Ordering number : EN*A1226

Preliminary

SANYO Semiconductors
DATA SHEET

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

Overview

The LV4995TT buili-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 = 8Ω, 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 = 0.1μA (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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Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		4	V
Allowable power dissipation	Pd max	PCB mounted*	500	mV
Maximum junction temperature	Tj max		150	°C
Operating temperature	Topr		-40 to +85	°C
Storage temperature	Tstg		-40 to +150	°C

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

Operating Conditions at Ta = 25°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.

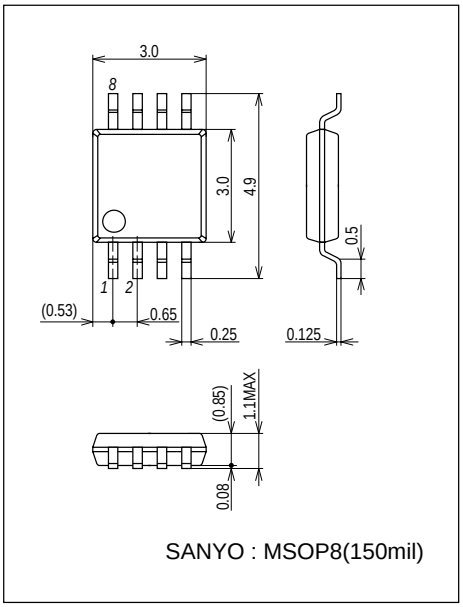
Electrical Characteristics Ta = 25°C, V_{CC} = 3V, fin = 1kHz, R_L = 8Ω, V2 = HIGH, V4 = HIGH

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current drain 1	$I_{CCO}P1$	No signal, R_L = ∞		2.8	4.8	mA
Quiescent current drain 2	$I_{CCO}P2$	No signal, R_L = ∞, V4 = LOW (second amplifier stop)		1.7		mA
Stand-by current drain	$I_{STB}Y$	No signal, R_L = ∞, V2 = LOW (standby)		0.1	5	μA
Maximum output power	P_OMAX	THD = 10%	170	250		mW
Voltage gain	VG	V_{IN} = -20dBV	14	15.5	17	dB
Voltage gain use range	VGR		0		26	dB
Total harmonic distortion	THD	V_{IN} = -20dBV		0.16	1	%
Output noise voltage	V_NOUT	Rg = 620Ω, 20 to 20kHz		56	150	μVrms
Output DC offset voltage	V_OS		-30	0	-30	mV
Mute attenuation level 1	MUTE1	V_{IN} = 0dBV, V2 = LOW (standby)		-100		dBV
Mute attenuation level 2	MUTE2	V_{IN} = -10dBV, V4 = LOW (second amplifier stop)		-89		dBV
Ripple rejection ratio	SVRR	Rg = 620Ω, fr = 100Hz, Vr = -20dBV		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

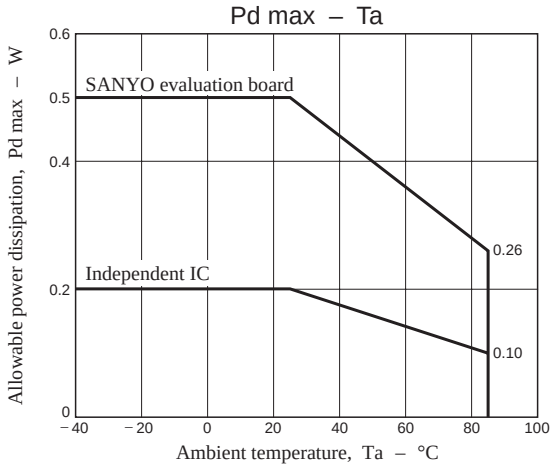
Package Dimensions

unit : mm (typ)

3245B

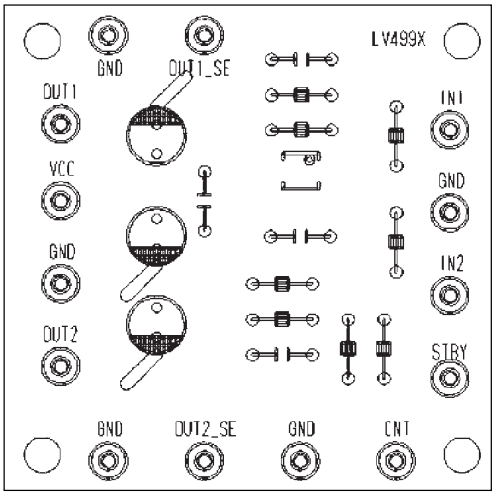


SANYO : MSOP8(150mil)

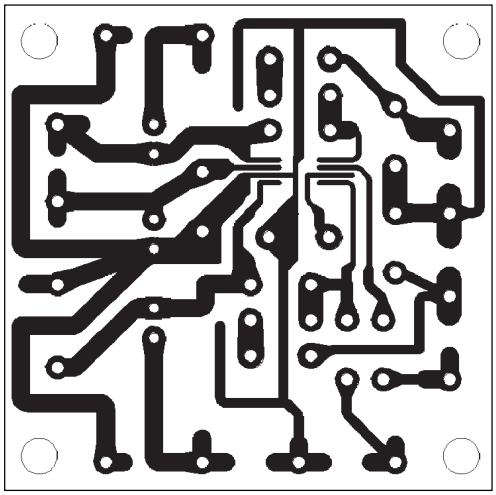


SANYO evaluation board (single sided printed circuit board)

Size : 40mm×40mm×1.6mm

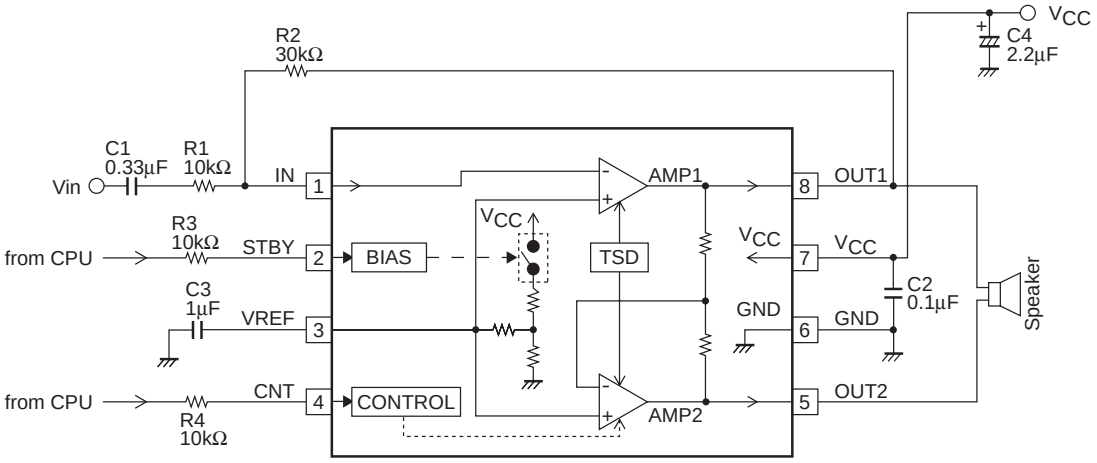


Top Layer

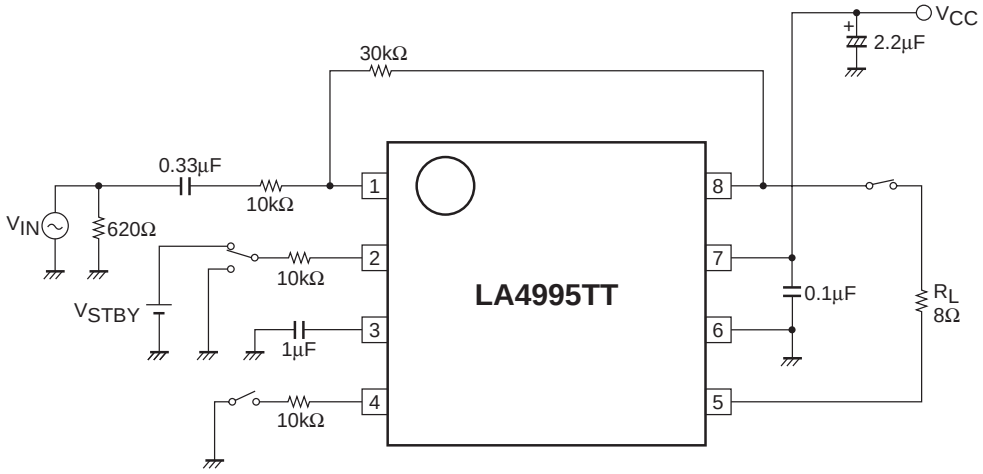


Bottom Layer

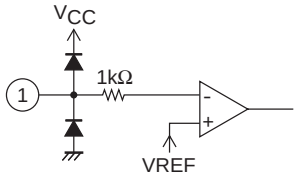
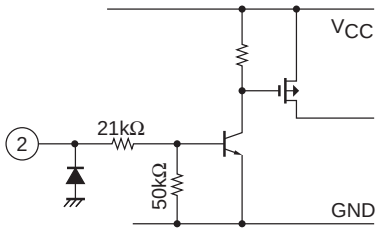
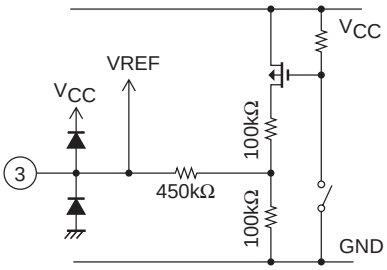
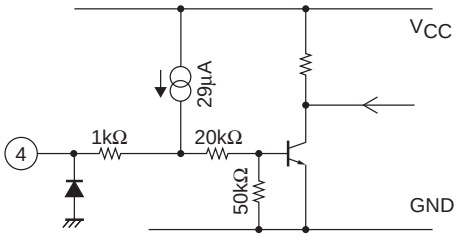
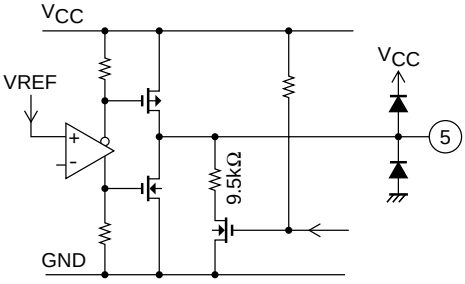
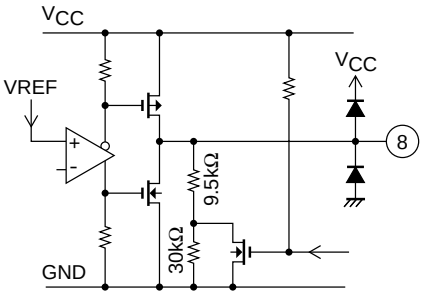
Block Diagram and Sample Application Circuit



Test Circuit



Pin Function

Pin No.	Pin name	Pin voltage V_{CC} = 3.0V	Description	Equivalent circuit
1	IN	1.48	Input pin	
2	STBY	Outside impression	Standby pin •Standby mode at 0 to 0.3V •Operation mode at 1.6 to VCC	
3	VREF	1.48	Ripple filter pin (For connection of capacitor for filter)	
4	CNT	1.26	Second amplifier stop control pin •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 Tmu to stop the second amplifier (see Fig. 1) while utilizing this function of the microcomputor.
   The recommended mute time Tmu is as follows.

C3 [µF]	0.1	0.22	0.33
Tmu [ms]	≥ 170	≥ 270	≥ 280

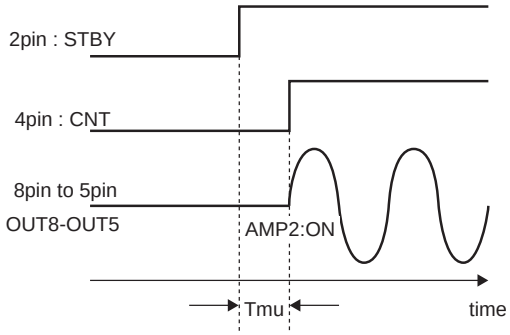


Fig. 1

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.

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

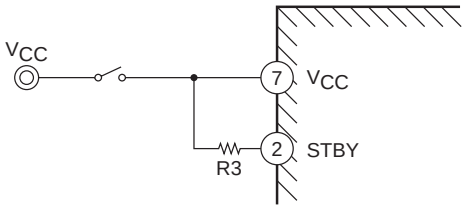


Fig. 2

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
   1st amplifier voltage gain = $20 \times \log (R2/R1)$ · · · · · Unit : dB
   Accordingly, BTL voltage gain is calculated as follows.
   BTL voltage gain = $6 + 20 \times \log (R2/R1)$ · · · · · Unit : dB

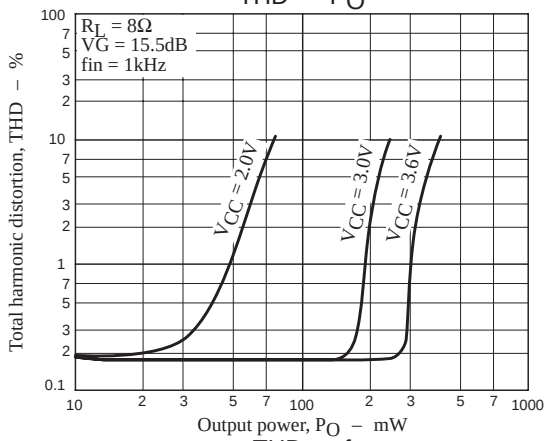
7. Short-circuit between pins
   When power is applied with pins left short-circuited, deterioration or damage may result.
   Therefore, check before power application if pins are short-circuited with solder, etc. during mounting of IC to the substrate.

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.

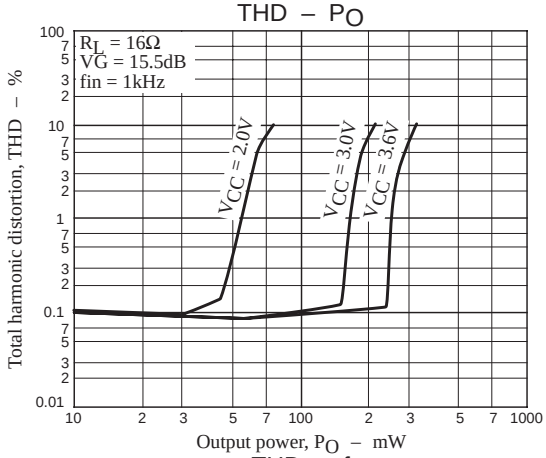
9. Maximum rating
   When IC is used near the maximum rating, there is a possibility that the maximum rating may be exceeded even under the smallest change of conditions, resulting in failure. Take the sufficient margin for variation of supply voltage and use IC within a range where the maximum rating will never be exceeded.

General Characteristics

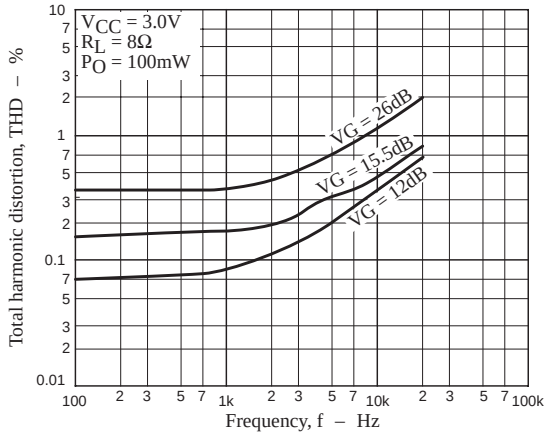
THD – P_O



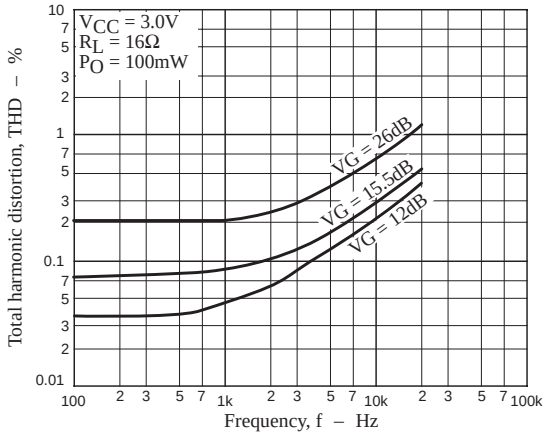
THD – P_O



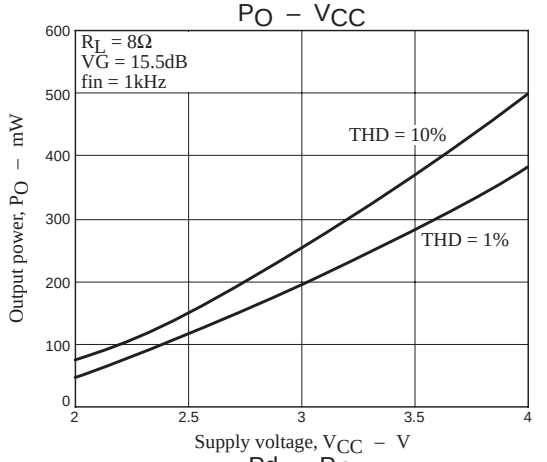
THD – f



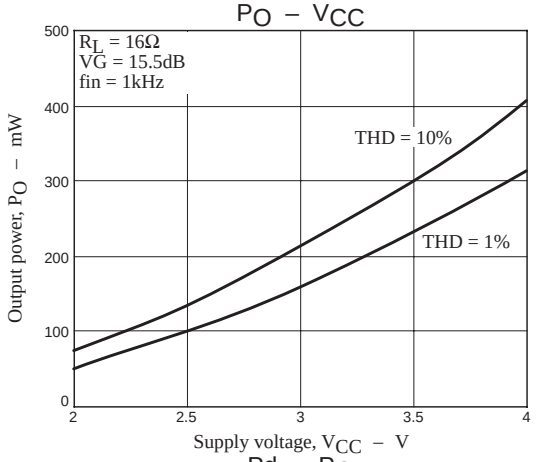
THD – f



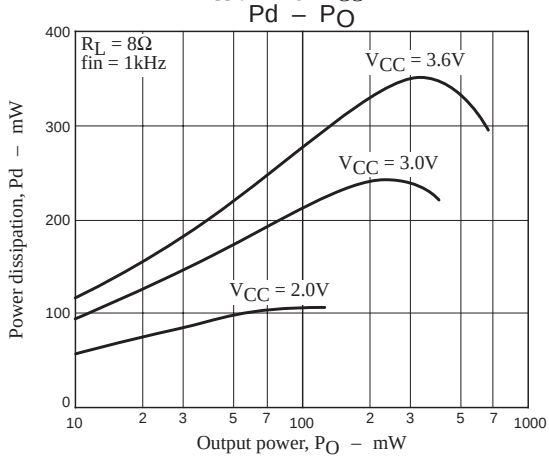
P_O – V_{CC}



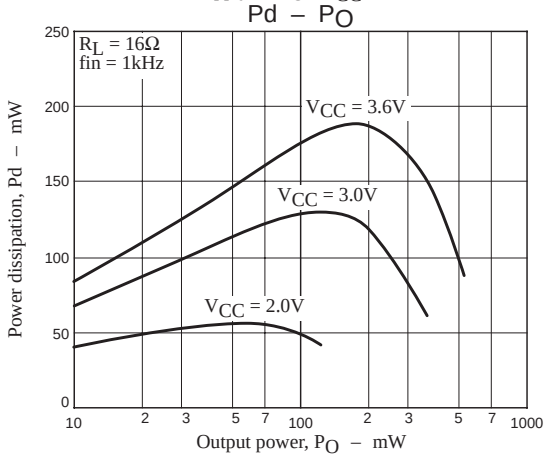
P_O – V_{CC}



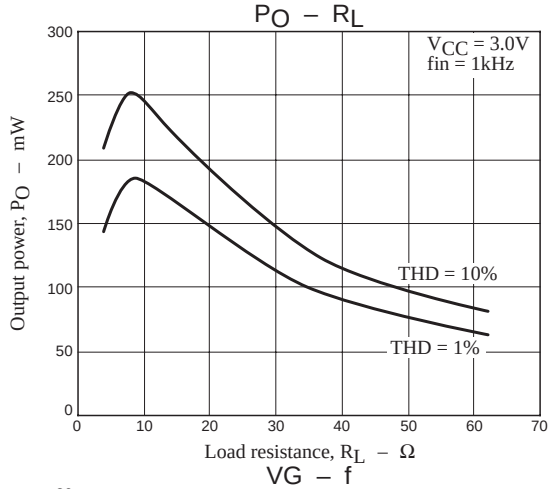
Pd – P_O



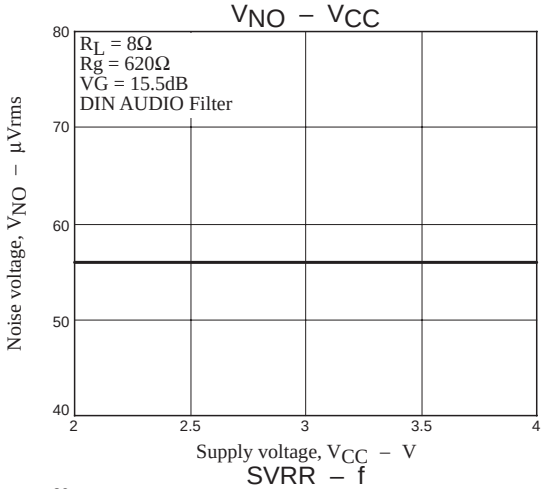
Pd – P_O



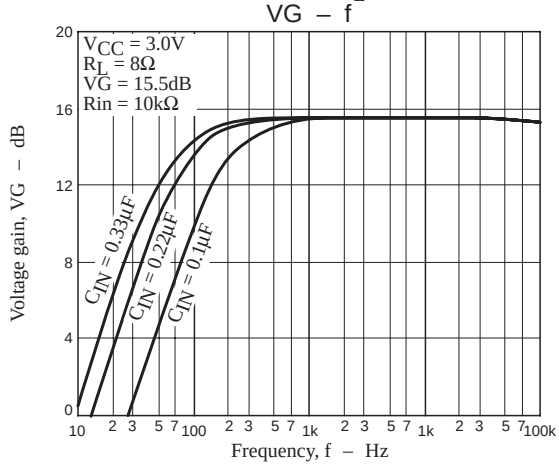
$P_O - R_L$



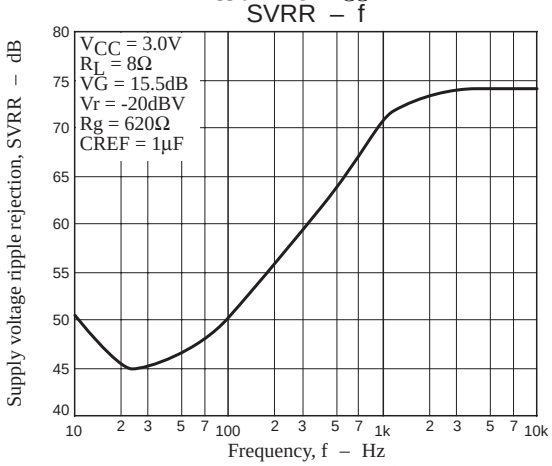
$V_{NO} - V_{CC}$



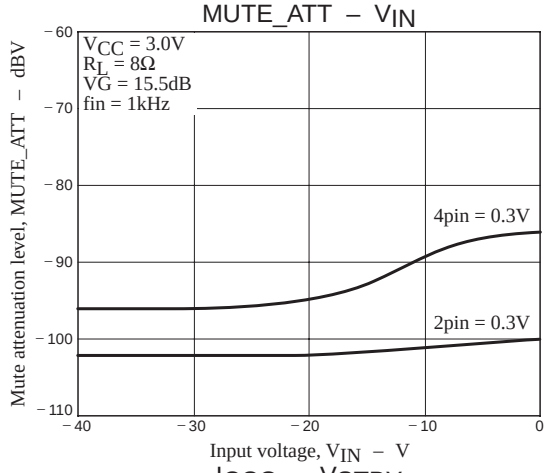
VG – f



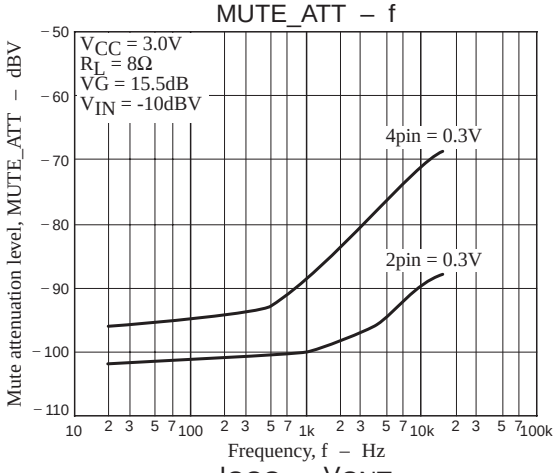
SVRR – f



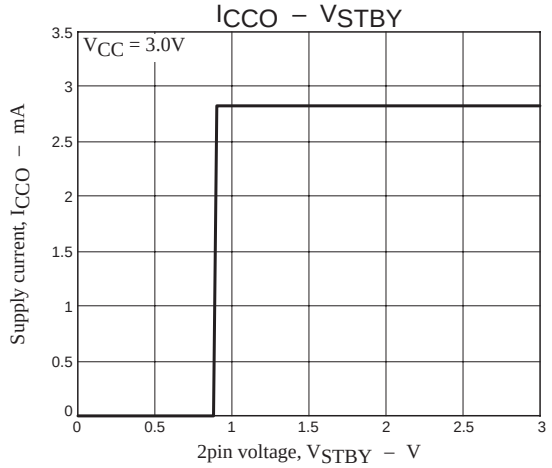
MUTE_ATT – V_{IN}



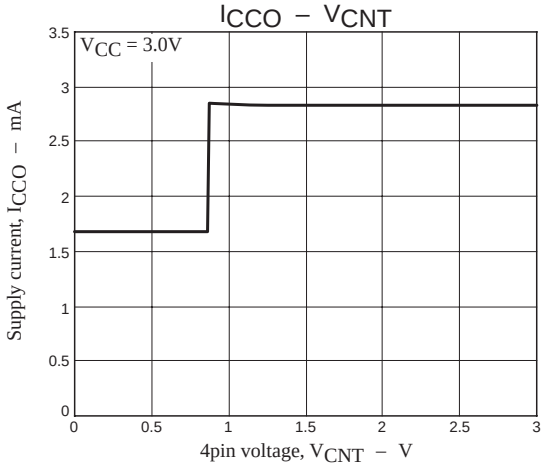
MUTE_ATT – f



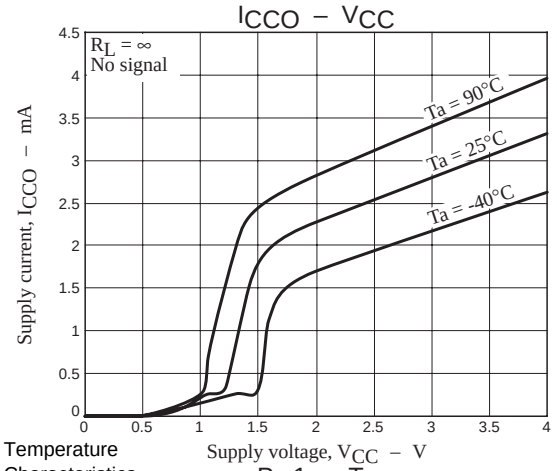
$I_{CCO} - V_{STBY}$

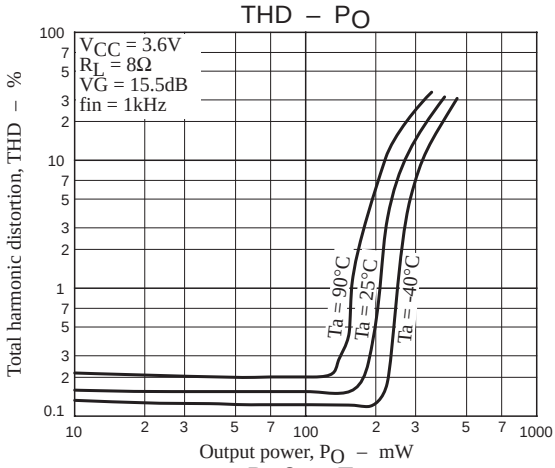


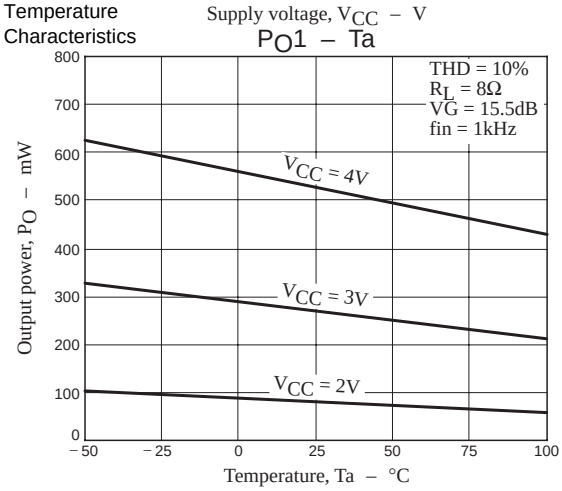
$I_{CCO} - V_{CNT}$

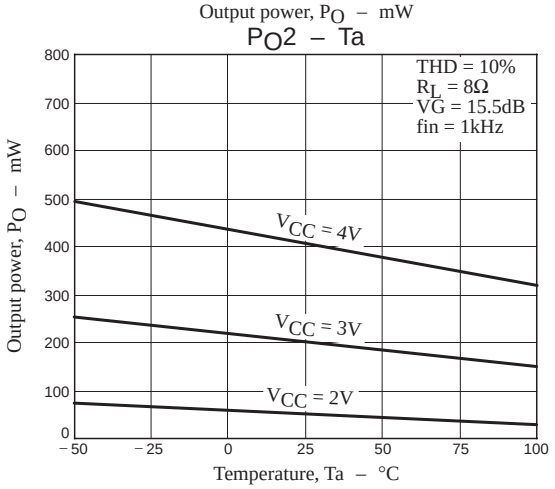


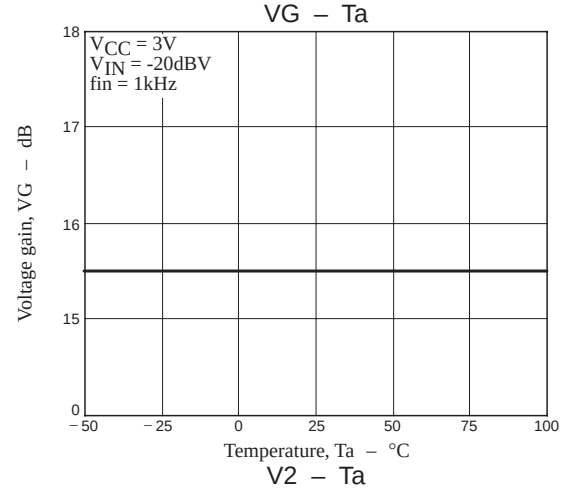
Temperature Characteristics

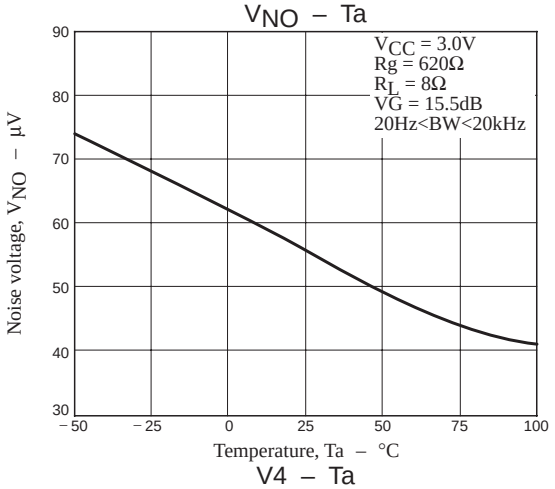


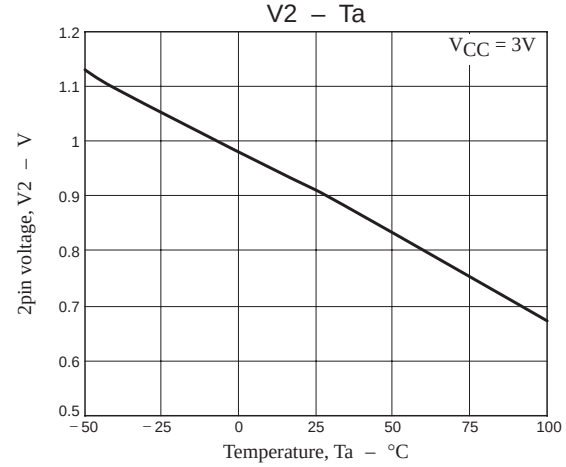


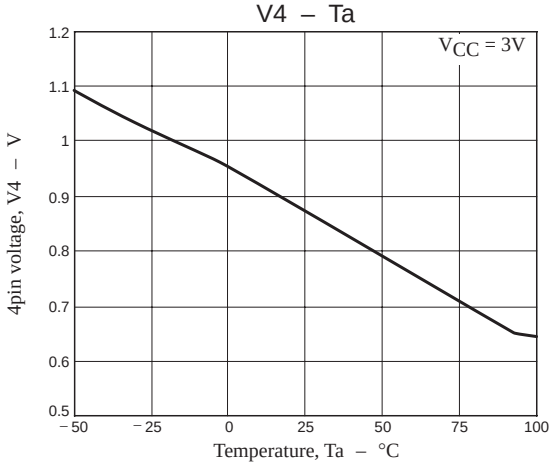




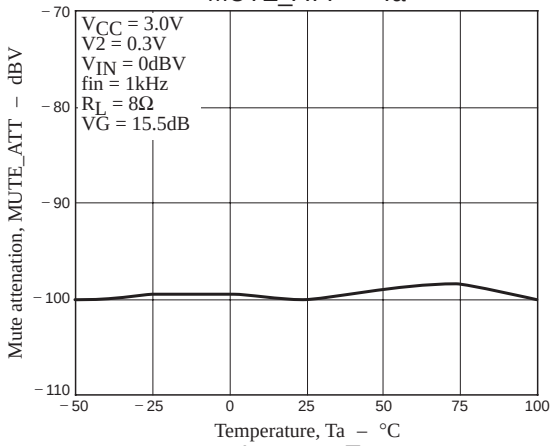




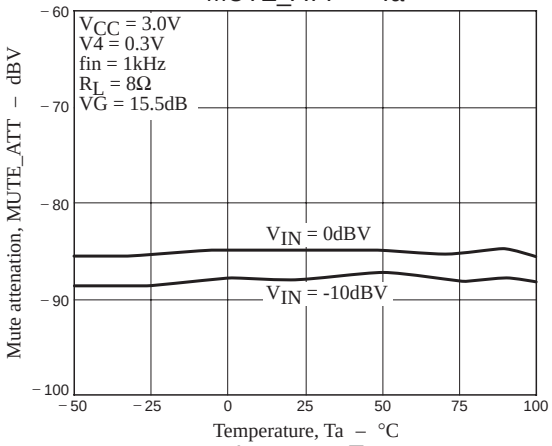




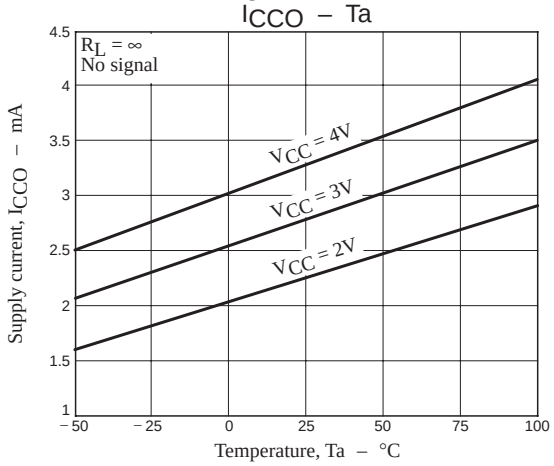
MUTE_ATT – Ta



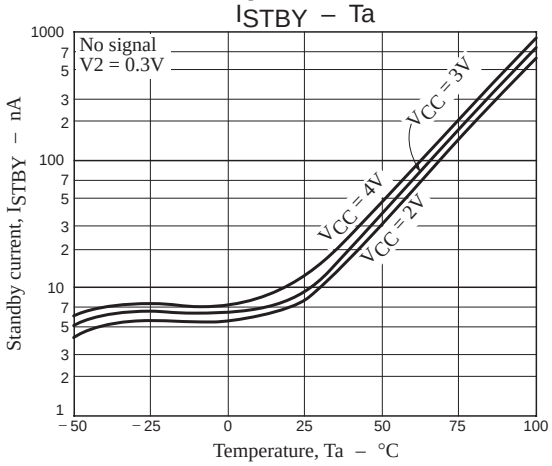
MUTE_ATT – Ta



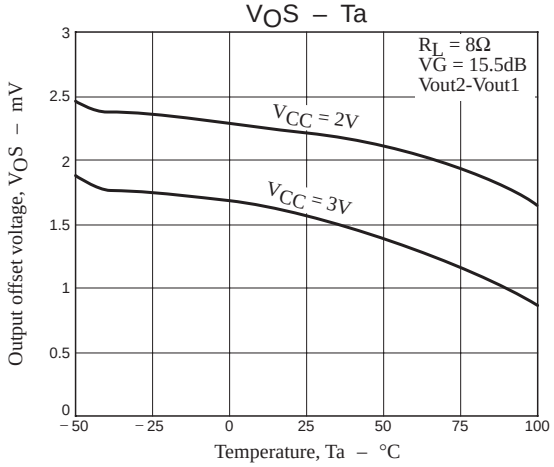
ICCO – Ta



ISTBY – Ta



VOS – Ta

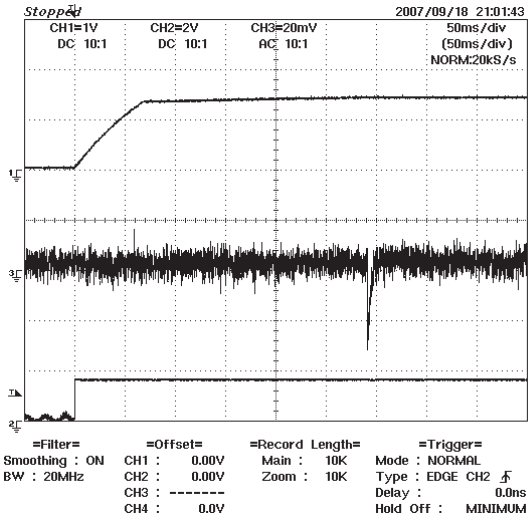


Transient characteristics

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)