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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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HA12230NT

Audio Signal Processor for Cassette Deck

ADE-207-322E (Z)

6th Edition
Nov. 2000

Description

HA12230NT is silicon monolithic bipolar IC providing PB equalizer, REC equalizer system and each electronic control switch in one chip.

Functions

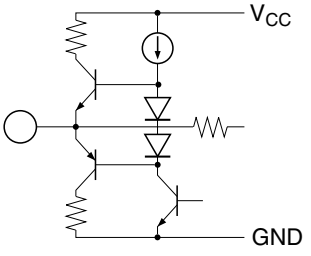
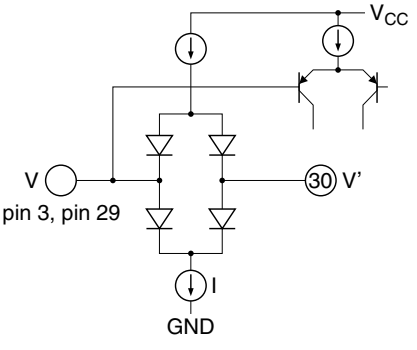
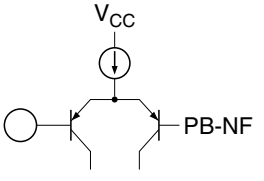
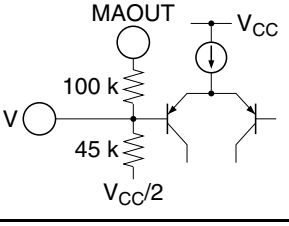
- PB equalizer × 2 channel
- REC equalizer × 2 channel
- MS use Mixing Amp.
- Each electronic control switch to change tape type and mute etc.
- REC mute
- REC head return switch
- Line Amp.
- Line mute

Features

- REC equalizer is very small number of external parts, built-in 2 types of frequency characteristics
- PB equalizer circuit built-in
- REC/PB are possible with TYPE I/II
- Controllable from direct micro-computer output
- Available to reduce substrate-area because of high integration and small external parts

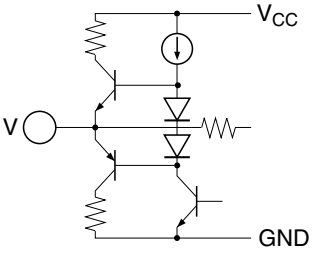
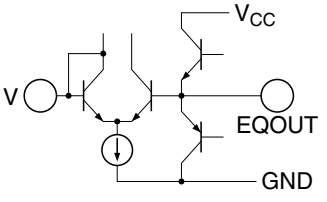
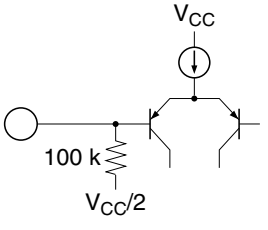
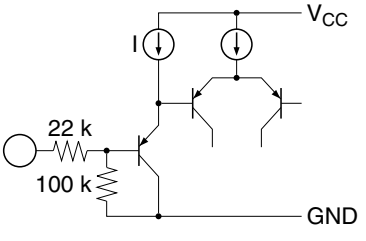
Pin Description, Equivalent Circuit

(V_{CC} = 12 V, Ta = 25°C, No signal, The value in the table show typical value.)

Pin No.	Pin Name	Note	Equivalent Circuit	Pin Description
17	V_{cc}	$V = V_{cc}$		V_{cc} pin
16	RECOUT(L)	$V = V_{cc}/2$		REC-EQ output
15	RECOUT(R)			
10	MAOUT			MS Amp. output
1	VREF			Reference
30	REC-RETURN	$V = V' = V_{cc}/2$		REC return
29	BIN(L)			PB B deck input
3	BIN(R)			
28	AIN(L)	$V = V_{cc}/2$		PB A deck input
4	AIN(R)			
11	MAI	$V = V_{cc}/2$		MS Amp. input

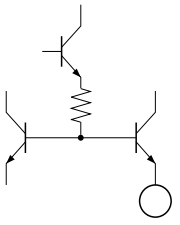
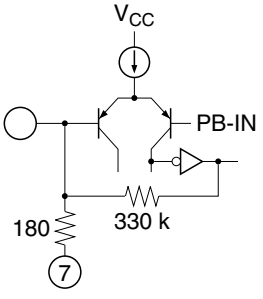
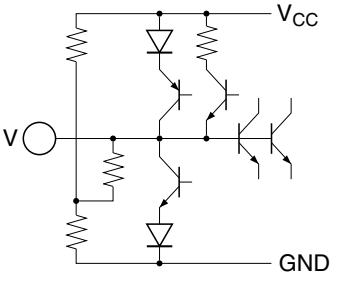
Pin Description, Equivalent Circuit

(V_{CC} = 12 V, Ta = 25°C, No signal, The value in the table show typical value.) (cont)

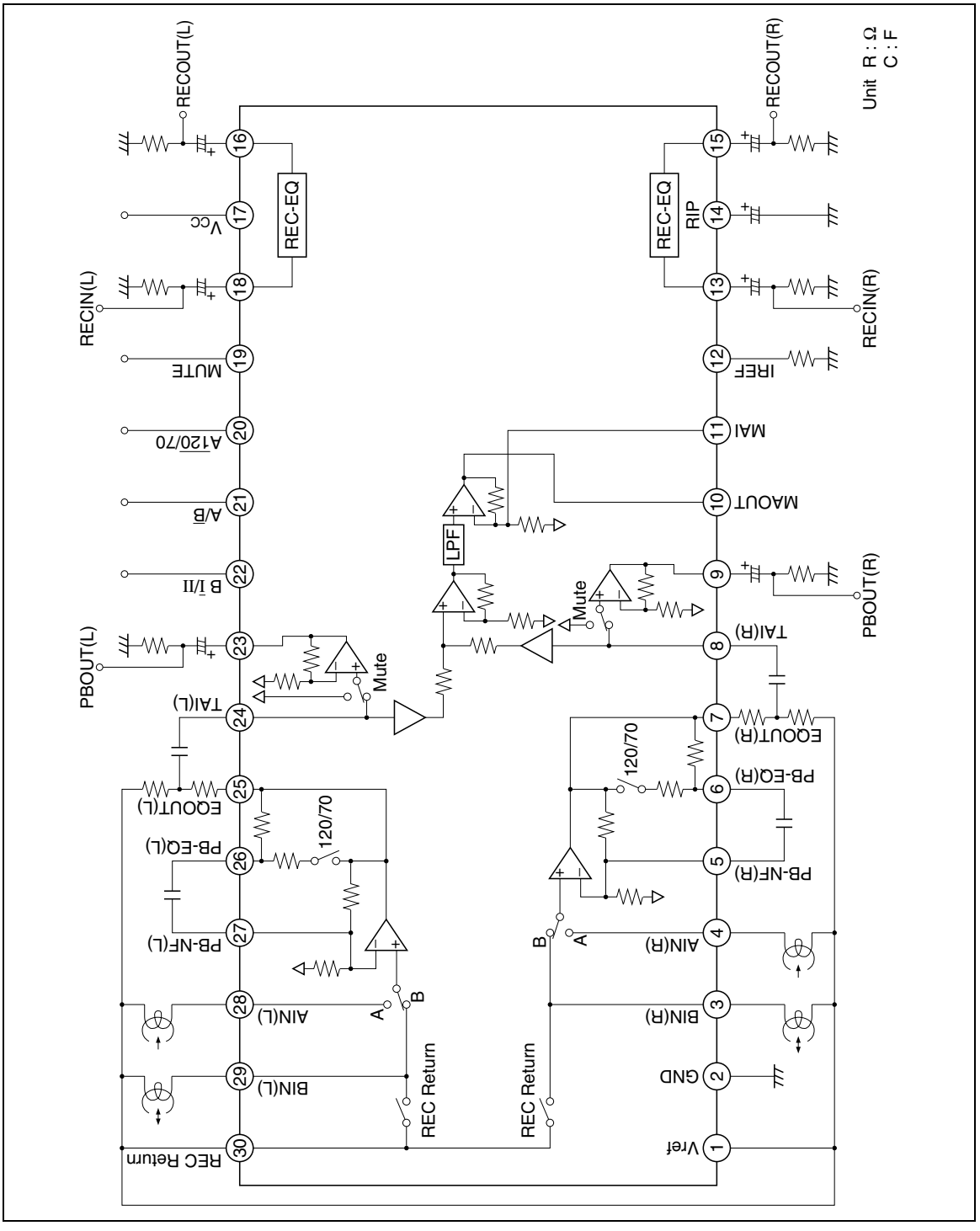
Pin No.	Pin Name	Note	Equivalent Circuit	Pin Description
23	PBOUT(L)	V = V_{CC}/2		PB output
9	PBOUT(R)			
25	EQOUT(L)			EQ output (120 μ)
7	EQOUT(R)			
26	PB-EQ(L)	V = V_{CC}/2		EQ output (70 μ)
6	PB-EQ(R)			
13	RECIN(R)	V = V_{CC}/2		REC-EQ input
18	RECIN(L)			
24	TAI(L)			Tape input
8	TAI(R)			
19	MUTE	I = 20 μA		Mode control input
20	A $\overline{120}$/70			
21	A/$\overline{B}$			
22	B $\overline{I}$/II			

Pin Description, Equivalent Circuit

(V_{CC} = 12 V, Ta = 25°C, No signal, The value in the table show typical value.) (cont)

Pin No.	Pin Name	Note	Equivalent Circuit	Pin Description
12	IREF	V = 1.2 V		Equalizer reference current input
2	GND			GND pin
27	PB-NF(L)	PB-IN = Vref		PB EQ feed back
5	PB-NF(R)			
14	RIP	PBOUT = Vref		NAB output

Block Diagram



Parallel Data Format

Pin No.	Pin Name	Lo	Mid	Hi
19	MUTE	MUTE OFF	—	MUTE ON
20	A $\overline{120}$/70	*	—	*
21	A/$\overline{B}$	B Return SW OFF REC Mute ON	A Return SW ON REC Mute ON	A Return SW ON REC Mute OFF
22	B $\overline{I}$/II	REC-EQ * TYPE I	—	REC-EQ * TYPE II

Note: PB-EQ 120/70 logic

		A/$\overline{B}$		
A $\overline{120}$/70	**B $\overline{I}$/II**	**Lo**	**Mid**	**Hi**
Low	Low	120 μ	120 μ	120 μ
Low	High	70 μ	120 μ	120 μ
High	Low	120 μ	70 μ	70 μ
High	High	70 μ	70 μ	70 μ

Functional Description

Power Supply Voltage Range

HA12230NT is designed to operate on single supply, shown by table 1.

Table 1 Operating Power Supply Voltage

Item	Power Supply Voltage Range
Single Supply	6.5 V to 15.0 V

Reference Voltage

These devices provide the reference voltage of half the supply voltage that is the signal grounds. As the peculiarity of these devices, the capacitor for the ripple filter is very small about 1/100 compared with their usual value. The block diagram is shown as figure 1.

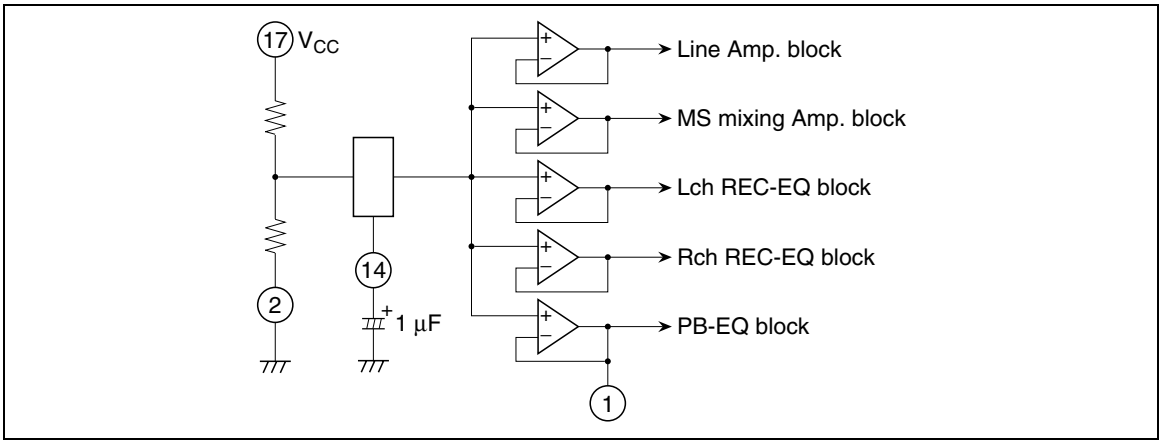


Figure 1 The Block Diagram of Reference Supply Voltage

Operating Mode Control

HA12230NT provide fully electronic switching circuits. And each operating mode control is controlled by parallel data (DC voltage).

Table 2 Threshold Voltage (Vth)

Pin No.	Lo	Mid	Hi	Unit	Test Condition
19, 20, 22	0.0 to 0.5	—	2.4 to V_{CC}	V	Input Pin Measure V
21	0.0 to 0.5	1.2 to 1.8	2.4 to V_{CC}	V	

Note: 1. Each pins are on pulled down with 100 kΩ internal resistor. Therefore, it will be low-level when each pins are open.
2. Over shoot level and under shoot level of input signal must be the standardized. (High: V_{CC}, Low: –0.2 V)

Block Diagram

Figure 2 shows the block diagram.

As this IC is built-in REC return switch, the configuration system can be simple system using a few external component and the REC/PB head.

About these logics, please look at the Parallel Data Format.

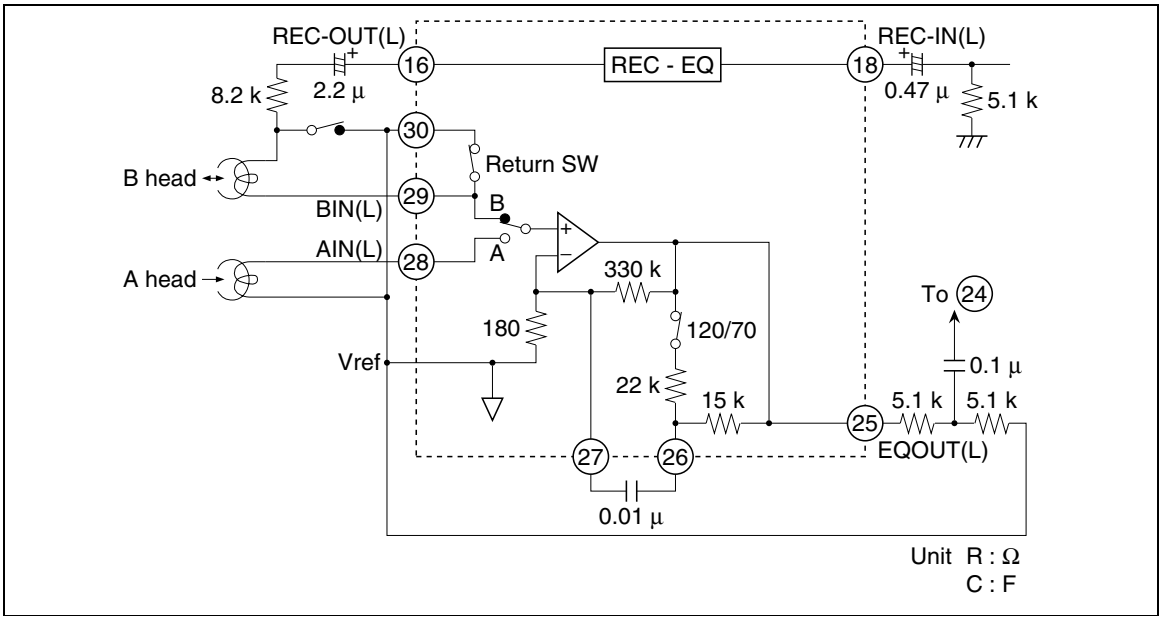


Figure 2 Block Diagram (Lch)

Level Diagram

The gain establishment of PB-EQ considers PB output level {(internal Line Amp. + PB Amp.) = 580 mV (Dolby Level)} like figure 3 at the target.

After replace RA and RB with a half-fix volume, adjust level.

Regarding REC-EQ adjust the gain in front of input to this IC.

The level diagram of 1 kHz is shown figure 3.

Similarly to PB, it consider Dolby level as a standard. And R1 needs the value more than 5.6 kΩ.

Because mode establishment resistances are built-in, REC-EQ frequency characteristics are respectively fixed value.

In case the change of the frequency characteristics are necessary, please inquire the responsible agent because the adjustment of resistors is necessary.

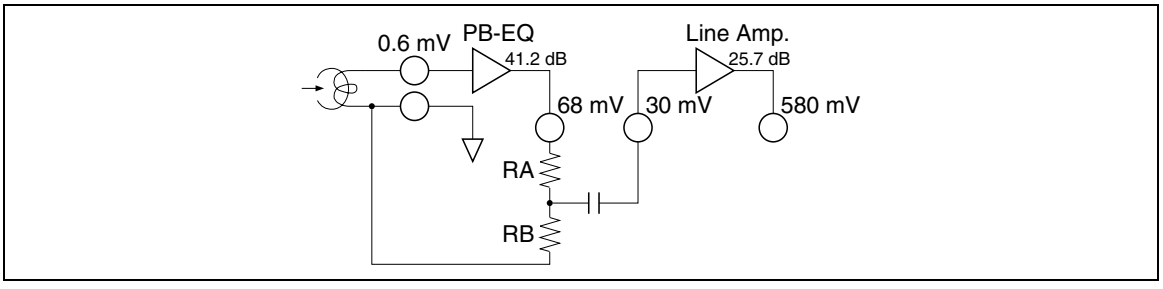


Figure 3 PB System Level Diagram

Line Mute

HA12230NT is built-in with mute circuit to Line Amp.

A mute control does with High/Low of pin 19.

Reducing pop noise is so much better 10 kΩ to 22 kΩ resistor to pin 19 in series and 1 µF to 22 µF capacitor.

A mute is not built-in when doing a power ON/OFF.

Please correspond to it, on the side of a set system.

Test Mode

Test mode becomes if it is resistor less than 10 kΩ of pin 12.

Please use resistor of 22 kΩ on the occasion of mount.

Music Sensor Mixing Block

- Gain with TAI to MAOUT

  Case of one-side input, gain with TAI to MAOUT is attenuations 6 dB.

  G_V = (L · R signal addition circuit) + (MS Amp. gain) + (TAI one-side input attenuations)

  $= 20 + 20\log \frac{100\text{ k} + 45\text{ k}}{45\text{ k}} + (-6)$

  ≈ 24.2 (dB)

  For a necessary case, please in series add CR to MAI terminal for gain regulation.

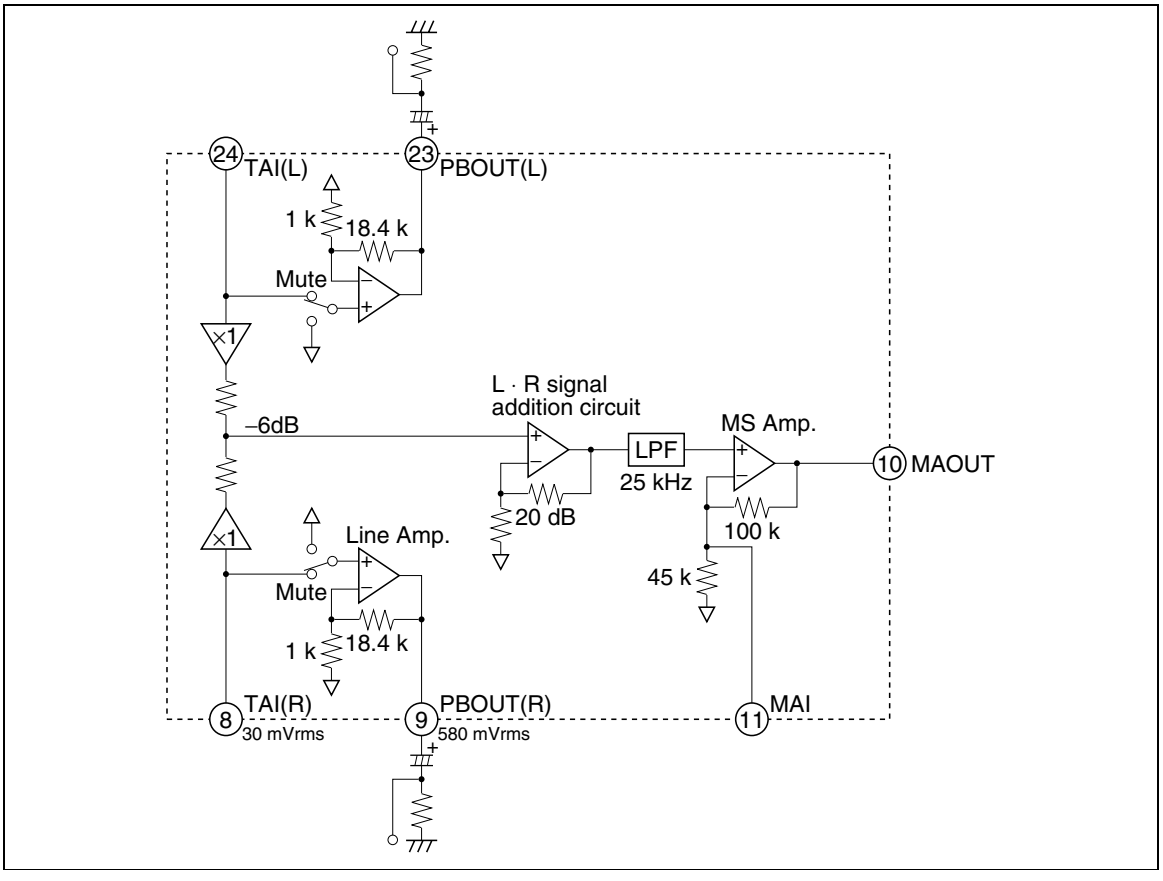


Figure 4 Music Sensor Mixing Amp. Block Diagram

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit	Note
Maximum supply voltage	V_{cc} max	16	V	
Power dissipation	Pd	500	mW	Ta ≤ 75°C
Operating temperature	Topr	–40 to +75	°C	
Storage temperature	Tstg	–55 to +125	°C	
Operating voltage	Vopr	6.5 to 15	V	

Note: HA12230NT operates on single supply voltage.

Electrical Characteristics

(Ta = 25°C, V_{CC} = 12 V, PBIN Standard Level = 0.6 mVrms at 1 kHz, LineIN Standard Level = 30 mVrms, LineOUT Standard Level = 580 mVrms)

Item	Symbol	Test Condition: IC Condition A/$\overline{B}$	B $\overline{I}$/II	A$\overline{120}$/70	MUTE	fin (Hz)	Vin (mVrms)	Other	Specification Min	Typ	Max	Unit	Application Terminal: Input R	Input L	Output R	Output L	COM	Remark
Quiescent current	I_Q	A	I	70	OFF	—	—	No signal	15.0	22.5	33.0	mA	—	—	—	—	17	
Logical threshold	V_{IL}	—	—	—	—	—	—		–0.2	—	0.5	V	—	—	—	—	19~22	
	V_{IM}	—	—	—	—	—	—		1.2	—	1.8	V	—	—	—	—	21	
	V_{IH}	—	—	—	—	—	—		2.4	—	V_{CC}	V	—	—	—	—	19~22	
PB-REC crosstalk	CT PB/REC(1)	A	I	120	OFF	1k	*1	REC-EQ → PB-EQ	50.0	60.0	—	dB	13	18	9	23	—	
	CT PB/REC(2)	A	I	120	OFF	1k	6.0	PB-EQ → REC-EQ	60.0	70.0	—	dB	4	28	15	16	—	
PB-EQ gain	G_V PB(1)	A/B	I	120	OFF	1k	0.6		38.2	41.2	44.2	dB	4/3	28/29	7	25	—	
	G_V PB(2)	A	I	120	OFF	10k	0.6		35.2	38.2	41.2	dB	4	28	7	25	—	
	G_V PB(3)	A	II	70	OFF	10k	0.6		31.0	34.0	37.0	dB	4	28	7	25	—	
PB-EQ maximum output level	Vomax PB	A/B	I	120	OFF	1k	—	THD = 1%	0.3	0.6	—	Vrms	4/3	28/29	7	25	—	*2
PB-EQ THD	THD PB	A/B	I	120	OFF	1k	2.4		—	0.2	0.5	%	4/3	28/29	7	25	—	
PB-EQ noise voltage	VN PB	A/B	I	120	OFF	—	—	Rg = 820Ω, DIN-AUDIO	—	90	180	μVrms	4/3	28/29	7	25	—	
PB-EQ channel separation	CT R/L(1)	A/B	I	120	OFF	1k	6.0		50.0	60.0	—	dB	4/3	28/29	9	23	—	
PB-EQ crosstalk	CT A/B	A/B	I	120	OFF	1k	6.0		60.0	70.0	—	dB	4/3	28/29	9	23	—	
Line AMP gain	G_V LA	A	I	120	OFF	1k	30.0		24.2	25.7	27.2	dB	8	24	9	23	—	
Line AMP THD	THD LA	A	I	120	OFF	1k	30.0		—	0.05	0.30	%	8	24	9	23	—	
Line AMP maximum output level	Vomax LA	A	I	120	OFF	1k	—	THD = 1%	1.16	1.40	—	Vrms	8	24	9	23	—	*2
MS AMP gain	G_V MS	A	I	120	OFF	1k	30.0		22.7	24.2	25.7	dB	8	24	—	—	10	
Line MUTE attenuation	L-MUTE ATT	A	I	120	ON	1k	120.0		70.0	80.0	—	dB	8	24	9	23	—	

Notes: 1. Large level without clipping
2. V_{CC} = 6.5 V

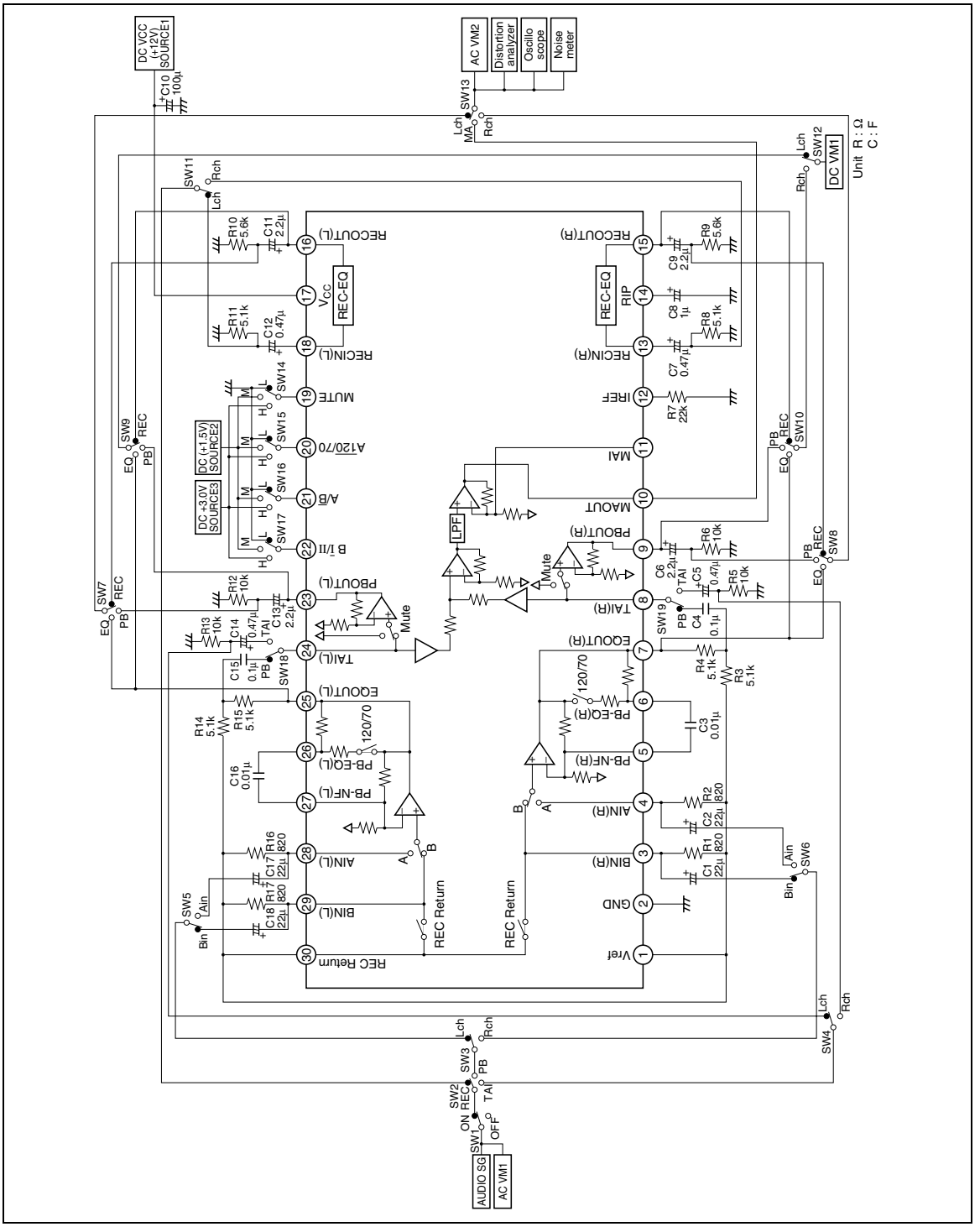
Electrical Characteristics (cont)

(Ta = 25°C, V_{CC} = 12 V, EQIN Standard Level = –20 dBs = 77.5 mVrms)

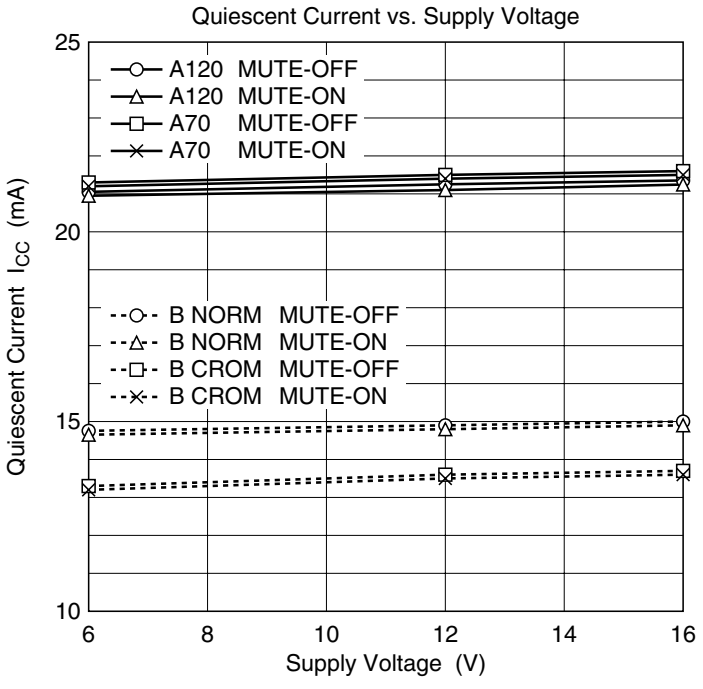
Item	Symbol	Test Condition							Specification				Application Terminal					Re-mark
		IC Condition											Input		Output			
		A/$\overline{B}$	B $\overline{I}$/II	A$\overline{120}$/70	MUTE	fin (Hz)	Vin (mVrms)	Other	Min	Typ	Max	Unit	R	L	R	L	COM	
REC-EQ frequency characteristics TYPE I	G_V REC-NN1	A	I	120	OFF	1k	7.75		13.5	15.0	16.5	dB	13	18	15	16	—	
	G_V REC-NN2	A	I	120	OFF	5k	7.75		15.25	17.25	19.25	dB	13	18	15	16	—	
	G_V REC-NN3	A	I	120	OFF	12.5k	7.75		25.0	28.0	31.0	dB	13	18	15	16	—	
REC-EQ frequency characteristics TYPE II	G_V REC-NC1	A	II	120	OFF	1k	7.75		18.0	19.5	21.0	dB	13	18	15	16	—	
	G_V REC-NC2	A	II	120	OFF	5k	7.75		20.5	22.5	24.5	dB	13	18	15	16	—	
	G_V REC-NC3	A	II	120	OFF	12.5k	7.75		29.0	32.0	35.0	dB	13	18	15	16	—	
REC-EQ channel separation	CT R/L(2)	A	I	120	OFF	1k	*1		61.0	70.0	—	dB	13	18	15	16	—	
REC-MUTE attenuation	R-MUTE ATT	MID	I	120	OFF	1k	*1		66.0	76.0	—	dB	13	18	15	16	—	
REC-EQ maximum output level	Vomax REC	A	I	120	OFF	1k	—	THD = 1%	0.7	1.0	—	Vrms	13	18	15	16	—	*2
REC-EQ THD	THD REC	A	I	120	OFF	1k	77.5		—	0.2	0.5	%	13	18	15	16	—	
REC-EQ S/N	S/N REC	A	I	120	OFF	1k	—	Rg = 5.1kΩ, A-WTG	56.0	59.0	—	dB	13	18	15	16	—	

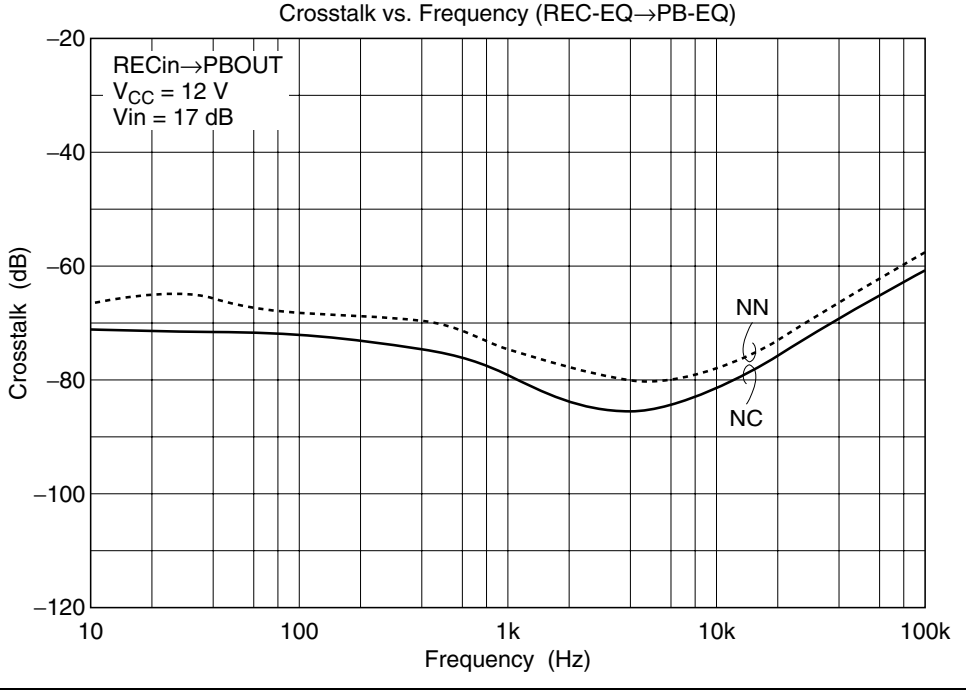
Notes: 1. Large level without clipping
2. V_{CC} = 6.5 V

Test Circuit

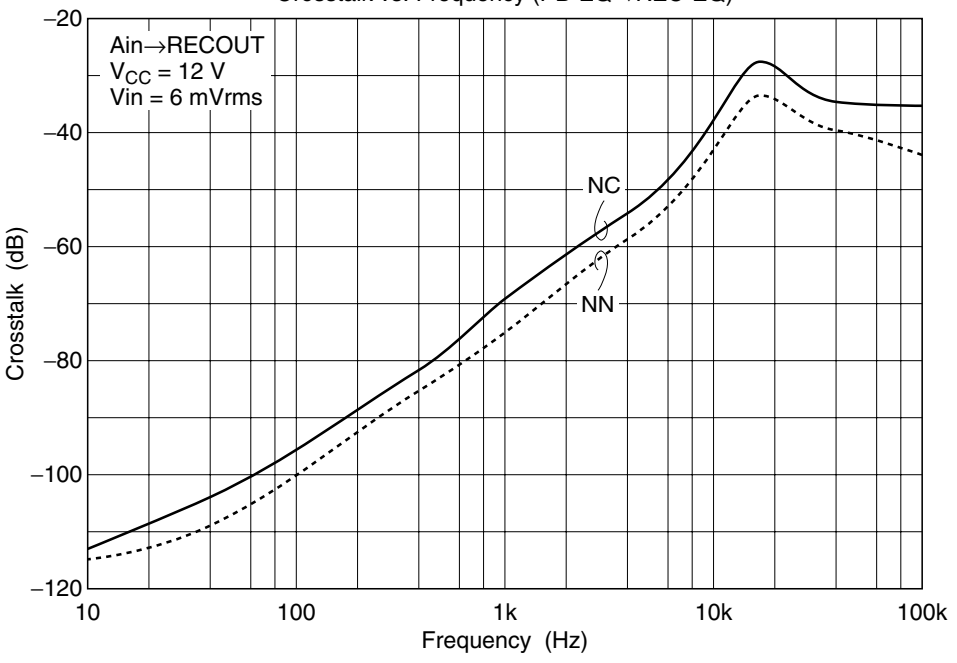


Characteristic Curves

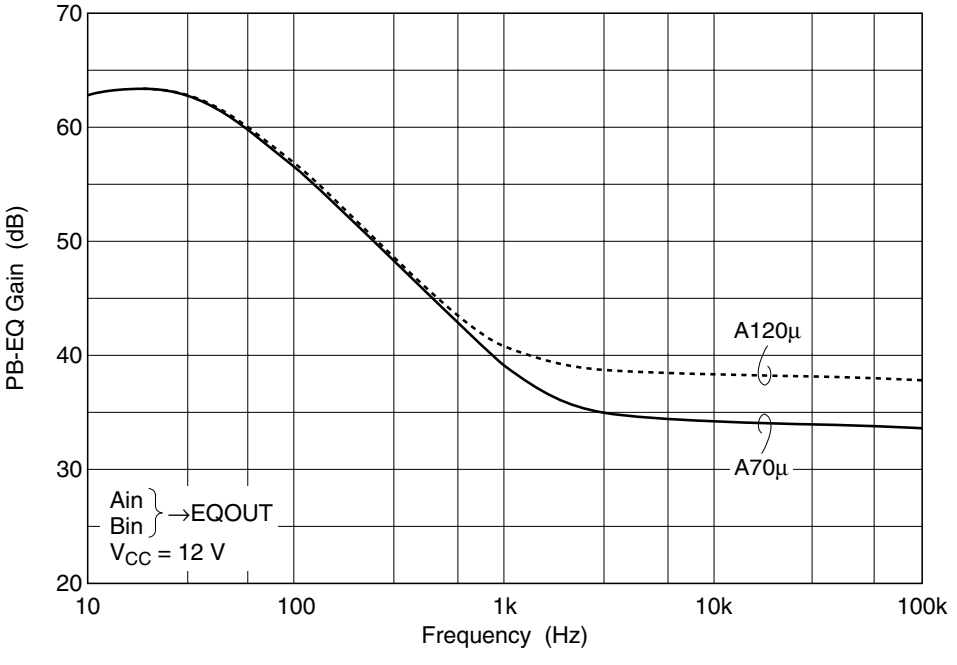




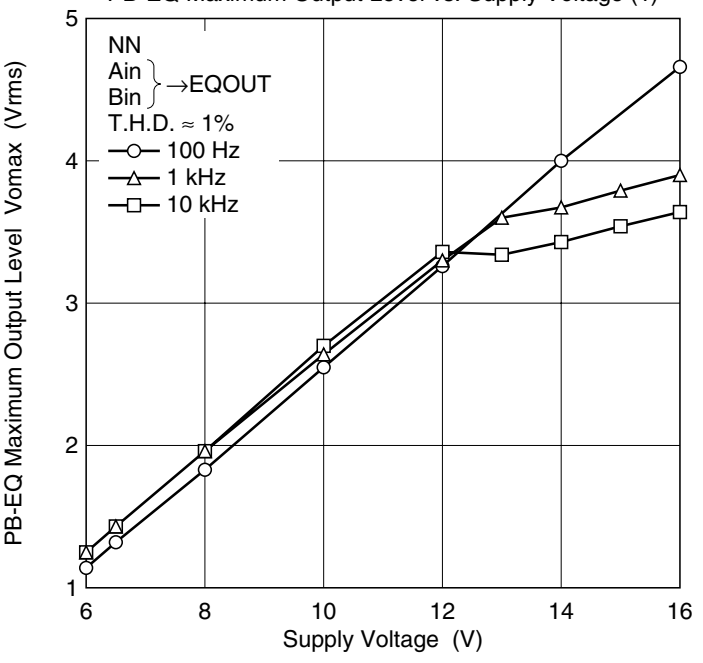
Crosstalk vs. Frequency (PB-EQ→REC-EQ)



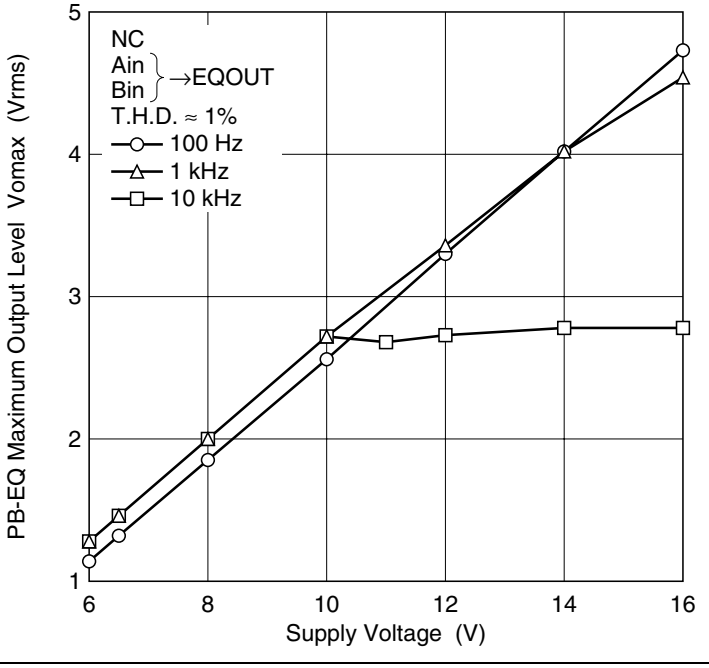
PB-EQ Gain vs. Frequency



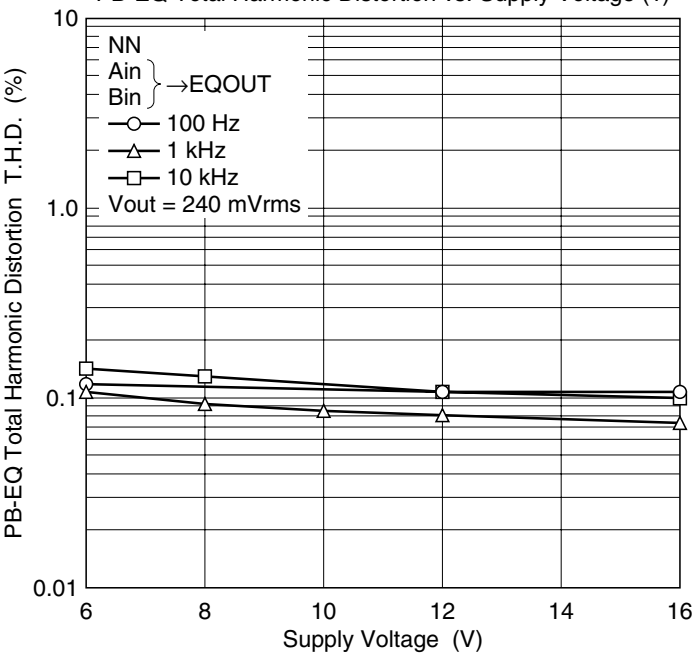
PB-EQ Maximum Output Level vs. Supply Voltage (1)



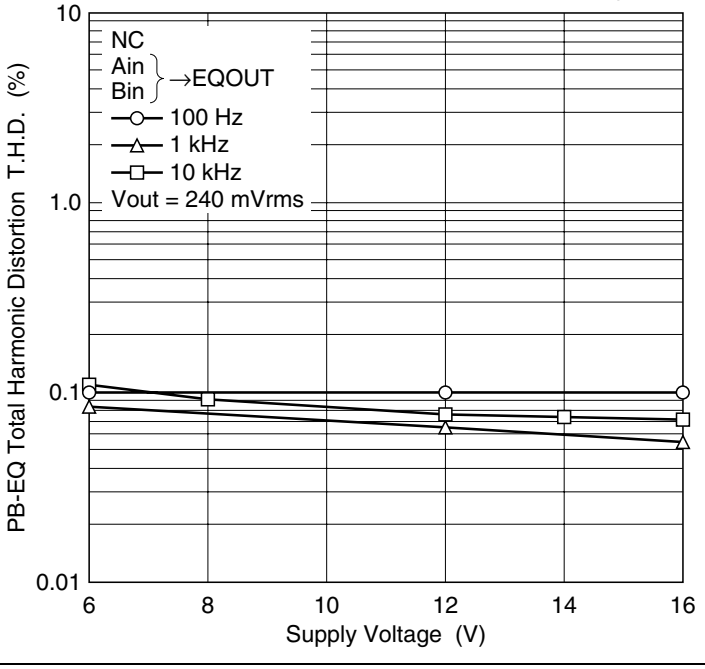
PB-EQ Maximum Output Level vs. Supply Voltage (2)



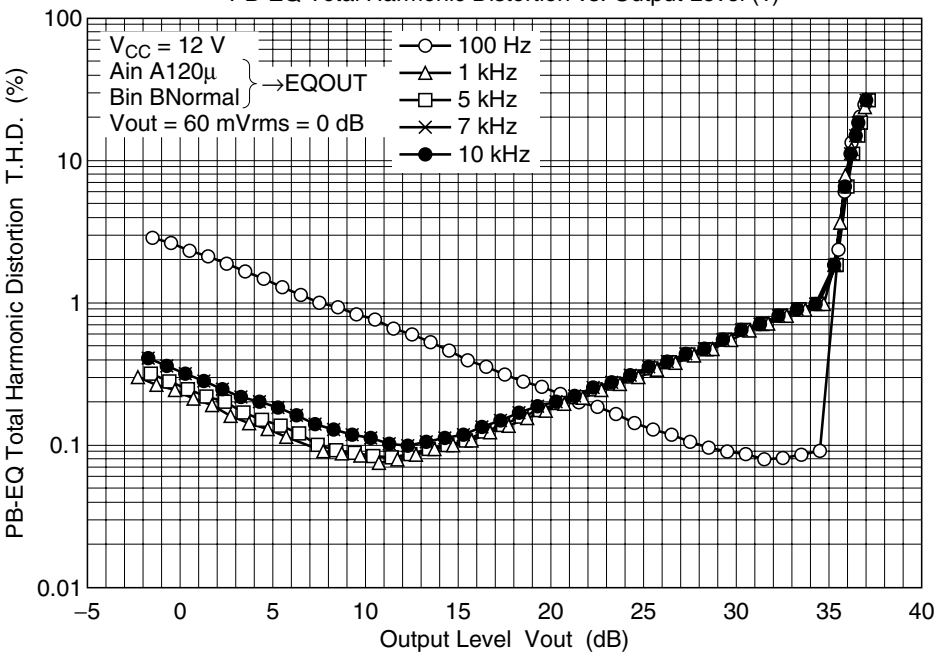
PB-EQ Total Harmonic Distortion vs. Supply Voltage (1)



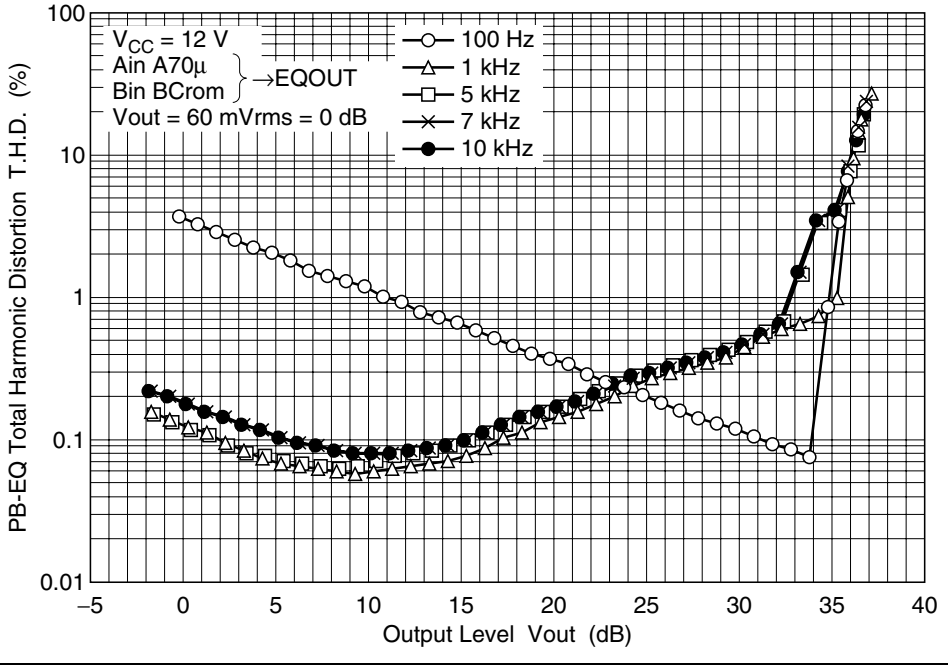
PB-EQ Total Harmonic Distortion vs. Supply Voltage (2)



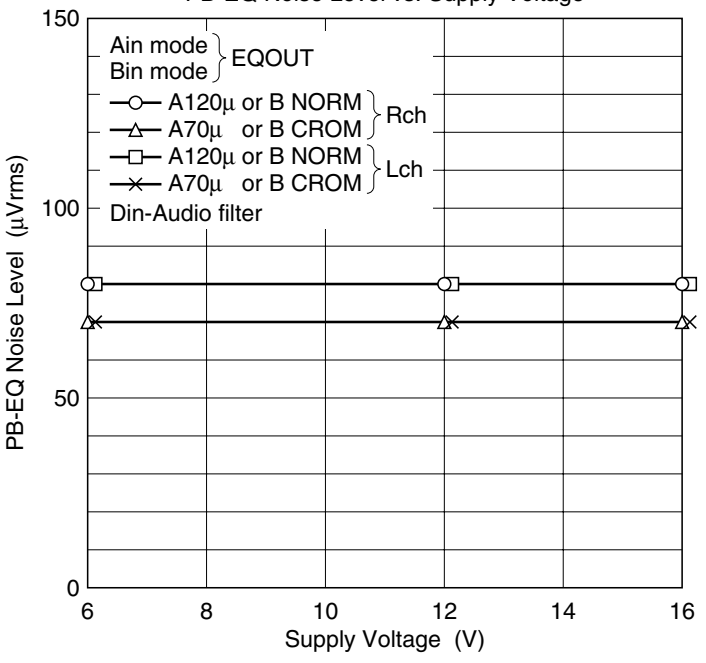
PB-EQ Total Harmonic Distortion vs. Output Level (1)



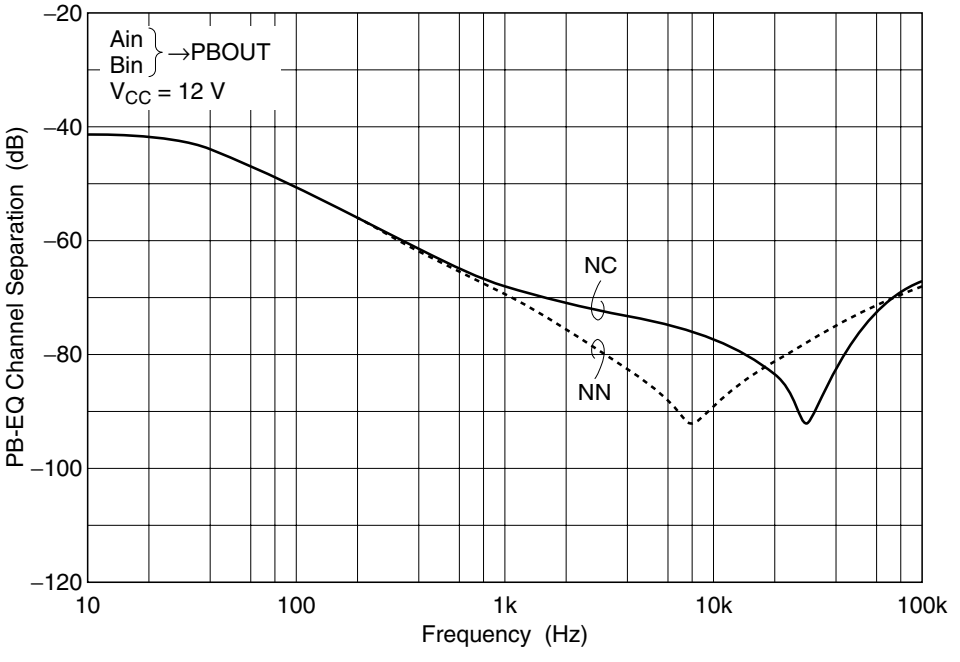
PB-EQ Total Harmonic Distortion vs. Output Level (2)



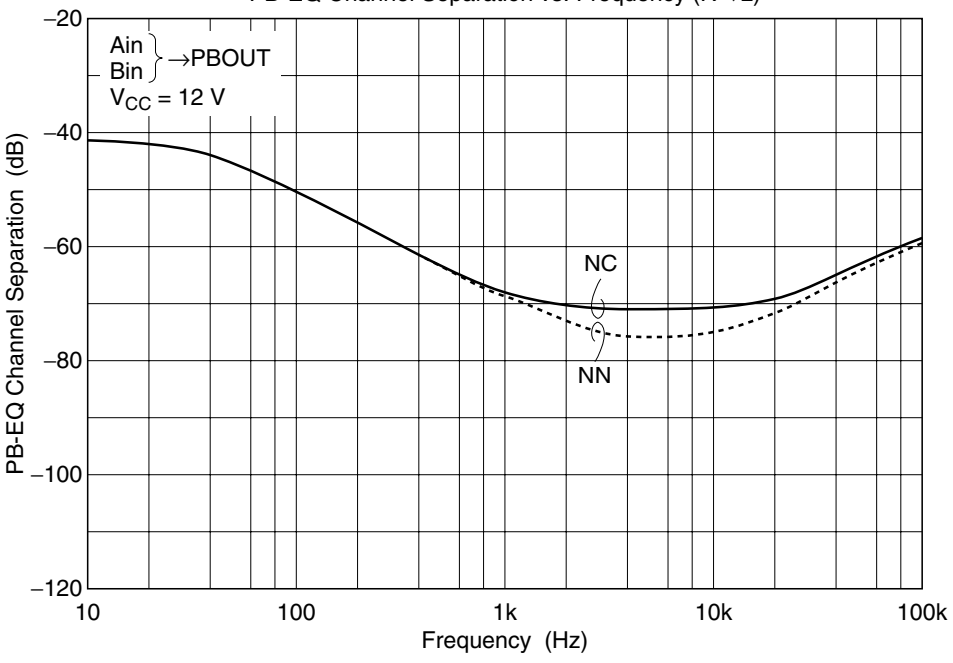
PB-EQ Noise Level vs. Supply Voltage



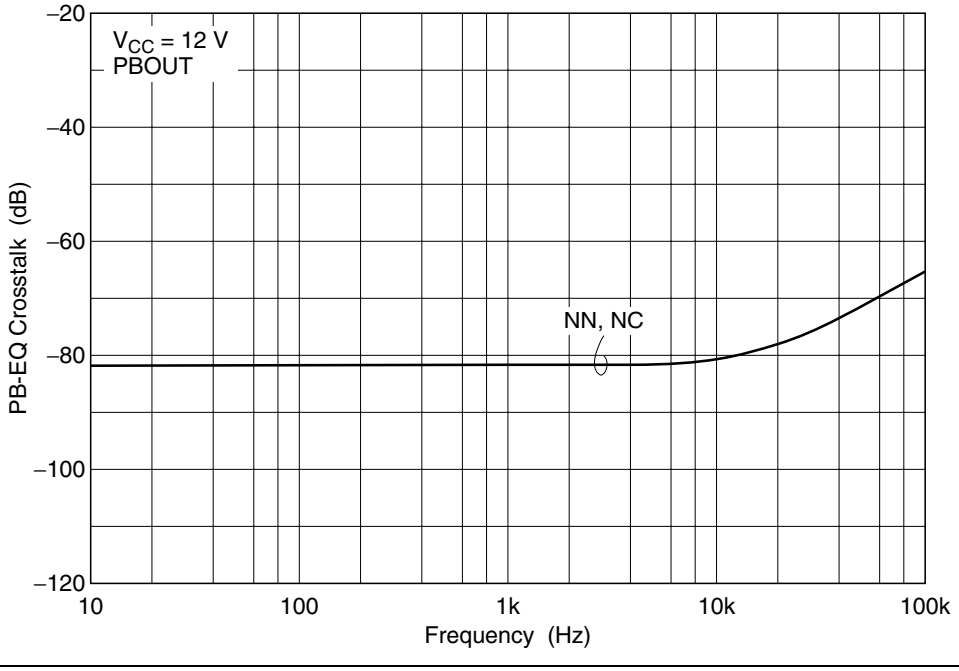
PB-EQ Channel Separation vs. Frequency (L→R)



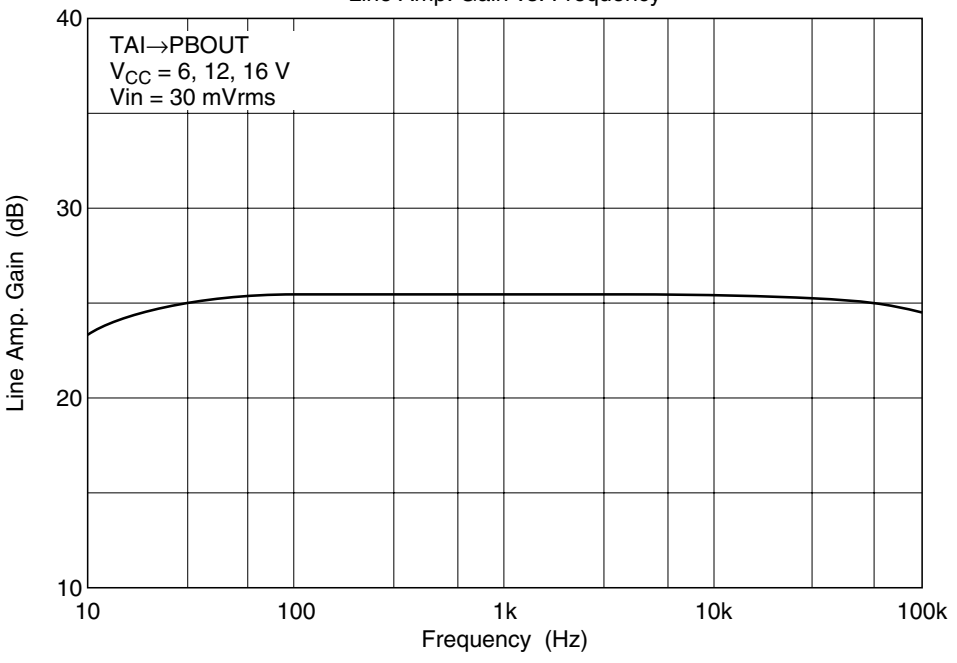
PB-EQ Channel Separation vs. Frequency (R→L)



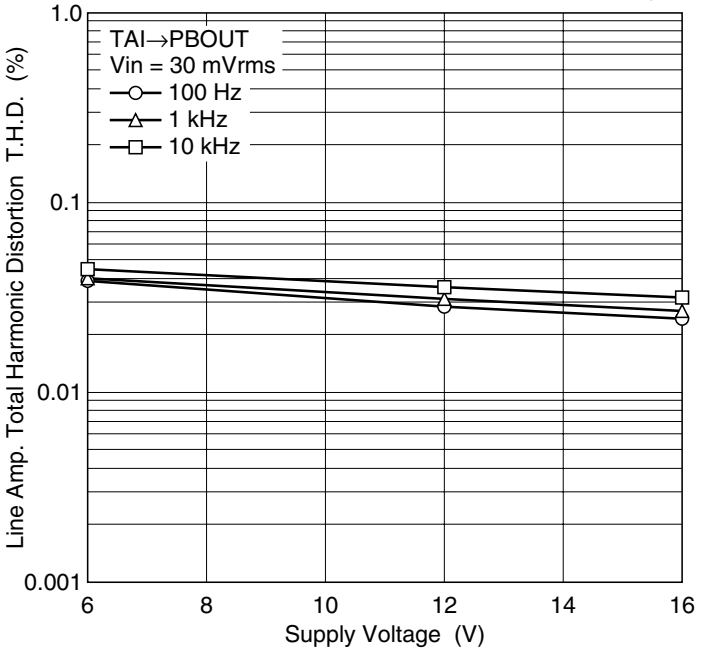
PB-EQ Crosstalk vs. Frequency (A→B)



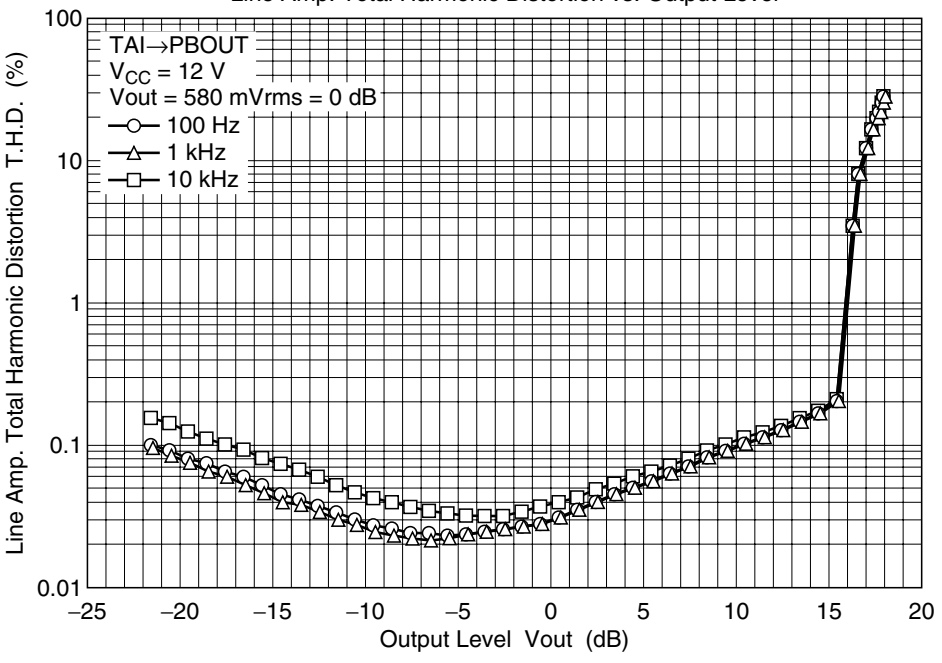
Line Amp. Gain vs. Frequency



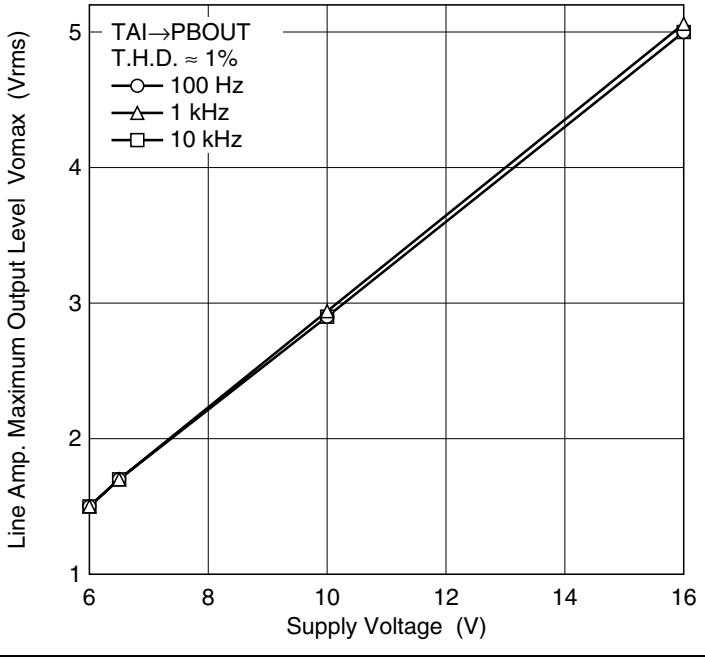
Line Amp. Total Harmonic Distortion vs. Supply Voltage



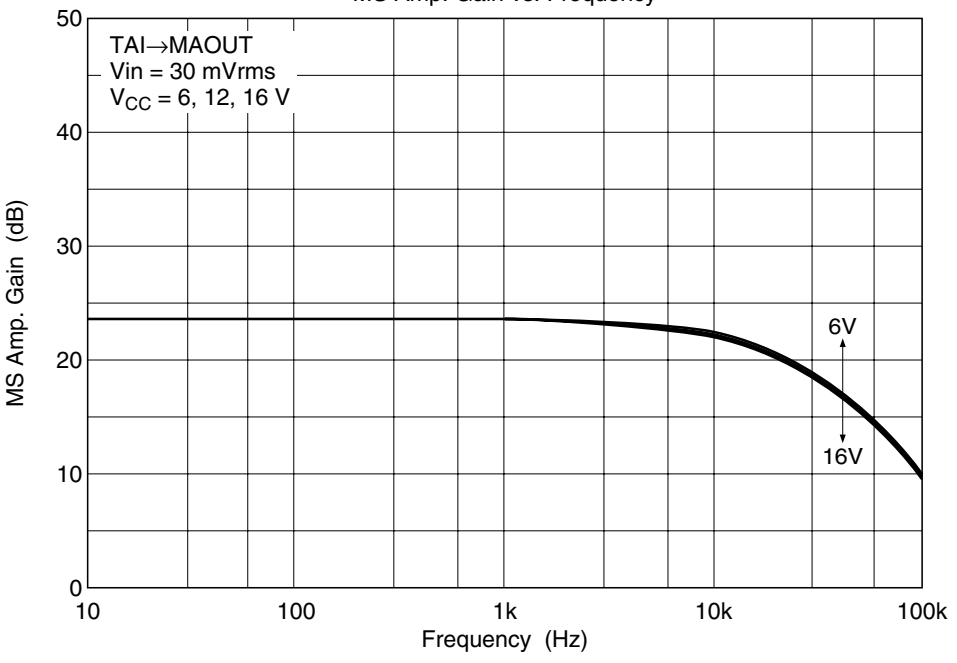
Line Amp. Total Harmonic Distortion vs. Output Level



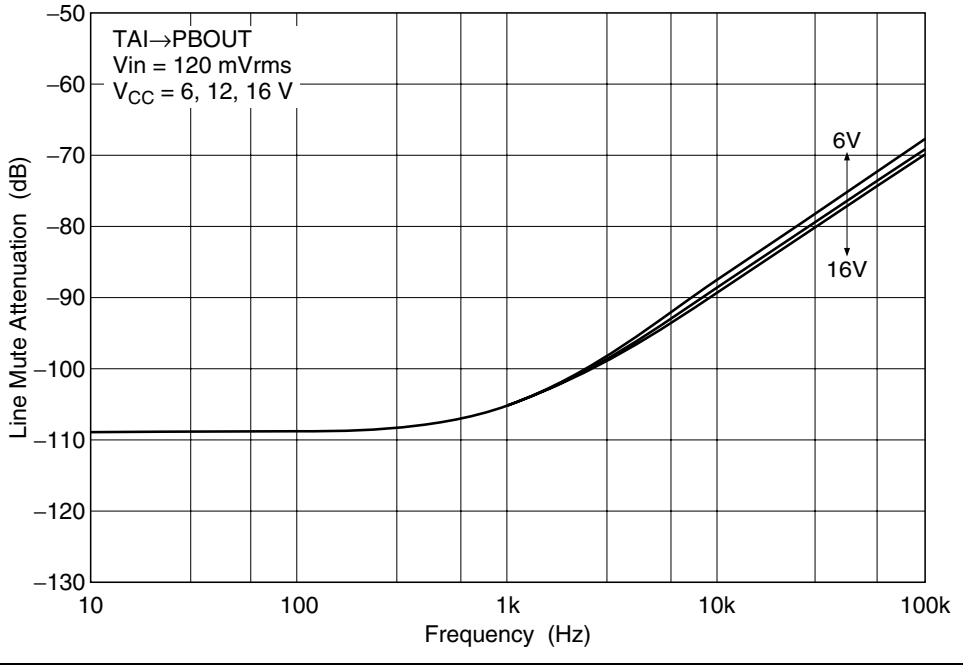
Line Amp. Maximum Output Level vs. Supply Voltage



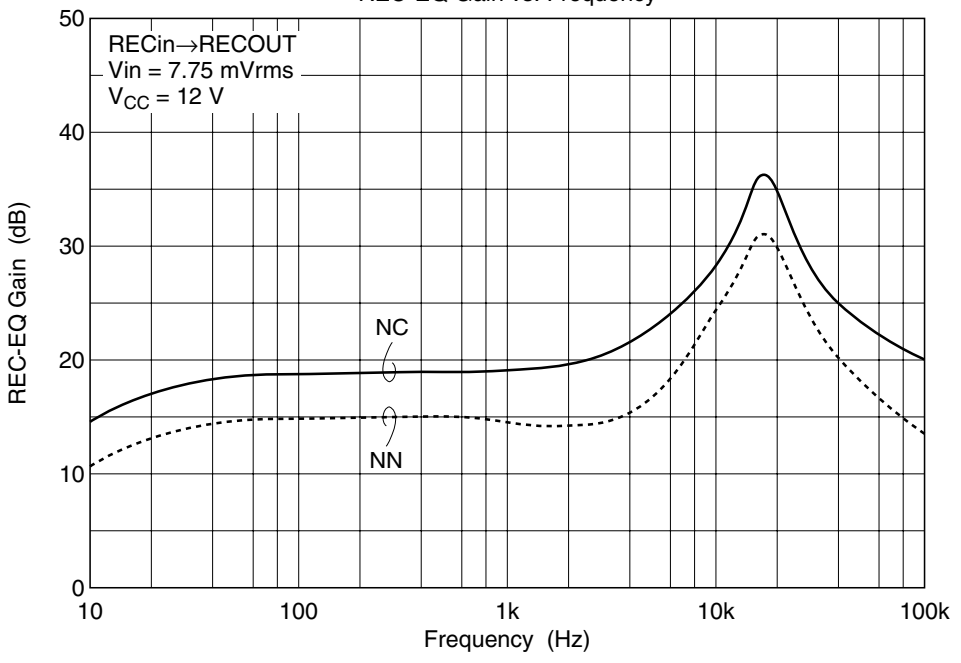
MS Amp. Gain vs. Frequency



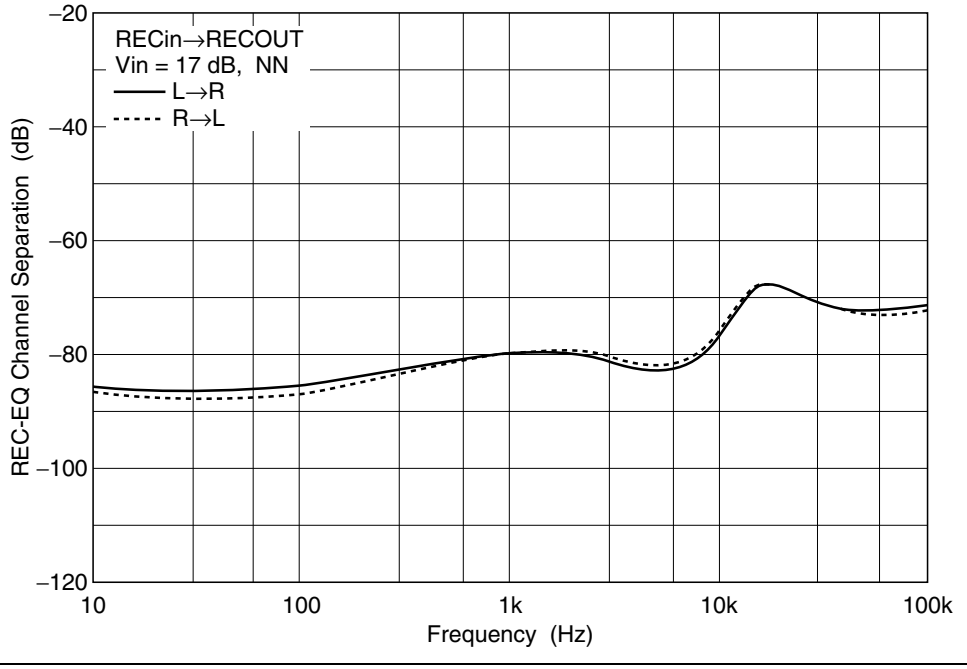
Line Mute Attenuation vs. Frequency



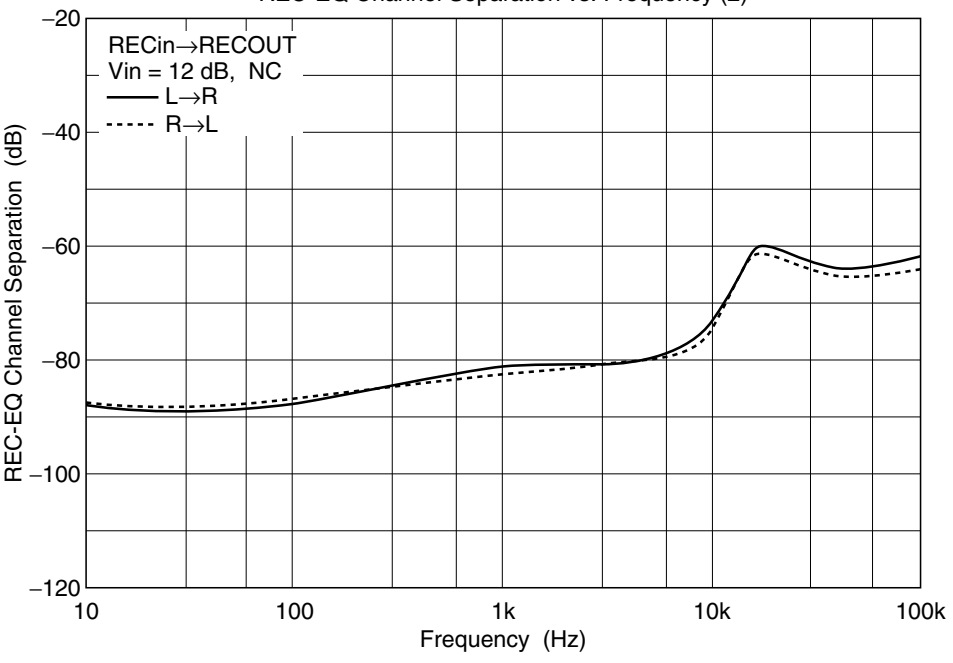
REC-EQ Gain vs. Frequency



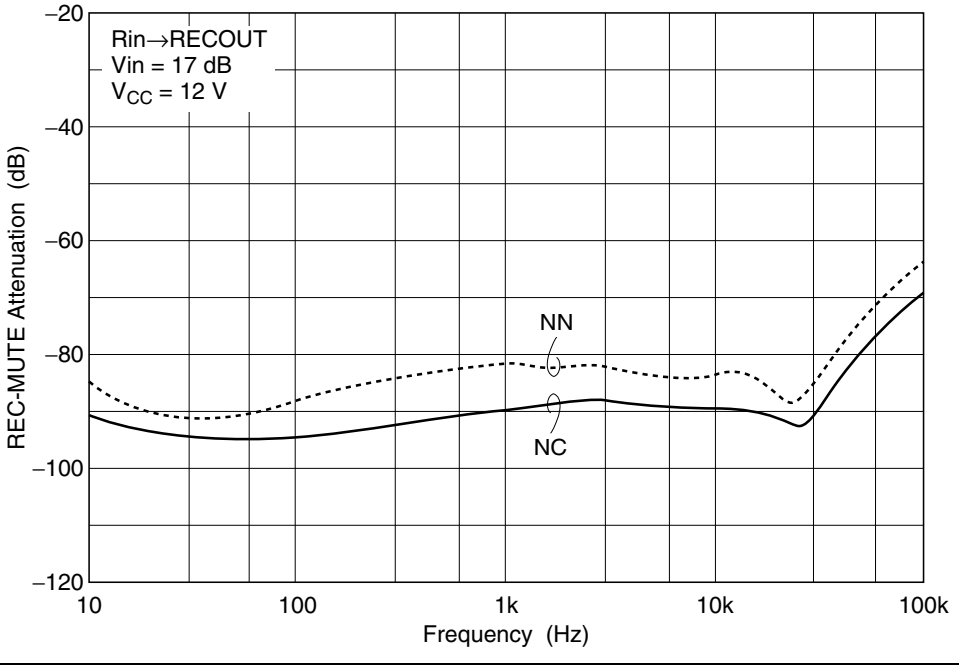
REC-EQ Channel Separation vs. Frequency (1)



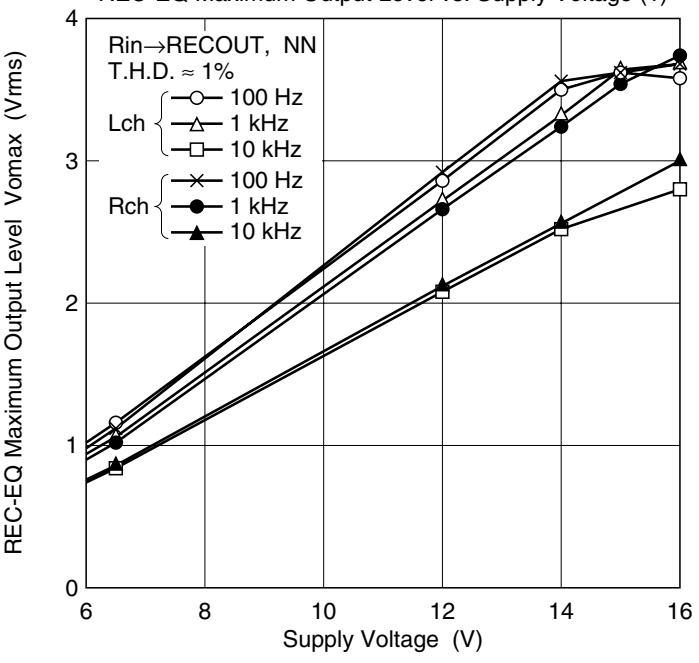
REC-EQ Channel Separation vs. Frequency (2)



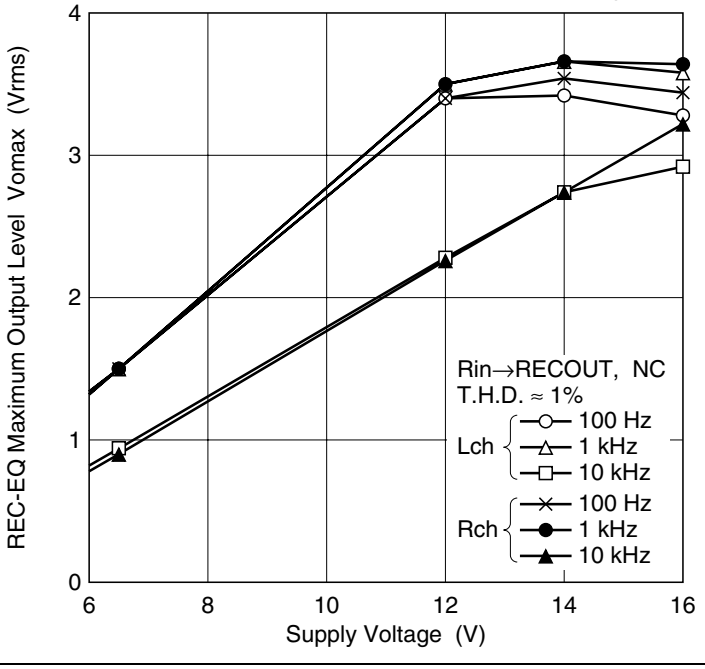
REC-MUTE Attenuation vs. Frequency



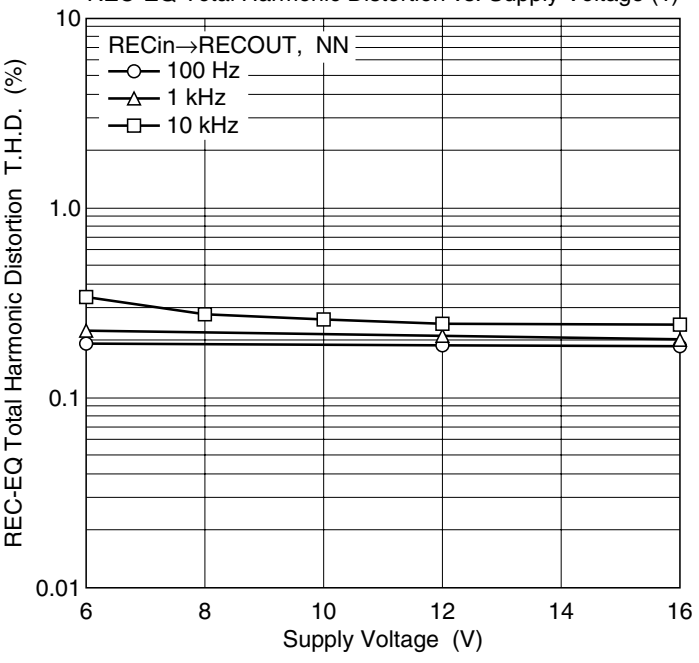
REC-EQ Maximum Output Level vs. Supply Voltage (1)



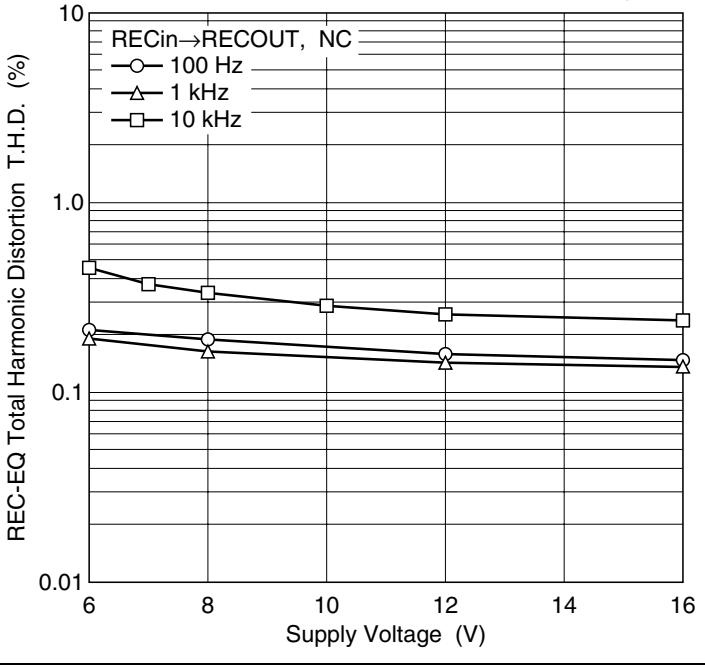
REC-EQ Maximum Output Level vs. Supply Voltage (2)



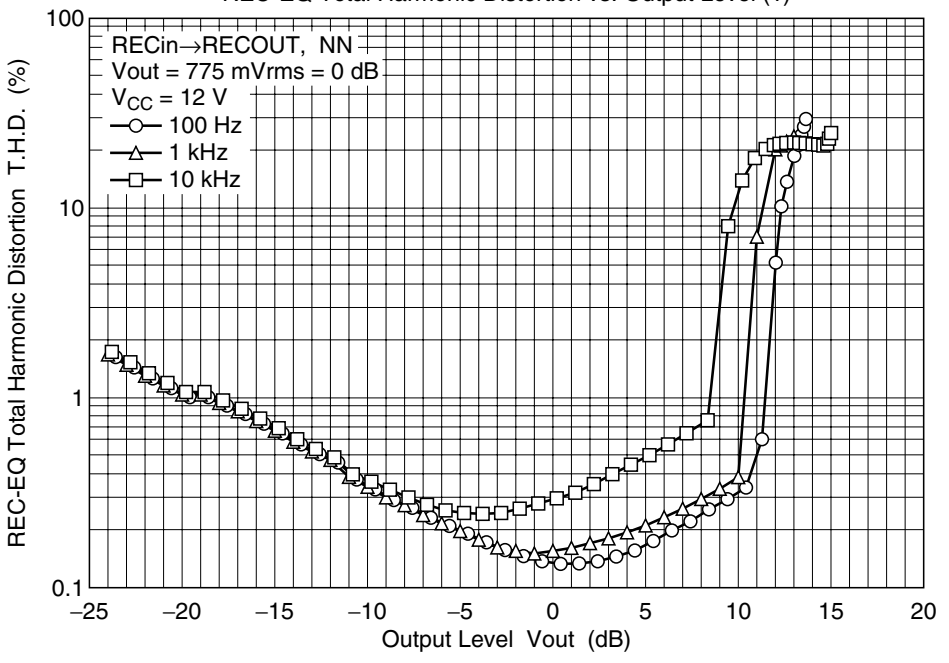
REC-EQ Total Harmonic Distortion vs. Supply Voltage (1)



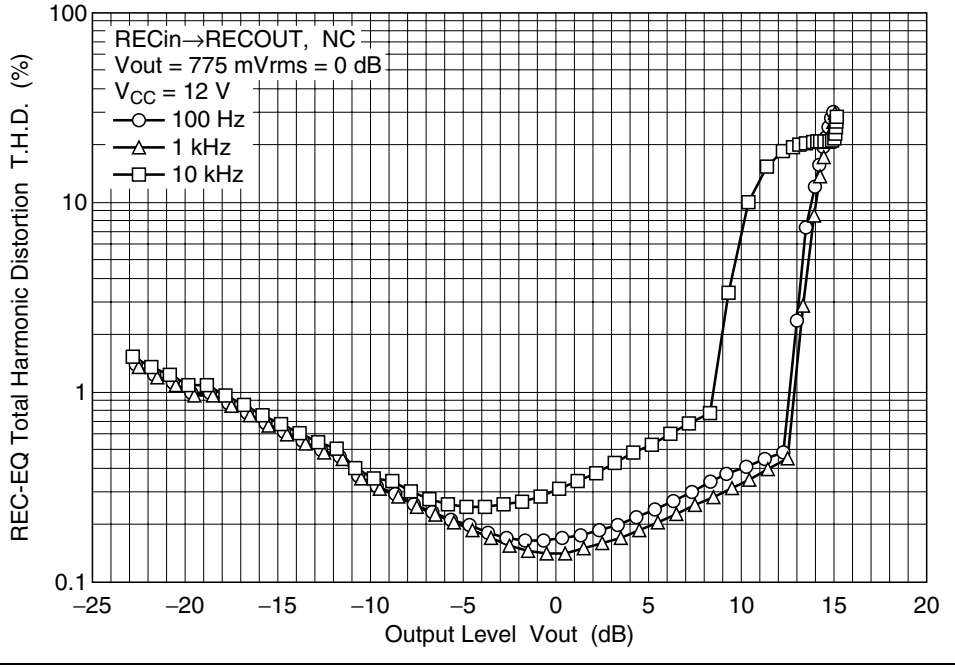
REC-EQ Total Harmonic Distortion vs. Supply Voltage (2)

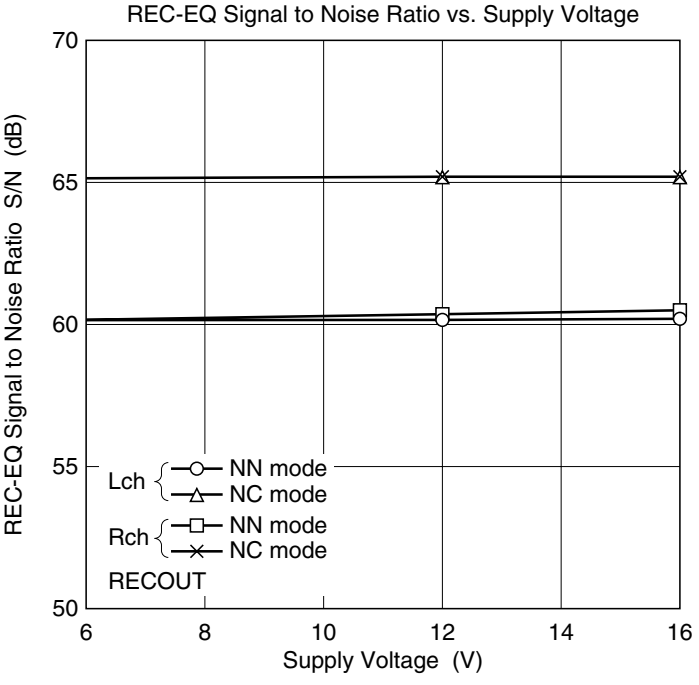


REC-EQ Total Harmonic Distortion vs. Output Level (1)



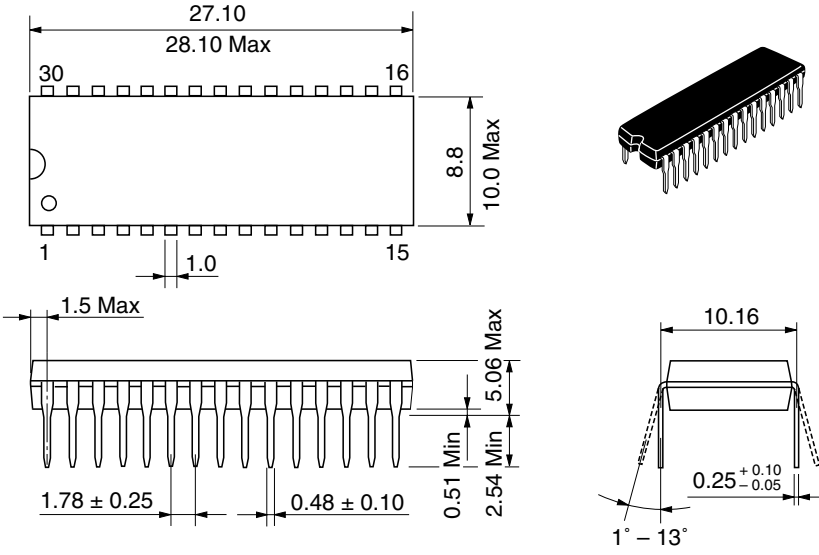
REC-EQ Total Harmonic Distortion vs. Output Level (2)




REC-EQ Signal to Noise Ratio vs. Supply Voltage
REC-EQ Signal to Noise Ratio S/N (dB)
70
65
60
55
50
6
8
10
12
14
16
Supply Voltage (V)
Lch
NN mode
NC mode
Rch
NN mode
NC mode
RECOUT

Package Dimensions

Unit: mm



Hitachi Code	DP-30S
JEDEC	—
EIAJ	Conforms
Mass(reference value)	1.98 g

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