4-channel BTL driver for CD players

BA6394FP

The BA6394FP is a 4-channel H-bridge BTL driver for CD players. The internal standard operational amplifier and 28-pin HSOP package make this IC suited to compact applications, while the 3V power supply is ideal for portable devices.

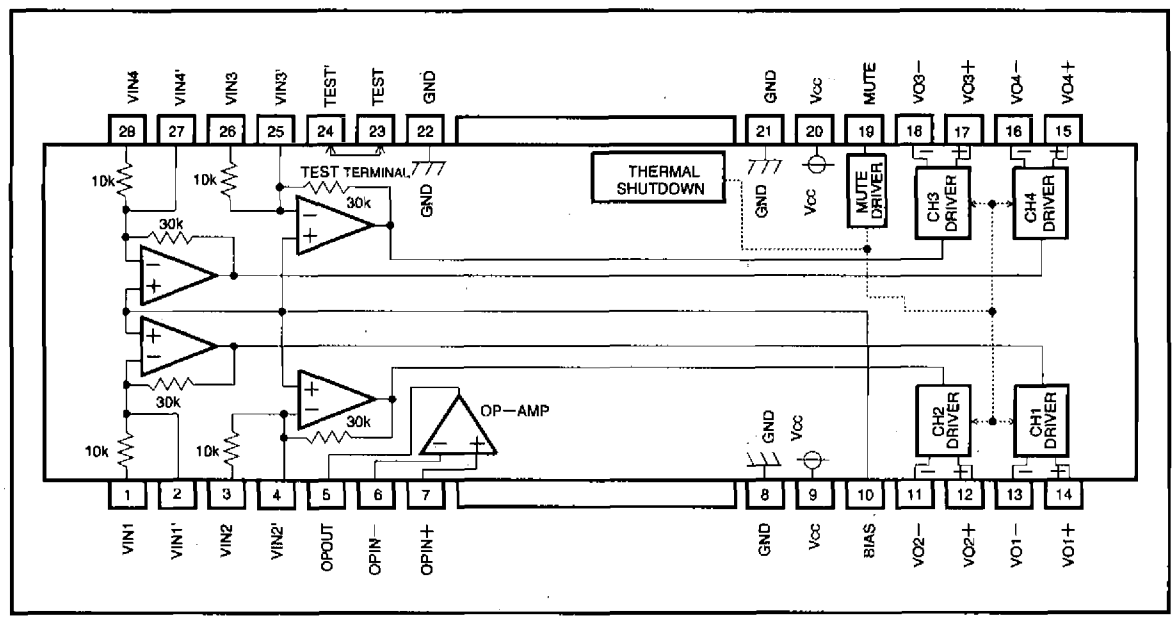
●Applications

CD players and CD-ROM drives

●Features

1) 4-channel BTL driver.
2) HSOP 28-pin package for compact applications.
3) Wide dynamic range.
4) Internal thermal shutdown circuit.
5) Gain is adjustable with a single attached resistor.
6) Internal standard operational adjuster.

●Block diagram



●Pin description

Pin No.	Pin name	Description
1	VIN1	Driver CH1 input
2	VIN1'	Driver CH1 input, gain adjustment pin
3	VIN2	Driver CH2 input
4	VIN2'	Driver CH2 input, gain adjustment pin
5	OPOUT	Operational amplifier output
6	OPIN−	Operational amplifier input, negative
7	OPIN+	Operational amplifier input, positive
8	GND	Substrate ground
9	Vcc	Vcc
10	BIAS	Bias input
11	VO2−	Driver Ch2 negative output
12	VO2+	Driver Ch2 positive output
13	VO1−	Driver Ch1 negative output
14	VO1+	Driver Ch1 positive output
15	VO4+	Driver Ch4 positive output
16	VO4−	Driver Ch4 negative output
17	VO3+	Driver Ch3 positive output
18	VO3−	Driver Ch3 negative output
19	MUTE	Driver mute control input
20	Vcc	Vcc
21	GND	Substrate ground
22	GND	Regulator ground (internal constant current source GND)
23	TEST	TEST
24	TEST'	TEST
25	VIN3'	Driver CH3 input, gain adjustment pin
26	VIN3	Driver CH3 input
27	VIN4'	Driver CH4 input, gain adjustment pin
28	VIN4	Driver CH4 input

●Input/output circuit

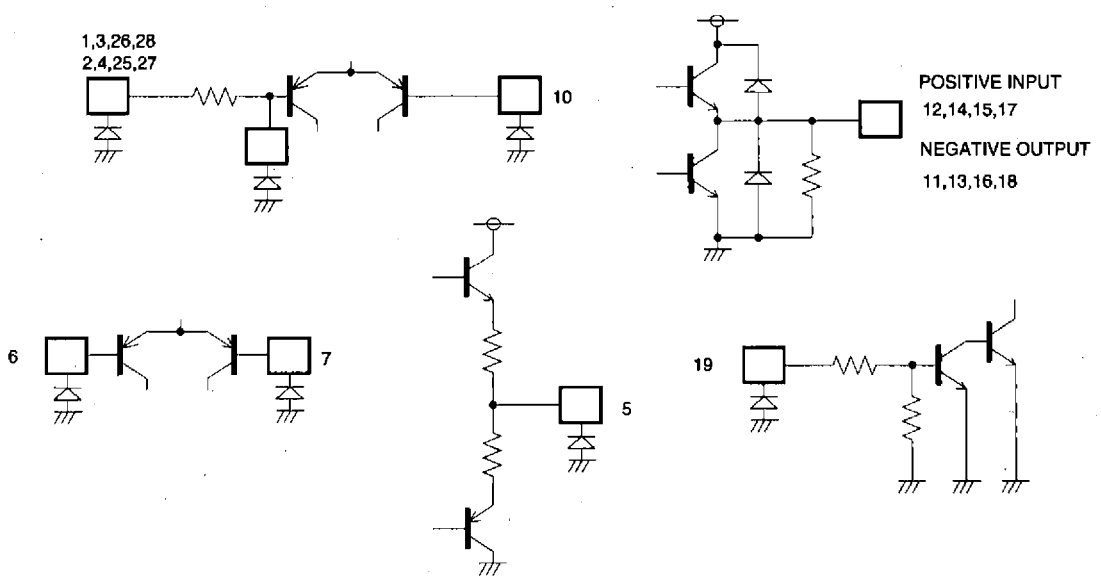


Fig. 1

●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	18	V
Power dissipation	Pd	1.7*1	W
Operating temperature range	Topr	−25~85	℃
Storage temperature range	Tstg	−55~150	℃

*1 When mounted to a 50 mm × 50 mm × 1.0 mm paper phenol board.
Reduced by 13.6 mW for each increase in Ta of 1℃ over 25℃.

●Recommended operating conditions (Ta=25℃)

Parameter	Symbol	Limits	Unit
Power supply voltage range	Vcc	3~11	V

●Electrical characteristics (Unless otherwise noted, Ta=25℃, V_{CC}=3.5V, R_L=8Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
〈Driver〉						
Quiescent current	I_Q	2.35	4.7	7.0	mA	No load
Input voltage, offset	V_{OI}	−5	0	5	mV	
Output voltage, offset	V_{OO}	−5	0	5	mV	
Dead band width	V_{DB}	10	20	30	mV	(Total for positive and negative sides)
Maximum output amplitude	V_{OM}	1.7	1.9	—	V	Differential output
Voltage gain (closed circuit)	G_{VC}	6.0	8.0	10.5	dB	Vin=500mV DC,differential output
Gain, positive and negative voltage differential	ΔG_{VC}	−0.9	0	0.9	dB	Vin=500mV DC,differential output
Ripple rejection	RR	—	80	—	dB	Vin=0.1Vrms, 100Hz
MUTE-OFF voltage	V_{MOFF}	2.0	—	—	V	
MUTE-ON voltage	V_{MON}	—	—	0.5	V	
〈OP - AMP〉						
Offset voltage	V_{OFOP}	−5	0	5	mV	
Input bias current	I_{BOP}	—	—	300	nA	
High level output voltage	V_{OHOP}	2.5	2.8	—	V	
Low level output voltage	V_{OLOP}	—	—	1.1	V	
Output drive current (sink)	I_{SINK}	10	25	—	mA	50Ω ℃V_{CC}
Output drive current (source)	I_{SOURCE}	10	25	—	mA	50Ω ℃GND
Voltage gain (open circuit)	G_{VO}	—	72	—	dB	Vin=−75dBV, 1kHz
Slew rate	SR	—	0.8	—	V / uS	

●Circuit operation

1. Driver

Inputs to the IC are the focus tracking error signal from the servo preamplifier and the control signal from the motor. Input signals are normally biased at 1 / 2V_{CC}, and switch polarity depending on voltage size relative to the bias voltage. When polarity is switched, power transistors Q1 and Q4 or Q2 and Q3 turn on. Power transistor Q1 or Q3, whichever is turned on, is driven by the full wave rectified signal and the level shifted signal, and supplies current to the load. When there is no input, both output pins are at the GND level.

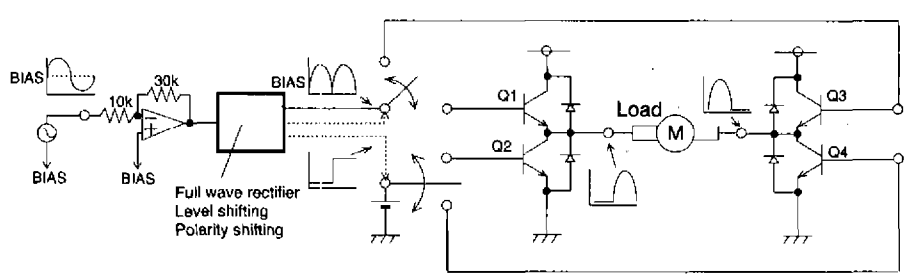


Fig. 2

2. Operational amplifier
A standard 4558 type.

●Application example

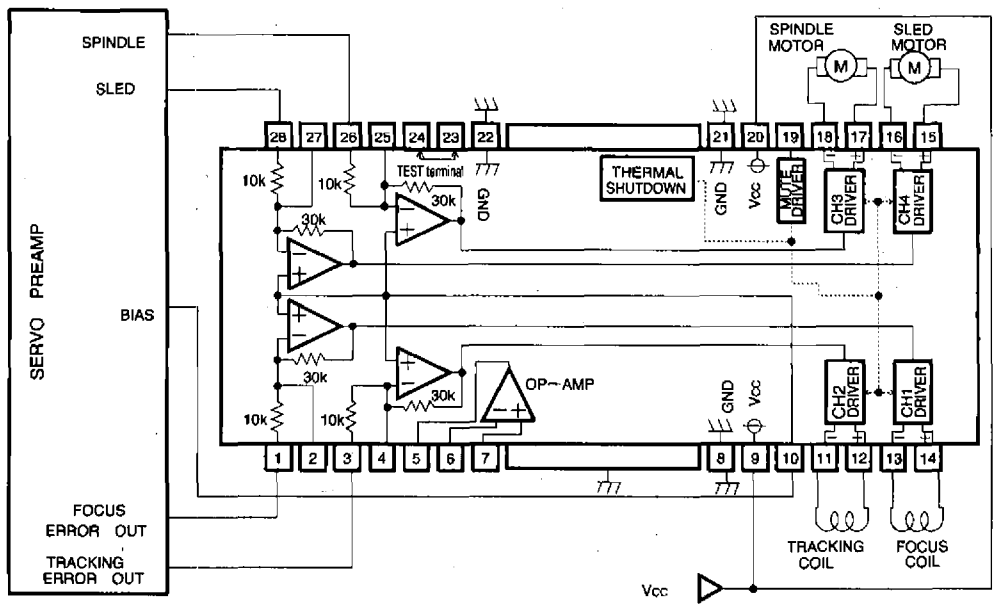


Fig. 3

●Operation notes

1. The BA6394FP has an internal thermal shutdown circuit. Output current is muted when the chip temperature exceeds 175℃ (typically).
2. If the mute pin (19 pin) voltage is opened or lowered below 0.5V, the output current will be muted.
3. The bias pin (10 pin) is muted when lowered below 1.0V (typically). Make sure it stays above 1.2V during normal use.
4. Muting occurs during thermal shutdown, mute-on operations or a drop in the bias pin voltage or supply voltage. In each case, only the drivers are muted.
5. Dead zone width is determined as follows :
Dead zone width=input resistance (attached resistor+internal input resistor 1kΩ)×1.0μA・・・①
When using the internal resistor (10kΩ), dead zone width is 10mV (typically one side). Because the input resistance and 1μA temperature characteristics are canceled out, there is virtually no variation due to temperature as long as the internal input resistor is used. However, a dead zone like that defined by the above equation occurs when an external resistor is used to change gain. Temperature change is typically 4000ppm per degree.
6. Be sure to connect the IC to a 0.1μF bypass capacitor to the power supply, at the base of the IC.
7. Because of the gain adjustment pin's high gain, connecting a long wire to it may result in output oscillation due to free capacitance. Use caution when designing wires.
8. Be sure to leave the test pins (23, 24 pin) open and unconnected.

●Thermal derating curve

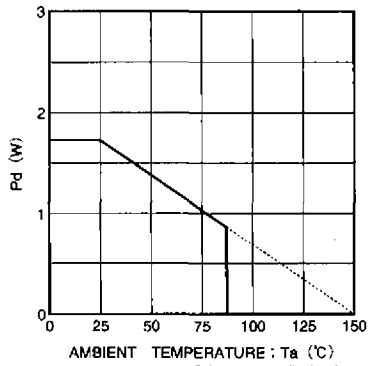


Fig. 4 When mounted to a 50× 50 × 1.0 (mm) paper phenol board

●Electrical characteristics curve

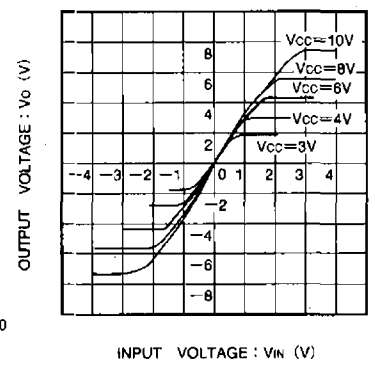


Fig. 5 Driver I/O characteristics (variable power supply)

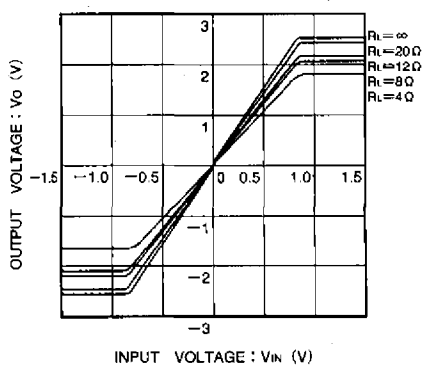


Fig. 6 Driver I/O characteristics (variable load)

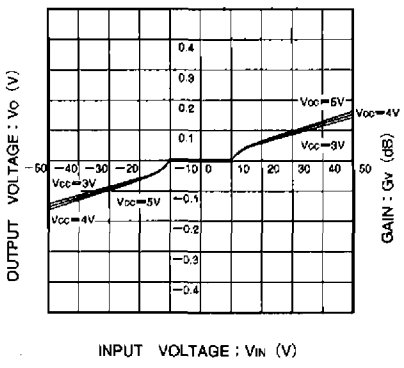


Fig. 7 Dead zone I/O characteristics

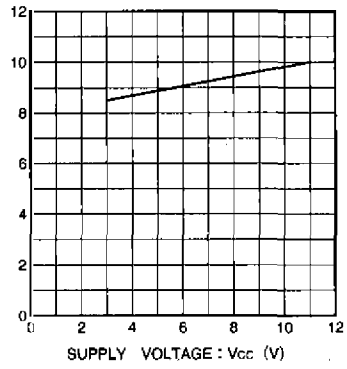


Fig. 8 Driver voltage gain vs. supply voltage

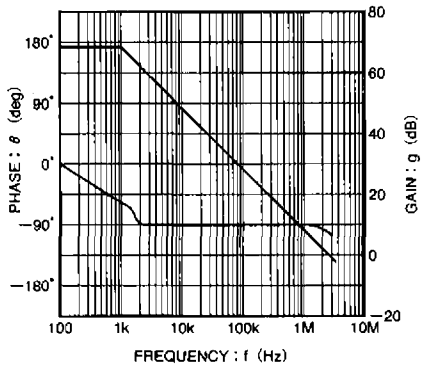
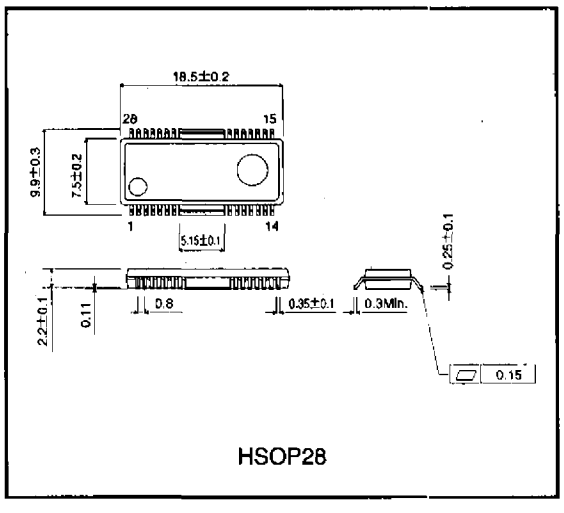


Fig. 9 Operational amplifier vs. open loop characteristics

●External dimensions (Units: mm)



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