

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

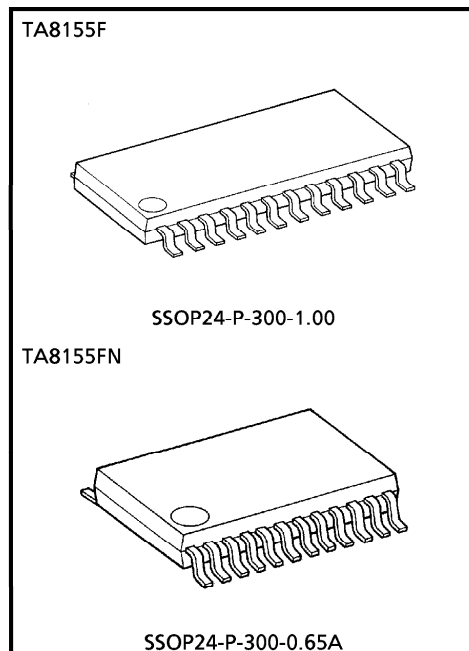
# TA8155F, TA8155FN

## REC / PB SYSTEM DUAL PRE-AMPLIFIER (1.5 / 3V USE)

The TA8155F and TA8155FN are REC / PB system dual pre amplifier ICs, which are developed for low voltage operation (1.5 / 3V use). These are especially suitable for a stereo headphone cassette player.

### FEATURES

- Built-in dual playback amplifiers.  
Input coupling condenser-less.  
Built-in capacitor for buzz noise.
- Built-in dual buffer amplifiers.  
For radio signal input.  
Monitor for REC mode.
- Built-in dual microphone amplifiers.  
Built-in an ALC circuit for MIC-REC mode.  
(Attack time. : 0.1s (Typ.)  
Recovery time. : 3.5s (Typ.)
- Built-in dual recording amplifiers.  
Single-end output type.
- Built-in a power switch.
- Low quiescent current. ( $V_{CC} = 1.2V$ ,  $T_a = 25^\circ C$ )  
PB mode .....  $I_{CCQ2} = 2.6mA$  (Typ.)  
RADIO mode .....  $I_{CCQ3} = 2.4mA$  (Typ.)  
RADIO-REC mode ..  $I_{CCQ4} = 3.0mA$  (Typ.)  
MIC-REC mode ....  $I_{CCQ5} = 4.5mA$  (Typ.)
- Low power dissipation.  
PB mode : 2.9mW (Typ.)  
MIC-REC mode : 8.9mW (Typ.)
- Operating supply voltage range. ( $T_a = 25^\circ C$ )  
 $V_{CC} (opr) = 0.9 \sim 4V$   
 $V_{CC} (opr) (REC) = 1.8 \sim 4V$

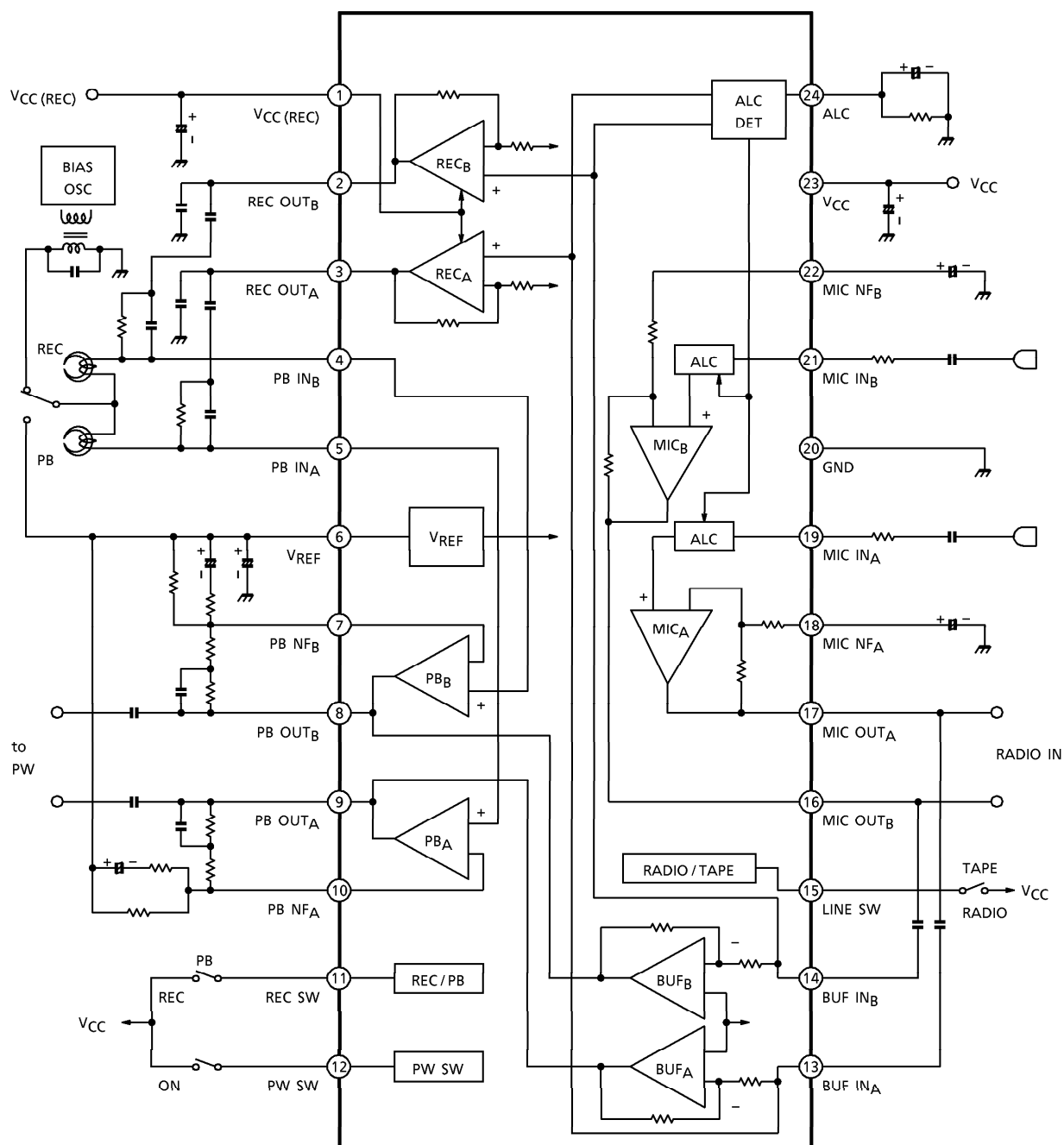


Weight  
 SSOP24-P-300-1.00 : 0.32g (Typ.)  
 SSOP24-P-300-0.65A : 0.14g (Typ.)

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**BLOCK DIAGRAM**



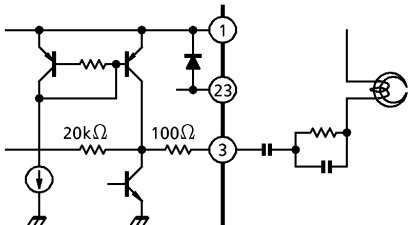
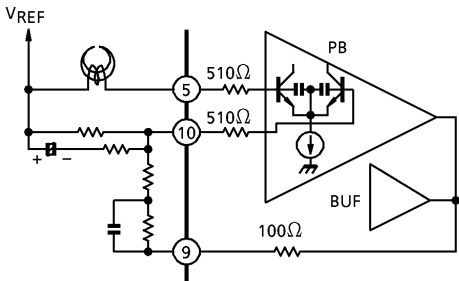
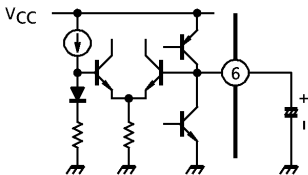
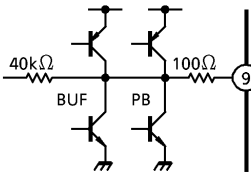
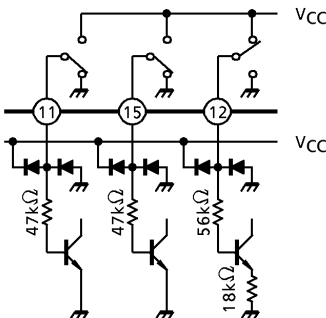
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# TERMINAL EXPLANATION

Terminal voltage : Typical terminal voltage at no signal with test circuit.

( $V_{CC} = 1.2V$ ,  $V_{CC(REC)} = 2.4V$ ,  $T_a = 25^\circ C$ )

| TERMINAL |                       | FUNCTION                                                                              | INTERNAL CIRCUIT                                                                     | TERMINAL VOLTAGE (V) |
|----------|-----------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------|
| No.      | NAME                  |                                                                                       |                                                                                      |                      |
| 1        | V <sub>CC</sub> (REC) | This terminal voltage supplies output stage of recording amplifier with power source. |    | 2.4                  |
| 2        | REC OUT <sub>B</sub>  | Output of recording amplifier.                                                        |                                                                                      | 1.15                 |
| 3        | REC OUT <sub>A</sub>  |                                                                                       |                                                                                      |                      |
| 4        | PB IN <sub>B</sub>    | Input of playback amplifier.                                                          |   | 0.85                 |
| 5        | PB IN <sub>A</sub>    |                                                                                       |                                                                                      | 0.85                 |
| 7        | PB NF <sub>B</sub>    | NF of playback amplifier.                                                             |                                                                                      |                      |
| 10       | PB NF <sub>A</sub>    |                                                                                       |                                                                                      |                      |
| 6        | V <sub>REF</sub>      | Reference voltage.<br>All amplifier operate on this voltage.                          |  | 0.85                 |
| 8        | PB OUT <sub>B</sub>   | Output of playback amplifier and buffer amplifier.                                    |  | 0.55                 |
| 9        | PB OUT <sub>A</sub>   |                                                                                       |                                                                                      |                      |
| 11       | REC SW                | REC / PB switch.<br>( V <sub>CC</sub> : REC mode.<br>GND / OPEN : PB mode.            |  | —                    |
| 12       | PW SW                 | Power switch.<br>( V <sub>CC</sub> : Power on.<br>GND / OPEN : Power off.             |                                                                                      | —                    |
| 15       | LINE SW               | Line switch.<br>( V <sub>CC</sub> : BUF (Radio) mode.<br>GND / OPEN : Tape mode.      |                                                                                      | —                    |

| TERMINAL |                      | FUNCTION                                                                                                                                                                       | INTERNAL CIRCUIT | TERMINAL VOLTAGE (V) |
|----------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------|
| No.      | NAME                 |                                                                                                                                                                                |                  |                      |
| 13       | BUF IN <sub>A</sub>  | Input of buffer amplifier and recording amplifier.<br>(Buffer amplifier is inverter type.)<br>ALC level of microphone amplifier is determined by signal level of this terminal |                  | 0.85                 |
| 14       | BUF IN <sub>B</sub>  |                                                                                                                                                                                |                  |                      |
| 16       | MIC OUT <sub>B</sub> | Output of microphone amplifier.                                                                                                                                                |                  | 0.55                 |
| 17       | MIC OUT <sub>A</sub> |                                                                                                                                                                                |                  |                      |
| 18       | MIC NF <sub>A</sub>  | NF of microphone amplifier.                                                                                                                                                    |                  | 0.05                 |
| 22       | MIC NF <sub>B</sub>  |                                                                                                                                                                                |                  |                      |
| 19       | MIC IN <sub>A</sub>  | Input of microphone amplifier.<br>Built-in capacitor for buzz noise.                                                                                                           |                  | 0.01                 |
| 21       | MIC IN <sub>B</sub>  |                                                                                                                                                                                |                  |                      |
| 20       | GND                  | —                                                                                                                                                                              | —                | 0                    |
| 23       | V <sub>CC</sub>      | —                                                                                                                                                                              | —                | 1.2                  |
| 24       | ALC                  | ALC terminal.<br>ALC function is operated in only MIC-REC mode.                                                                                                                |                  | 0.11                 |

## APPLICATION NOTE

## (1) PW SW

It is necessary to connect an external pull-down resistor with the terminal PW SW (pin<sup>12</sup>), in case that this IC is turned on due to external noise etc.

## (2) MODE SW

IC mode is determined by switch condition of REC SW (pin<sup>11</sup>) and LINE SW (pin<sup>15</sup>) (Table.1).

- H level : Bias current should be applied to switch terminal more than  $5\mu\text{A}$ .  
 L level : Bias voltage should be applied to switch terminal from 0V to 0.3V.

| Table.1 IC mode  |                  |                           |
|------------------|------------------|---------------------------|
| LINE SW \ REC SW | L                | H                         |
| L                | PB mode (PB)     | MIC-REC (BUF, MIC, REC)   |
| H                | RADIO mode (BUF) | RADIO-REC mode (BUF, REC) |

( ) : Operating amplifier.

The leak current flows through the terminal of REC SW (pin<sup>11</sup>) or LINE SW (pin<sup>15</sup>), in case that the terminals connected with  $V_{CC}$  line independently, even though this IC is off-mode (the terminal of PW SW (pin<sup>12</sup>) is off-mode).

And it is necessary to connect an external pull-down resistor with the terminal REC SW (pin<sup>11</sup>) and LINE SW (pin<sup>15</sup>), in case that this IC is turned on due to external noise etc.

## (3) PLAYBACK AMPLIFIER

Output voltage of playback amplifier is determined by an external resistor  $R_1$  and  $R_f$ .

$$V_O(\text{PRE}) = V_{\text{REF}} - \Delta V - R_f \left( \frac{\Delta V}{R_1} - I_B(\text{NF}) \right)$$

$\Delta V$  is an off-set voltage which is designed to 18mV.

In case that  $\beta$  of transistor is assumed 100,  $I_B(\text{NF})$  is flowed  $0.2\mu\text{A}$  in Fig.1. And output voltage of playback amplifier (pin<sup>8</sup>, <sup>9</sup>) in Fig.1 is

$$V_O(\text{PRE}) = 0.85\text{V} - 0.018\text{V} - (330\text{k}\Omega + 13\text{k}\Omega)$$

$$\times \left( \frac{0.018\text{V}}{18\text{k}\Omega} - 0.2\mu\text{A} \right) = 0.56(\text{V})$$

Output voltage of playback amplifier should be fixed  $V_{CC}/2$ , because playback amplifier get a enough dynamic range.

And current source of  $20\mu\text{A}$  is operated except playback mode, in order to reduce a pop sound in switchover between playback on/off mode (Fig.2).

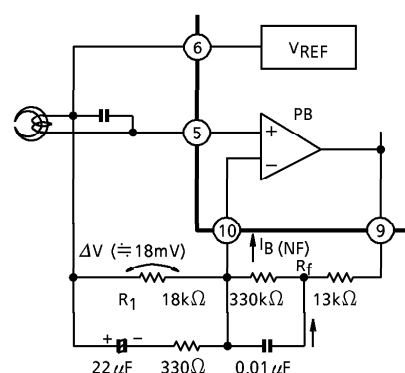


Fig.1 DC output voltage of playback amplifier.

## (4) MICROPHONE AMPLIFIER

Current source of  $5.5\mu\text{A}$  is operated except MIC-REC mode, because bias is applied to the same output voltage as output voltage of microphone amplifier in operation (Fig.3).

(5)  $V_{CC}(\text{REC})$ 

The  $V_{CC}(\text{REC})$  terminal (pin①) is applied bias to  $V_{CC}(\text{REC}) = V_{CC} - 0.7\text{V}$ , because the  $V_{CC}(\text{REC})$  terminal (pin①) is connected with the  $V_{CC}$  terminal (pin③) by diode, as internal circuit of terminal explanation.

And supply current doesn't flow through  $V_{CC}(\text{REC})$  terminal (pin①), in case that the terminal is connected with  $V_{CC}$  line, even though this IC is on-mode and except REC mode.

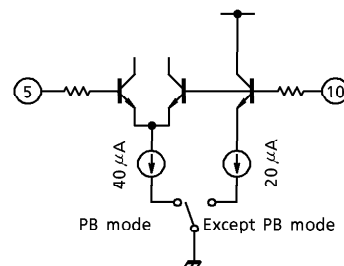


Fig.2 Reducing a pop sound of mode switchover (1).

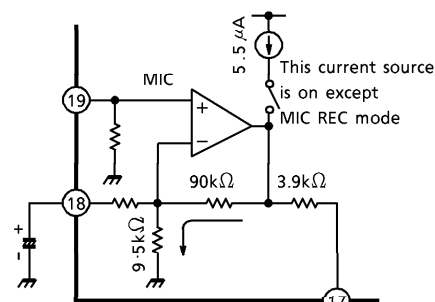


Fig.3 Reducing a pop sound of mode switchover (2).

MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

| CHARACTERISTIC        |          | SYMBOL               | RATING         | UNIT             |
|-----------------------|----------|----------------------|----------------|------------------|
| Supply Voltage        |          | $V_{CC}$             | 4.5            | V                |
|                       |          | $V_{CC}(\text{REC})$ | 4.5            |                  |
| Power Dissipation     | TA8155F  | $P_D$ (Note)         | 400            | mW               |
|                       | TA8155FN |                      | 500            |                  |
| Operating Temperature |          | $T_{opr}$            | $-25 \sim 75$  | $^\circ\text{C}$ |
| Storage Temperature   |          | $T_{stg}$            | $-55 \sim 150$ | $^\circ\text{C}$ |

(Note) Derated above  $T_a = 25^\circ\text{C}$  in the proportion of  $3.2\text{mW}/^\circ\text{C}$  for TA8155F, and of  $4\text{mW}/^\circ\text{C}$  for TA8155FN.

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified :  $V_{CC} = 1.2V$ ,  $V_{CC(REC)} = 2.4V$ ,  $f = 1kHz$ ,  $T_a = 25^\circ C$ ,  $SW_1 : a$ ,  $SW_8 : open$   
 $SW_9 : on$ ,  $SW_{10} : on$ ,  $SW_{11} : on$ ,  $SW_2 \sim SW_7$  condition by next page

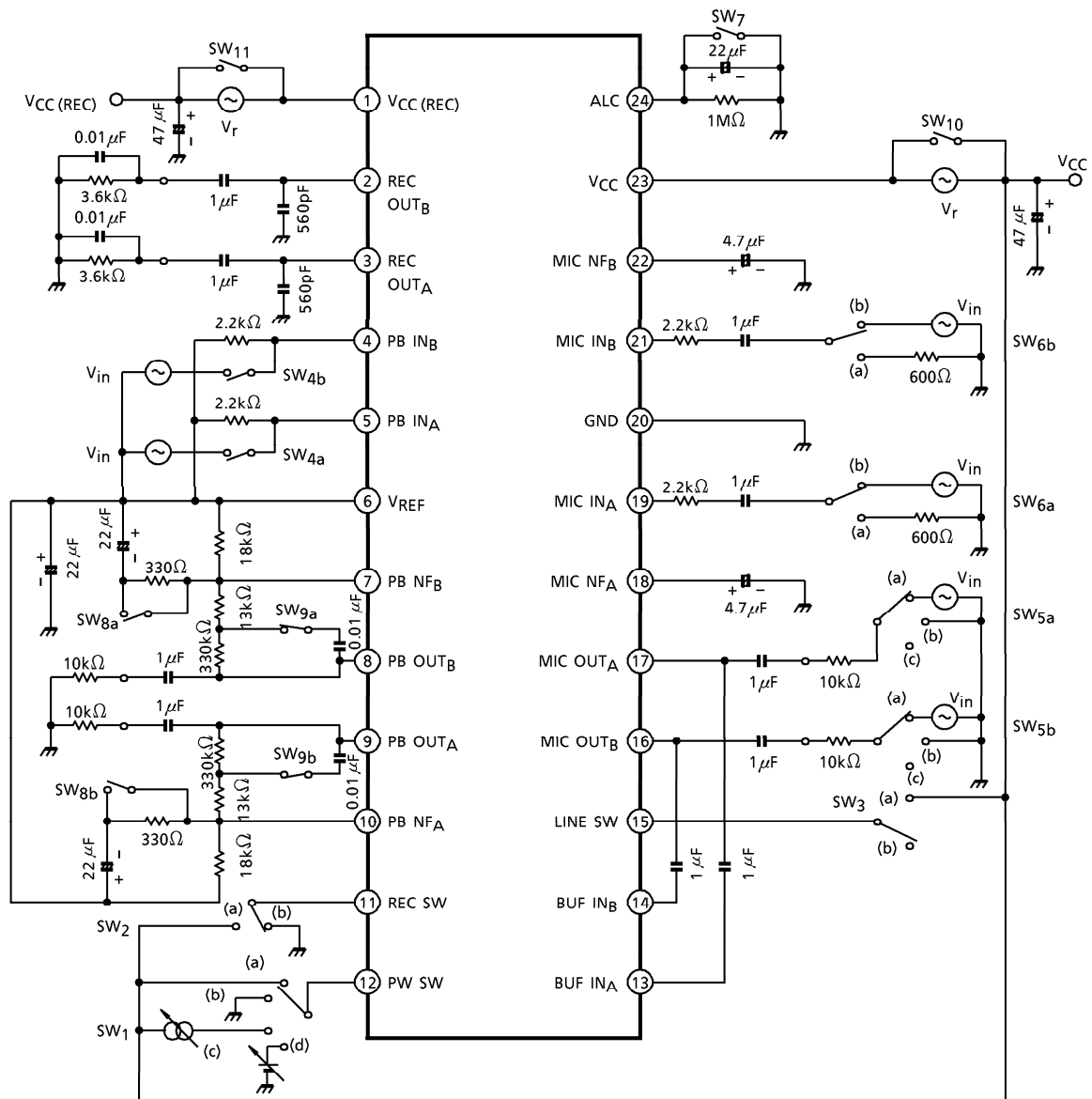
| CHARACTERISTIC      |                                | SYMBOL     | TEST CIR-CUIT | TEST CONDITION                                                         | MIN. | TYP. | MAX. | UNIT              |
|---------------------|--------------------------------|------------|---------------|------------------------------------------------------------------------|------|------|------|-------------------|
| Quiescent Current   | PW OFF                         | $I_{CCQ1}$ | —             | $SW_1 : b, SW_2 : b, SW_3 : b$                                         | —    | 0.1  | 5    | $\mu A$           |
|                     | PB                             | $I_{CCQ2}$ |               | $SW_2 : b, SW_3 : b$                                                   | —    | 2.6  | 3.9  | mA                |
|                     | RADIO                          | $I_{CCQ3}$ |               | $SW_2 : b, SW_3 : a$                                                   | —    | 2.4  | 3.6  |                   |
|                     | RADIO-REC                      | $I_{CCQ4}$ |               | $SW_2 : a, SW_3 : a$                                                   | —    | 3.0  | 4.5  |                   |
|                     | MIC-REC                        | $I_{CCQ5}$ |               | $SW_2 : a, SW_3 : b$                                                   | —    | 4.5  | 6.5  |                   |
|                     | $V_{CC(REC)}$                  | $I_{CCQ6}$ |               | $SW_2 : a, SW_3 : b$                                                   | 1.3  | 1.5  | 2.4  |                   |
| Reference Voltage   |                                | $V_{REF}$  | —             |                                                                        | 0.8  | 0.85 | 0.9  | V                 |
| Playback Amplifier  | Open Loop Voltage Gain         | $G_{VO}$   | —             | $SW_8 : on, SW_9 : open$<br>$V_O = -17dBV$                             | 58   | 70   | —    | dB                |
|                     | Closed Loop Voltage Gain       | $G_{VC}$   | —             | $V_O = -17dBV$                                                         | —    | 36   | —    |                   |
|                     | Maximum Output Voltage         | $V_{om1}$  | —             | THD = 1%                                                               | 200  | 310  | —    | mV <sub>rms</sub> |
|                     | Total Harmonic Distortion      | THD1       | —             | $V_O = -17dBV$                                                         | —    | 0.1  | 0.3  | %                 |
|                     | Equivalent Input Noise Voltage | $V_{ni}$   | —             | $SW_4 : open$<br>BPF = 30Hz~20kHz<br>NAB ( $G_V = 36dB$ , $f = 1kHz$ ) | —    | 1.2  | 3.0  | $\mu V_{rms}$     |
|                     | Cross Talk (CH-A / CH-B)       | CT1        | —             | $V_O = -17dBV$                                                         | —    | 62   | —    | dB                |
|                     | Ripple Rejection Ratio         | RR1        | —             | $SW_4 : open, SW_{10} : open$<br>$f_r = 100Hz, V_r = -32dBV$           | —    | 40   | —    |                   |
| Buffer Amplifier    | Voltage Gain                   | $G_{V2}$   | —             | $V_O = -17dBV$                                                         | -4   | -2   | 0    | dB                |
|                     | Maximum Output Voltage         | $V_{om2}$  | —             | THD = 1%                                                               | 200  | 270  | —    | mV <sub>rms</sub> |
|                     | Total Harmonic Distortion      | THD2       | —             | $V_O = -17dBV$                                                         | —    | 0.1  | —    | %                 |
|                     | Output Noise Voltage           | $V_{no2}$  | —             | $SW_5 : b$ , BPF = 30Hz~20kHz                                          | —    | 35   | —    | $\mu V_{rms}$     |
|                     | Cross Talk (CH-A / CH-B)       | CT2        | —             | $V_O = -17dBV$                                                         | —    | 51   | —    | dB                |
|                     | Ripple Rejection Ratio         | RR2        | —             | $SW_5 : b, SW_{10} : open$<br>$f_r = 100Hz, V_r = -32dBV$              | —    | 55   | —    |                   |
| Recording Amplifier | Voltage Gain                   | $G_{V3}$   | —             | $V_O = -12dBV$                                                         | 16.5 | 18.5 | 20.5 | dB                |
|                     | Maximum Output Voltage         | $V_{om3}$  | —             | THD = 1%                                                               | 500  | 720  | —    | mV <sub>rms</sub> |
|                     | Total Harmonic Distortion      | THD3       | —             | $V_O = -12dBV$                                                         | —    | 0.1  | 0.5  | %                 |
|                     | Output Noise Voltage           | $V_{no3}$  | —             | $SW_5 : b$ , BPF = 30Hz~20kHz                                          | —    | 0.09 | 0.25 | mV <sub>rms</sub> |
|                     | Cross Talk (CH-A / CH-B)       | CT3        | —             | $V_O = -12dBV$                                                         | —    | 49   | —    | dB                |
|                     | Ripple Rejection Ratio         | RR3        | —             | $SW_5 : b, SW_{10} : open$<br>$f_r = 100Hz, V_r = -32dBV$              | —    | 40   | —    |                   |

| CHARACTERISTIC                             |                               | SYMBOL      | TEST CIRCUIT | TEST CONDITION                                                                                     | MIN.  | TYP. | MAX. | UNIT                     |
|--------------------------------------------|-------------------------------|-------------|--------------|----------------------------------------------------------------------------------------------------|-------|------|------|--------------------------|
| Microphone Amplifier                       | Voltage Gain                  | $G_{V4}$    | —            | $V_O = -17\text{dBV}$                                                                              | 30    | 32.5 | 35   | dB                       |
|                                            | Maximum Output Voltage        | $V_{om4}$   | —            | THD = 1%                                                                                           | 120   | 200  | —    | $\text{mV}_{\text{rms}}$ |
|                                            | Total Harmonic Distortion     | THD4        | —            | $V_O = -17\text{dBV}$                                                                              | —     | 0.25 | 0.8  | %                        |
|                                            | Output Noise Voltage          | $V_{no4}$   | —            | $SW_6 : a$ , BPF = 30Hz~20kHz                                                                      | —     | 0.12 | —    | $\text{mV}_{\text{rms}}$ |
|                                            | Cross Talk (CH-A / CH-B)      | CT4         | —            | $V_O = -17\text{dBV}$                                                                              | —     | 52   | —    | dB                       |
|                                            | Ripple Rejection Ratio        | RR4         | —            | $SW_6 : a$ , $SW_{10} : \text{open}$<br>$f_r = 100\text{Hz}$ , $V_r = -32\text{dBV}$               | —     | 36   | —    |                          |
| Microphone Amplifier + Recording Amplifier | Voltage Gain                  | $G_{V5}$    | —            | $SW_7 : \text{on}$ , $V_O = -17\text{dBV}$                                                         | —     | 58   | —    | dB                       |
|                                            | Maximum Output Voltage        | $V_{om5}$   | —            | THD = 3%                                                                                           | 600   | 800  | —    | $\text{mV}_{\text{rms}}$ |
|                                            | ALC Total Harmonic Distortion | THD5        | —            | $V_{in} = -32\text{dBV}$                                                                           | —     | 0.8  | —    | %                        |
|                                            | Output Noise Voltage          | $V_{no5}$   | —            | $SW_6 : a$ , BPF = 30Hz~20kHz                                                                      | —     | 2.1  | 3.5  | $\text{mV}_{\text{rms}}$ |
|                                            | ALC Voltage                   | $V_{oALC1}$ | —            | $V_{in} = -62\text{dBV}$                                                                           | -11.7 | -8.5 | -6.7 | dBV                      |
|                                            |                               | $V_{oALC2}$ | —            | $V_{in} = -32\text{dBV}$                                                                           | -11.7 | -8.5 | -6.7 |                          |
|                                            | ALC Channel Balance           | $CB_{ALC}$  | —            |                                                                                                    | —     | 0    | 1.5  | dB                       |
|                                            | ALC Width                     | $W_{ALC}$   | —            | $V_{oALC} \leq 3\text{dB}$ (Input Voltage)<br>with respect to standard<br>$V_{in} = -42\text{dBV}$ | —     | 48   | —    |                          |
|                                            | Cross Talk (CH-A / CH-B)      | CT5         | —            | $V_{in} = -32\text{dBV}$                                                                           | —     | 37   | —    | dB                       |
|                                            | Ripple Rejection Ratio        | RR5         | —            | $SW_6 : a$<br>$f_r = 100\text{Hz}$ , $V_r = -17\text{dBV}$                                         | —     | 39   | —    |                          |
| Power Switch                               | Power On Current              | $I_{12}$    | —            | $SW_1 : c$ , $SW_2 : b$ , $SW_3 : b$<br>$V_6 \geq 0.6\text{V}$                                     | 5     | —    | —    | $\mu\text{A}$            |
|                                            | Power Off Voltage             | $V_{12}$    | —            | $SW_1 : d$ , $SW_2 : b$ , $SW_3 : b$<br>$V_6 \leq 0.2\text{V}$                                     | 0     | —    | 0.3  | V                        |

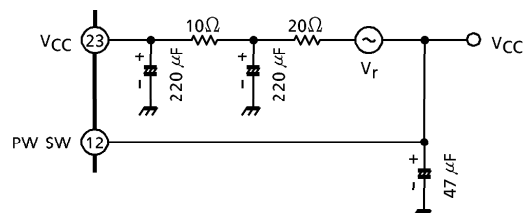
**SWITCH CONDITION FOR TEST MODE** (Unless otherwise specified.)

| MODE                             | PB AMP.<br>(PB MODE) | BUF AMP.<br>(RADIO MODE) | REC AMP.<br>(RADIO-REC MODE) | MIC AMP.<br>(MIC MODE) | MIC AMP. + REC AMP.<br>(MIC-REC MODE) |
|----------------------------------|----------------------|--------------------------|------------------------------|------------------------|---------------------------------------|
| OPERATING<br>AMPLIFIER<br>SWITCH | PB                   | BUF                      | BUF<br>REC                   | MIC-ALC<br>BUF, REC    |                                       |
| $SW_2$                           | b                    | b                        | a                            | a                      |                                       |
| $SW_3$                           | b                    | a                        | a                            | b                      |                                       |
| $SW_4$                           | on                   | open                     | open                         | open                   |                                       |
| $SW_5$                           | b                    | a                        | a                            | b                      | c                                     |
| $SW_6$                           | a                    | a                        | a                            | b                      |                                       |
| $SW_7$                           | open                 | open                     | open                         | on                     | open                                  |

## TEST CIRCUIT



(\*) RR5 is measured by circuit below (for  $V_{CC}$  line)

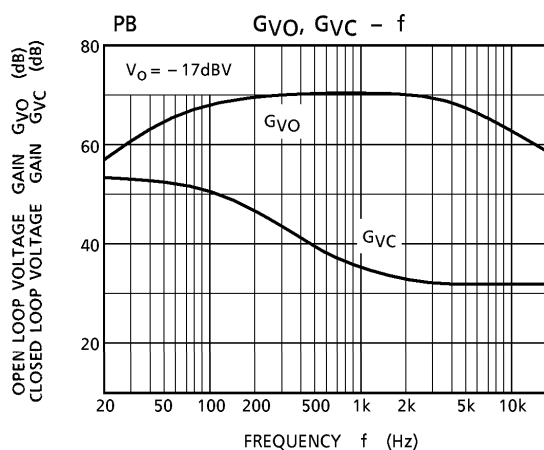
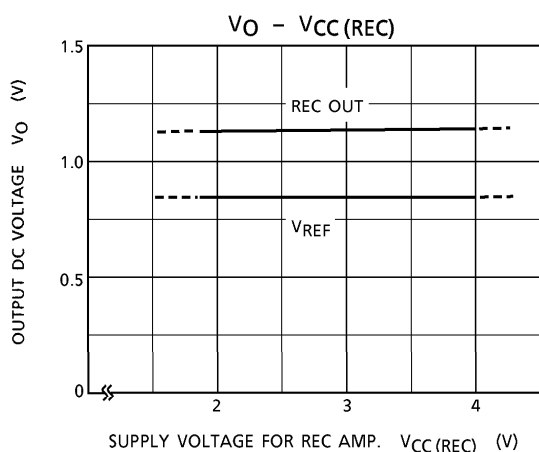
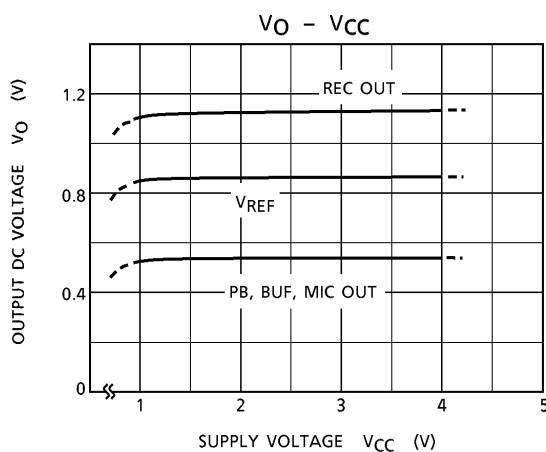
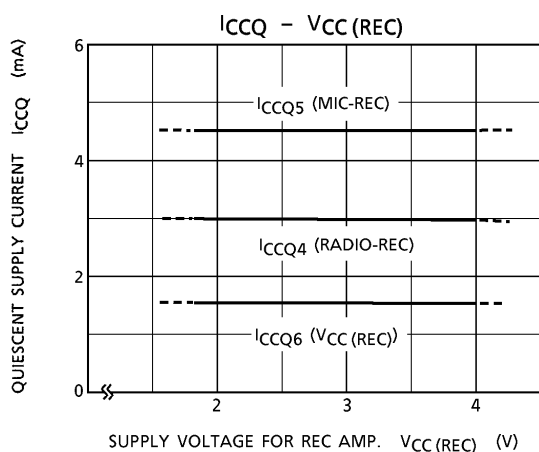
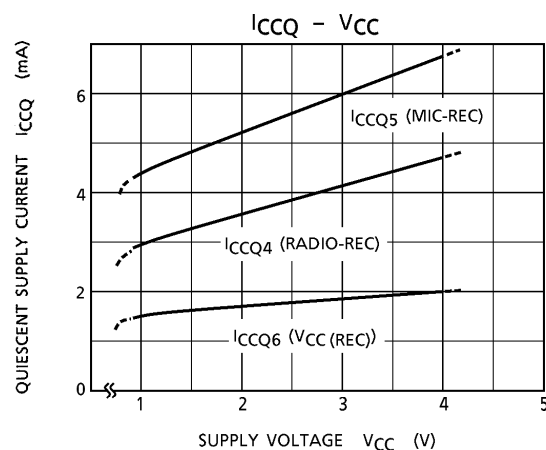
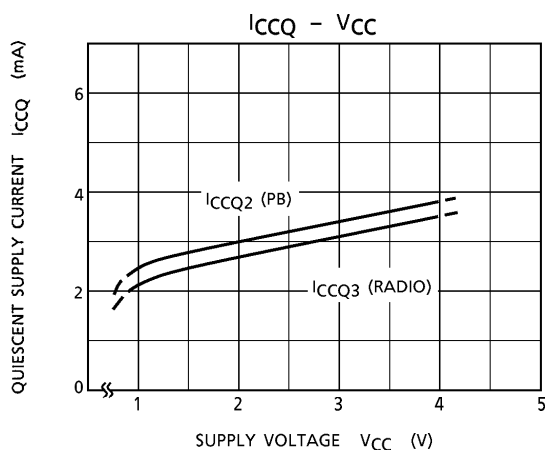


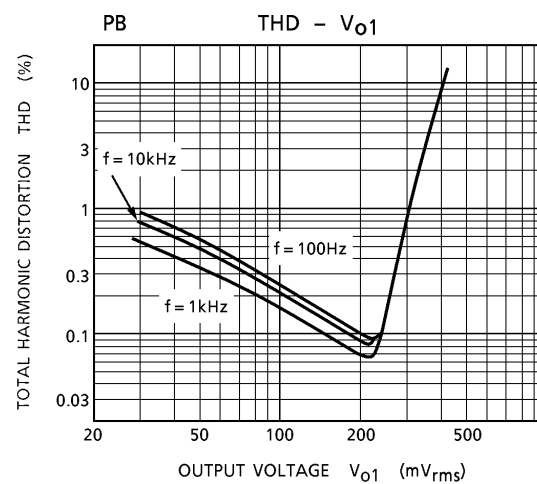
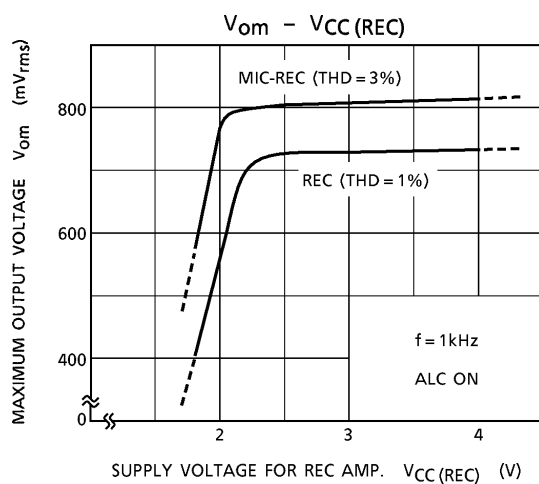
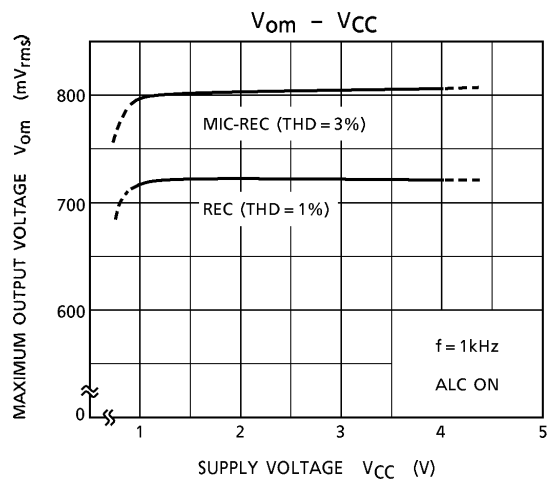
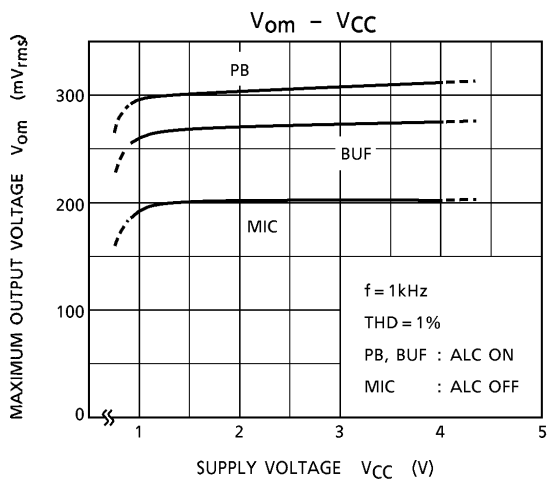
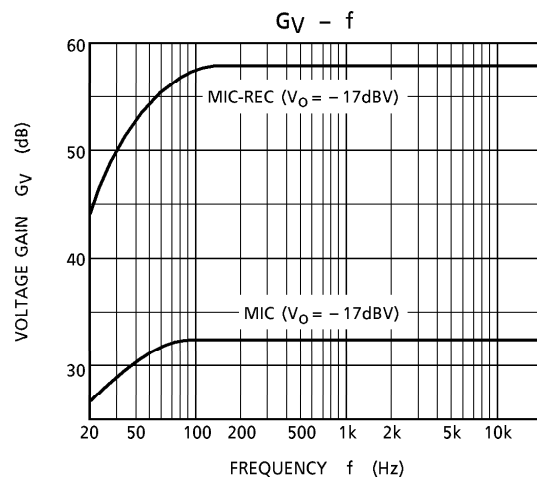
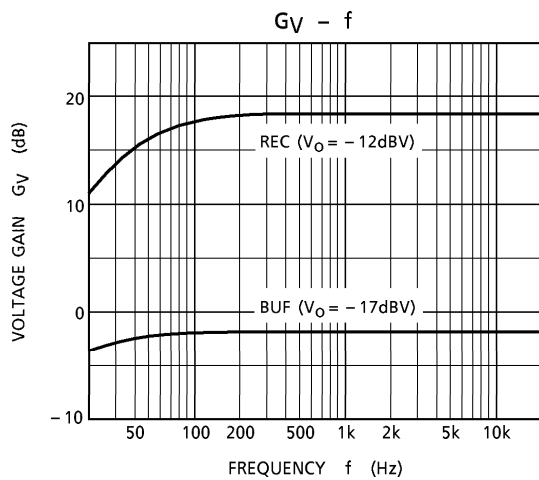
## CHARACTERISTIC CURVES

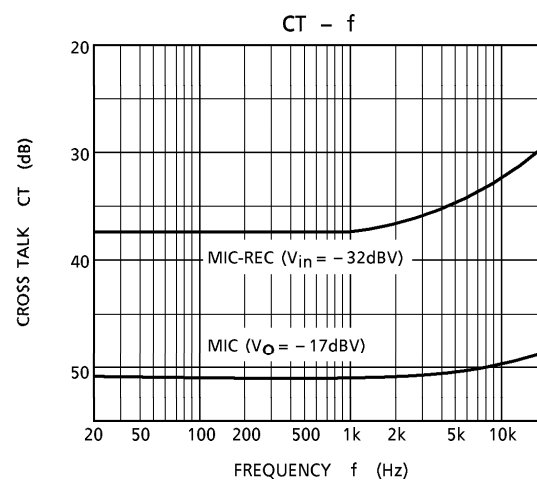
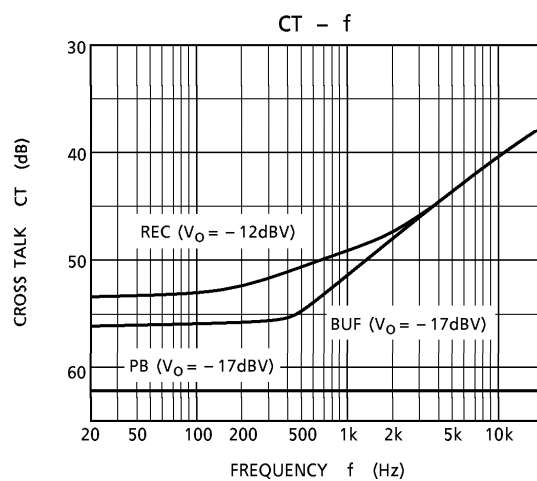
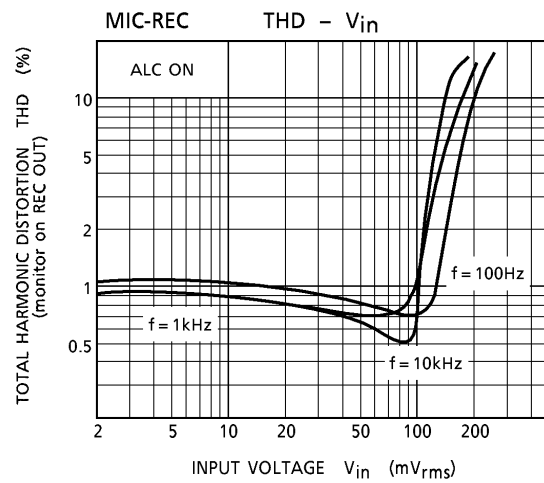
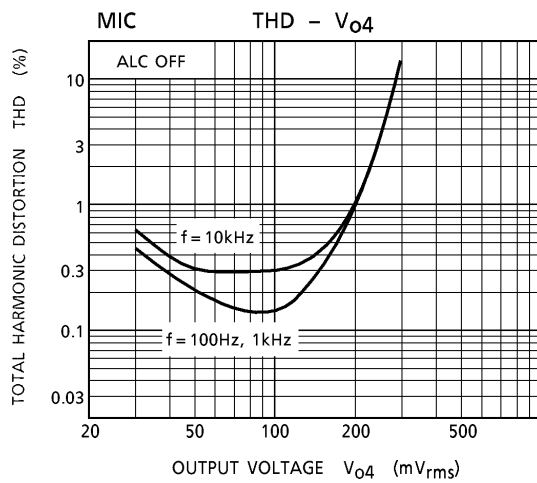
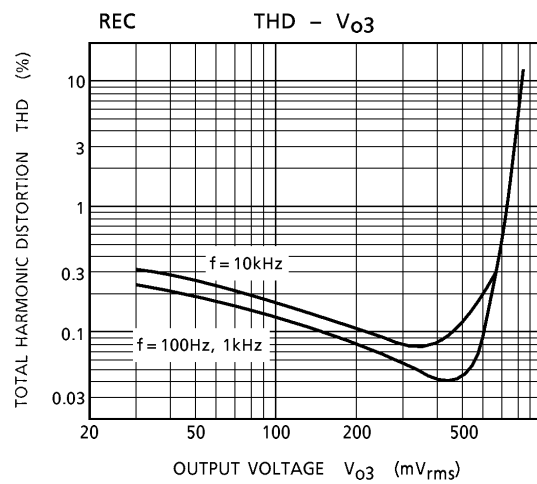
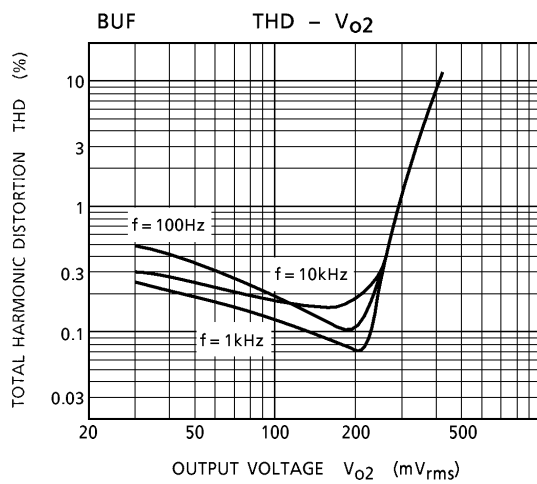
Unless otherwise specified  $V_{CC} = 1.2V$ ,  $V_{CC(REC)} = 2.4V$ ,  $f = 1kHz$ ,  $T_a = 25^\circ C$

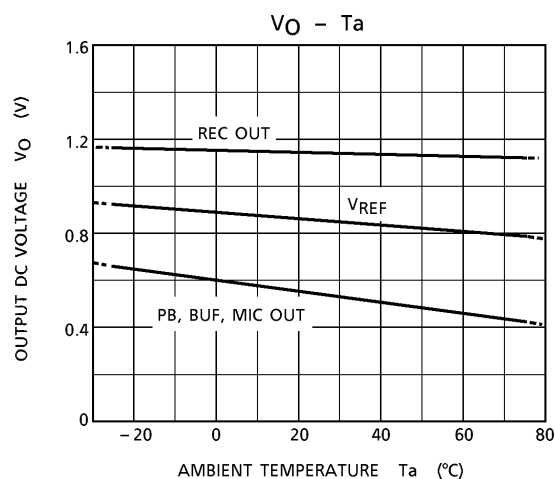
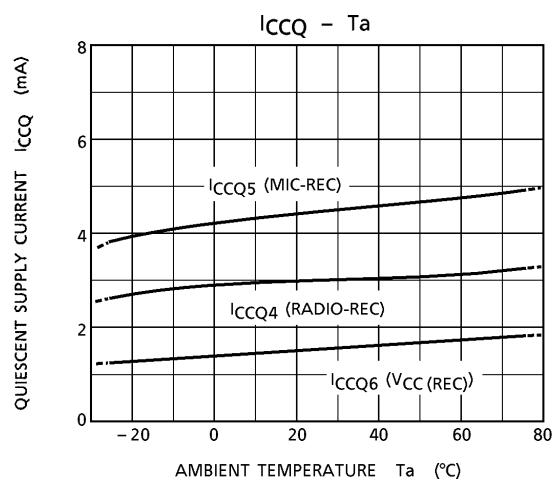
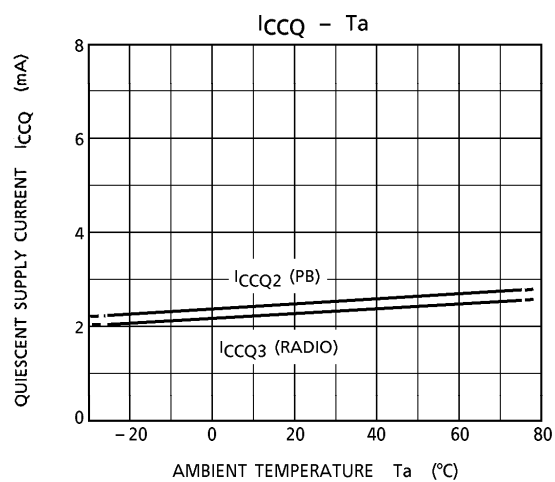
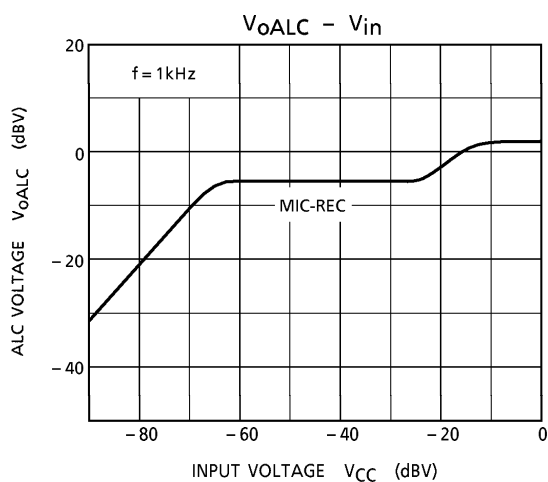
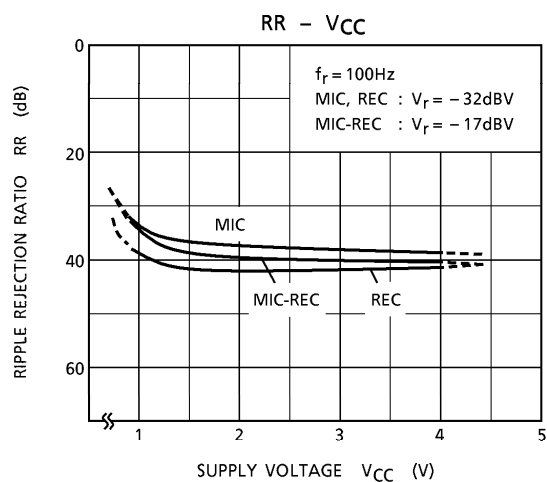
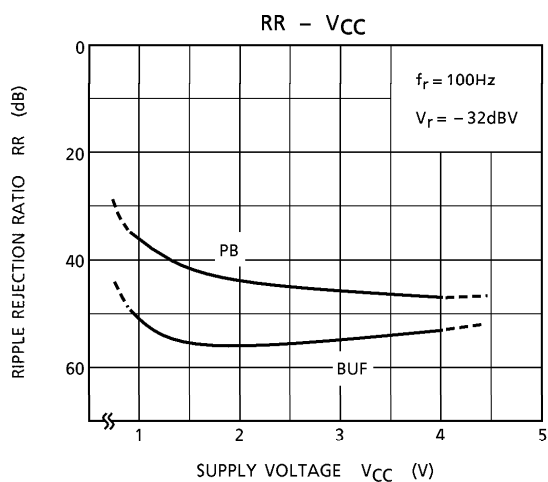
$R_L = 10k\Omega$  : PB AMP., BUF AMP., MIC AMP.

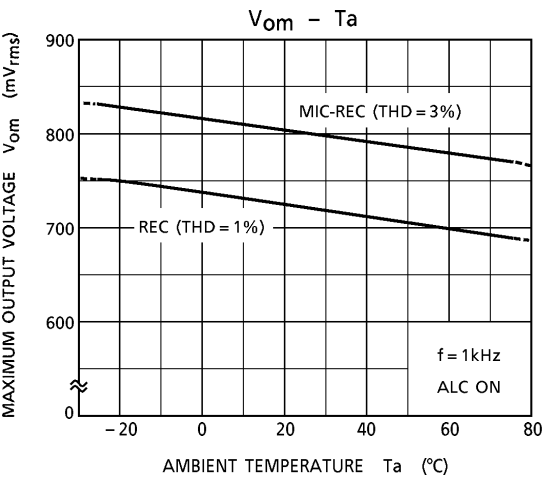
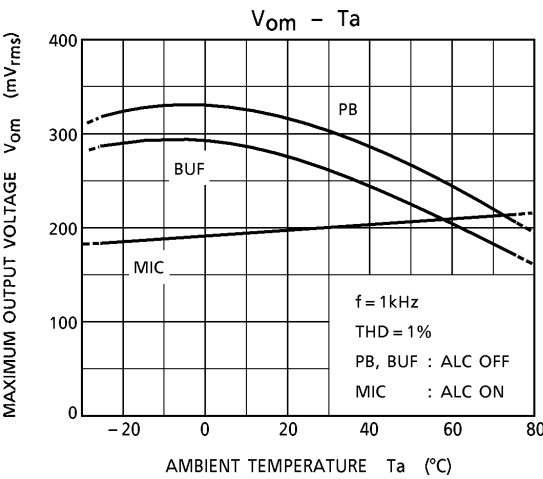
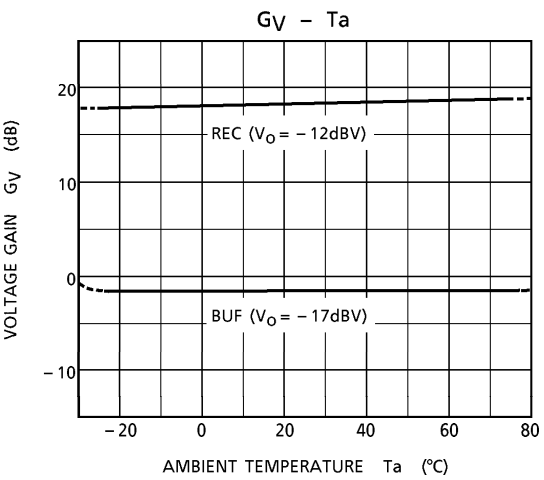
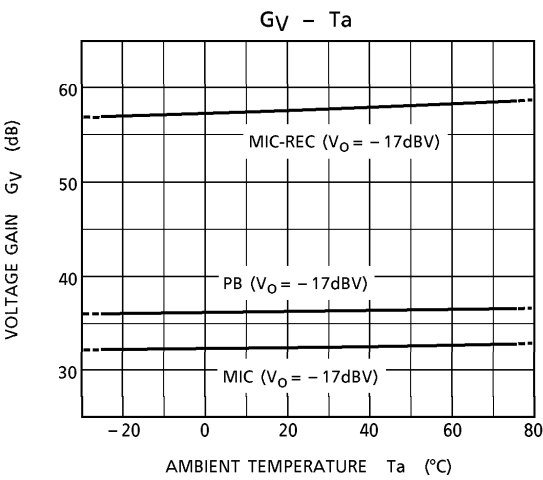
(Load of recoding amplifier is shown in test circuit)





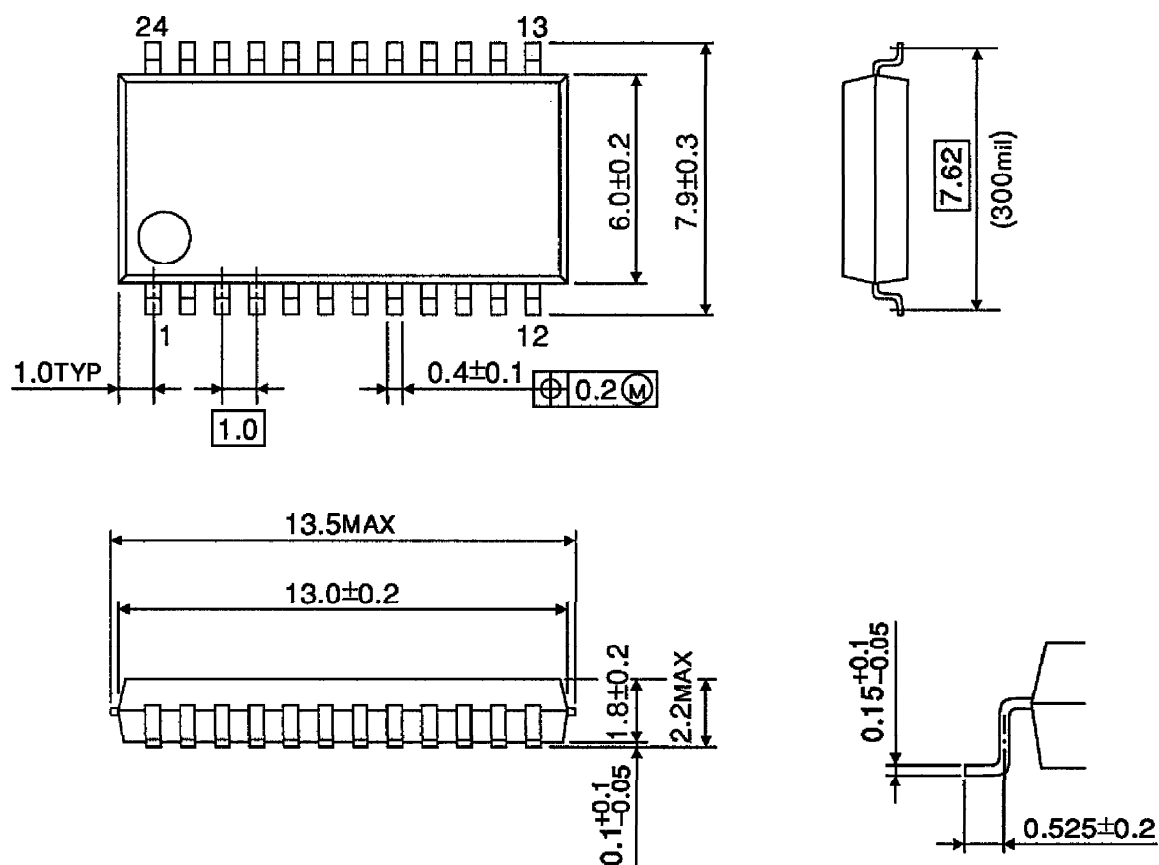






**OUTLINE DRAWING**  
SSOP24-P-300-1.00

Unit : mm

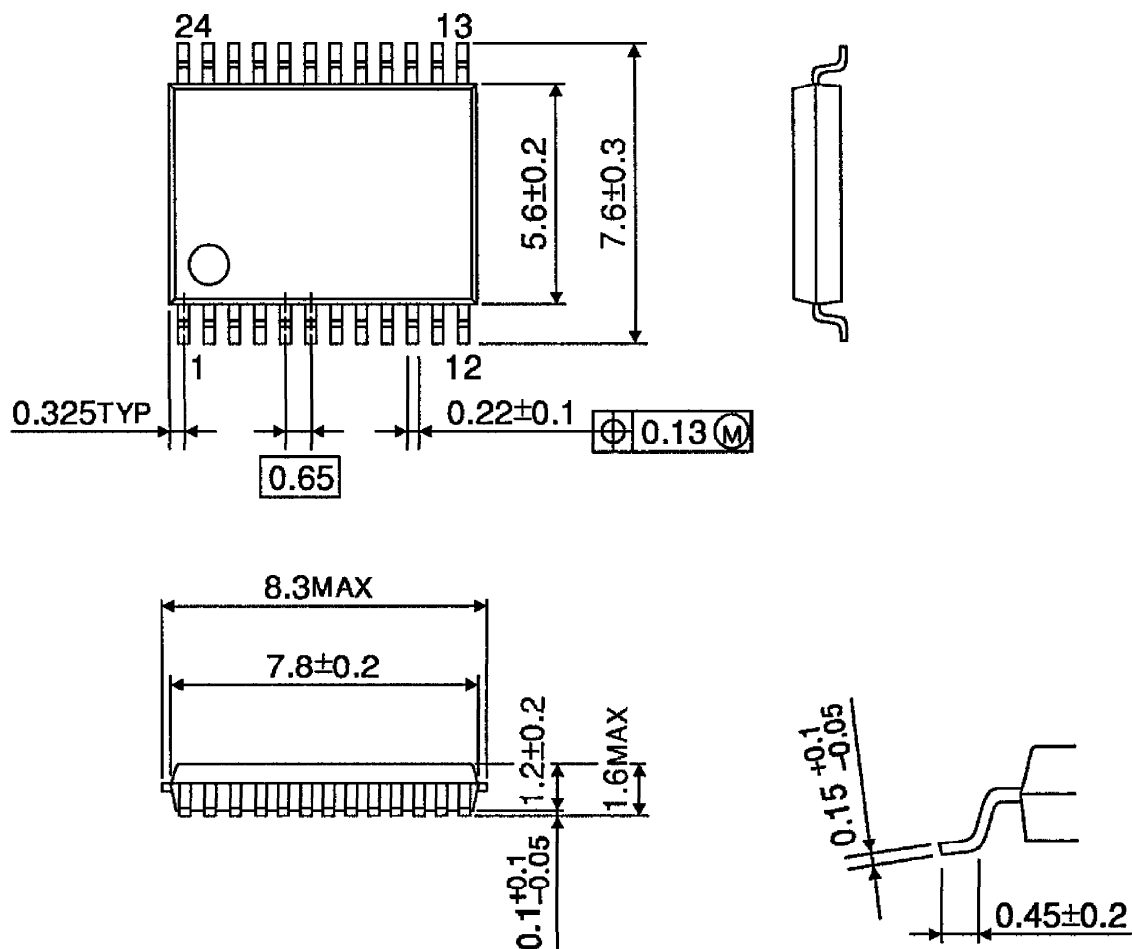


Weight : 0.32g (Typ.)

**OUTLINE DRAWING**

SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14g (Typ.)