

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 bypass, 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°C)

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	°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 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°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°C, 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	k Ω	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	μ Vrms	Measure: Pin27, 28 Tone: By-Pass, Rg=0 Ω , BW=IHF-A
	Residual noise voltage 2	Vnom2	—	1.0	6.0	μ Vrms	Measure: Pin29, 30, 31, 32 Rg=0 Ω , BW=IHF-A
	Cross talk between channels SWch→Cch	CTCSWC	—	-95	-80	dB	Measure: Pin 29(OUTC) Rg=0 Ω , 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.

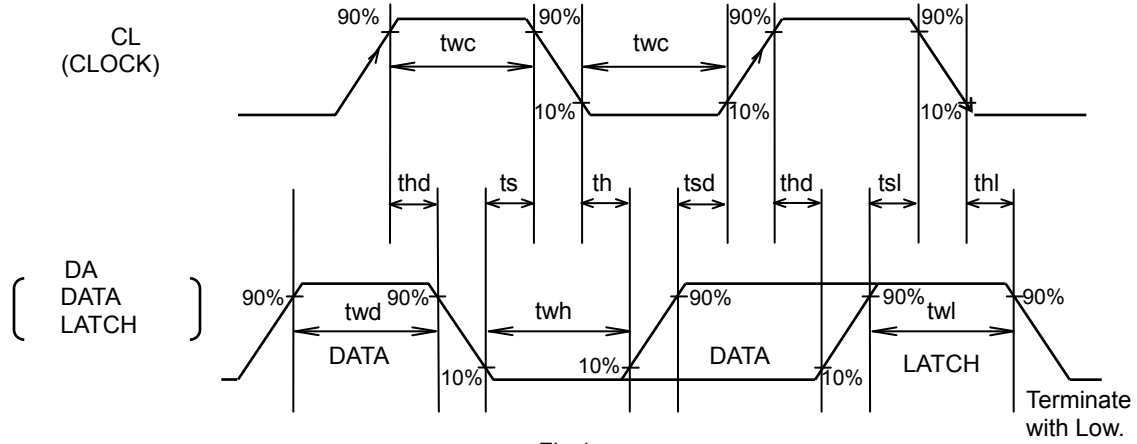


Fig.1

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

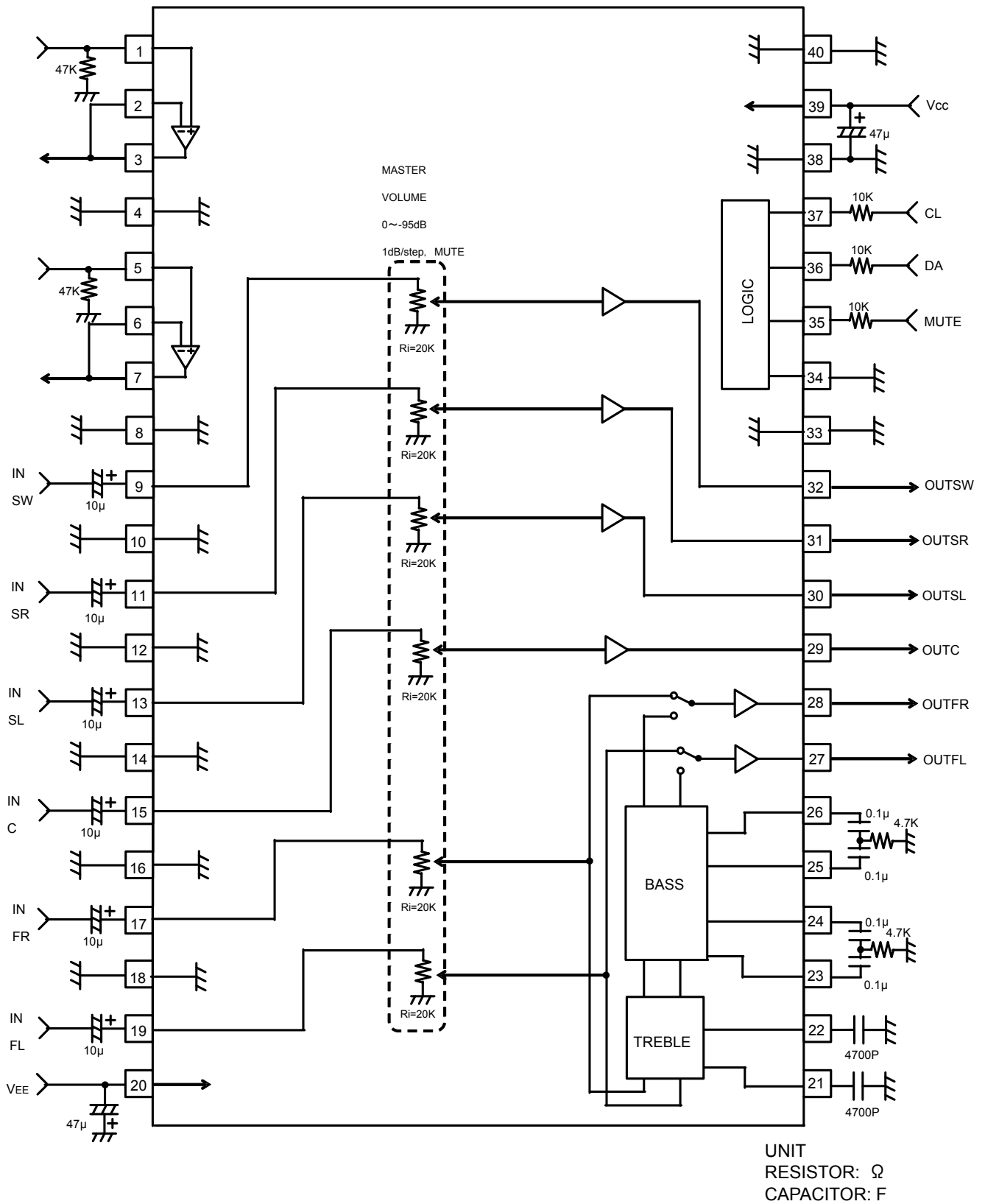


Fig.2

●Reference data

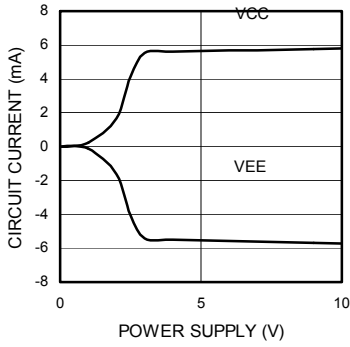


Fig.3 Circuit current - Power supply

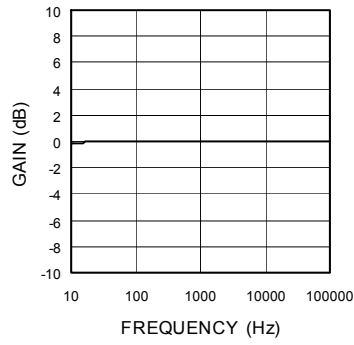


Fig.4 Voltage gain - Frequency

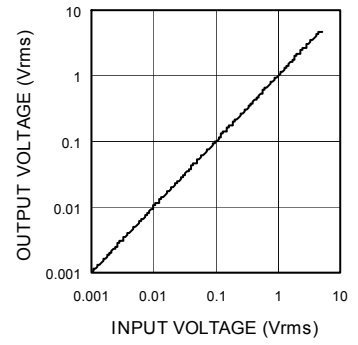


Fig.5 Output voltage - Input voltage

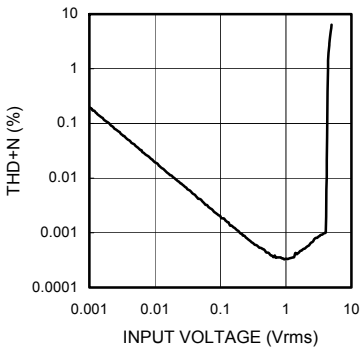


Fig.6 THD+N - Input voltage

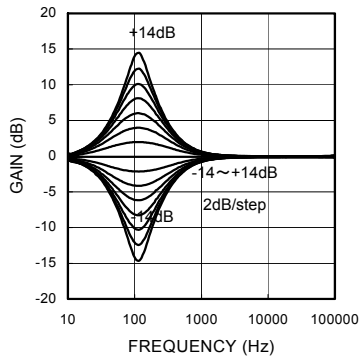


Fig.7 Bass gain - Frequency

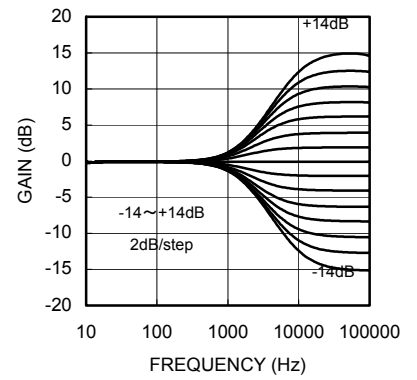


Fig.8 Treble gain - Frequency

●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 (T_{opr}), 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 (P_d) 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

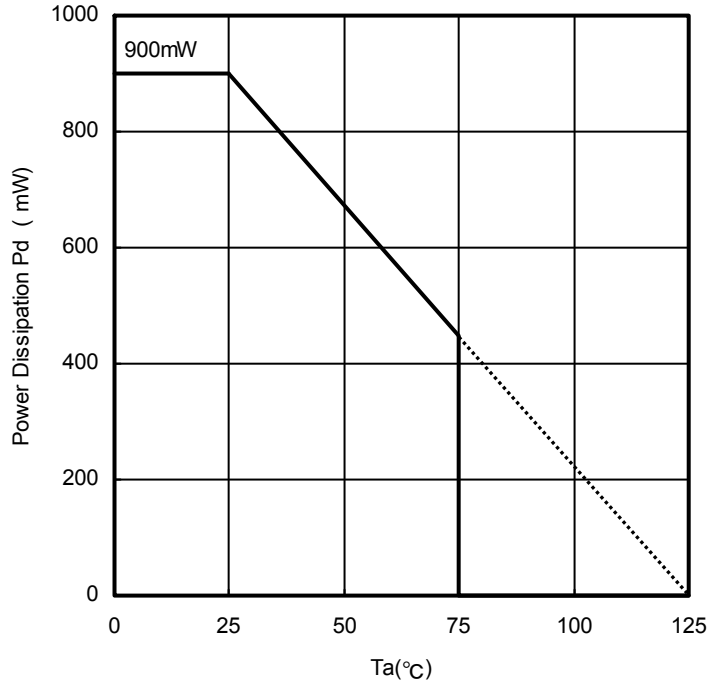
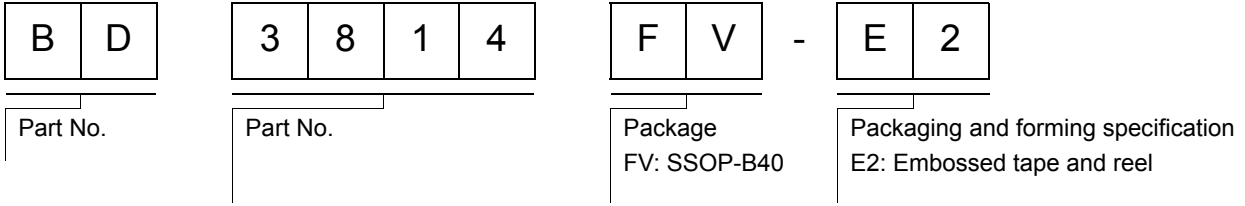


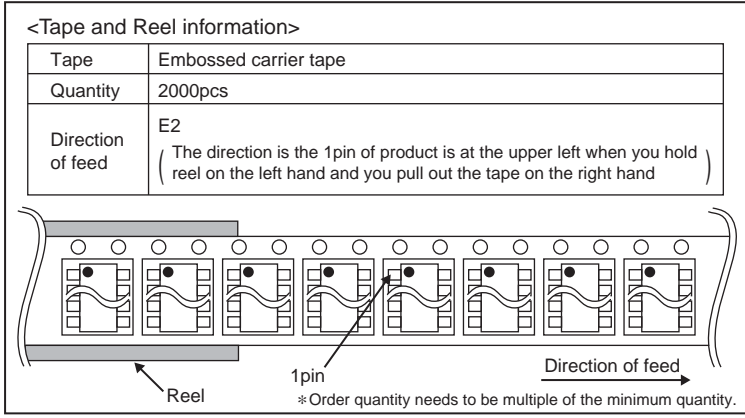
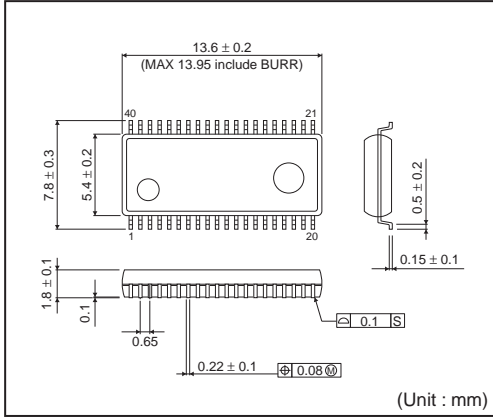
Fig.9

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



SSOP-B40



Notes

No copying or reproduction of this document, in part or in whole, is permitted without the consent of ROHM Co.,Ltd.

The content specified herein is subject to change for improvement without notice.

The content specified herein is for the purpose of introducing ROHM's products (hereinafter "Products"). If you wish to use any such Product, please be sure to refer to the specifications, which can be obtained from ROHM upon request.

Examples of application circuits, circuit constants and any other information contained herein illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

Great care was taken in ensuring the accuracy of the information specified in this document. However, should you incur any damage arising from any inaccuracy or misprint of such information, ROHM shall bear no responsibility for such damage.

The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM and other parties. ROHM shall bear no responsibility whatsoever for any dispute arising from the use of such technical information.

The Products specified in this document are intended to be used with general-use electronic equipment or devices (such as audio visual equipment, office-automation equipment, communication devices, electronic appliances and amusement devices).

The Products specified in this document are not designed to be radiation tolerant.

While ROHM always makes efforts to enhance the quality and reliability of its Products, a Product may fail or malfunction for a variety of reasons.

Please be sure to implement in your equipment using the Products safety measures to guard against the possibility of physical injury, fire or any other damage caused in the event of the failure of any Product, such as derating, redundancy, fire control and fail-safe designs. ROHM shall bear no responsibility whatsoever for your use of any Product outside of the prescribed scope or not in accordance with the instruction manual.

The Products are not designed or manufactured to be used with any equipment, device or system which requires an extremely high level of reliability the failure or malfunction of which may result in a direct threat to human life or create a risk of human injury (such as a medical instrument, transportation equipment, aerospace machinery, nuclear-reactor controller, fuel-controller or other safety device). ROHM shall bear no responsibility in any way for use of any of the Products for the above special purposes. If a Product is intended to be used for any such special purpose, please contact a ROHM sales representative before purchasing.

If you intend to export or ship overseas any Product or technology specified herein that may be controlled under the Foreign Exchange and the Foreign Trade Law, you will be required to obtain a license or permit under the Law.



Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact us.

ROHM Customer Support System

<http://www.rohm.com/contact/>