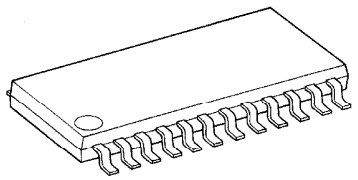
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8155F, TA8155FN

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

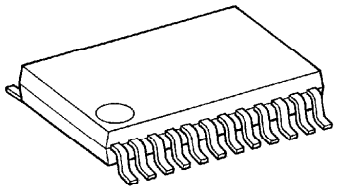
The TA8155F and TA8155FN are REC / PB system dual pre amplifier ICs, which are developed for low voltage operation (1.5 / 3V use). These are especially suitable for a stereo headphone cassette player.

TA8155F



SSOP24-P-300-1.00

TA8155FN



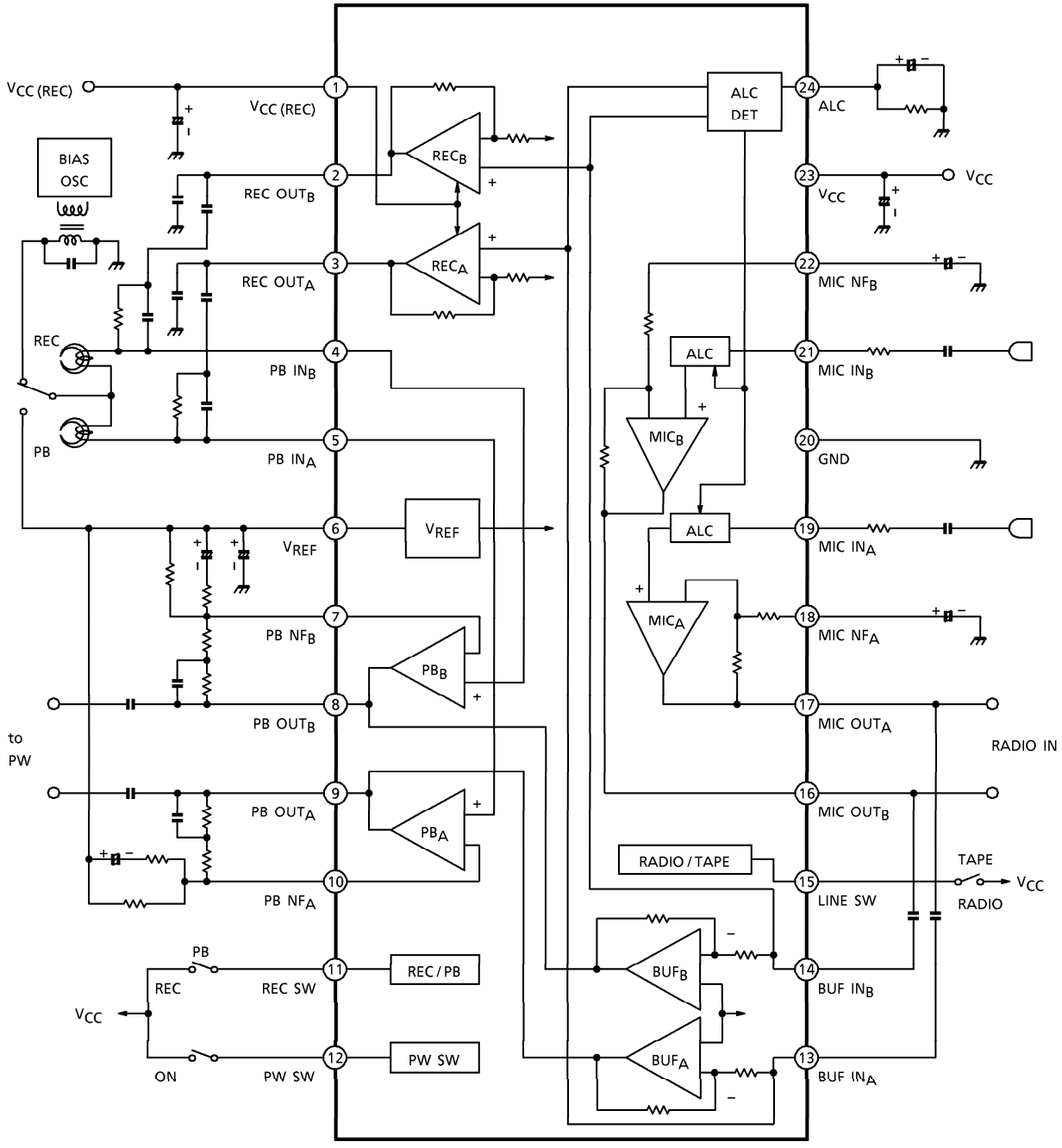
SSOP24-P-300-0.65A

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

FEATURES

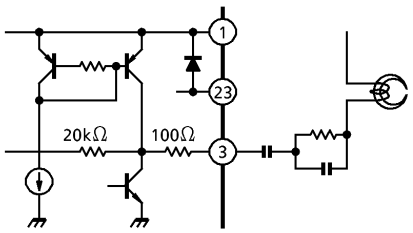
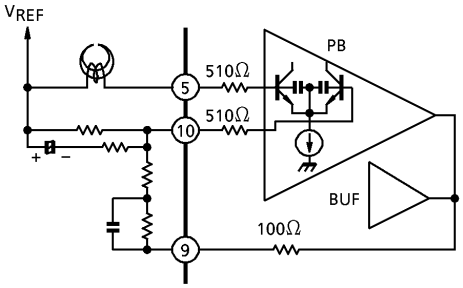
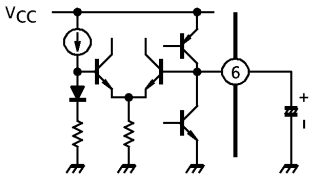
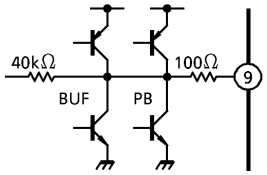
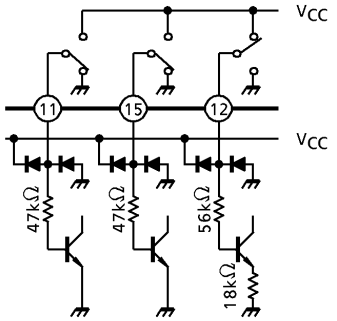
- Built-in dual playback amplifiers.
  Input coupling condenser-less.
  Built-in capacitor for buzz noise.
- Built-in dual buffer amplifiers.
  For radio signal input.
  Monitor for REC mode.
- Built-in dual microphone amplifiers.
  Built-in an ALC circuit for MIC-REC mode.
  (Attack time. : 0.1s (Typ.)
  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, Ta = 25°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. (Ta = 25°C)
  $V_{CC\ (opr)}$ = 0.9~4V
  $V_{CC\ (opr)\ (REC)}$ = 1.8~4V

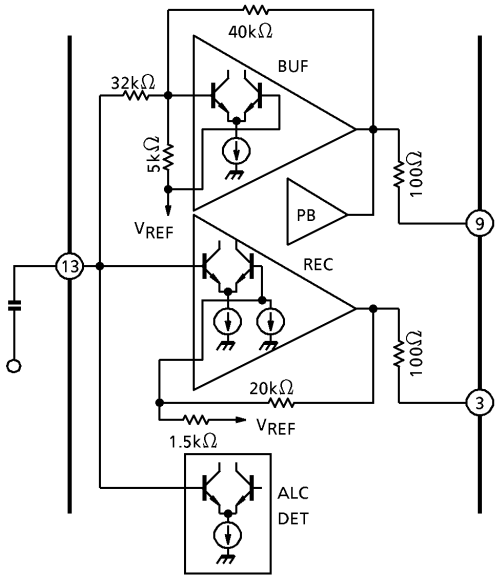
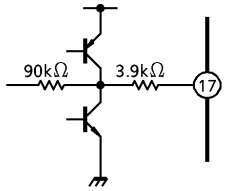
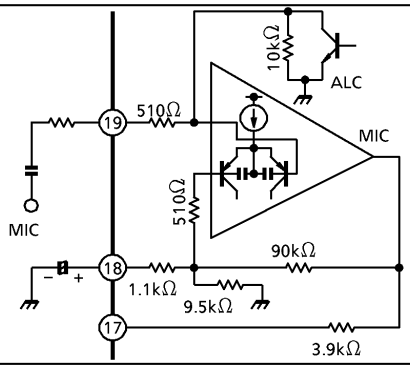
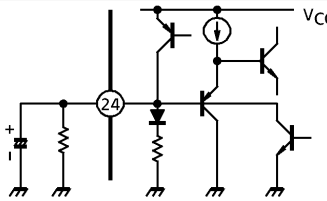
BLOCK DIAGRAM



TERMINAL EXPLANATION

Terminal voltage : Typical terminal voltage at no signal with test circuit.
(V_{CC} = 1.2V, $V_{CC\ (REC)}$ = 2.4V, Ta = 25°C)

TERMINAL No.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
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			
7	PB NF_B	NF of playback amplifier.		0.85
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 No.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
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 (pin⑫), 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 (pin⑪) and LINE SW (pin⑮) (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
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 (pin⑪) or LINE SW (pin⑮), in case that the terminals connected with V_{CC} line independently, even though this IC is off-mode (the terminal of PW SW (pin⑫) is off-mode).
And it is necessary to connect an external pull-down resistor with the terminal REC SW (pin⑪) and LINE SW (pin⑮), 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.

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

ΔV is an off-set voltage which is designed to 18mV.
In case that β of transistor is assumed 100, $I_{B\,(NF)}$ is flowed 0.2μA in Fig.1. And output voltage of playback amplifier (pin⑧, ⑨) in Fig.1 is

$$V_{O\,(PRE)} = 0.85V - 0.018V - (330k\Omega + 13k\Omega) \times \left(\frac{0.018V}{18k\Omega} - 0.2\mu A\right) = 0.56\,(V)$$

Output voltage of playback amplifier should be fixed $V_{CC}/2$, 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 switchover between playback on / off mode (Fig.2).

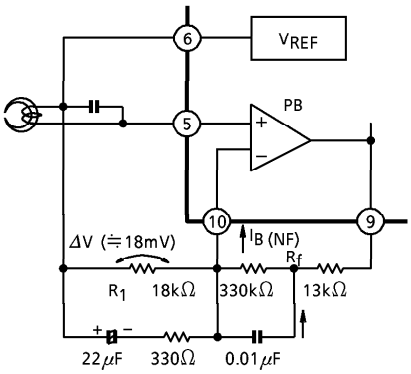


Fig.1 DC output voltage of playback amplifier.

(4) MICROPHONE AMPLIFIER

Current source of 5.5μA 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) $V_{CC\,(REC)}$

The $V_{CC\,(REC)}$ terminal (pin①) is applied bias to $V_{CC\,(REC)} = V_{CC} - 0.7V$, because the $V_{CC\,(REC)}$ terminal (pin①) is connected with the V_{CC} terminal (pin㉓) by diode, as internal circuit of terminal explanation.
And supply current doesn't flow through $V_{CC\,(REC)}$ terminal (pin①), in case that the terminal is connected with V_{CC} line, even though this IC is on-mode and except REC mode.

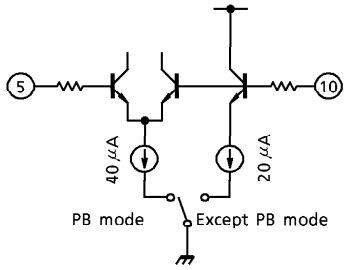


Fig.2 Reducing a pop sound of mode switchover (1).

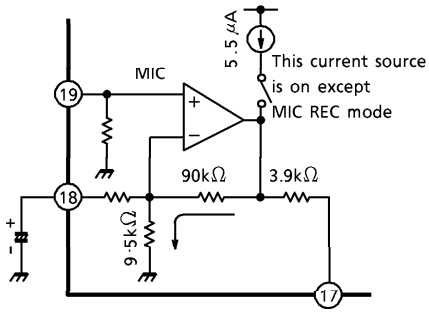


Fig.3 Reducing a pop sound of mode switchover (2).

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	4.5	V
		$V_{CC\,(REC)}$	4.5	
Power Dissipation	TA8155F	P_D (Note)	400	mW
	TA8155FN		500	
Operating Temperature		T_{opr}	−25~75	°C
Storage Temperature		T_{stg}	−55~150	°C

(Note) Derated above Ta = 25°C in the proportion of 3.2mW / °C for TA8155F, and of 4mW / °C for TA8155FN.

ELECTRICAL CHARACTERISTICS

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

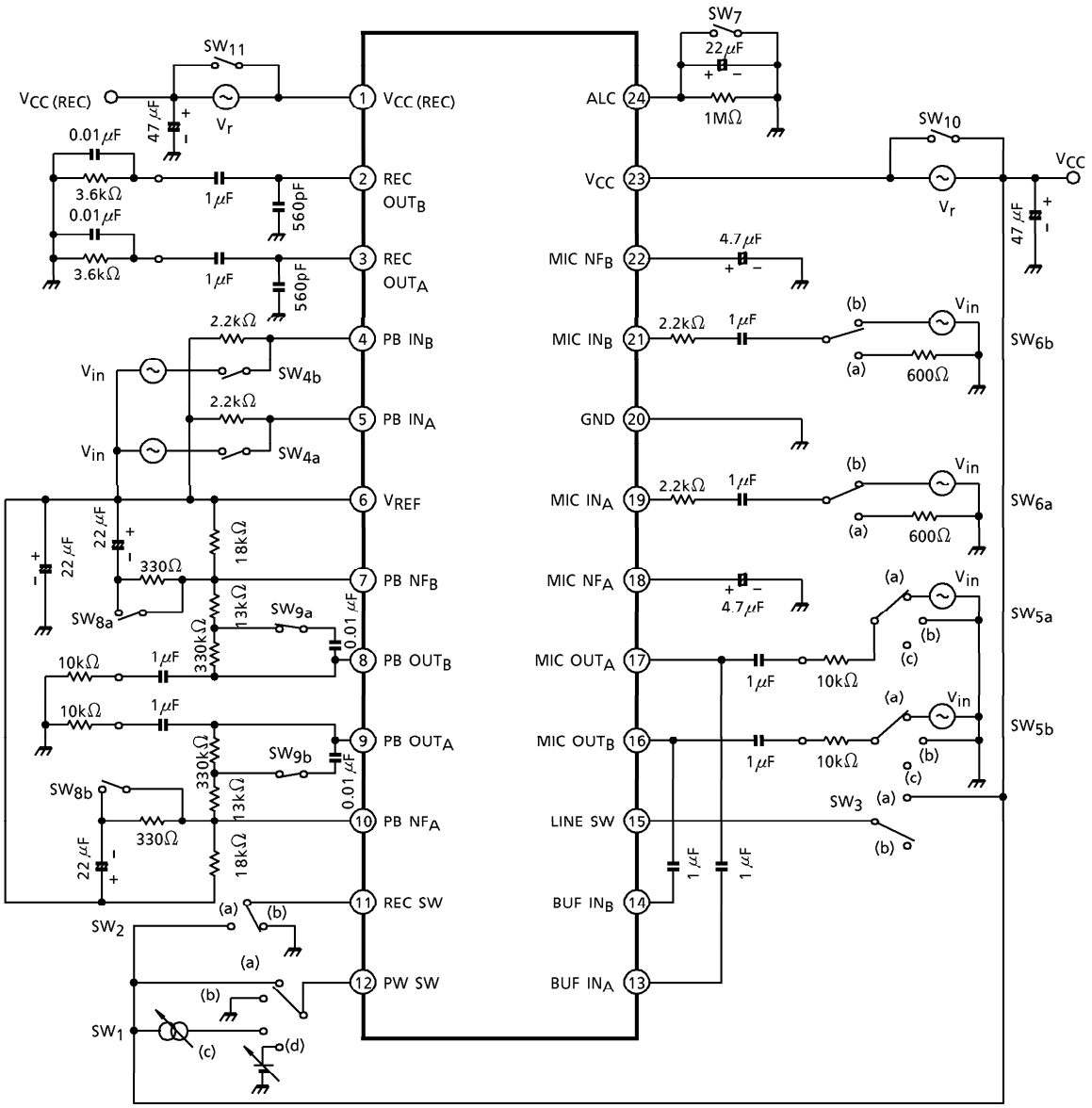
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	PW OFF	I_{CCQ1}	—	SW_1 : b, SW_2 : b, SW_3 : b	—	0.1	5	μA
	PB	I_{CCQ2}		SW_2 : b, SW_3 : b	—	2.6	3.9	mA
	RADIO	I_{CCQ3}		SW_2 : b, SW_3 : a	—	2.4	3.6	
	RADIO-REC	I_{CCQ4}		SW_2 : a, SW_3 : a	—	3.0	4.5	
	MIC-REC	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_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_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_o = – 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_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_5 : b, BPF = 30Hz~20kHz	—	35	—	μV_{rms}
	Cross Talk (CH-A / CH-B)	CT2	—	V_o = – 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_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_5 : 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_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_o = – 17dBV	30	32.5	35	dB
	Maximum Output Voltage	V_{om4}	—	THD = 1%	120	200	—	mV_{rms}
	Total Harmonic Distortion	THD4	—	V_o = – 17dBV	—	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_o = – 17dBV	—	52	—	dB
	Ripple Rejection Ratio	RR4	—	SW_6 : a, SW_{10} : open f_r = 100Hz, V_r = – 32dBV	—	36	—	
Microphone Amplifier + Recording Amplifier	Voltage Gain	G_{V5}	—	SW_7 : on, V_o = – 17dBV	—	58	—	dB
	Maximum Output Voltage	V_{om5}	—	THD = 3%	600	800	—	mV_{rms}
	ALC Total Harmonic Distortion	THD5	—	V_{in} = – 32dBV	—	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} = – 62dBV	– 11.7	– 8.5	– 6.7	dBV
		V_{oALC2}	—	V_{in} = – 32dBV	– 11.7	– 8.5	– 6.7	
	ALC Channel Balance	CB_{ALC}	—		—	0	1.5	dB
	ALC Width	W_{ALC}	—	$V_{oALC} \leqq$ 3dB (Input Voltage) with respect to standard V_{in} = – 42dBV	—	48	—	
	Cross Talk (CH-A / CH-B)	CT5	—	V_{in} = – 32dBV	—	37	—	dB
	Ripple Rejection Ratio	RR5	—	SW_6 : a f_r = 100Hz, V_r = – 17dBV	—	39	—	
Power Switch	Power On Current	I_{12}	—	SW_1 : c, SW_2 : b, SW_3 : b $V_6 \geqq$ 0.6V	5	—	—	μA
	Power Off Voltage	V_{12}	—	SW_1 : d, SW_2 : b, SW_3 : b $V_6 \leqq$ 0.2V	0	—	0.3	V

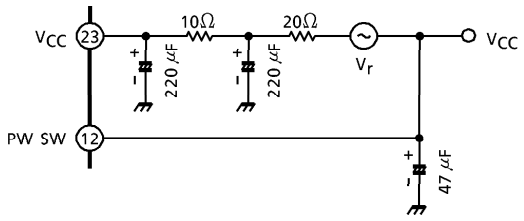
SWITCH CONDITION FOR TEST MODE (Unless otherwise specified.)

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 / SWITCH	PB	BUF	BUF REC	MIC-ALC 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



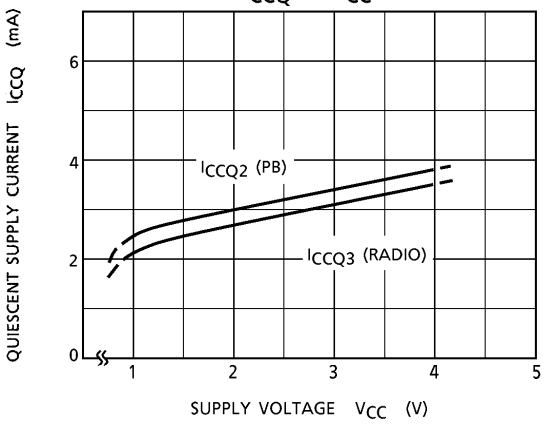
(*) RR5 is measured by circuit below (for V_{CC} line)



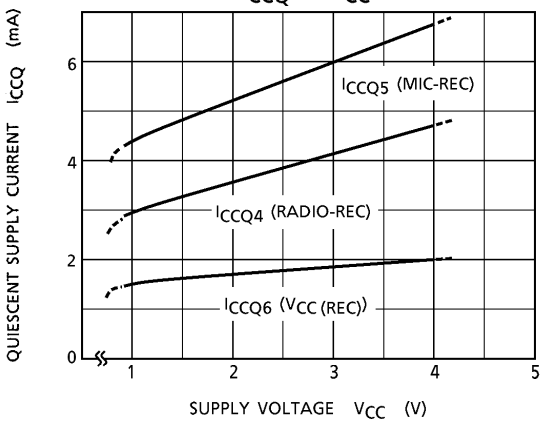
CHARACTERISTIC CURVES

Unless otherwise specified V_{CC} = 1.2V, $V_{CC\,(REC)}$ = 2.4V, f = 1kHz, Ta = 25°C
R_L = 10kΩ : PB AMP., BUF AMP., MIC AMP.
(Load of recoading amplifier is shown in test circuit)

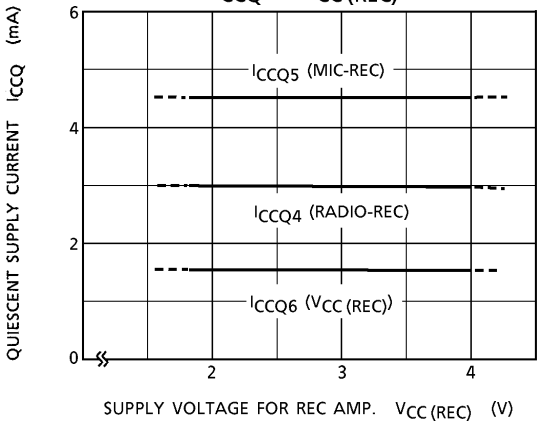
I_{CCQ} – V_{CC}



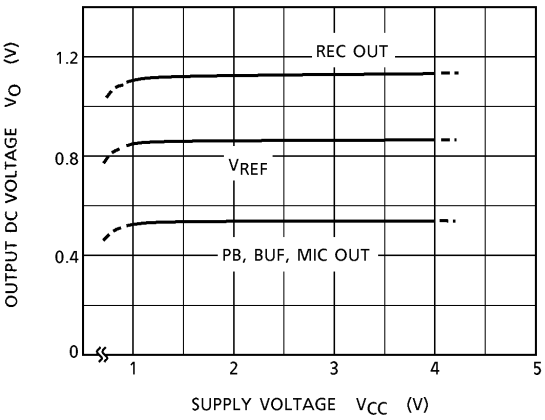
I_{CCQ} – V_{CC}



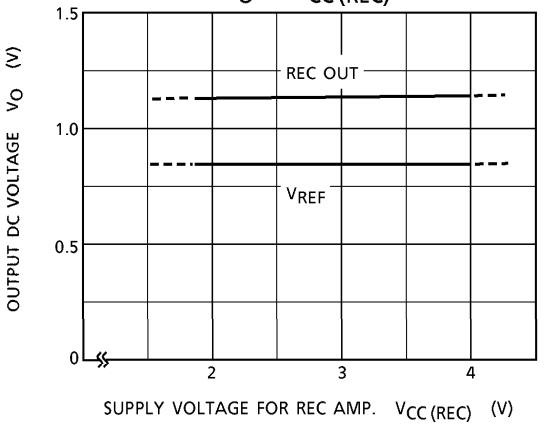
I_{CCQ} – $V_{CC\,(REC)}$



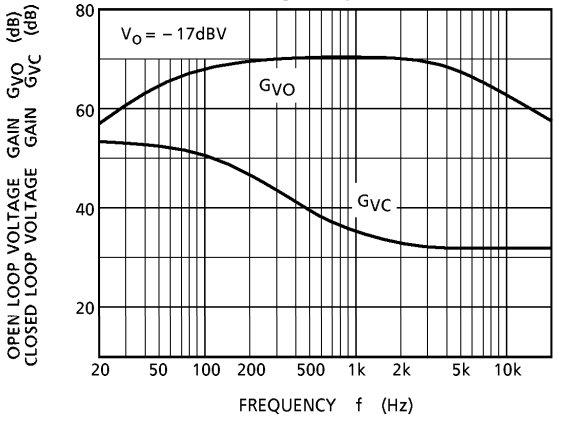
V_O – V_{CC}



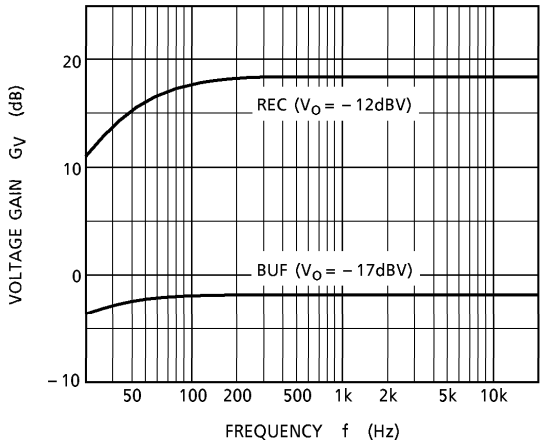
V_O – $V_{CC\,(REC)}$



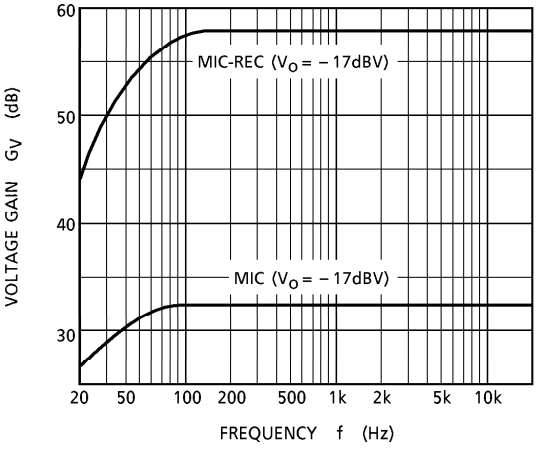
PB G_{VO}, G_{VC} – f



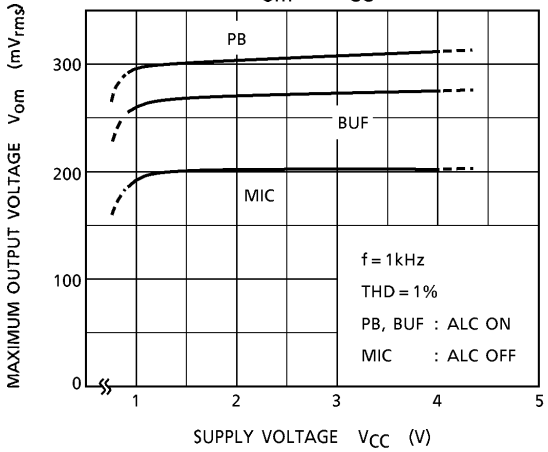
G_V – f



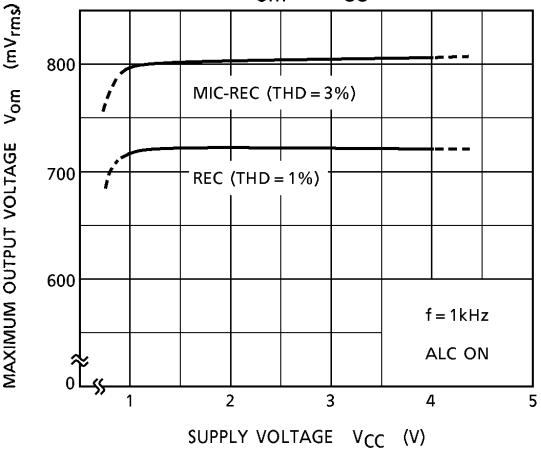
G_V – f



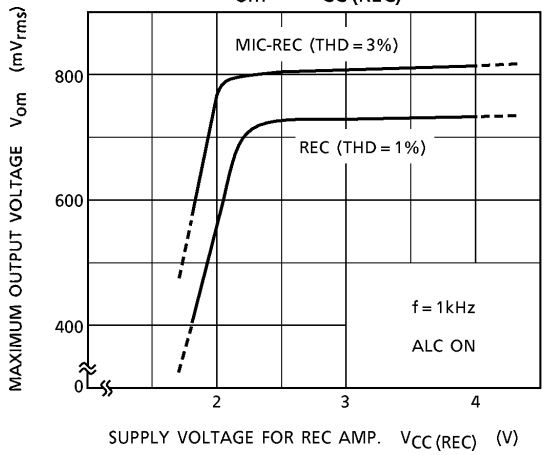
V_{om} – V_{CC}



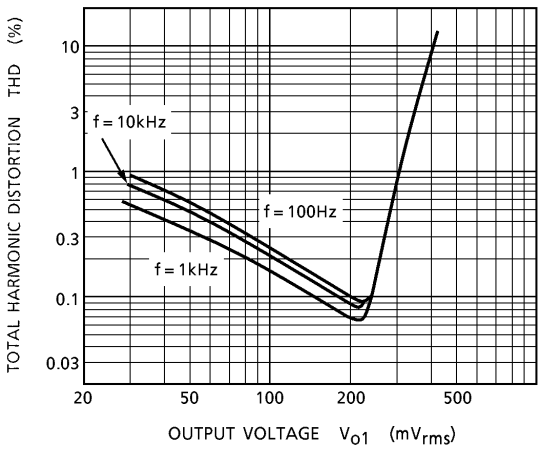
V_{om} – V_{CC}



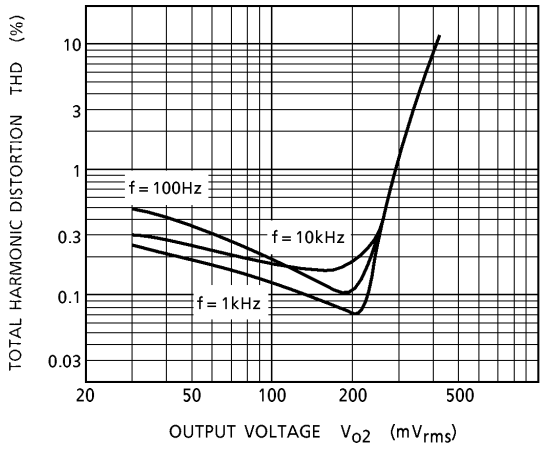
V_{om} – $V_{CC\,(REC)}$



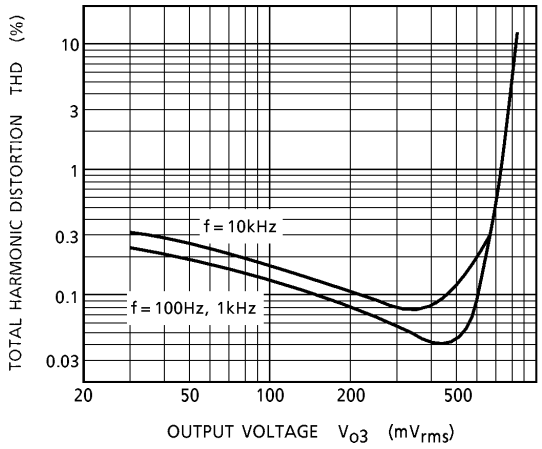
PB THD – V_{o1}



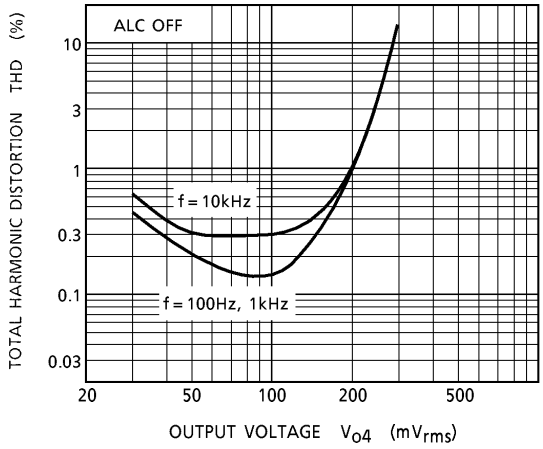
BUF THD – V_{O2}



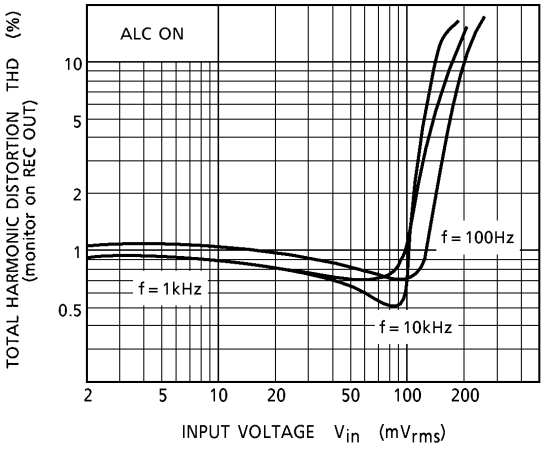
REC THD – V_{O3}



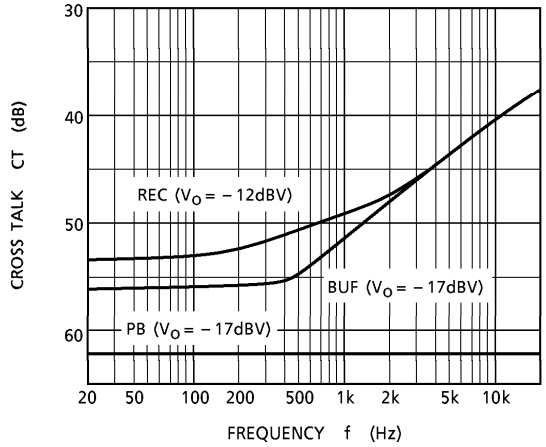
MIC THD – V_{O4}



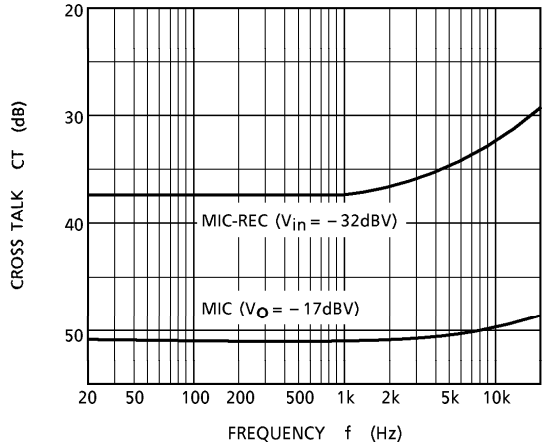
MIC-REC THD – V_{in}



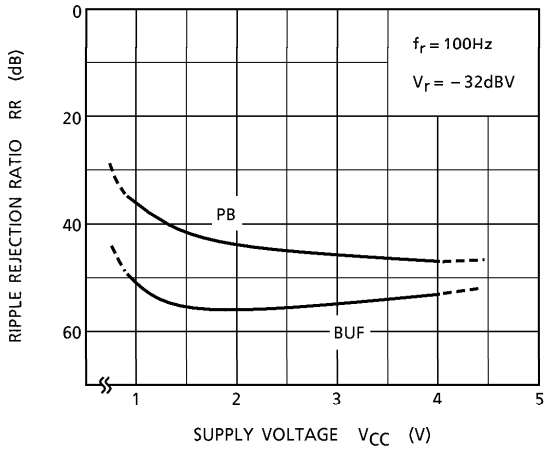
CT – f



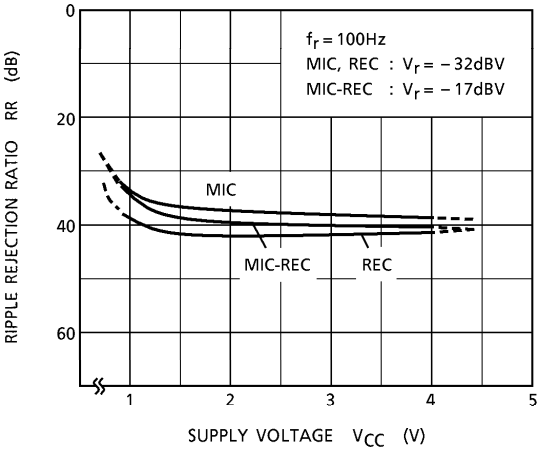
CT – f



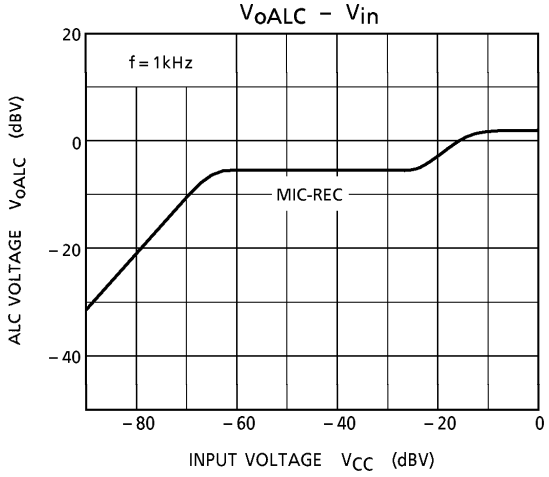
RR – V_{CC}



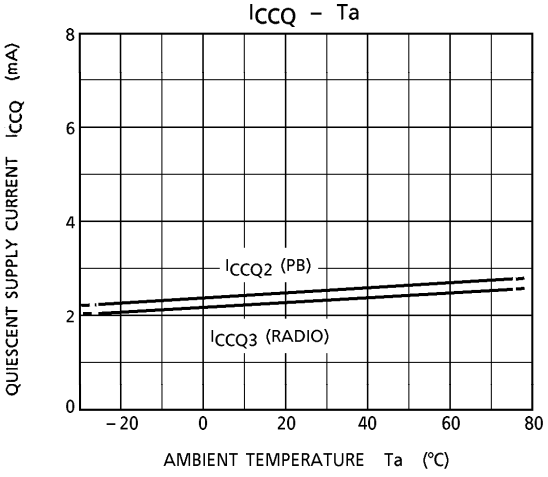
RR – V_{CC}



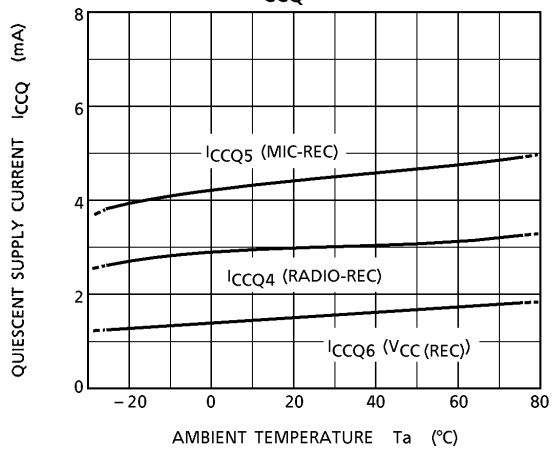
V_{OALC} – V_{in}



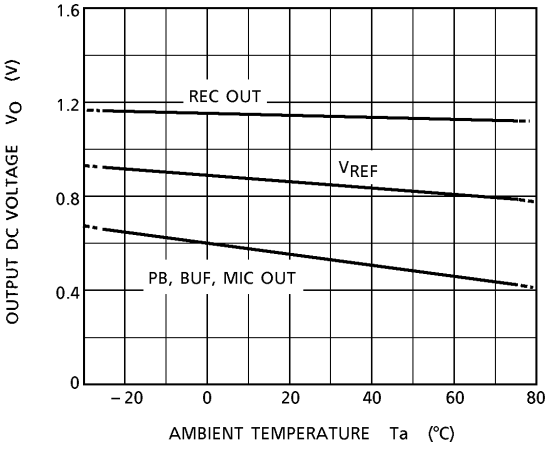
I_{CCQ} – Ta



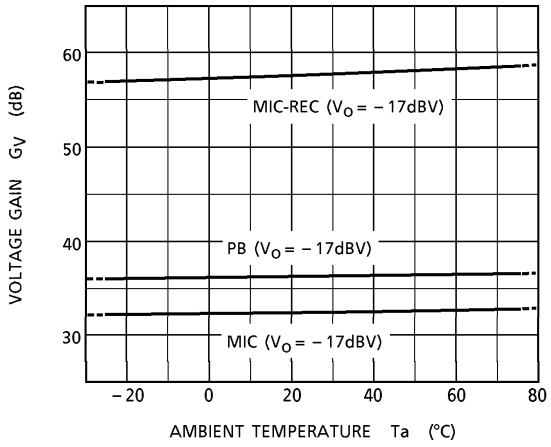
I_{CCQ} – Ta



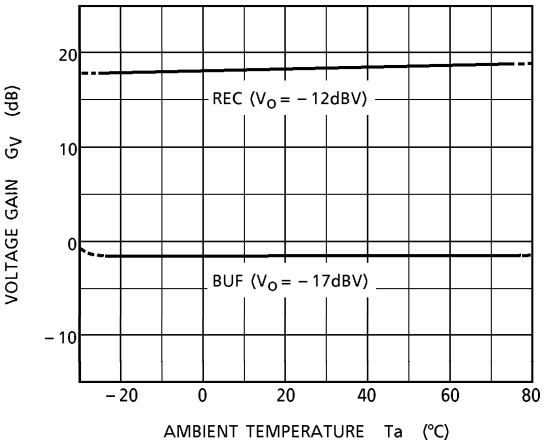
V_O – Ta



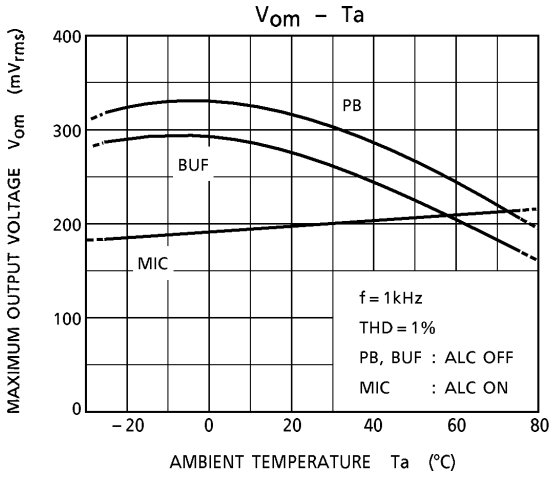
G_V – Ta



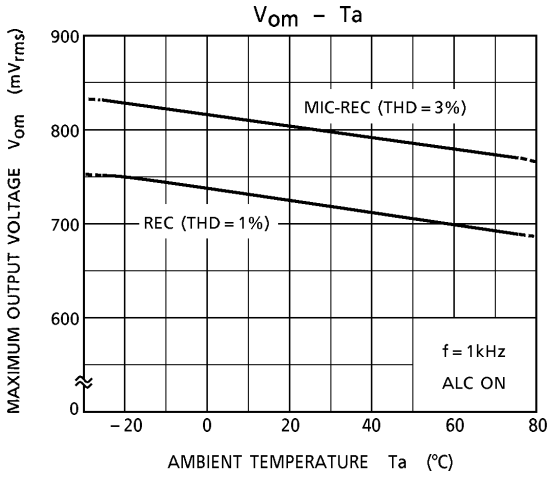
G_V – Ta



V_{om} – Ta



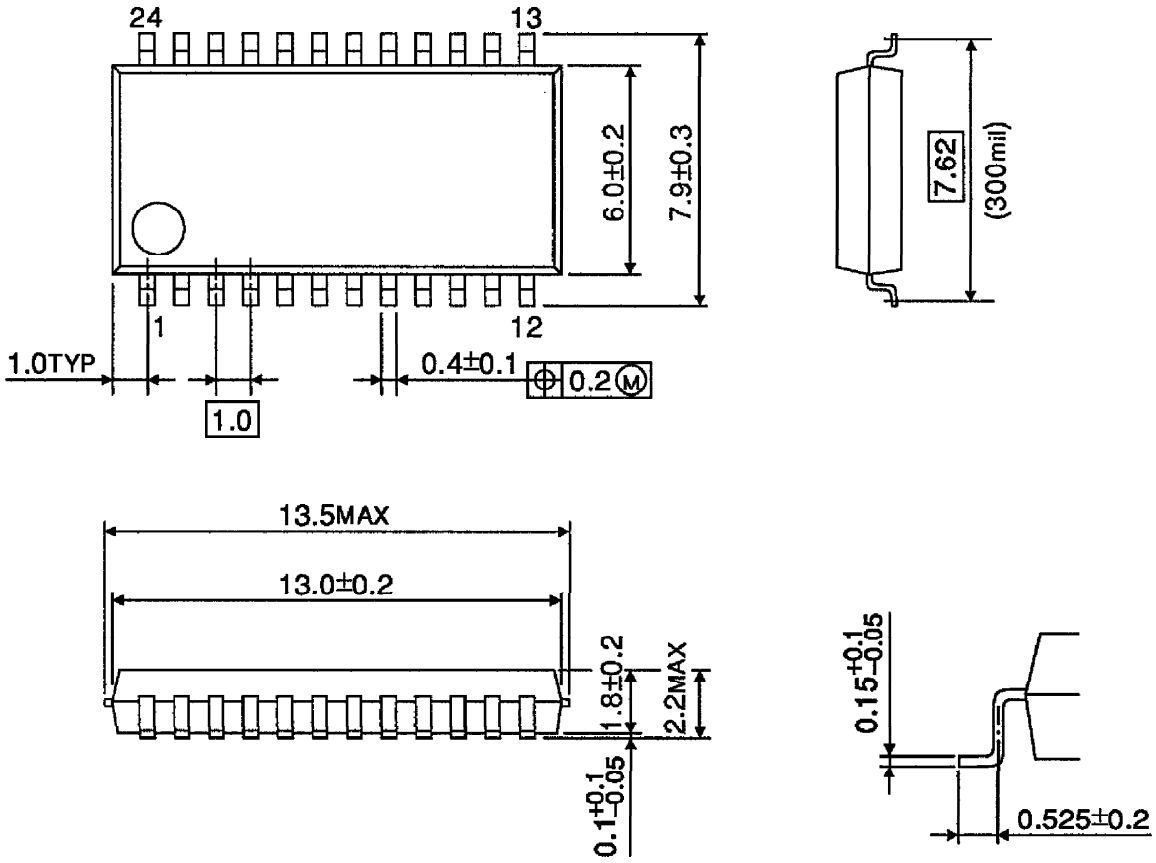
V_{om} – Ta



OUTLINE DRAWING

SSOP24-P-300-1.00

Unit : mm

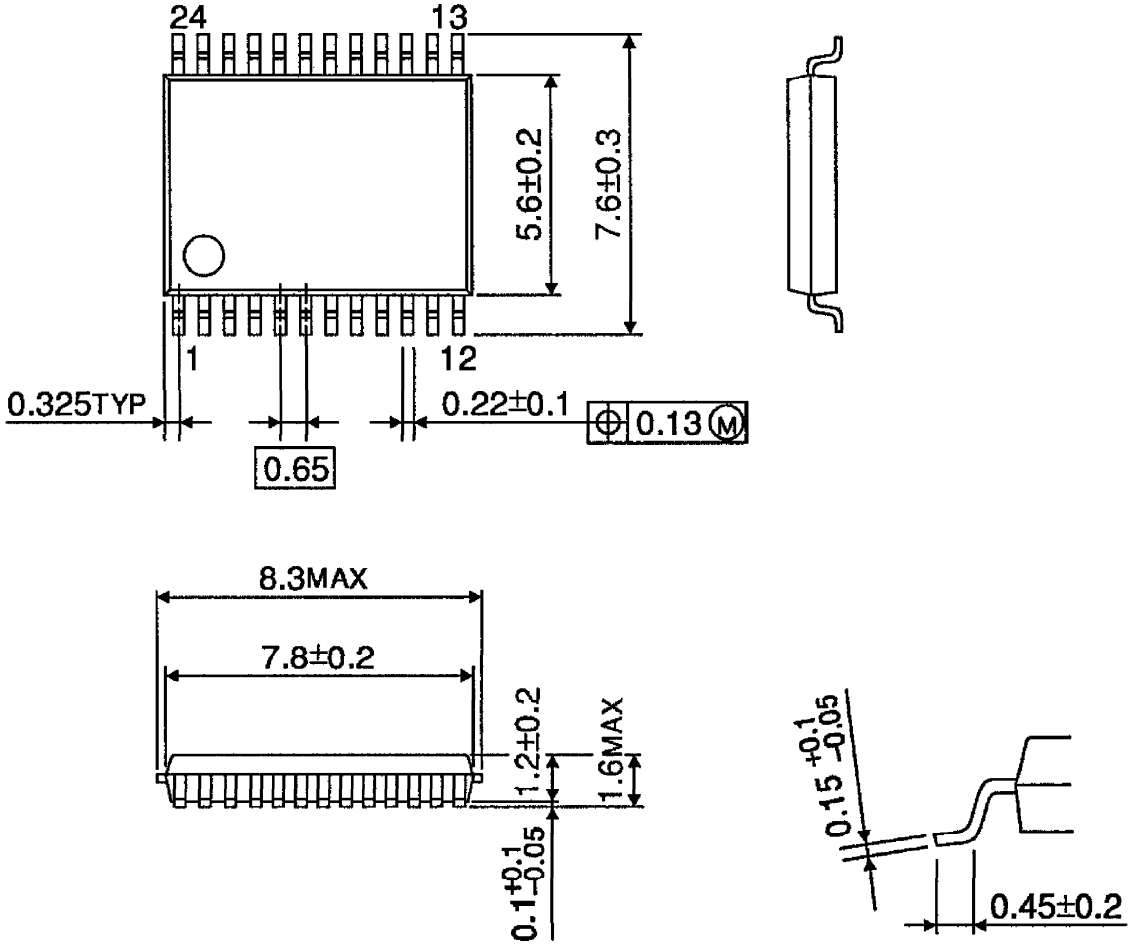


Weight : 0.32g (Typ.)

OUTLINE DRAWING

SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14g (Typ.)