

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

M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER

DESCRIPTION

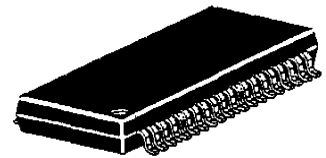
The M62444FP is 4 channels electric volume with trimmer controlled 3-wire serial data.

The IC is suitable for use in home-use audio systems and TV sets.

FEATURES

- Electric volume(Master volume)
 - Volume level ••••• 0dB to -80dB, - dB (32steps)
- Electric volume(trimmer volume)
 - Volume level ••••• 0dB to -24dB (1dB/step)
- 2 channels bass boost(loudness type)
- 6 Output ports
- Built-in microcomputer interface circuit controlled by 8-bit serial data.

PACKAGE



Outline

42P2R

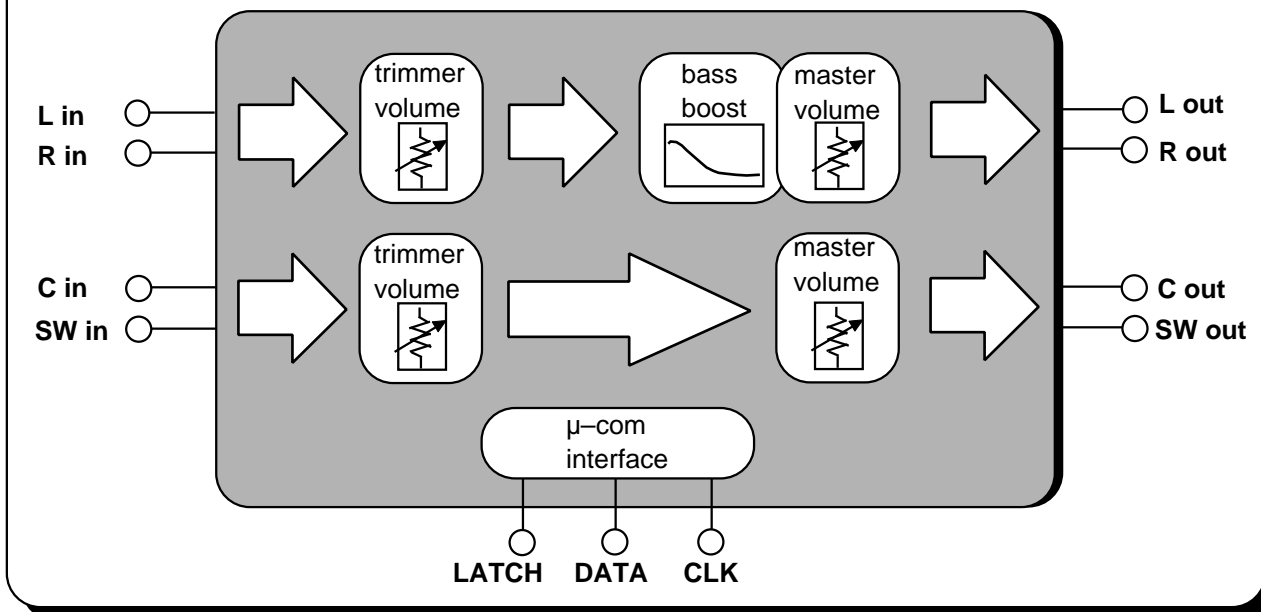
APPLICATION

DVD, Home Audio equipment, TV

RECOMMENDED OPERATING CONDITIONS

Supply voltage range ••• ±4.5 to ±7.3V (analog)
 4.5 to 5.5V (digital)
 Rated supply voltage ••• ±7.0V (analog)
 5.0V (digital)

SYSTEM BLOCK DIAGRAM



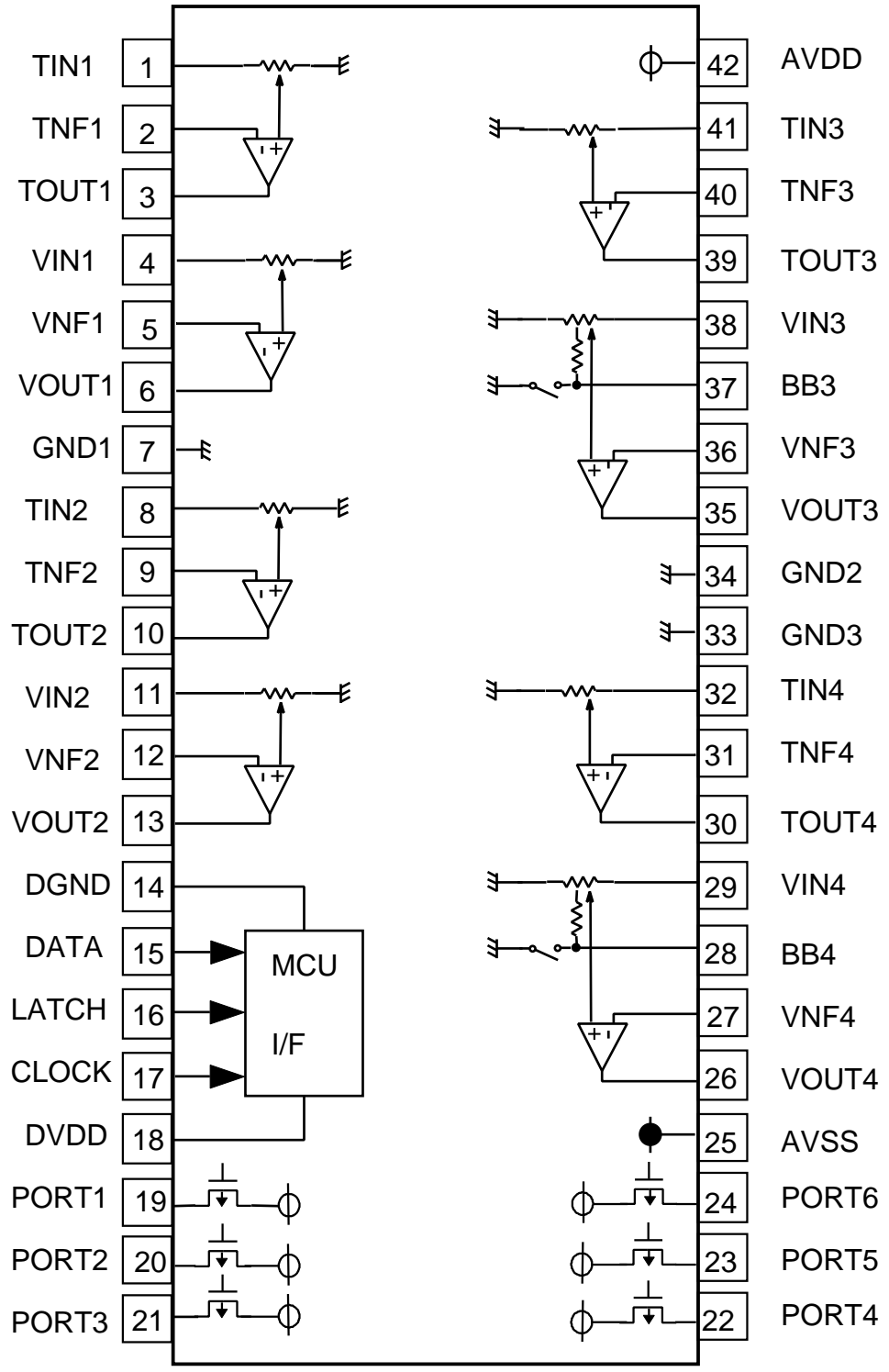
PRELIMINARY
 Notice ; This is not a final specification.
 some parametric limits are subject to change.

MITSUBISHI SOUND PROCESSORS

M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER

PIN CONFIGURATION AND IC INTERNAL BLOCK DIAGRAM



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

MITSUBISHI SOUND PROCESSORS

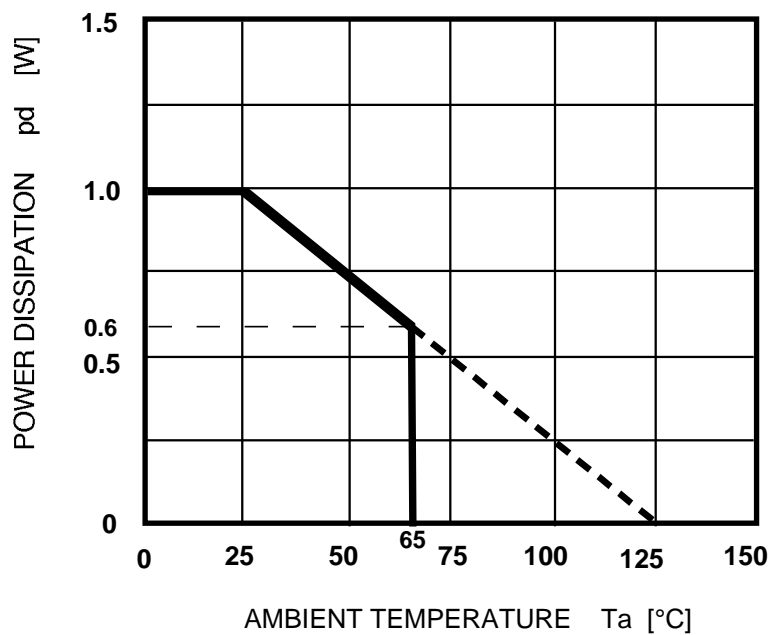
M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Ratings	Unit
Vsupply	Supply Voltage	AVDD-AVSS	16	v
Pd	Power dissipation	Ta 25°C	1000	mW
kθ	Thermal derating	Ta > 25°C	10	mW/ °C
Topr	Operating temperature		-20 to +65	°C
Tstg	Storage temperature		-40 to ±125	°C

THERMAL DERATING (MAXIMUM RATING)



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

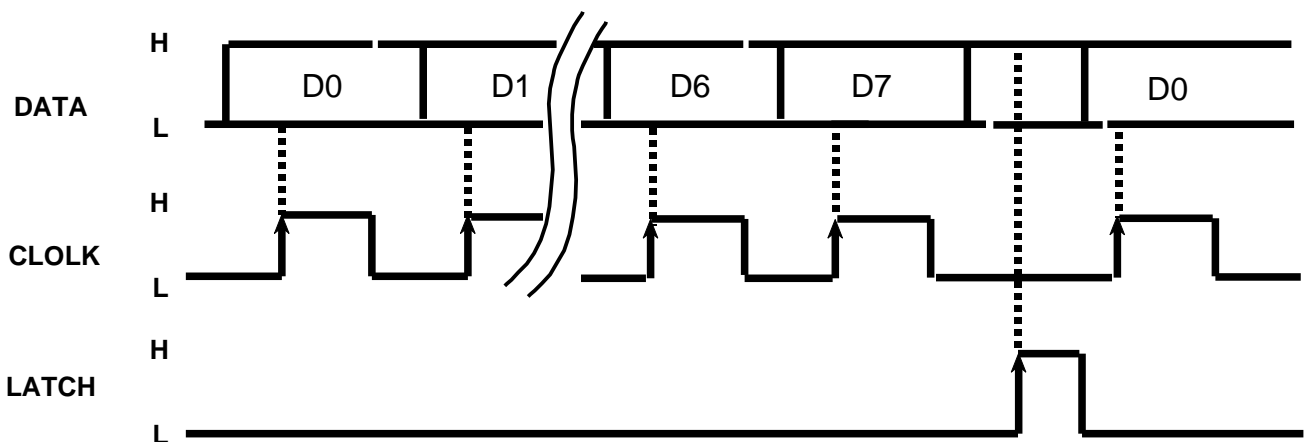
RECOMMENDED OPERATING CONDITION

(Ta=25°C, unless otherwise noted)

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit
Positive supply voltage	AVDD		4.5	7.0	7.3	V
	DVDD		4.5	5.0	5.5	
Negative supply voltage	AVSS		-7.3	-7.0	-4.5	V
High-level Input Voltage	VIH		$(DVDD/2)+1$	—	DVDD	V
Low-level Input Voltage	VIL		DGND	—	$(DVDD/2)-1$	V
Output port maximum current	IOH	"H" level	—	—	3	mA

(note) AVSS DGND < DVDD AVDD

DATA TIMING (Recommended conditions)

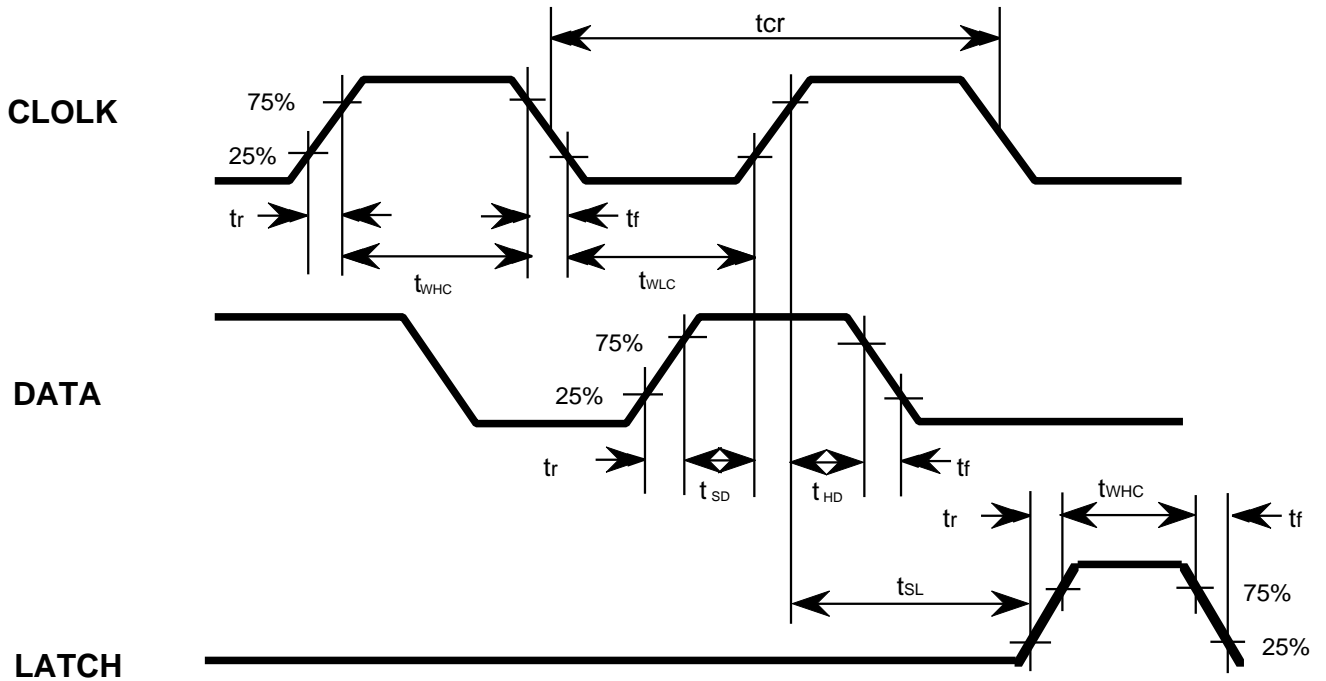


note : CLOCK and LATCH function at raising edges of pulse .

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

MITSUBISHI SOUND PROCESSORS
M62444FP
 4CH ELECTRIC VOLUME WITH TRIMMER

CLOCK, DATA, LATCH TIMING



DIGITAL BLOCK TIMING REGULATION

Symbol	Parameter	Limits			Unit
		Min	typ	Max	
t_{cr}	CLOCK cycle time	8	-	-	μs
t_{whc}	CLOCK pulse width ("H"level)	3.2	-	-	
t_{wlc}	CLOCK pulse width ("L"level)	3.2	-	-	
t_r	CLOCK,DATA,LATCH rise time	-	-	0.8	
t_f	CLOCK,DATA,LATCH fall time	-	-	0.8	
t_{SD}	DATA setup time	1.6	-	-	
t_{HD}	DATA hold time	1.6	-	-	
t_{SL}	LATCH setup time	2	-	-	
t_{WHL}	LATCH pulse width	3.2	-	-	

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

DIGITAL CONTROL SPECIFICATION

Fore kinds of input format options are available by changing slot settings of D6 and D7.
 (When the IC is powered up , the internal settings are not fixed.)

(1)

D01	D11	D21	D31	D41	D51	D61	D71
TRIMMER VOLUME 1					0	0	0

(2)

D02	D12	D22	D32	D42	D52	D62	D72
TRIMMER VOLUME 2					1	0	0

(3)

D03	D13	D23	D33	D43	D53	D63	D73
TRIMMER VOLUME 3					0	0	1

(4)

D04	D14	D24	D34	D44	D54	D64	D74
TRIMMER VOLUME 4					1	0	1

(5)

D05	D15	D25	D35	D45	D55	D65	D75
MASTER VOLUME					BASS BOOST (LOUDNESS) 1 : ON 0 : OFF	1	0

(6)

D06	D16	D26	D36	D46	D56	D66	D76
OUTPUT PORT 1 1 : H 0 : L	OUTPUT PORT 2 1 : H 0 : L	OUTPUT PORT 3 1 : H 0 : L	OUTPUT PORT 4 1 : H 0 : L	OUTPUT PORT 5 1 : H 0 : L	OUTPUT PORT 6 1 : H 0 : L	1	1

PRELIMINARY

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

MITSUBISHI SOUND PROCESSORS

M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER

SETTING CODE

TRIMMER VOLUME 1 to 4

Note : Do not input other data
than the above.

ATT	D0X	D1X	D2X	D3X	D4X
- 0dB	0	0	0	0	0
- 1dB	1	0	0	0	0
- 2dB	0	1	0	0	0
- 3dB	1	1	0	0	0
- 4dB	0	0	1	0	0
- 5dB	1	0	1	0	0
- 6dB	0	1	1	0	0
- 7dB	1	1	1	0	0
- 8dB	0	0	0	1	0
- 9dB	1	0	0	1	0
- 10dB	0	1	0	1	0
- 11dB	1	1	0	1	0
- 12dB	0	0	1	1	0
- 13dB	1	0	1	1	0
- 14dB	0	1	1	1	0
- 15dB	1	1	1	1	0
- 16dB	0	0	0	0	1
- 17dB	1	0	0	0	1
- 18dB	0	1	0	0	1
- 19dB	1	1	0	0	1
- 20dB	0	0	1	0	1
- 21dB	1	0	1	0	1
- 22dB	0	1	1	0	1
- 23dB	1	1	1	0	1
- 24dB	0	0	0	1	1

MASTER VOLUME

Note : Do not input other data
than the above.

ATT	D05	D15	D25	D35	D45
- 0dB	0	0	0	0	0
- 2dB	1	0	0	0	0
- 4dB	0	1	0	0	0
- 6dB	1	1	0	0	0
- 8dB	0	0	1	0	0
- 10dB	1	0	1	0	0
- 12dB	0	1	1	0	0
- 14dB	1	1	1	0	0
- 16dB	0	0	0	1	0
- 18dB	1	0	0	1	0
- 20dB	0	1	0	1	0
- 22dB	1	1	0	1	0
- 24dB	0	0	1	1	0
- 26dB	1	0	1	1	0
- 28dB	0	1	1	1	0
- 30dB	1	1	1	1	0
- 32dB	0	0	0	0	1
- 34dB	1	0	0	0	1
- 36dB	0	1	0	0	1
- 38dB	1	1	0	0	1
- 40dB	0	0	1	0	1
- 44dB	1	0	1	0	1
- 48dB	0	1	1	0	1
- 52dB	1	1	1	0	1
- 56dB	0	0	0	1	1
- 60dB	1	0	0	1	1
- 64dB	0	1	0	1	1
- 68dB	1	1	0	1	1
- 72dB	0	0	1	1	1
- 76dB	1	0	1	1	1
- 80dB	0	1	1	1	1
-	1	1	1	1	1

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

MITSUBISHI SOUND PROCESSORS

M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER


ELECTRICAL CHARACTERISTICS

(Ta=25°C, AVDD=7.0V, AVSS=-7.0V, DVDD=5.0V, f=1kHz, TRIMMER/MASTER VOLUME=0dB, Post Amp.gain=0dB, unless otherwise noted.)

(1) Power supply characteristics

Parameter	Symbol	Test condition	Limits			Unit
			MIN	TYP	MAX	
Analog positive circuit current	A _{Idd}	AVDD=7.0V, AVSS= -7.0V Current at pin 42 No signal	—	30	40	mA
Analog negative circuit current	A _{Iss}	AVDD=7.0V, AVSS= -7.0V Current at pin 25 No signal	-40	-30	—	mA
Digital circuit current	D _{Idd}	DVDD= 5V Current at pin 18 No signal	—	0.1	1.0	mA

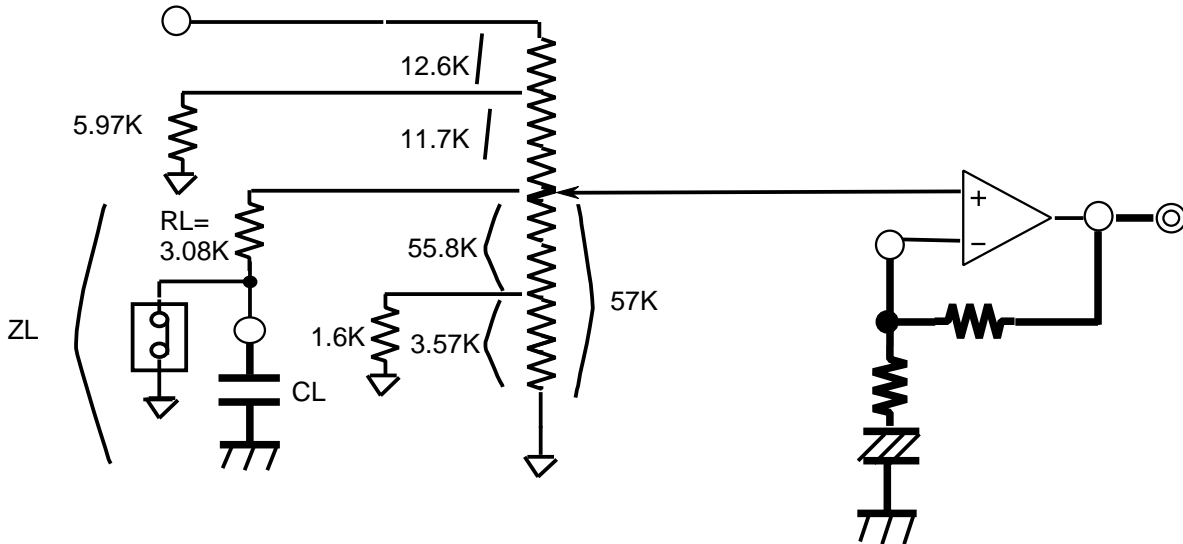
(2) Input / Output characteristics

Parameter	Symbol	Test condition	Limits			Unit
			MIN	TYP	MAX	
Maximum output voltage	V _{omax}	6,13,35,26pin OUTPUT RL=10K ,THD=1%	3.0	4.0	—	V _{rms}
Pass gain	G _v	V _{in} =1V _{rms} ,FLAT, 1,8,41,32pin INPUT 6,13,35,26pin OUTPUT	-2.0	0	2.0	dB
Distortion	THD	6,13,35,26pin OUTPUT V _i =0.2V _{rms} ,RL=10K , BW=400 to 30kHz	—	0.003	0.05	%
Output noise voltage	V _{no0}	6,13,35,26pin OUTPUT No signal,JIS-A R _g =0 ,VOL=0dB	—	3.0	15	μV _{rms}
	V _{no}	6,13,35,26pin OUTPUT No signal,JIS-A R _g =0 ,VOL=-	—	2.5	7.5	μV _{rms}
Maximum attenuation	ATT _{max}	6,13,35,26pin OUTPUT JIS-A R _g =1k ,TRIMMER VOL=0dB	-86	-95	—	dB
Volume gain between channels	D _{VOL}	6,13,35,26pin OUTPUT	-1.5	0	1.5	dB
Crosstalk between channels	CT	V _o =0.5V _{rms} ,RL=10K ,JIS-A R _g =1k	—	-97	-60	dB
Bass boost gain	G _{vbb}	V _o =0.5V _{rms} ,f=100Hz TRIMMER VOL=0dB,MASTER VOL=-26dB Bass boost=OFF  41,32pin INPUT 35,26pin OUTPUT	7	11	15	dB
OUTPUT PORT "H" current	I _{OH}	VOH=6.5V,AVDD=7V	1.0	—	—	mA
OUTPUT PORT "H" voltage	VOH	I _{OH} =3mA,AVDD=7V	5.5	—	—	V

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

FUNCTION DESCRIPTION

Bass Boost Equivalent Circuit



Bass Boost loudness Equivalent Circuit (Center Twp Type)

Regard " $RL + \frac{1}{wCL}$ " as "ZL"

Next formula show the frequency characteristic.

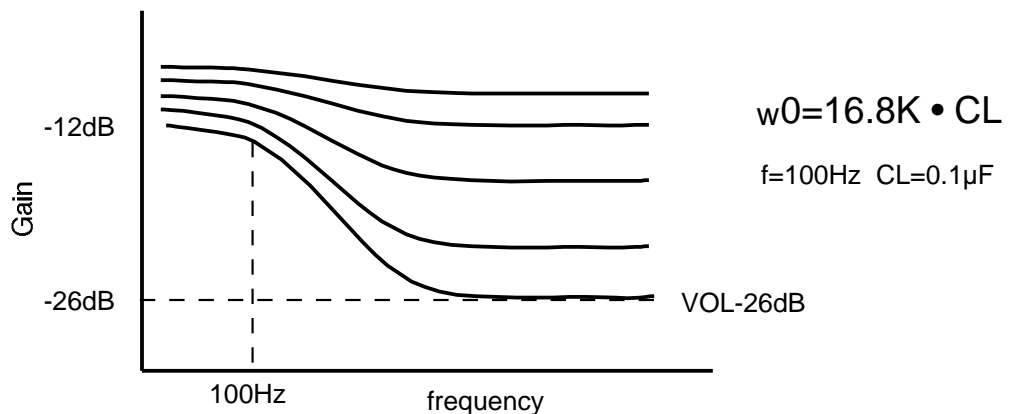
$$Gv = 20 \text{ Log} \left(\frac{ZL // 57K}{11.7K + ZL // 57K} \cdot \frac{5.97K // (11.7K + ZL // 57K)}{12.6K + 5.97K // (11.7K + ZL // 57K)} \right)$$

When a frequency is enough low ,

$$Gv = 20 \text{ Log} \left(\frac{57K}{11.7K + 57K} \cdot \frac{5.97K // (11.7K + 57K)}{12.6K + 5.97K // (11.7K + 57K)} \right) = -11.9\text{dB}$$

When a frequency is enough high ,

$$Gv = 20 \text{ Log} \left(\frac{3.08K // 57K}{11.7K + 3.08K // 57K} \cdot \frac{5.97K // (11.7K + 3.08K // 57K)}{12.6K + 5.97K // (11.7K + 3.08K // 57K)} \right) = -26\text{dB}$$



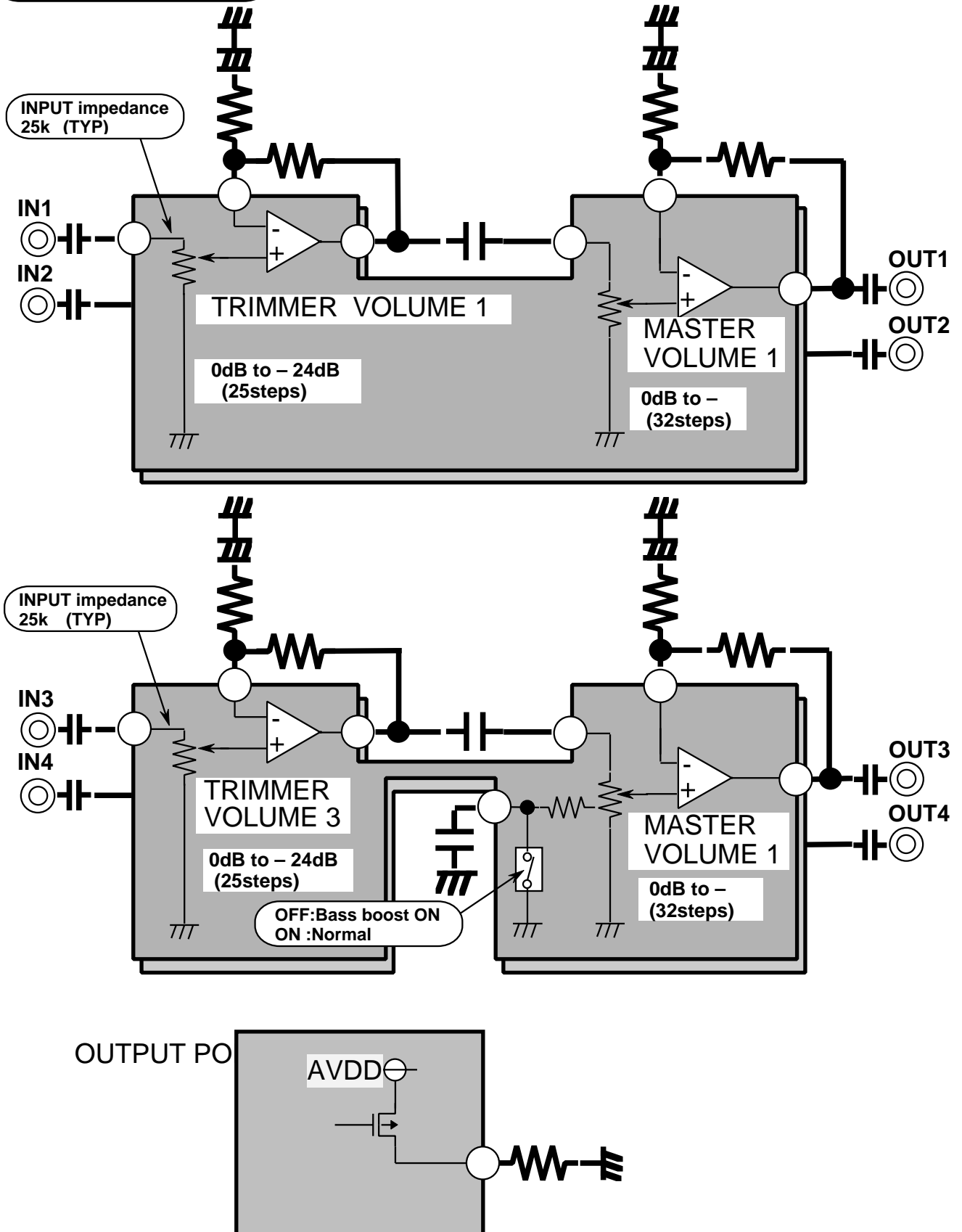
PRELIMINARY
 Notice ; This is not a final specification.
 some parametric limits are subject to change.

MITSUBISHI SOUND PROCESSORS

M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER

SYSTEM DIAGRAM



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

MITSUBISHI SOUND PROCESSORS

M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER

APPLICATION EXAMPLE

