Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

SRS ((O))
everything else is only stereo™

F((●))CUS™
BY SRS LABS

MITSUBISHI ELECTRIC

M62437FP

SOUND CONTROLLER WITH
SRS FOCUS & SRS SURROUND

SRS F(●)cus, SRS 3D Stereo Sound Controller

DESCRIPTION

● This is an IC for car audio.
● F(●)cus system can realize more optimal speaker position.

FEATURE

● Built-in F(●)cus [LF/HF elevation(position) and
  Bass Compensation can be changed by the external resisters.]
● Built-in SR
● SRS ON/OFF mode and FOCUS ON/OFF mode
 can be controlled by the DC voltage.

42P2R

RECOMMENDED OPERATING CONDITION

Supply voltage range••••Vcc=7 ~ 9V
Rated supply voltage••••Vcc=8V

SYSTEM BLOCK DIAGRAM

RENESAS
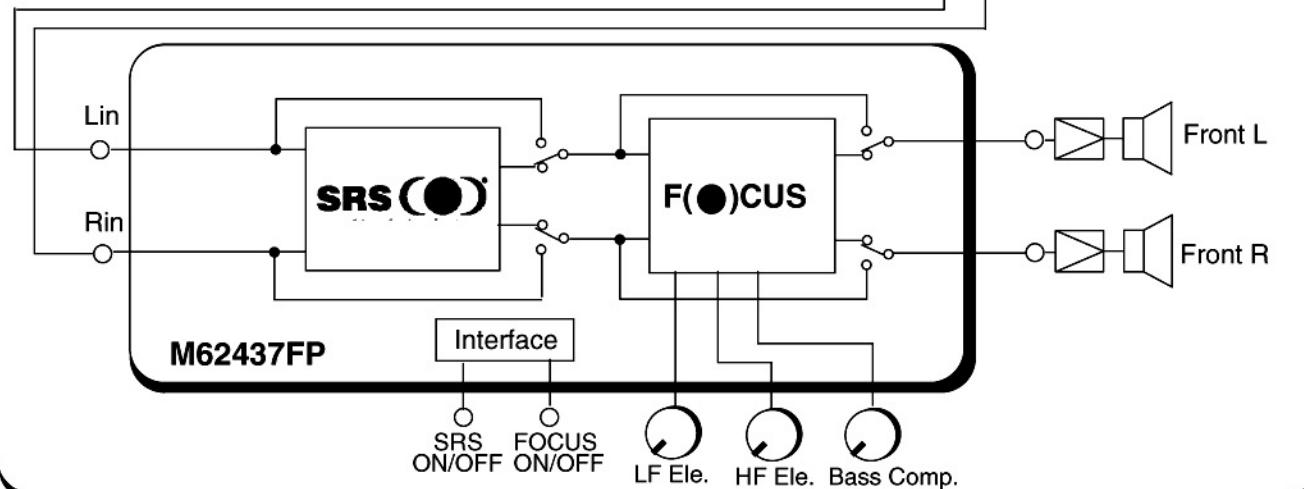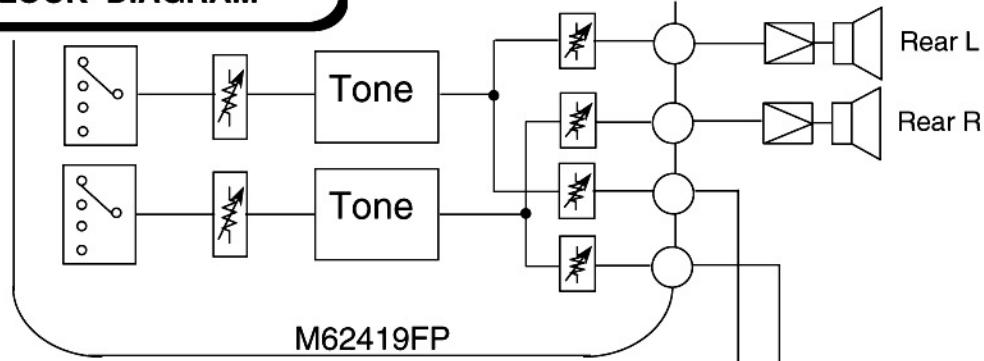
Block Diagram & Application Example
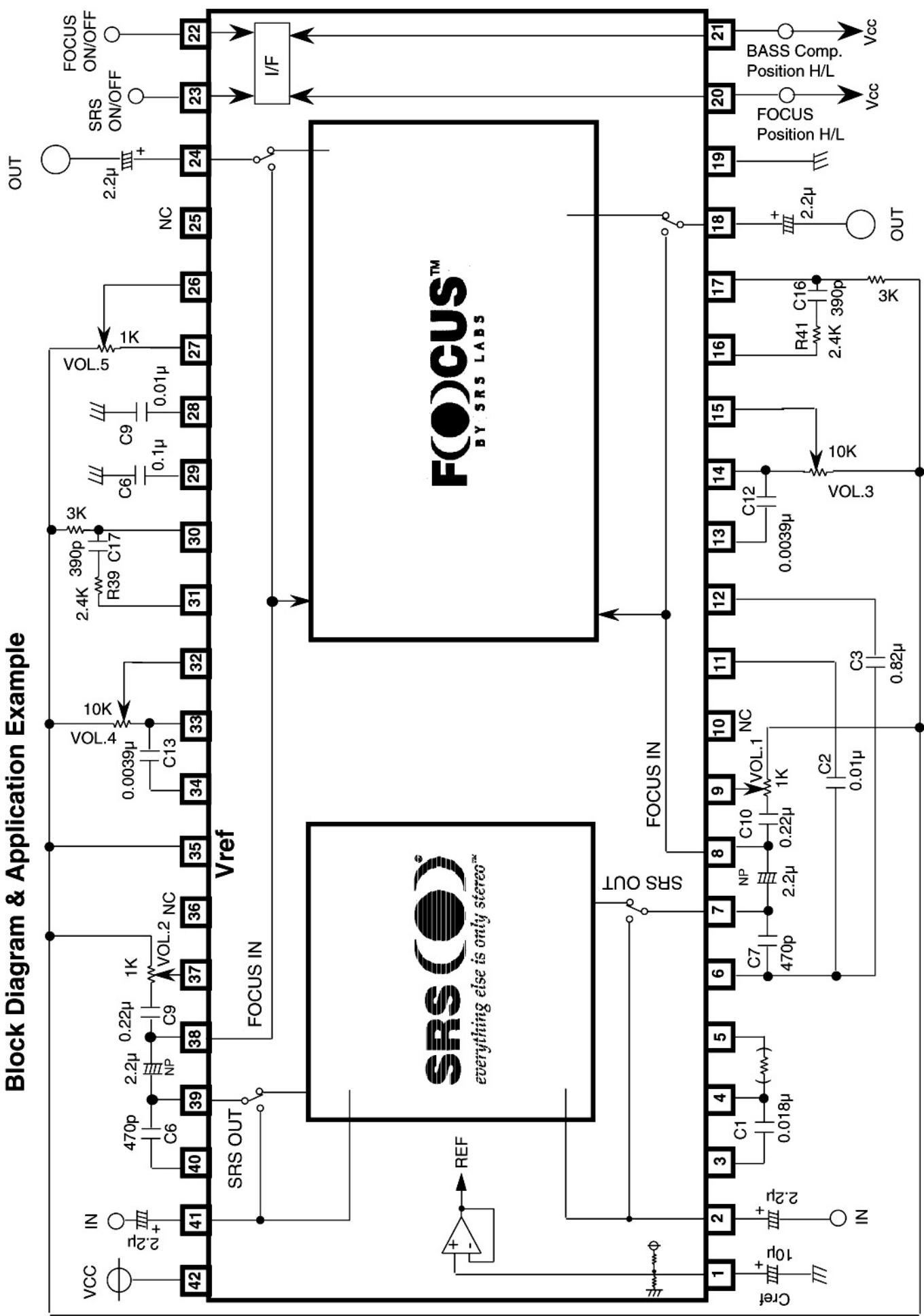
Symbol	Parameter	Conditions	Ratings	Unit
Vcc,Vdd	Supply Voltage		12	V
Pd	Power Dissipation	Ta≤25	990	mW
K$_\Theta$	Thermal Derating	Ta>25	9.9	mW/°C
Topr	Operating Temperature		-20 ~ +75	°C
Tstg	Storage Temperature		-55 ~ + 125	°C

Thermal Derating
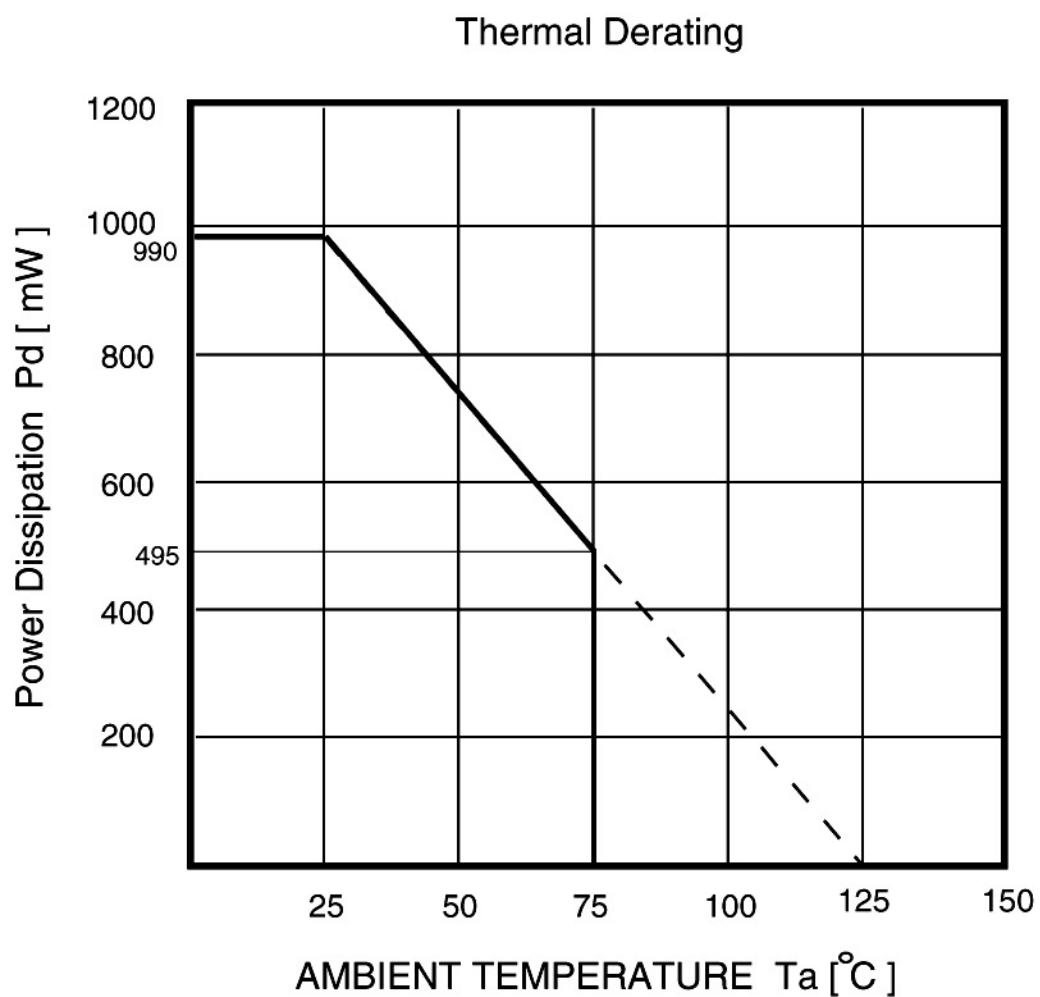
(1) Power Supply Characteristics (Ta=25°C,Vcc=8.0V, f=1kHz)

Parameter	Symbol	Conditions	Limit			Unit
			Min	typ	Max	
Circuit Current	Icc	42pin Icc No Signal	—	25	45	mA

(2) Input / Output Characteristics

$\left(\begin{array}{l}\text{Ta=25°C,Vcc=8.0V, f=1kHz}\\ \text{VOL.1,2=1K}\Omega\text{(VOL),VOL.3,4=10K}\Omega\text{(VOL)}\\ \text{VOL.5=1K}\Omega\text{(VOL)}\end{array}\right)$

Parameter	Symbol	Conditions		Limit			Unit
				Min	typ	Max	
Maximum Output Voltage	VOMt	Input; pin2,41 Output; pin18, 24 RL =10KΩ,THD=1%		1.6	1.9	-	Vrms
Maximum Input Voltage	VIM1	Input; pin2,41 /Output; pin18, 24 SRS➔ON,FOCUS➔OFF THD=1%	f=150Hz	0.4	0.6	-	Vrms
	VIM2	Input; pin2,41 /Output; pin18, 24 SRS➔ON	f=1KHz	0.2	0.3	-	
	VIM3	FOCUS➔ON(All VOL.=max) THD=1%	f=20KHz	0.06	0.11	-	
Pass Gain	Gvt	Vi=100mVrms SRS, Focus➔OFF Input; pin2,41 /Output; pin18, 24		-2.0	0	2.0	dB
	Gv1	Vi=100mVrms Input; pin2,41 /Output; pin18, 24 SRS➔ON,FOCUS➔OFF	f=150Hz	7	10	13	
	Gv2	Vi=100mVrms SRS➔ON	f=1KHz	15	18	21	
	Gv3	FOCUS➔ON(All VOL.=max) (2pin,41pin)-(18, 24Pin)	f=20KHz	25	28	31	
Output Noise Voltage	Vno1	Rg=0(2,41pin) SRS➔OFF ,FOCUS➔OFF DIN-AUDIO filter		-	5.5	15	μVrms
	Vno2	Rg=0(2,41pin) SRS➔ON ,FOCUS➔OFF DIN-AUDIO filter		-	18	50	
	Vno3	Rg=0(2,41pin), SRS➔ON, FOCUS➔ON(All VOL.=nax) DIN-AUDIO filter		-	90	150	
Channel Separation	CT	Input Side:f=1KHz,Vi=0.5Vrms Monitor Side:Rg=0, IHF-A filter Focus:OFF, SRS:OFF RL=10KΩ		-	-90	-75	dB

(3) DC Control Characteristic of the Switch Block

Symbol	Parameter	Condition	Limit			Unit
			Min	typ	Max	
V_{IH}	"H" Level Input Voltage	Pin 22,23	2.1	~	Vcc	V
V_{IL}	"L" Level Input Voltage	Pin 22,23	0	~	0.8	V

Switch Condition and the Mode

㉓SRS 3D Stereo	SRS ON/OFF Switch
SRS ON	H
SRS OFF	L

㉒ FOCUS	FOCUS ON/OFF Switch
FOCUS ON	H
FOCUS OFF	L

*Bypass mode can be set by both SRS ON/OFF switch and FOCUS ON/OFF switch are set to "L".

[For Exsample]The other Application Circuit

● R16(R13),R17(R14),R18(R15)

The resisters of R16(R13),R17(R14),R18(R15) can be set the FOCUS position(LF Elevation).

*This figure shows only the side channel.

```
        C10
 (8)────┤├──────────┐
      0.22μ    R16 ≷
                    │
                 (9)├──────▷──── FOCUS position "H"
                    │
              R17 ≷
                    │
                (10)├──────▷──── FOCUS position "L"
                    │
              R18 ≷
                    │
                 (35)
```
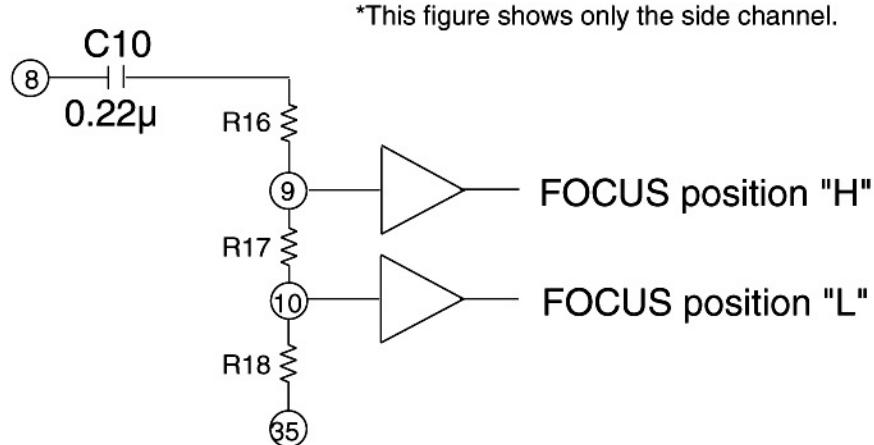
1. The setting of the FOCUS position "H"

$$\frac{R17 + R18}{R16 + R17 + R18}$$

2. The setting of the FOCUS position "L"

$$\frac{R18}{R16 + R17 + R18}$$

*please keep the following formula.
R16+R17+R18 ≒ 1KΩ

(Example) In the case of R16 = 390Ω,R17 = 200Ω,R18 = 390Ω

FOCUS position "H"≒ 60%
FOCUS position "L"≒ 40%

(SwithSetting)

	FOCUS ON/OFF Switch(22Pin)	FOCUS Position H/L Switch(20Pin)
FOCUS Position "H" (LF Elevation)	H	H
FOCUS Position "L" (LF Elevation)	H	L

● R20(R23),R21(R24)

The resisters of R20(R23),R21(R24)can be set the HF Elevation.

*This figure shows only the side channel.
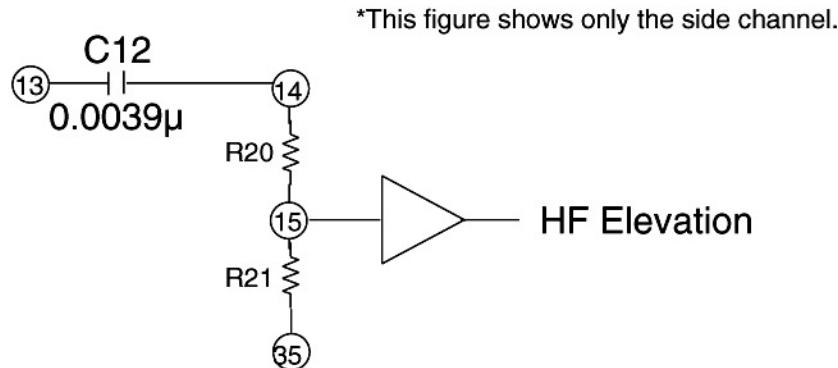
1. The setting of the HF Elevation.

$$\frac{R21}{R20+R21}$$

*please keep the following formula.
R20+R21 ≒ 10KΩ

(Example)
In the case of R20 = 3KΩ,R21 = 7KΩ

HF Elevation ≒ 70%

● R25,R26,R27

The resisters of R25,R26,R27 can be set the Bass Compensation.
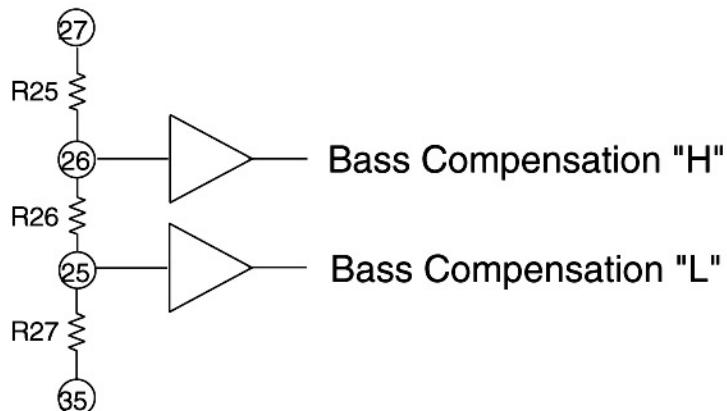
1. The setting of the Bass Compensation "H"

$$\frac{R26 + R27}{R25 + R26 + R27}$$

2. The setting of the Bass Compensation "L"

$$\frac{R27}{R25 + R26 + R27}$$

*please keep the following formula.
$$R25 + R26 + R27 \fallingdotseq 1K\Omega$$

(Example)   In the case of $R25 = 200\Omega, R26 = 390\Omega, R27 = 390\Omega$

Bass Compensation "H" $\fallingdotseq$ 80%
Bass Compensation "L" $\fallingdotseq$ 40%

(SwithSetting)

	FOCUS ON/OFF Switch(22Pin)	Bass Comp. H/L Switch(21Pin)
Bass Compensation "H"	H	H
Bass Compensation "L"	H	L

Add 10K of resistors between Pin16(31) and Pin17(30), can adjust the difference between the sound level of Focus ON and the sound level of Focus OFF.
Also add 10K of resistors between Pin16(31) and Pin17(30),can decrease the Focus gain.
Then the maximum input voltage and the output noise voltage can be improved.

(Reference)

In the case of $\left(\begin{array}{l}\text{VOL.1,2=1K}\Omega\text{,VOL.3,4=10K}\Omega\text{,VOL.5=1K}\Omega \\ \text{Add 10K}\Omega \text{ of resistors between Pin16(31) and Pin17(30)}\end{array}\right)$

| Parameter	Symbol	Conditions		Typ.	Unit
Maximum Output Voltage	VOMt	Input; pin2,41 Output; pin18, 24 RL =10KΩ,THD=1%		1.9	Vrms
Maximum Input Voltage	VIM1	Input; pin2,41 /Output; pin18, 24 SRS ➔ ON,FOCUS ➔ OFF THD=1%	f=150Hz	0.6	Vrms
	VIM2	Input; pin2,41 /Output; pin18, 24 SRS➔ ON	f=1KHz	0.55	
	VIM3	FOCUS ➔ ON(All VOL.=max) THD=1%	f=20KHz	0.2	
Pass Gain	Gvt	Vi=100mVrms SRS, Focus ➔OFF Input; pin2,41 /Output; pin18, 24		0	dB
	Gv1	Vi=100mVrms Input; pin2,41 /Output; pin18, 24 SRS ➔ ON,FOCUS ➔ OFF	f=150Hz	10	
	Gv2	Vi=100mVrms SRS➔ ON	f=1KHz	12	
	Gv3	FOCUS ➔ ON(All VOL.=max) (2pin,41pin)-(18, 24Pin)	f=20KHz	22	
Output Noise Voltage	Vno1	Rg=0(2,41pin) SRS ➔OFF ,FOCUS ➔OFF DIN-AUDIO filter		5.5	μVrms
	Vno2	Rg=0(2,41pin) SRS➔ ON ,FOCUS ➔OFF DIN-AUDIO filter		18	
	Vno3	Rg=0(2,41pin), SRS➔ ON, FOCUS ➔ ON(All VOL.=max) DIN-AUDIO filter		50	
Channel Separation	CT	Input Side:f=1KHz,Vi=0.5Vrms Monitor Side:Rg=0, IHF-A filter Focus:OFF, SRS:OFF RL=10KΩ		-90	dB

System Circuit Example

(The following figures show only the side channel.)

1. In the case of SRS 3D stereo is effective for the front speakers.
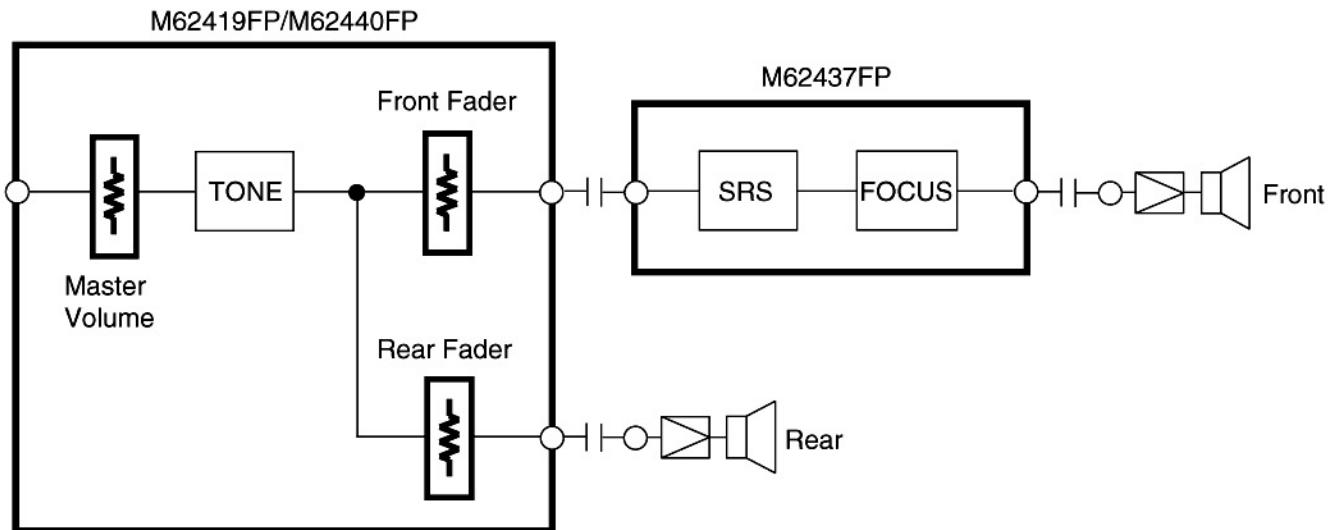
2. In the case of SRS 3D stereo is effective for the front and rear speakers.
   (FOCUS is effective for the front speakers.)