
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.

HA12203NT/HA12204NT

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

Ordering Information

Standard Level

Product	Package	PB-OUT	REC-OUT	Dolby	Operating Voltage Range		
		Level	Level	Level	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				—			

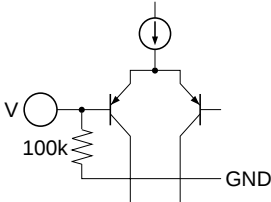
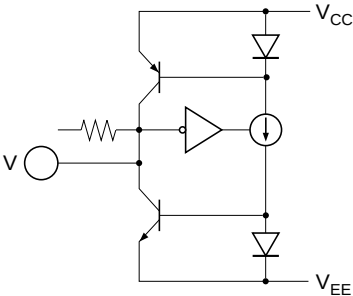
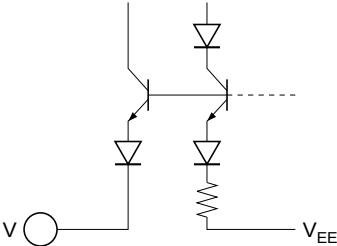
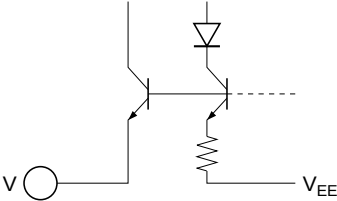
Function

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

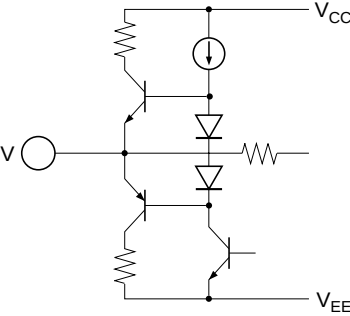
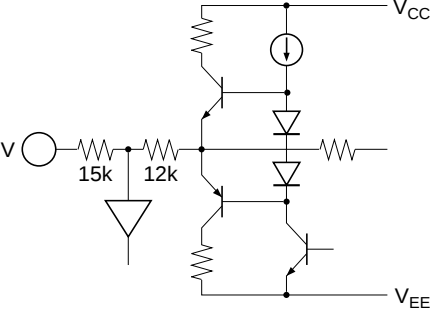
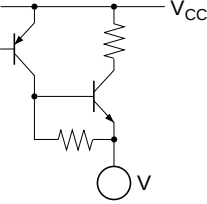
Note: Depending on the employed REC / PB head and test tape characteristics, there is a rare case that the REC-EQ characteristics of this LSI can not be matched to the required characteristics because of built-in resistors which determined the REC-EQ parameters in this case, please inquire the responsible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

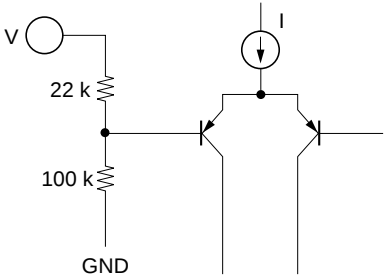
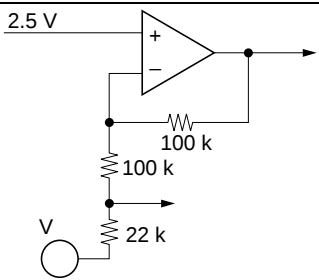
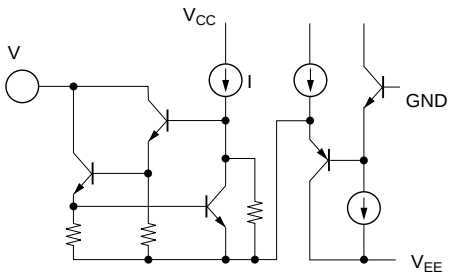
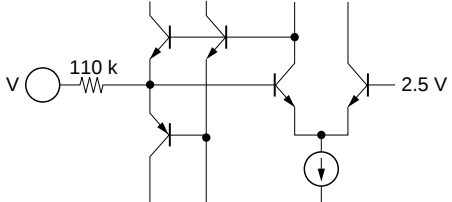
Pin Description, Equivalent Circuit

($V_{CC} = \pm 7\text{ V}$, $T_a = 25^\circ\text{C}$, No Signal, The value in the show typical value.)

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

HA12203NT/HA12204NT

Pin No.	Terminal Name	Note	Equivalent Circuit	Pin Description
8	PBOUT (R)	$V = \text{GND}$		PB output
35	PBOUT (L)			
9	RECOUT (R)	$V = \text{GND}$		REC output
34	RECOUT (L)			
11	EQOUT (R)	$V = \text{GND}$		Equalizer output
32	EQOUT (L)			
28	MAOUT	$V = \text{GND}$		MS Amp output
3	ABO (R)	$V = \text{GND}$		Time constant pin for PB equalizer
40	ABO (L)	$V = \text{GND}$		
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	$I = 50\mu\text{A}$		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	$I = 0\mu\text{A}$		MS output (to MPU)*1)
30	GPCAL	$V = \text{GND}$		GP gain Calibration terminal
31	RECCAL	$V = \text{GND}$		REC gain calibration terminal

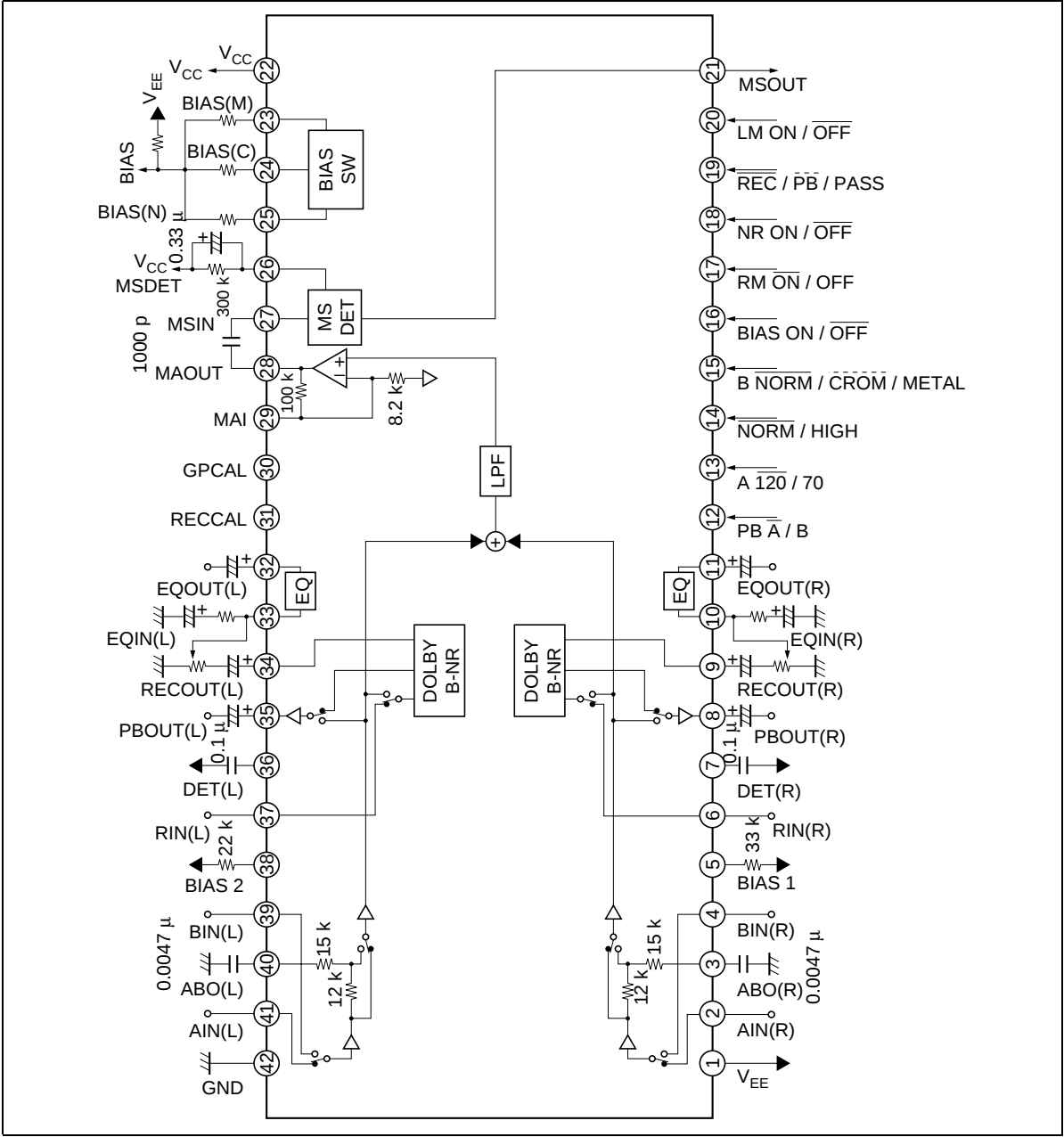
HA12203NT/HA12204NT

Pin No.	Terminal Name	Note	Equivalent Circuit	Pin Description
26	MSDET	$I = 0\mu A$		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.

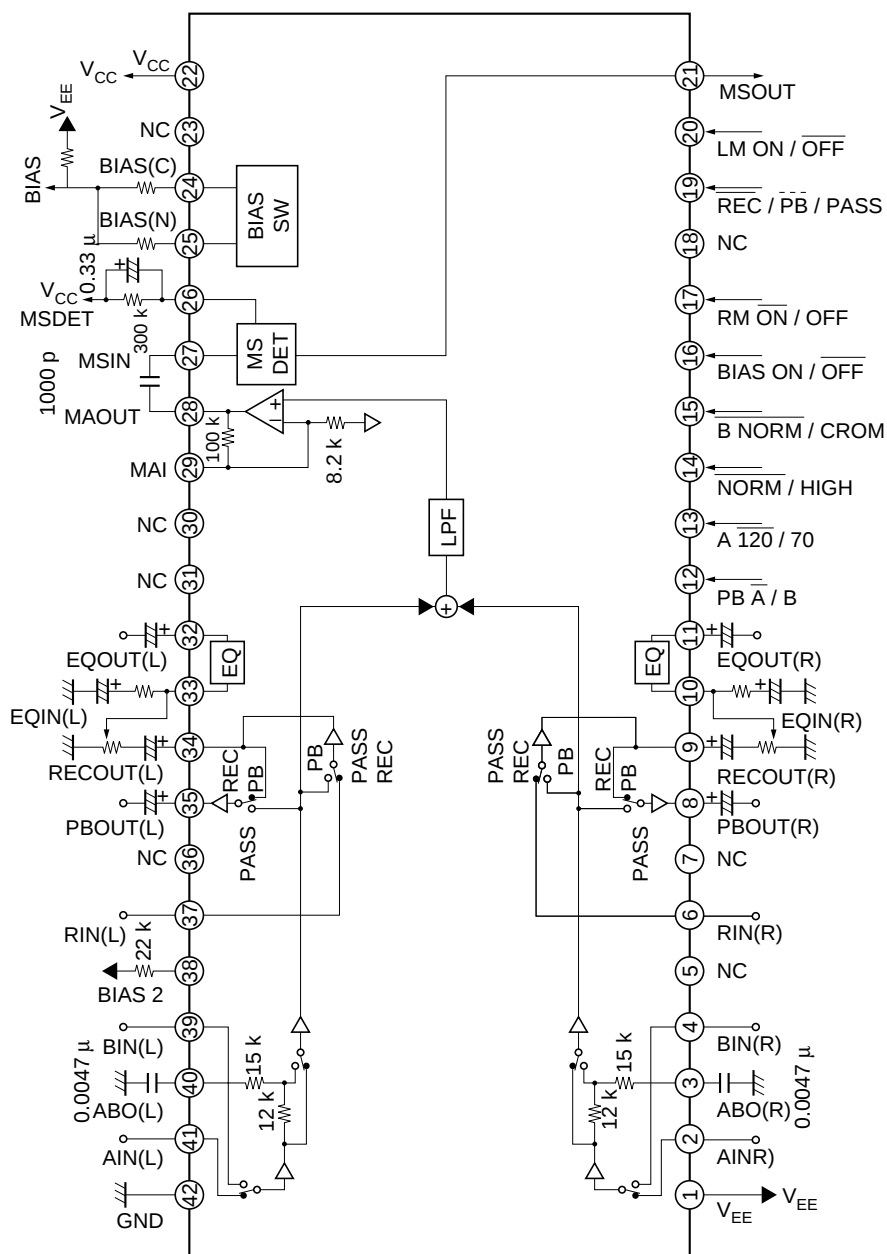
Block Diagram

HA12203NT



HA12203NT/HA12204NT

HA12204NT



HA12203NT Parallel-Data Format

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

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

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	V _{CC} + V _{EE} < 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.

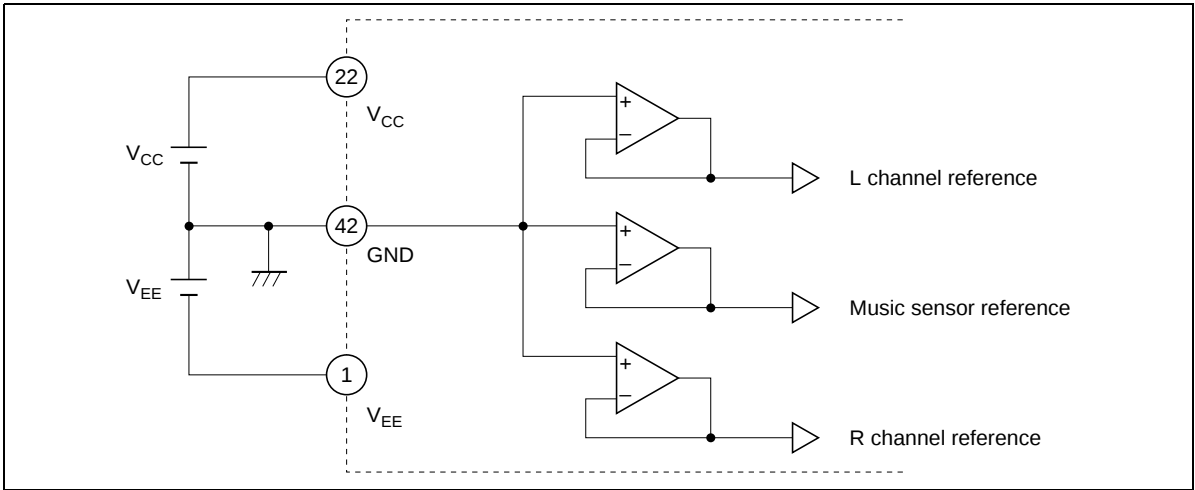


Figure 1 Reference Voltage

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:
- 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.
 - Over shoot level and under shoot level of input signal must be the standardized (High: V_{cc}, Low: -0.2V).
 - 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.

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

$$\begin{aligned}
 A &= \text{MS Amp Gain} \\
 B &= \text{PB input Gain} \times (1/2)^{*1} \\
 C &= \text{Sensed voltage} \\
 20\log (A \times B) &= D \text{ [dB]} \\
 C &= 130 \text{ [mVrms]} \\
 \text{PB input Gain} &= 21.3 \text{ [dB]} \\
 S &= 20\log \frac{C}{25.9 \cdot A \cdot B} \text{ [dB]} \\
 S &= 14 \text{ D [dB]}
 \end{aligned}$$

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.

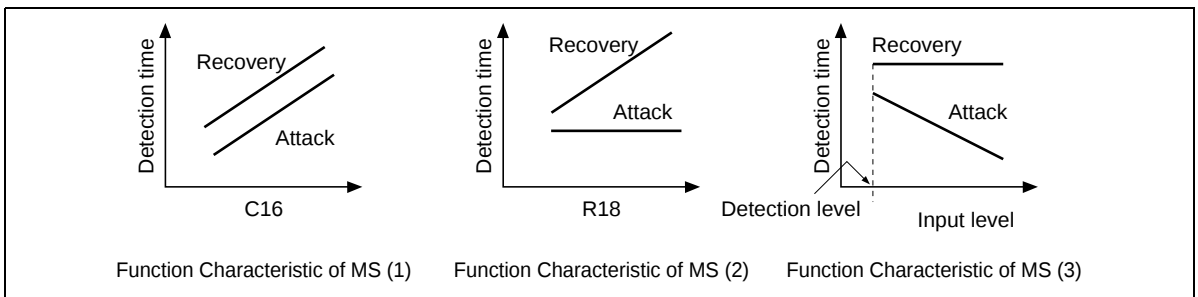


Figure 6 Function Characteristic of MS

Like the figure 6(2), Recovery time is variably possible by value of resistor 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 ($R_L = 10 \text{ k}\Omega$ to $22 \text{ k}\Omega$)

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.

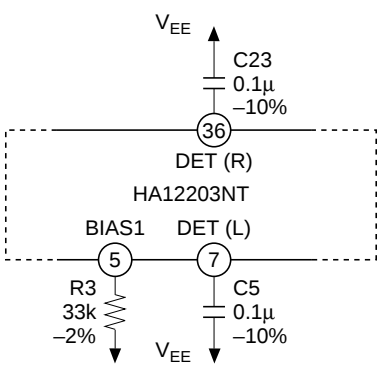


Figure 7 Tolerance of External Components

Low-Boost

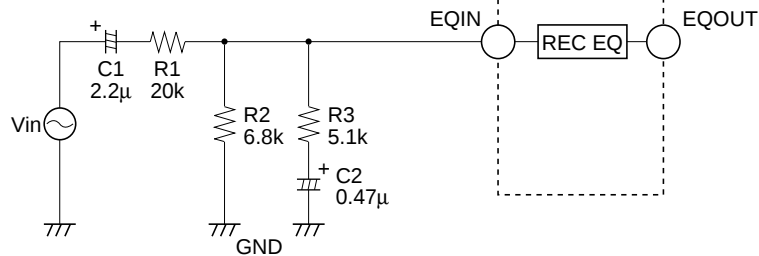


Figure 8 Example of Low Boost Circuit

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

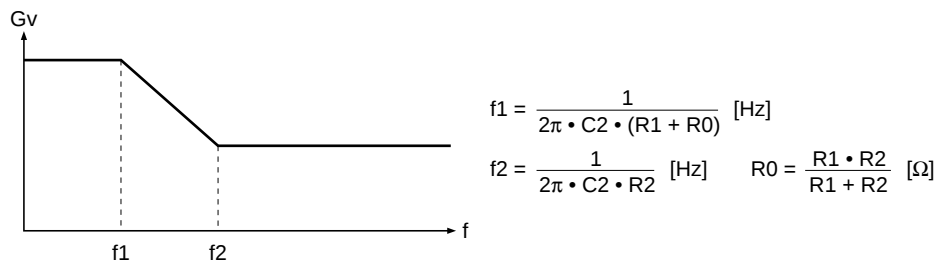


Figure 9 Frequency Characteristic of Low-Boost

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 $\pm 4.5\text{dB}$. 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.

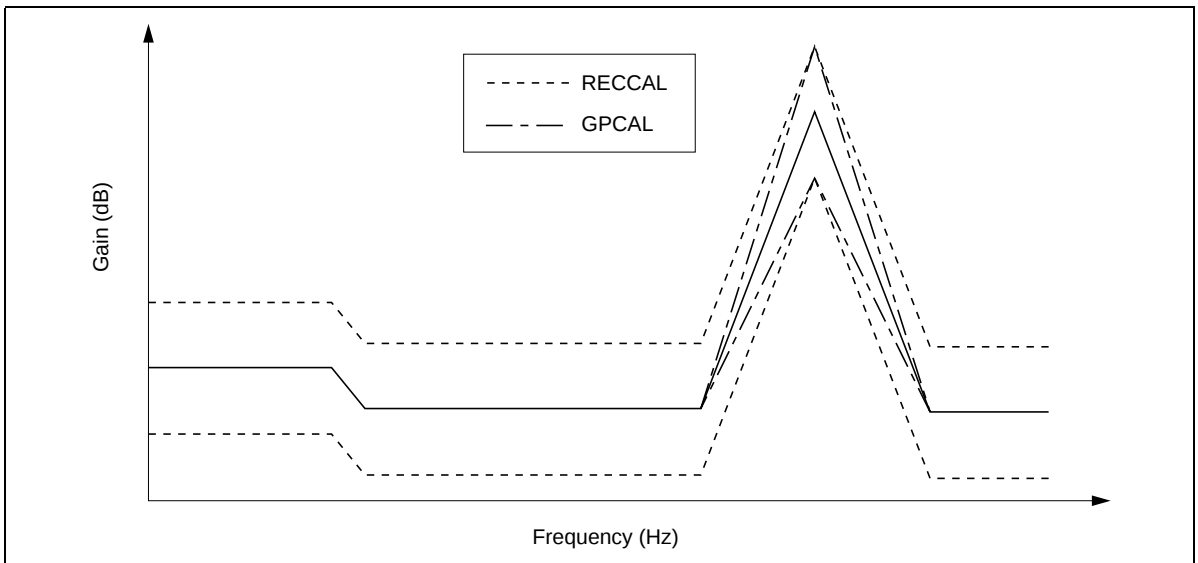


Figure 10 Frequency Characteristics of REC Equalizer

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.

$$V_{bias} \doteq \left(\frac{R_{14}}{(R_{15} \text{ or } R_{16} \text{ or } R_{17}) + R_{14}} \right) \times (V_{CC} - V_{EE} - 0.7) + V_{EE} \text{ [V]}$$

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.

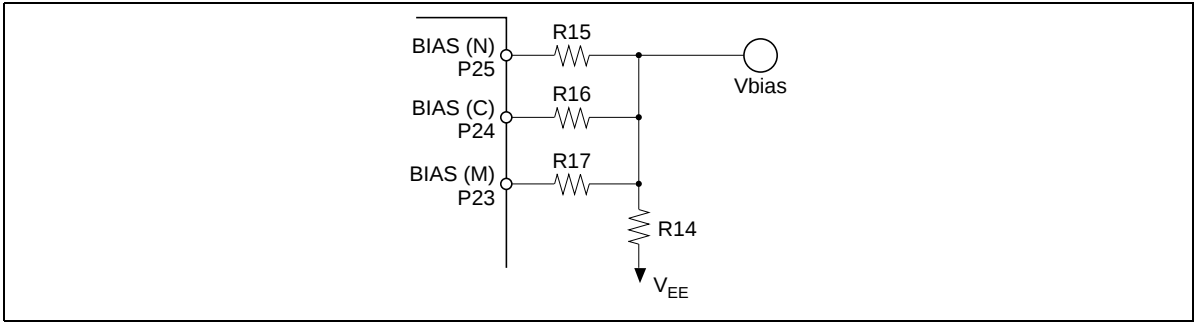


Figure 11 External Components of Bias Block

Absolute Maximum Ratings

Item	Symbol	Rating	Unit	Note
Max Supply Voltage	V_{cc} max	16	V	
Power Dissipation	Pd	500	mW	$T_a \leq 75^{\circ}\text{C}$
Operating Temperature	Topr	– 40 to + 75	$^{\circ}\text{C}$	
Storage Temperature	Tstg	– 55 to + 125	$^{\circ}\text{C}$	

HA12203NT/HA12204NT

Electrical Characteristics

HA12203NT

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

Item	Symbol	Test Condition							Unit	Specification				Remark	
		IC Condition *					Other	Specification							
		NR ON/OFF	REC/PB /PASS	A/B	120µ/ 70µ	LINE MUTE		f _{in} (Hz)		RECOUT level (dB)	Min	Typ	Max		
Quiescent current	I _Q	OFF	PB	A	120	Mute	—	—	No signal	—	22.0	35.0	—	—	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	—
	V _o 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	G _V PA	OFF	PASS	A/B	120	OFF	1k	0	G _V PA – G _V PB	25.5	27.0	28.5	dB	2/4 41/39	8 35 —
Gain deviation	ΔG _V	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. VCC = ±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			
			Max				Output						
			TAPE	SPEED	Min		Typ	Max	R		L	R	L
Equalizer S/N	S/N (EQ)	NORM	NORM	R _g = 5.1kΩ, A - WTG Filter (0dB = -5dBs at EQOUT)	55	58	—	dB	10	33	11	32	—
Equalizer maximum input	V _{in} max (EQ)	NORM	NORM	f = 1kHz, THD = 1%, V _{in} = -26dBs = 0dB	10.5	12.5	—	dB	10	33	11	32	—
Equalizer Total Harmonic Distortion	T.H.D. (EQ)	NORM	NORM	f = 1kHz, V _{in} = -26dBs	—	0.2	0.5	%	10	33	11	32	—
Equalizer offset voltage	V _{ofs} (EQ)	NORM	NORM	No - Signal	-500	0	500	mV	10	33	11	32	—
Equalizer Frequency Response (NORM - NORM)	GVEQ-NN1	NORM	NORM	f = 3kHz, V _{in} = -46dBs	18.8	20.3	21.8	dB	10	33	11	32	—
	GVEQ-NN2			f = 8kHz, V _{in} = -46dBs	23.9	25.9	27.9	dB	10	33	11	32	—
	GVEQ-NN3			f = 12kHz, V _{in} = -46dBs	30.1	32.6	35.1	dB	10	33	11	32	—
Equalizer Frequency Response (CROM - NORM)	GVEQ-CN1	CROM	NORM	f = 3kHz, V _{in} = -46dBs	24.0	25.5	27.0	dB	10	33	11	32	—
	GVEQ-CN2			f = 8kHz, V _{in} = -46dBs	29.8	31.8	33.8	dB	10	33	11	32	—
	GVEQ-CN3			f = 12kHz, V _{in} = -46dBs	36.3	38.8	41.3	dB	10	33	11	32	—
Equalizer Frequency Response (METAL - NORM)	GVEQ-MN1	METAL	NORM	f = 3kHz, V _{in} = -46dBs	24.8	26.3	27.8	dB	10	33	11	32	—
	GVEQ-MN2			f = 8kHz, V _{in} = -46dBs	27.8	29.8	31.8	dB	10	33	11	32	—
	GVEQ-MN3			f = 12kHz, V _{in} = -46dBs	31.4	33.9	36.4	dB	10	33	11	32	—
Equalizer Frequency Response (NORM - High)	GVEQ-NH1	NORM	HIGH	f = 5kHz, V _{in} = -46dBs	14.9	16.4	17.9	dB	10	33	11	32	—
	GVEQ-NH2			f = 15kHz, V _{in} = -46dBs	20.2	22.2	24.2	dB	10	33	11	32	—
	GVEQ-NH3			f = 20kHz, V _{in} = -46dBs	24.1	26.6	29.1	dB	10	33	11	32	—
Equalizer Frequency Response (CROM - High)	GVEQ-Q-CH1	CROM	HIGH	f = 5kHz, V _{in} = -46dBs	20.7	22.2	23.7	dB	10	33	11	32	—
	GVEQ-Q-CH2			f = 15kHz, V _{in} = -46dBs	25.1	27.1	29.1	dB	10	33	11	32	—
	GVEQ-Q-CH3			f = 20kHz, V _{in} = -46dBs	28.6	31.1	33.3	dB	10	33	11	32	—
Equalizer Frequency Response (METAL - High)	GVEQ-Q-MH1	METAL	HIGH	f = 5kHz, V _{in} = -46dBs	21.9	23.4	24.9	dB	10	33	11	32	—
	GVEQ-Q-MH2			f = 15kHz, V _{in} = -46dBs	23.8	25.8	27.8	dB	10	33	11	32	—
	GVEQ-Q-MH3			f = 20kHz, V _{in} = -46dBs	26.0	28.5	31.0	dB	10	33	11	32	—
REC - MUTE Attenuation	REC-MUTE	NORM	NORM	f = 1kHz, V _{in} = -14dBs	60	70	—	dB	10	33	11	32	—
REC CAL Response	R-CAL1	NORM	NORM	f = 3kHz, V _{in} = -46dBs, V _{REC-CAL} = 5V	3.0	4.5	6.0	dB	10	33	11	32	—
	R-CAL2			f = 3kHz, V _{in} = -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, V _{in} = -46dBs, V _{GP-CAL} = 0V	3.0	4.5	6.0	dB	10	33	11	32	—
	GP-CAL2			f = 12kHz, V _{in} = -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

HA12203NT/HA12204NT

HA12204NT

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

Item	Symbol	Test Condition						Specification			Unit	Application Terminal				Remark	
		IC Condition *				RECOUT level (dB)	fin (Hz)	Other	Min	Typ		Max	Input		Output		
		REC/PB /PASS	A/B	120μ/ 70μ	LINE MUTE								R	L	R		L
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	V _o 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	G _V PA	PASS	A/B	120	OFF	1k	0		25.5	27.0	28.5	dB	2/4	41/39	8	35	—
Gain deviation	ΔG _V	PASS	A/B	120	OFF	1k	0	G _V PA – G _V 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	—	—	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	—	—	—	—	12 to 17
Control voltage	V _{IL}	—	—	—	—	—	—		−0.2	—	1.0	V	—	—	—	—	19, 20
	V _{IM}	—	—	—	—	—	—		2.0	—	3.0		—	—	—	—	18 to 17
	V _{IH}	—	—	—	—	—	—		4.0	—	5.3		—	—	—	—	12 to 17
																	19, 20

Note 1) VCC = ±6V
2) For inputting signal to one side channel
* Other IC-condition : REC-MUTE OFF, Normal tape, Normal speed, Bias OFF

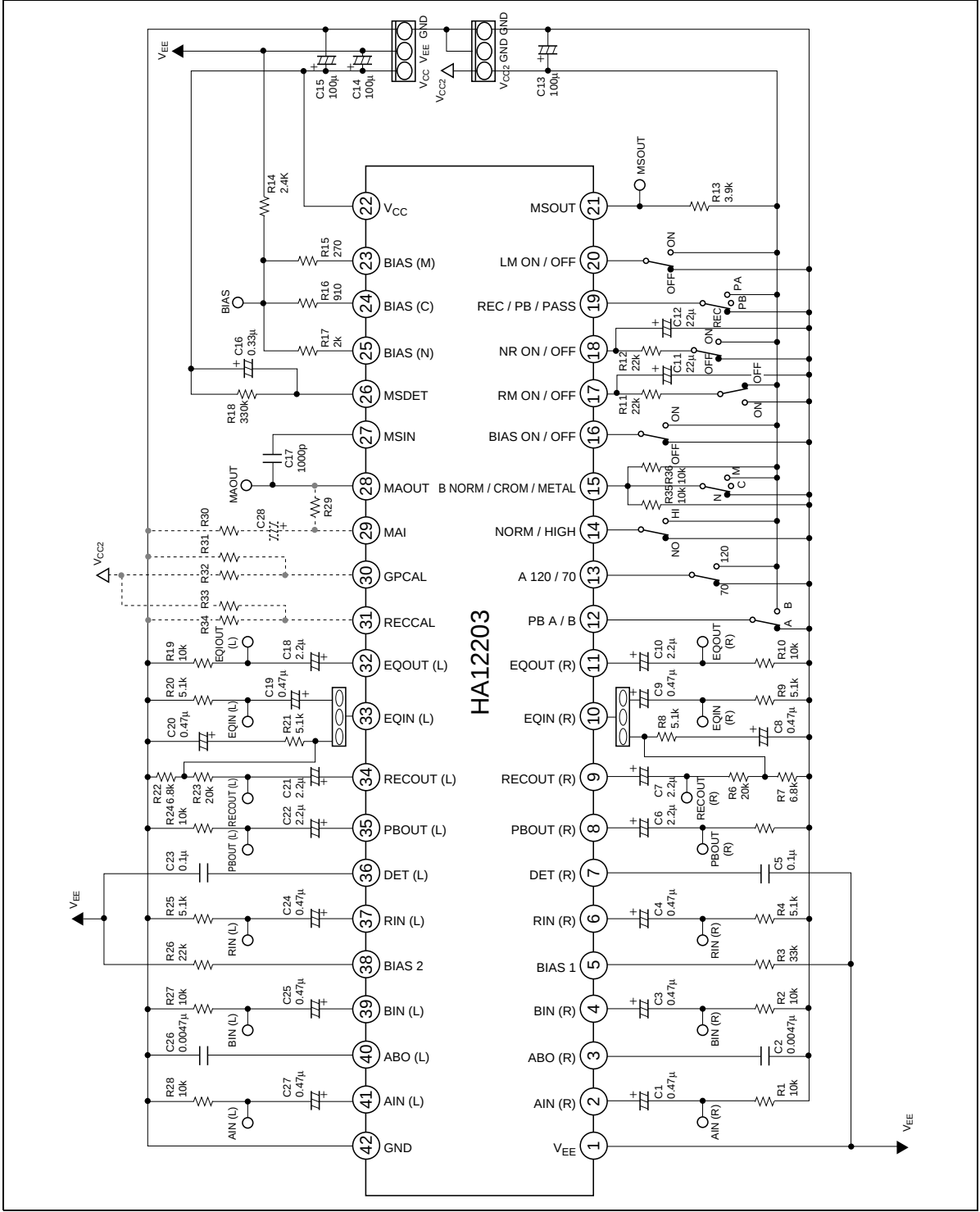
HA12204NT (cont)

(Ta = 25 °C, V_{CC} = ± 7 V)

Item	Symbol	Test Condition				Specification	Unit	Application Terminal				Remark		
		TAPE	SPEED	Input				Output						
				Min	Typ			Max	R	L	R		L	COM
Equalizer S/N	S/N (EQ)	NORM	NORM		R _g = 5.1kΩ, A - WTG Filter (0dB = -5dBs at EQOUT)	55	58	—	dB	10	33	11	32	—
Equalizer maximum input	V _{in} max (EQ)	NORM	NORM		f = 1kHz, THD = 1%, V _{in} = -26dBs = 0dB	10.5	12.5	—	dB	10	33	11	32	—
Equalizer Total Harmonic Distortion	T.H.D. (EQ)	NORM	NORM		f = 1kHz, V _{in} = -26dBs	—	0.2	0.5	%	10	33	11	32	—
Equalizer offset voltage	V _{ofs} (EQ)	NORM	NORM		No - Signal	-500	0	500	mV	10	33	11	32	—
Equalizer Frequency Response (NORM - NORM)	GVEQ-QN1	NORM	NORM		f = 3kHz, V _{in} = -46dBs	18.8	20.3	21.8	dB	10	33	11	32	—
	GVEQ-QN2				f = 8kHz, V _{in} = -46dBs	23.9	25.9	27.9	dB	10	33	11	32	—
	GVEQ-QN3				f = 12kHz, V _{in} = -46dBs	30.1	32.6	35.1	dB	10	33	11	32	—
Equalizer Frequency Response (CROM - NORM)	GVEQ-CN1	CROM	NORM		f = 3kHz, V _{in} = -46dBs	24.0	25.5	27.0	dB	10	33	11	32	—
	GVEQ-CN2				f = 8kHz, V _{in} = -46dBs	29.8	31.8	33.8	dB	10	33	11	32	—
	GVEQ-CN3				f = 12kHz, V _{in} = -46dBs	36.3	38.8	41.3	dB	10	33	11	32	—
Equalizer Frequency Response (NORM - High)	GVEQ-NH1	NORM	HIGH		f = 5kHz, V _{in} = -46dBs	14.9	16.4	17.9	dB	10	33	11	32	—
	GVEQ-NH2				f = 15kHz, V _{in} = -46dBs	20.2	22.2	24.2	dB	10	33	11	32	—
	GVEQ-NH3				f = 20kHz, V _{in} = -46dBs	24.1	26.6	29.1	dB	10	33	11	32	—
Equalizer Frequency Response (CROM - High)	GVEQ-CH1	CROM	HIGH		f = 5kHz, V _{in} = -46dBs	20.7	22.2	23.7	dB	10	33	11	32	—
	GVEQ-CH2				f = 15kHz, V _{in} = -46dBs	25.1	27.1	29.1	dB	10	33	11	32	—
	GVEQ-CH3				f = 20kHz, V _{in} = -46dBs	28.6	31.1	33.3	dB	10	33	11	32	—
REC - MUTE Attenuation	REC-MUTE	NORM	NORM		f = 1kHz, V _{in} = -14dBs	60	70	—	dB	10	33	11	32	—
Bias out Max level	Bias on				R _L = 2.4 k½ + 270 ½	V _{CC} -1.4	V _{CC} -0.7		V	—	—	—	—	25
Bias out offset	Bias off				R _L = 2.4 k½ + 270 ½	-100	0.0	100	mV	—	—	—	—	25

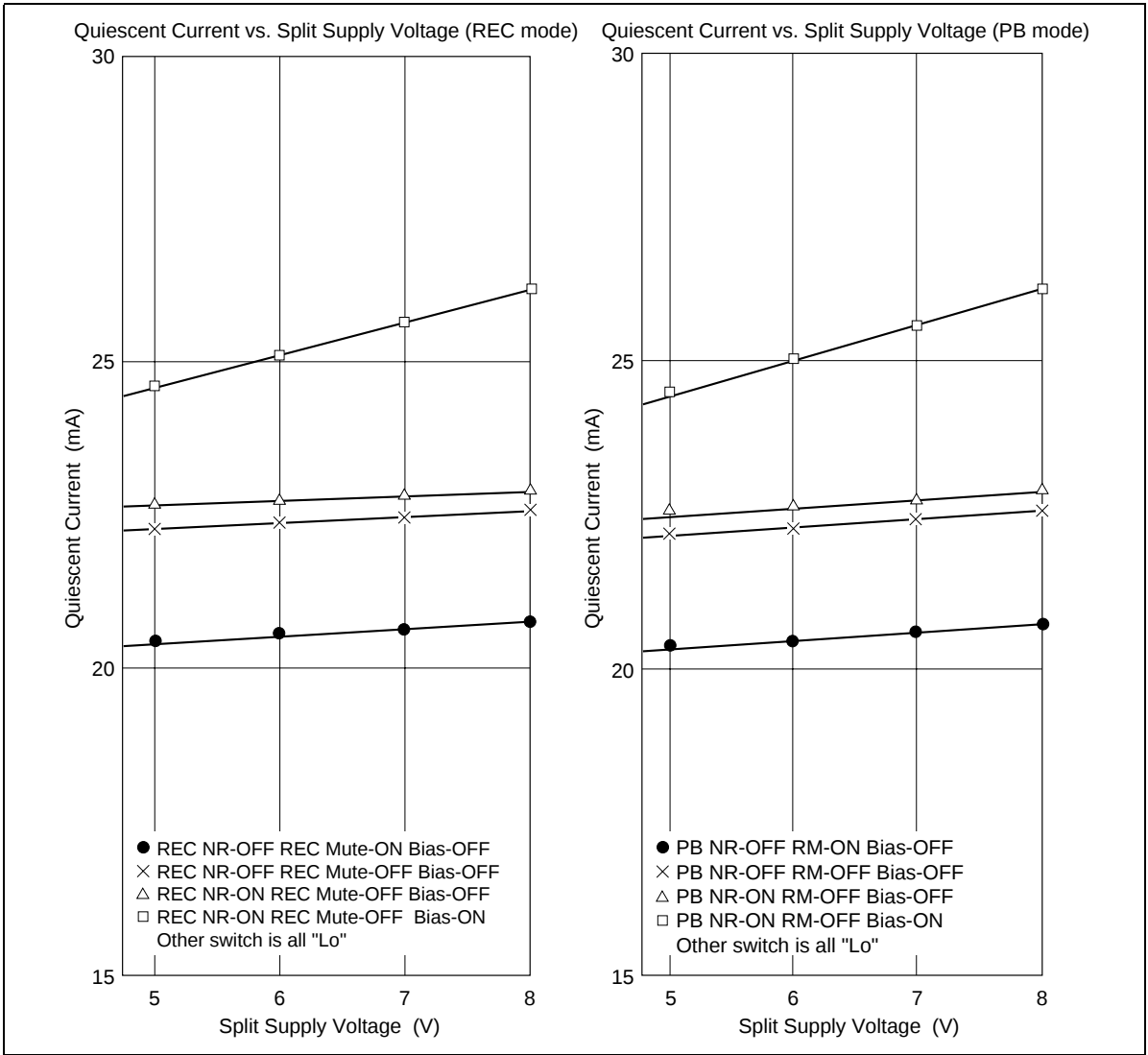
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Measurement Circuit



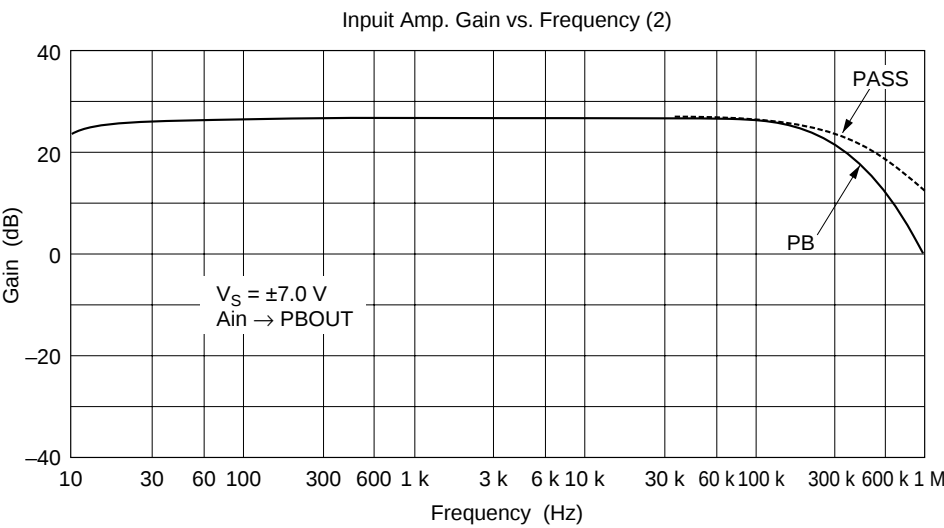
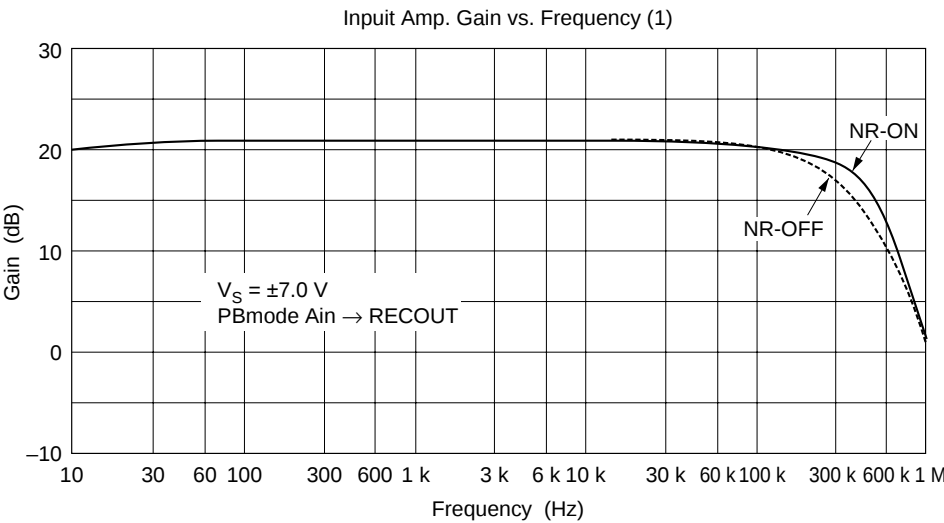
Electrical Characteristics Curve

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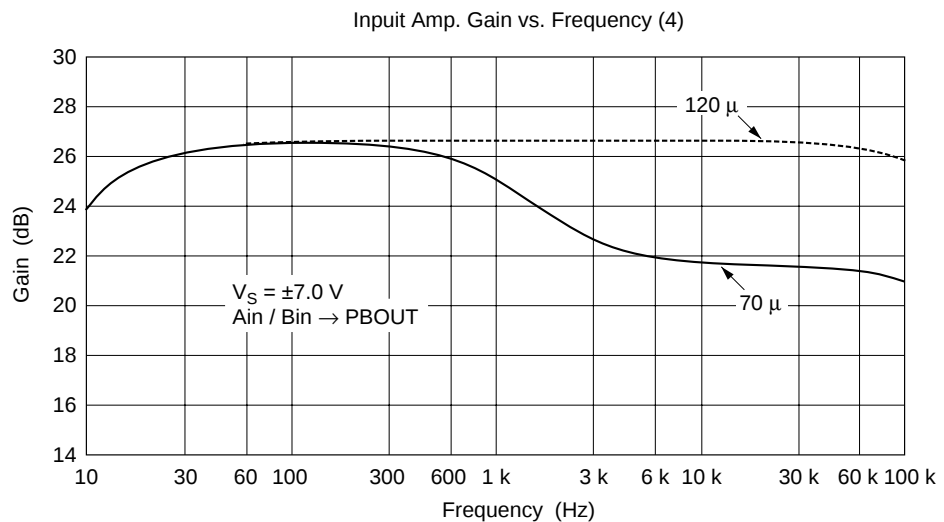
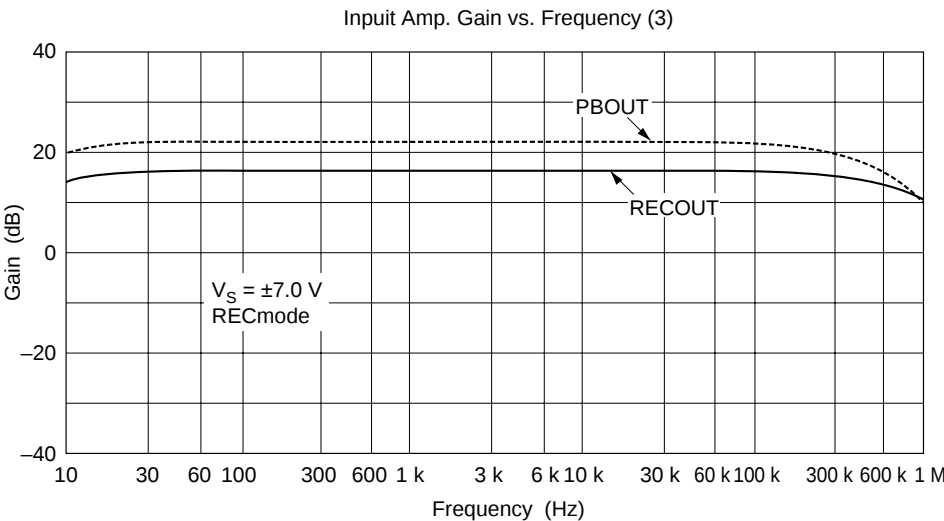


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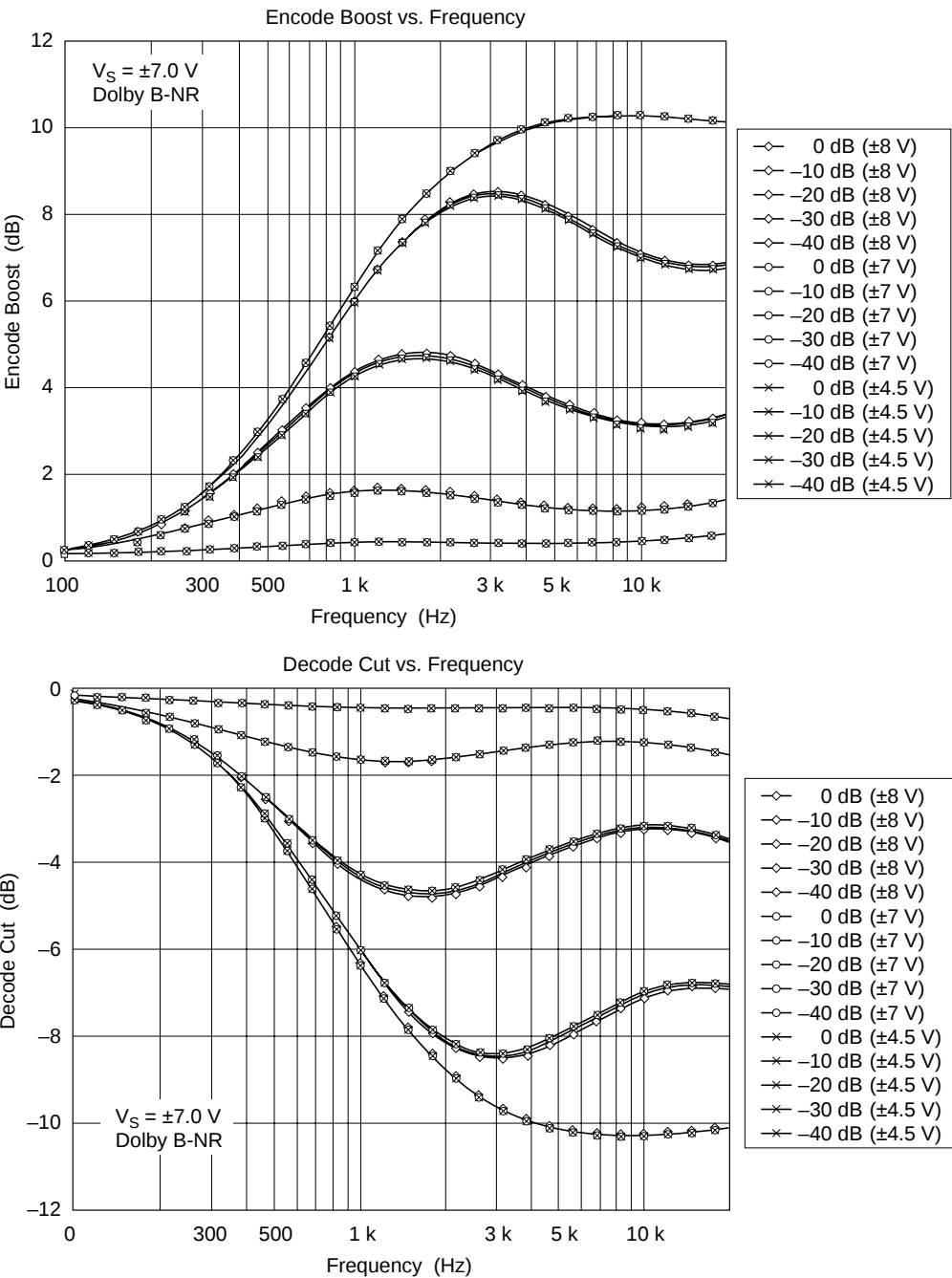
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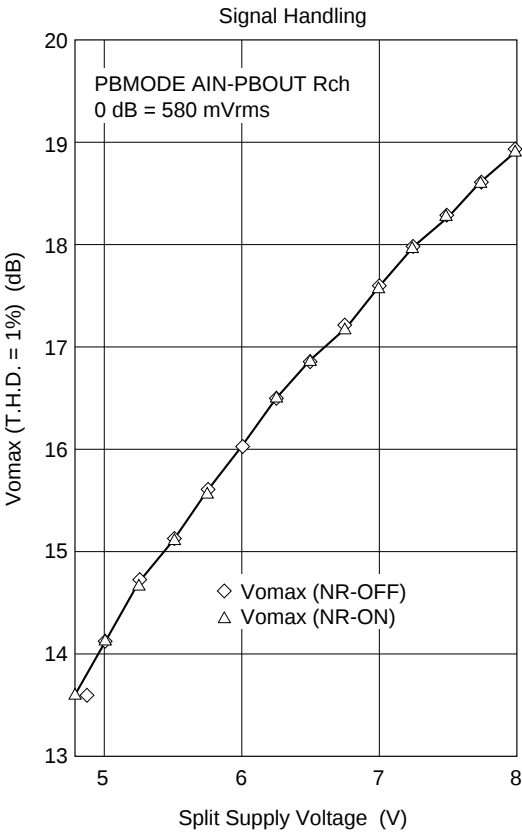
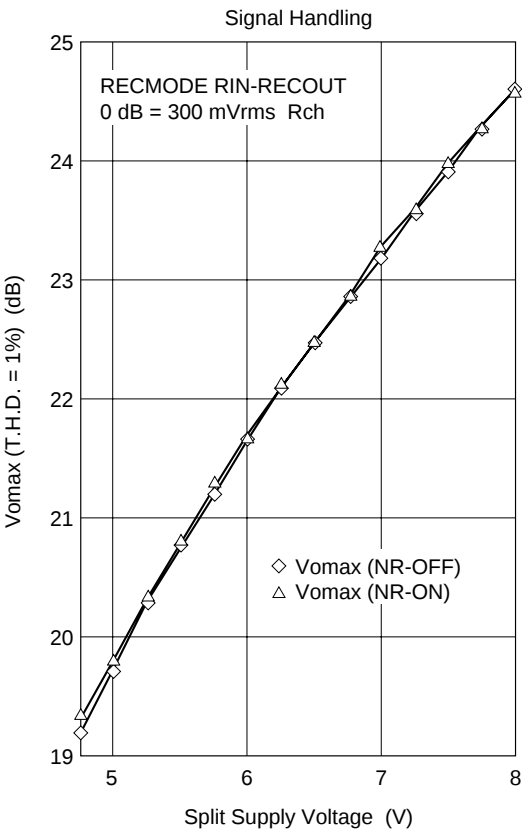
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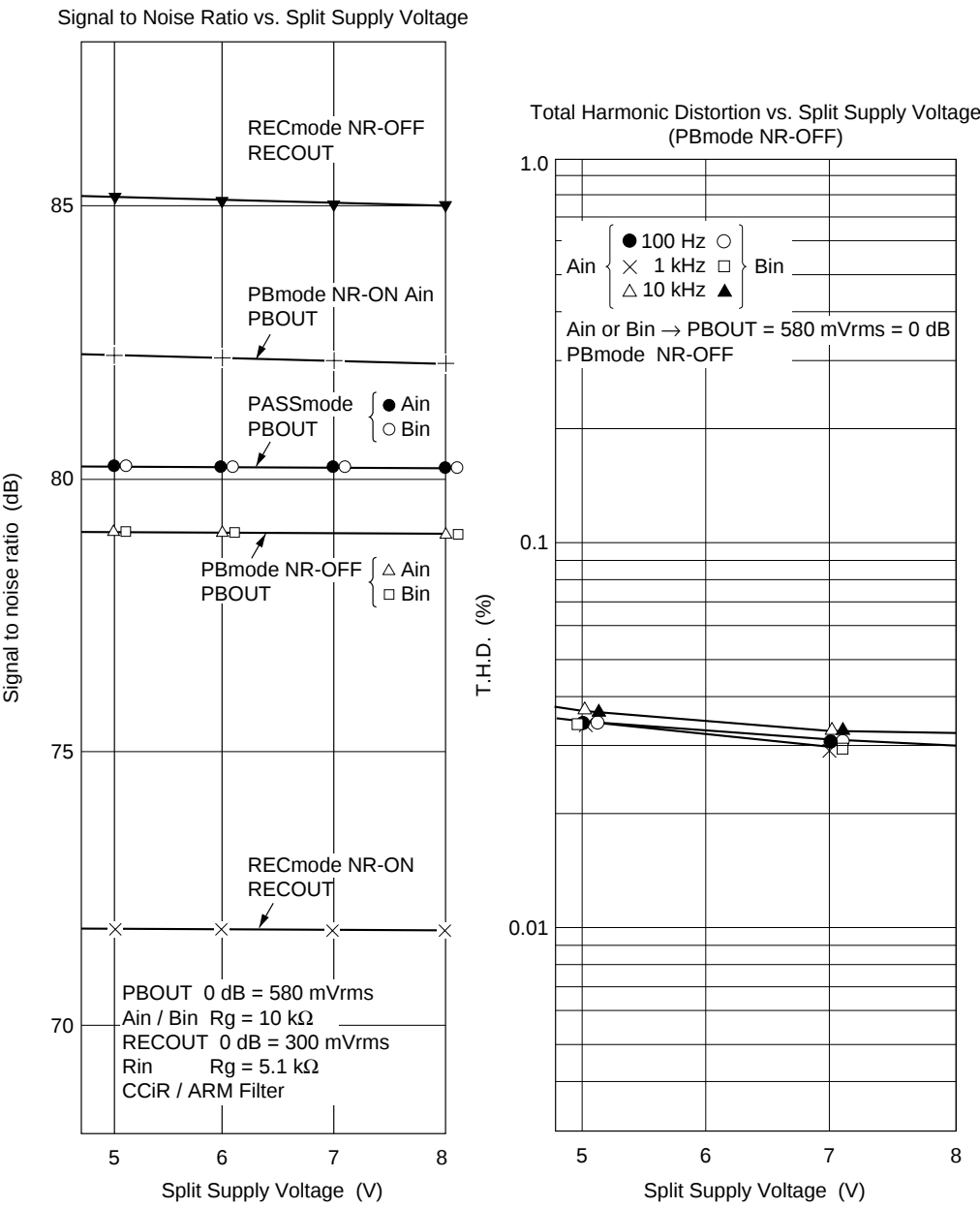
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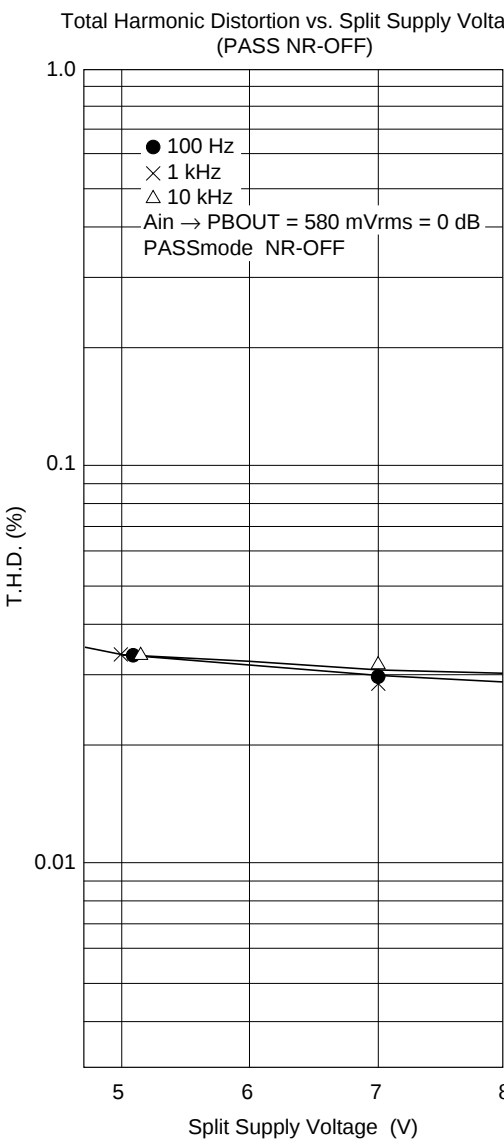
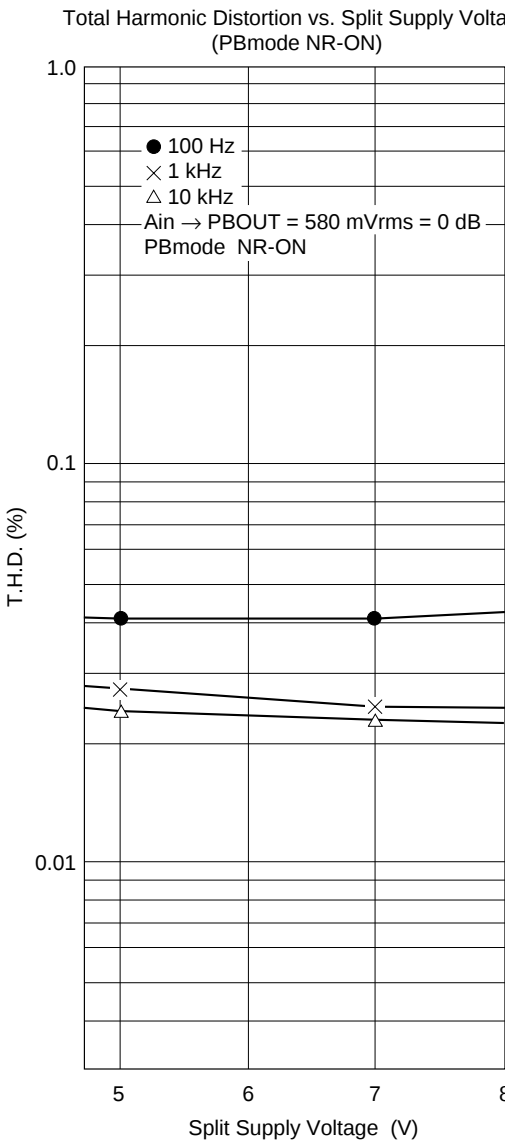
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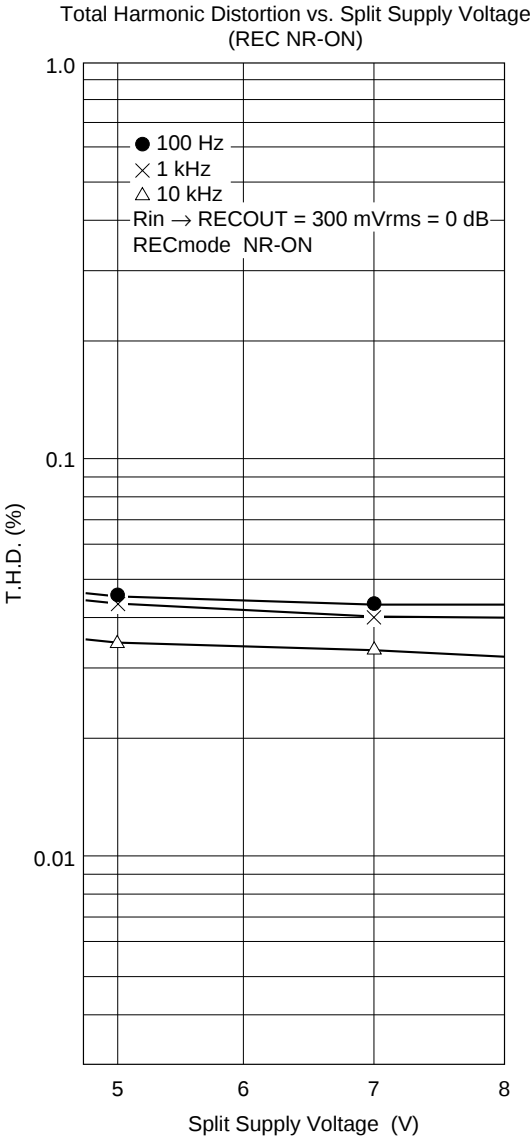
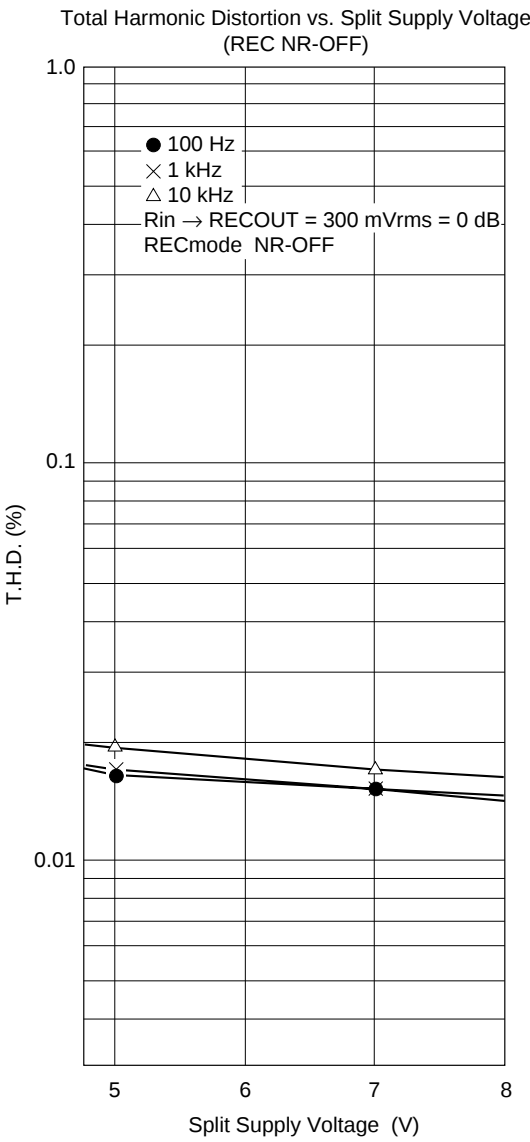
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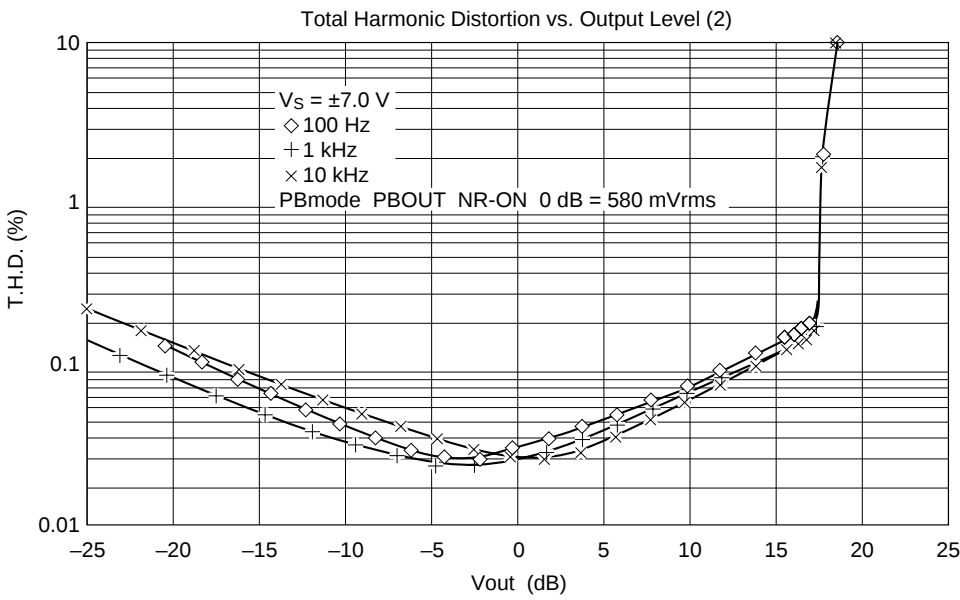
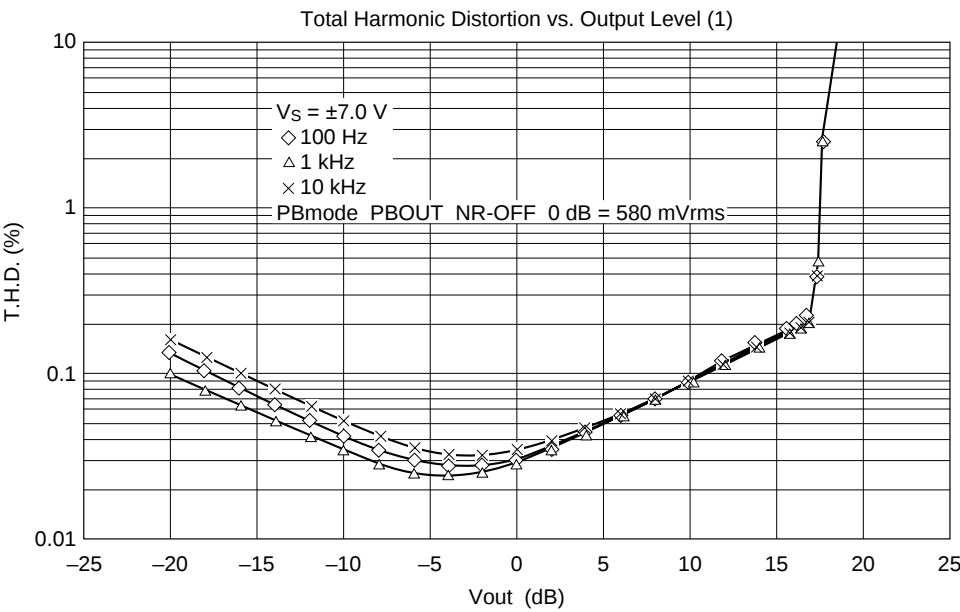
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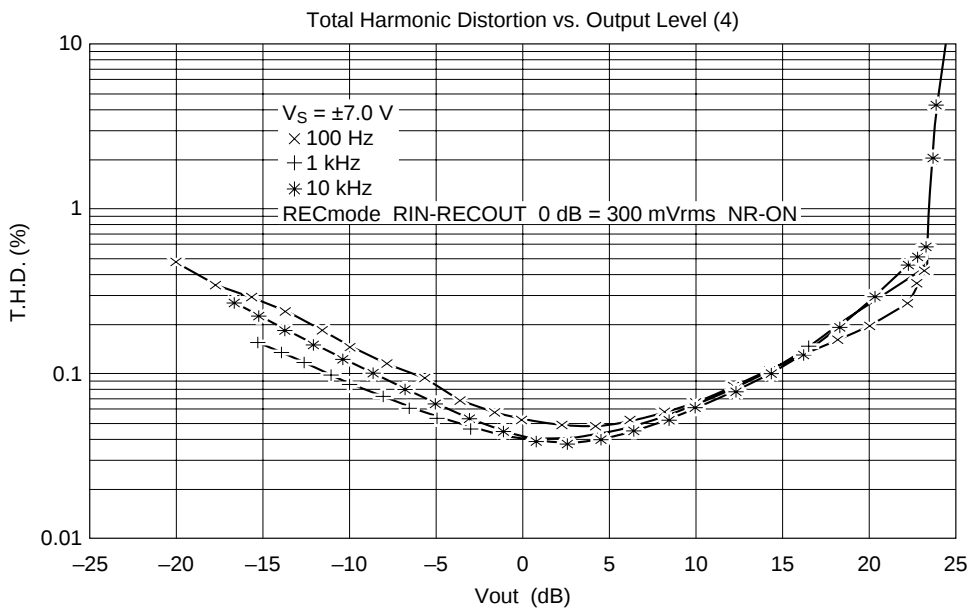
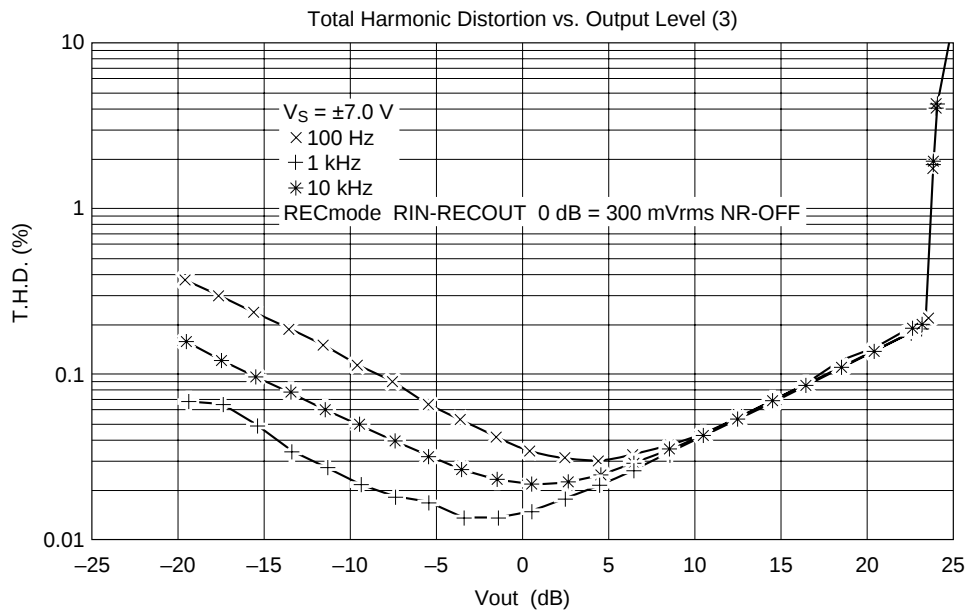
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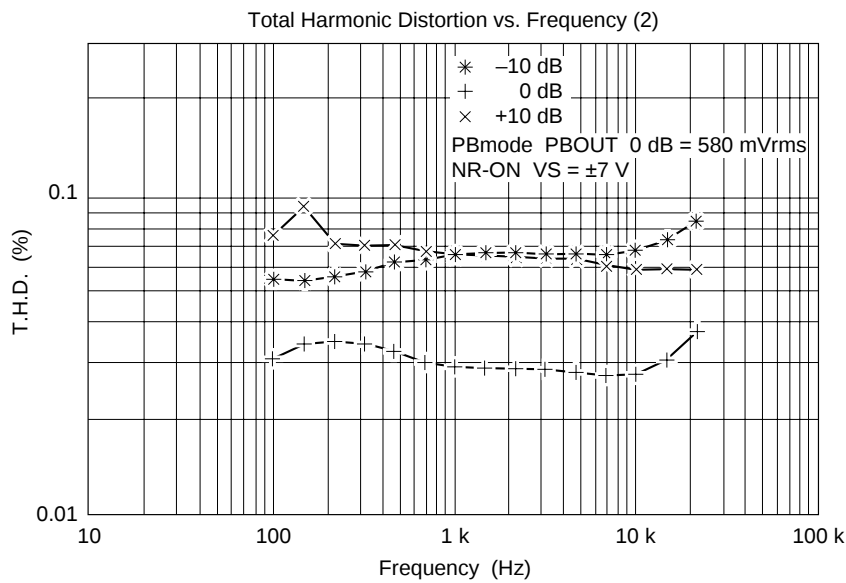
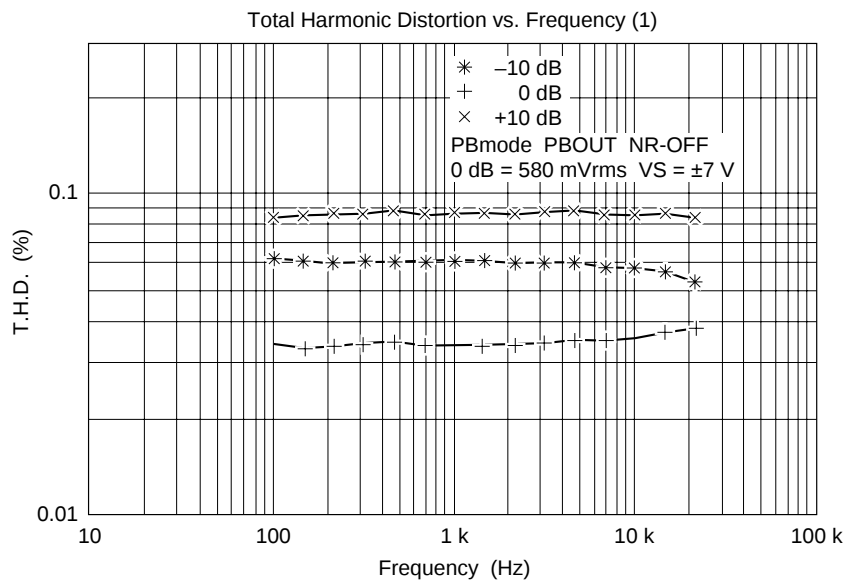
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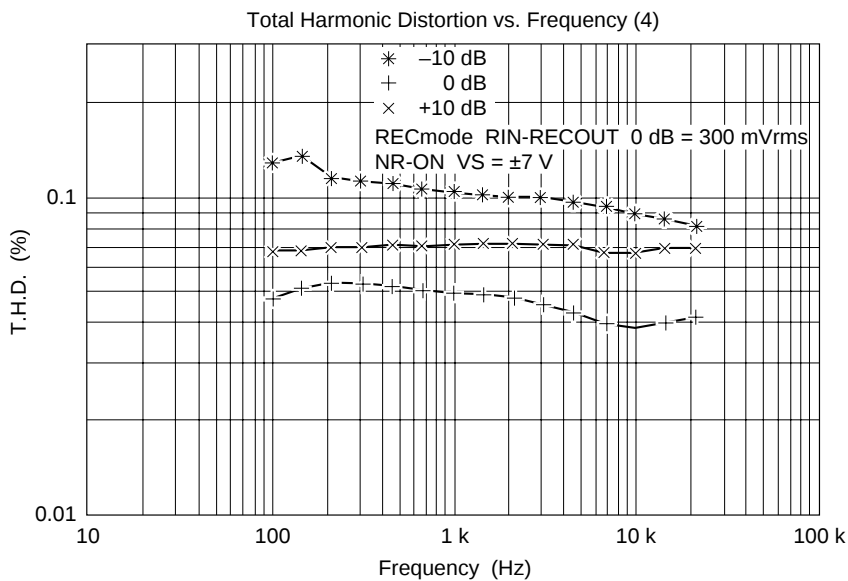
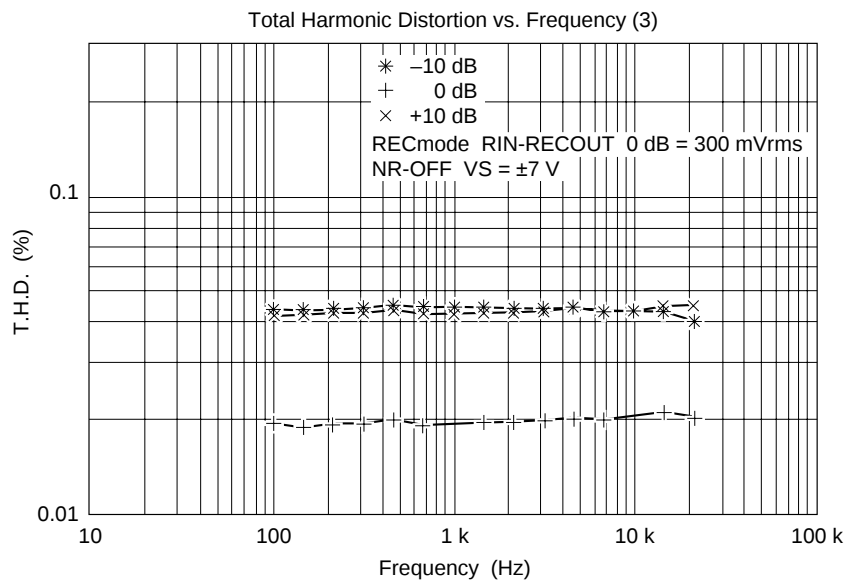
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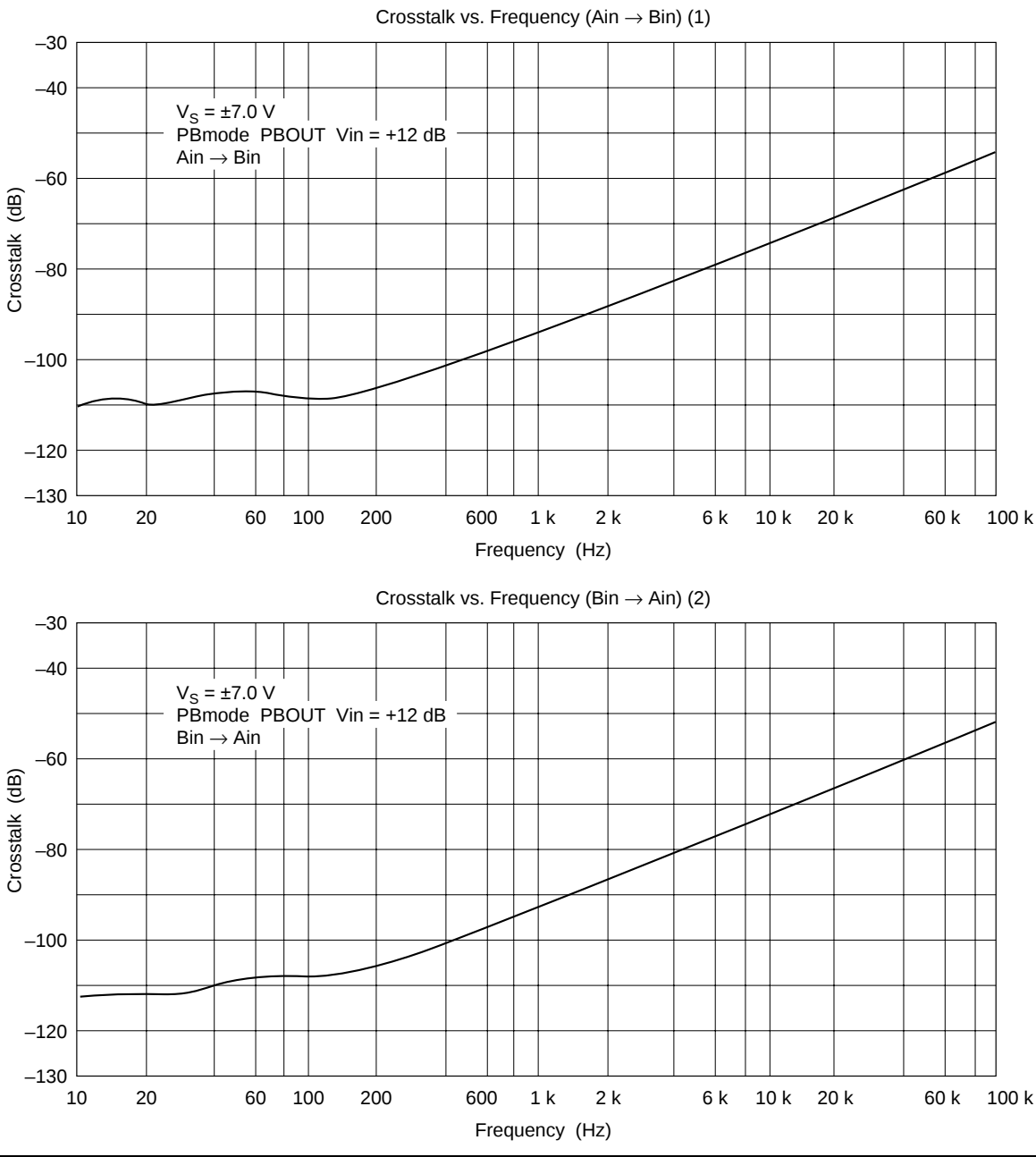
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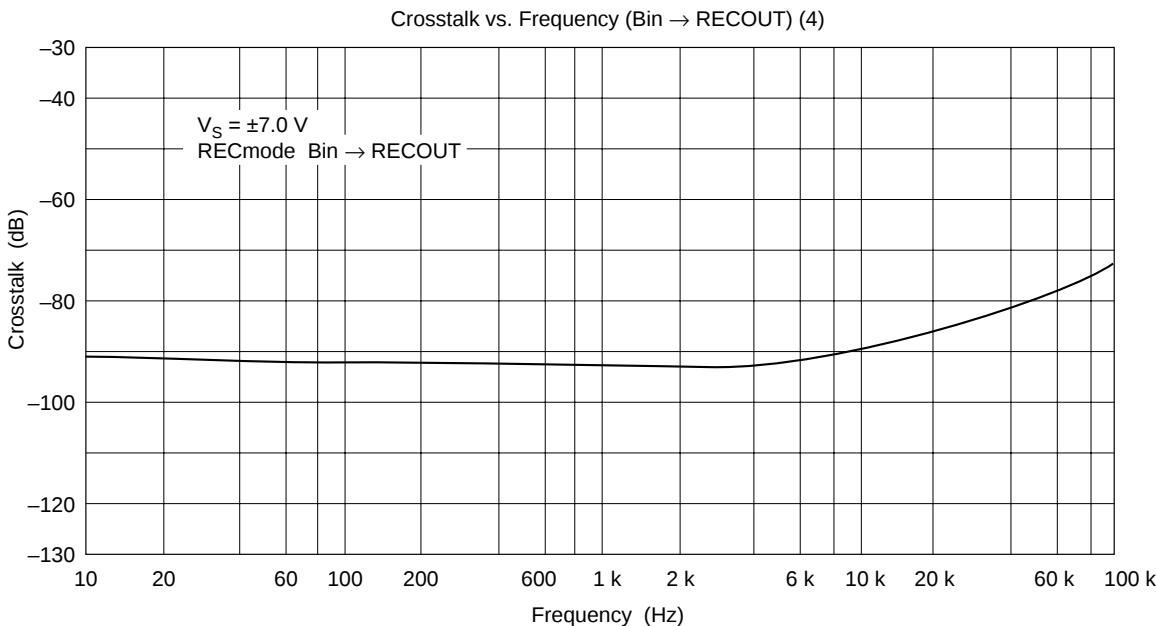
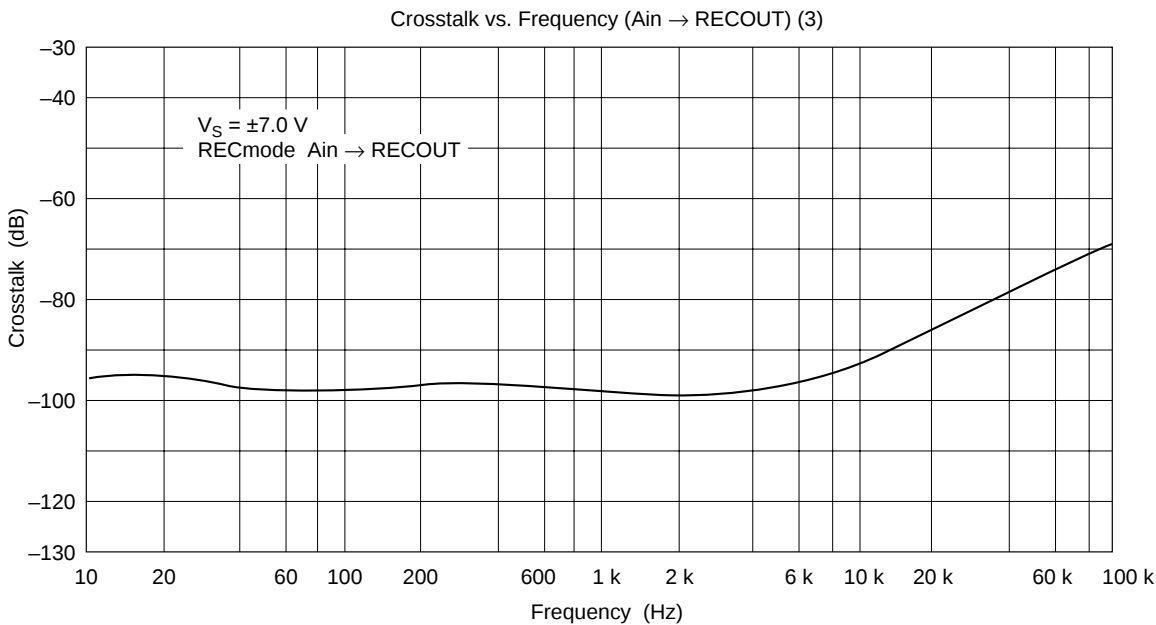
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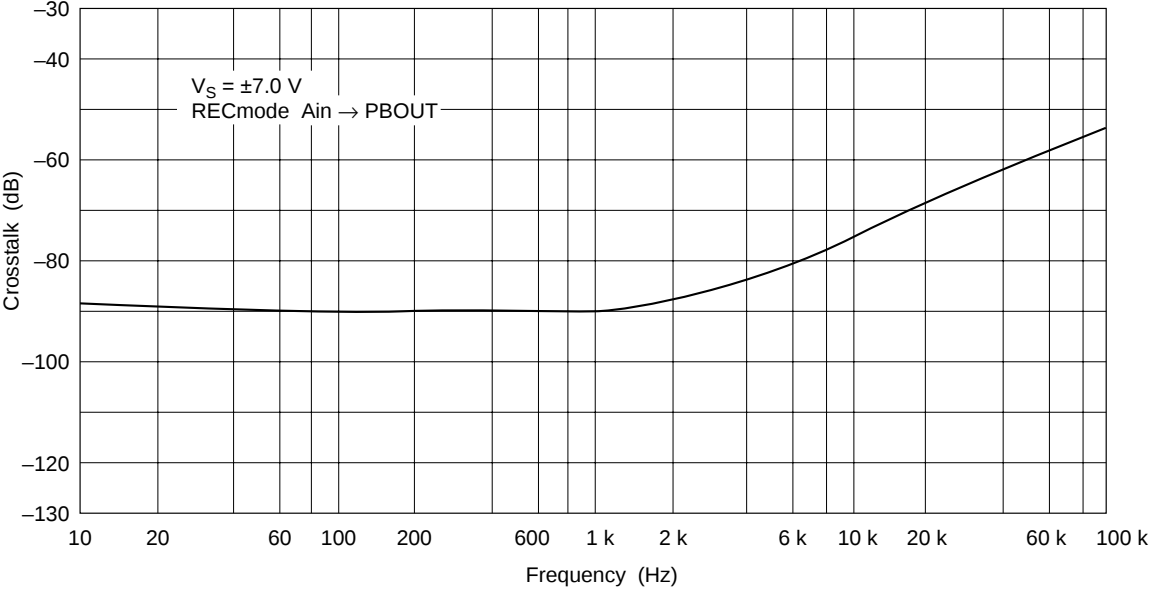


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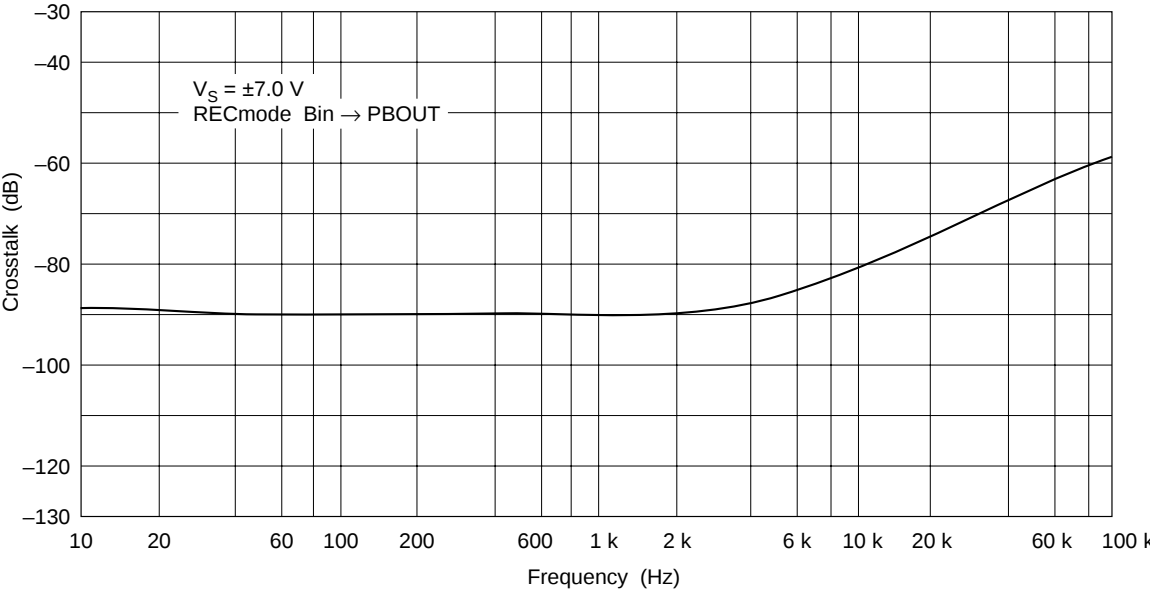


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Crosstalk vs. Frequency (5)

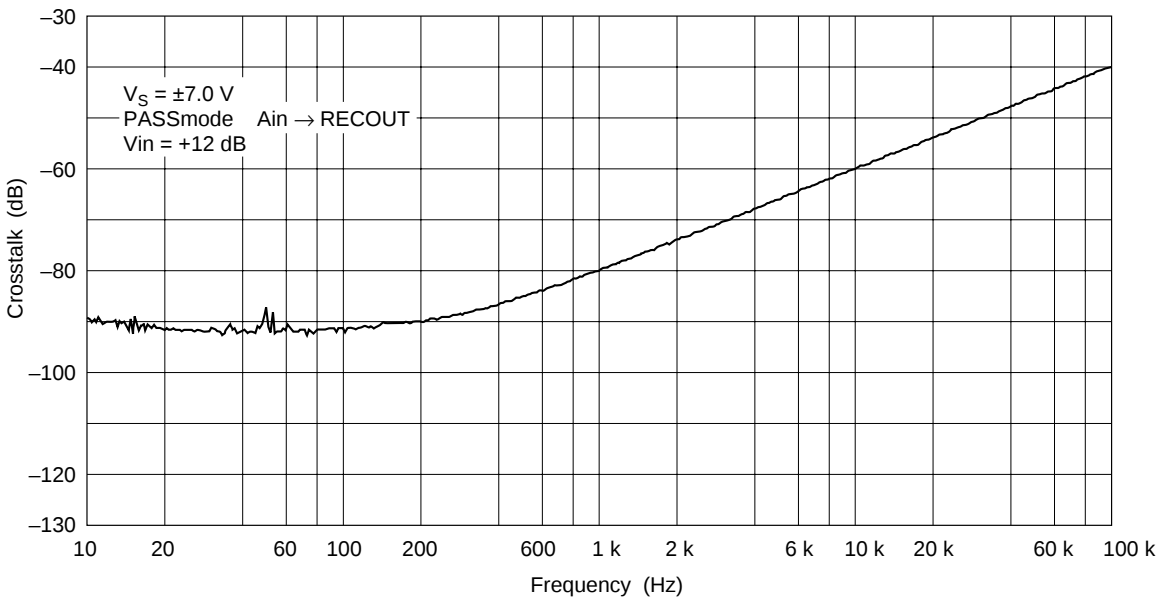


Crosstalk vs. Frequency (6)

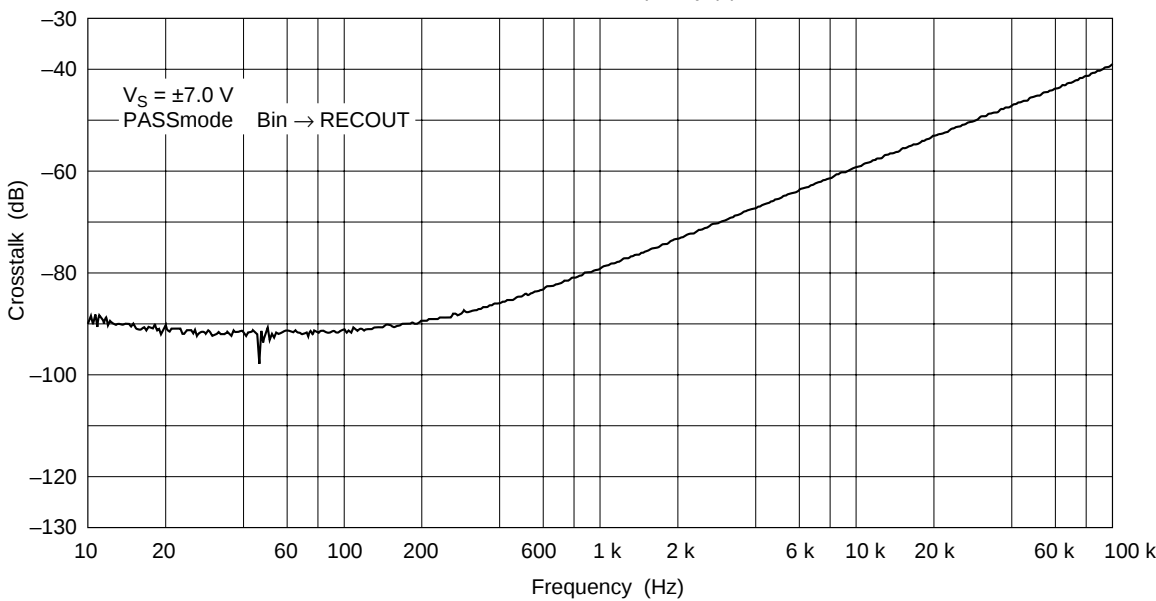


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Crosstalk vs. Frequency (7)

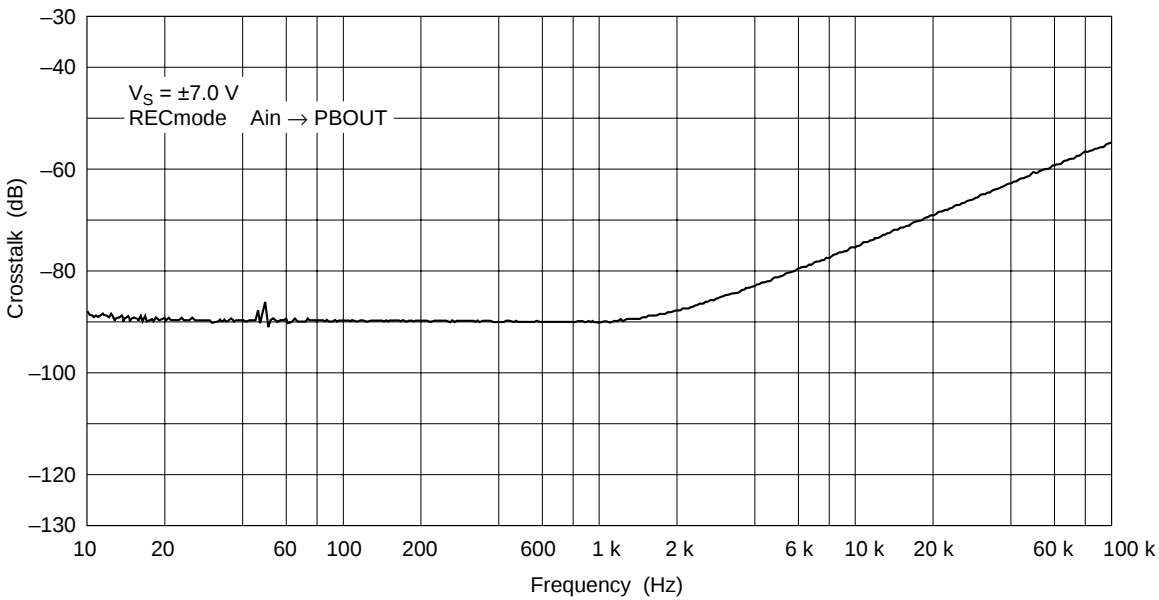


Crosstalk vs. Frequency (8)

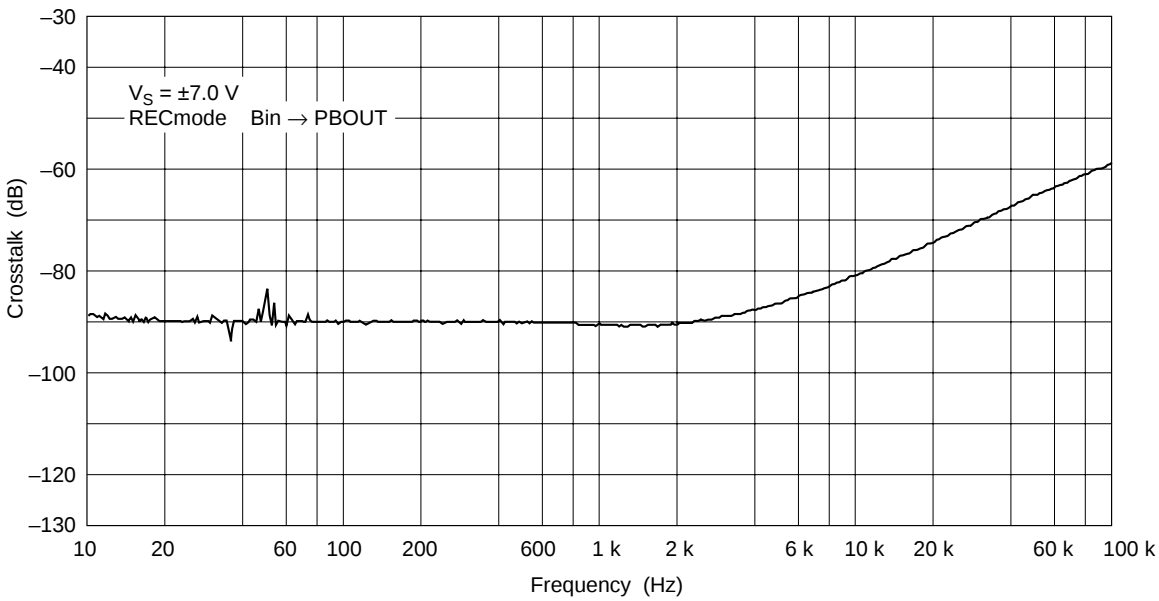


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Crosstalk vs. Frequency (9)

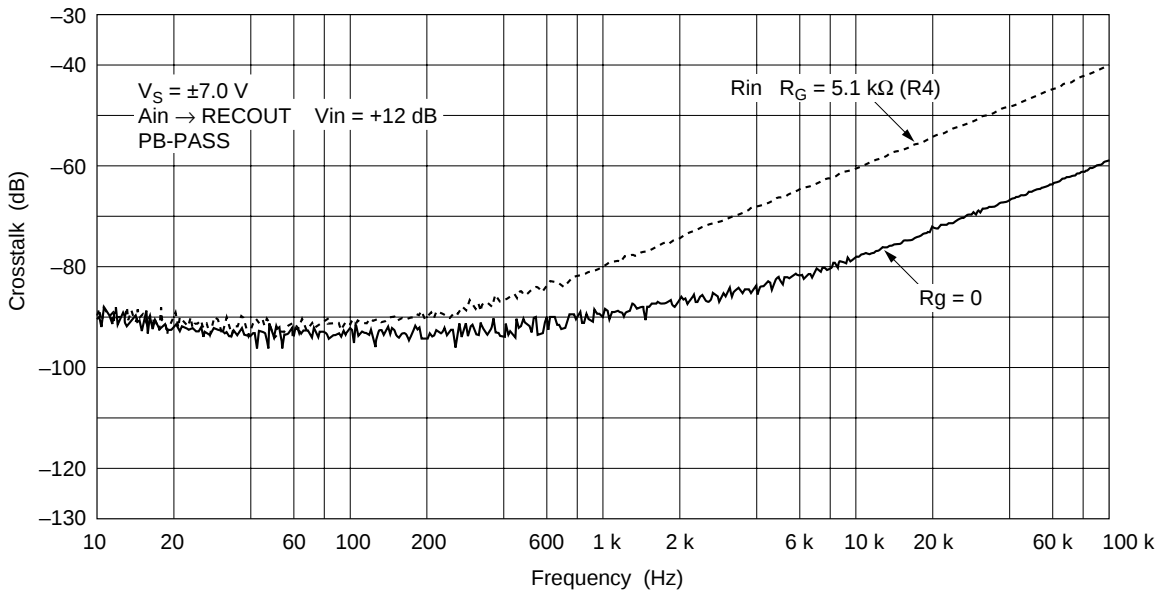


Crosstalk vs. Frequency (10)

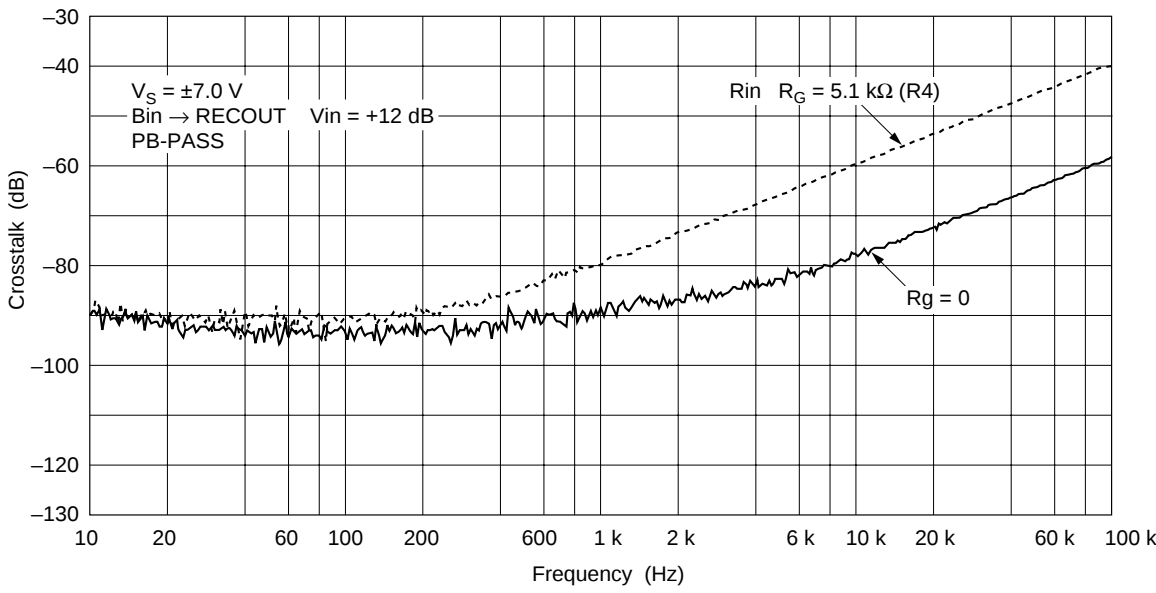


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Crosstalk vs. Frequency (11)

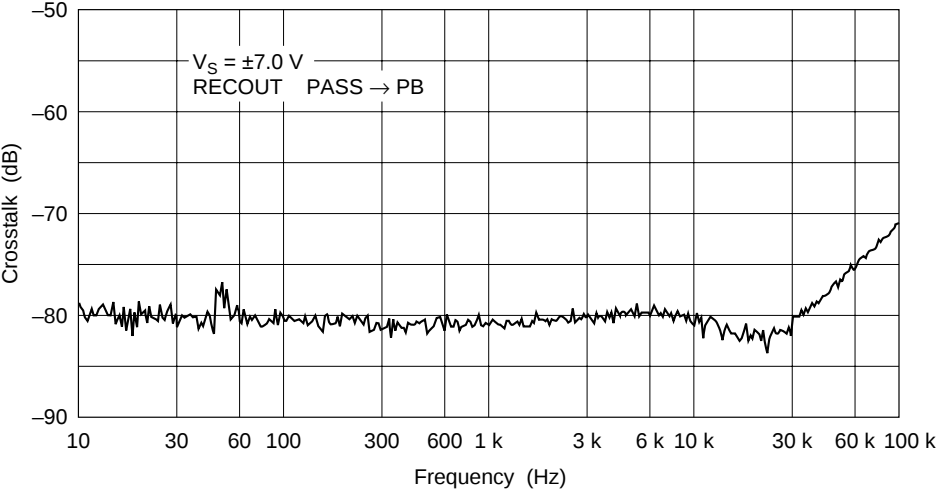


Crosstalk vs. Frequency (12)

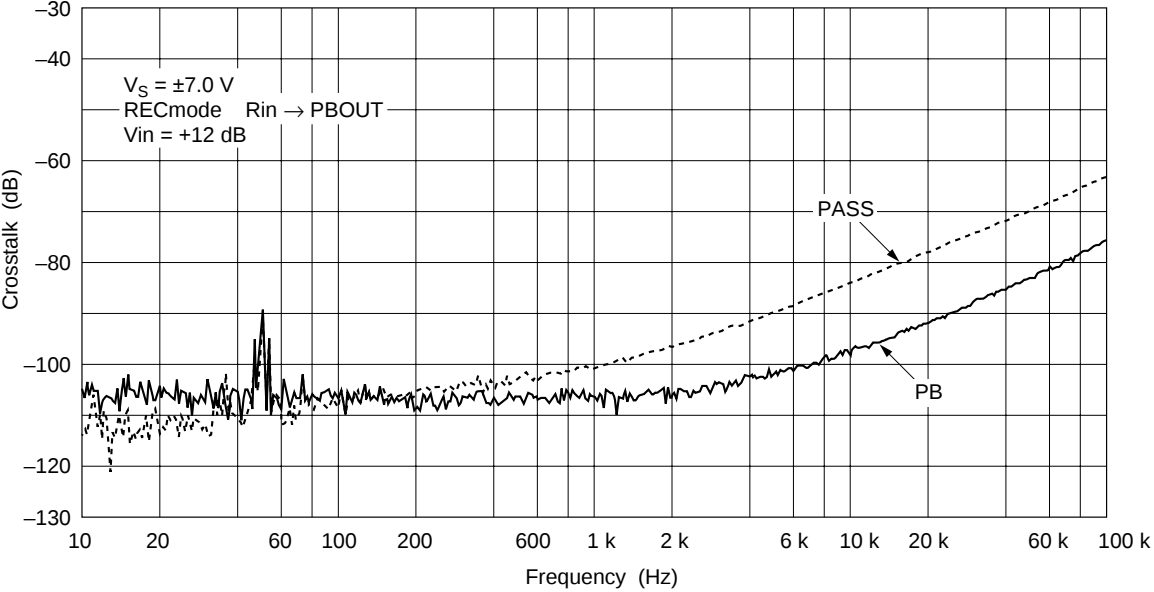


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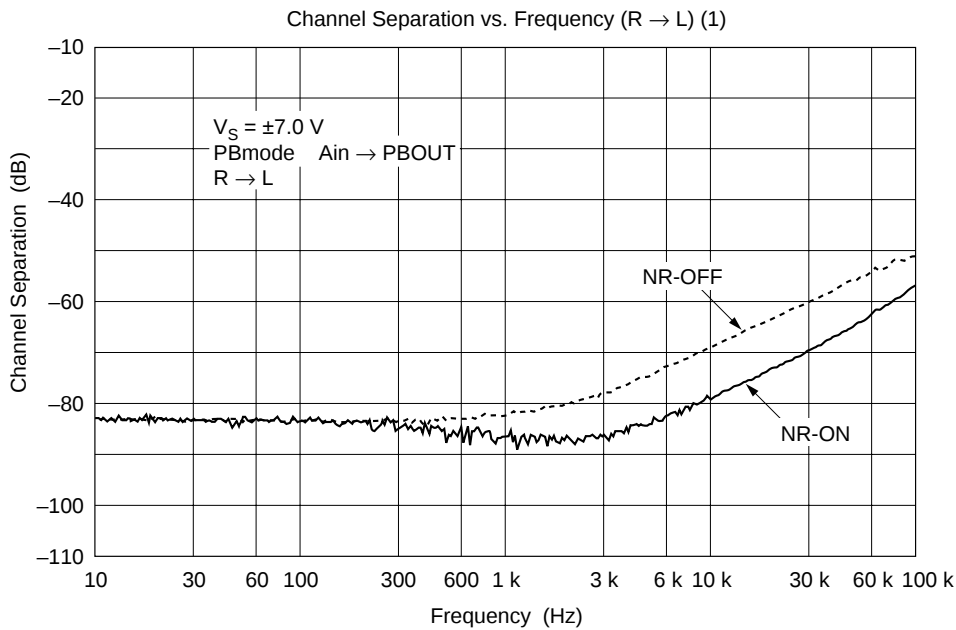
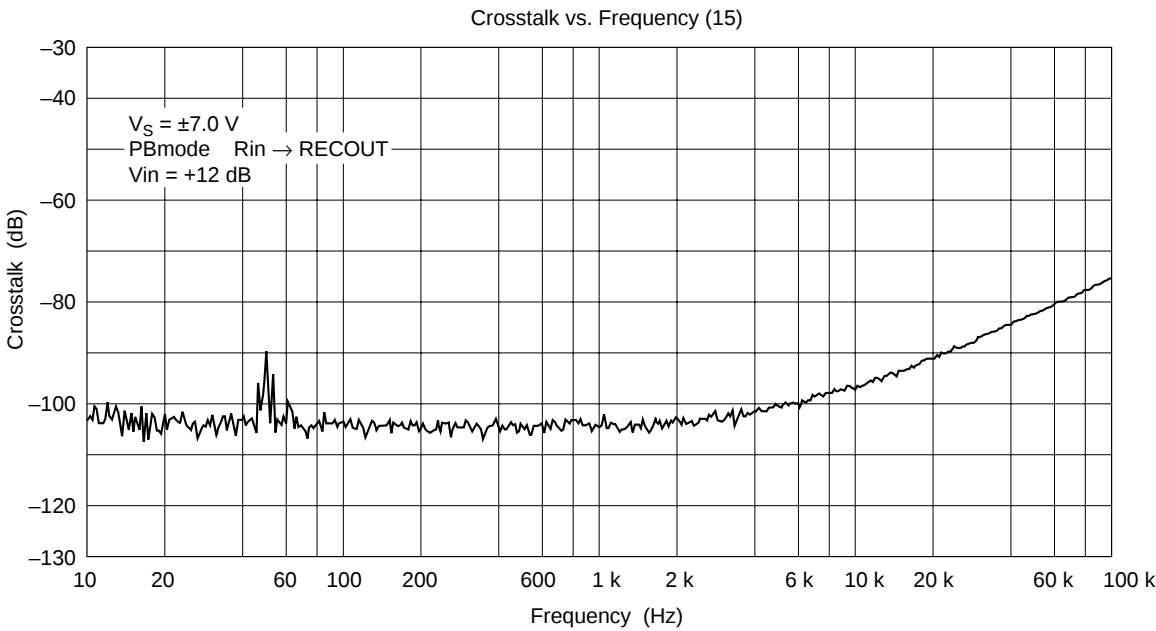
Crosstalk vs. Frequency (13)



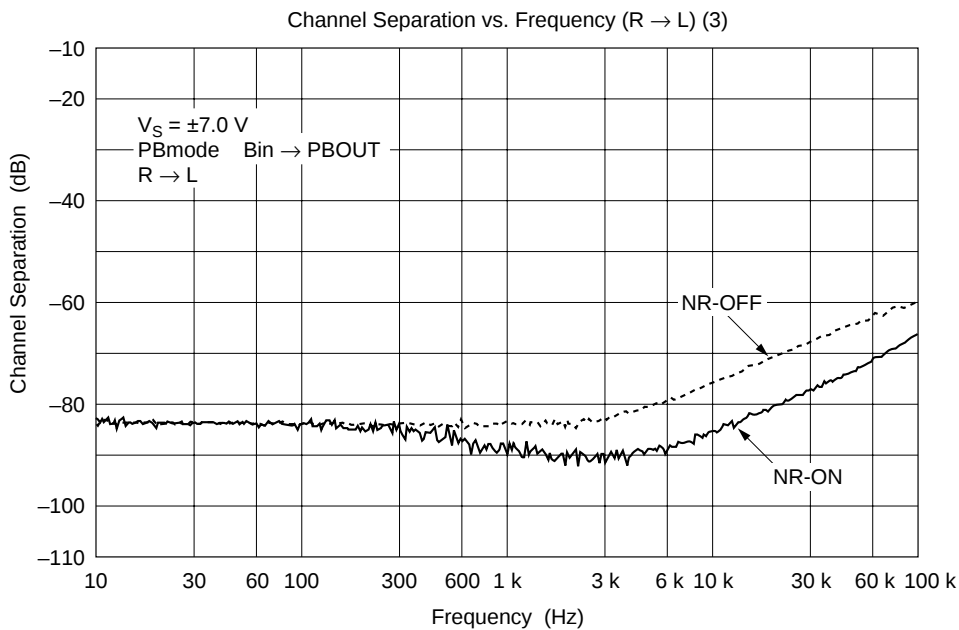
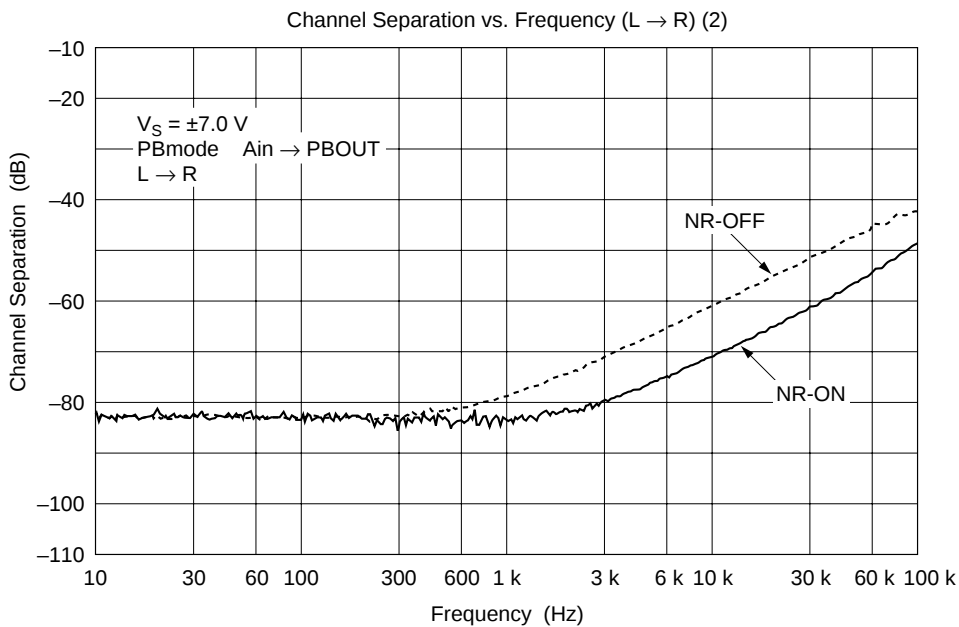
Crosstalk vs. Frequency (14)



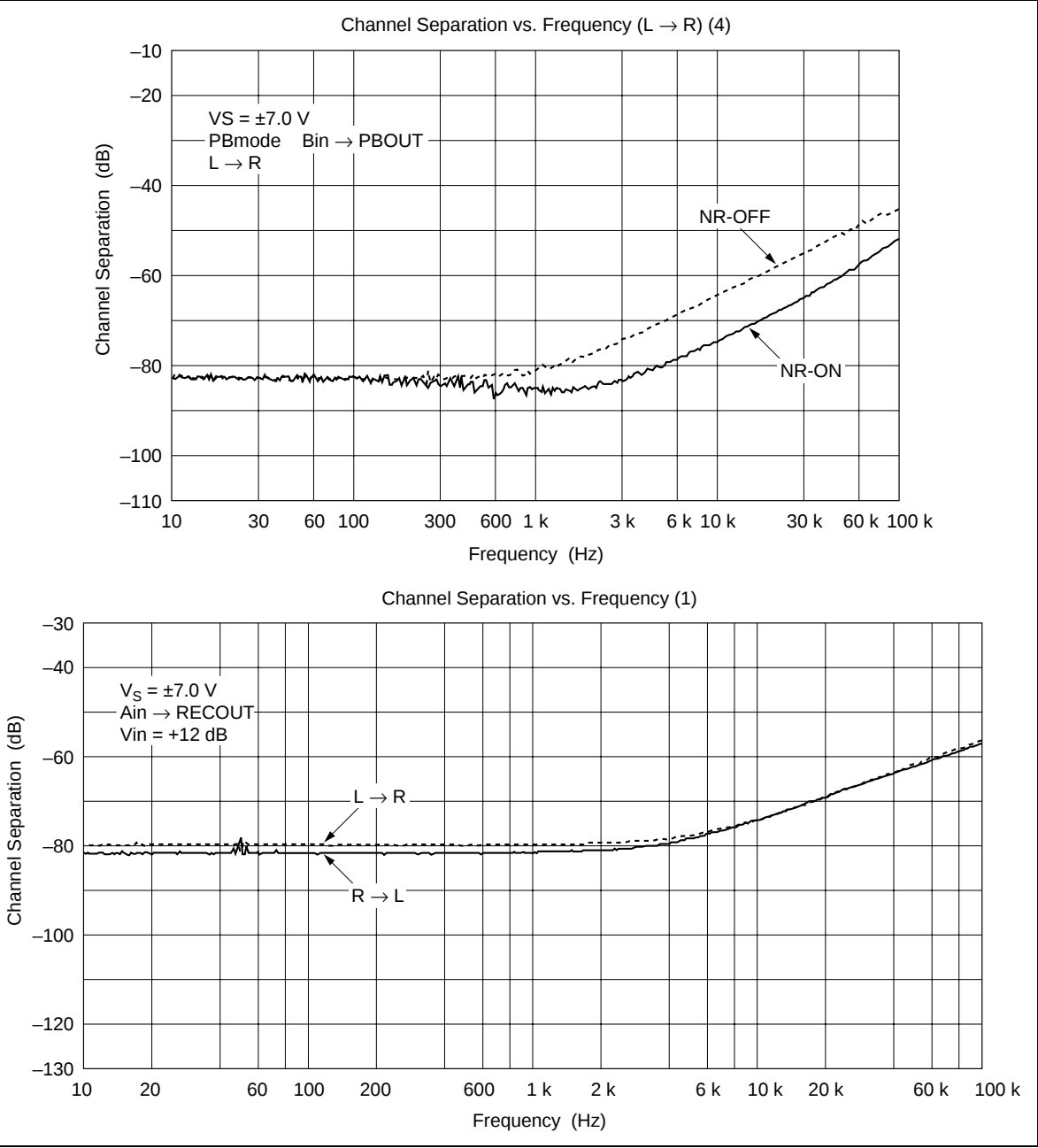
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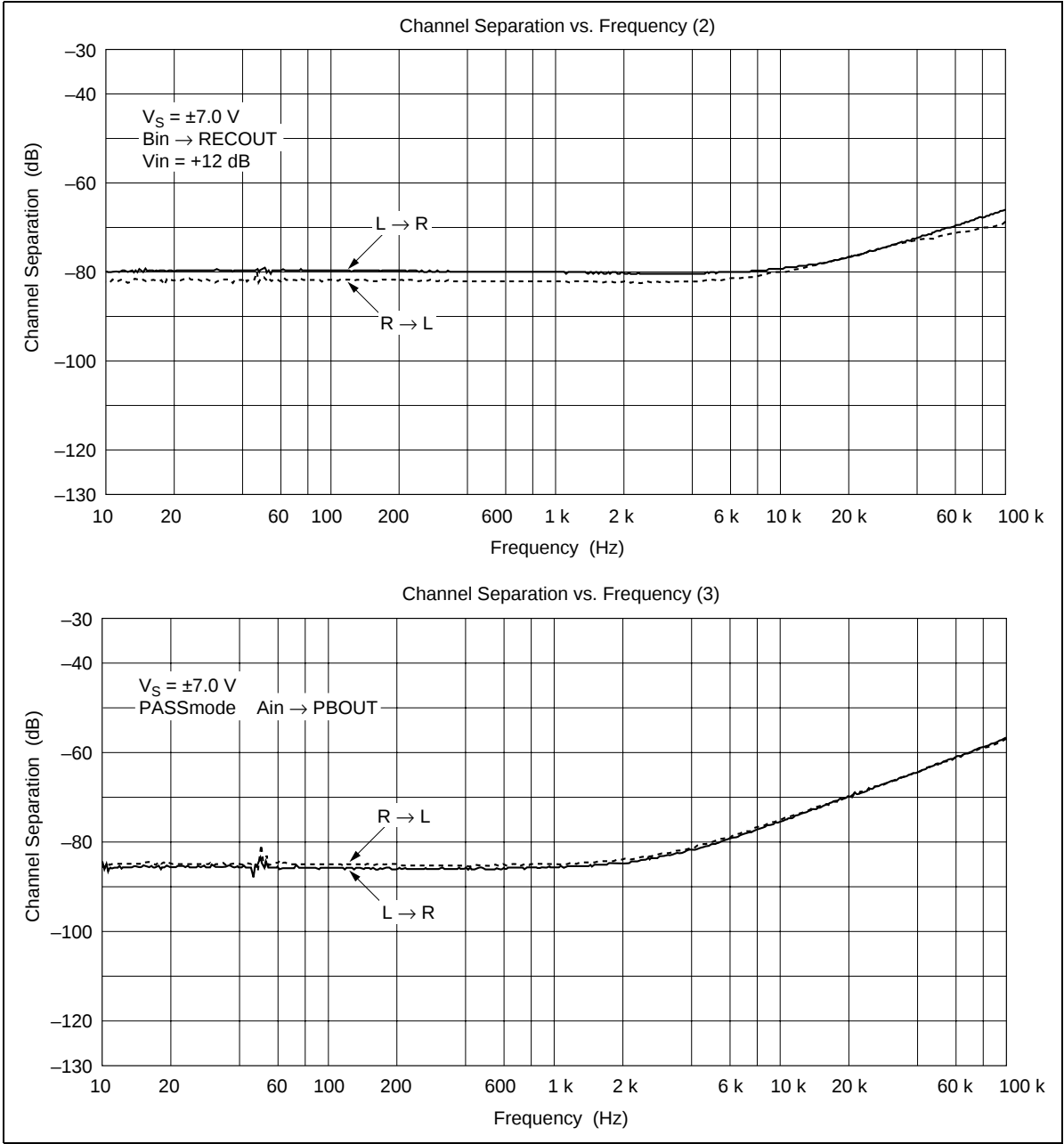
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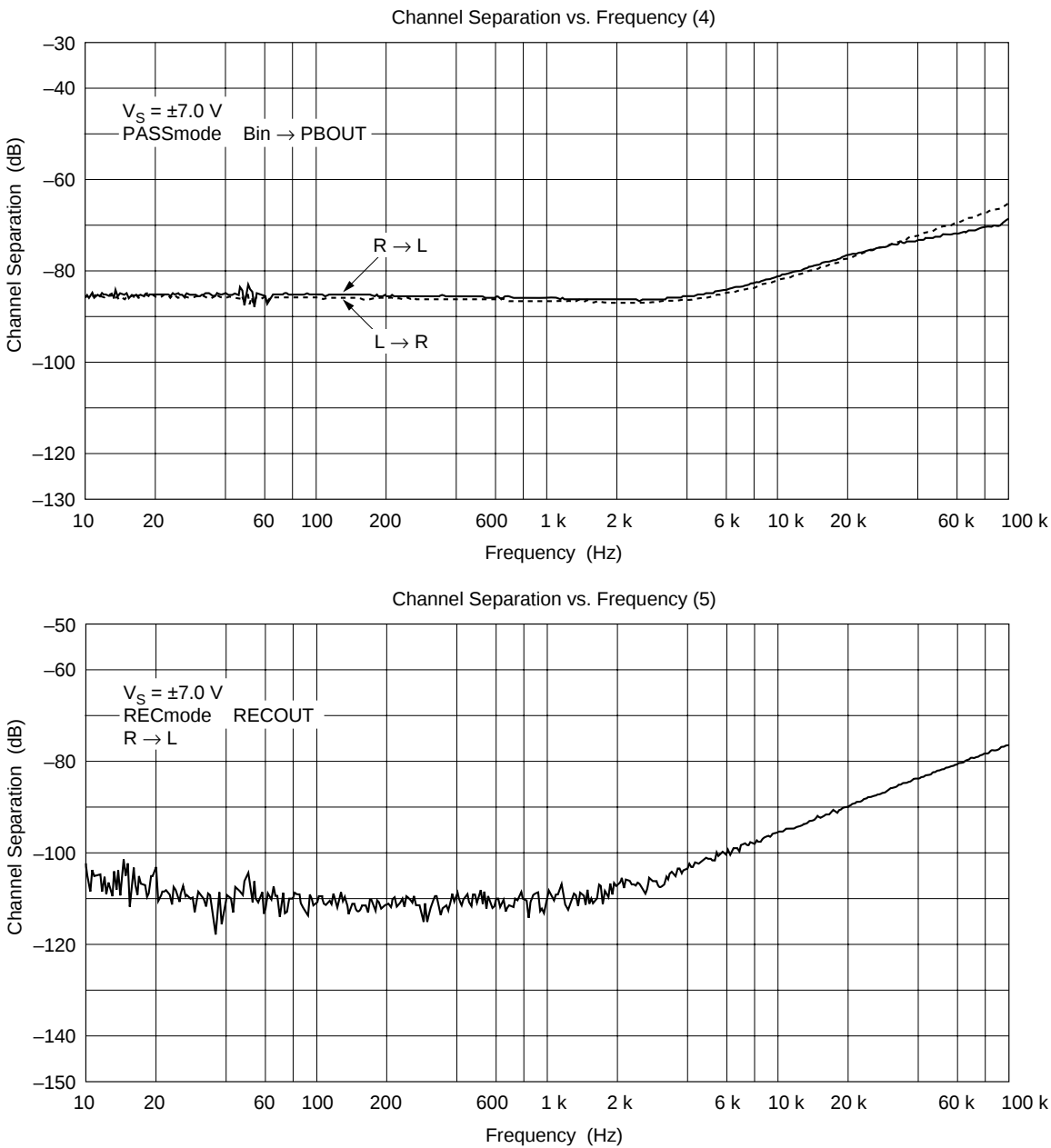


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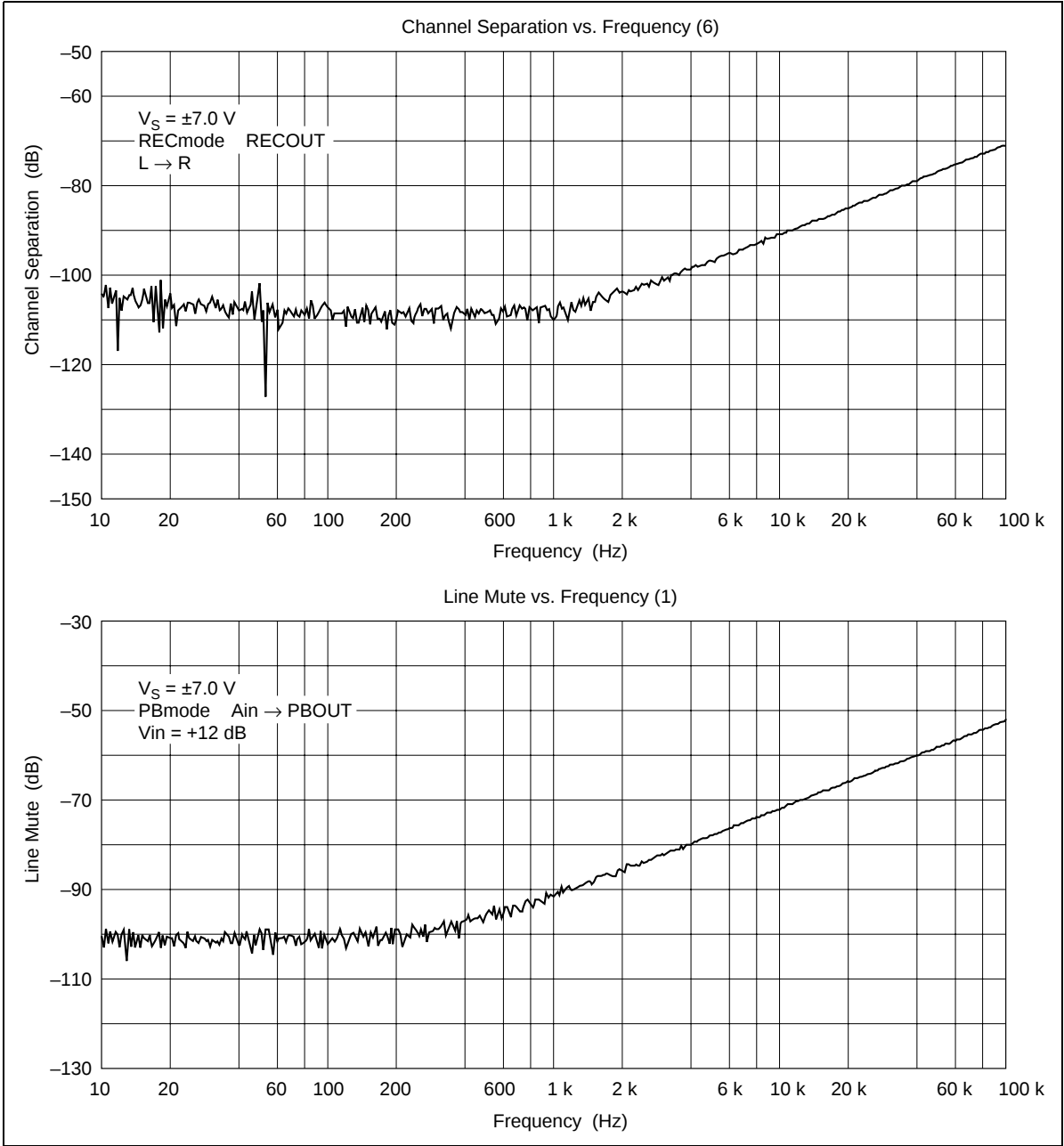


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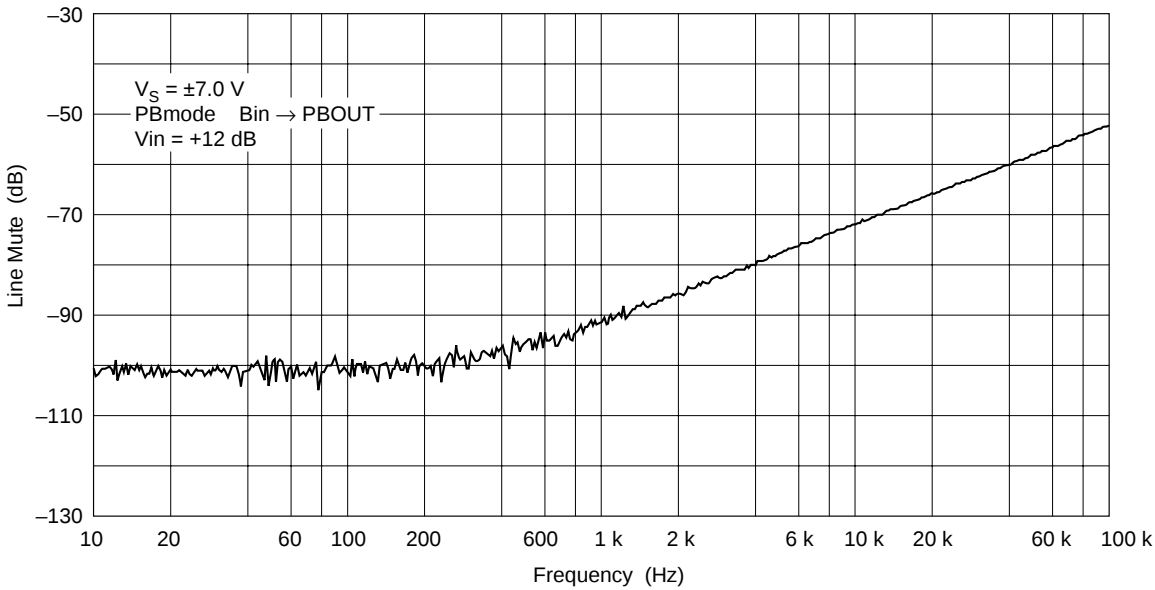
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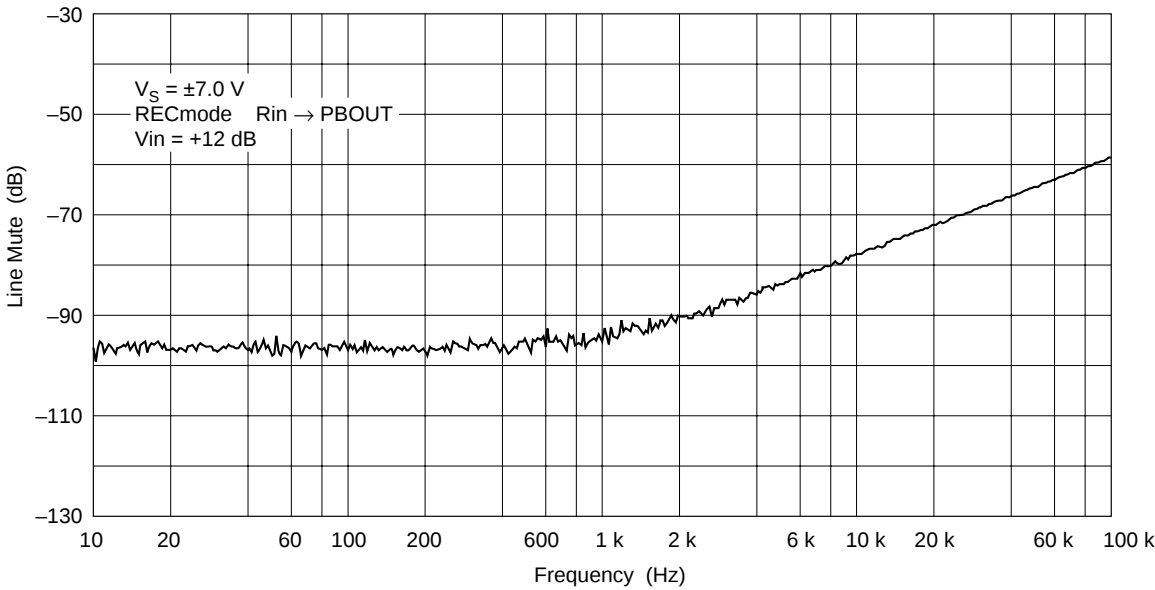
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HA12203NT

Line Mute vs. Frequency (2)

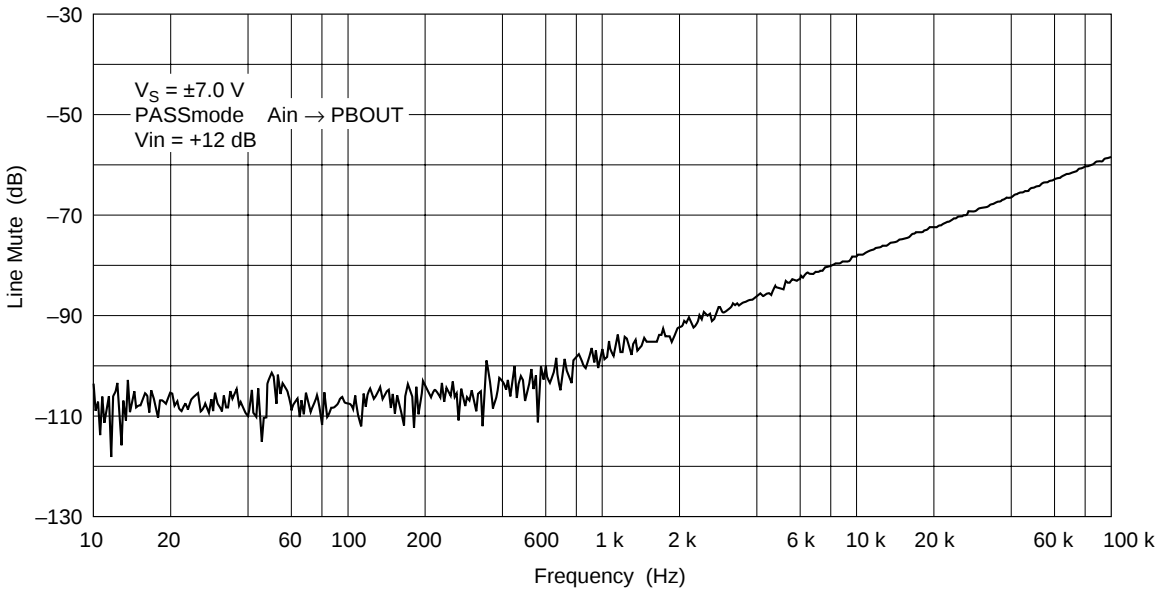


Line Mute vs. Frequency (3)

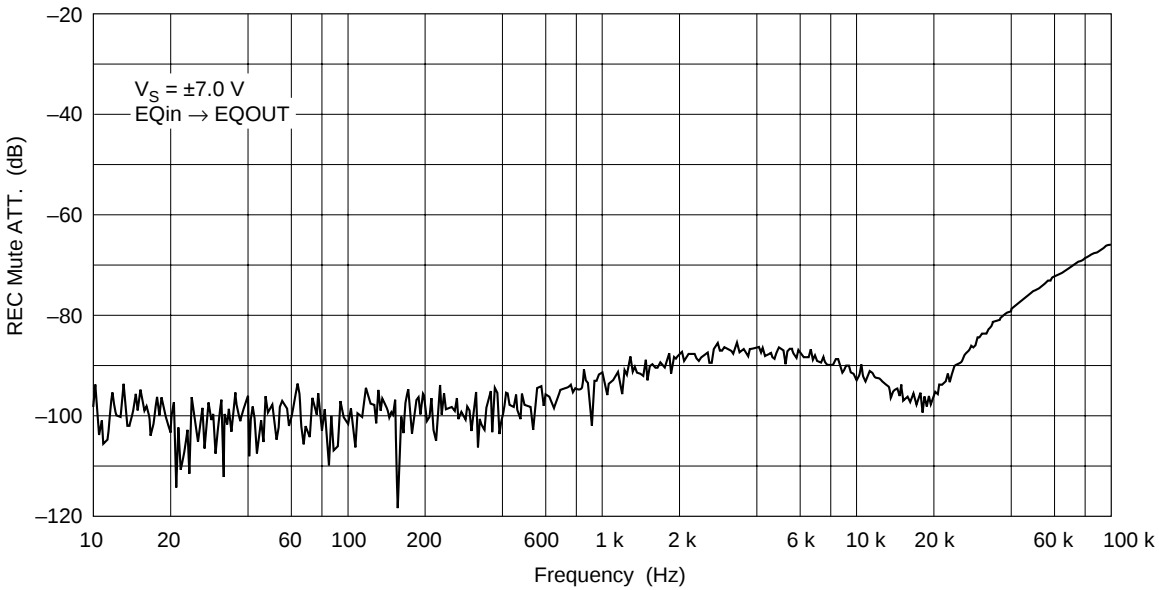


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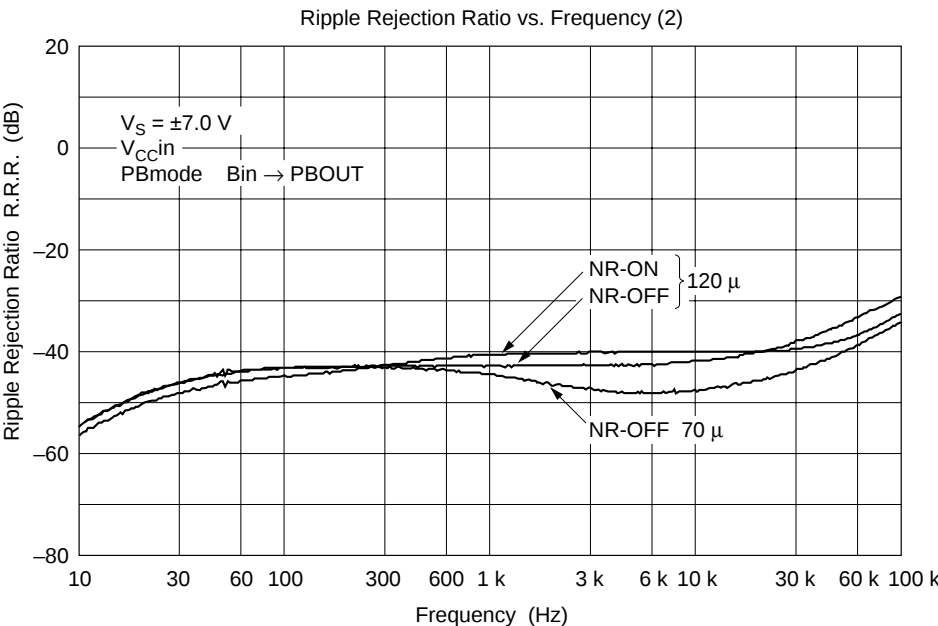
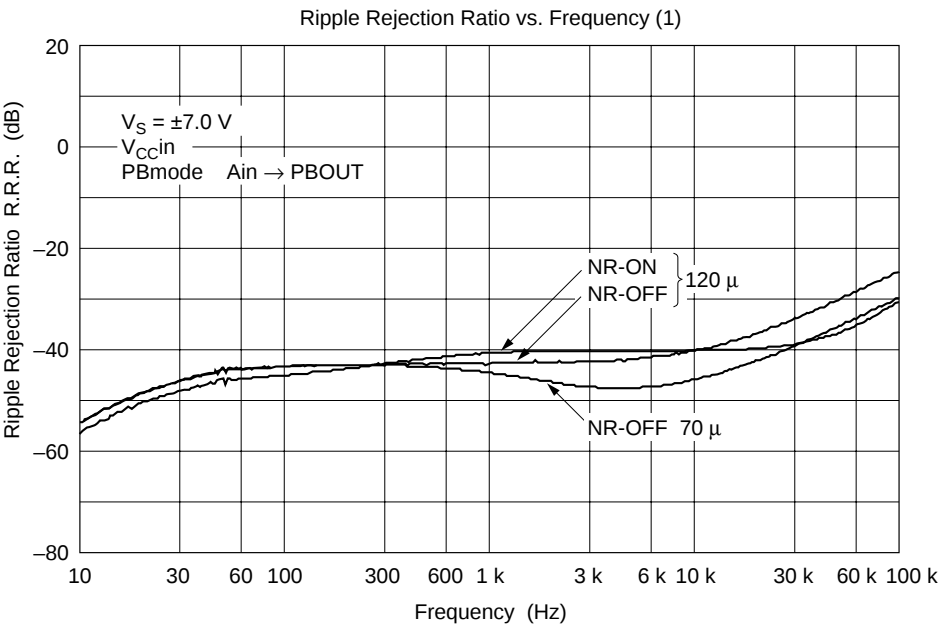
Line Mute vs. Frequency (4)



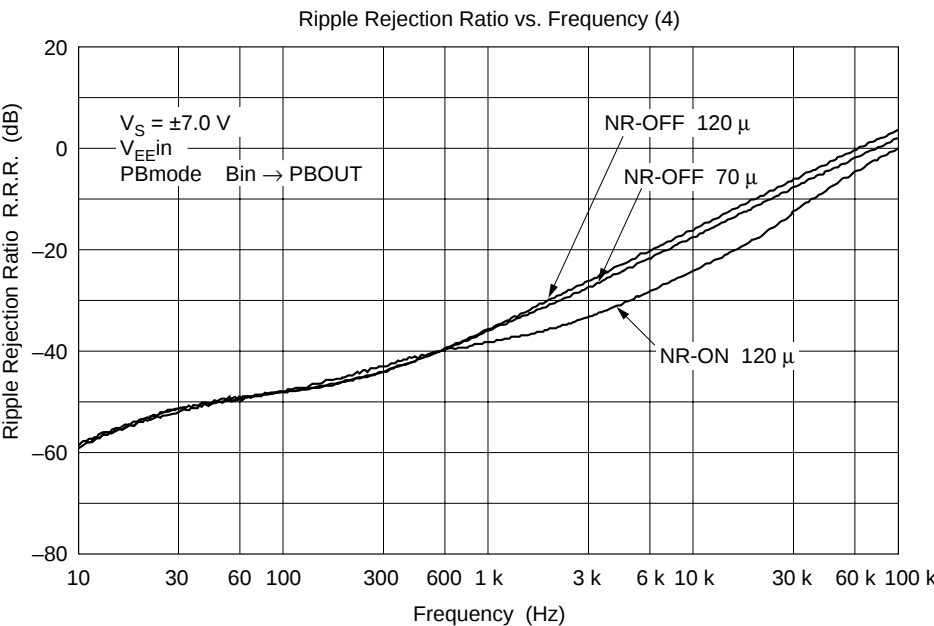
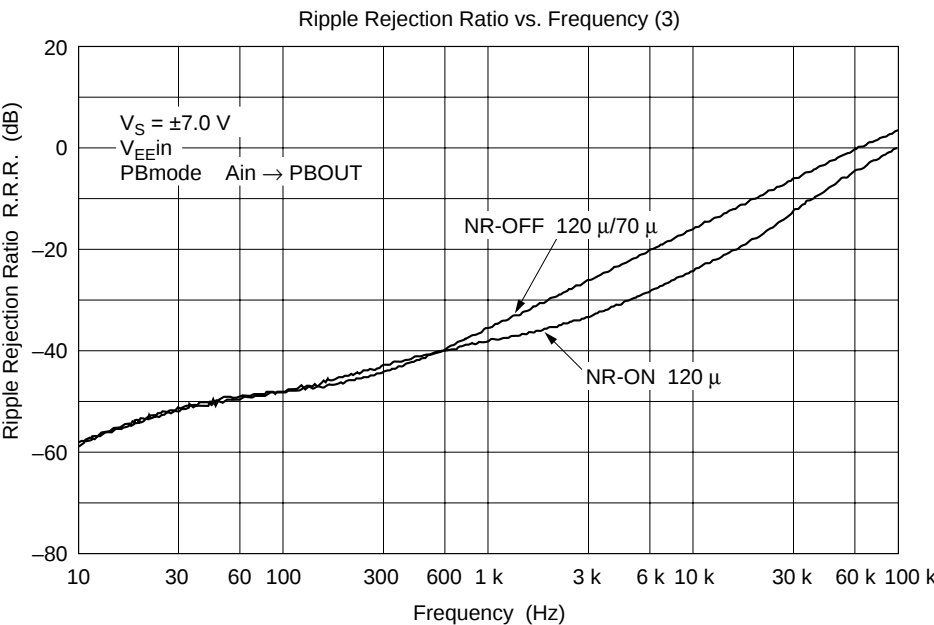
REC Mute Attenuation vs. Frequency



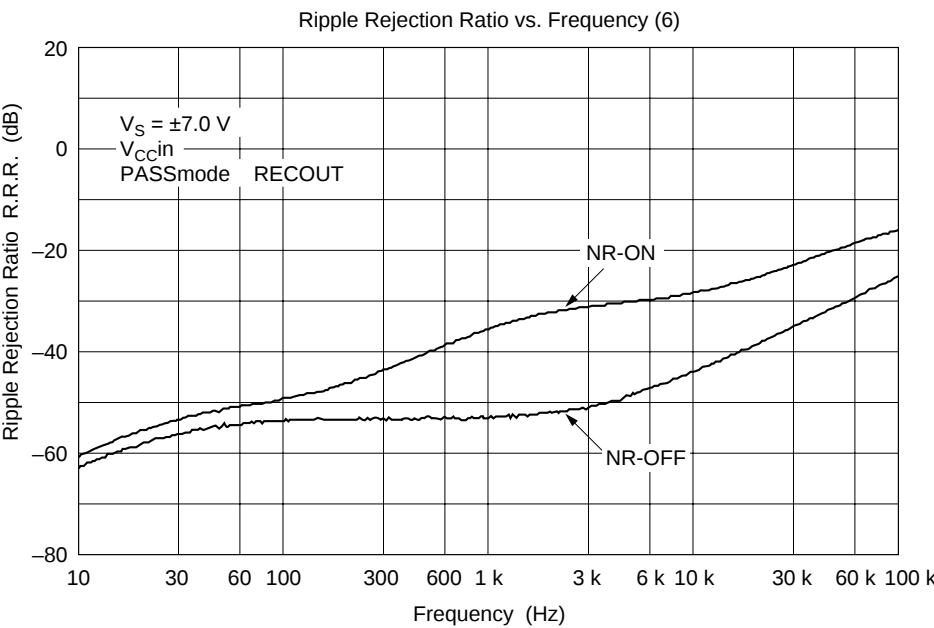
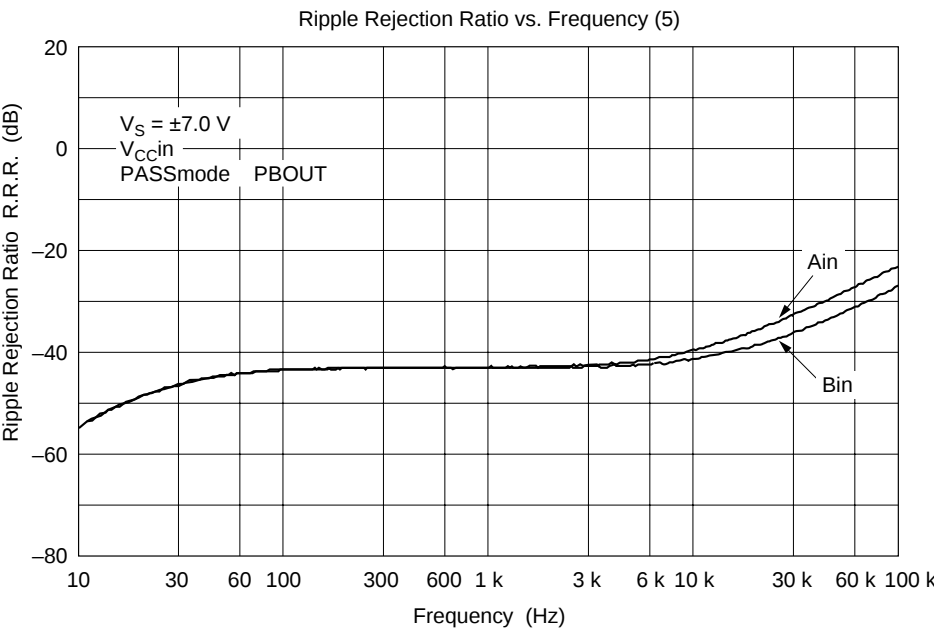
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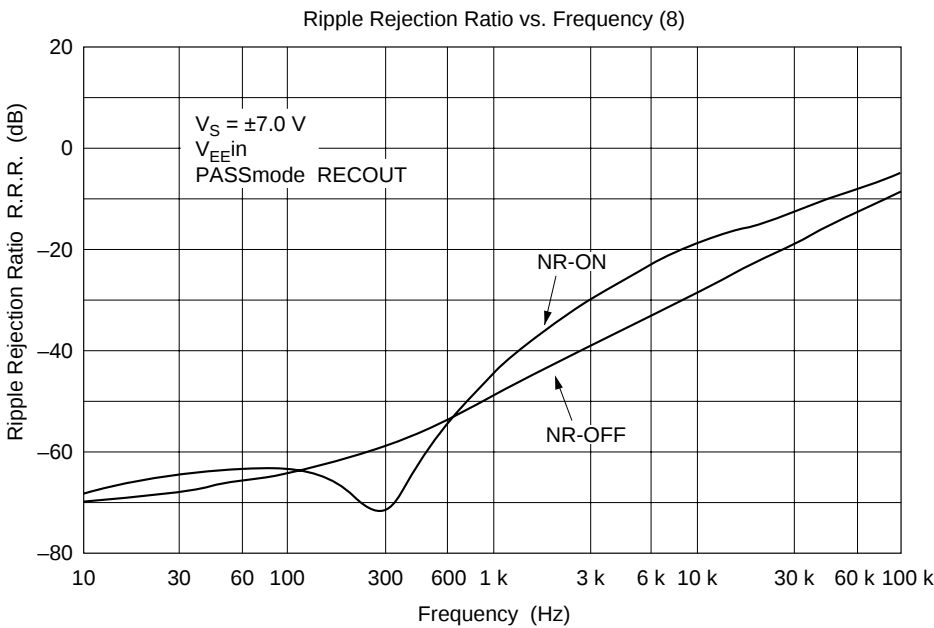
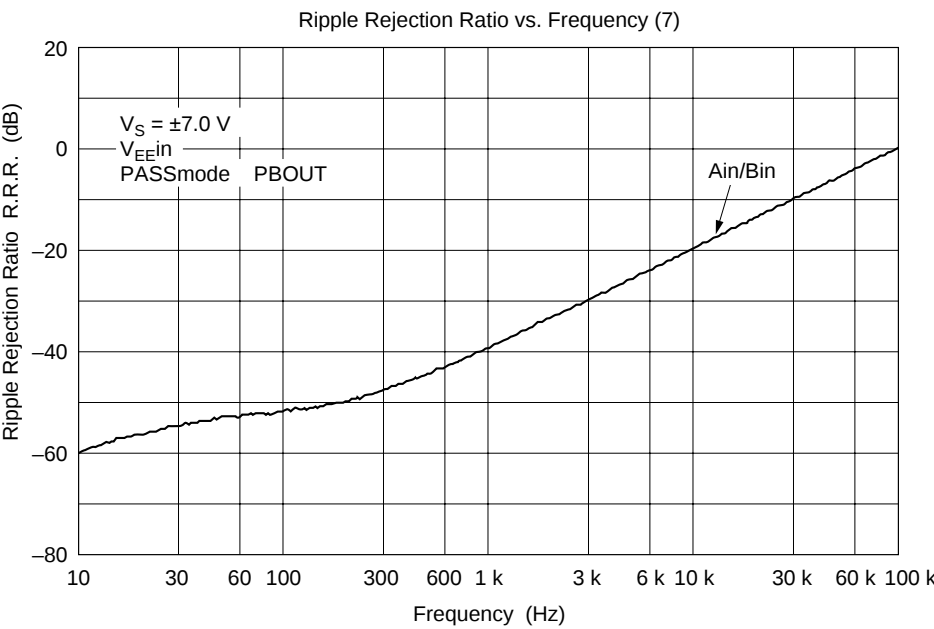
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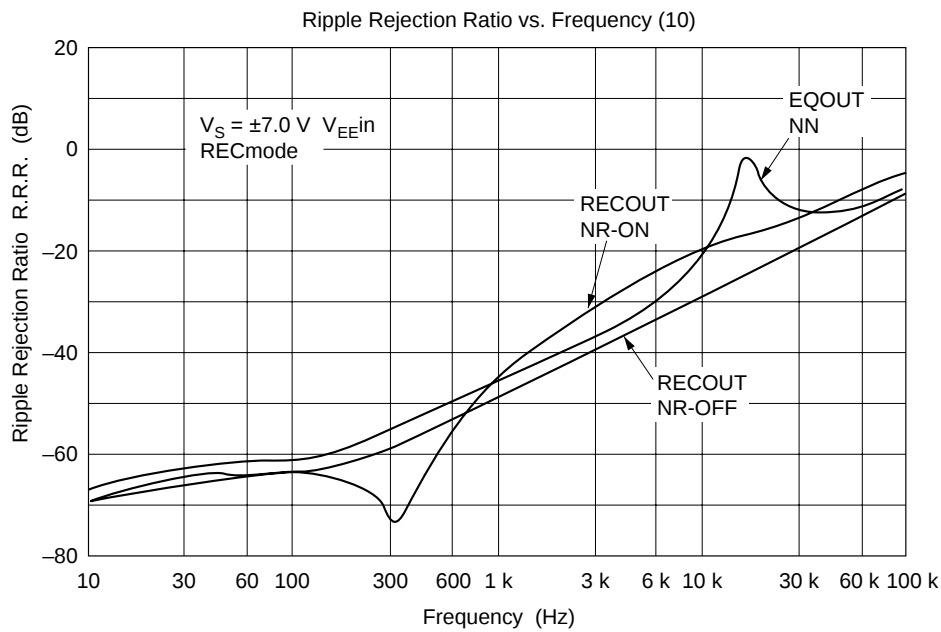
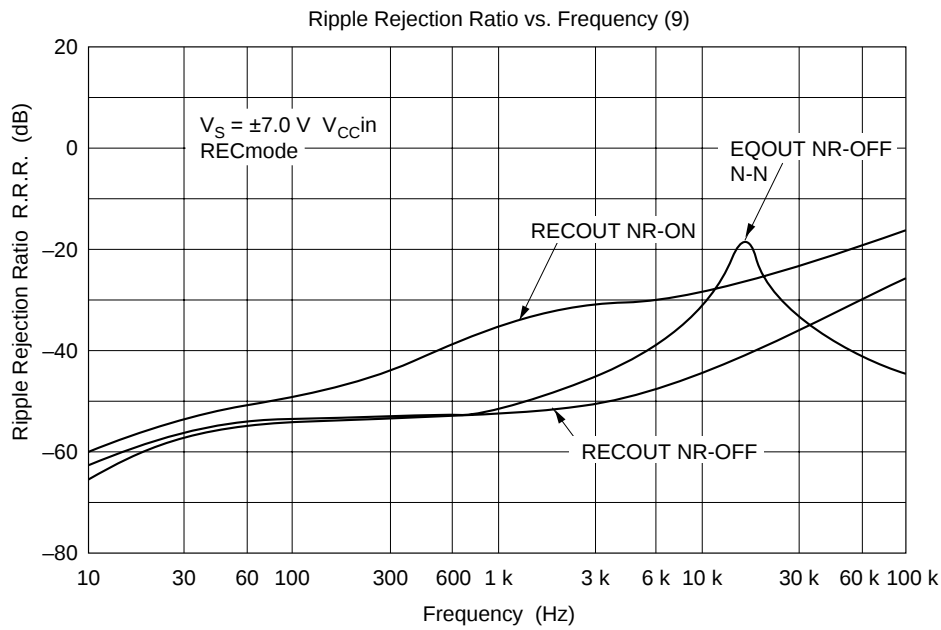
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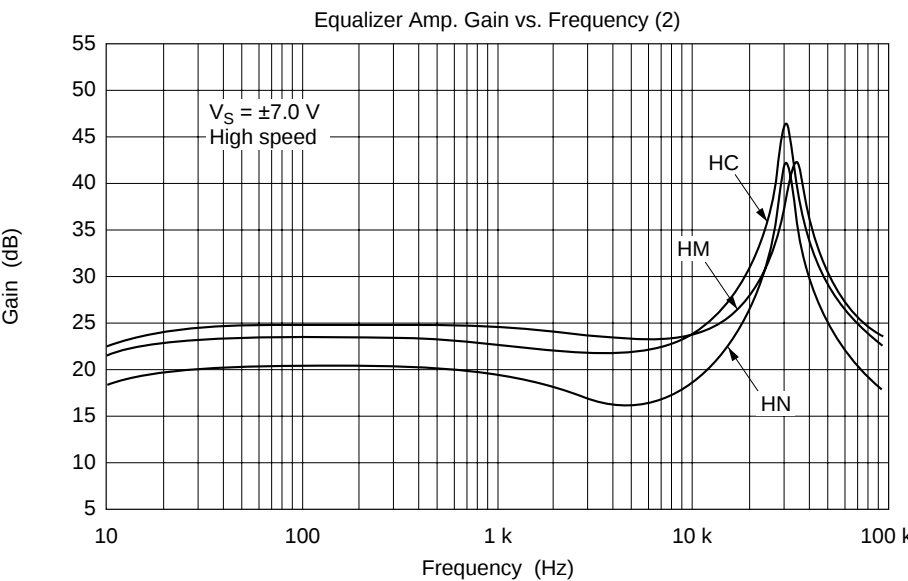
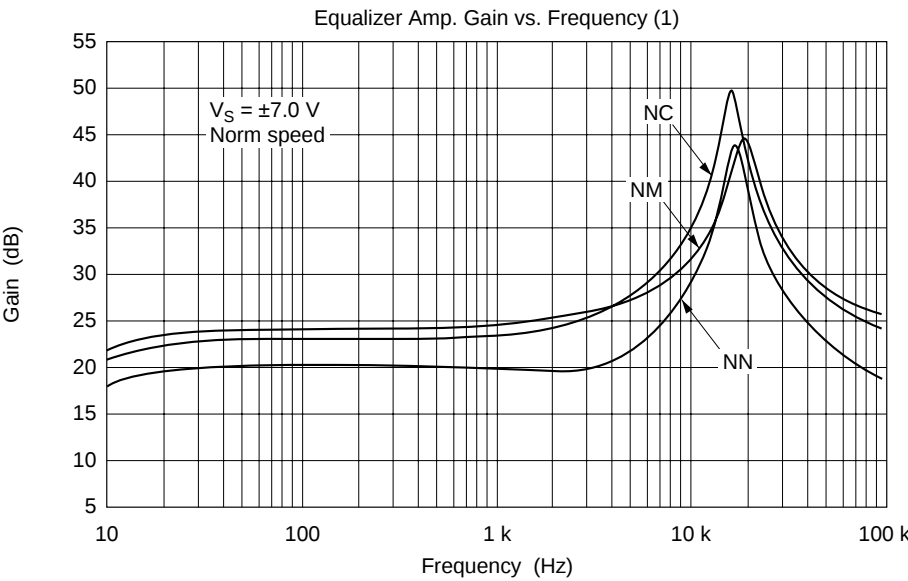
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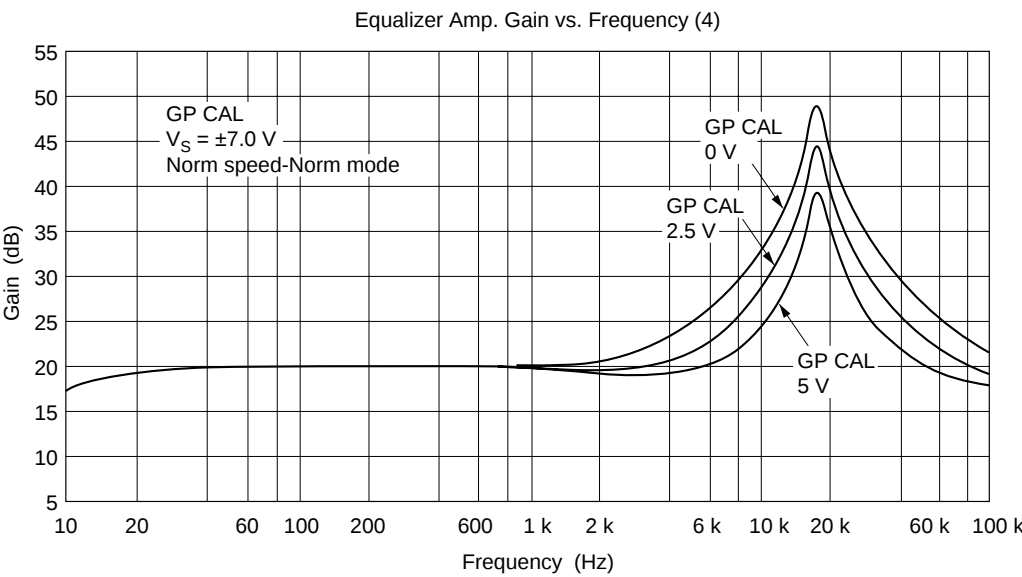
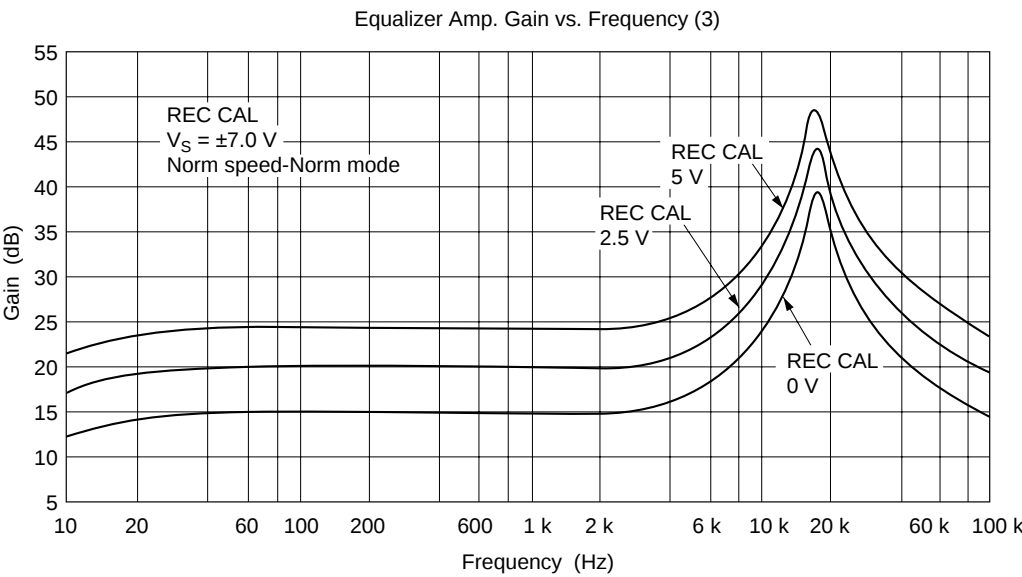
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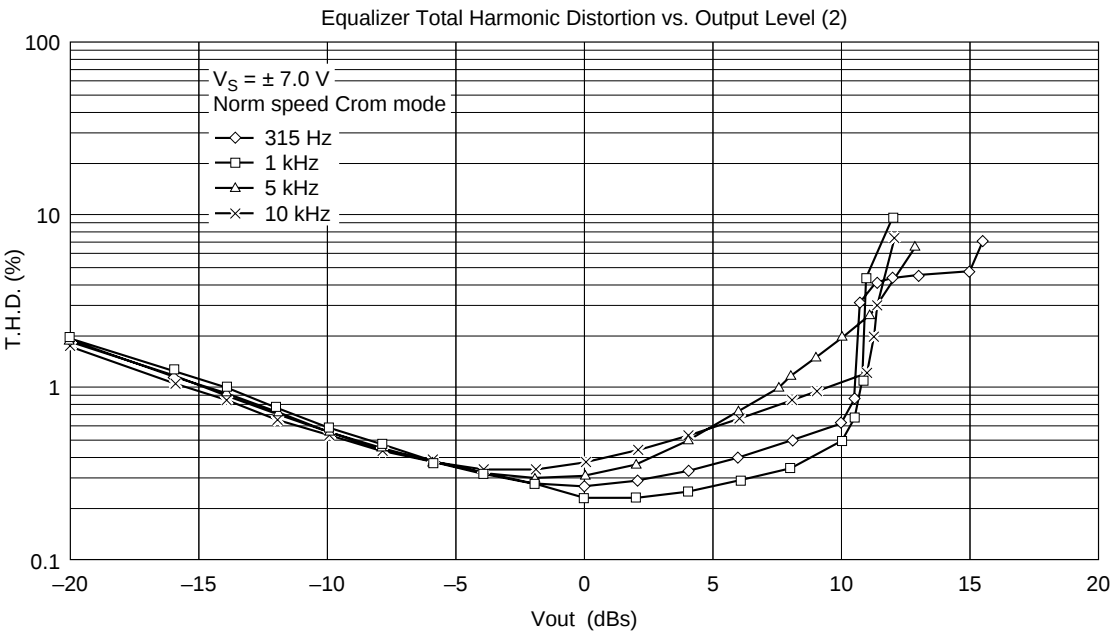
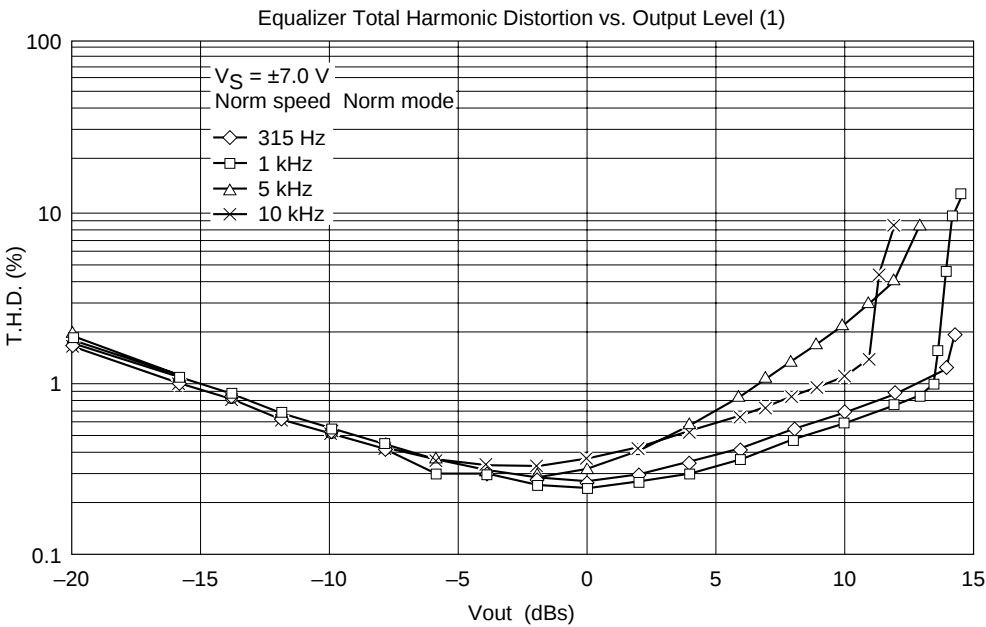
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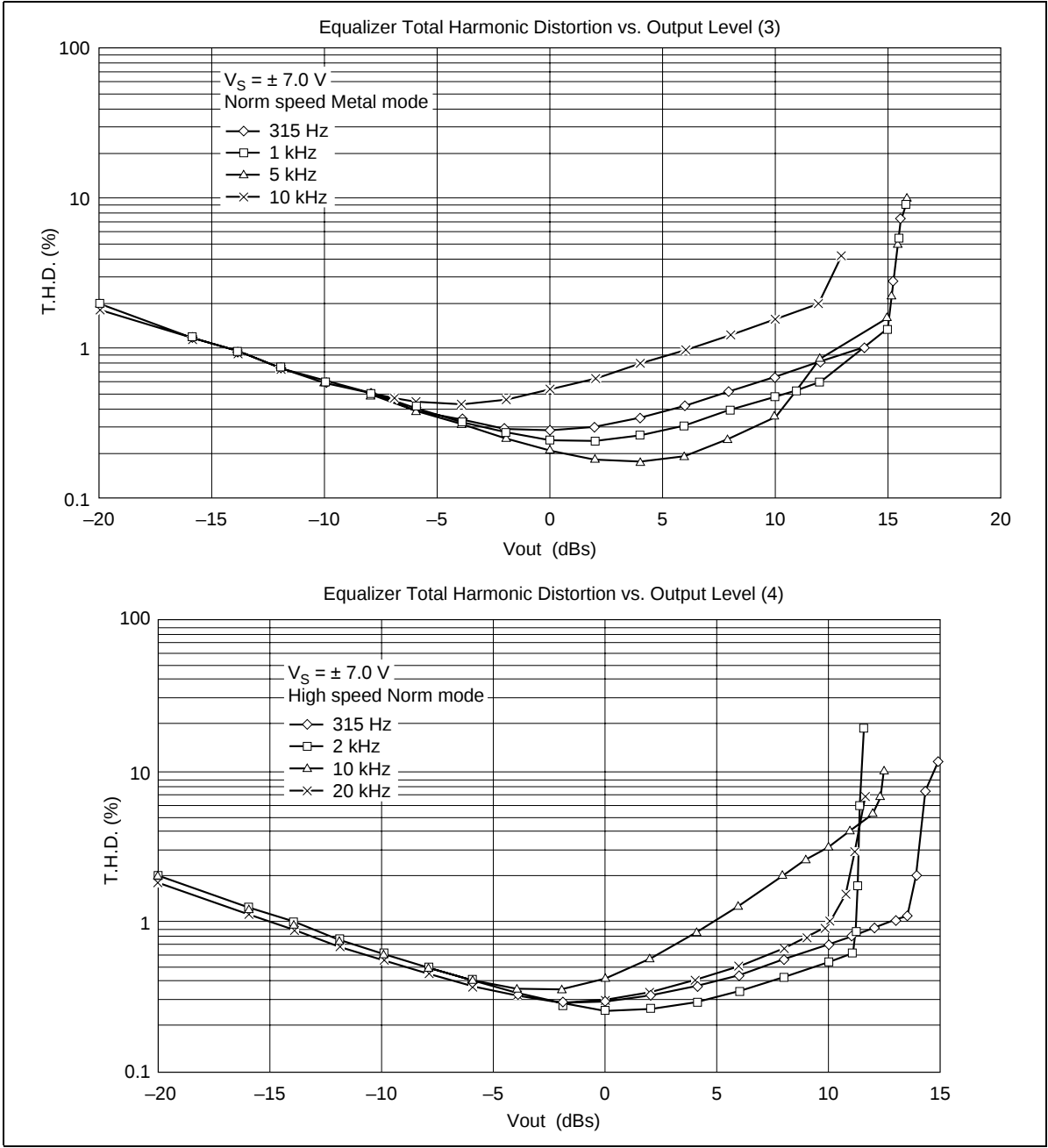
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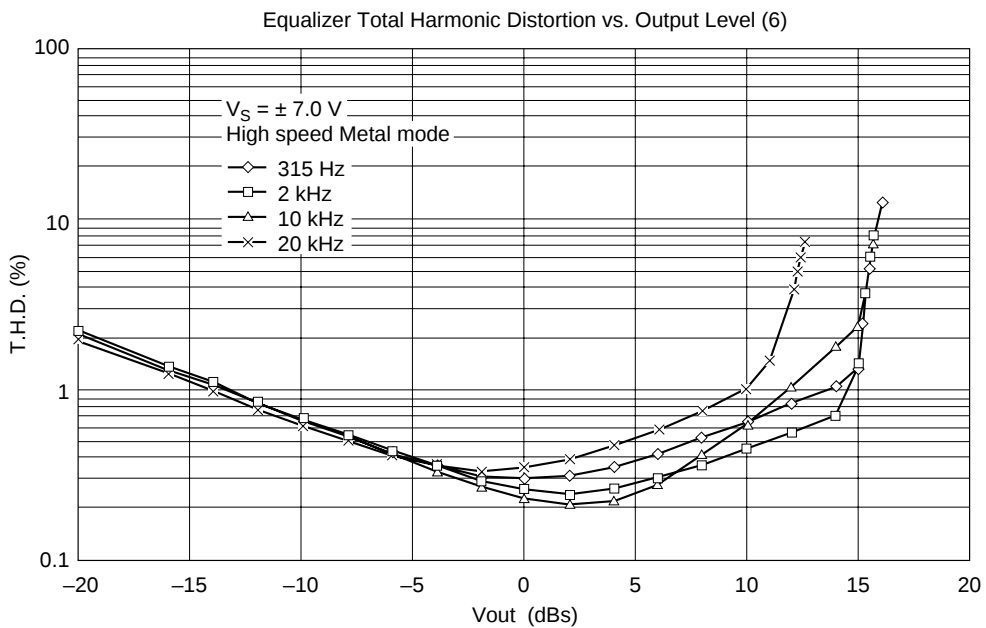
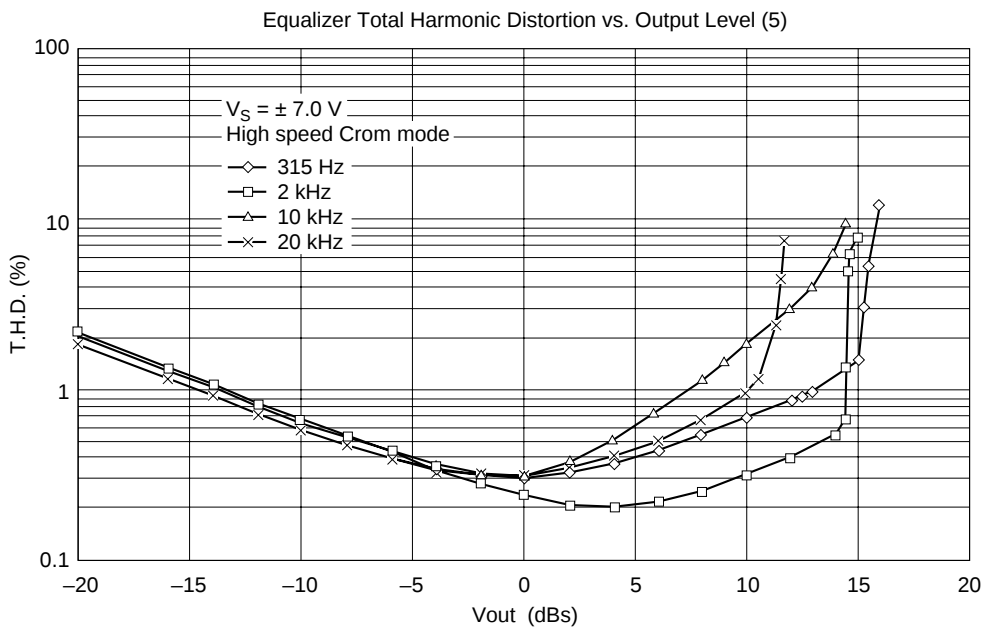
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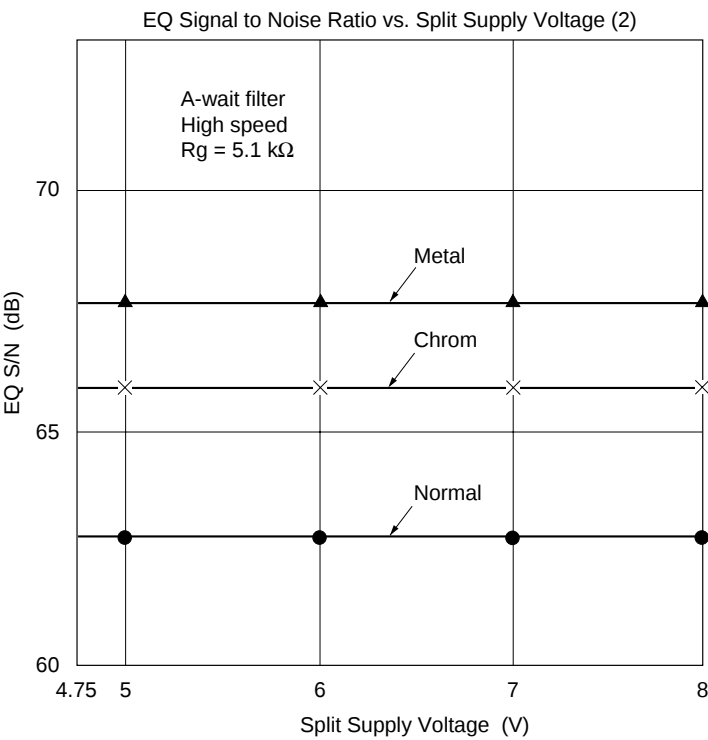
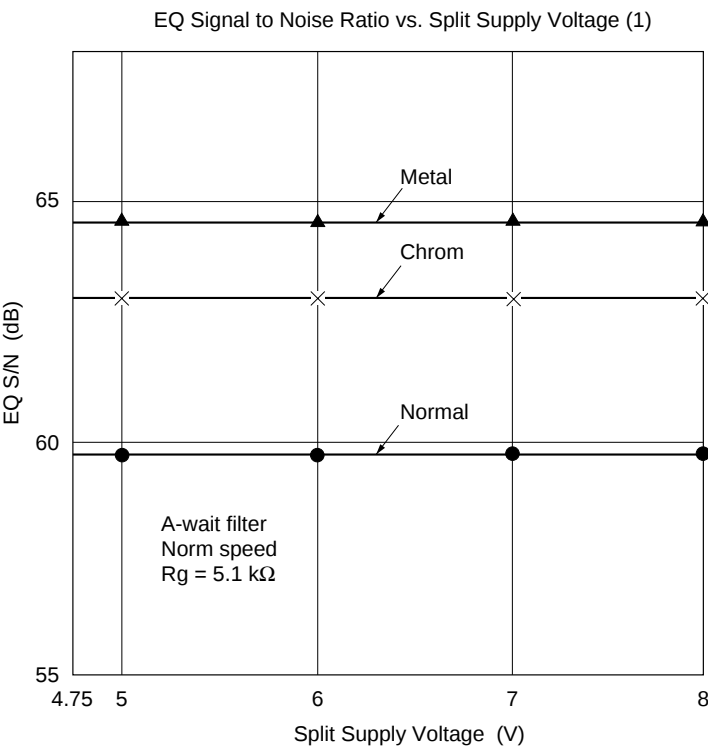
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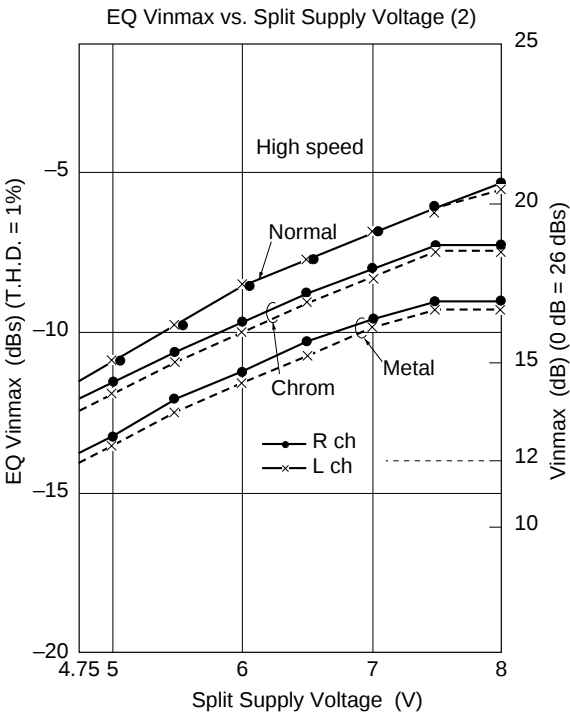
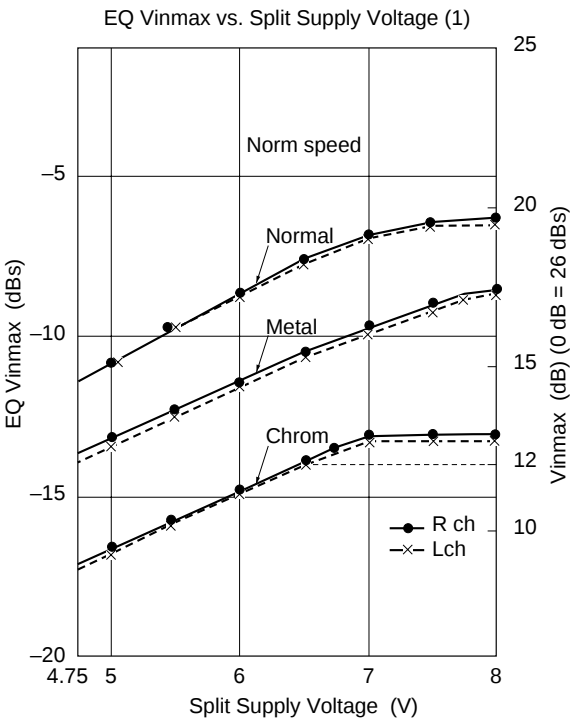
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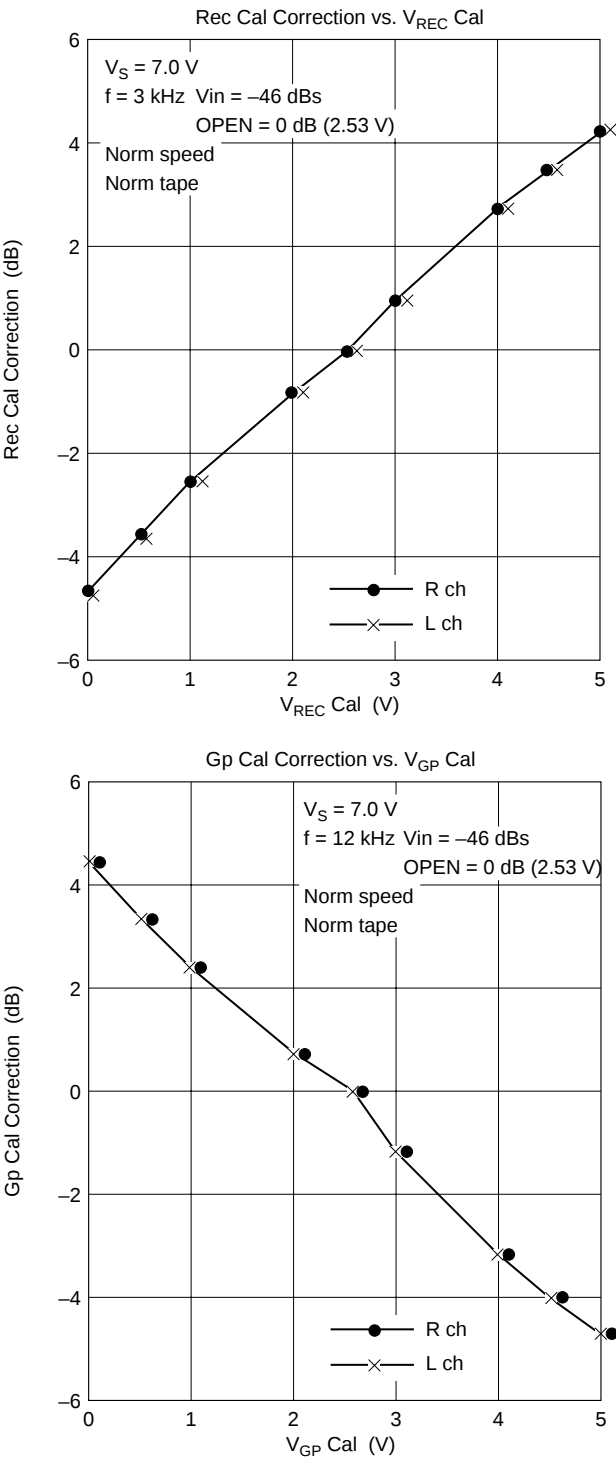
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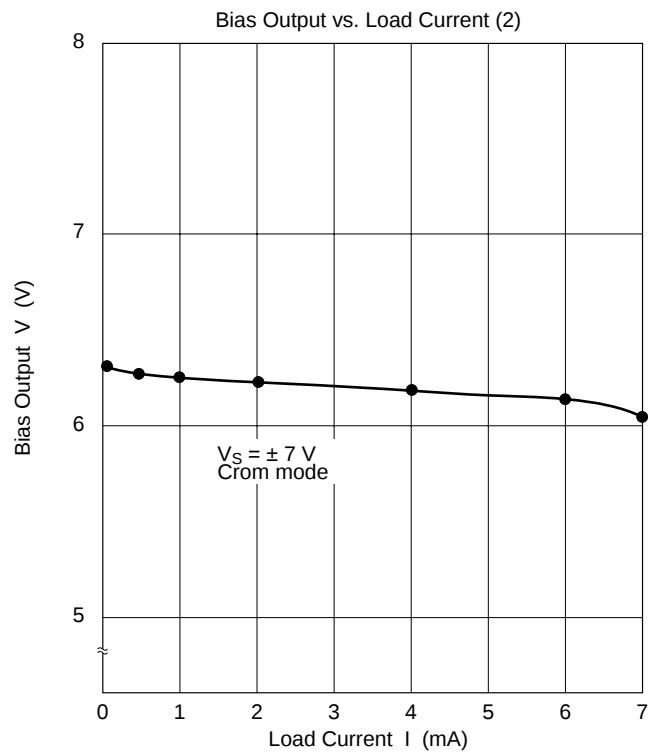
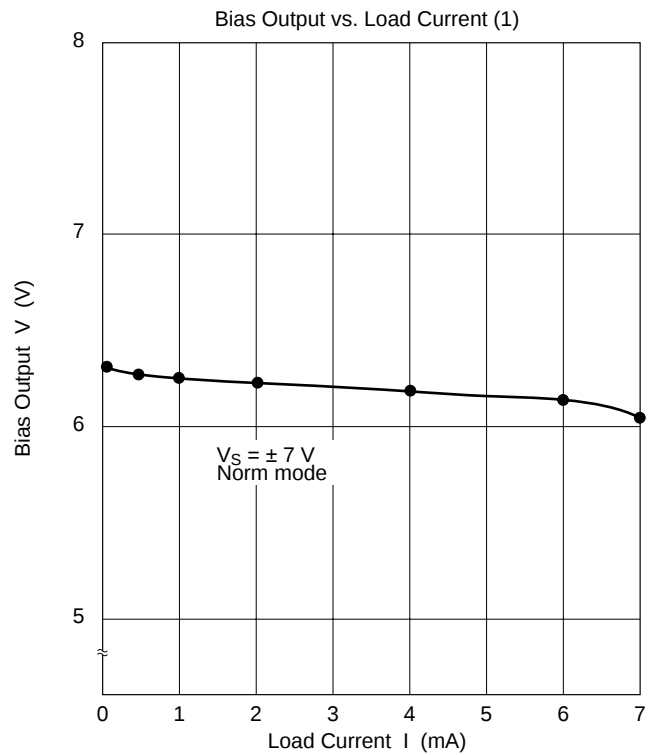
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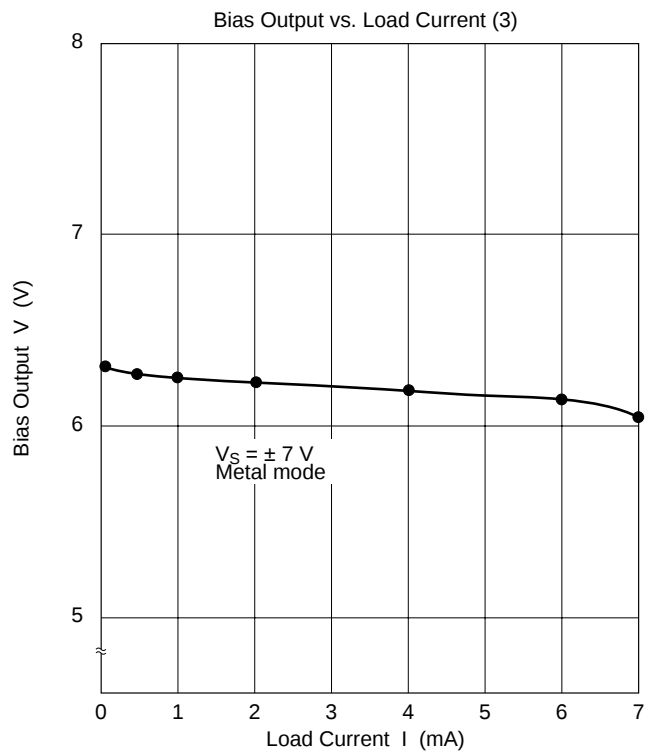
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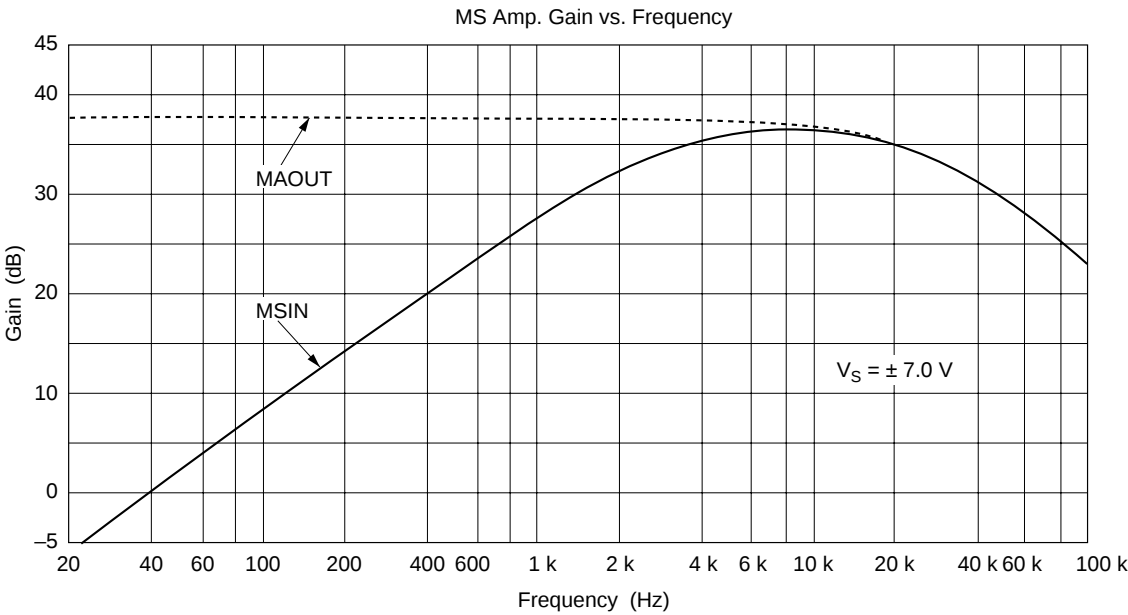
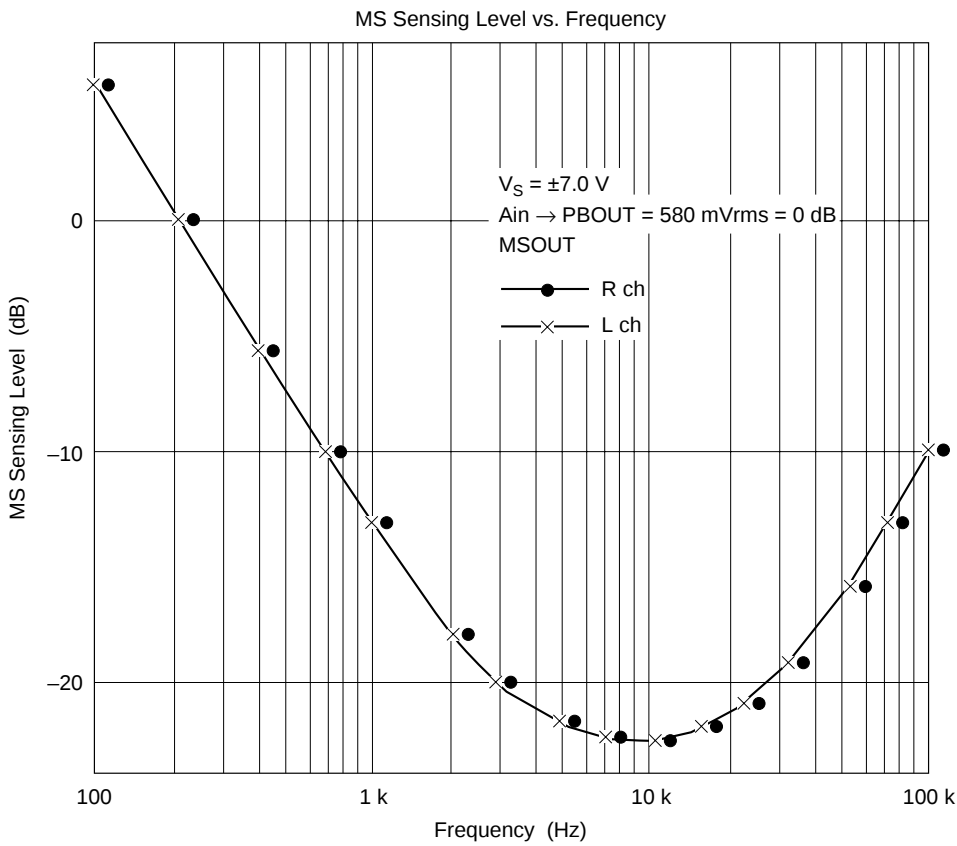
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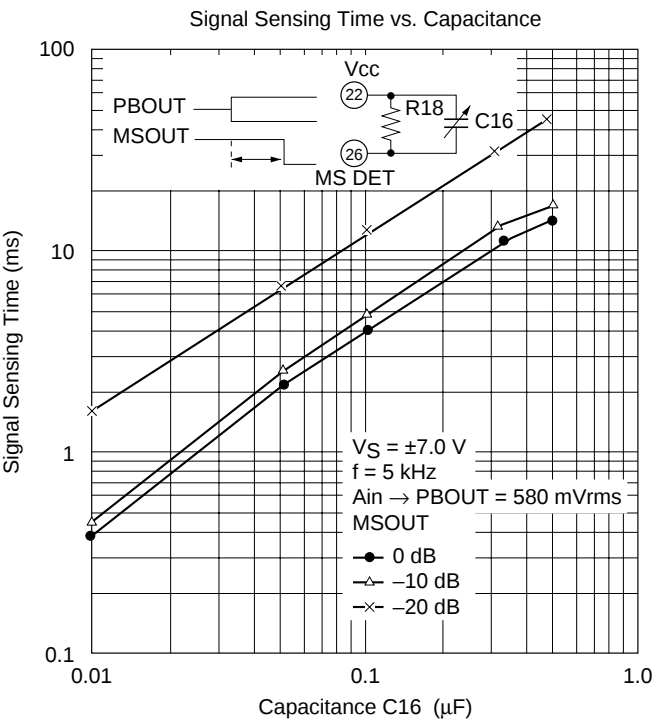
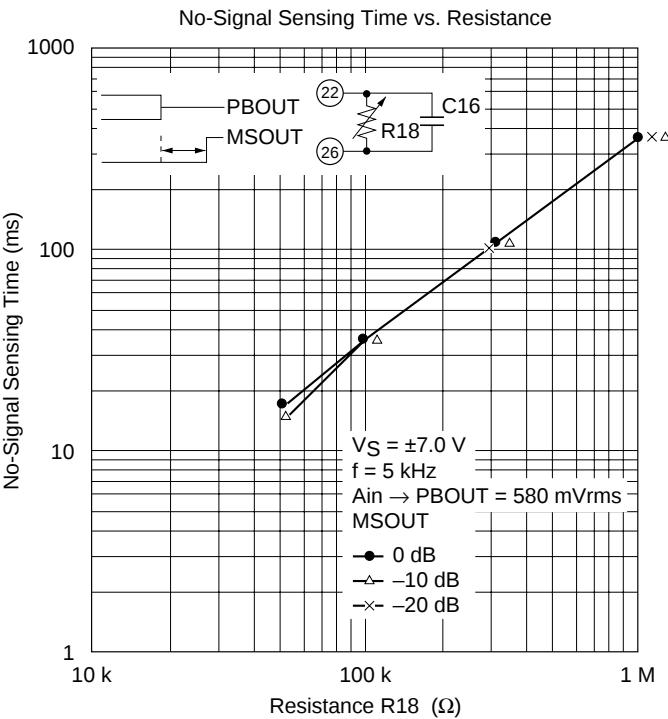


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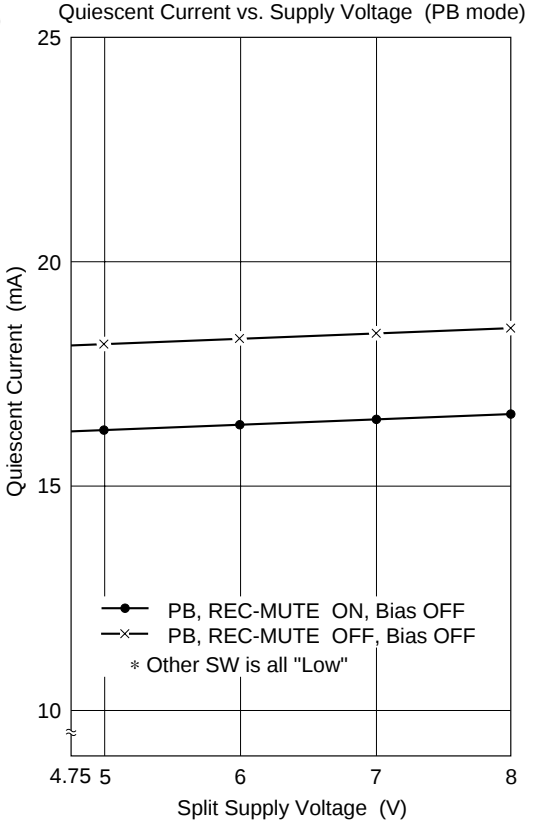
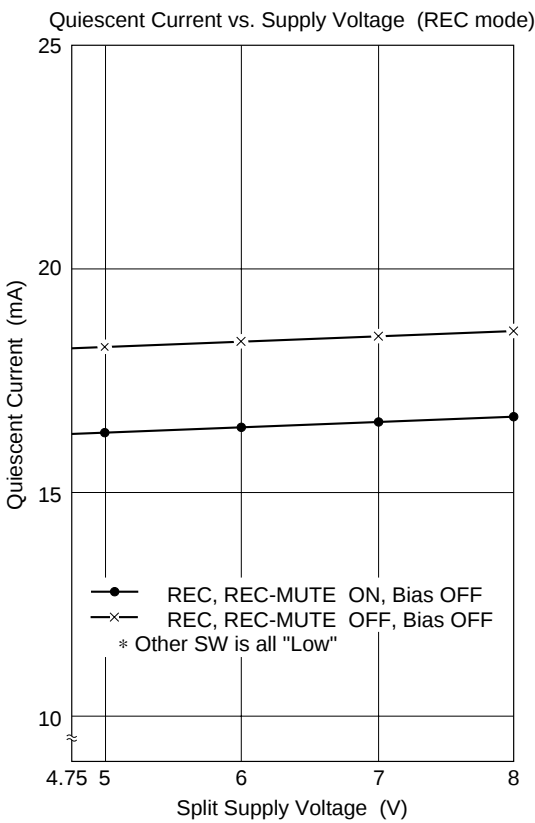


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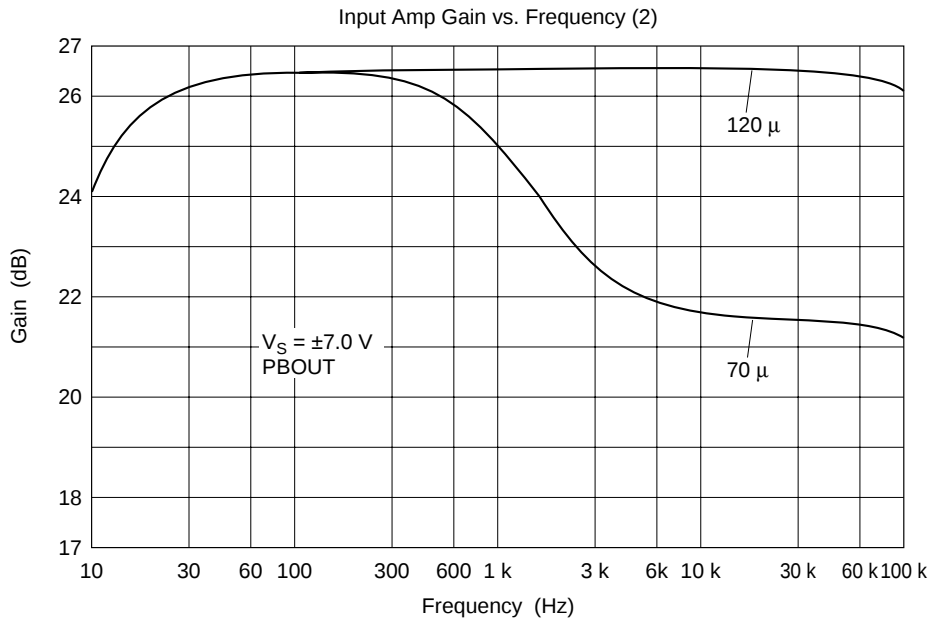
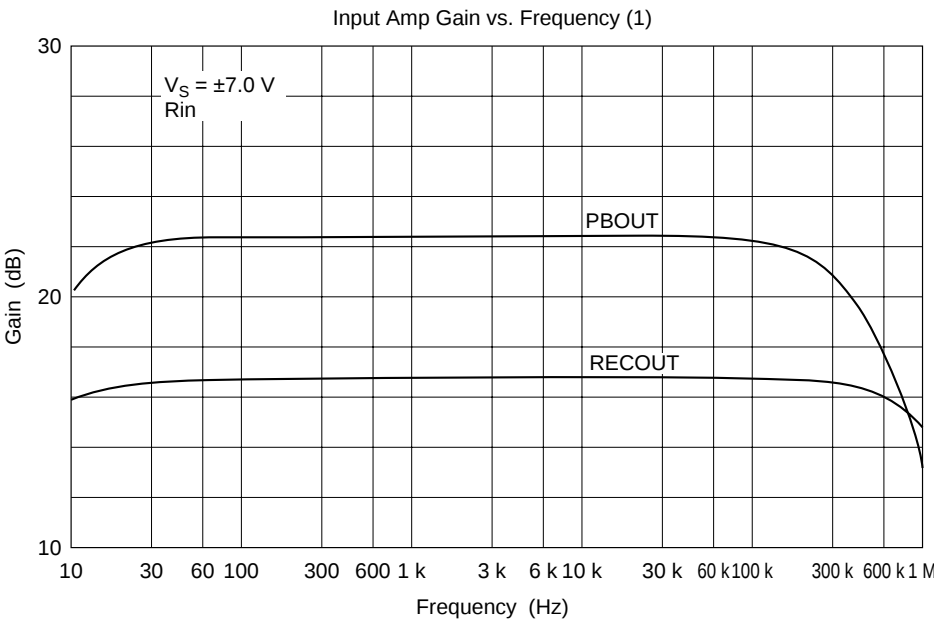




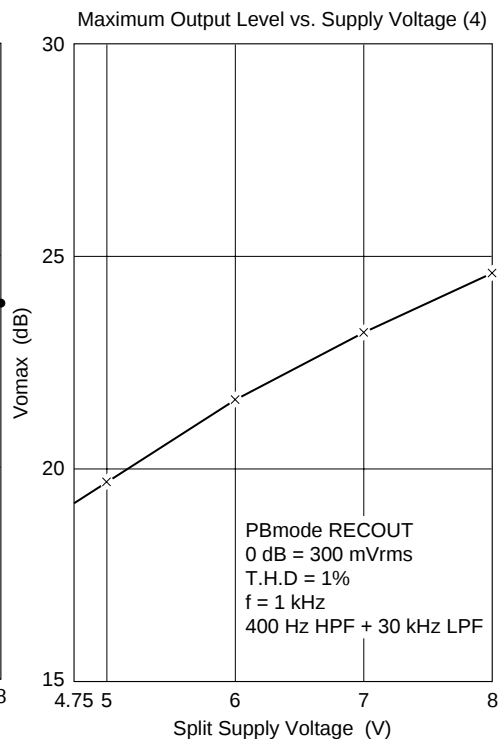
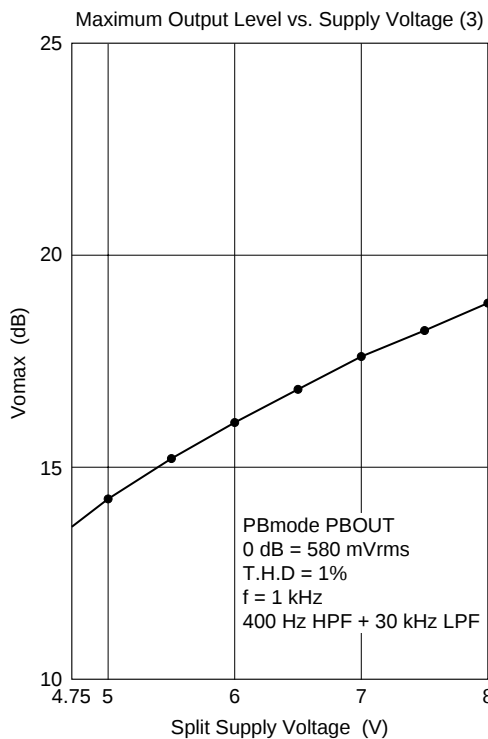
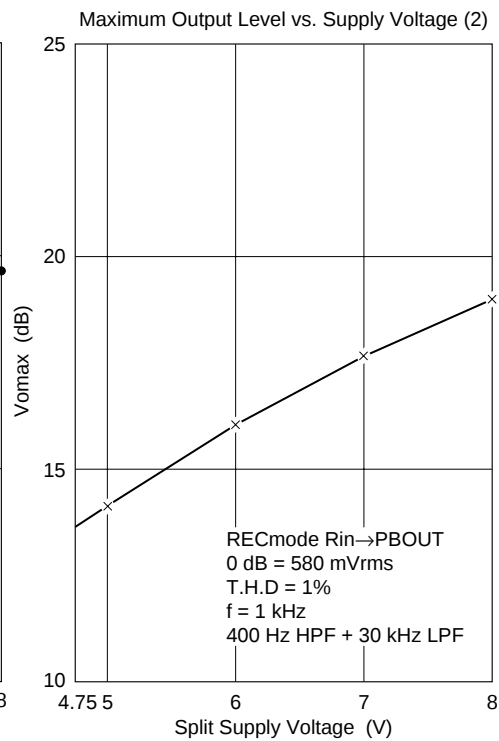
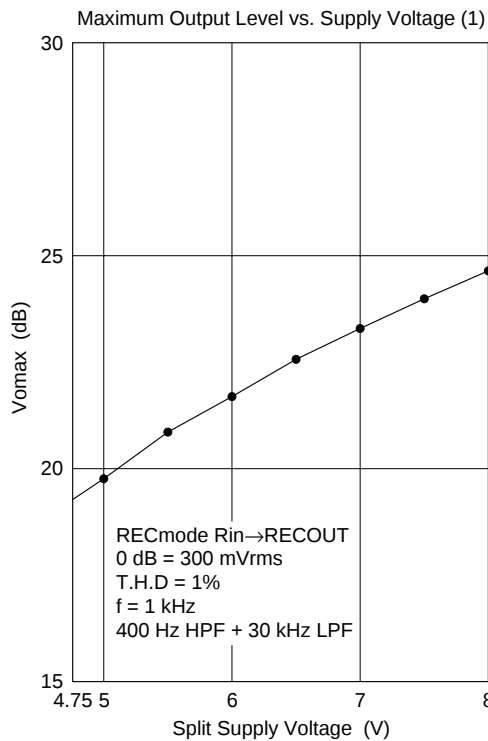
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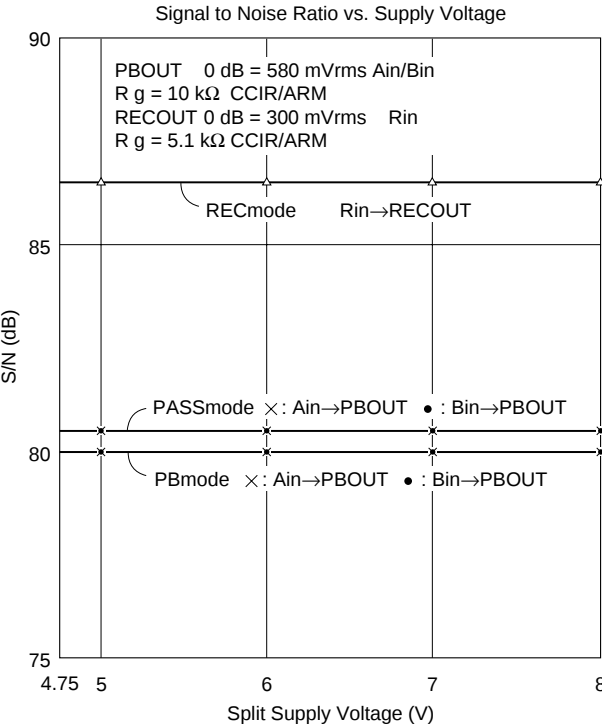
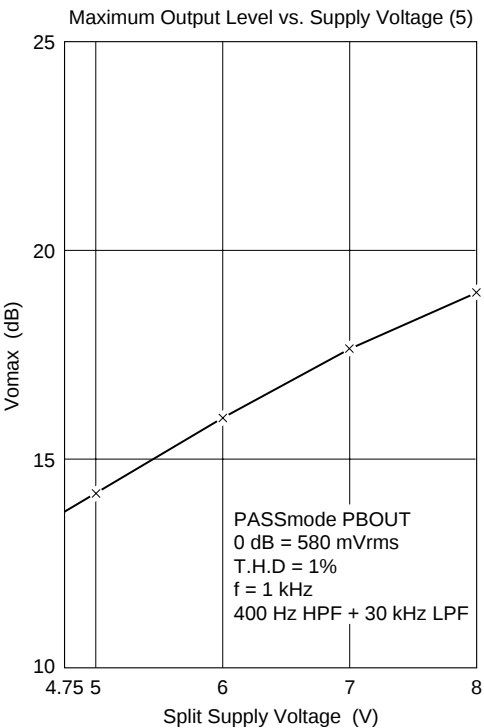
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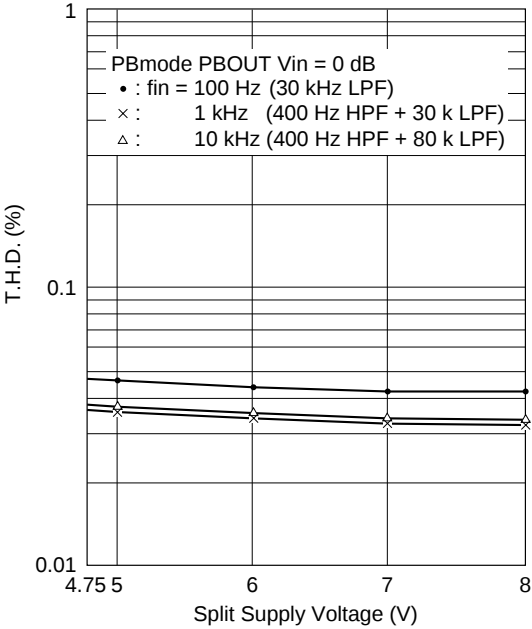


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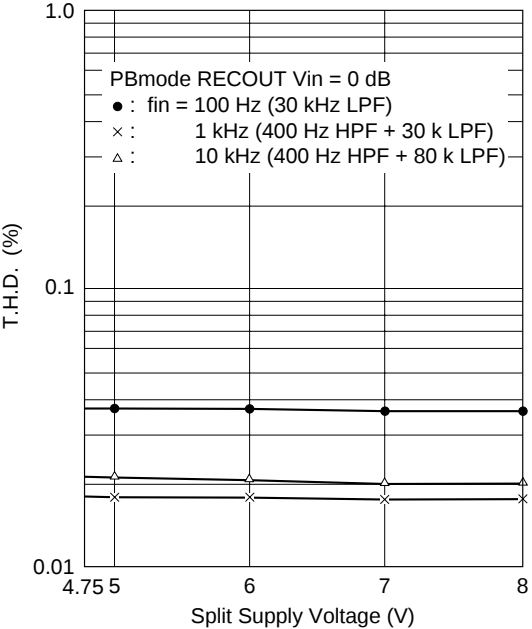


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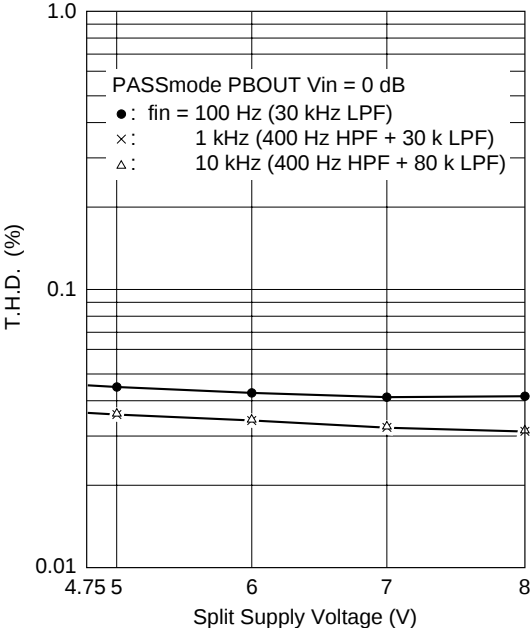
Total Harmonic Distortion vs. Supply Voltage (1)



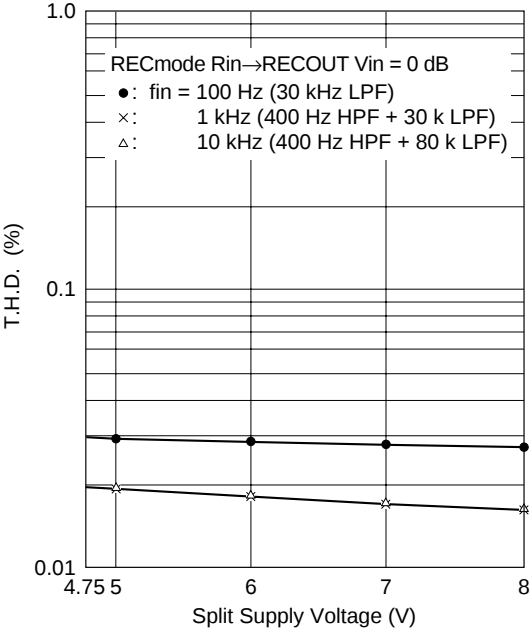
Total Harmonic Distortion vs. Supply Voltage (2)



Total Harmonic Distortion vs. Supply Voltage (3)

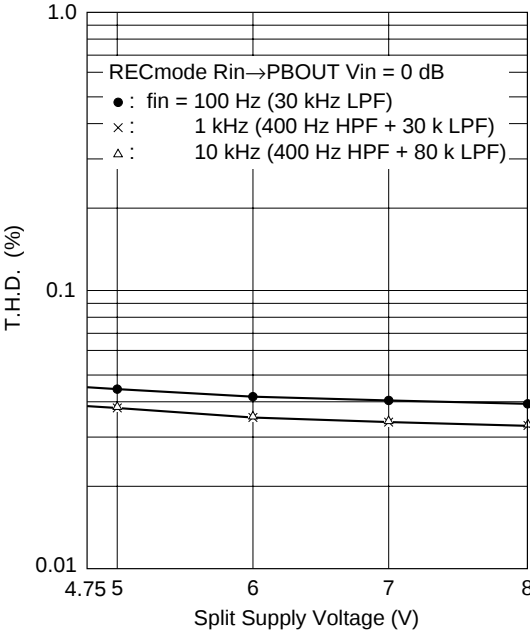


Total Harmonic Distortion vs. Supply Voltage (4)

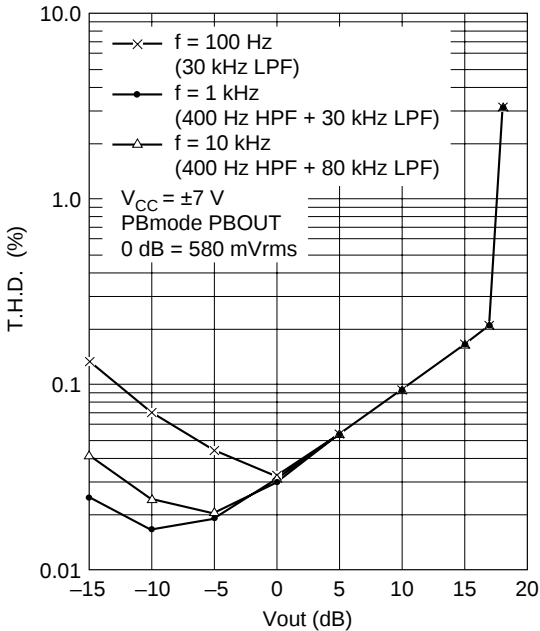


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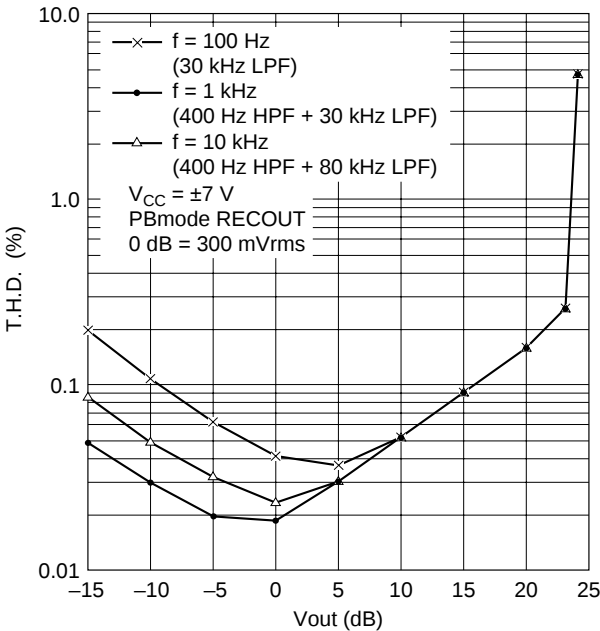
Total Harmonic Distortion vs. Supply Voltage (5)



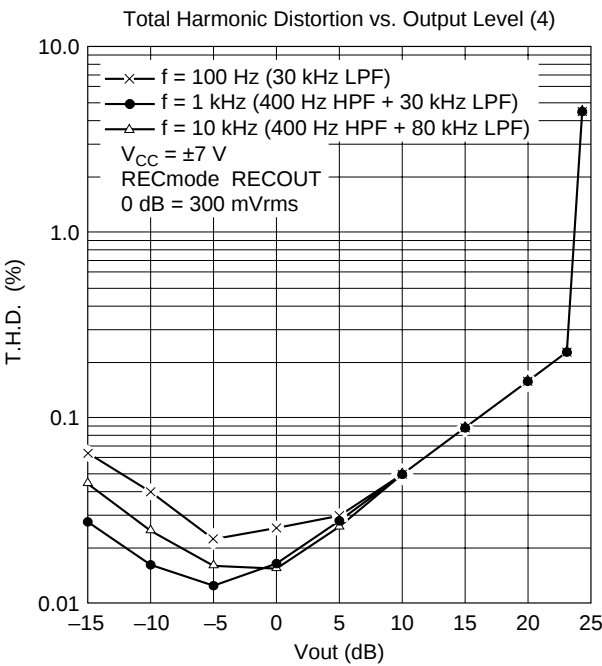
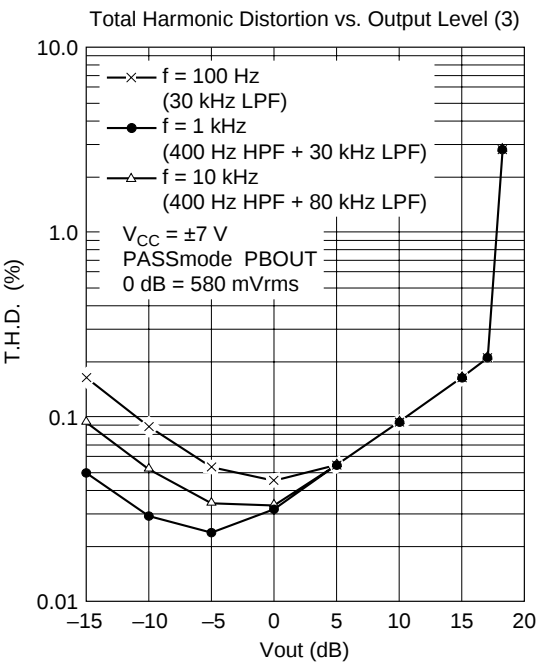
Total Harmonic Distortion vs. Output Level (1)



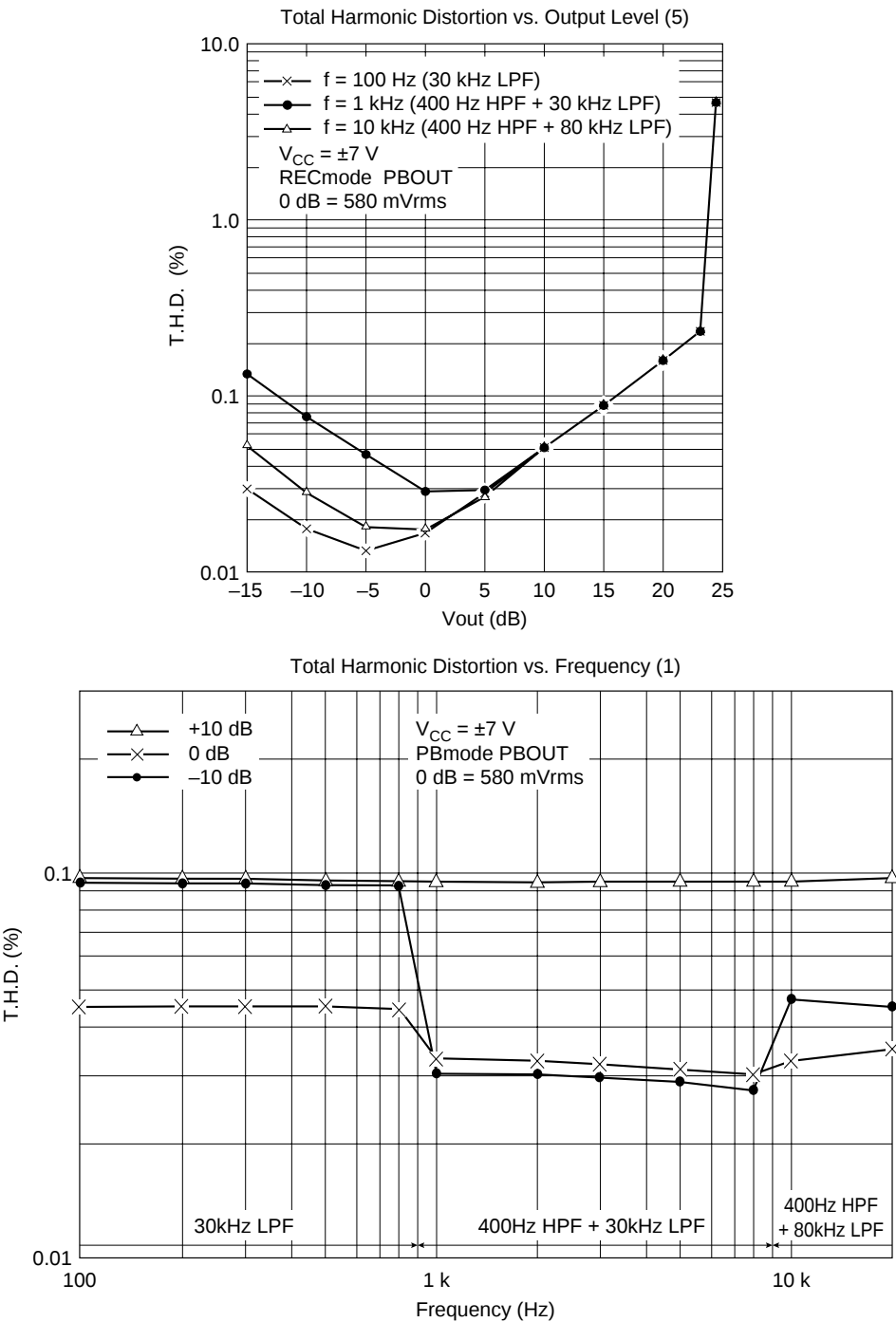
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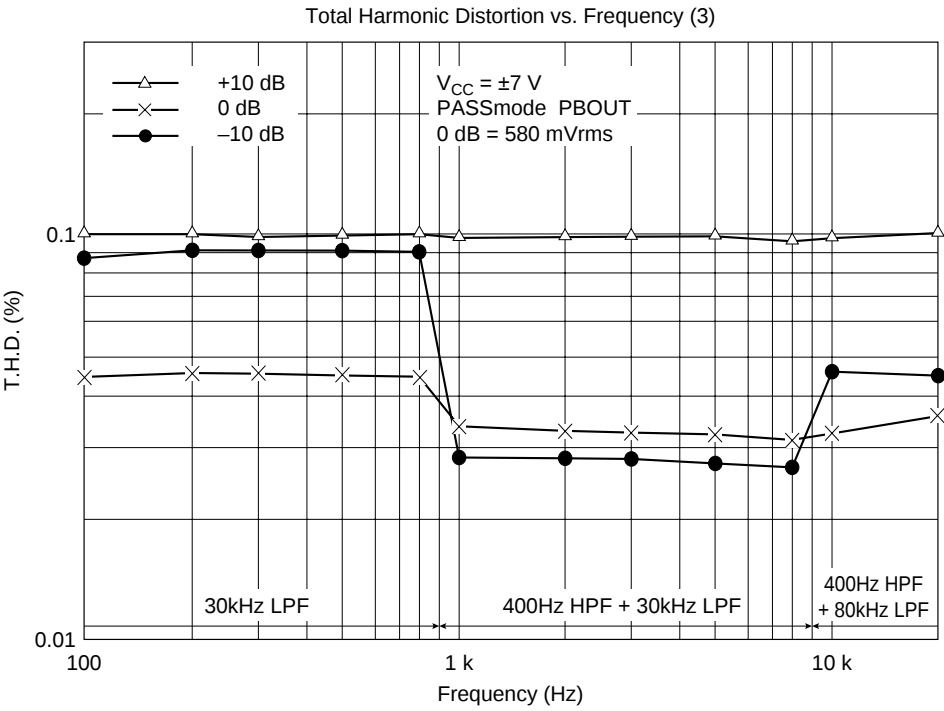
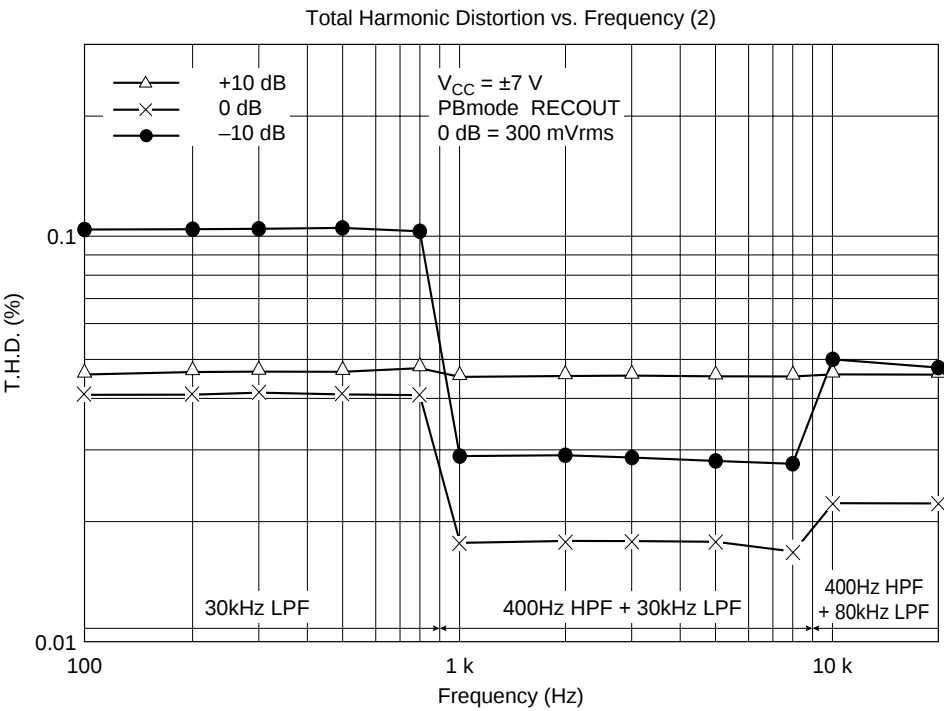
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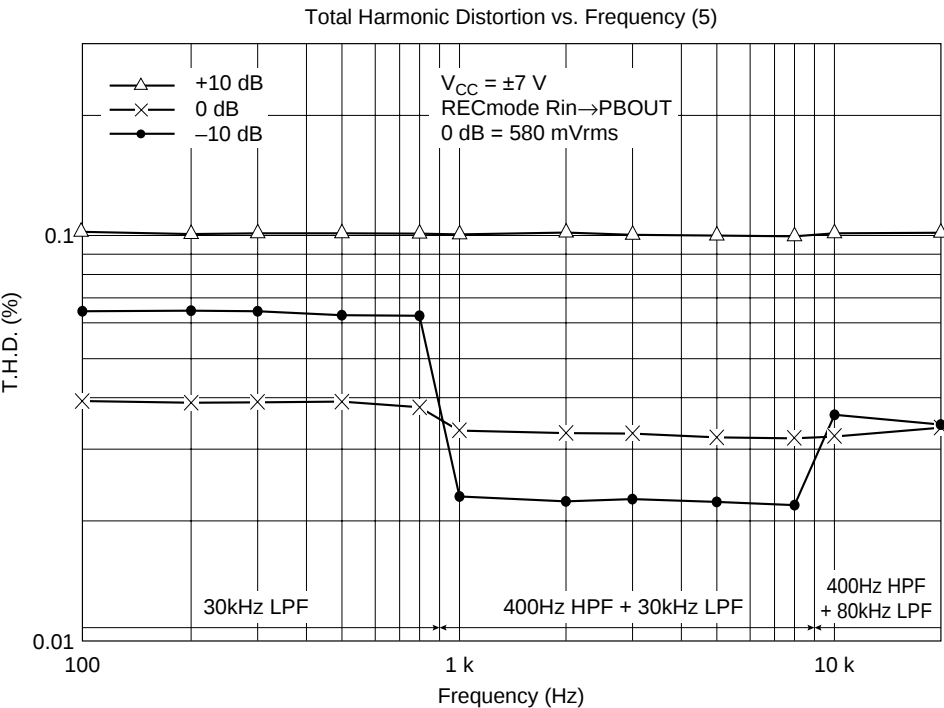
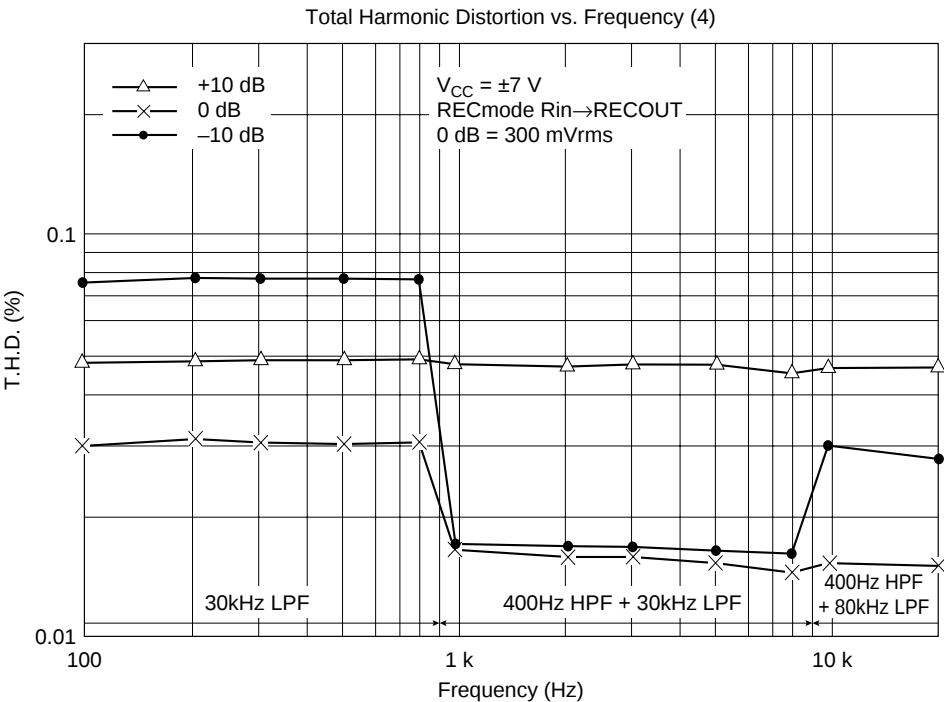
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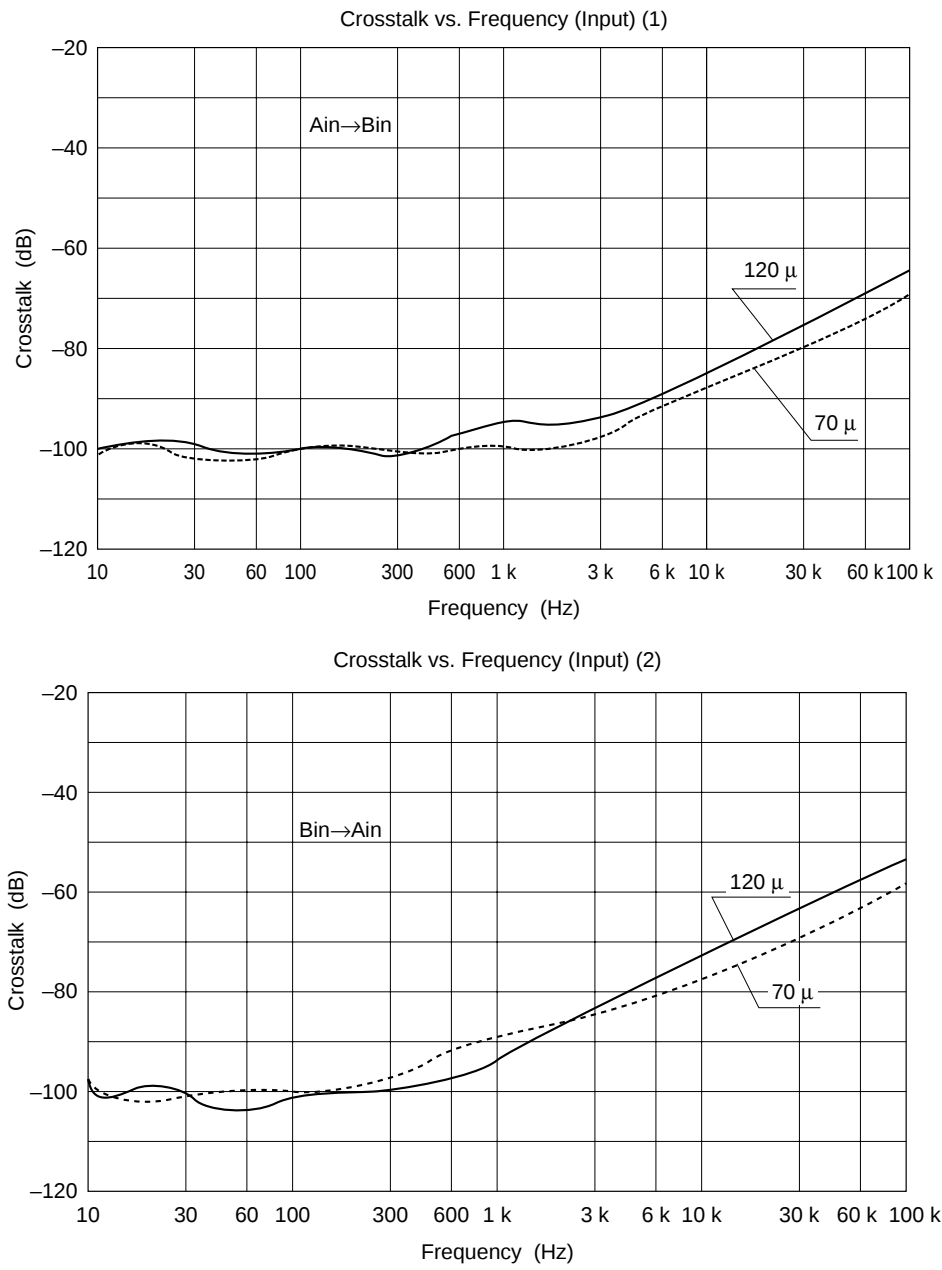
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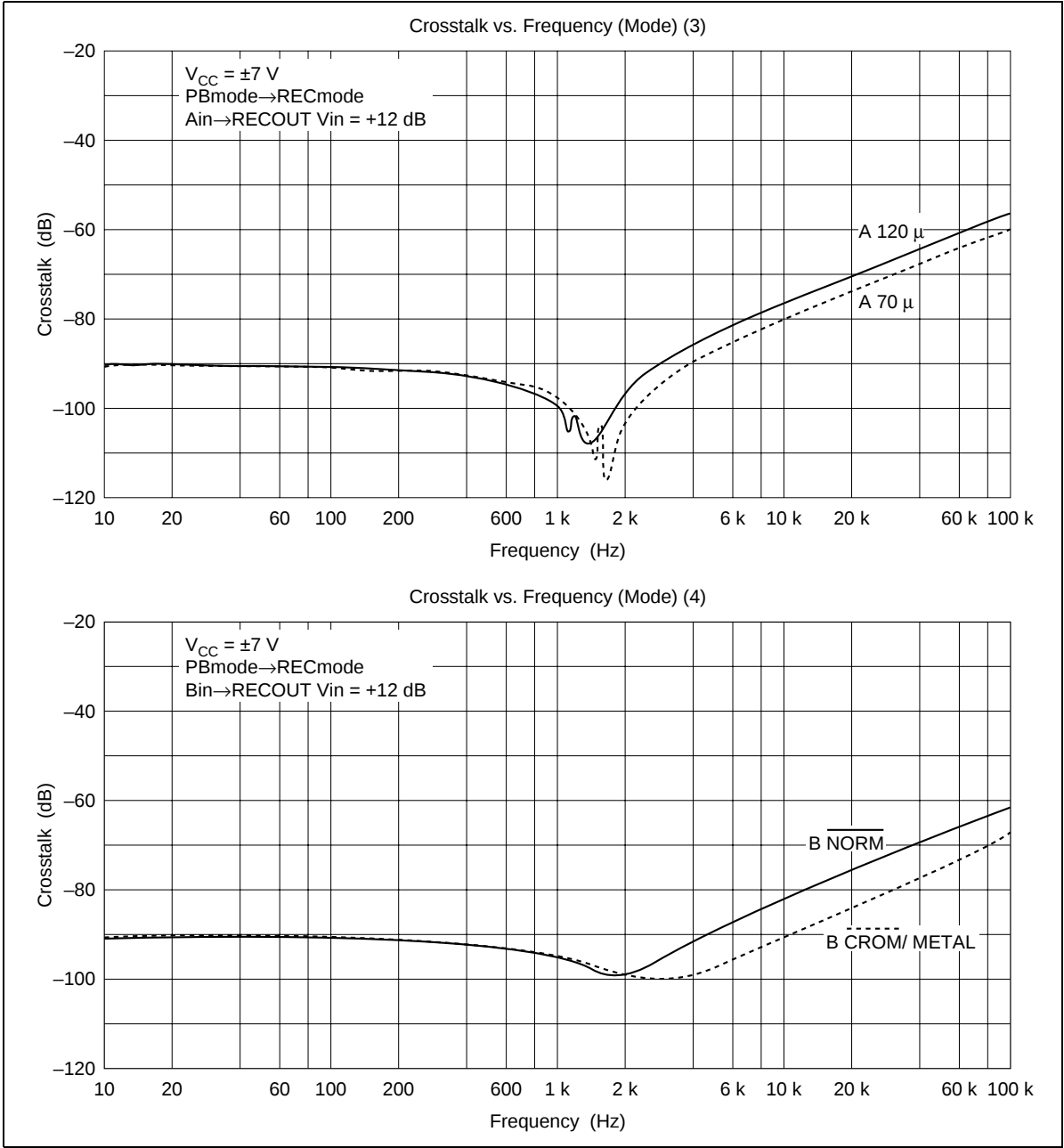
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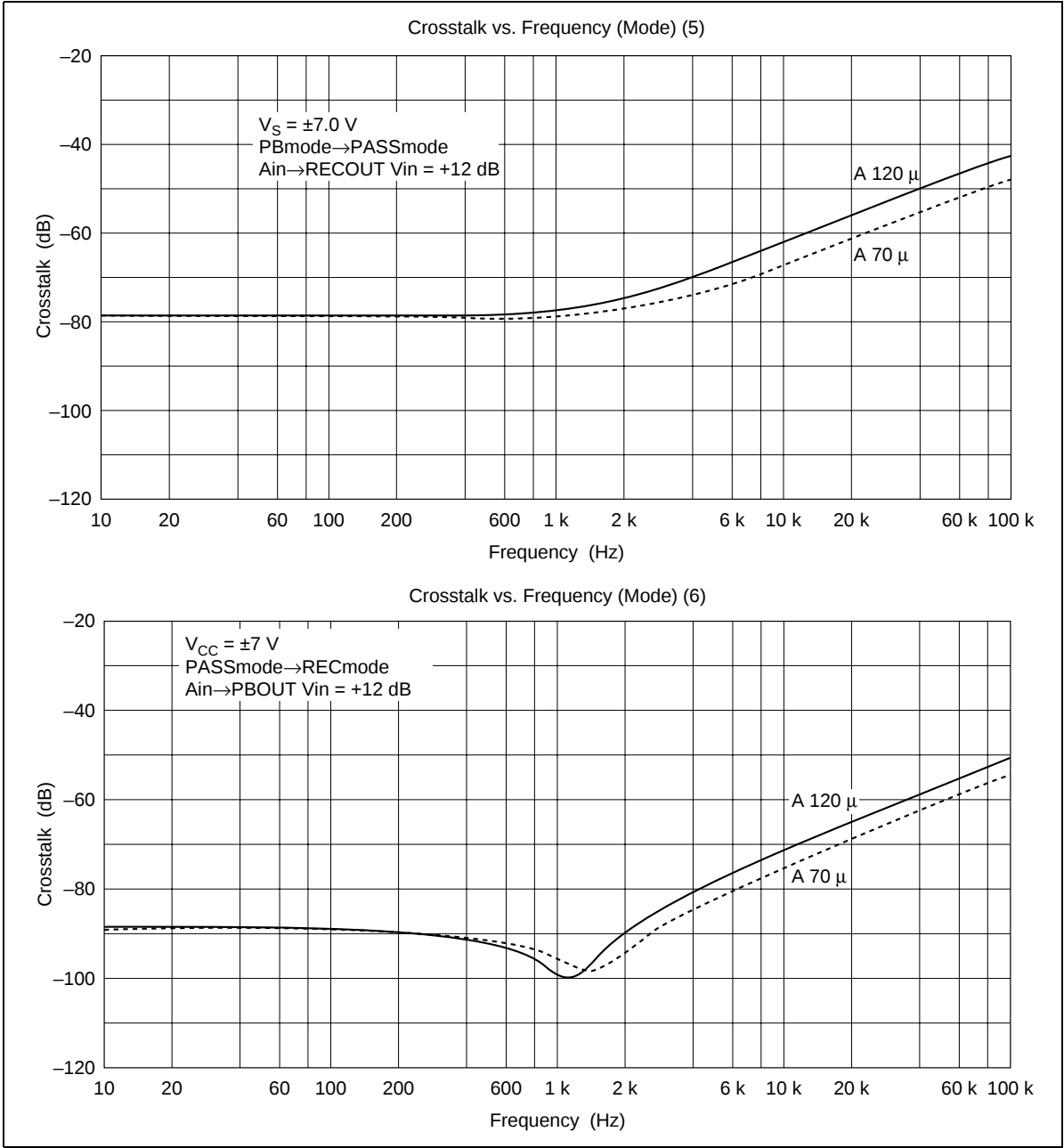
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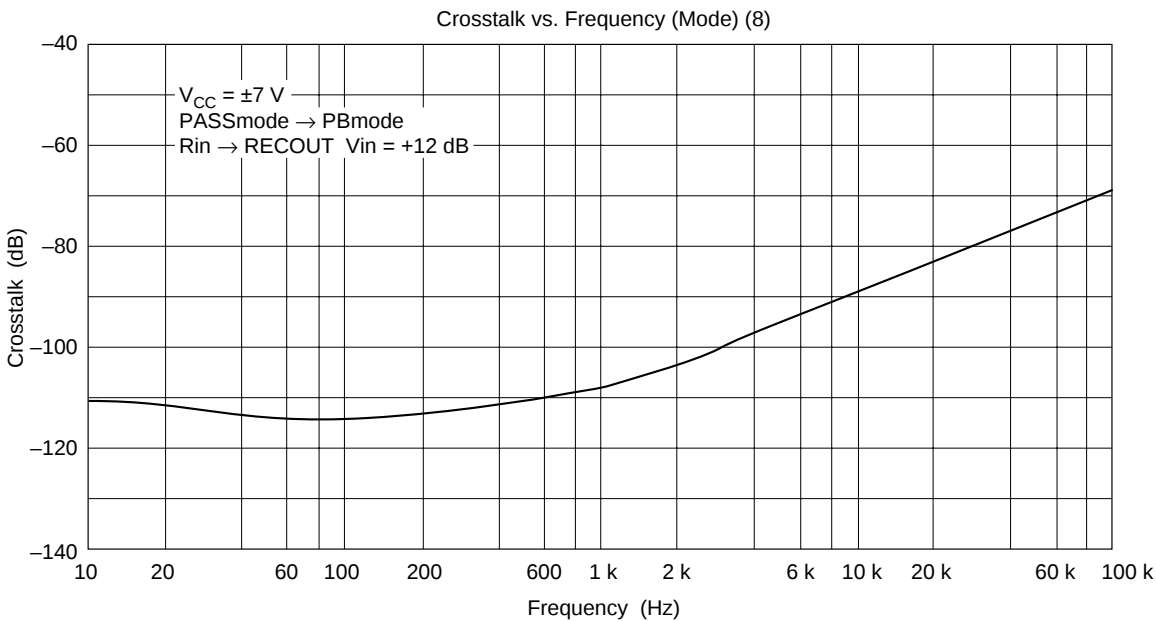
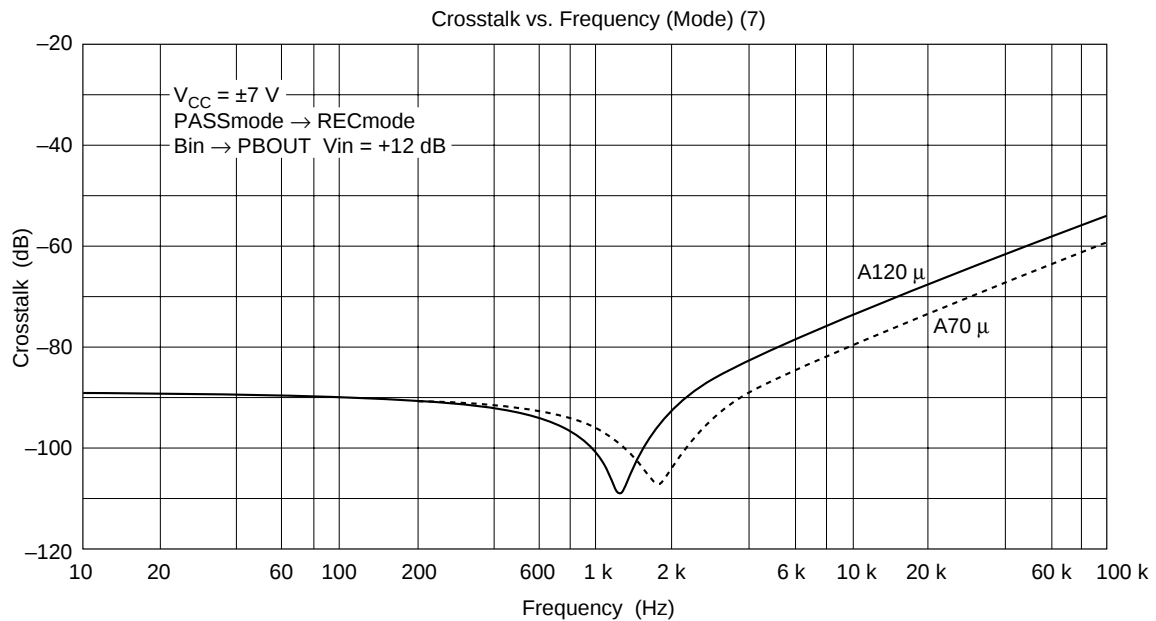
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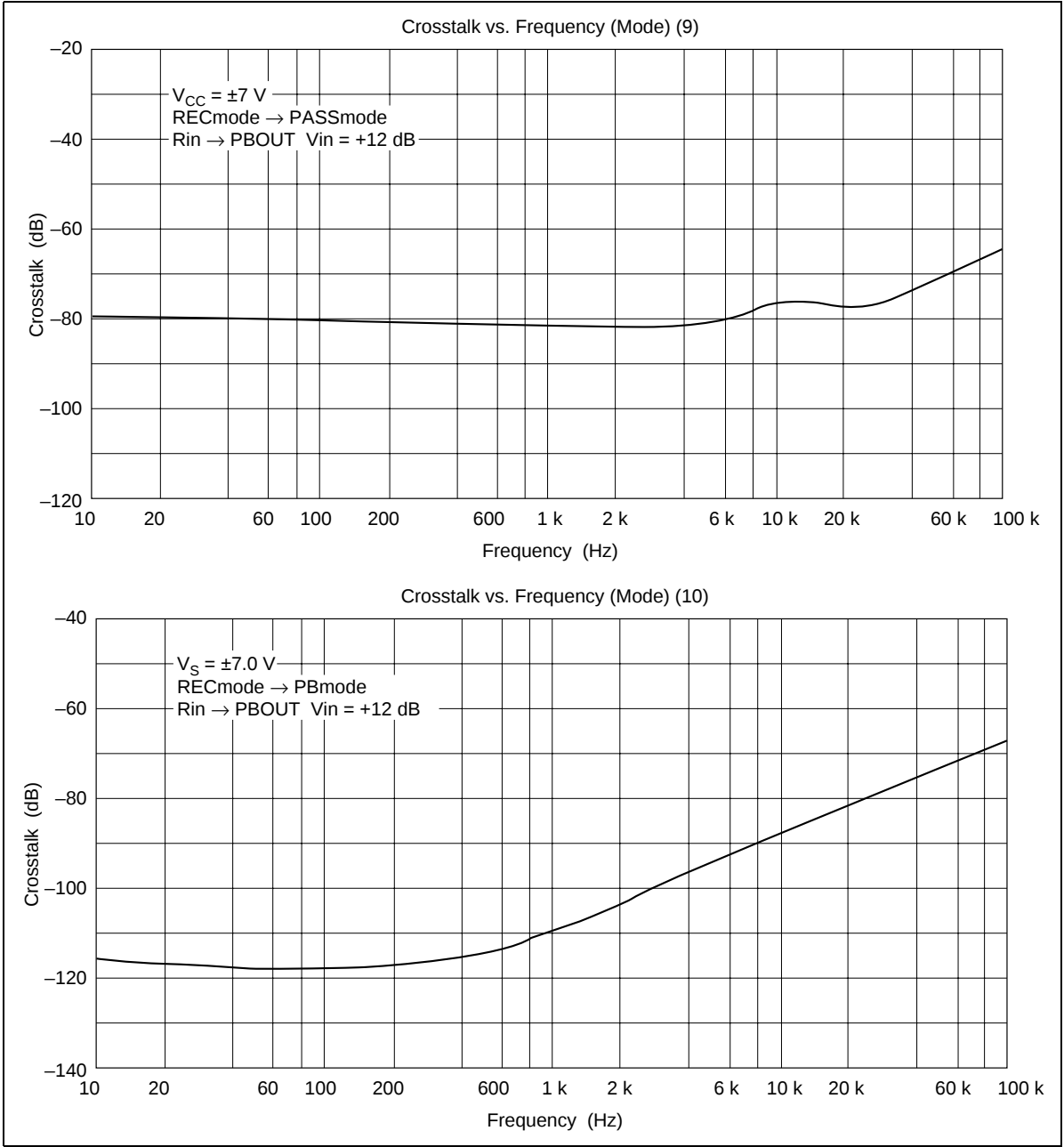
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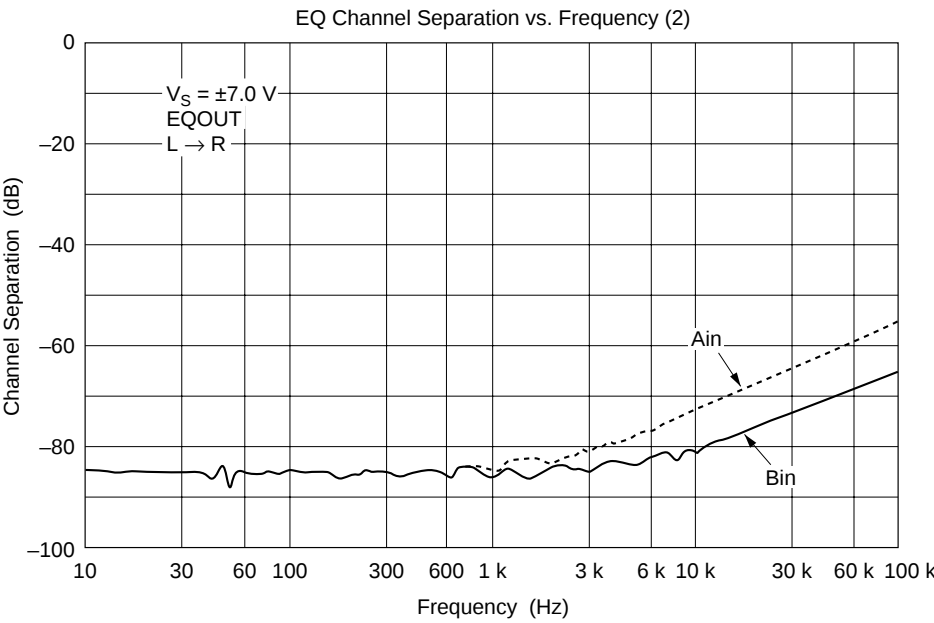
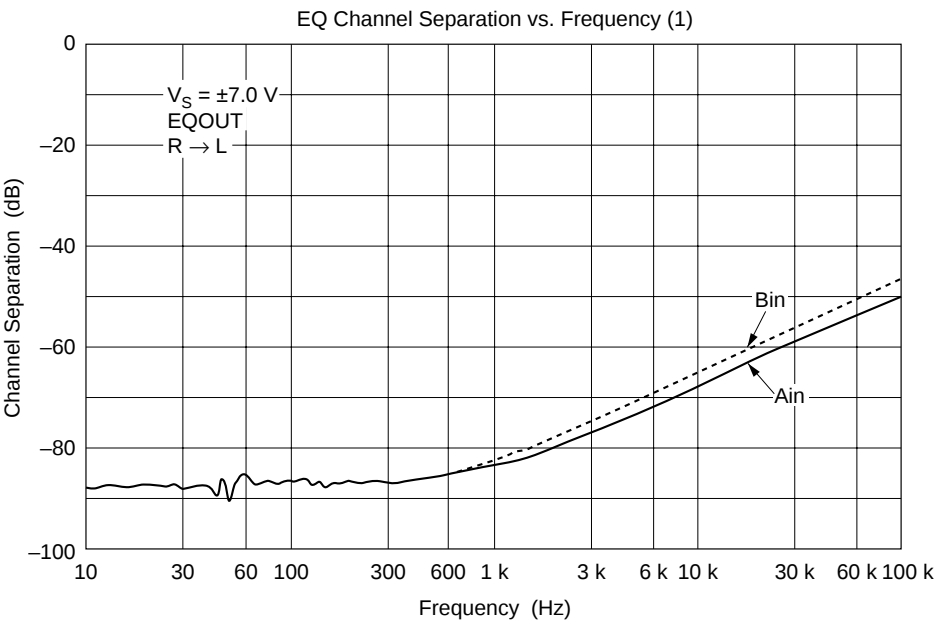
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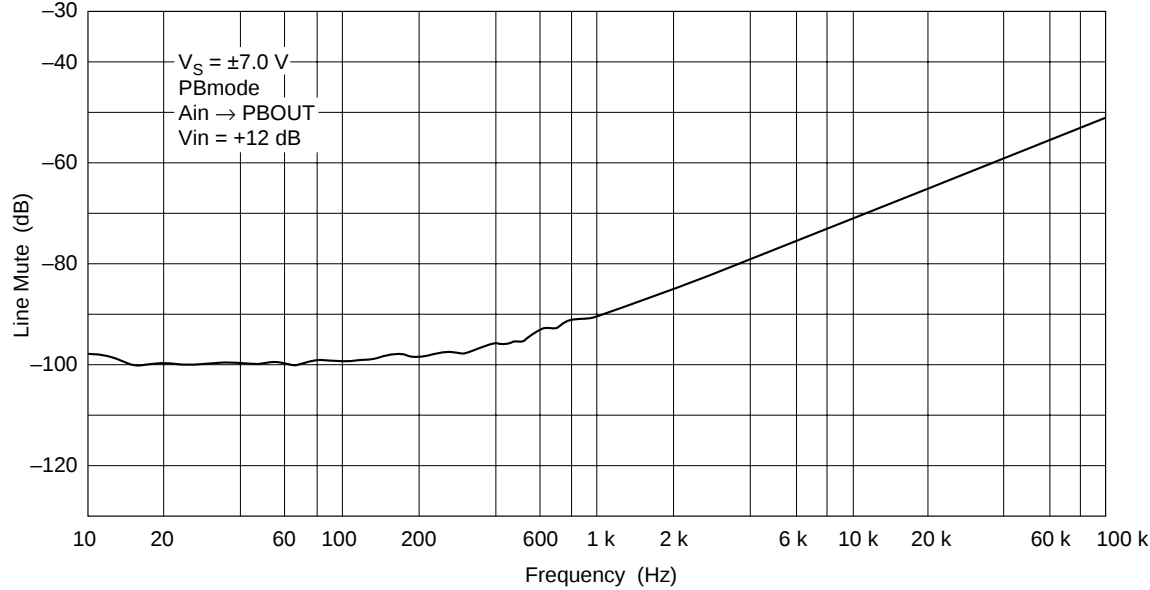


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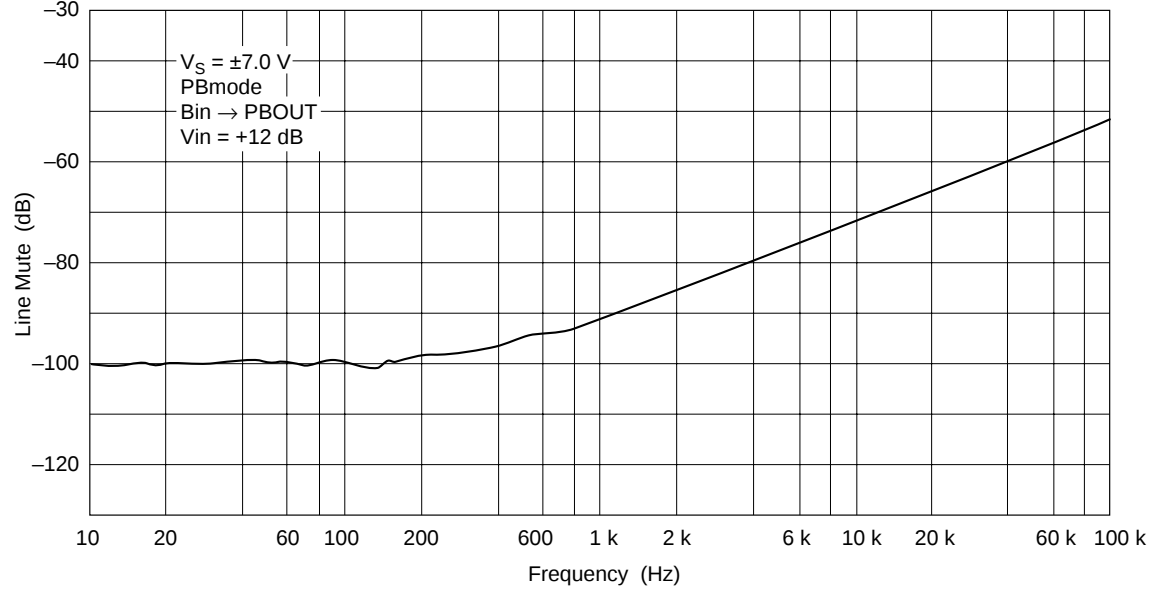


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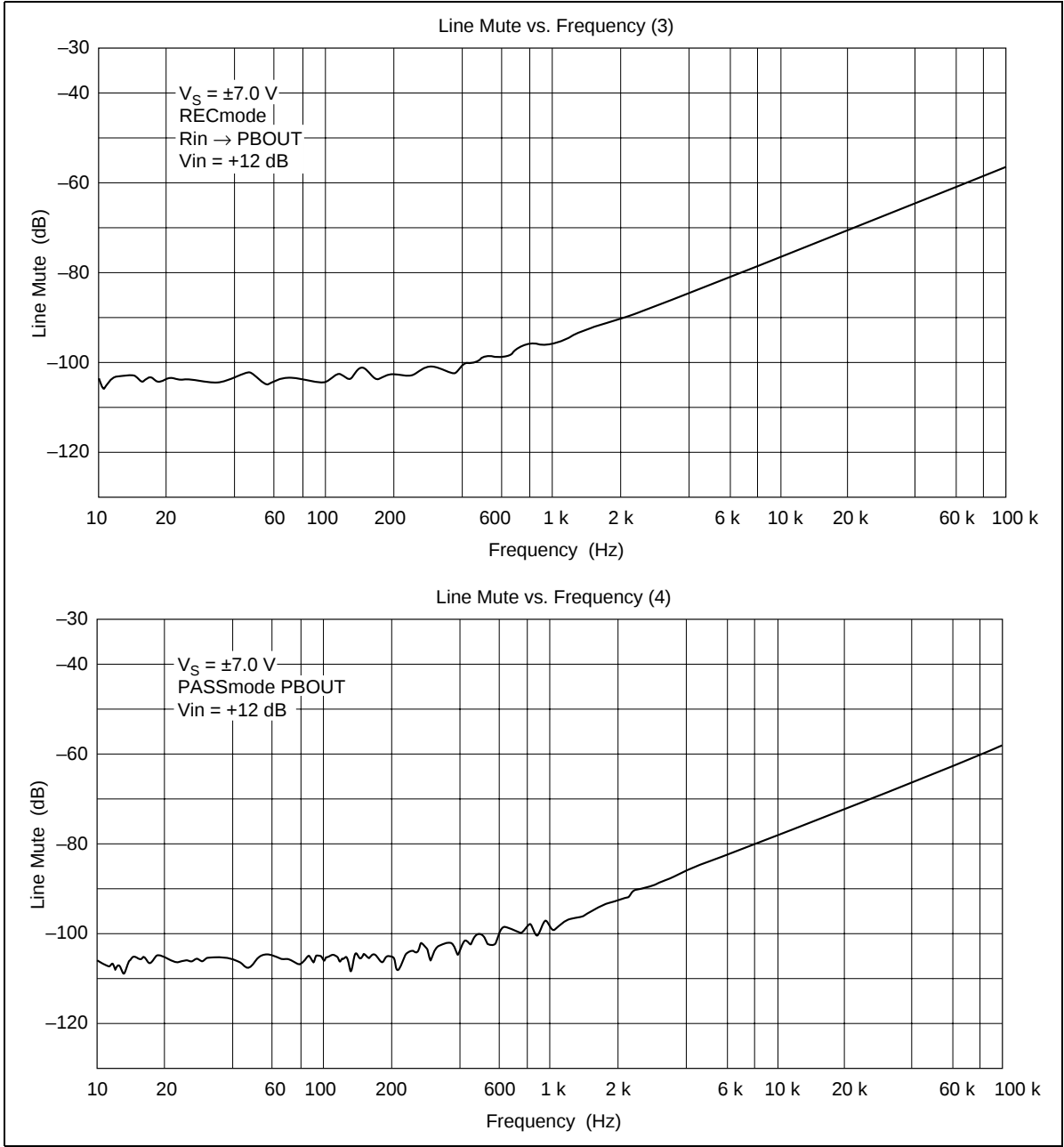
Line Mute vs. Frequency (1)



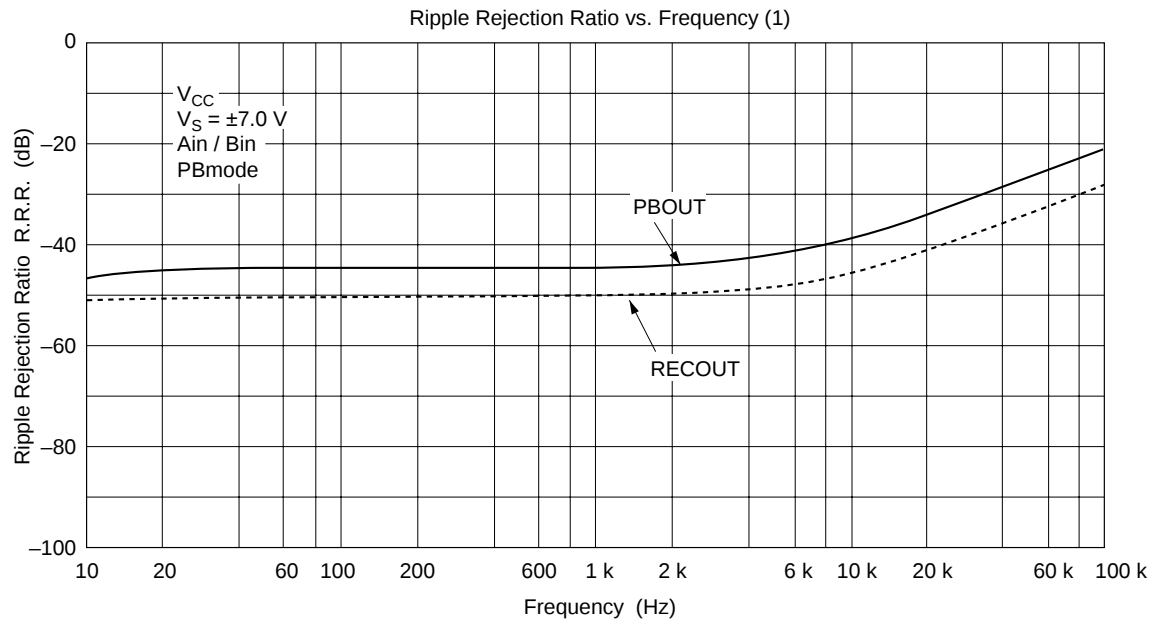
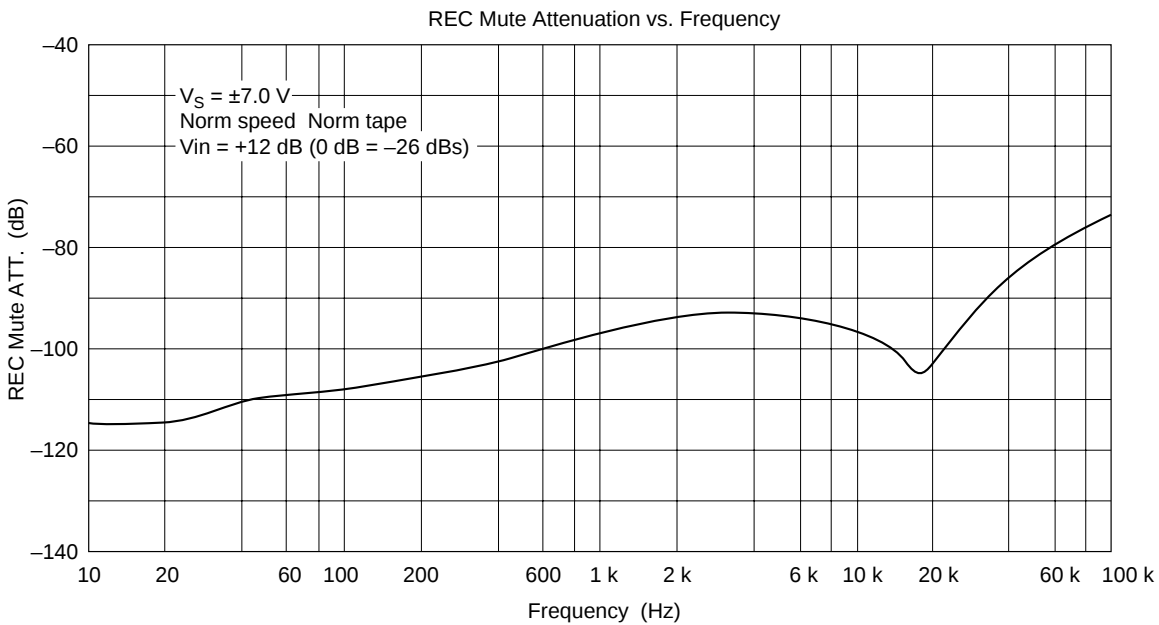
Line Mute vs. Frequency (2)



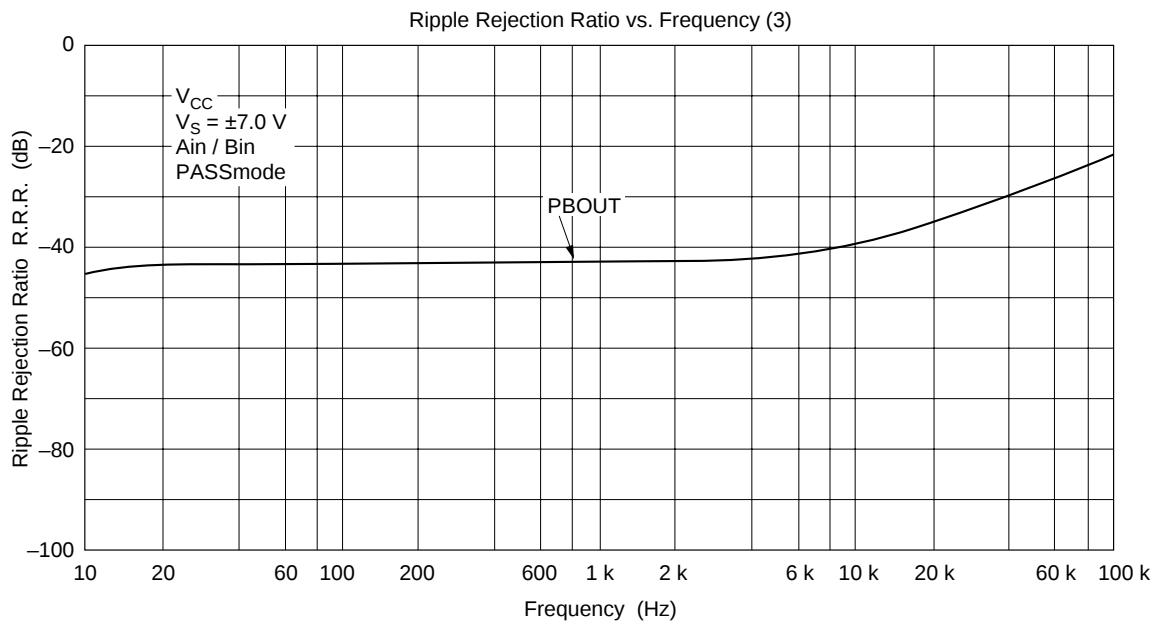
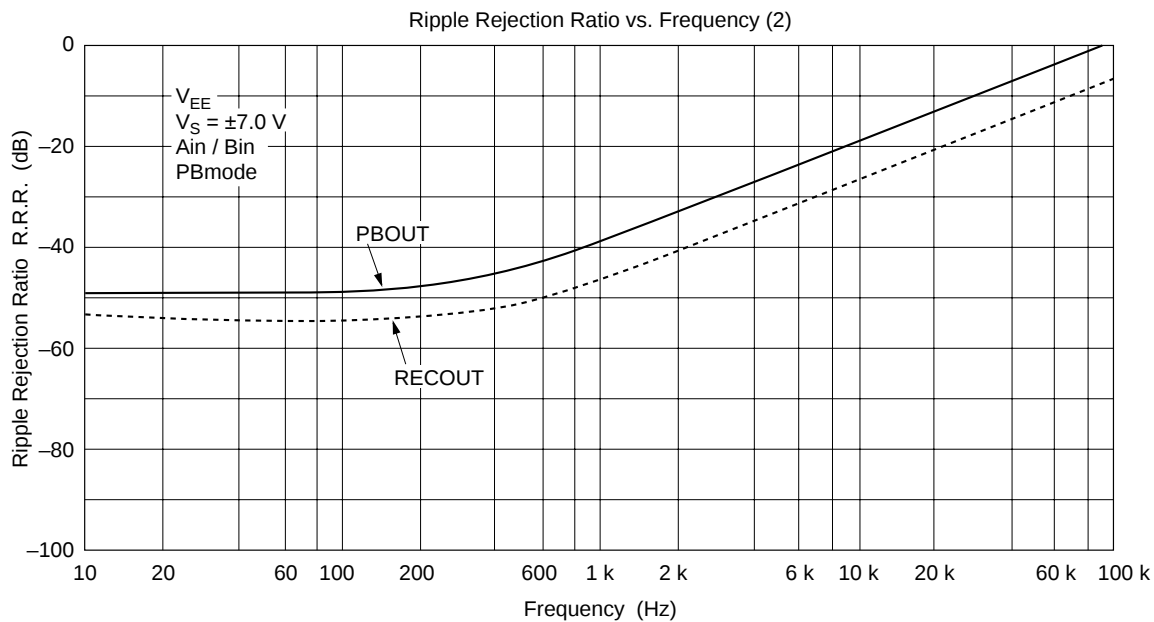
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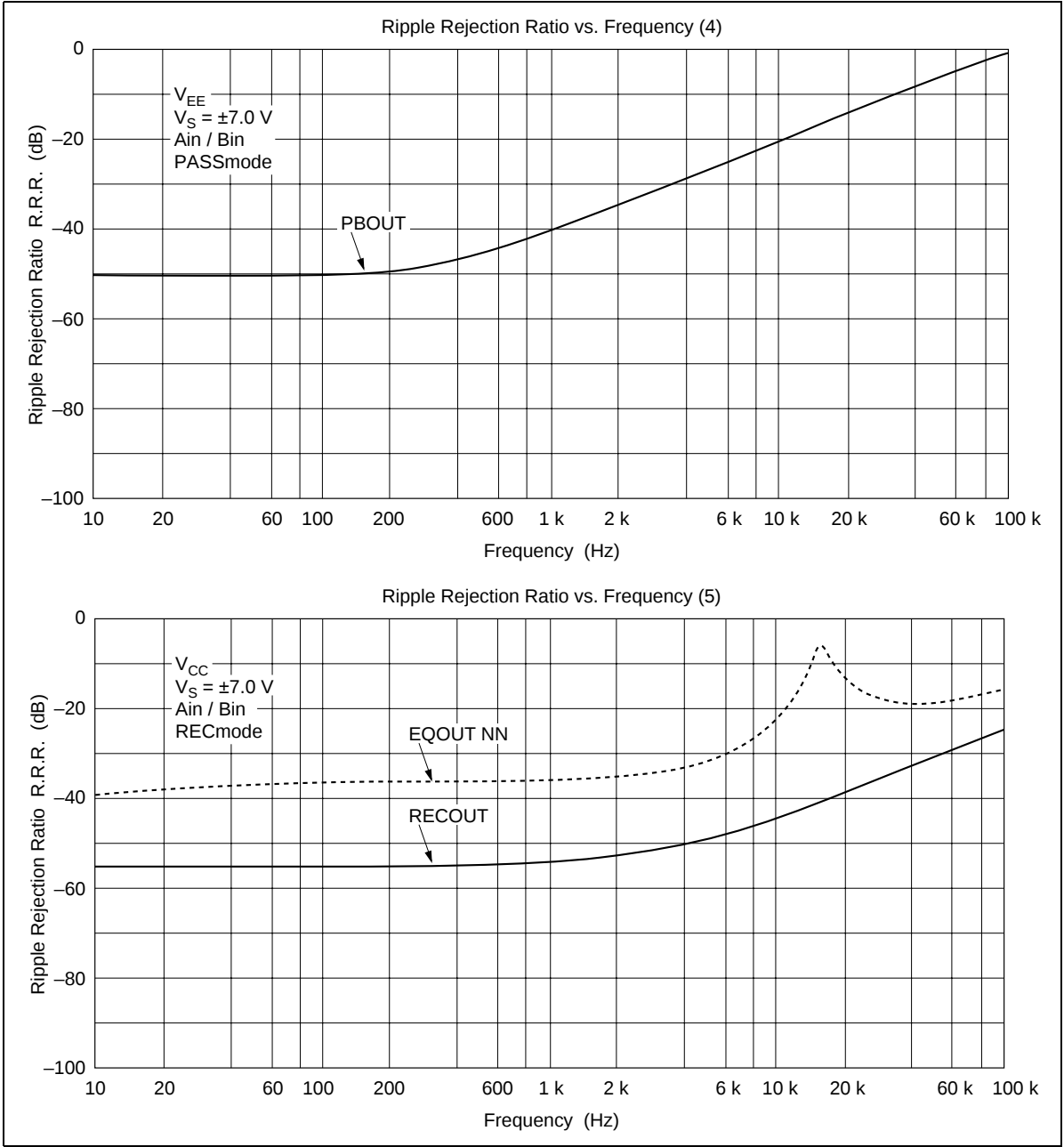
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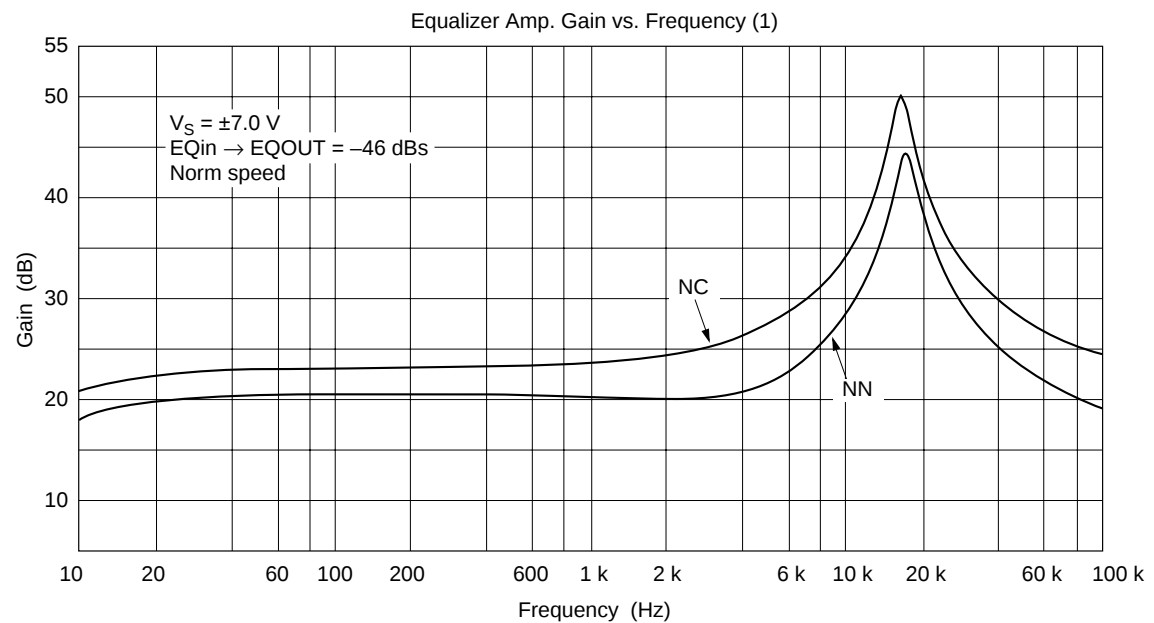
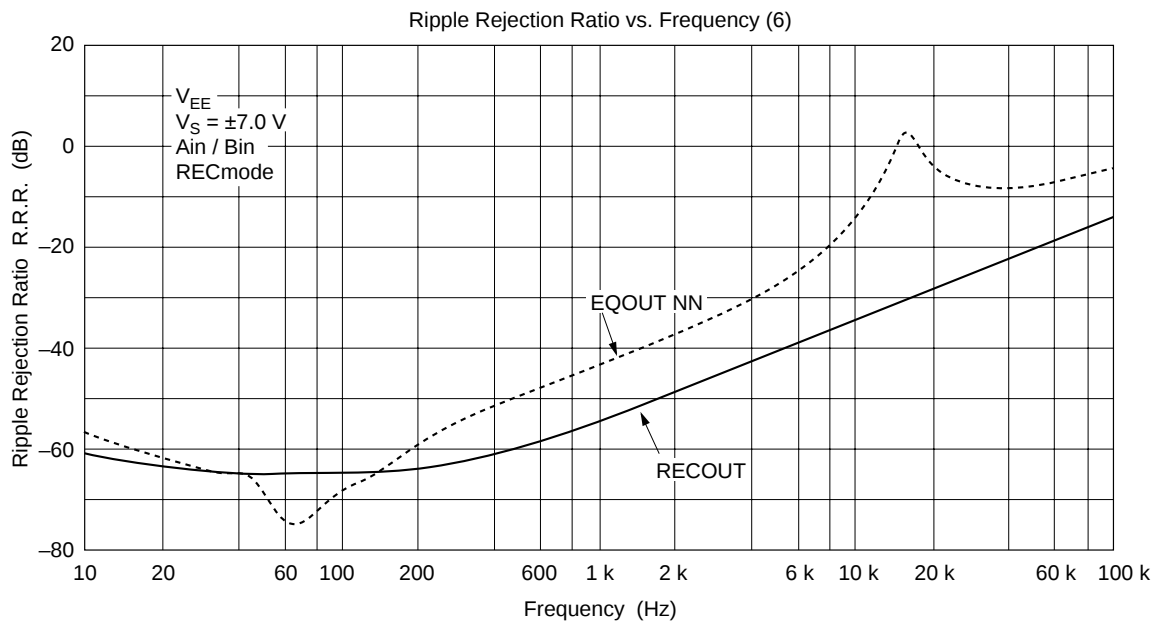
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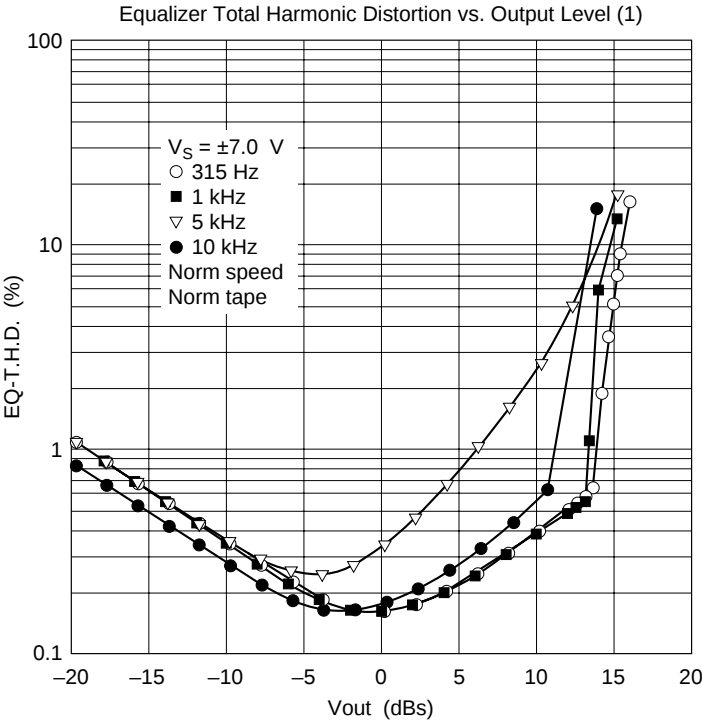
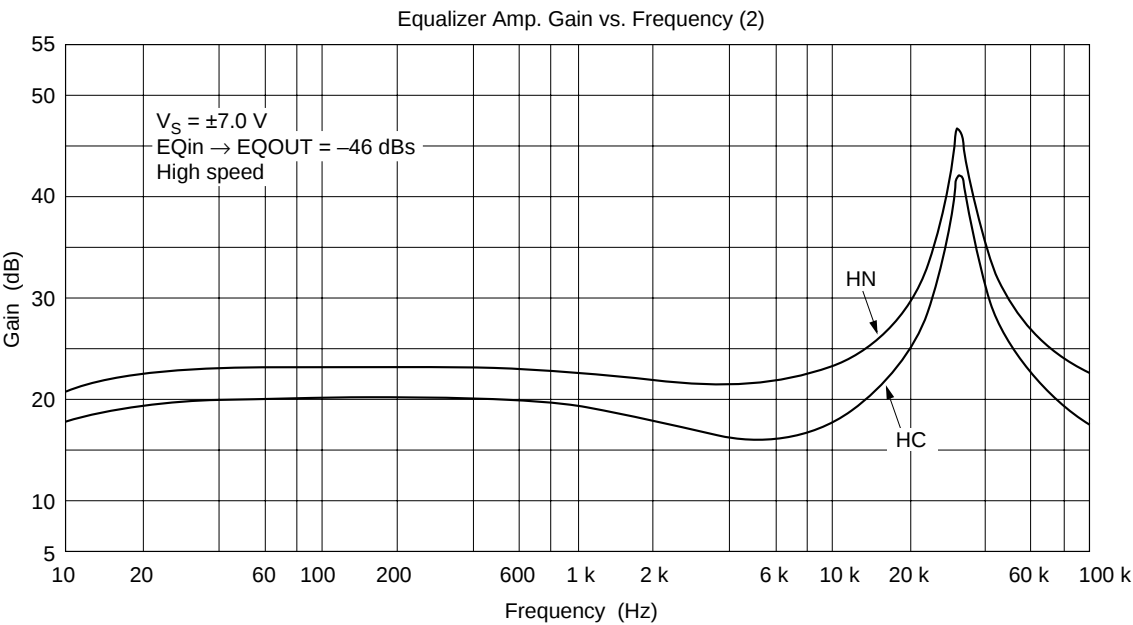
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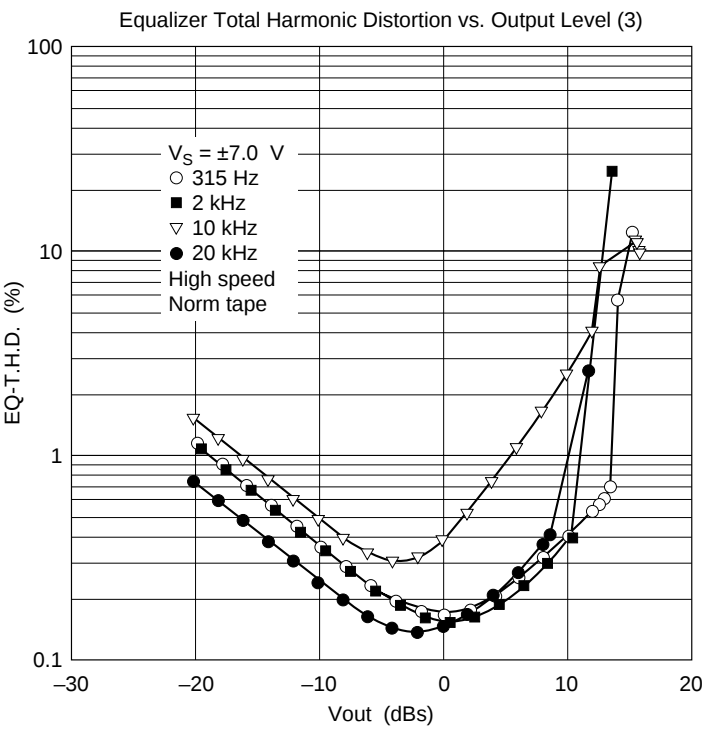
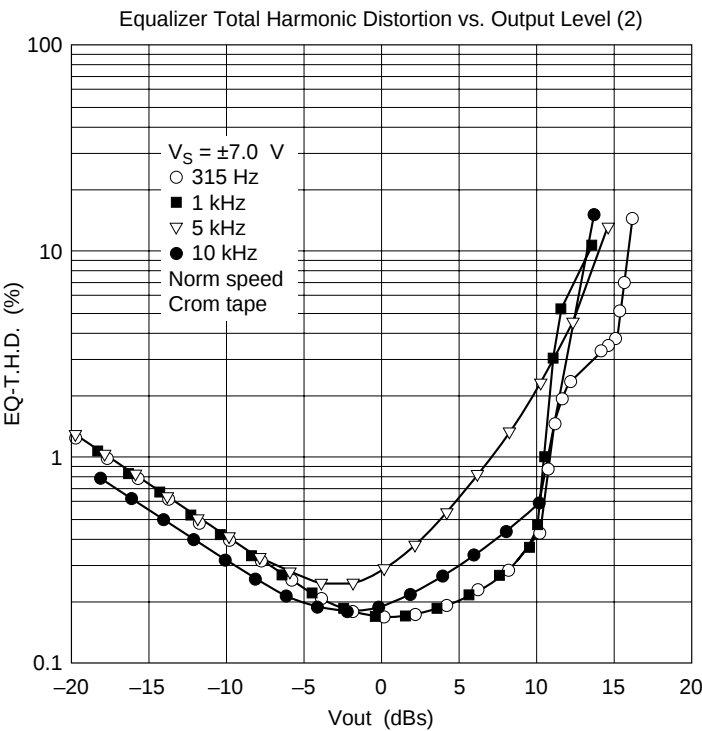
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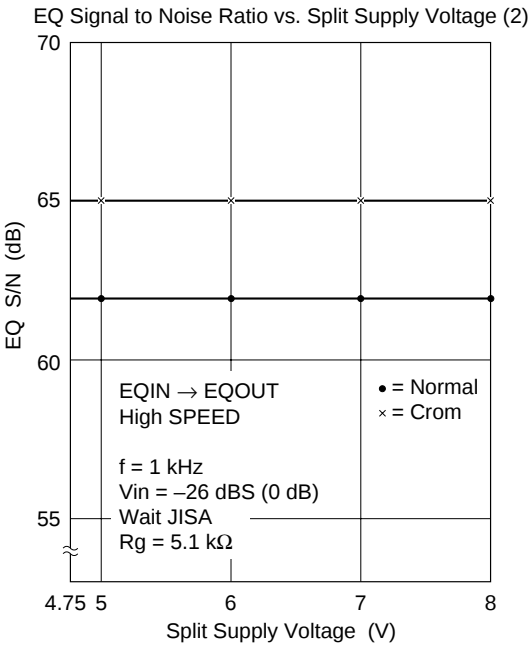
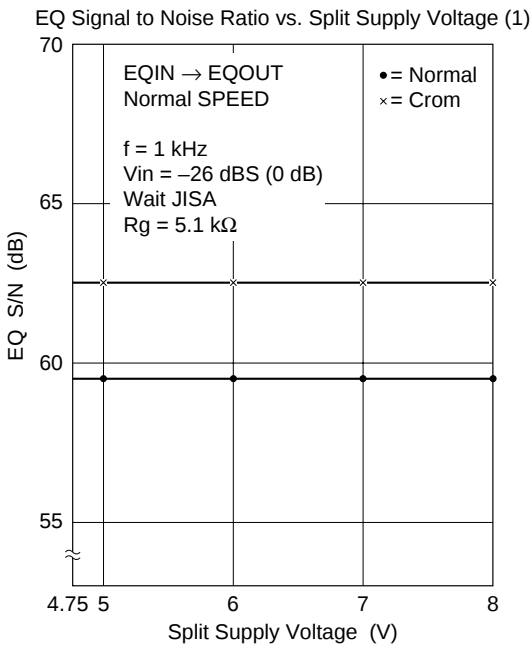
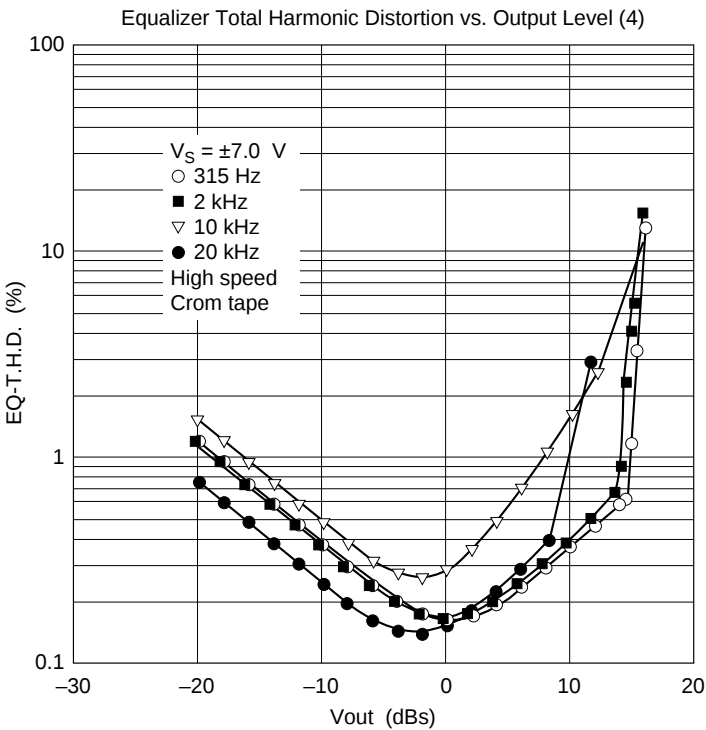
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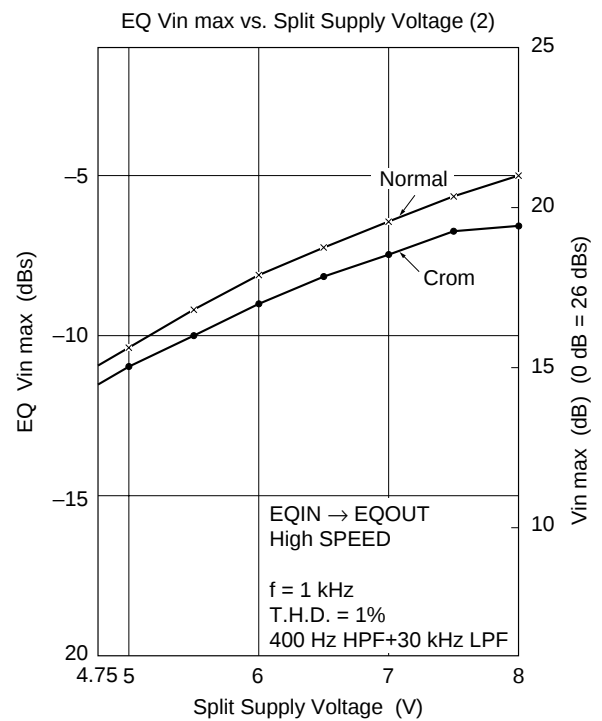
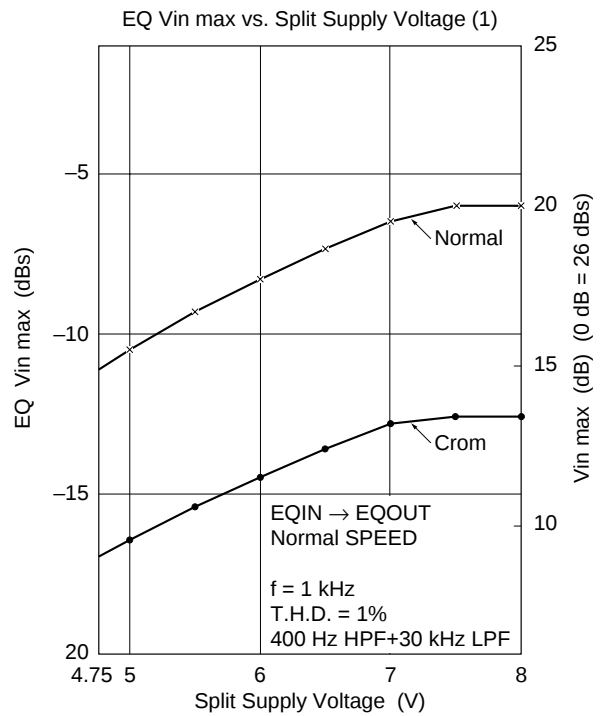
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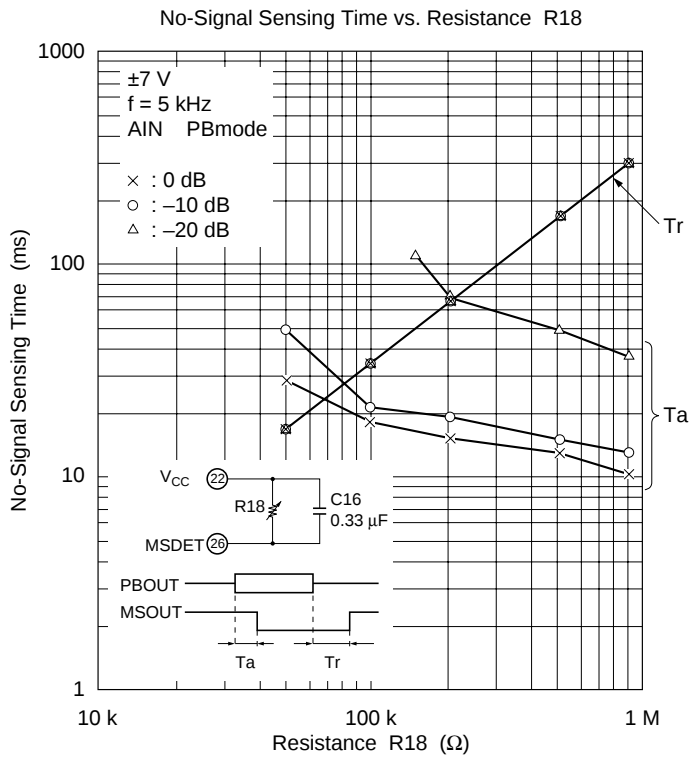
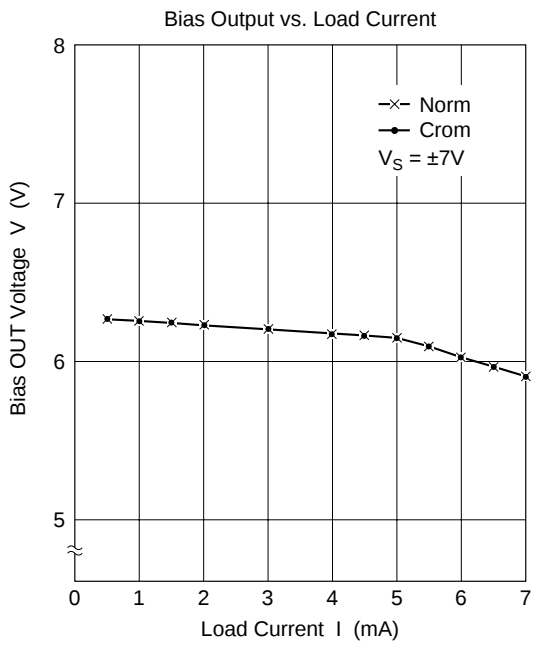
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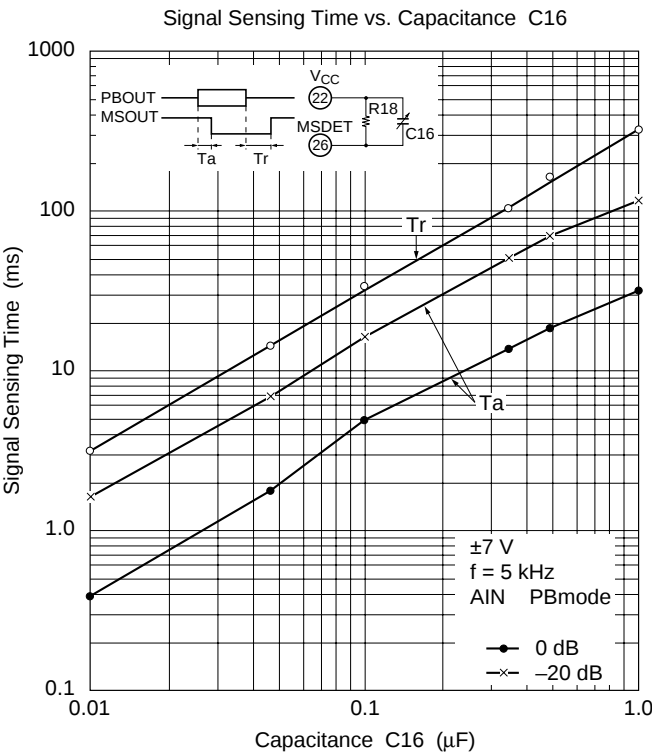
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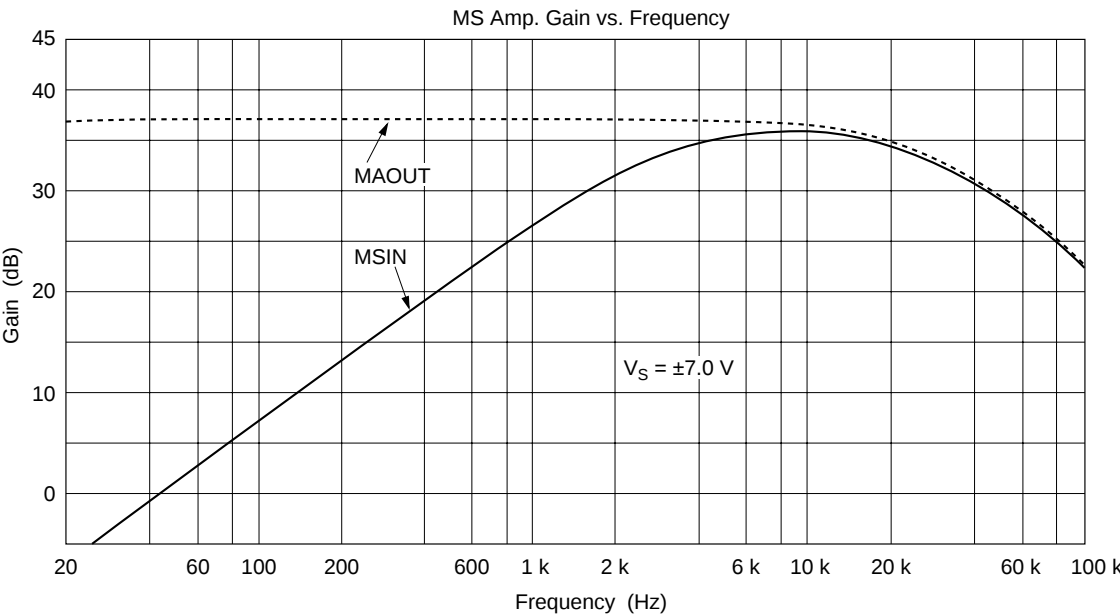
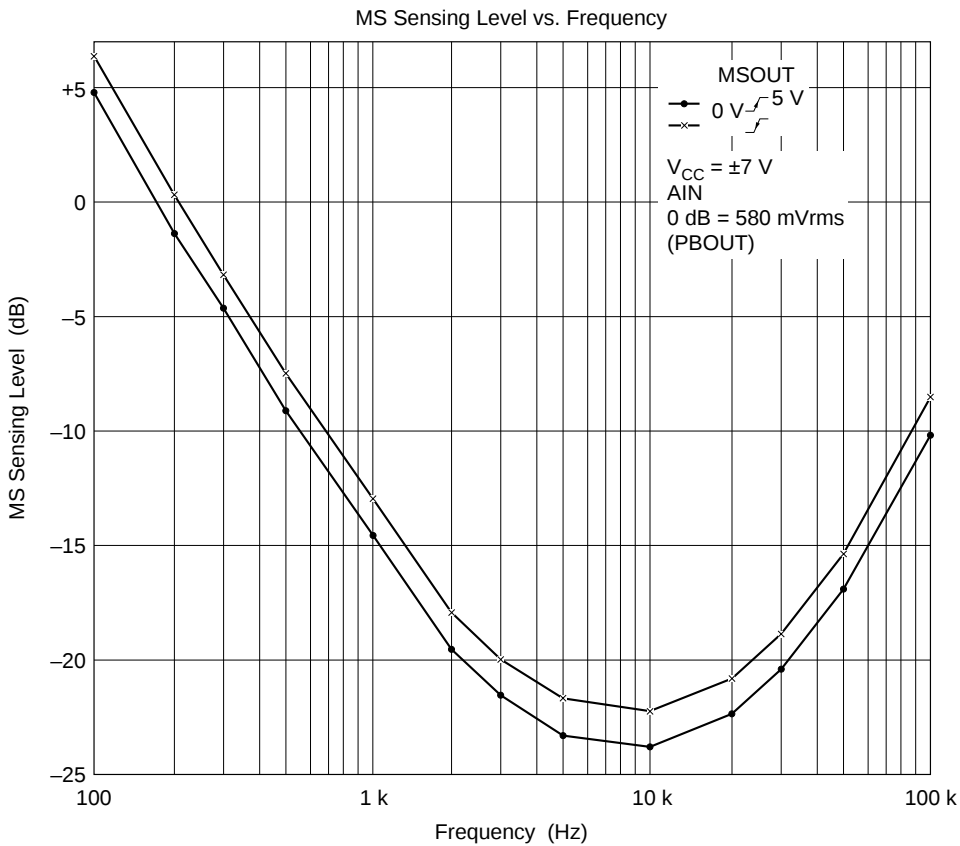
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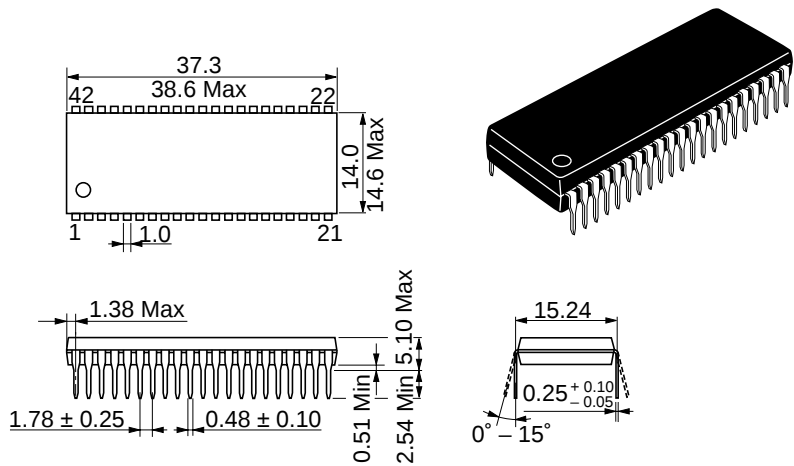
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HA12203NT/HA12204NT

Package Dimensions

Unit: mm



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

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