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

April 1st, 2010
Renesas Electronics Corporation

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M61519FP

Audio Signal Processor with Surround

REJ03F0206-0201

Rev.2.01

Mar 31, 2008

Description

M61519FP is the semiconductor integrated circuit for Home Audio. M61519FP includes 2ch electronic volume, Tone control, 4 Input Selector, Bass Boost, REC output and Mic Mixing. This IC is suitable for Mini Component.

Features

- 2ch master volume (L, R independent control)
Main volume: 0 dB to -76 dB (2 dB or 4 dB step), $-\infty$
Trim volume: 0 dB to -15 dB (1 dB step)
- Tone control (Bass/Mid/Treble)
 ± 8 dB (2 dB step)
- 4 input selector with Mute
- Surround function
- Vocal cut function
- Bass boost function
- L + R output for spectrum analysis display
- L + R output for subwoofer
- MIC mixing function
- 2 REC output with mute
- Input ATT: -5/0/+5 dB
- Tone input ATT: 0/-13 dB
- External input ATT: +3/0/-3/-6 dB

Application

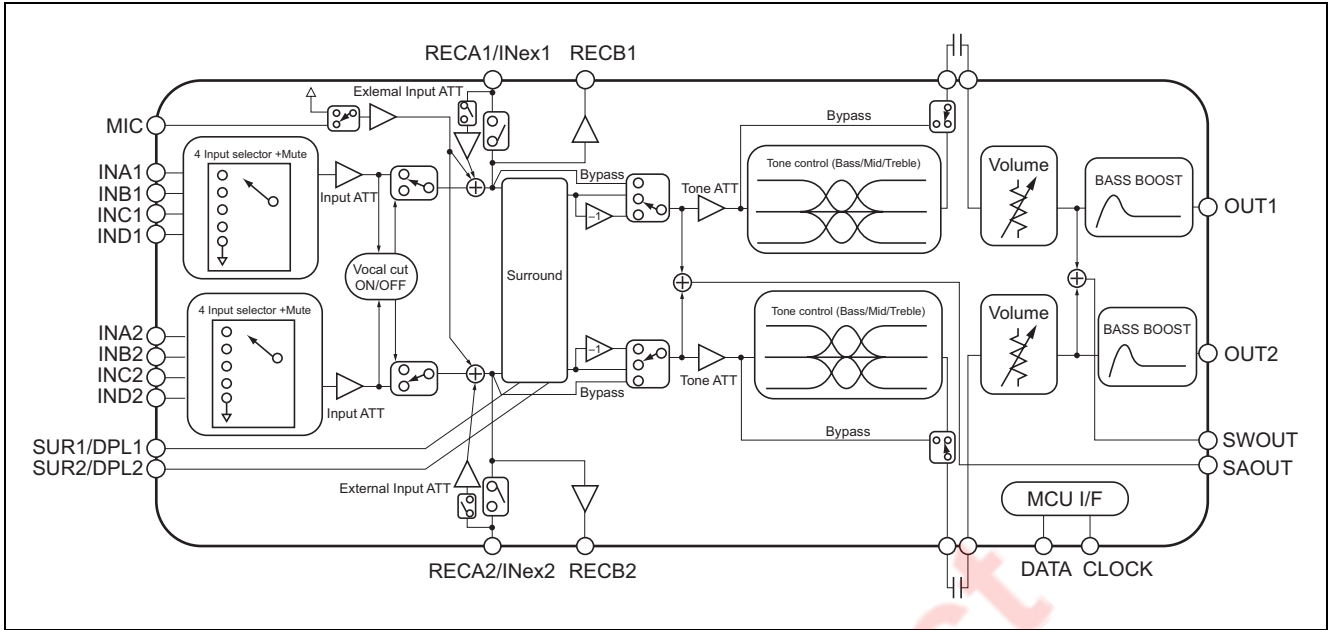
Mini/Micro Component, Radio-Cassette Recorder with CD Player, etc.

Recommended Operating Conditions

Supply voltage range: 8.0 to 10.0 V

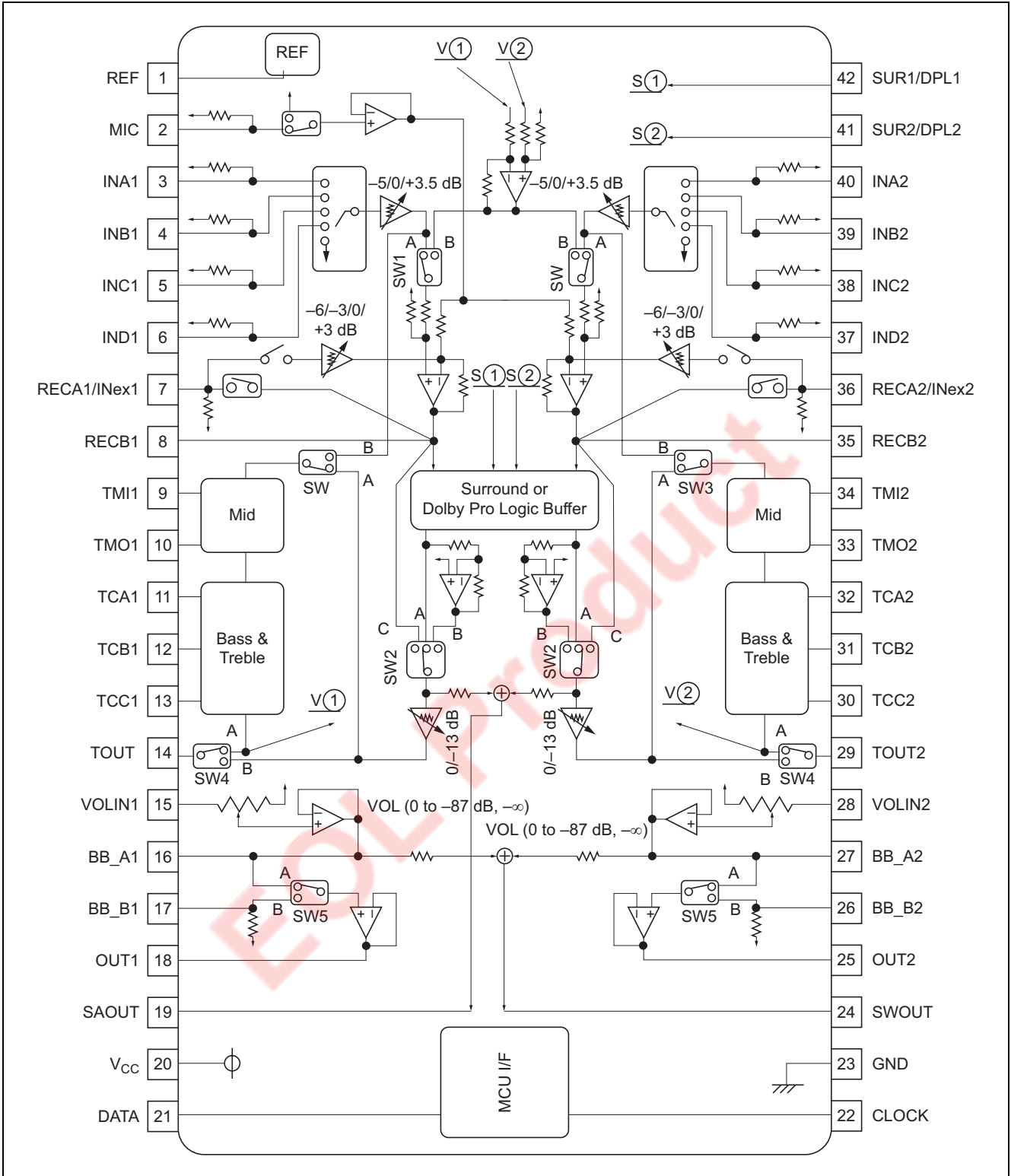
Recommended supply voltage: 9.0 V

System Block Diagram



EOL Product

Pin Configuration and Block Diagram

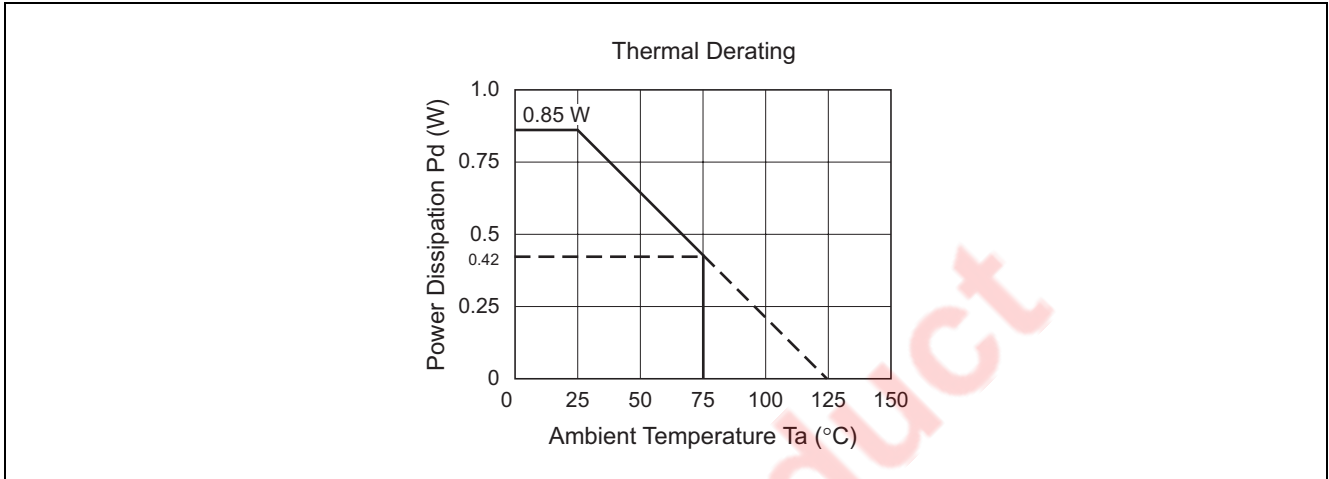


Pin Description

Pin No.	Symbol	Function
1	REF	Input pin of internal reference (REF = 4.5 V)
2	MIC	Input pin of MIC Mixing
3, 4, 5, 6 37, 38, 39, 40	INA to IND	Input Selector
41, 42	SUR/DPL	External pins for surround, Switching use with DPL Input pin
7, 8, 35, 36	RECA/Inex, RECB	Output pins for REC, RECA can switch mute function and external Input pins (At external input, RECA Switch is fixed mute position.)
9, 10, 33, 34	TMI, TMO	External pins for Mid (sympathetic vibration type)
11, 12, 13, 30, 31, 32	TCA, TCB, TCC	External pins for Bass/Treble (Shelving tape)
14, 29	TOUT	Output pins of tone control
15, 28	VOLIN	Input pins of electronic volume
16, 17, 26, 27	BB_A, BB_B	External pins for Bass boost
18, 25	OUT	Output pins
19	SAOUT	Mix pins for spectrum Analyzer (L + R/2)
24	SWOUT	Mix pin for super woofer
20	V _{CC}	Internal analog, power pin for digital circuit
23	GND	Internal analog, GND pin for digital circuit
21, 22	DATA, CLOCK	DATA for serial data, Clock input pin

Absolute Maximum Ratings

Item	Symbol	Limits	Units	Conditions
Supply voltage	V_{CC}	10.5	V	—
Power dissipation	P_d	850	mW	$T_a \leq 25\text{ }^\circ\text{C}$
Thermal derating	$K\theta$	8.6	mW/ $^\circ\text{C}$	$T_a > 25\text{ }^\circ\text{C}$
Operating temperature	T_{opr}	-20 to +75	$^\circ\text{C}$	—
Storage temperature	T_{stg}	-40 to +125	$^\circ\text{C}$	—

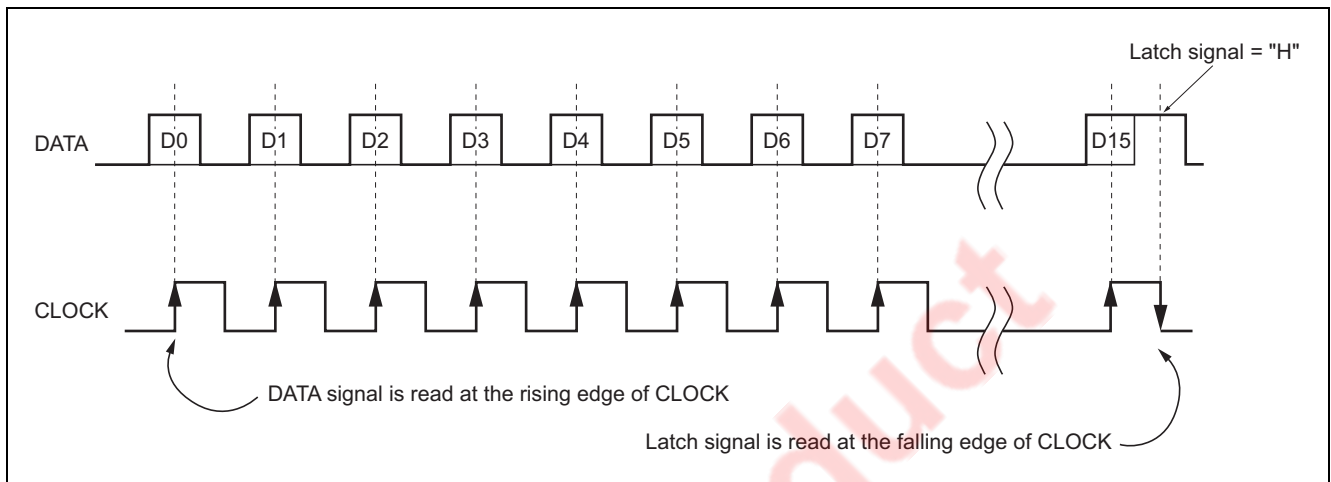


Recommended Operating Condition

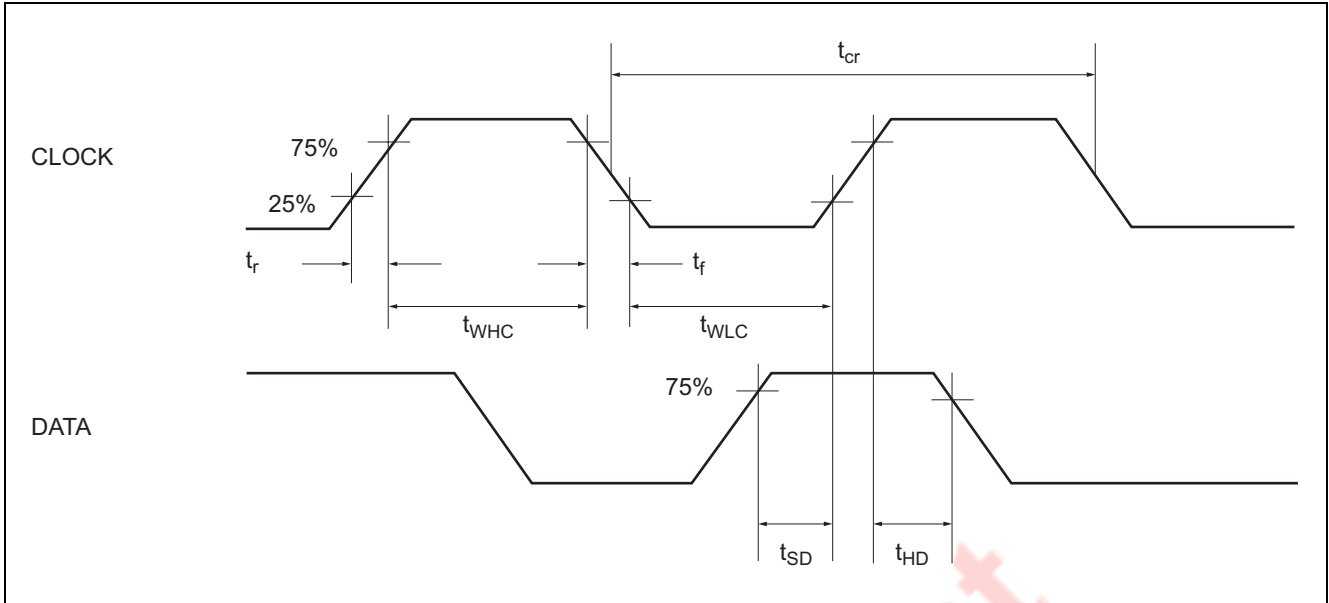
(Ta = 25°C, unless otherwise noted.)

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	AVDD	8	9	10	V
Logic "H" level input voltage	VIH	2.2	—	5.5	V
Logic "L" level input voltage	VIL	0	—	0.6	V

Relationship between Data and Clock and Latch



Data Timing (Recommended Conditions)



Digital Block Timing Regulation

Item	Symbol	Limits			Unit
		Min	Typ	Max	
CLOCK cycle time	t_{cr}	4	—	—	μs
CLOCK pulse width ("H" level)	t_{WHC}	1.6	—	—	
CLOCK pulse width ("L" level)	t_{WLC}	1.6	—	—	
CLOCK rise time	t_r	—	—	0.4	
CLOCK fall time	t_f	—	—	0.4	
DATA setup time	t_{SD}	0.8	—	—	
DATA hold time	t_{HD}	0.8	—	—	

Digital Control Specification

Prohibit using except specified Data code as follows.

(When the power is on, the following conditions in the shaded parts are initially set.)

← Input direction

	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
A	Input Selector			Input ATT		Tone ATT	Vocal cut Tone bypass		Mic MIX	RECA/ External Input			Surround/ DPLIN		0	0
B	Tone Control SW		Tone control Bass			Tone control Mid			Tone control Treble			0	1			
C	Lch Trim Volume			Rch Trim Volume			Bass Boost	0	0	0	0	0	0	1	0	
D	Lch Master Volume				Rch Master Volume				0	0	0	0	1	1		

(1) Input Selector

Selector	D0A	D1A	D2A
INA	0	0	0
INB	0	0	1
INC	0	1	0
IND	0	1	1
Mute	1	*	*

(2) Input ATT

Input ATT	D3A	D4A
-5 dB	0	0
0 dB	0	1
+3.5 dB	1	0

(3) Tone ATT

Tone ATT	D5A
-13 dB	0
0 dB	1

(4) Vocal Cut & Tone Bypass

Switching	D6A	D7A
Vocal cut OFF, Tone Bypass	0	0
Vocal cut OFF, Tone ON	0	1
Vocal cut ON, Tone Bypass	1	*

(5) MIC Mixing

MIC Mixing	D8A
OFF	0
ON	1

(6) RECA/External Input

Switching		D9A	D10A	D11A
External Input Off	RECA-OFF	0	*	0
	RECA-ON	0	*	1
External Input ON	+3 dB	1	0	0
	0 dB	1	0	1
	-3 dB	1	1	0
	-6 dB	1	1	1

Note: At external Input setting, RECA is OFF.

(7) Surround/DPLIN

Switching	D12A	D13A
Bypass	0	0
Surround	0	1
DPLIN	1	0

(8) Switching of Tone Control

Switching	D0B	D1B
Lch and Rch	0	0
Lch only	0	1
Rch only	1	0

(9) Tone Control (Bass, Mid, Treble)

Tone	D2, 6, 10B	D3, 7, 11B	D4, 8, 12B	D5, 9, 13B
+8 dB	1	1	0	0
+6 dB	1	0	1	1
+4 dB	1	0	1	0
+2 dB	1	0	0	1
0 dB	0	0	0	0
-2 dB	0	0	0	1
-4 dB	0	0	1	0
-6 dB	0	0	1	1
-8 dB	0	1	0	0

(10) Trim Volume (Lch and Rch)

Trim	D0, 4C	D1, 5C	D2, 6C	D3, 7C
0 dB	0	0	0	0
-1 dB	0	0	0	1
-2 dB	0	0	1	0
-3 dB	0	0	1	1
-4 dB	0	1	0	0
-5 dB	0	1	0	1
-6 dB	0	1	1	0
-7 dB	0	1	1	1
-8 dB	1	0	0	0
-9 dB	1	0	0	1
-10 dB	1	0	1	0
-11 dB	1	0	1	1
-12 dB	1	1	0	0
-13 dB	1	1	0	1
-14 dB	1	1	1	0
-15 dB	1	1	1	1

Note: Total level is fixed at -87 dB, on condition that the total level of Trim and Master volume is under "-87 dB".(example: Trim -15 dB, Master -76 dB Total level is -87 dB)

(11) Bass Boost

Bass Boost	D8C
OFF	0
ON	1

(12) Master Volume (L, Rch)

Master	D0, 5D	D1, 6D	D2, 7D	D3, 8D	D4, 9D
0 dB	0	0	0	0	0
-2 dB	0	0	0	0	1
-4 dB	0	0	0	1	0
-6 dB	0	0	0	1	1
-8 dB	0	0	1	0	0
-10 dB	0	0	1	0	1
-12 dB	0	0	1	1	0
-14 dB	0	0	1	1	1
-16 dB	0	1	0	0	0
-18 dB	0	1	0	0	1
-20 dB	0	1	0	1	0
-22 dB	0	1	0	1	1
-24 dB	0	1	1	0	0
-26 dB	0	1	1	0	1
-28 dB	0	1	1	1	0
-30 dB	0	1	1	1	1
-32 dB	1	0	0	0	0
-34 dB	1	0	0	0	1
-36 dB	1	0	0	1	0
-38 dB	1	0	0	1	1
-40 dB	1	0	1	0	0
-42 dB	1	0	1	0	1
-44 dB	1	0	1	1	0
-48 dB	1	0	1	1	1
-52 dB	1	1	0	0	0
-56 dB	1	1	0	0	1
-60 dB	1	1	0	1	0
-64 dB	1	1	0	1	1
-68 dB	1	1	1	0	0
-72 dB	1	1	1	0	1
-76 dB	1	1	1	1	0
-∞ dB	1	1	1	1	1

Electrical Characteristics

Unless otherwise noticed, $T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{ V}$, $f = 1\text{ kHz}$, Surround bypass, tone bypass and bass boost = OFF

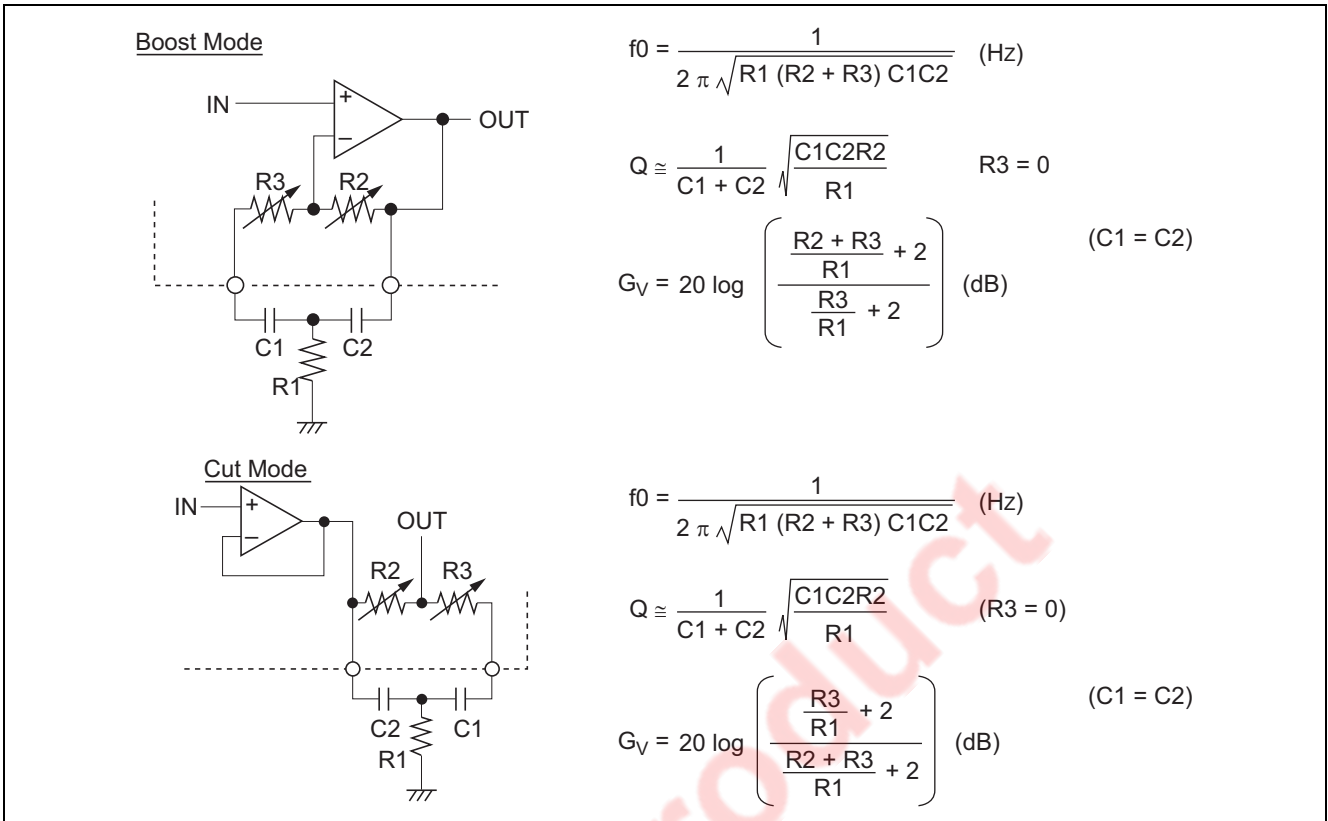
Item		Symbol	Limits			Unit	Test Condition	
			Min	Typ	Max			
Voltage	Analog positive power circuit current	Alcc	—	25	40	mA	At $V_{CC} = 9.0\text{ V}$, 20 pin terminal current and no signal	
Input and Output	Input resistance	Rin	30	60	90	k Ω	Input pin 3 ~ 6 pin, 37 ~ 40 pin, 2 pin	
	Maximum input voltage	VIM	1.8	2.2	—	Vrms	3, 40 pin IN, 8, 35 pin OUT RL = 10 k Ω , THD = 1%, Input ATT = -5 dB	
	Maximum output voltage	VOM	1.8	2.2	—	Vrms	3, 40 pin IN, 18, 25 pin OUT Bass boost ON, $f = 100\text{ Hz}$, RL = 10 k Ω , THD = 5%	
		VrecOM	1.6	2.0	—	Vrms	3, 40 pin IN, 7, 8, 35, 36 pin OUT RL = 47 k Ω , THD = 1%, Input ATT = +3.5 dB	
	Output terminal voltage	Vodc	4.0	4.5	5.0	V	At No signal, 18, 25 pin OUT	
		Vrecdc	4.0	4.5	5.0	V	At No signal, 8, 35 pin OUT	
	Pass gain	Gv	-2.0	0.0	2.0	dB	$V_i = 1\text{ Vrms}$, FLAT, Gain from 3 ~ 18 pin to 40 ~ 25 pin, Input ATT = 0 dB	
	Maximum attenuation	ATT	—	-92	-87	dB	$V_o = 1\text{ Vrms}$, 18, 25 pin OUT JIS-A, $V_{ol} = -\infty$	
	Output noise voltage	Vono	—	10.0	20.0	μVrms	JIS-A, At no signal, $R_g = 0\Omega$	$V_{ol} = 0\text{ dB}$
			—	4.0	8	μVrms	18, 25 pin OUT	$V_{ol} = -\infty$
	Distortion factor	Vrecno	—	6.0	12	μVrms	JIS-A, At no signal, $R_g = 0\text{ W}$ 8, 35 pin OUT	
		THD	—	0.02	0.05	%	BW: 400 - 30 kHz, $V_o = 0.5\text{ Vrms}$, RL = 10 k Ω	
		THDrec	—	0.01	0.05	%	BW: 400 - 30 kHz, $V_o = 0.5\text{ Vrms}$, RL = 47 k Ω	
	Cross talk between channels	CT	—	-70	55	dB	$V_o = 0.5\text{ Vrms}$, RL = 10 k Ω , JIS-A, $R_g = 0\text{ k}\Omega$	
CTrec		—	-70	55	dB	$V_o = 0.5\text{ Vrms}$, RL = 47 k Ω , JIS-A, $R_g = 0\text{ k}\Omega$		
Tone Control	Bass voltage gain	Gbassb	6	8	10	dB	$f = 100\text{ kHz}$	-8 dB
		Gbassc	-10	-8	6	dB		+8 dB
	Mid voltage gain	Gmidb	6	8	10	dB	$f = 1\text{ kHz}$	-8 dB
		Gmidc	-10	-8	6	dB		-8 dB
	Treble voltage gain	Gtrebb	-2	8	10	dB	$f = 10\text{ kHz}$	+8 dB
		Gtrebc	-10	-8	6	dB		-8 dB
Balance between channel	BALton	-2	0	2	dB	At each boost value of -8 dB and +8 dB $V_o = 1\text{ Vrms}$, 14, 29 pin OUT		
MIX Signal	Super woofa output gain	GvSW	-8	-6.0	-4	dB	$V_i = 1\text{ Vrms}$, FLAT, Gain from 3 ~ 18 pin to 40 ~ 25 pin, Input ATT = 0 dB	
	Distortion factor	THDSW	—	0.03	0.1	%	BW: 400 - 30 kHz, $V_o = 0.3\text{ Vrms}$, RL = 47 k Ω 15 pin IN, 24 pin OUT	
	Output noise voltage	VnoSW	—	20	—	μVrms	JIS-A, At no signal, $R_g = 0\Omega$, 24 pin OUT	
	Output gain for spectrum analyzer display	GvSP	-8.0	-6.0	-4.0	dB	$V_i = 1\text{ Vrms}$, FLAT, Input ATT = 0 dB, 3 pin IN, 19 pin OUT	

Note: Mix Signal Characteristics is provided only CH1 Input. (CH2 $R_g = 0\Omega$)

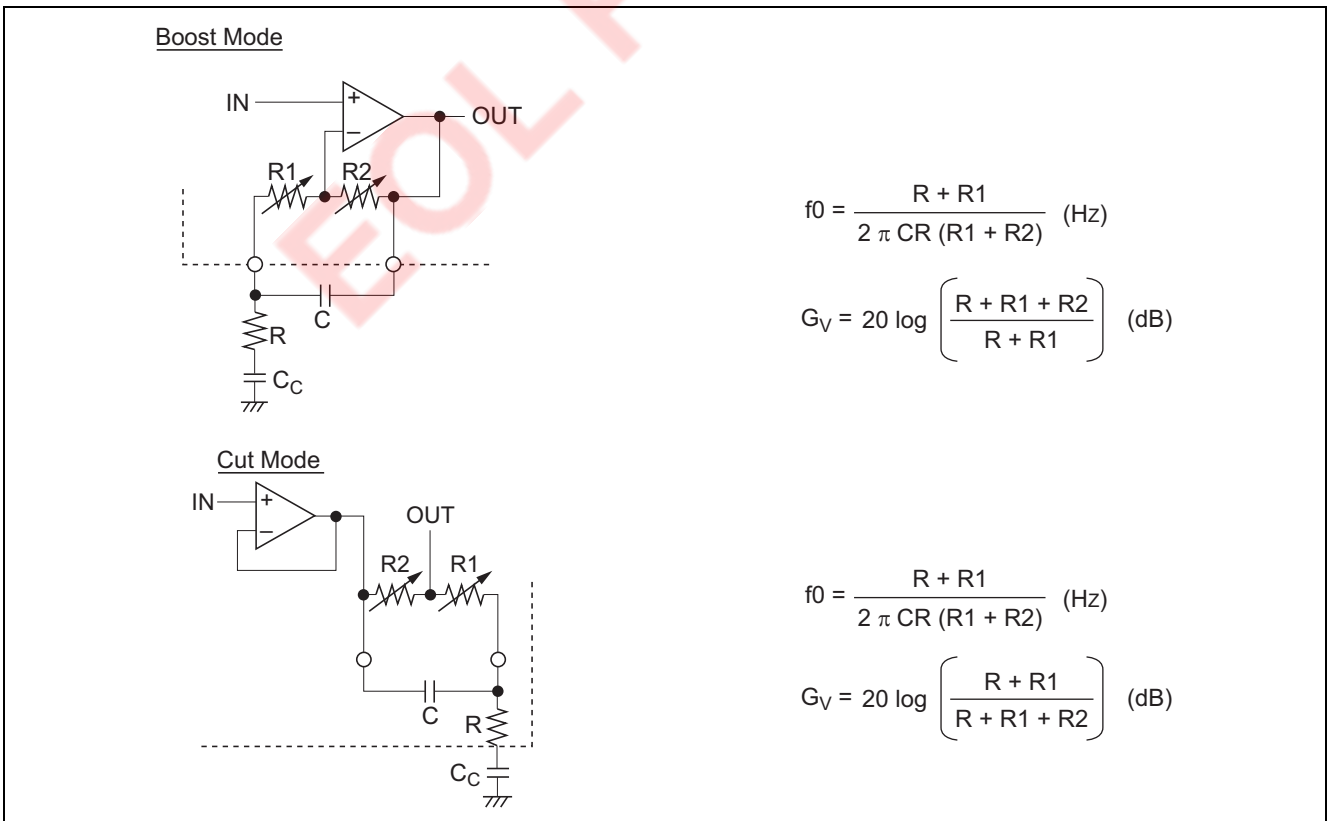
Function Description

(1) Equivalent circuit of tone control

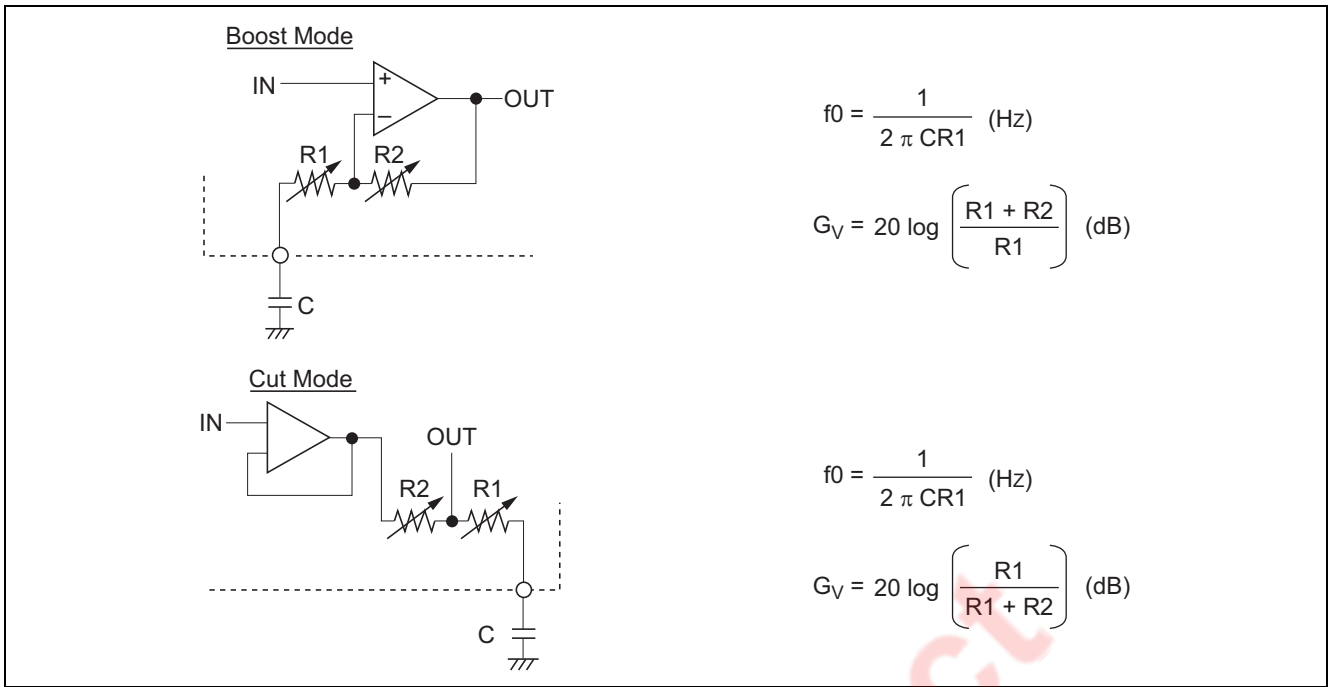
(a) Mid



(b) Bass



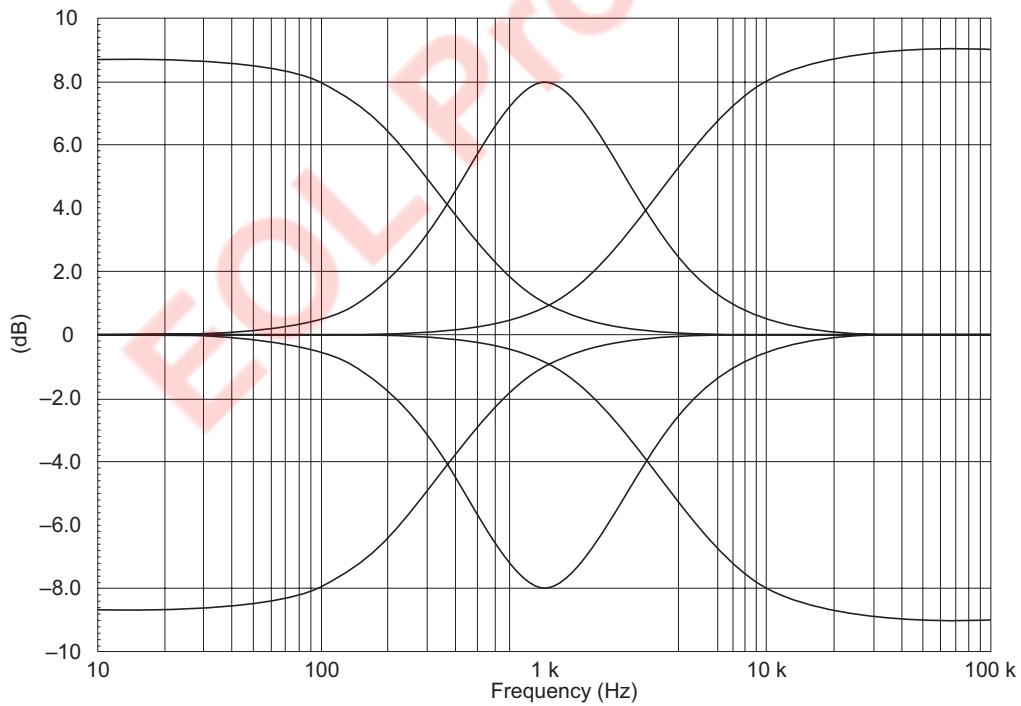
(c) Treble



(d) Characteristic Curve of Tone Control

Tone control setting = +8, -8 dB (Bass, Mid, Treble)

Note: This characteristic curve is as a result of circuit Simulation.



(2) Equivalent circuit of bass boost

Decrease Circuit of Switching noise

Amplitude characteristic of secondary high pass filter
(Reference Table)

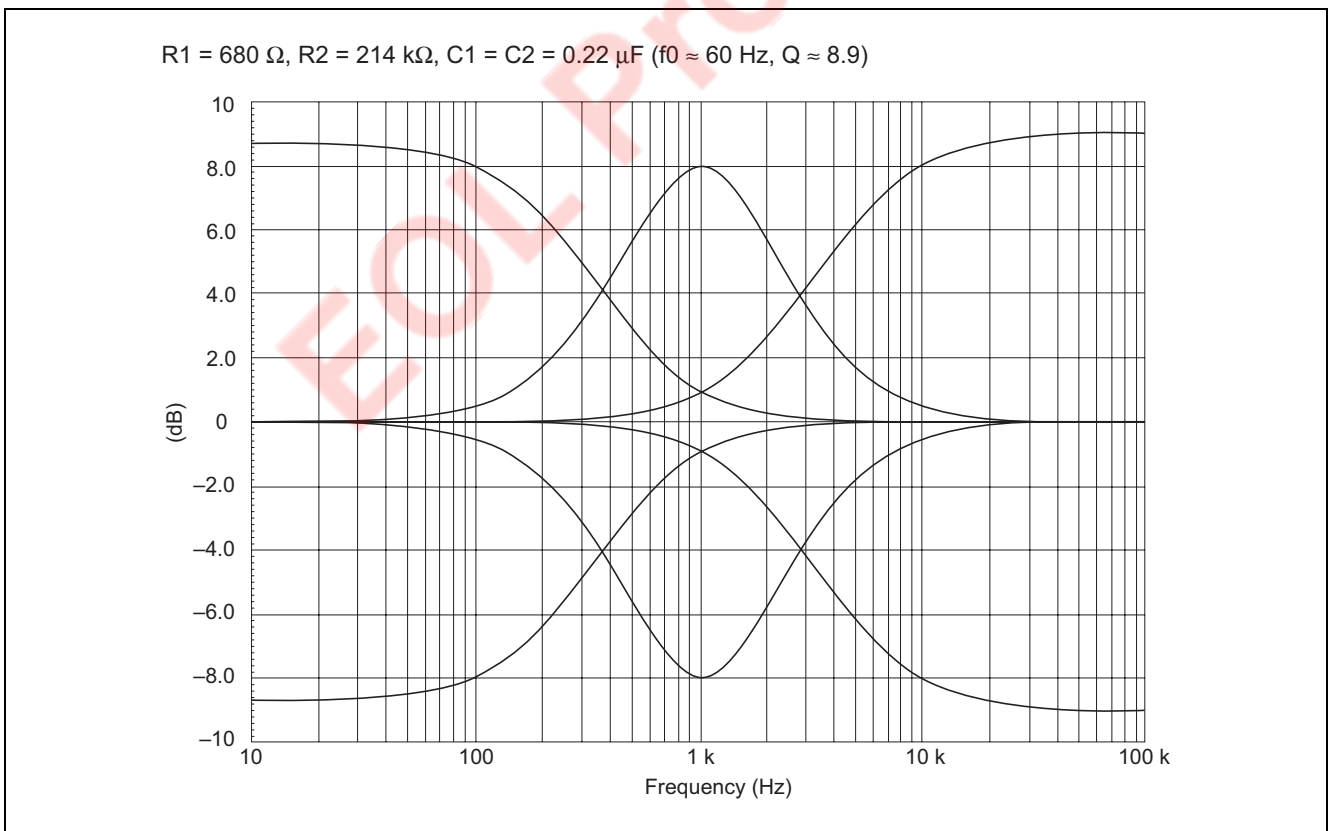
Q	G0
1	0 to 1 dB
2	6 dB
4	10 dB
5	13 dB
10	20 dB

Note: The Internal IC have built-in R2 resistance. (R2 = 214 kΩ)

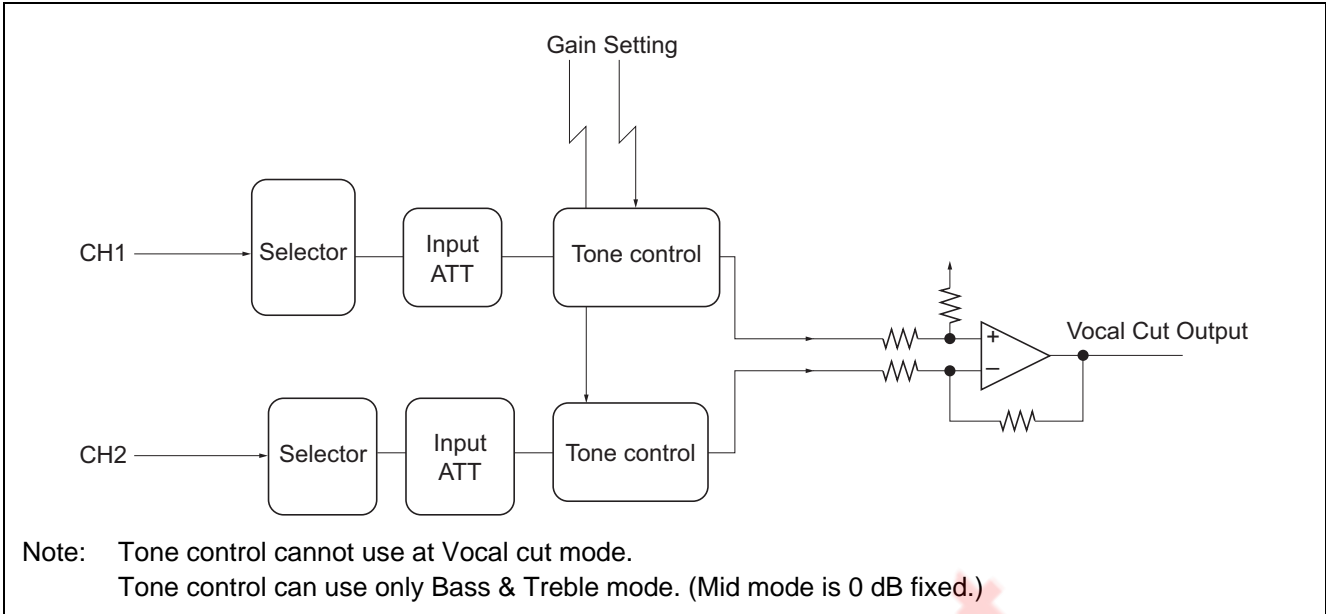
$$f_0 = \frac{1}{2\pi\sqrt{R_1R_2C_1C_2}} \text{ (Hz)}$$

$$Q = \frac{\sqrt{R_1R_2C_1C_2}}{R_1(C_1 + C_2) + (1 - K)R_2C_2}$$

Characteristic Curve of bass boost

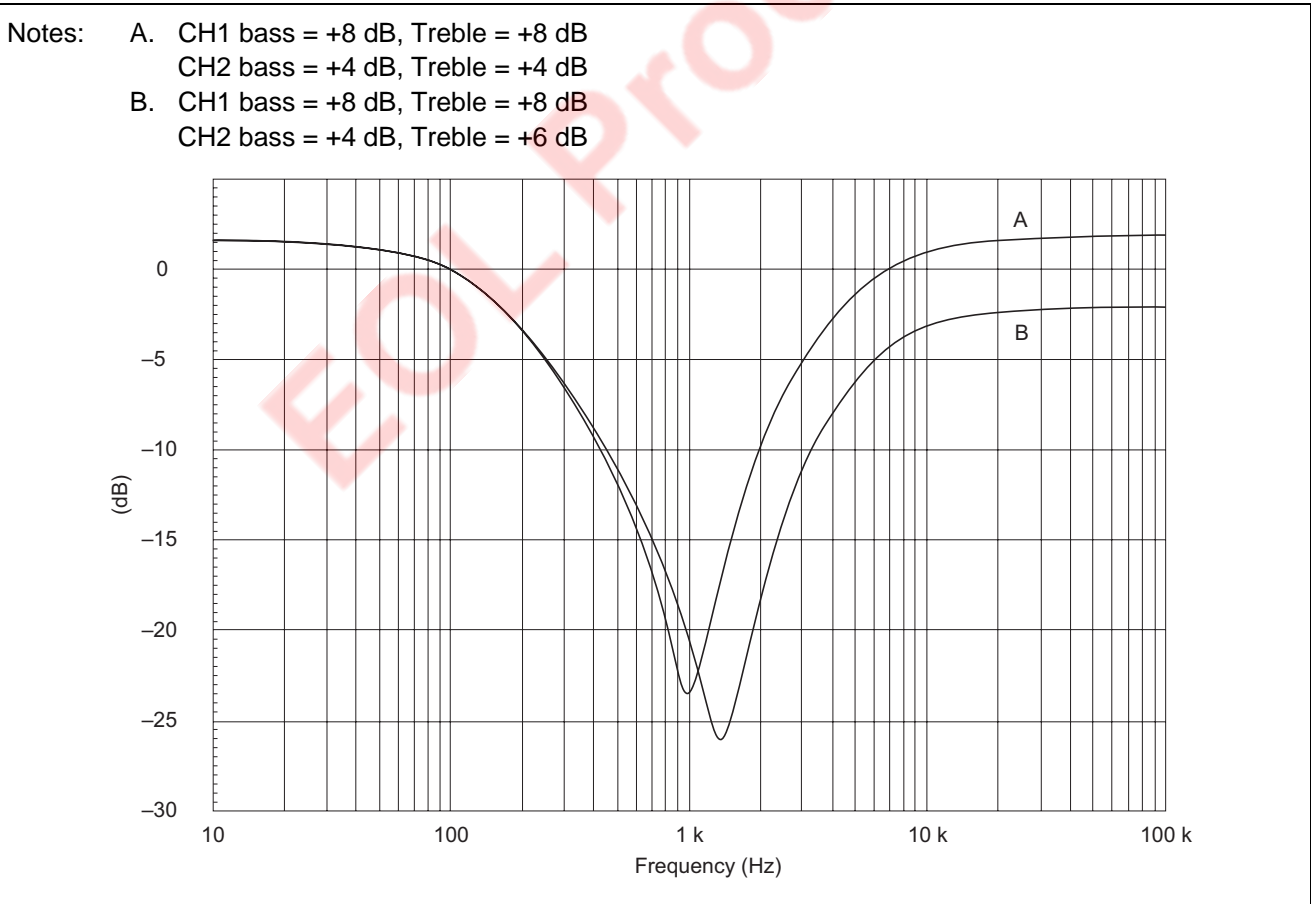


(3) Equivalent circuit of vocal cut

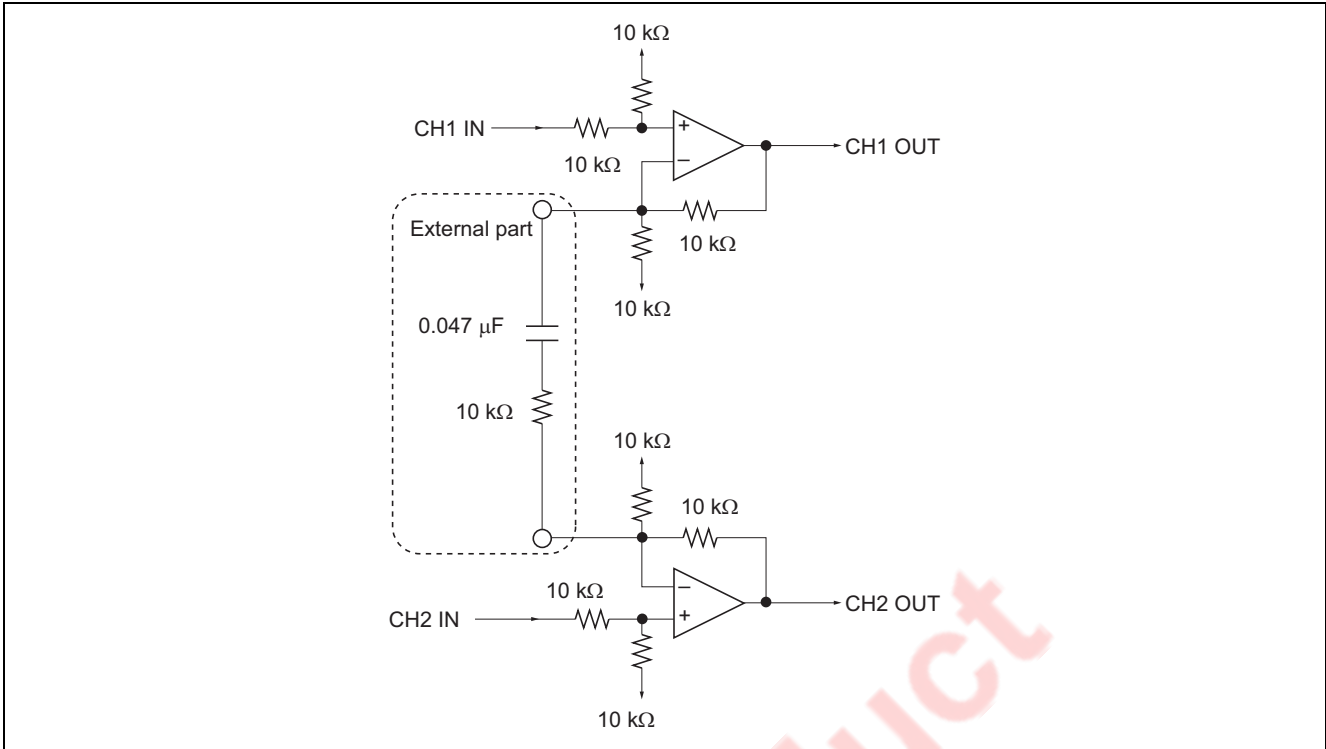


Output difference of Tone control CH1 and CH2, the characteristic to cut only Middle part of Phase Input Signal is realized.

Characteristic curve example (Phase signal input CH1, CH2)

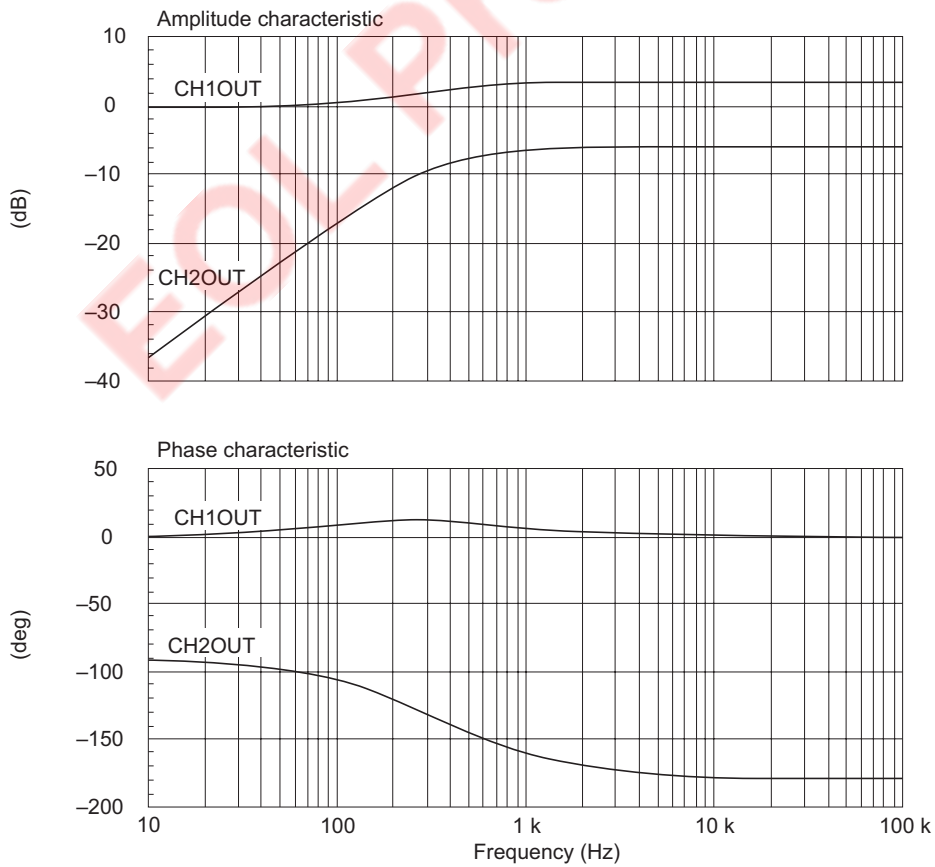


(4) Surround equivalent circuit



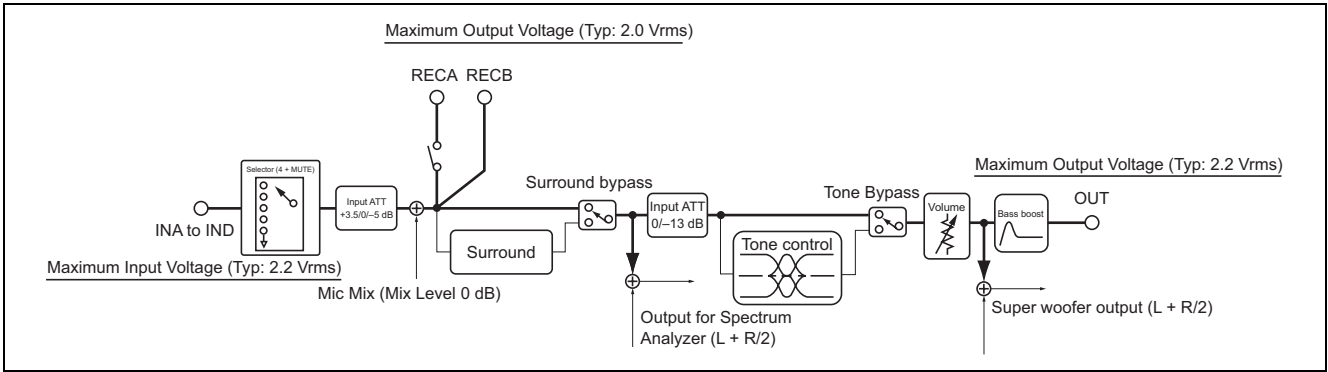
Characteristic curve example (Only CH1 Input)

Note: This characteristic curve is the result as circuit simulation.

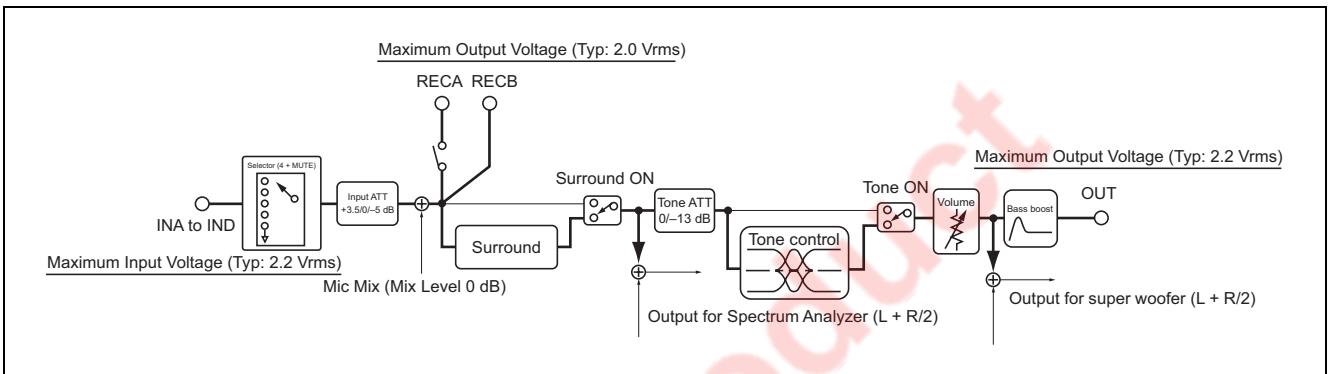


(5) Total equivalent circuit (signal flow diagram)

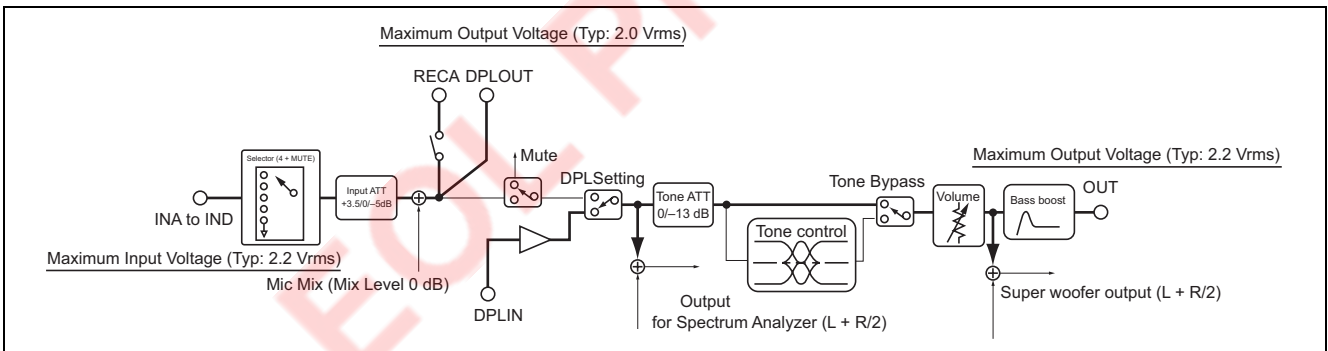
(a) Surround bypass, Tone bypass, Bass boost ON



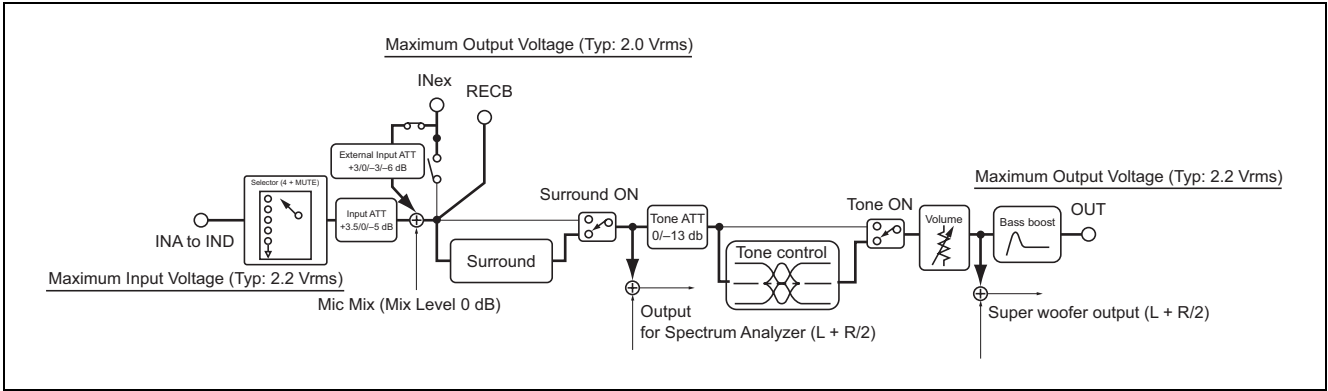
(b) Surround ON, Tone ON, Bass boost ON



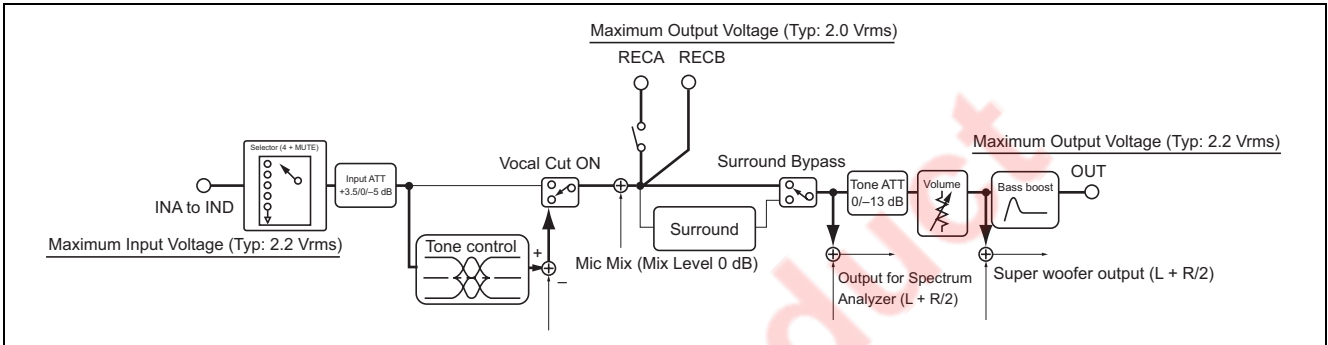
(c) DPL Input setting, Tone bypass, Bass boost ON



(d) External Input Setting, Surround ON, Tone ON, Bass boost ON



(e) Vocal Cut ON, Surround Bypass, Bass boost ON



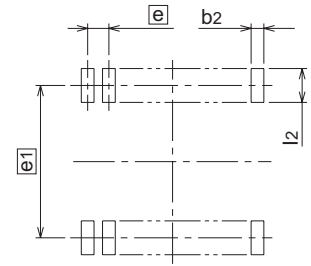
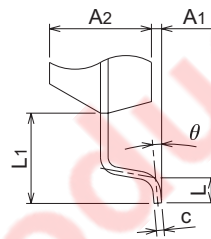
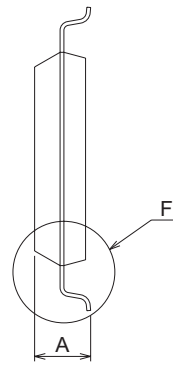
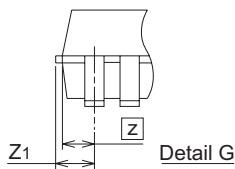
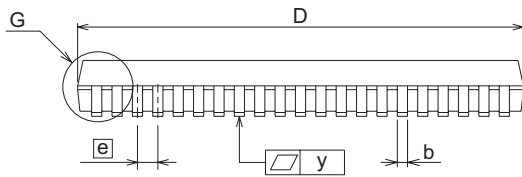
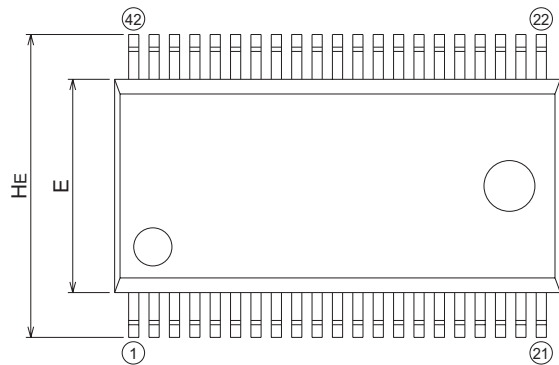
Package Dimensions

42P2R-A

(MMP)

Plastic 42pin 450mil SSOP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SSOP42-P-450-0.80	—	0.63	Alloy 42/Cu Alloy



Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	2.4
A1	0.05	—	—
A2	—	2.0	—
b	0.35	0.4	0.5
c	0.13	0.15	0.2
D	17.3	17.5	17.7
E	8.2	8.4	8.6
e	—	0.8	—
HE	11.63	11.93	12.23
L	0.3	0.5	0.7
L1	—	1.765	—
Z	—	0.75	—
Z1	—	—	0.9
y	—	—	0.15
theta	0°	—	10°
b2	—	0.5	—
e1	—	11.43	—
l2	1.27	—	—

EOL PRODUCT

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Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2377-3473

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510