

Speech network for telephones

BA6569AS / BA6569AFP

The BA6569AS and BA6569AFP are speech networks which possesses the basic functions required for handset communications. In addition to amplifying signals from a transmitter and sending them to a telephone line, they also amplify only reception signals from a telephone line and drive the receiver. In addition to a function which compensates for fluctuation in the transmission and reception volume caused by the length of the telephone line (AGC), they are also equipped with a manual PAD function in order to accommodate PBX.

●Applications

Telephones and telephone equipment

●Features

- 1) Basic speech network functions built in.
- 2) Single output pin of reception pre-amplifier is separate.
- 3) Single input pin of reception pre-amplifier is separate, enabling mixing of input.
- 4) Input to microphone pre-amplifier is balanced and offers high resistance to in-line noise.
- 5) Input pin of MF pre-amplifier enables mixing of input.
- 6) Manual pad pin included.
- 7) Pre-amplifiers for reception, microphone, and MF employ AGC based on telephone line current.
- 8) AC impedance can be raised by altering the positive feedback. This enables configuration of power supply circuits for microcomputers and other applications using only a single resistor.
- 9) A BTL circuit is used for reception output, and the wide dynamic range enables both dynamic and ceramic receivers to be accommodated.
- 10) Few external attachments are required.
- 11) 22-pin SDIP and 24-pin HSOP packages available.

●Absolute maximum ratings (Ta = 25°C)

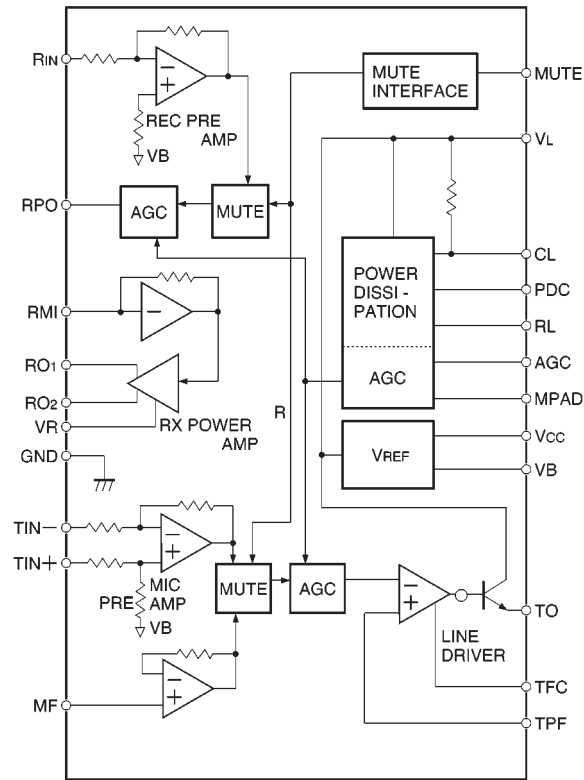
| Parameter | | Symbol | Limits | Unit |
|-----------------------|-----------|------------------|----------|------|
| Applied voltage | | V _L | 18 | V |
| Current dissipation | | I _L | 135 | mA |
| Power dissipation | BA6569AS | P _d | 1100*1 | mW |
| | BA6569AFP | | 1200*2 | |
| Operating temperature | | T _{opr} | -25~+60 | °C |
| Storage temperature | | T _{stg} | -55~+125 | °C |

*1 Reduced by 11 mW for each increase Ta of 1°C over 25°C.

*2 Reduced by 12 mW for each increase Ta of 1°C over 25°C.

When mounting on 90 mm × 50 mm × 1.6 mm glass epoxy boards, fins should be soldered to foil pattern.

● Block diagram



●Electrical characteristics (unless otherwise noted, Ta = 25°C, f = 1kHz, BPF = 400Hz to 30kHz)

| Parameter | | | Symbol | Min. | Typ. | Max. | Unit | I _L (mA) | S ₁ | S ₂ | S ₃ | Conditions | Measurement circuit |
|---------------------------------------|---------|-----------------|-------------------|------|------|------|------|---------------------|----------------|----------------|----------------|-------------------------|---------------------|
| Line voltage (20) | | | V _{L20} | 2.8 | 3.3 | 3.8 | V | 20 | 1 | 2 | 2 | | Fig.16 |
| Line voltage (120) | | | V _{L120} | 4.5 | 7.4 | 9.0 | V | 120 | 1 | 2 | 2 | | Fig.16 |
| Input high level voltage | | | V _{IH} | 1.3 | — | — | V | 40 | 2 | 2 | 2 | | Fig.16 |
| Input low level voltage | | | V _{IL} | — | — | 0.8 | V | 40 | 2 | 2 | 2 | | Fig.16 |
| Input low level current | | | I _{IL} | 20 | 39 | 60 | μA | 40 | 2 | 2 | 2 | | Fig.16 |
| Piezoelectric | Receive | Gain | G _{RP} | 5.5 | 8.5 | 11.5 | dB | 20 | 1 | 1 | 2 | V _T =−20dBV | Fig.17 |
| | | Delta AGC gain | ΔG _{RPA} | — | 2 | — | dB | — | 1 | 1 | 1 | *1 | Fig.17 |
| | | Delta MPAD gain | ΔG _{RPM} | 3.5 | 5.5 | 7.5 | dB | 20 | 1 | 1 | — | *2 | Fig.17 |
| | | Maximum output | V _{OMRP} | 0 | 3 | — | dBV | 20 | 1 | 1 | 2 | THD=5% | Fig.17 |
| | K | Gain | G _{KP} | 17.5 | 20.5 | 23.5 | dB | 20 | 3 | 1 | 2 | V _{KT} =−30dBV | Fig.17 |
| | | Maximum output | V _{OMKP} | 0.5 | 3.5 | — | dBV | 20 | 3 | 1 | 2 | THD=5% | Fig.17 |
| Electromagnetic | Receive | Gain | G _{RD} | −16 | −13 | −10 | dB | 20 | 1 | 2 | 2 | V _T =−20dBV | Fig.17 |
| | | Delta AGC gain | ΔG _{RDA} | — | 2 | — | dB | — | 1 | 2 | 1 | *1 | Fig.17 |
| | | Delta MPAD gain | ΔG _{RDM} | 3.5 | 5.5 | 7.5 | dB | 20 | 1 | 2 | — | *2 | Fig.17 |
| | | Maximum output | V _{OMRD} | −18 | −15 | — | dBV | 20 | 1 | 2 | 2 | THD=5% | Fig.17 |
| | K | Gain | G _{KD} | 3.5 | 6.5 | 9.5 | dB | 20 | 3 | 2 | 2 | V _{KT} =−30dBV | Fig.17 |
| | | Maximum output | V _{OMKD} | −17 | −14 | — | dBV | 20 | 3 | 2 | 2 | THD=5% | Fig.17 |
| MIC | | Gain | G _T | 30 | 33 | 36 | dB | 20 | 1 | 2 | 2 | V _M =−40dBV | Fig.18 |
| | | Delta AGC gain | ΔG _{TA} | — | 1.5 | — | dB | — | 1 | 2 | 1 | *1 | Fig.18 |
| | | Delta MPAD gain | ΔG _{TM} | 3 | 5 | 7 | dB | 20 | 1 | 2 | — | *2 | Fig.18 |
| | | Maximum output | V _{OMT} | −3 | 0 | — | dBV | 20 | 1 | 2 | 2 | THD=5% | Fig.18 |
| MF | | Gain | G _M | 12.8 | 14.8 | 16.8 | dB | 20 | 3 | 2 | 2 | V _D =−20dBV | Fig.18 |
| | | Delta AGC gain | ΔG _{MA} | — | 1.5 | — | dB | — | 3 | 2 | 1 | *1 | Fig.18 |
| | | Delta MPAD gain | ΔG _{MM} | 3 | 5 | 7 | dB | 20 | 3 | 2 | — | *2 | Fig.18 |
| | | Maximum output | V _{OMM} | −3.5 | −0.5 | — | dBV | 20 | 3 | 2 | 2 | THD=5% | Fig.18 |
| Mute output, piezoelectric receiver | | | V _{MRP} | — | −52 | −40 | dBV | 40 | 3 | 1 | 2 | V _T =0dBV | Fig.17 |
| Mute output, electromagnetic receiver | | | V _{MRD} | — | −67 | −57 | dBV | 40 | 3 | 2 | 2 | V _T =0dBV | Fig.17 |
| MIC mute output | | | V _{MT} | — | −51 | −43 | dBV | 40 | 3 | 2 | 2 | V _M =0dBV | Fig.17 |
| R _{IN} input impedance | | | Z _{RIN} | 12 | 18 | 24 | kΩ | 40 | 1 | 2 | 2 | V _T =−20dBV | |
| T _{IN} input impedance | | | Z _{TIN} | 21 | 30 | 39 | kΩ | 40 | 1 | 2 | 2 | V _M =−40dBV | |
| AC impedance | | | Z _{TEL} | 500 | 620 | 740 | Ω | 40 | 1 | 2 | 2 | V _S =−20dBV | Fig.19 |

*1 Change in gain when I_L changes from 20 to 90 mA

*2 Change in gain when S₃ is switched from position 2 to position 3

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●Electrical characteristic curves

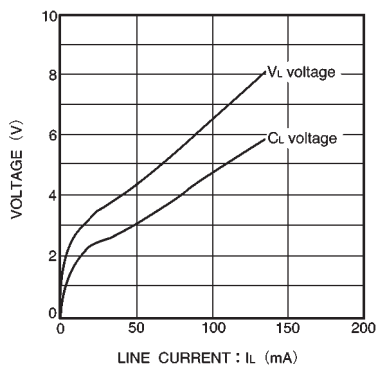


Fig. 1 DC voltage vs. line current

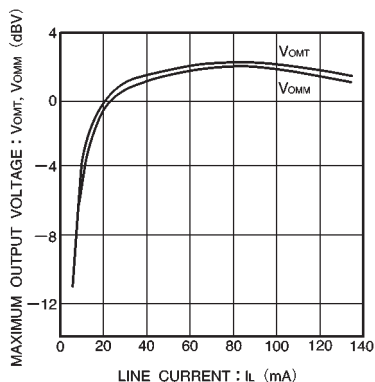


Fig. 2 MIC, MF maximum output voltage vs. line current

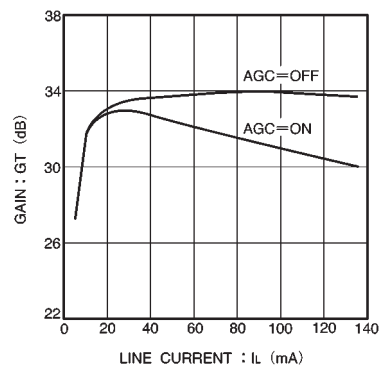


Fig. 3 MIC gain vs. line current

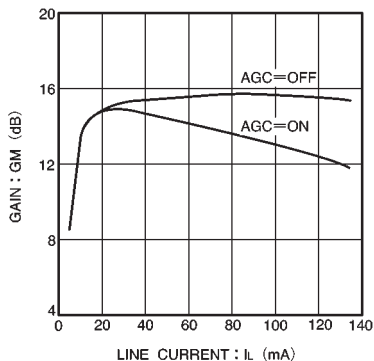


Fig. 4 MF gain vs. line current

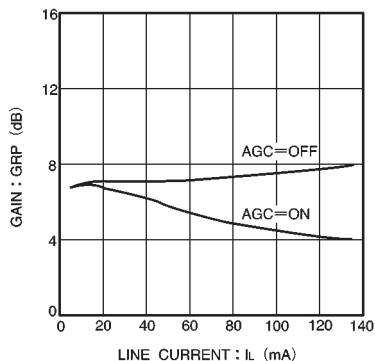


Fig. 5 Piezoelectric reception gain vs. line current

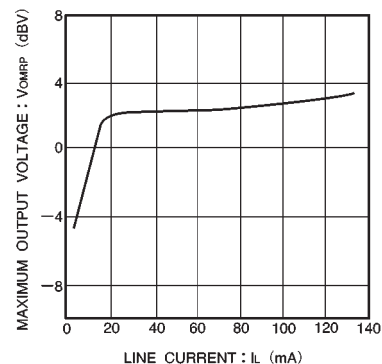


Fig. 6 Piezoelectric reception maximum output voltage vs. line current

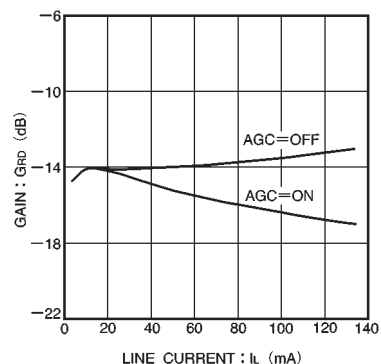


Fig. 7 Electromagnetic reception gain vs. line current

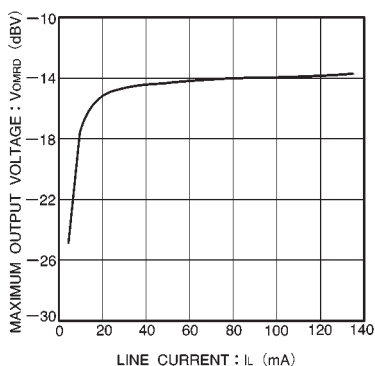


Fig. 8 Electromagnetic reception maximum output voltage vs. line current

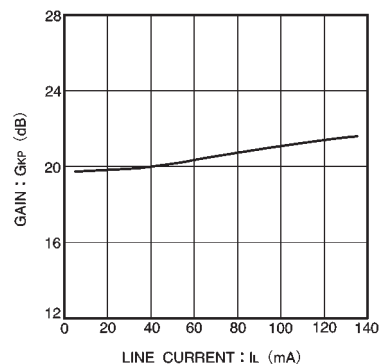


Fig. 9 Piezoelectric KT gain vs. line current

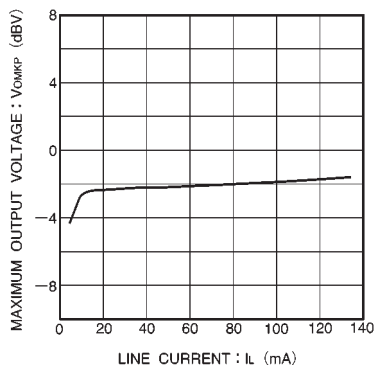


Fig. 10 Piezoelectric KT maximum output voltage vs. line current

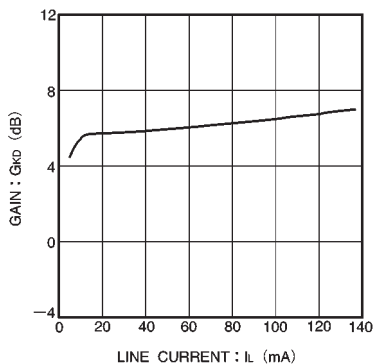


Fig. 11 Electromagnetic KT gain vs. line current

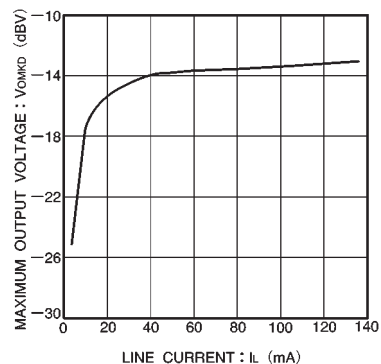


Fig. 12 Electromagnetic KT maximum output voltage vs. line current

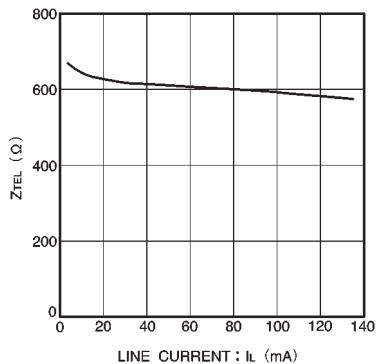


Fig. 13 AC impedance vs. line current

● Measurement circuits

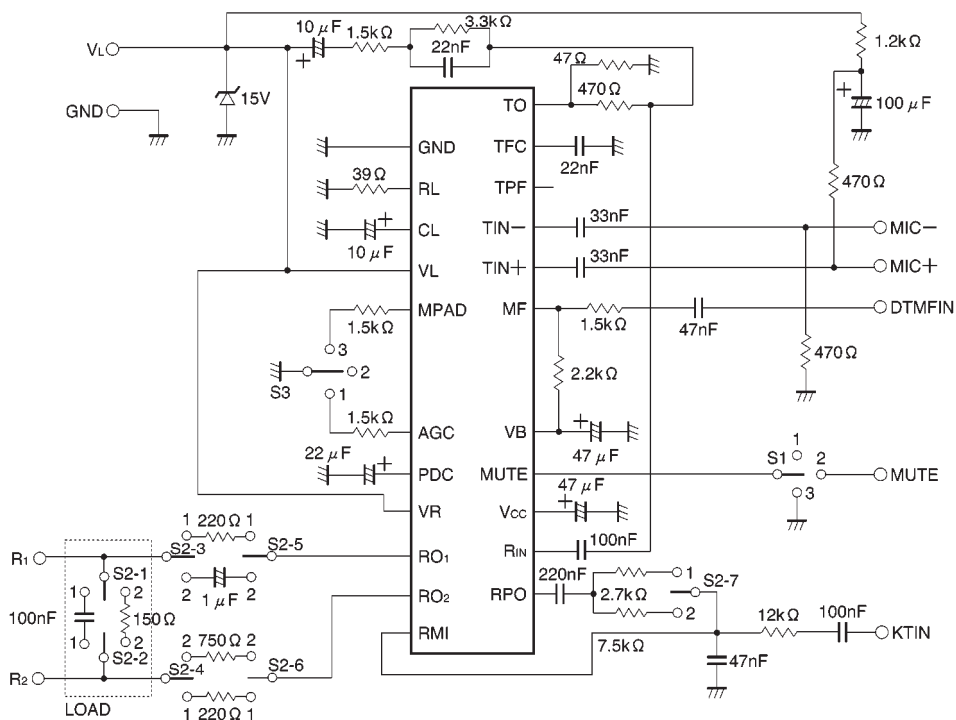


Fig. 14

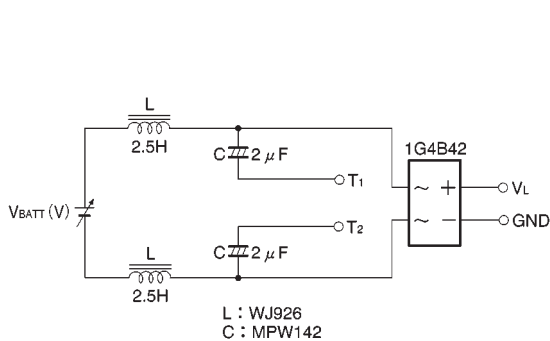


Fig. 15 Trunk circuit

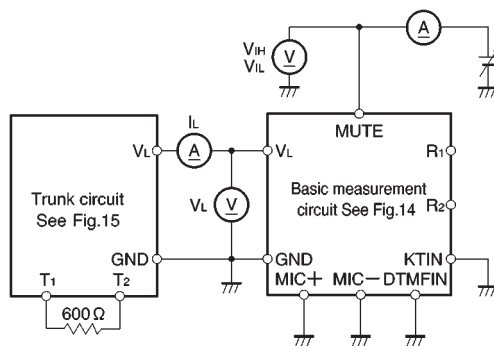


Fig. 16 DC characteristics measurement circuit

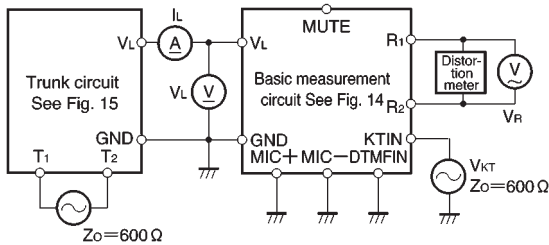


Fig. 17 Reception system measurement circuit

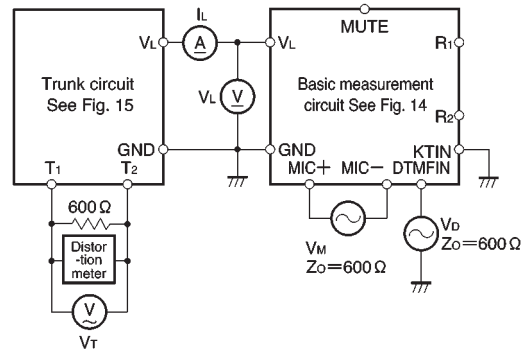


Fig. 18 Transmission system measurement circuit

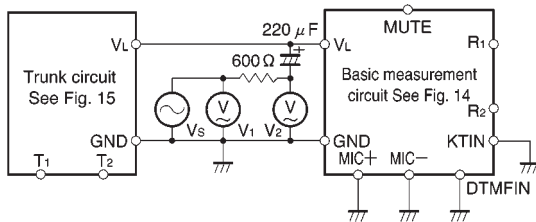


Fig. 19 AC impedance measurement circuit

● Circuit operation

The BA6569AS and BA6569AFP carry out the following basic operations.

(1) Handset talk and receive

Voice signals received from a telephone line are output to a handset speaker. Voice signals from the handset microphone are also output to the telephone line.

(2) DTMF send and key tone input

The BA6569AS and BA6569AFP have a mute switch which can be switched between a "handset send and receive" mode and a "DTMF send and key tone input" mode by an external logic signal. In the "DTMF send and key tone input" mode, it transmits DTMF signals from the dial pad to the telephone line, and key tones to the handset receiver.

(3) AGC

Gain is adjusted steplessly in response to the size of current from the telephone line. When there is a large current (a short distance is involved), the gain is lowered. The gain volume can also be adjusted by changing the value of the resistor connected to the AGC pin.

(4) Manual pad

In order to accommodate situations such as a PBX, where there is little current but a short distance is involved, the gain can be lowered by a constant volume regardless of the current value. Fluctuation in the amount of gain can be adjusted by changing the value connected to the MPAD pin.

● Pin descriptions

| SDIP Pin No. | HSOP Pin No. | Symbol | Name | Function |
|-----------------|-----------------|-----------------|---|---|
| — | 1,13 | NC | NC pin | Separate pin which is not connected inside the IC. |
| 1 | 2 | GND | Ground pin | This pin has the lowest potential on the IC. It is connected to the (—) pin of the diode bridge. |
| 2 | 3 | RL | Power dissipation resistor | A resistor is connected between this pin and the ground. This resistor dissipates undesired power(current) from a large line current. Because most of the current from the telephone line passes through this pin, the resistor must have a sufficient power tolerance. $R_{101} = 39\Omega$, and $1/2W$ should be connected between this pin and GND. |
| 3 | 4 | CL | Impedance setting | A bypass capacitor $C_{101} = 10\mu F$ is connected between this pin and GND. If the DC resistance is raised, R_{195} should be connected between this pin and GND. |
| 4 | 5 | VL | Power supply | This is the power supply pin. The transmit signal is output to the telephone line through this pin. It is connected to the (+) side of the diode bridge. |
| 5 | 6 | MPAD | Manual pad | When open (MPAD = OFF), there is no attenuation of gain. When connected to GND, there is maximum attenuation of gain. To obtain an attenuation of 5 dB, $R_{102} = 1.5k\Omega$ must be connected between this pin and GND. |
| 6 | 7 | AGC | AGC | If open (AGC = OFF), the gain is constant. If connected to GND, there is maximum fluctuation in gain. To obtain a gain fluctuation of 5 dB, $R_{103} = 1.5k\Omega$ must be connected between this pin and GND. |
| 7 | 8 | PDC | Bypass capacitor connecting pin | An AC bypass capacitor for the power dissipation circuit is connected to this pin. $C_{101} = 22\mu F$ must be connected between this pin and GND. |
| 8 | 9 | VR | Receive power amplifier power supply on | This pin supplies power to the receive power amplifier. It is connected to the (+) side of the diode bridge. |
| 9 | 10 | RO ₁ | Receive output pin 1 | When an electromagnetic receiver is used, connect a coupling capacitor $C_{103} = 1\mu F$ to this pin. When a piezoelectric receiver is used, connect a protective resistor $R_{199} = 220\Omega$. |
| 10 | 11 | RO ₂ | Receive output pin 2 | When an electromagnetic receiver is used, connect $R_{104} = 750\Omega$ to this pin, to divide the voltage. When a piezoelectric receiver is used, connect a protective resistor $R_{104} = 220\Omega$. |
| 11 | 12 | RMI | Receive power amplifier input | Signals input at this pin are output to the handset receiver regardless of the state of the MUTE pin. The output of the receive pre-amplifier is mixed with the key tone in a resistor network, and input to this pin. The AGC and MPAD do not affect the gain of the receive power amplifier. |
| 12 | 14 | RPO | Receive pre-amplifier output | The receive signal is amplified by the receive pre-amplifier and is output to this pin through the MUTE and AGC (MPAD) circuits. |
| 13 | 15 | R _{IN} | Receive input | After passing through a side tone suppression circuit, the receive signal from the telephone line is input to this pin. |
| 14 | 16 | V _{CC} | Internal power supply | A $47\mu F$ bypass capacitor C_{106} is connected between this pin and the GND. |
| 15 | 17 | MUTE | Mute input pin | When this is HIGH or open, handset transmission is normal. In this state, the MF pre-amplifier is inhibited. When this is low, DTMF signals applied at the MF input are output to the telephone line. The microphone amplifier and receive pre-amplifier are inhibited, thus muting the microphone and the receive signal from the telephone line. |
| 16 | 18 | VB | Internal bias | A $47\mu F$ bypass capacitor C_{109} is connected between this pin and the GND. |
| 17 | 19 | MF | DTMF signal input | When the MUTE pin is low, DTMF signals input to this pin are output to the telephone line. A bias voltage is supplied through a $2.2k\Omega$ resistor R_{107} connected between this pin and the VB pin. |
| 18 | 20 | TIN+ | Transmit input (non-inverting) | If the microphone input is balanced, make $C_{111} = C_{112}$. For an unbalanced MIC input, this pin should be bypassed to GND with a capacitor. |
| 19 | 21 | TIN— | Transmit input (inverting) | Signals from the microphone are input here. |
| 20 | 22 | TPF | Transmit positive feedback | This is used to boost the telephone impedance. It is normally left unconnected. |
| 21 | 23 | TFC | Transmit frequency response cutoff | Connect C_{113} between this pin and the GND to reduce the high-frequency gain of the transmission system. |
| 22 | 24 | TO | Transmit current output | This is the emitter in the current mirror circuit for line drive. $R_{110} = 47\Omega$ should be connected between this pin and the GND. R_{110} determines the gain of the transmission driver final output stage. R_{109} and R_{110} form two legs of the side tone suppression bridge circuit. |

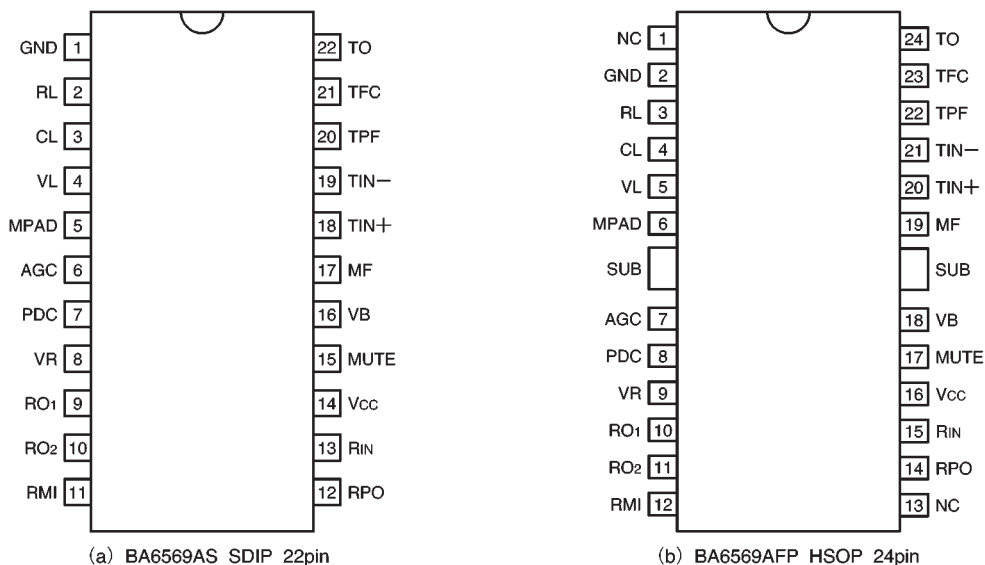


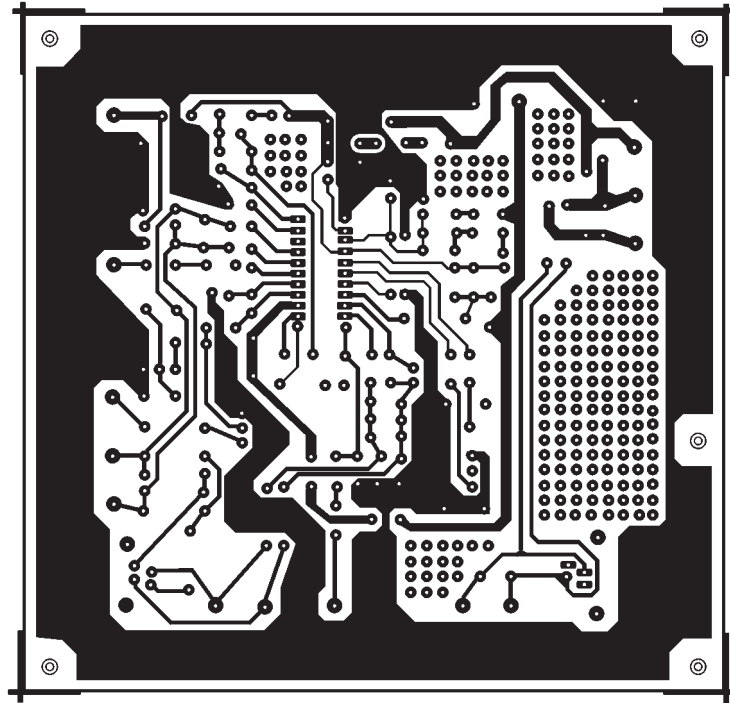
Fig. 20 Pin assignments

● Operation notes

The maximum power dissipation for the BA6569AS is 1100mW, and for the BA6569AFP, the maximum power dissipation is 1200mW (when mounted on 90mm × 50mm × 1.6mm glass epoxy boards, however, fins should be soldered to the foil pattern). Since the maximum power dissipation varies with temperature, the product of the applied voltage VL and the total current drawn by the IC, after factoring in the temperature, should not exceed the maximum dissipation.

ROHTE

●Application board pattern



Soldering surface

Fig. 22

●Application board component layout

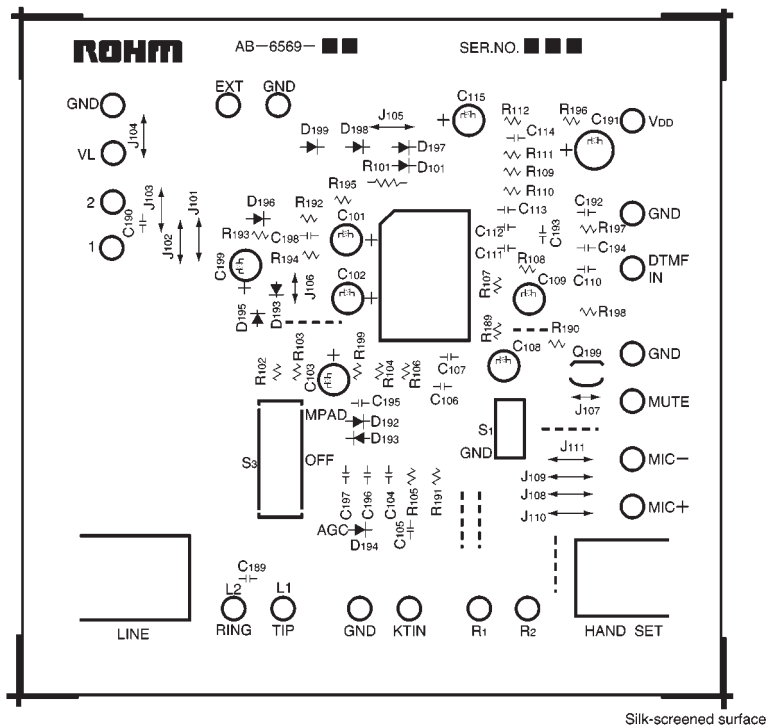


Fig. 23

●External dimensions (Units: mm)

