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April 1st, 2010
Renesas Electronics Corporation

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M62446AFP

6ch Electronic Volume with Tone Control

REJ03F0212-0201

Rev.2.01

Mar 31, 2008

Description

The M62446AFP is 6ch electronic volume with tone control. This IC is revised from M62446FP. The extended function of M62446AFP is volume level and tone control level. M62446AFP is easy to use more than M62446FP.

Features

- 6ch Electric volume
Volume level: 0 to -95 dB (1 dB/step)* <M62446FP: 0 to -79 dB (1 dB/step)>
- Tone control
Bass/Treble: -14 dB to +14 dB (2 dB/step)* <M62446FP: -10 dB to +10 dB (2 dB/step)>
- Noise voltage: 1.5 μ Vrms <M62446FP: 2.2 μ Vrms>
- 4 Output ports
- Bypass mode is high quality sound.

Note: * is an extended function.

Application

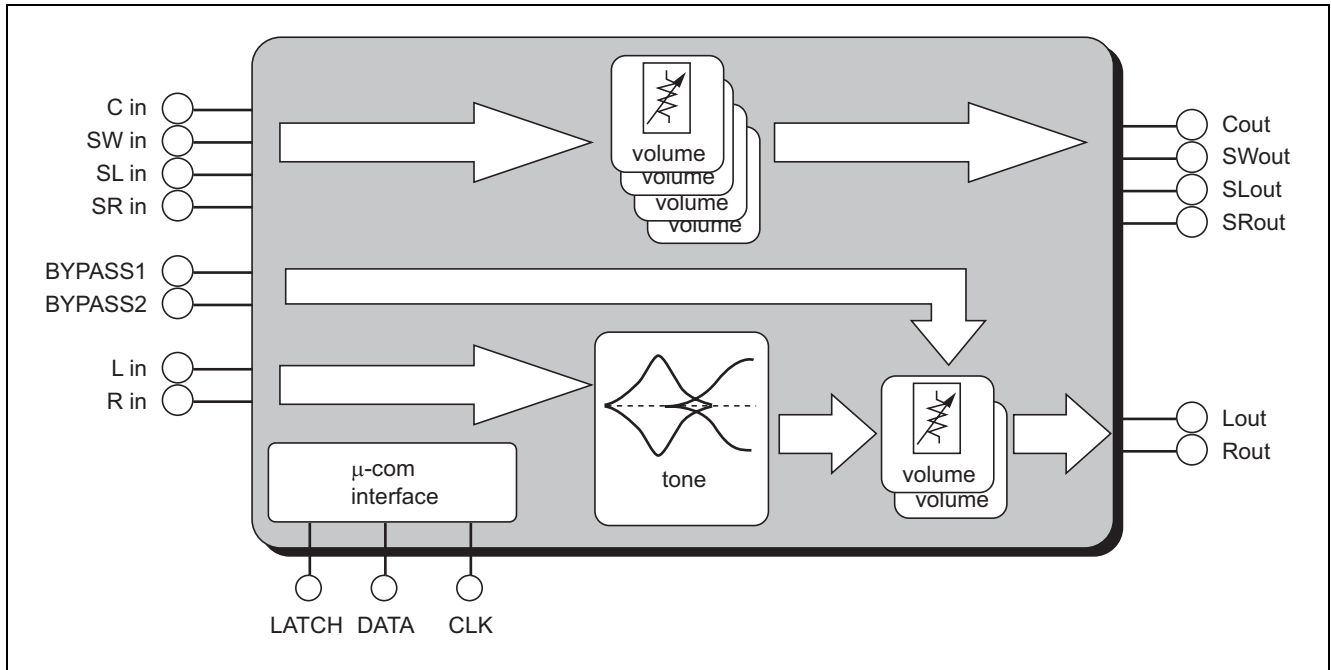
DVD, Home Audio equipment, TV

Recommended Operating Conditions

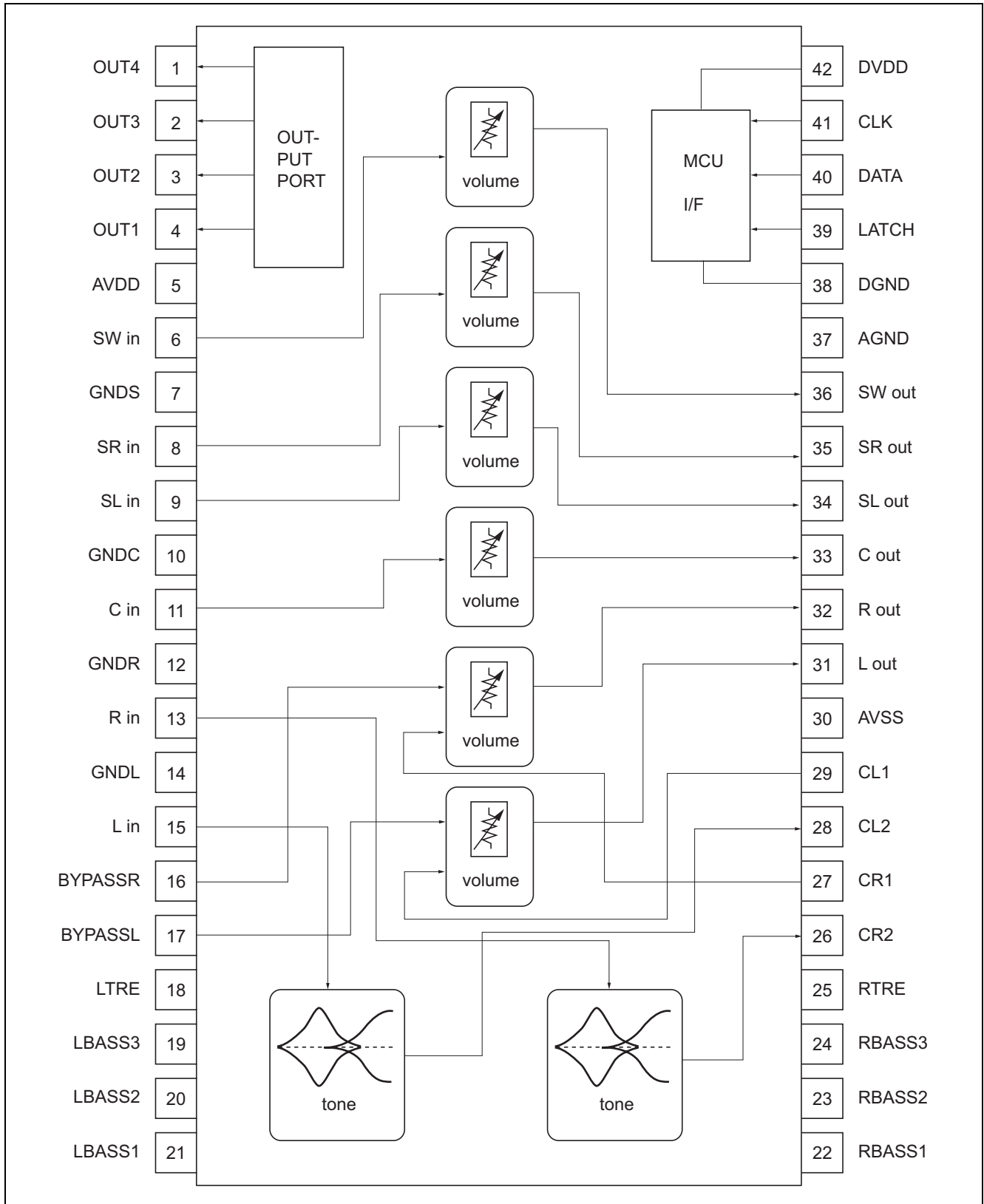
Supply voltage range: ± 4.5 to ± 7.5 V (analog), 4.5 V to 5.5 V (digital)

Recommended supply voltage: ± 7.0 V (analog), 5.0 V (digital)

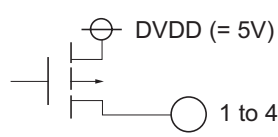
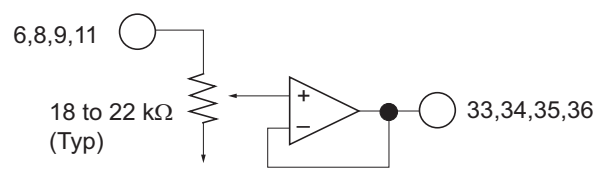
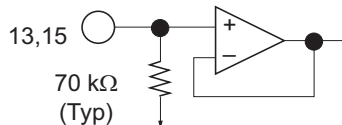
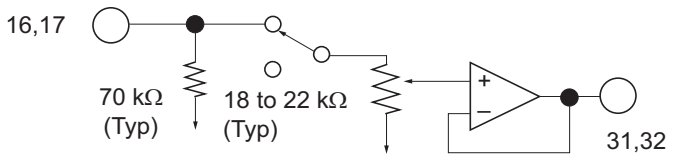
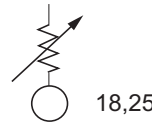
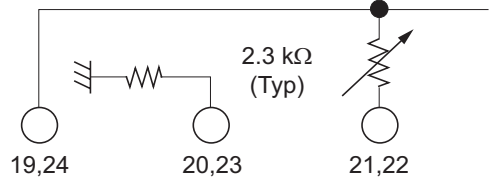
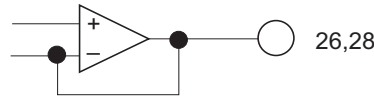
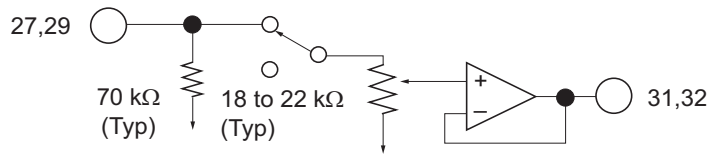
System Block Diagram

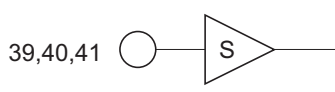


Pin Configuration and Block Diagram



Pin Description

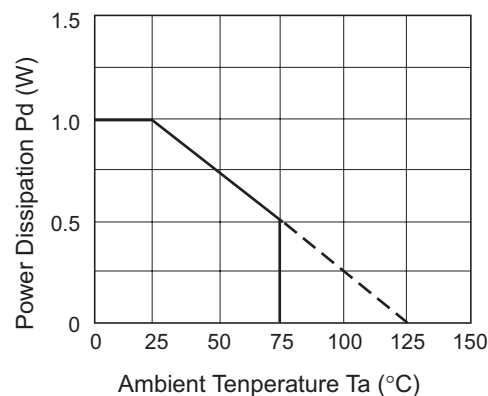
Pin No.	Symbol	Function	Circuit
1	OUT4	Port OUTPUT	OUTPUT: PMOS Transistor open drain 
2	OUT3		
3	OUT2		
4	OUT1		
5	AVDD	Analog positive power supply	+7 V
7	GNDS	GND	Connect to analog GND
10	GNDC		
12	GNDR		
14	GNDL		
6	SW in	Volume INPUT	
8	SR in		
9	SL in		
11	C in		
36	SW out	Volume OUTPUT	
35	SR out		
34	SL out		
33	C out		
13	R in	Tone INPUT	
15	L in		
16	BYPASSR	L, R volume INPUT in BYPASS mode	
17	BYPASSL		
31	L out		
32	R out		
18	LTRE	Tone treble cycle control	
25	RTRE		
19	LBASS3	Tone bass cycle control	
24	RBASS3		
20	LBASS2		
23	RBASS2		
21	LBASS1		
26	RBASS1		
22	CR2	Tone OUTPUT	
28	CL2		
27	CR1	L, R volume INPUT	
29	CL1		
31	L out		
32	R out		

Pin No.	Symbol	Function	Circuit
30	AVSS	Analog negative power supply	 39,40,41 INPUT: schmitt trigger type
37	AGND	Analog GND	
38	DGND	Digital GND	
39	LATCH	Latch INPUT	
40	DATA	Data INPUT	
41	CLK	Clock INPUT forward data	
42	DVDD	Digital power supply	+5 V

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Condition
Supply voltage	Vsupply	16	V	AVDD – AVSS
		7		DVDD – DGND
Power dissipation	Pd	1000	mW	Ta ≤ 25 °C
Thermal derating	Kθ	10	mW/°C	Ta > 25 °C
Operating temperature	Topr	–20 to +75	°C	
Storage temperature	Tstg	–40 to +125	°C	

Thermal Derating (Maximum Rating)
(with the standard board)



*Standard board

- board size 70 mm × 70 mm
- board thickness 1.6 mm
- board material glass epoxy
- copper pattern
 - copper thickness 18 μm
 - copper size 0.25 mm (wide) 30 mm (length/lead)

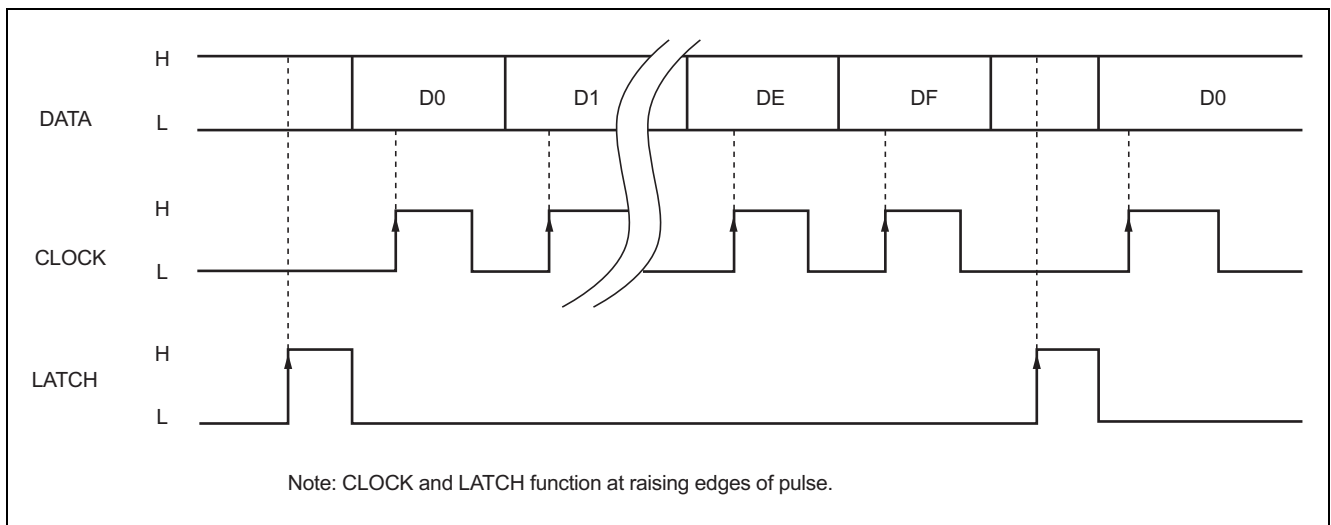
Recommended Operating Condition

(Ta = 25°C, unless otherwise noted)

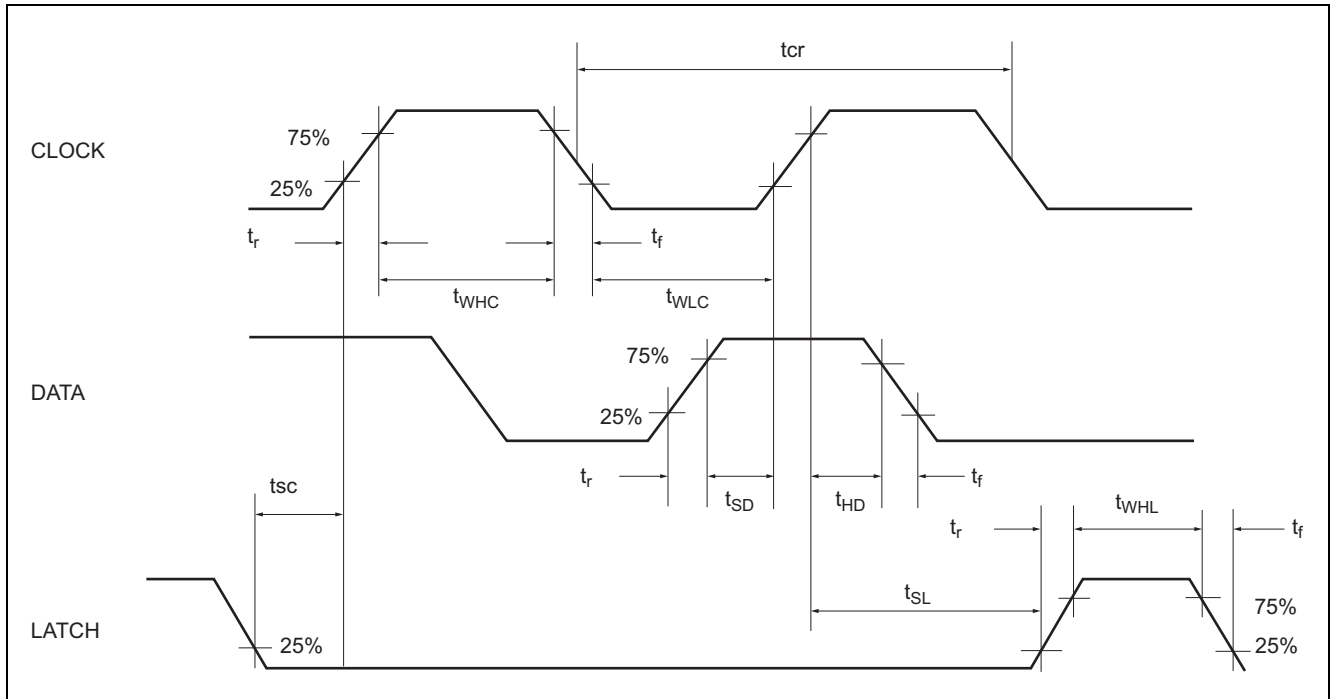
Item	Symbol	Min	Typ	Max	Unit	Condition
Analog positive supply voltage	AVDD	4.5	7.0	7.5	V	
Analog negative supply voltage	AVSS	-7.5	-7.0	-4.5	V	
Digital supply voltage	DVDD	4.5	5.0	5.5	V	
High-level input voltage	VIH	$DVDD \times 0.7$	—	DVDD	V	
Low-level input voltage	VIL	DGND	—	$DVDD \times 0.3$	V	

Note: $AVSS \leq DGND < DVDD \leq AVDD$

Relationship between Data and Clock and Latch



Data Timing (Recommended Conditions)



Digital Block Timing Regulation

Item	Symbol	Limits			Unit
		Min	Typ	Max	
CLOCK cycle time	t_{cr}	8	—	—	μs
CLOCK pulse width ("H" level)	t_{WHC}	3.2	—	—	
CLOCK pulse width ("L" level)	t_{WLC}	3.2	—	—	
CLOCK, DATA, LATCH rise time	t_r	—	—	0.8	
CLOCK, DATA, LATCH fall time	t_f	—	—	0.8	
DATA setup time	t_{SD}	1.6	—	—	
DATA hold time	t_{HD}	1.6	—	—	
LATCH setup time	t_{SL}	2	—	—	
LATCH pulse width	t_{WHL}	3.2	—	—	
CLOCK start time after LATCH	t_{sc}	3.2	—	—	

Digital Control Specification

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

(1)

D01	D11	D21	D31	D41	D51	D61	D71	D81	D91	DA1	DB1	DC1	DD1	DE	DF
TONE CONT TLEBLE				1	2	3	4	TONE CONT BASS				0	TONE : 0 BYPASS : 1	0	0
				OUTPUT PORT n CONT High: 1,Low: 0											

(2)

D02	D12	D22	D32	D42	D52	D62	D72	D82	D92	DA2	DB2	DC2	DD2	DE	DF
VOLUME Lch							VOLUME Rch							0	1

(3)

D03	D13	D23	D33	D43	D53	D63	D73	D83	D93	DA3	DB3	DC3	DD3	DE	DF
VOLUME Cch							VOLUME SWch							1	0

(4)

D04	D14	D24	D34	D44	D54	D64	D74	D84	D94	DA4	DB4	DC4	DD4	DE	DF
VOLUME SLch							VOLUME SRch							1	1

Setting Code

(1) Tone Control (Bass/Treble)

ATT	Treble	D01	D11	D21	D31
	Bass	D81	D91	DA1	DB1
* -14 dB		1	1	1	1
* -12 dB		1	1	0	1
-10 dB		1	1	1	0
-8 dB		1	1	0	0
-6 dB		1	0	1	1
-4 dB		1	0	1	0
-2 dB		1	0	0	1
+0 dB		0	0	0	0
+2 dB		0	0	0	1
+4 dB		0	0	1	0
+6 dB		0	0	1	1
+8 dB		0	1	0	0
+10 dB		0	1	1	0
* +12 dB		0	1	0	1
* +14 dB		0	1	1	1

Note: * is an extended function.

(2) Port Output

D41 D51 D61 D71	
Out: H	1
Out: L	0

(3) Bypass Control

DD1	
BYPASS	1
TONE	0

Note: Do not input other data than the above.

(4)-1 Volume (0 to -39 dB)

ATT	Volume	D0X	D1X	D2X	D3X	D4X	D5X	D6X
		D7X	D8X	D9X	DAX	DBX	DCX	DDX
	0 dB	0	0	0	0	0	0	0
	-1 dB	0	0	0	0	0	0	1
	-2 dB	0	0	0	0	0	1	0
	-3 dB	0	0	0	0	0	1	1
	-4 dB	0	0	0	0	1	0	0
	-5 dB	0	0	0	0	1	0	1
	-6 dB	0	0	0	0	1	1	0
	-7 dB	0	0	0	0	1	1	1
	-8 dB	0	0	0	1	0	0	0
	-9 dB	0	0	0	1	0	0	1
	-10 dB	0	0	0	1	0	1	0
	-11 dB	0	0	0	1	0	1	1
	-12 dB	0	0	0	1	1	0	0
	-13 dB	0	0	0	1	1	0	1
	-14 dB	0	0	0	1	1	1	0
	-15 dB	0	0	0	1	1	1	1
	-16 dB	0	0	1	0	0	0	0
	-17 dB	0	0	1	0	0	0	1
	-18 dB	0	0	1	0	0	1	0
	-19 dB	0	0	1	0	0	1	1
	-20 dB	0	0	1	0	1	0	0
	-21 dB	0	0	1	0	1	0	1
	-22 dB	0	0	1	0	1	1	0
	-23 dB	0	0	1	0	1	1	1
	-24 dB	0	0	1	1	0	0	0
	-25 dB	0	0	1	1	0	0	1
	-26 dB	0	0	1	1	0	1	0
	-27 dB	0	0	1	1	0	1	1
	-28 dB	0	0	1	1	1	0	0
	-29 dB	0	0	1	1	1	0	1
	-30 dB	0	0	1	1	1	1	0
	-31 dB	0	0	1	1	1	1	1
	-32 dB	0	1	0	0	0	0	0
	-33 dB	0	1	0	0	0	0	1
	-34 dB	0	1	0	0	0	1	0
	-35 dB	0	1	0	0	0	1	1
	-36 dB	0	1	0	0	1	0	0
	-37 dB	0	1	0	0	1	0	1
	-38 dB	0	1	0	0	1	1	0
	-39 dB	0	1	0	0	1	1	1

Note: Do not input other data than the above.

(4)-2 Volume (−40 to −∞ dB)

ATT	Volume	D0X	D1X	D2X	D3X	D4X	D5X	D6X
		D7X	D8X	D9X	DAX	DBX	DCX	DDX
	−40 dB	0	1	0	1	0	0	0
	−41 dB	0	1	0	1	0	0	1
	−42 dB	0	1	0	1	0	1	0
	−43 dB	0	1	0	1	0	1	1
	−44 dB	0	1	0	1	1	0	0
	−45 dB	0	1	0	1	1	0	1
	−46 dB	0	1	0	1	1	1	0
	−47 dB	0	1	0	1	1	1	1
	−48 dB	0	1	1	0	0	0	0
	−49 dB	0	1	1	0	0	0	1
	−50 dB	0	1	1	0	0	1	0
	−51 dB	0	1	1	0	0	1	1
	−52 dB	0	1	1	0	1	0	0
	−53 dB	0	1	1	0	1	0	1
	−54 dB	0	1	1	0	1	1	0
	−55 dB	0	1	1	0	1	1	1
	−56 dB	0	1	1	1	0	0	0
	−57 dB	0	1	1	1	0	0	1
	−58 dB	0	1	1	1	0	1	0
	−59 dB	0	1	1	1	0	1	1
	−60 dB	0	1	1	1	1	0	0
	−61 dB	0	1	1	1	1	0	1
	−62 dB	0	1	1	1	1	1	0
	−63 dB	0	1	1	1	1	1	1
	−64 dB	1	0	0	0	0	0	0
	−65 dB	1	0	0	0	0	0	1
	−66 dB	1	0	0	0	0	1	0
	−67 dB	1	0	0	0	0	1	1
	−68 dB	1	0	0	0	1	0	0
	−69 dB	1	0	0	0	1	0	1
	−70 dB	1	0	0	0	1	1	0
	−71 dB	1	0	0	0	1	1	1
	−72 dB	1	0	0	1	0	0	0
	−73 dB	1	0	0	1	0	0	1
	−74 dB	1	0	0	1	0	1	0
	−75 dB	1	0	0	1	0	1	1
	−76 dB	1	0	0	1	1	0	0
	−77 dB	1	0	0	1	1	0	1
	−78 dB	1	0	0	1	1	1	0
	−79 dB	1	0	0	1	1	1	1
	−∞ dB	1	0	1	0	0	0	0

Note: Do not input other data than the above.

Electrical Characteristics

($T_a = 25^\circ\text{C}$, $AVDD/AVSS/DVDD = 7/-7\text{ V}/5\text{ V}$, $f = 1\text{ kHz}$, unless otherwise noted.)

$R_g = 1\text{ k}\Omega$, $R_L = 10\text{ k}\Omega$, TONE CONTROL • VOL are set to 0 dB/FLAT.)

(1) Power Supply Characteristics

Item	Symbol	Limits			Unit	Test Condition
		Min	Typ	Max		
Analog positive circuit current	Al _{dd}	—	22	35	mA	Current at pin 5 No signal
Analog negative circuit current	Al _{ss}	—	22	35	mA	Current at pin 30 No signal
Digital circuit current	DI _{dd}	—	1.0	2.0	mA	Current at pin 42 No signal

(2) Input/Output Characteristics

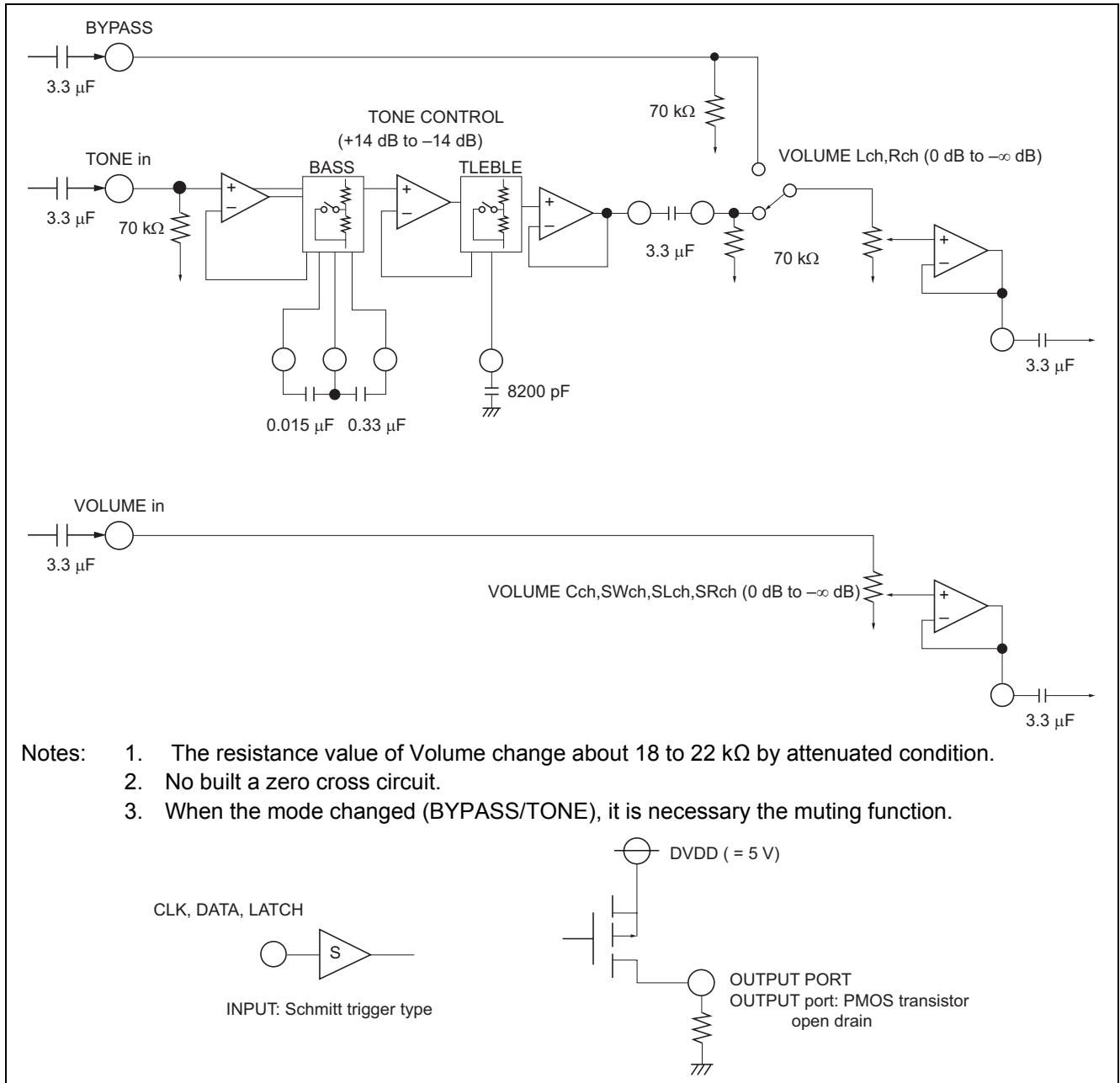
Item	Symbol	Limits			Unit	Test Condition
		Min	Typ	Max		
Input resistance	R _i	35	70	150	k Ω	13, 15, 16, 17, 27, 29 pin
Maximum output voltage	V _{OM}	3.0	4.2	—	V _{rms}	6, 8, 9, 11, 13, 15, 16, 17 pin INPUT 31 to 36 pin OUTPUT THD = 1%
Pass gain	G _v	-2.0	0	2.0	dB	V _i = 0.2 V _{rms} , FLAT 8, 9, 11, 13, 15, 16, 17 pin INPUT 31 to 36 pin OUTPUT
Distortion	THD	—	0.002	0.09	%	BW = 400 to 30 kHz V _i = 0.2 V _{rms} , R _L = 10 k Ω
Output noise voltage	V _n (VOL)	—	1.5	6	μV_{rms}	31 to 36 pin, R _g = 0 k Ω , JIS-A, VOL = 0 dB
	V _n (tone)	—	5	20	μV_{rms}	31, 32 pin JIS-A, VOL = 0 dB
Maximum attenuation	ATT _{max}	—	-100	-95	dB	31 to 36 pin JIS-A, VOL = $-\infty$ dB
Volume gain between channels	D _{vol}	-1.5	0	1.5	dB	
Crosstalk between channels	CT	—	-80	-65	dB	V _o = 0.5 V _{rms} , R _L = 10 k Ω , JIS-A, R _g = 1 k Ω
Port output current	I _L	0.2	—	—	mA	

(3) Tone Control Characteristics

Item	Symbol	Limits			Unit	Test Condition
		Min	Typ	Max		
Tone control voltage gain	*T +14 dB	12	14	16	dB	Vo = 0.2 Vrms, TREBLE (f = 10 kHz), BASS (f = 100 Hz), Voltage gain (Input to pin 13, 15 Output from pin 31, 32) INPUT 13, 15 pin OUTPUT 31, 32 pin
	*T +12 dB	10	12	14	dB	
	T +10 dB	8	10	12	dB	
	T +8 dB	6	8	10	dB	
	T +6 dB	4.5	6	7.5	dB	
	T +4 dB	2.5	4	5.5	dB	
	T +2 dB	1	2	3	dB	
	T -2 dB	-3	-2	-1	dB	
	T -4 dB	-5.5	-4	-2.5	dB	
	T -6 dB	-7.5	-6	-4.5	dB	
	T -8 dB	-10	-8	-6	dB	
	T -10 dB	-12	-10	-8	dB	
	*T -12 dB	-14	-12	-10	dB	
	*T -14 dB	-16	-14	-12	dB	
Balance between channel	BALT	-1.5	0	+1.5	dB	Input 13, 15 pin Vo = 0.2 Vrms Output 31, 32 pin

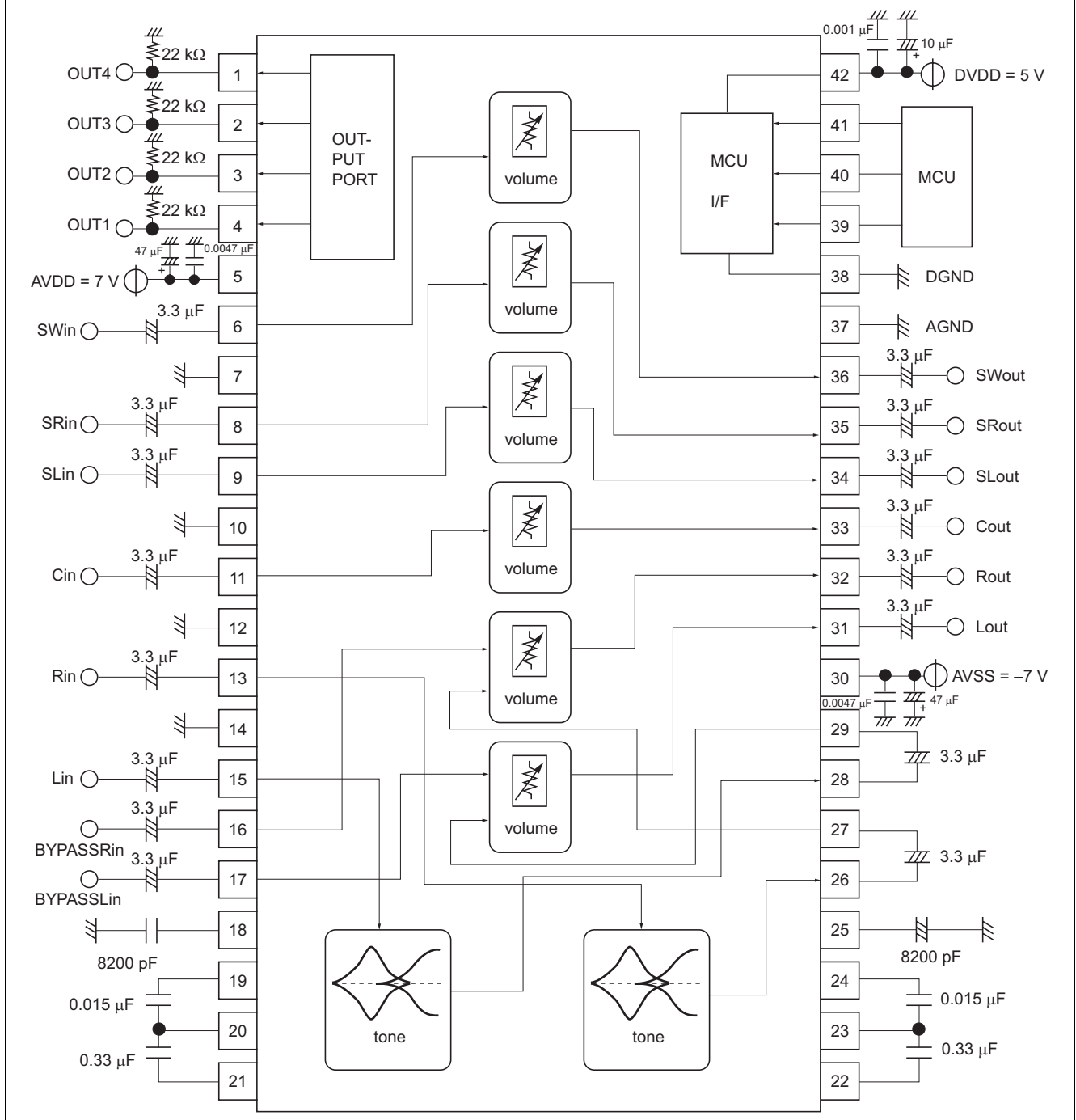
Note: * is an extended function.

Signal Processing Diagram



Application Example

When using Tone control and Bypass



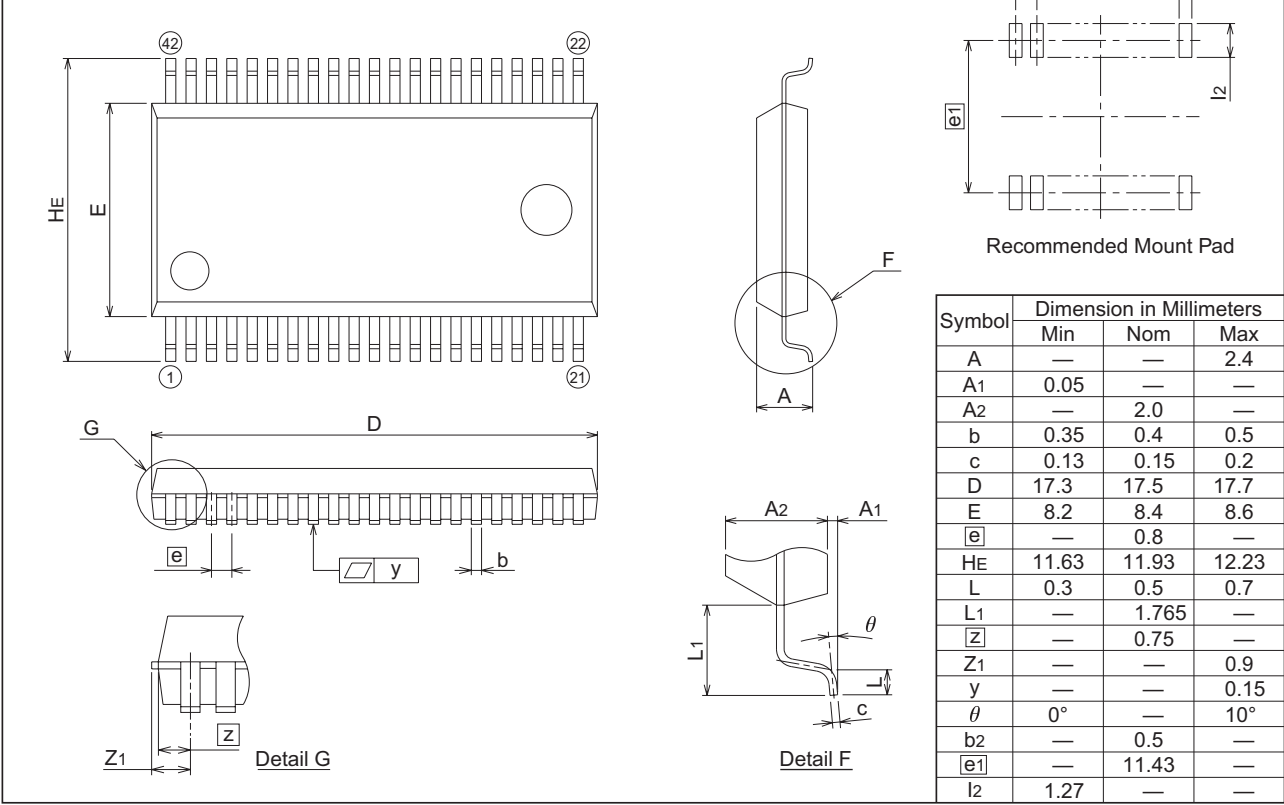
Package Dimensions

42P2R-A

(MMP)

Plastic 42pin 450mil SSOP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SSOP42-P-450-0.80	—	0.63	Alloy 42/Cu Alloy



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