HA12203NT/HA12204NT

Audio Signal Processor for Cassette Deck
(Dolby B-type NR with Recording System)

HITACHI

ADE-207-222B

Target Specification
3rd Edition
Jun. 1999

Description

HA12203NT is silicon monolithic bipolar IC providing Dolby noise reduction system*[1], music sensor system, REC equalizer system and each electronic control switch in one chip.

Note: 1. Dolby is a trademark of Dolby Laboratories Licensing Corporation. A license from Dolby Laboratories Licensing Corporation is required for the use of this IC.

Functions

- Dolby B - NR*[2] × 2 channel
- REC equalizer × 2 channel
- Music sensor × 1 channel
- Pass amp. × 2 channel
- Each electronic control switch to change REC equalizer, bias, etc.

Note: 2. HA12204NT is not built-in Dolby noise reduction system.

Features

- REC equalizer is very small number of external parts and have 6 types of frequency characteristics built-in.*[3]
- 2 types of input for PB, 1 type of input for REC.
- 70µ - PB equalizer changing system built-in.
- Dolby NR with dubbing double cassette decks.
  Unprocessed signal output available from recording out terminals during PB mode.
- Provide stable music sensor system, available to design music sensing time and level.
- Controllable from direct micro-computer output.
- Bias oscillator control switch built-in.
- NR ON / OFF and REC / PB fully electronic control switching built-in.
- Normal-speed / high-speed, Normal / Crom / Metal*[3] and PB equalizer fully electronic control switching built-in.
- Available to reduce substrate-area because of high integration and small external parts.

Note: 3. HA12204NT have 4 types of frequency characteristics.

Ordering Information

Standard Level

Product	Package	PB-OUT Level	REC-OUT Level	Dolby Level	Operating Voltage Range V_{CC} (V)	V_{EE} (V)	Note
HA12203NT	DP-42S	580mVrms	300mVrms	300mVrms	+6.0 to +7.5	–7.5 to –6.0	$\| V_{CC} + V_{EE} \| < 1.0V$
HA12204NT				—			

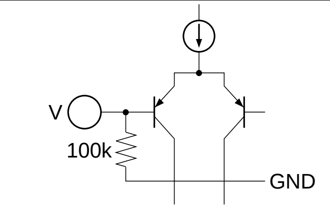
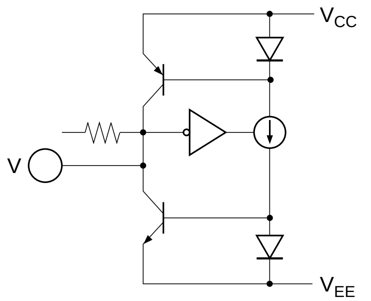
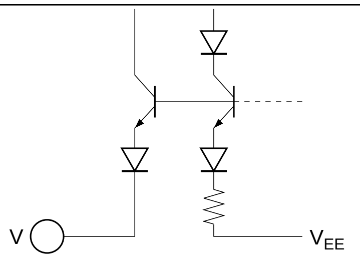
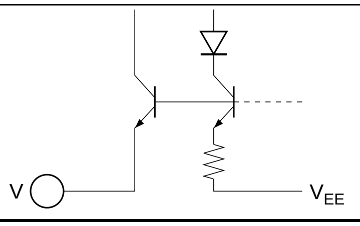
Function

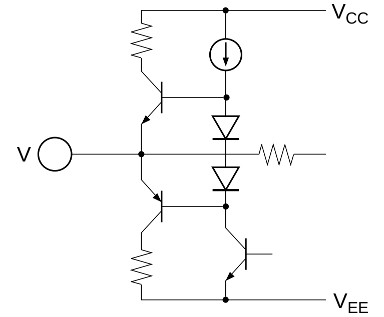
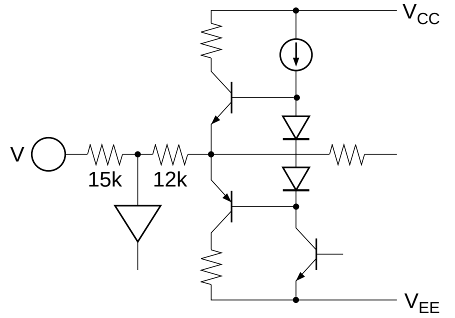
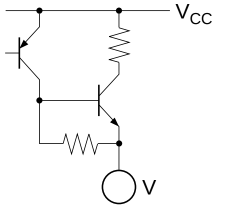
Product	Dolby B-NR	REC-EQ	Music Sensor	Pass Amp.	REC / PB	Selection
HA12203NT	○	○	○	○	○	○
HA12204NT		○	○	○	○	○

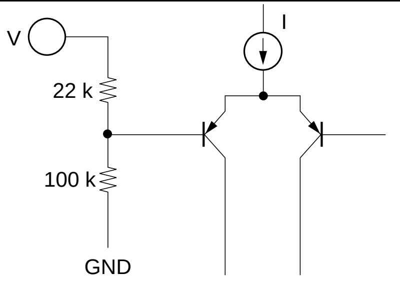
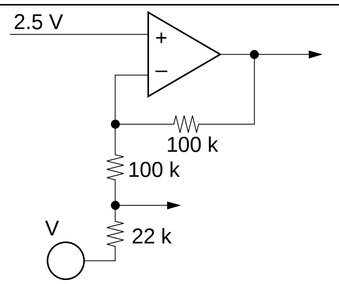
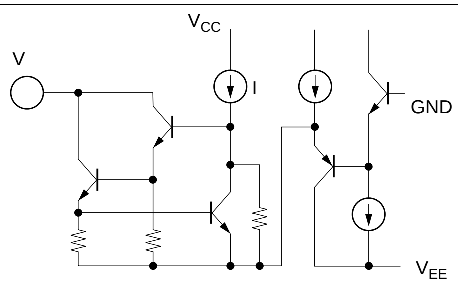
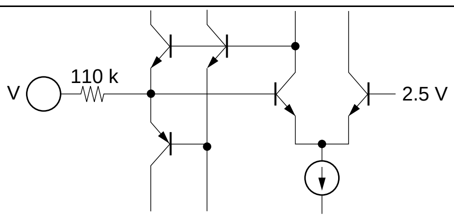
Note: Depending on the employed REC / PB head and test tape characteristics, there is a rare case that the REC-EQ characteristics of this LSI can not be matched to the required characteristics because of built-in resistors which determined the REC-EQ parameters in this case, please inquire the responsible agent because the adjustment built-in resistor is necessary.

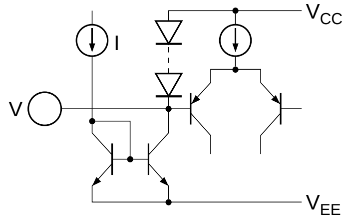
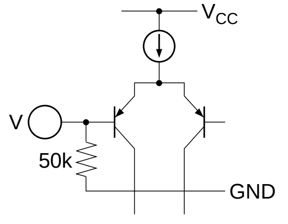
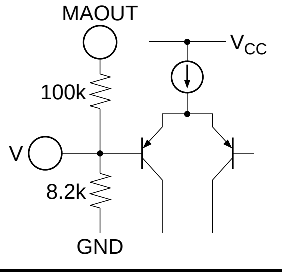
Pin Description, Equivalent Circuit

(V_{CC} = ±7 V, Ta = 25ºC, No Signal, The value in the show typical value.)

Pin No.	Terminal Name	Note	Equivalent Circuit	Pin Description
2	AIN (R)	V = GND		PB A Deck input
41	AIN (L)			
4	BIN (R)	V = GND		PB B Deck input
39	BIN (L)			
6	RIN (R)	V = GND		REC input
37	RIN (L)			
10	EQIN (R)	V = GND		REC equalizer input
33	EQIN (L)			
7	DET (R)	V = V_{EE}+2.7V		Time constant pin for Dolby-NR
36	DET (L)			
5	BIAS1	V = V_{EE}+0.6V		Dolby bias current input
38	BIAS2	V = V_{EE}+1.3V		REC equalizer bias current input

Pin No.	Terminal Name	Note	Equivalent Circuit	Pin Description
8	PBOUT (R)	V = GND		PB output
35	PBOUT (L)			
9	RECOUT (R)	V = GND		REC output
34	RECOUT (L)			
11	EQOUT (R)	V = GND		Equalizer output
32	EQOUT (L)			
28	MAOUT	V = GND		MS Amp output
3	ABO (R)	V = GND		Time constant pin for PB equalizer
40	ABO (L)	V = GND		
23	BIAS (M)	$V = V_{CC} -$ 0.7V		REC bias current output
24	BIAS (C)			
25	BIAS (N)			
22	V_{CC}	$V = V_{CC}$		Power supply
42	GND	V = 0V		GND pin
1	V_{EE}	$V = V_{EE}$		Negative power supply
5, 7, 18, 23, 30, 31, 36	NC	No connection only HA12204		No connection

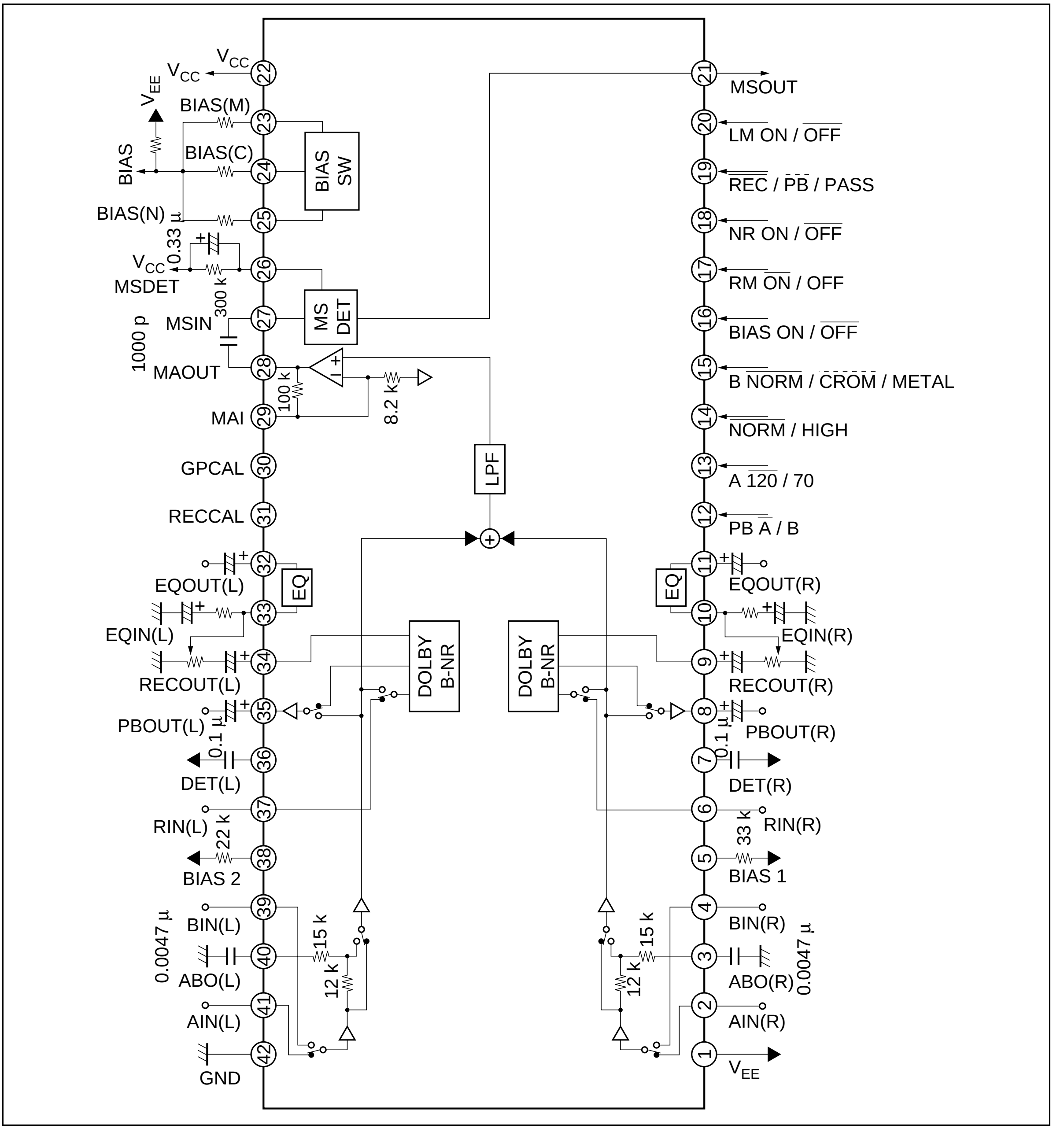
Pin No.	Terminal Name	Note	Equivalent Circuit	Pin Description
12	A / B	I = 50µA		Mode control input
13	A120 / 70			
14	NORM / HIGH			
15	B NORM / CROM / METAL			
16	BIAS ON / OFF			
17	RM ON / OFF			
18	NR ON / OFF			
20	LM ON / OFF			
19	REC / PB / PASS			Mode control input
21	MSOUT	I = 0µA		MS output (to MPU)*1)
30	GPCAL	V = GND		GP gain Calibration terminal
31	RECCAL	V = GND		REC gain calibration terminal

Pin No.	Terminal Name	Note	Equivalent Circuit	Pin Description
26	MSDET	I = 0µA		Time constant pin for MS
27	MSIN	V = GND		MS input *1)
29	MAI	V = GND		MS Amp input

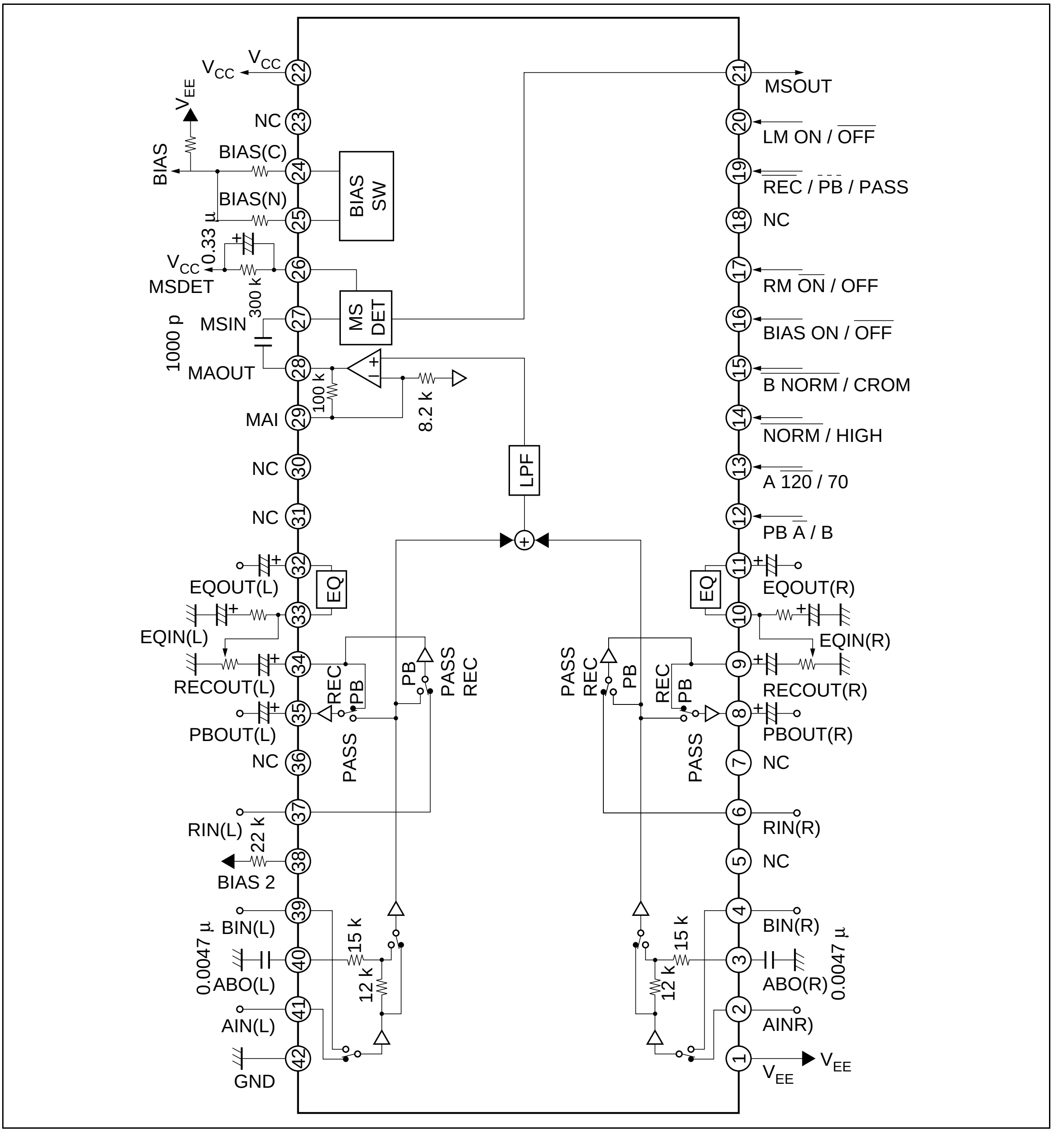
Note: 1. "MS" means Music Sensor.

Block Diagram

HA12203NT



HA12204NT



VCC
VCC
VEE
NC
BIAS
BIAS(C)
BIAS(N)
BIAS SW
0.33 µ
VCC
MSDET
300 k
1000 p
MSIN
MS DET
MAOUT
100 k
8.2 k
MAI
NC
NC
LPF
EQOUT(L)
EQ
EQIN(L)
RECOUT(L)
REC
PB
PASS
PBOUT(L)
NC
RIN(L)
22 k
BIAS 2
BIN(L)
0.0047 µ
15 k
ABO(L)
12 k
AIN(L)
GND
MSOUT
LM ON / OFF
REC / PB / PASS
NC
RM ON / OFF
BIAS ON / OFF
B NORM / CROM
NORM / HIGH
A 120 / 70
PB A / B
EQOUT(R)
EQIN(R)
RECOUT(R)
PBOUT(R)
NC
RIN(R)
NC
BIN(R)
ABO(R)
AINR)
VEE
VEE

HA12203NT Parallel-Data Format

Pin No.	Pin Name	Lo	Mid	Hi	MODE "Pin Open"
12	PB $\overline{\text{A}}$ / B	Ain *1	—	Bin *1	Lo
13	A $\overline{\text{120}}$ / 70	*1	—	*1	Lo
17	RM $\overline{\text{ON}}$ / OFF	REC MUTE ON	—	REC MUTE OFF	Lo
16	BIAS ON / $\overline{\text{OFF}}$	BIAS OFF	—	BIAS ON	Lo
18	NR ON / $\overline{\text{OFF}}$ *2	NR OFF	—	NR ON	Lo
19	$\overline{\text{REC}}$ / PB / PASS	REC MODE	PB MODE	REC MODE PASS	Mid
20	LM ON / $\overline{\text{OFF}}$	LINE MUTE OFF	—	LINE MUTE ON	Lo
14	$\overline{\text{NORM}}$ / HIGH	Normal speed	—	High speed	Lo
15	B $\overline{\text{NORM}}$ / CROM / METAL	REC EQ Normal *1 Bias Normal	REC EQ CROM *1 Bias CROM	REC EQ METAL *1 Bias METAL *2	Lo

Note: 1. PB EQ logic

A 120 / 70	B $\overline{\text{NORM}}$ / CROM / METAL	PB Lo	PB Hi
Lo	Lo	FLAT	FLAT
Lo	Hi or Mid	FLAT	70µ
Hi	Lo	70µ	FLAT
Hi	Hi or Mid	70µ	70µ

Note: 2. HA12203NT only

Functional Description

Power Supply Range

HA12203NT / 204NT are designed to operate on split supply.

Table 1 Supply Voltage

Product	V_{CC}	V_{EE}	Note
HA12203NT	+6.0 to +7.5 V	–7.5 to –6.0 V	$\lvert V_{CC} + V_{EE} \rvert$ <1.0 V
HA12204NT			

Note: The lower limit of supply voltage depends on the line output reference level.
The minimum value of the overload margin is specified as 12dB by Dolby Laboratories.

Reference Voltage

The reference voltage are provided for the left channel and the right channel separately. The block diagram is shown as figure 1.

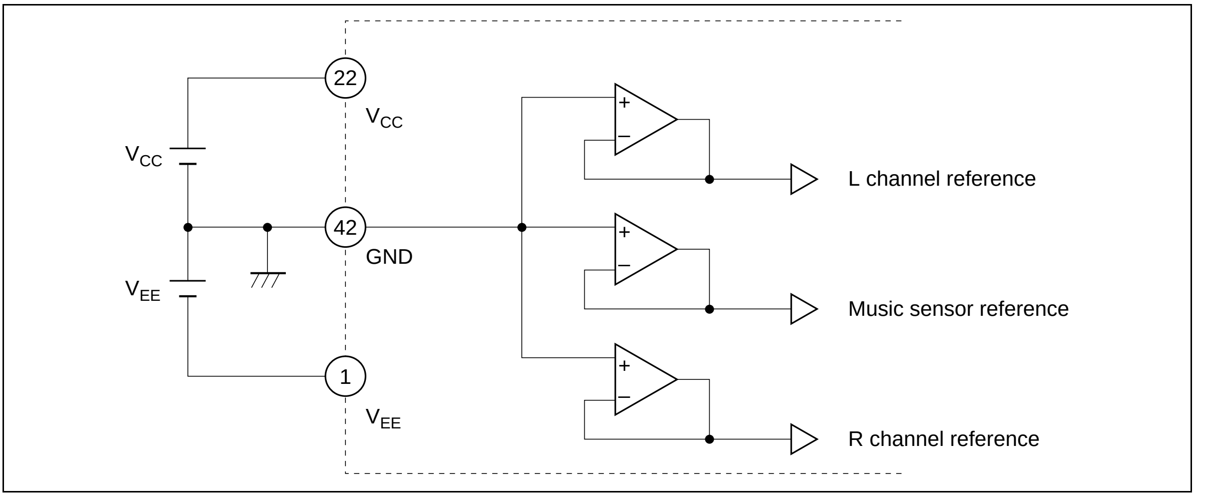
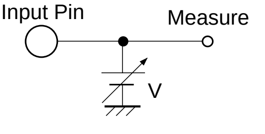


Figure 1 Reference Voltage

Operating Mode Control

HA12203NT / 204NT provide fully electronic switching circuits. And each operating mode control is controlled by parallel data (DC voltage).

Table 2 Control Voltage

Pin No.	Lo	Mid	Hi	Unit	Test Condition
12, 13, 14, 16, 17, 18, 20	– 0.2 to 1.0	—	4.0 to V_{cc}	V	
15, 19	– 0.2 to 1.0	2.0 to 3.0	4.0 to V_{cc}	V	

Notes: 1. Each pins are on pulled down with 100 kΩ internal resistor.
Therefore, it will be low-level when each pins are open.
But 19 pin are mid-level when it is open.
2. Over shoot level and under shoot level of input signal must be the standardized (High: V_{cc}, Low: –0.2V).
3. For reduction of pop noise, connect 1µF to 22µF capacitor with mode control pins.
But it is impossible to reduce completely in regard to Line mute, therefore, use external mute at the same time.

Input Block Diagram and Level Diagram

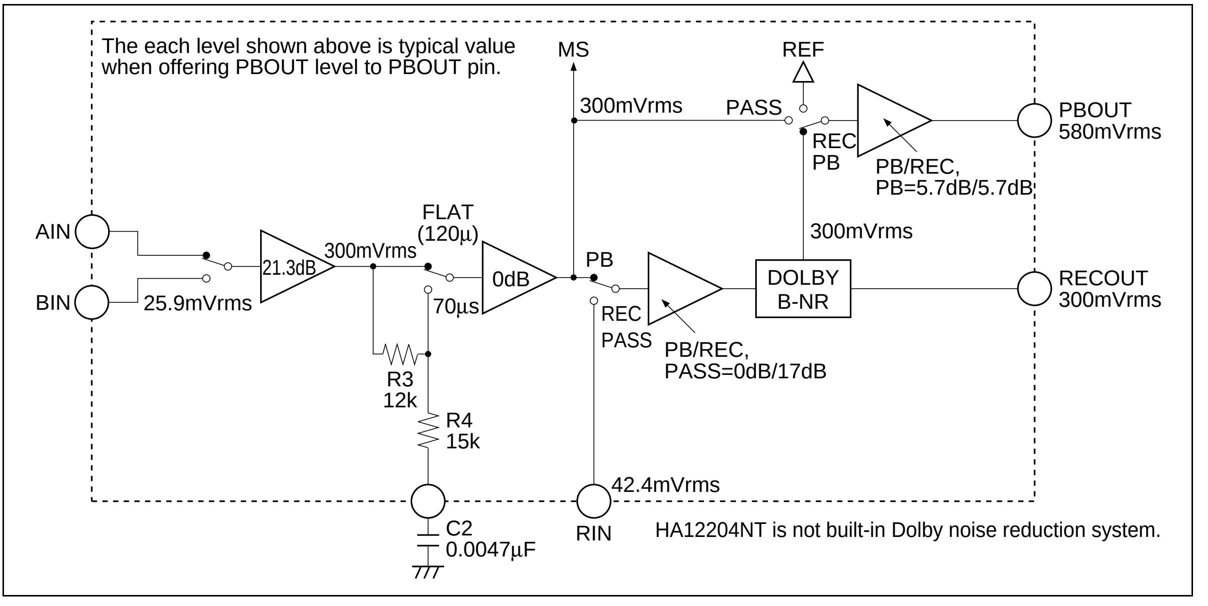


Figure 2 Input Block Diagram

PB Equalizer

By switching logical input level of 13 pin (for Ain) and 15 pin (for Bin), you can equalize corresponding to tape position at play back mode.

With the capacity C2 capacitance that we showed for figure 2 70 µs by the way figure seem to 3 they are decided.

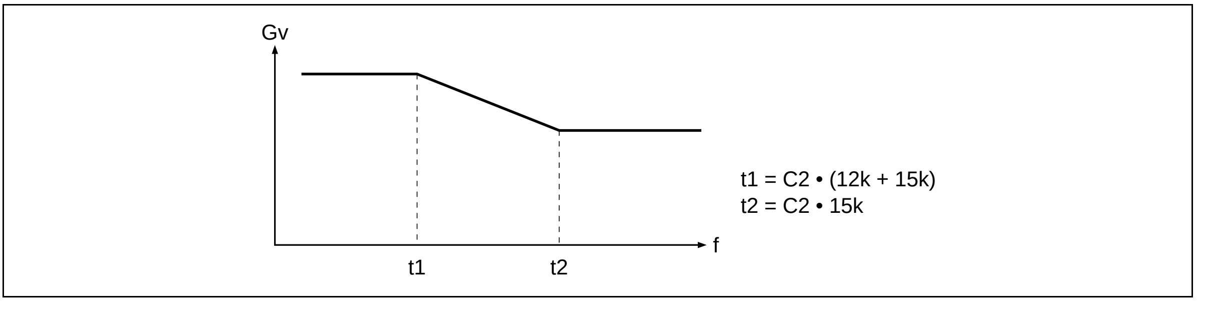


Figure 3 Frequency Characteristic of PB Equalizer

The Sensitivity Adjustment of Music Sensor

Adjusting MS Amp gain by external resistor, the sensitivity of music sensor can set up.

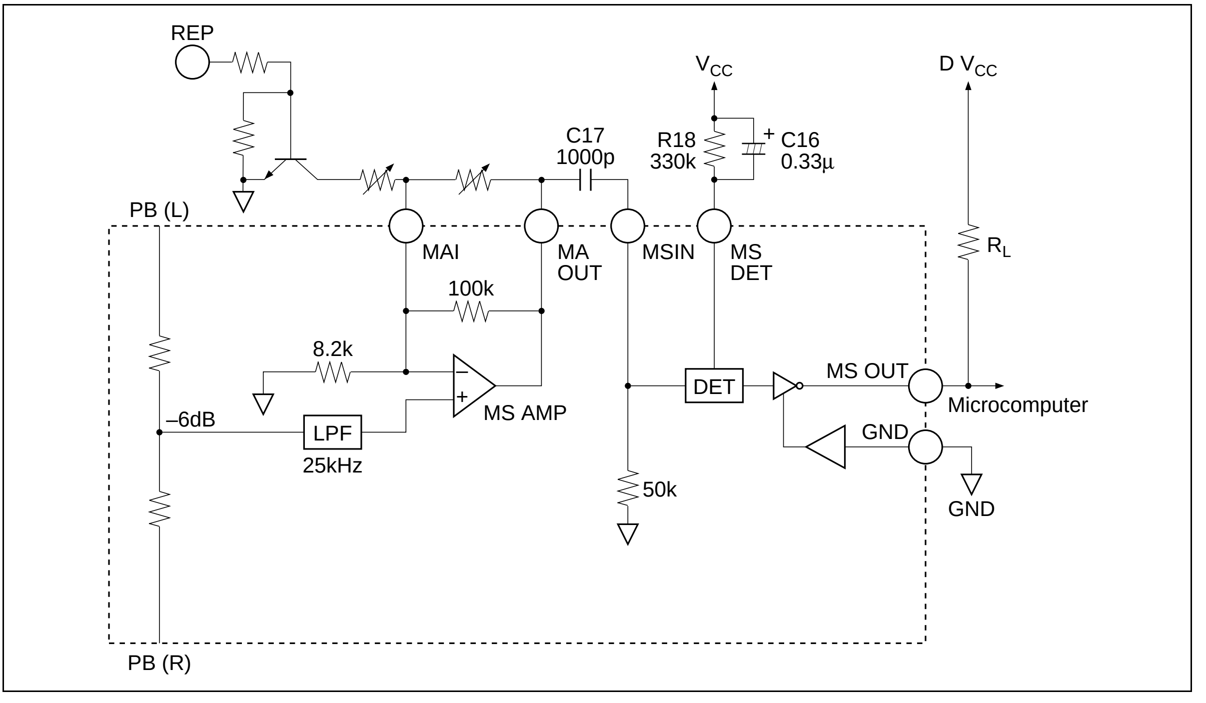


Figure 4 Music Sensor Block Diagram

The Sensitivity of Music Sensor

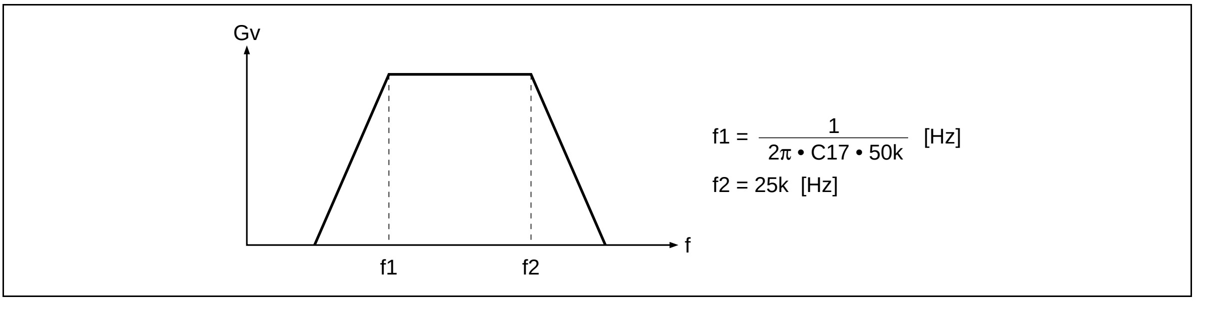


Figure 5 Frequency Characteristic of MSIN

Occasion of the external component of figure 4, f1 is 3.18 kHz.

A standard level of MS input pin 25.9 mVrms, therefore, the sensitivity of music sensor (S) can request it , by lower formulas.

A = MS Amp Gain
B = PB input Gain × (1/2)*1
C = Sensed voltage
20log (A × B) = D [dB]
C = 130 [mVrms]
PB input Gain = 21.3 [dB]

$$S = 20\log \frac{C}{25.9 \bullet A \bullet B} \quad [dB]$$

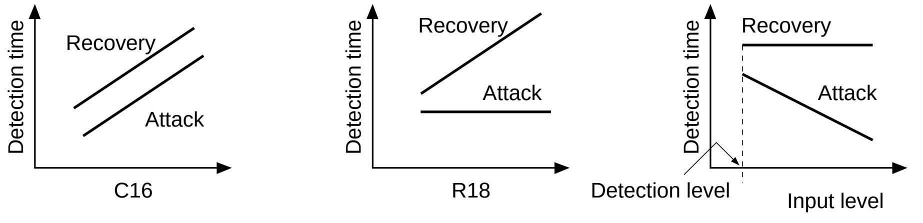
$$S = 14 \quad D\ [dB]$$

Notes: 1. Case of one-sided channel input

- Time constant of detection

  Figure 6(1) generally shows that detection time is in proportion to value of capacitor C16.

  But, with Attack *[2] and Recovery *[3] the detection time differs exceptionally.



Function Characteristic of MS (1) Function Characteristic of MS (2) Function Characteristic of MS (3)

Figure 6 Function Characteristic of MS

Like the figure 6(2), Recovery time is variably possible by value of resister R18. But Attack time gets about fixed value. Attack time has dependence by input level. When a large signal is inputted, Attack time is short tendency.

Notes 2. Attack : Non- music to Music

3. Recovery : Music to Non-music

- Music Sensor Output (MSOUT)

  As for internal circuit of music sensor block, music sensor out pin is connected to the collector of NPN type directly, output level will be “high” when sensing no signal. And output level will be “low” when sensing signal.

  Connection with microcomputer, it is requested to use external pull up resistor (R_L = 10 k• to 22 k•)

Note: Supply voltage of MSOUT pin must be less than V_{CC} voltage.

The Tolerances of External Components

For Dolby NR precision securing, please use external components shown at figure 7. If leak-current are a few electrolytic-capacitor, it can be applicable to C5 and C23.

Note: As Dolby-NR aren't built-in at HA12204NT, R3, C5 and C23 aren't necessary.

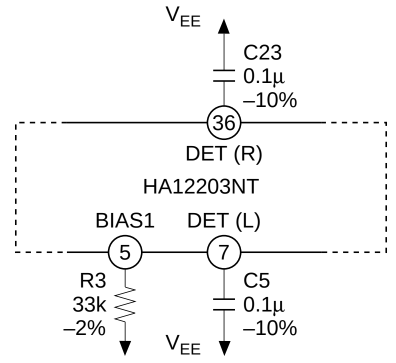


Figure 7 Tolerance of External Components

Low-Boost

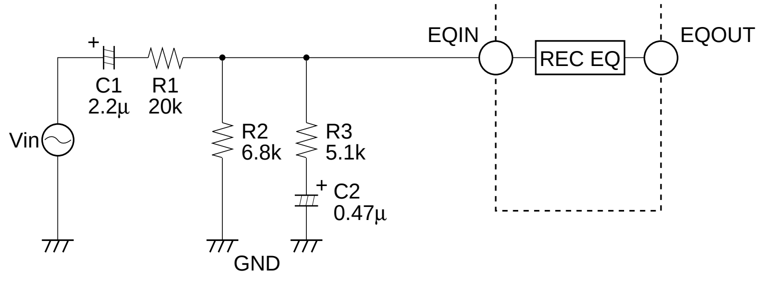
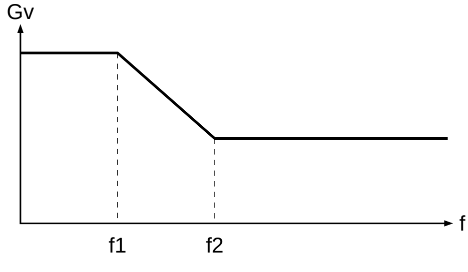


Figure 8 Example of Low Boost Circuit

External components shown Figure 8 gives Frequency response to take 6dB boost. And cut off Frequency can request it, by lower formulas.



$$f1 = \frac{1}{2\pi \bullet C2 \bullet (R1 + R0)} \text{ [Hz]}$$

$$f2 = \frac{1}{2\pi \bullet C2 \bullet R2} \text{ [Hz]} \qquad R0 = \frac{R1 \bullet R2}{R1 + R2} \text{ [}\Omega\text{]}$$

Figure 9 Frequency Characteristic of Low-Boost

REC Equalizer

The outlines of REC Equalizing frequency characteristics are shown by figure 10. Those peak level can be set up by supplying voltage. (0 V to 5 V, GND = 0 V) to 30pin (GPCAL).

And whole band gain can be set up by supplying voltage (0 V to 5 V, GND = 0 V) to 31pin (RECCAL).

Both setting up range are ± 4.5dB. In case that you don't need setting up, 30 pin, 31pin should be open bias.

Note: Depending on the employed REC/PB head and test tape characteristics, there is a rare case that the REC-EQ characteristics of this LSI can not be matched to the required characteristics because of built-in resistors which determined the REC-EQ parameters in this care, please inquire the responsible agent because of the adjustment of built-in resistor is necessary.

Since an output pin and an input pin for REC-EQ are adjacent, it will easily oscillate if patterns run abreast.

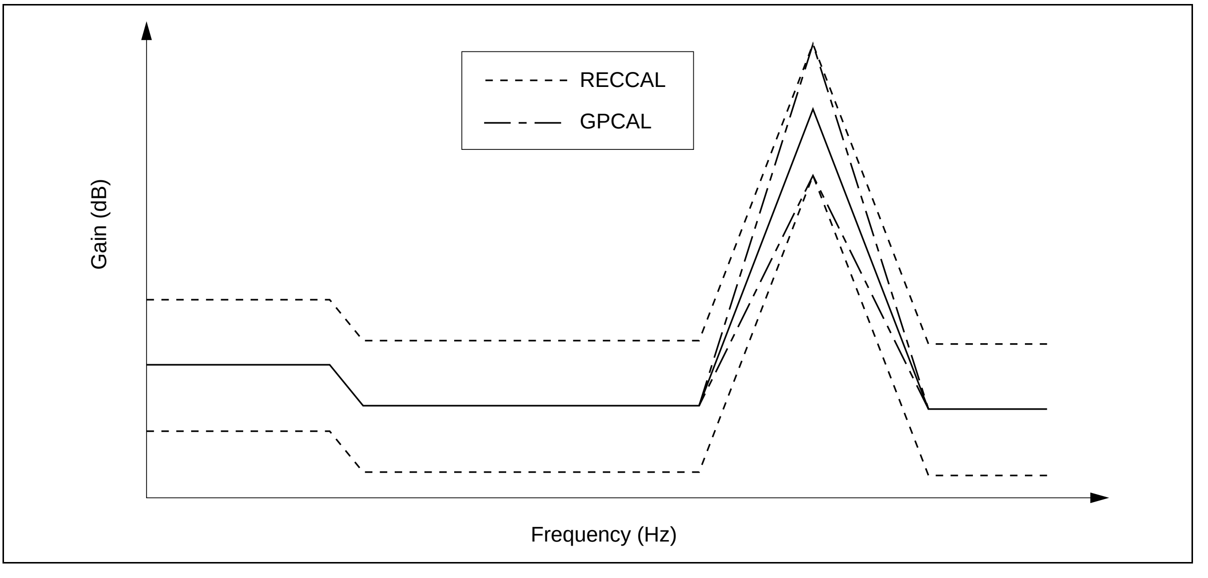


Figure 10 Frequency Characteristics of REC Equalizer

Bias Switch

This series built-in DC voltage generator for bias oscillator and its bias switches.

External resistor R15, R16, R17 Which corresponded with tape positions and bias out voltage are relater with below.

$$Vbias \fallingdotseq \left(\frac{R14}{(R15 \text{ or } R16 \text{ or } R17) + R14}\right) \times (V_{CC} - V_{EE} - 0.7) + V_{EE} \quad [V]$$

Bias switch follows to a logic of 15 pin (B / Norm / Crom / Metal).

Note: A current that flows at bias out pin, please use it less than 5 mA.

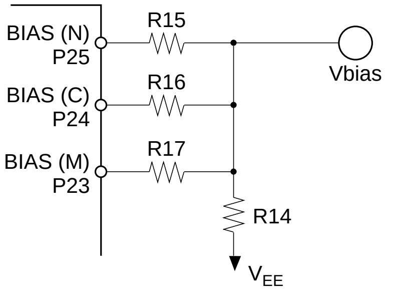


Figure 11 External Components of Bias Block

Absolute Maximum Ratings

Item	Symbol	Rating	Unit	Note
Max 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	

Electrical Characteristics

HA12203NT

(Ta = 25˚C, V_{CC} = ± 7 V, Dolby Level = REC - OUT Level = 300 mVrms = 0 dB)

Item	Symbol	Test Condition: IC Condition *: NR ON/OFF	REC/PB /PASS	A/B	120µ/ 70µ	LINE MUTE	fin (Hz)	RECOUT level (dB)	Other	Specification: Min	Typ	Max	Unit	Application Terminal: Input R	Input L	Output R	Output L	COM	Remark
Quiescent current	I_Q	OFF	PB	A	120	Mute	—	—	No signal	—	22.0	35.0	mA	—	—	—	—	22	
Input AMP. gain	G_V PB	OFF	PB	A/B	120	OFF	1k	0		25.5	27.0	28.5	dB	2/4	41/39	8	35	—	
	G_V REC	OFF	REC	A	120	OFF	1k	0		21.2	22.7	24.2		6	37	8	35	—	
B-type Encode boost	ENC 2k (1)	ON	REC	A	120	OFF	2k	–20		2.8	4.3	5.8	dB	6	37	9	34	—	
	ENC 2k (2)	ON	REC	A	120	OFF	2k	–30		7.0	8.5	10.0		6	37	9	34	—	
	ENC 5k (1)	ON	REC	A	120	OFF	5k	–20		1.7	3.2	4.7		6	37	9	34	—	
	ENC 5k (2)	ON	REC	A	120	OFF	5k	–30		6.7	8.2	9.7		6	37	9	34	—	
Signal handling	Vo max	ON	REC	A	120	OFF	1k	—	THD=1%	12.0	13.0	—	dB	6	37	9	34	—	1
Signal to noise ratio	S/N	ON	REC	A	120	OFF	1k	—	Rg=5.1kΩ, CCIR/ARM	64.0	70.0	—	dB	6	37	9	34	—	
Total Harmonic Distortion	THD	ON	REC	A	120	OFF	1k	0		—	0.05	0.3	%	6	37	9	34	—	
Channel separation	CTRL (1)	OFF	PB	A/B	120	OFF	1k	+12		70.0	80.0	—	dB	2/4	41/39	8	35	—	
	CTRL (2)	OFF	REC	A	120	OFF	1k	+12		70.0	85.0	—		6	37	8	35	—	
Crosstalk	CT A/B	OFF	PB	A/B	120	OFF	1k	+12		70.0	80.0	—	dB	2/4	41/39	8	35	—	
	CT R/P	OFF	REC/PB	A/B	120	OFF	1k	+12		70.0	80.0	—		2/4/6	41/39 /37	8	35	—	
Pass AMP. gain	Gv PA	OFF	PASS	A/B	120	OFF	1k	0	Gv PA – Gv PB	25.5	27.0	28.5	dB	2/4	41/39	8	35	—	
Gain deviation	ΔGv	OFF	PASS	A/B	120	OFF	1k	0		–1.0	0.0	1.0	dB	2/4	41/39	8	35	—	
MUTE ATT.	MUTE	OFF	PB	A	120	ON	1k	+12		70.0	80.0	—	dB	2	41	8	35	—	
70µ EQ gain	G_V EQ 1k	OFF	PB	A/B	70	OFF	1k	0		24.0	25.5	27.0	dB	2/4	41/39	8	35	—	
	G_V EQ 10k	OFF	PB	A/B	70	OFF	10k	0		20.8	22.3	23.8		2/4	41/39	8	35	—	
MS sensing level	V_{ON}	OFF	PB	A	120	OFF	5k	—		–26.0	–22.0	–18.0	dB	2	41	—	—	21	2
MS output low level	V_{OL}	OFF	PB	A	120	OFF	—	—		—	1.0	1.5	V	2	41	—	—	21	
MS output leak current	I_{OH}	OFF	PB	A	120	OFF	—	—		—	—	2.0	µA	—	—	—	—	21	
Control voltage	V_{IL}	—	—	—	—	—	—	—		–0.2	—	1.0	V	—	—	—	—	12 to 20	
	V_{IM}	—	—	—	—	—	—	—		2.0	—	3.0		—	—	—	—	12 to 20	
	V_{IH}	—	—	—	—	—	—	—		4.0	—	5.3		—	—	—	—	12 to 20	

Notes 1. V_{CC} = ±6.0 V

2. For inputting signal to one side channel

* Other IC-condition : REC-MUTE OFF, Normal tape, Normal speed, Bias OFF

HA12203NT (cont)

(Ta = 25 ˚C, V_{CC} = ± 7 V)

Item	Symbol	Test Condition			Specification			Unit	Application Terminal					Remark
									Input		Output			
		TAPE	SPEED		Min	Typ	Max		R	L	R	L	COM	
Equalizer S/N	S/N (EQ)	NORM	NORM	Rg = 5.1kΩ, A - WTG Filter (0dB = –5dBs at EQOUT)	55	58	—	dB	10	33	11	32	—	
Equalizer maximum input	Vin max (EQ)	NORM	NORM	f = 1kHz, THD = 1%, Vin = –26dBs = 0dB	10.5	12.5	—	dB	10	33	11	32	—	
Equalizer Total Harmonic Distortion	T.H.D. (EQ)	NORM	NORM	f = 1kHz, Vin = –26dBs	—	0.2	0.5	%	10	33	11	32	—	
Equalizer offset voltage	Vofs (EQ)	NORM	NORM	No - Signal	–500	0	500	mV	10	33	11	32	—	
Equalizer Frequency Response (NORM - NORM)	GVEQ-NN1	NORM	NORM	f = 3kHz, Vin = –46dBs	18.8	20.3	21.8	dB	10	33	11	32	—	
	GVEQ-NN2			f = 8kHz, Vin = –46dBs	23.9	25.9	27.9	dB	10	33	11	32	—	
	GVEQ-NN3			f = 12kHz, Vin = –46dBs	30.1	32.6	35.1	dB	10	33	11	32	—	
Equalizer Frequency Response (CROM - NORM)	GVEQ-CN1	CROM	NORM	f = 3kHz, Vin = –46dBs	24.0	25.5	27.0	dB	10	33	11	32	—	
	GVEQ-CN2			f = 8kHz, Vin = –46dBs	29.8	31.8	33.8	dB	10	33	11	32	—	
	GVEQ-CN3			f = 12kHz, Vin = –46dBs	36.3	38.8	41.3	dB	10	33	11	32	—	
Equalizer Frequency Response (METAL - NORM)	GVEQ-MN1	METAL	NORM	f = 3kHz, Vin = –46dBs	24.8	26.3	27.8	dB	10	33	11	32	—	
	GVEQ-MN2			f = 8kHz, Vin = –46dBs	27.8	29.8	31.8	dB	10	33	11	32	—	
	GVEQ-MN3			f = 12kHz, Vin = –46dBs	31.4	33.9	36.4	dB	10	33	11	32	—	
Equalizer Frequency Response (NORM - High)	GVEQ-NH1	NORM	HIGH	f = 5kHz, Vin = –46dBs	14.9	16.4	17.9	dB	10	33	11	32	—	
	GVEQ-NH2			f = 15kHz, Vin = –46dBs	20.2	22.2	24.2	dB	10	33	11	32	—	
	GVEQ-NH3			f = 20kHz, Vin = –46dBs	24.1	26.6	29.1	dB	10	33	11	32	—	
Equalizer Frequency Response (CROM - High)	GVEQ-CH1	CROM	HIGH	f = 5kHz, Vin = –46dBs	20.7	22.2	23.7	dB	10	33	11	32	—	
	GVEQ-CH2			f = 15kHz, Vin = –46dBs	25.1	27.1	29.1	dB	10	33	11	32	—	
	GVEQ-CH3			f = 20kHz, Vin = –46dBs	28.6	31.1	33.3	dB	10	33	11	32	—	
Equalizer Frequency Response (METAL - High)	GVEQ-MH1	METAL	HIGH	f = 5kHz, Vin = –46dBs	21.9	23.4	24.9	dB	10	33	11	32	—	
	GVEQ-MH2			f = 15kHz, Vin = –46dBs	23.8	25.8	27.8	dB	10	33	11	32	—	
	GVEQ-MH3			f = 20kHz, Vin = –46dBs	26.0	28.5	31.0	dB	10	33	11	32	—	
REC - MUTE Attenuation	REC-MUTE	NORM	NORM	f = 1kHz, Vin = –14dBs	60	70	—	dB	10	33	11	32	—	
REC CAL Response	R-CAL1	NORM	NORM	f = 3kHz, Vin = –46dBs, $V_{REC-CAL}$ = 5V; $G_{V\ EQ-NN1}$ = 0dB	3.0	4.5	6.0	dB	10	33	11	32	—	
	R-CAL2			f = 3kHz, Vin = –46dBs, $V_{REC-CAL}$ = 0V	–6.0	–4.5	–3.0	dB	10	33	11	32	—	
GP CAL Response	GP-CAL1	NORM	NORM	f = 12kHz, Vin = –46dBs, V_{GP-CAL} = 0V; $G_{V\ EQ-NN3}$ = 0dB	3.0	4.5	6.0	dB	10	33	11	32	—	
	GP-CAL2			f = 12kHz, Vin = –46dBs, V_{GP-CAL} = 5V	–6.0	–4.5	–3.0	dB	10	33	11	32	—	
Bias out Max level	Bias on	R_L = 2.4kΩ + 270Ω			V_{CC} –1.4	V_{CC} –0.7	—	V	—	—	—	—	25	
Bias out offset	Bias off	R_L = 2.4kΩ + 270Ω			–100	0	100	mV	—	—	—	—	25	

HA12204NT

(Ta = 25˚C, V_{CC} = ±7 V, REC - OUT Level = 300 mVrms = 0 dB)

Item	Symbol	Test Condition: IC Condition * REC/PB /PASS	A/B	120µ/ 70µ	LINE MUTE	fin (Hz)	RECOUT level (dB)	Other	Specification Min	Typ	Max	Unit	Application Terminal: Input R	Input L	Output R	Output L	COM	Remark
Quiescent current	I_Q	PB	A	120	Mute	—	—	No signal	—	19.2	25.0	mA	—	—	—	—	22	
Input AMP. gain	G_V PB	PB	A/B	120	OFF	1k	0		25.5	27.0	28.5	dB	2/4	41/39	8	35	—	
	G_V REC	REC	A	120	OFF	1k	0		21.2	22.7	24.2		6	37	8	35	—	
Signal handling	Vo max	REC	A	120	OFF	1k	—	THD=1%	12.0	13.0		dB	6	37			—	1)
Signal to noise ratio	S/N	REC	A	120	OFF	1k	—	Rg=5.1kΩ, CCIR/ARM	70.0	80.0	—	dB	6	37	8	35	—	
Total Harmonic Distortion	THD	REC	A	120	OFF	1k	0		—	0.05	0.3	%	6	37	8	35	—	
Channel separation	CTRL (1)	PB	A/B	120	OFF	1k	+12		70.0	80.0	—	dB	2/4	41/39	8	35	—	
	CTRL (2)	REC	A	120	OFF	1k	+12		70.0	85.0	—		6	37	8	35	—	
Crosstalk	CT A/B	PB	A/B	120	OFF	1k	+12		70.0	80.0	—	dB	2/4	41/39	8	35	—	
	CT R/P	REC/PB	A/B	120	OFF	1k	+12		70.0	80.0	—				8	35	—	
Pass AMP. gain	Gv PA	PASS	A/B	120	OFF	1k	0		25.5	27.0	28.5	dB	2/4	41/39	8	35	—	
Gain deviation	ΔGv	PASS	A/B	120	OFF	1k	0	Gv PA – Gv PB	–1.0	0.0	1.0	dB	2/4	41/39	8	35	—	
MUTE ATT.	MUTE	PB	A	120	ON	1k	+12		70.0	80.0	—	dB	2	41	8	35	—	
70µ EQ gain	G_V EQ 1k	PB	A/B	70	OFF	1k	0		24.0	25.5	27.0	dB	2/4	41/39	8	35	—	
	G_V EQ 10k	PB	A/B	70	OFF	10k	0		20.8	22.3	23.8		2/4	41/39	8	35	—	
MS sensing level	V_{ON}	PB	A	120	OFF	5k	—		–26.0	–22.0	–18.0	dB	2	41	—	—	21	2)
MS output low level	V_{OL}	PB	A	120	OFF	—	—		—	1.0	1.5	V	2	41	—	—	21	
MS output leak current	I_{OH}	PB	A	120	OFF	—	—		—	—	2.0	µA	—	—	—	—	21	
Control voltage	V_{IL}	—	—	—	—	—	—		–0.2	—	1.0	V	—	—	—	—	12 to 17 19, 20	
	V_{IM}	—	—	—	—	—	—		2.0	—	3.0		—	—	—	—	12 to 17 19, 20	
	V_{IH}	—	—	—	—	—	—		4.0	—	5.3		—	—	—	—	12 to 17 19, 20	

Note 1) V_{CC} = ±6V

2) For inputting signal to one side channel

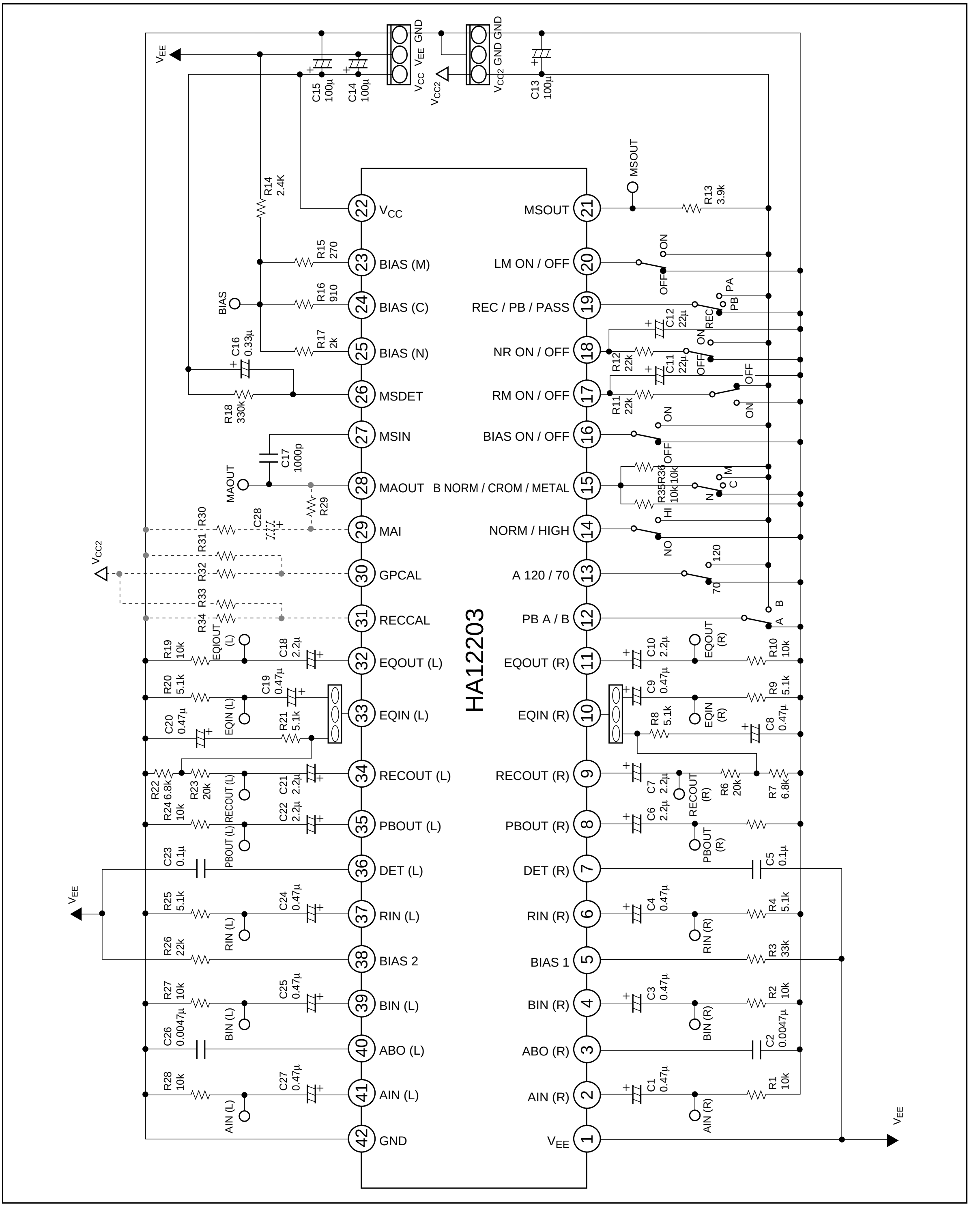
* Other IC-condition : REC-MUTE OFF, Normal tape, Normal speed, Bias OFF

HA12204NT (cont)

(Ta = 25 °C, V_{CC} = ± 7 V)

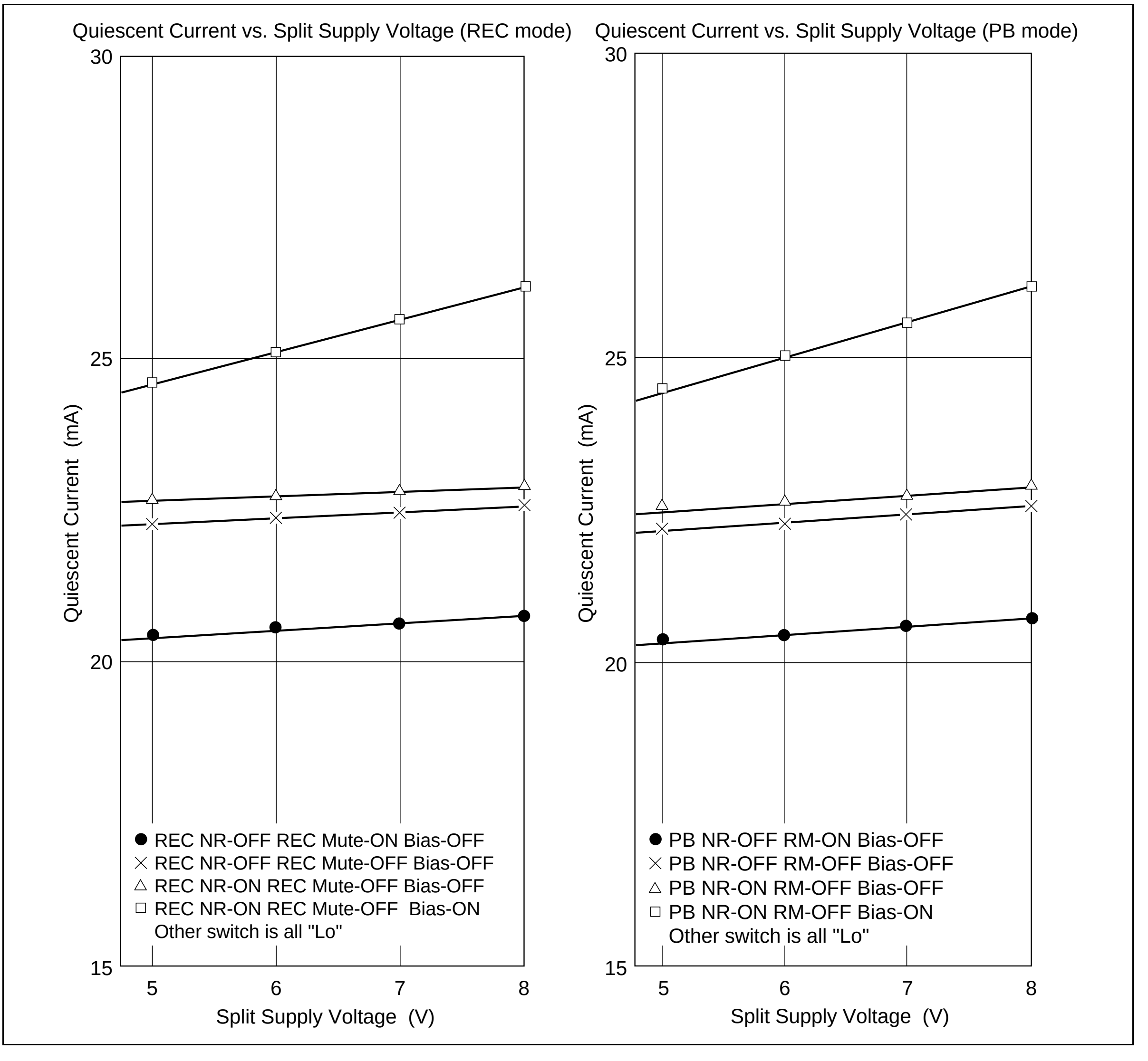
Item	Symbol	Test Condition TAPE	Test Condition SPEED	Test Condition	Spec. Min	Spec. Typ	Spec. Max	Unit	Application Terminal Input R	Input L	Output R	Output L	COM	Remark
Equalizer S/N	S/N (EQ)	NORM	NORM	Rg = 5.1kΩ, A - WTG Filter (0dB = –5dBs at EQOUT)	55	58	—	dB	10	33	11	32	—	
Equalizer maximum input	Vin max (EQ)	NORM	NORM	f = 1kHz, THD = 1%, Vin = –26dBs = 0dB	10.5	12.5	—	dB	10	33	11	32	—	
Equalizer Total Harmonic Distortion	T.H.D. (EQ)	NORM	NORM	f = 1kHz, Vin = –26dBs	—	0.2	0.5	%	10	33	11	32	—	
Equalizer offset voltage	Vofs (EQ)	NORM	NORM	No - Signal	–500	0	500	mV	10	33	11	32	—	
Equalizer Frequency Response (NORM - NORM)	GVEQ-NN1	NORM	NORM	f = 3kHz, Vin = –46dBs	18.8	20.3	21.8	dB	10	33	11	32	—	
	GVEQ-NN2			f = 8kHz, Vin = –46dBs	23.9	25.9	27.9	dB	10	33	11	32	—	
	GVEQ-NN3			f = 12kHz, Vin = –46dBs	30.1	32.6	35.1	dB	10	33	11	32	—	
Equalizer Frequency Response (CROM - NORM)	GVEQ-CN1	CROM	NORM	f = 3kHz, Vin = –46dBs	24.0	25.5	27.0	dB	10	33	11	32	—	
	GVEQ-CN2			f = 8kHz, Vin = –46dBs	29.8	31.8	33.8	dB	10	33	11	32	—	
	GVEQ-CN3			f = 12kHz, Vin = –46dBs	36.3	38.8	41.3	dB	10	33	11	32	—	
Equalizer Frequency Response (NORM - High)	GVEQ-NH1	NORM	HIGH	f = 5kHz, Vin = –46dBs	14.9	16.4	17.9	dB	10	33	11	32	—	
	GVEQ-NH2			f = 15kHz, Vin = –46dBs	20.2	22.2	24.2	dB	10	33	11	32	—	
	GVEQ-NH3			f = 20kHz, Vin = –46dBs	24.1	26.6	29.1	dB	10	33	11	32	—	
Equalizer Frequency Response (CROM - High)	GVEQ-CH1	CROM	HIGH	f = 5kHz, Vin = –46dBs	20.7	22.2	23.7	dB	10	33	11	32	—	
	GVEQ-CH2			f = 15kHz, Vin = –46dBs	25.1	27.1	29.1	dB	10	33	11	32	—	
	GVEQ-CH3			f = 20kHz, Vin = –46dBs	28.6	31.1	33.3	dB	10	33	11	32	—	
REC - MUTE Attenuation	REC-MUTE	NORM	NORM	f = 1kHz, Vin = –14dBs	60	70	—	dB	10	33	11	32	—	
Bias out Max level	Bias on	RL = 2.4 k½ + 270 ½			Vcc –1.4	Vcc –0.7		V	—	—	—	—	25	
Bias out offset	Bias off	RL = 2.4 k½ + 270 ½			–100	0.0	100	mV	—	—	—	—	25	

Measurement Circuit



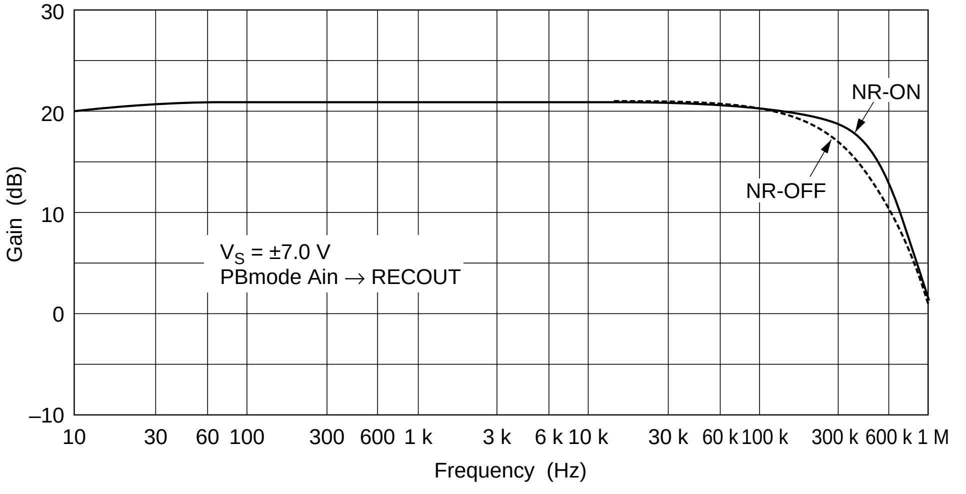
Electrical Characteristics Curve

HA12203NT

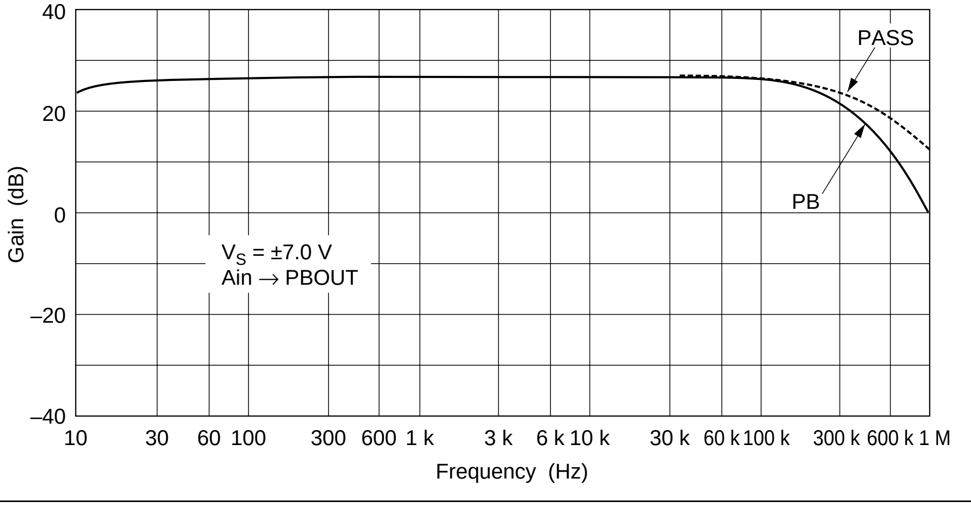


HA12203NT

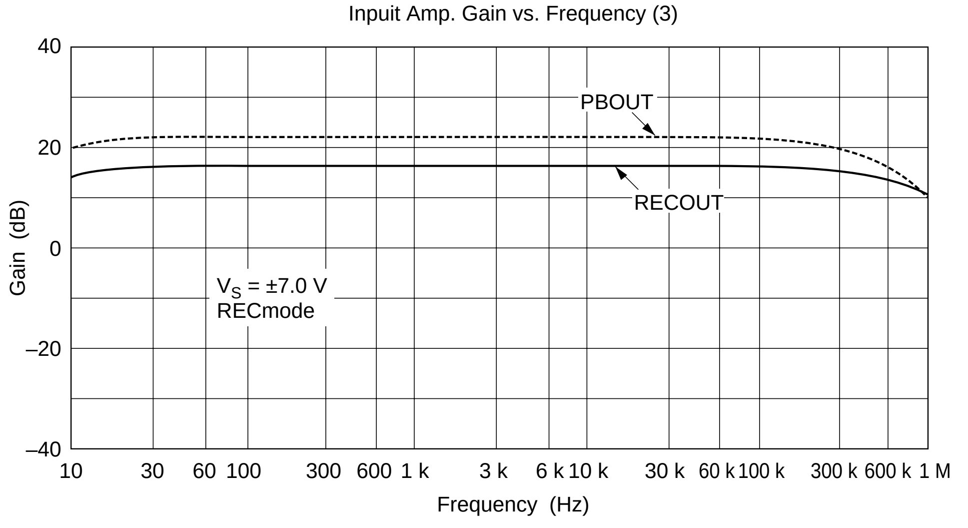
Inpuit Amp. Gain vs. Frequency (1)

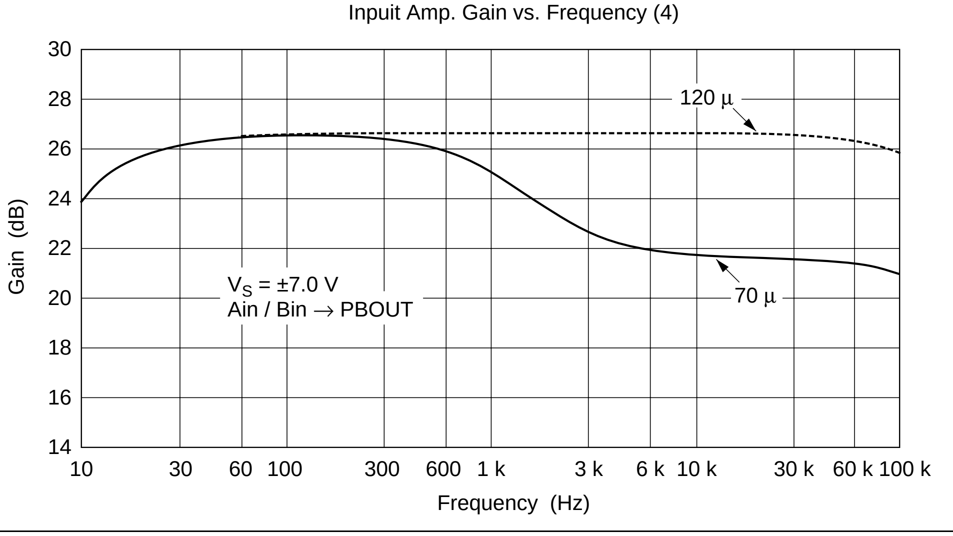


Inpuit Amp. Gain vs. Frequency (2)

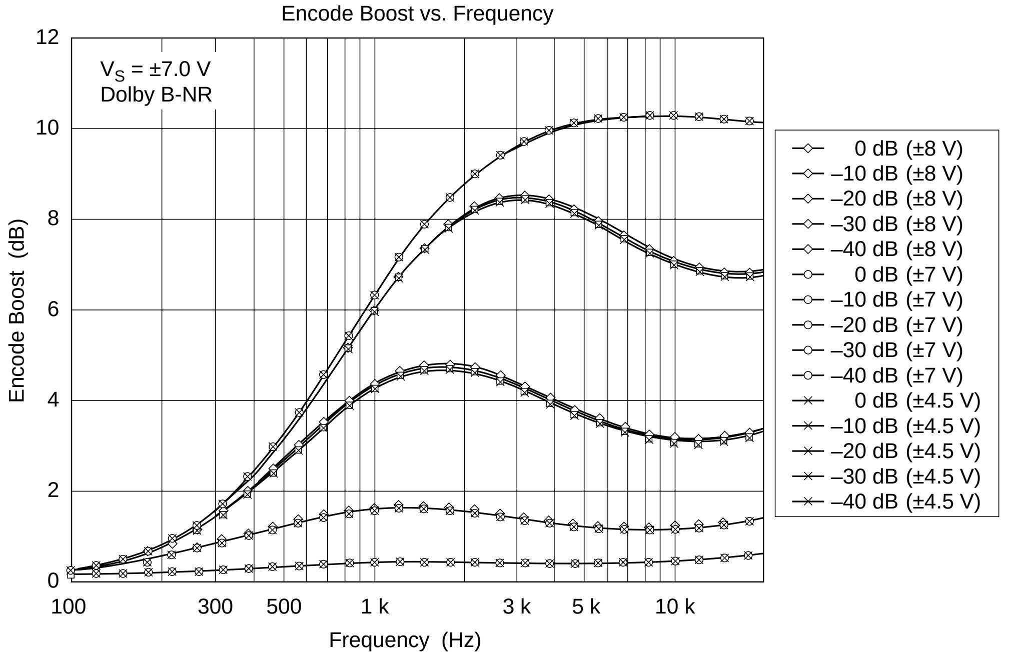


HA12203NT

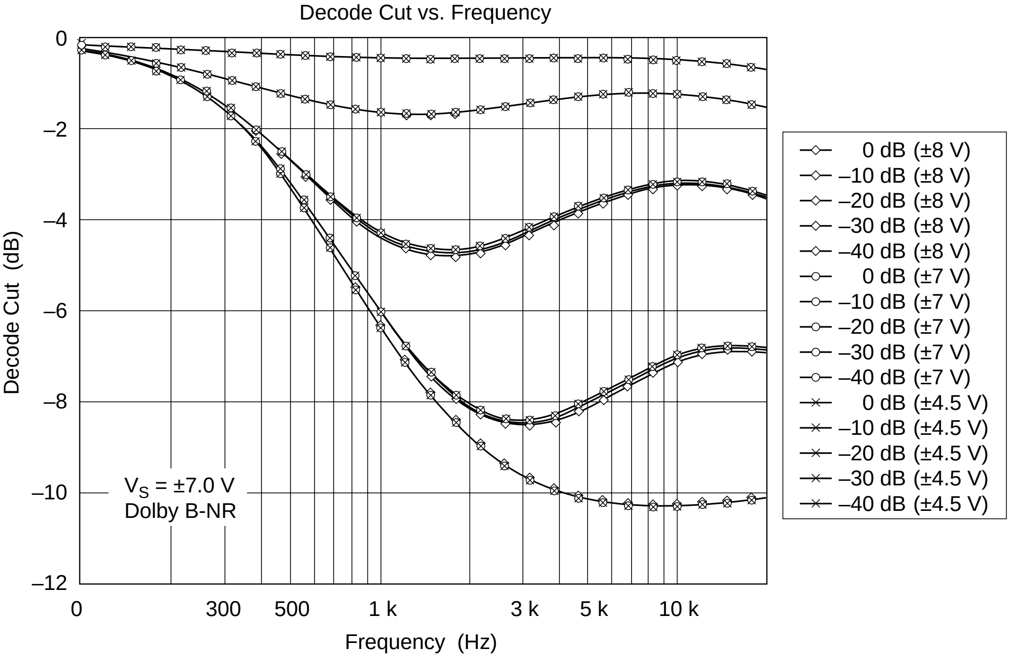

Inpuit Amp. Gain vs. Frequency (3)
Gain (dB)
40
20
0
–20
–40
PBOUT
RECOUT
V_S = ±7.0 V
RECmode
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
300 k
600 k
1 M
Frequency (Hz)


Inpuit Amp. Gain vs. Frequency (4)
Gain (dB)
30
28
26
24
22
20
18
16
14
120 µ
70 µ
V_S = ±7.0 V
Ain / Bin → PBOUT
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

HA12203NT

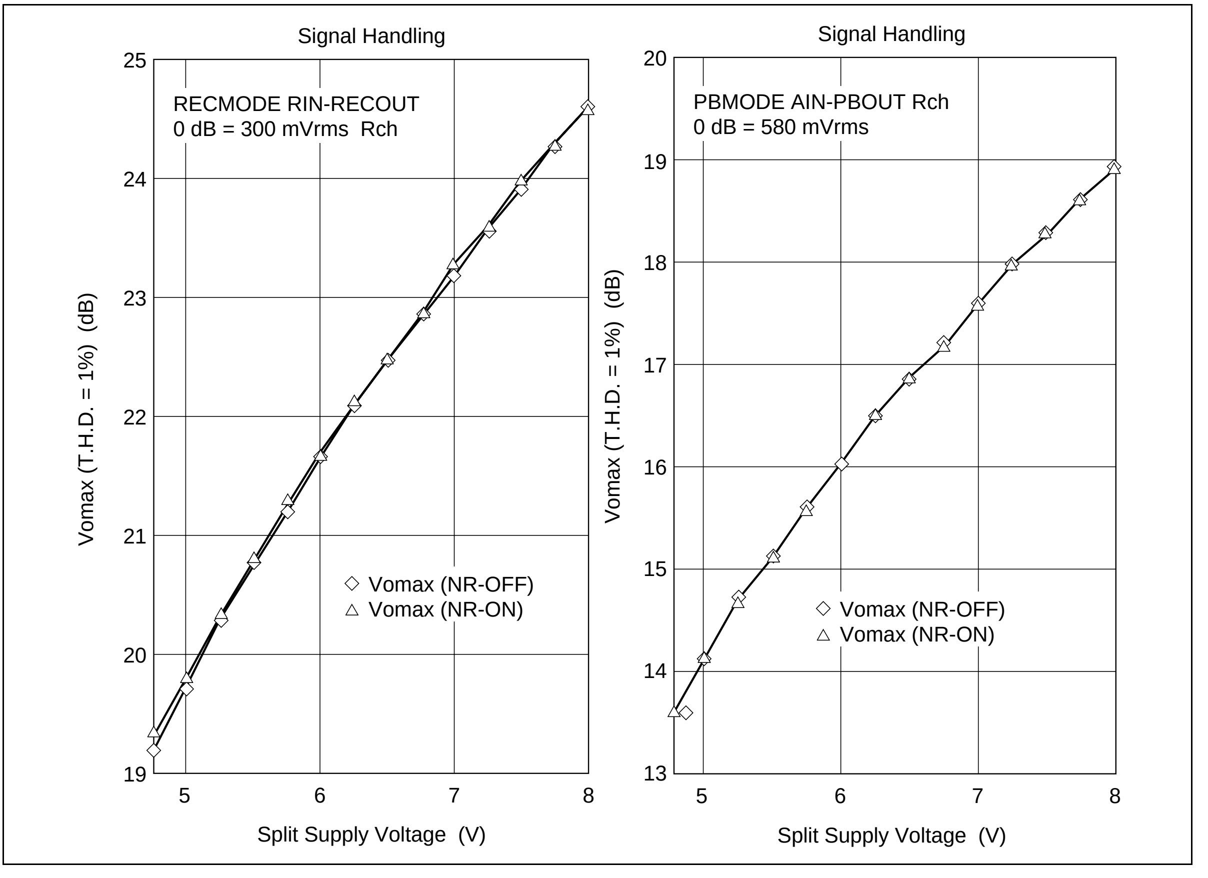


Encode Boost vs. Frequency
V_S = ±7.0 V
Dolby B-NR
Encode Boost (dB)
12
10
8
6
4
2
0
100
300
500
1 k
3 k
5 k
10 k
Frequency (Hz)
0 dB (±8 V)
–10 dB (±8 V)
–20 dB (±8 V)
–30 dB (±8 V)
–40 dB (±8 V)
0 dB (±7 V)
–10 dB (±7 V)
–20 dB (±7 V)
–30 dB (±7 V)
–40 dB (±7 V)
0 dB (±4.5 V)
–10 dB (±4.5 V)
–20 dB (±4.5 V)
–30 dB (±4.5 V)
–40 dB (±4.5 V)

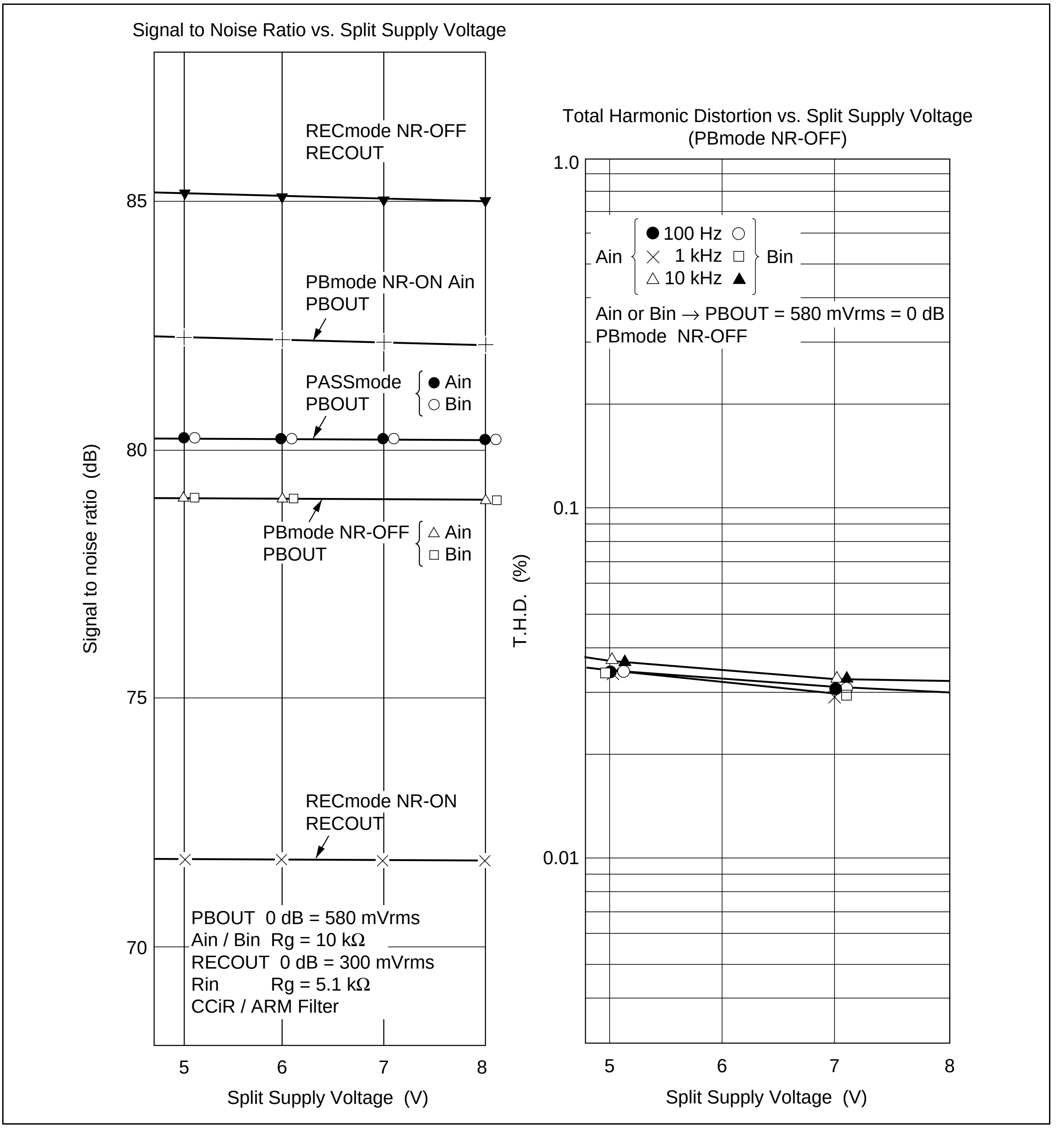


Decode Cut vs. Frequency
V_S = ±7.0 V
Dolby B-NR
Decode Cut (dB)
0
–2
–4
–6
–8
–10
–12
0
300
500
1 k
3 k
5 k
10 k
Frequency (Hz)
0 dB (±8 V)
–10 dB (±8 V)
–20 dB (±8 V)
–30 dB (±8 V)
–40 dB (±8 V)
0 dB (±7 V)
–10 dB (±7 V)
–20 dB (±7 V)
–30 dB (±7 V)
–40 dB (±7 V)
0 dB (±4.5 V)
–10 dB (±4.5 V)
–20 dB (±4.5 V)
–30 dB (±4.5 V)
–40 dB (±4.5 V)

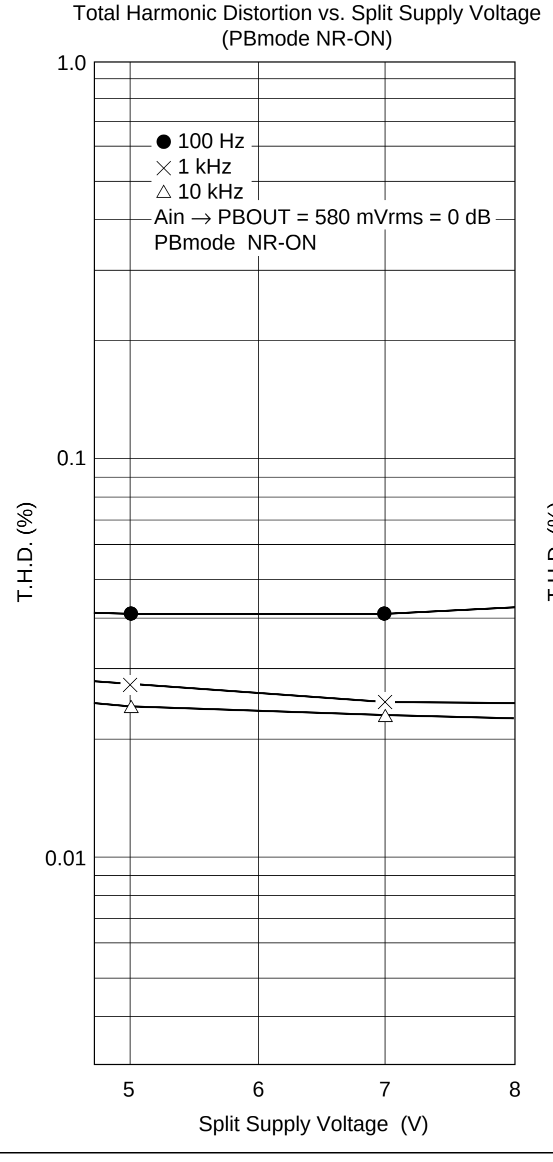
HA12203NT

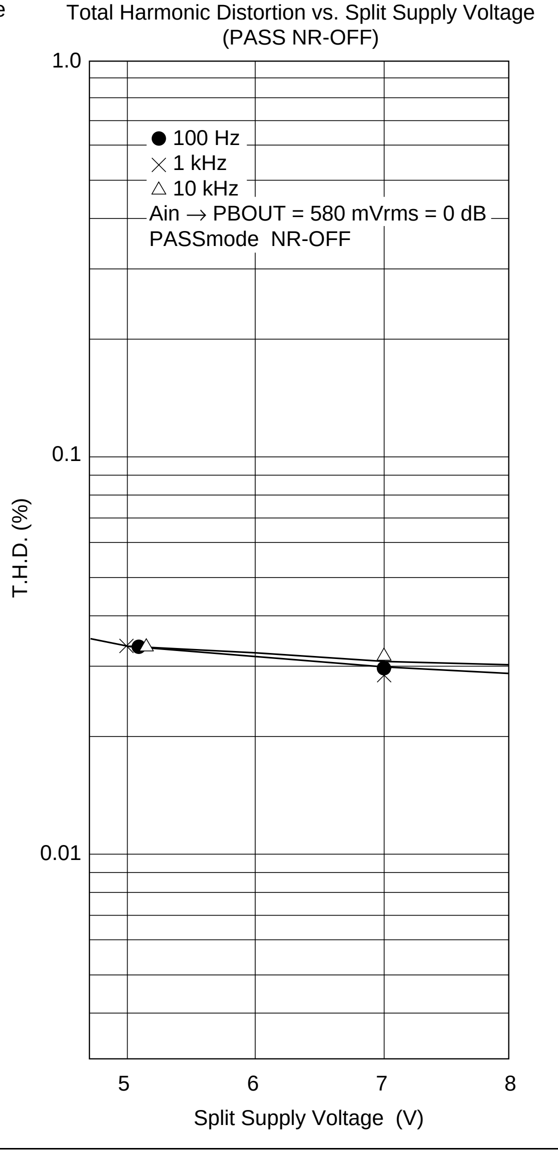

Signal Handling
RECMODE RIN-RECOUT
0 dB = 300 mVrms Rch
Vomax (T.H.D. = 1%) (dB)
Split Supply Voltage (V)
Vomax (NR-OFF)
Vomax (NR-ON)
Signal Handling
PBMODE AIN-PBOUT Rch
0 dB = 580 mVrms
Vomax (T.H.D. = 1%) (dB)
Split Supply Voltage (V)
Vomax (NR-OFF)
Vomax (NR-ON)

HA12203NT

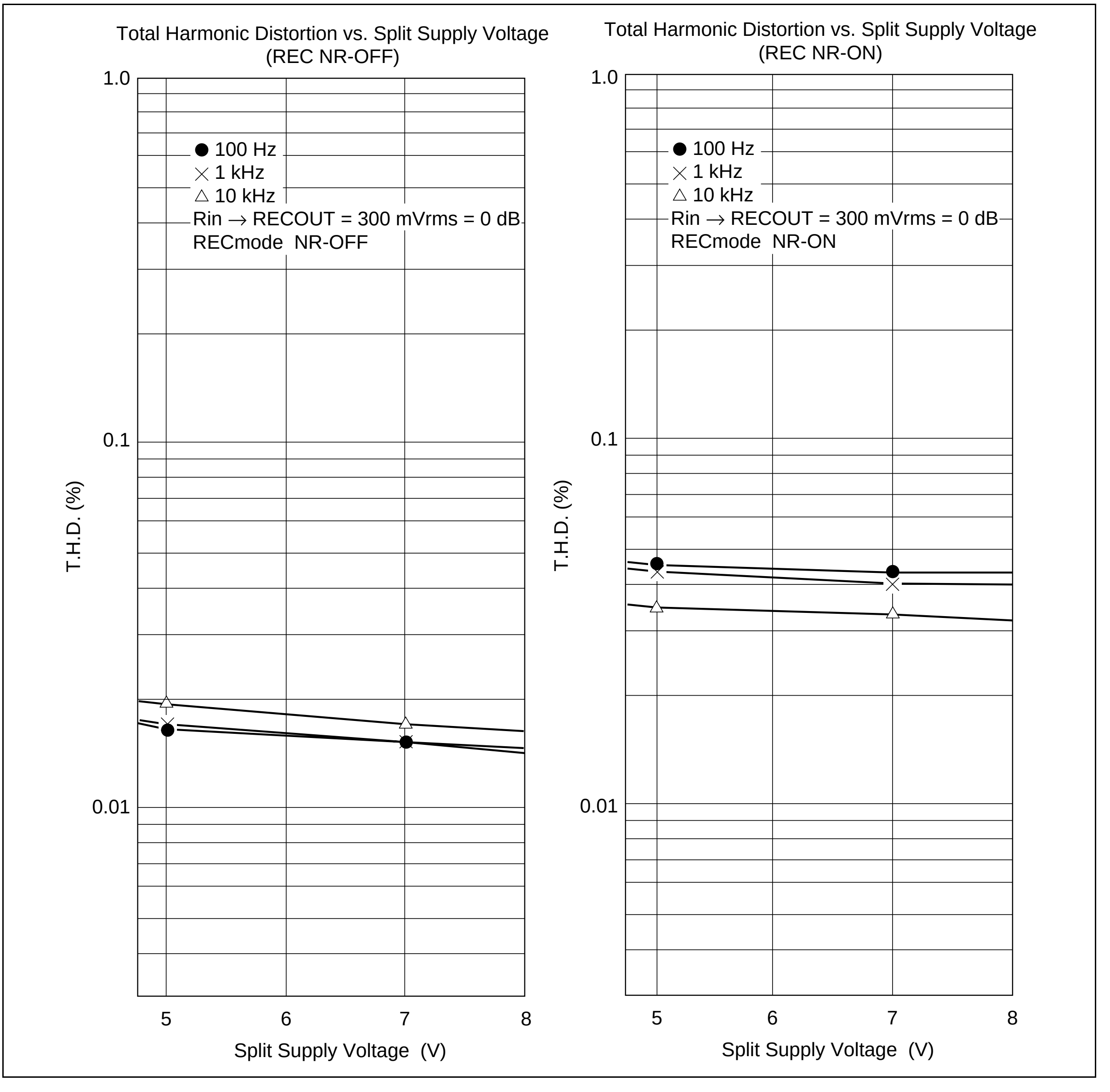

Signal to Noise Ratio vs. Split Supply Voltage
RECmode NR-OFF
RECOUT
PBmode NR-ON Ain
PBOUT
PASSmode
PBOUT
Ain
Bin
PBmode NR-OFF
PBOUT
Ain
Bin
RECmode NR-ON
RECOUT
PBOUT 0 dB = 580 mVrms
Ain / Bin Rg = 10 kΩ
RECOUT 0 dB = 300 mVrms
Rin Rg = 5.1 kΩ
CCiR / ARM Filter
Signal to noise ratio (dB)
85
80
75
70
5
6
7
8
Split Supply Voltage (V)
Total Harmonic Distortion vs. Split Supply Voltage
(PBmode NR-OFF)
Ain
100 Hz
1 kHz
10 kHz
Bin
Ain or Bin → PBOUT = 580 mVrms = 0 dB
PBmode NR-OFF
T.H.D. (%)
1.0
0.1
0.01
5
6
7
8
Split Supply Voltage (V)

HA12203NT

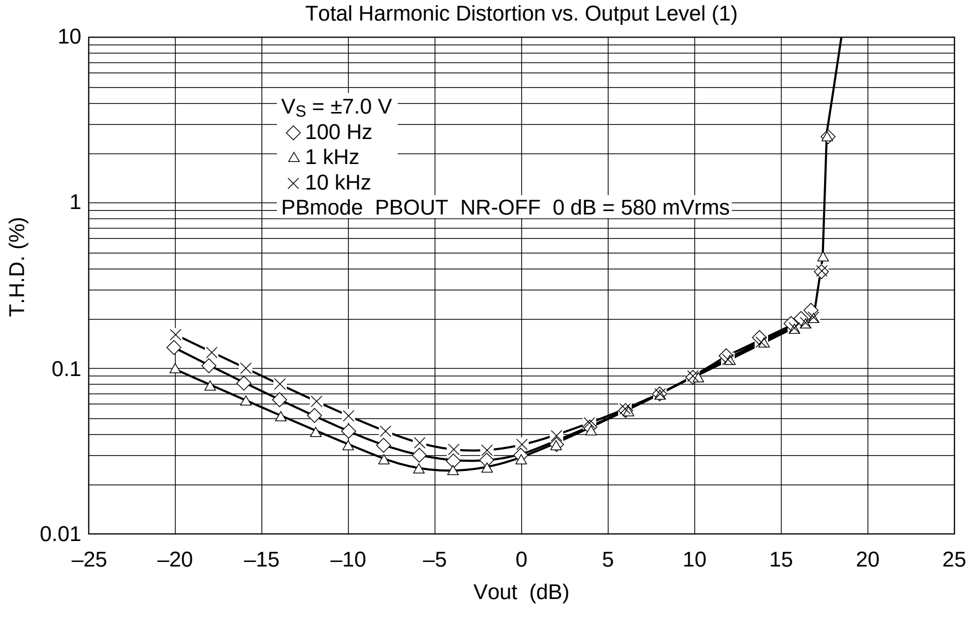

Total Harmonic Distortion vs. Split Supply Voltage
(PBmode NR-ON)
1.0
0.1
0.01
T.H.D. (%)
● 100 Hz
× 1 kHz
△ 10 kHz
Ain → PBOUT = 580 mVrms = 0 dB
PBmode NR-ON
5
6
7
8
Split Supply Voltage (V)

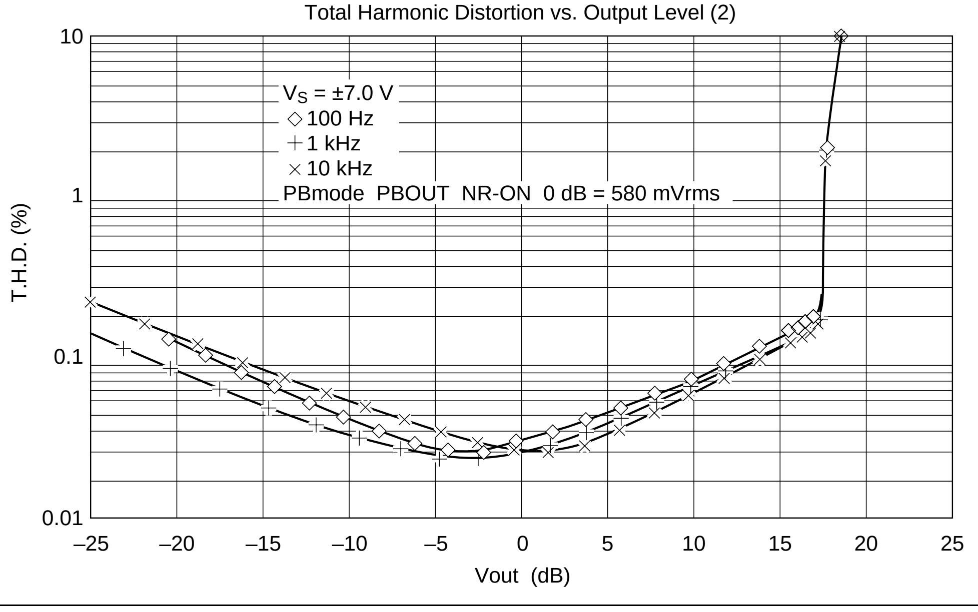

Total Harmonic Distortion vs. Split Supply Voltage
(PASS NR-OFF)
1.0
0.1
0.01
T.H.D. (%)
● 100 Hz
× 1 kHz
△ 10 kHz
Ain → PBOUT = 580 mVrms = 0 dB
PASSmode NR-OFF
5
6
7
8
Split Supply Voltage (V)

HA12203NT

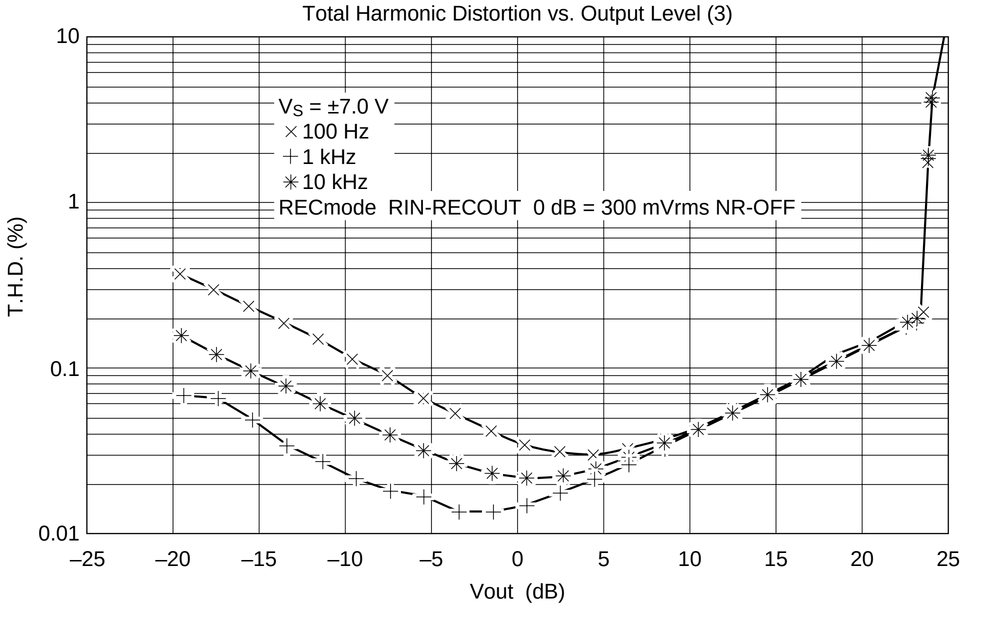

Total Harmonic Distortion vs. Split Supply Voltage
(REC NR-OFF)
1.0
0.1
0.01
T.H.D. (%)
● 100 Hz
× 1 kHz
△ 10 kHz
Rin → RECOUT = 300 mVrms = 0 dB
RECmode NR-OFF
5
6
7
8
Split Supply Voltage (V)
Total Harmonic Distortion vs. Split Supply Voltage
(REC NR-ON)
1.0
0.1
0.01
T.H.D. (%)
● 100 Hz
× 1 kHz
△ 10 kHz
Rin → RECOUT = 300 mVrms = 0 dB
RECmode NR-ON
5
6
7
8
Split Supply Voltage (V)

HA12203NT

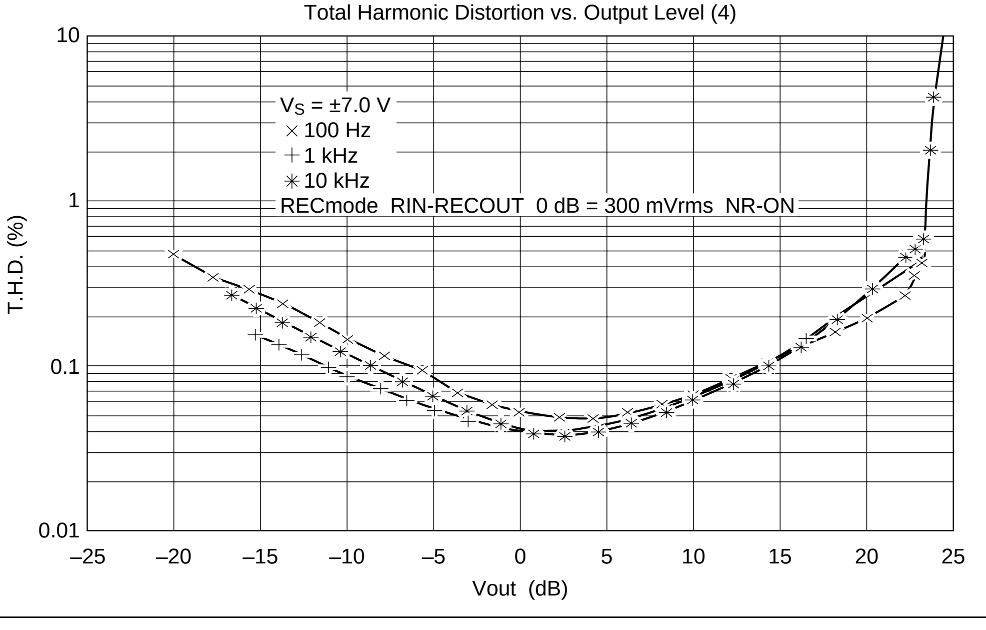

Total Harmonic Distortion vs. Output Level (1)
V_S = ±7.0 V
100 Hz
1 kHz
10 kHz
PBmode PBOUT NR-OFF 0 dB = 580 mVrms
T.H.D. (%)
10
1
0.1
0.01
–25
–20
–15
–10
–5
0
5
10
15
20
25
Vout (dB)


Total Harmonic Distortion vs. Output Level (2)
V_S = ±7.0 V
100 Hz
1 kHz
10 kHz
PBmode PBOUT NR-ON 0 dB = 580 mVrms
T.H.D. (%)
10
1
0.1
0.01
–25
–20
–15
–10
–5
0
5
10
15
20
25
Vout (dB)

HA12203NT



Total Harmonic Distortion vs. Output Level (3)
V_S = ±7.0 V
100 Hz
1 kHz
10 kHz
RECmode RIN-RECOUT 0 dB = 300 mVrms NR-OFF
T.H.D. (%)
Vout (dB)
10
1
0.1
0.01
–25
–20
–15
–10
–5
0
5
10
15
20
25



Total Harmonic Distortion vs. Output Level (4)
V_S = ±7.0 V
100 Hz
1 kHz
10 kHz
RECmode RIN-RECOUT 0 dB = 300 mVrms NR-ON
T.H.D. (%)
Vout (dB)
10
1
0.1
0.01
–25
–20
–15
–10
–5
0
5
10
15
20
25

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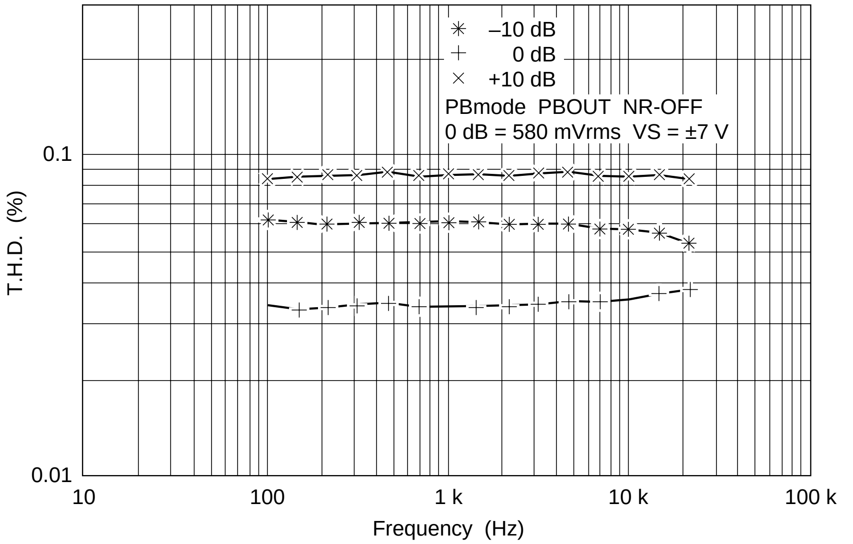
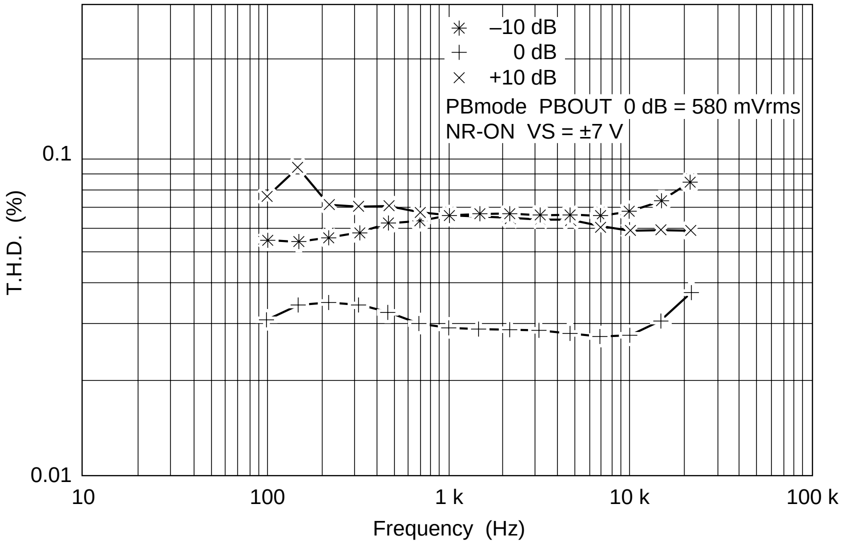
Total Harmonic Distortion vs. Frequency (1)



Total Harmonic Distortion vs. Frequency (2)



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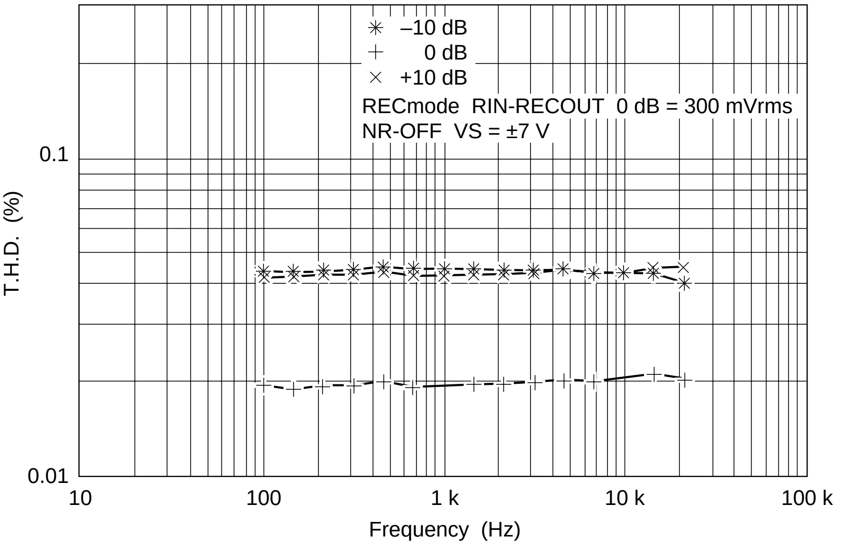
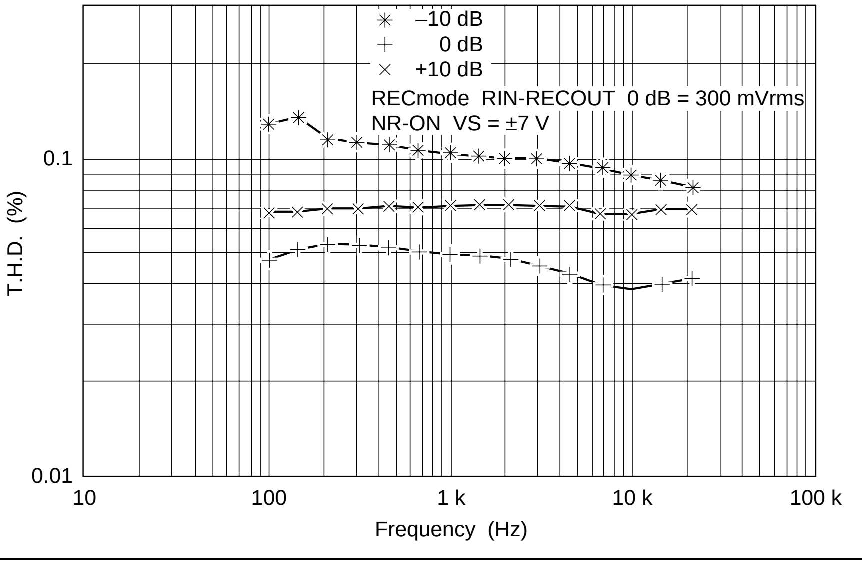
Total Harmonic Distortion vs. Frequency (3)



Total Harmonic Distortion vs. Frequency (4)



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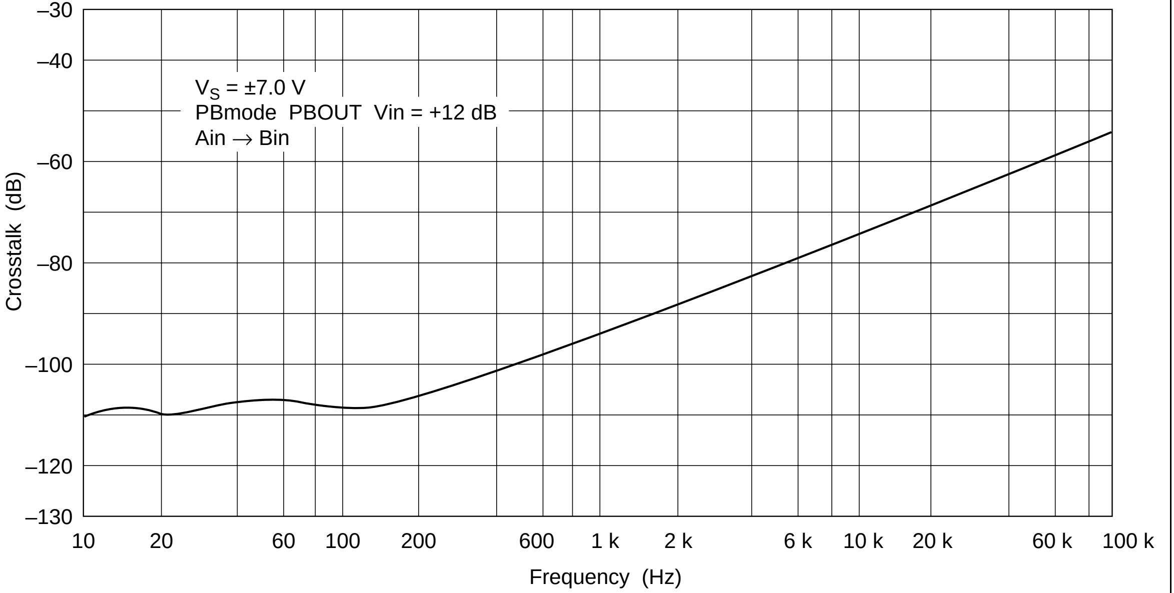
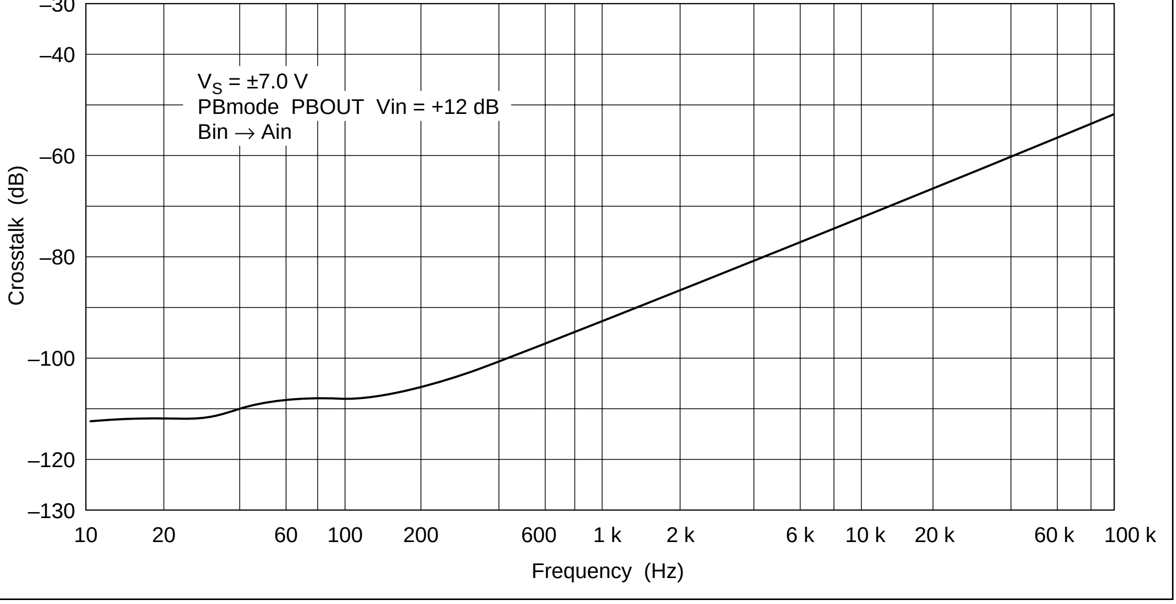
Crosstalk vs. Frequency (Ain → Bin) (1)



Crosstalk vs. Frequency (Bin → Ain) (2)



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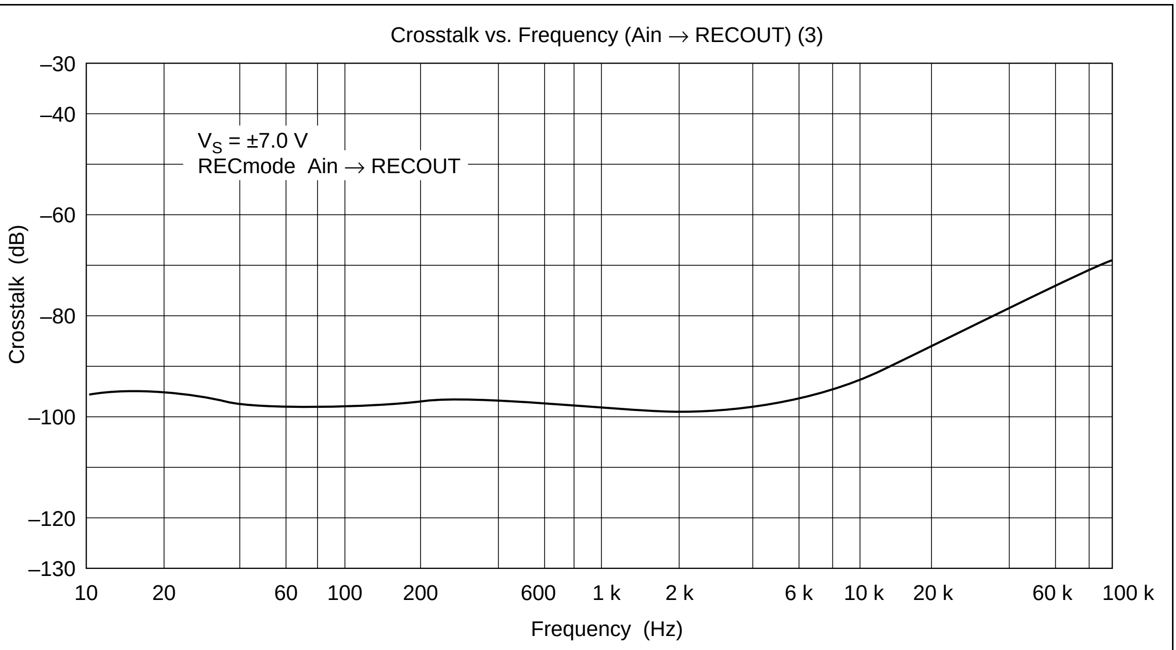
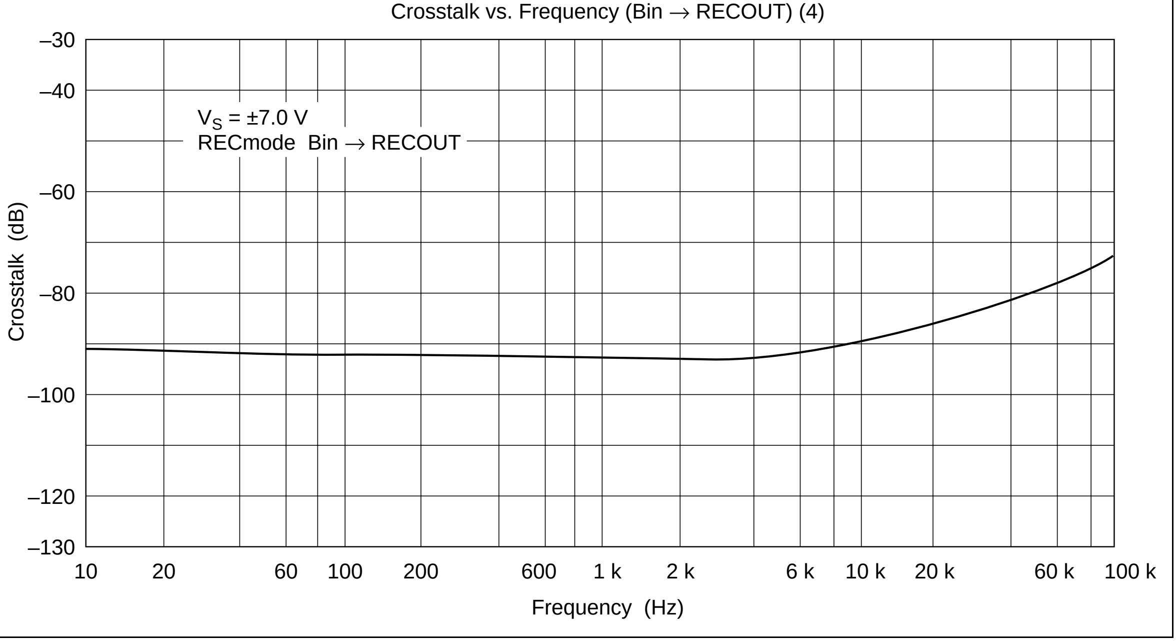
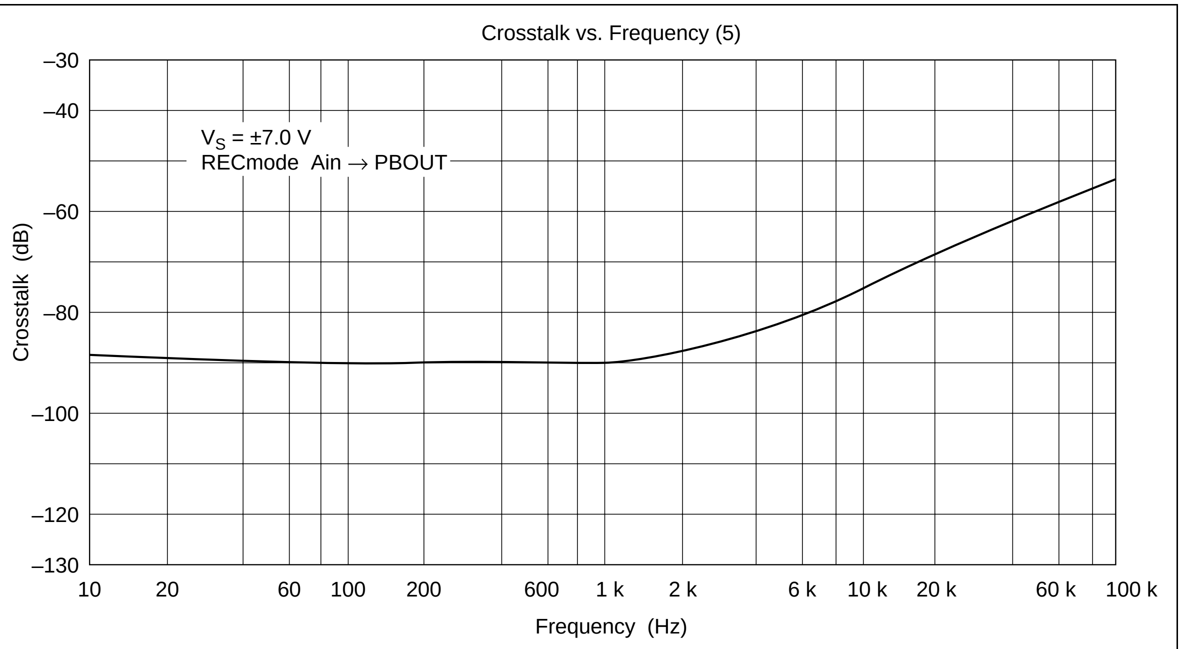
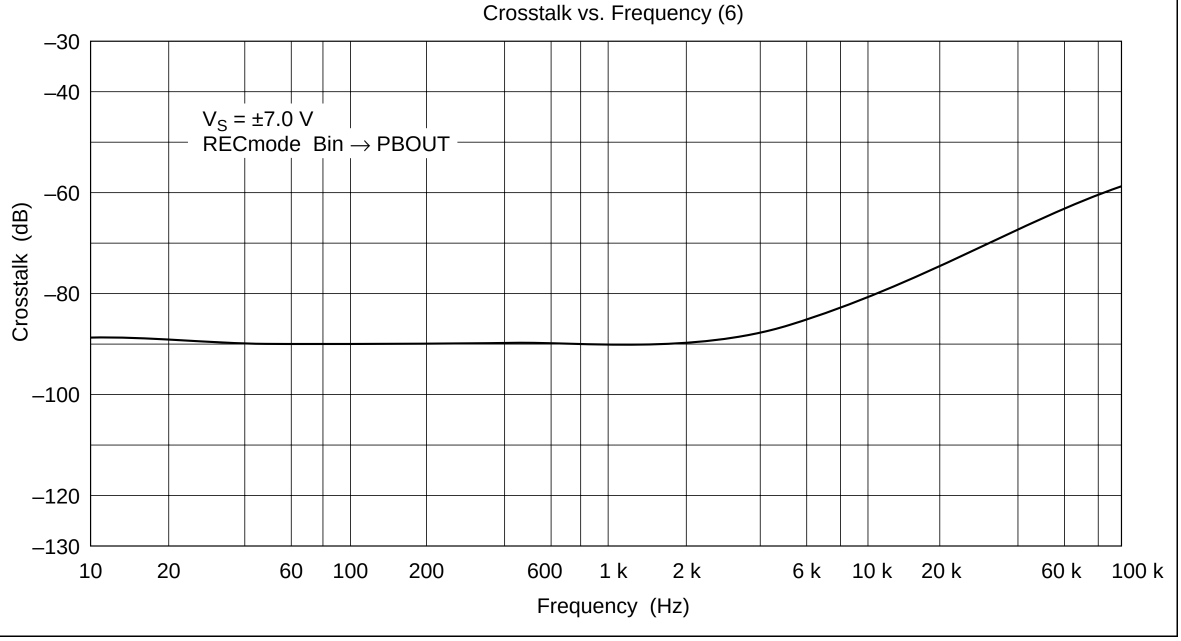

Crosstalk vs. Frequency (Ain → RECOUT) (3)
VS = ±7.0 V
RECmode Ain → RECOUT
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

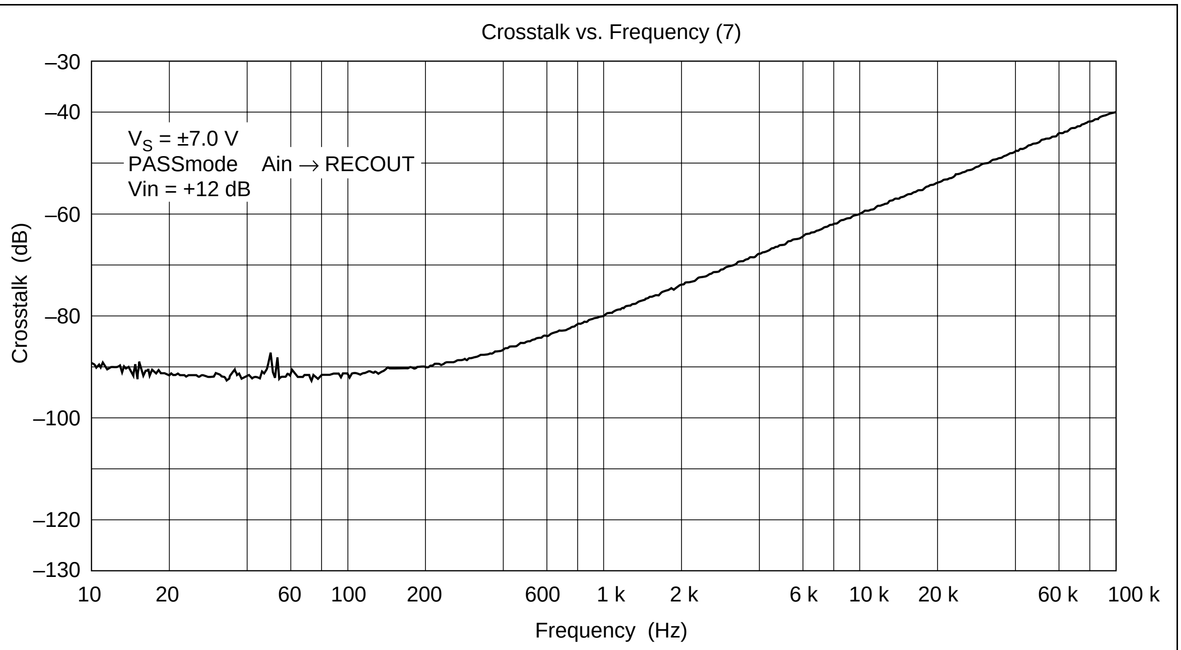

Crosstalk vs. Frequency (Bin → RECOUT) (4)
VS = ±7.0 V
RECmode Bin → RECOUT
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

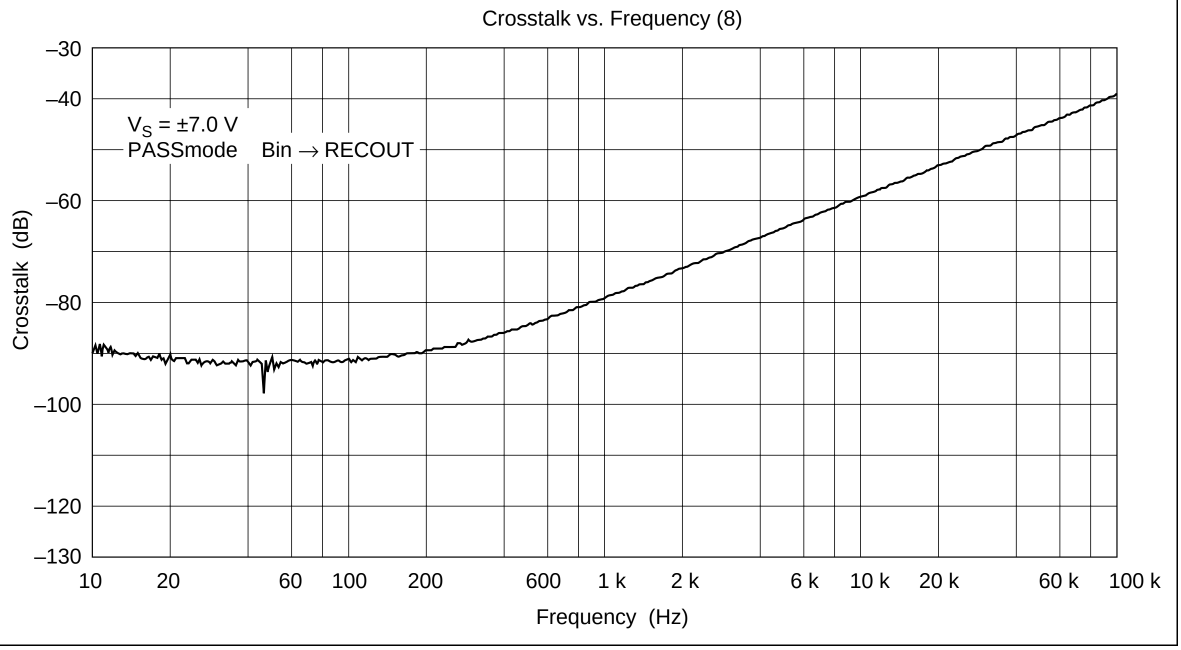
HA12203NT


Crosstalk vs. Frequency (5)
V_S = ±7.0 V
RECmode Ain → PBOUT
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

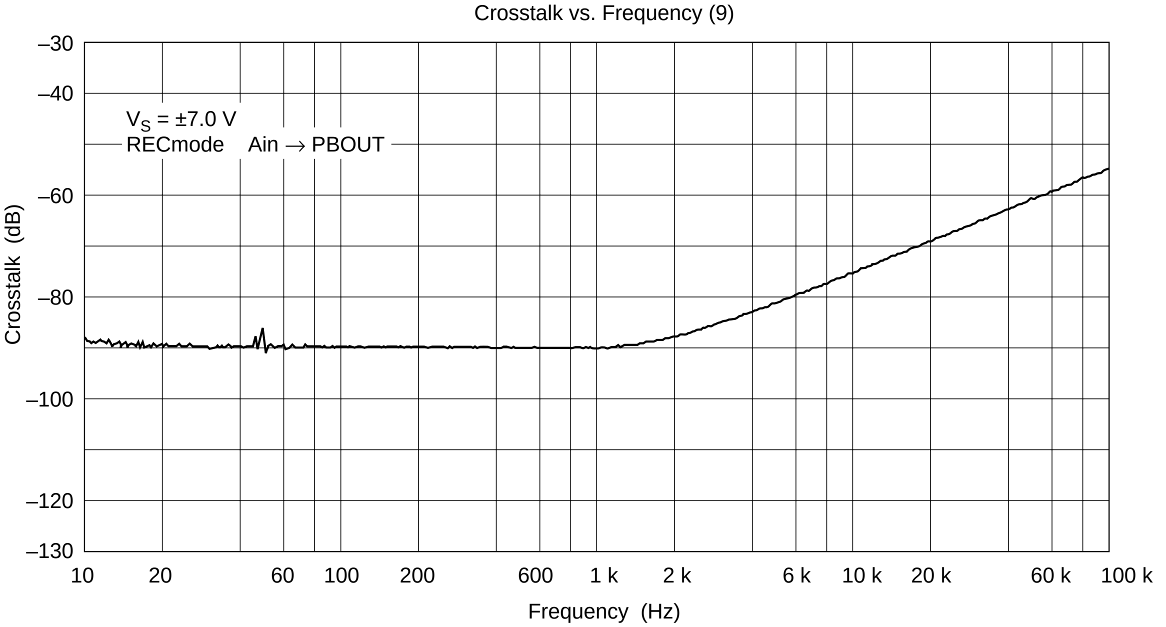

Crosstalk vs. Frequency (6)
V_S = ±7.0 V
RECmode Bin → PBOUT
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

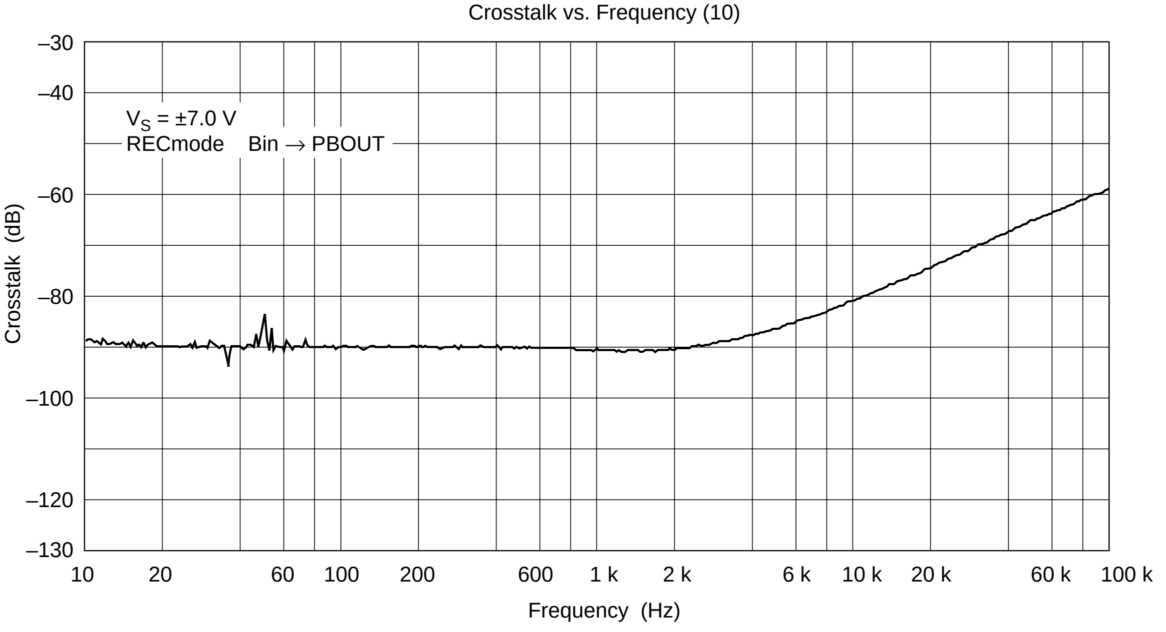
HA12203NT


Crosstalk vs. Frequency (7)
V_S = ±7.0 V
PASSmode Ain → RECOUT
Vin = +12 dB
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

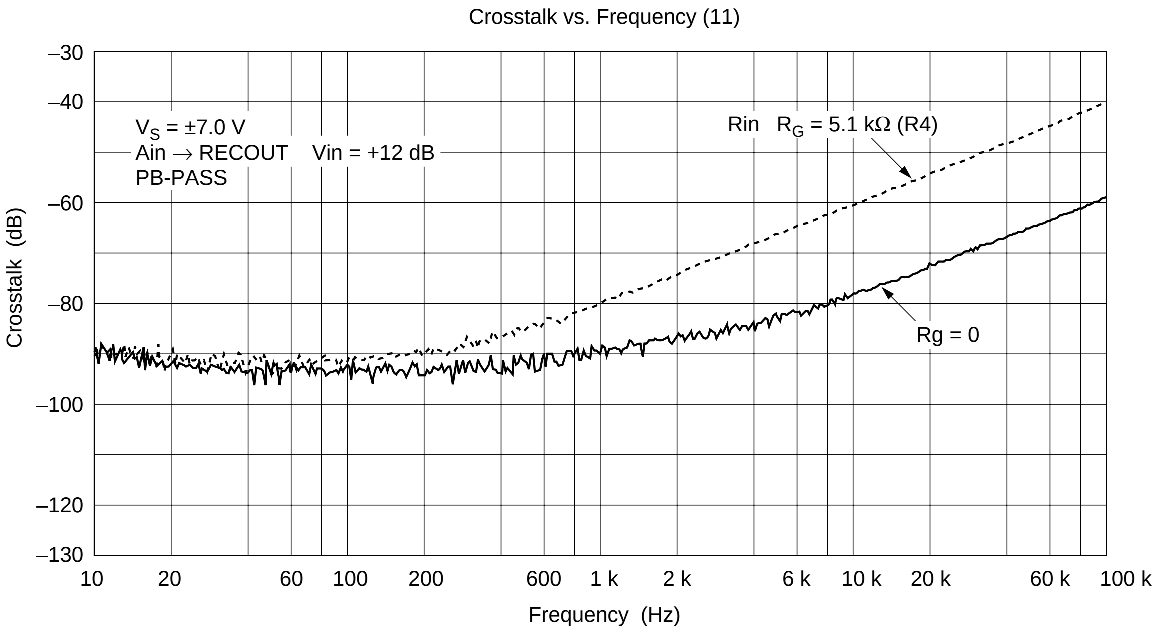

Crosstalk vs. Frequency (8)
V_S = ±7.0 V
PASSmode Bin → RECOUT
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

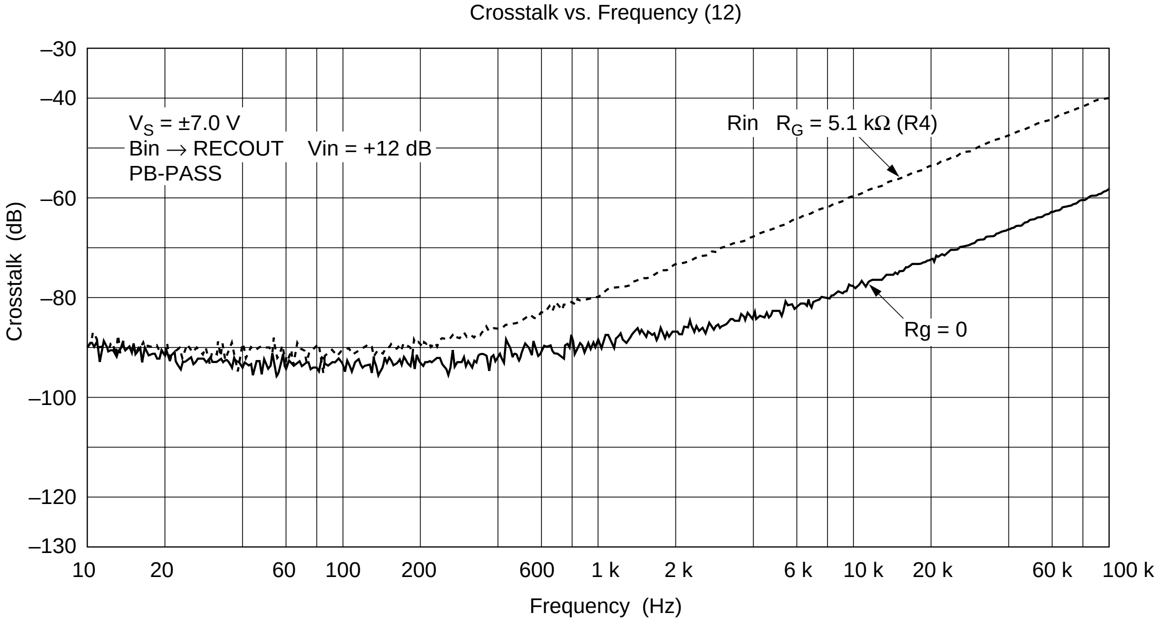
HA12203NT


Crosstalk vs. Frequency (9)
VS = ±7.0 V
RECmode Ain → PBOUT
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)


Crosstalk vs. Frequency (10)
VS = ±7.0 V
RECmode Bin → PBOUT
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

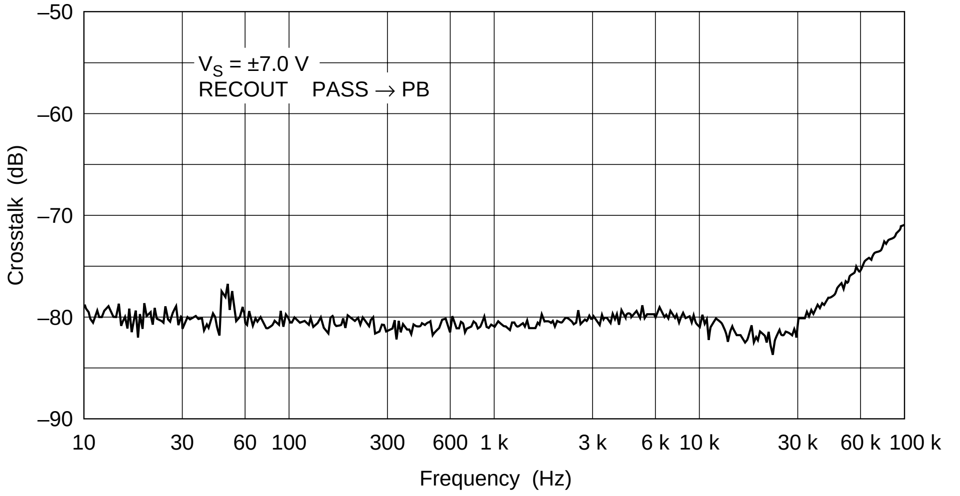
HA12203NT


Crosstalk vs. Frequency (11)
VS = ±7.0 V
Ain → RECOUT Vin = +12 dB
PB-PASS
Rin RG = 5.1 kΩ (R4)
Rg = 0
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

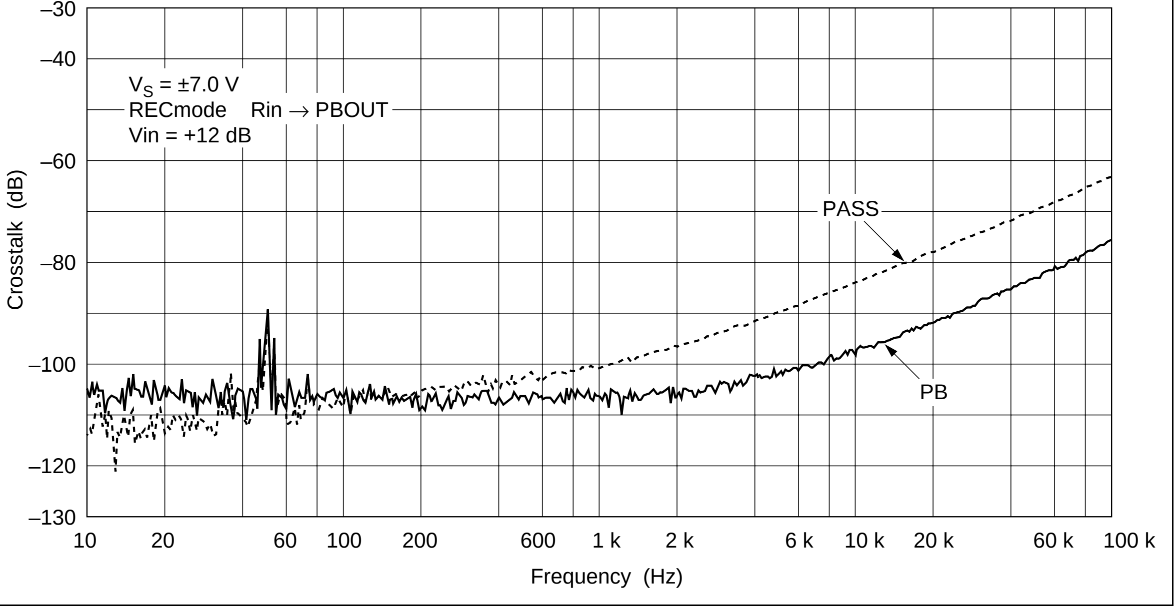

Crosstalk vs. Frequency (12)
VS = ±7.0 V
Bin → RECOUT Vin = +12 dB
PB-PASS
Rin RG = 5.1 kΩ (R4)
Rg = 0
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

HA12203NT

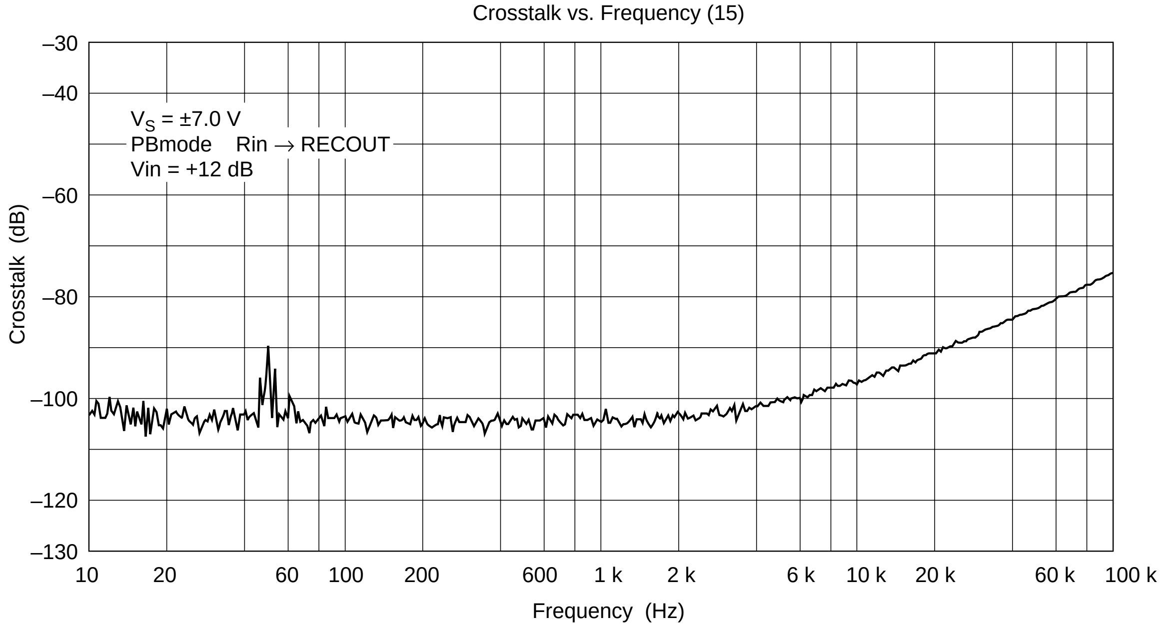
Crosstalk vs. Frequency (13)

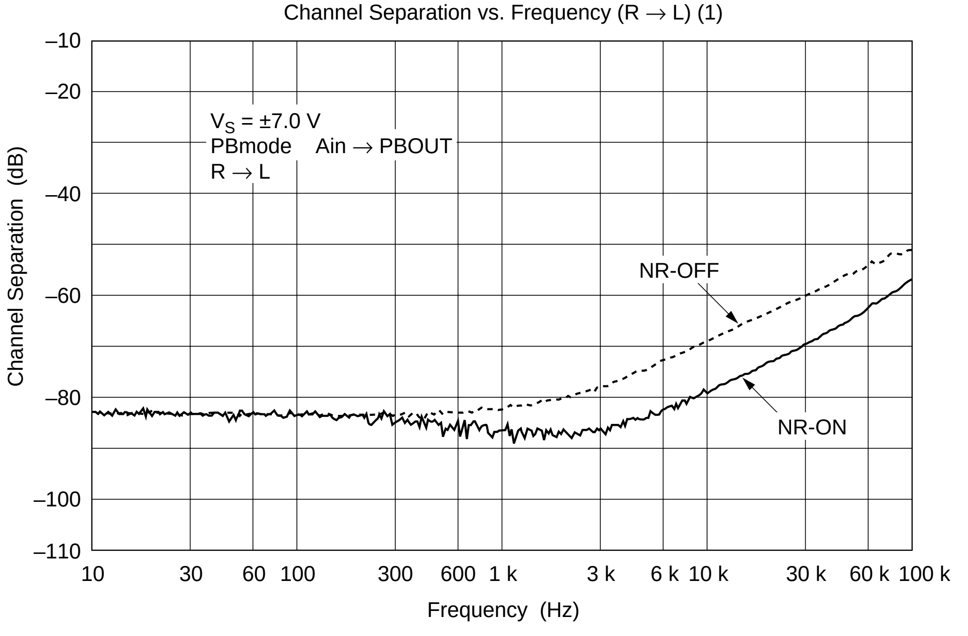


Crosstalk vs. Frequency (14)

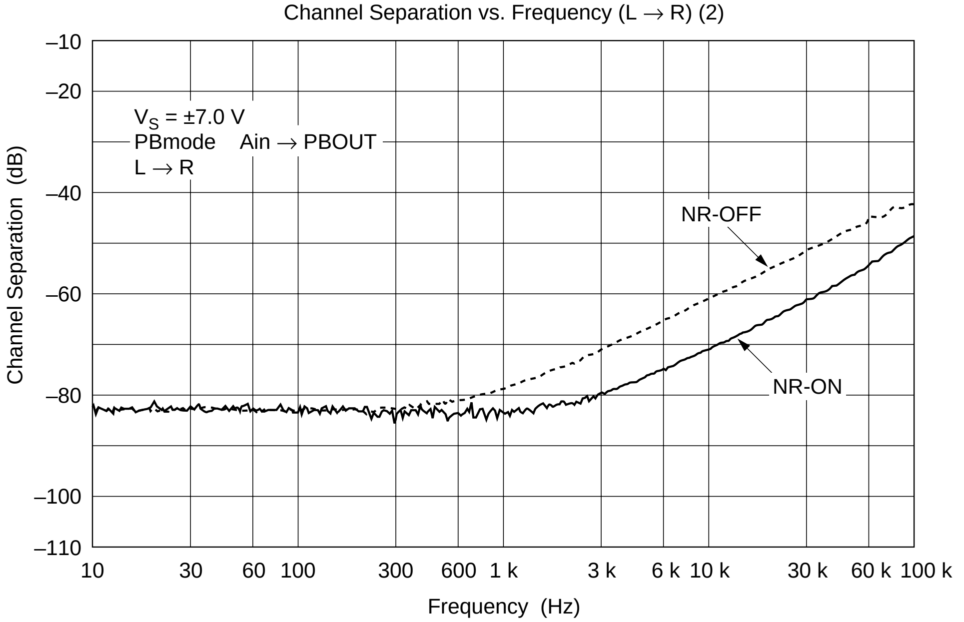


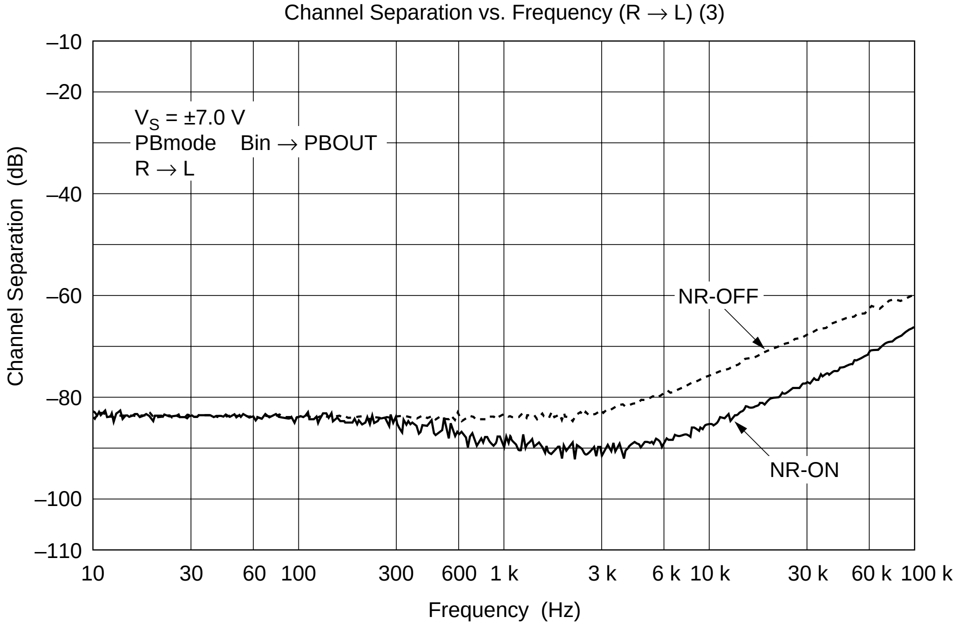
HA12203NT


Crosstalk vs. Frequency (15)
VS = ±7.0 V
PBmode Rin → RECOUT
Vin = +12 dB
Crosstalk (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

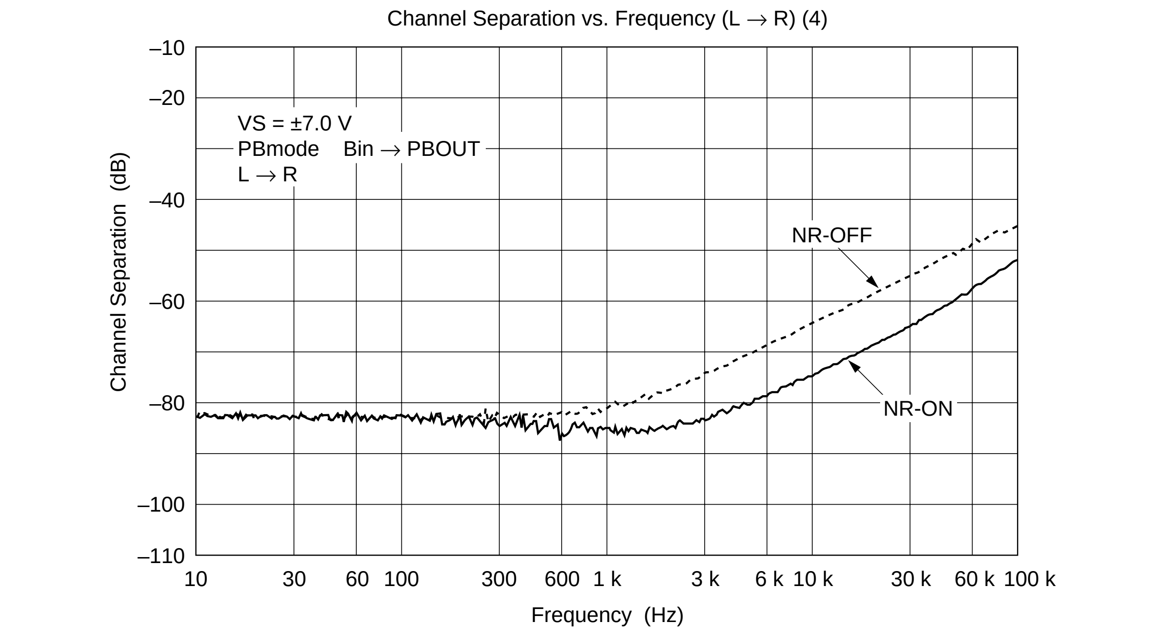

Channel Separation vs. Frequency (R → L) (1)
VS = ±7.0 V
PBmode Ain → PBOUT
R → L
NR-OFF
NR-ON
Channel Separation (dB)
–10
–20
–40
–60
–80
–100
–110
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

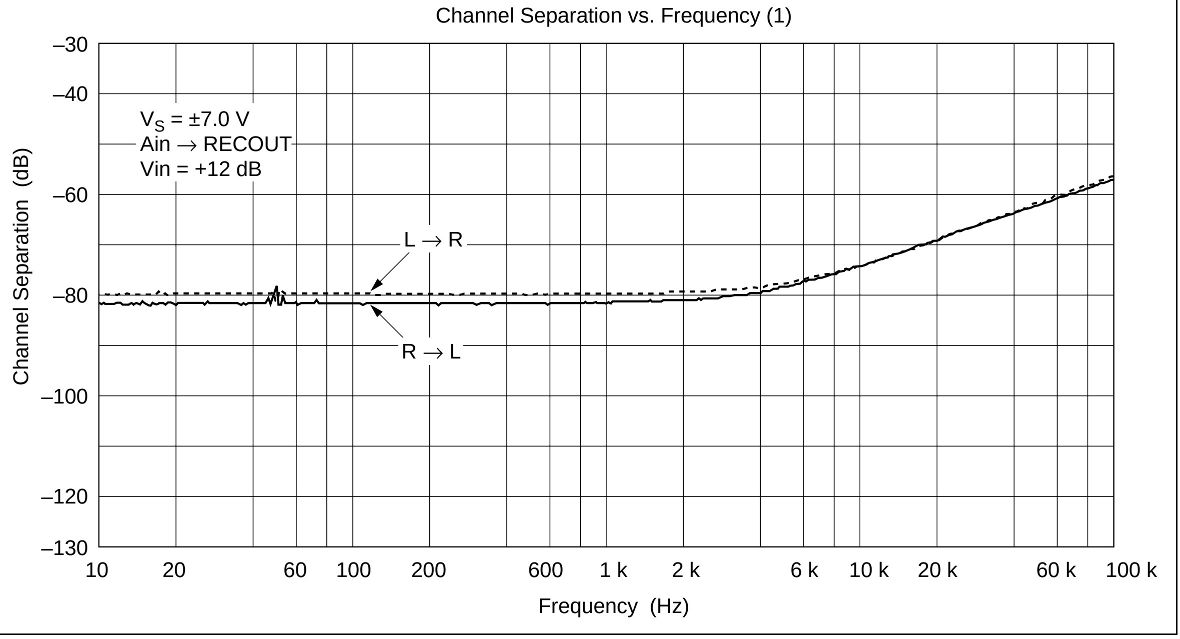
HA12203NT


Channel Separation vs. Frequency (L → R) (2)
V_S = ±7.0 V
PBmode Ain → PBOUT
L → R
NR-OFF
NR-ON
Channel Separation (dB)
–10
–20
–40
–60
–80
–100
–110
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)


Channel Separation vs. Frequency (R → L) (3)
V_S = ±7.0 V
PBmode Bin → PBOUT
R → L
NR-OFF
NR-ON
Channel Separation (dB)
–10
–20
–40
–60
–80
–100
–110
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

HA12203NT


Channel Separation vs. Frequency (L → R) (4)
VS = ±7.0 V
PBmode Bin → PBOUT
L → R
NR-OFF
NR-ON
Channel Separation (dB)
–10
–20
–40
–60
–80
–100
–110
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)


Channel Separation vs. Frequency (1)
VS = ±7.0 V
Ain → RECOUT
Vin = +12 dB
L → R
R → L
Channel Separation (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

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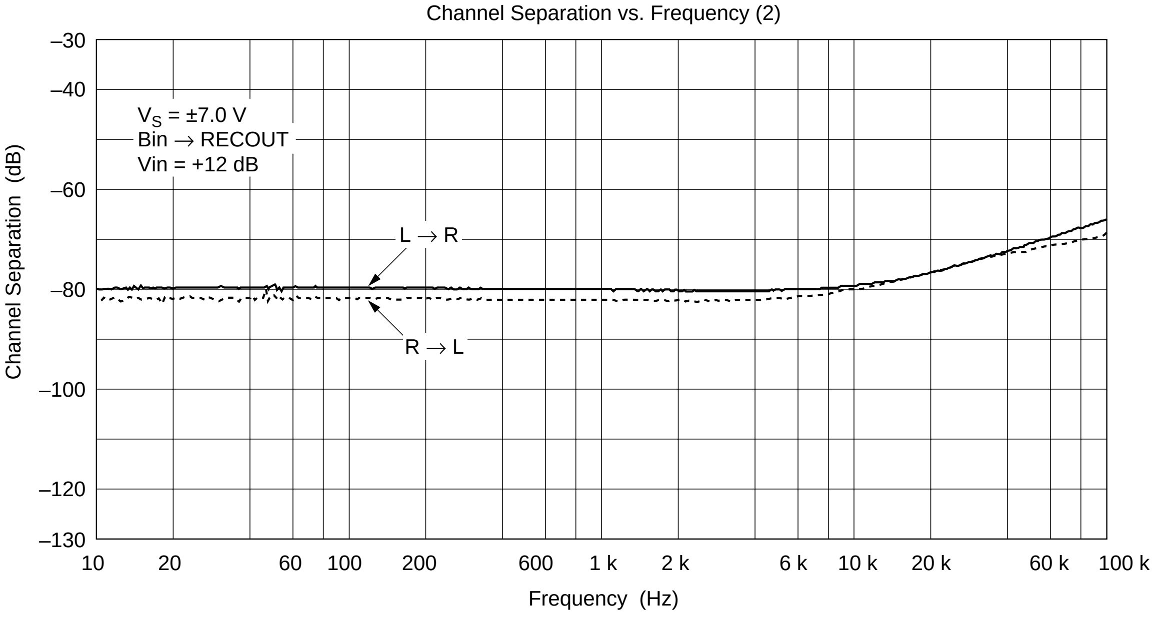
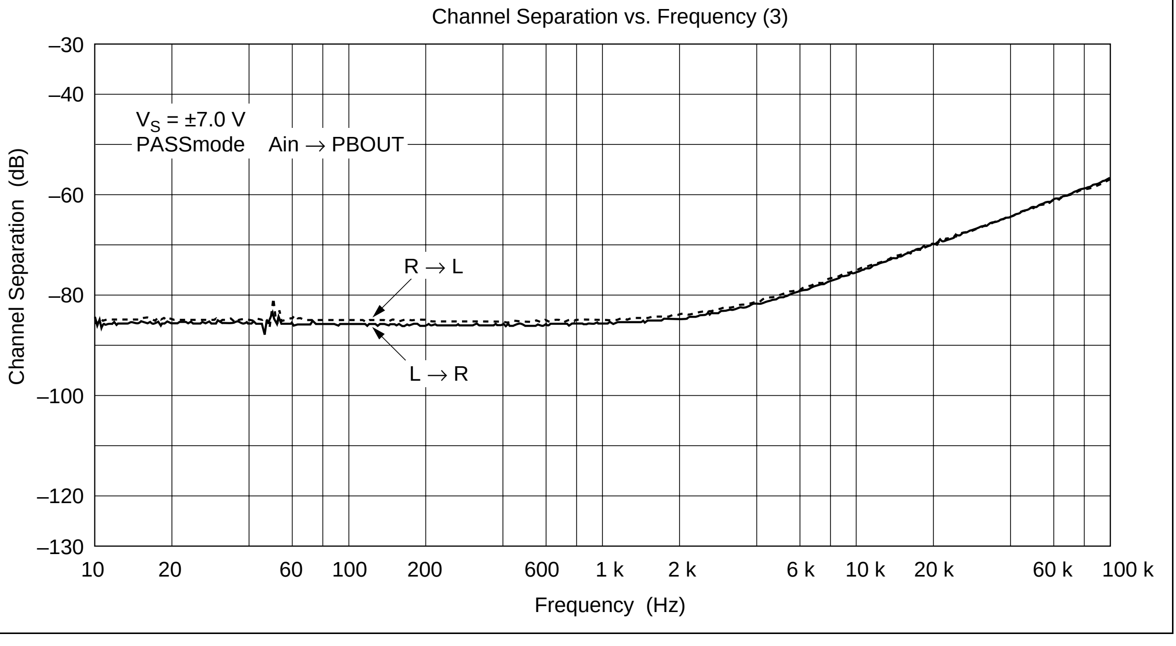

Channel Separation vs. Frequency (2)
V_S = ±7.0 V
Bin → RECOUT
Vin = +12 dB
L → R
R → L
Channel Separation (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)


Channel Separation vs. Frequency (3)
V_S = ±7.0 V
PASSmode Ain → PBOUT
R → L
L → R
Channel Separation (dB)
–30
–40
–60
–80
–100
–120
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

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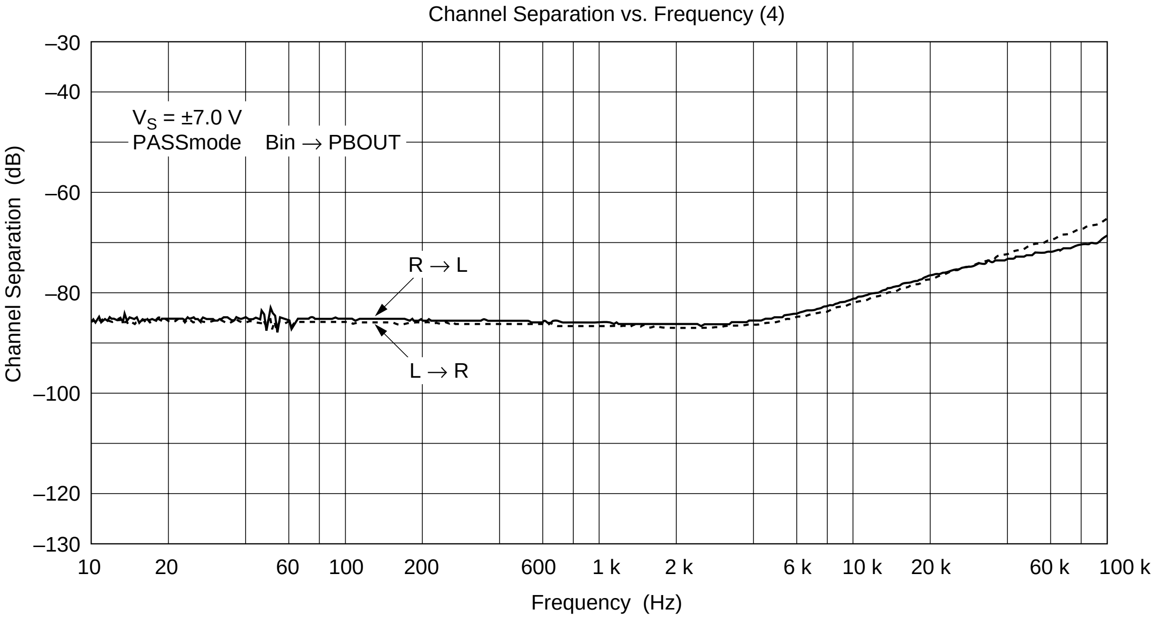
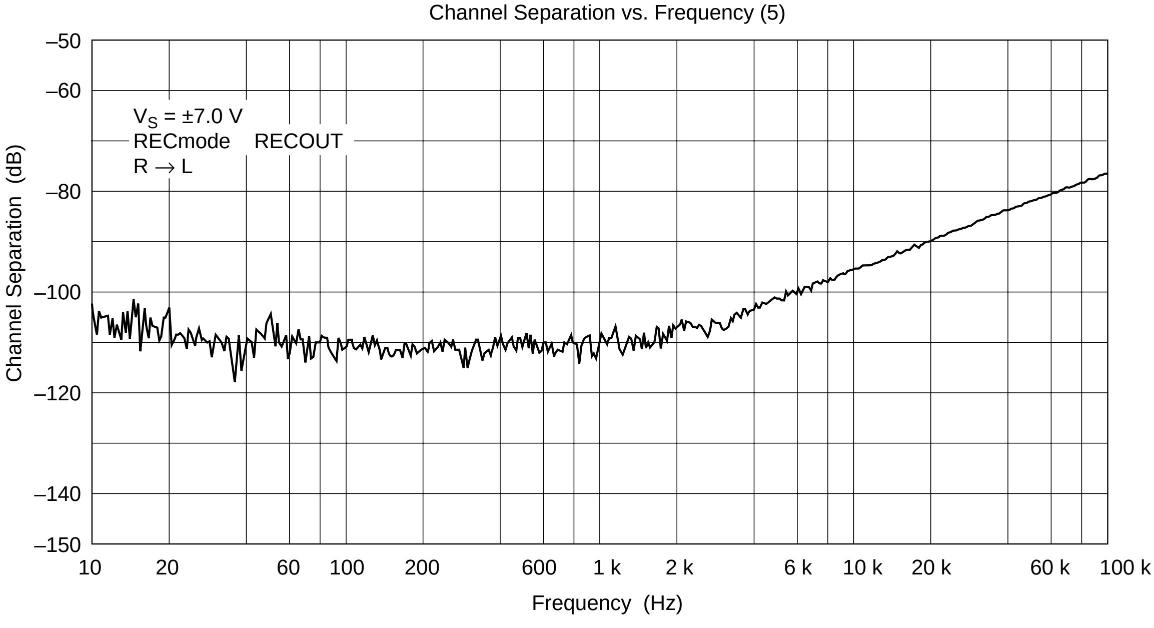
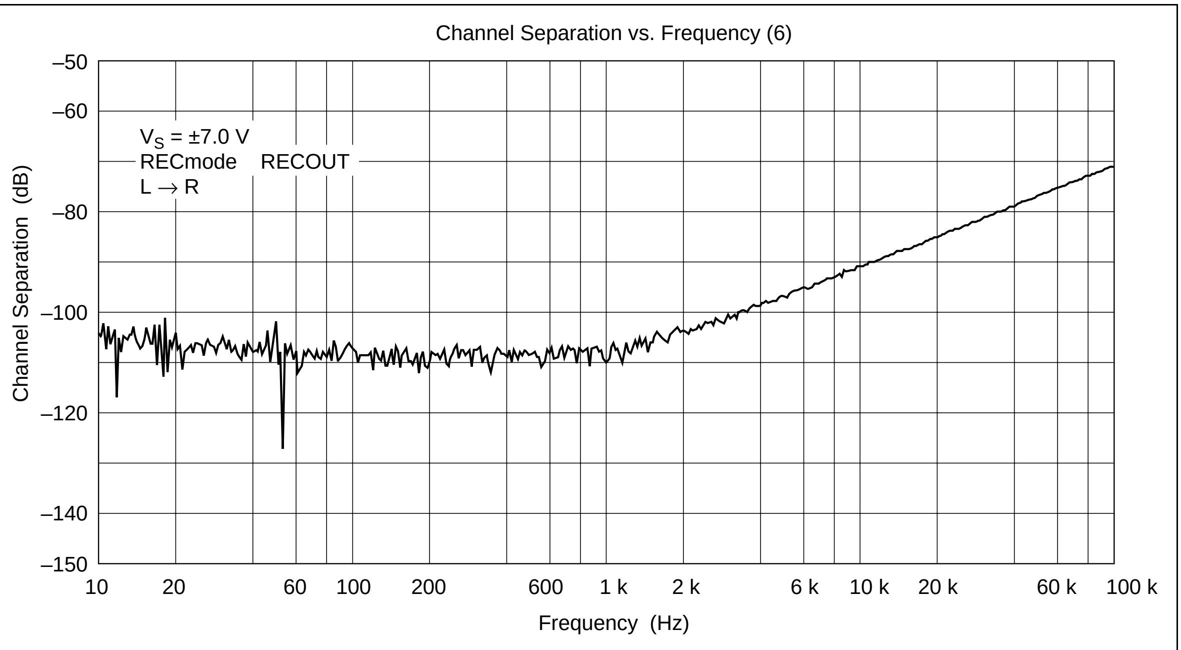
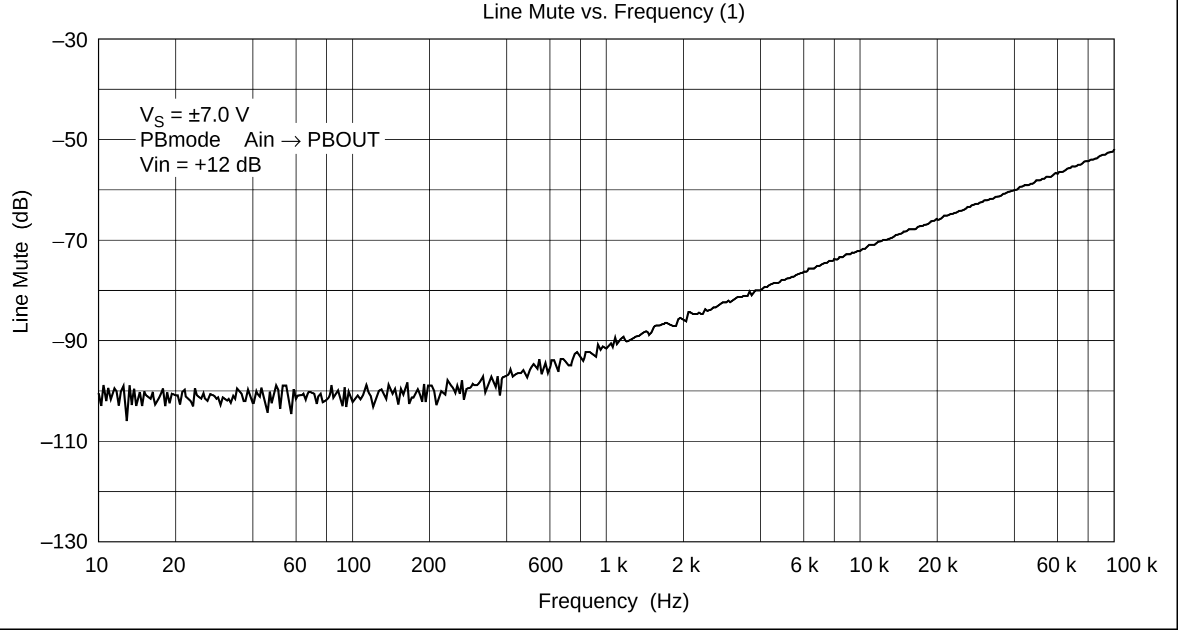

Channel Separation vs. Frequency (4)
–30
–40
–60
–80
–100
–120
–130
Channel Separation (dB)
VS = ±7.0 V
PASSmode Bin → PBOUT
R → L
L → R
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

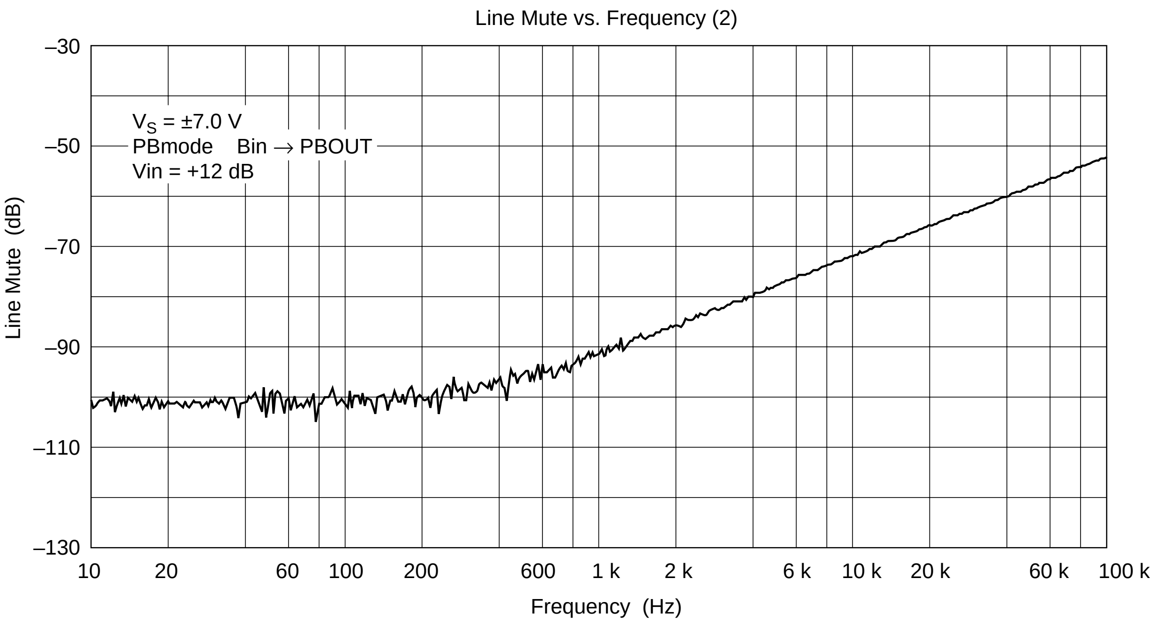

Channel Separation vs. Frequency (5)
–50
–60
–80
–100
–120
–140
–150
Channel Separation (dB)
VS = ±7.0 V
RECmode RECOUT
R → L
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

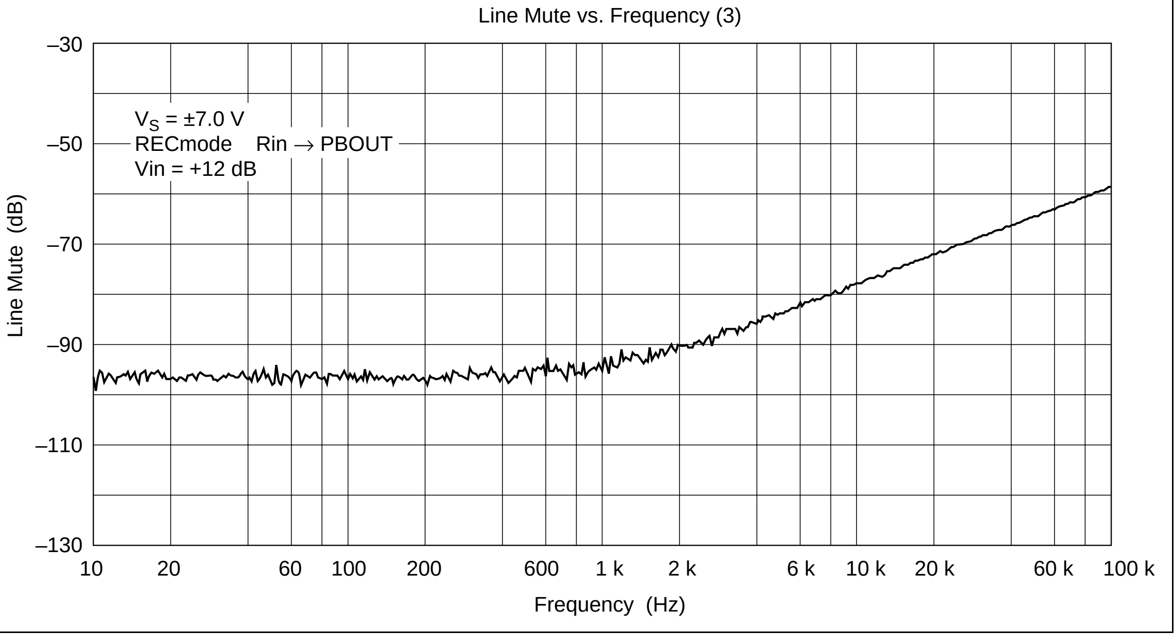
HA12203NT


Channel Separation vs. Frequency (6)
V_S = ±7.0 V
RECmode RECOUT
L → R
Channel Separation (dB)
–50
–60
–80
–100
–120
–140
–150
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)


Line Mute vs. Frequency (1)
V_S = ±7.0 V
PBmode Ain → PBOUT
Vin = +12 dB
Line Mute (dB)
–30
–50
–70
–90
–110
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

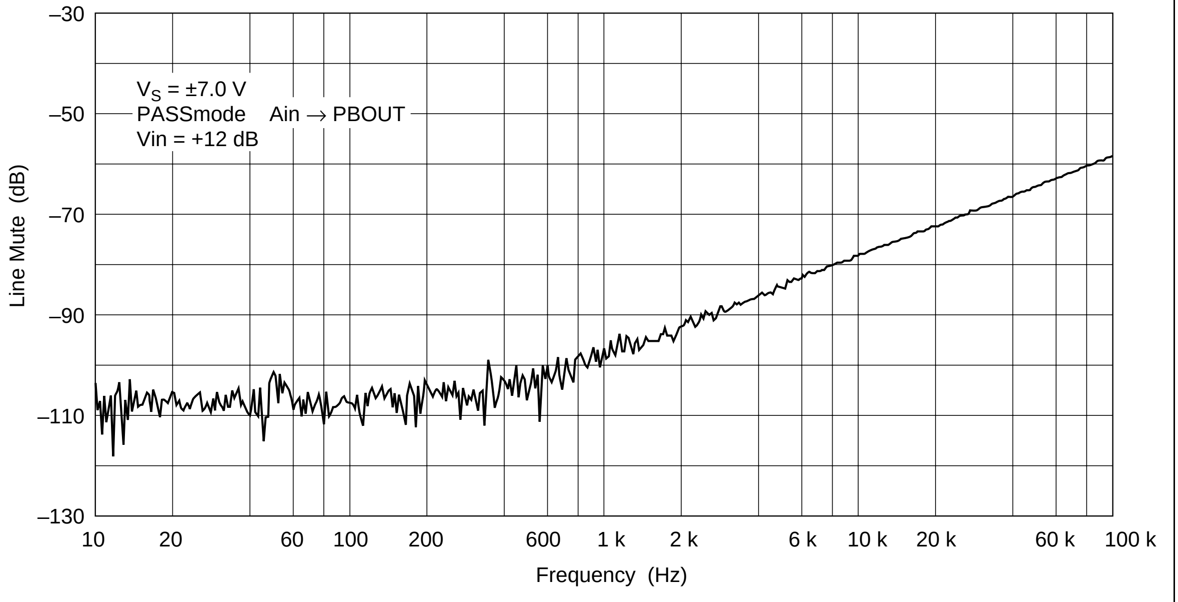
HA12203NT


Line Mute vs. Frequency (2)
VS = ±7.0 V
PBmode Bin → PBOUT
Vin = +12 dB
Line Mute (dB)
–30
–50
–70
–90
–110
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

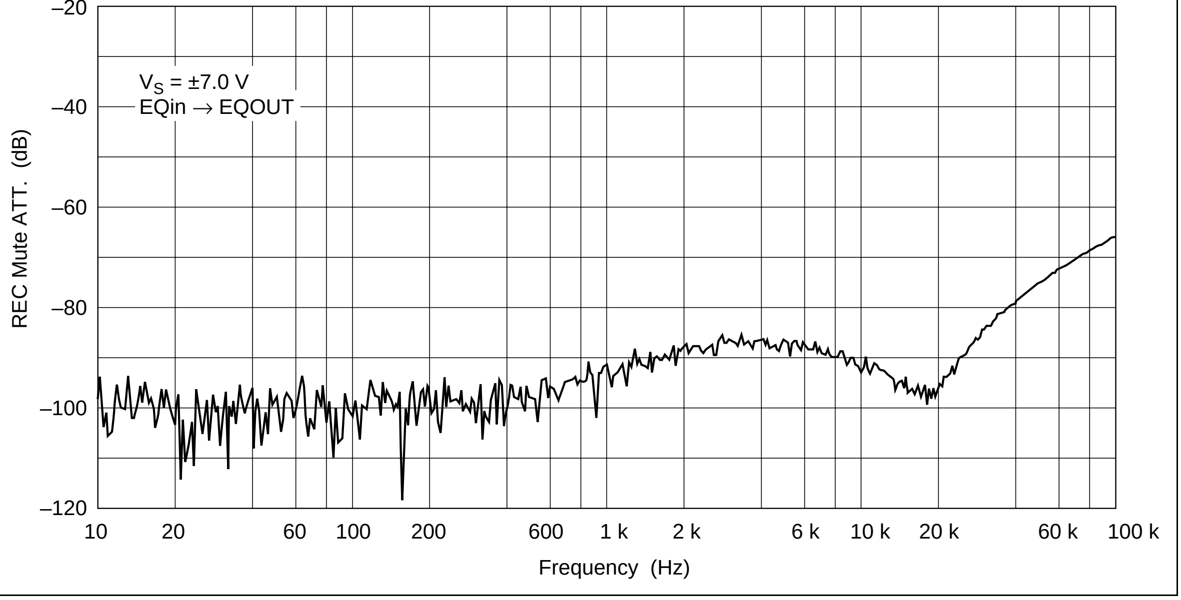

Line Mute vs. Frequency (3)
VS = ±7.0 V
RECmode Rin → PBOUT
Vin = +12 dB
Line Mute (dB)
–30
–50
–70
–90
–110
–130
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

HA12203NT

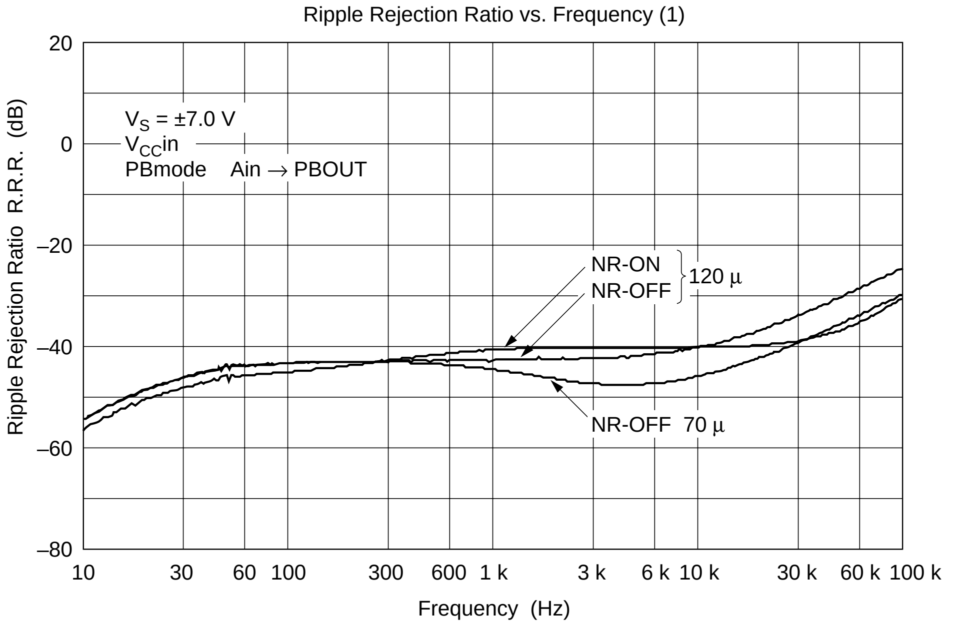
Line Mute vs. Frequency (4)

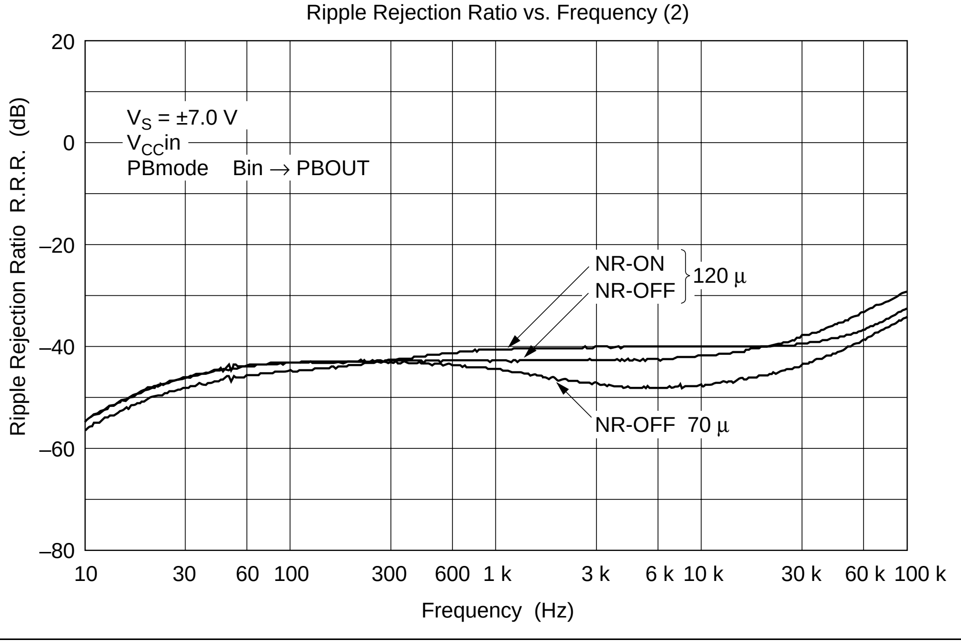


REC Mute Attenuation vs. Frequency

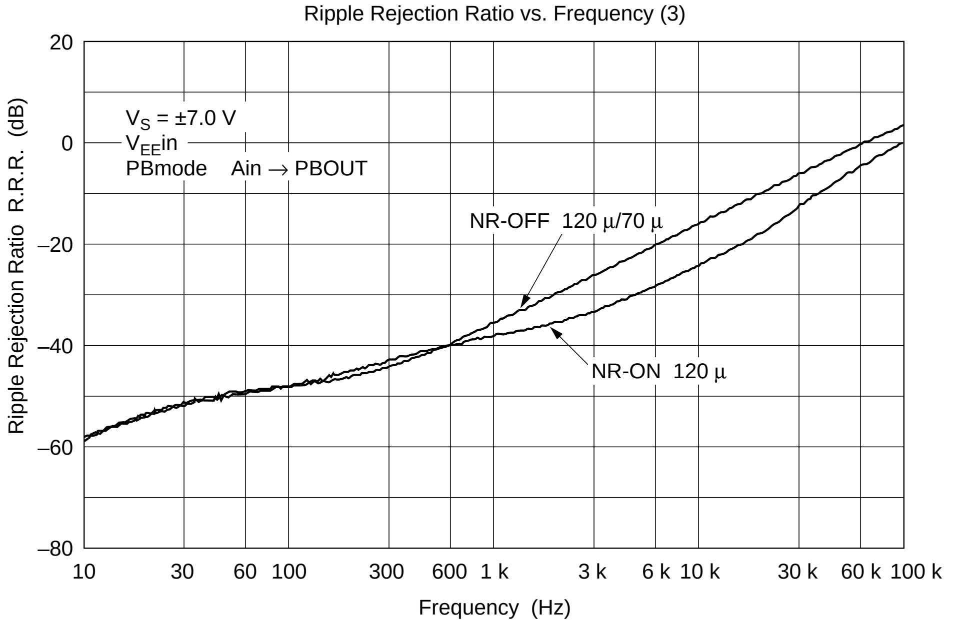


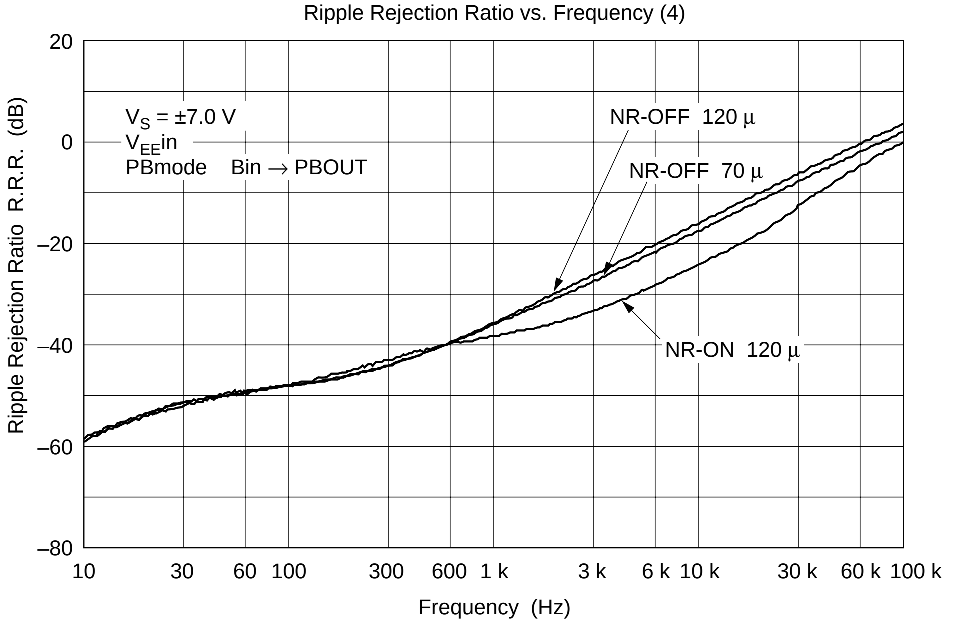
HA12203NT


Ripple Rejection Ratio vs. Frequency (1)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
V_S = ±7.0 V
V_{CC}in
PBmode Ain → PBOUT
NR-ON
NR-OFF
120 μ
NR-OFF 70 μ
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

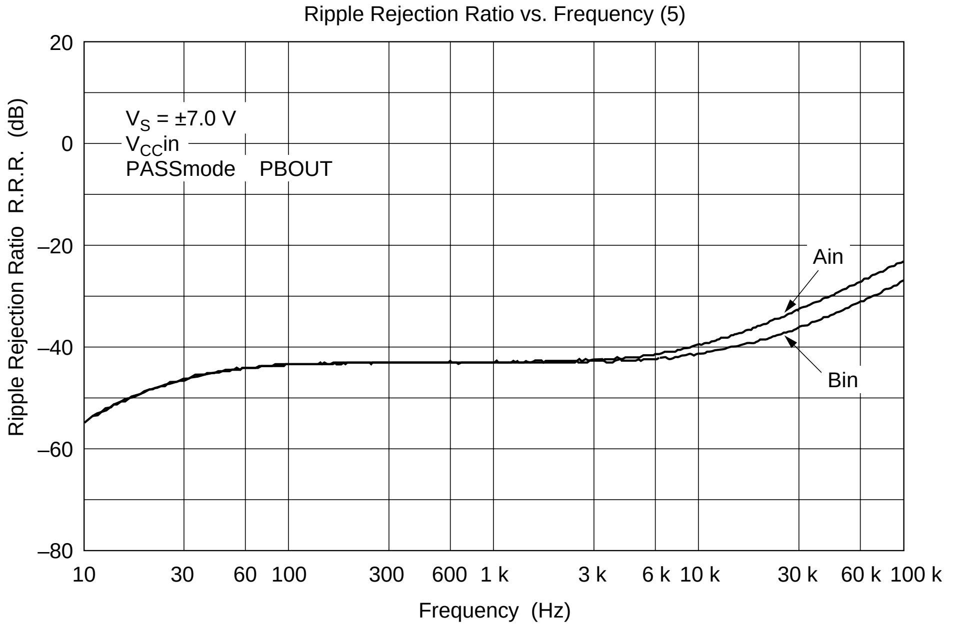

Ripple Rejection Ratio vs. Frequency (2)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
V_S = ±7.0 V
V_{CC}in
PBmode Bin → PBOUT
NR-ON
NR-OFF
120 μ
NR-OFF 70 μ
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

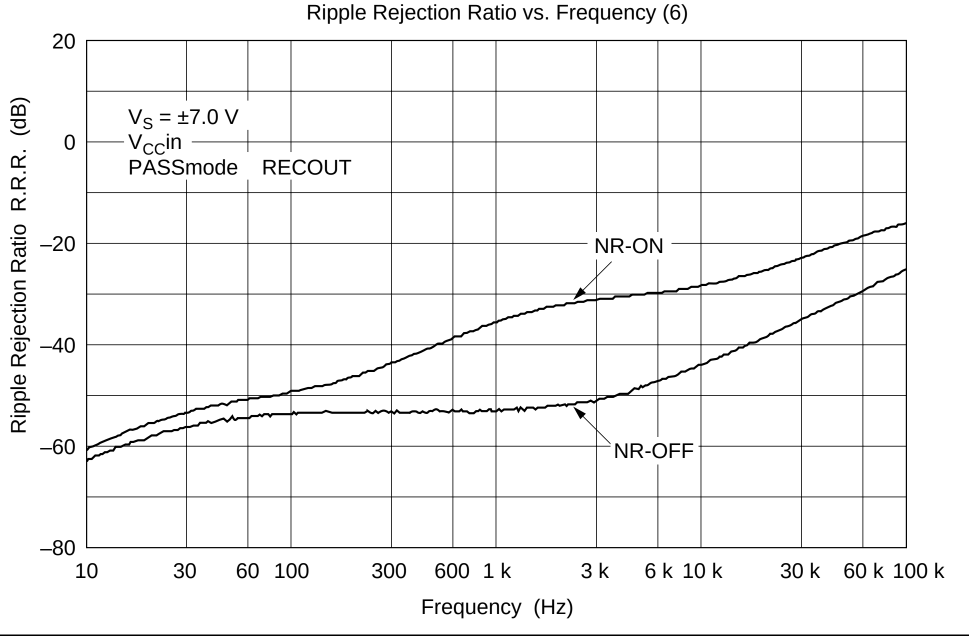
HA12203NT


Ripple Rejection Ratio vs. Frequency (3)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
V_S = ±7.0 V
V_{EE}in
PBmode Ain → PBOUT
NR-OFF 120 µ/70 µ
NR-ON 120 µ
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)


Ripple Rejection Ratio vs. Frequency (4)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
V_S = ±7.0 V
V_{EE}in
PBmode Bin → PBOUT
NR-OFF 120 µ
NR-OFF 70 µ
NR-ON 120 µ
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

HA12203NT


Ripple Rejection Ratio vs. Frequency (5)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
VS = ±7.0 V
VCCin
PASSmode PBOUT
Ain
Bin
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)


Ripple Rejection Ratio vs. Frequency (6)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
VS = ±7.0 V
VCCin
PASSmode RECOUT
NR-ON
NR-OFF
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

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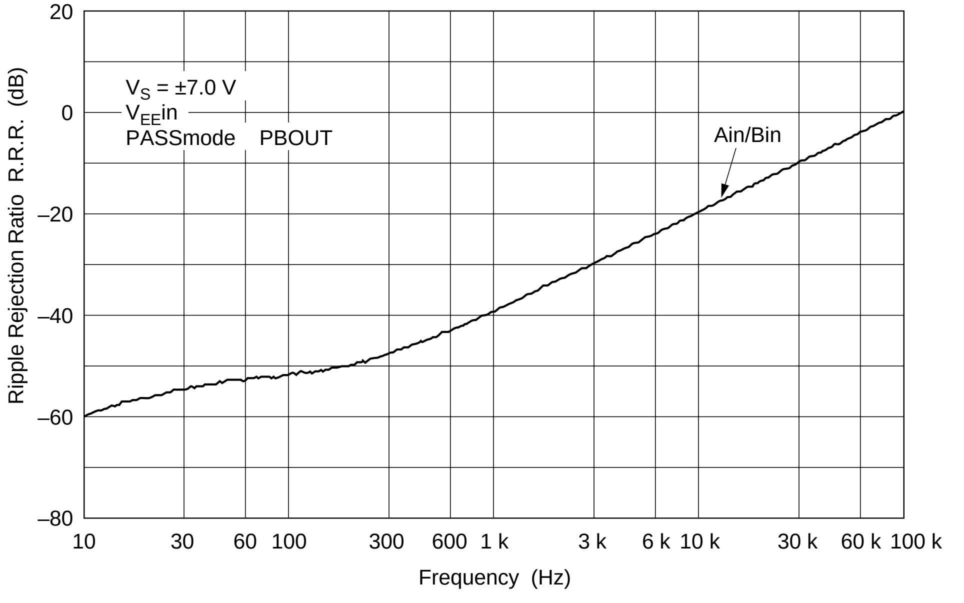
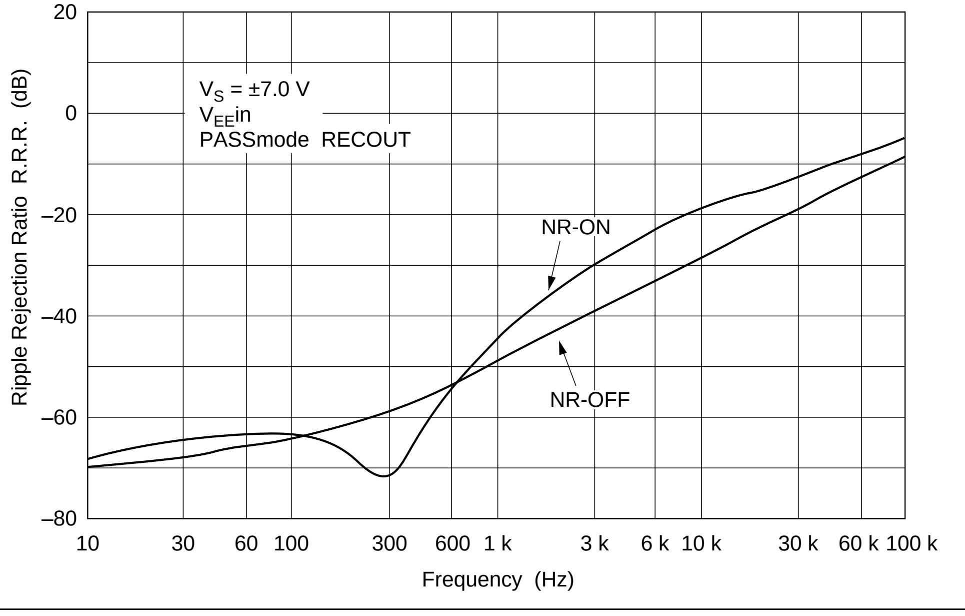
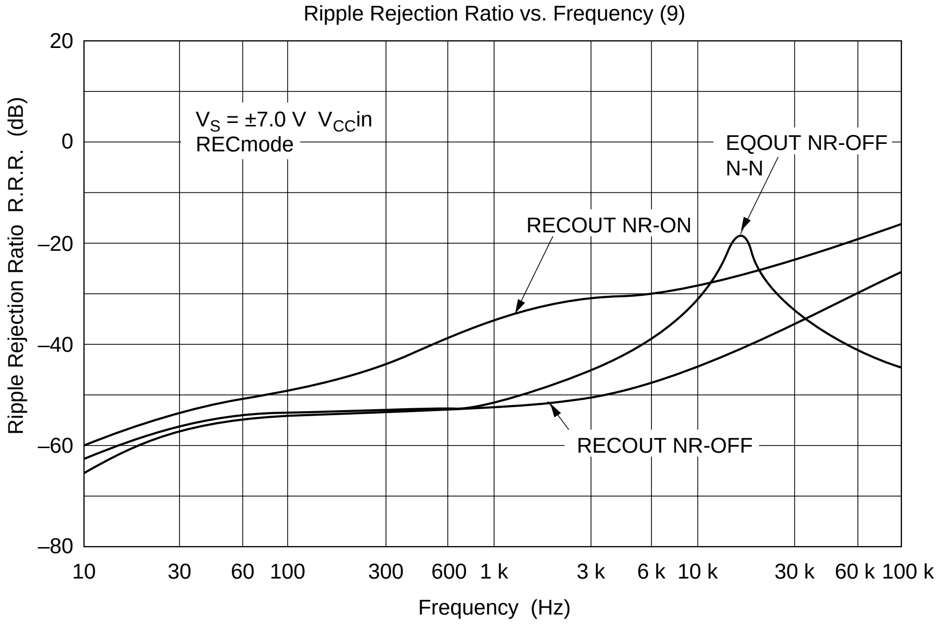
Ripple Rejection Ratio vs. Frequency (7)

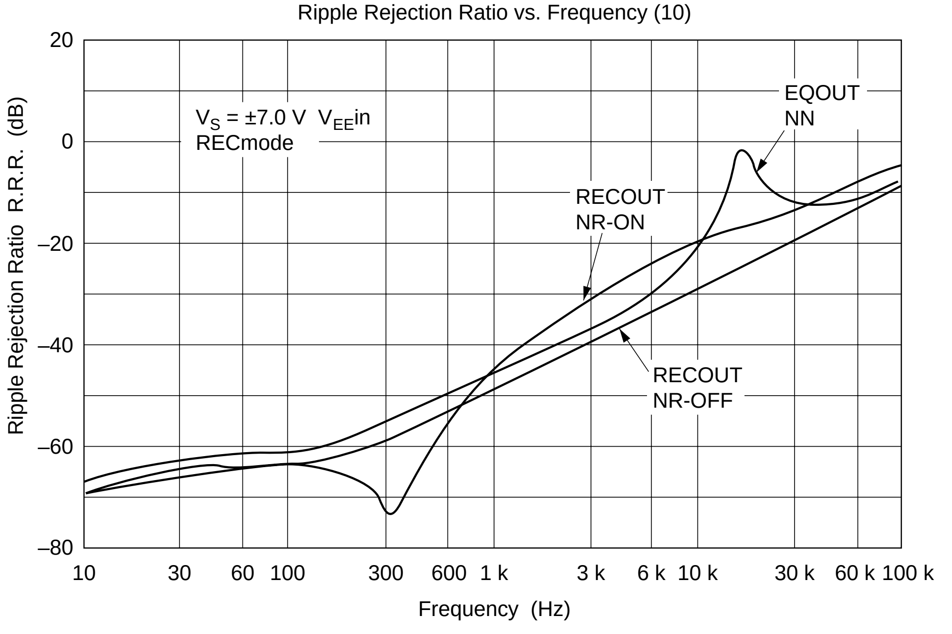


Ripple Rejection Ratio vs. Frequency (8)



HA12203NT


Ripple Rejection Ratio vs. Frequency (9)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)
V_S = ±7.0 V V_{CC}in
RECmode
EQOUT NR-OFF
N-N
RECOUT NR-ON
RECOUT NR-OFF


Ripple Rejection Ratio vs. Frequency (10)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)
V_S = ±7.0 V V_{EE}in
RECmode
EQOUT
NN
RECOUT
NR-ON
RECOUT
NR-OFF

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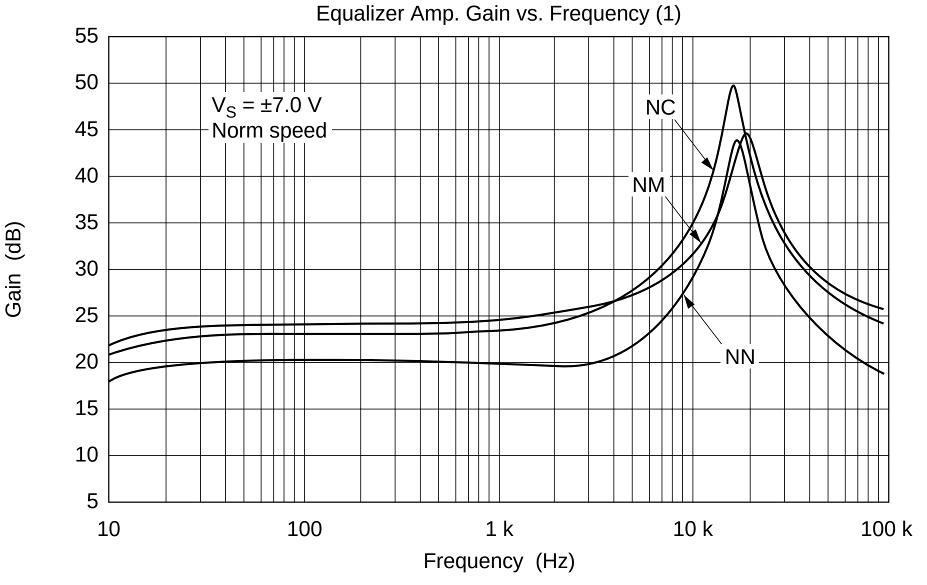
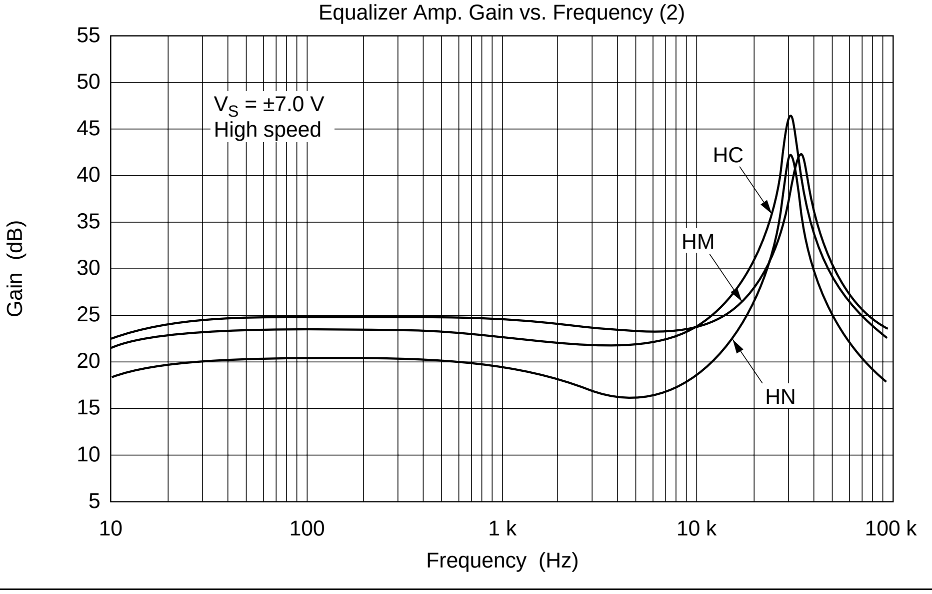

Equalizer Amp. Gain vs. Frequency (1)
V_S = ±7.0 V
Norm speed
NC
NM
NN
Gain (dB)
Frequency (Hz)
55
50
45
40
35
30
25
20
15
10
5
10
100
1 k
10 k
100 k


Equalizer Amp. Gain vs. Frequency (2)
V_S = ±7.0 V
High speed
HC
HM
HN
Gain (dB)
Frequency (Hz)
55
50
45
40
35
30
25
20
15
10
5
10
100
1 k
10 k
100 k

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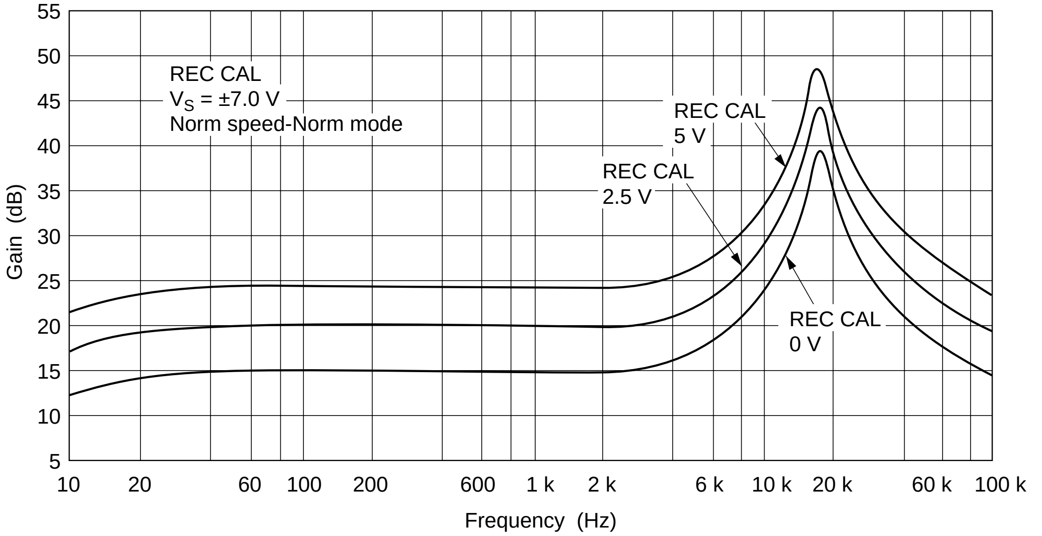
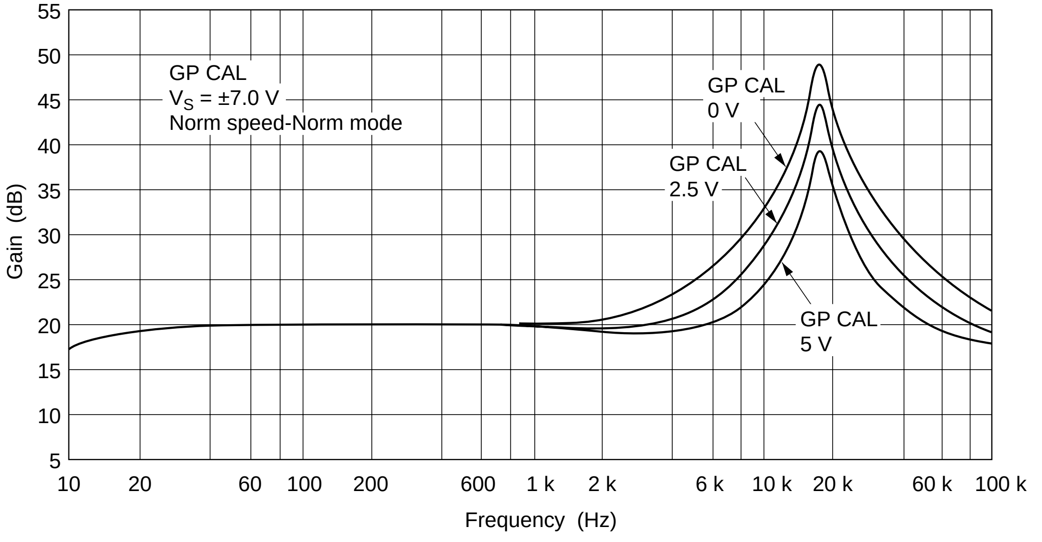
Equalizer Amp. Gain vs. Frequency (3)



Equalizer Amp. Gain vs. Frequency (4)



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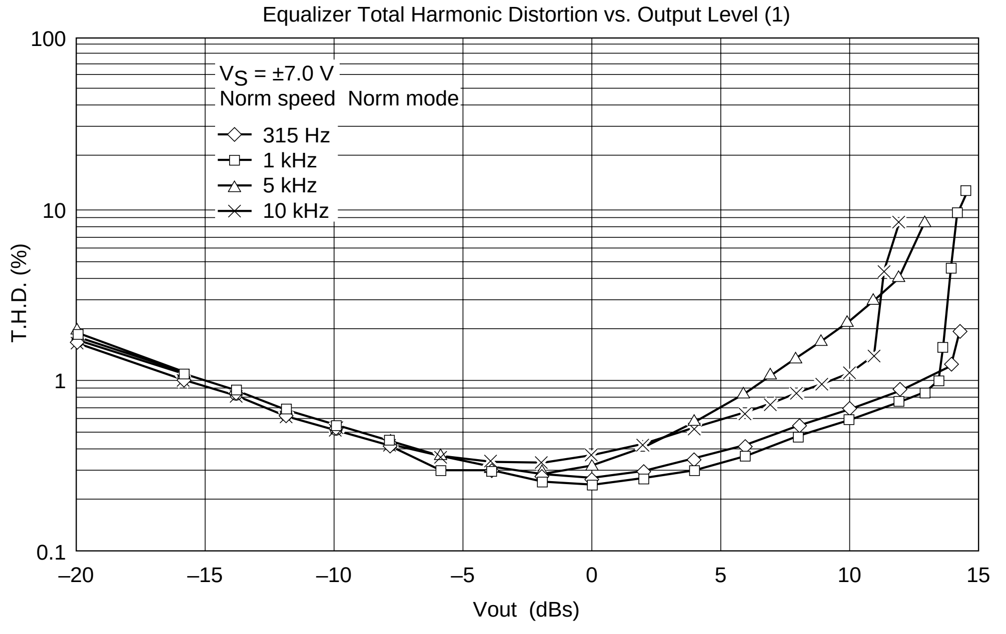
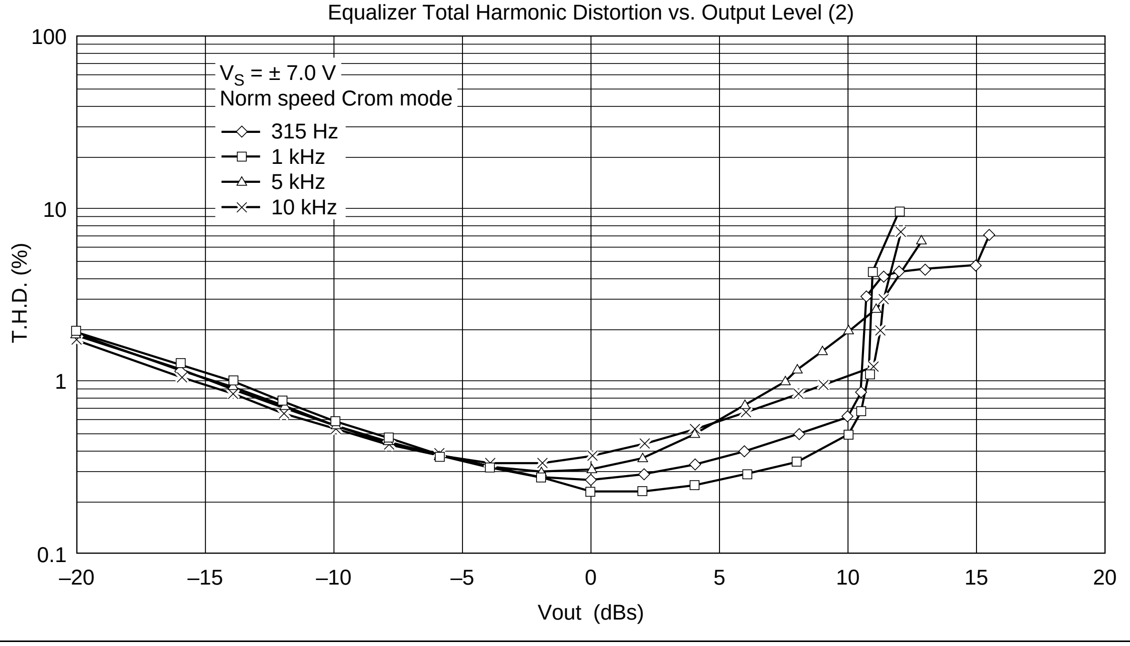
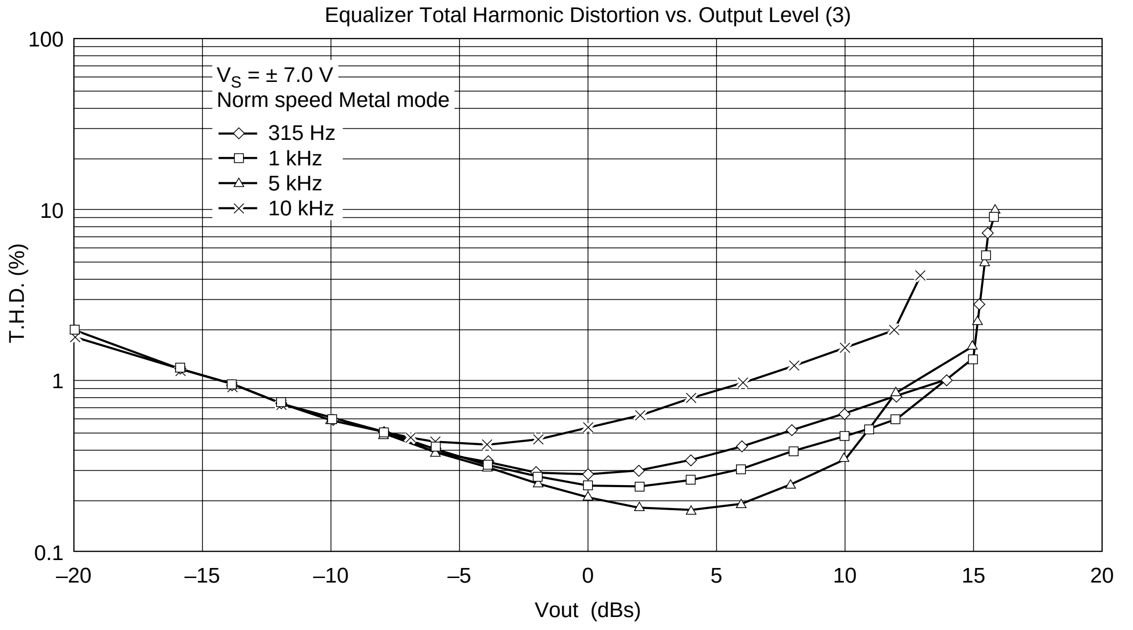
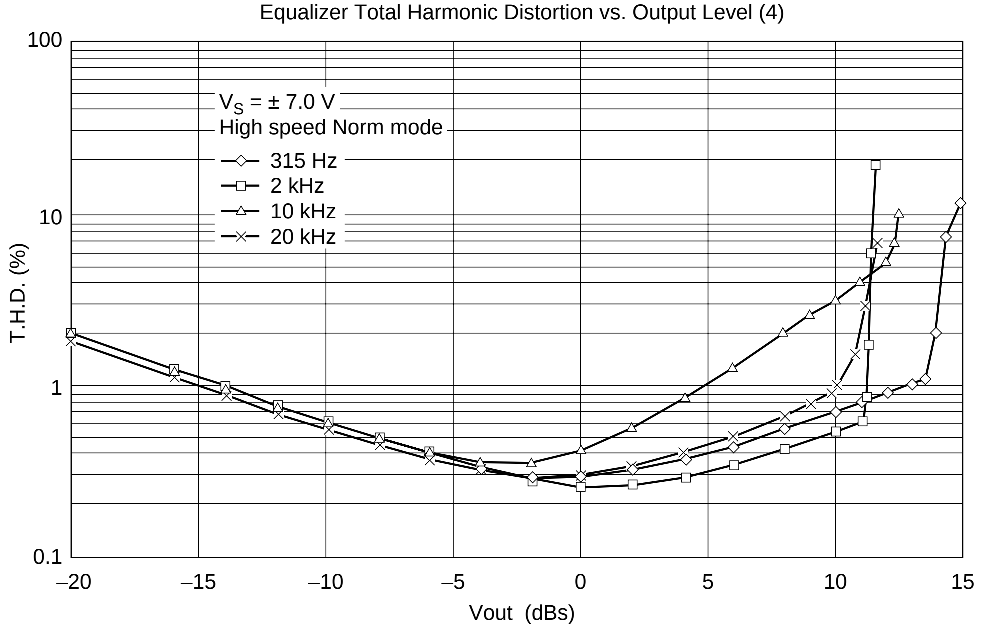

Equalizer Total Harmonic Distortion vs. Output Level (1)
V_S = ±7.0 V
Norm speed Norm mode
315 Hz
1 kHz
5 kHz
10 kHz
T.H.D. (%)
100
10
1
0.1
–20
–15
–10
–5
0
5
10
15
Vout (dBs)


Equalizer Total Harmonic Distortion vs. Output Level (2)
V_S = ± 7.0 V
Norm speed Crom mode
315 Hz
1 kHz
5 kHz
10 kHz
T.H.D. (%)
100
10
1
0.1
–20
–15
–10
–5
0
5
10
15
20
Vout (dBs)

HA12203NT


Equalizer Total Harmonic Distortion vs. Output Level (3)
VS = ± 7.0 V
Norm speed Metal mode
315 Hz
1 kHz
5 kHz
10 kHz
T.H.D. (%)
100
10
1
0.1
–20
–15
–10
–5
0
5
10
15
20
Vout (dBs)


Equalizer Total Harmonic Distortion vs. Output Level (4)
VS = ± 7.0 V
High speed Norm mode
315 Hz
2 kHz
10 kHz
20 kHz
T.H.D. (%)
100
10
1
0.1
–20
–15
–10
–5
0
5
10
15
Vout (dBs)

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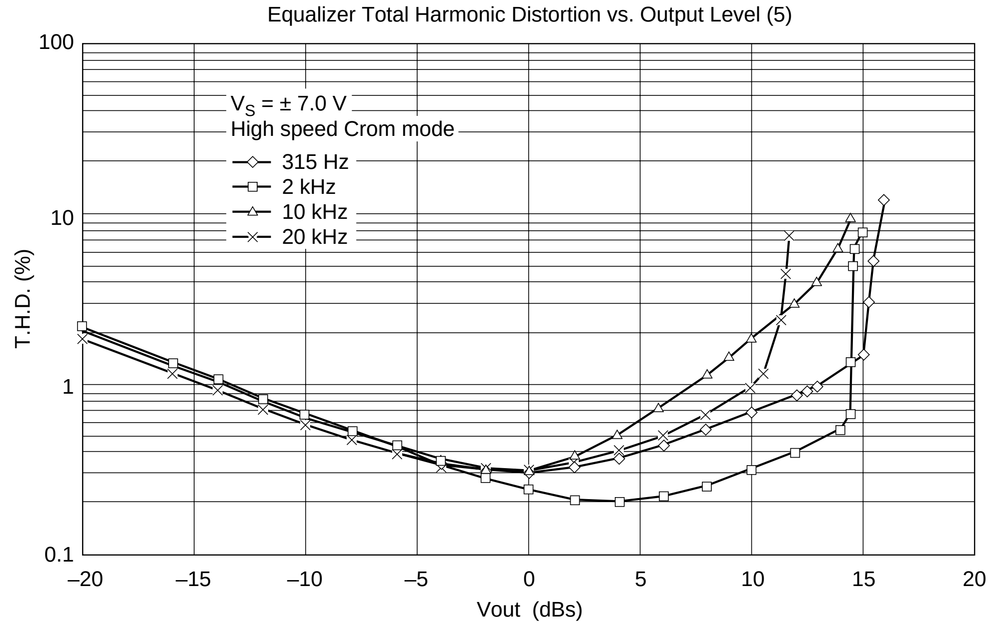
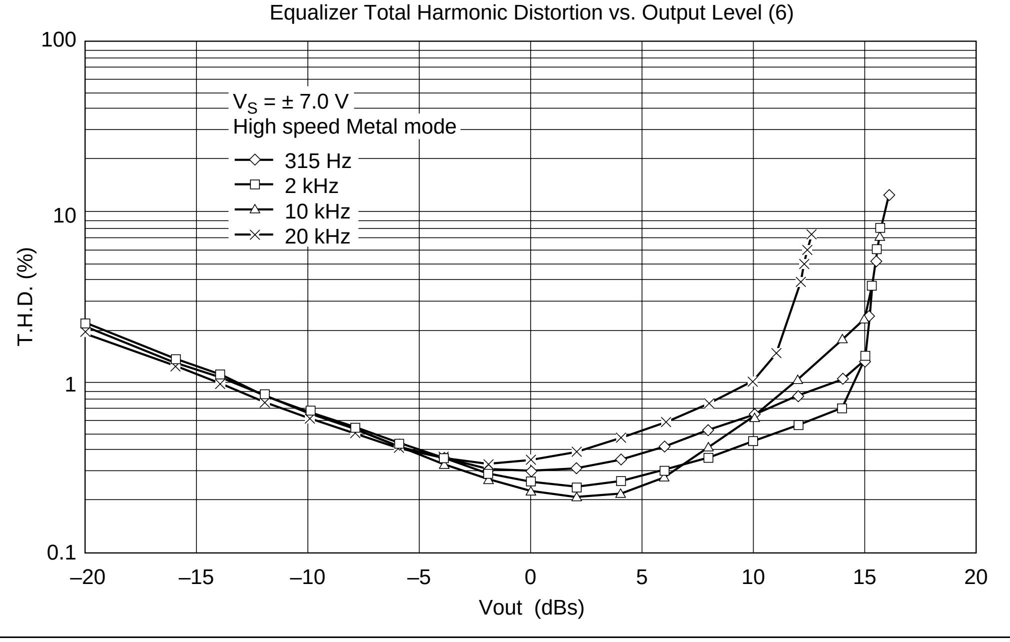

Equalizer Total Harmonic Distortion vs. Output Level (5)
VS = ± 7.0 V
High speed Crom mode
315 Hz
2 kHz
10 kHz
20 kHz
T.H.D. (%)
Vout (dBs)
100
10
1
0.1
–20
–15
–10
–5
0
5
10
15
20


Equalizer Total Harmonic Distortion vs. Output Level (6)
VS = ± 7.0 V
High speed Metal mode
315 Hz
2 kHz
10 kHz
20 kHz
T.H.D. (%)
Vout (dBs)
100
10
1
0.1
–20
–15
–10
–5
0
5
10
15
20

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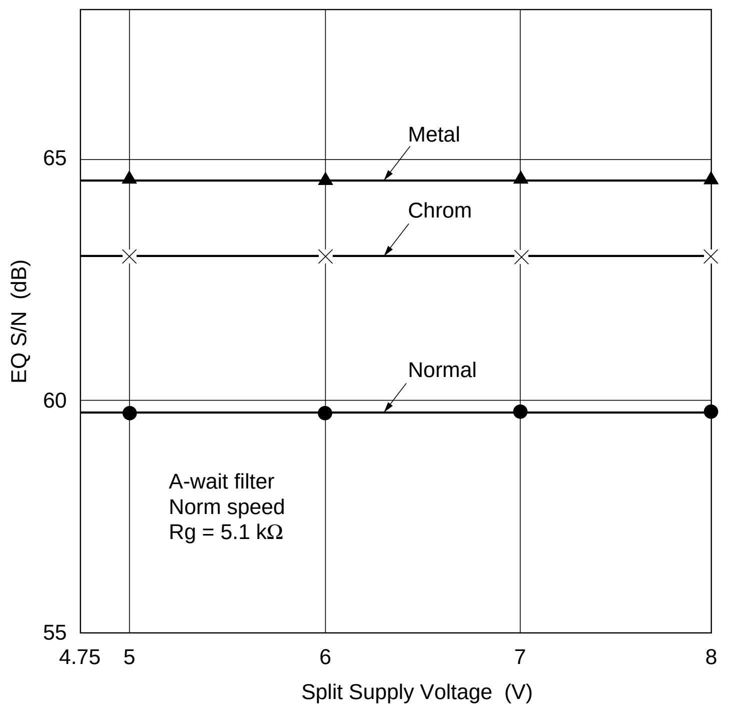
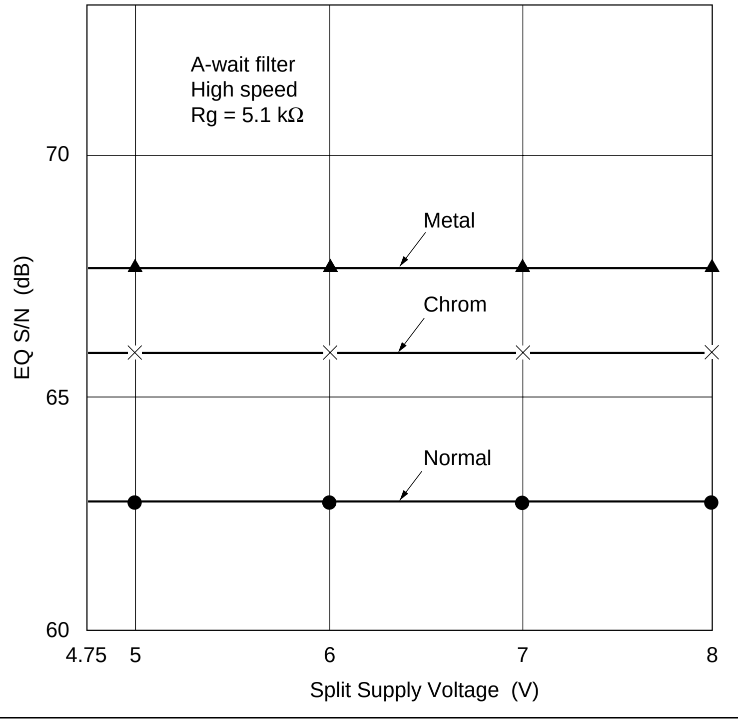
EQ Signal to Noise Ratio vs. Split Supply Voltage (1)



EQ Signal to Noise Ratio vs. Split Supply Voltage (2)



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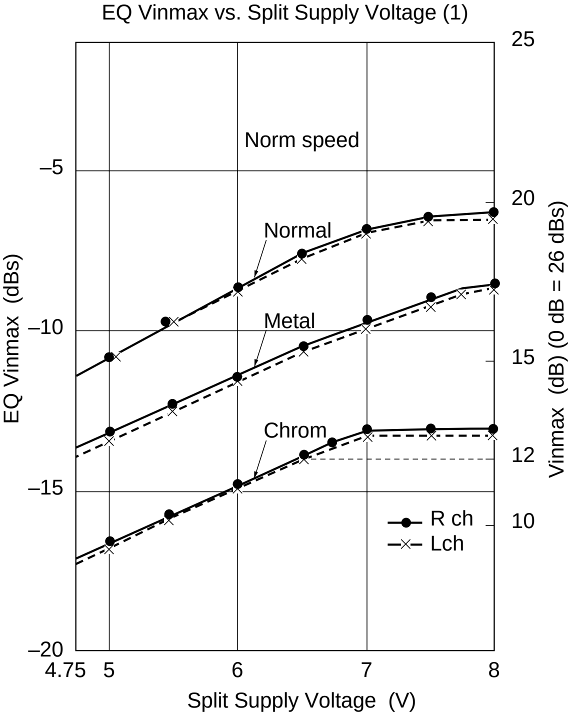
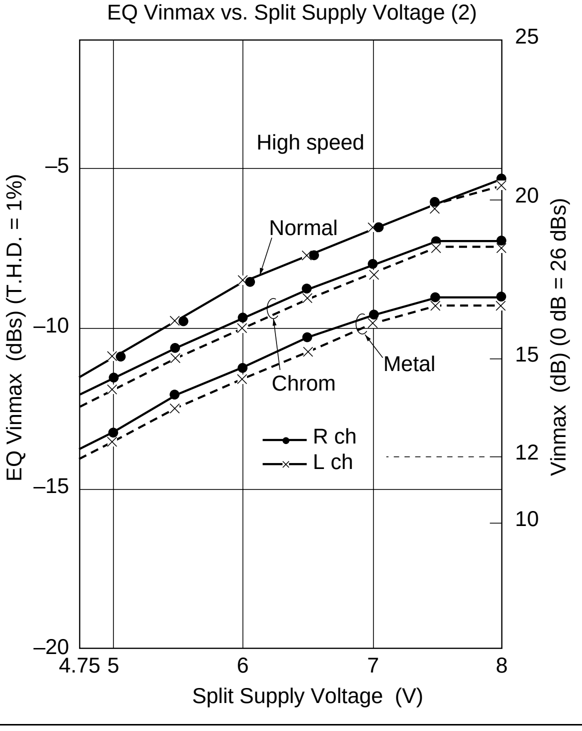
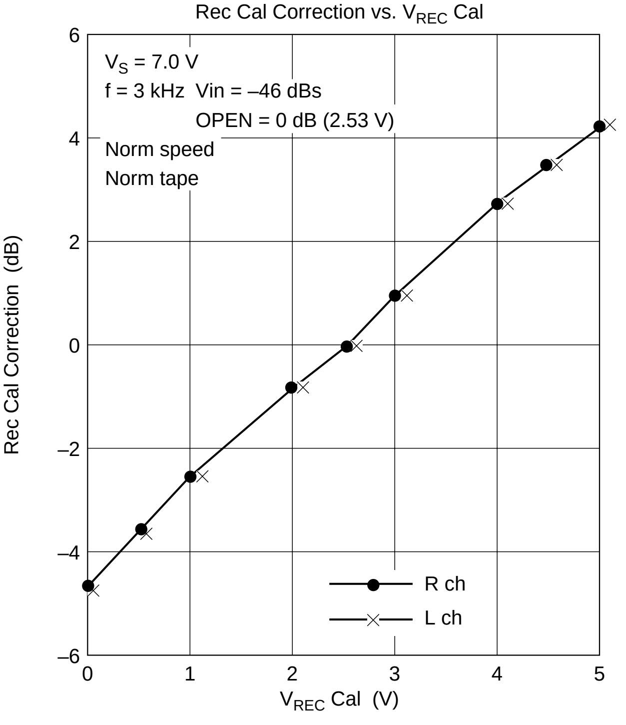
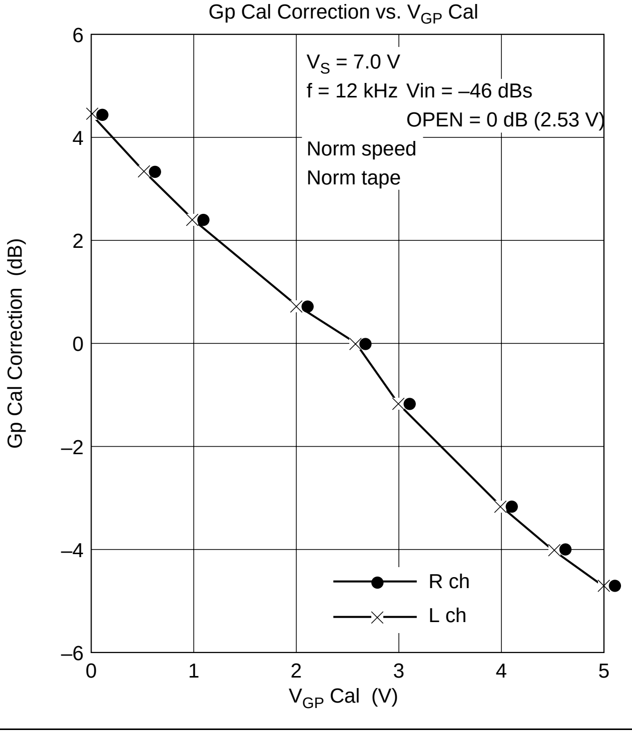

EQ Vinmax vs. Split Supply Voltage (1)
Norm speed
Normal
Metal
Chrom
R ch
Lch
EQ Vinmax (dBs)
Vinmax (dB) (0 dB = 26 dBs)
Split Supply Voltage (V)
–5
–10
–15
–20
25
20
15
12
10
4.75
5
6
7
8


EQ Vinmax vs. Split Supply Voltage (2)
High speed
Normal
Chrom
Metal
R ch
L ch
EQ Vinmax (dBs) (T.H.D. = 1%)
Vinmax (dB) (0 dB = 26 dBs)
Split Supply Voltage (V)
–5
–10
–15
–20
25
20
15
12
10
4.75
5
6
7
8

HA12203NT


Rec Cal Correction vs. V_REC Cal
V_S = 7.0 V
f = 3 kHz Vin = –46 dBs
OPEN = 0 dB (2.53 V)
Norm speed
Norm tape
R ch
L ch
Rec Cal Correction (dB)
6
4
2
0
–2
–4
–6
0
1
2
3
4
5
V_REC Cal (V)


Gp Cal Correction vs. V_GP Cal
V_S = 7.0 V
f = 12 kHz Vin = –46 dBs
OPEN = 0 dB (2.53 V)
Norm speed
Norm tape
R ch
L ch
Gp Cal Correction (dB)
6
4
2
0
–2
–4
–6
0
1
2
3
4
5
V_GP Cal (V)

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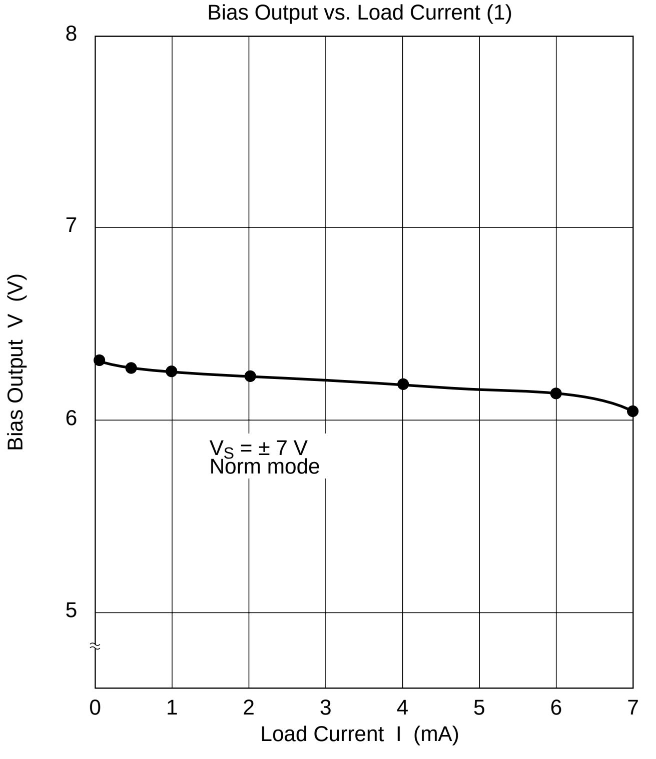
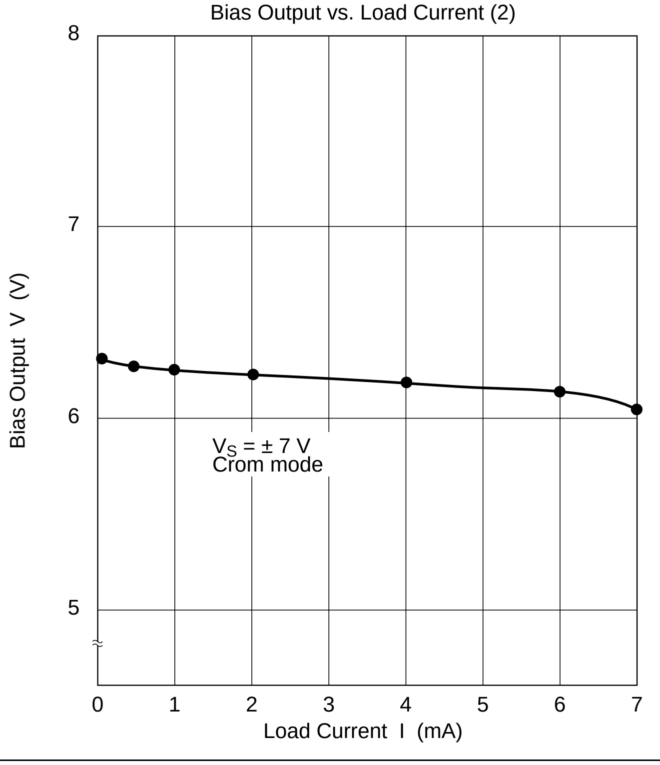
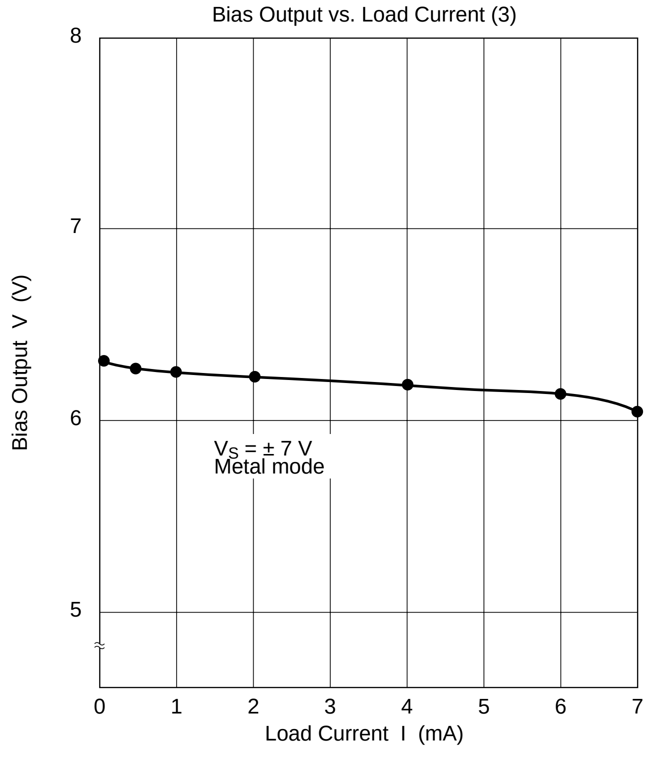

Bias Output vs. Load Current (1)
8
7
6
5
Bias Output V (V)
VS = ± 7 V
Norm mode
0
1
2
3
4
5
6
7
Load Current I (mA)

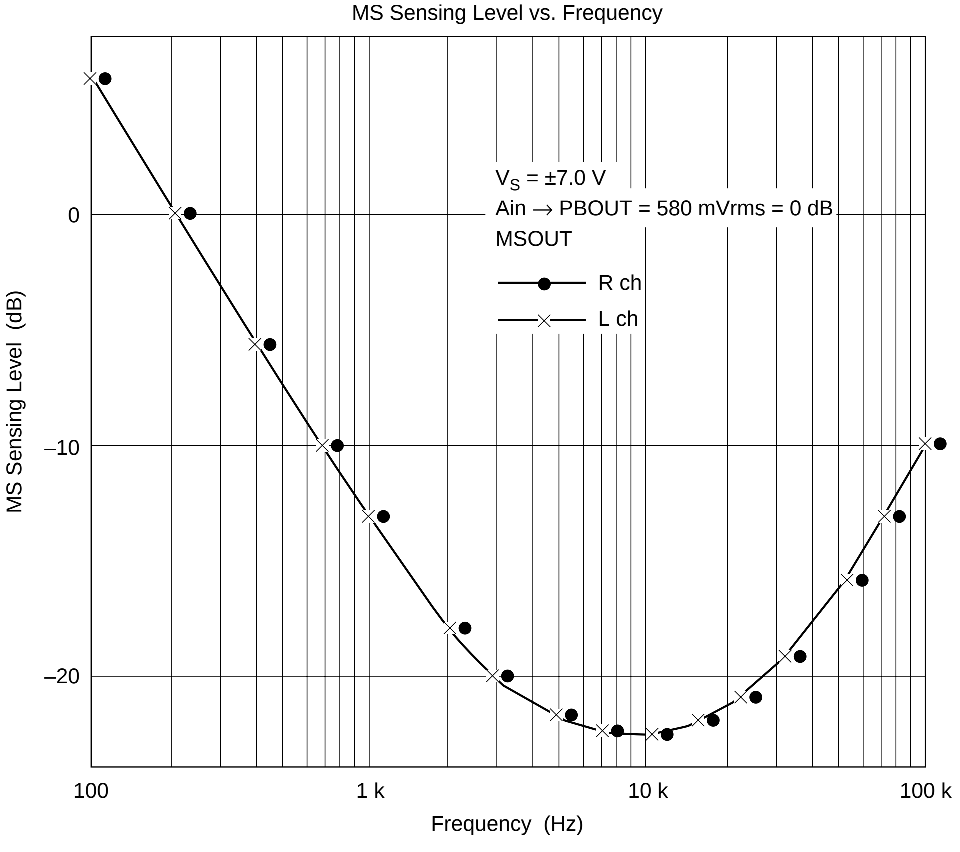

Bias Output vs. Load Current (2)
8
7
6
5
Bias Output V (V)
VS = ± 7 V
Crom mode
0
1
2
3
4
5
6
7
Load Current I (mA)

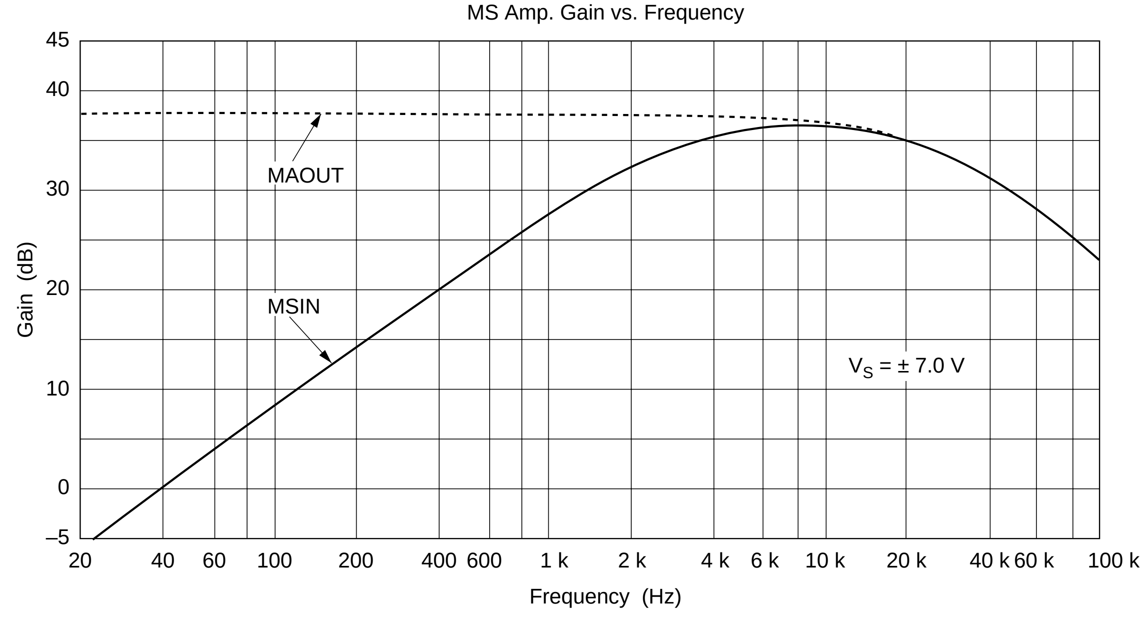
HA12203NT



Bias Output vs. Load Current (3)
8
7
6
5
Bias Output V (V)
V_S = ± 7 V
Metal mode
0
1
2
3
4
5
6
7
Load Current I (mA)

HA12203NT


MS Sensing Level vs. Frequency
MS Sensing Level (dB)
0
–10
–20
V_S = ±7.0 V
Ain → PBOUT = 580 mVrms = 0 dB
MSOUT
R ch
L ch
100
1 k
10 k
100 k
Frequency (Hz)


MS Amp. Gain vs. Frequency
Gain (dB)
45
40
30
20
10
0
–5
MAOUT
MSIN
V_S = ± 7.0 V
20
40
60
100
200
400
600
1 k
2 k
4 k
6 k
10 k
20 k
40 k
60 k
100 k
Frequency (Hz)

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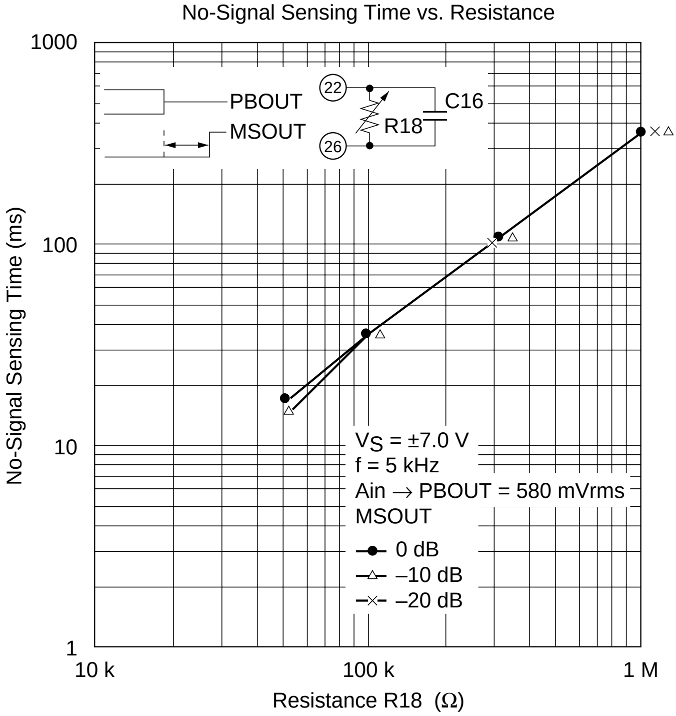
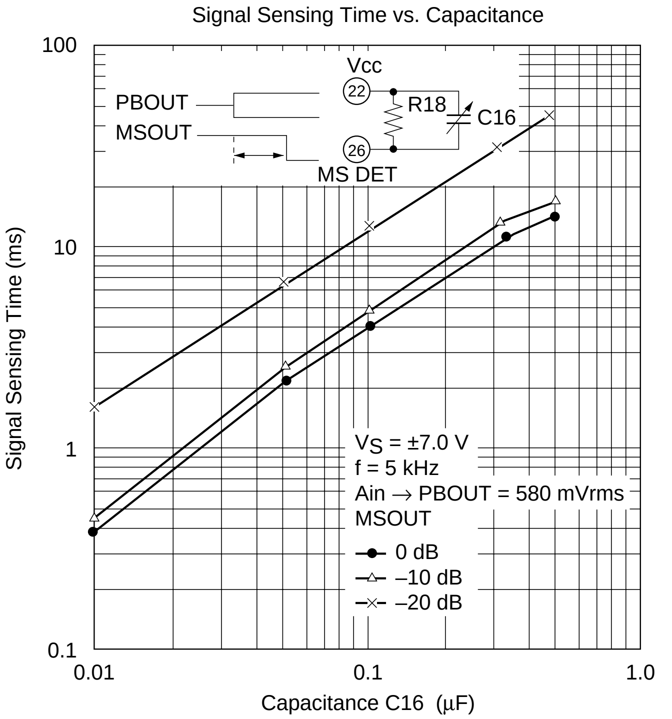

No-Signal Sensing Time vs. Resistance
1000
100
10
1
10 k
100 k
1 M
Resistance R18 (Ω)
No-Signal Sensing Time (ms)
PBOUT
MSOUT
22
26
R18
C16
VS = ±7.0 V
f = 5 kHz
Ain → PBOUT = 580 mVrms
MSOUT
0 dB
–10 dB
–20 dB


Signal Sensing Time vs. Capacitance
100
10
1
0.1
0.01
0.1
1.0
Capacitance C16 (μF)
Signal Sensing Time (ms)
Vcc
PBOUT
MSOUT
22
26
R18
C16
MS DET
VS = ±7.0 V
f = 5 kHz
Ain → PBOUT = 580 mVrms
MSOUT
0 dB
–10 dB
–20 dB

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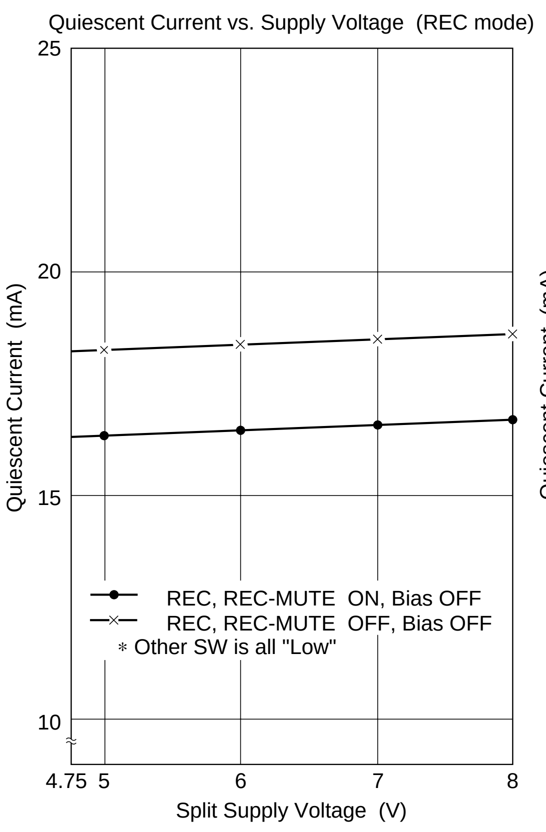
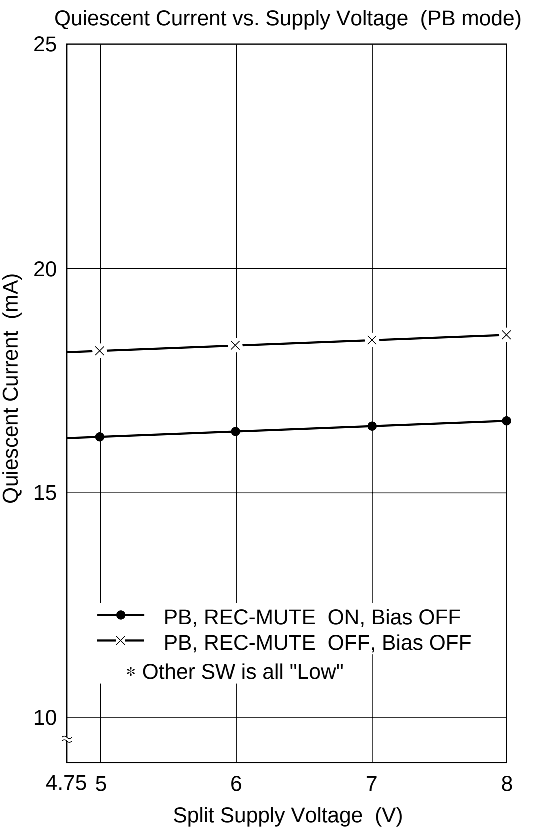

Quiescent Current vs. Supply Voltage (REC mode)
25
20
15
10
Quiescent Current (mA)
4.75
5
6
7
8
Split Supply Voltage (V)
REC, REC-MUTE ON, Bias OFF
REC, REC-MUTE OFF, Bias OFF
* Other SW is all "Low"


Quiescent Current vs. Supply Voltage (PB mode)
25
20
15
10
Quiescent Current (mA)
4.75
5
6
7
8
Split Supply Voltage (V)
PB, REC-MUTE ON, Bias OFF
PB, REC-MUTE OFF, Bias OFF
* Other SW is all "Low"

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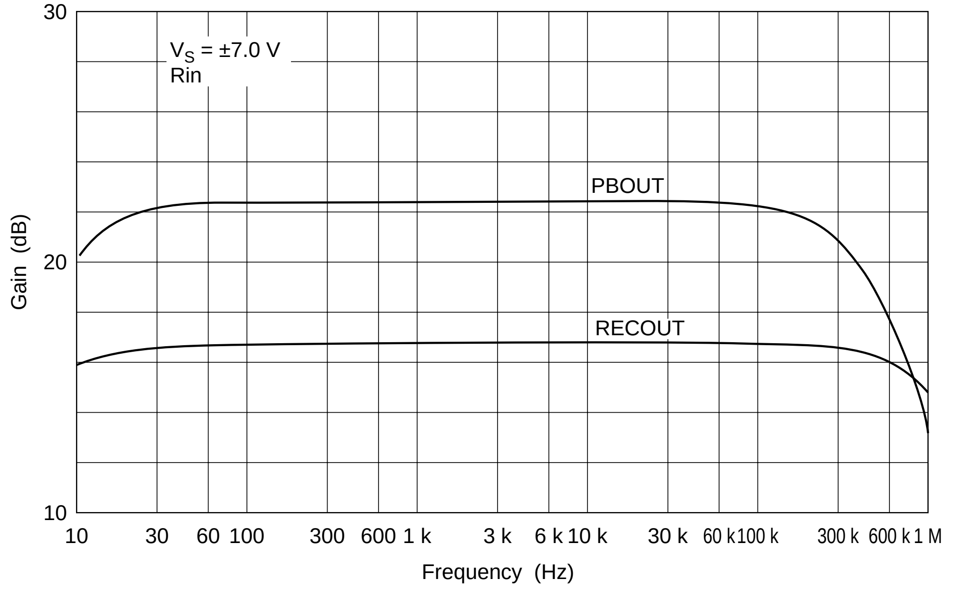
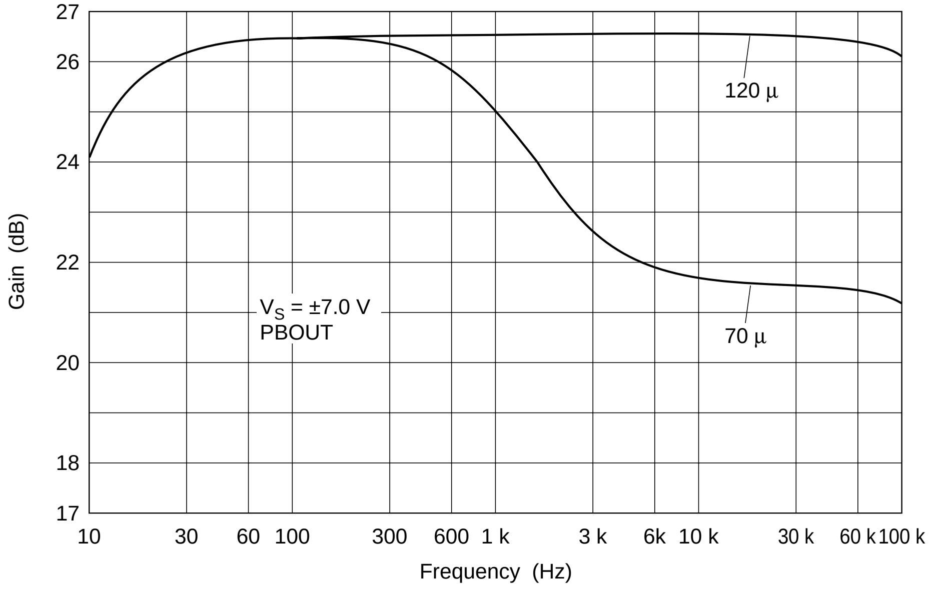
Input Amp Gain vs. Frequency (1)



Input Amp Gain vs. Frequency (2)



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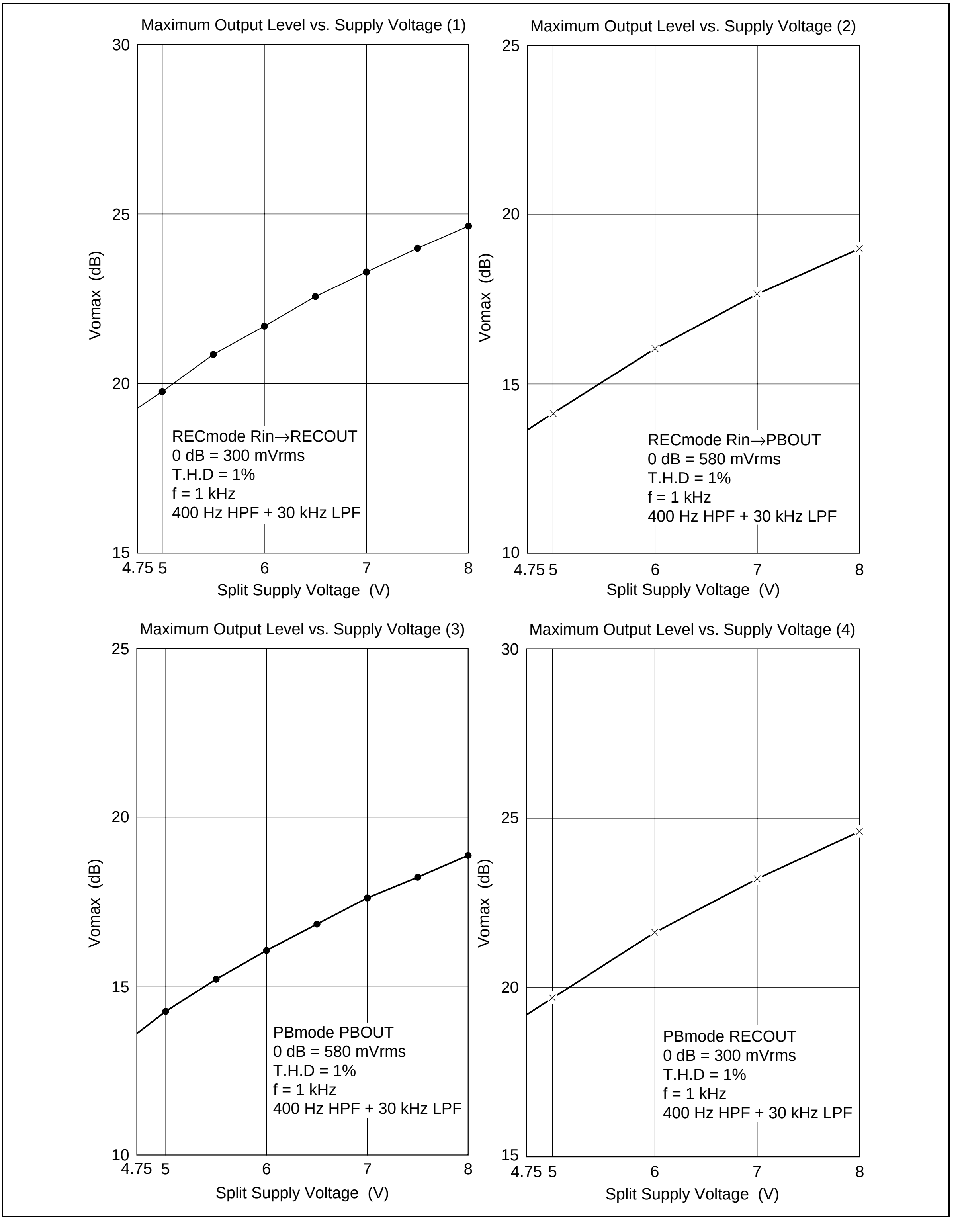
Maximum Output Level vs. Supply Voltage (1)
Vomax (dB)
Split Supply Voltage (V)
RECmode Rin→RECOUT
0 dB = 300 mVrms
T.H.D = 1%
f = 1 kHz
400 Hz HPF + 30 kHz LPF
Maximum Output Level vs. Supply Voltage (2)
Vomax (dB)
Split Supply Voltage (V)
RECmode Rin→PBOUT
0 dB = 580 mVrms
T.H.D = 1%
f = 1 kHz
400 Hz HPF + 30 kHz LPF
Maximum Output Level vs. Supply Voltage (3)
Vomax (dB)
Split Supply Voltage (V)
PBmode PBOUT
0 dB = 580 mVrms
T.H.D = 1%
f = 1 kHz
400 Hz HPF + 30 kHz LPF
Maximum Output Level vs. Supply Voltage (4)
Vomax (dB)
Split Supply Voltage (V)
PBmode RECOUT
0 dB = 300 mVrms
T.H.D = 1%
f = 1 kHz
400 Hz HPF + 30 kHz LPF

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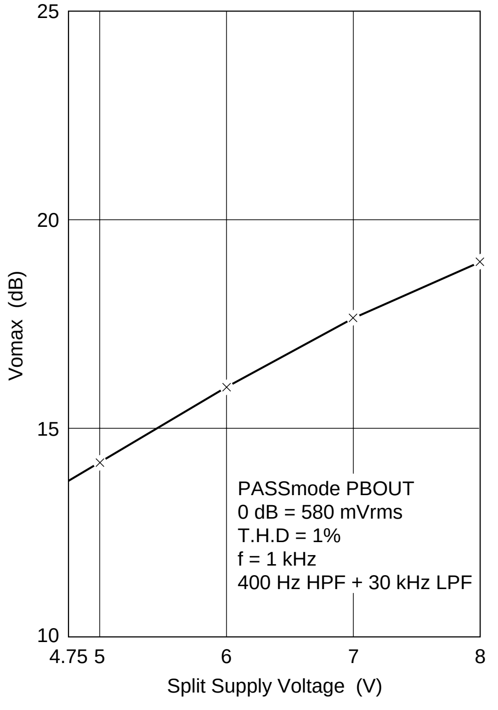
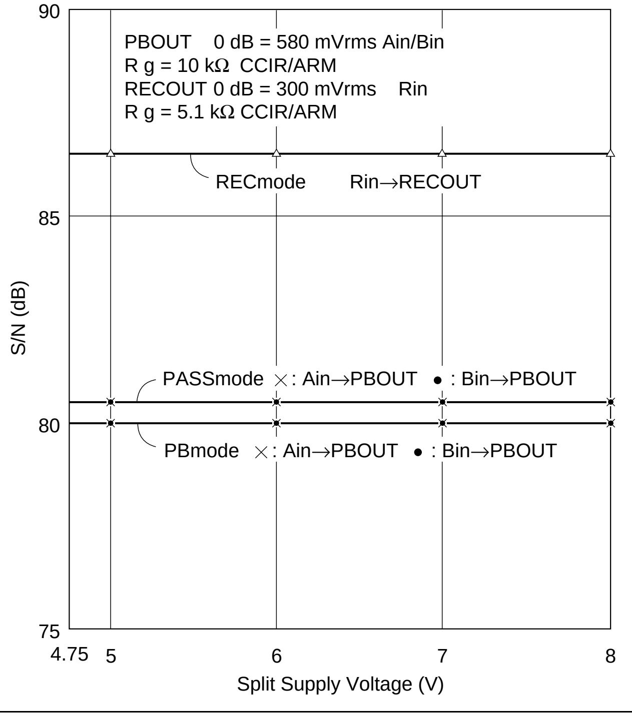
Maximum Output Level vs. Supply Voltage (5)



Signal to Noise Ratio vs. Supply Voltage



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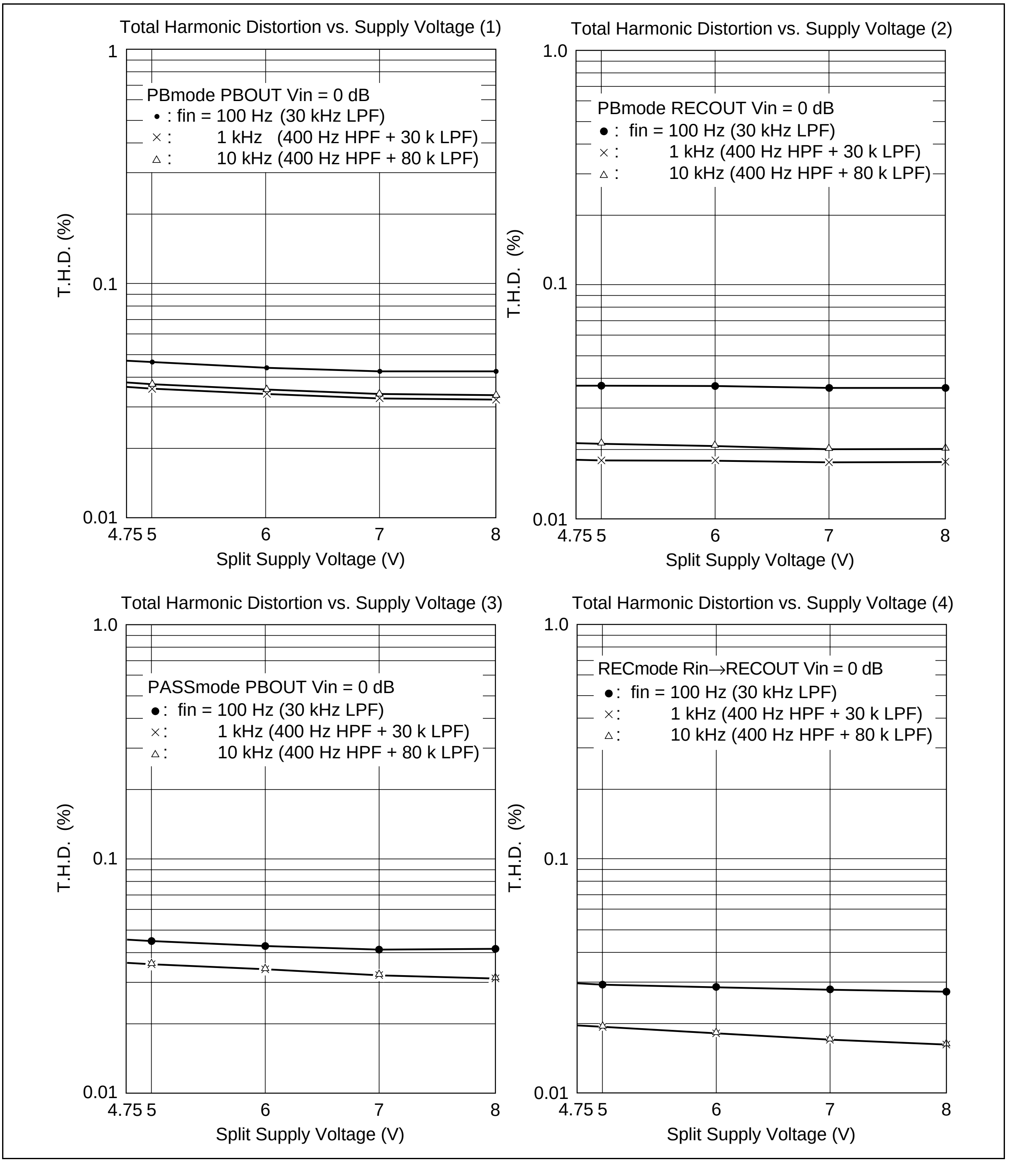
Total Harmonic Distortion vs. Supply Voltage (1)
PBmode PBOUT Vin = 0 dB
• : fin = 100 Hz (30 kHz LPF)
× : 1 kHz (400 Hz HPF + 30 k LPF)
△ : 10 kHz (400 Hz HPF + 80 k LPF)
T.H.D. (%)
1
0.1
0.01
4.75 5
6
7
8
Split Supply Voltage (V)
Total Harmonic Distortion vs. Supply Voltage (2)
PBmode RECOUT Vin = 0 dB
● : fin = 100 Hz (30 kHz LPF)
× : 1 kHz (400 Hz HPF + 30 k LPF)
△ : 10 kHz (400 Hz HPF + 80 k LPF)
T.H.D. (%)
1.0
0.1
0.01
4.75 5
6
7
8
Split Supply Voltage (V)
Total Harmonic Distortion vs. Supply Voltage (3)
PASSmode PBOUT Vin = 0 dB
●: fin = 100 Hz (30 kHz LPF)
×: 1 kHz (400 Hz HPF + 30 k LPF)
△: 10 kHz (400 Hz HPF + 80 k LPF)
T.H.D. (%)
1.0
0.1
0.01
4.75 5
6
7
8
Split Supply Voltage (V)
Total Harmonic Distortion vs. Supply Voltage (4)
RECmode Rin→RECOUT Vin = 0 dB
●: fin = 100 Hz (30 kHz LPF)
×: 1 kHz (400 Hz HPF + 30 k LPF)
△: 10 kHz (400 Hz HPF + 80 k LPF)
T.H.D. (%)
1.0
0.1
0.01
4.75 5
6
7
8
Split Supply Voltage (V)

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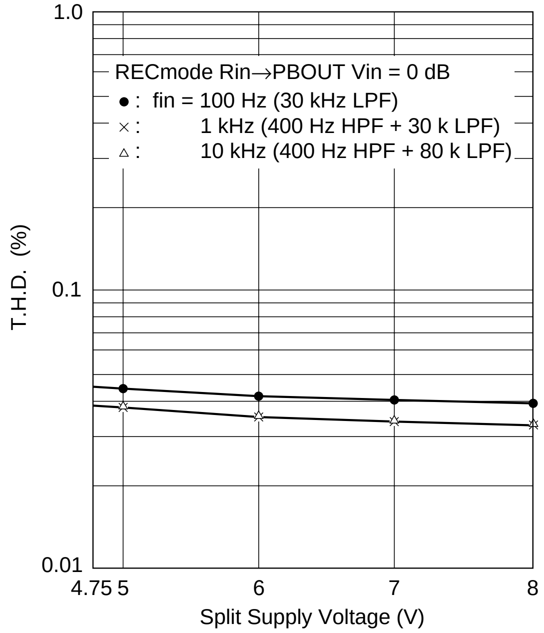
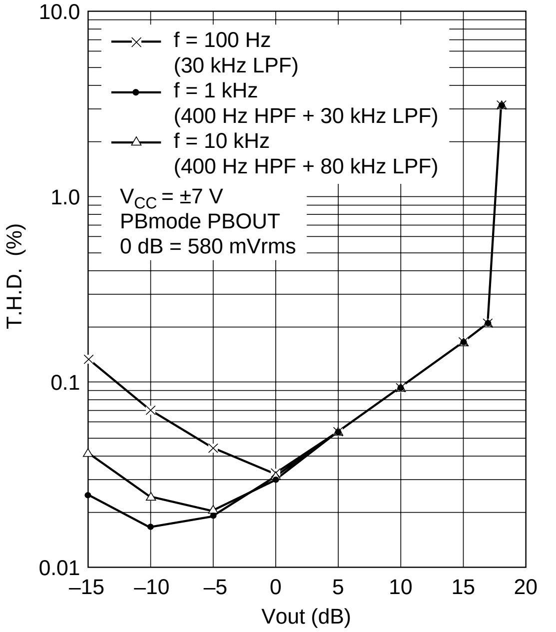
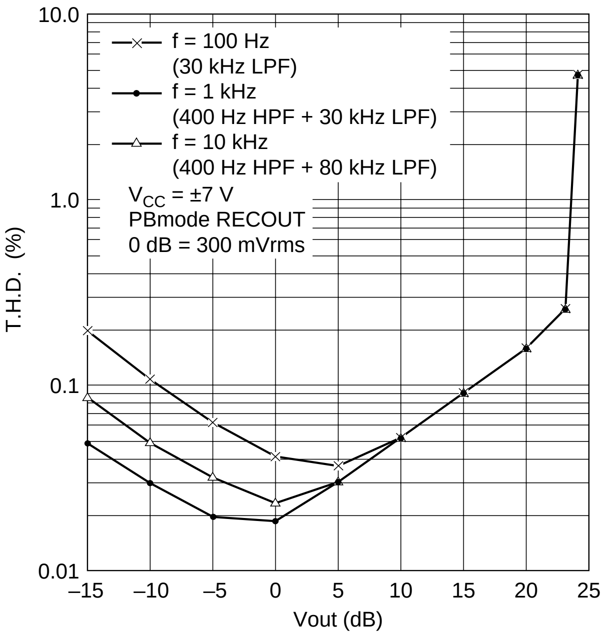
Total Harmonic Distortion vs. Supply Voltage (5)



Total Harmonic Distortion vs. Output Level (1)



Total Harmonic Distortion vs. Output Level (2)



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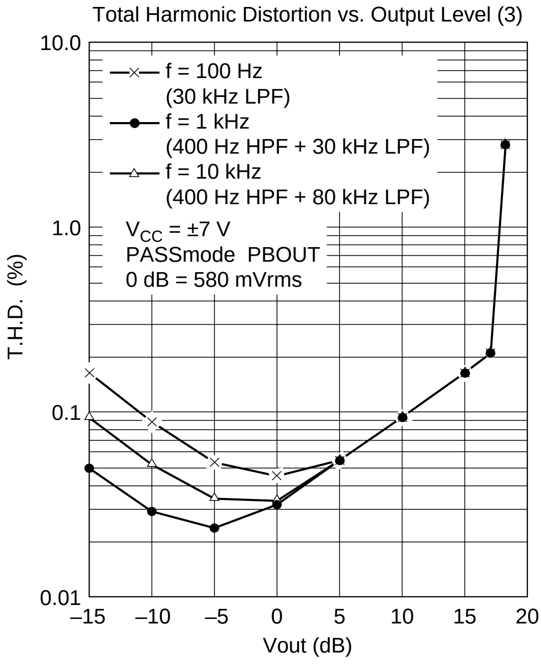
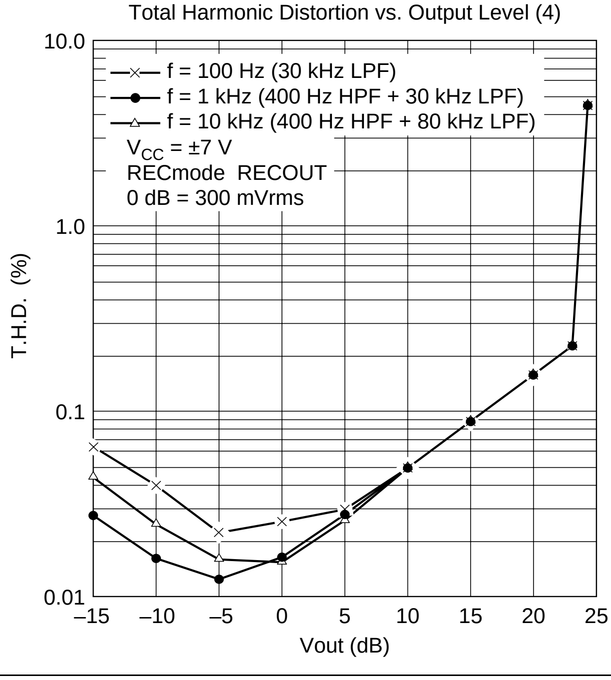
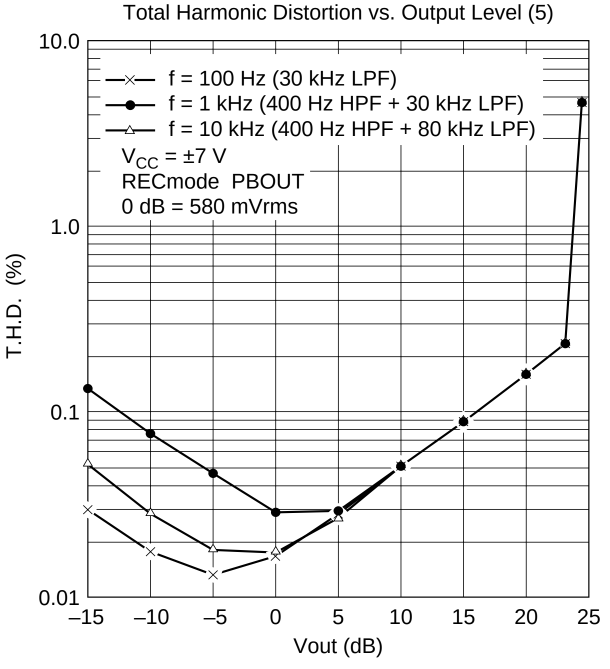
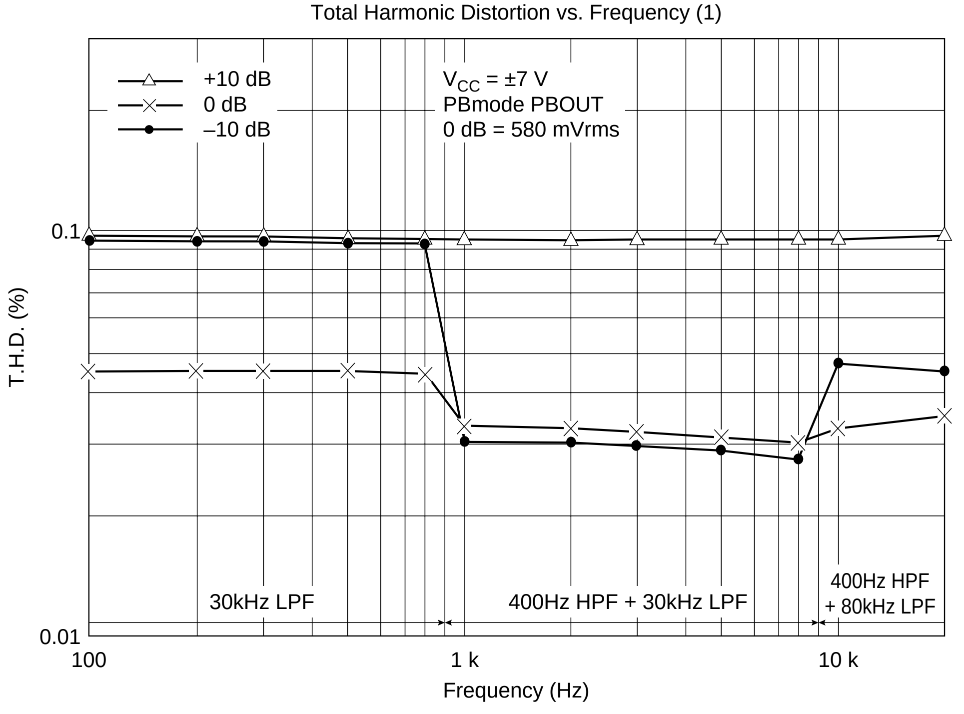

Total Harmonic Distortion vs. Output Level (3)
f = 100 Hz (30 kHz LPF)
f = 1 kHz (400 Hz HPF + 30 kHz LPF)
f = 10 kHz (400 Hz HPF + 80 kHz LPF)
VCC = ±7 V
PASSmode PBOUT
0 dB = 580 mVrms
T.H.D. (%)
10.0
1.0
0.1
0.01
–15
–10
–5
0
5
10
15
20
Vout (dB)


Total Harmonic Distortion vs. Output Level (4)
f = 100 Hz (30 kHz LPF)
f = 1 kHz (400 Hz HPF + 30 kHz LPF)
f = 10 kHz (400 Hz HPF + 80 kHz LPF)
VCC = ±7 V
RECmode RECOUT
0 dB = 300 mVrms
T.H.D. (%)
10.0
1.0
0.1
0.01
–15
–10
–5
0
5
10
15
20
25
Vout (dB)

HA12204NT


Total Harmonic Distortion vs. Output Level (5)
f = 100 Hz (30 kHz LPF)
f = 1 kHz (400 Hz HPF + 30 kHz LPF)
f = 10 kHz (400 Hz HPF + 80 kHz LPF)
VCC = ±7 V
RECmode PBOUT
0 dB = 580 mVrms
T.H.D. (%)
10.0
1.0
0.1
0.01
–15
–10
–5
0
5
10
15
20
25
Vout (dB)


Total Harmonic Distortion vs. Frequency (1)
+10 dB
0 dB
–10 dB
VCC = ±7 V
PBmode PBOUT
0 dB = 580 mVrms
T.H.D. (%)
0.1
0.01
30kHz LPF
400Hz HPF + 30kHz LPF
400Hz HPF
+ 80kHz LPF
100
1 k
10 k
Frequency (Hz)

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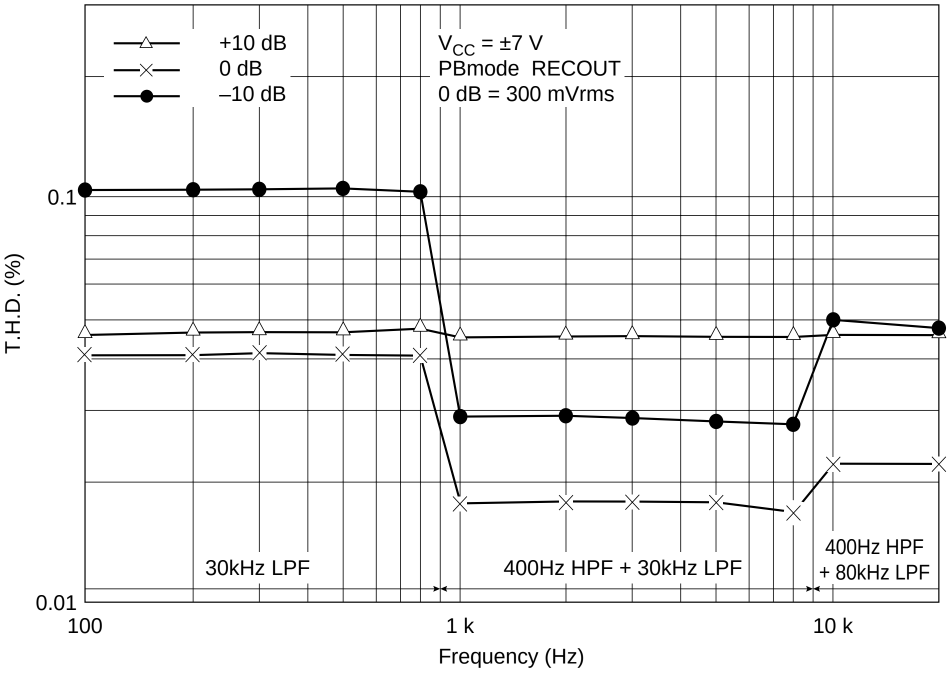
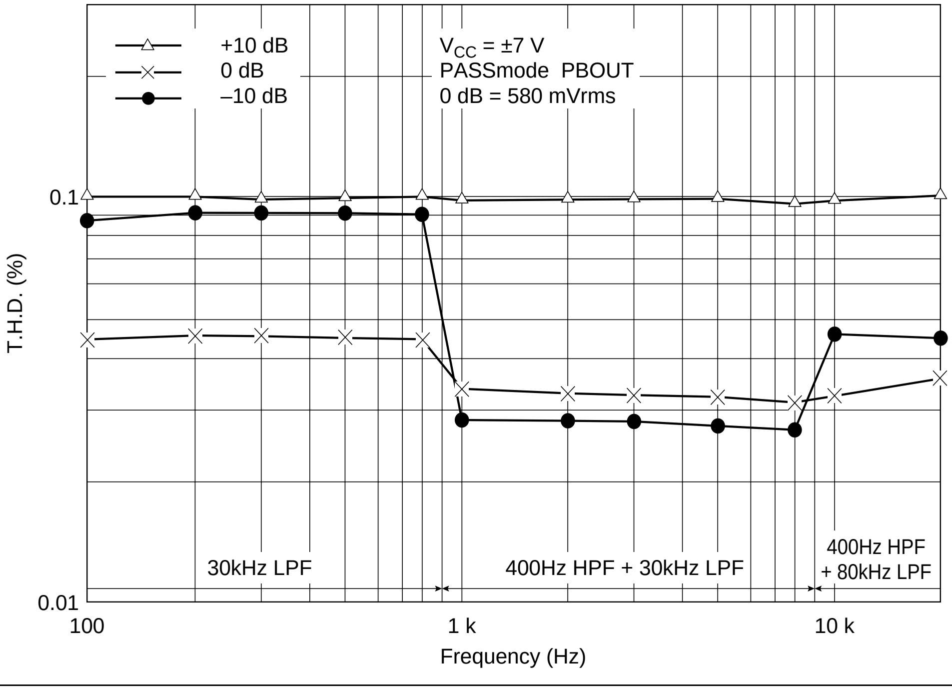
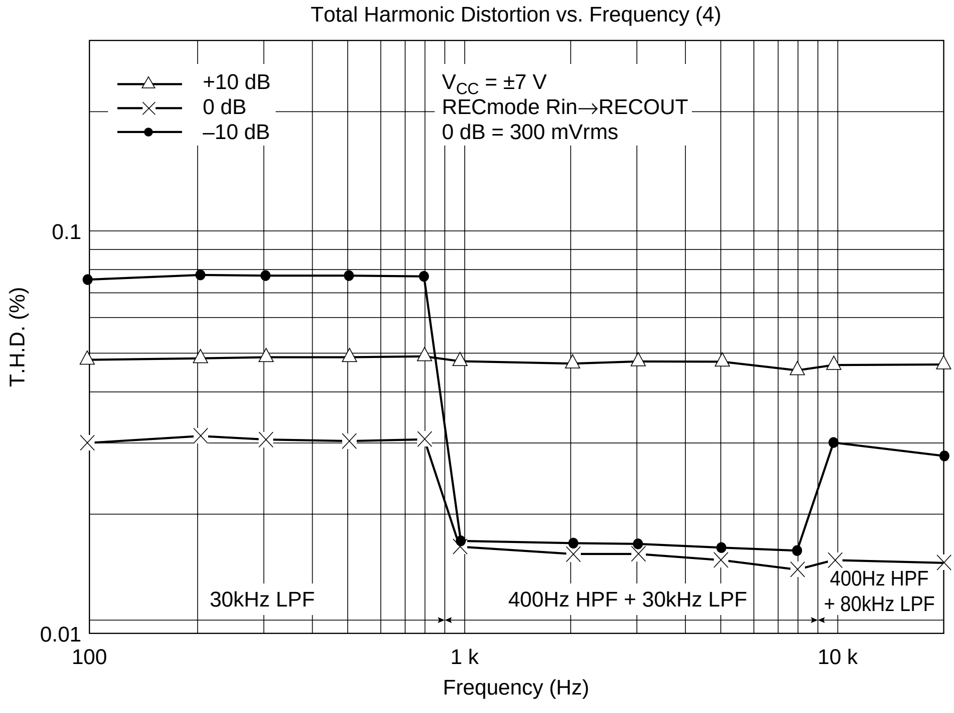
Total Harmonic Distortion vs. Frequency (2)

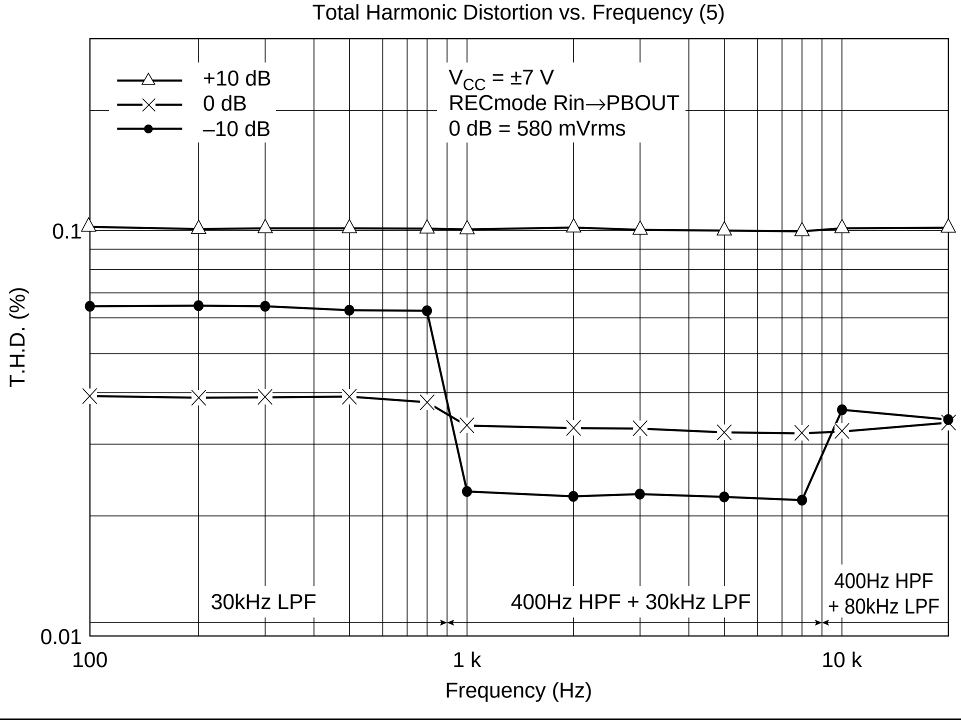


Total Harmonic Distortion vs. Frequency (3)

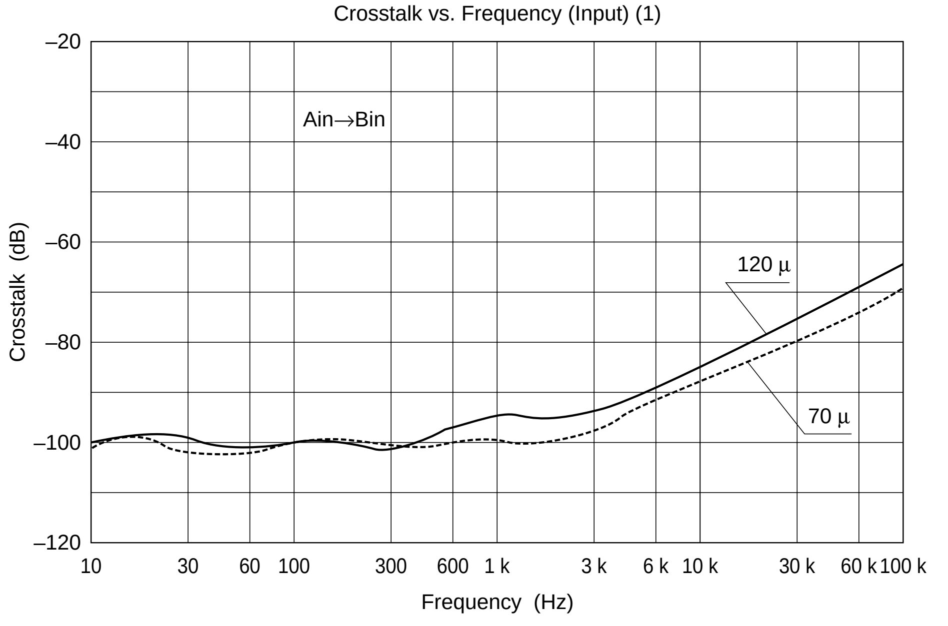


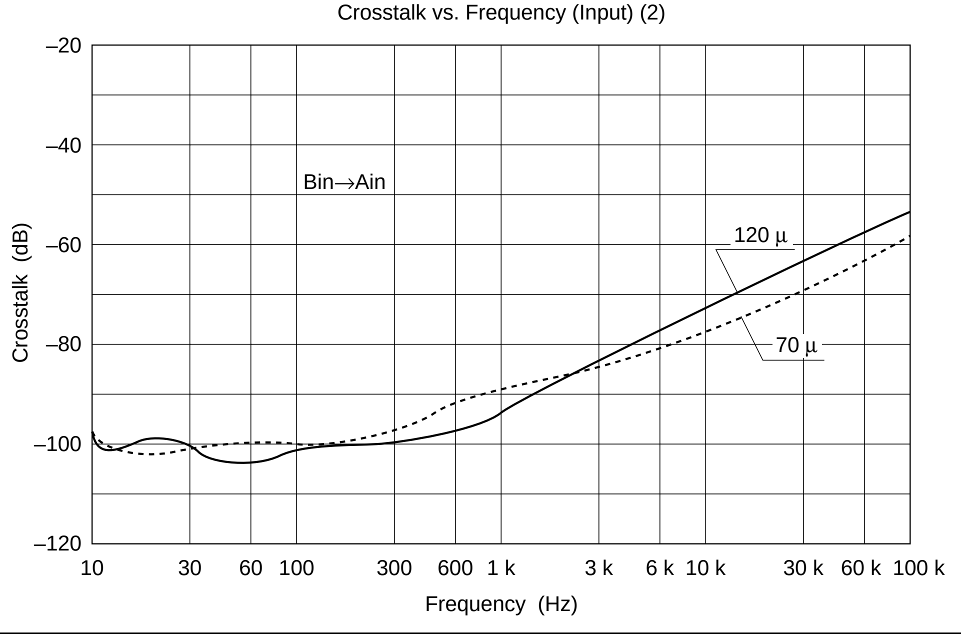
HA12204NT


Total Harmonic Distortion vs. Frequency (4)
+10 dB
0 dB
–10 dB
VCC = ±7 V
RECmode Rin→RECOUT
0 dB = 300 mVrms
0.1
0.01
T.H.D. (%)
30kHz LPF
400Hz HPF + 30kHz LPF
400Hz HPF
+ 80kHz LPF
100
1 k
10 k
Frequency (Hz)

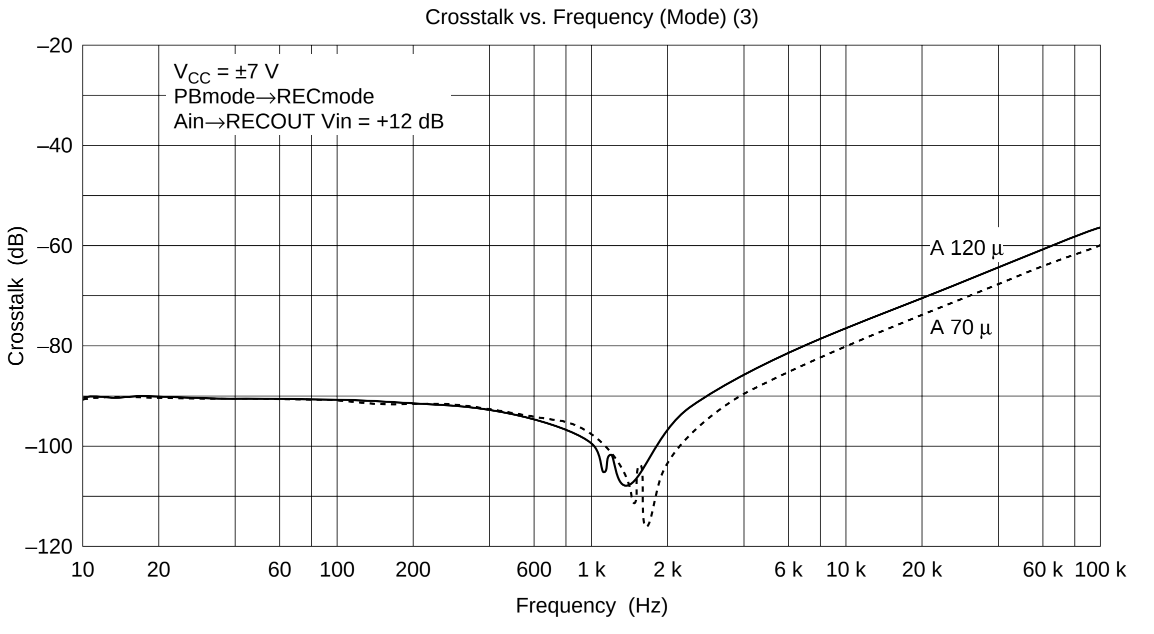

Total Harmonic Distortion vs. Frequency (5)
+10 dB
0 dB
–10 dB
VCC = ±7 V
RECmode Rin→PBOUT
0 dB = 580 mVrms
0.1
0.01
T.H.D. (%)
30kHz LPF
400Hz HPF + 30kHz LPF
400Hz HPF
+ 80kHz LPF
100
1 k
10 k
Frequency (Hz)

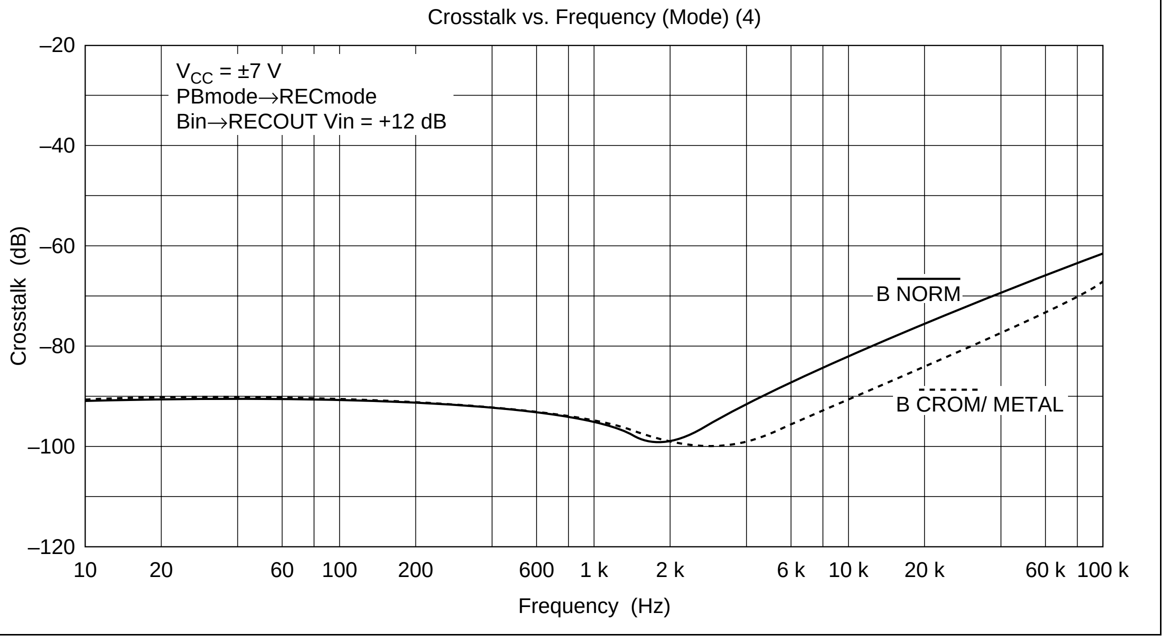
HA12204NT


Crosstalk vs. Frequency (Input) (1)
Ain→Bin
120 µ
70 µ
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

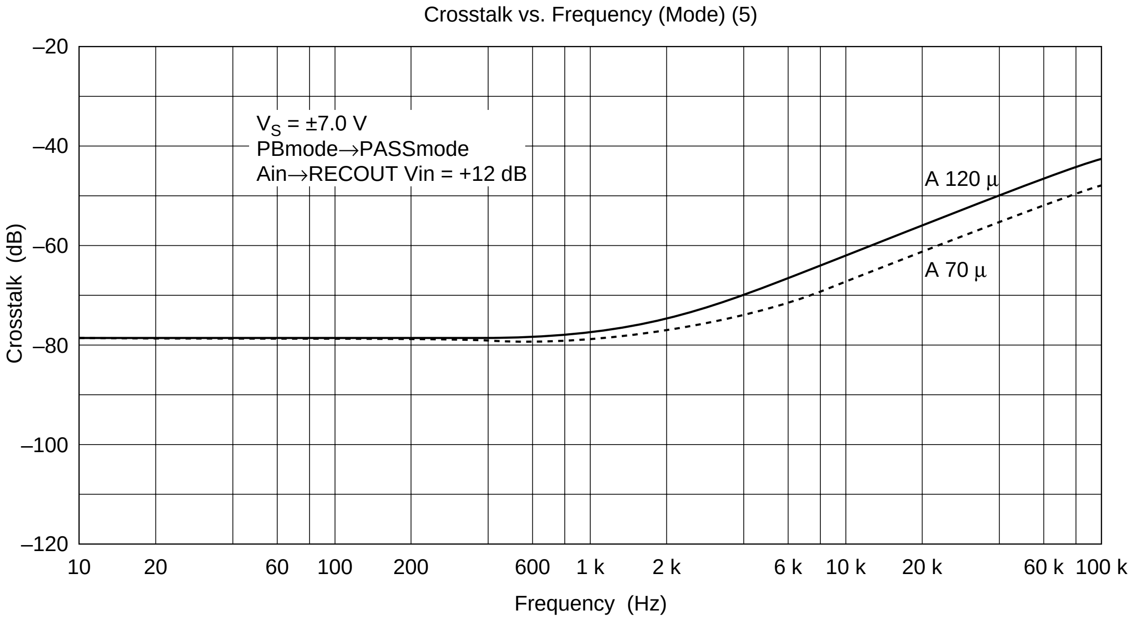

Crosstalk vs. Frequency (Input) (2)
Bin→Ain
120 µ
70 µ
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
Frequency (Hz)

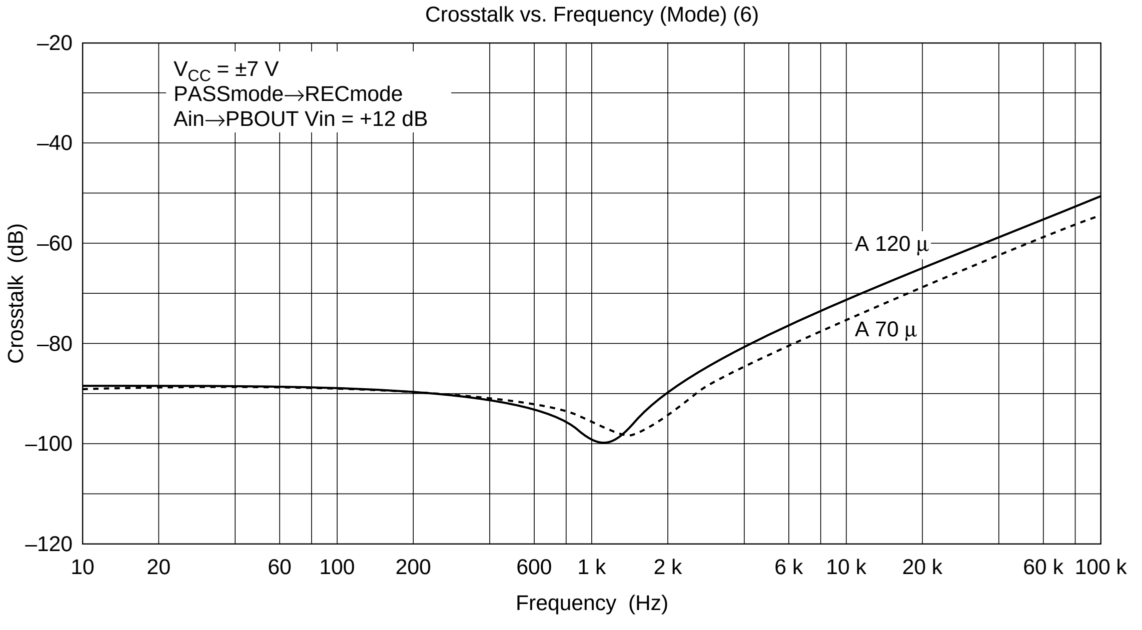
HA12204NT


Crosstalk vs. Frequency (Mode) (3)
VCC = ±7 V
PBmode→RECmode
Ain→RECOUT Vin = +12 dB
A 120 µ
A 70 µ
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

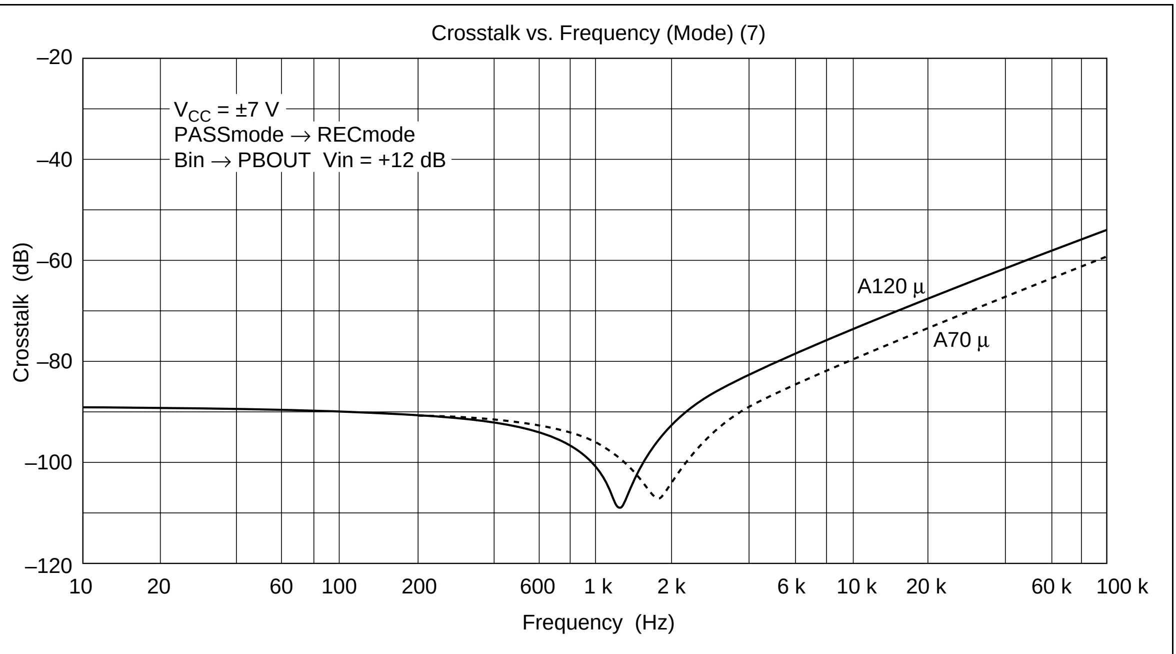

Crosstalk vs. Frequency (Mode) (4)
VCC = ±7 V
PBmode→RECmode
Bin→RECOUT Vin = +12 dB
B NORM
B CROM/ METAL
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

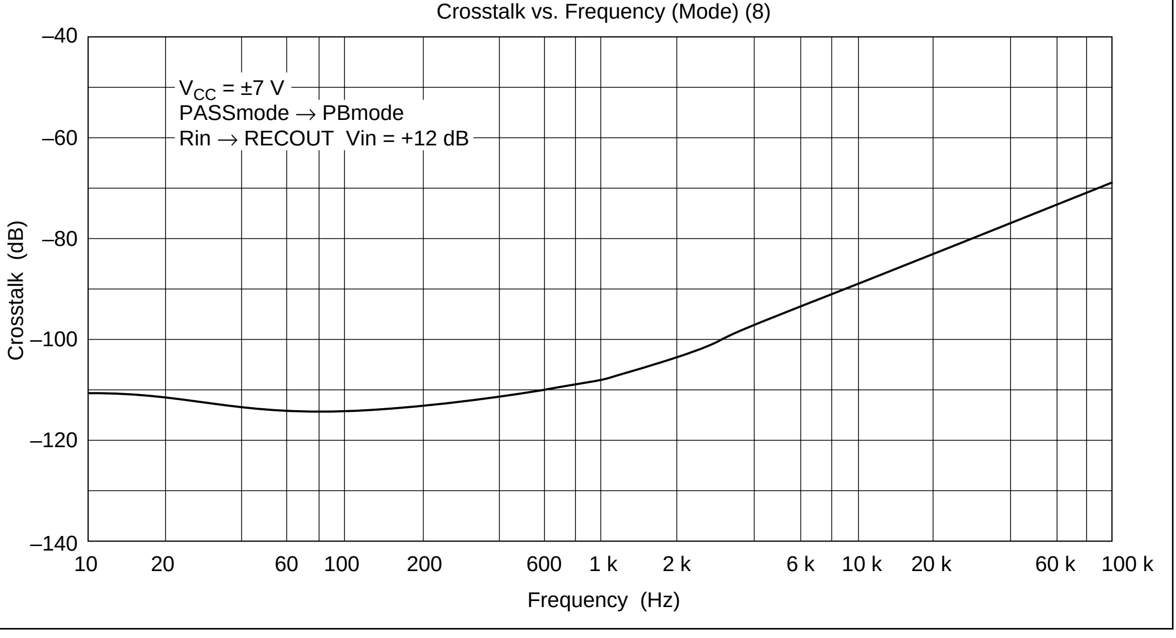
HA12204NT


Crosstalk vs. Frequency (Mode) (5)
VS = ±7.0 V
PBmode→PASSmode
Ain→RECOUT Vin = +12 dB
A 120 µ
A 70 µ
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

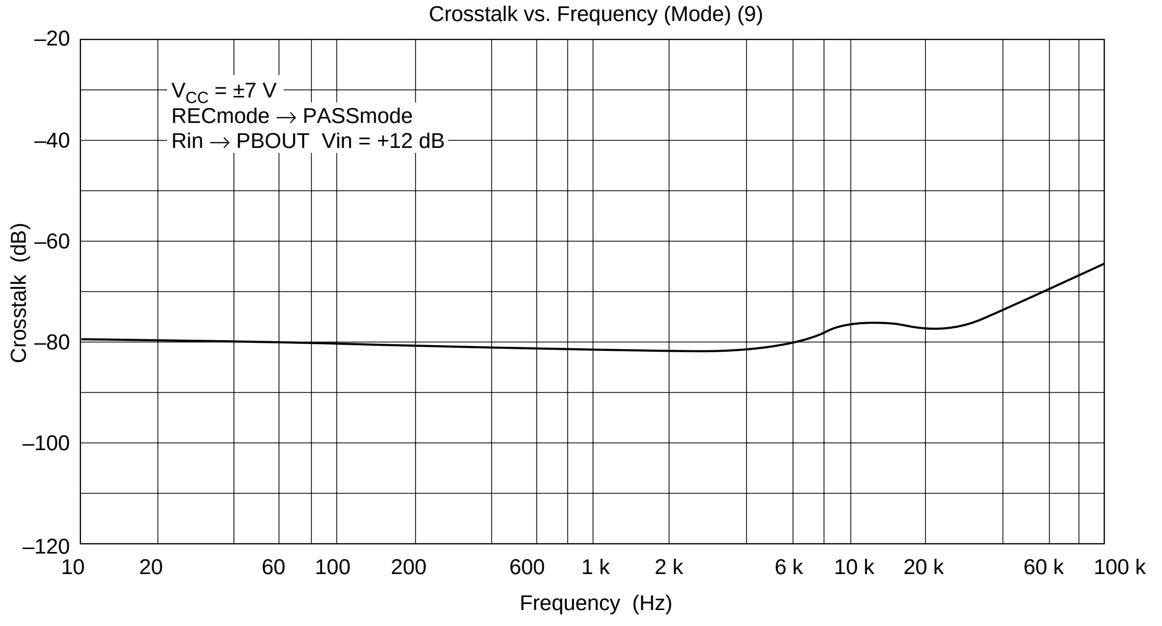

Crosstalk vs. Frequency (Mode) (6)
VCC = ±7 V
PASSmode→RECmode
Ain→PBOUT Vin = +12 dB
A 120 µ
A 70 µ
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

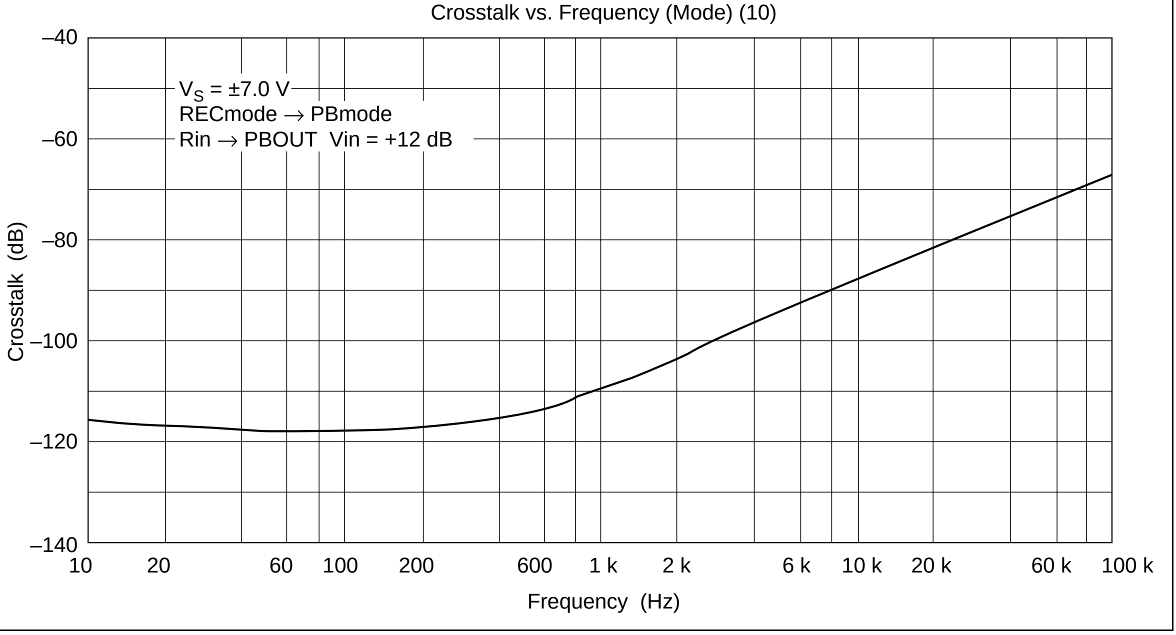
HA12204NT


Crosstalk vs. Frequency (Mode) (7)
VCC = ±7 V
PASSmode → RECmode
Bin → PBOUT Vin = +12 dB
A120 µ
A70 µ
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

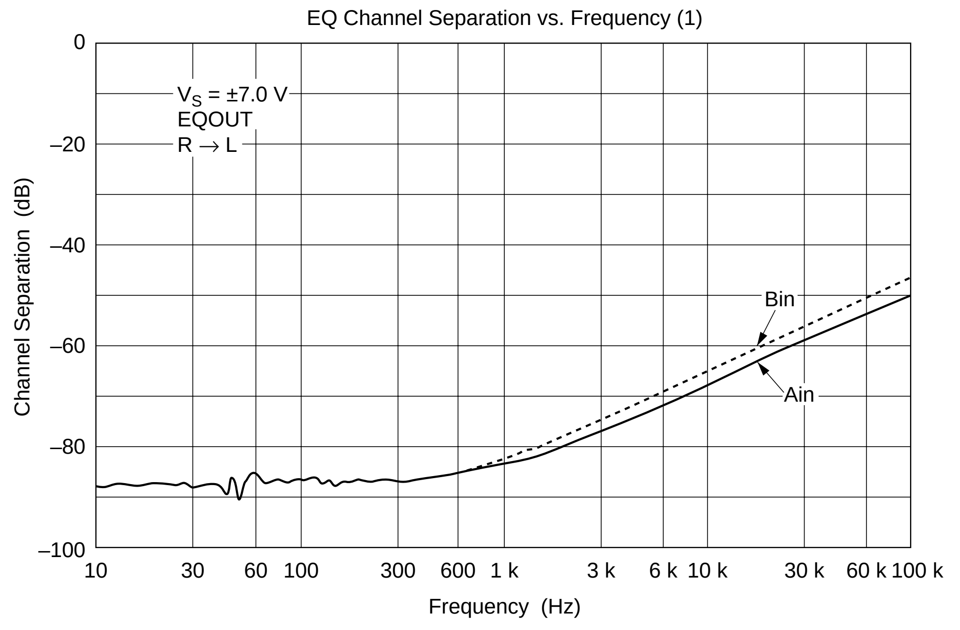

Crosstalk vs. Frequency (Mode) (8)
VCC = ±7 V
PASSmode → PBmode
Rin → RECOUT Vin = +12 dB
Crosstalk (dB)
–40
–60
–80
–100
–120
–140
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

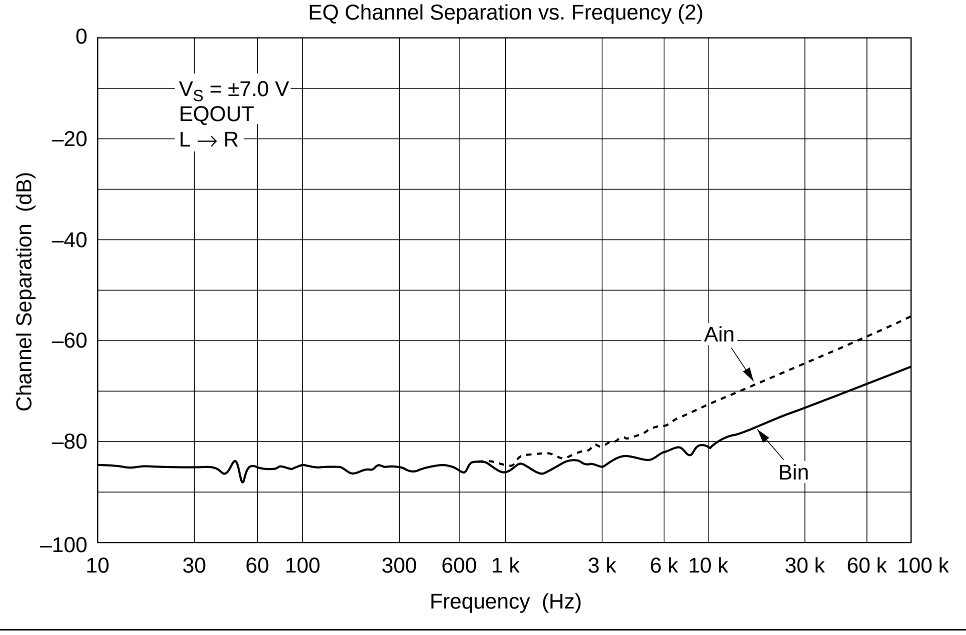
HA12204NT


Crosstalk vs. Frequency (Mode) (9)
VCC = ±7 V
RECmode → PASSmode
Rin → PBOUT Vin = +12 dB
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)


Crosstalk vs. Frequency (Mode) (10)
VS = ±7.0 V
RECmode → PBmode
Rin → PBOUT Vin = +12 dB
Crosstalk (dB)
–40
–60
–80
–100
–120
–140
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

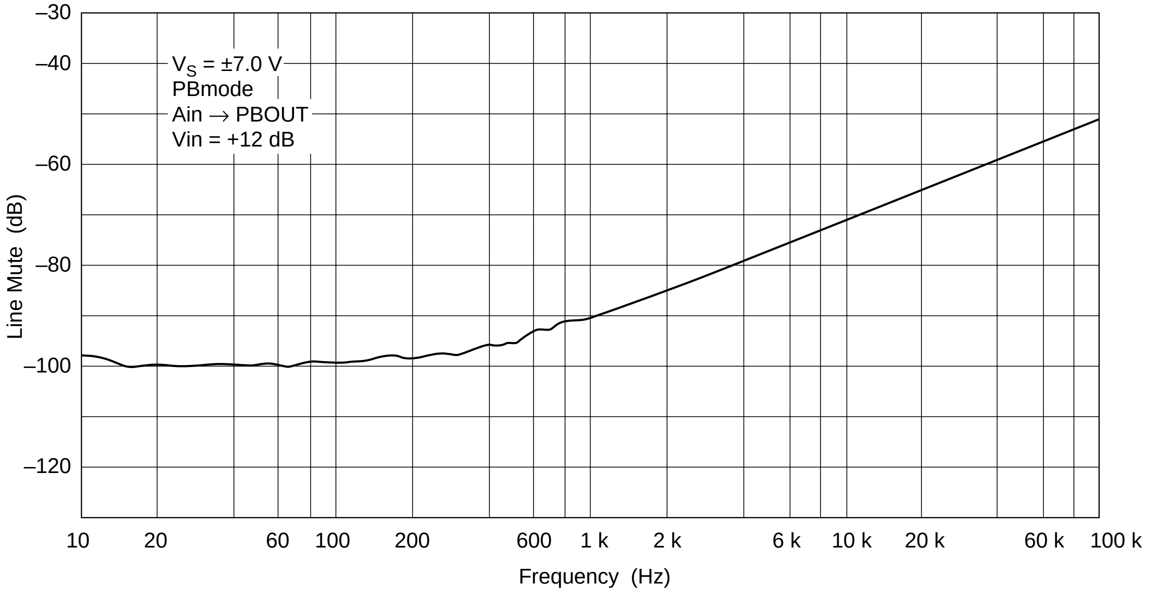
HA12204NT


EQ Channel Separation vs. Frequency (1)
Channel Separation (dB)
0
–20
–40
–60
–80
–100
Frequency (Hz)
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
VS = ±7.0 V
EQOUT
R → L
Bin
Ain

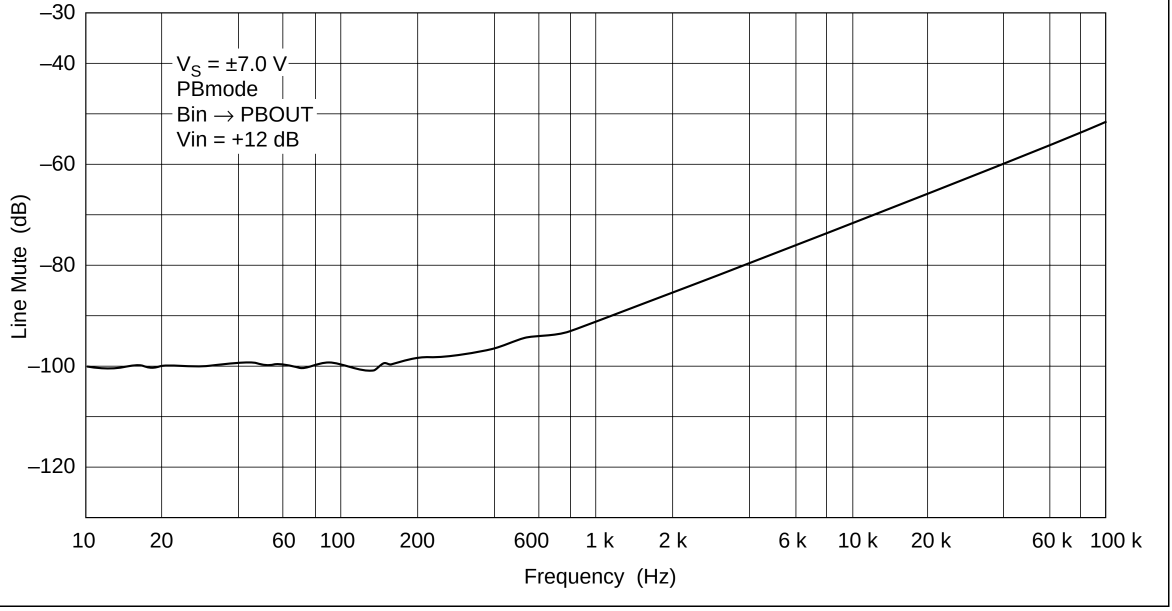

EQ Channel Separation vs. Frequency (2)
Channel Separation (dB)
0
–20
–40
–60
–80
–100
Frequency (Hz)
10
30
60
100
300
600
1 k
3 k
6 k
10 k
30 k
60 k
100 k
VS = ±7.0 V
EQOUT
L → R
Ain
Bin

HA12204NT

Line Mute vs. Frequency (1)



Line Mute vs. Frequency (2)



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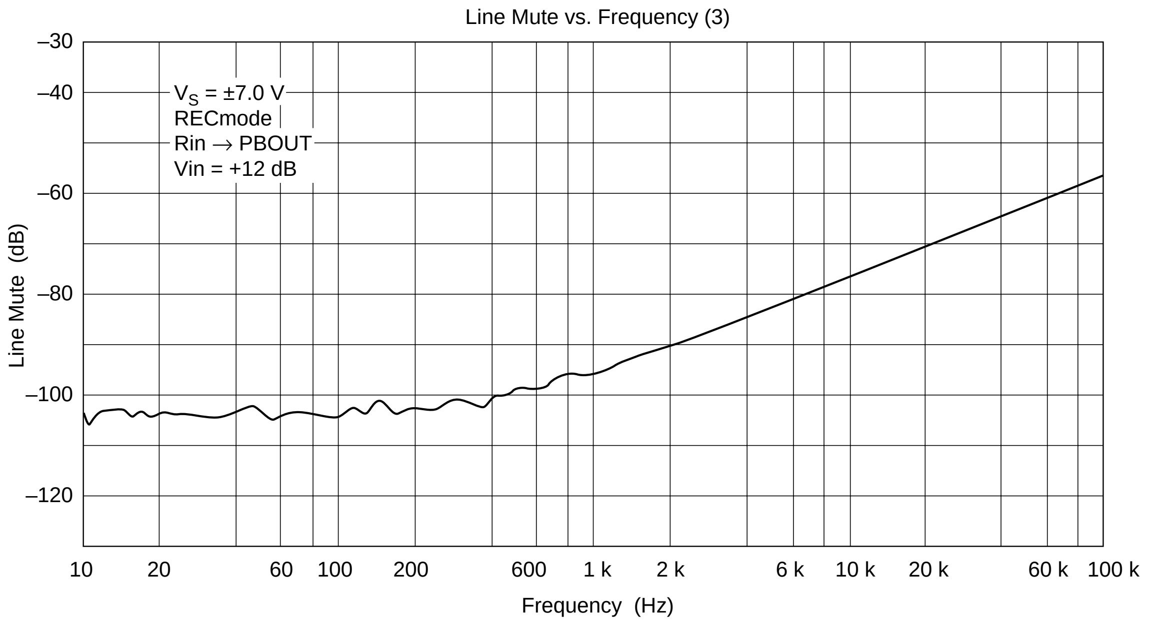
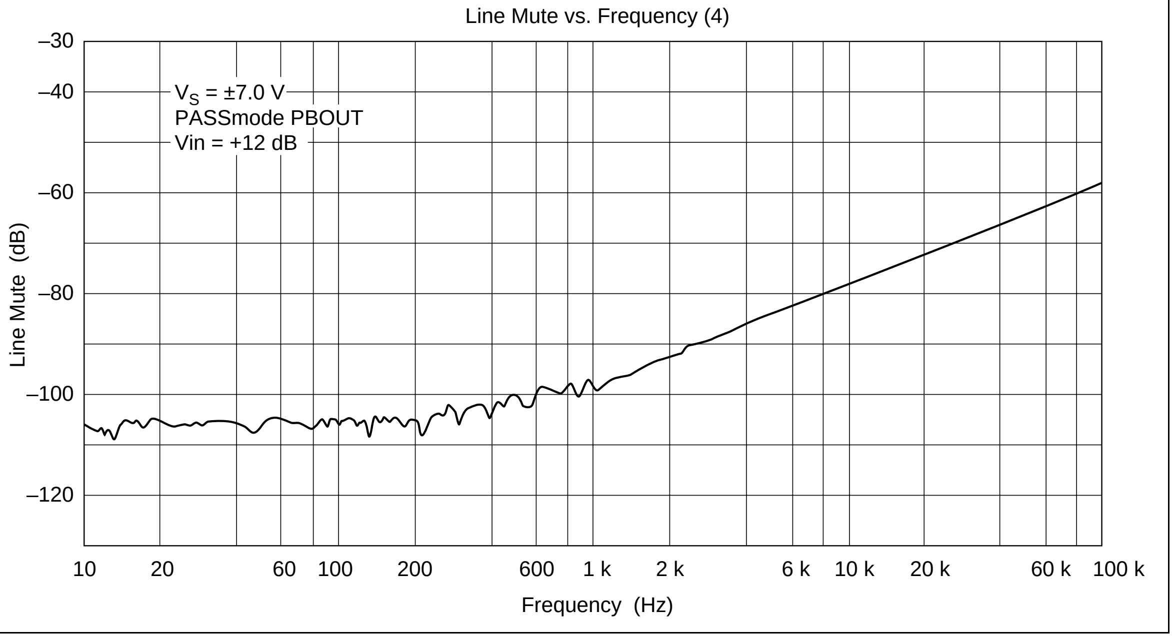
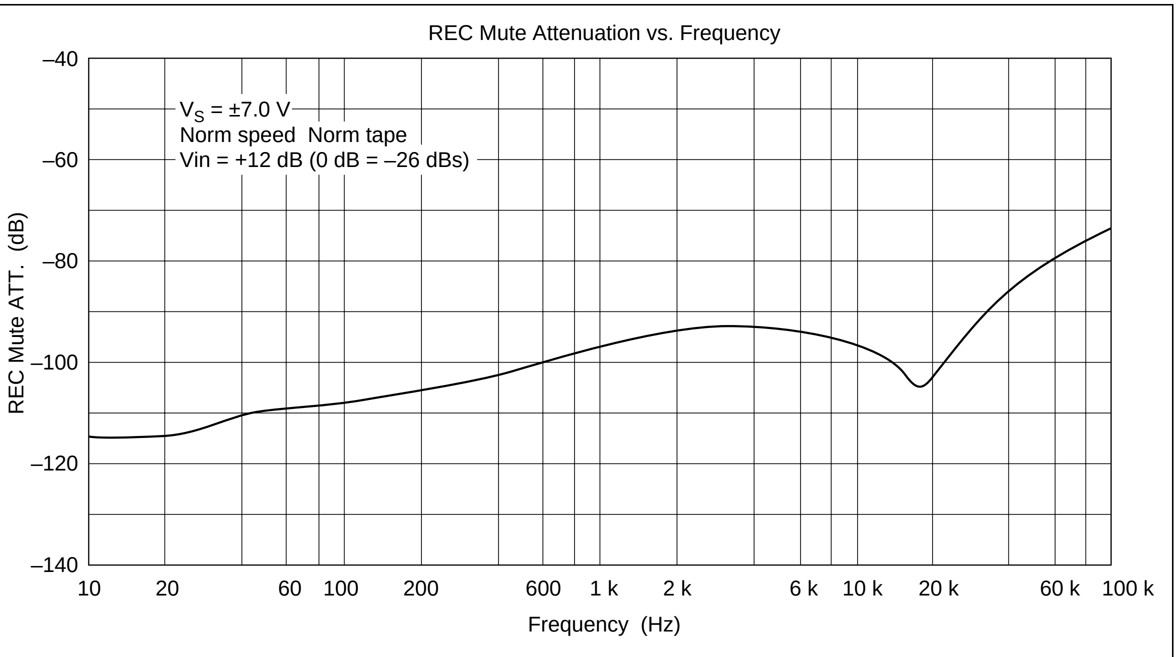
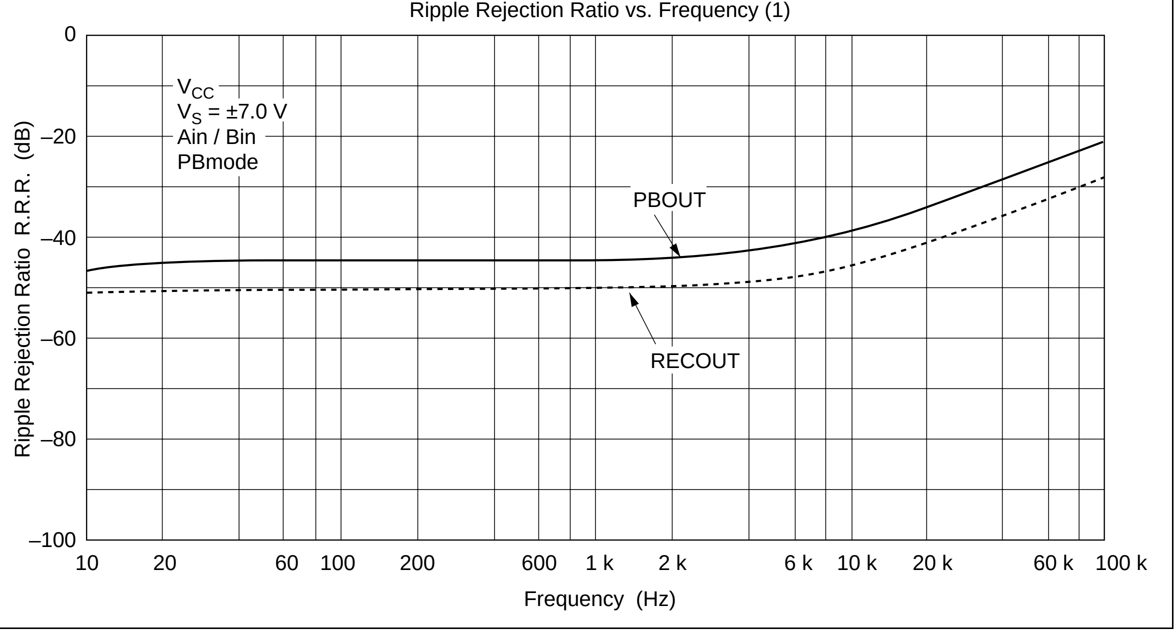

Line Mute vs. Frequency (3)
V_S = ±7.0 V
RECmode
Rin → PBOUT
Vin = +12 dB
Line Mute (dB)
–30
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

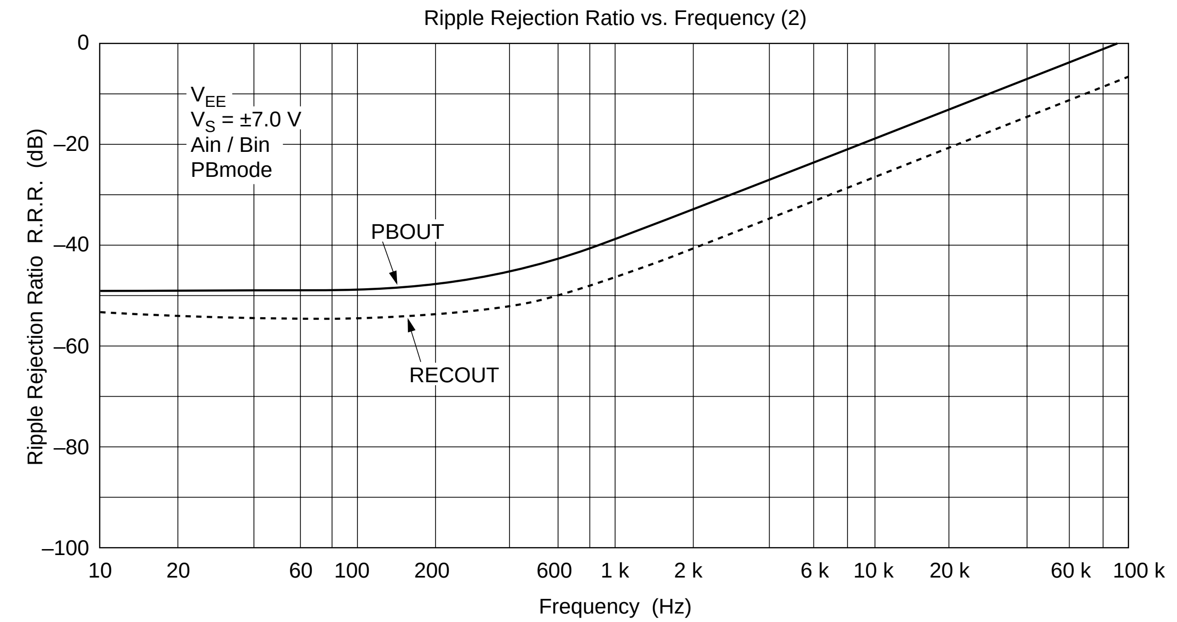

Line Mute vs. Frequency (4)
V_S = ±7.0 V
PASSmode PBOUT
Vin = +12 dB
Line Mute (dB)
–30
–40
–60
–80
–100
–120
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

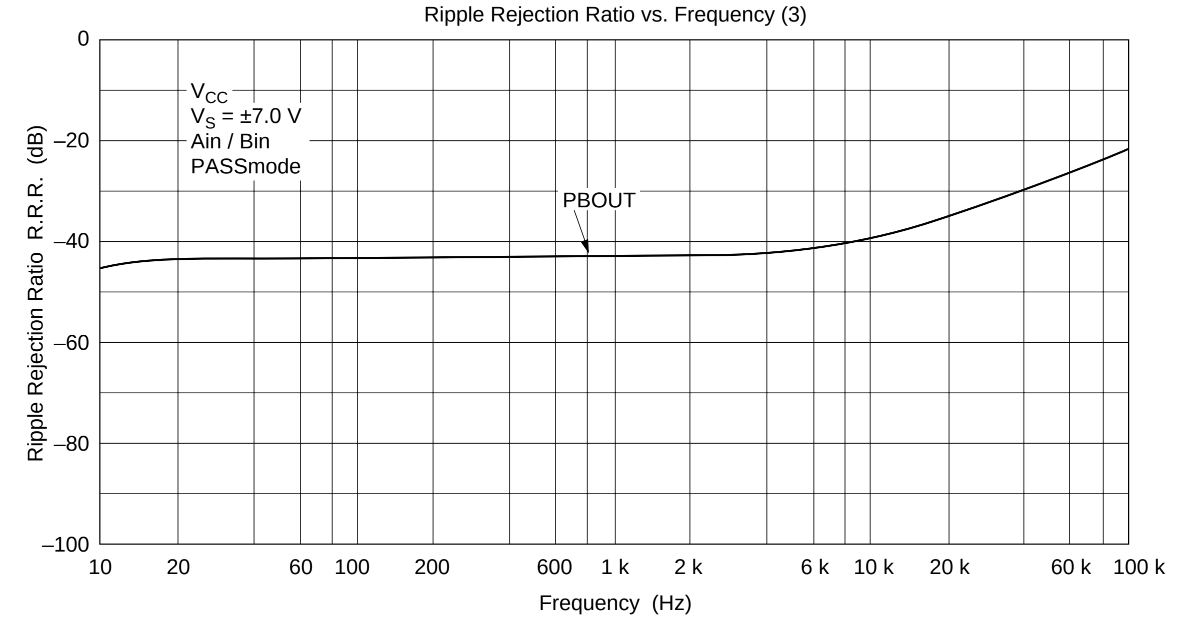
HA12204NT


REC Mute Attenuation vs. Frequency
V_S = ±7.0 V
Norm speed Norm tape
Vin = +12 dB (0 dB = –26 dBs)
REC Mute ATT. (dB)
–40
–60
–80
–100
–120
–140
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

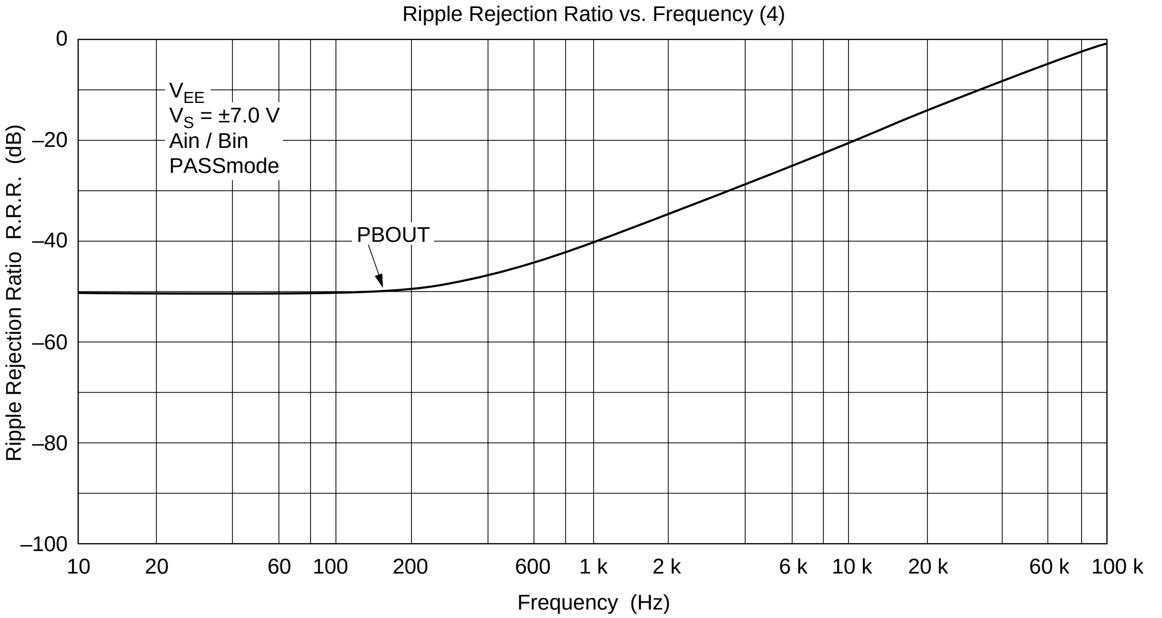

Ripple Rejection Ratio vs. Frequency (1)
V_{CC}
V_S = ±7.0 V
Ain / Bin
PBmode
PBOUT
RECOUT
Ripple Rejection Ratio R.R.R. (dB)
0
–20
–40
–60
–80
–100
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

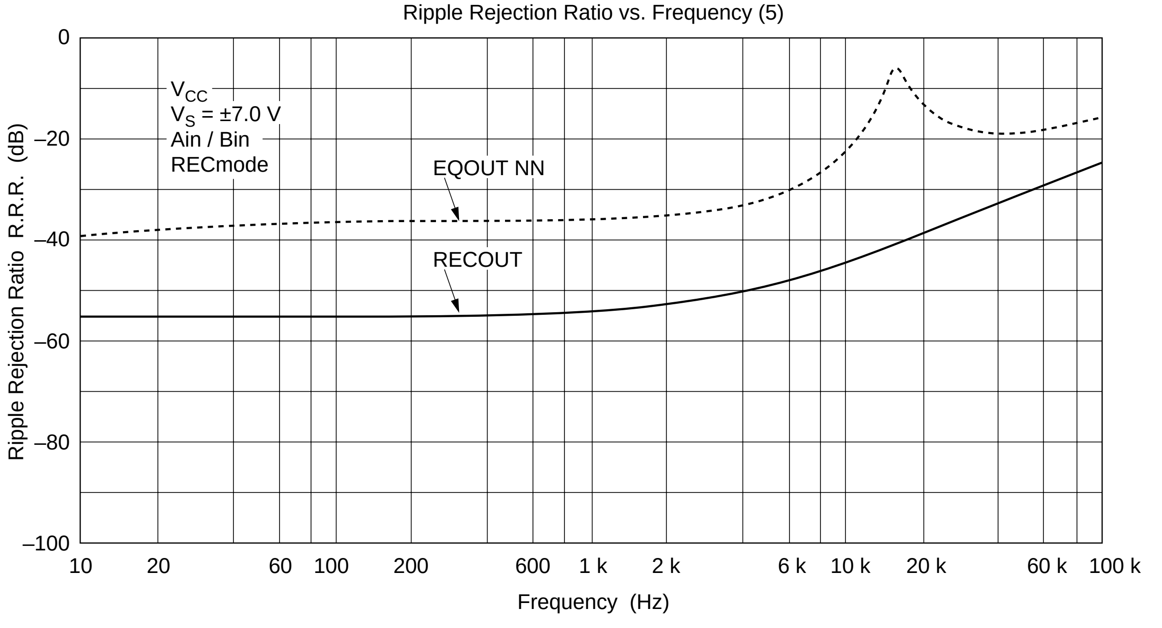
HA12204NT


Ripple Rejection Ratio vs. Frequency (2)
VEE
VS = ±7.0 V
Ain / Bin
PBmode
PBOUT
RECOUT
Ripple Rejection Ratio R.R.R. (dB)
0
–20
–40
–60
–80
–100
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

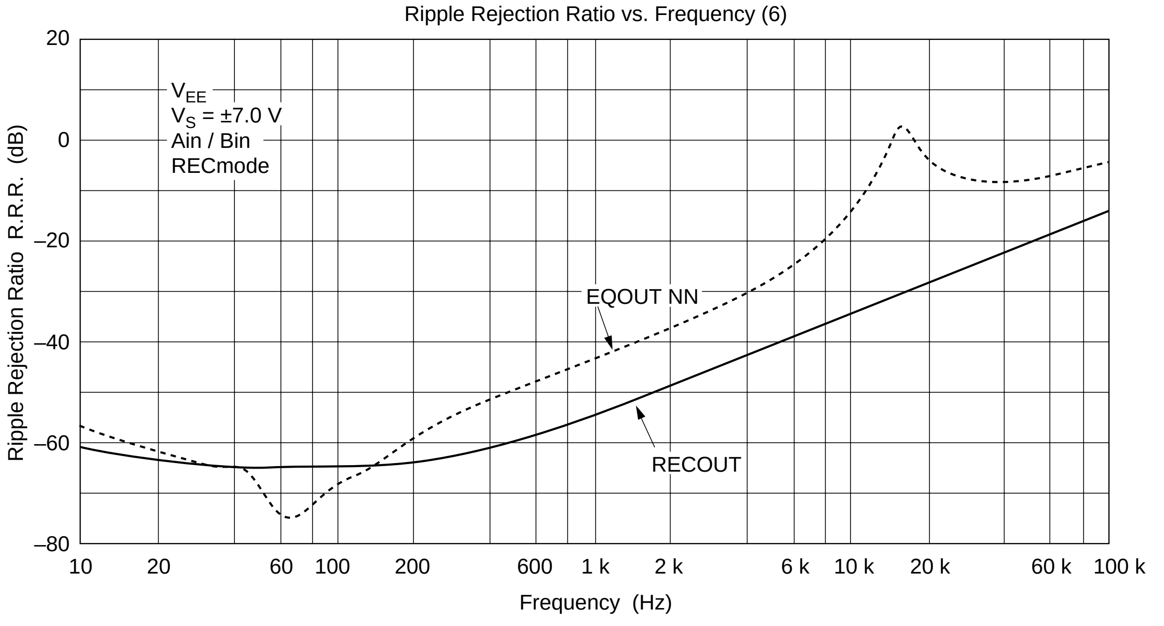

Ripple Rejection Ratio vs. Frequency (3)
VCC
VS = ±7.0 V
Ain / Bin
PASSmode
PBOUT
Ripple Rejection Ratio R.R.R. (dB)
0
–20
–40
–60
–80
–100
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

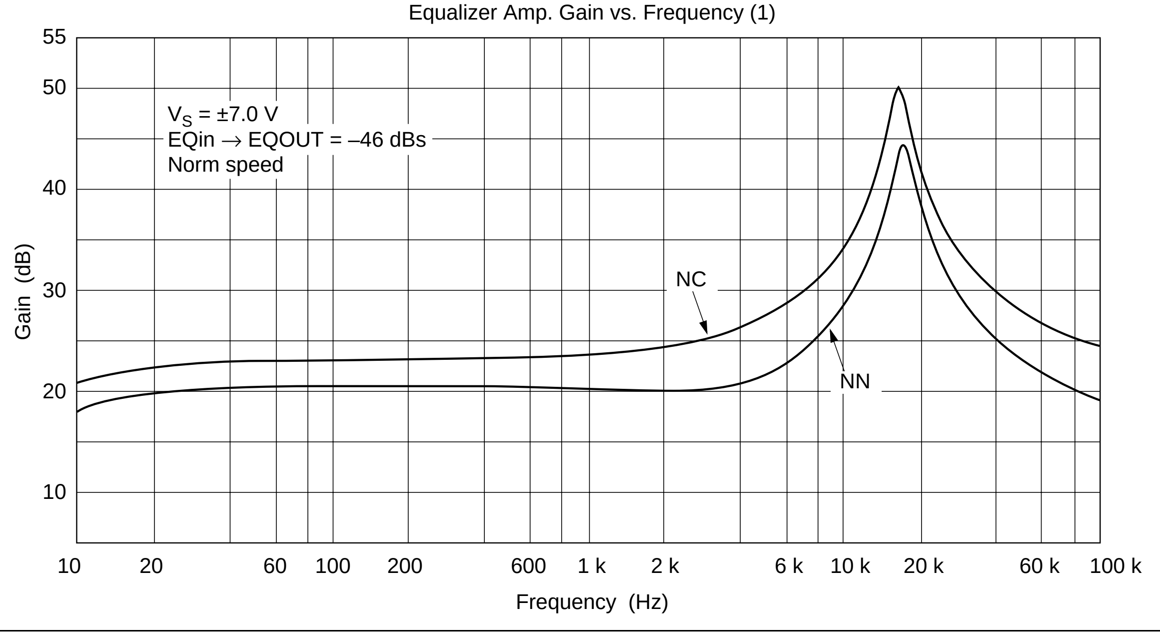
HA12204NT


Ripple Rejection Ratio vs. Frequency (4)
V_{EE}
V_S = ±7.0 V
Ain / Bin
PASSmode
PBOUT
Ripple Rejection Ratio R.R.R. (dB)
0
–20
–40
–60
–80
–100
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)


Ripple Rejection Ratio vs. Frequency (5)
V_{CC}
V_S = ±7.0 V
Ain / Bin
RECmode
EQOUT NN
RECOUT
Ripple Rejection Ratio R.R.R. (dB)
0
–20
–40
–60
–80
–100
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

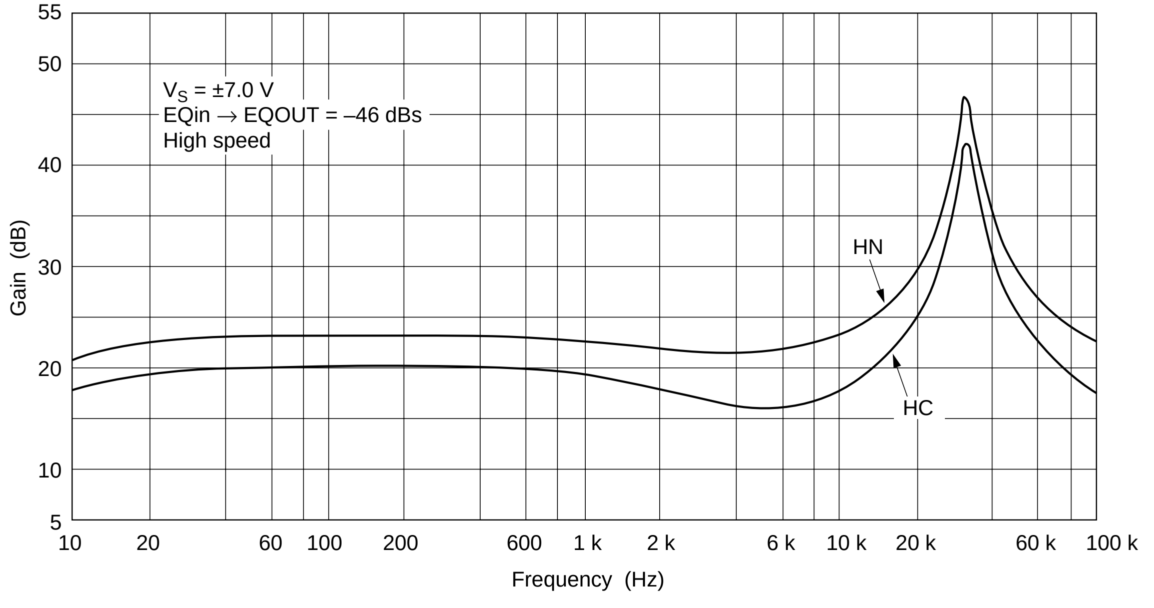
HA12204NT


Ripple Rejection Ratio vs. Frequency (6)
Ripple Rejection Ratio R.R.R. (dB)
20
0
–20
–40
–60
–80
V_{EE}
V_S = ±7.0 V
Ain / Bin
RECmode
EQOUT NN
RECOUT
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

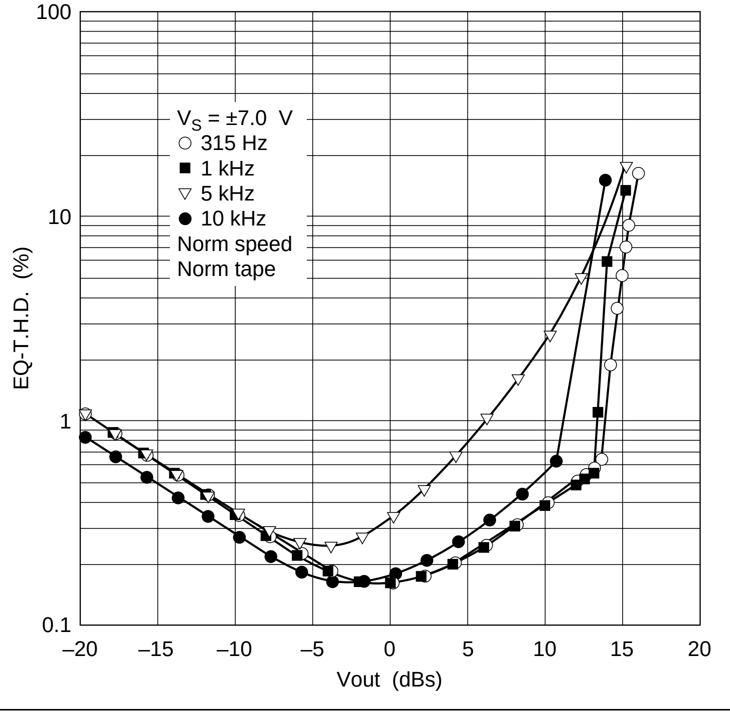

Equalizer Amp. Gain vs. Frequency (1)
Gain (dB)
55
50
40
30
20
10
V_S = ±7.0 V
EQin → EQOUT = –46 dBs
Norm speed
NC
NN
10
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

HA12204NT

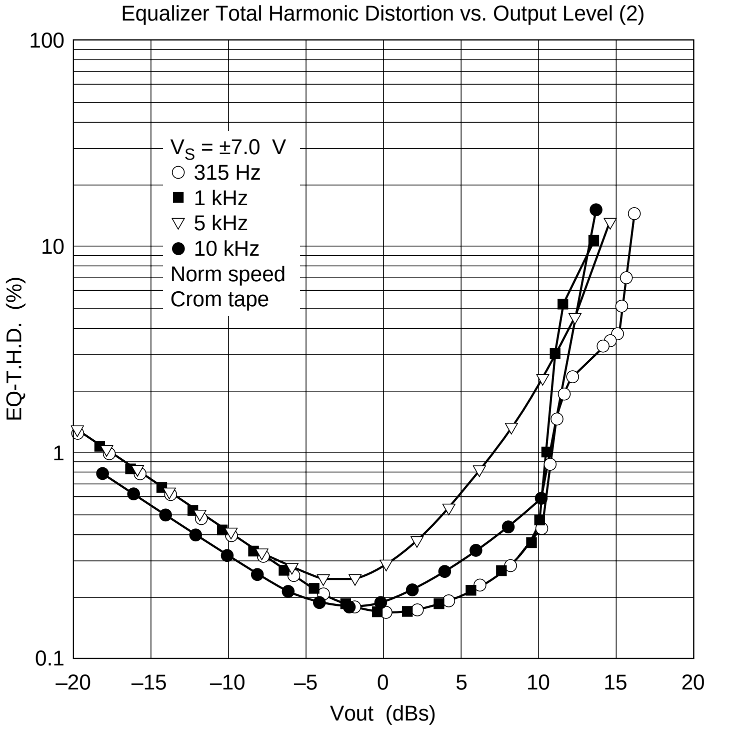
Equalizer Amp. Gain vs. Frequency (2)

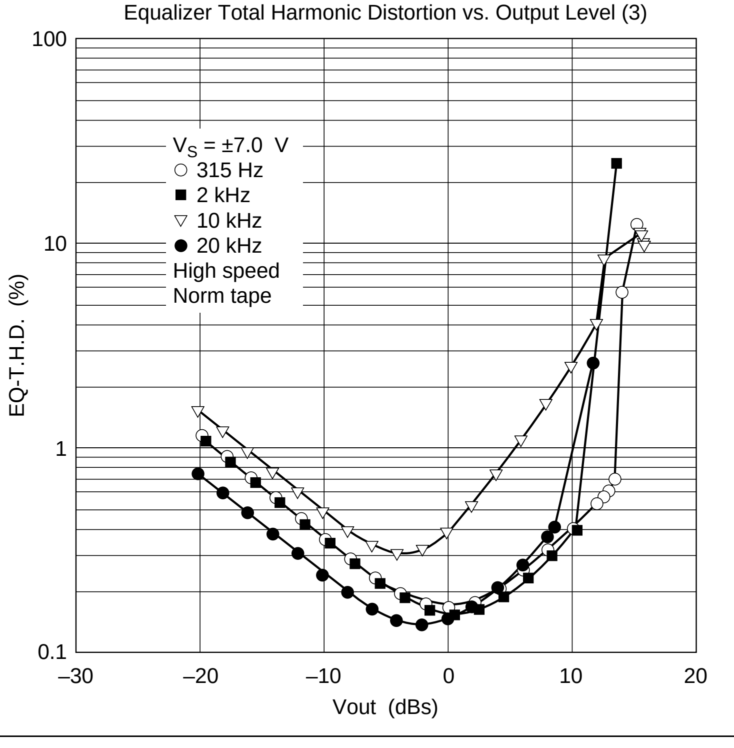


Equalizer Total Harmonic Distortion vs. Output Level (1)



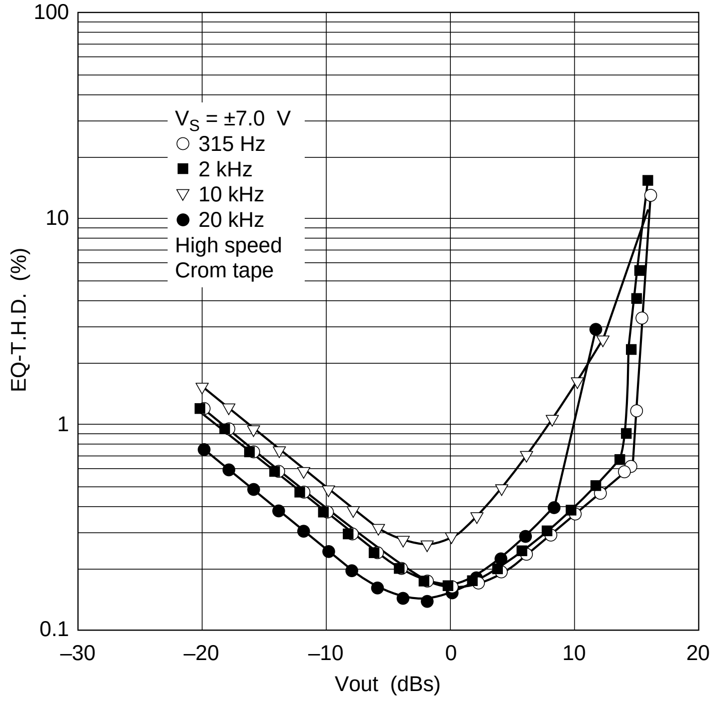
HA12204NT


Equalizer Total Harmonic Distortion vs. Output Level (2)
EQ-T.H.D. (%)
Vout (dBs)
V_S = ±7.0 V
315 Hz
1 kHz
5 kHz
10 kHz
Norm speed
Crom tape
100
10
1
0.1
–20
–15
–10
–5
0
5
10
15
20

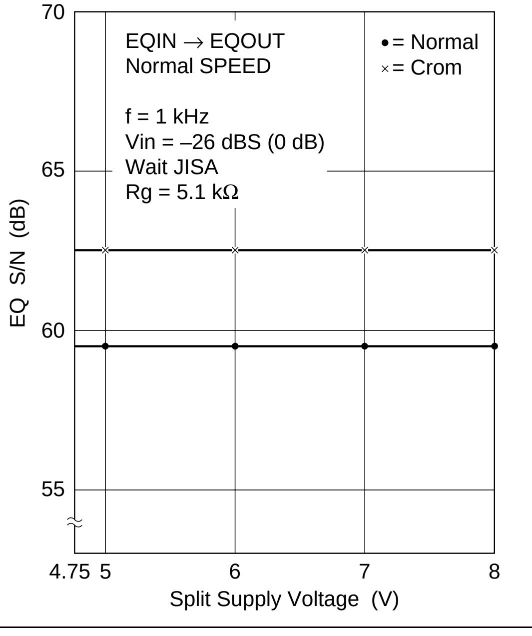

Equalizer Total Harmonic Distortion vs. Output Level (3)
EQ-T.H.D. (%)
Vout (dBs)
V_S = ±7.0 V
315 Hz
2 kHz
10 kHz
20 kHz
High speed
Norm tape
100
10
1
0.1
–30
–20
–10
0
10
20

HA12204NT

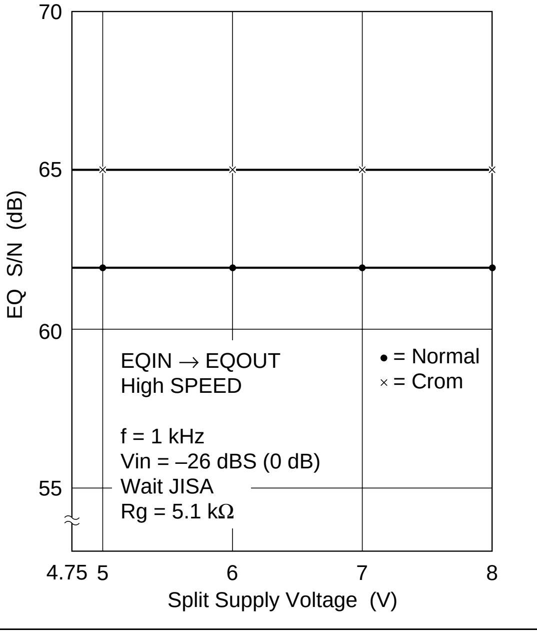
Equalizer Total Harmonic Distortion vs. Output Level (4)



EQ Signal to Noise Ratio vs. Split Supply Voltage (1)



EQ Signal to Noise Ratio vs. Split Supply Voltage (2)



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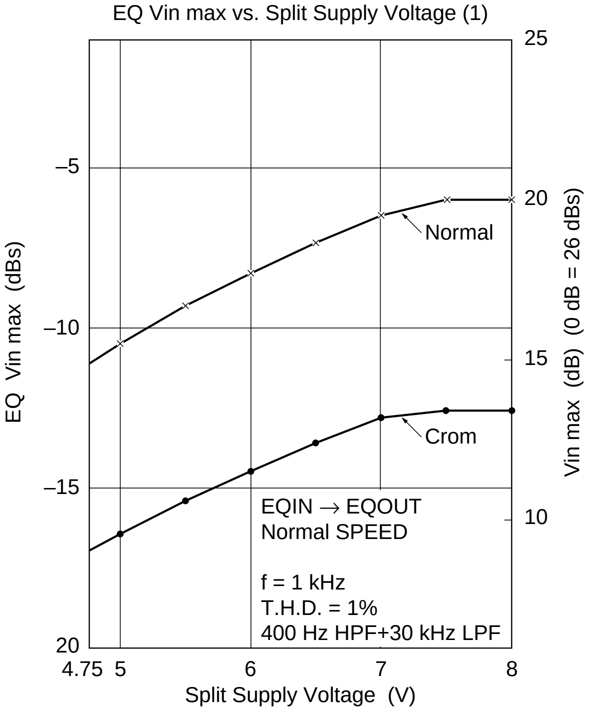
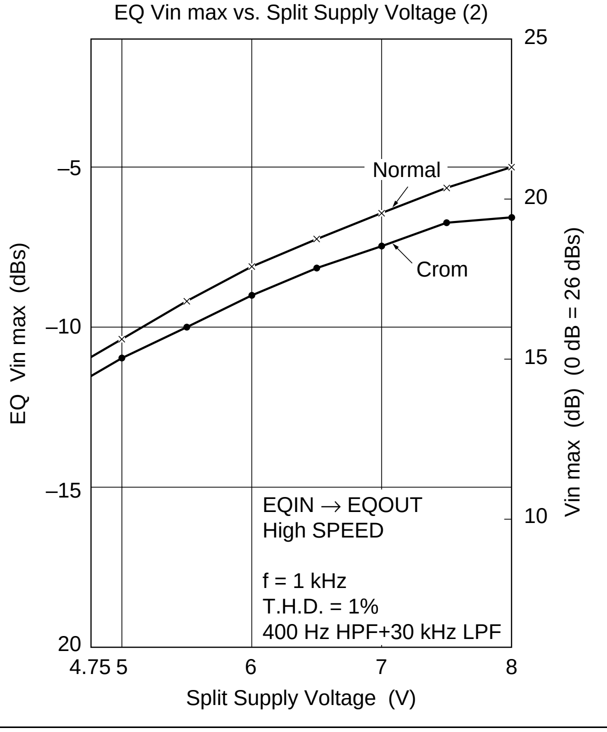


EQ Vin max vs. Split Supply Voltage (1)
EQ Vin max (dBs)
Vin max (dB) (0 dB = 26 dBs)
Split Supply Voltage (V)
Normal
Crom
EQIN → EQOUT
Normal SPEED
f = 1 kHz
T.H.D. = 1%
400 Hz HPF+30 kHz LPF
–5
–10
–15
20
25
20
15
10
4.75
5
6
7
8



EQ Vin max vs. Split Supply Voltage (2)
EQ Vin max (dBs)
Vin max (dB) (0 dB = 26 dBs)
Split Supply Voltage (V)
Normal
Crom
EQIN → EQOUT
High SPEED
f = 1 kHz
T.H.D. = 1%
400 Hz HPF+30 kHz LPF
–5
–10
–15
20
25
20
15
10
4.75
5
6
7
8

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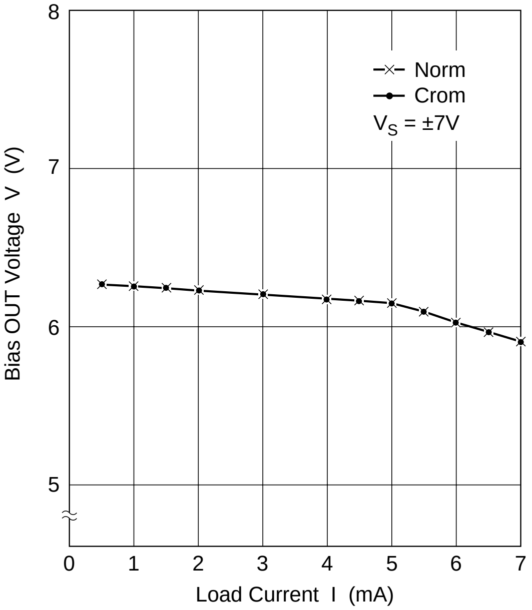
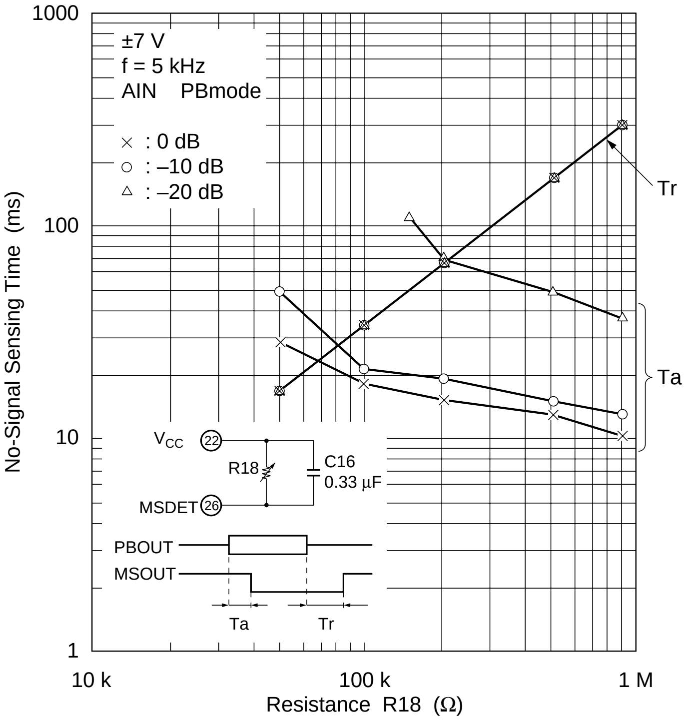
Bias Output vs. Load Current



No-Signal Sensing Time vs. Resistance R18



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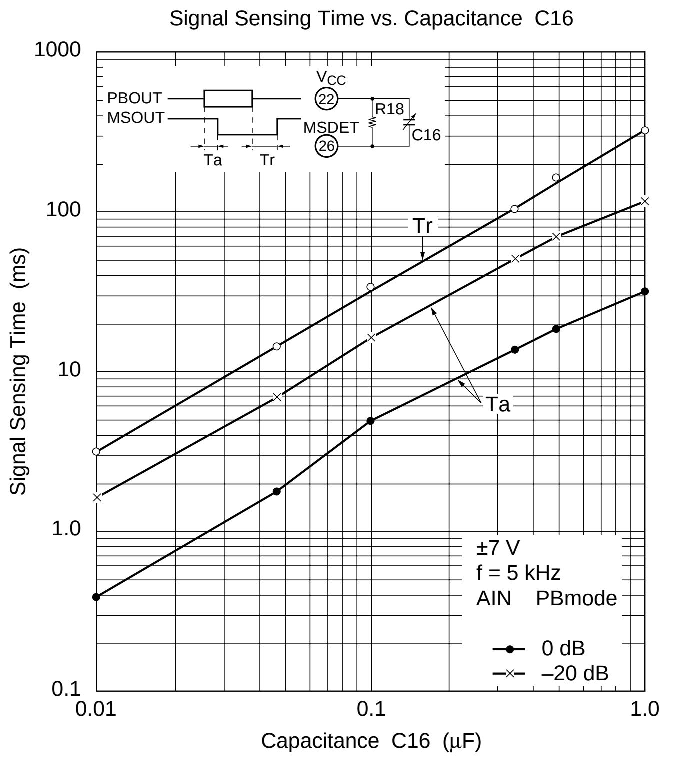
Signal Sensing Time vs. Capacitance C16
1000
100
10
1.0
0.1
Signal Sensing Time (ms)
PBOUT
MSOUT
Ta
Tr
VCC
22
R18
MSDET
26
C16
Tr
Ta
±7 V
f = 5 kHz
AIN PBmode
0 dB
–20 dB
0.01
0.1
1.0
Capacitance C16 (µF)

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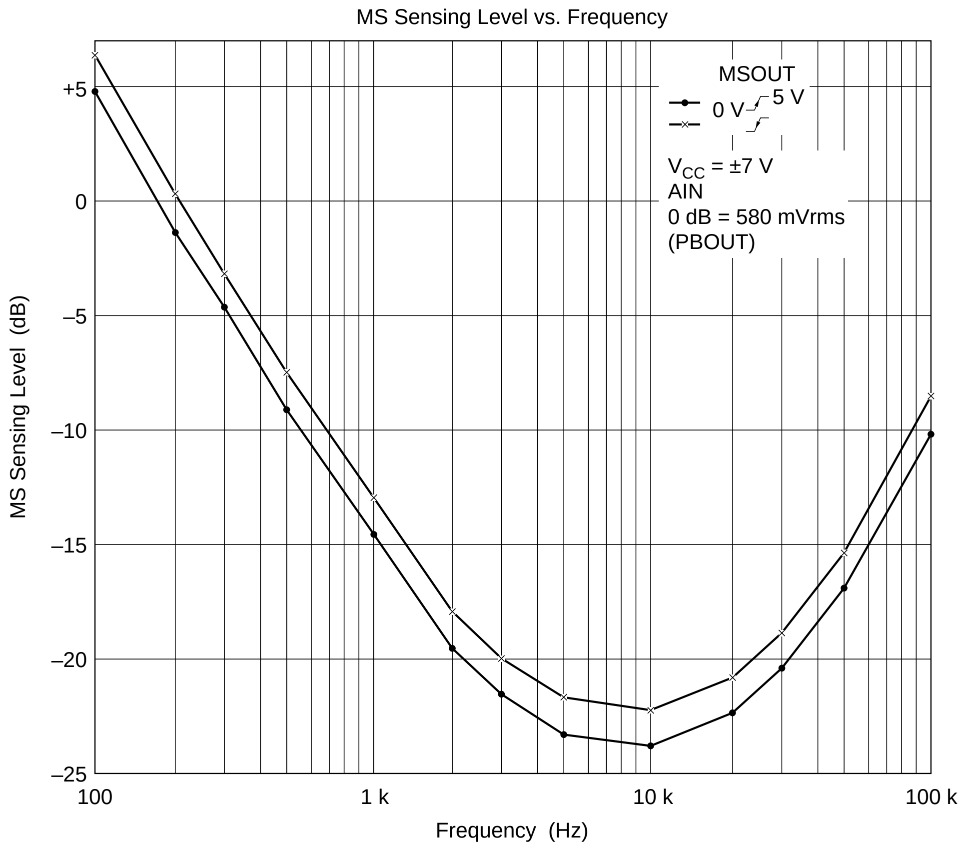
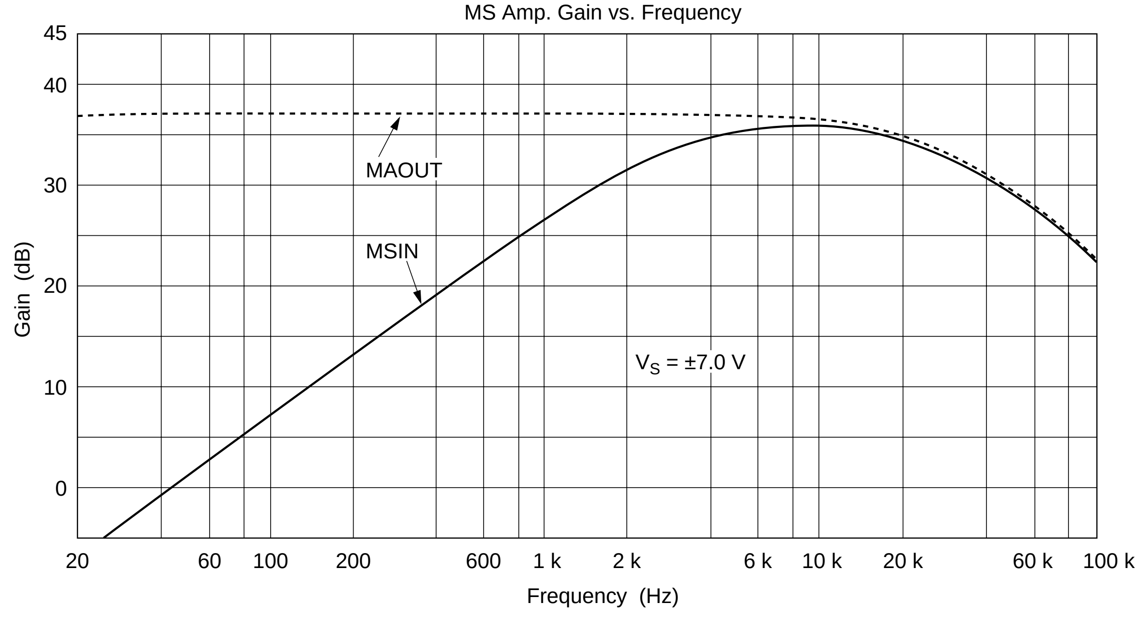
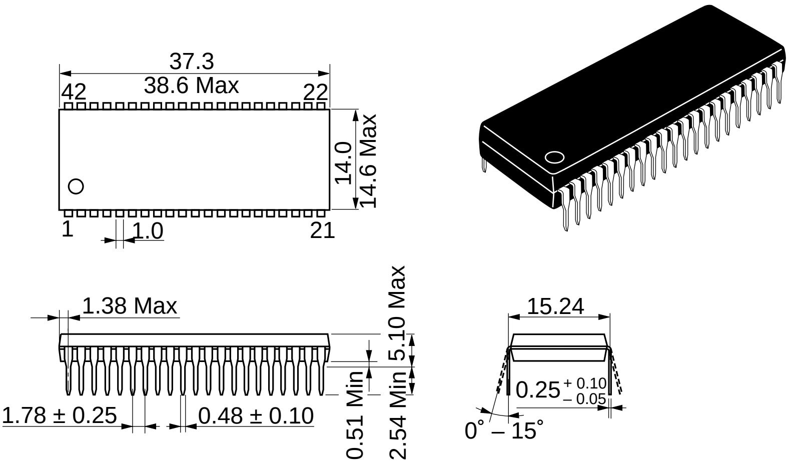

MS Sensing Level vs. Frequency
MSOUT
0 V
5 V
VCC = ±7 V
AIN
0 dB = 580 mVrms
(PBOUT)
MS Sensing Level (dB)
+5
0
–5
–10
–15
–20
–25
100
1 k
10 k
100 k
Frequency (Hz)


MS Amp. Gain vs. Frequency
MAOUT
MSIN
VS = ±7.0 V
Gain (dB)
45
40
30
20
10
0
20
60
100
200
600
1 k
2 k
6 k
10 k
20 k
60 k
100 k
Frequency (Hz)

Package Dimensions

Unit: mm



Hitachi Code	DP-42S
JEDEC	—
EIAJ	Conforms
Weight (reference value)	4.8 g

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