

Dual operational amplifier

BA728/BA728F/BA728N

The BA728, BA728F, and BA728N are ICs with two independently functioning operational amplifiers featuring internal phase compensation. These products offer a wide range of operating voltages, from 3 to 18V (± 1.5 to 9V) and are high-performance operational amplifiers which can be driven from a single power supply within the in-phase mode input range, including a negative power supply.

●Applications

Ground sensing small-signal amplifiers

Control amplifiers requiring high phase margin, such as motor drivers

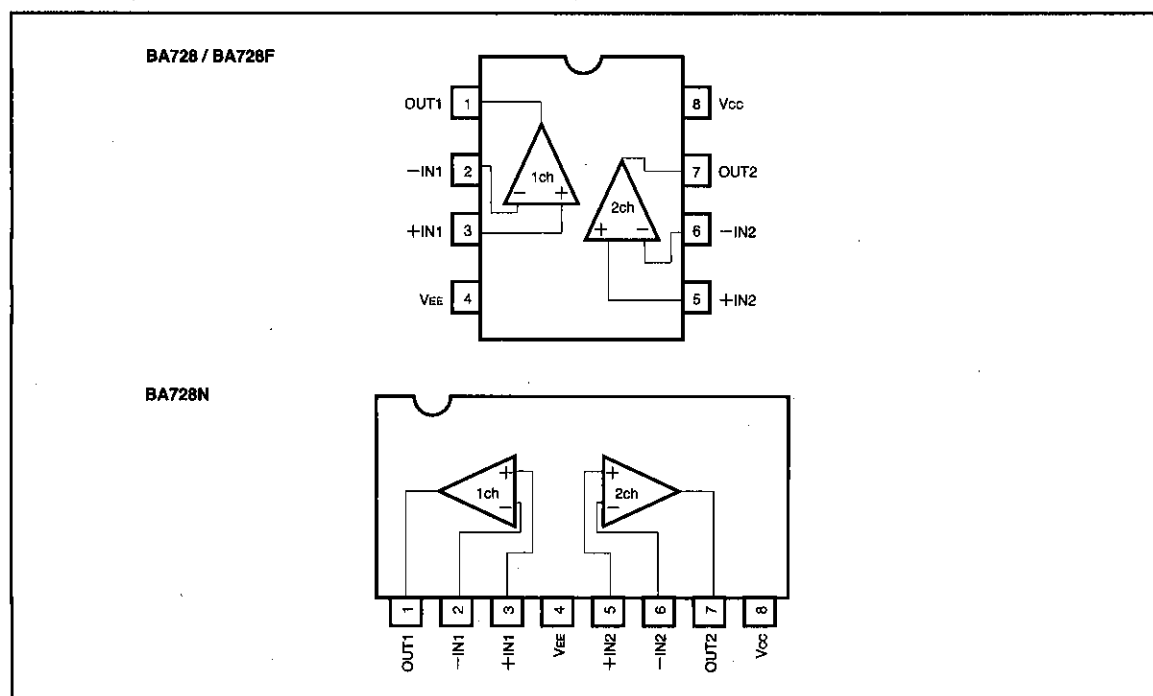
Amplifiers operated on low voltages

Capacitive loaded amplifiers

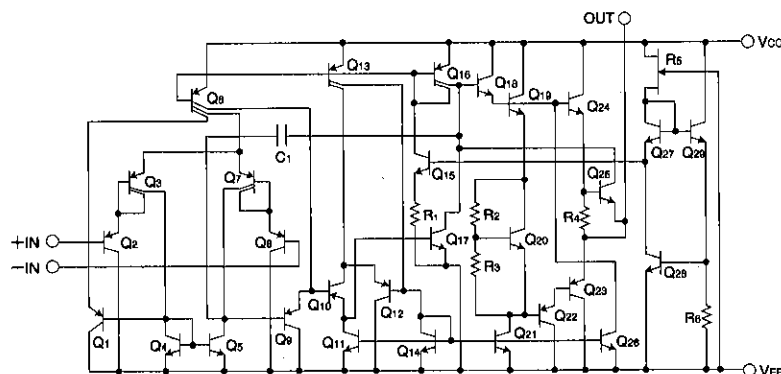
●Features

- 1) Can be driven from a single power supply.
- 2) Low power.
- 3) Pin layout is the same as that of the general-purpose 4558 operational amplifier.
- 4) When driven from a single power supply, the power supply voltage ranges from 3 to 18V.
- 5) When driven from a dual power supply, the power supply voltage ranges from ± 1.5 to ± 9 V.
- 6) Output is protected against short-circuits.
- 7) Output block is operated as a class AB to minimize crossover distortion.
- 8) Low input bias current of 10nA (typ.).
- 9) Each package contains two operational amplifiers.
- 10) Internal phase compensation provided.

●Block diagram



●Internal circuit configuration diagram



●Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits			Unit
		BA728	BA728F	BA728N	
Power supply voltage	V _{CC}	18 (±9)	18 (±9)	18 (±9)	V
Power dissipation	P _d	600 *	450 *	900 *	mW
Differential input voltage	V _{IO}	V _{CC}	V _{CC}	V _{CC}	V
In-phase input voltage	V _I	-0.3~V _{CC}	-0.3~V _{CC}	-0.3~V _{CC}	V
Operating temperature	T _{opr}	-20~75	-20~75	-20~75	°C
Storage temperature	T _{stg}	-55~125	-55~125	-55~125	°C

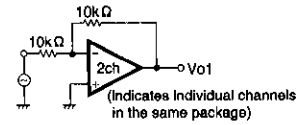
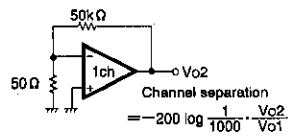
* For Pd values, please see Pd characteristic diagram.

* Values are those when BA728F is mounted on a glass epoxy PCB (50 mm x 50 mm x 1.6 mm).

●Electrical characteristics (unless otherwise noted, $T_a=25^{\circ}\text{C}$, $V_{CC}=+6\text{V}$, $V_{EE}=-6\text{V}$)

Parameter		Symbol	Min.	Typ.	Max.	Unit	Conditions
Input offset voltage		V_{IO}	—	2	10	mV	—
Input offset current		I_{IO}	—	1	50	nA	—
Input bias current		I_B	—	10	250	nA	—
High amplitude voltage gain		A_v	86	100	—	dB	$R_L \geq 2k\Omega$
Common mode input voltage		V_{ICM}	4~—6	4.5~—6	—	V	—
Maximum output voltage		V_{OM}	± 3.0	± 4.5	—	V	$R_L \geq 2k\Omega$
Common mode rejection ratio		CMRR	70	90	—	dB	—
Power supply voltage rejection ratio		PSRR	—	30	150	$\mu V/V$	—
Slew rate		S. R.	—	0.7	—	V/ μS	$A_v=1$, $R_L=2k\Omega$
Maximum frequency		f_r	—	0.7	—	MHz	—
Channel separation		CS	—	120	—	dB	—
Maximum output current	source	I_{source}	—	20	—	mA	$V_{IN}^+=1V$, $V_{IN}^-=0V$
	sink	I_{sink}	—	10	—	mA	$V_{IN}^-=1V$, $V_{IN}^+=0V$

The circuit diagram shows a 1-bit digital-to-analog converter. It features a BA728 op-amp configured as a voltage follower. The non-inverting input of the op-amp is connected to a network of resistors and switches. A 200Ω resistor is connected to the input signal. This is followed by a 10Ω resistor. A switch labeled 'S' is connected to the input signal and the 10Ω resistor. Another switch labeled 'S' is connected to the output of the op-amp and the 10Ω resistor. The output of the op-amp is connected to a load resistor R_L . The op-amp is powered by V_{CC} and V_{EE} . The text "(per circuit)" is written below the op-amp symbol.



A line graph showing the power dissipation capability of three diode models (BA728N, BA728, and BA728F) as a function of ambient temperature. The y-axis represents Power Dissipation in milliwatts (mW), ranging from 0 to 1000 in increments of 200. The x-axis represents Ambient Temperature in degrees Celsius (°C), ranging from 0 to 80 in increments of 20. Each model has a constant power dissipation limit at lower temperatures, which then decreases linearly as the temperature increases beyond a certain point.

Ambient Temperature (°C)	BA728N Power Dissipation (mW)	BA728 Power Dissipation (mW)	BA728F Power Dissipation (mW)
0	850	600	400
20	850	600	400
25	850	600	450
30	850	600	450
40	750	500	400
60	550	350	250
70	450	250	150
75	450	250	150

Supply Voltage V^+ (V)	Quiescent Current I_q (mA)
0	1.0
5	1.1
10	1.2
15	1.35
20	1.6

Supply Voltage V^+ (V)	Input Bias Current I_b (nA)
5	9
10	10.5
15	12.5
20	15

Graph showing Open Loop Voltage Gain (A_v) in dB versus Supply Voltage (V^+) in Volts. The gain increases from approximately 100 dB at 5V to about 125 dB at 20V.

Supply Voltage (V^+) [V]	Open Loop Voltage Gain (A_v) [dB]
5	100
10	115
15	122
20	125

A line graph showing the relationship between Output Current I_O (mA) and Ambient Temperature T_a (°C). The y-axis ranges from 0 to 40 mA with major grid lines every 10 units. The x-axis ranges from -20 to 80 °C with major grid lines every 20 units. A single straight line is plotted, starting at approximately 28 mA at -20 °C and ending at approximately 13 mA at 80 °C.

Ambient Temperature T_a (°C)	Output Current I_O (mA)
-20	28
0	24
20	20
40	16
60	12
80	13

A Bode plot showing the open loop voltage gain A_v in dB versus frequency f in Hz. The y-axis is logarithmic, ranging from 0 to 120 dB. The x-axis is logarithmic, ranging from 1 Hz to 10 MHz. The plot shows a constant gain of 100 dB from 1 Hz to 10 Hz, followed by a roll-off at -20 dB/decade, reaching 0 dB at 1 MHz.

Frequency f (Hz)	Open Loop Voltage Gain A_v (dB)
1	100
10	100
100	80
1k	60
10k	40
100k	20
1M	0

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●Electrical characteristic curve

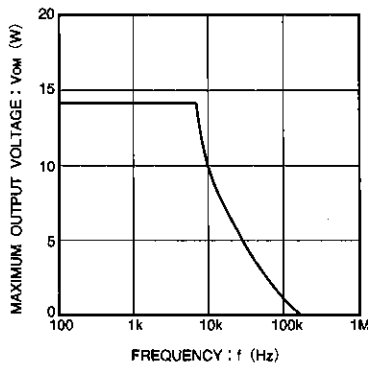


Fig.8 Maximum output voltage - frequency characteristic

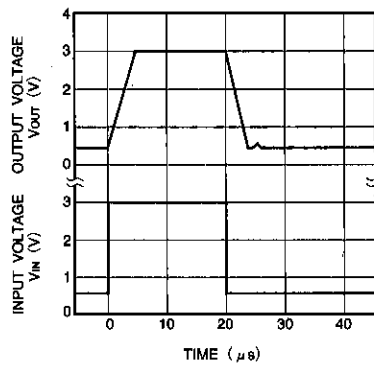


Fig.9 Output response characteristic

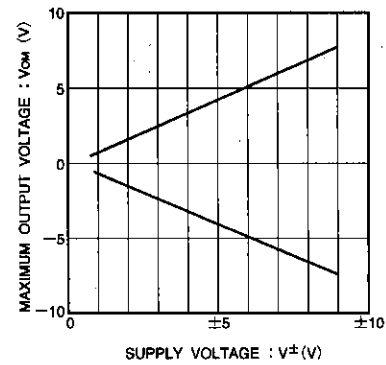


Fig.10 Maximum output voltage - power supply voltage characteristic

●Operation notes

Unused circuit connections

If there are any circuits which are not being used, we recommend making connections as shown in Figure 11, with the non-inverted input pin connected to the potential within the in-phase input voltage range (V_{ICM}).

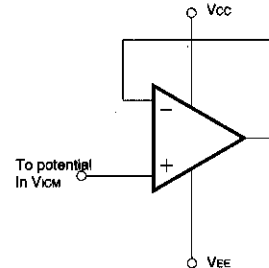


Fig.11 Unused circuit connections

●External dimensions (Units: mm)

