

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

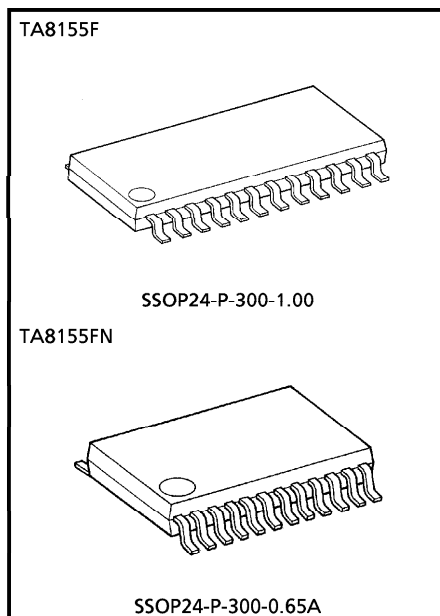
TA8155F, TA8155FN

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. ($T_a = 25^\circ C$)
 $V_{CC}(\text{opr}) = 0.9\sim 4V$
 $V_{CC}(\text{opr})(\text{REC}) = 1.8\sim 4V$

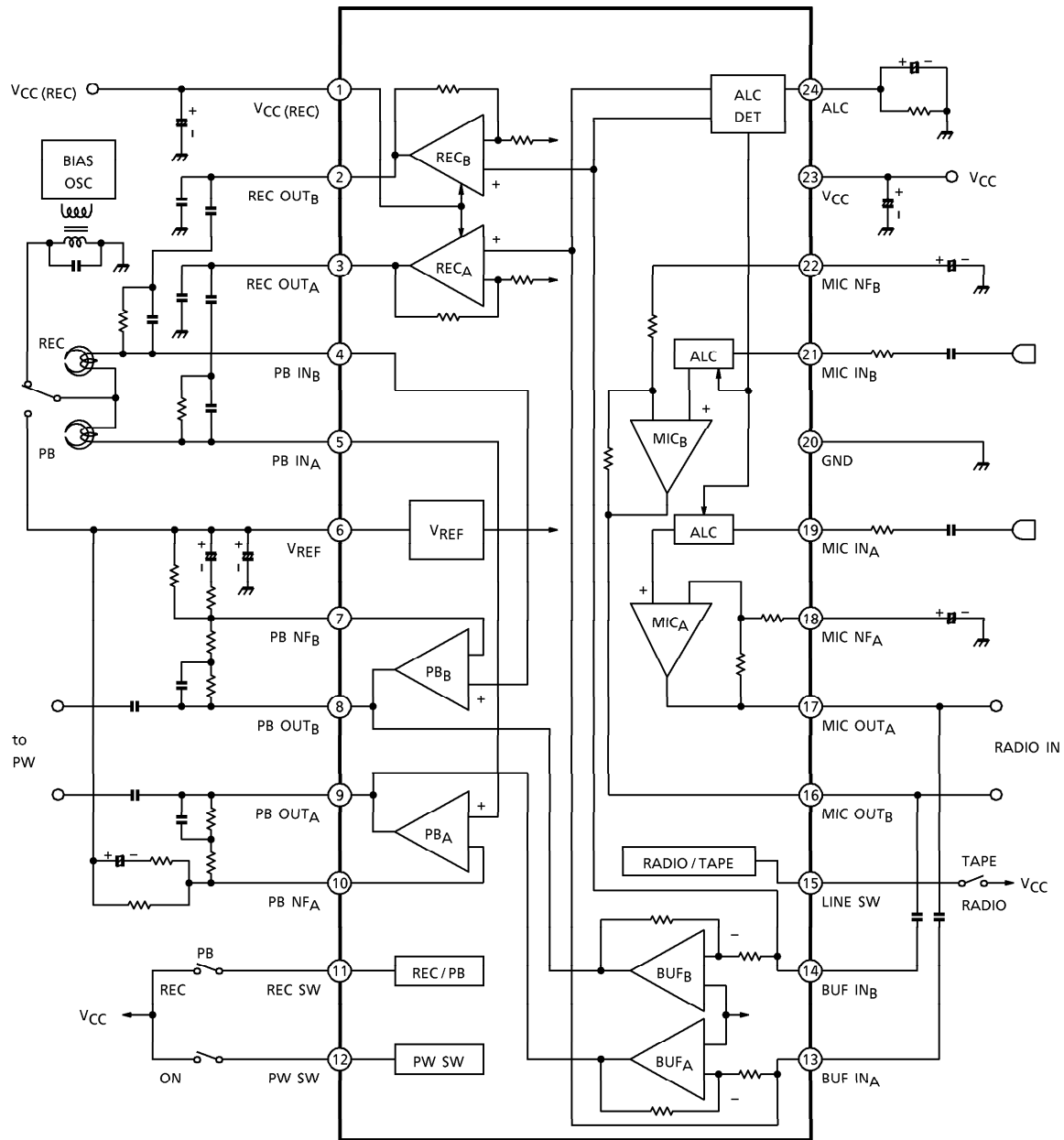


Weight	
SSOP24-P-300-1.00	: 0.32g (Typ.)
SSOP24-P-300-0.65A	: 0.14g (Typ.)

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BLOCK DIAGRAM

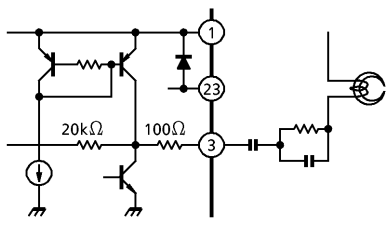
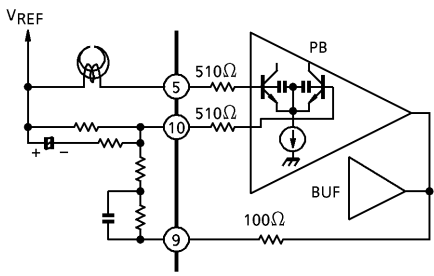
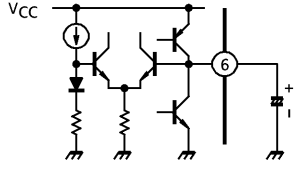
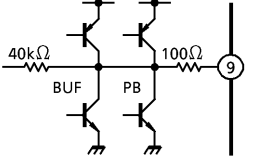
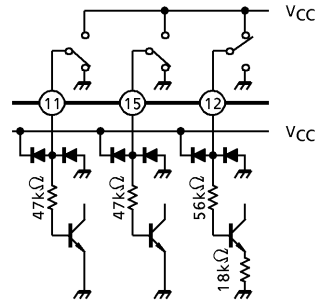


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TERMINAL EXPLANATION

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	$V_{CC(REC)}$	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		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 (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).

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.

- 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.

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 R₁ 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).

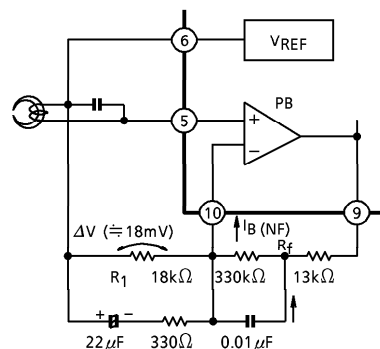


Fig.1 DC output voltage of playback amplifier.

(4) MICROPHONE AMPLIFIER

Current source of $5.5\mu A$ 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) $V_{CC(REC)}$

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 (pin⑭) 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.

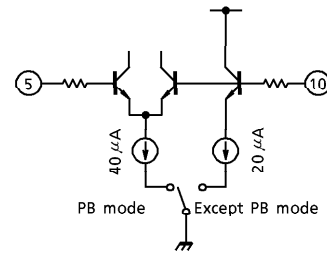


Fig.2 Reducing a pop sound of mode switchover (1).

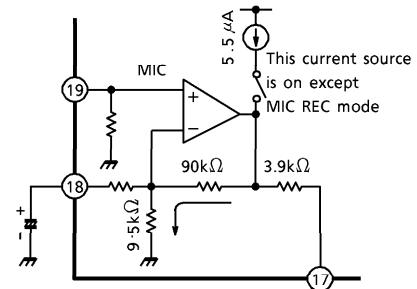


Fig.3 Reducing a pop sound of mode switchover (2).

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	4.5	V
	$V_{CC(REC)}$	4.5	
Power Dissipation	P_D (Note)	400	mW
		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 : $V_{CC} = 1.2V$, $V_{CC(REC)} = 2.4V$, $f = 1kHz$, $T_a = 25^\circ C$, $SW_1 : a$, $SW_8 : open$
 $SW_9 : on$, $SW_{10} : on$, $SW_{11} : on$, $SW_2 \sim SW_7$ condition by next page

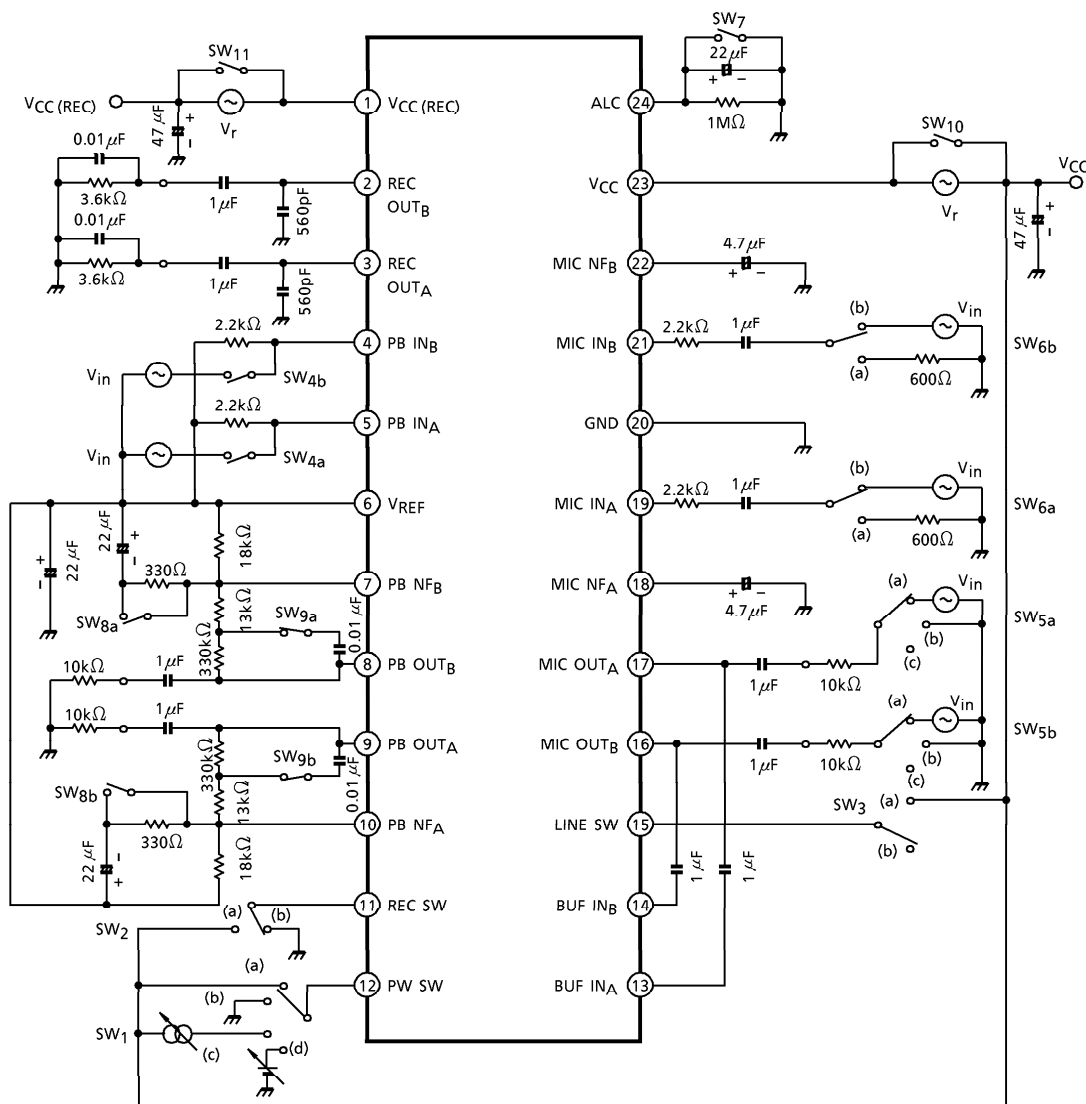
CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	PW OFF	I_{CCO1}	—	$SW_1 : b$, $SW_2 : b$, $SW_3 : b$	—	0.1	5	μA
	PB	I_{CCO2}		$SW_2 : b$, $SW_3 : b$	—	2.6	3.9	mA
	RADIO	I_{CCO3}		$SW_2 : b$, $SW_3 : a$	—	2.4	3.6	
	RADIO-REC	I_{CCO4}		$SW_2 : a$, $SW_3 : a$	—	3.0	4.5	
	MIC-REC	I_{CCO5}		$SW_2 : a$, $SW_3 : b$	—	4.5	6.5	
	$V_{CC(REC)}$	I_{CCO6}		$SW_2 : a$, $SW_3 : b$	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 CIRCUIT	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}	—	V _{in} = -32dBV	—	0	1.5	dB
	ALC Width	W _{ALC}	—	V _{oALC} ≤ 3dB (Input Voltage) with respect to standard V _{in} = -42dBV	—	48	—	
	Cross Talk (CH-A / CH-B)	CT5	—	V _{in} = -32dBV	—	37	—	
Ripple Rejection Ratio	RR5	—	SW ₆ : a f _r = 100Hz, V _r = -17dBV	—	39	—	dB	
Power Switch	Power On Current	I ₁₂	—	SW ₁ : c, SW ₂ : b, SW ₃ : b V ₆ ≥ 0.6V	5	—	—	μA
	Power Off Voltage	V ₁₂	—	SW ₁ : d, SW ₂ : b, SW ₃ : b V ₆ ≤ 0.2V	0	—	0.3	V

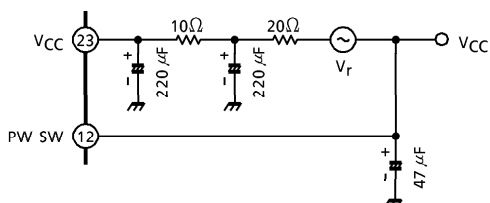
SWITCH CONDITION FOR TEST MODE (Unless otherwise specified.)

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

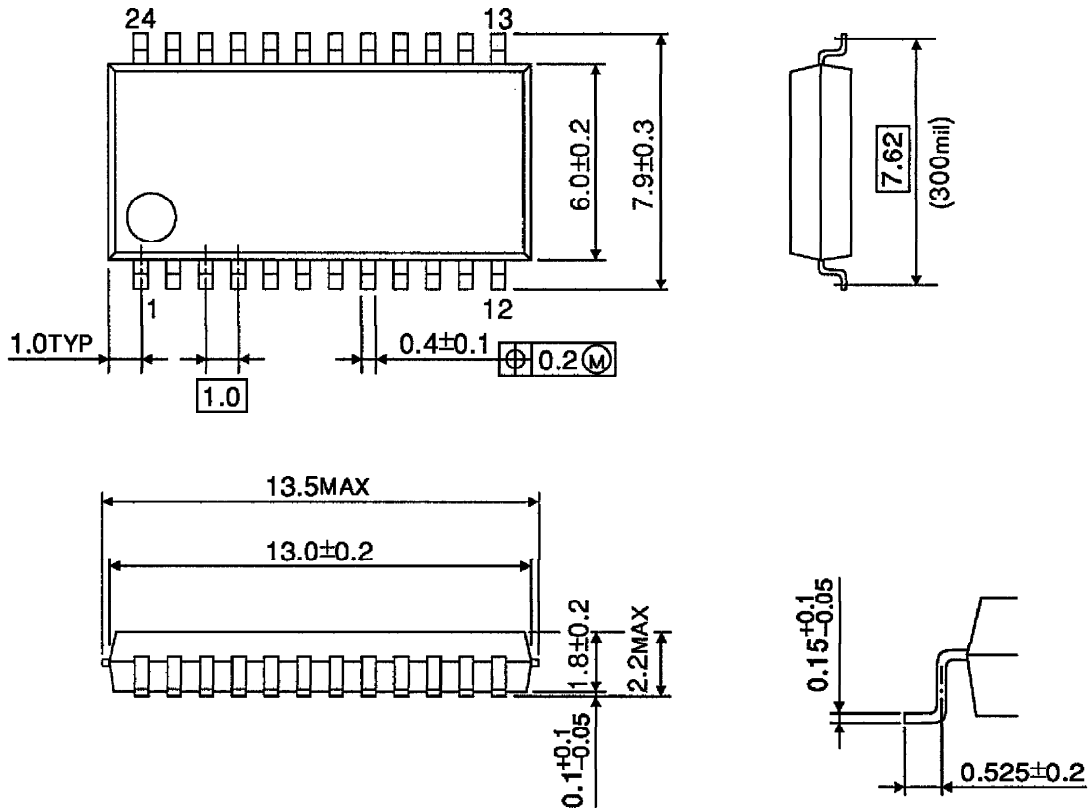


(*) RR5 is measured by circuit below (for VCC line)



OUTLINE DRAWING
SSOP24-P-300-1.00

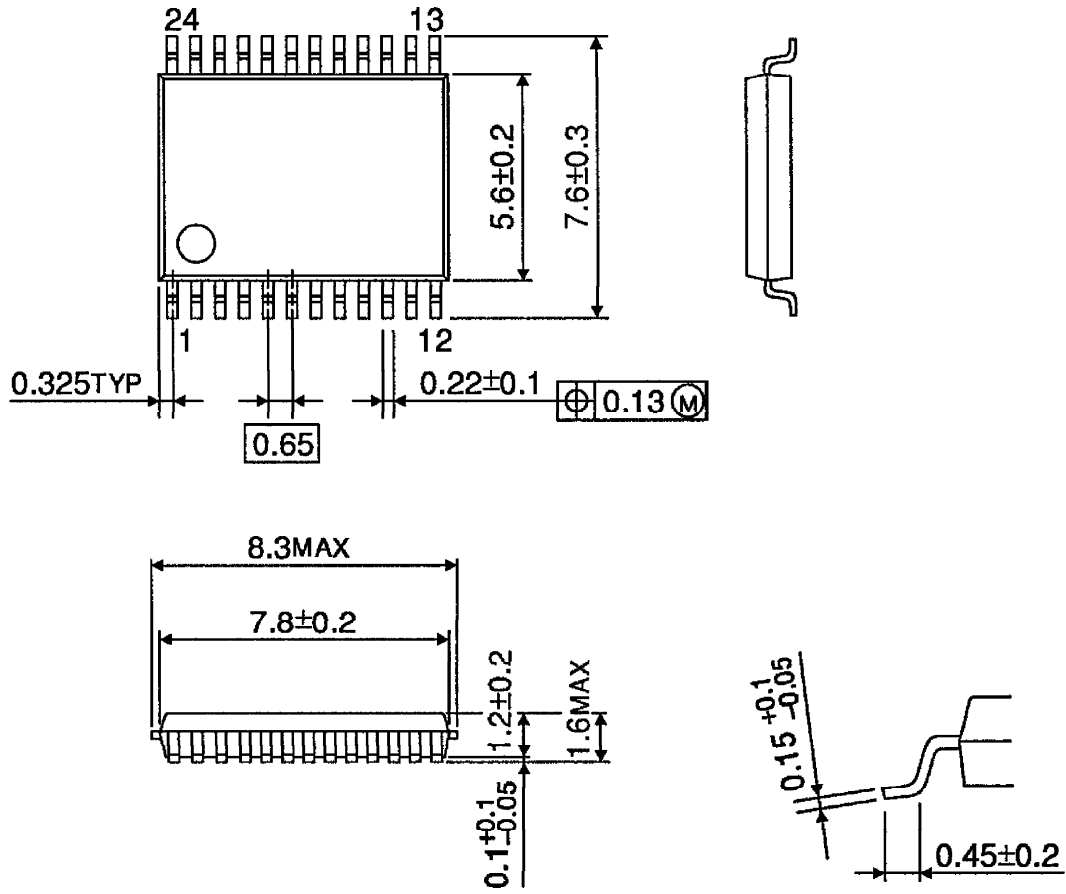
Unit : mm



Weight : 0.32g (Typ.)

OUTLINE DRAWING
SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14g (Typ.)