

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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

April 1st, 2010
Renesas Electronics Corporation

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

Send any inquiries to <http://www.renesas.com/inquiry>.

Notice

1. All information included in this document 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 Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
"Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics 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 appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

M61510AFP

Sound Controller for Quality/Sound Field Control,
with Built-in Surround Sound

REJ03F0013-0100Z

Rev.1.00

Aug.07.2003

Description

The M61510AFP is a digital sound controller IC which is ideal for home audio applications. M61510AFP includes five-input selector, input volume control, surround sound (effect switchable in three stages), tone control (3 bands), loudness, and two-channel master volume control, all controllable via serial data. The M61510AFP can be interfaced with external circuits even when using the internal surround sound. And a common data format (software-compatible) facilitates M61510AFP substitution.

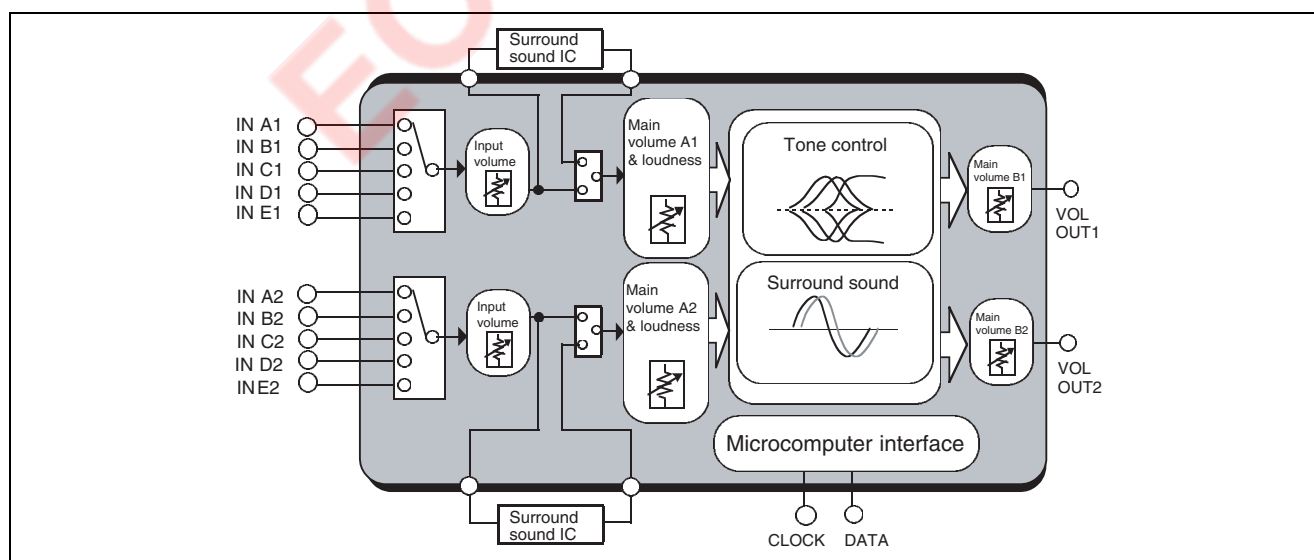
Features

- Five-input selector
- Input volume control (2 dB steps/3 bits)
- Surround sound IC interface
- Internal surround function (ON/OFF, High/Mid/Low)
- Internal surround function (bass/mid/treble)
- Internal loudness function
- Main volume control (1 dB steps (0 to -80 dB, $-\infty$))
- Microcomputer interface

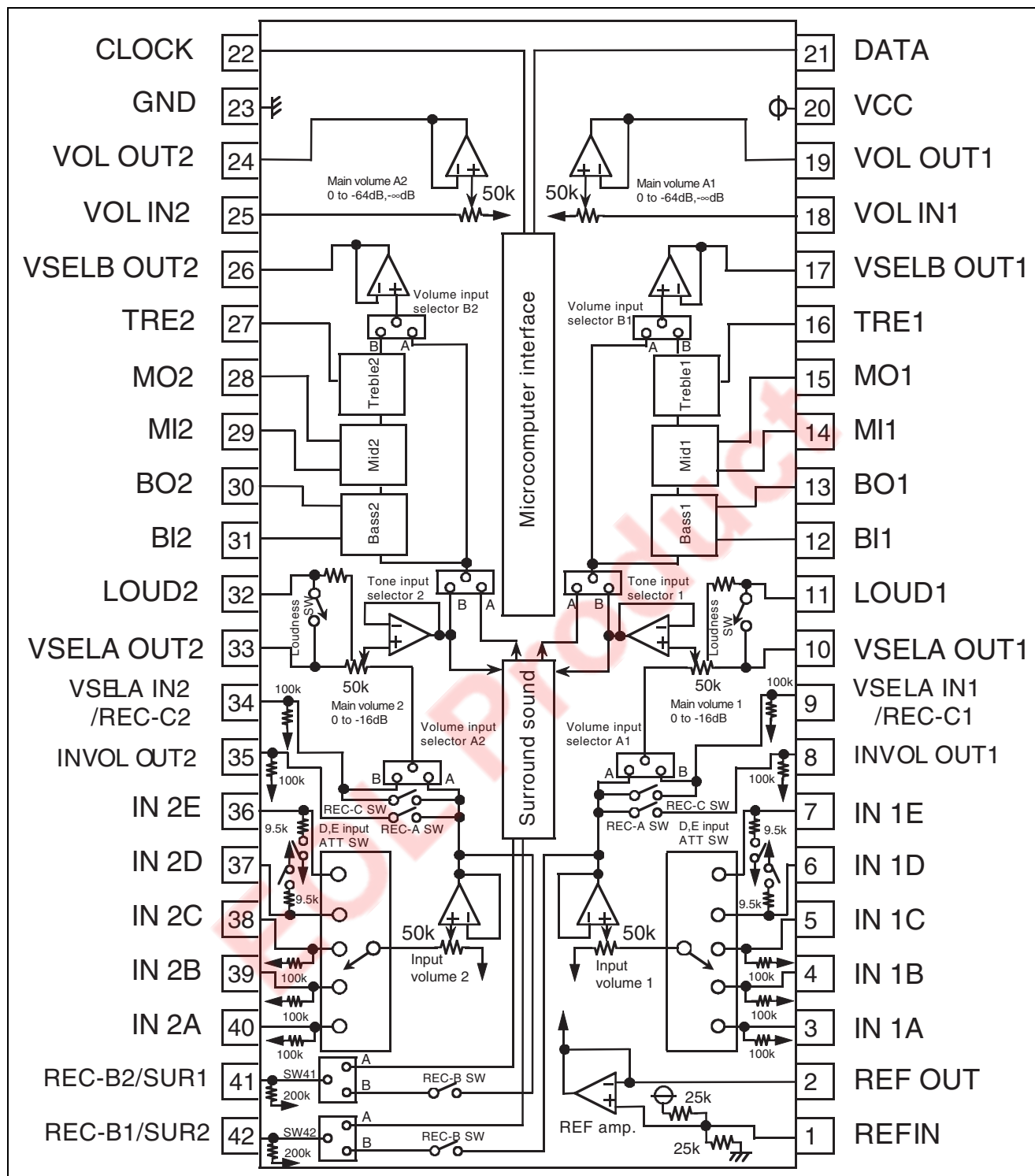
Recommended Operating Conditions

- Power supply voltage range: $V_{CC} = 4.5$ to 5.5 V
- Rated power supply voltage: $V_{CC} = 5$ V

System Block Diagram



Block Diagram and Pin Arrangement



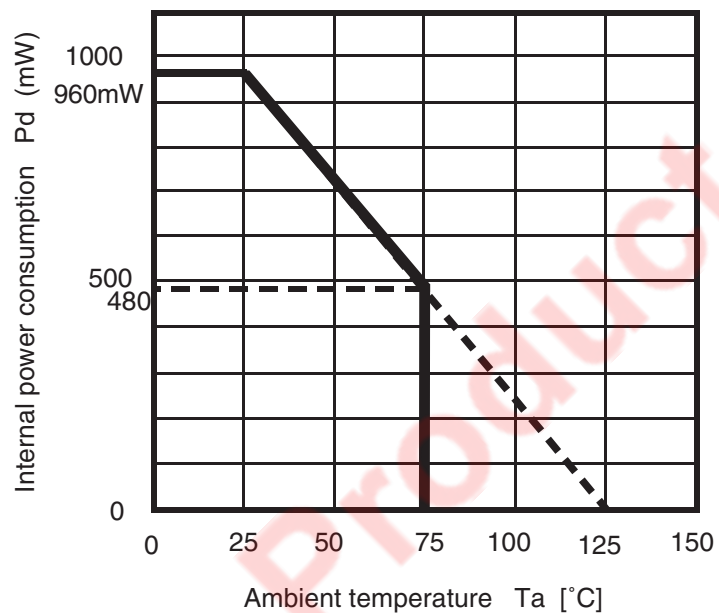
Pin Description

Pin No.	Pin Name	Function
1	REF IN	Reference amp input pin
2	REF OUT	Reference amp output pin
3, 4, 5, 6, 7, 36, 37, 38, 39, 40	IN 1A, 1B, 1C, 1D, 1E, 2A, 2B, 2C, 2D, 2E	Ch 1, 2 input selector input pins
8, 35	INVOL ONT1, 2	Input volume 1,2 output pins
9, 34	VSELA IN1, 2/REC-C1, 2	Volume input selector A1, 2 input/REC-C1, 2 output pins
10, 33	VSELA OUT1, 2	Volume switching noise reduction capacitor connection pins
11, 32	LOUD1, 2	Loudness circuitry frequency characteristic setting pins
12, 31	BI1, 2	Tone (bass) frequency characteristic setting pins
13, 30	BO1, 2	
14, 29	MI1, 2	Tone (mid) frequency characteristic setting pins
15, 28	MO1, 2	
16, 27	TRE1, 2	Tone (treble) frequency characteristic setting pins
17, 26	VSELB OUT1, 2	Volume input selector B1, 2 output pins
18, 25	VOL IN1, 2	Volume input pins
19, 24	VOL OUT1, 2	Volume output pins
20	VCC	Power supply
21	DATA	Serial data input pin
22	CLOCK	Clock input pin for serial data transfer
23	GND	GND
41	REC-B2/SUR1	REC-B2 output/surround external device connection pin
42	REC-B1/SUR2	REC-B1 output/surround external device connection pin

Absolute Maximum Ratings

Symbol	Item	Conditions	Rating	Unit
VCC	Power supply voltage		6.0	V
Pd	Internal power consumption	$T_a \leq 25^{\circ}\text{C}$	960	mV
K	Thermal reduction rate	$T_a > 25^{\circ}\text{C}$	9.6	mV/ $^{\circ}\text{C}$
Topr	Operating temperature range		$-20 \sim +75$	$^{\circ}\text{C}$
Tstg	Storage temperature		$-40 \sim +125$	$^{\circ}\text{C}$

Thermal Reduction Curve

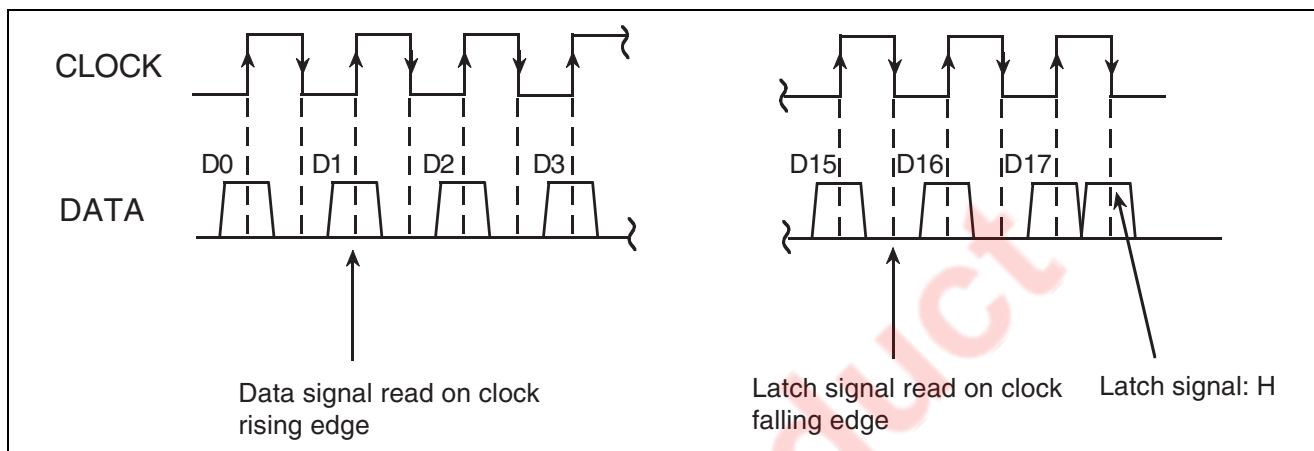


Recommended Operating Conditions

(Unless otherwise specified, Ta=25°C)

Item	Symbol	Condition	MIN	TYP	MAX	Units
Power supply voltage	VCC		4.5	5.0	5.5	V
Logic "H" level input voltage	VIH	GND reference	2.4	—	VCC	V
Logic "L" level input voltage	VIL	GND reference	GND	—	0.7	V

Relation of Data and Clock



Data Input Format

(Data other than the following settings should not be sent)

By changing the D14 and D15 slot setting states, any of four input formats can be selected.

(However, each time the power is turned on, after sending the following MUTE release data, initial settings should be made for the data of all four formats.)

MUTE release data (X indicates any setting)

D0d D1d D2d D3d D4d D5d D6d D7d D8d D9d D10d D11d D12d D13d D14 D15 D16 D17
X X X 0 X 1 X X X X X X X 1 1 0 0

Chip address

(1)

D0a	D1a	D2a	D3a	D4a	D5a	D6a	D7a	D8a	D9a	D10a	D11a	D12a	D13a	D14	D15	D16	D17
Tone control treble				Tone control mid				Tone control bass				Vocal cut	0	0	0	0	0

(2)

D0b	D1b	D2b	D3b	D4b	D5b	D6b	D7b	D8b	D9b	D10b	D11b	D12b	D13b	D14	D15	D16	D17
First-stage main volume CH1				Second-stage main volume CH1								D input ATT SW	E input ATT SW	0	1	0	0

(3)

D0c	D1c	D2c	D3c	D4c	D5c	D6c	D7c	D8c	D9c	D10c	D11c	D12c	D13c	D14	D15	D16	D17
First-stage main volume CH2				Second-stage main volume CH2								Tone input selector	D/E input ATTSW -5/-8 dB	1	0	0	0

(4)

	D0d	D1d	D2d	D3d	D4d	D5d	D6d	D7d	D8d	D9d	D10d	D11d	D12d	D13d	D14	D15	D16	D17
Note 1) Using external surround	Input selector			Note2: Mute	REC-B ON : 1 OFF : 0	1	Input volume			Volume input selector A	Volume input selector B	REC-A ON : 1 OFF : 0	Loudness switch	0	1	1	0	0
Note 1) Using internal surround [1]				Surround	0	REC-C ON : 1 OFF : 0				0				1				
Note 3) Using internal surround [2]						0				1								

Note 1) Using external surround ("D5d=1", "D13d=0") → SW41, 42 settings fixed at B, REC-C SW fixed at OFF
Using internal surround [1] ("D5d=0", "D13d=0") → SW41, 42 settings fixed at A, REC-B SW fixed at OFF,
volume input selector A setting fixed at A.

Note 2) The following settings are used to mute the output pin at power-on.
Input selector = ALL OFF, external surround mode setting, REC-A to C SW=OFF, second-stage main volume =--∞
(and, when D14=D15=1 and D16=D17=0, by setting D3d=D5d=1, mute can be similarly set)

It is the same as that of
M61510FP

Note 3) This function is added in the M61510AFP

When using internal surround [2] ("D5d=0", "D13d=1") → SW41, 42 fixed at A,
REC-B/C SW fixed at OFF, volume input selector A setting fixed at B

*Regarding [1]/[2] when using internal surround

*Using internal surround [1] (same function as in existing model M61510FP)

In this mode only the internal surround function is used, and external circuitry is not used.

*Using internal surround [2] (function unique to M61510AFP, added to this IC)

In this mode the internal surround function is used, and in addition an external circuit is connected and used.
(However, because REC-C is fixed at OFF, use as the REC output is not possible.)

Setting Codes

(Data other than the following settings should not be sent)

(1) Tone control (treble/mid/bass)

ATT amount	Treble	D0a	D1a	D2a	D3a
	Mid	D4a	D5a	D6a	D7a
	Bass	D8a	D9a	DAa	DBa
+ 8dB		1	1	0	0
+ 6dB		1	0	1	1
+ 4dB		1	0	1	0
+ 2dB		1	0	0	1
0dB		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

(2) Loudness

Loudness	D12d
OFF	0
ON	1

(3) Volume input selector A

*Controllable only when D5d=1

Volume input selector A setting	D9d
Bypass	0
External surround input	1

(4) Volume input selector B

Volume input selector B setting	D10d
Bypass	0
Tone	1

(5) Tone input selector

Tone input setting	D12c
Bypass	0
Internal surround input	1

(6) E input ATT switch

E input ATT switch	D13b
0dB	0
-5/-8 dB	1

(7) D input ATT switch

D input ATT switch	D12b
0dB	0
-5/-8 dB	1

(13) D/E input ATT amount switch

D/E input ATT switch(*1)	D13c
-8 dB	0
-5 dB	1

(8) Vocal cut switch

Vocal cut switch	D12a
OFF	0
ON	1

(9) Input selector

INPUT	D0d	D1d	D2d
A ch	0	0	0
B ch	0	0	1
C ch	0	1	0
D ch	0	1	1
E ch	1	0	0
ALL OFF	1	1	1

(10) REC-A,B,C switch

*REC-B controllable only when D5d = 1

REC-C controllable only when D5d = 0 and D13d = 0

Data	D11d	D4d	D9d
REC output	A	B	C
0	OFF		
1	ON		

(11) Surround

*Controllable only when D5d = 0

Surround setting	D3d	D4d
OFF	0	0
L	1	0
M	0	1
H	1	1

(12) Input volume

Input volume setting	D6d	D7d	D8d
0 dB	0	0	0
-2 dB	0	0	1
-4 dB	0	1	0
-6 dB	0	1	1
-8 dB	1	0	0
-10 dB	1	0	1
-12 dB	1	1	0
-14 dB	1	1	1

(*1) ATT amount when an Rin = 12 kΩ input resistance is connected to the D/E input pin

(14) First-stage main volume

ATT amount	First stage volume CH1	D0b	D1b	D2b	D3b	D4b
	First stage volume CH2	D0c	D1c	D2c	D3c	D4c
	0dB	0	0	0	0	0
	-1dB	0	0	0	0	1
	-2dB	0	0	0	1	0
	-3dB	0	0	0	1	1
	-4dB	0	0	1	0	0
	-5dB	0	0	1	0	1
	-6dB	0	0	1	1	0
	-7dB	0	0	1	1	1
	-8dB	0	1	0	0	0
	-9dB	0	1	0	0	1
	-10dB	0	1	0	1	0
	-11dB	0	1	0	1	1
	-12dB	0	1	1	0	0
	-13dB	0	1	1	0	1
	-14dB	0	1	1	1	0
	-15dB	0	1	1	1	1
	-16dB	1	0	0	0	0

(15) Second-stage main volume

ATT amount	Second stage volume CH1	D5b	D6b	D7b	D8b	D9b	D10b	D11b
Second stage volume CH2	D5c	D6c	D7c	D8c	D9c	D10c	D11c	
0dB	0	0	0	0	0	0	0	0
-1dB	0	0	0	0	0	0	0	1
-2dB	0	0	0	0	0	0	1	0
-3dB	0	0	0	0	0	0	1	1
-4dB	0	0	0	0	0	1	0	0
-5dB	0	0	0	0	0	1	0	1
-6dB	0	0	0	0	0	1	1	0
-7dB	0	0	0	0	0	1	1	1
-8dB	0	0	0	0	1	0	0	0
-9dB	0	0	0	0	1	0	0	1
-10dB	0	0	0	0	1	0	1	0
-11dB	0	0	0	0	1	0	1	1
-12dB	0	0	0	0	1	1	0	0
-13dB	0	0	0	0	1	1	0	1
-14dB	0	0	0	0	1	1	1	0
-15dB	0	0	0	0	1	1	1	1
-16dB	0	0	0	1	0	0	0	0
-17dB	0	0	0	1	0	0	0	1
-18dB	0	0	0	1	0	0	1	0
-19dB	0	0	0	1	0	0	1	1
-20dB	0	0	0	1	0	1	0	0
-21dB	0	0	0	1	0	1	0	1
-22dB	0	0	0	1	0	1	1	0
-23dB	0	0	0	1	0	1	1	1
-24dB	0	0	0	1	1	0	0	0
-25dB	0	0	0	1	1	0	0	1
-26dB	0	0	0	1	1	0	1	0
-27dB	0	0	0	1	1	0	1	1
-28dB	0	0	0	1	1	1	0	0
-29dB	0	0	0	1	1	1	0	1
-30dB	0	0	0	1	1	1	1	0
-31dB	0	0	0	1	1	1	1	1

ATT amount	Second stage volume CH1	D5b	D6b	D7b	D8b	D9b	D10b	D11b
Second stage volume CH2	D5c	D6c	D7c	D8c	D9c	D10c	D11c	
-32dB	0	1	0	0	0	0	0	0
-33dB	0	1	0	0	0	0	0	1
-34dB	0	1	0	0	0	0	1	0
-35dB	0	1	0	0	0	0	1	1
-36dB	0	1	0	0	0	1	0	0
-37dB	0	1	0	0	0	1	0	1
-38dB	0	1	0	0	0	1	1	0
-39dB	0	1	0	0	0	1	1	1
-40dB	0	1	0	0	1	0	0	0
-41dB	0	1	0	0	1	0	0	1
-42dB	0	1	0	0	1	0	1	0
-43dB	0	1	0	0	1	0	1	1
-44dB	0	1	0	0	1	1	0	0
-45dB	0	1	0	0	1	1	0	1
-46dB	0	1	0	0	1	1	1	0
-47dB	0	1	0	0	1	1	1	1
-48dB	0	1	0	1	0	0	0	0
-49dB	0	1	0	1	0	0	0	1
-50dB	0	1	0	1	0	0	1	0
-51dB	0	1	0	1	0	0	1	1
-52dB	0	1	0	1	0	1	0	0
-53dB	0	1	0	1	0	1	0	1
-54dB	0	1	0	1	0	1	1	0
-55dB	0	1	0	1	0	1	1	1
-56dB	0	1	0	1	0	0	0	0
-57dB	0	1	0	1	0	0	0	1
-58dB	0	1	0	1	0	0	1	0
-59dB	0	1	0	1	0	0	1	1
-60dB	0	1	0	1	0	1	0	0
-61dB	0	1	0	1	0	1	0	1
-62dB	0	1	0	1	0	1	1	0
-63dB	0	1	0	1	0	1	1	1
-64dB	1	0	0	0	0	0	0	0
-∞dB	1	0	0	0	0	0	0	1

Electrical Characteristics

(Unless otherwise specified, $T_a = 25^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$, $f = 1\text{ kHz}$, the input main volume = 0 dB, surround and loudness are OFF, the volume input selector A, B settings =BYPASS, and tone input selector =BYPASS; see the application circuit example)

(1) Power supply characteristics

Item	Symbol	Conditions	Ratings			Unit
			MIN	TYP	MAX	
Circuit current	Aldd	No signal	—	35	60	mA

(2) I/O characteristics (total)

Item	Symbol	Conditions	Ratings			Unit
			Min	typ	Max	
Input resistance	Rin	3~5 pin, 38~40 pin	22	33	48	k Ω
Maximum input voltage	VIMt	(input to pins 3-5, 38-40) pin 19, 24 output, first stage main volume setting =-2 dB RL = 10 k Ω , THD = 1%	1.2	1.4	—	Vrms
	VIMtDE	(pin 6, 7, 36, 37 input) pin 19, 24 output Note) Input resistance =12 k Ω , RL = 10 k Ω , THD = 1% D, E ch ATT switch = -8 dB setting, input VOL=-2 dB setting	2.8	4.4	—	Vrms
Maximum output voltage	VOMt	(pin 3, 40 input) pin 19, 24 output, RL = 10 k Ω , THD = 1%	1.0	1.25	—	Vrms
Pass gain	Gvt	Gain across (pins 3-6, 37-40)-pins 19, 24, Vi=0.5 Vrms, FLAT	-2.0	0	2.0	dB
Total harmonic distortion	THDA	(pin 3, 40 input) pin 19, 24 output, DIN-AUDIO, Vi=0.5 Vrms, RL = 30 k Ω ,	—	0.006	0.07	%
	THDB	Volume input selector B settings THDA: bypass, THDB: tone	—	0.009	0.09	%
Output noise voltage	NoA	pin 19, 24, Rg = 0 Ω , JIS-A Main volume setting =- ∞	—	2.5	6	μVrms
		pin 19, 24, Rg = 0 Ω , JIS-A Main volume setting = 0 dB	—	5	10	μVrms
	NoB	pin 19, 24, Rg = 0 Ω , JIS-A Volume input selector B: tone	—	7	15	μVrms
		pin 19, 24, Rg = 0 Ω , JIS-A Volume input selector B: tone, tone input selector: surround	—	10	20	μVrms
Crosstalk between channels	CT	Vo = 0.5 Vrms, RL = 10 k Ω , JIS-A, Across pins 19-24, Rg = 0 Ω ,	—	-80	-65	dB
Maximum volume attenuation	ATTmax	Vi = 1 Vrms, JIS-A, Main volume setting =- ∞	—	—	-80	dB

Note: The 12 k Ω input resistance should be inserted in series with the pin.

(3) Tone control characteristics

(Unless otherwise specified, $V_i=0.2$ Vrms, 9.34 PIN input, 17.26 PIN output, volume input selector A: external surround input, tone input selector: BYPASS, volume input selector B: TONE).

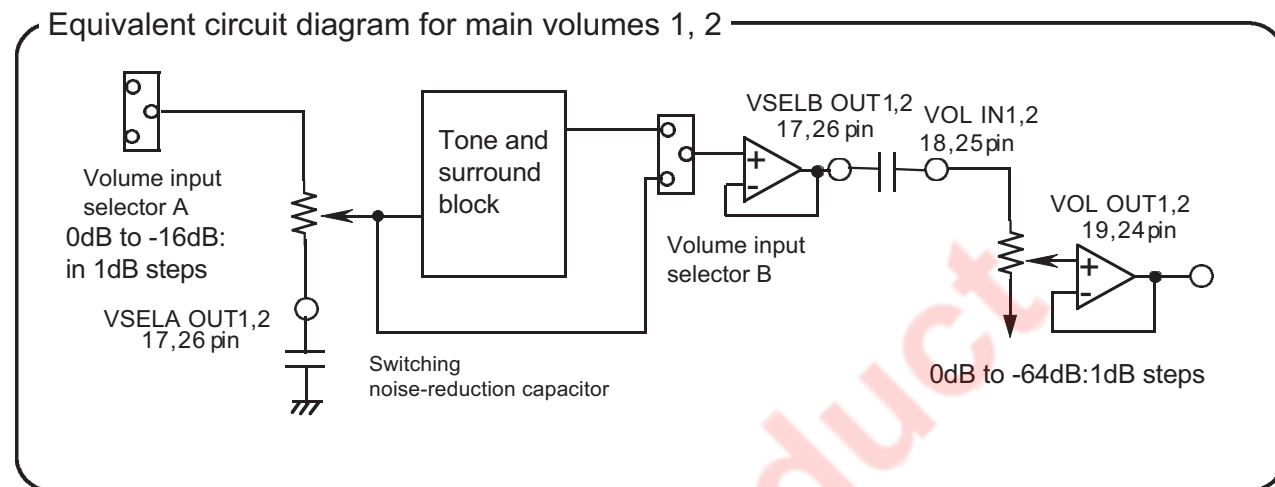
Item	Symbol	Conditions	Ratings			Unit
			Min	typ	Max	
Boost amount (bass)	G(BASS)B	$f = 100$ Hz Tone base set to +8 dB	6	8	10	dB
Cut amount (bass)	G(BASS)C	$f = 100$ Hz Tone base set to -8 dB	-10	-8	-6	dB
Boost amount (mid)	G(MID)B	$f = 1$ kHz Tone mid set to +8 dB	6	8	10	dB
Cut amount (mid)	G(MID)B	$f = 1$ kHz Tone mid set to -8 dB	-10	-8	-6	dB
Boost amount (treble)	G(TRE)B	$f = 10$ kHz Tone treble set to +8 dB	6	8	10	dB
Cut amount (treble)	G(TRE)B	$f = 10$ kHz Tone treble set to -8 dB	-10	-8	-6	dB
Channel balance	BALT	When each boost amount is +8, -8 dB	-2	0	+2	dB

Explanation of Functions

(1) Main volume

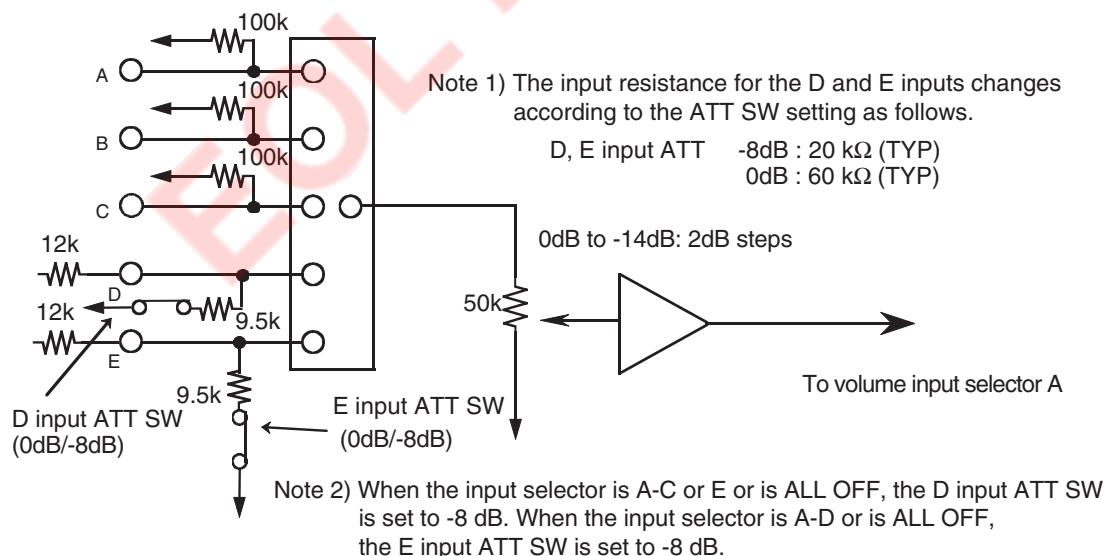
This IC includes two independent low-distortion, low-noise electronic volume systems. The attenuation can be set from 0 dB to $-\infty$ dB in 1 dB steps.

Also, the attenuation can be set between 0 and -16 dB for the first stage, and between 0 and -64 dB for the second stage, and both can be controlled independently.



(2) Input selector, input volume

Two channels of 5-input selectors, and two channels of input volume controls for input trimmers, are incorporated. The D and E inputs of the input selectors can select either 0 dB or -8 dB input levels for an input resistance of 12 k Ω using the ATT switch. The input volume can be set between 0 and -14 dB in 2 dB steps.



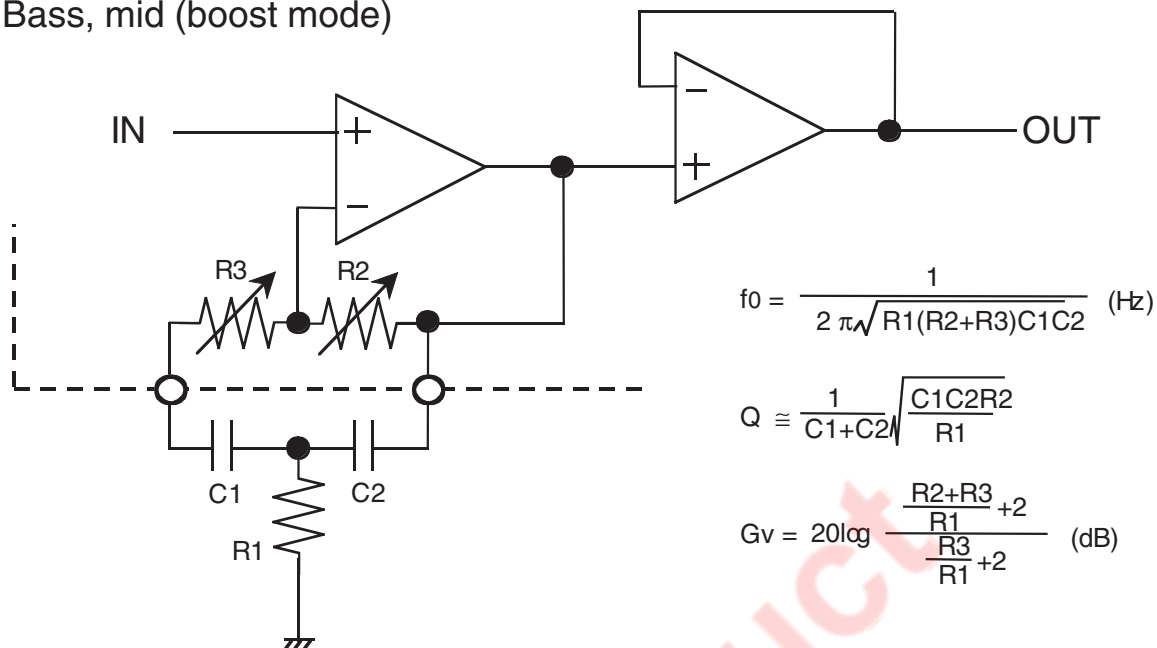
Note 3) The D and E input ATT amounts shown are the values when a D and E input resistance $R_{in}=12\text{ k}\Omega$ is connected.

Note 4) When the external 12 k Ω resistance is eliminated, the D and E input ATT amounts are set as follows.

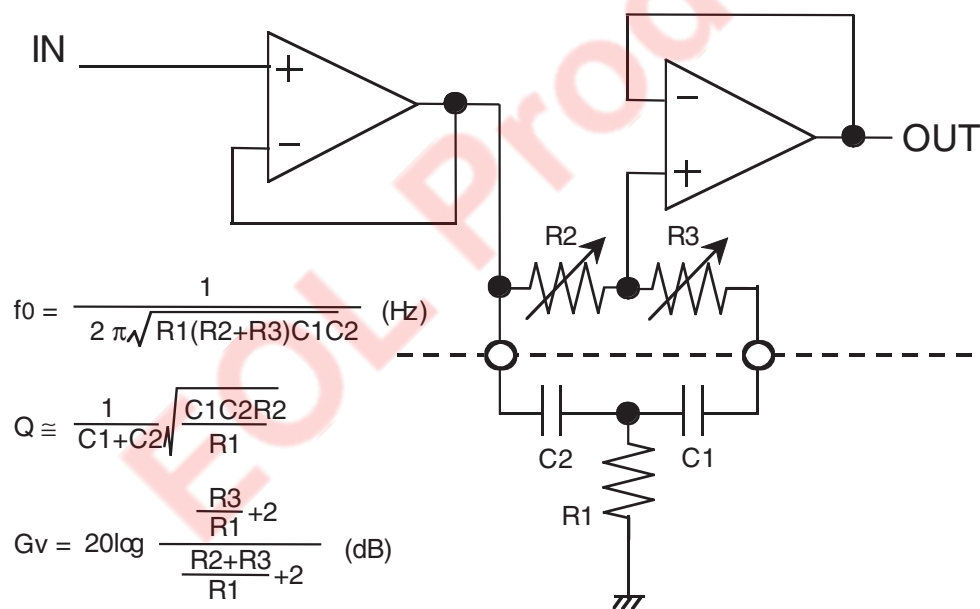
Setting	ATT Amount
0dB setting	1.87dB
-8dB setting	0dB

(3) Tone control equivalent circuit

3-1 Bass, mid (boost mode)



3-2 Bass, mid (cut mode)

*Internal resistance values (units: Ω)

<Boost>

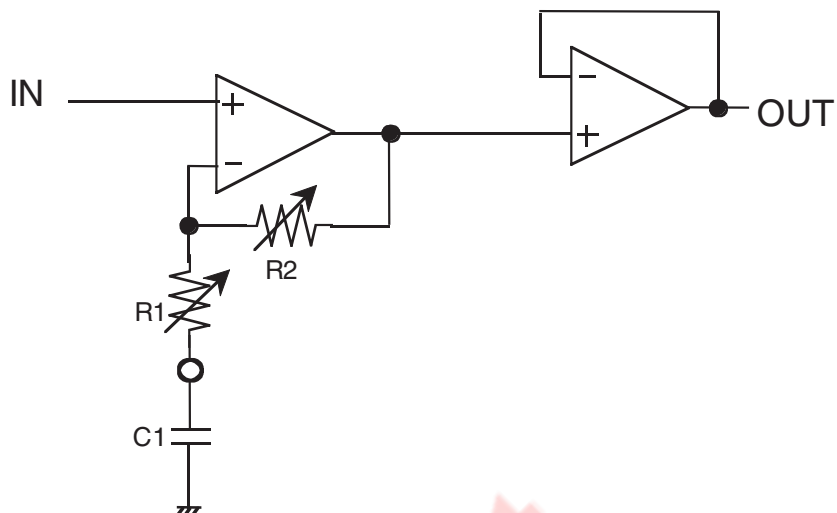
Setting	R2	R3
+2dB	10.6k	27.3k
+4dB	19.1k	18.8k
+6dB	25.8k	12.1k
+8dB	31.1k	6.8k

<Cut>

Setting	R2	R3
+2dB	10.6k	27.3k
+4dB	19.1k	18.8k
+6dB	25.8k	12.1k
+8dB	31.1k	6.8k

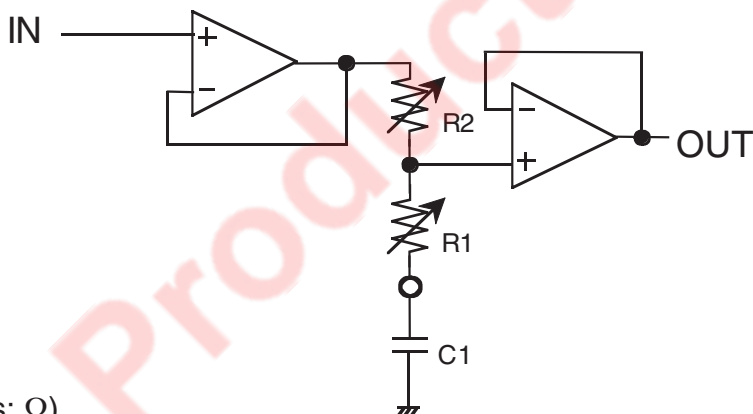
3-3 Treble (boost)

$$G_v = 20 \log \frac{R_1 + R_2}{R_1} \text{ (dB)}$$



3-4 Treble (cut)

$$G_v = 20 \log \frac{R_1}{R_1 + R_2} \text{ (dB)}$$



*Internal resistance values (units: Ω)

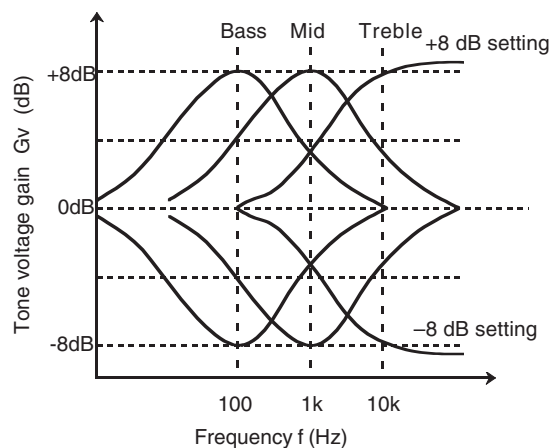
<Boost>

Setting	R1	R2
+2dB	16.0k	4.4k
+4dB	12.6k	7.8k
+6dB	9.7k	10.7k
+8dB	7.1k	13.3k

<Cut>

Setting	R1	R2
-2dB	16.0k	4.4k
-4dB	12.6k	7.8k
-6dB	9.7k	10.7k
-8dB	7.1k	13.3k

<Characteristic curves>

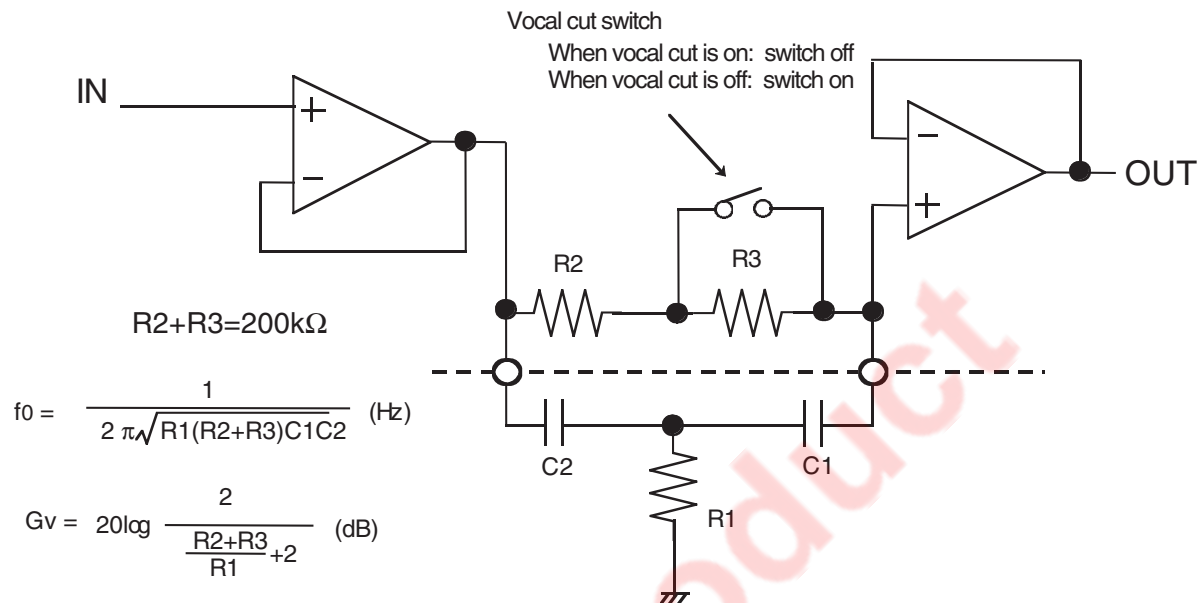


(4) Vocal cut equivalent circuit diagram

This IC incorporates a circuit which uses a tone control midrange circuit to lower the midrange gain, to easily realize a vocal cut function.

However, when the vocal cut function is on, the tone control midrange cannot be used.

Vocal cut switch



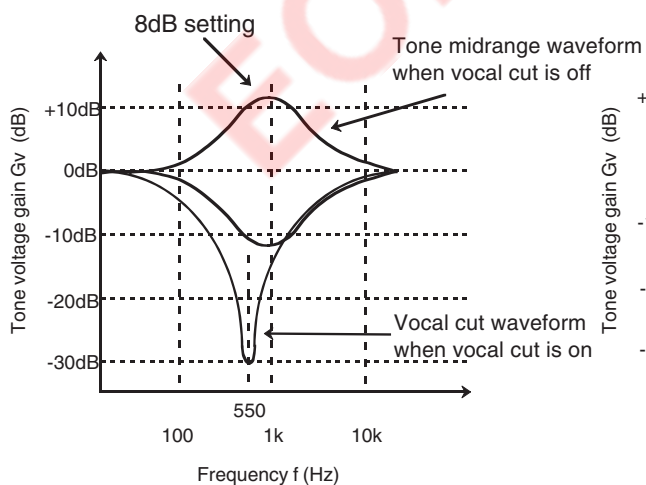
External resistances: The frequency characteristics when vocal cut is on can be set as shown below through the constants R1, C1, and C2.

<Characteristic curves>

1. Emphasis on vocal cut characteristic $f_0=550\text{Hz}$

$R=3\text{k}\Omega$ $C1=C2=0.012\mu\text{F}$

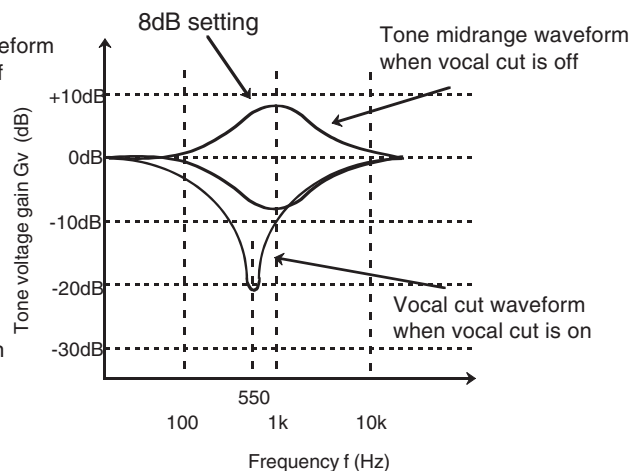
$G_v=-30\text{dB}$



2. Emphasis on tone control mid characteristic $f_0=530\text{Hz}$

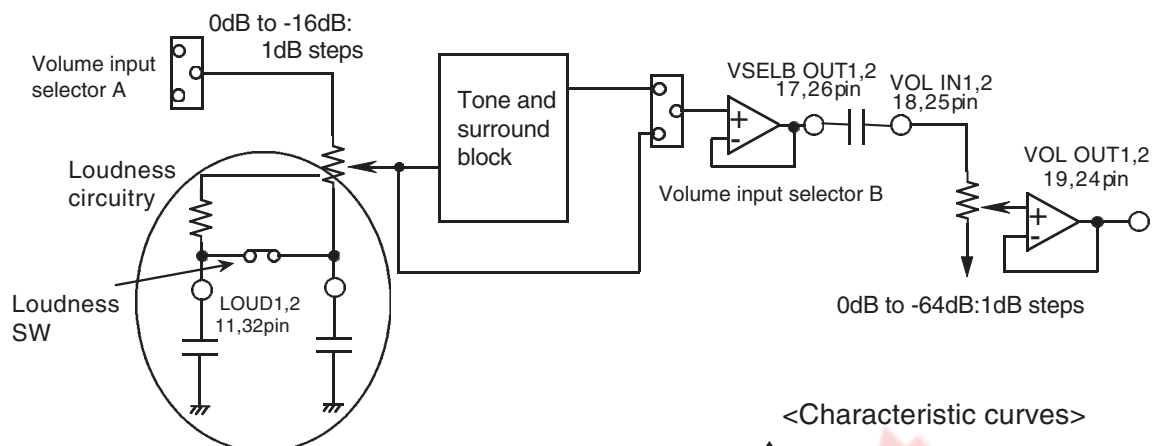
$R=10\text{k}\Omega$, $C1=C2=6800\text{pF}$

$G_v=-20\text{dB}$



(5) Loudness

This IC incorporates a center-tap loudness circuit.

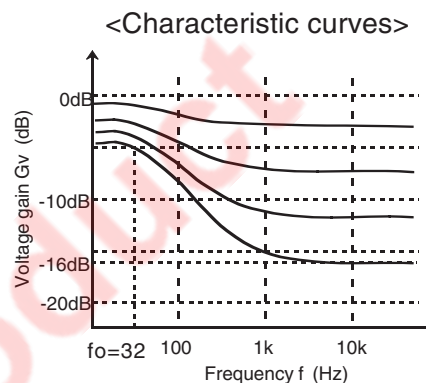
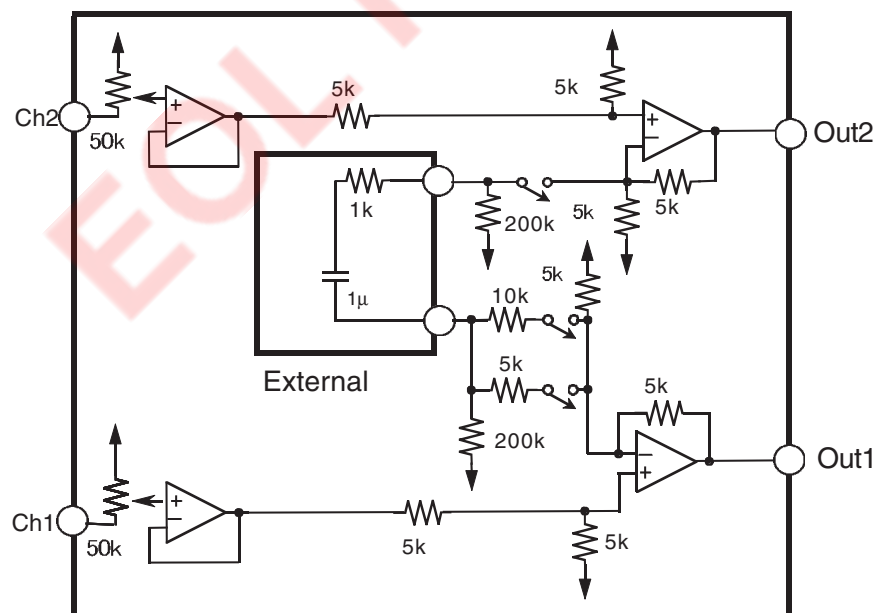


The loudness circuitry f_0 is determined by the 50 k Ω internal resistance and the external capacitor C, represented by the following equation.

$$f_0 = 1 / (2\pi \times 50k\Omega \times C) \text{ Hz}$$

When $C = 0.1 \mu\text{F}$,

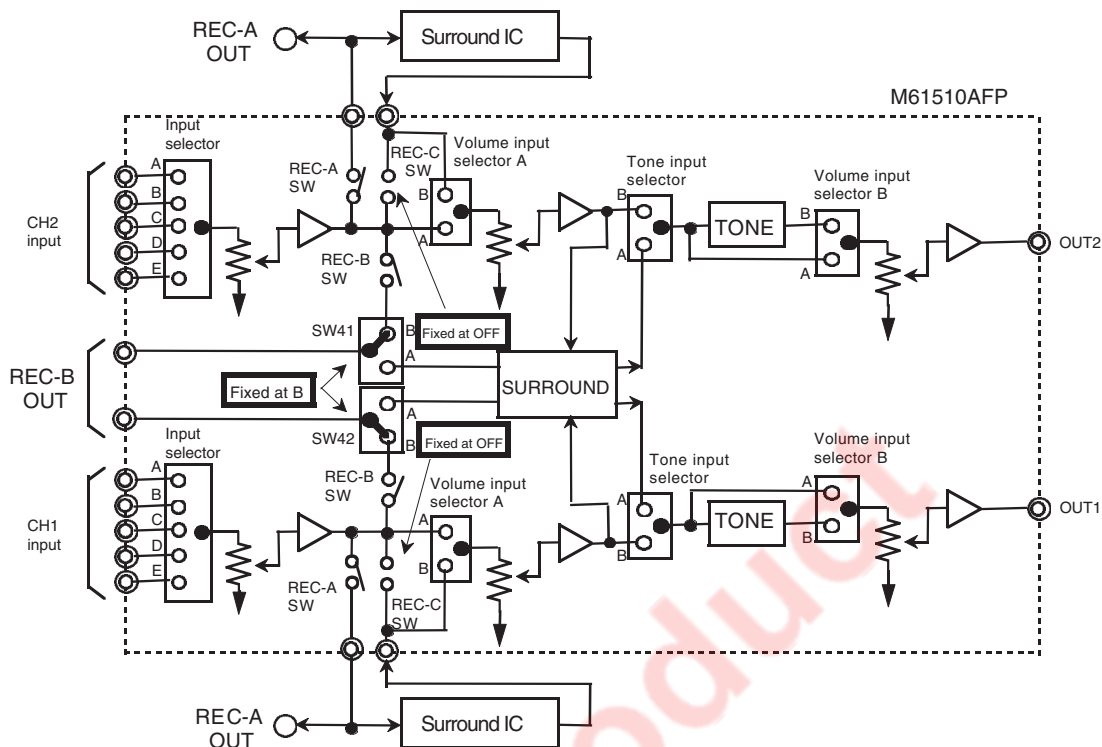
$$f_0 = 1 / (2\pi \times 50k\Omega \times 0.1\mu\text{F}) = 32 \text{ Hz}$$

**(6) Equivalent circuit with surround on**

(7) IC internal configuration

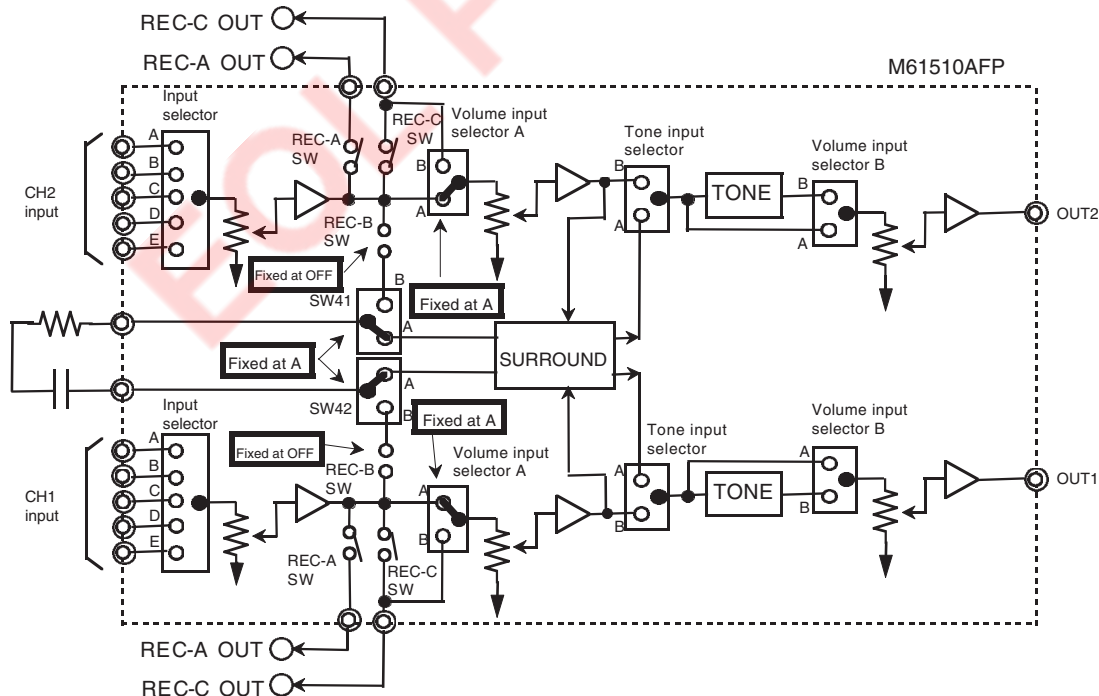
(7-1) Using external surround (surround IC)

<"D5d=1" → SW41, 42 fixed at B, REC-C SW fixed to OFF>



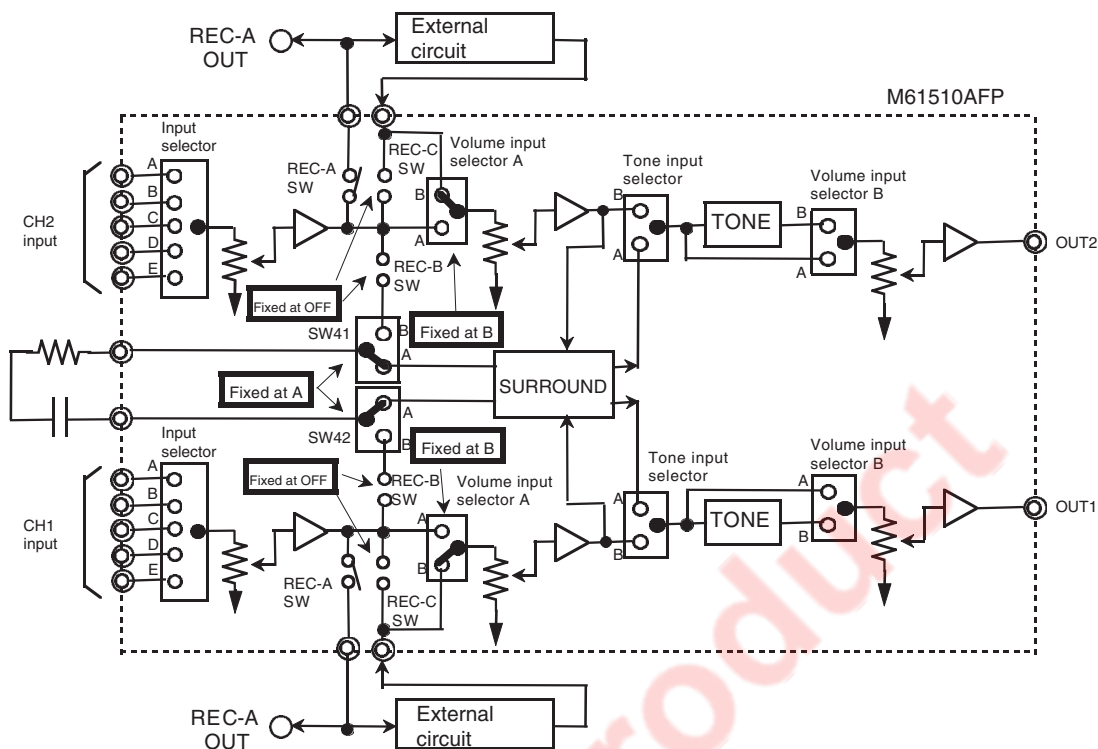
(7-2) Using internal surround [1]

<"D5d=0", "D13d=0" → Volume input selector A fixed at A, SW41, 42 fixed at A, REC-B SW fixed to OFF>



(7-2) Using internal surround [2]

<"D5d=0", "D13d=1" → Volume input selector A fixed at B, SW41, 42 fixed at A, REC-B/C SW fixed to OFF>

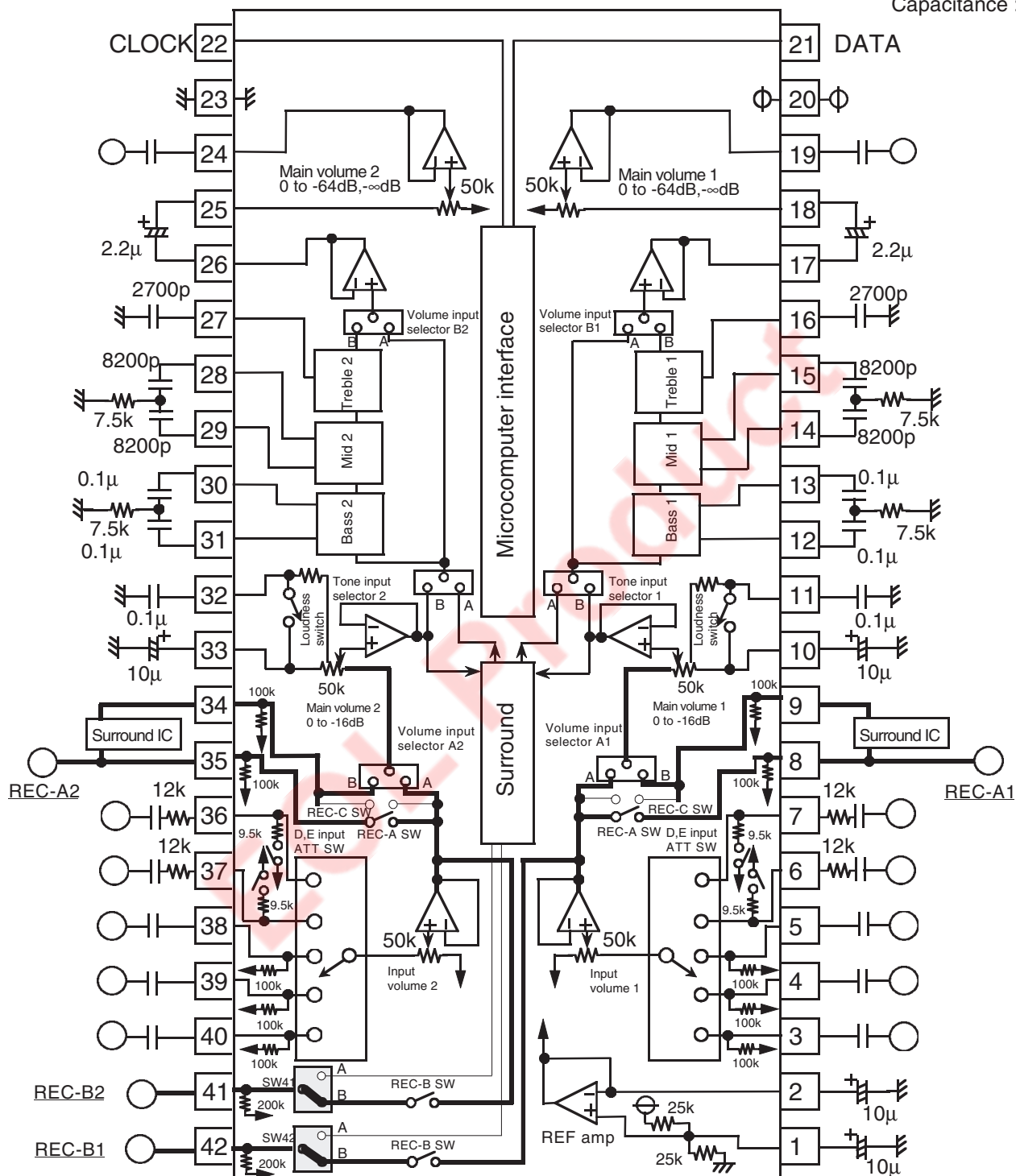


Application Circuit Example

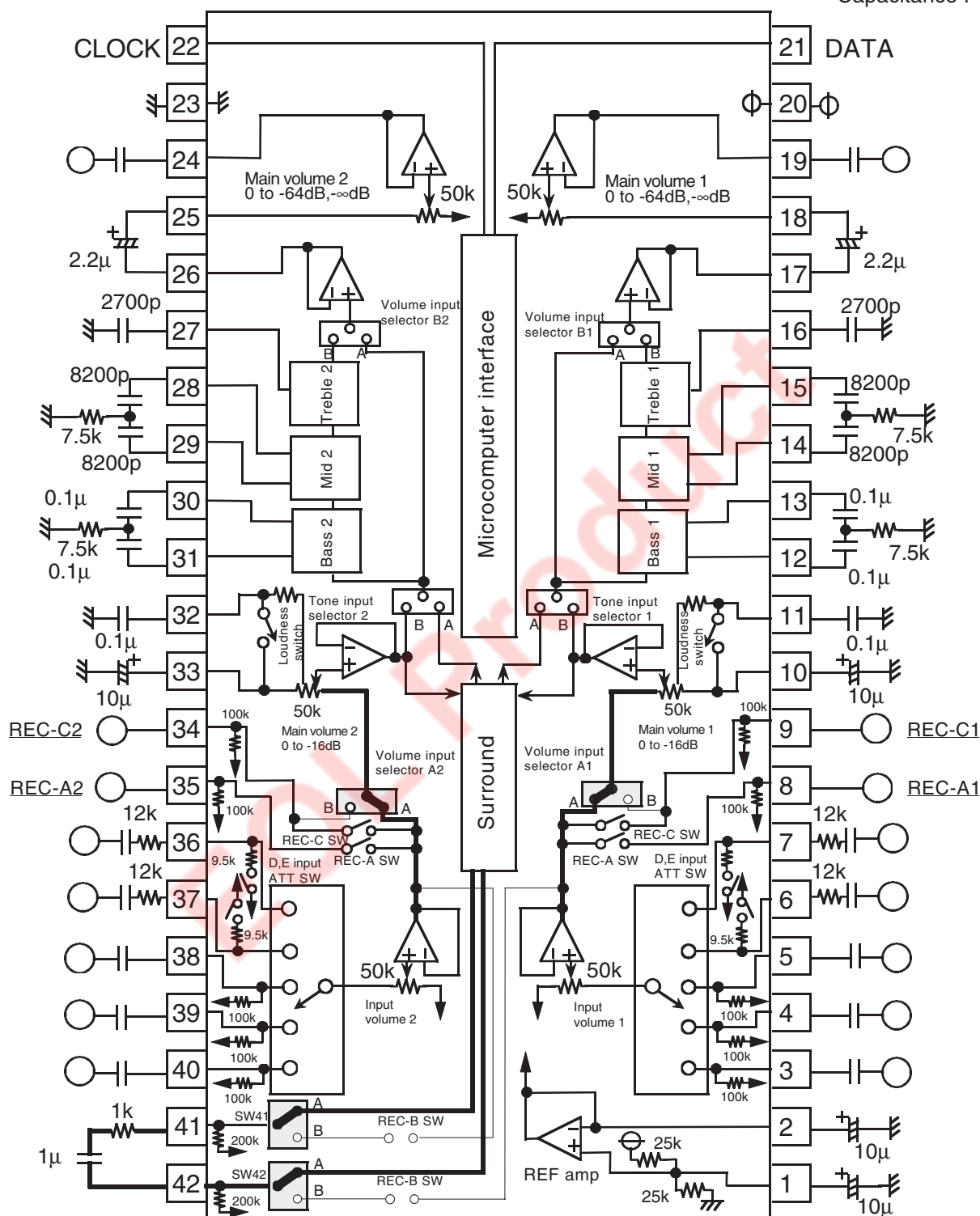
- (1) Using external surround (surround IC) ("D5d=1" → SW41, 42 fixed at B)

However, with these specifications, internal surround cannot be used.

Units Resistance : Ω
Capacitance : F



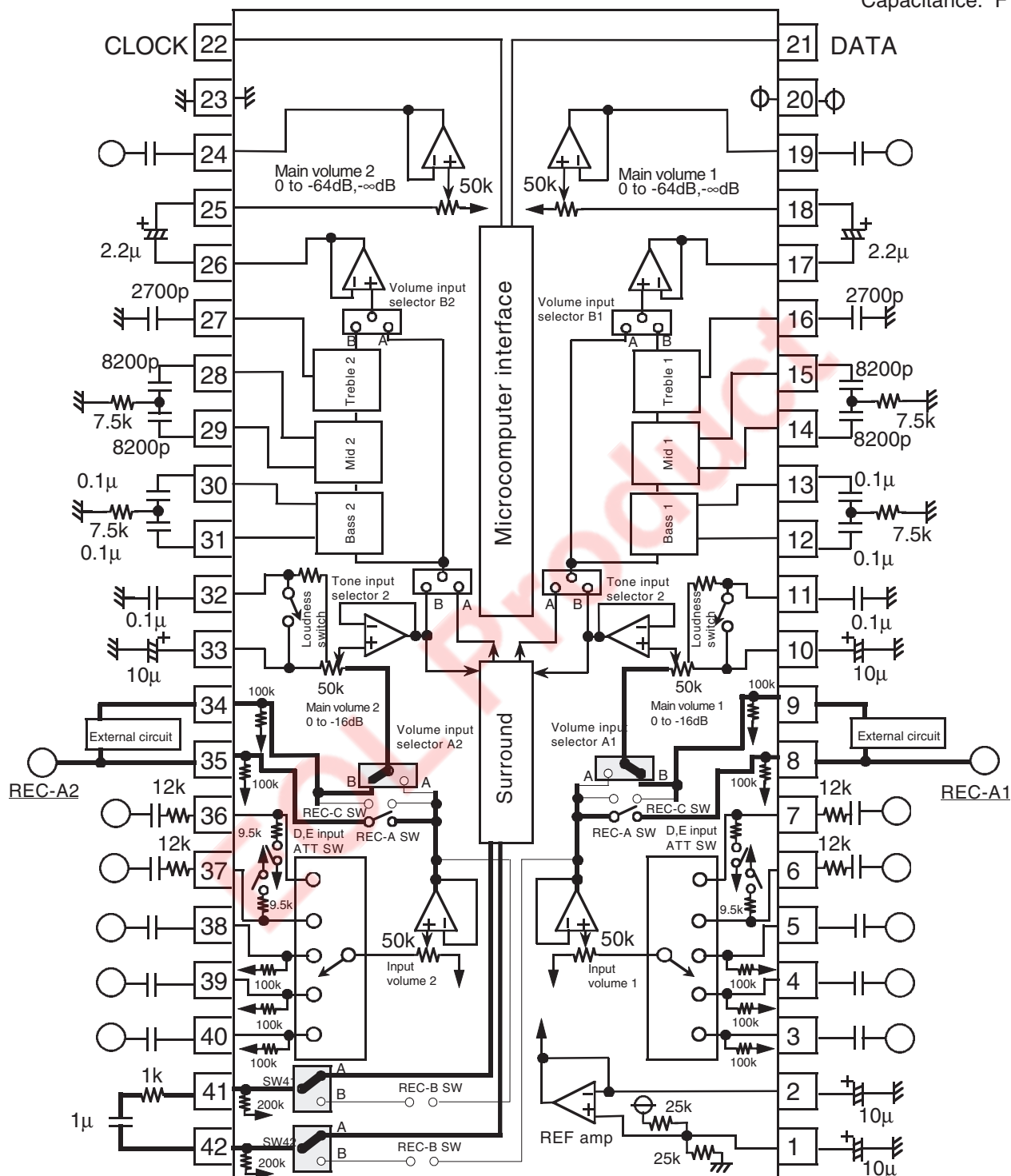
Units Resistance : Ω
 Capacitance : F



(2) Using internal surround [2] (also using external circuit)

<"D5d=0", "D13d=1" → SW41, 42 fixed at A, REC-C switch fixed at OFF,
volume input selector A fixed at B>

Units Resistance: Ω
Capacitance: F



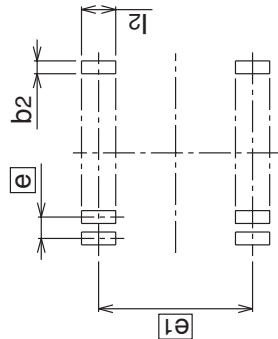
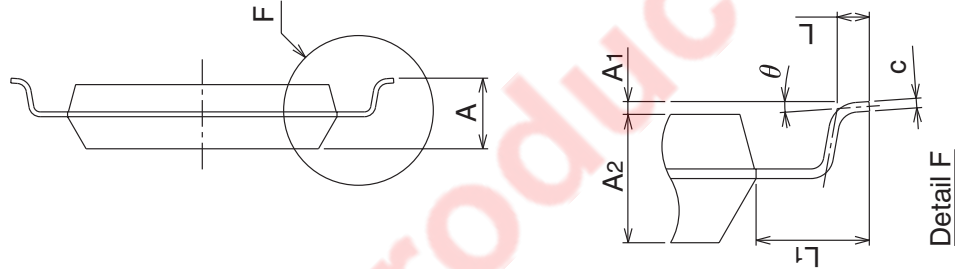
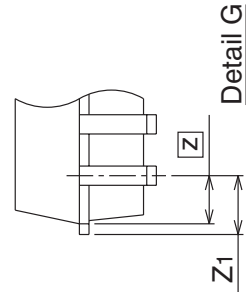
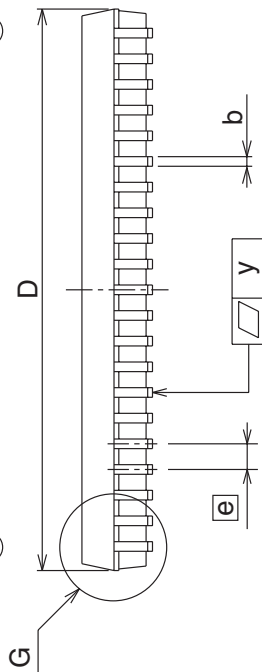
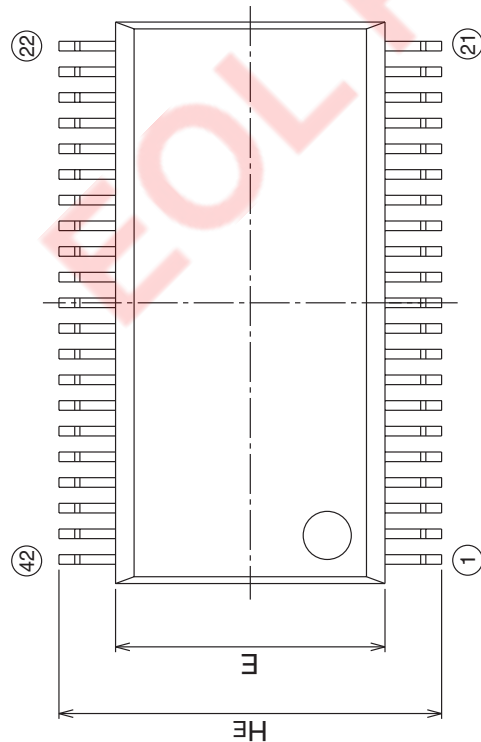
Package Dimensions

42P2R-E

MMP

Plastic 42pin 450mil SSOP

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



Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	2.4
A1	0.05	—	—
A2	—	2.0	—
b	0.25	0.3	0.4
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
θ	0°	—	10°
b2	—	0.5	—
el	—	11.43	—
l2	1.27	—	—

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

Keep safety first in your circuit designs!

1. Renesas Technology Corp. 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 Corp. 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 Corp. or a third party.
2. Renesas Technology Corp. 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 Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. 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 Corp. 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 Corp. by various means, including the Renesas Technology Corp. 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 Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. 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 Corp. or an authorized Renesas Technology Corp. 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 Corp. 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 Corp. for further details on these materials or the products contained therein.



RENESAS SALES OFFICES

<http://www.renesas.com>

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, United Kingdom
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

Renesas Technology Europe GmbH
Dornacher Str. 3, D-85622 Feldkirchen, Germany
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

Renesas Technology Hong Kong Ltd.
7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2375-6836

Renesas Technology Taiwan Co., Ltd.
FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

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