

To all our customers

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

M61518FP

AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

DESCRIPTION

The M61518FP is an audio signal processor suitable for the mini component system with the cassette tape. The circuit includes Selector for selecting input source, REC/Play back amp., Tone control and 2ch Electronic Volume.

FEATURES

- Input Selector
Built-in 3Input selector + Tape Input
- Play Back Amp.
Built-in Low noise P.B Amp
- REC Amp.
Built-in Low noise REC Amp (Mute function built-in)
- Tone Control
Bass/Mid/Treble -10 to +10dB/2dBstep
- Electronic Volume with high voltage transistor
0 to -86dB, $-\infty$ dB
(Input Vol : 0 to -70dB, $-\infty$ dB)
(Output Vol : +18 to +2dB)



Outline 36P2R-D
0.8mm Pitch SSOP
(8.4mm × 15.0mm × 2.0mm)

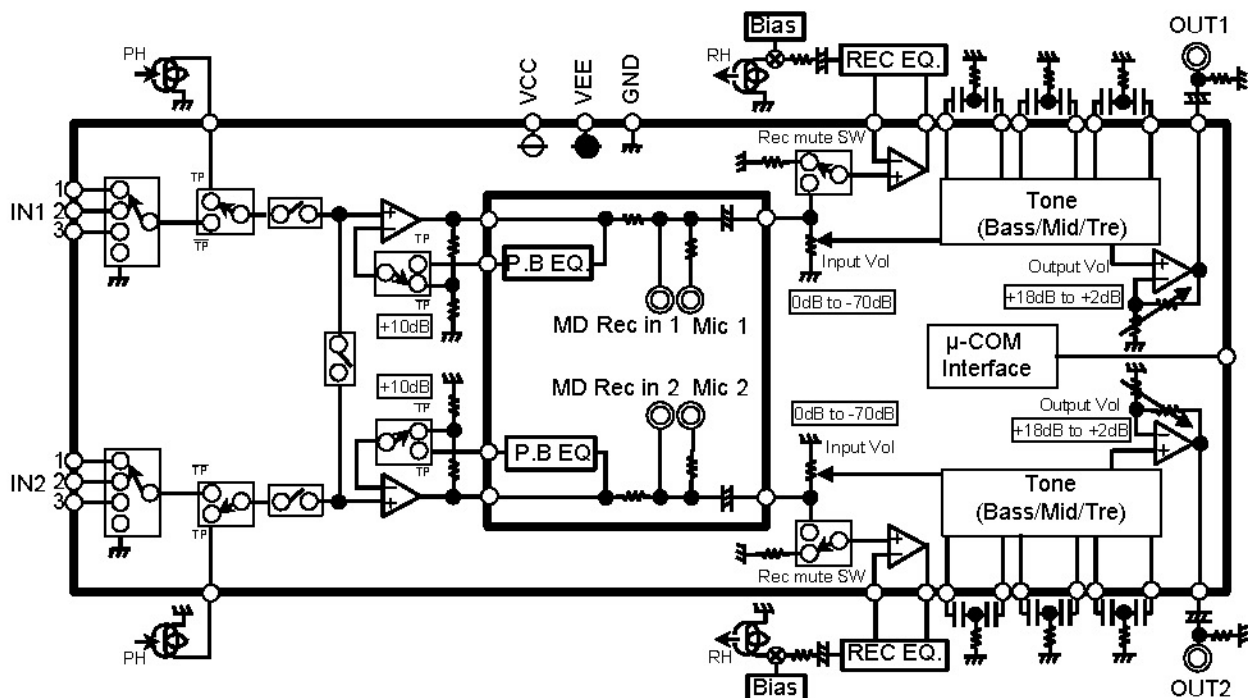
APPLICATION

Mini Stereo, Receiver, etc.

RECOMMENDED OPERATING CONDITIONS

Recommended supply voltage..... VCC=4.5V(typ) , VEE=-4.5V(typ)

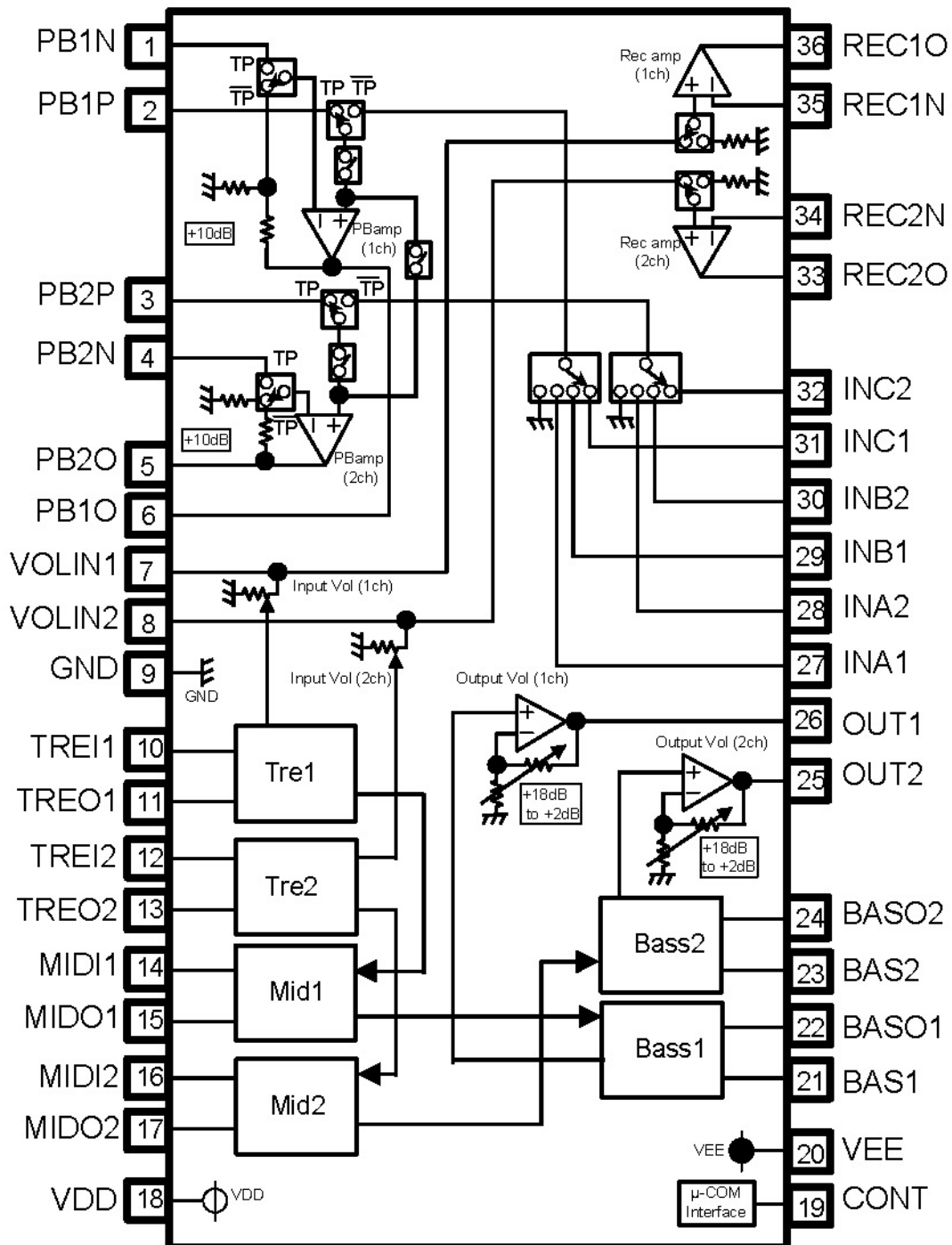
SYSTEM BLOCK DIAGRAM



M61518FP

AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

BLOCK DIAGRAM AND PIN CONFIGURATION(TOP VIEW)



M61518FP**AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER****PIN DESCRIPTION**

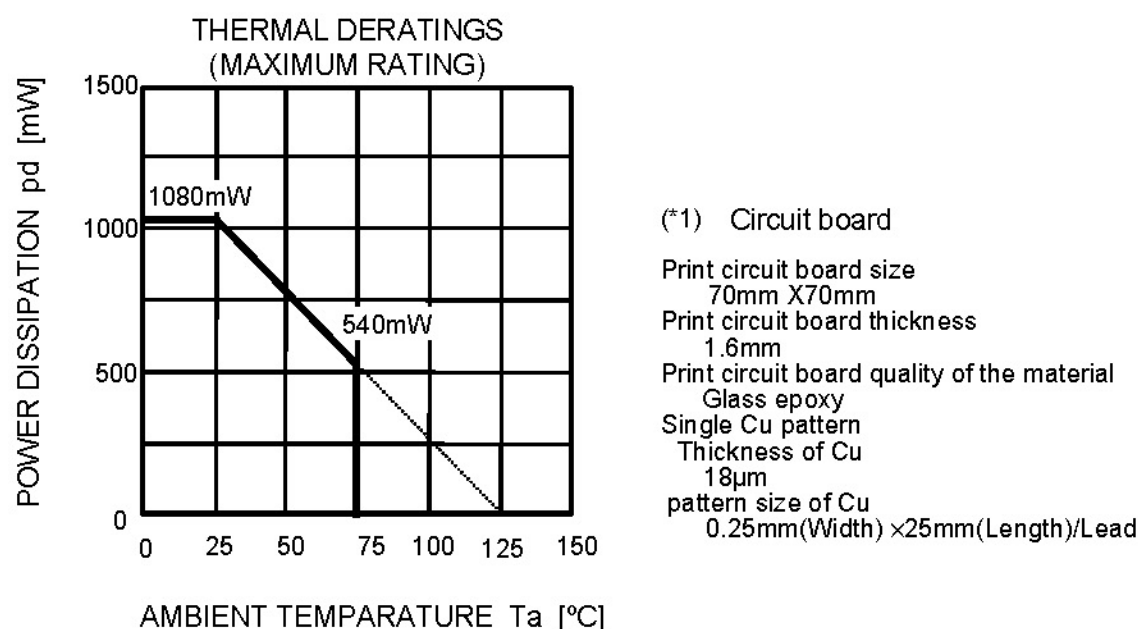
PIN No.	Name	Function
1,4	PB1N,PB2N	Input pin of PB amp(Negative)
2,3	PB1P,PB2P	Input pin of PB amp(Positive)
5,6	PB1O,PB2O	Output PIN of PB amp
7,8	VOLIN1, VOLIN2	Input PIN of volume
9	GND	GND PIN
10,11,12,13	TREI,TREO	Frequency setting pin in the tone control(Tre)
14,15,16,17	MIDI,MIDO	Frequency setting pin in the tone control(Mid)
18	VDD	Positive power supply
19	CONT	Microcomputer data Input PIN
20	VEE	Negative supply PIN
21,22,23,24	BASI,BASO	Frequency setting pin in the tone control(Bass)
25,26	OUT1, OUT2	Output PIN
27,28	INA1, INA2	Selector A Input PIN
29,30	INB1, INB2	Selector B Input PIN
31,32	INC1, INC2	Selector C Input PIN
33,34	REC1O, REC2O	Output PIN of REC amp
35,36	REC1N, REC2N	Input PIN of REC amp

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AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

ABSOLUTE MAXIMUM RATINGS

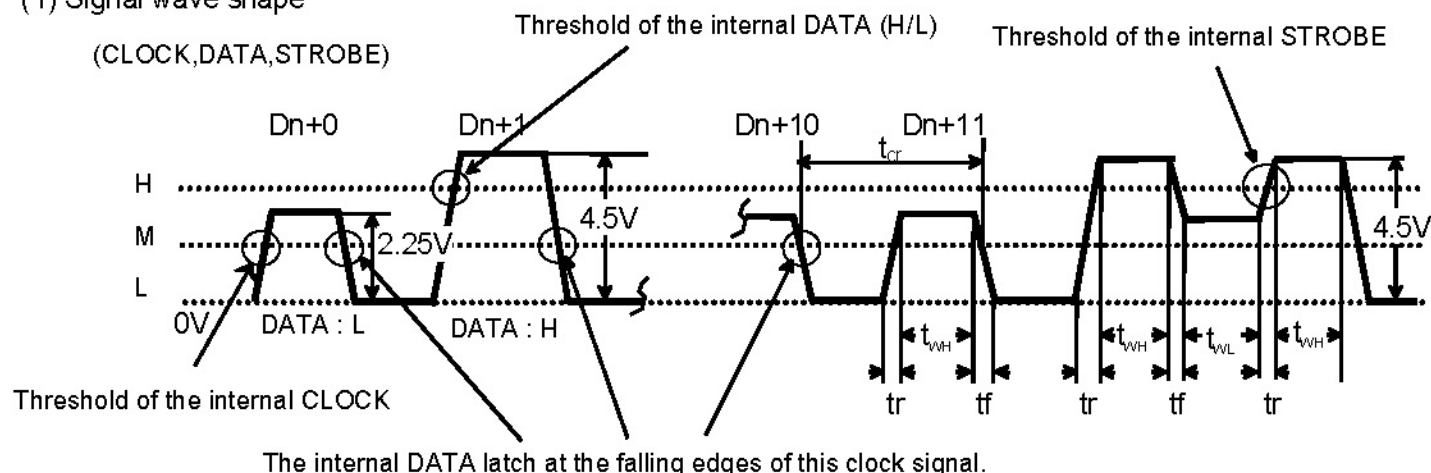
Symbol	Parameter	Condition	Ratings	Unit
VDD-VEE	Plus and minus power supply difference		+10.5	V
Pd	Power dissipation	Ta≤25°C	1080	mW
K	Thermal derating	Ta>25°C (*1) Circuit board	10.8	mW/°C
Topr	Operating temperature		-20 to +75	°C
Tstg	Storage temperature		-40 to +125	°C



RECOMMENDED OPERATING CONDITIONS

(Ta=25°C unless otherwise noted)

Parameter	Symbol	Condition	Range			Unit
			MIN	TYP	MAX	
Positive supply voltage	VDD		4.25	4.5	4.75	V
Negative supply voltage	VEE		-4.75	-4.5	-4.25	V

AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER
SERIAL DATA CONTROL FORMAT
(1) Signal wave shape

(2) Control signal voltage regulation

Digital signal		Condition	Limits			Unit
			MIN	TYP	MAX	
L signal	L	VDD=4.5V, VEE=-4.5V	GND	—	0.2×VDD	V
M signal	M	VDD=4.5V, VEE=-4.5V	0.3×VDD	0.5×VDD	0.7×VDD	
H signal	H	VDD=4.5V, VEE=-4.5V	0.8×VDD	—	VDD	

(3) Control signal timing regulation

Symbol	Parameter	Limits			Unit
		Min	typ	Max	
t _{cr}	Cycle time of the digital signal	4	—	—	μs
t _{WH}	Pulse width of the digital signal("H"level)	1.6	—	—	
t _{WL}	Pulse width of the digital signal("L"level)	1.6	—	—	
tr	Rising time of digital signal	—	—	0.4	
tf	Falling time of digital signal	—	—	0.4	

AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

DATA CONTROL SPECIFICATION

(1) Data input address

*note1:The interval of data transmission from the micro controller is over 0.1sec.

This is waiting time for soft-switching to reduce the shock noise.

*note2:Input only the control data at slot0 (slot1).

(MSB) ←Input direction

D140	D130	D120	D110	D100	D90	D80	D70	D60	D50	D40	D30	D20	D10	D00	
Selector				Karaoke				Input volume				Output volume			0 slot0

D141	D131	D121	D111	D101	D91	D81	D71	D61	D51	D41	D31	D21	D11	D01	
Tone control Bass				Tone control Mid				Tone control Treble				REC Mute	0	1	slot1

Output volume control

	D40	D30	D20	D10
+18dB	0	0	0	0
+16dB	0	0	0	1
+14dB	0	0	1	0
+12dB	0	0	1	1
+10dB	0	1	0	0
+8dB	0	1	0	1
+6dB	0	1	1	0
+4dB	0	1	1	1
+2dB	1	0	0	0

Note:Do not input other data than the above.

Input volume control

	D90	D80	D70	D60	D50
0dB	0	0	0	0	0
-2dB	0	0	0	0	1
-4dB	0	0	0	1	0
-6dB	0	0	0	1	1
-8dB	0	0	1	0	0
-10dB	0	0	1	0	1
-12dB	0	0	1	1	0
-14dB	0	0	1	1	1
-16dB	0	1	0	0	0
-18dB	0	1	0	0	1
-20dB	0	1	0	1	0
-22dB	0	1	0	1	1
-26dB	0	1	1	0	0
-30dB	0	1	1	0	1
-34dB	0	1	1	1	0
-38dB	0	1	1	1	1
-42dB	1	0	0	0	0
-46dB	1	0	0	0	1
-50dB	1	0	0	1	0
-54dB	1	0	0	1	1
-58dB	1	0	1	0	0
-62dB	1	0	1	0	1
-66dB	1	0	1	1	0
-70dB	1	0	1	1	1
-∞dB	1	1	1	1	1

Note:Do not input other data than the above.

Karaoke control

	D110	D100
Stereo	0	0
Mono1	0	1
Mono2	1	0
Mono1+2	1	1

Initial setting

Selector control

Selector	D140	D130	D120
TP	0	0	0
IN A	0	0	1
IN C	0	1	0
IN B	0	1	1
IN mute	1	1	1
Supply OFF	1	1	0

Note:Do not input other data than the above.

REC mete control

REC MUTE	D21
OFF	0
ON	1

Tone control

Bass	D141	D131	D121	D111
Mid	D101	D91	D81	D71
Treble	D61	D51	D41	D31
+10dB	0	1	0	1
+8dB	0	1	0	0
+6dB	0	0	1	1
+4dB	0	0	1	0
+2dB	0	0	0	1
0dB	0	0	0	0
-2dB	1	0	0	1
-4dB	1	0	1	0
-6dB	1	0	1	1
-8dB	1	1	0	0
-10dB	1	1	0	1

Note:Do not input other data than the above.

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POWER OFF SETTING DATA

It's necessary to set up the Power off setting data when power off before 0.1 sec.
Power off setting data reduce the power off shock noise.

Power off setting data

(MSB) ← Input direction

D140	D130	D120	D110	D100	D90	D80	D70	D60	D50	D40	D30	D20	D10	D00	slot0
1	1	0	*		1	1	1	1	1		*			0	
Selector			Karaoke		Input volume(−∞dB)					Output volume					

Selector control

Selector	D140	D130	D120
TP	0	0	0
IN A	0	0	1
IN C	0	1	0
IN B	0	1	1
IN mute	1	1	1
Supply off	1	1	0

* Karaoke is same data before the Power off setting.

* Output volume is same data before the Power off setting.

Note:Do not input other data than the above.

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AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

ELECTRICAL CHARACTERISTICS

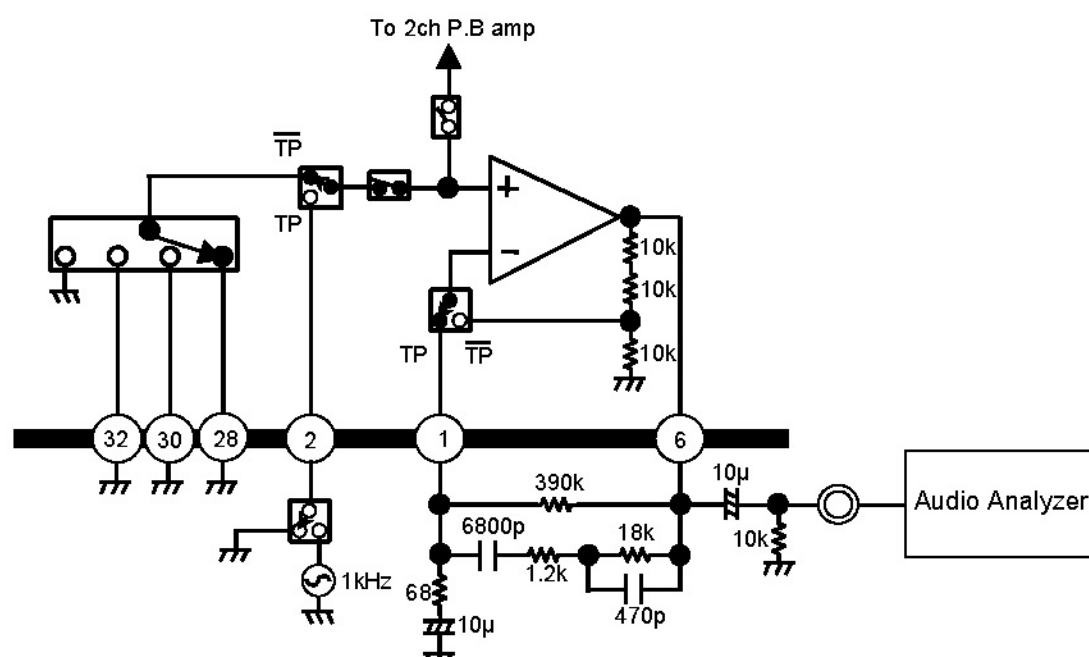
Ta=25°C, VDD=4.5V, VEE=-4.5V, f=1kHz, Vi=100mVrms, Input Vol=0dB, Output Vol=18dB, Bass=0dB, Mid=0dB, Treble=0dB, RL=10kΩ unless otherwise noted.

Parameter	Symbol	Condition	Limits			Unit
			Min	typ	Max	
Positive power current	IDD	No Input signal	—	10	20	mA
Negative power current	IEE	No Input signal	-20	-10	—	mA
Pass gain	GV1	INA/B/C(Pin27 to 32) → PBP(Pin5,6)	8	10	12	dB
	GV2	VOLIN(Pin7,8) → OUT(Pin25,26)	16	18	20	dB
Maximum output voltage	VOM1	OUT(Pin25,26), THD=1%	2.2	2.4	—	Vrms
	VOM2	RECO(Pin33,36), THD=1%	2.2	2.4	—	Vrms
	VOM3	PBO(Pin5,6), THD=1%	1.4	1.6	—	Vrms
Distortion	THD	INA/B/C(Pin27 to 32) → OUT(Pin25,26), Vo=0.5Vrms, BW=400 to 30kHz	—	0.02	0.08	%
Output noise voltage	VON1	VOLIN(Pin7,8) → OUT(Pin25,26) Input VOL=-∞dB, Output VOL=2dB, JIS-A, Rg=0Ω	—	6	15	μVrms
	VON2	VOLIN(Pin7,8) → RECO(Pin33,36) JIS-A, Rg=0Ω	—	35	70	μVrms
Input conversion noise voltage	VIN	PB1P/2P(Pin2,3) → PBO(Pin5,6), JIS-A, Rg=0Ω	—	1.0	1.9	μVrms
Channel cross talk	CT	INA/B/C(Pin27 to 32) → OUT(Pin25,26), Vo=2Vrms, JIS-A, Rg=0Ω	—	-70	-60	dB
Input impedance	Rvin	VOLIN(Pin7,8)	14	20	26	kΩ
Maximum attenuation	Volmin	VOLIN(Pin7,8) → OUT(Pin25,26), JIS-A, Input VOL=-∞dB, Output VOL=2dB, Vo=2Vrms	—	-95	-90	dB
Boost amount(Bass)	GBB	OUT(Pin25,26), Vo=0.5Vrms(Bass:0dB), Bass:10dB, f=100Hz	7	10	13	dB
Cut amount(Bass)	GBC	OUT(Pin25,26), Vo=0.5Vrms(Bass:0dB), Bass:-10dB, f=100Hz	-13	-10	-7	dB
Boost amount(Mid)	GMB	OUT(Pin25,26), Vo=0.5Vrms(Mid:0dB), Mid:10dB, f=1kHz	7	10	13	dB
Cat amount(Mid)	GMC	OUT(Pin25,26), Vo=0.5Vrms(Mid:0dB), Mid:-10dB, f=1kHz	-13	-10	-7	dB
Boost amount(Treble)	GTB	OUT(Pin25,26), Vo=0.5Vrms(Tre:0dB), Tre:10dB, f=10kHz	7	10	13	dB
Cat amount(Treble)	GTC	OUT(Pin25,26), Vo=0.5Vrms(Tre:0dB), Tre:-10dB, f=10kHz	-13	-10	-7	dB

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P.B. amp MEASUREMENT CIRCUIT FIGURE



Input conversion noise voltage

< Measurement method >

< Limits >

Typ: 1.0μVrms (JIS-A)

Max: 1.9μVrms (JIS-A)

- (1) Input signal (1kHz) to PB1P(pin2) and measure output gain of PB1O(pin6).
- (2) Measure output noise voltage of PB1O(pin6) and convert Input conversion noise voltage from output noise voltage.

Maximum output voltage

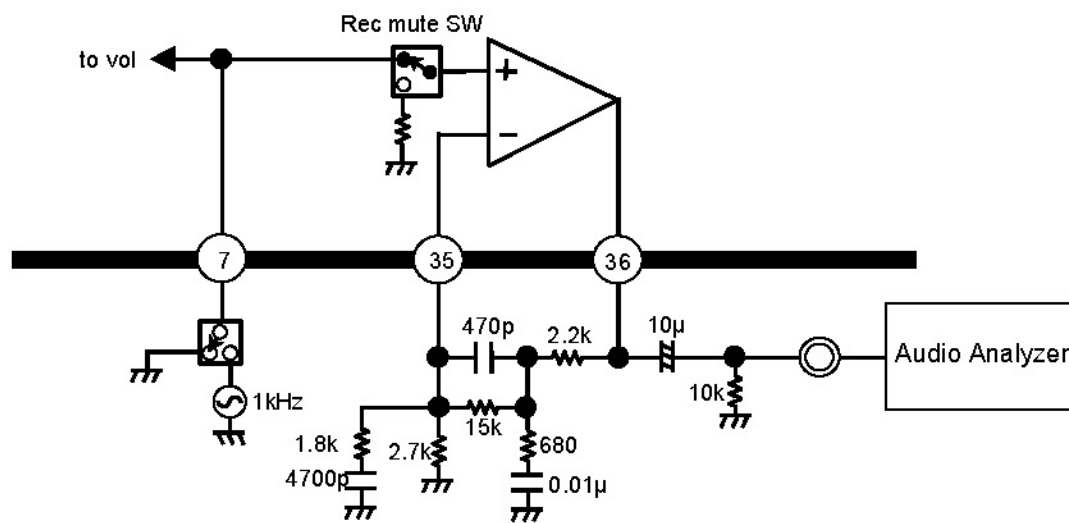
< Measurement method >

< Limits >

Min: 1.4Vrms (THD=1%)

Typ: 1.6Vrms (THD=1%)

Input signal (1kHz) to PB1P(pin2) and measure output gain of PB1O(pin6) when output THD is 1%.

AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER
Rec amp MEASUREMENT CIRCUIT FIGURE

Output noise voltage
< Limits >

Typ:35μVrms(JIS-A)
Max:70μVrms(JIS-A)

< Measurement method >

Measure output noise voltage of REC1O(pin36) when VOLIN1(pin7) is GND.

Maximum output voltage
< Limits >

Min:2.2Vrms(THD=1%)
Typ:2.4Vrms(THD=1%)

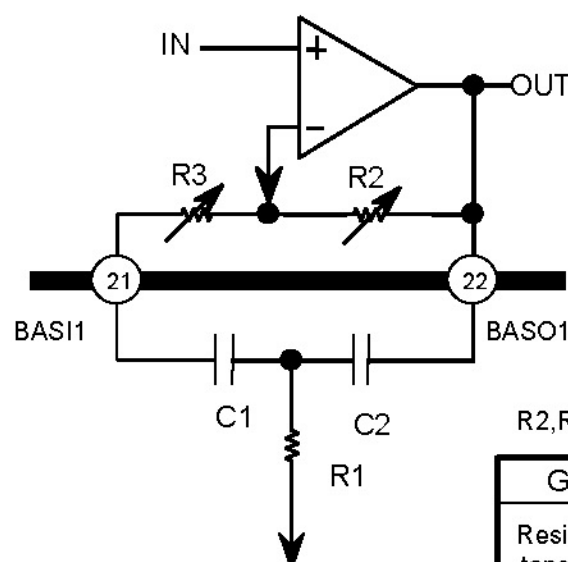
< Measurement method >

Input signal (1kHz) to VOLIN1(pin7) and measure output gain of REC1O(pin36) when output THD is 1%.

TONE CONTROL EQUIVALENT CIRCUIT

Bass, Mid, Treble Circuit composition is common

(1) Boost equivalent circuit



$$F_0 = \frac{1}{2\pi\sqrt{R_1(R_2+R_3)C_1C_2}} \quad (\text{Hz})$$

$$Q \doteq \frac{1}{C_1 + C_2} \sqrt{\frac{C_1 C_2 R_2}{R_1}}$$

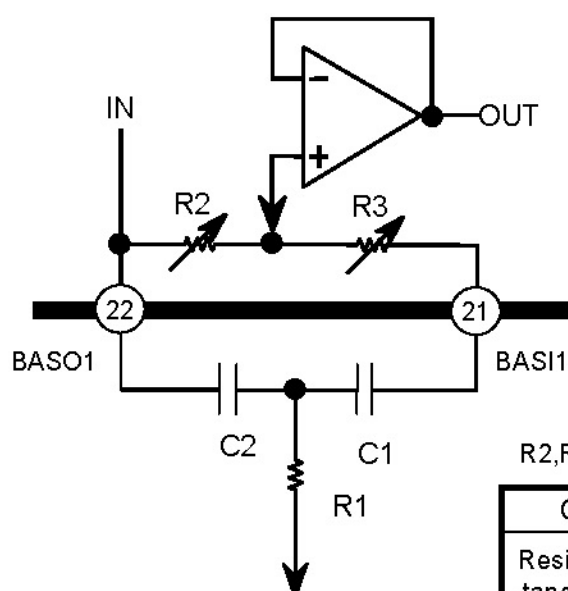
(In the case of $C1=C2$)

$$G_v = 20 \log \frac{\frac{R_2 + R_3}{R_1} + 2}{\frac{R_3}{R_1} + 2} \quad (\text{dB})$$

R2,R3 Standard value(Reference)

Gain		2dB	4dB	6dB	8dB	10dB
Resis- -tance (k Ω)	R2	10.46	18.77	25.36	30.61	34.77
	R3	26.79	18.48	11.89	6.64	2.48

(2) Cut equivalent circuit



$$F_o = \frac{1}{2\pi\sqrt{R_1(R_2+R_3)C_1C_2}} \quad (\text{Hz})$$

$$Q \doteq \frac{1}{C_1 + C_2} \sqrt{\frac{C_1 C_2 R_2}{R_1}}$$

(in the case of $C1=C2$)

$$G_v = 20 \log \frac{\frac{R_3}{R_1} + 2}{\frac{R_2 + R_3}{R_1} + 2} \quad (\text{dB})$$

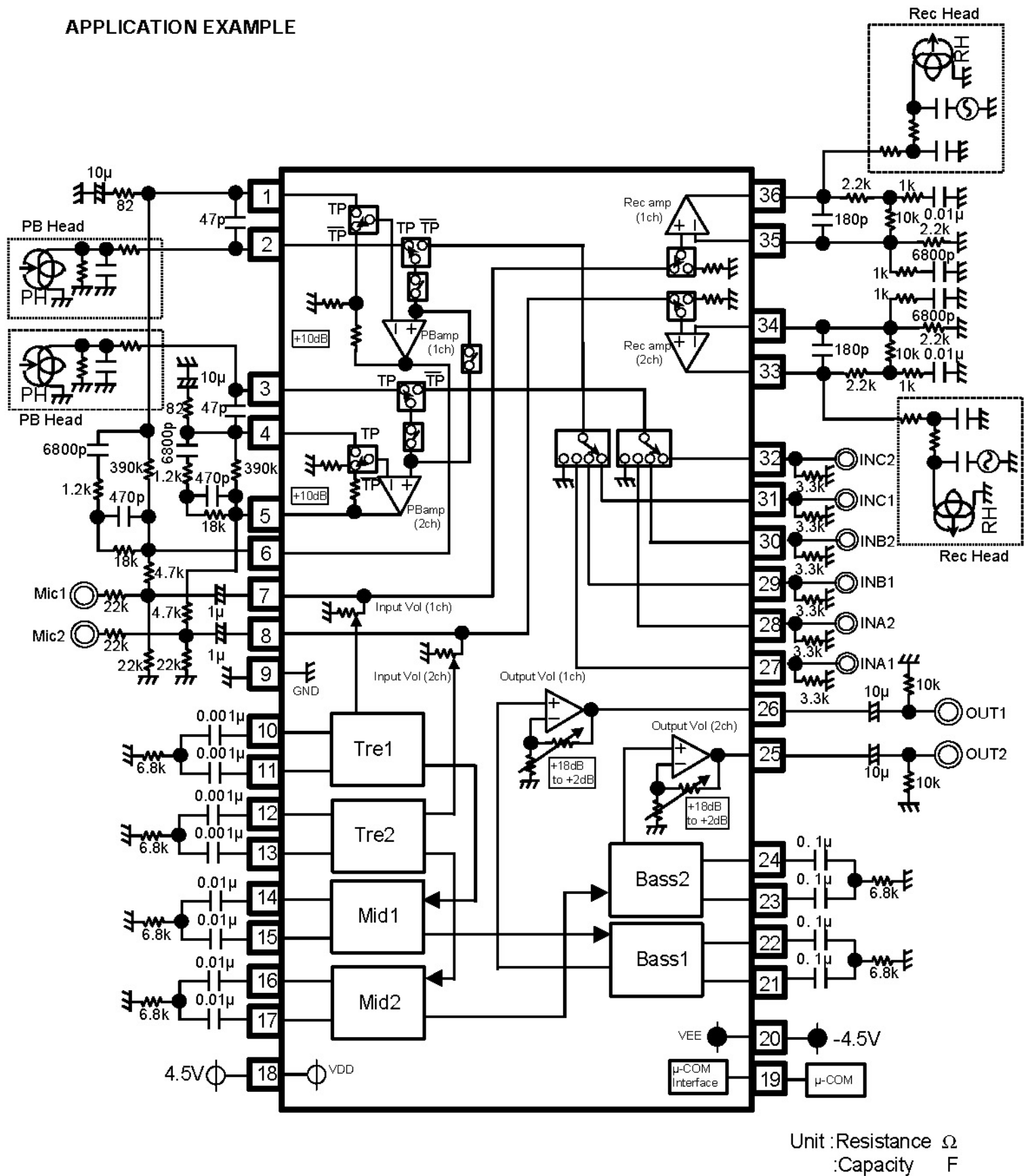
R2,R3 Standard value(Reference)

Gain		-2dB	-4dB	-6dB	-8dB	-10dB
Resis- tance	R2	10.46	18.77	25.36	30.61	34.77
(k Ω)	R3	26.79	18.48	11.89	6.64	2.48

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AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

APPLICATION EXAMPLE



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AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

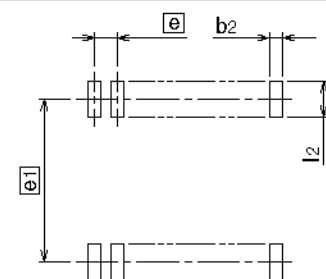
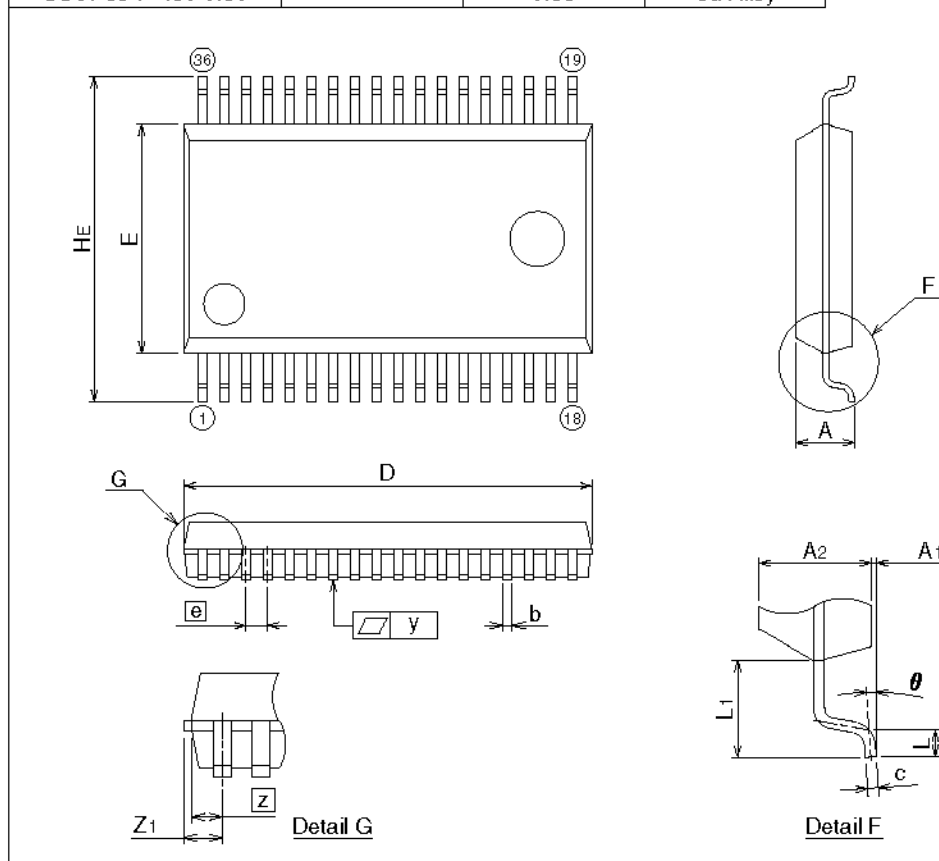
DETAILED DIAGRAM OF PACKAGE OUTLINE

36P2R-D

(MMP)

Plastic 36pin 450mil SSOP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SSOP36-P-450-0.80	—	0.53	Cu Alloy



Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	2.35
A1	0	0.1	0.2
A2	—	2.05	—
b	0.3	0.35	0.45
c	0.18	0.2	0.25
D	14.8	15.0	15.2
E	8.2	8.4	8.6
e	—	0.8	—
HE	11.63	11.93	12.23
L	0.3	0.5	0.7
L1	—	1.765	—
l2	—	0.7	—
Z1	—	—	0.85
y	—	—	0.15
θ	0°	—	8°
b2	—	0.5	—
e1	—	11.43	—
l2	1.27	—	—

AUDIO SIGNAL PROCESSOR WITH REC/PLAY BACK AMPLIFIER

Keep safety first in your circuit designs!

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