HA12192F/HA12197F/HA12212F Series

Audio Signal Processor for Car Deck
(Decode only Dolby B-type NR with PB Amp.)

HITACHI

ADE-207-167D (Z)

5th Edition
Jun. 1999

Description

HA12192F/HA12197F/HA12212F series are silicon monolithic bipolar ICs providing Dolby noise reduction system*, music sensor, PB equalizer system in one chip.

Functions

- PB equalizer × 2 channel
- Music sensor × 1 channel
- Decode only Dolby B-NR × 2 channel

Note: HA12197F series is not built in Dolby B-NR.

Features

- Different type of PB equalizer characteristics selection (120μ / 70μ position) is available with fully electronic control switching built-in.
- Changeable to Forward, Reverse-mode for PB head with fully electronic control switching built-in.
- Available to change music sensing level by external resistor.
- Available to change frequency response of music sensor by external capacitor.
- NR ON/OFF fully electronic control switching built-in. (HA12192F/HA12212F series only)
- Available to connect direct with MPU.
- HA12192F series, HA12197F series and HA12212F available to allow common PCB designs.
- HA12212F only changes by package from HA12192F series. It is the same electrical characteristics that HA12192F series.

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

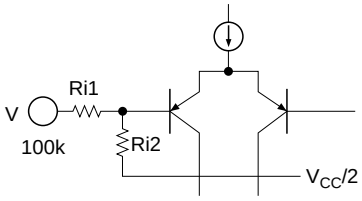
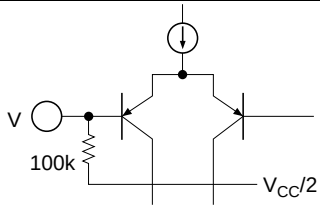
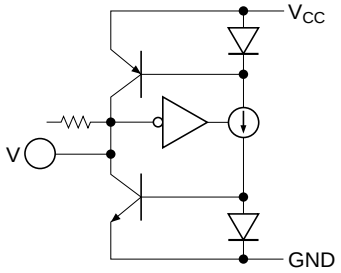
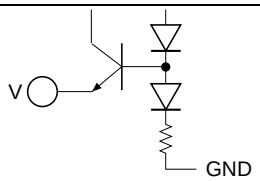
Hitachi semiconductor

Ordering Information

			Function			Operating Voltage	
Product	**Package**	**PB-OUT Level**	**PB-EQ**	**Dolby B-NR**	**MS**	**Min**	**Max**
HA12192F	FP-28TB	300mVrms	○	○	○	6.5V	15V
HA12197F			○	×	○		
HA12193F		387.5mVrms	○	○	○	6.8V	
HA12198F			○	×	○		
HA12194F		450mVrms	○	○	○	7.2V	
HA12199F			○	×	○		
HA12212F	FP-40B	300mVrms	○	○	○	6.5V	

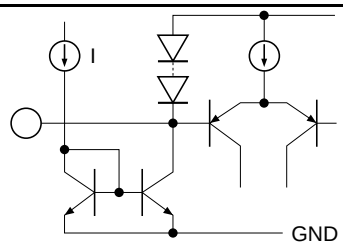
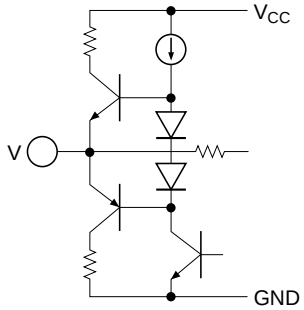
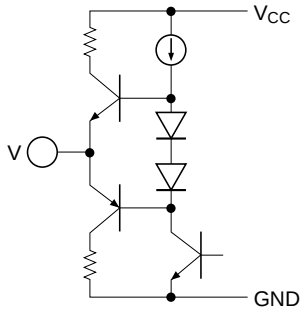
Note: These ICs are designed to operate on single supply.

Pin Description and Equivalent Circuit (V_{CC} = 9V, single supply, Ta = 25°C, No signal, The value in the table show typical value.)

Pin No.					
FP-28TB	**FP-40B**	**Pin Name**	**Note**	**Equivalent Circuit**	**Description**
13	19	MSI	V = V_{cc} / 2		MS input *1 Ri1 / Ri2 HA12192/3/4, HA12212F, HA12197: 0 / 100k HA12198: 22.6k / 77.4k HA12199: 33.3k / 66.7k
18	28	DIN (L)	V = V_{cc} / 2		Deck input
3	3	DIN (R)			
16 *2	22	DET (L)	V = 2.5V		Time constant pin for rectifier
5 *2	9	DET (R)			
23	33	RIP	V = V_{cc} / 2		Ripple filter
6 *2	10	BIAS	V = 0.28V		Dolby bias current input

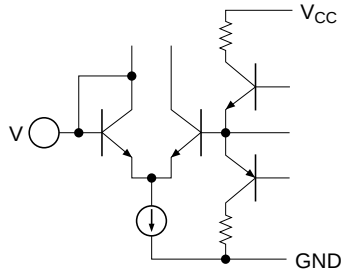
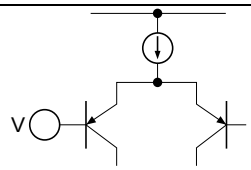
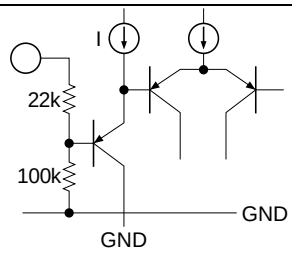
Note: 1. MS : Music Sensor
2. Non connection regarding HA12197F series.

Pin Description and Equivalent Circuit (V_{CC} = 9V, single supply, Ta = 25°C, No signal, The value in the table show typical value.) (cont)

Pin No.					
FP-28TB	**FP-40B**	**Pin Name**	**Note**	**Equivalent Circuit**	**Description**
12	18	MSDET	I = 0µA		Time constant pin for rectifier
17	23	PBOUT (L)	V = V_{cc} / 2		PB output
4	8	PBOUT (R)			
14	20	MAOUT	V = V_{cc} / 2		MS amp. output *1
26	38	VREF			Reference output
19	29	EQOUT (L)			Equalizer output
2	2	EQOUT (R)			(120µ)

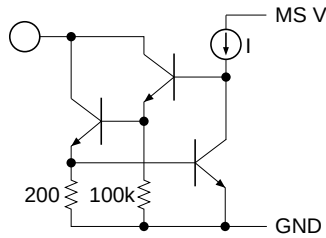
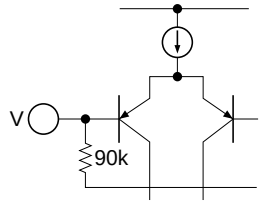
Note: 1. MS : Music Sensor

Pin Description and Equivalent Circuit (V_{CC} = 9V, single supply, Ta = 25°C, No signal, The value in the table show typical value.) (cont)

Pin No.					
FP-28TB	**FP-40B**	**Pin Name**	**Note**	**Equivalent Circuit**	**Description**
20	30	M-OUT (L)	V = V_{cc} / 2		Equalizer output (70µ)
1	1	M-OUT (R)			
11	17	V_{cc}	V = V_{cc}		Power supply
—	35, 36	TAB	V = 0V		GND pin
—	4,5,6,7, 15,16,24, 25,26,27	—	—		NC pin
24	34	FIN (L)	V = V_{cc} / 2		Equalizer input (FORWARD)
25	37	FIN (R)			
22	32	RIN (L)			Equalizer input
27	39	RIN (R)			(REVERSE)
21	31	NFI (L)			Negative feedback
28	40	NFI (R)			
7 *[1]	11	NR OFF / ON	I = 20µA		Mode control input
8	12	120 / 70			
9	13	F / R			

Note: 1. Non connection regarding HA12197F series.

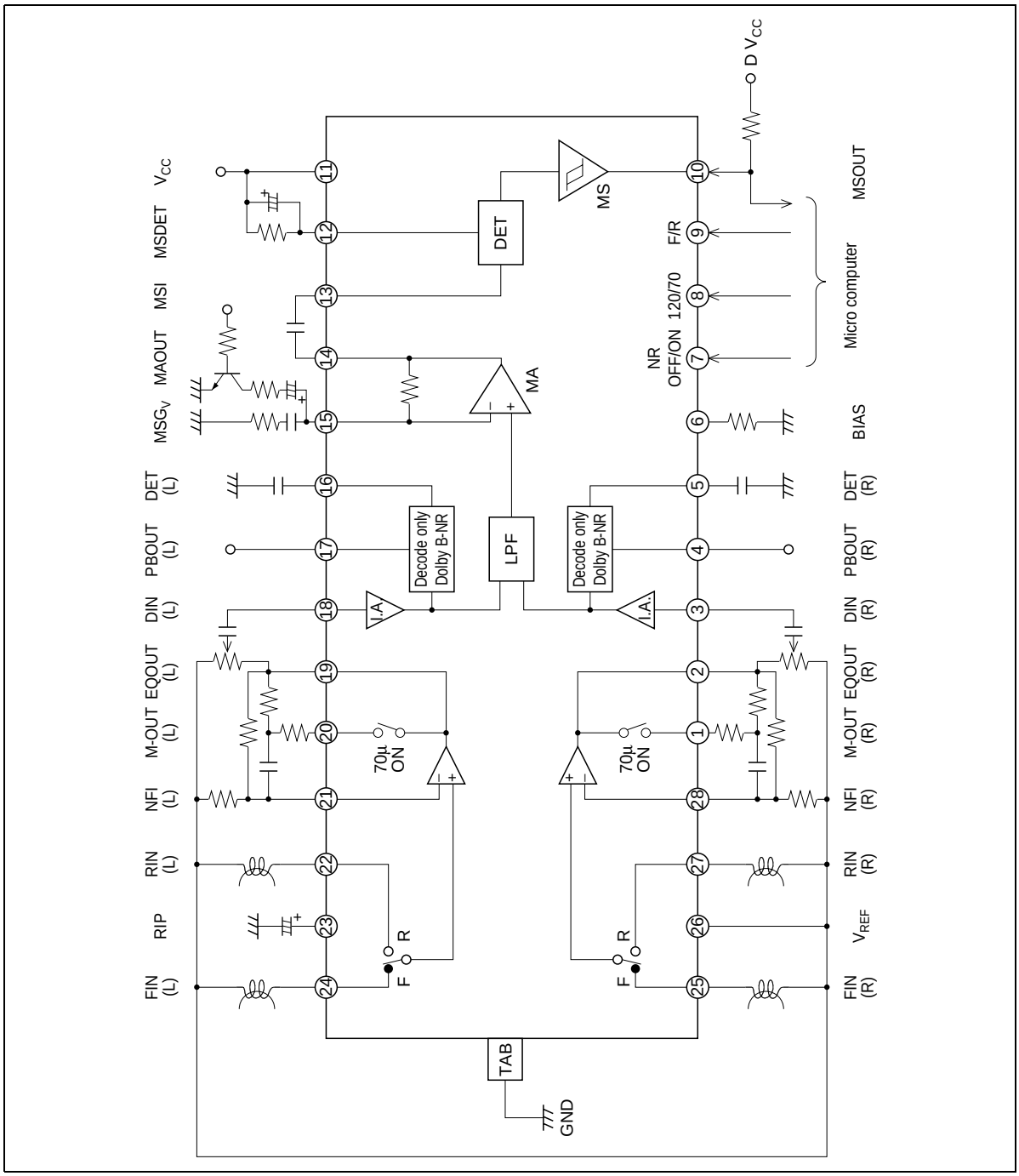
Pin Description and Equivalent Circuit (V_{CC} = 9V, single supply, Ta = 25°C, No signal, The value in the table show typical value.) (cont)

Pin No.					
FP-28TB	**FP-40B**	**Pin Name**	**Note**	**Equivalent Circuit**	**Description**
10	14	MSOUT	I = 0µA		MS output (to MPU) *1
15	21	MSG_V	$V = V_{CC} / 2$		MS gain terminal *1

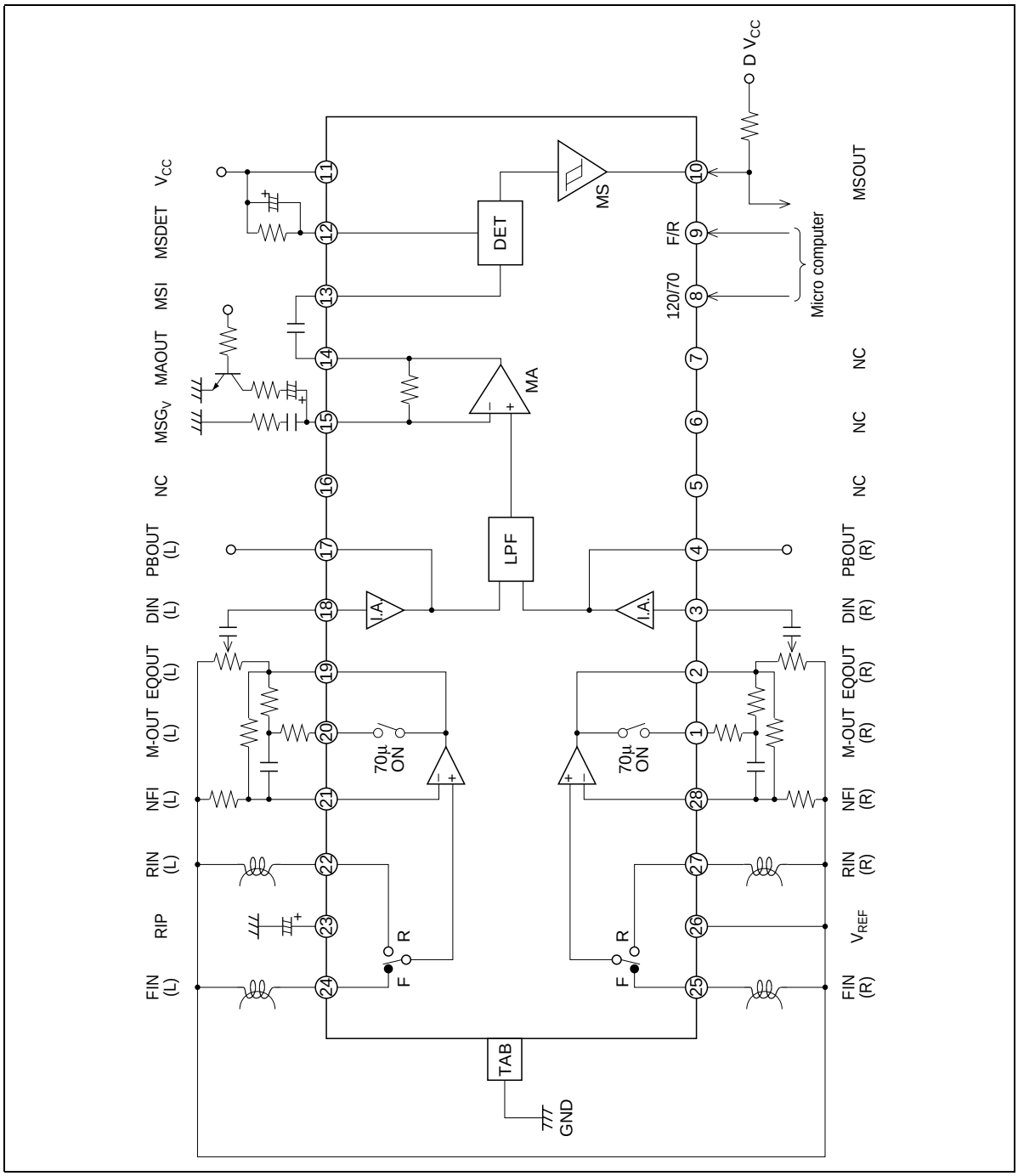
Note: 1. MS : Music Sensor

Block Diagram

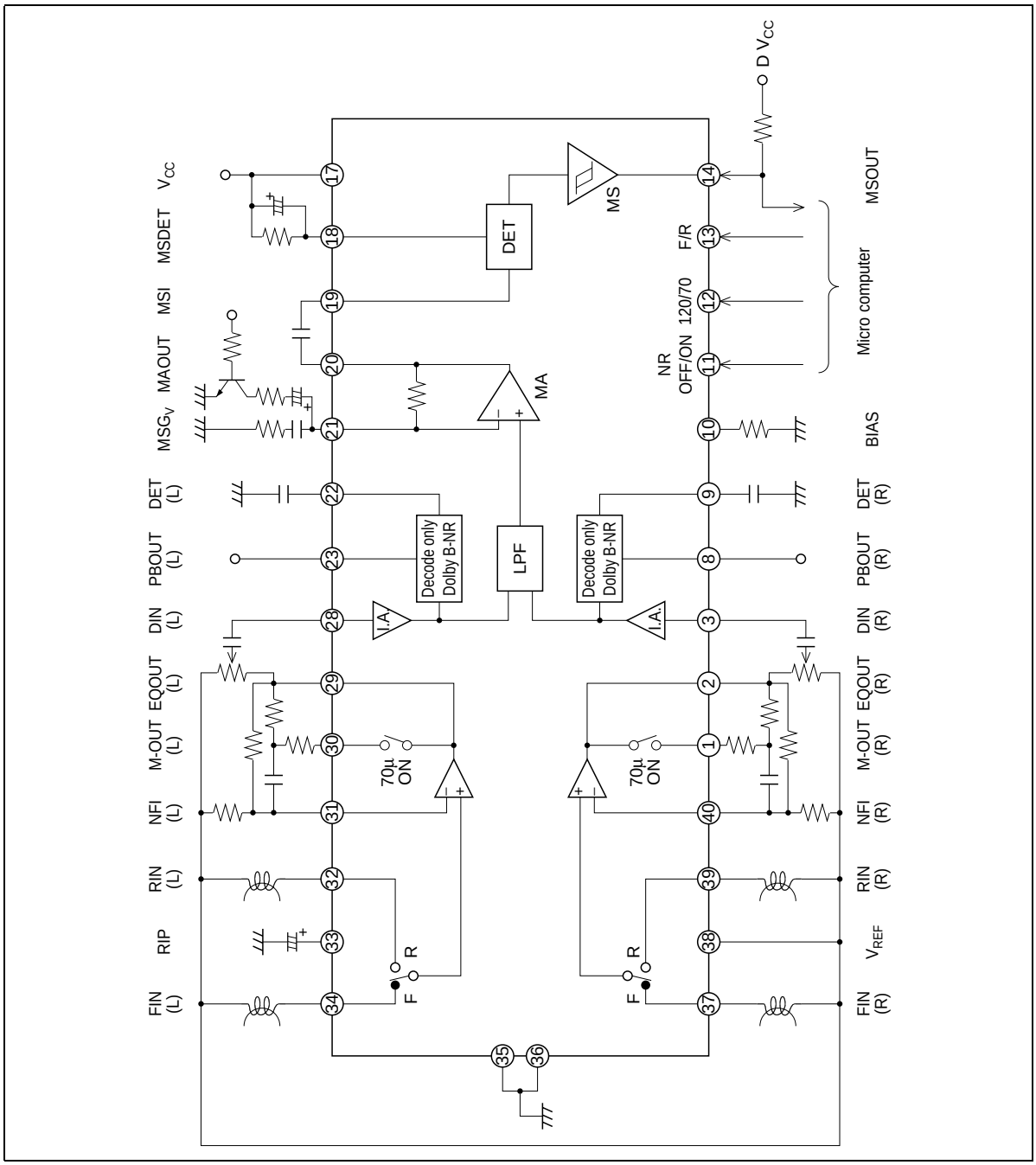
HA12192F Series



HA12197F Series



HA12212F


D VCC
VCC
MSDET
MSI
MAOUT
MSGV
DET (L)
PBOUT (L)
DIN (L)
EQOUT (L)
M-OUT (L)
NFI (L)
RIN (L)
RIP
FIN (L)
MS
DET
MA
LPF
Decode only Dolby B-NR
Decode only Dolby B-NR
I.A.
I.A.
70µ ON
70µ ON
R
F
R
F
NR
OFF/ON
120/70
F/R
MSOUT
Micro computer
BIAS
DET (R)
PBOUT (R)
DIN (R)
EQOUT (R)
M-OUT (R)
NFI (R)
RIN (R)
VREF
FIN (R)

Functional Description

Power Supply Range

HA12192F series and HA12197F series are provided with three line output level, which will permit on optimum overload margin for power supply conditions. And these series are designed to operate on single supply only.

Table 1 Spply Voltage Range

Product	Single Supply
HA12192F, HA12197F	6.5V to 15.0V
HA12193F, HA12198F	6.8V to 15.0V
HA12194F, HA12199F	7.2V to 15.0V

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

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

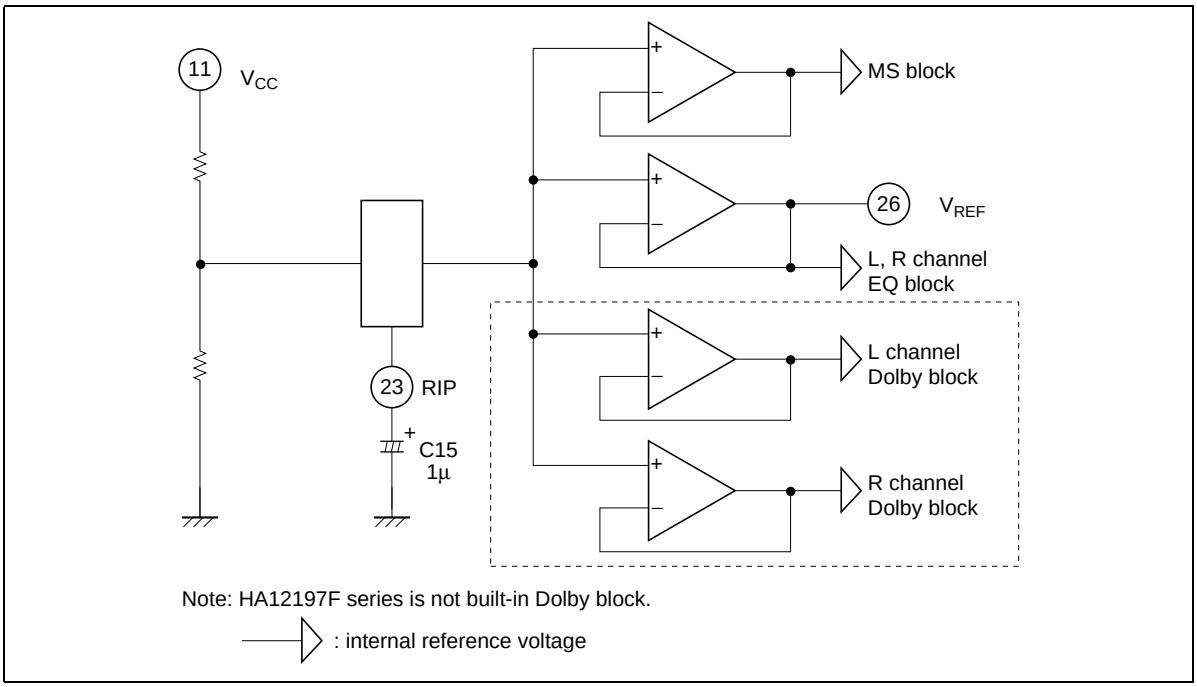


Figure 1 The Block Diagram of Reference Supply Voltage

Operating Mode Control

HA12192F series and HA12197F series provides fully electronic switching circuits. And each operating mode control are controlled by parallel data (DC voltage).

Table 2 Threshold Voltage (V_{TH})

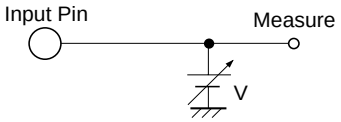
Pin No.	Lo	Hi	Unit	Test Condition
7*[1], 8, 9	–0.2 to 1.0	3.5 to 5.3	V	

Table 3 Switching Truth Table

Pin No.	Lo	Hi
7*[1]	NR-OFF	NR-ON
8	120µ (NORMAL)	70µ (MATAL or CHROME)
9	FORWARD	REVERSE

*1. Non connection regarding HA12197F series.

Note: 1. Each pins are on pulled down with 100kΩ internal resistor. Therefore, it will be low-level when each pins are open.
2. Over shoot level and under shoot level of input signal must be the standardized. (High: 5.3V, Low: –0.2V)
3. Reducing pop noise is so much better for 10kΩ to 22kΩ resistor and 1µF to 22µF capacitor shown figure 2.

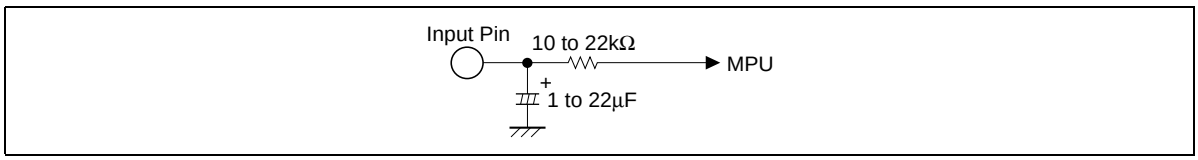


Figure 2 Interface for Reduction of Pop Noise

Input Block Diagram and Level Diagram

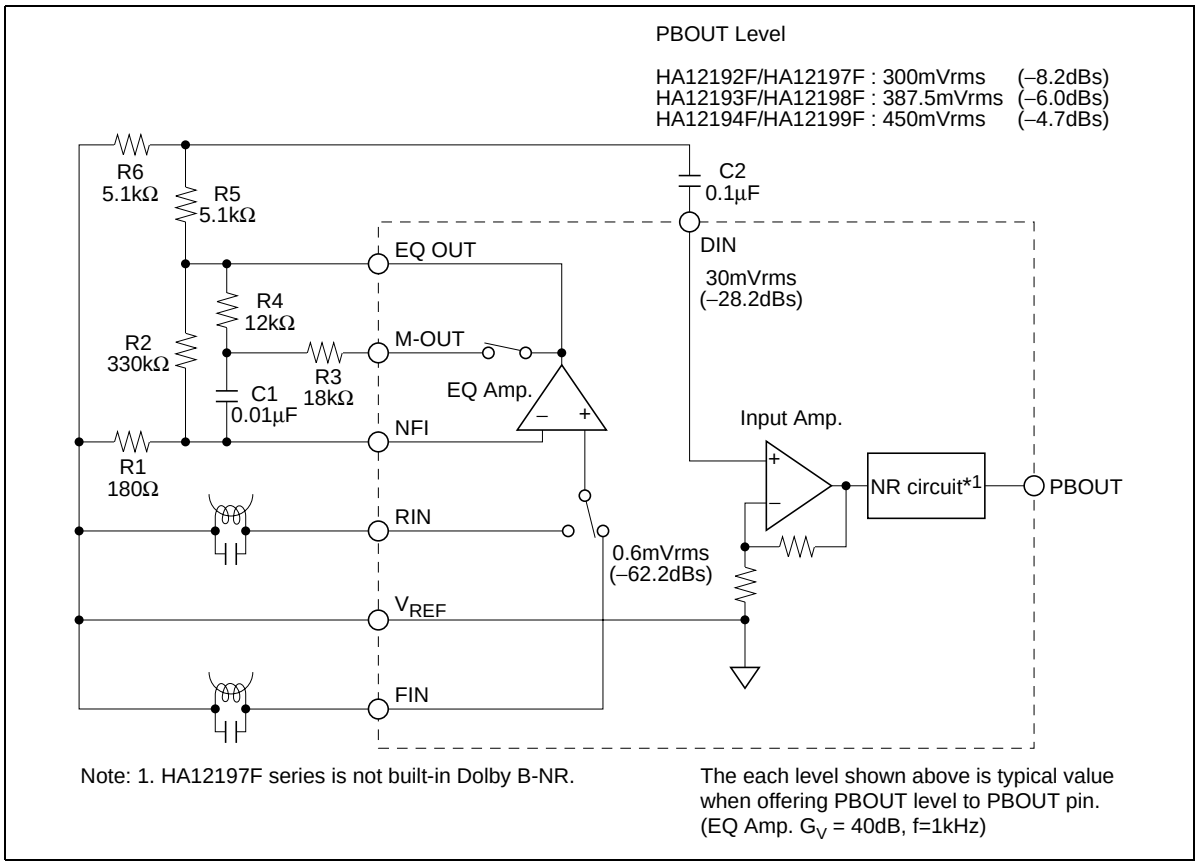


Figure 3 Input Block Diagram

Adjustment of Playback Dolby Level

After replace R5 and R6 with a half-fix volume of 10kΩ, adjust playback Dolby level.

The Sensitivity Adjustment of Music Sensor

Adjusting MS Amp. gain by external resistor, the sensitivity of music sensor can set up.
The music sensor block diagram is shown in figure 4, and frequency response is shown in figure 5.

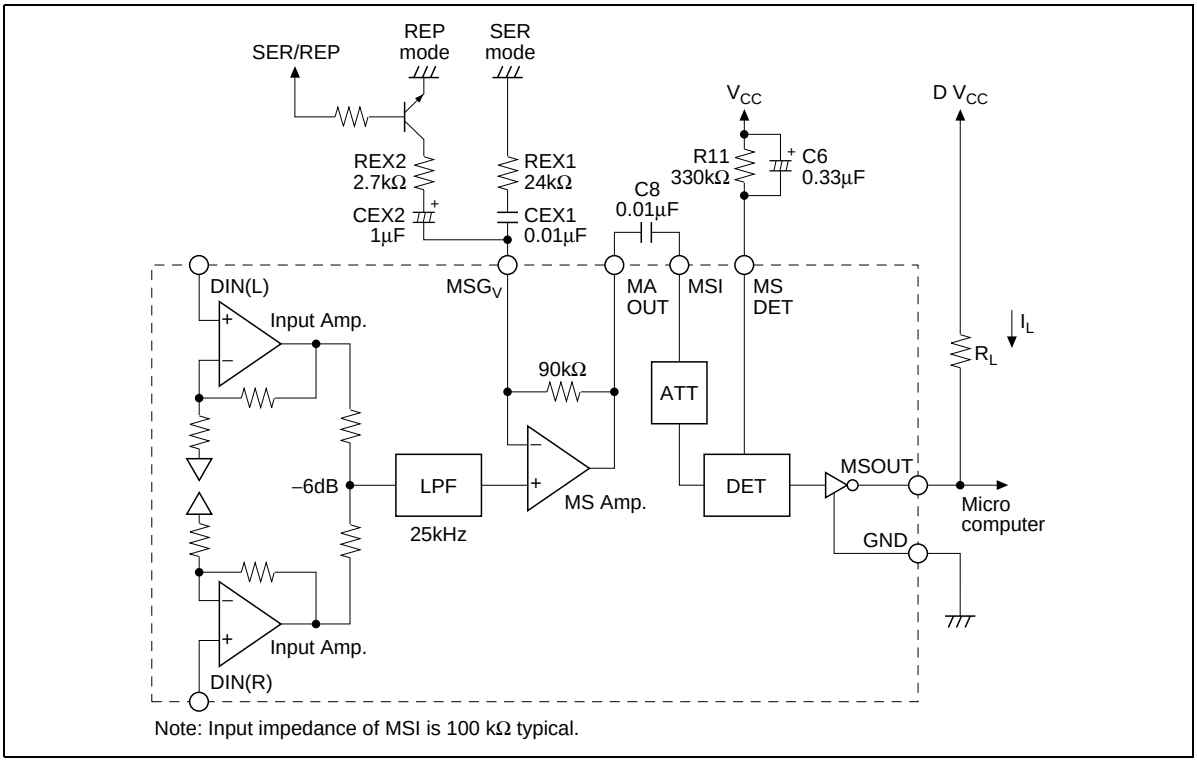


Figure 4 Music Sensor Block Diagram

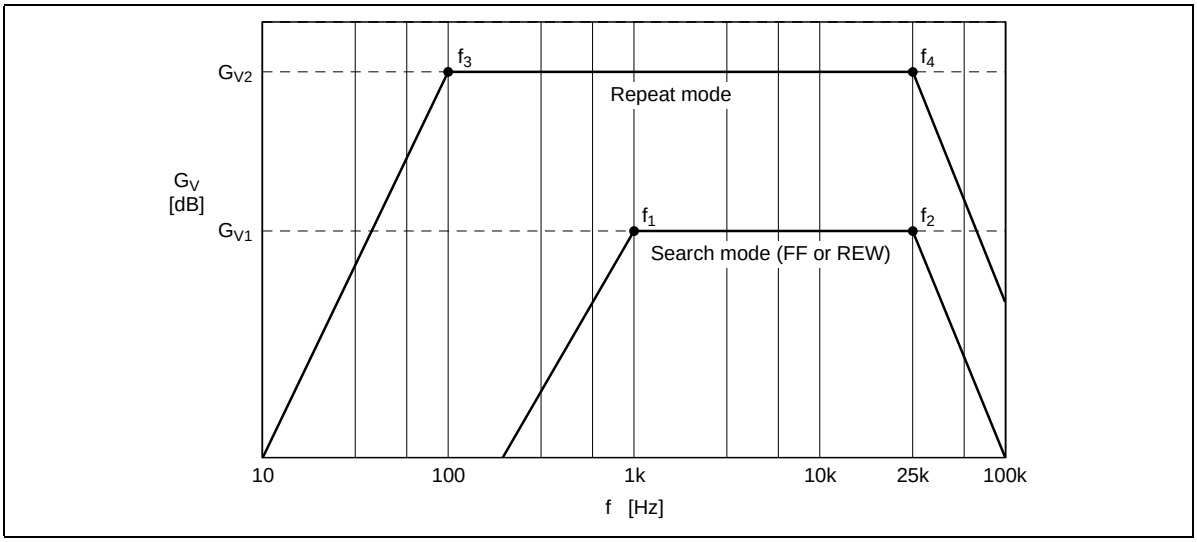


Figure 5 Frequency Response

Product	G_VIA	ATT	G_VIA + ATT
HA12192F series	20dB	0dB	20dB
HA12197F	20dB	0dB	20dB
HA12198F	22.2dB	–2.2dB	20dB
HA12199F	23.5dB	–3.5dB	20dB

1. Search mode (FF or REW)

$$G_{V1} = G_V IA + 20\log\left(1 + \frac{90k}{REX1}\right) + ATT \quad [dB]$$

$$f_1 = \frac{1}{2\pi \cdot CEX1 \cdot REX1} \quad [Hz], \quad f_2 = 25k \quad [Hz]$$

2. Repeat mode

$$G_{V2} = G_V IA + 20\log\left(1 + \frac{90k}{Z}\right) + ATT \quad [dB],$$

$$Z = \frac{REX1 \cdot REX2}{REX1 + REX2}$$

$$f_3 = \frac{1}{2\pi \cdot CEX2 \cdot REX2} \quad [Hz], \quad f_4 = 25k \quad [Hz]$$

G_VIA: Input Amp. G_V = 20dB

The sensitivity of music sensor (S) is computed by the formula mentioned below.

$$S = -\left(G_V{}^{*1} - 20\log\frac{130^{*2}}{30^{*3}}\right) = 12.7 - G_V \quad [dB]$$

Note: 1. Search mode: G_{V1}, Repeat mode: G_{V2}
2. Standard level of DIN pin (Dolby level)
3. Standard sensing level of music sensor

Item	REX1, 2	CEX1, 2	$G_{V1, 2}$	$f_{1, 3}$	$f_{2, 4}$	S (one-side channel)
Search mode	24kΩ	0.01μF	33.5dB	663Hz	25kHz	–14.8dB
Repeat mode	2.7kΩ	1μF	51.6dB	58.9Hz	25kHz	–33.0dB

Note: S is 6dB down in case of one-side channel. And this MS presented hysteresis lest MSOUT terminal should turn over again Hi level or Lo level, in case of thresh S level constantly.

Music Sensor Time Constant

(1) Sensing no signal to signal (Attack) is determined by C6.
0.01µF to 1µF capacitor C6 can be applicable.
Sensing no signal to signal = C6 × 45000 (sec)

(2) Sensing signal to no signal (Recovery) is determined by C6 and R11, however preceding (1), 100kΩ to 1MΩ R11 can be applicable.
Sensing signal to no signal = C6 × R11 (sec)

Music Sensor Output (MSOUT)

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

Connection with microcomputer, design I_L at 1mA Typ.

$$I_L = \frac{DV_{CC} - MSOUT_{Lo}\,*}{R_L}$$

*$MSOUT_{Lo}$: Sensing signal (about 1V)

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

The Tolerances of External Components for Dolby NR-Block (Only HA12192F Series)

For adequate Dolby NR tracking response, take external components shown below.

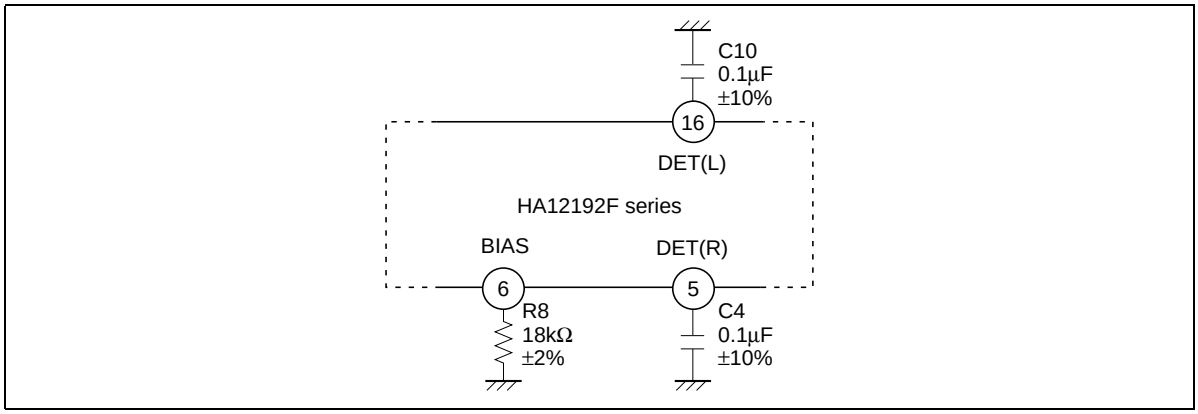


Figure 6 Tolerance of External Components

Absolute Maximum Rating (Ta=25°C)

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

Electrical Characteristics HA12192F/HA12212F Series

(Ta = 25°C, PBOUT Level, 300mVrms(HA12192F/HA12212F), 387.5mVrms (HA12193F), 450mVrms(HA12194F), V_{CC} = 9.0V)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Remark
Quiescent current	I_Q	—	9.5	—	mA	NR-ON, 70µ, No signal	
Imput Amp. gain (HA12192F/HA12212F)	G_VIA	19.0	20.0	21.0	dB	Vin = 0dB, f = 1kHz	
Imput Amp. gain (HA12193F)	G_VIA	21.2	22.2	23.2			
Imput Amp. gain (HA12194F)	G_VIA	22.5	23.5	24.5			
B-type Decode boost	DEC-2k (1)	2.8	4.3	5.8	dB	Vout = –20dB, f = 2kHz	
	DEC-2k (2)	7.0	8.5	10.0		Vout = –30dB, f = 2kHz	
	DEC-5k (1)	1.7	3.2	4.7		Vout = –20dB, f = 5kHz	
	DEC-5k (2)	6.7	8.2	9.7		Vout = –30dB, f = 5kHz	
Signal handling	Vo max	12.0	13.0	—	dB	THD = 1%, f = 1kHz	*1
Signal to noise ratio	S / N	70.0	80.0	—	dB	Rg = 5.1kΩ, CCIR / ARM	
THD	THD	—	0.05	0.3	%	Vin = 0dB, f = 1kHz	
Channel separation	CT RL (1)	65	80.0	—	dB	Vin = 10dB, f = 1kHz	DIN IN
	CT RL (2)	50	60.0	—			EQ IN
PB-EQ gain	G_V EQ 1k	37.0	40.0	43.0	dB	Vin = 0.6mVrms, f = 1kHz	120µ
	G_V EQ 10k(1)	33.0	36.0	39.0		Vin = 0.6mVrms, f = 10kHz	
	G_V EQ 10k(2)	29.0	32.0	35.0			70µ
PB-EQ maximum output	VoM	300	600	—	mVrms	THD = 1%, f = 1kHz	*1
PB-EQ THD	THD-EQ	—	0.05	0.3	%	Vin = 0.6mVrms, f = 1kHz	
Noise voltage level converted in input	V_N	—	0.7	1.5	µVrms	Rg = 680Ω, DIN-AUDIO	
MS sensing level	V_{ON}	–18.0	–14.0	–10.0	dB	f = 5kHz	
MS output low level	V_{OL}	—	1.0	1.5	V		
MS output leak current	I_{OH}	—	0.0	2.0	µA		
Control voltage	V_{IL}	–0.2	—	1.0	V		
	V_{IH}	3.5	—	5.3			

Note: 1. V_{CC} = 6.5V (HA12192F/HA12212F)
V_{CC} = 6.8V (HA12193F)
V_{CC} = 7.2V (HA12194F)

Electrical Characteristics HA12197F Series

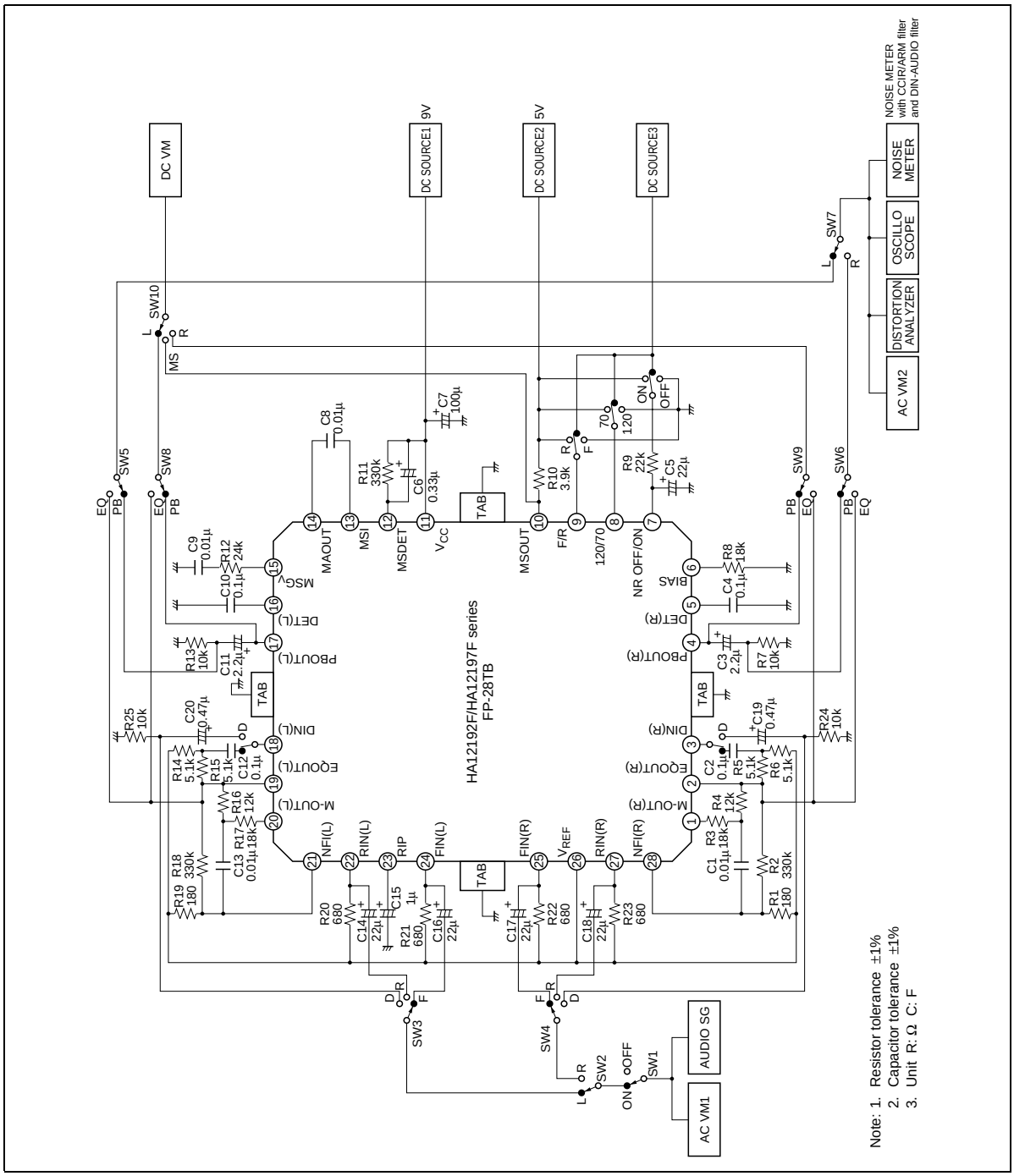
(Ta = 25°C, PBOUT Level, 300mVrms(HA12197F), 387.5mVrms(HA12198F), 450mVrms(HA12199F), V_{CC} = 9.0V)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Remark
Quiescent current	I_Q	—	4.7	7.1	mA	70µ, No signal	
Imput Amp. gain (HA12197F)	G_VIA	19.0	20.0	21.0	dB	Vin = 0dB, f = 1kHz	
Imput Amp. gain (HA12198F)	G_VIA	21.2	22.2	23.2			
Imput Amp. gain (HA12199F)	G_VIA	22.5	23.5	24.5			
Signal handling	Vo max	12.0	13.0	—	dB	THD = 1%, f = 1kHz	*1
Signal to noise ratio	S / N	70.0	80.0	—	dB	Rg = 5.1kΩ, CCIR / ARM	
THD	THD	—	0.05	0.3	%	Vin = 0dB, f = 1kHz	
Channel separation	CT RL (1)	65	80.0	—	dB	Vin = 10dB, f = 1kHz	DIN IN
	CT RL (2)	50	60.0	—			EQ IN
PB-EQ gain	G_V EQ 1k	37.0	40.0	43.0	dB	Vin = 0.6mVrms, f = 1kHz	120µ
	G_V EQ 10k(1)	33.0	36.0	39.0		Vin = 0.6mVrms, f = 10kHz	
	G_V EQ 10k(2)	29.0	32.0	35.0			70µ
PB-EQ maximum output	VoM	300	600	—	mVrms	THD = 1%, f = 1kHz	*1
PB-EQ THD	THD-EQ	—	0.05	0.3	%	Vin = 0.6mVrms, f = 1kHz	
Noise voltage level converted in input	V_N	—	0.7	1.5	µVrms	Rg = 680Ω, DIN-AUDIO	
MS sensing level	V_{ON}	–18.0	–14.0	–10.0	dB	f = 5kHz	
MS output low level	V_{OL}	—	1.0	1.5	V		
MS output leak current	I_{OH}	—	0.0	2.0	µA		
Control voltage	V_{IL}	–0.2	—	1.0	V		
	V_{IH}	3.5	—	5.3			

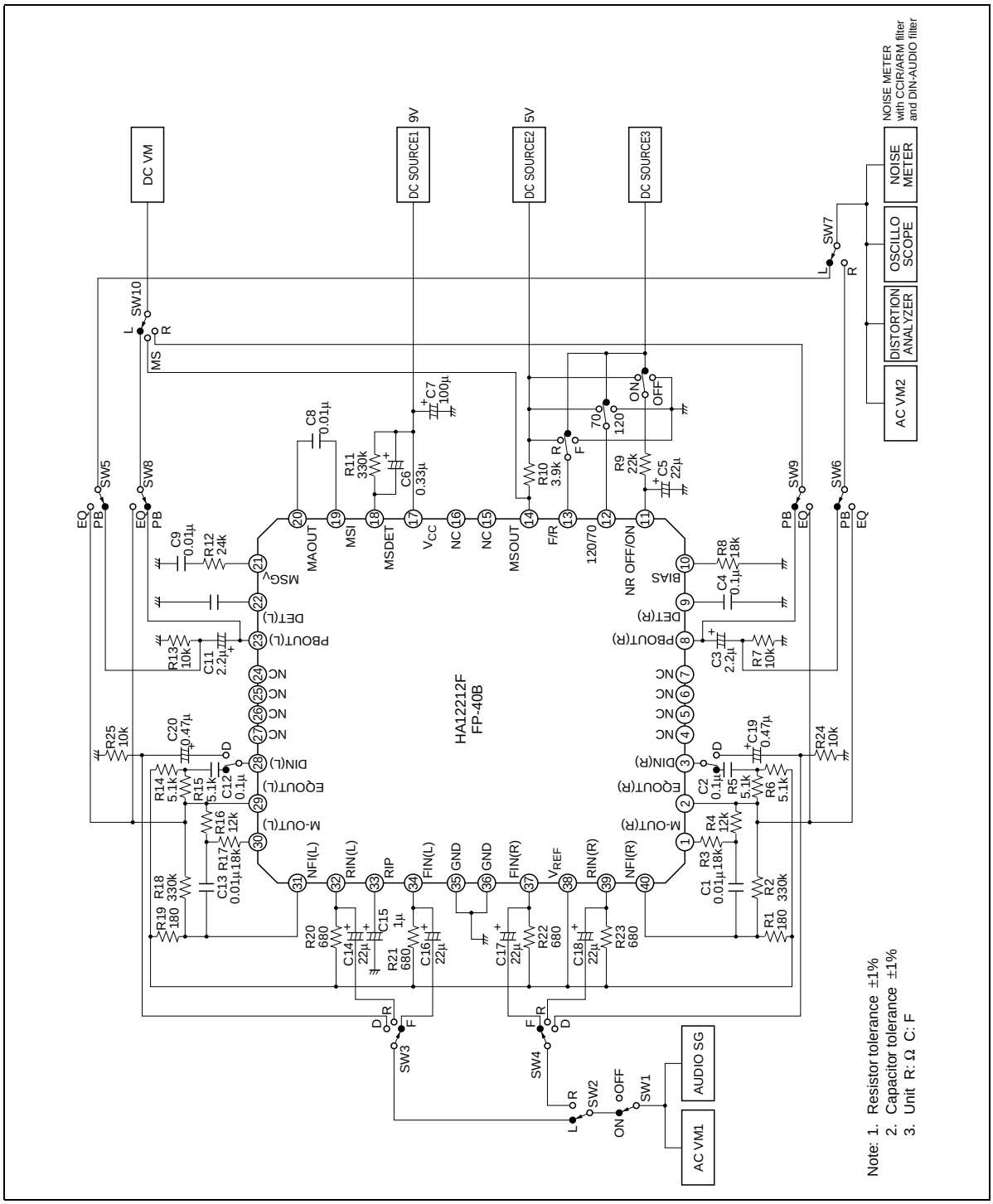
Note: 1. V_{CC} = 6.5V (HA12197F)
V_{CC} = 6.8V (HA12198F)
V_{CC} = 7.2V (HA12199F)

Test Circuit

HA12192F/HA12197F Series



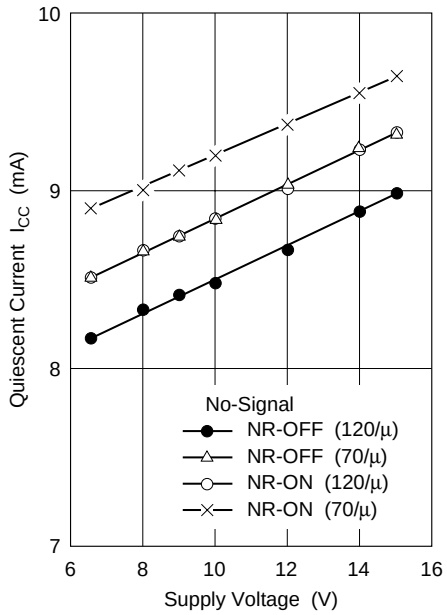
HA12212F


DC VM
DC SOURCE1 9V
DC SOURCE2 5V
DC SOURCE3
NOISE METER with CCIR/ARM filter and DIN-AUDIO filter
NOISE METER
OSCILLO SCOPE
DISTORTION ANALYZER
AC VM2
SW10
SW7
SW5
SW8
SW9
SW6
SW3
SW4
SW2
SW1
AUDIO SG
AC VM1
HA12212F
FP-40B
MAOUT
MSI
MSDET
VCC
NC
MSOUT
F/R
120/70
NR OFF/ON
BIAS
MSGV
DET(L)
PBOUT(L)
DIN(L)
EQOUT(L)
M-OUT(L)
NFI(L)
RIN(L)
RIP
FIN(L)
GND
FIN(R)
VREF
RIN(R)
NFI(R)
M-OUT(R)
EQOUT(R)
DIN(R)
PBOUT(R)
DET(R)
Note: 1. Resistor tolerance ±1%
2. Capacitor tolerance ±1%
3. Unit R: Ω C: F

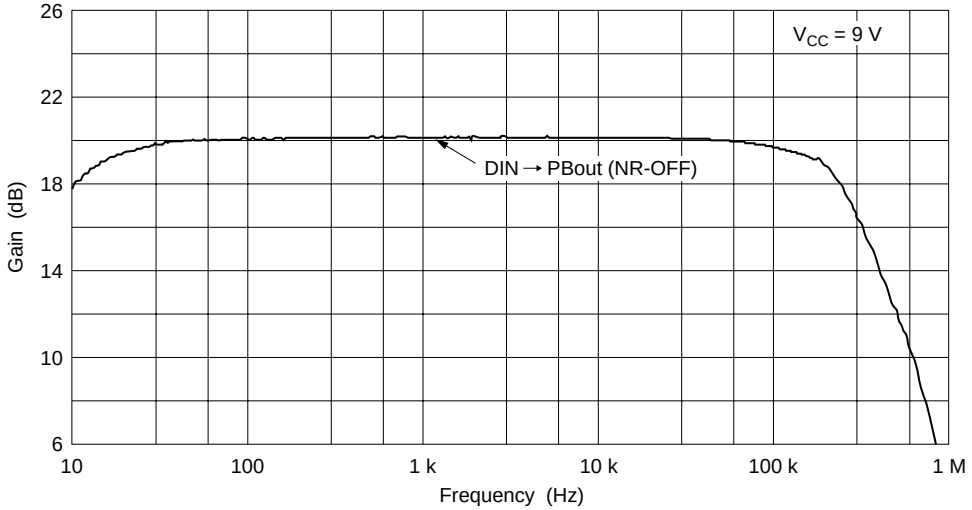
Characteristic Curves

HA12192F Series

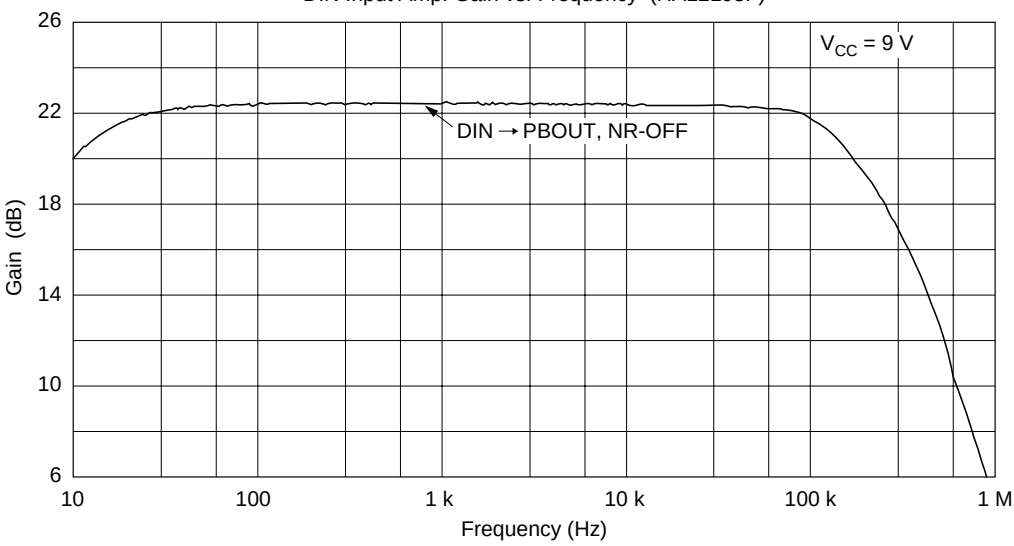
Quiescent Current vs. Supply Voltage (HA12192F/3F/4F)



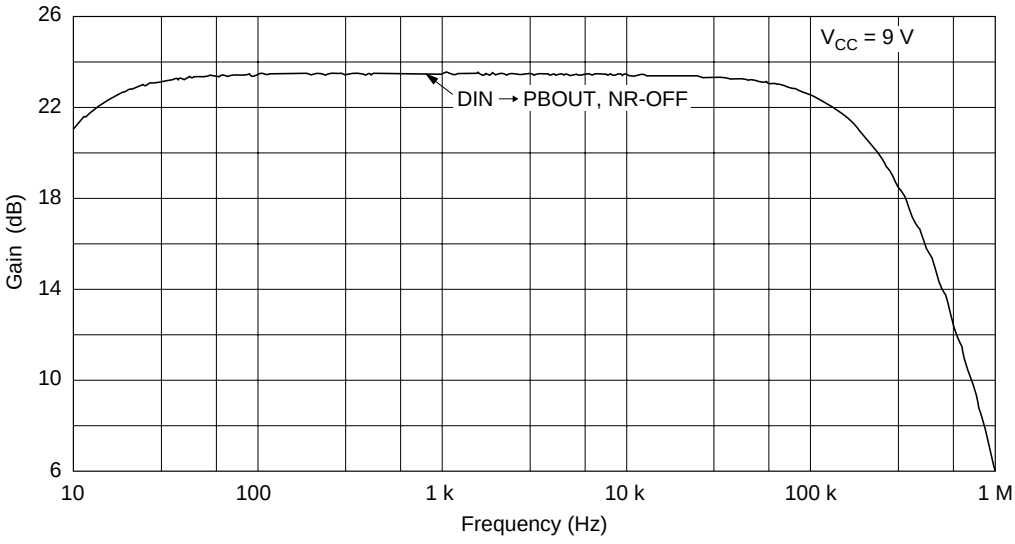
Input Amp Gain vs. Frequency (HA12192F)



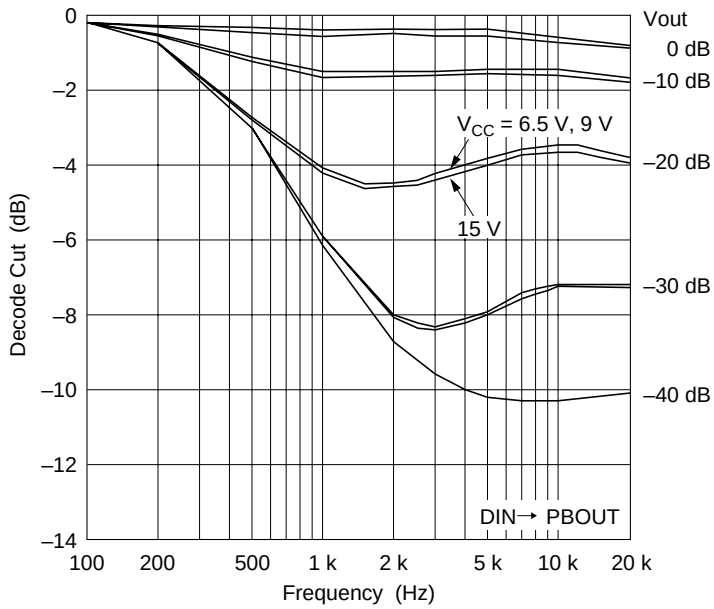
DIN Input Amp. Gain vs. Frequency (HA12193F)



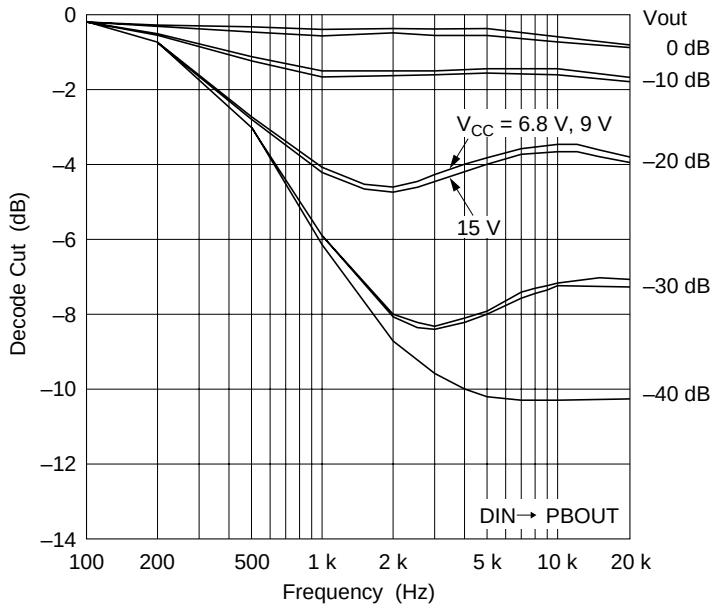
DIN Input Amp. Gain vs. Frequency (HA12194F)



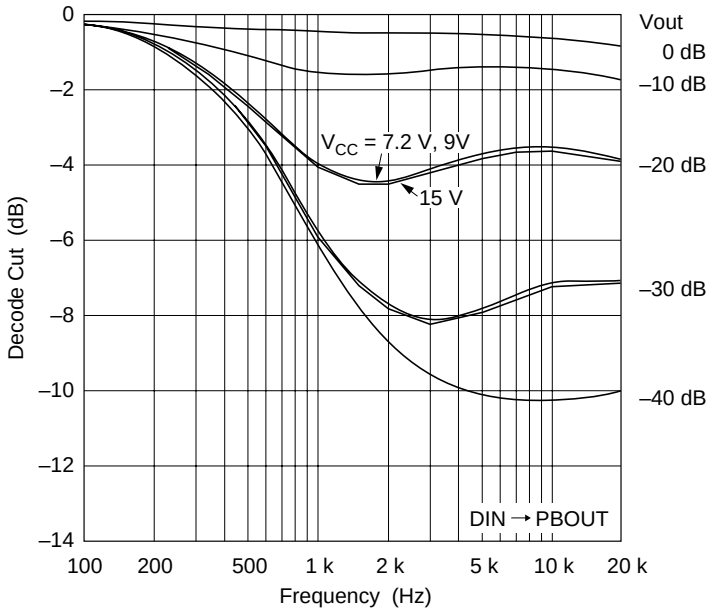
Decode Cut vs. Frequency (HA12192F)



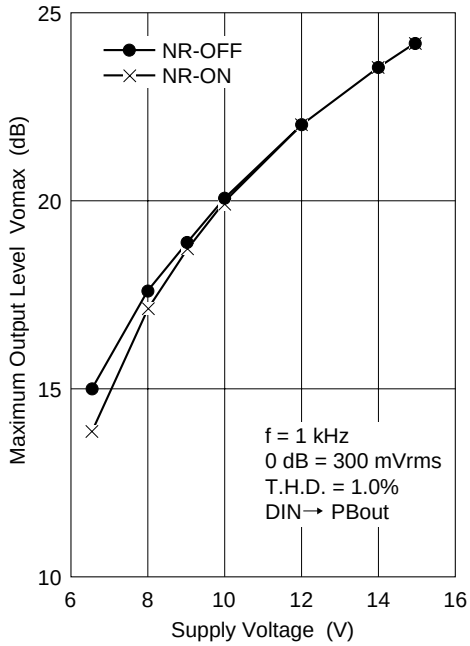
Decode Cut vs. Frequency (HA12193F)



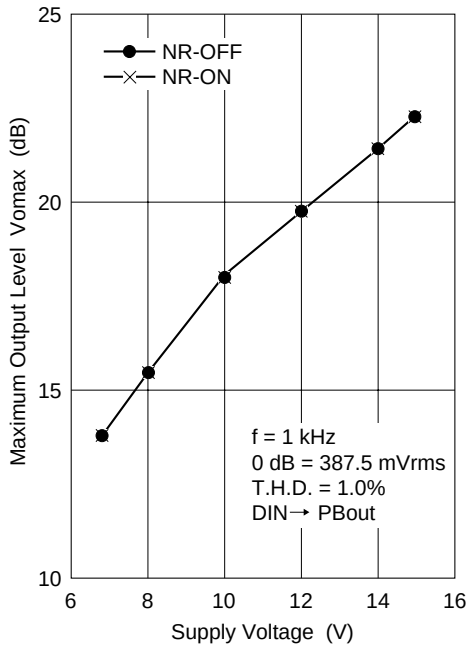
Decode Cut vs. Frequency (HA12194F)



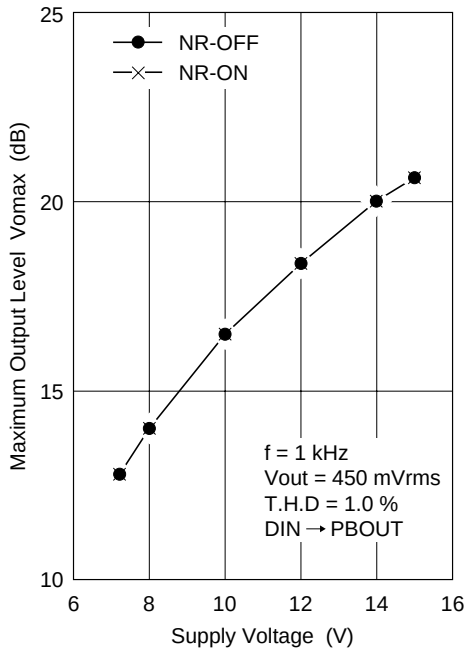
Maximum Output Level
vs. Supply Voltage (HA12192F)



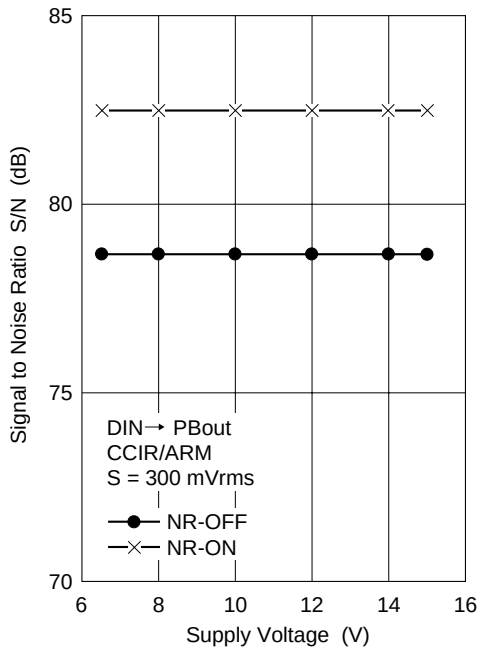
Maximum Output Level
vs. Supply Voltage (HA12193F)



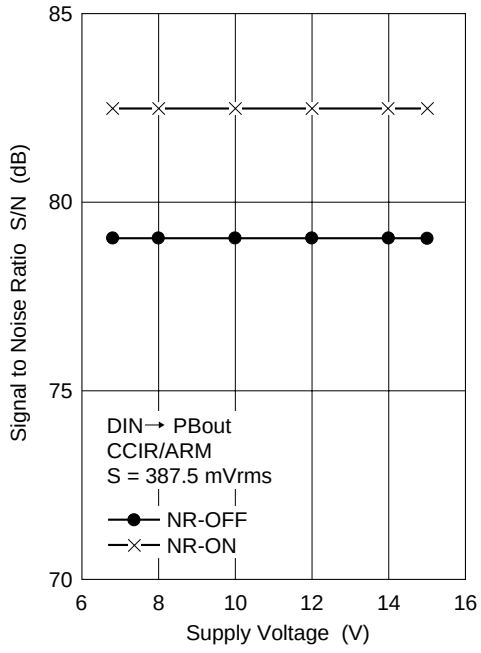
Maximum Output Level
vs. Supply Voltage (HA12194F)



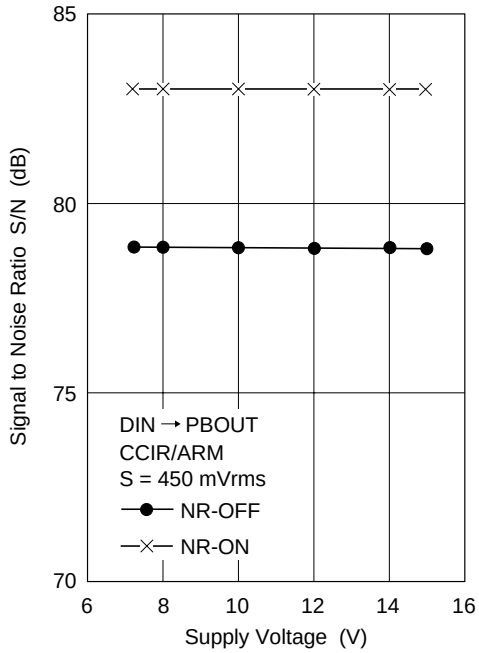
Signal to Noise Ratio
vs. Supply Voltage (HA12192F)



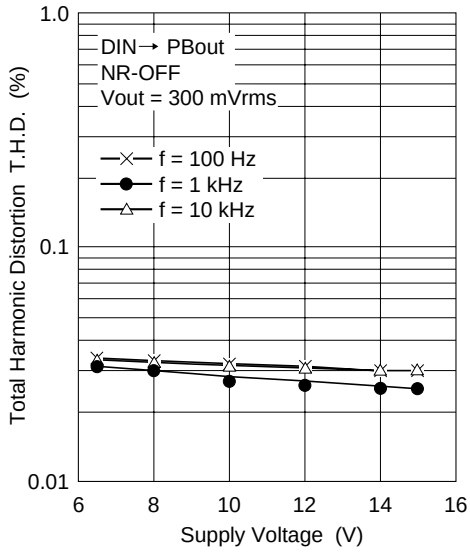
Signal to Noise Ratio
vs. Supply Voltage (HA12193F)



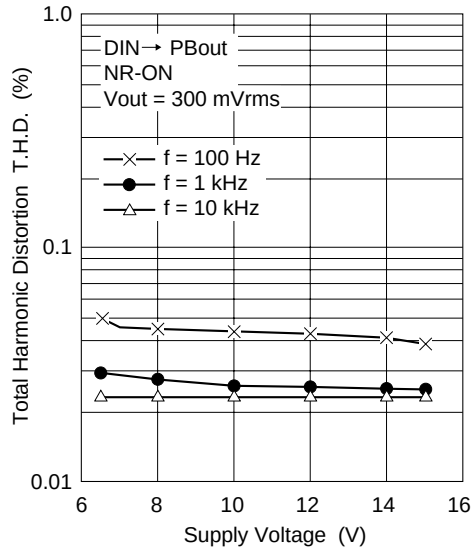
Signal to Noise Ratio
vs. Supply Voltage (HA12194F)



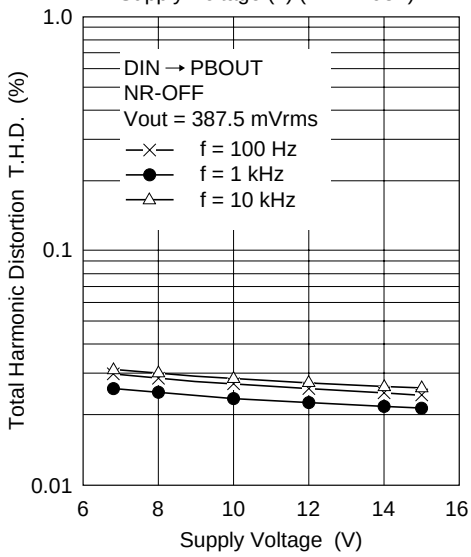
Total Harmonic Distortion vs.
Supply Voltage (1) (HA12192F)



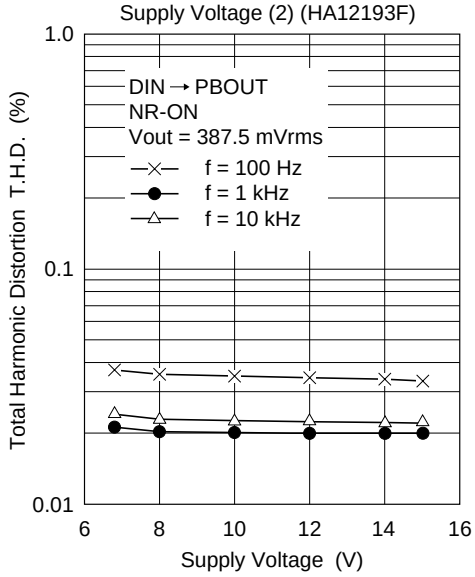
Total Harmonic Distortion vs.
Supply Voltage (2) (HA12192F)



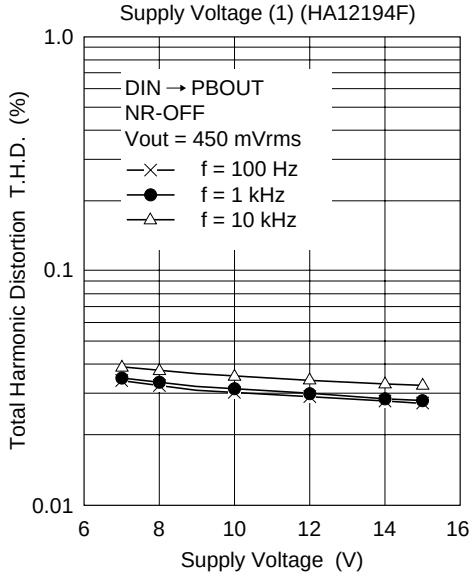
Total Harmonic Distortion vs.
Supply Voltage (1) (HA12193F)



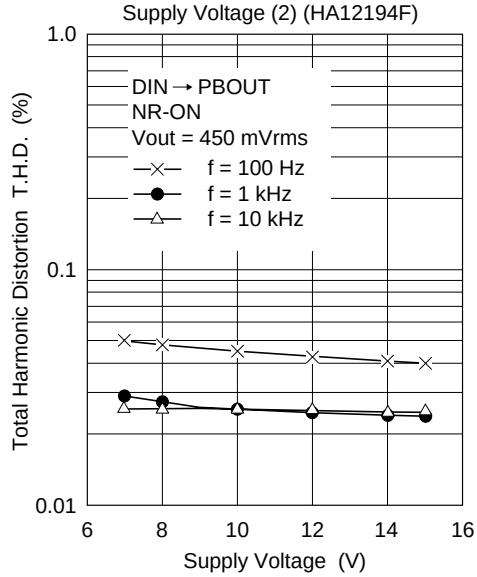
Total Harmonic Distortion vs.
Supply Voltage (2) (HA12193F)



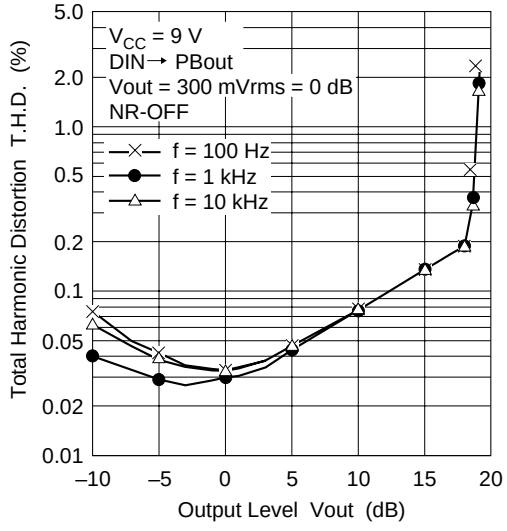
Total Harmonic Distortion vs.
Supply Voltage (1) (HA12194F)



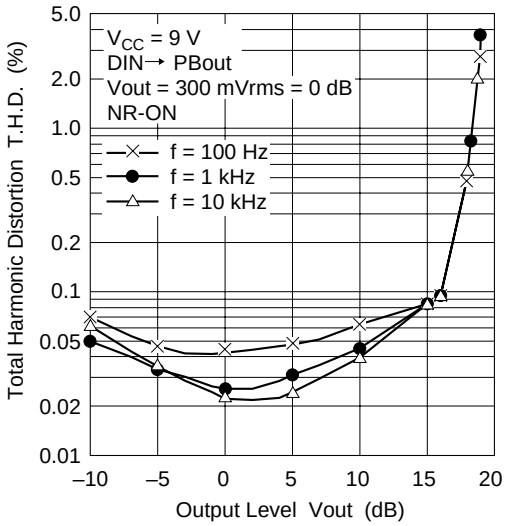
Total Harmonic Distortion vs.
Supply Voltage (2) (HA12194F)



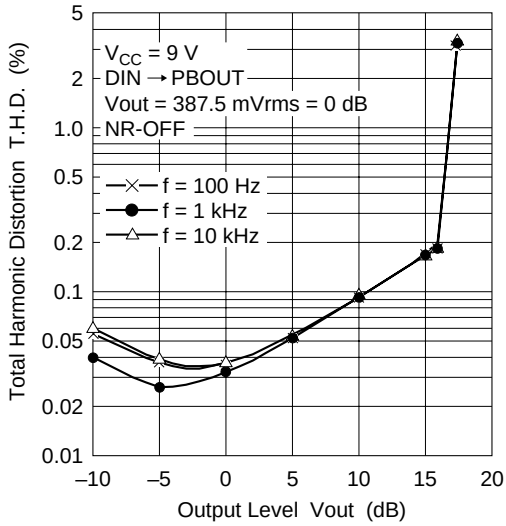
Total Harmonic Distortion vs.
Output Level (1) (HA12192F)



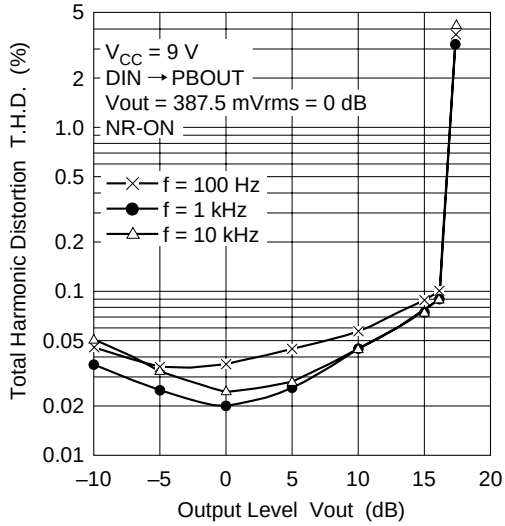
Total Harmonic Distortion vs.
Output Level (2) (HA12192F)



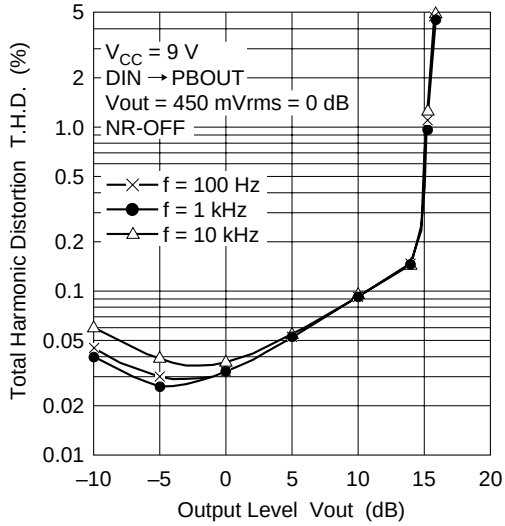
Total Harmonic Distortion vs.
Output Level (1) (HA12193F)



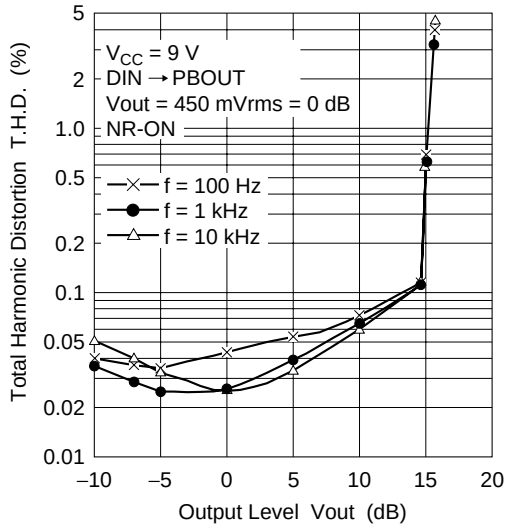
Total Harmonic Distortion vs.
Output Level (2) (HA12193F)



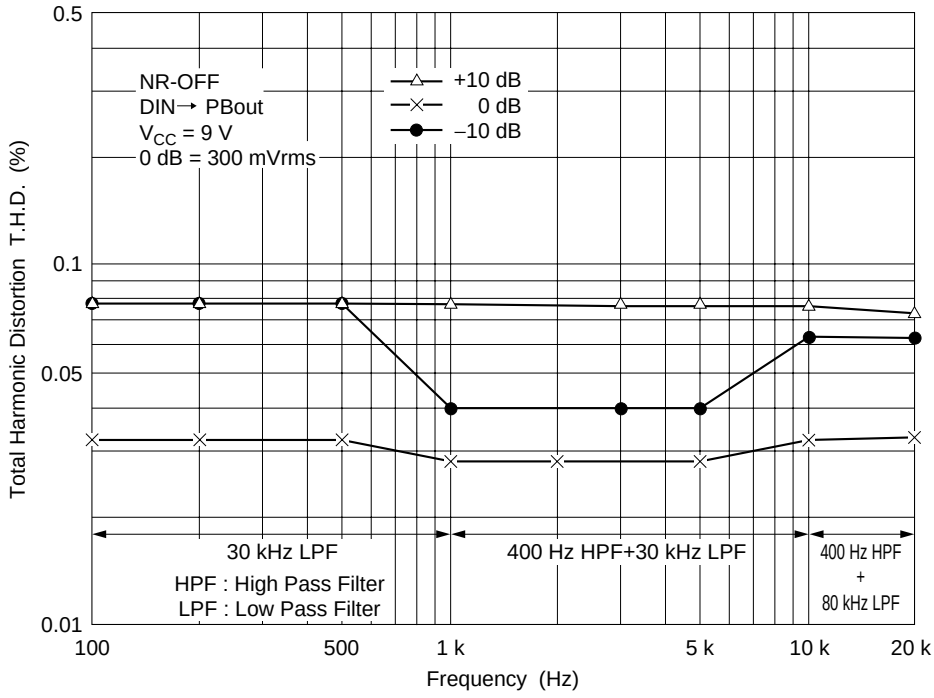
Total Harmonic Distortion vs.
Output Level (1) (HA12194F)



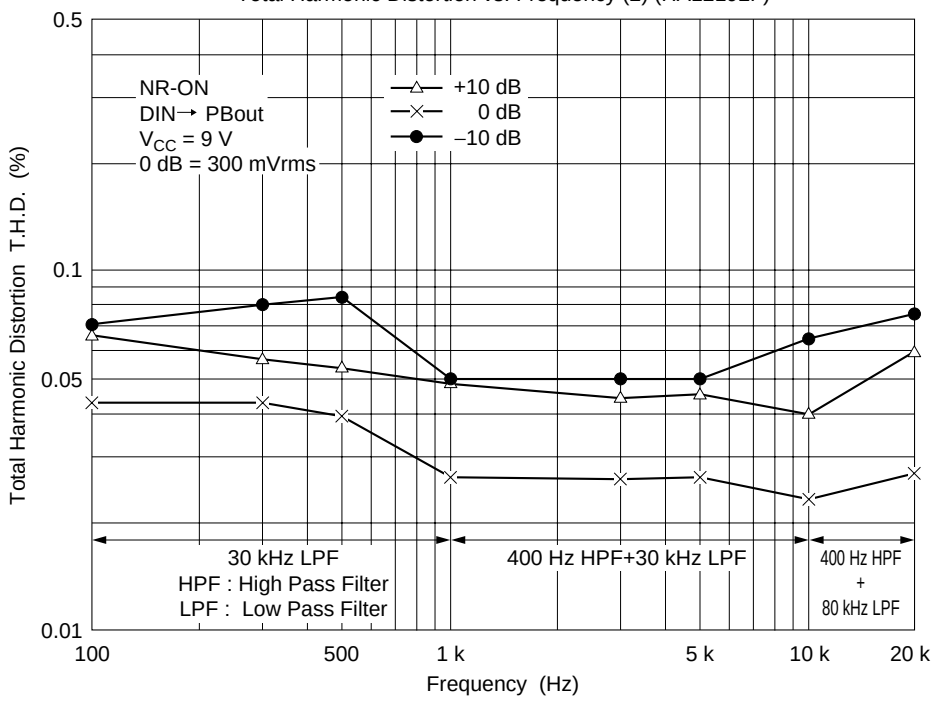
Total Harmonic Distortion vs.
Output Level (2) (HA12194F)



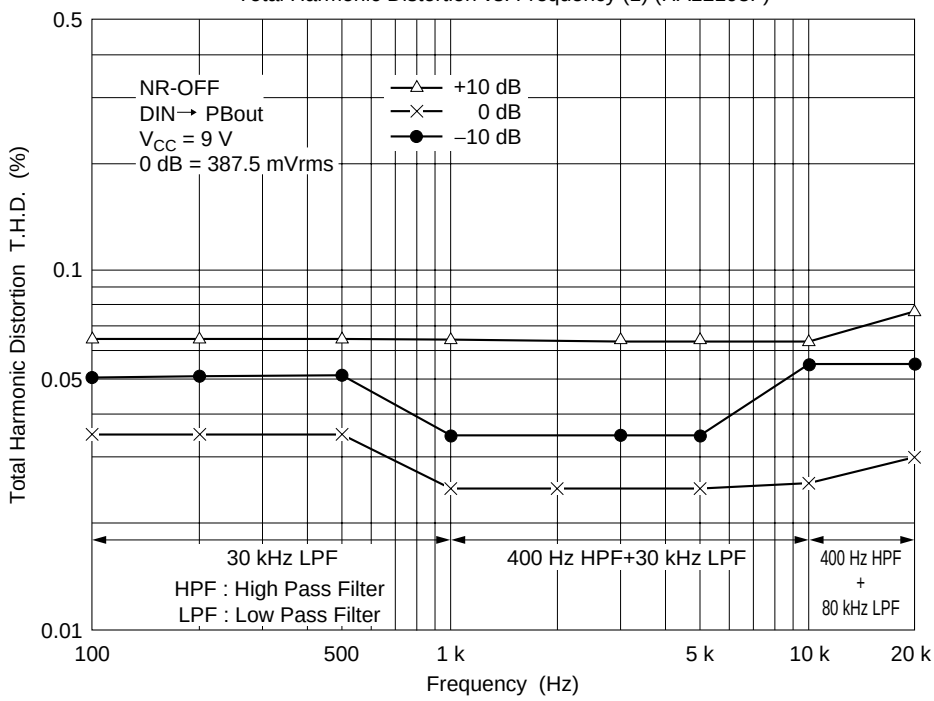
Total Harmonic Distortion vs. Frequency (1) (HA12192F)



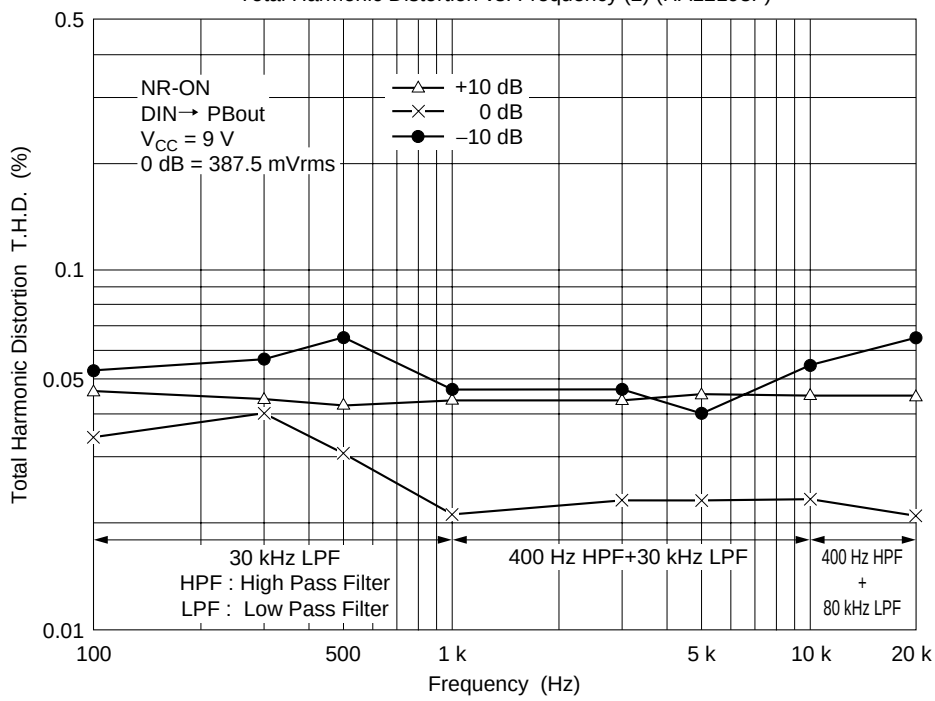
Total Harmonic Distortion vs. Frequency (2) (HA12192F)



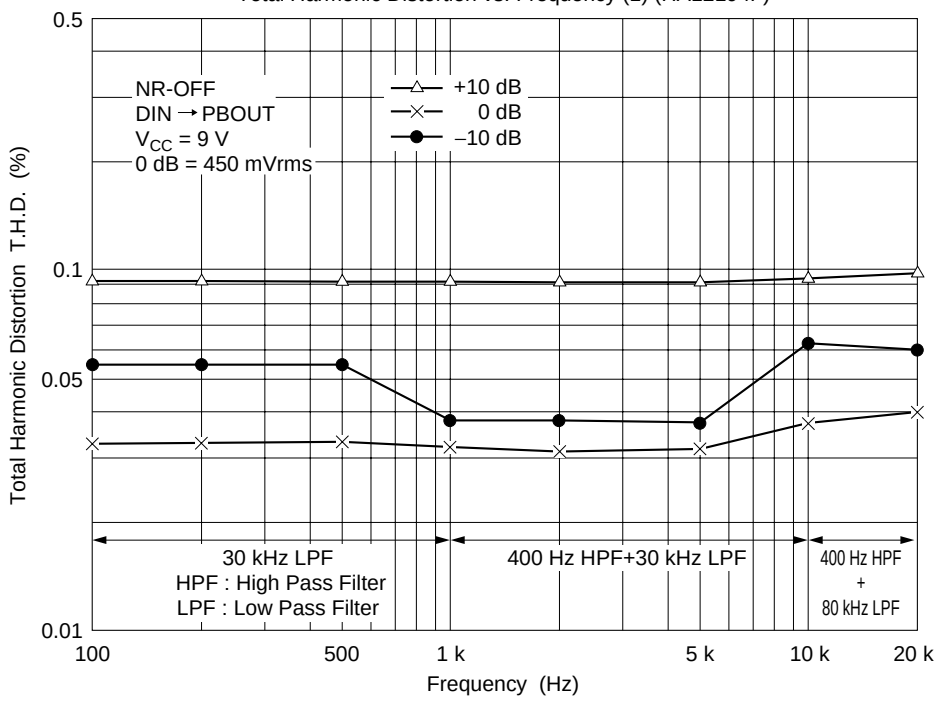
Total Harmonic Distortion vs. Frequency (1) (HA12193F)



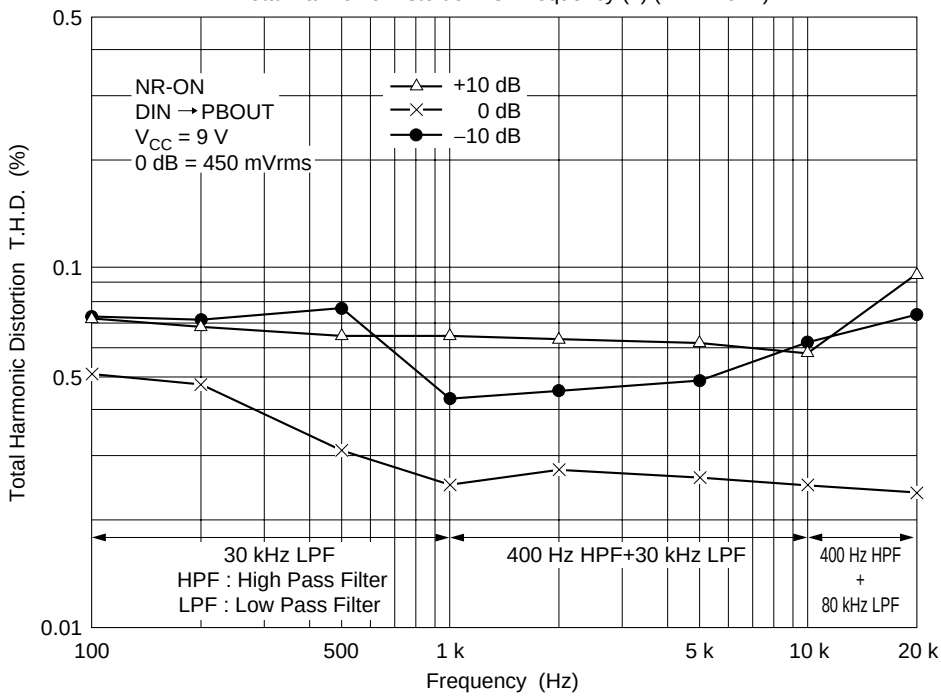
Total Harmonic Distortion vs. Frequency (2) (HA12193F)



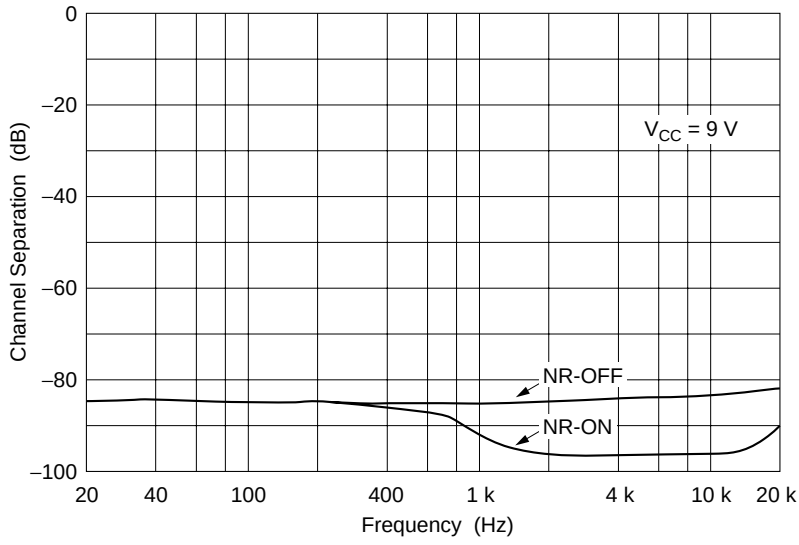
Total Harmonic Distortion vs. Frequency (1) (HA12194F)



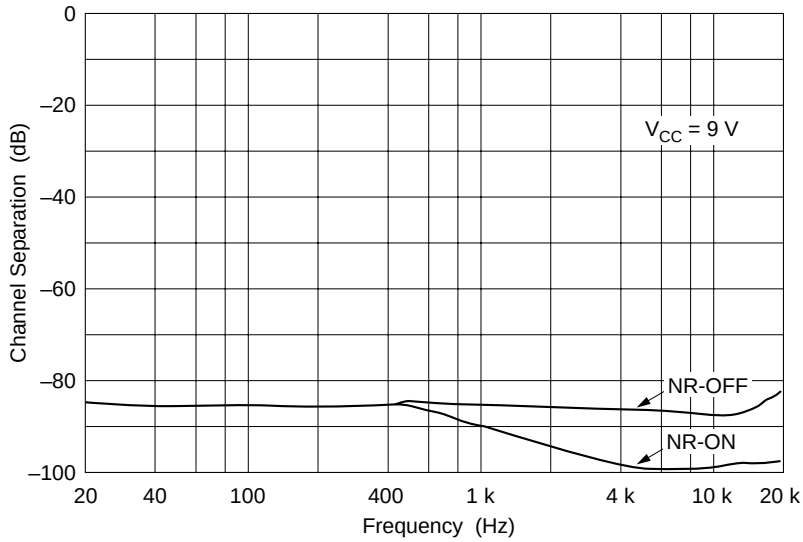
Total Harmonic Distortion vs. Frequency (2) (HA12194F)



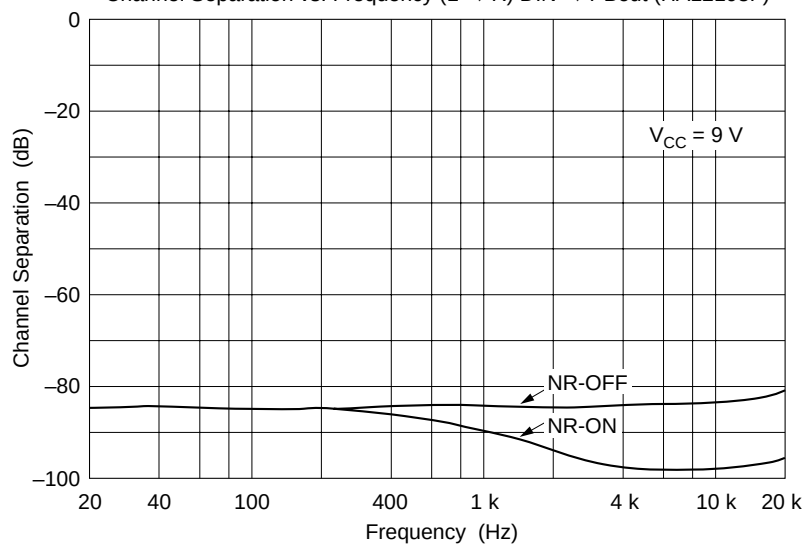
Channel Separation vs. Frequency (L → R) DIN → PBout (HA12192F)



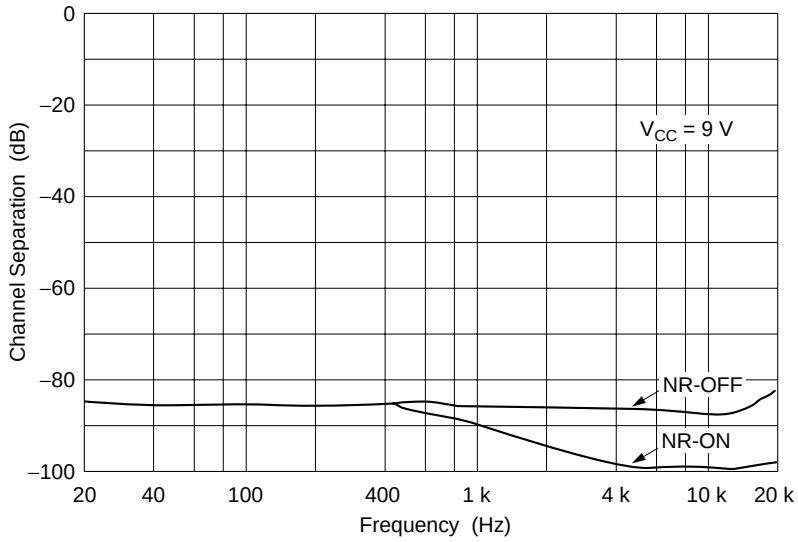
Channel Separation vs. Frequency (R → L) DIN → PBout (HA12192F)



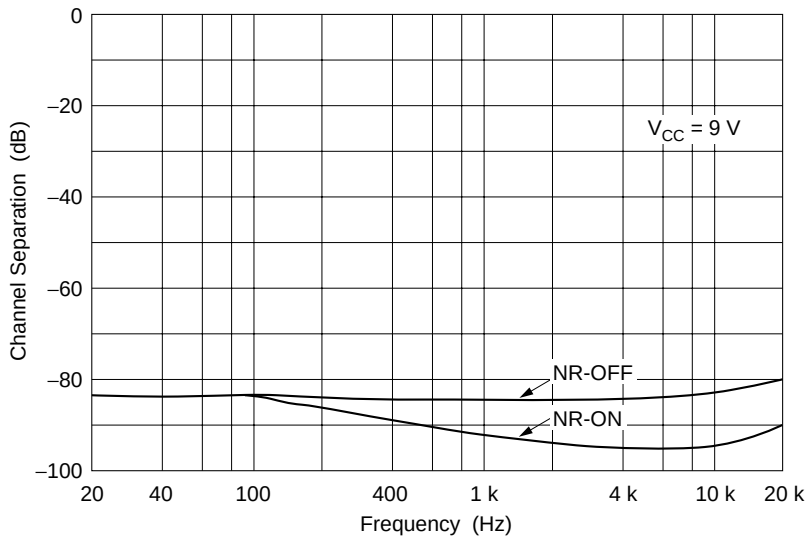
Channel Separation vs. Frequency (L → R) DIN → PBout (HA12193F)



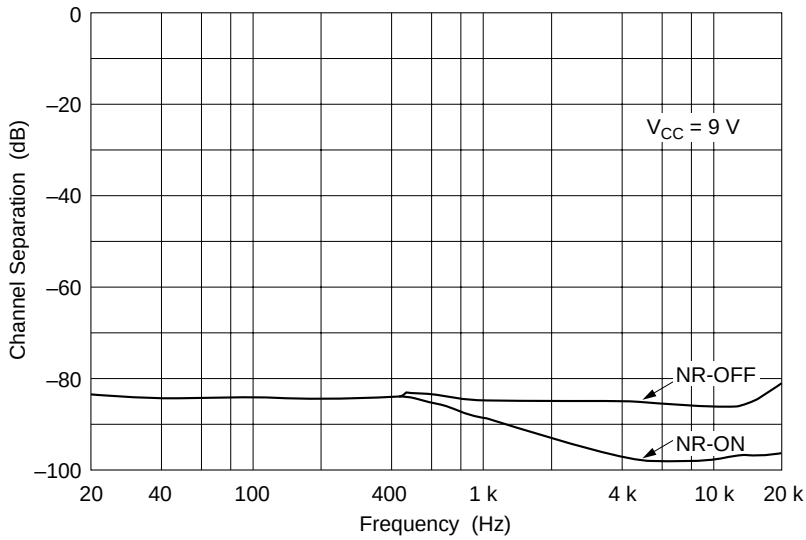
Channel Separation vs. Frequency (R → L) DIN → PBout (HA12193F)



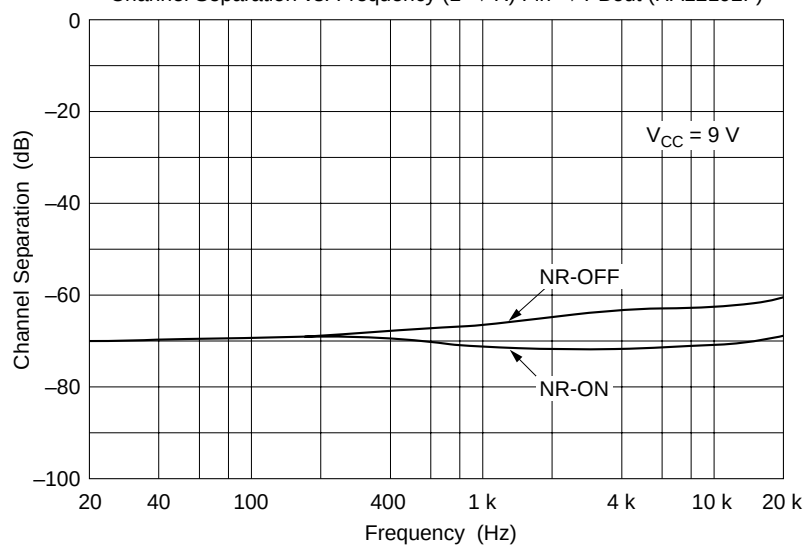
Channel Separation vs. Frequency (L → R) DIN → PBout (HA12194F)



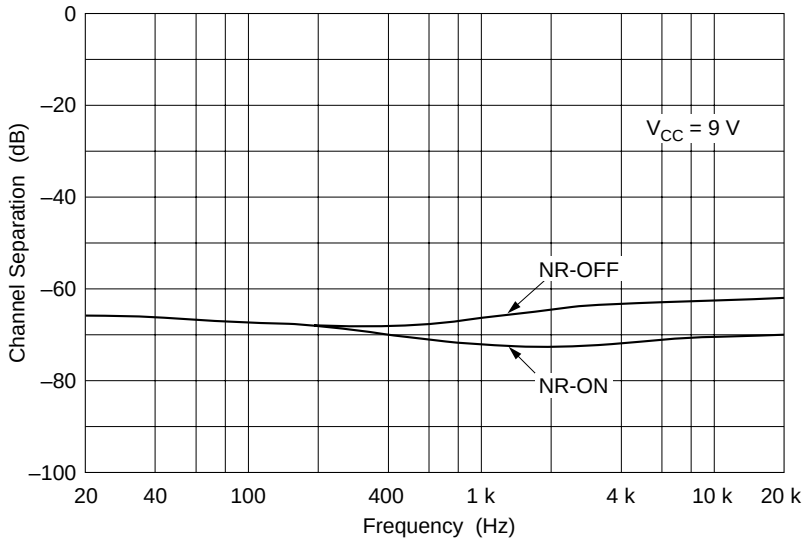
Channel Separation vs. Frequency (R → L) DIN → PBout (HA12194F)



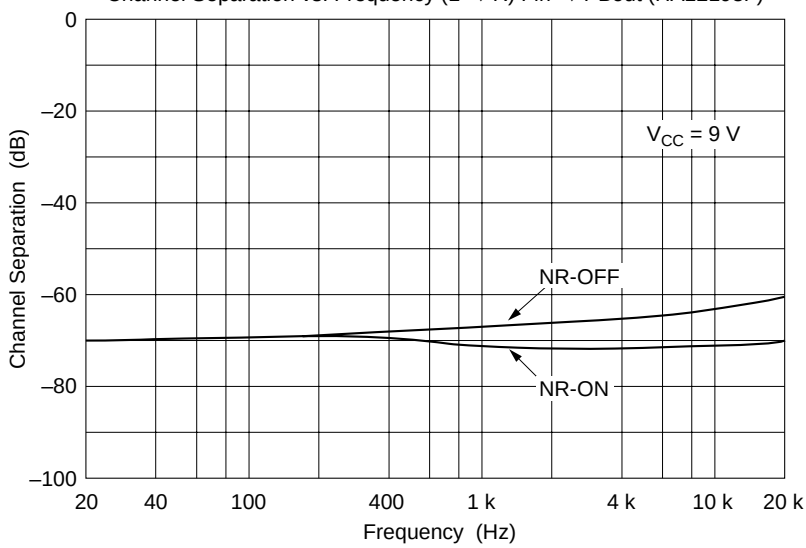
Channel Separation vs. Frequency (L → R) Fin → PBout (HA12192F)



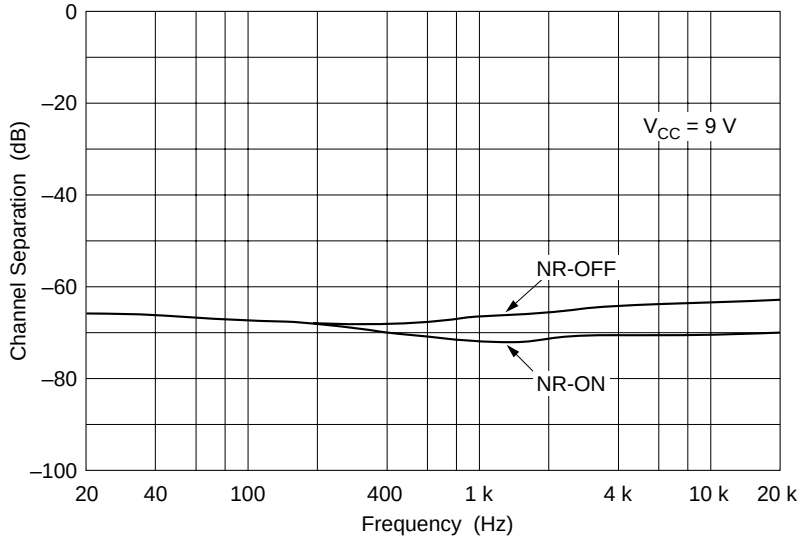
Channel Separation vs. Frequency (R → L) Fin → PBout (HA12192F)



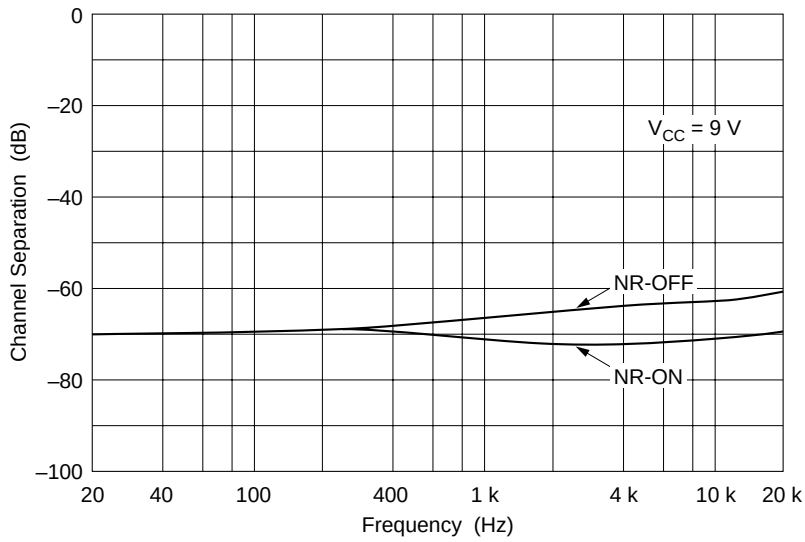
Channel Separation vs. Frequency (L → R) Fin → PBout (HA12193F)



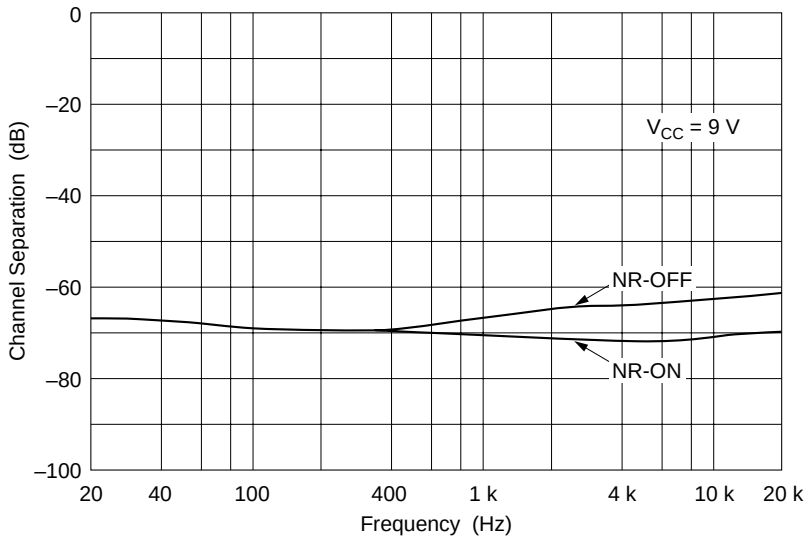
Channel Separation vs. Frequency (R → L) Fin → PBout (HA12193F)



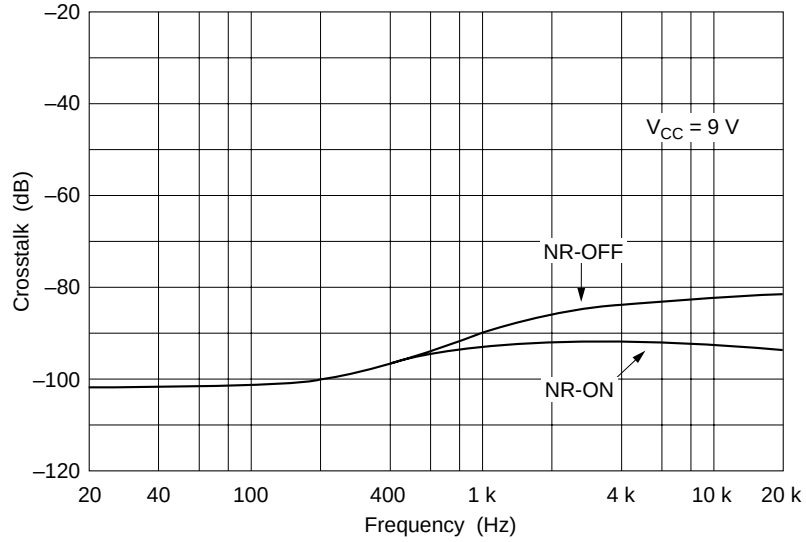
Channel Separation vs. Frequency (L → R) EQFin → PBout (HA12194F)



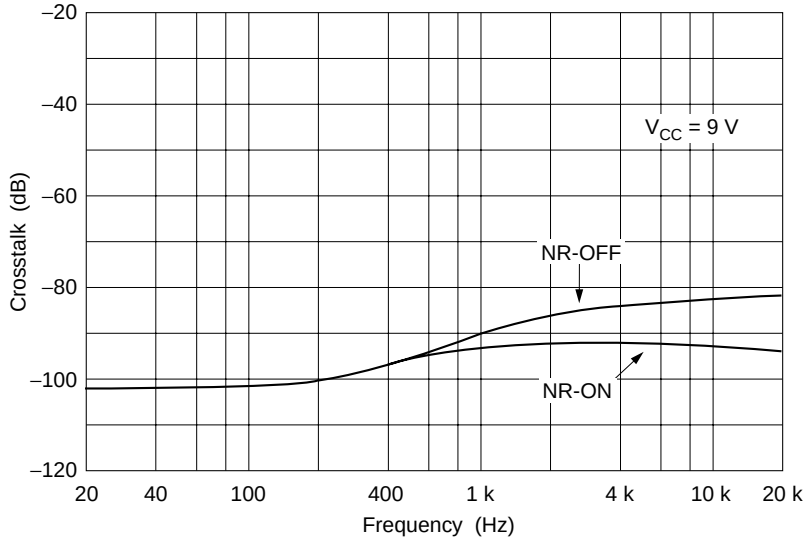
Channel Separation vs. Frequency (R → L) EQFin → PBout (HA12194F)



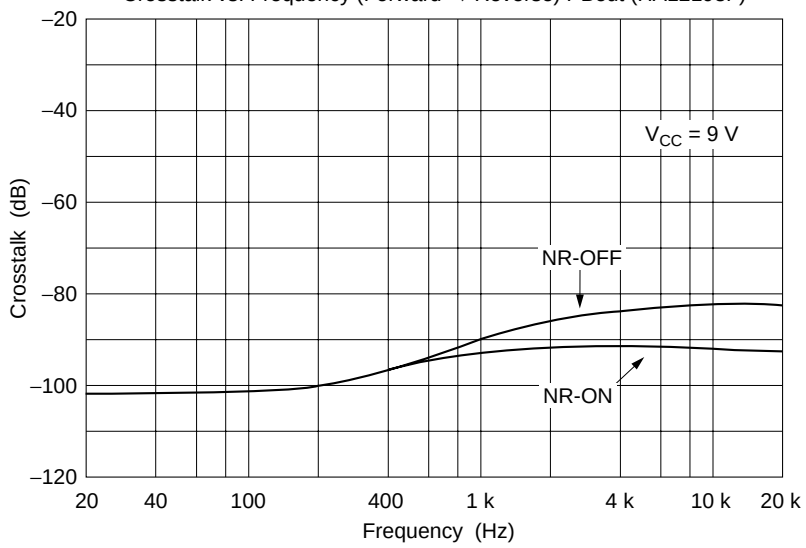
Crosstalk vs. Frequency (Forward → Reverse) PBout (HA12192F)



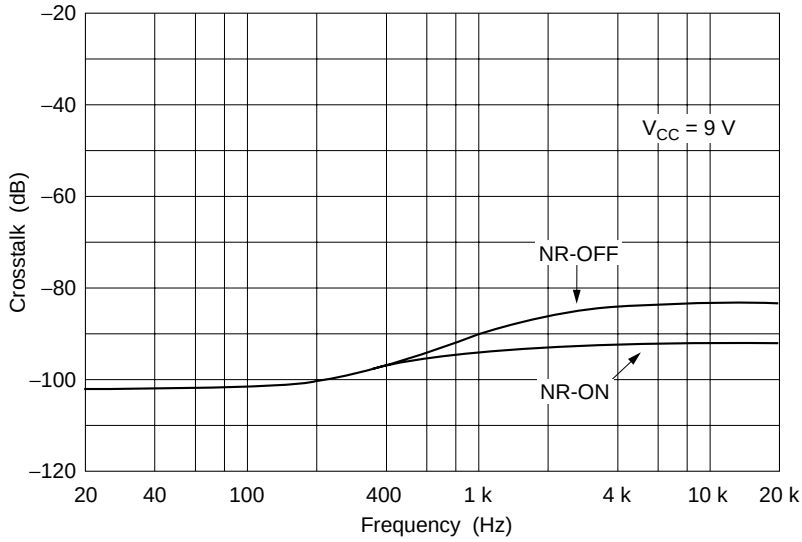
Crosstalk vs. Frequency (Reverse → Forward) PBout (HA12192F)



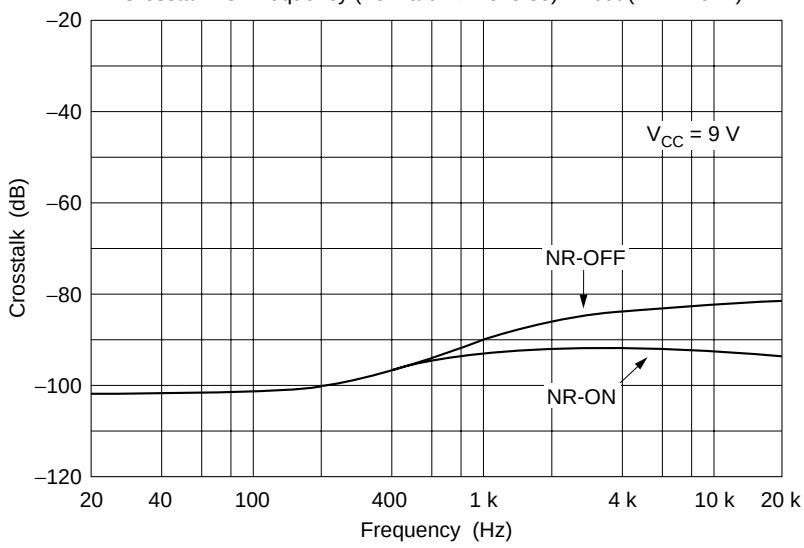
Crosstalk vs. Frequency (Forward → Reverse) PBout (HA12193F)



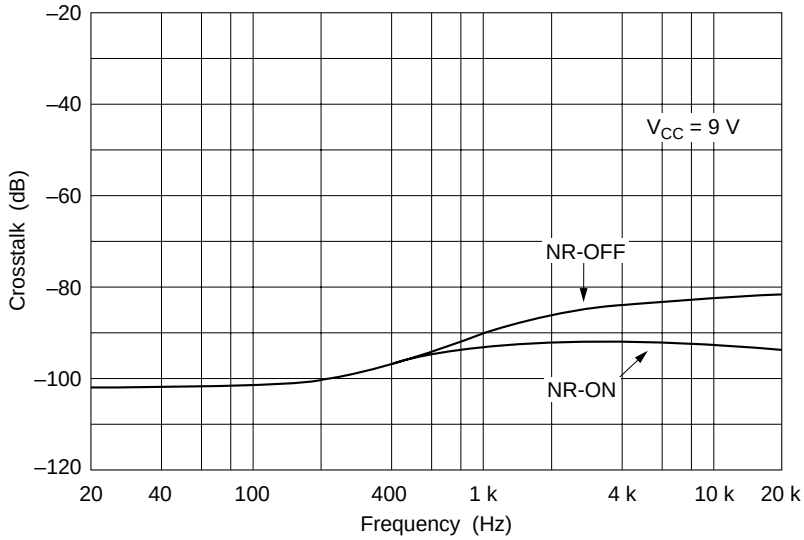
Crosstalk vs. Frequency (Reverse → Forward) PBout (HA12193F)



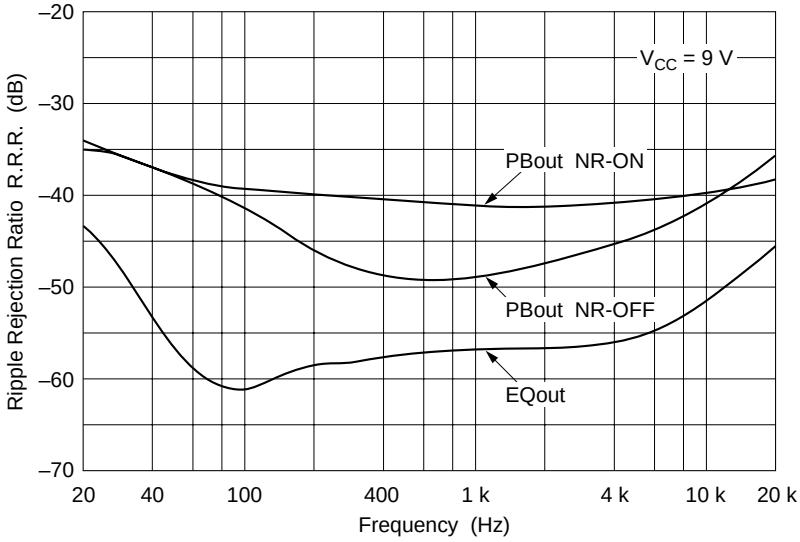
Crosstalk vs. Frequency (Forward → Reverse) PBout (HA12194F)



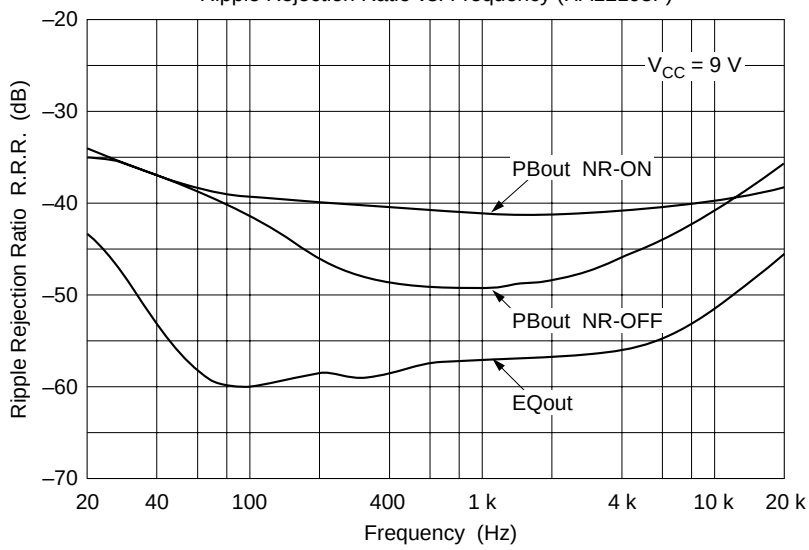
Crosstalk vs. Frequency (Reverse → Forward) PBout (HA12194F)



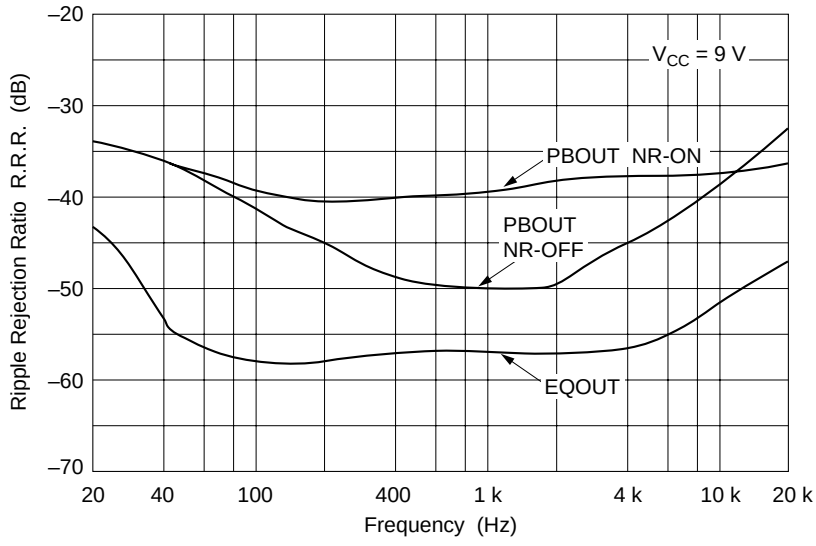
Ripple Rejection Ratio vs. Frequency (HA12192F)



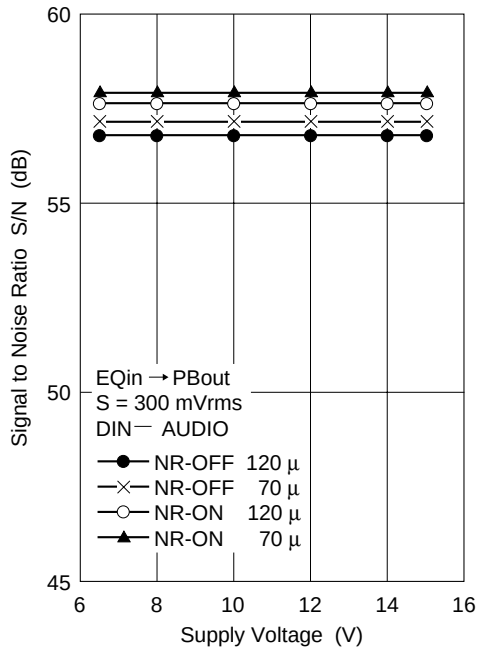
Ripple Rejection Ratio vs. Frequency (HA12193F)



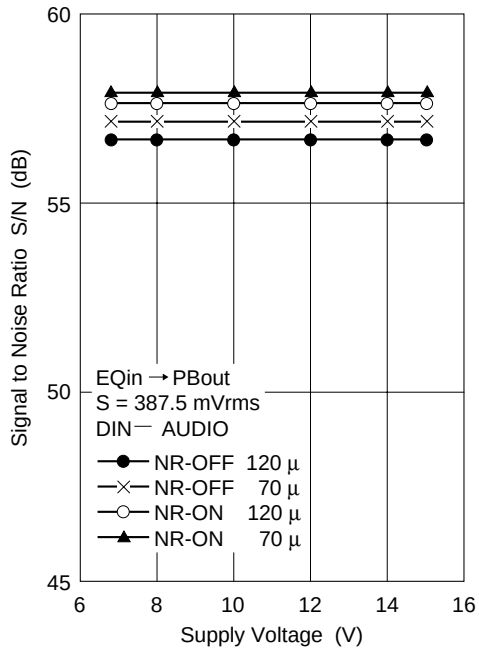
Ripple Rejection Ratio vs. Frequency (HA12194F)



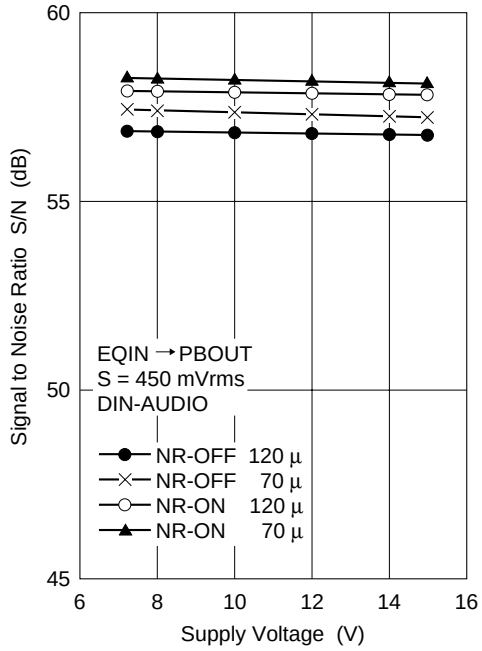
Signal to Noise Ratio vs.
Supply Voltage (HA12192F)



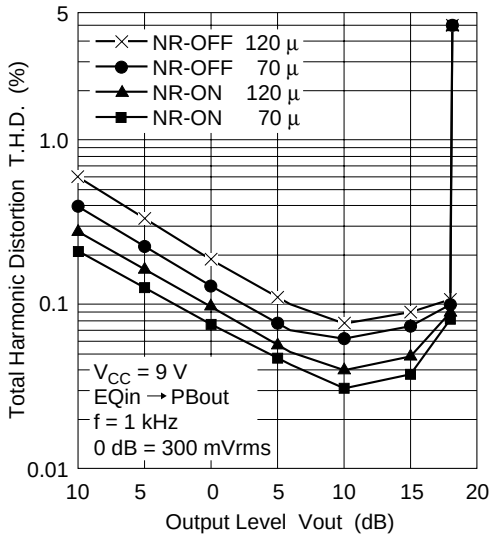
Signal to Noise Ratio vs.
Supply Voltage (HA12193F)



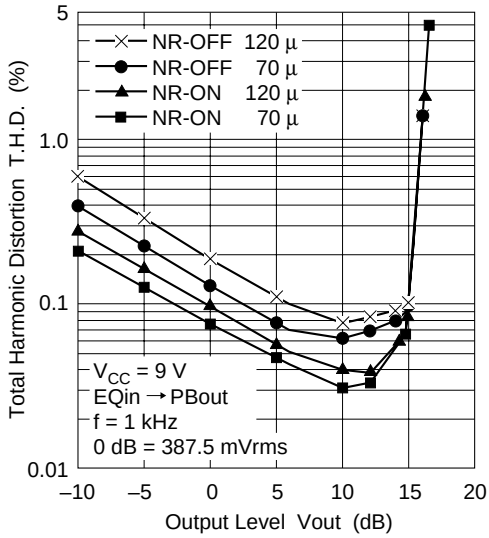
Signal to Noise Ratio vs.
Supply Voltage (HA12194F)



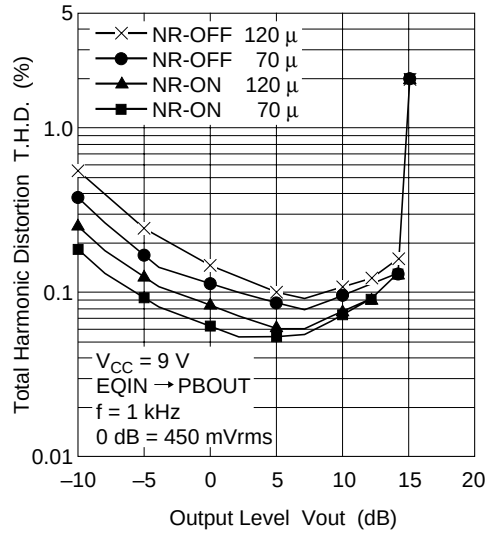
Total Harmonic Distortion vs.
Output Level (HA12192F)



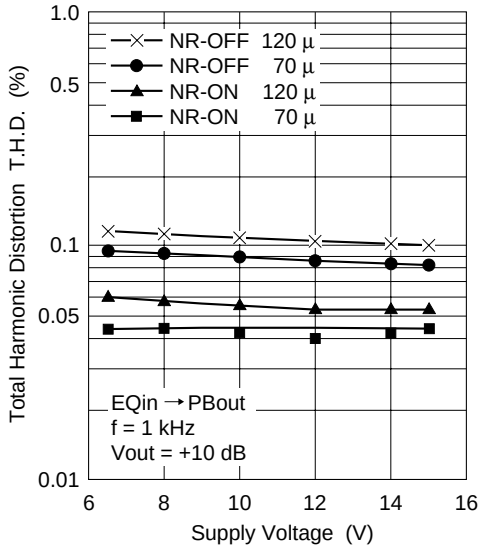
Total Harmonic Distortion vs.
Output Level (HA12193F)



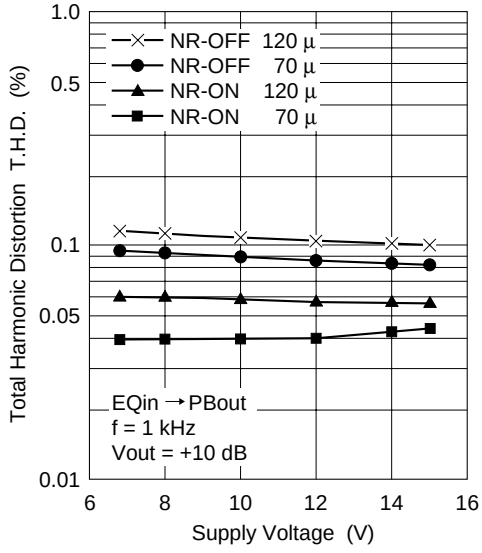
Total Harmonic Distortion vs.
Output Level (HA12194F)



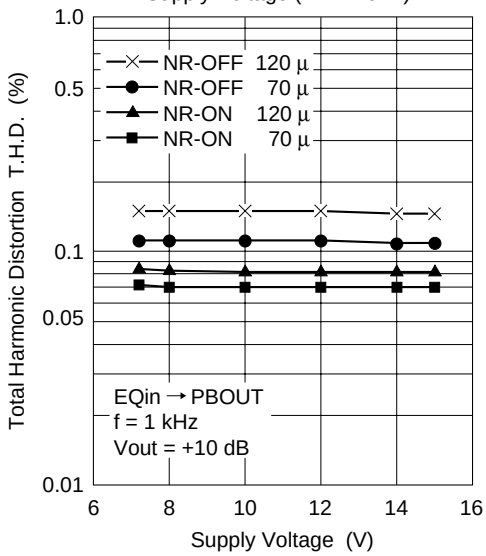
Total Harmonic Distortion vs.
Supply Voltage (HA12192F)



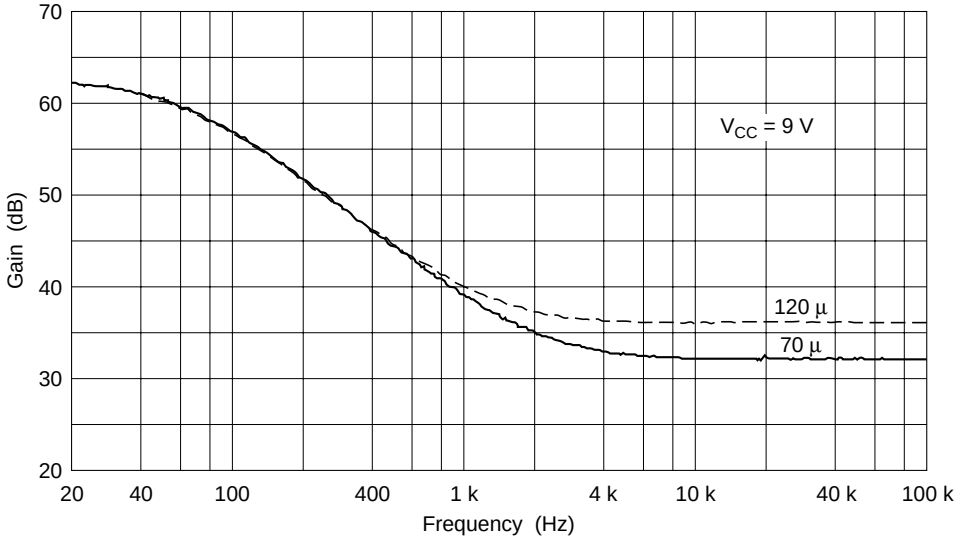
Total Harmonic Distortion vs.
Supply Voltage (HA12193F)



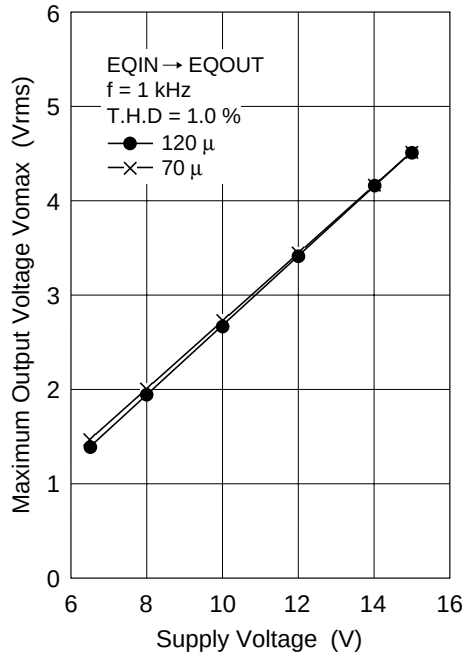
Total Harmonic Distortion vs.
Supply Voltage (HA12194F)



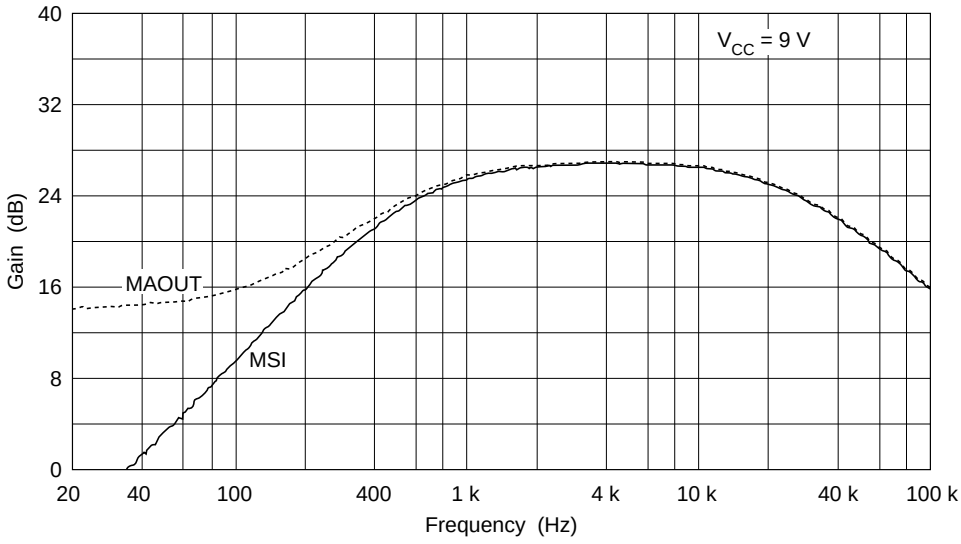
EQ AMP. Gain vs. Frequency (HA12192F/3F/4F)



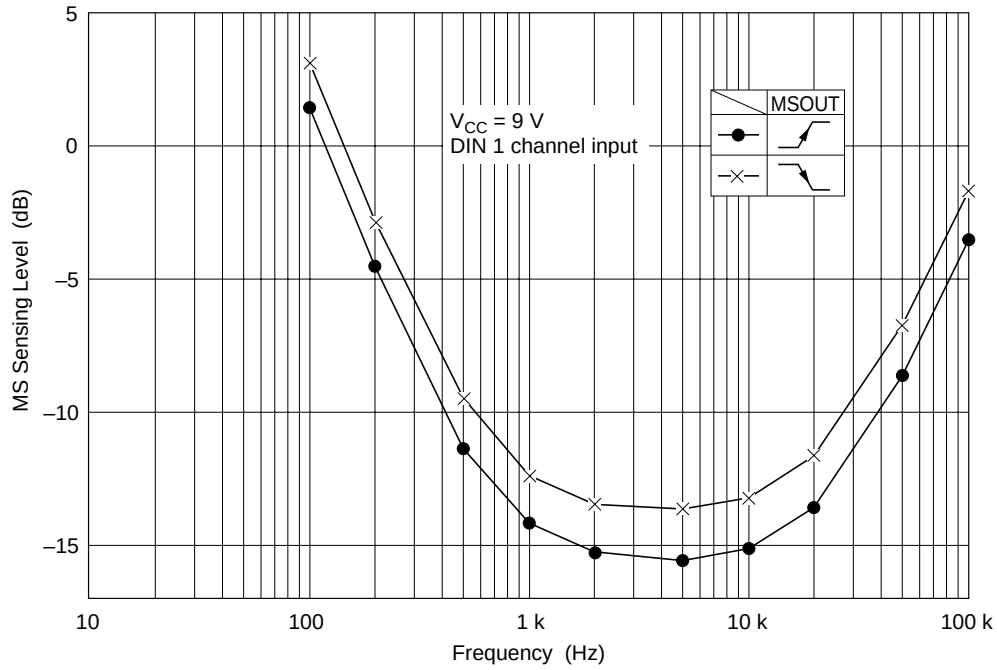
Maximum Output Voltage vs.
Supply Voltage (HA12192F/3F/4F)



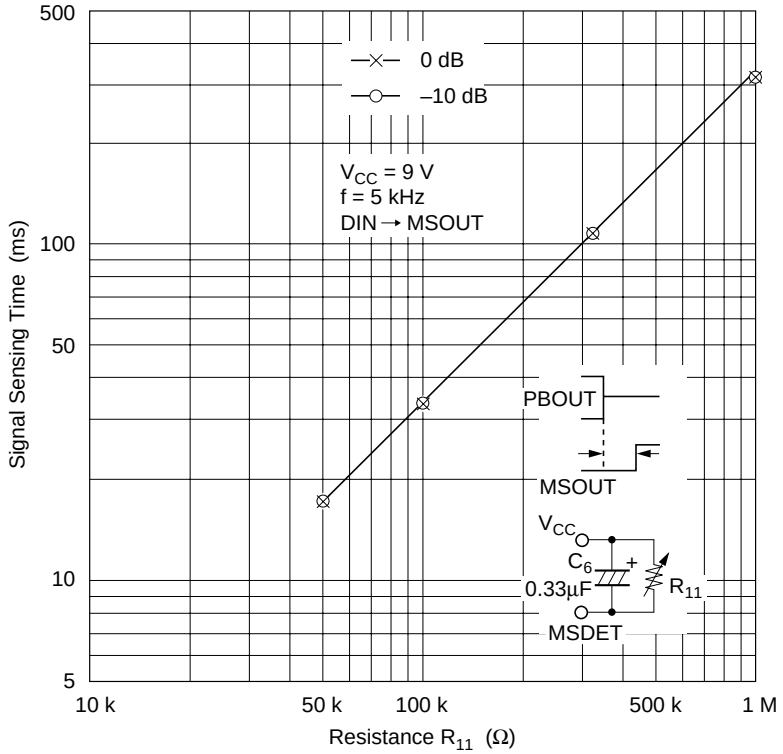
MS-AMP Gain vs. Frequency (HA12192F/3F/4F)

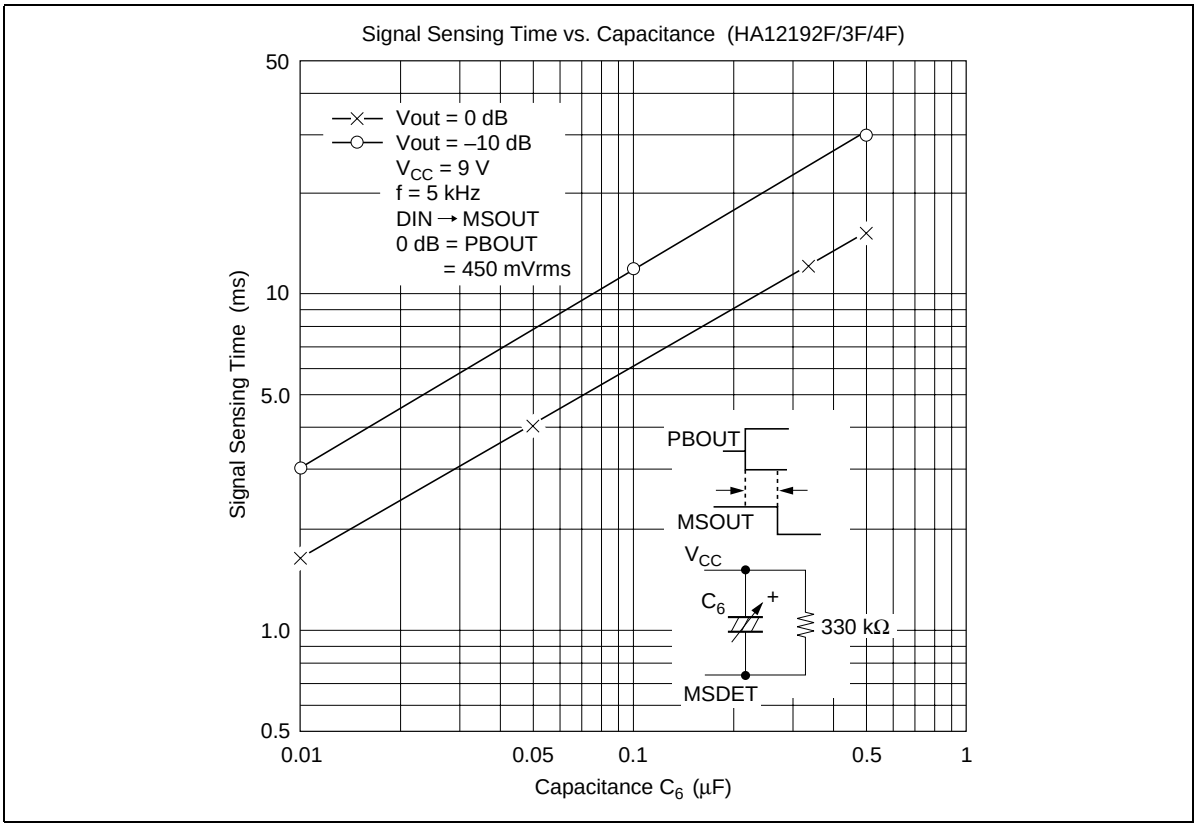


MS Sensing vs. Frequency (HA12192F/3F/4F)

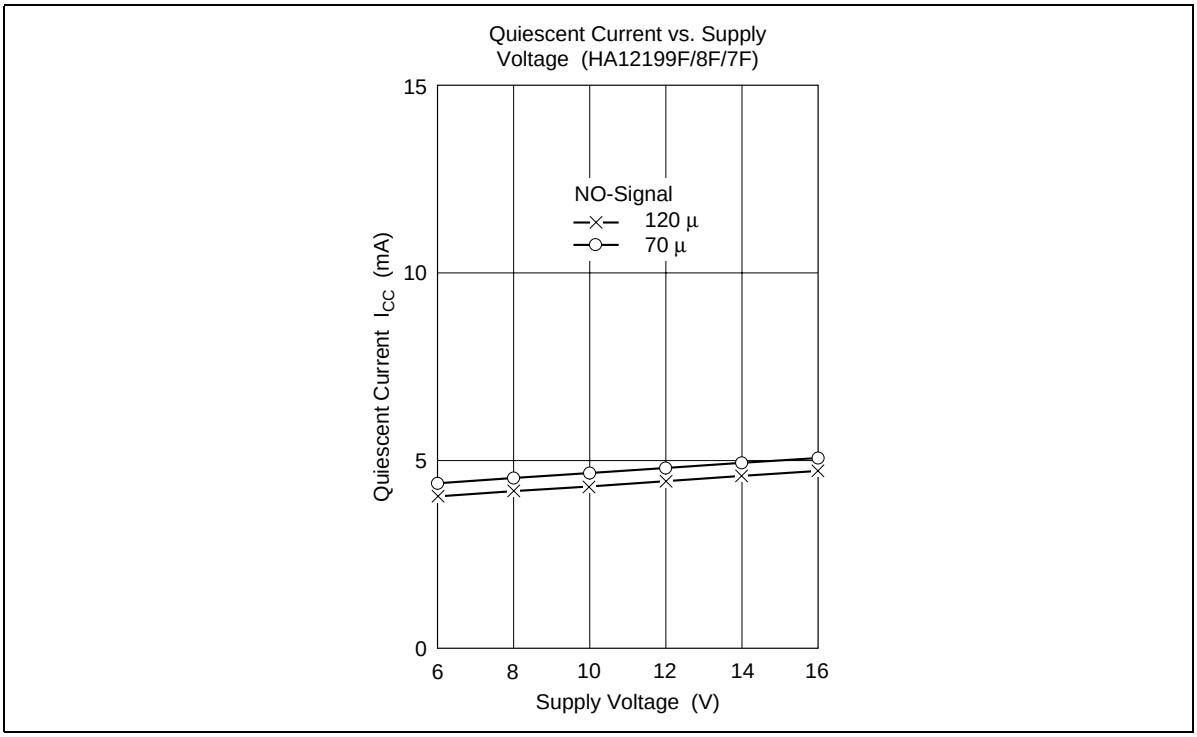


Signal Sensing Time vs. Resistance (HA12192F/3F/4F)

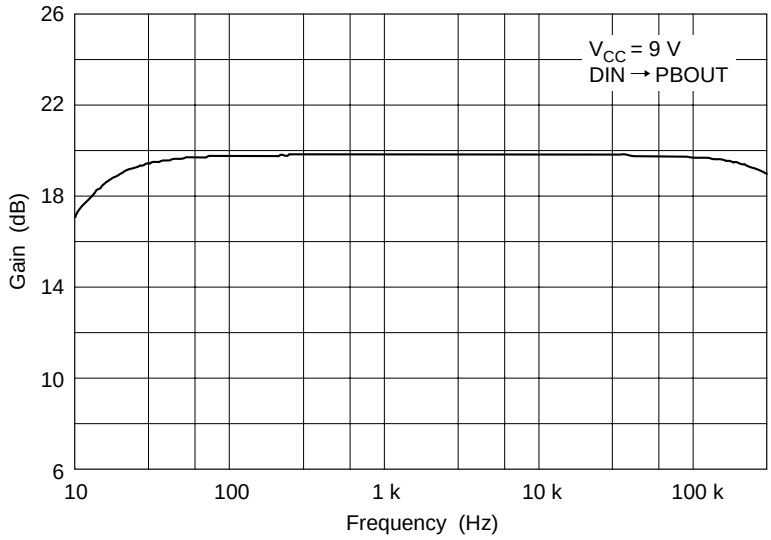



Signal Sensing Time vs. Capacitance (HA12192F/3F/4F)
Vout = 0 dB
Vout = –10 dB
V_{CC} = 9 V
f = 5 kHz
DIN → MSOUT
0 dB = PBOUT
= 450 mVrms
Signal Sensing Time (ms)
50
10
5.0
1.0
0.5
0.01
0.05
0.1
0.5
1
Capacitance C_6 (µF)
PBOUT
MSOUT
V_{CC}
C_6
+
330 kΩ
MSDET

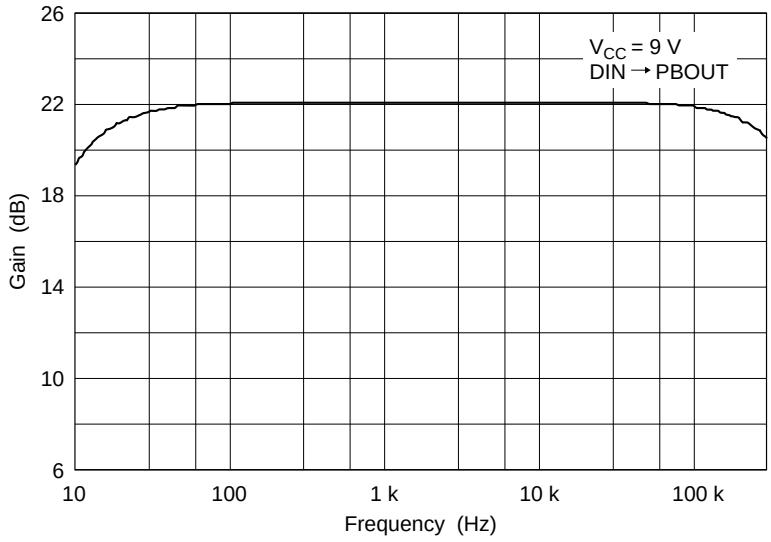
- HA12197F Series



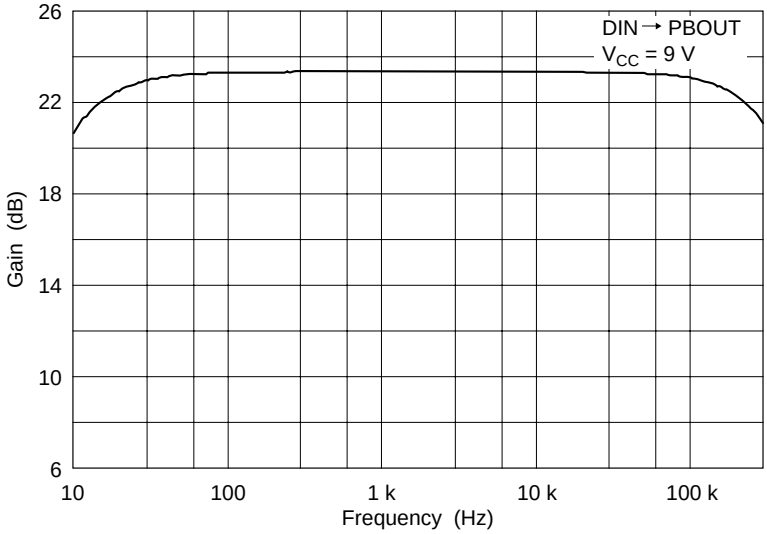
Input Amp. Gain vs. Frequency (HA12197F)



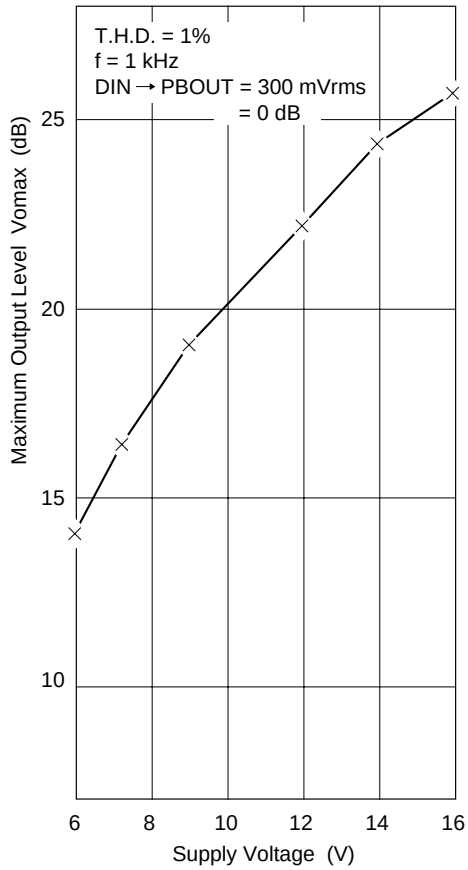
Input Amp. Gain vs. Frequency (HA12198F)



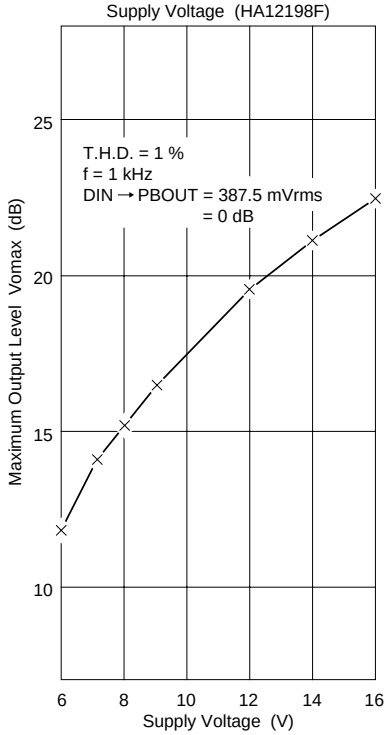
Input Amp. Gain vs. Frequency (HA12199F)



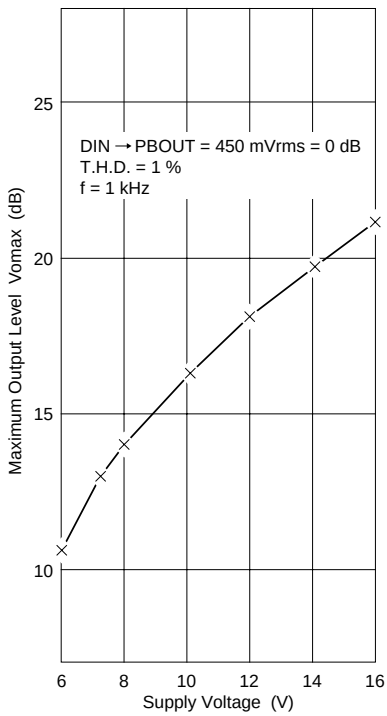
Maximum Output Level vs.
Supply Voltage (HA12197F)



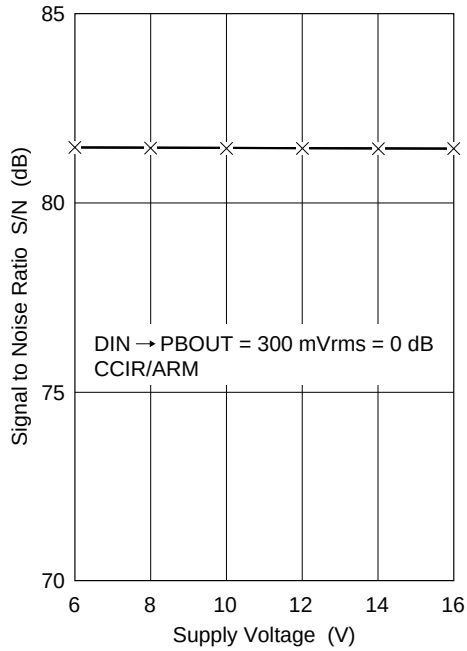
Maximum Output Level vs.
Supply Voltage (HA12198F)



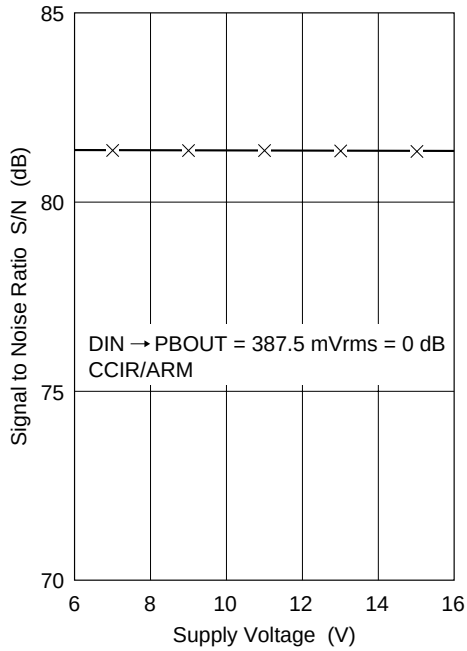
Maximum Output Level vs.
Supply Voltage (HA12199F)



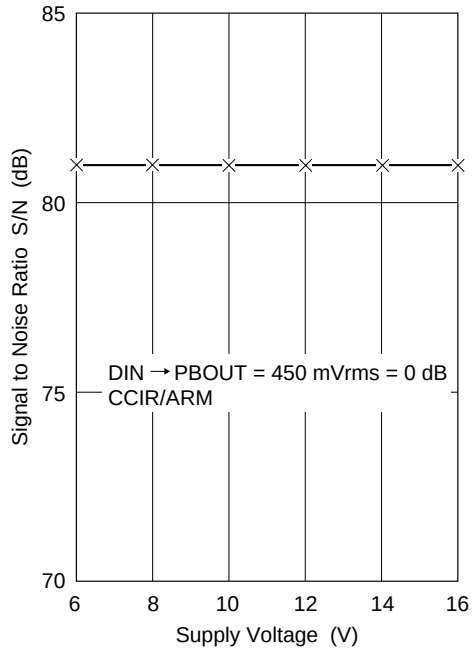
Signal to Noise Ratio vs.
Supply Voltage (HA12197F)



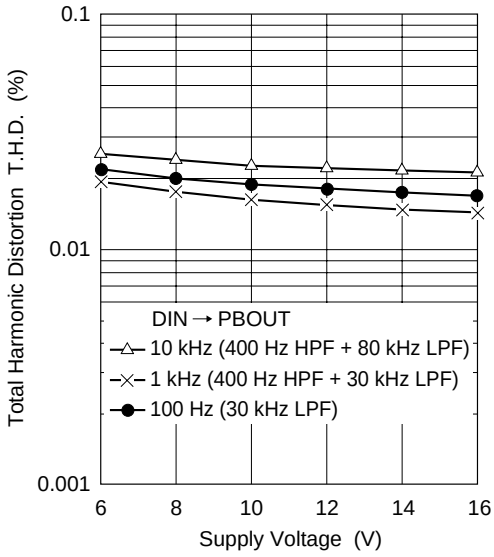
Signal to Noise Ratio vs.
Supply Voltage (HA12198F)



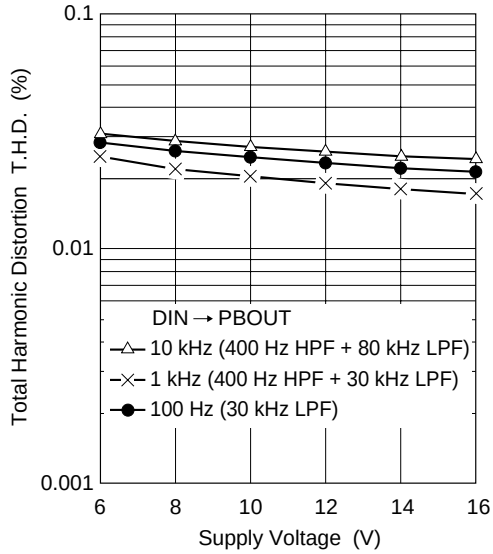
Signal to Noise Ratio vs.
Supply Voltage (HA12199F)



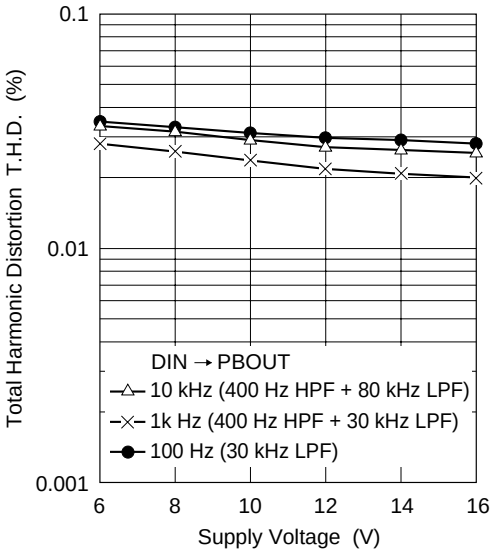
Total Harmonic Distortion vs.
Supply Voltage (HA12197F)



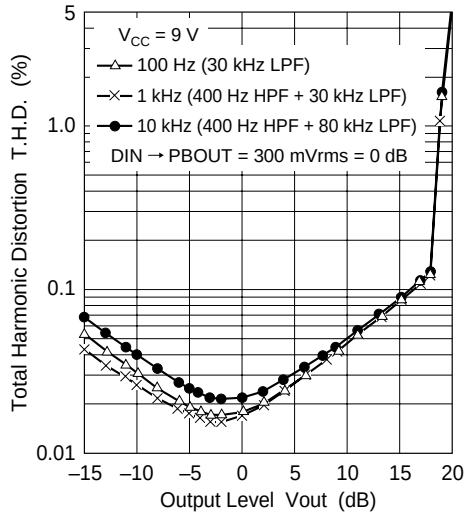
Total Harmonic Distortion vs.
Supply Voltage (HA12198F)



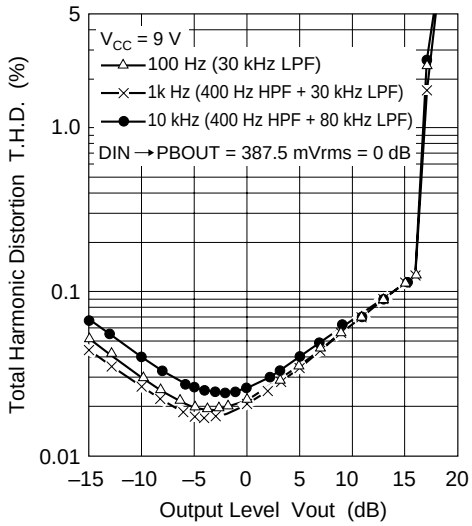
Total Harmonic Distortion vs.
Supply Voltage (HA12199F)



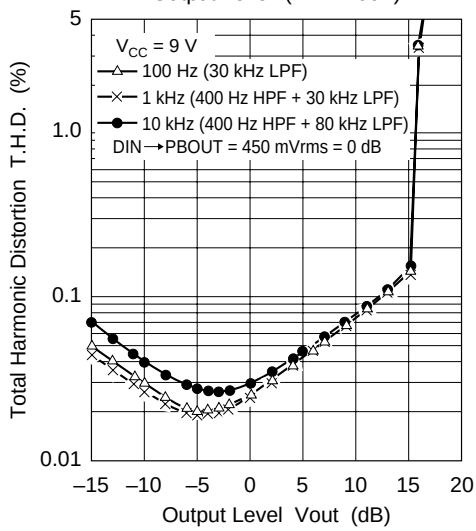
Total Harmonic Distortion vs.
Output Level (HA12197F)



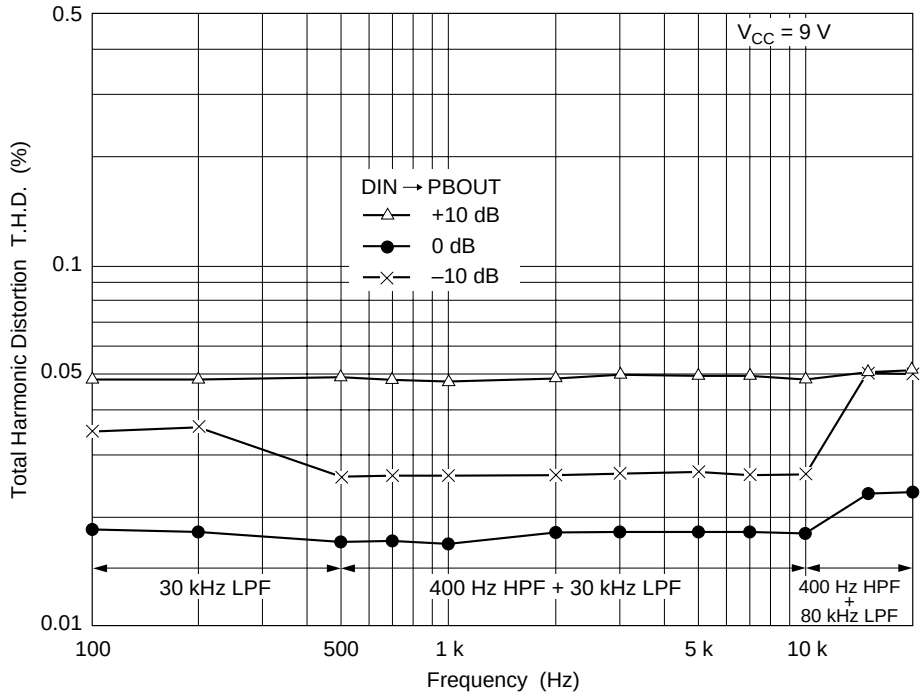
Total Harmonic Distortion vs.
Output Level (HA12198F)



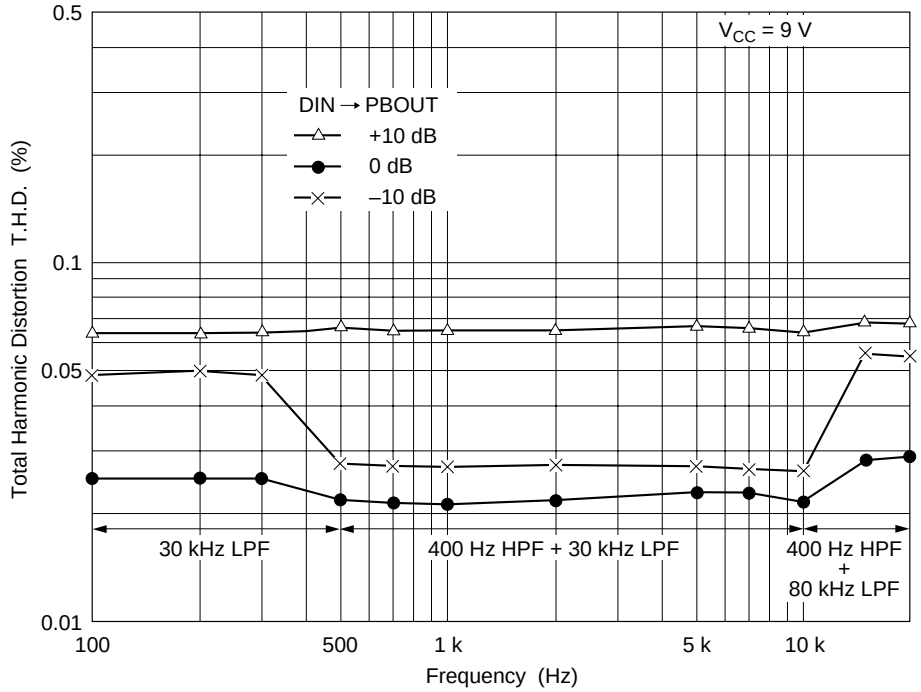
Total Harmonic Distortion vs.
Output Level (HA12199F)



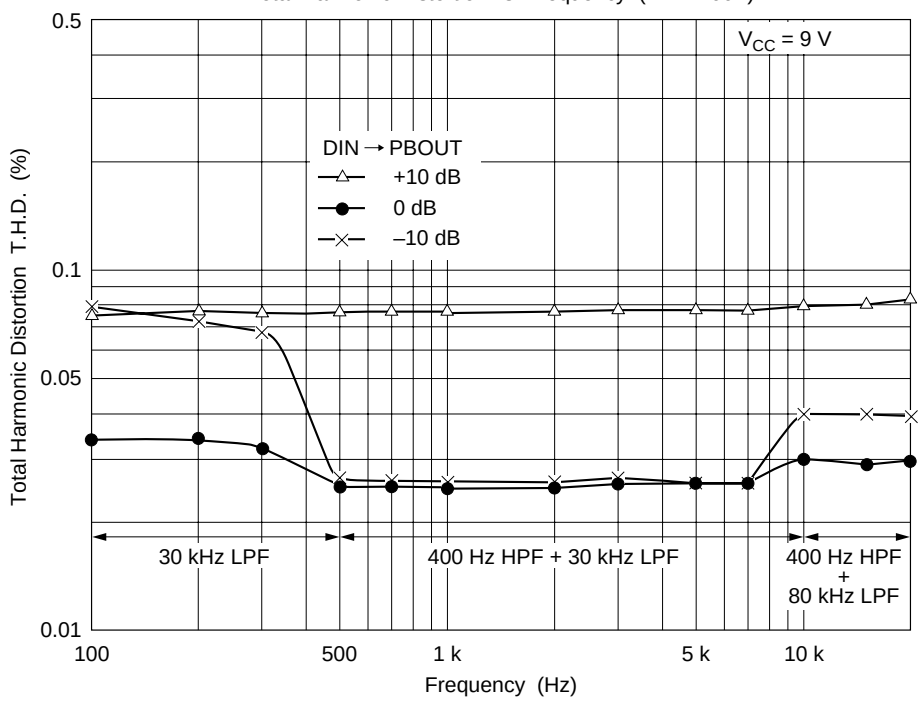
Total Harmonic Distortion vs. Frequency (HA12197F)



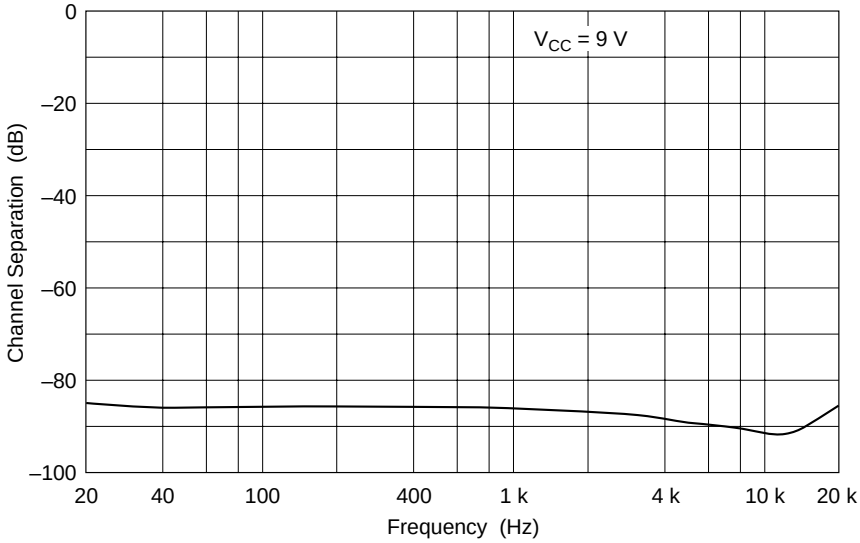
Total Harmonic Distortion vs. Frequency (HA12198F)



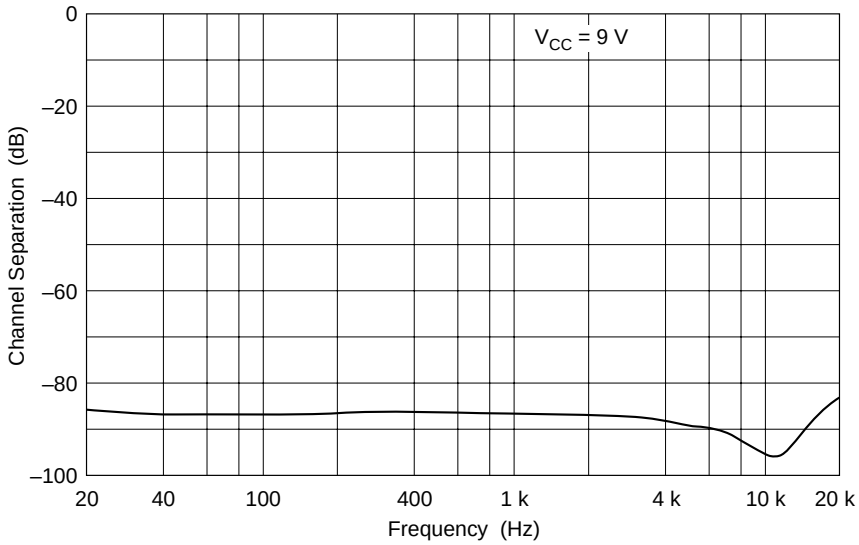
Total Harmonic Distortion vs. Frequency (HA12199F)



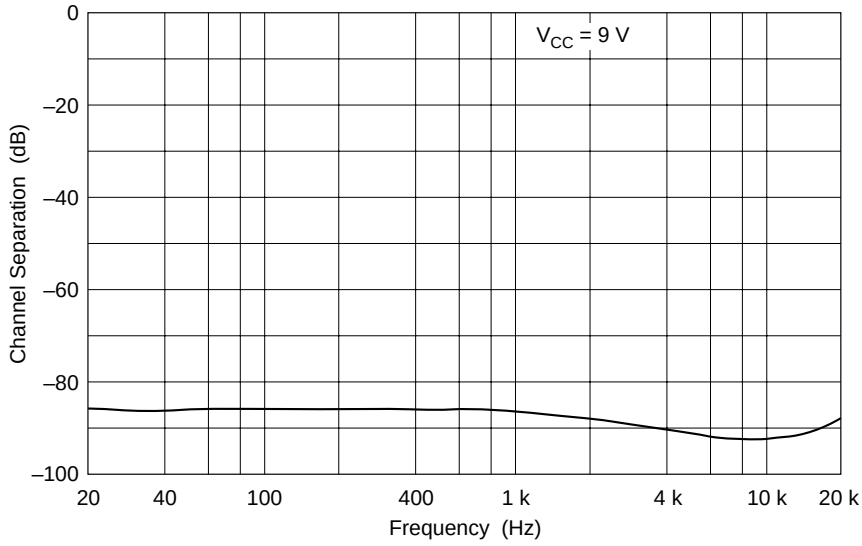
Channel Separation vs. Frequency (L → R) DIN → PBOUT (HA12197F)



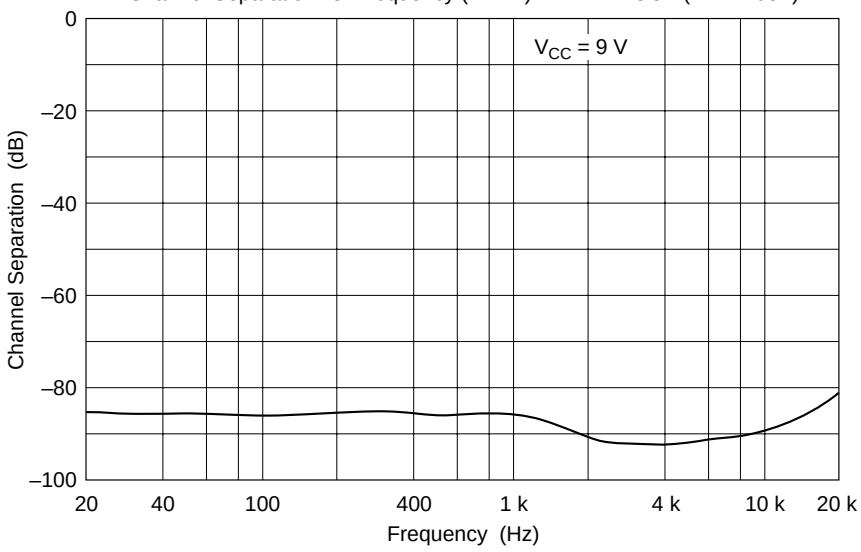
Channel Separation vs. Frequency (R → L) DIN → PBOUT (HA12197F)



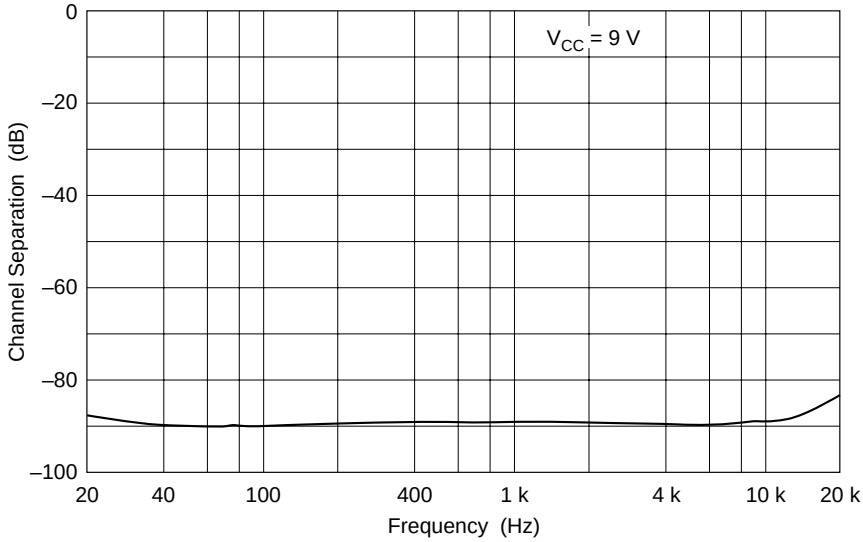
Channel Separation vs. Frequency (L → R) DIN → PBOUT (HA12198F)



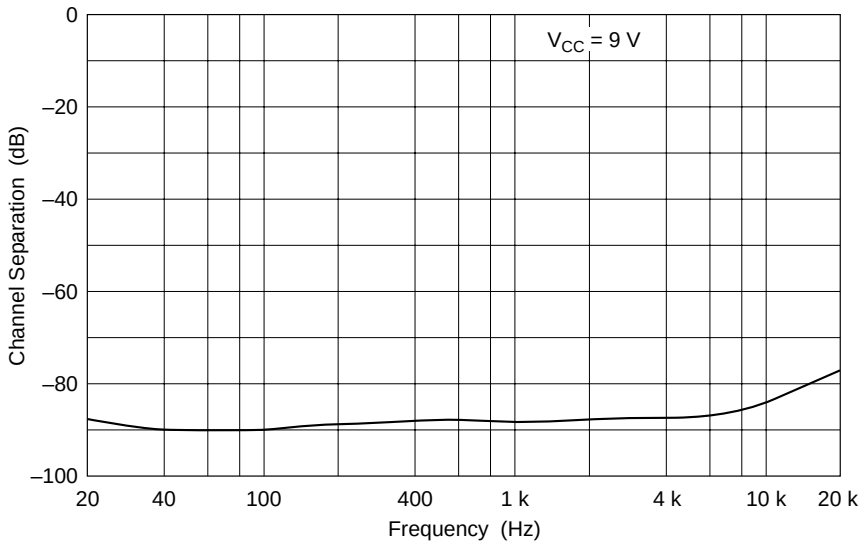
Channel Separation vs. Frequency (R → L) DIN → PBOUT (HA12198F)



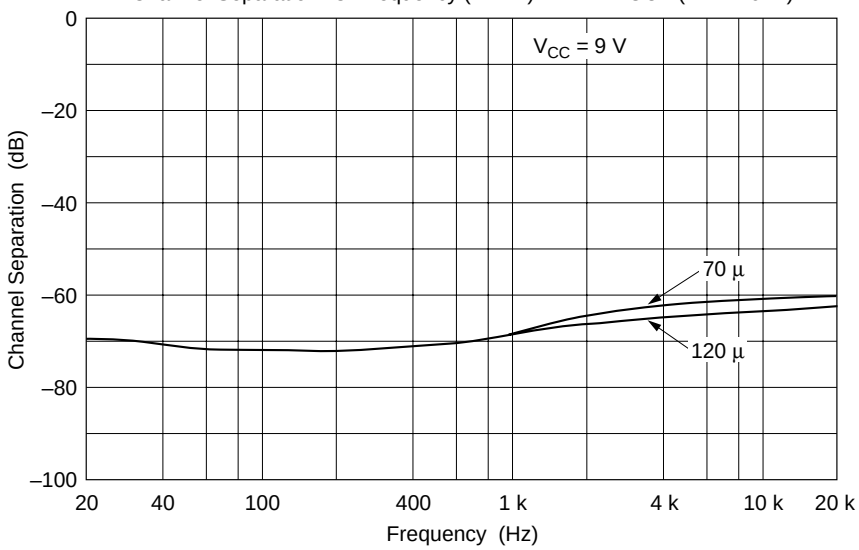
Channel Separation vs. Frequency (L → R) DIN → PBOUT (HA12199F)



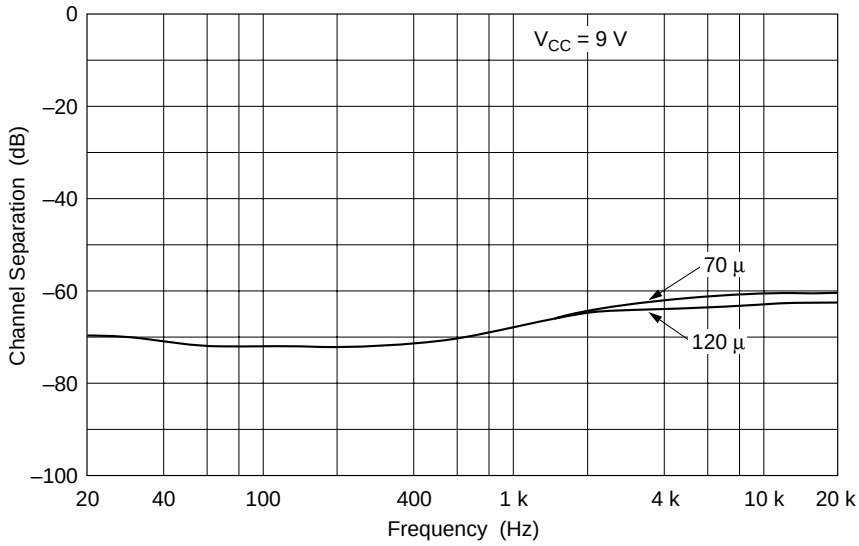
Channel Separation vs. Frequency (R → L) DIN → PBOUT (HA12199F)



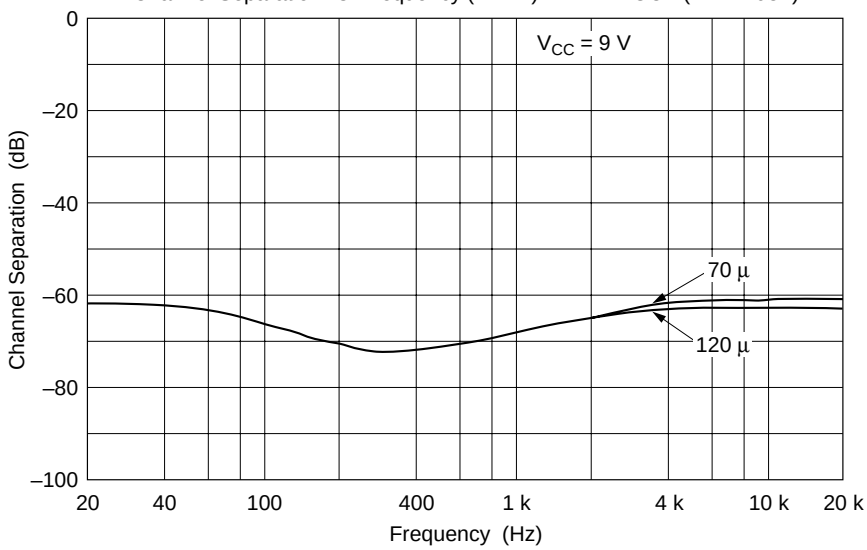
Channel Separation vs. Frequency (L → R) Fin →PBOUT (HA12197F)



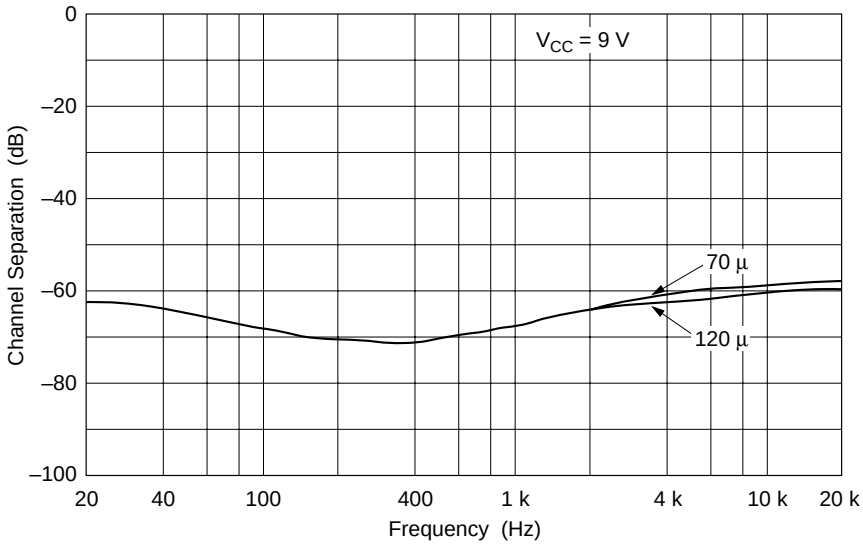
Channel Separation vs. Frequency (R → L) Fin →PBOUT (HA12197F)



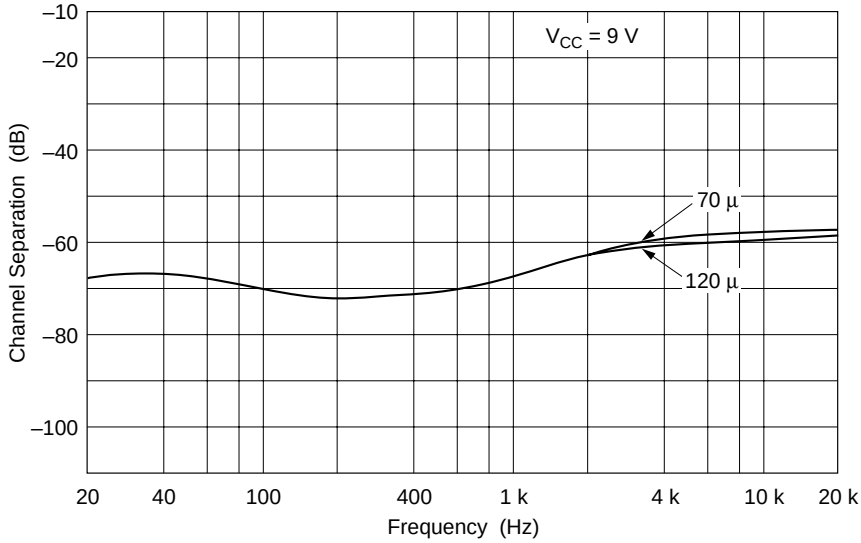
Channel Separation vs. Frequency (L → R) Fin → PBOUT (HA12198F)



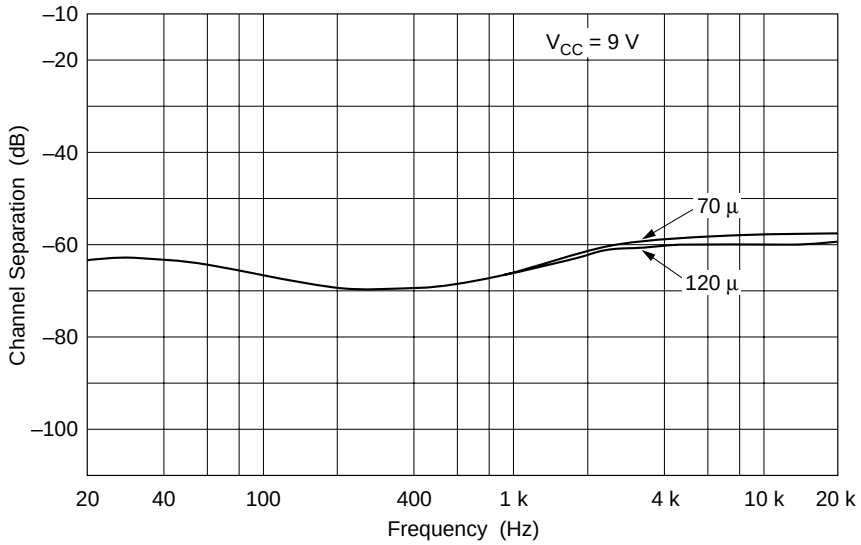
Channel Separation vs. Frequency (R → L) Fin → PBOUT (HA12198F)



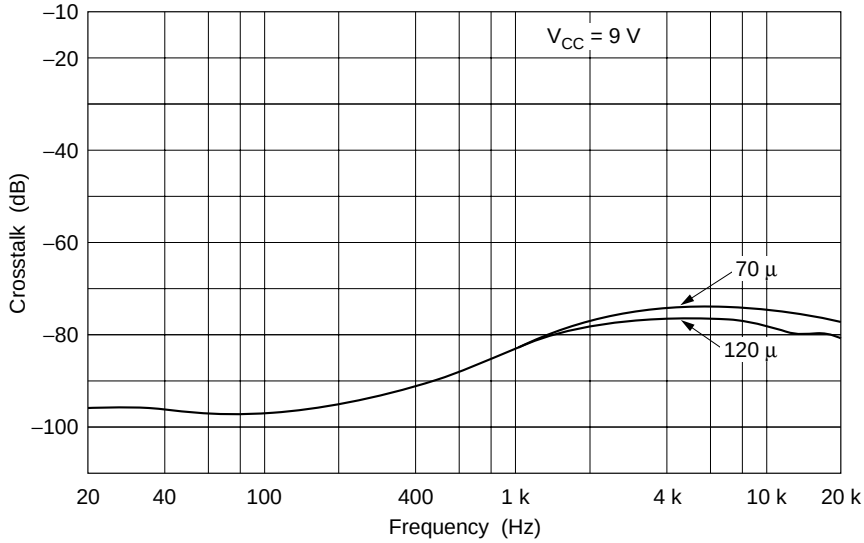
Channel Separation vs. Frequency (L → R) Fin → PBOUT (HA12199F)



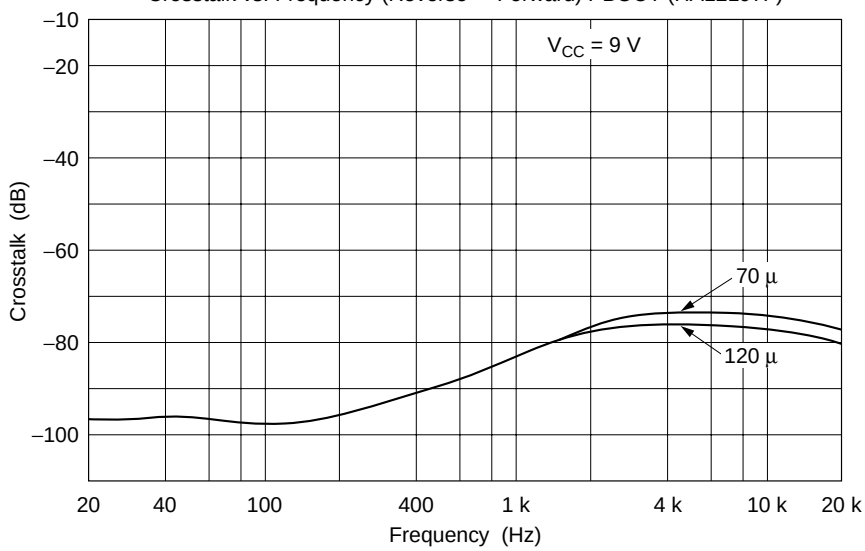
Channel Separation vs. Frequency (R → L) Fin → PBOUT (HA12199F)



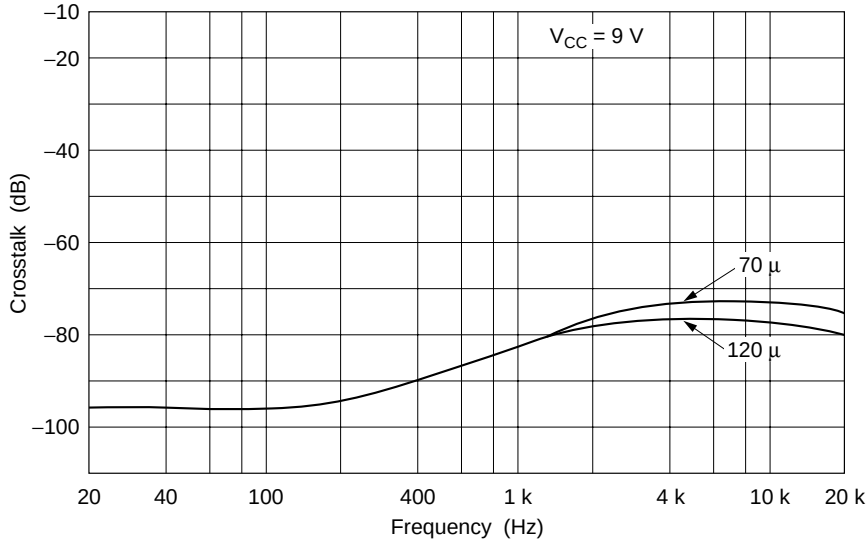
Crosstalk vs. Frequency (Forward → Reverse) PBOUT (HA12197F)



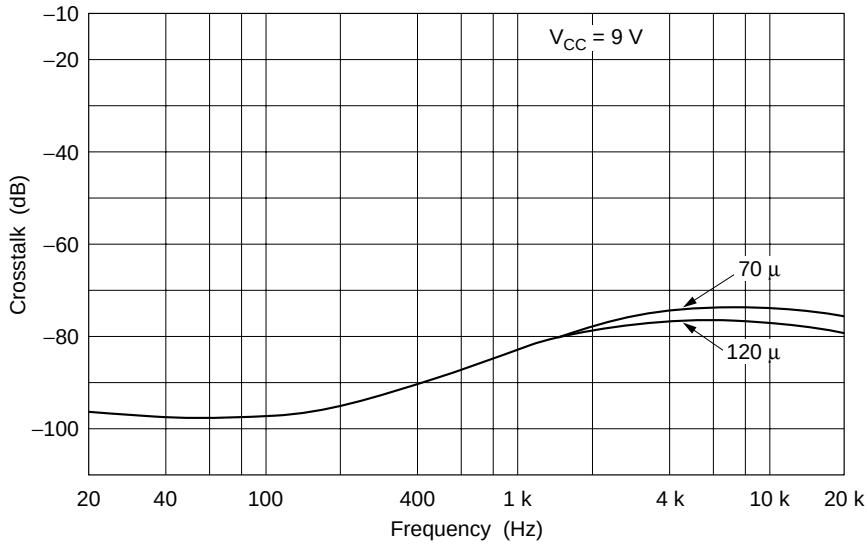
Crosstalk vs. Frequency (Reverse → Forward) PBOUT (HA12197F)



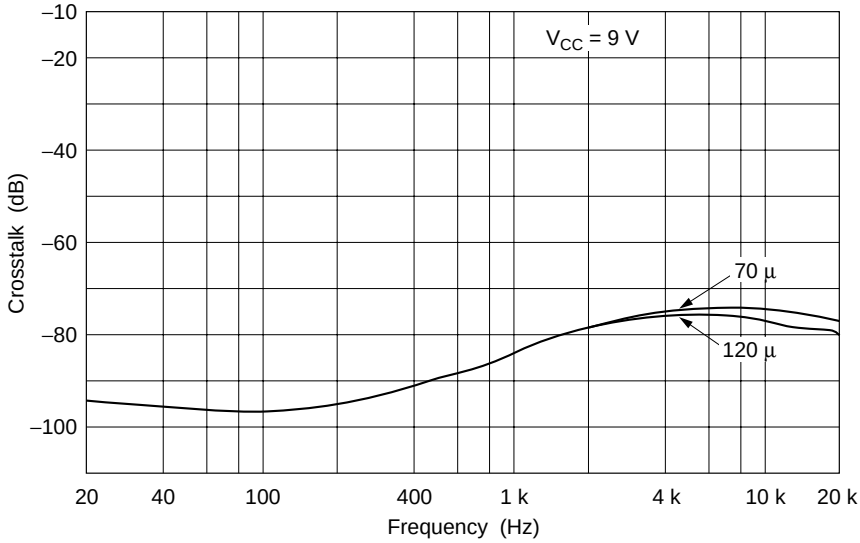
Crosstalk vs. Frequency (Forward → Reverse) PBOUT (HA12198F)



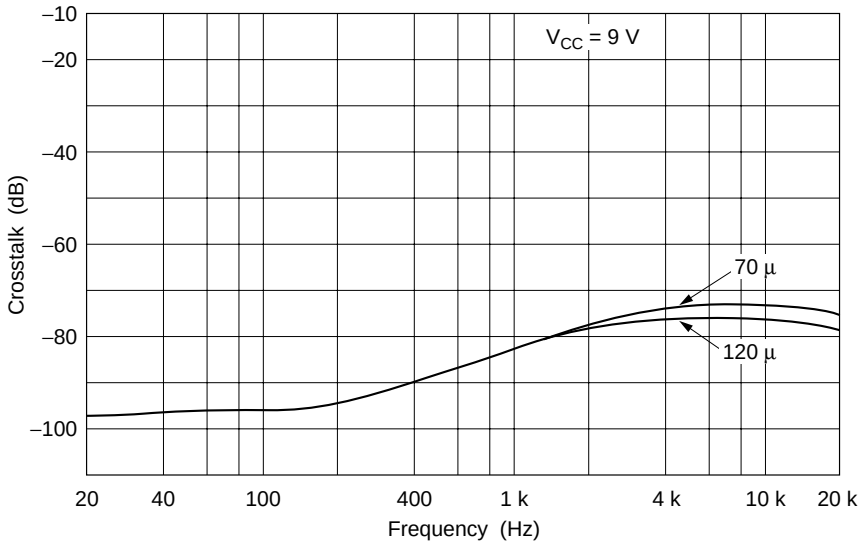
Crosstalk vs. Frequency (Reverse → Forward) PBOUT (HA12198F)



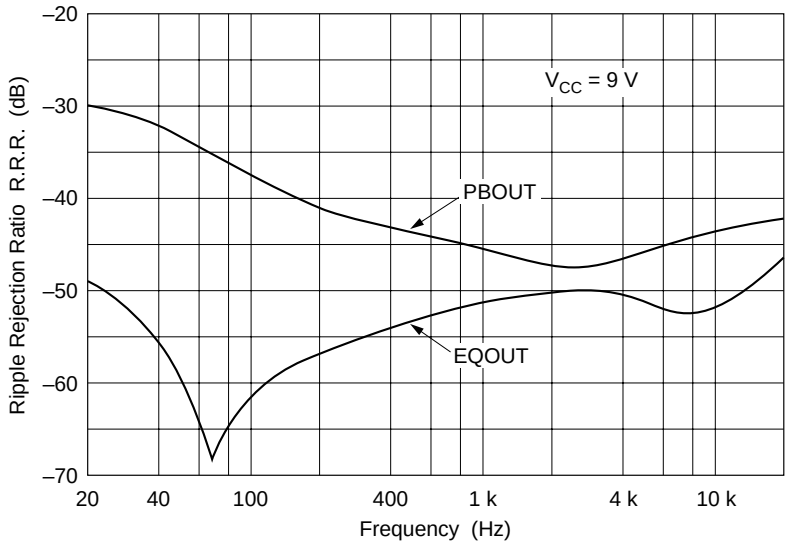
Crosstalk vs. Frequency (Forward → Reverse) PBOUT (HA12199F)



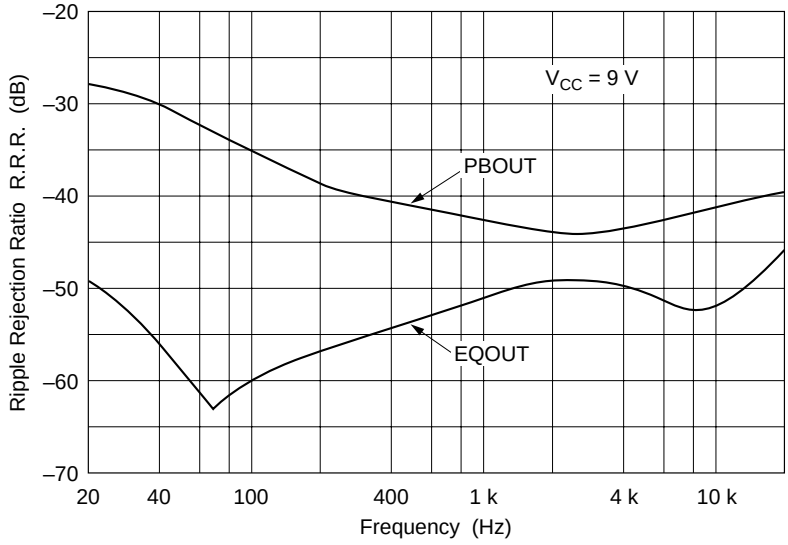
Crosstalk vs. Frequency (Reverse → Forward) PBOUT (HA12199F)



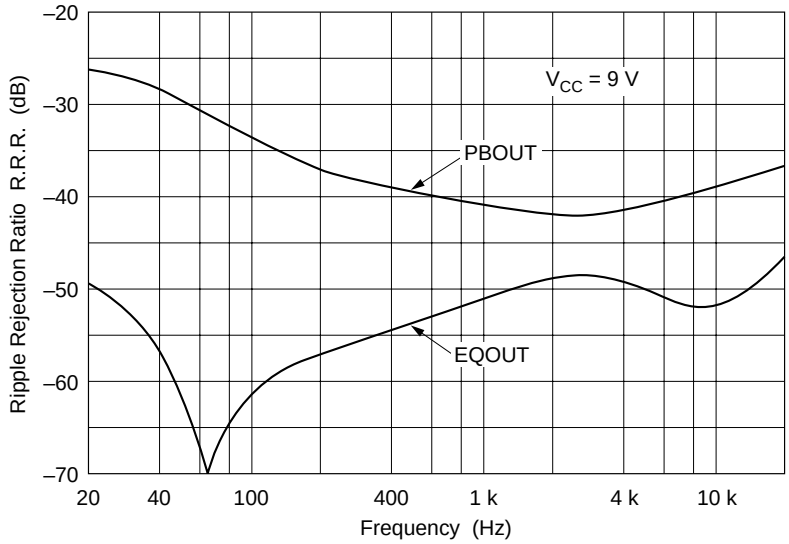
Ripple Rejection Ratio vs. Frequency (HA12197F)



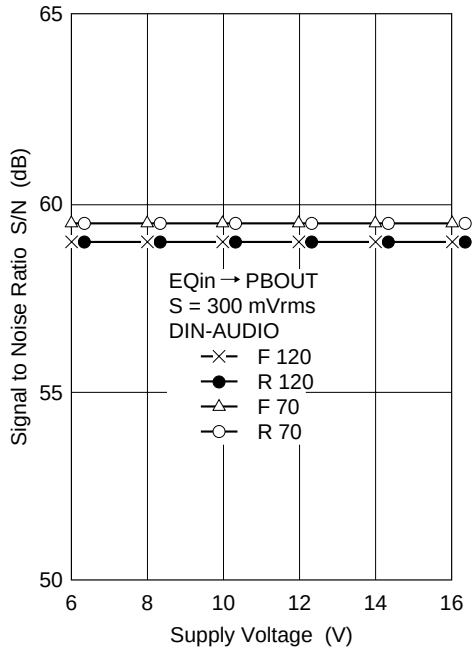
Ripple Rejection Ratio vs. Frequency (HA12198F)



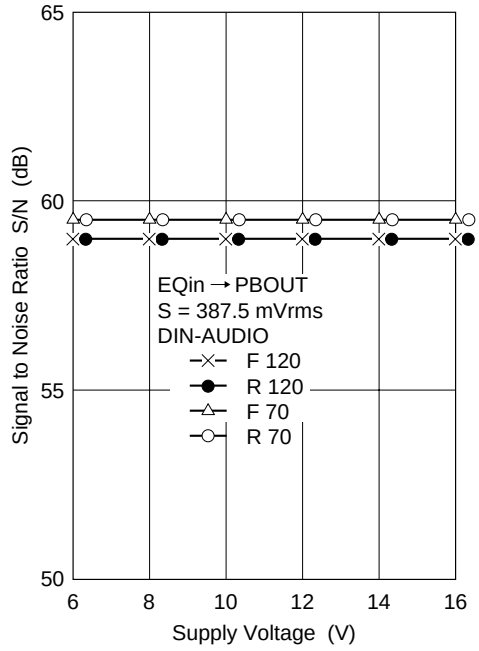
Ripple Rejection Ratio vs. Frequency (HA12199F)



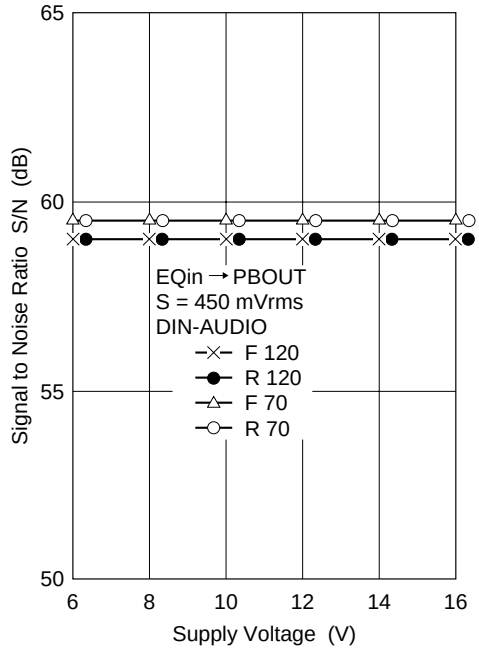
Signal to Noise Ratio vs.
Supply Voltage (HA12197F)



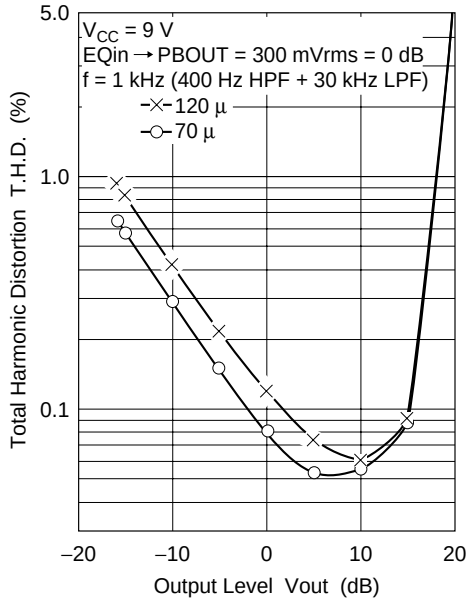
Signal to Noise Ratio vs.
Supply Voltage (HA12198F)



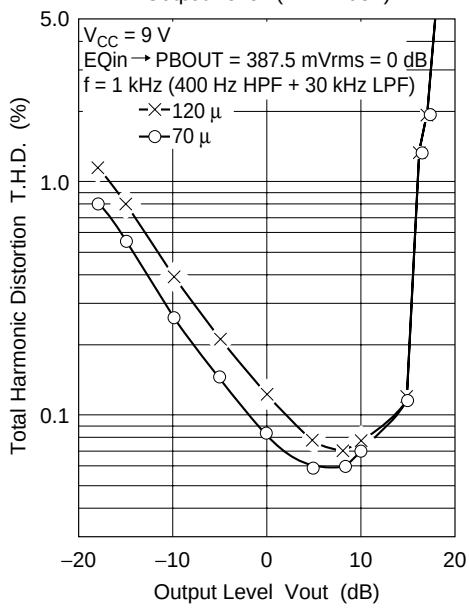
Signal to Noise Ratio vs.
Supply Voltage (HA12199F)



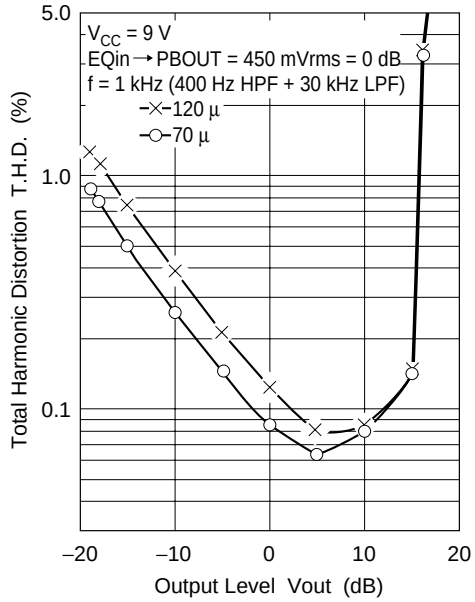
Total Harmonic Distortion vs.
Output Level (HA12197F)



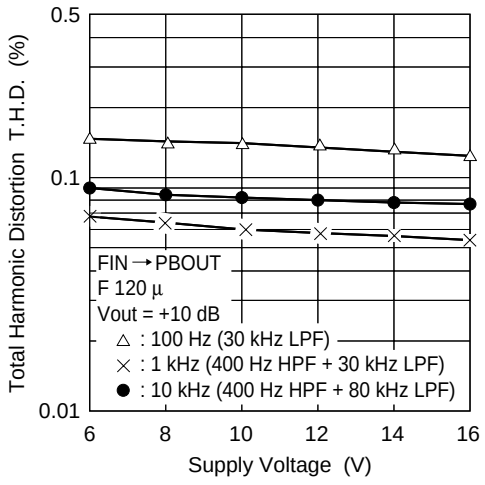
Total Harmonic Distortion vs.
Output Level (HA12198F)



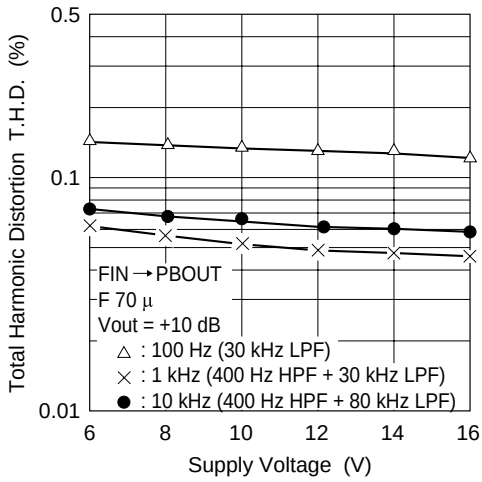
Total Harmonic Distortion vs.
Output Level (HA12199F)



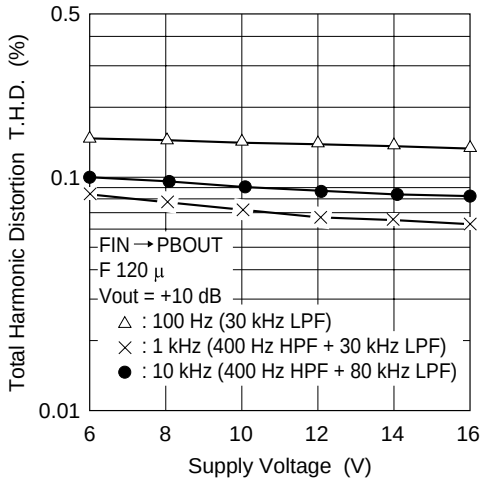
Total Harmonic Distortion vs.
Supply Voltage (1) (HA12197F)



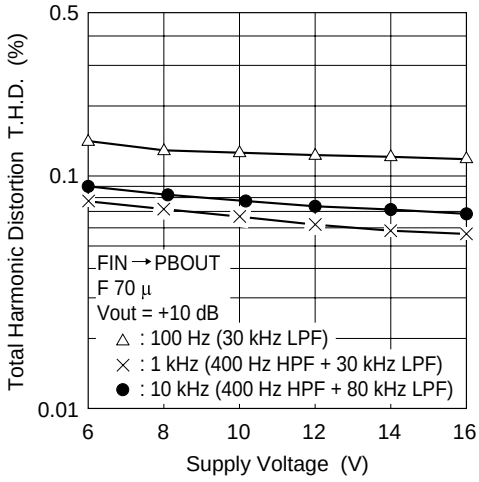
Total Harmonic Distortion vs.
Supply Voltage (2) (HA12197F)



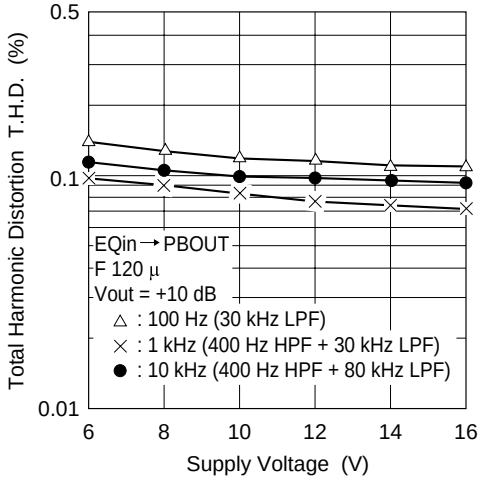
Total Harmonic Distortion vs.
Supply Voltage (1) (HA12198F)



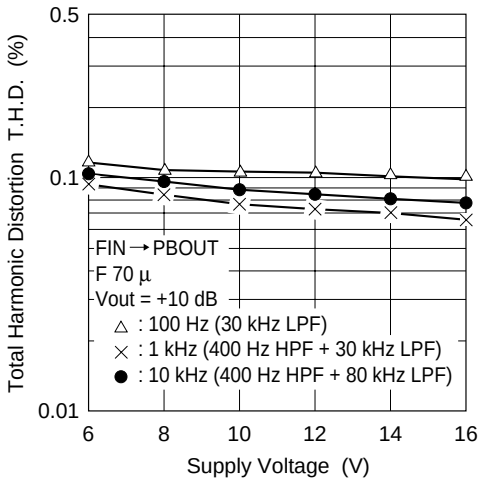
Total Harmonic Distortion vs.
Supply Voltage (2) (HA12198F)



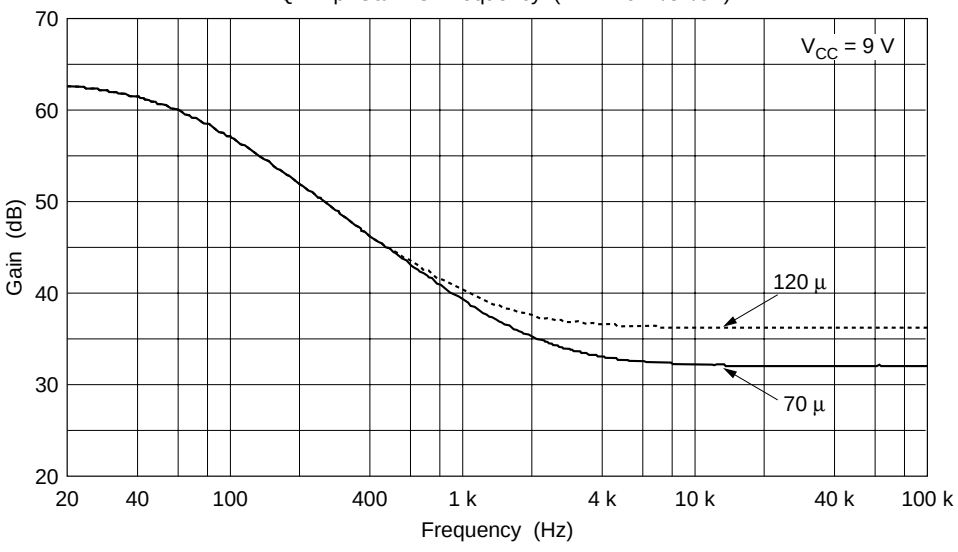
Total Harmonic Distortion vs.
Supply Voltage (1) (HA12199F)



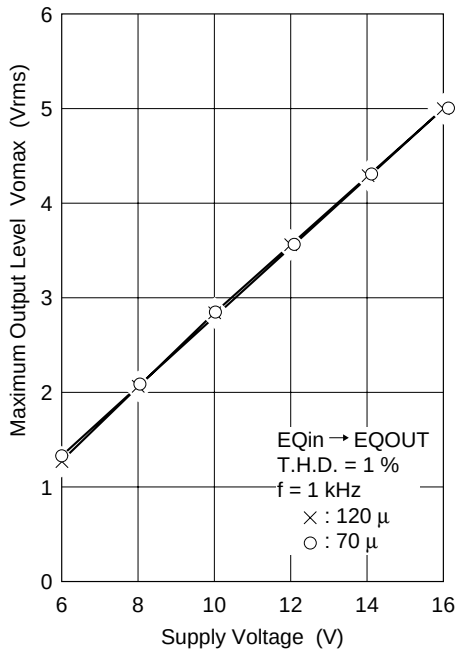
Total Harmonic Distortion vs.
Supply Voltage (2) (HA12199F)



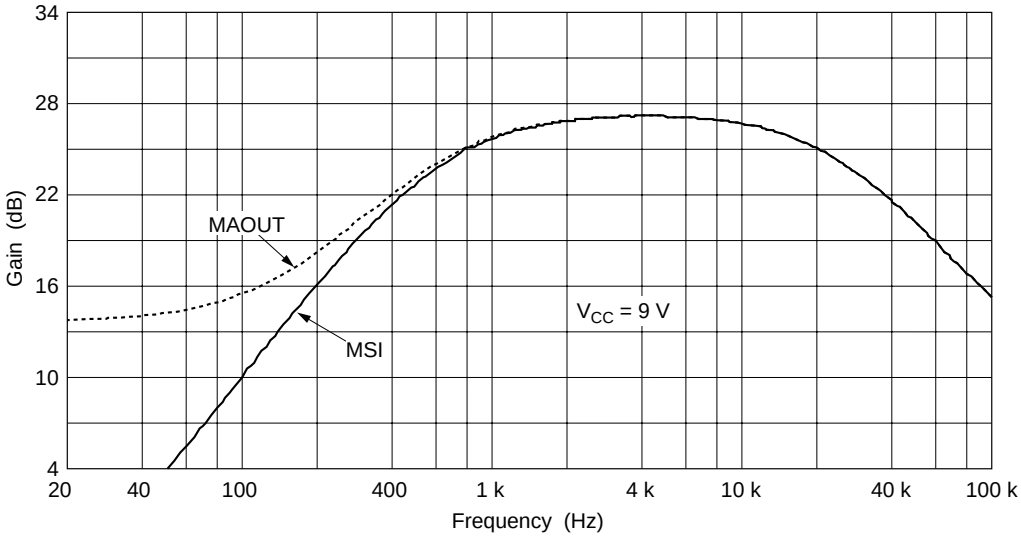
EQ-Amp. Gain vs. Frequency (HA12197F/8F/9F)



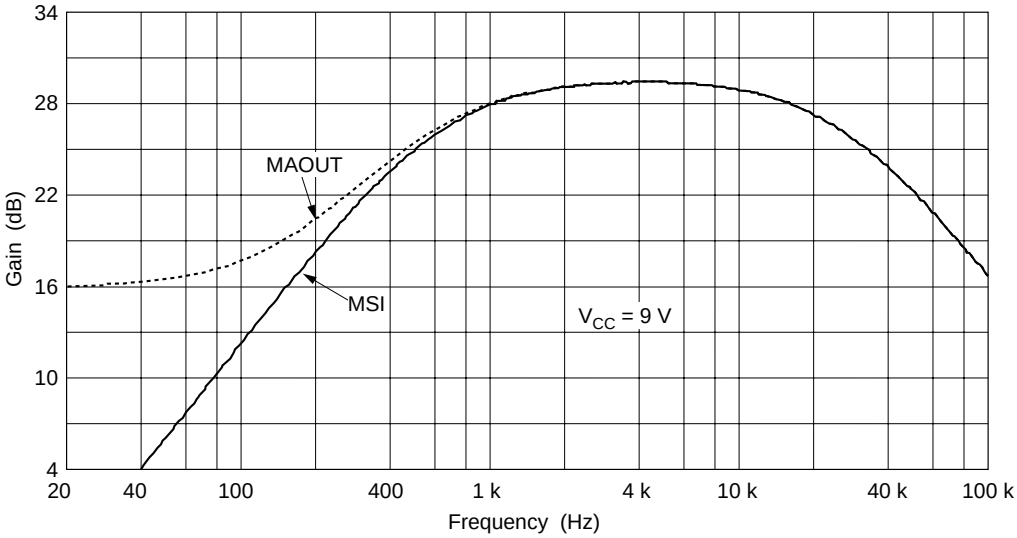
Maximum Output Level vs.
Supply Voltage (HA12197F/8F/9F)



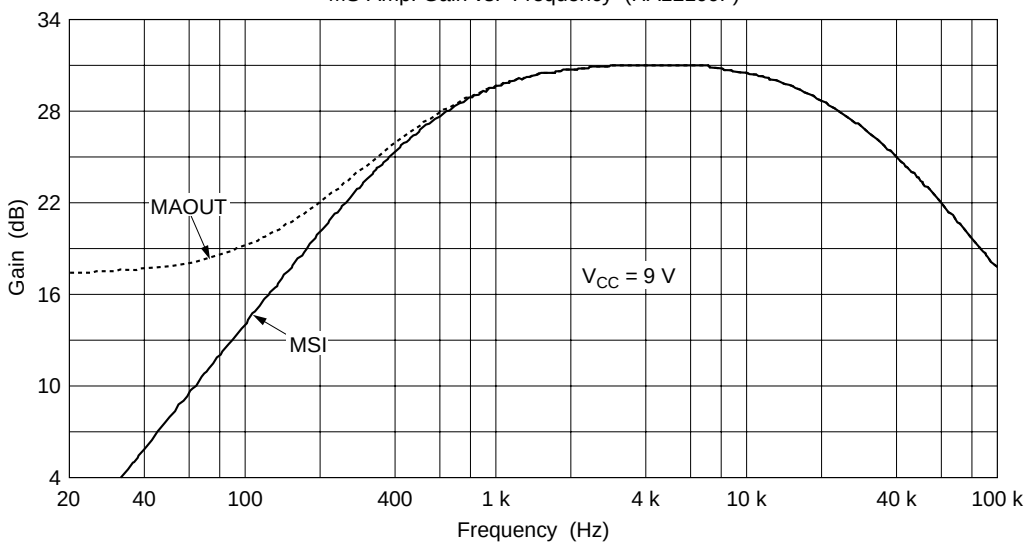
MS-Amp. Gain vs. Frequency (HA12197F)



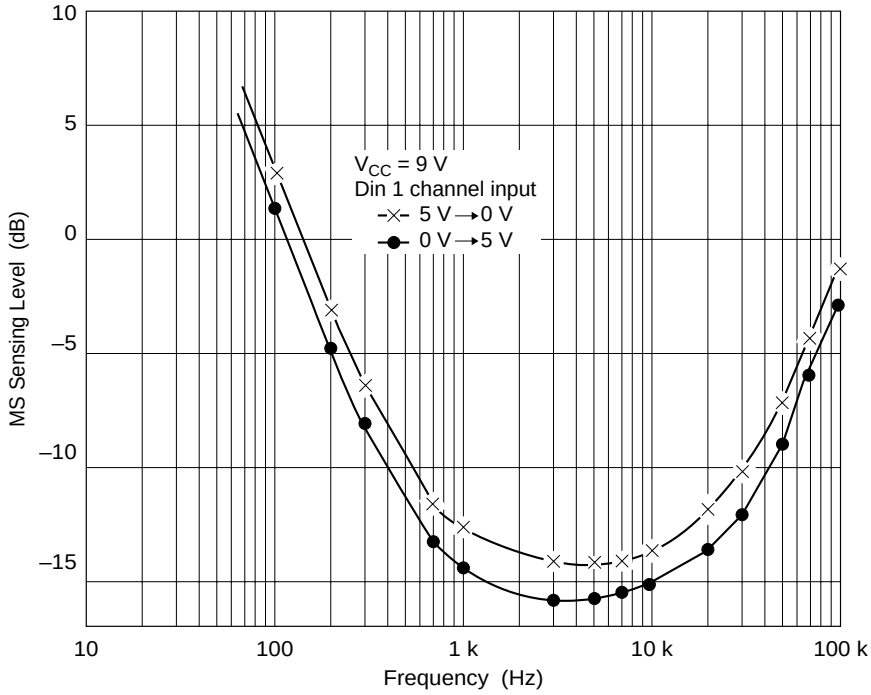
MS-Amp. Gain vs. Frequency (HA12198F)



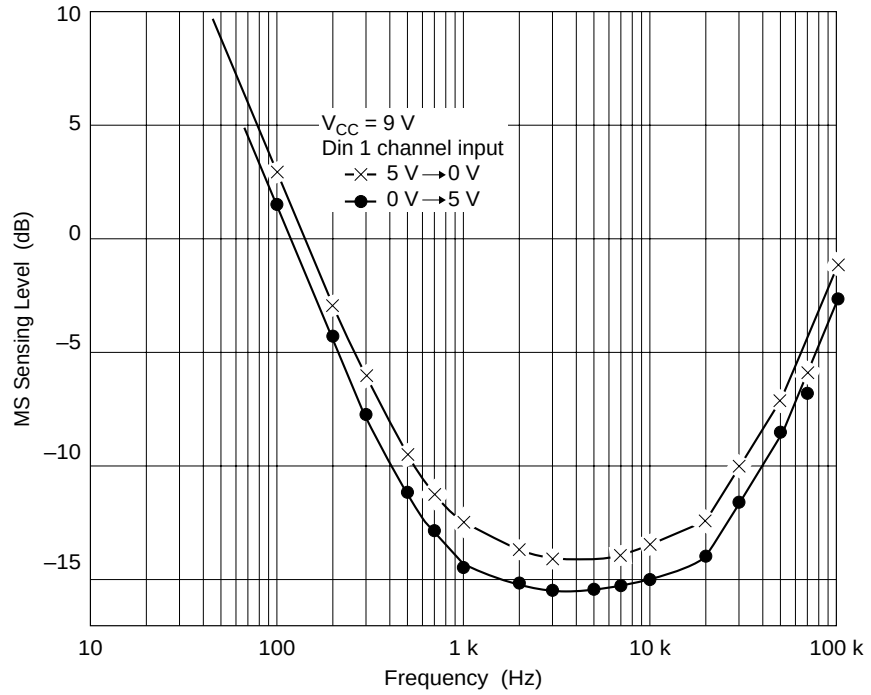
MS-Amp. Gain vs. Frequency (HA12199F)

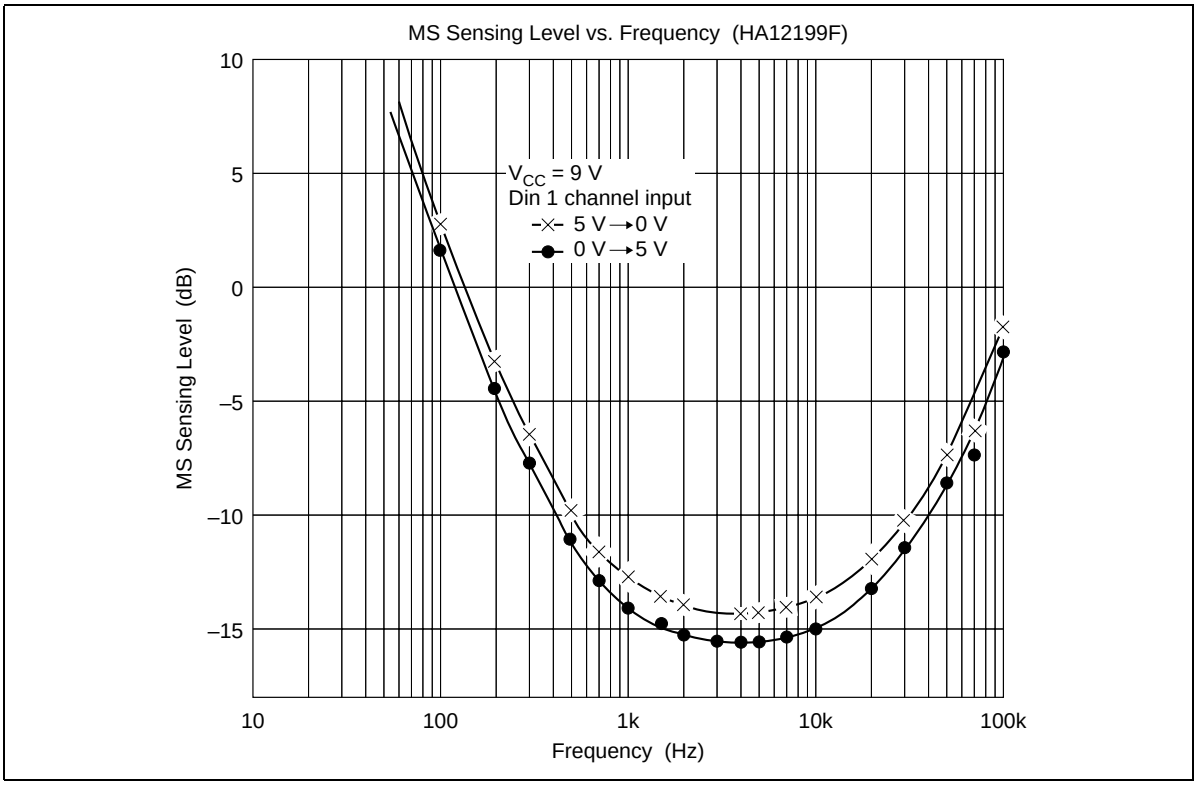


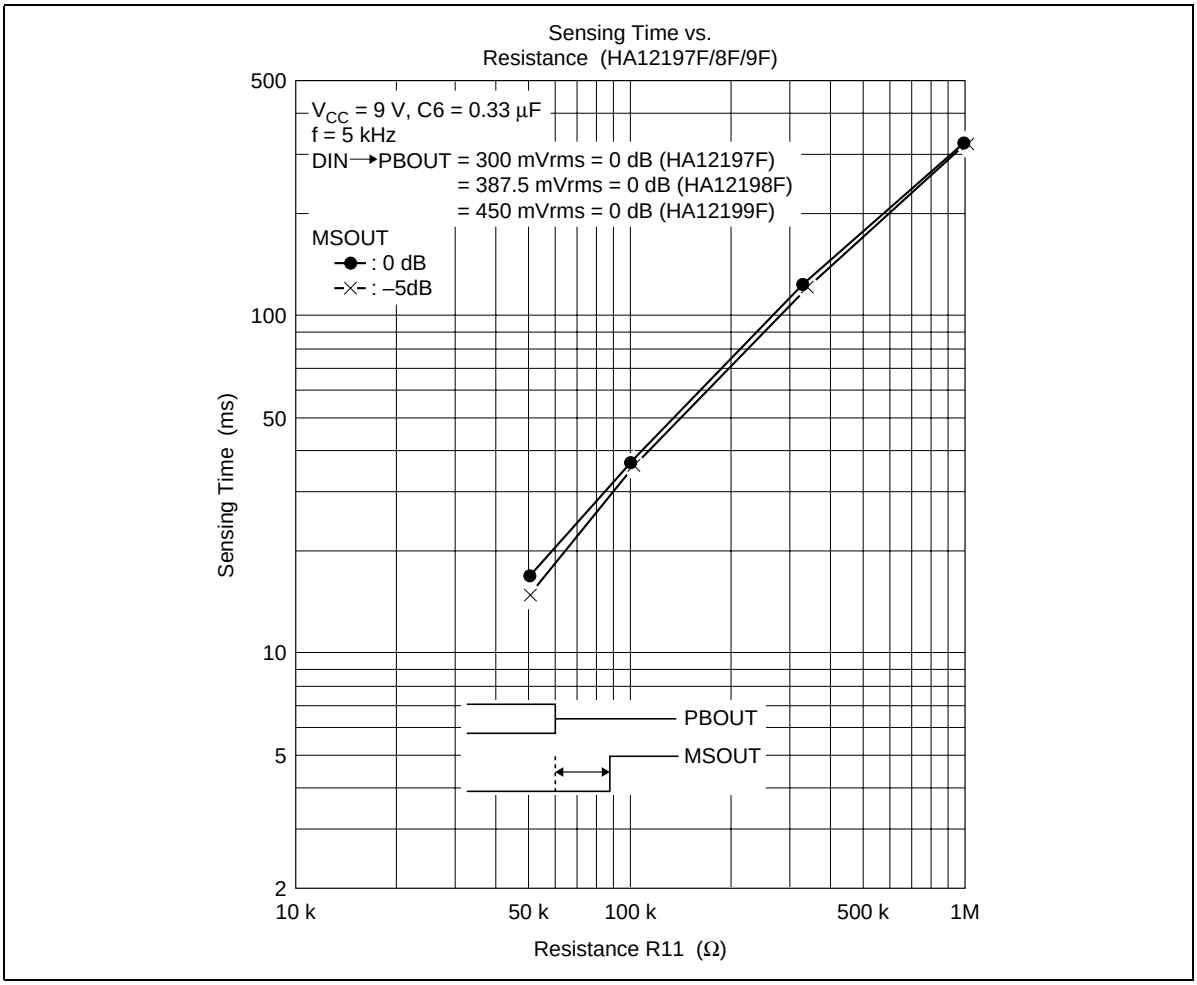
MS Sensing Level vs. Frequency (HA12197F)

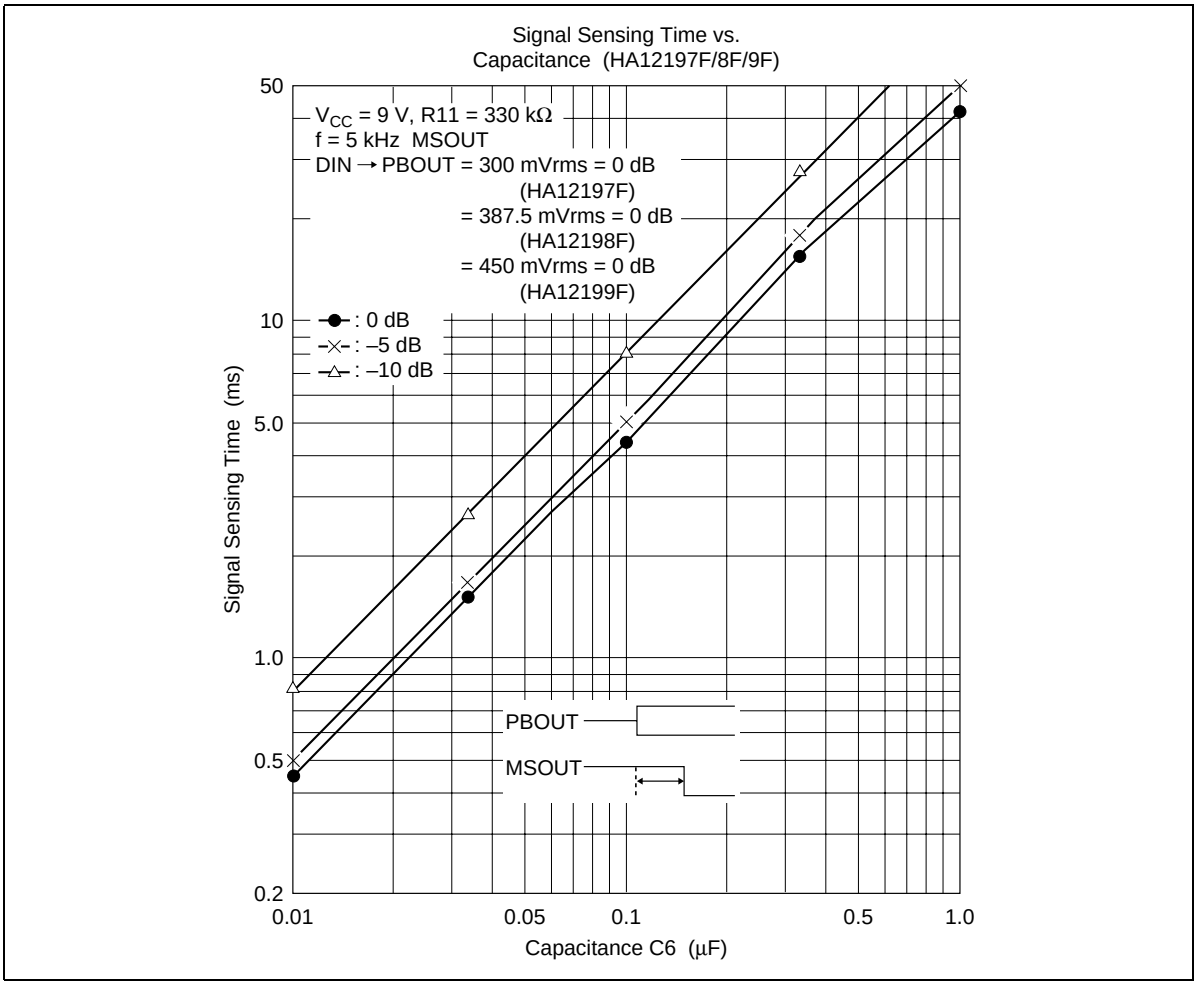


MS Sensing Level vs. Frequency (HA12198F)



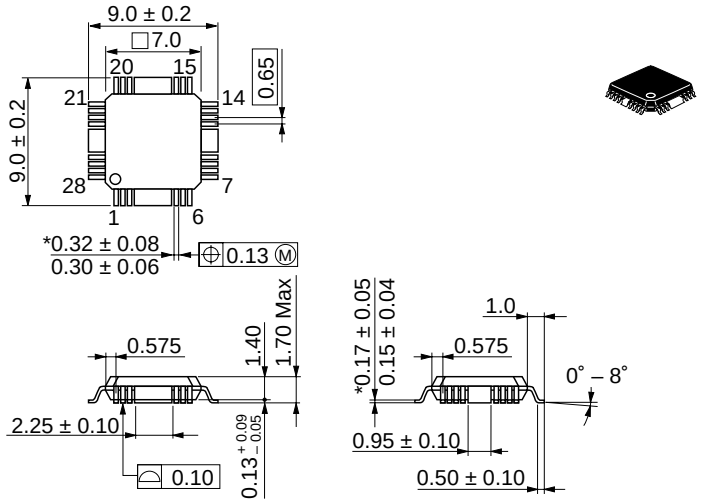

MS Sensing Level vs. Frequency (HA12199F)
10
5
0
–5
–10
–15
MS Sensing Level (dB)
V_{CC} = 9 V
Din 1 channel input
5 V → 0 V
0 V → 5 V
10
100
1k
10k
100k
Frequency (Hz)


Sensing Time vs.
Resistance (HA12197F/8F/9F)
500
100
50
10
5
2
Sensing Time (ms)
V_{CC} = 9 V, C6 = 0.33 µF
f = 5 kHz
DIN→PBOUT = 300 mVrms = 0 dB (HA12197F)
= 387.5 mVrms = 0 dB (HA12198F)
= 450 mVrms = 0 dB (HA12199F)
MSOUT
: 0 dB
: –5dB
PBOUT
MSOUT
10 k
50 k
100 k
500 k
1M
Resistance R11 (Ω)


Signal Sensing Time vs.
Capacitance (HA12197F/8F/9F)
V_{CC} = 9 V, R11 = 330 kΩ
f = 5 kHz MSOUT
DIN → PBOUT = 300 mVrms = 0 dB
(HA12197F)
= 387.5 mVrms = 0 dB
(HA12198F)
= 450 mVrms = 0 dB
(HA12199F)
: 0 dB
: –5 dB
: –10 dB
PBOUT
MSOUT
Signal Sensing Time (ms)
50
10
5.0
1.0
0.5
0.2
0.01
0.05
0.1
0.5
1.0
Capacitance C6 (µF)

Package Dimensions

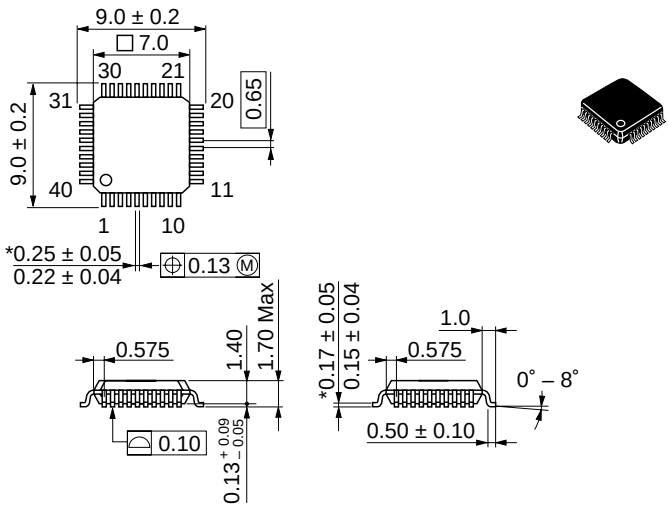
Unit: mm



Hitachi Code	FP-28TB
JEDEC	—
EIAJ	—
Weight (reference value)	0.2 g

*Dimension including the plating thickness
Base material dimension

Unit: mm



Hitachi Code	FP-40B
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.2 g

*Dimension including the plating thickness
Base material dimension

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