

## Audio Accessory ICs

# Preamps with Built-in ALC



## BA3308F,BA3308FV

No.11087ECT01

### ●Description

The BA3308F/FV is a dual preamplifier for recording and playback with ALC (auto level control), developed for stereo radio, cassette recorders, tape recorders, and other pre amplifiers audio applications.

ALC circuit has a build in rectification circuit with wide adjustable dynamic range, high gain, low distortion amplifiers with direct coupling and mute circuit, used to cut off pop noise during power on.

Available in SOP14, or SSOP-B14 Packages.

### ●Features

- 1) Built-in ALC rectification diode
- 2) Wide operating power supply voltage range ( $V_{CC}=4.5\sim14\text{ V}$ )
- 3) Low current consumption ( $I_Q=3.5\text{mA}$ )
- 4) High gain ( $G_{VO}=80\text{dB}$ )
- 5) Low distortion ( $\text{THD}=0.1\%$ )
- 6) Low noise ( $V_{NIN}=1\text{ }\mu\text{V}_{\text{rms}}$ )
- 7) Input coupling capacitor not needed
- 8) Good ALC channel balance
- 9) Built-in power supply mute circuit
- 10) Dynamic range of ALC can be changed by attaching input resistance.

### ●Applications

Stereo radio, cassette tape recorders, stereo cassette decks, home stereos, music centers, etc.

### ●Line up matrix

|          |         |          |
|----------|---------|----------|
| Part No. | BA3308F | BA3308FV |
| Package  | SOP14   | SSOP-B14 |

● **Absolute maximum ratings**(Ta=25°C)

| Parameter             |          | Symbol          | Limits            | Unit |
|-----------------------|----------|-----------------|-------------------|------|
| Supply voltage        |          | V <sub>CC</sub> | 16                | V    |
| Power dissipation     | BA3308F  | Pd              | 450 <sup>*1</sup> | mW   |
|                       | BA3308FV |                 | 350 <sup>*2</sup> |      |
| Operating temperature |          | Topr            | -25~+75           | °C   |
| Storage temperature   |          | Tstg            | -55~+125          | °C   |

<sup>\*1</sup> Reduce by 4.5 mW/°C over 25°C, when mounted on a 70mm × 70mm × 1.6mm PCB board.

<sup>\*2</sup> Reduce by 3.5 mW/°C over 25°C

● **Operating conditions**(Ta=25°C)

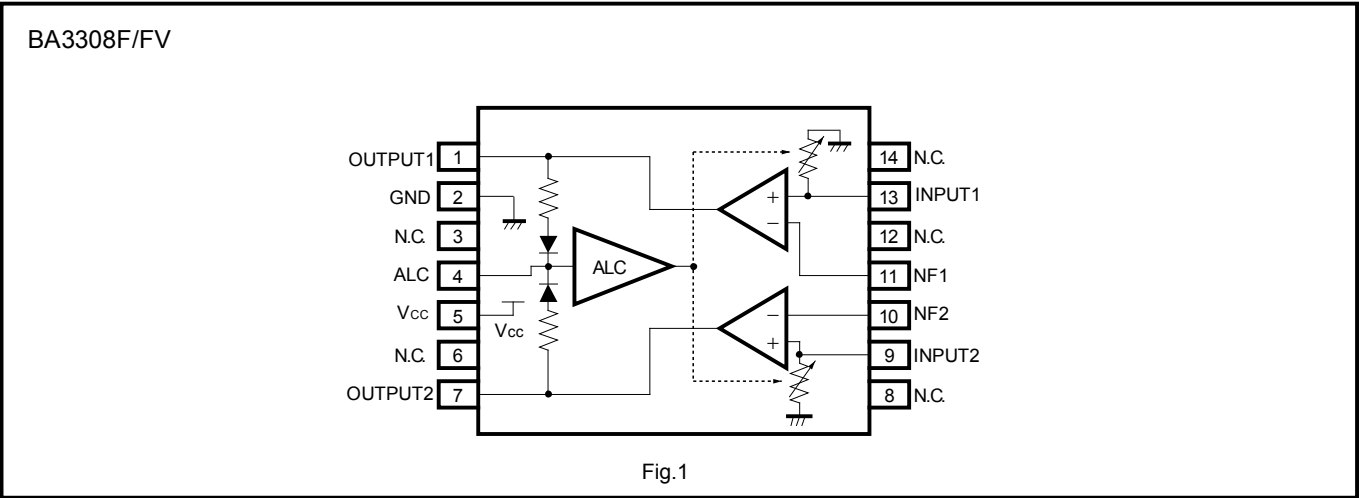
| Parameter      | Symbol          | Min. | Typ. | Max. | Unit |
|----------------|-----------------|------|------|------|------|
| Supply voltage | V <sub>CC</sub> | 4.5  | -    | 14   | V    |

Note: This IC is not designed to be radiation-resistant.

● **Electrical characteristics**(Unless otherwise noted, Ta=25°C, V<sub>CC</sub>=7.0V, f=1kHz, BPF20~20kHz)

| Parameter                      | Symbol           | Min. | Typ. | Max. | Unit              | Conditions                                                        | Test Circuit |
|--------------------------------|------------------|------|------|------|-------------------|-------------------------------------------------------------------|--------------|
| Quiescent current              | I <sub>Q</sub>   | 1.5  | 3.5  | 4.5  | mA                | V <sub>IN</sub> =0V <sub>rms</sub>                                | Fig.17       |
| Open loop voltage gain         | G <sub>VO</sub>  | 70   | 80   | -    | dB                | V <sub>OUT</sub> =-10dBV                                          | Fig.17       |
| Total harmonic distortion      | THD              | -    | 0.1  | 0.3  | %                 | NAB34dB, V <sub>OUT</sub> =40mV <sub>rms</sub>                    | Fig.17       |
| Input resistance               | R <sub>IN</sub>  | 15   | 25   | 45   | kΩ                |                                                                   | Fig.17       |
| Maximum output voltage         | V <sub>OM</sub>  | 0.6  | 1.2  | -    | V <sub>rms</sub>  | THD=1%                                                            | Fig.17       |
| Input conversion noise voltage | V <sub>NIN</sub> | -    | 1    | 2    | μV <sub>rms</sub> | R <sub>g</sub> =2.2kΩ, referenced to NAB 34dB at 1kHz             | Fig.17       |
| ALC range                      | ALC              | 40   | 45   | -    | dB                | R <sub>g</sub> =3.9 kΩ, V <sub>IN</sub> =-70 dBV standard, THD=3% | Fig.17       |
| ALC channel balance            | ΔALC             | -    | 0    | 2.5  | dB                | V <sub>IN</sub> =-60dBV,-30dBV                                    | Fig.17       |
| Channel separation             | CS               | 60   | 75   | -    | dB                | V <sub>O</sub> =0dBV, NAB 34dB                                    | Fig.17       |

●Block diagram



# ●Electrical characteristic curves (Reference data)

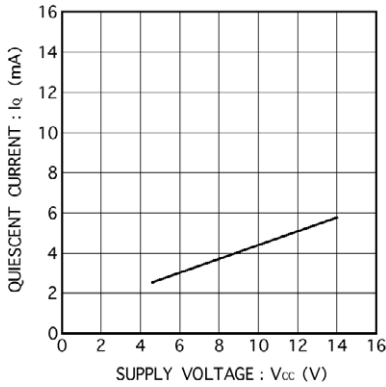


Fig.2 Quiescent current vs. power supply voltage

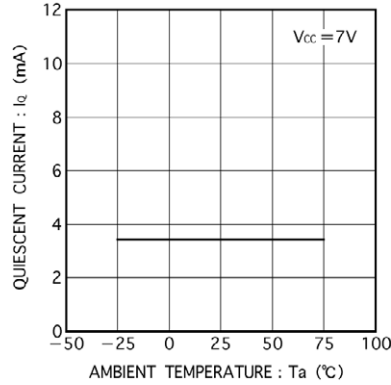


Fig.3 Quiescent current vs. ambient temperature

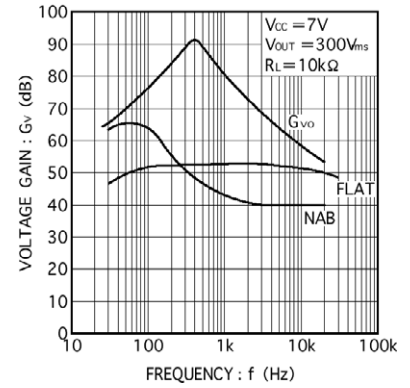


Fig.4 Voltage gain vs. frequency

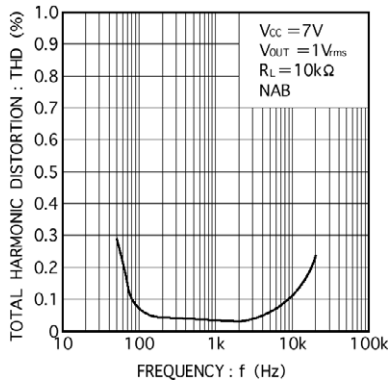


Fig.5 Total harmonic distortion vs. frequency

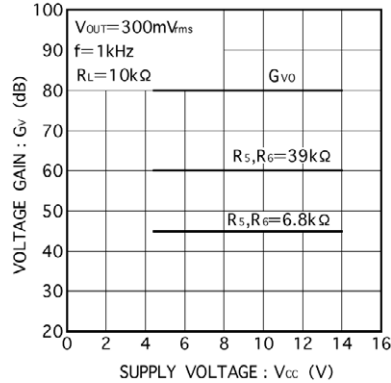


Fig.6 Voltage gain vs. supply voltage

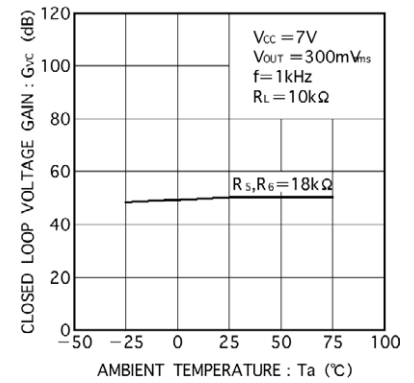


Fig.7 Closed loop voltage gain vs. ambient temperature

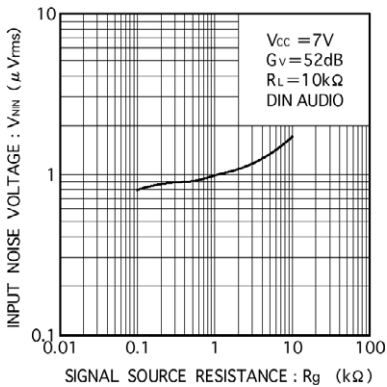


Fig.8 Input conversion noise voltage vs. signal source resistance

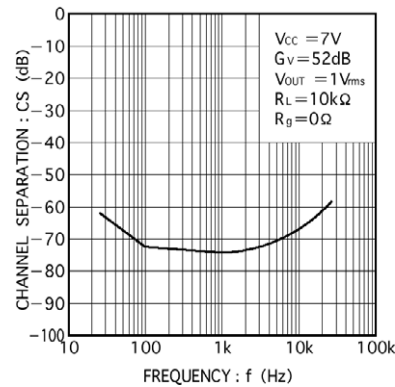


Fig.9 Channel separation vs. frequency

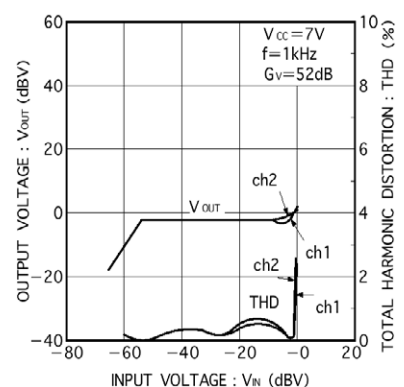


Fig.10 ALC characteristics

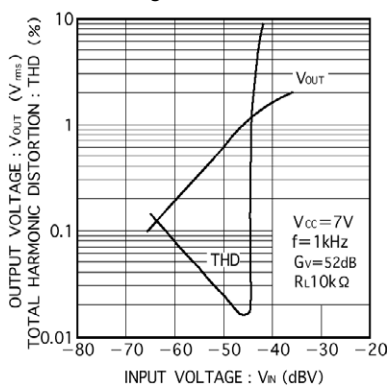


Fig.11 Input/output characteristics

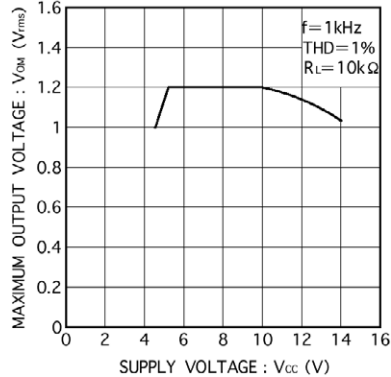


Fig.12 Maximum output voltage vs. power supply voltage

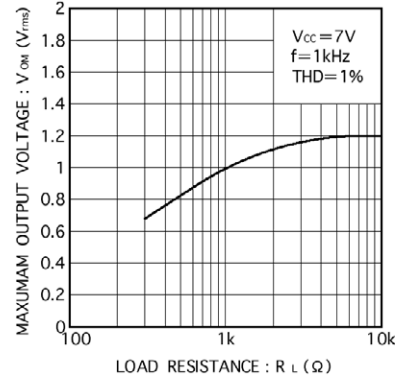


Fig.13 Maximum output voltage vs. load resistance

## ●Description of operations

### 1. Recording

#### 1) Record amplifier

The BA3308F/FV amplifier of ch1 and ch2 input stage (13pin, 9pin) can be direct coupled or use coupling capacitors (C1/C2). The voltage gain of the record amplifier is determined by  $G_v = R_5/R_3$ . The  $R_5/R_6$ , and  $C_3/R_3$  regulate control of the pop noise that occurs at power-on (see "Cautions on use") and direct current bias fed back is set by  $R_5/R_6$  and  $C_5/C_6$  at the output stage.

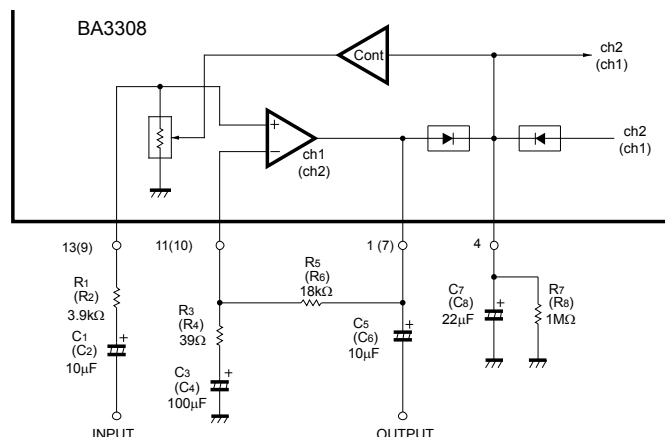


Fig.14

#### 2) ALC

The BA3308F/FV has an on-chip signal rectifier and electronic volume needed for ALC. The signal rectifier compares the direct current output voltage that is superposed in the output stage (1, 7pin) signal to the reference voltage  $4.5V_F$  ( $\approx 3V$ ;  $1V_F$  is approximately  $0.7V$ ) in the comparator circuit and if the output voltage is higher, it turns the comparator ON to charge the smoothing capacitor  $C_7$ . Since the operation point of the output stage of amplifier ch1 and ch2 is fixed at  $3V_F$ , the comparator turns ON when the peak value of the signal output voltage is  $1.5V_F$  (effective value approx.  $0.75V$ ). Once the direct current signal for electronic volume is controlled, ALC operation starts. The electronic volume, which is connected between the input line (13, 9pin) and GND, causes the input signal to attenuate according to the ratio of the external resistance ( $R_1$ ,  $R_2$ ) to the resistance value of the electronic volume. The ALC range varies according to the values of  $R_1$  and  $R_2$ . For small ALC variation the S/N will determinate an adequate ALC range is obtained by applying several k $\Omega$  of the  $R_1$  and  $R_2$ . The attack time and recovery time of ALC are set according to  $C_7$  and  $R_7$  of 4pin. If the time constants ( $C_7$ ,  $R_7$ ) are large, the recovery time will be long and as  $C_7$  becomes smaller, and the attack time will be shorter.

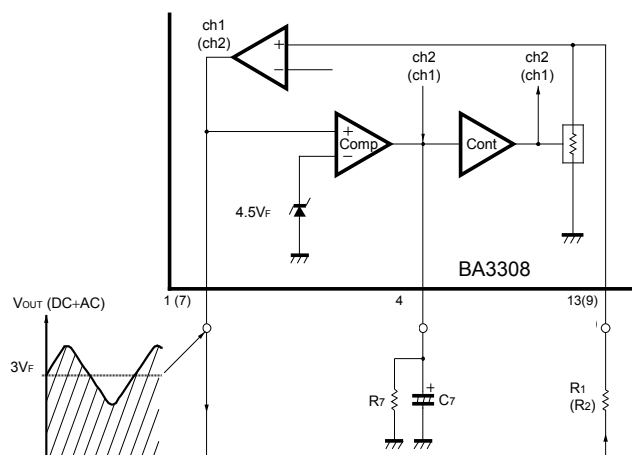


Fig.15

## 2. On playback

Since amplifier ch1 and ch2 are used as a NAB equalizer amplifier at playback, a time constant circuit is established in the NF section (1-11pin, 7-10pin) to obtain NAB characteristics. The voltage gain at this time is determined by the following formula:

$$G_v = |R_{11} + R_9 / (| + j\omega C_9 \cdot R_9) | / R_3$$

Obtain the necessary gain by regulating the (power-on pop noise prevention) NAB time constant circuit in the same way when regulating the gain at recording stage. The operating point of the output stage (1,7pin) is fixed at 3VF. Accordingly, even if VCC is raised to 5V or more, as in the VMAX-VCC characteristic (Fig.13), the maximum output voltage does not rise above 1.2V (Typ.). 4pin is grounded at playback since ALC is not needed. For better signal-to-noise ratio characteristics at playback, don't use R1 and R2, which are attached to the input pin (13pin, 9pin).

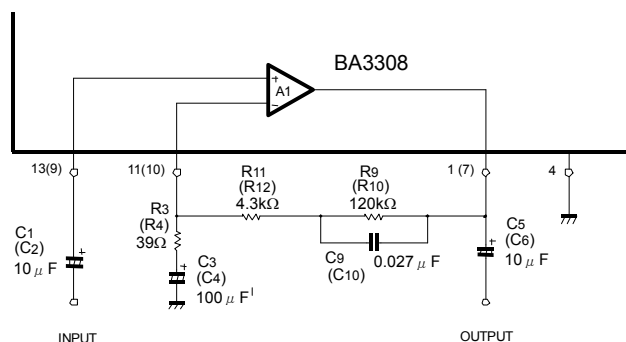


Fig.16

# Measurement circuit

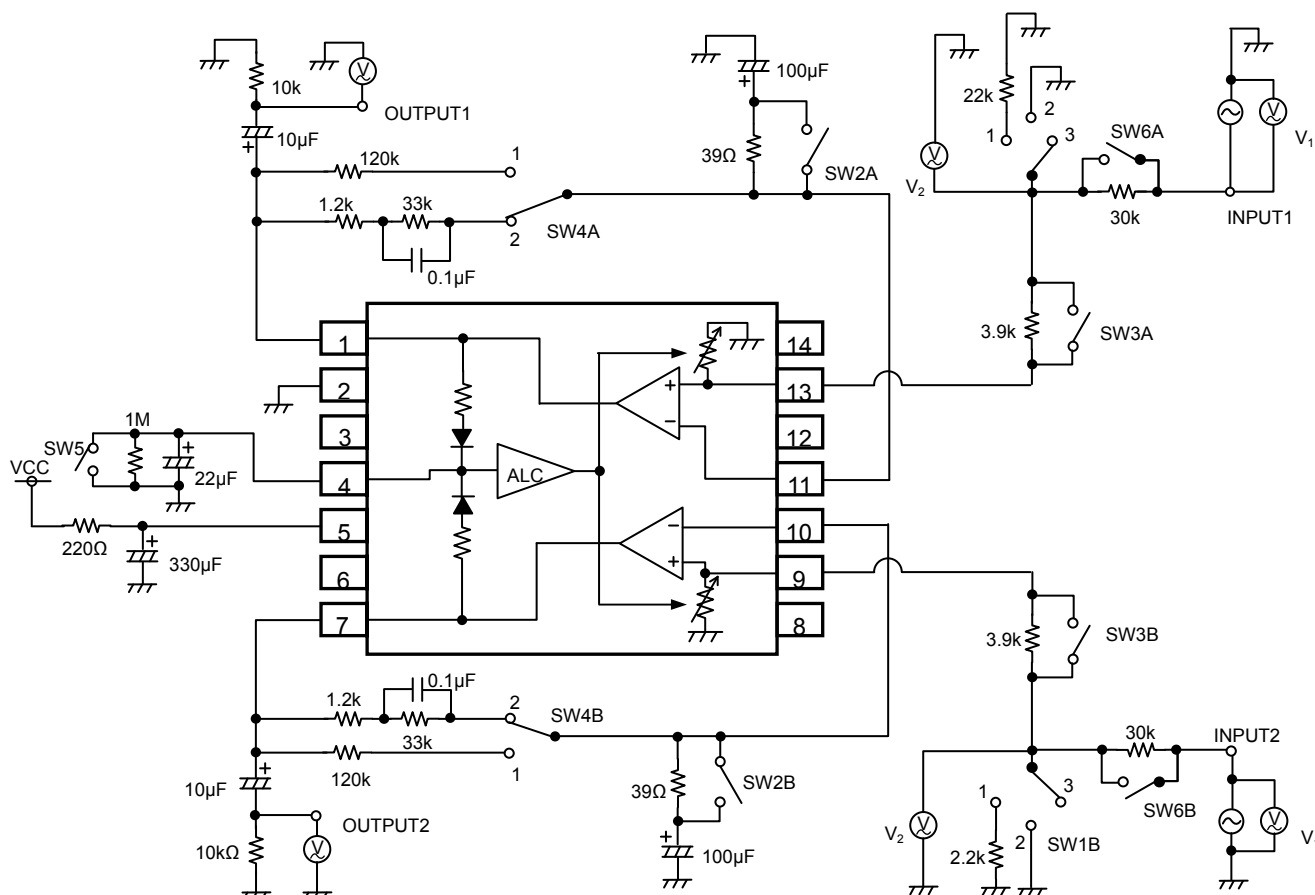


Fig.17

# Application circuit

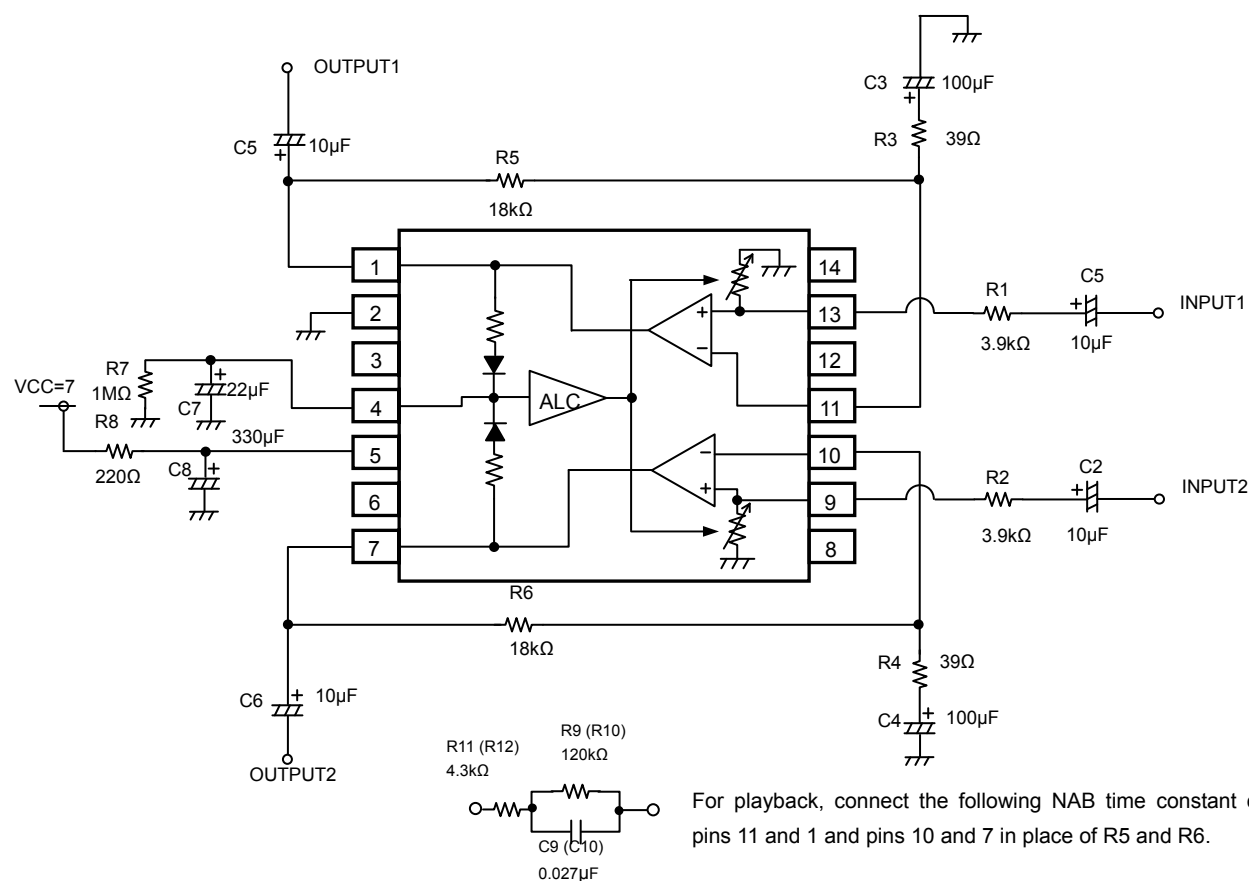


Fig.18

**●Notes for use**

- 1) Numbers and data in entries are representative design values and are not guaranteed values of the items.
- 2) Although ROHM is confident that the example application circuit reflects the best possible recommendations, be sure to verify circuit characteristics for your particular application. Modification of constants for other externally connected circuits may cause variations in both static and transient characteristics for external components as well as this Rohm IC. Allow for sufficient margins when determining circuit constants.
- 3) Absolute maximum ratings  
Use of the IC in excess of absolute maximum ratings, such as the applied voltage or operating temperature range (Topr), may result in IC damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure, such as a fuse, should be implemented when using the IC at times where the absolute maximum ratings may be exceeded.
- 4) GND potential  
Ensure a minimum GND pin potential in all operating conditions. Make sure that no pins are at a voltage below the GND at any time, regardless of whether it is a transient signal or not.
- 5) Thermal design  
Perform thermal design, in which there are adequate margins, by taking into account the permissible dissipation (Pd) in actual states of use.
- 6) Short circuit between terminals and erroneous mounting  
Pay attention to the assembly direction of the ICs. Wrong mounting direction or shorts between terminals, GND, or other components on the circuits, can damage the IC.
- 7) Operation in strong magnetic fields  
Using the ICs in a strong electromagnetic field can cause operation malfunction.
- 8) The BA3308F/FV has an on-chip power supply mute circuit that checks for pop noise at power-on. This prevents the occurrence of pop noise by timing the charge times of the direct current cut capacitors C3 and C4 of 10pin and 11pin, and of capacitor C8 for the ripple filter of 5pin.  
Accordingly, to obtain an adequate effect, it is recommended that the constants of the application circuit be used in C3, C4, R3, R4, C8, and R8.



●Ordering part number

B A

Part No.

3 3 0 8

Part No.

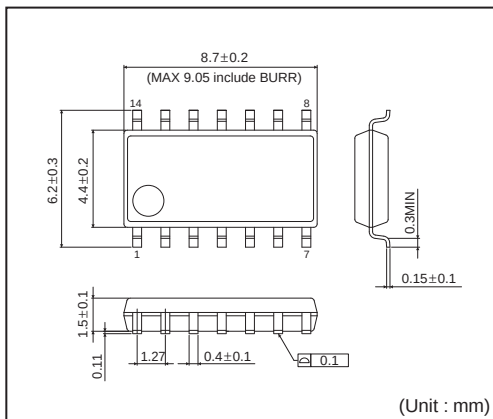
F

Package  
F: SOP14  
FV: SSOP-B14

E 2

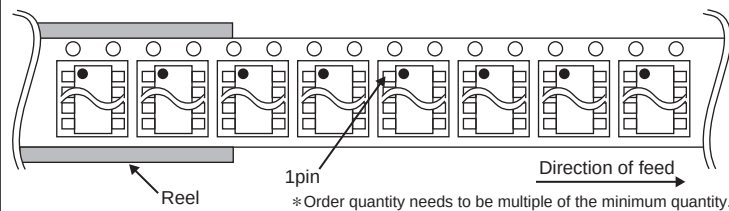
Packaging and forming specification  
E2: Embossed tape and reel

SOP14

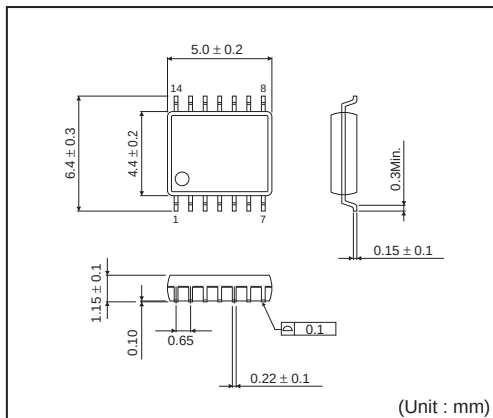


<Tape and Reel information>

|                   |                                                                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Tape              | Embossed carrier tape                                                                                                                              |
| Quantity          | 2500pcs                                                                                                                                            |
| Direction of feed | E2<br>(The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand ) |

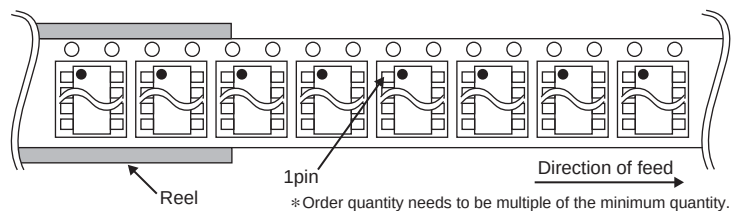


SSOP-B14



<Tape and Reel information>

|                   |                                                                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Tape              | Embossed carrier tape                                                                                                                              |
| Quantity          | 2500pcs                                                                                                                                            |
| Direction of feed | E2<br>(The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand ) |



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