

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

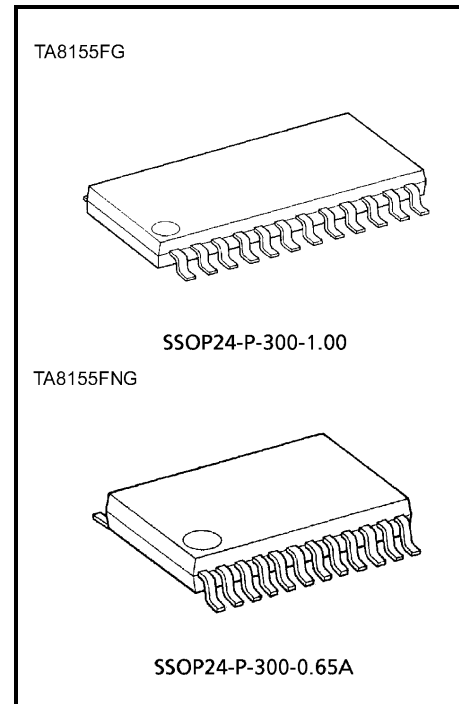
TA8155FG, TA8155FNG

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.

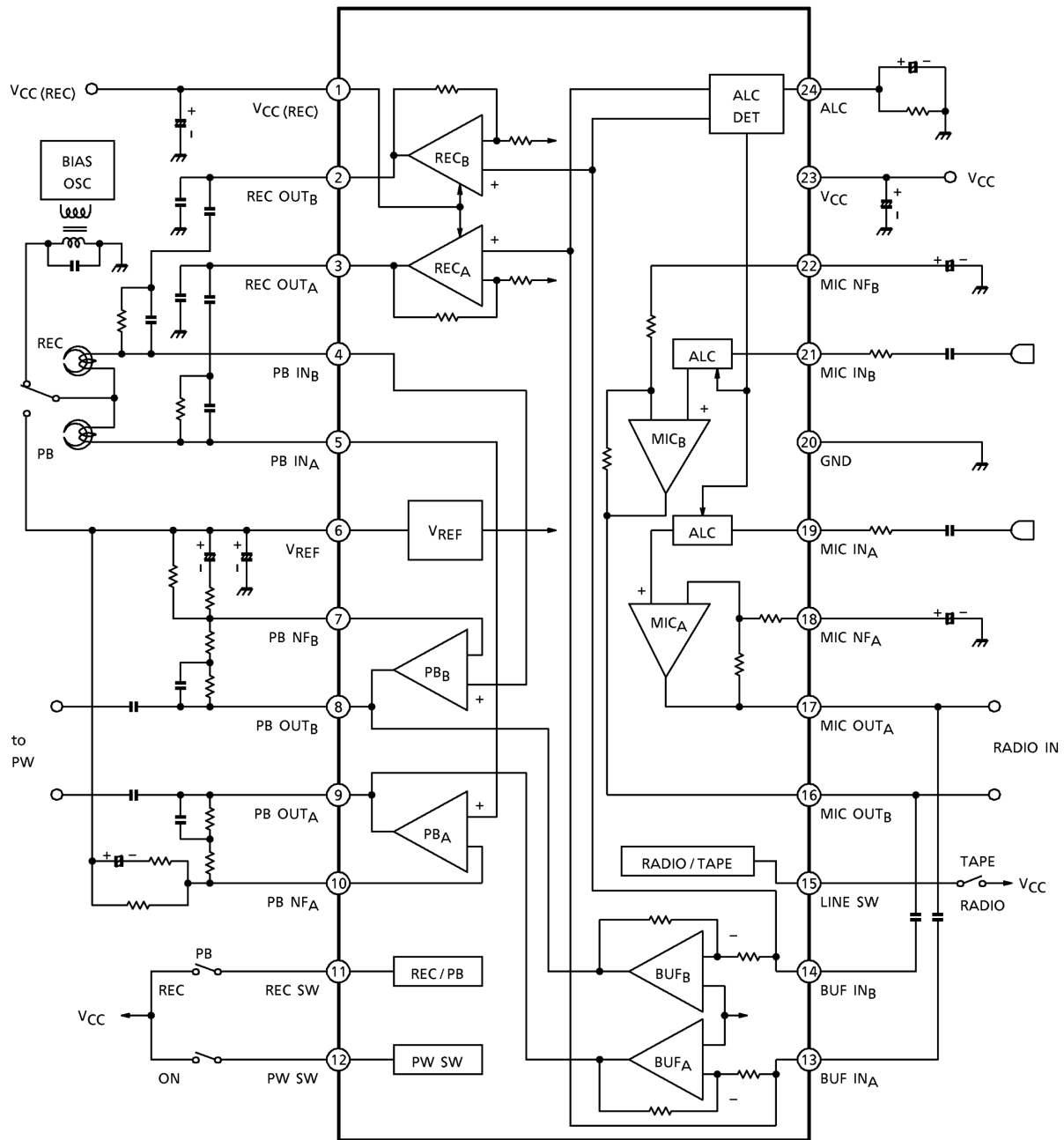
Features

- Built-in dual playback amplifiers.
Input coupling condenser-less.
Built-in capacitor for buzz noise.
- Built-in dual buffer amplifiers.
For radio signal 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 $ICCQ2 = 2.6mA$ (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. ($T_a = 25^\circ C$)
 $V_{CC} (opr) = 0.9 \sim 4V$
 $V_{CC} (opr) (REC) = 1.8 \sim 4V$



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

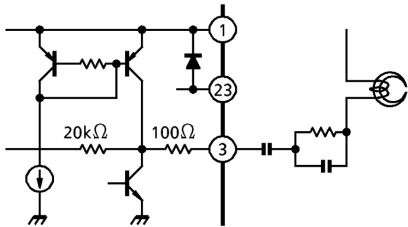
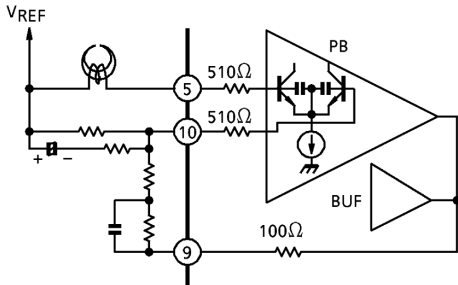
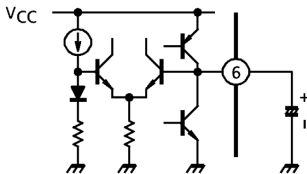
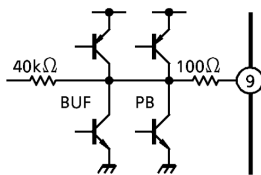
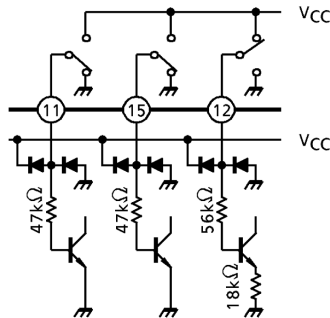
Block Diagram

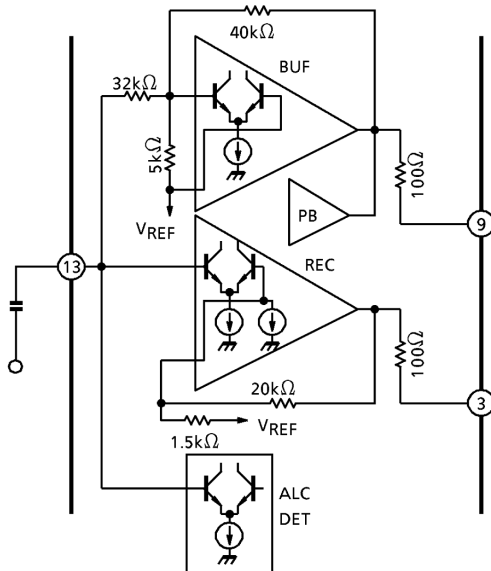
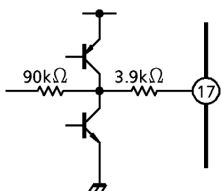
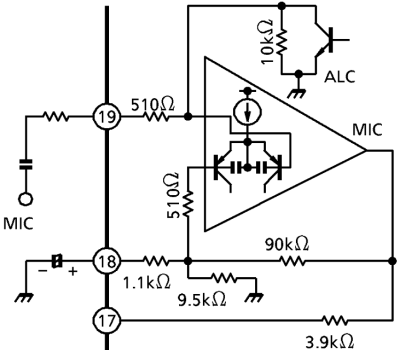
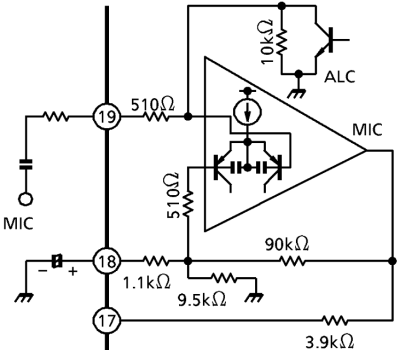
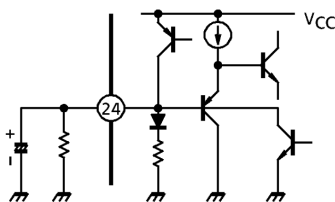


Terminal Explanation

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 _{CC(REC)}	This terminal voltage supplies output stage of recording amplifier with power source.		2.4
2	REC OUT _B	Output of recording amplifier.		1.15
3	REC OUT _A			
4	PB IN _B	Input of playback amplifier.		0.85
5	PB IN _A			0.85
7	PB NF _B	NF of playback amplifier.		
10	PB NF _A			
6	V _{REF}	Reference voltage. All amplifier operate on this voltage.		0.85
8	PB OUT _B	Output of playback amplifier and buffer amplifier.		0.55
9	PB OUT _A			
11	REC SW	REC / PB switch. V _{CC} : REC mode. GND / OPEN: PB mode.		—
12	PW SW	Power switch. V _{CC} : Power on. GND / OPEN: Power off.		—
15	Line SW	Line switch. V _{CC} : BUF (radio) mode. GND / OPEN: Tape mode.		—

Terminal		Function	Internal Circuit	Terminal Voltage (V)
No.	Name			
13	BUF IN _A	Input of buffer amplifier and recording amplifier. (Buffer amplifier is inverter type.) ALC level of microphone amplifier is determined by signal level of this terminal		0.85
14	BUF IN _B			
16	MIC OUT _B	Output of microphone amplifier.		0.55
17	MIC OUT _A			
18	MIC NF _A	NF of microphone amplifier.		0.05
22	MIC NF _B			
19	MIC IN _A	Input of microphone amplifier. Built-in capacitor for buzz noise.		0.01
21	MIC IN _B			
20	GND	—	—	0
23	V _{CC}	—	—	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 RED 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

LINE SW \ REC SW	L	H
	PB mode (PB)	MIC-REC (BUF,MIC,REC)
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 R₁ and R_f.

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

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

In case that β of transistor is assumed 100, I_{B(NF)} is flowed 0.2μA in Fig.1. And output voltage of playback amplifier (pin (8),(9)) 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 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).

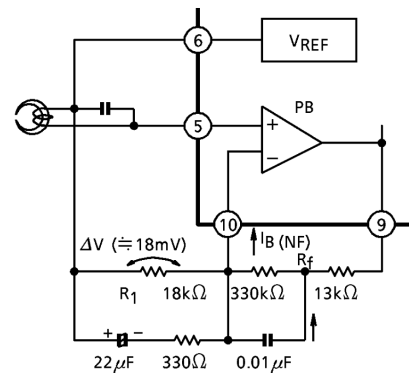


Fig.1 DC output voltage of playback amplifier.

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

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

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

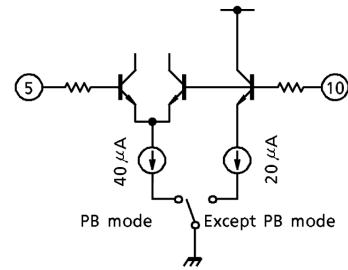


Fig.2 Reducing a pop sound of mode switchover (1).

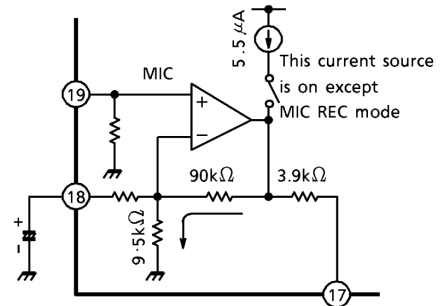


Fig.3 Reducing a pop sound of mode switchover (2).

Absolute 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	TA8155FG	P_D (Note)	400	mW
	TA8155FNG		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 TA8155FG, and of $4\text{mW} / ^\circ\text{C}$ for TA8155FNG.

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

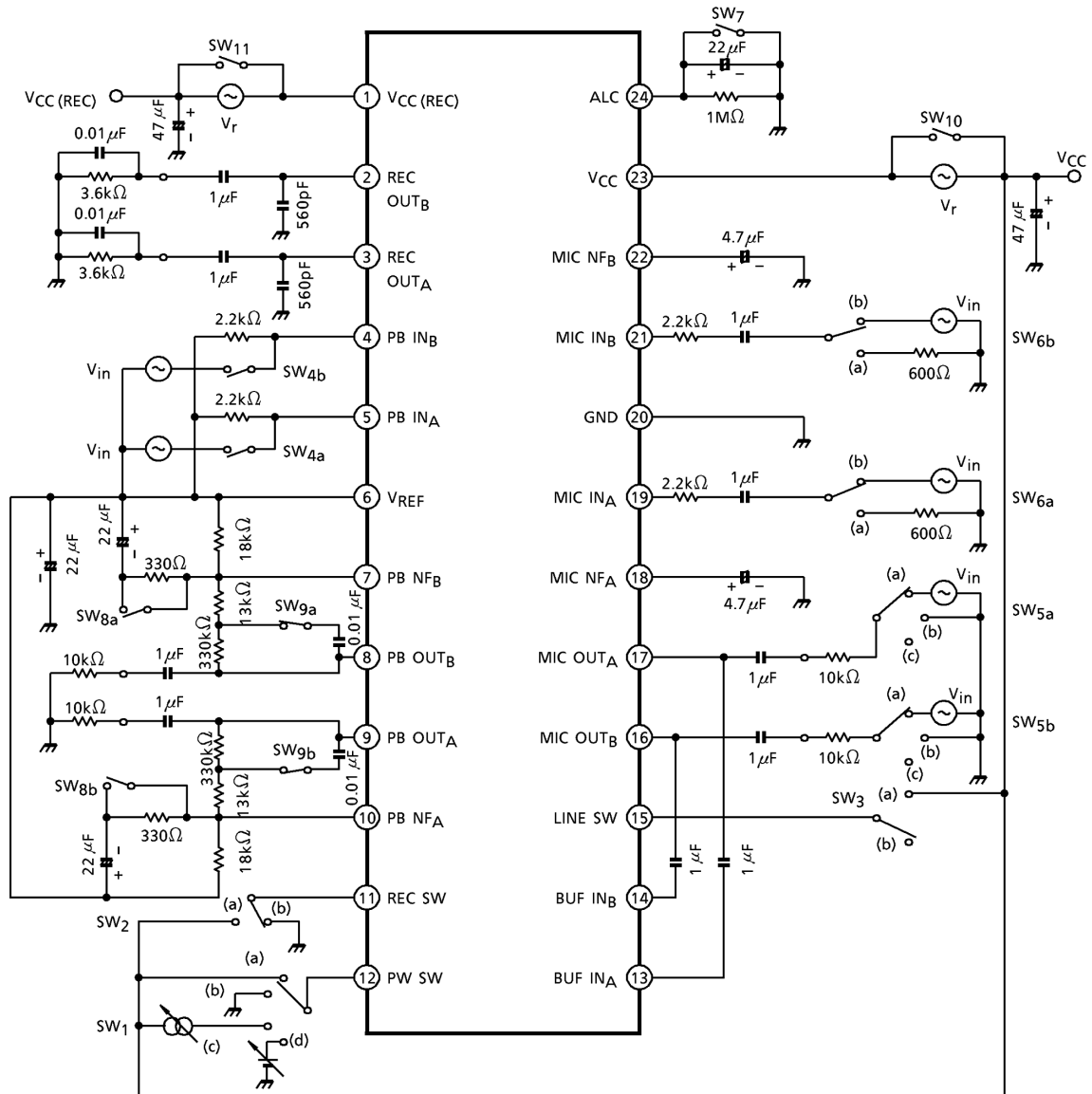
Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Quiescent current	PW off	I_{CCQ1}	—	SW_1 : b, SW_2 : b, SW_3 : b	—	0.1	5	μA
	PB	I_{CCQ2}		SW_2 : b, SW_3 : b	—	2.6	3.9	mA
	Radio	I_{CCQ3}		SW_2 : b, SW_3 : a	—	2.4	3.6	
	Radio-REC	I_{CCQ4}		SW_2 : a, SW_3 : a	—	3.0	4.5	
	MIC-REC	I_{CCQ5}		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 $V_0 = -17dBV$	58	70	—	dB
	Closed loop voltage gain	G_{VC}	—	$V_0 = -17dBV$	—	36	—	
	Maximum output voltage	V_{om1}	—	THD = 1%	200	310	—	mV _{rms}
	Total harmonic distortion	THD1	—	$V_0 = -17dBV$	—	0.1	0.3	%
	Equivalent input noise voltage	V_{ni}	—	SW_4 : OPEN BPF = 30Hz~20kHz NAB ($G_V = 36dB, f = 1kHz$)	—	1.2	3.0	μV_{rms}
	Cross talk (CH-A / CH-B)	CT1	—	$V_0 = -17dBV$	—	62	—	dB
	Ripple rejection ratio	RR1	—	SW_4 : OPEN, SW_{10} : OPEN $f_r = 100Hz, V_r = -32dBV$	—	40	—	
Buffer amplifier	Voltage gain	G_{V2}	—	$V_0 = -17dBV$	-4	-2	0	dB
	Maximum output voltage	V_{om2}	—	THD = 1%	200	270	—	mV _{rms}
	Total harmonic distortion	THD2	—	$V_0 = -17dBV$	—	0.1	—	%
	Output noise voltage	V_{no2}	—	SW_5 : b, BPF = 30Hz~20kHz	—	35	—	μV_{rms}
	Cross talk (CH-A / CH-B)	CT2	—	$V_0 = -17dBV$	—	51	—	dB
	Ripple rejection ratio	RR2	—	SW_5 : b, SW_{10} : OPEN $f_r = 100Hz, V_r = -32dBV$	—	55	—	
Recording amplifier	Voltage gain	G_{V3}	—	$V_0 = -12dBV$	16.5	18.5	20.5	dB
	Maximum output voltage	V_{om3}	—	THD = 1%	500	720	—	mV _{rms}
	Total harmonic distortion	THD3	—	$V_0 = -12dBV$	—	0.1	0.5	%
	Output noise voltage	V_{no3}	—	SW_5 : b, BPF = 30Hz~20kHz	—	0.09	0.25	mV _{rms}
	Cross talk (CH-A / CH-B)	CT3	—	$V_0 = -12dBV$	—	49	—	dB
	Ripple rejection ratio	RR3	—	SW_5 : b, SW_{10} : OPEN $f_r = 100Hz, V_r = -32dBV$	—	40	—	

Characteristic		Symbol	Test Cir-cuit	Test Condition	Min.	Typ.	Max.	Unit
Microphone amplifier	Voltage gain	G_{V4}	—	$V_0 = -17\text{dBV}$	30	32.5	35	dB
	Maximum output voltage	V_{om4}	—	THD = 1%	120	200	—	mV_{rms}
	Total harmonic distortion	THD4	—	$V_0 = -17\text{dBV}$	—	0.25	0.8	%
	Output noise voltage	V_{no4}	—	SW ₆ : a, BPF = 30Hz~20kHz	—	0.12	—	mV_{rms}
	Cross talk (CH-A / CH-B)	CT4	—	$V_0 = -17\text{dBV}$	—	52	—	dB
	Ripple rejection ratio	RR4	—	SW ₆ : a, SW ₁₀ : OPEN $f_r = 100\text{Hz}$, $V_r = -32\text{dBV}$	—	36	—	
Microphone amplifier + recording amplifier	Voltage gain	G_{V5}	—	SW ₇ : ON, $V_0 = -17\text{dBV}$	—	58	—	dB
	Maximum output voltage	V_{om5}	—	THD = 3%	600	800	—	mV_{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	mV_{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) with respect to standard $V_{in} = -42\text{dBV}$	—	48	—	
	Cross talk (CH-A / CH-B)	CT5	—	$V_{in} = -32\text{dBV}$	—	37	—	dB
	Ripple rejection ratio	RR5	—	SW ₆ : a, $f_r = 100\text{Hz}$, $V_r = -17\text{dBV}$	—	39	—	
Power switch	Power on current	I_{12}	—	SW ₁ : c, SW ₂ : b, SW ₃ : b $V_6 \geq 0.6\text{V}$	5	—	—	μA
	Power off voltage	V_{12}	—	SW ₁ : d, SW ₂ : b, SW ₃ : b $V_6 \leq 0.2\text{V}$	0	—	0.3	V

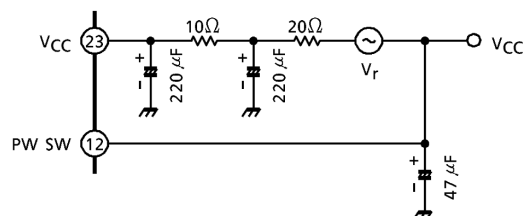
Switch Condition For Test Mode (unless otherwise specified.)

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 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 VCC line)



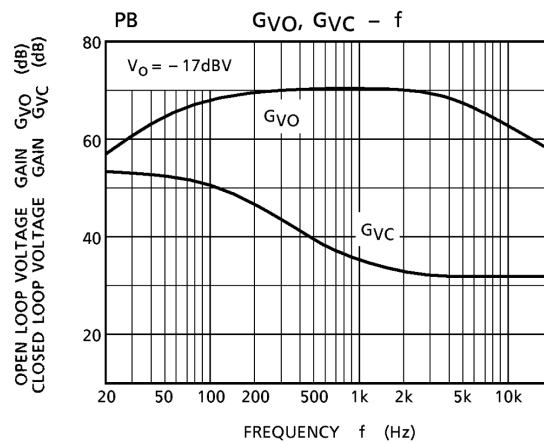
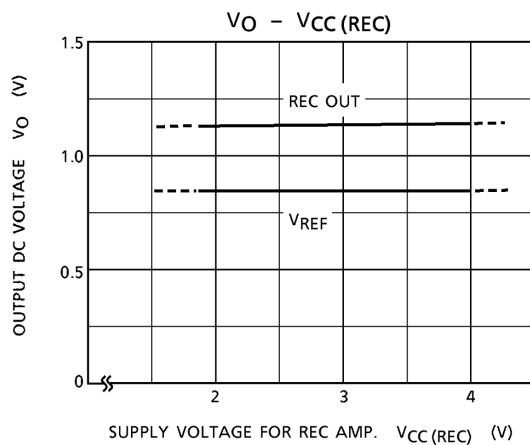
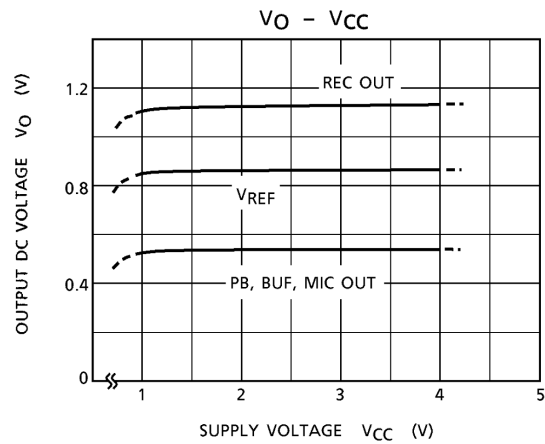
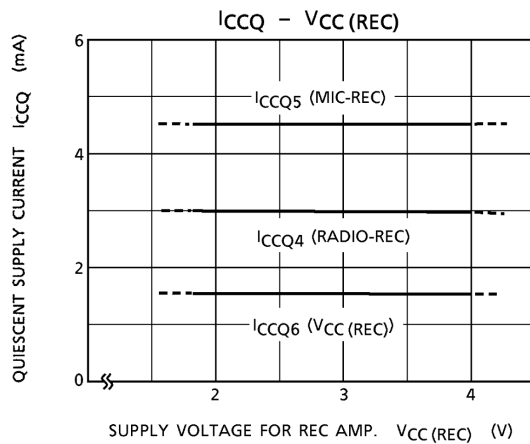
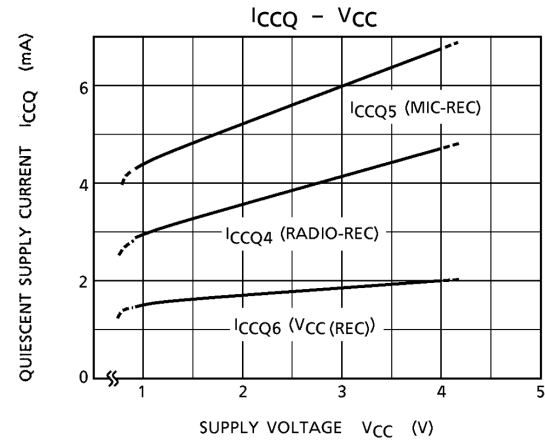
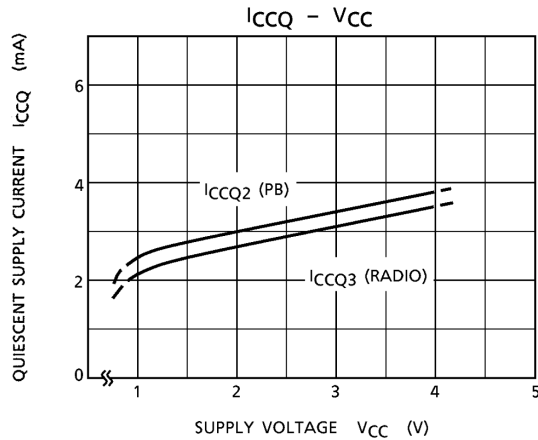
Characteristic Curves

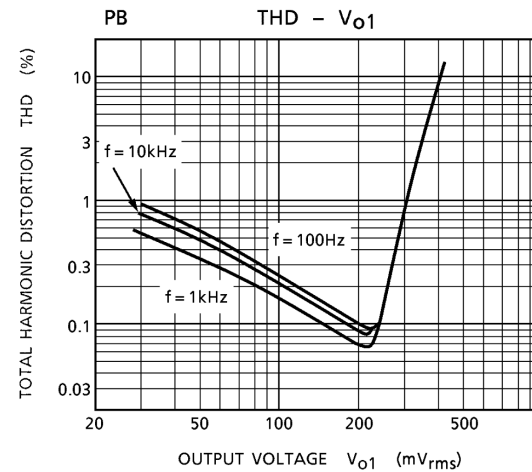
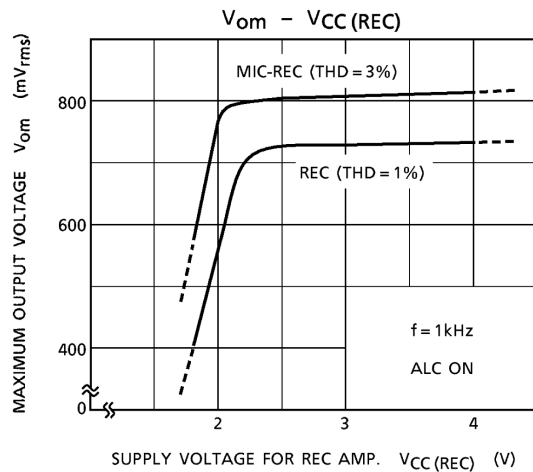
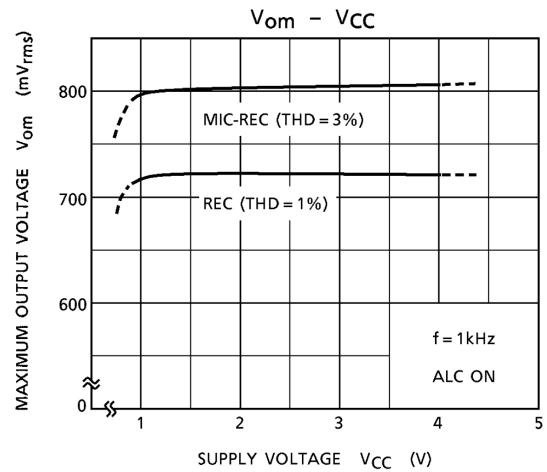
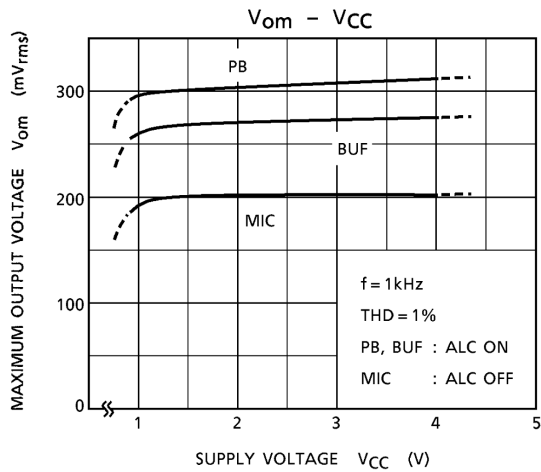
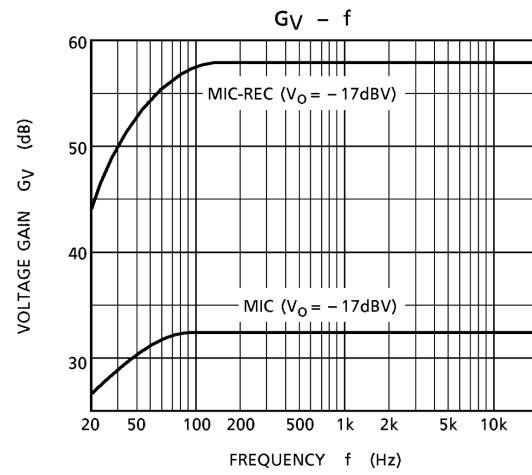
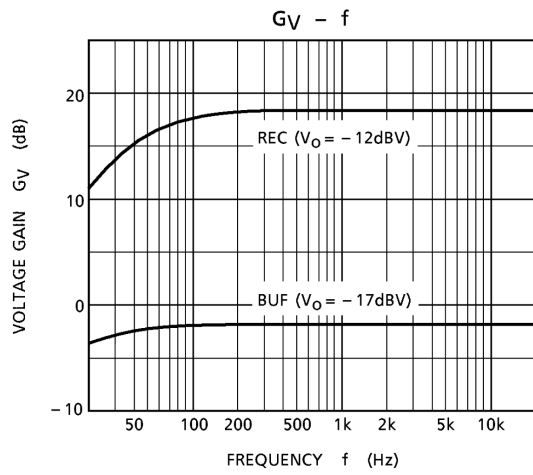
Unless Otherwise Specified

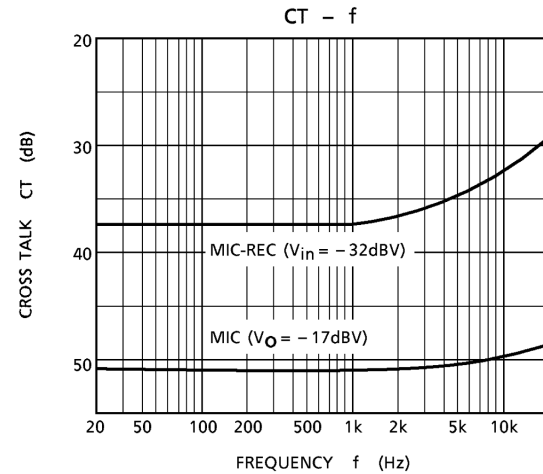
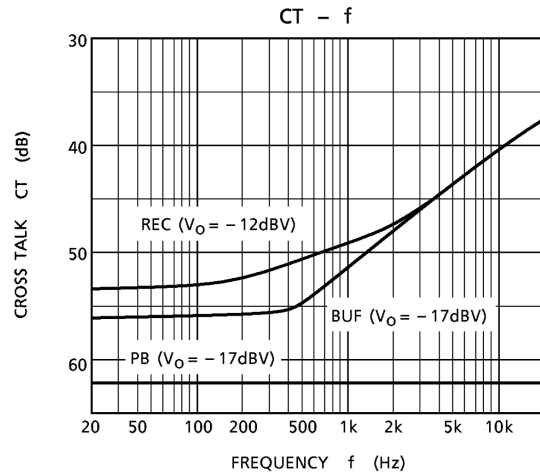
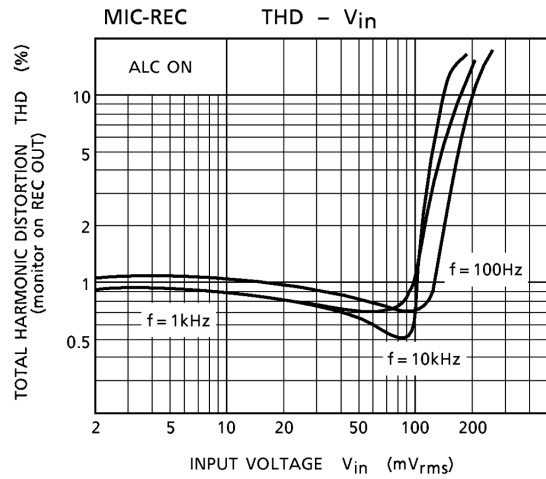
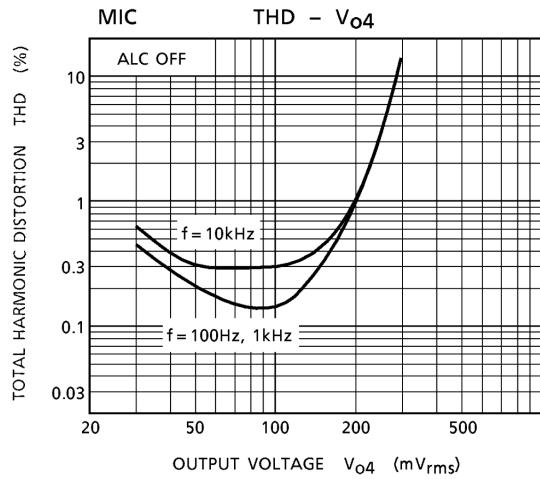
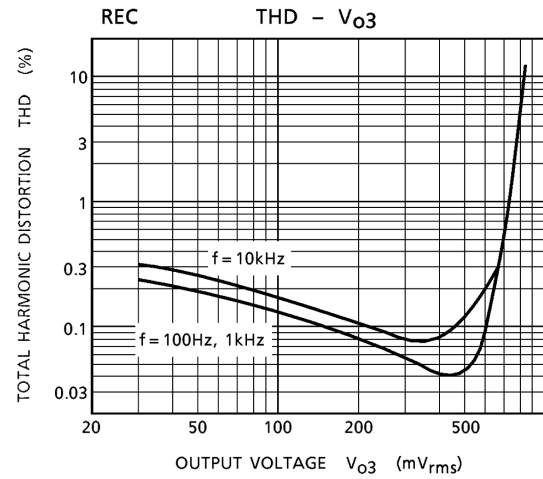
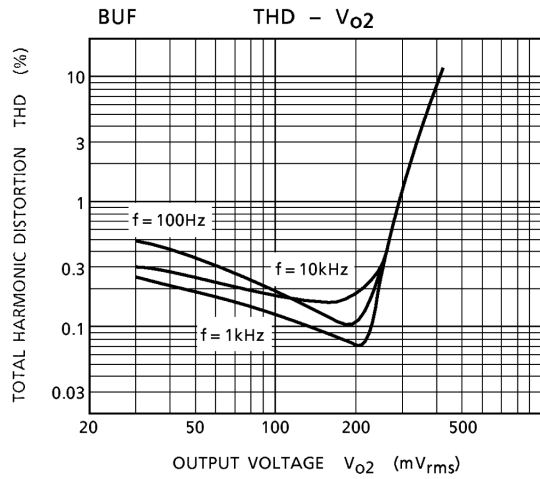
$V_{CC} = 1.2V$, $V_{CC(REC)} = 2.4V$, $f = 1kHz$, $T_a = 25^\circ C$

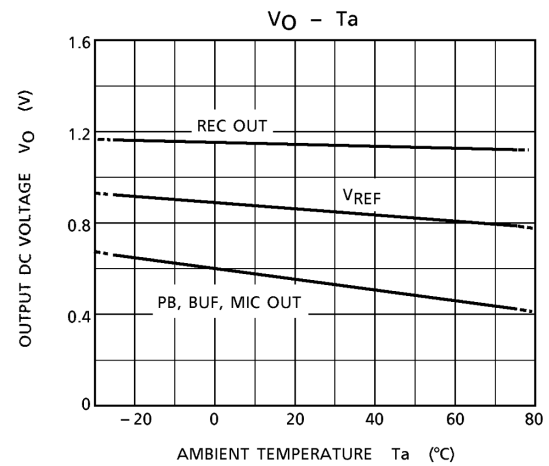
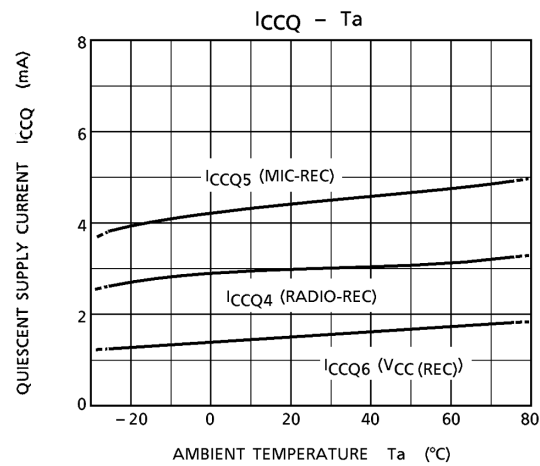
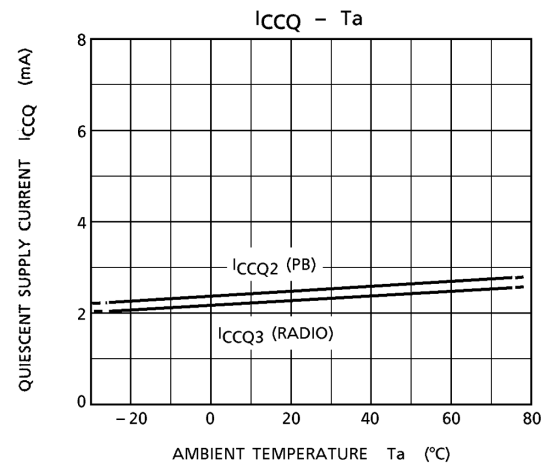
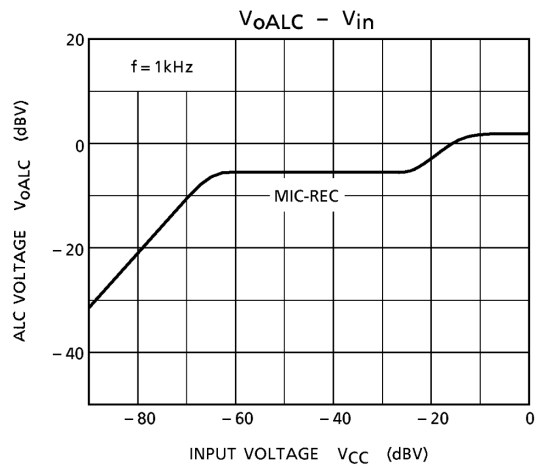
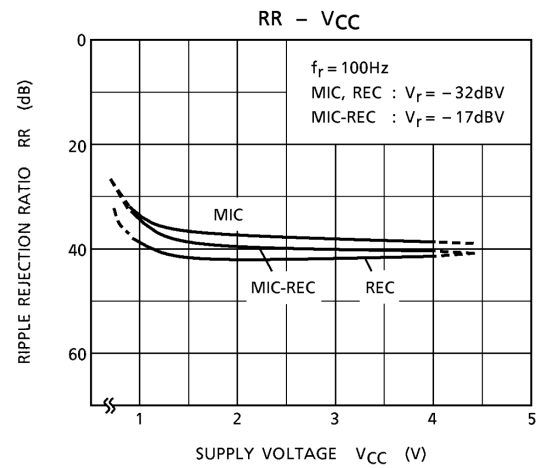
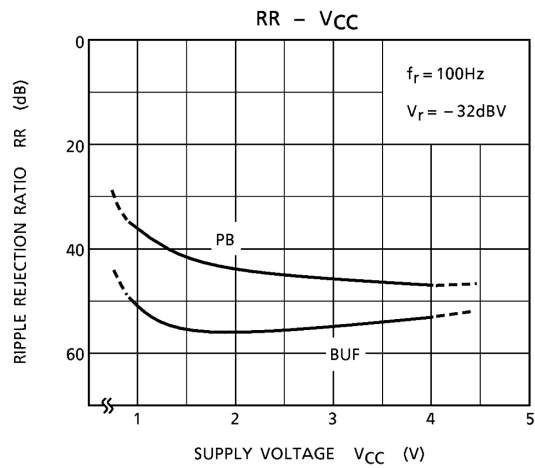
$R_L = 10k\Omega$: PB amp., BUF amp., MIC amp.

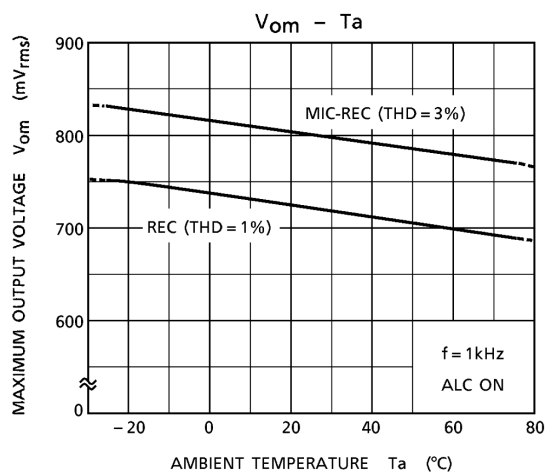
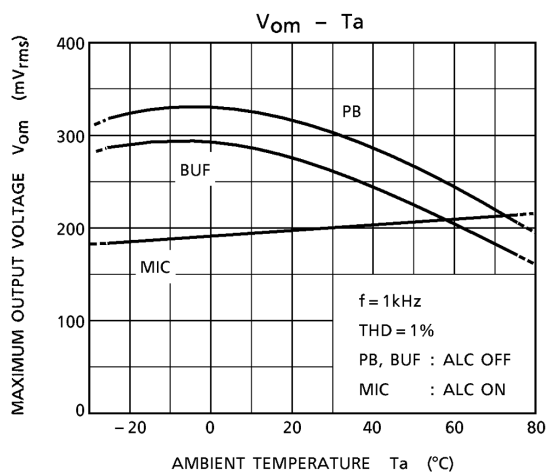
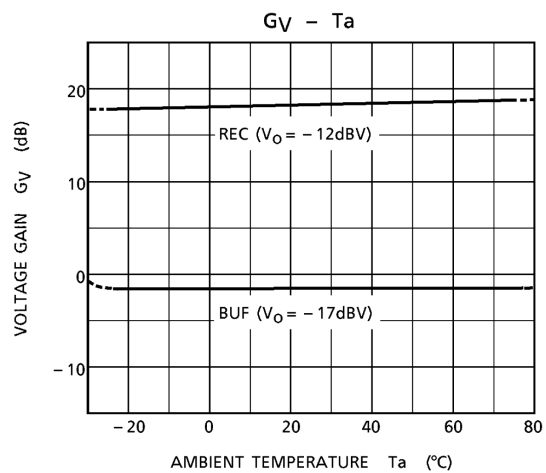
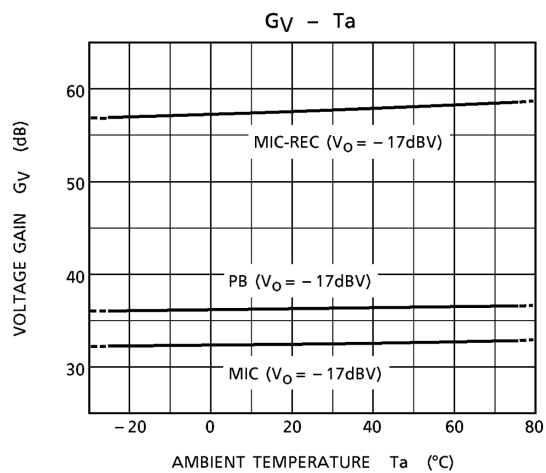
(load of recoding amplifier is shown in test circuit)







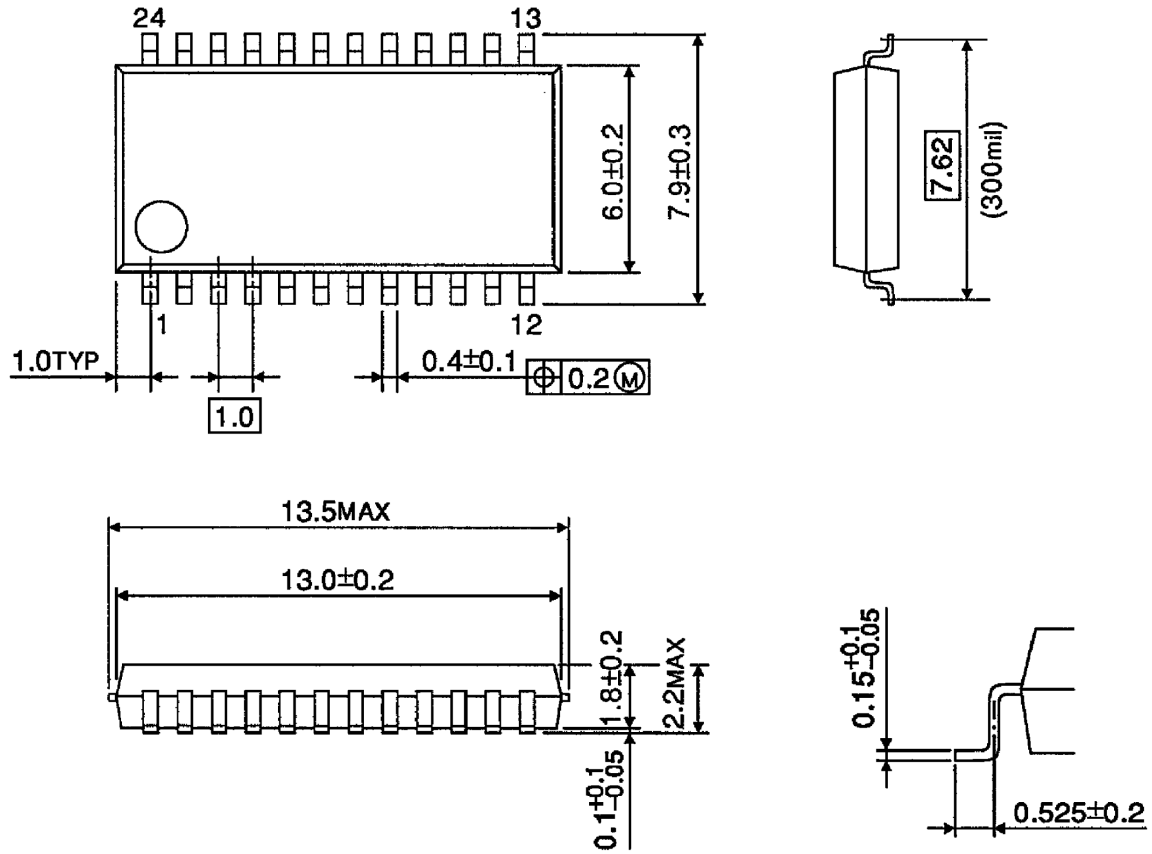




Package Dimensions

SSOP24-P-300-1.00

Unit : mm

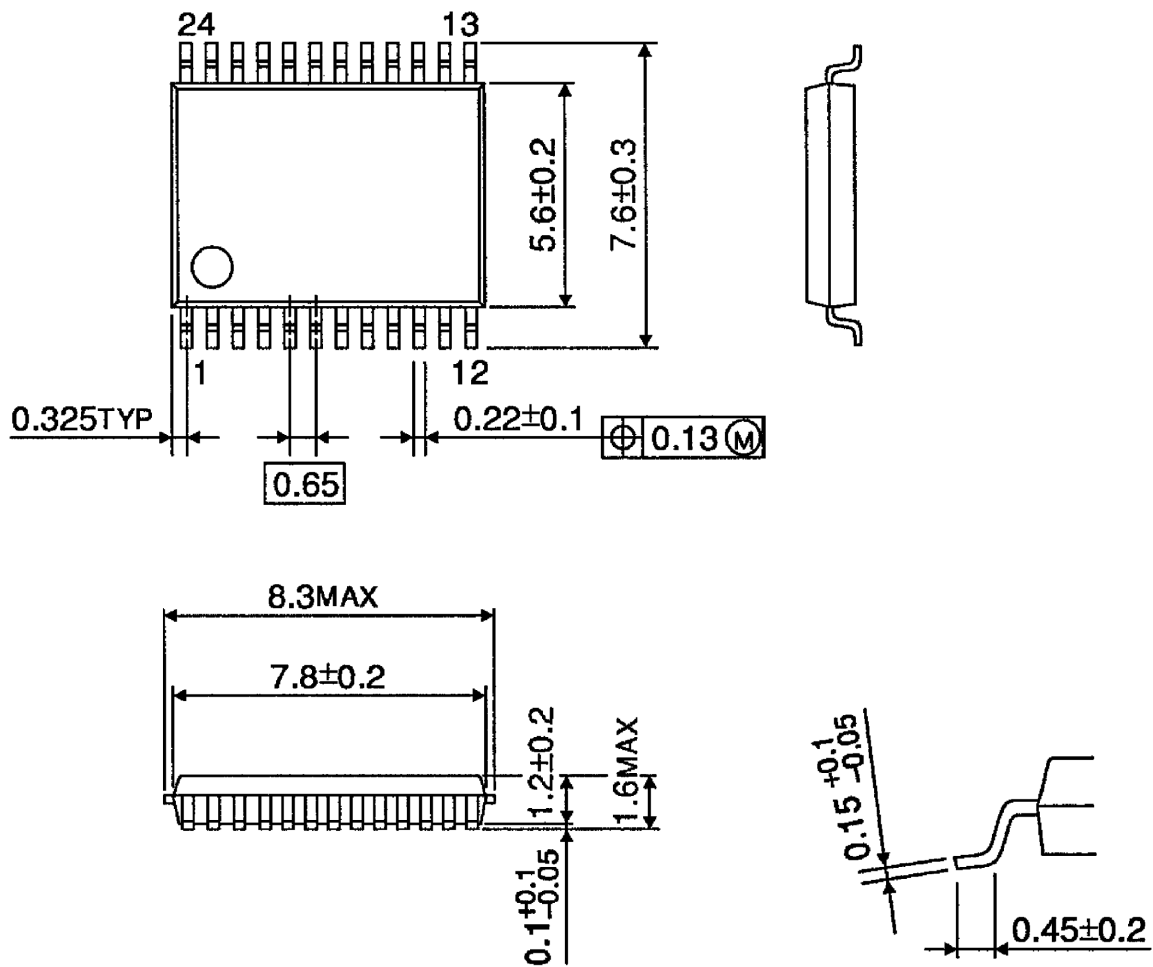


Weight: 0.32g (typ.)

Package Dimensions

SSOP24-P-300-0.65A

Unit : mm



Weight: 0.14g (typ.)

RESTRICTIONS ON PRODUCT USE

060116EBA

- The information contained herein is subject to change without notice. 021023_D
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc. 021023_A
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk. 021023_B
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations. 060106_Q
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others. 021023_C
- The products described in this document are subject to the foreign exchange and foreign trade laws. 021023_E

About solderability, following conditions were confirmed

- Solderability
 - (1) Use of Sn-37Pb 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