# R2S15902FP

## 6ch Electronic Volume with 4 Input Selector

REJ03F0152-0100
Rev.1.0
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## Description

R2S15902FP is an audio signal processor for home audio. This IC contains 6 channels electronic volume, gain control, input selector and 2 band tone control.

## Features

- 6 channels independent electronic volume (0 to –99dB/1dBstep, –∞dB)
- 6 channels independent gain control (0 to +14dB/ 2dB step)
- L/R channel 4 input selector (Input gain: 0 to +14dB/ 2dB step)
- Multi channel input: 6 channels input
- Tone control Bass: –14 to + 14dB(2dB step),
  Treble: –14 to + 14dB(2dB step)
- Can use 1 input for REC output (REC output gain: 0, +2, +4, +6dB)
- Built-in ADC output (Input Att: 0/ –6/ –12/ –18dB)
- Built-in L+R/ L–R block
- Built-in digital power supply

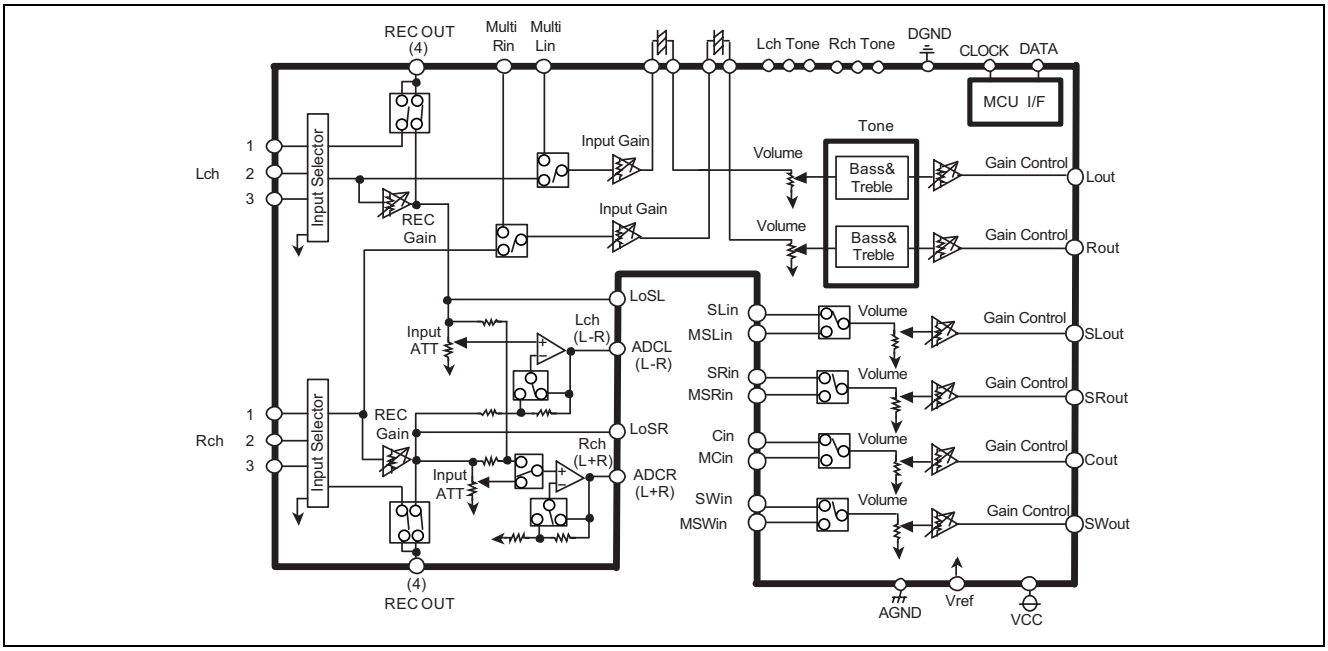
## Recommended Operating Condition

Supply voltage range $V_{CC}$ = 8.0V to 10.0V: 9.0V(typ)

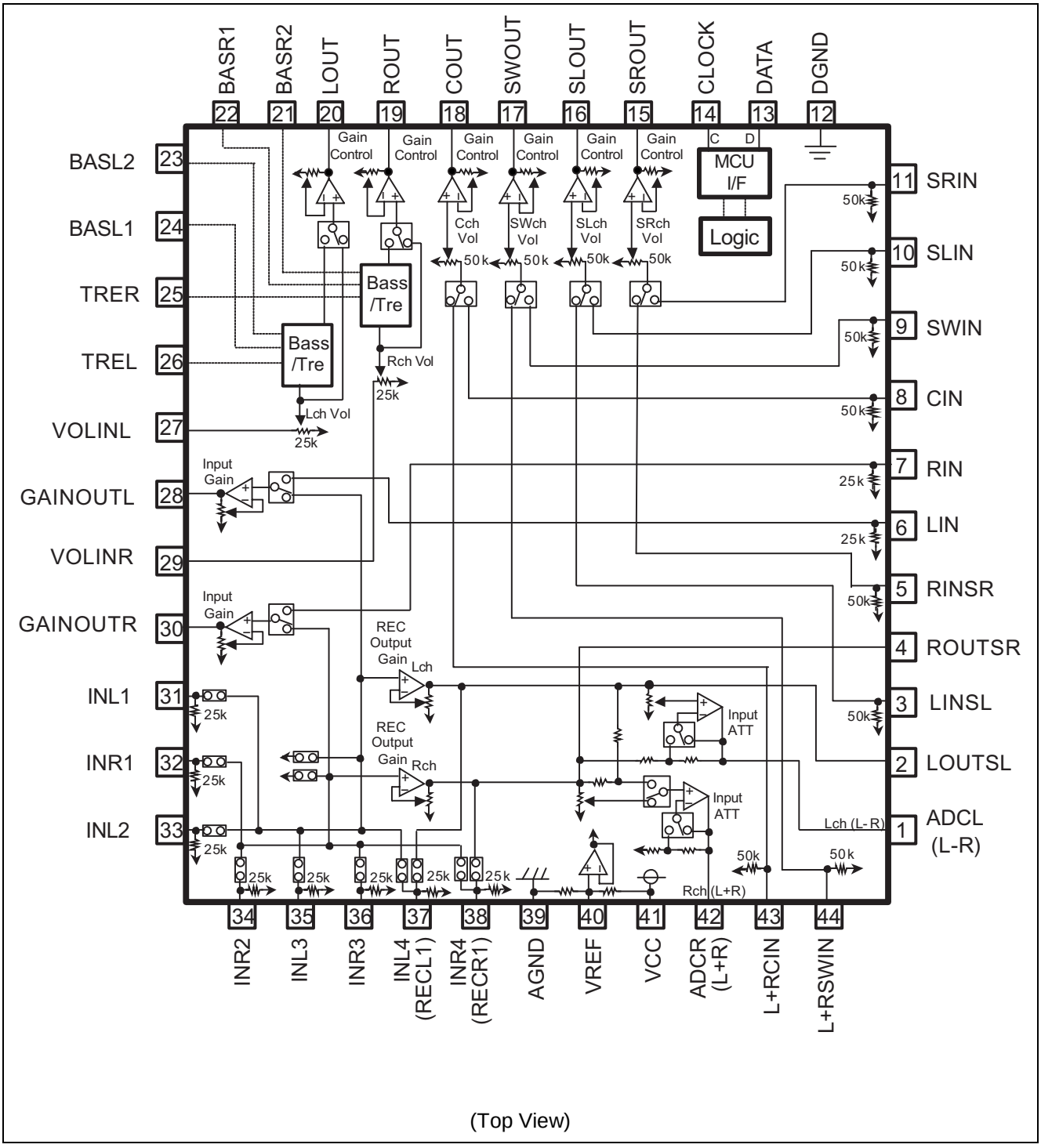
## Application

Receiver, AV amp, Home theater, Mini stereo etc.

## System Block Diagram



## Block Diagram and Pin Configuration



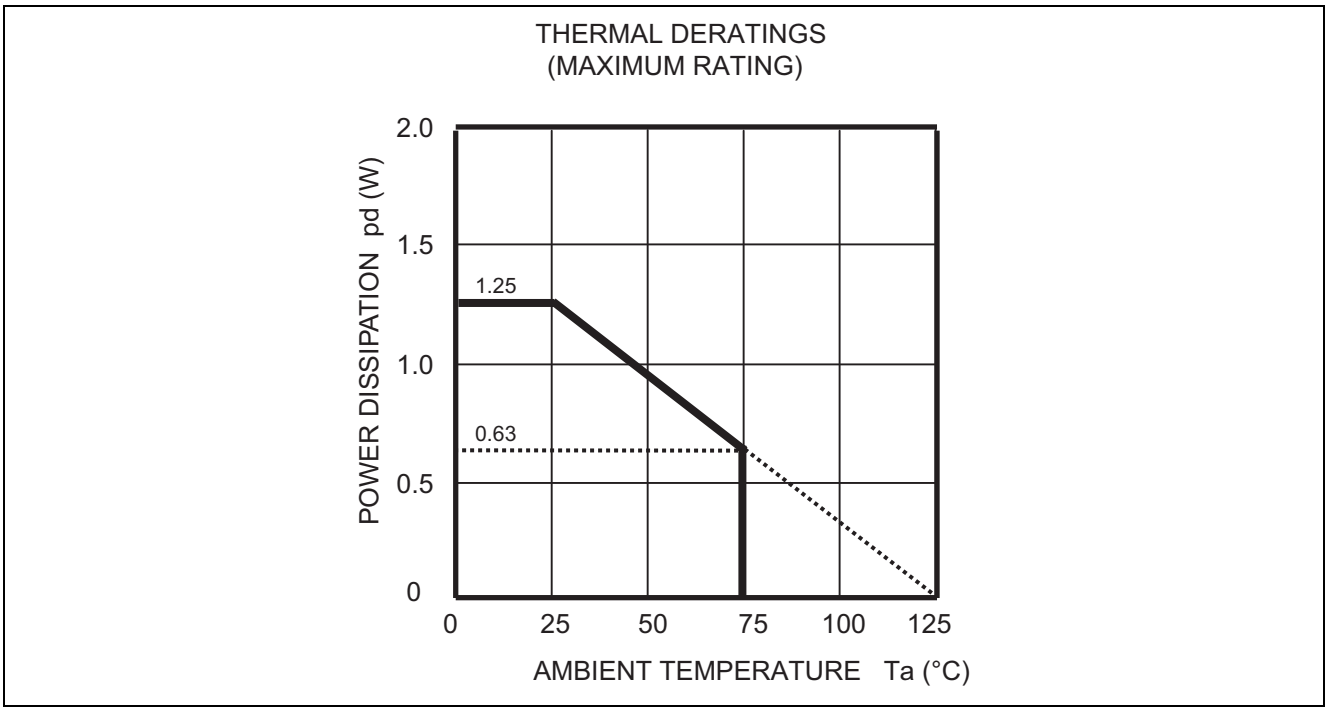

(Top View)

## Pin Description

| Pin No. | Name | Function |
|---|---|---|
| 1 | ADCL (L-R) | Output pin for ADC (and L-R output) |
| 2 | LOUTSL | L channel pre-output (REC output) for SL channel |
| 3 | LINSL | SL channel input from L channel pre-output (REC output) |
| 4 | ROUTSR | R channel pre-output (REC output) for SR channel |
| 5 | RINSR | SR channel input from R channel pre-output (REC output) |
| 6, 7, 8,<br>9, 10, 11 | LIN, RIN, CIN,<br>SWIN, SLIN, SRIN | Input pin of L/R/C/SW/SL/SR channel (Multi) |
| 12 | DGND | Digital ground |
| 13 | DATA | Input pin of control data |
| 14 | CLOCK | Input pin of control clock |
| 15, 16,<br>17, 18,<br>19, 20 | SROUT, SLOUT,<br>SWOUT, COUT,<br>ROUT, LOUT | Output pin of SR/SL/SW/C/R/L channel |
| 21, 22<br>23, 24 | BASR1, BASR2,<br>BASL1, BASL2 | Frequency characteristic setting pin of R/L channel tone control (BASS) |
| 25, 26 | TRER, TREL | Frequency characteristic setting pin of R/L channel tone control (Treble) |
| 27, 29 | VOLINL, VOLINR | Input pin of L/R channel volume |
| 28, 30 | GAINOUTL,<br>GAINOUTR | Output pin of L/R channel Input gain |
| 31,33,35,<br>32,34,36 | INL1, 2, 3,<br>INR1, 2, 3 | Input pin of L/R channel (Input selector) |
| 37, 38 | INL4/RECL1,<br>INR4/RECR1 | Input pin of L/R channel (Input selector) can use REC output pin |
| 39 | AGND | Analog ground |
| 40 | VREF | 1/2 $V_{CC}$ input |
| 41 | VCC | Power supply to internal analog circuit |
| 42 | ADCR(L+R) | Output pin for ADC(and L+R output) |
| 43 | L+RCIN | L+R input for C channel |
| 44 | L+RSWIN | L+R input for SW channel |

## Absolute Maximum Ratings

| Parameter | Symbol | Ratings | Unit | Condition |
|---|---|---|---|---|
| Power supply | Supply voltage | 10.5 | V | $V_{CC}$ |
| Power dissipation | Pd | 1.25 | W | Ta≤25°C |
| Thermal derating | K | 12.5 | mW/°C | Ta>25°C |
| Operating temperature | Topr | –20 to +75 | °C | |
| Storage temperature | Tstg | –40 to +125 | °C | |

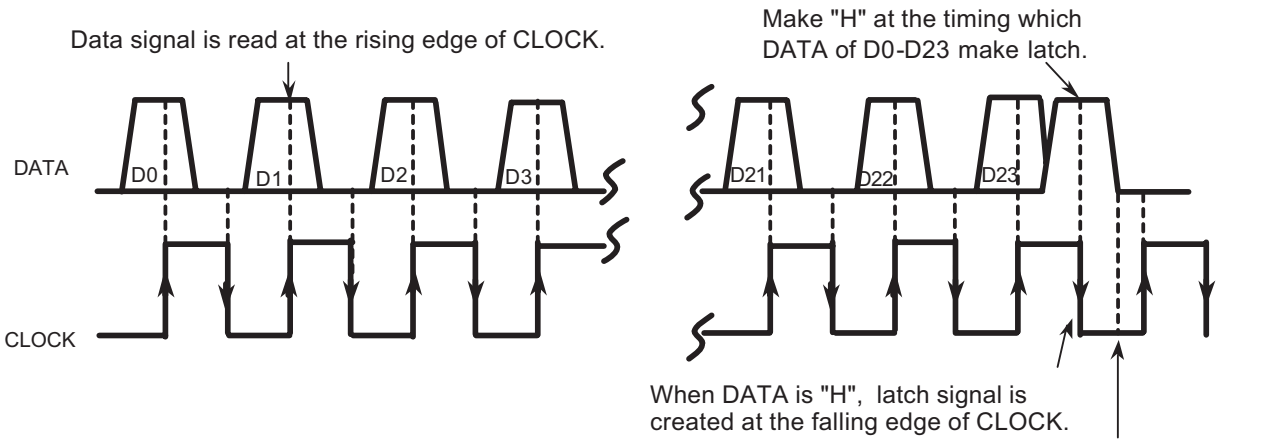



## Recommended Operating Conditions

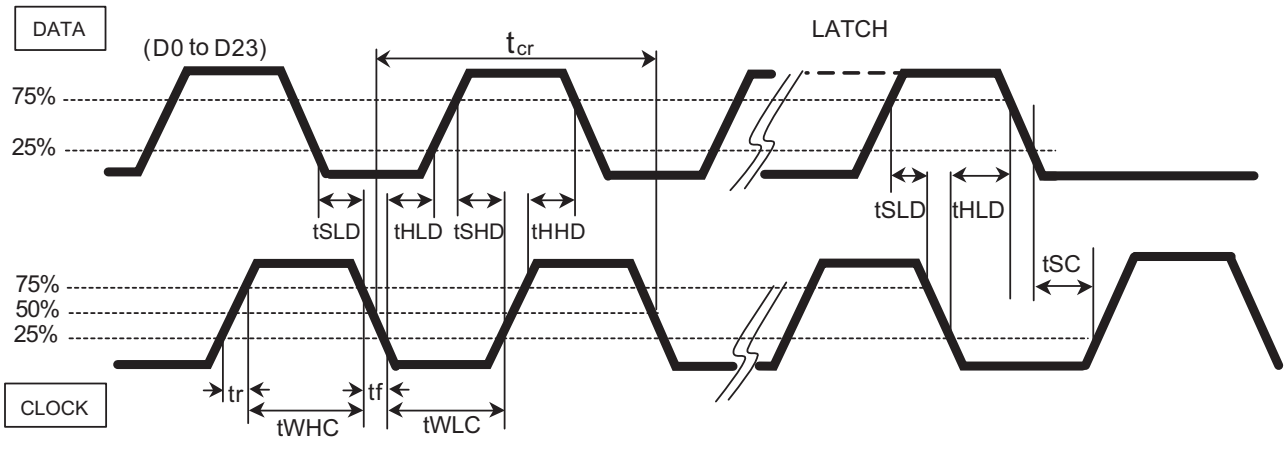
(Ta=25°C, unless otherwise noted.)

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 8.0 | 9.0 | 10.0 | V | |
| Logic “H” level input voltage | $V_{IH}$ | 2.7 | — | 5.5 | V | $V_{CC}$ = 9V |
| Logic “L” level input voltage | $V_{IL}$ | 0 | — | 0.7 | V | $V_{CC}$ = 9V |

## Relationship Between Data and Clock




## Clock and Data Timings

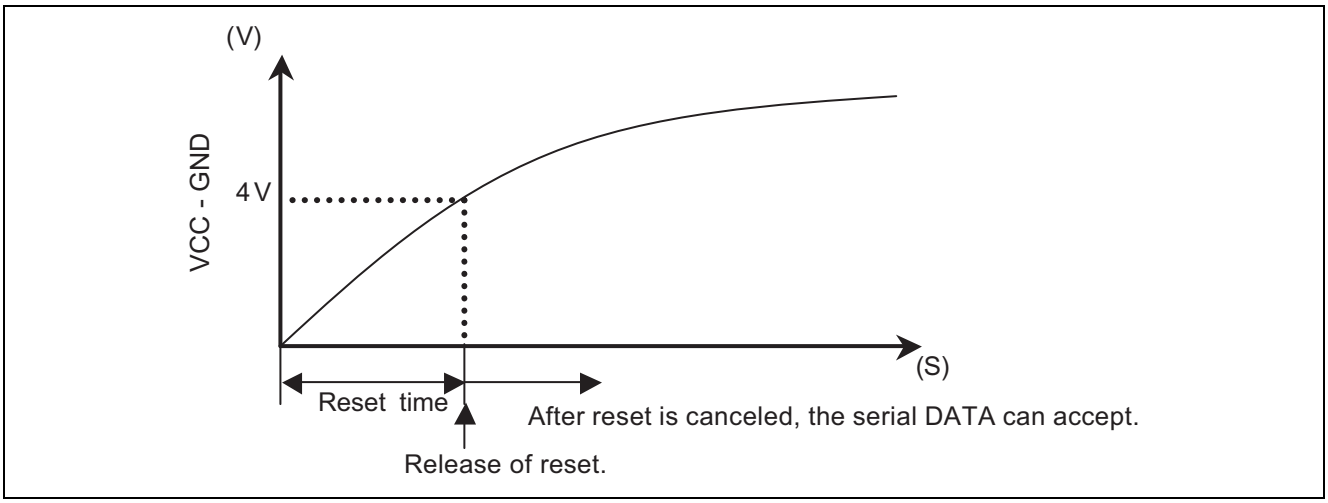



## Timing Definition of Digital Block

| Parameter | Symbol | Limits | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| CLOCK cycle time | tcr | 8 | — | — | µs |
| CLOCK pulse width ("H" level) | tWHC | 3.2 | — | — | |
| CLOCK pulse width ("L" level) | tWLC | 3.2 | — | — | |
| Rising time of clock and data | tr | — | — | 0.8 | |
| Falling time of clock and data | tf | — | — | 0.8 | |
| DATA setup time (Rising time of clock) | tSHD | 1.6 | — | — | |
| DATA setup time (Falling time of clock) | tSLD | 1.6 | — | — | |
| DATA hold time ("H" level) | tHHD | 1.6 | — | — | |
| DATA hold time ("L" level) | tHLD | 1.6 | — | — | |
| CLOCK setup time | tSC | 1.6 | — | — | |

## Power on Reset

This IC built-in the power on reset function.
The voltage of VCC-GND less than 4V, the serial DATA can not accept.




## Data Control Specification

Initialize all data of the 4 formats when digital power supply ($V_{CC}$) turns on.

Prohibit using except specified data code as follows.

Slot1

| D0a | D1a | D2a | D3a | D4a | D5a | D6a | D7a | D8a | D9a | D10a | D11a | D12a | D13a | D14a | D15a | D16a | D17a | D18a | D19a | D20a | D21a | D22 | D23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Input Selector | | | (2) REC Out | (3) REC- Output Gain Control | | (4) ADC Input ATT | | (5) L/R Input | (6) Bass/ Tone Control Bypass | | | | (7) Treble | | | | (8) SL/SR /C/SW Input | (9) Input Gain | | | 0 | 0 | 0 |

Slot2

| D0b | D1b | D2b | D3b | D4b | D5b | D6b | D7b | D8b | D9b | D10b | D11b | D12b | D13b | D14b | D15b | D16b | D17b | D18b | D19b | D20b | D21b | D22 | D23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (10) Lch Gain Control | | | (11) Lch Volume | | | | | | | (10) Rch Gain Control | | | (11) Rch Volume | | | | | | | 0 | 0 | 0 | 1 |

Slot3

| D0c | D1c | D2c | D3c | D4c | D5c | D6c | D7c | D8c | D9c | D10c | D11c | D12c | D13c | D14c | D15c | D16c | D17c | D18c | D19c | D20c | D21c | D22 | D23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (10) Cch Gain Control | | | (11) Cch Volume | | | | | | | (10) SWch Gain Control | | | (11) SWch Volume | | | | | | | 0 | 0 | 1 | 0 |

Slot4

| D0d | D1d | D2d | D3d | D4d | D5d | D6d | D7d | D8d | D9d | D10d | D11d | D12d | D13d | D14d | D15d | D16d | D17d | D18d | D19d | D20d | D21d | D22 | D23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (10) SLch Gain Control | | | (11) SLch Volume | | | | | | | (10) SRch Gain Control | | | (11) SRch Volume | | | | | | | 0 | 0 | 1 | 1 |

Note: No guarantee except for these codes.

## Setting Code

It's initial setting when power is turned on.

### (1) Input Selector

| Setting | D0a | D1a | D2a |
|---|---|---|---|
| ALL OFF | 0 | 0 | 0 |
| IN1 | 0 | 1 | 0 |
| IN2 | 1 | 0 | 0 |
| IN3 | 1 | 1 | 0 |
| IN4*1 | 0 | 0 | 1 |

Note: No guarantee except for these codes.

### (2) REC Output

| REC output | REC1 |
|---|---|
| Setting | D3a |
| OFF | 0 |
| ON | 1*1 |

*1: When IN4 selected, REC1 can not use.

| IN4 | REC1 | D0a | D1a | D2a | D3a |
|---|---|---|---|---|---|
| ON | OFF | 0 | 0 | 1 | 1 |

### (3) REC-Output Gain Control

| Gain setting | D4a | D5a |
|---|---|---|
| 0dB | 0 | 0 |
| +2dB | 0 | 1 |
| +4dB | 1 | 0 |
| +6dB | 1 | 1 |

### (4) ADC Input ATT *2

| ATT setting | D6a | D7a |
|---|---|---|
| 0dB | 0 | 0 |
| –6dB | 0 | 1 |
| –12dB | 1 | 0 |
| –18dB | 1 | 1 |

*2: When L ± R selected, ADC input ATT can not use.

### (5) L/R Input

| Setting | D8a |
|---|---|
| Selector in | 0 |
| Multi in | 1 |

It's initial setting when power is turned on.

### (6) Bass/Bypass (Tone control is bypass)

| Gain setting | D9a | D10a | D11a | D12a |
|---|---|---|---|---|
| +14dB | 1 | 1 | 1 | 1 |
| +12dB | 1 | 1 | 1 | 0 |
| +10dB | 1 | 1 | 0 | 1 |
| +8dB | 1 | 1 | 0 | 0 |
| +6dB | 1 | 0 | 1 | 1 |
| +4dB | 1 | 0 | 1 | 0 |
| +2dB | 1 | 0 | 0 | 1 |
| 0dB | 1 | 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 |
| Bypass*3 | 0 | 0 | 0 | 0 |

*3: Tone control is bypass.

### (7) Treble

| Gain setting | D13a | D14a | D15a | D16a |
|---|---|---|---|---|
| +14dB | 1 | 1 | 1 | 1 |
| +12dB | 1 | 1 | 1 | 0 |
| +10dB | 1 | 1 | 0 | 1 |
| +8dB | 1 | 1 | 0 | 0 |
| +6dB | 1 | 0 | 1 | 1 |
| +4dB | 1 | 0 | 1 | 0 |
| +2dB | 1 | 0 | 0 | 1 |
| 0dB | 1/0 | 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 |

### (8) SL/ SR/ C/ SW Input *2

| Setting | D17a |
|---|---|
| L ± R in | 0*2 |
| Multi in | 1 |

*2: When L ± R selected, ADC input ATT can not use.

### (9) Input Gain

| Gain setting | D18a | D19a | D20a |
|---|---|---|---|
| 0dB | 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 |

### (10) Gain Control

| Gain setting | | | | |
|---|---|---|---|---|
| | Lch | D0b | D1b | D2b |
| | Rch | D10b | D11b | D12b |
| | Cch | D0c | D1c | D2c |
| | SWch | D10c | D11c | D12c |
| | SLch | D0d | D1d | D2d |
| | SRch | D10d | D11d | D12d |
| 0dB | | 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 |

### (11) 6channels Volume

It's initial setting when power is turned on.

| ATT | | D3b | D4b | D5b | D6b | D7b | D8b | D9b |
|---|---|---|---|---|---|---|---|---|
| | Lch | D3b | D4b | D5b | D6b | D7b | D8b | D9b |
| | Rch | D13b | D14b | D15b | D16b | D17b | D18b | D19b |
| | Cch | D3c | D4c | D5c | D6c | D7c | D8c | D9c |
| | SWch | D13c | D14c | D15c | D16c | D17c | D18c | D19c |
| | SLch | D3d | D4d | D5d | D6d | D7d | D8d | D9d |
| | SRch | D13d | D14d | D15d | D16d | D17d | D18d | D19d |
| 0dB | | 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 |

| ATT | Lch | D3b | D4b | D5b | D6b | D7b | D8b | D9b |
|---|---|---|---|---|---|---|---|---|
| | Rch | D13b | D14b | D15b | D16b | D17b | D18b | D19b |
| | Cch | D3c | D4c | D5c | D6c | D7c | D8c | D9c |
| | SWch | D13c | D14c | D15c | D16c | D17c | D18c | D19c |
| | SLch | D3d | D4d | D5d | D6d | D7d | D8d | D9d |
| | SRch | D13d | D14d | D15d | D16d | D17d | D18d | D19d |
| –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 |
| –49dB | | 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 |
| –88dB | | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| –89dB | | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| –90dB | | 1 | 0 | 1 | 1 | 0 | 1 | 0 |

| ATT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Lch | D3b | D4b | D5b | D6b | D7b | D8b | D9b |
| | Rch | D13b | D14b | D15b | D16b | D17b | D18b | D19b |
| | Cch | D3c | D4c | D5c | D6c | D7c | D8c | D9c |
| | SWch | D13c | D14c | D15c | D16c | D17c | D18c | D19c |
| | SLch | D3d | D4d | D5d | D6d | D7d | D8d | D9d |
| | SRch | D13d | D14d | D15d | D16d | D17d | D18d | D19d |
| –91dB | | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| –92dB | | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| –93dB | | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| –94dB | | 1 | 0 | 1 | 1 | 1 | 1 | 0 |
| –95dB | | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| –96dB | | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| –97dB | | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| –98dB | | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| –99dB | | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| –∞dB | | 1 | 1 | 1/0 | 1/0 | 1 | 1/0 | 1/0 |

Note: No guarantee except for these codes.

## Electrical Characteristics

Unless otherwise noted, Ta = 25°C, $V_{CC}$ = 9V, f = 1kHz, Volume = 0dB, Input selector = IN1, Input gain = 0db, Gain control = 0dB, ADC input ATT = 0dB, Tone = Bypass, L/R input = Selector in, SL/SR/C/SW input = L±R in

### (1) Power supply characteristics

| Parameter | Symbol | Limits | | | Unit | Test condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Analog power supply circuit current | $I_{CC}$ | — | 35 | 55 | mA | With $V_{CC}$ = 9V<br>$V_{CC}$ current, when no signal is provided |

### (2) Input/Output characteristics (OVER ALL)

| Parameter | Symbol | Limits | | | Unit | Test condition | |
|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | | |
| Input resistance | Rin | 17 | 25 | 33 | kΩ | 6 to 11, 31 to 36 pin | |
| Maximum output voltage | VOM | 1.8 | 2.2 | — | Vrms | 6 to 11pin input, 15 to 20pin output, THD = 1%, RL = 10kΩ, Output gain control = +6dB | |
| Pass gain | Gv | –2.0 | 0 | 2.0 | dB | 6 to 11pin input, 15 to 20pin output, Vi = 0.3Vrms, FLAT | |
| Total harmonic distortion | THD | — | 0.005 | 0.02 | % | 6 to 11pin input, 15 to 20pin output, BW: 400Hz to 30kHz, f = 1kHz, Vo = 0.5Vrms, RL = 10kΩ | |
| Balance of mutual channels | CBAL | –0.5 | 0 | 0.5 | dB | 31,32pin input, 19,20pin output, Vi = 0.3Vrms | |
| Output noise voltage | Vono1 | — | 2 | 6 | μVrms | JIS-A, Rg = 0Ω, 19,20pin output, Volume = –∞dB setting | Output gain control = 0dB |
| | | — | 9 | 18 | | | Output gain control = +14dB |
| | Vono2 | — | 2 | 6 | | JIS-A, Rg = 0Ω, 19,20pin output, Volume = 0dB setting | Output gain control = 0dB |
| | | — | 9 | 18 | | | Output gain control = +14dB |
| | Vono3 | — | 2 | 6 | | JIS-A, Rg = 0Ω, 15 to 18pin output, Volume = 0dB setting | Output gain control = 0dB |
| | | — | 9 | 18 | | | Output gain control = +14dB |
| Selector separation | SS1 | — | –90 | –70 | dB | < Input selector> Vo = 1Vrms, Rg = 0Ω, RL = 10kΩ, JIS-A | |
| | SS2 | — | –90 | –70 | | < Multi input selector > Vo = 1Vrms, Rg = 0Ω, RL = 10kΩ, JIS-A | |
| Channel separation | CS | — | –90 | –70 | | Vo = 1Vrms, Rg = 0Ω, RL = 10kΩ, JIS-A | |

### (3) 6 channel Volume characteristics

| Parameter | Symbol | Limits | | | Unit | Test condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Maximum attenuation | ATTmax | — | –105 | –95 | dB | Vi = 2Vrms, JIS-A, VOL = –∞dB |
| Volume gain gang error of mutual channels | Dvol | –0.5 | 0 | +0.5 | dB | Volume = 0dB |

### (4) Tone control characteristics

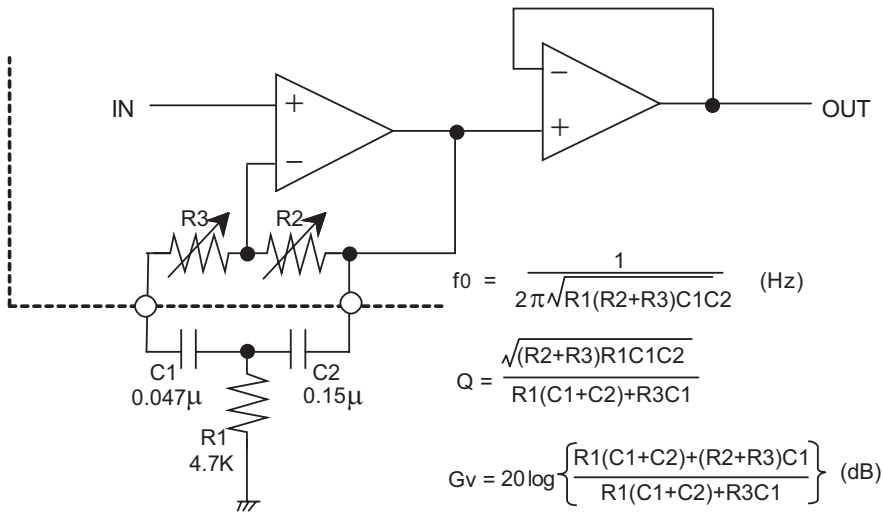
Unless otherwise noted, Tone ON/OFF = ON

| Parameter | Symbol | Limits | | | Unit | Test condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Tone control voltage gain (Boost/Bass) | G (BASS) B | +11 | +14 | +17 | dB | f = 100Hz Bass +14dB setting |
| Tone control voltage gain (Cut/Bass) | G (BASS) C | –17 | –14 | –11 | dB | f = 100Hz Bass –14dB setting |
| Tone control voltage gain (Boost/Treble) | G (TRE) B | +11 | +14 | +17 | dB | f = 10kHz Treble +14dB setting |
| Tone control voltage gain (Cut/Treble) | G (TRE) C | –17 | –14 | –11 | dB | f = 10kHz Treble –10dB setting |
| Balance of mutual channels | BALT | –2 | 0 | +2 | dB | Bass setting +14, –14dB Treble setting +14, –14dB |

## Tone Control

### (1) Bass

< Boost >




$$f0 = \frac{1}{2\pi\sqrt{R1(R2+R3)C1C2}} \quad (Hz)$$

$$Q = \frac{\sqrt{(R2+R3)R1C1C2}}{R1(C1+C2)+R3C1}$$

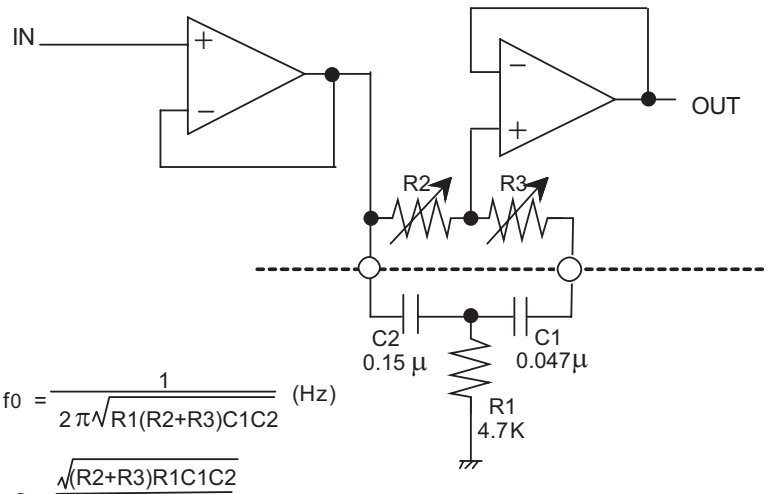
$$Gv = 20\log\left\{\frac{R1(C1+C2)+(R2+R3)C1}{R1(C1+C2)+R3C1}\right\} \quad (dB)$$

**[Designed Parameter]**

R1=4.7kΩ, C1=0.047µF, C2=0.15µF

| Gain Setting | Designed Parameter | |
|---|---|---|
| | R3(kΩ) | R2(kΩ) |
| +14dB | 0.19 | 79.81 |
| +12dB | 5.21 | 74.66 |
| +10dB | 11.83 | 68.17 |
| +8dB | 19.99 | 60.01 |
| +6dB | 30.27 | 49.73 |
| +4dB | 43.21 | 36.79 |
| +2dB | 59.49 | 20.51 |

< Cut >




$$f0 = \frac{1}{2\pi\sqrt{R1(R2+R3)C1C2}} \quad (Hz)$$

$$Q = \frac{\sqrt{(R2+R3)R1C1C2}}{R1(C1+C2)+R3C1}$$

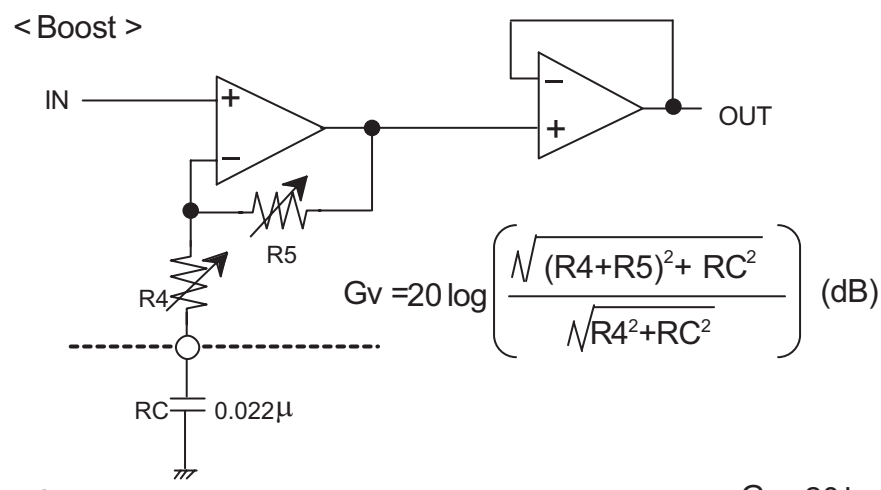
$$Gv = 20\log\left\{\frac{R1(C1+C2)+R3C1}{R1(C1+C2)+(R2+R3)C1}\right\} \quad (dB)$$

**[Designed Parameter]**

R1=4.7kΩ, C1=0.047µF, C2=0.15µF

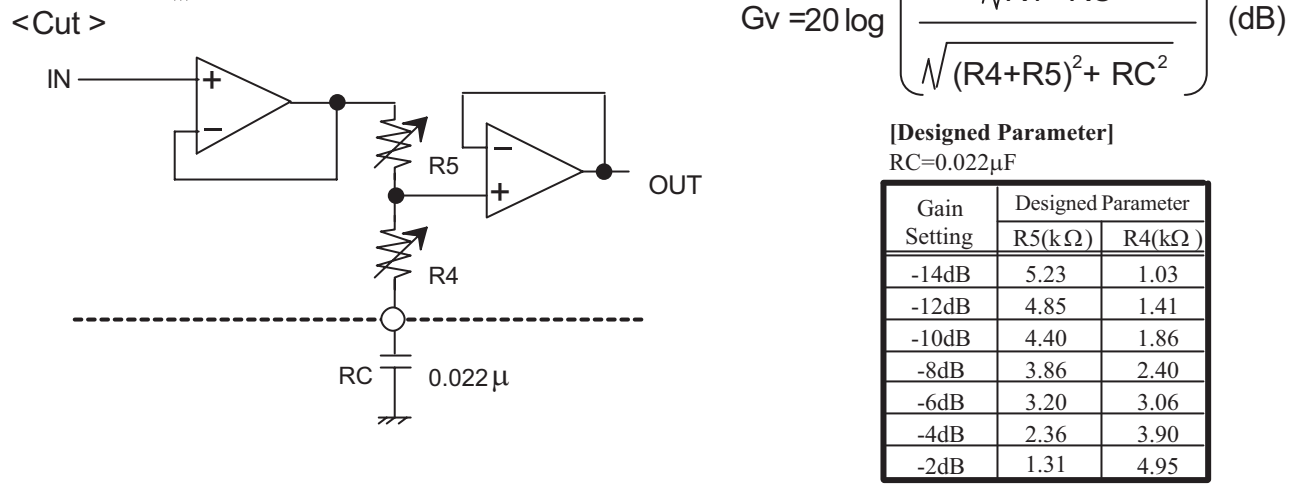
| Gain Setting | Designed Parameter | |
|---|---|---|
| | R2(kΩ) | R3(kΩ) |
| -14dB | 79.81 | 0.19 |
| -12dB | 74.66 | 5.21 |
| -10dB | 68.17 | 11.83 |
| -8dB | 60.01 | 19.99 |
| -6dB | 49.73 | 30.27 |
| -4dB | 36.79 | 43.21 |
| -2dB | 20.51 | 59.49 |

### (2) Treble




**[Designed Parameter]**
RC=0.022µF

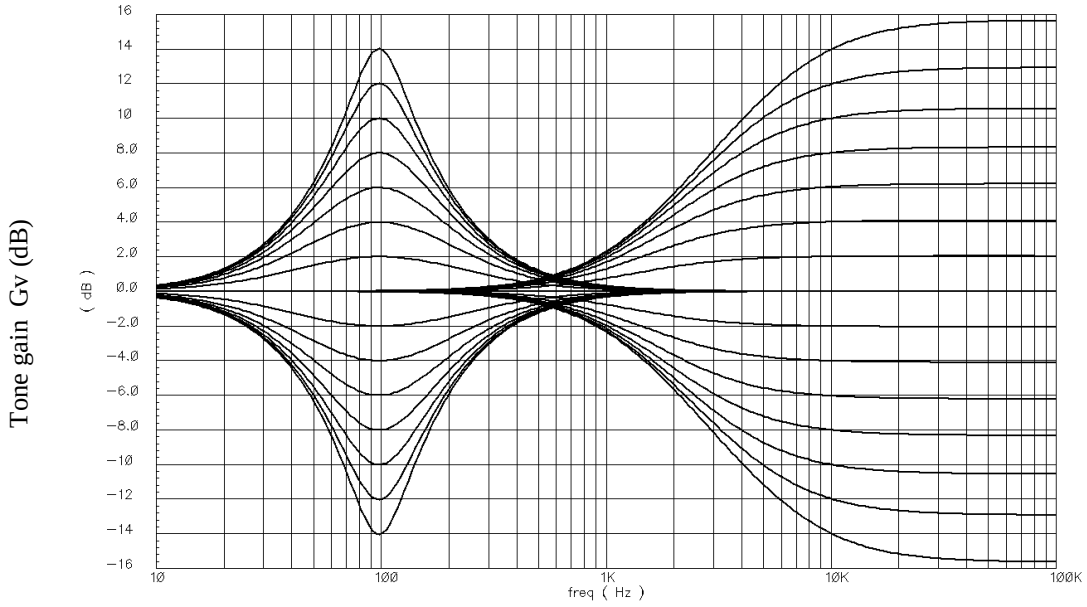
| Gain Setting | Designed Parameter | |
|---|---|---|
| | R4(kΩ) | R5(kΩ) |
| +14dB | 1.03 | 5.23 |
| +12dB | 1.41 | 4.85 |
| +10dB | 1.86 | 4.40 |
| +8dB | 2.40 | 3.86 |
| +6dB | 3.06 | 3.20 |
| +4dB | 3.90 | 2.36 |
| +2dB | 4.95 | 1.31 |




**[Designed Parameter]**
RC=0.022µF

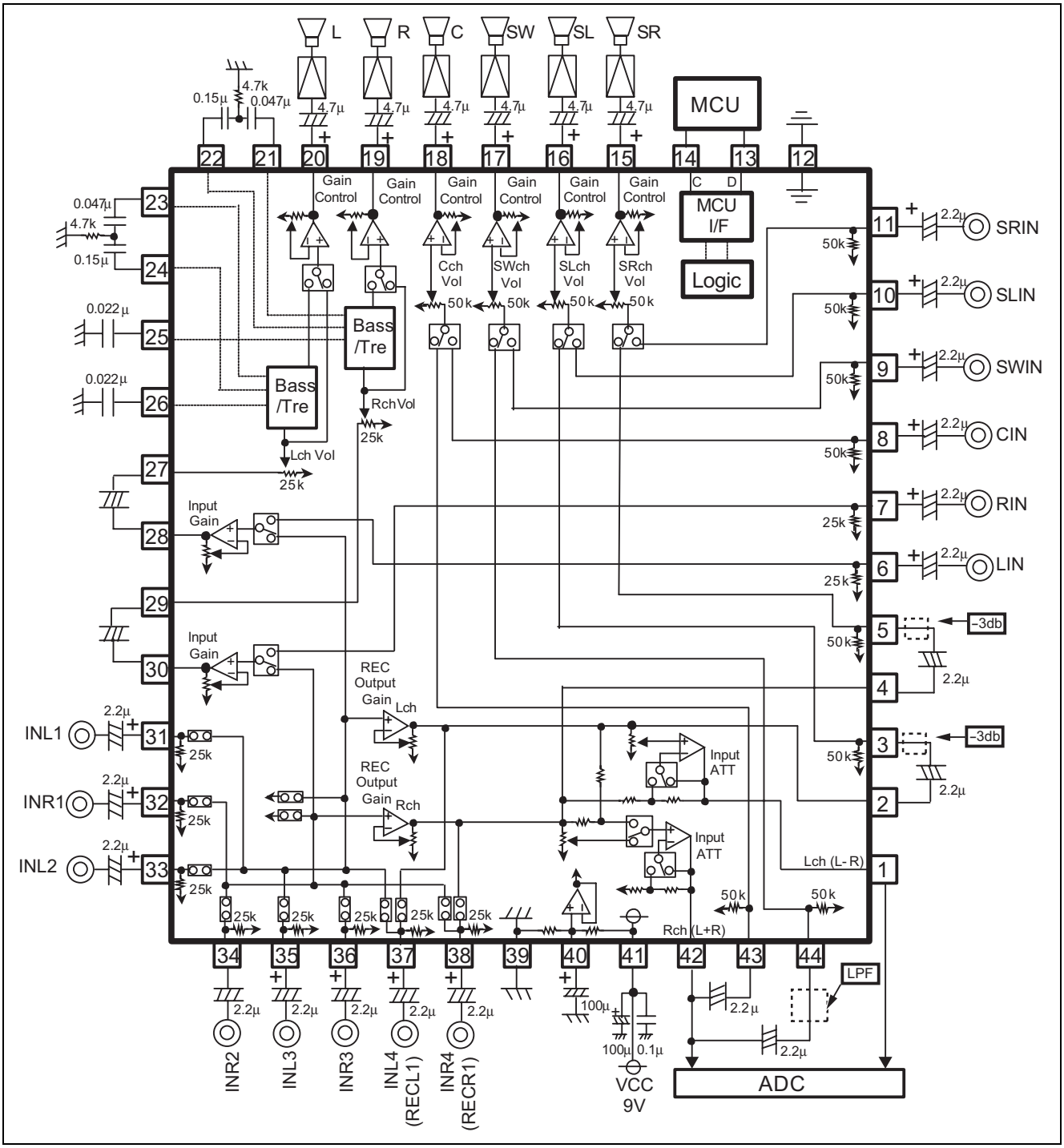
| Gain Setting | Designed Parameter | |
|---|---|---|
| | R5(kΩ) | R4(kΩ) |
| -14dB | 5.23 | 1.03 |
| -12dB | 4.85 | 1.41 |
| -10dB | 4.40 | 1.86 |
| -8dB | 3.86 | 2.40 |
| -6dB | 3.20 | 3.06 |
| -4dB | 2.36 | 3.90 |
| -2dB | 1.31 | 4.95 |

**Curve of characteristics**




Frequency f(Hz)

## Application Example



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