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.

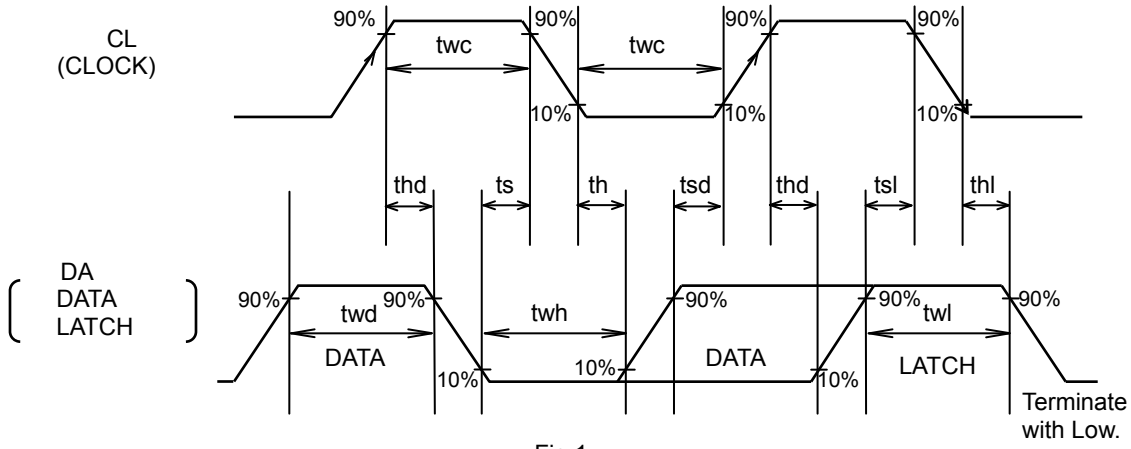


Fig.1

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

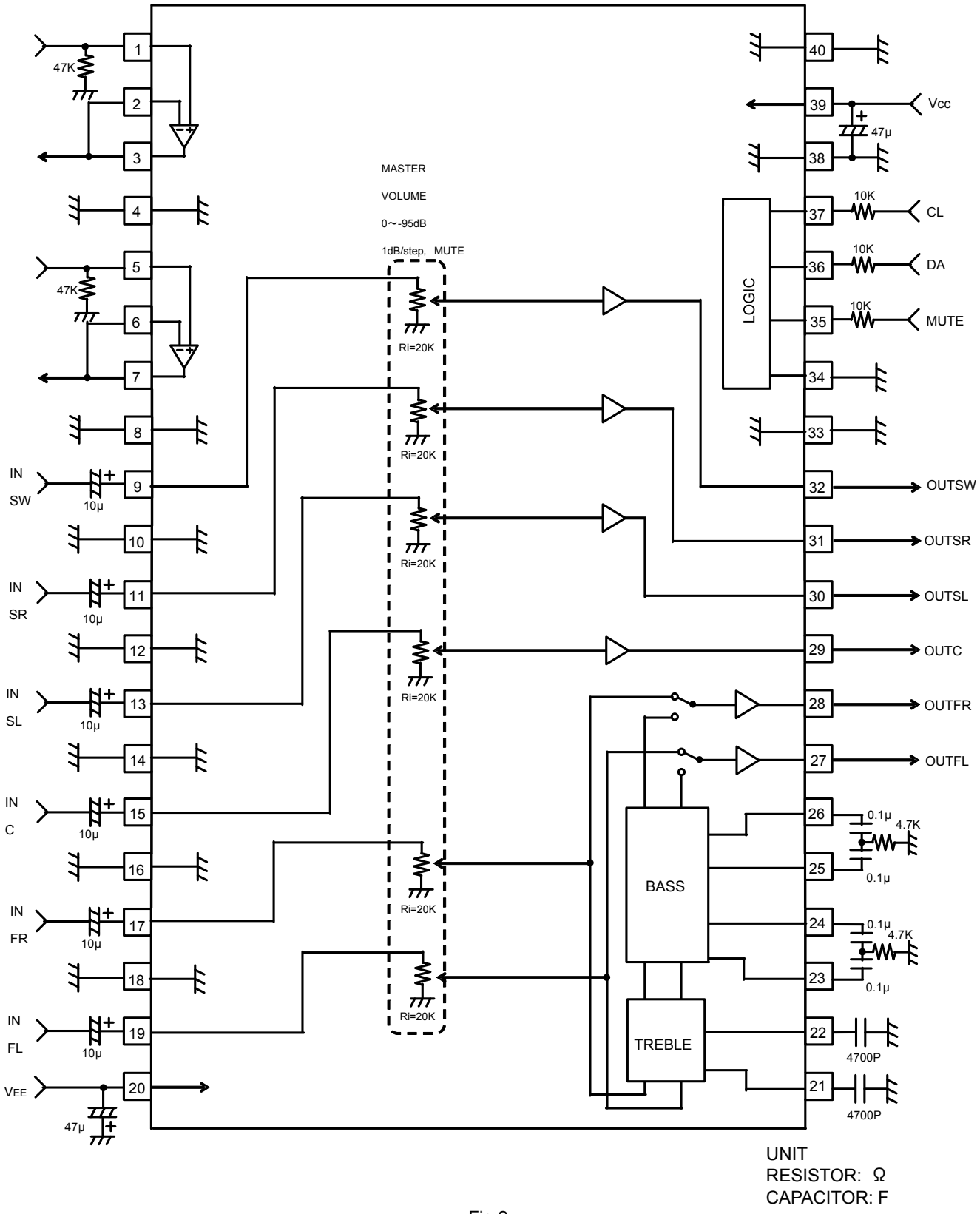


Fig.2

●Reference data

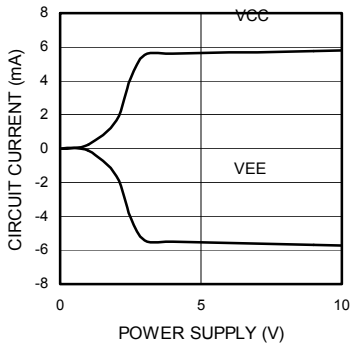


Fig.3 Circuit current - Power supply

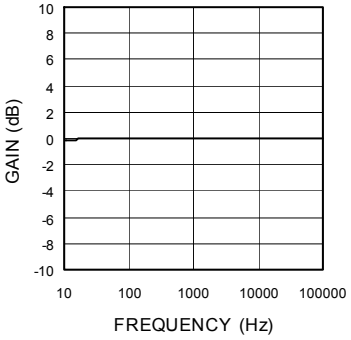


Fig.4 Voltage gain - Frequency

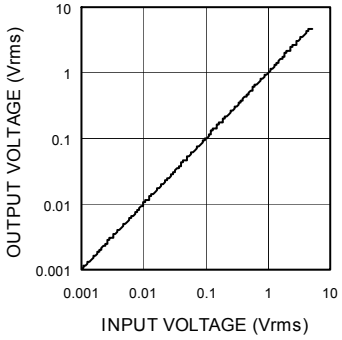


Fig.5 Output voltage - Input voltage

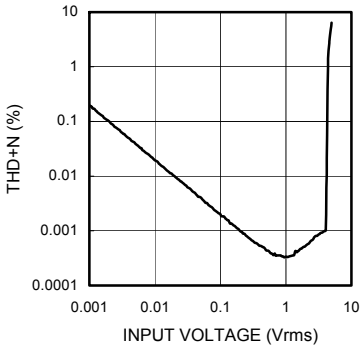


Fig.6 THD+N - Input voltage

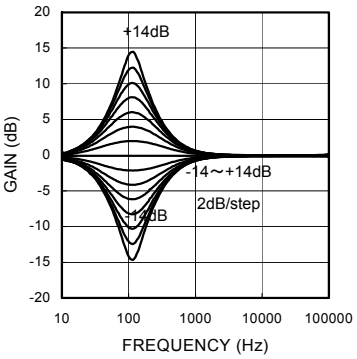


Fig.7 Bass gain - Frequency

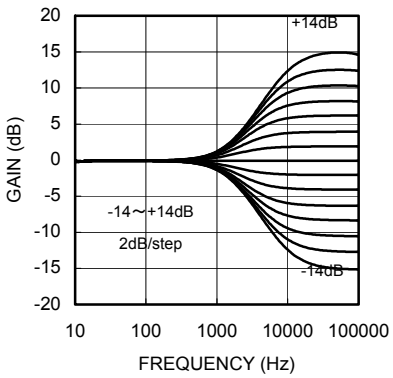


Fig.8 Treble gain - Frequency

●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

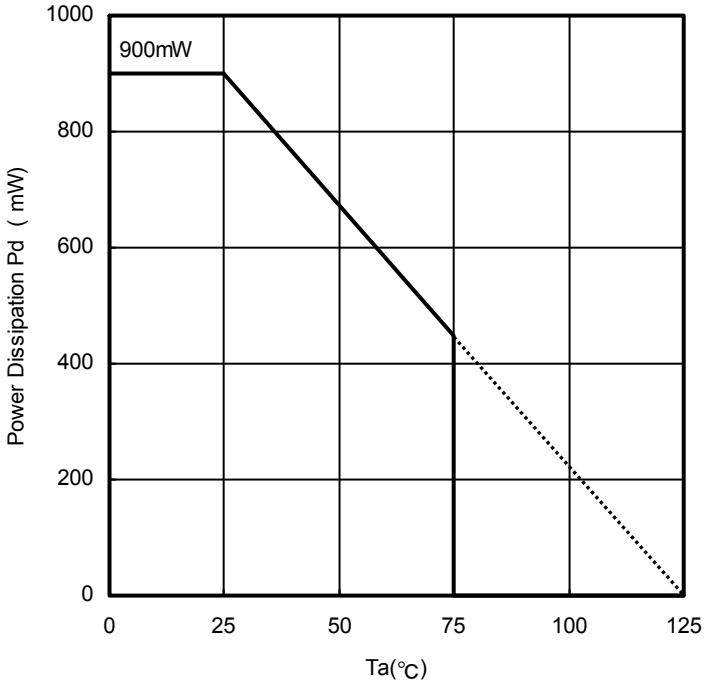


Fig.9

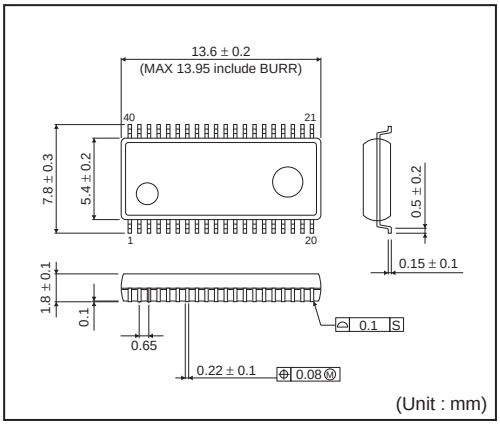
BD3814FV
ROHM standard board packaging time value
Board size: 70 x 70 x 1.6mm　Raw material : FR4 glass epoxy board (copper area 3% or below)

●Ordering part number

B	D	3	8	1	4	F	V	-	E	2

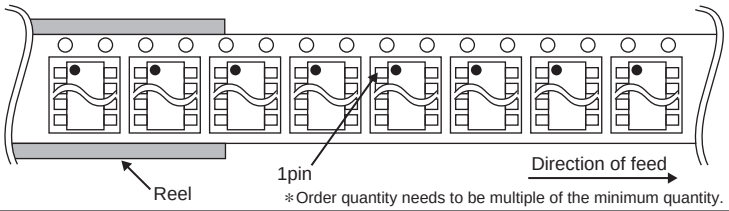
Part No. Part No. Package FV: SSOP-B40 Packaging and forming specification E2: Embossed tape and reel

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.

Notes

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