HA12173 Series

Audio Signal Processor for Car Deck and Cassette Deck
(Dolby B/C-type NR with PB Amp)

HITACHI

ADE-204-016
1st Edition
Nov. 1992

Description

HA12173 series are silicon monolithic bipolar IC providing Dolby noise reduction system*, music sensor and PB equalizer system in one chip.

Functions

- PB equalizer × 2 channel
- Dolby B/C-NR × 2 channel
- Music sensor × 1 channel

Features

- Different type of PB equalizer characteristics selection (normal/chrome or metal) is available with fully electronic control switching built-in.
- 2 type of input selection (RADIO/TAPE) is available.
- Changeable to Forward, Reverse-mode for PB head with fully electronic control switching built-in.
- Available to change music sensing level by external resistor.
- Music sensing level selection is available with fully electronic control switching built-in.
- Available to change frequency response of music sensor.
- NR-ON/OFF and REC/PB fully electronic control switching built-in.
- 4 type of PB-out level.
- Available to allow common PCB designs with HA12163 series.

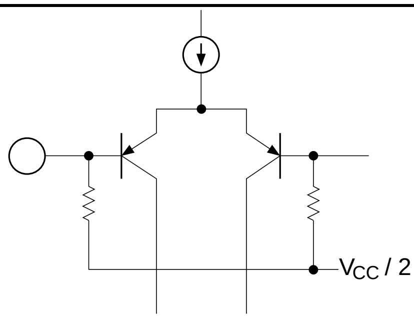
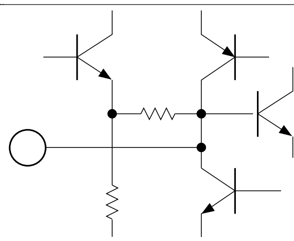
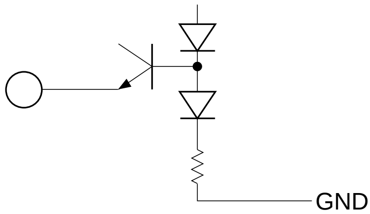
Hitachi semiconductor

Ordering Information

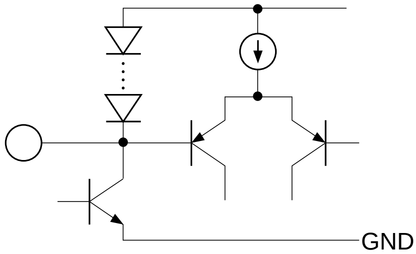
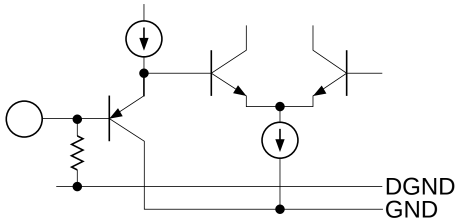
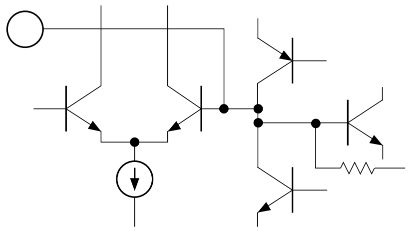
				Operating voltage range*1	
Products	**PB-OUT level**	**REC-OUT level**	**Dolby-level**	**Min**	**Max**
HA12173	300 mVrms	300 mVrms	300 mVrms	7.0V	16V
HA12174	450 mVrms	300 mVrms	300 mVrms	8.0V	16V
HA12175	580 mVrms	300 mVrms	300 mVrms	9.5V	16V
HA12177	775 mVrms	300 mVrms	300 mVrms	12.0V	16V

Note: 1. The minimum operating voltage of HA12173 series are defferent from the HA12163 series (Dolby B - type).

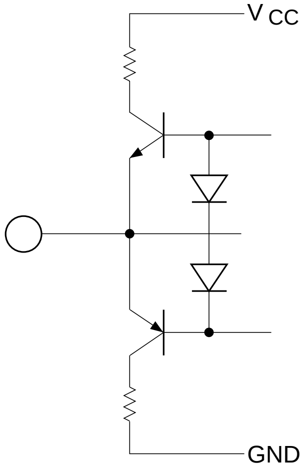
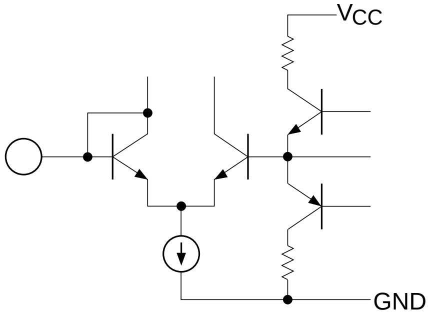
Pin Description (V_{CC} = 9 V Single supply, Ta = 25°C, No signal, The value in the table show typical value)

Pin No.	Terminal name	Zin	DC voltage	Equivalent circuit	Description
2, 41	TAI	100 kΩ	$V_{CC}/2$		Tape input
4, 39	RAI				Radio input
25	MSI				Music sensor rectifier input
10, 33	HLS DET	—	2.5 V		Time constant pin for rectifier
11, 32	LLS DET				
3	BIAS	—	0.28 V		Reference current input

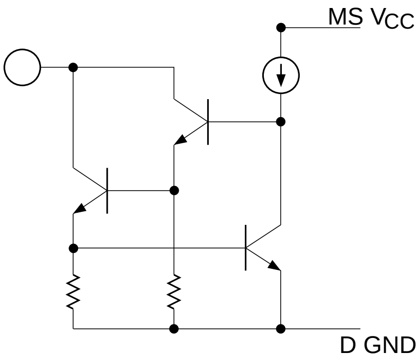
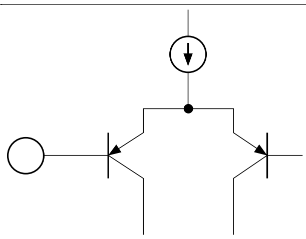
Pin Description (V_{CC} = 9 V Single supply, Ta = 25°C, No signal, The value in the table show typical value) (cont)

Pin No.	Terminal name	Zin	DC voltage	Equivalent circuit	Description
24	MS DET	—	V_{CC}		Time constant pin for rectifier
19	MS GV	100 kΩ	—		Mode control input
40	RIP	—	$V_{CC}/2$		Ripple filter

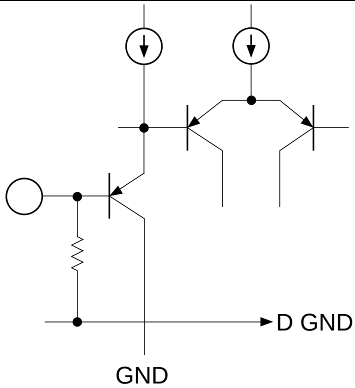
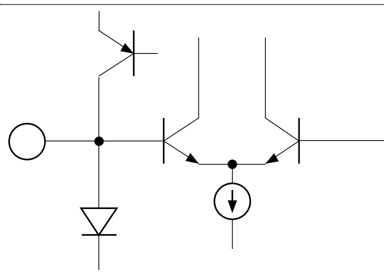
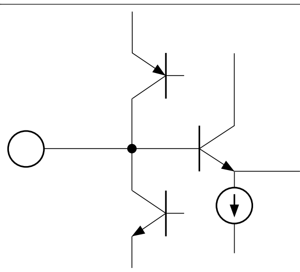
Pin Description (V_{CC} = 9 V Single supply, Ta = 25°C, No signal, The value in the table show typical value) (cont)

Pin No.	Terminal name	Zin	DC voltage	Equivalent circuit	Description
43, 56	EQ OUT	—	$V_{CC}/2$		Equalizer output
6, 37	PB OUT				Play back (Decode) output
30	MS V_{REF}				Reference voltage buffer output
26	MA OUT				Music sensor amp output
47, 52	V_{REF}				Reference voltage buffer output
12, 31	REC OUT				Recording (Encode) output
8, 35	SS2				Spectral skewing amp. output
44, 55	EQ OUT-M	—	$V_{CC}/2$		Equalizer output (Metal)

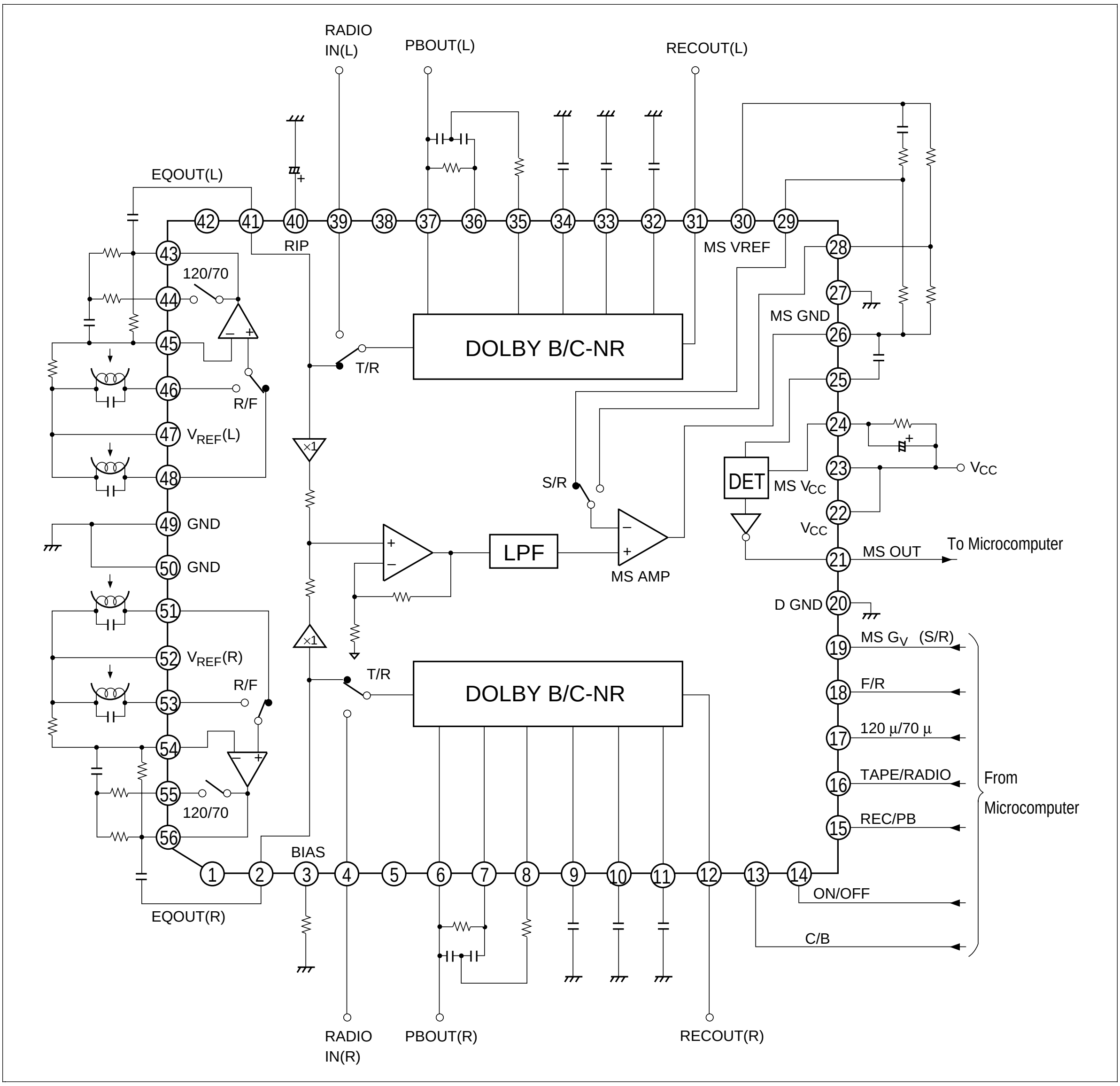
Pin Description (V_{CC} = 9 V Single supply, Ta = 25°C, No signal, The value in the table show typical value) (cont)

Pin No.	Terminal name	Zin	DC voltage	Equivalent circuit	Description
21	MS OUT	—	—		Music sensor output to MPU
22	V_{cc}	—	V_{cc}	—	Power supply
23	MS V_{cc}				
20	D GND	—	0V	—	Digital (Logic) ground
27	MS GND				Music sensor ground
49, 50	GND				Ground
48, 51	FIN	—	$V_{cc}/2$		PB - EQ input for forward
46, 53	RIN				PB - EQ input for reverse
45, 54	NFI				Negative feedback terminal of PB - EQ amp.
28	NOI				Negative feedback input for normal speed
29	FFI				Negative feedback input for FF or REW

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

Pin No.	Terminal name	Zin	DC voltage	Equivalent circuit	Description
13	C/B	100 kΩ	—		Mode control input
14	ON/OFF				
15	REC/PB				
16	TAPE/RADIO				
17	120 µ/170 µ				
18	F/R				
7, 36	SS1	—	$V_{CC}/2$		Spectral skewing amp. input
9, 34	CCR	—	$V_{CC}/2$		Current controled resistor output
1, 5, 38, 42	NC				No connection

Block Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC} max	16	V	
Power dissipation	P_T	500	mW	Ta≤85°C
Operating temperature	Topr	–40 to +85	°C	
Storage temperature	Tstg	–55 to +125	°C	

Electrical Characteristics (Ta = 25°C Dolby level 300 mVrms (Rec-out pin))

HA12173 V_{CC} = 9.0 V HA12174 V_{CC} = 9.0 V
HA12175 V_{CC} = 12.0 V HA12177 V_{CC} = 14.0 V

Item		Symbol	Min	Typ	Max	Unit	Test Condition	Note
Quiescent current		I_Q	10.0	16.0	24.0	mA	No input	No Signal NR-B70 µ
Input Amp. gain	HA12173	GvIA TAI	18.5	20.0	21.5	dB	Vin = 0 dB, f = 1 kHz	
		GvIA RAI	15.5	17.0	18.5			
	HA12174	GvIA TAI	22.0	23.5	25.0		Vin = 0 dB, f = 1 kHz	
		GvIA RAI	19.0	20.5	22.0			
	HA12175	GvIA TAI	24.2	25.7	27.2		Vin = 0 dB, f = 1 kHz	
		GvIA RAI	21.2	22.7	24.2			
	HA12177	GvIA TAI	26.7	28.2	29.7		Vin = 0 dB, f = 1 kHz	
		GvIA RAI	23.7	25.2	26.7			
B-type Encode boost		ENC –2k	2.8	4.3	5.8	dB	Vin = –20 dB, f = 2 kHz	
		ENC –5k	1.7	3.2	4.7		Vin = –20 dB, f = 5 kHz	
C-type Encode boost		ENC –1k (1)	3.9	5.9	7.9	dB	Vin = –20 dB, f = 1 kHz	
		ENC –1k (2)	18.1	19.6	21.6		Vin = –60 dB, f = 1 kHz	
		ENC –700	9.8	11.8	13.8		Vin = –30 dB, f = 700 Hz	
Signal handling		Vo max	12.0	13.0	—	dB	THD = 1%, f = 1 kHz	*1
Signal to noise ratio		S/N	60.0	64.0	—	dB	Rg = 5.1 kΩ, CCIR/ARM	
THD		THD	—	0.05	0.3	%	Vin = 0 dB, f = 1 kHz	
Channel separation		CT RL (1)	70.0	85.0	—	dB	Vin = 0 dB, f = 1 kHz	RAI input
		CT RL (2)	50.0	60.0	—		Vin = 0.6 mVrms, f = 1 kHz	EQ input
Crosstalk		CT EQ → RAI	70.0	80.0	—		Vin = 0.6 mVrms, f = 1 kHz	EQ input
		CT RAI → EQ	50.0	60.0	—		Vin = 0 dB, f = 1 kHz	RAI input
PB - EQ gain		Gv EQ 1k	37.0	40.0	43.0	dB	Vin = 0.6 mVrms, f = 1 kHz	120 µ
		Gv EQ 10k (1)	33.0	36.0	39.0		Vin = 0.6 mVrms, f = 10 kHz	
		Gv EQ 10k (2)	29.0	32.0	35.0			70 µ
PB - EQ maximum output		VoM	300	600	—	mVrms	THD = 1%, f = 1 kHz	*1
PB - EQ THD		THD - EQ	—	0.05	0.3	%	Vin = 0.6 mVrms, f = 1 kHz	
Noise voltage level converted in input		V_N	—	0.7	1.5	µVrms	Rg = 680 Ω, DIN - AUDIO	
MS sensing level		V_{ON} (1)	–36.0	–32.0	–28.0	dB	f = 5 kHz, Normal speed	
		V_{ON} (2)	–18.0	–14.0	–10.0		f = 5 kHz, High speed	

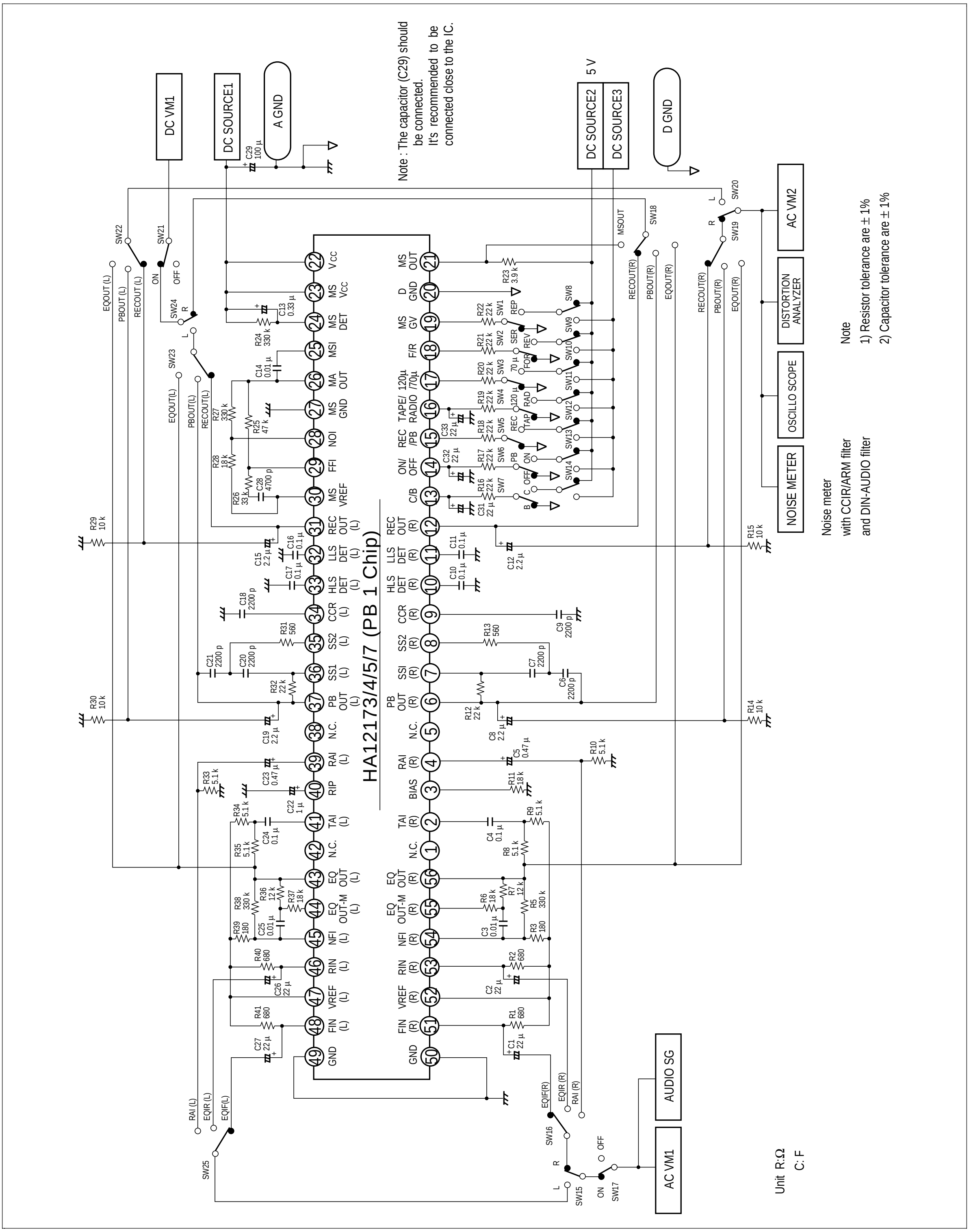
Electrical Characteristics (Ta = 25°C Dolby level 300 mVrms (Rec-out pin)) (cont)

HA12173 V_{CC} = 9.0 V   HA12174 V_{CC} = 9.0 V
HA12175 V_{CC} = 12.0 V   HA12177 V_{CC} = 14.0 V

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Note
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	—	1.5	V		
	V_{IH}	3.5	—	5.3			

Note: 1. HA12173 V_{CC} = 7.0 V, HA12174 V_{CC} = 8.0 V, HA12175 V_{CC} = 9.5 V, HA12177 V_{CC} = 12.0 V

Test Circuit



Functional Description

Power Supply Range

HA12173 series are provided with four line output level, which will permit on optimum overload margin for power supply conditions. And this series are designed to operate on either single supply or split supply.

Table 1 Supply Voltage

Item		HA12173	HA12174	HA12175	HA12177
Single supply		7.0 V to 16.0 V	8.0 V to 16.0 V	9.5 V to 16.0 V	12.0 V to 16.0 V
Split supply	GND level	±5.0 V to 8.0 V	±5.0 V to 8.0 V	±5.0 V to 8.0 V	±6.0 V to 8.0 V
	V_{EE} level	±3.5 V to ±8.0 V	±4.0 V to 8.0 V	±4.8 V to 8.0 V	±6.0 V to 8.0 V

A. 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.

B. In case of using digital GND terminal referring to GND level, operating voltage range varies depending on the condition at power on. On using the HA12173/174/175, use within the following ranges to avoid latch-ups.
   When power on in NR-OFF mode: ±5.0 V to ±8.0 V
   When power on in NR-ON mode: ±5.7 V to ±8.0 V

C. In the reverse-voltage conditions such as 'D-GND is higher than V_{CC}' or 'D-GND is lower than GND', excessive current flows into the D-GND to destory this IC. To prevent such destruction, pay attention to the followings on using.
   Single power supply : Short-circuit the D-GND and GND directory on the board mounting this IC.
   Split power supply : Avoid reverse conditions of D-GND and V_{CC} or V_{EE} voltage, including transient-time of power ON/OFF.

Reference Voltage

For the single supply operation 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 Reference voltage are provided for the left channel and the right channel separately. The block diagram is shown as figure 1.

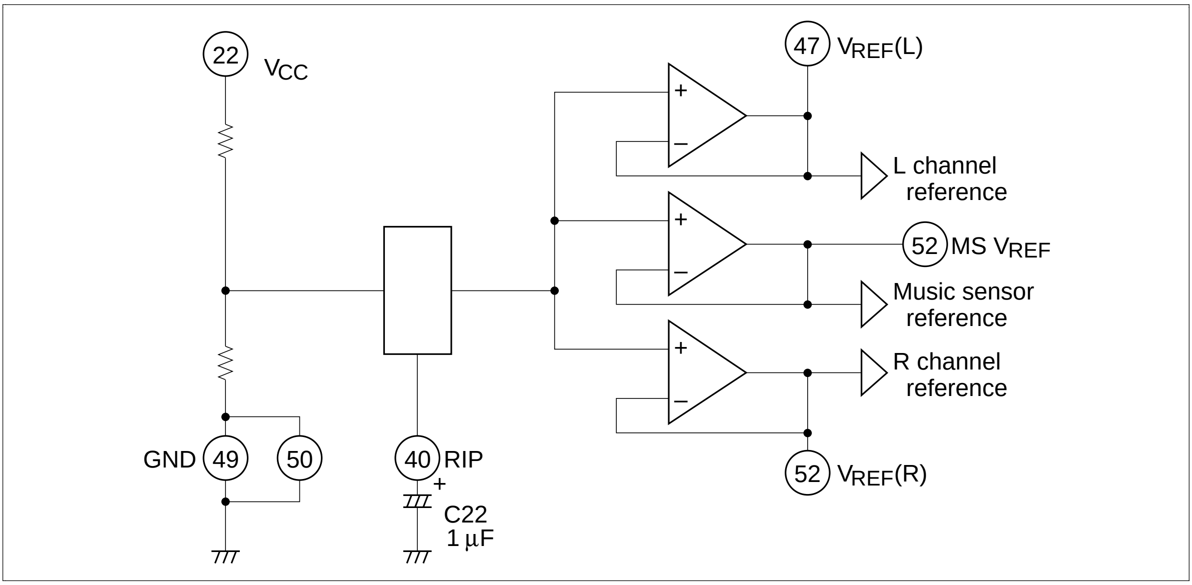


Figure 1 The Block Diagram of Reference Voltage Supply

Operating Mode Control

HA12173 series provide fully electronic switching circuits. And each operating mode control are controlled by parallel data (DC voltage).

Table 2 Threshold Voltage (V_{TH})

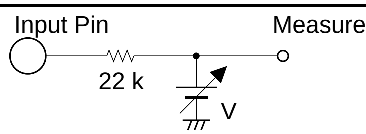
Pin No.	Low	High	Unit	Test condition
13, 14, 15, 16, 17, 18, 19	–0.2 to 1.5	3.5 to 5.3	V	

Table 3 Switching Truth Table

Pin No.	Low	High
13	B - NR	C - NR
14	NR - OFF	NR - ON
15	PB	REC
16	TAPE	RADIO
17	120 µ (NORMAL)	70 µ (METAL or CHROME)
18	FORWARD	REVERSE
19	SER (FF or REV)	REP (NORMAL SPEED)

Notes: 1. Voltages shown above are determined by internal circuits of LSI when take pin 20 (DGND pin) as reference pin. On split supply use, same V_{TH} can be offered by connecting DGND pin to GND pin.
This means that it can be controlled directly by microprocessor. But power supply should be over ±5 V, notwithstanding the prescription of table 1.
2. Each pins are on pulled down with 100 kΩ internal resistor.
Therefore, it will be low-level when each pins are open.
3. Over shoot level and under shoot level of input signal must be the standardized (High: 5.3 V, Low: –0.2 V)
4. When connecting microcomputer or Logic-IC with HA12173 series directly, there is apprehension of rush-current under some transition timming of raising voltage or falling voltage at V_{CC} ON/OFF.
On using, connect protective resistors of 10 to 22 kΩ to all the control pins. It is shown istest circuit on this data sheet. And pins fixed to low level should be preferably open.
5. Pay attention not to make digital GND voltage lower than GND voltage.

Input Block Diagram and Level Diagram

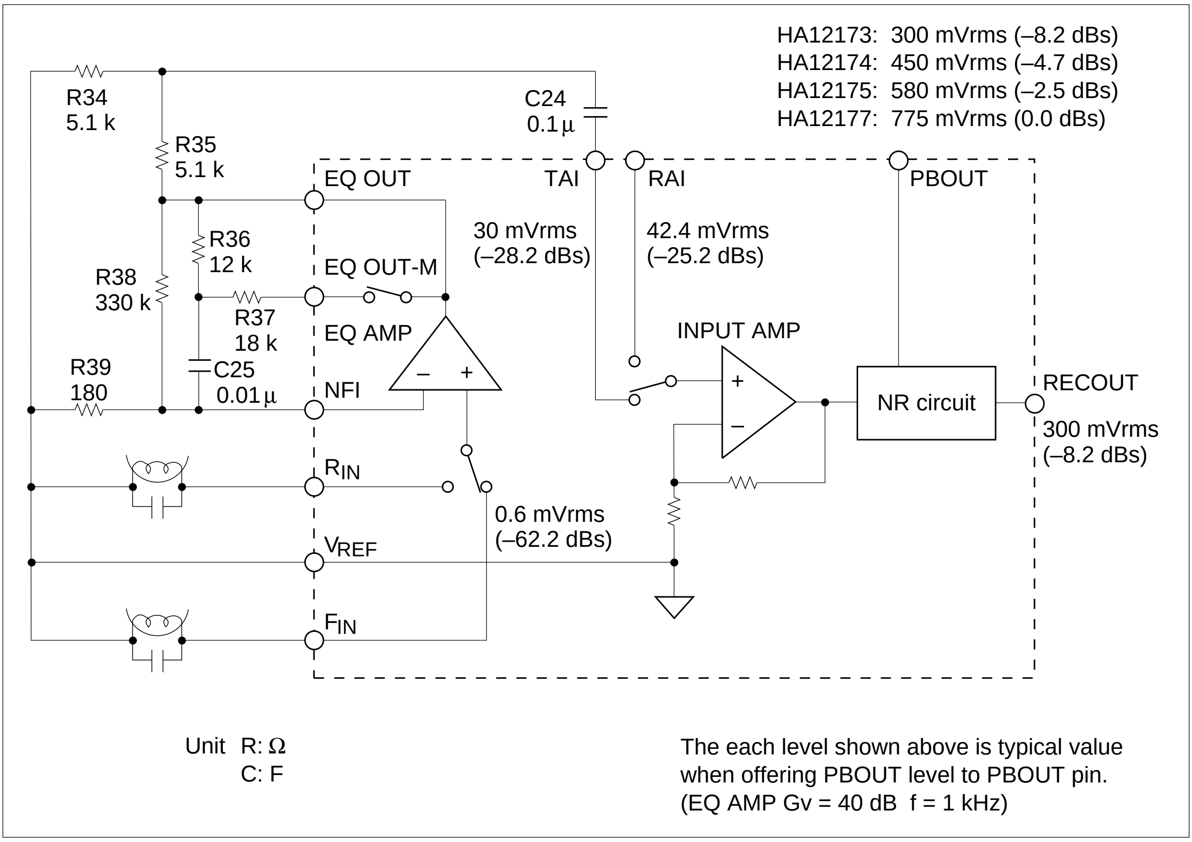


Figure 2 Input Block Diagram

Adjustment of Playback Dolby Level

After replace R34 and R35 with a half-fix volume of 10 kΩ, adjust RECOUT level to be Dolby level with playback mode.

Note on Connecting with Tape Head to IC

This IC has no internal resistor to give the DC bias current to equalizer amp., therefore the DC bias current will give through the head. This IC provides the Vref buffer output pin for Rch and Lch separately (has two Vref terminal). In case of use that the Rch and Lch reference of head are connected commonly, please use one of Vref terminals of IC (47 pin or 52 pin) for head reference. If both 47 pin and 52 pin of IC are connected, rush current give the great damage to IC. The application circuit is shown in figure 3.

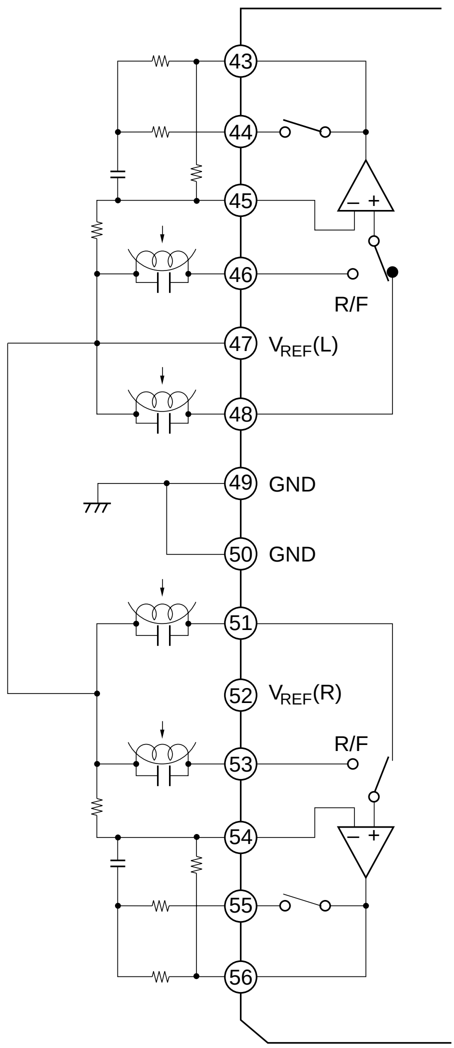


Figure 3 Application Circuit

The Sensitivity Adjustment of a Music Sensor

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

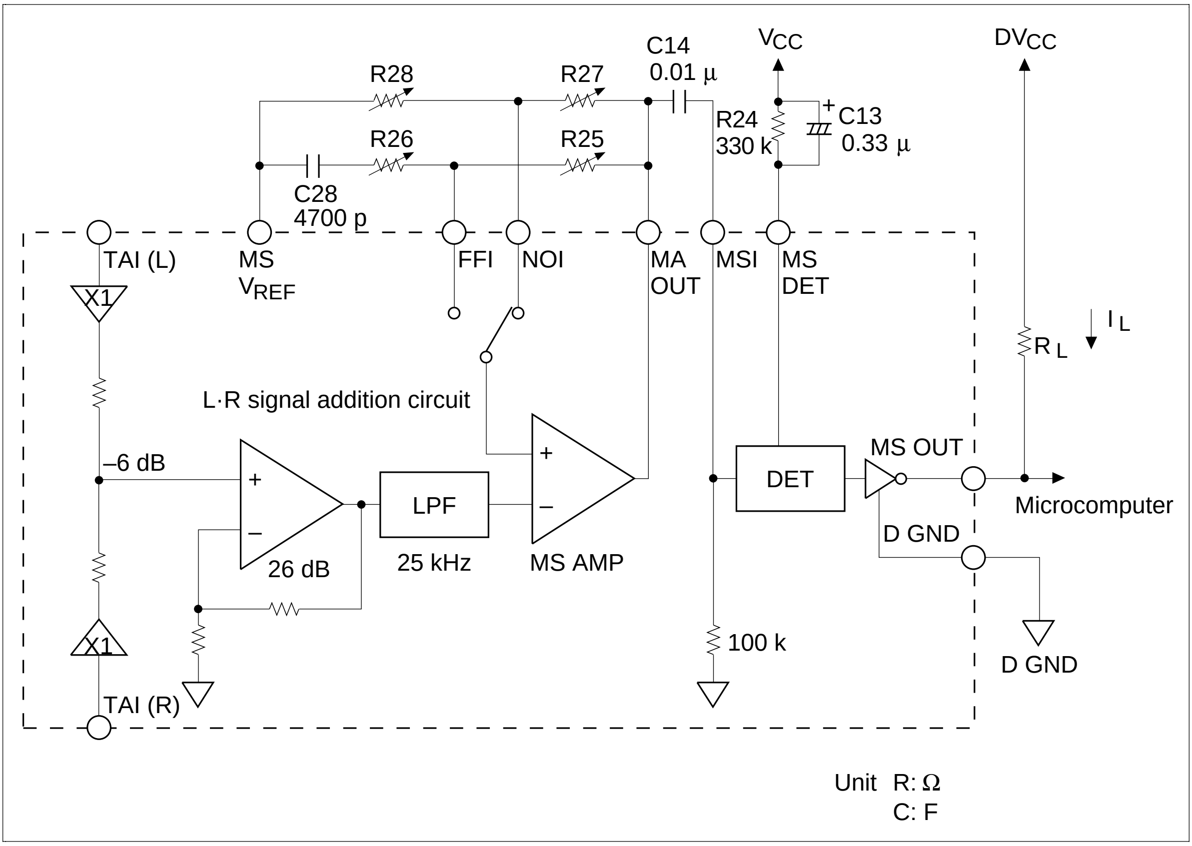


Figure 4 Music Sensor Block Diagram

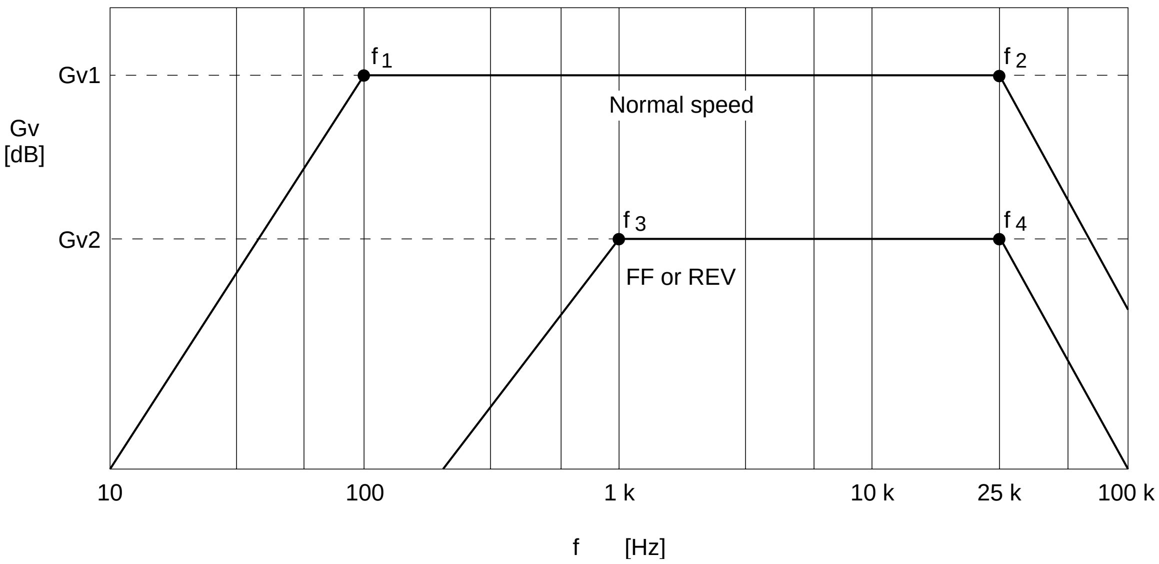


Figure 5 Frequency Response

1. Normal mode

$$Gv1 = 20\log\left(1+\frac{R27}{R28}\right)[dB]$$

$$f1=\frac{1}{2\cdot\pi\cdot C14\cdot 100\,k}[Hz], f2=25\,k[Hz]$$

2. FF or REW mode

$$Gv2 = 20\log\left(1+\frac{R25}{R26}\right)[dB]$$

$$f3=\frac{1}{2\cdot\pi\cdot C28\cdot R26}[Hz], f4=25\,k[Hz]$$

A standard level of TAI pin is 30 mVrms and the gain for TAI to MS AMP input is 10, therefore, the other channel sensitivity of music sensor (S) is computed by the formula mentioned below.

$$S=20\log\frac{C}{30}\cdot\frac{1}{10\cdot A}[dB]$$

A = MS AMP. gain (B dB)

S = –7.3–B [dB] C = 130 mVrms (typ.)

S is 6 dB up in case of the both channels.

C = The sensing level of music sensor

Music Sensor Output (MS OUT)

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

Connection with microcomputer, design I_L at 1 mA typ.

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

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

Notes: 1. Supply voltage of MS OUT pin must be less than V_{CC} voltage.
2. MS V_{CC} pin and V_{CC} pin are required the same voltage.

The Tolerances of External Components for Dolby NR-block

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

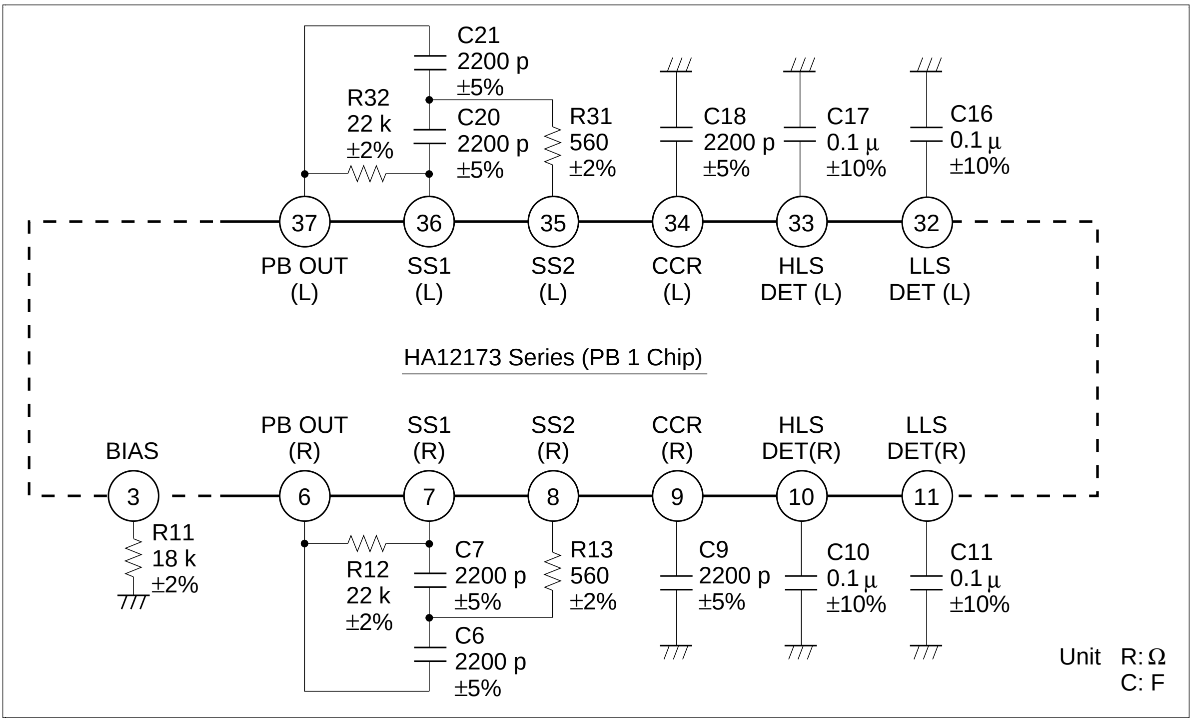


Figure 6 Tolerances of External Components

PB Equalizer for Double Speed

PB equalizer can be design for double speed by using external components shown in figure 7. Application data is shown in figure 8.

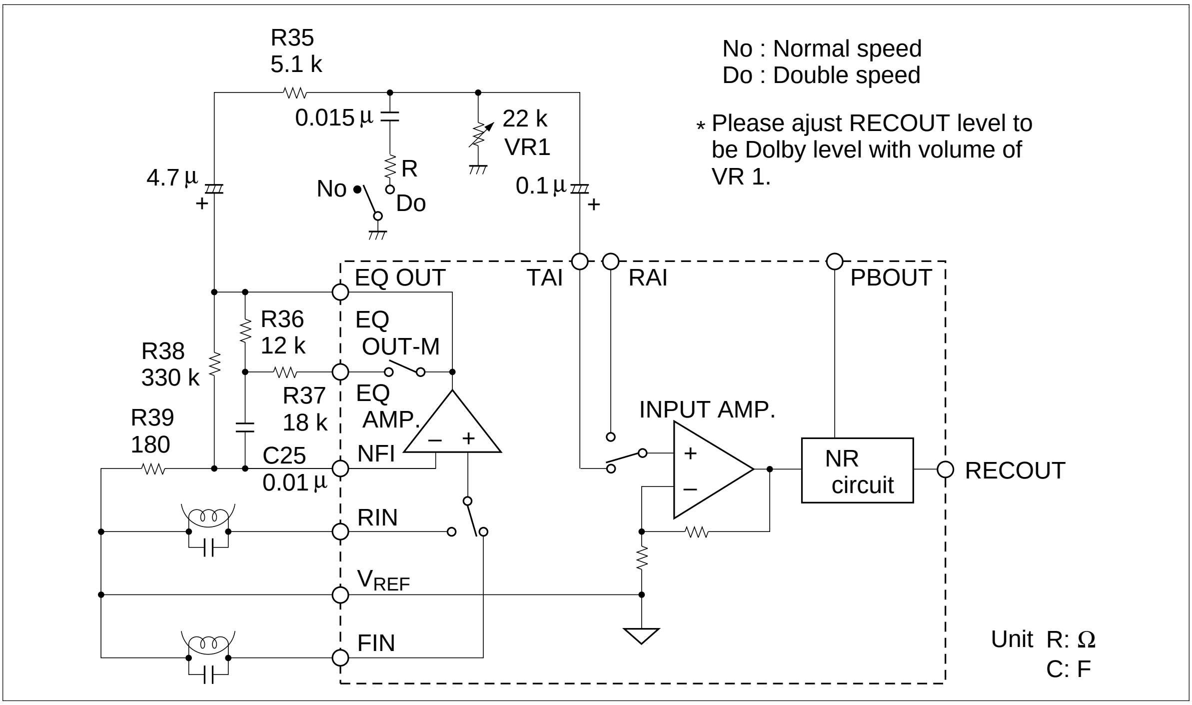


Figure 7 Application Circuit for Double Speed

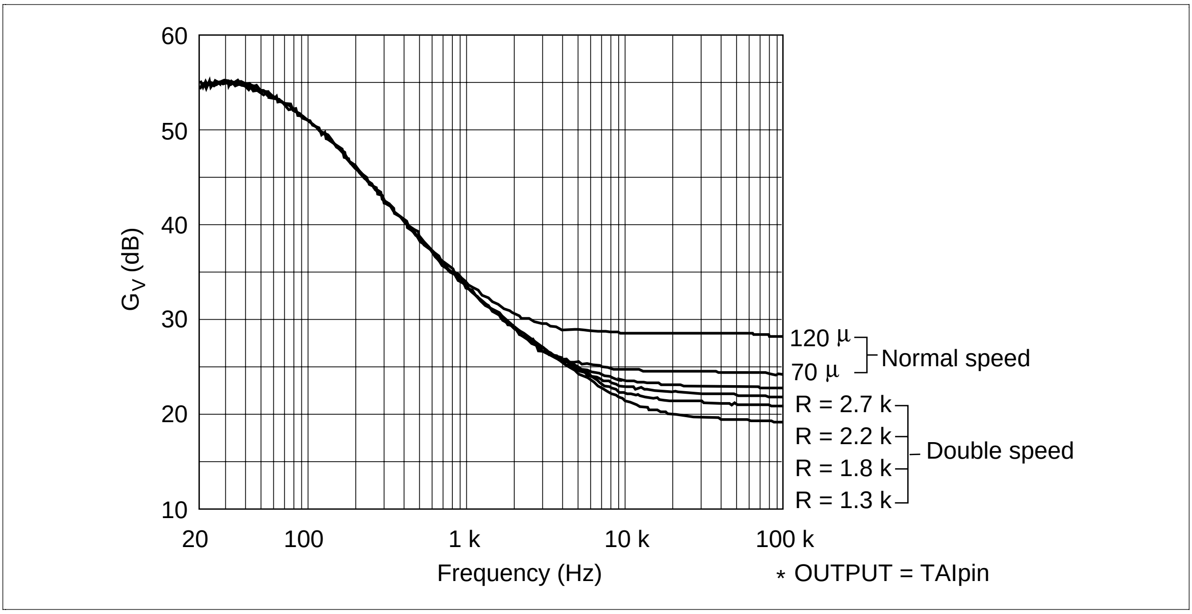
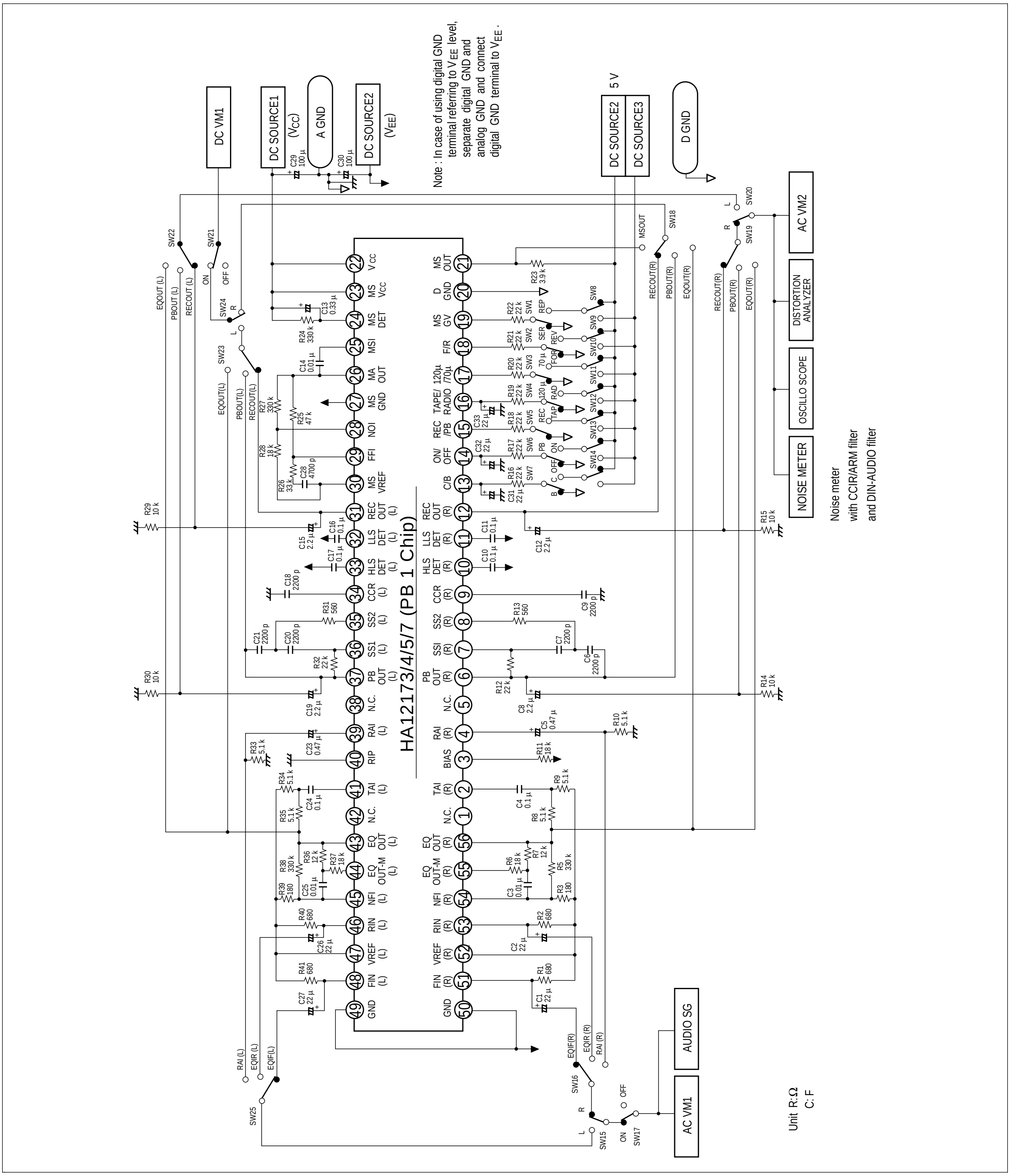


Figure 8 Application data

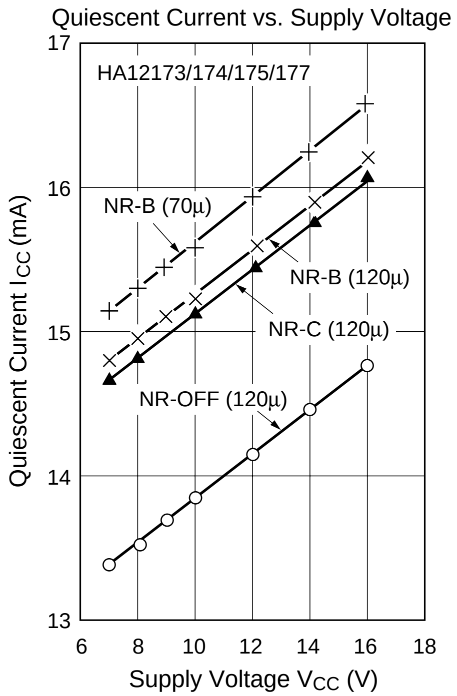
Circuit For Split Supply

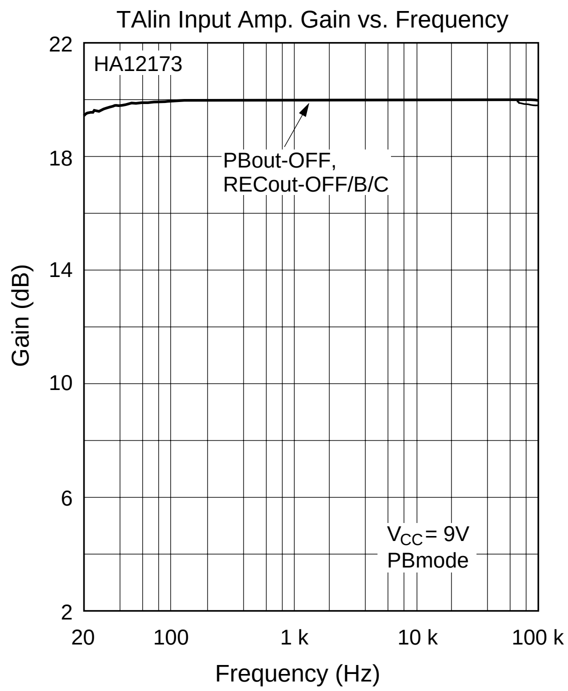
HA12173

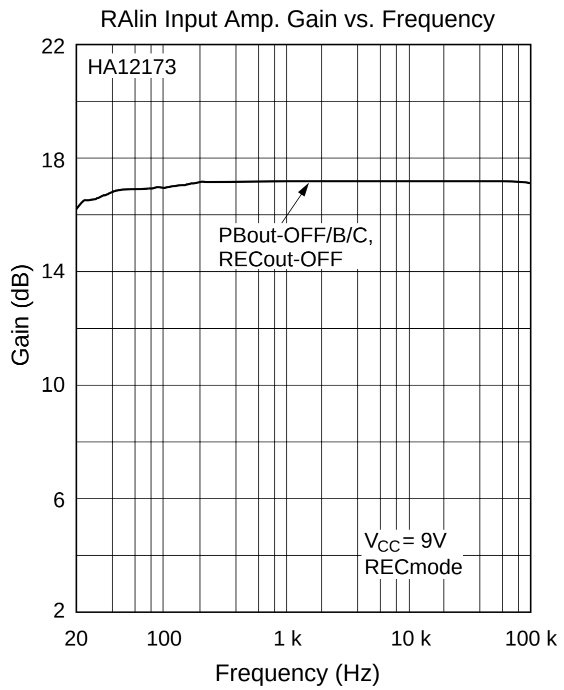


Typical Characteristic Curves

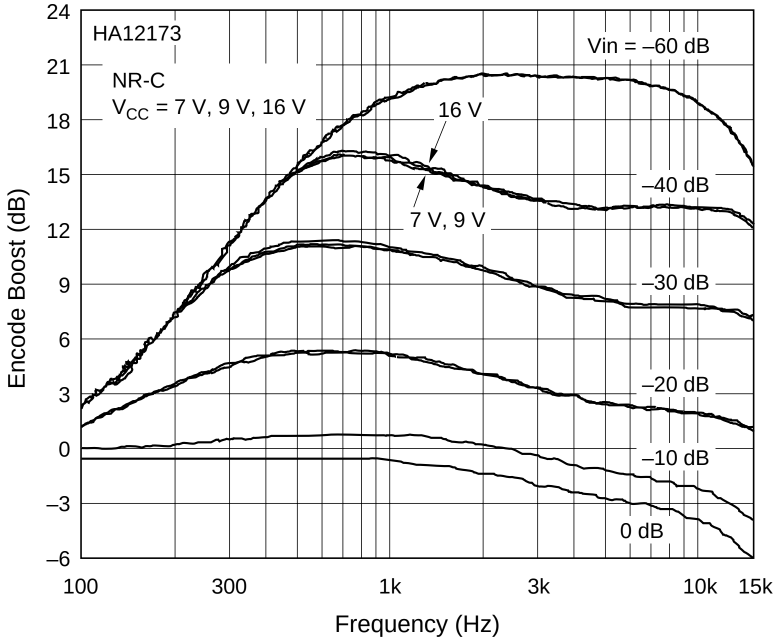
HA12173



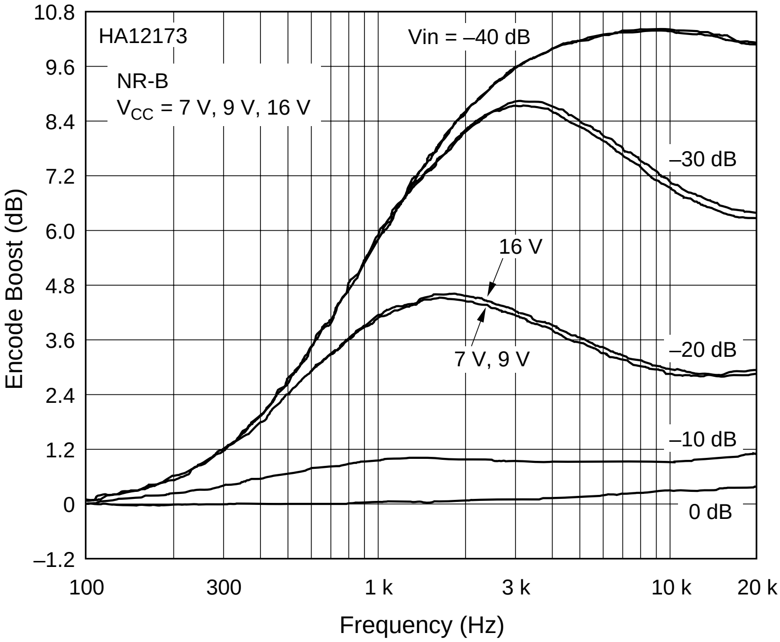

TAlin Input Amp. Gain vs. Frequency
HA12173
PBout-OFF,
RECout-OFF/B/C
VCC = 9V
PBmode
Gain (dB)
22
18
14
10
6
2
20
100
1 k
10 k
100 k
Frequency (Hz)

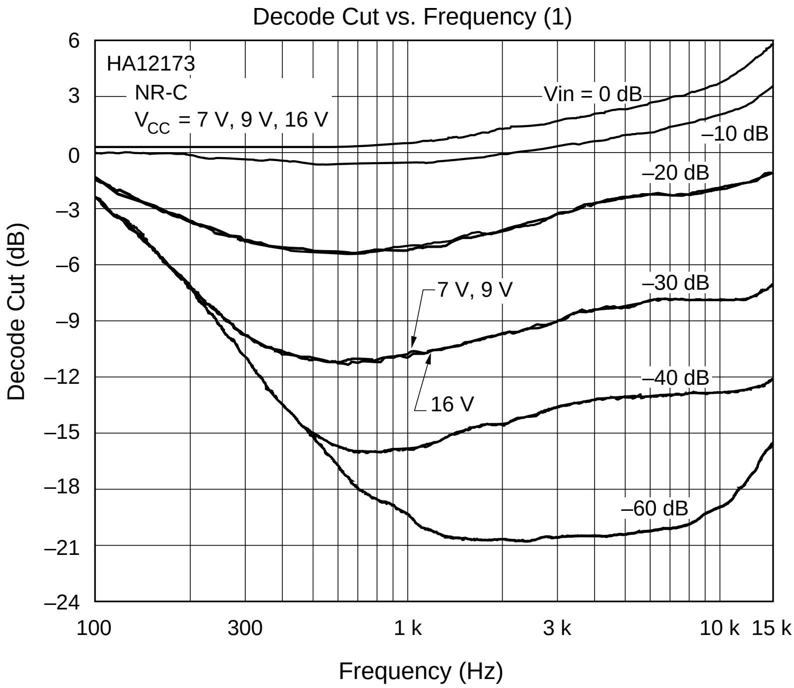

RAlin Input Amp. Gain vs. Frequency
HA12173
PBout-OFF/B/C,
RECout-OFF
VCC = 9V
RECmode
Gain (dB)
22
18
14
10
6
2
20
100
1 k
10 k
100 k
Frequency (Hz)

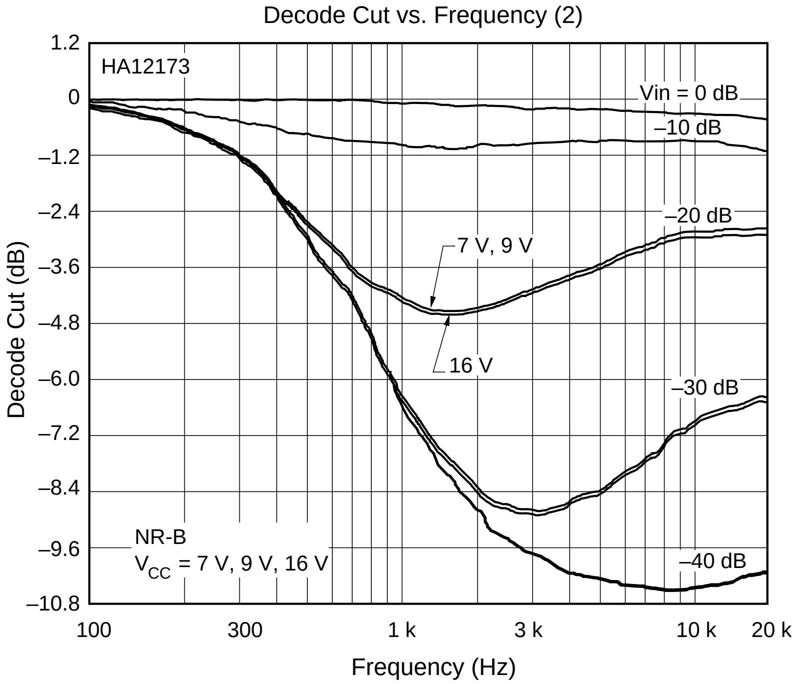
Encode Boost vs. Frequency (1)



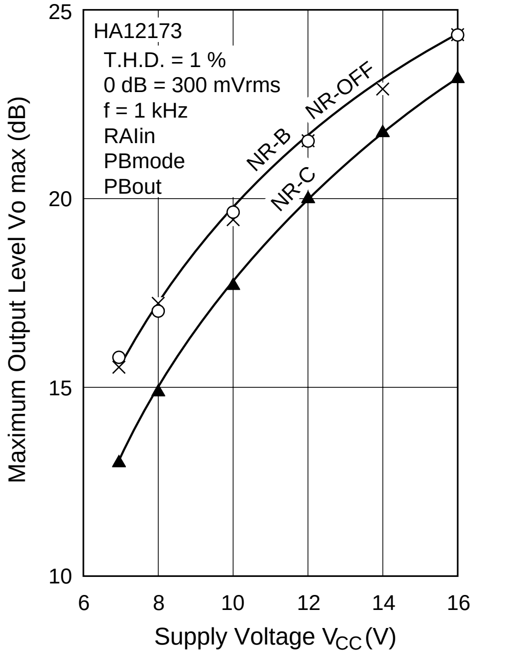
Encode Boost Frequency (2)



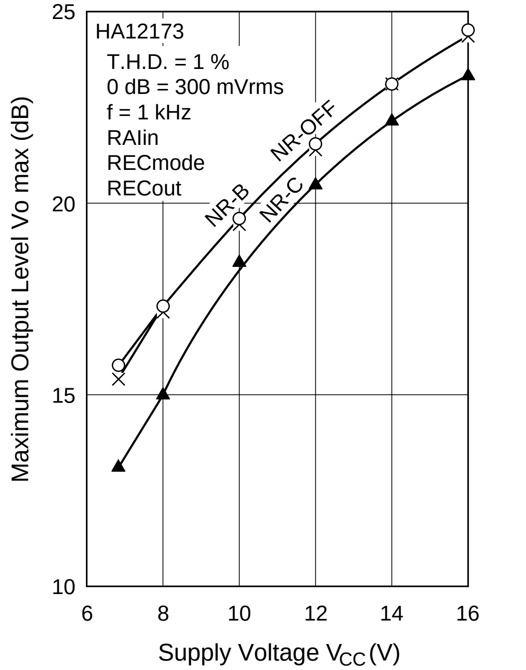

Decode Cut vs. Frequency (1)
HA12173
NR-C
VCC = 7 V, 9 V, 16 V
Vin = 0 dB
–10 dB
–20 dB
–30 dB
–40 dB
–60 dB
7 V, 9 V
16 V
Decode Cut (dB)
6
3
0
–3
–6
–9
–12
–15
–18
–21
–24
100
300
1 k
3 k
10 k
15 k
Frequency (Hz)


Decode Cut vs. Frequency (2)
HA12173
NR-B
VCC = 7 V, 9 V, 16 V
Vin = 0 dB
–10 dB
–20 dB
–30 dB
–40 dB
7 V, 9 V
16 V
Decode Cut (dB)
1.2
0
–1.2
–2.4
–3.6
–4.8
–6.0
–7.2
–8.4
–9.6
–10.8
100
300
1 k
3 k
10 k
20 k
Frequency (Hz)

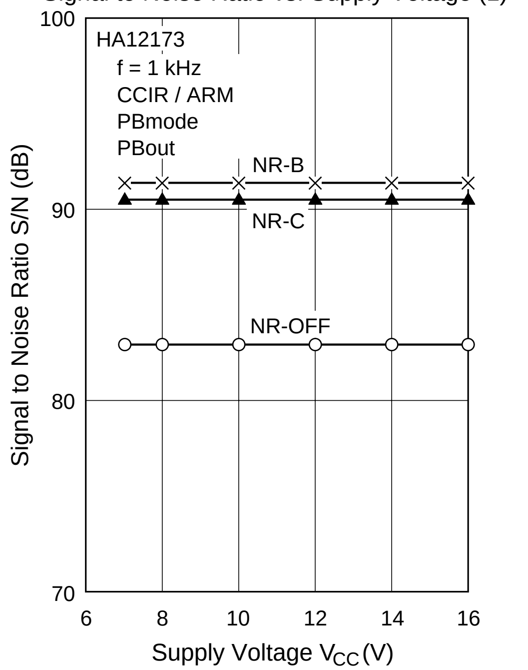
Maximum Output Level vs. Supply Voltage (1)



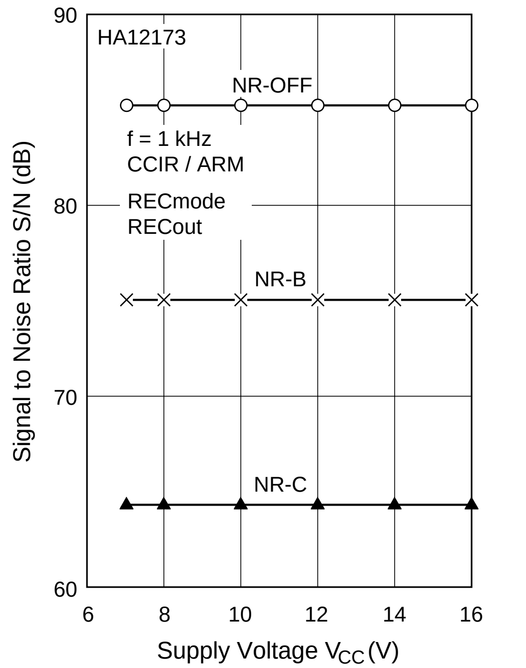
Maximum Output Level vs. Supply Voltage (2)



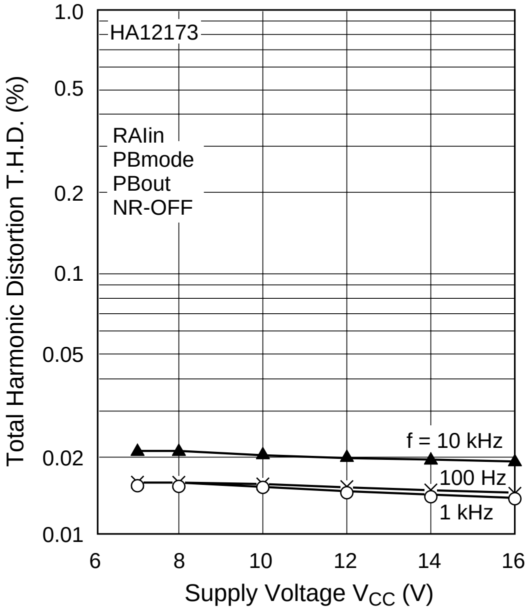
Signal to Noise Ratio vs. Supply Voltage (1)



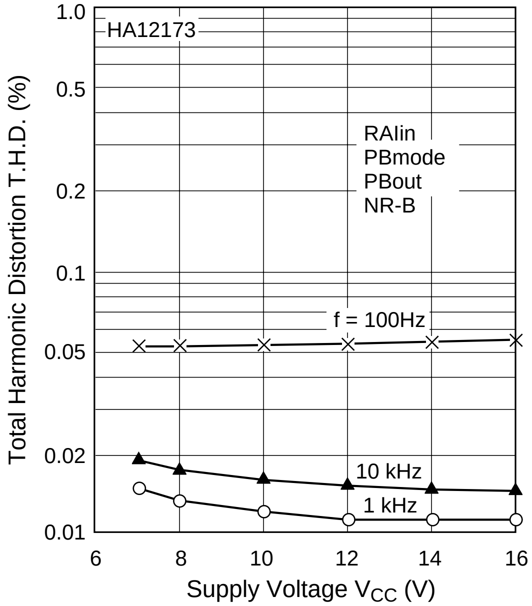
Signal to Noise Ratio vs. Supply Voltage (2)



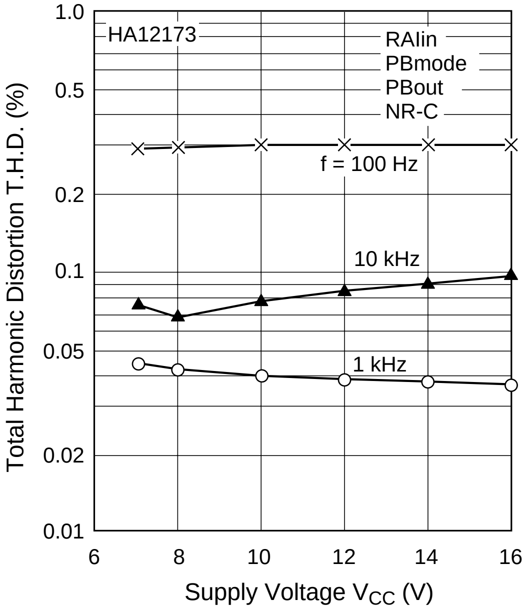
Total Harmonic Distortion vs. Supply Voltage (1)



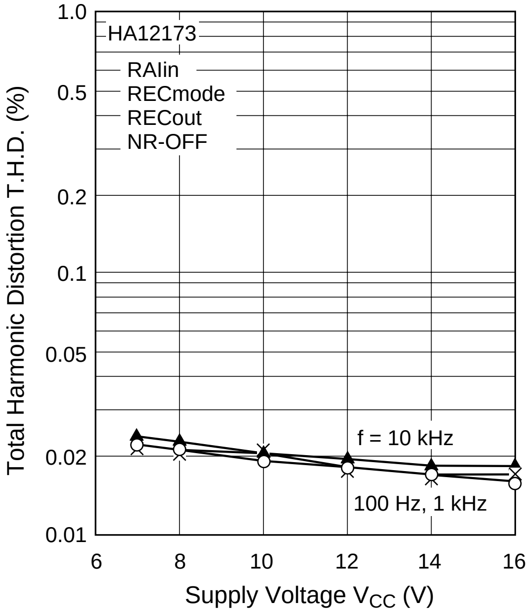
Total Harmonic Distortion vs. Supply Voltage (2)

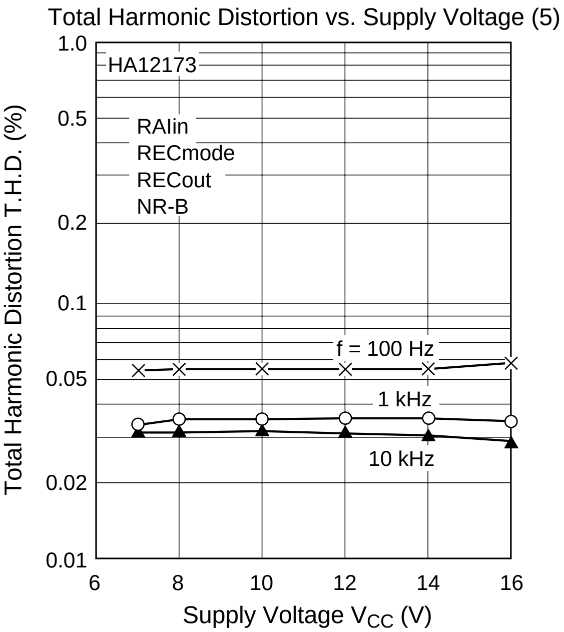


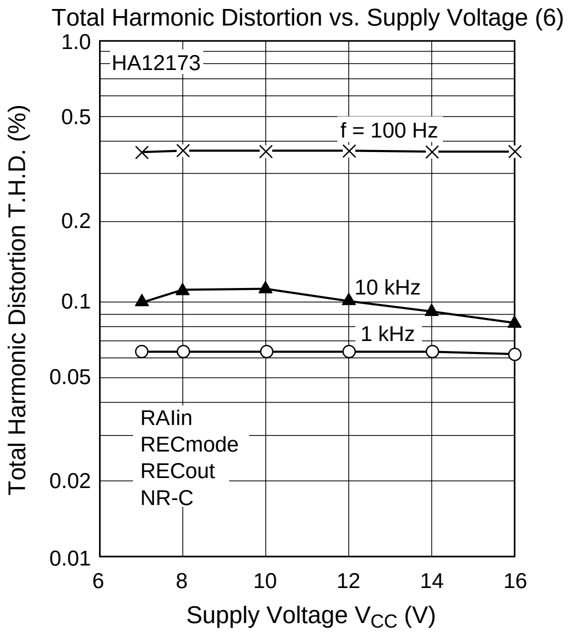
Total Harmonic Distortion vs. Supply Voltage (3)

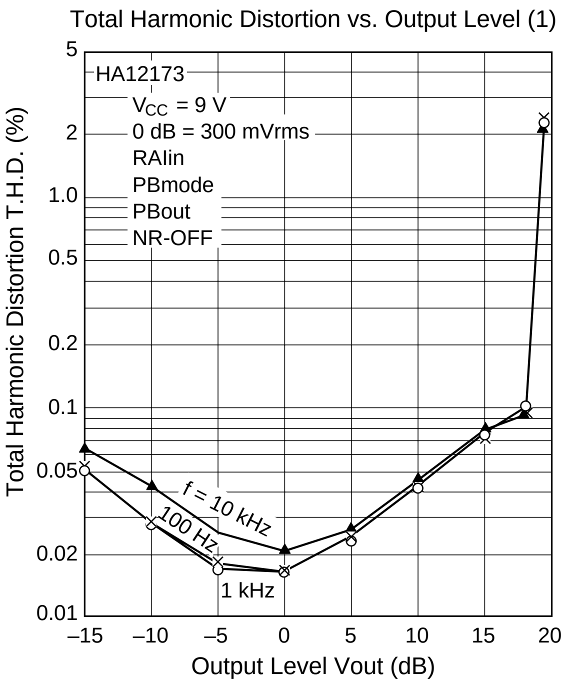


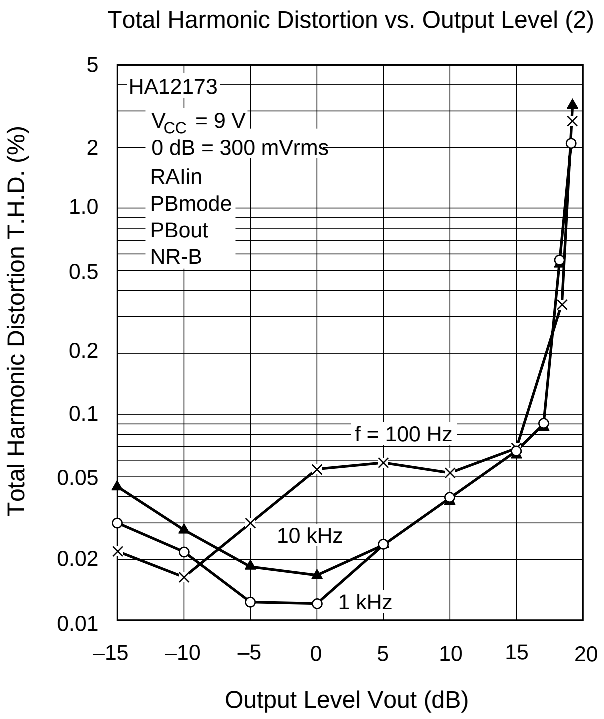
Total Harmonic Distortion vs. Supply Voltage (4)



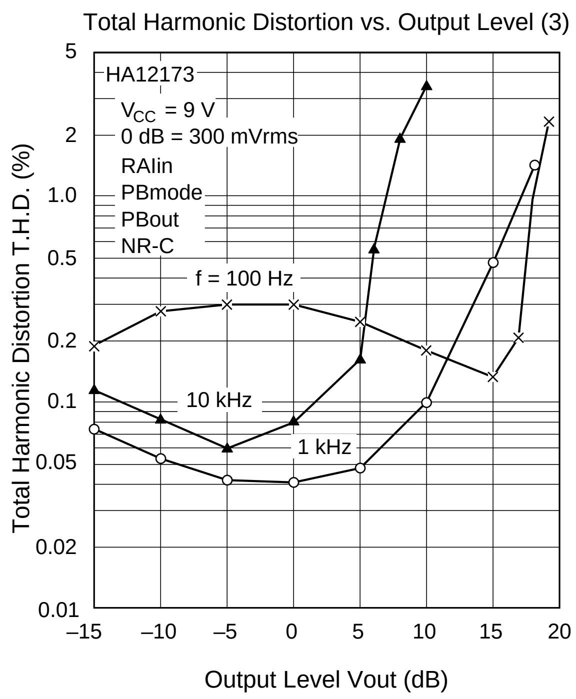

Total Harmonic Distortion vs. Supply Voltage (5)
HA12173
RAIin
RECmode
RECout
NR-B
f = 100 Hz
1 kHz
10 kHz
Total Harmonic Distortion T.H.D. (%)
Supply Voltage VCC (V)


Total Harmonic Distortion vs. Supply Voltage (6)
HA12173
f = 100 Hz
10 kHz
1 kHz
RAIin
RECmode
RECout
NR-C
Total Harmonic Distortion T.H.D. (%)
Supply Voltage VCC (V)


Total Harmonic Distortion vs. Output Level (1)
HA12173
VCC = 9 V
0 dB = 300 mVrms
RAIin
PBmode
PBout
NR-OFF
f = 10 kHz
100 Hz
1 kHz
Total Harmonic Distortion T.H.D. (%)
Output Level Vout (dB)

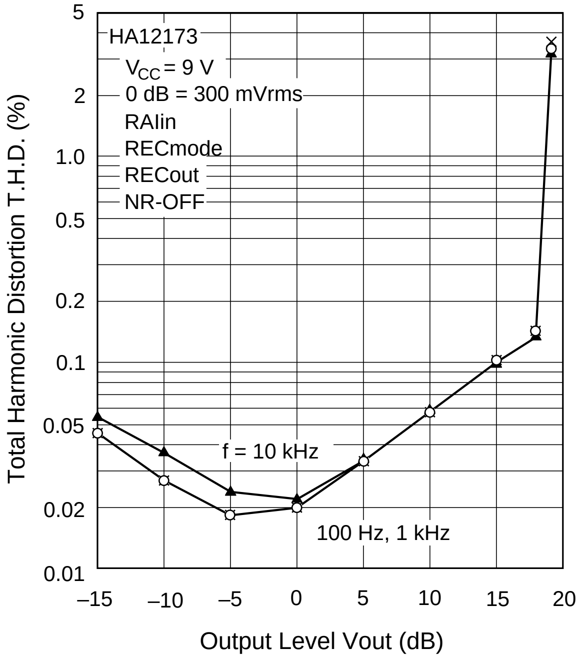


Total Harmonic Distortion vs. Output Level (2)
HA12173
V_{CC} = 9 V
0 dB = 300 mVrms
RAIin
PBmode
PBout
NR-B
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

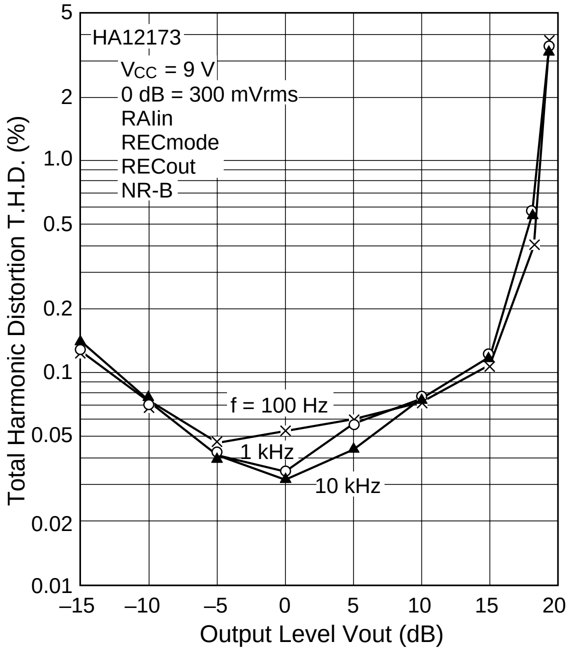


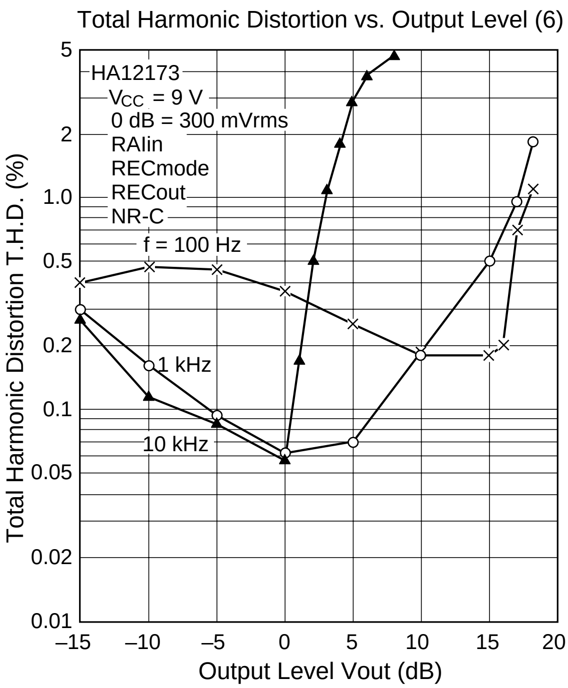
Total Harmonic Distortion vs. Output Level (3)
HA12173
V_{CC} = 9 V
0 dB = 300 mVrms
RAIin
PBmode
PBout
NR-C
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

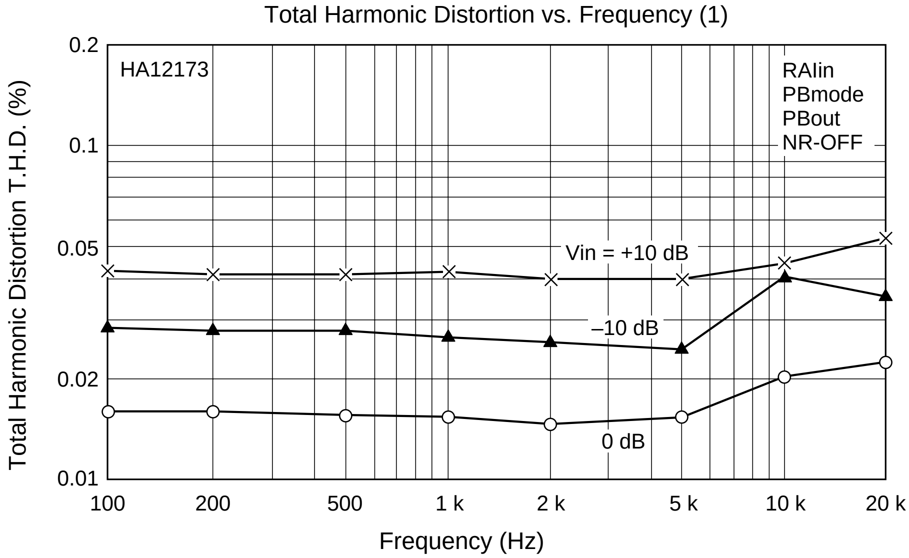
Total Harmonic Distortion vs. Output Level (4)



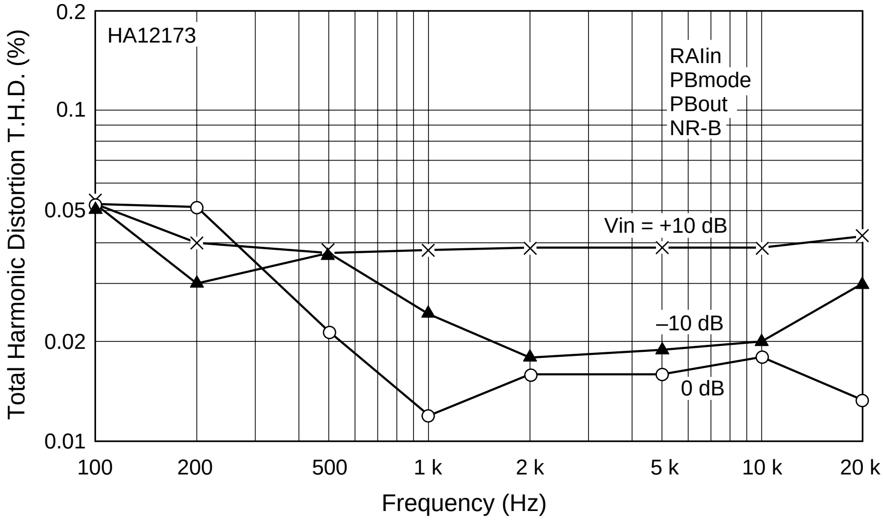
Total Harmonic Distortion vs. Output Level (5)



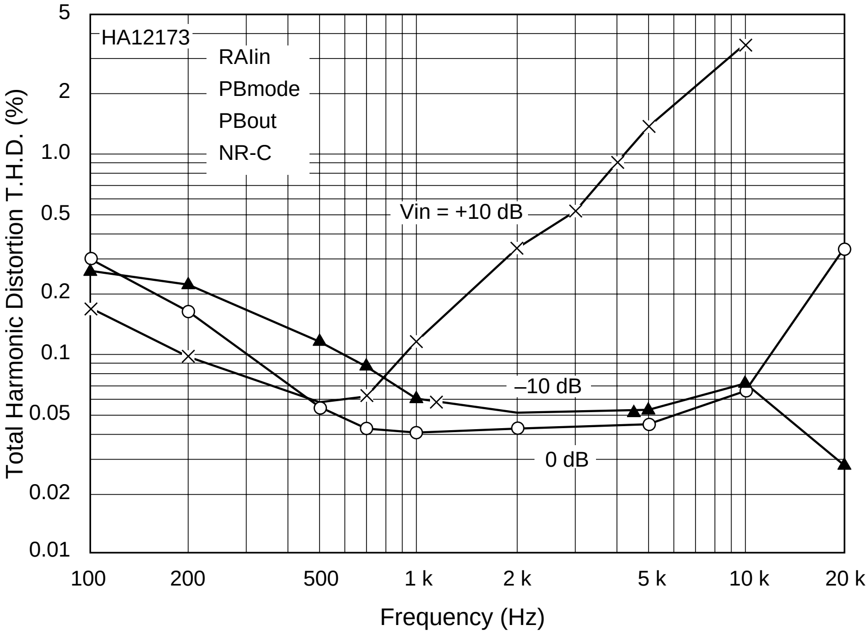

Total Harmonic Distortion vs. Output Level (6)
HA12173
VCC = 9 V
0 dB = 300 mVrms
RAIin
RECmode
RECout
NR-C
f = 100 Hz
1 kHz
10 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

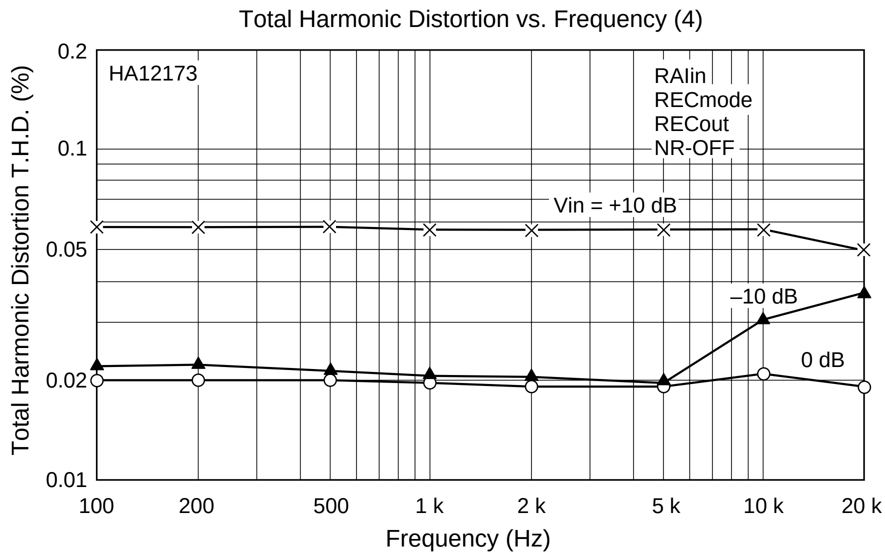

Total Harmonic Distortion vs. Frequency (1)
HA12173
RAIin
PBmode
PBout
NR-OFF
Vin = +10 dB
–10 dB
0 dB
Total Harmonic Distortion T.H.D. (%)
0.2
0.1
0.05
0.02
0.01
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

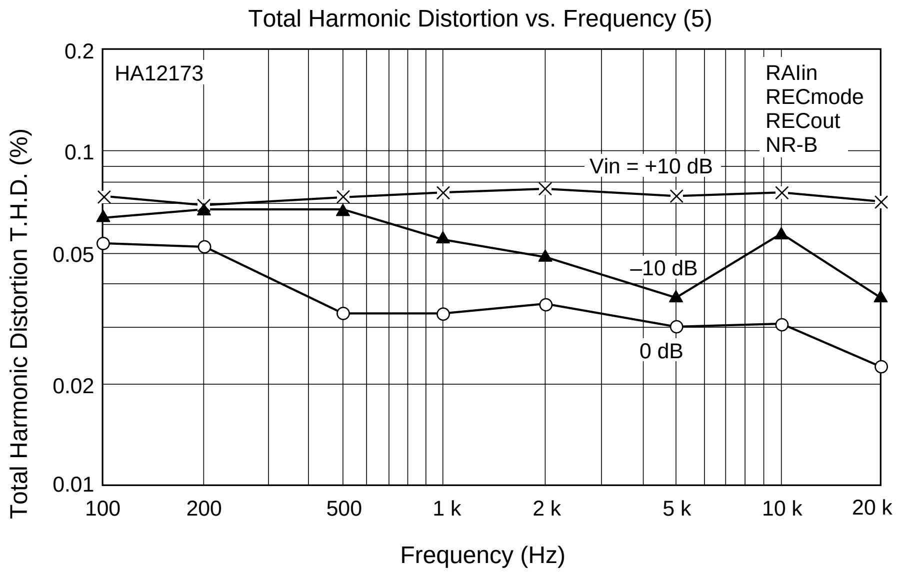
Total Harmonic Distortion vs. Frequency (2)

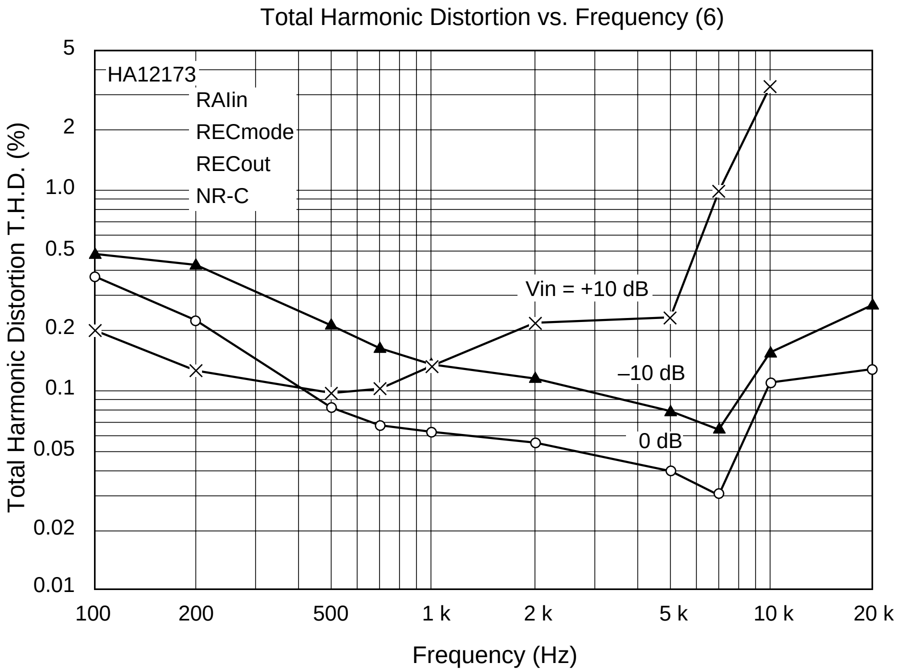


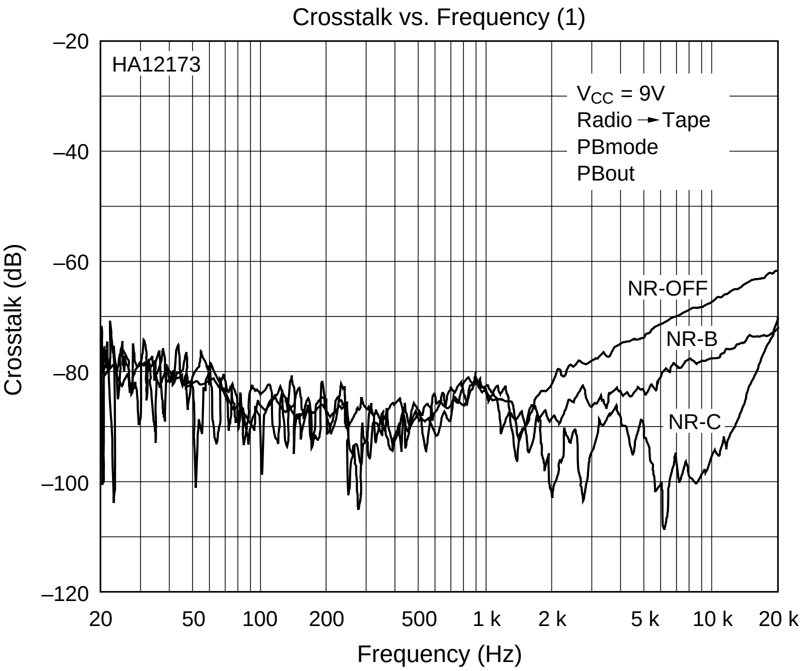
Total Harmonic Distortion vs. Frequency (3)

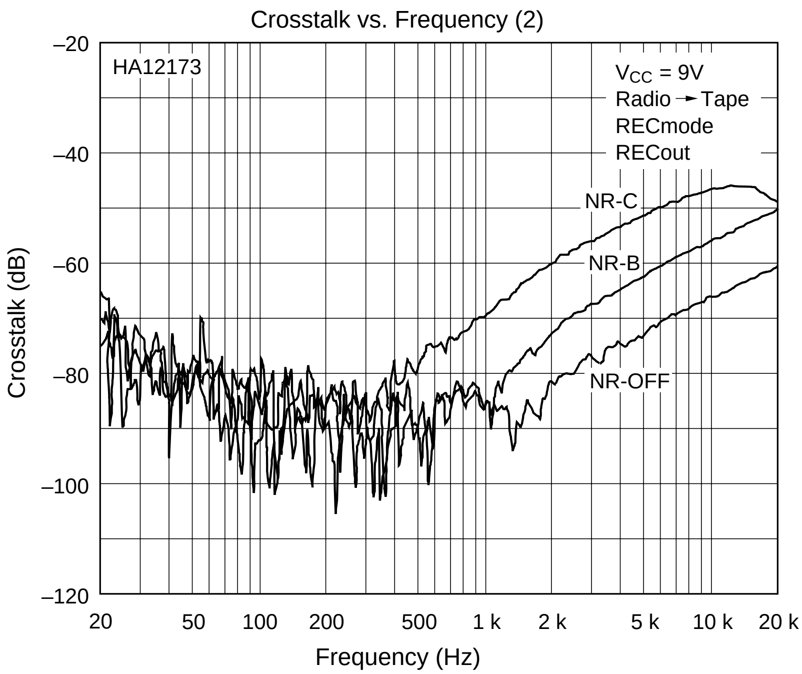


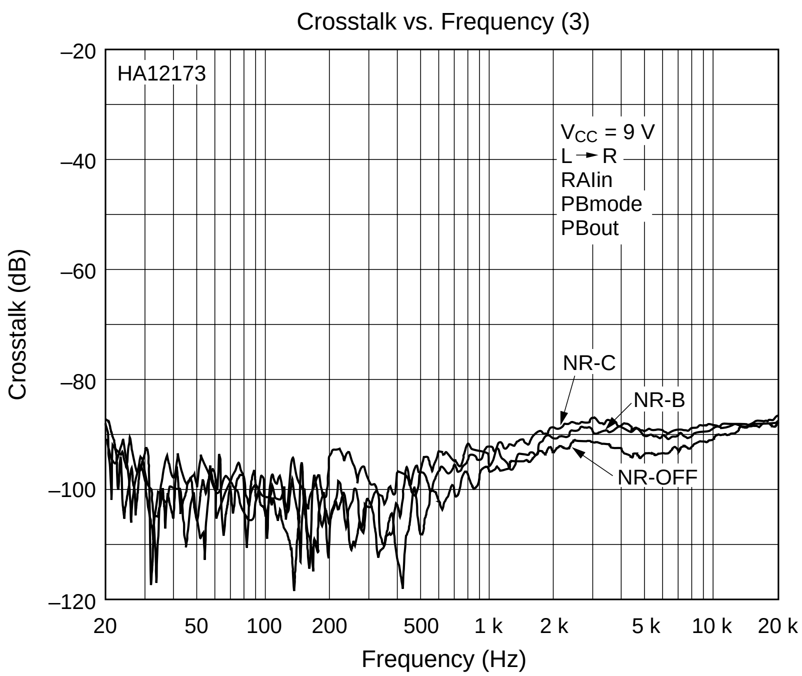

Total Harmonic Distortion vs. Frequency (4)
HA12173
RAIin
RECmode
RECout
NR-OFF
Vin = +10 dB
–10 dB
0 dB
Total Harmonic Distortion T.H.D. (%)
0.2
0.1
0.05
0.02
0.01
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

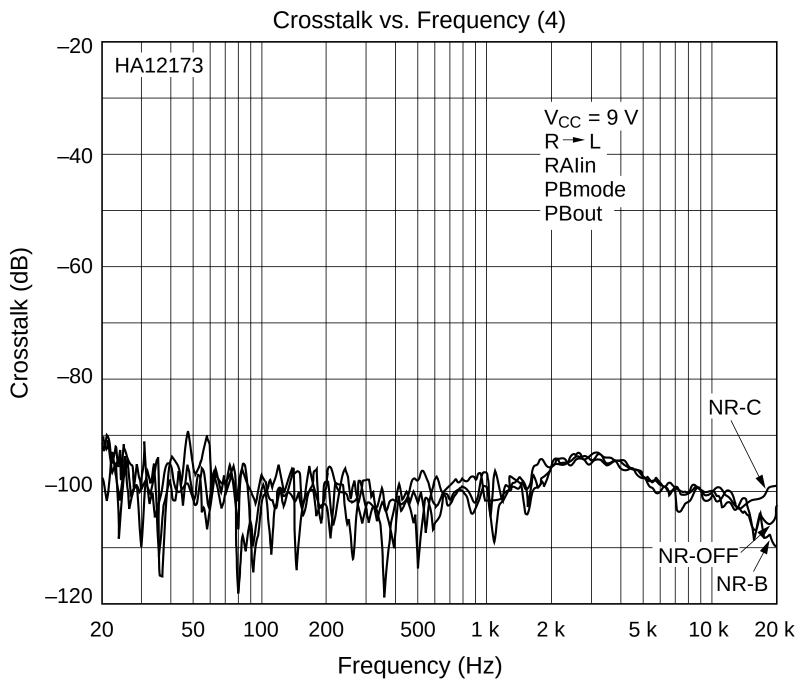

Total Harmonic Distortion vs. Frequency (5)
HA12173
RAIin
RECmode
RECout
NR-B
Vin = +10 dB
–10 dB
0 dB
Total Harmonic Distortion T.H.D. (%)
0.2
0.1
0.05
0.02
0.01
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

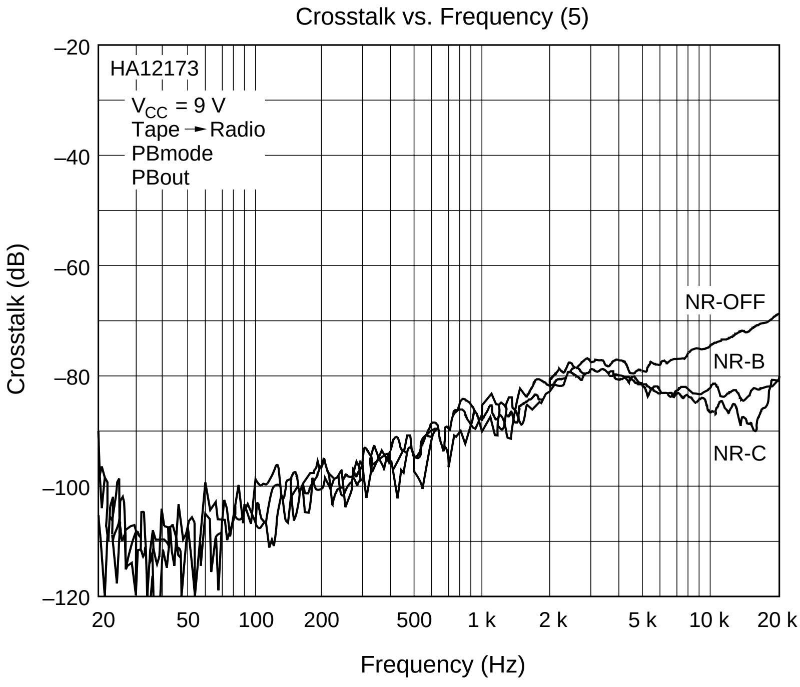

Total Harmonic Distortion vs. Frequency (6)
HA12173
RAIin
RECmode
RECout
NR-C
Vin = +10 dB
–10 dB
0 dB
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

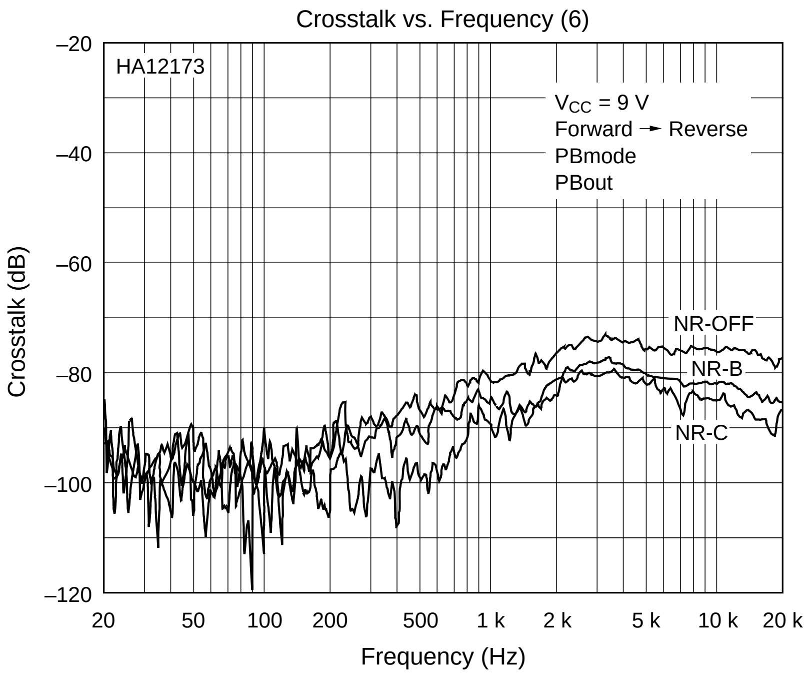

Crosstalk vs. Frequency (1)
HA12173
VCC = 9V
Radio → Tape
PBmode
PBout
NR-OFF
NR-B
NR-C
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

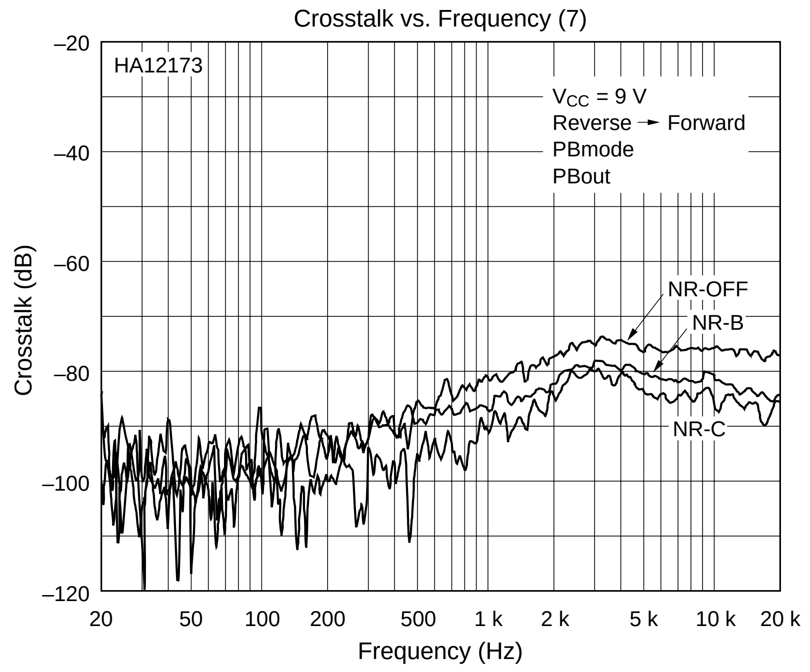

Crosstalk vs. Frequency (2)
HA12173
VCC = 9V
Radio → Tape
RECmode
RECout
NR-C
NR-B
NR-OFF
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

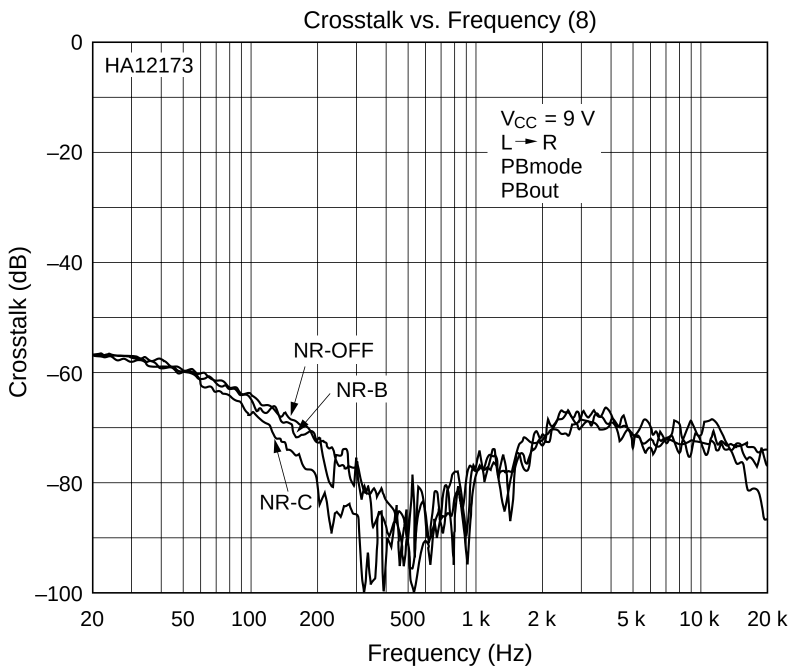

Crosstalk vs. Frequency (3)
HA12173
VCC = 9 V
L → R
RAIin
PBmode
PBout
NR-C
NR-B
NR-OFF
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

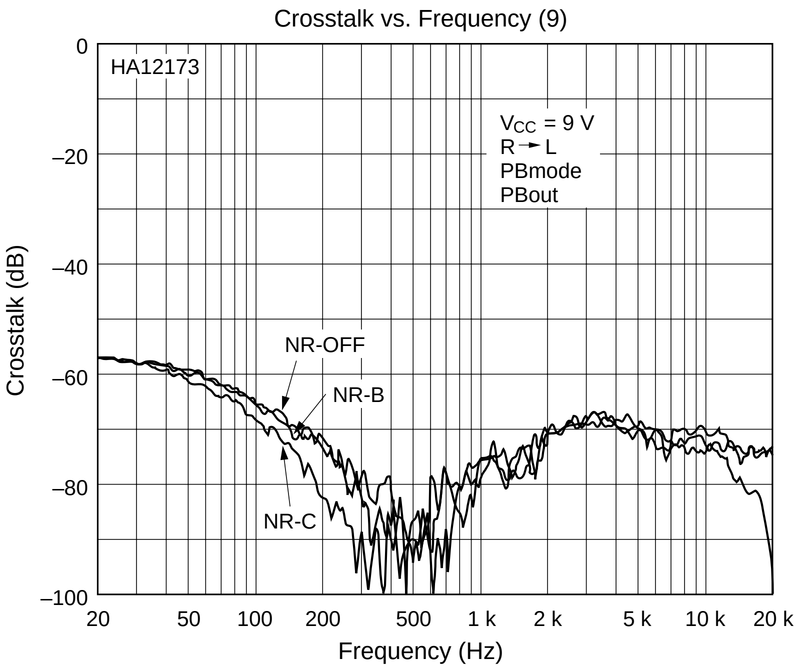

Crosstalk vs. Frequency (4)
HA12173
VCC = 9 V
R → L
RAIin
PBmode
PBout
NR-C
NR-OFF
NR-B
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

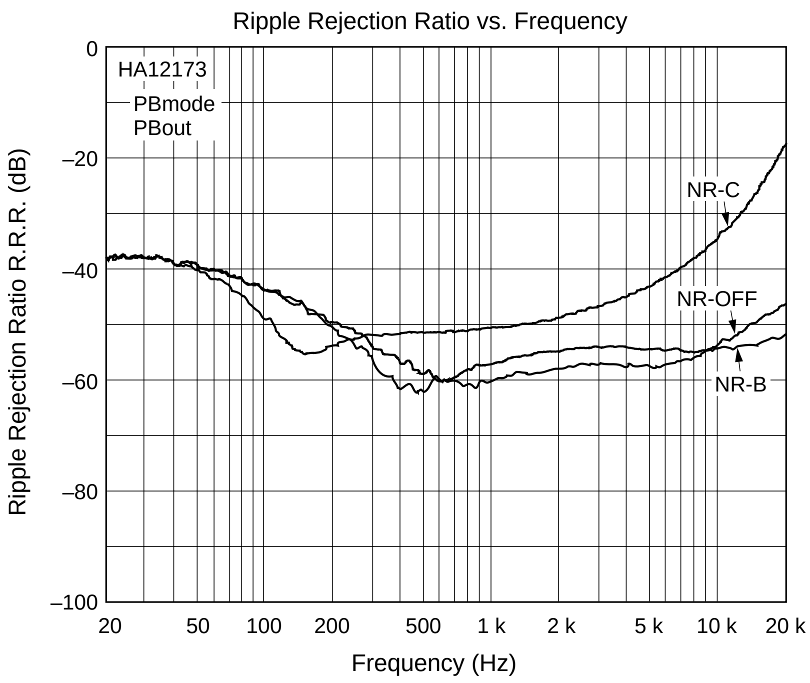

Crosstalk vs. Frequency (5)
HA12173
VCC = 9 V
Tape → Radio
PBmode
PBout
NR-OFF
NR-B
NR-C
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

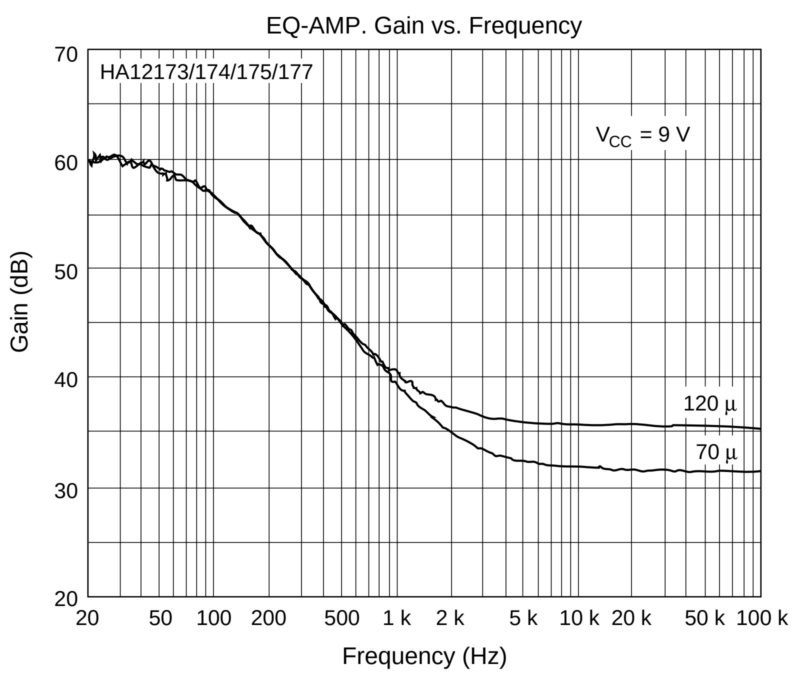

Crosstalk vs. Frequency (6)
HA12173
VCC = 9 V
Forward → Reverse
PBmode
PBout
NR-OFF
NR-B
NR-C
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

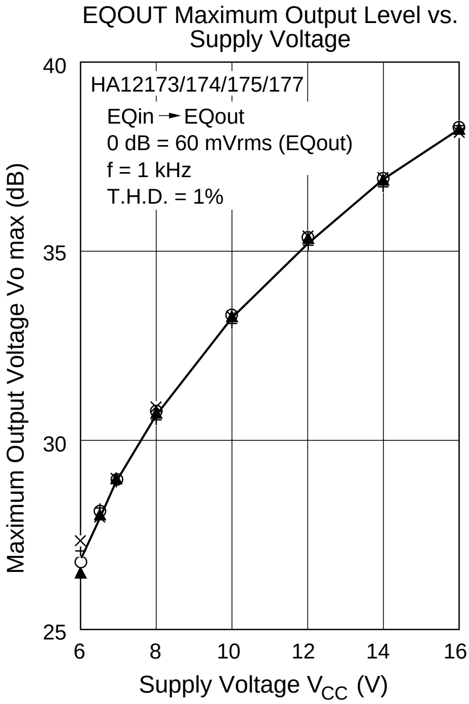

Crosstalk vs. Frequency (7)
HA12173
VCC = 9 V
Reverse → Forward
PBmode
PBout
NR-OFF
NR-B
NR-C
Crosstalk (dB)
–20
–40
–60
–80
–100
–120
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

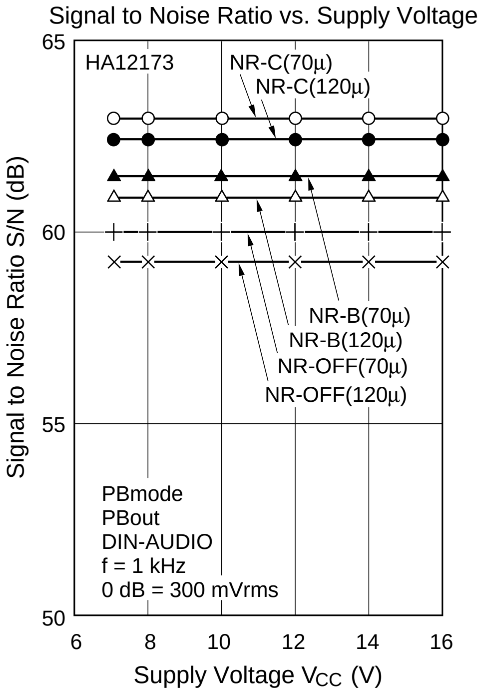

Crosstalk vs. Frequency (8)
HA12173
VCC = 9 V
L → R
PBmode
PBout
NR-OFF
NR-B
NR-C
Crosstalk (dB)
0
–20
–40
–60
–80
–100
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

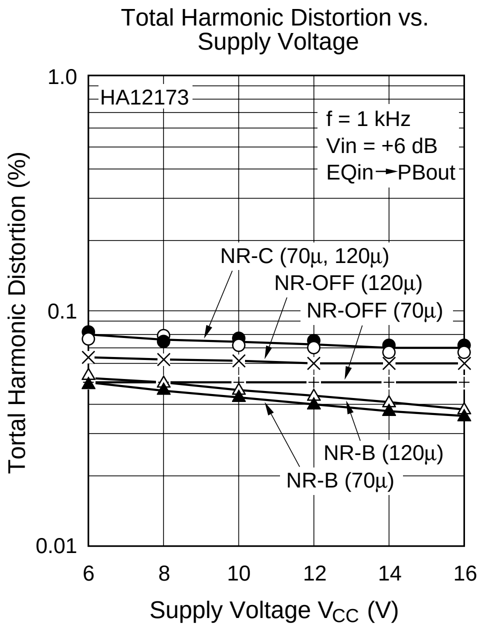

Crosstalk vs. Frequency (9)
HA12173
VCC = 9 V
R → L
PBmode
PBout
NR-OFF
NR-B
NR-C
Crosstalk (dB)
0
–20
–40
–60
–80
–100
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

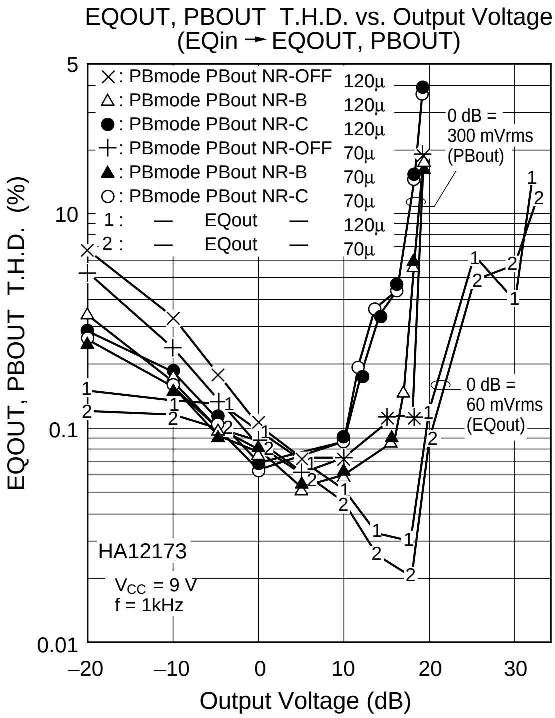

Ripple Rejection Ratio vs. Frequency
HA12173
PBmode
PBout
NR-C
NR-OFF
NR-B
0
–20
–40
–60
–80
–100
Ripple Rejection Ratio R.R.R. (dB)
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

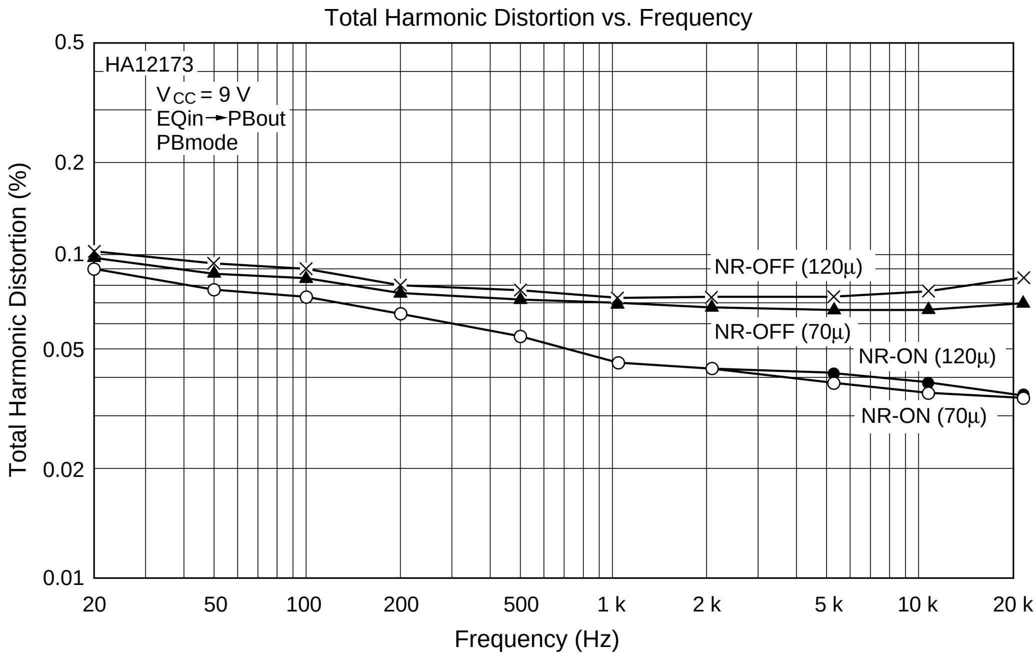

EQ-AMP. Gain vs. Frequency
HA12173/174/175/177
VCC = 9 V
120 µ
70 µ
70
60
50
40
30
20
Gain (dB)
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
50 k
100 k
Frequency (Hz)

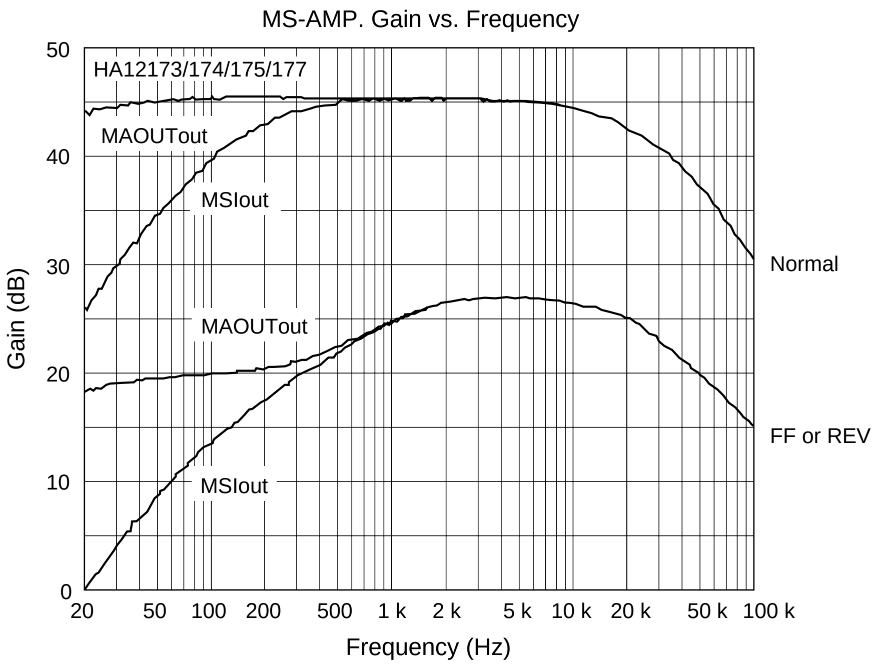

EQOUT Maximum Output Level vs.
Supply Voltage
HA12173/174/175/177
EQin → EQout
0 dB = 60 mVrms (EQout)
f = 1 kHz
T.H.D. = 1%
Maximum Output Voltage Vo max (dB)
40
35
30
25
6
8
10
12
14
16
Supply Voltage VCC (V)

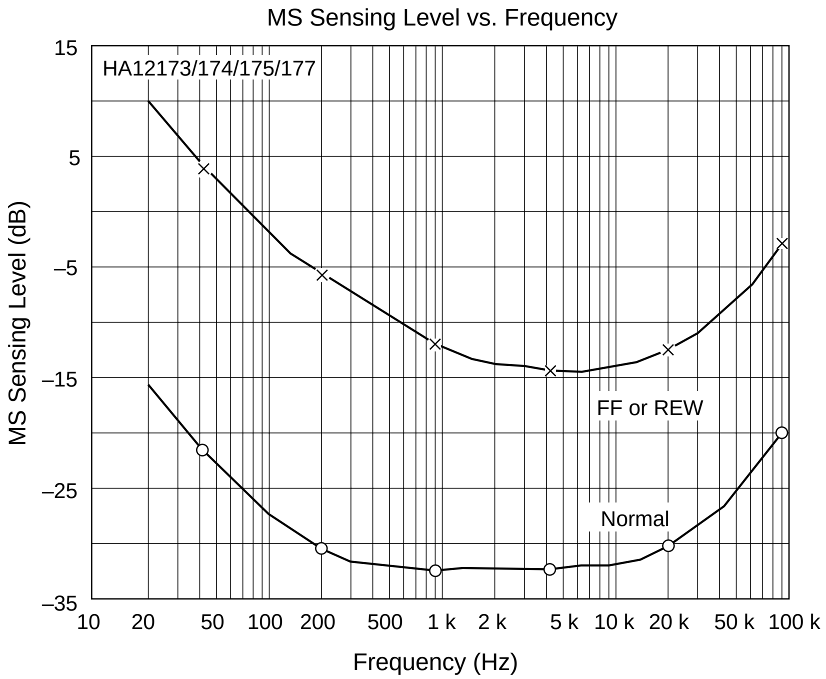

Signal to Noise Ratio vs. Supply Voltage
HA12173
NR-C(70µ)
NR-C(120µ)
NR-B(70µ)
NR-B(120µ)
NR-OFF(70µ)
NR-OFF(120µ)
PBmode
PBout
DIN-AUDIO
f = 1 kHz
0 dB = 300 mVrms
Signal to Noise Ratio S/N (dB)
65
60
55
50
6
8
10
12
14
16
Supply Voltage VCC (V)

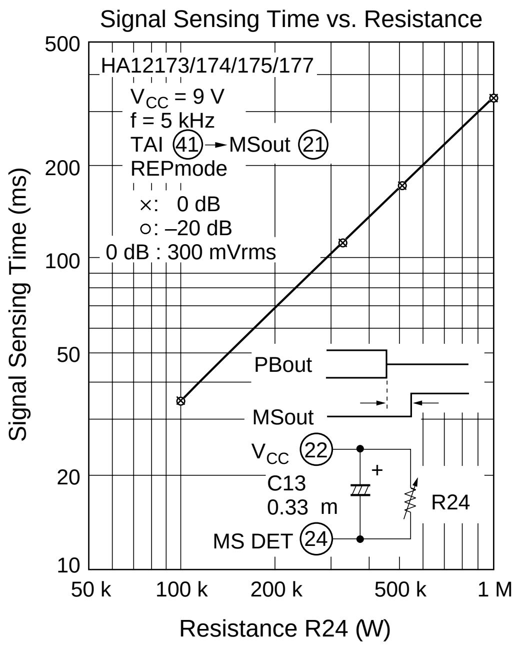

Total Harmonic Distortion vs.
Supply Voltage
HA12173
f = 1 kHz
Vin = +6 dB
EQin → PBout
NR-C (70µ, 120µ)
NR-OFF (120µ)
NR-OFF (70µ)
NR-B (120µ)
NR-B (70µ)
Tortal Harmonic Distortion (%)
1.0
0.1
0.01
6
8
10
12
14
16
Supply Voltage VCC (V)

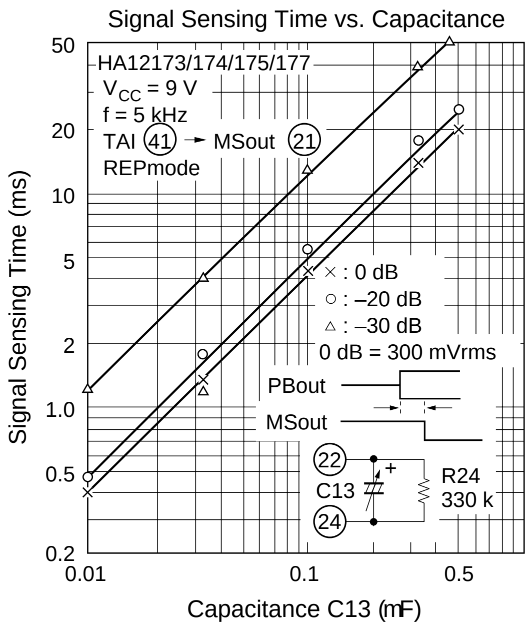

EQOUT, PBOUT T.H.D. vs. Output Voltage
(EQin → EQOUT, PBOUT)
×: PBmode PBout NR-OFF 120µ
△: PBmode PBout NR-B 120µ
●: PBmode PBout NR-C 120µ
+: PBmode PBout NR-OFF 70µ
▲: PBmode PBout NR-B 70µ
○: PBmode PBout NR-C 70µ
1 : — EQout — 120µ
2 : — EQout — 70µ
0 dB = 300 mVrms (PBout)
0 dB = 60 mVrms (EQout)
HA12173
VCC = 9 V
f = 1kHz
EQOUT, PBOUT T.H.D. (%)
Output Voltage (dB)
5
10
0.1
0.01
–20
–10
0
10
20
30


Total Harmonic Distortion vs. Frequency
HA12173
VCC = 9 V
EQin→PBout
PBmode
NR-OFF (120µ)
NR-OFF (70µ)
NR-ON (120µ)
NR-ON (70µ)
Total Harmonic Distortion (%)
Frequency (Hz)
0.5
0.2
0.1
0.05
0.02
0.01
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k

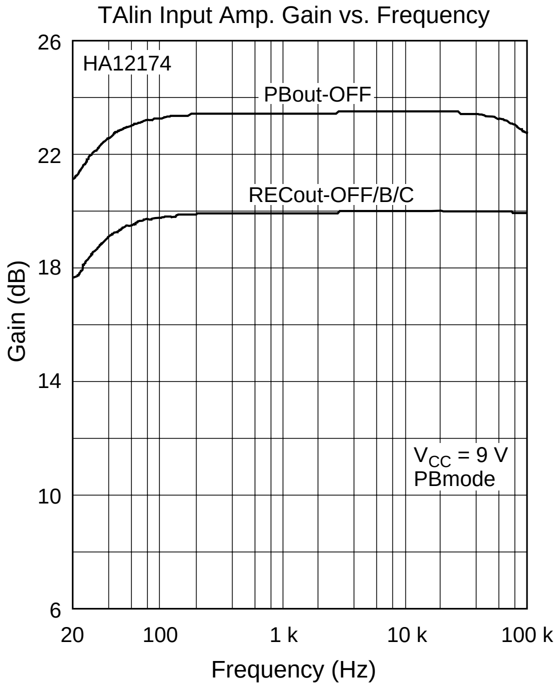

MS-AMP. Gain vs. Frequency
HA12173/174/175/177
MAOUTout
MSIout
MAOUTout
MSIout
Normal
FF or REV
Gain (dB)
0
10
20
30
40
50
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
50 k
100 k
Frequency (Hz)

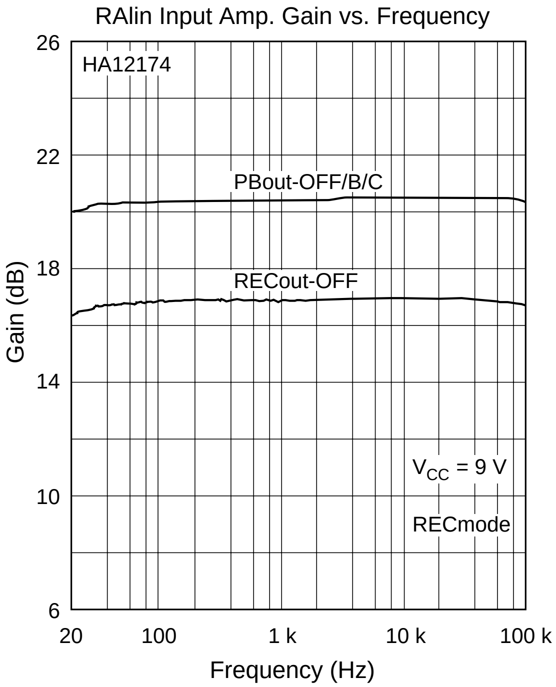

MS Sensing Level vs. Frequency
HA12173/174/175/177
FF or REW
Normal
MS Sensing Level (dB)
15
5
–5
–15
–25
–35
10
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
50 k
100 k
Frequency (Hz)

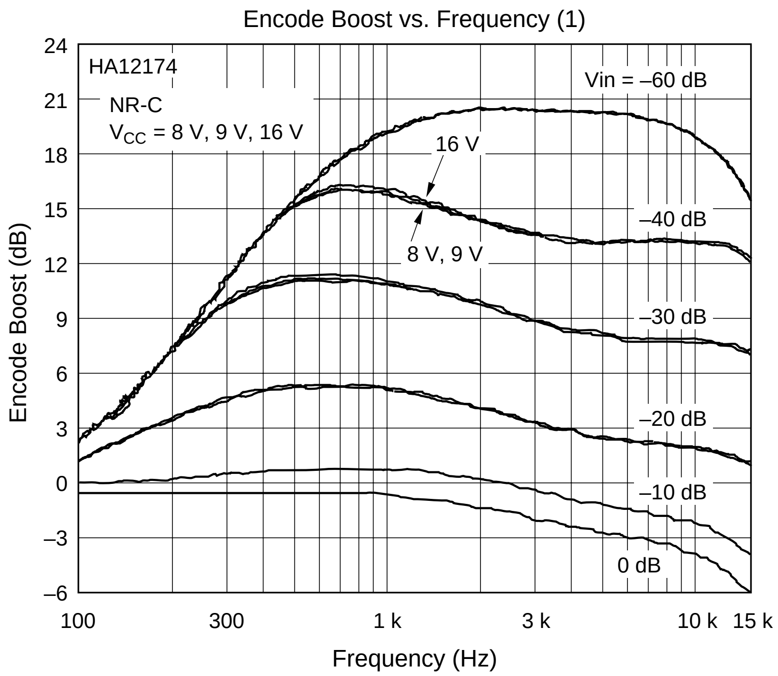

Signal Sensing Time vs. Resistance
HA12173/174/175/177
VCC = 9 V
f = 5 kHz
TAI (41) → MSout (21)
REPmode
×: 0 dB
○: –20 dB
0 dB : 300 mVrms
PBout
MSout
VCC (22)
C13
0.33 m
R24
MS DET (24)
Signal Sensing Time (ms)
500
200
100
50
20
10
50 k
100 k
200 k
500 k
1 M
Resistance R24 (W)

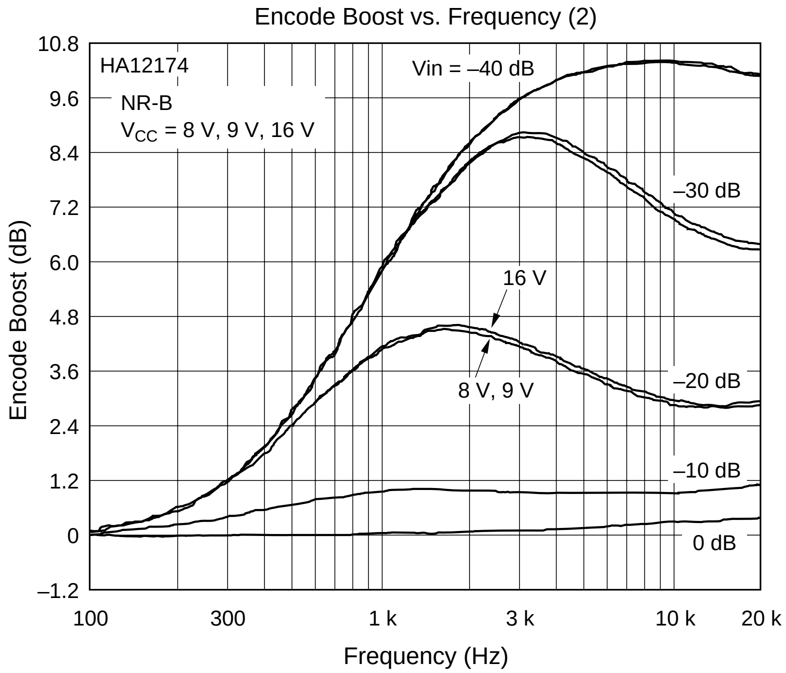

Signal Sensing Time vs. Capacitance
HA12173/174/175/177
VCC = 9 V
f = 5 kHz
TAI (41) → MSout (21)
REPmode
× : 0 dB
○ : –20 dB
△ : –30 dB
0 dB = 300 mVrms
PBout
MSout
(22)
C13
(24)
R24
330 k
Signal Sensing Time (ms)
50
20
10
5
2
1.0
0.5
0.2
0.01
0.1
0.5
Capacitance C13 (mF)

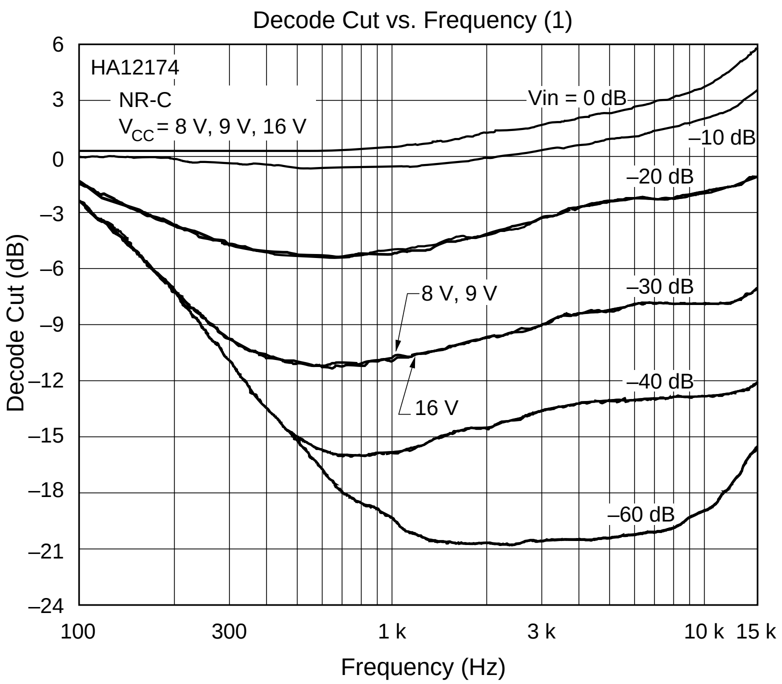
HA12174


TAlin Input Amp. Gain vs. Frequency
HA12174
PBout-OFF
RECout-OFF/B/C
VCC = 9 V
PBmode
Gain (dB)
26
22
18
14
10
6
20
100
1 k
10 k
100 k
Frequency (Hz)

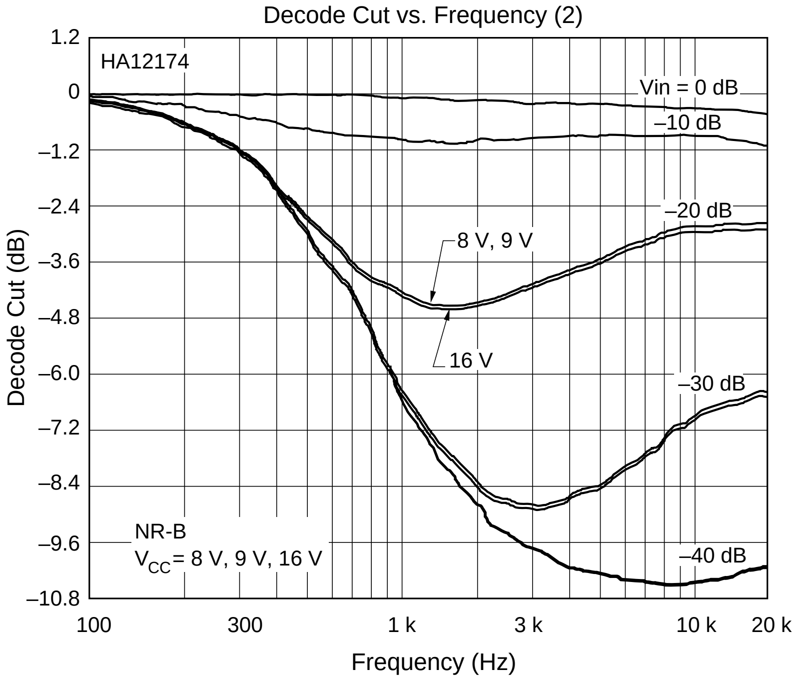

RAlin Input Amp. Gain vs. Frequency
HA12174
PBout-OFF/B/C
RECout-OFF
VCC = 9 V
RECmode
Gain (dB)
26
22
18
14
10
6
20
100
1 k
10 k
100 k
Frequency (Hz)


Encode Boost vs. Frequency (1)
HA12174
NR-C
V_{CC} = 8 V, 9 V, 16 V
Vin = –60 dB
16 V
8 V, 9 V
–40 dB
–30 dB
–20 dB
–10 dB
0 dB
Encode Boost (dB)
24
21
18
15
12
9
6
3
0
–3
–6
100
300
1 k
3 k
10 k
15 k
Frequency (Hz)

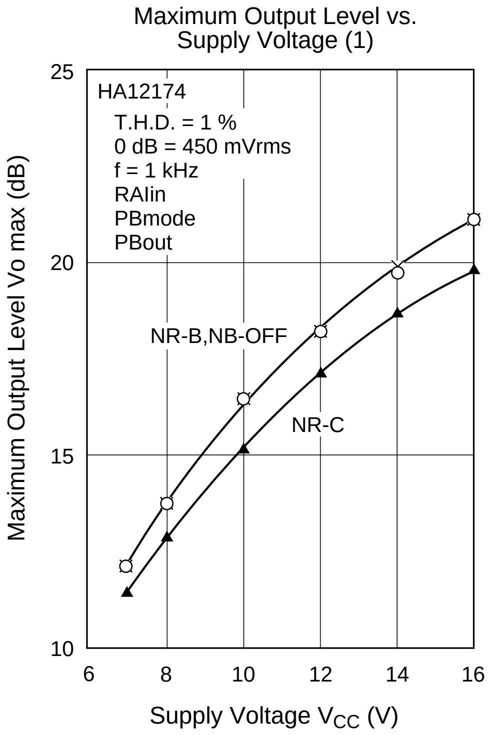

Encode Boost vs. Frequency (2)
HA12174
NR-B
V_{CC} = 8 V, 9 V, 16 V
Vin = –40 dB
–30 dB
16 V
8 V, 9 V
–20 dB
–10 dB
0 dB
Encode Boost (dB)
10.8
9.6
8.4
7.2
6.0
4.8
3.6
2.4
1.2
0
–1.2
100
300
1 k
3 k
10 k
20 k
Frequency (Hz)

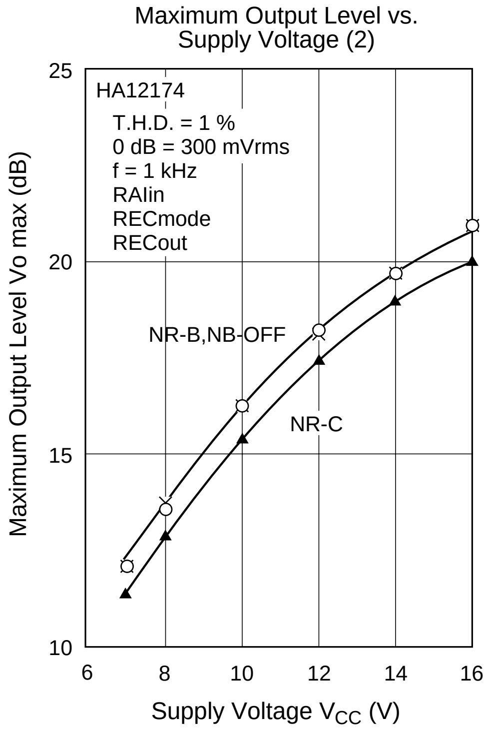


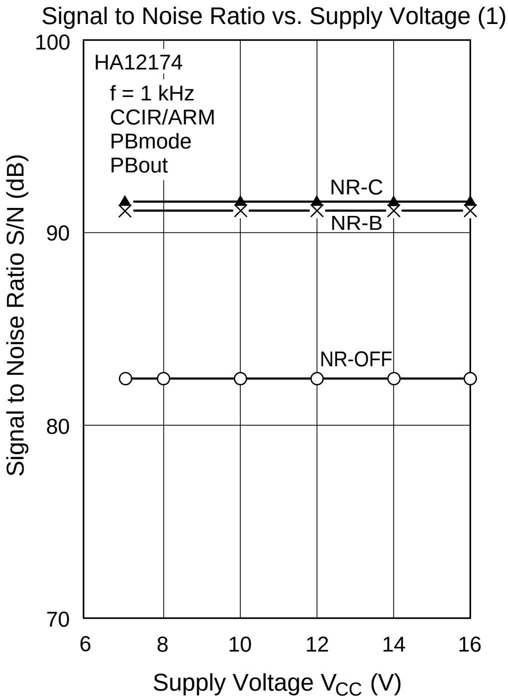
Decode Cut vs. Frequency (1)
HA12174
NR-C
VCC = 8 V, 9 V, 16 V
Vin = 0 dB
–10 dB
–20 dB
–30 dB
–40 dB
–60 dB
8 V, 9 V
16 V
Decode Cut (dB)
Frequency (Hz)
6
3
0
–3
–6
–9
–12
–15
–18
–21
–24
100
300
1 k
3 k
10 k
15 k

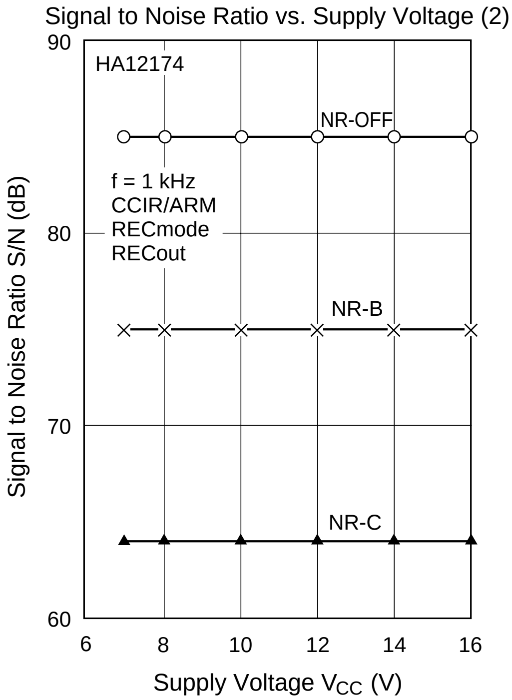


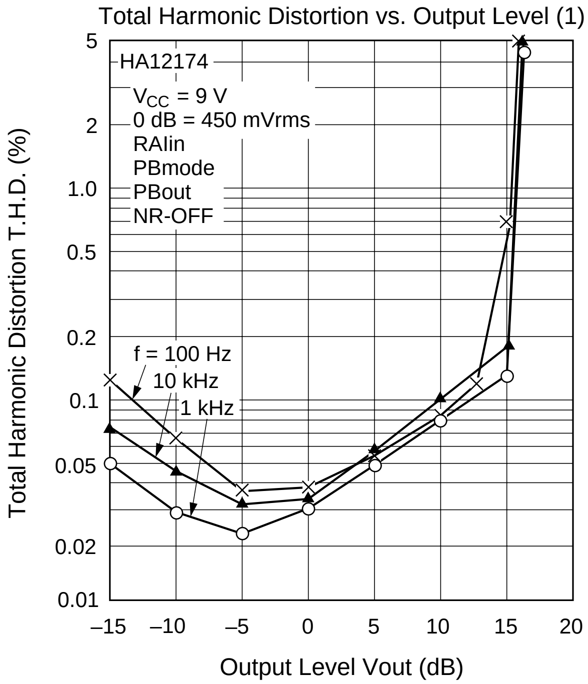
Decode Cut vs. Frequency (2)
HA12174
NR-B
VCC = 8 V, 9 V, 16 V
Vin = 0 dB
–10 dB
–20 dB
–30 dB
–40 dB
8 V, 9 V
16 V
Decode Cut (dB)
Frequency (Hz)
1.2
0
–1.2
–2.4
–3.6
–4.8
–6.0
–7.2
–8.4
–9.6
–10.8
100
300
1 k
3 k
10 k
20 k

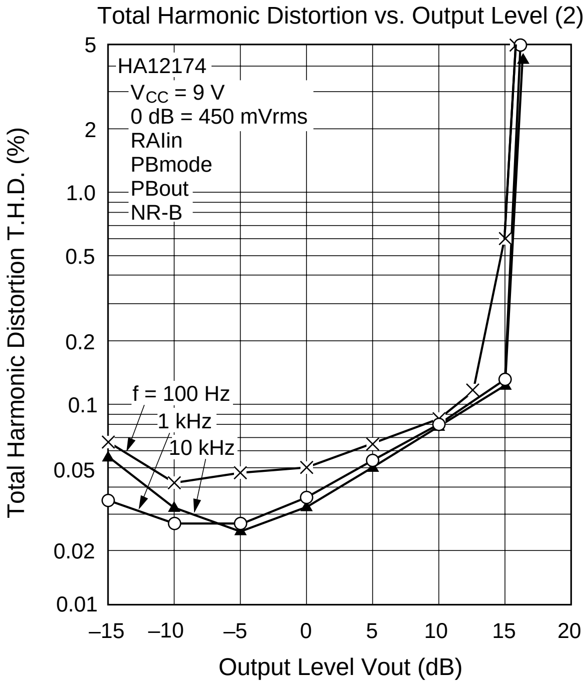

Maximum Output Level vs.
Supply Voltage (1)
HA12174
T.H.D. = 1 %
0 dB = 450 mVrms
f = 1 kHz
RAIin
PBmode
PBout
NR-B,NB-OFF
NR-C
Maximum Output Level Vo max (dB)
25
20
15
10
6
8
10
12
14
16
Supply Voltage VCC (V)

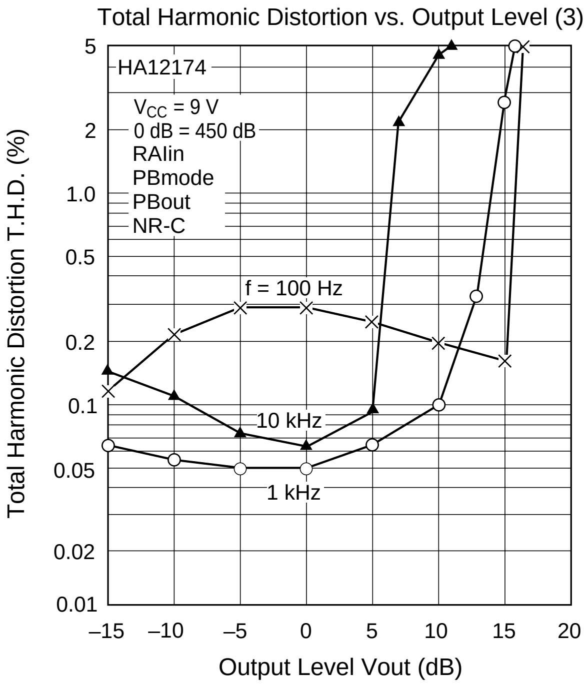

Maximum Output Level vs.
Supply Voltage (2)
HA12174
T.H.D. = 1 %
0 dB = 300 mVrms
f = 1 kHz
RAIin
RECmode
RECout
NR-B,NB-OFF
NR-C
Maximum Output Level Vo max (dB)
25
20
15
10
6
8
10
12
14
16
Supply Voltage VCC (V)

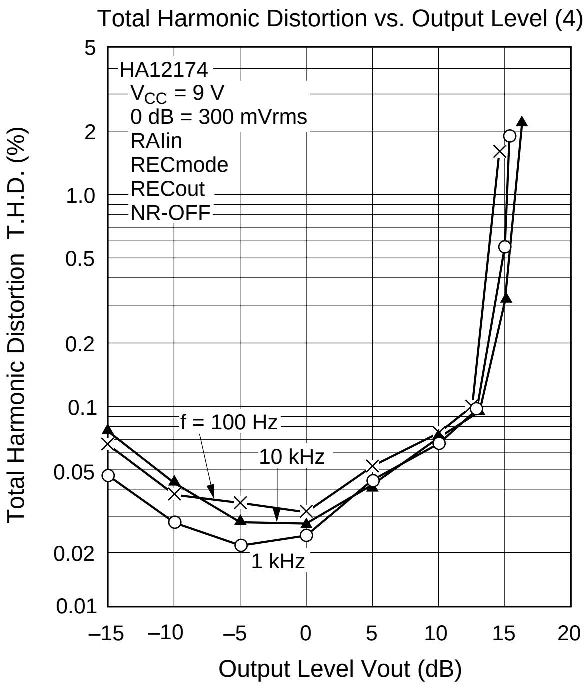

Signal to Noise Ratio vs. Supply Voltage (1)
HA12174
f = 1 kHz
CCIR/ARM
PBmode
PBout
NR-C
NR-B
NR-OFF
Signal to Noise Ratio S/N (dB)
100
90
80
70
6
8
10
12
14
16
Supply Voltage VCC (V)

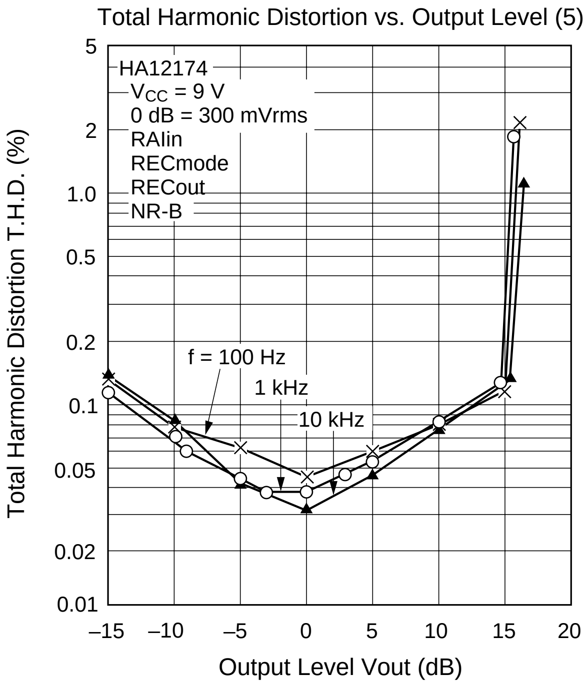

Signal to Noise Ratio vs. Supply Voltage (2)
HA12174
NR-OFF
f = 1 kHz
CCIR/ARM
RECmode
RECout
NR-B
NR-C
Signal to Noise Ratio S/N (dB)
90
80
70
60
6
8
10
12
14
16
Supply Voltage VCC (V)

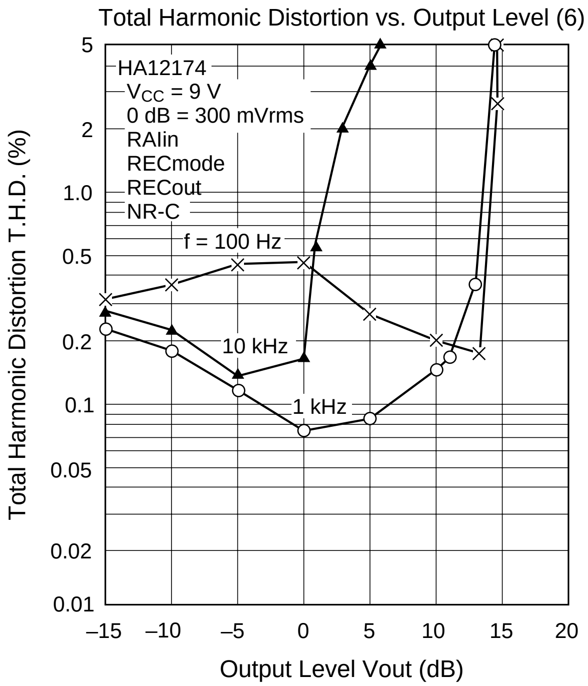

Total Harmonic Distortion vs. Output Level (1)
HA12174
VCC = 9 V
0 dB = 450 mVrms
RAIin
PBmode
PBout
NR-OFF
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
Output Level Vout (dB)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20

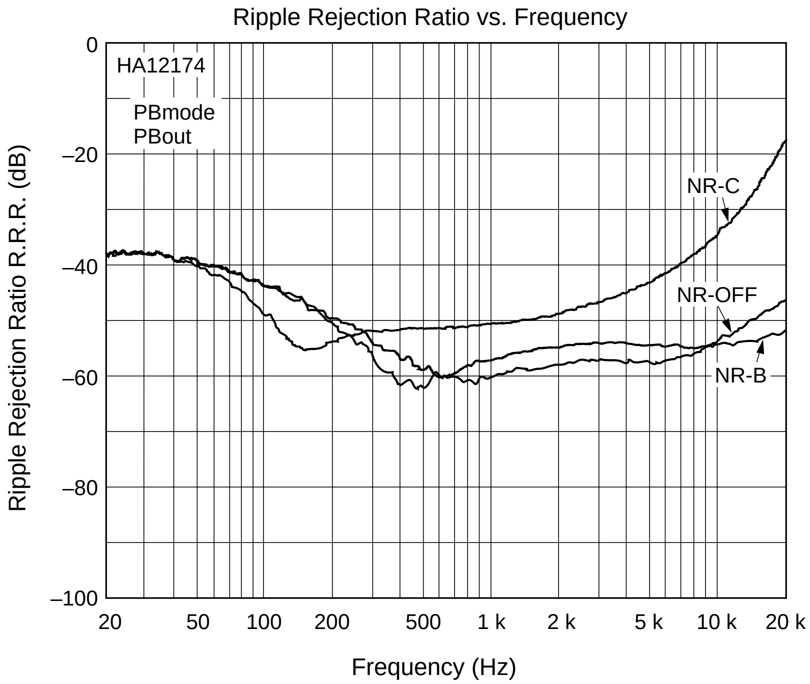

Total Harmonic Distortion vs. Output Level (2)
HA12174
VCC = 9 V
0 dB = 450 mVrms
RAIin
PBmode
PBout
NR-B
f = 100 Hz
1 kHz
10 kHz
Total Harmonic Distortion T.H.D. (%)
Output Level Vout (dB)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20


Total Harmonic Distortion vs. Output Level (3)
HA12174
VCC = 9 V
0 dB = 450 dB
RAIin
PBmode
PBout
NR-C
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

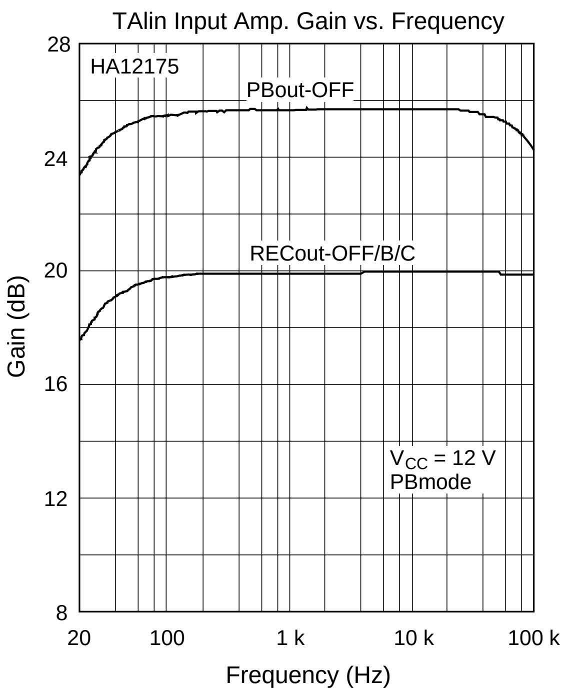

Total Harmonic Distortion vs. Output Level (4)
HA12174
VCC = 9 V
0 dB = 300 mVrms
RAIin
RECmode
RECout
NR-OFF
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

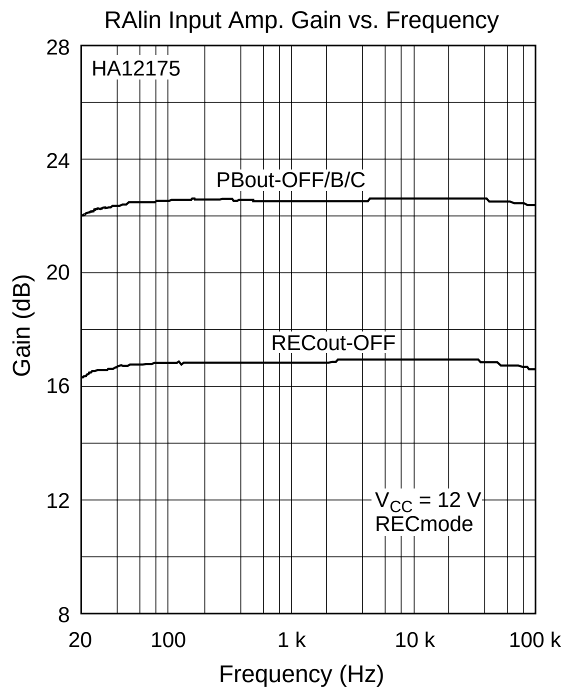

Total Harmonic Distortion vs. Output Level (5)
HA12174
V_{CC} = 9 V
0 dB = 300 mVrms
RAIin
RECmode
RECout
NR-B
f = 100 Hz
1 kHz
10 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

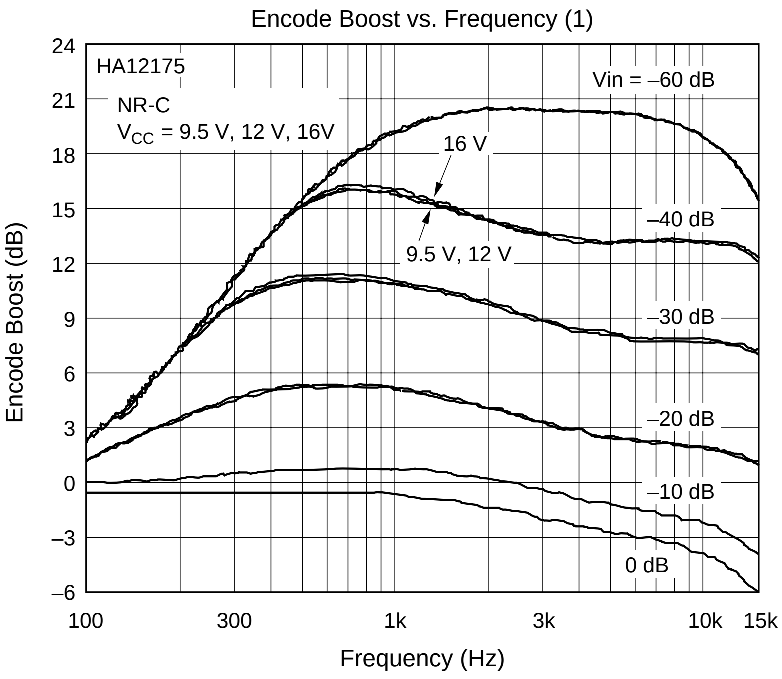

Total Harmonic Distortion vs. Output Level (6)
HA12174
V_{CC} = 9 V
0 dB = 300 mVrms
RAIin
RECmode
RECout
NR-C
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

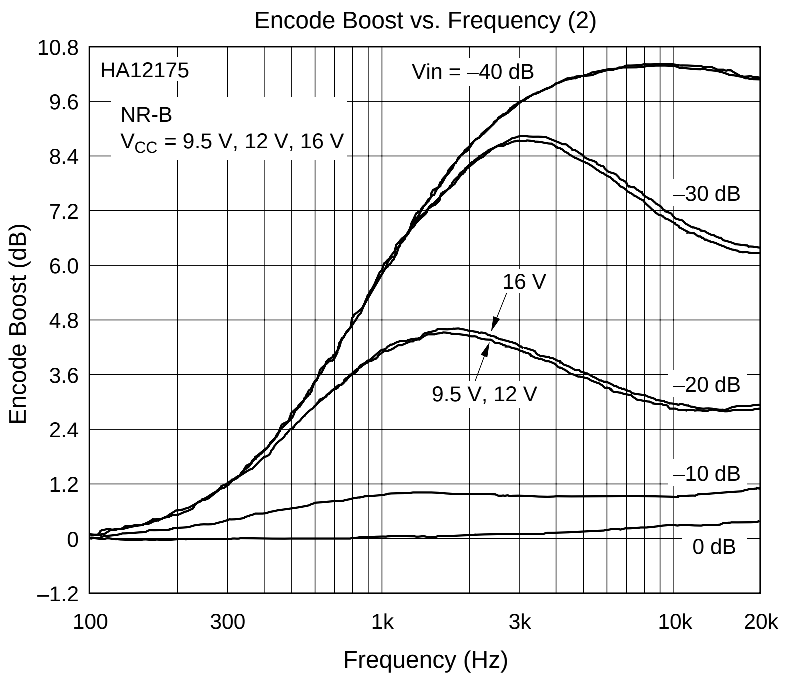

Ripple Rejection Ratio vs. Frequency
HA12174
PBmode
PBout
NR-C
NR-OFF
NR-B
Ripple Rejection Ratio R.R.R. (dB)
0
–20
–40
–60
–80
–100
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

HA12175

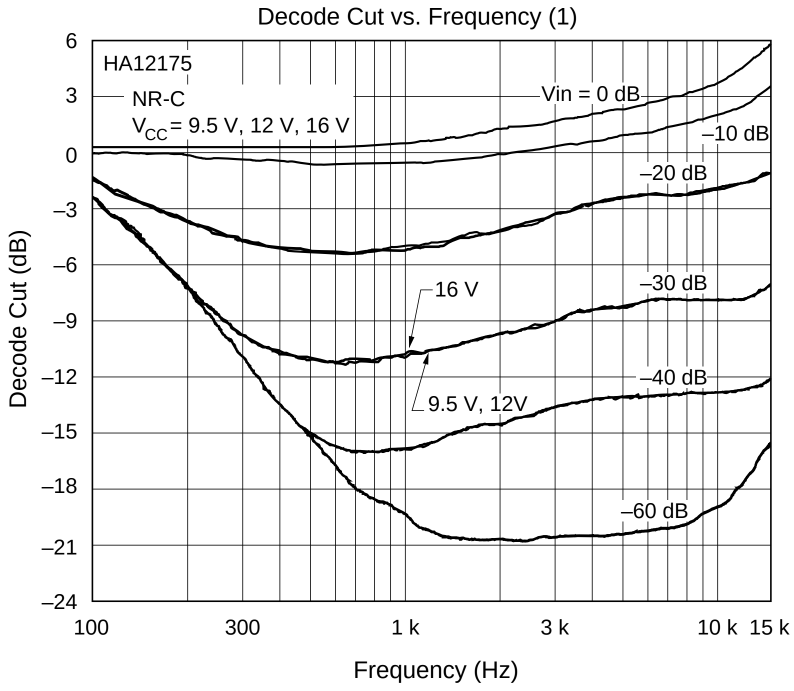

TAlin Input Amp. Gain vs. Frequency
HA12175
PBout-OFF
RECout-OFF/B/C
VCC = 12 V
PBmode
Gain (dB)
28
24
20
16
12
8
20
100
1 k
10 k
100 k
Frequency (Hz)


RAlin Input Amp. Gain vs. Frequency
HA12175
PBout-OFF/B/C
RECout-OFF
VCC = 12 V
RECmode
Gain (dB)
28
24
20
16
12
8
20
100
1 k
10 k
100 k
Frequency (Hz)

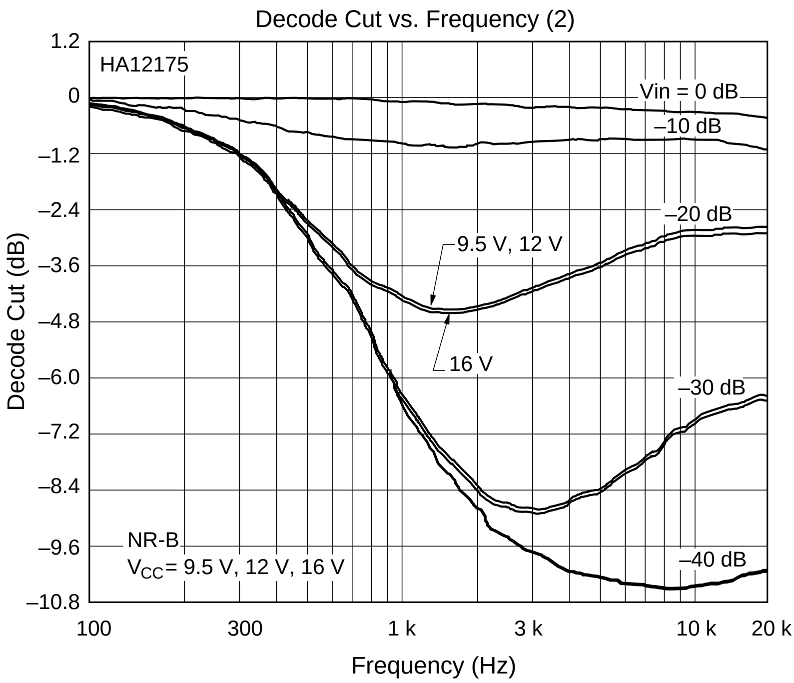

Encode Boost vs. Frequency (1)
HA12175
NR-C
VCC = 9.5 V, 12 V, 16V
Vin = –60 dB
16 V
9.5 V, 12 V
–40 dB
–30 dB
–20 dB
–10 dB
0 dB
Encode Boost (dB)
24
21
18
15
12
9
6
3
0
–3
–6
100
300
1k
3k
10k
15k
Frequency (Hz)

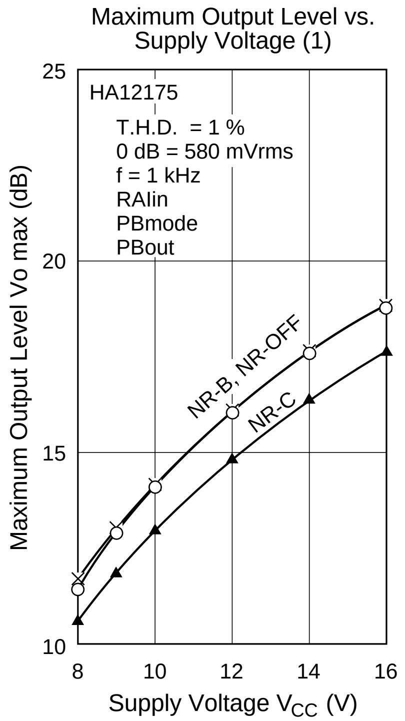


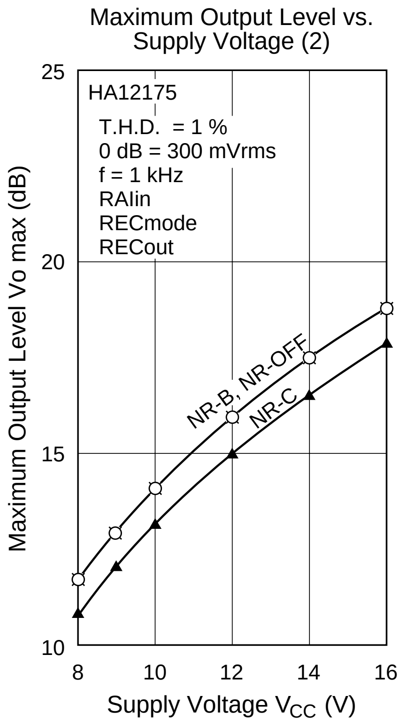
Encode Boost vs. Frequency (2)
HA12175
NR-B
VCC = 9.5 V, 12 V, 16 V
Vin = –40 dB
–30 dB
16 V
9.5 V, 12 V
–20 dB
–10 dB
0 dB
Encode Boost (dB)
10.8
9.6
8.4
7.2
6.0
4.8
3.6
2.4
1.2
0
–1.2
100
300
1k
3k
10k
20k
Frequency (Hz)

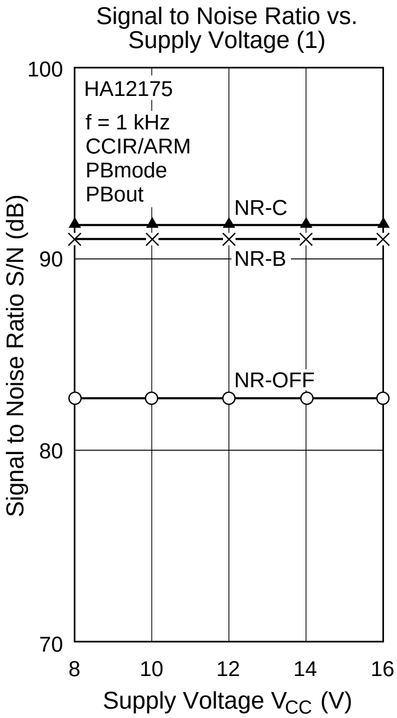


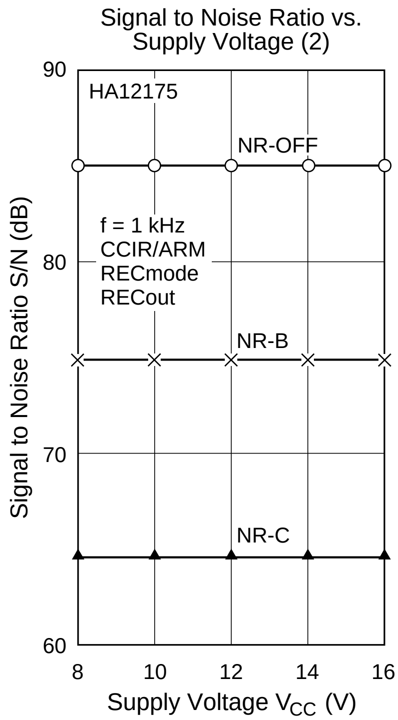
Decode Cut vs. Frequency (1)
HA12175
NR-C
VCC = 9.5 V, 12 V, 16 V
Vin = 0 dB
–10 dB
–20 dB
16 V
–30 dB
9.5 V, 12V
–40 dB
–60 dB
Decode Cut (dB)
6
3
0
–3
–6
–9
–12
–15
–18
–21
–24
100
300
1 k
3 k
10 k
15 k
Frequency (Hz)

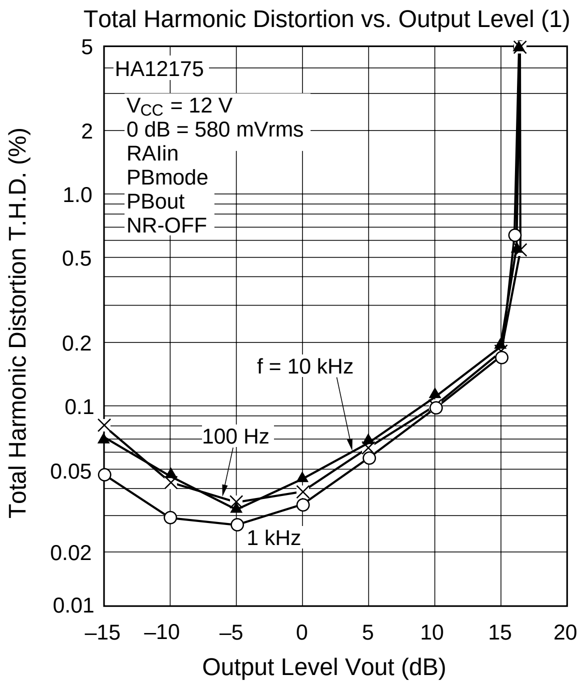

Decode Cut vs. Frequency (2)
HA12175
Vin = 0 dB
–10 dB
–20 dB
9.5 V, 12 V
16 V
–30 dB
–40 dB
NR-B
VCC= 9.5 V, 12 V, 16 V
Decode Cut (dB)
1.2
0
–1.2
–2.4
–3.6
–4.8
–6.0
–7.2
–8.4
–9.6
–10.8
100
300
1 k
3 k
10 k
20 k
Frequency (Hz)

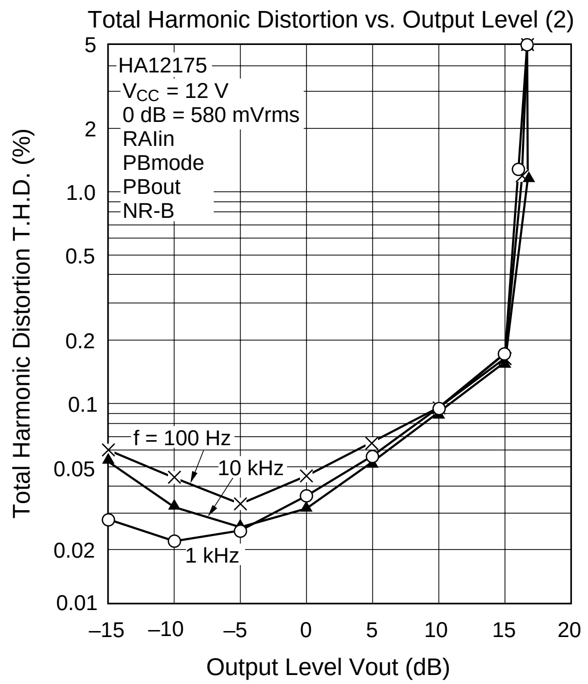

Maximum Output Level vs.
Supply Voltage (1)
HA12175
T.H.D. = 1 %
0 dB = 580 mVrms
f = 1 kHz
RAIin
PBmode
PBout
NR-B, NR-OFF
NR-C
Maximum Output Level Vo max (dB)
25
20
15
10
8
10
12
14
16
Supply Voltage VCC (V)

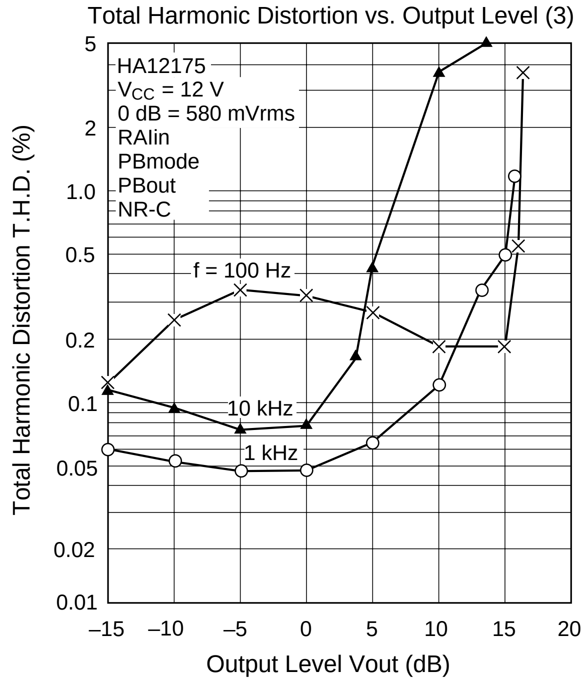

Maximum Output Level vs.
Supply Voltage (2)
HA12175
T.H.D. = 1 %
0 dB = 300 mVrms
f = 1 kHz
RAIin
RECmode
RECout
NR-B, NR-OFF
NR-C
Maximum Output Level Vo max (dB)
25
20
15
10
8
10
12
14
16
Supply Voltage VCC (V)

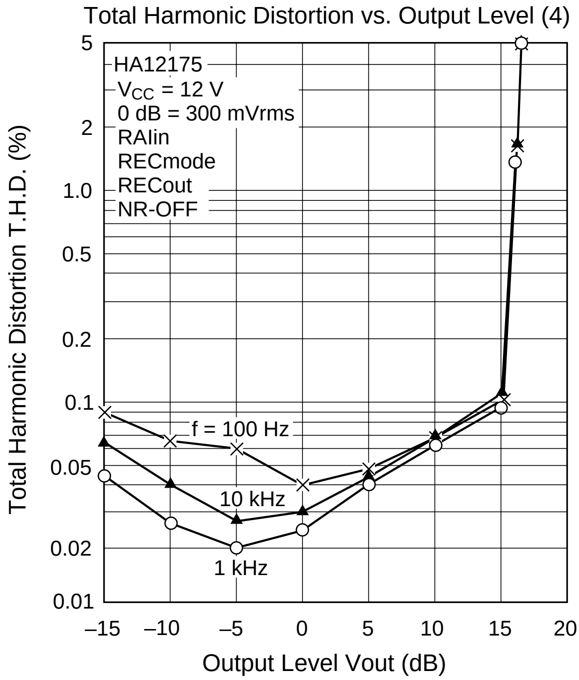

Signal to Noise Ratio vs.
Supply Voltage (1)
HA12175
f = 1 kHz
CCIR/ARM
PBmode
PBout
NR-C
NR-B
NR-OFF
Signal to Noise Ratio S/N (dB)
100
90
80
70
8
10
12
14
16
Supply Voltage VCC (V)

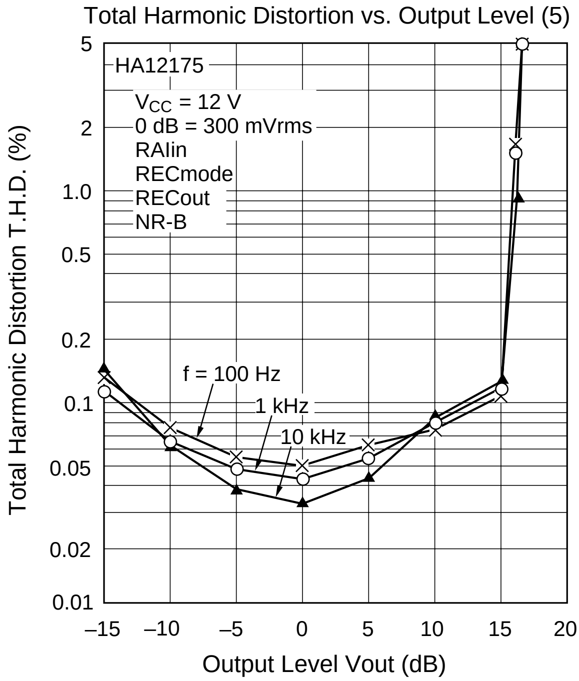

Signal to Noise Ratio vs.
Supply Voltage (2)
HA12175
NR-OFF
f = 1 kHz
CCIR/ARM
RECmode
RECout
NR-B
NR-C
Signal to Noise Ratio S/N (dB)
90
80
70
60
8
10
12
14
16
Supply Voltage VCC (V)

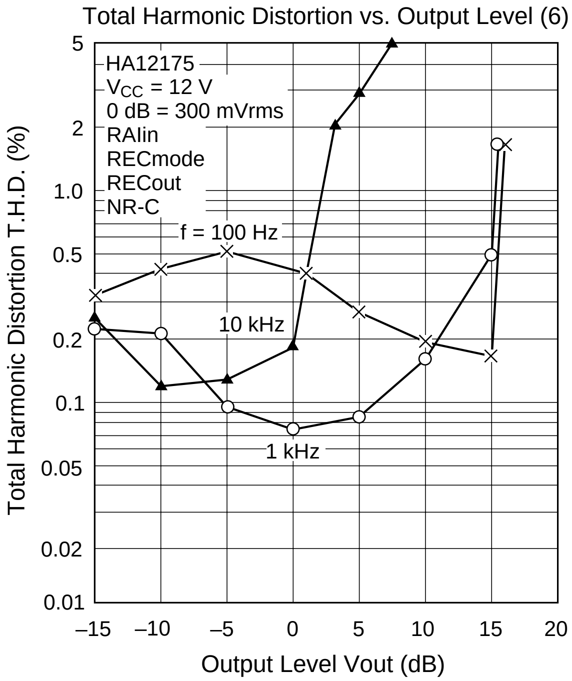

Total Harmonic Distortion vs. Output Level (1)
HA12175
VCC = 12 V
0 dB = 580 mVrms
RAIin
PBmode
PBout
NR-OFF
f = 10 kHz
100 Hz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

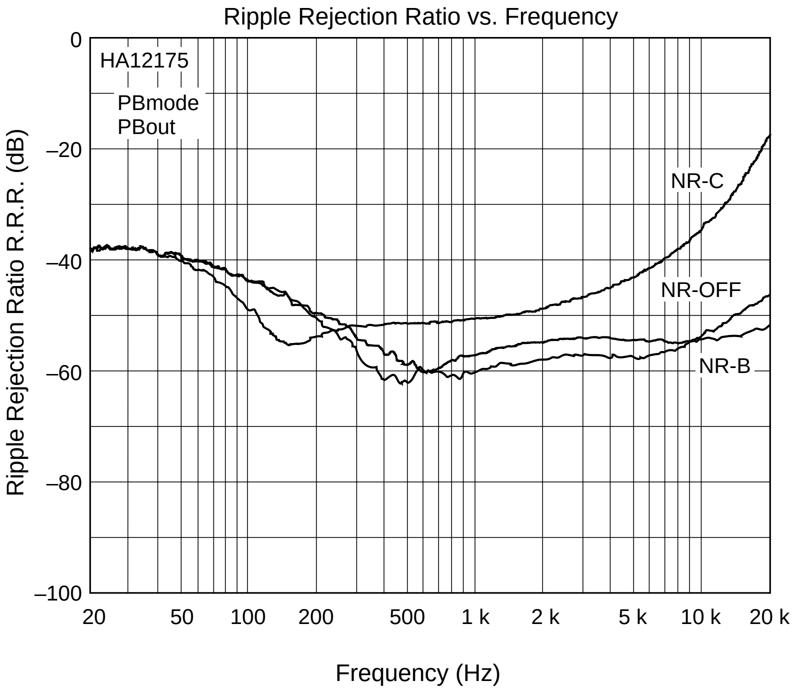

Total Harmonic Distortion vs. Output Level (2)
HA12175
VCC = 12 V
0 dB = 580 mVrms
RAIin
PBmode
PBout
NR-B
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
Output Level Vout (dB)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20


Total Harmonic Distortion vs. Output Level (3)
HA12175
VCC = 12 V
0 dB = 580 mVrms
RAIin
PBmode
PBout
NR-C
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
Output Level Vout (dB)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20

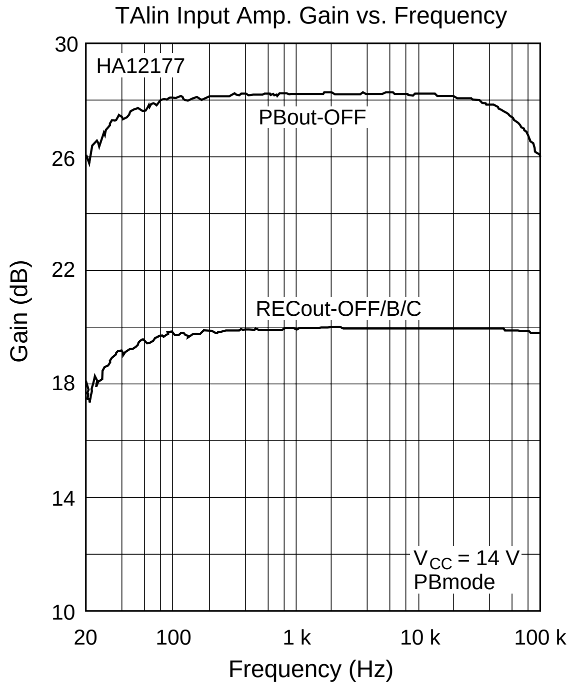

Total Harmonic Distortion vs. Output Level (4)
HA12175
V_{CC} = 12 V
0 dB = 300 mVrms
RAIin
RECmode
RECout
NR-OFF
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)


Total Harmonic Distortion vs. Output Level (5)
HA12175
V_{CC} = 12 V
0 dB = 300 mVrms
RAIin
RECmode
RECout
NR-B
f = 100 Hz
1 kHz
10 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

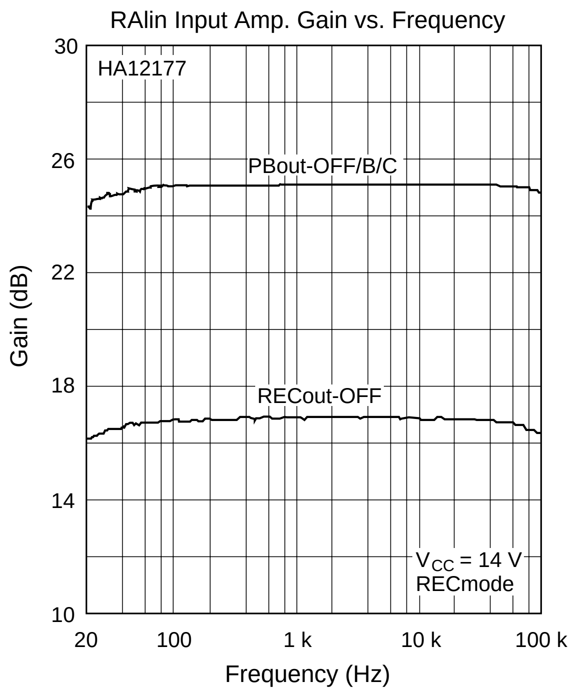

Total Harmonic Distortion vs. Output Level (6)
HA12175
VCC = 12 V
0 dB = 300 mVrms
RAIin
RECmode
RECout
NR-C
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15 –10 –5 0 5 10 15 20
Output Level Vout (dB)


Ripple Rejection Ratio vs. Frequency
HA12175
PBmode
PBout
NR-C
NR-OFF
NR-B
Ripple Rejection Ratio R.R.R. (dB)
0
–20
–40
–60
–80
–100
20 50 100 200 500 1 k 2 k 5 k 10 k 20 k
Frequency (Hz)

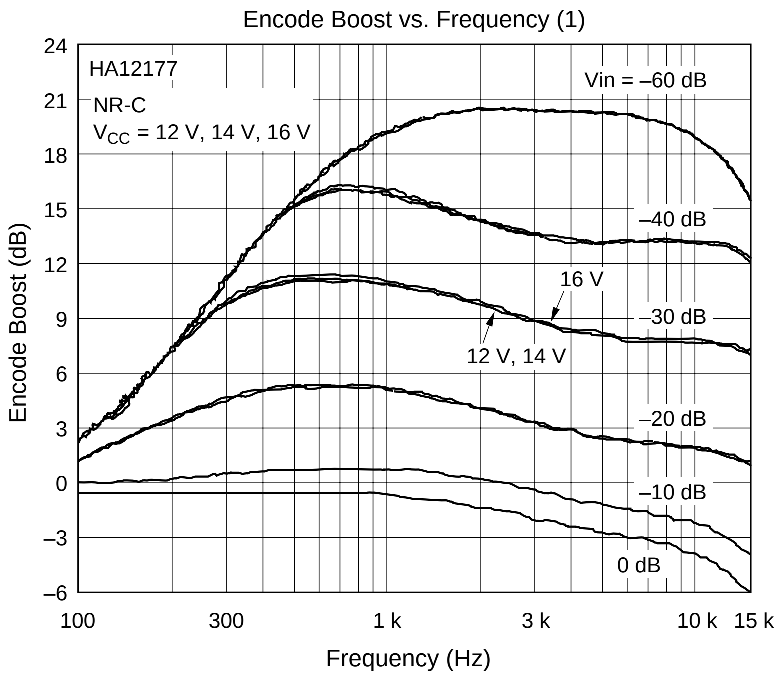
HA12177

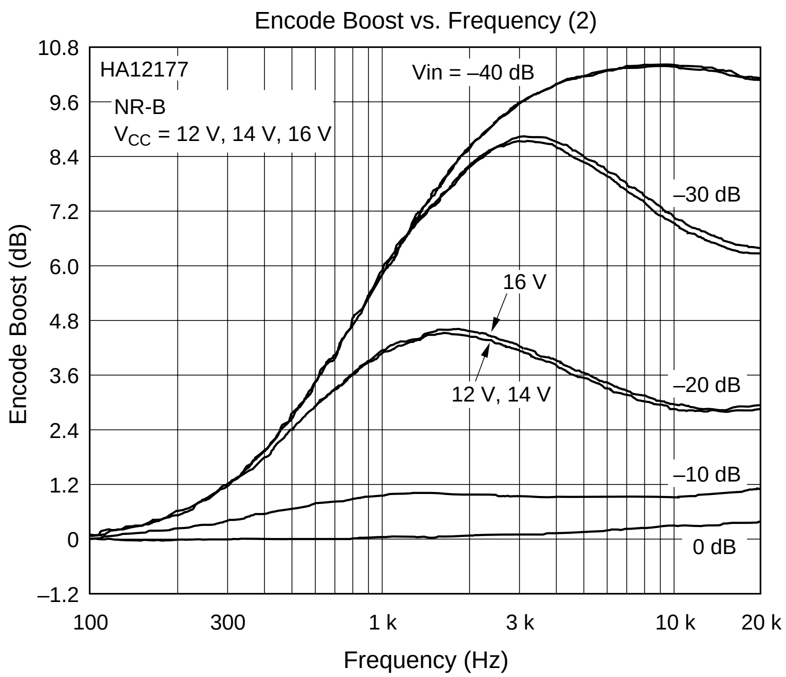


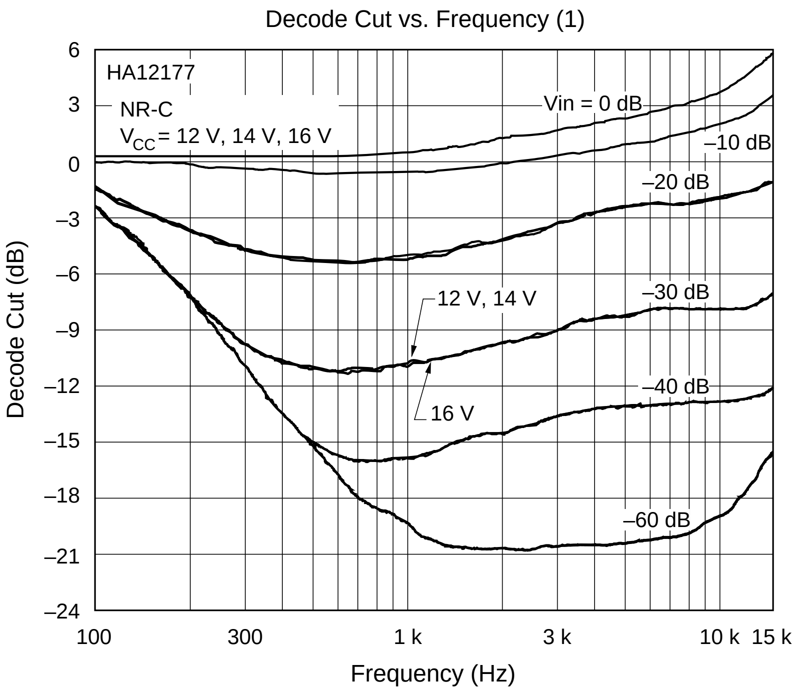
TAlin Input Amp. Gain vs. Frequency
HA12177
PBout-OFF
RECout-OFF/B/C
V_{CC} = 14 V
PBmode
Gain (dB)
30
26
22
18
14
10
20
100
1 k
10 k
100 k
Frequency (Hz)

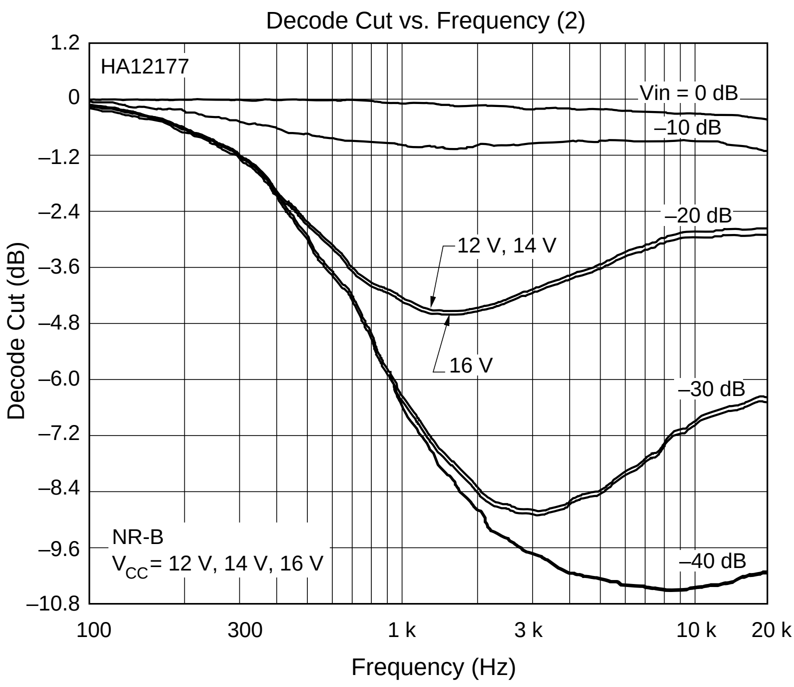


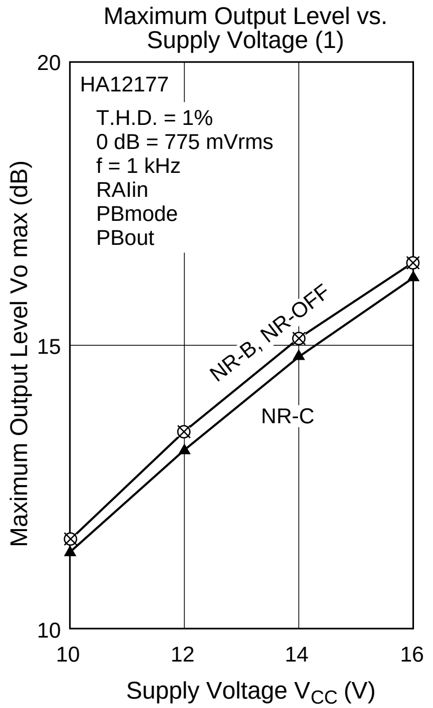
RAlin Input Amp. Gain vs. Frequency
HA12177
PBout-OFF/B/C
RECout-OFF
V_{CC} = 14 V
RECmode
Gain (dB)
30
26
22
18
14
10
20
100
1 k
10 k
100 k
Frequency (Hz)

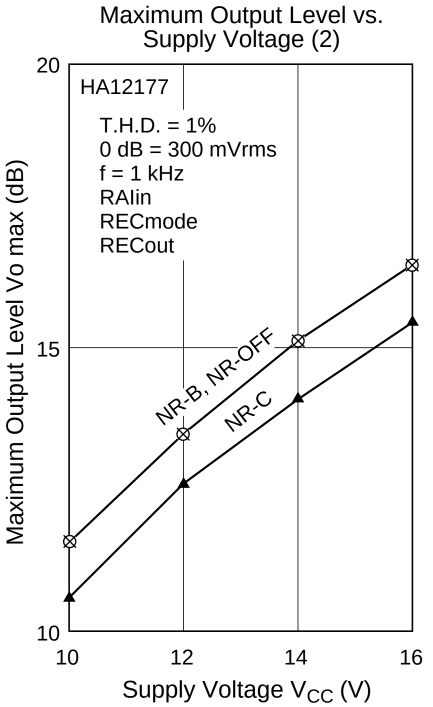

Encode Boost vs. Frequency (1)
HA12177
NR-C
VCC = 12 V, 14 V, 16 V
Vin = –60 dB
–40 dB
16 V
–30 dB
12 V, 14 V
–20 dB
–10 dB
0 dB
Encode Boost (dB)
24
21
18
15
12
9
6
3
0
–3
–6
100
300
1 k
3 k
10 k
15 k
Frequency (Hz)

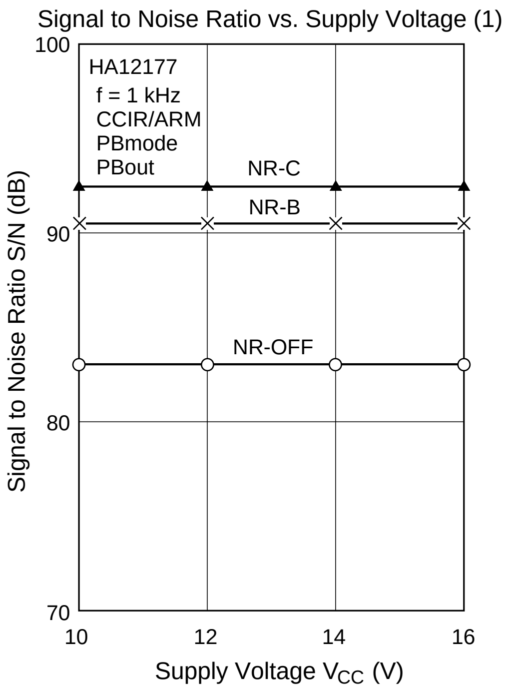

Encode Boost vs. Frequency (2)
HA12177
NR-B
VCC = 12 V, 14 V, 16 V
Vin = –40 dB
–30 dB
16 V
12 V, 14 V
–20 dB
–10 dB
0 dB
Encode Boost (dB)
10.8
9.6
8.4
7.2
6.0
4.8
3.6
2.4
1.2
0
–1.2
100
300
1 k
3 k
10 k
20 k
Frequency (Hz)

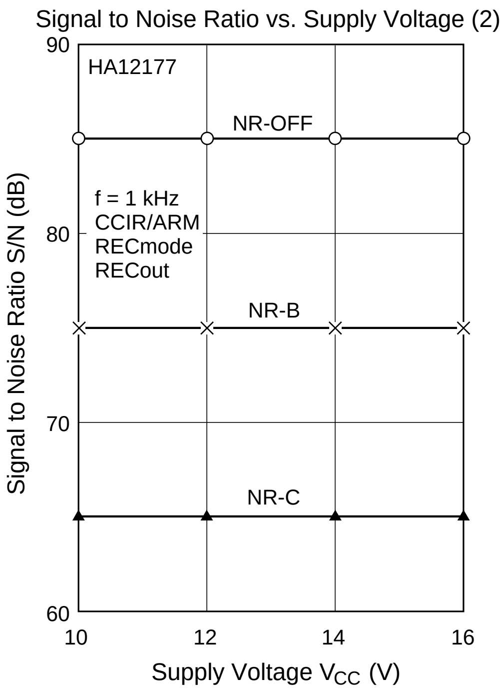

Decode Cut vs. Frequency (1)
HA12177
NR-C
V_{CC} = 12 V, 14 V, 16 V
Vin = 0 dB
–10 dB
–20 dB
–30 dB
–40 dB
–60 dB
12 V, 14 V
16 V
6
3
0
–3
–6
–9
–12
–15
–18
–21
–24
Decode Cut (dB)
100
300
1 k
3 k
10 k
15 k
Frequency (Hz)

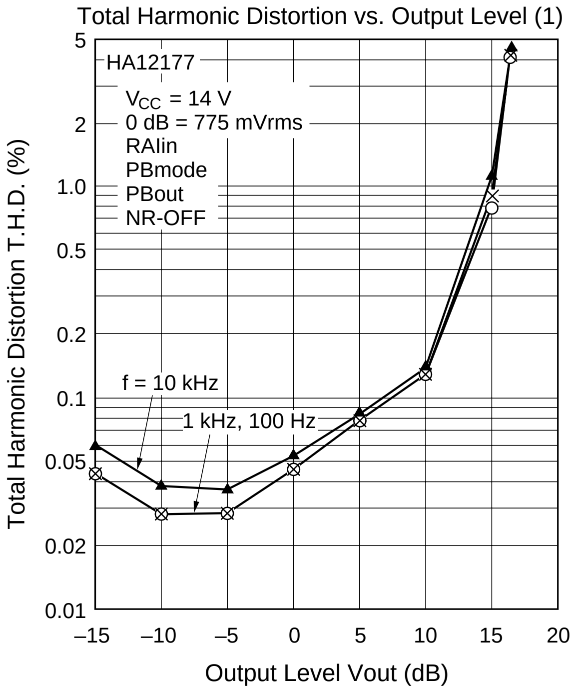

Decode Cut vs. Frequency (2)
HA12177
NR-B
V_{CC} = 12 V, 14 V, 16 V
Vin = 0 dB
–10 dB
–20 dB
–30 dB
–40 dB
12 V, 14 V
16 V
1.2
0
–1.2
–2.4
–3.6
–4.8
–6.0
–7.2
–8.4
–9.6
–10.8
Decode Cut (dB)
100
300
1 k
3 k
10 k
20 k
Frequency (Hz)

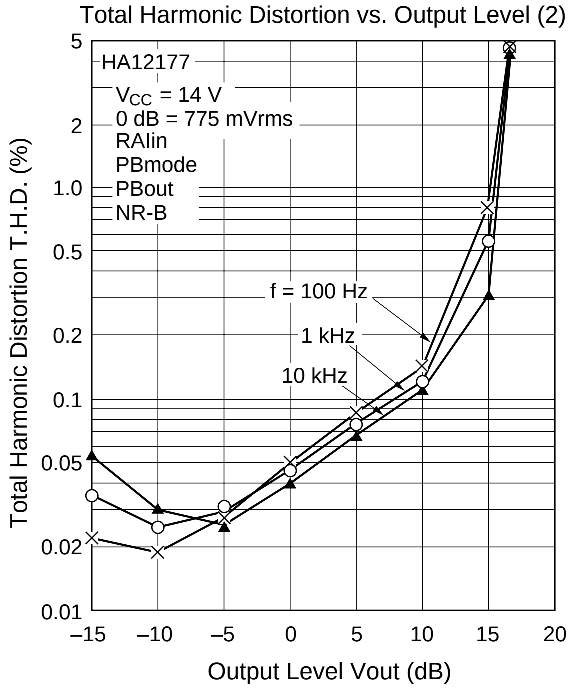

Maximum Output Level vs.
Supply Voltage (1)
HA12177
T.H.D. = 1%
0 dB = 775 mVrms
f = 1 kHz
RAIin
PBmode
PBout
NR-B, NR-OFF
NR-C
Maximum Output Level Vo max (dB)
Supply Voltage VCC (V)
20
15
10
10
12
14
16

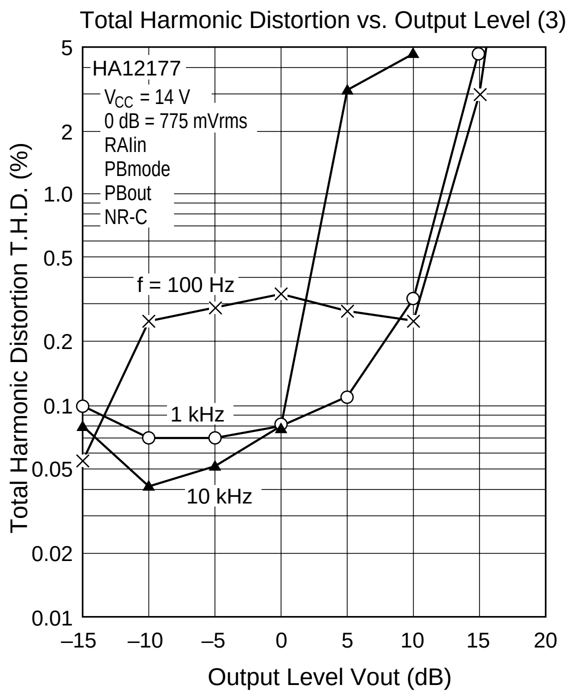

Maximum Output Level vs.
Supply Voltage (2)
HA12177
T.H.D. = 1%
0 dB = 300 mVrms
f = 1 kHz
RAIin
RECmode
RECout
NR-B, NR-OFF
NR-C
Maximum Output Level Vo max (dB)
Supply Voltage VCC (V)
20
15
10
10
12
14
16

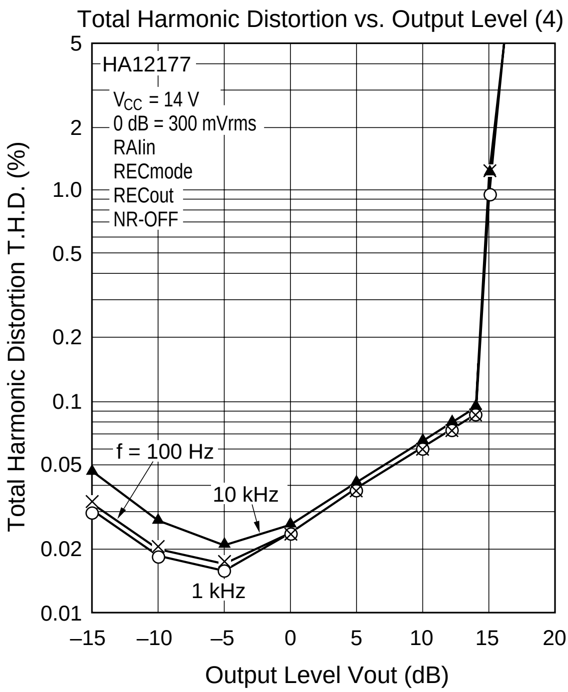

Signal to Noise Ratio vs. Supply Voltage (1)
HA12177
f = 1 kHz
CCIR/ARM
PBmode
PBout
NR-C
NR-B
NR-OFF
Signal to Noise Ratio S/N (dB)
Supply Voltage VCC (V)
100
90
80
70
10
12
14
16


Signal to Noise Ratio vs. Supply Voltage (2)
HA12177
NR-OFF
f = 1 kHz
CCIR/ARM
RECmode
RECout
NR-B
NR-C
Signal to Noise Ratio S/N (dB)
Supply Voltage VCC (V)
90
80
70
60
10
12
14
16

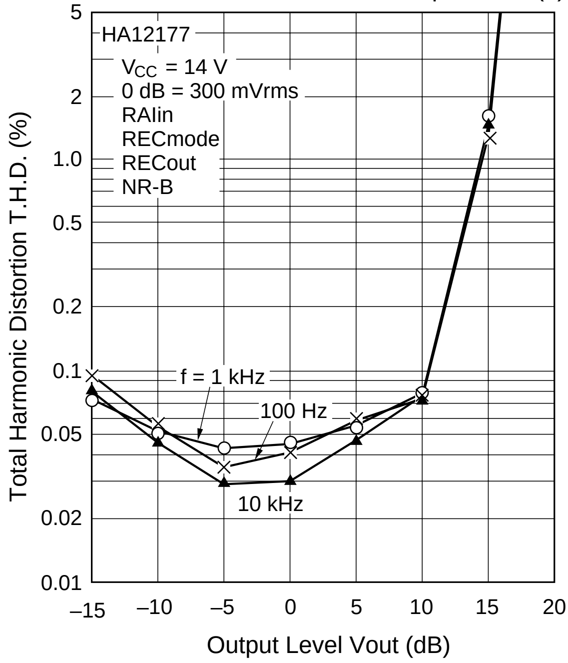

Total Harmonic Distortion vs. Output Level (1)
HA12177
VCC = 14 V
0 dB = 775 mVrms
RAIin
PBmode
PBout
NR-OFF
f = 10 kHz
1 kHz, 100 Hz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)


Total Harmonic Distortion vs. Output Level (2)
HA12177
VCC = 14 V
0 dB = 775 mVrms
RAIin
PBmode
PBout
NR-B
f = 100 Hz
1 kHz
10 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

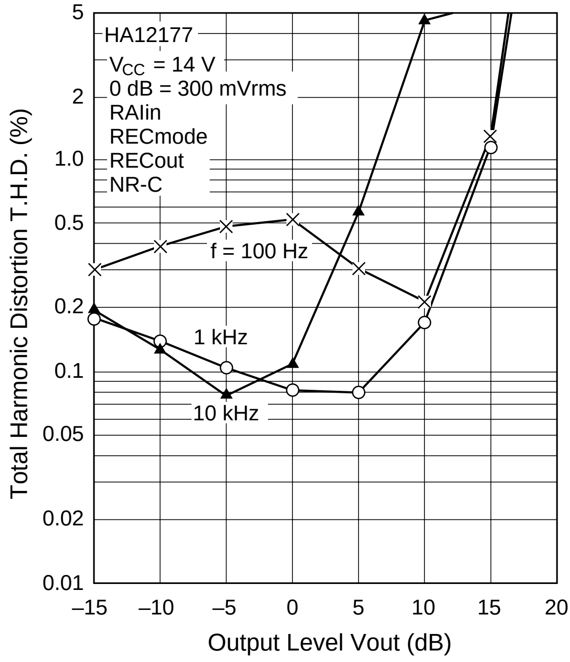

Total Harmonic Distortion vs. Output Level (3)
HA12177
VCC = 14 V
0 dB = 775 mVrms
RAlin
PBmode
PBout
NR-C
f = 100 Hz
1 kHz
10 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

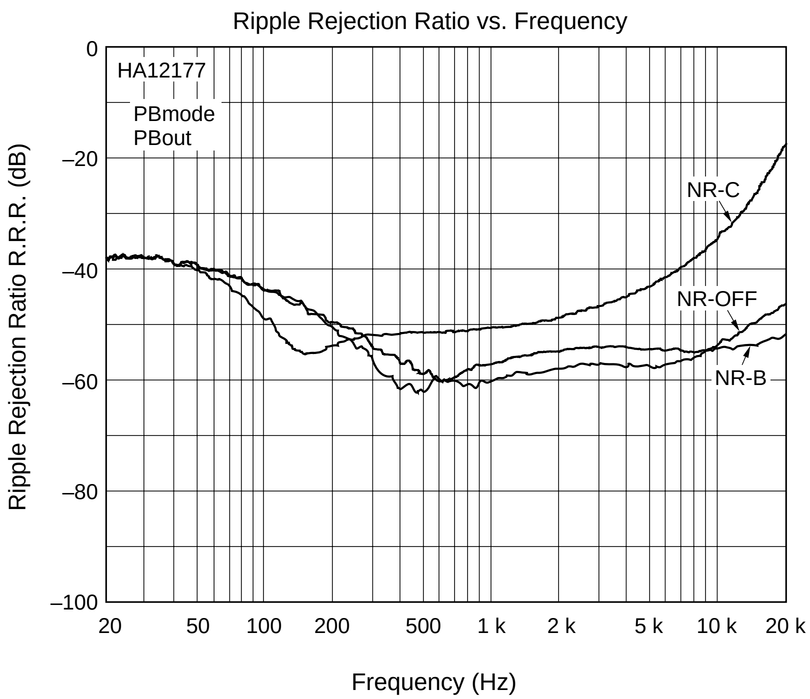

Total Harmonic Distortion vs. Output Level (4)
HA12177
VCC = 14 V
0 dB = 300 mVrms
RAlin
RECmode
RECout
NR-OFF
f = 100 Hz
10 kHz
1 kHz
Total Harmonic Distortion T.H.D. (%)
5
2
1.0
0.5
0.2
0.1
0.05
0.02
0.01
–15
–10
–5
0
5
10
15
20
Output Level Vout (dB)

Total Harmonic Distortion vs. Output Level (5)

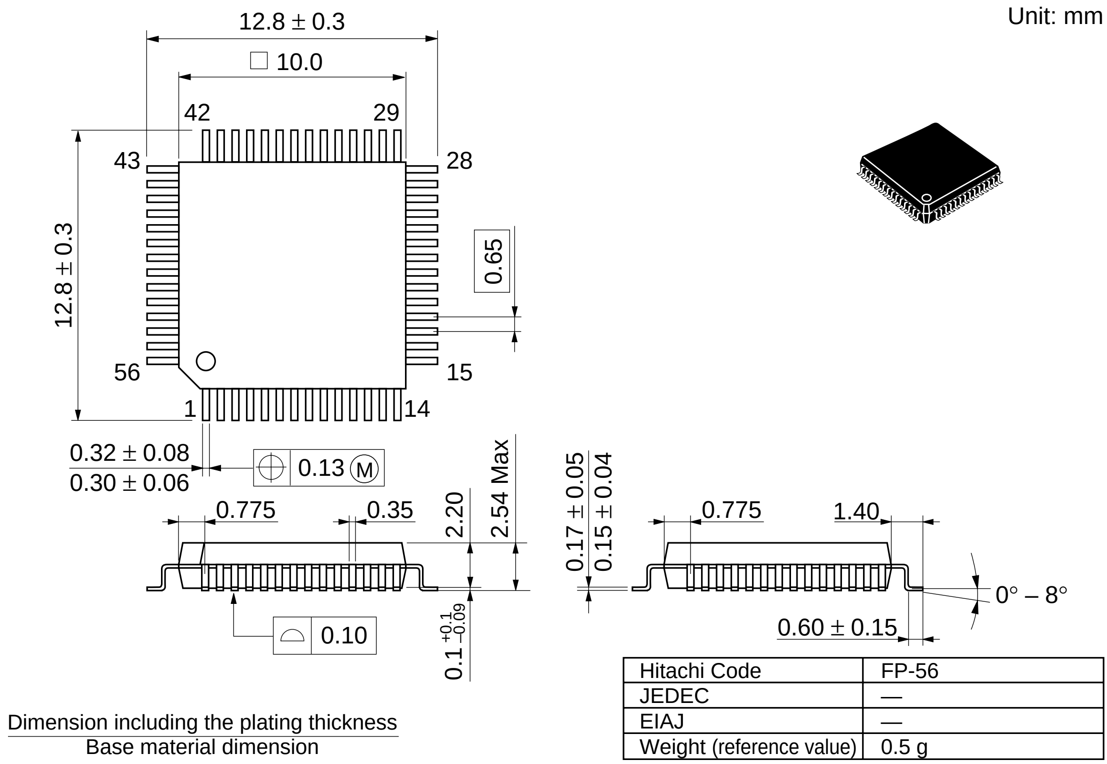


Total Harmonic Distortion vs. Output Level (6)




Ripple Rejection Ratio vs. Frequency
HA12177
PBmode
PBout
NR-C
NR-OFF
NR-B
0
–20
–40
–60
–80
–100
Ripple Rejection Ratio R.R.R. (dB)
20
50
100
200
500
1 k
2 k
5 k
10 k
20 k
Frequency (Hz)

Package Dimensions



Hitachi Code	FP-56
JEDEC	—
EIAJ	—
Weight (reference value)	0.5 g

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