

STRUCTURE SILICON MONOLITHIC INTEGRATED CIRCUIT

FUNCTION GROUND SENSE QUAD OPERATIONAL AMPLIFIERS

PRODUCT SERIES **BA2902F**  
**BA2902FV**  
**BA2902KN**

FEATURES

- Wide operating temperature range. ( $-40\sim+125[^\circ\text{C}]$ )
- Operable with a single power supply. ( $3[\text{V}]\sim 32[\text{V}]$ )

○ABSOLUTE MAXIMUM RATINGS( $T_a=25[^\circ\text{C}]$ )

| Parameter                       | Symbol  | Rating             | Unit             |
|---------------------------------|---------|--------------------|------------------|
| Supply Voltage                  | VCC-VEE | +32                | V                |
| Power dissipation               | Pd      | BA2902F            | 610(*1) (*4)     |
|                                 |         | BA2902FV           | 870(*2) (*4)     |
|                                 |         | BA2902KN           | 660(*3) (*4)     |
| Differential Input Voltage (*5) | Vid     | $\pm 32$           | V                |
| Input Common-mode Voltage Range | Vicm    | (VEE-0.3) ~ VEE+32 | V                |
| Operating Temperature           | Topr    | $-40\sim+125$      | $^\circ\text{C}$ |
| Storage Temperature Range       | Tstg    | $-55\sim+150$      | $^\circ\text{C}$ |
| Maximum junction Temperature    | Tjmax   | 150                | $^\circ\text{C}$ |

• This IC is not designed for protection against radioactive rays.

(\*1) To use at temperature above  $T_a=25[^\circ\text{C}]$  reduce  $4.9[\text{mW}]/[^\circ\text{C}]$ .

(\*2) To use at temperature above  $T_a=25[^\circ\text{C}]$  reduce  $7.0[\text{mW}]/[^\circ\text{C}]$ .

(\*3) To use at temperature above  $T_a=25[^\circ\text{C}]$  reduce  $5.3[\text{mW}]/[^\circ\text{C}]$ .

(\*4) Mounted on a glass epoxy PCB( $70[\text{mm}]\times 70[\text{mm}]\times 1.6[\text{mm}]$ ).

(\*5) The voltage difference between inverting input and non-inverting input is the differential input voltage. Then input terminal voltage is set to more than VEE.

○OPERATING CONDITION( $T_a=-40\sim+125[^\circ\text{C}]$ )

| Parameter      | Symbol | Rating                               | Unit |
|----------------|--------|--------------------------------------|------|
| Supply Voltage | VCC    | +3.0~+32.0 (Single Supply)           | V    |
|                |        | $\pm 1.5\sim\pm 16.0$ (Split Supply) |      |

Status of this document

The Japanese version of this document is the formal specification.

A customer may use this translation version only for a reference to help reading the formal version.

If there are any differences in translation version of this document formal version takes priority.

Application example

• 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).

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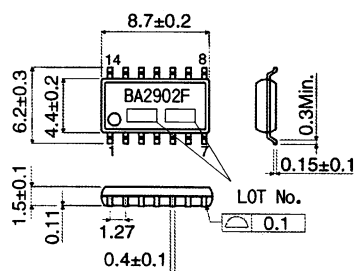
## ○ELECTRICAL CHARACTERISTICS (unless otherwise specified VCC=+5[V]、VEE=0[V])

| Parameter                                       | Symbol                   | Temperature Range | Guaranteed Limit |          |         | Unit              | Condition                                                      |
|-------------------------------------------------|--------------------------|-------------------|------------------|----------|---------|-------------------|----------------------------------------------------------------|
|                                                 |                          |                   | Min.             | Typ.     | Max.    |                   |                                                                |
| Input Offset Voltage (*6)                       | Vio                      | 25°C              | –                | 2        | 7       | mV                | VOUT=1.4[V]                                                    |
|                                                 |                          | full range        | –                | –        | 10      |                   | VCC=5~30[V], VOUT=1.4[V]                                       |
| Temperature Coefficient of Input Offset Voltage | $\Delta V_{io}/\Delta T$ | –                 | –                | $\pm 7$  | –       | $\mu V/^{\circ}C$ | VOUT=1.4[V]                                                    |
| Input Offset Current (*6)                       | Iio                      | 25°C              | –                | 2        | 50      | nA                | VOUT=1.4[V]                                                    |
|                                                 |                          | full range        | –                | –        | 200     |                   |                                                                |
| Temperature Coefficient of Input Offset Current | $\Delta I_{io}/\Delta T$ | –                 | –                | $\pm 10$ | –       | pA/^{\circ}C      | VOUT=1.4[V]                                                    |
| Input Bias Current (*6)                         | Ib                       | 25°C              | –                | 20       | 250     | nA                | VOUT=1.4[V]                                                    |
|                                                 |                          | full range        | –                | –        | 250     |                   |                                                                |
| Supply Current                                  | ICC                      | 25°C              | –                | 0.7      | 2       | mA                | RL=∞ All Op-Amps                                               |
|                                                 |                          | full range        | –                | –        | 3       |                   |                                                                |
| High Level Output Voltage                       | VOH                      | 25°C              | 3.5              | –        | –       | V                 | RL=2[kΩ]                                                       |
|                                                 |                          | full range        | 27               | 28       | –       |                   | VCC=30[V], RL=10[kΩ]                                           |
| Low Level Output Voltage                        | VOL                      | full range        | –                | 5        | 20      | mV                | RL=∞ All Op-Amps                                               |
| Large Signal Voltage Gain                       | AV                       | 25°C              | 25               | 100      | –       | V/mV              | RL≥2[kΩ], VCC=15[V]<br>VOUT=1.4~11.4[V]                        |
| Input Common-mode Voltage Range                 | Vicm                     | 25°C              | 0                | –        | VCC–1.5 | V                 | (VCC–VEE)=5[V], VOUT=VEE+1.4[V]                                |
| Common-mode Rejection Ratio                     | CMRR                     | 25°C              | 50               | 80       | –       | dB                | VOUT=1.4[V]                                                    |
| Power Supply Rejection Ratio                    | PSRR                     | 25°C              | 65               | 100      | –       | dB                | VCC=5~30[V]                                                    |
| Output Source Current (*7)                      | IOH                      | 25°C              | 20               | 30       | –       | mA                | VIN+=1[V], VIN–=0[V], VOUT=0[V],<br>Only 1CH is short circuits |
|                                                 |                          | full range        | 10               | –        | –       |                   |                                                                |
| Output Sink Current (*7)                        | IOL                      | 25°C              | 10               | 20       | –       | mA                | VIN+=0[V], VIN–=1[V], VOUT=5[V],<br>Only 1CH is short circuits |
|                                                 |                          | full range        | 2                | –        | –       |                   |                                                                |
|                                                 | Isink                    | 25°C              | 12               | 40       | –       | $\mu A$           | VIN+=0[V], VIN–=1[V], VOUT=200[mV]                             |
| Channel Separation                              | CS                       | 25°C              | –                | 120      | –       | dB                | f=1[kHz], input referred                                       |
| Slew Rate                                       | SR                       | 25°C              | –                | 0.2      | –       | V/μs              | VCC=15[V], AV=0[dB], RL=2[kΩ],<br>CL=100[pF]                   |
| Maximum Frequency                               | ft                       | 25°C              | –                | 0.5      | –       | MHz               | VCC=30[V], RL=2[kΩ], CL=100[pF]                                |
| Input Referred Noise Voltage                    | Vn                       | 25°C              | –                | 40       | –       | nV/√Hz            | VCC=15[V], VEE=–15[V], RS=100[Ω],<br>Vi=0[V], f=1[kHz]         |

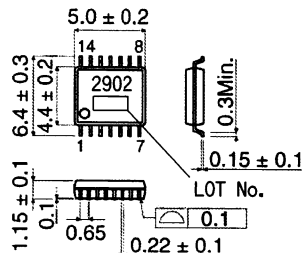
(\*6) Absolute value.

(\*7) Under the high temperature environment, consider the power dissipation of IC when select the output current.  
When output terminal short circuits continuously, the output current reduce to climb temperature inside IC by flash.

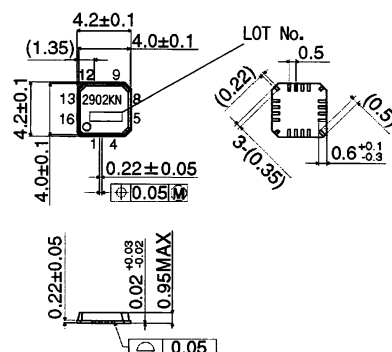
## ○Physical Dimensions



BA2902F(SOP14) (Unit:[mm])

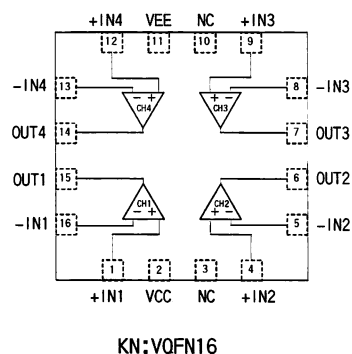
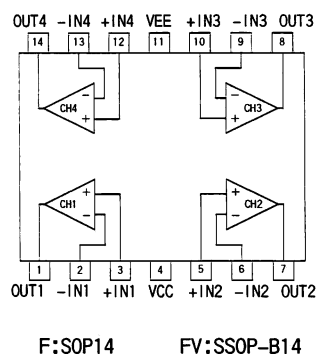


BA2902FV(SSOP-B14) (Unit:[mm])



BA2902KN(VQFN16) (Unit:[mm])

## Block diagram



## Pin No. • Pin Name

| Pin No. | Pin Name |
|---------|----------|
| 1       | OUT1     |
| 2       | -IN1     |
| 3       | +IN1     |
| 4       | VCC      |
| 5       | +IN2     |
| 6       | -IN2     |
| 7       | OUT2     |
| 8       | OUT3     |
| 9       | -IN3     |
| 10      | +IN3     |
| 11      | VEE      |
| 12      | +IN4     |
| 13      | -IN4     |
| 14      | OUT4     |

| Pin No. | Pin Name |
|---------|----------|
| 1       | +IN1     |
| 2       | VCC      |
| 3       | NC       |
| 4       | +IN2     |
| 5       | -IN2     |
| 6       | OUT2     |
| 7       | OUT3     |
| 8       | -IN3     |
| 9       | +IN3     |
| 10      | NC       |
| 11      | VEE      |
| 12      | +IN4     |
| 13      | -IN4     |
| 14      | OUT4     |
| 15      | OUT1     |
| 16      | -IN1     |

## Application example

### (1) Absolute maximum ratings

Absolute maximum ratings are the values which indicate the limits, within which the given voltage range can be safely charged to the terminal. However, it does not guarantee the circuit operation.

### (2) The example of disabled circuit application

When there is a circuit not in use, it is recommended to make the non-inverting input terminal be the potential in the common-mode input voltage range like in Fig.1.

### (3) Applied voltage to the input terminal

Regardless of power supply voltage, VEE+32 [V] can be applied to input terminals without deterioration or destruction of its characteristics. However, this does not guarantee a circuit operation. Note that circuits do not operate normally with input voltage not within input common mode voltage in terms of the electrical characteristics.

### (4) Operating power supply (split power supply/single power supply)

The OP-Amp operates if a given level of voltage is applied between VCC and VEE. Therefore, the OP-Amp can be operated under single power supply or split power supply.

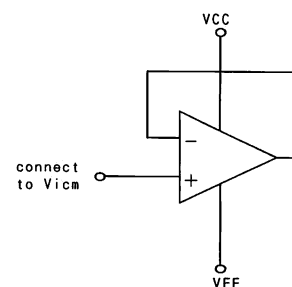


Fig.1 The example of disabled circuit

(5) Power dissipation(Pd)

If the IC is used under excessive power dissipation. An increase in the chip temperature will cause deterioration of the radical characteristics of IC.

For example, reduction of current capability. Take consideration of the effective power dissipation and thermal design with a sufficient margin. Pd is reference to the provided power dissipation curve.

(6) Short circuits between pins and incorrect mounting

Short circuits between pins and incorrect mounting when mounting the IC on a printed circuits board, take notice of the direction and positioning of the IC.

If IC is mounted erroneously, It may be damaged. Also, when a foreign object is inserted between output, between output and VCC terminal or VEE terminal which causes short circuit, the IC may be damaged.

(7) Using under strong electromagnetic field

Be careful when using the IC under strong electromagnetic field because it may malfunction.

(8) Usage of IC

When stress is applied to the IC through warp of the printed circuit board,

The characteristics may fluctuate due to the piezo effect.

Be careful of the warp of the printed circuit board.

(9) Output operation

This IC is configured with a push-pull circuit and Class C output stage. Therefore, when load resistance is connected to the middle point potential of VCC and VEE, this configuration generates crossover distortion when switching source and sink current.

To suppress crossover distortion, connect a resistor between the output terminal and VEE then increase the bias current to enable Class A operation.

(10) Testing IC on the set board

When testing IC on the set board, in cases where the capacitor is connected to the low impedance, make sure to discharge per fabrication because there is a possibility that IC may be damaged by stress.

When removing IC from the set board, it is essential to cut supply voltage.

As a countermeasure against the static electricity, observe proper grounding during fabrication process and take due care when carrying and storage it.

(11) Output terminal capacitor

Tr in circuits may be damaged when VCC terminal and VEE terminal is shorted with the charged output terminal capacitor.

When IC is used as a comparator or as an application circuit, where oscillation is not activated by an output capacitor, the output capacitor must be kept below  $0.1[\mu F]$  in order to prevent the damage mentioned above.

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