Sound Processors for Home Theater Systems

2ch Electronic Volume

BD3812F

No.10081EAT03

●Description

BD3812F is an electronic volume having volume, gain amplifier functions necessary for applications in AV receivers, home theatre systems, min-component systems and so forth. Having a chip select terminal, it can be controlled until 4 chips with common bus line.

●Features

1) Residual noise : 1.2μVrms {dynamic range : 131dB (IHF-A)}
2) 2ch independent volume (0 to -103dB, MUTE 1dB/step)
3) 8ch at maximum available in combination of any of BD3811K1, BD3813KS, BD3814FV, BD3815KS (6ch volume) in common bus line
4) It can be controlled until 4 chips with common bus line at the same time
5) Maximum output voltage : 4.2Vrms (Vcc=7, VEE=-7V, RL=10kΩ)
6) 2-line serial control (for both 3.3V and 5V)
7) Built-in Output gain amplifier for adjustment of output signal voltage (0, 6 to 18dB, 2dB/step)
8) Output mute controllable by serial data and external control terminal

●Applications

AV receivers, home theater systems, mini-component systems, etc.

●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Ratings	Unit
Powewr supply voltage	VCC	7.5 *1	V
	VEE	-7.5	
Input signal voltage	VIN	VCC+0.3 to VEE-0.3	V
Power dissipation	Pd	450*2	mW
Operating temperature range	Topr	−20 to +75	℃
Storage temperature range	Tastg	−55 to +125	℃

*1 Even in the specified range of Power Supply Voltage, applying voltage only to the VCC side may cause an excessive current to give a permanent damage to the IC.
When starting up power supplies, VEE and VCC should be powered on simultaneously or VEE first; then followed by VCC.

*2 Over Ta=25°C, reduce at the rate of 4.5mW/°C. When installed on the standard board (size: 70x70x1.6mm).

●Operating conditions

It must function normally at Ta=25°C.

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
Operating source voltage	VCC	5	7	7.3	V
	VEE	-7.3	-7	-5	

●Electrical characteristics

Ta=25℃, VCC=7V, VEE=-7V, f=1kHz, Vin=1Vrms, RL=10kΩ, Rg=600Ω, Master volume=0dB, Output gain=0dB , unless otherwise specified.

Parameter		Symbol	Limits			Unit	Conditions
			Min.	Typ.	Max.		
Circuit current	VCC	IQ	—	2	6	mA	No signal
	VEE		-6	-2	—		
Output voltage gain		Gv	-2	0	2	dB	Measure : Pin14, 13
Total harmonic distortion ratio		THD	—	0.005	0.09	%	Measure : Pin14, 13 BW=400～30kHz
Maximum output voltage		Vomax	3.4	4.2	—	Vrms	Measure : Pin14, 13 THD=1%
Output noise voltage		Vno	—	1.2	5	μVrms	Measure : Pin 14, 13 Rg=0Ω, BW=IHF-A
Input impedance		Rin	20	30	40	kΩ	Measure : Pin1, 3
Cross talk between channels 1ch→2ch		CTC12	—	-100	-70	dB	Measure : Pin13(OUT2) Rg=0Ω, BW=IHF-A Reference : Pin14(OUT1)=1Vrms
Cross talk between channels 2ch→1ch		CTC21	—	-100	-70	dB	Measure : Pin14(OUT1) Rg=0Ω, BW=IHF-A Reference : Pin13(OUT2)=1Vrms
Volume control range		GVR	-106	-103	-100	dB	Measure : Pin 14, 13 Vin=3Vrms
Volume set error 1		VE1	-2	0	2	dB	Measure : Pin 14, 13 0 to –53dB, Vin=3Vrms
Volume set error 2		VE2	-3	0	3	dB	Measure : Pin 14, 13 -54 to –103dB, Vin=3Vrms
Maximum attenuation		Vmin	—	-118	-105	dB	Measure : Pin 14, 13 BW=IHF-A, Vin=3Vrms
Output gain control range		GOG	16	18	20	dB	Measure : Pin 14, 13 Vin=0.4Vrms
Output gain set error		GOE	-2	0	-2	dB	Measure : Pin 14, 13 Vin=0.4Vrms

* This product is not of “anti radiation design”.

●Timing chart

1) Signal timing conditions

・Data is read on the rising edge of the clock.
・Latch is read on the falling edge of the clock.
・Latch signal must terminate with the LOW state.

* To avoid malfunctions, clock and data signals must terminate with the LOW state.

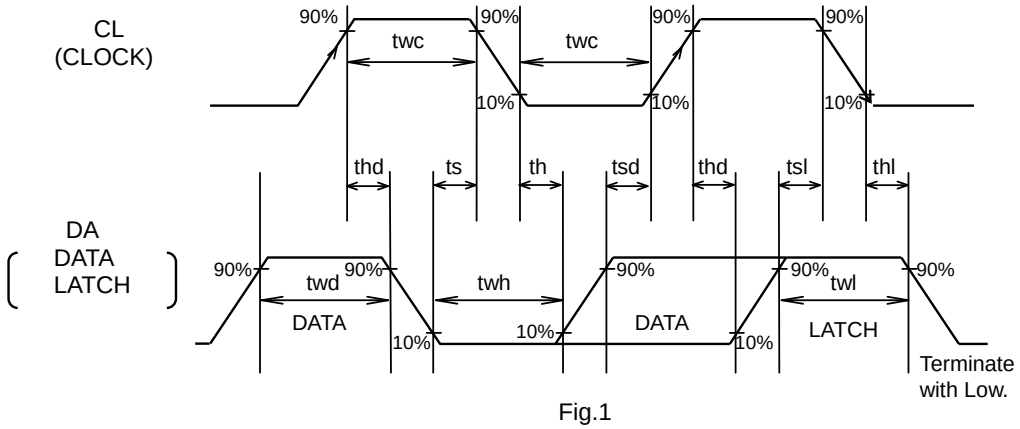


Fig.1

Parameter	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Minimum clock width	twc	2.0	−	−	μs
Minimum data width	twd	2.0	−	−	μs
Minimum latch width	twl	2.0	−	−	μs
LOW hold width	twh	2.0	−	−	μs
Data setup time (DATA→CLK)	tsd	1.0	−	−	μs
Data hold time(CLK→DATA)	thd	1.0	−	−	μs
Latch setup time(CLK→LATCH)	tsl	1.0	−	−	μs
Latch hold time(DATA→LATCH)	thl	1.0	−	−	μs
Latch low setup time	ts	1.0	−	−	μs
Latch low hold time	th	1.0	−	−	μs

2) Voltage conditions for control signal

Parameter	Condition	Limits			Unit
		Min.	Typ.	Max.(≦Vcc)	
“H”input voltage	Vcc=5～7.3V VEE=-5～-7.3V	2.2	−	5.5	V
“L” input voltage		0	−	1.0	V

3) Basic configuration of control data format

← Input direction

	MSB															LSB
Data	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Data														Select Address		

・Control data format

←Input direction

															Select Address		
Data ①	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master Volume 2ch							Master Volume 1ch							1	1	0
Data ②	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	*	*	*	*	*	*	*	*	*	*	*	Output gain amp			1	1	1

* is 0 or 1.

By changing the setting of select address, 4 control data formats can be selected.

Do not set the select address data to other than specified above.

At power on, initialize all the data.

← Input direction

MSB	LSB	MSB	LSB
Data①	L	Data②	L

"L" shows latch.

After power on, in the second time or after, only data you want to change can be set.

(Example) When to change bus

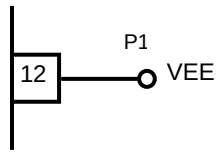
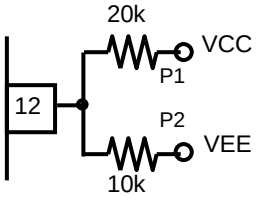
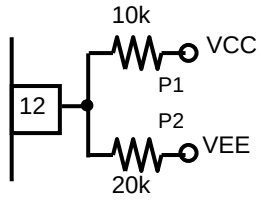
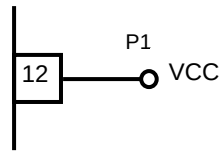
← Input direction

MSB	LSB
Data①	L

"L" shows latch.

4) SEL terminal setting

By determining the SEL terminal voltage, select address can be fixed.
An example of the SEL terminal voltage setting method is shown below.

Setting	P1 Condition	P2 Condition	Setting of SEL(12pin) Terminal	SEL(12pin) Terminal Voltage(V)	Select Address	
					D2	D1
Setting 1	VEE	–		VEE	0	0
Setting 2	VCC	VEE		VCC/3+2×VEE/3	0	1
Setting 3	VCC	VEE		VCC/3	1	0
Setting 4	VCC	–		VCC	1	1

SEL terminal voltage is DGND standard.

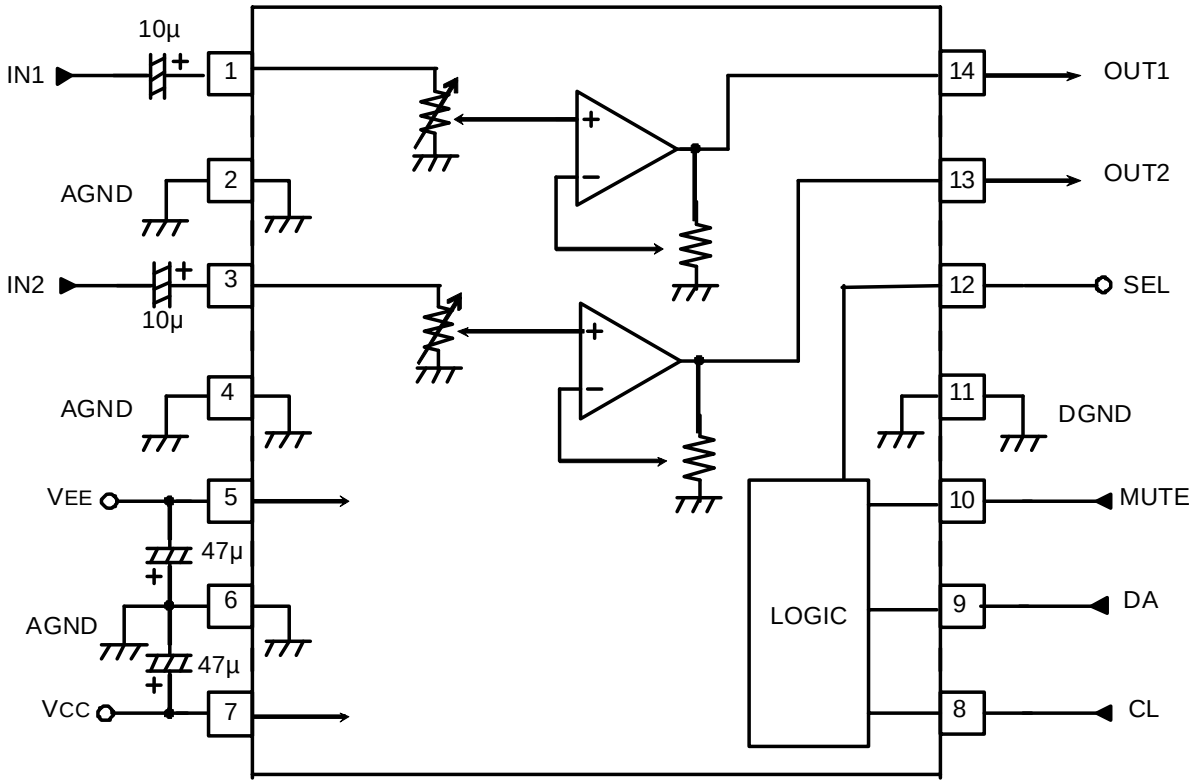
When to use several chips of BD3812F

Select address can be changed by setting SEL terminal (12pin), therefore, up to 4 chips can be used on a same bus line. When to use one chip or two chips of this IC, use the setting 1 and the setting 4. In this case, the terminal voltage of 12pin may be VCC or VEE, therefore external resistor of 12pin is unnecessary.

When to use BD3812F and BD3811K1 at the same time

By using BD3812F and BD3811K1 at the same time, independent control of 8ch volume can be made. And control is available on a same bus line. In this case, be sure to set the SEL terminal setting to “setting 4”.

●Application circuit



UNIT
RESISTOR :Ω
CAPACITOR : F

Fig.2

●Reference data

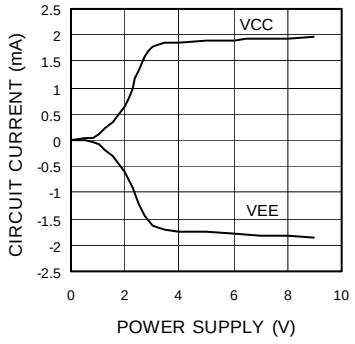


Fig.3 Circuit current - Power supply

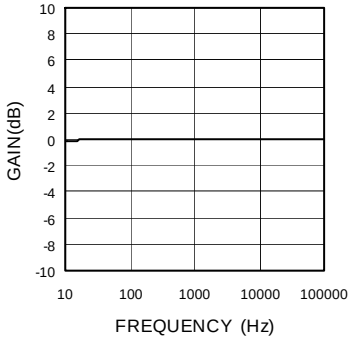


Fig.4 Voltage gain - Frequency

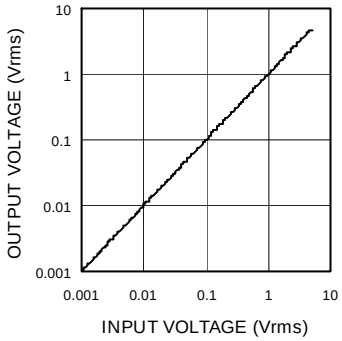


Fig.5 Output voltage - Input voltage

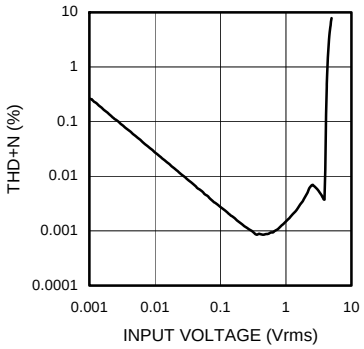


Fig.6 THD+N - Input voltage

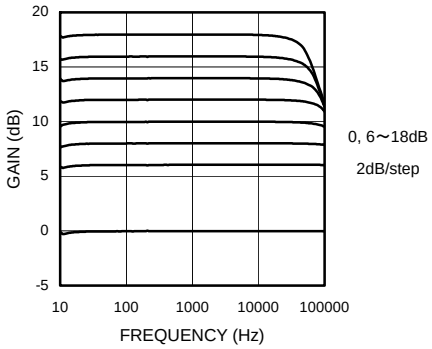


Fig.7 Output gain - Frequency

●Notes for use

(1) Numbers and data in entries are representative design values and are not guaranteed values of the items.

(2) Although we are confident in recommending the sample application circuits, carefully check their characteristics further when using them. When modifying externally attached component constants before use, determine them so that they have sufficient margins by taking into account variations in externally attached components and the Rohm LSI, not only for static characteristics but also including transient characteristics.

(3) Absolute maximum ratings
If applied voltage, operating temperature range, or other absolute maximum ratings are exceeded, the LSI may be damaged. Do not apply voltages or temperatures that exceed the absolute maximum ratings. If you think of a case in which absolute maximum ratings are exceeded, enforce fuses or other physical safety measures and investigate how not to apply the conditions under which absolute maximum ratings are exceeded to the LSI.

(4) VEE potential
Make the VEE pin voltage such that it is the lowest voltage even when operating below it. Actually confirm that the voltage of each pin does not become a lower voltage than the VEE pin, including transient phenomena.

(5) Thermal design
Perform thermal design in which there are adequate margins by taking into account the allowable power dissipation in actual states of use.

(6) Shorts between pins and misinstallation
When mounting the LSI on a board, pay adequate attention to orientation and placement discrepancies of the LSI. If it is misinstalled and the power is turned on, the LSI may be damaged. It also may be damaged if it is shorted by a foreign substance coming between pins of the LSI or between a pin and a power supply or a pin and a GND.

(7) Operation in strong magnetic fields
Adequately evaluate use in a strong magnetic field, since there is a possibility of malfunction.

(8) Serial control
For the CL and DA terminals, the patterned and other wirings should be routed not to cause interference with the analog-signal-related lines.

(9) About power ON/OFF
(a) At power ON/OFF, a shock sound will be generated and, therefore, use MUTE on the set.
(b) When turning on power supplies, VEE and VCC should be powered on simultaneously or VEE first; then followed by VCC. If the VCC side is started up first, an excessive current may pass VCC through VEE.

(10) Function switching
For the functions except master volume, use MUTE on the set.

(11) Reduction of switching noise when changing volume from -3dB to -4dB
In order to reduce switching noise when changing volume from -3dB to -4dB, after switching the switch of -4dB step, change the switch of -1dB step by -1dB.

●**Thermal derating characteristic**

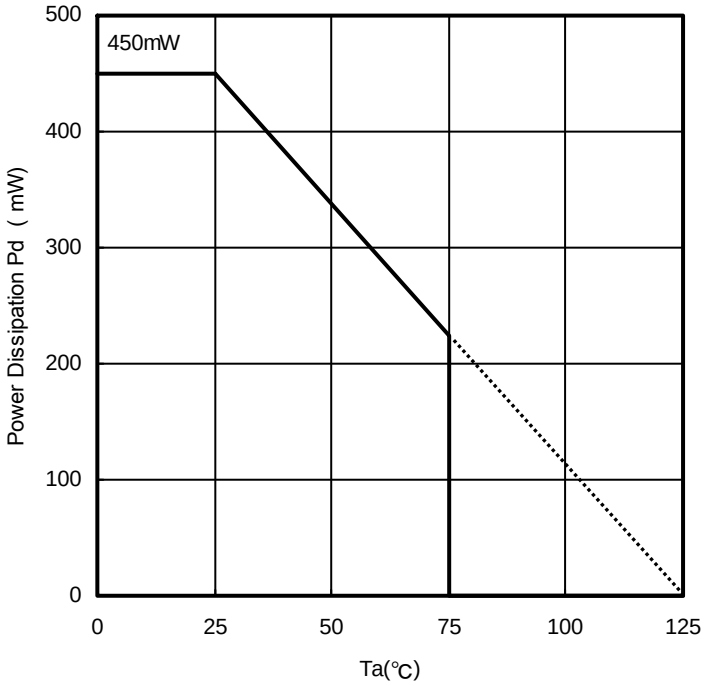


Fig.8

BD3812
ROHM standard board packaging time value
Board size : 70 x 70 x 1.6mm Raw material : FR4 glass epoxy board (copper area 3% or below)

●Ordering part number

B	D	3	8	1	2	F	-	E	2

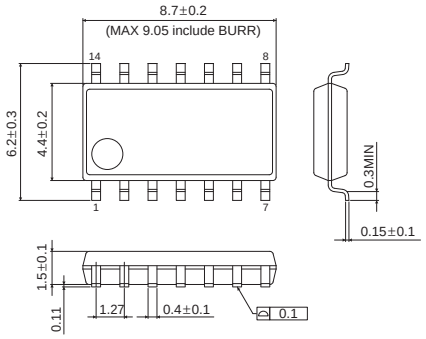
Part No. (BD)

Part No. (3812)

Package
F:SOP14

Packaging and forming specification
E2: Embossed tape and reel

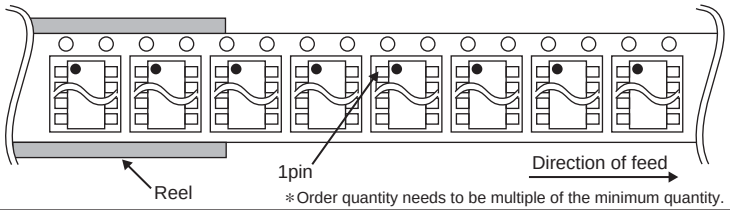
SOP14



(Unit : mm)

<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2500pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

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JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

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1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

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1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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