
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Dolby B- and C-Type Noise Reduction System

HITACHI

ADE-207-036B (Z)

3rd Edition
Jun. 1999

Description

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

Functions

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

Features

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

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

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Ordering Information

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

Notes: 1. The common specifications are shown below.

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

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

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

| Item | Symbol | Rating | Unit | Note |
|-----------------------|---------------------|-------------|------|-----------|
| Supply voltage | V _{cc} max | 16 | V | |
| Power dissipation | P _d | 400 | mW | Ta ≤ 85°C |
| Operating temperature | T _{opr} | -40 to +85 | °C | |
| Storage temperature | T _{stg} | -55 to +125 | °C | |

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Electrical Characteristics (HA12141NT, HA12142NT, HA12170NT) (Ta = 25°C,

V_{CC} = Vopr-typ, unless otherwise specified)

(Dolby Level = 300 mVrms at TP (REC-mode: TP2, TP4 PB-mode: TP1, TP3))

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

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Electrical Characteristics (Ta = 25°C, V_{cc} = Vopr-typ, unless otherwise specified)

(Dolby Level = 300 mVrms at TP (REC-mode: TP2, TP4 PB-mode: TP1, TP3)) (cont)

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

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Electrical Characteristics (HA12161FP, HA12162FP) (Ta = 25°C, V_{cc} = 12 V, Unless otherwise specified)

(Dolby Level = 300 mVrms at TP (PB-mode: TP1, TP3))

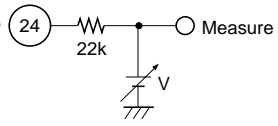
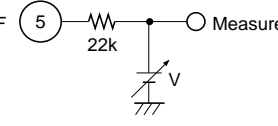
| Item | Symbol | Min | Typ | Max | Unit | Test conditions | | | | |
|----------------------------|-----------------|-------|-------|-------|------|-----------------|-----|--------|-----------------------|------------------------------------|
| | | | | | | P/AUX | NR | f (Hz) | | |
| Operating voltage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

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Electrical Characteristics (HA12161FP, HA12162FP) ($T_a = 25^\circ\text{C}$, $V_{cc} = 12\text{ V}$, Unless otherwise specified)

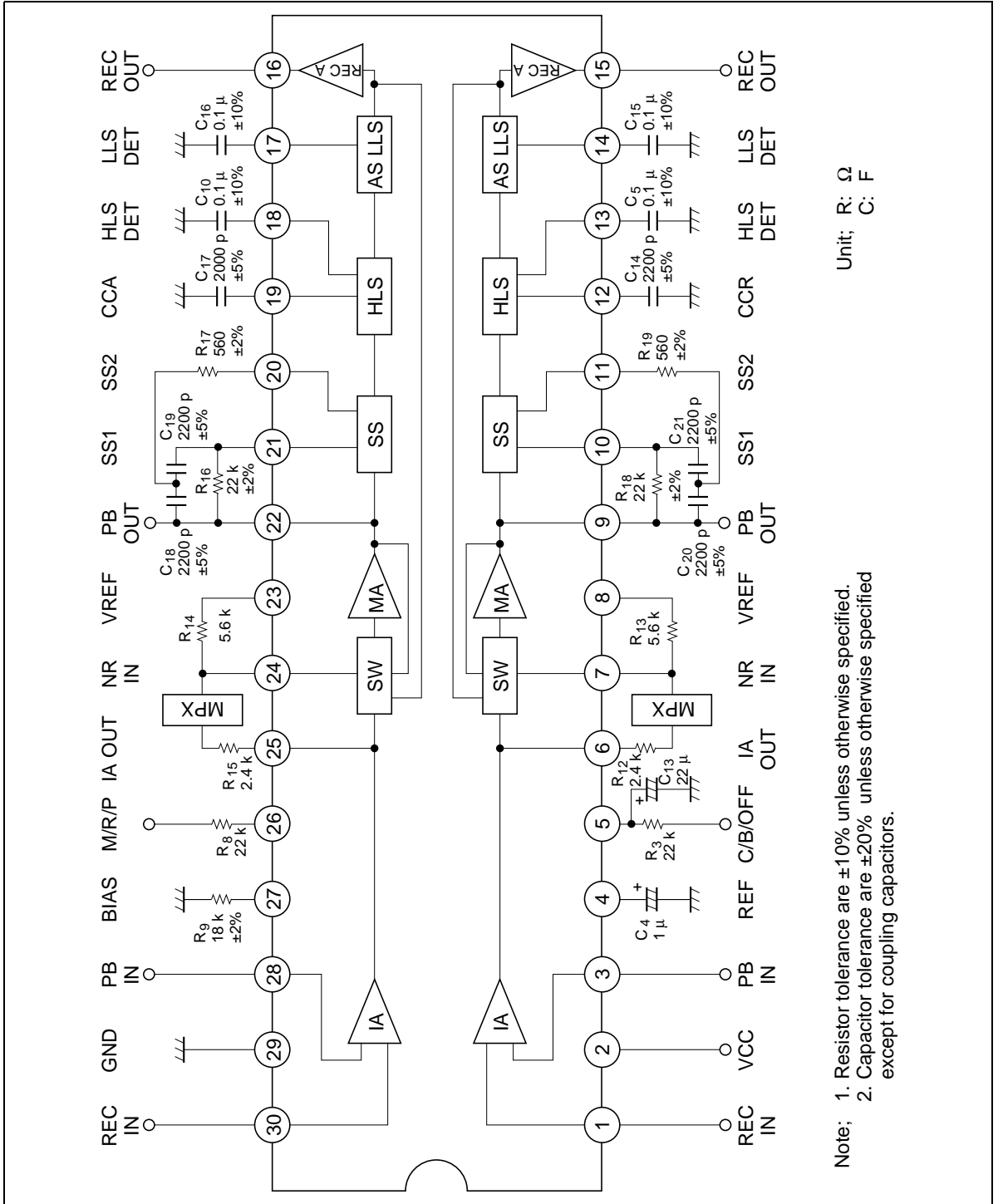
(Dolby Level = 300 mVrms at TP (PB-mode: TP1, TP3)) (cont)

Test conditions

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

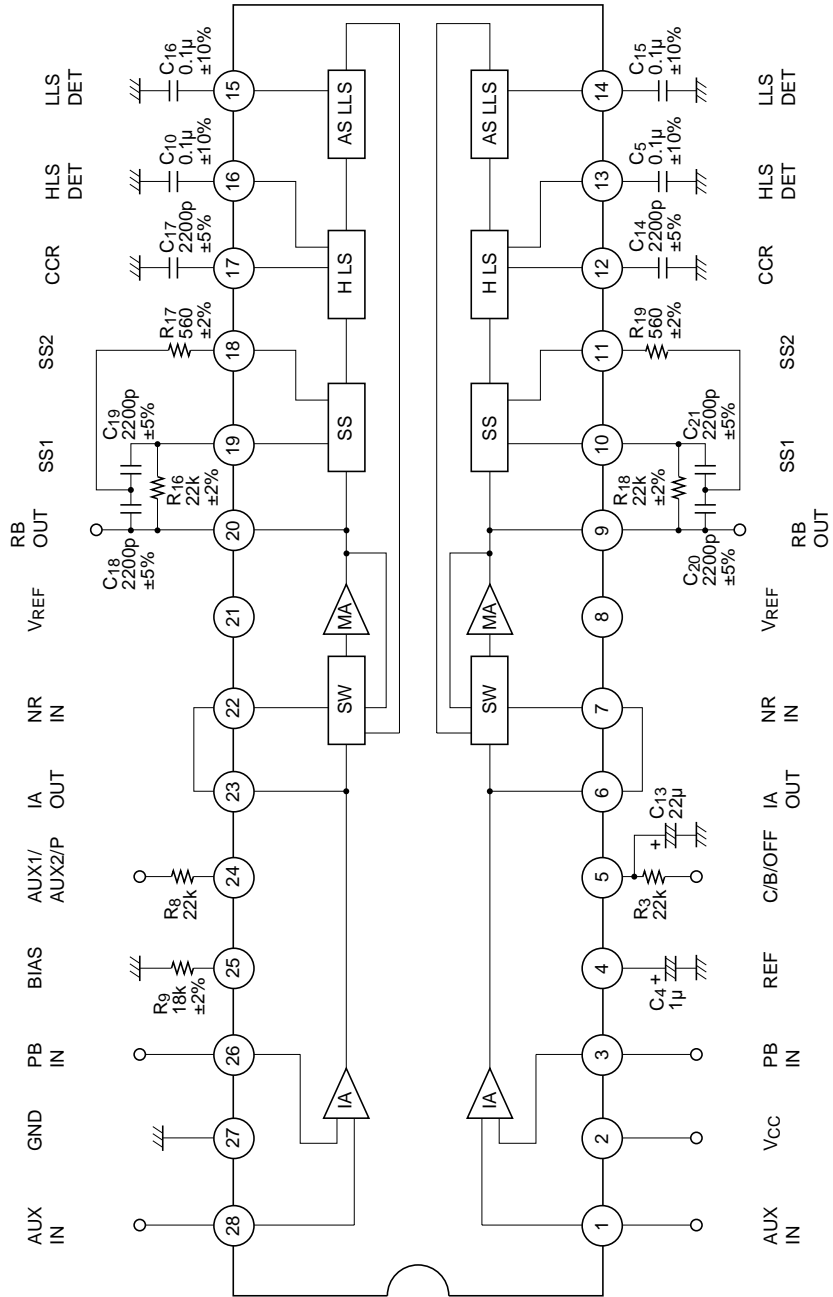
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Block Diagram (HA12141NT, HA12142NT, HA12170NT)



HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Block Diagram (HA12161FP, HA12162FP)

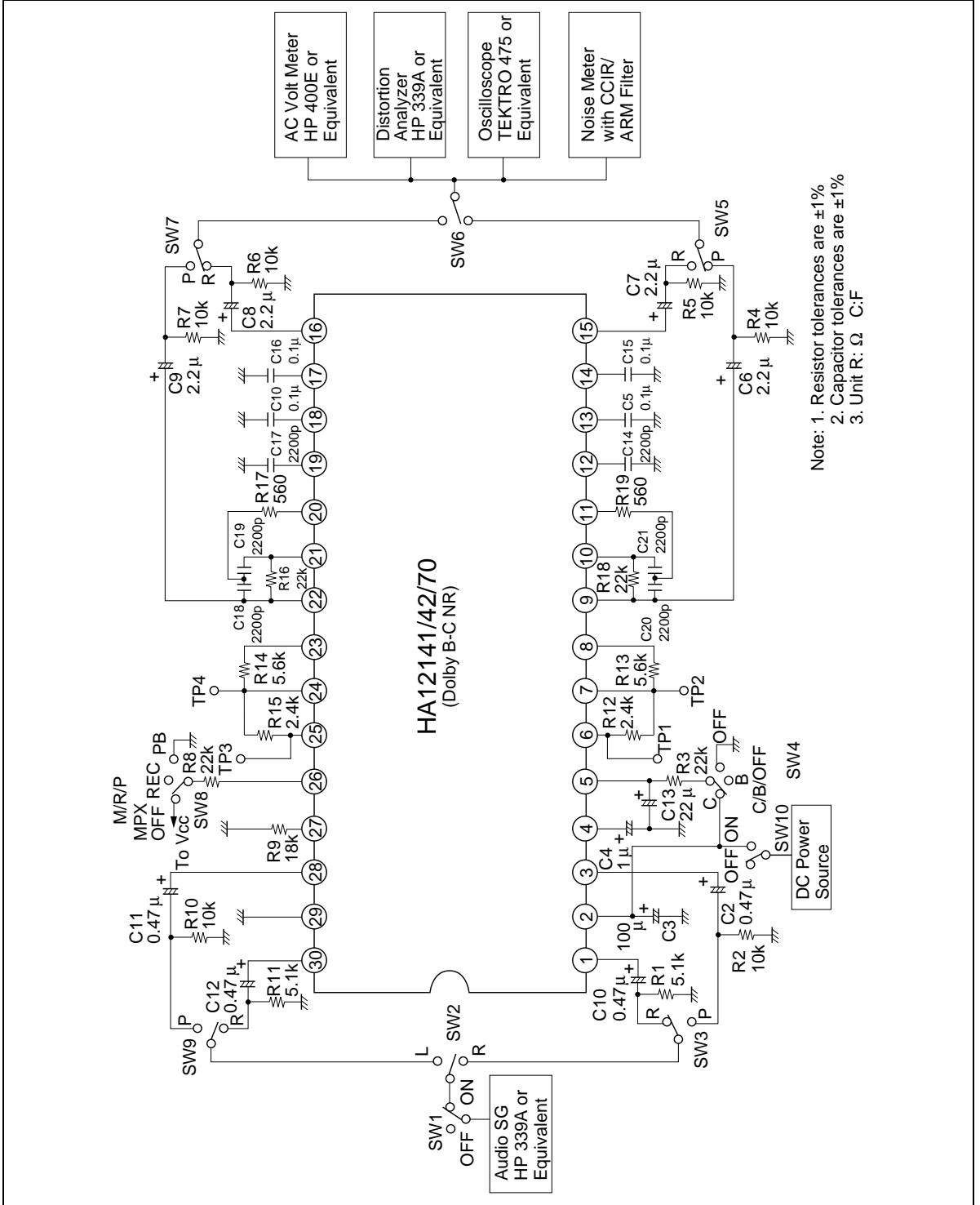


Unit R: Ω
C: F

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

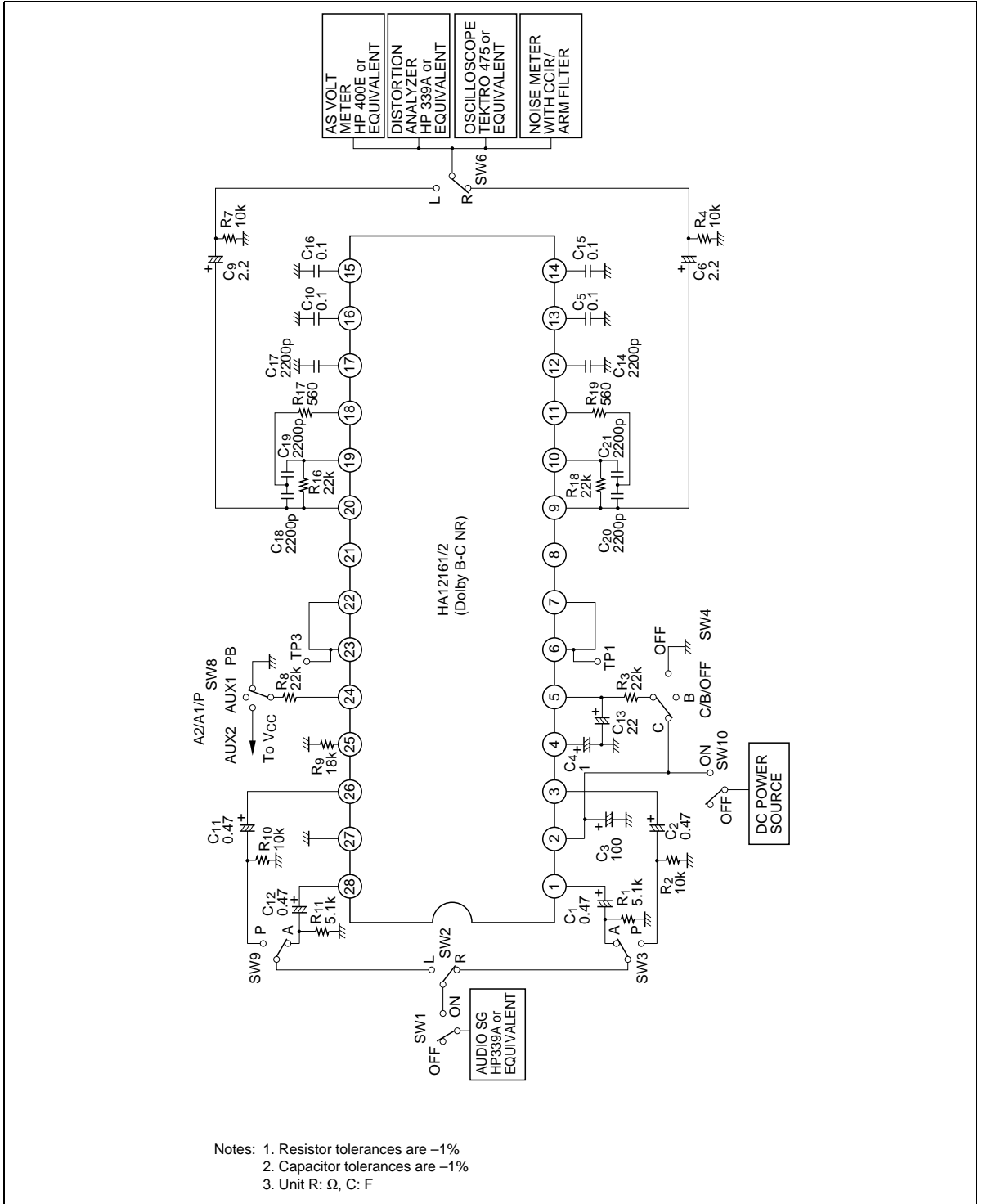
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Test Circuit (HA12141NT, HA12142NT, HA12170NT)



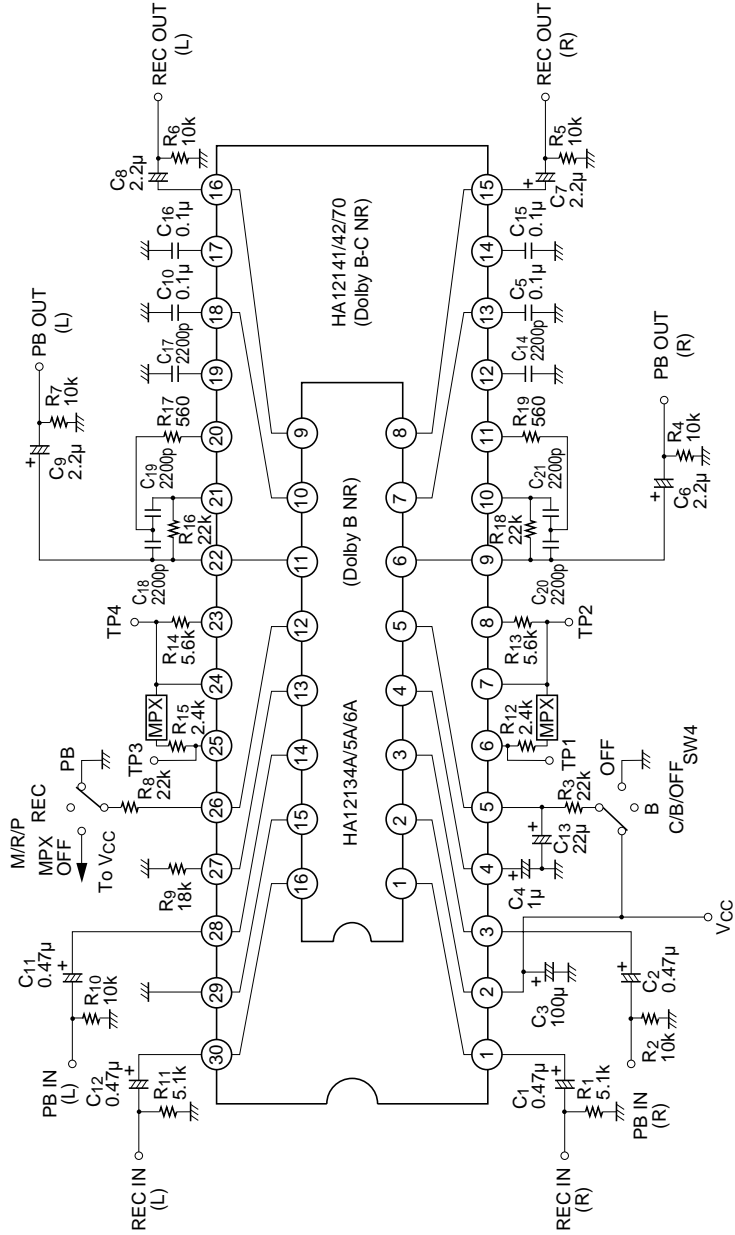
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Test Circuit (HA12161FP, HA12162FP)



HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

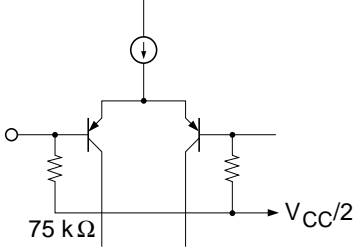
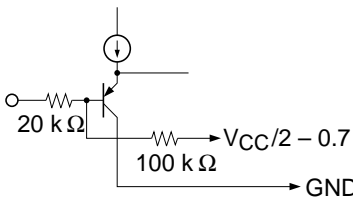
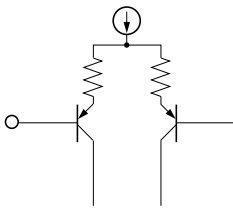
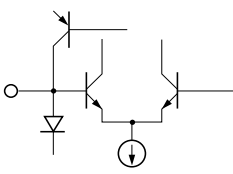
Connection Diagram (HA12134A Series, HA12141 Series)



Note: C₅, C₁₀=0.22μF with HA12134A Series

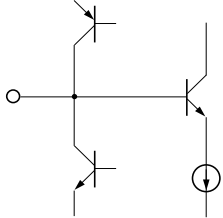
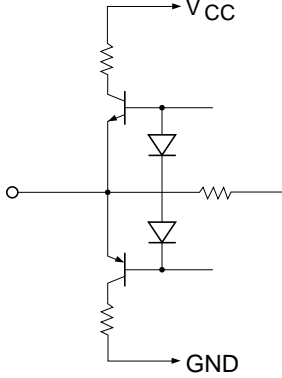
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Pin Description ($V_{CC} = 12\text{ V}$, $T_a = 25^\circ\text{C}$, no signal, the value in the table show typical value.)

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

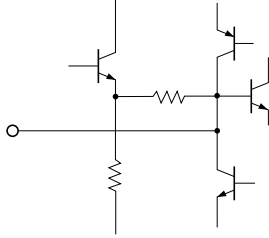
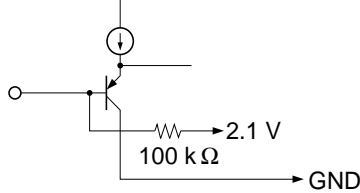
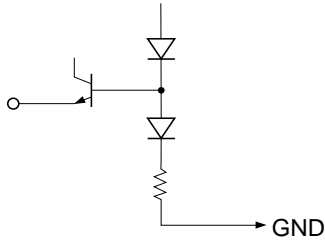
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Pin Description ($V_{CC} = 12\text{ V}$, $T_a = 25^\circ\text{C}$, no signal, the value in the table show typical value.) (cont)

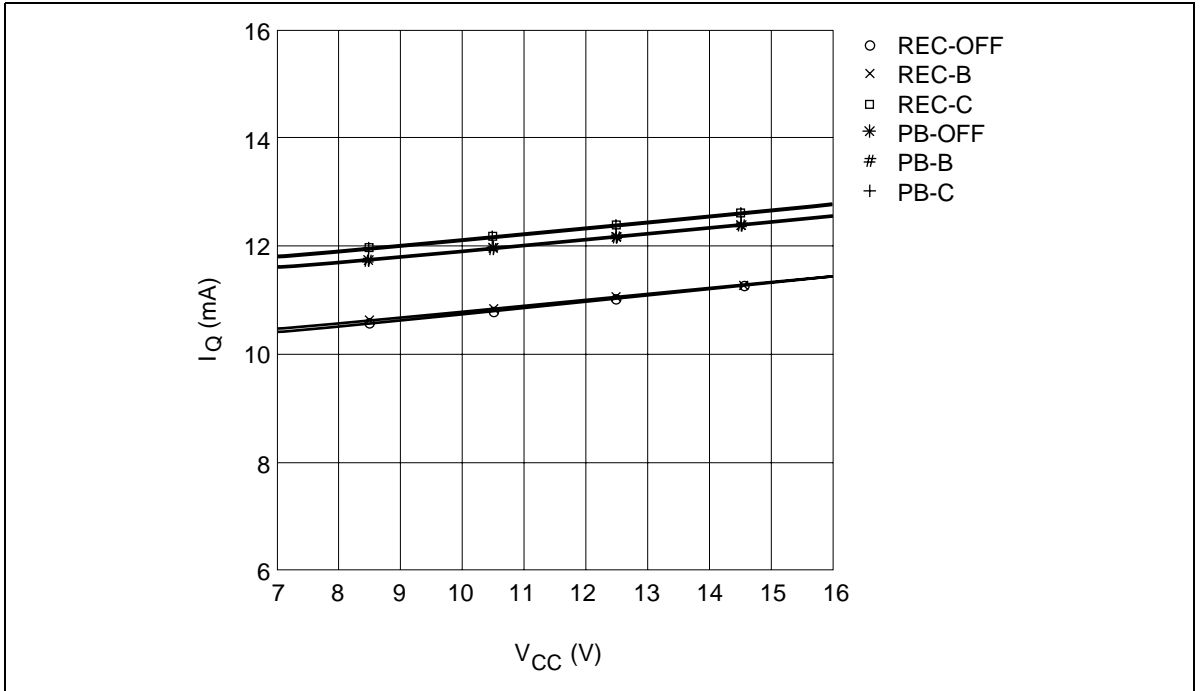
| Pin No. | Terminal | DC | Description | | | |
|---------|----------|--------|-------------|------------|--|------------------------------------|
| DP | SOP | Name | Zin | Voltage | Equivalent circuit | Description |
| 12 | 12 | CCR | — | $V_{CC}/2$ |  | Current controlled resistor output |
| 19 | 17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

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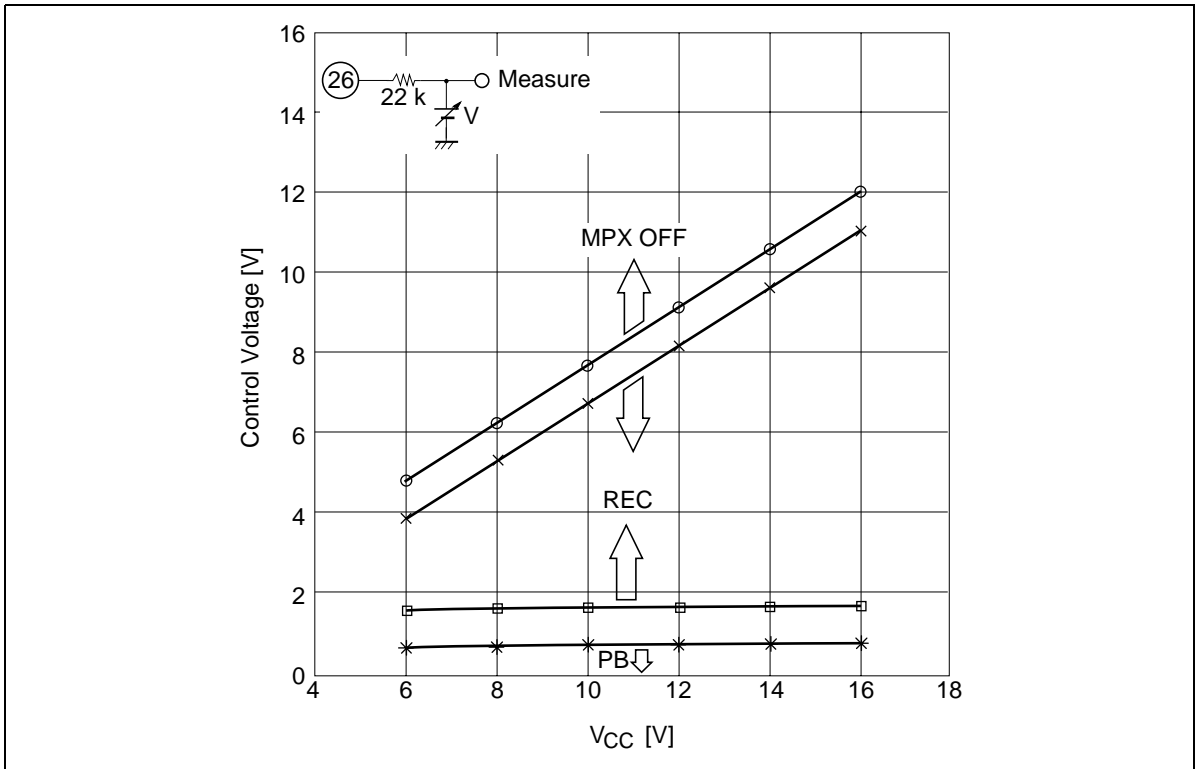
Pin Description ($V_{CC} = 12\text{ V}$, $T_a = 25^\circ\text{C}$, no signal, the value in the table show typical value.) (cont)

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

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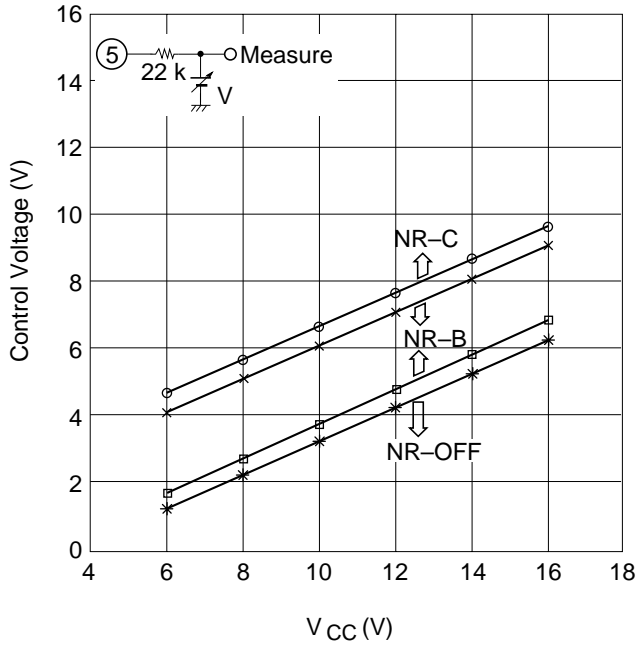


Quiescent Circuit vs. Supply Voltage



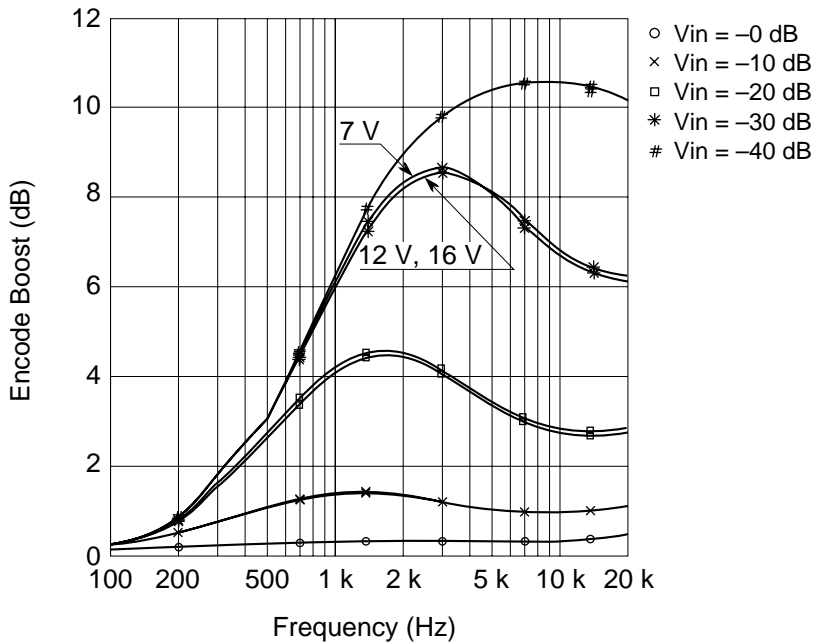
Control Voltage vs. Supply Voltage (PB/REC/MPX)

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

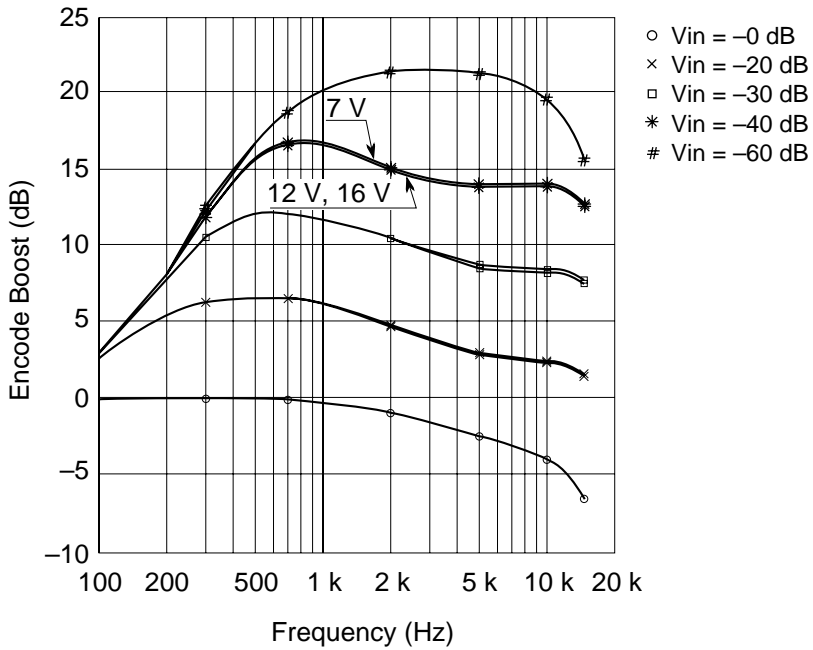
HA12141NT



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

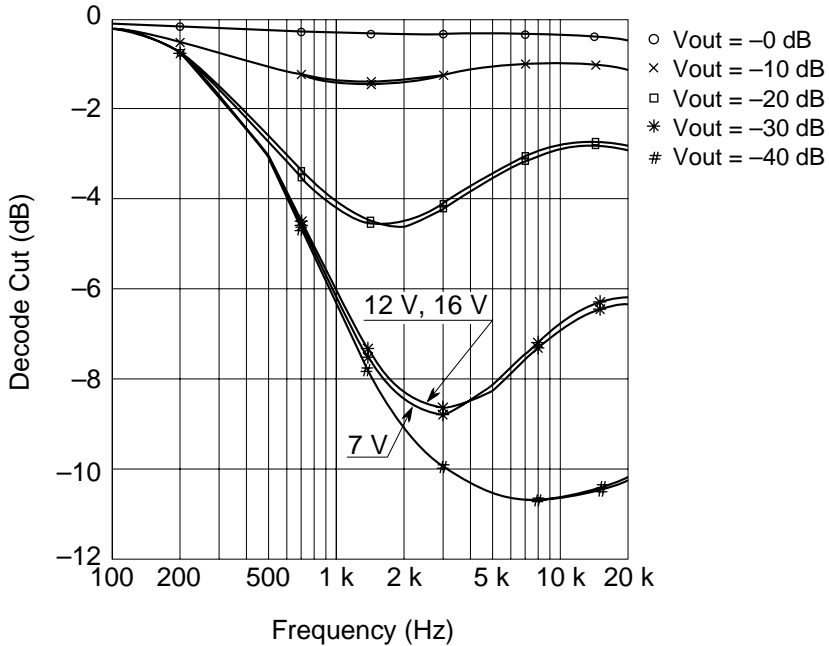
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HA12141NT



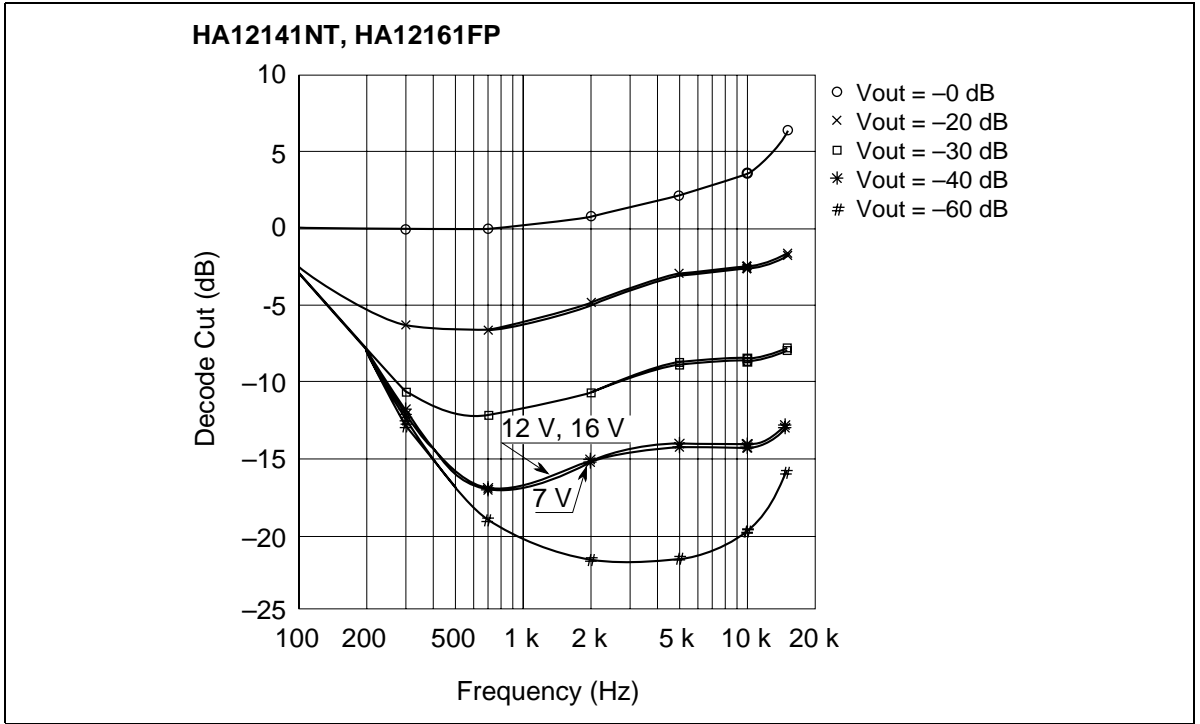
Encode Boost vs. Frequency (NR-C $V_{cc} = 7 \text{ V}, 12 \text{ V}, 16 \text{ V}$)

HA12141NT, HA12161FP

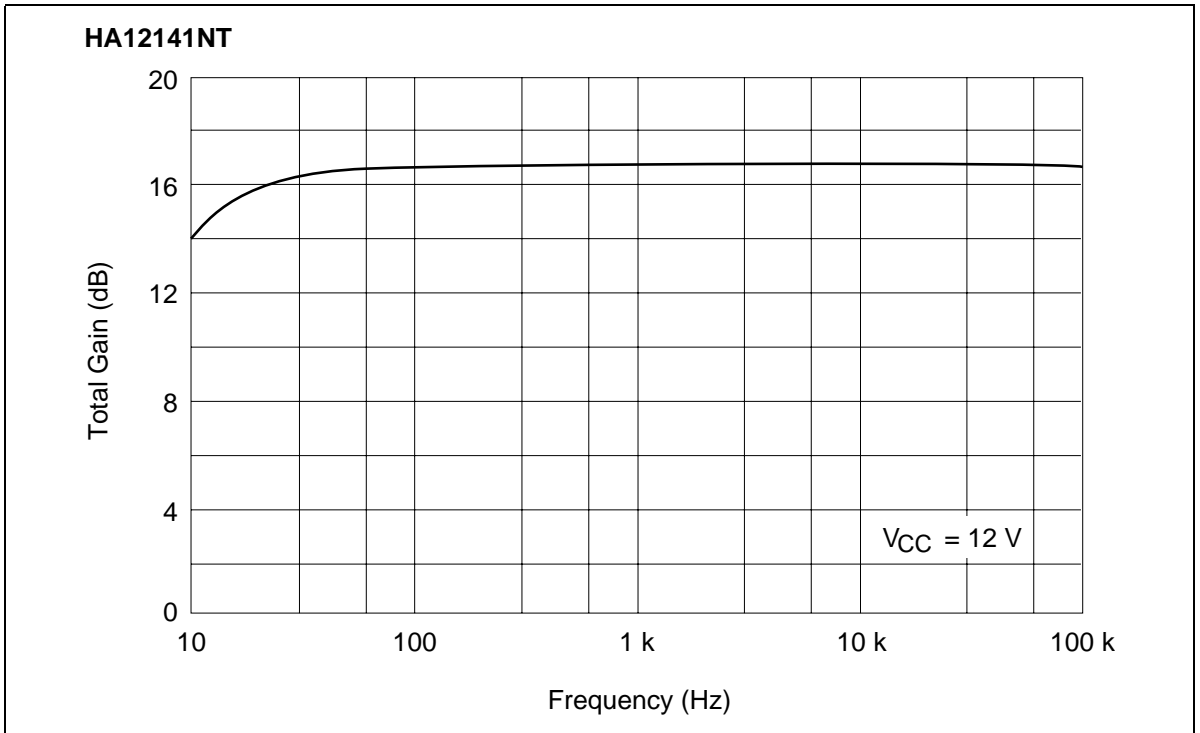


Decode Cut vs. Frequency (NR-B $V_{cc} = 7 \text{ V}, 12 \text{ V}, 16 \text{ V}$)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



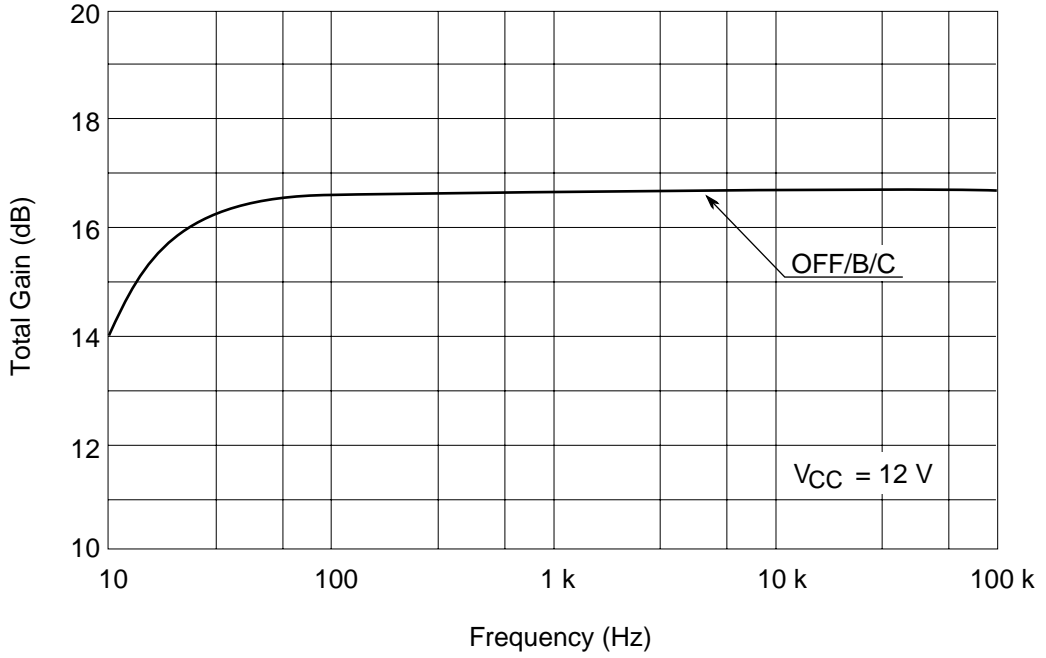
Decode Cut vs Frequency (NR-C $V_{cc} = 7\text{ V}, 12\text{ V}, 16\text{ V}$)



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

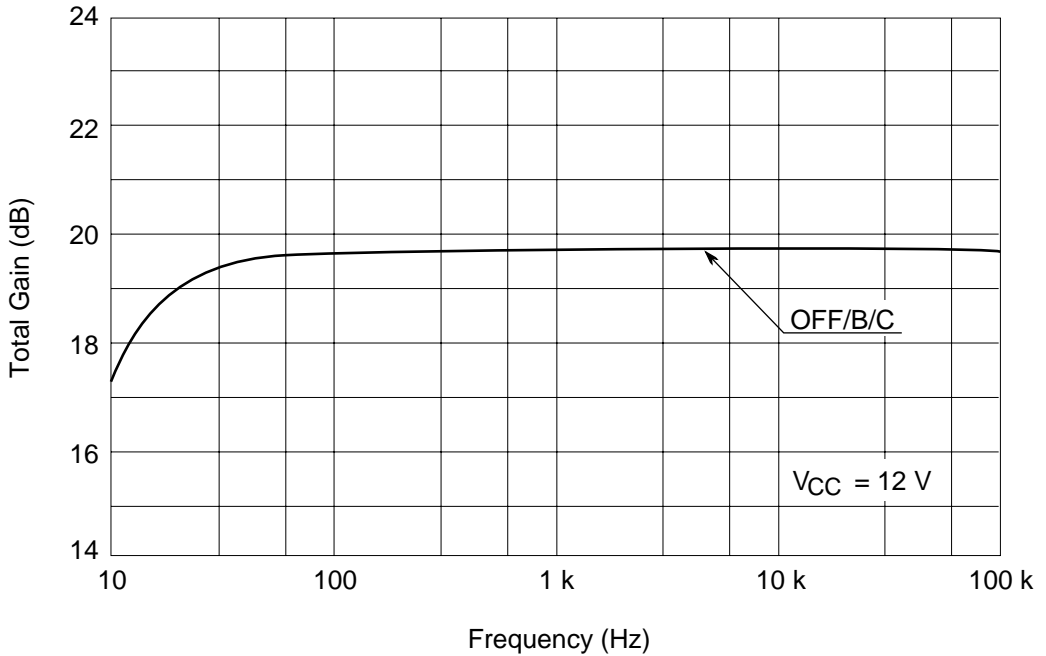
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT, HA12161FP



Total Gain vs. Frequency (REC MODE PBOUT)

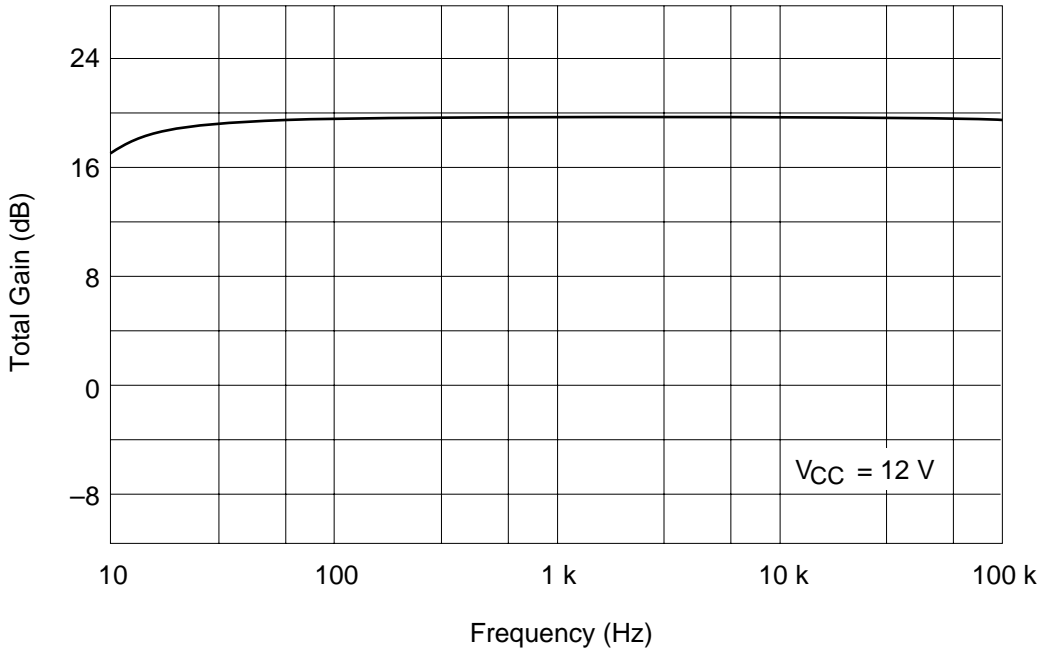
HA12141NT



Total Gain vs. Frequency (PB MODE RECOUT)

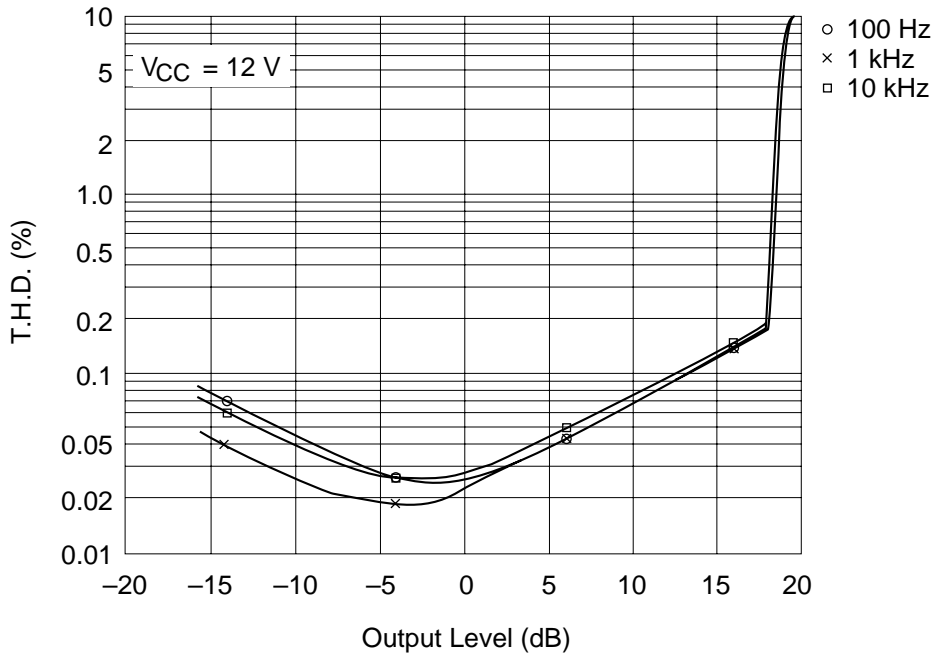
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT, HA12161FP



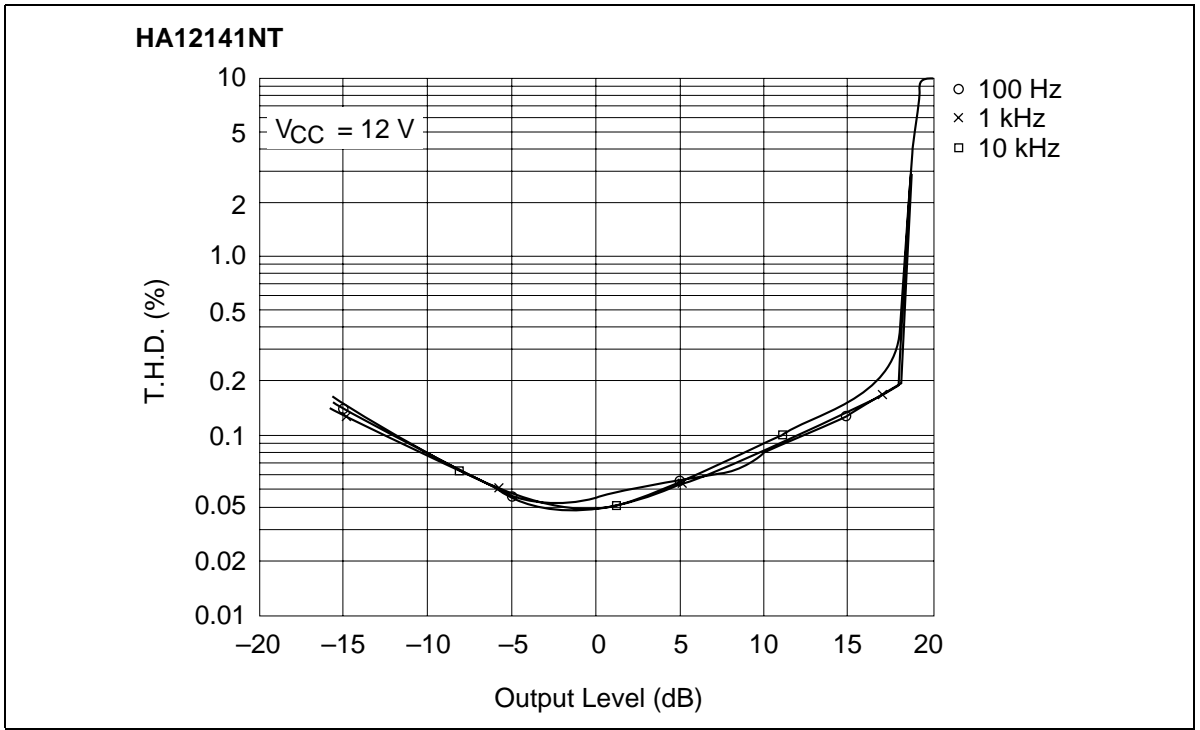
Total Gain vs. Frequency (PB MODE PBOUT NR-OFF)

HA12141NT

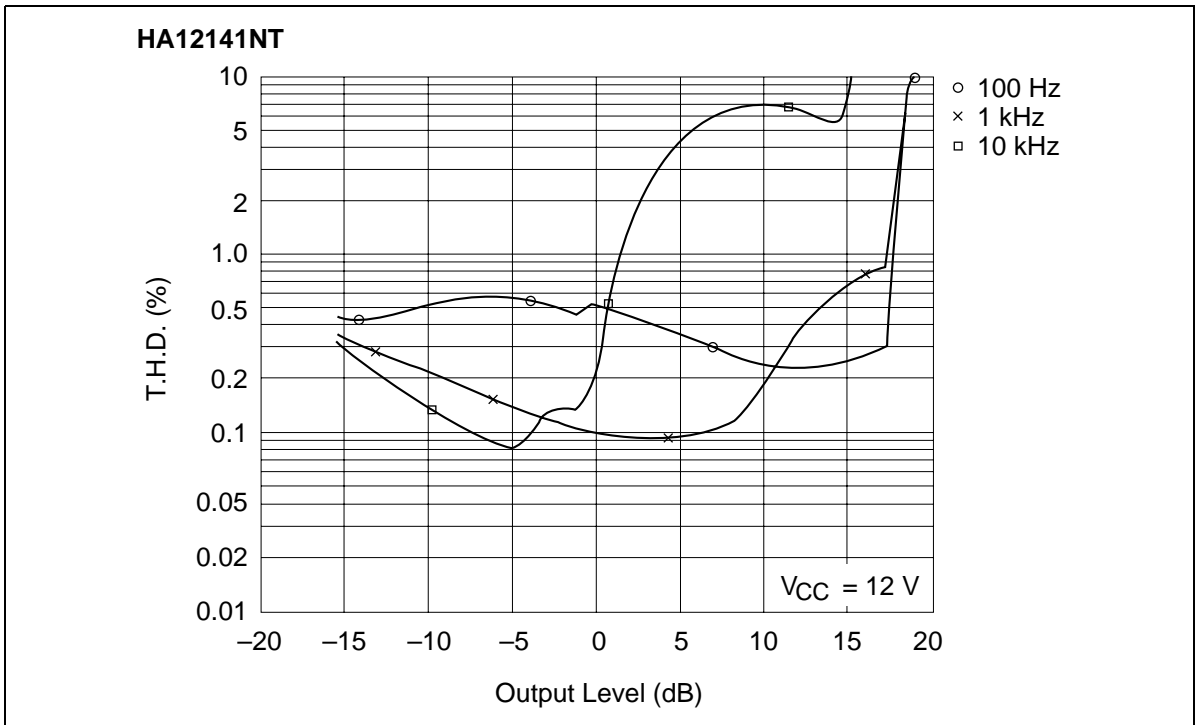


Total Harmonic Distortion vs. Output Level (REC MODE NR-OFF)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

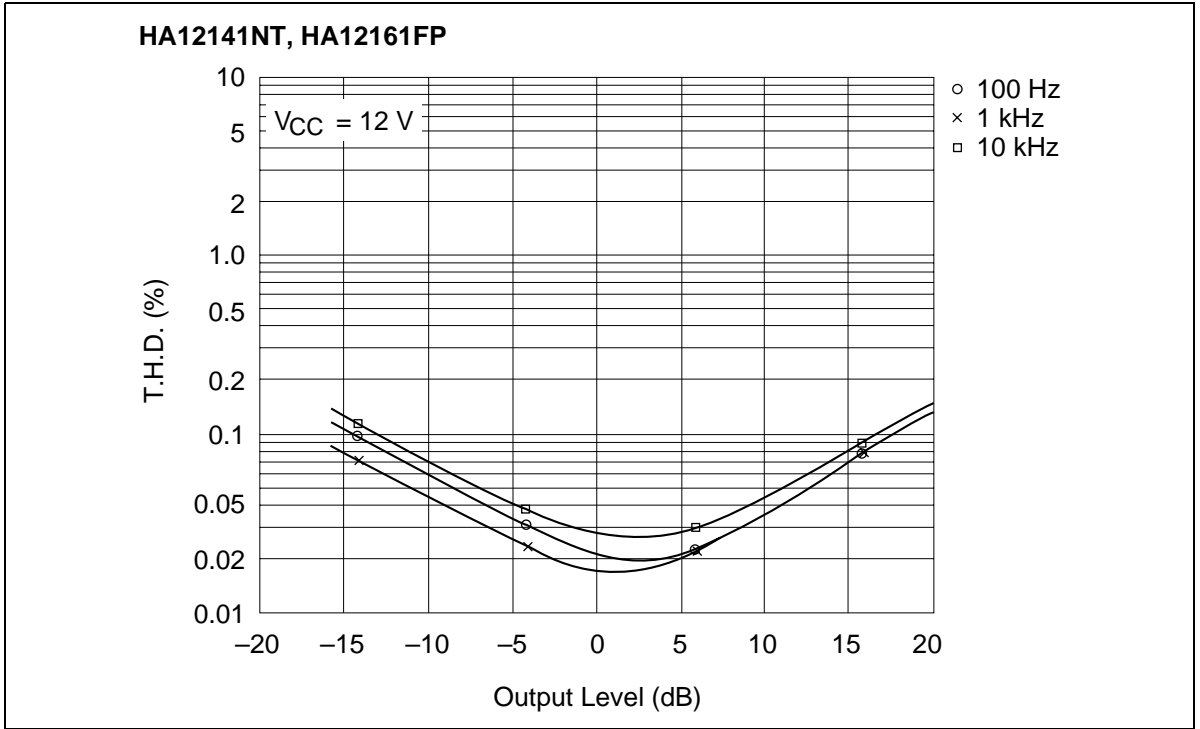


Total Harmonic Distortion vs. Output Level (REC MODE NR-B)

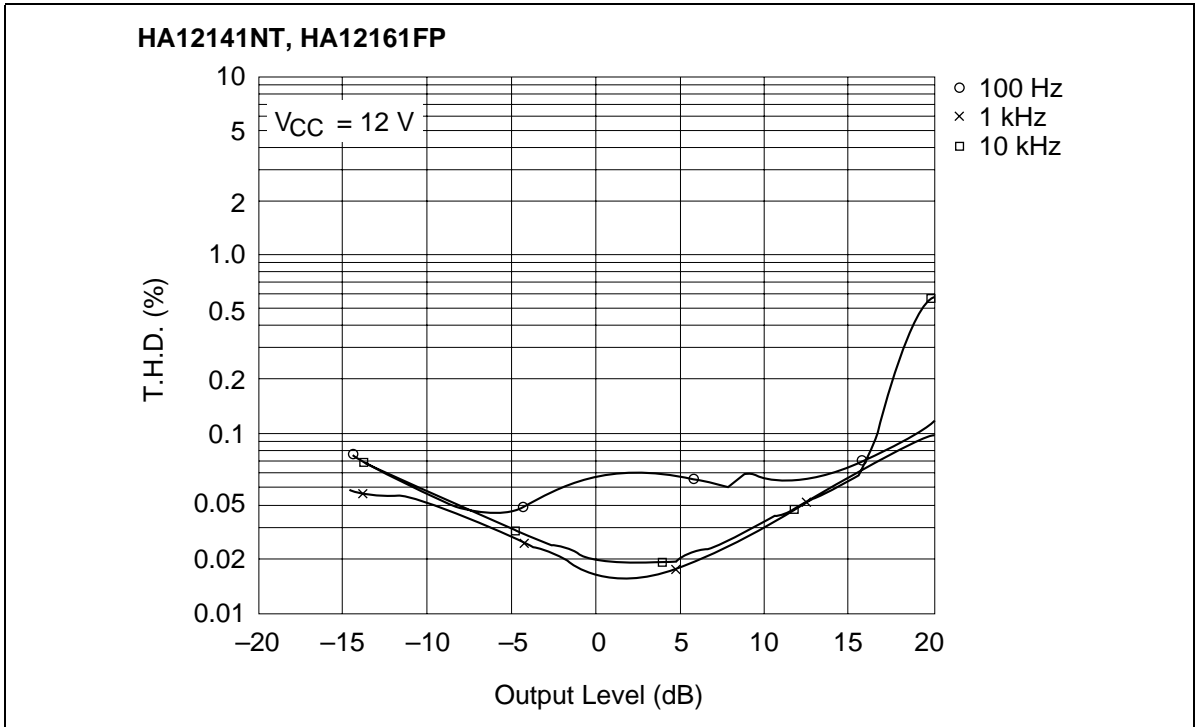


Total Harmonic Distortion vs. Output Level (REC MODE NR-C)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



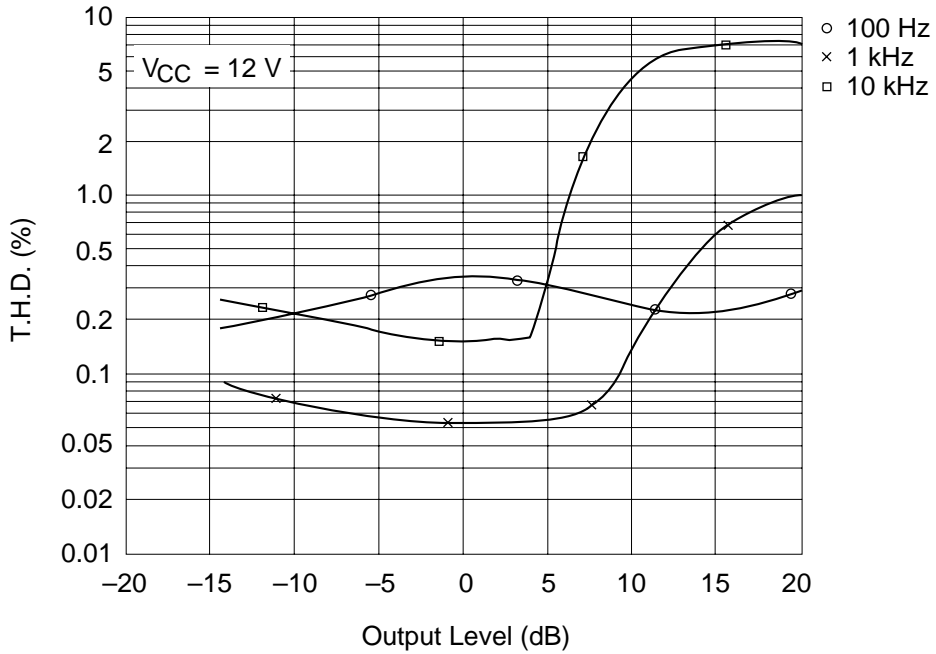
Total Harmonic Distortion vs. Output Level (PB MODE NR-OFF)



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

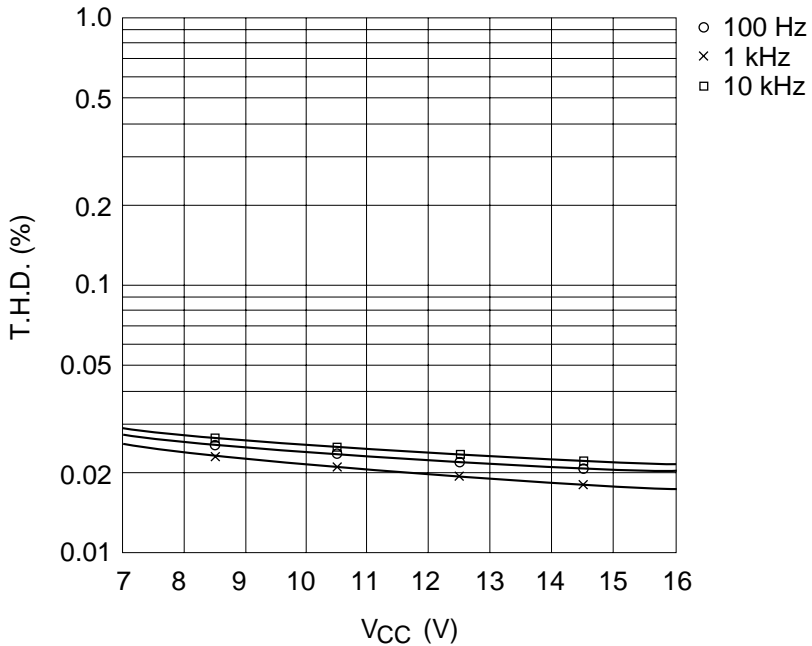
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT, HA12161FP



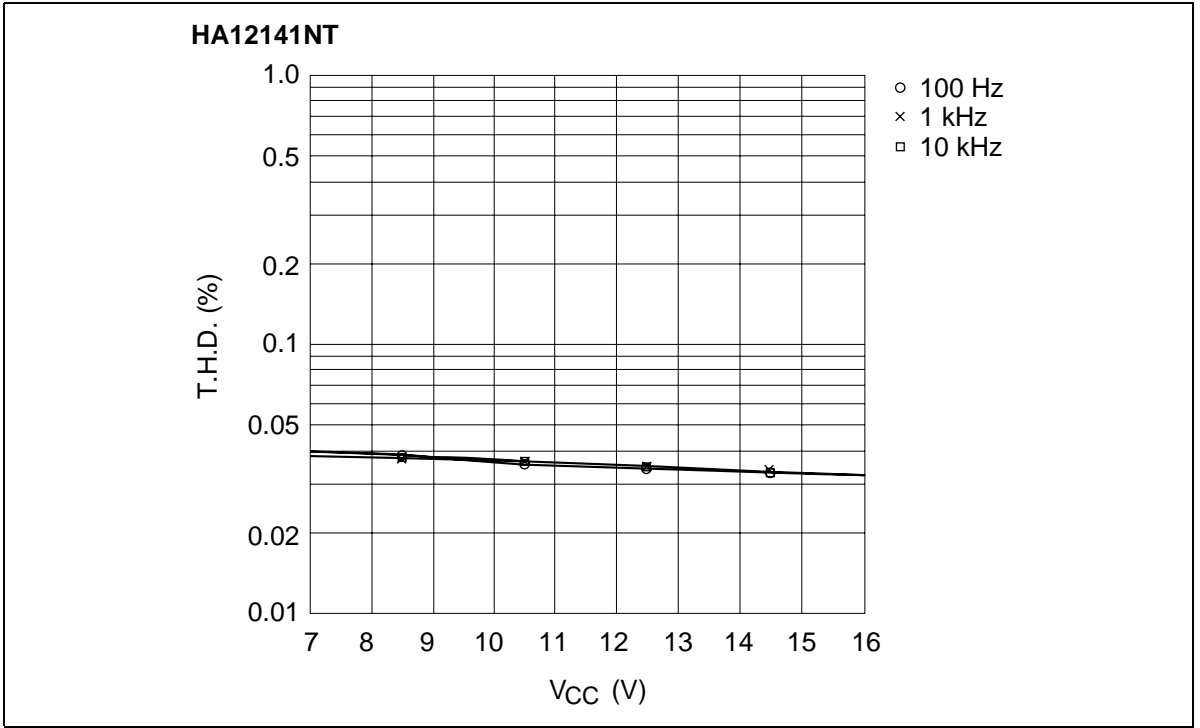
Total Harmonic Distortion vs. Output Level (PB MODE NR-C)

HA12141NT

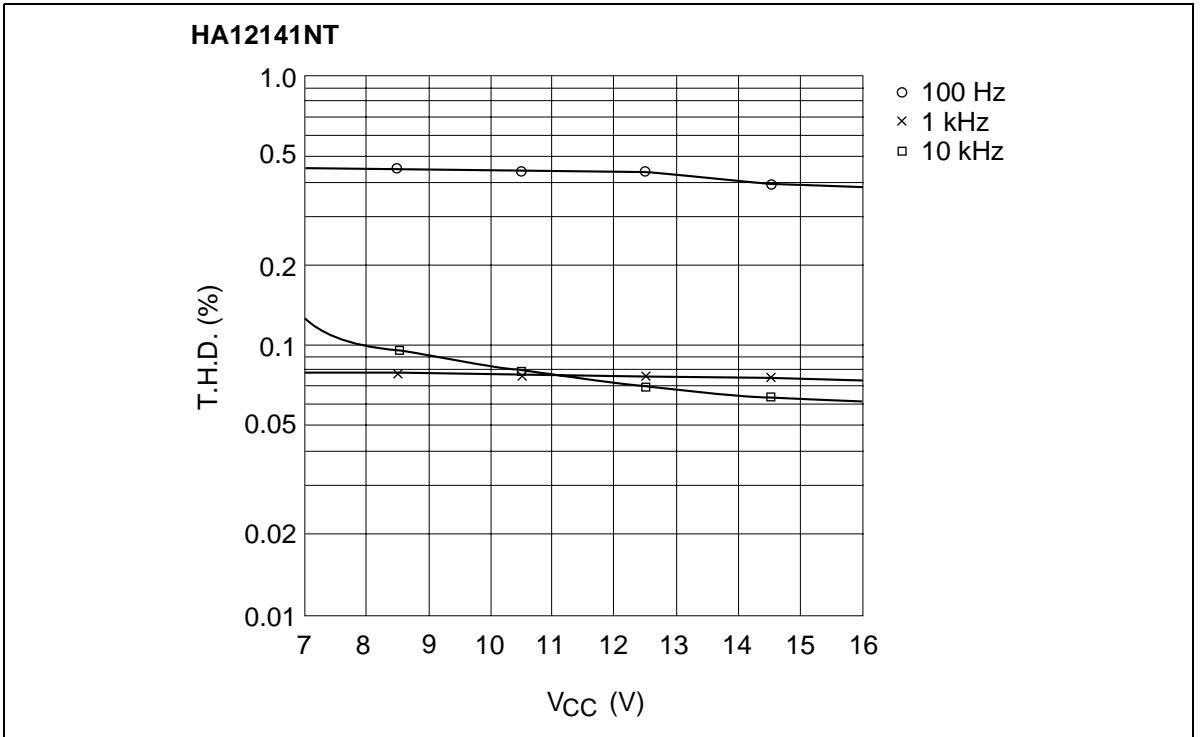


Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-OFF)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



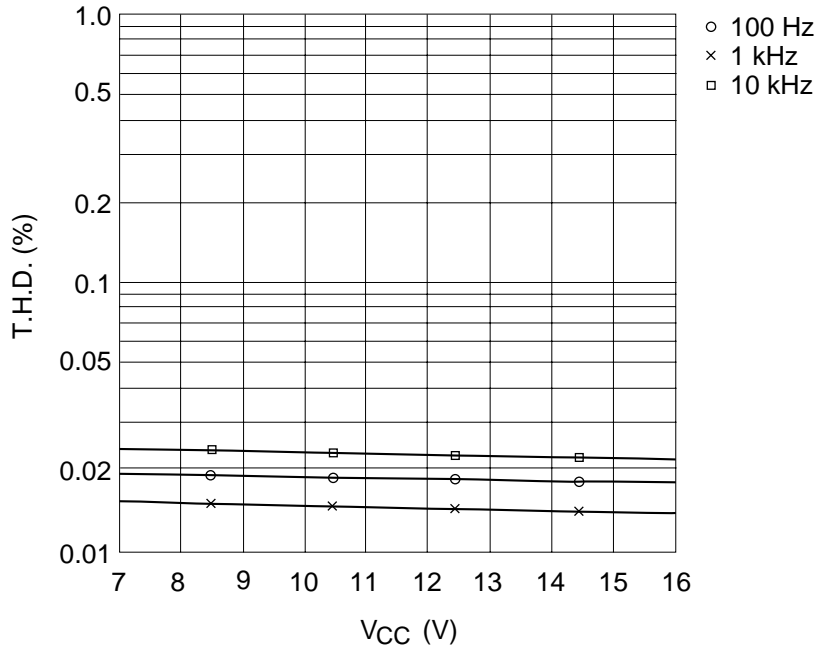
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-B)



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

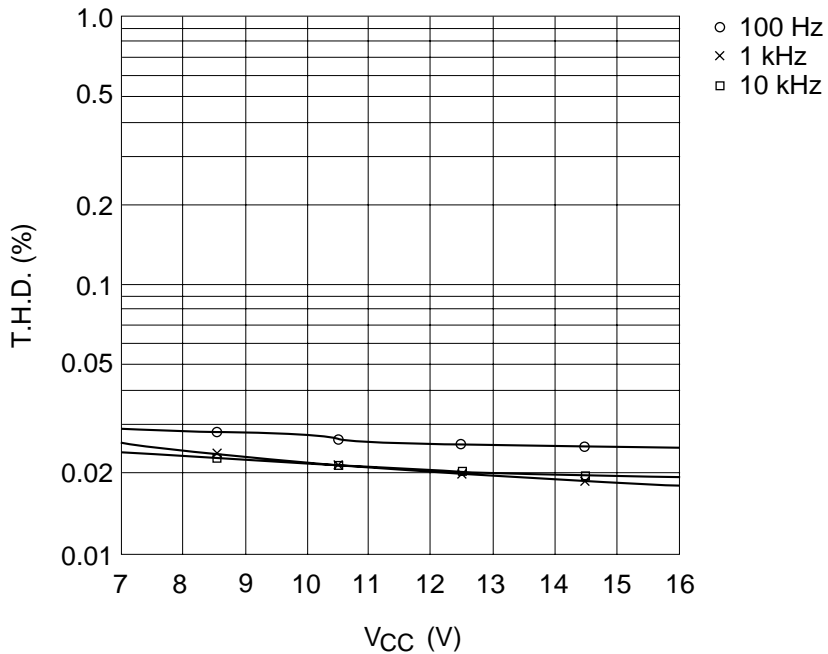
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT, HA12161FP



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

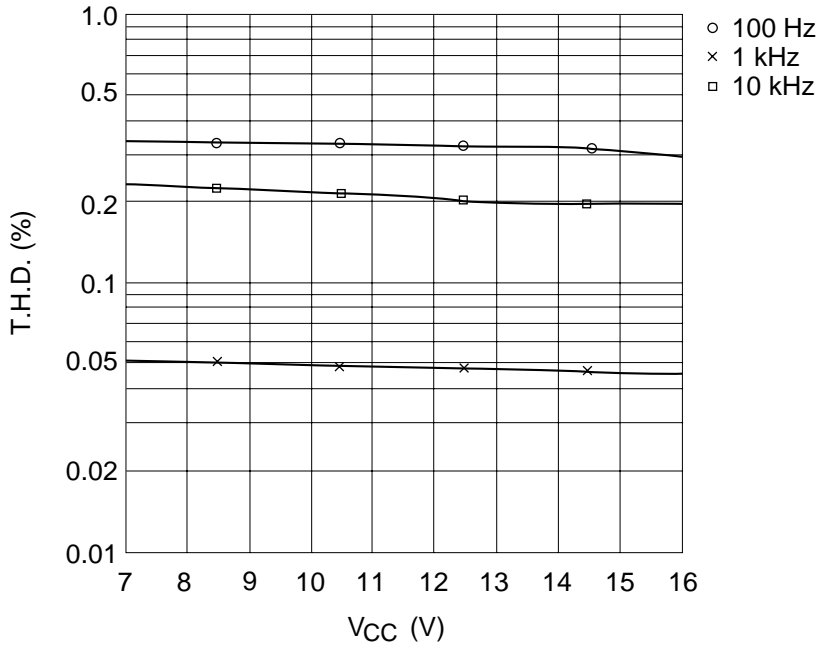
HA12141NT, HA12161FP



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

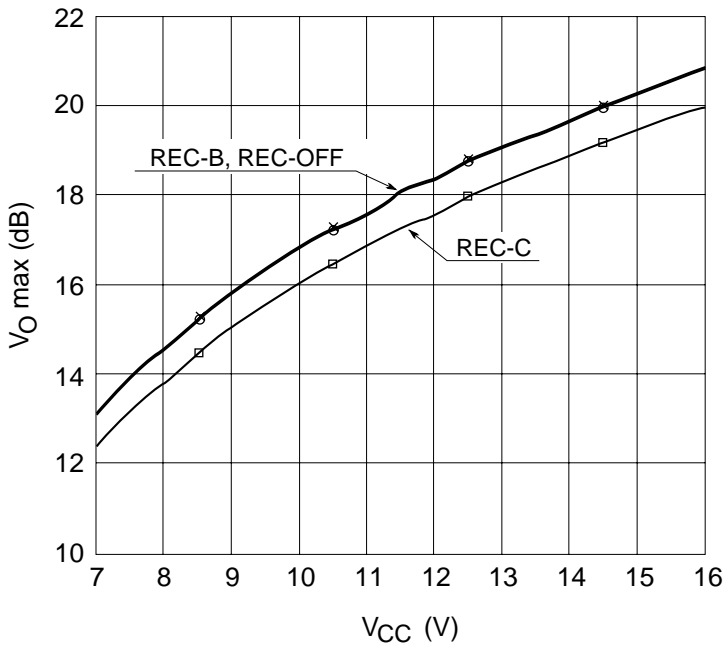
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT, HA12161FP



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

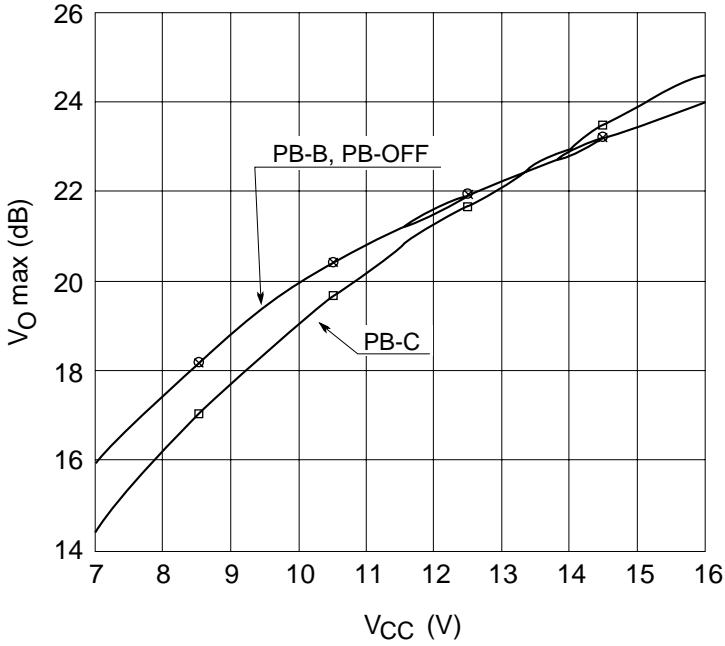
HA12141NT



Maximum Output Level vs. Supply Voltage (REC MODE)

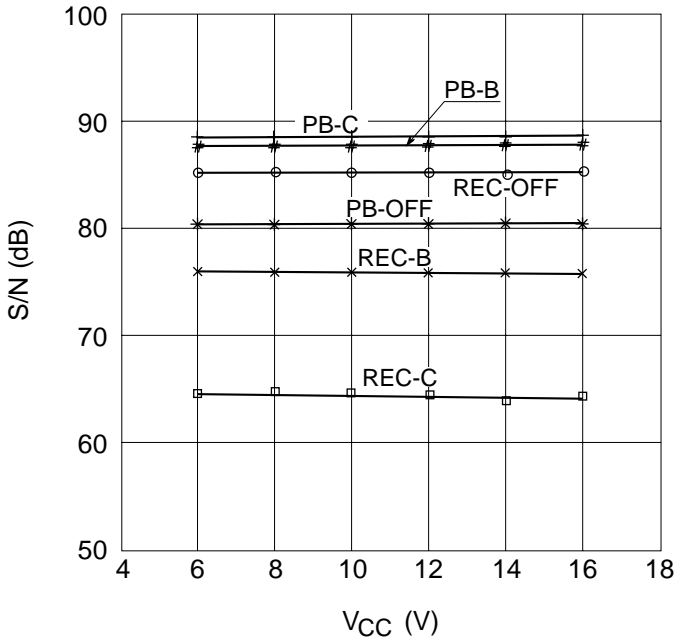
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT, HA12161FP



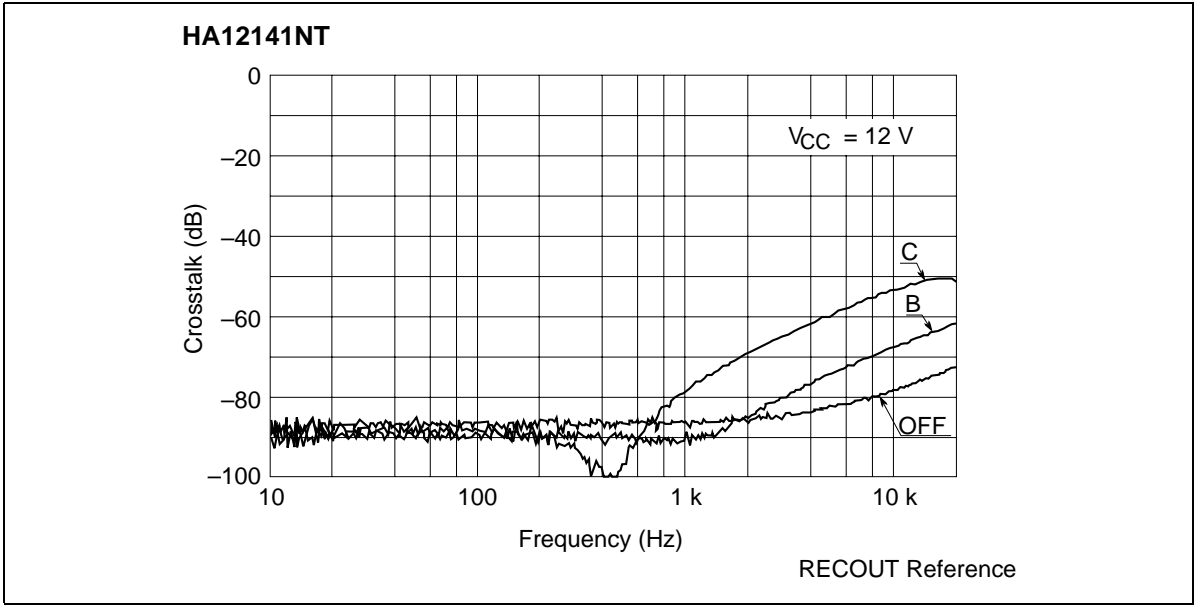
Maximum Output Level vs. Supply Voltage (PB MODE)

HA12141NT, HA12161FP

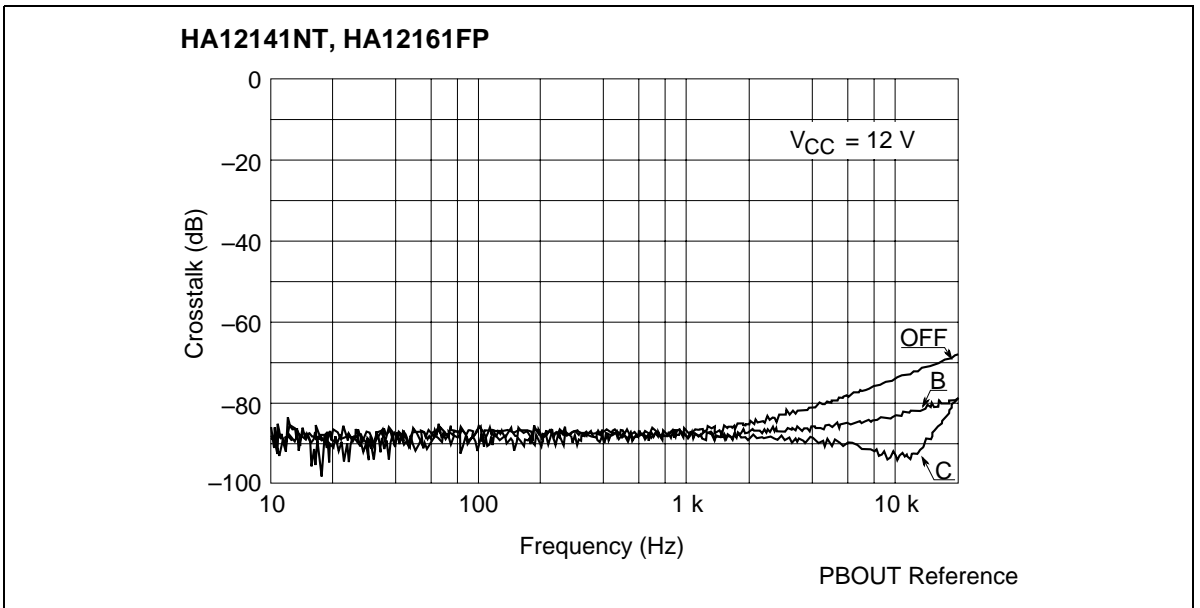


S/N vs. Supply Voltage

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



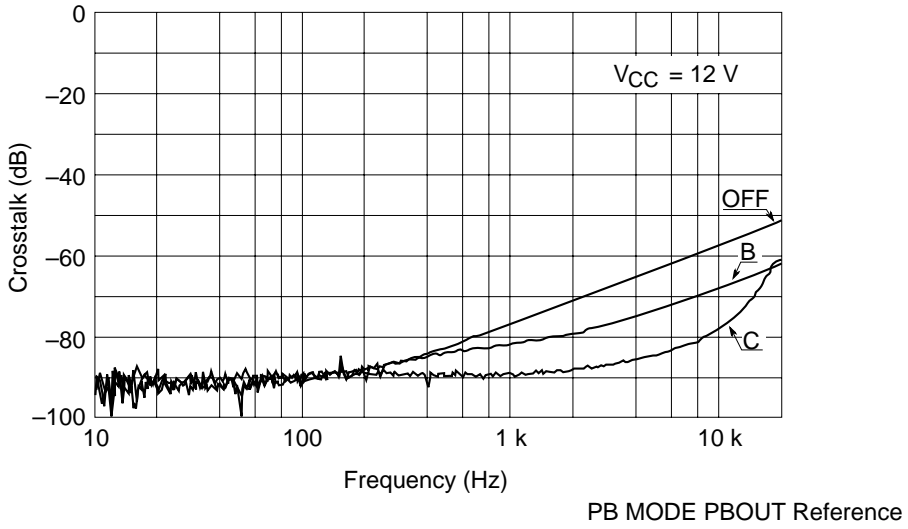
Crosstalk vs. Frequency (REC MODE R→L)



Crosstalk vs. Frequency (PB MODE R→L)

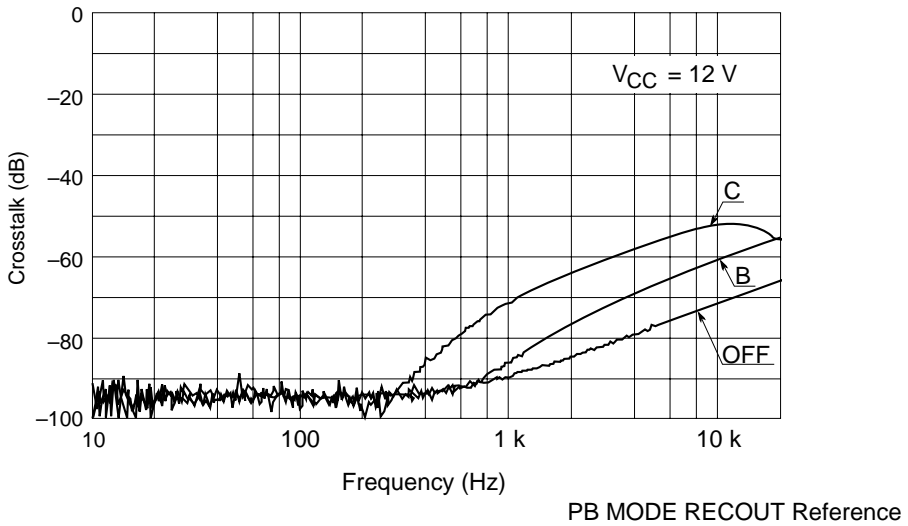
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT, HA12161FP



Crosstalk vs. Frequency (REC→PB)

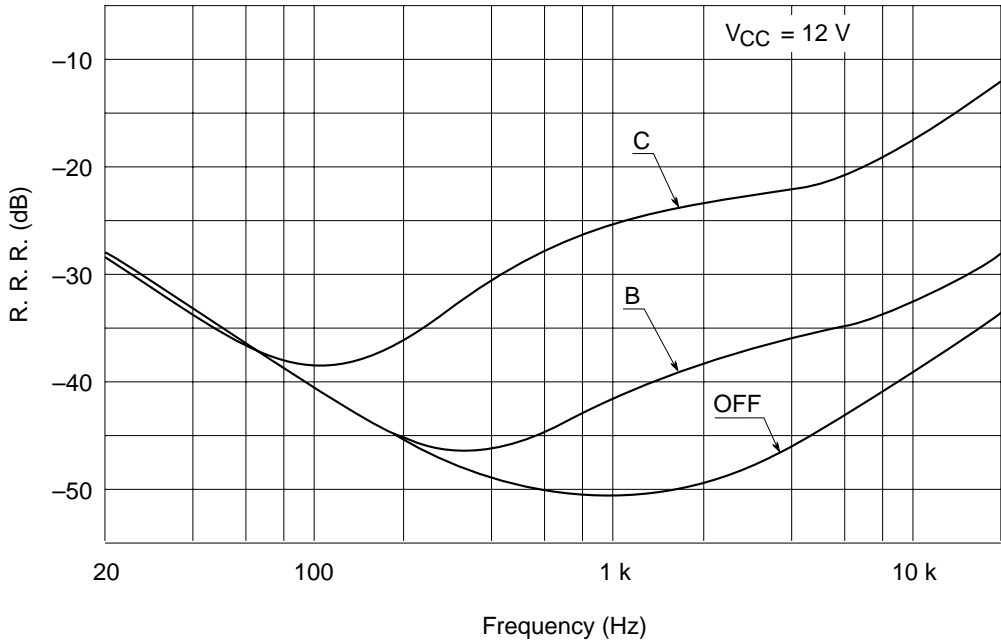
HA12141NT



Crosstalk vs. Frequency (PB→REC)

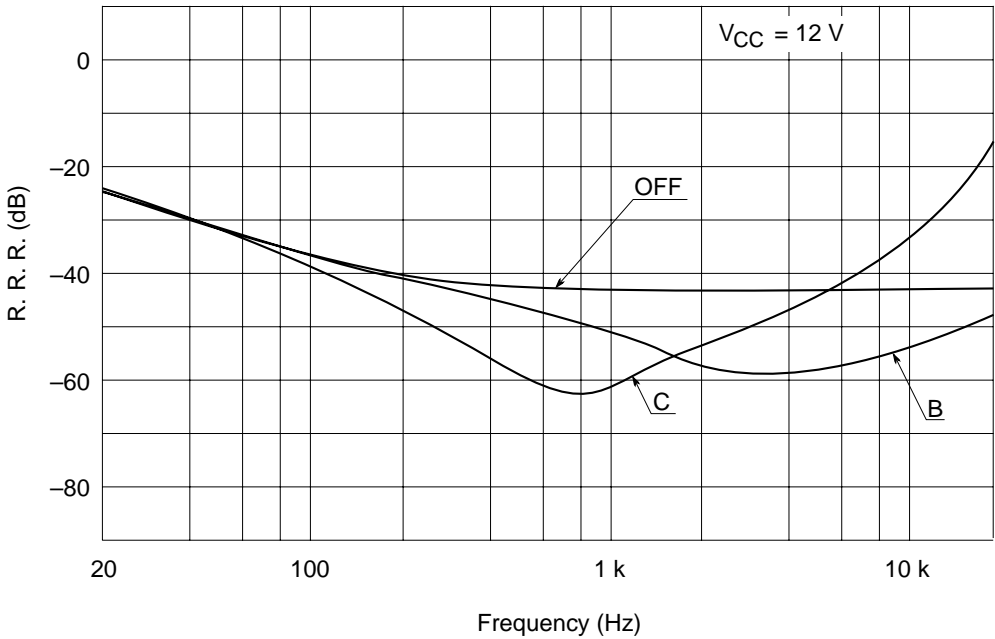
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12141NT



Ripple Rejection Ratio vs. Frequency (REC MODE RECOUT)

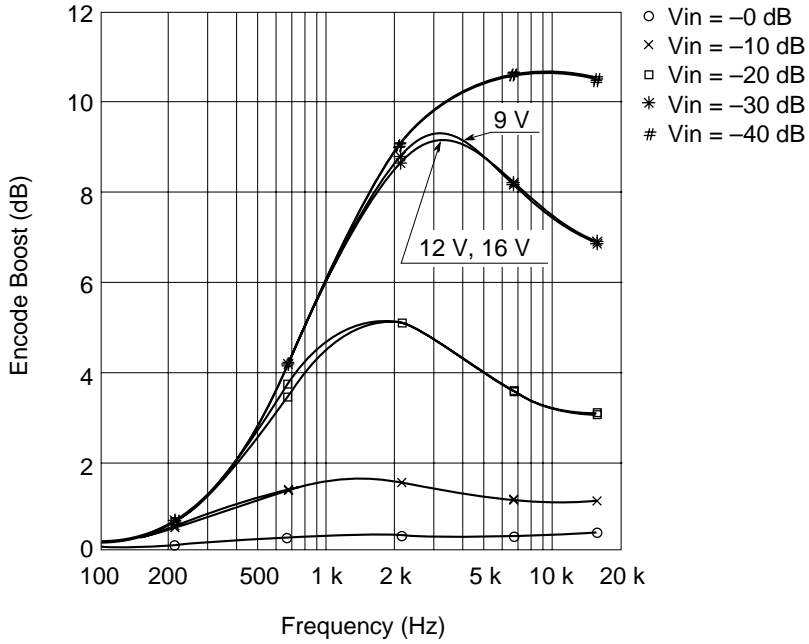
HA12141NT, HA12161FP



Ripple Rejection Ratio vs. Frequency (PB MODE PBOU)

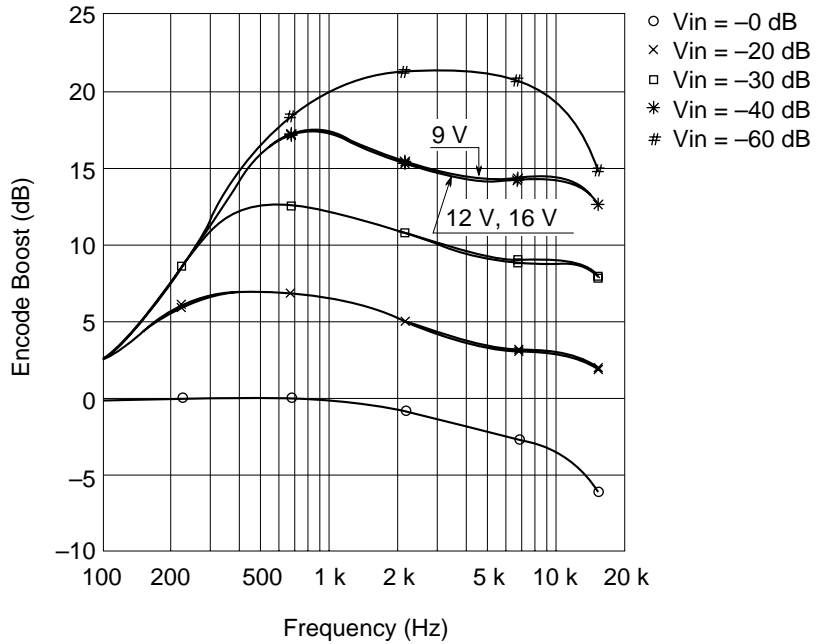
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT



Encode Boost vs. Frequency (NR-B, $V_{cc} = 9 \text{ V}, 12 \text{ V}, 16 \text{ V}$)

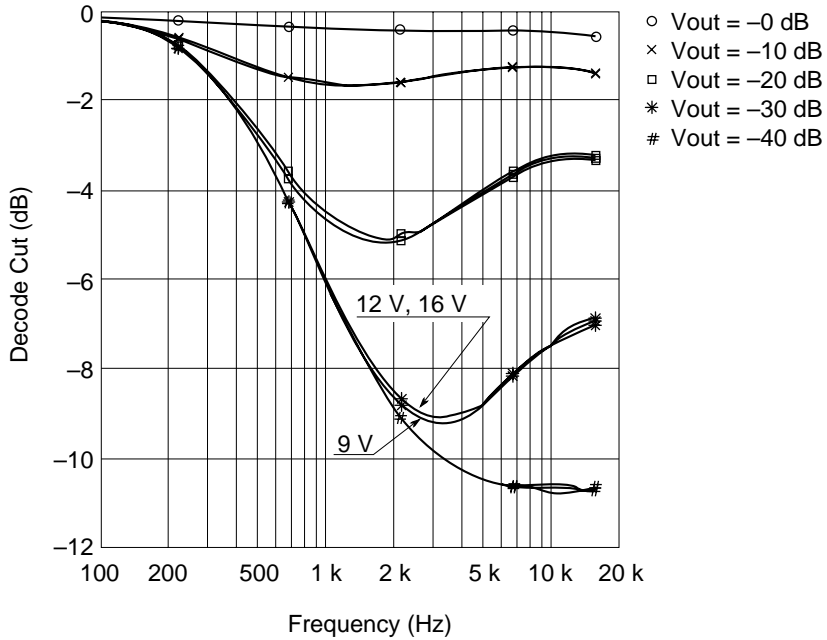
HA12142NT



Encode Boost vs. Frequency (NR-C, $V_{cc} = 9 \text{ V}, 12 \text{ V}, 16 \text{ V}$)

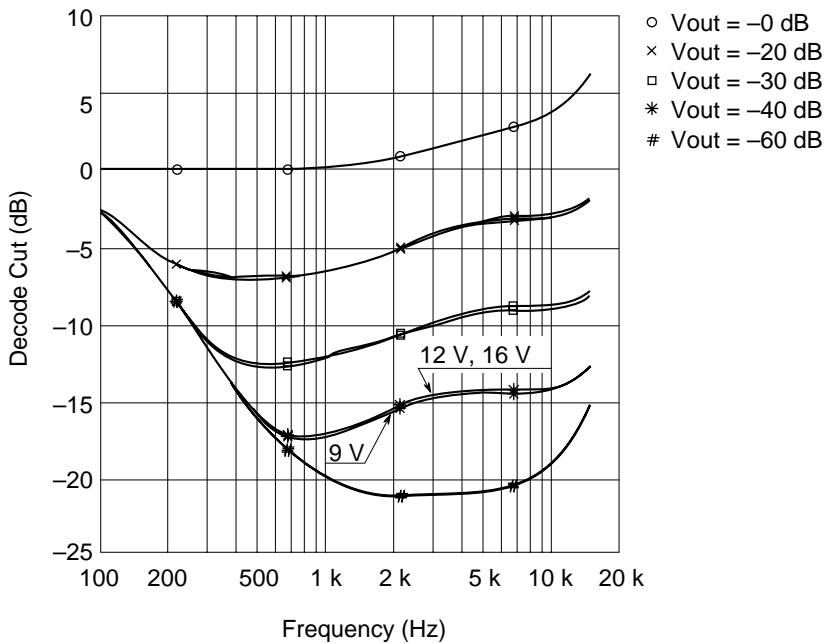
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT, HA12162FP



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

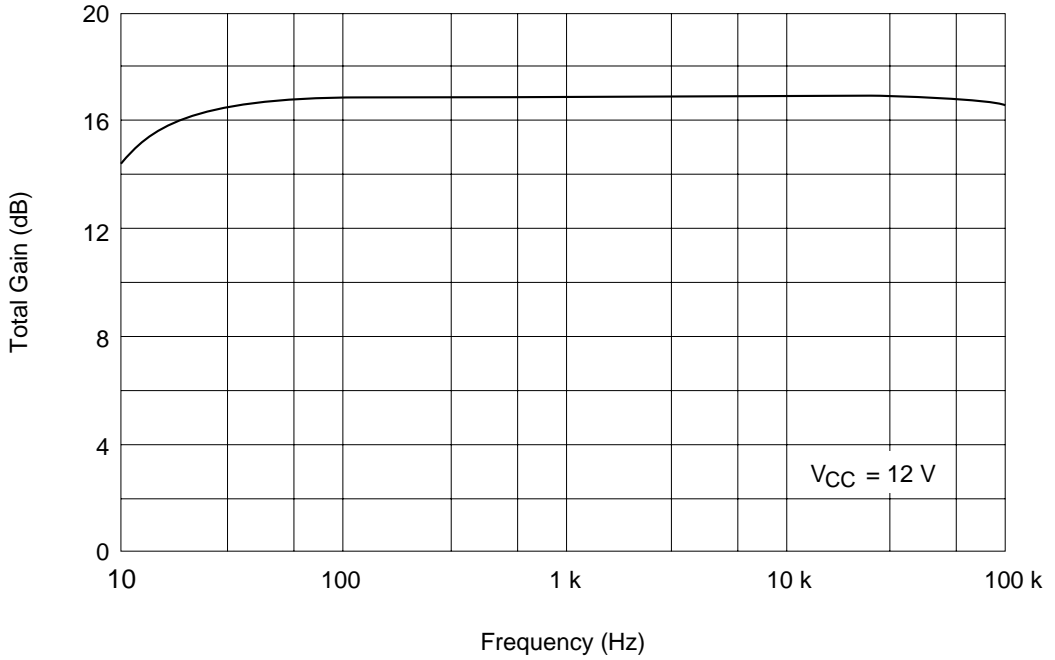
HA12142NT, HA12162FP



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

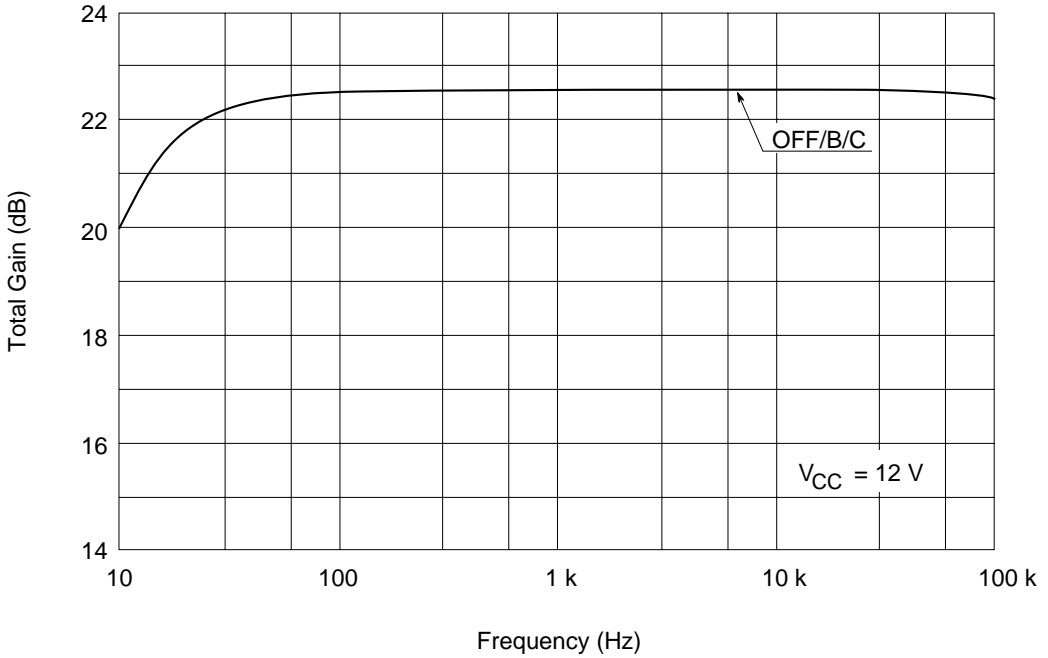
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT



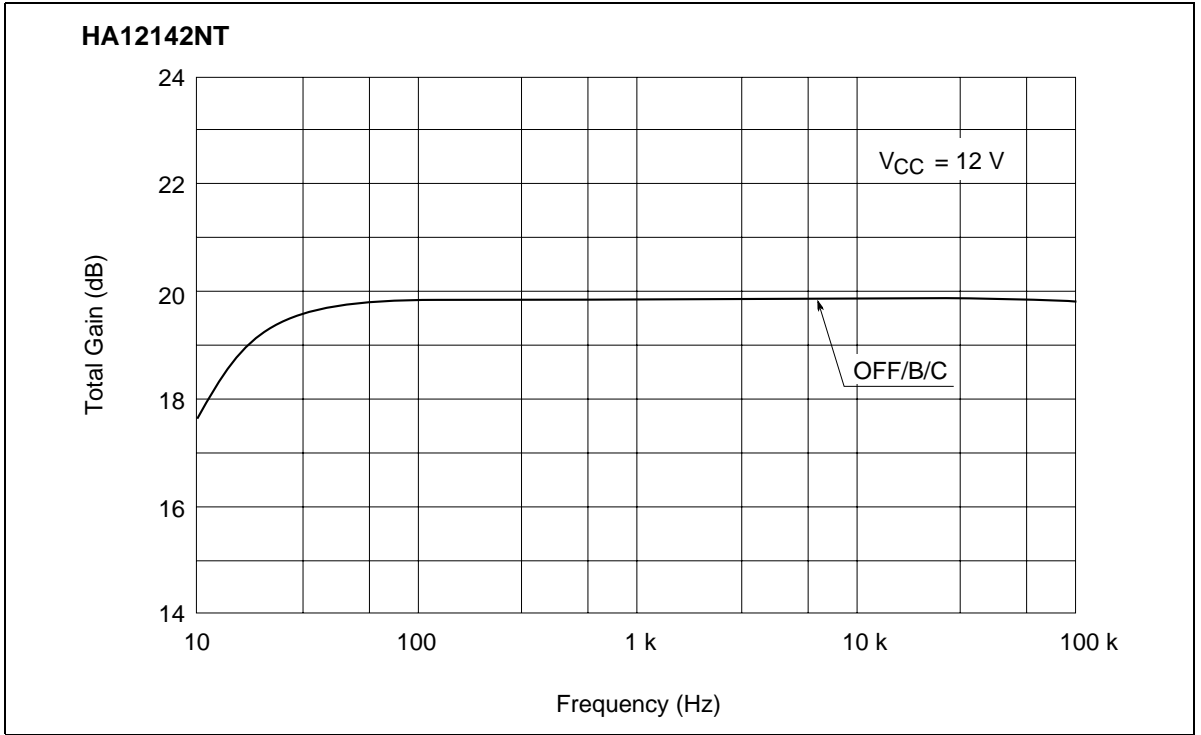
Total Gain vs. Frequency (REC MODE RECOUT NR-OFF)

HA12142NT, HA12162FP

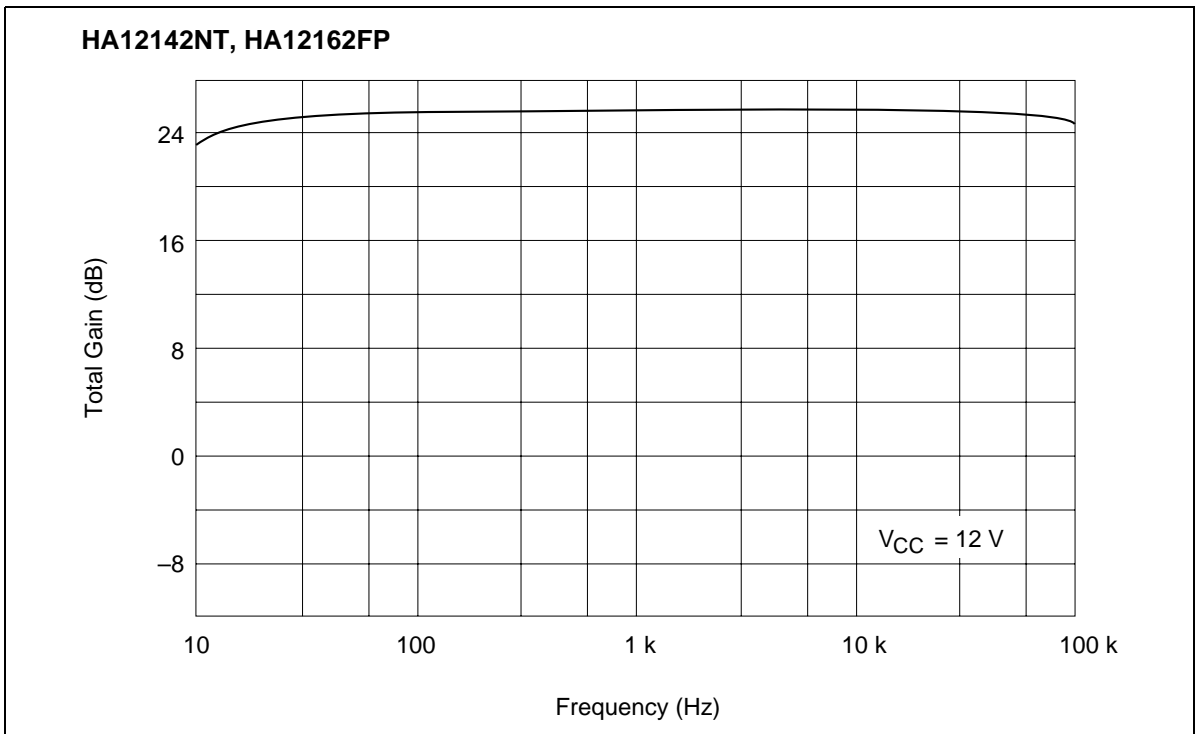


Total Gain vs. Frequency (REC MODE PBOUT)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

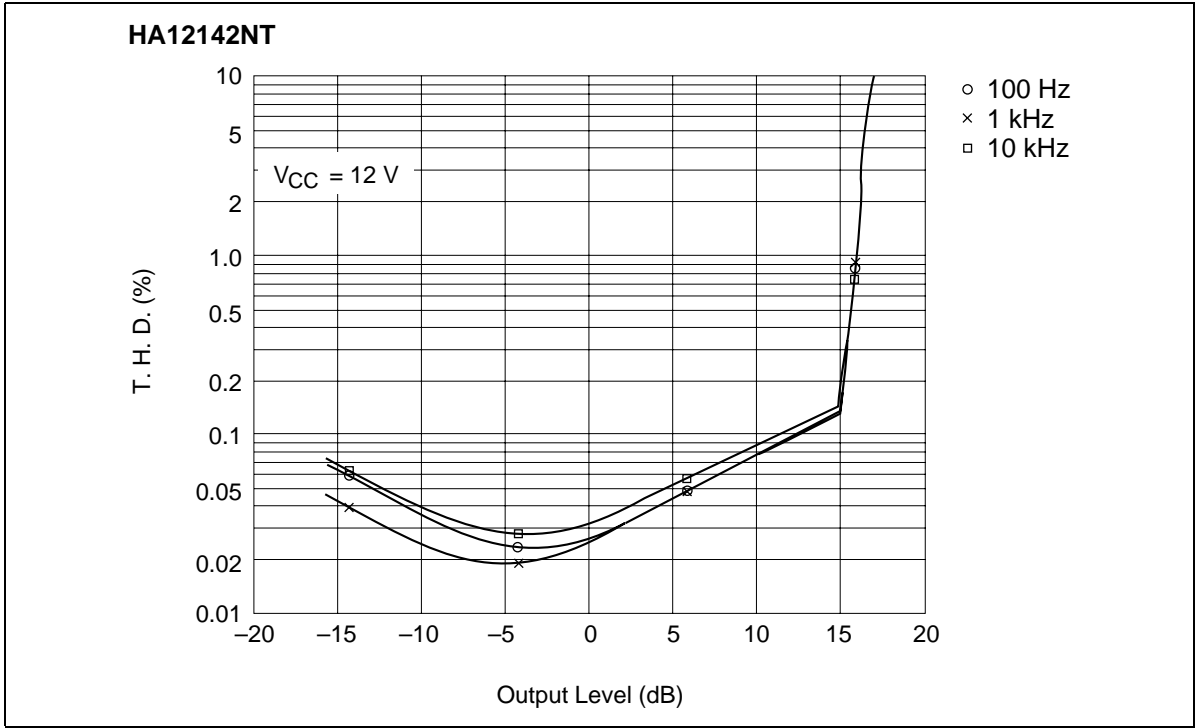


Total Gain vs. Frequency (PB MODE RECOUT)

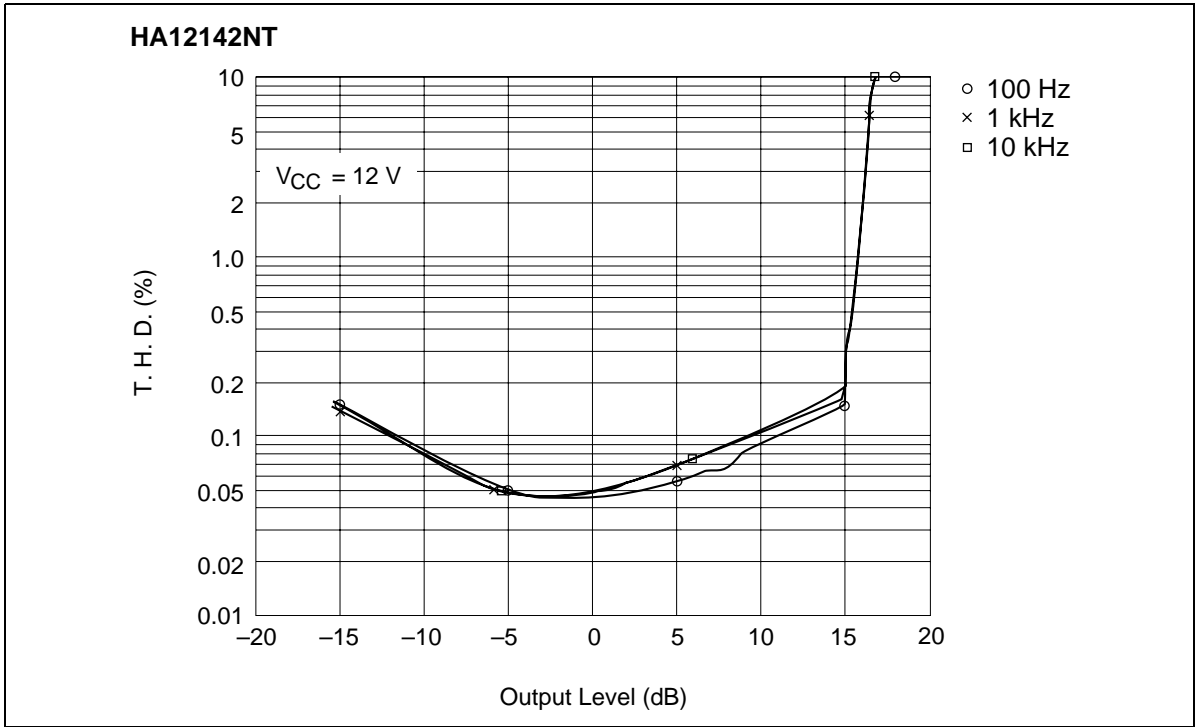


Total Gain vs. Frequency (PB MODE PBOUR NR-OFF)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



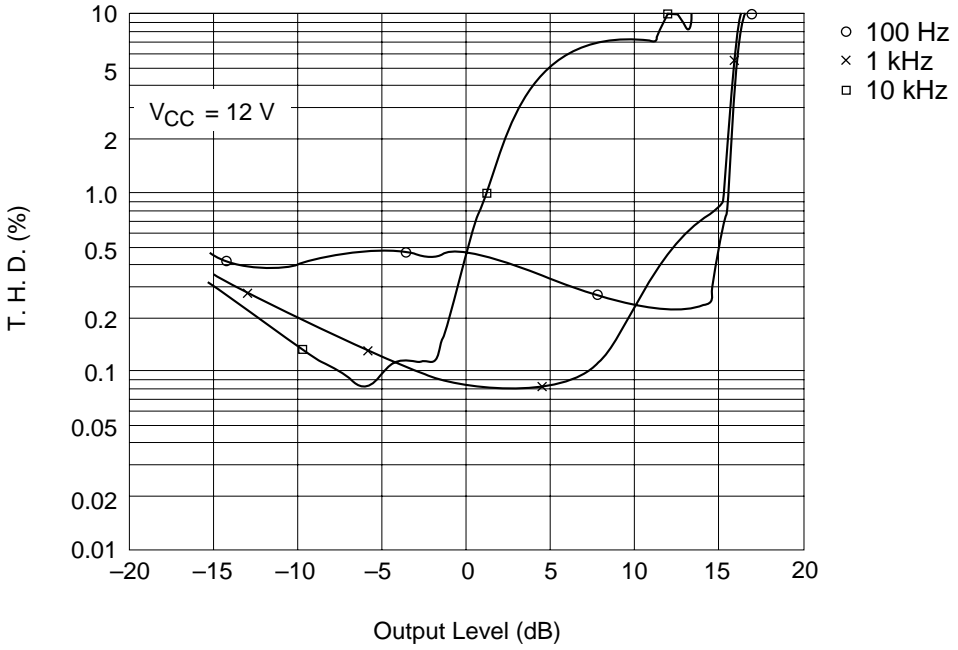
Total Harmonic Distortion vs. Output Level (REC MODE NR-OFF)



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

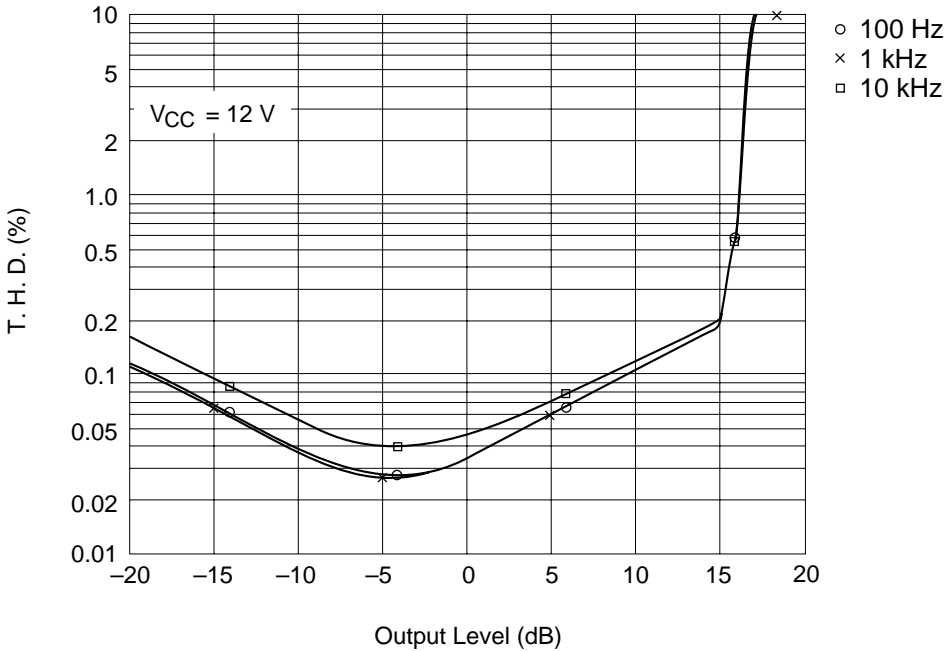
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT



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

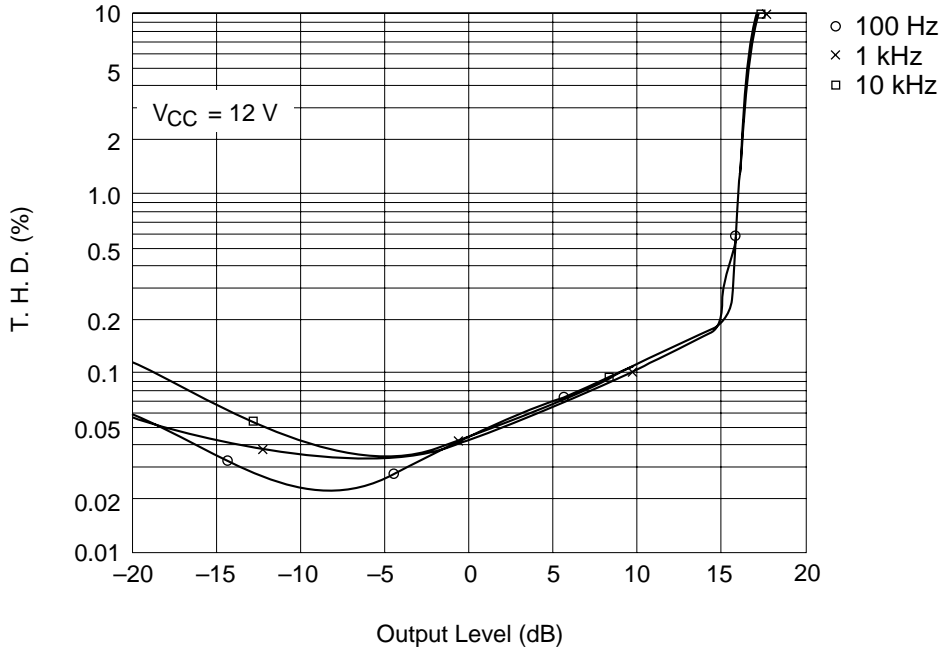
HA12142NT, HA12162FP



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

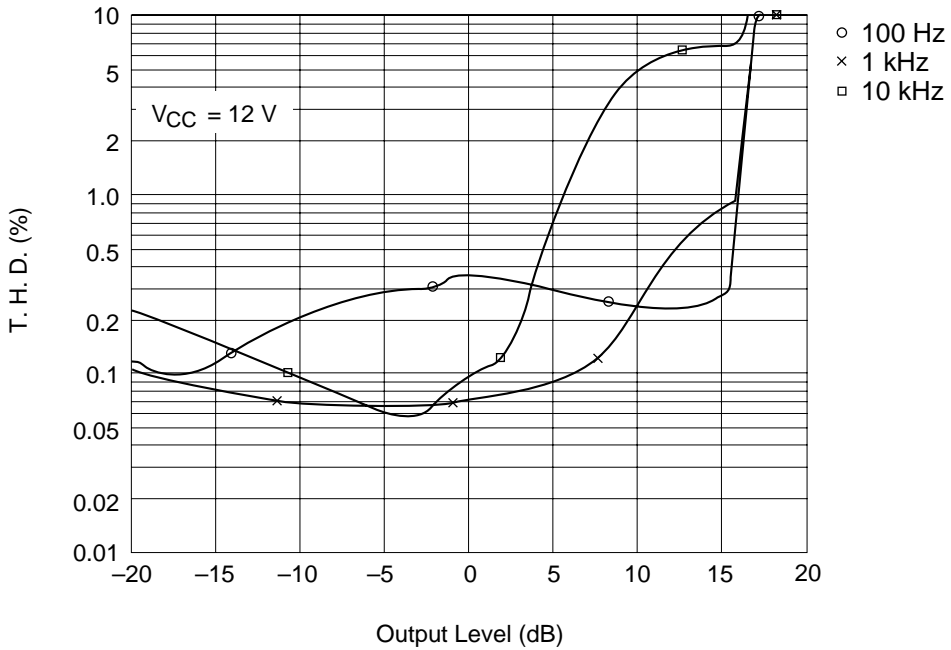
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT, HA12162FP



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

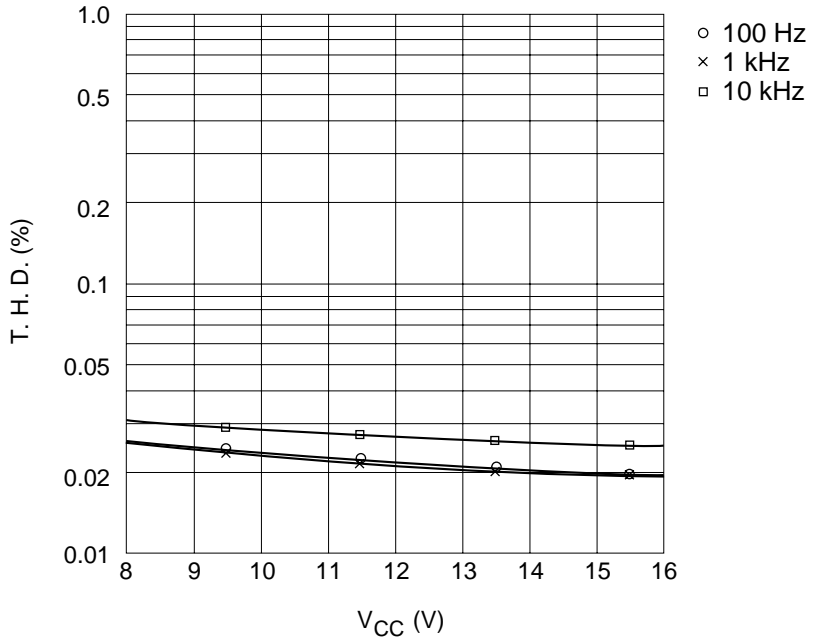
HA12142NT, HA12162FP



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

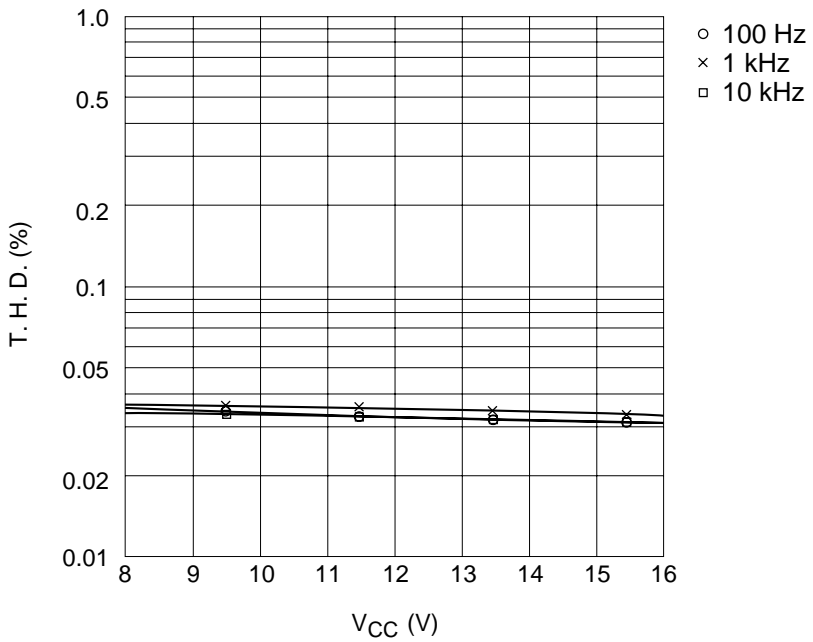
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT



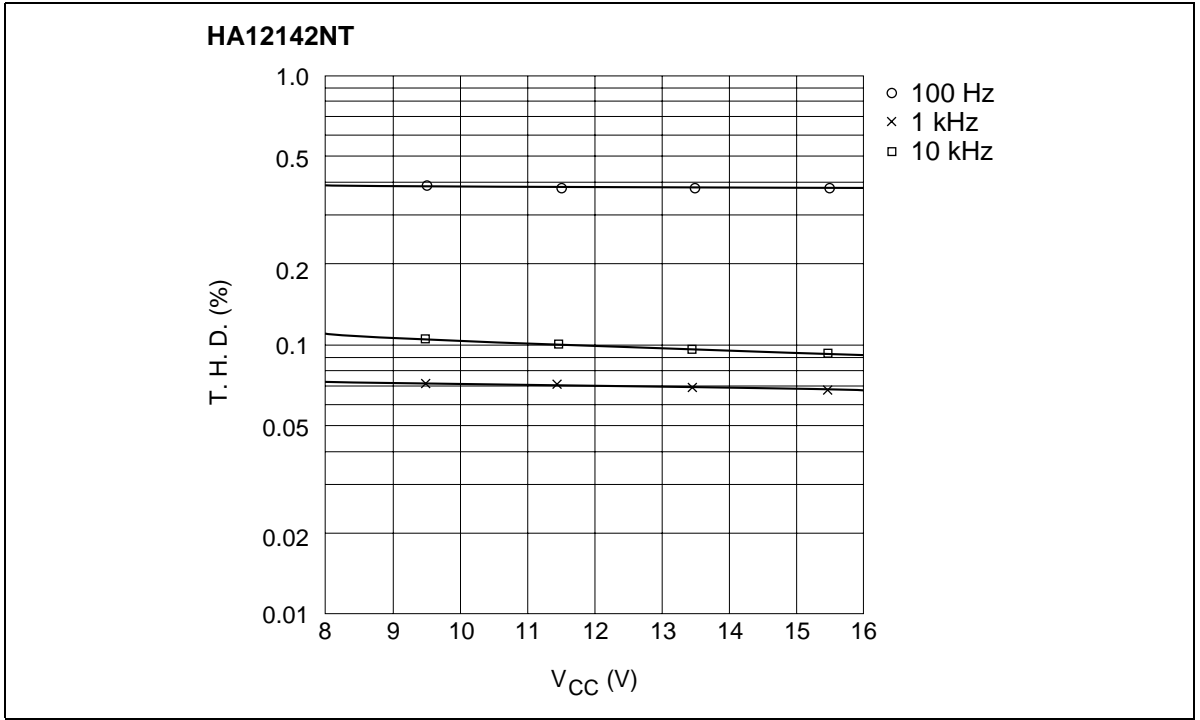
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-OFF)

HA12142NT

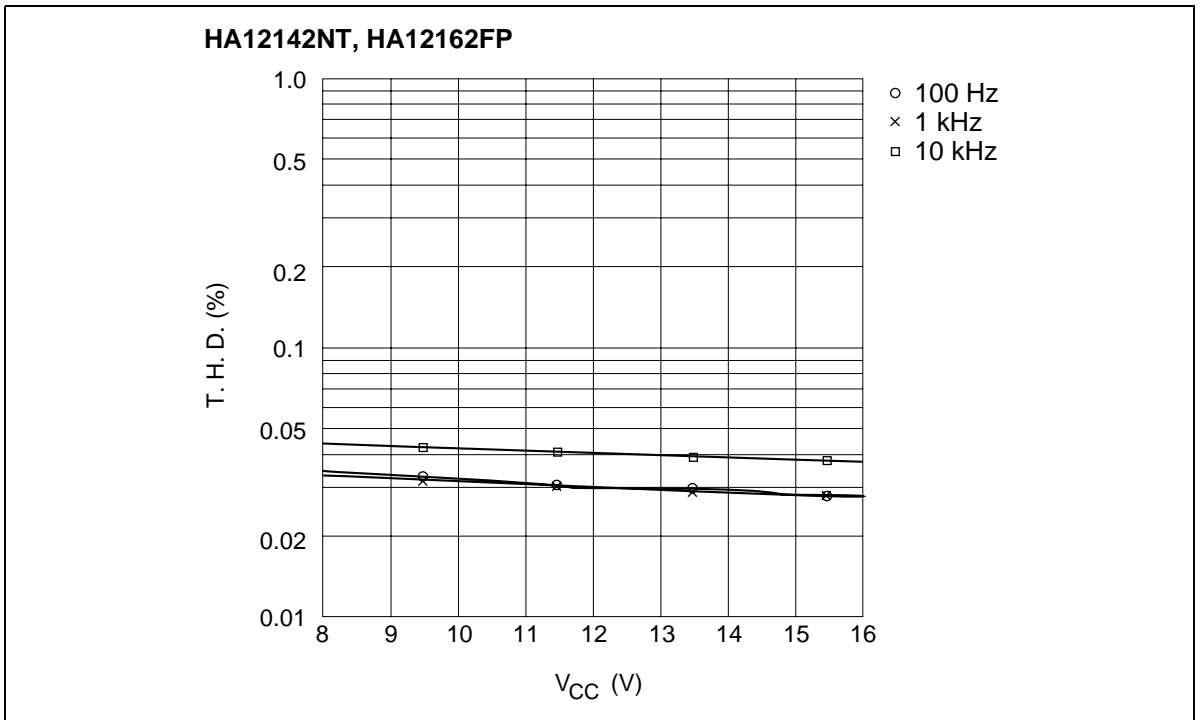


Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-B)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



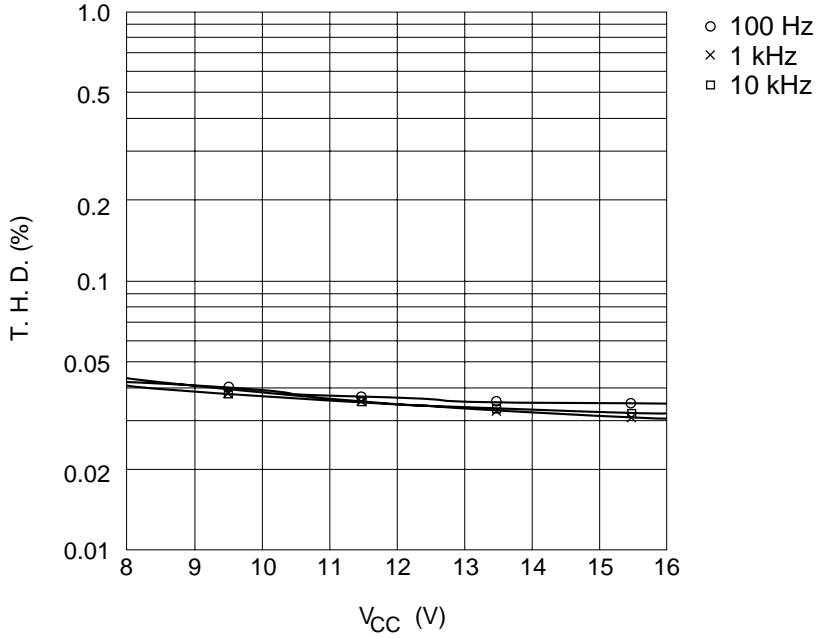
Total Harmonic Distortion vs. Supply Voltage (REC MODE NR-C)



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

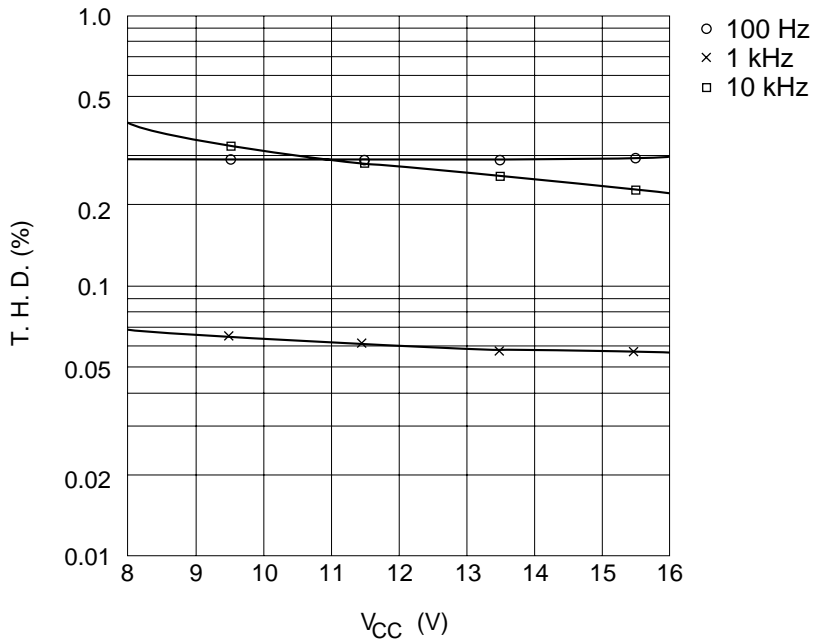
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT, HA12162FP



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

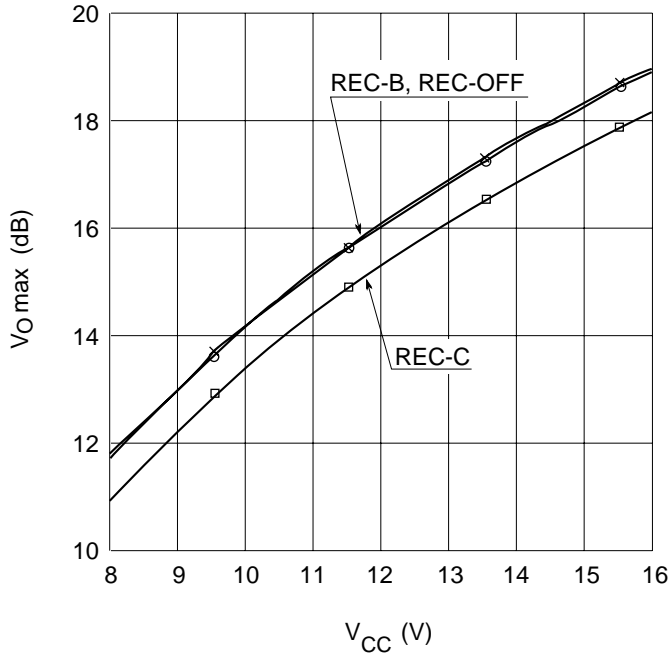
HA12142NT, HA12162FP



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

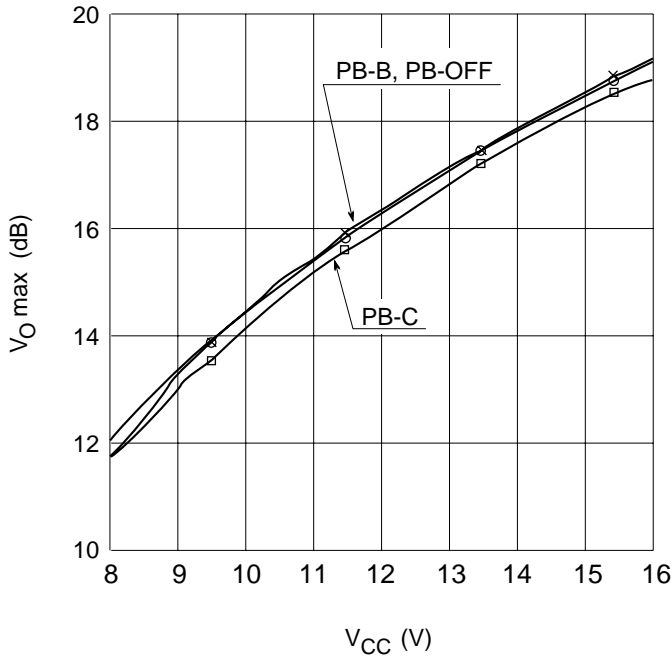
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT



Maximum Output Level vs. Supply Voltage (REC MODE)

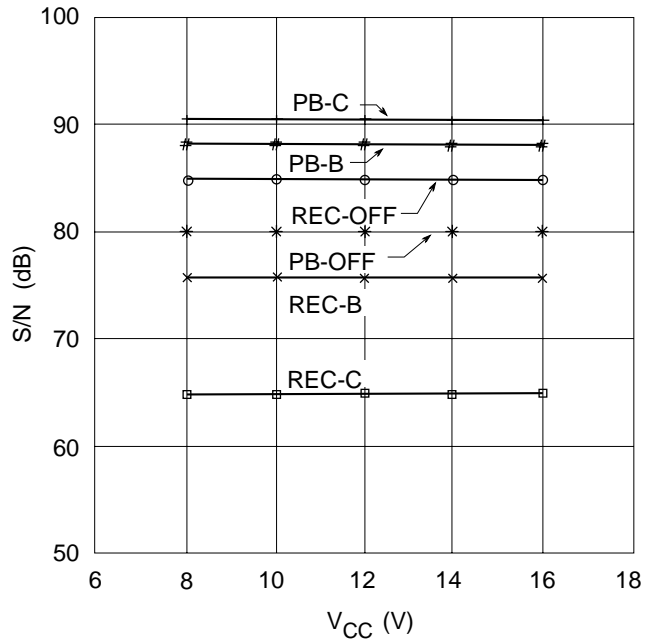
HA12142NT, HA12162FP



Maximum Output Level vs. Supply Voltage (PB MODE)

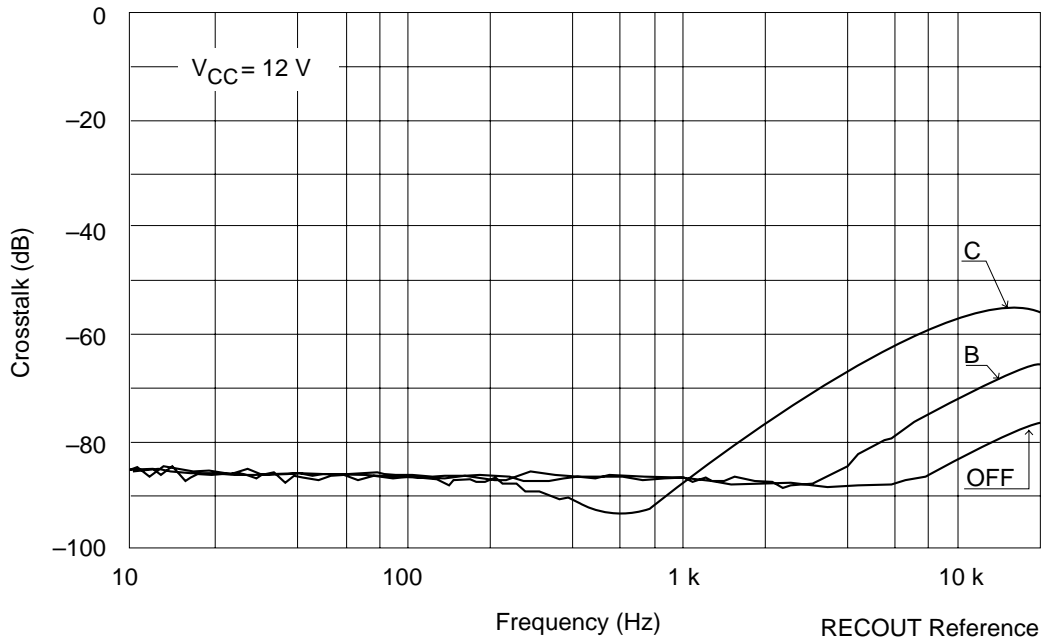
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT, HA12162FP



S/N vs. Supply Voltage

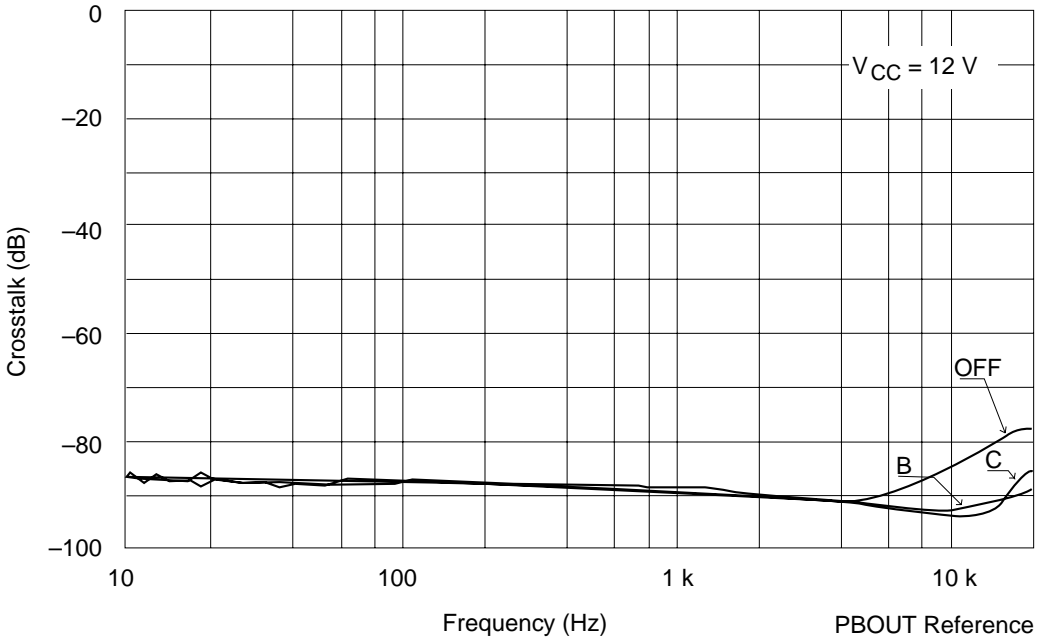
HA12142NT



Crosstalk vs. Frequency (REC MODE R↔L)

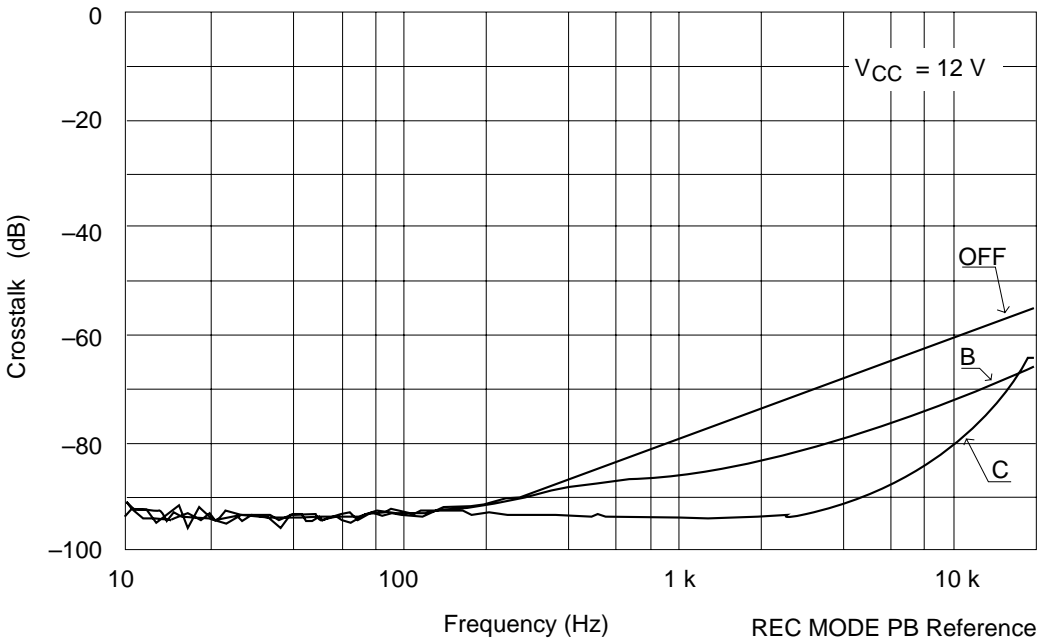
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT, HA12162FP



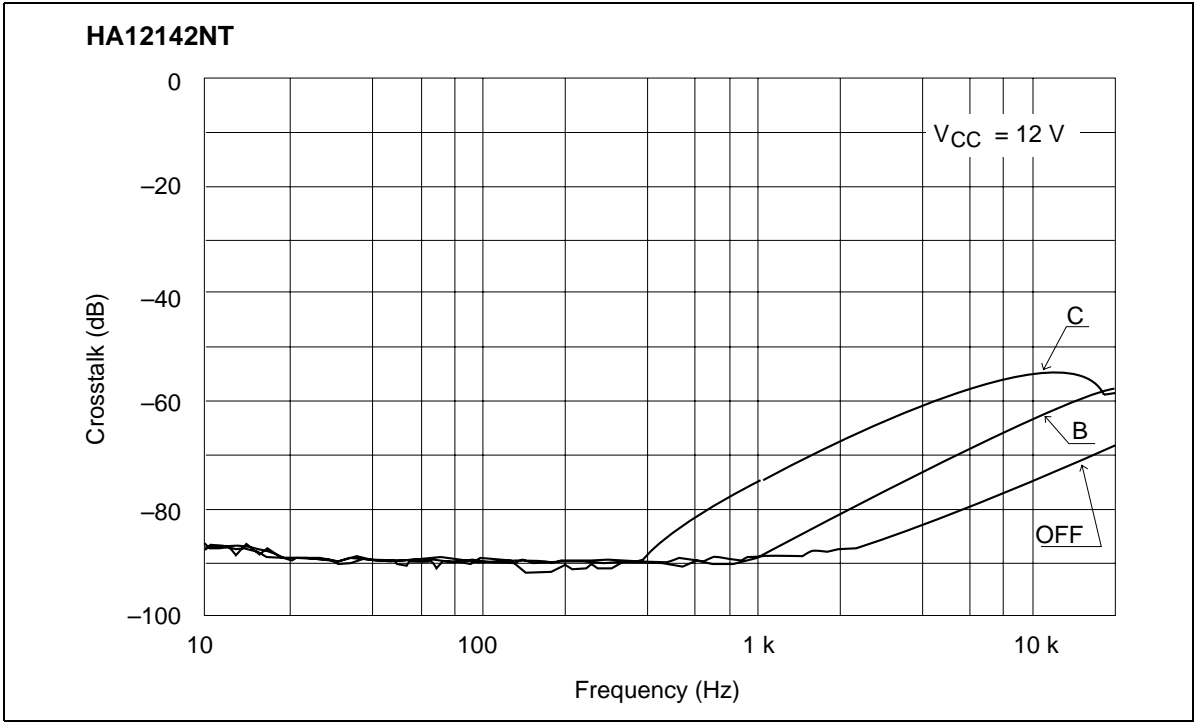
Crosstalk vs. Frequency (PB MODE R↔L)

HA12142NT

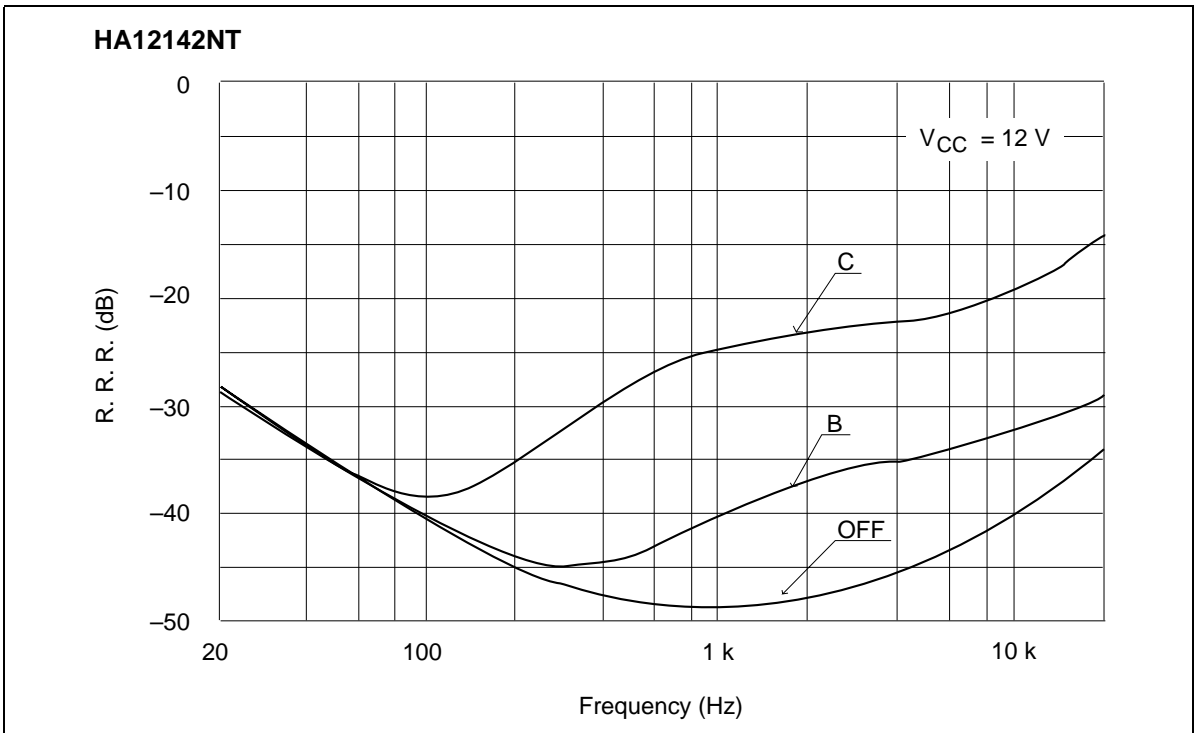


Crosstalk vs. Frequency (REC→PB)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



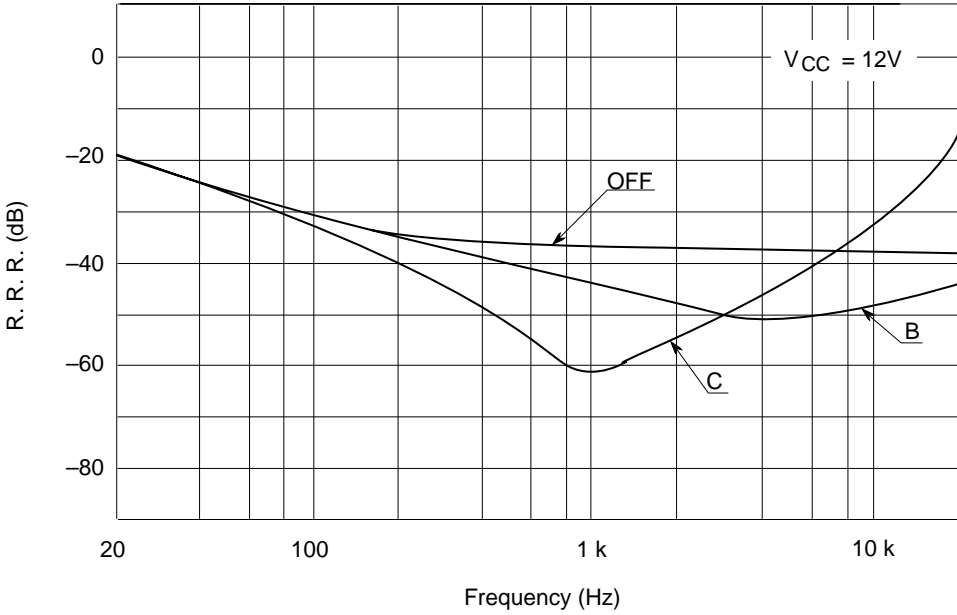
Crosstalk vs. Frequency (PB→REC)



Ripple Rejection Ratio vs. Frequency (REC MODE RECOUT)

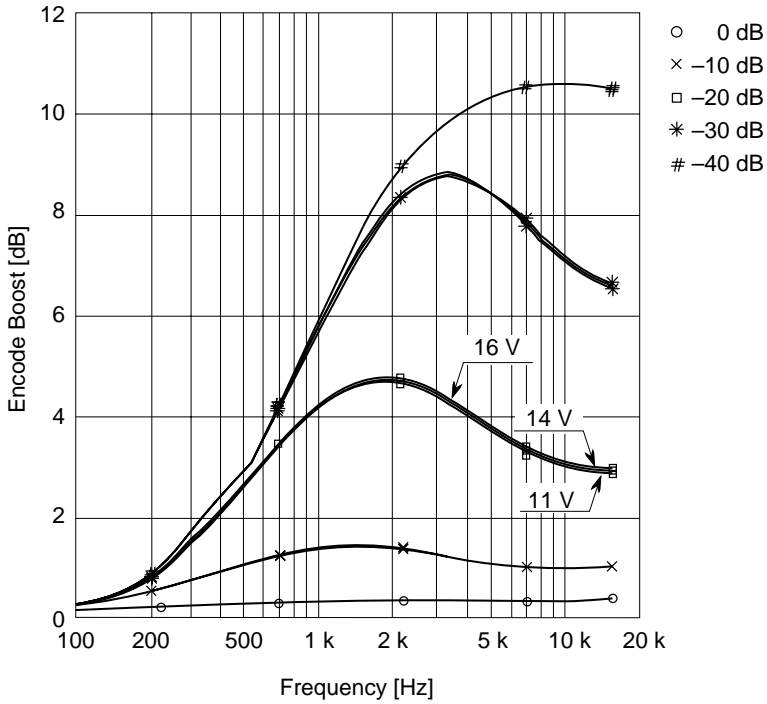
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12142NT, HA12162FP



Ripple Rejection Ratio vs. Frequency (PB MODE RECOUT)

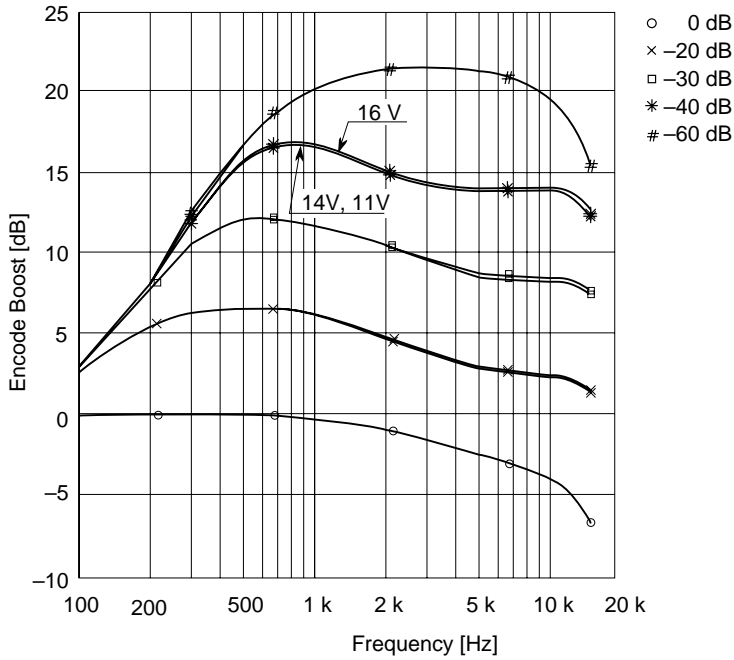
HA12170NT



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

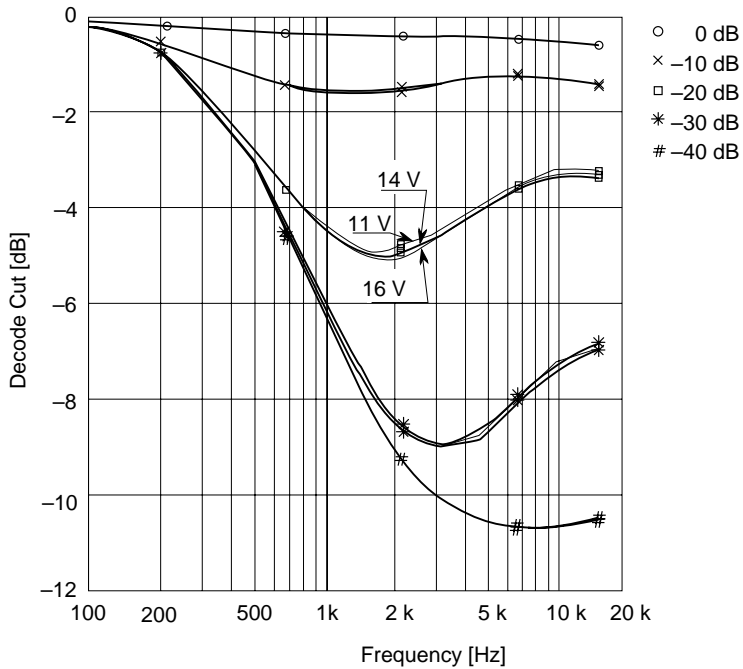
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12170NT



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

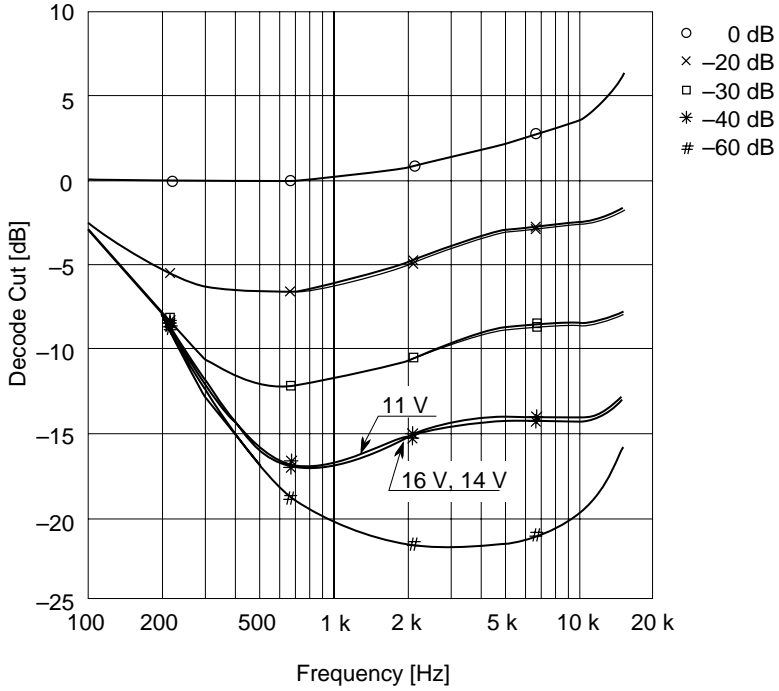
HA12170NT



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

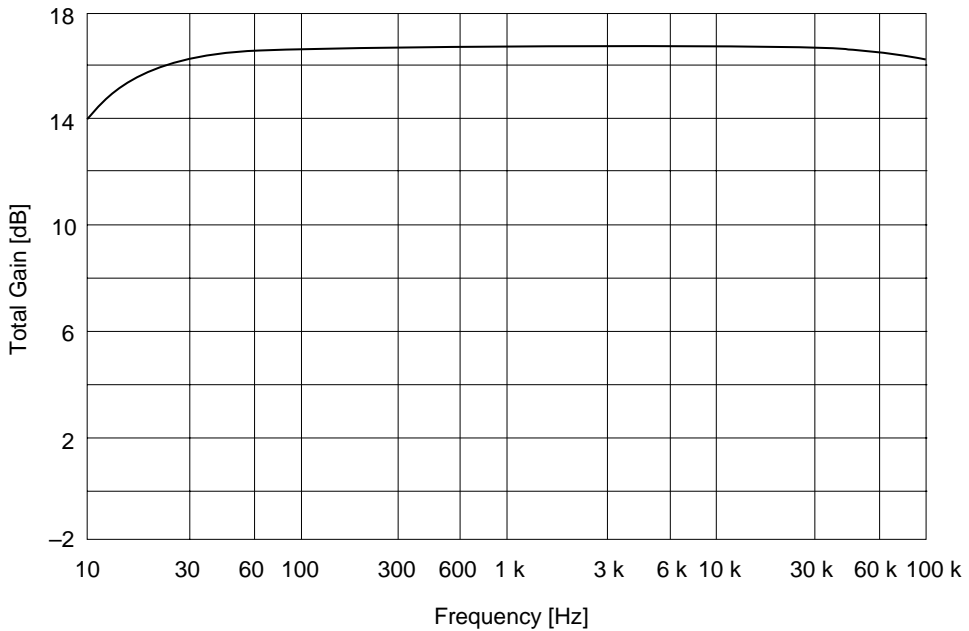
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12170NT



Decode Cut vs. Frequency (NR-C $V_{cc} = 11\text{ V}, 14\text{ V}, 16\text{ V}$)

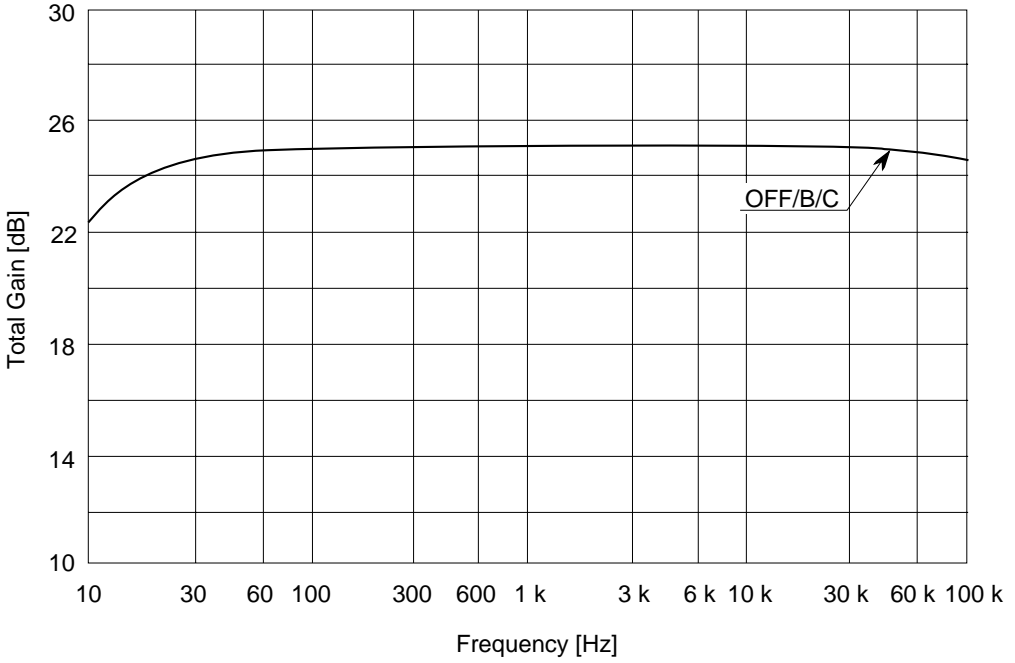
HA12170NT



Total Gain vs. Frequency (REC MODE RECOUT NR-OFF $V_{cc} = 14\text{ V}$)

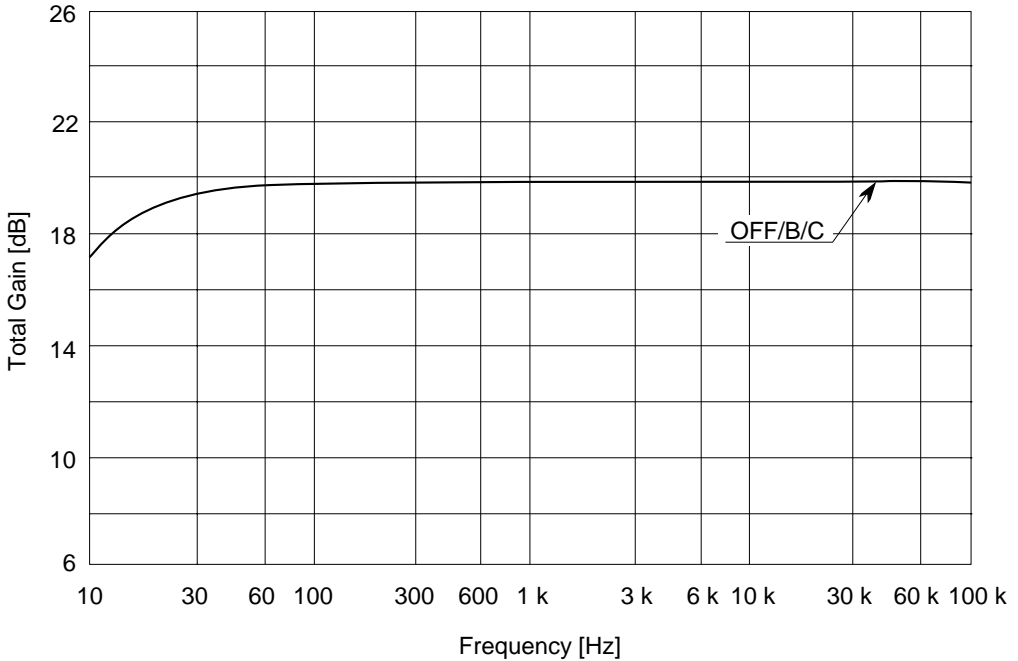
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12170NT



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

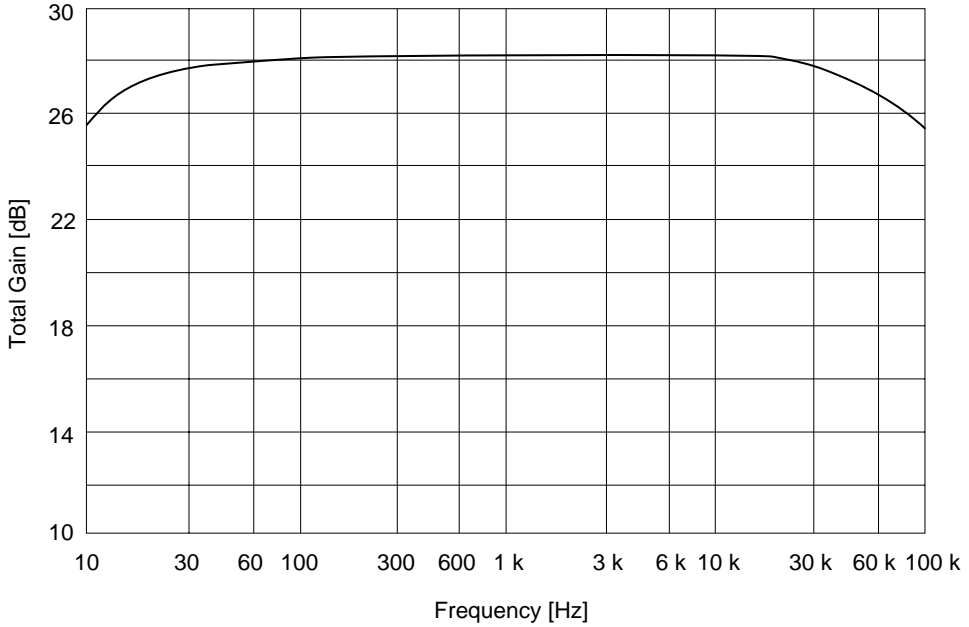
HA12170NT



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

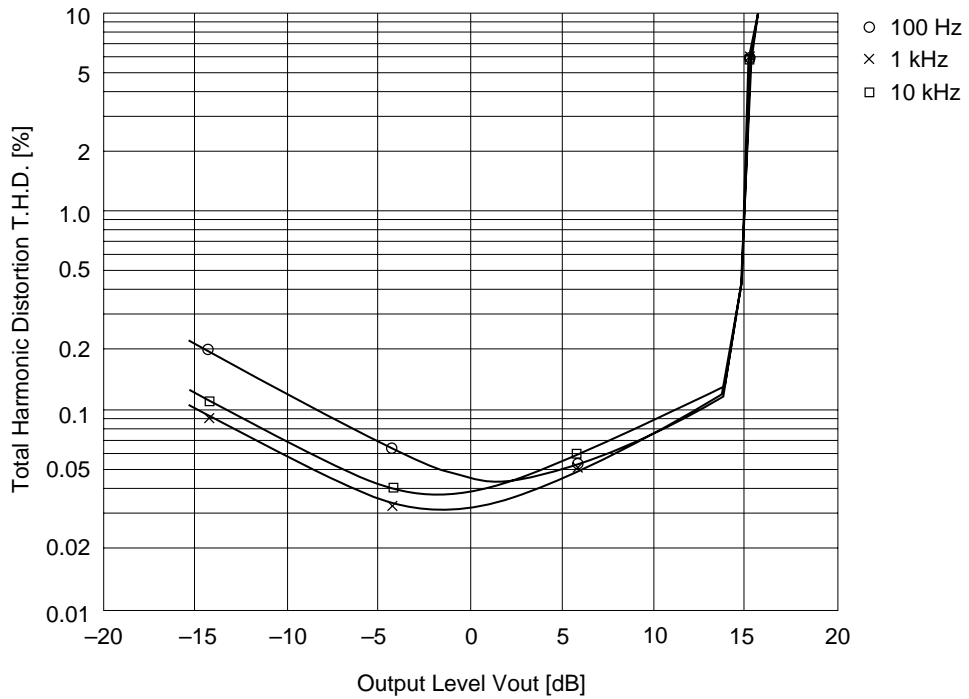
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12170NT



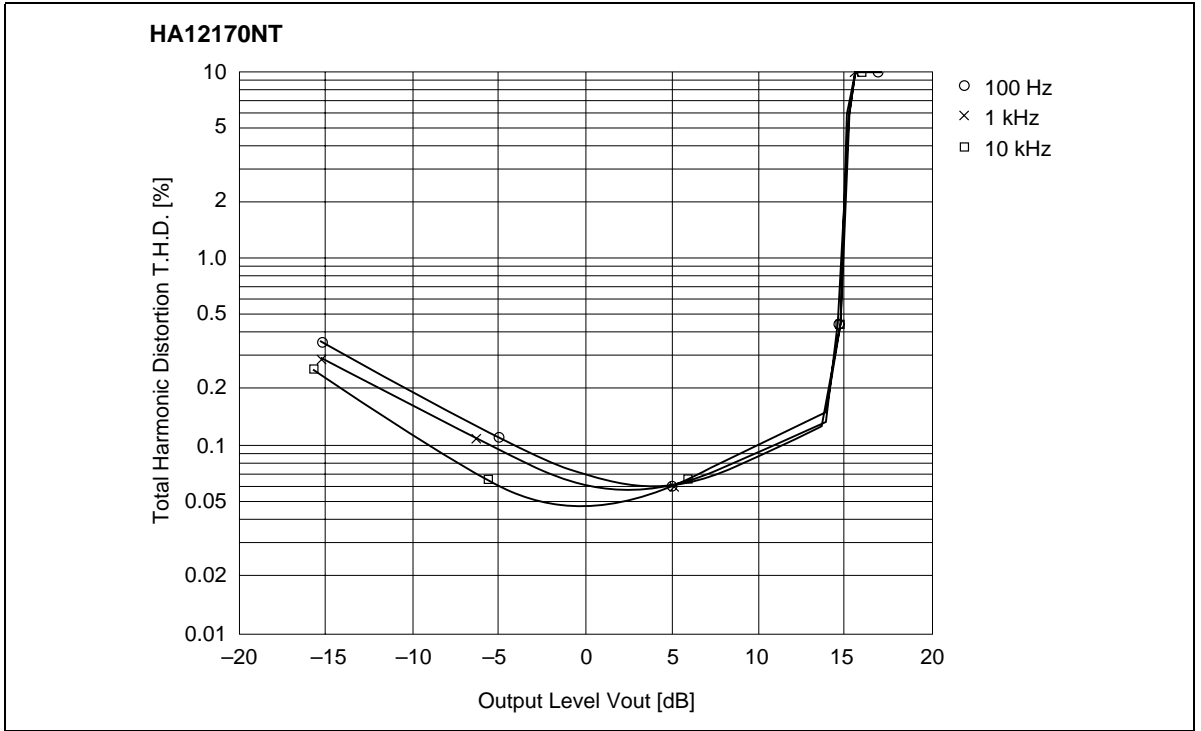
Total Gain vs. Frequency (PB MODE PBOUt NR-OFF $V_{cc} = 14\text{ V}$)

HA12170NT

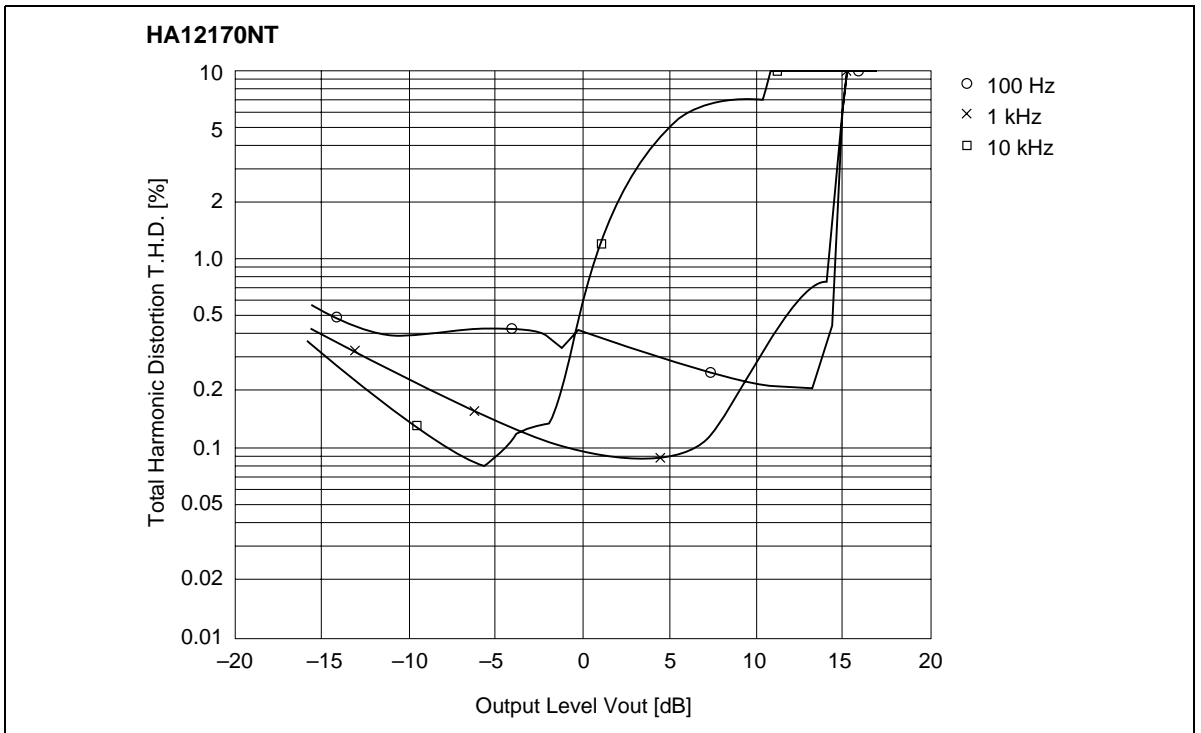


Total Harmonic Distortion vs. Output Level (REC MODE NR-OFF $V_{cc} = 14\text{ V}$)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

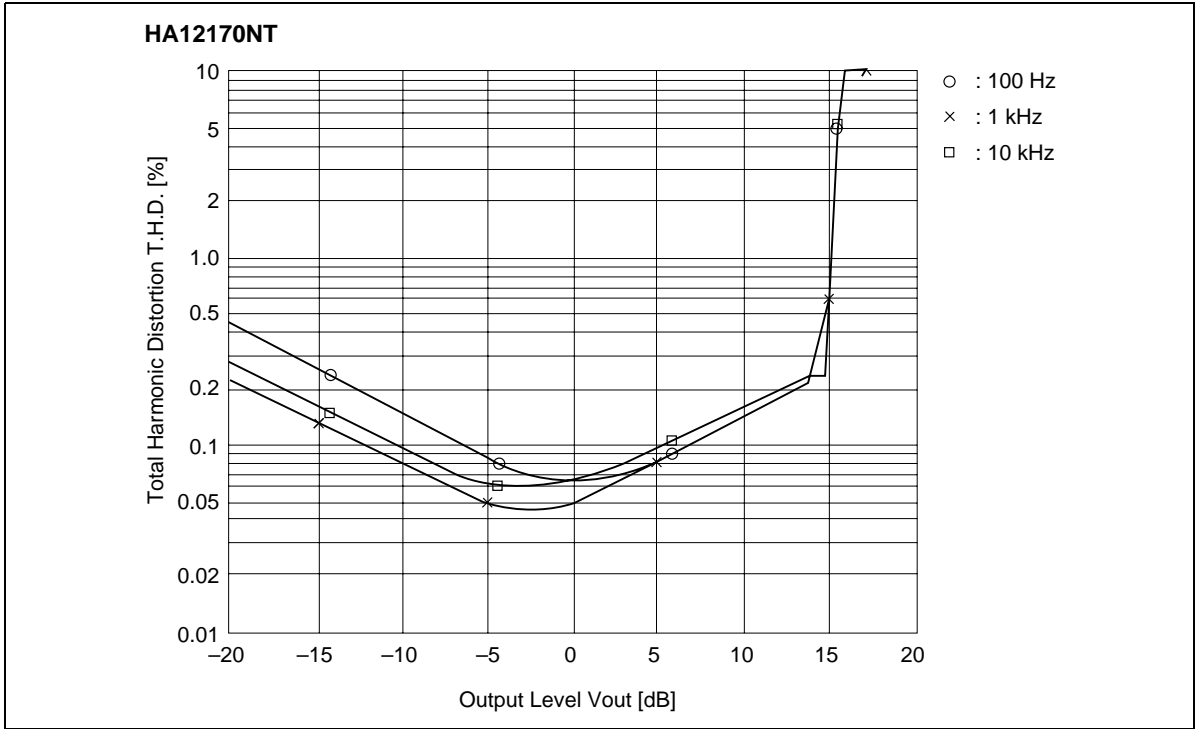


Total Harmonic Distortion vs. Output Level (REC MODE NR-B $V_{CC} = 14\text{ V}$)

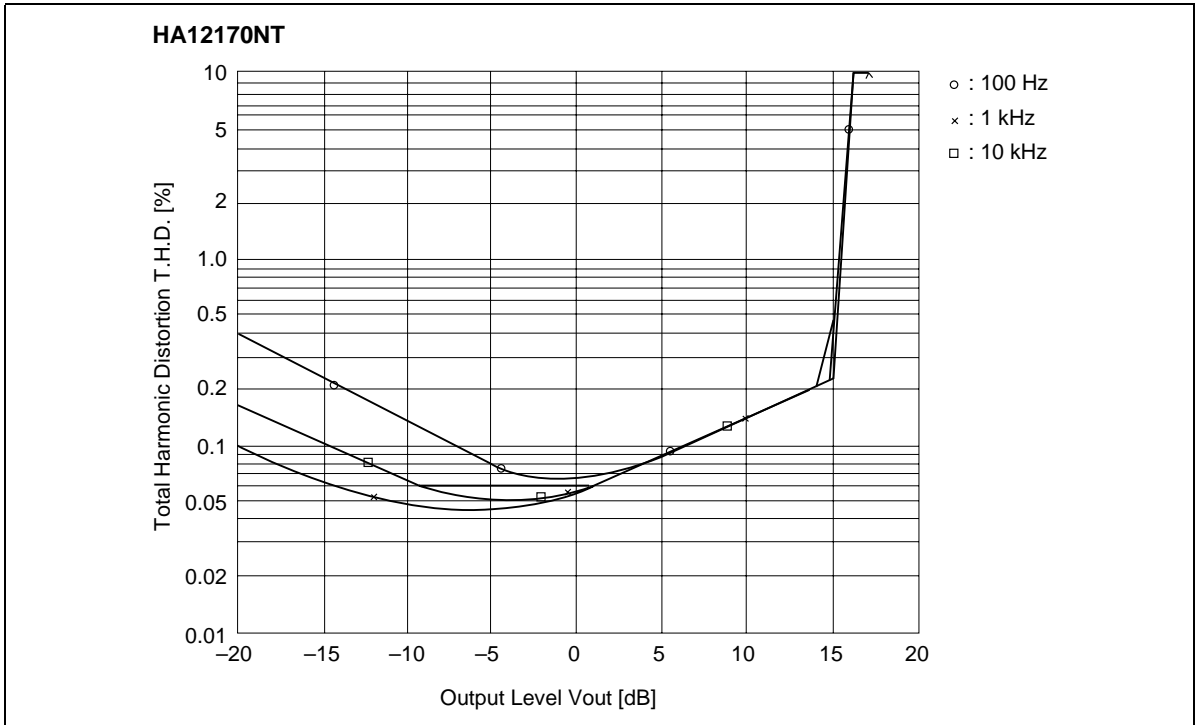


Total Harmonic Distortion vs. Output Level (REC MODE NR-C $V_{CC} = 14\text{ V}$)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

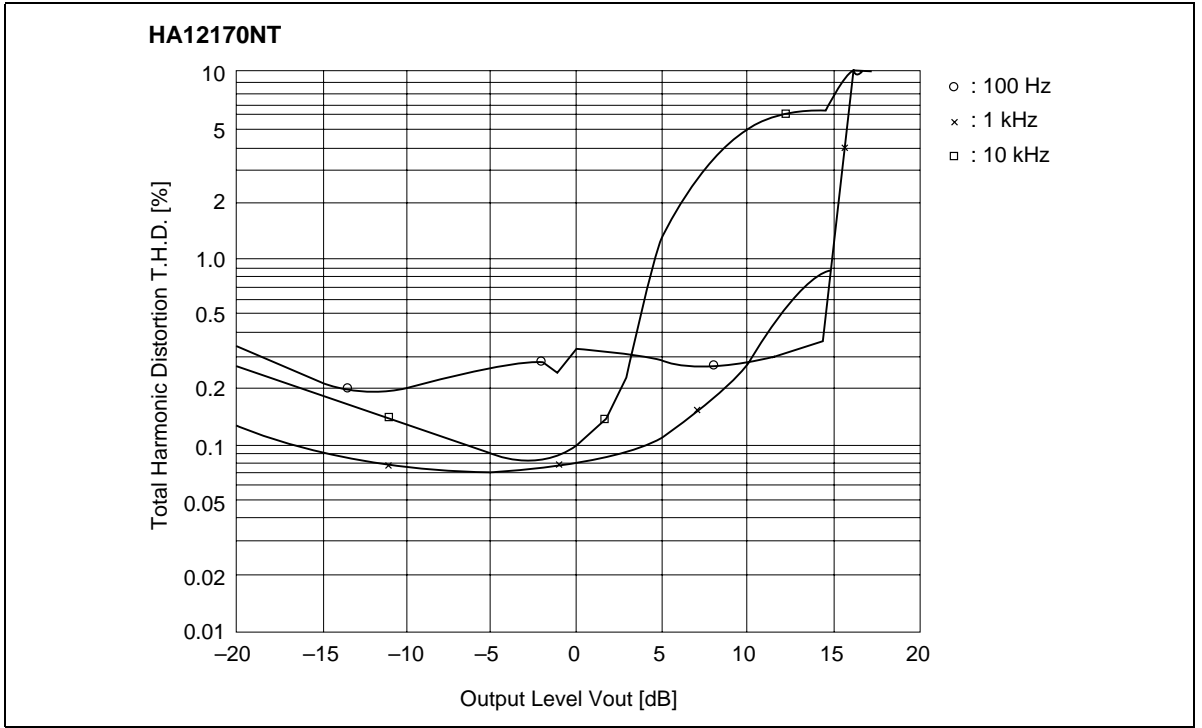


Total Harmonic Distortion vs. Output Level (PB MODE NR-OFF $V_{cc} = 14\text{ V}$)

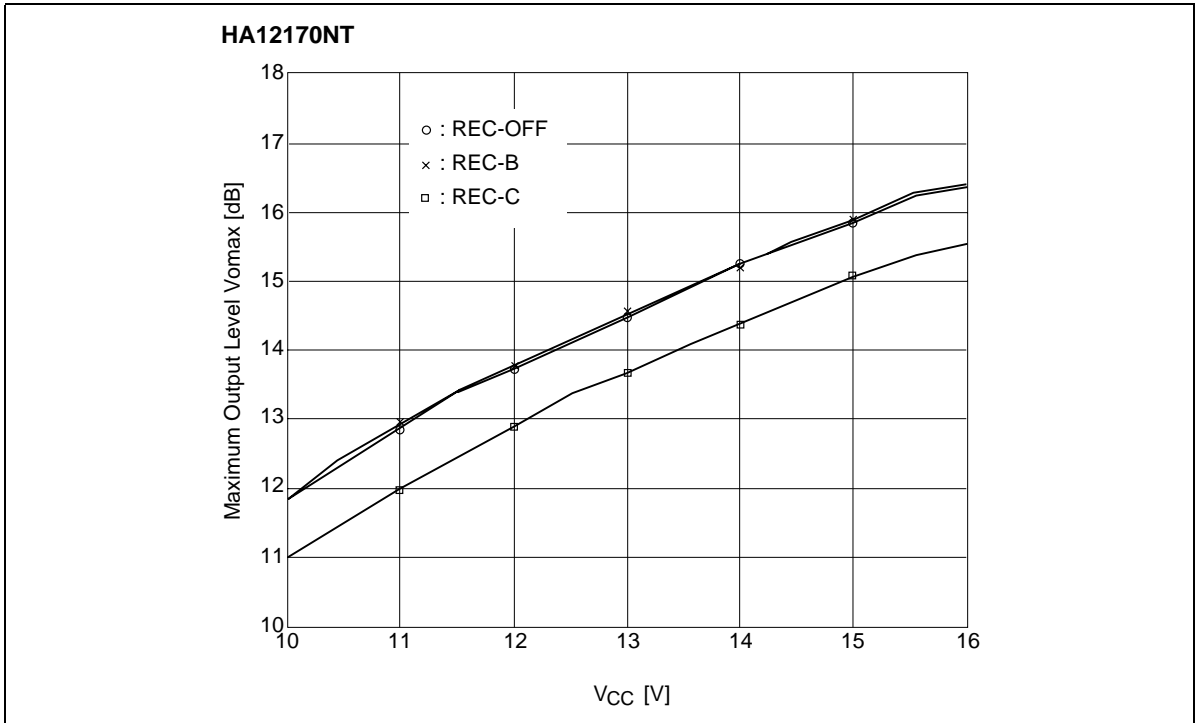


Total Harmonic Distortion vs. Output Level (PB MODE NR-B $V_{cc} = 14\text{ V}$)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



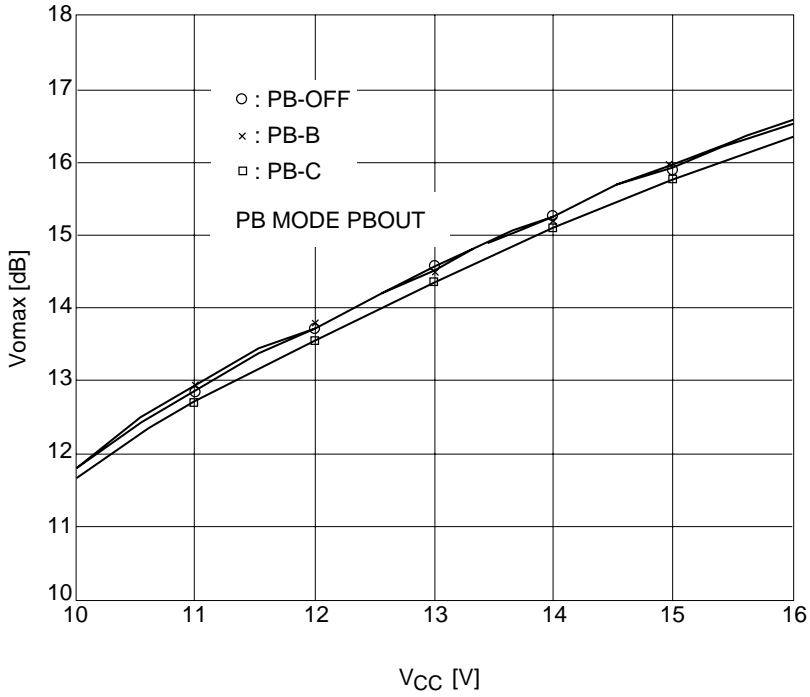
Total Harmonic Distortion vs. Output Level (PB MODE NR-C $V_{cc} = 14$ V)



Maximum Output Level vs. Supply Voltage (REC MODE)

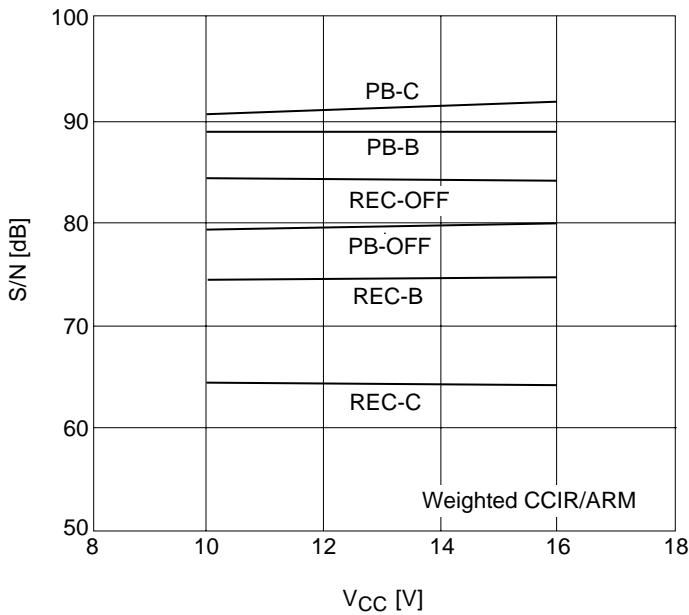
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12170NT



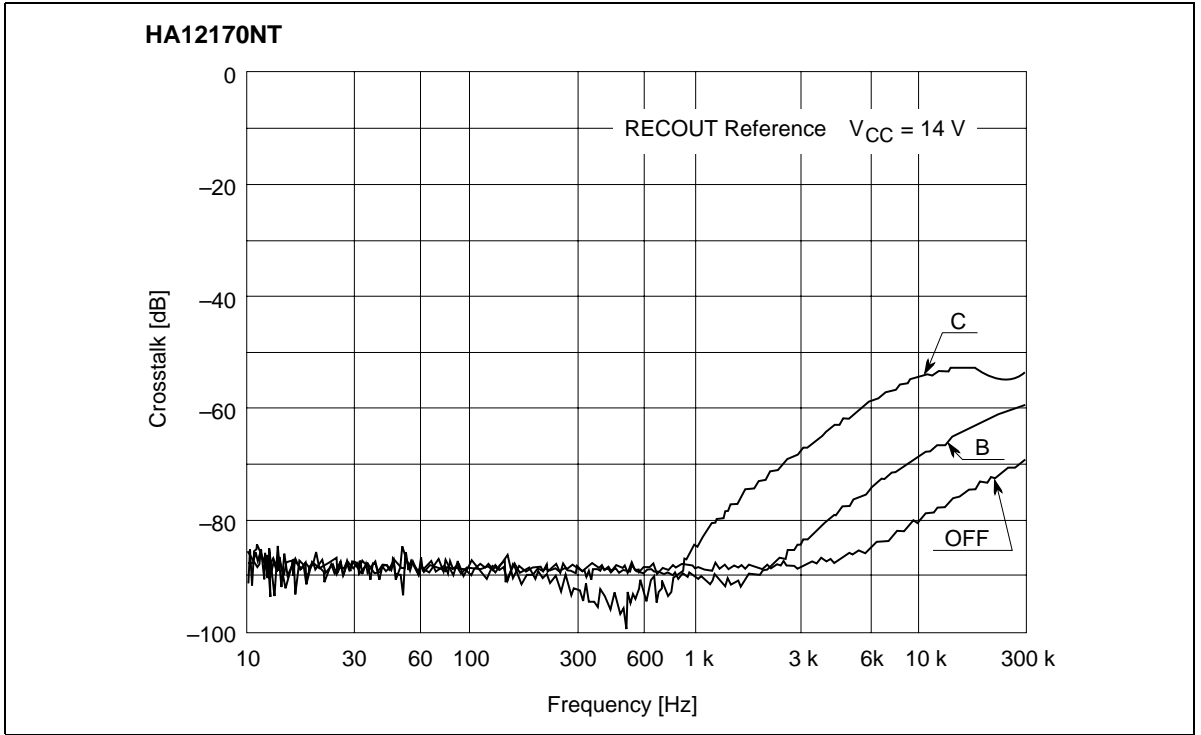
Maximum Output Level vs. Supply Voltage

HA12170NT

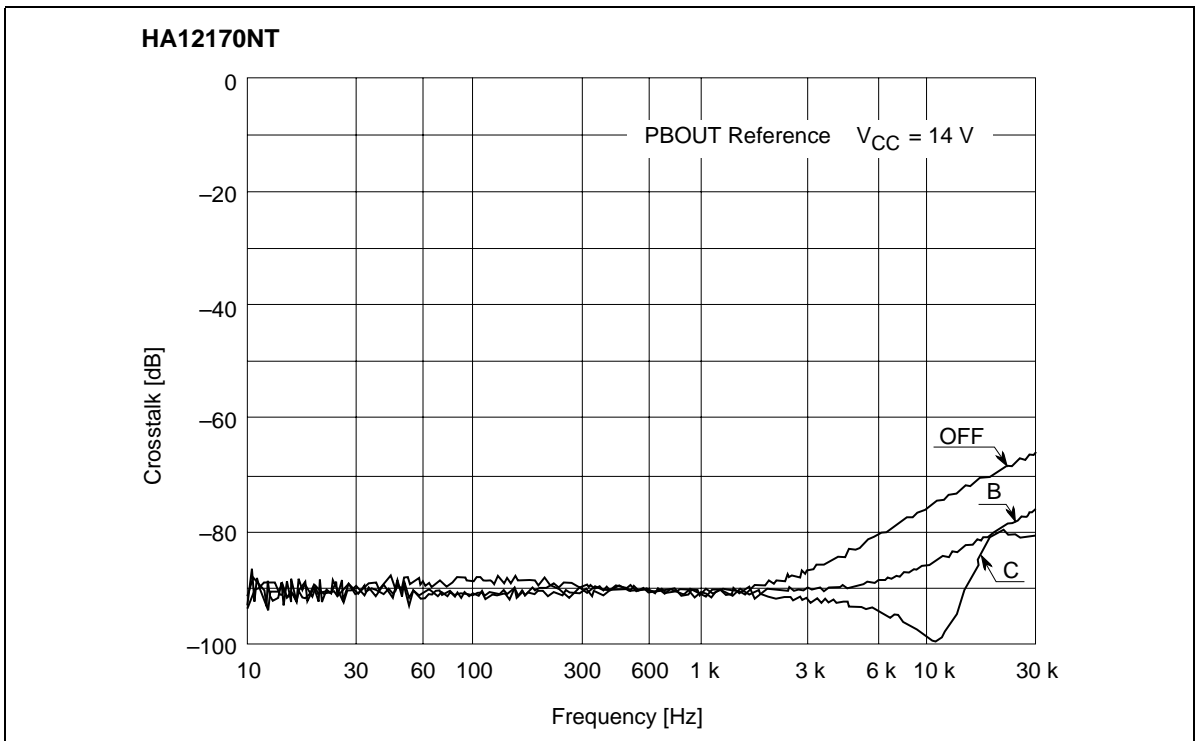


S/N vs. Supply Voltage

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



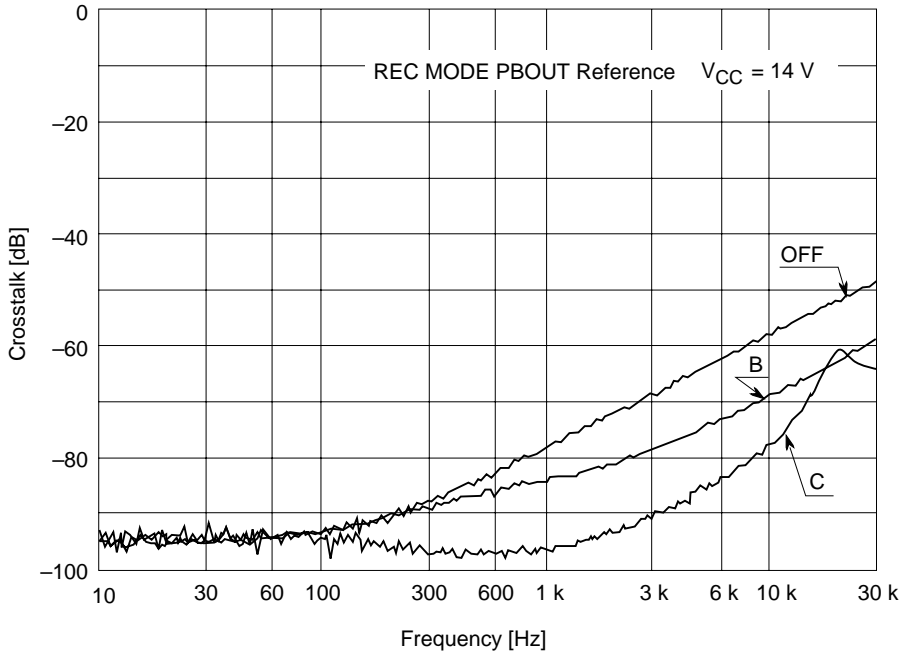
Crosstalk vs. Frequency (REC MODE R↔L)



Crosstalk vs. Frequency (PB MODE R↔L)

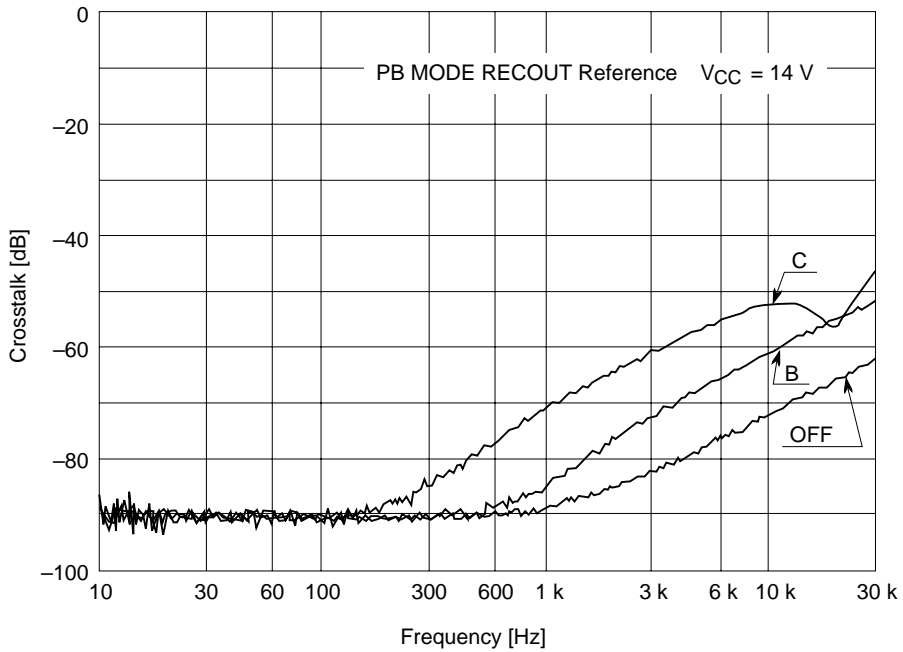
HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

HA12170NT



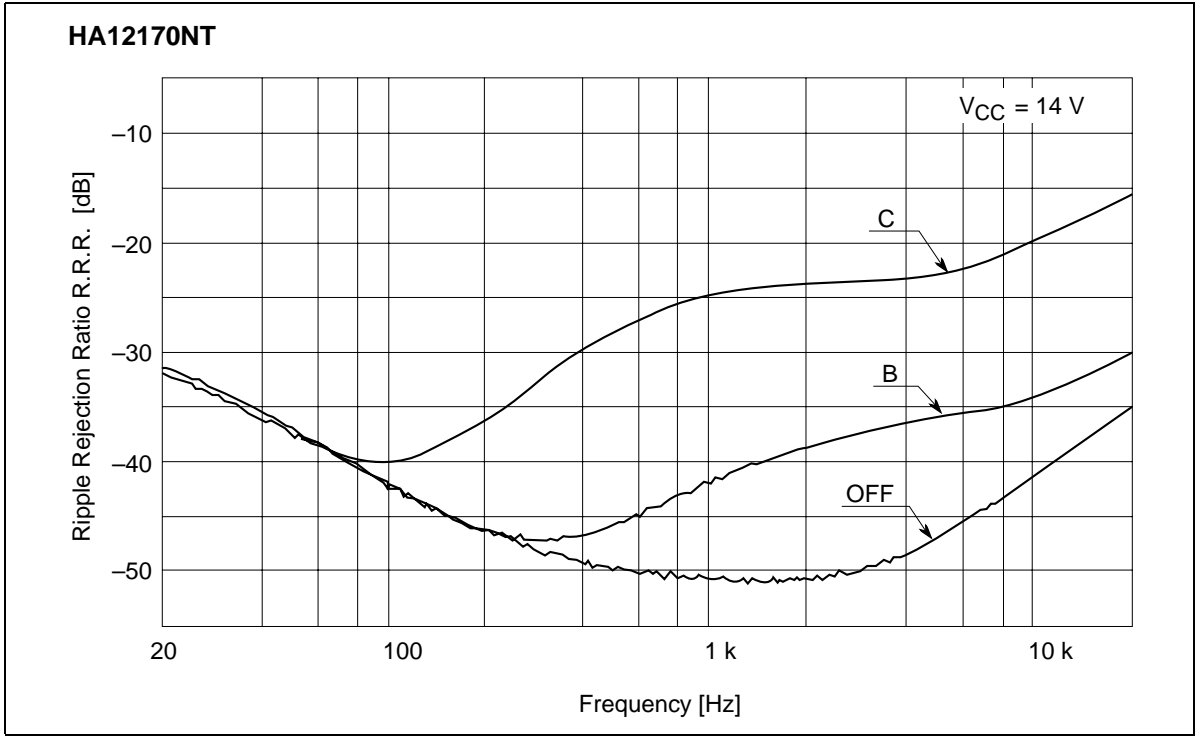
Crosstalk vs. Frequency (REC→PB)

HA12170NT

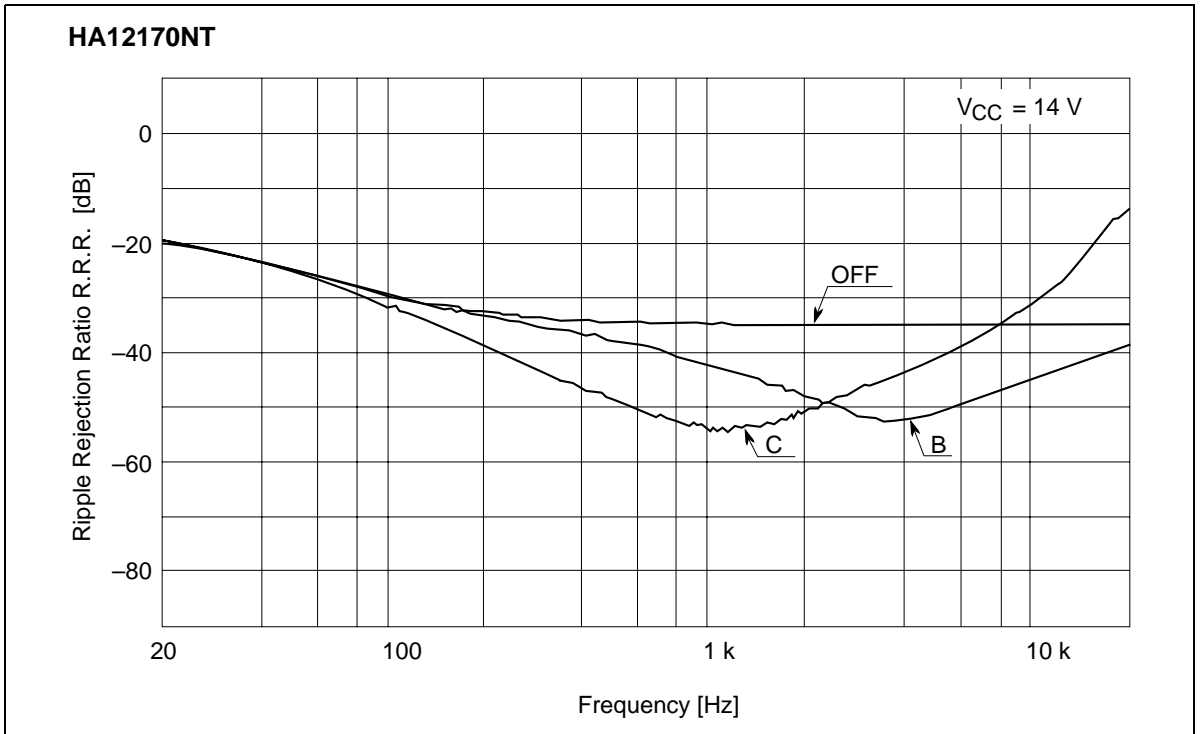


Crosstalk vs. Frequency (PB→REC)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP



Ripple Rejection Ratio vs. Frequency (REC MODE RECOUT)



Ripple Rejection Ratio vs. Frequency (PB MODE PBOUT)

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Functional Description

Power Supply Range

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

Table 1 Supply Voltage

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

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

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

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

Reference Voltage

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

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

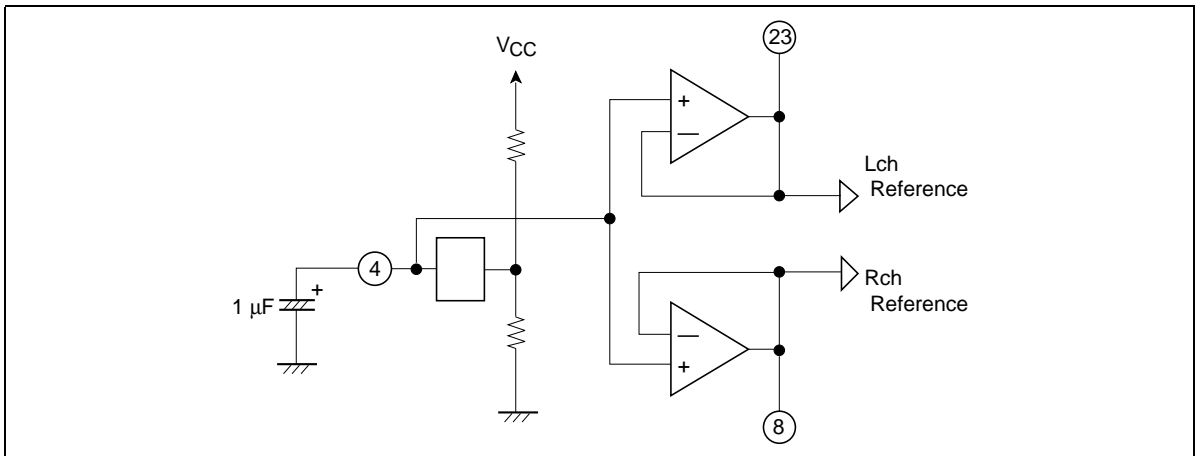


Figure 1 The Block-Diagram of Reference Voltage Supply

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

Operation Mode Control

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

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

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

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

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

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

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

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

2. MPX-OFF mode control Voltage of HA12170NT is available with range from $V_{cc} - 2$ to V_{cc} .

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

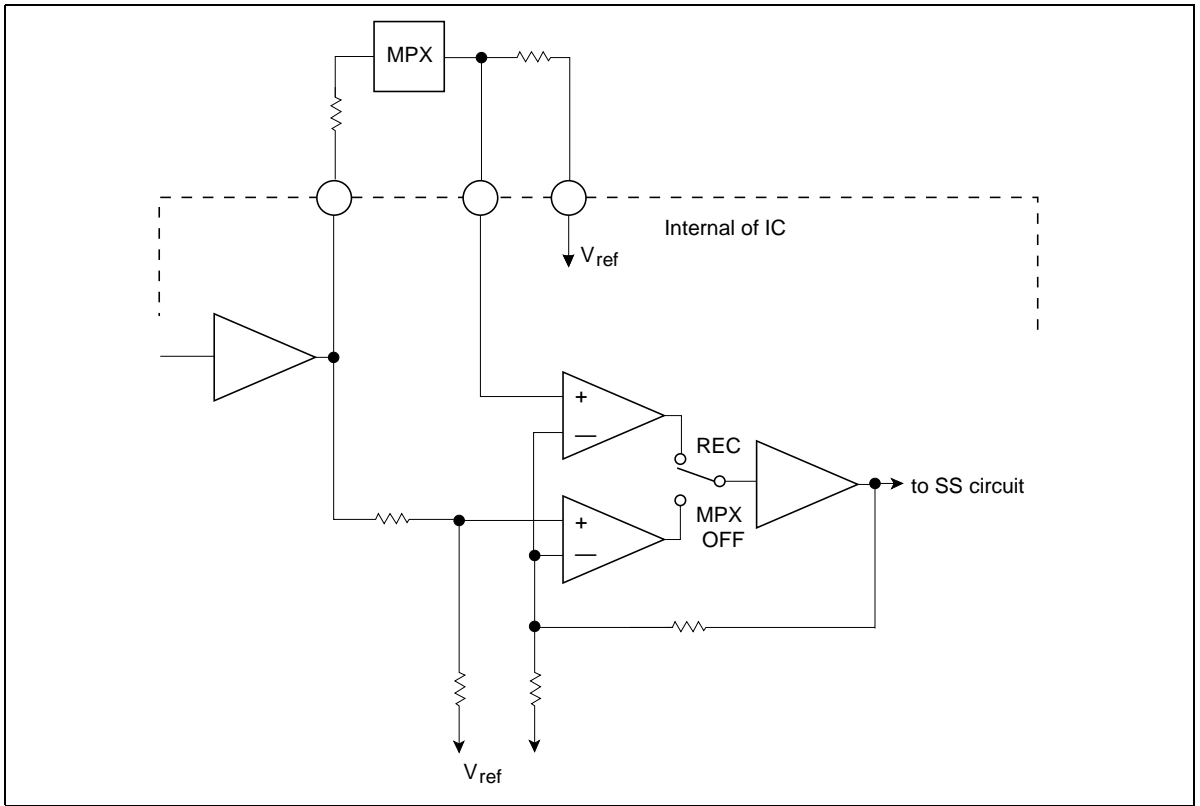


Figure 2 The Block-Diagram of MPX Driving Circuit

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

Application Circuits

1. HA12161FP/62FP application

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

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

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

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

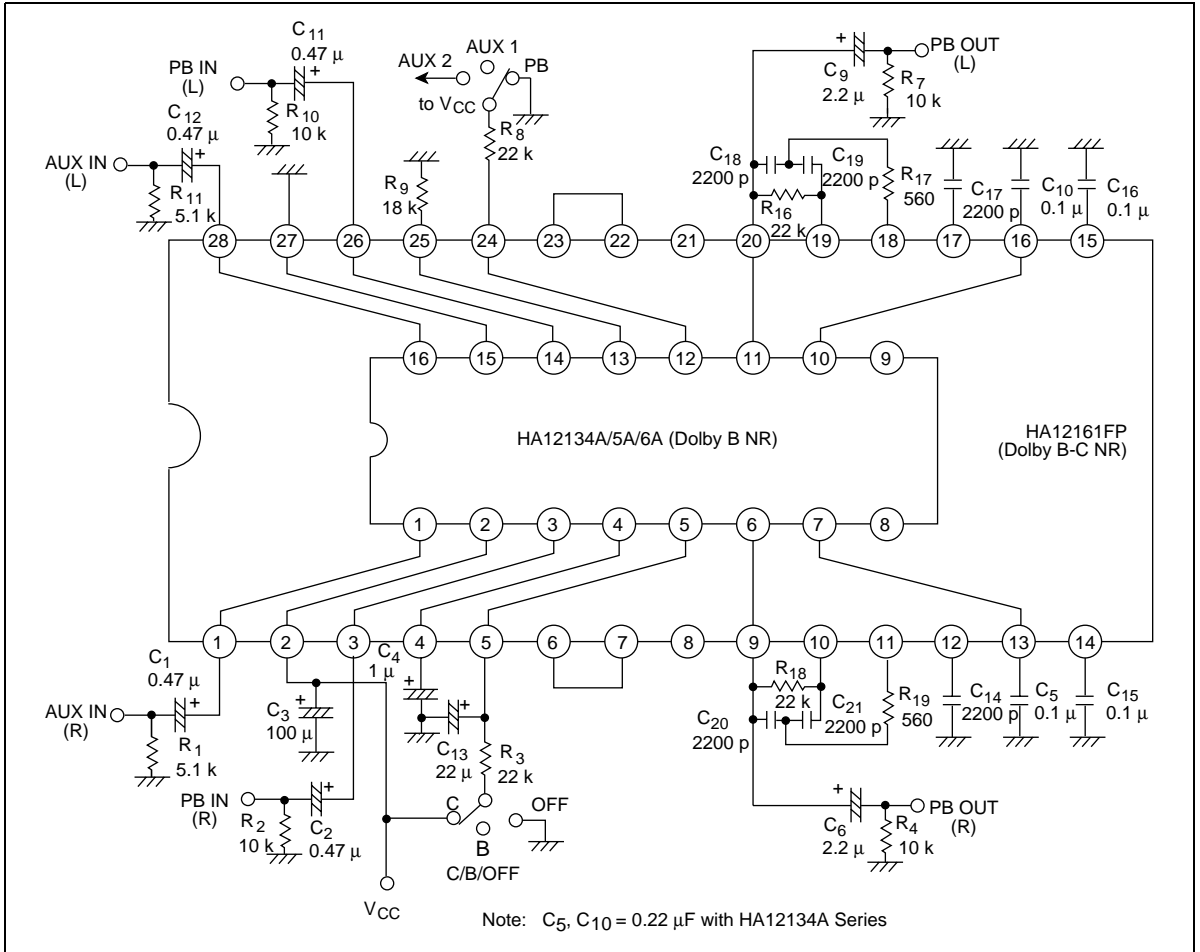


Figure 3 Application of HA12161FP/162FP

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

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

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

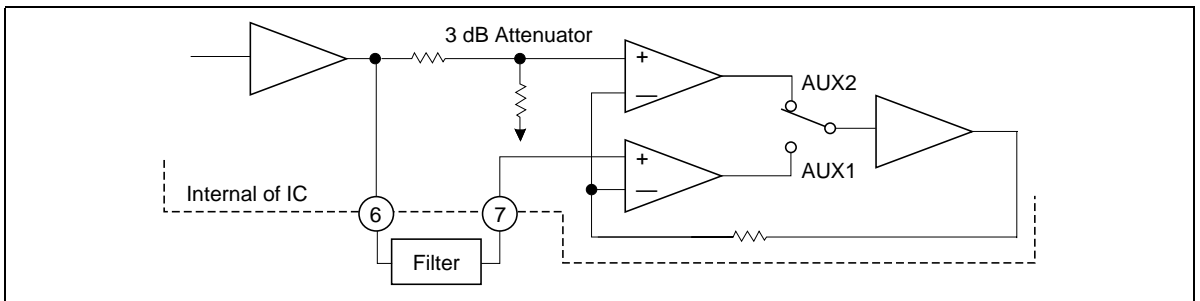


Figure 4 Application of AUX Mode

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

2. Application for dubbing cassette decks.

HA12141 series has unprocessor signal from recording out terminals during playback mode.

So, it is simply applied for dubbing cassette decks.

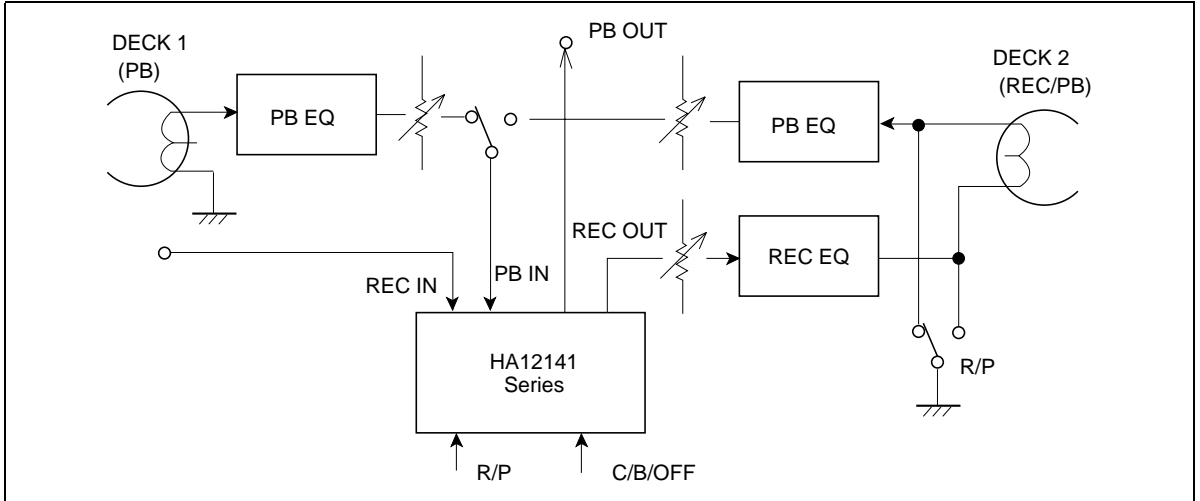
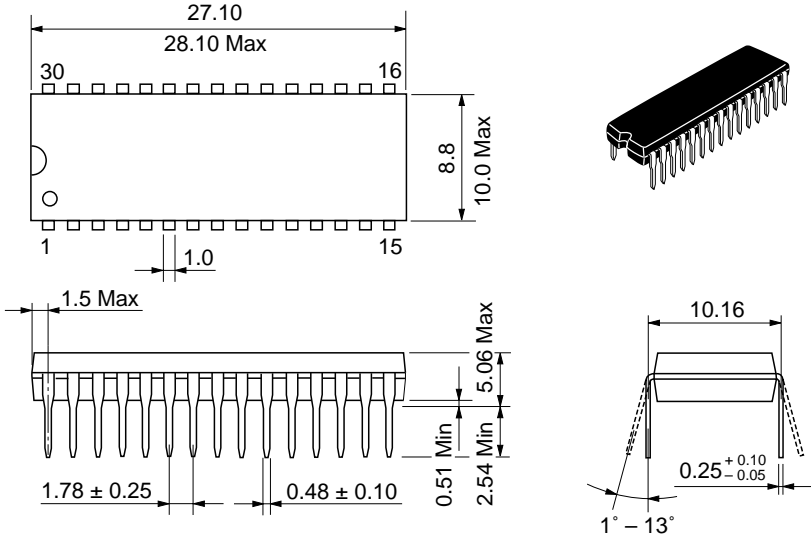


Figure 5 Application for Dubbing Deck

HA12141NT, HA12142NT, HA12170NT, HA12161FP, HA12162FP

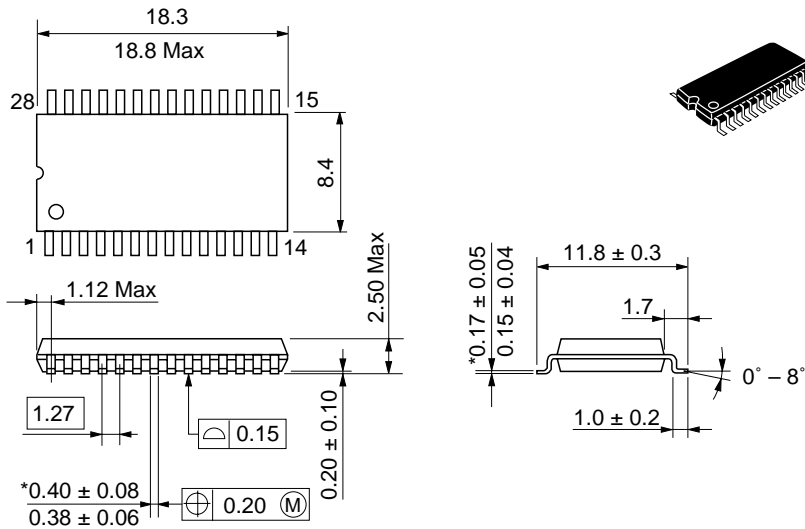
Package Dimensions

Unit: mm



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

Unit: mm



*Dimension including the plating thickness
Base material dimension

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

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