



SANYO Semiconductors

DATA SHEET

LV4995TT — Bi-CMOS IC For Portable Audio Equipment Monaural BTL Power Amplifier

Overview

The LV4995TT built-in the power amplifier circuit capable of low-voltage (2V and up) operation and has additionally a standby function to reduce the current drain. It is a power amplifier IC optimal for speaker drive used in battery-driven portable equipment and other such products.

Features

- Monaural BTL power amplifier built-in
 - Standard output power = 250mW ($V_{CC} = 3V$, $R_L = 8\Omega$, THD = 10%)
 - Output coupling capacitor not necessary because of differential output type
- Operation at low voltage possible (operates with two dry cells)
 - $V_{CC} = 2V$ or more
- Standby function built-in
 - Standard current drain at standby = 0.1 μ A ($V_{CC} = 3V$)
- Second amplifier stop control function built-in : Reducing the pop noise at startup, simple MUTE
- Overheat protection circuit built-in
- Gain setting possible
 - BTL voltage gain = 0 to 26dB
- Output phase compensation capacitor not necessary

Use

- Portable audio equipment including IC recorders, portable radios, and more.

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61108 MS PC No.A1226-1/12

LV4995TT

Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		4	V
Allowable power dissipation	P_d max	PCB mounted*	500	mW
Maximum junction temperature	T_j max		150	$^\circ\text{C}$
Operating temperature	T_{opr}		-40 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +150	$^\circ\text{C}$

* SANYO evaluation board : 40mm × 40mm × 1.6m, glass epoxy single sided circuit board

Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3	V
Recommended load resistance	R_L		8 to 32	Ω
Allowable operating supply voltage range	V_{CC} op		2 to 3.6	V

* Determine the supply voltage to be used with due consideration of allowable power dissipation.

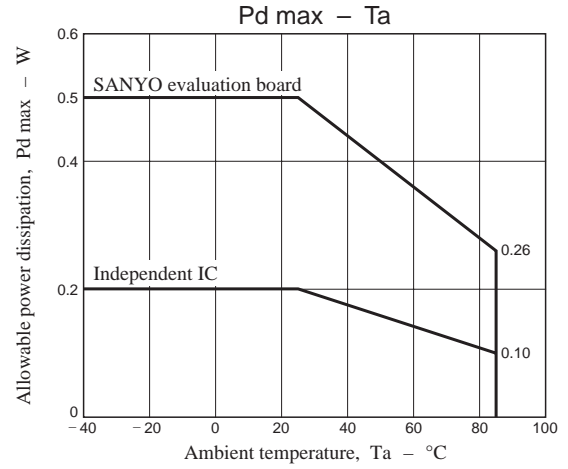
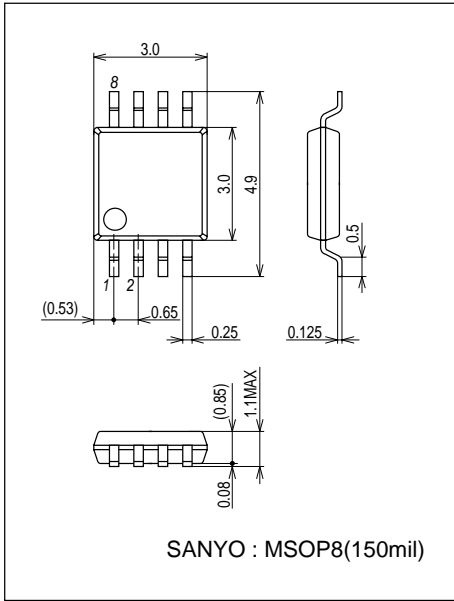
Electrical Characteristics $T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$, $f_{in} = 1\text{kHz}$, $R_L = 8\Omega$, $V_2 = \text{HIGH}$, $V_4 = \text{HIGH}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current drain 1	I_{CCOP1}	No signal, $R_L = \infty$		2.8	4.8	mA
Quiescent current drain 2	I_{CCOP2}	No signal, $R_L = \infty$, $V_4 = \text{LOW}$ (second amplifier stop)		1.7		mA
Stand-by current drain	I_{STBY}	No signal, $R_L = \infty$, $V_2 = \text{LOW}$ (standby)		0.1	5	μA
Maximum output power	P_{OMAX}	THD = 10%	170	250		mW
Voltage gain	VG	$V_{IN} = -20\text{dBV}$	14	15.5	17	dB
Voltage gain use range	VGR		0		26	dB
Total harmonic distortion	THD	$V_{IN} = -20\text{dBV}$		0.16	1	%
Output noise voltage	V_{NOUT}	$R_g = 620\Omega$, 20 to 20kHz		56	150	μVrms
Output DC offset voltage	V_{OS}		-30	0	-30	mV
Mute attenuation level 1	MUTE1	$V_{IN} = 0\text{dBV}$, $V_2 = \text{LOW}$ (standby)		-100		dBV
Mute attenuation level 2	MUTE2	$V_{IN} = -10\text{dBV}$, $V_4 = \text{LOW}$ (second amplifier stop)		-89		dBV
Ripple rejection ratio	SVRR	$R_g = 620\Omega$, $f_r = 100\text{Hz}$, $V_r = -20\text{dBV}$		50		dB
Reference (pin 3) voltage	VREF			1.48		V
Pin 2 control HIGH voltage	VSTBH	Power amplifier operation mode	1.6		V_{CC}	V
Pin 2 control LOW voltage	VSTBL	Power amplifier standby mode	0		0.3	V
Pin 4 control HIGH voltage	VCNTH	Second power amplifier operation mode	1.6		V_{CC}	V
Pin 4 control LOW voltage	VCNTL	Second power amplifier standby mode	0		0.3	V

Package Dimensions

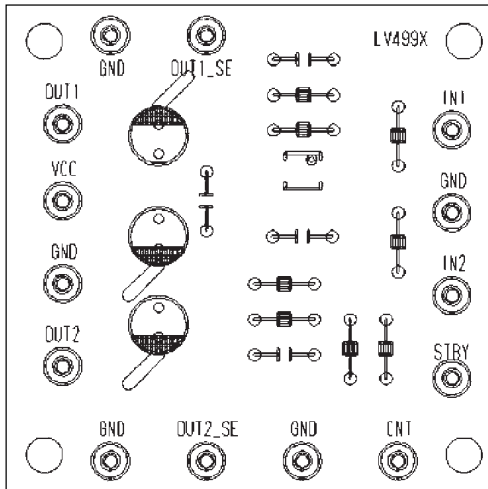
unit : mm (typ)

3245B

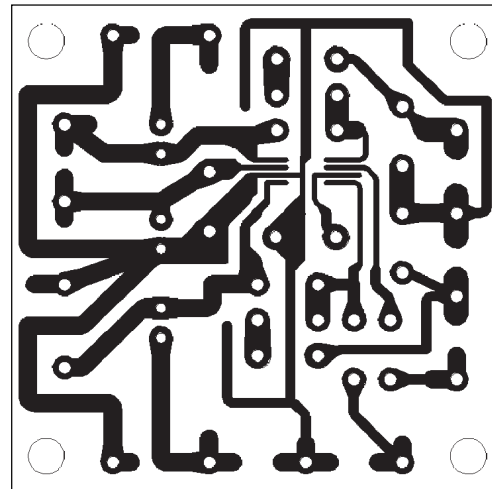


SANYO evaluation board (single sided printed circuit board)

Size : 40mmx40mmx1.6mm



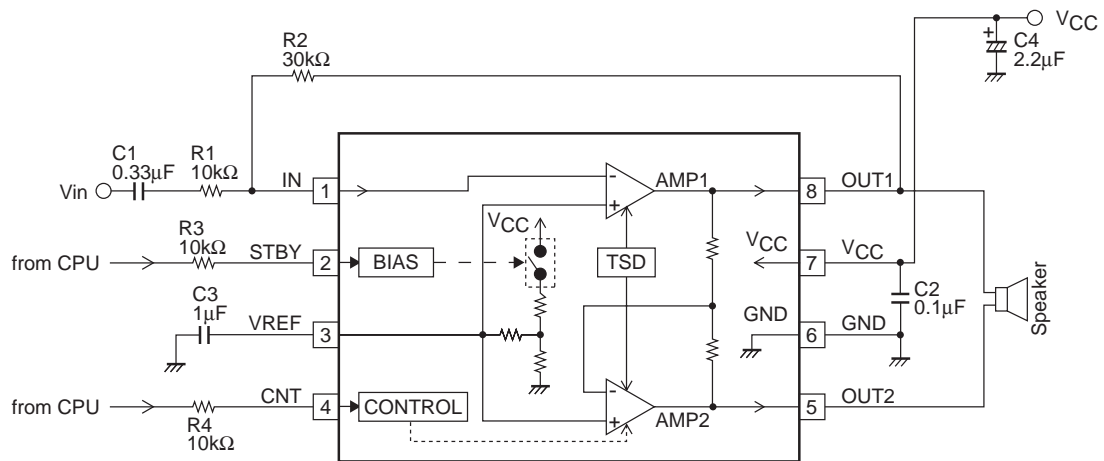
Top Layer



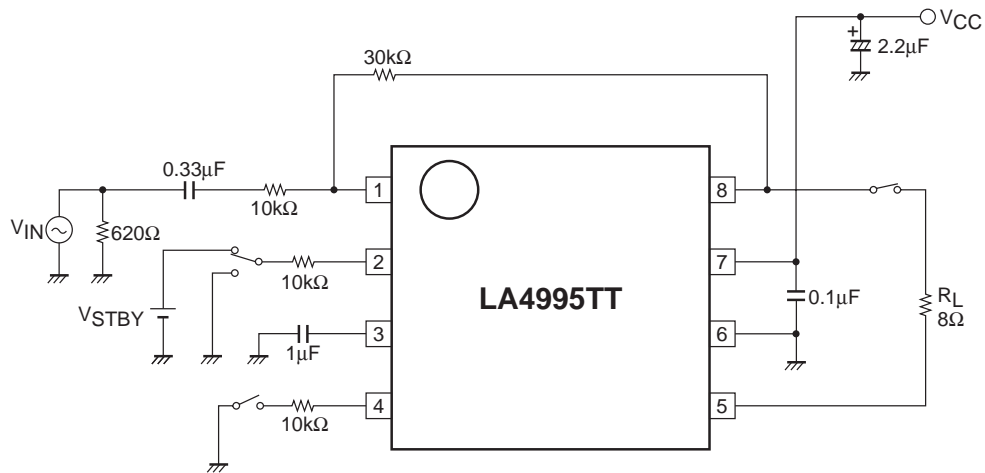
Bottom Layer

LV4995TT

Block Diagram and Sample Application Circuit



Test Circuit



LV4995TT

Pin Function

Pin No.	Pin name	Pin voltage	Description	Equivalent circuit
		$V_{CC} = 3.0V$		
1	IN	1.48	Input pin	
2	STBY	Outside impression	Standby pin <ul style="list-style-type: none"> •Standby mode at 0 to 0.3V •Operation mode at 1.6 to V_{CC} 	
3	VREF	1.48	Ripple filter pin (For connection of capacitor for filter)	
4	CNT	1.26	Second amplifier stop control pin <ul style="list-style-type: none"> •Second amplifier stopped at 0 to 0.3V 	
5	OUT2	1.48	Power amplifier second output pin	
6	GND	0	Ground pin	
7	V_{CC}	3.0	Power pin	
8	OUT1	1.48	Power amplifier first output pin	

Cautions for use

1. Input coupling capacitor (C1)

The input coupling capacitor C1 and input resistor R1 make up the high-pass filter, attenuating the bass frequency. Therefore, the capacitance value must be selected with due consideration of the pass band. Note with care that this capacitance value affects the pop sound at startup. Namely, the increased capacitance value will make the pop sound louder.

2. Pin 3 capacitor (C3)

This capacitor C3 is designed to reduce the power ripple. The ripple removal ratio increases when the capacitance is larger. Note however that this capacitor affects the pop sound at startup. Design must therefore be made by taking into both features as above described.

3. Pin 4 control (second amplifier stop control function)

Pin 4 is a pin to turn ON/OFF the operation of second amplifier. By using this function, the pop sound at startup can be reduced. Note that pin 4 can be controlled by applying the voltage described below. Leave this pin open when not in use :

Second amplifier ON $\Rightarrow V4 = 1.6$ to V_{CC} or OPEN
 Second amplifier OFF $\Rightarrow V4 = 0$ to $0.3V$

When the pin-3 capacitor C3 is downsized, the pop sound becomes louder. The pop sound can be reduced by providing the time T_{mu} to stop the second amplifier (see Fig. 1) while utilizing this function of the microcomputer. The recommended mute time T_{mu} is as follows.

C3 [μF]	0.1	0.22	0.33
T_{mu} [ms]	≥ 170	≥ 270	≥ 280

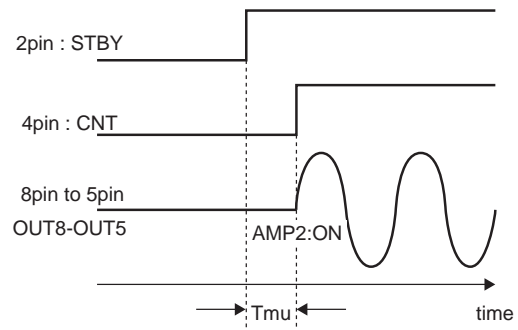


Fig. 1

4. Standby pin (pin 2)

By controlling the standby pin, the mode changeover can be made between standby and operation modes.

Standby mode $\Rightarrow V2 = 0$ to $0.3V$
 Operation mode $\Rightarrow V2 = 1.6$ to $V_{CC}V$

When using the standby pin as interlocked with power supply as shown in Fig. 2, care should be taken because the current I_{STBY} as expressed by the following equation flows through the standby pin.

$$I_{STBY} = \frac{V_{CC} - 0.7V}{R3 + 21k\Omega}$$

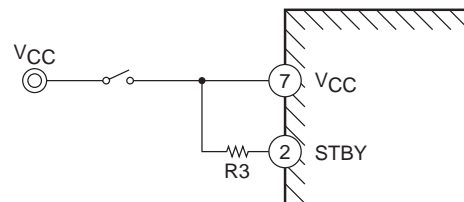
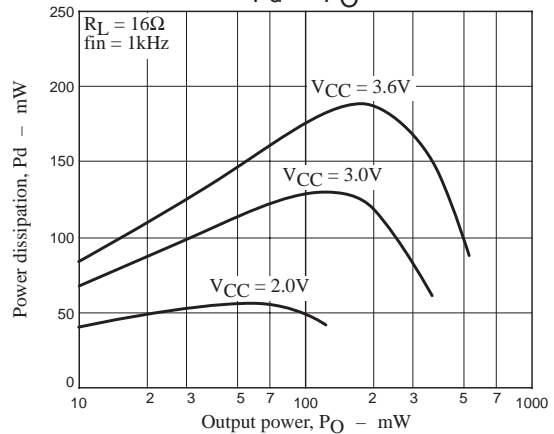
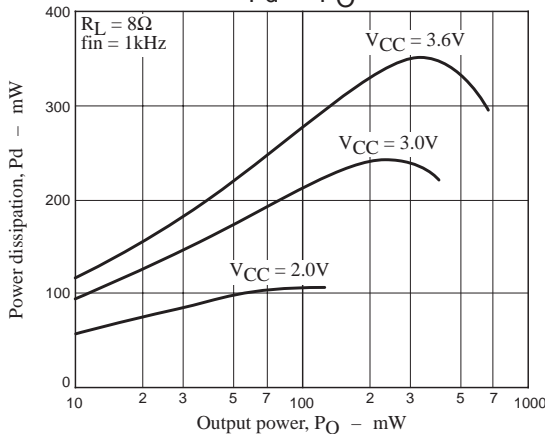
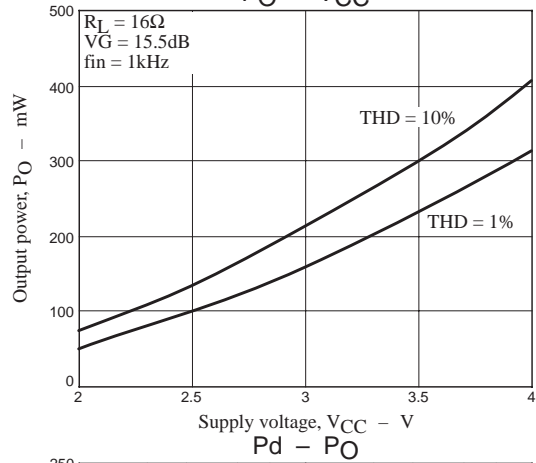
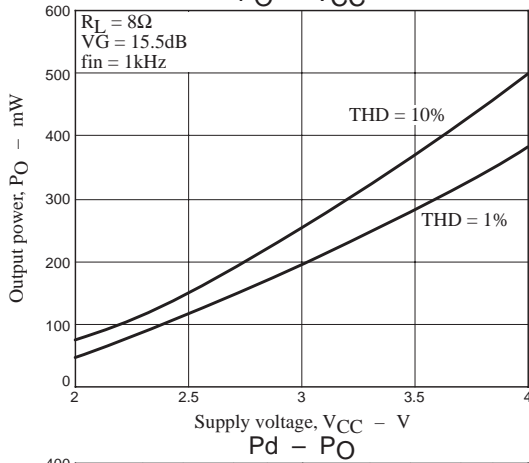
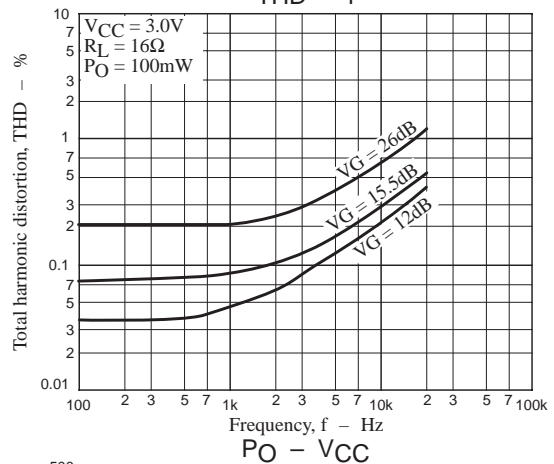
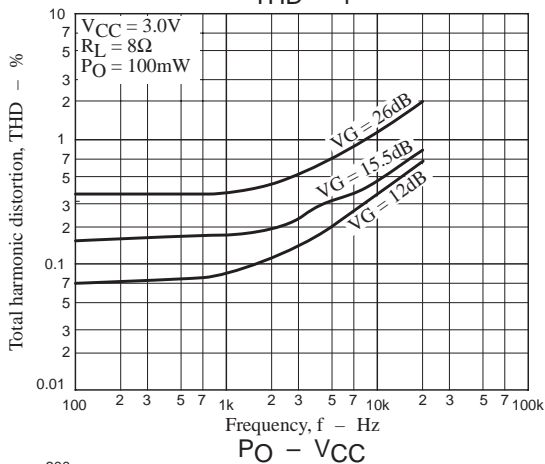
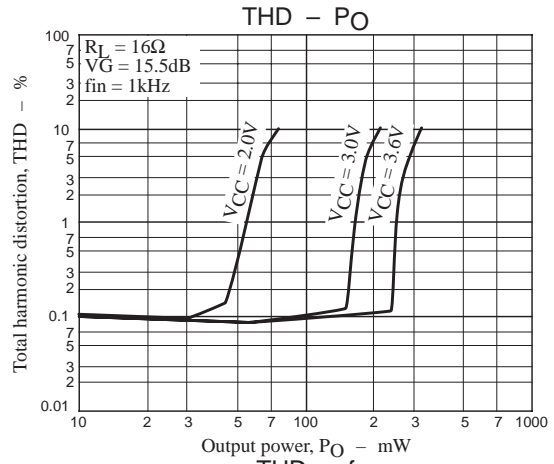
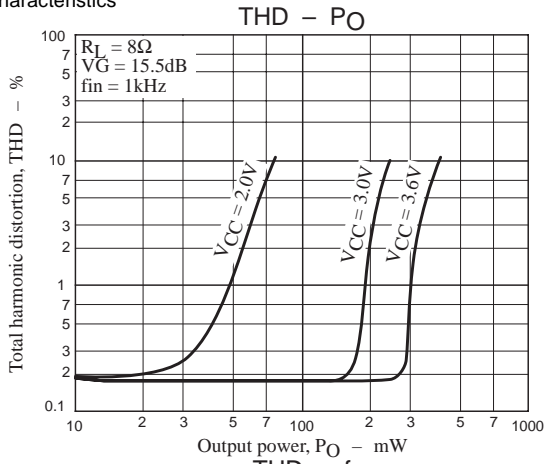


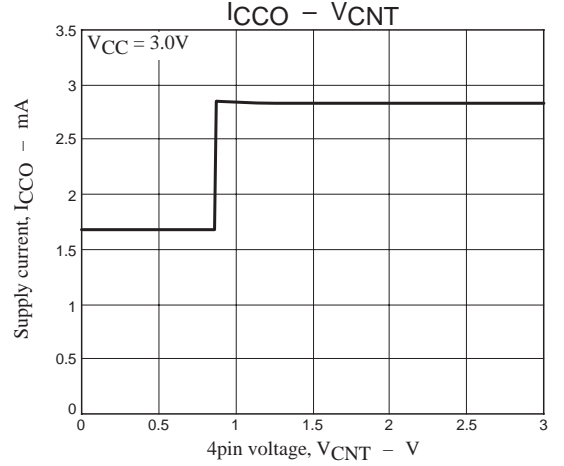
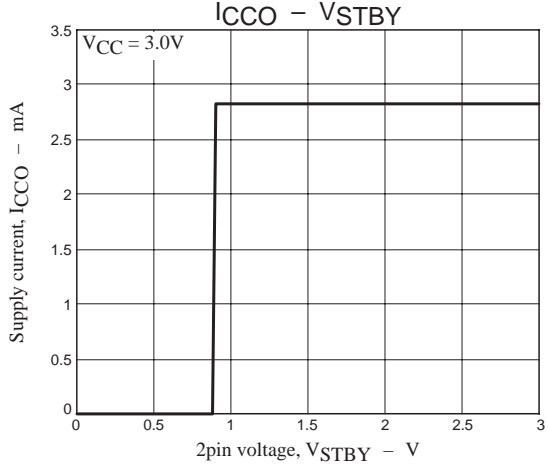
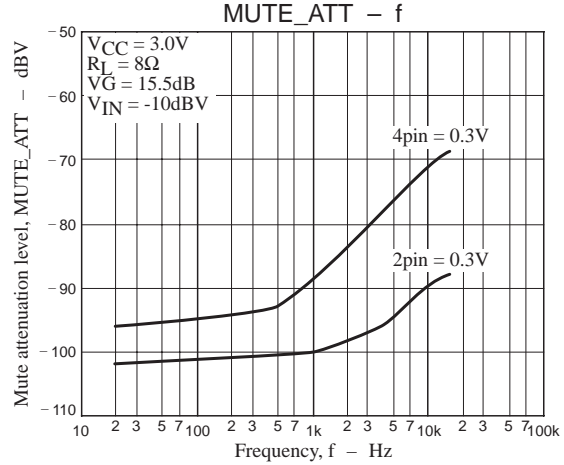
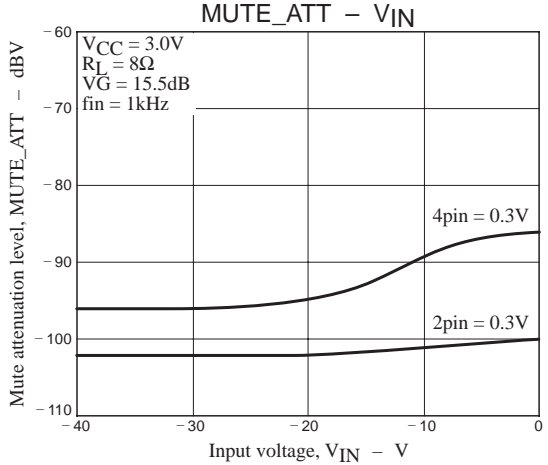
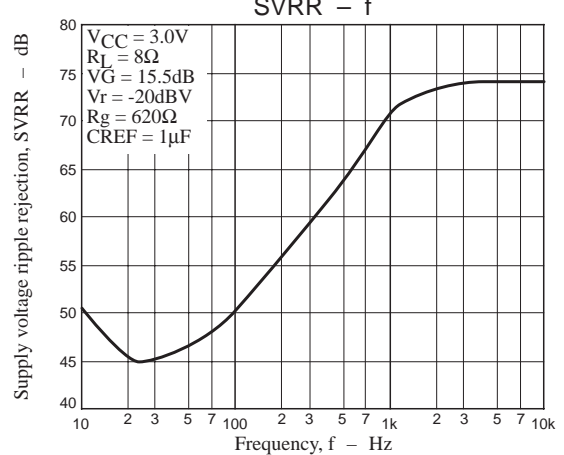
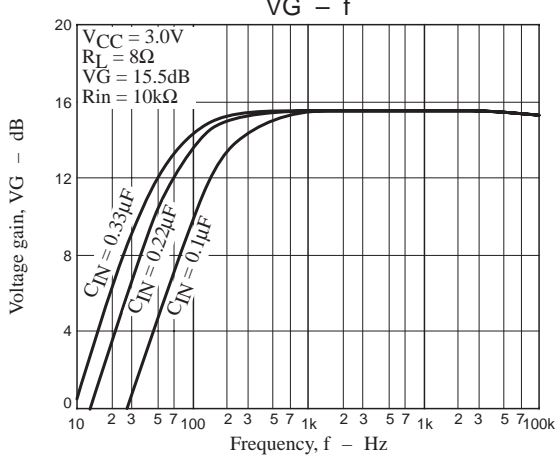
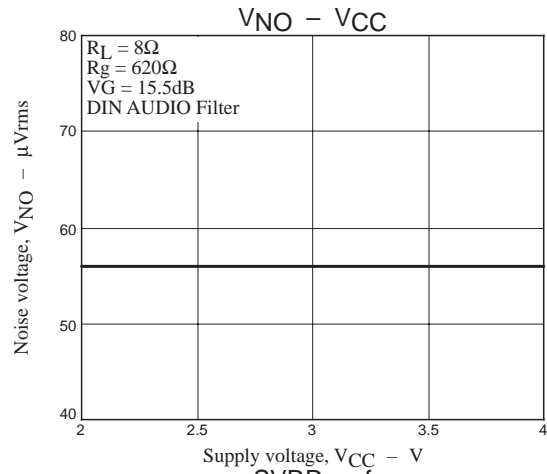
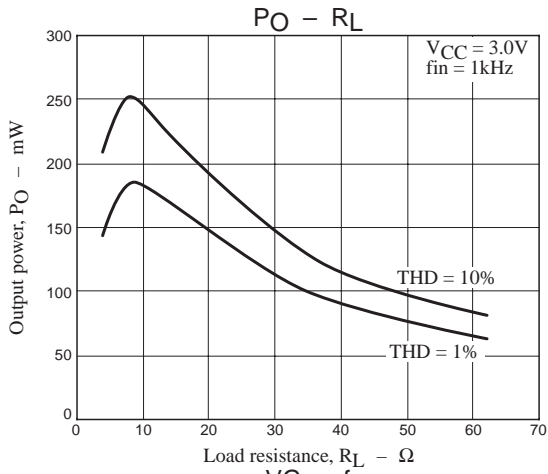
Fig. 2

5. Bypass capacitor (C2) of the power supply block
The bypass capacitor attached to the power pin (pin 7) must be arranged as near to this pin as possible.
6. BTL voltage gain
Voltage gain of the first amplifier is determined by the ratio of resistors R1 and R2
$$\text{1st amplifier voltage gain} = 20 \times \log (R2/R1) \dots \text{Unit : dB}$$
Accordingly, BTL voltage gain is calculated as follows.
$$\text{BTL voltage gain} = 6 + 20 \times \log (R2/R1) \dots \text{Unit : dB}$$
7. Short-circuit between pins
When power is applied with pins left short-circuited, deterioration or damage may result.
Therefore, check before power application if pins are short-circuited with solder, etc. during mounting of IC to the substrate.
8. Short-circuit of load
If the load is left short-circuited for a long period of time, deterioration or damage may occur.
Never allow the load to short-circuit.
9. Maximum rating
When IC is used near the maximum rating, there is a possibility that the maximum rating may be exceeded even under the smallest change of conditions, resulting in failure. Take the sufficient margin for variation of supply voltage and use IC within a range where the maximum rating will never be exceeded.

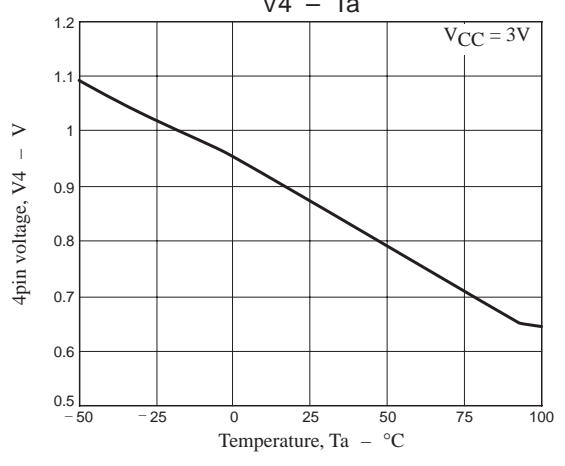
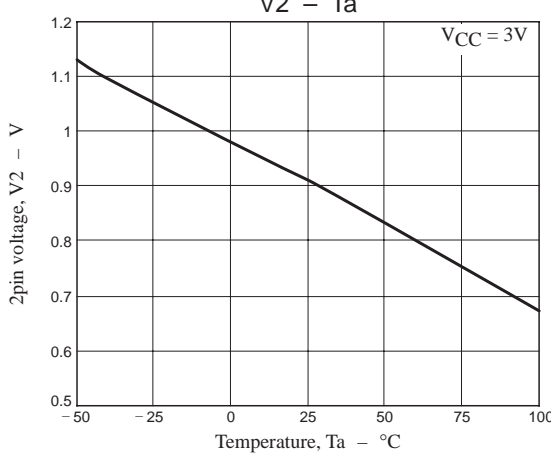
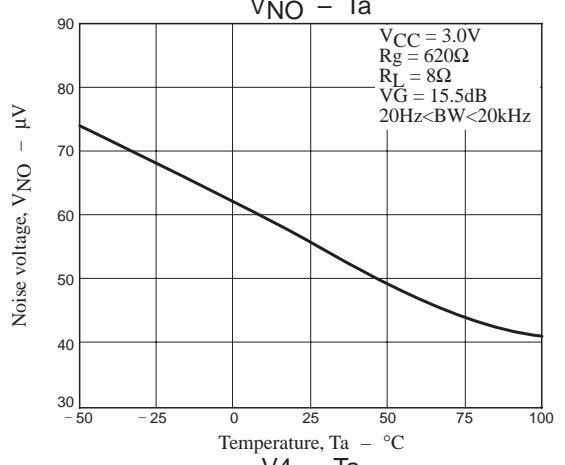
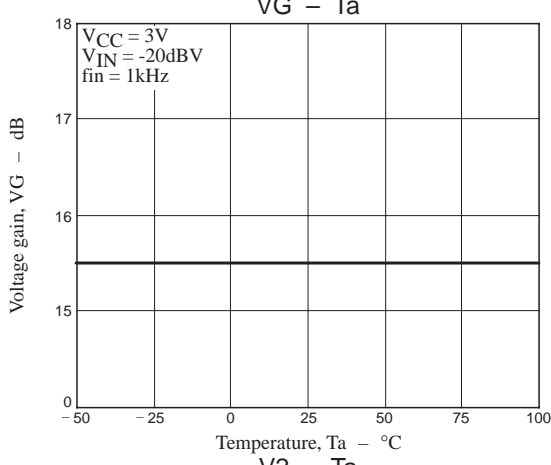
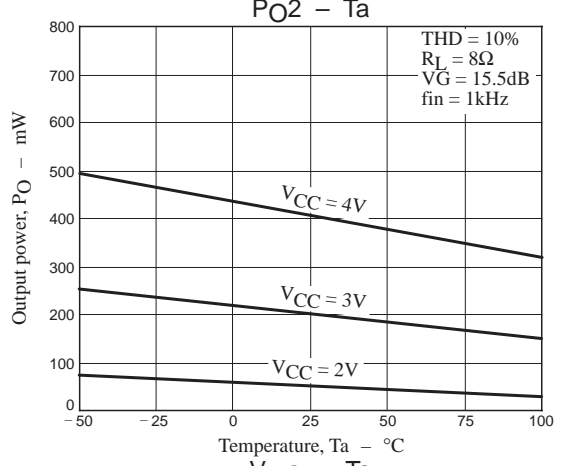
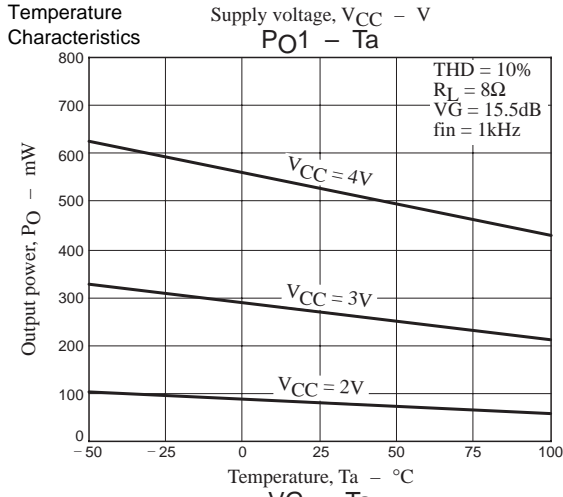
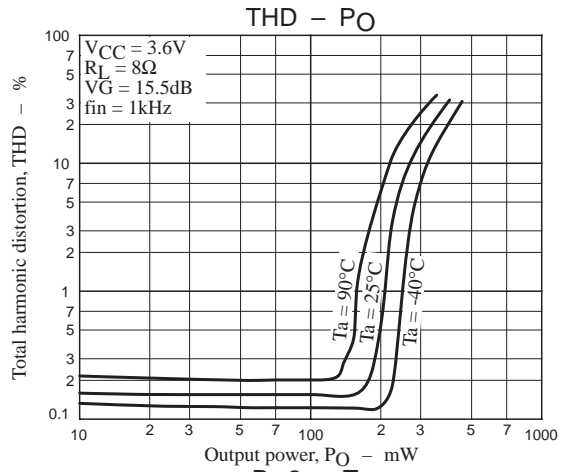
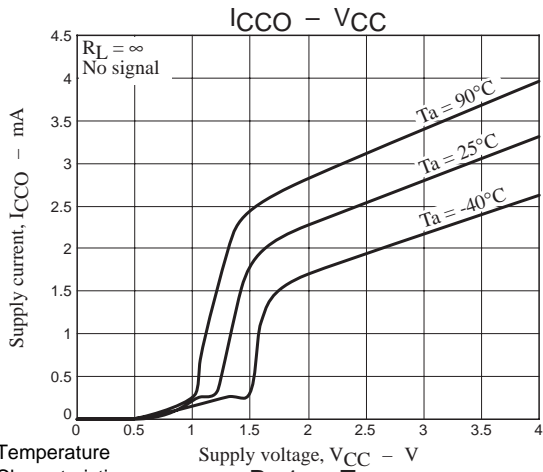
General Characteristics

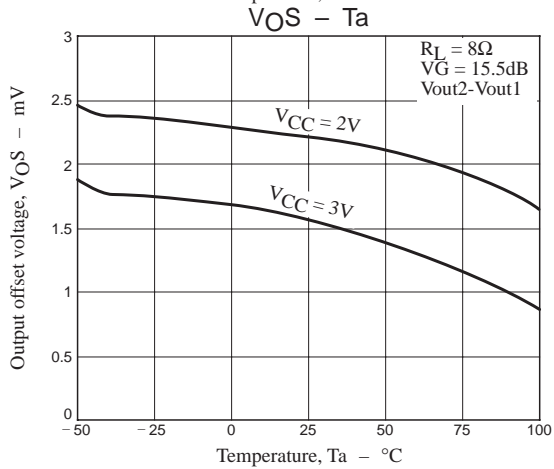
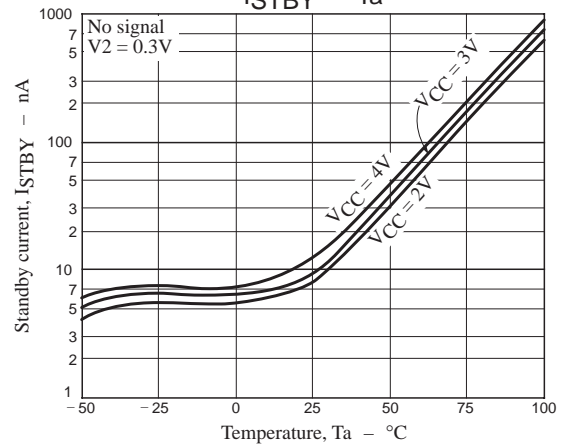
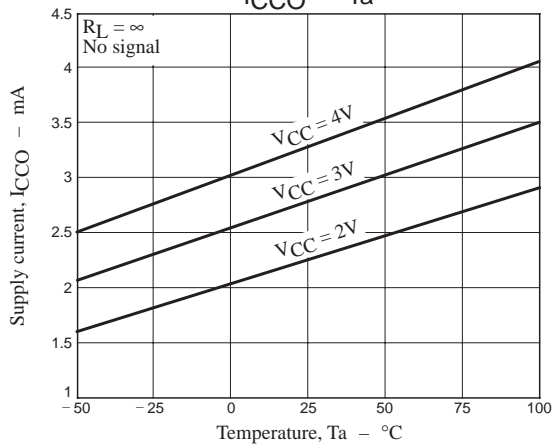
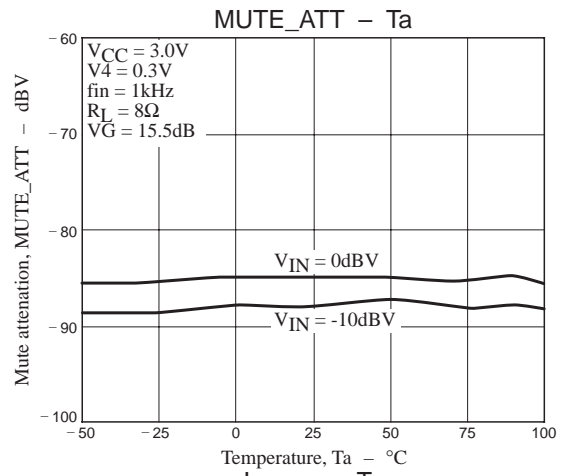
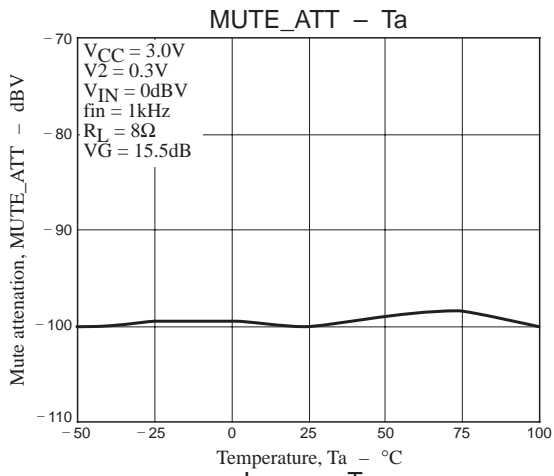


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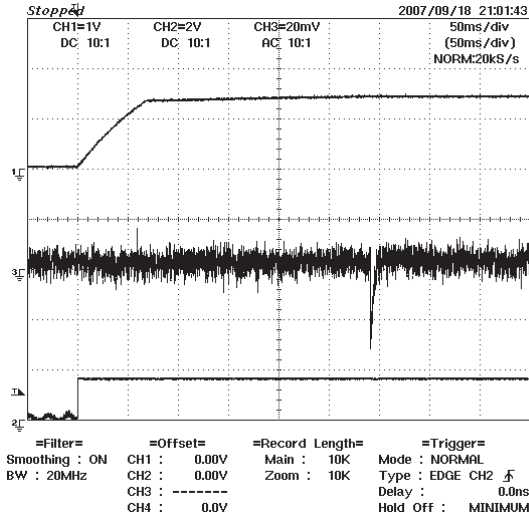




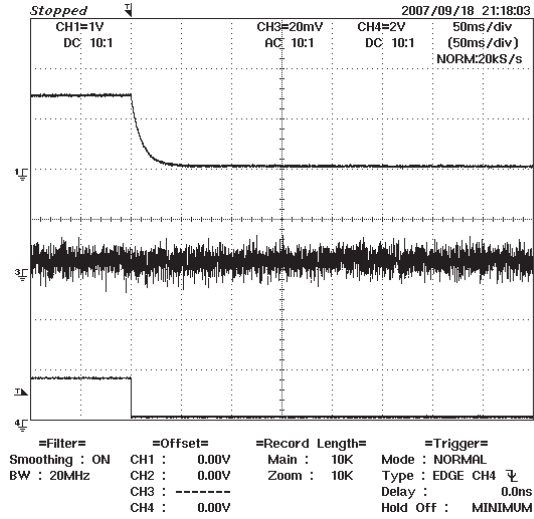
Transient characteristics

Vertical axis ⇒ Upper region Pin 3 voltage (1V/div), Middle region : BTL output (20mV/div),
 Lower region : Pin 2 voltage (2V/div)
 Horizontal axis ⇒ 50msec/div

- Standby ⇒ When power ON (Pin 2 : High)



- Power ON ⇒ when in standby (Pin 2 : Low)



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