To all our customers

Regarding the change of names mentioned in the document, such as Hitachi Electric and Hitachi XX, to Renesas Technology Corp.

The semiconductor operations of Mitsubishi Electric and Hitachi were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Hitachi, Hitachi, Ltd., Hitachi Semiconductors, and other Hitachi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Renesas Technology Home Page: http://www.renesas.com

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

Cautions

Keep safety first in your circuit designs!

1. Renesas Technology Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corporation product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corporation or a third party.
2. Renesas Technology Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors.
   Renesas Technology Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corporation by various means, including the Renesas Technology Corporation Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corporation is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
   Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corporation for further details on these materials or the products contained therein.

HA12211NT

Audio Signal Processor for Cassette Deck (Deck 1 Chip)

ADE-207-223A (Z)

2nd. Edition
June 1997

Description

HA12211NT is silicon monolithic bipolar IC providing REC equalizer system, PB equalizer system and each electronic control switch in one chip.

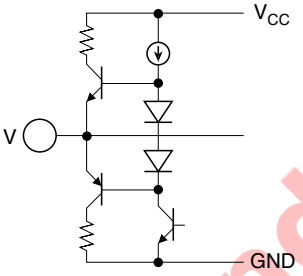
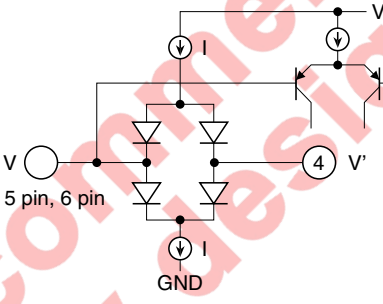
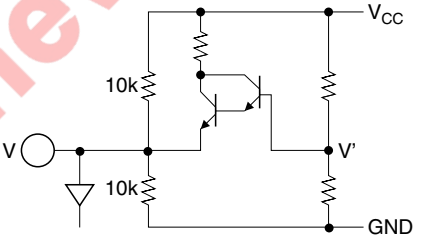
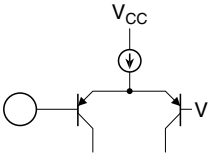
Functions

- PB equalizer × 2 channel
- REC equalizer × 2 channel
- Each electronical control switch to change equalizer characteristics
- REC mute
- REC head return switch

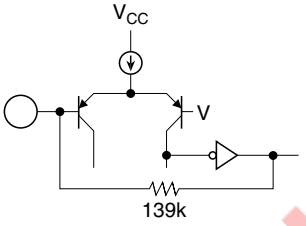
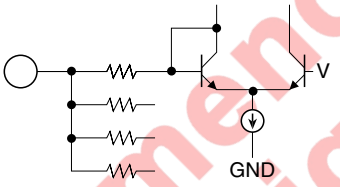
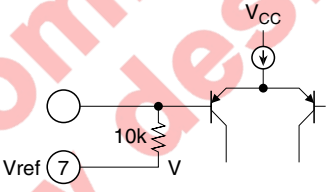
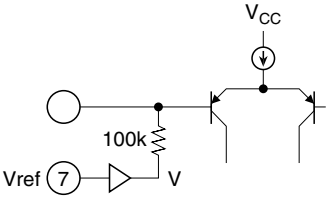
Features

- REC equalizer is very small number of external parts.(4 types of frequency characteristics built-in)
- PB equalizer built-in. (A/B input changing system, 4 types of frequency characteristics)
- Independent PB sensitivity for A deck, B deck.
- Normal-speed/high-speed, normal tape/chrome tape switching built-in.
- Controllable from direct micro-computer output.
- Available to reduce substrate-area because of high integration and small external parts.

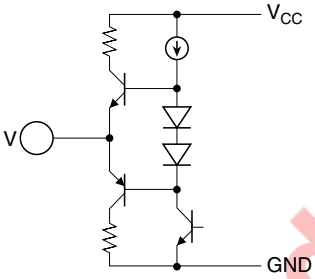
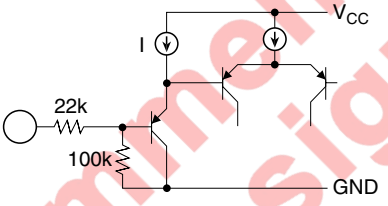
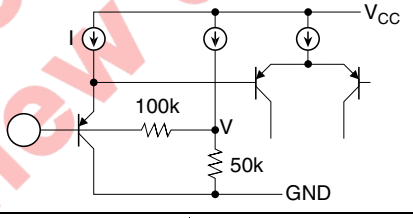
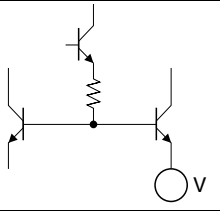
Pin Description, Equivalent Circuit (V_{CC} = 10.5V, Vref = 5.25V, Ta = 25°C, No signal, The value in the table show typical value.)

Pin No.	Pin Name	Note	Equivalent Circuit	Pin Description
1	V_{CC}	V = V_{CC}		V_{CC} Pin
2	RECOUT (L)	V = Vref		REC-EQ output
3	RECOUT (R)			
4	REC-RETURN	V = Vref V' = Vref		REC Return
5	PB-IN B (L)			PB B Deck input
6	PB-IN B (R)			
7	VREF	V = Vref V' = V_{CC} / 2		Reference
8	PB-IN A(L)	V = Vref		PB A Deck input
9	PB-IN A(R)			

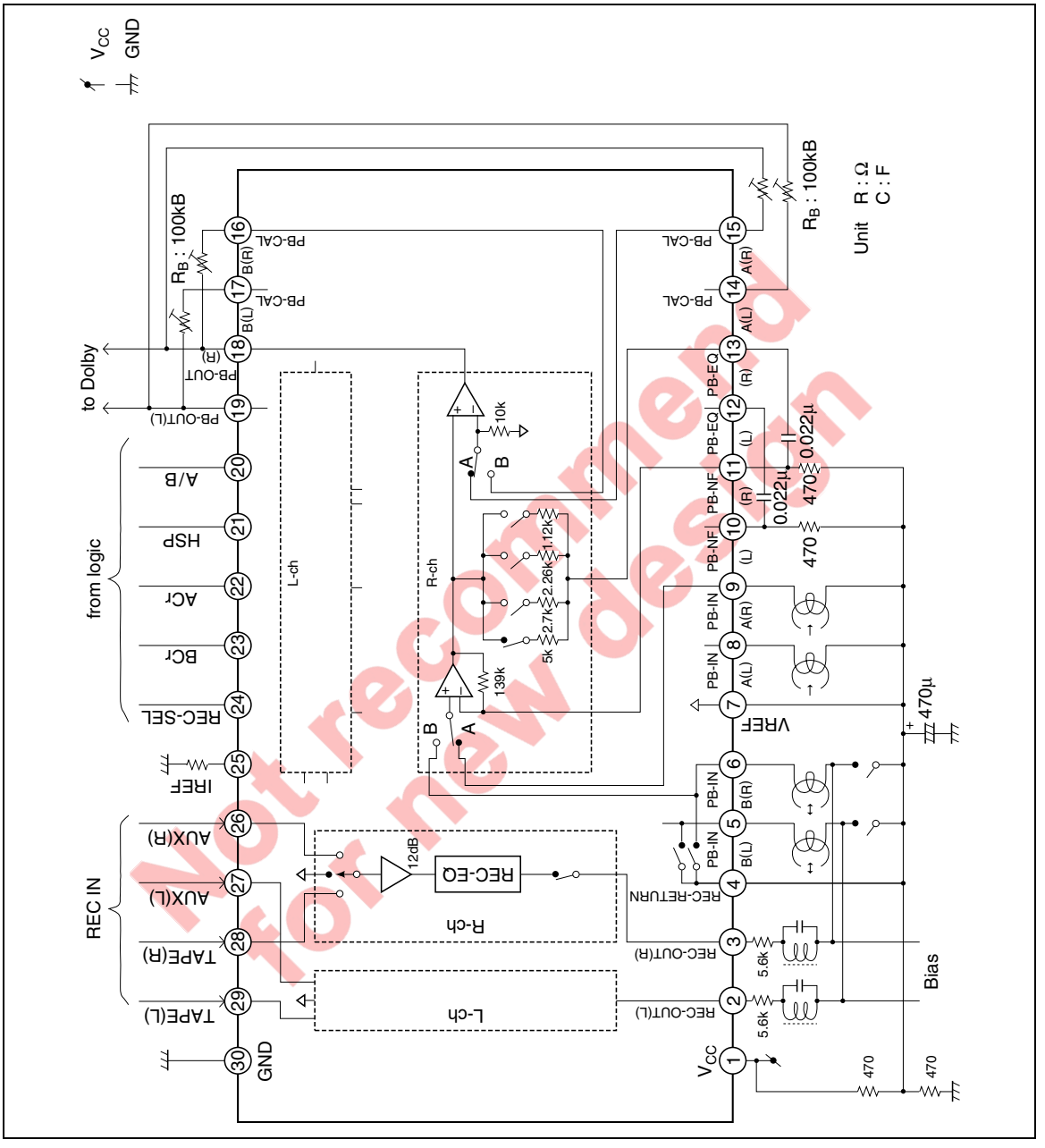
Pin Description, Equivalent Circuit (V_{CC} = 10.5V, Vref = 5.25V, Ta = 25°C, No signal, The value in the table show typical value.) (cont)

Pin No.	Pin Name	Note	Equivalent Circuit	Pin Description
10	PB-NF (L)	V = Vref		PB EQ Feed back
11	PB-NF (R)			
12	PB-EQ (L)	V = Vref		NAB Output
13	PB-EQ (R)			
14	PB-Cal A(L)	V = Vref		Feed back input for gain adjustment
15	PB-Cal A(R)			
16	PB-Cal B(R)			
17	PB-Cal B(L)			
26	AUX (R)	V = Vref		REC-EQ input
27	AUX (L)			
28	TAPE (R)			
29	TAPE (L)			

Pin Description, Equivalent Circuit (V_{CC} = 10.5V, Vref = 5.25V, Ta = 25°C, No signal, The value in the table show typical value.) (cont)

Pin No.	Pin Name	Note	Equivalent Circuit	Pin Description
18	PBOUT (R)	V = Vref		PB output
19	PBOUT (L)			
20	A/B	I = 20µA		Mode control input
21	HSP			
22	Acr			
23	Bcr			
24	REC-SEL	I = 20µA V = 2.5V		Mode control input
25	IREF	V = 1.2V		Equalizer reference current input
30	GND			GND Pin

Block Diagram



Parallel Data Format

Pin No.	Pin Name	L	M	H
22	A CrO2	*1, *3	—	*1
23	B CrO2	*1, *2, *3	—	*1, *2
21	HSP	Normal speed *3	—	Hi speed
20	A/B	Ain active *1, *3	—	Bin active *1
		Return SW ON *3	—	Return SW OFF
		REC OUT active *3	—	REC OUT Hiz
24	REC IN SEL	TAPE	MUTE *3	AUX

Note: 1. PB-EQ LOGIC

		HSP			
		L		H	
		A/B			
A CrO2	B CrO2	L	H	L	H
L	L	120µ	120µ	60µ	60µ
L	H	120µ	70µ	60µ	35µ
H	L	70µ	120µ	35µ	60µ
H	H	70µ	70µ	35µ	35µ

2. REC-EQ LOGIC

	HSP	
B CrO2	L	H
L	Normal speed TAPE I	High speed TAPE I
H	Normal speed TAPE II	High speed TAPE II

3. Unforced pin state

Functional Description

Power Supply Range

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

Table 1 Spply Voltage

Item	Power Supply Range
Single Supply	9.5V to 15.0V

Reference Voltage

So little is the current drivability of AC reference (Vref) that the Vref voltage may be altered by A/B switching of PB-EQ.

Provided it causes you anxiety, please use the constant 1/2 V_{CC} voltage circuit, for example, figure 1.

In addition, this IC has a capacitor charger for Vref pin.

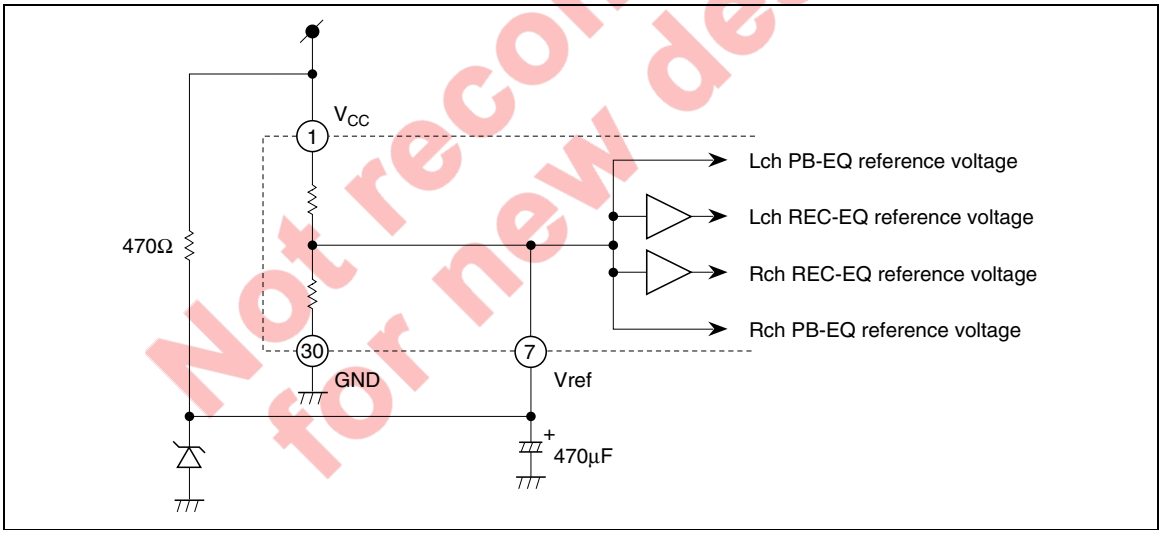


Figure 1 Reference Voltage Circuit

Operating Mode Control

This IC provides fully electronic switching circuits. And each operating mode control is controlled by parallel data (DC voltage).

Table 2 Threshold Voltage (Vth)

Pin No.	Lo	Mid	Hi	Unit	Test Condition
20, 21, 22, 23	0.0 to 2.5	—	4.0 to V_{CC}	V	Input Pin — Measure — V
24	0.0 to 1.0	2.0 to 3.0	4.0 to V_{CC}	V	

Note: 1. 20 to 23 pins are pulled down Lo level, and 24 pin is pulled to Mid level by the inside resistor 100kΩ.
2. Over shoot level and under shoot level of input signal must be the standardized. (High: V_{CC}, Low: –0.2V)

Block Diagram

This IC can be constructed for simple system which has little external parts by used the head serving both as Recording and Play back because of REC return SW built-in.

With output Hi-Z of REC-EQ and input muting, this IC is realized not only REC mute attenuation sufficiently but reducing pop noise in REC muting.

Note: Referring to Parallel Data Format also.

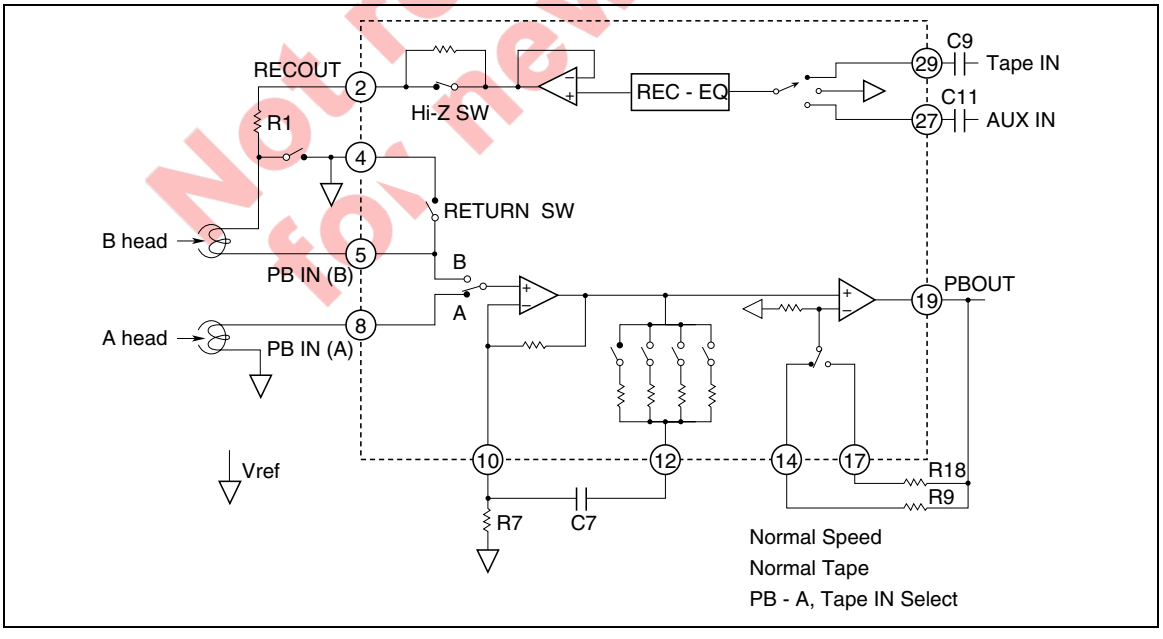


Figure 2 Block Diagram (Lch)

Level Diagram

It is the target that total play back output level is adjusted to 300mV; Dolby level, which the PB system gain in all is included of external amplifier's (Dolby IC etc.) as follows figure 3. Though A head adjustment is independent of B, select the value of R9, R18 adequately.

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

The level diagram at 1kHz is shown by figure 4.

Note: 1. R1 needs the value more than 1kHz.

2. Depending on the employed REC/PB head and test tape characteristics, there is rare case that the REC-EQ frequency characteristics of this IC can not be matched to the required characteristics because of built-in resistors which determined the REC-EQ parameters in this case, please inquire the responsible agent because of the adjustment of built-in resistors is necessary.

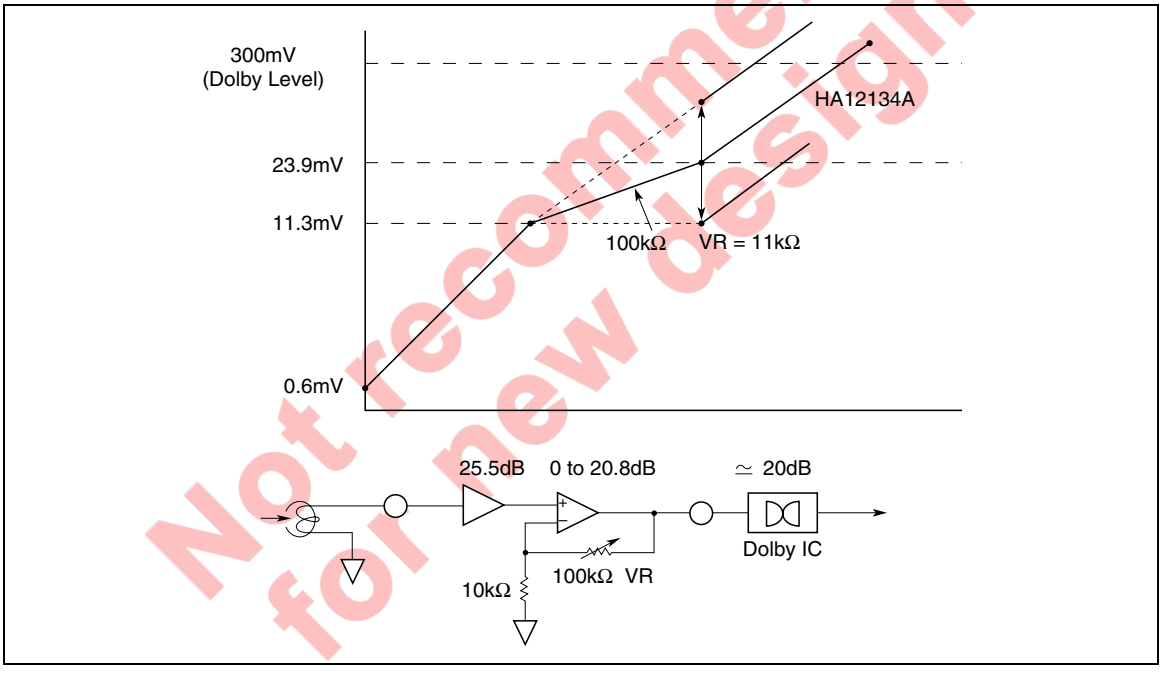


Figure 3 PB Level Diagram (Normal Speed, Normal Tape, 1kHz)

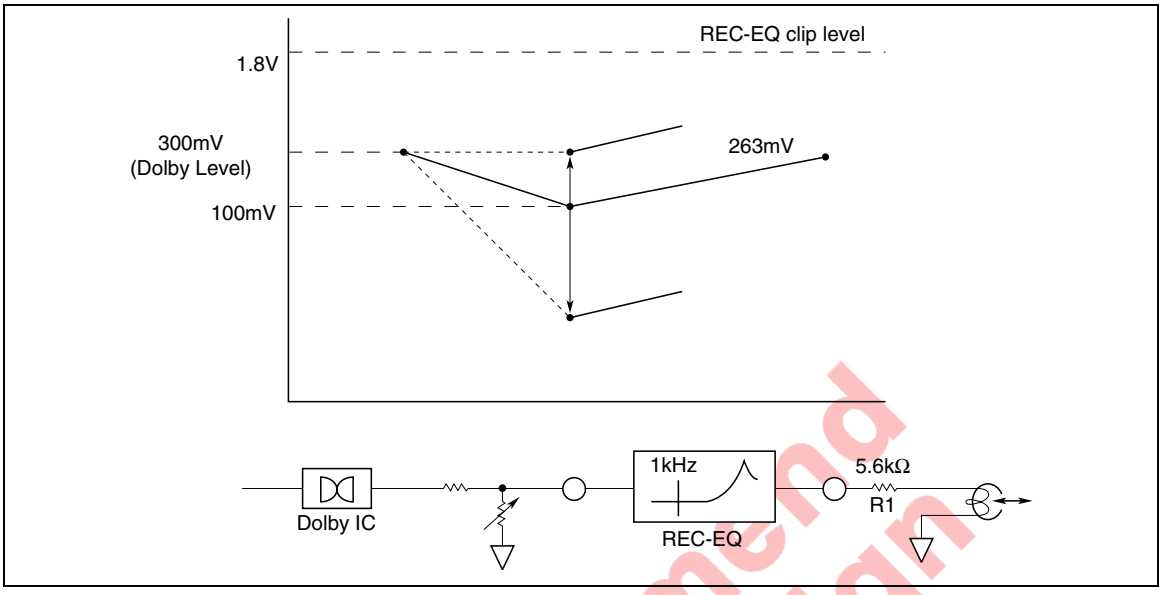


Figure 4 REC Level Diagram (Normal Speed, Normal Tape, 1kHz)

Absolute Maximum Rating (Ta = 25°C)

Item	Symbol	Rating	Unit	Note
Max supply voltage	V_{CC} max	16	V	
Power dissipation	P_d	500	mW	Ta ≤ 75°C
Operating temperature	Topr	–40 to +75	°C	
Storage temperature	Tstg	–55 to +125	°C	
Operating voltage	Vopr	9.5 to 15	V	

Electrical Characteristics (Ta = 25°C, V_{CC} = 10.5V, Vref = 5.25V, PB-EQ standard DC gain 55.9dB (R9, R10, R18, R19 = 11.0kΩ))

						Test Condition								Application Terminal				
						IC Condition								Input		Output		
Item	Symbol	Min	Typ	Max	Unit	A/B	HSP	A CrO2	B CrO2	REC IN SEL	fin (Hz)	Vin (mVrms)	Other	R	L	R	L	COM
Quiescent current	I_Q	16.0	22.8	32.0	mA	A	Norm	TYPE I	TYPE I	Mute	—	—	No signal					1
Logical threshold	$V_{IL}1$	–0.2	—	2.5	V	—	—	—	—	—	—	—						20 to 23
	$V_{IL}2$	–0.2	—	1.0	V	—	—	—	—	—	—	—						24
	V_{IM}	2.0	—	3.0	V	—	—	—	—	—	—	—						24
	V_{IH}	4.0	—	V_{CC}	V	—	—	—	—	—	—	—						20 to 24
PB-REC Crosstalk	CT PB/REC(1)	50	60	—	dB	A/B	Norm	TYPE I	TYPE I	Tape/ AUX	1k	*1		27/ 29	26/ 28	18	19	
	CT PB/REC(2)	60	70	—	dB	A	Norm	TYPE I	TYPE I	Tape/ AUX	1k	*1		9	8	3	2	
PB-EQ Gain	G_V PB (1)	29.0	32.0	35.0	dB	A/B	Norm	TYPE I	TYPE I	Tape	1k	0.6		9/6	8/5	18	19	
	G_V PB (2)	25.0	28.0	31.0	dB	A/B	Norm	TYPE I	TYPE I	Tape	10k	0.6		9/6	8/5	18	19	
	G_V PB (3)	20.8	23.8	26.8	dB	A/B	Norm	TYPE II	TYPE II	Tape	10k	0.6		9/6	8/5	18	19	
	G_V PB (4)	19.4	22.4	25.4	dB	A/B	High	TYPE I	TYPE I	Tape	20k	0.6		9/6	8/5	18	19	
	G_V PB (5)	14.8	17.8	20.8	dB	A/B	High	TYPE II	TYPE II	Tape	20k	0.6		9/6	8/5	18	19	
PB-EQ Maximum output	Vomax PB	0.3	2.0	—	Vrms	A/B	Norm	TYPE I	TYPE I	Tape	1k	—	THD=1%*2	9/6	8/5	18	19	
PB-EQ THD	THD PB	—	0.1	0.5	%	A/B	Norm	TYPE I	TYPE I	Tape	1k	0.6		9/6	8/5	18	19	
PB-EQ Noise voltage	V_N PB	—	38	70	µVrms	A/B	Norm	TYPE I	TYPE I	Tape	—	—	Rg=820Ω, DIN-AUDIO	9/6	8/5	18	19	
PB-EQ Channel separation	CT R/L (1)	50	60	—	dB	A/B	Norm	TYPE I	TYPE I	Tape	1k	*1		8/5	9/6	18	19	
PB-EQ Crosstalk	CT A/B	60	70	—	dB	A	Norm	TYPE I	TYPE I	Tape	1k	*1		11	10	18	19	
						B								9	8			

Note: 1. Large level without clipping

2. V_{CC} = 9.5V, Vref = 4.75V, R9, R10, R18, R19 = 56kΩ

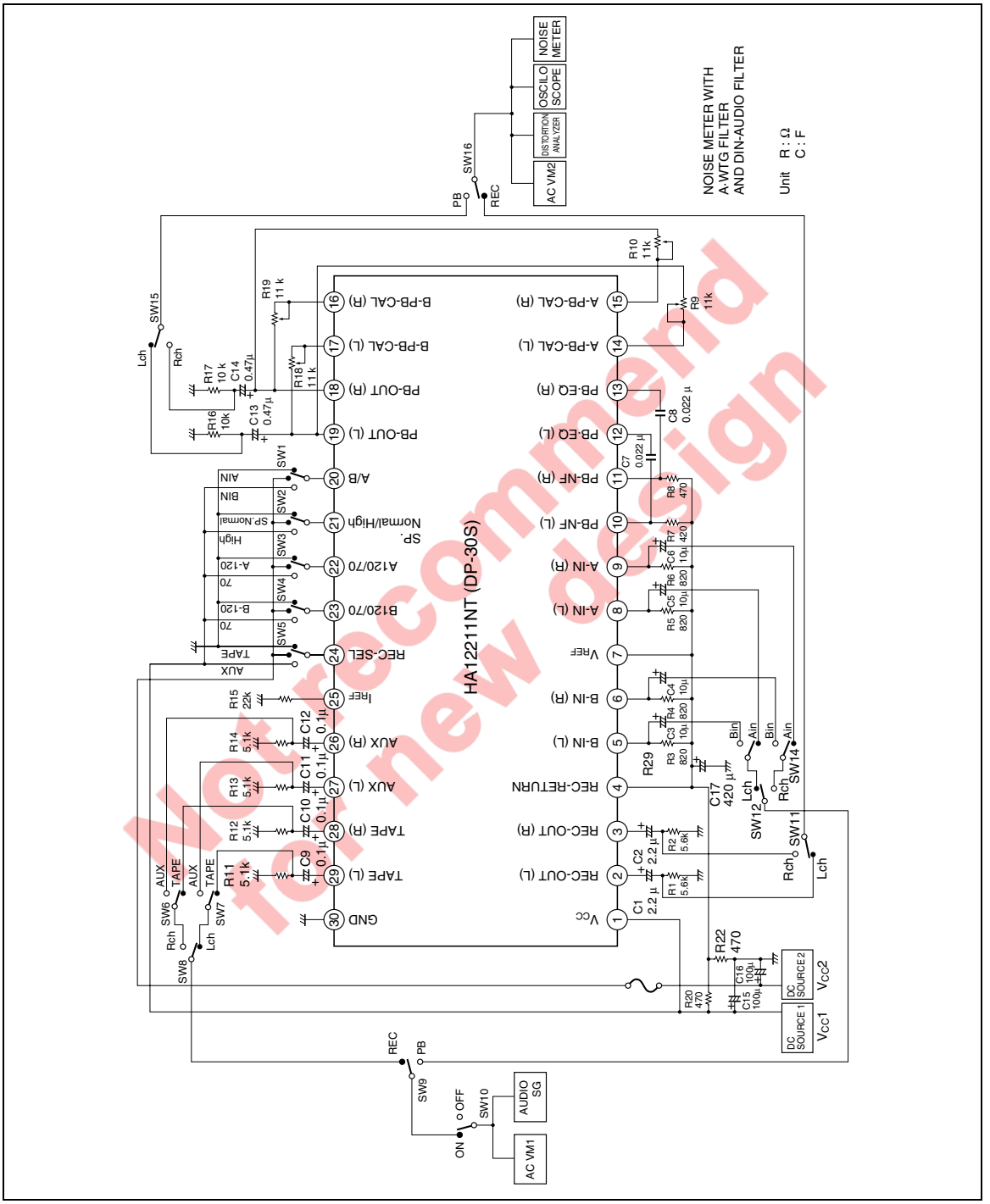
Electrical Characteristics (Ta = 25°C, V_{CC} = 10.5V, Vref = 5.25V, EQIN standard level = 100mV = 0dB) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test Condition: IC Condition A/B	HSP	A CrO2	B CrO2	REC IN SEL	fin (Hz)	Vin (mVrms)	Other	Application Terminal Input R	Input L	Output R	Output L	COM
REC-EQ Frequency response Normal speed TYPE I	G_V REC-NN 1	6.7	8.2	9.7	dB	A	Norm	TYPE I	TYPE I	Tape/AUX	1k	10		26/28	27/29	3	2	
	G_V REC-NN 2	9.3	11.3	13.3	dB	A	Norm	TYPE I	TYPE I	Tape/AUX	5k	10		26/28	27/29	3	2	
	G_V REC-NN 3	17.3	20.3	23.3	dB	A	Norm	TYPE I	TYPE I	Tape/AUX	10k	10		26/28	27/29	3	2	
REC-EQ Frequency response Normal speed TYPE II	G_V REC-NC 1	9.8	11.3	12.8	dB	A	Norm	TYPE I	TYPE II	Tape/AUX	1k	10		26/28	27/29	3	2	
	G_V REC-NC 2	14.2	16.2	18.2	dB	A	Norm	TYPE I	TYPE II	Tape/AUX	5k	10		26/28	27/29	3	2	
	G_V REC-NC 3	20.5	23.5	26.5	dB	A	Norm	TYPE I	TYPE II	Tape/AUX	10k	10		26/28	27/29	3	2	
REC-EQ Frequency response High speed TYPE I	G_V REC-HN 1	7.0	8.5	10.0	dB	A	High	TYPE I	TYPE I	Tape/AUX	2k	10		26/28	27/29	3	2	
	G_V REC-HN 2	10.9	12.9	14.9	dB	A	High	TYPE I	TYPE I	Tape/AUX	10k	10		26/28	27/29	3	2	
	G_V REC-HN 3	18.7	21.7	24.7	dB	A	High	TYPE I	TYPE I	Tape/AUX	20k	10		26/28	27/29	3	2	
REC-EQ Frequency response High speed TYPE II	G_V REC-HC 1	11.0	12.5	14.0	dB	A	High	TYPE I	TYPE II	Tape/AUX	2k	10		26/28	27/29	3	2	
	G_V REC-HC 2	16.2	18.2	20.2	dB	A	High	TYPE I	TYPE II	Tape/AUX	10k	10		26/28	27/29	3	2	
	G_V REC-HC 3	23.7	26.7	29.7	dB	A	High	TYPE I	TYPE II	Tape/AUX	20k	10		26/28	27/29	3	2	
REC-EQ Channel separation	CT R/L (2)	50	60	—	dB	A	Norm	TYPE I	TYPE I	Tape/AUX	1k	*1		26/28	27/29	3	2	
REC-EQ Crosstalk	CT Tape/AUX	50	60	—	dB	A	Norm	TYPE I	TYPE I	Tape / AUX	1k	*1		26/28	27/29	3	2	
REC-EQ Attenuation	R-MUTE ATT	70	80	—	dB	A	Norm	TYPE I	TYPE I	Mute	1k	*1		26/28	27/29	3	2	
REC-EQ Maximum output	Vomax REC	1.2	1.8	—	Vrms	A	Norm	TYPE I	TYPE I	Tape/AUX	1k	—	THD=1%*2	26/28	27/29	3	2	
REC-EQ THD	THD REC	—	0.35	0.7	%	A	Norm	TYPE I	TYPE I	Tape/AUX	1k	100		26/28	27/29	3	2	
REC-EQ S/N	S/N REC	52	56	—	dB	A	Norm	TYPE I	TYPE I	Tape/AUX	—	—	Rg=5.1kΩ, A-WTG	26/28	27/29	3	2	

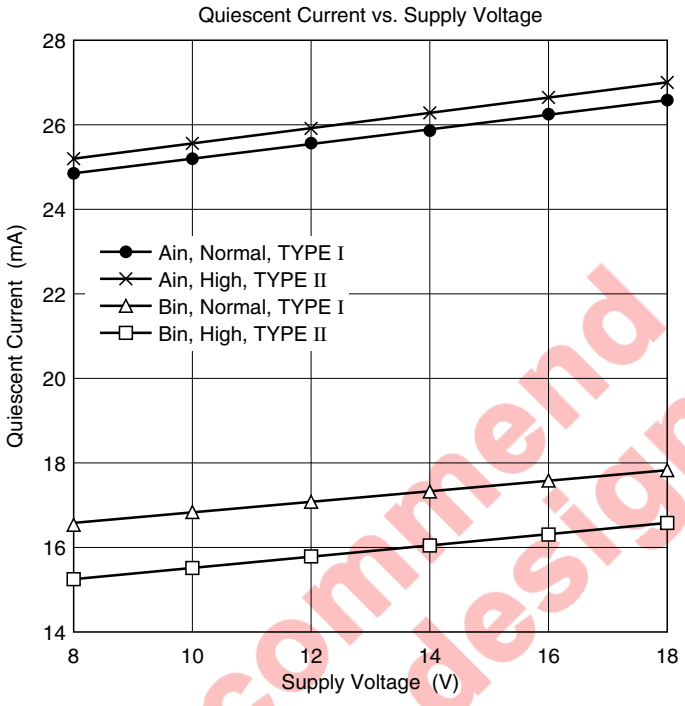
Note: 1. Large level without clipping

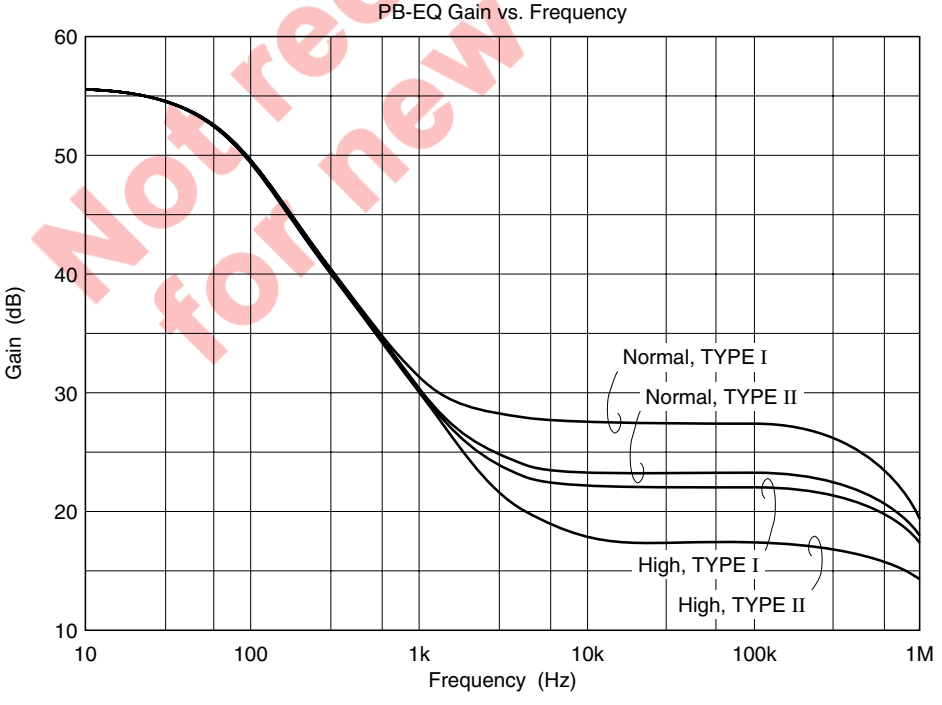
2. V_{CC} = 9.5V, Vref = 4.75V

Test Circuit

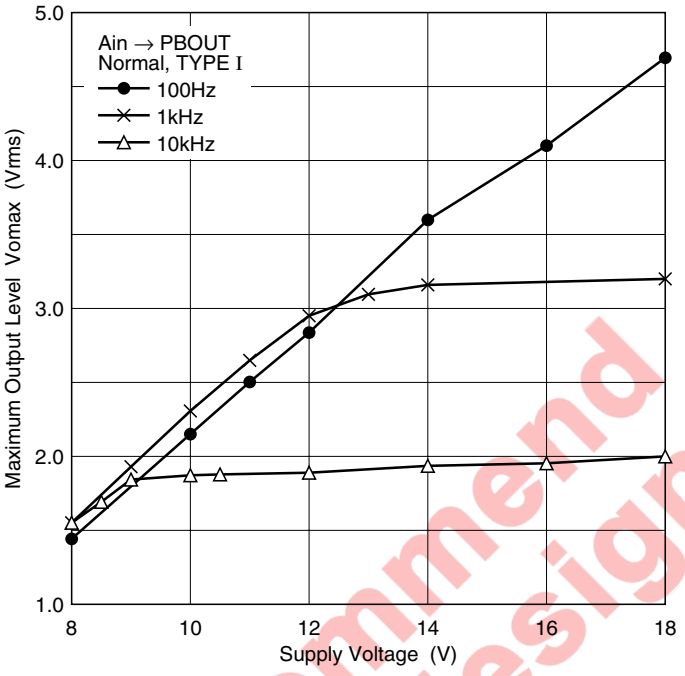


Characteristics Curve

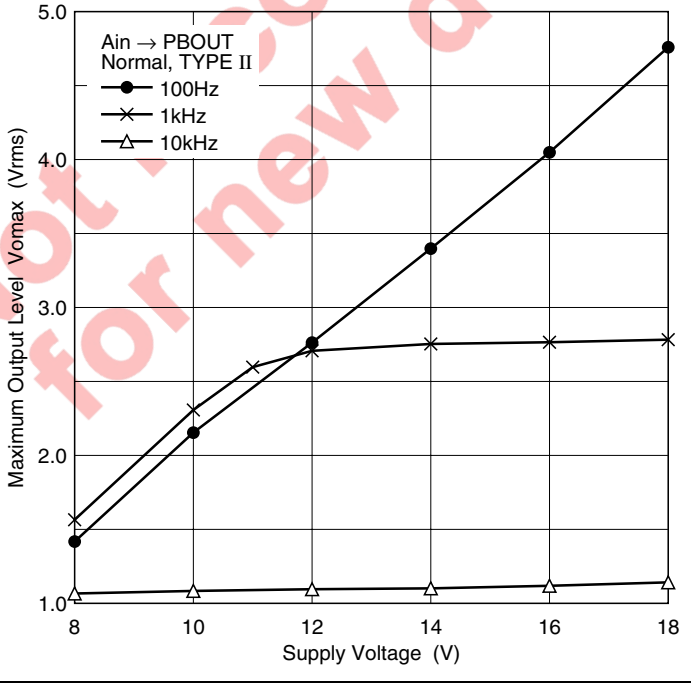




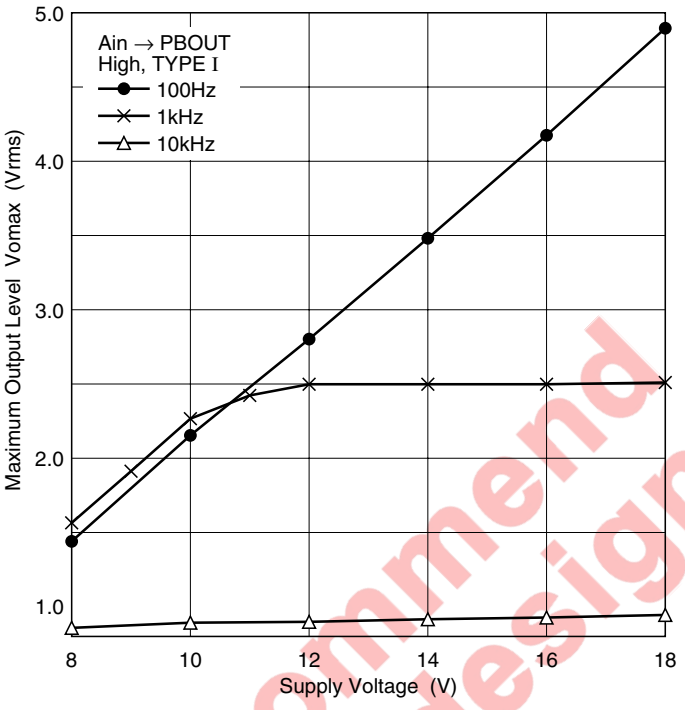
PB-EQ Maximum Output Level vs. Supply Voltage (1)



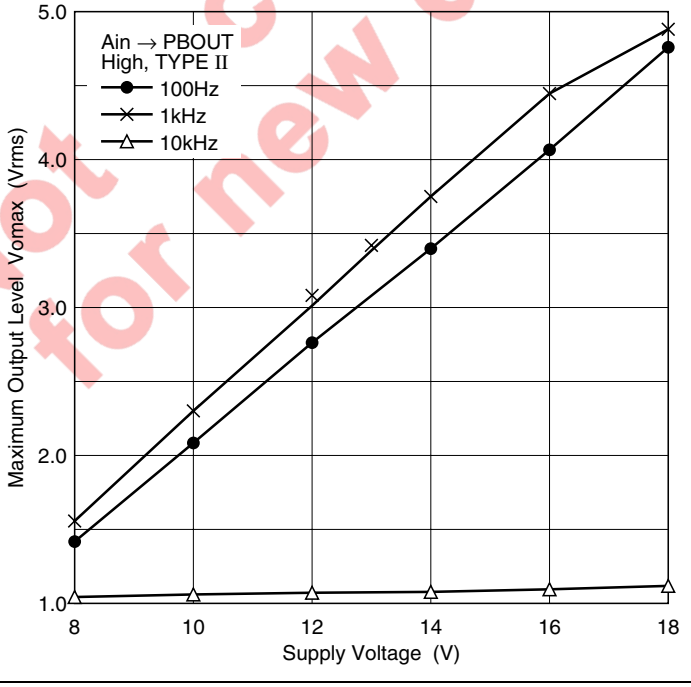
PB-EQ Maximum Output Level vs. Supply Voltage (2)



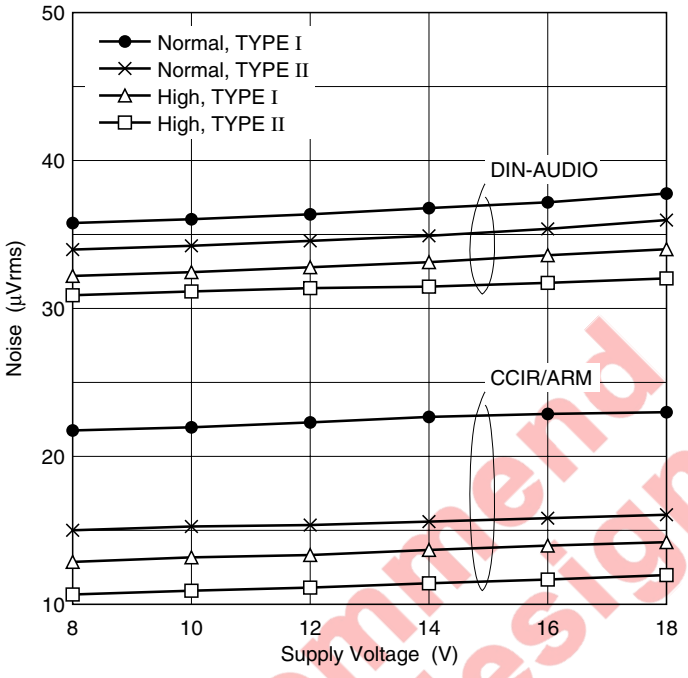
PB-EQ Maximum Output Level vs. Supply Voltage (3)



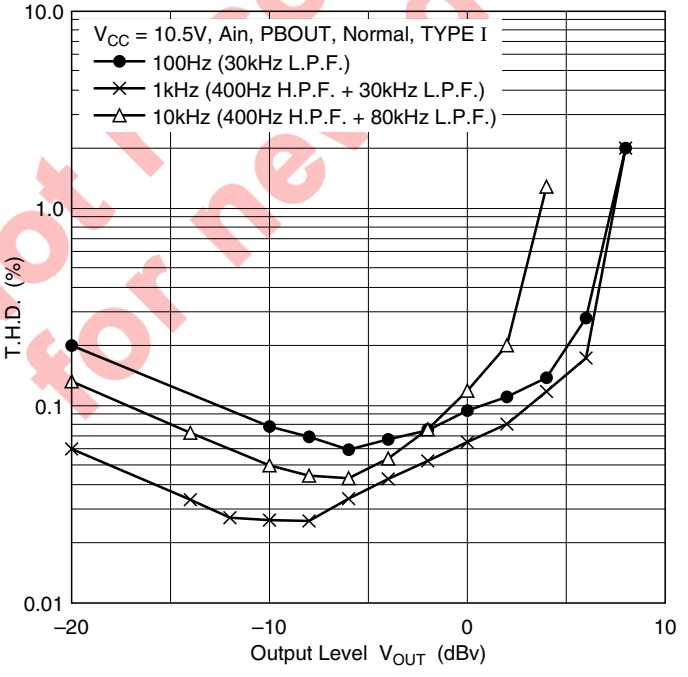
PB-EQ Maximum Output Level vs. Supply Voltage (4)



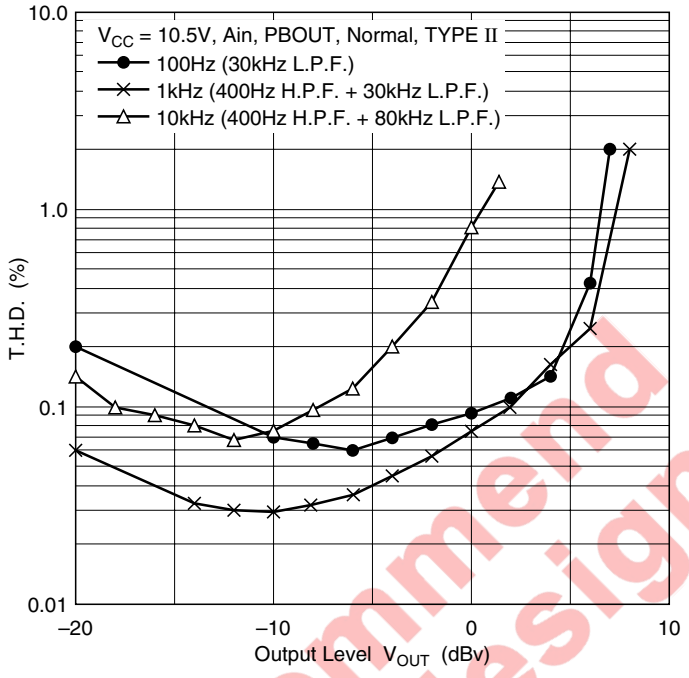
PB-EQ Noise vs. Supply Voltage



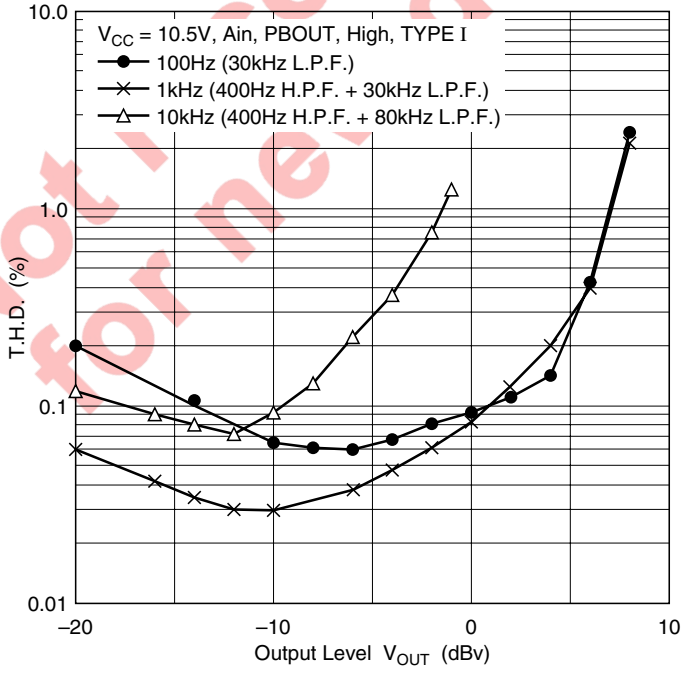
PB-EQ Total Harmonic Distortion vs. Output Level (1)



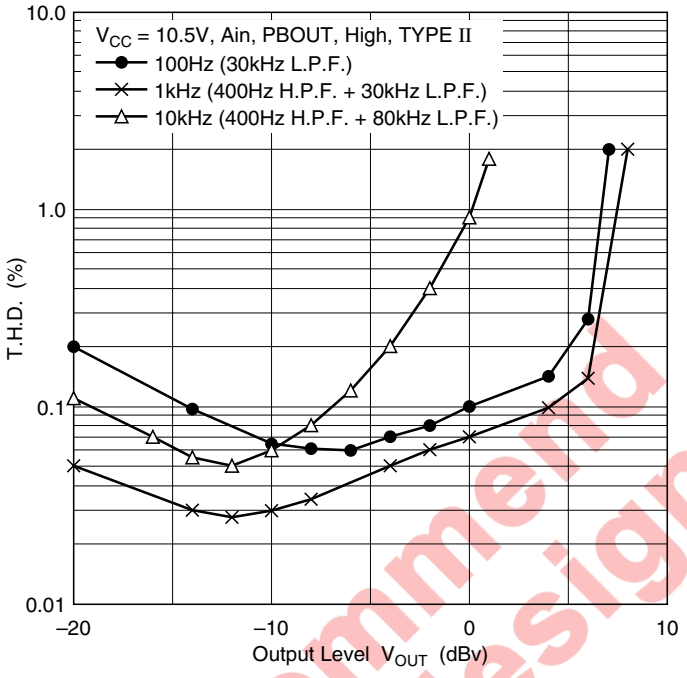
PB-EQ Total Harmonic Distortion vs. Output Level (2)



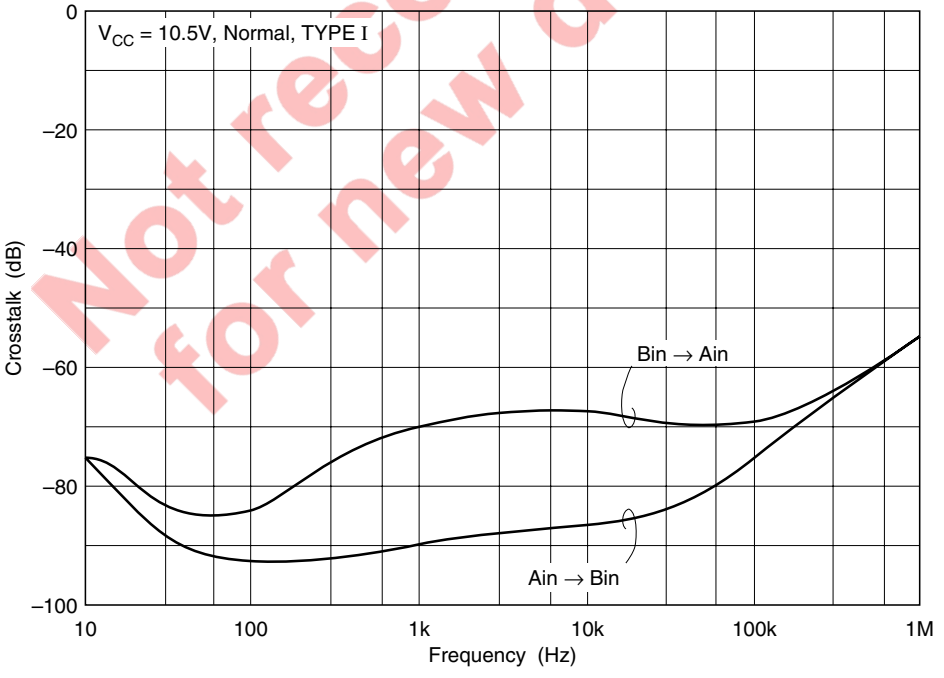
PB-EQ Total Harmonic Distortion vs. Output Level (3)



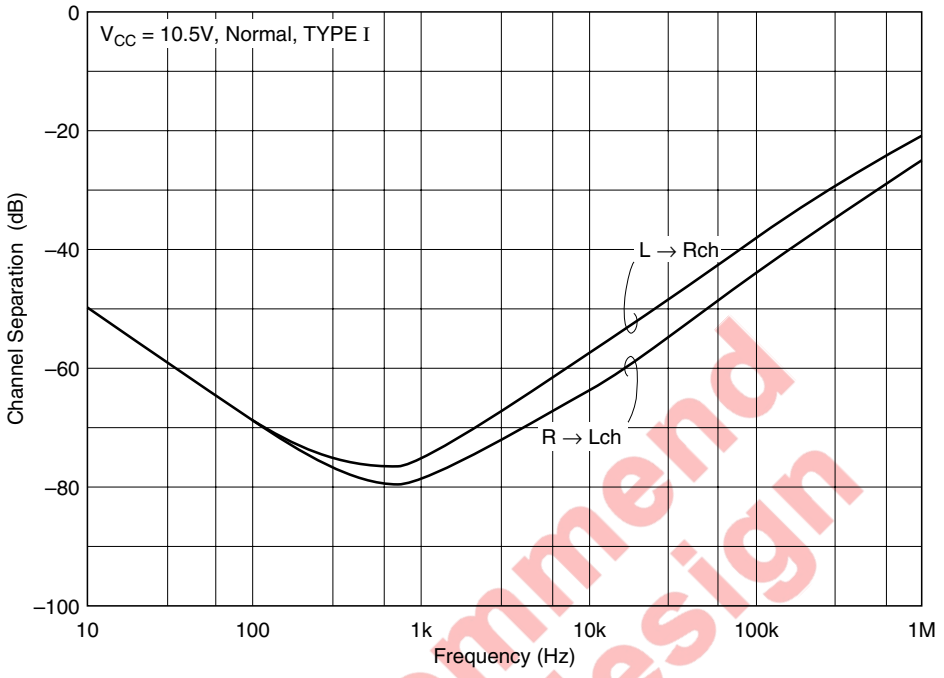
PB-EQ Total Harmonic Distortion vs. Output Level (4)



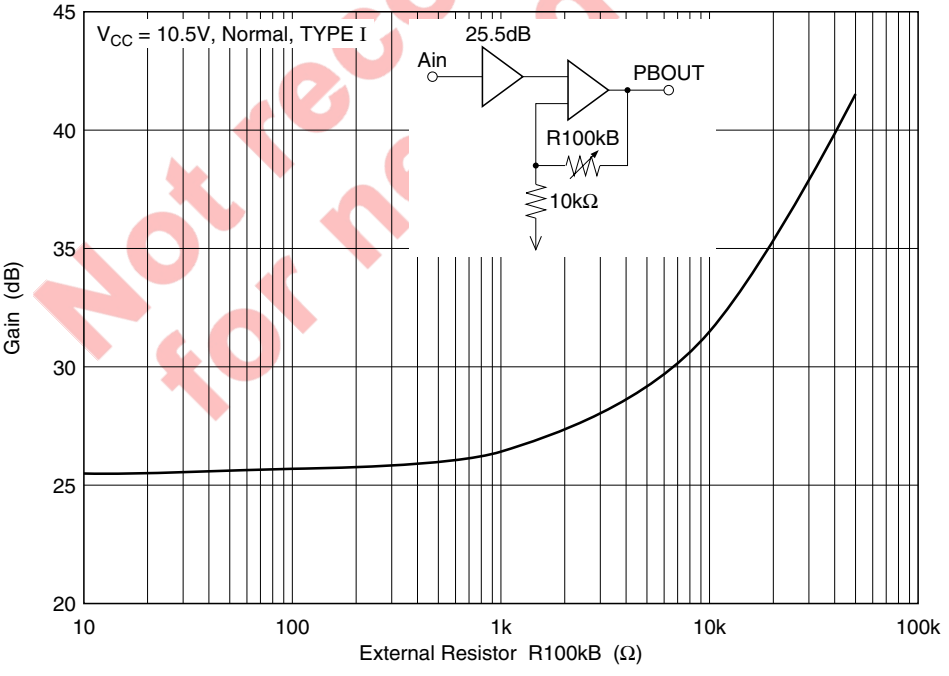
PB-EQ Crosstalk vs. Frequency



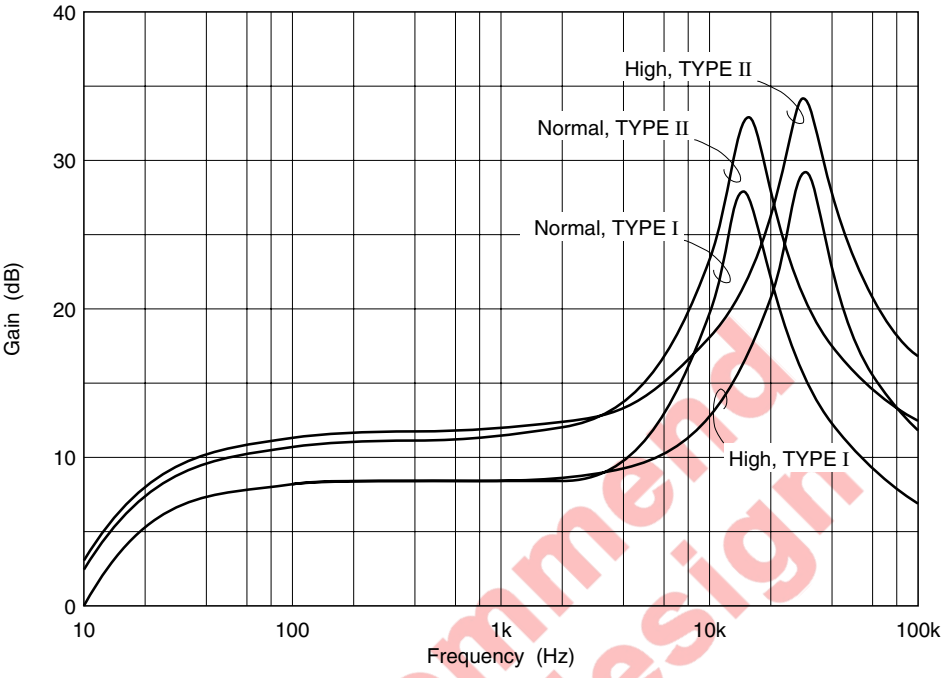
PB-EQ Channel Separation vs. Frequency



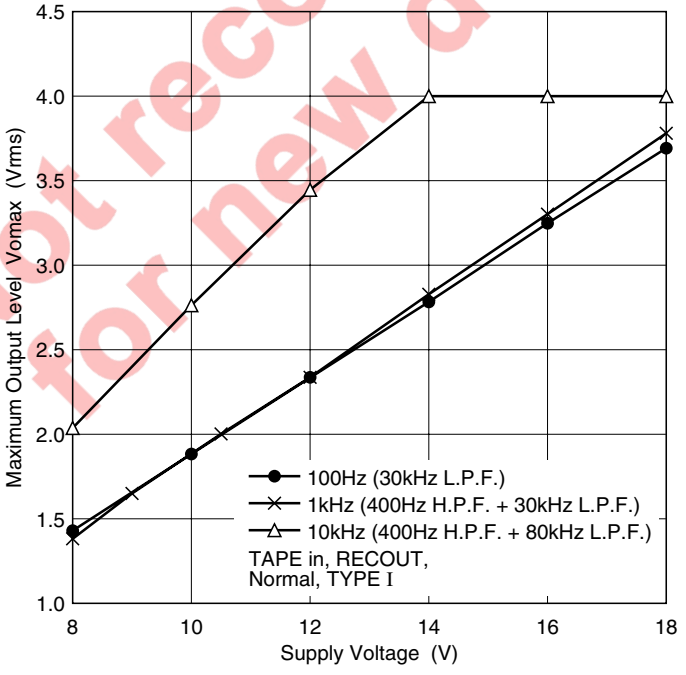
PB-EQ Gain vs. External Resistor



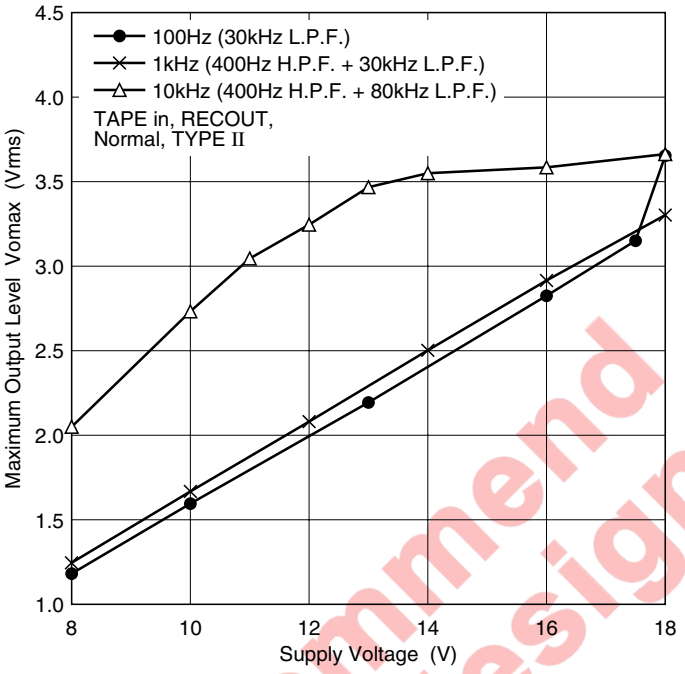
PB-EQ Gain vs. Frequency



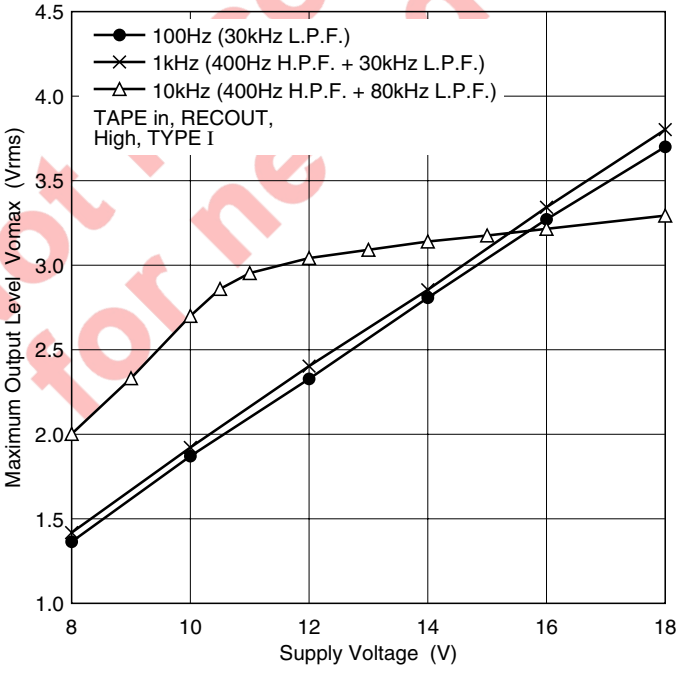
REC-EQ Maximum Output Level vs. Supply Voltage (1)



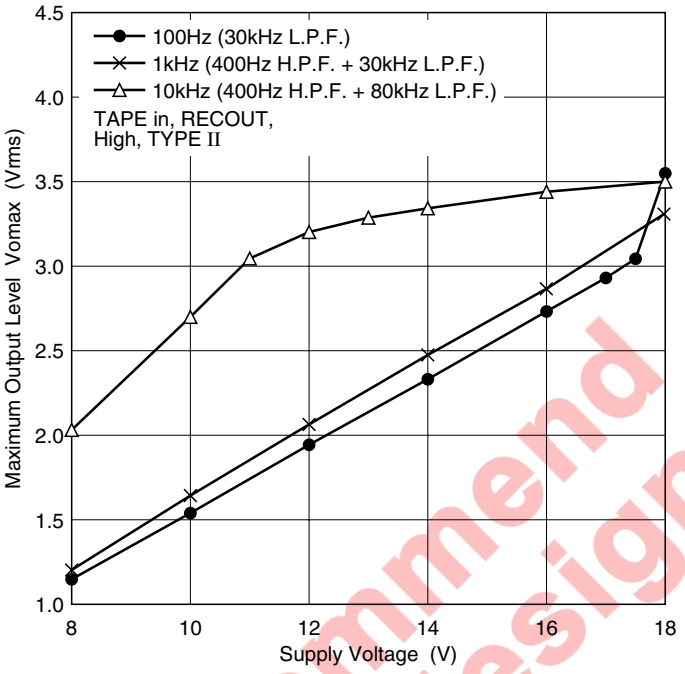
REC-EQ Maximum Output Level vs. Supply Voltage (2)



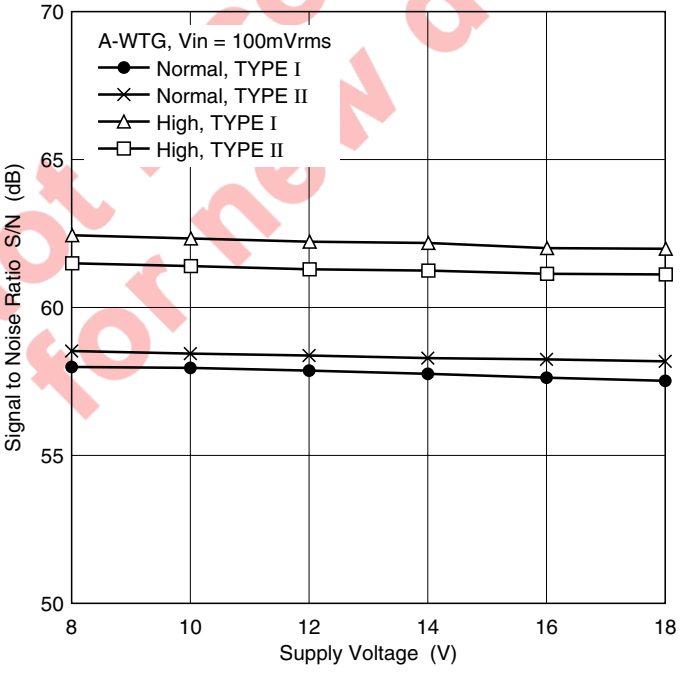
REC-EQ Maximum Output Level vs. Supply Voltage (3)



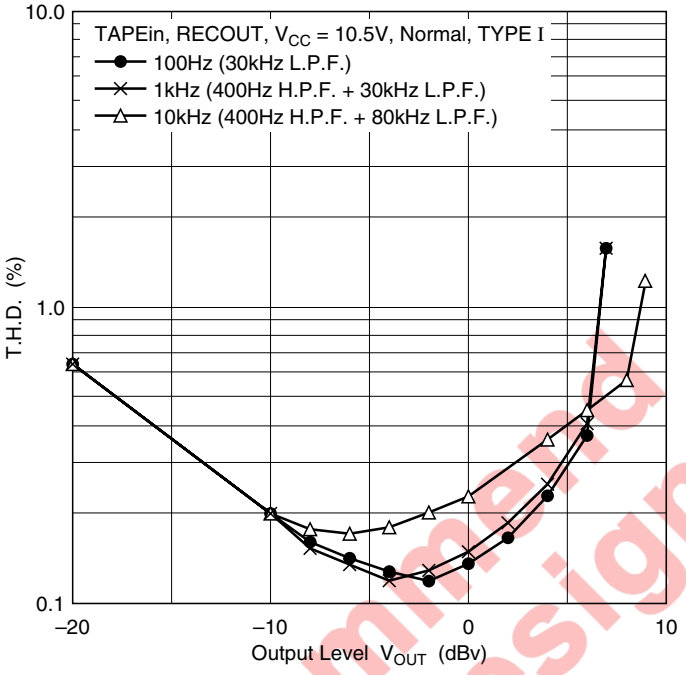
REC-EQ Maximum Output Level vs. Supply Voltage (4)



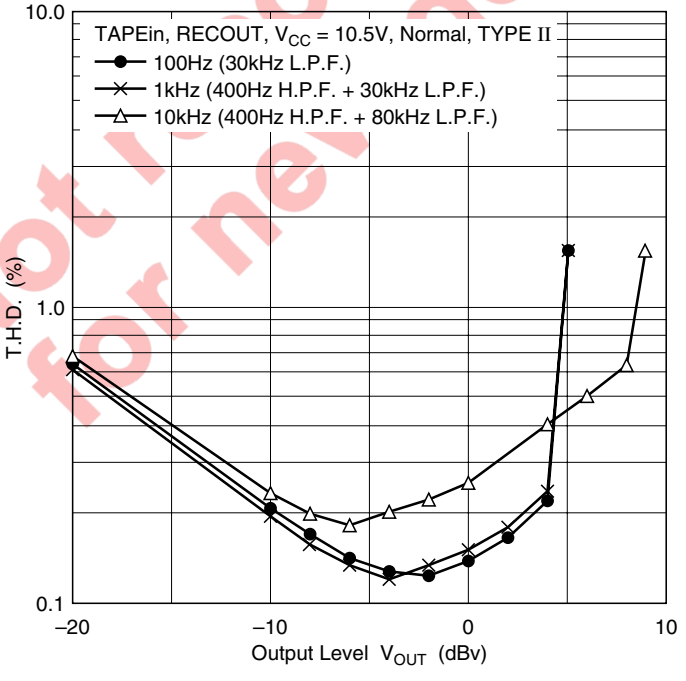
REC-EQ Signal to Noise Ratio vs. Supply Voltage



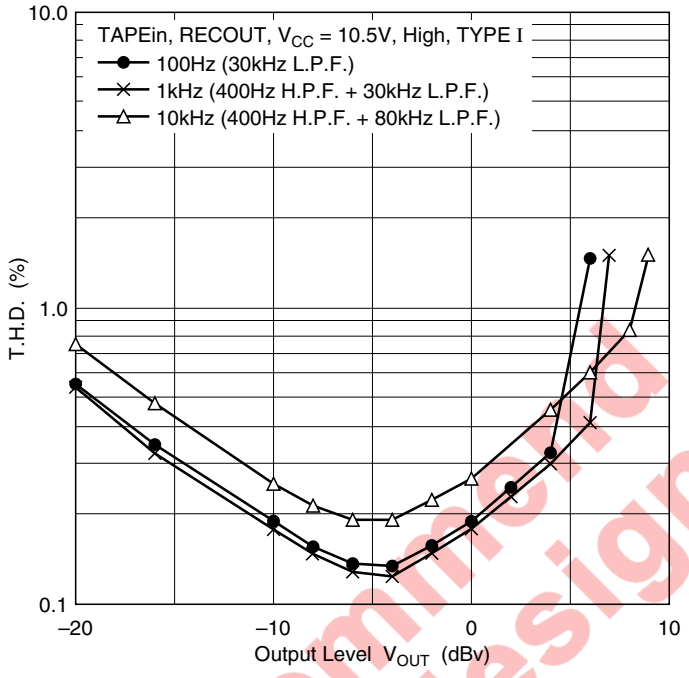
REC-EQ Total Harmonic Distortion vs. Output Level (1)



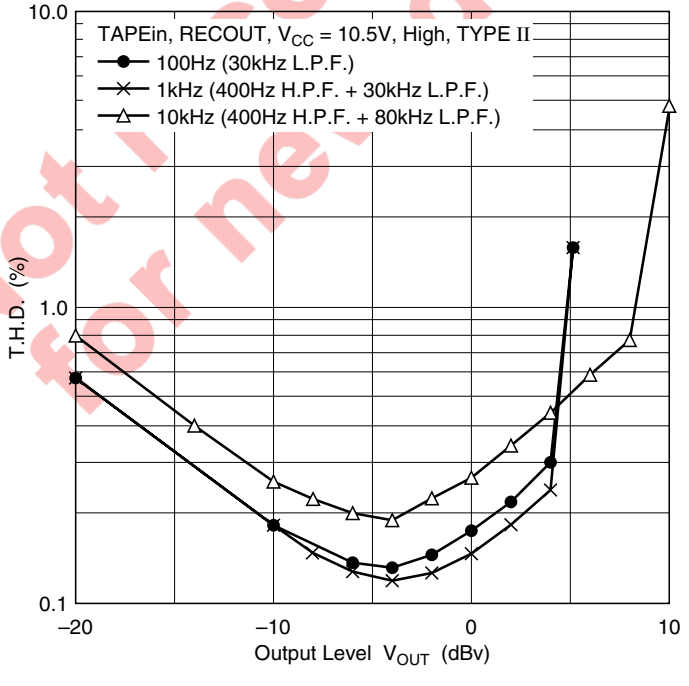
REC-EQ Total Harmonic Distortion vs. Output Level (2)



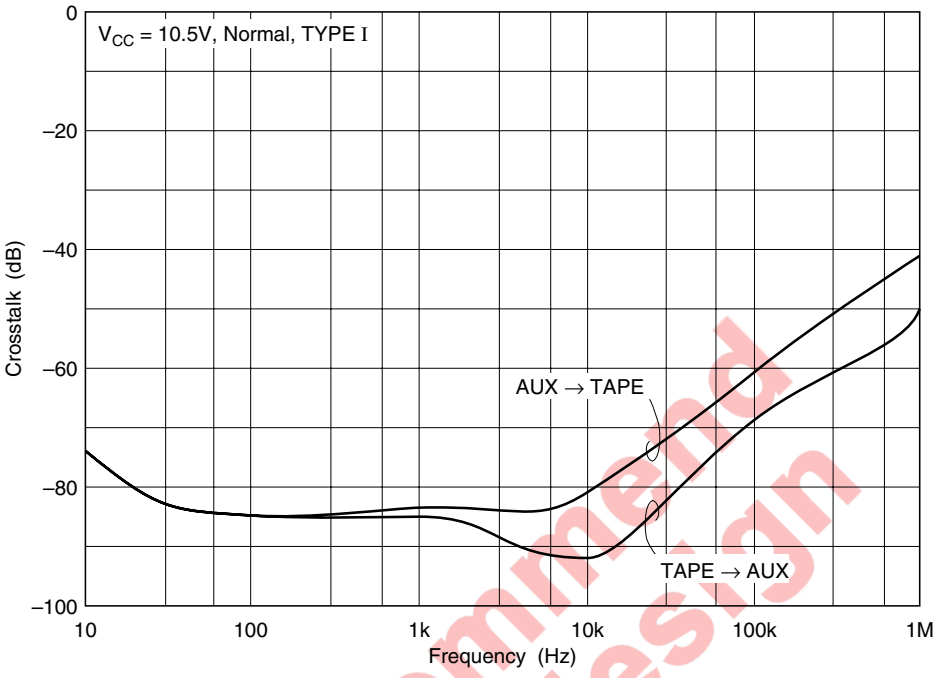
REC-EQ Total Harmonic Distortion vs. Output Level (3)



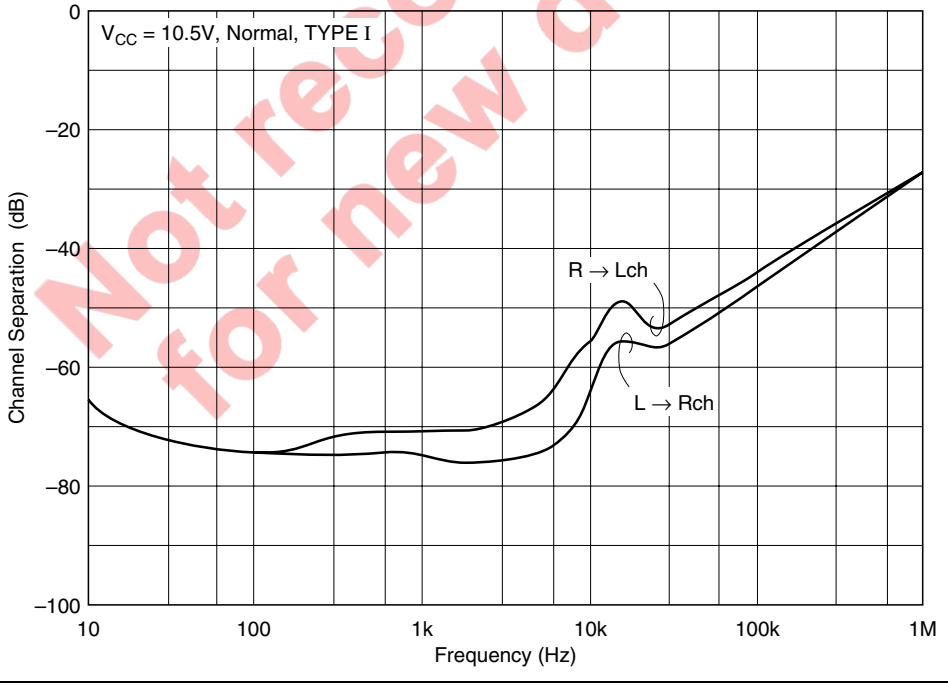
REC-EQ Total Harmonic Distortion vs. Output Level (4)

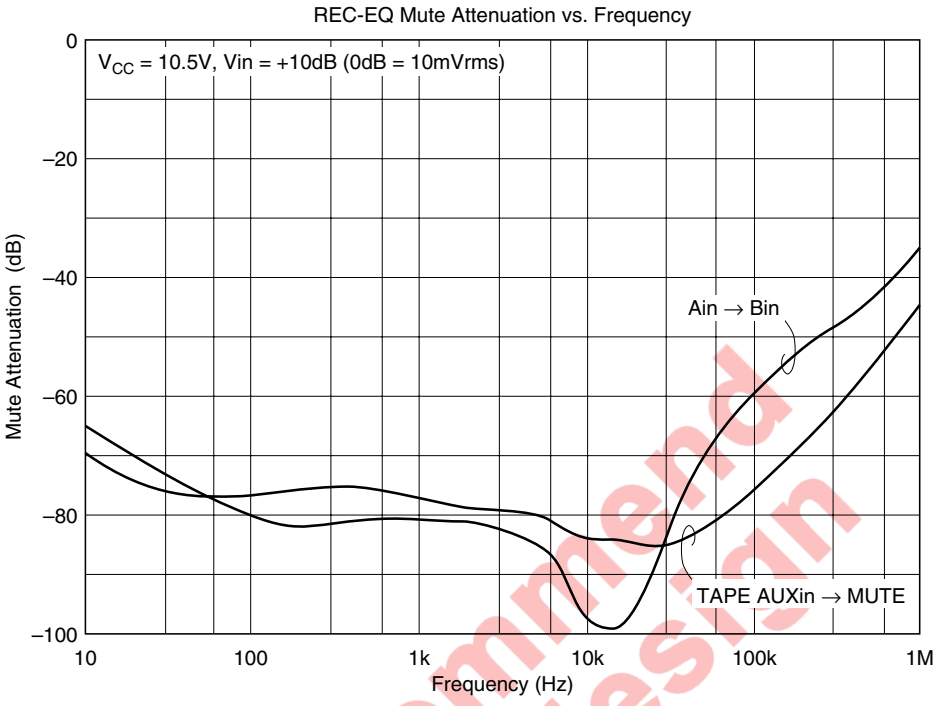


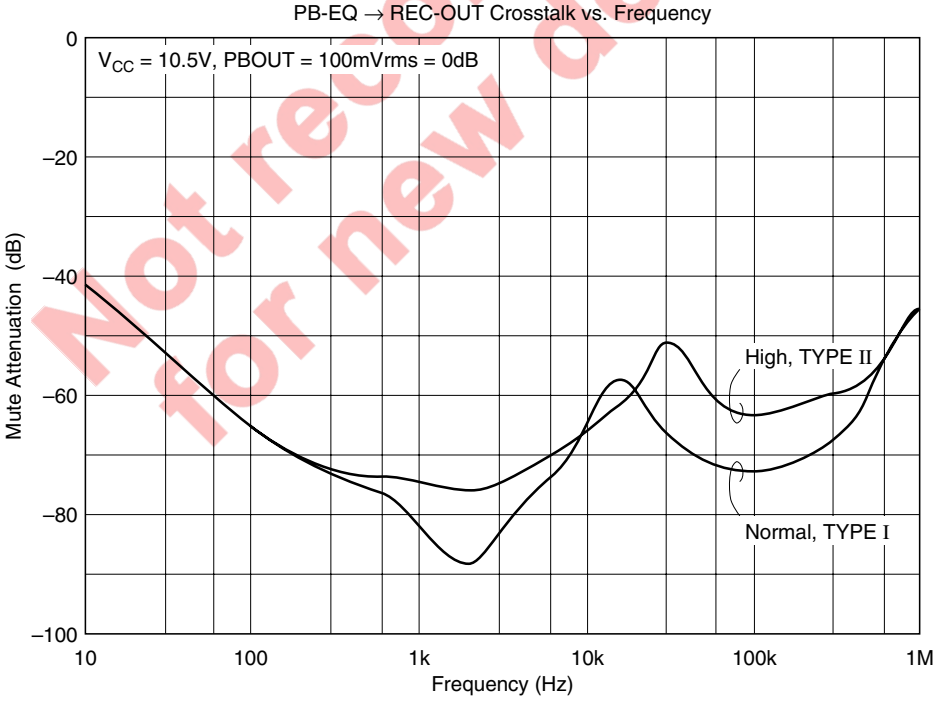
REC-EQ Crosstalk vs. Frequency



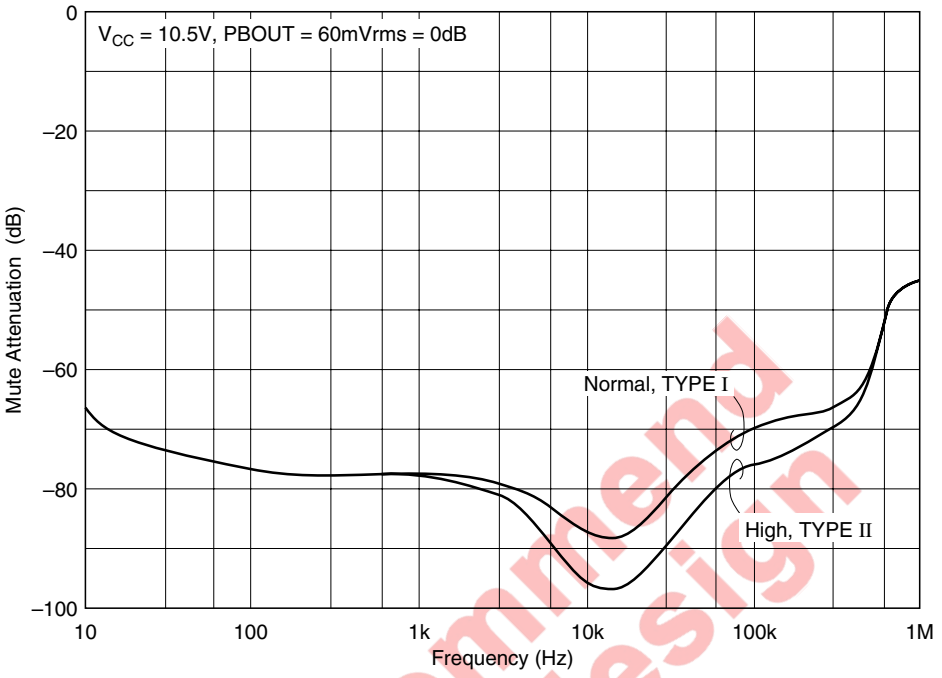
REC-EQ Channel Separation vs. Frequency



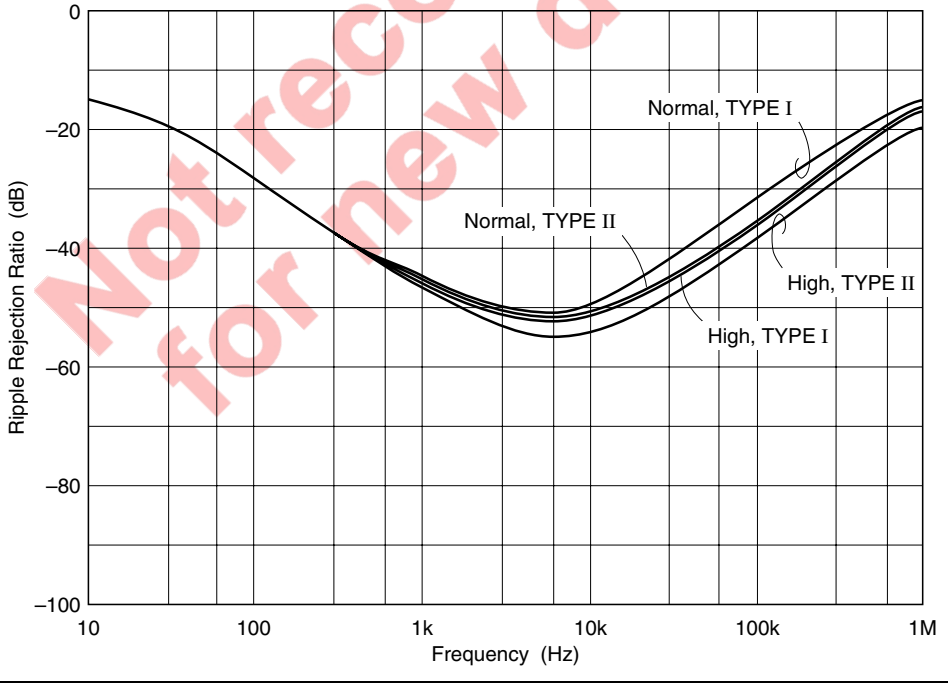




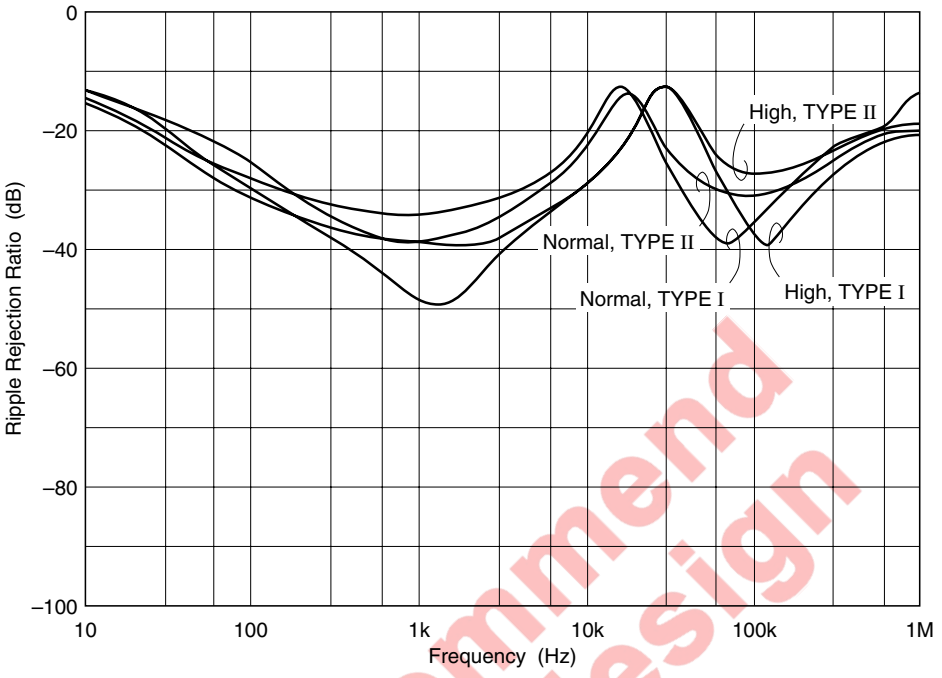
REC-EQ → PB-EQ Crosstalk vs. Frequency



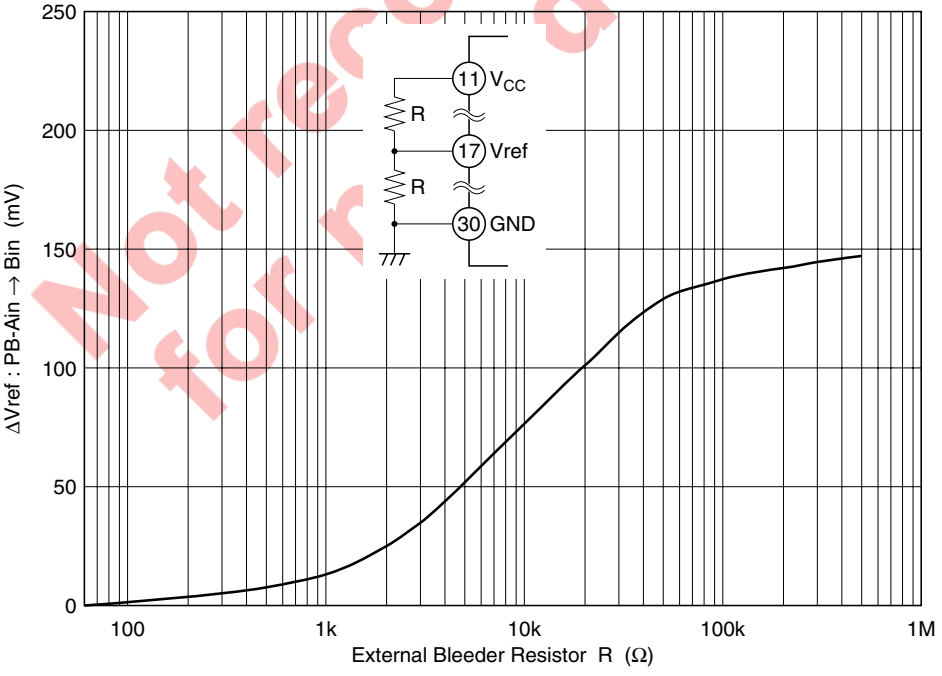
Ripple Rejection Ratio (PBOUT) vs. Frequency



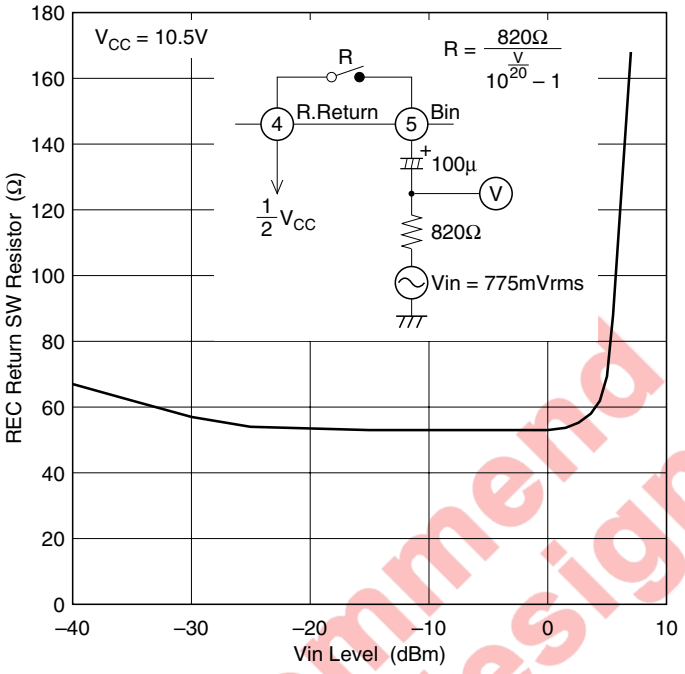
Ripple Rejection Ratio (RECOUT) vs. Frequency



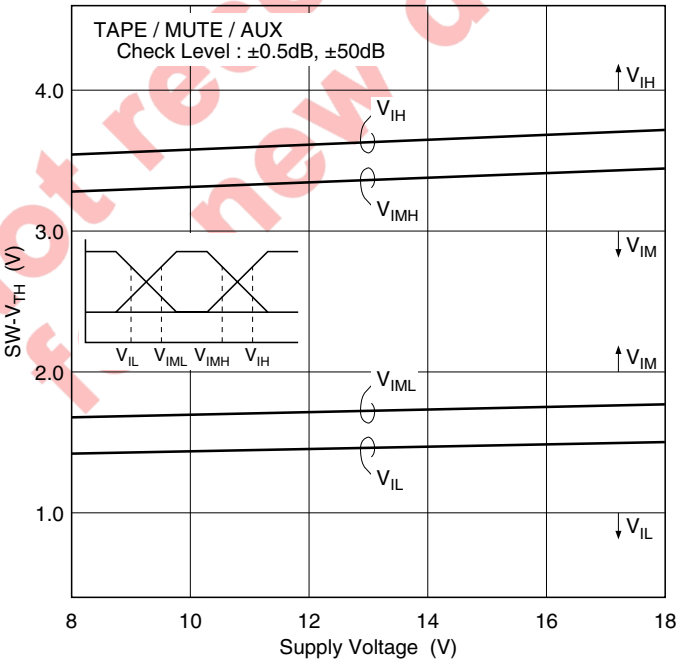
ΔVref vs. External Bleeder Resistor



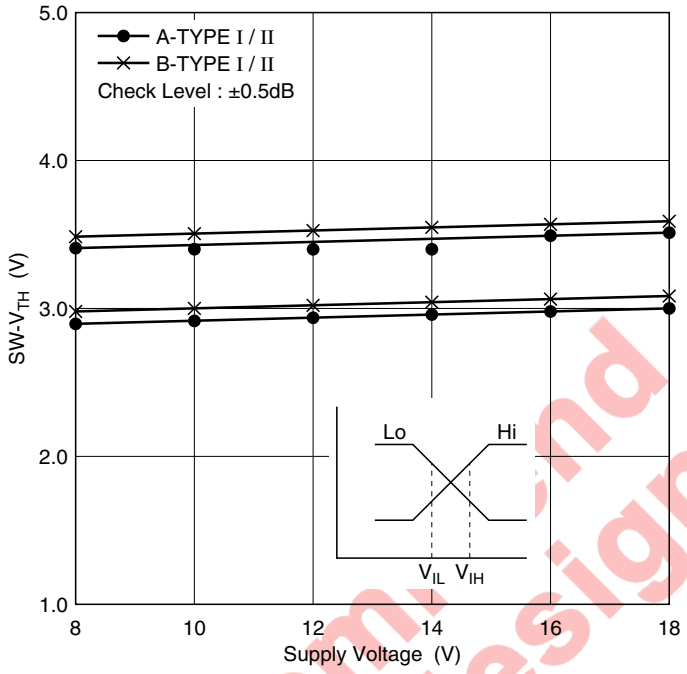
REC Return SW Resistor vs. Vin Level



SW-V_{TH} vs. Supply Voltage (1)

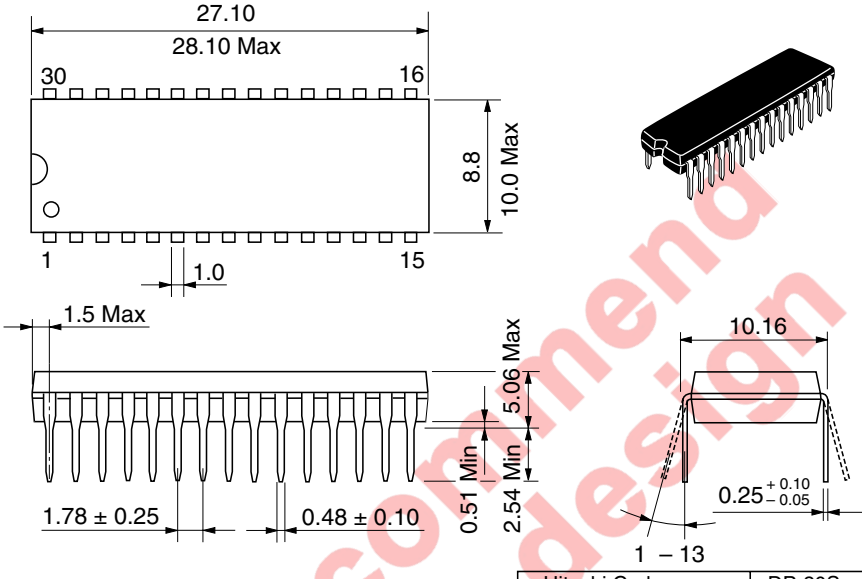


SW-V_{TH} vs. Supply Voltage (2)



Package Dimensions

Unit: mm



Hitachi Code	DP-30S
JEDEC Code	—
EIAJ Code	SC-549-30
Weight	1.98 g

Disclaimer

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

Sales Offices

HITACHI

Hitachi, Ltd.
Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL
NorthAmerica : http://semiconductor.hitachi.com/
Europe : http://www.hitachi-eu.com/hel/ecg
Asia : http://sicapac.hitachi-asia.com
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

For further information write to:

Hitachi Semiconductor (America) Inc.
179 East Tasman Drive,
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic Components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585160

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00,
Singapore 049318
Tel : <65>-538-6533/538-8577
Fax : <65>-538-6933/538-3877
URL : http://www.hitachi.com.sg

Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road,
Hung-Kuo Building,
Taipei (105), Taiwan
Tel : <886>-(2)-2718-3666
Fax : <886>-(2)-2718-8180
Telex : 23222 HAS-TP
URL : http://www.hitachi.com.tw

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower,
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon,
Hong Kong
Tel : <852>-(2)-735-9218
Fax : <852>-(2)-730-0281
URL : http://www.hitachi.com.hk

Colophon 2.0

RENESAS