Audio Accessory IC Series

Pb Free ROHM Electronic Components

OP Amp.

with 3 Inputs Selector

BA3131FS

●Description

The BA3131FS incorporates two built-in circuits with Audio amplifiers, configured of three differential input circuits, an output circuit, and a switch circuit. The three differential input circuits are separate, enabling independent settings to be entered for the gain and frequency characteristics.

●Features

1) High gain and low distortion. (Gv = 110dB, THD = 0.0015% typ.)
2) Low noise. (Vn = 2μVrms typ.)
3) Switching circuit can be directly coupled to microcomputer port.
4) Small switching noise.
5) Equipped with 1/2 Vcc output circuit for single power supply.

●Applications

Car stereos, audio amplifiers, and other electronic circuits

●Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	18.0	V
Power dissipation	Pd	750*	mW
Operating temperature	Topr	−40-+85	℃
Storage temperature	Tastg	−55-+125	℃
Common-mode input voltage	Vi	3-Vcc	V
Differential input voltage	Vid	Vcc	V
Load current	IoMax.	±50.0	mA

*Reduced by 7.5 mW/°C over 25°C, when mounted on a glass epoxy board (90mm ×50mm × 1.6t)

●Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating power supply voltage	Vcc	6.0	8.0	16.0	V	single power source

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●Electrical characteristics (unless otherwise noted, Ta=25°C, Vcc=8V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Test Circuit
Quiescent current	Iq	2.0	4.9	7.8	mA	V_{IN}=0,RL=∞,SW pin open	Fig.7
Input offset voltage	Vio	–	0.5	5.0	mV	RS≤10kΩ	Fig.6
Input offset current	Iio	–	5	200	nA		Fig.6
Input bias current	Ib	–	50	500	nA	*1	Fig.6
High-amplitude voltage gain	Avol	86	110	–	dB	RL≥2kΩ, VO=±1.5V	Fig.6
Common-mode input voltage	Vicm	3	6	–	V		Fig.6
In-phase signal rejection ratio	CMRR	60	72	–	dB	RS≤10kΩ	Fig.6
Power supply voltage rejection ratio	PSRR	76	90	–	dB	RS≤10kΩ	Fig.6
Maximum output voltage	V_{OH}/V_{OL}	3	6	–	V	RL≥10kΩ	Fig.8/Fig.9
		3	6	–	V	RL≥2kΩ	
Input conversion noise voltage	Vn	–	2.0	4.0	μVrms	*2	Fig.12
Reference voltage change	ΔV_{REF}	–	–	±10	mV	Ioref=±1mA	–

*1 Since the first stage is configured with PNP transistors, input bias current is from the IC.
*2 Tested under the following conditions: Gv = 40dB, RS = 2kΩ, Matsushita Tsuko VP-9690A (using DIN audio filter)

●Design guaranteed values (unless otherwise noted, Ta=25°C, Vcc=8V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Test Circuit
Slew rate	SR	0.5	1.2	–	V/μS	Gv=0dB,RL=2kΩ	Fig.10
Gainbandwidth product	GBW	1.5	2.6	–	MHz	f=10kHz	Fig.11
Crosstalk between A, B and C	CT_{ABC}	60	73	–	dB	f=1kHz	Fig.13
Total harmonic distortion	THD	–	0.0025	0.01	%	Gv=0dB, f=1kHz, Vo=1Vrms	Fig.14
Channel separation	CS	90	115	–	dB	f=1kHz, input conversion	Fig.15

*This item is not guaranteed during processes.

●Electrical characteristic curves

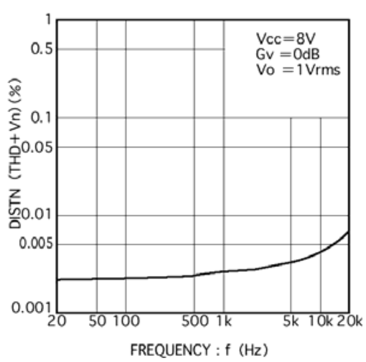

Fig.1 Distortion vs. frequency

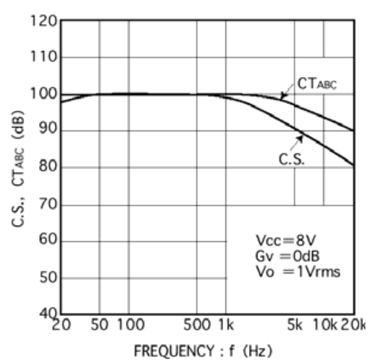

Fig.2 Channel separation and crosstalk vs. frequency

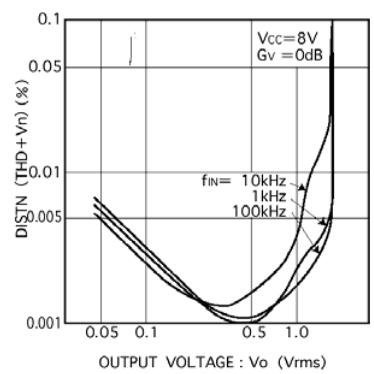

Fig.3 Distortion vs. output voltage

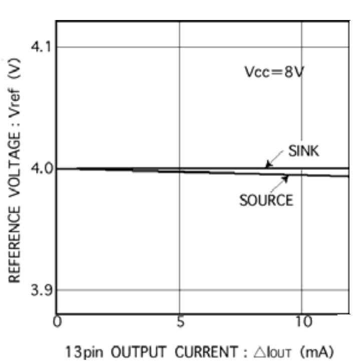

Fig.4 4pin Reference voltage vs. pin 13 output current

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● **Block diagram**

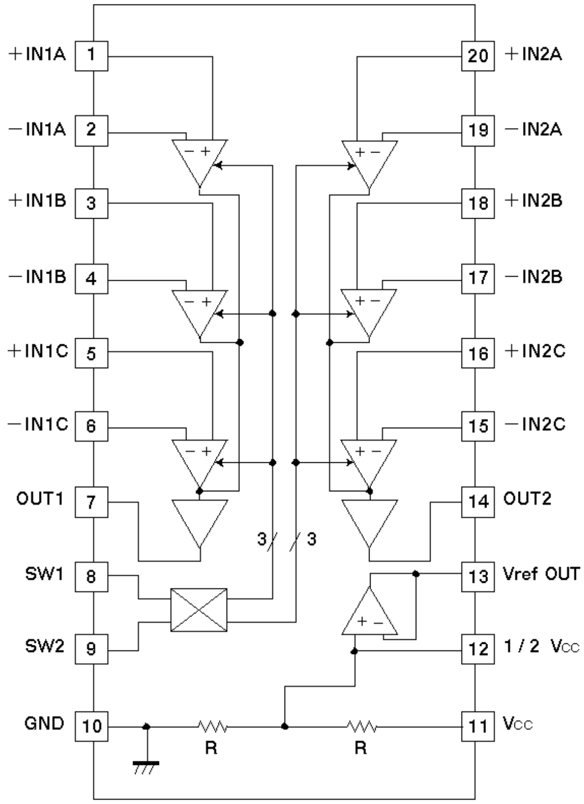
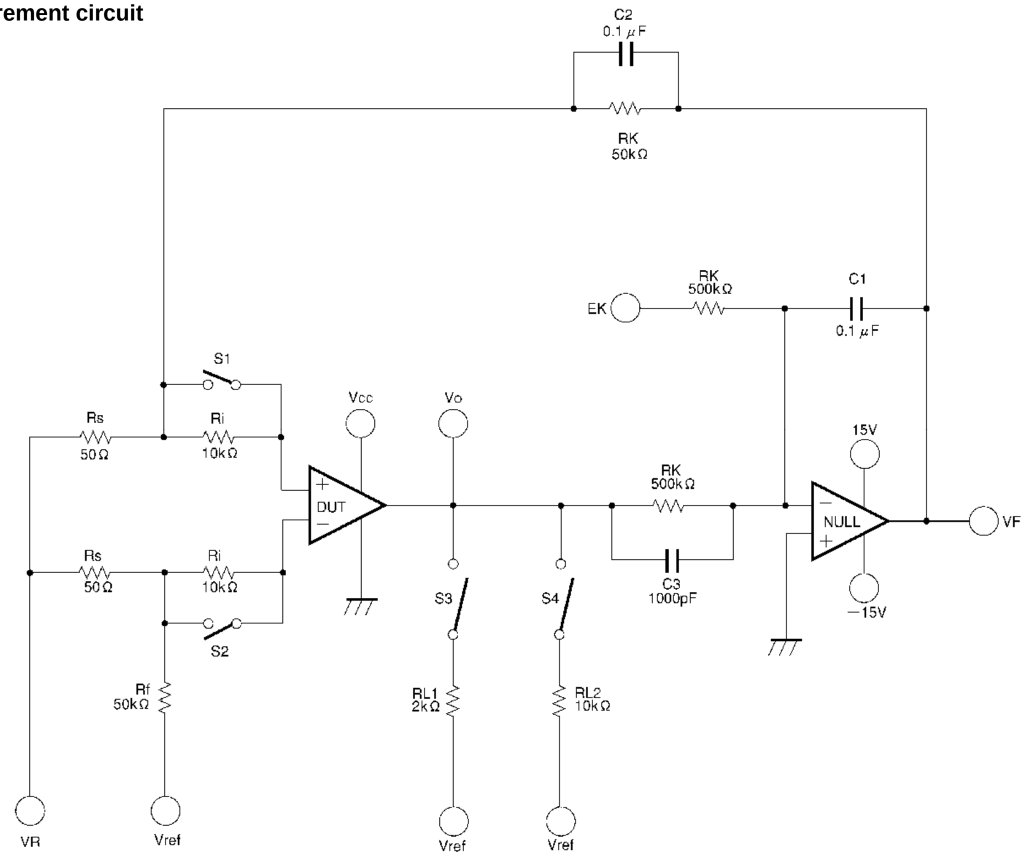


Fig.5

● **Measurement circuit**



*C2 and C3 are used to prevent oscillation (adjustment required)

Fig.6

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●**Measurement conditions** (Figure 6)

Measurement Item	Vcc	VR	EK	VF	S1	S2	S3	S4	Equation
Input offset voltage	8	Vref	–	VF1	ON	ON	OFF	OFF	1
Input offset current	8	Vref	–	VF2	OFF	OFF	OFF	OFF	2
Input bias current	8	Vref	–	VF3	OFF	ON	OFF	OFF	3
				VF4	ON	OFF			
High-amplitude voltage gain	8	Vref	5.5	VF5	ON	ON	ON	OFF	4
			2.5	VF6					
Common-mode signal rejection ratio (Common-mode input voltage)	8	6	8	VF7	ON	ON	OFF	OFF	5
	8	2	0	VF8					
Power supply voltage rejection ratio	6	Vref	–	VF9	ON	ON	OFF	OFF	6
	18	Vref	–	VF10					

●**Equations**

(1) Input offset voltage (Vio)

$Vio = | VF1 | / (1 + Rf / Rs)$

(2) Input offset current (Iio)

$Iio = | VF2 - VF1 | / (Ri (1 + Rf / Rs))$

(3) Input bias current (Ib)

$Ib = | VF4 - VF3 | / (2 Ri (1 + Rf / Rs))$

(4) High-amplitude voltage gain (Avol)

$Avol = 20\log (3 (1 + Rf / Rs) / | VF6 - VF5 |)$ (dB)

(5) In-phase signal rejection ratio (CMRR)

$CMRR = 20\log (4 (1 + Rf / Rs) / | VF8 - VF7 |)$ (dB)

(6) In-phase input voltage range (PSRR)

$PSRR = 20\log (12 (1 + Rf / Rs) / | VF10 - VF9 |)$ (dB)

●**Measurement circuits**

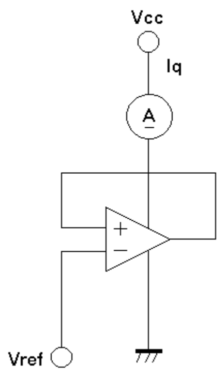

Fig.7 Iq

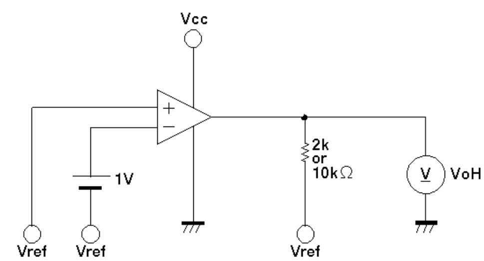

Fig.8 Maximum output voltage: High

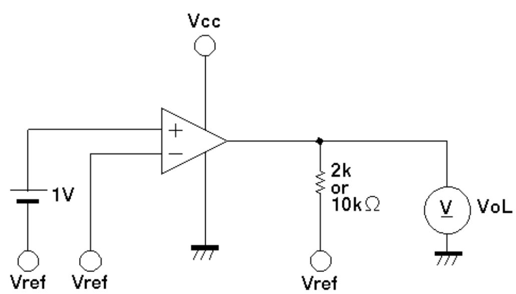

Fig.9 Maximum output voltage: Low

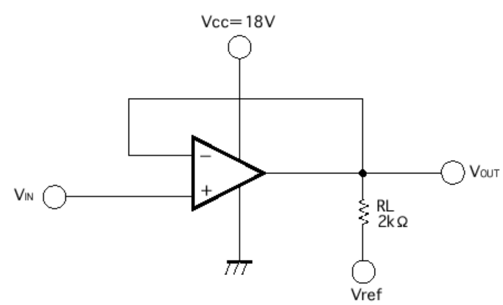

Fig.10 Slew rate (I)

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●Measurement circuits

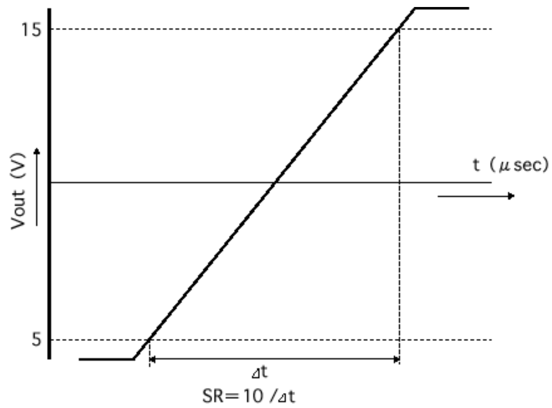

Fig.11 Slew rate (II)

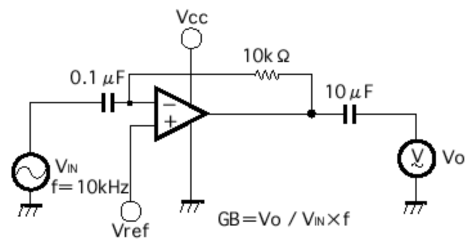

Fig.12 Band width frequency gain

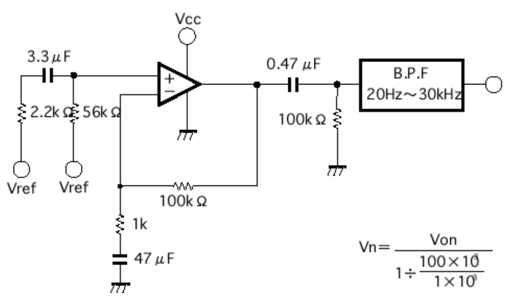

Fig.13 Input conversion noise voltage

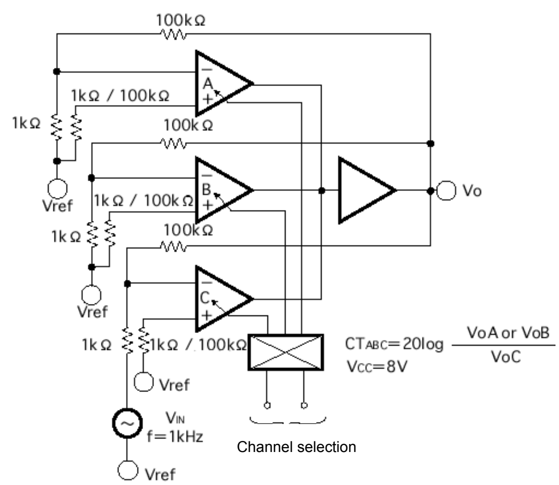

Fig.14 Crosstalk between A and B

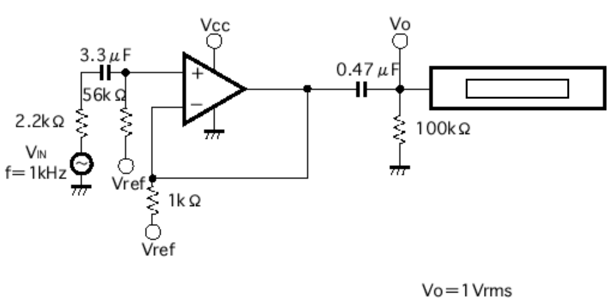

Fig.15 Total harmonic distortion

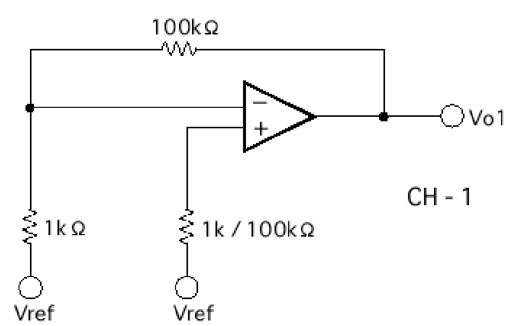

Fig.16 Channel separation (I)

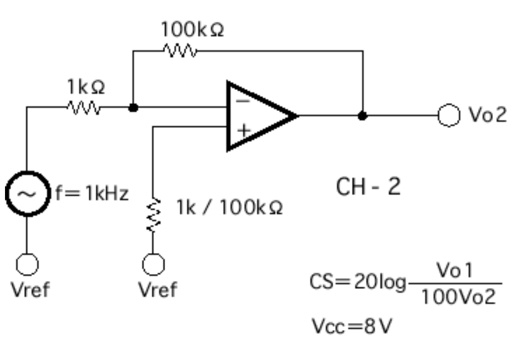

Fig.17 Channel separation (II)

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●Application example

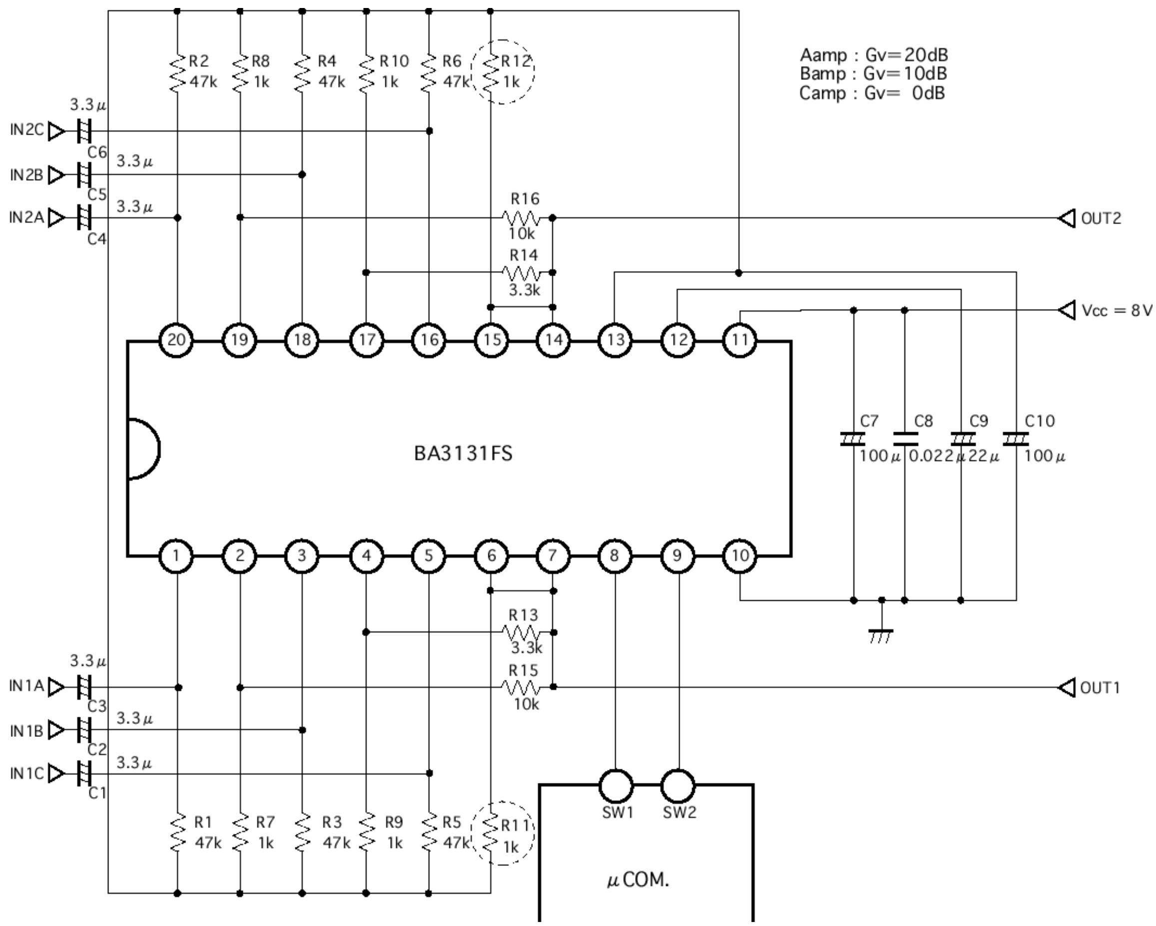

Fig.18

●Truth value table

	ch1	ch2	ch3	OFF	Conditions
SW1 (8pin)	H	H	L	L	Corresponds to μCOM output
SW2 (9pin)	H	L	H	L	

*"H" when the applied voltage at pins 8 and 9 is 2.0V or more, and "L" when it is 1.0V or less.

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●Cautions on use

(1) Numbers and data in entries

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

(2) Example application circuit

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 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) Pin13 (reference output terminal)

Pin 13 is the reference output terminal, which outputs 1/2 Vcc. Determine the bypass condenser value in accordance with the desired characteristics. In addition, as the value may oscillate within the 500pF- 1μF, make sure to set the bypass condenser value to more than 10μF for alternate grounding. Furthermore, as pin 12 is located in the reference circuit, make sure to use bypass condenser for ac grounding for the reference output. (Recommended value22μF)

●Reference data (these values are intended only as a reference, and performance is not guaranteed)

12 pin bypass capacitor（μF）	Ripple Rejection　(fin=100Hz)　(dB)	Output Startup Time
10	－35	150
22	－42	300
47	－48	550

* Measuring condition: With Power Voltage ON (Vcc=8V), Vcc path control, pin 13 path control100μF, the time which is 90% of equilibrium output voltage

(9) Capacity load

This IC can be used in the low grain range (0-2dB). It may oscillate at a capacity load of more than 200pF. The phase margin 10° Typ.（Ta=85℃, 0dB point）for capacity 200pF. Therefore, take precaution when using capacity load.
In addition, for using 0db buffer, as shown in the application example (Fig. 18), inserting bias resister of kΩ to minus input [R11, R12（within ◌ mark of Fig 18）] will enable stable use against the capacity load.

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●**Order model name selection**

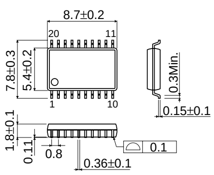
B	A	3	1	3	1	F	S	-	E	2

Product Name
BA3131FS

Packing & Foaming
Specification

SSOP-A20

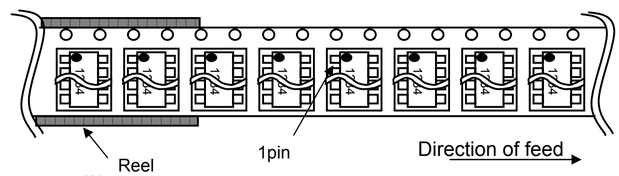
<Dimension>



（Unit: mm)

<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2000pcs
Direction of feed	E2 (Correct direction: 1pin of product should be 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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ROHM CO., LTD.
21, Saiin Mizosaki-cho, Ukyo-ku, Kyoto
615-8585, Japan
TEL: (075)311-2121 FAX: (075)315-0172
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TEL: +33(0)1 56 97 30 60 FAX: +33(0)1 56 97 30 80
Hong Kong China / ROHM ELECTRONICS (H.K.) CO., LTD.
TEL: +852(2)7406262 FAX: +852(2)375-8971
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Beijing China / BEIJING REPRESENTATIVE OFFICE
TEL: +86(10)8525-2483 FAX: +86(10)8525-2489
Taiwan / ROHM ELECTRONICS TAIWAN CO., LTD.
TEL: +886(2)2500-6956 FAX: +886(2)2503-2869
Korea / ROHM ELECTRONICS KOREA CORPORATION
TEL: +82(2)8182-700 FAX: +82(2)8182-715
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ROHM CO., LTD. 21 Saiin Mizosaki-cho, Ukyo-ku, Kyoto 615-8585, Japan
TEL : +81-75-311-2121
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