

M61508FP

The Electric Volume of Built-in Non Fader Volume with Tone Control

REJ03F0203-0201

Rev.2.01

Mar 31, 2008

Application

- This IC can be used Analog Signal processing of Power Amp. front stage
- This IC can be used Car Audio System, Home Audio System and TV.

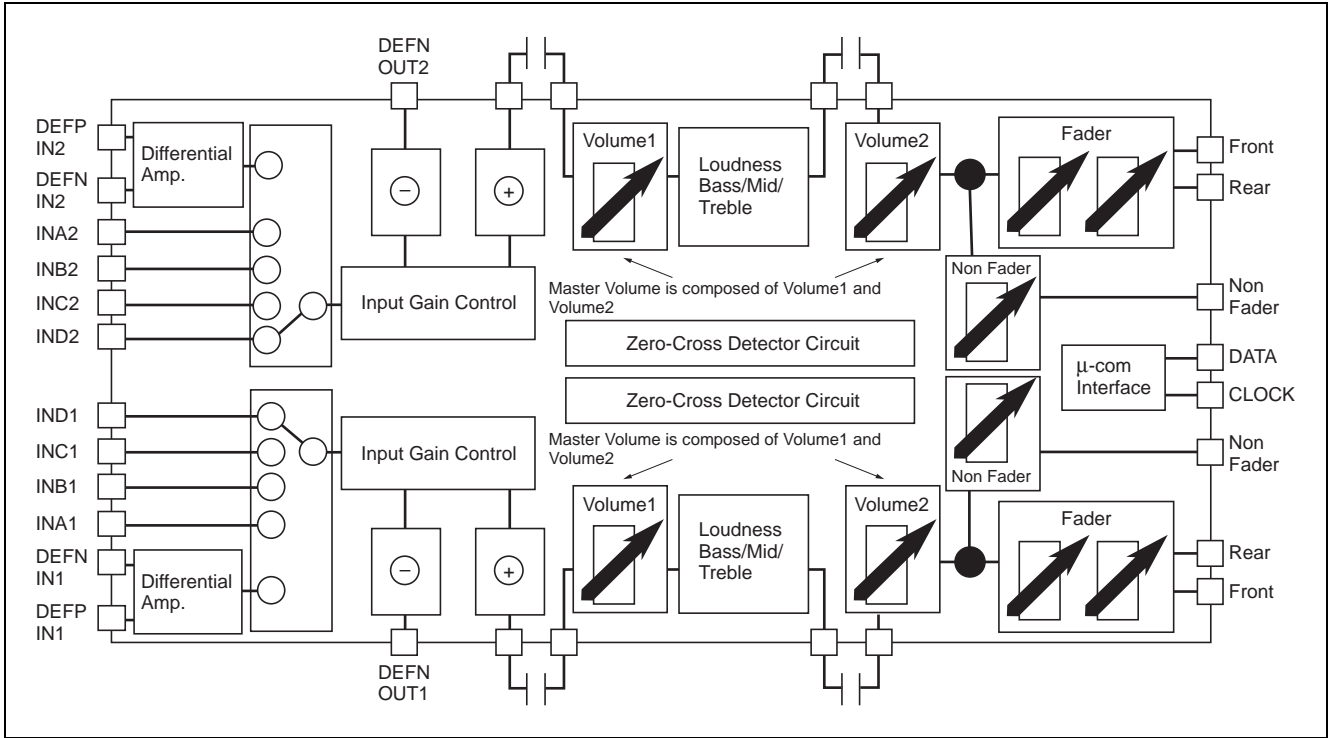
Features

- This IC is unnecessary for outside putting CR by using SCF for Loudness and Tone Control.
 - Bass: +16 dB to -12 dB/2 dBstep. f_0 , Q = variable. $f_0 = 50$ Hz, 80 Hz, 120 Hz Q = 1, 1.25, 1.5, 2
 - Mid: +12 dB to -12 dB/2 dBstep. f_0 , Q = variable. $f_0 = 700$ Hz, 1 kHz, 2 kHz, 10 kHz Q = 1.5, 2
 - Treble: +12 dB to -12 dB/2 dBstep. $f_0 =$ variable. $f_0 = 8$ kHz, 12 kHz
 - Loudness: $f_0 =$ variable. $f_0 = 60$ Hz, 80 Hz, 100 Hz
- Built-in Non Fader Volume
 - +12 dB to -12 dB/2 dB step, $-\infty$ dB
- Built-in Zero-Crossing Detector Circuit for Changing Noise Measure.
- Built-in Differential Input and Differential Output
- Built-in Input Selector (4 input + Differential Input)
- Built-in Input Gain Control
 - 0 dB to +18.75 dB/1.25 dB step
- Built-in Master Volume and Fader Volume (Front, Rear)
 - Volume: 0 dB to -83 dB, $-\infty$ dB/1 dB step
 - Fader: 0 dB, -1 dB, -2 dB, -3 dB, -4 dB, -6 dB, -8 dB, -12 dB, -16 dB, -20 dB, -30 dB, -45 dB, -60 dB, $-\infty$ dB/16 step
- Serial Data Control of 2 lines formula.

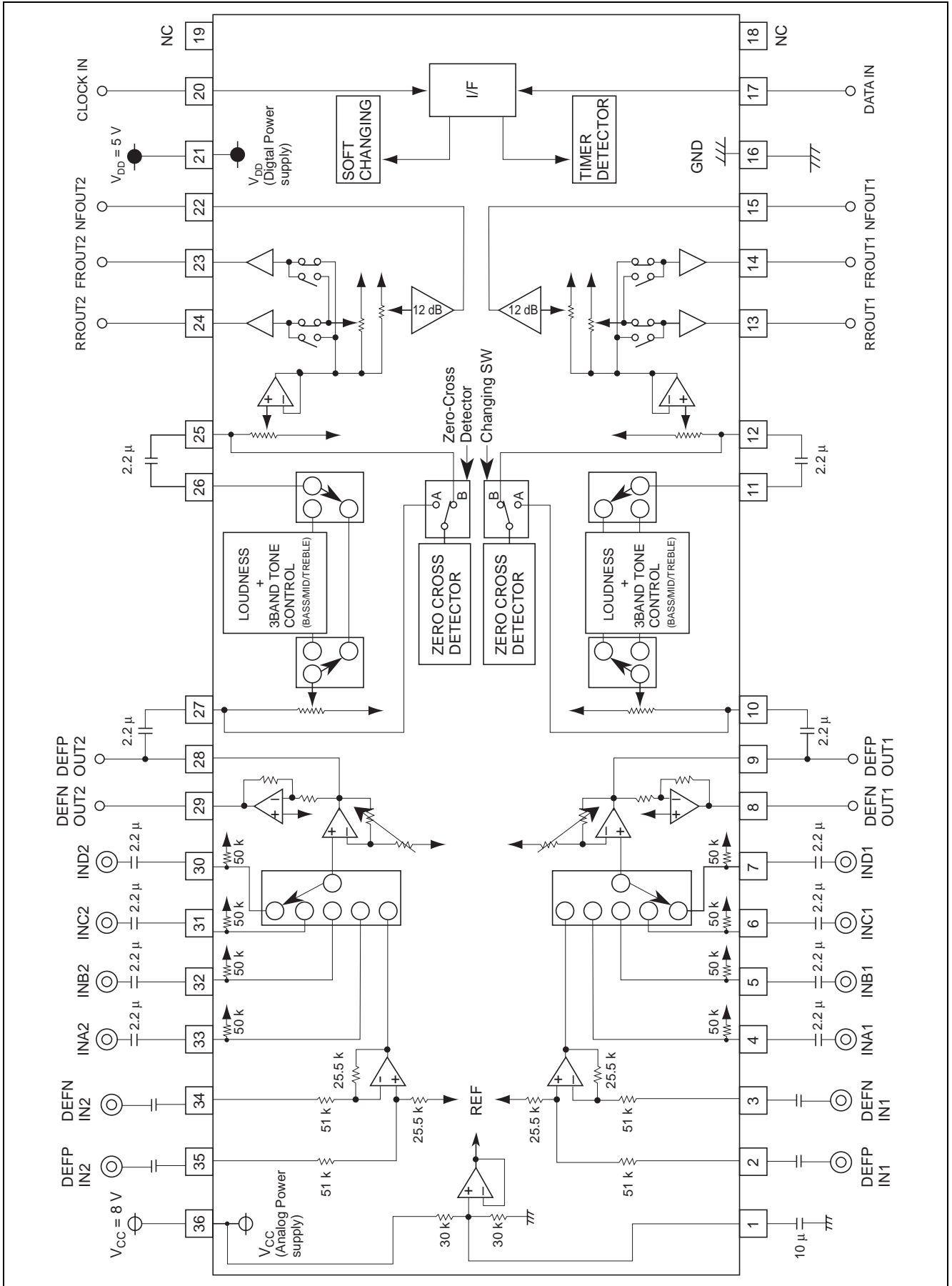
Recommended Operating Conditions

Supply voltage range... $V_{CC} = 7$ V to 9 V $V_{DD} = 4.5$ V to 5.5 VRated supply voltage... $V_{CC} = 8$ V $V_{DD} = 5$ V

System Block Diagram



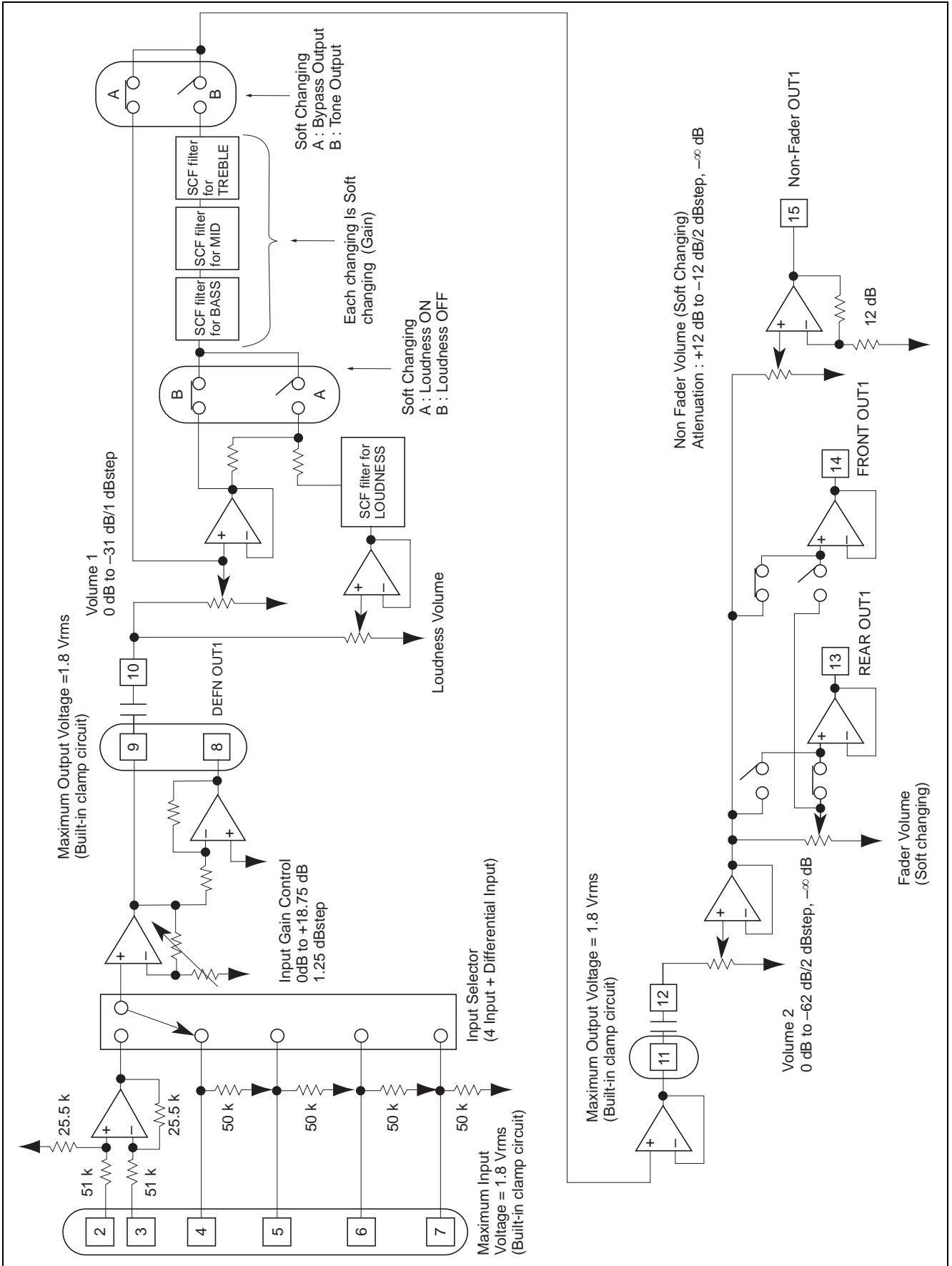
IC Internal Block Diagram



Pin Description

Pin No.	Symbol	Function
1	REF	Signal Ground of IC. Grounding about 10 μ F
2	DEFP IN1	Positive Input pin of Differential Amp.
3	DEFN IN1	Negative Input pin of Differential Amp.
4	INA1	Input pin of Channel 1 for Input Selector SW
5	INB1	
6	INC1	
7	IND1	
8	DEFN OUT1	
9	SEL OUT1	Output pin of Input Selector
10	VOL IN1	Input pin of Volume1
11	TONE OUT1	Output pin of Tone
12	FADER IN1	Input pin of Volume2
13	REAR OUT1	Output pin of Fader Volume (rear)
14	FRONT OUT1	Output pin of Fader Volume (front)
15	Non Fader OUT1	Output pin of Non Fader Volume
16	GND	Ground Pin
17	DATA	Input pin of Control Data. It synchronized at CLOCK and inputted Data
18	N.C.	N.C. Pin
19	N.C.	N.C. Pin
20	CLOCK	Clock Input pin for Serial Data Transmission
21	V _{DD}	Digital Power Supply pin
22	Non Fader OUT2	Output pin of Non Fader Volume
23	FRONT OUT2	Output pin of Fader Volume (front)
24	REAR OUT2	Output pin of Fader Volume (rear)
25	FADER IN2	Input pin of Volume2
26	TONE OUT2	Output pin of Tone
27	VOL IN2	Input pin of Volume1
28	SEL OUT2	Output pin of Input Selector
29	DEFN OUT1	Output pin (-) of Differential Amp.
30	IND2	Input pin of Channel 2 for Input Selector SW
31	INC2	
32	INB2	
33	INA2	
34	DEFN IN1	Negative Input pin of Differential Amp.
35	DEFP IN1	Positive Input pin of Differential Amp.
36	V _{CC}	Analog Power Supply pin

Signal Communication Diagram (Channel 1 side only)

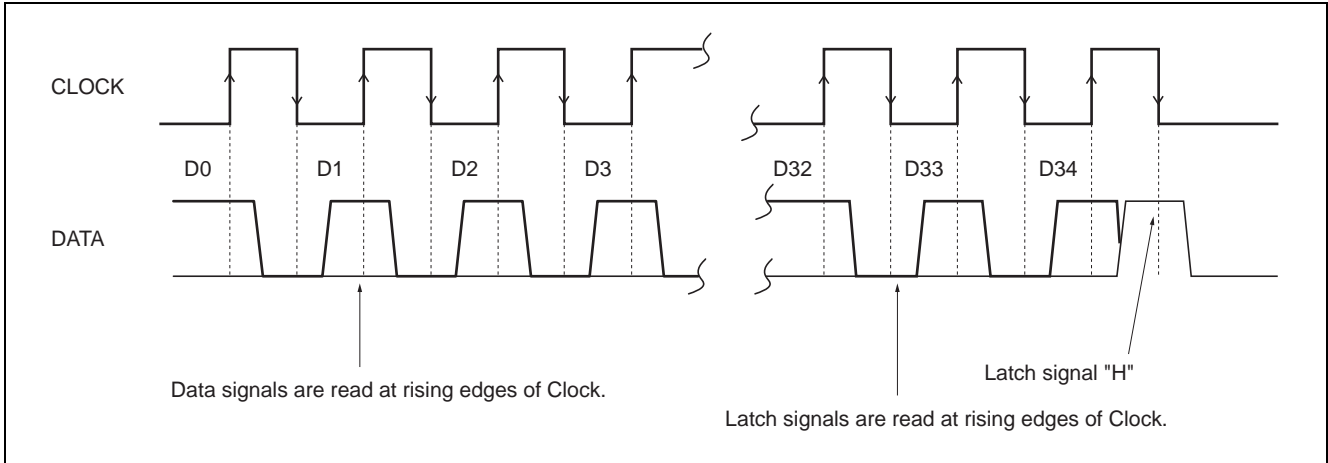


Electrical Characteristics

($T_a = 25\text{ }^\circ\text{C}$, $V_{CC} = 8\text{ V}$, $V_{DD} = 5\text{ V}$, Input Gain/Volume/Tone/fader = 0 dB, Loudness = OFF, unless otherwise noted.)

Item	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Circuit current	I_{CC}	—	—	40	mA	No signal setting
Pass gain	Gv	-2	0	+2	dB	—
Volume maximum Attenuation quantity	A_{TT} (VOL)	—	-90	-80	dB	$V_i = 1\text{ V}_{rms}$, $f = 1\text{ kHz}$ ATT (VOL) = $-\infty$ dB
Crosstalk between Channels	ΔA_{TT} (VOL)	-2	0	+2	dB	ATT (VOL) = 0 dB
Maximum input voltage	V_{IM}	—	—	1.8	Vrms	$f = 1\text{ kHz}$, DIN-AUDIO THD = 1%
Boost quantity (Bass)	G (Bass) B	13	16	19	dB	$f = 100\text{ Hz}$
Cut quantity (Bass)	G (Bass) C	-15	-12	-9	dB	$f = 100\text{ Hz}$
Boost quantity (Mid)	G (MID) B	9	12	15	dB	$f = 1\text{ kHz}$
Cut quantity (Mid)	G (MID) C	-15	-12	-9	dB	$f = 1\text{ kHz}$
Boost quantity (Treble)	G (Tre) B	9	12	15	dB	$f = 10\text{ kHz}$
Cut quantity (Treble)	G (Tre) C	-15	-12	-9	dB	$f = 10\text{ kHz}$
Fader maximum attenuation quantity	A_{TT} (FED)	—	-90	-80	dB	$V_i = 1\text{ V}_{rms}$, $f = 1\text{ kHz}$, DIN-AUDIO ATT (FED) = $-\infty$ dB
Maximum input voltage	V_{OM}	1.8	—	—	Vrms	$f = 1\text{ kHz}$, DIN-AUDIO THD = 1%
Output noise voltage	Vno 1	—	12	—	μV_{rms}	Rg = 0, DIN-AUDIO
	Vno 2	—	5	—		Bypass setting Rg = 0, DIN-AUDIO
	Vno 3	—	3.5	—		ATT (VOL) = $-\infty$ dB Rg = 0, DIN-AUDIO
Total harmonic distortion	THD	—	0.01	0.05	%	$f = 1\text{ kHz}$, $V_0 = 0.5\text{ V}_{rms}$ BW : 400 Hz to 30 kHz
Channel separation	CS	—	-90	-75	dB	$f = 1\text{ kHz}$, DIN-AUDIO
Input selector crosstalk	CT	—	-75	-60	dB	$f = 1\text{ kHz}$, DIN-AUDIO
Loudness voltage gain	Gv (LOUD)	10	13	16	dB	Loudness ON, $f = 100\text{ Hz}$ VOL1 = -30 dB, VOL2 = 0 dB LOUD_VOL = -20 dB
Input gain control	Gv (GAIN)	15.75	18.75	21.75	dB	Gv (GAIN) = +18.75 dB
Common mode rejection ratio	CMRR	—	50	—	dB	2, 3 pin/34, 35 pin Common mode signal input setting

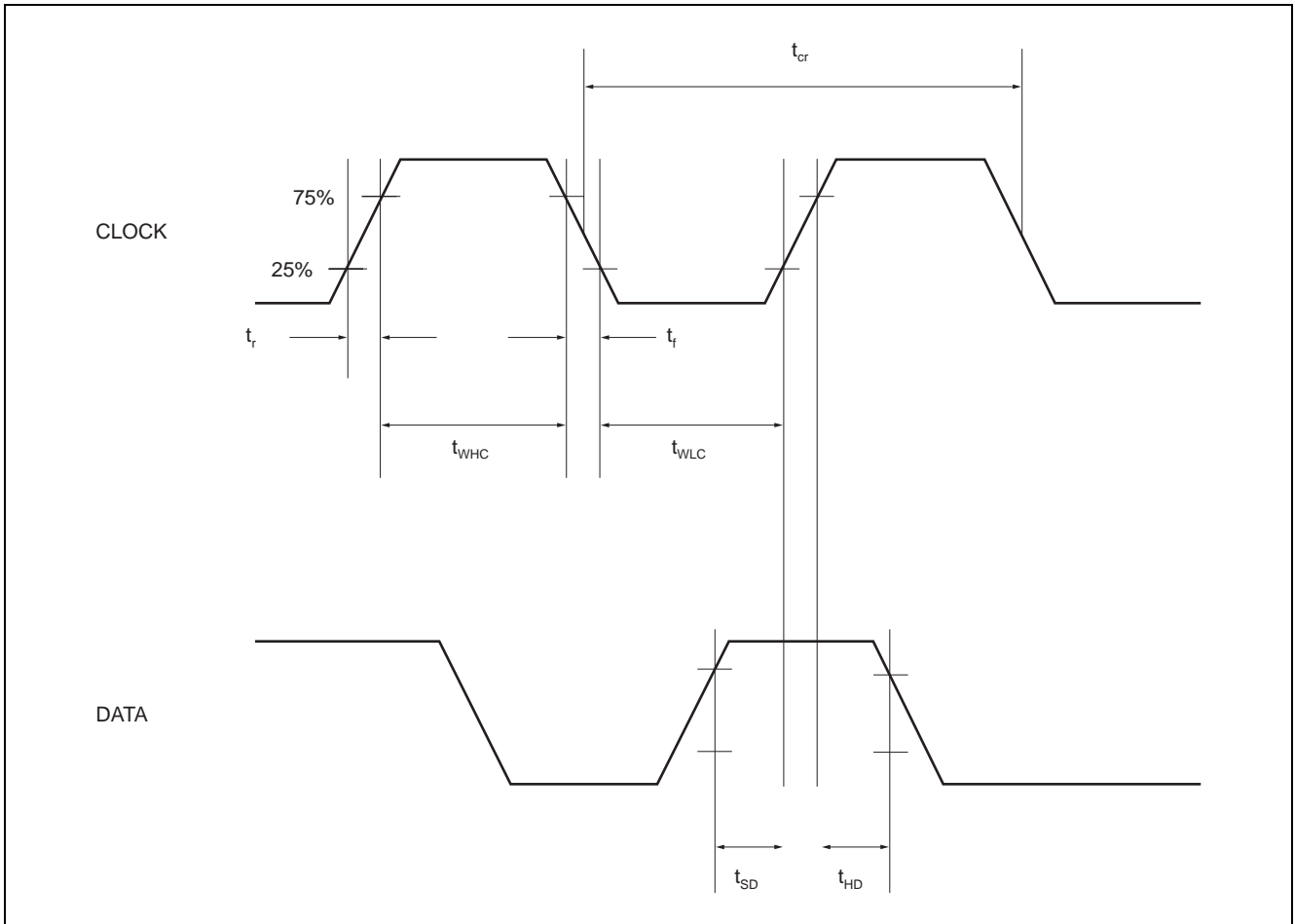
Connection of Data and Clock



Digital Block Direct Current Characteristic

Item	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
"L" Level Input Voltage	V_{IL}	0	~	1.0	V	$V_{DD} = 5\text{ V}$ setting DATA, CLOCK Pin
"H" Level Input Voltage	V_{IH}	4.0	~	5.0		
"L" Level Input Electric Current	I_{IL}	-10	—	10	μA	$V = 0\text{ V}$ DATA, $V = 5\text{ V}$ CLOCK Pin
"H" Level Input Electric Current	I_{IH}	—	—	10		

Clock and Data Timing



Digital Block Alternating Current Characteristic

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	—	—	

Data Input Format

DATA SELECT (D33, D34)
 00: Volume 1/Input Selector/Input Gain Control/Loudness Gain
 01: Volume 2
 10: Fader/Non Fader/Bass/Mid/Treble/Loudness ON/OFF

Data Transmission Direction →

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34																	
Volume 1 (CH1)																Volume 1 (CH2)																																			
Volume 2 (CH1)																Volume 2 (CH2)																																			
Bass				Bass f0 Control				Bass Q Control				MID				Mid f0 Control				TREBLE				0/1				Input Gain Control				LOUDNESS				Timer Setting				0/1											
Bass f0 Control				Bass Q Control				MID				Mid f0 Control				TREBLE				0/1				Input Gain Control				LOUDNESS				Timer Setting				0/1				Non Fader (ATT)				Loudness f0 Control				Loudness ON/OFF			
Bass f0 Control				Bass Q Control				MID				Mid f0 Control				TREBLE				0/1				Input Gain Control				LOUDNESS				Timer Setting				0/1				Non Fader (ATT)				Loudness f0 Control				Loudness ON/OFF			

Loudness ON/OFF
 0: OFF
 1: ON

Fader Output Front/Rear changing
 0: Front
 1: Rear

Zero-cross Detector Changing Saw
 0: Front Step Detector (9 pin, 28 pin)
 1: Back Step Detector (11 pin, 26 pin)

Bypass Bypass Output
 0: Bypass Output
 1: Tone Output

Note: Data transmission (Rewriting) of D33 = 1, D34 = 0 setting, put 100 ms interval and data transmission

Volume 1 Code

ATTVA1	CH1	D0	D1	D2	D3	D4
	CH2	D7	D8	D9	D10	D11
0 dB		0	0	0	0	1
-1 dB		1	1	1	1	0
-2 dB		0	1	1	1	0
-3 dB		1	0	1	1	0
-4 dB		0	0	1	1	0
-5 dB		1	1	0	1	0
-6 dB		0	1	0	1	0
-7 dB		1	0	0	1	0
-8 dB		0	0	0	1	0
-9 dB		1	1	1	0	0
-10 dB		0	1	1	0	0
-11 dB		1	0	1	0	0
-12 dB		0	0	1	0	0
-16 dB		1	1	0	0	0
-20 dB		0	1	0	0	0
-24 dB		1	0	0	0	0
-28 dB		0	0	0	0	0

ATTVA2	CH1	D5	D6
	CH2	D12	D13
0 dB		1	1
-1 dB		0	1
-2 dB		1	0
-3 dB		0	0

ATTVA2 fixed to 0 dB
when 0 dB to -12 dB setting.

Volume 2 Code

ATTVB1	CH1	D0	D1	D2	D3
	CH2	D6	D7	D8	D9
0 dB		0	1	1	1
-2 dB		1	0	1	1
-4 dB		0	0	1	1
-6 dB		1	1	0	1
-8 dB		0	1	0	1
-10 dB		1	0	0	1
-12 dB		0	0	0	1
-14 dB		1	1	1	0
-16 dB		0	1	1	0
-24 dB		1	0	1	0
-32 dB		0	0	1	0
-40 dB		1	1	0	0
-48 dB		0	1	0	0
-56 dB		1	0	0	0
-∞ dB		0	0	0	0

ATTVB2	CH1	D4	D5
	CH2	D10	D11
0 dB		1	1
-2 dB		0	1
-4 dB		1	0
-6 dB		0	0

ATTVB2 fixed to 0 dB
when 0 dB to -16 dB setting.

Timer Setting Code

Timer	D25	D26
5 ms	1	1
10 ms	0	1
15 ms	1	0
20 ms	0	0

Tone Code

Mid	D8	D9	D10	D11
Treble	D15	D16	D17	D18
12 dB	0	1	1	0
10 dB	1	0	1	0
8 dB	0	0	1	0
6 dB	1	1	0	0
4 dB	0	1	0	0
2 dB	1	0	0	0
0 dB	0	0	0	0/1
-2 dB	1	0	0	1
-4 dB	0	1	0	1
-6 dB	1	1	0	1
-8 dB	0	0	1	1
-10 dB	1	0	1	1
-12 dB	0	1	1	1

Bass	D0	D1	D2	D3
16 dB	0	0	0	1
14 dB	1	1	1	0
12 dB	0	1	1	0
10 dB	1	0	1	0
8 dB	0	0	1	0
6 dB	1	1	0	0
4 dB	0	1	0	0
2 dB	1	0	0	0
0 dB	0	0	0	0
-2 dB	1	0	0	1
-4 dB	0	1	0	1
-6 dB	1	1	0	1
-8 dB	0	0	1	1
-10 dB	1	0	1	1
-12 dB	0	1	1	1

Loudness Volume Code

Loudness	D21	D22	D23	D24
-2 dB	1	1	1	1
-4 dB	0	1	1	1
-6 dB	1	0	1	1
-8 dB	0	0	1	1
-10 dB	1	1	0	1
-12 dB	0	1	0	1
-14 dB	1	0	0	1
-16 dB	0	0	0	1
-18 dB	1	1	1	0
-20 dB	0	1	1	0
-22 dB	1	0	1	0
-24 dB	0	0	1	0
-26 dB	1	1	0	0
-28 dB	0	1	0	0
-30 dB	1	0	0	0
-∞ dB	0	0	0	0

Please refer to 21, 22 page for Loudness gain setting.

Loudness f0 Control

Loudness f0 Control	D30	D31
f0 = 60 Hz	1	1
f0 = 80 Hz	0	1
f0 = 100 Hz	1	0

Tone f0, Q Control Code

Bass f0 Control	D4	D5
f0 = 50 Hz	1	1
f0 = 80 Hz	0	1
f0 = 120 Hz	1	0

Mid f0 Control	D12	D13
f0 = 700 Hz	1	1
f0 = 1 kHz	0	1
f0 = 2 kHz	1	0
f0 = 10 kHz	0	0

Treble f0 Control	D19
f0 = 8 kHz	1
f0 = 12 kHz	0

Bass Q Control	D6	D7
Q = 2	1	1
Q = 1.5	0	1
Q = 1.25	1	0
Q = 1	0	0

Mid Q Control	D14
Q = 1.5	1
Q = 2	0

Selector Code

Selector	D14	D15	D16
INA	0	0	1
INB	1	1	0
INC	0	1	0
IND	1	0	0
Differential Input	0	0	0

Non Fader Code

ATT	D26	D27	D28	D29
+12 dB	1	0	1	1
+10 dB	0	0	1	1
+8 dB	1	1	0	1
+6 dB	0	1	0	1
+4 dB	1	0	0	1
+2 dB	0	0	0	1
0 dB	1	1	1	0
-2 dB	0	1	1	0
-4 dB	1	0	1	0
-6 dB	0	0	1	0
-8 dB	1	1	0	0
-10 dB	0	1	0	0
-12 dB	1	0	0	0
-∞ dB	0	0	0	0

Input Gain Control Code

Input Gain Control	D17	D18	D19	D20
0 dB	1	1	1	1
1.25 dB	0	1	1	1
2.50 dB	1	0	1	1
3.75 dB	0	0	1	1
5.00 dB	1	1	0	1
6.25 dB	0	1	0	1
7.50 dB	1	0	0	1
8.75 dB	0	0	0	1
10.00 dB	1	1	1	0
11.25 dB	0	1	1	0
12.50 dB	1	0	1	0
13.75 dB	0	0	1	0
15.00 dB	1	1	0	0
16.25 dB	0	1	0	0
17.50 dB	1	0	0	0
18.75 dB	0	0	0	0

Fader Code

Fader	D21	D22	D23	D24
0 dB	1	1	1	1
-1 dB	0	1	1	1
-2 dB	1	0	1	1
-3 dB	0	0	1	1
-4 dB	1	1	0	1
-6 dB	0	1	0	1
-8 dB	1	0	0	1
-10 dB	0	0	0	1
-12 dB	1	1	1	0
-14 dB	0	1	1	0
-16 dB	1	0	1	0
-20 dB	0	0	1	0
-30 dB	1	1	0	0
-45 dB	0	1	0	0
-60 dB	1	0	0	0
-∞ dB	0	0	0	0

Loudness, Tone Control Frequency Characteristic

Figure 1 Loudness Frequency Characteristic

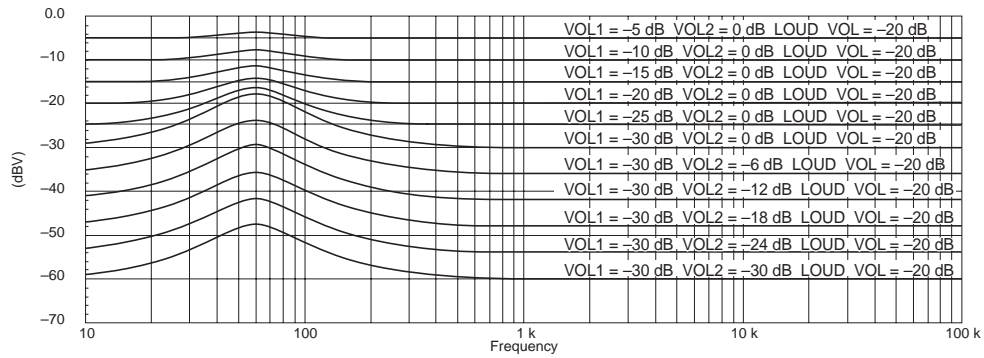


Figure 2 Loudness Frequency Characteristic (VOL = -30 dB, Loudness = -20 dB, f0 = Variable)

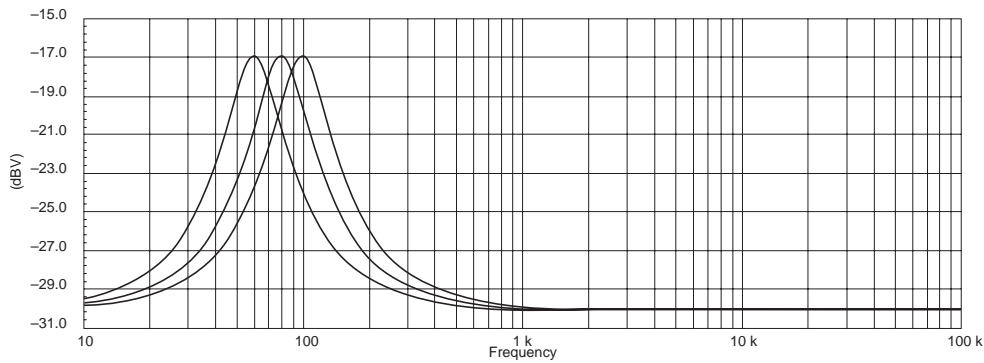


Figure 3 Bass Frequency Characteristic (f0 = 50 Hz, Q = 2, Gv = Variable)

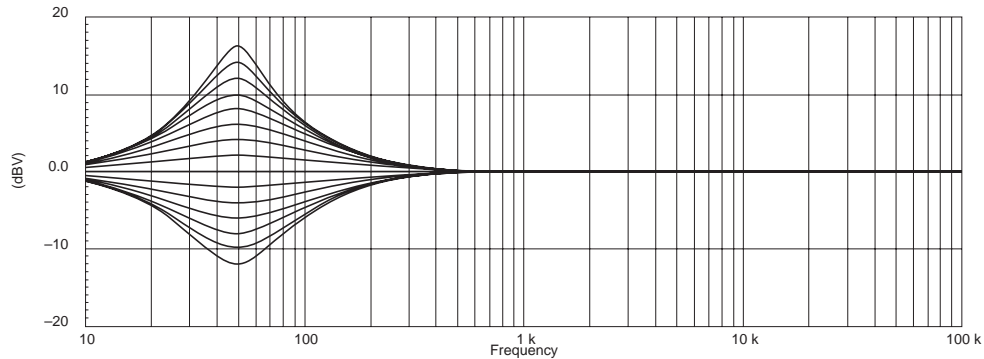


Figure 4 Bass Frequency Characteristic (Gv = +16 dB, f0 = Variable, Q = 2)

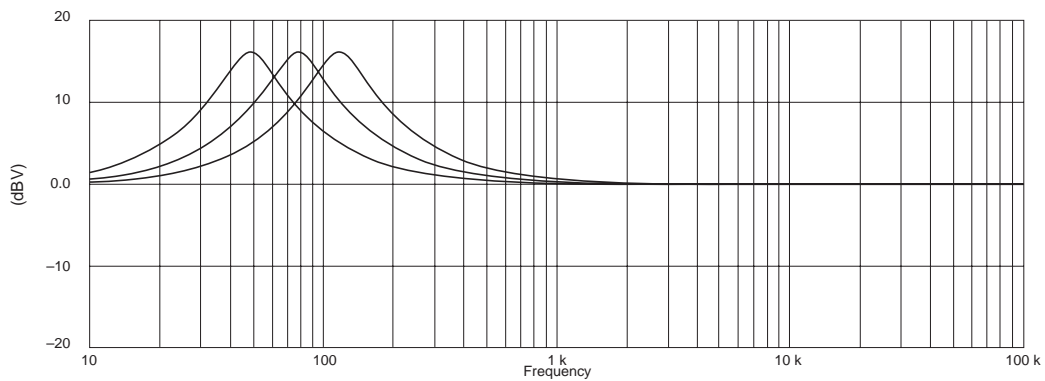


Figure 5 Bass Frequency Characteristic ($G_v = +16$ dB, $Q = \text{Variable}$, $f_0 = 50$ Hz)

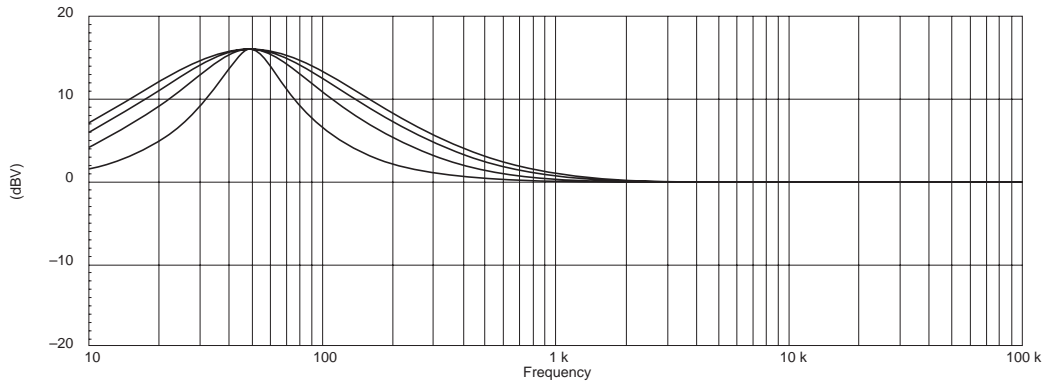


Figure 6 Mid Frequency Characteristic ($f_0 = 1$ kHz, $Q = 2$, $G_v = \text{Variable}$)

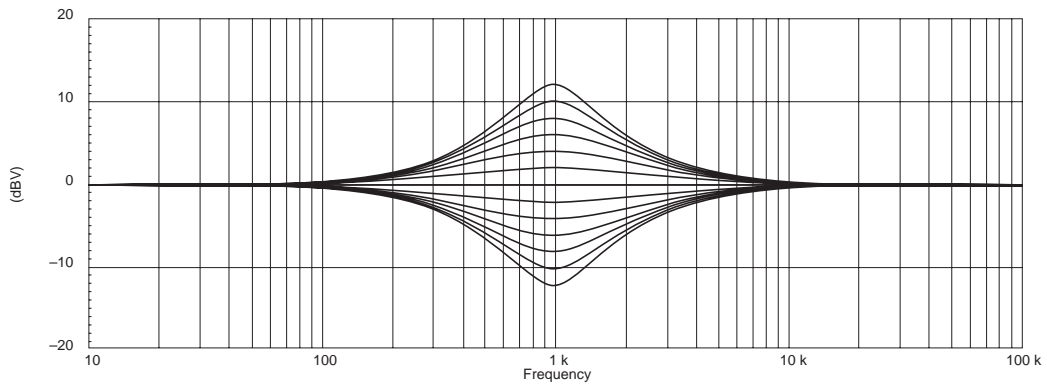


Figure 7 Mid Frequency Characteristic ($G_v = +12$ dB, $Q = 2$, $f_0 = \text{Variable}$)

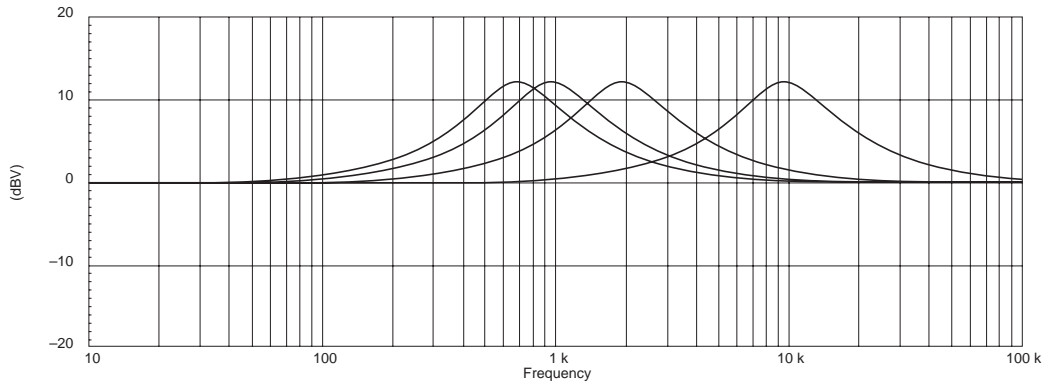


Figure 8 Mid Frequency Characteristic ($G_v = +12$ dB, $f_0 = 1$ kHz, $Q = \text{Variable}$)

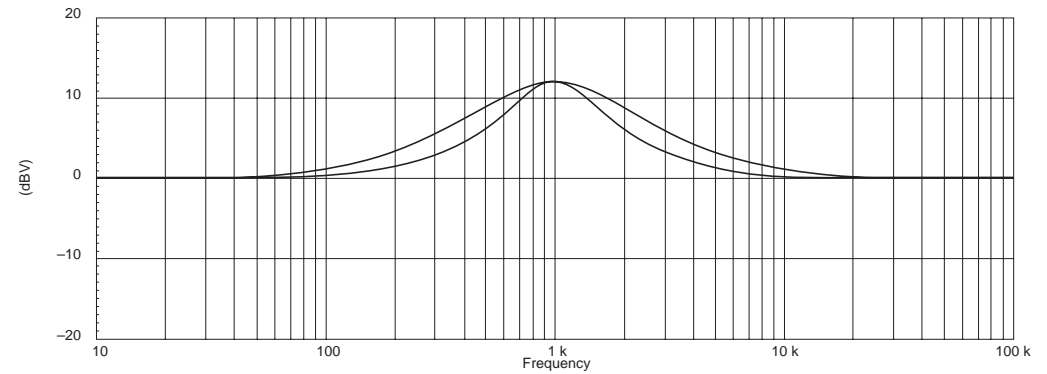


Figure 9 Treble Frequency Characteristic ($G_v = \text{Variable}$)

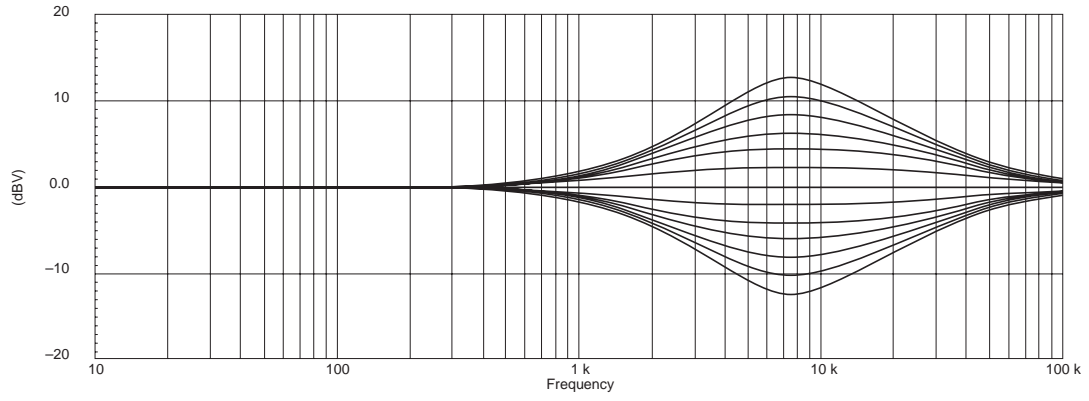
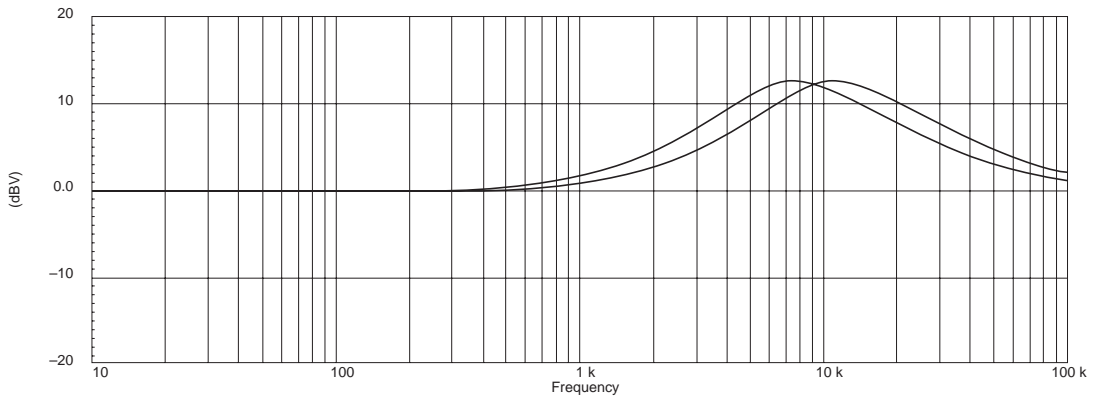


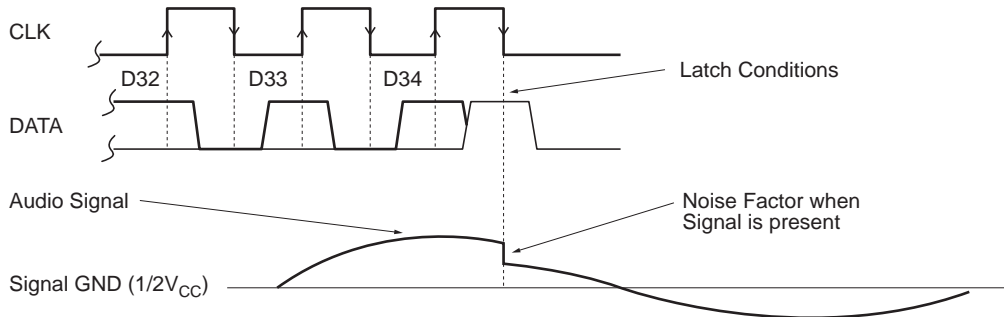
Figure 10 Treble Frequency Characteristic ($G_v = +12 \text{ dB}$, $f_0 = \text{Variable}$)



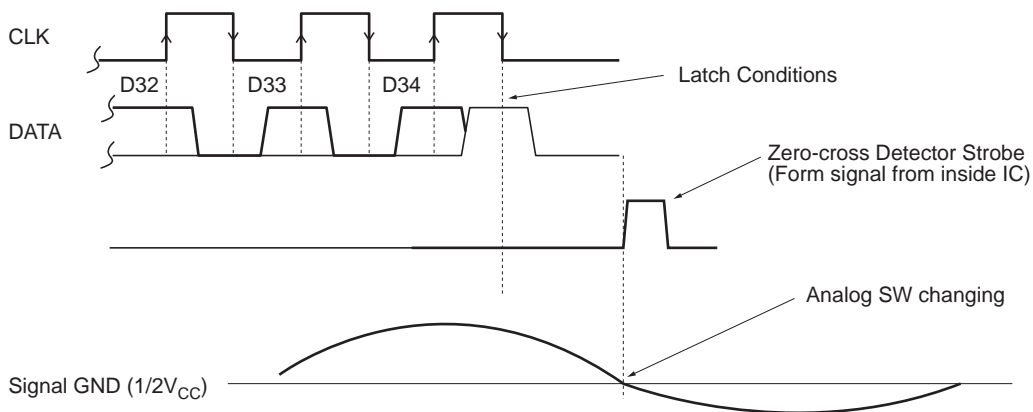
Zero-Crossing Detection Circuit

1. Meaning of Zero-Crossing Detection Circuit

In the conventional Serial Data Control Type Volume, Analog SW inside switches over simultaneously with Latch Condition Detector. And the operation completes.



In this case the changing noise occurs at the time of Latch Condition Detector, the Analog SW switches over (Zero-cross Detector Strobe occurs) in the moment that the Analog Signal cross Signal Ground ($1/2V_{CC}$).



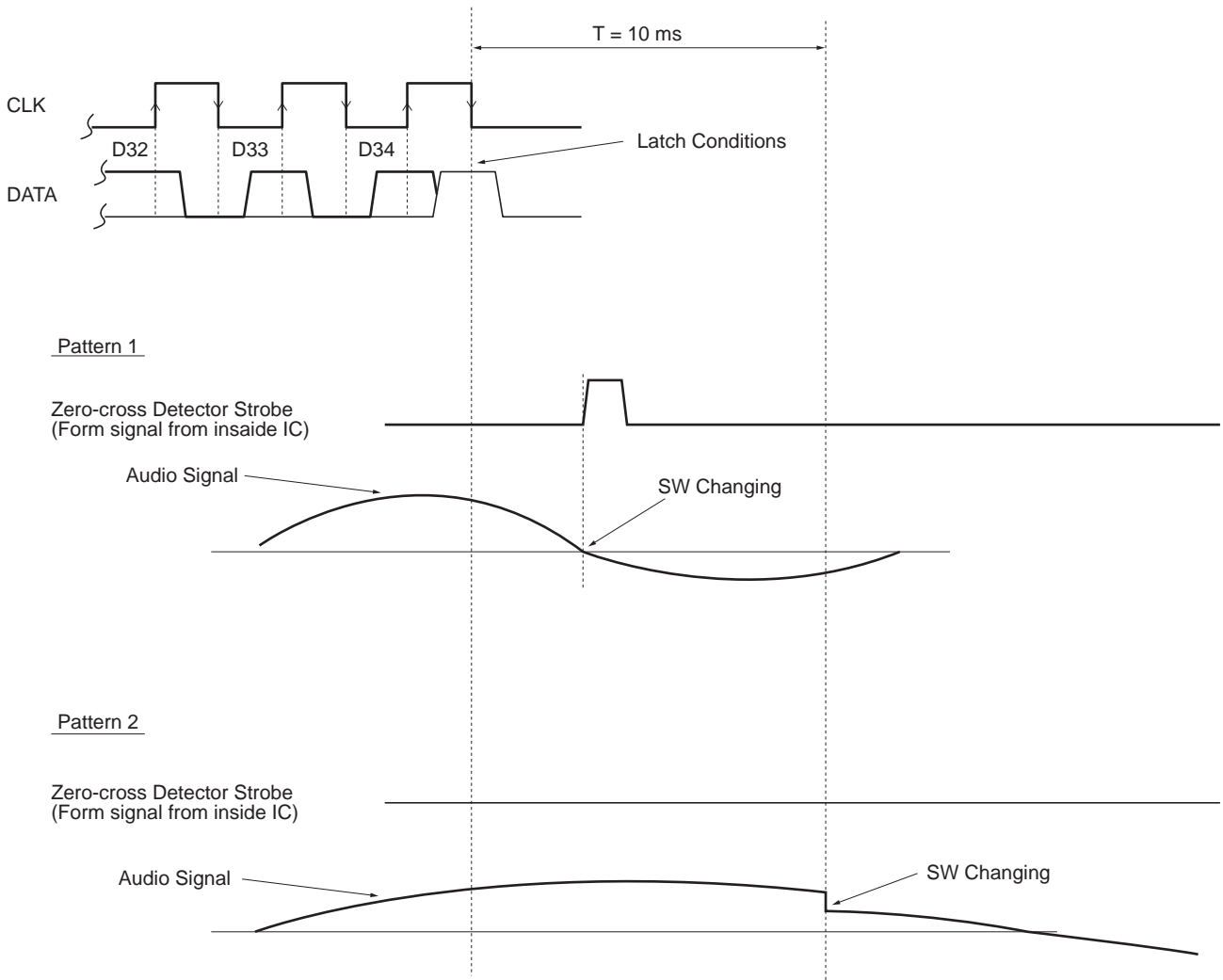
Other, In the case of Audio Signal isn't inputted (No signal), even if only Zero-cross Detector Circuit detects Latch Condition, Analog SW doesn't switch over for the Audio Signal never cuts Signal Ground ($1/2V_{CC}$).

The Time Function switches the Analog SW after some time T.

The Timer Time can setting with the Serial Data of 5 ms, 10 ms, 15 ms, 20 ms.

2. Connection of Zero-Crossing Detector and Timer Setting

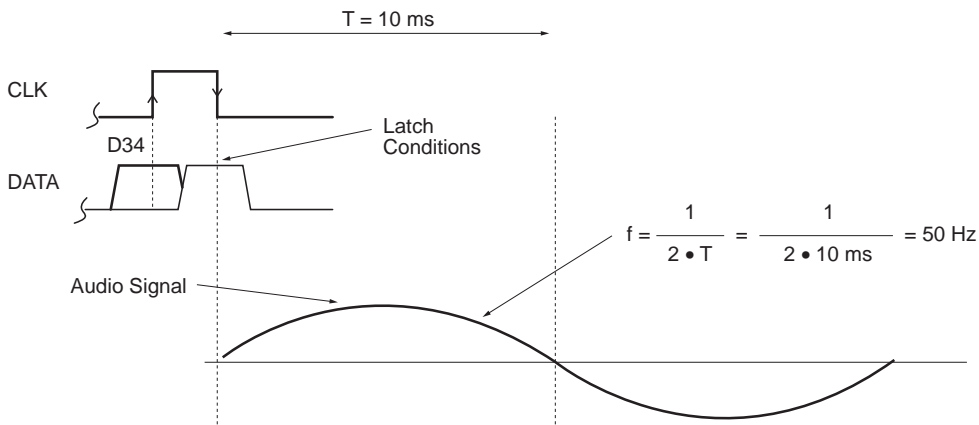
"OR" of [Zero-cross Detector Strobe] or [Compulsion SW of Timer Circuit] moves Internal Analog SW. When for example, suppose that it set to $T = 10$ ms.



In case of Pattern 1, the Zero-cross Detector Strobe occurs with the Zero-cross Detector Function, and SW is switched. But in case of Pattern 2, the Timer Function switches the Analog SW after $T = 10$ ms, for the Audio Input Signal didn't cut the Signal Ground after $T = 10$ ms which were set with the timer.

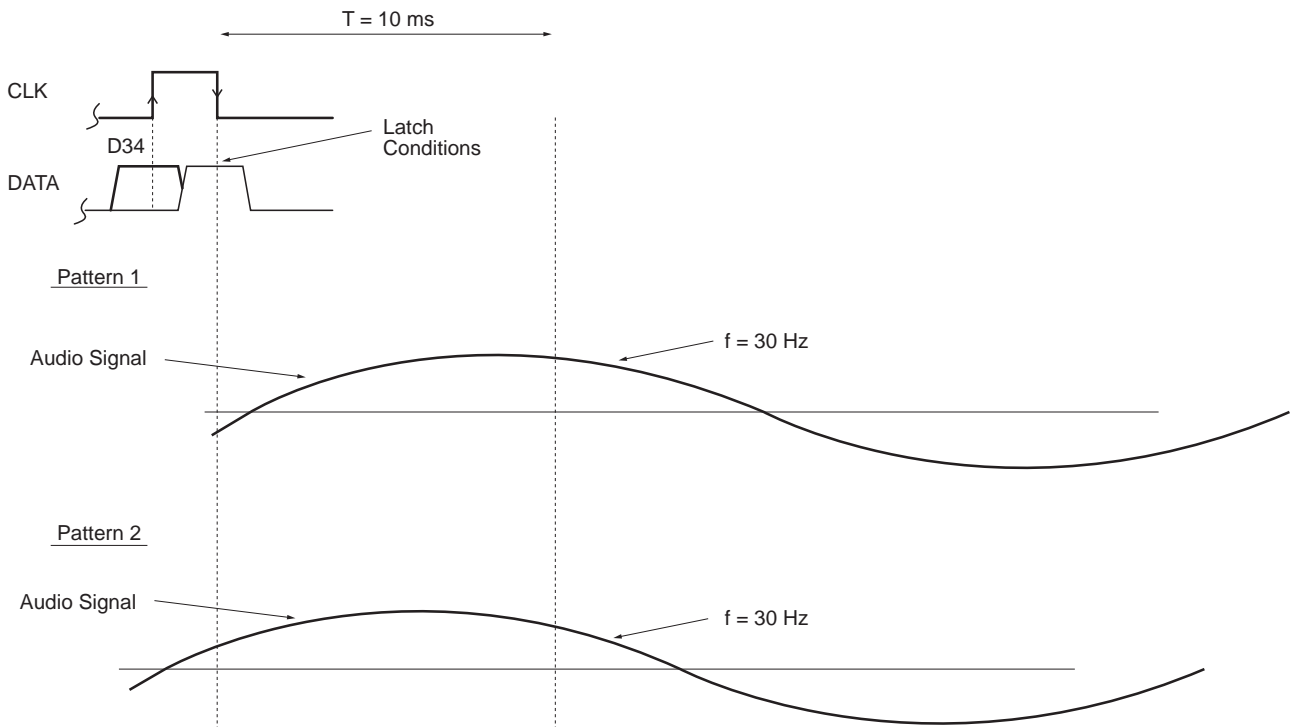
Timer Setting Time setting for Frequency band of Input Audio Signal.

3. Timer Setting System



In case of Timer Setting Time/T = 10 ms setting

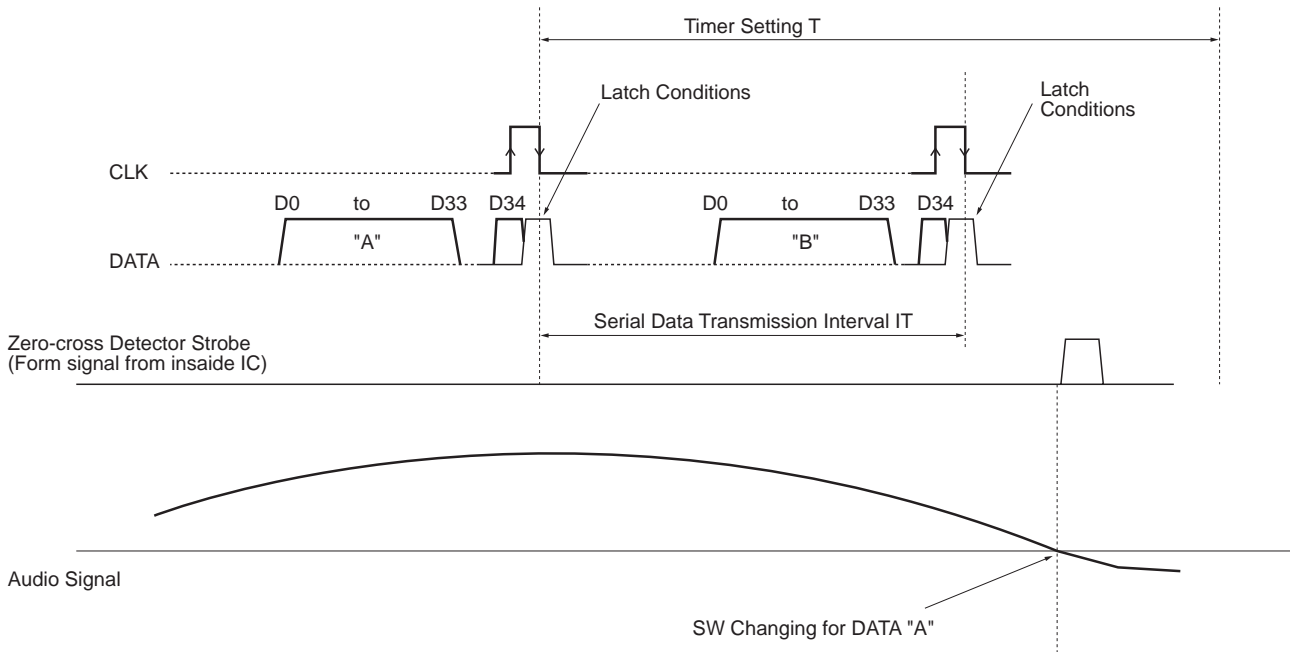
Audio Signal	Zero-cross Detector	
50 Hz <	100%	Upper fig.
50 Hz >	100%	Pattern 1
	0%	Pattern 2



The Timer Setting Time T makes T = 20 ms (Zero-cross detect of 25 Hz is 100%) maximum and it is setting by it.

4. Connection of Data Transmission and Timer Setting

M61508FP has the function to make the Serial Data invalid until it generation the Zero-cross Detector Strobe in IC, after the Latch Condition detected.



* In case of upper figurative. The order of DATA "B" is invalid.

In to make the Serial Data Transmission Interval IT from MCU (microcomputer) to M61508FP

$$\text{Serial Data Transmission Interval} = IT > \text{Timer Setting} = T$$

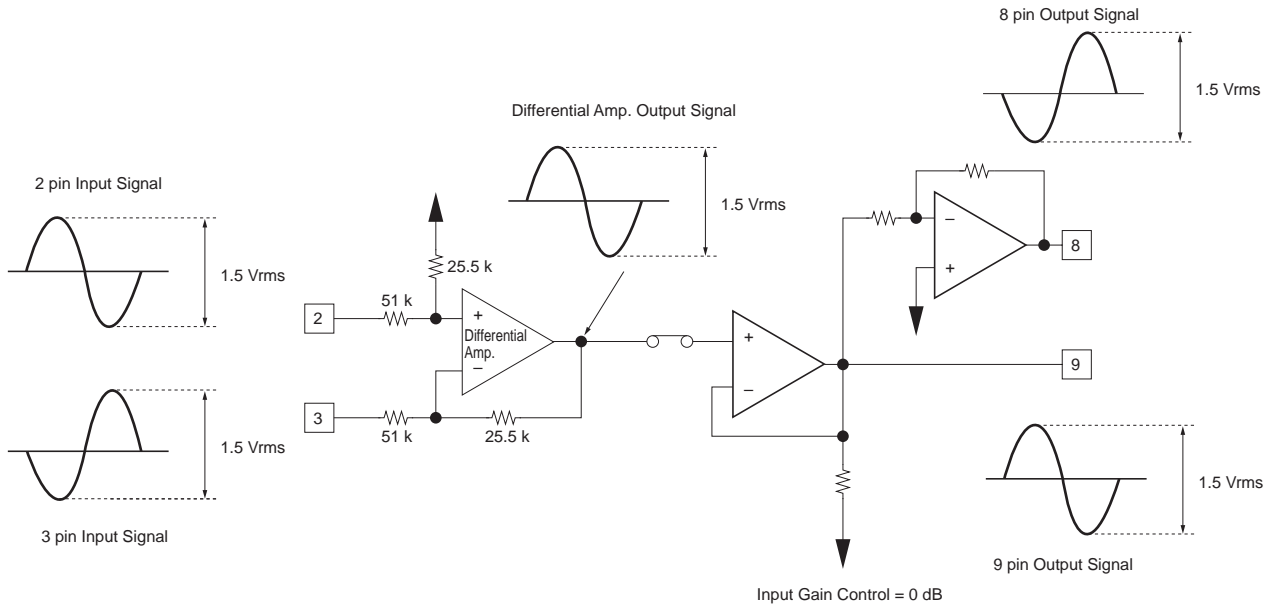
the reading error of the data doesn't occur.

* Serial Data Transmission Interval IT = Interval of between Latch Condition and Latch Condition

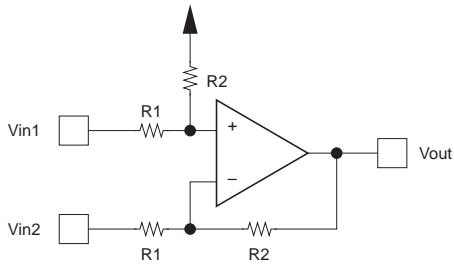
The Others

1. Differential Amp.

The lower fig. is Equalizing Circuit, Output Signal/Output Voltage of each point.



● Differential Amp. Gain Calculation Formula

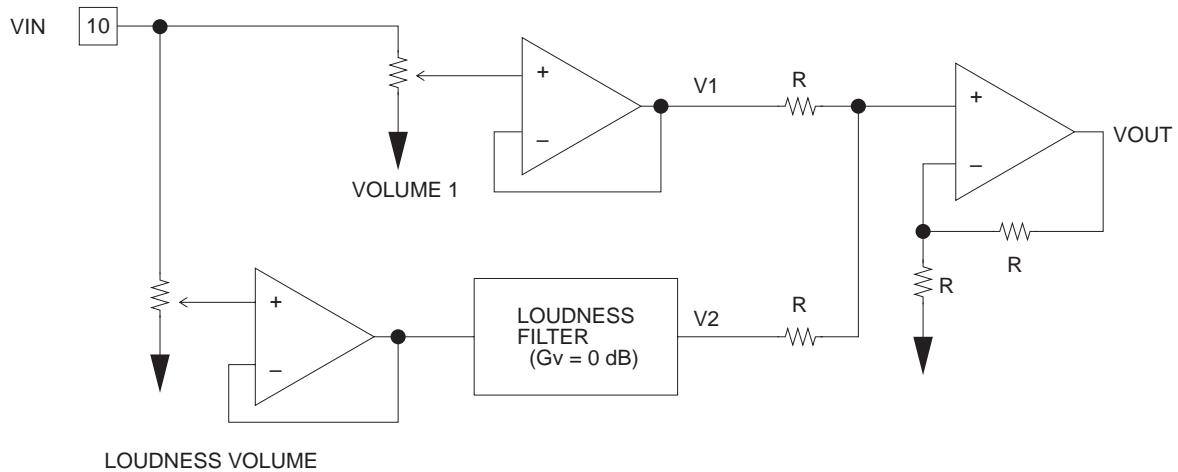


$$V_{out} = \frac{R_2}{R_1} (V_{in1} - V_{in2})$$

$$G_v = 20 \log \frac{R_2}{R_1}$$

2. Loudness Gain Setting

Lower Figure is Structure of Loudness Circuit.



Output Voltage (VOUT) of Setting Structure of Upper Figure

It is noted as Volume 1 Output Voltage = V1, Loudness Filter Output Voltage = V2, VOUT and Gv (Boost quantity) is given at the lower formula

$$VOUT = V1 + V2 \text{ (Vrms)}$$

$$Gv = 20 \log \frac{(V1 + V2)}{VIN} - (\text{Volume 1 attenuation quantity}) \text{ (dB)}$$

ex.) VIN = 1 Vrms/60 Hz, Volume1 = -30 dB,
Output Volutage and Boost Quantity of 60 Hz of Loudness Volume = -20 dB setting

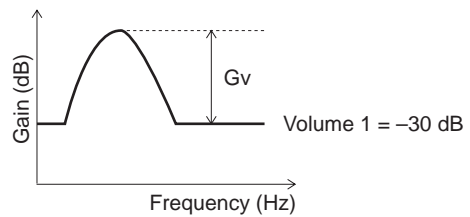
From: Volume1, Loudness Volume attenuation quantity
Become: V1 = 31.6 mVrms
V2 = 100 mVrms

If the sub situdes the equation for the upper formula,
the following equation is given,

$$\begin{aligned} VOUT &= 31.6 \text{ m} + 100 \text{ m} \\ &= 131.6 \text{ mVrms} \end{aligned}$$

$$Gv = 20 \log \frac{(31.6 \text{ m} + 100 \text{ m})}{1} - (-30 \text{ dB})$$

=12.4 dB is obtained

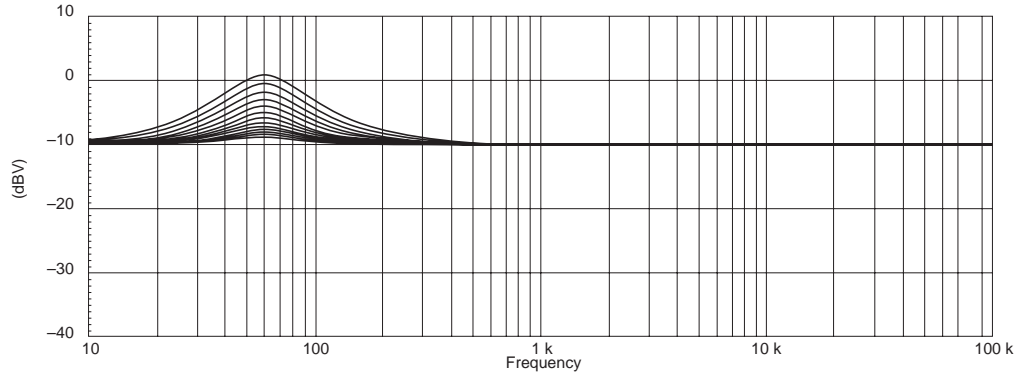


In the item, the Loudness Gain Setting example is shown, when Volume 1 fixation and doing the Loudness Volume variably. Please refer to Plan.

Loudness Gain Setting Example

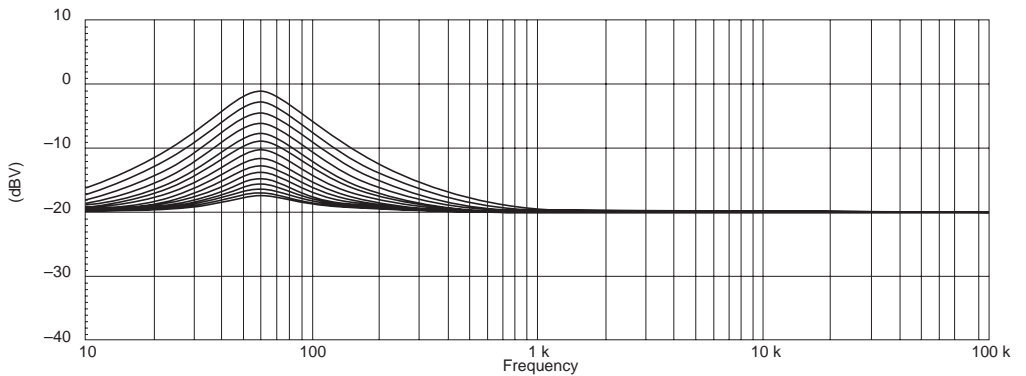
1. Volume 1 = -10 dB

Loudness Volume	Loudness Gain
-2 dB	10.9 dB
-4 dB	9.5 dB
-6 dB	8.2 dB
-8 dB	7.1 dB
-10 dB	6.0 dB
-12 dB	5.1 dB
-14 dB	4.2 dB
-16 dB	3.5 dB
-18 dB	2.9 dB
-20 dB	2.4 dB
-22 dB	1.9 dB
-24 dB	1.6 dB
-26 dB	1.3 dB
-28 dB	1.0 dB
-30 dB	0.8 dB
-∞ dB	0 dB



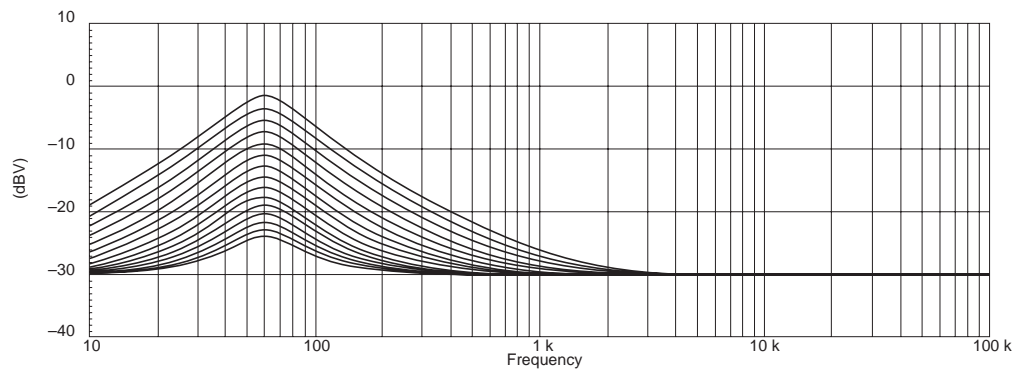
2. Volume 1 = -20 dB

Loudness Volume	Loudness Gain
-2 dB	19.0 dB
-4 dB	17.3 dB
-6 dB	15.6 dB
-8 dB	13.9 dB
-10 dB	12.4 dB
-12 dB	10.9 dB
-14 dB	9.5 dB
-16 dB	8.2 dB
-18 dB	7.1 dB
-20 dB	6.0 dB
-22 dB	5.1 dB
-24 dB	4.2 dB
-26 dB	3.5 dB
-28 dB	2.9 dB
-30 dB	2.4 dB
-∞ dB	0 dB



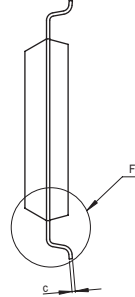
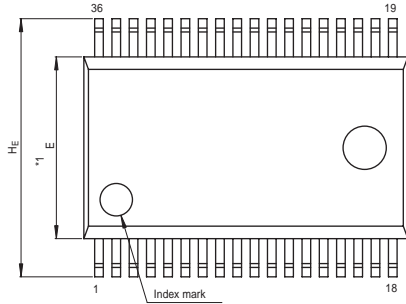
3. Volume 1 = -30dB

Loudness Volume	Loudness Gain
-2 dB	28.3 dB
-4 dB	26.4 dB
-6 dB	24.5 dB
-8 dB	22.7 dB
-10 dB	20.8 dB
-12 dB	19.0 dB
-14 dB	17.3 dB
-16 dB	15.6 dB
-18 dB	13.9 dB
-20 dB	12.4 dB
-22 dB	10.9 dB
-24 dB	9.5 dB
-26 dB	8.2 dB
-28 dB	7.1 dB
-30 dB	6.0 dB
$-\infty$ dB	0 dB

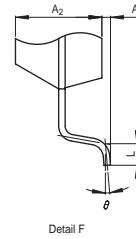
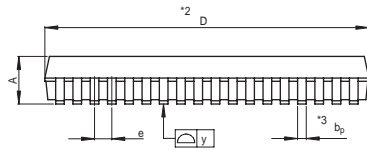


Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SSOP36-8.4x15-0.80	PRSP0036GA-A	36P2R-A	0.5g



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



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	14.8	15.0	15.2
E	8.2	8.4	8.6
A ₂	—	2.0	—
A	—	—	2.4
A ₁	0.05	—	—
b _p	0.35	0.4	0.5
c	0.13	0.15	0.2
θ	0°	—	10°
H _E	11.63	11.93	12.23
e	0.65	0.8	0.95
y	—	—	0.15
L	0.3	0.5	0.7

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, 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