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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M62496FP

Electronic Volume Control with Built-in Speaten Filter

REJ03F0221-0201
Rev.2.01
Mar 31, 2008

Description

The M62496FP is a sound controller IC for mini stereo component and radio cassette units. It has stereo enhancing processor Speaten filter. (Best suited for compact size speakers systems) As a result, the reproduced sound is much clear to a live performance. You can get several class high quality.

Note: Licensing and application information may be obtained from Dedekind Lab.
The device available only to licensees of Dedekind Lab.
Use of this IC requires the license of Dedekind Lab. (Tokushima C. Japan)

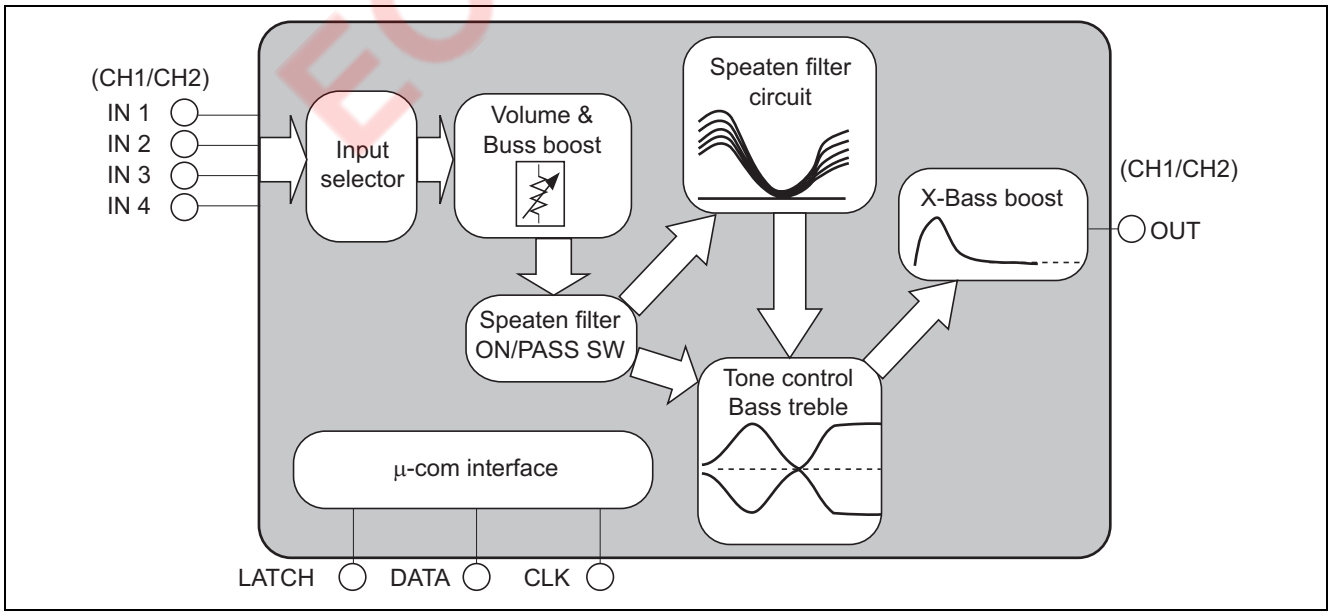
Features

- Built-in 4ch input selector
- Variable volume range 0 to –83 dB, –∞ (1 dB/step)
- Built-in bass boost circuit (loudness type)
- Built-in speaten filter (5 mode)
- 2band tone control
  (0, ±2.0, ±4.0, ±6.0, ±8.0, ±10.0, dB)
- Bass boost ON/OFF

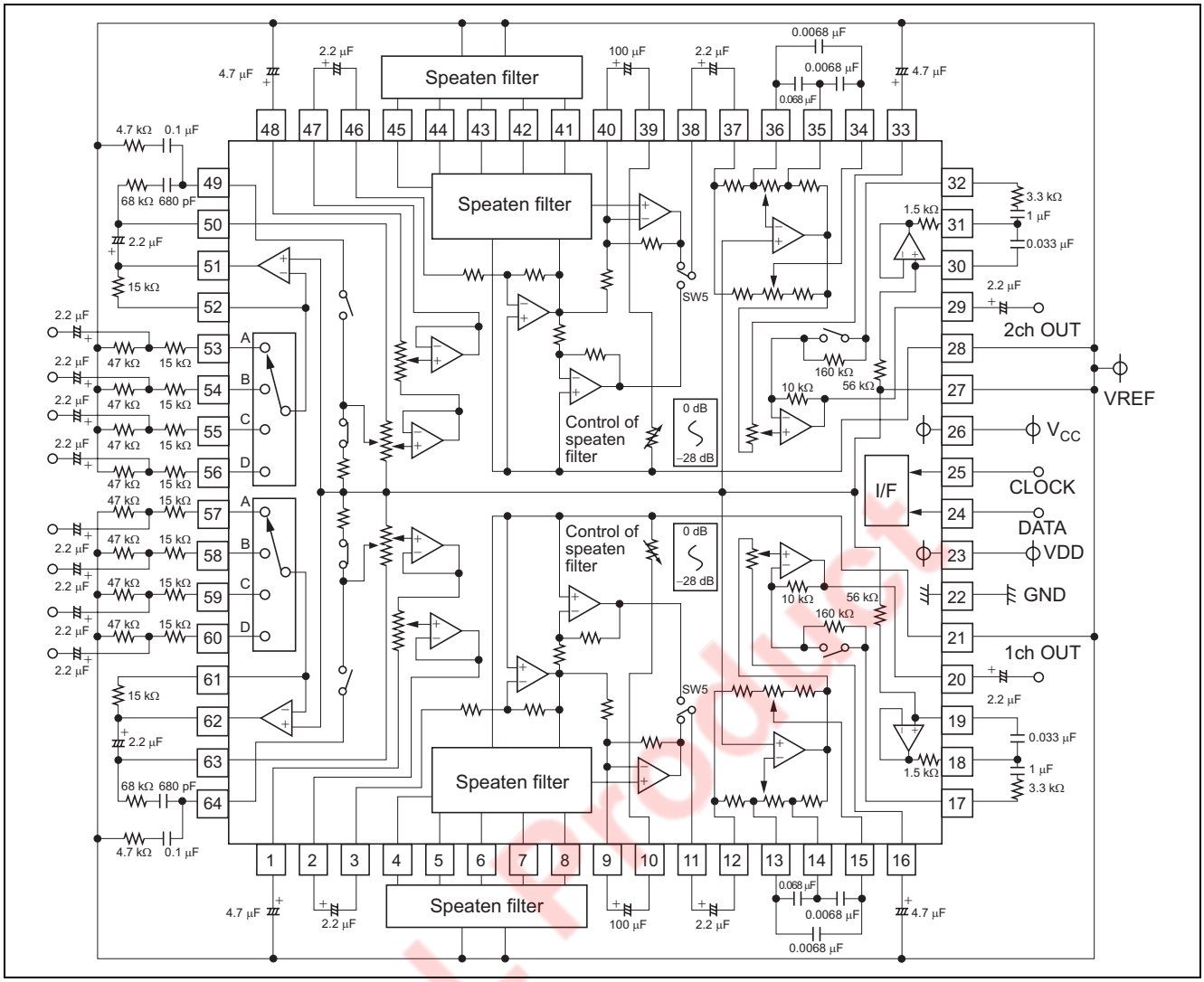
Recommended Operating Conditions

- Analog supply voltage range: 6.0 to 9.0 V
- Digital supply voltage range: 4.5 to 5.5 V

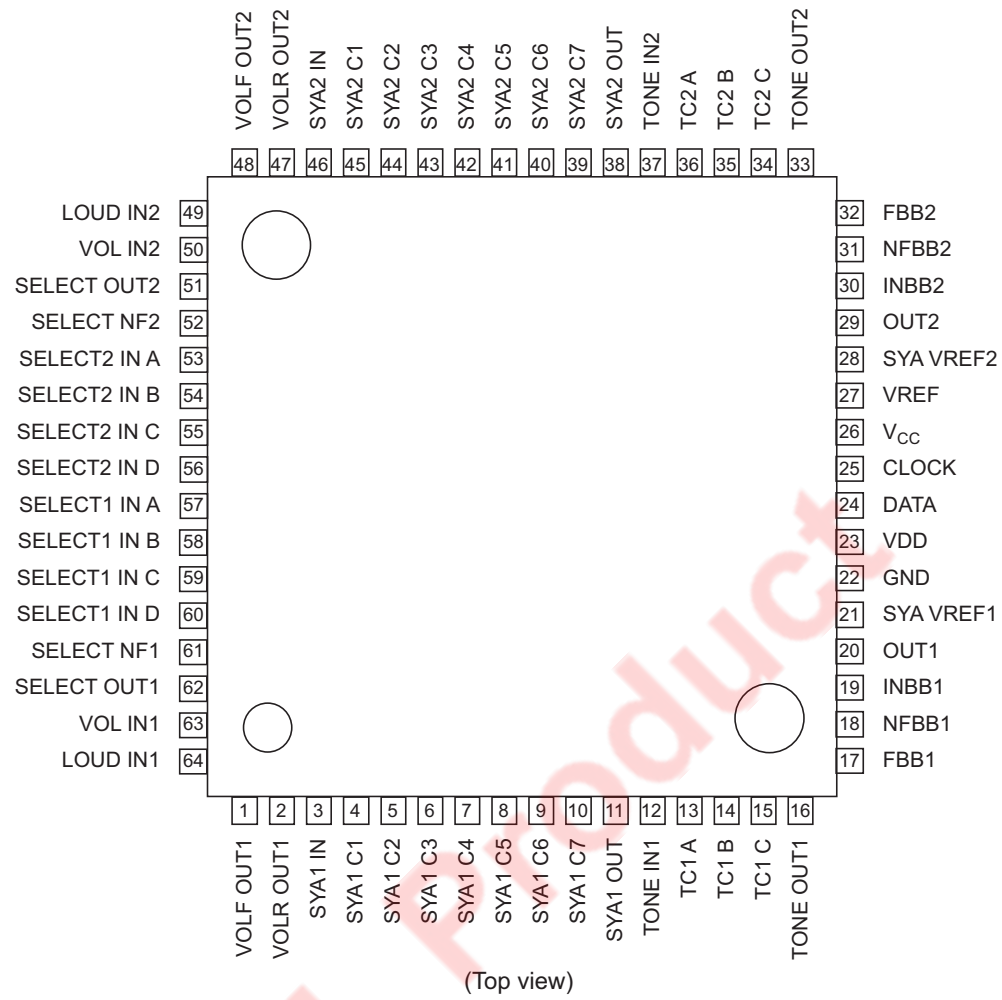
System Block Diagram



IC Internal Block Diagram



Pin Arrangement



(Top view)

Outline: PRQP0064GA-A (64P6N-A)

Pin Description

Pin No.	Symbol	Function
57	SELECT1 IN A	Input pin for channel 1 of the input selector switch block.
58	SELECT1 IN B	
59	SELECT1 IN C	
60	SELECT1 IN D	
53	SELECT2 IN A	Input pin for channel 2 of the input selector switch block.
54	SELECT2 IN B	
55	SELECT2 IN C	
56	SELECT2 IN D	
61	SELECT NF1	Adjusts input gains by using the resistance between this pin and the SELECT OUT pin and by using resistance added to INA to IND.
52	SELECT NF2	
62	SELECT OUT1	Output pin of the input selector switch.
51	SELECT OUT2	
63	VOL IN1	Input pin of the volume block.
50	VOL IN2	
64	LOUD IN1	Pin for setting the frequency characteristics of the loudness block.
49	LOUD IN2	
1	VOLF OUT1	Output pin of the volume block (1st stage). Connect this pin to VREF pin with C connection to reduce switching noise.
48	VOLF OUT2	
2	VOLR OUT1	Output pin of the volume block (2nd stage).
47	VOLR OUT2	
3	SYA1 IN	Input pin of the speaten filter block.
46	SYA2 IN	
4	SYA1 C1	Pin for connecting filter of the speaten filter. (ch1)
5	SYA1 C2	
6	SYA1 C3	
7	SYA1 C4	
8	SYA1 C5	
45	SYA2 C1	Pin for connecting filter of the speaten filter. (ch2)
44	SYA2 C2	
43	SYA2 C3	
42	SYA2 C4	
41	SYA2 C5	
9	SYA1 C6	Reduce switching noise on speaten filter effect by using the capacitance between pin9 and pin10 (ch1)
10	SYA1 C7	
40	SYA2 C6	Reduce switching noise on speaten filter effect by using the capacitance between pin39 and pin40 (ch2)
39	SYA2 C7	
11	SYA1 OUT	Output pin of the speaten filter block.
38	SYA2 OUT	
12	TONE IN1	Input pin of the tone control block.
37	TONE IN2	
13	TC1 A	Pin for setting frequency characteristics of the tone control block for channel 1.
14	TC1 B	
15	TC1 C	
36	TC2 A	Pin for setting frequency characteristics of the tone control block for channel 2.
35	TC2 B	
34	TC2 C	
16	TONE OUT1	Output pin of the tone control block.
33	TONE OUT2	
17	FBB1	Resonant impedance (band-pass filter) connection pin for base section.
32	FBB2	

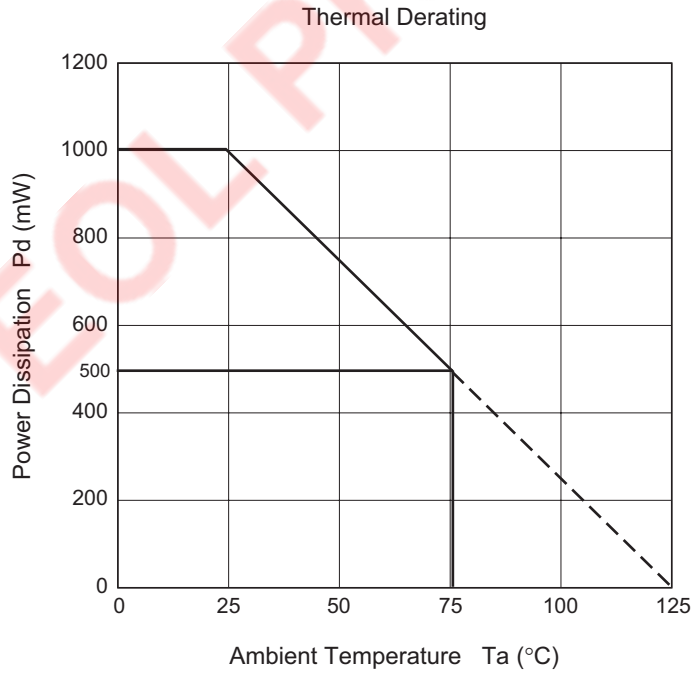
Pin Description(cont.)

Pin No.	Symbol	Function
18	NFBB1	Output pin of bass boosting resonant buffer amp.
31	NFBB2	
19	INBB1	Input pin of bass boosting resonant buffer amp.
30	INBB2	
20	OUT1	Final output pin of the ATT block.
29	OUT2	
21	SYA VREF1	Ground of the speaten filter speaten filter block. Apply 1/2V_{CC}.
28	SYA VREF2	
22	GND	Ground pin
23	VDD	Digital power supply pin.
24	DATA	Input pin of the control data. This pin inputs data in synchronization with CLOCK.
25	CLOCK	Clock input pin for serial data transfer.
26	VCC	Analog power supply pin.
27	VREF	IC signal ground. Apply 1/2V_{CC}.

Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Condition
Supply Voltage	V_{CC}, V_{DD}	10.7	V	
Power Dissipation	Pd	1000	mW	
Operating Temperature	Topr	–20 to + 75	°C	
Storage Temperature	Tstg	–40 to + 125	°C	



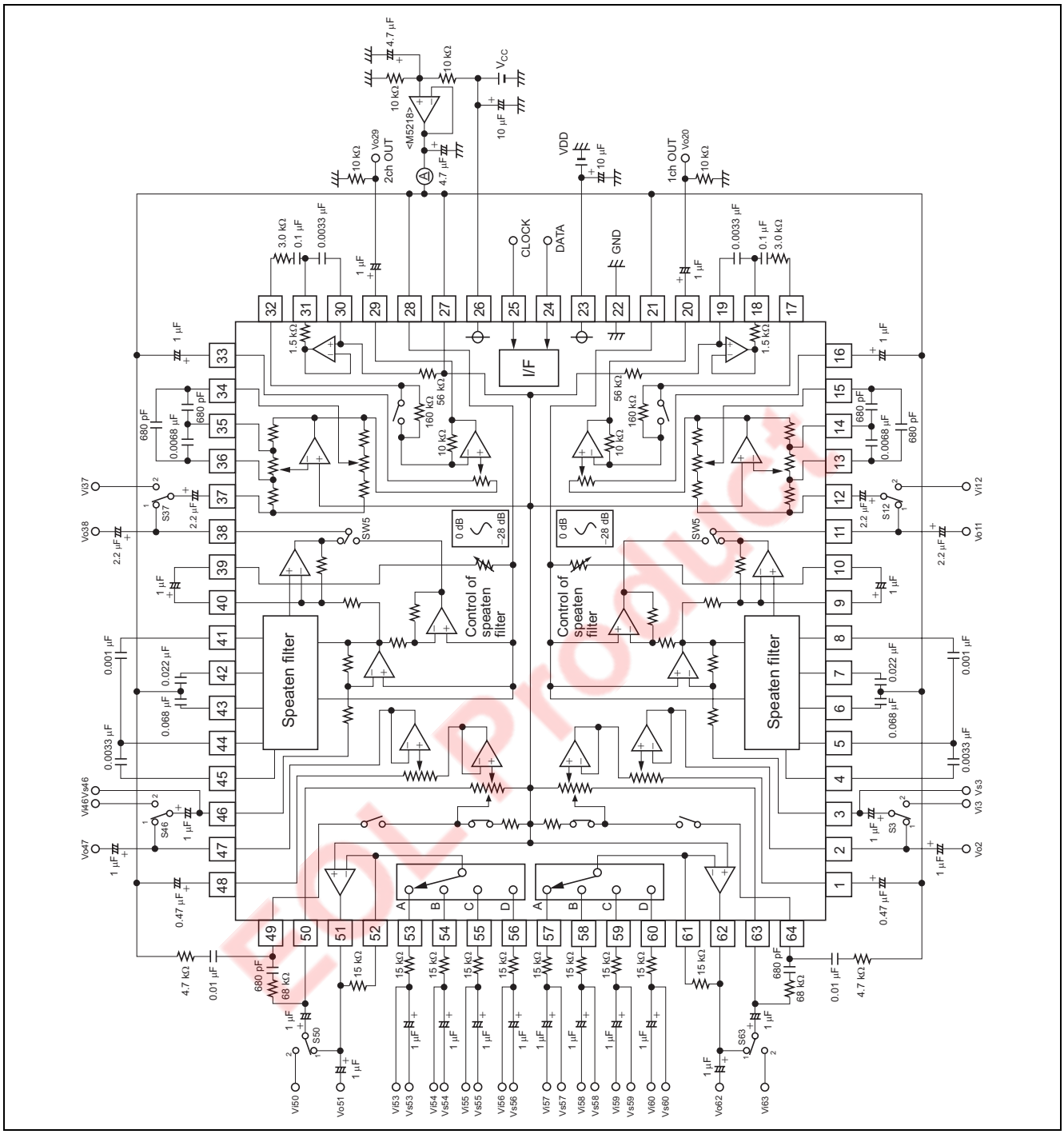
Electrical Characteristics

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Supply voltage						
Circuit current	ICC	—	50	65	mA	No signal
REF input current	IREF	—	3.2	6.0	mA	Speaten filter: MAX
I/O (Output of selector)						
Maximum output amplitude of selector amp	VOM(SEL)	1.8	2.2	—	Vrms	THD = 1%
Output noise level of selector amp.	V_{NO}(SEL)	—	5.5	11	μVrms	Rg = 0 DIN-Audio
Total harmonic distortion of selector amp.	THD(SEL)	—	0.003	0.05	%	f = 1 kHz Vo = 0.5 Vrms DIN-Audio
Cannel separation of selector amp	CS(SEL)	—	–90	–80	dB	f = 1 kHz DIN-Audio
Volume						
Maximum ATT of the main volume	ATT(VOL)	—	–90	–80	dB	ATT(VOL) = –∞
ΔATT of the main volume	ΔATT(VOL)	–2	0	2	dB	ATT(VOL) = 0 dB
I/O (total)						
Maximum input amplitude	VIM	2.0	2.8	—	Vrms	THD = 1%, Speaten filter: OFF VOL = –4 dB ATT = 0 dB
Maximum output amplitude	VOM	1.4	1.8	—	Vrms	THD = 1%, Speaten filter: ON
		1.8	2.2	—	Vrms	THD = 1%, Speaten filter: OFF
Output noise level	V_{NO}	—	100	200	μVrms	VOL = 0 dB ATT = 0 dB Speaten filter: MAX Rg = 0, DIN-Audio
		—	12	24	μVrms	VOL = 0 dB ATT = 0 dB Speaten filter: OFF Rg = 0, DIN-Audio
		—	6.5	13	μVrms	VOL = –∞ ATT = –28 dB Speaten filter: MAX Rg = 0, DIN-Audio
Total harmonic distortion	THD	—	0.01	0.2	%	f = 1 kHz, Loudness = OFF Vo = 0.5 Vrms DIN-Audio
Cannel separation	CS	—	–80	–70	dB	f = 1 kHz DIN-Audio
Tone control						
Value of bass boost	G(BASS)B	9	12	15	dB	f = 100 Hz
Value of bass cut	G(BASS)C	–15	–12	–9	dB	f = 100 Hz
Value of treble boost	G(TRE)B	9	12	15	dB	f = 10 kHz
Value of treble boost	G(TRE)C	–15	–12	–9	dB	f = 10 kHz
Bass boost						
Gain of bass boost	GBB	6.5	8.5	10.5	dB	f = 100 Hz

Test Circuit

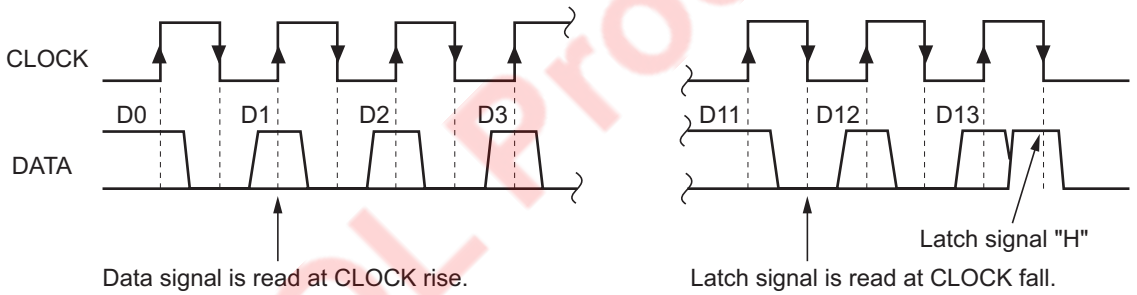
(ICC, ATT(VOL), Delta ATT(VOL), G(BASS)B, G(BASS)C, G(TRE)B, G(TRE)C, VOM, VNO, THD, CS)



Switch Condition

Item	Symbol	Switch condition					
		S3	S12	S37	S46	S50	S63
Circuit current	ICC	1	1	1	1	1	1
REF input current	IREF	1	1	1	1	1	1
Maximum output amplitude of selector amp.	VOM(SEL)	2	2	2	2	2	2
Output noise level of selector amp.	V_{NO}(SEL)	↓	↓	↓	↓	↓	↓
Total harmonic distortion of selector amp.	THD(SEL)	↓	↓	↓	↓	↓	↓
Cannel separation of selector amp.	CS(SEL)	↓	↓	↓	↓	↓	↓
Maximum ATT of the main volume	ATT(VOL)	↓	↓	↓	↓	↓	↓
ΔATT of the main volume	ΔATT(VOL)	2	2	2	2	2	2
Maximum input amplitude	VIM	1	1	1	1	1	1
Maximum output amplitude	VOM	↓	↓	↓	↓	↓	↓
Output noise level	V_{NO}	↓	↓	↓	↓	↓	↓
Total harmonic distortion	THD	↓	↓	↓	↓	↓	↓
Cannel separation	CS	1	1	1	1	1	1
Value of bass boost	G(BASS)B	2	2	2	2	2	2
Value of bass cut	G(BASS)C	↓	↓	↓	↓	↓	↓
Value of treble boost	G(TRE)B	↓	↓	↓	↓	↓	↓
Value of treble boost	G(TRE)C	↓	↓	↓	↓	↓	↓
Gain of bass boost	GBB	2	2	2	2	2	2

Relationships Between Data and Clock



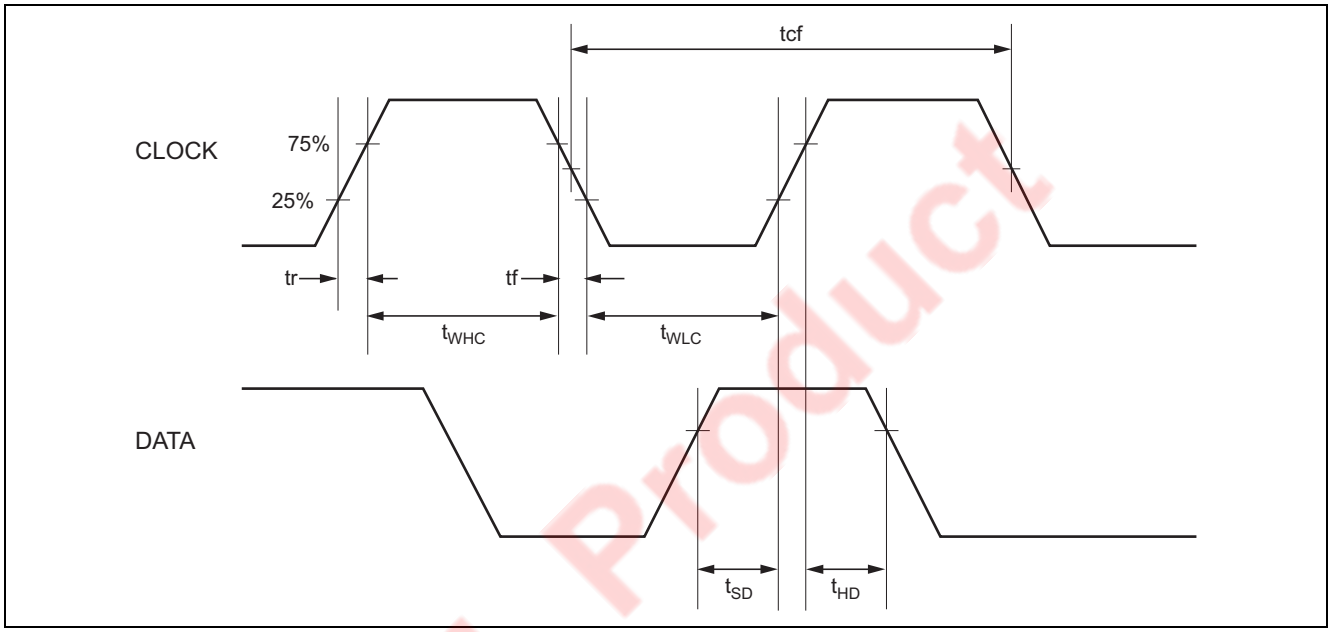
Digital Block Alternating Current

Item	Symbol	Limits			Unit	Conditions	
		Min	Typ	Max			
Input voltage (L level)	V_{IL}	0	—	0.2 V_{DD}	V	DATA and CLOCK pins	
Input voltage (H level)	V_{IH}	0.8 V_{DD}	—	V_{DD}			
Input current (L level)	I_{IL}	–10	—	10	μA	V_I = 0	DATA and CLOCK pins
Input current (H level)	I_{IH}	—	—	10		V_I = V_{DD}	

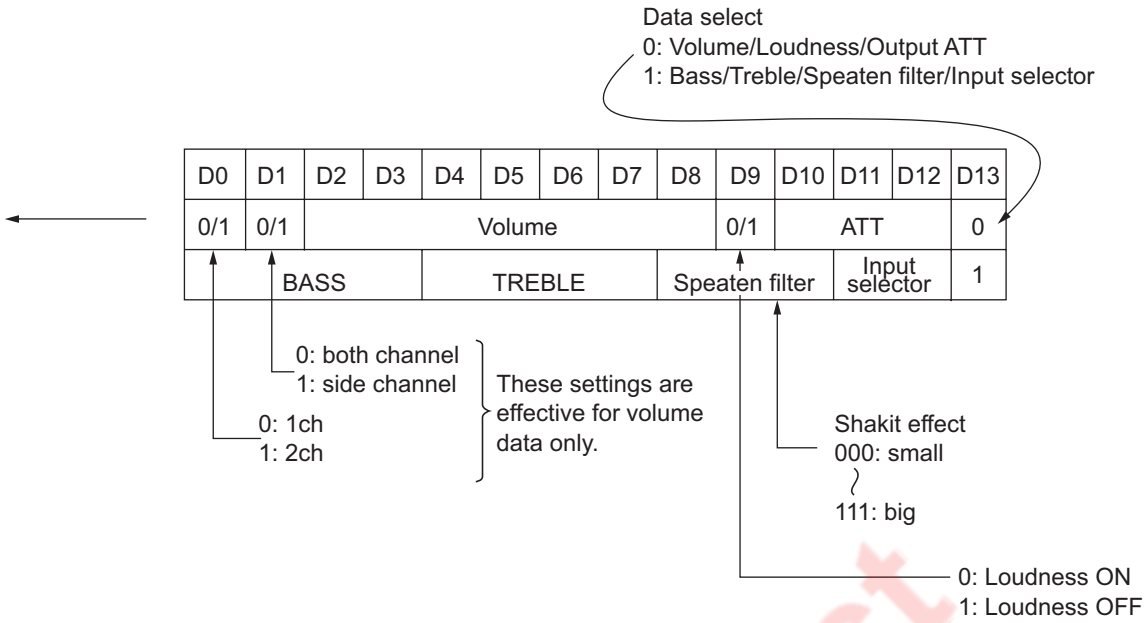
Digital Block Direct Current

Item	Symbol	Limits			Unit
		Min	Typ	Max	
CLOCK cycle time	tcf	4	—	—	µs
CLOCK pulse width (H level)	tw_{HC}	1.6	—	—	
CLOCK pulse width (L level)	tw_{LC}	1.6	—	—	
CLOCK rise time	tr	—	—	0.4	
CLOCK fall time	tf	—	—	0.4	
DATA setup time	t_{SD}	0.8	—	—	
DATA hold time	t_{HD}	0.8	—	—	

Clock and Data Timing



Data Format



Note: Loudness, Input selector, Tone (Bass and Treble) are only both channel simultaneous operation.

Data Select: 0

Volume Code

ATT1	D2	D3	D4	D5	D6
0 dB	H	L	H	L	H
–4 dB	L	L	H	L	H
–8 dB	H	H	L	L	H
–12 dB	L	H	L	L	H
–16 dB	H	L	L	L	H
–20 dB	L	L	L	L	H
–24 dB	H	H	H	H	L
–28 dB	L	H	H	H	L
–32 dB	H	L	H	H	L
–36 dB	L	L	H	H	L
–40 dB	H	H	L	H	L
–44 dB	L	H	L	H	L
–48 dB	H	L	L	H	L
–52 dB	L	L	L	H	L
–56 dB	H	H	H	L	L
–60 dB	L	H	H	L	L
–64 dB	H	L	H	L	L
–68 dB	L	L	H	L	L
–72 dB	H	H	L	L	L
–76 dB	L	H	L	L	L
–80 dB	H	L	L	L	L
–∞	L	L	L	L	L

ATT2	D7	D8
0dB	H	H
–1dB	L	H
–2dB	H	L
–3dB	L	L

Output ATT Code

Output ATT	D10	D11	D12
0 dB	H	H	H
–4 dB	H	H	L
–8 dB	H	L	H
–12 dB	H	L	L
–16 dB	L	H	H
–20 dB	L	H	L
–24 dB	L	L	H
–28 dB	L	L	L

Data Select: 1

Tone Code

Buss	D0	D1	D2	D3
Treble	**D4**	**D5**	**D6**	**D7**
12 dB	H	H	H	H
10 dB	L	H	H	H
8 dB	H	L	H	H
6 dB	L	L	H	H
4 dB	H	H	L	H
2 dB	L	H	L	H
0 dB	H	L	L	H
–2 dB	L	L	L	H
–4 dB	H	H	H	L
–6 dB	L	H	H	L
–8 dB	H	L	H	L
–10 dB	L	L	H	L
–12 dB	H	H	L	L

Speaten Filter Effect, X-BASS ON/OFF Code

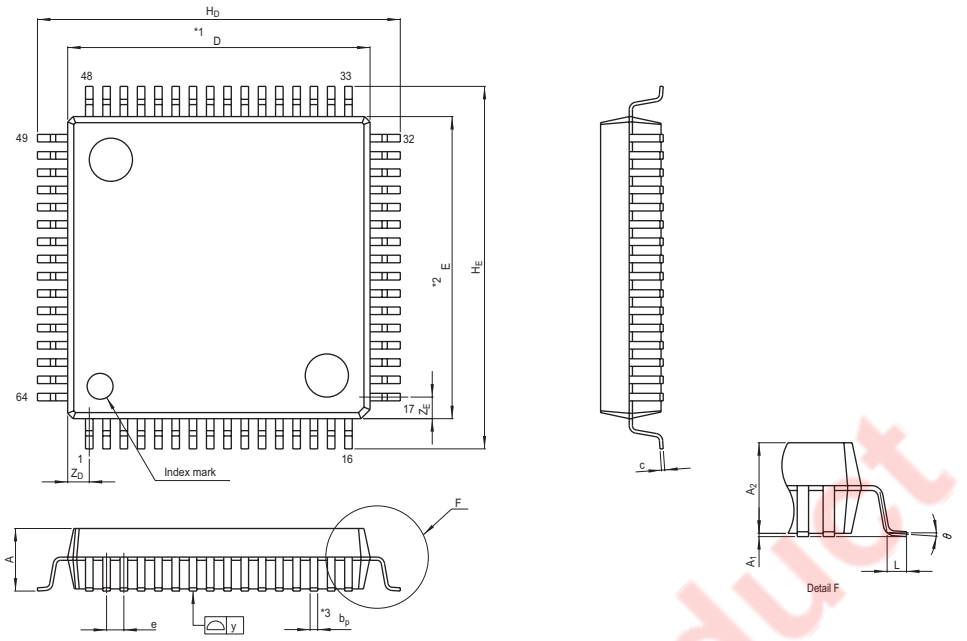
Effect NF Reistor	X-BASS ON/OFF	SHAKIT ON/PASS	D8	D9	D10
189 Ω	OFF	ON	H	H	H
267 Ω	OFF	ON	L	H	H
378 Ω	OFF	ON	H	L	H
533 Ω	OFF	ON	L	L	H
754 Ω	OFF	ON	H	H	L
50 kΩ	OFF	ON	L	H	L
50 kΩ	OFF	PASS	H	L	L
50 kΩ	ON	PASS	L	L	L

Input Selector Code

Input Selector	D11	D12
A CH	H	H
B CH	L	H
C CH	H	L
D CH	L	L

Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-QFP64-14x14-0.80	PRQP0064GA-A	64P6N-A	1.1g



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

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	13.8	14.0	14.2
E	13.8	14.0	14.2
A_2	—	2.8	—
H_D	16.5	16.8	17.1
H_E	16.5	16.8	17.1
A	—	—	3.05
A_1	0	0.1	0.2
b_p	0.3	0.35	0.45
c	0.13	0.15	0.2
θ	0°	—	10°
e	0.65	0.8	0.95
y	—	—	0.10
Z_D	—	1.0	—
Z_E	—	1.0	—
L	0.4	0.6	0.8

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