Speaker / Headphone Amplifier Series

Stereo Headphone Amplifiers

BH3541F, BH3544F, BH3547F, BH3548F

No.09077EAT01

Pb Free
ROHM Electronic Components

RoHS
Directive Compliance

●Description

BH3541F, BH3544F, BH3547F, BH3548F is headphone amplifiers suitable for portable products.

BH3541F has a fixed gain of 0 dB and BH3544F, BH3547F, BH3548F has a fixed gain of 6 dB.

External resistors for gain setting are not needed. Package of BH3541F, BH3544F, BH3547F, BH3548F is pin-to-pin compatible (SOP8), enable to replace each other easily.

BH3541F, BH3544F, BH3547F, BH3548F also has mute functions that make it easy to prevent pop noise when power supply turns on/off. Moreover, thermal shutdown function is built-in.

BH3541F, BH3544F, BH3547F can drive 16/32Ω load, BH3548F can drive 8/16/32Ω. So, BH3548F is suitable for 8Ω receiver.

●Features

1) Built-in mute function for preventing pop noise when power supply turns on/off
2) Built-in thermal shutdown function
3) BH3541F, BH3544F, BH3547F, BH3548F are pin-to-pin compatible
4) SOP8 small package

●Applications

TV, Desktop PC, Notebook PC, Camcorder and other equipment having headphone output

●Line up

Part No.	BH3541F	BH3544F	BH3547F	BH3548F	Unit
Supply voltage	+2.8 ～ +6.5		+4.5 ～ +5.5	+4.0 ～ +5.5	V
Quiescent current	7.0		3.7	6.5	mA
Amplifier gain	0	6			dB
Output [R_L=16Ω]	62		77	62	mW
load impedance	16 / 32			8/16/32	Ω
Operating temperature range	-25 ～ +75			-40 ～ +85	℃

●Absolute maximum ratings（Ta=25°C）

Parameter	Symbol	Limit BH3541F,BH3544F,BH3547F,BH3548F	Unit
Applied voltage	VCC	7.0	V
Power dissipation	Pd	550 [*1]	mW
Storage temperature	Tstg	-55～+125	°C

*1 Derating is done at 5.5mW/°C above Ta=25°C. (When mounted on a 70mm×70mm×1.6mm PCB board, FR4)

●Operating conditions (Ta=25°C)

Parameter	Symbol	BH3541F,BH3544F	BH3547F	BH3548F	Unit
Supply voltage	VCC	+2.8 ～ +6.5	+4.5 ～ +6.5	+4.0 ～ +5.5	V
Temperature Range	Topr	-25～+75		-40 ～ +85	℃

＊ These product are not designed for protection against radioactive rays.

●Electrical characteristics (Unless otherwise noted, Ta=25°C,VCC=5V,RL=32Ω,f=1kHz,BW=400～30kHz
  BH3541F : VIN=0dBV,   BH3544F, BH3547F, BH3548F : VIN =-6dBV)

Parameter	Symbol	TYP.				Unit	Conditions
		BH3541F	BH3544F	BH3547F	BH3548F		
Quiescent current	I$_Q$	7		3.7	6.5	mA	V$_{IN}$=0Vrms
Mute pin control voltage H	V$_{TMH}$	1.6<				V	Mute OFF
Mute pin control voltage L	V$_{TML}$	<0.3				V	Mute ON
Gain	G$_{VC}$	0	6			dB	-
Gain difference between channels	△G$_{VC}$	0				dB	-
Total harmonic distortion	THD	0.02		0.05	0.02	%	BW=20～20kHz
Rated output 1	P$_{O1}$	31		46	31	mW	R$_L$=32Ω,THD<0.1% (BH3541F,BH3544F,BH3548F) R$_L$=32Ω,THD＜0.3% (BH3547F)
Rated output 2	P$_{O2}$	62		77	62	mW	R$_L$=16Ω,THD<0.1% (BH3541F,BH3544F,BH3548F) R$_L$=16Ω,THD＜0.5% (BH3547F)
Rated output 3	P$_{O3}$	-			120	mW	R$_L$=8Ω,THD＜0.25% (BH3548F)
Output noise voltage	V$_{NO}$	-93				dBV	BW=20～20kHz,Rg=0Ω
Channel separation	CS	-90		-87	-90	dB	Rg=0Ω
Mute attenuation	ATT	-80				dB	Rg=0Ω
Ripple rejection	RR	-57				dB	f$_{RR}$=100Hz,V$_{RR}$=-20dBV
Input resistance	Rin	180	90			kΩ	-

●Reference data
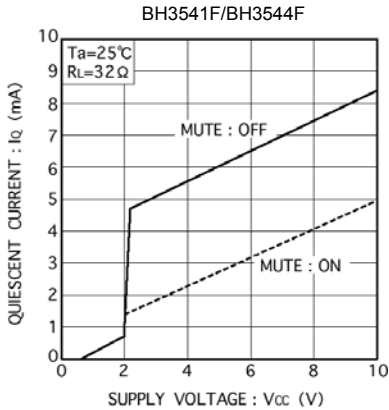
Fig. 1 Quiescent current vs.
power supply voltage
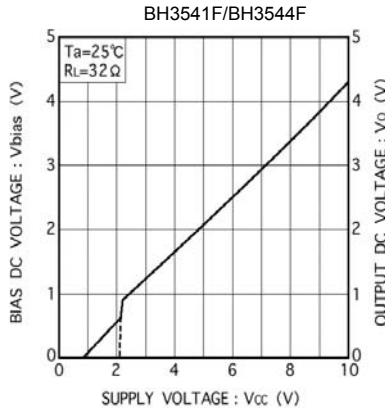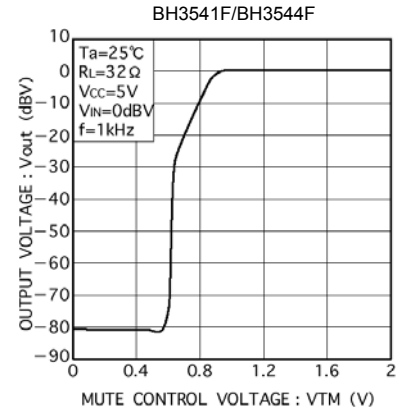
Fig. 2 in DC current vs.
power supply voltage

Fig. 3 Output voltage vs.
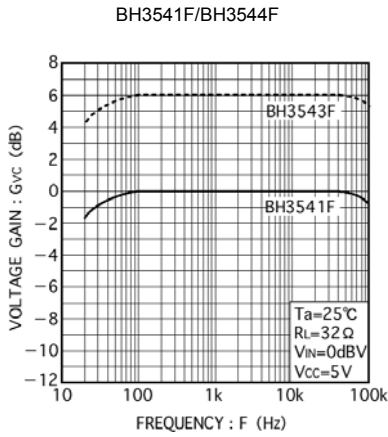Mute control voltage

●Reference data (Continued)
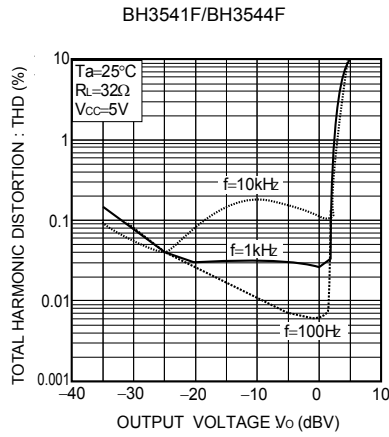
BH3541F/BH3544F

Fig. 4 Voltage gain vs. frequency

BH3541F/BH3544F

Fig. 5 Total harmonic distortion vs. output voltage (1)

BH3541F/BH3544F
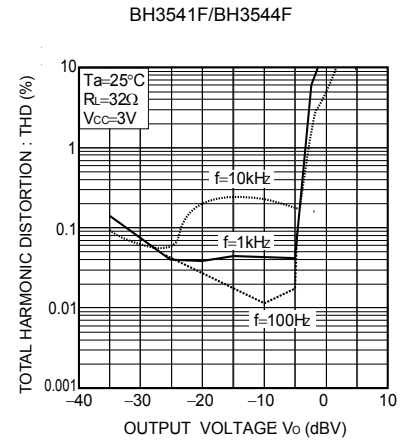
Fig. 6 Total harmonic distortion vs. output voltage (2)

BH3541F/BH3544F
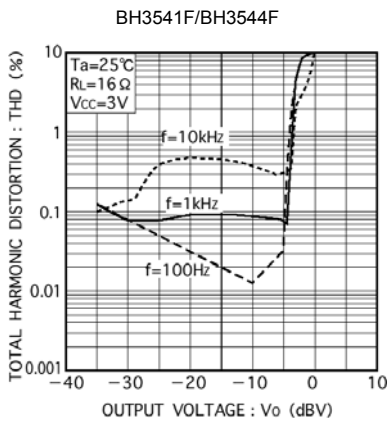
Fig. 7 Total harmonic distortion vs. output voltage (3)

BH3541F/BH3544F
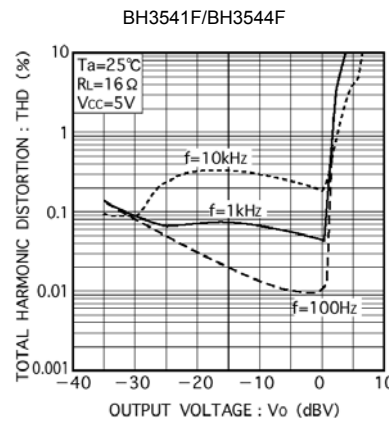
Fig. 8 Total harmonic distortion vs. output voltage (4)
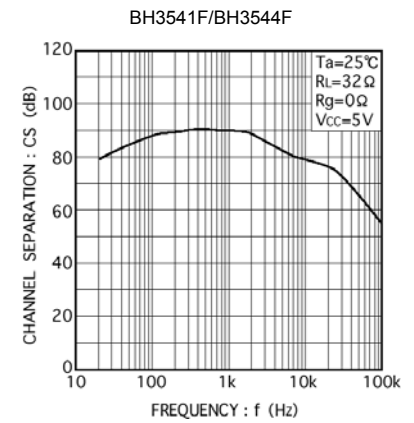
BH3541F/BH3544F

Fig. 9 Channel separation vs. frequency
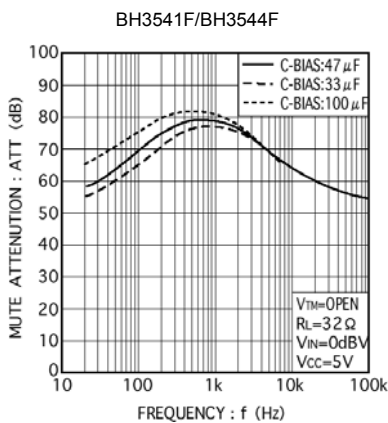
BH3541F/BH3544F

Fig. 10 MUTE attenuation vs. frequency
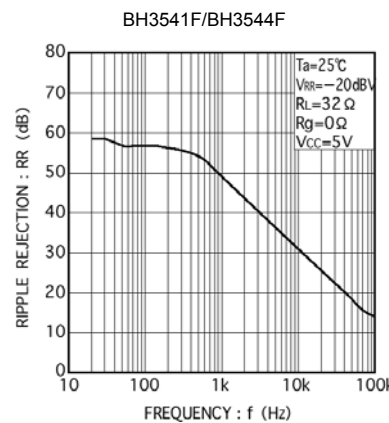
BH3541F/BH3544F

Fig. 11 Ripple rejection vs. frequency
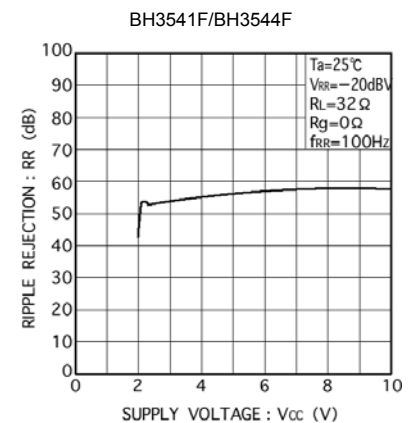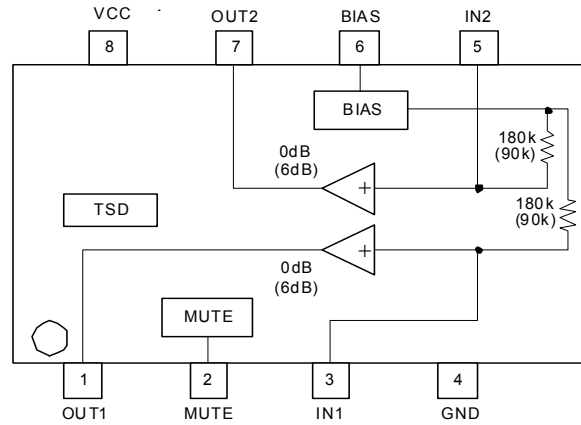
BH3541F/BH3544F

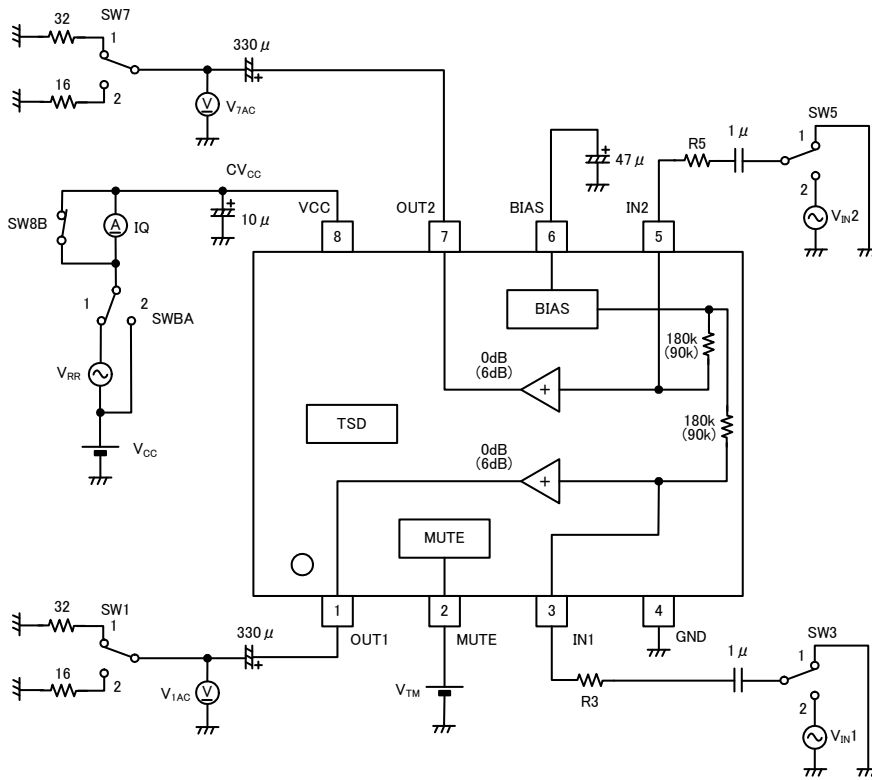Fig. 12 Ripple rejection vs. power supply voltage

●Block diagram

( ) are BH3544F, BH3547F, BH3548F values.

Fig. 13

●Measurement circuit

( ) are BH3544F, BH3547F, BH3548F values.

Fig. 14

●Terminal Equivalent Circuit / Description

Pin No.	Pin Name	I /O	Pin voltage	Equivalent circuit		Function
				BH3544F,BH3547F,BH3548F	BH3547F	
1 7	OUT1 OUT2	O	2.1V (VCC=5V)			Output pin
2	MUTE	I	0.1V (When open)			Mute control pin Mute on : Hi Mute off : Lo (open)
3 5	IN1 IN2	I	2.1V (VCC=5V)			Input pin
6	BIAS	I/O	2.1V (VCC=5V)			Bias pin (Since the 47 µF externally attached capacitor also serves as the time constant for pop noise countermeasures, evaluate adequately when changing it.)
4	GND	I	-	-	-	GND pin
8	VCC	I	-	-	-	Power supply pin

※The figure in the pin explanation and input/output equivalent circuit is reference value, it doesn't guarantee the value.

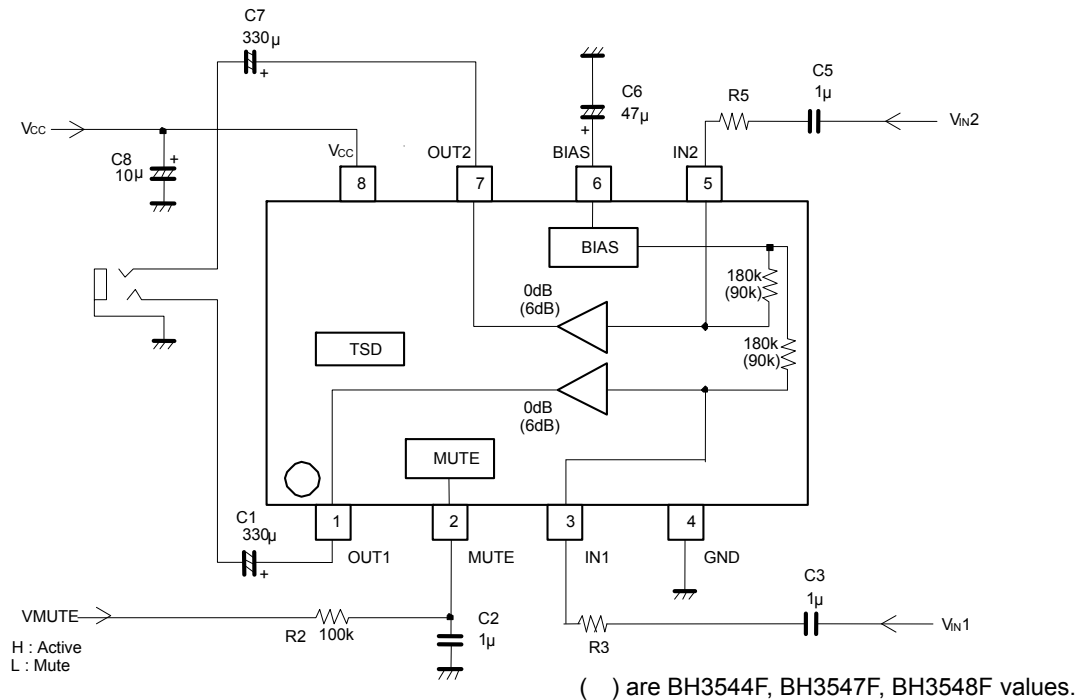●Application circuit

( ) are BH3544F, BH3547F, BH3548F values.

Fig. 15

●Description of external components.
1) Input coupling capacitors (C3, C5)

These are determined according to the lower cutoff frequency fc. Moreover, since lowering the capacitance can cause the occurrence of pop noise, when changing this, determine it after adequate checking.

Since the input impedance of the BH3541F is 180kΩ and that of the BH3544F,BH3547F,BH3548F is 90kΩ, these are found by the expressions below, although drift, temperature characteristics, and other considerations are necessary. (Layered ceramic capacitors are recommended.)

$C3(C5)=1/(2\pi \times 180k\Omega \times fc)$ [BH3541F]

$C3(C5)=1/(2\pi \times 90k\Omega \times fc)$ [BH3544 F ,BH3547F,BH3548F]

2) Bias capacitor (C6)

When VCC=5V, 47μF is recommended. Since lowering the capacitance too much can cause worsening of electrical characteristics or the occurrence of pop noise, when changing this, determine it after checking this adequately.

3) Mute pin pop noise countermeasures (R2, C2)

Since the BH3541F,BH3544F,BH3548F has an impedance of 190kΩ against GND and the BH3547F has 200kΩ, it may be impossible to cancel mute mode if R2 is made too large.

4) Output coupling capacitors (C1, C7)

These are determined by the lower cutoff frequency.   If R$_L$ is the output load resistance (assuming a resistance Rx is put in for output protection or current restriction), these are found by the expression below.

$C1(C7)=1/(2\pi \times (R_L+R x) \times fc)$

5) Input gain adjustment resistances (R3, R5)   (BH3544F,BH3547F)

Externally attached resistances (R3, R5) make input gain adjustment possible.   The gain found by the expression below can be set.

$G_{VC}=6+20\log(90k\Omega/(90k\Omega+R3[R5]))$ [dB]

When input gain is not accommodated, these resistors have no use.

●Notes for use
1) Numbers and data in entries are representative design values and are not guaranteed values of the items.
2) Although we are confident in recommending the sample application circuits, carefully check their characteristics further when using them.   When modifying externally attached component constants before use, determine them so that they have sufficient margins by taking into account variations in externally attached components and the Rohm LSI, not only for static characteristics but also including transient characteristics.
3) Absolute maximum ratings

If applied voltage, operating temperature range, or other absolute maximum ratings are exceeded, the LSI may be damaged.   Do not apply voltages or temperatures that exceed the absolute maximum ratings.   If you think of a case in which absolute maximum ratings are exceeded, enforce fuses or other physical safety measures and investigate how not to apply the conditions under which absolute maximum ratings are exceeded to the LSI.

4) GND potential

Make the GND 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 GND pin, including transient phenomena.

5) Thermal design

Perform thermal design in which there are adequate margins by taking into account the allowable power dissipation in actual states of use.

6) Shorts between pins and misinstallation

When mounting the LSI on a board, pay adequate attention to orientation and placement discrepancies of the LSI. If it is misinstalled and the power is turned on, the LSI may be damaged. It also may be damaged if it is shorted by a foreign substance coming between pins of the LSI or between a pin and a power supply or a pin and a GND.

7) Operation in strong magnetic fields

Adequately evaluate use in a strong magnetic field, since there is a possibility of malfunction.

8) Pop noise countermeasures

In order to prevent the pop noise that occurs when the power supply turns ON or OFF, make the rise and fall with reference to the timing diagram shown below.

1)BH3541F/ BH3544F/ BH3548F
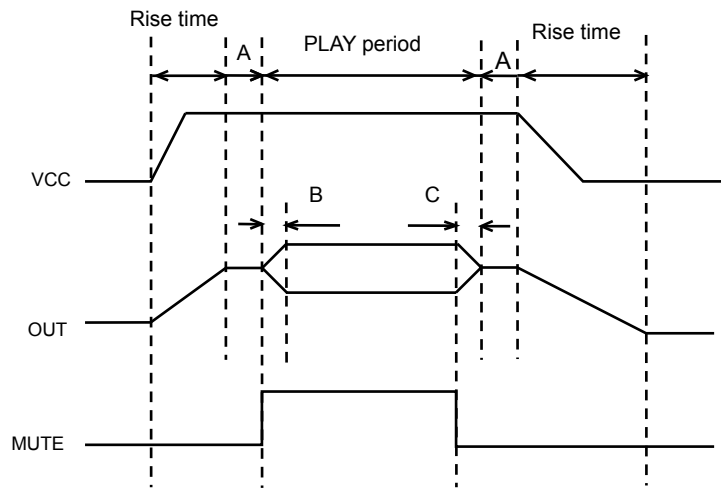
Fig. 16

(A)：Mute period (Use as pop noise countermeasure when power supply turns ON/OFF by makingVMUTE=Lo.)

(B)：Mute cancellation period (This has a time constant because it is used by the externally attached C2 and R2 as a pop noise countermeasure on mute cancellation, so be careful of the timing.)

(C)：Mute start time (As on cancellation, this has a time constant.)

2)BH3547F
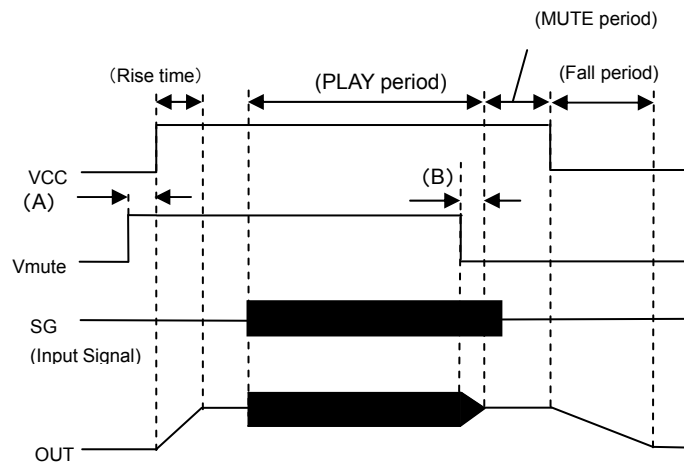
Fig. 17

(A)：Before VCC rise (or at the same time as VCC) make mute cancelled (VMUTE＝Hi).

(B)：Soft mute period (This time can be set by externally attached R2 and C2)

● Ordering part number

B	H		3	5	4	1		F	-		E	2

Part No.

Part No.
3541
3544
3547
3548

Package
F: SOP8

Packaging and forming specification
E2: Embossed tape and reel

SOP8

5.0±0.2
(MAX 5.35 include BURR)

6.2±0.3

4.4±0.2

4°⁺⁶°₋₄°

0.3MIN

0.9±0.15

0.595

0.17 ⁺⁰·¹₋₀.₀₅

1.5±0.1

0.11

1.27

0.42±0.1

(Unit : mm)

<Tape and Reel information>
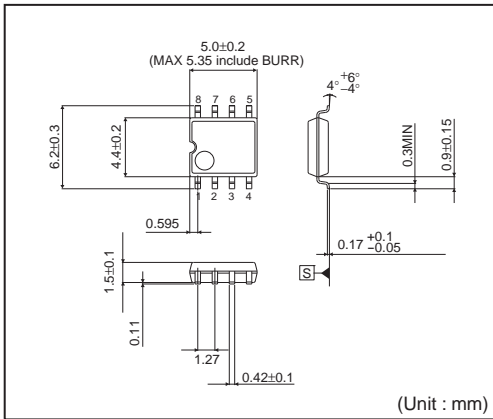
Tape	Embossed carrier tape
Quantity	2500pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)

Reel

1pin

Direction of feed

＊Order quantity needs to be multiple of the minimum quantity.

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

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