M61539FP

6ch Electronic Volume with Tone Control

REJ03F0112-0100Z
Rev.1.0
Apr.16.2004

Description

The M61539FP is 6ch electronic volume with tone control. M61539FP is easy to use more than M62446AFP.

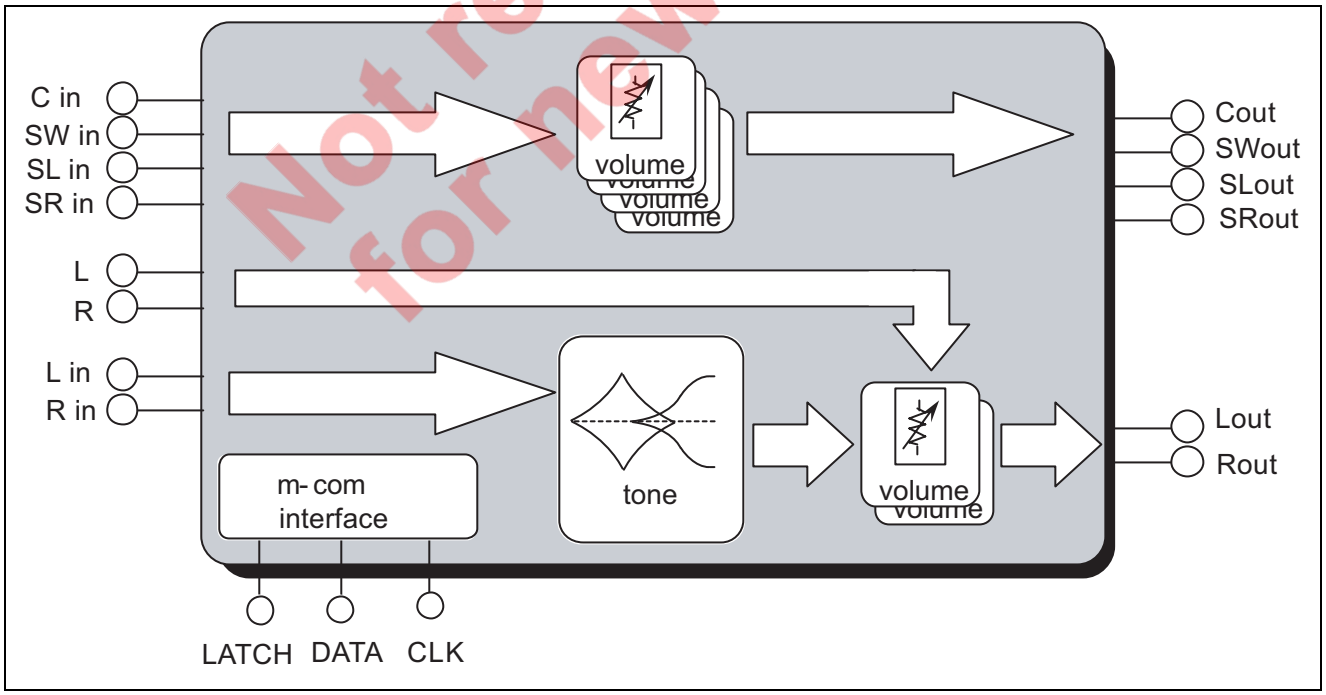
Features

- 6ch Electronic volume
  Volume level: 0 to-95dB(1dB/step)
- Tone control
  Bass/Treble:-14dB to +14dB(2dB/step)
- Noise voltage: 1.5µVrms
- Bypass mode is high quality sound.

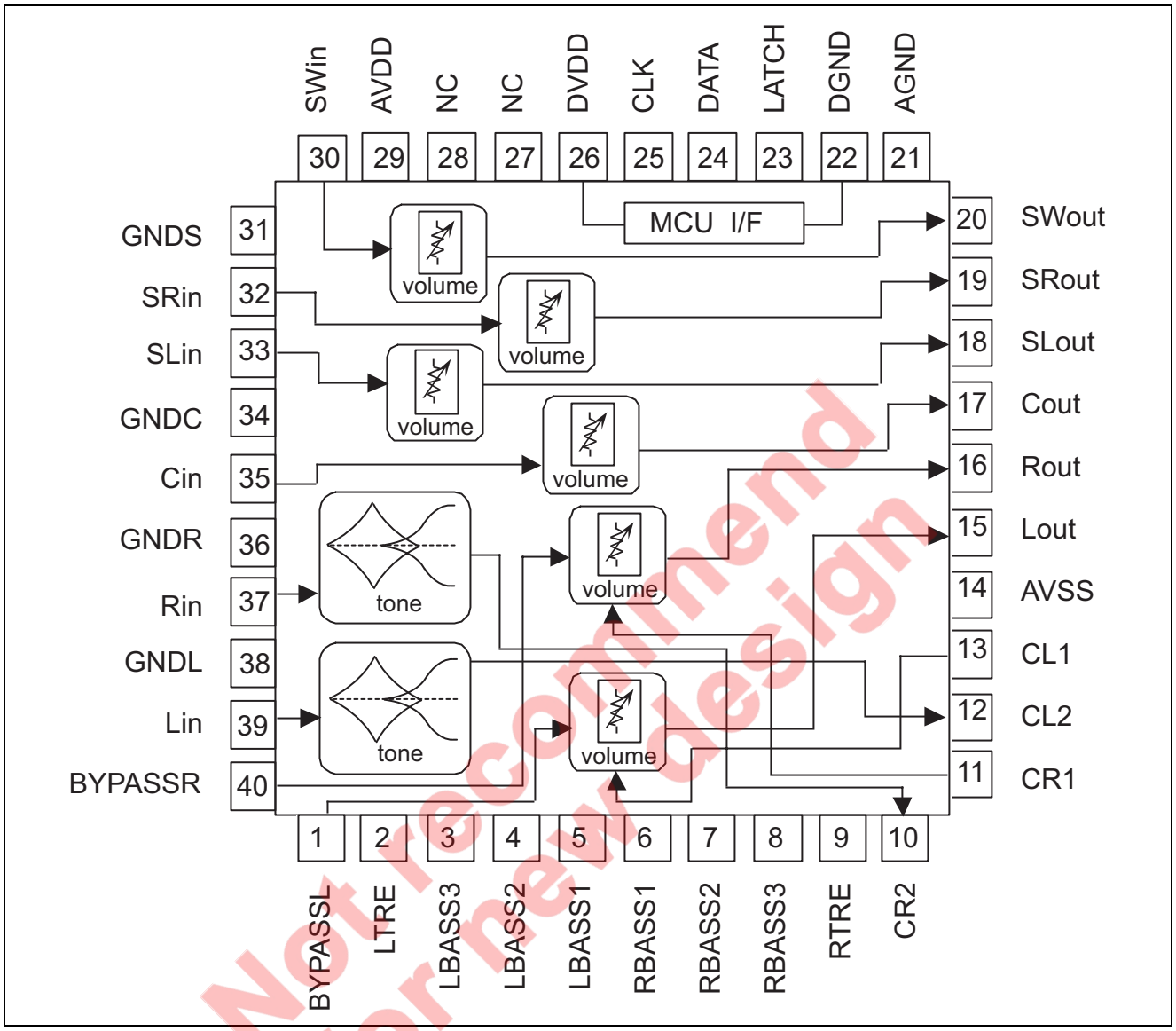
Recommended Operating Conditions

- Supply voltage range: 4.5 to ±7.5V (analog) (Single supply voltage 9 to 12V)
  4.5 to 5.5V(digital)
- Rated supply voltage: ±7.0V(analog)
  5.0V(digital)

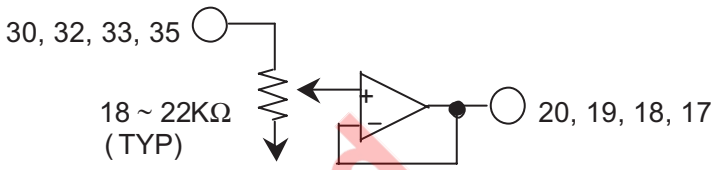
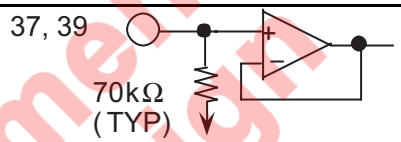
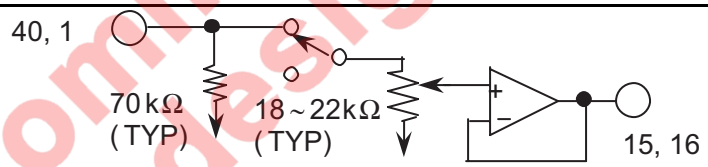
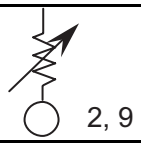
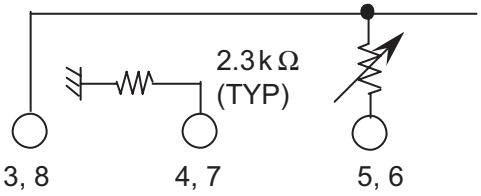
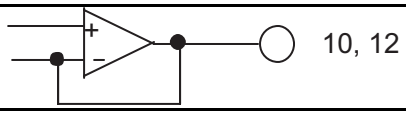
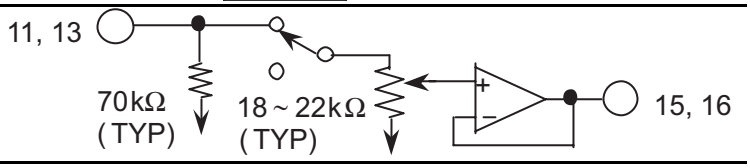
System Block Diagram

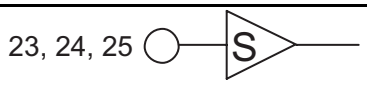


Pin Configuration and IC Internal Block Diagram



Pin Description

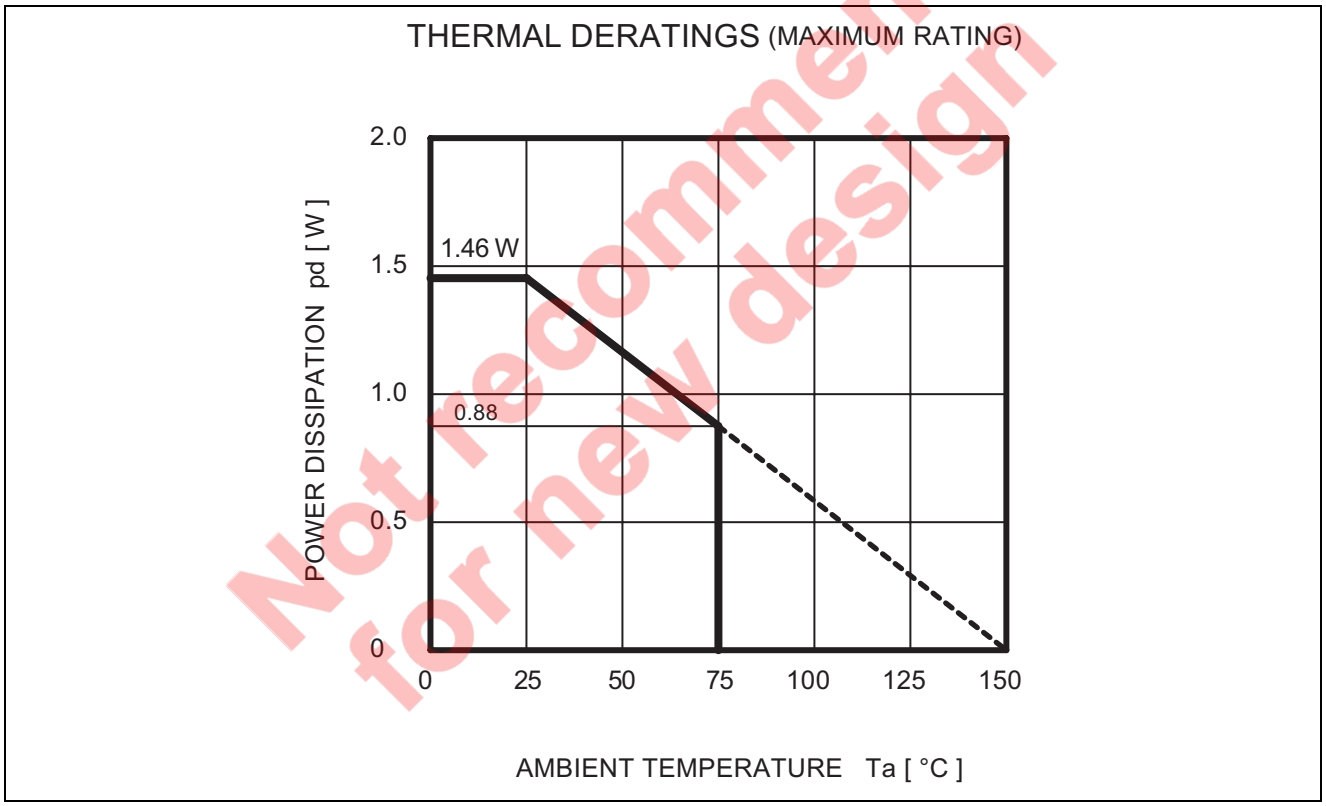
Pin No.	Symbol	Function	Circuit
29	AVDD	Analog positive Power supply	+7 V
31	GNDS	GND	Connect to analog GND
34	GNDC		
36	GNDR		
38	GNDL		
30	SWin	Volume INPUT	
32	SRin		
33	SLin		
35	Cin		
20	SWout	Volume OUTPUT	
19	SRout		
18	SLout		
17	Cout		
37	Rin	Tone INPUT	
39	Lin		
40	BYPASSR	L, R Volume INPUT in BYPASS mode	
1	BYPASSL		
15	Lout	L OUTPUT	
16	Rout	R OUTPUT	
2	LTRE	Tone Treble cycle control	
9	RTRE		
3	LBASS3	Tone Bass cycle control	
8	RBASS3		
4	LBASS2		
7	RBASS2		
5	LBASS1		
6	RBASS1		
10	CR2	Tone OUTPUT	
12	CL2		
11	CR1	L, R Volume INPUT	
13	CL1		
15	Lout	L OUTPUT	
16	Rout	R OUTPUT	
14	AVSS	Analog negative Power Supply	−7 V
21	AGND	Analog GND	
22	DGND	Digital GND	

Pin No.	Symbol	Function	Circuit
23	LATCH	Latch INPUT	
24	DATA	Data INPUT	
25	CLK	Clock INPUT Forward data	
26	DVDD	Digital Power supply	+5 V

INPUT: Schmitt trigger type

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Condition
Supply Voltage	Vsupply	16	V	AVDD-AVSS
		7		DVDD-DGND
Power dissipation	Pd	1460	mW	Ta≤25°C
Thermal derating	Kθ	11.7	mW/°C	Ta>25°C
Operating temperature	Topr	-20 to +75	°C	
Storage temperature	Tstg	-40 to +125	°C	



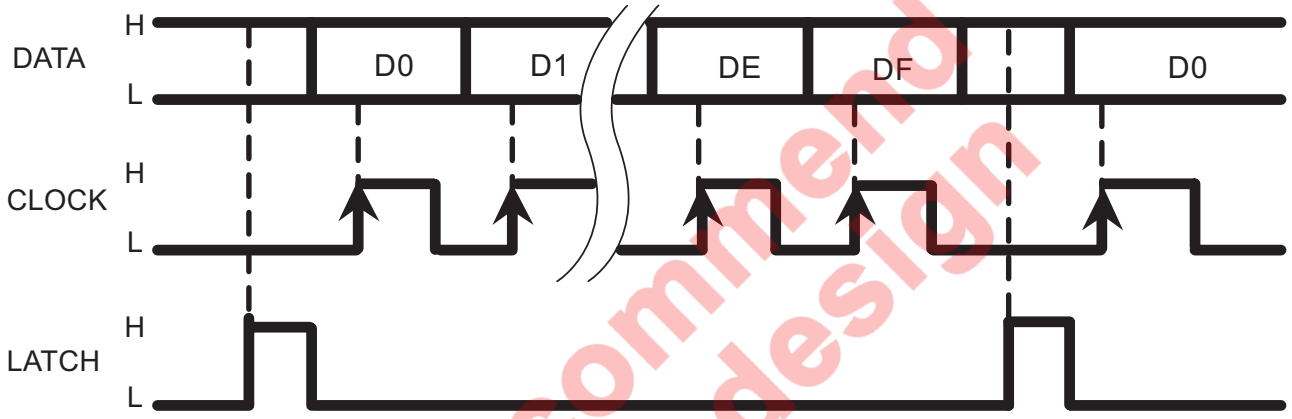
Recommended DC Operating Conditions

(Ta=25°C, unless otherwise noted.)

Parameter	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×0.7	—	DVDD	V	
Low-level Input Voltage	VIL	DGND	—	DVDD×0.3	V	

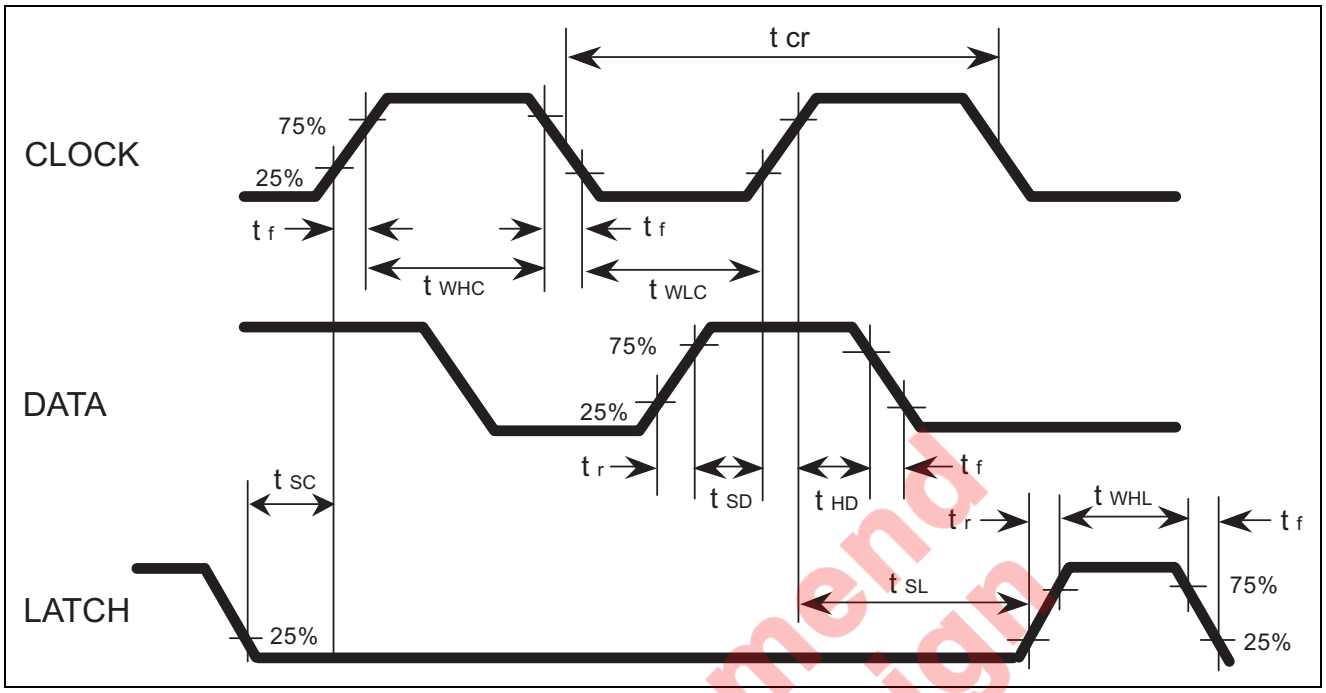
Note: 1. AVSS≤DGND<DVDD≤AVDD
2. Apply AVDD, AVEE and DVDD at the same time.

Relationship between Data and clock and Latch



Note: 1. Make LATCH "L" when CLOCK and DATA is inputted.
2. Make LATCH "H" when Reading in DATA.
3. CLOCK function at raising edges of pulse.

Data Timing (Recommended conditions)



Digital Block Timing Regulation

Parameter	Symbol	Limits			Unit
		Min	Min	Max	
CLOCK cycle time	tcr	8	—	—	µsec
CLOCK pulse width ("H" level)	tWHC	3.2	—	—	
CLOCK pulse width ("L" level)	tWLC	3.2	—	—	
CLOCK, DATA, LATCH rise time	tr	—	—	0.8	
CLOCK, DATA, LATCH fall time	tf	—	—	0.8	
DATA setup time	tSD	1.6	—	—	
DATA hold time	tHD	1.6	—	—	
LATCH setup time	tSL	2	—	—	
LATCH pulse width	tWHL	3.2	—	—	
CLOCK start time after LATCH	tSC	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				0	0	0	0	TONE CONT BASS				0	TONE :0 BYPASS :1	0	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
–14dB		1	1	1	1
–12dB		1	1	0	1
–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
+12dB		0	1	0	1
+14dB		0	1	1	1

(2) BYPASS control

DD1	
BYPASS	1
TONE	0

(3)-1 Volume (0 to –39dB)

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

Note: Do not input other data than the above.

(3)-2 Volume (–40 to –∞dB)

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

Note: Do not input other data than the above.

(3)-3 Volume (–80 to –∞dB)

ATT	Volume	D0X D7X	D1X D8X	D2X D9X	D3X DAX	D4X DBX	D5X DCX	D6X DDX
	–∞dB	1	0	1	0	0	0	1
	–∞dB	1	0	1	0	0	1	0
	–∞dB	1	0	1	0	0	1	1
	↓							
	–∞dB	1	0	1	1	1	1	0
	–∞dB	1	0	1	1	1	1	1
	–80dB	1	1	0	0	0	0	0
	–81dB	1	1	0	0	0	0	1
	–82dB	1	1	0	0	0	1	0
	–83dB	1	1	0	0	0	1	1
	–84dB	1	1	0	0	1	0	0
	–85dB	1	1	0	0	1	0	1
	–86dB	1	1	0	0	1	1	0
	–87dB	1	1	0	0	1	1	1
	–88dB	1	1	0	1	0	0	0
	–89dB	1	1	0	1	0	0	1
	–90dB	1	1	0	1	0	1	0
	–91dB	1	1	0	1	0	1	1
	–92dB	1	1	0	1	1	0	0
	–93dB	1	1	0	1	1	0	1
	–94dB	1	1	0	1	1	1	0
	–95dB	1	1	0	1	1	1	1
	–∞dB	1	1	1	0	0	0	0
	–∞dB	1	1	1	0	0	0	1
	↓							
	–∞dB	1	1	1	1	1	1	0
	–∞dB	1	1	1	1	1	1	1

Electrical Characteristics

(Ta = 25°C, AVDD/AVSS/DVDD = 7/–7/5V, f = 1kHz unless otherwise noted.
Rg = 1kΩ, RL = 10kΩ, TONE CONTROL•VOL are set to 0dB/FLAT.)

(1) Power supply characteristics

Parameter	Symbol	Limits			Unit	Condition
		Min	typ	Max		
Analog positive circuit current	Aldd	—	22	35	mA	Current at pin29 No signal
Analog negative circuit current	Alss	—	22	35	mA	Current at pin 14 No signal
Digital circuit current	Dldd	—	0.5	2.0	mA	Current at pin 26 No signal

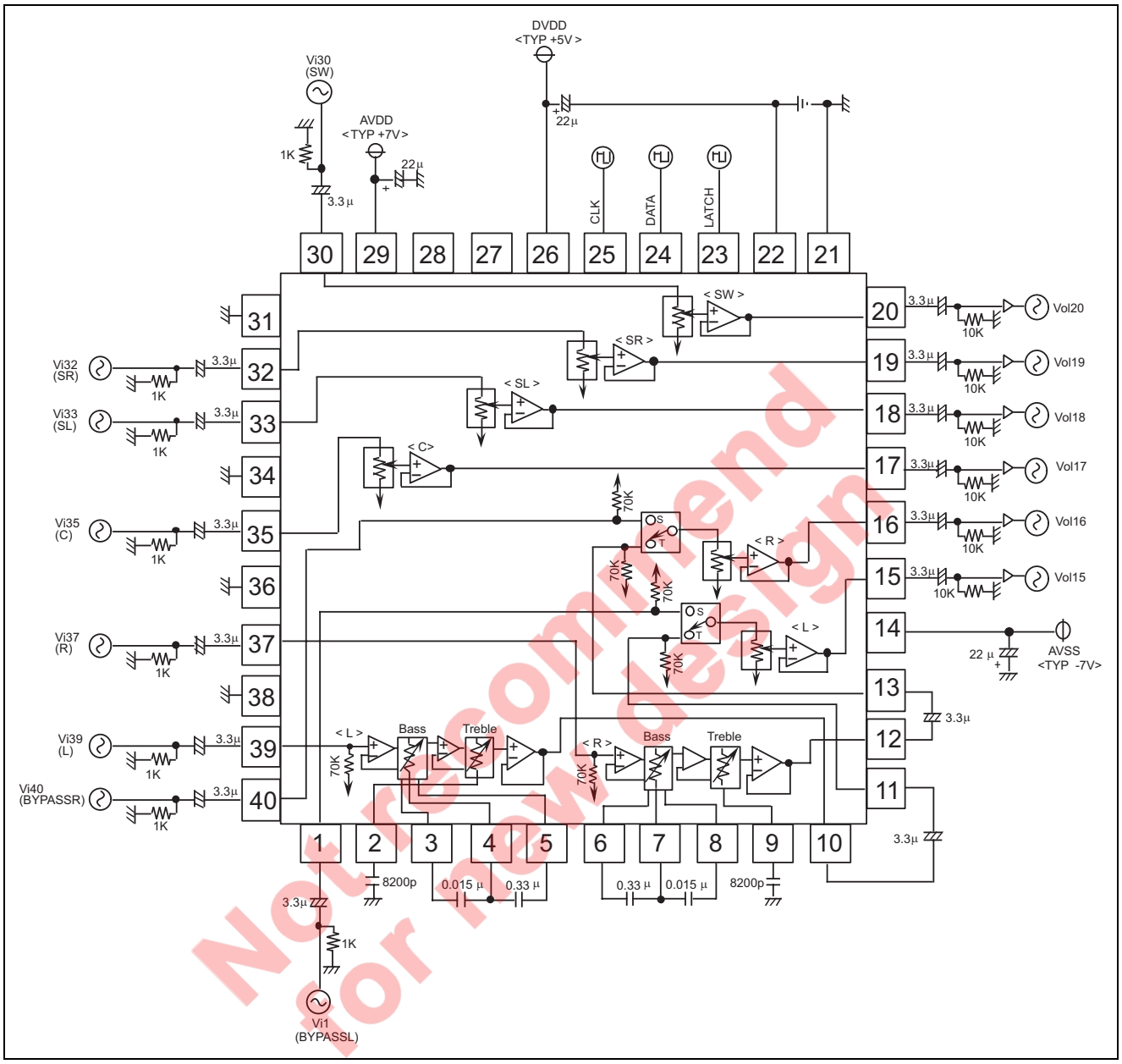
(2) Input / Output characteristics

Parameter	Symbol	Limits			Unit	Condition
		Min	typ	Max		
Input resistance	Ri	35	70	150	kΩ	30, 32, 33, 35, 37, 39 pin
Maximum output voltage	VOM	3.0	4.2	—	Vrms	30, 32, 33, 35, 37, 39 pin INPUT 15 to 20pin OUTPUT THD = 1%
Pass gain	Gv	–2.0	0	2.0	dB	Vi = 0.2Vrms, FLAT 30, 32, 33, 35, 37, 39 pin INPUT 15 to 20pin OUTPUT
Distortion	THD	—	0.002	0.09	%	BW = 400 to 30 kHz, Vi = 0.2 Vrms, RL = 10 kΩ
Output noise voltage	Vn (VOL)	—	1.5	6	µVrms	15 to 20pin, Rg = 0kΩ, IHF-A, VOL = 0dB
	Vn (tone)	—	5	20	µVrms	15, 16pin IHF-A, VOL = 0dB
Maximum attenuation	ATTmax	—	–100	–95	dB	15 to 20pin IHF-A, VOL = –∞dB
Volume gain between channels	Dvol	–1.5	0	1.5	dB	
Cross talk between channels	CT	—	–80	–65	dB	Vo = 0.5Vrms, RL=10kΩ, IHF-A Rg = 1kΩ

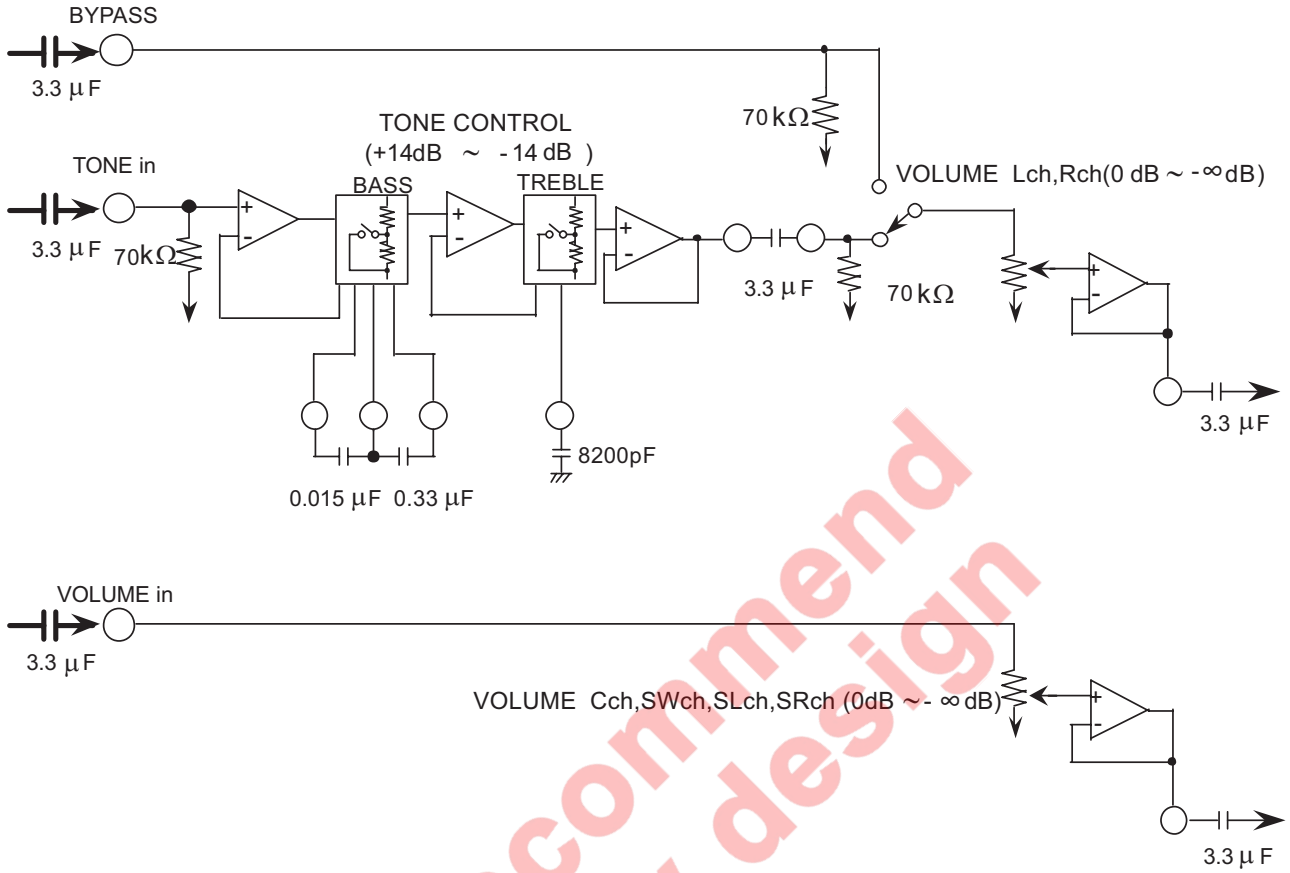
(3) Tone control characteristics

Parameter	Symbol	Limits			Unit	Condition
		Min	typ	Max		
Tone control voltage gain	T+14dB	12	14	16	T+14dB	Vo = 0.2 Vrms TREBLE (f = 10 kHz), BASS (f = 100 kHz) Voltage gain INPUT to pin 37, 39 OUTPUT from pin 16, 15
	T+12dB	10	12	14	T+12dB	
	T+10dB	8	10	12	T+10dB	
	T+8dB	6	8	10	T+8dB	
	T+6dB	4.5	6	7.5	T+6dB	
	T+4dB	2.5	4	5.5	T+4dB	
	T+2dB	1	2	3	T+2dB	
	T–2dB	–3	–2	–1	T–2dB	
	T–4dB	–5.5	–4	–2.5	T–4dB	
	T–6dB	–7.5	–6	–4.5	T–6dB	
	T–8dB	–10	–8	–6	T–8dB	
	T–10dB	–12	–10	–8	T–10dB	
	T–12dB	–14	–12	–10	T–12dB	
	T–14dB	–16	–14	–12	T–14dB	
Balance between channel	BALT	–1.5	0	+1.5	BALT	Input37, 39pin Vo=0.2Vrms Output16, 15pin

Test Circuit



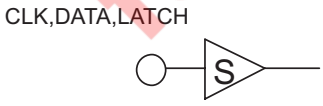
Signal Processing Diagram



Note: 1. The resistance value of Volume change about 18 to 22kΩ by attenuated condition.

2. No built in a zero cross circuit.

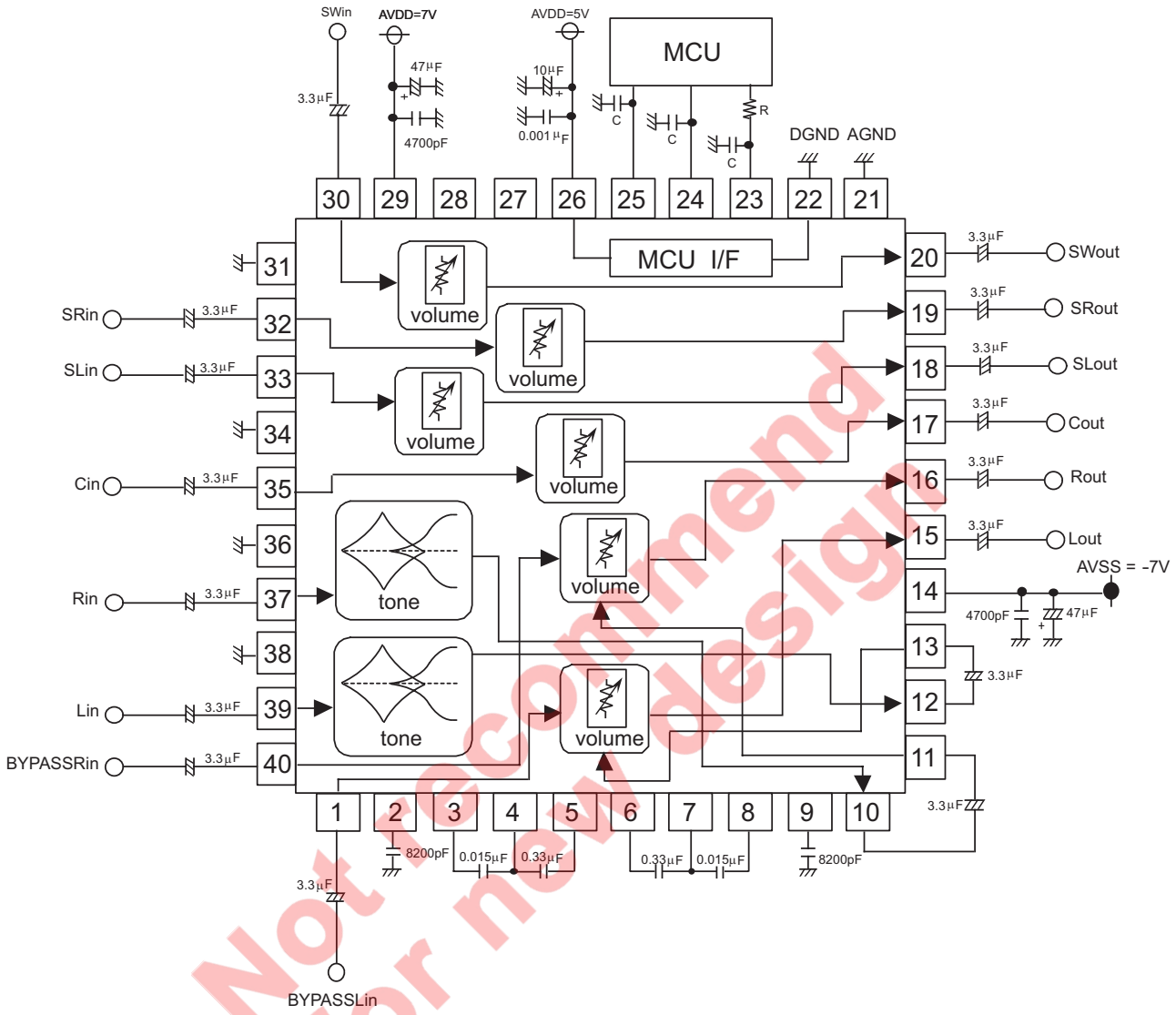
3. When the mode changed(BYPASS/TONE), it is necessary the muting function.



INPUT: Schmitt trigger type

Application Example

(When using Tone control and Bypass)

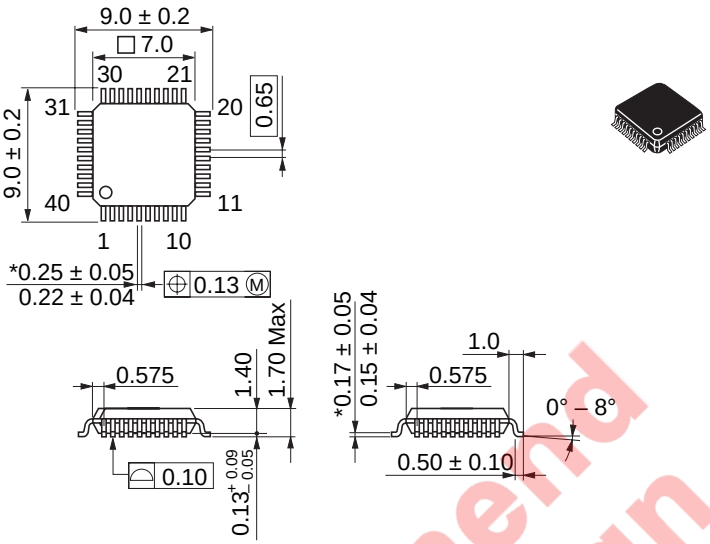


Note: To connect capacitor to DATA, CLOCK pin is the incorrect operation prevention by the noise.
(Recommendation value :47 to 100pF)
For the same reason, LATCH pin connect resistor and capacitor.
(about 1kΩ, 330pF)

Package Dimensions

As of January, 2003

Unit: mm



Package Code	FP-40B
JEDEC	—
JEITA	Conforms
Mass(reference value)	0.2 g

*Dimension including the plating thickness
Base material dimension

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

Keep safety first in your circuit designs!

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