

Structure : Silicon Monolithic Integrated Circuit  
 Product : 3 Dual operational amplifier with switch for car audio systems

Type : **BA3131FS**

- Function :
1. High gain and low distortion. ( $G_v = 110\text{dB}$ , THD = 0.0015% typ.)
  2. Low noise. ( $V_n = 2\mu\text{Vrms}$  typ.)
  3. Switching circuit can be directly coupled to microcomputer port.
  4. Small switching noise.
  5. Equipped with  $1/2 V_{cc}$  output circuit for single power supply.

Absolute Maximum Ratings ( $T_a=25^\circ\text{C}$ )

| Parameter                  | Symbol      | Rating         | Unit             |
|----------------------------|-------------|----------------|------------------|
| Power supply voltage       | $V_{cc}$    | 18.0           | V                |
| Power dissipation          | $P_d$       | 750*           | mW               |
| Operating temperature      | $T_{opr}$   | -40~+85        | $^\circ\text{C}$ |
| Storage temperature        | $T_{astg}$  | -55~+125       | $^\circ\text{C}$ |
| Common-mode input voltage  | $V_i$       | $3\sim V_{cc}$ | V                |
| Differential input voltage | $V_{id}$    | $V_{cc}$       | V                |
| Load current               | $I_{oMax.}$ | $\pm 50.0$     | mA               |

※ This value decreases 7.5 mW/ $^\circ\text{C}$  for  $T_a=25^\circ\text{C}$  or more.  
 (When mounted on a glass epoxy board (90mm × 50mm × 1.6t))

Operating Voltage Range ( $T_a=25^\circ\text{C}$ )

| Parameter            | Symbol   | Min. | Typ. | Max. | Unit | Conditions          |
|----------------------|----------|------|------|------|------|---------------------|
| Power supply voltage | $V_{cc}$ | 6.0  | 8.0  | 16.0 | V    | Single power source |

Application example

Note that ROHM cannot provide adequate confirmation of patents.

The product described in this specification is designed to be used with ordinary electronic equipment or devices (such as audio-visual equipment, office-automation equipment, communications devices, electrical appliances, and electronic toys).

Should you intend to use this product with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

Electrical characteristics

(unless otherwise noted,  $T_a=25^{\circ}\text{C}$ ,  $V_{cc}=8\text{V}$ )

| Parameter                            | Symbol           | Limit |      |          | Unit                | Conditions  |
|--------------------------------------|------------------|-------|------|----------|---------------------|---|
|                                      |                  | Min.  | Typ. | Max.     |                     |   |
| Quiescent current                    | $I_q$            | 2.0   | 4.9  | 7.8      | mA                  | $V_{IN}=0, R_L=\infty, \text{SW pin open}$        |
| Input offset voltage                 | $V_{io}$         | —     | 0.5  | 5.0      | mV                  | $R_S \leq 10\text{k}\Omega$                       |
| Input offset current                 | $I_{io}$         | —     | 5    | 200      | nA                  |   |
| Input bias current                   | $I_b$            | —     | 50   | 500      | nA                  | *1  |
| High-amplitude voltage gain          | $A_{vol}$        | 86    | 110  | —        | dB                  | $R_L \geq 2\text{k}\Omega, V_O = \pm 1.5\text{V}$ |
| Common-mode input voltage            | $V_{icm}$        | 3     | 6    | —        | V                   |   |
| In-phase signal rejection ratio      | CMRR             | 60    | 72   | —        | dB                  | $R_S \leq 10\text{k}\Omega$                       |
| Power supply voltage rejection ratio | PSRR             | 76    | 90   | —        | dB                  | $R_S \leq 10\text{k}\Omega$                       |
| Maximum output voltage               | $V_{OH}/V_{OL}$  | 3     | 6    | —        | V                   | $R_L \geq 10\text{k}\Omega$                       |
|                                      |                  | 3     | 6    | —        | V                   | $R_L \geq 2\text{k}\Omega$                        |
| Input conversion noise voltage       | $V_n$            | —     | 2.0  | 4.0      | $\mu\text{V}_{rms}$ | *2  |
| Reference voltage change             | $\Delta V_{REF}$ | —     | —    | $\pm 10$ | mV                  | $I_{oref} = \pm 1\text{mA}$                       |

0. 1 Because the first stage is configured with PNP transistors, input bias current is from the IC.  
 0. 2 Tested under the following conditions:  $G_v = 40\text{dB}$ ,  $R_S = 2\text{k}\Omega$ , Matsushita Tsuko VP-9690A (using DIN audio filter)

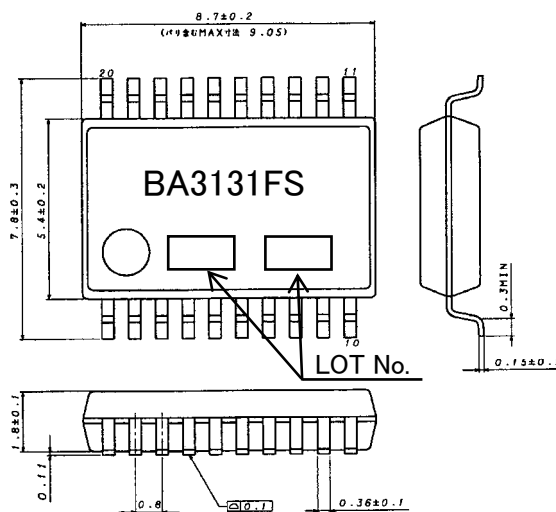
Design guaranteed values

(unless otherwise noted,  $T_a=25^{\circ}\text{C}$ ,  $V_{cc}=8\text{V}$ )

| Parameter                    | Symbol     | Limit |        |      | Unit                   | Conditions   |
|------------------------------|------------|-------|--------|------|------------------------|--|
|                              |            | Min.  | Typ.   | Max. |                        |  |
| Slew rate                    | SR         | 0.5   | 1.2    | —    | $\text{V}/\mu\text{S}$ | $G_v = 0\text{dB}, R_L = 2\text{k}\Omega$                  |
| Gainbandwidth product        | GBW        | 1.5   | 2.6    | —    | MHz                    | $f = 10\text{kHz}$   |
| Crosstalk between A, B and C | $CT_{ABC}$ | 60    | 73     | —    | dB                     | $f = 1\text{kHz}$  |
| Total harmonic distortion    | THD        | —     | 0.0025 | 0.01 | %                      | $G_v = 0\text{dB}, f = 1\text{kHz}, V_o = 1\text{V}_{rms}$ |
| Channel separation           | CS         | 90    | 115    | —    | dB                     | $f = 1\text{kHz}, \text{input conversion}$                 |

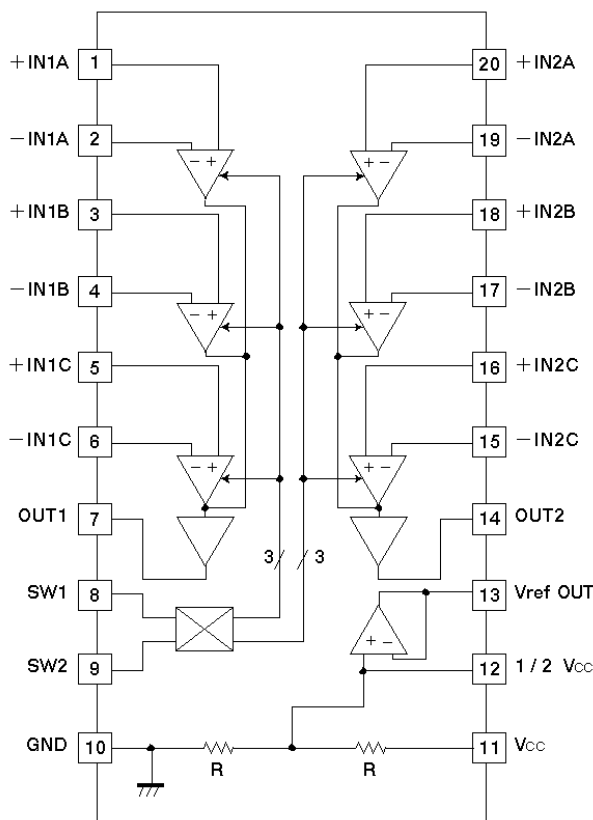
※This item is not guaranteed during processes.

Outline Dimension



SSOP-A20 (Unit:mm)

Block Diagram



Terminal Number/ Terminal Name

| Terminal Number | Terminal Name |
|-----------------|---------------|
| 1               | +IN1A         |
| 2               | -IN1A         |
| 3               | +IN1B         |
| 4               | -IN1B         |
| 5               | +IN1C         |
| 6               | -IN1C         |
| 7               | OUT1          |
| 8               | SW1           |
| 9               | SW2           |
| 10              | GND           |
| 11              | Vcc           |
| 12              | 1/2 Vcc       |
| 13              | Vref OUT      |
| 14              | OUT2          |
| 15              | -IN2C         |
| 16              | +IN2C         |
| 17              | -IN2B         |
| 18              | +IN2B         |
| 19              | -IN2A         |
| 20              | +IN2A         |

Application example

- (1) Numbers and data in entries are representative design values and are not guaranteed values of the items.
- (2) Although we are confident in recommending the sample application circuits, carefully check their characteristics further when using them. When modifying externally attached component constants before use, determine them so that they have sufficient margins by taking into account variations in externally attached components and the Rohm LSI, not only for static characteristics but also including transient characteristics.
- (3) Absolute maximum ratings  
If applied voltage, operating temperature range, or other absolute maximum ratings are exceeded, the LSI may be damaged. Do not apply voltages or temperatures that exceed the absolute maximum ratings. If you think of a case in which absolute maximum ratings are exceeded, enforce fuses or other physical safety measures and investigate how not to apply the conditions under which absolute maximum ratings are exceeded to the LSI.
- (4) GND potential  
Make the GND pin voltage such that it is the lowest voltage even when operating below it. Actually confirm that the voltage of each pin does not become a lower voltage than the GND pin, including transient phenomena.
- (5) Thermal design  
Perform thermal design in which there are adequate margins by taking into account the allowable power dissipation in actual states of use.

(6) Shorts between pins and misinstallation

When mounting the LSI on a board, pay adequate attention to orientation and placement discrepancies of the LSI. If it is misinstalled and the power is turned on, the LSI may be damaged. It also may be damaged if it is shorted by a foreign substance coming between pins of the LSI or between a pin and a power supply or a pin and a GND.

(7) Operation in strong magnetic fields

Adequately evaluate use in a strong magnetic field, since there is a possibility of malfunction.

(8) The 13 Pin is the reference output terminal, which outputs  $1/2 V_{cc}$ . Determine the bypass condenser value in accordance with the desired characteristics. In addition, as the value may oscillate within the 500pF– 1 $\mu$ F, make sure to set the bypass condenser value of more than 10 $\mu$ F for alternate grounding. Further, as 12 pin is located in the reference circuit, make sure to use bypass condenser for ac grounding for reference output. (Recommended value 22 $\mu$ F)

●Reference data (these values are intended only as a reference, and performance is not guaranteed)

| 12 pin bypass capacitor ( $\mu$ F) | Ripple Rejection ( $f_{in}=100\text{Hz}$ ) (dB) | Output Startup Time |
|------------------------------------|---|---------------------|
| 10                                 | -35   | 150                 |
| 22                                 | -42   | 300                 |
| 47                                 | -48   | 550                 |

\* Measuring condition: With Power Voltage ON ( $V_{cc}=8\text{V}$ ),  $V_{cc}$  path control, 13 pin path control 100 $\mu$ F, the time which is 90% of equilibrium output voltage

(9) This IC can be stably used in the low gain range (0–2dB). It may oscillate at the capacity load of more than 200pF. [the phase margin 10° Typ. ( $T_a=85^\circ\text{C}$ , 0dB point) for capacity 200pF] Therefore, caution is required for using capacity load.

In addition, for using 0db buffer, inserting bias resistor of  $k\Omega$  to minus input will enable stable use against the capacity load.

(10) Truth value table

|            | ch1 | ch2 | ch3 | OFF | Conditions                      |
|------------|-----|-----|-----|-----|---------------------------------|
| SW1 (8pin) | H   | H   | L   | L   | Corresponds to $\mu$ COM output |
| SW2 (9pin) | H   | L   | H   | L   |                                 |

※“H” when the applied at pins 8 and 9 is 2.0V or more, and “L” when it is 1.0V or less.

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