



CMOS IC Application Note

Automotive HSNT Package User's Guide

Rev.2.0_00

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This manual describes the features, package dimensions, recommended land, handling methods as well as marking specifications and packing specifications of the automotive HSNT package, for users in the semiconductor mounting technology fields.

In addition, mounting evaluation results are also provided as reference data.

For the quality assurance system, notes on use and electrical characteristics of ABLIC Inc. CMOS ICs, refer to our website and individual data sheets available from ABLIC Inc.

Note that the conditions and other information listed in this document may require adjustment or modification depending on the customer's equipment, materials, conditions, environment, and other factors.

[Target Packages]

- HSNT-4(0808)B
- HSNT-4(1010)B
- HSNT-6(2025)
- HSNT-8(1616)B
- HSNT-8(2030)

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1. Features of automotive HSNT Package

1.1 General description of automotive HSNT package

The automotive HSNT package is a thin and lightweight resin molded package for surface-mounting onto printed circuit boards, and there is a heat sink on the back of the package which also gives the package excellent heat dissipation performance.

In addition, the automotive HSNT package Series is very thin, with a maximum thickness of 0.5 mm, making it especially well-suited for products in which you want to reduce the attachment height of mounted parts.

The automotive HSNT package series consists of 5 types of packages: HSNT-4(0808)B, HSNT-4(1010)B, HSNT-6(2025), HSNT-8(1616)B, HSNT-8(2030).

Despite being thin, the automotive HSNT package fully meets the same level of reliability as ABLIC's other compact packages.

Table 1 Specifications of Automotive HSNT Package

Package name	HSNT-4(0808)B	HSNT-4(1010)B	HSNT-6(2025)	HSNT-8(1616)B	HSNT-8(2030)
Dimensions (mm)	0.8 × 0.8 × t0.41 max.	1.0 × 1.0 × t0.41 max.	2.0 × 2.5 × t0.5 max.	1.6 × 1.6 × t0.4 max.	2.0 × 3.0 × t0.5 max.
Number of pins	4	4	6	8	8
Pitch (mm)	0.40	0.65	0.50	0.40	0.50
Package weight*1 (mg)	0.64	1.05	6.20	2.81	7.50
JEDEC MSL	Level 1				

*1. There may be some variation depending on the mounted IC.

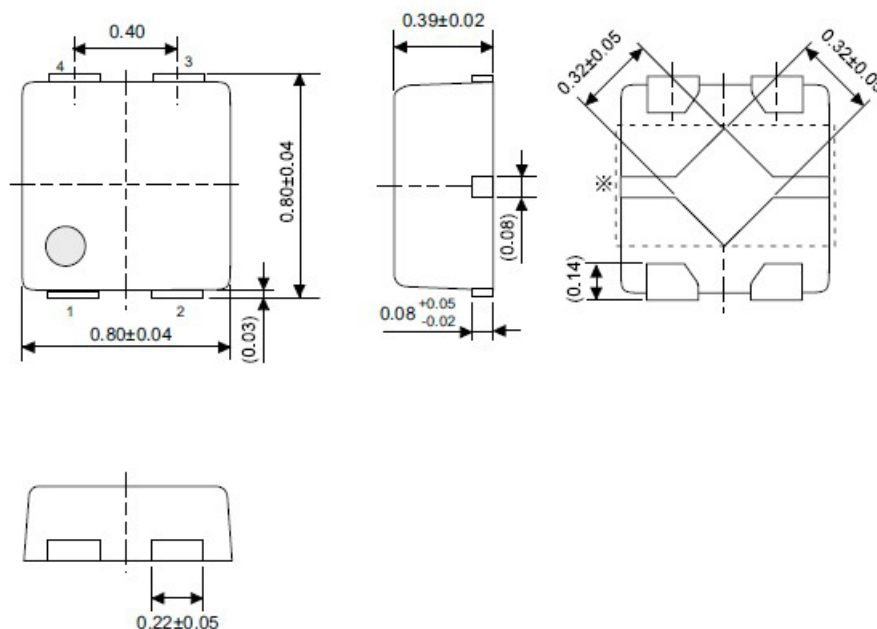
Table 2 Package, Tape and Reel Materials

Package and Reel Component	Material
Molding resin	EP
Lead frame	Cu
Surface processing on pins	Sn 100%
Bonding wire	Au
Die bonding agent	EP
Embossed carrier tape	PS
Cover tape	PET
Reel	PS

1.2 Dimension, land and stencil opening of automotive HSNT package

The land drawing and mask aperture drawing dimensions are not design values but finished dimension values. Finish to the noted dimensions with reference for the circuit board and mask manufacturing tolerances.

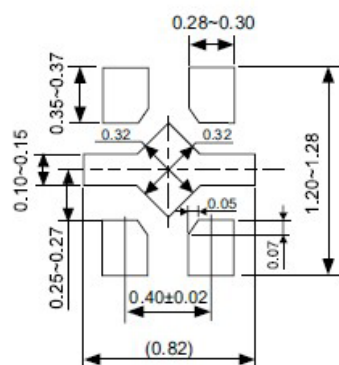
1.2.1 HSNT-4(0808)B



※ The heat sink of back side has different electric potential depending on the product.
Confirm specifications of each product.
Do not use it as the function of electrode.

Unit: mm

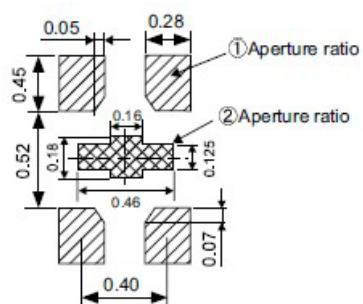
Figure 1 Dimensions of HSNT-4(0808)B



Caution It is recommended to solder the heat sink to a board in order to ensure the heat radiation.

Unit : mm

Figure 2 Land of HSNT-4(0808)B



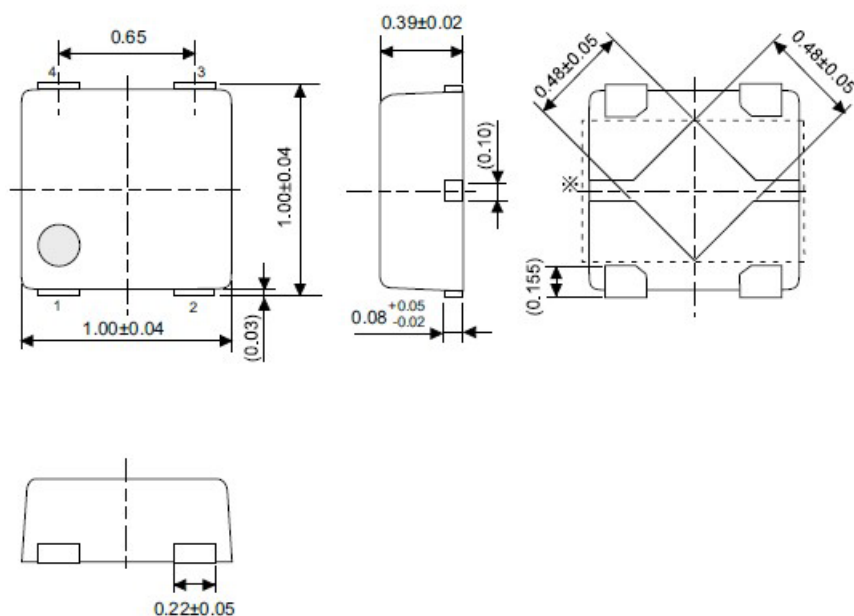
Caution

- ① Mask aperture ratio of the lead mounting part is approximately 120%.
- ② Mask aperture ratio of the heat sink mounting part is approximately 40%.
- ③ Mask thickness: t0.12 mm

Unit : mm

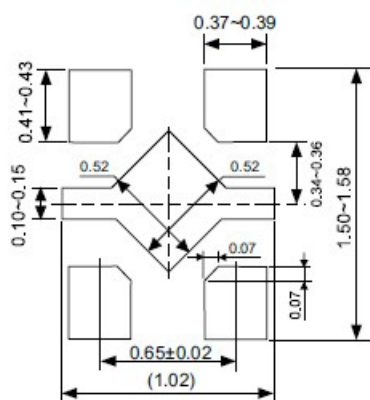
Figure 3 Stencil Opening of HSNT-4(0808)B

1. 2. 2 HSNT-4(1010)B



Unit: mm

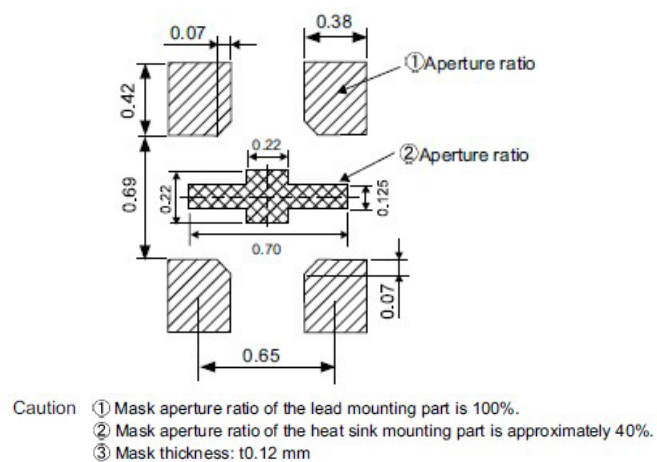
Figure 4 Dimensions of HSNT-4(1010)B



Caution It is recommended to solder the heat sink to a board in order to ensure the heat radiation.

Unit : mm

Figure 5 Land of HSNT-4(1010)B



Unit : mm

Figure 6 Stencil Opening of HSNT-4(1010)B

Unit: mm

Technical drawing of a mechanical part showing top and front views with dimensions.

Top View Dimensions:

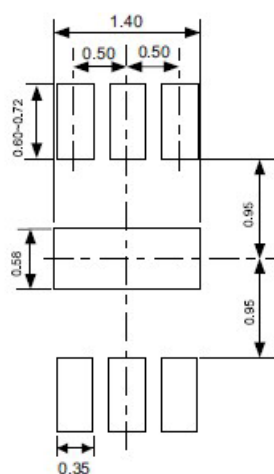
- Overall width: 2.10
- Overall height: 0.95
- Distance between vertical centerlines of the three rectangular features: 0.50 (between first and second), 0.50 (between second and third).
- Width of each rectangular feature: 0.35
- Distance from the left edge to the centerline of the first feature: 0.35
- Distance from the centerline of the second feature to the right edge: 0.35

Front View Dimensions:

- Overall height: 0.95
- Distance from the top edge to the top of the first rectangular feature: 0.50
- Distance from the top of the first rectangular feature to the top of the second rectangular feature: 0.78
- Distance from the top of the second rectangular feature to the top of the third rectangular feature: 0.78
- Distance from the top of the third rectangular feature to the top edge: 0.50

Unit : mm

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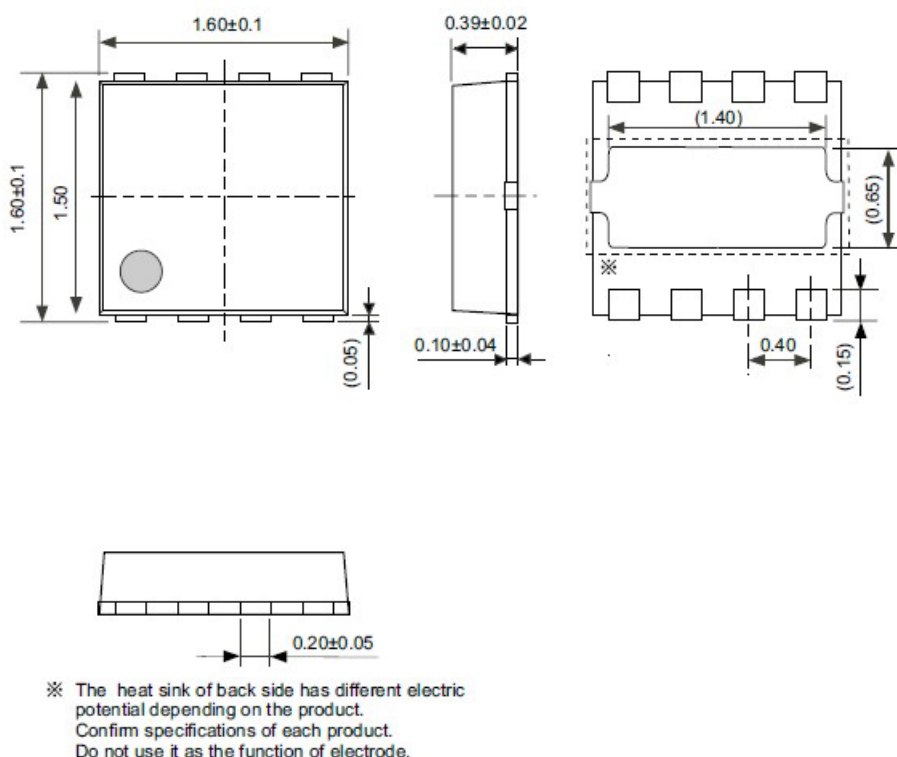


- Caution
- ① Mask aperture ratio of the lead mounting part is 100~120%.
 - ② Mask aperture ratio of the heat sink mounting part is 30%.
 - ③ Mask thickness: t0.12 mm
 - ④ Reflow atmosphere: Nitrogen atmosphere is recommended.
(Oxygen concentration: 1000ppm or less)

Unit : mm

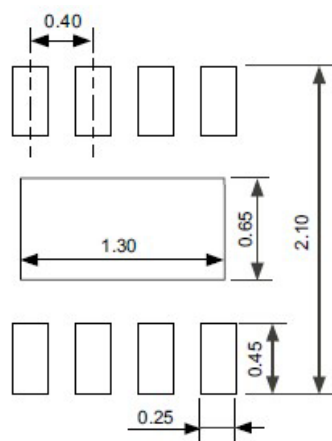
Figure 9 Stencil Opening of HSNT-6(2025)

1. 2. 4 HSNT-8(1616)B



Unit: mm

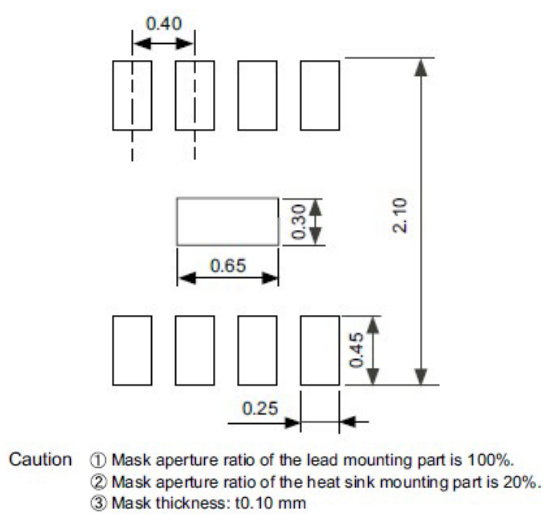
Figure 10 Dimensions of HSNT-8(1616)B



Caution It is recommended to solder the heat sink to a board in order to ensure the heat radiation.

Unit : mm

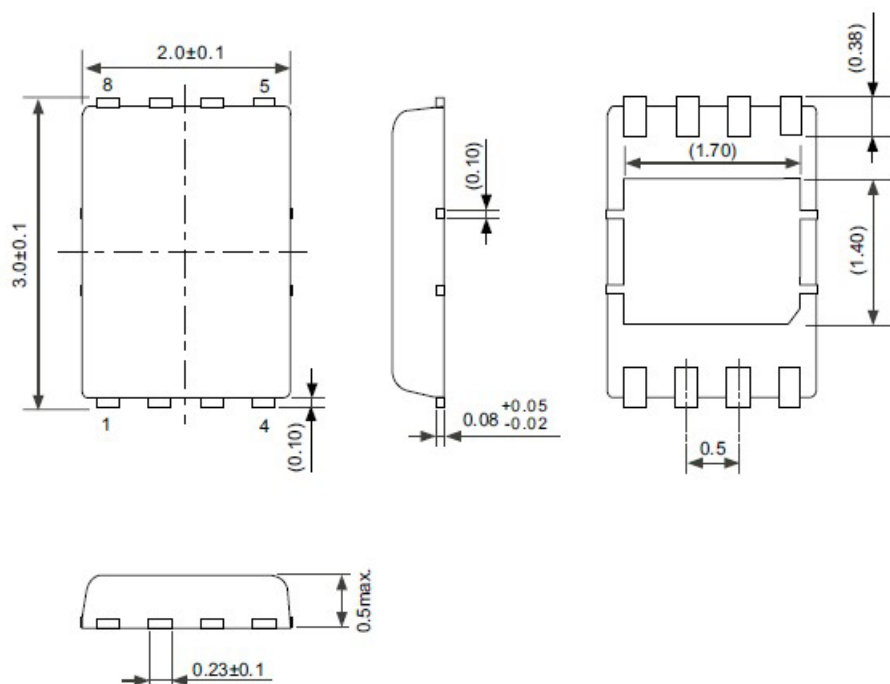
Figure 11 Land of HSNT-8(1616)B



Unit : mm

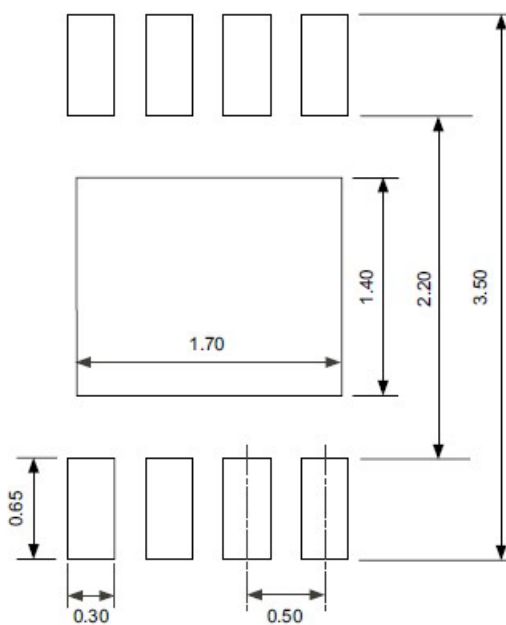
Figure 12 Stencil Opening of HSNT-8(1616)B

1. 2. 5 HSNT-8(2030)



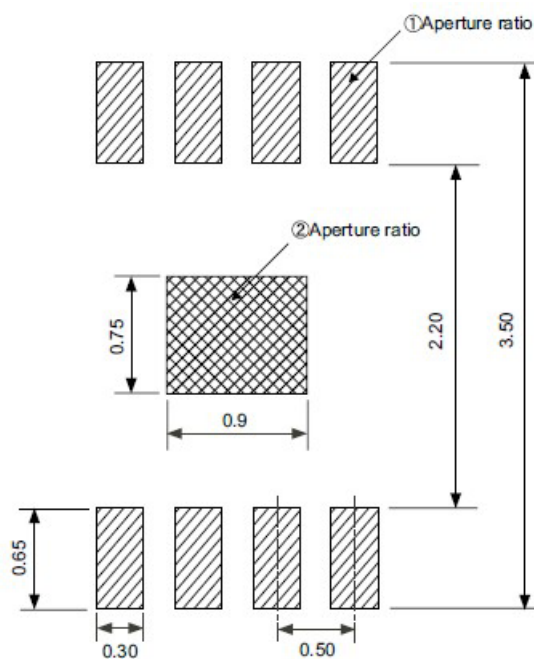
Unit: mm

Figure 13 Dimensions of HSNT-8(2030)



Unit : mm

Figure 14 Land of HSNT-8(2030)



- Caution
- ① Mask aperture ratio of the lead mounting part is 100%.
 - ② Mask aperture ratio of the heat sink mounting part is approximately 30%.
 - ③ Mask thickness: t0.12 mm
 - ④ Reflow atmosphere: Nitrogen atmosphere is recommended.
(Oxygen concentration: 1000ppm or less)

Unit : mm

Figure 15 Stencil Opening of HSNT-8(2030)

2. Mounting Method

2.1 Storage of automotive HSNT package

Like other plastic packages, the automotive HSNT package tends to absorb moisture from the ambient air.

If too much moisture is absorbed, the moisture may expand during solder mounting, which may cause delamination between the IC chip and the package or cracks the resin mold.

In addition, if stored in high temperature or high humidity environments, the package lead plating solder wettability may deteriorate or the adhesive strength of the carrier tape and cover tape may change.

Store at the room temperature and humidity shown below.

Storage conditions: Ta = 5°C to 30°C, RH = 40% to 70%

It is recommended the package be used within 1 year of delivery.

2.2 Cautions when mounting

2.2.1 Printing process

The automotive HSNT package has small land dimensions on the printed circuit board. Therefore, it requires very precise printing with cream solder.

(1) Printing machine

The recommended printing accuracy of the printing machine is as follows.

Cream solder printing accuracy: $\pm 20\ \mu\text{m}$ or less is recommended.

(2) Solder printing mask

(a) Mask aperture ratio

- Aperture ratio of lead mounting part

Print sufficient solder to achieve good mounting.

It is recommended that the lead section mask aperture ratio be 100% or higher.

- Aperture ratio of heat sink mounting part

It is recommended to reduce the mask aperture ratio to 30% to 40%. Refer to the mask aperture drawings for each package.

If a large amount of solder is printed on the heat sink section, it could cause the package to float off of the board surface and result in bad mounting of the lead section.

Also mask aperture ratio of the heat sink part may need to be adjusted depending on the mask thickness.

Remark The heat sink is exposed out of the package back surface in order to improve heat dissipation of automotive HSNT package.

It is recommended that the heat sink and printed circuit board be soldered together to improve heat dissipation and mounting strength.

(b) Mask aperture processing

It is recommended to use a smoothed mask aperture wall surface to improve solder printability.

(3) Cream solder

Use a cream solder which has good printability for the small mask aperture sections, and which has good solder wettability for the package lead and heat sink.

The recommended solder particle diameter is as follows.

Solder particle diameter: 15 μm to 25 μm or less is recommended.

Remark Printability and solder solderability will differ depending on the solder used and printing conditions. Please confirm the status in advance.

2. 2. 2 Mounting process

The automotive HSNT package size is very small, so accuracy of mounting on the printed circuit board is important.

The recommended mounting accuracy of the mounter is as follows.

Mounting accuracy: $\pm 50\ \mu\text{m}$ or less is recommended.

Use a tape feeder with small vibration during tape feed.

If tape feeder vibration is large, it may result in the package flying off of the tape or the posture changing within the tape pocket. Confirm the status in the pocket before package pickup.

Also confirm that the pickup nozzle sucks the package in the correct posture.

2. 2. 3 Reflow process

(1) Reflow oven internal settings

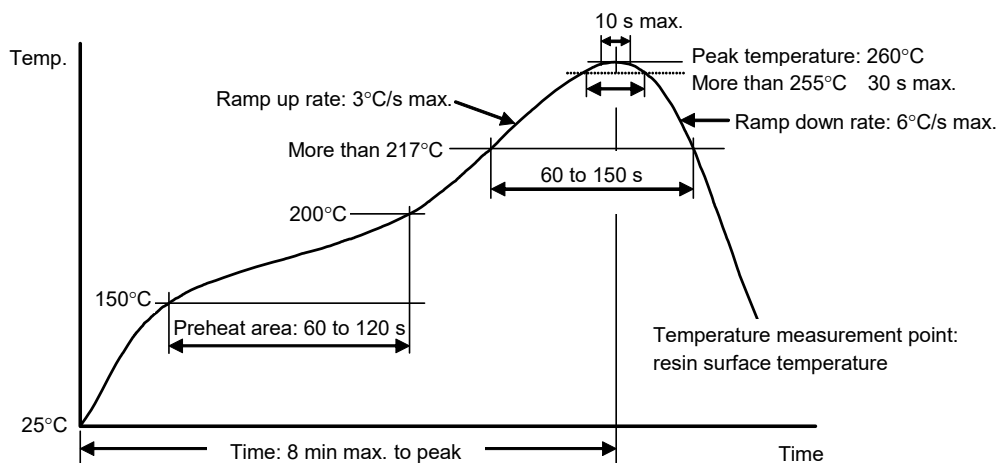
The automotive HSNT package is very small and light, so it can be affected by airflow and vibration in the reflow oven. Please use appropriate oven internal environment settings.

Make sure the temperature is applied evenly to each of the automotive HSNT package leads and that there is no deviation in the timing between melting and solidification among the leads.

(2) Reflow atmosphere

A nitrogen atmosphere is recommended for the atmosphere inside the reflow oven. The oxygen concentration should be 1000 ppm or less.

The automotive HSNT package series reflow profile for heat resistance evaluation is compliant with JEDEC J-STD-020.



Number of maximum reflow cycles: three times

Figure 16 Reflow Profile for Heat Resistance Evaluation

2. 2. 4 Other mounting processes**(1) Flow mounting compatibility**

Automotive HSNT packages are non-lead packages with a heat sink on the back surface and are not compatible with flow mounting. Do not carry out flow mounting because rapid temperature increases can cause chip surface peeling and package cracking in the molded resin parts.

(2) Manual soldering compatibility

Automotive HSNT packages are non-lead packages and are not compatible with manual soldering.

2. 2. 5 Cleaning method

When clean-free flux is applied, cleaning is not necessary. It may cause corrosion when residue of the active agents remained in the flux. Good selection of flux is indispensable to avoid corrosion.

Avoid chloride and chlorofluocarbon cleaning agents, and use environmentally-friendly flux cleaning solvents, pure water, etc. for cleaning.

Avoid high temperatures, rapid heating, and rapid cooling for cleaning agents and drying temperatures.

If performing ultrasonic cleaning, do the processing in the shortest possible time, and ensure the products being cleaned do not resonate.

2.3 Land pattern design and solder printing mask specifications

2.3.1 Land pattern design precautions

- (1) When designing the board for automotive HSNT packages, be sure to design within the dimension values shown in **Figure 17**. **Figure 17** shows an example with the automotive HSNT-4(1010)B, however the dimensions are the same for other automotive HSNT packages.

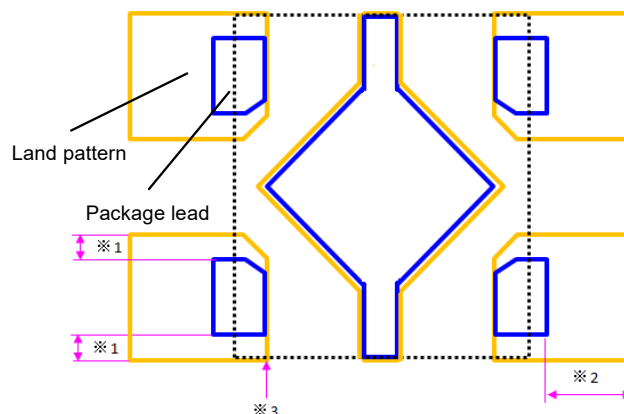


Figure 17 Land Pattern Design Precautions

- *1. Make the land pattern width wider than the lead width in order to improve solder wettability from the lead side.
For 0.4 mm pitch packages, it is recommended the width be 0.02 mm larger, and for 0.5 mm pitch and larger packages, it is recommended the width be 0.05 mm larger.
- *2. In order to wet the HSNT package leads with solder, expand the land pattern in the direction of the lead tips to improve solder wettability from the lead tips. Expand the land pattern by approximately 0.25 mm to 0.3 mm from the lead tip section.
- *3. Do not expand the land pattern past the back of the heel. Doing so could cause the package to float or impede self-alignment. It is recommended to align the land pattern to the lead heel section (0 mm to 0.05 mm max.).

- (2) For the solder resist forming method, make sure that solder does not flow into the wiring pattern which is directly connected to the land pattern as shown in **Figure 18**. Preventing solder from flowing into the wiring pattern makes it possible to maintain the amount of solder required for the package leads.

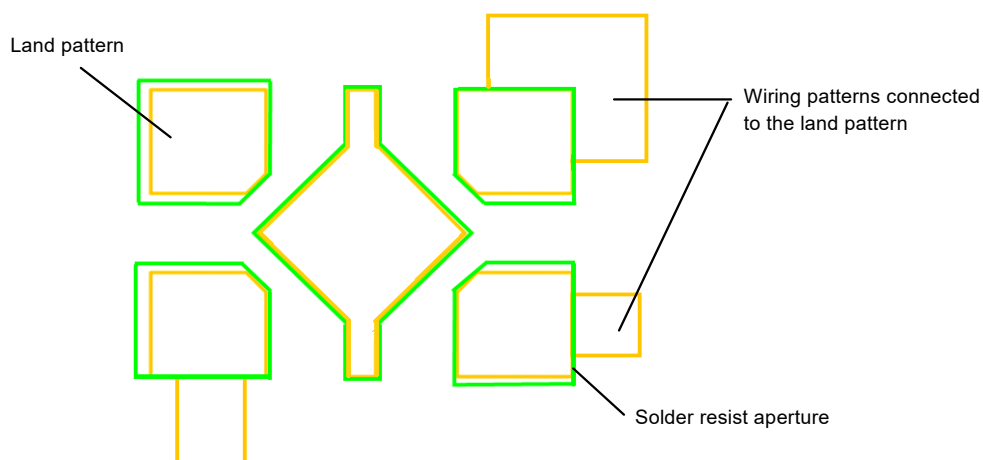


Figure 18 Solder Resist Formation Example (Good Example)

Solder resist aperture areas which are too wide and into which solder will flow are marked with an "x" in **Figure 19**. In such a case, solder may flow into the wiring patterns and a sufficient amount of solder may not be supplied to the package leads. In addition, the package leads may get pulled toward certain lands in some cases.

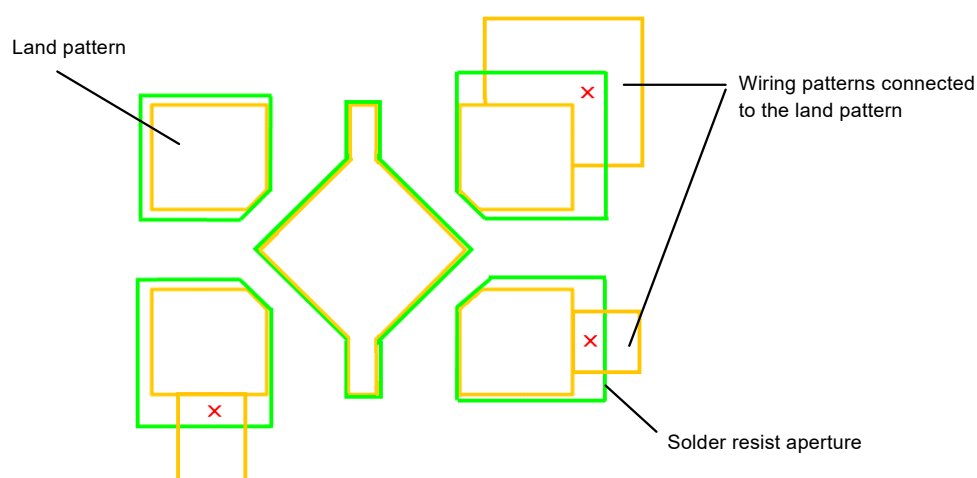


Figure 19 Solder Resist Formation Example (Bad Example)

2.3.2 Solder printing mask specifications

- (1) The aperture ratio is different for sections where package leads are mounted and the sections where heat sinks are mounted for automotive HSNT package solder printing masks. A sufficient amount of solder is required for the sections where package leads are mounted, so the mask aperture ratio should be 100% relative to the land pattern area. However, for the heat sink sections, if the amount of printed solder is excessive, the package may float up, so the mask aperture ratio must be lower. It is recommended that the heat sink section mask aperture ratio be maintained between 30% to 40%.

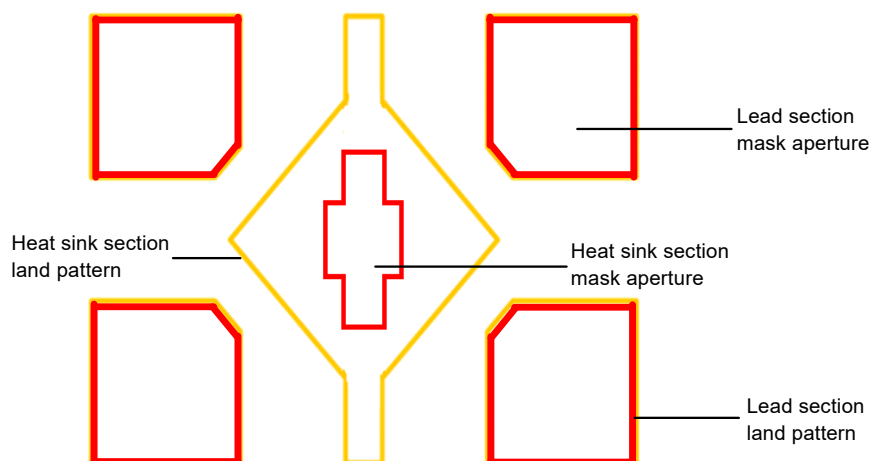


Figure 20 Stencil Opening

- (2) If the printed solder shorts between the lands, expand the lead section mask aperture in the direction of the lead tips, and adjust the solder printing amount so that it is the same as the 100% aperture ratio (Refer to **Figure 21**). Do not expand the aperture toward the center (the sections marked with an "x" in **Figure 22**), even if it is to increase the solder printing amount.

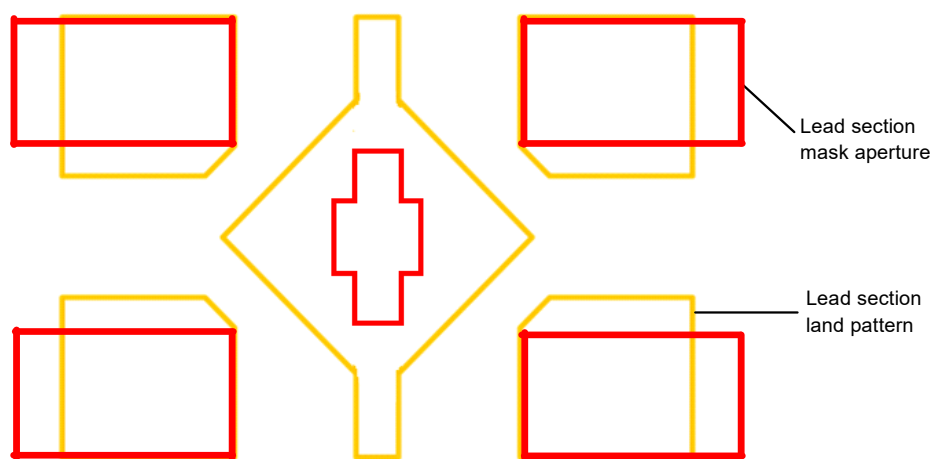


Figure 21 Special Mask Aperture Example

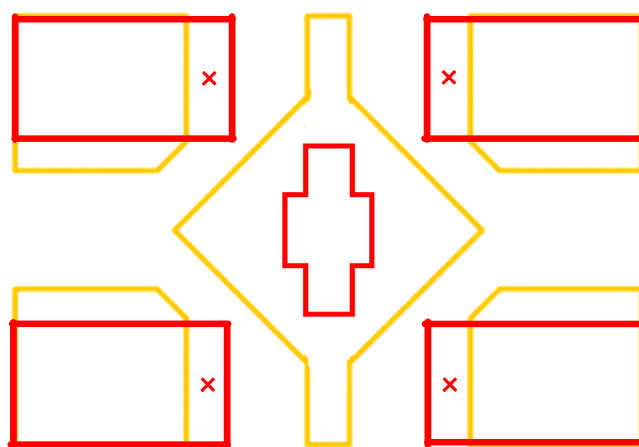
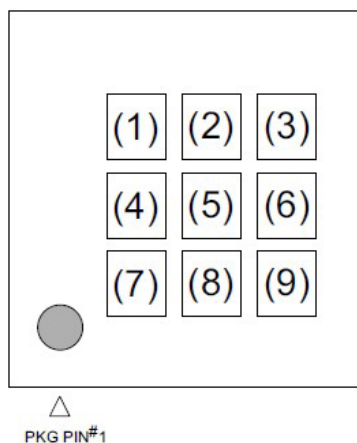


Figure 22 Special Mask Aperture Example (Bad Example)

2.3.3 Other special notes

- Design the printed circuit board with a flat surface for mounting the automotive HSNT package.
The automotive HSNT package is a flat lead type, so if the package mounting surface of the printed circuit board is uneven, then the package may incline and defects may appear in the lead's mounting.
The following are potential causes of unevenness in the board surface.
(1) Silk printing on package installation sections
(2) Uneven thickness of the solder resist
- Also pay much attention to printed circuit board curvature.
- The package solder connection could be damaged by any vibration during circuit board splitting or board curvature during the assembly process, etc., so exercise caution when planning the board mounting layout.
- Lead soldering appearance
Cu, which is the lead frame material, is exposed on the cut surface of the lead tip.
Solder may not wet on this area, but this is not a package defect.
- The content described in this user's guide might not satisfy some customer's mounting quality requirements.
In such cases, optimal mounting conditions must be adjusted by each customer.

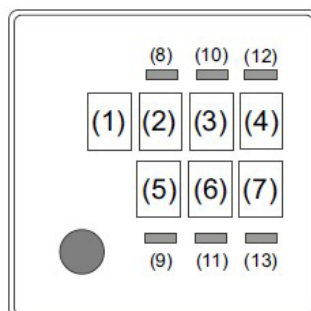
3.3 HSNT-6(2025)



(1) to (4) : Product code
(5) : Year of assembly
(6) : Month of assembly
(7) to (9) : Lot No.

Figure 25 Marking Specification of HSNT-6(2025)

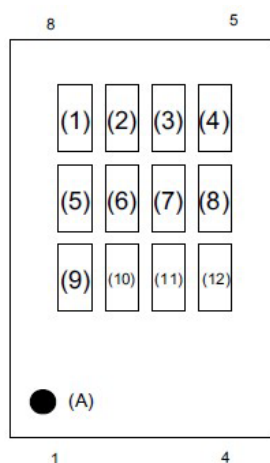
3.4 HSNT-8(1616)B



(1) to (4) : Product code
(5) to (7) : Lot No.
(8) , (9) : Year of assembly (bar)
(10) to (13) : Month of assembly (bar)
● : 1Pin mark

Figure 26 Marking Specification of HSNT-8(1616)B

3.5 HSNT-8(2030)



(1) to (5) : Product code

(6) : Assembly code

(7) : Year of assembly

(8) : Month of assembly

(9) to (12) : Lot No. code

(A) : 1 Pin mark

Figure 27 Marking Specification of HSNT-6(2030)

4. Packing Specifications

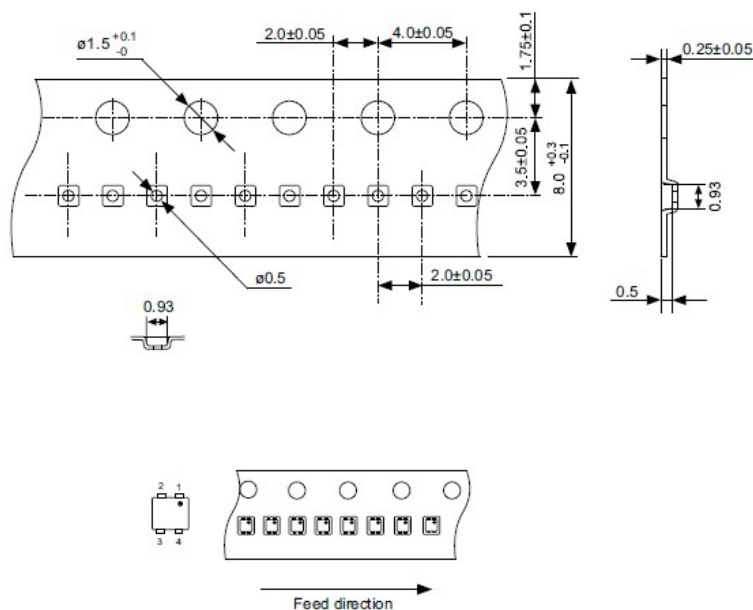
4.1 Packed units

HSNT-4(0808)B, HSNT-4(1010)B: 10000 / reel

HSNT-6(2025), HSNT-8(1616)B, HSNT-8(2030): 5000 / reel

4.2 Embossed carrier tape specifications

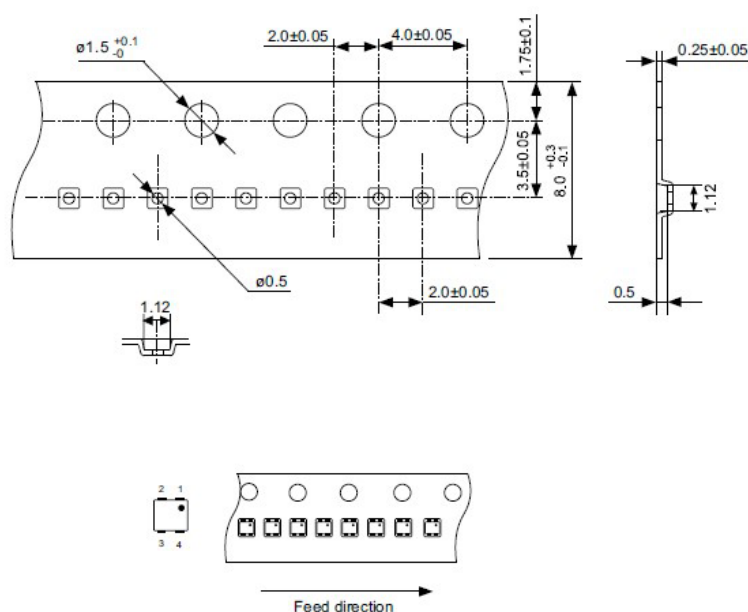
4.2.1 HSNT-4(0808)B



Unit : mm

Figure 28 Tape Dimensions of HSNT-4(0808)B

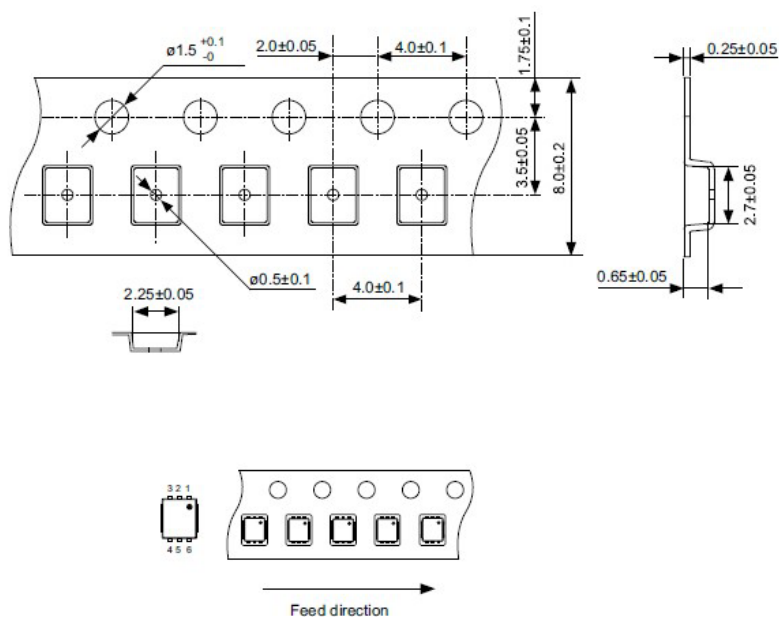
4.2.2 HSNT-4(1010)B



Unit : mm

Figure 29 Tape Dimensions of HSNT-4(1010)B

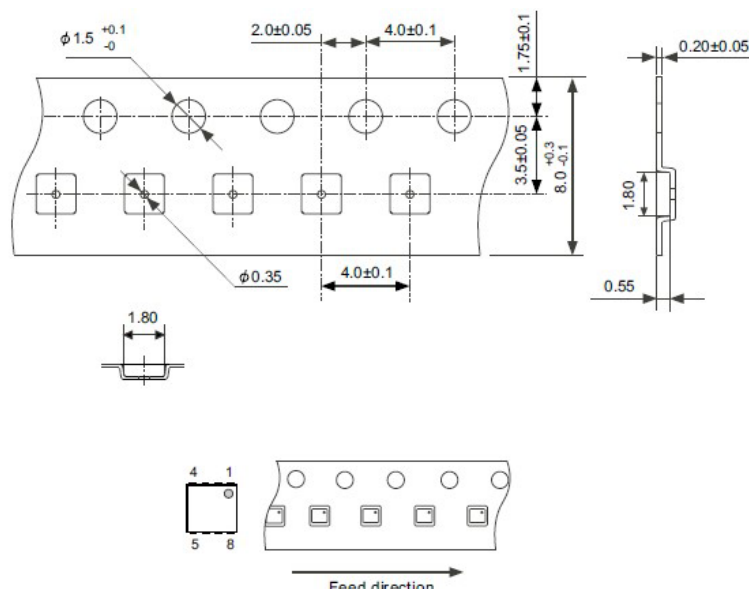
4.2.3 HSNT-6(2025)



Unit : mm

Figure 30 Tape Dimensions of HSNT-6(2025)

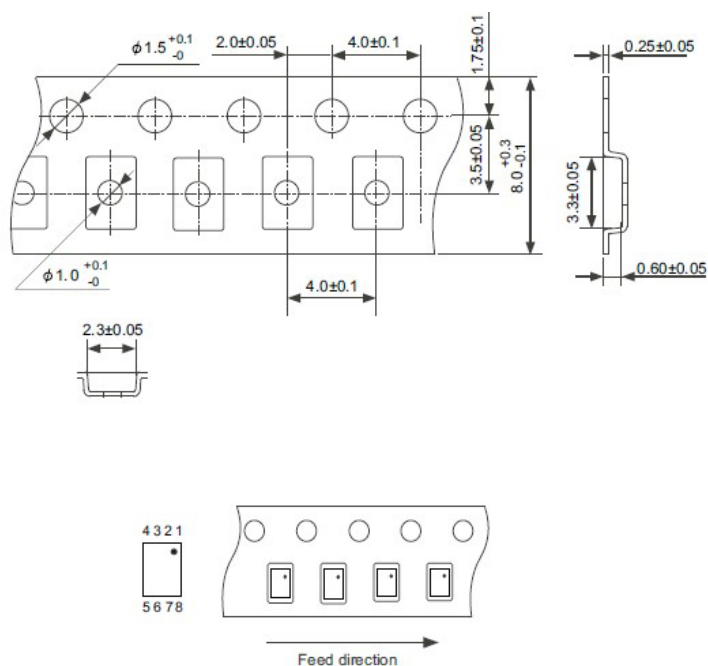
4.2.4 HSNT-8(1616)B



Unit : mm

Figure 31 Tape Dimensions of HSNT-8(1616)B

4.2.5 HSNT-8(2030)



Unit : mm

Figure 32 Tape Dimensions of HSNT-8(2030)

4.3 Reel specifications

The reel drawings for the HSNT-4(0808)B, HSNT-4(1010)B, HSNT-6(2025), HSNT-8(1616)B, HSNT-8(2030) packages are the same. The reel drawing for the HSNT-4(0808)B is shown here.

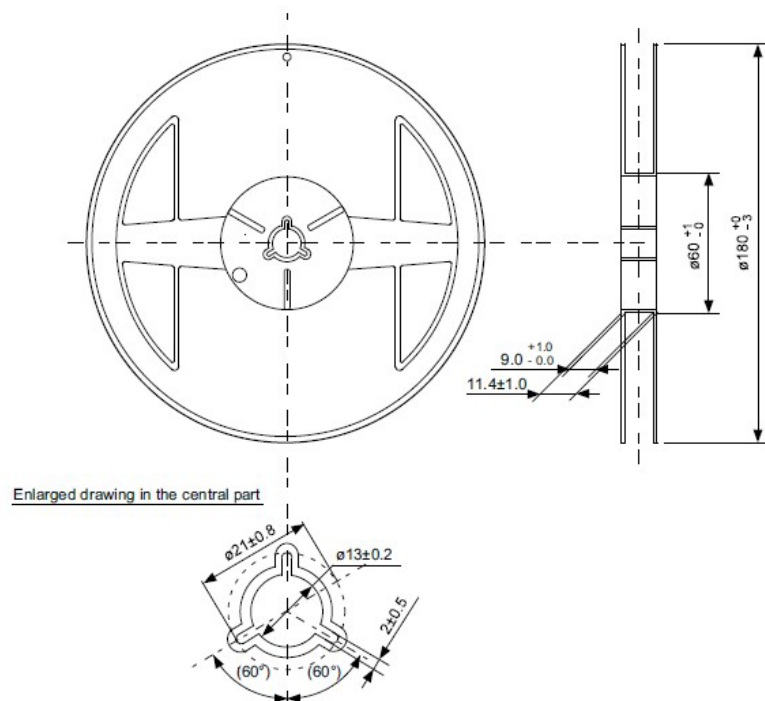


Figure 33 Reel Dimensions of HSNT-4(0808)B

Unit : mm

5. Mounting Evaluation Results

Automotive HSNT package mounting evaluation results are shown as reference data in **Table 3**. The evaluation results are not guaranteed.

Table 3 Mounting Evaluation Results of Automotive HSNT Package

Evaluation Item	Result	Main Condition
(1) Solderability test	Pass	Wetting balance method Solder: Sn-3.0Ag-0.5Cu Solder vat temperature: 245°C Criteria: Pass if zero close time is 3 seconds or less.
(2) Push strength test for soldering joint	Pass	The package mounted to the board is pressed with a jig from the side to test for break resistance. Criteria: 10 N or more
(3) PCB bending test (constant stress method)	Pass	Bend amount: 1 mm Repetitions: 1500 Span: 90 mm Criteria: Resistance value fluctuation must not exceed twice the initial value. Must be without visual defects.
(4) PCB bending test (Monotonic bending test)	Pass	Maximum bend amount: 3 mm Bend span: 90 mm Criteria: Resistance value fluctuation must not exceed twice the initial value. Must be without visual defects.
(5) Drop test	Pass	Automotive HSNT mounted boards are fixed to a 100-g jig. Dropped 30 times from a 170 cm height (six sides × five times each) Drop surface: Concrete Criteria: Resistance value fluctuation must not exceed twice the initial value. Must be without visual defects.
(6) Vibration test	Pass	Sine wave Frequency: 20 Hz to 2000 Hz Acceleration: Maximum 196m/s ² (20G) Directions: X / Y / Z Sweep rate: 4 min / cycle No. of sweep: 4 times (12 times total) Criteria: Resistance value fluctuation must not exceed twice the initial value. Must be without visual defects.
(7) Whisker evaluation	Pass	Temperature cycles: -40°C to 85°C × 1500 cycles Criteria: Whisker length 45 μm or less
		High-temperature and high-humidity storage: 55°C × 85% × 4000 h Criteria: Whisker length 40 μm or less
		Room temperature and room humidity storage: 30°C × 60% × 4000 h Criteria: Whisker length 40 μm or less

Remark In tests (3) to (6), a daisy chain was formed in the package to confirm that the resistance value did not increase.

<Mounting Evaluation Conditions>

- Printed circuit board for evaluation
FR4 and FR5: 4 layer double-sided board
Thickness = 1.0 mm
Surface processing of mounting land: Gold flash plating
- Packages are preprocessed before each test (before PCB mounting).
(Preconditioning = 105°C × 100% × 8 hours)
- Solder print mask
Mask thickness: 120 μm
Aperture ratio: Refer to the mask aperture drawings for each package.

- Solder
Composition: Sn-3Ag-0.5Cu
Solder particle diameter: Average 15 μm to 25 μm
Flux: ROL1
- Reflow Conditions
This is the reflow profile used when evaluating mountability. An air atmosphere is used.

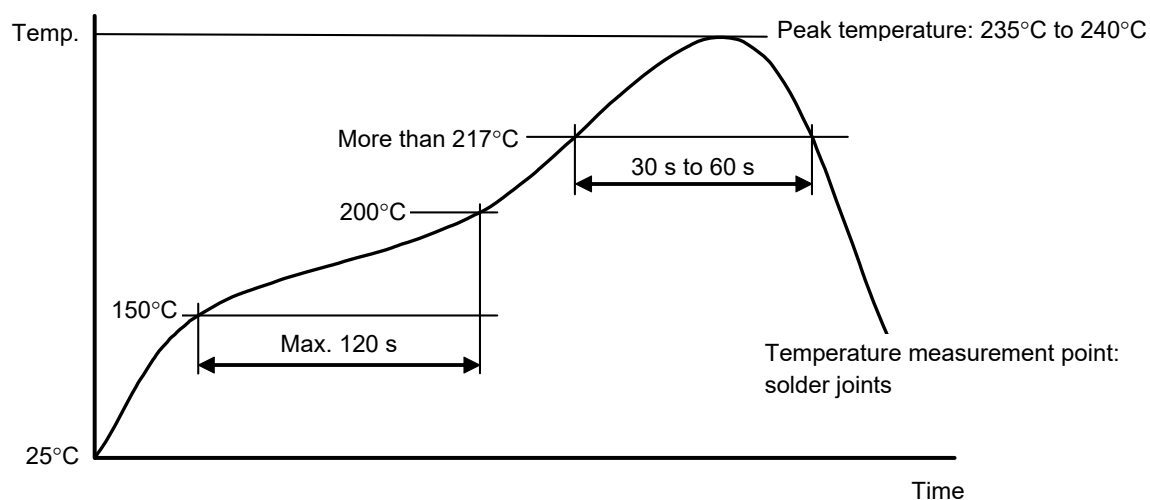


Figure 34 Mountability Evaluation Reflow Profile

Disclaimers (Handling Precautions)

1. All the information described herein (product data, specifications, figures, tables, programs, algorithms and application circuit examples, etc.) is current as of publishing date of this document and is subject to change without notice.
2. The circuit examples and the usages described herein are for reference only, and do not guarantee the success of any specific mass-production design.
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5. Before using the products, confirm their applications, and the laws and regulations of the region or country where they are used and verify suitability, safety and other factors for the intended use.
6. When exporting the products, comply with the Foreign Exchange and Foreign Trade Act and all other export-related laws, and follow the required procedures.
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The entire system in which the products are used must be sufficiently evaluated and judged whether the products are allowed to apply for the system on customer's own responsibility.
10. The products are not designed to be radiation-proof. The necessary radiation measures should be taken in the product design by the customer depending on the intended use.
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12. When disposing of the products, comply with the laws and ordinances of the country or region where they are used.
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