Sound Processors for Home Theater Systems

6ch Electronic Volume

BD3814FV

No.10081EAT05

●Description

BD3814FV is a 1-chip sound processor incorporating such functions as volume, bass, and treble, necessary for AV receivers, home theater systems, and mini-audio systems. This IC adopts the Bi-CMOS process, and realizes low distortion, low noise, and a wide dynamic range.

●Features

1) Dynamic range: 132dB (tone bypath, VOL = MUTE, IHF-A)
2) Master volume 6ch independent (0 to -95dB, MUTE 1dB/step)
3) Low current consumption design achieved by adopting the BiCMOS process
4) Maximum output voltage: 4.3Vrms (Vcc=7V, VEE=-7V, RL=10kΩ)
5) Built-in 2 OP amplifiers
6) 2-line serial control (for both 3.3V and 5V)

●Applications

AV receivers, home theater systems, mini-audio systems, TVs etc.

●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Ratings	Unit
Power 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	900*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 Reduced by 9 mW/°C over 25°C, when installed on the standard board (size: 70x70x1.6mm).

●Operating conditions

Must function normally at Ta=25℃.

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,
Bass and Treble=0dB unless otherwise noted.

	Parameter		Symbol	Limits			Unit.	Conditions
				Min.	Typ.	Max.		
Total output	Circuit current	VCC	IQ	—	7	17	mA	No signal
		VEE		-17	-7	—		
	L input current(CL,DA)		IIL	—	0.5	5	μA	CL=DA=0V
	H input current(CL,DA)		IIH	—	0	5	μA	CL=DA=5V
	Output voltage gain 1		Gv1	-2	0	2	dB	Measure: Pin27,28,29,30, 31,32
	Output voltage gain 2		Gv2	-2	0	2	dB	Measure: Pin3, 7
	Total harmonic distortion ratio 1		THD1	—	0.001	0.03	%	Measure: Pin27,28,29,30,31,32 BW=400 ~ 30kHz
	Total harmonic distortion ratio 2		THD2	—	0.001	0.03	%	Measure: Pin3, 7 BW=400 ~ 30KHz
	Maximum output voltage 1		Vomax1	3.6	4.3	—	Vrms	Measure: Pin27,28,29,30,31,32 THD=1%
	Maximum output voltage 2		Vomax2	3.6	4.3	—	Vrms	Measure: Pin 3,7 THD=1%
	Output noise voltage 1		Vno1	—	1.0	6.0	μVrms	Measure: Pin 27, 28 Tone: By-pass, Rg=0Ω, BW=IHF-A
				—	1.7	10	μVrms	Measure: Pin 27, 28 Tone: ON, Rg=0Ω, BW=IHF-A
	Output noise voltage 2		Vno2	—	1.0	6.0	μVrms	Measure: Pin3, 7, 29, 30, 31, 32 Rg=0Ω, BW=IHF-A
	Cross talk between channels Rch→Lch		CTCRL	—	-95	-80	dB	Measure: Pin27(OUTFL) Rg=0Ω, BW=IHF-A Reference: Pin28(OUTFR)=1Vrms
	Cross talk between channels Lch→Rch		CTCLR	—	-95	-80	dB	Measure: Pin28(OUTFR) Rg=0Ω, BW=IHF-A Reference: Pin27(OUTFL)=1Vrms
	Cross talk between channels SRch→SLch		CTCSRL	—	-95	-80	dB	Measure: Pin 30(OUTSL) Rg=0Ω, BW=IHF-A Reference: Pin31(OUTSR)=1Vrms
	Cross talk between channels SLch→SRch		CTCSLR	—	-95	-80	dB	Measure: Pin 31(OUTSR) Rg=0Ω, BW=IHF-A Reference: Pin30(OUTSL)=1Vrms
	Cross talk between channels Cch→SWch		CTCCSW	—	-95	-80	dB	Measure: Pin 32(OUTSW) Rg=0Ω, BW=IHF-A Reference: Pin29(OUTC) =1Vrms

	Parameter	Symbol	Limits			Unit.	Conditions
			Min.	Typ.	Max.		
Volume output	Input impedance V	RinV	14	20	26	kΩ	Measure: Pin27,28,29,30,31,32
	Volume control range	GVR	-98	-95	-92	dB	Measure: Pin27,28,29,30,31,32 Vin=3Vrms
	Volume set error 1	VE1	-1.5	0	1.5	dB	Measure: Pin27,28,29,30, 31,32 0 to –53dB, Vin=3Vrms
	Volume set error 2	VE2	-2.5	0	2.5	dB	Measure: Pin27,28,29,30,31,32 -54 to –95dB, Vin =3Vrms
	Maximum attenuation amount	Vmin	—	-115	-105	dB	Measure: Pin27,28,29,30,31,32 Vin =3Vrms, BW=IHF-A
	Residual noise voltage 1	Vnom1	—	1.0	6.0	μVrms	Measure: Pin27, 28 Tone: By-Pass, Rg=0Ω, BW=IHF-A
	Residual noise voltage 2	Vnom2	—	1.0	6.0	μVrms	Measure: Pin29, 30, 31, 32 Rg=0Ω, BW=IHF-A
	Cross talk between channels SWch→Cch	CTCSWC	—	-95	-80	dB	Measure: Pin 29(OUTC) Rg=0Ω, BW=IHF-A Reference: Pin32(OUTSW)=1Vrms
Treble	Treble maximum boost gain	GTB	12	14	16	dB	Measure: Pin 27, 28 f=15kHz, Vin =0.4Vrms
	Treble maximum cut gain	GTC	-16	-14	-12	dB	Measure: Pin 27, 28 f=15kHz, Vin =0.4Vrms
	Treble step resolution	TR	—	2	—	dB	Measure: Pin 27, 28 f=15kHz, Vin =0.4Vrms
	Treble gain set error	TE	-2	0	2	dB	Measure: Pin 27, 28 f=15kHz, Vin =0.4Vrms
Bass	Bass maximum boost gain	GBB	12	14	16	dB	Measure: Pin 27, 28 f=100Hz, Vin=0.4Vrms
	Bass maximum cut gain	GBC	-16	-14	-12	dB	Measure: Pin 27, 28 f=100Hz, Vin =0.4Vrms
	Bass step resolution	BR	—	2	—	dB	Measure: Pin 27, 28 f=100Hz, Vin =0.4Vrms
	Bass gain set error	BE	-2	0	2	dB	Measure: Pin 27, 28 f=100Hz, Vin =0.4Vrms

* Note: This IC is not designed to be radiation-resistant.

●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.

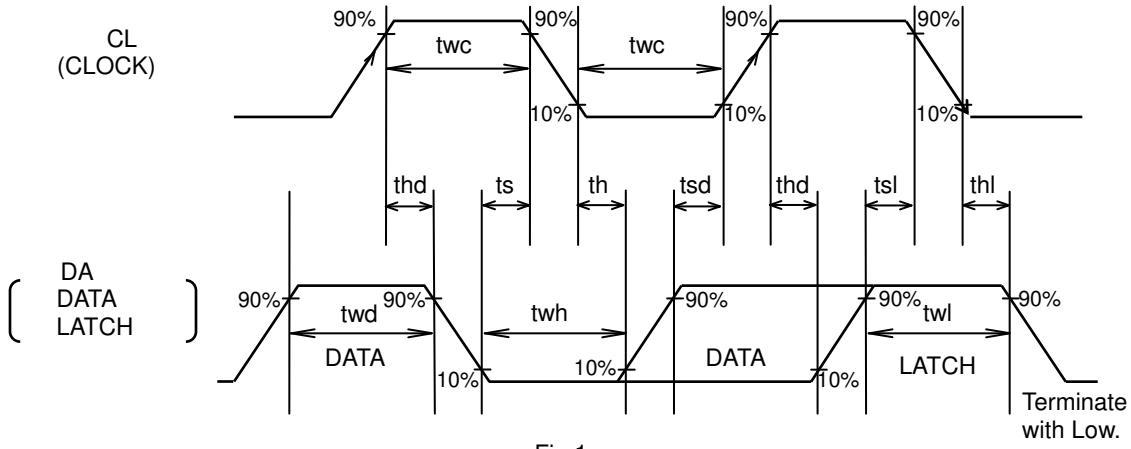


Fig.1

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

← Data 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

←Data input direction

															Select Address		
Data ①	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Treble				Bass				Tone	*	*	*	*	*	0	0	0
Data ②	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master Volume FRch							Master Volume FLch							0	0	1
Data ③	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master Volume SRch							Master Volume SLch							0	1	0
Data ④	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master Volume Cch							Master Volume SWch							0	1	1

By changing select address, 4 control data formats can be selected.
Do not set the select address data to any format other than that specified above.
At power-on sequence, initialize all data.
* is 0 or 1.

Example:

← Data input direction

MSB LSB	MSB LSB	MSB LSB	MSB LSB
Data① L	Data② L	Data③ L	Data④ L

"L" shows latch.

After power-on, for the second and subsequent times, only the necessary data can be selected for setting

Example: When to change bus,

Input direction

← MSB LSB

Data①	L

"L" shows latch.

●Application circuit

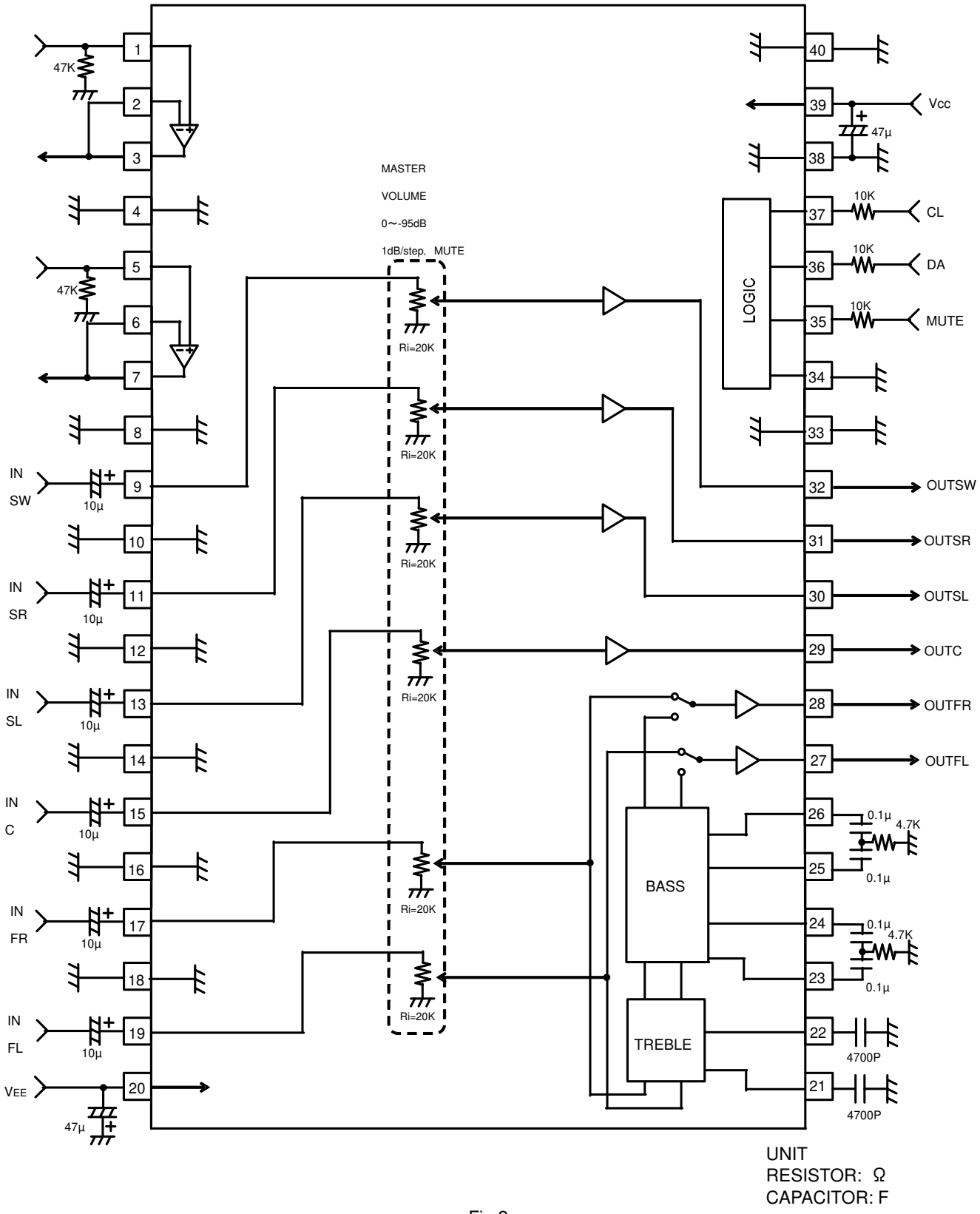


Fig.2

●Reference data

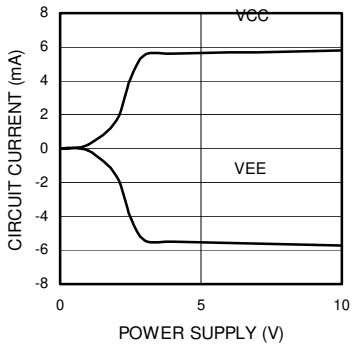


Fig.3 Circuit current - Power supply

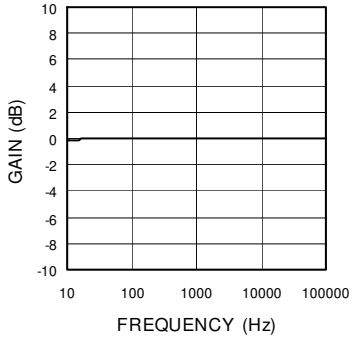


Fig.4 Voltage gain - Frequency

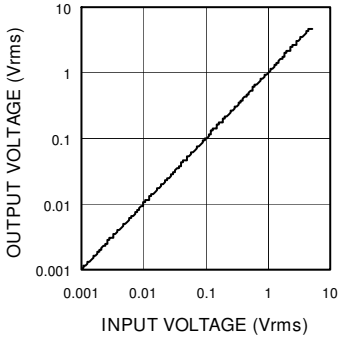


Fig.5 Output voltage - Input voltage

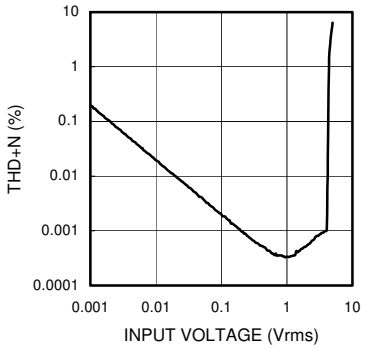


Fig.6 THD+N - Input voltage

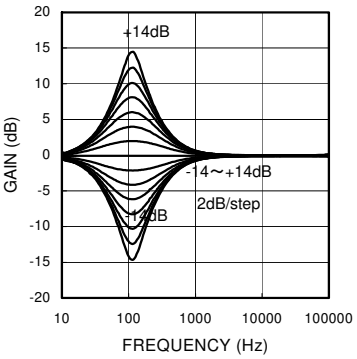


Fig.7 Bass gain - Frequency

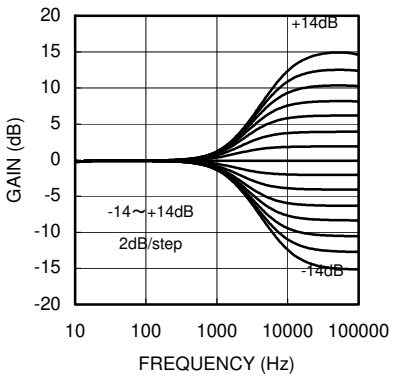


Fig.8 Treble gain - Frequency

●Notes for use

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

2. Although ROHM is confident that the example application circuit reflects the best possible recommendations, be sure to verify circuit characteristics for your particular application. Modification of constants for other externally connected circuits may cause variations in both static and transient characteristics for external components as well as this Rohm IC. Allow for sufficient margins when determining circuit constants.

3. Absolute maximum ratings
   Use of the IC in excess of absolute maximum ratings, such as the applied voltage or operating temperature range (Topr), may result in IC damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure, such as a fuse, should be implemented when using the IC at times where the absolute maximum ratings may be exceeded.

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 power dissipation (Pd) in actual states of use.

6. Short circuit between terminals and erroneous mounting
   Pay attention to the assembly direction of the ICs. Wrong mounting direction or shorts between terminals, GND, or other components on the circuits, can damage the IC.

7. Operation in strong electromagnetic field
   Using the ICs in a strong electromagnetic field can cause operation malfunction.

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

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

10. Tone bypath switching
    For tone bypath switching, use MUTE on the set.

●Thermal derating characteristic

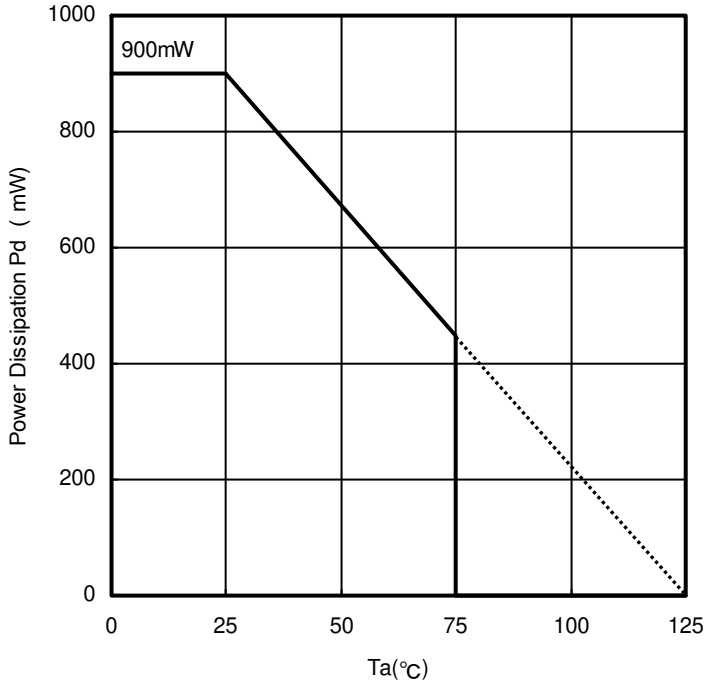


Fig.9

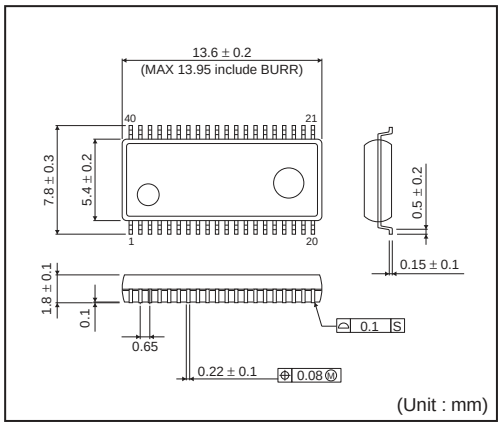
BD3814FV
ROHM standard board packaging time value
Board size: 70 x 70 x 1.6mm Raw material : FR4 glass epoxy board (copper area 3% or below)

●Ordering part number

B	D	3	8	1	4	F	V	-	E	2

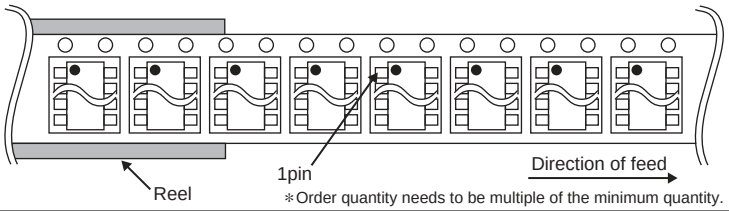
Part No. Part No. Package FV: SSOP-B40 Packaging and forming specification E2: Embossed tape and reel

SSOP-B40



<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2000pcs
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.

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [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.

Precaution for Mounting / Circuit board design

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

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

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).

Precaution for Storage / Transportation

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.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

Precaution Regarding Intellectual Property Rights

1. All information and data including but not limited to application example contained in this document is for reference only. ROHM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data. ROHM shall not be in any way responsible or liable for infringement of any intellectual property rights or other damages arising from use of such information or data.:

2. No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of ROHM or any third parties with respect to the information contained in this document.

Other Precaution

1. This document may not be reprinted or reproduced, in whole or in part, without prior written consent of ROHM.

2. The Products may not be disassembled, converted, modified, reproduced or otherwise changed without prior written consent of ROHM.

3. In no event shall you use in any way whatsoever the Products and the related technical information contained in the Products or this document for any military purposes, including but not limited to, the development of mass-destruction weapons.

4. The proper names of companies or products described in this document are trademarks or registered trademarks of ROHM, its affiliated companies or third parties.

General Precaution

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.

2. All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.

3. The information contained in this document is provided on an "as is" basis and ROHM does not warrant that all information contained in this document is accurate and/or error-free. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties resulting from inaccuracy or errors of or concerning such information.