

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.

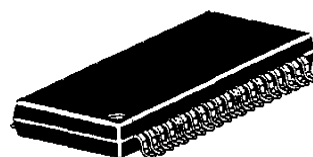
FEATURES

- 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

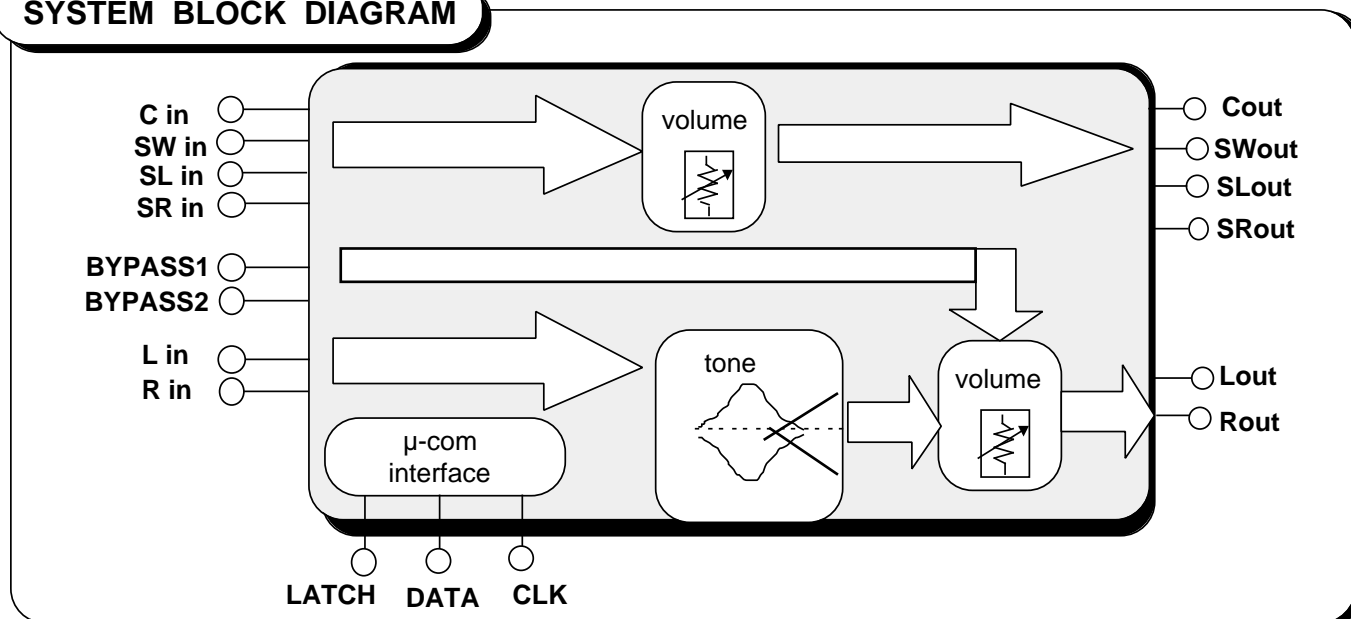
Supply voltage range..... ±4.5 ~ ±7.3V (analog)

4.5 ~ 5.5V (digital)

Rated supply voltage ±7.0V (analog)

5.0V (digital)

SYSTEM BLOCK DIAGRAM



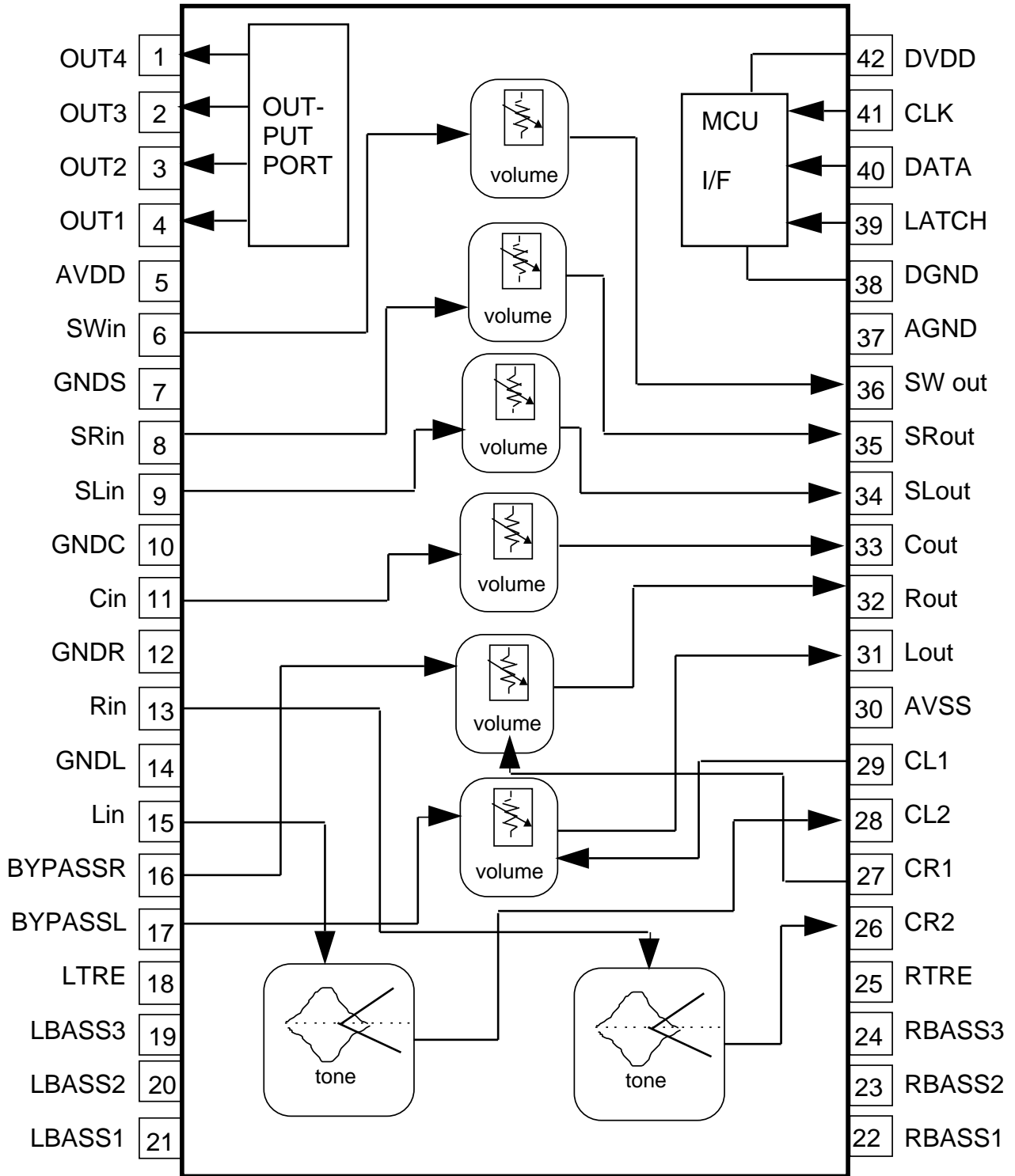
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PIN CONFIGURATION AND IC INTERNAL BLOCK DIAGRAM



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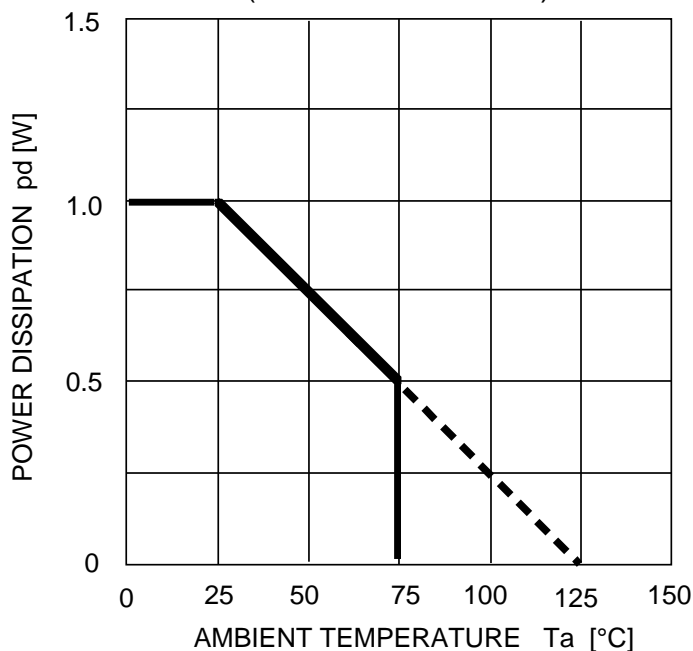
M62446FP

6CH ELECTRIC VOLUME WITH TONE CONTROL

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Ratings	Unit
Vsupply	Supply Voltage	AVDD-AVSS	15.0	V
Pd	Power dissipation	Ta 25°C	1000	mW
K θ	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)



*Standard board

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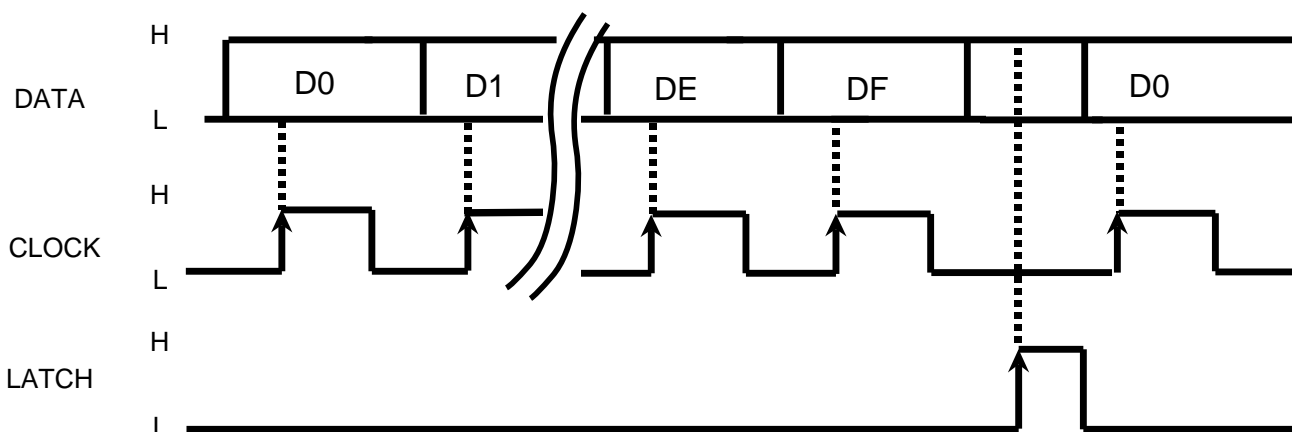
6CH ELECTRIC VOLUME WITH TONE CONTROL

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 DGND<DVDD AVDD

DATA TIMING (Recommended conditions)



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

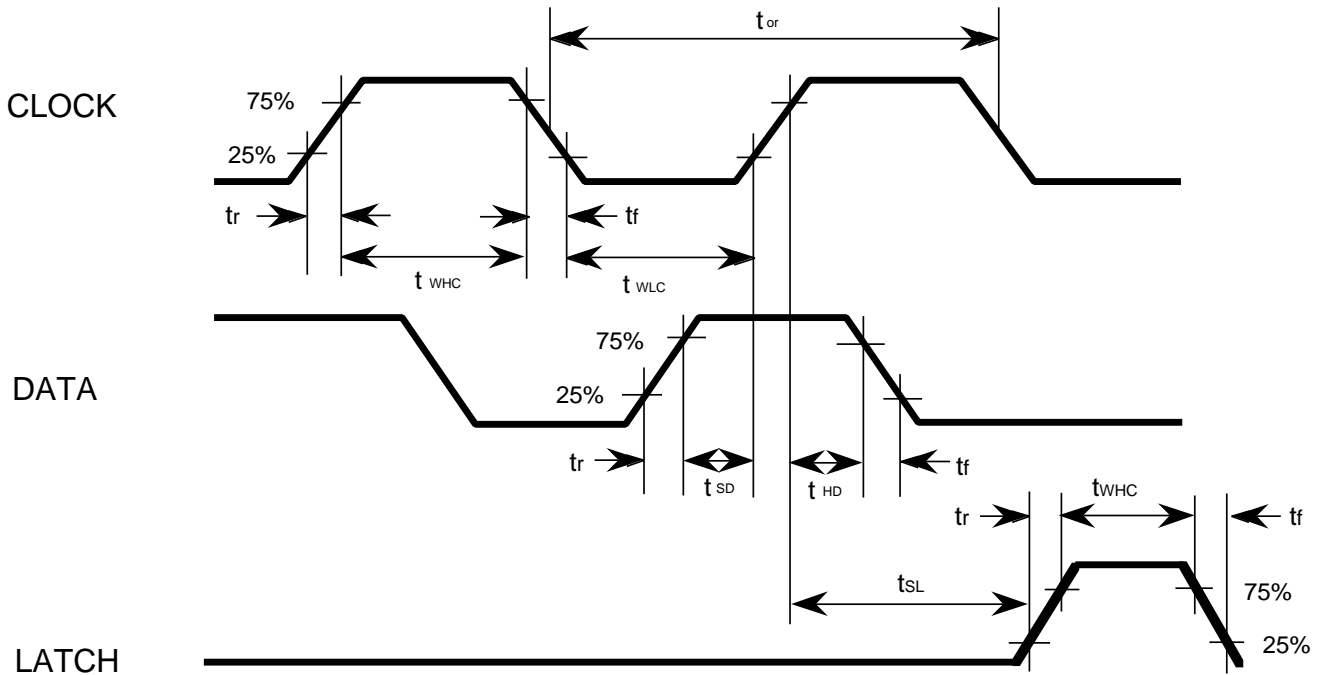
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6CH ELECTRIC VOLUME WITH TONE CONTROL

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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M62446FP

6CH ELECTRIC VOLUME WITH TONE CONTROL

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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M62446FP

6CH ELECTRIC VOLUME WITH TONE CONTROL

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

($T_a=25^{\circ}\text{C}$, $AVDD=7.0\text{V}$, $AVSS=-7.0\text{V}$, $DVDD=5.0\text{V}$, $f=1\text{kHz}$, 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	A _{Idd}	Current at pin 5 No signal	—	25	35	mA
Analog negative circuit current	A _{Iss}	Current at pin 30 No signal	—	25	35	mA
Digital circuit current	D _{Idd}	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	R _i	13,15,16,17,27,29pin	35	70	150	K
Maximum output voltage	V _{OM}	6,8,9,11,13,15,16,17pin INPUT 31 ~ 36pin OUTPUT R _L =10K, THD=1%	3.0	4.0	—	V _{rms}
Pass gain	G _v	V _i =0.2V _{rms} , FLAT 6,8,9,11,13,15,16,17pin INPUT 31 ~ 36pin OUTPUT	-2.0	0	2.0	dB
Distortion	THD	BW=400 ~ 30kHz V _i =0.2V _{rms} , R _L =10K	—	0.02	0.09	%
Output noise voltage	V _n (VOL)	31 ~ 36pin, R _g =0K JIS-A, VOL=0dB	—	2	6	μV _{rms}
	V _n (tone)	31,32pin, R _g =1K, JIS-A, VOL=0dB	—	8	20	μV _{rms}
Maximum attenuation	ATT _{max}	31 ~ 36pin, R _g =1K, JIS-A, VOL=- dB	-86	—	—	dB
Volume gain between channels	D _{vol}		-1.5	0	1.5	dB
Crosstalk between channels	CT	V _o =0.5V _{rms} , R _L =10K, JIS-A R _g =1K	—	-80	-65	dB
Port output current	I _L	R _L =22K	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

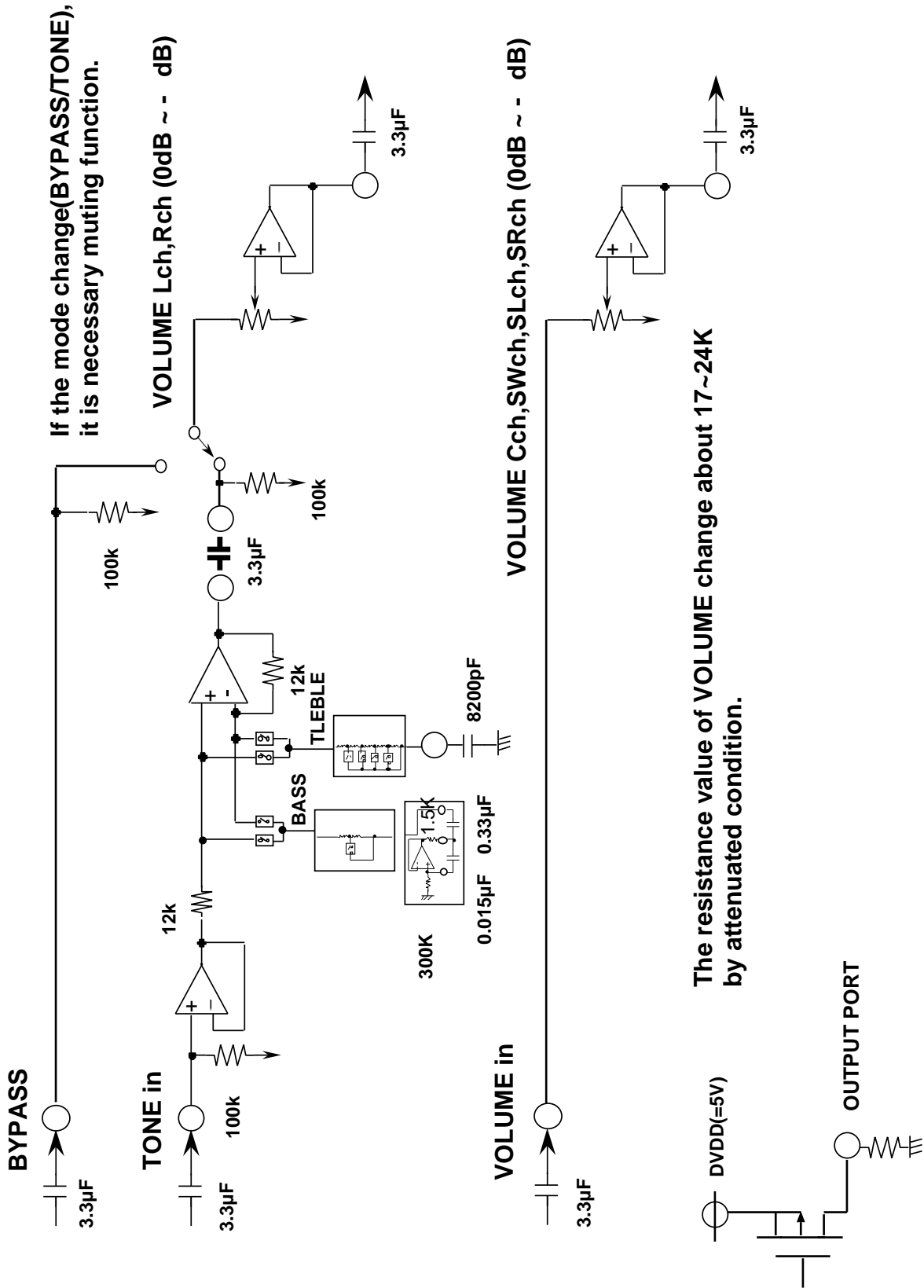
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SYSTEM DIAGRAM



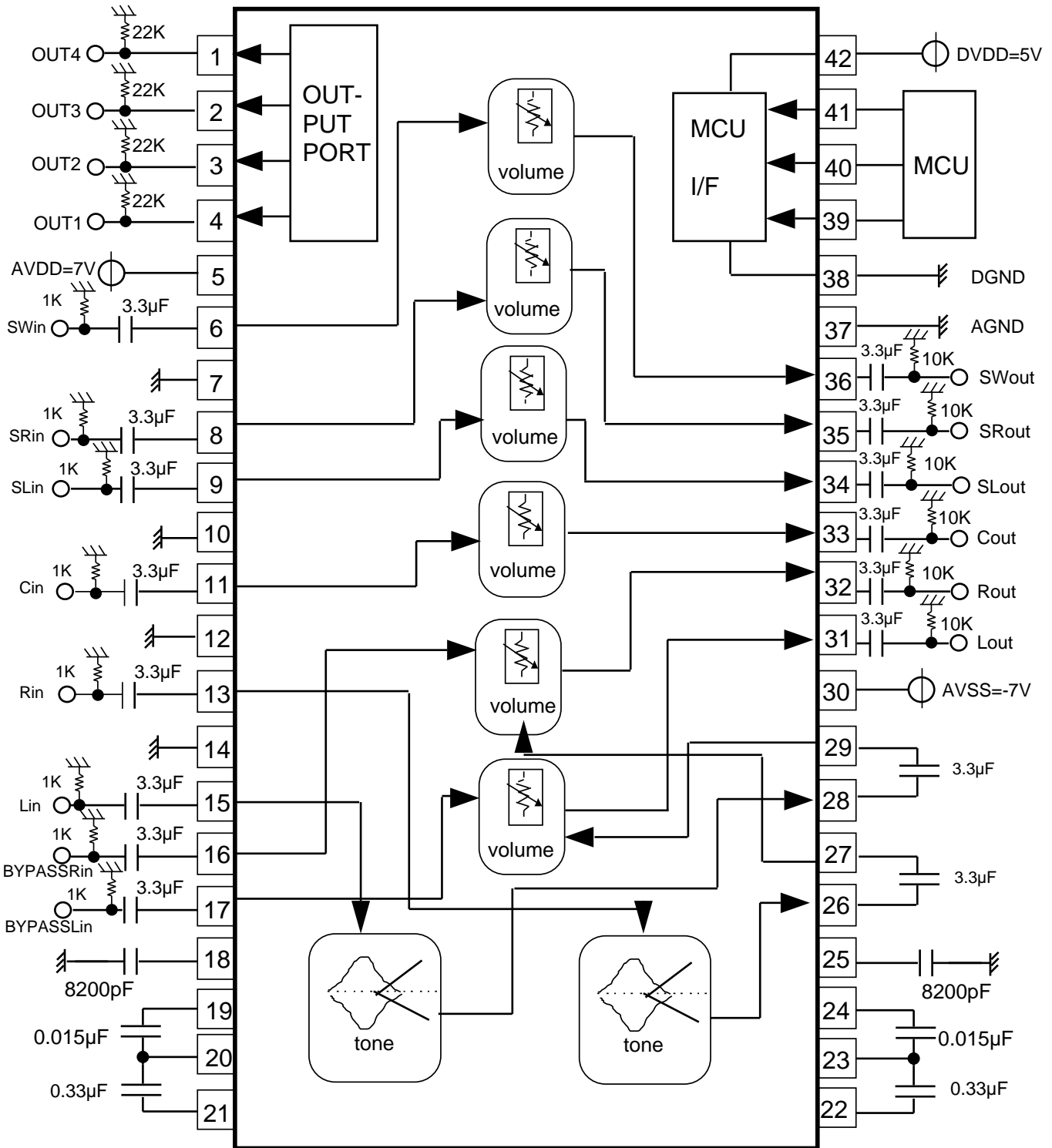
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APPLICATION EXAMPLE



Units Resistance :
 Capacitance : F