To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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HA12232FP

Audio Signal Pre-Amp. for Car Deck

REJ03F0136-0100
(Previous: ADE-207-328)
Rev.1.00
Jun 15, 2005

Description

HA12232FP is audio signal pre-amp. LSI providing PB equalizer op-amp. in one chip.

Functions

- PB equalizer × 2 channel
- Vref buffer × 1 channel

Features

- Built-in referential voltage (VREF) for PB equalizer decreases external components.
- This IC is low noise.
- This IC is strong for a cellular phone noise.

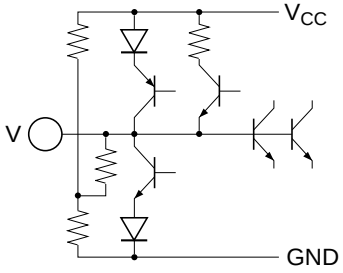
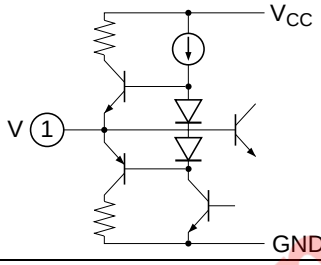
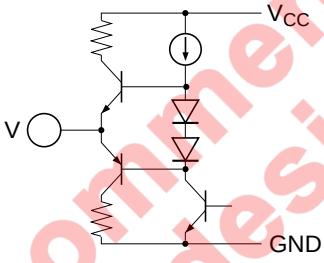
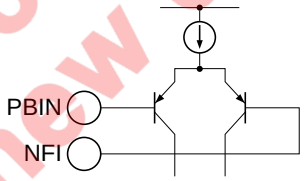
Operating Voltage Range

Product	Min	Max	Unit
HA12232FP	6.5	15	V

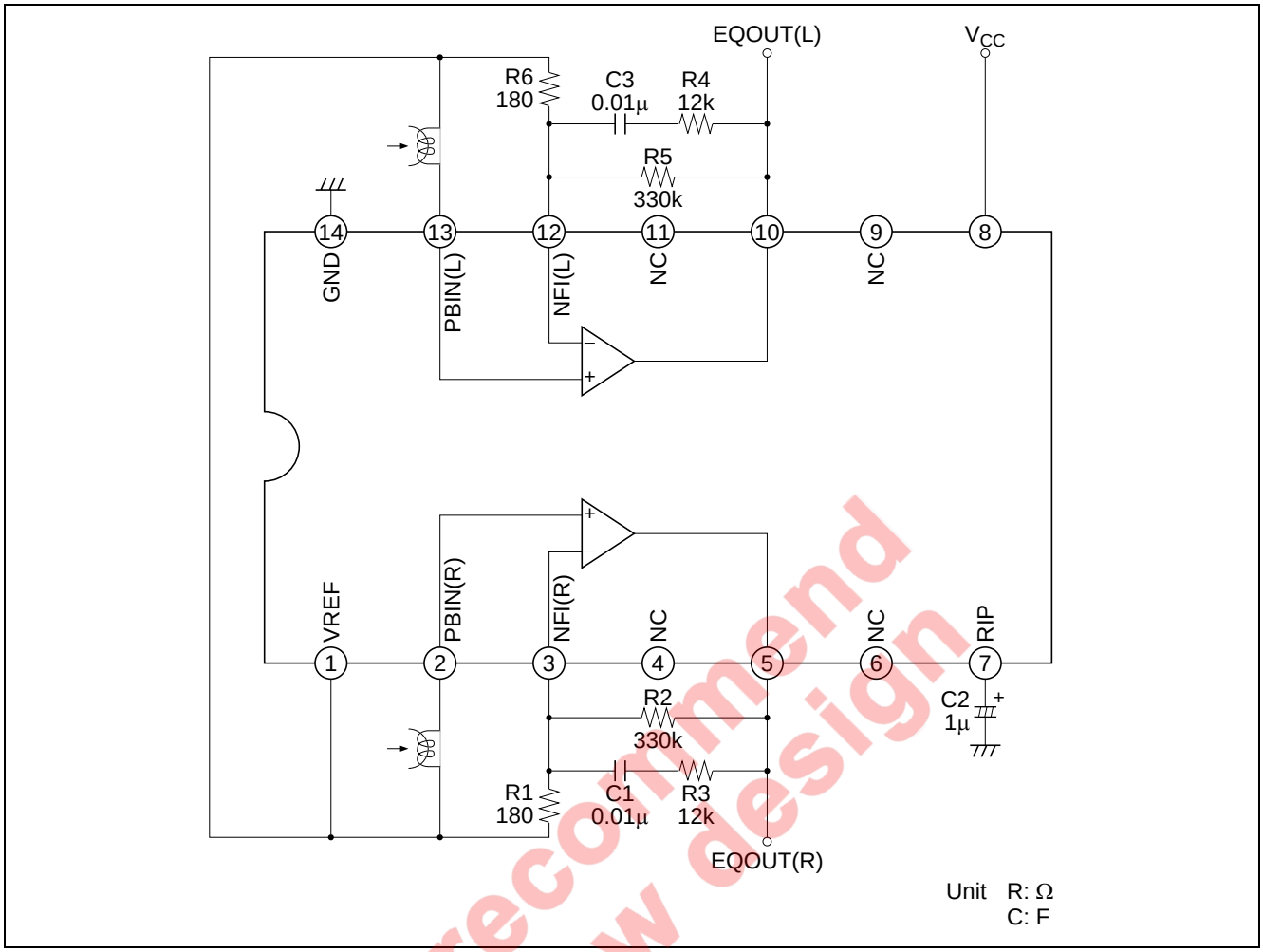
Note: This IC is designed to operate on single supply.

Pin Description, Equivalent Circuit

(V_{CC} = 9 V single supply, Ta = 25°C, No Signal, The value in the table shows typical value.)

Pin No.	Pin Name	Note	Equivalent Circuit	Description
7	RIP	V = V_{CC}/2		Ripple filter
1	VREF	V = V_{CC}/2		Reference output
10	EQOUT(L)	V = V_{CC}/2		Equalizer output
5	EQOUT(R)			
2	PBIN(R)	—		PB equalizer input
13	PBIN(L)			
3	NFI(R)	V = V_{CC}/2		Equalizer output for time constant
12	NFI(L)			
8	V_{CC}	—		Power supply
14	GND	—		GND pin
4	NC	—		
6				
9				
11				

Block Diagram



Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Rating	Unit	Note
Supply voltage	V_{CC} Max	16	V	
Power dissipation	Pd	400	mW	Ta ≤ 85°C
Operating temperature	Topr	–40 to +85	°C	
Storage temperature	Tstg	–55 to +125	°C	

Electrical Characteristics

(Ta = 25°C, V_{CC} = 9 V, Rg = 680 Ω)

Item	Symbol	Test Condition	Specification			Unit	Remark
			Min	Typ	Max		
Quiescent current	I_Q	No signal	1.5	2.2	3.2	mA	
Channel separation	CT RL	Fin = 1kHz, Vin = 6mVrms	50.0	60.0	—	dB	
EQ gain	G_V 1k	Fin = 1kHz, Vin = 0.6mVrms	37.0	40.0	43.0	dB	
	G_V 10k	Fin = 10kHz, Vin = 0.6mVrms	33.0	36.0	39.0	dB	
THD	THD	Fin = 1kHz, Vin = 2.4mVrms	—	0.1	0.5	%	
EQ maximum output	V_{OM}	Fin = 1kHz, THD = 1%	300	600	—	mVrms	*1
Noise voltage level converted in input	VN	Rg = 680Ω, Din-Audio Filter	—	0.7	1.5	μVrms	

Note: 1. V_{CC} = 6.5 V

Functional Description

Power Supply Range

HA12232FP is designed to operate on single supply only.

Table 1 Supply Voltage Range

Product	Single Supply
HA12232FP	6.5 V to 15.0 V

Reference Voltage

HA12232FP provides 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.

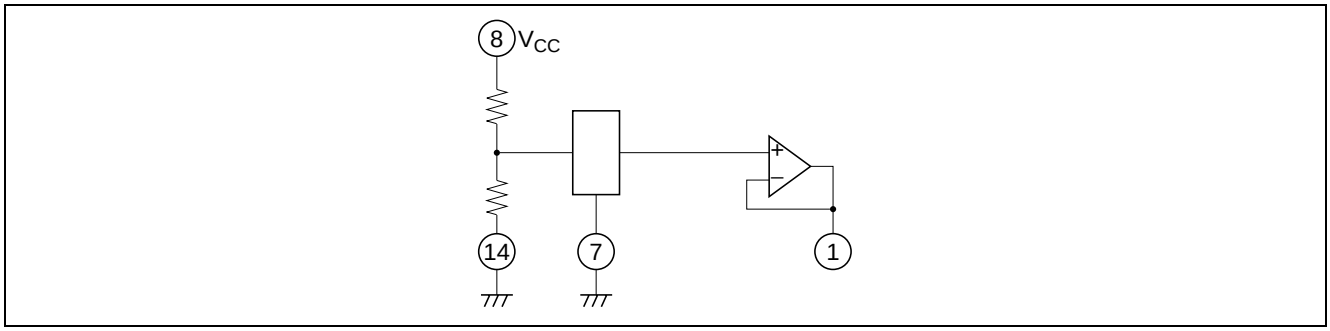


Figure 1 The Block Diagram of Reference Supply Voltage

Input Block Diagram and Level Diagram

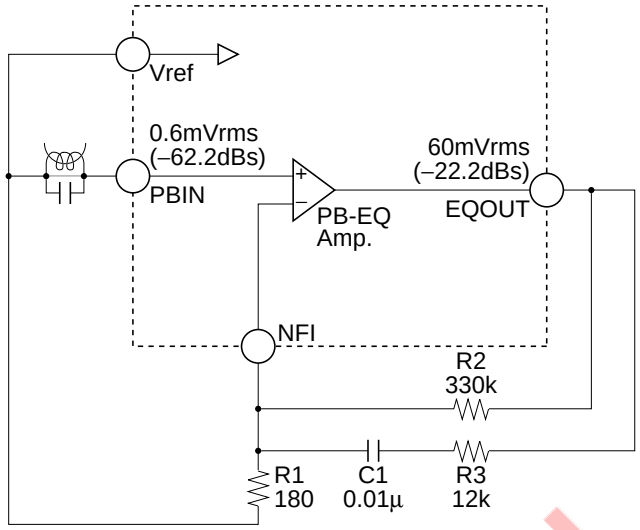
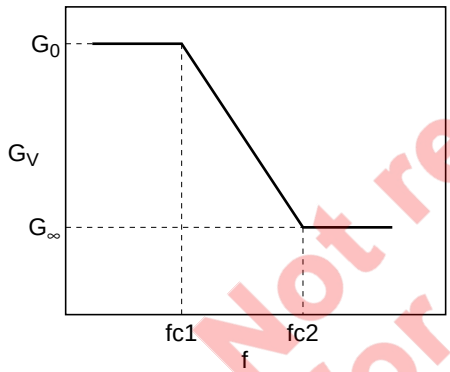


Figure 2 Input Block Diagram

Cutoff Frequency, Gain of PB-EQ Amp.



Transfer Function

$$T = R_2 [w^2 c_1^2 (R_2 + R_3) (R_1 + R_3) + 1] / R_1 [w^2 c_1^2 (R_2 + R_3)^2 + 1] + j \cdot R_2 w c_1^2 (R_1 - R_2) / R_1 [w^2 c_1^2 (R_2 + R_3)^2 + 1]$$

Cutoff Frequency

$$fc = \{[-b \pm (b^2 - 4a)^{1/2}] / 2a\} / 2\pi$$
$$a = 2c_1^4 (R_2 + R_3)^2 (R_3 + R_1)^2$$
$$b = [3 (R_2 + R_3) (R_3 + R_1) - (R_2 + R_3)^2 - (R_3 + R_1)^2] c_1^2$$

Changing the value of each element to one shown in figure 2, will be as follows.

fc1 = 50 Hz, fc2 = 1300 Hz

PB-EQ Amp. Gain (f = 0, ∞)

f = 0

$T_0 = R_2 / R_1$

$G_0 = 65.3$ dB

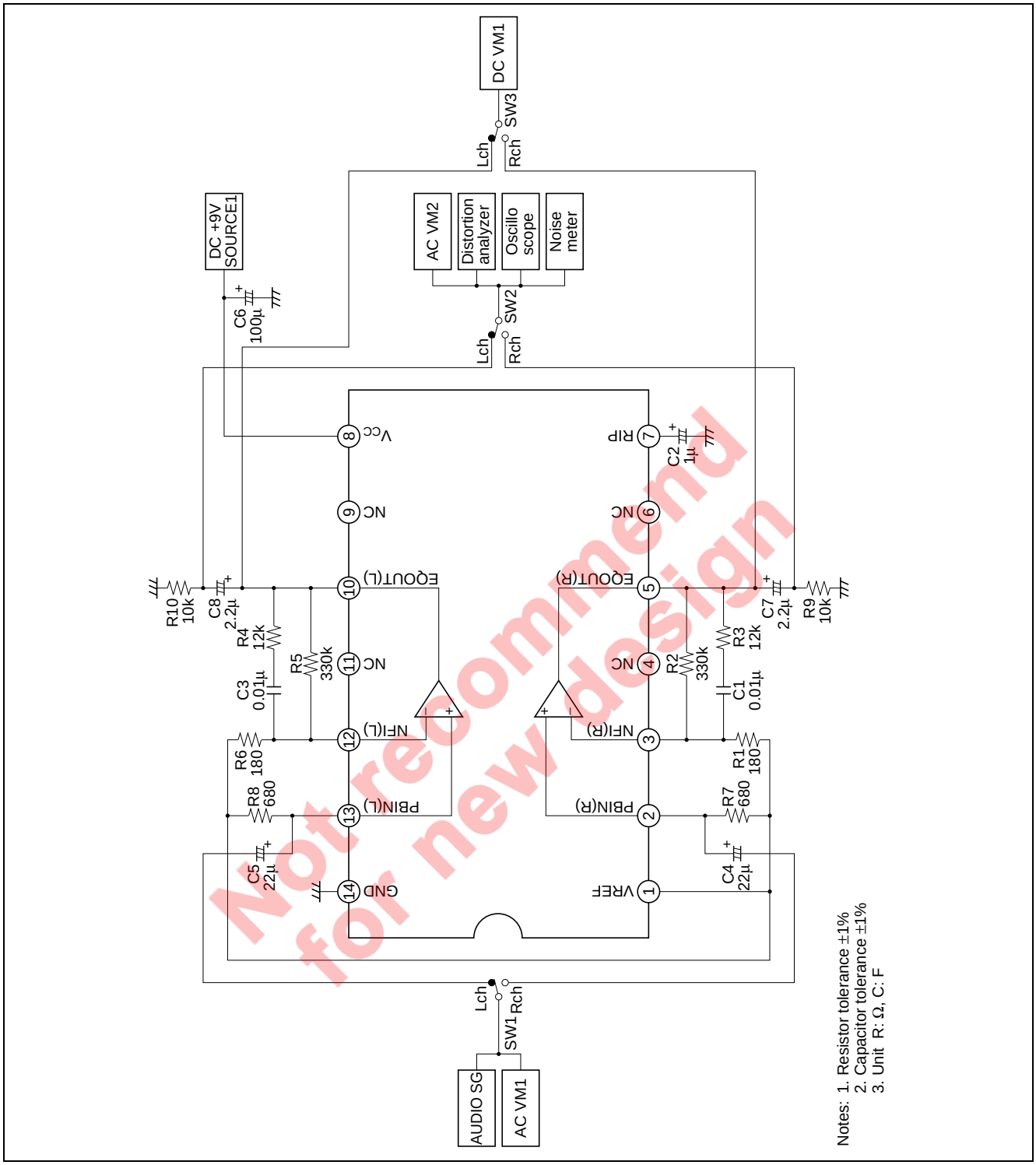
f = ∞

$T_\infty = R_2 (R_3 + R_1) / R_1 (R_2 + R_3)$

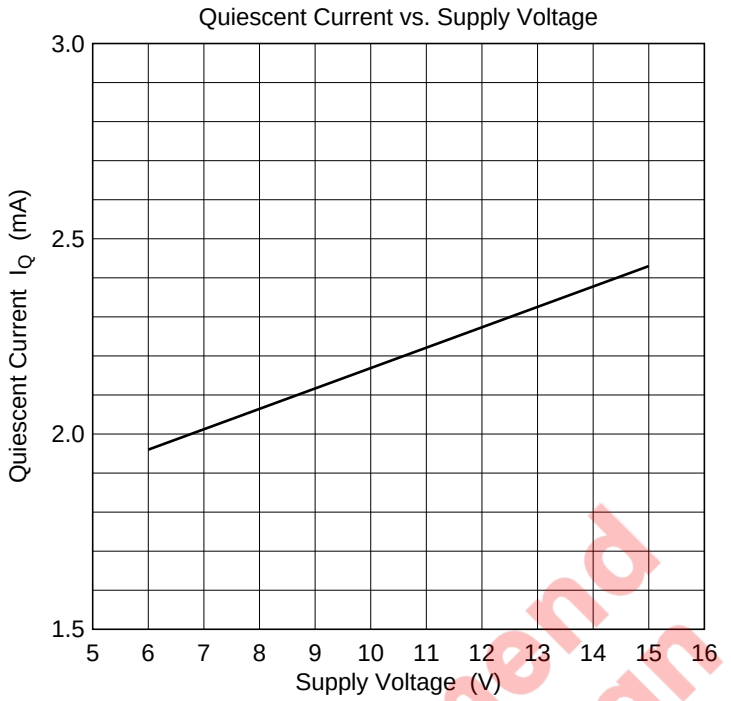
$G_\infty = 36.3$ dB

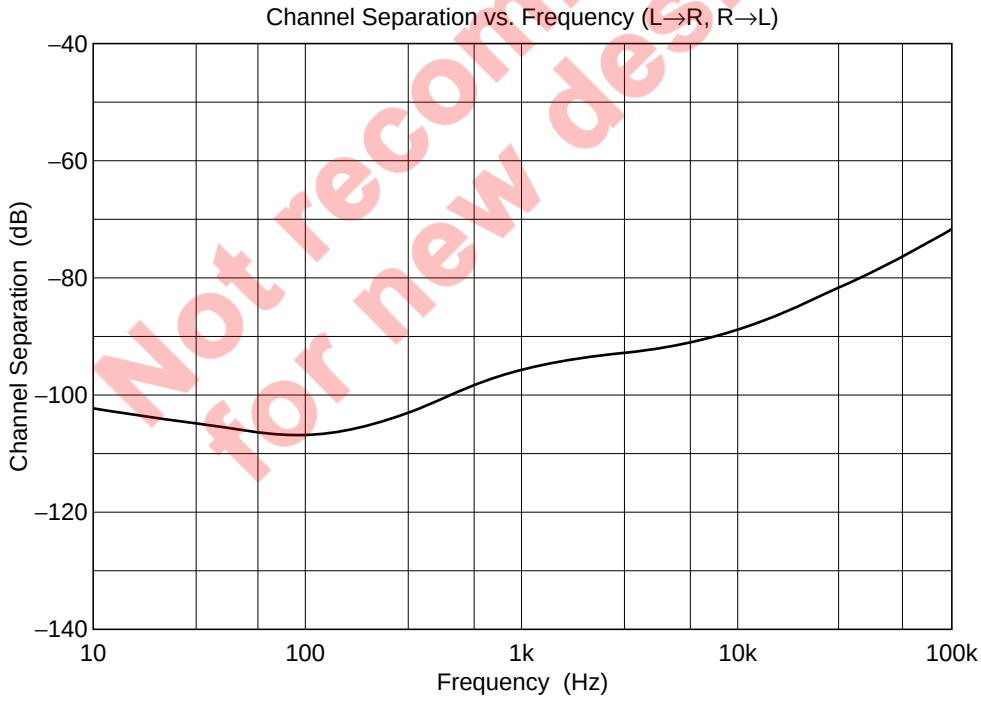
Figure 3 Cutoff Frequency of PB-EQ Amp.

Test Circuit

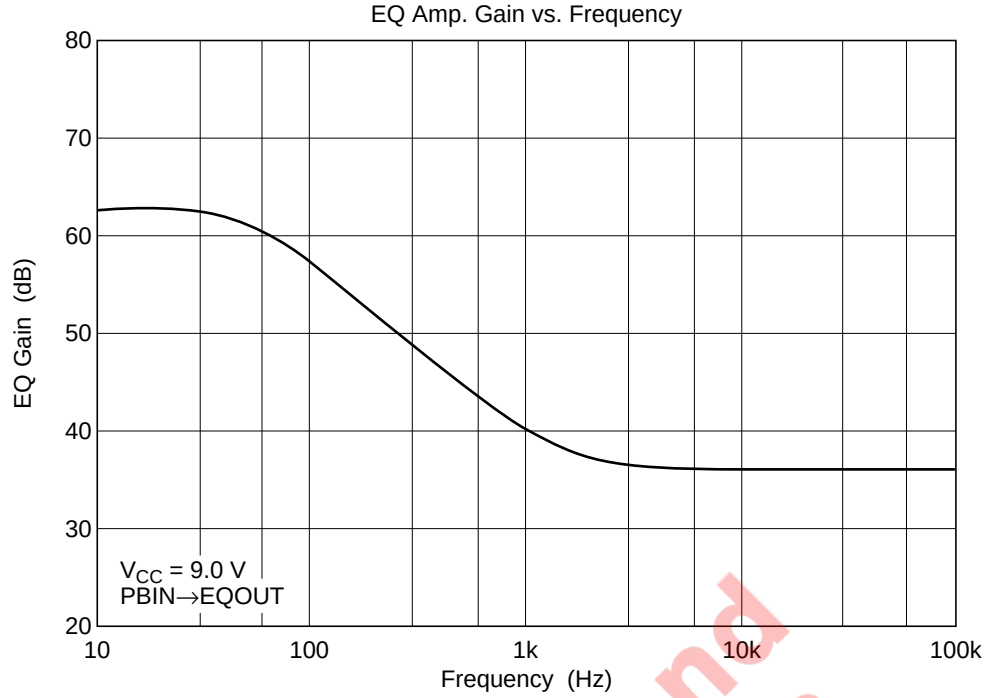


Characteristic Curves

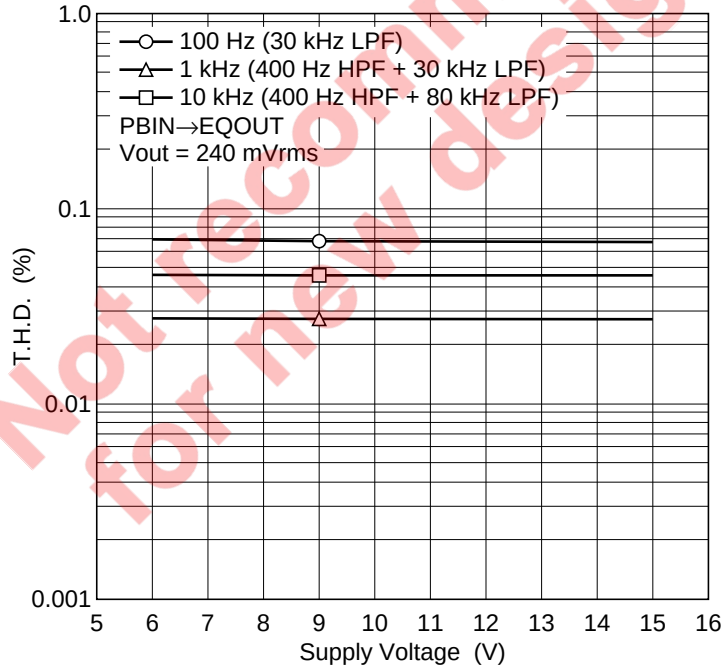




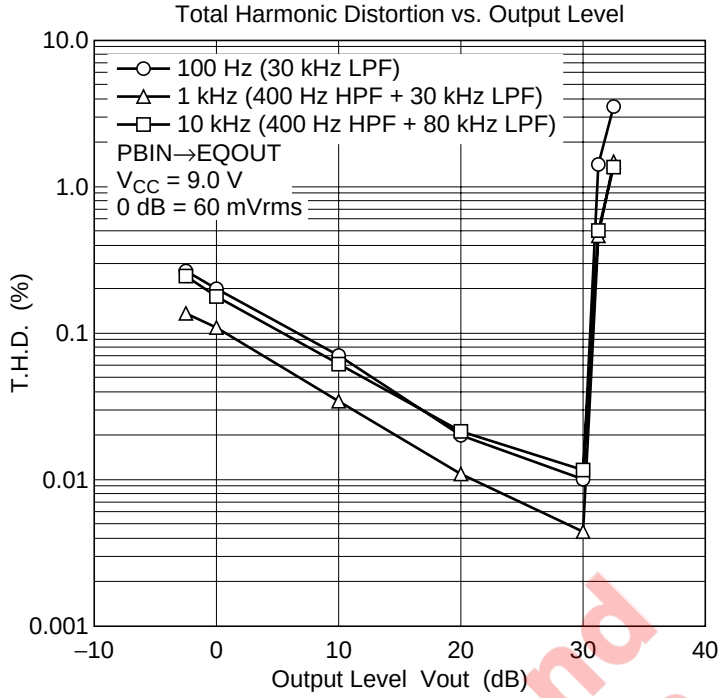
EQ Amp. Gain vs. Frequency



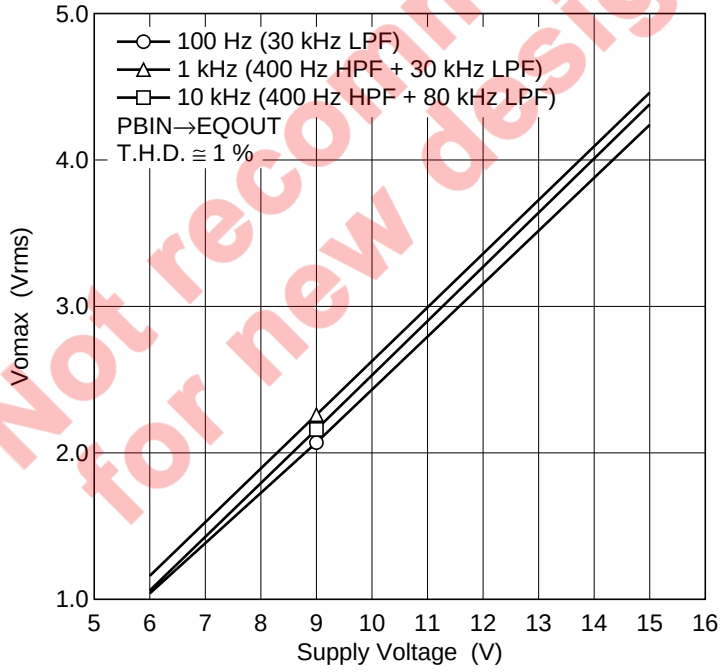
Total Harmonic Distortion vs. Supply Voltage

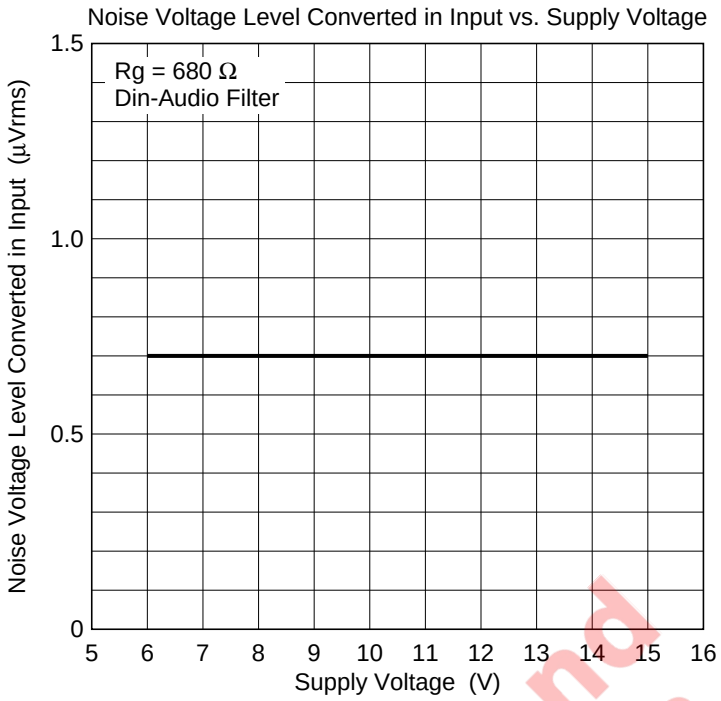


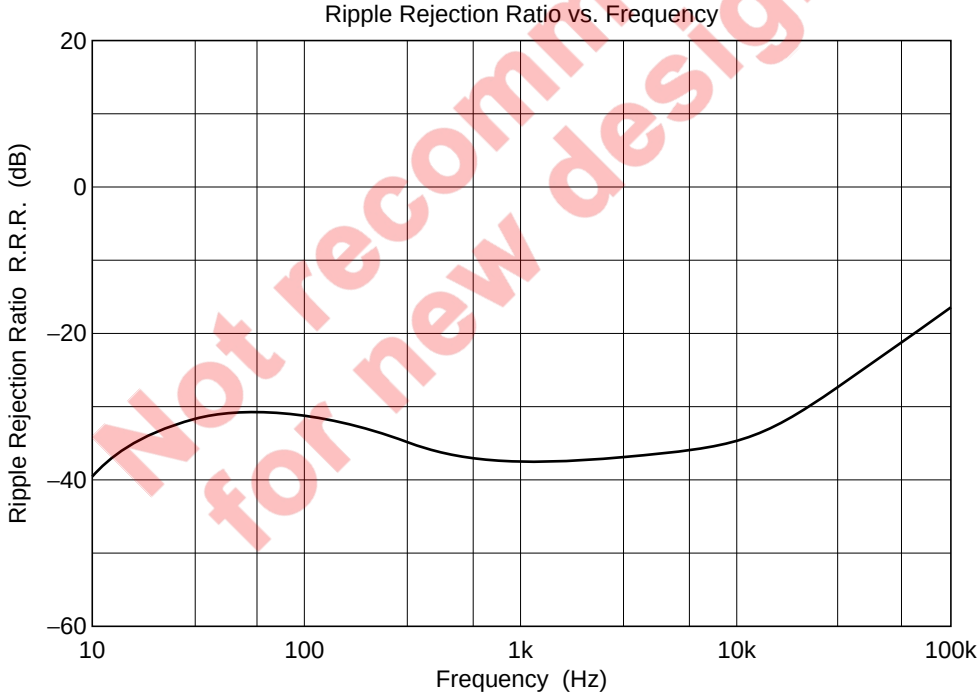
Total Harmonic Distortion vs. Output Level



Signal Handling

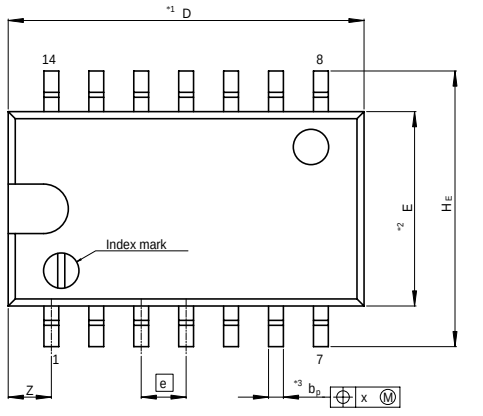


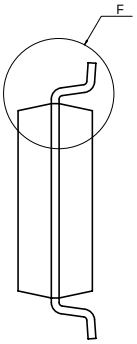




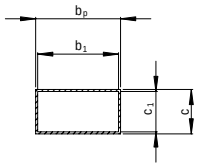
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-5.5x10.06-1.27	PRSP0014DF-A	FP-14DA	0.23g

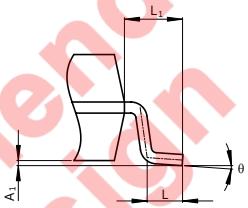




NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.



Terminal cross section



Detail F

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	——	10.06	10.5
E	——	5.5	——
A_2	——	——	——
A_1	0.00	0.10	0.20
A	——	——	2.20
b_p	0.34	0.42	0.50
b_1	——	0.40	——
c	0.17	0.22	0.27
c_1	——	0.20	——
θ	0°	——	8°
H_E	7.50	7.80	8.00
e	——	1.27	——
x	——	——	0.12
y	——	——	0.15
Z	——	——	1.42
L	0.50	0.70	0.90
L_1	——	1.15	——

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