

DD Dolby B type Noise Reduction System

Description

The CXA1550/CXA1551/CXA1552/CXA1553 are bipolar ICs providing two separate Dolby B-type noise reduction processors. The series is composed of seven devices having four Dolby levels and two types of package for various applications. These devices feature very few external components, which is achieved by monolithic filter circuits using integrated thin film capacitors with high capacitance.

Features

- Pin replaceable with CXA1100 series
- Minimum number of external components
- NR ON/OFF/Double Speed, REC/PB switches included
- Small package (16 pin DIP, 16 pin SOP)
- Low current consumption 5.6mA typ. (CXA1550)
- Dual channel processors in one chip
- Double speed encode and decode functions are provided.

Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

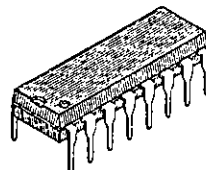
- Supply voltage Vcc 23 V
- Operating temperature Topr -40 to +85 °C
- Storage temperature Tstg -65 to +150 °C
- Allowable power dissipation Pd

DIP16 (A1550P/A1551P/A1552P/A1553P)	900 mW
SOP16 (A1551M/A1552M/A1553M)	500 mW

* These ICs are available only to the licensees of Dolby Laboratories Licensing Corporation from whom licensing and applications information may be obtained.

* "Dolby" and the double D symbols are trade marks of Dolby Laboratories Licensing Corporation.

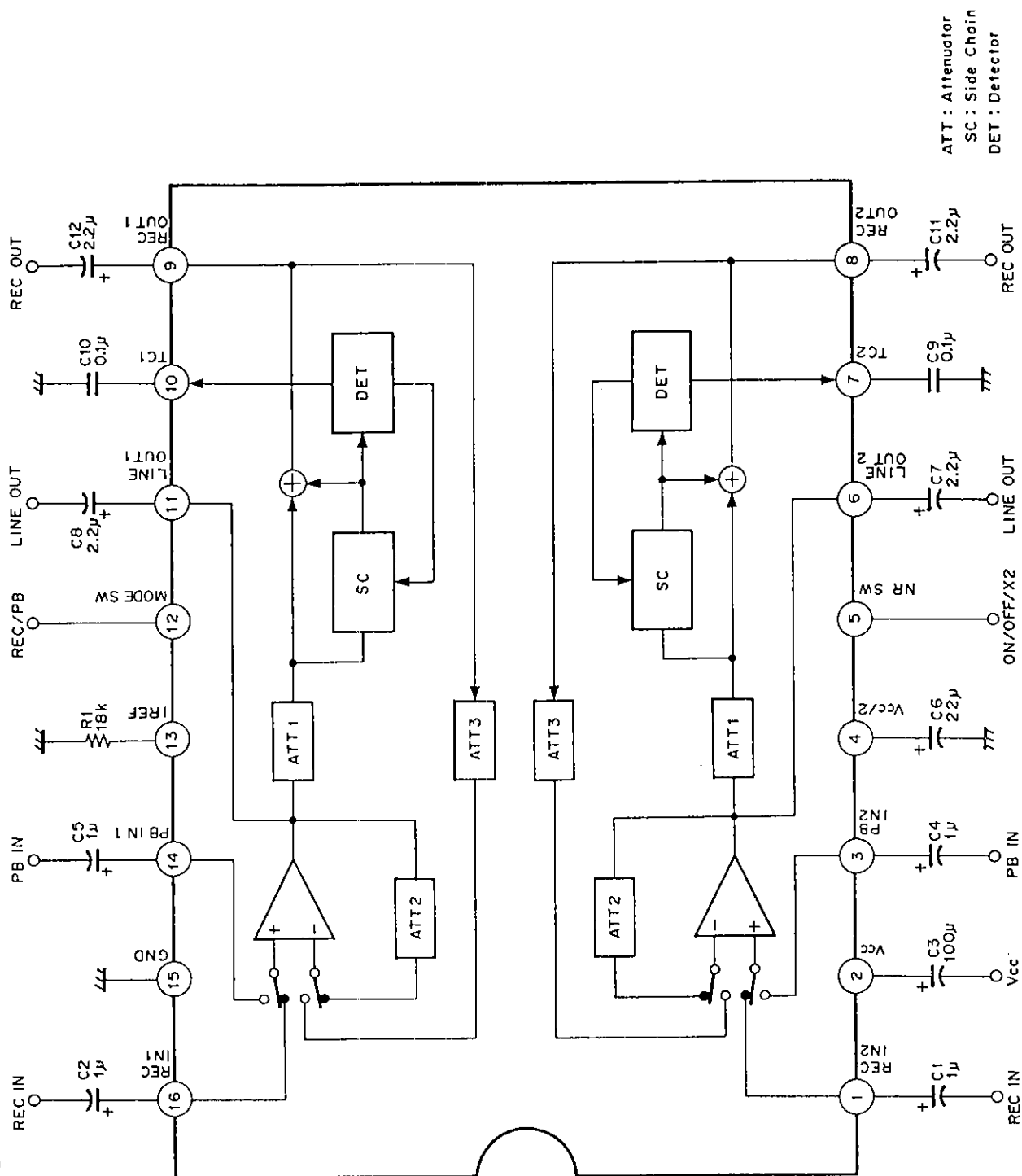
CXA1550P/CXA1551P
CXA1552P/CXA1553P
16 pin DIP (Plastic)



CXA1551M/CXA1552M
CXA1553M
16 pin SOP (Plastic)



Block Diagram



Pin Description and Equivalent Circuit (Single supply, no signal)

Pin No.	Symbol	Z: Imp	VDC (V)	Equivalent circuit	Description
1,16	REC IN	40K	6.0V		Record input pin
2	Vcc	—	12.0V		Vcc power supply pin
3,14	PB IN	40K	6.0V		Playback input pin
4	VCT	2K	6.0V		Vcc/2 output pin
5	NRSW	—	—		NR control pin H : Double speed M : NR off L : NR on

Pin No.	Symbol	Z: Imp	VDC (V)	Equivalent circuit	Description
6, 11	LINE OUT	—	6.0V		Line output pin
7, 10	TC	—	0.3V		Time constant connecting pin
8, 9	REC OUT	—	6.0V		Record output pin

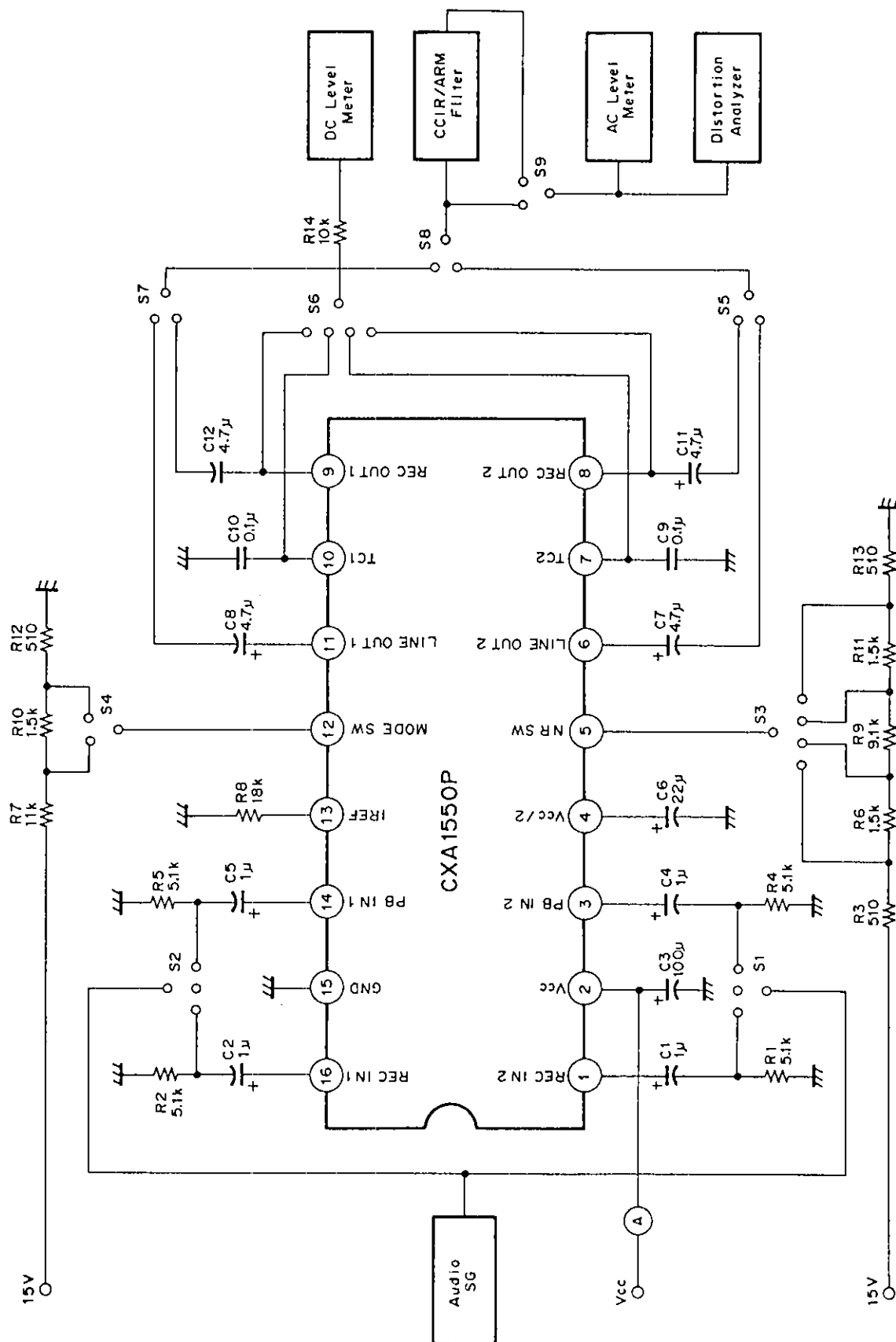
Pin No.	Symbol	Z: Imp	VDC (V)	Equivalent circuit	Description
12	MODE	—	—		Mode control H : PB L : REC
13	IREF	—	12V		Reference current pin
15	GND	—	0V		GND pin

Electrical Characteristics Ta=25°C, Dolby Level: -10dBm (=245mVrms) at RECOUT, 0dBm=775mVrms
Vcc=15V (CXA1550), Vcc=12 (CXA1551), Vcc=9V (CXA1552), Vcc=6V (CXA1553) unless otherwise specified

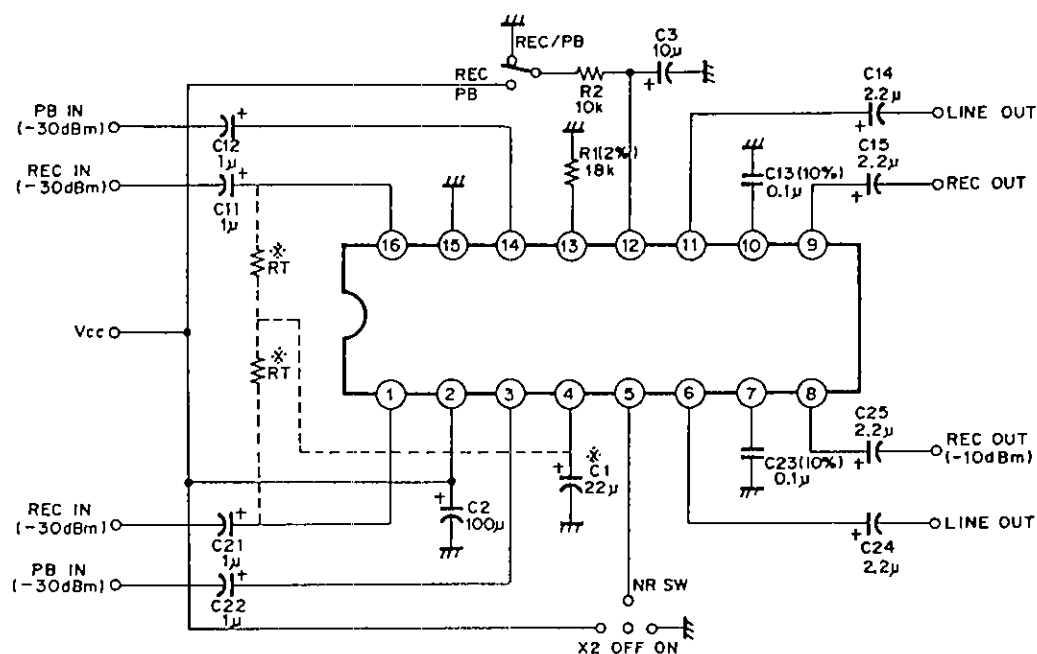
Characteristics		Symbol	Test Conditions				Min.	Typ.	Max.	Unit
			R/P	NR	f (Hz)	other				
Operating voltage	CXA1550	Vopr	—	—	—	Signal handling ≥12dB	11.5	—	16.0	V
	CXA1551						8.5	—	16.0	V
	CXA1552						6.5	—	16.0	V
	CXA1553						5.0	—	16.0	V
Current consumption	CXA1550	Icc	REC	OFF	—	No signal	3.5	5.6	7.7	mA
	CXA1551						3.5	5.5	7.7	mA
	CXA1552						3.5	5.3	7.7	mA
	CXA1553						3.5	5.1	7.7	mA
LINE OUT Level	CXA1550	Vlout	REC	OFF	1K		-1.0	0.0	1.0	dBm
	CXA1551						-4.0	-3.0	-2.0	dBm
	CXA1552						-7.0	-6.0	-5.0	dBm
	CXA1553						-11.0	-10.0	-9.0	dBm
REC IN Level		Vrin	REC	OFF	1K		-32	-30	-28	dBm
PB IN Level		Vpin	REC	OFF	1K		-32	-30	-28	dBm
Encode characteristics (Boost)	(1)	B-R-1	REC	ON	500	-25dB	1.4	2.9	4.4	dB
	(2)	B-R-2	REC	ON	2K	-25dB	5.5	7.0	8.5	dB
	(3)	B-R-3	REC	ON	5K	-25dB	3.9	5.4	6.9	dB
	(4)	B-R-4	REC	ON	10K	-40dB	9.7	10.4	11.9	dB
	(5)	B-R-5	REC	ON	10K	0dB	-1.1	0.4	1.9	dB
Signal handling	CXA1550	Vomax	REC	OFF	1K	THD=1%	13.5	15.3	—	dB
	CXA1551						14.0	15.9	—	dB
	CXA1552						14.0	15.9	—	dB
	CXA1553						13.0	15.0	—	dB
Total harmonic distortion	(1) NR OFF	CXA1550		OFF			—	0.03	0.2	%
		CXA1551					—	0.04	0.2	%
		CXA1552					—	0.05	0.2	%
		CXA1553					—	0.06	0.2	%
	(2) NR ON	CXA1550		ON			—	0.03	0.3	%
		CXA1551					—	0.04	0.3	%
		CXA1552					—	0.06	0.3	%
		CXA1553					—	0.09	0.3	%
Encode S/N ratio		SN (CCIR)	R	ON	—	Rg=5kΩ (CCIR/ARM)	65	69	—	dB
Crosstalk	REC-PB	CT-1					—	-82	-65	dB
	PB-REC	CT-2					—	-81	-60	dB
	REC ch to ch	CT-3					—	-70	-60	dB
	PB ch to ch	CT-4					—	-70	-60	dB
REC OUT offset voltage (NR ON-OFF)		Voff					-40	—	40	mV
Control voltage	REC	VC-R					0	—	0.5	V
	PB	VC-P					2.5	—	Vcc	V
	ON	VC-ON					0	—	0.5	V
	OFF	VC-OFF					2.5	—	Vcc-2.5	V
	×2	VC-×2					Vcc-0.5	—	Vcc	V

* 0dB means the level which provides the Dolby level at the record output in the noise reduction off mode.

Test Circuit

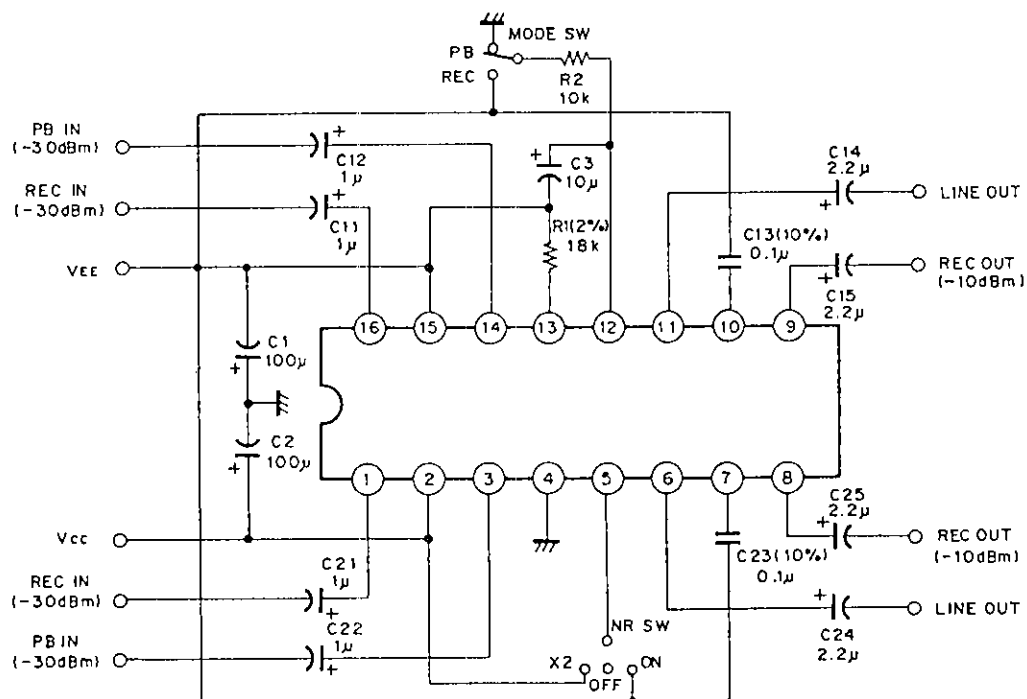


Switchable Processor with Single Supply



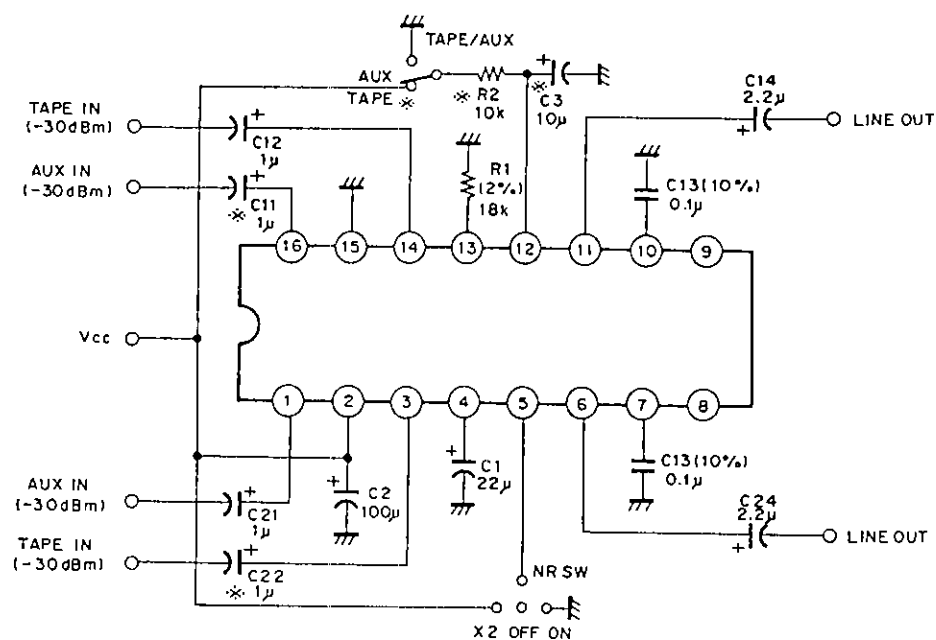
- Note)**
1. Resistor and capacitor tolerances are $\pm 10\%$ and $\pm 20\%$ respectively unless otherwise specified.
 2. When resistors RT are connected to Pin 4 for the MPX filter termination, increase the capacitances of C1 and C11 (C21) to 470 μF and 4.7 μF respectively.

Switching Processor with Split Power Supply



- Note)** Resistor and capacitor tolerances are $\pm 10\%$ and $\pm 20\%$ respectively unless otherwise specified.

Playback Processor with AUX input



Note) Resistor and capacitor tolerances are $\pm 10\%$ and $\pm 20\%$ respectively unless otherwise specified.

Notes on Applications

1) Power Supply

The CXA1550 series is designed to operate on either single or split power supply. The ripple rejection performance is excellent for either supply. VCT (Pin 4) is a reference voltage of the $V_{CC}/2$ buffer amplifier. With single power supply operation, internally generated $V_{CC}/2$ voltage appears at the pin, and a bypass capacitor has to be connected between the pin and ground. On split power supply operation, the VCT (Pin 4) pin has to be connected to ground, and V_{EE} (negative power supply) is supplied to the GND (Pin 15) pin.

2) Double speed (×2)

The CXA1550 series provide double speed encode/decode modes, which offer high speed dubbing function. On double speed mode, the frequency response shifts twice as the normal B type.

3) Operation mode control

The CXA1550 series provide fully electronic switching circuits. The functions are controlled by DC voltages of the two control pins of REC/PB (Pin 12) and ON/OFF/×2 (Pin 5). The switching truth tables are shown in Table 1.

Pin	Function	Single Supply	Split Supply
Pin 12	PB (Decode)	$V_{CC} \geq V \geq 2.5V$	$V_{CC} \geq V \geq V_{EE}+2.5V$
	REC (Encode)	$0.5V \geq V \geq 0V$	$V_{EE}+0.5V \geq V \geq V_{EE}$
Pin 15	NR×2	$V_{CC} \geq V \geq V_{CC}-0.5V$	$V_{CC} \geq V \geq V_{CC}-0.5V$
	NR OFF	$V_{CC}-2.5 \geq V \geq 2.5V$	$V_{CC}-2.5V \geq V \geq V_{EE}+2.5V$
	NR ON	$0.5V \geq V \geq 0V$	$V_{EE}+0.5V \geq V \geq V_{EE}$

Table 1.

It is desirable to provide CR time constant circuits at the mode control pins with time constant from 100msec to 1sec, which will reduce switching clicks effectively.

4) Reference levels

Characteristics and specifications of the Dolby noise reduction processor are defined as the levels and measured with reference to the Dolby level. This particular level in these devices is -10dBm (245mVrms), and is measured at the recording output (REC OUT) in the NR off mode.

The reference levels of the recording input (REC IN), play back input (PB IN) and line output (LINE OUT) are defined the levels which provide the Dolby level at the recording output in the NR off mode.

The CXA1550 series has a common silicon die, and has different internal connection. The series provides four different line output levels for various applications. Other reference levels, recording input level, playback input level and recording output level (=Dolby level) are identical in all devices.

The reference levels are as follows

Recording output level (=Dolby level)	-10dBm (245mVrms)
Recording input level	-30dBm (24.5mVrms)
Play back input level	-30dBm (24.5mVrms)
Line output level	CXA1550 0dBm (775mVrms)
	CXA1551 -3dBm (548mVrms)
	CXA1552 -6dBm (388mVrms)
	CXA1553 -10dBm (245mVrms)

5) MPX filter termination and C_1 for $V_{cc}/2$ (Pin 4)

The MPX (multiplex) filter termination method shown in Fig. 1 allows saving the coupling capacitors between the buffer amplifiers and MPX filters. However, the channel to channel separation and REC to PB crosstalk of low frequency signals will be degraded by the termination resistor R_T . For example, $5k\Omega$ of R_T will degrade the channel to channel separation to 50dB. Better separation can be obtained by increasing the capacitance of C_1 (Pin 4) to 220 μF or 470 μF .

The allowable minimum value of C_1 is 47 μF , and 100 μF is the standard recommended value. Larger values of C_1 are generally desirable in order to improve the crosstalk and ripple rejection ratio.

6) Application for dubbing cassette decks

The CXA1550 series generates non decoded signal at the recoding output in the decode mode, and can simplify the structure of dubbing decks. See the SONY' Dolby B/C type IC (CX20187/CXA1097Q or CX20188/CXA1098Q) data sheet in detail.

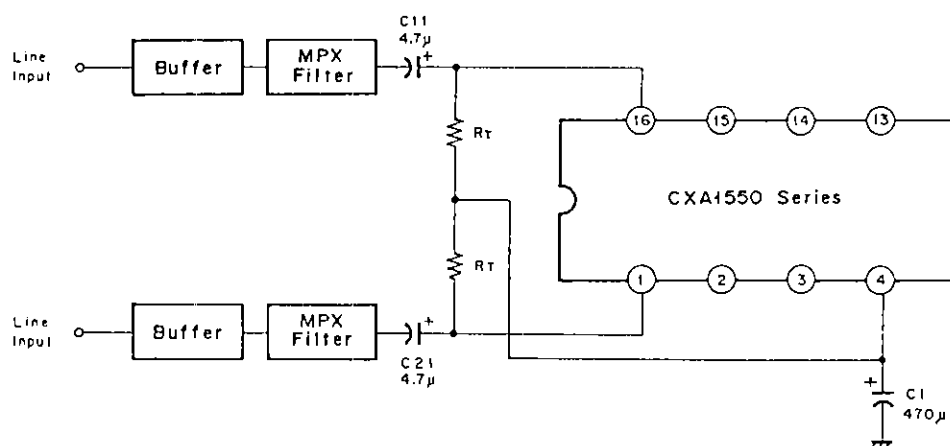
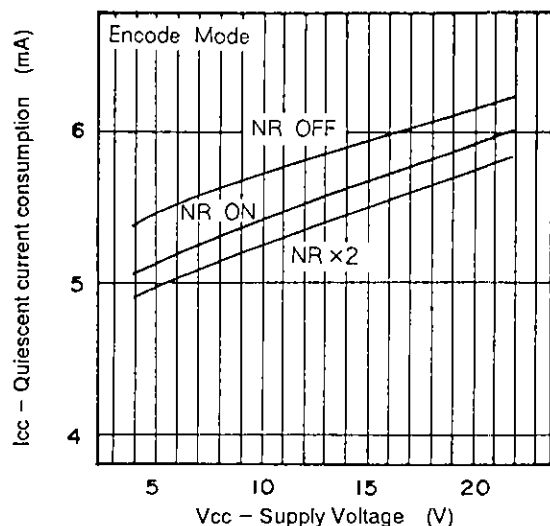


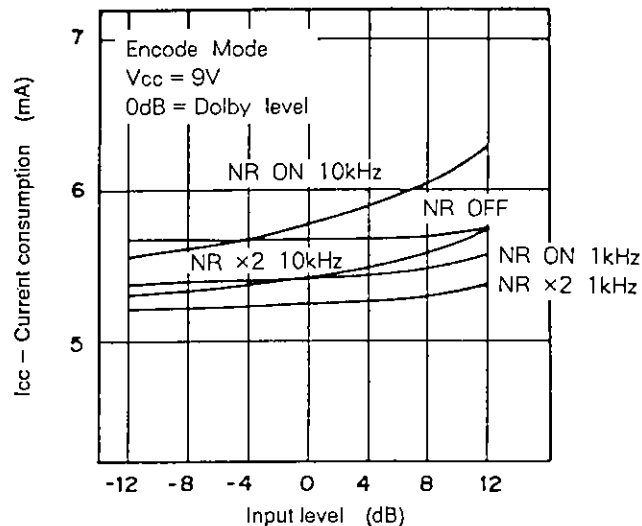
Fig. 1

Main Characteristics

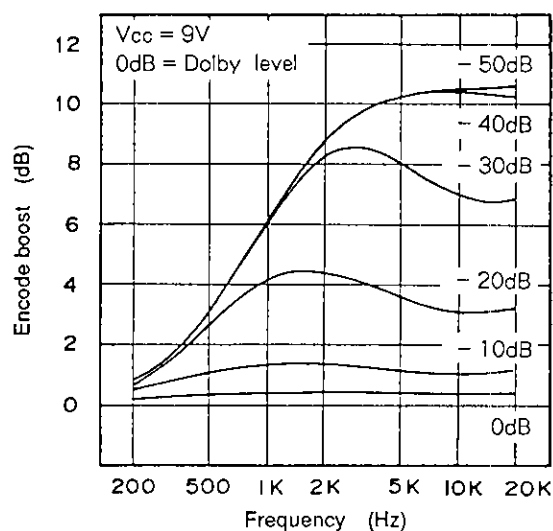
Quiescent current consumption vs. Supply voltage



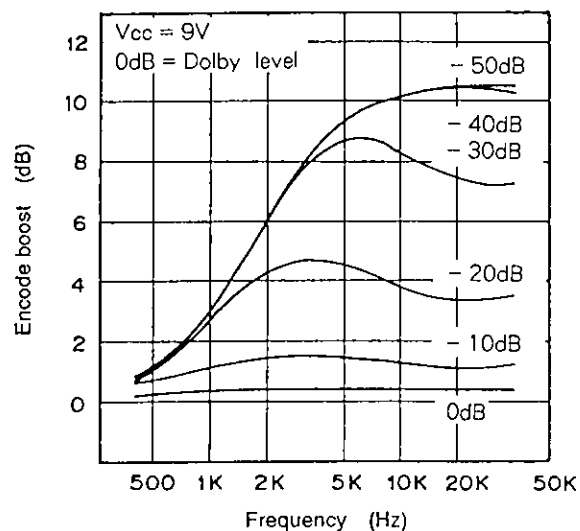
Current consumption vs. Input level (CXA1552)



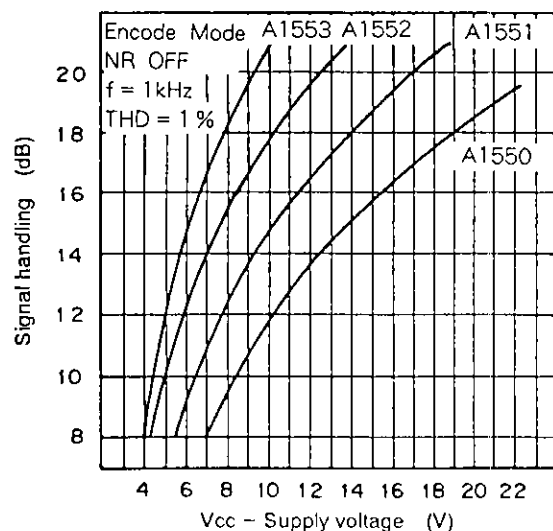
NR on encode characteristics



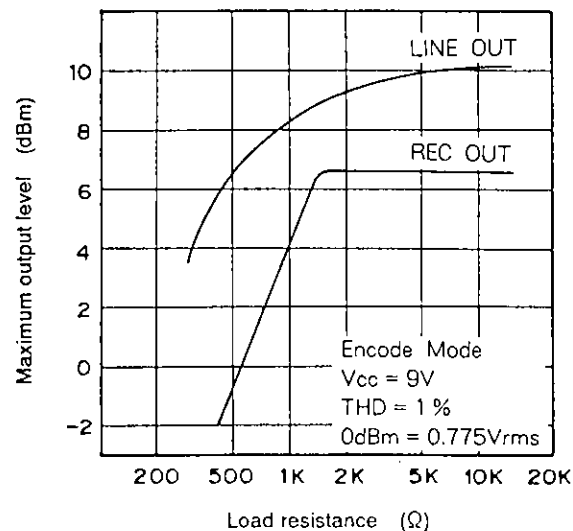
Double Speed Encode Boost



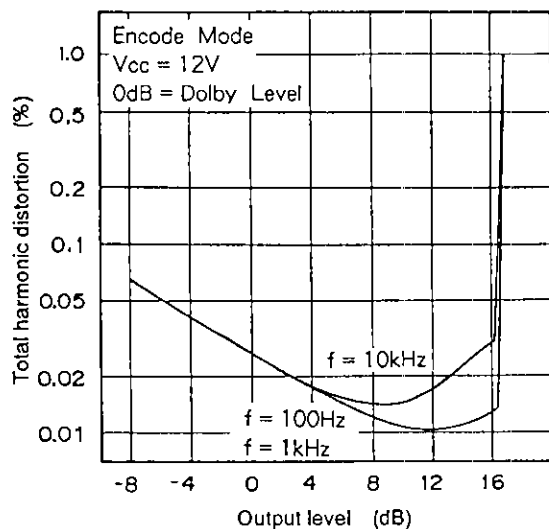
Signal handling



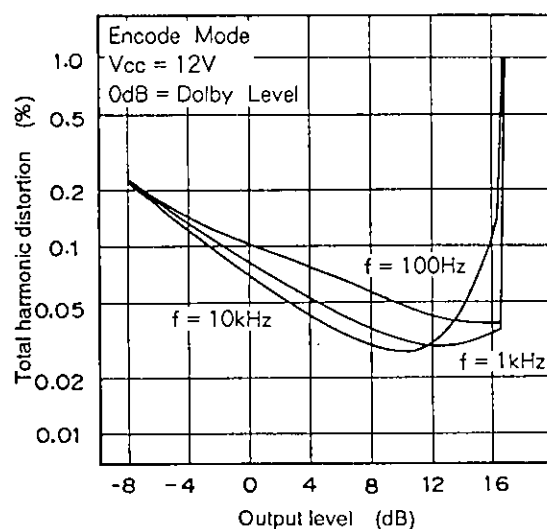
Load characteristics (CXA1552)



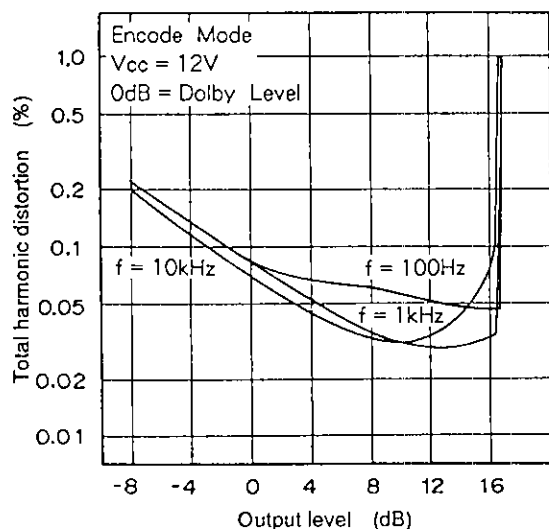
NR OFF total harmonic distortion – 1 (CXA1551)



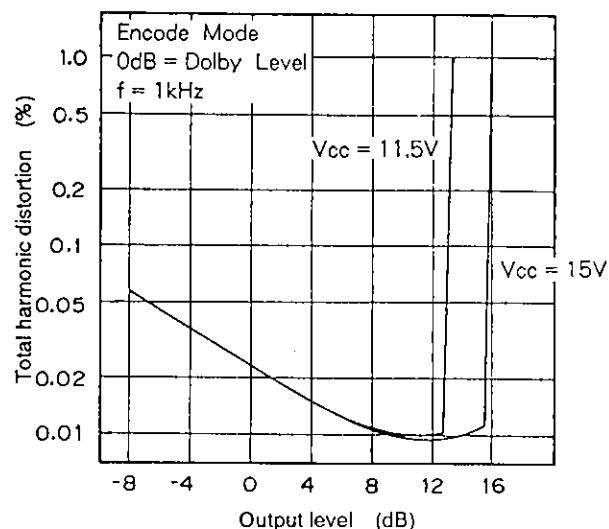
NR ON total harmonic distortion – 1 (CXA1551)



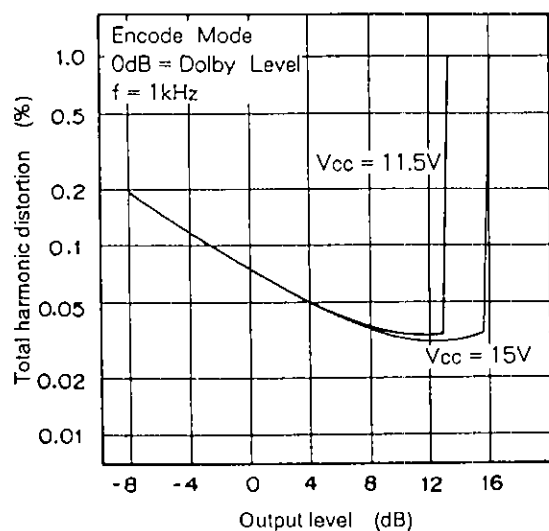
Double speed total harmonic distortion – 1 (CXA1551)



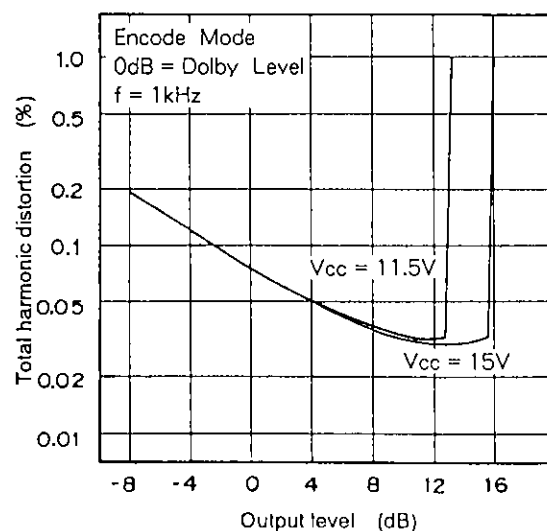
NR OFF total harmonic distortion – 2 (CXA1550)



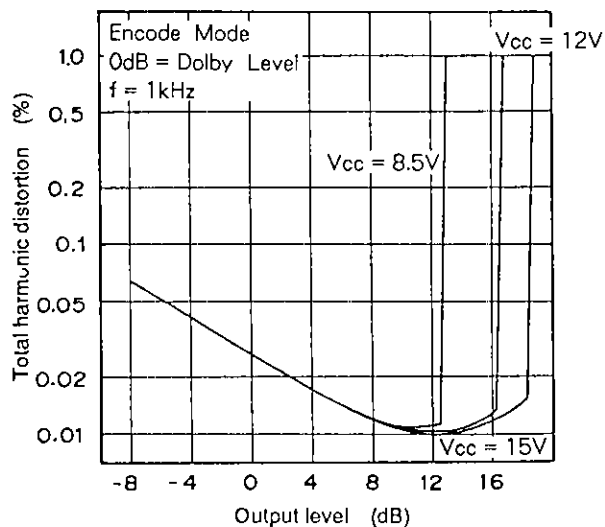
NR ON total harmonic distortion – 2 (CXA1550)



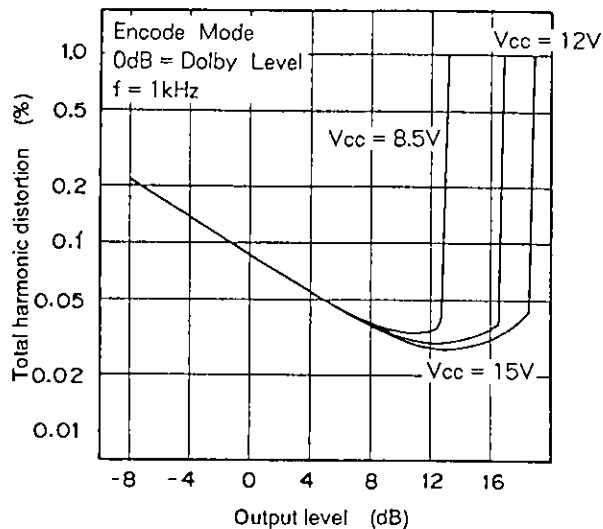
Double speed total harmonic distortion – 2 (CXA1550)



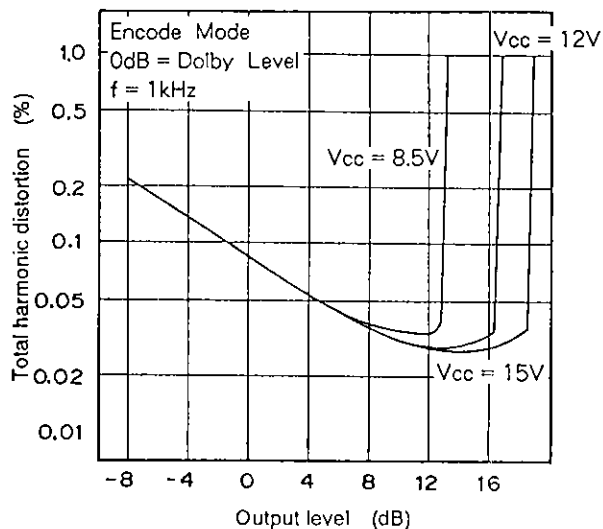
NR OFF total harmonic distortion - 3 (CXA1551)



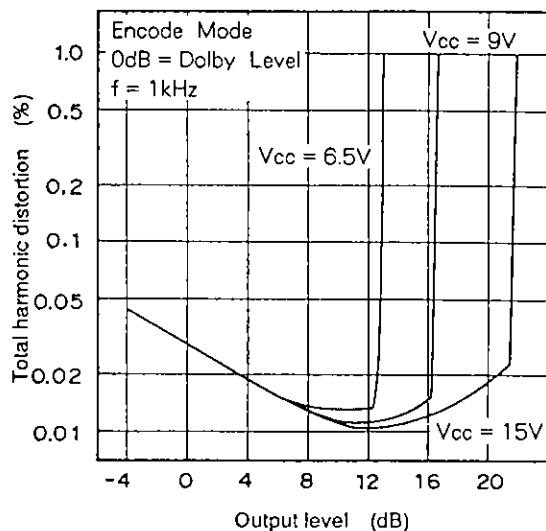
NR ON total harmonic distortion - 3 (CXA1551)



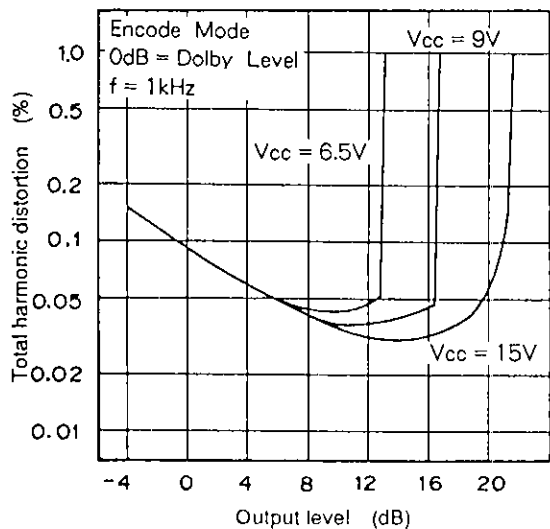
Double Speed total harmonic distortion - 3 (CXA1551)



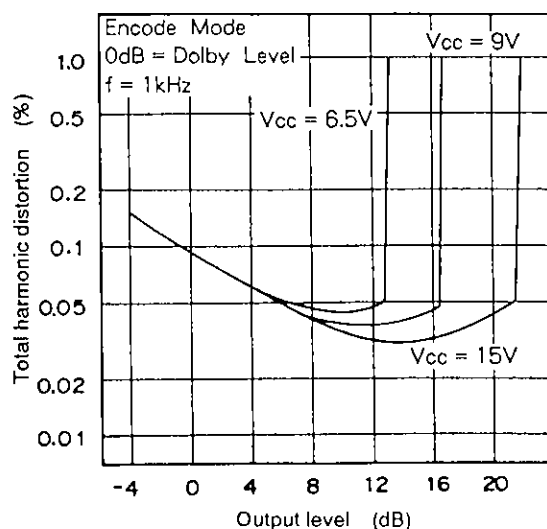
NR OFF total harmonic distortion - 4 (CXA1552)



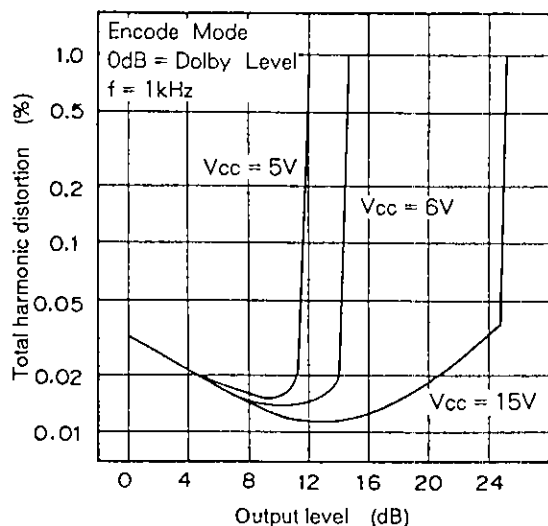
NR ON total harmonic distortion - 4 (CXA1552)



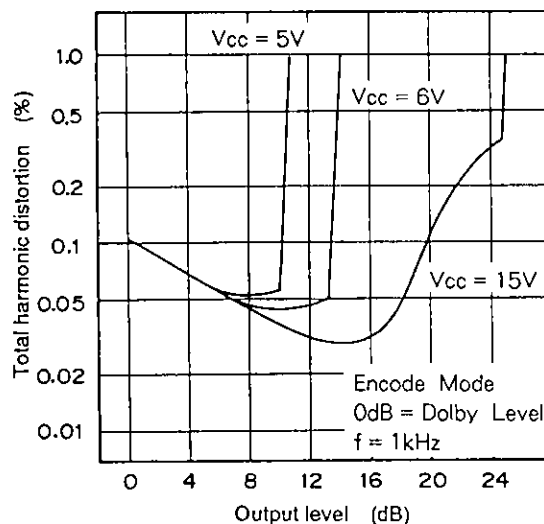
Double speed total harmonic distortion - 4 (CXA1552)



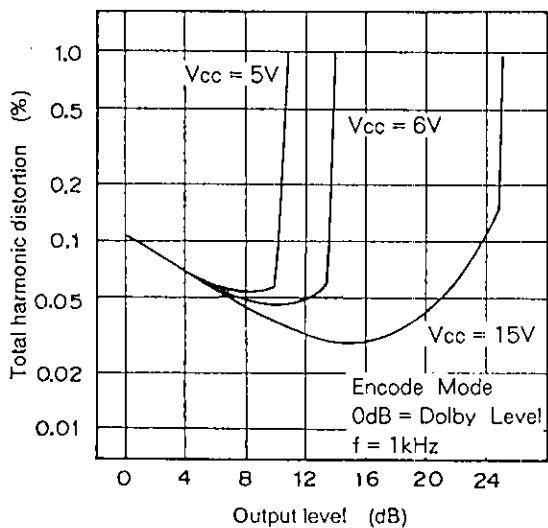
NR OFF total harmonic distortion – 5 (CXA1553)



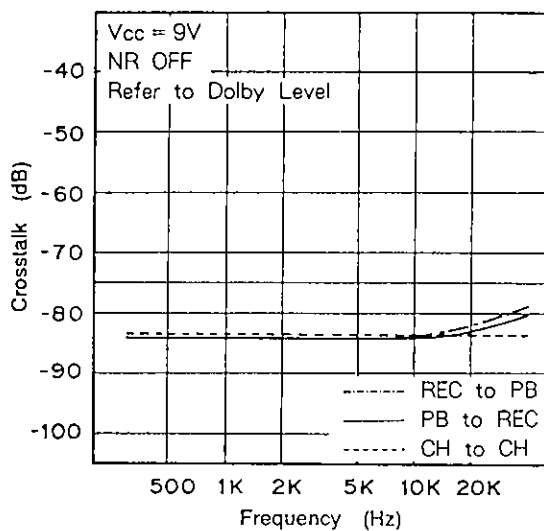
NR ON total harmonic distortion – 5 (CXA1553)



Double Speed total harmonic distortion – 5 (CXA1553)



Crosstalk (CXA1552)

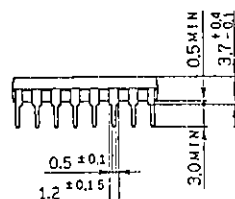
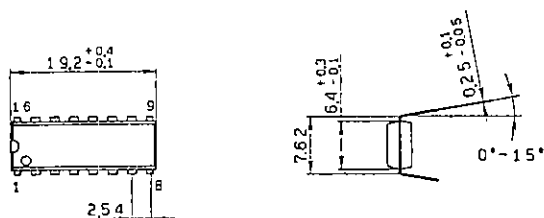


Package Outline Unit : mm

CXA1550P, CXA1551P

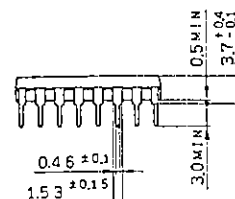
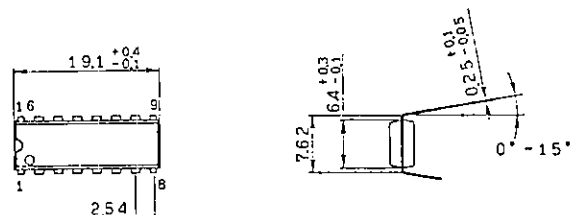
CXA1552P, CXA1553P

16pin DIP (Plastic) 300mil 1.0g



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EIAJ NAME	*DIP016-P-0300-A
JEDEC CODE	MO-001-AE *

* (Similar)



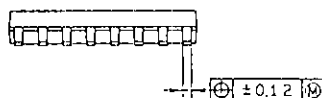
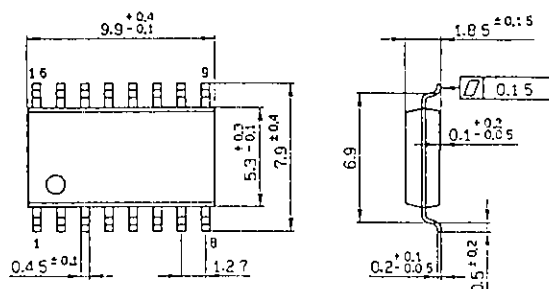
SONY NAME	DIP-16P-03
EIAJ NAME	*DIP016-P-0300-B
JEDEC CODE	MO-001-AE *

* (Similar)

CXA1551M, CXA1552M

CXA1553M

16pin SOP (Plastic) 300mil 0.2g



SONY NAME	SOP-16P-L01
EIAJ NAME	*SOP016-P-0300-A
JEDEC CODE	