PRELIMINARY
some parametric limits are subject to change.

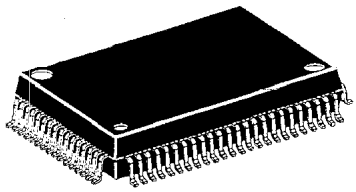
M62493FP

DIGITAL SOUND CONTROLLER

SINGLE CHIP ANALOG SOUND PROCESSOR

DESCRIPTION

Home Audio, Equipment, Radio-Cassette, Recorder, TV.



Outline 80P6N

Pitch ; 0.8 mm

Size ; 20.0 mmX14.0mmX 2.8mm

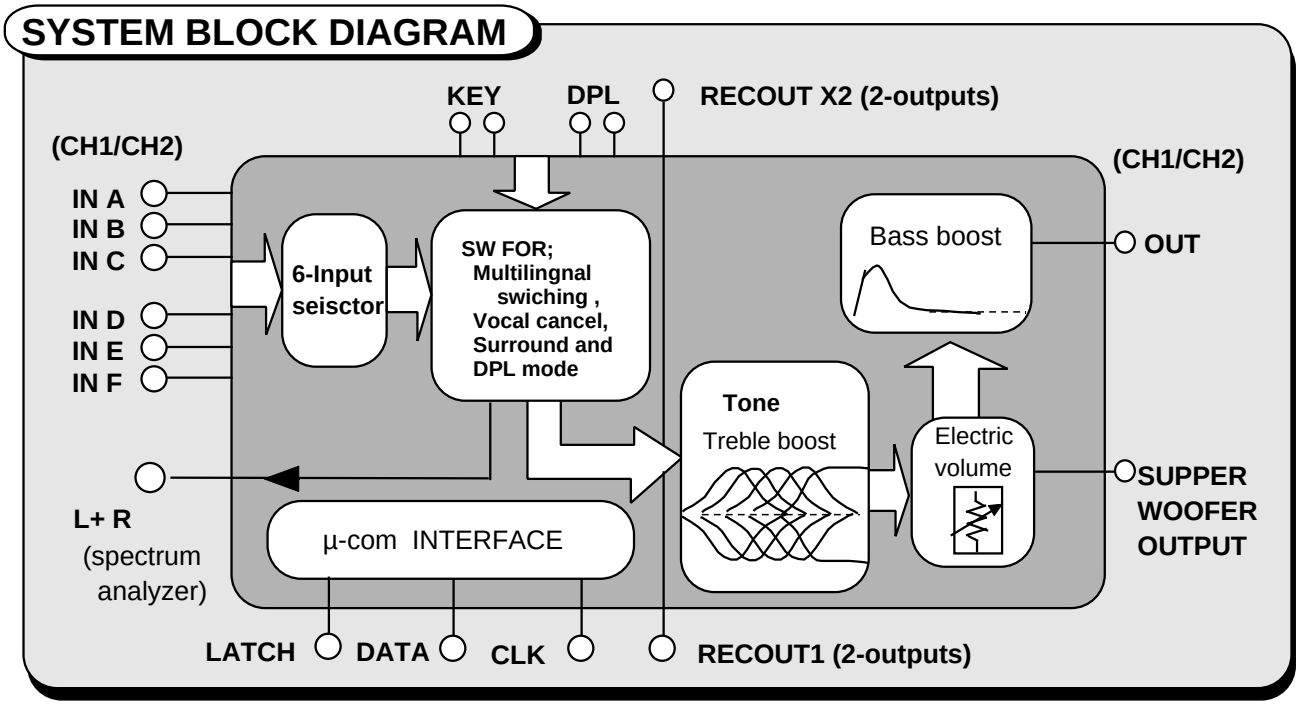
FEATURES

- 6-input selector
- Input ATT (-5dB) [ON / OFF]
- 5 band graphic equalizer ; 1 band (0,±3.8,±7.6,±13dB)
  4 band (0,±3,±6,±10dB)
- Elactric volume 32 steps (.dB to -76dB,-∞)
- Treble, Bass boost [ON / OFF]
- Surround (Using external delay) [ON / OFF]
- Vocal cancel [ON / OFF]
- Multilingual record switching [ON / OFF]
- SW mode for control of DPL fields 2-lines for Rec output, 1-line for mute output.
- Input / output of adapter supporting karaoke control.
- Ability fair a single power,±power. (The outside COM power is necessary when uses single power.)
- Supper woofer output
- Output of spectrum analyzer (L+R)

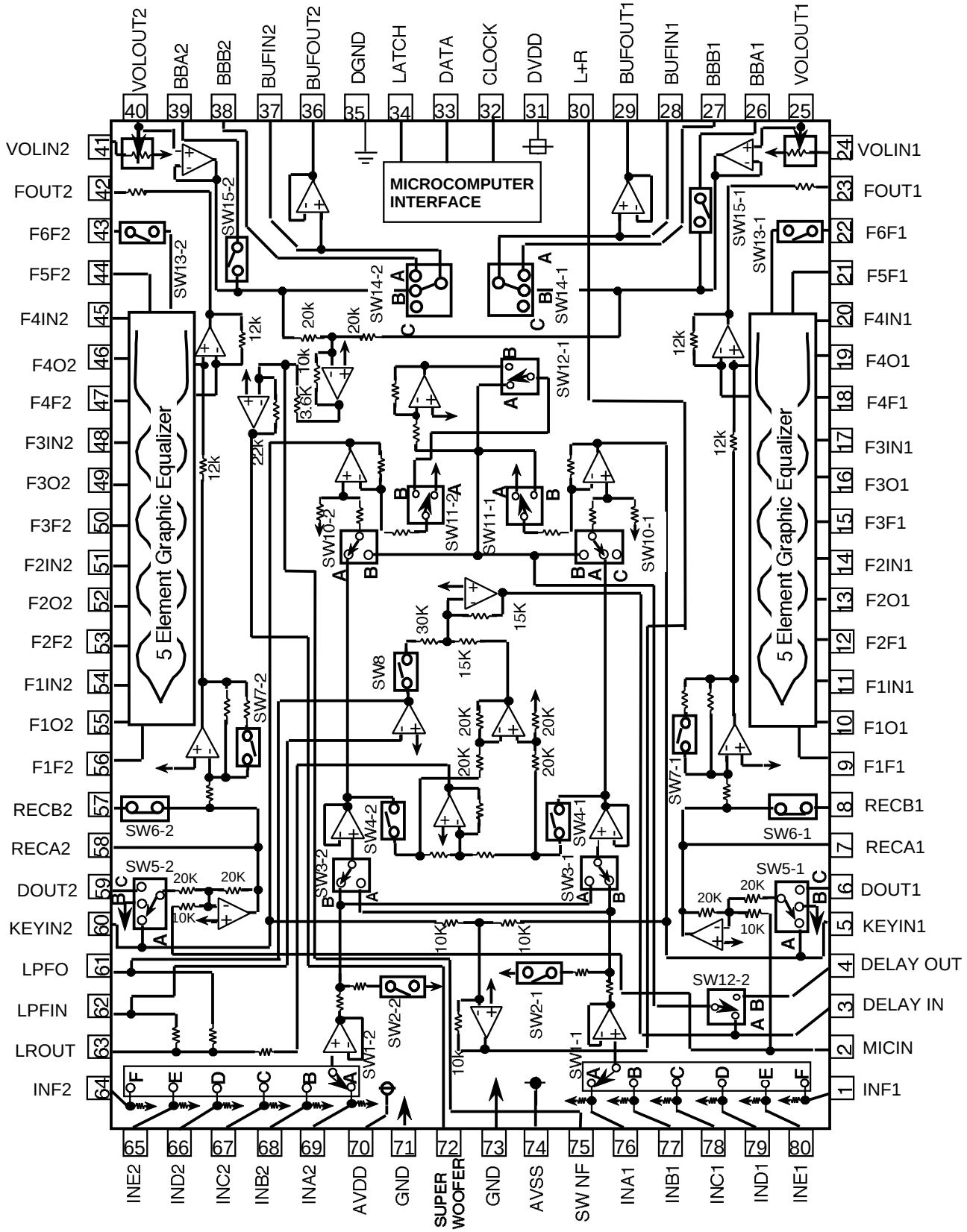
RECOMMENDED OPERATING CONDITION

Power voltage range • • • ±4.5V to ±7.5V [9V to 15V (When uses single power)]

SYSTEM BLOCK DIAGRAM



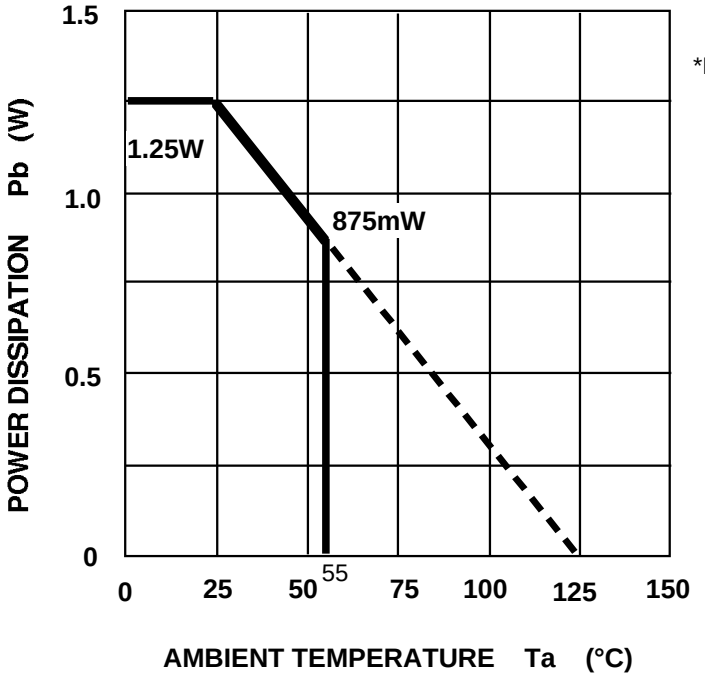
PIN CONFIGURATION AND IC INTERNAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

System	Parameter	Condition	Ratings	Unit
AVDD,AVSS	Analog supply voltage		± 7.8	V
DVDD	Digital supply voitage		6.0	V
Pd	Power disipation	Ta ≤ 2°C	1250	mW
K	Thermal derating	Ta > 25°C Attached PC Board*	12.5	mW / °C
Topr	Operating temperature		-20 to +55	°C
Tstg	Storage temperature		-40 to +125	°C

TYPICAL CHARACTERISTICS THERMAL DERATING



*Note ; PC Board

PC Board Size
140mm X140mm
PC Board Thickness
1.6mm
PC Board Material
Epoxy
Copper Film Thickness
18µm
Copper Foil Size
0.25mm X50mm

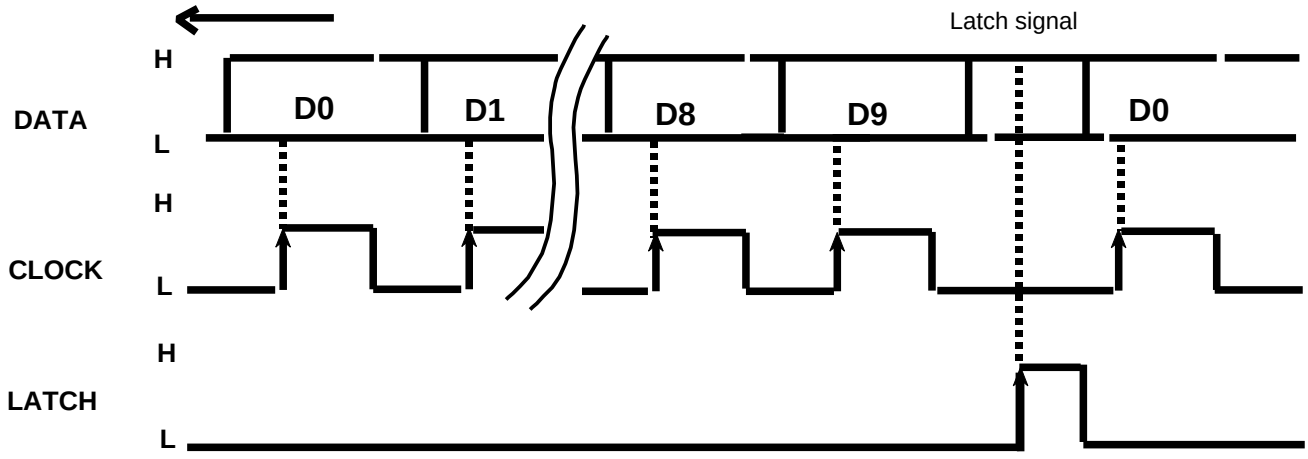
RECOMMENDED OPERATION CONDITION

(Ta = 25°C,unless otherwise noted)

Parameter	Symbol	Condition	Limits			Unit
			MIN	TYP	MAX	
Circuit current of analog positive power voltage	AVDD	Note.1	4.5	7.0	7.5	V
Circuit current of analog negative power voltage	AVSS	Note.1	-7.5	-7.0	-4.5	V
Circuit current of digital power voltage	DVDD	DVDD ≤ AVDD	4.5	5.0	5.5	V
High-level Input voltage	VIH		DVDD-0.7	—	VDD	V
Low-level Input voltage	VIL		0	—	DGND+0.7	V

Note 1 ; The sequence of the power supply is as follows.
AVDD → AVSS → DVDD

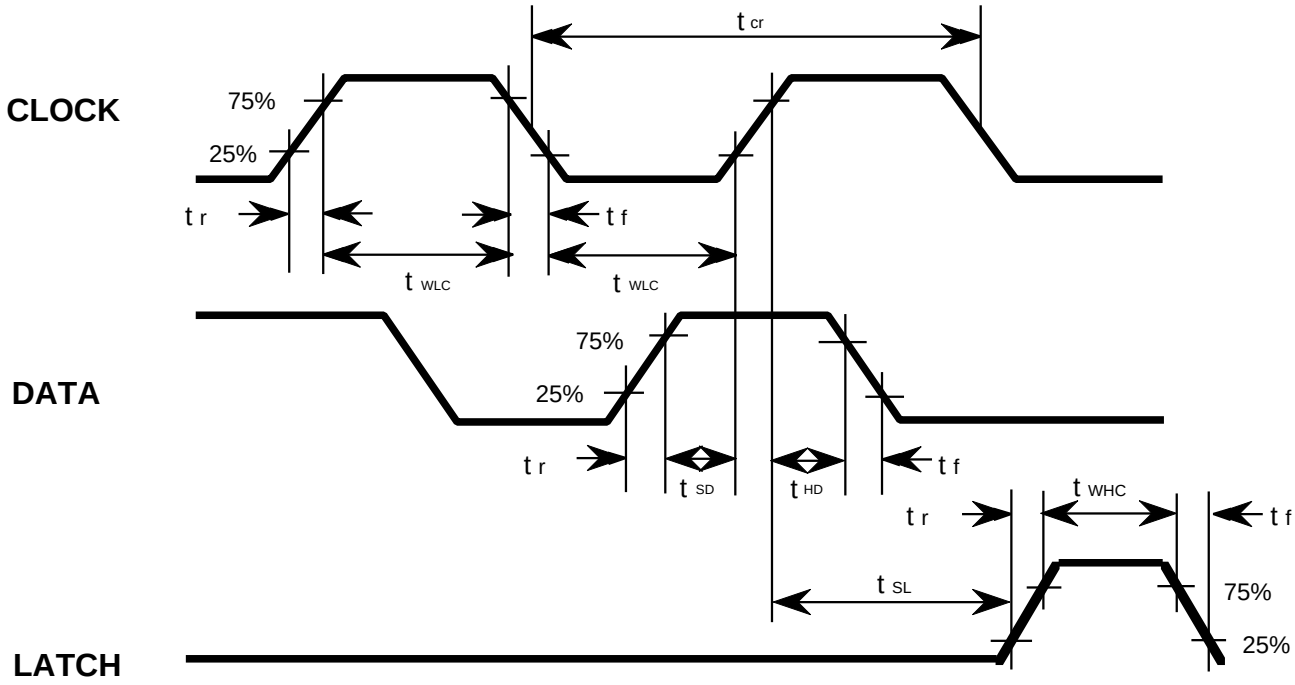
RELATIONSHIPS BETWEEN DATA AND CLOCK



DATA reading mode ;
The rising edge of the CLOCK signal.

LATCH reading mode ;
The rising edge of the LATCH signal.

CLOCK AND DATA TIMING



DIGITAL BLOCK TIMING REGULATION

Symbol	Parameter	Limirs			Unit
		Min	typ	Max	
t_{cr}	CLOCK cycle time	4	–	–	µsec
t_{WHC}	CLOCK pulse width ("H"level)	1.6	–	–	
t_{WLC}	CLOCK pulse width ("L"level)	1.6	–	–	
t_r	CLOCK,DATA,LATCH rise time	–	–	0.4	
t_f	CLOCK,DATA,LATCH fall time	–	–	0.4	
t_{SD}	DATA setup time	0.8	–	–	
t_{HD}	DATA hold time	0.8	–	–	
t_{SL}	LATCH setup time	1	–	–	
t_{WHL}	LATCH pulse width	1.6	–	–	

DATA INPUT FORMAT

5 kinds of input format option are available by changing slot setting of D5,D6,andD7.
(When tha IC is powered up, the internal setting are not fixed.)

← **Input direction**

SLOTS OF INPUT FORMAT SELECTION — **FIXATION BIT OF ADDRESS**

(1)

DO1	D11	D21	D31	D41	D51	D6	D7	D8	D9
Input ATT 1 : -5dB 0 : 0dB	**Tone ATT** 1 : -6dB 0 : 0dB	**For the multipiex software** cf. (8) Setting code		**For the function software** cf. (11) Setting code		0	0	1	1

(2)

DO2	D12	D22	D32	D42	D52	D6	D7	D8	D9
For Input Selector cf. (10) Setting code			**LOW BOOST** 1: ON sw15-1,2 : ON sw14-1,2: : A 0: OFF	**HI BOOST** 1: ON sw13-1,2 : ON 0: OFF	**SW12-2** 1 : B-SIDE 0 : A-SIDE	0	1	1	1

(3)

DO3	D13	D23	D33	D43	D53	D6	D7	D8	D9
For Tone Control cf. (5) Setting code			**Foe Tone Boost / cut** cf. (6) Setting code			1	0	1	1

(4-1)

DO4-1	D14-1	D24-1	D34-1	D44-1	D54-1	D6-1	D7-1	D8-1	D9-1
For Master Volume cf. (7) Setting code					0	1	1	1	1

(4-2)

DO4-2	D14-2	D24-2	D34-2	D44-2	D54-2	D6-2	D7-2	D8-2	D9-2
For REC Input Signal cf. (9) Setting code		**REC OUTPUT MUTE** 1 : ON sw6-1,2 : OFF 0 : OFF	0	0	1	1	1	1	1

(5) Setting code (Tone control)

	D03	D13	D23
Tone 1 (F1)	0	0	1
Tone 2 (F2)	0	1	0
Tone 3 (F3)	0	1	1
Tone 4 (F4)	1	0	0
Tone 5 (F5)	1	0	1

Note; Do not input other data than the above.

(6) Setting code (Tone boost / cut and bass boost)

	F1	F2 to F5	D33	D43	D53
BOOST	+0 dB	+0 dB	0	0	0
	+3.8 dB	+3 dB	0	0	1
	+7.6 dB	+6 dB	0	1	0
	+13 dB	+10 dB	0	1	1
CUT	-0 dB	-0 dB	1	0	0
	-3.8 dB	-3 dB	1	0	1
	-7.6 dB	-6 dB	1	1	0
	-13 dB	-10 dB	1	1	1

(7) SETTING CODE (MASTER VOLUME)

ATT	D04	D14	D24	D34	D44
– 0.0dB	0	0	0	0	0
– 2.0dB	1	0	0	0	0
– 4.0dB	0	1	0	0	0
– 6.0dB	1	1	0	0	0
– 8.0dB	0	0	1	0	0
– 10.0dB	1	0	1	0	0
– 12.0dB	0	1	1	0	0
– 14.0dB	1	1	1	0	0
– 16.0dB	0	0	0	1	0
– 18.0dB	1	0	0	1	0
– 20.0dB	0	1	0	1	0
– 22.0dB	1	1	0	1	0
– 24.0dB	0	0	1	1	0
– 26.0dB	1	0	1	1	0
– 28.0dB	0	1	1	1	0
– 30.0dB	1	1	1	1	0
– 32.0dB	0	0	0	0	1
– 34.0dB	1	0	0	0	1
– 36.0dB	0	1	0	0	1
– 38.0dB	1	1	0	0	1
– 40.0dB	0	0	1	0	1
– 42.0dB	1	0	1	0	1
– 44.0dB	0	1	1	0	1
– 48.0dB	1	1	1	0	1
– 52.0dB	0	0	0	1	1
– 56.0dB	1	0	0	1	1
– 60.0dB	0	1	0	1	1
– 64.0dB	1	1	0	1	1
– 68.0dB	0	0	1	1	1
– 72.0dB	1	0	1	1	1
– 76.0dB	0	1	1	1	1
– ∞	1	1	1	1	1

(8) MULTILINGUAL RECORD CODE

	D21	D31	SW3-1	SW3-2
NORMAL	0	0	B	B
CH1 only	0	1	B	A
CH2 only	1	0	A	B
CH1 / CH2 Exchange	1	1	A	A

(9) REC INPUT SIGNAL CHANGE SETTING CODE

INPUT SIGNAL	D04-2	D14-2	SW5-1 SW5-2
THROUGH	0	0	A
DPL	1	0	C
GND	0	1	B

(10) INPUT SELECTOR CODE

SELECTOR	D02	D12	D22
A	0	0	0
B	0	0	1
C	0	1	0
D	0	1	1
E	1	0	0
F	1	0	1

(11) FUNCTION CODE

INPUT SIGNAL	D41	D51	sw4-1 sw4-2	sw8	sw10-1	sw10-2	sw11-1 sw11-2	sw12-1
NORMAL	0	0	OFF	OFF	A	A	A	A
VOCAL CANCELLATTION	0	1	ON	ON	B	B	A	A
SURROUND	1	0	ON	OFF	A	A	B	B

Note ; Do not input other data than the above.

ELECTRICAL CHARACTERISTICS

(Ta=25°C, AVdd=7V,AVss= -7V,DVdd=5V,f=1kHz,unless otherwise noted.
Tone control and boost are set to 0dB)

(1) POWER SUPPLY CHARACTERISTICS

Parameter	Symbol	Test conditions	Limits			Unit
			Min	typ	Max	
Circuit current (Analog+)	AIdd	Current at pin 70 with AVdd=7.0V,AVss= -7.0V No signal	—	50	58	mA
Circuit current (Analog-)	AIss	Current at pin 74 with AVdd=7.0V,AVss= -7.0V No signal	-58	-50	—	mA
Circuit current (Digital)	DIdd	Current at pin 31 with DVdd=5.0V No signal	—	0.3	1.2	mA

(2) INPUT / OUTPUT CHARACTERISTICS

Parameter	Symbol	Test conditions		Limits			Unit
				Min	typ	Max	
Input resistance	Rin	76pin,69Pin		30	60	120	KΩ
Max. input voltage	VIM	Input pin (76,64), Output pin (29,36) RL =10KΩ, THD=1%		3.0	4.0	—	Vrms
Output pin voltage	Vodc	29pin,36pin, No signal		-0.4	0.0	0.4	V
	Vrecdc	7pin,58pin, No signal		-0.4	0.0	0.4	V
Pass gain	Gv	Vin=1Vrms,FLAT,(76,69pin)-(29, 36pin)gains.		-2.0	0	2.0	dB
Max. attenuation	ATT	Vo=1Vrms,29,36pin JIS-A filter		—	-85	-77	dB
Output noise voltage	Vono	JIS-A filter No signal,Rg=10KΩ FLAT condition	(29,36)pin	—	10.0	24	μVrms
	Vrecno		(7,58)pin	—	10.0	20	μVrms
Distortion factor	THD	29pin,36pin, BW=400 to 30kHz Vo=0.5Vrms, RL=10kΩ		—	0.01	0.05	%
	THDrecA	7pin,58pin, BW=400 to 30kHz Vo=0.5Vrms, RL=30kΩ		—	0.01	0.05	%
	THDrecB	8pin,57pin, BW=400 to 30kHz Vo=0.5Vrms, RL=51kΩ		—	0.01	0.05	%
Crosstalk between channels	CT	Vo=0.5Vrms , RL=10KΩ,JIS-A 29pin - 36pin gains Rg=10KΩ 2pin GND		—	-70	-55	dB
	CTrec	Vo=0.5Vrms , RL=30KΩ,JIS-A 7pin - 58pin gains Rg=10KΩ 2pin GND		—	-70	-55	dB

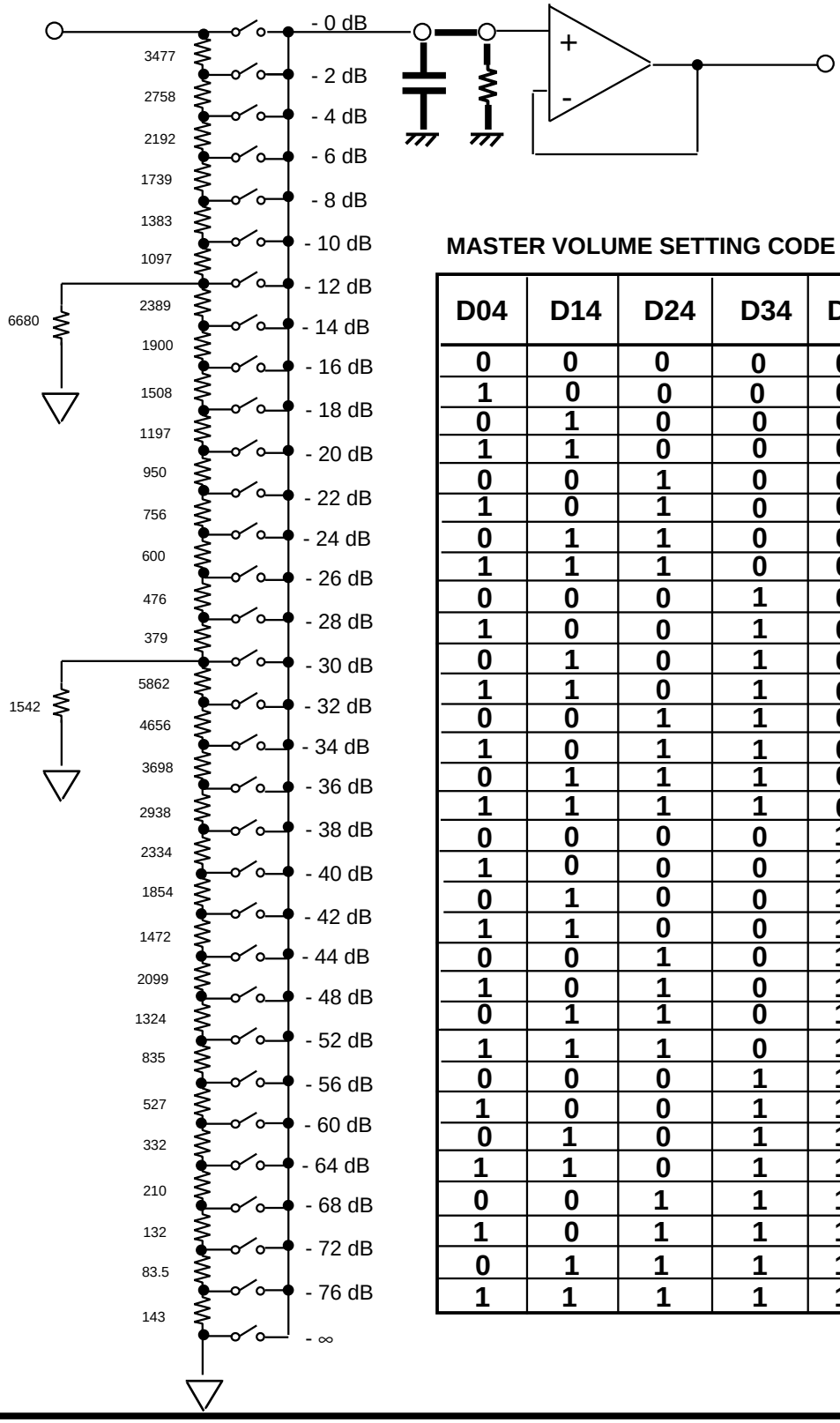
(3) TONE CONTROL CHARATERISTICS

Parameter	Symbol		Test condition	Limits Min	Limits typ	Limits Max	Unit
Voltage Gain (Tone control)	Gboost1	F1	3.8dB	2.3	3.8	5.3	dB
		F2 to 5	3 dB	1.5	3	4.5	
	Gboost2	F1	7.6dB	6.1	7.6	9.1	dB
		F2 to 5	6 dB	4.5	6	7.5	
	Gboost3	F1	13 dB	11.0	13	15.0	dB
		F2 to 5	10 dB	8.0	10	12.0	
	Gcut1	F1	-3.8dB	-5.3	-3.8	-2.3	dB
		F2 to 5	-3 dB	-4.5	-3	-1.5	
	Gcut2	F1	-7.6dB	-9.1	-7.6	-6.1	dB
		F2 to 5	-6 dB	-7.5	-6	-4.5	
	Gcut3	F1	-13dB	-15.0	-13	-11.0	dB
		F2 to 5	-10 dB	-12.0	-10	-8.0	
			f=1kHz, Vo=1Vms Input pin (6,59) - Output pin(23,42) gains.				
Voltage Gain (HI Boost)	Hboost		Input pin (6,59) - Output pin (23,42) gains.	6.5	8	9.5	dB
Balance between channels	BALton		Each of boost,+10,-10dB conditions.	-1.5	0	+1.5	dB

(4) CH1 / CH2 MIX SIGNAL

Parameter		Symbol	Test conditions	Limits Min	Limits typ	Limits Max	Unit
Supper woofer output	Gain	GvSW	Condition same as Gv RL=30kΩ	8	10	12	dB
	Distortion factor	THDSW	BW=400 to 30kHz Vo=0.5Vrms , RL=30KΩ	—	0.03	0.15	%
	Output noise voltage	VnoSW	Condition same as Vono No signal, JIS-A filter	—	70	170	µVrms
L+R Output voltage		GvLR	Condition same as Gv RL=51kΩ	-2	0	2	dB

MASTER VOLUME CIRCUIT

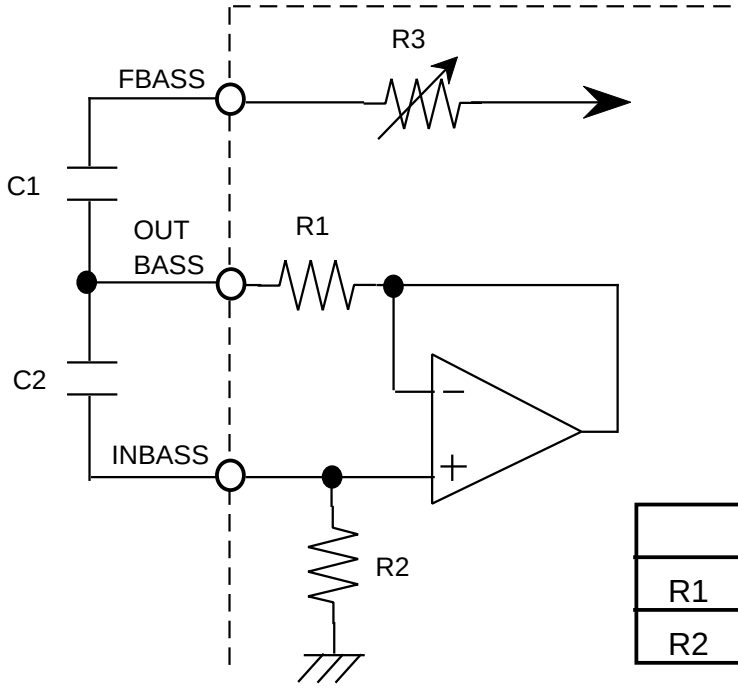


MASTER VOLUME SETTING CODE

D04	D14	D24	D34	D44	ATT
0	0	0	0	0	- 0.0dB
1	0	0	0	0	- 2.0dB
0	1	0	0	0	- 4.0dB
1	1	0	0	0	- 6.0dB
0	0	1	0	0	- 8.0dB
1	0	1	0	0	- 10.0dB
0	1	1	0	0	- 12.0dB
1	1	1	0	0	- 14.0dB
0	0	0	1	0	- 16.0dB
1	0	0	1	0	- 18.0dB
0	1	0	1	0	- 20.0dB
1	1	0	1	0	- 22.0dB
0	0	1	1	0	- 24.0dB
1	0	1	1	0	- 26.0dB
0	1	1	1	0	- 28.0dB
1	1	1	1	0	- 30.0dB
0	0	0	0	1	- 32.0dB
1	0	0	0	1	- 34.0dB
0	1	0	0	1	- 36.0dB
1	1	0	0	1	- 38.0dB
0	0	1	0	1	- 40.0dB
1	0	1	0	1	- 42.0dB
0	1	1	0	1	- 44.0dB
1	1	1	0	1	- 48.0dB
0	0	0	1	1	- 52.0dB
1	0	0	1	1	- 56.0dB
0	1	0	1	1	- 60.0dB
1	1	0	1	1	- 64.0dB
0	0	1	1	1	- 68.0dB
1	0	1	1	1	- 72.0dB
0	1	1	1	1	- 76.0dB
1	1	1	1	1	- ∞

FUNCTION DESCRIPTION

(1) TONE CONTROLLER EQUIVALENT CIRCUIT



Center frequency

$f0 = 1 / 2\pi \sqrt{C1 \cdot C2 \cdot R1 \cdot R2}$ [Hz]

$Q = \sqrt{C2 (R1 \cdot R2) / C1(R1+R3)^2}$

	F1	F2	F3	F4	F5
R1	1.49kΩ	1.49kΩ	1.49kΩ	1.49kΩ	—
R2	306kΩ	306kΩ	306kΩ	306kΩ	—

Fig.1 ; The equivalent circuit of tone controller.

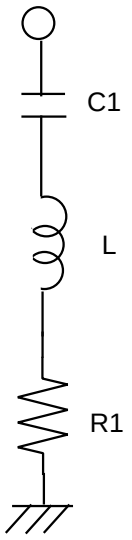
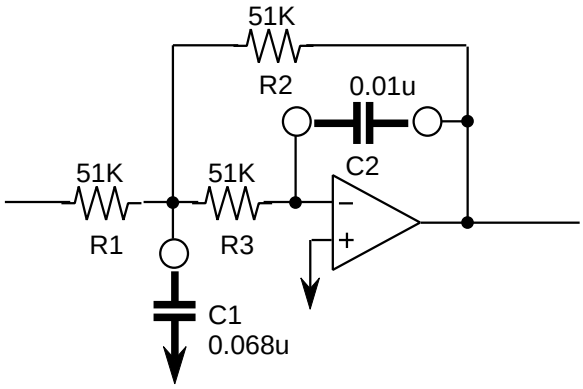


Fig.2 is equivalent to Fig.1.
To convent component constans,
the eqution below is used.

$L = C2 \cdot R1 \cdot R2$

Fig.2 ; The equivalent circuit using L

(2) VOCAL CUT L.P.F EQUIVALENT CIRCUIT



$$T(S) = \frac{A W_0^2}{S^2 + \frac{W_0}{Q} + W_0}$$

$$Q = \frac{\sqrt{R1 \bullet R2 \bullet C1 \bullet C2}}{R2 \bullet C2 + R1 \bullet C2 + \frac{R1 \bullet R2}{R3} C2}$$

$$A = -\frac{R1}{R2}$$

$$\frac{W_0}{Q} = \frac{1}{C1}\left(\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}\right)$$

$$W_0 = \frac{1}{R1 \bullet R2 \bullet C1 \bullet C2}$$

At the time of ; R1=R2=R3 ,
Become ; A = -1

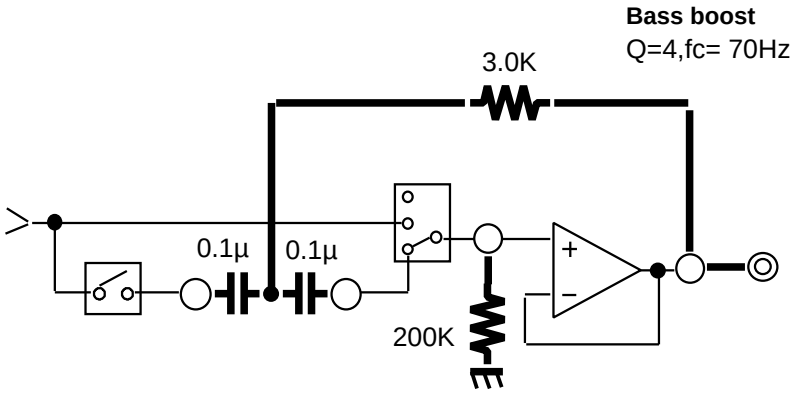
$$fc = \frac{1}{2\pi\sqrt{R1 \bullet R2 \bullet C1 \bullet C2}}$$

$$Q = \frac{1}{3}\sqrt{\frac{C1}{C2}} \quad (\text{Using } Q<Z)$$

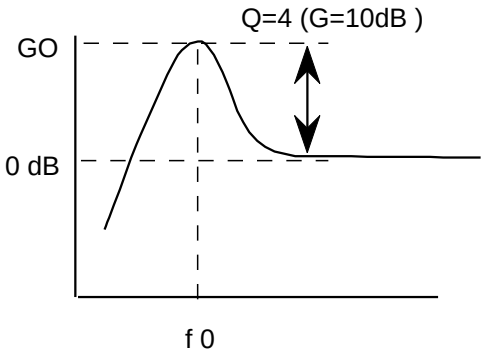
At the time of ; R1=R2=R3=51kΩ,
C1=0.068uF,C2=0.01uF
Become ; fc ÷120Hz
Q ÷ 0.87

Pay attention to In-Output turning over, because using turnig over mode.

(3) BASS BOOST EQUIVALENT CIRCUIT

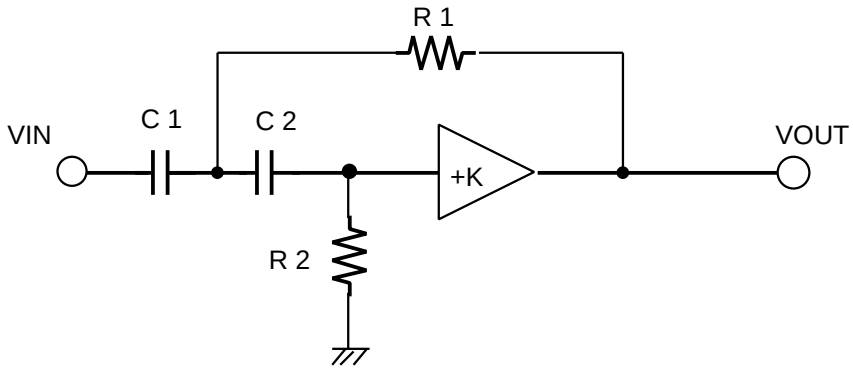


Orginal return type 2 dimensions HPF circuit of Bass boost.



Amplitude characteristic of HPF
(Reference)

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



Communication function is ;

$$\frac{VOUT}{VIN} = \frac{Ks^2}{s^2+s\left[\frac{1}{R2C1}+\frac{1}{R2C2}+(1-K)\frac{1}{R1C1}\right]+\frac{1}{R1R2C1C2}}$$

$$W_0^2 = \frac{1}{R1R2C1C2}$$

$$Q = \frac{1}{\sqrt{\frac{R1C1}{R2C2}}+\sqrt{\frac{R1C2}{R2C1}}+(1-K)\sqrt{\frac{R2C2}{R1C1}}}$$

Bass boost consists of orginal return type 2 dimensions HPF circuit of upper figure.
To the following showing an example of method of design calculction of Bass boost.

At the time of ;
C 1 = C 2 = C f, K = +1

The upper expression becomes ;
R f = 1 / (w0 C f) • • • • (1)

R 1 = R f / 2 Q • • • • • • • (2)

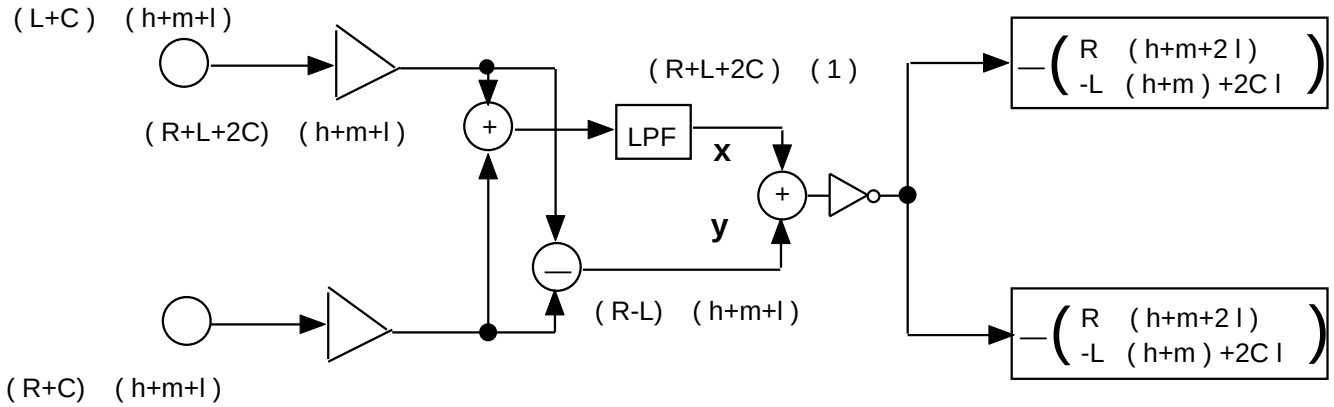
R 2 = 2 Q R f • • • • • • • (3)

When cut off frequency is 70Hz ,
w0=2π x 70Hz, Q=4,condition.

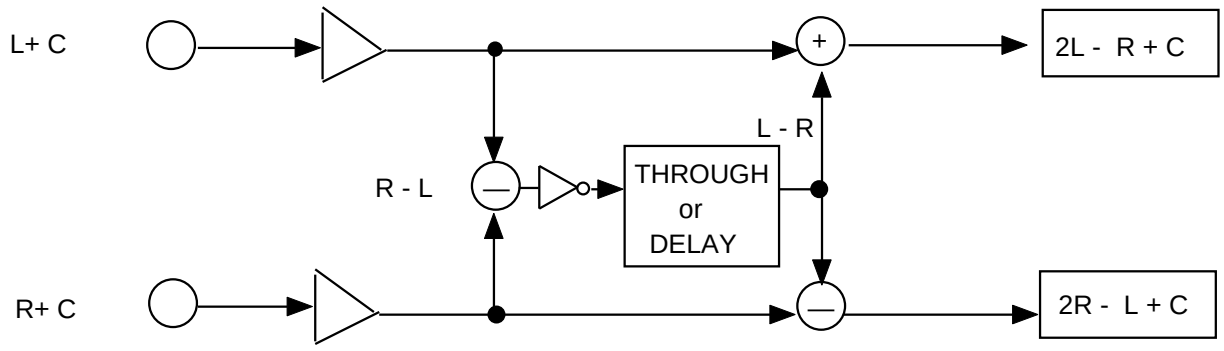
At the time of ; C1=C2=C f=0.1µF
From ; (1),(2),(3)
Become ; R f=22.7 KΩ
R1 = 2.84KΩ
R2 = 182 KΩ

R1,R2 is about 3.0KΩ,200KΩ

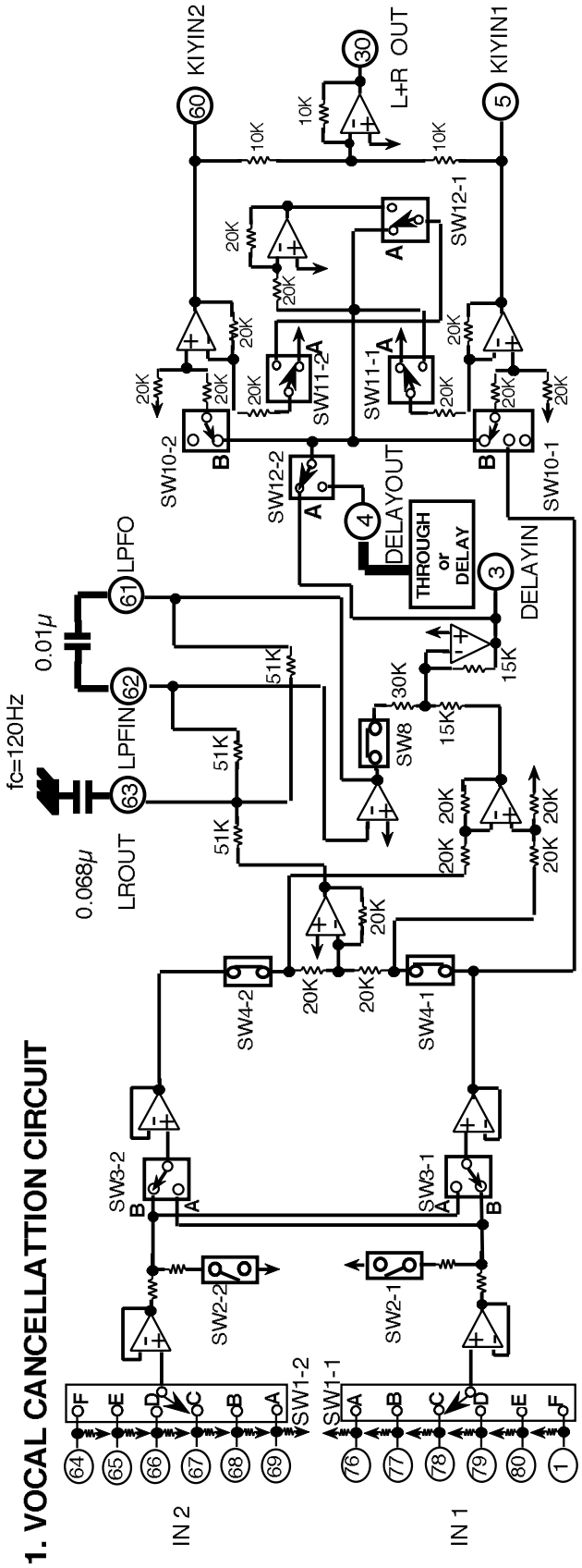
(4) VOCAL CANCELLATION EQUIVALENT CIRCUIT

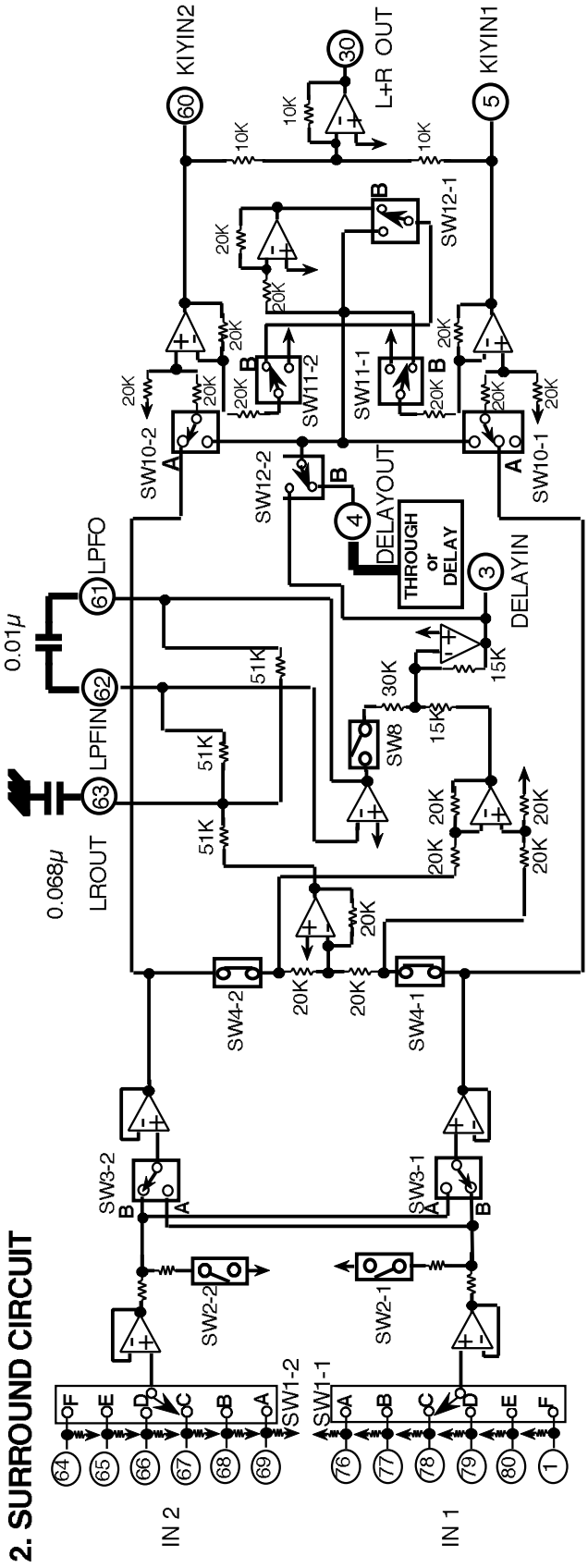


(5) SURROUND EQUIVALENT CIRCUIT

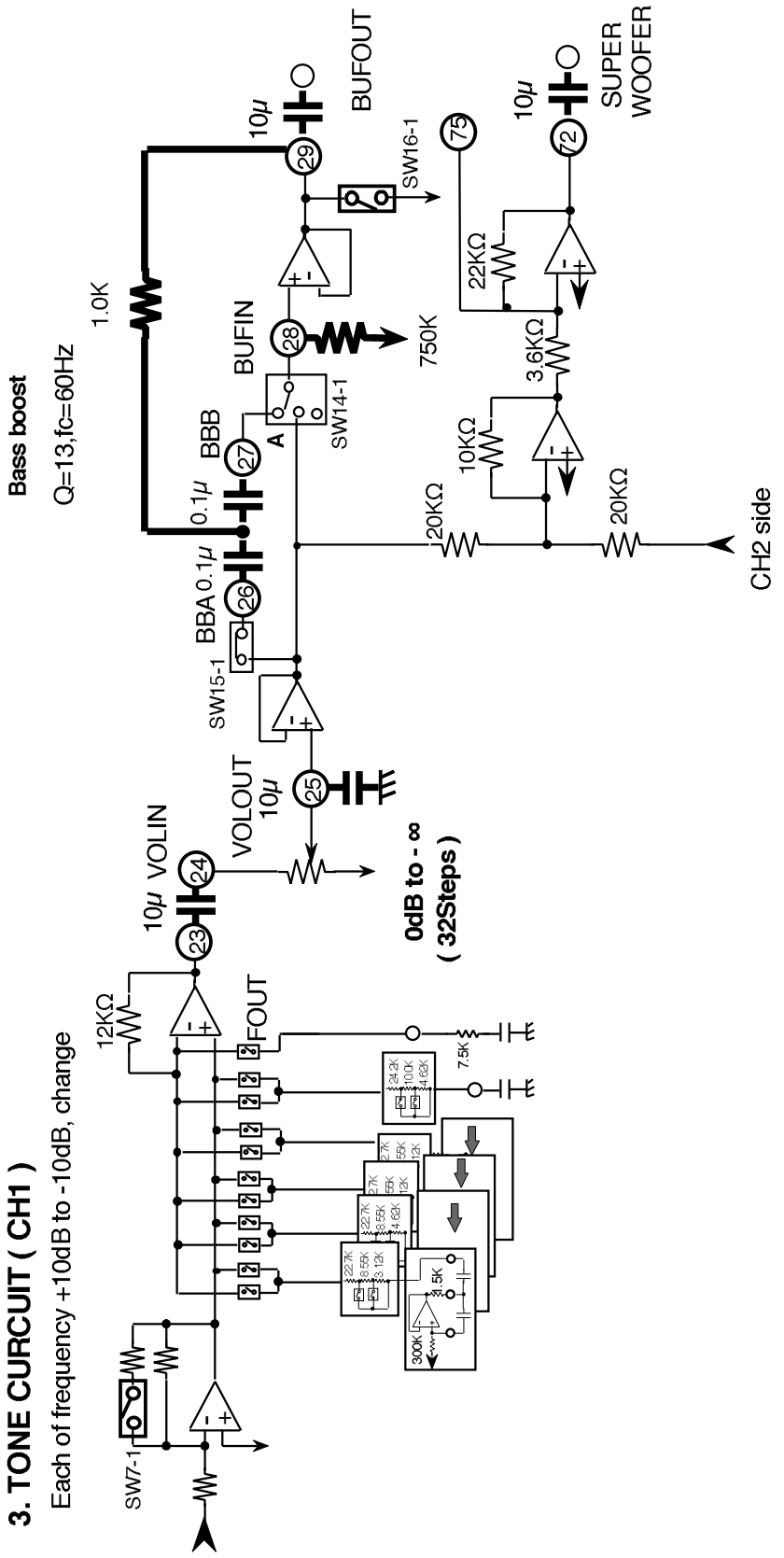


SIGNAL COMMUNICATION BLOCK CIRCUIT (NO.1)



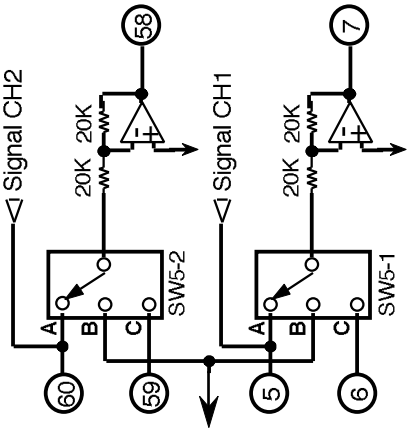


SIGNAL COMMUNICATION BLOCK CIRCUIT (No.2)

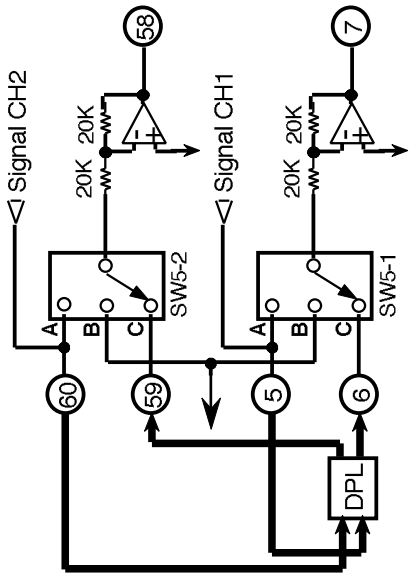


REC INPUT CHANGE CIRCUIT

(1) THROUGH MODE



(2) DPL MODE



PRELIMINARY

Notice ; This is not a final specification.
some parametric limits are subject to change.

M62493FP

DIGITAL SOUND CONTROLLER

APPLICATION CIRCUIT (±Power)