Sound Processor Series for FPD TVs

Sound Processor with built-in Surround

BD3884FS, BD3886FS

●Description

BD3884FS and BD3886FS are pin-compatible and software-compatible sound processors with surround sound and AGC functions. BD3886FS is equipped with a BBE processor, and supports 3 stereo inputs. It is best suited for TV and audio units with 2-channel output, and is capable of presenting high-performance sound.

●Features

1) BD3886FS is equipped with a BBE processor that can precisely reproduce original sound. It is possible to control the clarity of sound in an optimal way by adjusting the BBE effect.
2) The volume difference between input sources is controlled by the AGC circuit.
3) Matrix surround that can control diffusion of sound.
4) Resistance ladder type circuit is used for volume and tone, realizing low noise (6μVrms) and low distortion (0.008%).
5) Reduced shock sound from switching volume or tone.
6) By collecting the audio input terminal and audio output terminal respectively, the flow of signals is aligned to one direction. This contributes to facilitate the layout of board pattern, and to reduce the area of the board.

●Applications

TV units, such as LCD TV, PDP TV, CATV, DVD, PC, and personal audio.

●Product lineup

Function	BD3884FS	BD3886FS
No. of inputs	Stereo 1 input	Stereo 3 input
BBE processor	–	Available
Package	SSOP-A24	SSOP-A32

BD3886FS is an advanced compatible IC with BD3884FS.

Ver.B June 2006

●**Absolute maximum ratings** (Ta=25℃)

Parameter	Symbol	Limits	Unit
Applied Voltage	VCC	10.0	V
Input Voltage	VIN	VCC+0.3～GND-0.3	V
Power Dissipation	Pd	BD3884FS :1000 *1	mW
		BD3886FS :1190 *2	
Operating Temperature	Topr	-40～+85 *3	℃
Storage Temperature	Tstg	-55～+150	℃

*1 Reduced by 8.0 mW/°C at 25°C or higher.
Thermal resistance θja = 125(°C/W).

*2 Reduced by 9.5 mW/°C at 25°C or higher.
Thermal resistance θja = 105 (°C/W), when ROHM standard board is mounted.
ROHM standard board : Size:70×70×1.6 (mm^3)
Material: FR4 glass-epoxy substrate (copper foil area: not more than 3%).

*3 As long as voltage stays within operating voltage range, certain circuit operation is guaranteed in the operating temperature range.
Allowable power loss conditions are related to temperature, to which care must be taken.
In addition though the standard value of its electrical characteristics cannot be guaranteed under the conditions other than those specified, basic functions are maintained.

●**Operating range**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage *4	VCC	7.0	9.0	9.5	V

Basic operation shall be available at Ta = 25℃.

*4 As long as temperature and operating voltage meet specifications
In addition, though the standard value of its electrical characteristics cannot be guaranteed under the conditions other than those specified, basic functions are maintained.

●**Electrical characteristics** (BD3884FS、BD3886FS)

Unless specified: Ta=25°C, Vcc=9V, f=1kHz, VIN=1Vrms, Rg=600Ω, RL=10kΩ, INPUT=A1, OUTPUT=OUT1, Volume 0dB, Bass=0dB, Treble=0dB, Surround=OFF, AGC=OFF, BBE=OFF(Only BD3886FS) when corresponding I^2C data are sent. The data of 1ch shall be noted, and 2ch shall be of similar characteristics.

	Parameter	Symbol	Limits			Unit	Conditions
			Min.	Typ.	Max.		
GENERAL	Current upon no signal	I_Q	—	8	20	mA	Vin=0Vrms
	Maximum input voltage	V_{IM}	2.6	2.8	—	Vrms	Front Volume = -6dB THD(Vout)=1% BPF=400-30KHz
	Maximum output voltage	V_{OM}	2.2	2.5	—	Vrms	THD=1% BPF=400-30KHz
	Voltage gain	G_v	-2	0	2	dB	GV=20log(Vout/Vin)
	Channel balance	CB	-1.5	0	1.5	dB	CB = GV1-GV2
	Total harmonic distortion	THD	—	0.008	0.1	%	Vout=500mVrms BPF=400-30KHz
	Output noise voltage *	V_{NO}	—	6	18	μVrms	BPF = IHF-A, Rg=0Ω
	Residual noise voltage *	V_{MNO}	—	1.5	10	μVrms	Front Volume = -87dB Rear Volume = -∞dB BPF = IHF-A, Rg=0Ω
	Cross talk *	CT	70	80	—	dB	CT = 20log(Vin/Vout) BPF = IHF-A
	Input impedance	R_{INA}	70	100	130	kΩ	BD3884FS : IN1(11pin), IN2(12pin) BD3886FS : A1(13pin), A2(14pin)
	Input impedance (B,C) (only BD3886FS)	R_{INBC}	52	75	98	kΩ	B1(15pin), C1(18pin) B2(16pin), C2(17pin)

	Parameter	Symbol	Limits			Unit	Conditions
			Min.	Typ.	Max.		
FRONT VOLUME	Control range	V_{ATIF1}	-90	-87	-84	dB	V_{ATT} =20log(Vout/Vin)、BPF = IHF-A
	Switching step	S_{VFC}	-	1	-	dB	
	Set error 1	E_{VFC1}	-2	0	2	dB	0dB to -63dB
	Set error 2	E_{VFC2}	-3	0	3	dB	-64dB to –87dB
REAR VOLUME	Control range	V_{ATTR}	-	-100	-90	dB	V_{ATT}=20log(Vout/Vin)、BPF = IHF-A
	Switching step1	S_{VRC1}	-	2	-	dB	0dB to -20dB
	Switching step 2	S_{VRC2}	-	5	-	dB	-20dB to –30dB
	Switching step 3	S_{VRC3}	-	15	-	dB	-30dB to –60dB
	Set error 1	E_{VRC1}	-2	0	2	dB	0dB to -30dB
	Set error 2	E_{VRC2}	-3	0	3	dB	-45dB , -60dB
	Max. Attenuation	A_{TTMAX}	—	-110	-90	dB	Front Volume = -87dB Rear Volume = -∞ BPF = IHF-A
BASS	Boost control range	V_{BBMAX}	+11	+14	+17	dB	f=80Hz、Vin=100mVrms Bass = +14dB V_{BBMAX}=20log(Vout/Vin)
	Cut control range	V_{BCMAX1}	-17	-14	-11	dB	f=80Hz、Vin=100mVrms Bass = -14dB V_{BCMAX}=20log(Vout/Vin)
	Control step	S_{BC}	-	2	-	dB	
	Set error 1	E_{BS1}	-2	0	2	dB	f =80Hz、0dB～8dB
	Set error 2	E_{BS2}	-3	0	3	dB	f =80Hz、10dB～14dB
TREBLE	Boost control range	V_{TBMAX1}	+11	+14	+17	dB	f=15kHz、Vin=100mVrms Treble = +14dB V_{TBMAX}=20log(Vout/Vin)
	Cut control range	V_{TCMAX1}	-17	-14	-11	dB	f=15kHz、Vin=100mVrms Treble = -14dB V_{TCMAX}=20log(Vout/Vin)
	Control step	S_{TC}	-	2	-	dB	
	Set error 1	E_{TS1}	-2	0	2	dB	f =15Hz、0dB～8dB
	Set error 2	E_{TS2}	-3	0	3	dB	f =15Hz、10dB～14dB
AGC	AGC I/O level 1	AGC1	0.7	1.0	1.4	mVrms	Vin=1.0mVrms [1)]
	AGC I/O level 2	AGC2	70	100	130	mVrms	Vin=50mVrms [1)]
	AGC I/O level 3	AGC3	150	200	250	mVrms	Vin=200mVrms [1)]
	AGC I/O level 4	AGC4	150	220	300	mVrms	Vin=1.0Vrms [1)]
BBE (Only BD3886FS)	Contour control range	V_{BBCMAX}	+8	+10	+12	dB	f=50Hz、Vin=100mVrms BBE Contour = +10dB V_{BBCMAX}=20log(Vout/Vin)
	Process control range	V_{BBCMAX}	+8	+10	+12	dB	f=10kHz、Vin=100mVrms BBE Process = +10dB V_{BBPMAX}=20log(Vout/Vin)
SURROUND SEL LINE	Surround common mode gain	V_{sur1}	-2	0	2	dB	Vin=100mVrms
	Surround single mode gain	V_{sur2}	4.3	6.3	8.3	dB	Vin=100mVrms ch contacts AC
	Surround reverse mode gain	V_{sur3}	8	10	12	dB	Vin=100mVrms ch : reverse mode
	SEL output gain	V_{SEL}	-3	-1	+1	dB	
	LINE OUT output gain						
	SEL output gain	V_{LINE}	-2	0	2	dB	
	LINE OUT output gain						

* VP-9690A (Average value detection, effective value display) IHF-A filter by Matsushita Communication is used for * measurement.
* Phase of I/O signal terminals is the same phase.
* This IC is not designed to be radiation-resistant.
* 1): 1ch/2ch simultaneous input, AGC level = 200 mVrms

● **Timing chart**

Electric specifications and timing of bus line and I/O stages

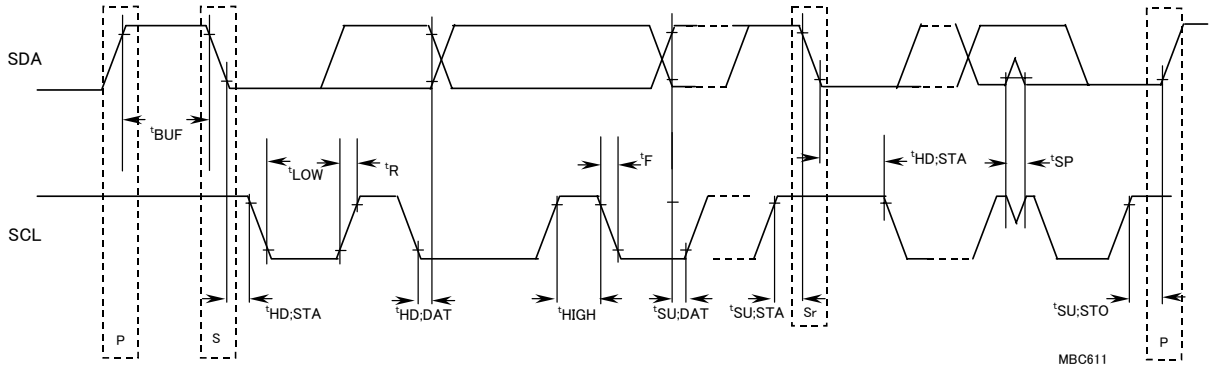


Fig.-1 Timing definition on I^2C BUS

Table 1: Characteristics of SDA of I^2C BUS and SCL bus line

Parameter		Symbol	Standard mode I^2C BUS		Unit
			Min.	Max.	
1	SCL clock frequency	f_{SCL}	0	100	kHz
2	Bus free time between a STOP and START condition	t_{BUF}	4.7	—	μs
3	Hold time (repeated) START condition. After this period, the first clock pulse is generated	$t_{HD;STA}$	4.0	—	μs
4	LOW period of the SCL clock	t_{LOW}	4.7	—	μs
5	HIGH period of the SCL clock	t_{HIGH}	4.0	—	μs
6	Set-up time for a repeated START condition	$t_{SU;STA}$	4.7	—	μs
7	Data hold time	$t_{HD;DAT}$	0*	—	μs
8	Data set-up time	$t_{SU;DAT}$	250	—	ns
9	Rise time of both SDA and SCL signals	t_R	—	1000	ns
10	Fall time of both SDA and SCL signals	t_F	—	300	ns
11	Set-up time for STOP condition	$t_{SU;STO}$	4.0	—	μs
12	Capacitive load for each bus line	C_b	—	400	pF

All the above values correspond to V_{iHmin} and V_{ILmax} level. (See Table 2)

∗ Since the transmitter exceeds the un-defined area of SCL trail end, it is necessary to provide the internal hold time of minimum 300ns for SDA signal (SCL signal $V_{IH\,min.}$).

Table 2: Characteristics of I^2C bus SDA and SCL I/O stage

Parameter		Symbol	Standard mode I^2C BUS		Unit
			Min.	Max.	
13	Low-level input voltage: fixed input levels	V_{IL}	-0.5	1.5	V
14	Low-level input voltage: fixed input levels	V_{IH}	3.0	—	V
15	Hysteresis of Schmitt trigger inputs: fixed input levels	V_{hys}	n/a	n/a	V
16	Pulse width of spikes which must be suppressed by the input filter.	t_{SP}	n/a	n/a	ns
17	Low-level output voltage (open drain): at 3mA sink current	V_{OL1}	0	0.4	V
18	Output fall time from $V_{IHmin.}$ to $V_{IHmax.}$ with a bus capacitance from 10 pF to 400pF: with up to 3mA sink current at VOL1	t_{OF}	—	250	ns
19	Input current each I/O pin with an input voltage between 0.4V and 0.9 $V_{DDmax.}$	I_i	-10	10	μA
20	Capacitance for each I/O pin	C_i	—	10	pF

n/a = Not applicable

●**Data format**

(BD3884FS)

Set item	Select Address (HEX)	MSB data LSB							
		D7	D6	D5	D4	D3	D2	D1	D0
Front Volume	00H	*	Front Volume						
Rear Volume	01H	Rear Volume 1ch				Rear Volume 2ch			
Bass/Treble	02H	Bass Gain				Treble Gain			
AGC Level	03H	*						AGC Suppression Level	
Input Selector	04H	*					Input Selector		
Mute/Surround/ AGC	05H	*					AGC ON/OFF	Surround ON/OFF	MUTE ON/OFF

(BD3886FS)

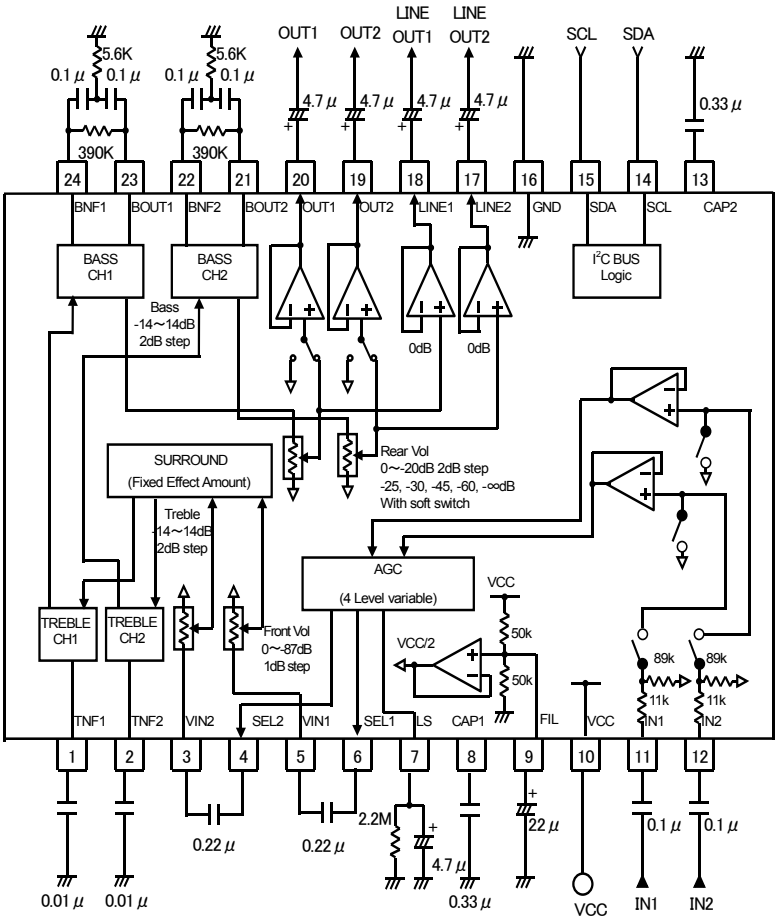
Set item	Select Address (HEX)	MSB data LSB							
		D7	D6	D5	D4	D3	D2	D1	D0
Front Volume	00H	*	Front Volume						
Rear Volume	01H	Rear Volume 1ch				Rear Volume 2ch			
Bass/Treble	02H	Bass Gain				Treble Gain			
AGC Level/ BBE	03H	BBE Contour			BBE Process			AGC Suppression Level	
Input Selector	04H	*					Input Selector		
Mute/Surround/ AGC/BBE	05H	*				BBE ON/OFF	AGC ON/OFF	Surround ON/OFF	MUTE ON/OFF

*: Don't care

●**Operation Notes**

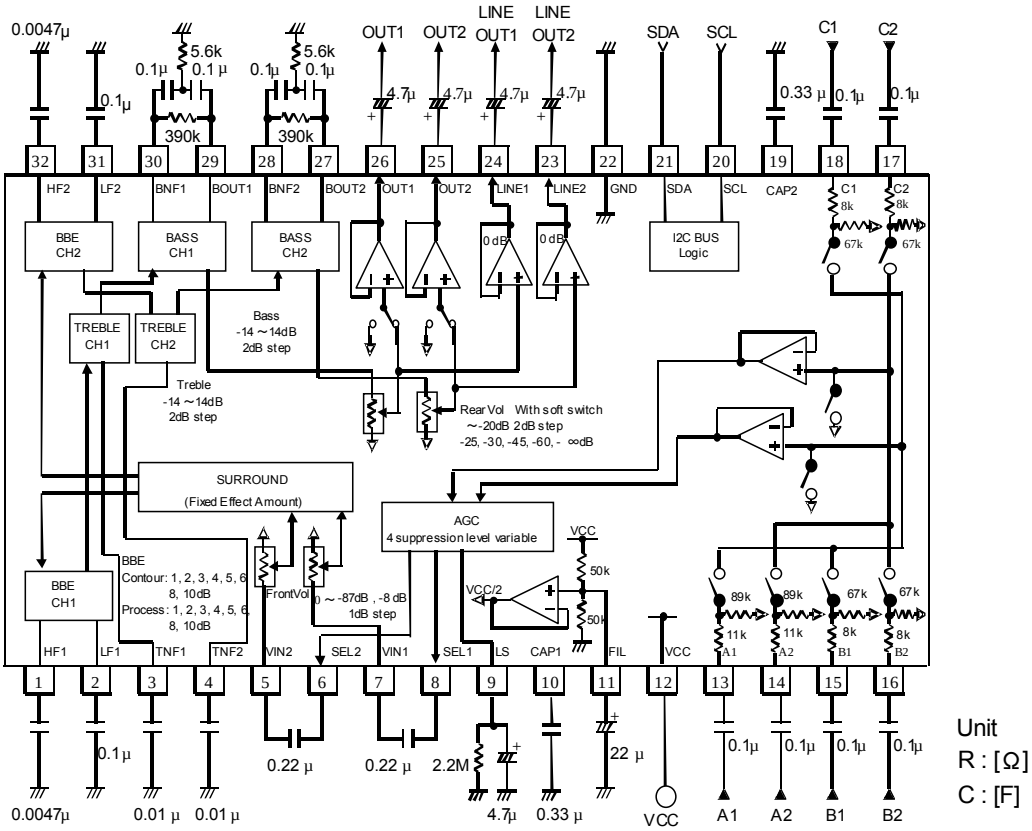
1. Numbers and data in entries are representative design values and are not guaranteed values of the items.
2. Although ROHM is confident that the example application circuit reflects the best possible recommendations, be sure to verify circuit characteristics for your particular application. Modification 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. GND potential
   Ensure a minimum GND pin potential in all operating conditions. Make sure that no pins are at a voltage below the GND at any time, regardless of whether it is a transient signal or not.
5. Thermal design
   Perform thermal design, in which there are adequate margins, by taking into account the permissible 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.

●Application circuit diagram



Unit
R : [Ω]
C : [F]

Fig.2 Application circuit diagram (BD3884FS)



Unit
R : [Ω]
C : [F]

Fig.3 Application circuit diagram（BD3886FS）

●Reference data

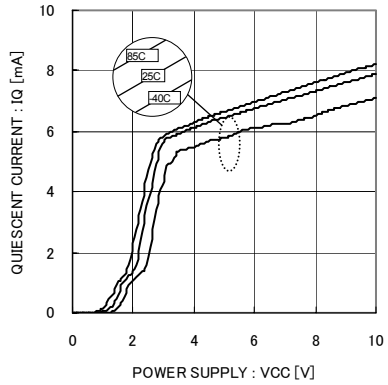


Fig.4 Quiescent current vs Power supply

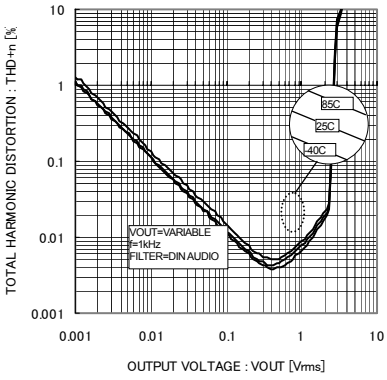


Fig.5 Total harmonic distortion vs Output voltage

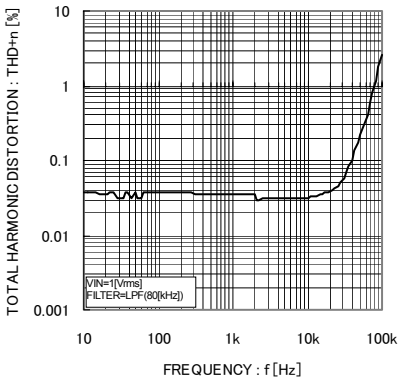


Fig.6 Total harmonic distortion vs Frequency

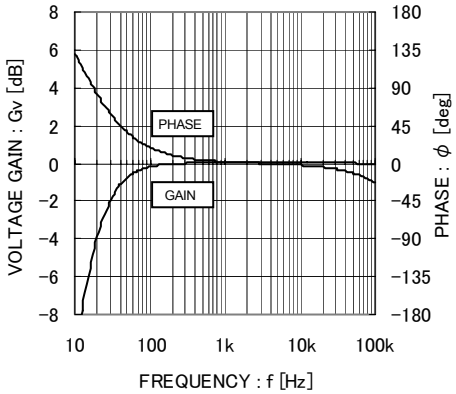


Fig.7 Voltage gain/phase vs Frequency

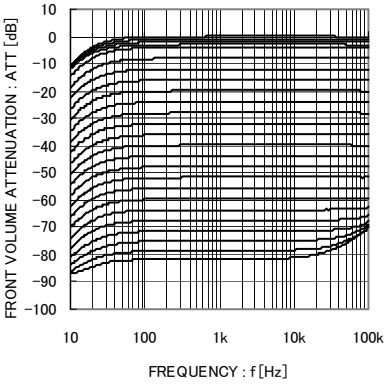


Fig.8 Front volume attenuation vs Frequency

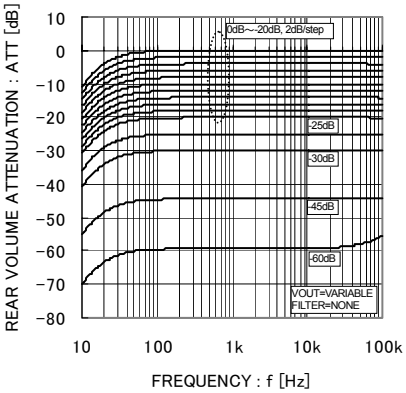


Fig.9 Rear volume attenuation vs Frequency

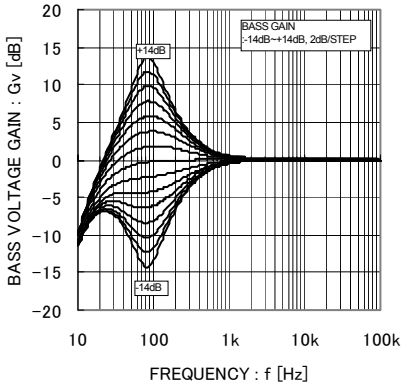


Fig.10 BASS voltage gain vs Frequency

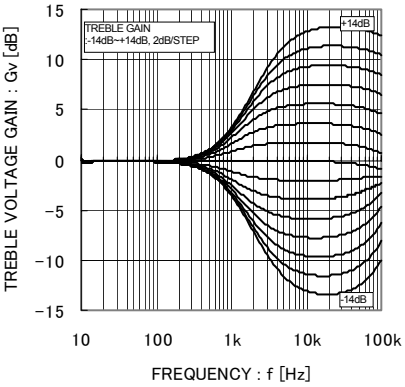


Fig.11 TREBLE voltage gain vs Frequency

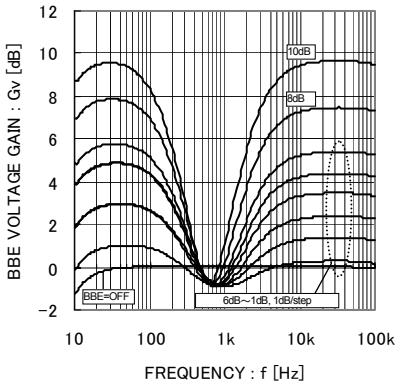


Fig.12 BBE voltage gain vs Frequency

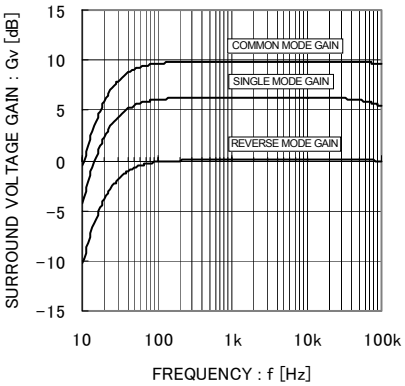


Fig.13 Surround voltage gain vs Frequency

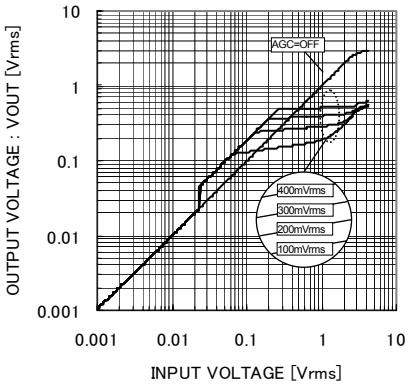


Fig.14 AGC input volume vs Output voltage

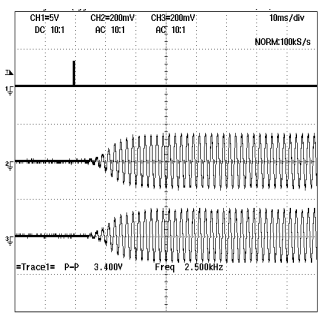


Fig.15 Soft switching wave

●**Selection of order type**

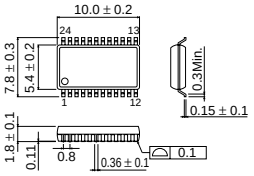
B	D	3	8	8	4	F	S	—	E	2

Part No.
BD3884FS
BD3886FS

Tape and Reel information

SSOP-A24

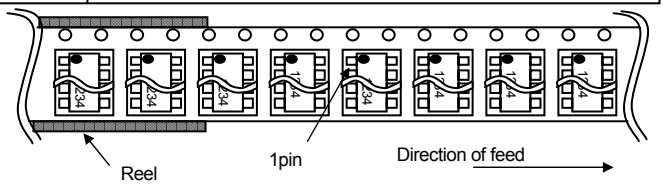
<Dimension>



(Unit:mm)

<Tape and Reel information>

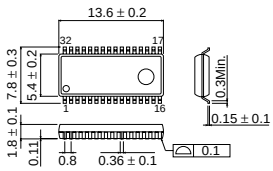
Tape	Embossed carrier tape
Quantity	2000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



※When you order , please order in times the amount of package quantity.

SSOP-A32

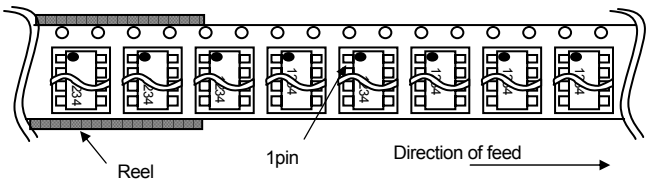
<Dimension>



(Unit:mm)

<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)



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