

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

# M62444FP

4CH ELECTRIC VOLUME WITH TRIMMER

## DESCRIPTION

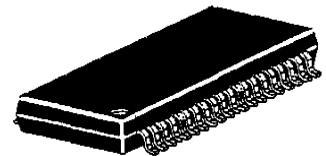
The M62444FP is 4 channels electric volume with trimmer controlled 3-wire serial data.

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

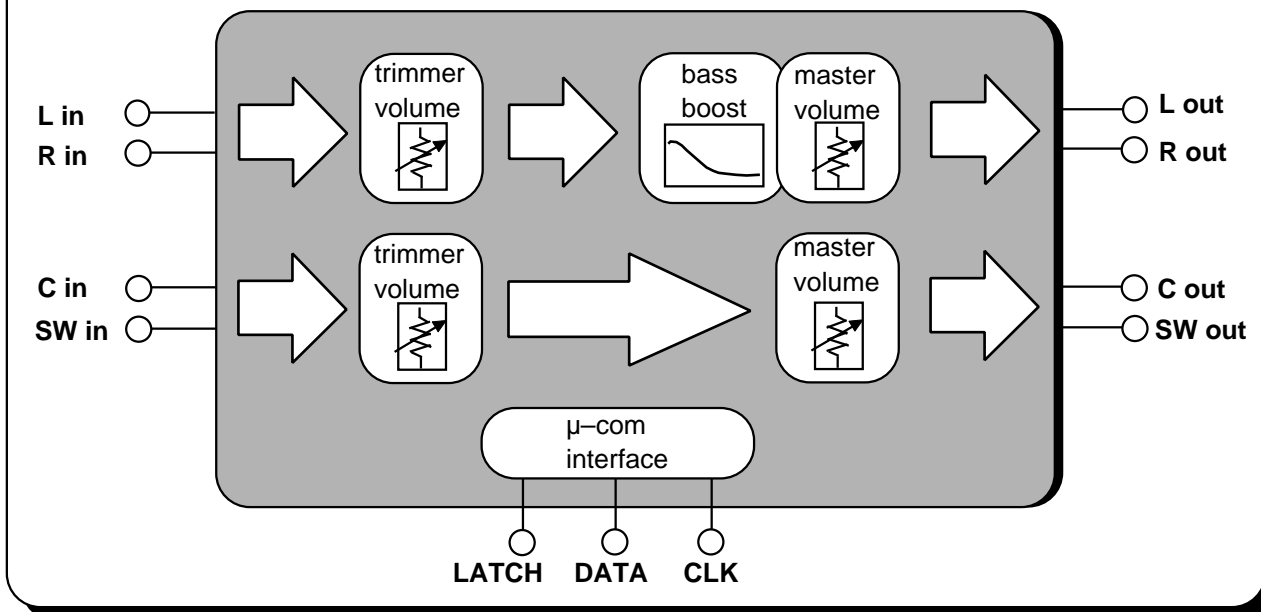
## APPLICATION

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



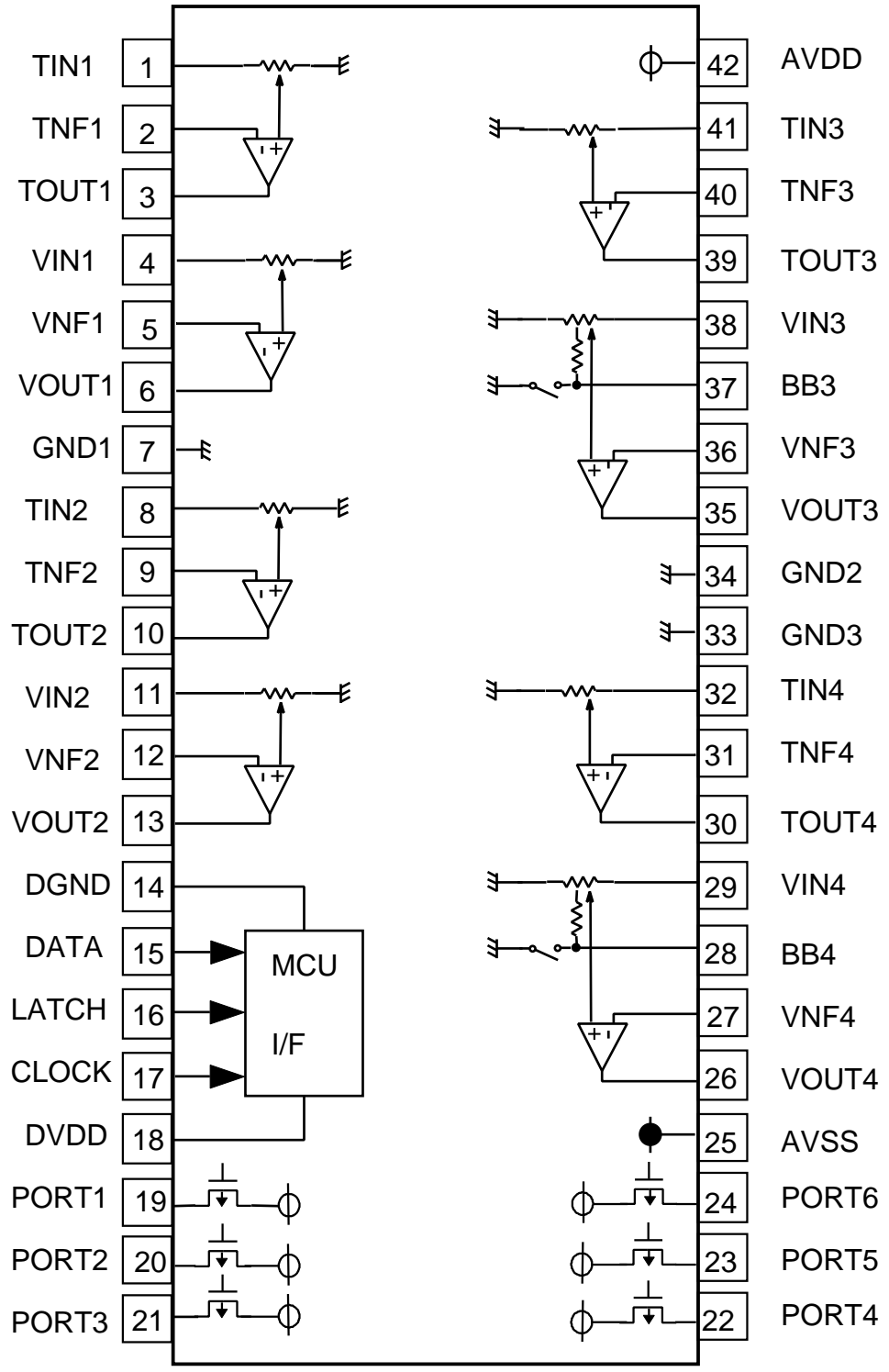
**PRELIMINARY**  
 Notice ; This is not a final specification.  
 some parametric limits are subject to change.

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

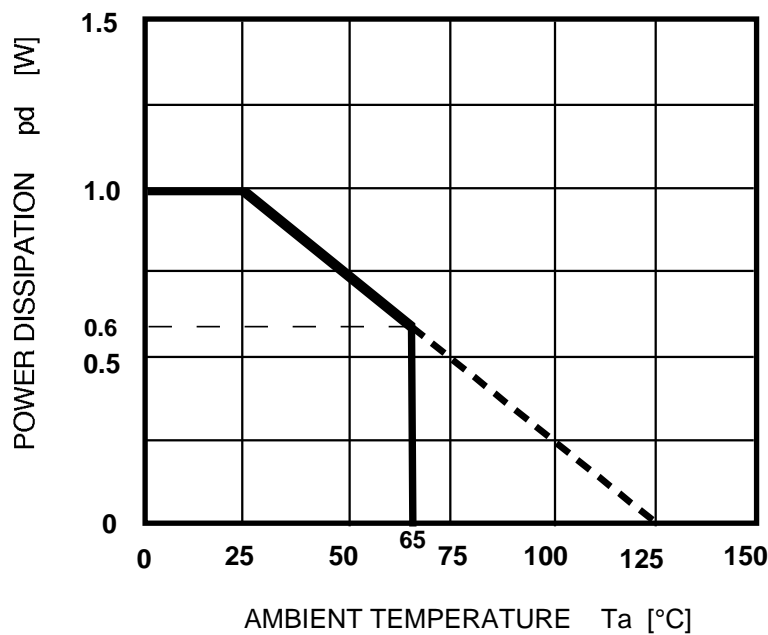
**M62444FP**

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.

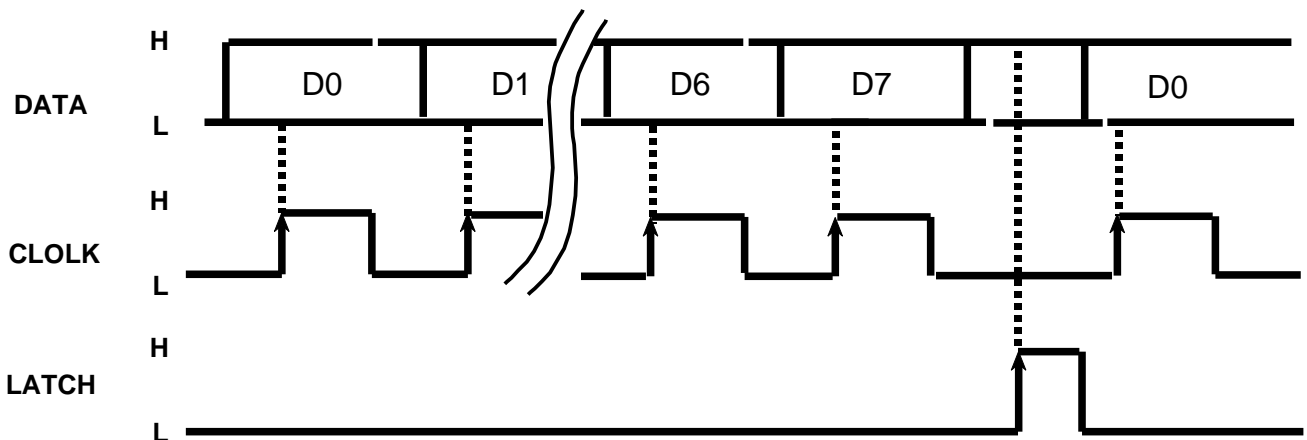
**RECOMMENDED OPERATING CONDITION**

( 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)**

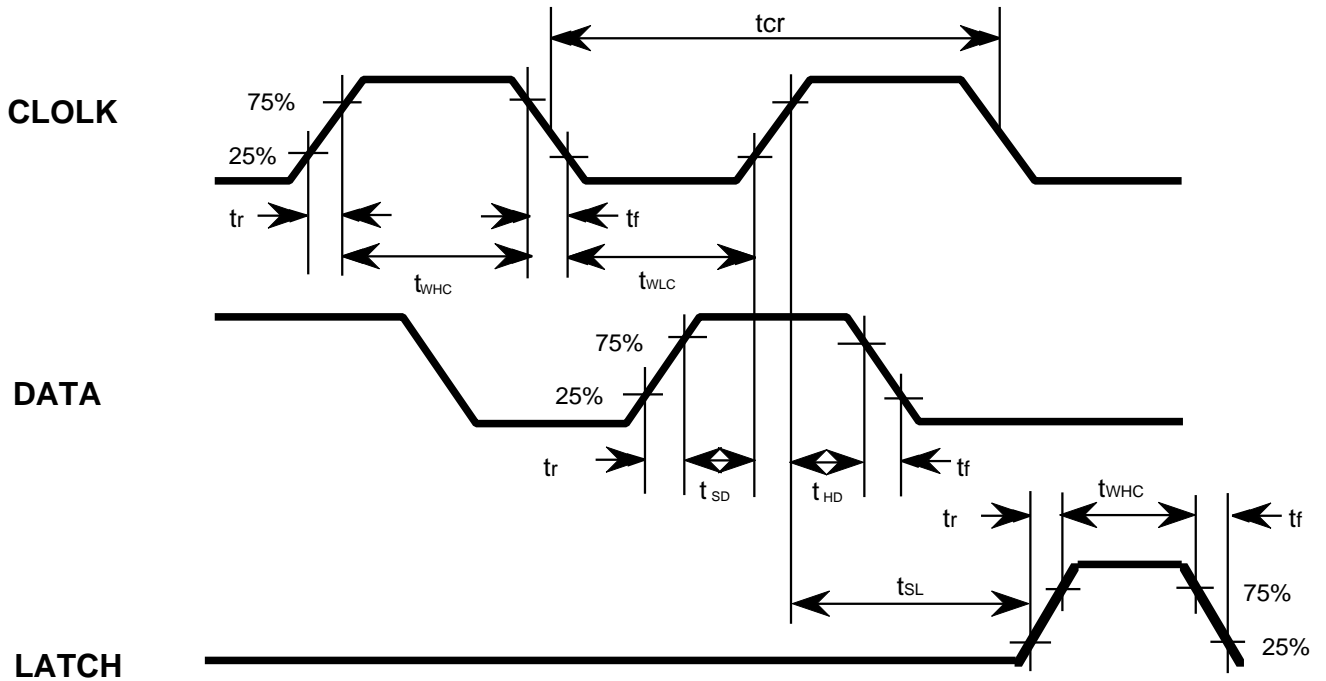


note : CLOCK and LATCH function at raising edges of pulse .

**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	-	-	$\mu s$
$t_{whc}$	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.


**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 <sub>Idd</sub>	AVDD=7.0V, AVSS= -7.0V Current at pin 42 No signal	—	30	40	mA
Analog negative circuit current	A <sub>Iss</sub>	AVDD=7.0V, AVSS= -7.0V Current at pin 25 No signal	-40	-30	—	mA
Digital circuit current	D <sub>Idd</sub>	DVDD= 5V Current at pin 18 No signal	—	0.1	1.0	mA

(2) Input / Output characteristics

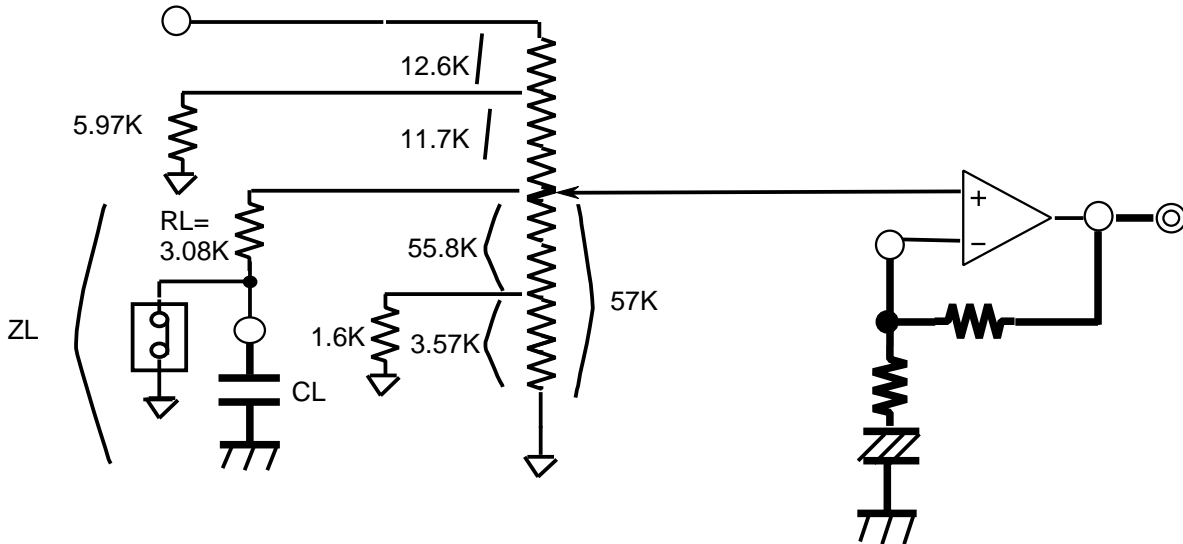
Parameter	Symbol	Test condition	Limits			Unit
			MIN	TYP	MAX	
Maximum output voltage	V <sub>omax</sub>	6,13,35,26pin OUTPUT RL=10K ,THD=1%	3.0	4.0	—	V <sub>rms</sub>
Pass gain	G <sub>v</sub>	V <sub>in</sub> =1V <sub>rms</sub> ,FLAT, 1,8,41,32pin INPUT 6,13,35,26pin OUTPUT	-2.0	0	2.0	dB
Distortion	THD	6,13,35,26pin OUTPUT V <sub>i</sub> =0.2V <sub>rms</sub> ,RL=10K , BW=400 to 30kHz	—	0.003	0.05	%
Output noise voltage	V <sub>no0</sub>	6,13,35,26pin OUTPUT No signal,JIS-A R <sub>g</sub> =0 ,VOL=0dB	—	3.0	15	μV <sub>rms</sub>
	V <sub>no</sub>	6,13,35,26pin OUTPUT No signal,JIS-A R <sub>g</sub> =0 ,VOL=-	—	2.5	7.5	μV <sub>rms</sub>
Maximum attenuation	ATT <sub>max</sub>	6,13,35,26pin OUTPUT JIS-A R <sub>g</sub> =1k ,TRIMMER VOL=0dB	-86	-95	—	dB
Volume gain between channels	DVOL	6,13,35,26pin OUTPUT	-1.5	0	1.5	dB
Crosstalk between channels	CT	V <sub>o</sub> =0.5V <sub>rms</sub> ,RL=10K ,JIS-A R <sub>g</sub> =1k	—	-97	-60	dB
Bass boost gain	G <sub>vbb</sub>	V <sub>o</sub> =0.5V <sub>rms</sub> ,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	IOH	VOH=6.5V,AVDD=7V	1.0	—	—	mA
OUTPUT PORT "H" voltage	VOH	IOH=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 Tup Type)

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

Next formula show the frequency characteristic.

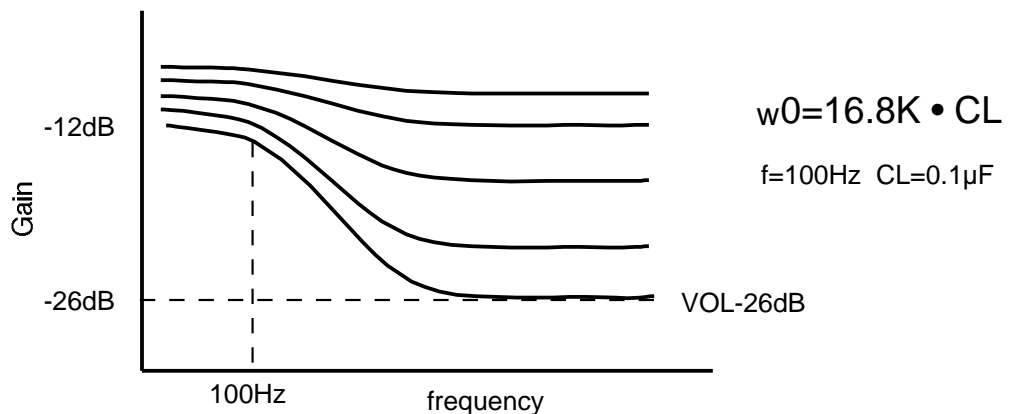
$$Gv = 20 \text{ Log} \left( \frac{ZL // 57K}{11.7K + ZL // 57K} \cdot \frac{5.97K // (11.7K + ZL // 57K)}{12.6K + 5.97K // (11.7K + ZL // 57K)} \right)$$

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 ,

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



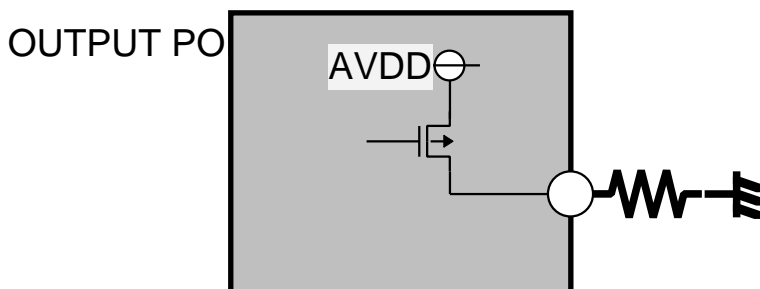
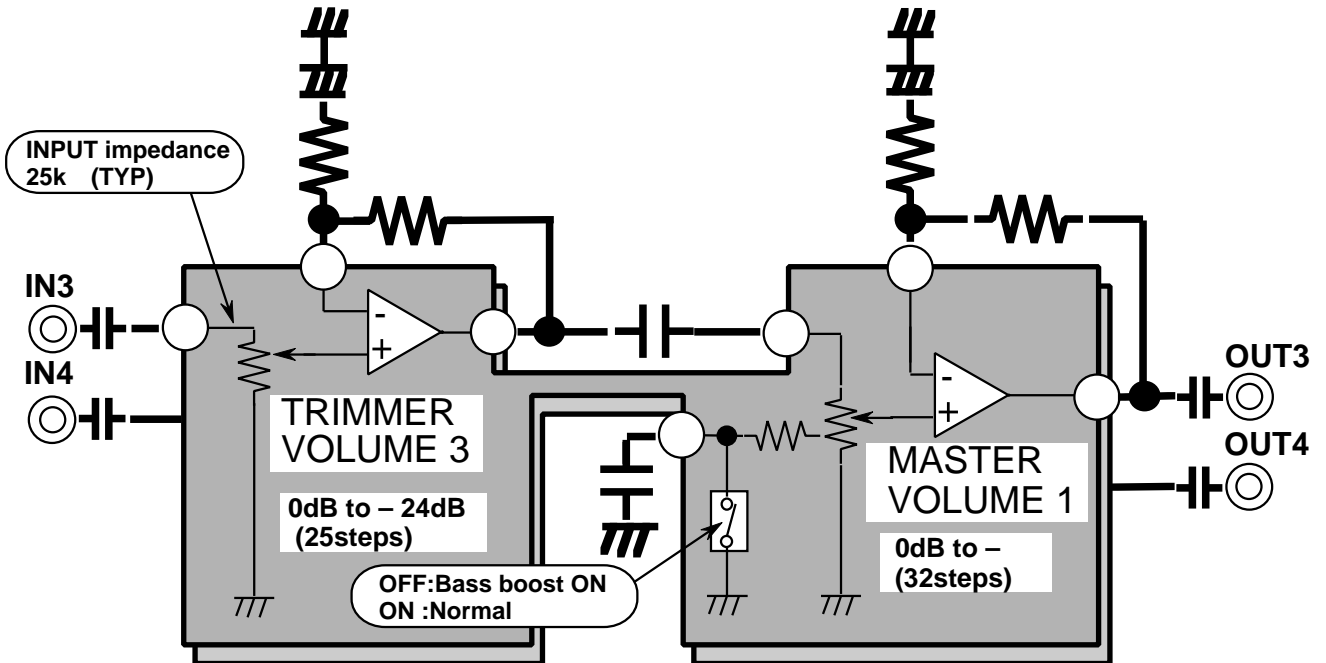
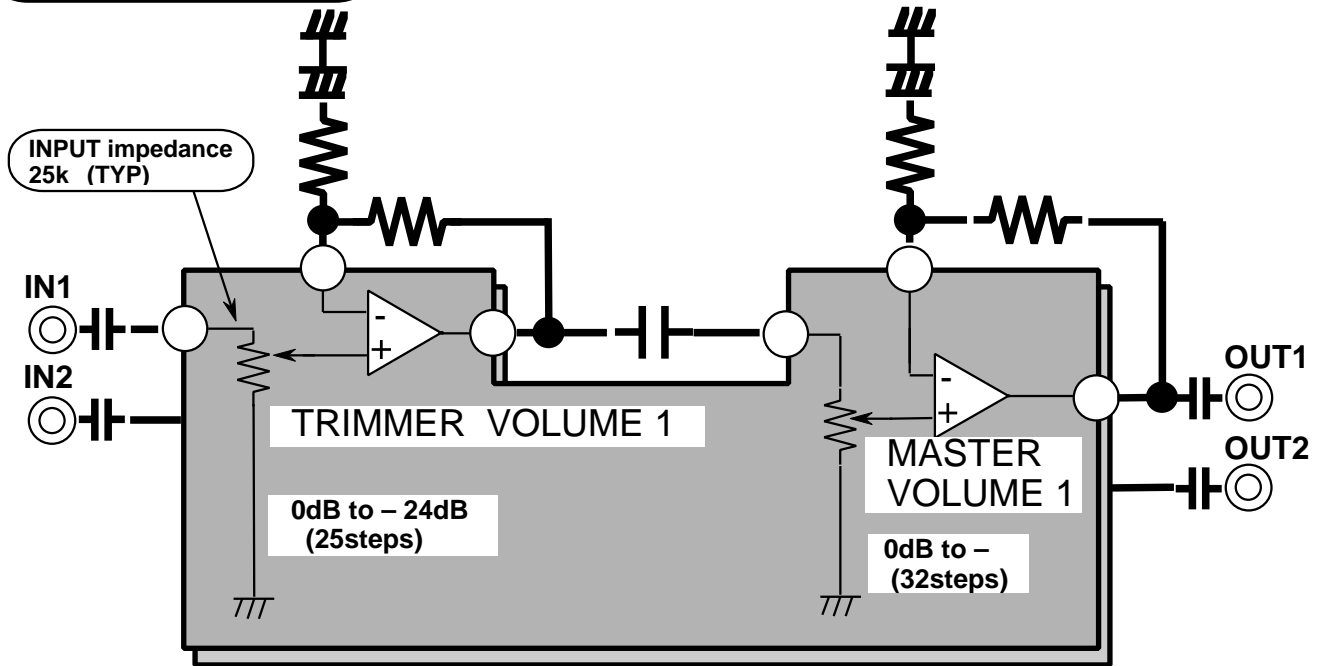
**PRELIMINARY**  
 Notice ; This is not a final specification.  
 some parametric limits are subject to change.

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

