

No.10081EAT03

# Sound Processors for Home Theater Systems

# 2ch Electronic Volume

# BD3812F

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°C)

Parameter	Symbol	Ratings	Unit	
Powewr supply voltage	VCC	7.5 *1	V	
r onom oupply rollage	VEE	-7.5	v	
Input signal voltage	VIN	VCC+0.3 to VEE-0.3	V	
Power dissipation	Pd	450 <sup>*2</sup>	mW	
Operating temperature range	Topr	-20 to +75	°C	
Storage temperature range	Tastg	-55 to +125	°C	

\*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 a tarting up power supplies VEE and VCC should be powered on simultaneously or VEE first:

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.

Deremeter	Sumbol		Linit			
Parameter	Symbol	Min.	Тур.	Max.	Unit	
	VCC	5	7	7.3	V	
Operating source voltage	VEE	-7.3	-7	-5	V	

### •Electrical characteristics

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

Parameter		O make al	Limits			Lloit	Conditions	
Falamete	1	Symbol	Min.	Тур.	Max.	Unit	Conditions	
O'muit aurorat	VCC	2	_	2	6			
Circuit current	VEE	IQ	-6	-2		mA	No signal	
Output voltage gair	1	Gv	-2	0	2	dB	Measure : Pin14, 13	
Total harmonic dist	ortion ratio	THD	_	0.005	0.09	%	Measure : Pin14, 13 BW=400~30kHz	
Maximum output vo	oltage	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 ran	ge	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 attenuati	on	Vmin	_	-118	-105	dB	Measure : Pin 14, 13 BW=IHF-A, Vin=3Vrms	
Output gain control	range	GOG     16     18     20     dB     Measure : Pin Vin=0.4Vrms		Measure : Pin 14, 13 Vin=0.4Vrms				
Output gain set error		GOE	-2	0	-2	dB	Measure : Pin 14, 13 Vin=0.4Vrms	

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\* This product is not of "anti radiation design".

## Timing chart

- 1) Signal timing conditions
  - Data is read on the rising edge of the clock.
  - $\boldsymbol{\cdot}$  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

Paramotor	Symbol		Unit		
Falametei	Symbol	Min.	Тур.	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

Peremeter	Condition		Linit			
Falameter	Condition	Min.	Тур.	Max.(≦Vcc)	Offic	
"H"input voltage	Vcc=5~7.3V	2.2	_	5.5	V	
"L" input voltage	VEE=-5~-7.3V	0	_	1.0	V	

3) Basic configuration of control data format

	Input	directio	on														
	MSB																LSB
	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Data							Da	ata							Sele	ct Add	ress

• Cont	trol dat Input c	ol data format put direction										Select Address					
Data	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1			Maste	r Volur	ne 2ch			Master Volume 1ch					1	1	0		
Data	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
2	*	*	*	*	*	*	*	*	*	*	*	Outp	ut 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 LSE		3	MSB	LS	SΒ		
Data(1		L	Data	2)	L		
"L" shows latch.							

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



### 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	P2	Setting of	SEL(12pin)	Select A	Address
County	Condition	Condition	SEL(12pin) Terminal	Terminal Voltage(V)	D2	D1
Setting 1	VEE	_	P1 12 VEE	VEE	0	0
Setting 2	VCC	VEE	20k P1 VCC P2 VEE	VCC/3+2 × VEE/3	0	1
Setting 3	VCC	VEE		VCC/3	1	0
Setting 4	VCC	_	P1 12 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



### Reference data













### 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





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



SOP14



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# Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.З, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж: moschip.ru moschip.ru\_4

moschip.ru\_6 moschip.ru\_9