and the reset output turns low. If the chip temperature then drops below 150°C (Typ.), then the mute turns off and the reset output turns high.

Mute (pin 15) ..... If the mute pin (pin 15) voltage is open or lowers to 0.5V or below, the mute turns on but the reset output does not change.

(2) If the voltage of the thermal shutdown, mute ON, or bias pin drops, or if the regulator 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. $(V_{CC} - V_F) / 2$).

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

(4) Even though pins 16 and 32 are connected to ground within the package, be sure to also connect them to a ground externally as well.

(5) The capacitor connected between the regulator output pin (pin 14) and GND also serves to prevent oscillation, so be sure to use a capacitor with excellent thermal characteristics.

(6) If the regulator is not used, short the regulator output pin (pin 14) to V_{CC} and have the pin for the externally connected transistor base (pin 13) open.

(7) Of the ground pins, only pin 18 is not connected to the IC substrate. Therefore, design the PC board pattern so that the potential of GND pin 18 does not go below the substrate GND (including transient conditions).

●Electrical characteristic curves

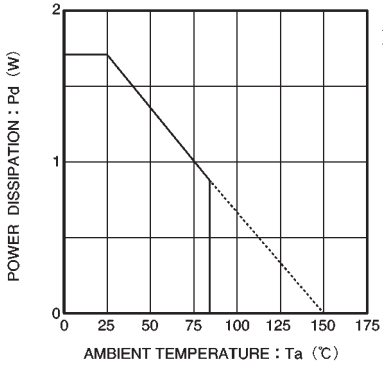


Fig.5 Thermal derating curve (unmounted)

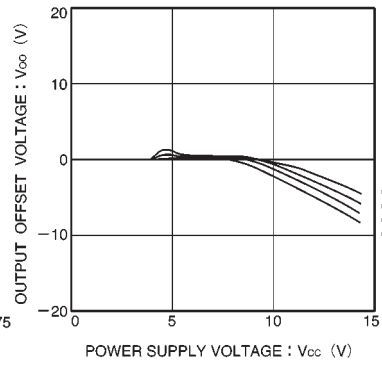


Fig.6 Power supply voltage vs. driver output offset voltage

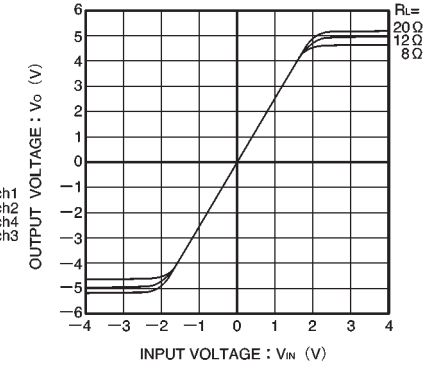


Fig.7 Driver I / O characteristics (during load regulation)

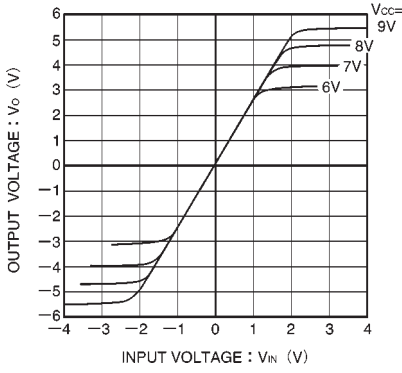


Fig.8 Driver I / O characteristics (power supply regulation)

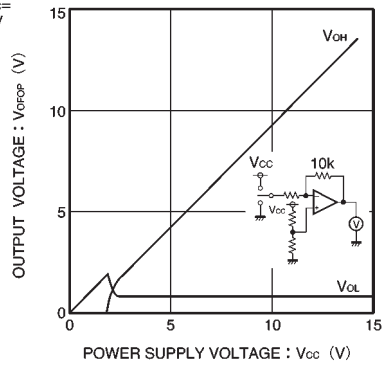


Fig.9 Op-amp high / low level output voltage

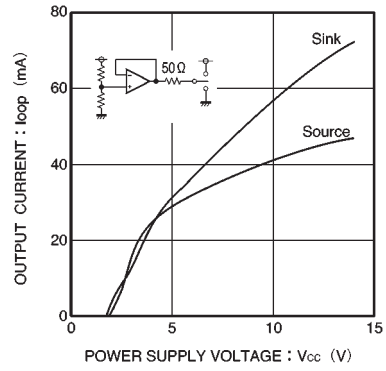


Fig.10 Power supply voltage vs. op-amp output drive voltage

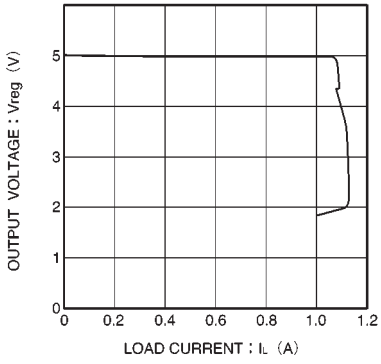


Fig.11 Load current vs. regulator voltage

●External dimensions (Units: mm)

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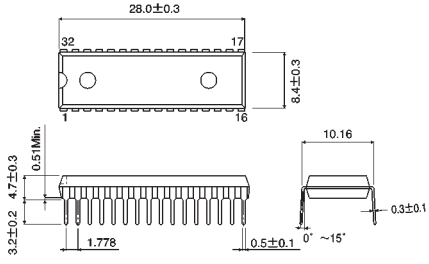

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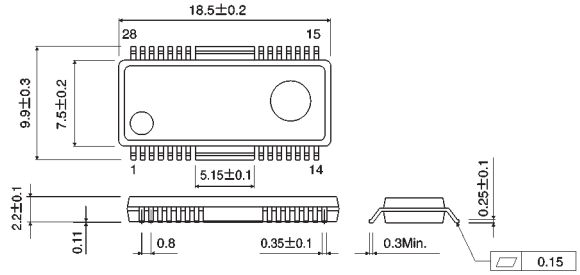

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