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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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HA12237F

Audio Signal Processor for Cassette Deck



ADE-207-343 (Z)

Rev.0
Feb. 2002

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/ $\overline{\text{OFF}}$	ALC OFF	ALC ON
12	High/ $\overline{\text{Norm}}$	Normal speed	High speed
13	A/ $\overline{\text{B}}$	B	A
	REC Return ON/ $\overline{\text{OFF}}$	Return OFF	Return ON
14	MUTE ON/ $\overline{\text{OFF}}$	MUTE OFF	MUTE ON
15	REC MUTE OFF/ $\overline{\text{ON}}$	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)	$V = 2.9\text{ V}$		EQ output
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)	$V = V_{CC}/2$		Tape input
4	TAI(R)			

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.)

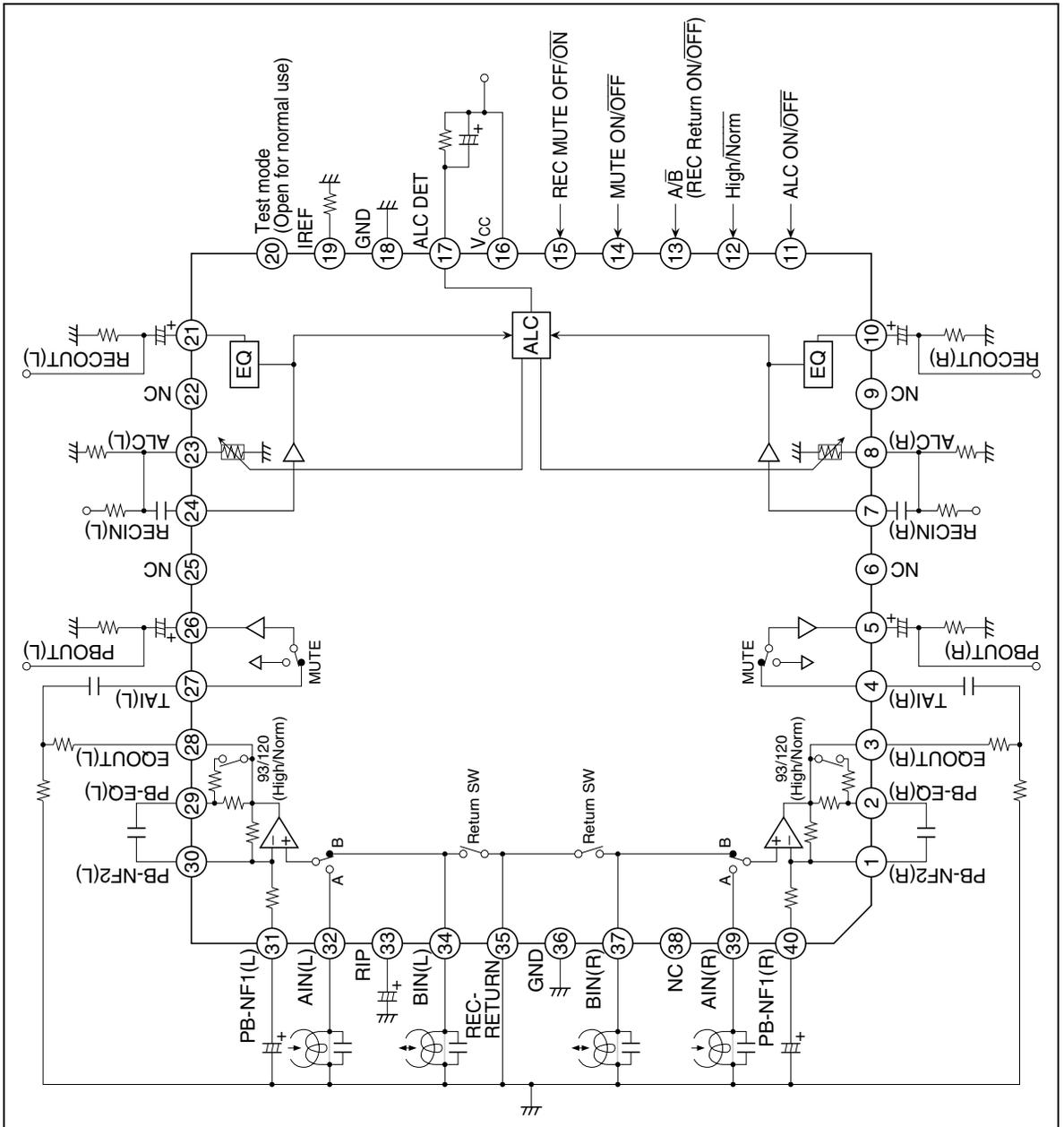
Pin No.	Pin Name	Note	Equivalent Circuit	Description
11	ALC ON/OFF	(Control voltage = 3 V)		Mode control input
12	High/Norm			
13	A/B			
14	MUTE ON/OFF			
15	REC MUTE OFF/ON			
19	IREF	$V = 1.2\text{ V}$		Equalizer reference current input
18, 36	GND			GND pin
6, 9, 22, 25, 38	NC			NC pin
20	Test mode			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)			

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
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.

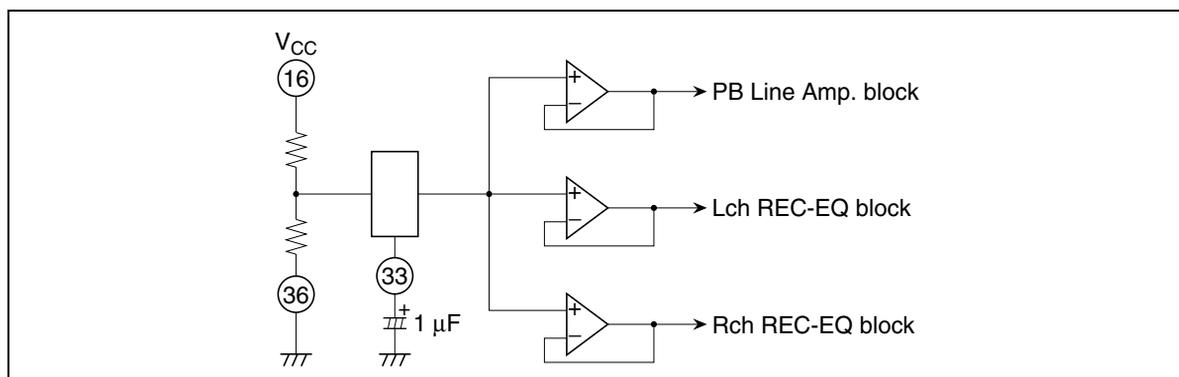
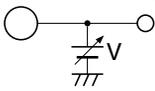


Figure 1 **Block Diagram of Reference Supply Voltage**

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 k Ω 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.

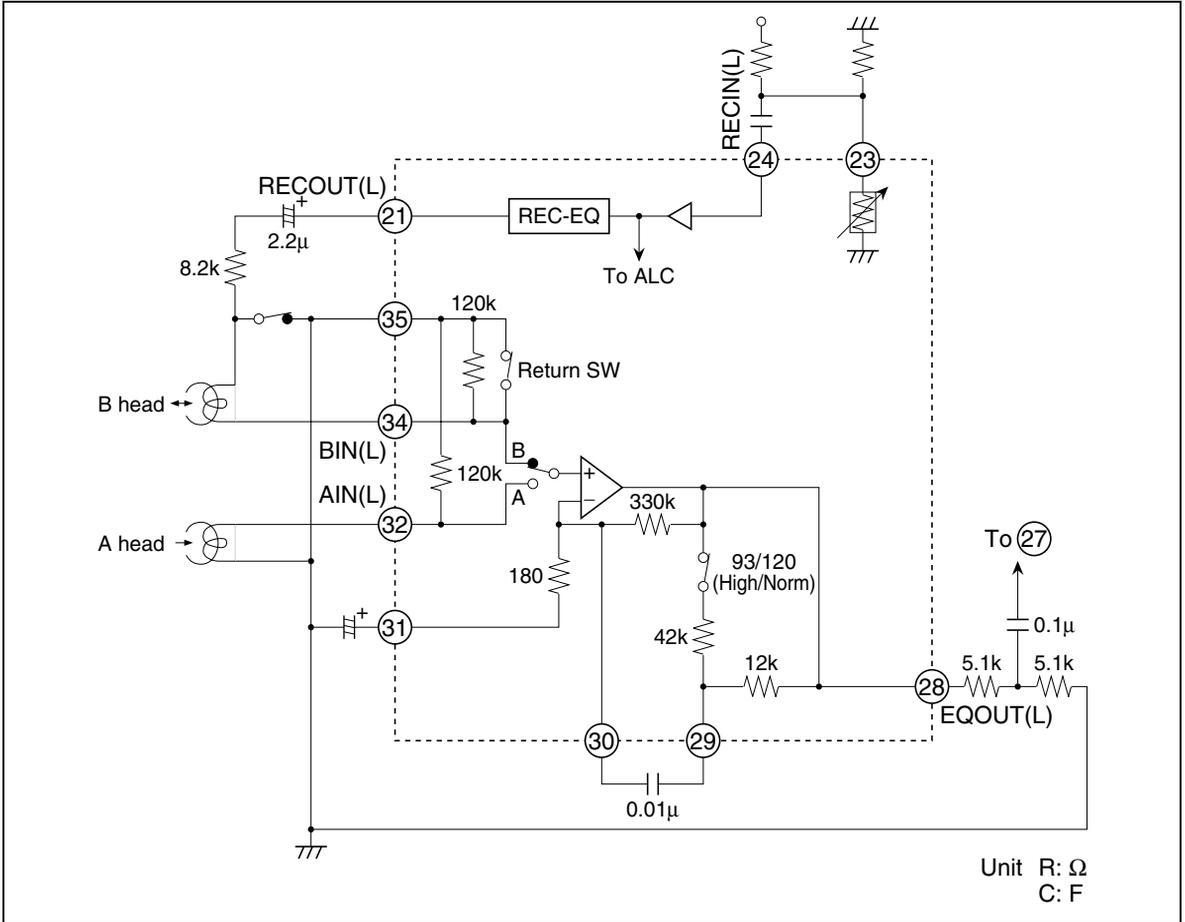


Figure 2 Block Diagram (Lch)

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 \geq 10 k Ω ”

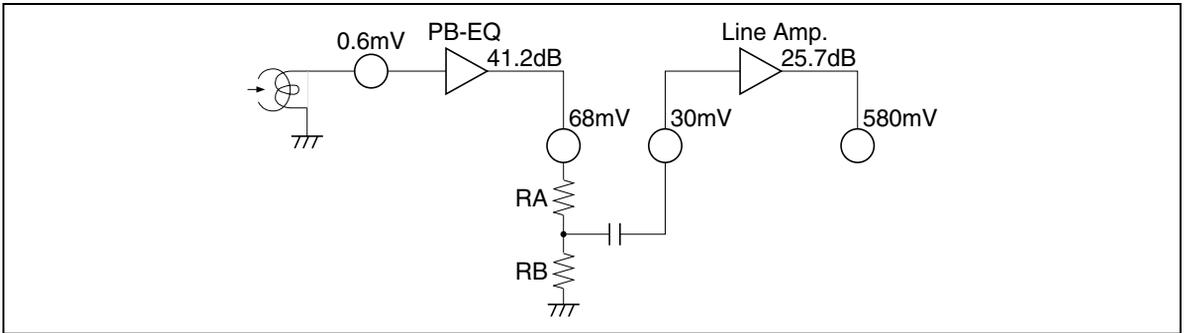


Figure 3 PB System Level Diagram (1 kHz)

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 k Ω to 22 k Ω resistor to pin 14 in series and 1 μ F to 22 μ F 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 k Ω 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.

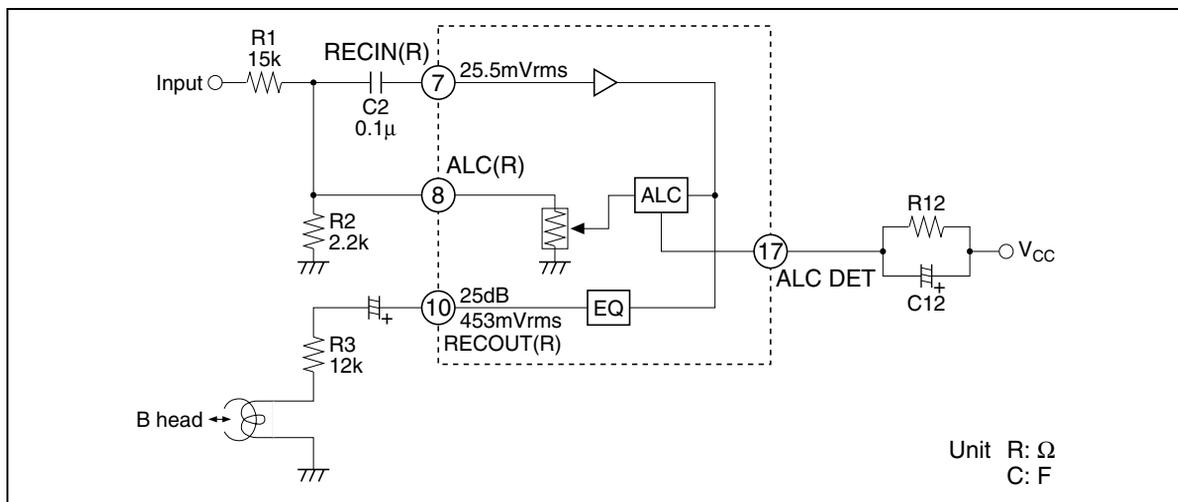


Figure 4 REC-EQ Block Diagram

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 RECOUT.

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.

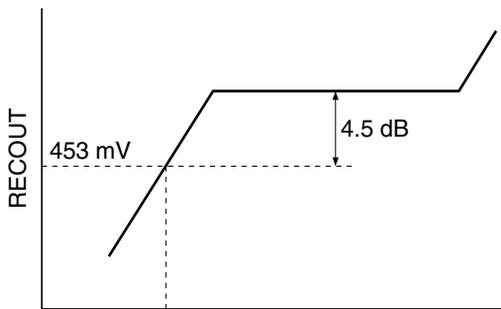


Figure 5 ALC Operation Level

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	Topr	-40 to +75	°C	
Storage temperature	Tstg	-55 to +125	°C	
Operating voltage	Vopr	6.5 to 15	V	

Note: HA12235F operates on single supply voltage.

Electrical Characteristics

(T_a = 25°C, V_{CC} = 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		f _{in} (Hz)	V _{in} (mVrms)	Other	Min	Typ	Max	Unit	Input		Output		COM Remark
		A/B	High/ Norm								ALC ON/OFF	R	L	R	
Quiescent current	I _Q	A	Norm	OFF	—	No signal	—	12.2	20.2	mA	—	—	—	16	
Logical threshold	V _{IL}	—	—	—	—	—	—	—	0.5	V	—	—	—	11 to 15	
	V _{IH}	—	—	—	—	—	—	2.4	V _{CC}	V	—	—	—	11 to 15	
PB-REC crosstalk	GT PB/REC(1)	A	Norm	OFF	1k	REC-EQ→PB-EQ	*1	50.0	60.0	dB	7	24	3	28	
	GT PB/REC(2)	A	Norm	OFF	1k	PB-EQ→REC-EQ	6.0	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	39/37	28/29	3	28	
	GV PB(2)	A	Norm	OFF	10k	—	0.6	33.3	36.3	39.3	39	32	3	28	
	GV PB(3)	A	High	OFF	20k	—	0.6	31.2	34.2	37.2	39	32	3	28	
PB-EQ maximum output level	V _{omax} PB	A	Norm	OFF	1k	THD = 1%	—	0.3	0.6	—	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	V _N PB	A/B	Norm	OFF	—	Rg = 680Ω, DIN-AUDIO	—	—	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	—	39	32	3	28	
	CT A/B	A/B	Norm	OFF	1k	—	6.0	60.0	70.0	—	39/37	28/29	3	28	
Line Amp. gain	G _V LA	A	Norm	OFF	1k	—	30.0	24.2	25.7	27.2	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	V _{omax} LA	A	Norm	OFF	1k	THD = 1%	—	1.16	1.40	—	4	27	5	26	
Line mute attenuation	L-MUTE ATT	A	Norm	OFF	1k	—	120.0	70.0	80.0	—	4	27	5	26	

Notes: 1. Large level without clipping

2. V_{CC} = 6.5V

Electrical Characteristics (cont)

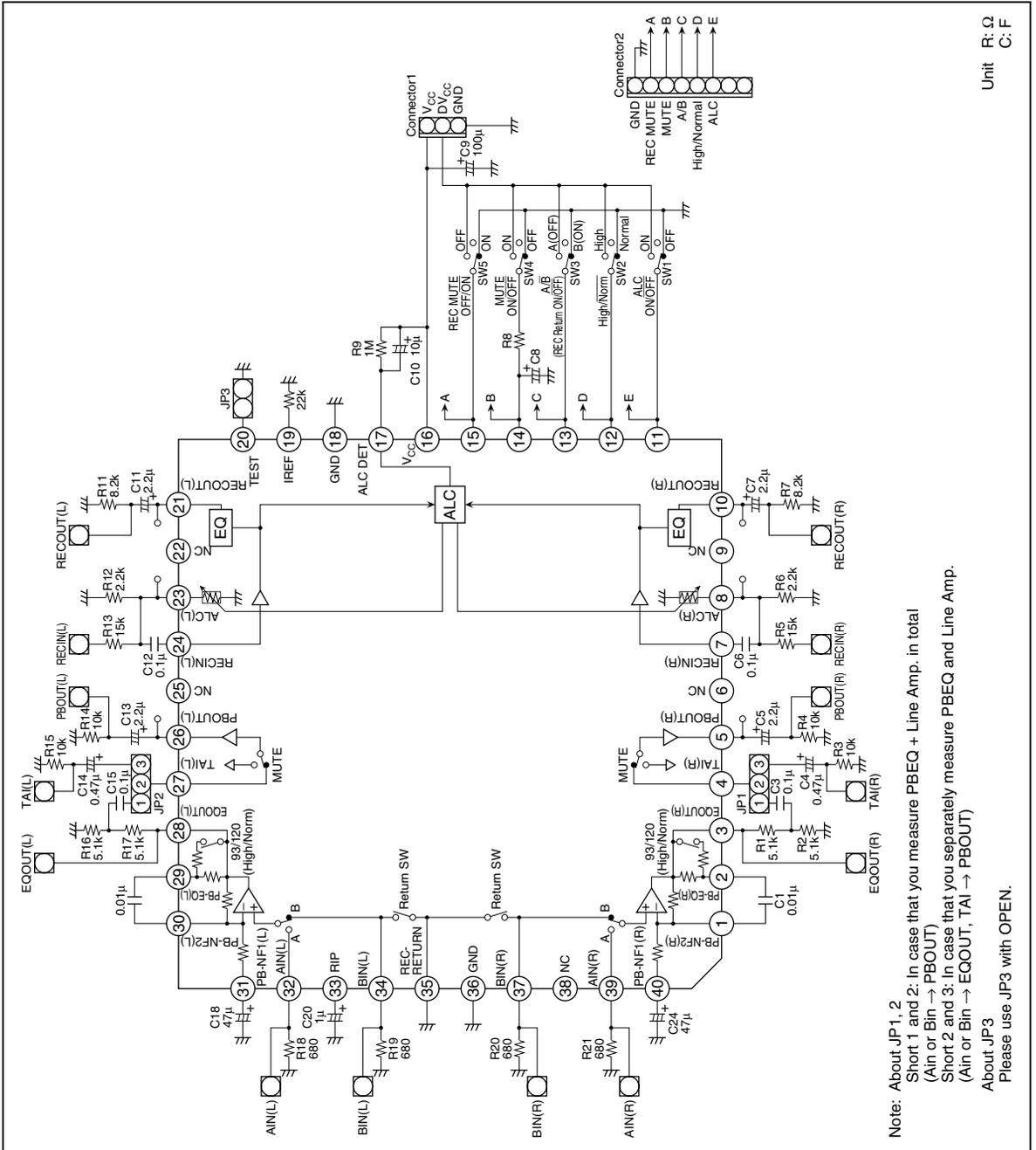
(Ta = 25°C, V_{CC} = 12 V, RECIN Standard level = 200 mVrms (IC in Level = 25.5 mVrms) = 0 dB

Item	Symbol	Test Condition						Specification			Application Terminal			COM Remark		
		IC Condition		f _{in} (Hz)	V _{in} (mVrms)	Other	Min	Typ	Max	Input		Output				
		A/B	High/ Norm							ALC ON/OFF	R	L	R		L	
ALC operate level	ALC	A	Norm	ON	1k	+12		2.0	4.5	7.0	dB	7	24	10	21	—
REC-EQ frequency characteristics	GV REC-NN1	A	Norm	OFF	1k	-26		23.5	25.0	26.5	dB	7	24	10	21	—
Normal speed	GV REC-NN2	A	Norm	OFF	5k	-26		26.9	28.9	30.9	dB	7	24	10	21	—
	GV REC-NN3	A	Norm	OFF	10k	-26		33.2	35.7	38.2	dB	7	24	10	21	—
	GV REC-HN1	A	High	OFF	2k	-26		23.4	24.9	26.4	dB	7	24	10	21	—
High speed	GV REC-HN2	A	High	OFF	10k	-26		26.5	28.5	30.5	dB	7	24	10	21	—
	GV REC-HN3	A	High	OFF	20k	-26		33.4	35.9	38.4	dB	7	24	10	21	—
	CT R/L(2)	A	Norm	OFF	1k	*1		61.0	70.0	—	dB	7	24	10	21	—
REC-MUTE attenuation	R-MUTE ATT	A	Norm	OFF	1k	*1		66.0	76.0	—	dB	7	24	10	21	—
REC-EQ maximum output level	Vomax REC	A	Norm	OFF	1k	—	THD = 1%	0.7	1.0	—	Vrms	7	24	10	21	*2
REC-EQ T.H.D.	THD REC	A	Norm	OFF	1k	0		—	0.2	0.5	%	7	24	10	21	—
REC-EQ S/N	S/N REC	A	Norm	OFF	1k	—	Rg = 2.2kΩ, A-WTG	55.0	59.0	—	dB	—	—	10	21	—

Notes: 1. Large level without clipping

2. V_{CC} = 6.5V

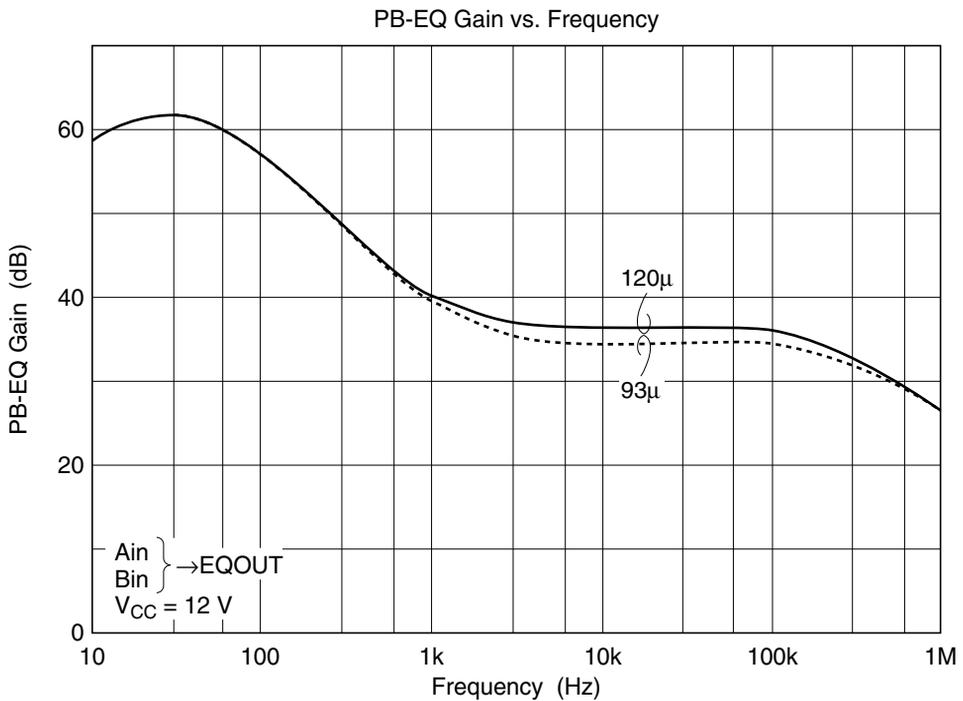
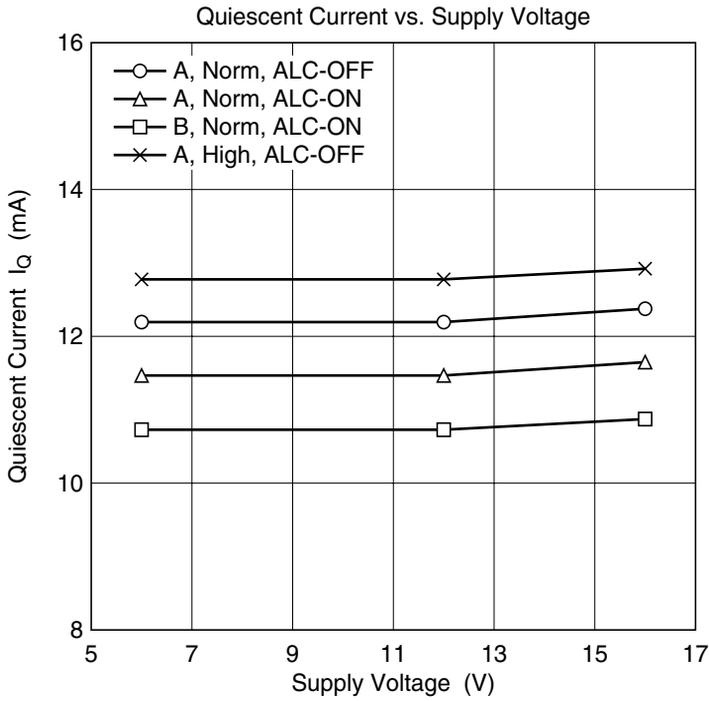
Test Circuit



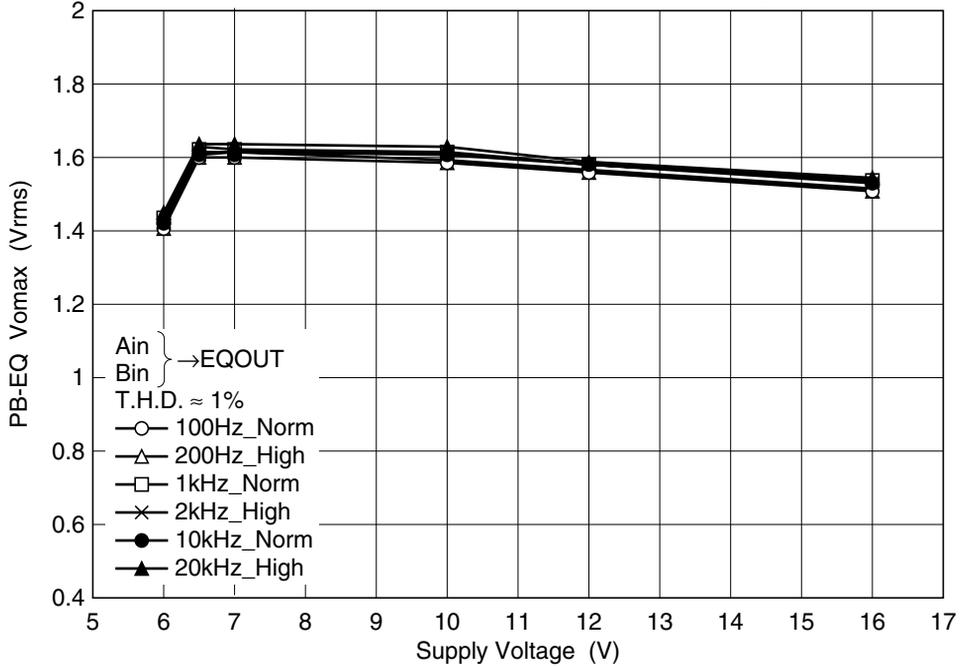
Unit R: Ω
C: F

Note: About JP1, 2
 Short 1 and 2: In case that you measure PBEQ + Line Amp. in total
 (Ain or Bin → PBOUT)
 Short 2 and 3: In case that you separately measure PBEQ and Line Amp.
 (Ain or Bin → EQOUT, TAI → PBOUT)
 About JP3
 Please use JP3 with OPEN.

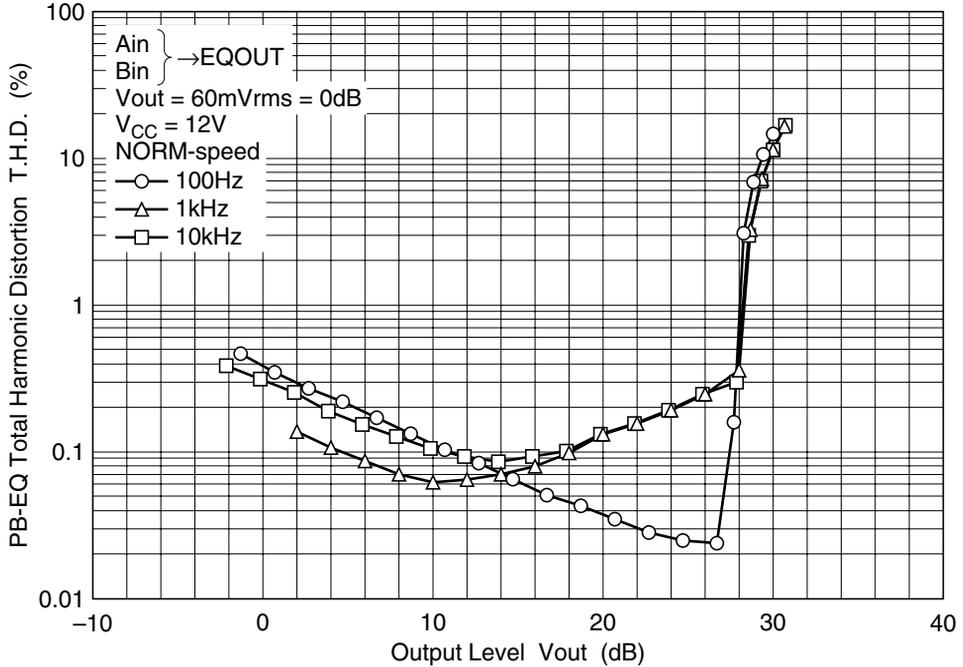
Characteristic Curves

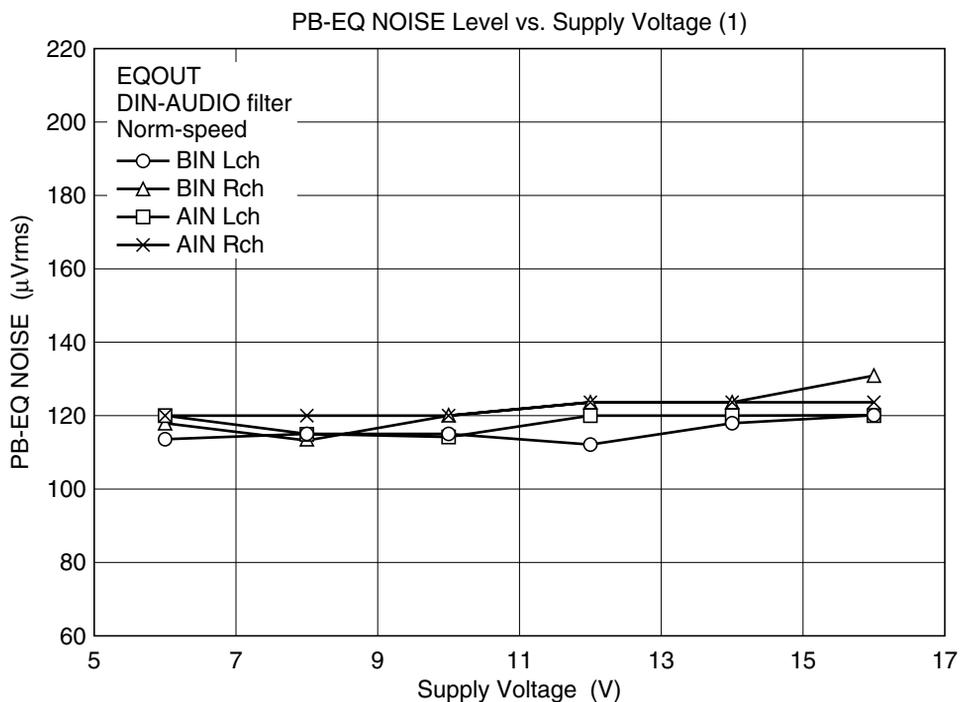
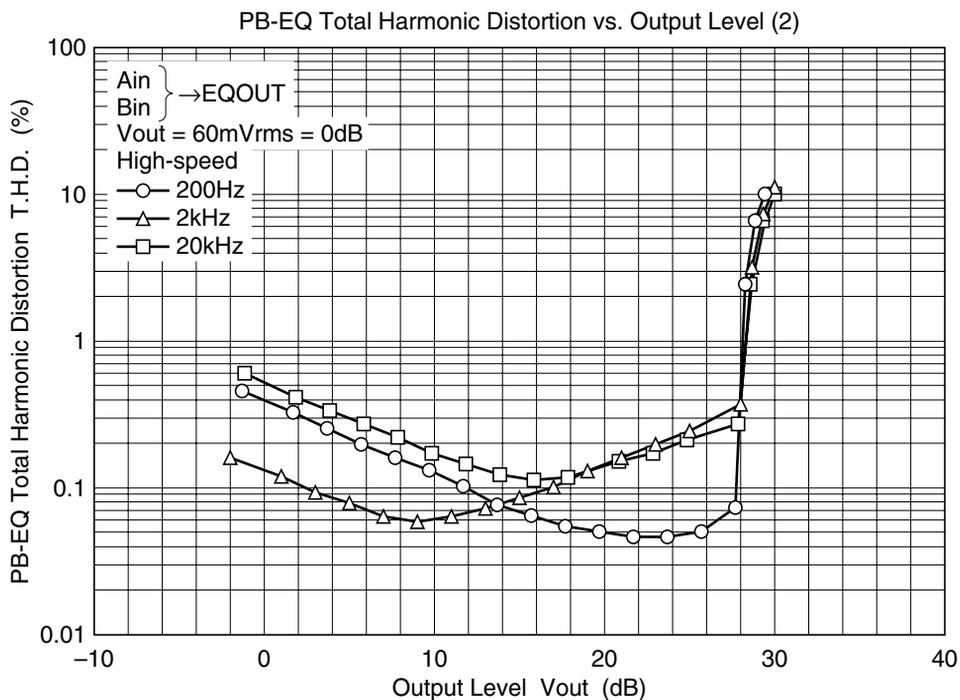


PB-EQ Maximum Output Level vs. Supply Voltage

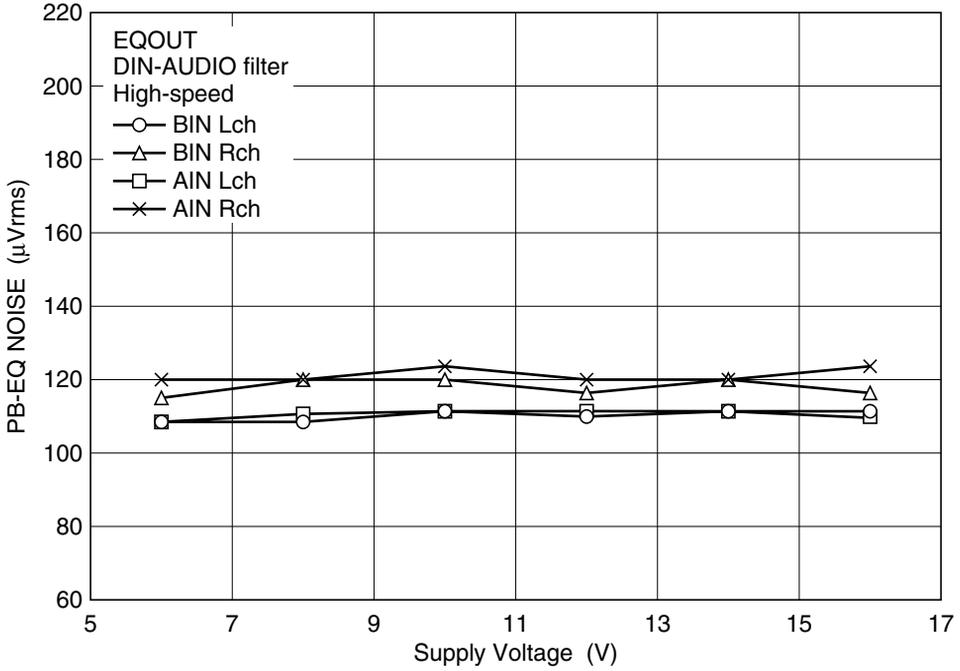


PB-EQ Total Harmonic Distortion vs. Output Level (1)

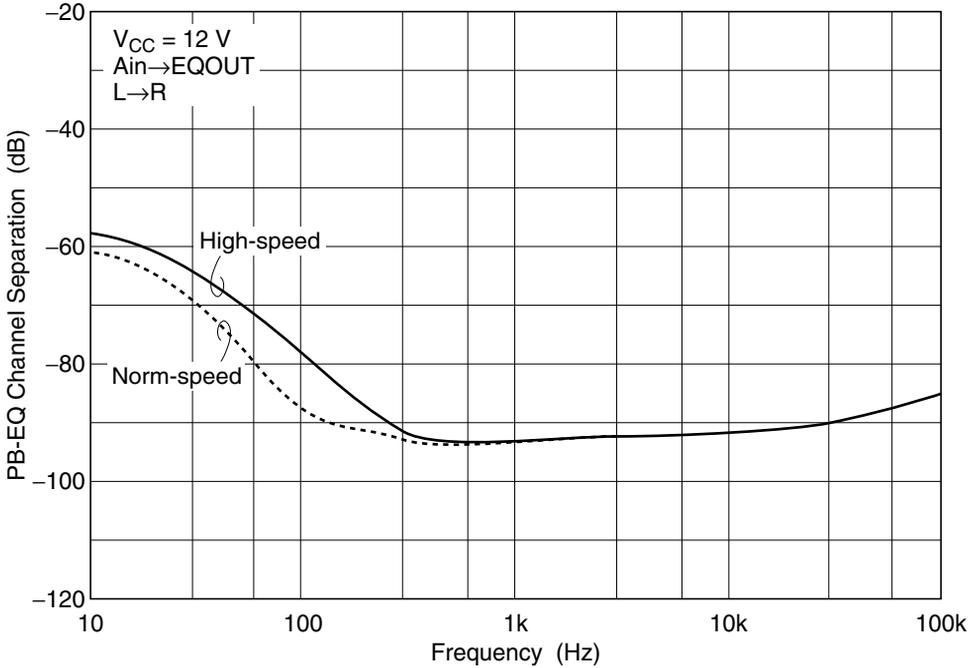


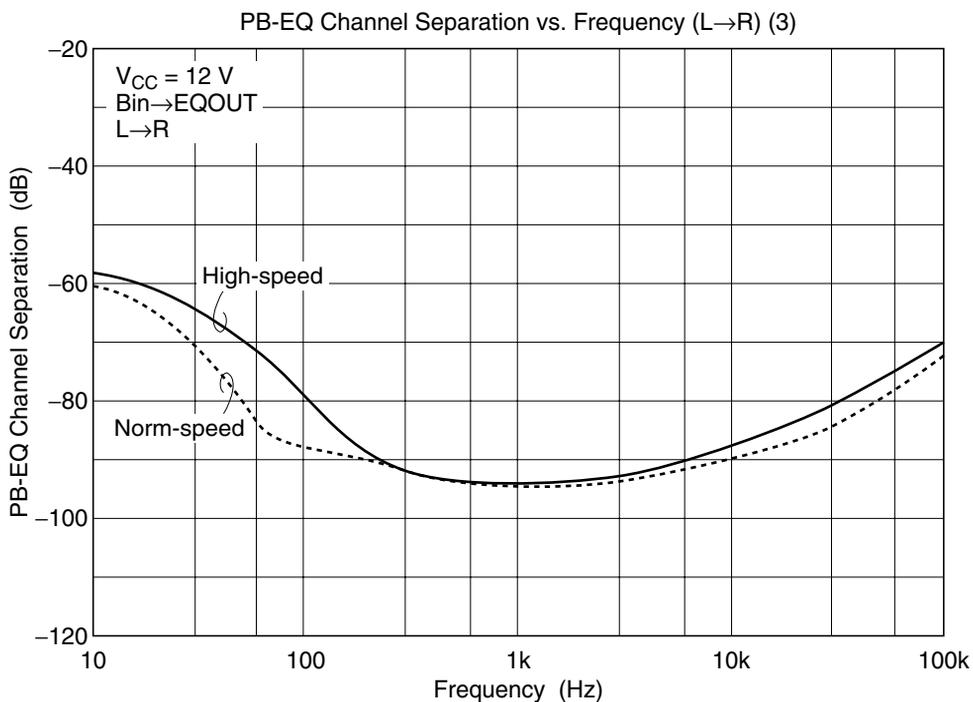
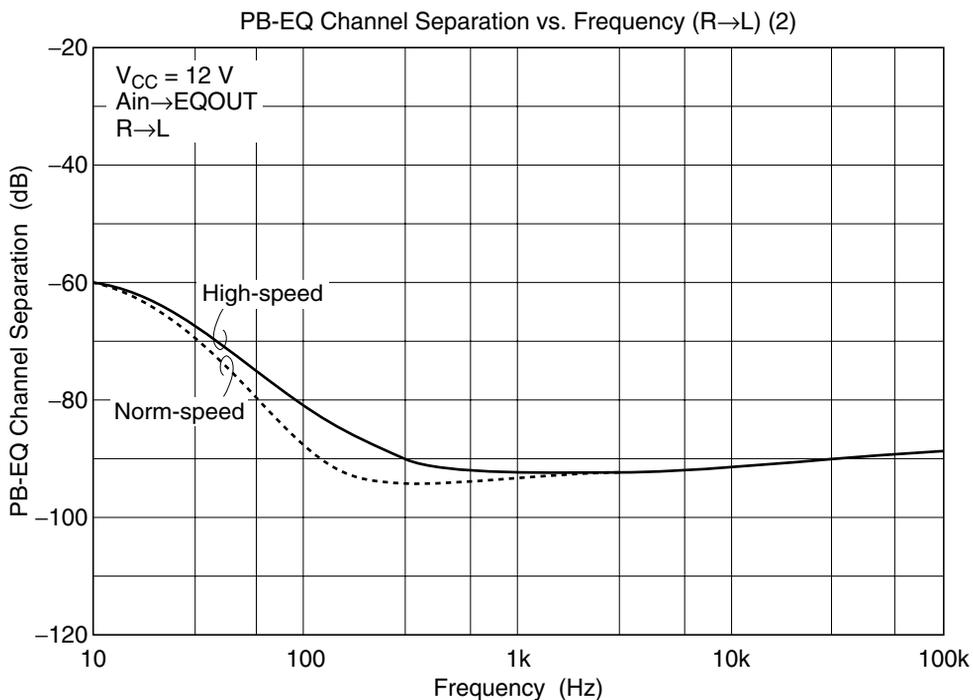


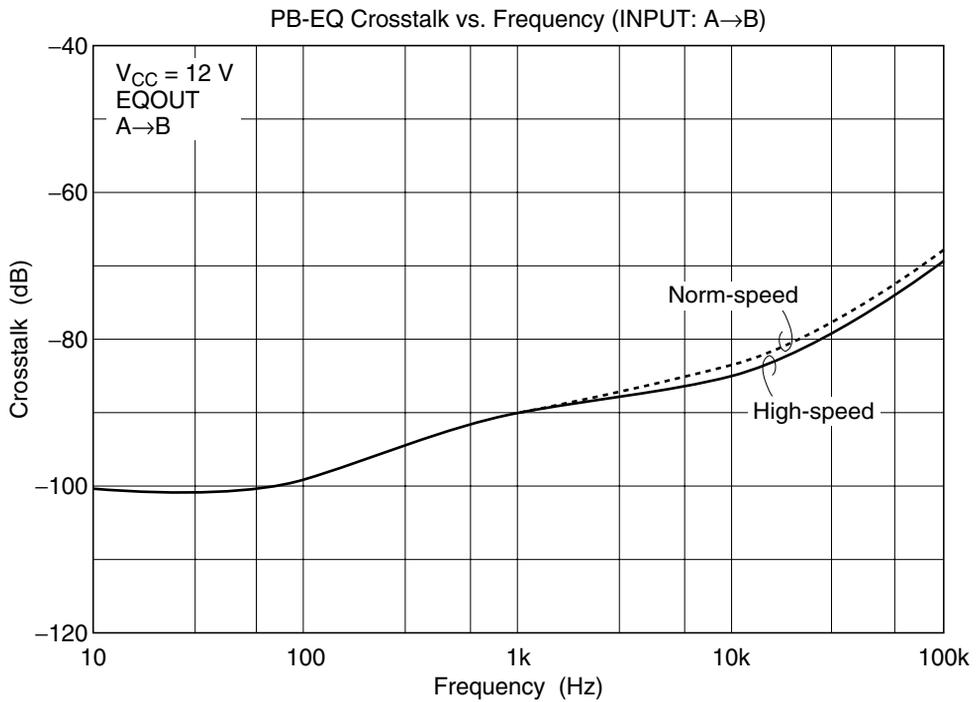
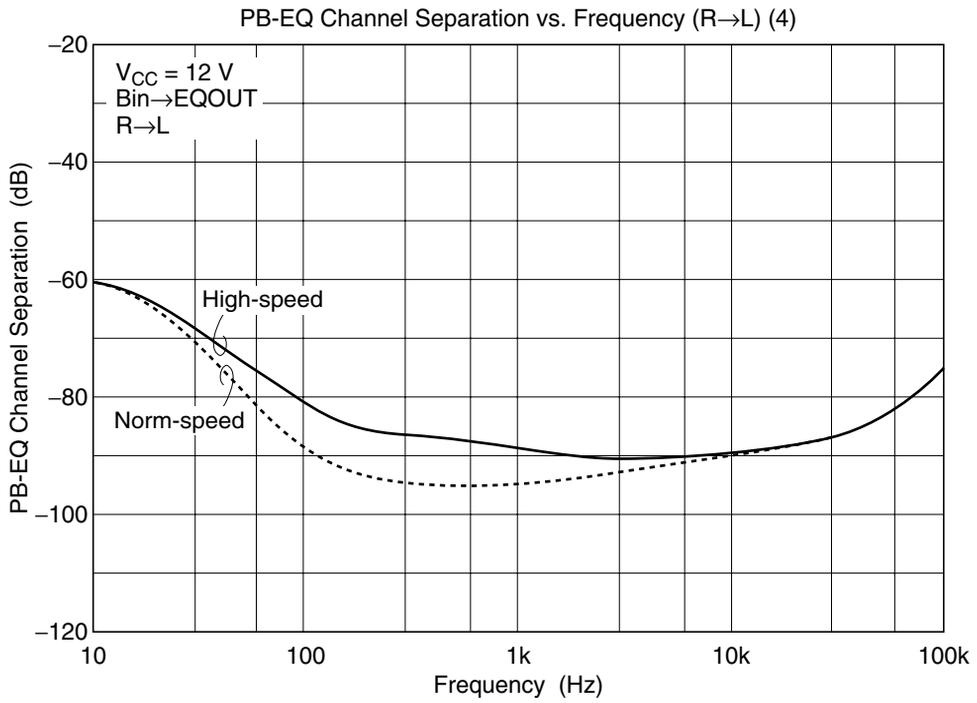
PB-EQ NOISE Level vs. Supply Voltage (2)

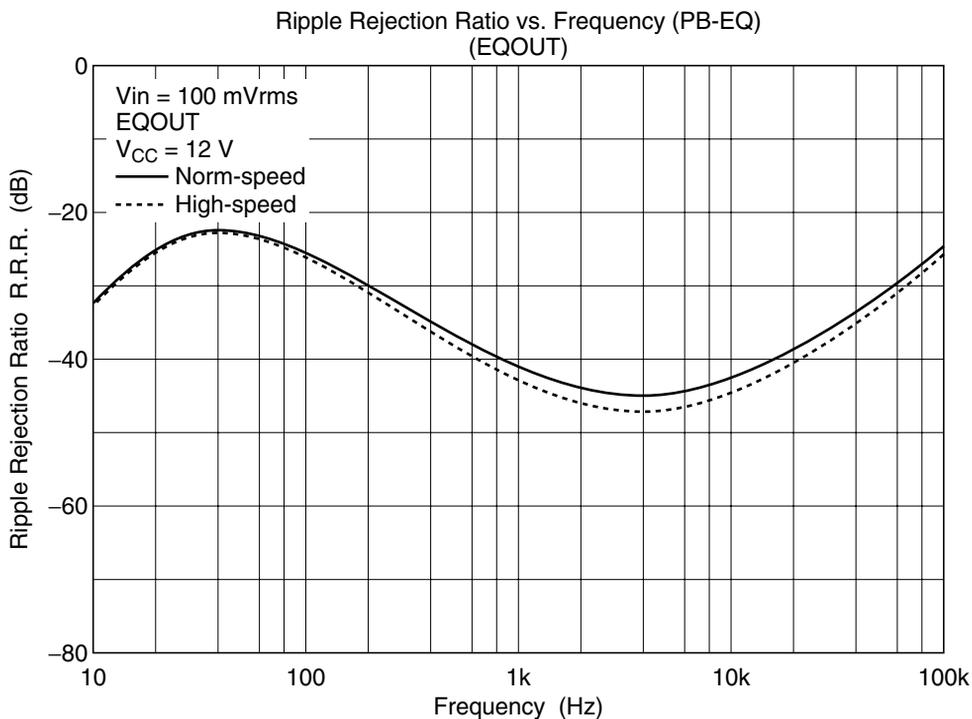
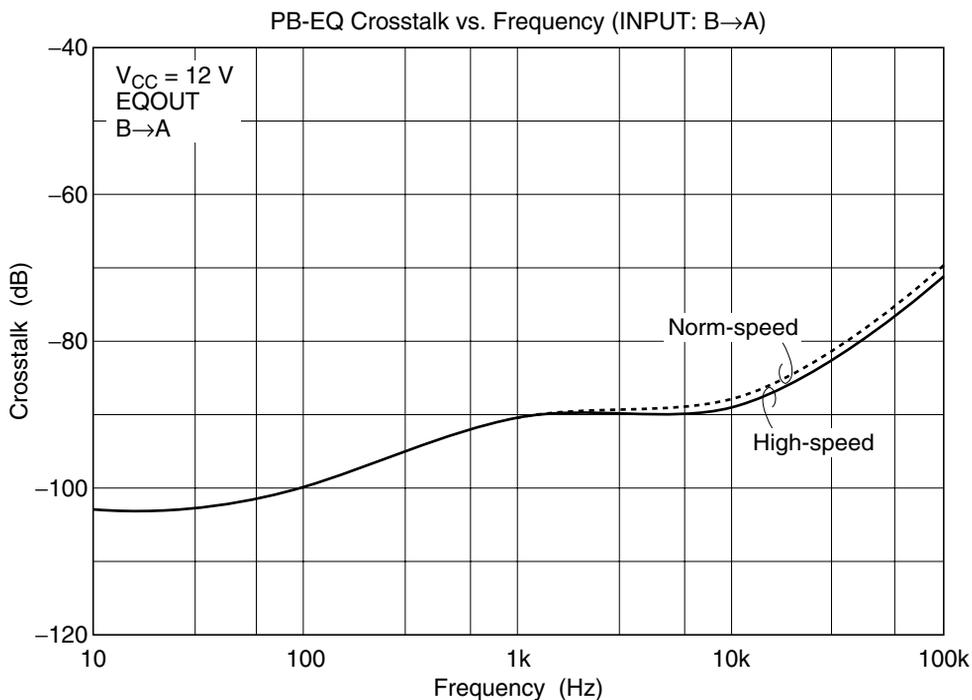


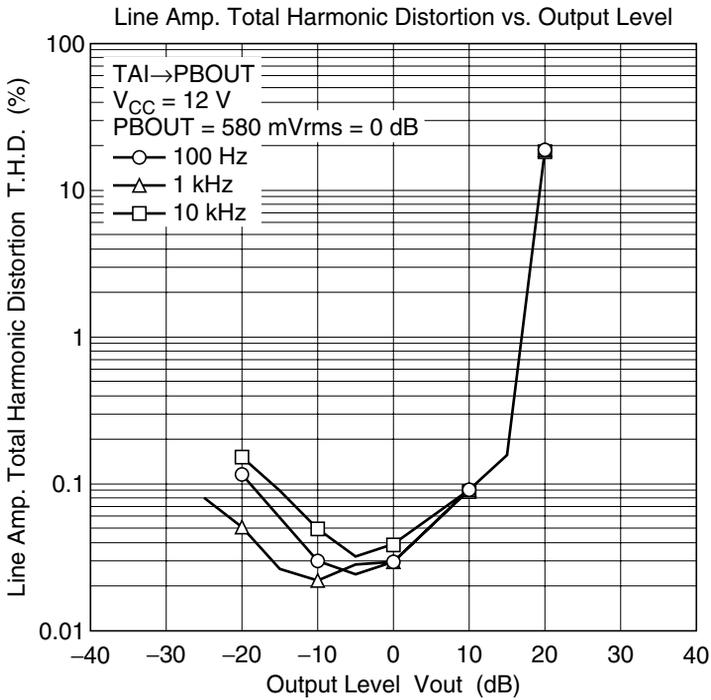
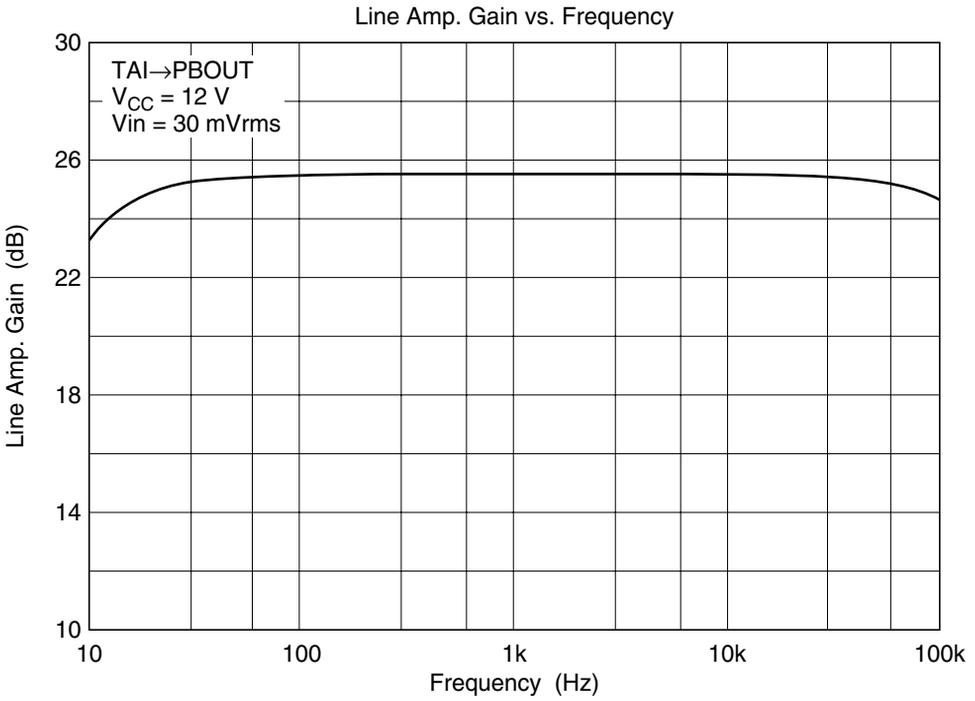
PB-EQ Channel Separation vs. Frequency (L→R) (1)

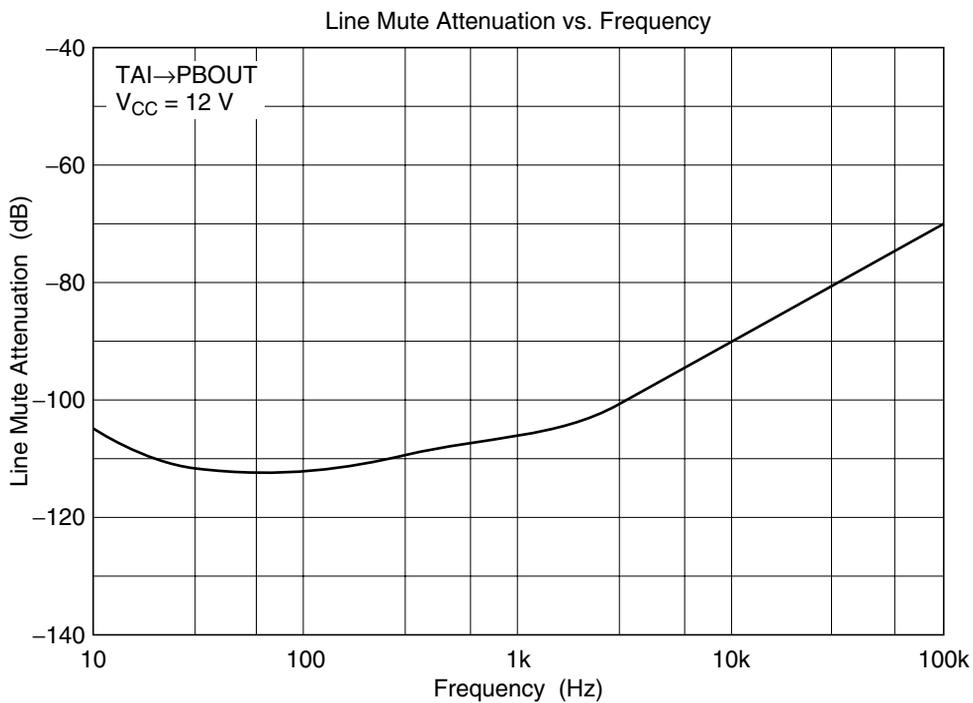
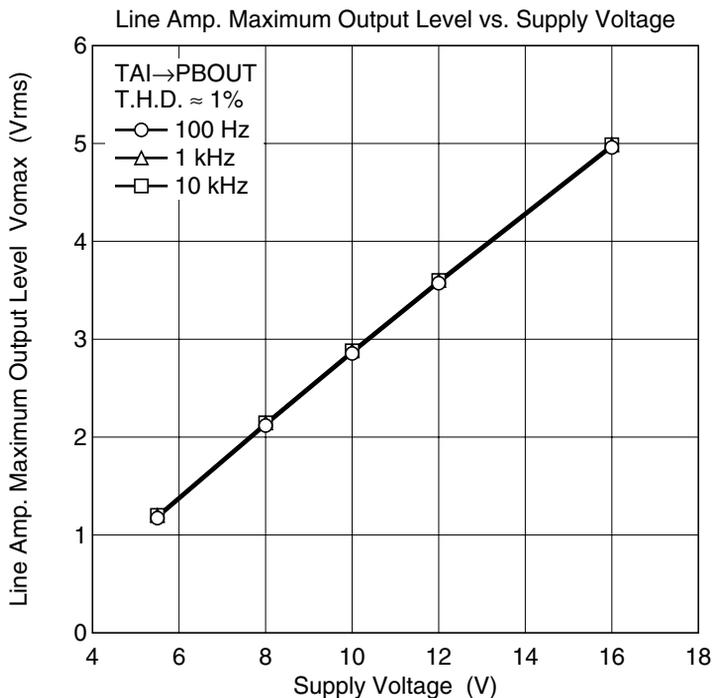


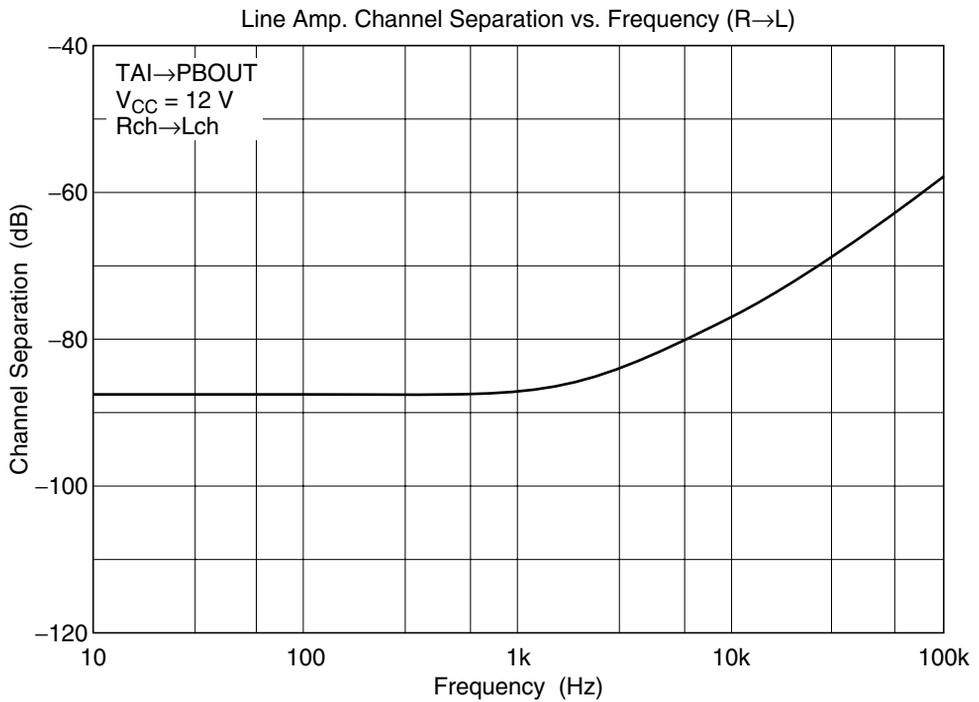
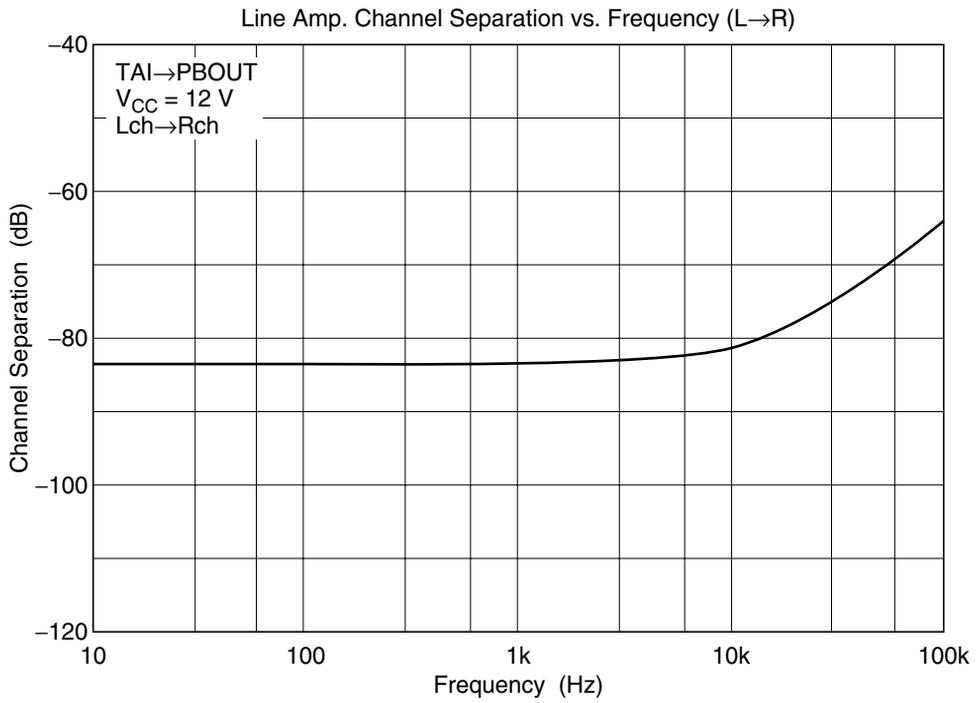


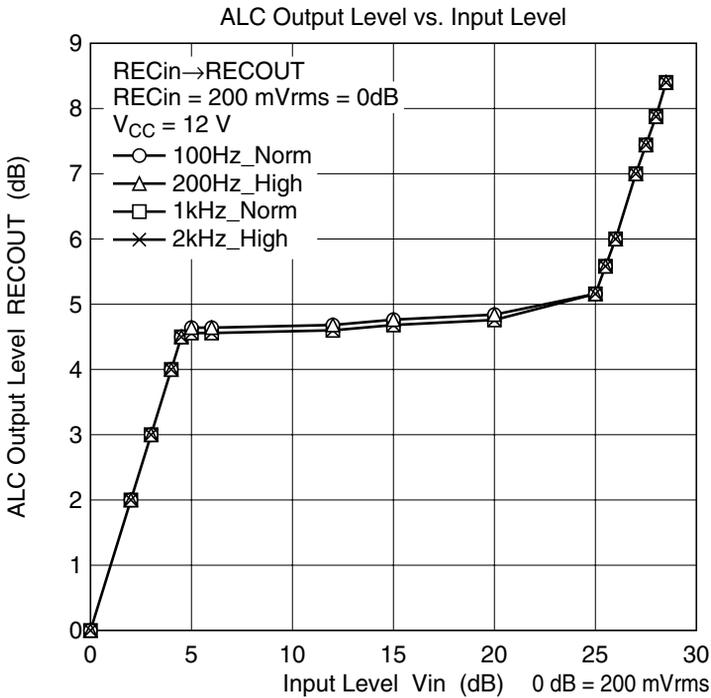
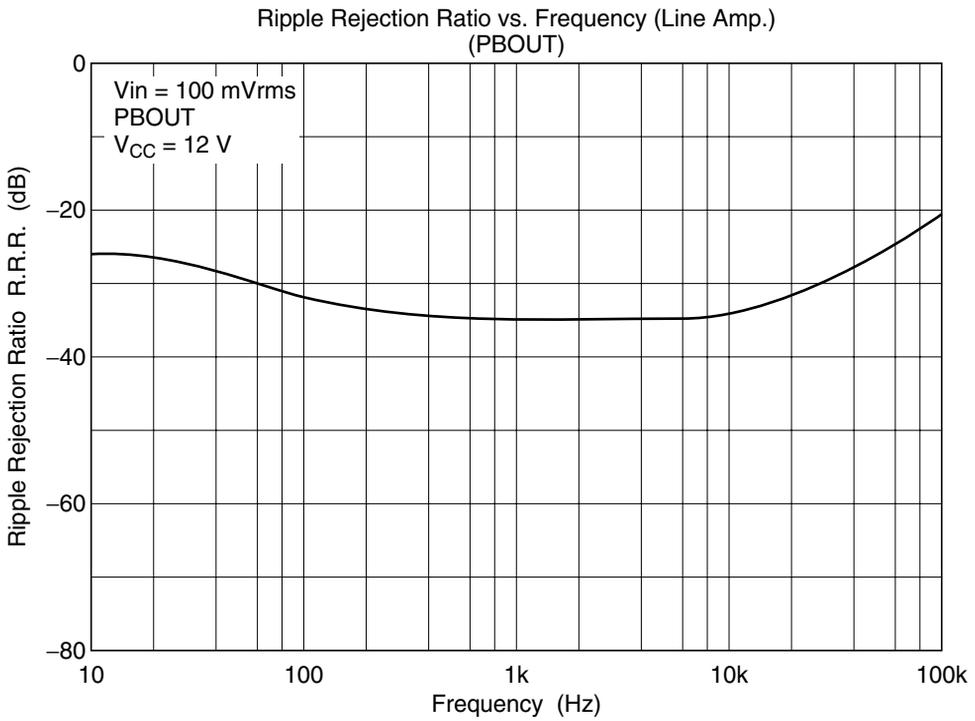


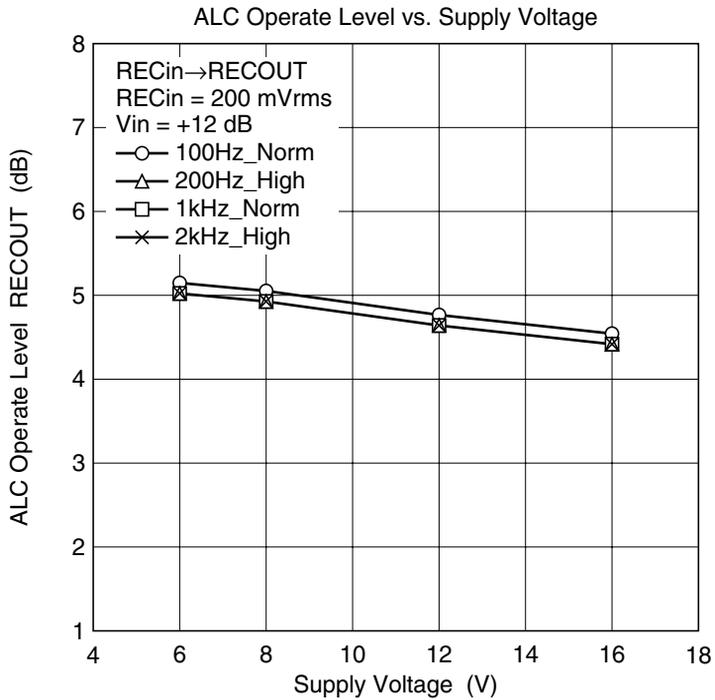
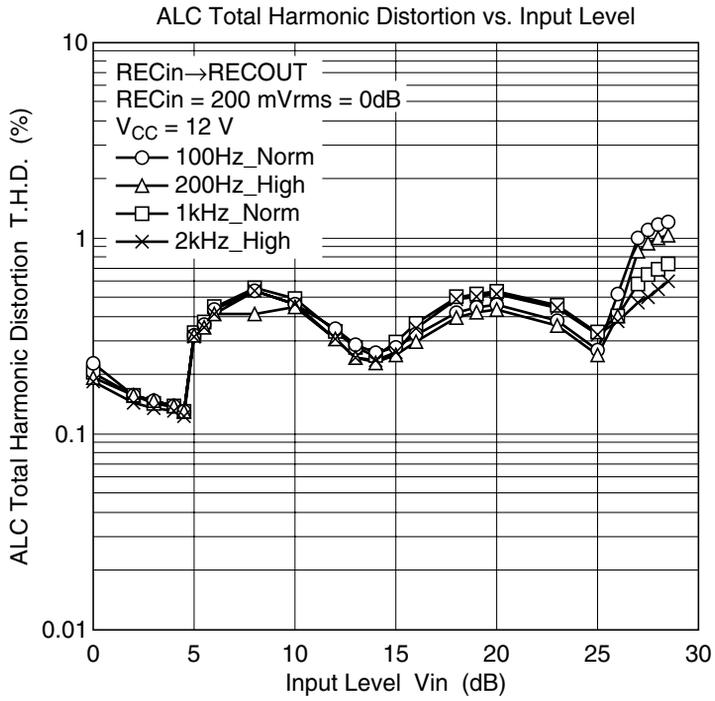


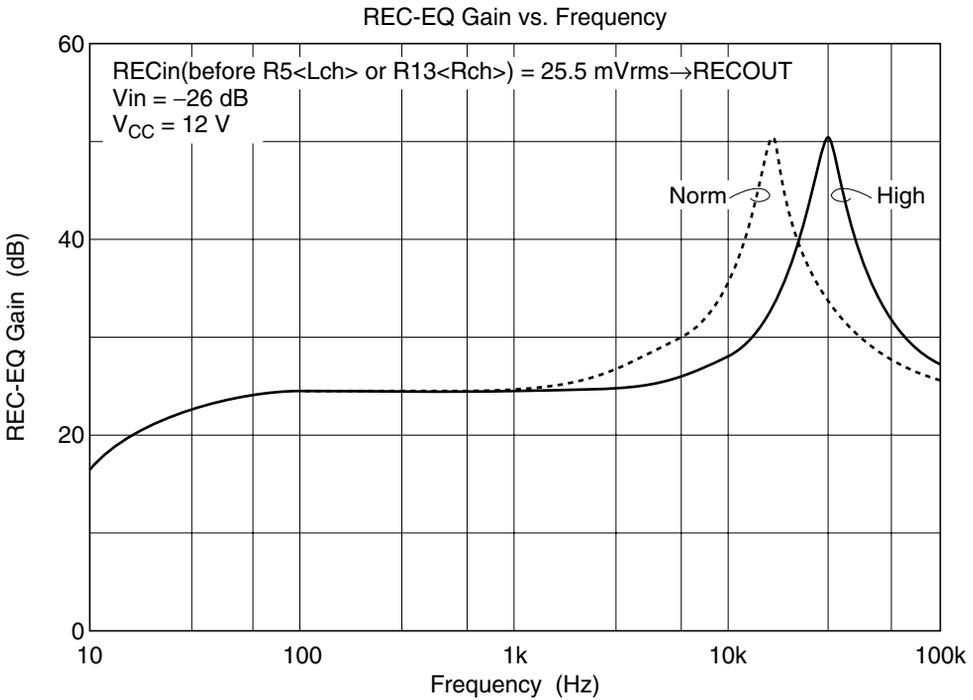
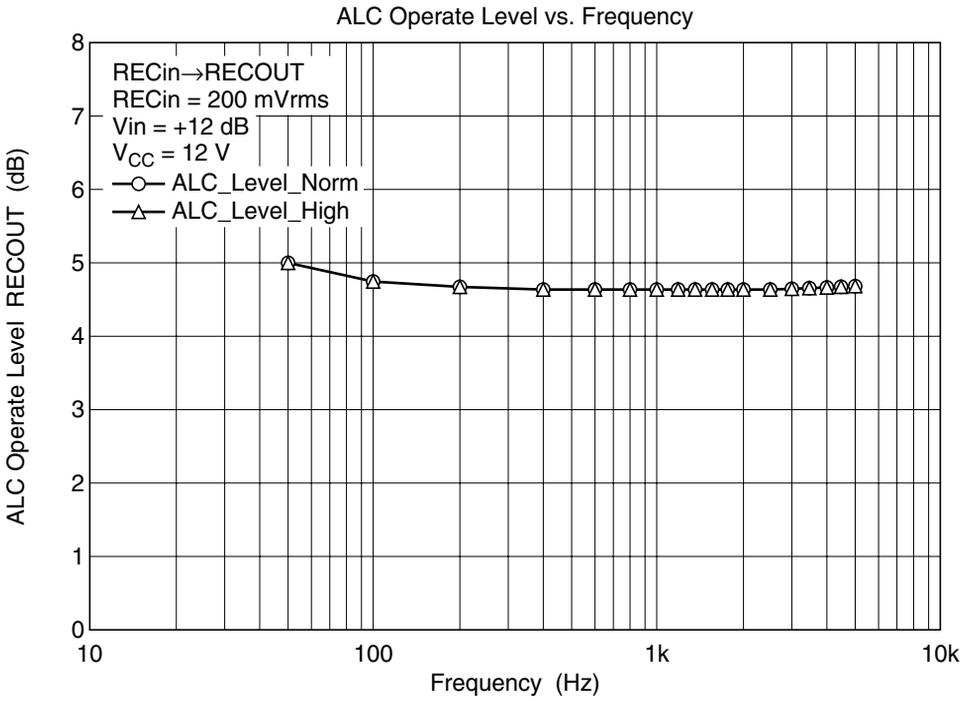


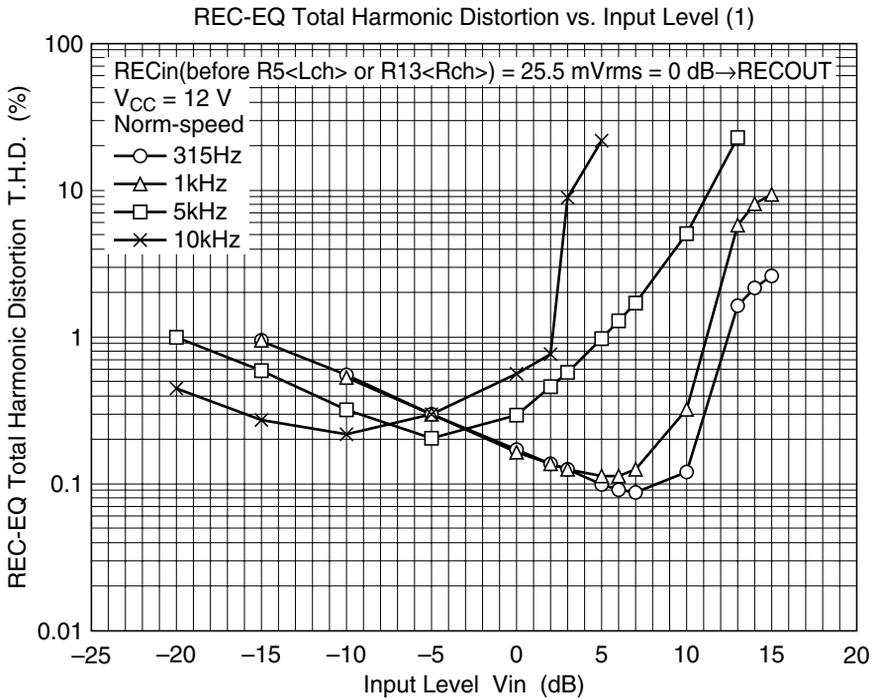
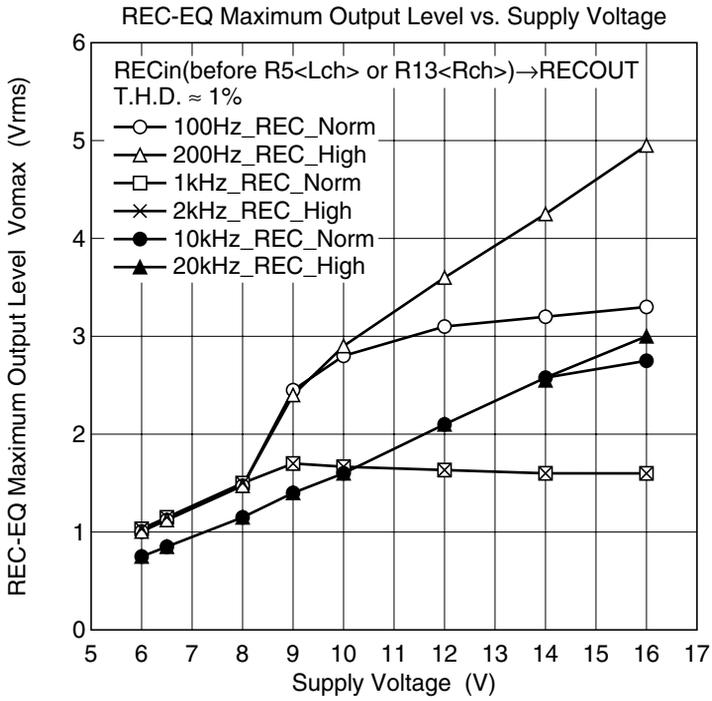


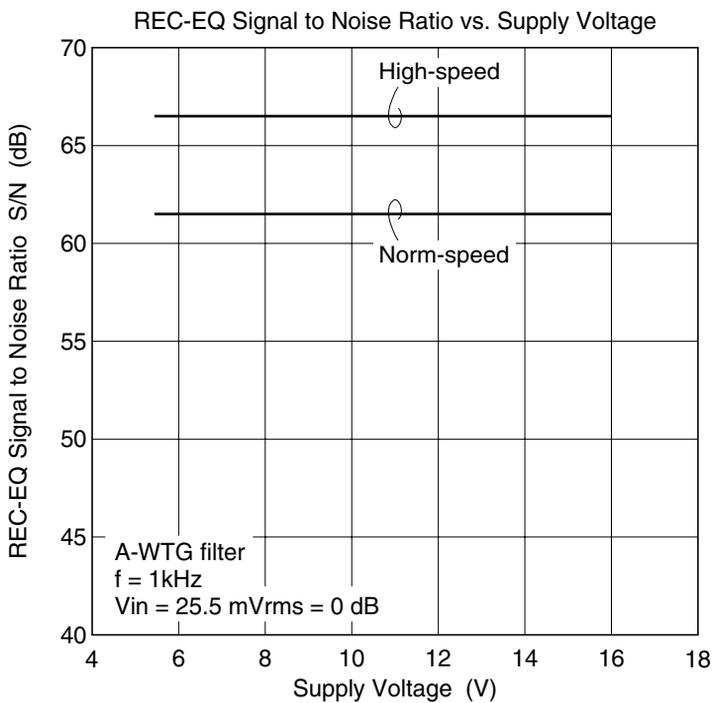
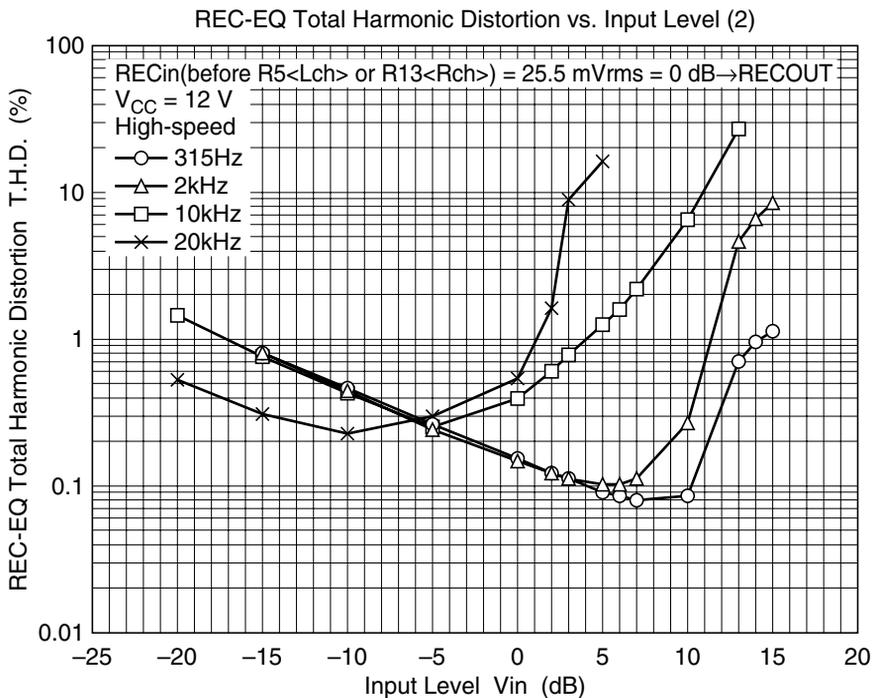


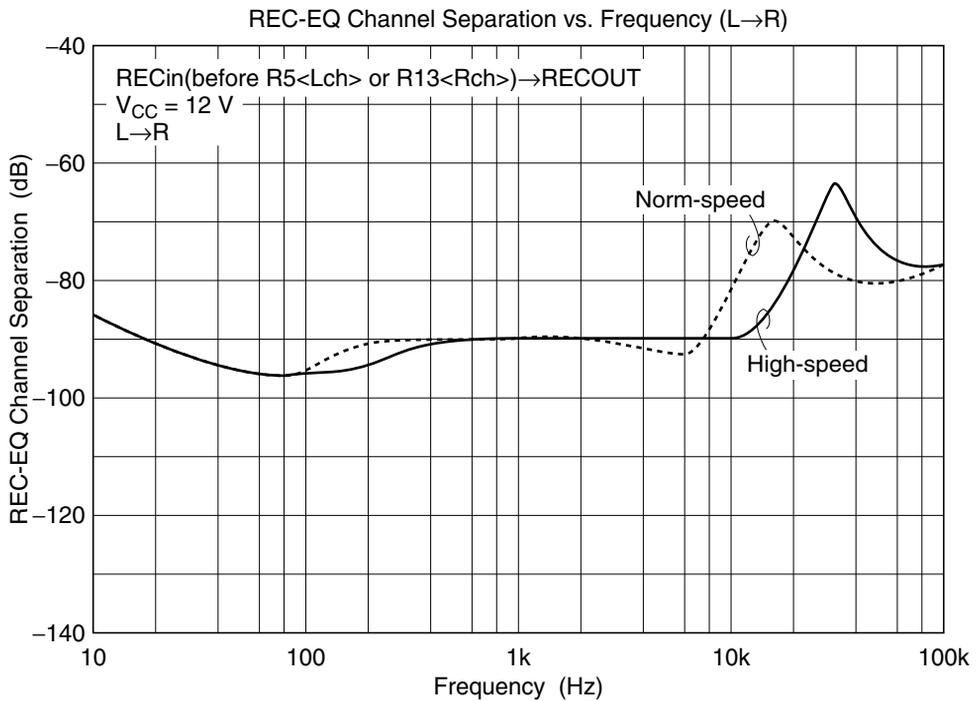
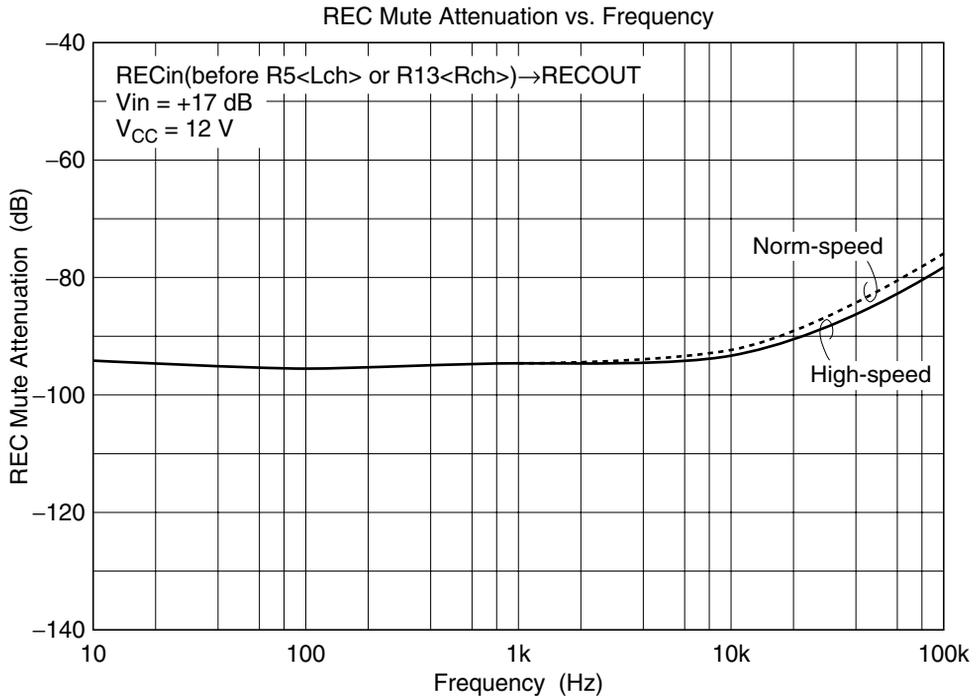


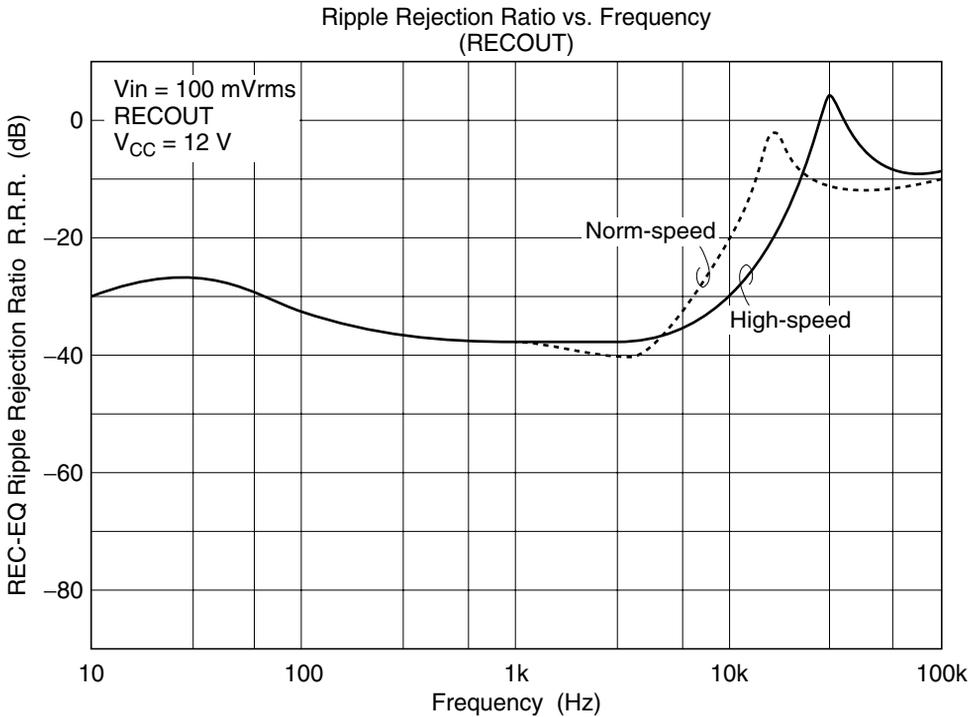
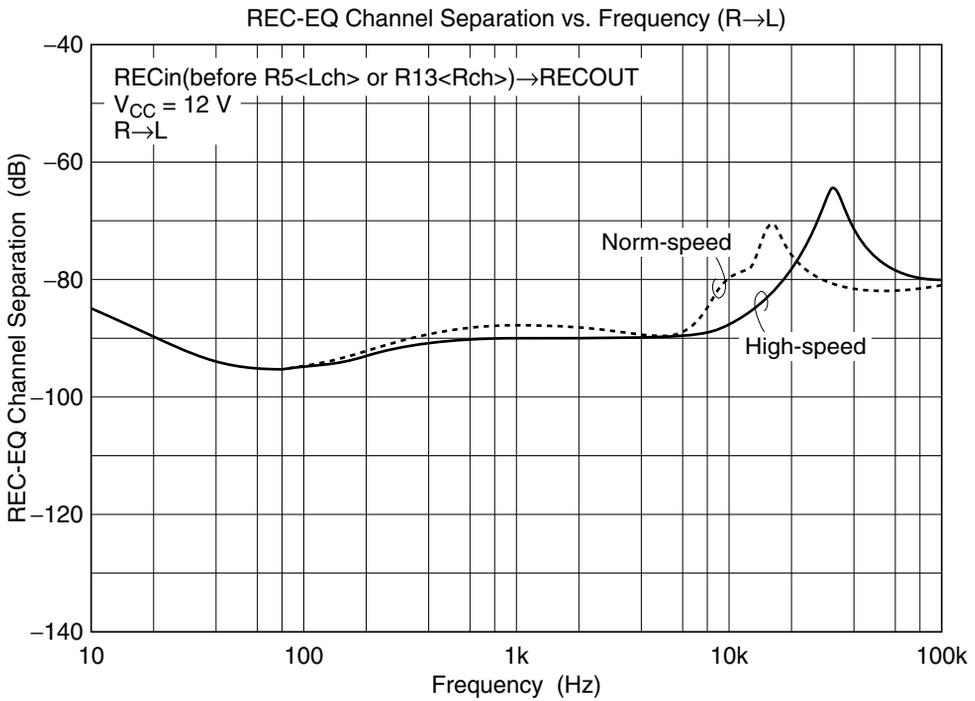


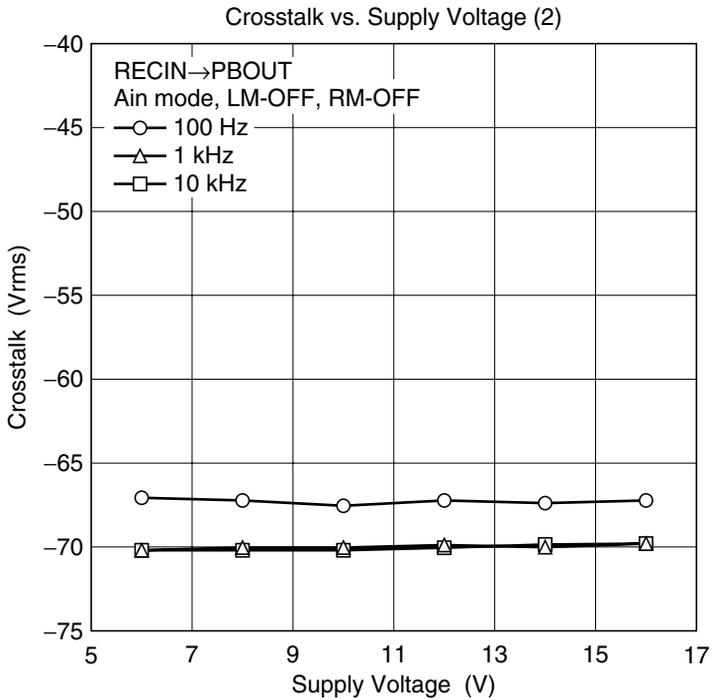
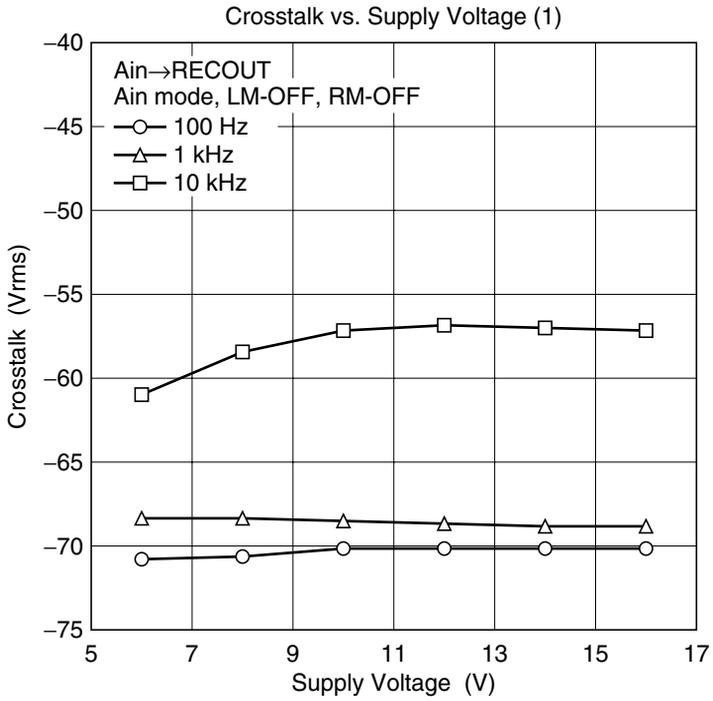


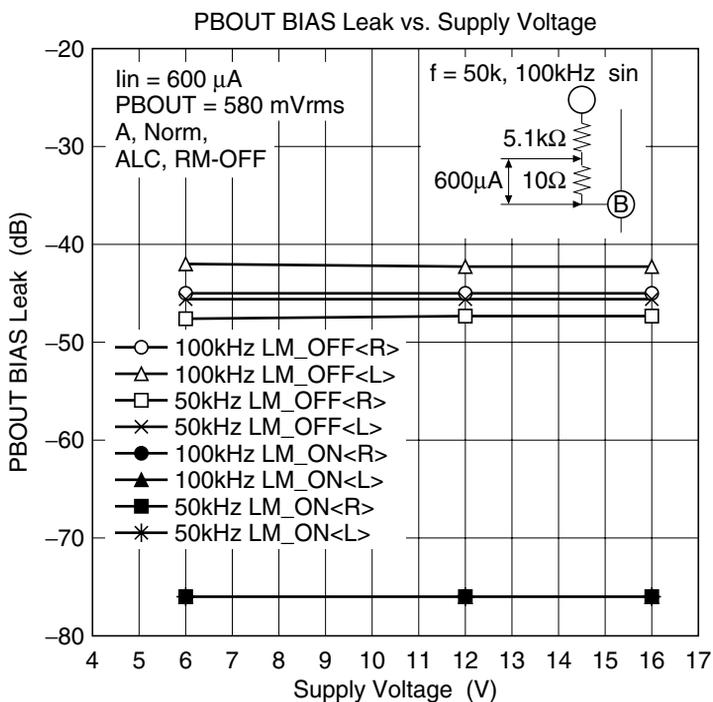
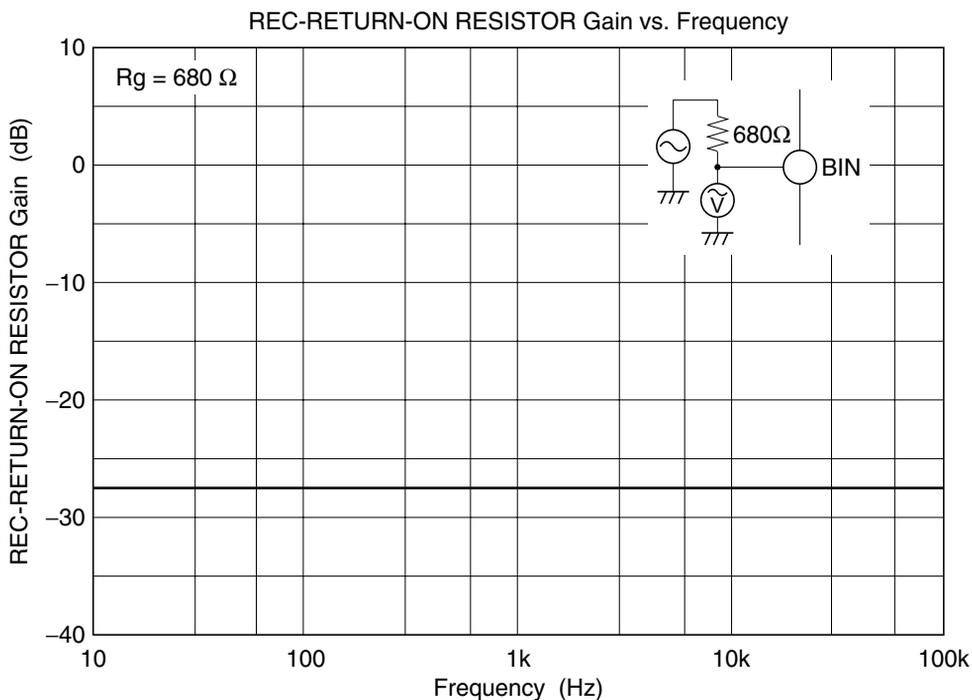








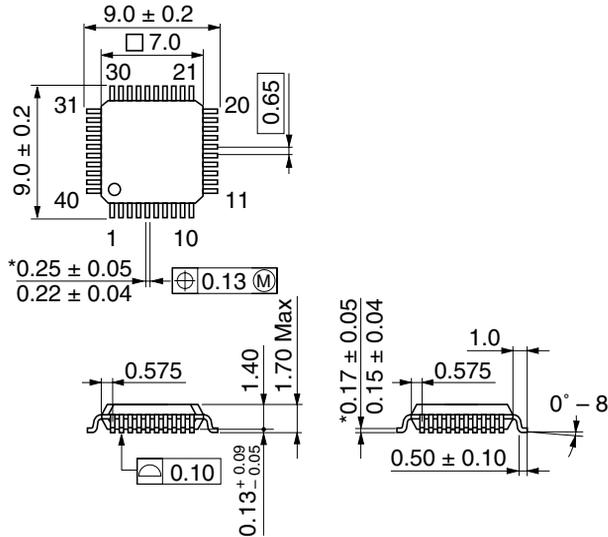




Package Dimensions

As of July, 2001

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-40B
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.2 g

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