

**PRELIMINARY**  
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MITSUBISHI SOUND PROCESSORS

# M62446FP

6CH ELECTRIC VOLUME WITH TONE CONTROL

## DESCRIPTION

The M62446FP is 6 channels electric volume controlled 3-wire serial data.  
 The IC is suitable for use in home-use audio systems and TV sets.

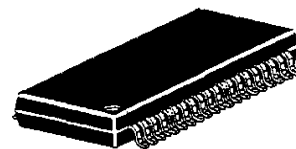
## FEATURES

- Electric volume
  - Volume level..... 0dB ~ -79dB,-∞dB (1dB / step)
- Tone control
  - Bass / Treble , 0dB ~ ±10dB(2dB / step)
- 4 Output ports
- Built-in microcomputer interface circuit controlled by 16-bit serial data.

## APPLICATION

DVD,Home Audio equipment,TV

## PACKAGE

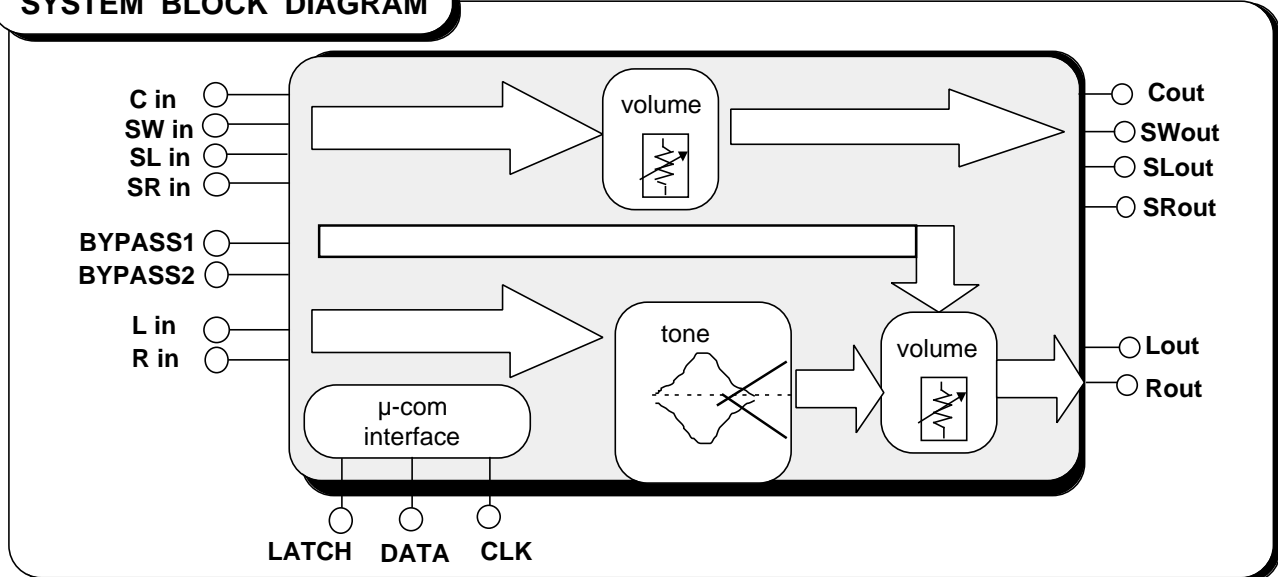


Outline 42P2R

## RECOMMENDED OPERATING CONDITIONS

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

## SYSTEM BLOCK DIAGRAM



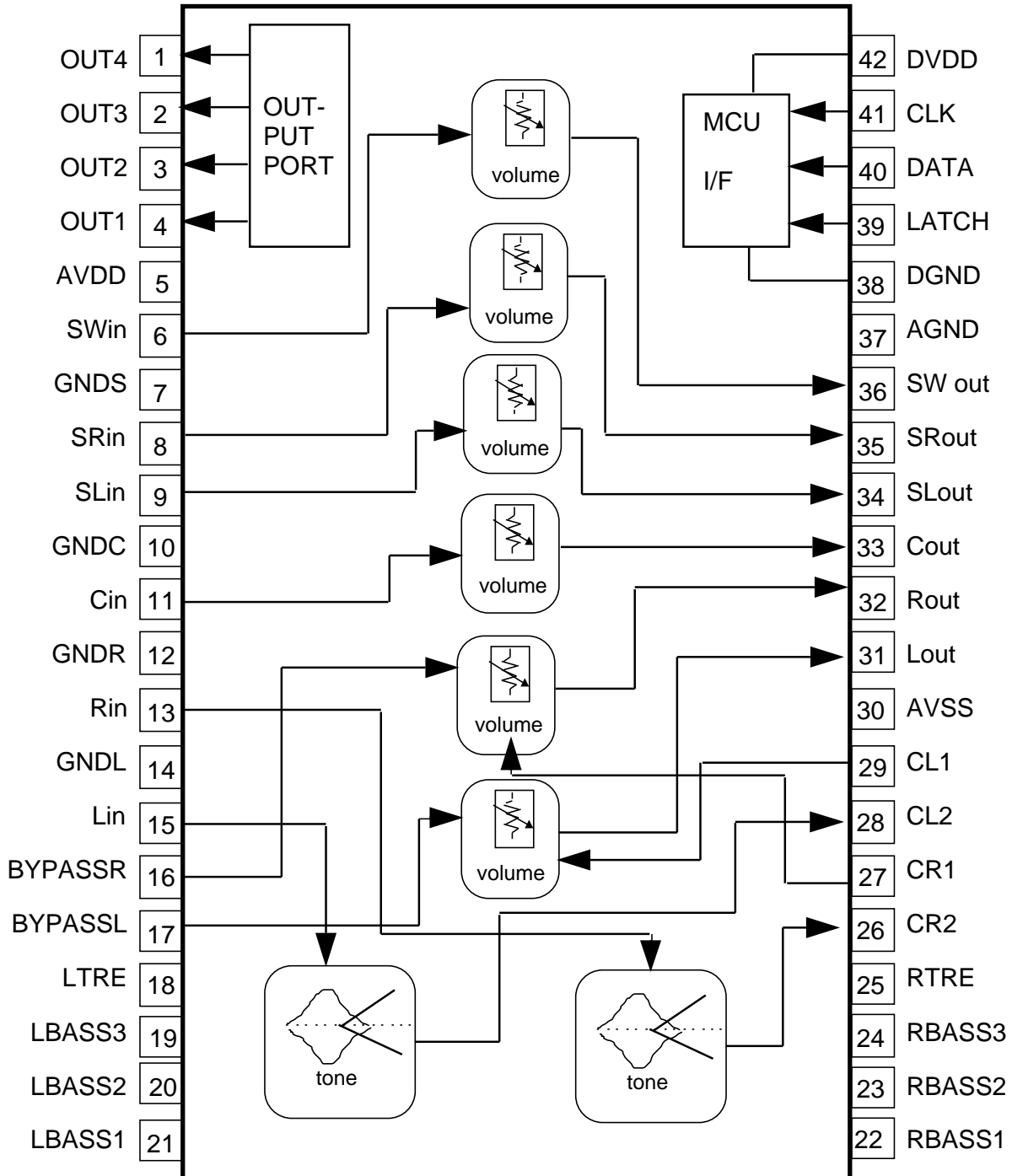
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## PIN CONFIGURATION AND IC INTERNAL BLOCK DIAGRAM



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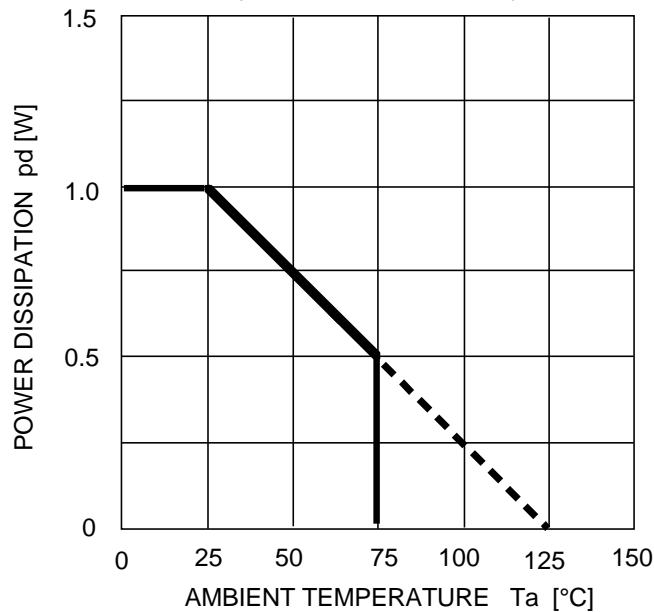
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## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Ratings	Unit
Vsupply	Supply Voltage	AVDD-AVSS	15.0	V
Pd	Power dissipation	Ta≤25°C	1000	mW
Kθ	Thermal derating	Ta>25°C *standard board	10	mW/°C
Topr	Operating temperature		-20~+75	°C
Tstg	Storage temperature		-40~+125	°C

THERMAL DERATING  
(MAXIMUM RATING)



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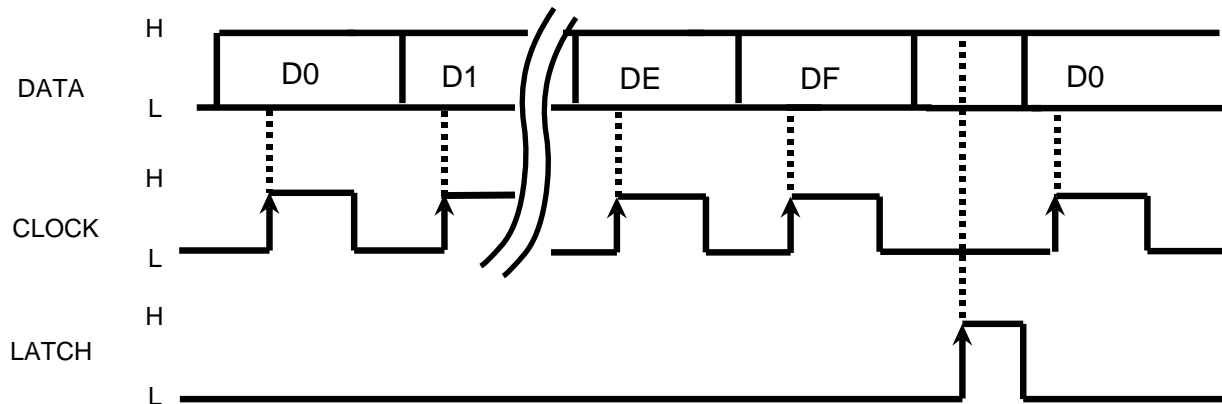
6CH ELECTRIC VOLUME WITH TONE CONTROL

## RECOMMENDED OPERATING CONDITION

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit
Analog positive Supply Voltage	AVDD		4.5	7.0	7.3	V
Analog negative Supply Voltage	AVSS		-7.3	-7.0	-4.5	V
Digital Supply Voltage	DVDD		4.5	5.0	5.5	V
High-level Input Voltage	VIH		DVDD/2+1	—	DVDD	V
Low-level Input Voltage	VIL		DGND	—	DVDD/2-1	V

(note)  $AVSS \leq DGND < DVDD \leq AVDD$

## DATA TIMING (Recommended conditions)



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

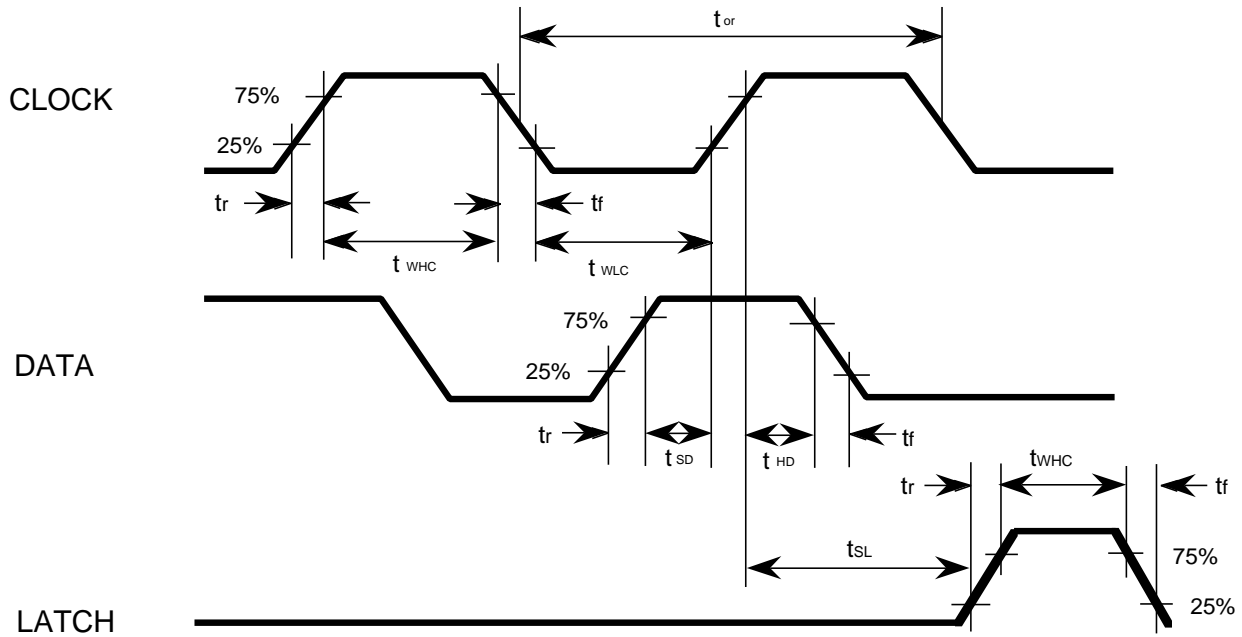
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## CLOCK, DATA, LATCH TIMING



## DIGITAL BLOCK TIMING REGULATION

Symbol	Parameter	Limits			Unit
		Min	typ	Max	
$t_{or}$	CLOCK cycle time	8	-	-	μsec
$t_{wHC}$	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	-	-	

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## DIGITAL CONTROL SPECIFICATION

Fore 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 )

DO1	D11	D21	D31	D41	D51	D61	D71	D81	D91	DA1	DB1	DC1	DD1	DE	DF
TONE CONTROL TREBLE				1	2	3	4	TONE CONTROL BASS				0	BY PASS 1: ON 0: OFF	0	0
				OUTPUT PORT n 1: High 0: Low											

( 2 )

DO2	D12	D22	D32	D42	D52	D62	D72	D82	D92	DA2	DB2	DC2	DD2	DE	DF
VOLUME Lch							VOLUME Rch							0	1

( 3 )

DO3	D13	D23	D33	D43	D53	D63	D73	D83	D93	DA3	DB3	DC3	DD3	DE	DF
VOLUME Cch							VOLUME SWch							1	0

( 4 )

DO4	D14	D24	D34	D44	D54	D64	D74	D84	D94	DA4	DB4	DC4	DD4	DE	DF
VOLUME SLch							VOLUME SRch							1	1

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## SETTING CODE

(1) Tone control (bass / treble)

ATT	treble	D01	D11	D21	D31
	bass	D81	D91	DA1	DB1
- 10dB		1	1	1	0
- 8dB		1	1	0	0
- 6dB		1	0	1	1
- 4dB		1	0	1	0
- 2dB		1	0	0	1
+ 0dB		0	0	0	0
+ 2dB		0	0	0	1
+ 4dB		0	0	1	0
+ 6dB		0	0	1	1
+ 8dB		0	1	0	0
+ 10dB		0	1	1	0

Port output

		D41	D51	D61	D71
PORT1	0	L	-	-	-
	1	H			
PORT2	0	-	L	-	-
	1		H		
PORT3	0	-	-	L	-
	1			H	
PORT4	0	-	-	-	L
	1				H

BYPASS control

DD1	
TONE	0
BYPASS	1

Note : Do not input other data than the above.

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6CH ELECTRIC VOLUME WITH TONE CONTROL

(2),(3),(4) VOLUME ( 0 ~ -39dB)

Note : Do not input other data than the above.

A T T	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



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VOLUME ( -40 ~ - ∞dB)

Note : Do not input other data than the above.

A T T	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

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## ELECTRICAL CHARACTERISTICS

(Ta=25°C, AVDD=7.0V, AVSS=-7.0V, DVDD=5.0V, f=1kHz, unless otherwise noted.)

TONE CONTROL, VOLUME are set to 0dB)

### (1) Power supply characteristics

Parameter	Symbol	Test condition	Limits			Unit
			Min	typ	Max	
Analog positive circuit current	Aldd	Current at pin 5 No signal	—	25	35	mA
Analog negative circuit current	Alss	Current at pin 30 No signal	—	25	35	mA
Digital circuit current	Didd	Current at pin 42 No signal	—	0.5	2.0	mA

### (2) Input / Output characteristics

Parameter	Symbol	Test condition	Limits			Unit
			Min	typ	Max	
Input resistance	Ri	13,15,16,17,27,29pin	35	70	150	KΩ
Maximum output voltage	VOM	6,8,9,11,13,15,16,17pin INPUT 31 ~ 36pin OUTPUT RL =10KΩ, THD=1%	3.0	4.0	—	Vrms
Pass gain	Gv	Vi=0.2Vrms, FLAT 6,8,9,11,13,15,16,17pin INPUT 31 ~ 36pin OUTPUT	-2.0	0	2.0	dB
Distortion	THD	BW=400 ~ 30kHz Vi=0.2Vrms, RL=10KΩ	—	0.02	0.09	%
Output noise voltage	Vn(VOL)	31 ~ 36pin, Rg=0KΩ JIS-A, VOL=0dB	—	2	6	μVrms
	Vn(tone)	31,32pin, Rg=1KΩ, JIS-A, VOL=0dB	—	8	20	μVrms
Maximum attenuation	ATTmax	31 ~ 36pin, Rg=1KΩ, JIS-A, VOL=-∞dB	-86	—	—	dB
Volume gain between channels	Dvol		-1.5	0	1.5	dB
Crosstalk between channels	CT	Vo=0.5Vrms, RL=10KΩ, JIS-A Rg=1KΩ	—	-80	-65	dB
Port output current	IL	RL=22KΩ	0.2	—	—	mA

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### (3) Tone control characteristics

Parameter	Symbol	Test condition	Limits			Unit
			Min	typ	Max	
Tone control voltage gain	T -10dB	Vo=0.2Vrms,f=1kHz TLEBLE(f=10kHz) BASS(f=100Hz)  INPUT 13,15pin OUTPUT 31,32pin	-12	-10	-8	dB
	T - 8dB		-10	-8	-6	dB
	T - 6dB		-7.5	-6	-4.5	dB
	T - 4dB		-5.5	-4	-2.5	dB
	T - 2dB		-3	-2	-1	dB
	T+2dB		1	2	3	dB
	T+4dB		2.5	4	5.5	dB
	T+6dB		4.5	6	7.5	dB
	T+8dB		6	8	10	dB
	T+10dB		8	10	12	dB
Balance between channel	BALT	Input pin13,15 Vo=0.2Vrms Output pin31,32,	-1.5	0	+1.5	dB

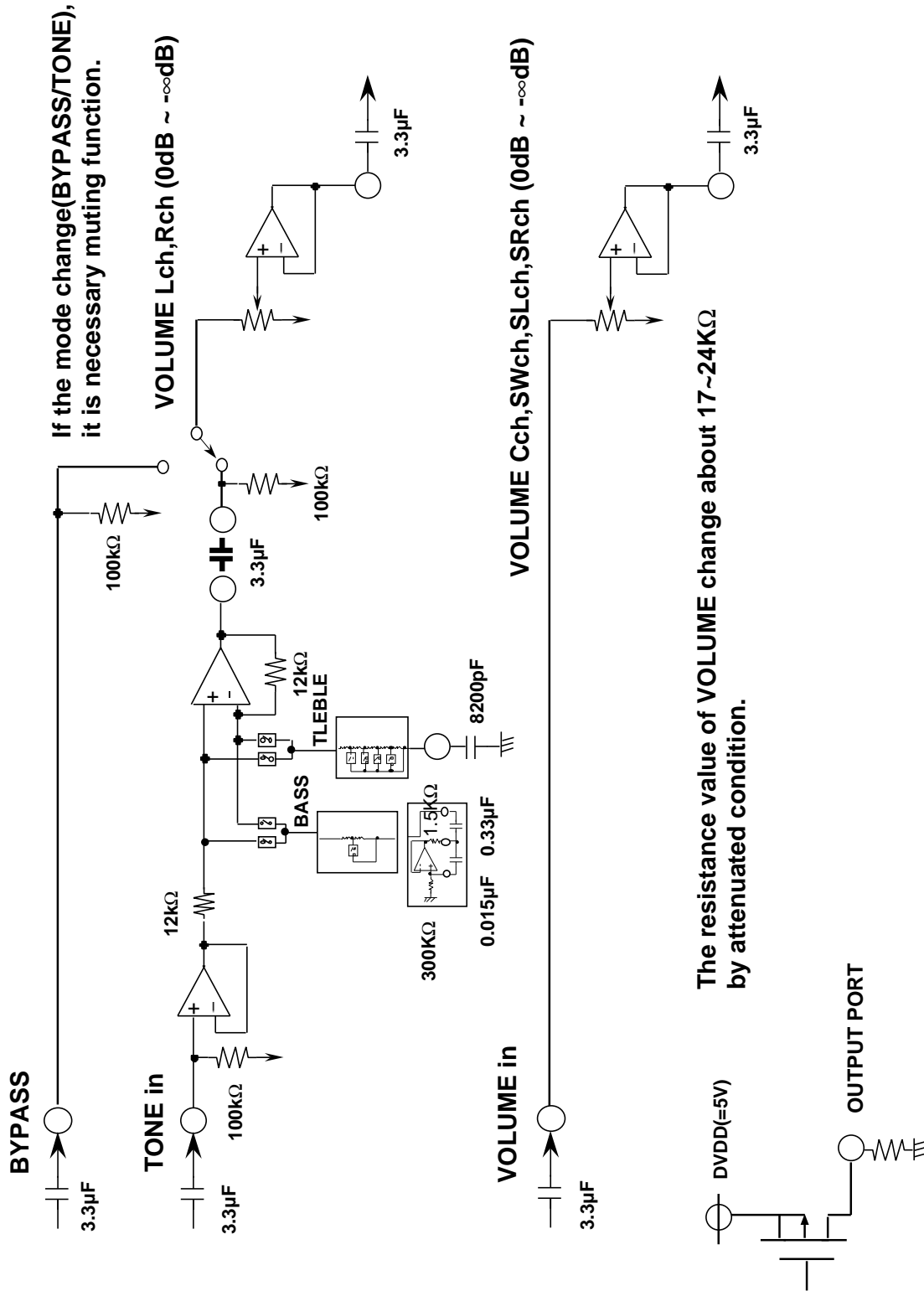
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**SYSTEM DIAGRAM**



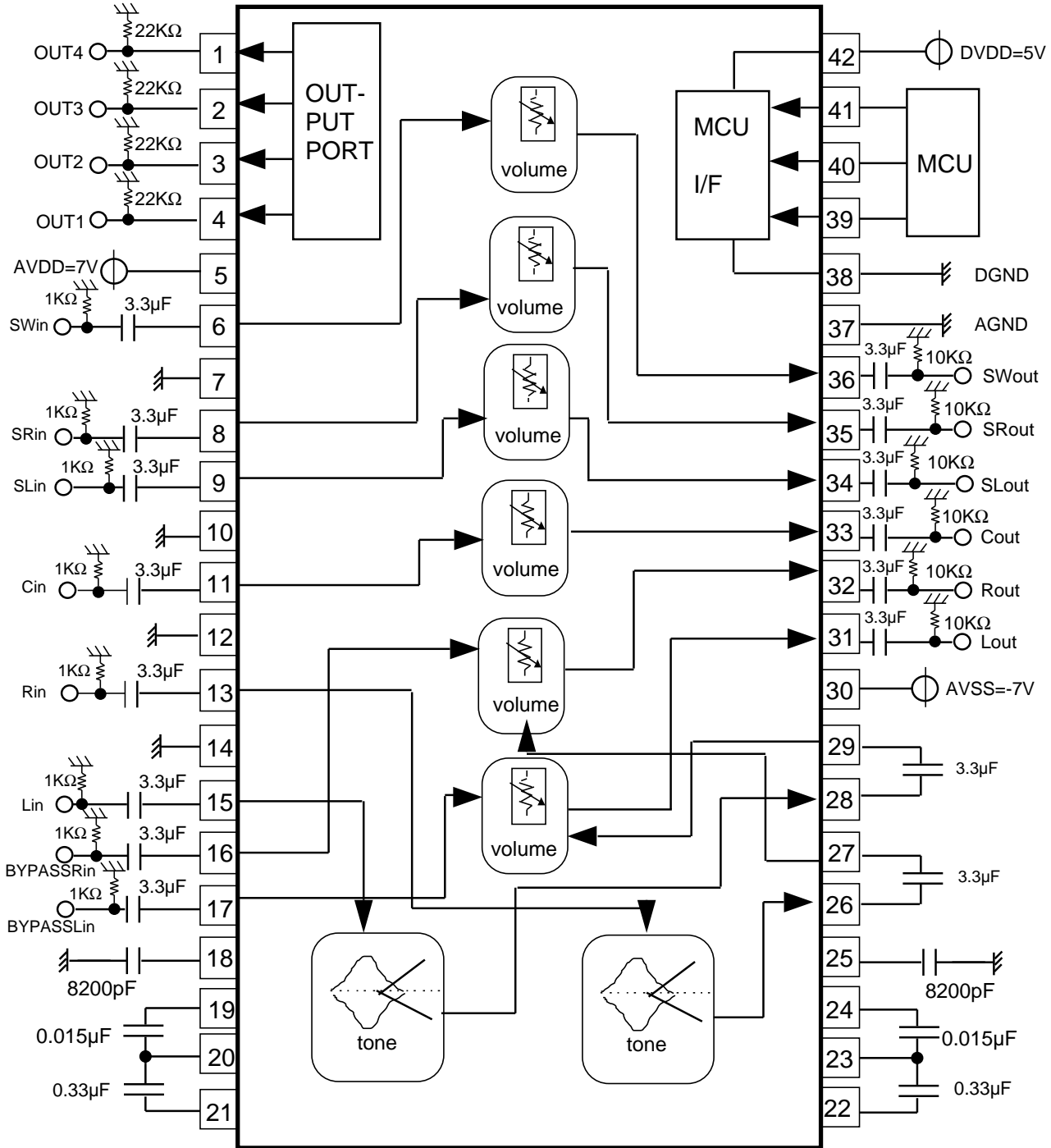
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**APPLICATION EXAMPLE**



Units Resistance : Ω  
 Capacitance : F

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