

PRELIMINARY
 some parametric limits are subject to change.

M62493FP

DIGITAL SOUND CONTROLLER

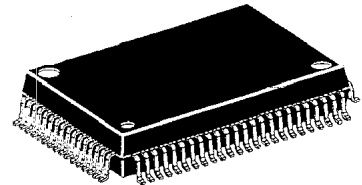
SINGLE CHIP ANALOG SOUND PROCESSOR

DESCRIPTION

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

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)
- Electric 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)



Outline 80P6N

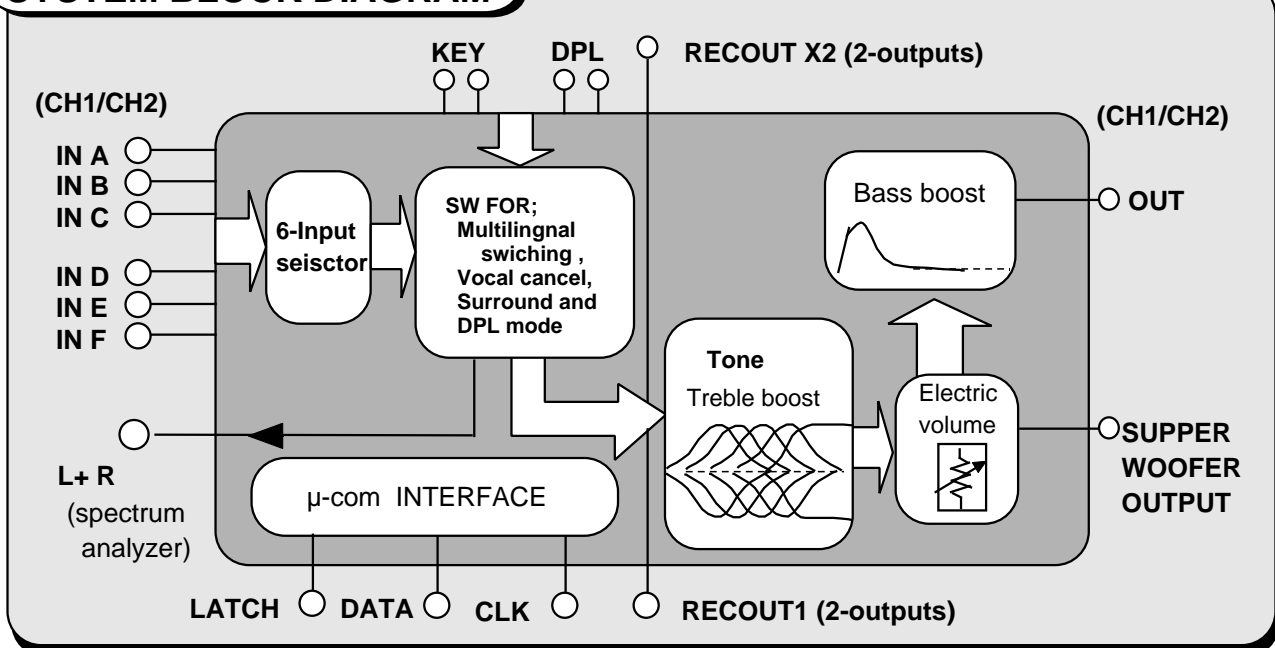
Pitch ; 0.8 mm

Size ; 20.0 mmX14.0mmX
 2.8mm

RECOMMENDED OPERATING CONDITION

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

SYSTEM BLOCK DIAGRAM

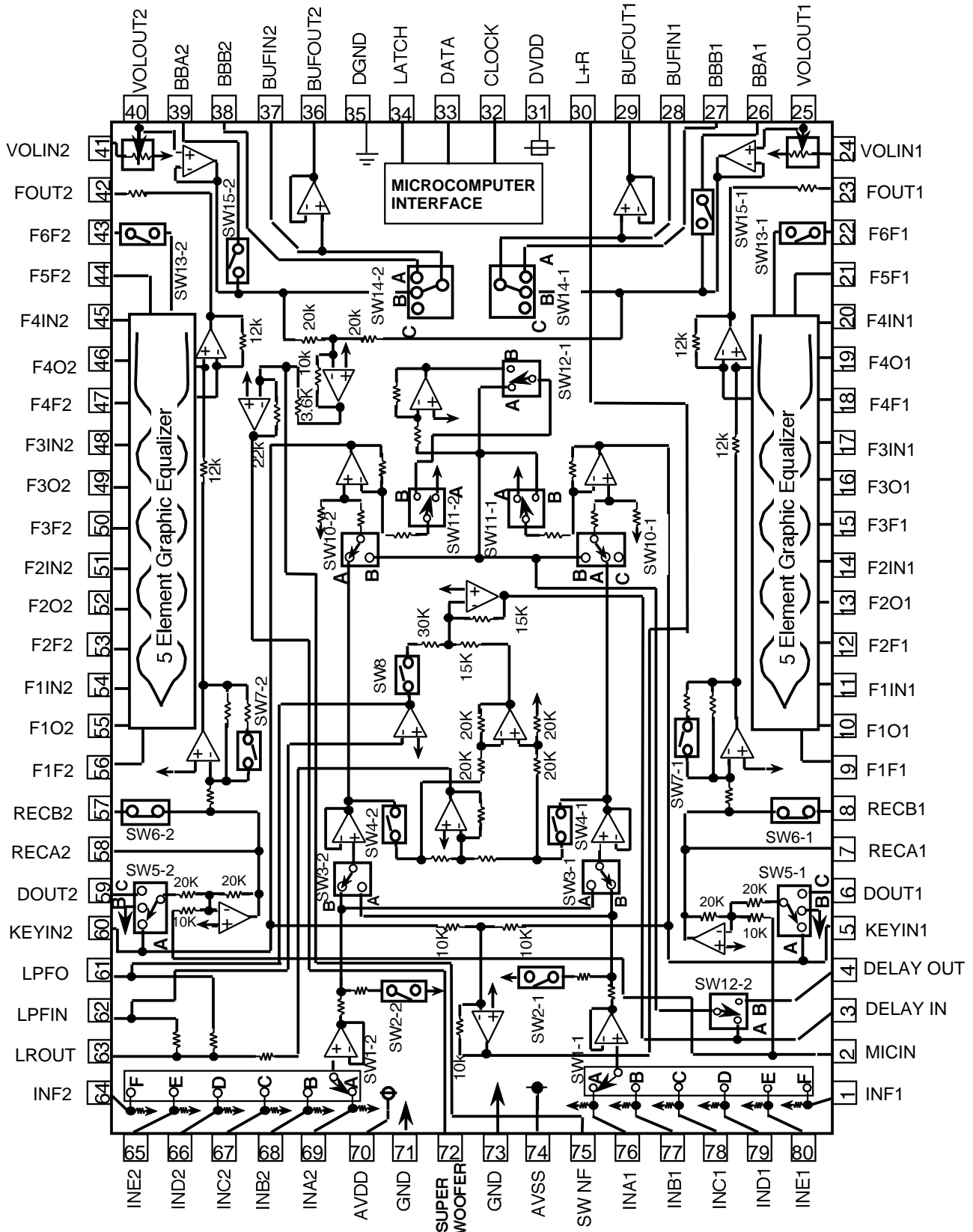


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PIN CONFIGURATION AND IC INTERNAL BLOCK DIAGRAM



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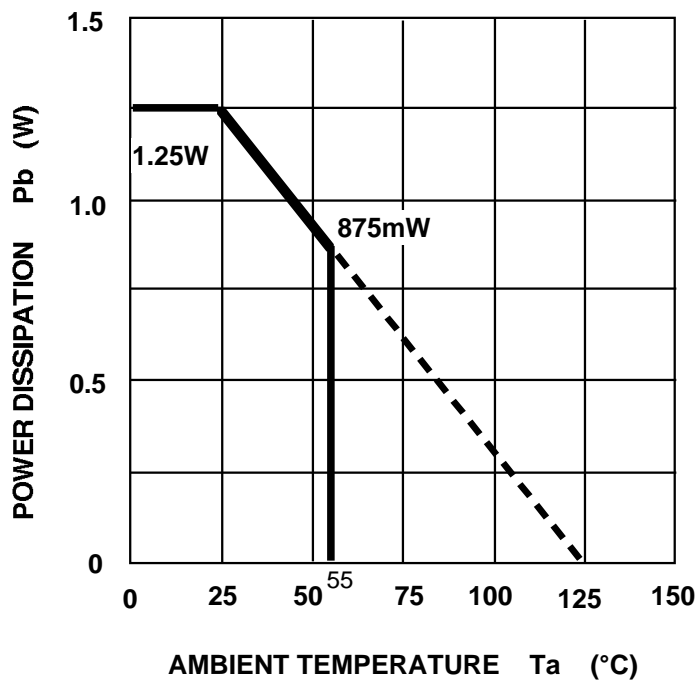
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ABSOLUTE MAXIMUM RATINGS

System	Parameter	Condition	Ratings	Unit
AVDD,AVSS	Analog supply voltage		± 7.8	V
DVDD	Digital supply voltage		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

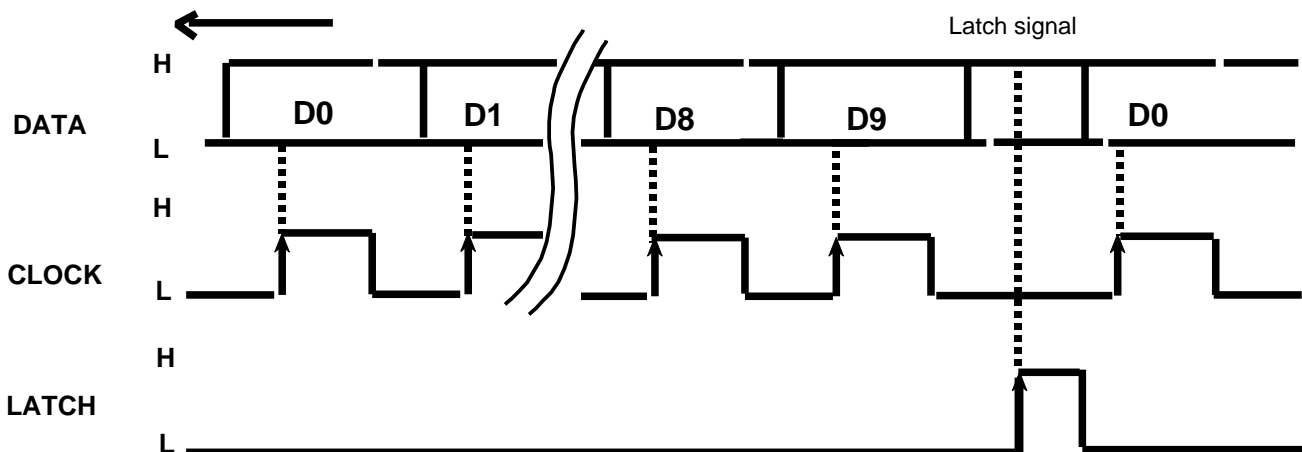
RECOMMENDED OPERATION CONDITION

(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

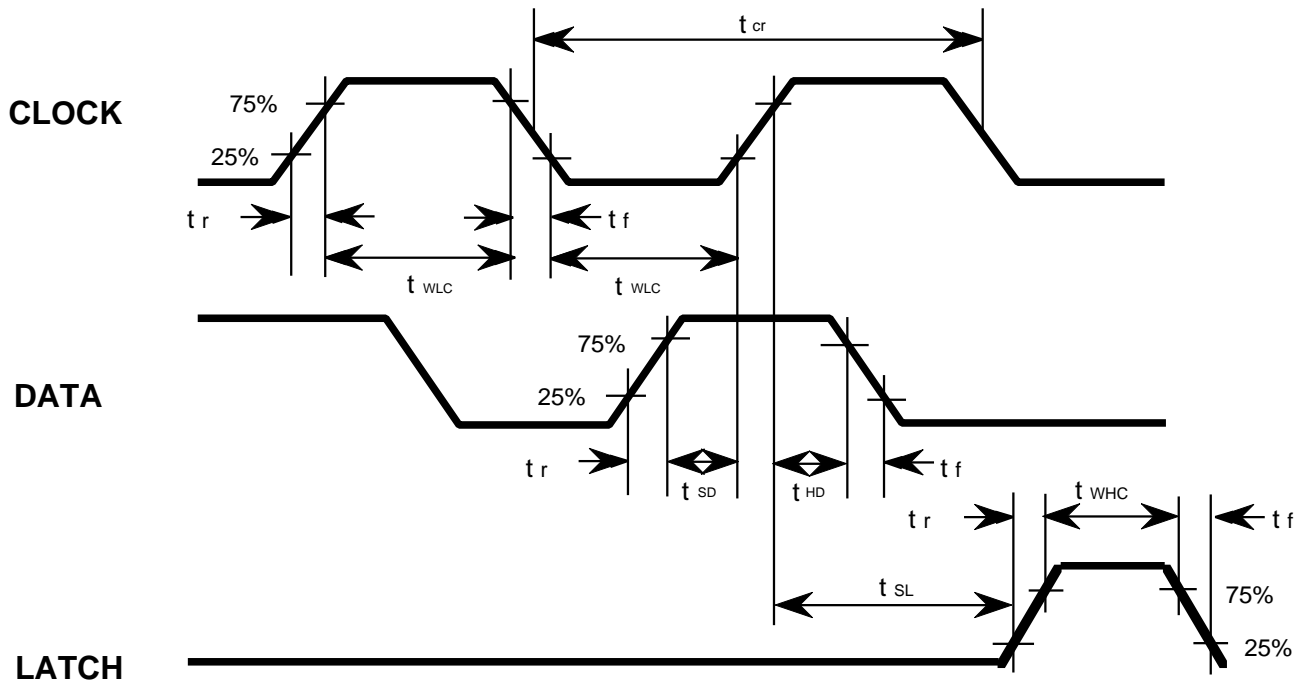
RELATIONSHIPS BETWEEN DATA AND CLOCK



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 the IC is powered up, the internal setting are not fixed.)

← **Input direction**

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

	DO1	D11	D21	D31	D41	D51	D6	D7	D8	D9
(1)	Input ATT 1 : -5dB 0 : 0dB	Tone ATT 1 : -6dB 0 : 0dB	For the multiplex software cf. (8) Setting code		For the function software cf. (11) Setting code		0	0	1	1
(2)	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)	For Tone Control cf. (5) Setting code		For Tone Boost / cut cf. (6) Setting code			1	0	1	1	
(4-1)	For Master Volume cf. (7) Setting code					0	1	1	1	1
(4-2)	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

**(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

Note; Do not input other data than the above.

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(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 CANCELLATION	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+)	Aldd	Current at pin 70 with AVdd=7.0V,AVss= -7.0V No signal	—	50	58	mA
Circuit current (Analog-)	Alss	Current at pin 74 with AVdd=7.0V,AVss= -7.0V No signal	-58	-50	—	mA
Circuit current (Digital)	Dldd	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	K	
Max. input voltage	VIM	Input pin (76,64), Output pin (29,36) RL =10K , 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=10K	(29,36)pin	—	10.0	24	μVrms
	Vrecno	FLAT condition	(7,58)pin	—	10.0	20	μVrms
Distortion factor	THD	29pin,36pin, BW=400 to 30kHz Vo=0.5Vrms, RL=10k	—	0.01	0.05	%	
	THDrecA	7pin,58pin, BW=400 to 30kHz Vo=0.5Vrms, RL=30k	—	0.01	0.05	%	
	THDrecB	8pin,57pin, BW=400 to 30kHz Vo=0.5Vrms, RL=51k	—	0.01	0.05	%	
Crosstalk between channels	CT	Vo=0.5Vrms , RL=10K ,JIS-A 29pin - 36pin gains Rg=10K 2pin GND	—	-70	-55	dB	
	CTrec	Vo=0.5Vrms , RL=30K ,JIS-A 7pin - 58pin gains Rg=10K 2pin GND	—	-70	-55	dB	

(3) TONE CONTROL CHARACTERISTICS

Parameter	Symbol		Test condition	Limits			Unit	
				Min	typ	Max		
Voltage Gain (Tone control)	Gboost1	F1	3.8dB	f=1kHz, Vo=1Vms Input pin (6,59) - Output pin(23,42) gains.	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	
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

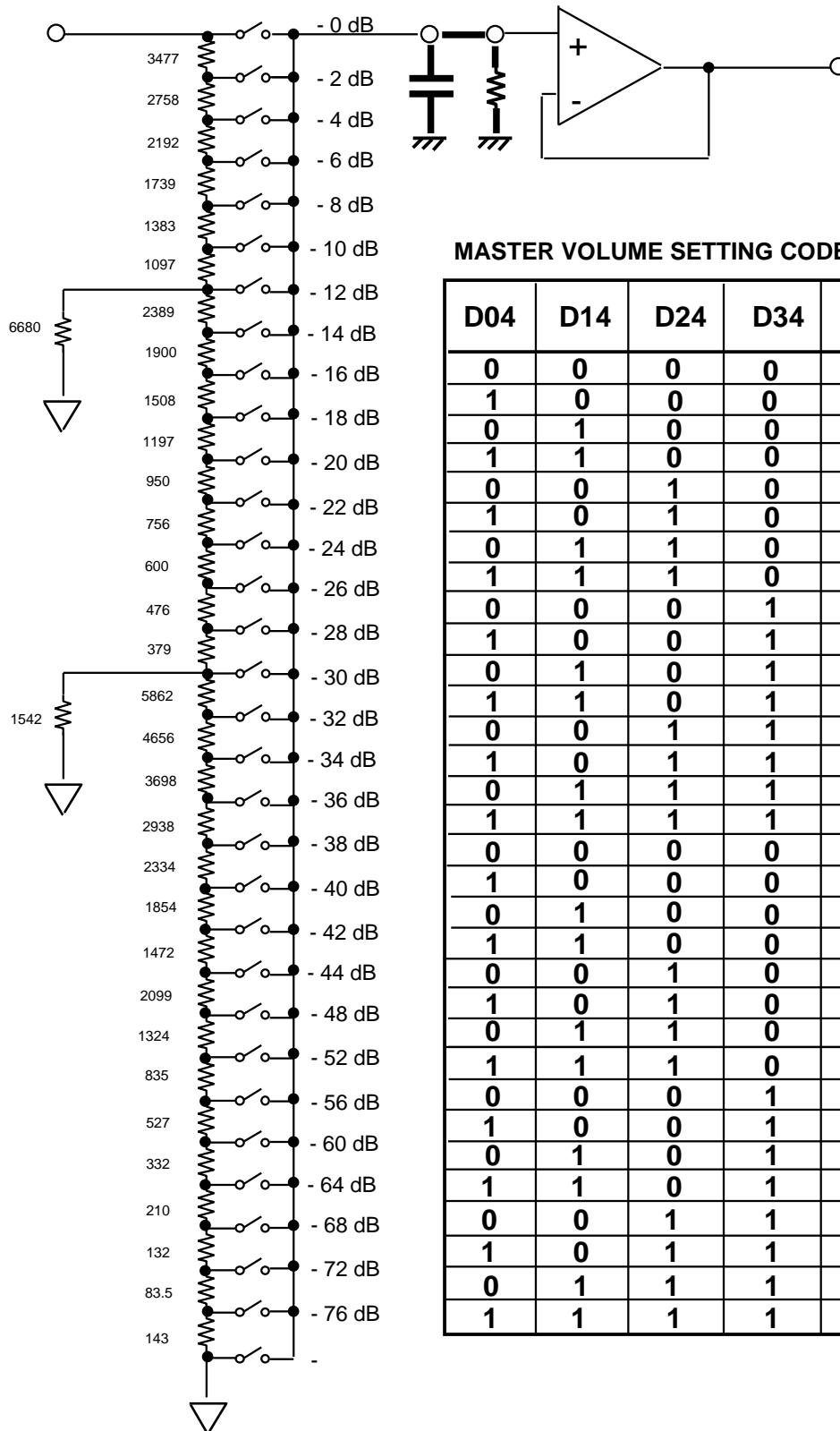
Parameter		Symbol	Test conditions	Limits			Unit
				Min	typ	Max	
Supper woofer output	Gain	GvSW	Condition same as Gv RL=30k	8	10	12	dB
	Distortion factor	THDSW	BW=400 to 30kHz Vo=0.5Vrms , RL=30K	—	0.03	0.15	%
	Output noise voltage	VnoSW	Condition same as Vono No signal, JIS-A filter	—	70	170	μVrms
L+R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

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DIGITAL SOUND CONTROLLER

MASTER VOLUME CIRCUIT



MASTER VOLUME SETTING CODE

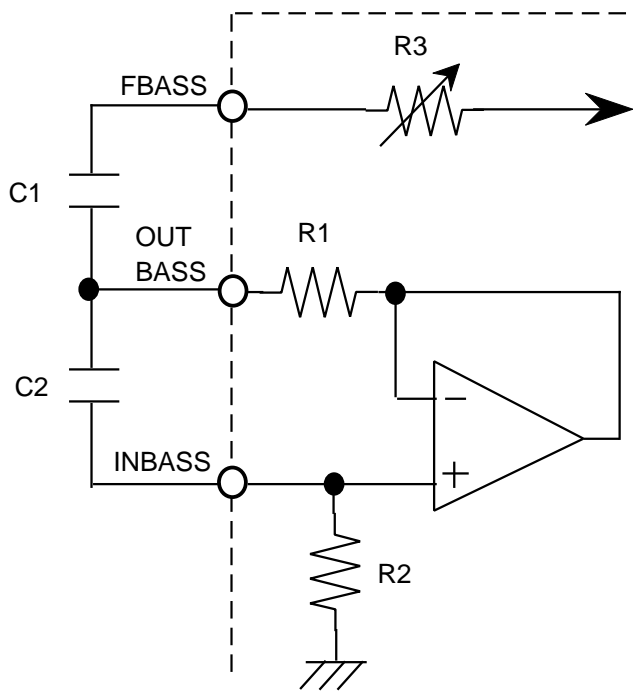
D04	D14	D24	D34	D44	ATT
0	0	0	0	0	- 0.0dB
1	0	0	0	0	- 2.0dB
0	1	0	0	0	- 4.0dB
1	1	0	0	0	- 6.0dB
0	0	1	0	0	- 8.0dB
1	0	1	0	0	- 10.0dB
0	1	1	0	0	- 12.0dB
1	1	1	0	0	- 14.0dB
0	0	0	1	0	- 16.0dB
1	0	0	1	0	- 18.0dB
0	1	0	1	0	- 20.0dB
1	1	0	1	0	- 22.0dB
0	0	1	1	0	- 24.0dB
1	0	1	1	0	- 26.0dB
0	1	1	1	0	- 28.0dB
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	-

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FUNCTION DESCRIPTION

(1) TONE CONTROLLER EQUIVALENT CIRCUIT



Center frequency

$$f_0 = 1 / 2 \sqrt{C1 \cdot C2 \cdot R1 \cdot R2} \text{ [Hz]}$$

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

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

Fig.1 ; The equivalent circuit of tone controller.

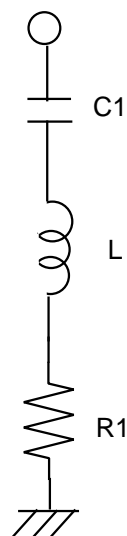


Fig.2 is equivalent to Fig.1.
 To convert component constants,
 the equation below is used.

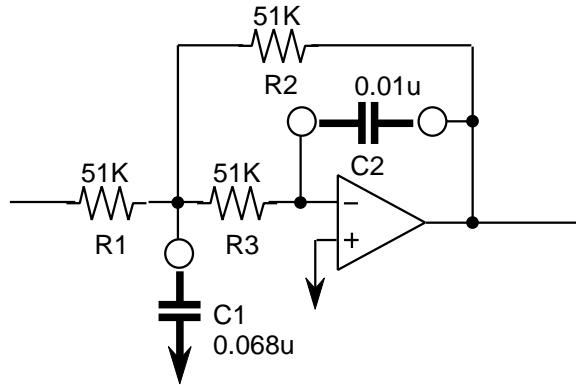
$$L = C2 \cdot R1 \cdot R2$$

Fig.2 ; The equivalent circuit using L

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



$$T(s) = \frac{A\omega_0^2}{s^2 + \frac{\omega_0}{Q}s + \omega_0^2}$$

$$Q = \frac{\sqrt{R_1 \cdot R_2 \cdot C_1 \cdot C_2}}{R_2 \cdot C_2 + R_1 \cdot C_2 + \frac{R_1 \cdot R_2}{R_3} C_2}$$

$$\left\{ \begin{array}{l} A = -\frac{R_1}{R_2} \\ \frac{\omega_0}{Q} = \frac{1}{C_1} \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \right) \\ \omega_0^2 = \frac{1}{R_1 \cdot R_2 \cdot C_1 \cdot C_2} \end{array} \right.$$

At the time of ; $R_1=R_2=R_3$,
 Become ; $A = -1$

$$f_c = \frac{1}{2 \sqrt{R_1 \cdot R_2 \cdot C_1 \cdot C_2}}$$

$$Q = \frac{1}{3} \sqrt{\frac{C_1}{C_2}} \quad (\text{Using } Q < Z)$$

At the time of ; $R_1=R_2=R_3=51k$,
 $C_1=0.068\mu F, C_2=0.01\mu F$
 Become ; $f_c \div 120\text{Hz}$
 $Q \div 0.87$

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

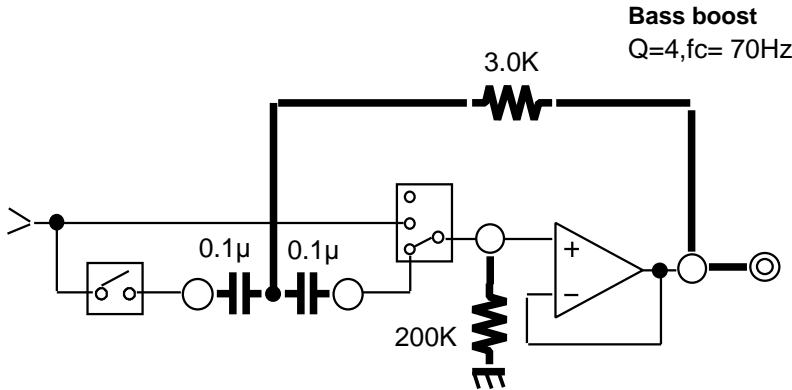
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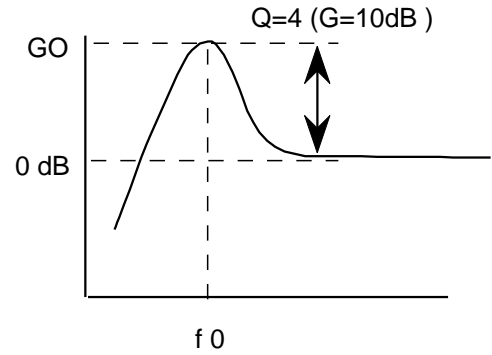
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DIGITAL SOUND CONTROLLER

(3) BASS BOOST EQUIVALENT CIRCUIT

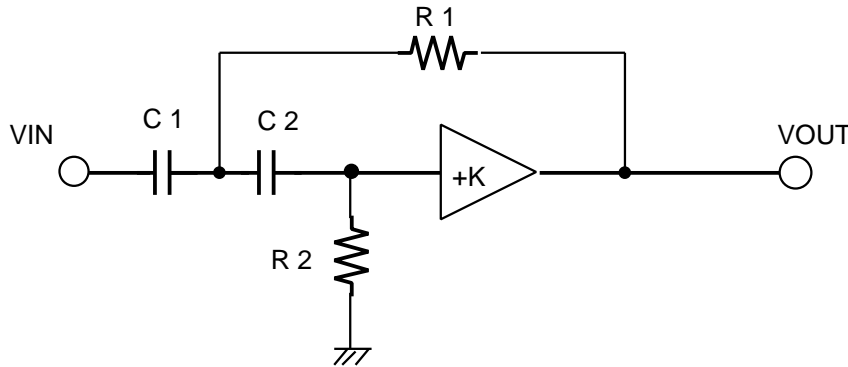


Original return type 2 dimensions HPF circuit of Bass boost.



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 ;

$$\frac{V_{OUT}}{V_{IN}} = \frac{Ks^2}{s^2 + s \left[\frac{1}{R_2C_1} + \frac{1}{R_2C_2} + (1-K) \frac{1}{R_1C_1} \right] + \frac{1}{R_1R_2C_1C_2}}$$

$$\omega_0^2 = \frac{1}{R_1R_2C_1C_2}$$

$$Q = \frac{1}{\sqrt{\frac{R_1C_1}{R_2C_2}} + \sqrt{\frac{R_1C_2}{R_2C_1}} + (1-K)\sqrt{\frac{R_2C_2}{R_1C_1}}}$$

Bass boost consists of original return type 2 dimensions HPF circuit of upper figure.

To the following showing an example of method of design calculation of Bass boost.

At the time of ;
 $C_1 = C_2 = C_f, K = +1$

The upper expression becomes ;
 $R_f = 1 / (\omega_0 C_f) \dots (1)$

$R_1 = R_f / 2Q \dots (2)$

$R_2 = 2Q R_f \dots (3)$

When cut off frequency is 70Hz ,
 $\omega_0 = 2\pi \times 70\text{Hz}, Q=4, \text{condition.}$

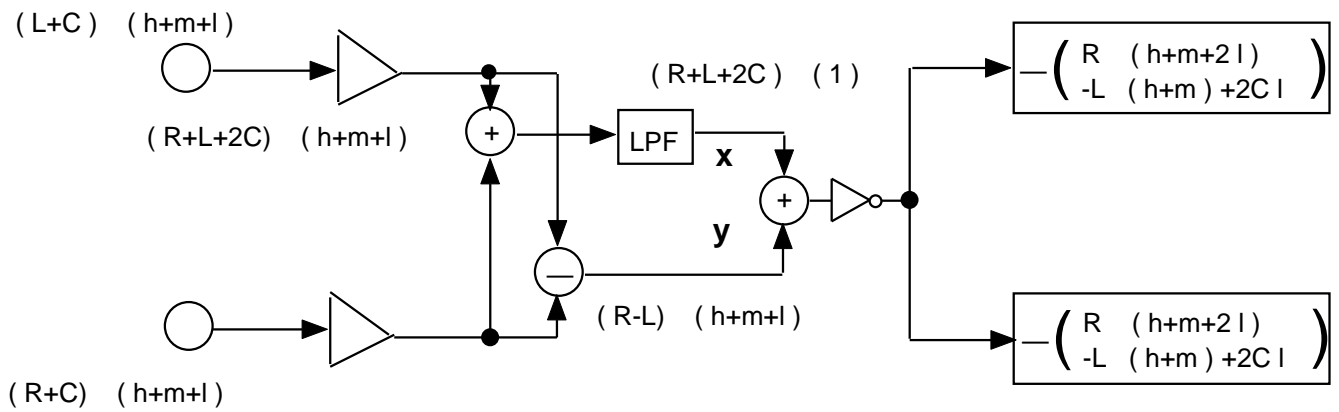
At the time of ; $C_1=C_2=C_f=0.1\mu\text{F}$
 From ; (1),(2),(3)
 Become ; $R_f=22.7 \text{ K}$
 $R_1 = 2.84\text{K}$
 $R_2 = 182 \text{ K}$

R_1, R_2 is about 3.0K , 200K

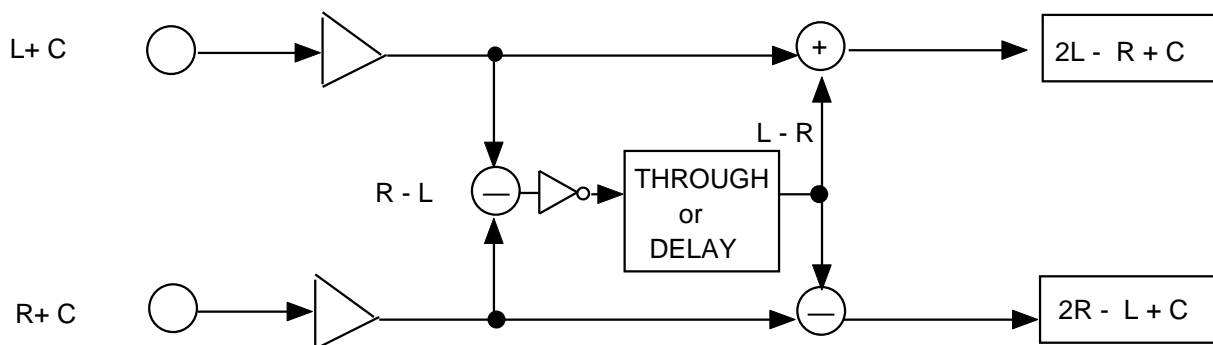
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(4) VOCAL CANCELLATION EQUIVALENT CIRCUIT



(5) SURROUND EQUIVALENT CIRCUIT



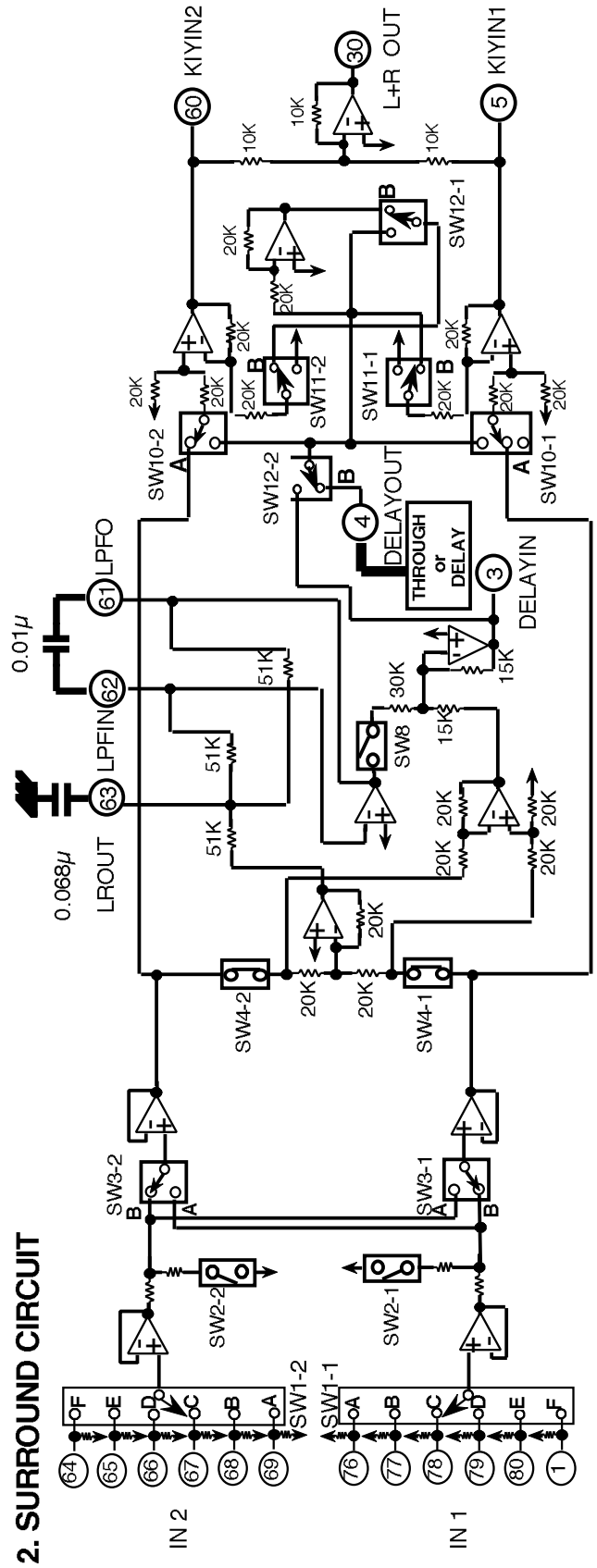
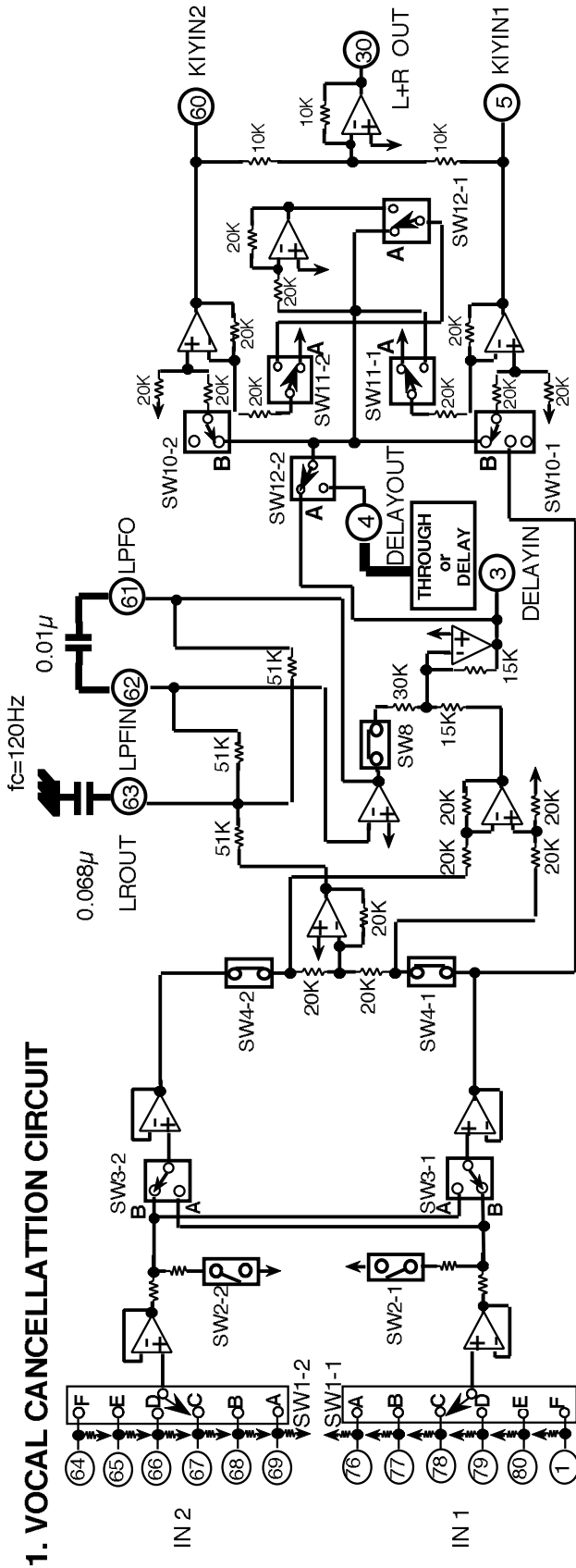
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DIGITAL SOUND CONTROLLER

SIGNAL COMMUNICATION BLOCK CIRCUIT (NO.1)



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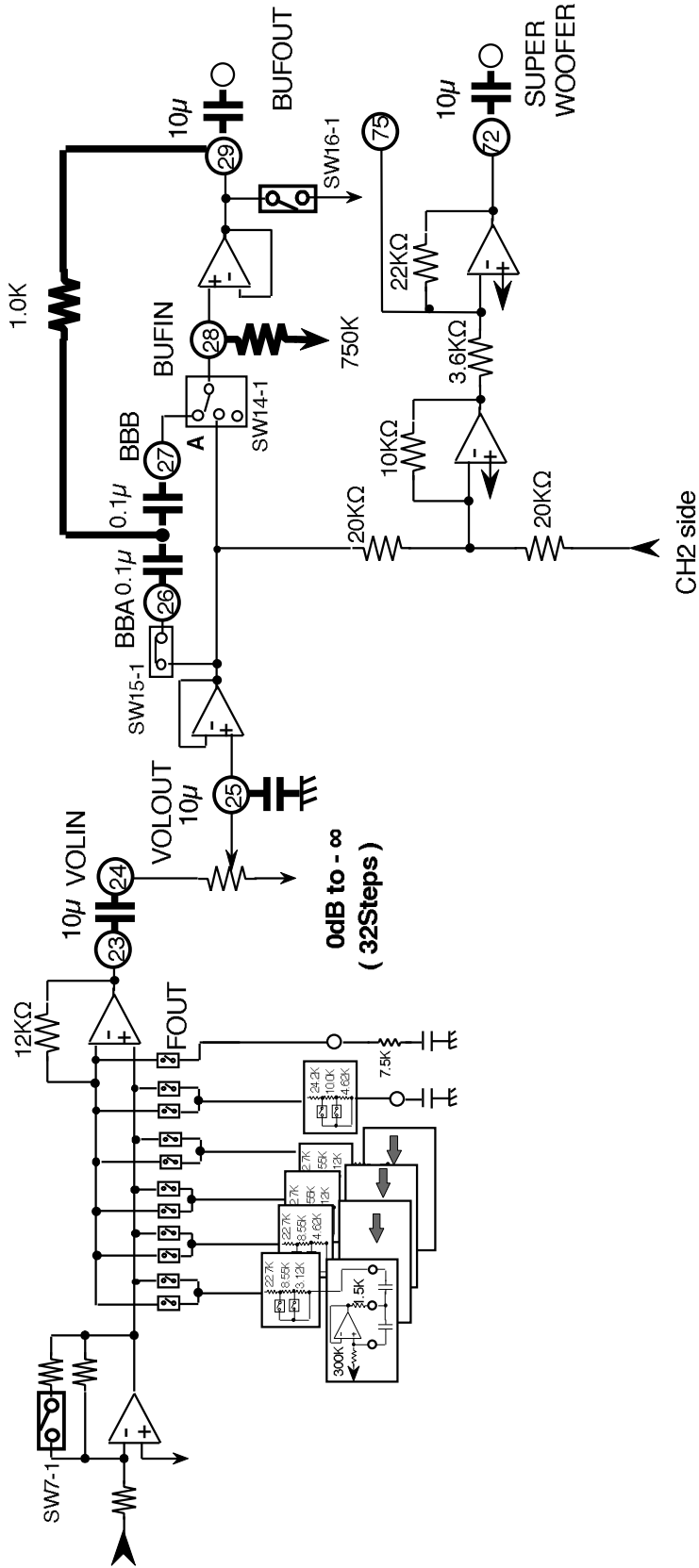
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DIGITAL SOUND CONTROLLER

SIGNAL COMMUNICATION BLOCK CIRCUIT (No.2)

3. TONE CURCUIT (CH1)

Each of frequency +10dB to -10dB, change



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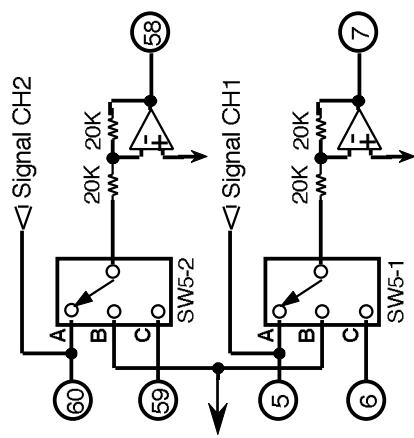
MITSUBISHI SOUND PROCESSORS

M62493FP

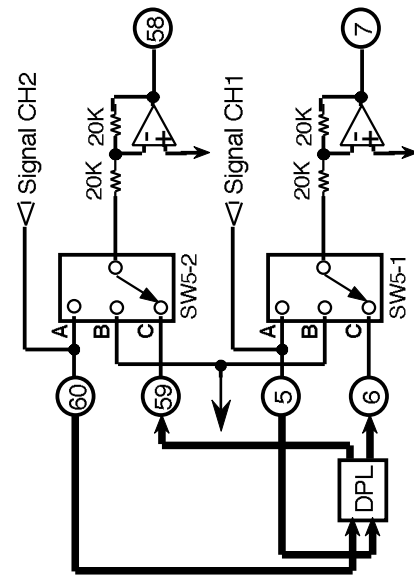
DIGITAL SOUND CONTROLLER

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.

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DIGITAL SOUND CONTROLLER

APPLICATION CIRCUIT (±Power)

