HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Dolby B- and C-Type Noise Reduction System

HITACHI

ADE-207-036B (Z)
3rd Edition
Jun. 1999

Description

HA12141/142NT, HA12170NT, HA12161/162FP are silicon monolithic bipolar IC series providing dual channel Dolby B- and C-type noise reduction* in one chip.

Functions

- Dual Dolby B/C-type NR processor
- NR OFF/B/C control switch
- MPX by-pass / Encode / Decode (MPX OFF / REC / PB) control switch
- MPX Filter Drive Circuit

Features

- Low external parts count
- R-C spectrum skewing network using passive component
- External capacitors are E-3 series (small values)
- Several time constant capacitors built into the IC
- Separate REC/PB input and output. Unprocessed signal output available in the encode and decode modes.
- Common PCB pattern is available with HA12134A series (Dolby B NR), because these ICs offer similar pin layout.
- 3 type PB-out level (300 mV, 580 mV, 775 mV)
- 2 type package (DP-30S, FP-28D)
- Wide range of operating supply voltage (7.5 V to 16 V)

Hitachi semiconductor

Ordering Information

Type No.	Package	Dolby Level	PB-OUT Level	REC-OUT Level	Remark
HA12141NT	DP-30S	300 m Vrms	300 m Vrms	300 m Vrms	—
HA12142NT	DP-30S	300 m Vrms	580 m Vrms	300 m Vrms	—
HA12170NT	DP-30S	300 m Vrms	775 m Vrms	300 m Vrms	—
HA12161FP	FP-28D	300 m Vrms	300 m Vrms	—	PB-mode only
HA12162FP	FP-28D	300 m Vrms	580 m Vrms	—	↓

Notes: 1. The common specifications are shown below.

REC-IN Level	PB-IN Level	IA-OUT Level (REC)	IA-OUT Level (PB)
42.9 mVrms	30.0 mVrms	429 mVrms	300 mVrms

2. The values listed above show approximate values to be offered Dolby Level at TP.

Absolute Maximum Ratings (Ta = 25°C, unless otherwise specified)

Item	Symbol	Rating	Unit	Note
Supply voltage	V_{CC}max	16	V	
Power dissipation	P_D	400	mW	Ta 85°C
Operating temperature	Topr	–40 to +85	°C	
Storage temperature	Tstg	–55 to +125	°C	

Electrical Characteristics (HA12141NT, HA12142NT, HA12170NT) (Ta = 25°C, V_{CC} = Vopr-typ, unless otherwise specified)
(Dolby Level = 300 mVrms at TP (REC-mode: TP2, TP4 PB-mode: TP1, TP3))

							Test conditions				
Item		**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**R/P**	**NR**	**f (Hz)**		
Operating voltage	HA12141NT	Vopr	7.5	12.0	16.0	V	—	—	—		
	HA12142NT		9.5	12.0	16.0	V					
	HA12170NT		12.0	14.0	16.0	V					
Quiescent current		I_{CC}	—	12.0	—	mA	R	OFF	—	No signal	
Input amp gain		Gv (IA REC)	18.0	20.0	22.0	dB	R	OFF	1 k	Vin = 0dB	
		Gv (IA PB)	18.0	20.0	22.0	dB	P	OFF	1 k		
B–type NR		B-ENC-2 k	2.8	4.3	5.8	dB	R	B	2 k	Vin = –20dB	
Encode boost		B-ENC-5 k	1.7	3.2	4.7	dB	R	B	5 k	Vin = –20dB	
C–Type NR		C-ENC-1 k (1)	3.9	5.9	7.9	dB	R	C	1 k	Vin = –20dB	
Encode boost		C-ENC-1 k (2)	18.1	19.6	21.6	dB	R	C	1 k	Vin = –60dB	
		C-ENC-700	9.8	11.8	13.8	dB	R	C	700	Vin = –30dB	
Signal handling	HA12141NT	Vomax	12.0	13.0	—	dB	R	OFF	1 k	THD = 1%	V_{CC} = 7.5V
	HA12142NT		12.0	13.0	—	dB					V_{CC} = 9.5V
	HA12170NT		12.0	13.0	—	dB					V_{CC} = 12V

Electrical Characteristics (Ta = 25°C, V_{CC} = Vopr-typ, unless otherwise specified) (Dolby Level = 300 mVrms at TP (REC-mode: TP2, TP4 PB-mode: TP1, TP3)) (cont)

							Test conditions			
Item		**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**R/P**	**NR**	**f (Hz)**	
Signal to noise ratio		S/N (REC)	60.0	64.0	—	dB	R	C	—	Rg = 5.1k CCIR/ARM
Total harmonic distortion		THD (OFF)	—	0.03	0.15	%	R	OFF	1 k	Vin = 0dB
		THD (C)	—	0.09	0.3	%	R	C	1 k	Vin = 0dB
NR OFF frequency response		FR-OFF	–3.0	0.0	+3.0	dB	P	OFF	100 k	Vin = 0dB
Crosstalk between		CT (R→P)	—	80.0	—	dB	P	OFF	1 k	Vin = 0dB
REC-PB		CT (P→R)	—	80.0	—	dB	R	OFF	1 k	
Crosstalk between		CT (L→R)	—	85.0	—	dB	R	OFF	1 k	Vin = 0dB
channel		CT (R→L)	—	85.0	—	dB				
Control voltage for MPX OFF/REC/PB		Vcont (MPX)	V_{CC}–1	—	V_{CC}	V				
		Vcont (REC)	2.5	—	$\frac{Vcc}{2}+0.5$	V				
		Vcont (PB)	0.0	—	0.4	V				
Control voltage for NR C/B OFF		Vcont (C)	$\frac{Vcc}{2}+3$	—	V_{CC}	V				
		Vcont (B)	$\frac{Vcc}{2}-0.5$	—	$\frac{Vcc}{2}+0.5$	V				
		Vcont (OFF)	0.0	—	$\frac{Vcc}{2}-3$	V				
PB-OUT level	HA12141NT	Vout	250	300	350	mVrms	R	OFF	1 k	Vin = 0dB
	HA12142NT		490	580	670	mVrms				
	HA12170NT		646	775	904	mVrms				
REC-OUT offset		Voffset	–70	0.0	70	mV	R	OFF →C	—	V_{CC} = 16V No signal
Channel balance		ΔGv	–1.0	0.0	1.0	dB	R	OFF	1 k	Vin = 0dB

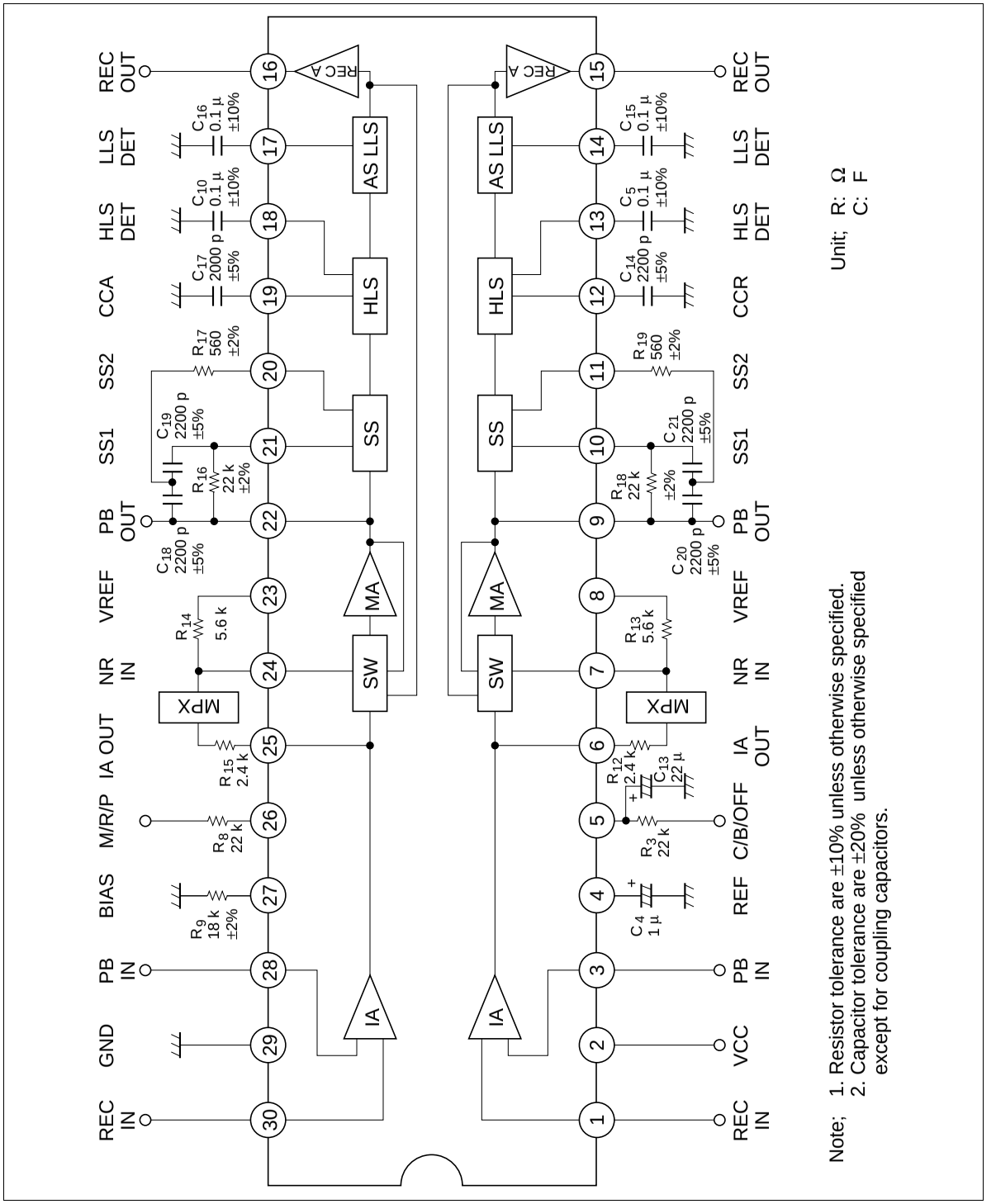
Electrical Characteristics (HA12161FP, HA12162FP) (Ta = 25°C, V_{CC} = 12 V, Unless otherwise specified) (Dolby Level = 300 mVrms at TP (PB-mode: TP1, TP3))

							Test conditions				
Item		**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**P/AUX**	**NR**	**f (Hz)**		
Operating	HA12161FP	Vopr	7.5	12.0	16.0	V	—	—	—		
voltage	HA12162FP		9.5	12.0	16.0	V					
Quiescent current		I_{CC}	—	12.0	—	mA	P	OFF	—	No signal	
Input amp gain		Gv (IA AUX 1)	18.0	20.0	22.0	dB	AUX1	OFF	1 k	Vin = 0dB	
		Gv (IA PB)	18.0	20.0	22.0	dB	P	OFF	1 k		
B-type NR		B-DEC-2 k	–5.8	–4.3	–2.8	dB	P	B	2 k	Vout = –20dB	
decode cut		B-DEC-5 k	–4.7	–3.2	–1.7	dB	P	B	5 k	Vout = –20dB	
C-Type NR decode cut		C-DEC-1 k (1)	–7.9	–5.9	–3.9	dB	P	C	1 k	Vout = –20dB	
		C-DEC-1 k (2)	–21.6	–19.6	–18.1	dB	P	C	1 k	Vout = –60dB	
Signal	HA12161FP	Vomax	12.0	13.0	—	dB	P	OFF	1 k	THD = 1%	V_{CC} = 7.5V
handling	HA12162FP		12.0	13.0	—	dB					V_{CC} = 9.5V
Signal to noise ratio		S/N (PB)	70.0	76.0	—	dB	P	OFF	—	Rg = 10k CCIR/ARM	
Total harmonic distortion		THD (OFF)	—	0.03	0.15	%	P	OFF	1 k	Vin = 0dB	
		THD (C)	—	0.09	0.3	%	P	C	1 k	Vin = 0dB	
NR OFF frequency response		FR-OFF	–4.0	–1.0	+3.0	dB	P	OFF	100 k	Vin = 0dB	
Crosstalk between AUX 1→PB		CT (AUX 1→PB)	—	80.0	—	dB	P	OFF	1 k	Vin = 0dB	
Crosstalk		CT (L→R)	—	85.0	—	dB	P	OFF	1 k	Vin = 12dB	
between channel		CT (R→L)	—	85.0	—	dB					

Electrical Characteristics (HA12161FP, HA12162FP) (Ta = 25°C, V_{CC} = 12 V, Unless otherwise specified) (Dolby Level = 300 mVrms at TP (PB-mode: TP1, TP3)) (cont)

Item		Symbol	Min	Typ	Max	Unit	Test conditions P/AUX	NR	f (Hz)	
Control voltage for AUX 2/AUX 1/PB		Vcont (AUX 2)	V_{CC}–1	—	V_{CC}	V	A2/ A1/ P (24) 22k Measure V			
		Vcont (AUX 1)	2.5	—	$\frac{Vcc}{2}+0.5$	V				
		Vcont (PB)	0.0	—	0.4	V				
Control voltage for NR C/B OFF		Vcont (C)	$\frac{Vcc}{2}+3$	—	V_{CC}	V	C/ B/ OFF (5) 22k Measure V			
		Vcont (B)	$\frac{Vcc}{2}-0.5$	—	$\frac{Vcc}{2}+0.5$	V				
		Vcont (OFF)	0.0	—	$\frac{Vcc}{2}-3$	V				
PB-OUT level	HA12161FP	Vout	250	300	350	mVrms	P	OFF	1 k	Vin = 0dB
	HA12162FP		490	580	670	mVrms				
PB-out offset		Voffset	–100	0.0	+100	mV	P	OFF →C	—	No signal
Channel balance		ΔGv	–1.0	0.0	1.0	dB	P	OFF	1 k	Vin = 0dB

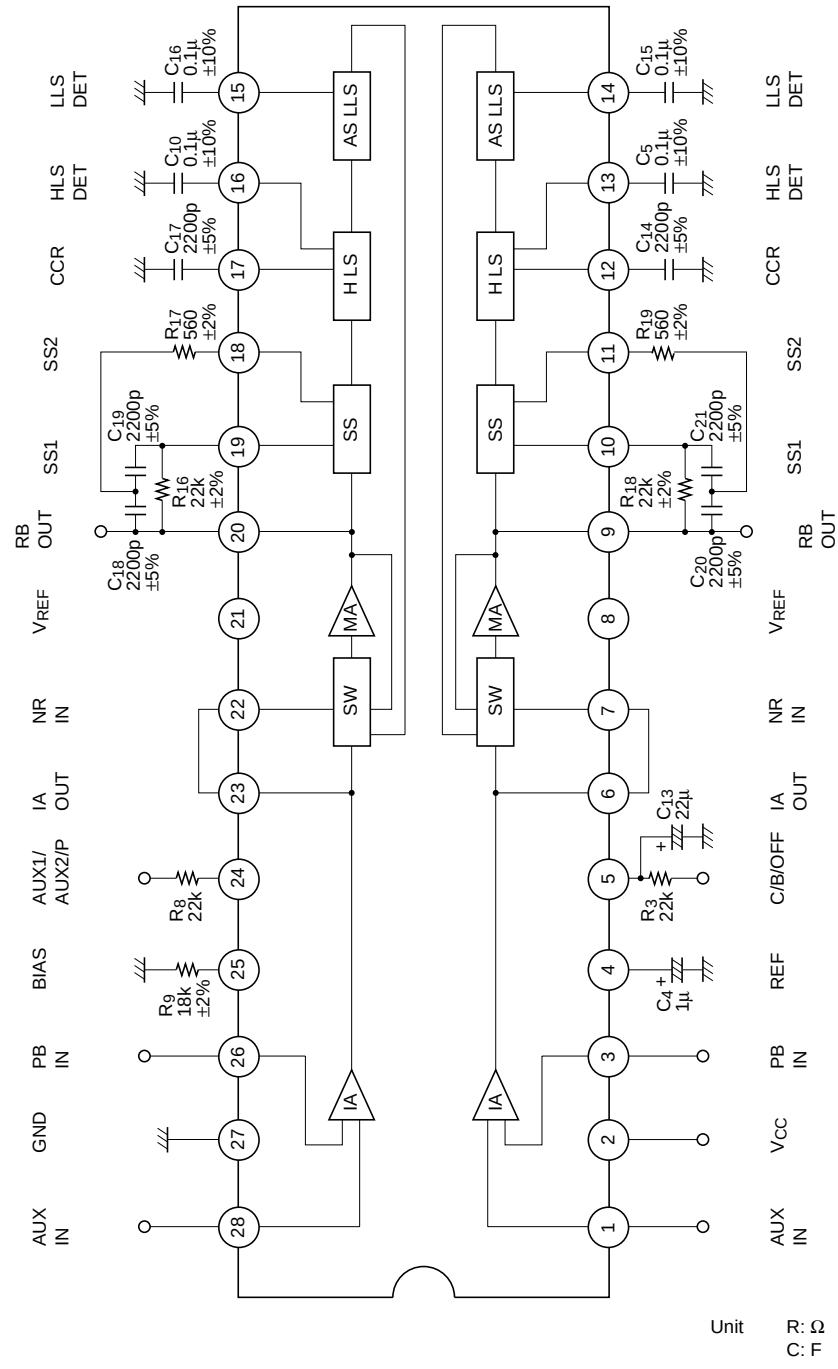
Block Diagram (HA12141NT, HA12142NT, HA12170NT)



Unit; R: Ω
C: F

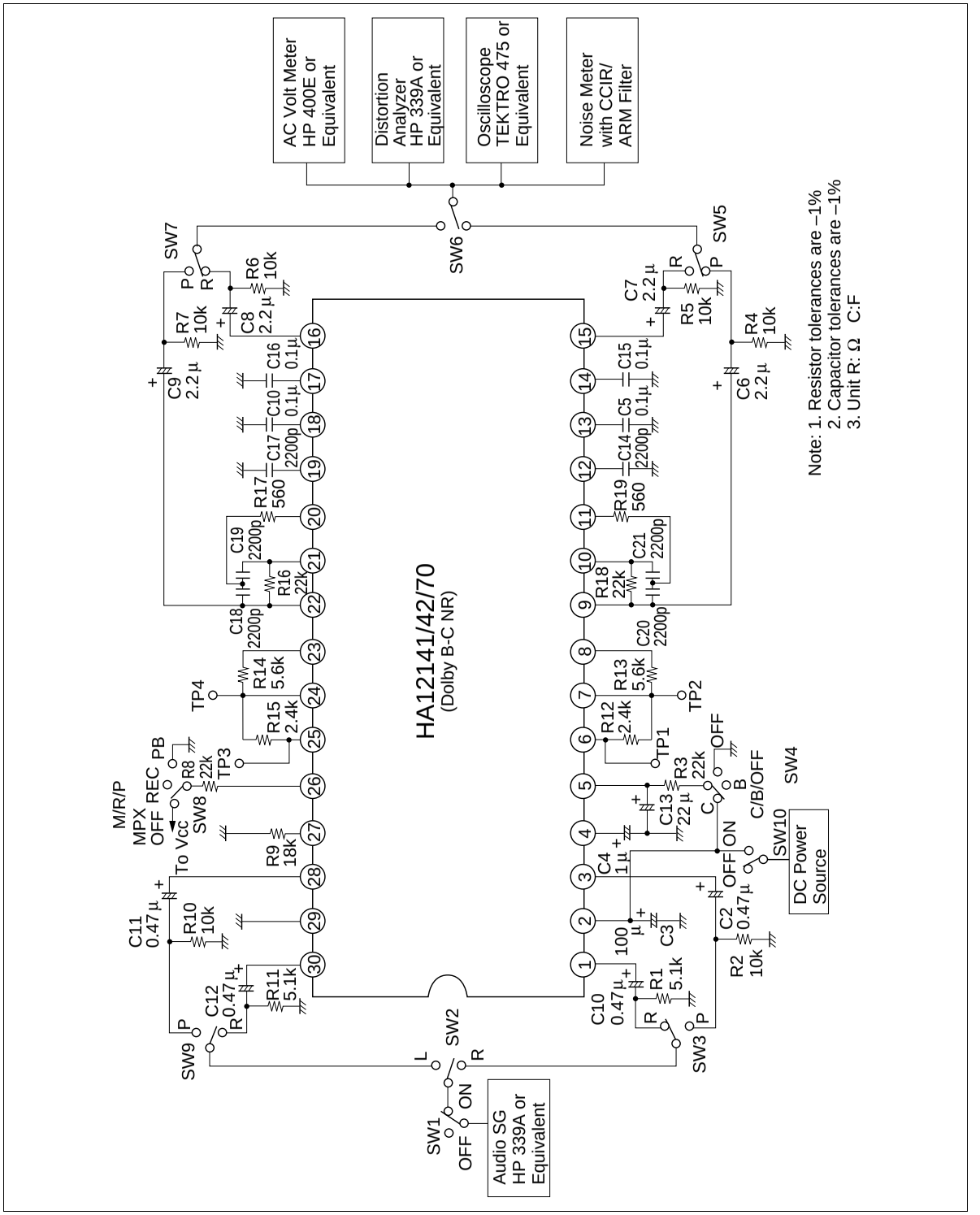
Note; 1. Resistor tolerance are ±10% unless otherwise specified.
2. Capacitor tolerance are ±20% unless otherwise specified except for coupling capacitors.

Block Diagram (HA12161FP, HA12162FP)

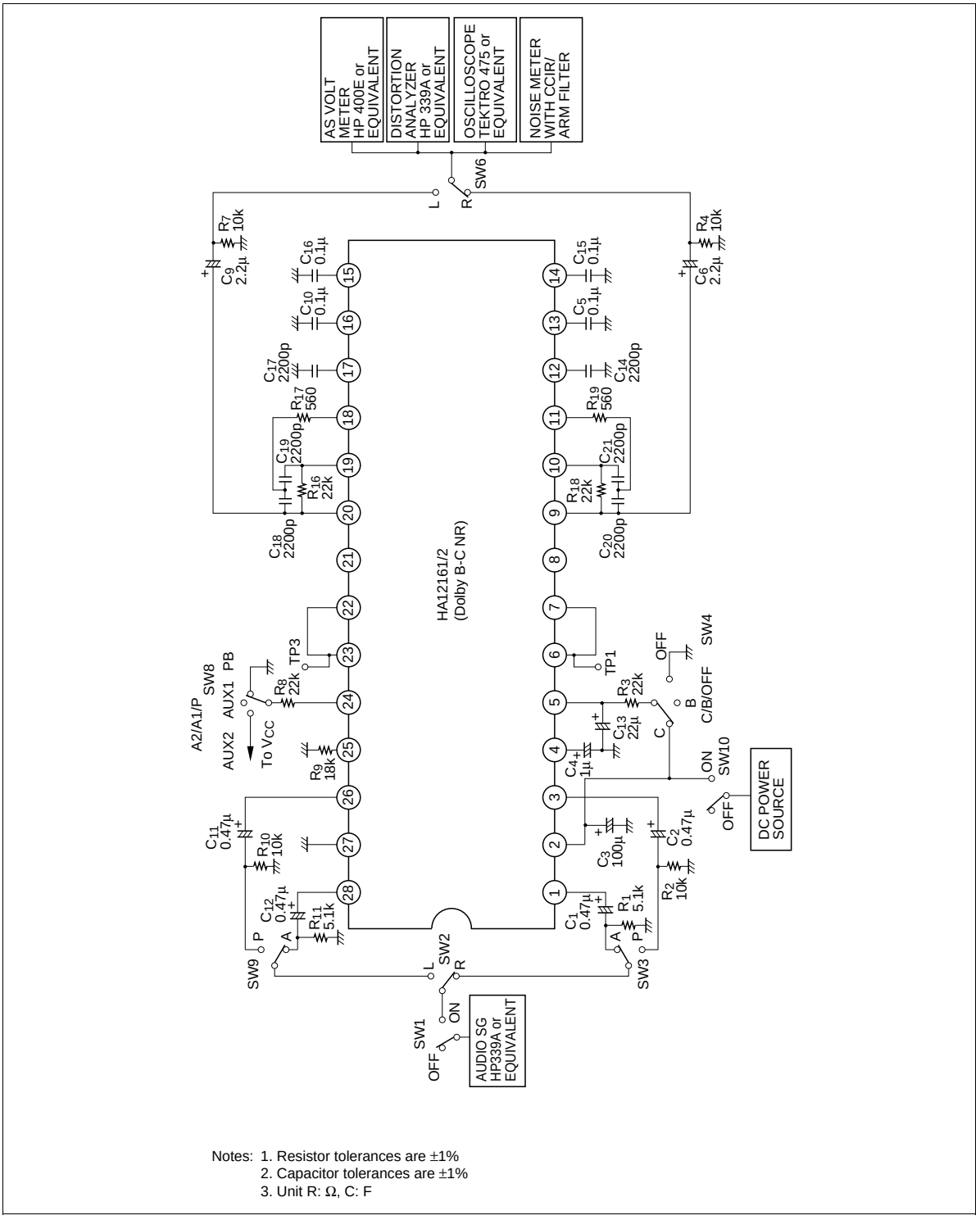


Notes: 1. Resistor tolerances are ±10% unless otherwise specified.
2. Capacitor tolerances are ±20% unless otherwise specified except for coupling capacitors.

Test Circuit (HA12141NT, HA12142NT, HA12170NT)

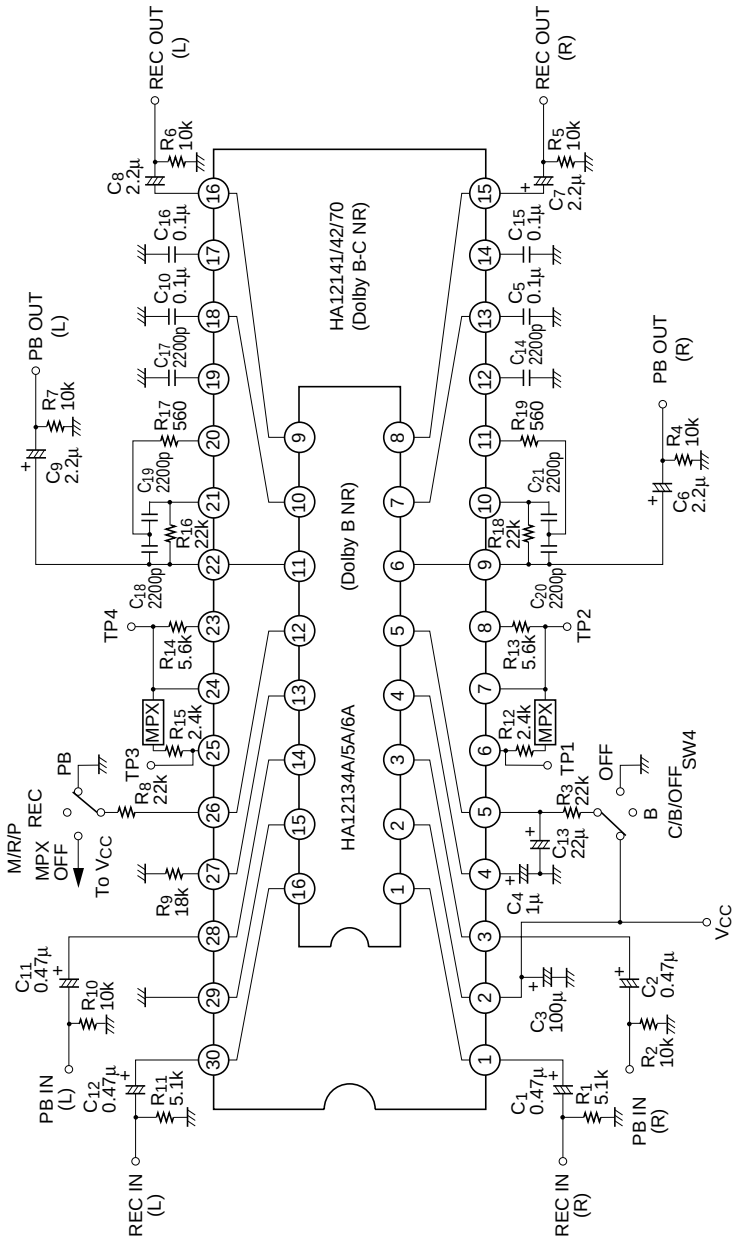


Test Circuit (HA12161FP, HA12162FP)



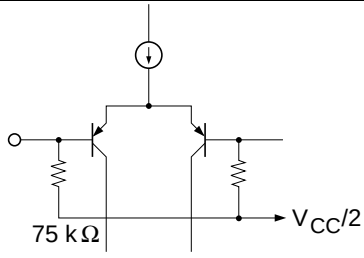
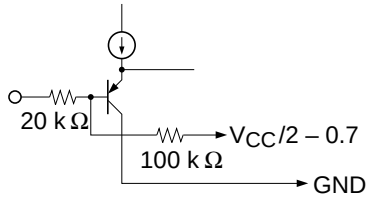
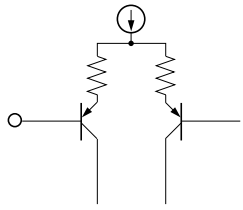
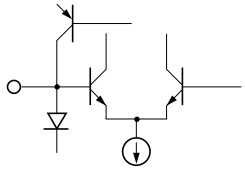
Notes: 1. Resistor tolerances are ±1%
2. Capacitor tolerances are ±1%
3. Unit R: Ω, C: F

Connection Diagram (HA12134A Series, HA12141 Series)

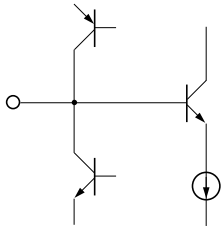
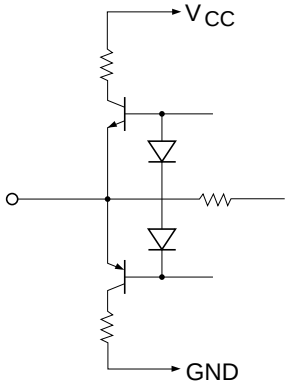


Note: C_5, C_{10}=0.22µF with HA12134A Series

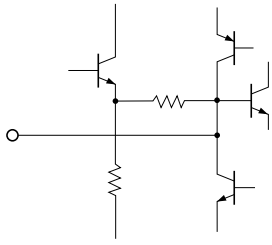
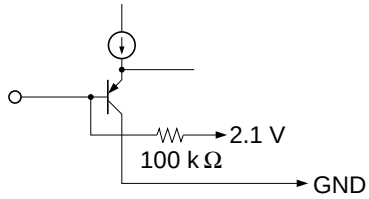
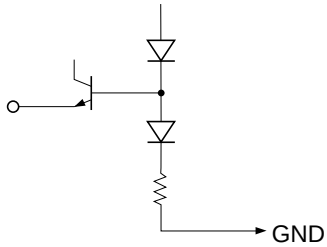
Pin Description (V_{CC} = 12 V, Ta = 25°C, no signal, the value in the table show typical value.)

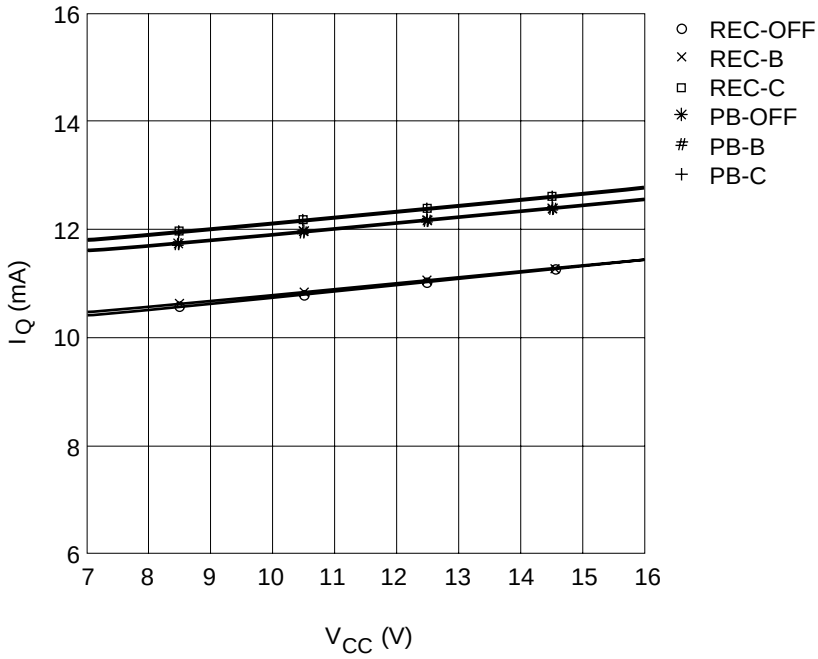
Pin No.		Terminal		DC		
DP	SOP	Name	Zin	Voltage	Equivalent circuit	Description
1	1	REC IN	75 kΩ	V_{cc}/2		Recording input
30	28					
3	3	PB IN				Playback input
28	26					
2	2	V_{CC}	—	V_{CC}	—	Power supply
4	4	REF	—	V_{cc}/2	—	Ripple filter
5	5	C/B/OFF	—	V_{cc}/2 – 0.7V		Mode control pin for NR “H”→C “M”→B “L”→NR OFF
7	7	NR IN	—	V_{cc}/2		NR processor input
24	22					
10	10	SS 1	—	V_{cc}/2		Spectral skewing amp input
21	19					

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

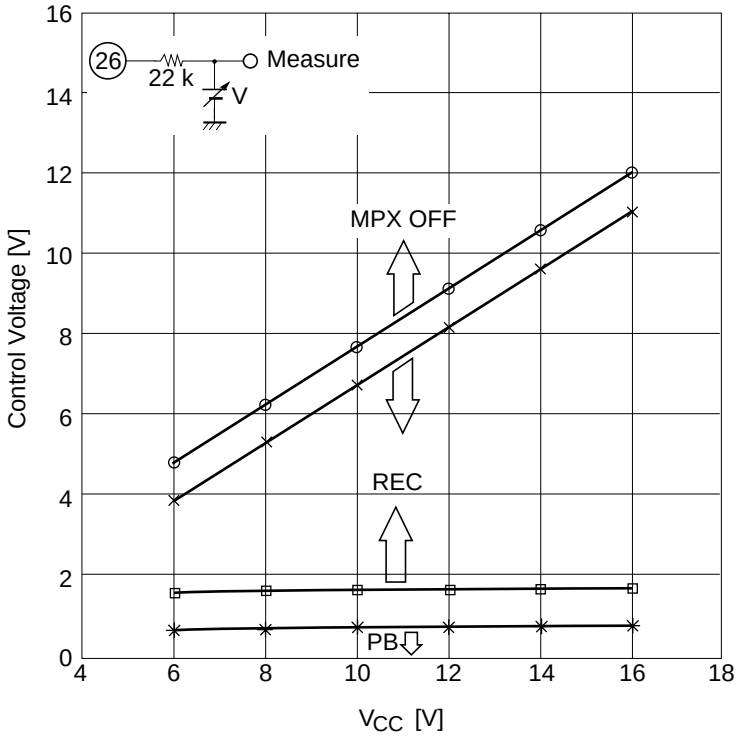
Pin No.		Terminal		DC		
DP	SOP	Name	Zin	Voltage	Equivalent circuit	Description
12	12	CCR	—	V_{CC}/2		Current controlled resistor output
19	17					
6	6	IA OUT	—	V_{CC}/2		Input amp. output
25	23					
8	8	VREF				Reference voltage output
23	21					
9	9	PB OUT				Playback (Decode) output
22	20					
11	11	SS 2				Spectral skewing amp. output
20	18					
15	—	REC				Recording (Encode) output
16	—	OUT				

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

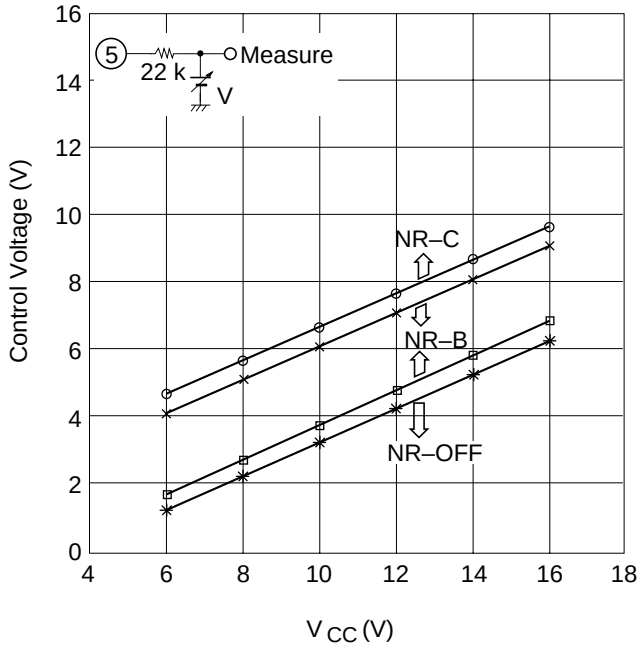
Pin No.		Terminal		DC		
DP	SOP	Name	Zin	Voltage	Equivalent circuit	Description
13	13	HLS DET	—	2.1 V		Time constant pin for rectifier
18	16					
14	14	LLS DET				
17	15					
26	24	M/R/P	—	2.1 V		Mode control pin for REC/PB "H"→REC MPX OFF "M"→REC MPX ON "L"→PB
27	25	BIAS	—	0.24 V		Reference current input
29	27	GND	—	0.0 V	—	Ground



Quiescent Circuit vs. Supply Voltage

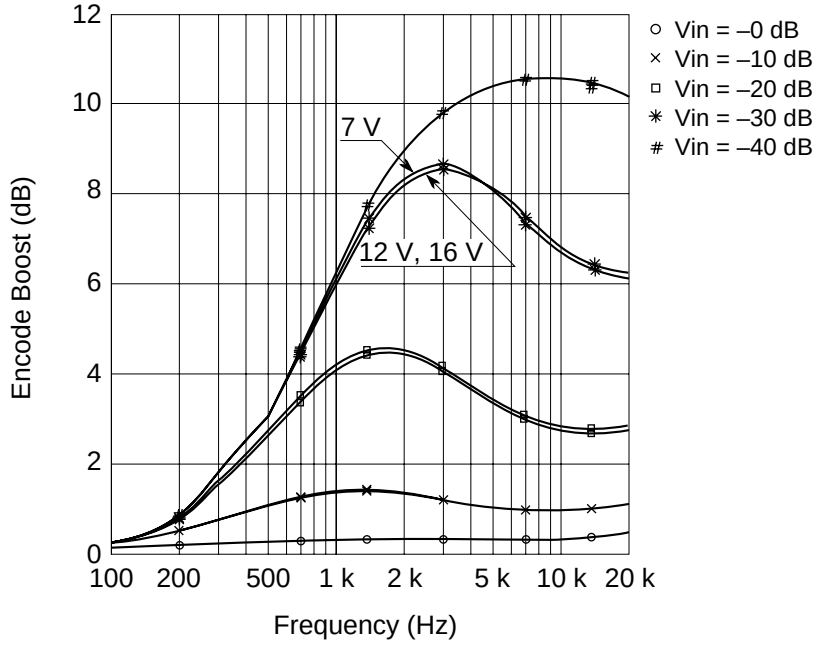


Control Voltage vs. Supply Voltage (PB/REC/MPX)

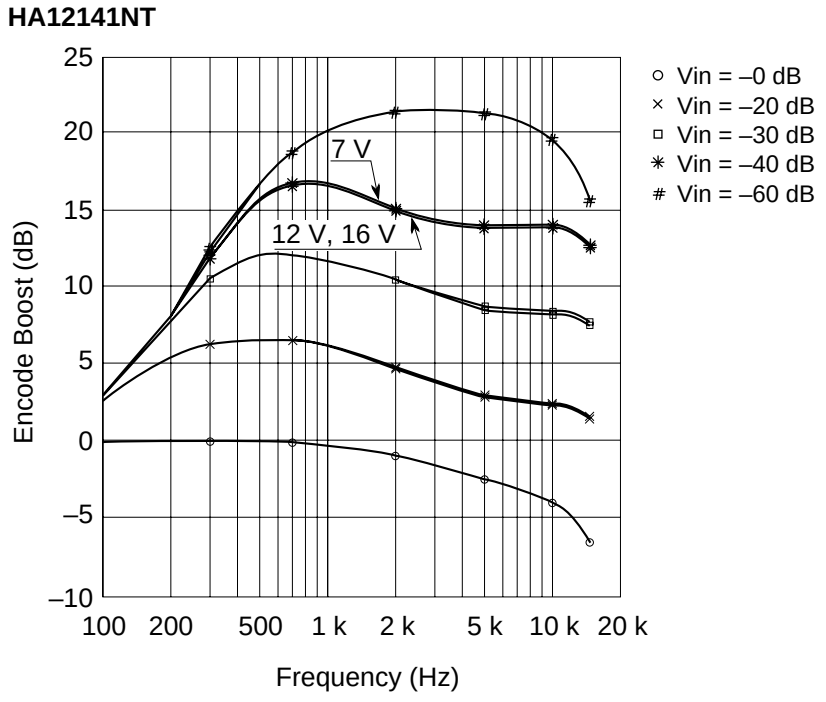


Control Voltage vs. Supply voltage (NR-OFF/B/C)

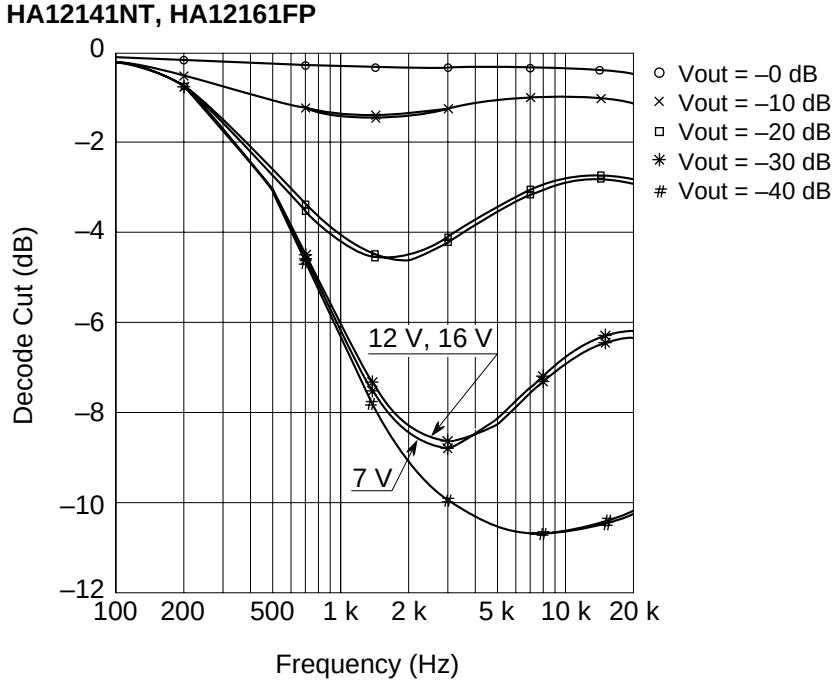
HA12141NT



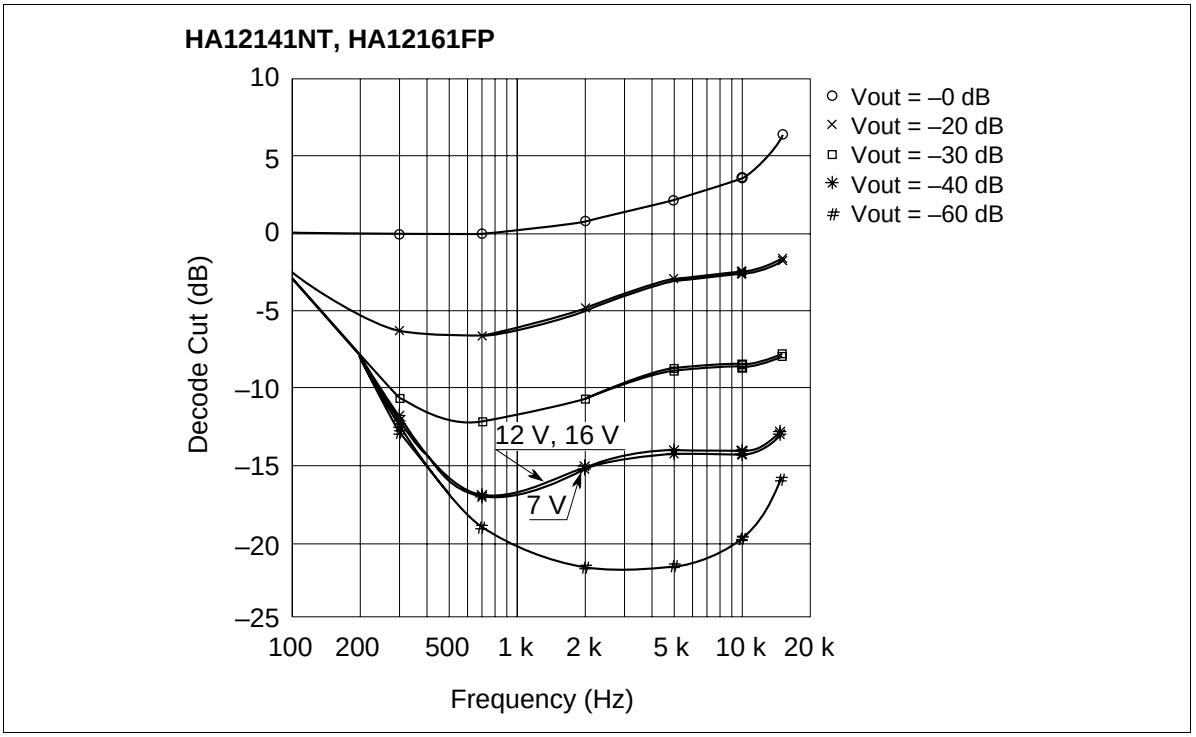
Encode Boost vs. Frequency (NR-B V_{CC} = 7V, 12 V, 16 V)



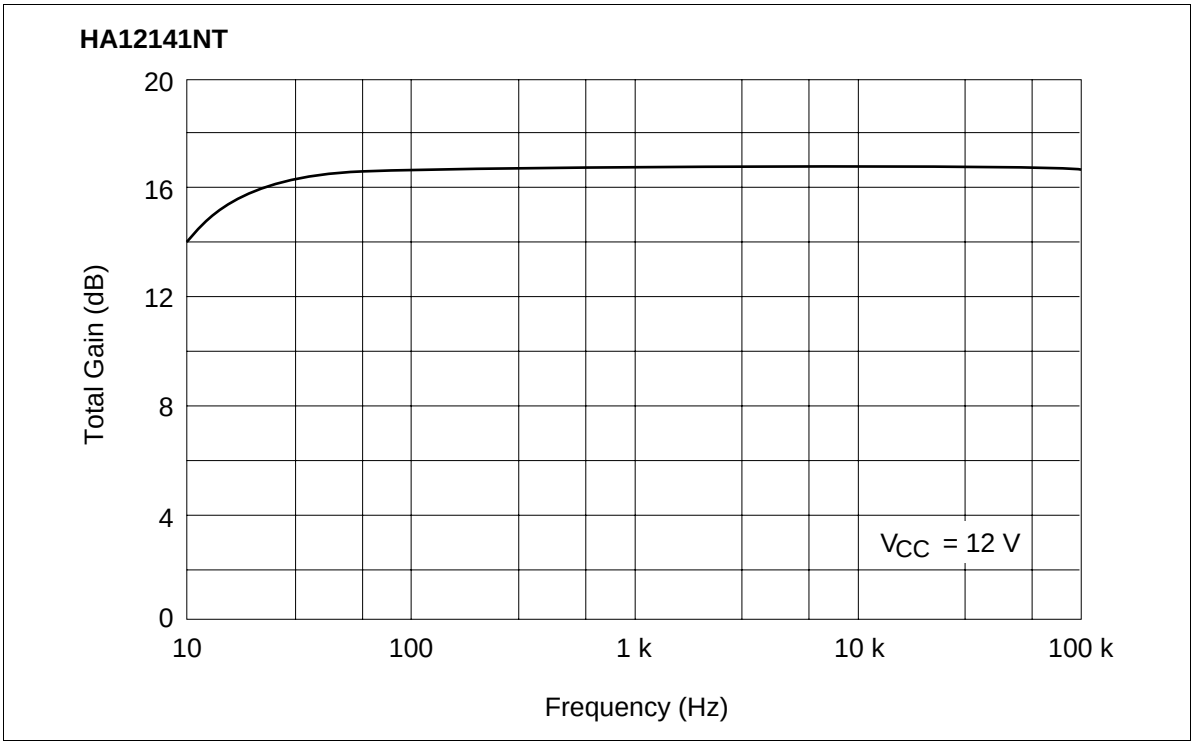
Encode Boost vs. Frequency (NR-C V_{CC} = 7 V, 12 V, 16 V)



Decode Cut vs. Frequency (NR-B V_{CC} = 7 V, 12 V, 16 V)

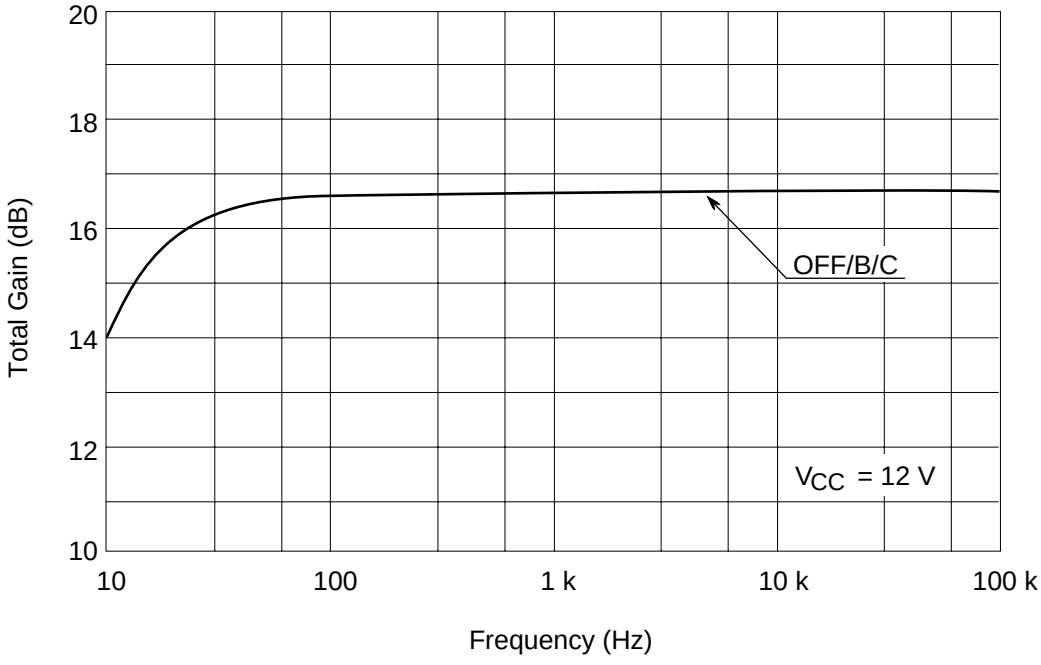


Decode Cut vs Frequency (NR-C V_{CC} = 7 V, 12 V, 16 V)



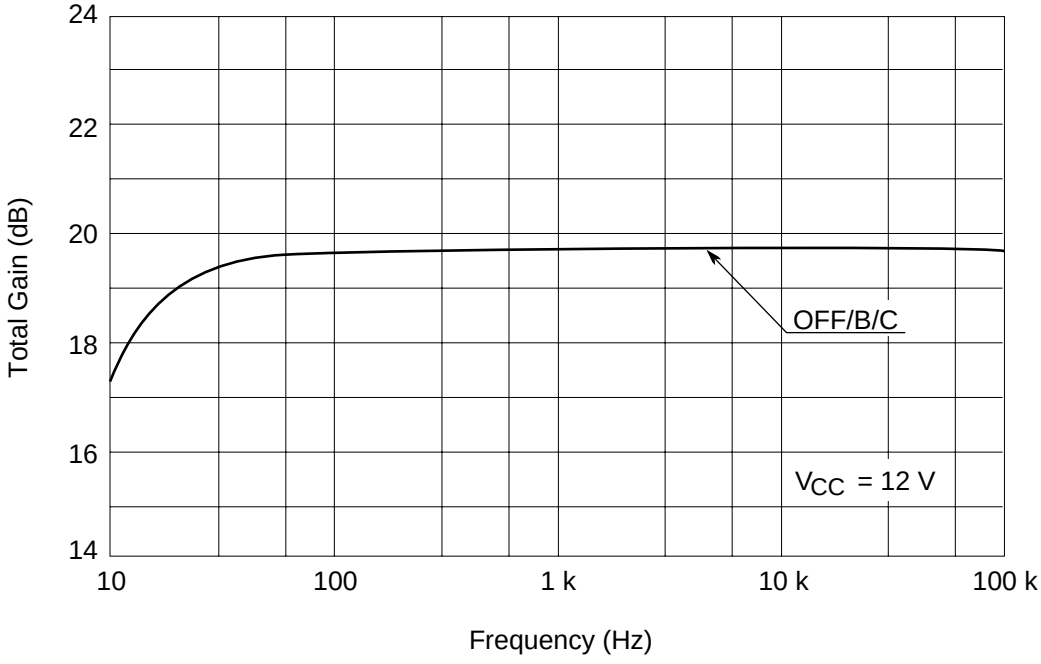
Total Gain vs. Frequency (REC MODE RECOUT NR-OFF)

HA12141NT, HA12161FP

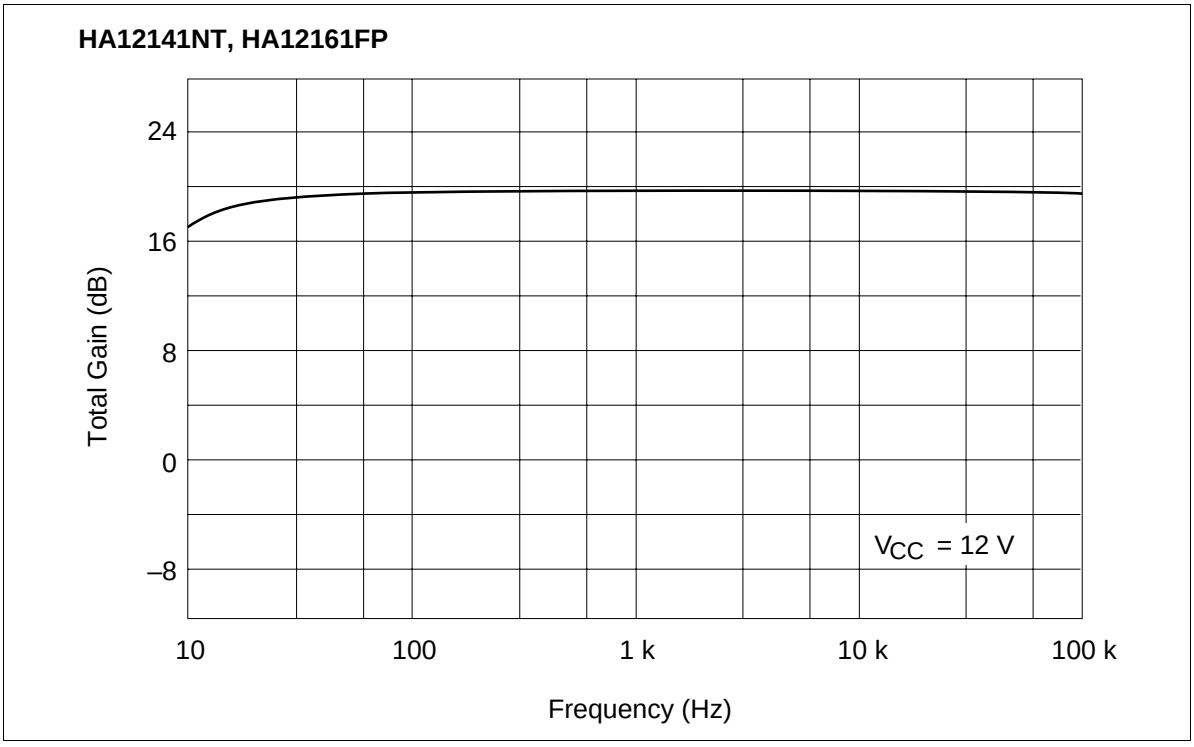


Total Gain vs. Frequency (REC MODE PBOUT)

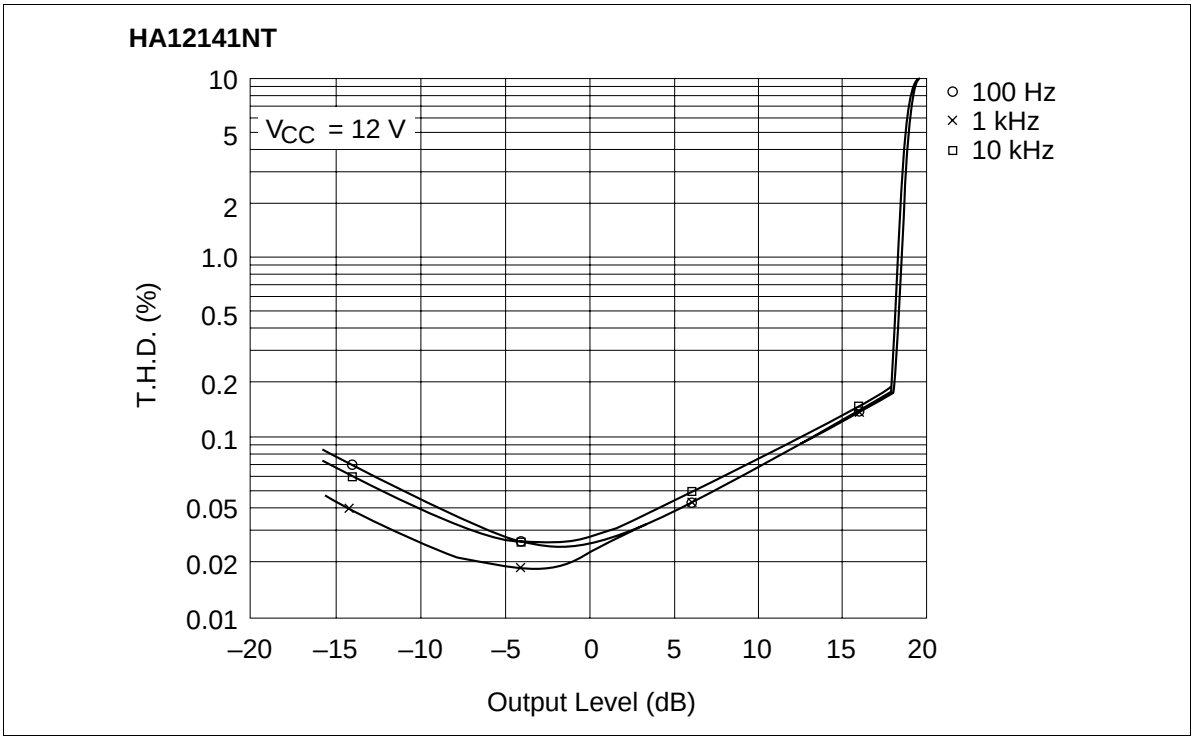
HA12141NT



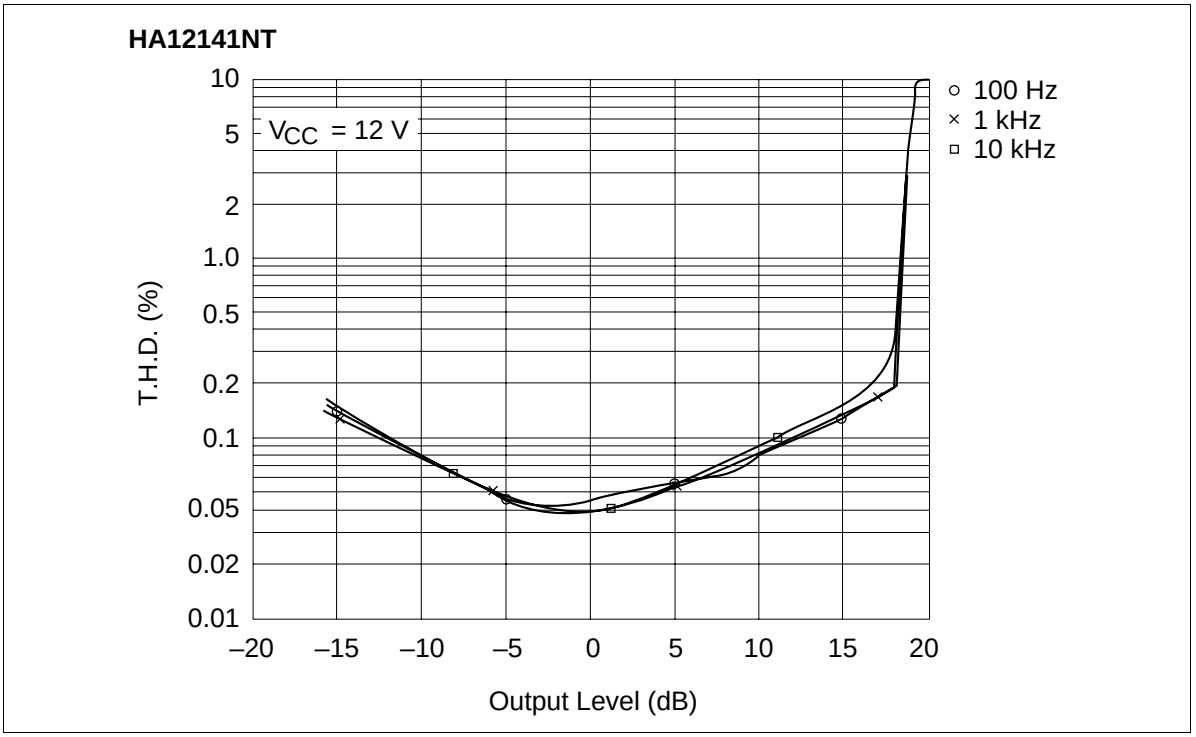
Total Gain vs. Frequency (PB MODE RECOUT)



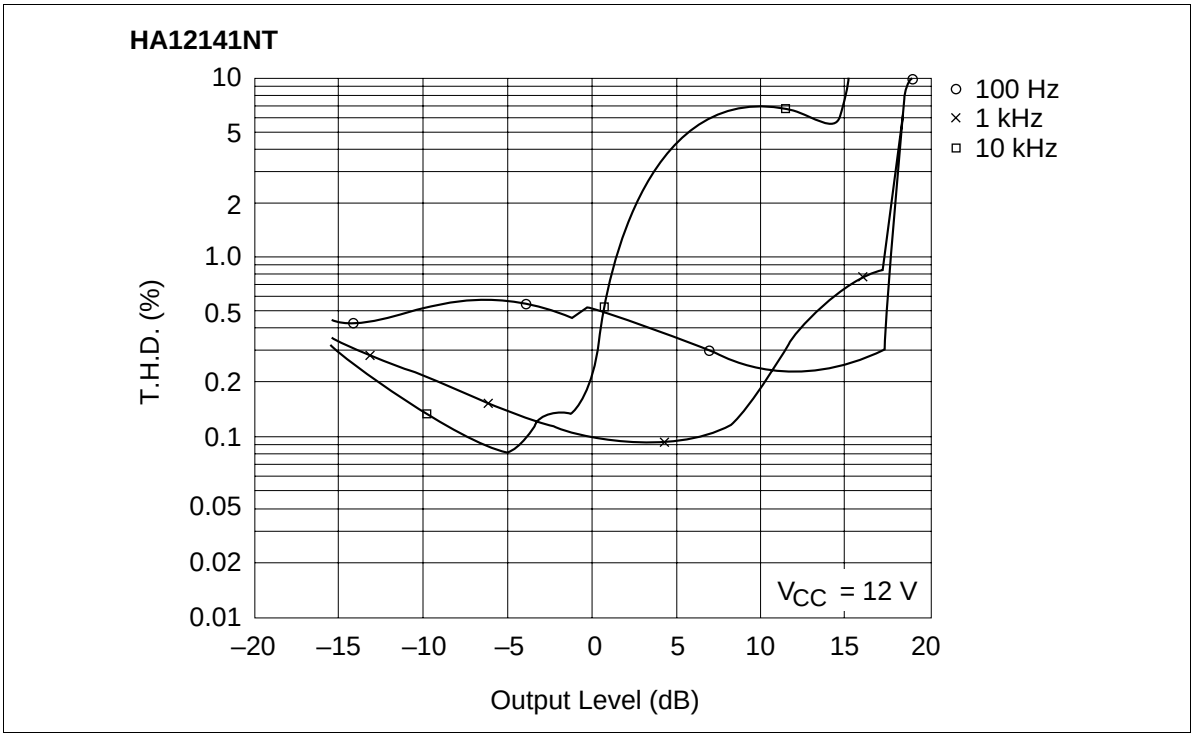
Total Gain vs. Frequency (PB MODE PBOUT NR-OFF)



Total Harmonic Distortion vs. Output Level (REC MODE NR-OFF)

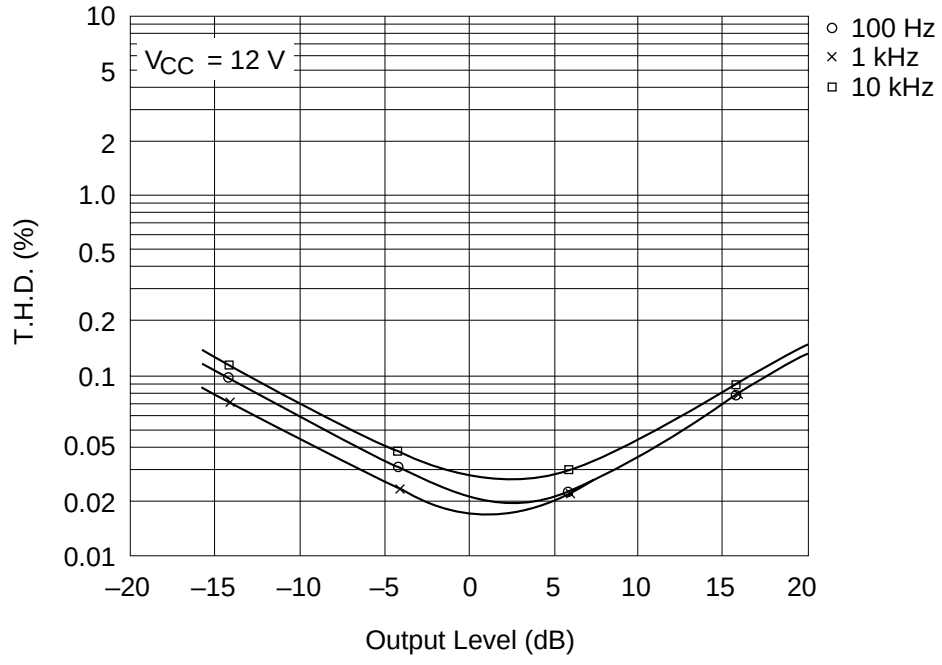


Total Harmonic Distortion vs. Output Level (REC MODE NR-B)



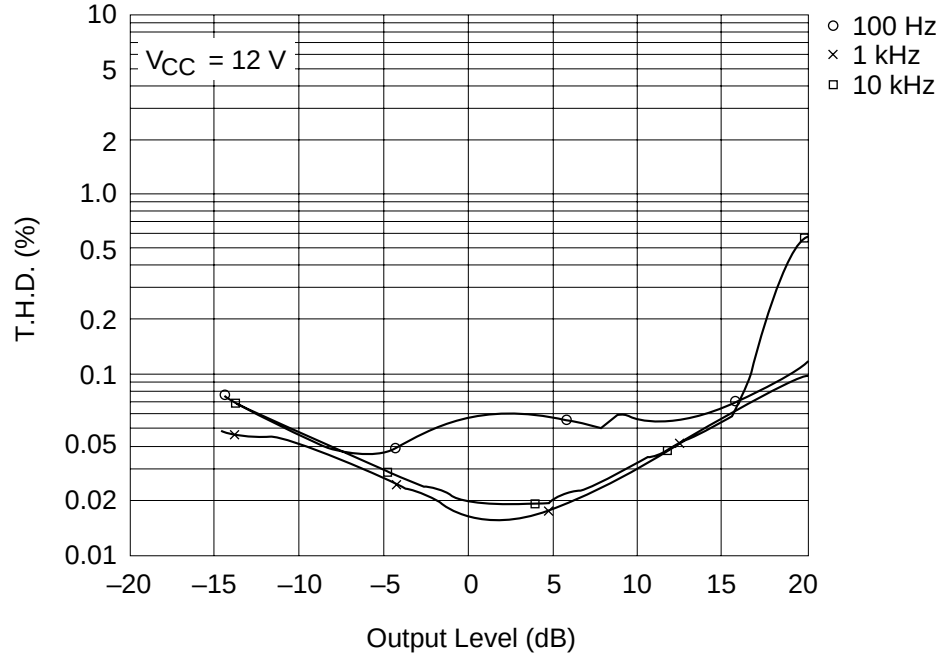
Total Harmonic Distortion vs. Output Level (REC MODE NR-C)

HA12141NT, HA12161FP



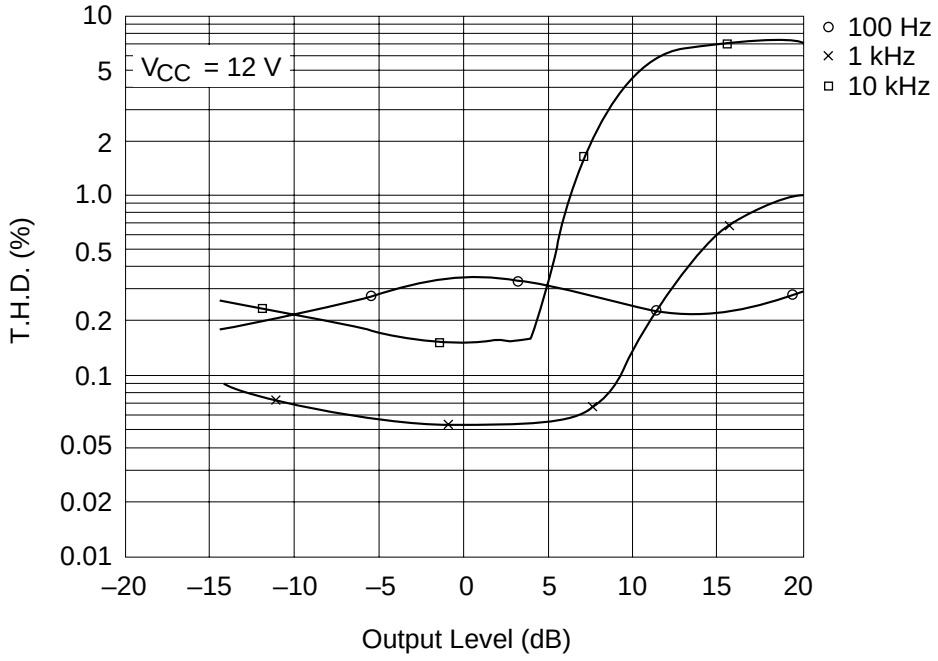
Total Harmonic Distortion vs. Output Level (PB MODE NR-OFF)

HA12141NT, HA12161FP



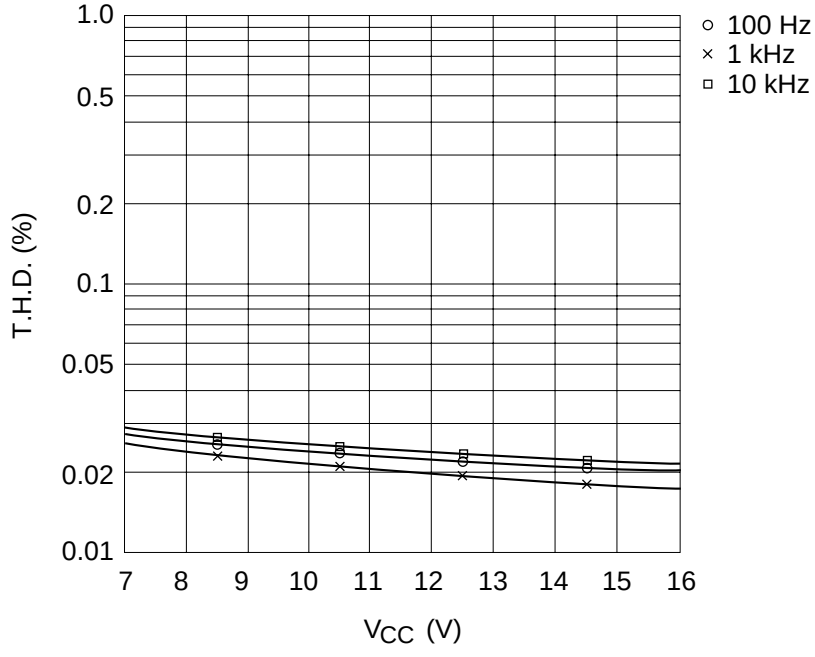
Total Harmonic Distortion vs. Output Level (PB MODE NR-B)

HA12141NT, HA12161FP

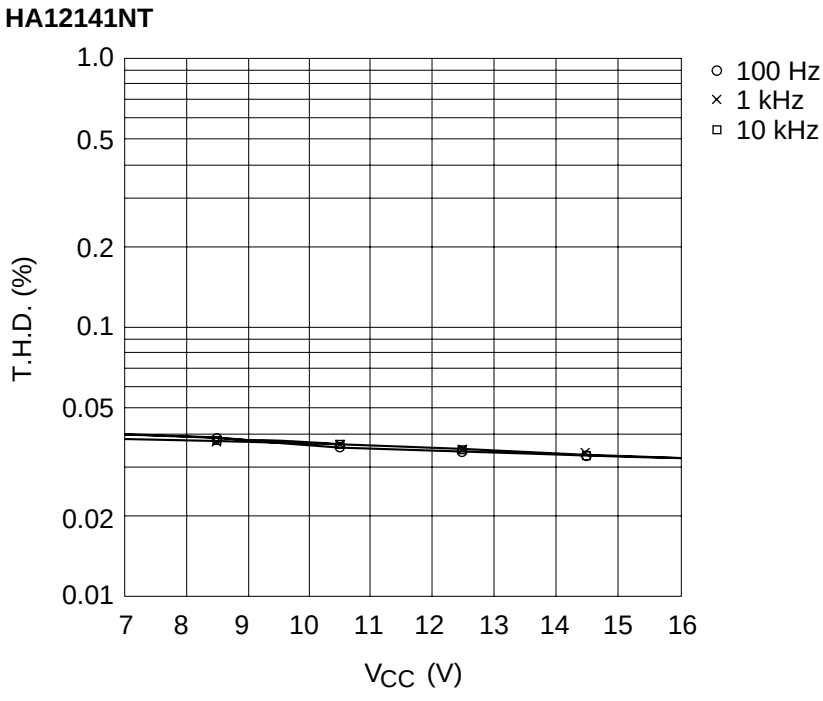


Total Harmonic Distortion vs. Output Level (PB MODE NR-C)

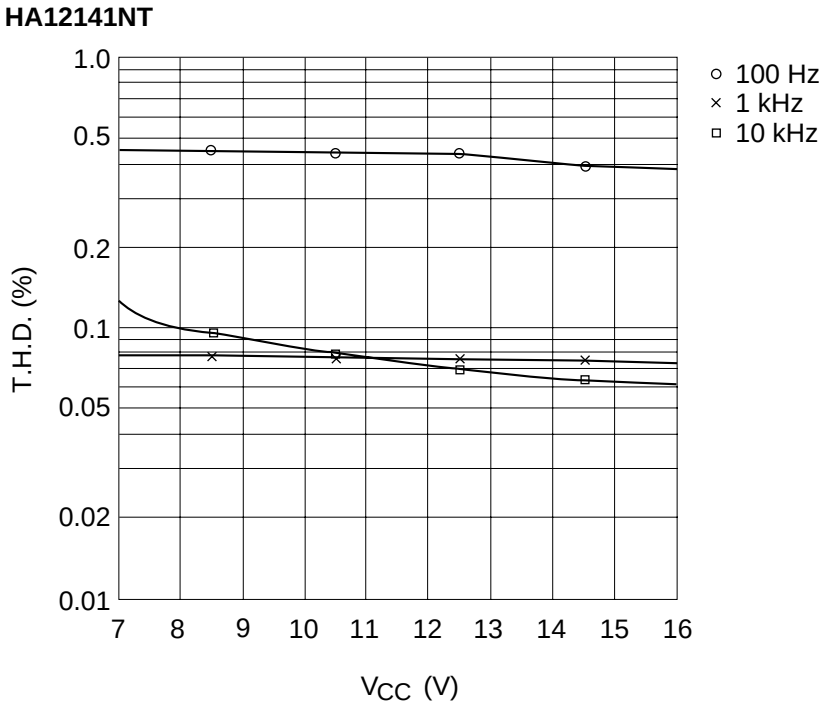
HA12141NT



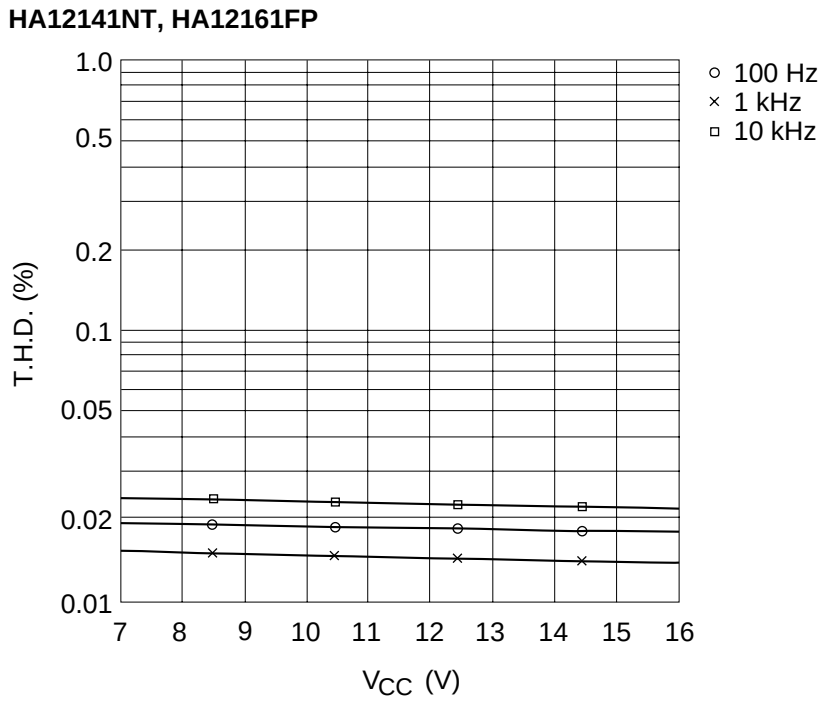
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-OFF)



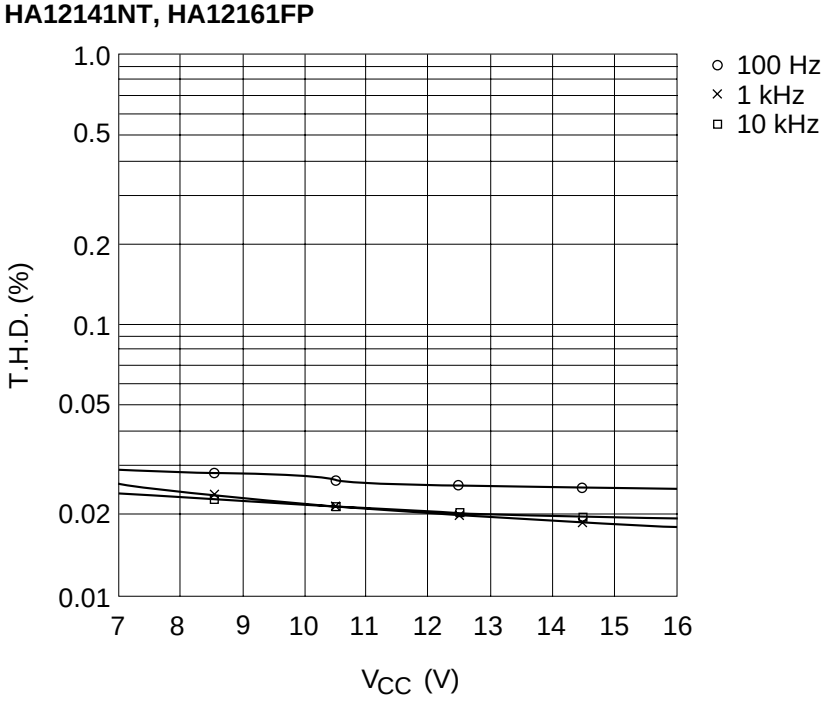
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-B)



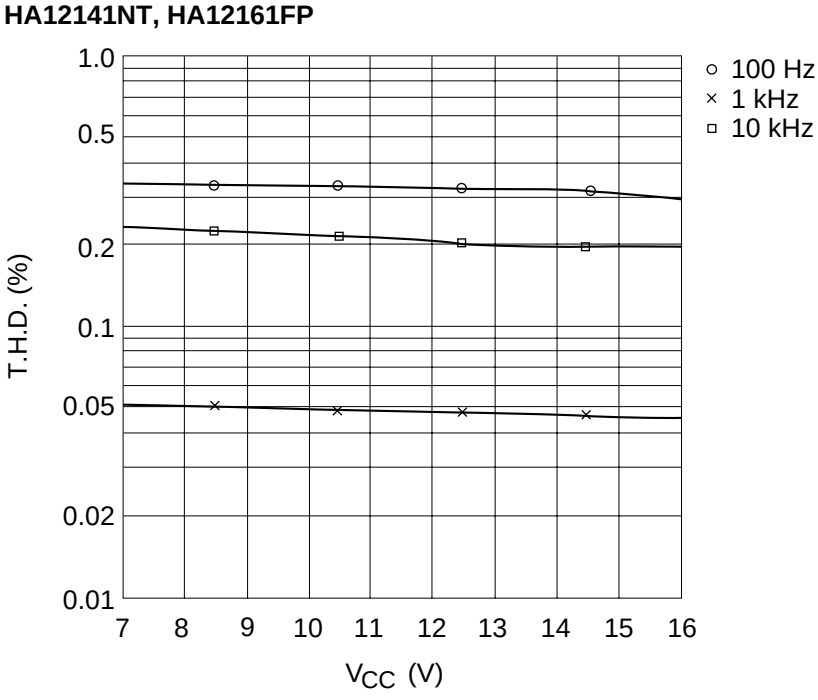
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-C)



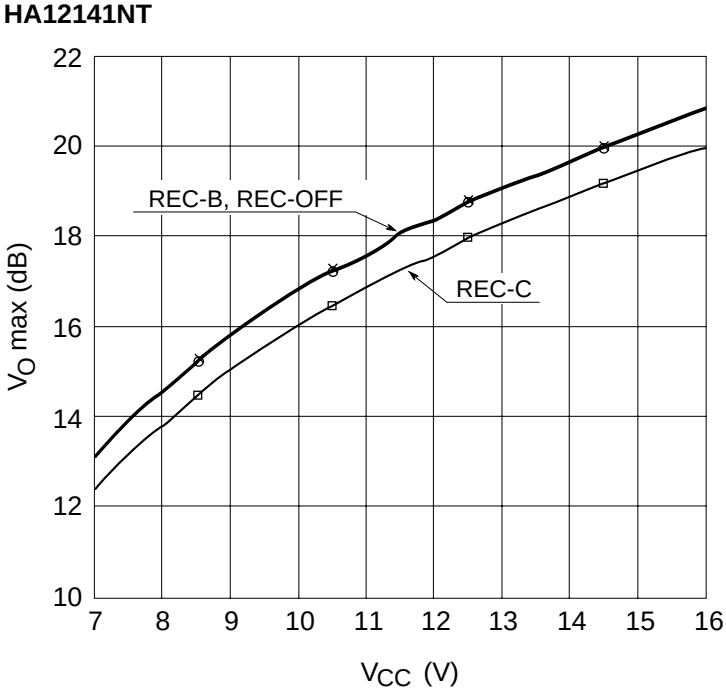
Total Harmonic Distortion vs. Supply Voltage (PB MODE NR-OFF)



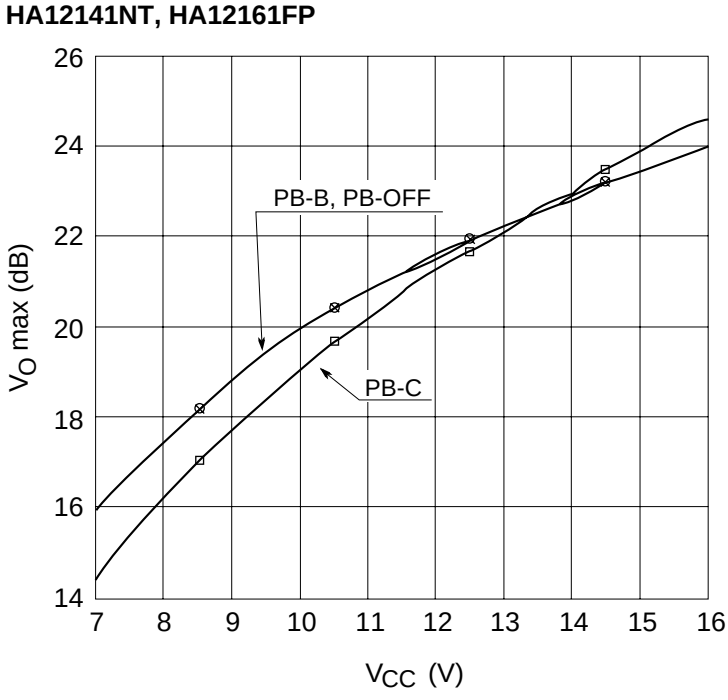
Total Harmonic Distortion vs. Supply Voltage (PB MODE NR-B)



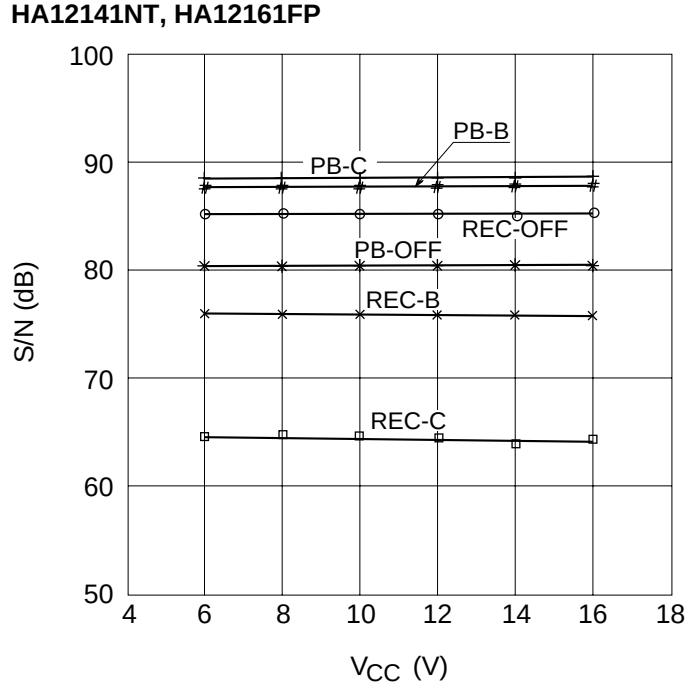
Total Harmonic Distortion vs. Supply Voltage (PB MODE NR-C)



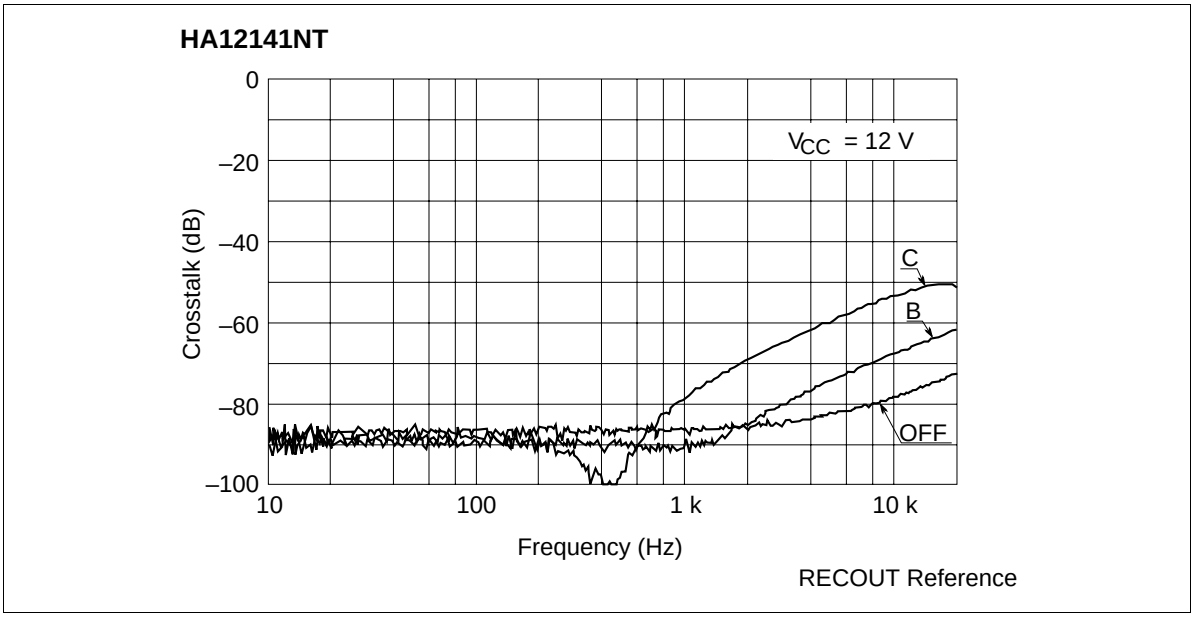
Maximum Output Level vs. Supply Voltage (REC MODE)



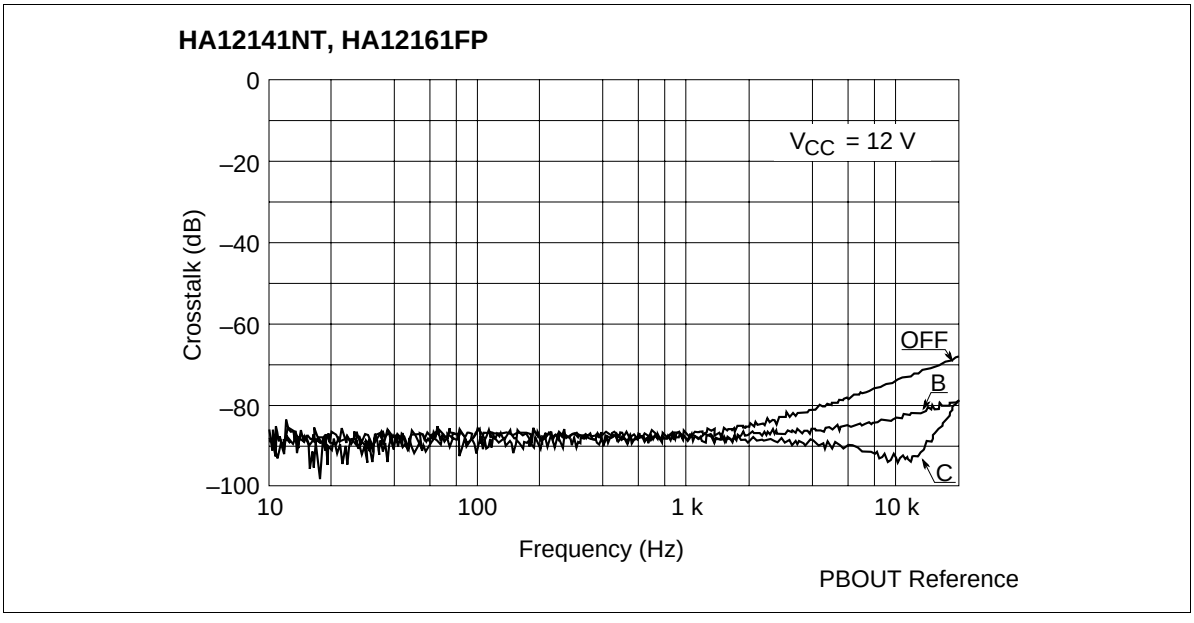
Maximum Output Level vs. Supply Voltage (PB MODE)



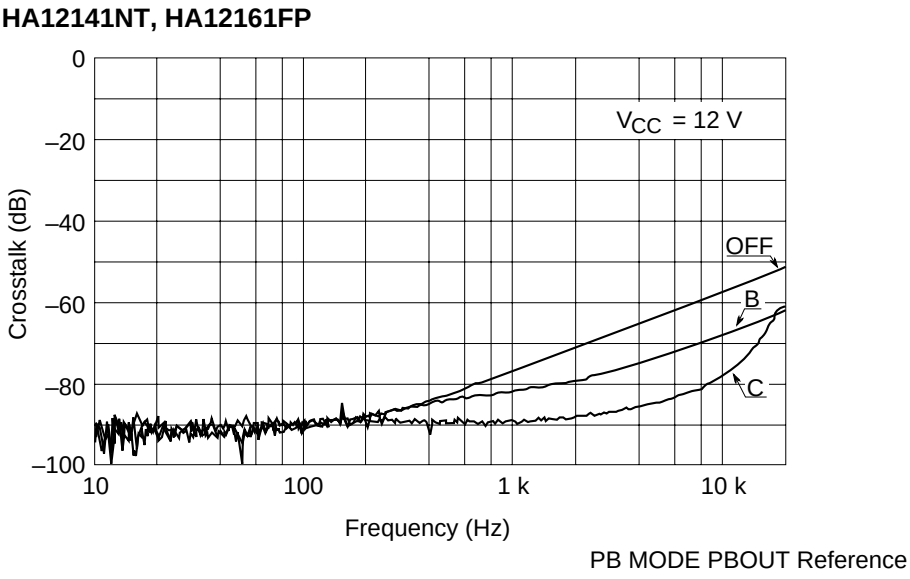
S/N vs. Supply Voltage



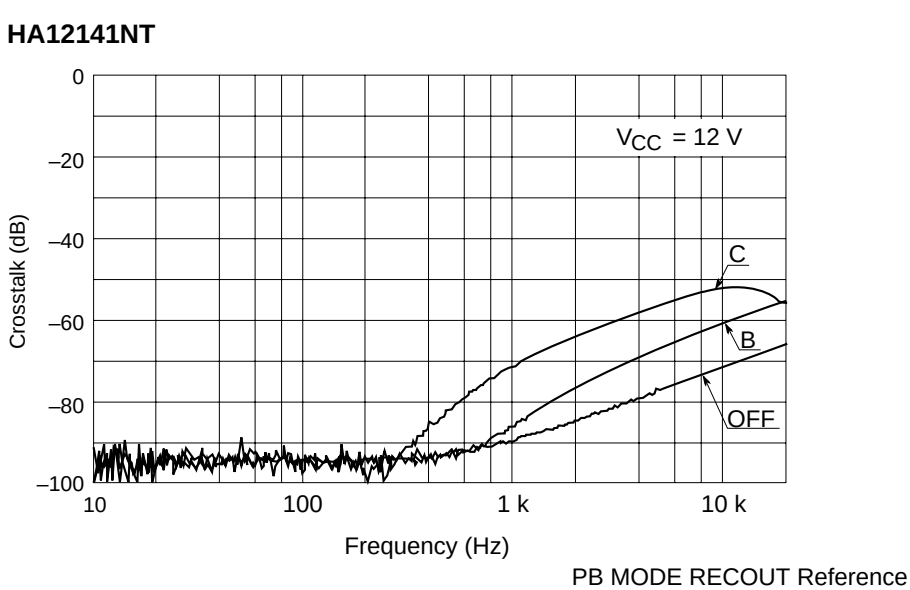
Crosstalk vs. Frequency (REC MODE R→L)



Crosstalk vs. Frequency (PB MODE R→L)

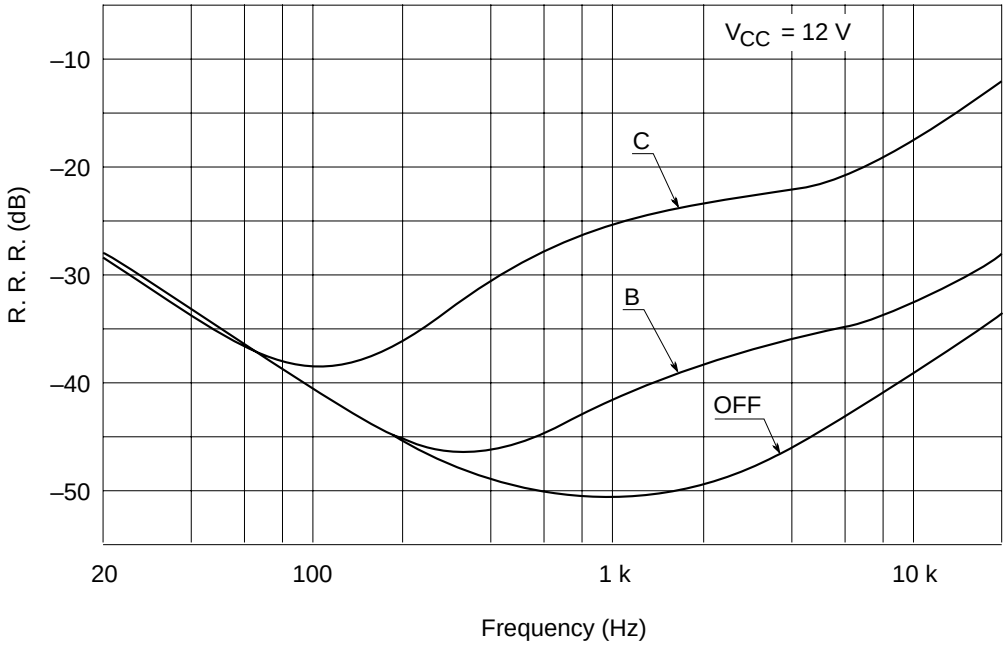


Crosstalk vs. Frequency (REC→PB)



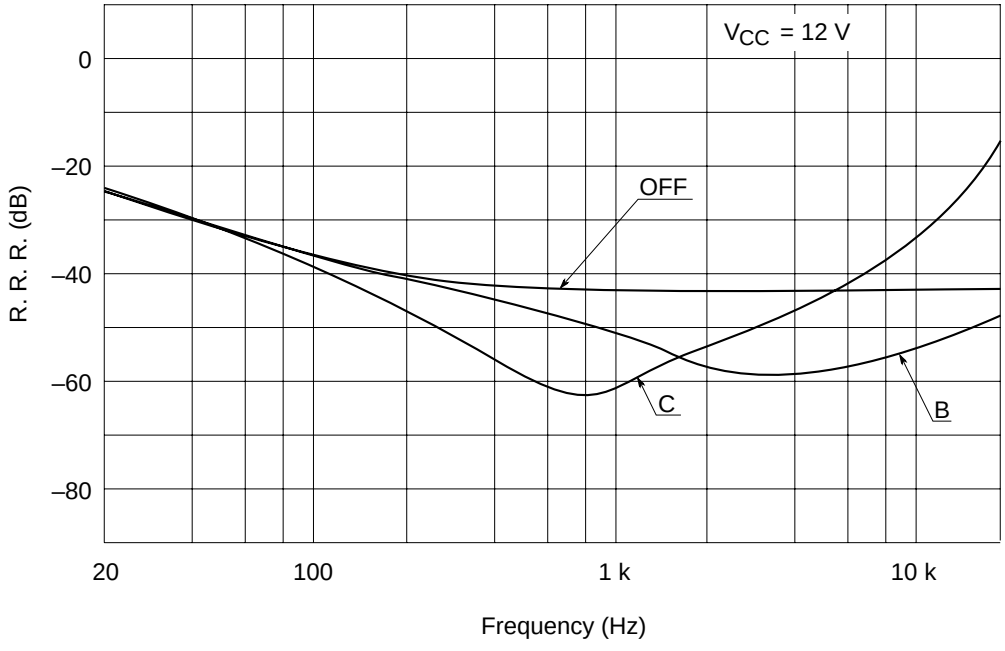
Crosstalk vs. Frequency (PB→REC)

HA12141NT

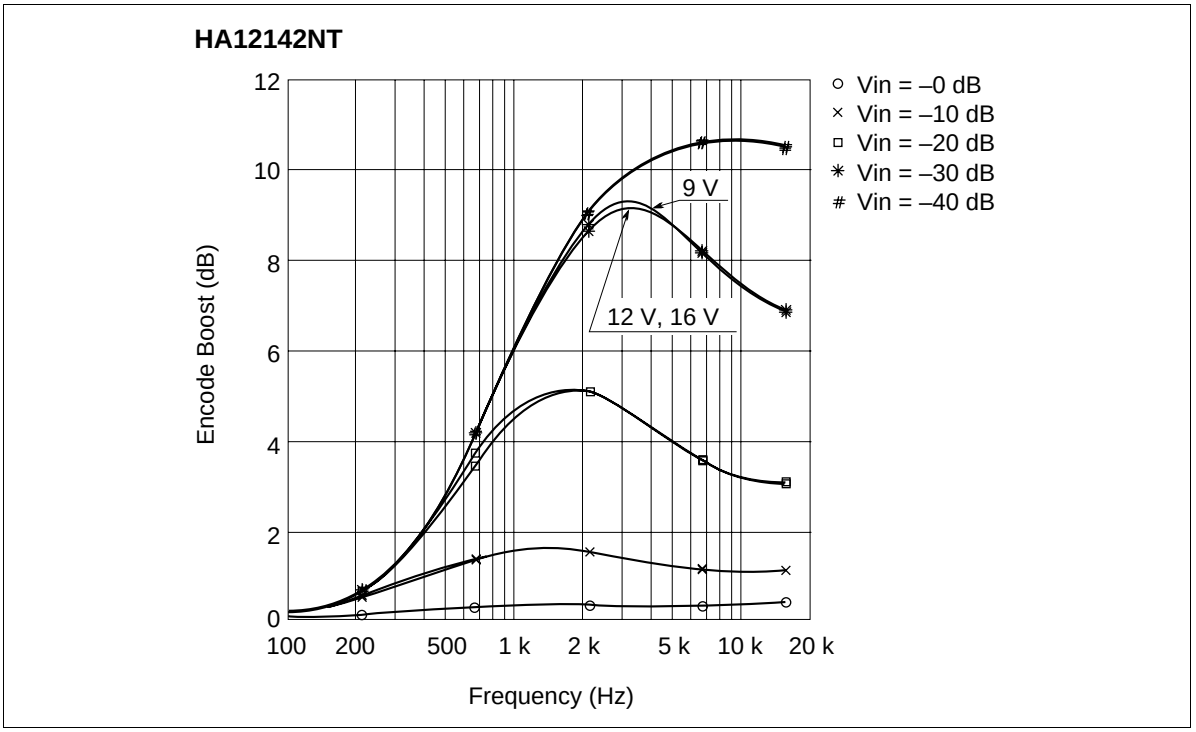


Ripple Rejection Ratio vs. Frequency (REC MODE RECOUT)

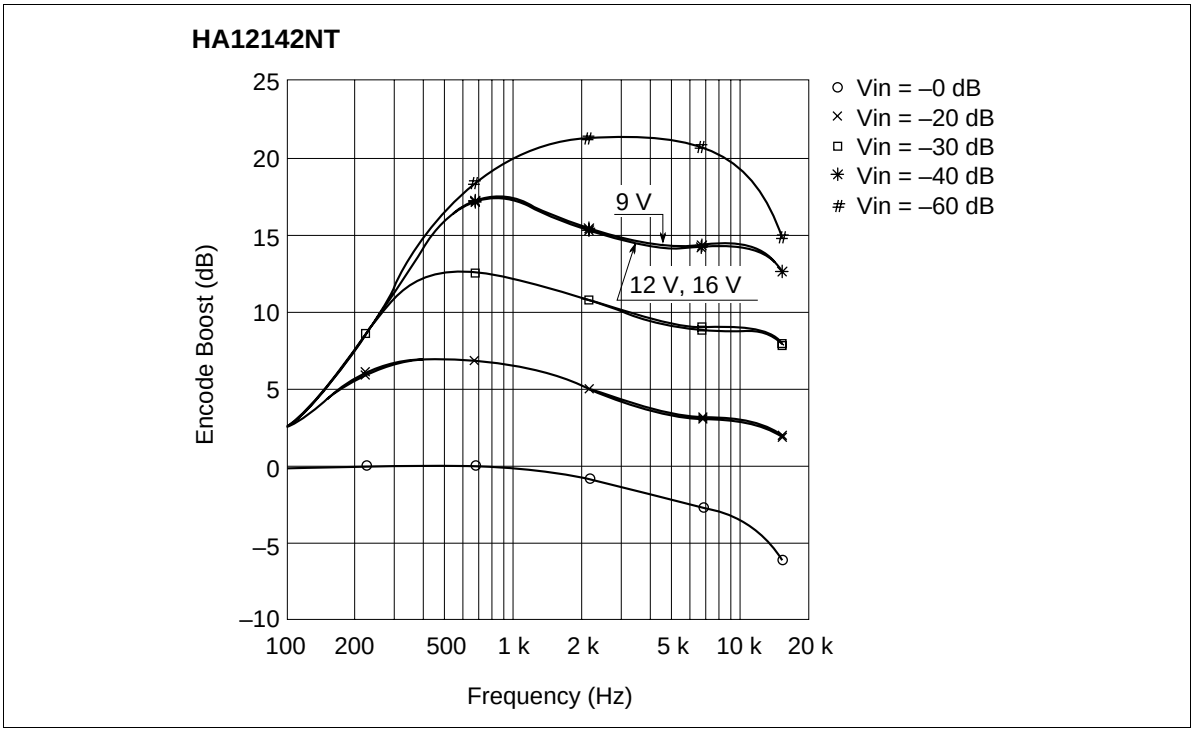
HA12141NT, HA12161FP



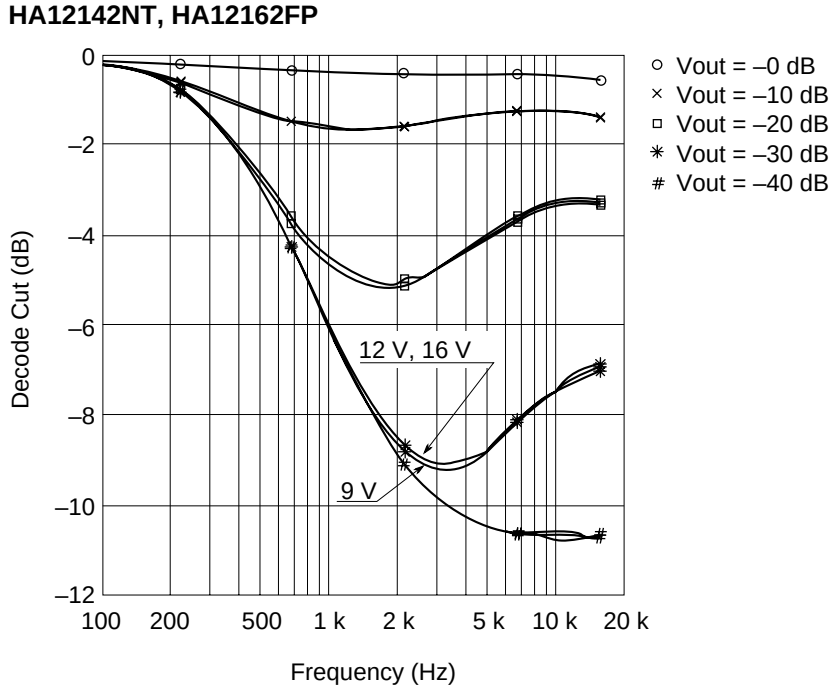
Ripple Rejection Ratio vs. Frequency (PB MODE PBOUT)



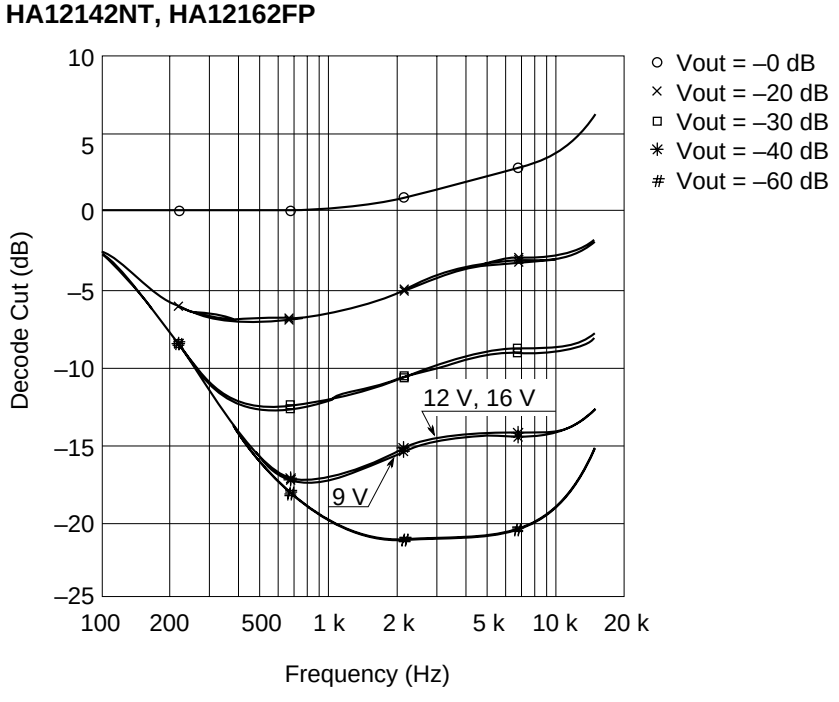
Encode Boost vs. Frequency (NR-B, V_{CC} = 9 V, 12 V, 16 V)



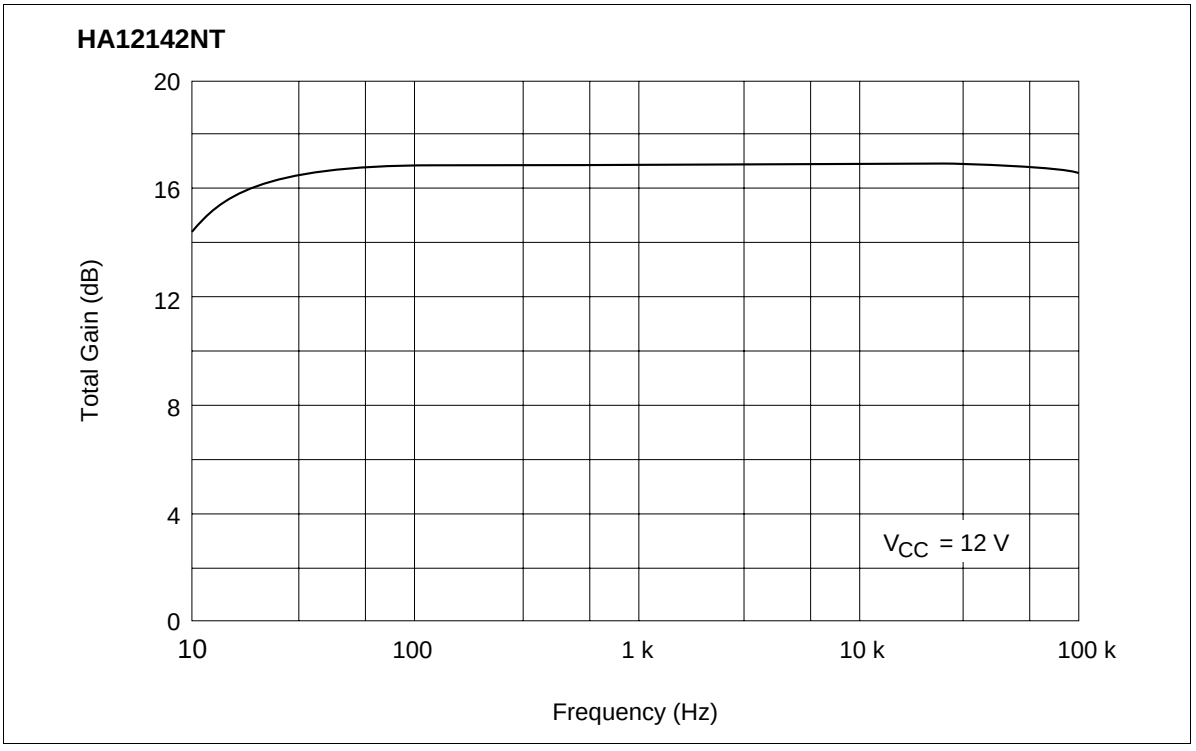
Encode Boost vs. Frequency (NR-C, V_{CC} = 9 V, 12 V, 16 V)



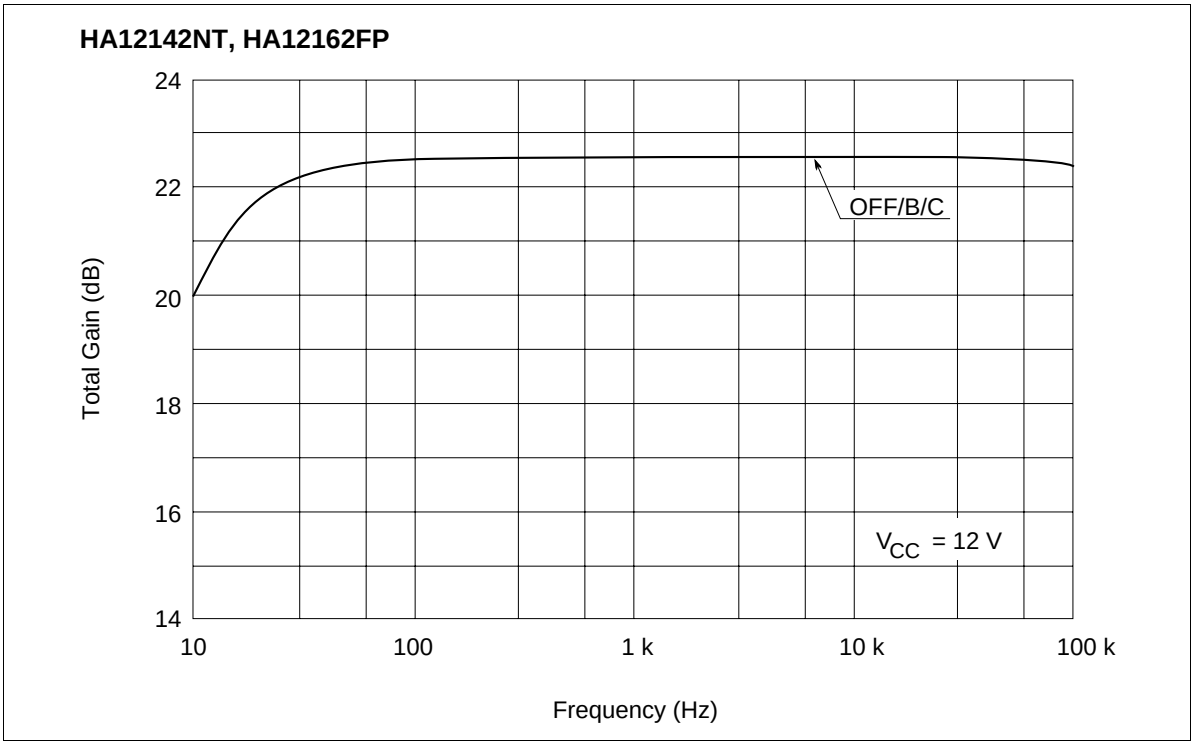
Decode Cut vs. Frequency (NR-B, V_{CC} = 9V, 12 V, 16 V)



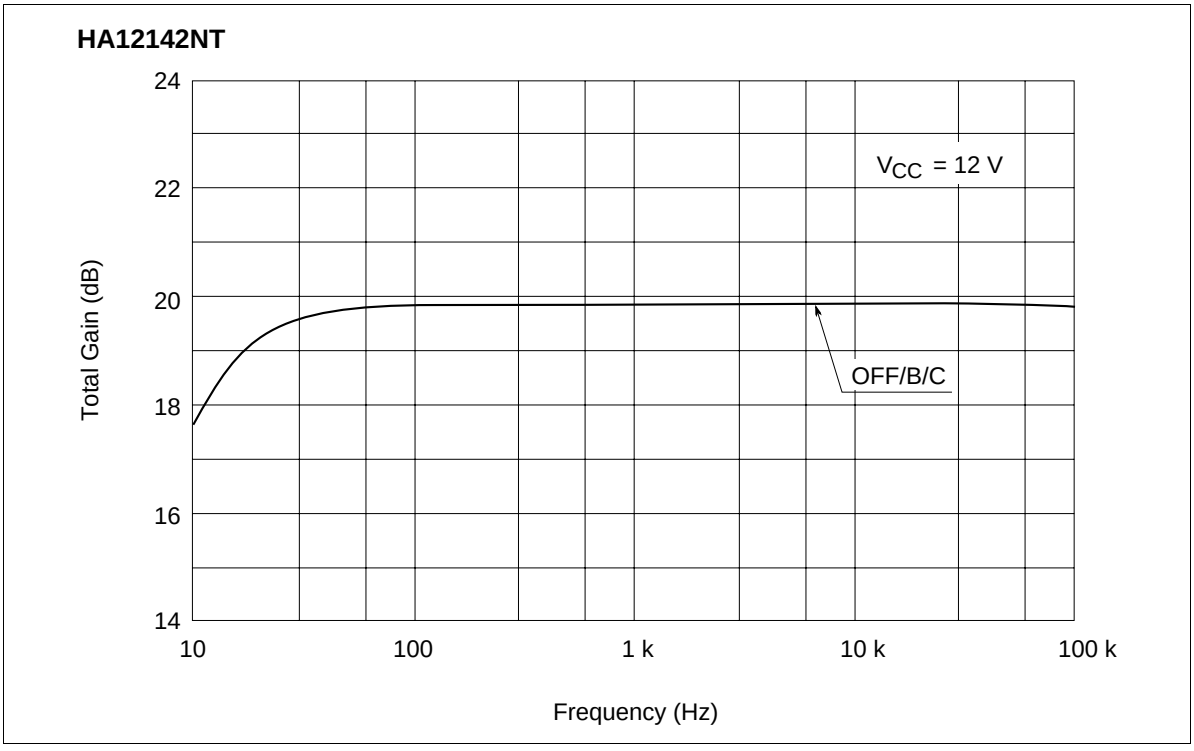
Decode Cut vs. Frequency (NR-C, V_{CC} = 9V, 12 V, 16 V)



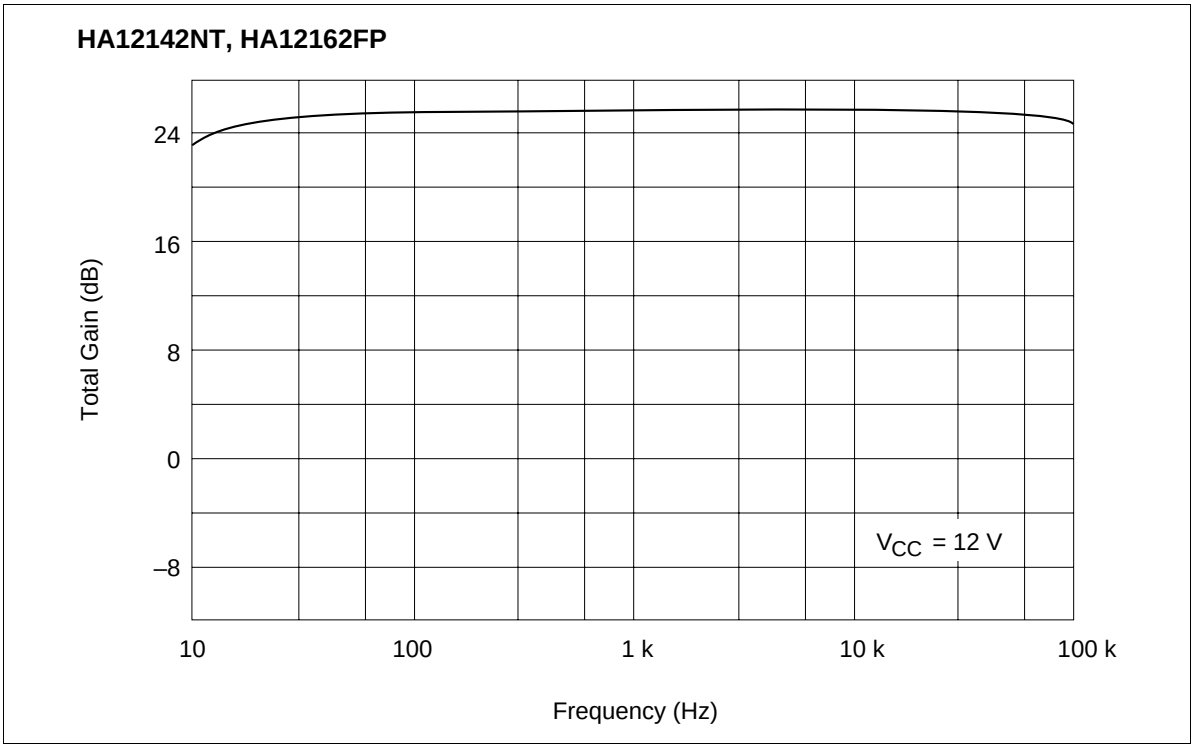
Total Gain vs. Frequency (REC MODE RECOUT NR-OFF)



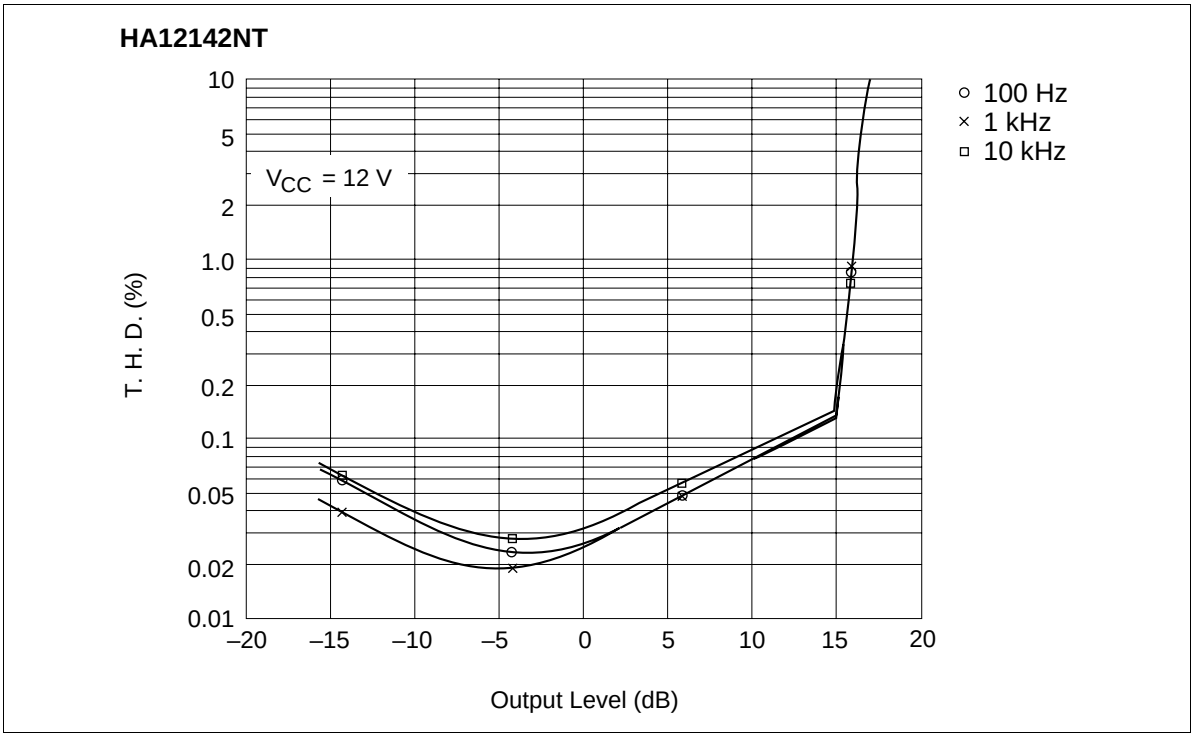
Total Gain vs. Frequency (REC MODE PBOUT)



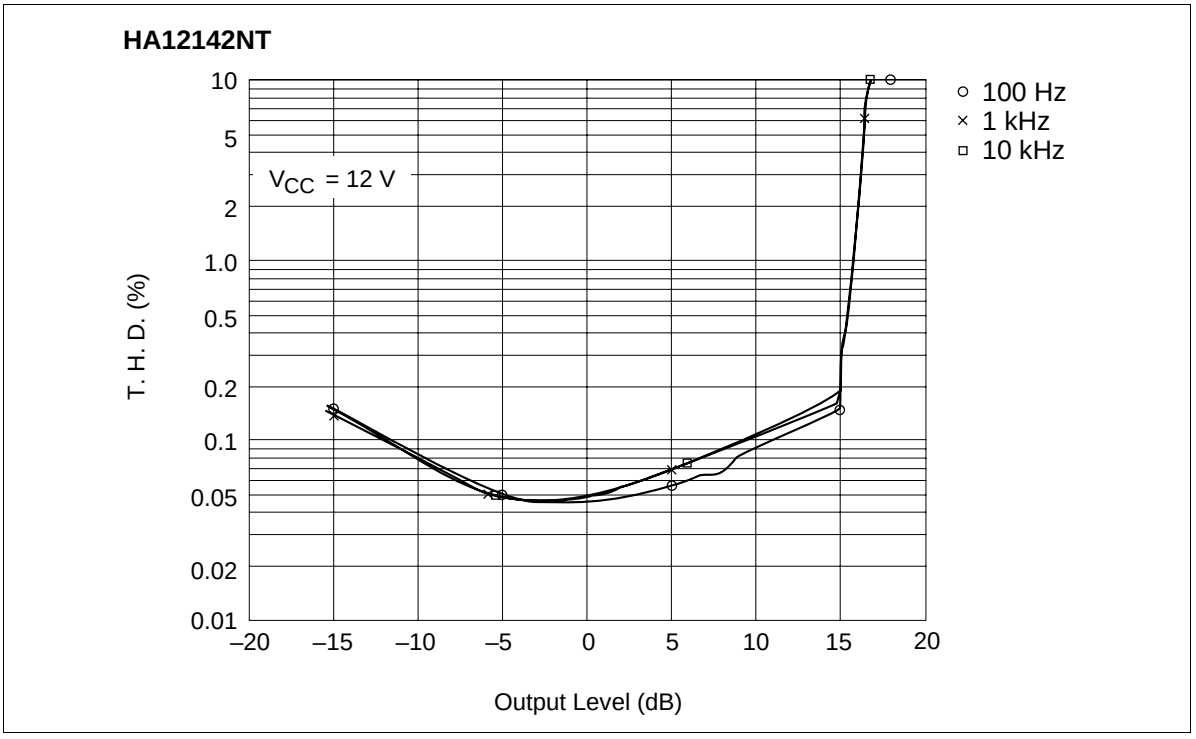
Total Gain vs. Frequency (PB MODE RECOUT)



Total Gain vs. Frequency (PB MODE PBOUT NR-OFF)

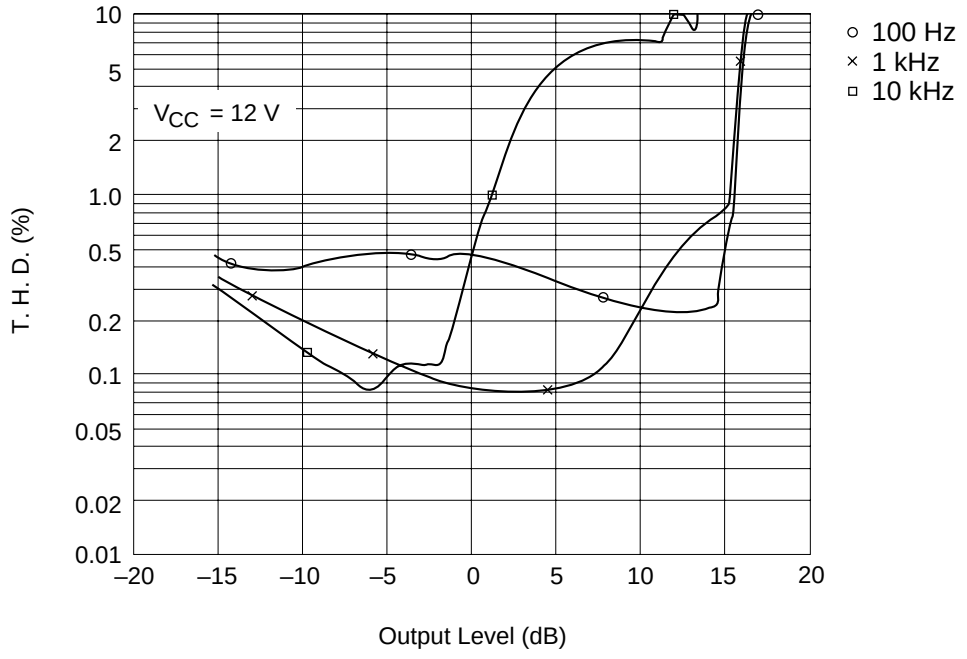


Total Harmonic Distortion vs. Output Level (REC MODE NR-OFF)



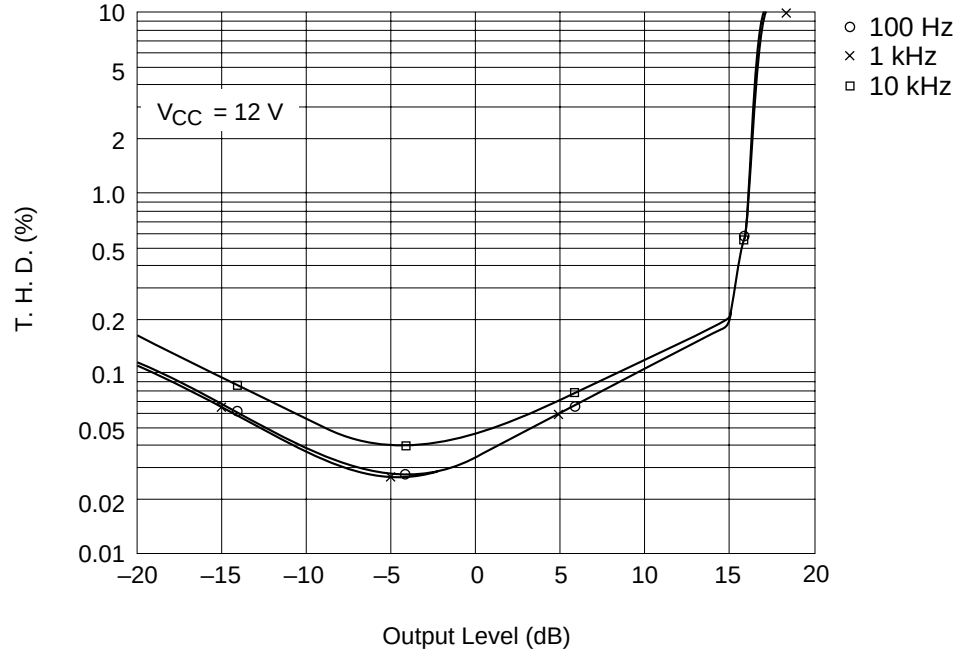
Total Harmonic Distortion vs. Output Level (REC MODE NR-B)

HA12142NT

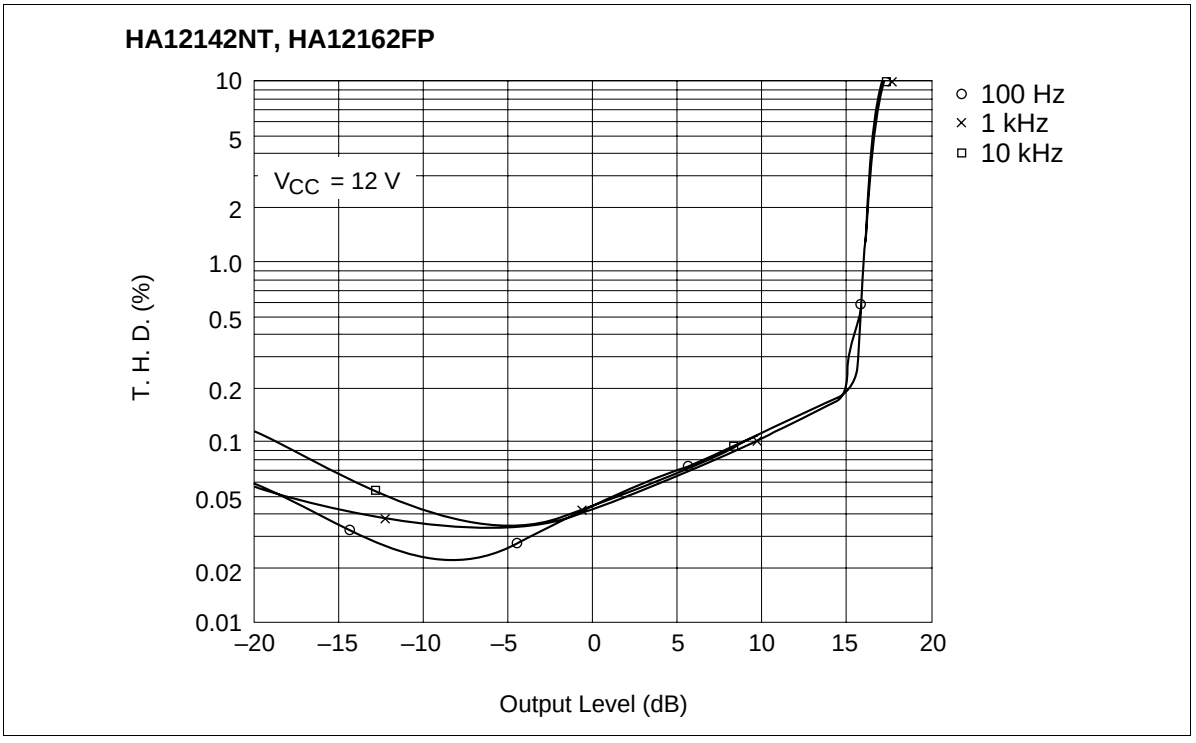


Total Harmonic Distortion vs. Output Level (REC MODE NR-C)

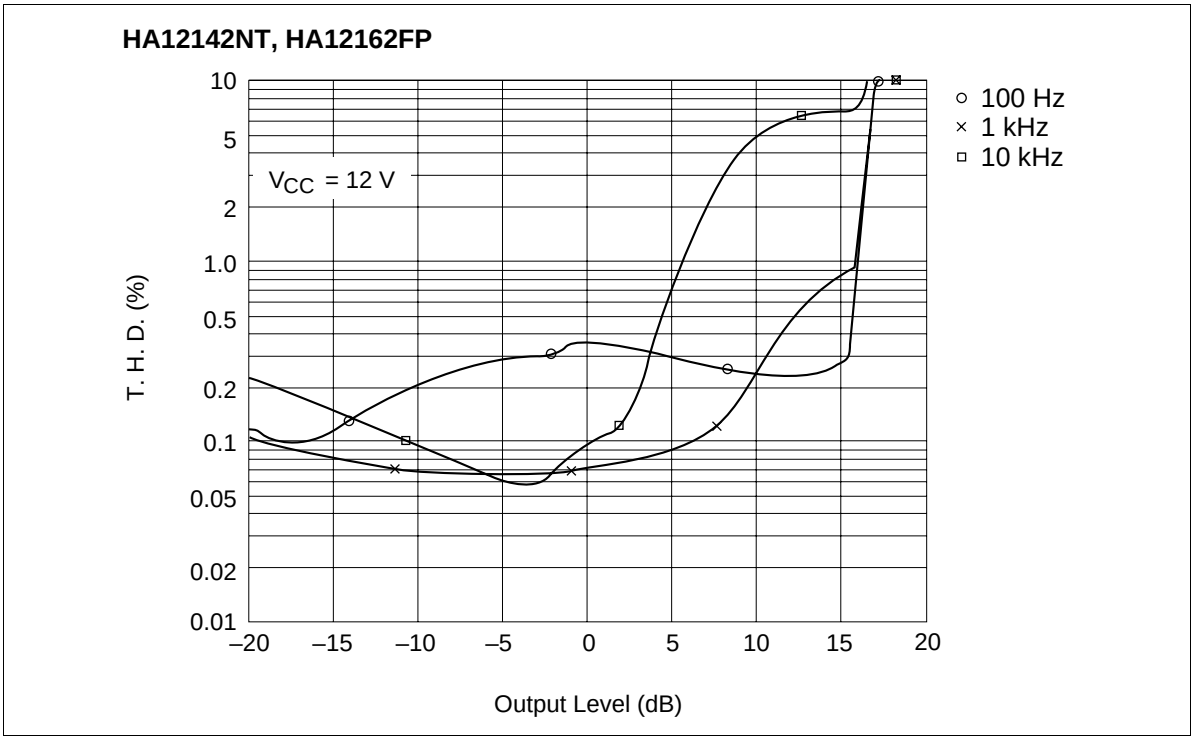
HA12142NT, HA12162FP



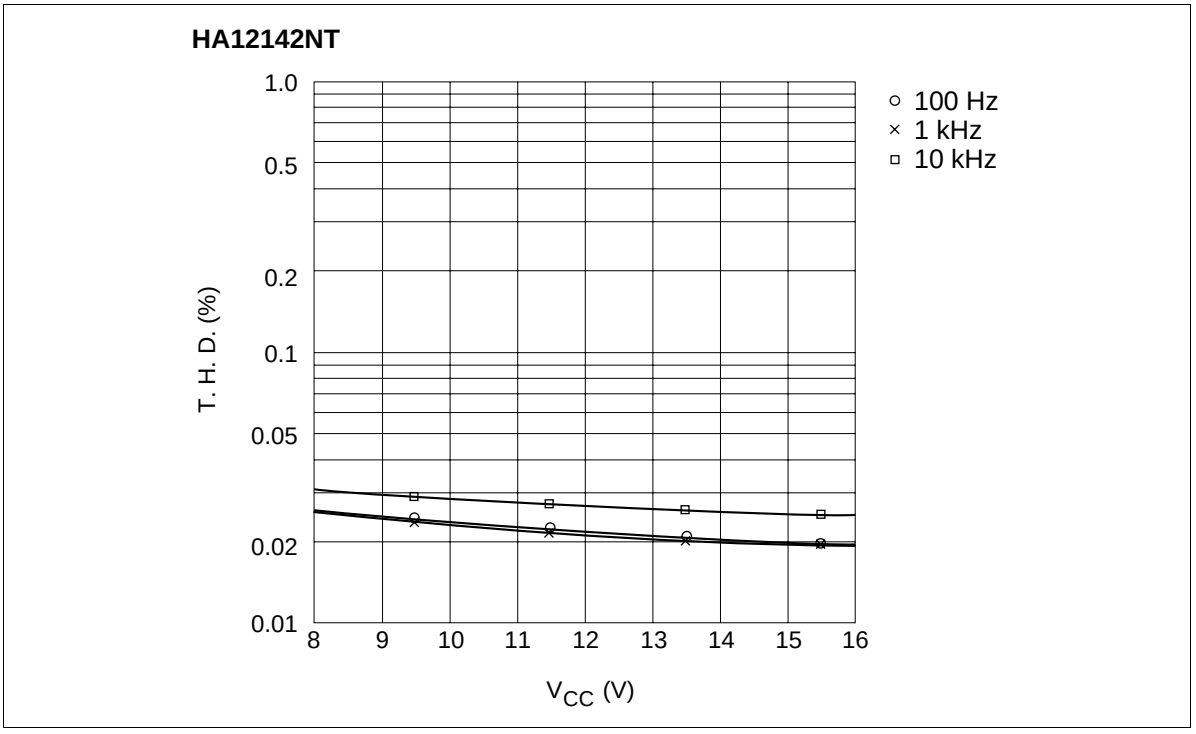
Total Harmonic Distortion vs. Output Level (PB MODE NR-OFF)



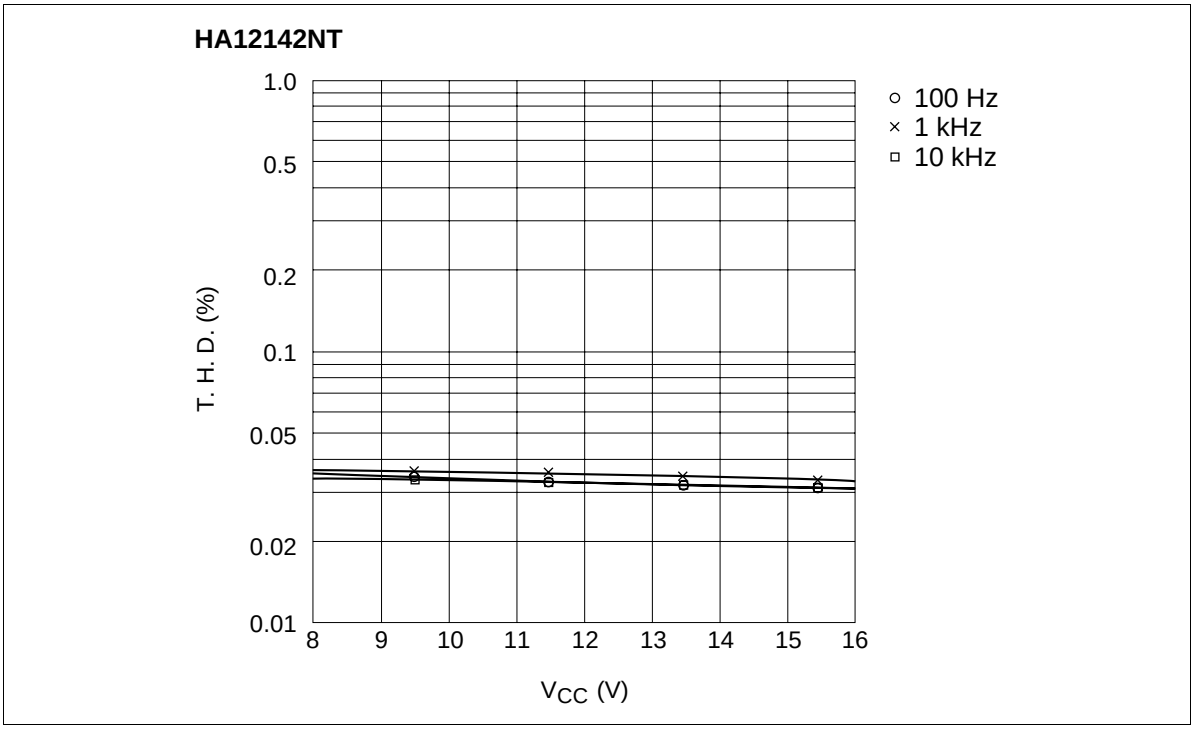
Total Harmonic Distortion vs. Output Level (PB MODE NR-B)



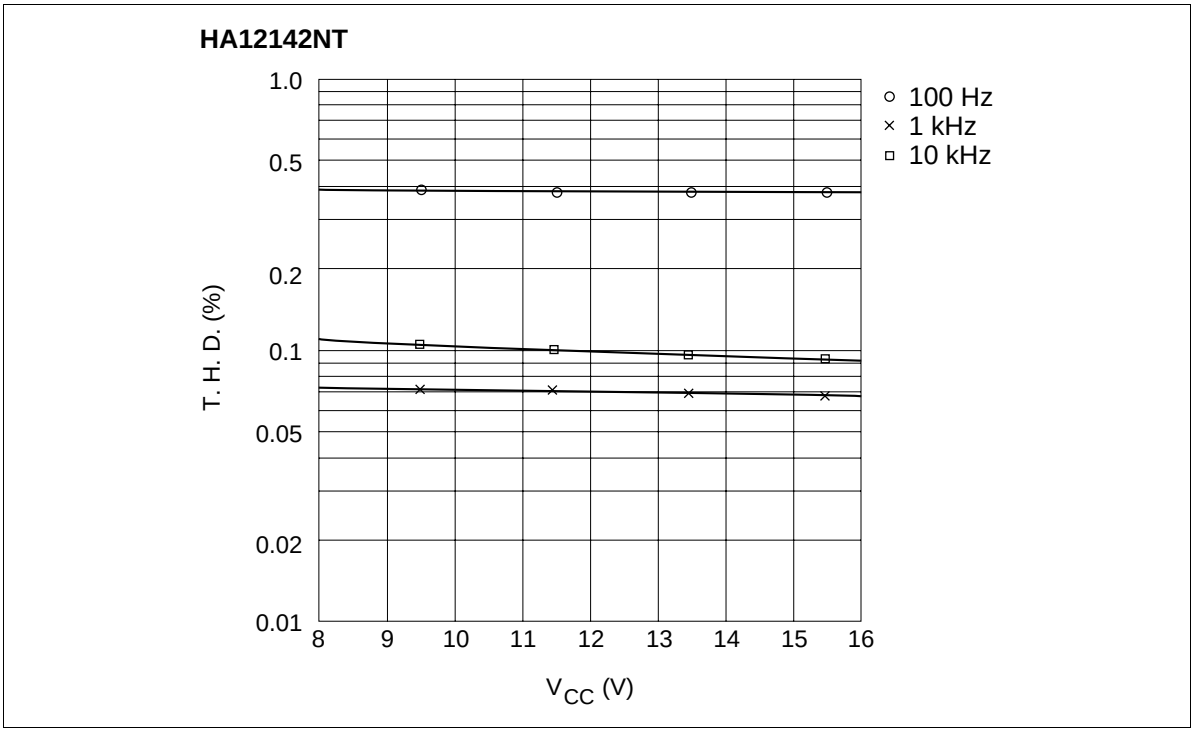
Total Harmonic Distortion vs. Output Level (PB MODE NR-C)



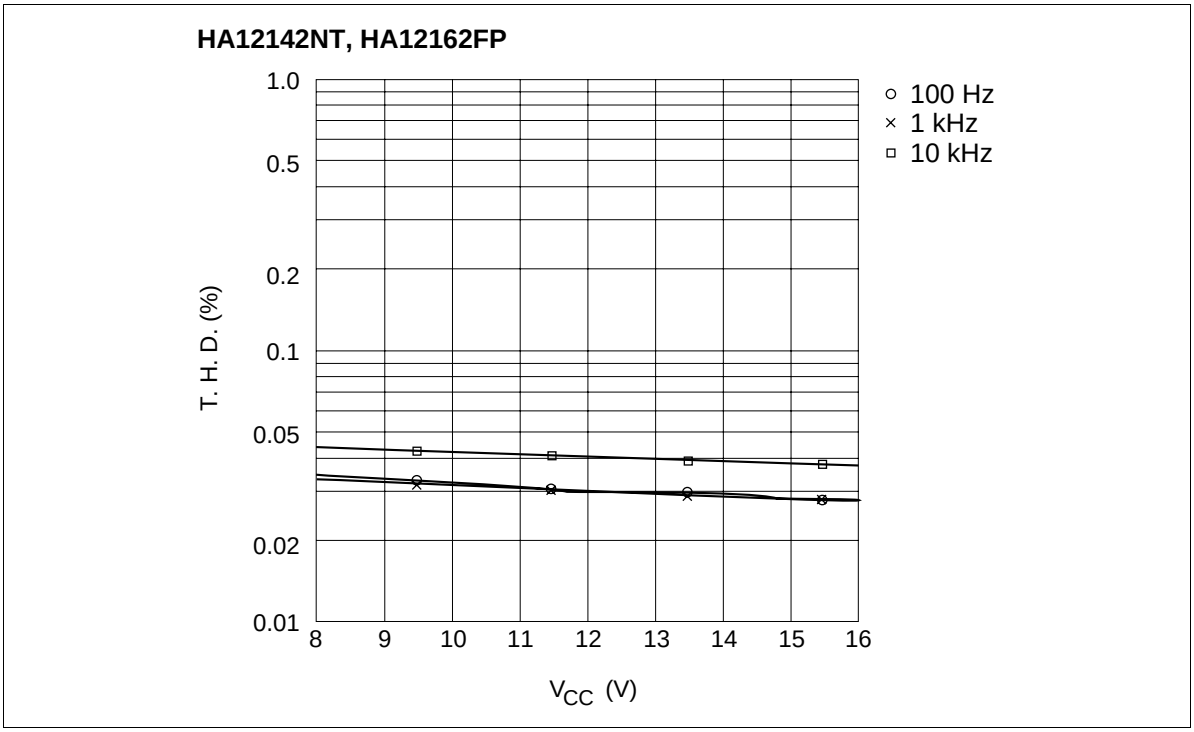
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-OFF)



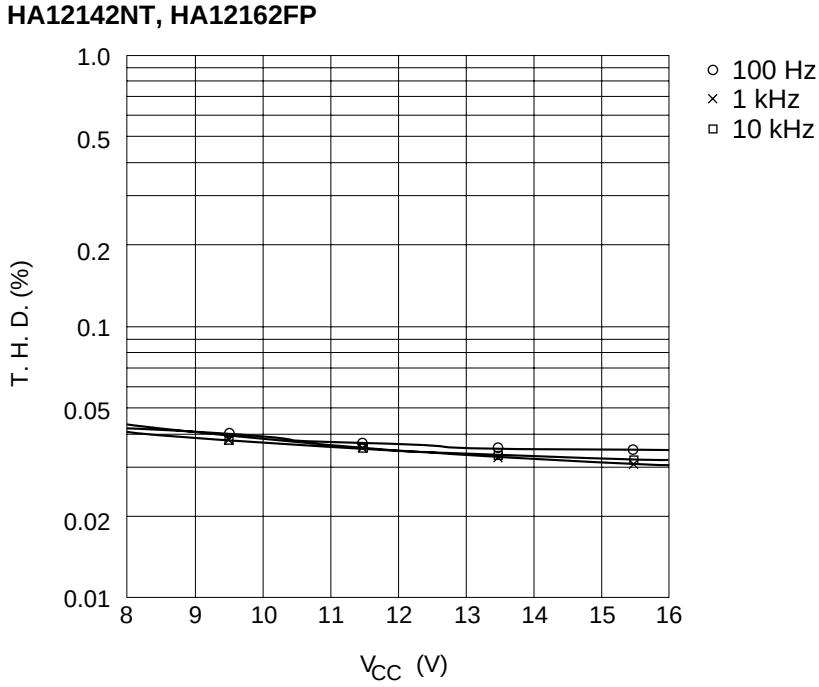
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-B)



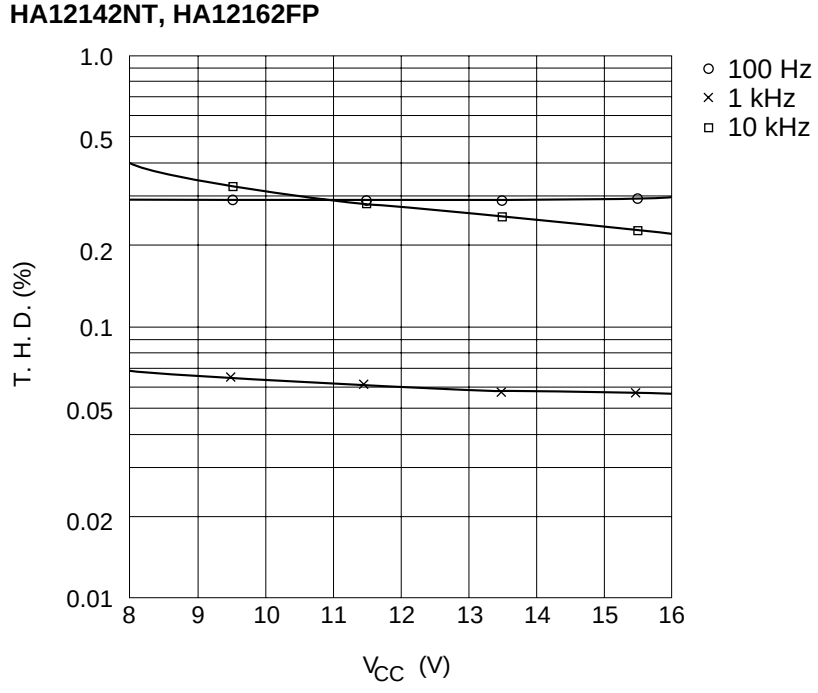
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-C)



Total Harmonic Distortion vs. Supply Voltage (PB MODE NR-OFF)

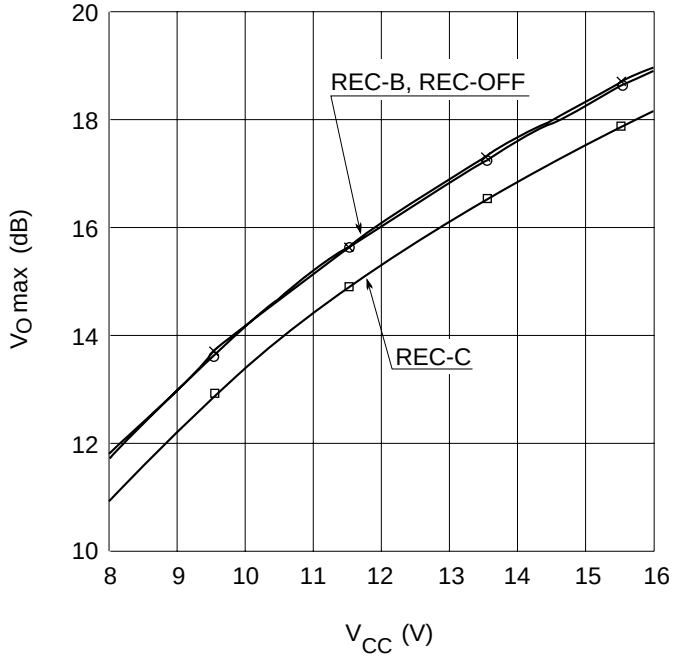


Total Harmonic Distortion vs. Supply Voltage (PB MODE NR-B)



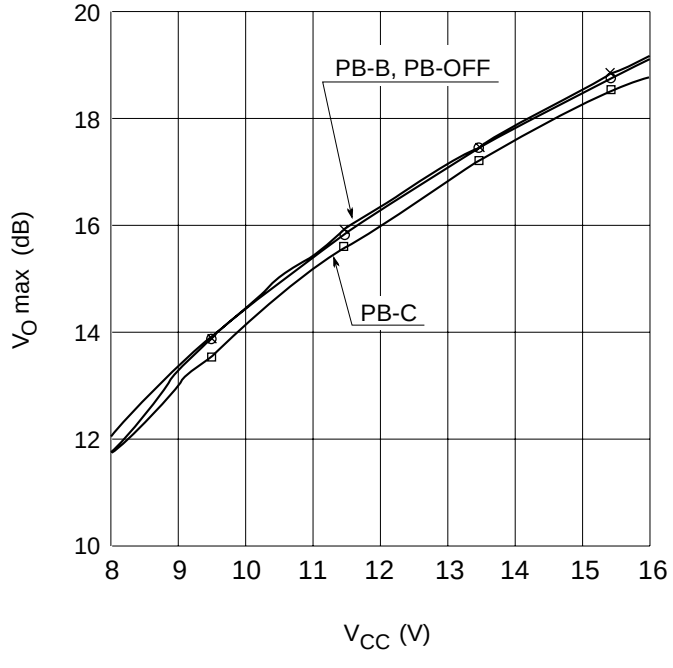
Total Harmonic Distortion vs. Supply Voltage (PB MODE NR-C)

HA12142NT

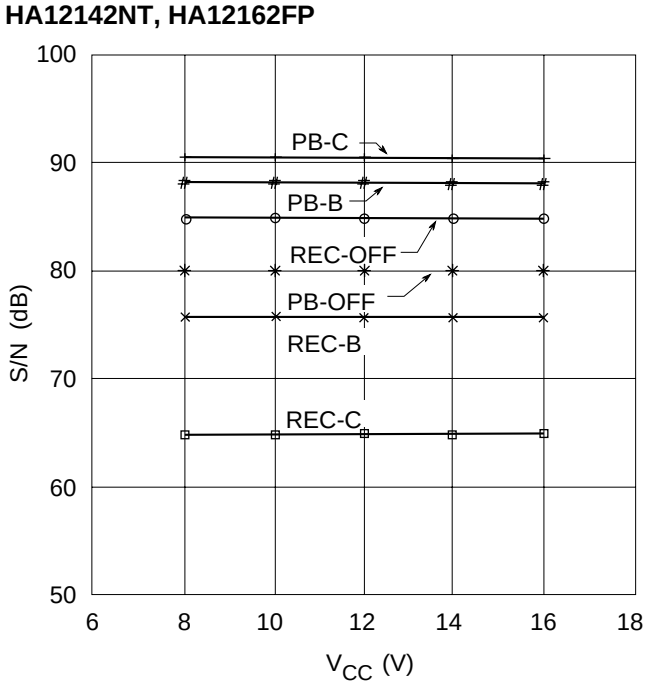


Maximum Output Level vs. Supply Voltage (REC MODE)

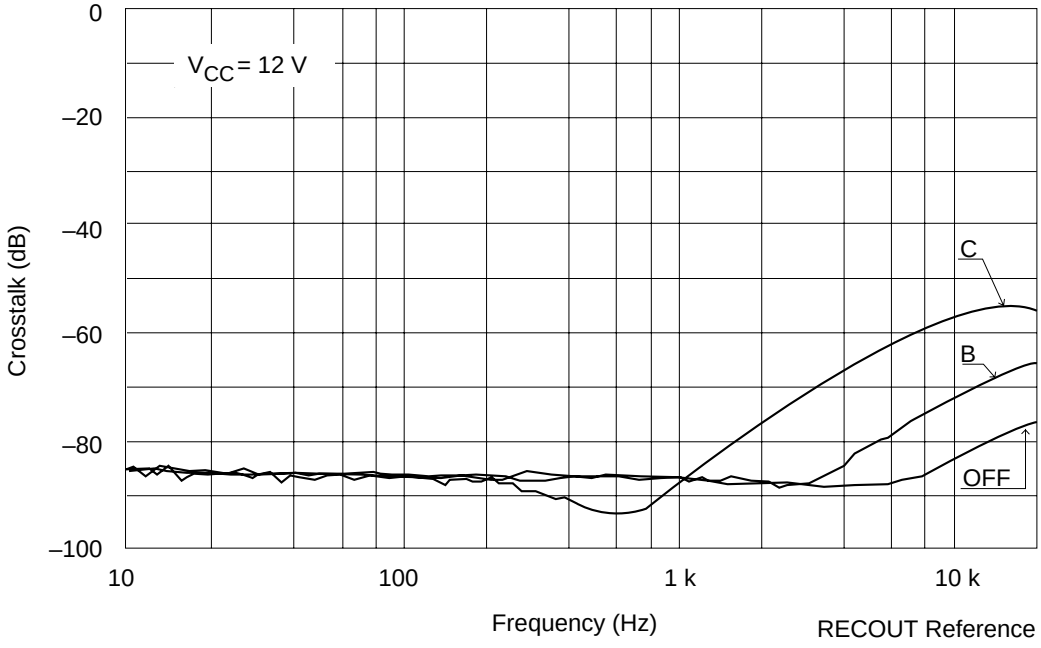
HA12142NT, HA12162FP



Maximum Output Level vs. Supply Voltage (PB MODE)

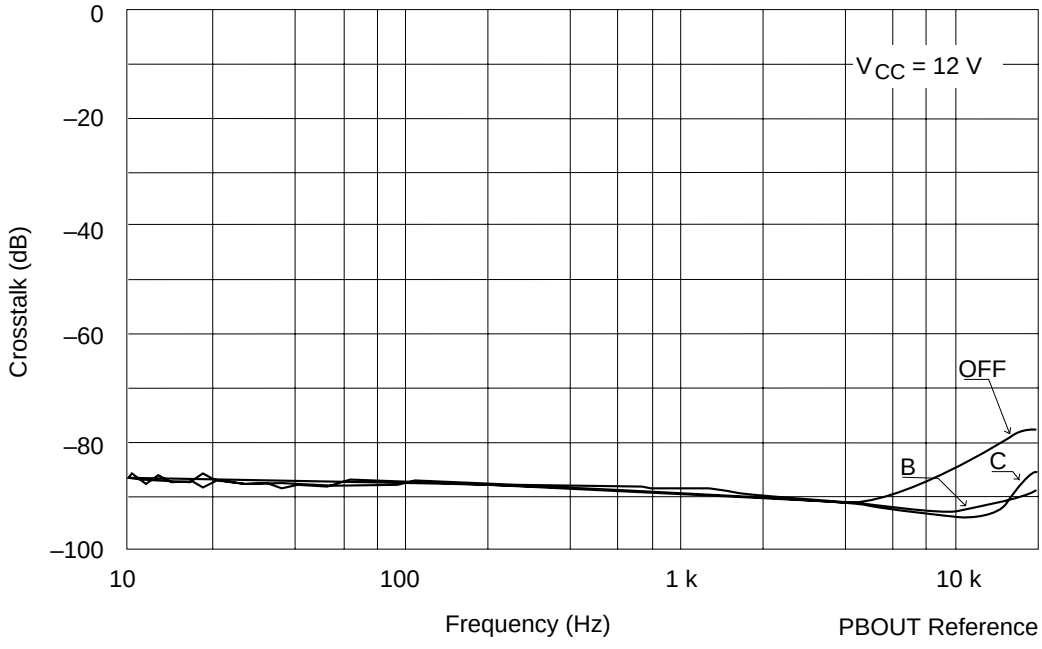


S/N vs. Supply Voltage



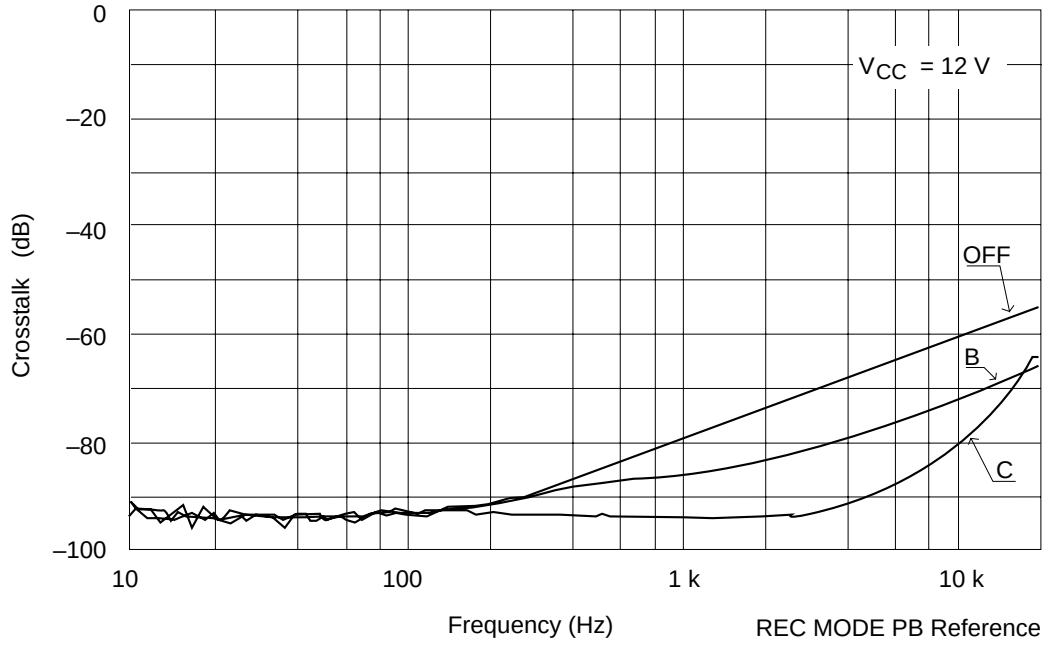
Crosstalk vs. Frequency (REC MODE R↔L)

HA12142NT, HA12162FP

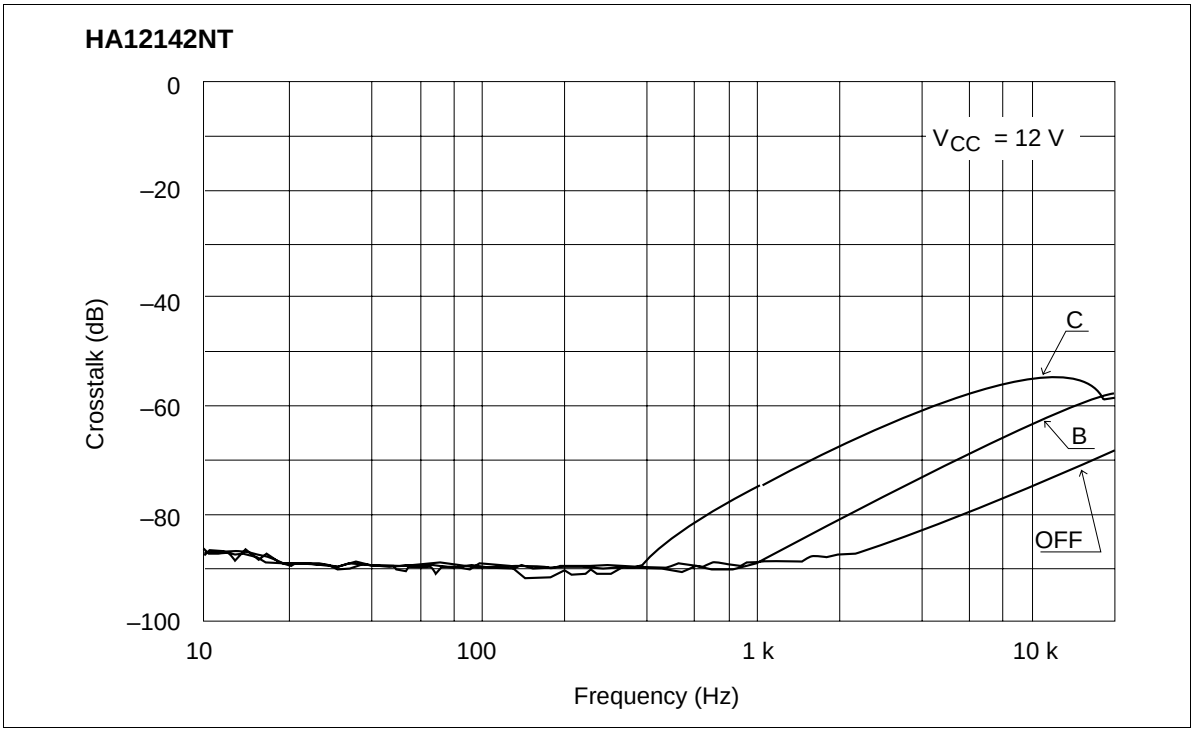


Crosstalk vs. Frequency (PB MODE R↔L)

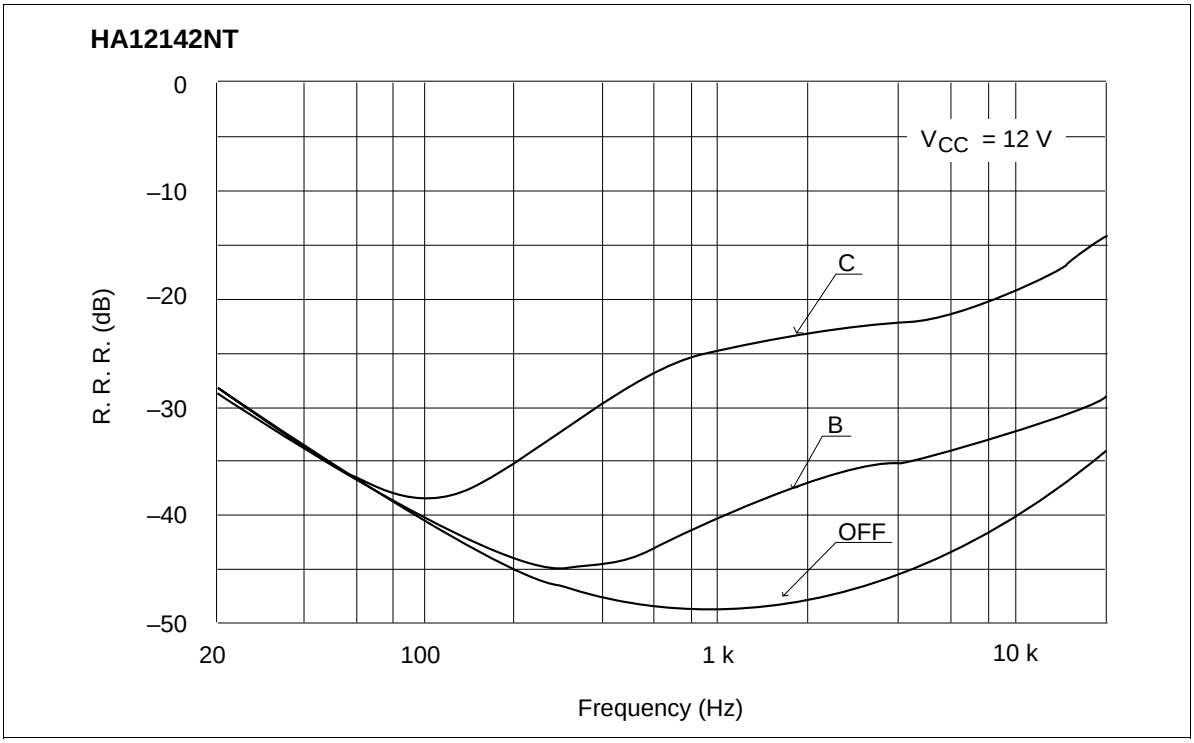
HA12142NT



Crosstalk vs. Frequency (REC→PB)

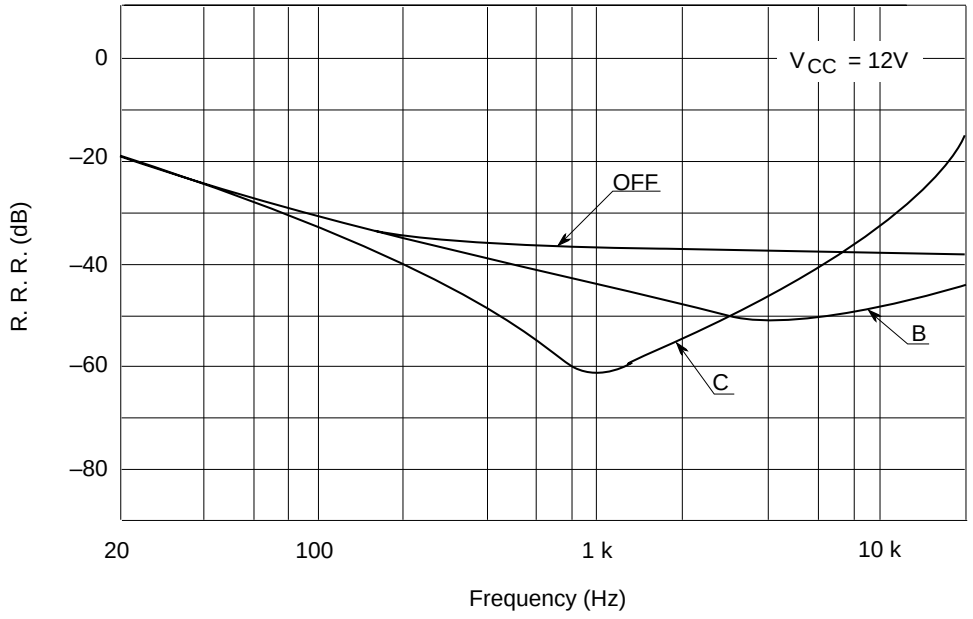


Crosstalk vs. Frequency (PB→REC)



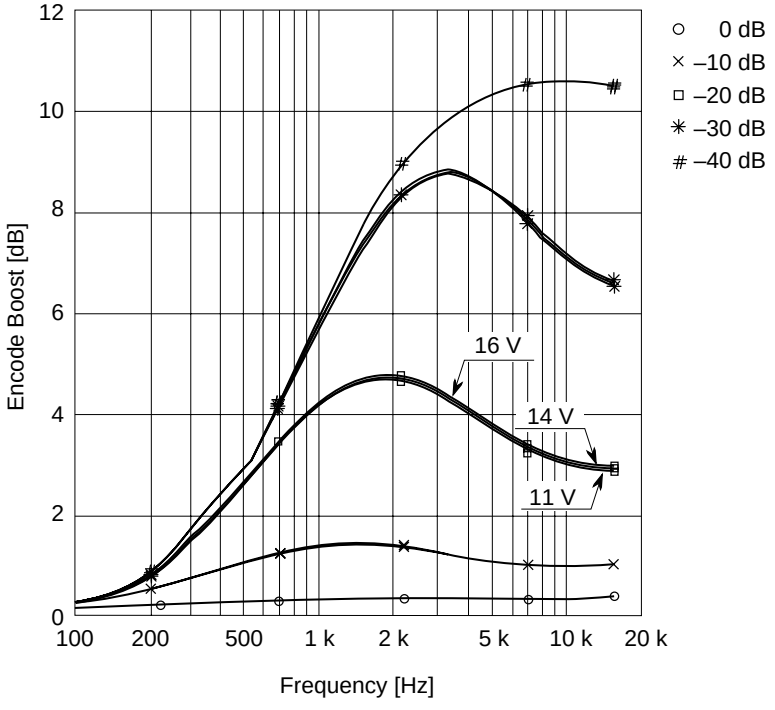
Ripple Rejection Ratio vs. Frequency (REC MODE RECOUT)

HA12142NT, HA12162FP

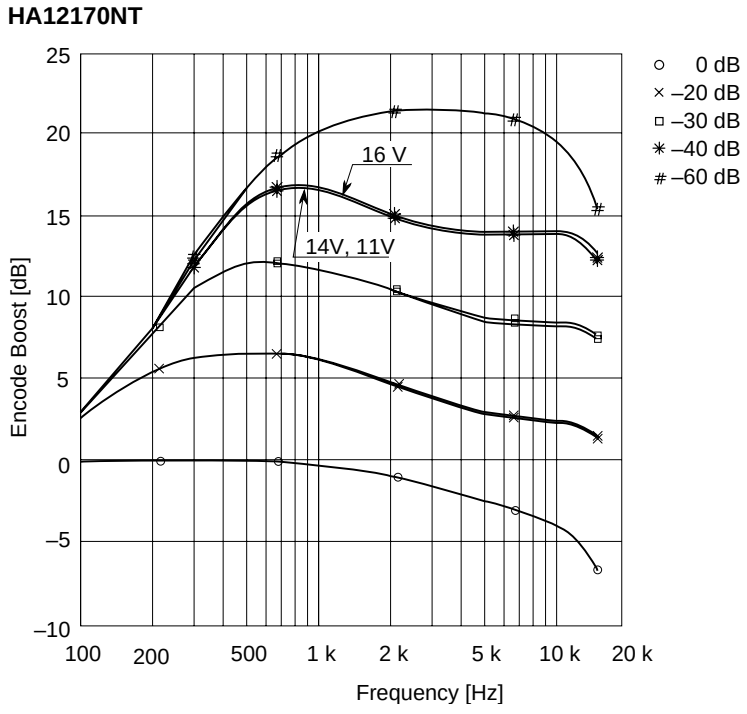


Ripple Rejection Ratio vs. Frequency (PB MODE RECOUT)

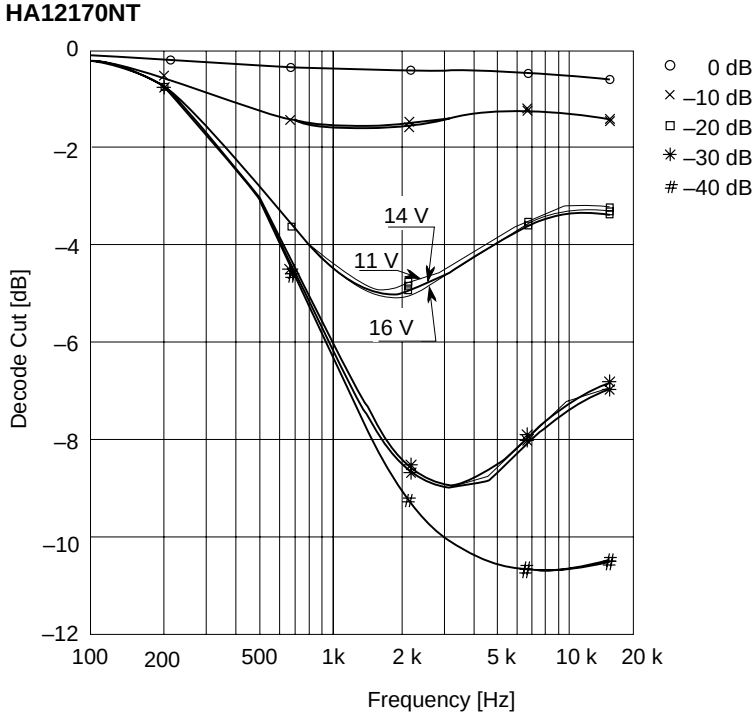
HA12170NT



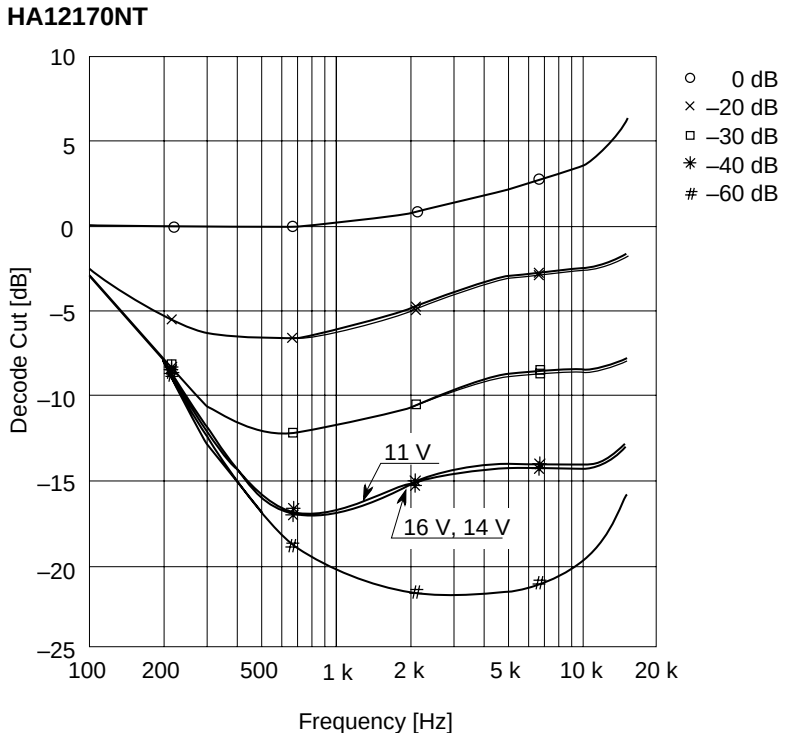
Encode Boost vs. Frequency (NR-B V_{CC} = 11 V, 14 V, 16 V)



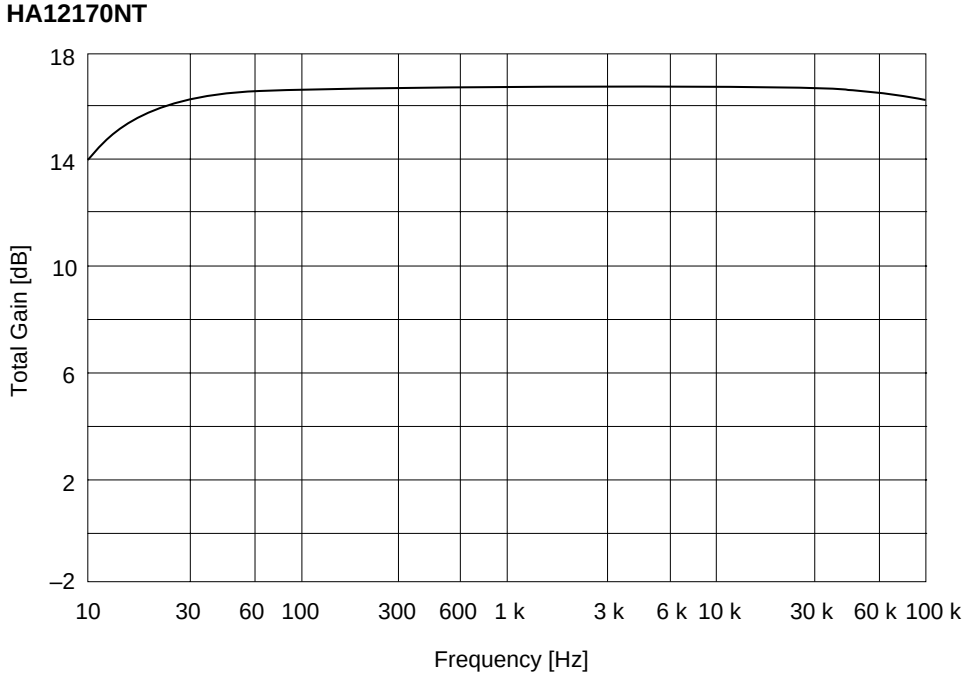
Encode Boost vs. Frequency (NR-C V_{CC} = 11 V, 14 V, 16 V)



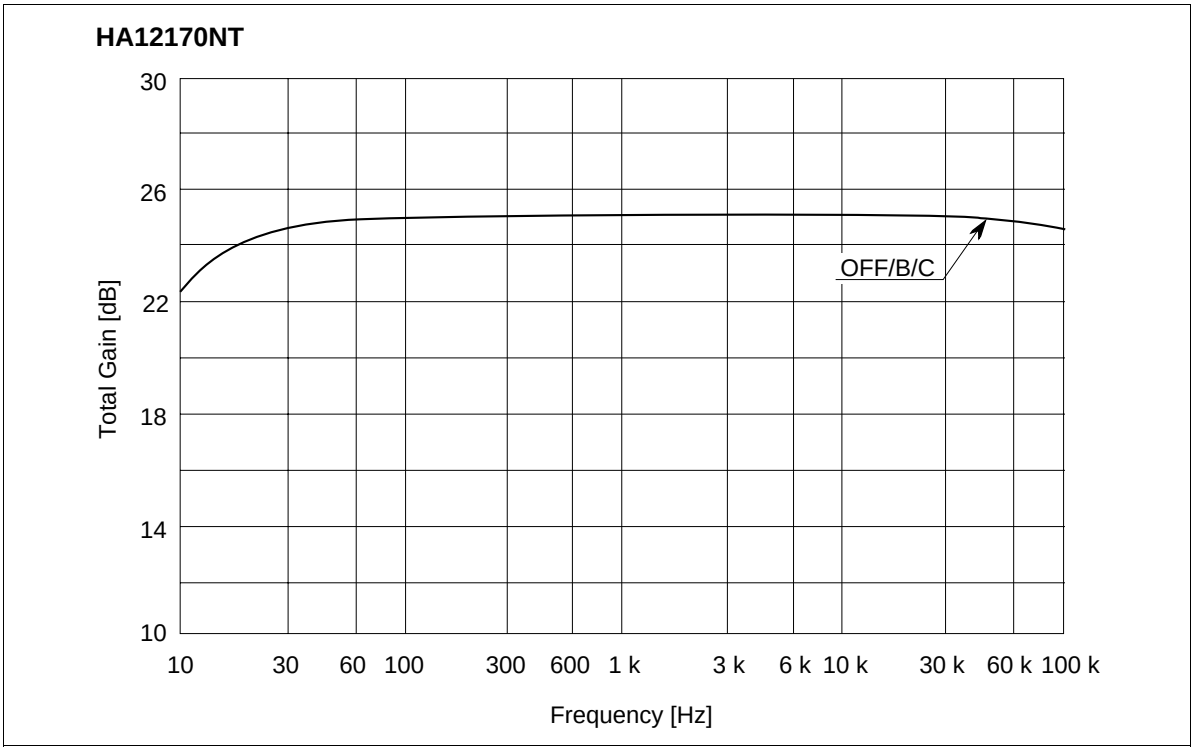
Decode Cut vs. Frequency (NR-B V_{CC} = 11 V, 14 V, 16 V)



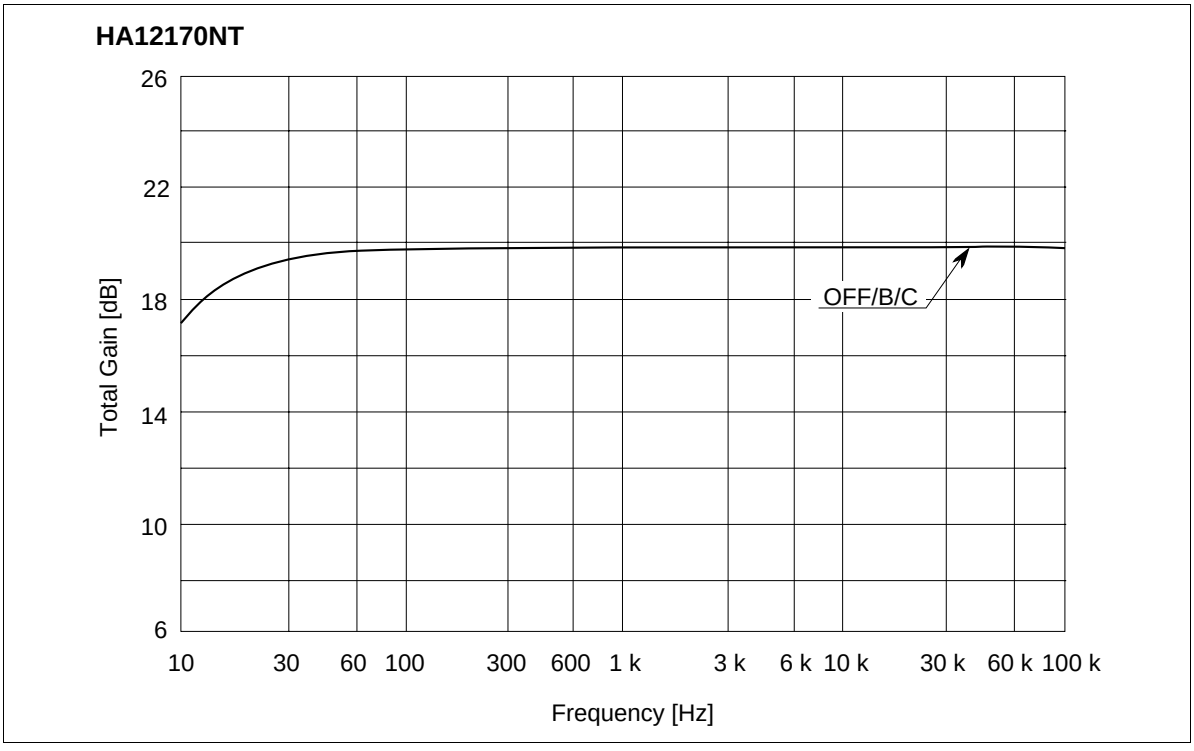
Decode Cut vs. Frequency (NR-C V_{CC} = 11 V, 14 V, 16 V)



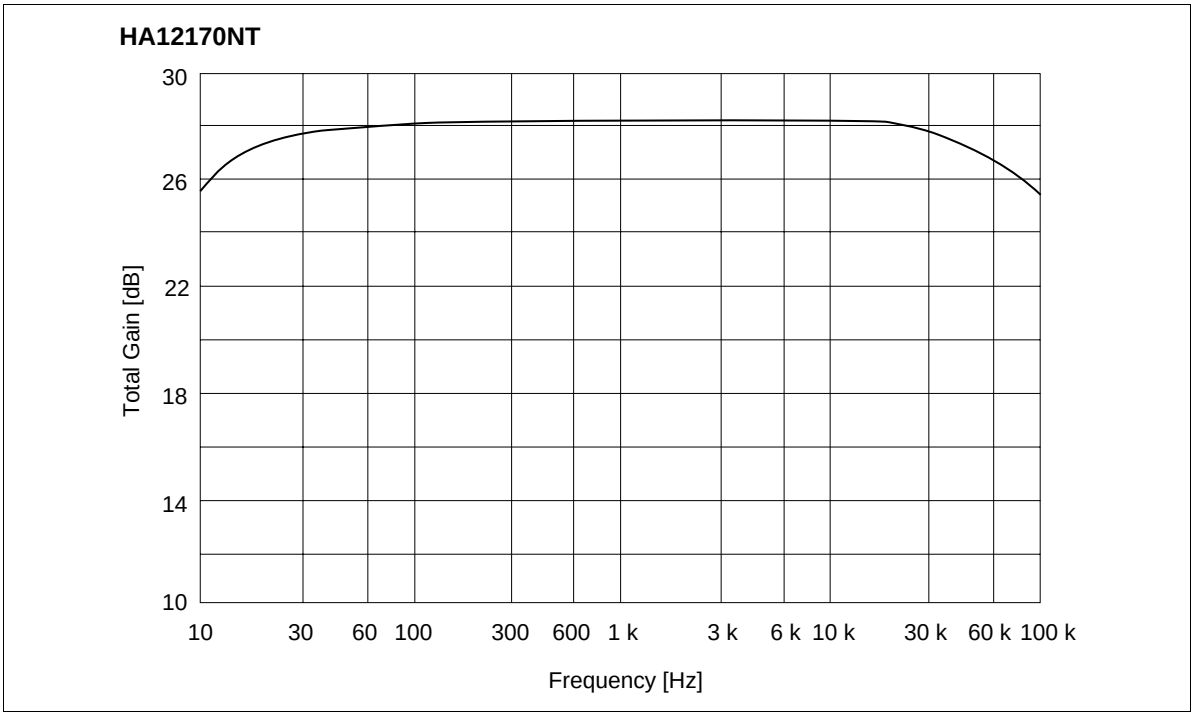
Total Gain vs. Frequency (REC MODE RECOUT NR-OFF V_{CC} = 14 V)



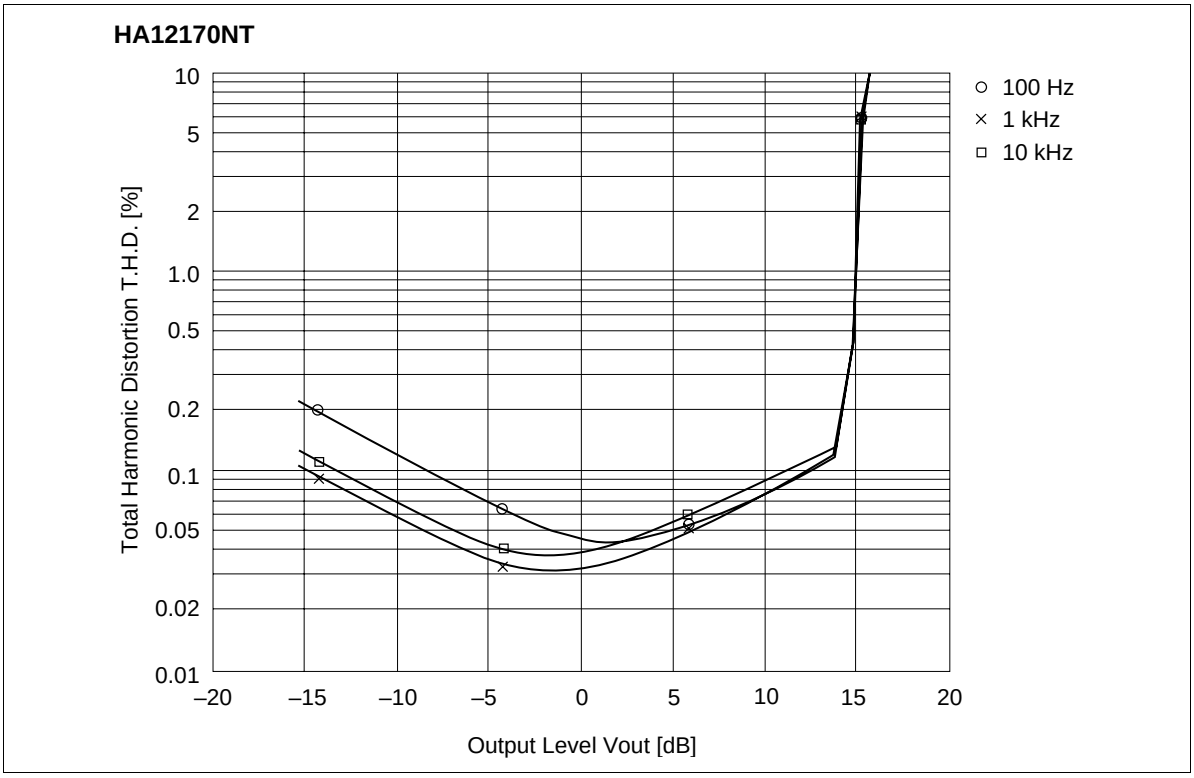
Total Gain vs. Frequency (REC MODE PBOUT V_{CC} = 14 V)



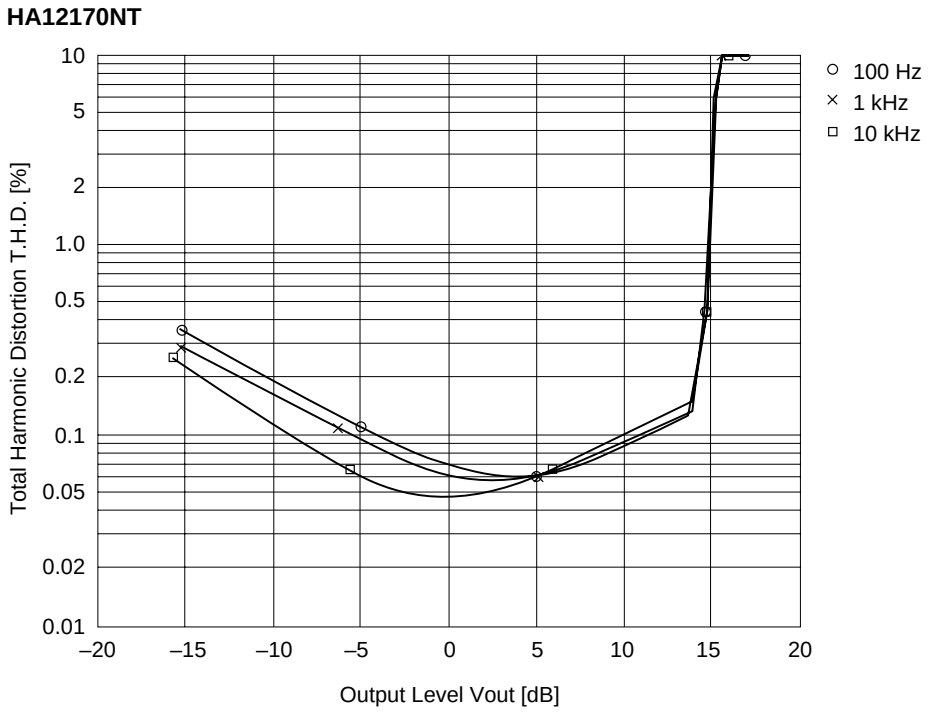
Total Gain vs. Frequency (PB MODE RECOUT V_{CC} = 14 V)



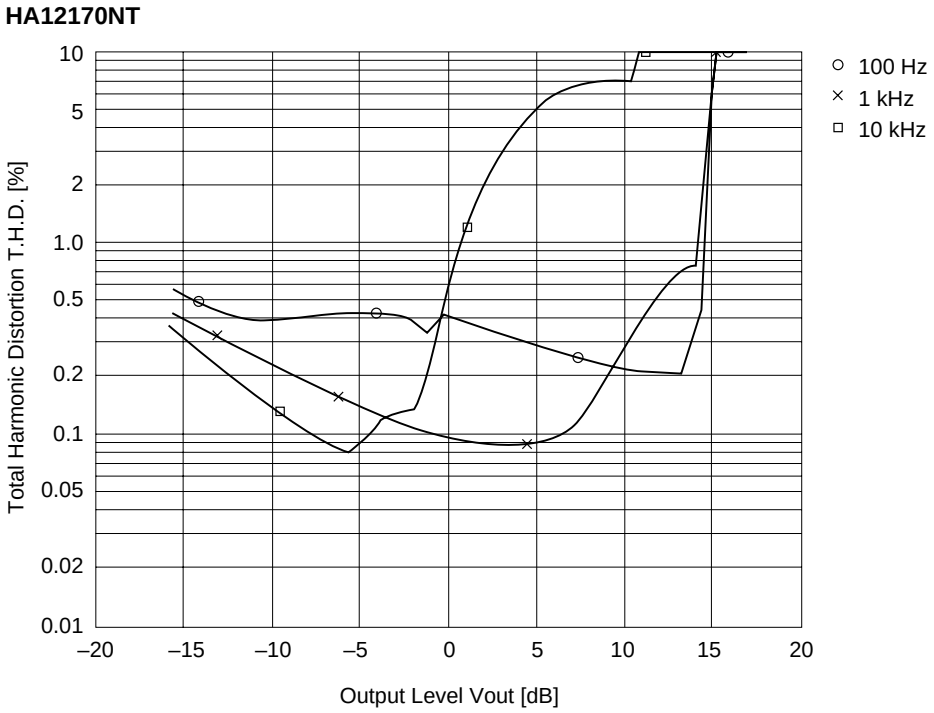
Total Gain vs. Frequency (PB MODE PBOUT NR-OFF V_{CC} = 14 V)



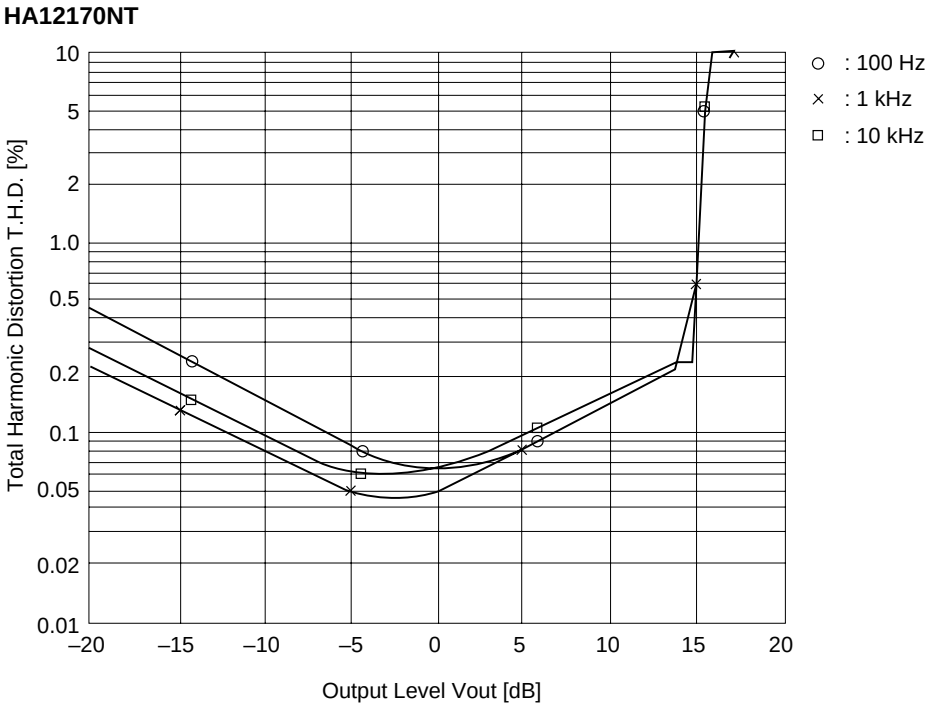
Total Harmonic Distortion vs. Output Level (REC MODE NR-OFF V_{CC} = 14 V)



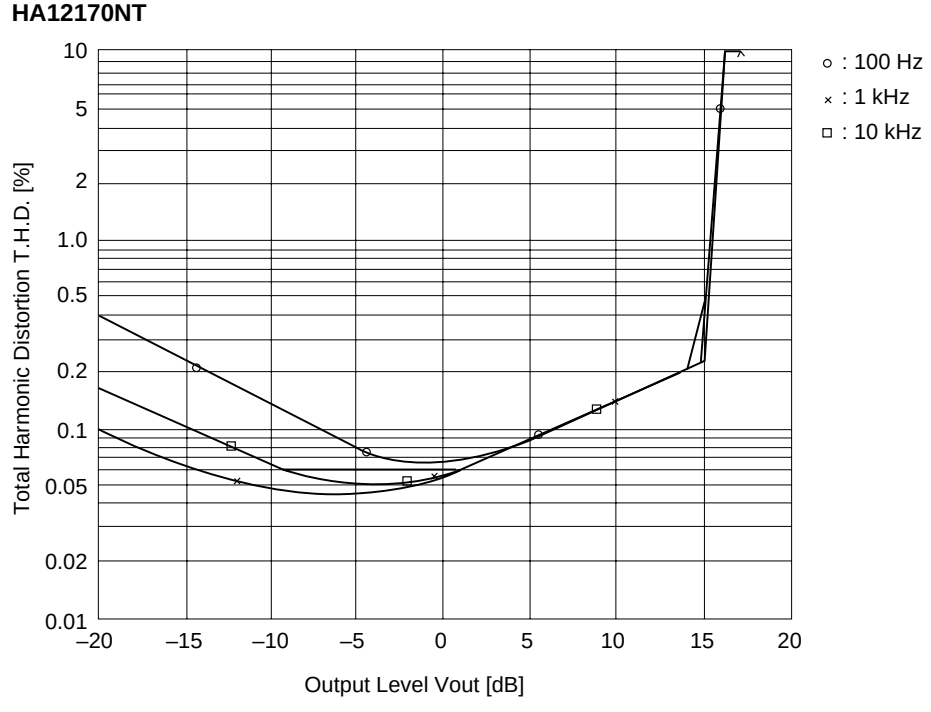
Total Harmonic Distortion vs. Output Level (REC MODE NR-B V_{CC} = 14 V)



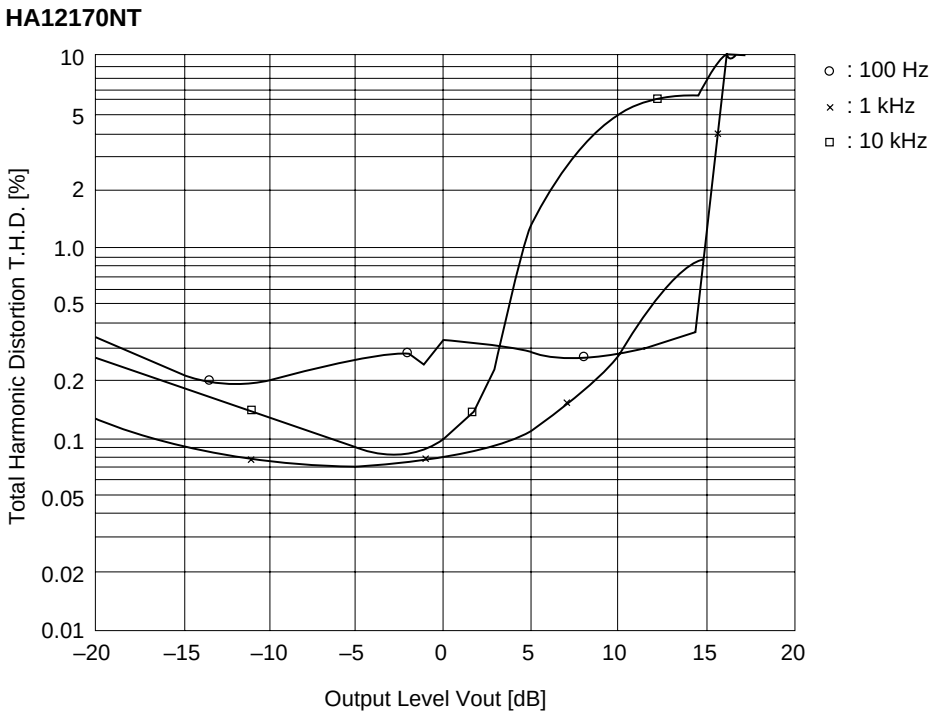
Total Harmonic Distortion vs. Output Level (REC MODE NR-C V_{CC} = 14 V)



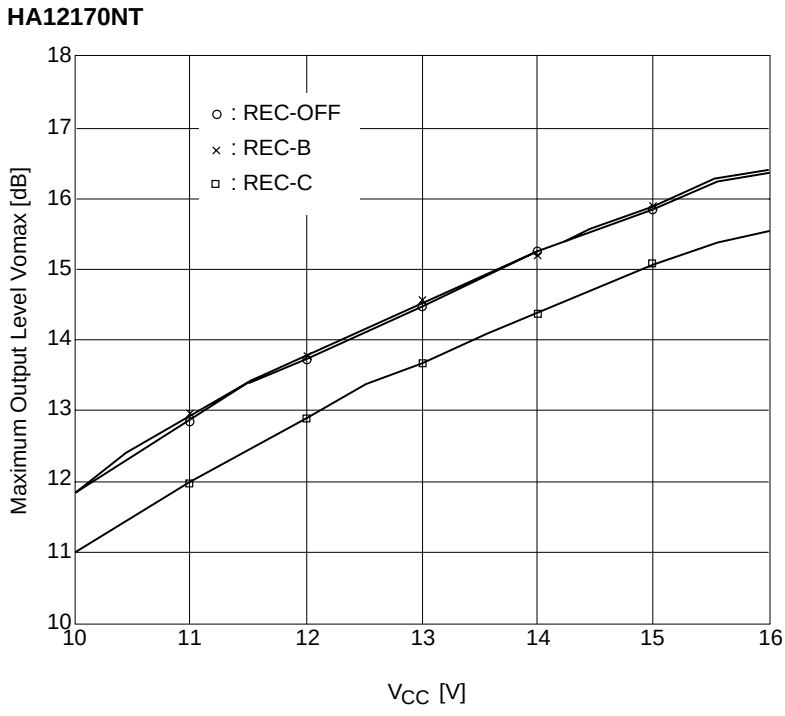
Total Harmonic Distortion vs. Output Level (PB MODE NR-OFF V_{CC} = 14 V)



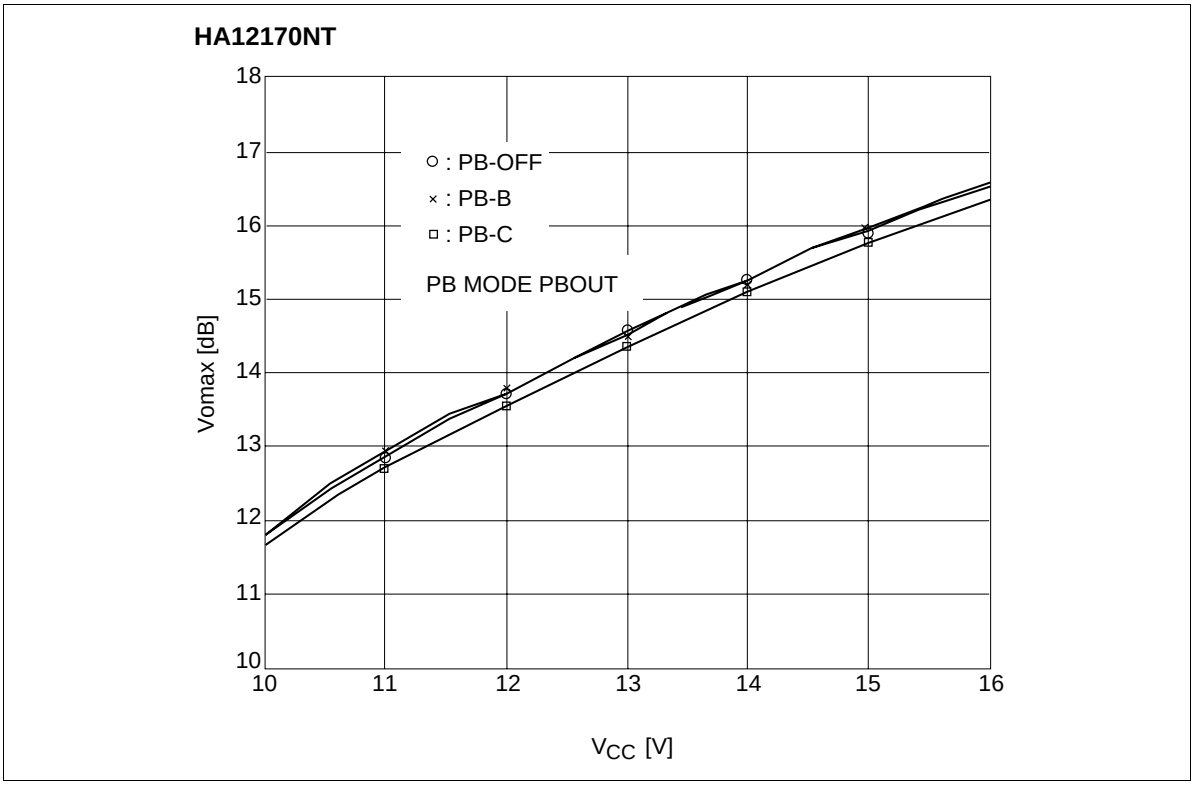
Total Harmonic Distortion vs. Output Level (PB MODE NR-B V_{CC} = 14 V)



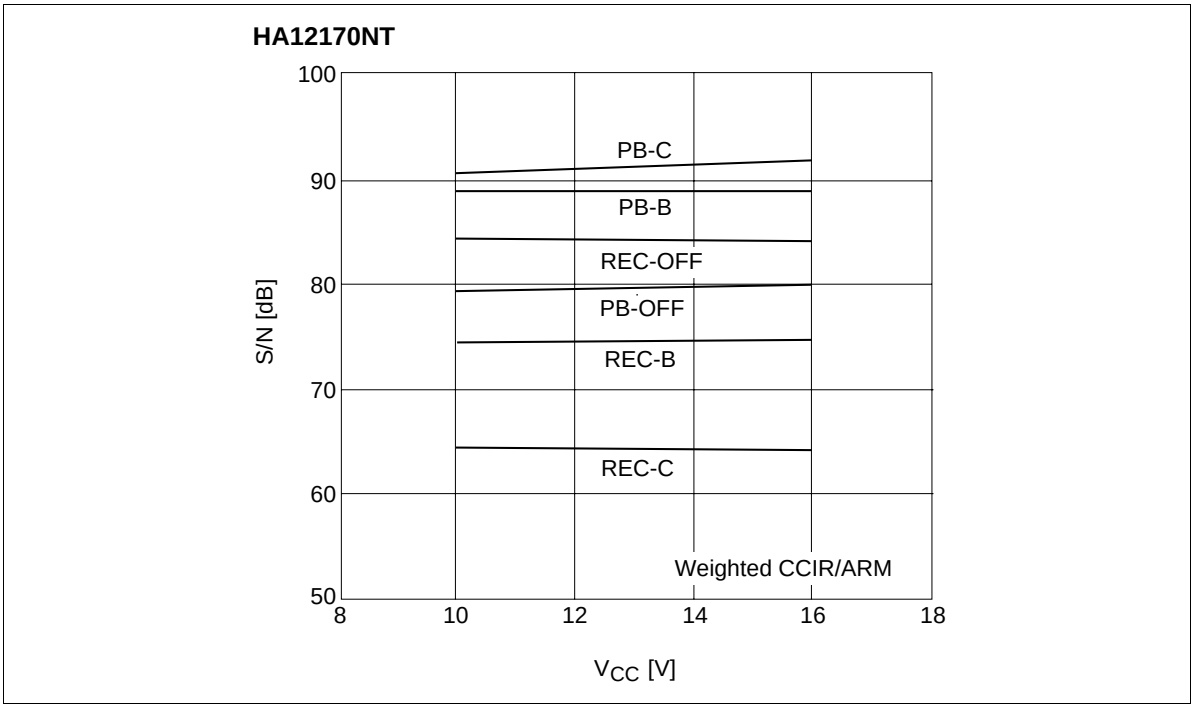
Total Harmonic Distortion vs. Output Level (PB MODE NR-C V_{CC} = 14 V)



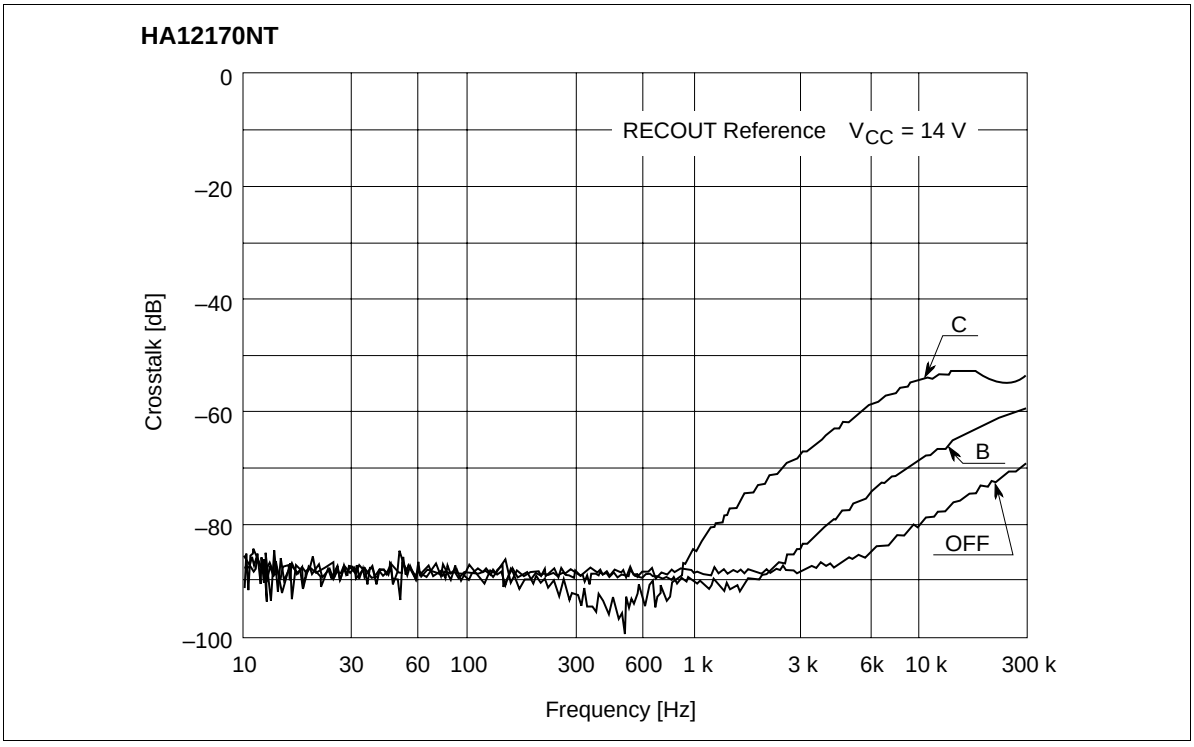
Maximum Output Level vs. Supply Voltage (REC MODE)



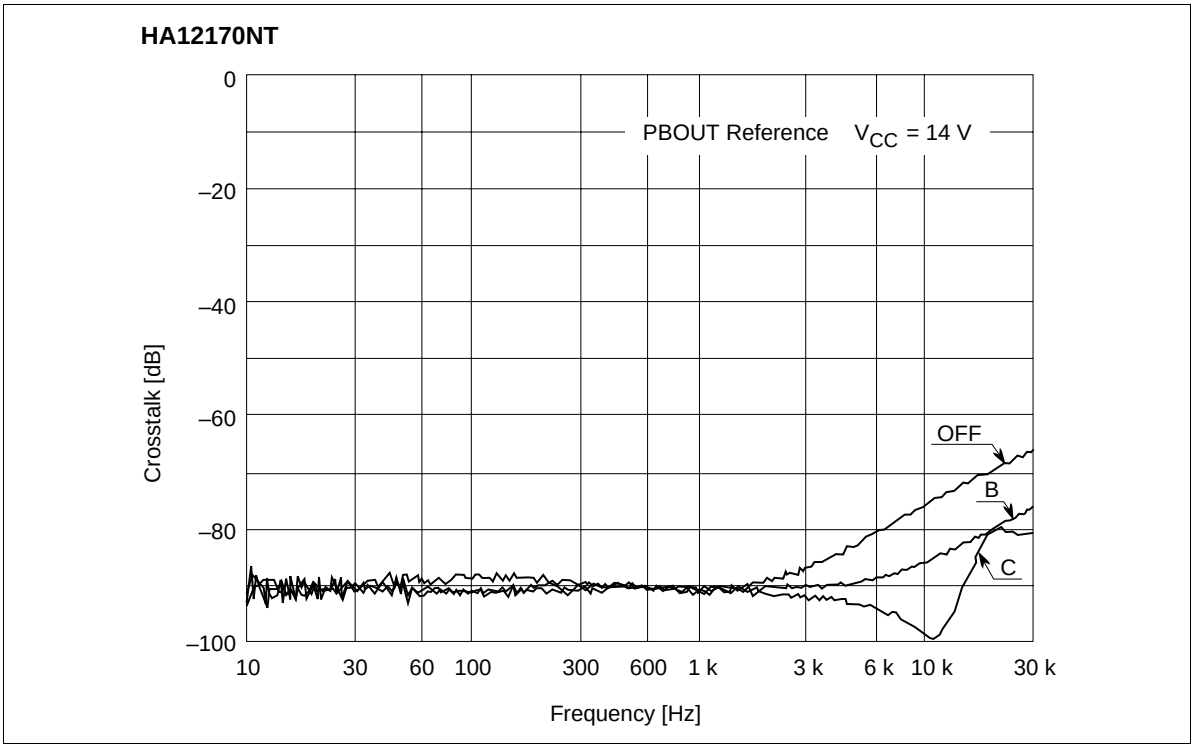
Maximum Output Level vs. Supply Voltage



S/N vs. Supply Voltage

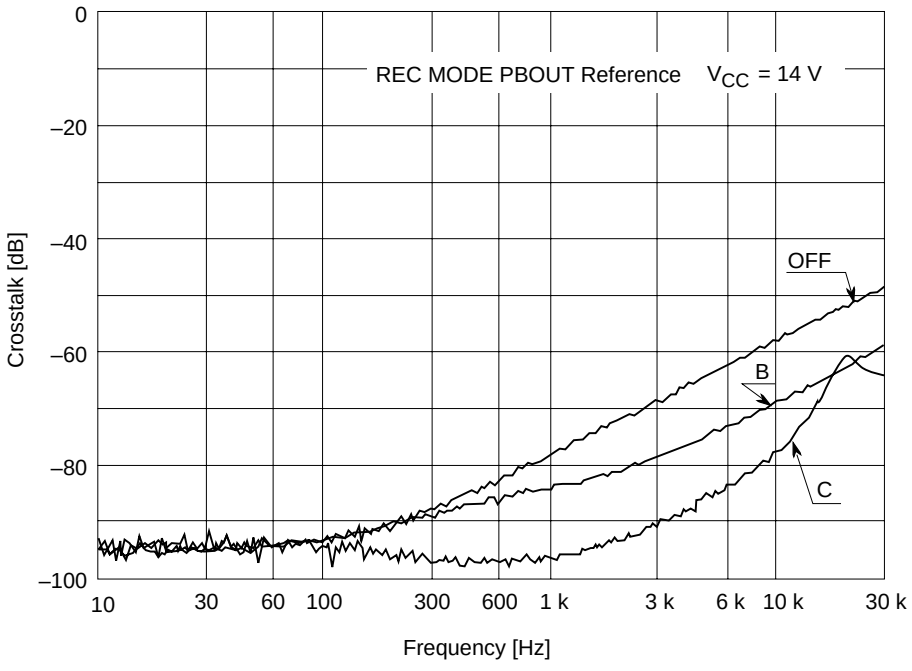


Crosstalk vs. Frequency (REC MODE R↔L)



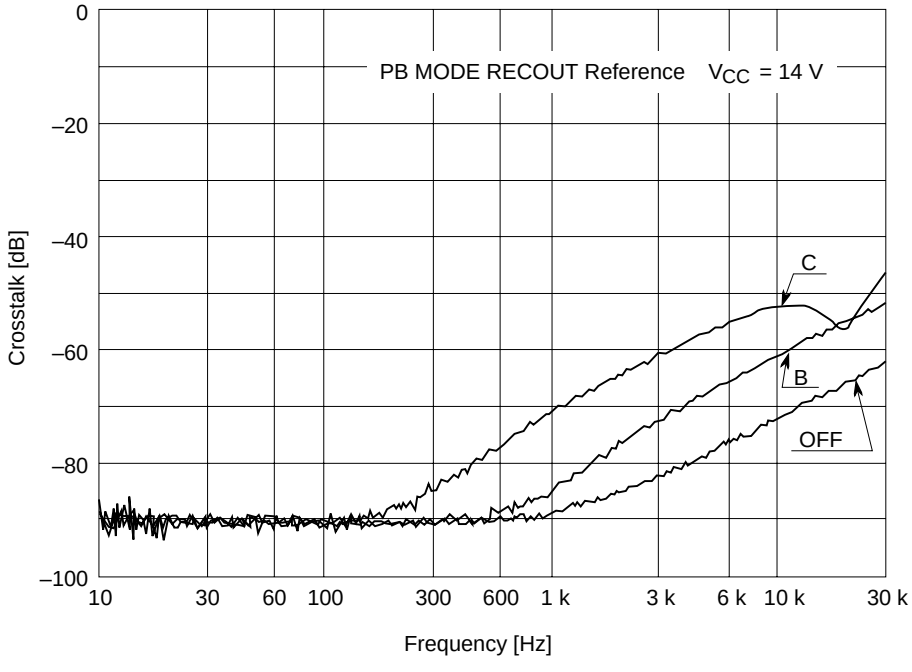
Crosstalk vs. Frequency (PB MODE R↔L)

HA12170NT



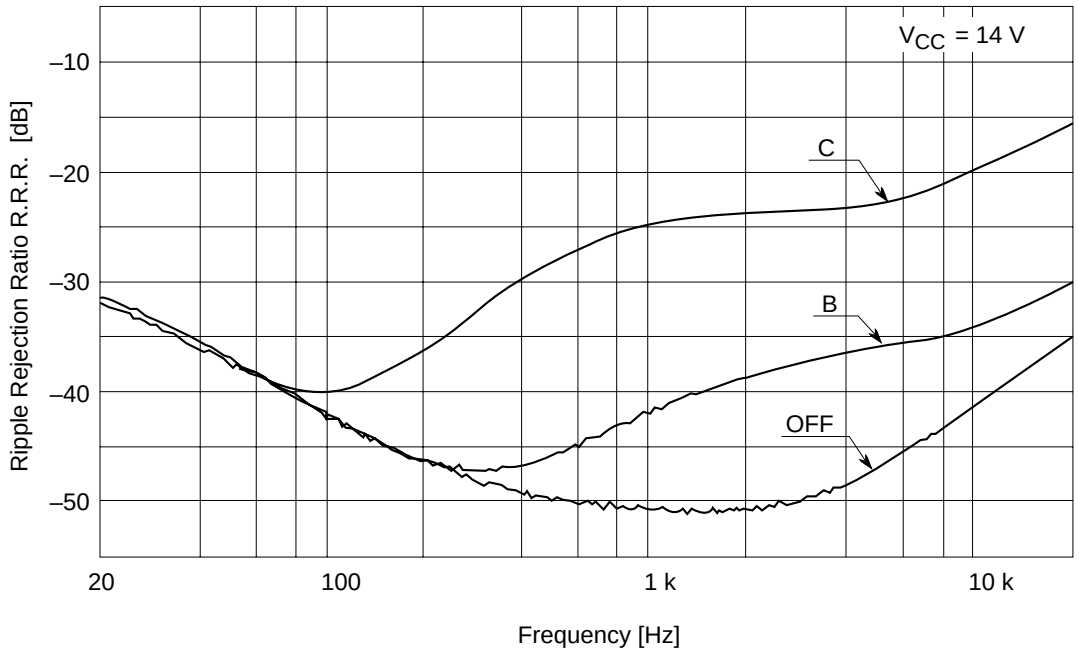
Crosstalk vs. Frequency (REC→PB)

HA12170NT



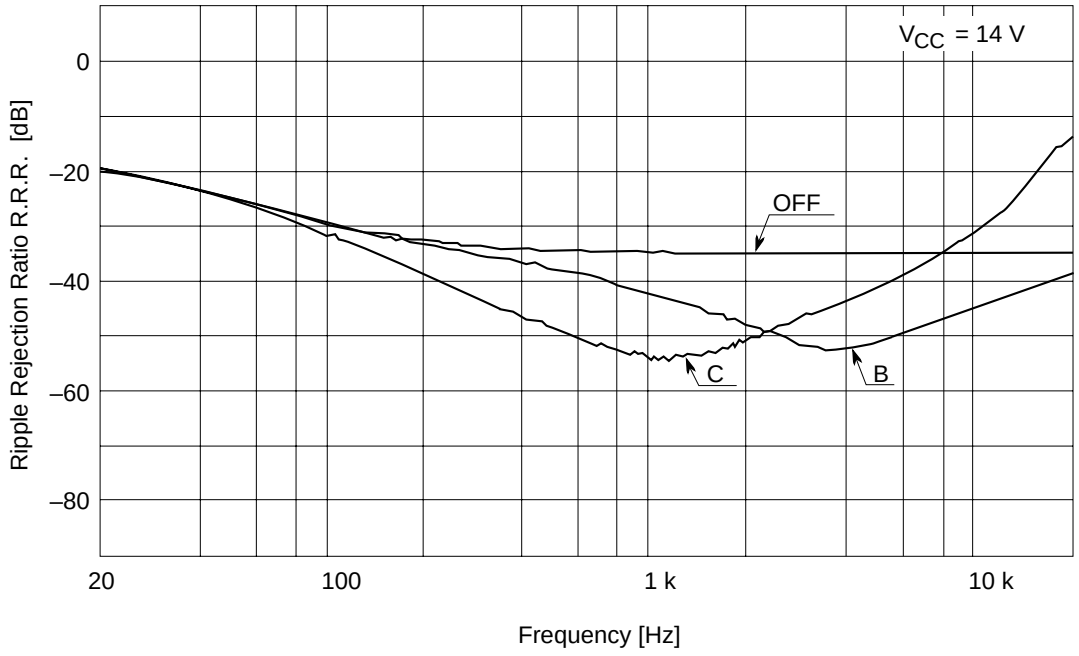
Crosstalk vs. Frequency (PB→REC)

HA12170NT



Ripple Rejection Ratio vs. Frequency (REC MODE RECOUT)

HA12170NT



Ripple Rejection Ratio vs. Frequency (PB MODE PBOUT)

Functional Description

Power Supply Range

HA12141 series are designed to operate on either single supply or split supply. The operating range of the supply voltage is shown in table 1.

Table 1 Supply Voltage

Type No.	Single supply	Split supply
HA12141NT HA1211161FP	7.5 to 16 volts	±3.8 to ±8 volts
HA12142NT HA12162FP	9.5 to 16 volts	±4.8 to ±8 volts
HA12170NT	12 to 16 volts	±6 to ±8 volts

The lower limit of supply voltage depends on the line output reference level.

The minimum value of the overload margin is specified as 12 dB by Dolby Laboratories.

HA12141 series are provided with 3 line output level, which will permit an optimum overload margin for power supply conditions.

Reference Voltage

For the single supply operation these devices generate the reference voltage of half the supply voltage that is the signal grounds. As the peculiarity of these devices the capacitor for the ripple filter is very small about 1/100 compared with conventional devices.

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

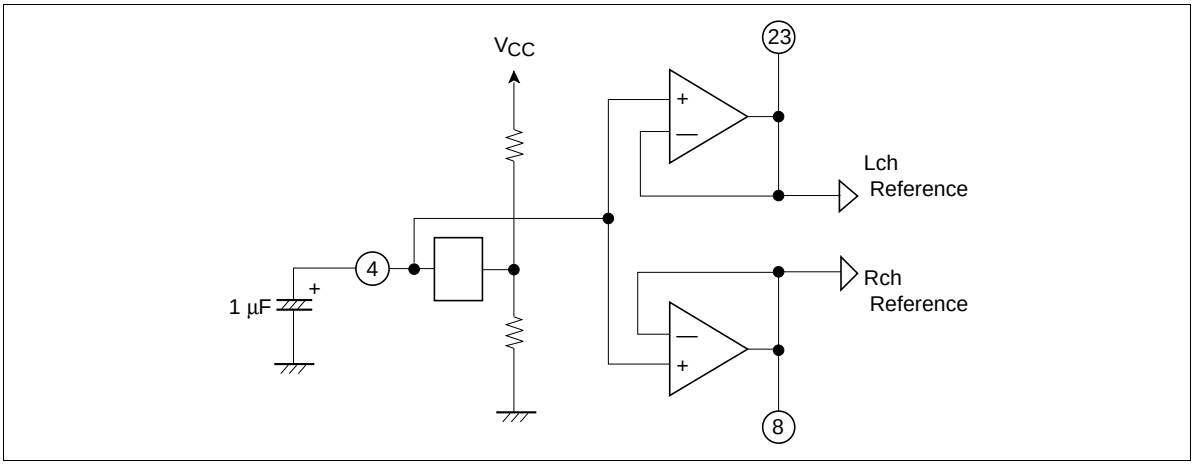


Figure 1 The Block-Diagram of Reference Voltage Supply

Operation Mode Control

HA12141 series provide fully electronic switching circuits. The function are controlled by DC voltage and are NR OFF/B/C and PB/REC/MPX.

The switching truth tables are shown in table 2 and table 3.

Table 2 Switching Truth Table (NR OFF/B/C)

Function	Single supply	Split supply	Unit	Note
NR OFF	0 to $V_{CC}/2 - 3$	V_{EE} to –3	V	
B type	$V_{CC}/2 - 0.5$ to $V_{CC}/2 + 0.5$	–0.5 to 0.5	V	*1
C type	$V_{CC}/2 + 3$ to V_{CC}	3 to V_{CC}	V	

Note: 1. These functions are available for being open at NR B mode and REC mode

Table 3 Switching Truth Table (PB/REC/MPX)

Function	Single supply	Split supply	Unit	Note
Play back (Decode mode)	0 to 0.4	V_{EE} to $V_{EE} + 0.4$	V	
Record (Encode mode)	2.5 to $V_{CC}/2 + 0.5$	$V_{EE} + 2.5$ to 0.5	V	*1
MPX-OFF	$V_{CC} - 1$ to V_{CC}	$V_{CC} - 1$ to V_{CC}	V	*2

Notes: 1. These functions are available for being open at NR B mode and REC mode.
2. MPX-OFF mode control Voltage of HA12170NT is available with range from $V_{CC} - 2$ to V_{CC}.

MPX-off mode means that signal from input amp doesn't go through the MPX filter, but signal goes through the SS circuit after being attenuated 3 dB by internal resistor. Refer to figure 2.

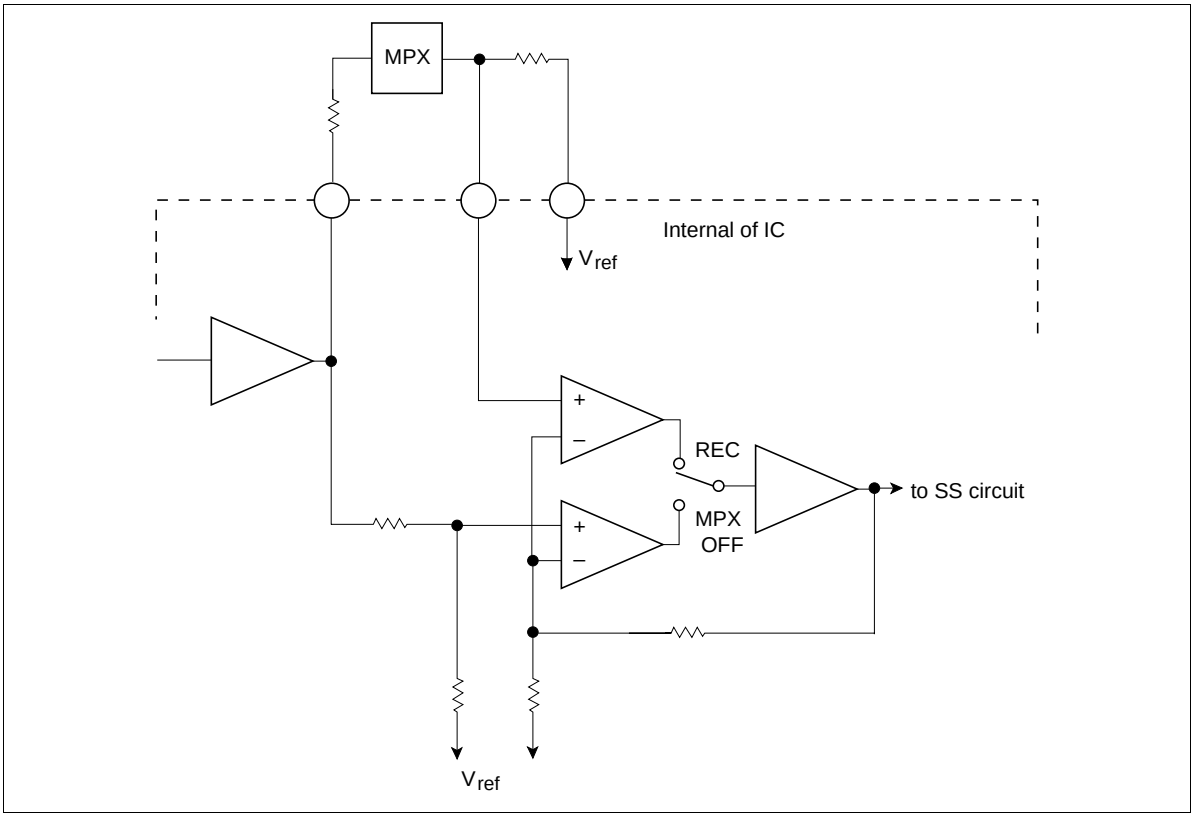


Figure 2 The Block-Diagram of MPX Driving Circuit

It is to be desired that CR time constant circuits are provided at NR OFF/B/C terminal and PB/REC/MPX terminal with time constant from 0.1 sec to 1 sec. If so, it will reduce the switching click noise effectively.

Application Circuits

1. HA12161FP/62FP application

   HA12161FP/62FP are developed for exclusive playback of car stereo players.

   But these devices are provided with AUX input. This application providing AUX input is available for car stereo players and car stereo cassette decks.

   AUX input will be useful for a tuner input. In this case PB/REC/MPX switching operates as the switching of PB/AUX1/AUX2.

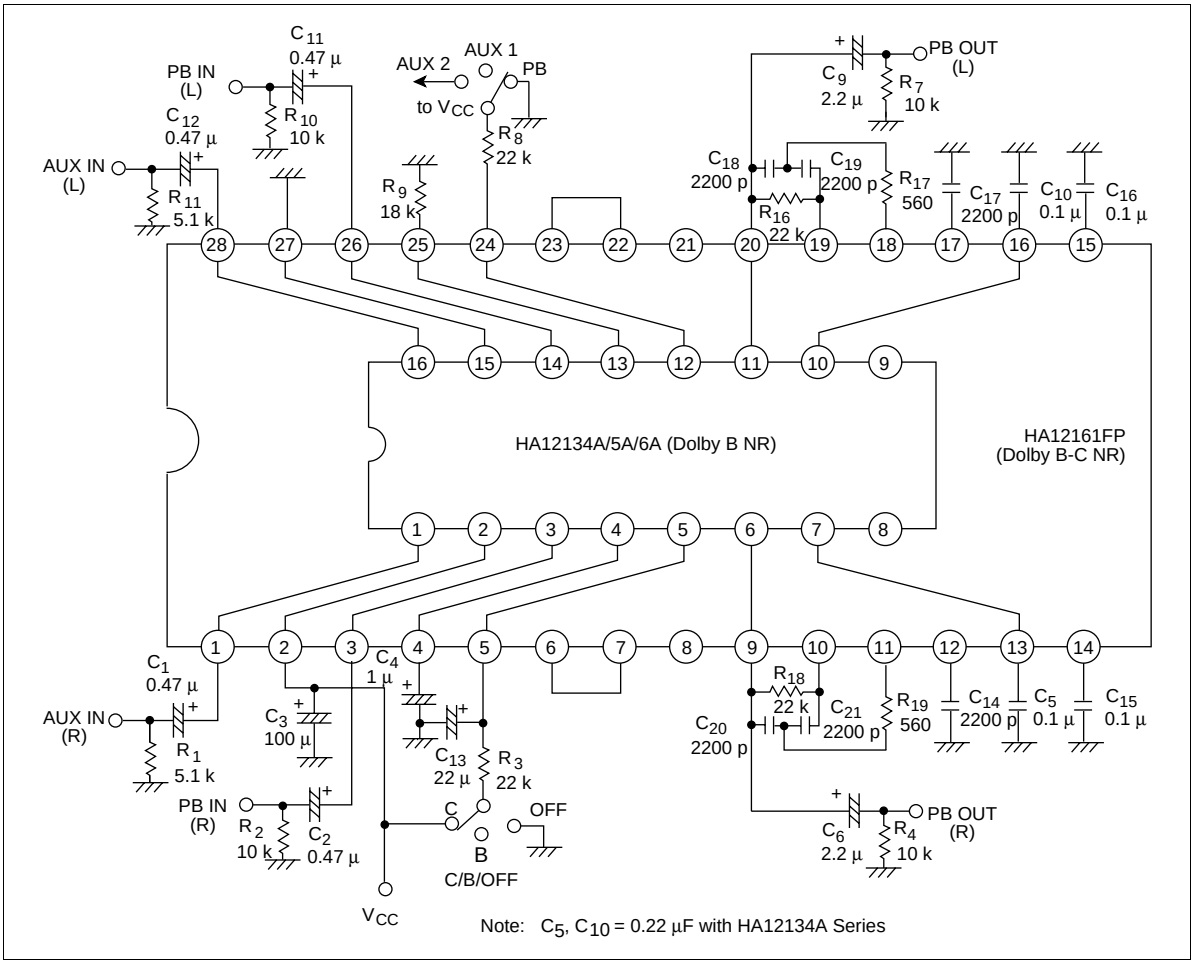


Figure 3 Application of HA12161FP/162FP

We show such application in figure 3. In this application there is 3dB difference between mode AUX1 and mode AUX2 of controlled terminal's pin 24.

Another application is show in figure 4. It is put in filter circuit between pin 6 or 23 and pin 7 or 22.

For example AUX1 mode is AM tuner input and AUX2 mode is FM tuner input respectivily.

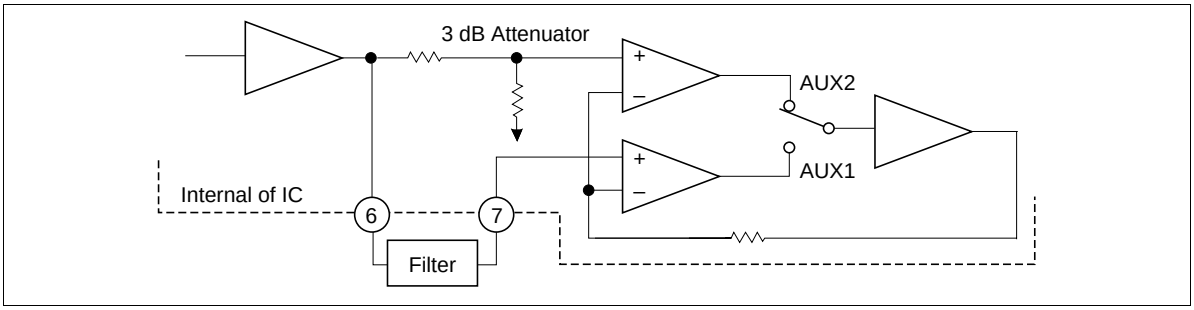


Figure 4 Application of AUX Mode

2. Application for dubbing cassette decks.
   HA12141 series has unprocessor signal from recording out terminals during playback mode.
   So, it is simply applied for dubbing cassette decks.

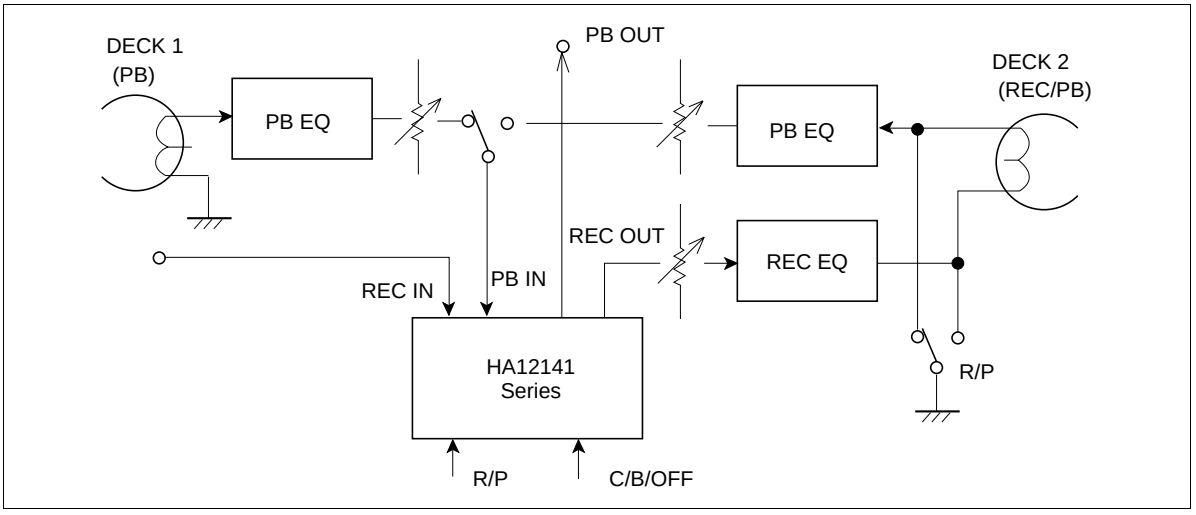
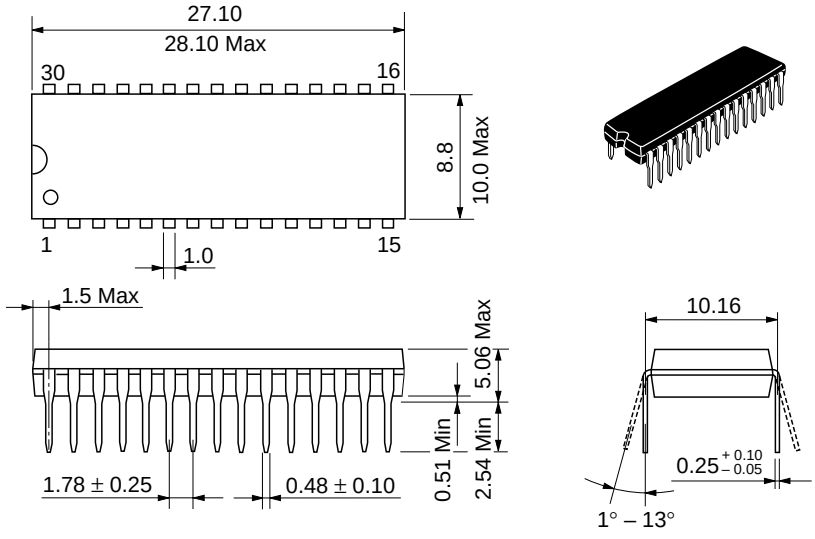


Figure 5 Application for Dubbing Deck

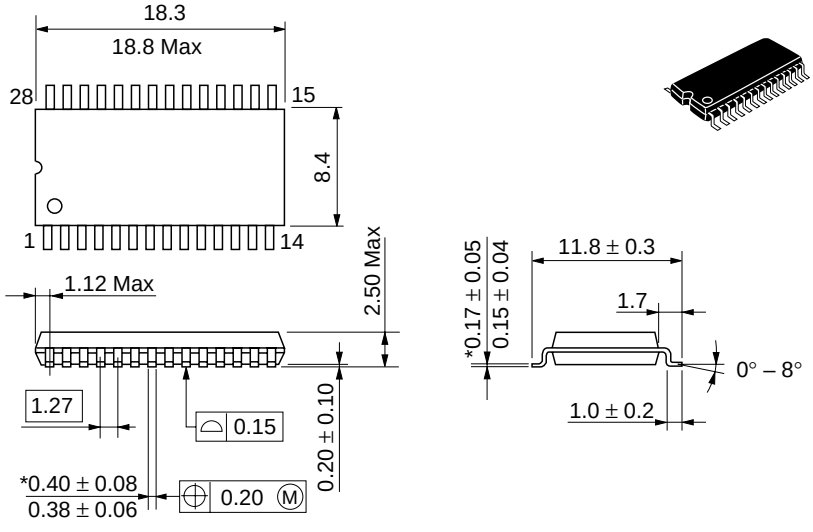
Package Dimensions

Unit: mm



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

Unit: mm



Hitachi Code	FP-28D
JEDEC	Conforms
EIAJ	—
Weight (reference value)	0.7 g

*Dimension including the plating thickness
Base material dimension

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Hitachi, Ltd.
Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL
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For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straβe 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building. No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX