

HA12237F

Audio Signal Processor for Cassette Deck

REJ03F0137-0100
(Previous: ADE-207-343)
Rev.1.00
Jun 15, 2005

Description

HA12237F is silicon monolithic bipolar IC providing PB equalizer, REC equalizer system, ALC and each electronic control switch in one chip.

Functions

- PB equalizer × 2 channel
- REC equalizer × 2 channel
- ALC (Automatic Level Control)
- REC mute
- REC head return switch
- Line Amp. × 2 channel
- Line mute

Features

- REC equalizer is very small number of external parts built-in 2 types of frequency characteristics.
- TYPE I REC correspondence, High-speed dubbing correspondence.
- PB equalizer circuit built-in 2 types of frequency characteristics. (external parts of capacitor only)
- Head control switch built-in.
- Line mute switch built-in.
- Controllable from direct micro-computer output.

Parallel Data Format

| Pin No. | Pin Name | Lo | Hi |
|---------|-------------------|--------------|--------------|
| 11 | ALC ON/OFF | ALC OFF | ALC ON |
| 12 | High/Norm | Normal speed | High speed |
| 13 | A/B | B | A |
| | REC Return ON/OFF | Return OFF | Return ON |
| 14 | MUTE ON/OFF | MUTE OFF | MUTE ON |
| 15 | REC MUTE OFF/ON | REC MUTE ON | REC MUTE OFF |

Pin Description, Equivalent Circuit

($V_{CC} = 12\text{ V}$, $T_a = 25^\circ\text{C}$, No Signal, The value in the table shows typical value.)

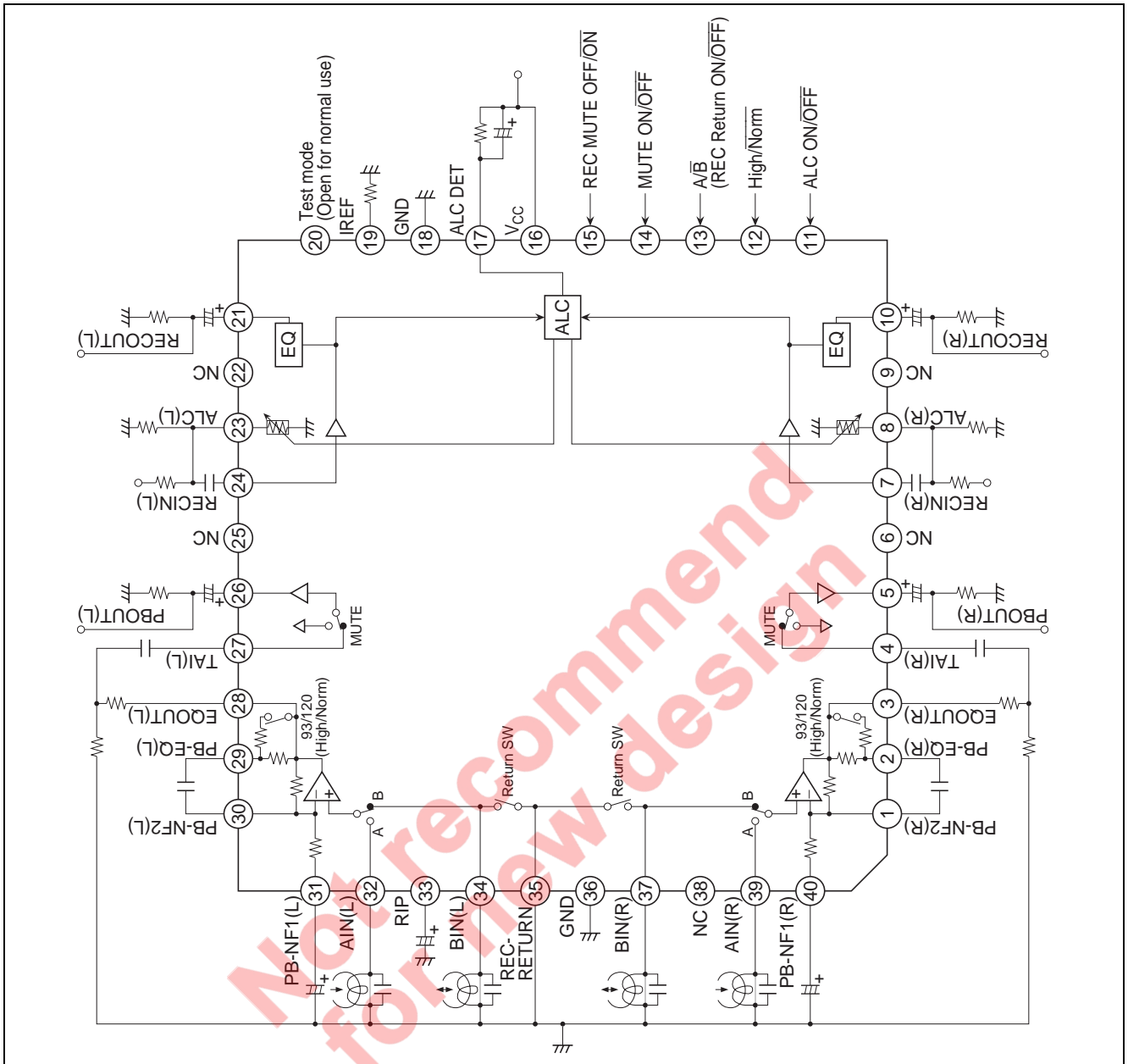
| Pin No. | Pin Name | Note | Equivalent Circuit | Description |
|---------|-----------------|-------------------------|--------------------|-----------------------------------|
| 16 | V_{CC} | $V = V_{CC}$ | | V_{CC} pin |
| 21 | RECOUT(L) | $V = V_{CC}/2$ | | REC output |
| 10 | RECOUT(R) | | | PB output |
| 26 | PBOUT(L) | | | |
| 5 | PBOUT(R) | | | |
| 28 | EQOUT(L) | | | $V = 2.9\text{ V}$ |
| 3 | EQOUT(R) | | | |
| 35 | REC-RETURN | $V = 0\text{ V}$ | | REC Return |
| 34 | BIN(L) | | | PB B deck input |
| 37 | BIN(R) | | | |
| 32 | AIN(L) | $V = 0\text{ V}$ | | PB A deck input |
| 39 | AIN(R) | | | |
| 24 | RECIN(L) | $V = V_{CC}/2$ | | REC-EQ input |
| 7 | RECIN(R) | | | |
| 27 | TAI(L) | | | |
| 4 | TAI(R) | | | |
| 11 | ALC ON/OFF | (Control voltage = 3 V) | | Mode control input |
| 12 | High/Norm | | | |
| 13 | A/B | | | |
| 14 | MUTE ON/OFF | | | |
| 15 | REC MUTE OFF/ON | | | |
| 19 | IREF | $V = 1.2\text{ V}$ | | Equalizer reference current input |

Pin Description, Equivalent Circuit (cont.)

($V_{CC} = 12\text{ V}$, $T_a = 25^\circ\text{C}$, No Signal, The value in the table shows typical value.)

| Pin No. | Pin Name | Note | Equivalent Circuit | Description |
|------------------|-----------|--------------------|--------------------|-----------------|
| 18, 36 | GND | | | GND pin |
| 6, 9, 22, 25, 38 | NC | | | NC pin |
| 20 | Test mode | | | Test mode pin |
| 31 | PB-NF1(L) | $V = 0.6\text{ V}$ | | PB EQ feed back |
| 40 | PB-NF1(R) | | | |
| 30 | PB-NF2(L) | | | |
| 1 | PB-NF2(R) | | | |
| 33 | RIP | $V = V_{CC}/2$ | | Ripple filter |
| 29 | PB-EQ(L) | | | NAB output |
| 2 | PB-EQ(R) | | | |

Block Diagram



Functional Description

Power Supply Range

This IC designed to operate on single supply, shown by table 1.

Table 1 Supply Voltage

| Item | Power Supply Range |
|---------------|--------------------|
| Single supply | 6.5 V to 15.0 V |

Reference Voltage

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

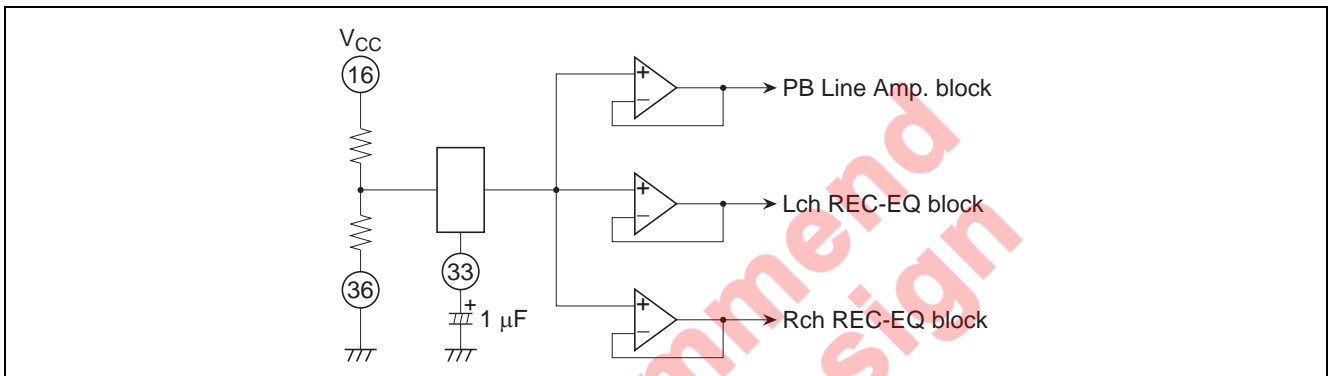


Figure 1 Block Diagram of Reference Supply Voltage

Operating Mode Control

HA12235F provide fully electronic switching circuits. And each operating mode control is controlled by parallel data (DC voltage).

Table 2 Threshold Voltage (V_{TH})

| Pin No. | Lo | Mid | Hi | Unit | Test Condition |
|----------|-------------|-----|-----------------|------|-----------------------|
| 11 to 15 | -0.2 to 0.5 | — | 2.4 to V_{CC} | V | Input Pin Measure |

Notes: 1. Each pins are on pulled down with 100 kΩ internal resistor. Therefore, it will be low-level when each pins are open.

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

Test Mode

Test mode becomes when pin 20 is shorted to GND. Please open pin 20 on the occasion of mount.

Block Diagram

As this IC is built-in REC return switch, the configuration system can be simple system using a few external component and the REC/PB head.

About these logics, please look at the Parallel Data Format.

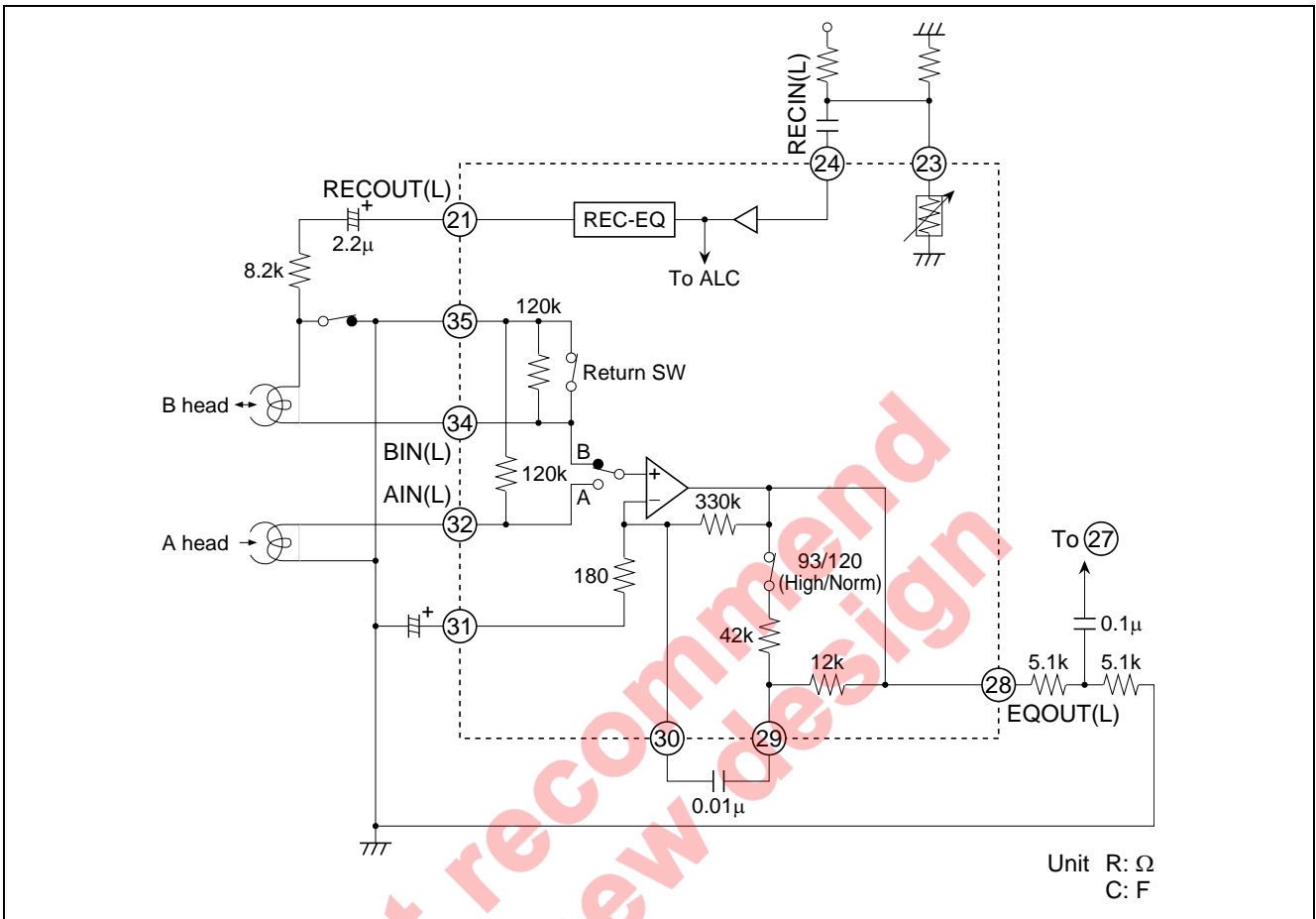


Figure 2 Block Diagram (Lch)

PB Equalizer

The gain establishment of PB-EQ considers PB output level {(internal Line Amp. + PB Amp.) = 580 mVrms} like figure 3 at the target.

After replace RA and RB with a half-fix volume, adjust level.

REC-EQ adjust the gain in front of input to this IC.

The level digram of 1 kHz is shown figure 3.

Please set “RA + RB ≥ 10 kΩ”

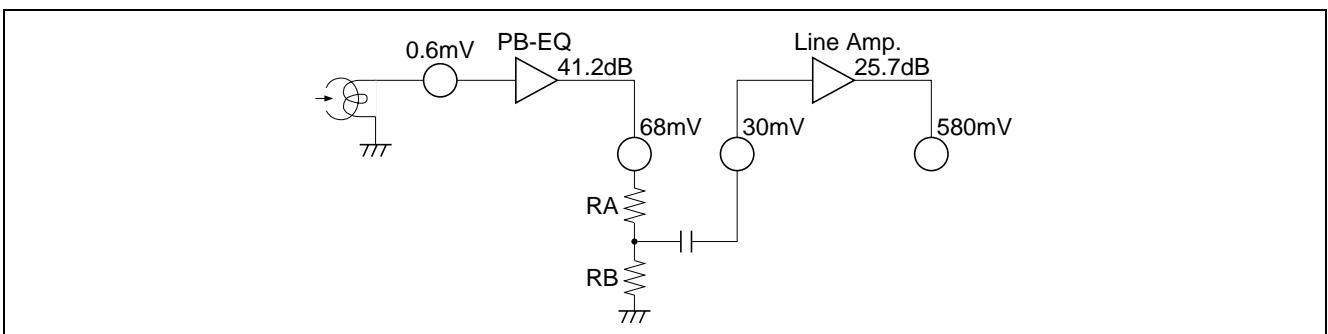


Figure 3 PB System Level Diagram (1 kHz)

Line Mute

This IC is built-in with mute circuit to Line Amp.

A mute control does with Low/High of pin 14.

Reducing pop noise is so much better 10 kΩ to 22 kΩ resistor to pin 14 in series and 1 μF to 22 μF capacitor.

A mute is not built-in when doing a power ON/OFF.

Please correspond to it, on the side of a set system.

REC Equalizer

REC-EQ gain adjust before the input of this IC.

R_L needs the value more than 5.6 kΩ based on the output at reference input.

Because mode establishment resistances are built-in, REC-EQ frequency characteristics are respectively fixed value.

In vase the change of the frequency characteristics are necessary, please inquire the responsible agent because the adjustment of resistors is necessary.

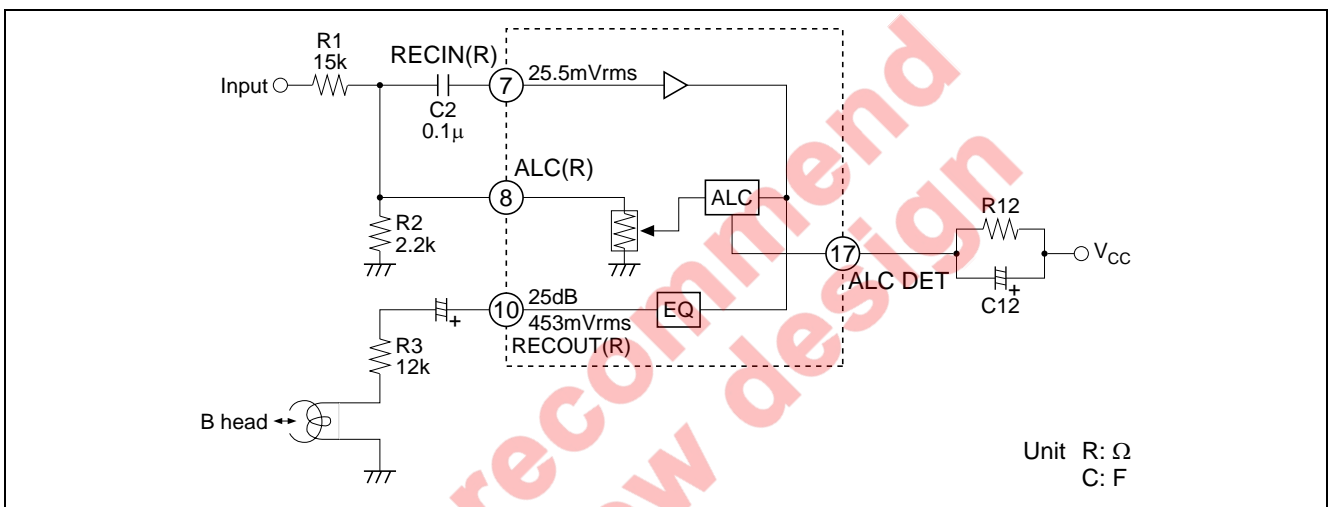


Figure 4 REC-EQ Block Diagram

ALC (Automatic Level Control)

ALC is the input decay rate variable system. It has internal variable resistors of pin 8 (pin 23) by REC signal that is inputted to pin 7 (pin 24).

Pin 17 is detector pin.

The signal input pin is pin 7 (pin 24). Resistor R1, R2 and capacitor C2, external components, for the input circuit are commended as figure 4. There are requested to use value of the block diagram figure for performance maintenance of S/N, T.H.D. etc.

Figure 5 shows the relation with R1 and C1 front input point and RECOU.T.

ALC operation level acts for the center of +4.5 dB to standard level (453 mVrms).

Then, adopted maximum value circuit, ALC is operated by a large channel of signal.

ALC ON/OFF can switch it by pin 11. Please do ALC ON, after it does for one time ALC OFF inevitably, for ALC time to start usefully, in order to reset ALC circuit.

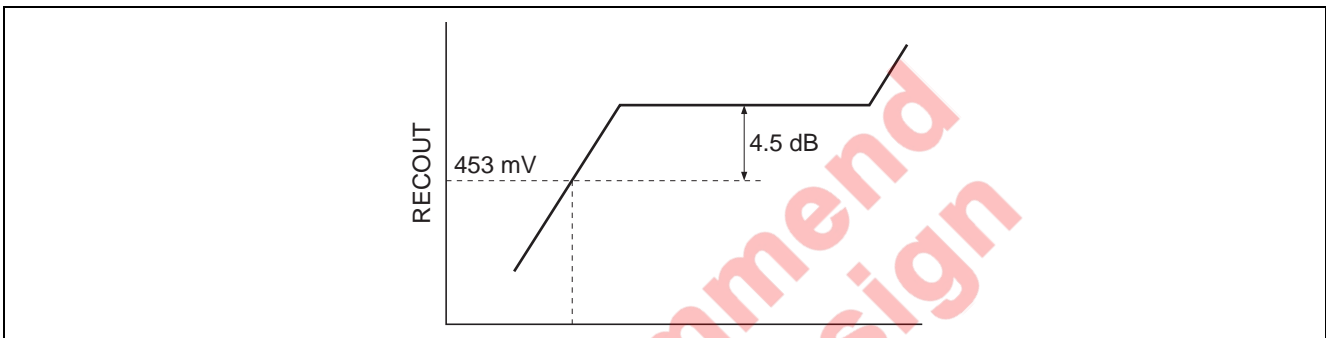


Figure 5 ALC Operation Level

Not recommended for new design

Absolute Maximum Ratings

(Ta = 25°C)

| Item | Symbol | Rating | Unit | Note |
|------------------------|---------------------|-------------|------|-----------|
| Maximum supply voltage | V _{CC} Max | 16 | V | |
| Power dissipation | P _T | 625 | mW | Ta ≤ 75°C |
| Operating temperature | T _{opr} | -40 to +75 | °C | |
| Storage temperature | T _{stg} | -55 to +125 | °C | |
| Operating voltage | V _{opr} | 6.5 to 15 | V | |

Note: HA12235F operates on single supply voltage.

Not recommend
for new design

Electrical Characteristics

(Ta = 25°C, Vcc = 12 V, PB-EQIN Standard level = 0.6 mVrms at 1 kHz, TAI Standard level = 30 mVrms, PBOUT Standard level = 580 mVrms)

| Item | Symbol | Test Condition | | | | | | Specification | | | | Application Terminal | | | |
|--------------------------------|--------------|----------------|-----------------|----------|-------------|------------------|------|---------------|------|-------|-------------|----------------------|--------|----------|--|
| | | IC Condition | | fin (Hz) | Vin (mVrms) | Other | Unit | Min | Typ | Max | Input | | Output | | |
| | | A/B | High/Low/ON/OFF | | | | | | | | R | L | R | L | |
| Quiescent current | Iq | A | Norm | OFF | — | No signal | — | 12.2 | 20.2 | mA | — | — | — | 16 | |
| Logical threshold | VIL | — | — | — | — | — | —0.2 | — | 0.5 | V | — | — | — | 11 to 15 | |
| | VIH | — | — | — | — | — | 2.4 | — | VCC | V | — | — | — | 11 to 15 | |
| PB-REC crosstalk | GT PB/REC(1) | A | Norm | OFF | 1k | *1 REC-EQ→PB-EQ | 50.0 | 60.0 | — | dB | 7 | 24 | 3 | 28 | |
| | GT PB/REC(2) | A | Norm | OFF | 1k | 6.0 PB-EQ→REC-EQ | 60.0 | 70.0 | — | dB | 39 | 32 | 10 | 21 | |
| PB-EQ gain | GV PB(1) | A/B | Norm | OFF | 1k | 0.6 | 37.4 | 40.4 | 43.4 | dB | 39/37/28/29 | 3 | 28 | — | |
| | GV PB(2) | A | Norm | OFF | 10k | 0.6 | 33.3 | 36.3 | 39.3 | dB | 39 | 32 | 3 | 28 | |
| | GV PB(3) | A | High | OFF | 20k | 0.6 | 31.2 | 34.2 | 37.2 | dB | 39 | 32 | 3 | 28 | |
| PB-EQ maximum output level | Vomax PB | A | Norm | OFF | 1k | — | 0.3 | 0.6 | — | Vrms | 39 | 32 | 3 | 28 | |
| PB-EQ T.H.D. | THD PB | A/B | Norm | OFF | 1k | 2.4 | — | 0.2 | 0.5 | % | 39/37/28/29 | 3 | 28 | — | |
| PB-EQ noise voltage | VN PB | A/B | Norm | OFF | — | — | — | 110 | 200 | µVrms | 39/37/28/29 | 3 | 28 | — | |
| PB-EQ channel separation | CT R/L(1) | A | Norm | OFF | 1k | 6.0 | 50.0 | 60.0 | — | dB | 39 | 32 | 3 | 28 | |
| | CT A/B | A/B | Norm | OFF | 1k | 6.0 | 60.0 | 70.0 | — | dB | 39/37/28/29 | 3 | 28 | — | |
| Line Amp. gain | Gv LA | A | Norm | OFF | 1k | 30.0 | 24.2 | 25.7 | 27.2 | dB | 4 | 27 | 5 | 26 | |
| Line Amp. T.H.D. | THD LA | A | Norm | OFF | 1k | 30.0 | — | 0.05 | 0.30 | % | 4 | 27 | 5 | 26 | |
| Line Amp. maximum output level | Vomax LA | A | Norm | OFF | 1k | — | 1.16 | 1.40 | — | Vrms | 4 | 27 | 5 | 26 | |
| Line mute attenuation | L-MUTE ATT | A | Norm | OFF | 1k | 120.0 | 70.0 | 80.0 | — | dB | 4 | 27 | 5 | 26 | |

Notes: 1. Large level without clipping
2. Vcc = 6.5V

Electrical Characteristics (cont.)

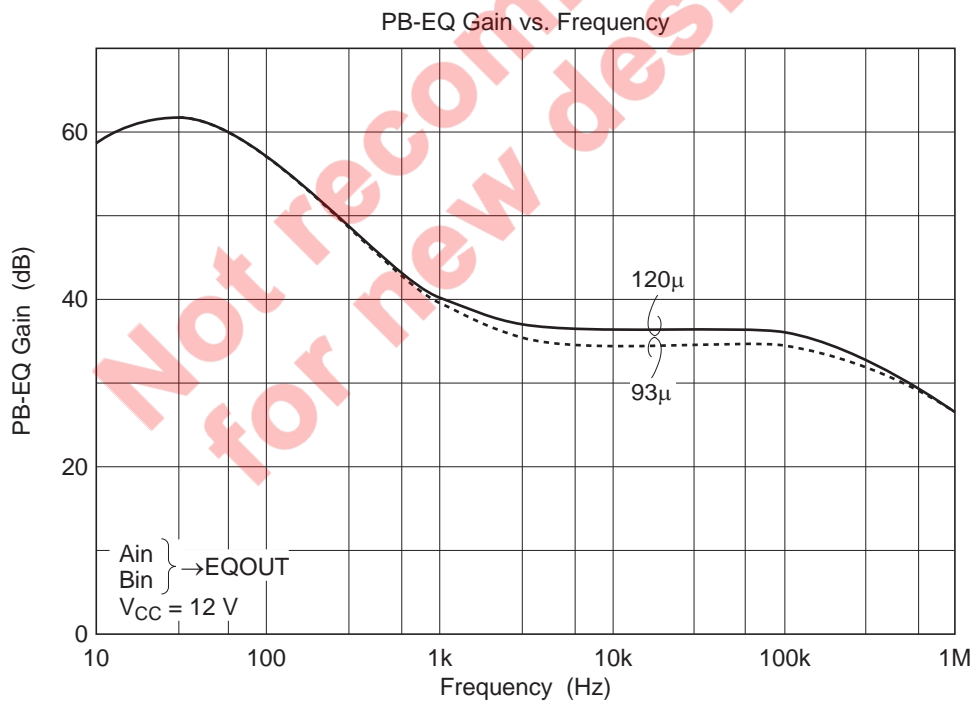
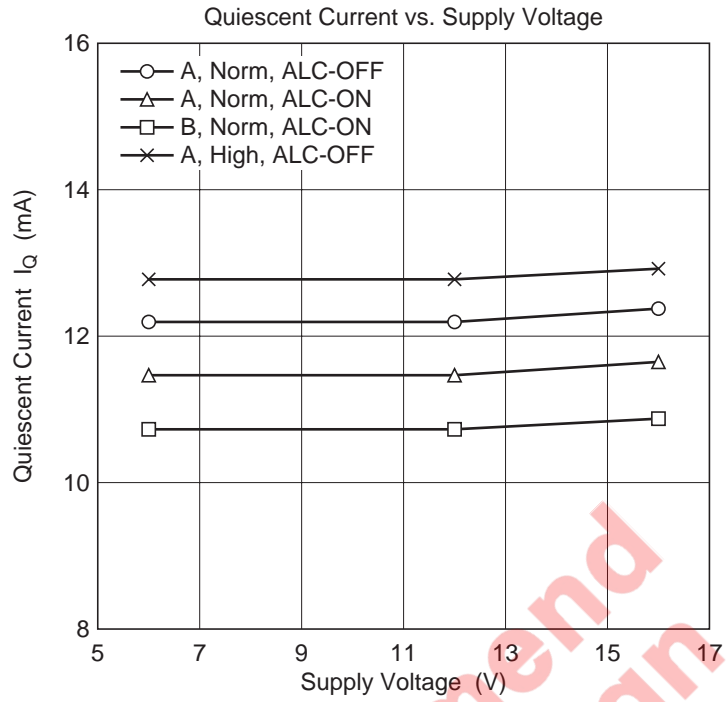
(Ta = 25°C, V_{CC} = 12 V, RECI Standard level = 200 mVrms (IC in Level = 25.5 mVrms) = 0 dB

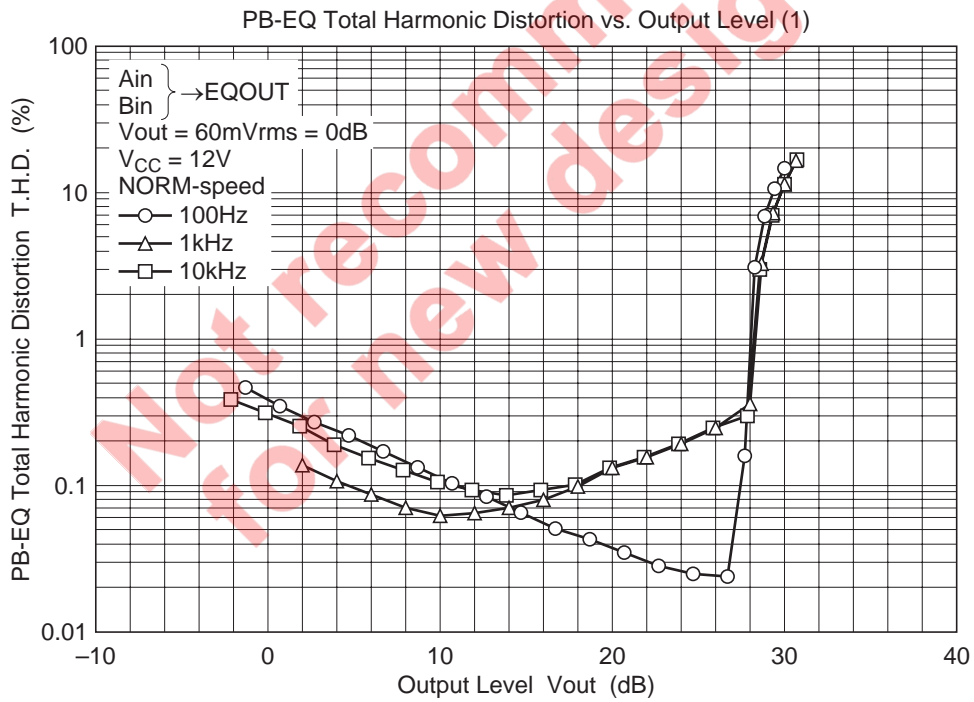
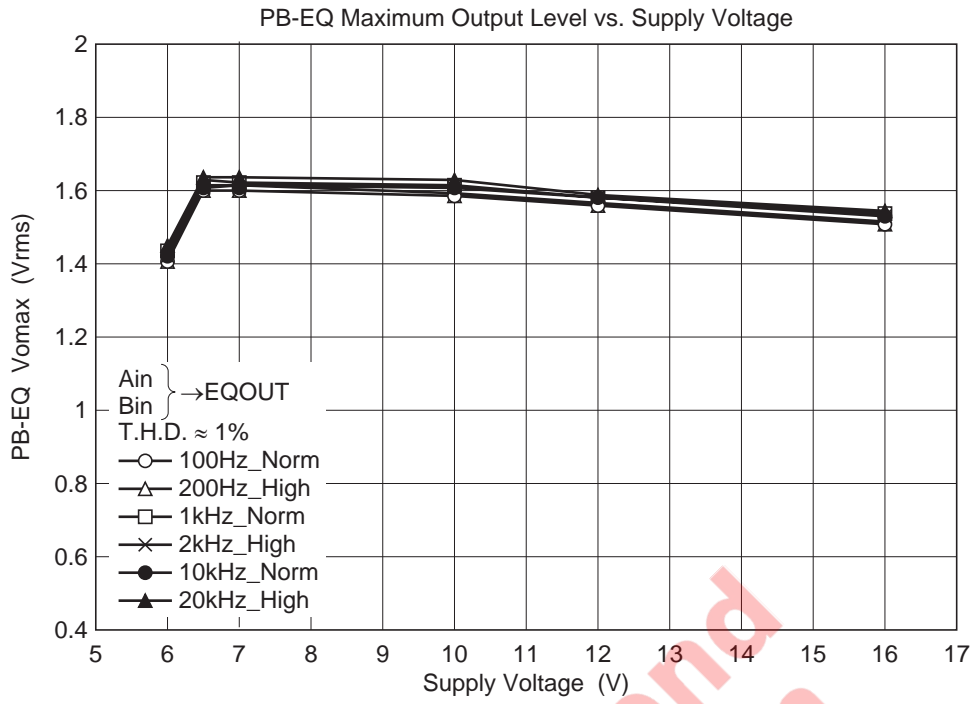
| Item | Symbol | Test Condition | | | | | | Specification | | | Application Terminal | | | |
|----------------------------------|------------|----------------|---------------|-------------------------|----------------------------|-------|-------------------|---------------|------|------|----------------------|----|--------|----|
| | | IC Condition | | f _{in} (Hz) | V _{in} (mVrms) | Other | Min | Typ | Max | Unit | Input | | Output | |
| | | A/B | High/ Norm | | | | | | | | ALC ON/OFF | R | L | R |
| | | A | Norm | ON | 1k | +12 | 2.0 | 4.5 | 7.0 | dB | 7 | 24 | 10 | 21 |
| ALC operate level | ALC | A | Norm | ON | 1k | +12 | | | dB | 7 | 24 | 10 | 21 | |
| REC-EQ frequency characteristics | GV REC-NN1 | A | Norm | OFF | 1k | -26 | | | dB | 7 | 24 | 10 | 21 | |
| Normal speed | GV REC-NN2 | A | Norm | OFF | 5k | -26 | | | dB | 7 | 24 | 10 | 21 | |
| | GV REC-NN3 | A | Norm | OFF | 10k | -26 | | | dB | 7 | 24 | 10 | 21 | |
| REC-EQ frequency characteristics | GV REC-HN1 | A | High | OFF | 2k | -26 | | | dB | 7 | 24 | 10 | 21 | |
| High speed | GV REC-HN2 | A | High | OFF | 10k | -26 | | | dB | 7 | 24 | 10 | 21 | |
| | GV REC-HN3 | A | High | OFF | 20k | -26 | | | dB | 7 | 24 | 10 | 21 | |
| REC-EQ channel separation | CT R/L(2) | A | Norm | OFF | 1k | *1 | | | dB | 7 | 24 | 10 | 21 | |
| REC-MUTE attenuation | R-MUTE ATT | A | Norm | OFF | 1k | *1 | | | dB | 7 | 24 | 10 | 21 | |
| REC-EQ maximum output level | Vomax REC | A | Norm | OFF | 1k | — | THD = 1% | | Vrms | 7 | 24 | 10 | 21 | |
| REC-EQ T.H.D. | THD REC | A | Norm | OFF | 1k | 0 | | | % | 7 | 24 | 10 | 21 | |
| REC-EQ S/N | S/N REC | A | Norm | OFF | 1k | — | Rg = 2.2kΩ, A-WTG | | dB | — | — | 10 | 21 | |

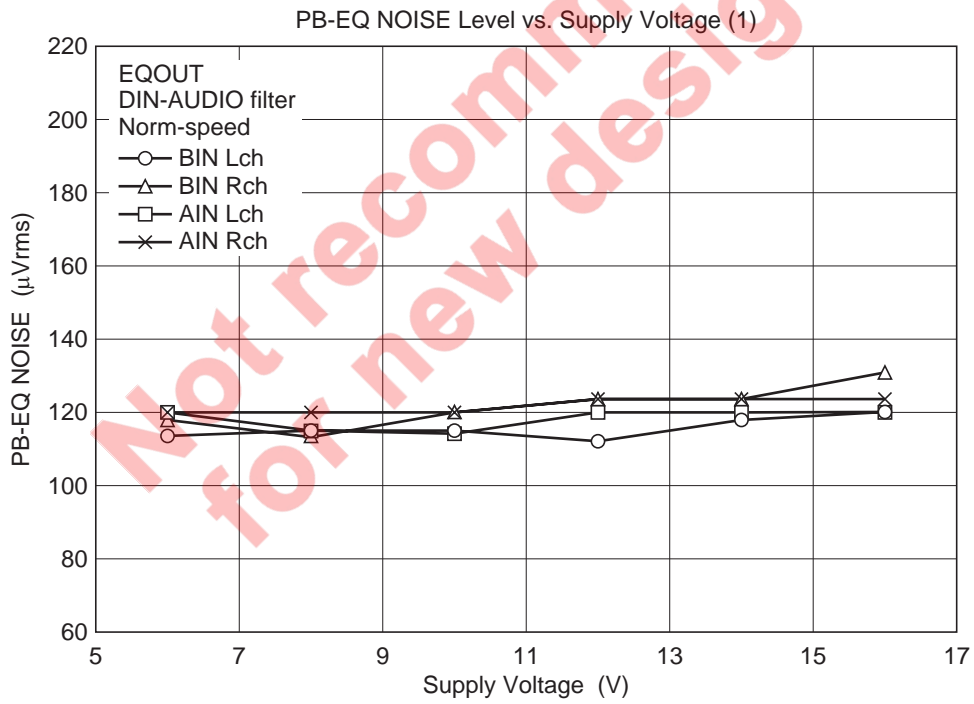
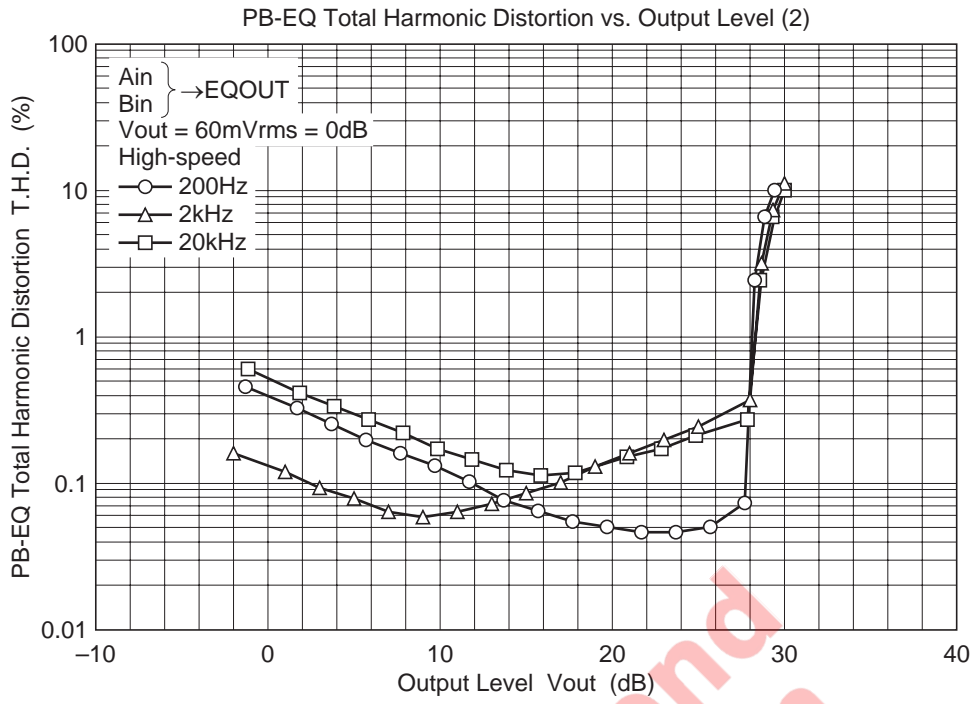
Notes: 1. Large level without clipping

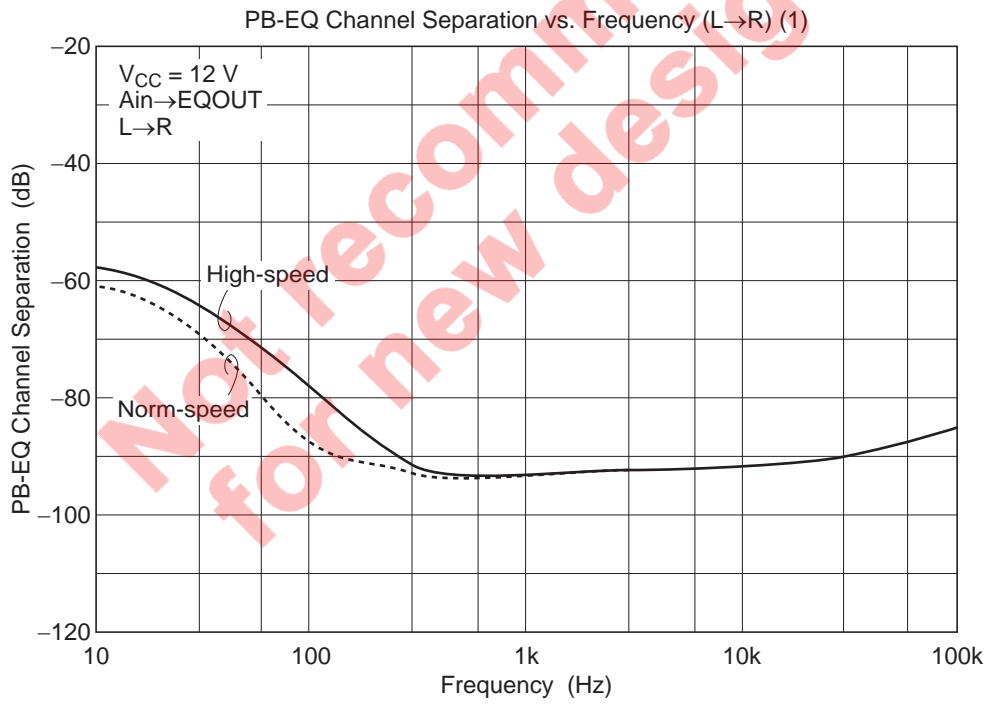
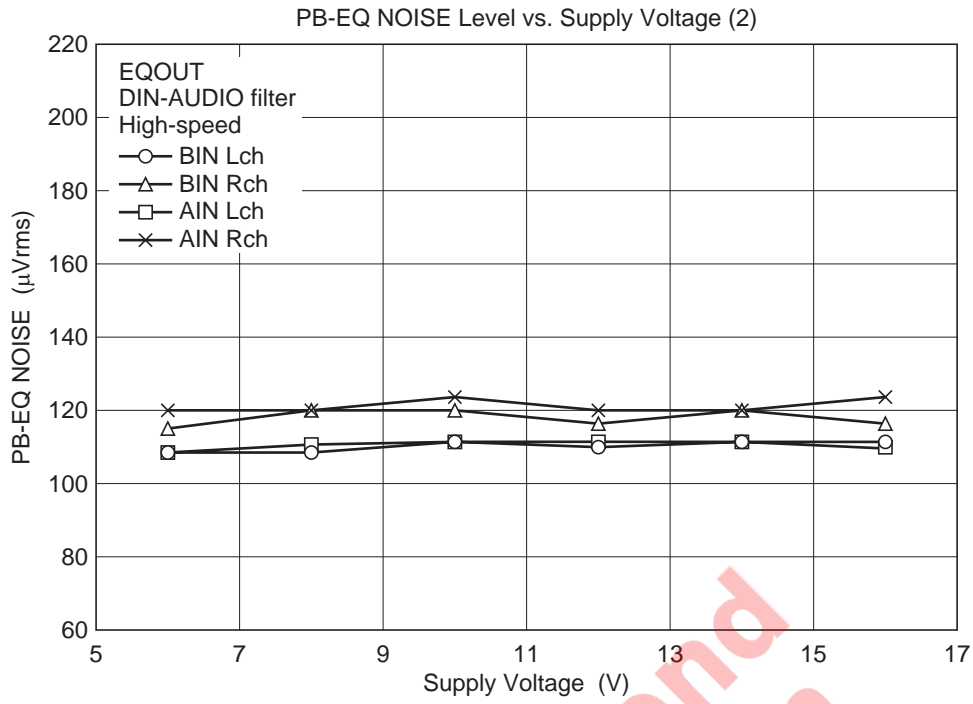
2. V_{CC} = 6.5V

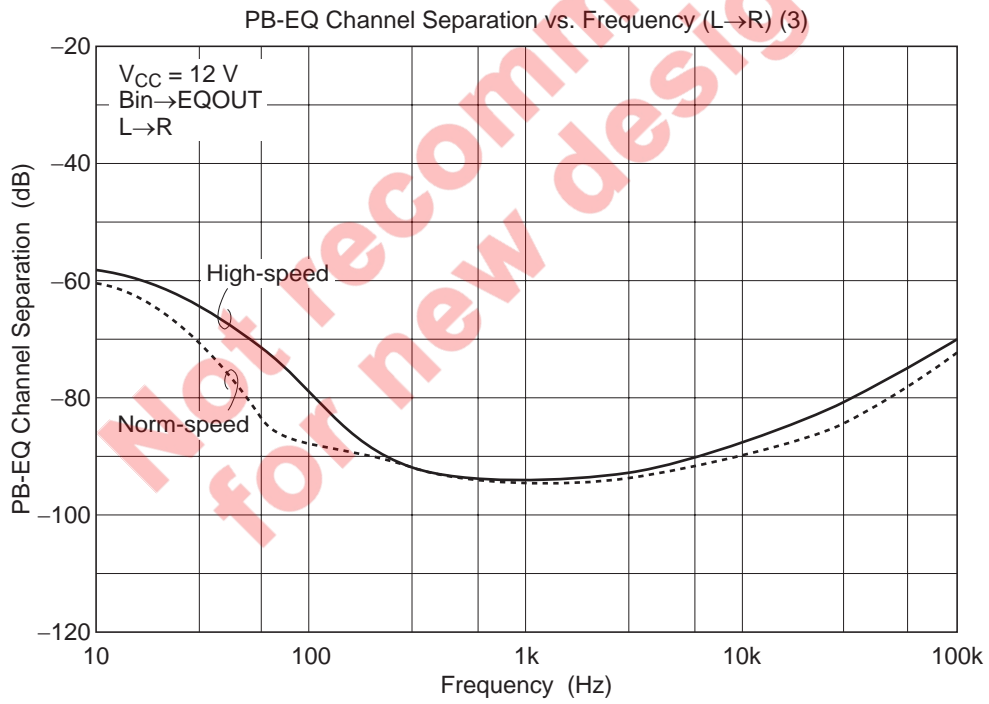
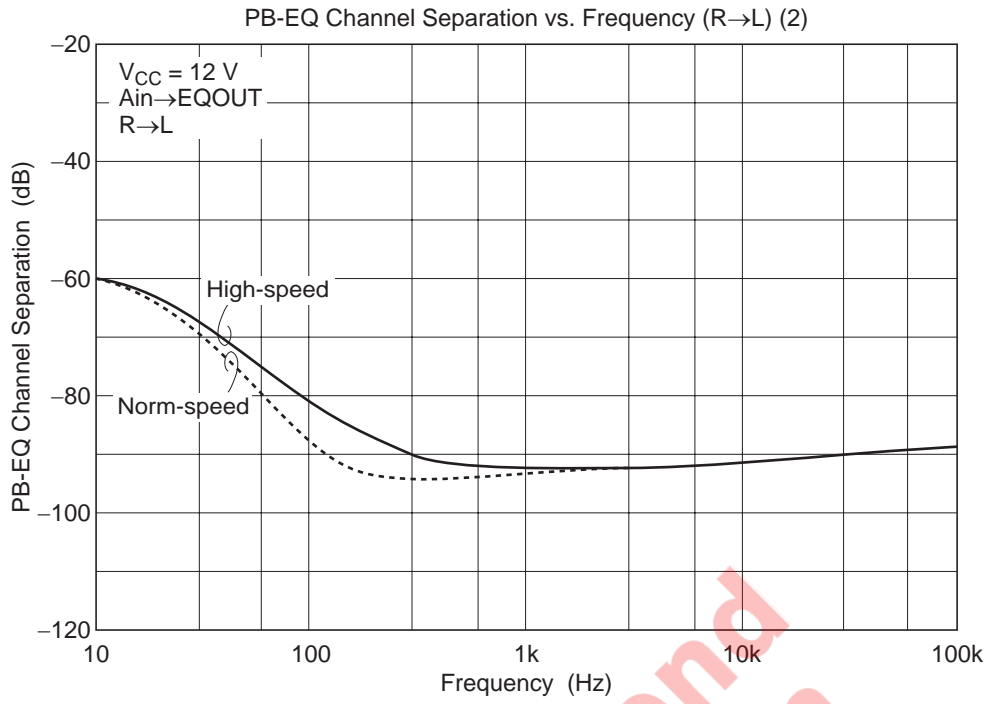
Characteristic Curves

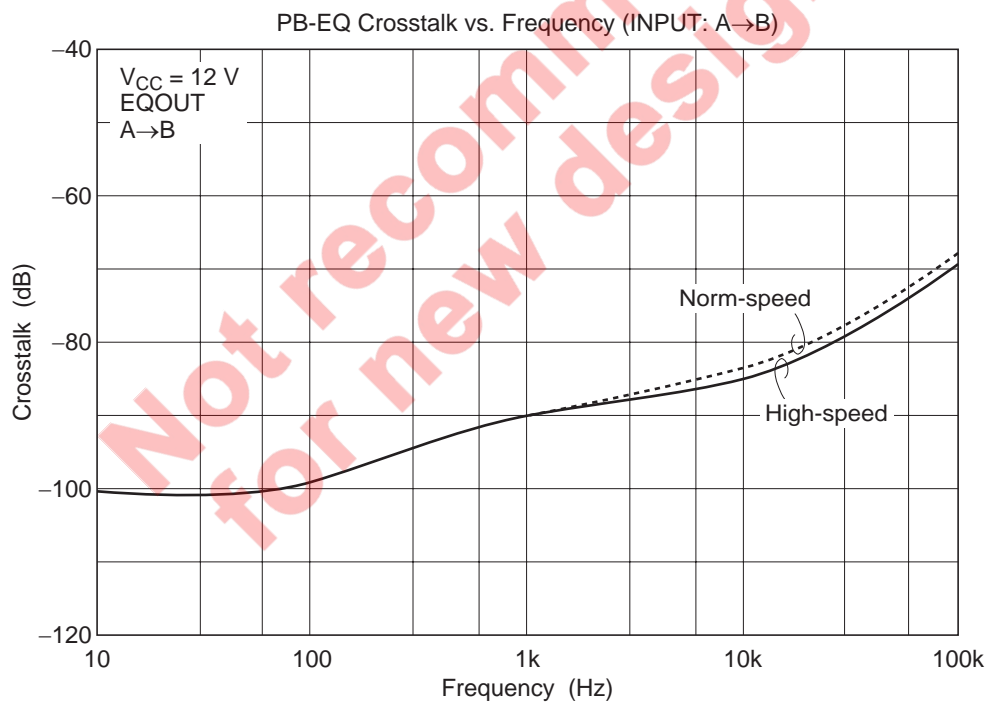
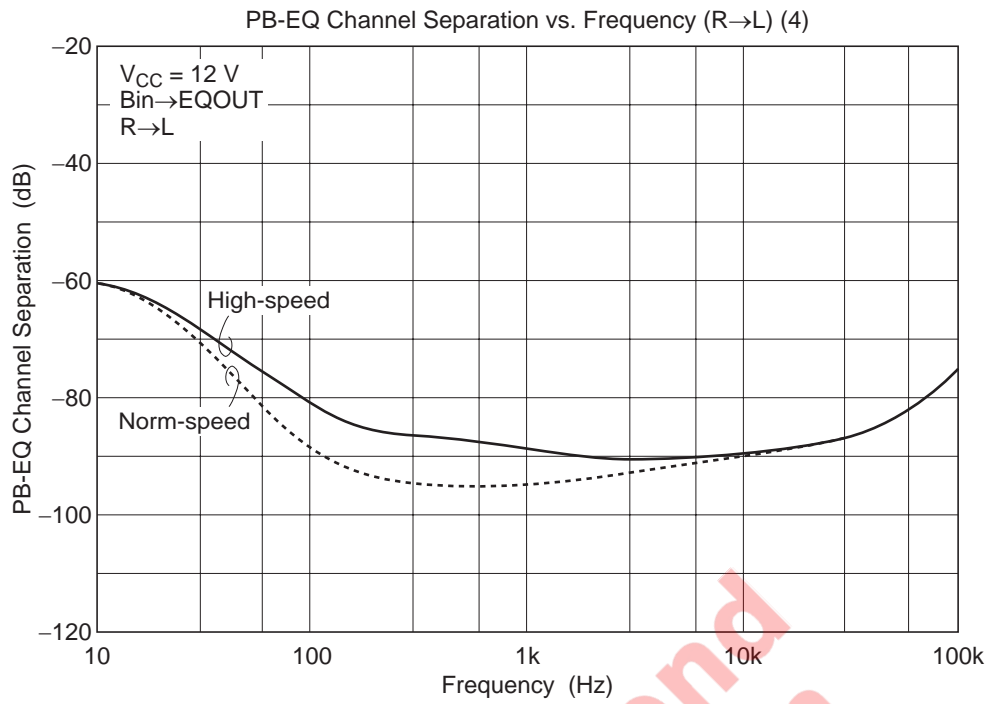


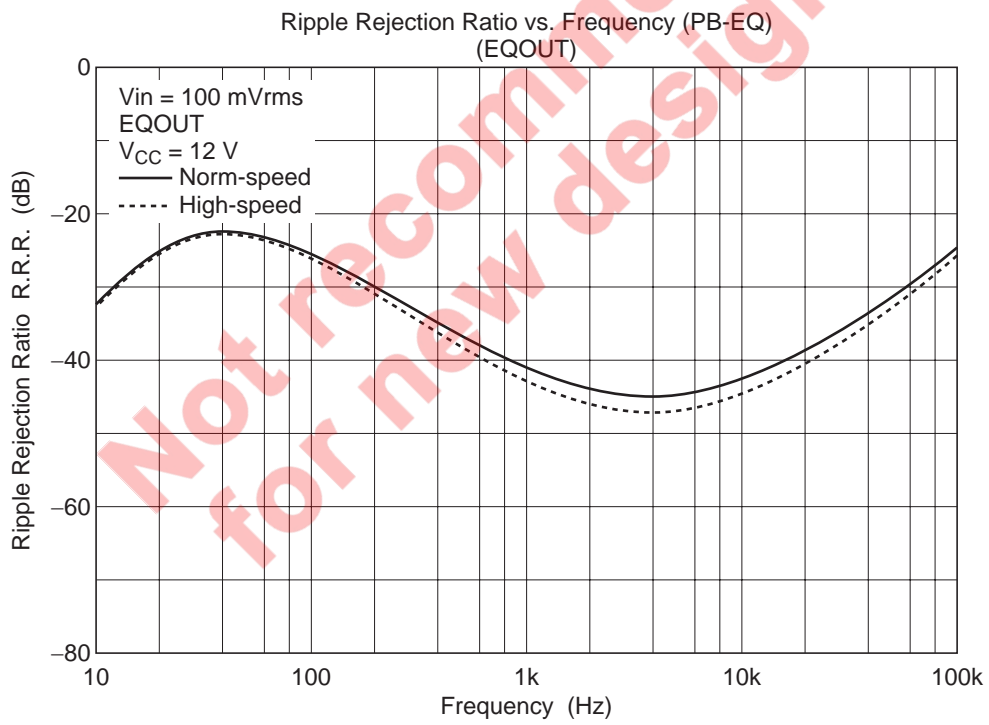
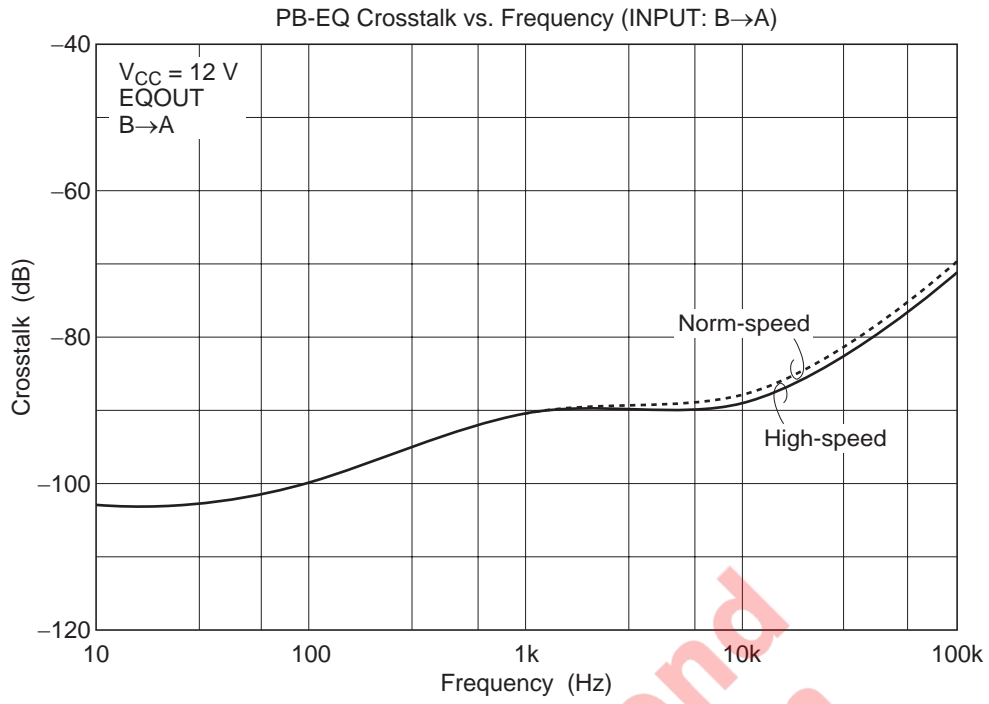


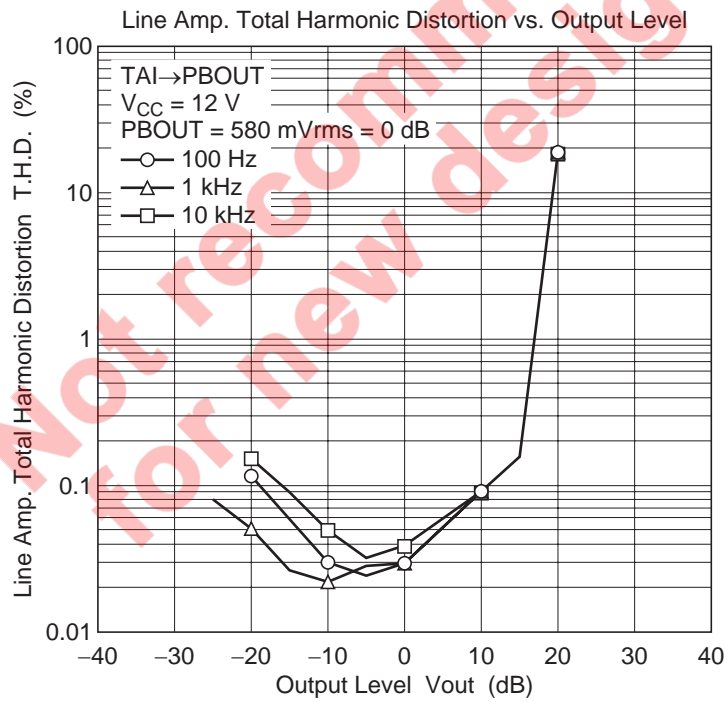
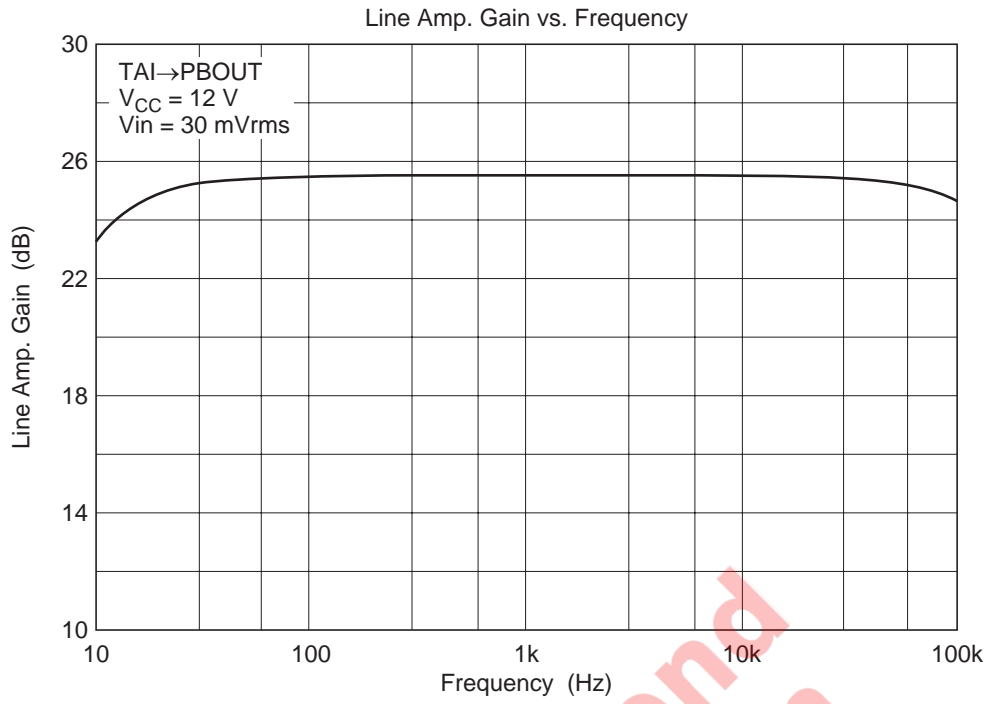


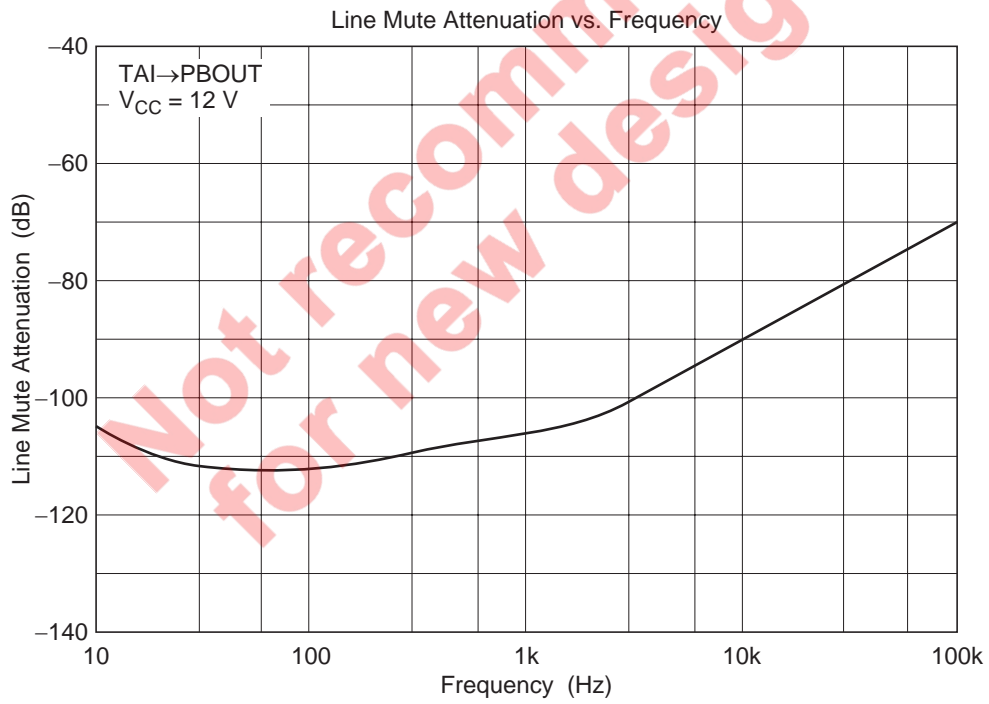
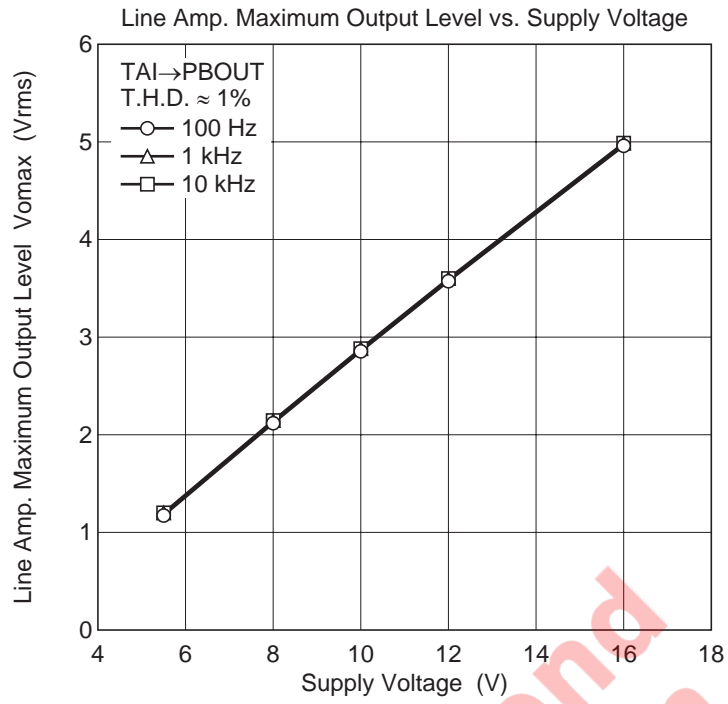


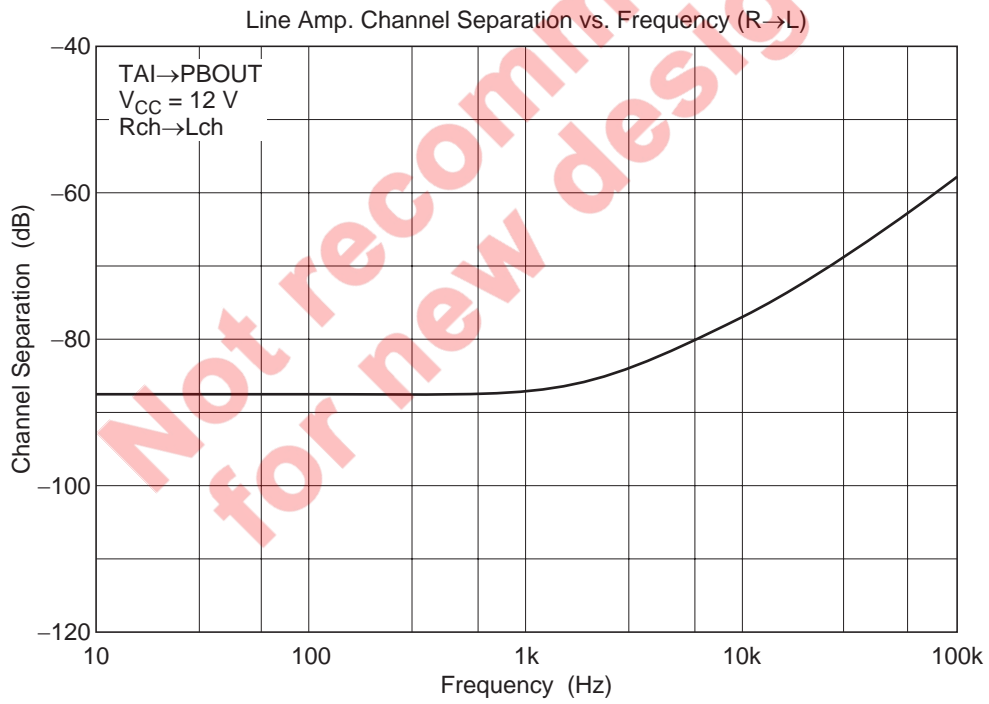
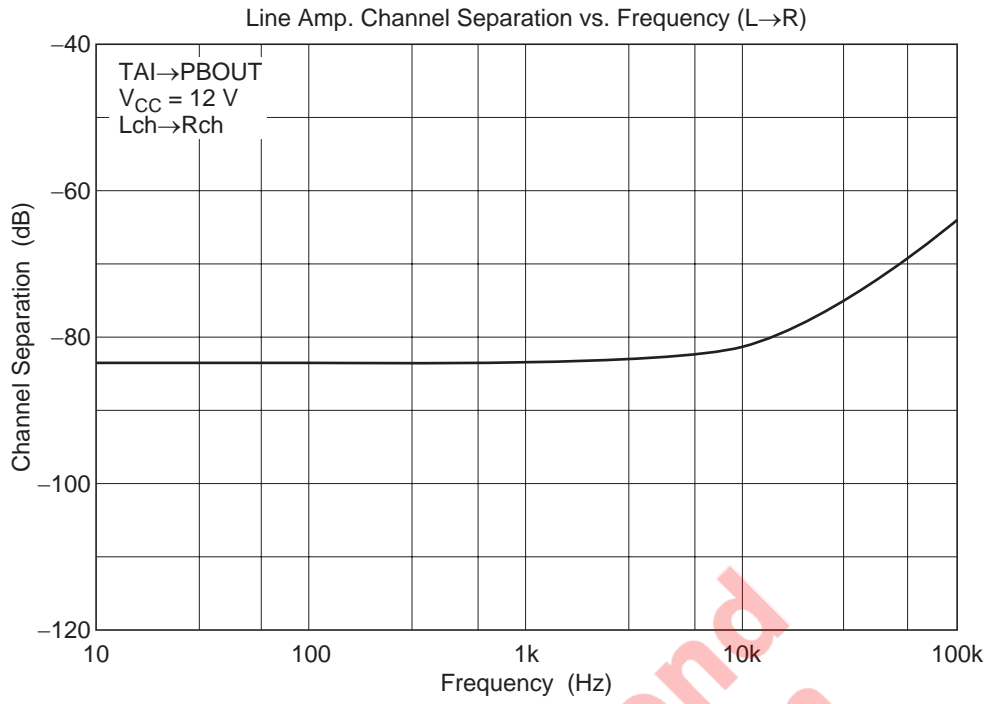


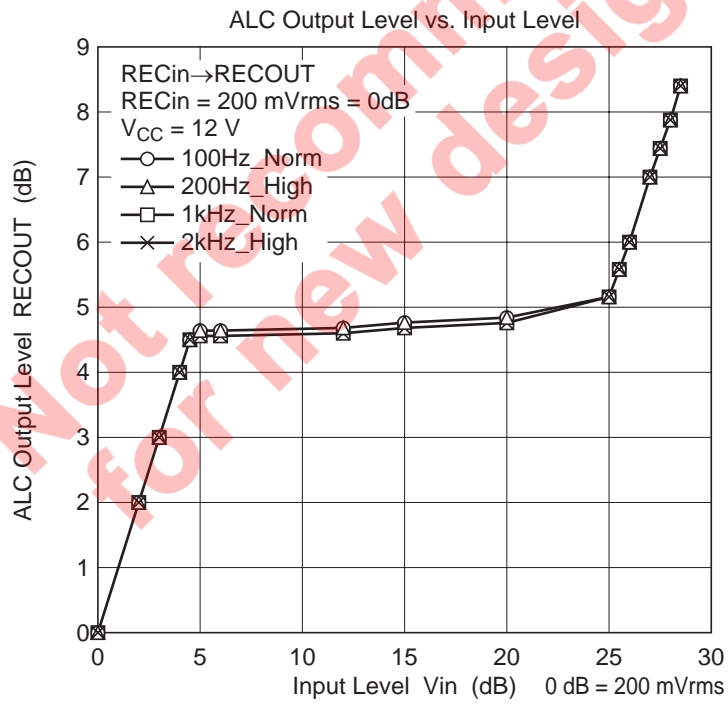
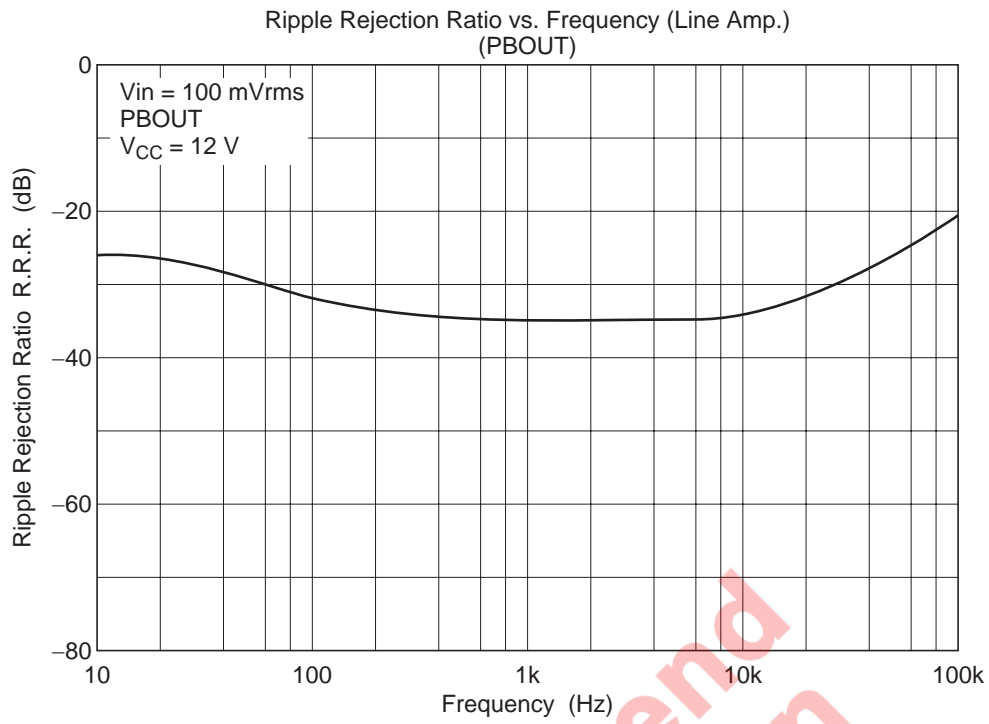


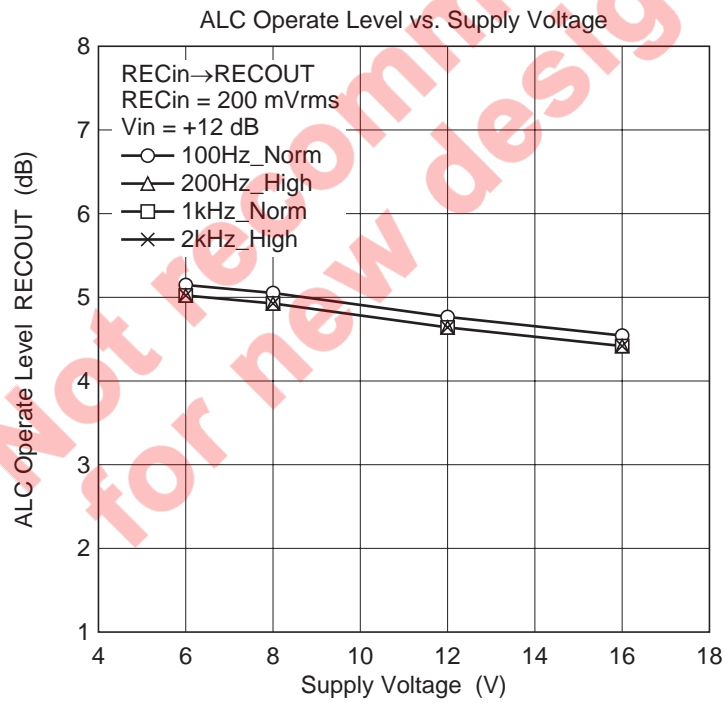
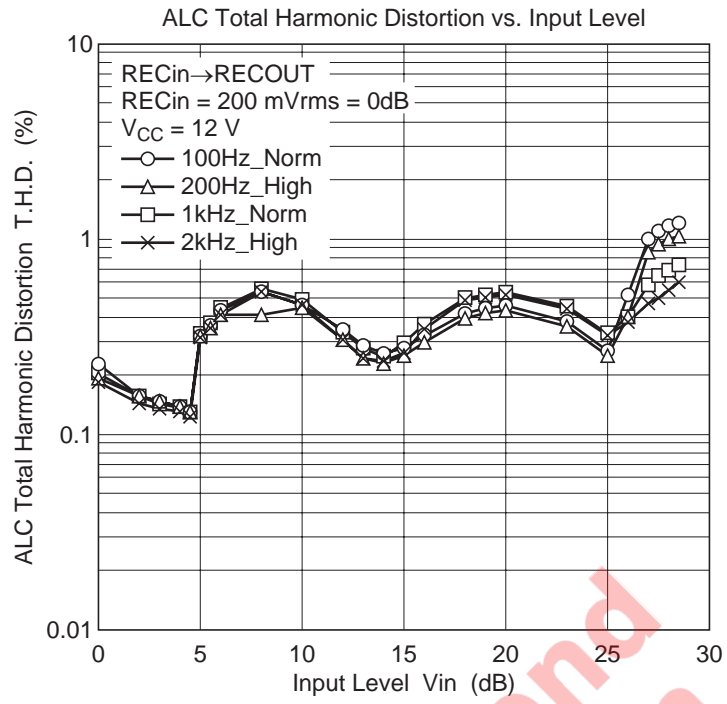


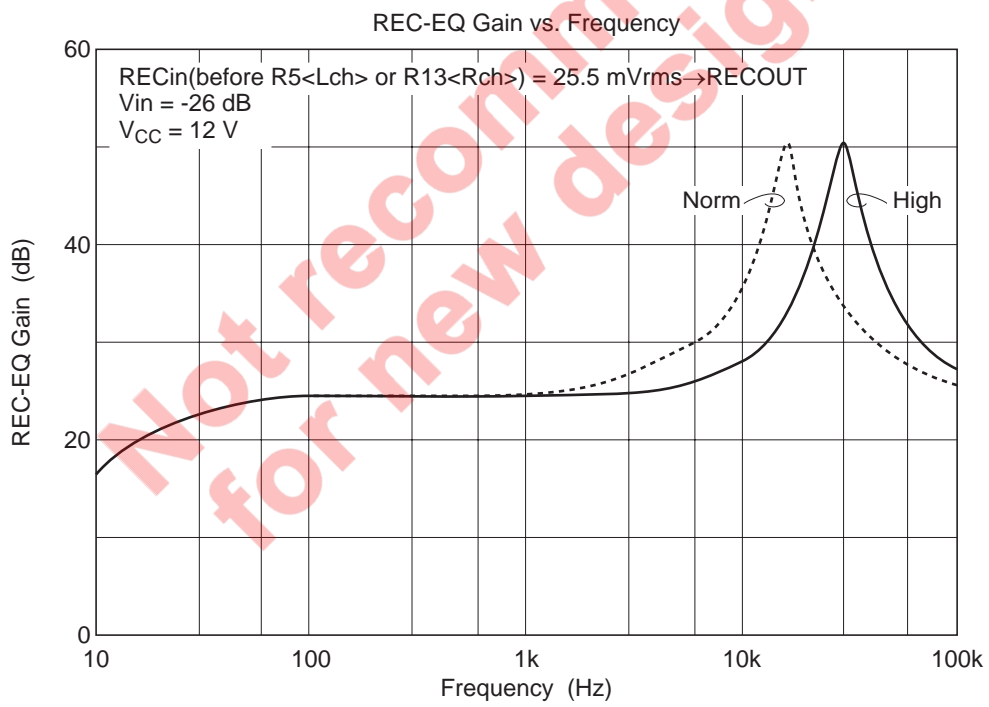
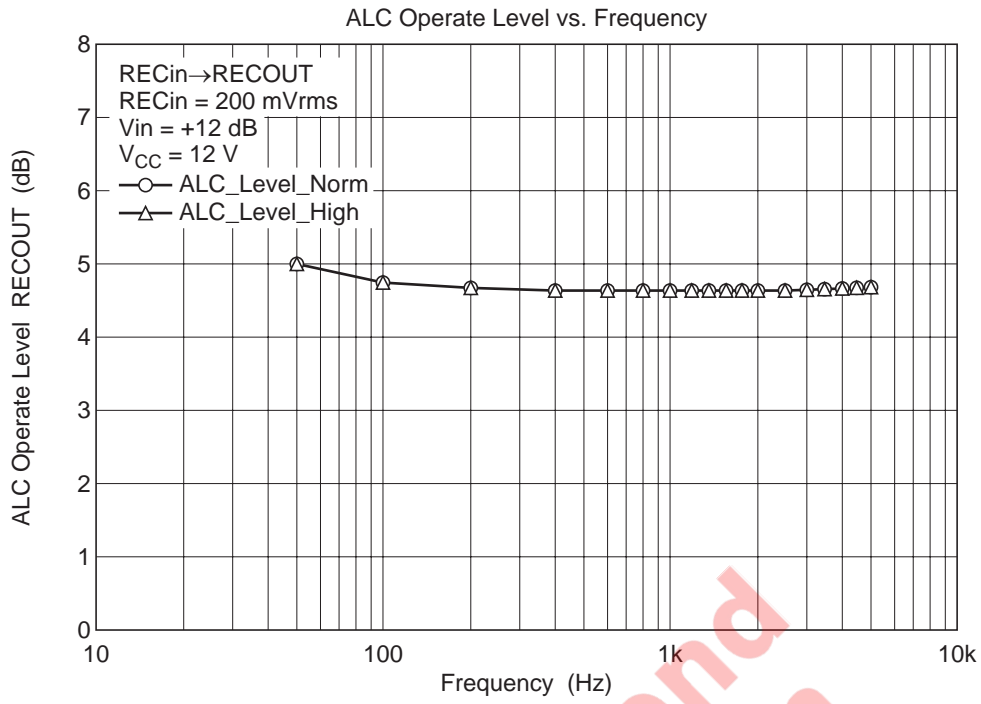


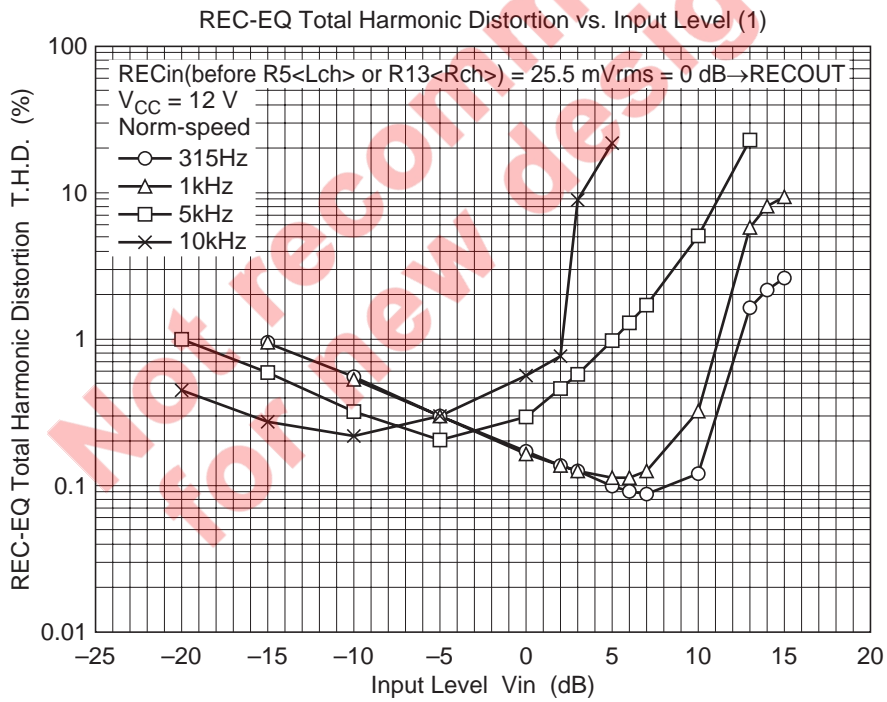
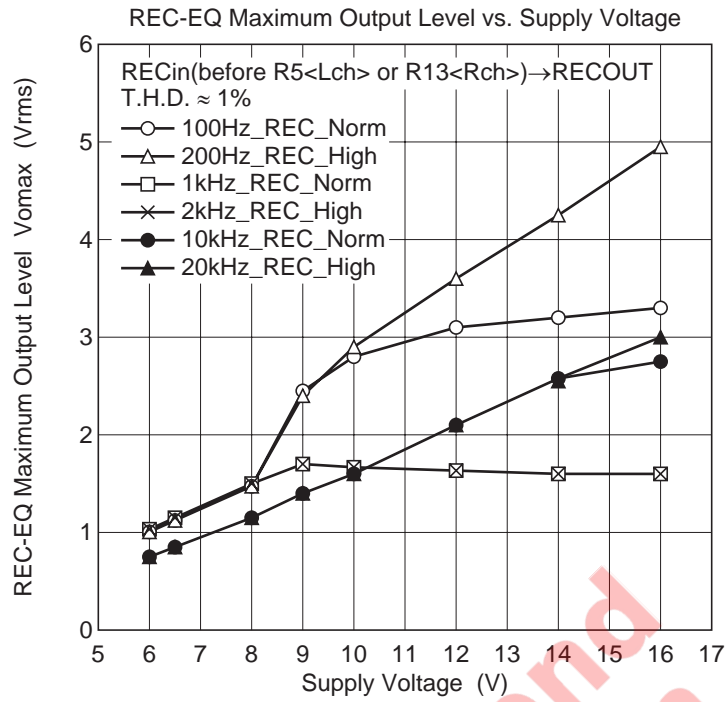


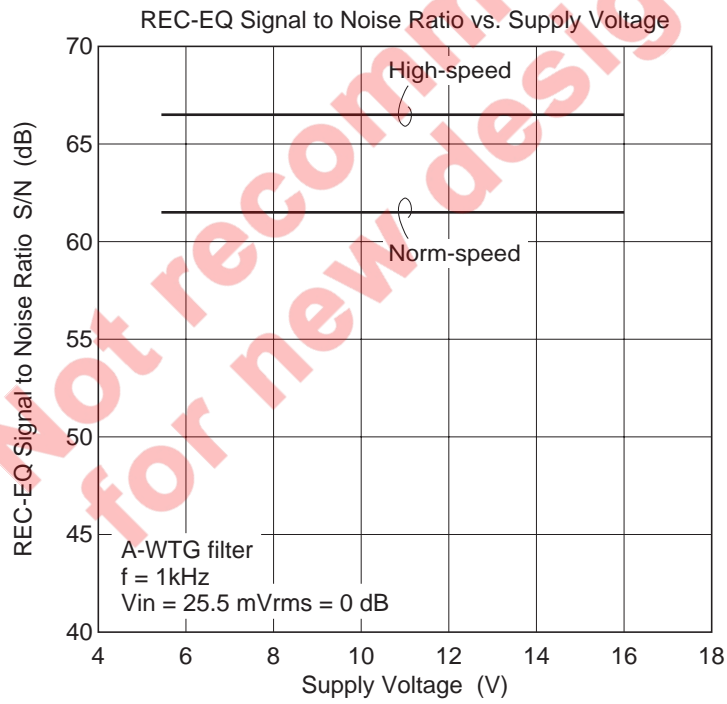
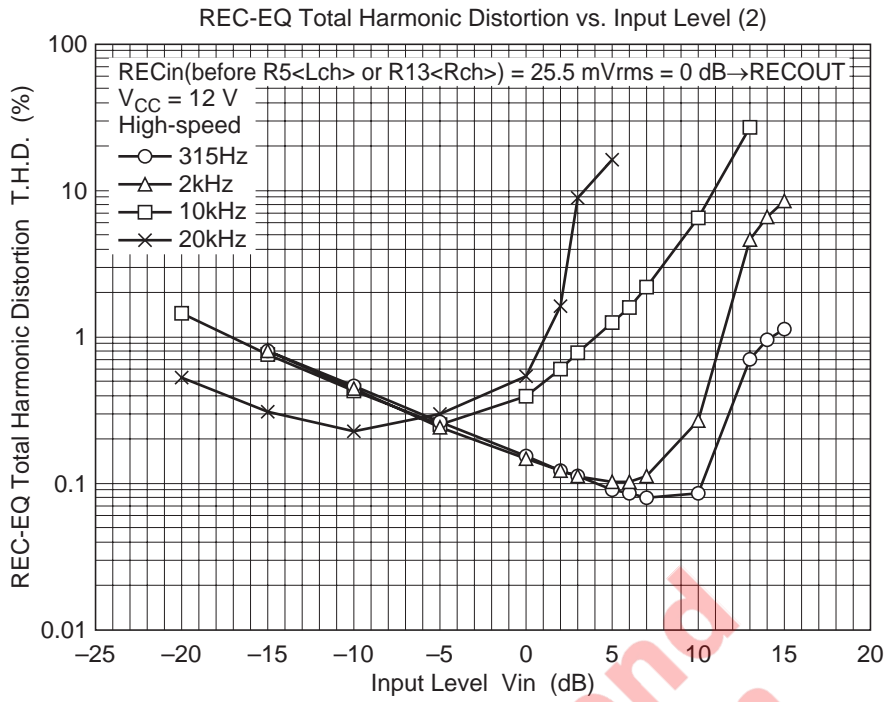


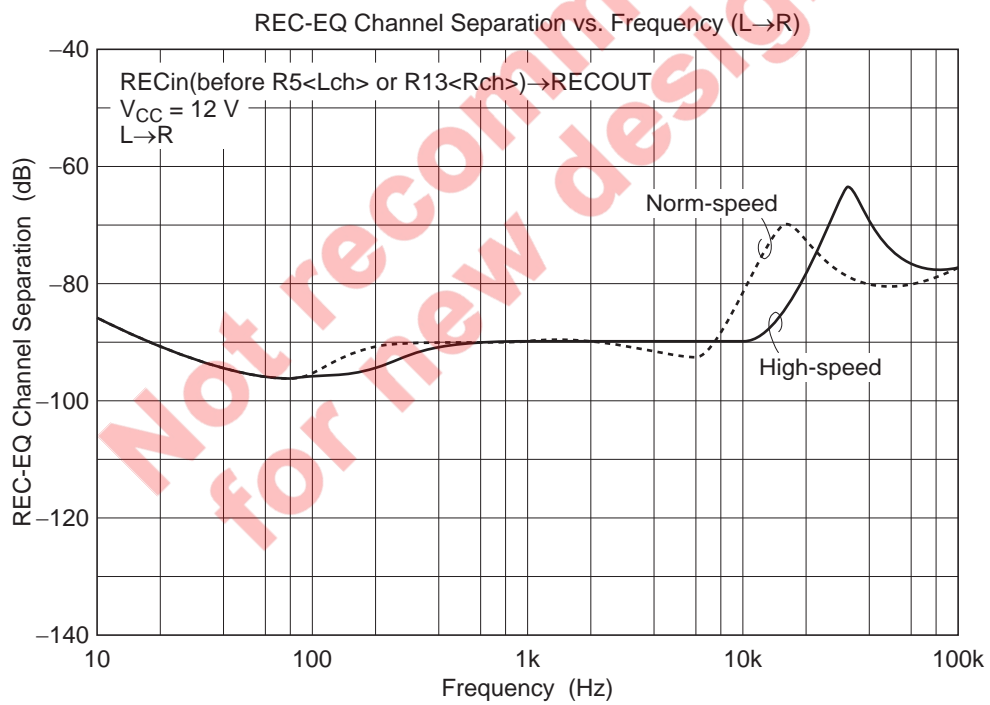
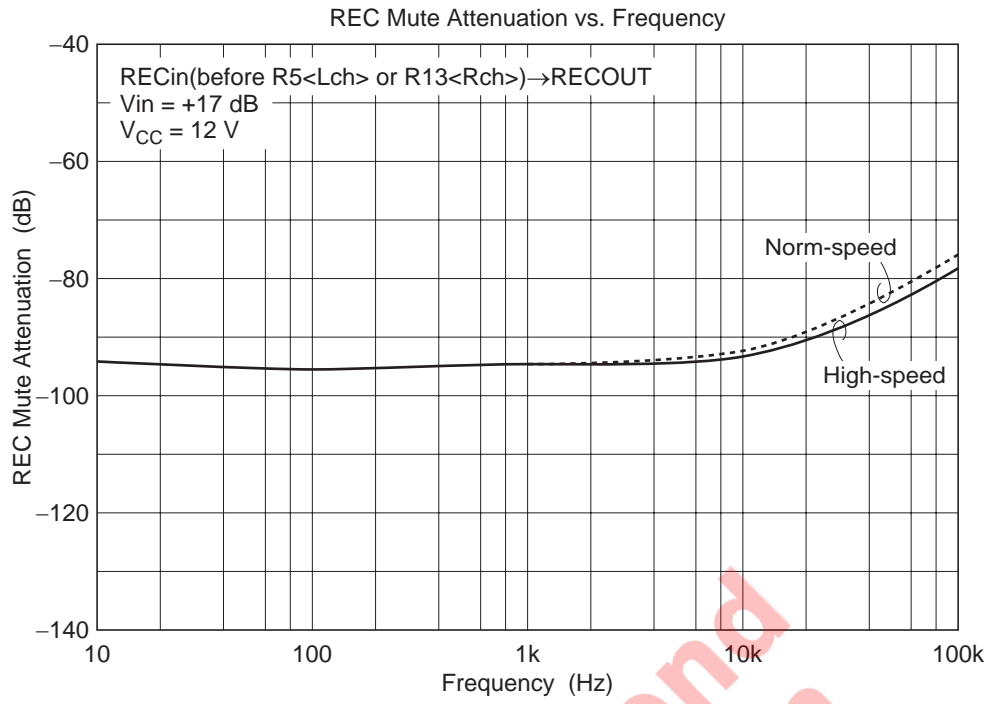


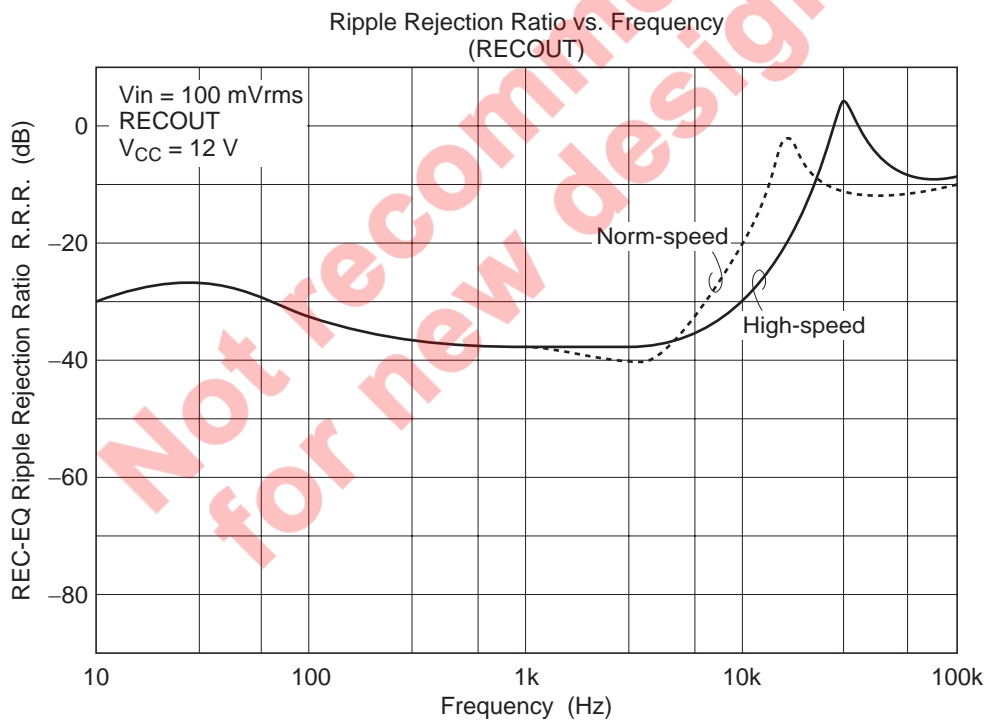
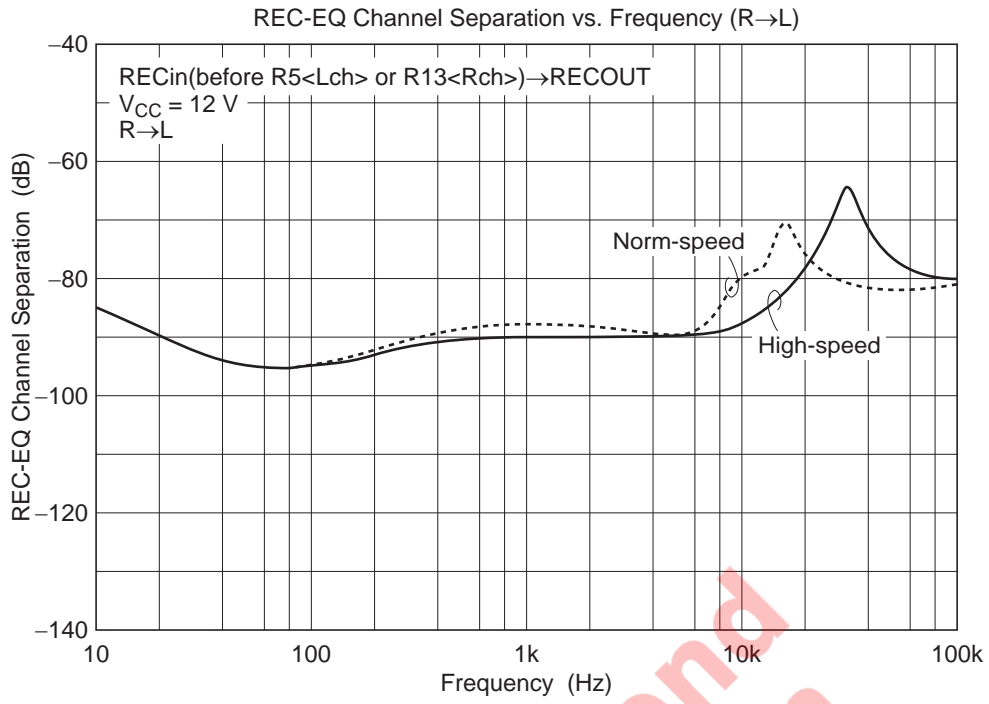


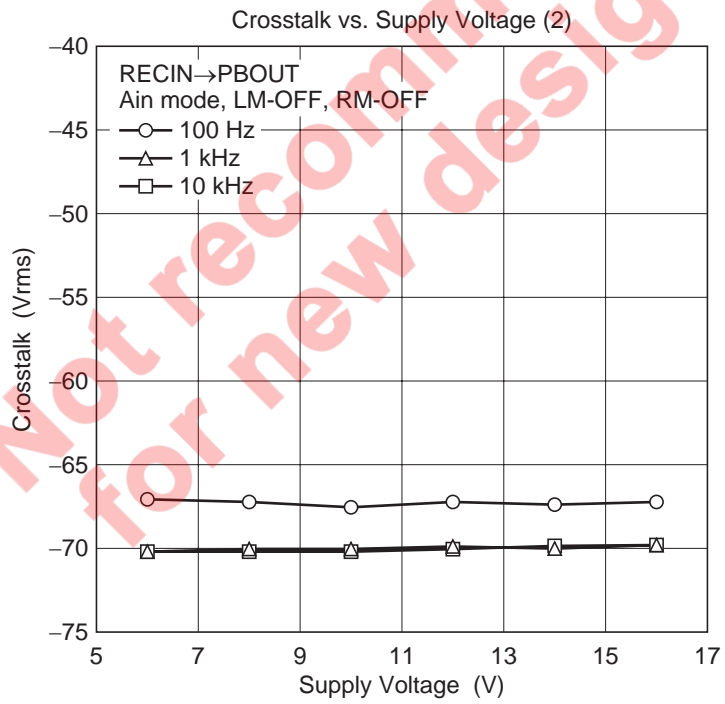
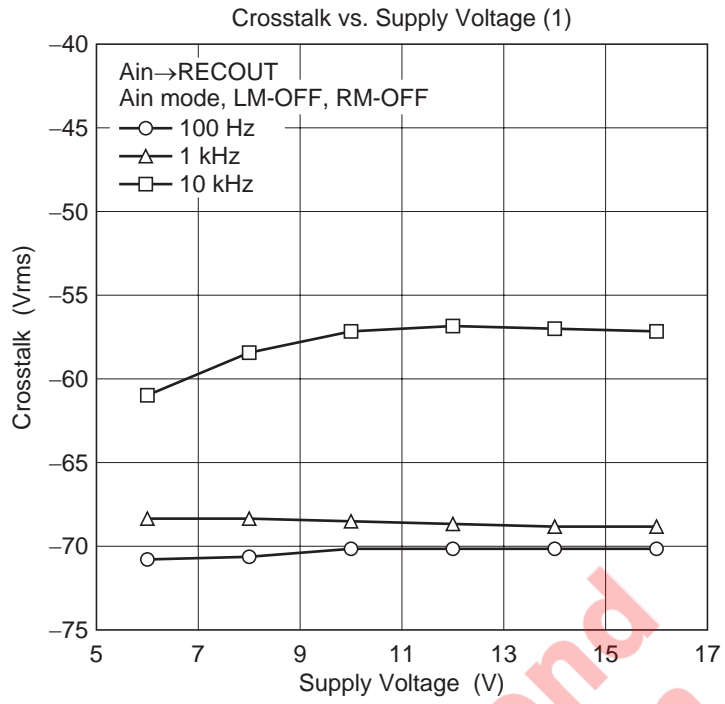


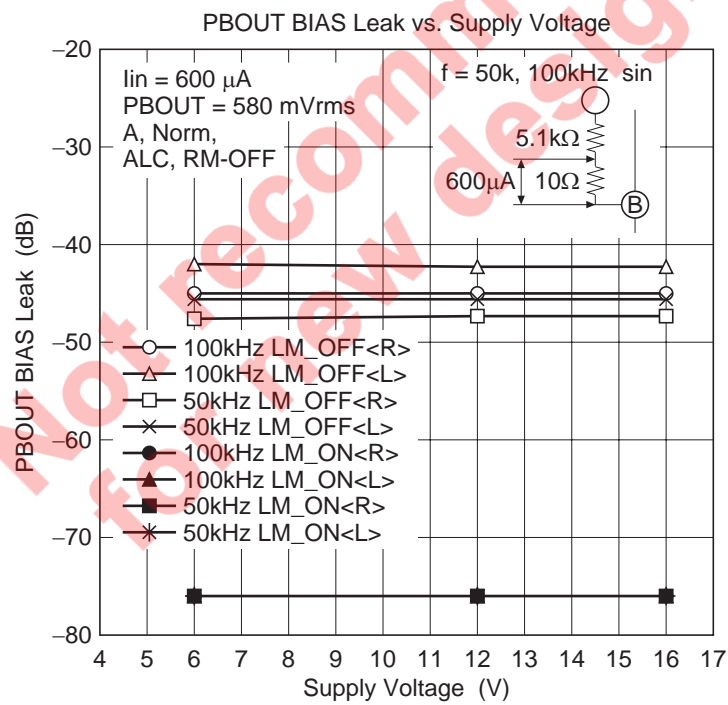
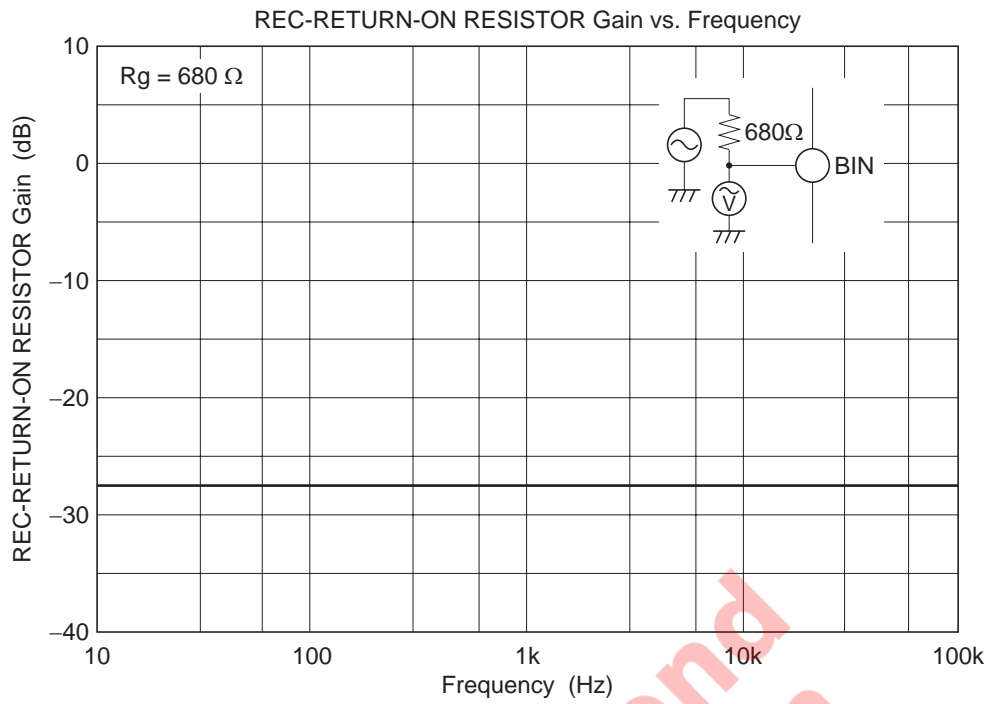






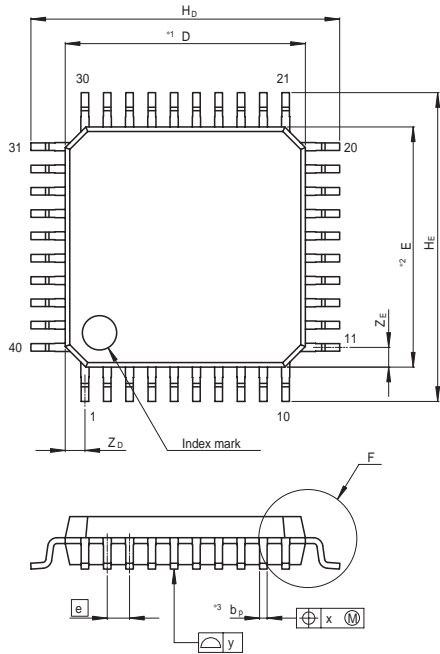




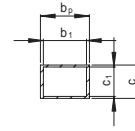


Package Dimensions

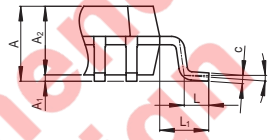
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|---|------------------------------|-------------------------|--------------------|



NOTE)
 1. DIMENSIONS*1*AND*2*
 DO NOT INCLUDE MOLD FLASH
 2. DIMENSION*3*DOES NOT
 INCLUDE TRIM OFFSET.



Terminal cross section



Detail F

| Reference Symbol | Dimension in Millimeters | | |
|------------------|--------------------------|-------|------|
| | Min | Nom | Max |
| D | — | 7.0 | — |
| E | — | 7.0 | — |
| A ₂ | — | 1.40 | — |
| H _D | 8.8 | 9.0 | 9.2 |
| H _E | 8.8 | 9.0 | 9.2 |
| A | — | — | 1.70 |
| A ₁ | 0.08 | 0.13 | 0.22 |
| b _p | 0.20 | 0.25 | 0.30 |
| b ₁ | — | 0.22 | — |
| c | 0.12 | 0.17 | 0.22 |
| c ₁ | — | 0.15 | — |
| θ | 0° | — | 8° |
| e | — | 0.65 | — |
| x | — | — | 0.13 |
| y | — | — | 0.10 |
| Z _D | — | 0.575 | — |
| Z _E | — | 0.575 | — |
| L | 0.40 | 0.50 | 0.60 |
| L ₁ | — | 1.0 | — |

Not recommended for new designs

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