

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

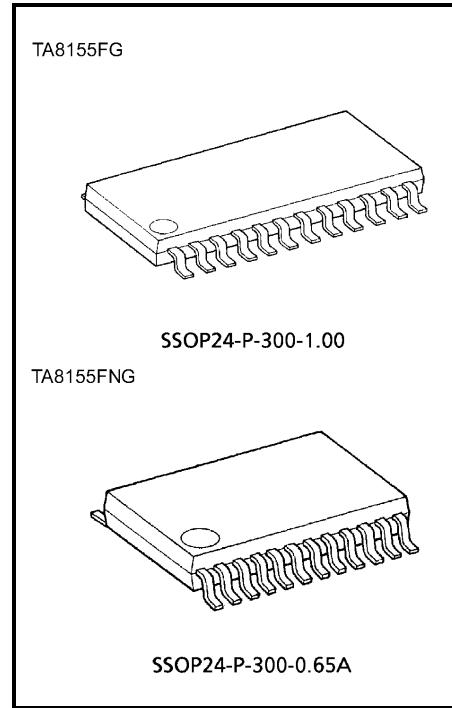
# TA8155FG,TA8155FNG

REC / PB System Dual Pre-amplifier (1.5 / 3V USE)

The TA8155FG and TA8155FNG 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.

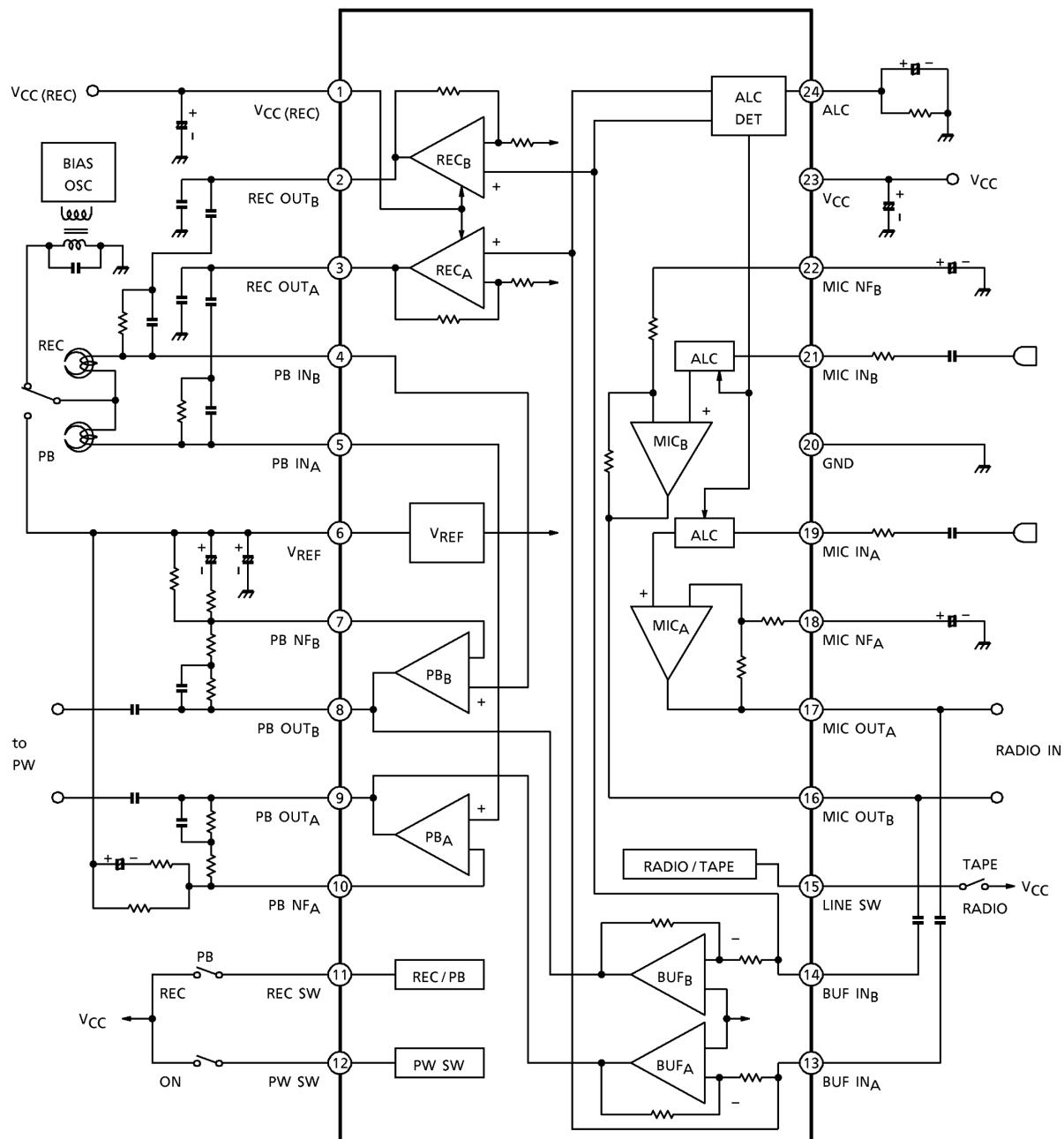
## Features

- Built-in dual playback amplifiers.  
Input coupling condenser-less.  
Built-in capacitor for buzz noise.
- Built-in dual buffer amplifiers.  
For radio signal inut.  
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. (VCC = 1.2V, Ta = 25°C)  
PB mode ..... ICCQ2 = 2.6mA (typ.)  
Radio mode ..... ICCQ3 = 2.4mA (typ.)  
Radio-REC mode ... ICCQ4 = 3.0mA (typ.)  
MIC-REC mode ..... ICCQ5 = 4.5mA (typ.)
- Low power dissipation.  
PB mode : 2.9mW (typ.)  
MIC-REC mode : 8.9mW (typ.)
- Operating supply voltage range. (Ta = 25°C)  
VCC (opr) = 0.9~4V  
VCC (opr) (REC) = 1.8~4V



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

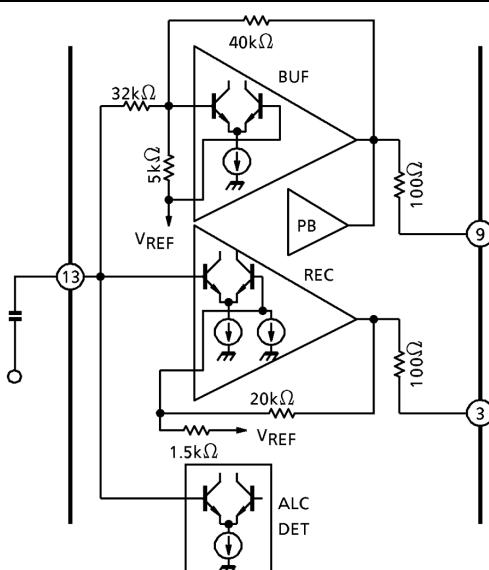
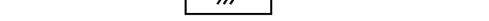
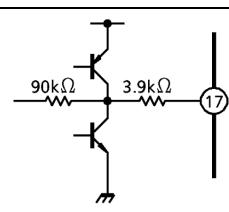
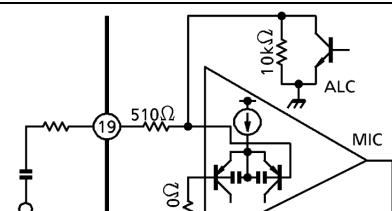
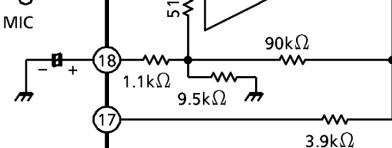
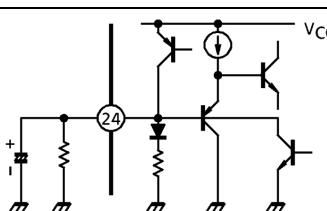
## Block Diagram



**Terminal Explanation**

Terminal Voltage : Typical Terminal Voltage at no Signal with Test Circuit.  
 (V<sub>CC</sub> = 1.2V, V<sub>CC</sub> (REC) = 2.4V, Ta = 25°C)

Terminal	Function	Internal Circuit	Terminal Voltage (V)	
No.	Name			
1	VCC(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>			
7	PB NFB	NF of playback amplifier.		0.85
10	PB NFA			
6	VREF	Reference voltage. 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. V <sub>CC</sub> : REC mode. GND / OPEN: PB mode.		—
12	PW SW	Power switch. V <sub>CC</sub> : Power on. GND / OPEN: Power off.		—
15	Line SW	Line switch. V <sub>CC</sub> : BUF (radio) mode. GND / OPEN: Tape mode.		—

Terminal No.	Terminal Name	Function	Internal Circuit	Terminal Voltage (V)
13	BUF IN <sub>A</sub>	Input of buffer amplifier and recording amplifier. (Buffer amplifier is inverter type.)		0.85
14	BUF IN <sub>B</sub>	ALC level of microphone amplifier is determined by signal level of this terminal		
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. 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. 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(12)), 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(11)) and LINE SW (pin(15))

(Table.1)

H level: Bias current should be applied to switch terminal more than 5μA.

L level: Bias voltage should be applied to switch terminal from 0V to 0.3V.

Table.1 IC mode

REC SW LINE 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(11)) or LINE SW (pin(15)), in case that the terminals connected with VCC line independently, even though this IC is off-mode (the terminal of PW SW (pin(12)) is off-mode).

And it is necessary to connect an external pull-down resistor with the terminal REC SW (pin(11)) and LINE SW (pin(15)), 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<sub>1</sub> and R<sub>f</sub>.

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

ΔV is an off-set voltage which is designed to 18mV.

In case that β of transistor is assumed 100, I<sub>B(NF)</sub> is flowed 0.2μA in Fig.1. And output voltage of playback amplifier (pin (8),(9)) in Fig.1 is

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

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

Output voltage of playback amplifier should be fixed VCC / 2, because playback amplifier get a enough dynamic range. And current source of 20μA is operated except playback mode, in order to reduce a pop sound in swichover between playback on / off mode (Fig.2).

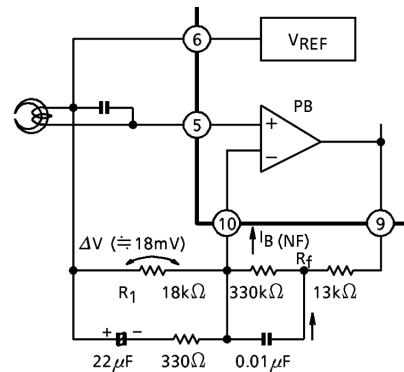


Fig.1 DC output voltage of playback amplifier.

## (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) VCC (REC)

The VCC (REC) terminal (pin(1)) is applied bias to  $\text{VCC}(\text{REC}) = \text{VCC} - 0.7\text{V}$ , because the VCC (REC) terminal (pin(1)) is connected with the VCC terminal (pin(23)) by diode, as internal circuit of terminal explanation.

And supply current doesn't flow through VCC (REC) terminal (pin(1)), in case that the terminal is connectd with VCC line, even though this IC is on-mode and except REC mode.

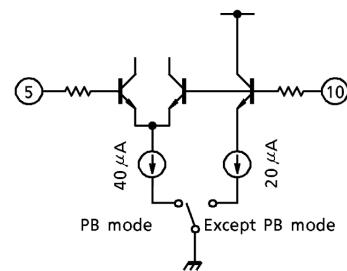


Fig.2 Reducing a pop sound of mode switchover (1).

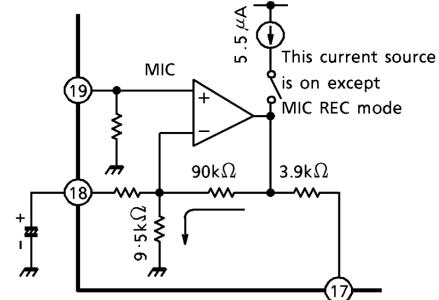


Fig.3 Reducing a pop sound of mode switchover (2).

### Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	V <sub>CC</sub>	4.5	V
	V <sub>CC</sub> (REC)	V <sub>CC</sub> (REC)	4.5	
Power dissipation	TA8155FG	P <sub>D</sub> (Note)	400	mW
	TA8155FNG		500	
Operating Temperature		T <sub>opr</sub>	-25~75	°C
Storage temperature		T <sub>stg</sub>	-55~150	°C

(Note) Derated above Ta = 25°C in the proportion of  $3.2\text{mW} / \text{°C}$  for TA8155FG, and of  $4\text{mW} / \text{°C}$  for TA8155FNG.

**Electrical Characteristics**

Unless Otherwise Specified:  $V_{CC} = 1.2V$ ,  $V_{CC(REC)} = 2.4V$ ,  $f = 1kHz$ ,  $Ta = 25^\circ C$ ,  $SW_1: a$ ,  
 $SW_8: OPEN$ ,  $SW_9: ON$ ,  $SW_{10}: ON$ ,  $SW_{11}: ON$ ,  $SW_2 \sim SW_7$  condition  
 by next page

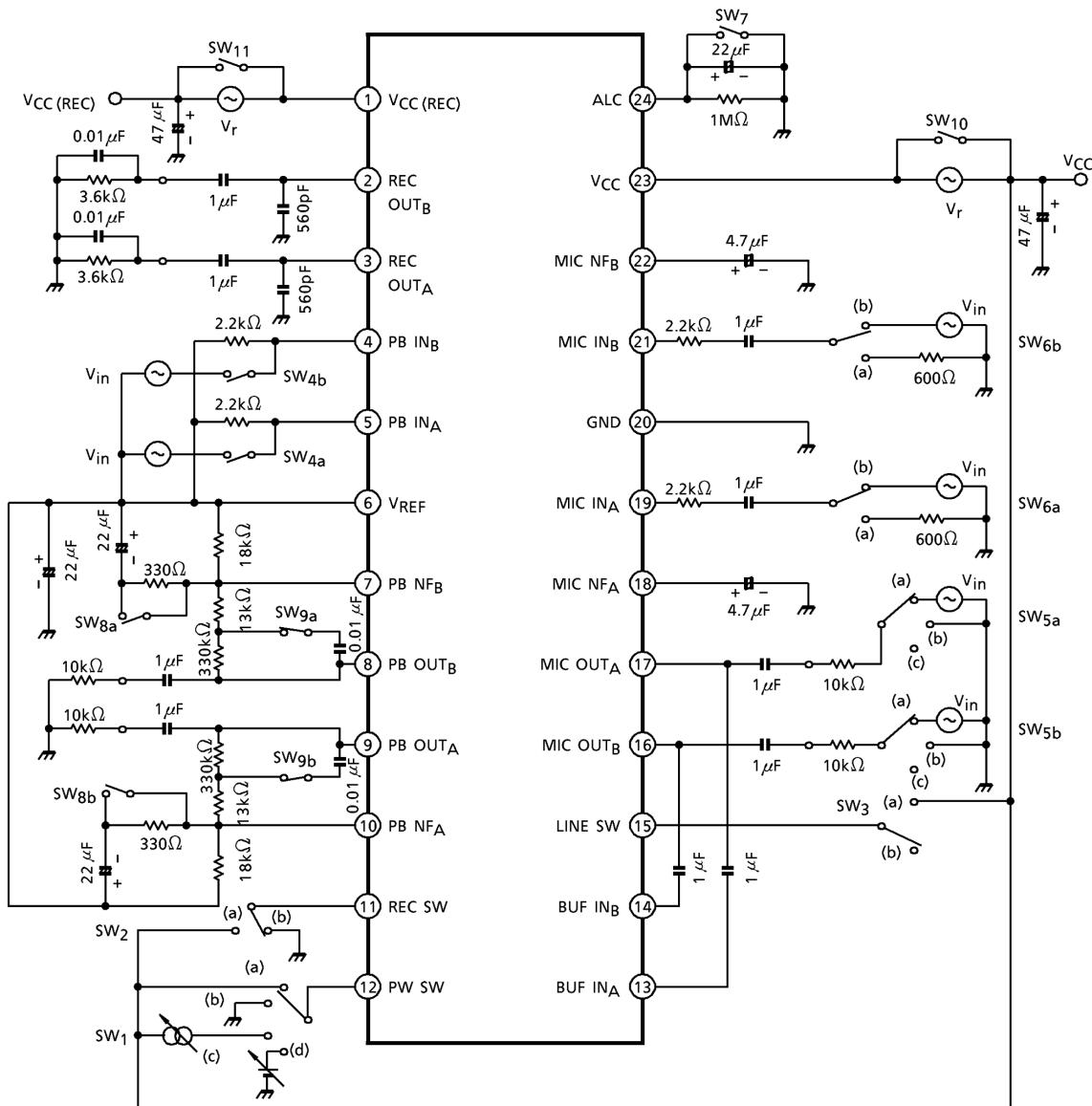
Characteristic	Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Quiescent current	PW off	$I_{CCQ1}$	— SW <sub>1</sub> : b, SW <sub>2</sub> : b, SW <sub>3</sub> : b SW <sub>2</sub> : b, SW <sub>3</sub> : b SW <sub>2</sub> : b, SW <sub>3</sub> : a SW <sub>2</sub> : a, SW <sub>3</sub> : a SW <sub>2</sub> : a, SW <sub>3</sub> : b	—	0.1	5	$\mu A$
	PB	$I_{CCQ2}$		—	2.6	3.9	mA
	Radio	$I_{CCQ3}$		—	2.4	3.6	
	Radio-REC	$I_{CCQ4}$		—	3.0	4.5	
	MIC-REC	$I_{CCQ5}$		—	4.5	6.5	
	$V_{CC}$ (REC)	$I_{CCQ6}$		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 <sub>8</sub> : ON, SW <sub>9</sub> : OPEN $V_O = -17dBV$	58	70	—	dB
	Closed loop voltage gain	$G_{VC}$	— $V_O = -17dBV$	—	36	—	
	Maximum output voltage	$V_{om1}$	— THD = 1%	200	310	—	$mV_{rms}$
	Total harmonic distortion	THD1	— $V_O = -17dBV$	—	0.1	0.3	%
	Equivalent input noise voltage	$V_{ni}$	— SW <sub>4</sub> : OPEN BPF = 30Hz~20kHz 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 <sub>4</sub> : OPEN, SW <sub>10</sub> : OPEN $f_r = 100Hz$ , $V_r = -32dBV$	—	40	—	
Buffer amplifier	Voltage gain	$G_{V2}$	— $V_O = -17dBV$	-4	-2	0	dB
	Maximum output voltage	$V_{om2}$	— THD = 1%	200	270	—	$mV_{rms}$
	Total harmonic distortion	THD2	— $V_O = -17dBV$	—	0.1	—	%
	Output noise voltage	$V_{no2}$	— SW <sub>5</sub> : 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 <sub>5</sub> : b, SW <sub>10</sub> : OPEN $f_r = 100Hz$ , $V_r = -32dBV$	—	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	—	$mV_{rms}$
	Total harmonic distortion	THD3	— $V_O = -12dBV$	—	0.1	0.5	%
	Output noise voltage	$V_{no3}$	— SW <sub>5</sub> : b, BPF = 30Hz~20kHz	—	0.09	0.25	$mV_{rms}$
	Cross talk (CH-A / CH-B)	CT3	— $V_O = -12dBV$	—	49	—	dB
	Ripple rejection ratio	RR3	— SW <sub>5</sub> : b, SW <sub>10</sub> : OPEN $f_r = 100Hz$ , $V_r = -32dBV$	—	40	—	

Characteristic		Symbol	Test Circuit	Test Condition		Min.	Typ.	Max.	Unit
Microphone amplifier	Voltage gain	G <sub>V4</sub>	—	V <sub>o</sub> = -17dBV		30	32.5	35	dB
	Maximum output voltage	V <sub>om4</sub>	—	THD = 1%		120	200	—	mV <sub>rms</sub>
	Total harmonic distortion	THD4	—	V <sub>o</sub> = -17dBV		—	0.25	0.8	%
	Output noise voltage	V <sub>no4</sub>	—	SW <sub>6</sub> : a, BPF = 30Hz~20kHz		—	0.12	—	mV <sub>rms</sub>
	Cross talk (CH-A / CH-B)	CT4	—	V <sub>o</sub> = -17dBV		—	52	—	dB
	Ripple rejection ratio	RR4	—	SW <sub>6</sub> : a, SW <sub>10</sub> : OPEN f <sub>r</sub> = 100Hz, V <sub>r</sub> = -32dBV		—	36	—	
Microphone amplifier + recording amplifier	Voltage gain	G <sub>V5</sub>	—	SW <sub>7</sub> : ON, V <sub>o</sub> = -17dBV		—	58	—	dB
	Maximum output voltage	V <sub>om5</sub>	—	THD = 3%		600	800	—	mV <sub>rms</sub>
	ALC total harmonic distortion	THD5	—	V <sub>in</sub> = -32dBV		—	0.8	—	%
	Output noise voltage	V <sub>no5</sub>	—	SW <sub>6</sub> : a, BPF = 30Hz~20kHz		—	2.1	3.5	mV <sub>rms</sub>
	ALC voltage	V <sub>oALC1</sub>	—	V <sub>in</sub> = -62dBV		-11.7	-8.5	-6.7	dBV
		V <sub>oALC2</sub>	—	V <sub>in</sub> = -32dBV		-11.7	-8.5	-6.7	
	ALC channel balance	CB <sub>ALC</sub>	—			—	0	1.5	dB
	ALC width	W <sub>ALC</sub>	—	V <sub>oALC</sub> ≤ 3dB (input voltage) with respect to standard V <sub>in</sub> = -42dBV		—	48	—	
	Cross talk (CH-A / CH-B)	CT5	—	V <sub>in</sub> = -32dBV		—	37	—	dB
	Ripple rejection ratio	RR5	—	SW <sub>6</sub> : a, f <sub>r</sub> = 100Hz, V <sub>r</sub> = -17dBV		—	39	—	
Power switch	Power on current	I <sub>12</sub>	—	SW <sub>1</sub> : c, SW <sub>2</sub> : b, SW <sub>3</sub> : b V <sub>6</sub> ≥ 0.6V		5	—	—	μA
	Power off voltage	V <sub>12</sub>	—	SW <sub>1</sub> : d, SW <sub>2</sub> : b, SW <sub>3</sub> : b V <sub>6</sub> ≤ 0.2V		0	—	0.3	V

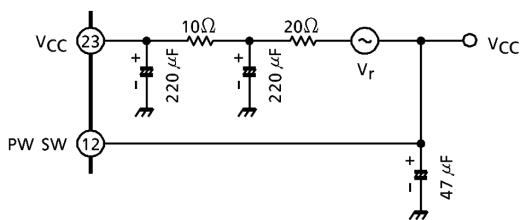
### Switch Condition For Test Mode (unless otherwise specified.)

Mode	PB AMP. (PB mode)	BUF AMP. (radio mode)	REC AMP. (radio-REC mode)	MIC AMP. (MIC mode)	MIC AMP. + REC AMP. (MIC-REC mode)
Operating Amplifier	PB	BUF	BUF REC	MIC-ALC BUF, REC	
Switch					
SW <sub>2</sub>	b	b	a	a	
SW <sub>3</sub>	b	a	a	b	
SW <sub>4</sub>	ON	OPEN	OPEN	OPEN	
SW <sub>5</sub>	b	a	a	b	c
SW <sub>6</sub>	a	a	a	b	
SW <sub>7</sub>	OPEN	OPEN	OPEN	ON	OPEN

## Test Circuit



(\*) RR5 is measured by circuit below (for VCC line)



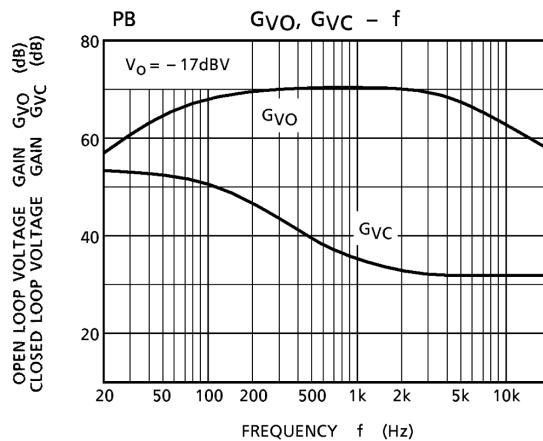
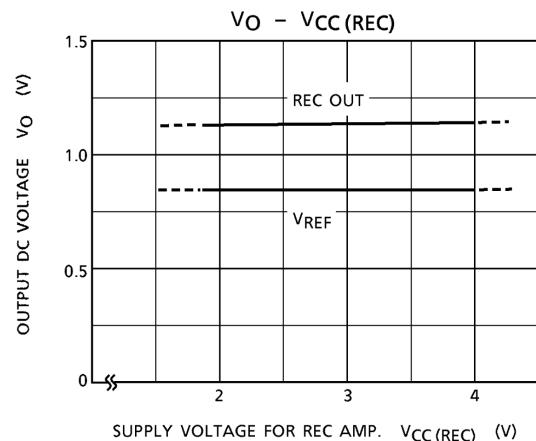
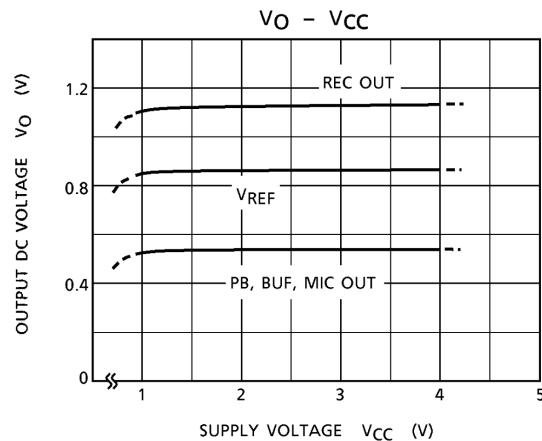
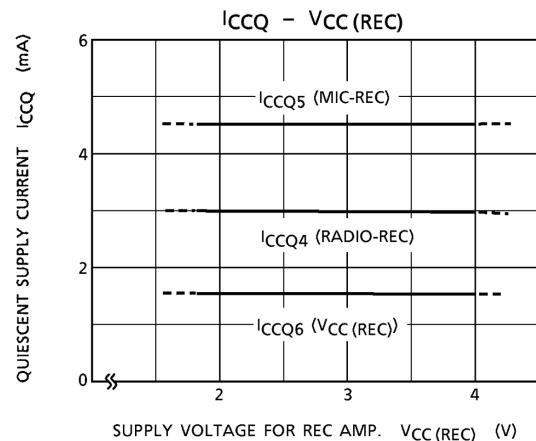
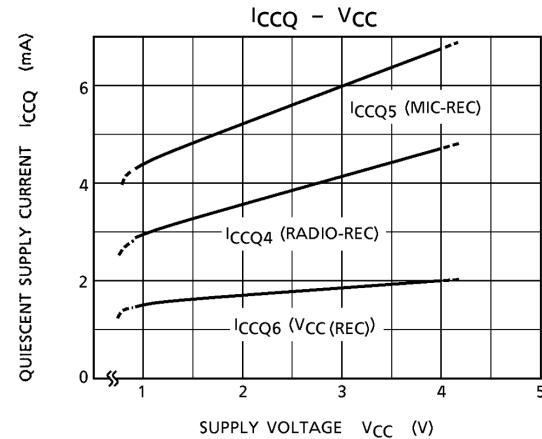
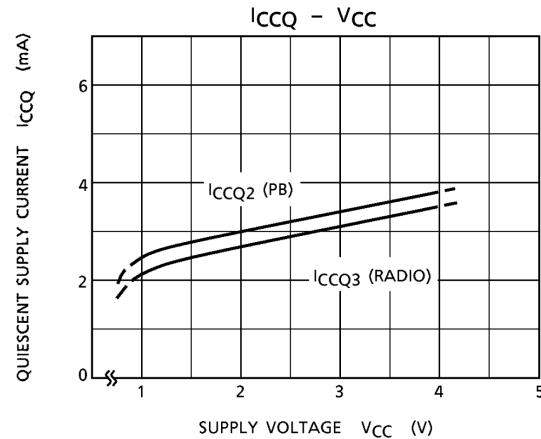
## Characteristic Curves

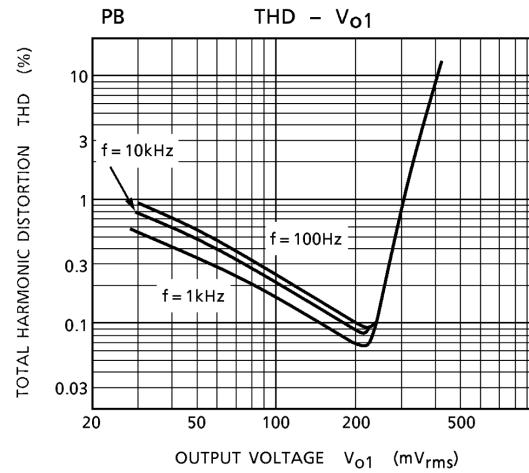
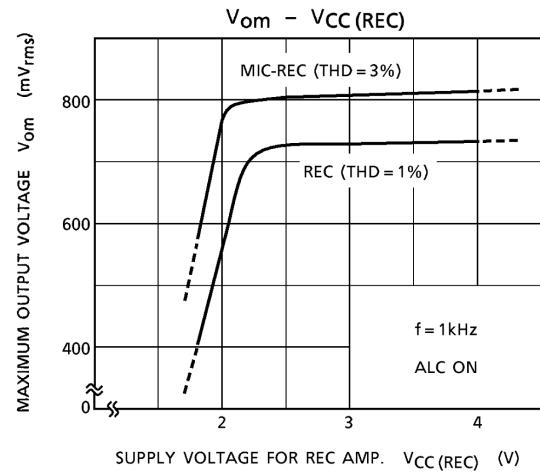
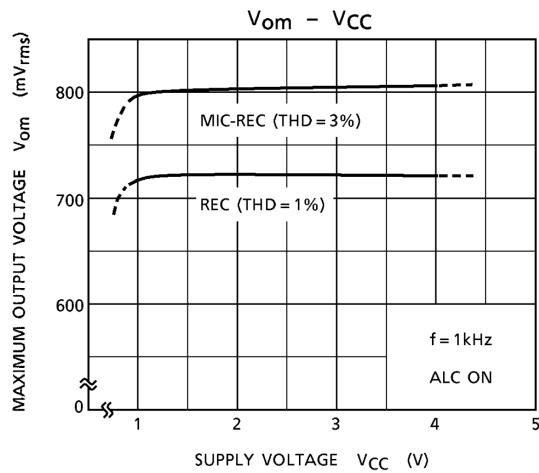
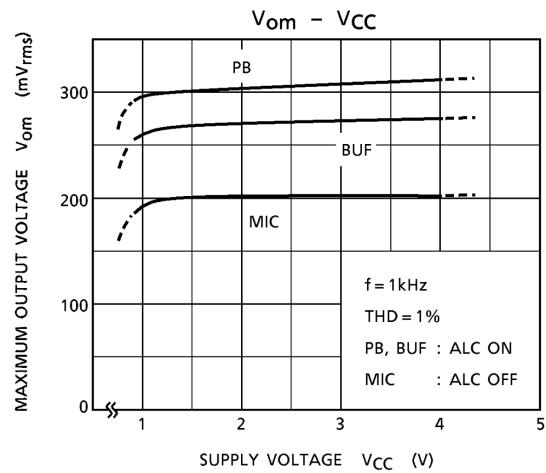
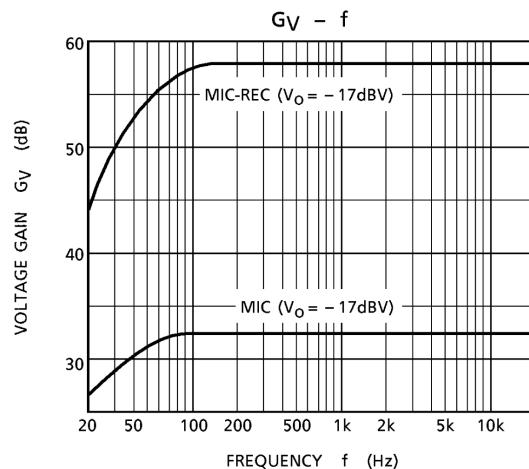
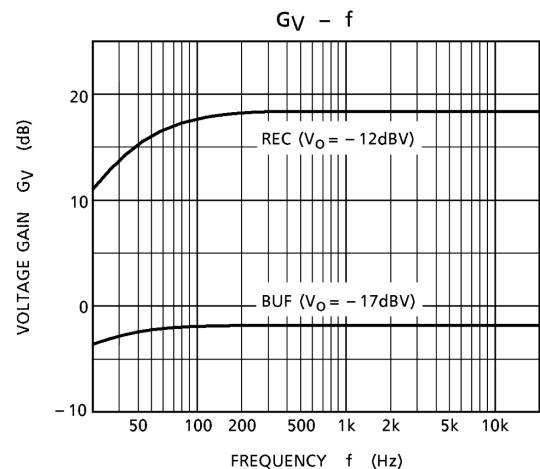
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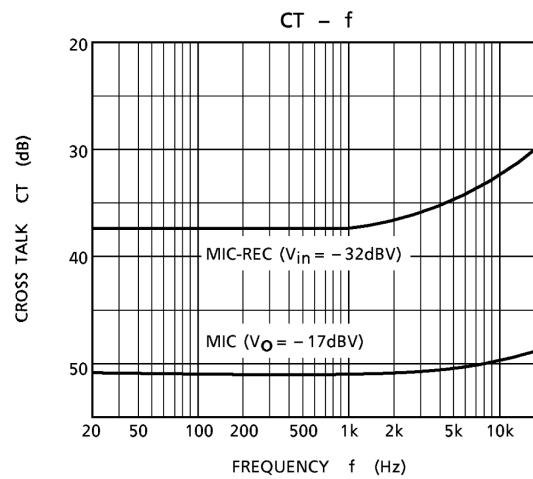
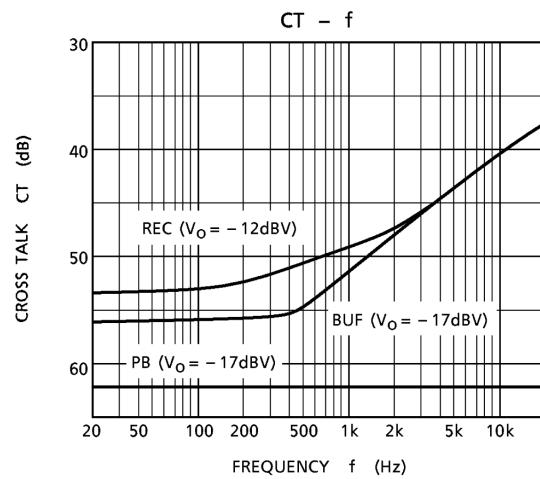
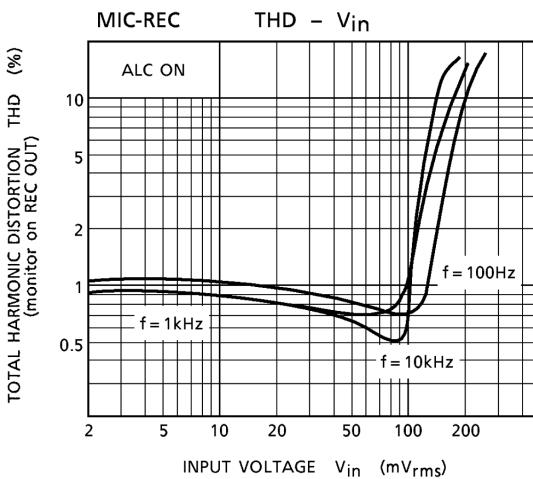
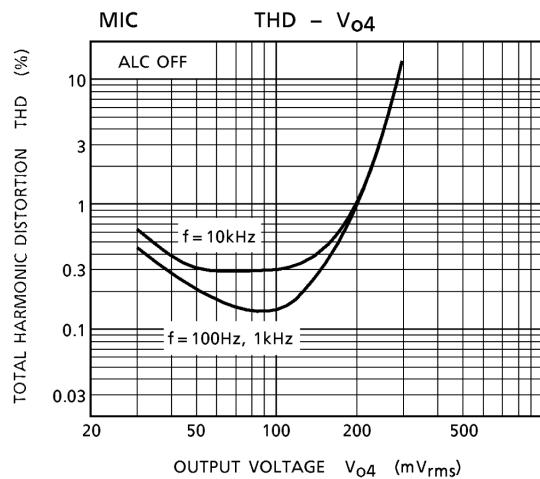
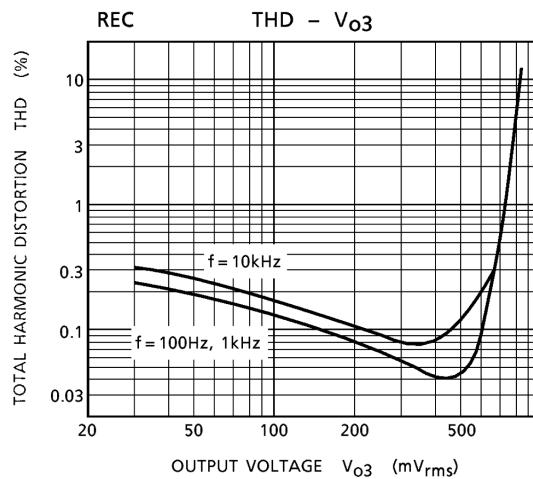
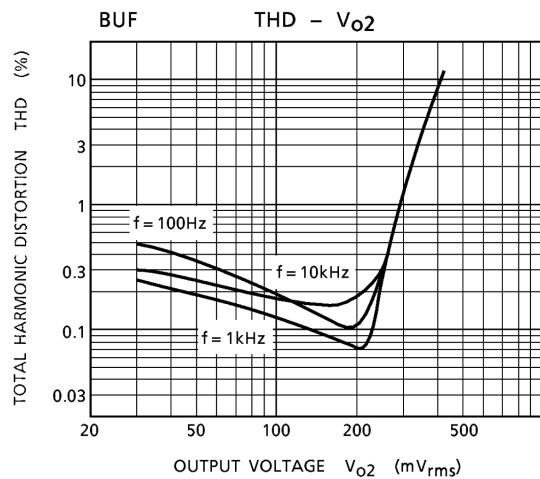
$V_{CC} = 1.2V$ ,  $V_{CC(REC)} = 2.4V$ ,  $f = 1kHz$ ,  $Ta = 25^\circ C$

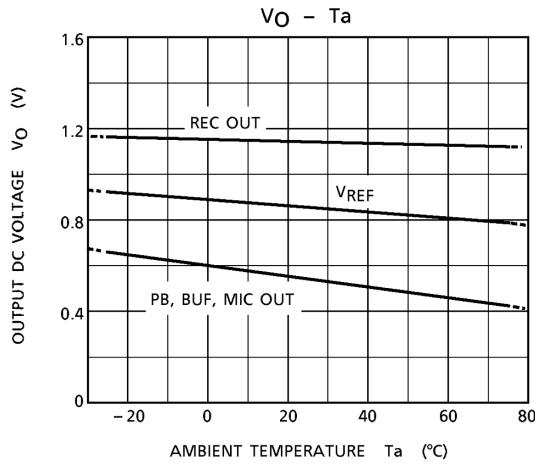
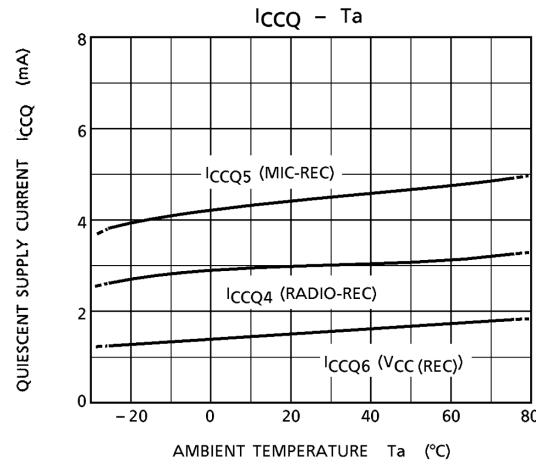
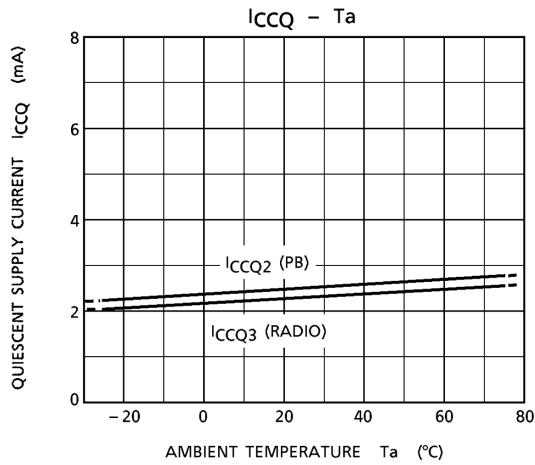
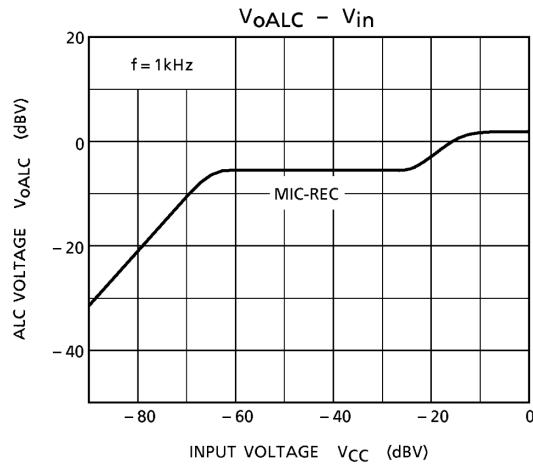
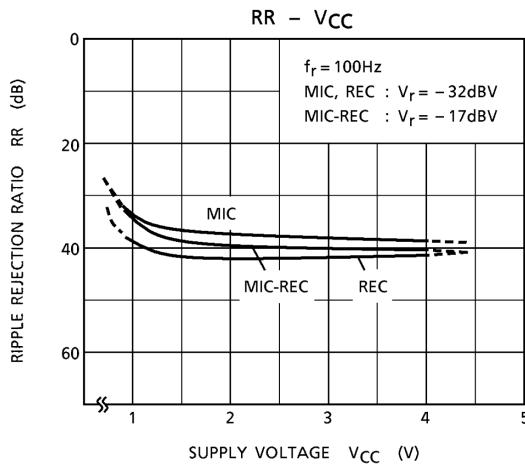
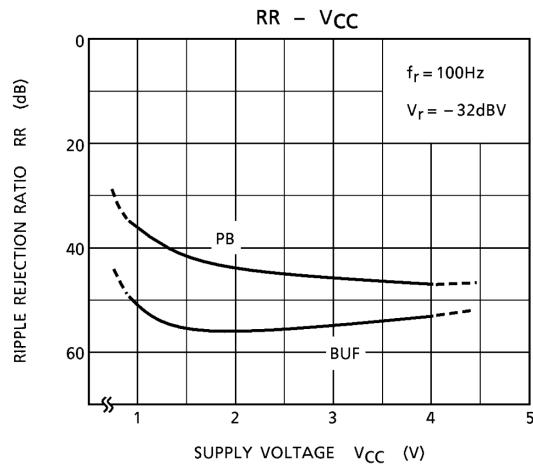
$R_L = 10k\Omega$  : PB amp., BUF amp., MIC amp.

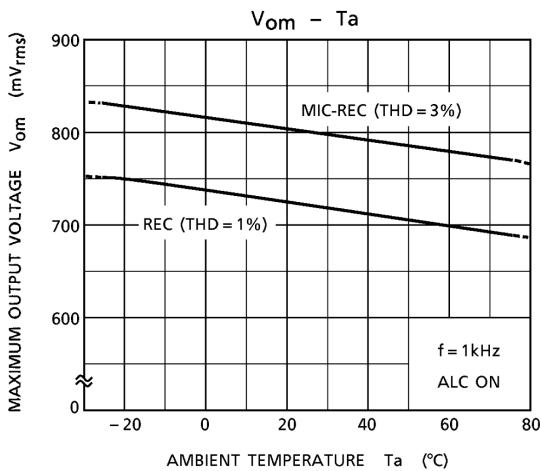
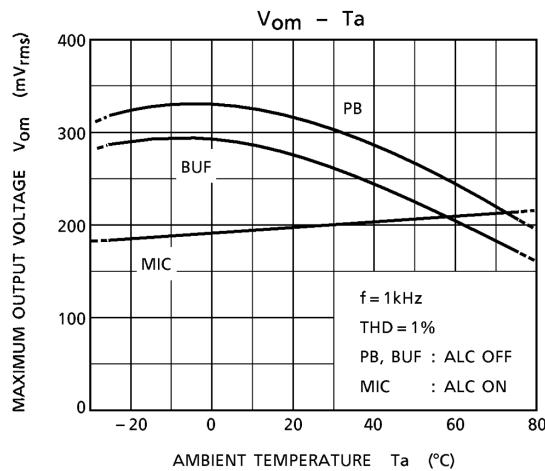
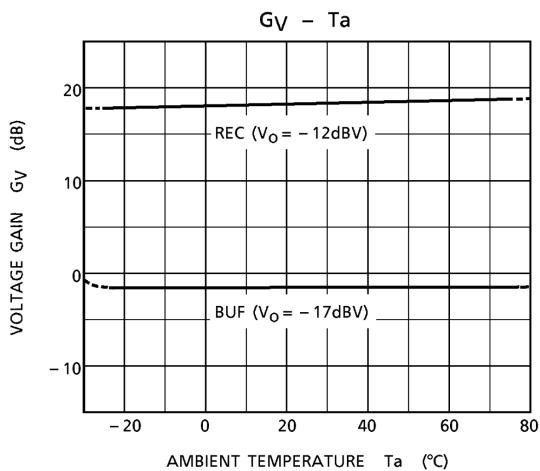
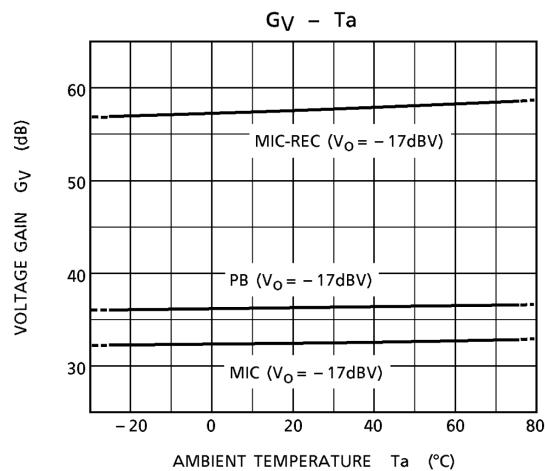
(load of reconding amplifier is shown in test circuit)







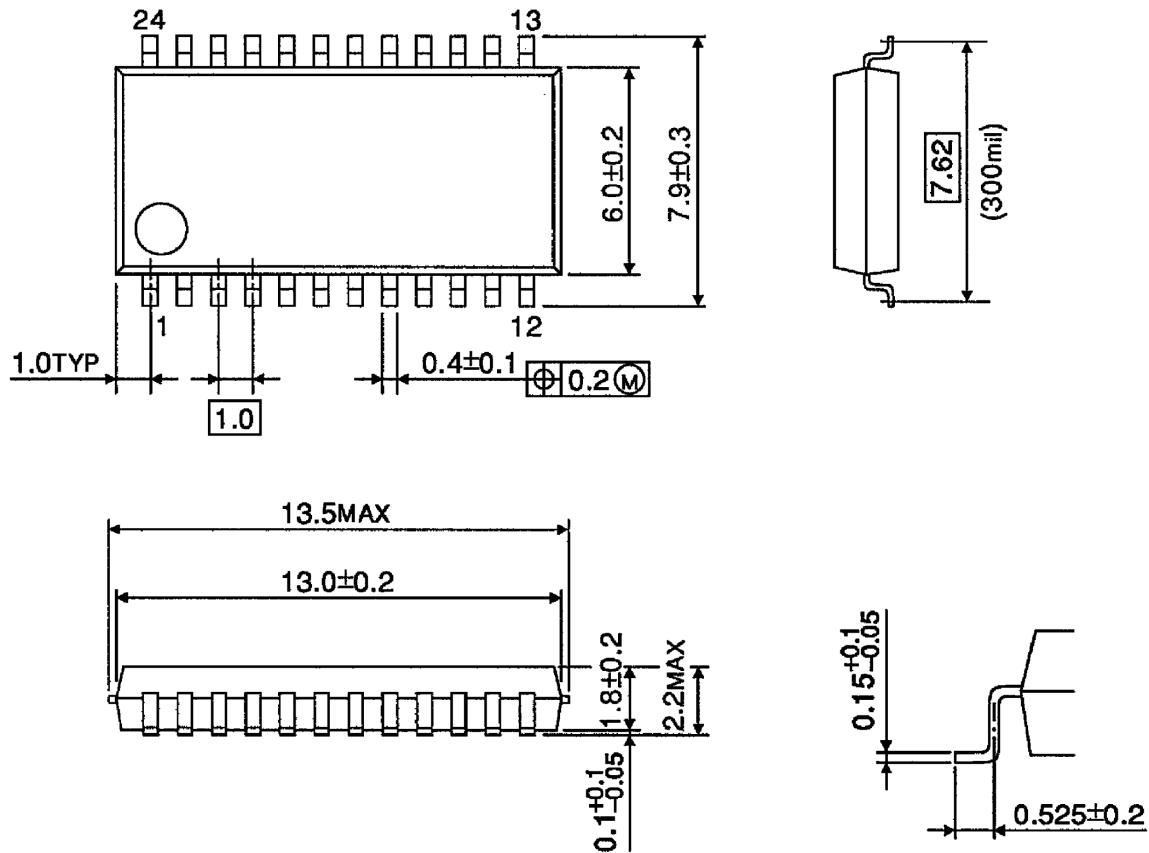




**Package Dimensions**

SSOP24-P-300-1.00

Unit : mm

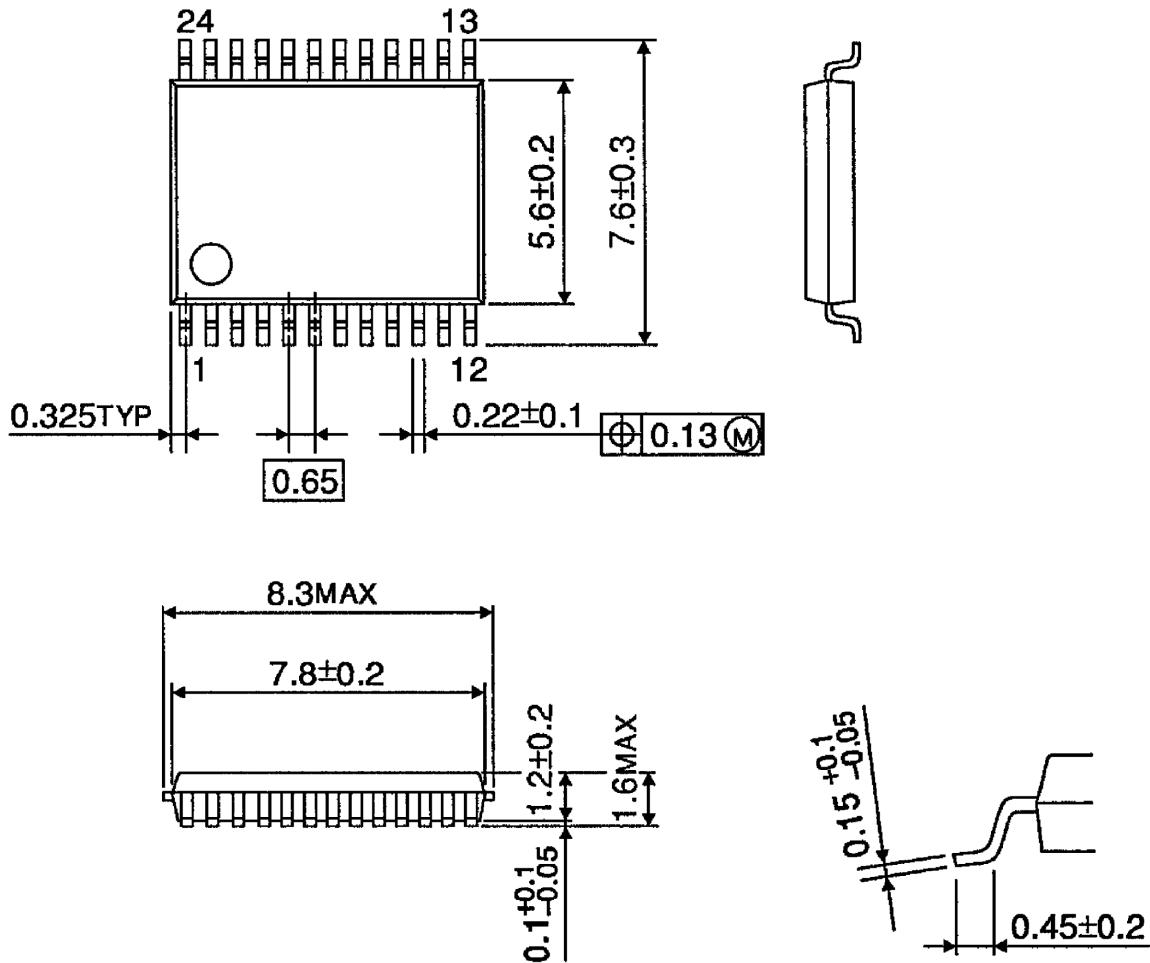


Weight: 0.32g (typ.)

**Package Dimensions**

SSOP24-P-300-0.65A

Unit : mm



Weight: 0.14g (typ.)

About solderability, following conditions were confirmed

- Solderability
  - (1) Use of Sn-63Pb solder Bath
    - solder bath temperature = 230°C
    - dipping time = 5 seconds
    - the number of times = once
    - use of R-type flux
  - (2) Use of Sn-3.0Ag-0.5Cu solder Bath
    - solder bath temperature = 245°C
    - dipping time = 5 seconds
    - the number of times = once
    - use of R-type flux

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