

R2A15908SP

5 Input Selector 2ch Electronic Volume with Tone & Surround

REJ03F0270-0100

Rev.1.00

Jan 25, 2008

Description

The R2A15908SP is an optimum audio signal processor IC for TV. It has a 5ch input selector with mono switch, surround, tone control (2band), input gain control and 2ch master volume. It can control all of these functions with I₂C bus.

Features

- Volume 0 to -87dB, $-\infty$ / 1dB step
Each channel is independent control.
- 5 input selector + MUTE with mono switch
- Input gain control 0dB to +20dB / 2dB step
- Tone control Bass : -14dB to +14dB / 2dB step
Treble : -14dB to +14dB / 2dB step
- Surround Low / High
- Mode selector Bypass / Tone / Tone & Surround
- I₂C-bus control
- Package SOP with 28 pin

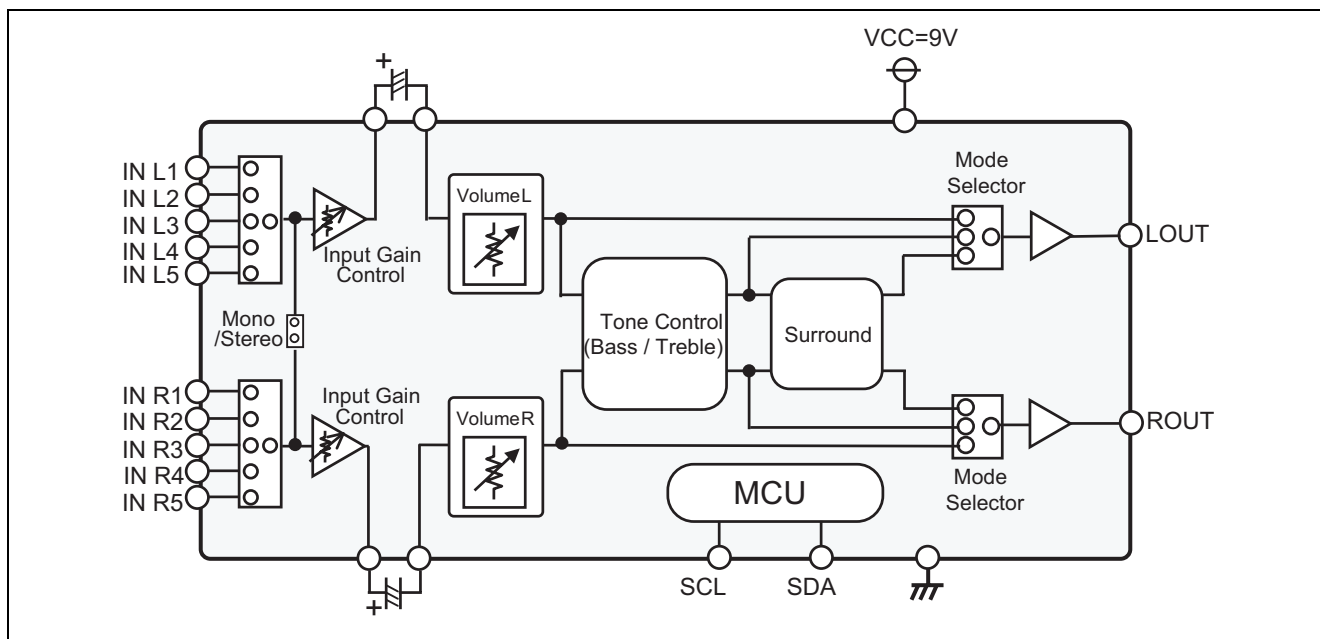
Application

- Mini stereo, TV, etc.

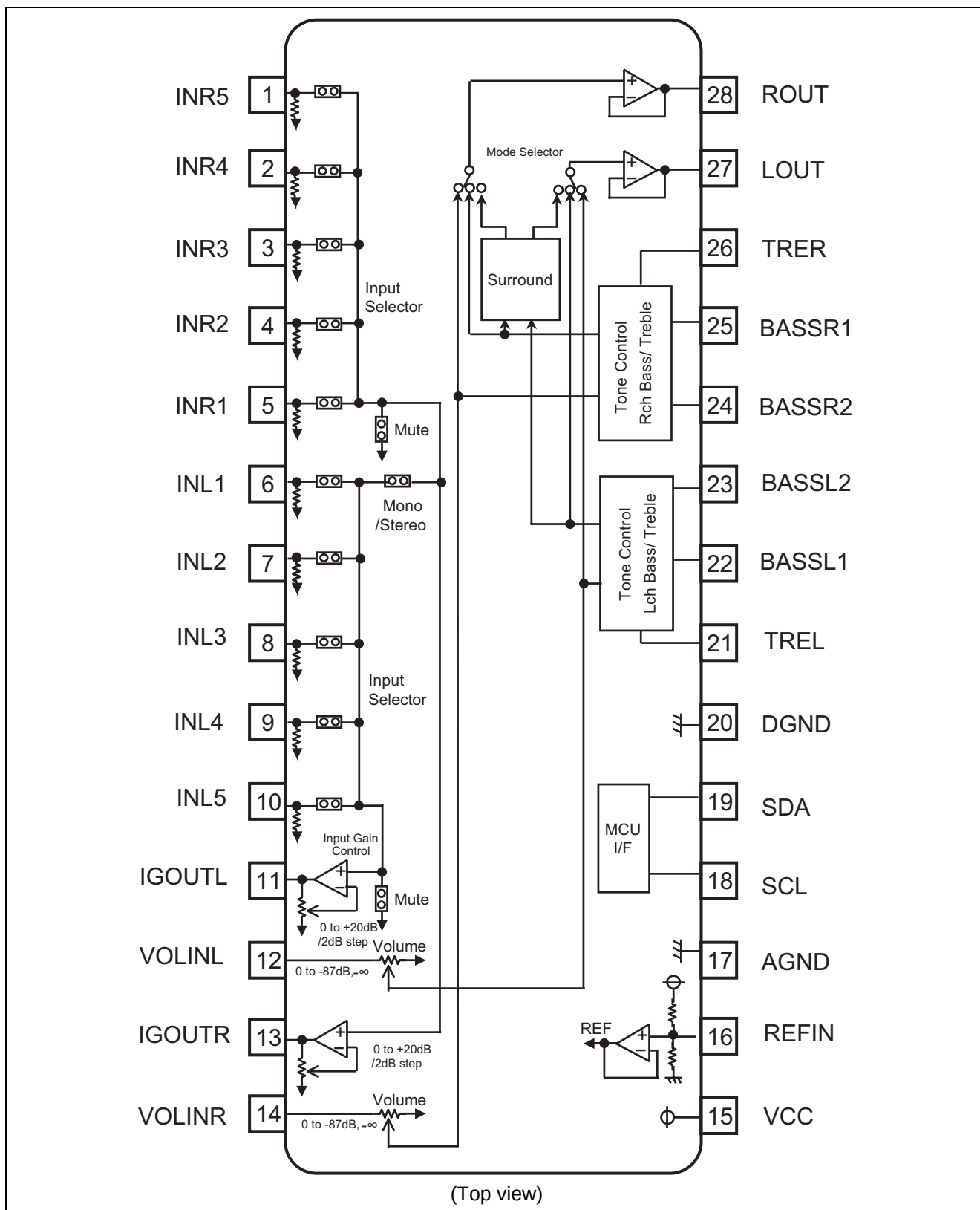
Recommended Operating Condition

- Supply voltage V_{CC} = 9.0V (typ)

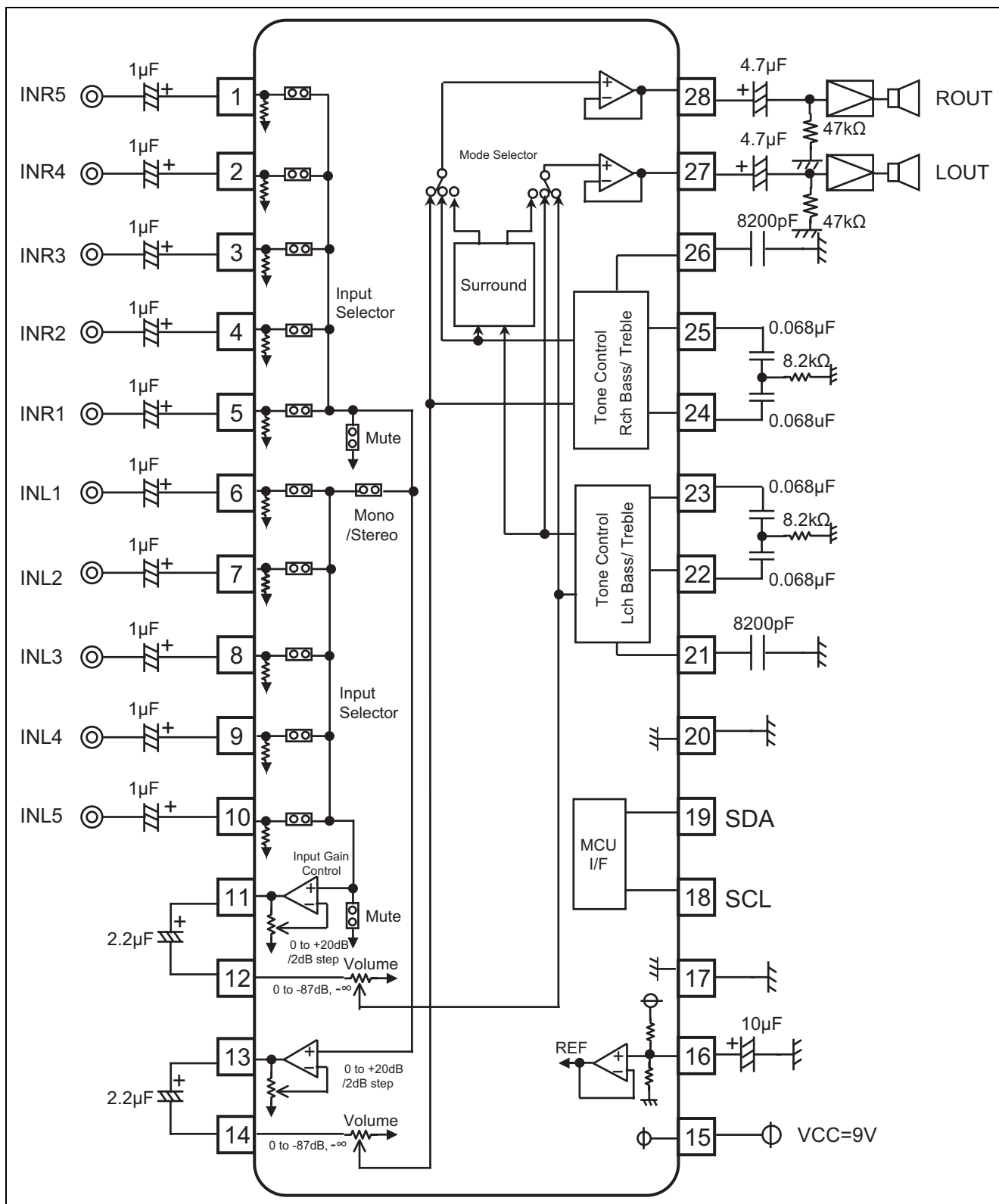
System Configuration



Block Diagram and Pin Configuration

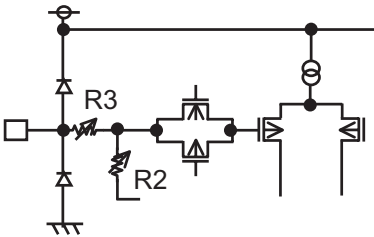
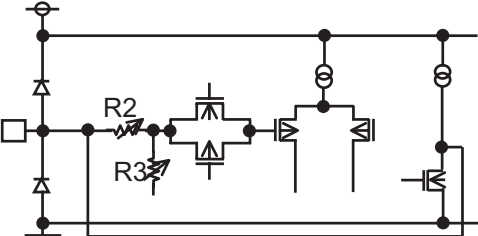
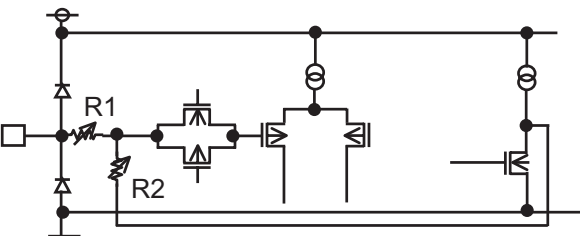


Application Example



Equivalent Circuit of Pin Interface Block

Pin	Pin Name	Equivalent Circuit
1 2 3 4 5 6 7 8 9 10	INR5 INR4 INR3 INR2 INR1 INL1 INL2 INL3 INL4 INL5	
11 13 27 28	IGOUTL IGOUTR LOUT ROUT	
12 14	VOLINL VOLINR	
18	SCL	
19	SDA	
16	REFIN	
15 17 20	VCC AGND DGND	

Pin	Pin Name	Equivalent Circuit
22 25	BASSR1 BASSL1	 $R2+R3=80k\Omega$
23 24	BASSR2 BASSL2	 $R2+R3=80k\Omega$
21 26	TRER TREL	 $R1+R2=30k\Omega$

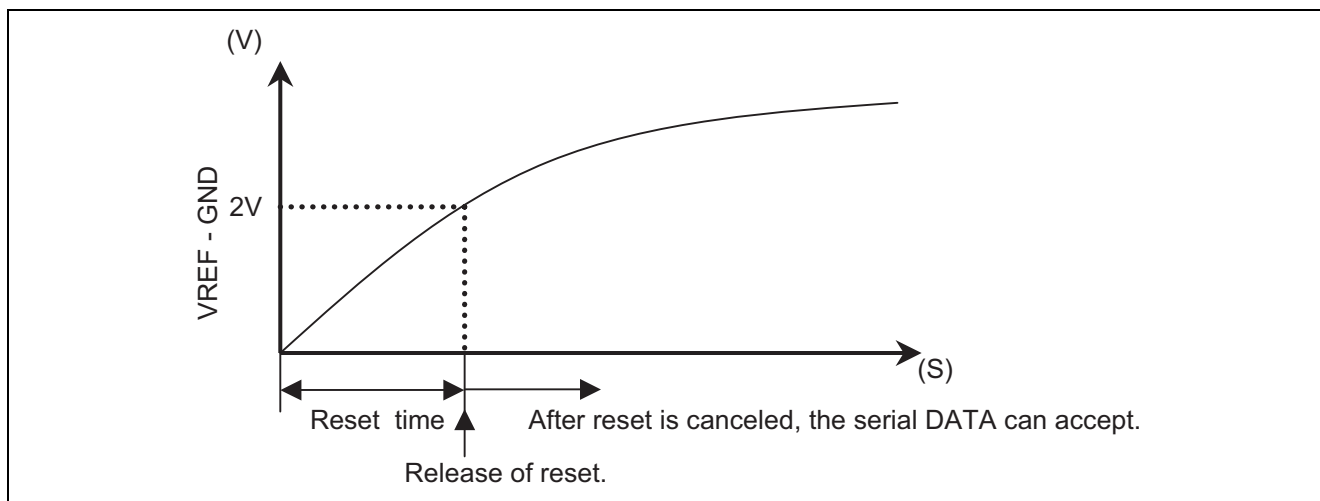
Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Condition
Power supply	V_{CC}	10	V	
Power dissipation	P_d		W	$T_a \leq 25^\circ\text{C}$
Thermal derating	K		mW / $^\circ\text{C}$	$T_a > 25^\circ\text{C}$ (Circuit board installation)
Operating temperature	T_{opr}	-20 to +75	$^\circ\text{C}$	
Storage temperature	T_{stg}	-40 to +125	$^\circ\text{C}$	

Power on Reset

This IC built-in the power on reset function.

The voltage of VREF-GND less than 2V, the serial DATA can not accept.



I²C Bus Format

MSB	LSB	MSB	LSB	MSB	LSB		
S	Slave Address	A	Sub Address	A	Data	A	P
1 bit	8 bit	1 bit	8 bit	1 bit	8 bit	1 bit	1 bit

S: Starting Term

A: Acknowledge Bit

P: Stop Term

If more than one Data Byte is transmitted, then the significant SUB ADDRESS bits are auto incremented.
00H→01H→02H→03H→04H→00H

1. Slave Address

MSB							LSB
1	0	0	0	0	0	1	R/W _B

R/W_B=0 : Write mode for register setting

R/W_B=1 : Not available

2. Sub Address Table

Sub Address	BIT								
	D7	D6	D5	D4	D3	D2	D1	D0	
00H	<1>Lch Master volume								0
01H	<1>Rch Master volume								0
02H	<2>Input selector				<3>Input gain				0
03H	<4>Stereo / Mono		<5>Mode selector		0	0	0	0	
04H	<6>Tone control Bass				<6>Tone control Treble				

3. Data Table

<1> Master Volume (Sub Address: 00H, 01H)

ATT	Lch	Sub Address	00H	D7	D6	D5	D4	D3	D2	D1
	Rch		01H	D7	D6	D5	D4	D3	D2	D1
0dB		L ch R ch Volume		0	0	0	0	0	0	0
-1dB				0	0	0	0	0	0	1
-2dB				0	0	0	0	0	1	0
-3dB				0	0	0	0	0	1	1
-4dB				0	0	0	0	1	0	0
-5dB				0	0	0	0	1	0	1
-6dB				0	0	0	0	1	1	0
-7dB				0	0	0	0	1	1	1
-8dB				0	0	0	1	0	0	0
-9dB				0	0	0	1	0	0	1
-10dB				0	0	0	1	0	1	0
-11dB				0	0	0	1	0	1	1
-12dB				0	0	0	1	1	0	0
-13dB				0	0	0	1	1	0	1
-14dB				0	0	0	1	1	1	0
-15dB				0	0	0	1	1	1	1
-16dB				0	0	1	0	0	0	0
-17dB				0	0	1	0	0	0	1
-18dB				0	0	1	0	0	1	0
-19dB				0	0	1	0	0	1	1
-20dB				0	0	1	0	1	0	0
-21dB				0	0	1	0	1	0	1
-22dB				0	0	1	0	1	1	0
-23dB				0	0	1	0	1	1	1
-24dB				0	0	1	1	0	0	0
-25dB				0	0	1	1	0	0	1
-26dB				0	0	1	1	0	1	0
-27dB				0	0	1	1	0	1	1
-28dB				0	0	1	1	1	0	0
-29dB				0	0	1	1	1	0	1
-30dB				0	0	1	1	1	1	0
-31dB				0	0	1	1	1	1	1
-32dB				0	1	0	0	0	0	0
-33dB				0	1	0	0	0	0	1
-34dB				0	1	0	0	0	1	0
-35dB				0	1	0	0	0	1	1
-36dB				0	1	0	0	1	0	0
-37dB				0	1	0	0	1	0	1
-38dB				0	1	0	0	1	1	0
-39dB				0	1	0	0	1	1	1
-40dB				0	1	0	1	0	0	0
-41dB				0	1	0	1	0	0	1
-42dB				0	1	0	1	0	1	0
-43dB				0	1	0	1	0	1	1
-44dB				0	1	0	1	1	0	0
-45dB				0	1	0	1	1	0	1
-46dB				0	1	0	1	1	1	0
-47dB				0	1	0	1	1	1	1
-48dB				0	1	1	0	0	0	0

ATT	Lch	Sub Address	00H	D7	D6	D5	D4	D3	D2	D1
	Rch		01H	D7	D6	D5	D4	D3	D2	D1
-49dB		L ch R ch Volume		0	1	1	0	0	0	1
-50dB				0	1	1	0	0	1	0
-51dB				0	1	1	0	0	1	1
-52dB				0	1	1	0	1	0	0
-53dB				0	1	1	0	1	0	1
-54dB				0	1	1	0	1	1	0
-55dB				0	1	1	0	1	1	1
-56dB				0	1	1	1	0	0	0
-57dB				0	1	1	1	0	0	1
-58dB				0	1	1	1	0	1	0
-59dB				0	1	1	1	0	1	1
-60dB				0	1	1	1	1	0	0
-61dB				0	1	1	1	1	0	1
-62dB				0	1	1	1	1	1	0
-63dB				0	1	1	1	1	1	1
-64dB				1	0	0	0	0	0	0
-65dB				1	0	0	0	0	0	1
-66dB				1	0	0	0	0	1	0
-67dB				1	0	0	0	0	1	1
-68dB				1	0	0	0	1	0	0
-69dB				1	0	0	0	1	0	1
-70dB				1	0	0	0	1	1	0
-71dB				1	0	0	0	1	1	1
-72dB				1	0	0	1	0	0	0
-73dB				1	0	0	1	0	0	1
-74dB				1	0	0	1	0	1	0
-75dB				1	0	0	1	0	1	1
-76dB				1	0	0	1	1	0	0
-77dB				1	0	0	1	1	0	1
-78dB				1	0	0	1	1	1	0
-79dB				1	0	0	1	1	1	1
-80dB				1	0	1	0	0	0	0
-81dB				1	0	1	0	0	0	1
-82dB				1	0	1	0	0	1	0
-83dB				1	0	1	0	0	1	1
-84dB				1	0	1	0	1	0	0
-85dB				1	0	1	0	1	0	1
-86dB				1	0	1	0	1	1	0
-87dB				1	0	1	0	1	1	1
-∞				1	1	1	1	1	1	1

 * It's initial setting when power is turned on.

<2> Input Selector (Sub Address: 02H)

Setting	Input Selector		
	D7	D6	D5
IN1	0	0	0
IN2	0	0	1
IN3	0	1	0
IN4	0	1	1
IN5	1	0	0
MUTE	1	1	1

<3> Input Gain (Sub Address: 02H)

Setting	Input Gain			
	D4	D3	D2	D1
0dB	0	0	0	0
+2dB	0	0	0	1
+4dB	0	0	1	0
+6dB	0	0	1	1
+8dB	0	1	0	0
+10dB	0	1	0	1
+12dB	0	1	1	0
+14dB	0	1	1	1
+16dB	1	0	0	0
+18dB	1	0	0	1
+20dB	1	0	1	0

<4> Stereo / Mono Selector (Sub Address: 03H)

Setting	Mode Selector	
	D7	D6
Stereo	0	0
Lch Mono	0	1
Rch Mono	1	0

<5> Mode Selector (Sub Address: 03H)

Setting	Mode Selector	
	D5	D4
Bypass	0	0
Tone	0	1
Tone & Surround Hi	1	0
Tone & Surround Low	1	1

 * It's initial setting when power is turned on.

<6> Tone control (Sub Address: 04H)

Gain	Bass	D7	D6	D5	D4
	Treble	D3	D2	D1	D0
0dB		A	0	0	0
2dB			0	0	1
4dB			0	1	0
6dB			0	1	1
8dB			1	0	0
10dB			1	0	1
12dB			1	1	0
14dB			1	1	1

If A = 0 means Tone control gain CUT(-), then A = 1 means Tone control gain BOOST(+).

 * It's initial setting when power is turned on.

Electrical Characteristics

($V_{CC} = 9V$, $T_a = 25^{\circ}C$, $V_i = 100mV_{rms}$, $f = 1kHz$, Tone control = 0dB, $R_g = 600\Omega$, $R_L = 47k\Omega$)

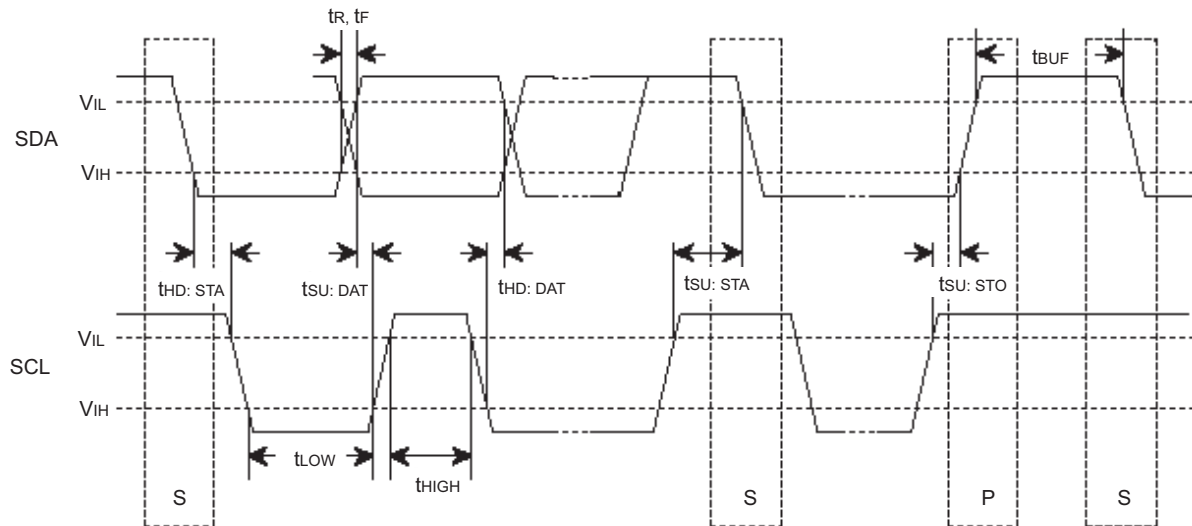
General Characteristics

Parameter	Symbol	Limits			Unit	Condition
		Min	Typ	Max		
Operational power supply	V_{CC}	4.75	9.0	9.7	V	
Supply current	I_{CC}	—	15	25	mA	No signal
Reference voltage	V_{ref}	4.0	4.5	5.0	V	No signal
Input impedance	R_{IN}	35	50	65	$k\Omega$	
Maximum output voltage	V_{OM}	—	2.5	—	V_{rms}	$VOL = 0dB$, THD = 1%
Volume maximum	VOL_{max}	-2	0	+2	dB	$VOL = 0dB$
Volume minimum	VOL_{min}	—	-100	-90	dB	$VOL = Mute$, $V_{in} = 1V_{rms}$, IHF-A
Channel balance	$CBAL$	-1.5	0	1.5	dB	$VOL = 0dB$
Total harmonic distortion	THD	—	0.01	0.5	%	400Hz to 30kHz BPF, $V_o = 0.5V_{rms}$
Input selector cross talk	CT	—	-100	-70	dB	400Hz to 30kHz BPF $V_{in} = 1V_{rms}$
Channel separation	CS	—	-100	-70	dB	400Hz to 30kHz BPF $V_{in} = 1V_{rms}$
Output noise 1	V_{no1}	—	30	50	μV_{rms}	$VOL = 0dB$, Input gain = 0dB Tone = 0dB, Surround = Low, IHF-A
Output noise 2	V_{no2}	—	5	15	μV_{rms}	$VOL = Mute$, Input gain = 0dB Bypass, IHF-A

Tone Control

Parameter	Symbol	Limits			Unit	Condition
		Min	Typ	Max		
Tone control voltage gain (Boost/ Bass)	G(Bass)B	+11.5	+14	+16.5	dB	$f = 100Hz$, Bass = +14dB
Tone control voltage gain (Cut/ Bass)	G(Bass)C	-16.5	-14	-11.5	dB	$f = 100Hz$, Bass = -14dB
Tone control voltage gain (Flat/ Bass)	G(Bass)F	-2	0	+2	dB	$f = 100Hz$, Bass = 0dB
Tone control voltage gain (Boost/ Treble)	G(Treble)B	+11.5	+14	+16.5	dB	$f = 10kHz$, Tre = +14dB
Tone control voltage gain (Cut/ Treble)	G(Treble)C	-16.5	-14	-11.5	dB	$f = 10kHz$, Tre = -14dB
Tone control voltage gain (Flat/ Treble)	G(Treble)F	-2	0	+2	dB	$f = 100Hz$, Tre = 0dB

Bus Line Timing Specification

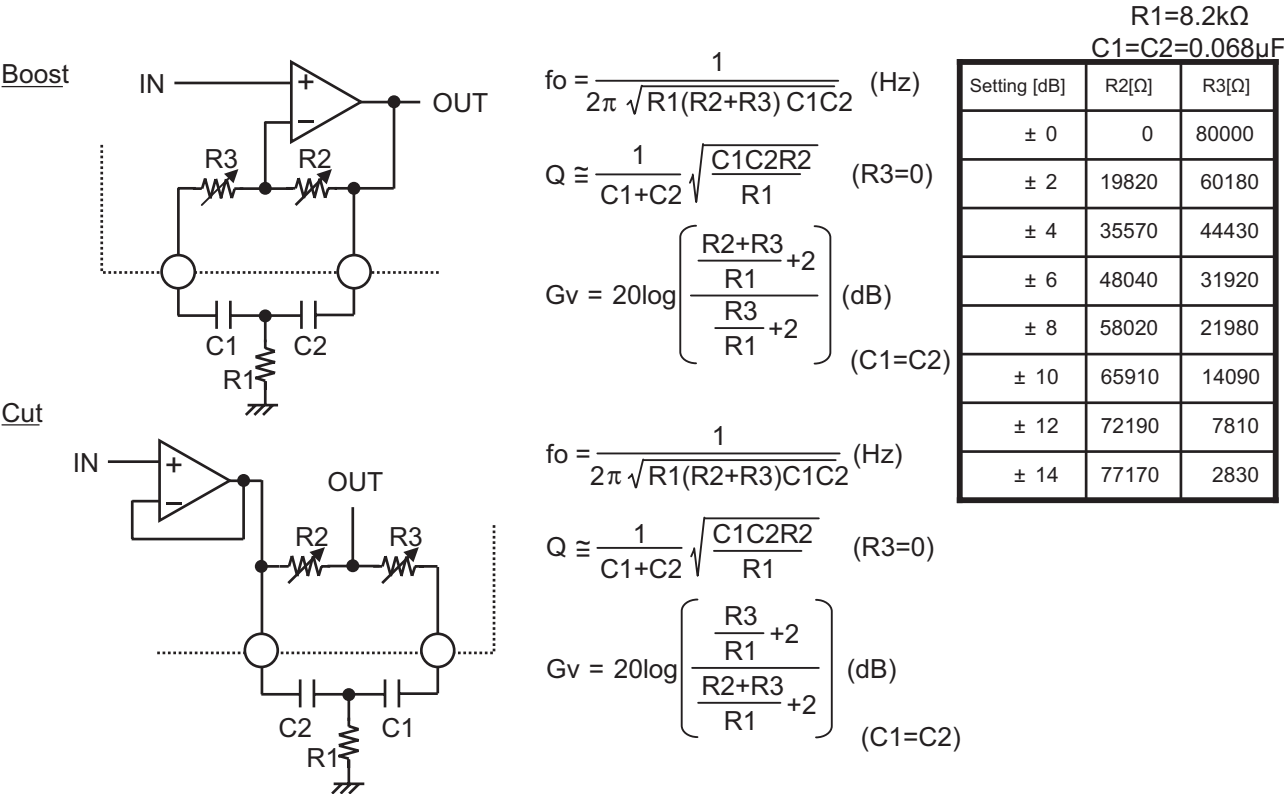


Parameters	Symbol	Min	Max	Units
Min input low voltage	V_{IL}	0	1.5	V
Max input high voltage	V_{IH}	3.0	5.0	V
SCL clock frequency	f_{SCL}	—	100	kHz
Time the bus must be free before a new transmission can start	t_{BUF}	4.7	—	μ S
Hold time start condition. After this period the first clock pulse is generated	$t_{HD:STA}$	4.0	—	μ S
The Low period of the clock	t_{Low}	4.7	—	μ S
The High period of the clock	t_{High}	4.0	—	μ S
Set-up time for start condition (Only relevant for a repeated start condition)	$t_{SU:STA}$	4.7	—	μ S
Hold time DATA	$t_{HD:DAT}$	0	—	μ S
Set-up time DATA	$t_{SU:DAT}$	250	—	ns
Rise time of both SDA & SCL lines	t_R	—	1000	ns
Fall time of both SDA & SCL lines	t_F	—	300	ns
Set-up time for stop condition	$t_{SU:STO}$	4.0	—	μ S

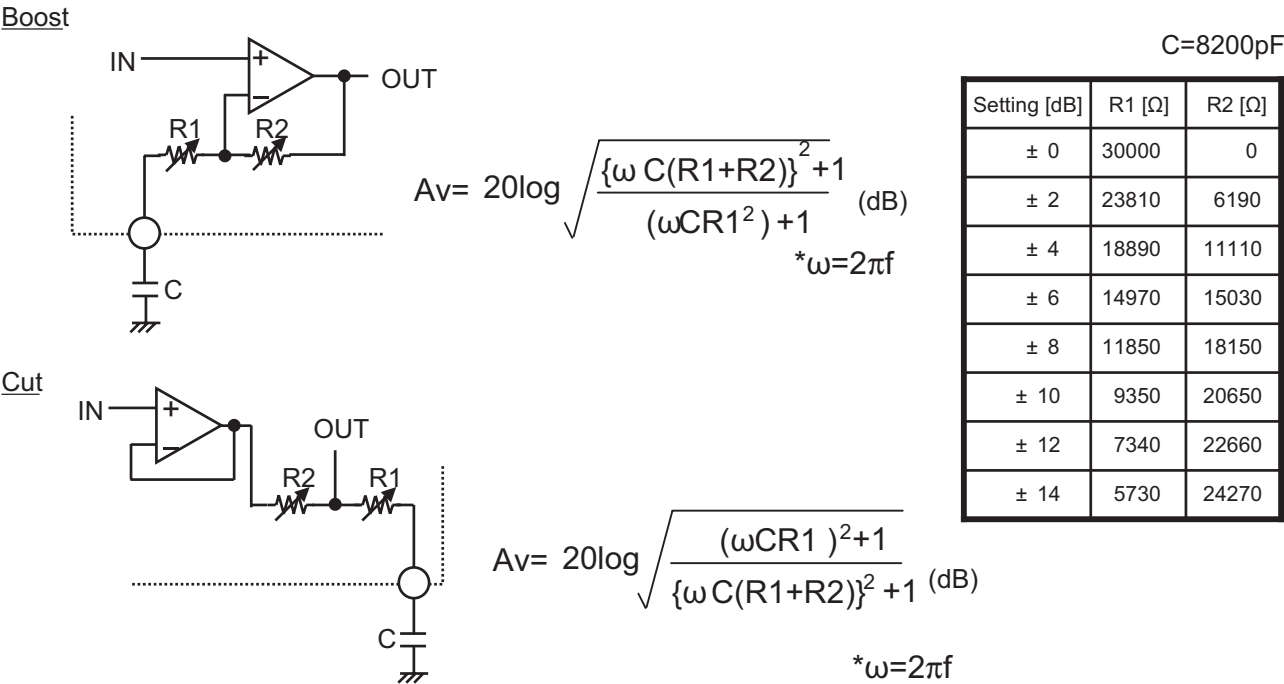
Function Description

1. Tone Control

<1> Bass Circuit



<2> Treble Circuit



Notes:

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guarantees regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
 - (1) artificial life support devices or systems
 - (2) surgical implantations
 - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
 - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



RENESAS SALES OFFICES

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

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, AZIA Center, 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