

CMOS IC Application Note

HSNT Package User's Guide

Rev.2.0_03

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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 HSNT super small package, for users in the semiconductor mounting technology fields.

In addition, mounting evaluation, reliability testing results and thermal resistance data 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 recommended conditions are subject to change depending on the external materials, conditions, environment, etc.

[Target Packages]

- HSNT-4(0808)
- HSNT-4(1010)
- HSNT-6(1212)

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1. Features of HSNT package

1. 1 General description of HSNT package

The HSNT package is a super small, thin and lightweight resin molded package for surface-mounting onto printed circuit boards, which has the following features.

1. 1. 1 Package size

(1) HSNT-4(0808)

The package size of HSNT-4(0808) is 0.8 mm × 0.8 mm × t0.40 mm max. This package is equal to or less than 1/3 the component area of and thinner than our other conventional compact package, SNT-4A (1.6 mm × 1.2 mm × t0.5 mm).

(2) HSNT-4(1010)

The package size of HSNT-4(1010) is 1.0 mm × 1.0 mm × t0.40 mm max. This package is approximately 1/2 the component area of and thinner than the SNT-4A as HSNT-4(0808).

(3) HSNT-6(1212)

The package size of HSNT-6(1212) is 1.2 mm × 1.2 mm × t0.40 mm max. This package is approximately 1/2 the component area of and thinner than our other conventional compact package, SNT-6A (1.8 mm × 1.57 mm × t0.5mm).

The HSNT package size is small and thin, making it an optimal package for mobile equipment and other products which require miniaturization and lightweight.

Figure 1 to Figure 3 show the dimensions of each HSNT package.

1. 1. 2 Heat dissipation

Copper is used for the lead frame in order to improve package heat dissipation, and the heat sink (lead frame) is exposed out of the package back surface.

By soldering the heat sink onto the printed circuit board, the heat generated from the IC can be quickly released to the circuit board.

1. 1. 3 Package mountability and reliability

Despite its compact size and thin shape, the HSNT package fully meets the same mountability and reliability level as is applied to our other compact packages. Refer to "**5. 1 Mounting evaluation results of HSNT package (reference values)**" and "**5. 2 Reliability testing results of HSNT package**".

Table 1 shows specifications of the HSNT package.

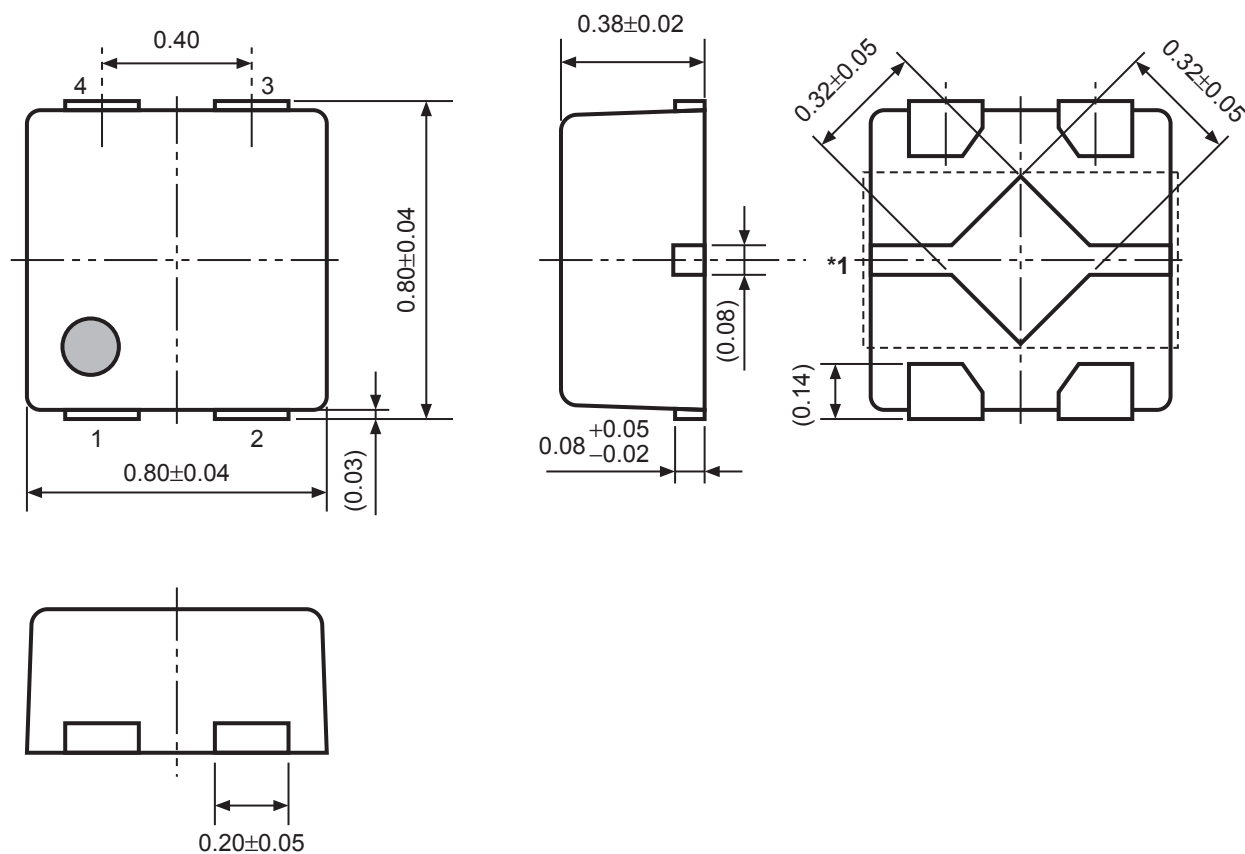
Table 1 Specifications of HSNT Package

Item	HSNT-4(0808)	HSNT-4(1010)	HSNT-6(1212)
Number of pins	4	4	6
Sealing	Resin mold		
Dimensions (L × W × H)	0.8 mm × 0.8 mm × t0.4 mm max.	1.0 mm × 1.0 mm × t0.4 mm max.	1.2 mm × 1.2 mm × t0.4 mm max.
Pitch	0.40 mm	0.65 mm	0.40 mm
Pin material / surface processing	Cu / Sn 100%		
Plating thickness	Approximately 10 μm		
Package weight*1	0.64 mg	1.05 mg	1.59 mg
MSL	JEDEC Level 1		

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

1. 2 Dimensions of HSNT package

1. 2. 1 HSNT-4(0808)

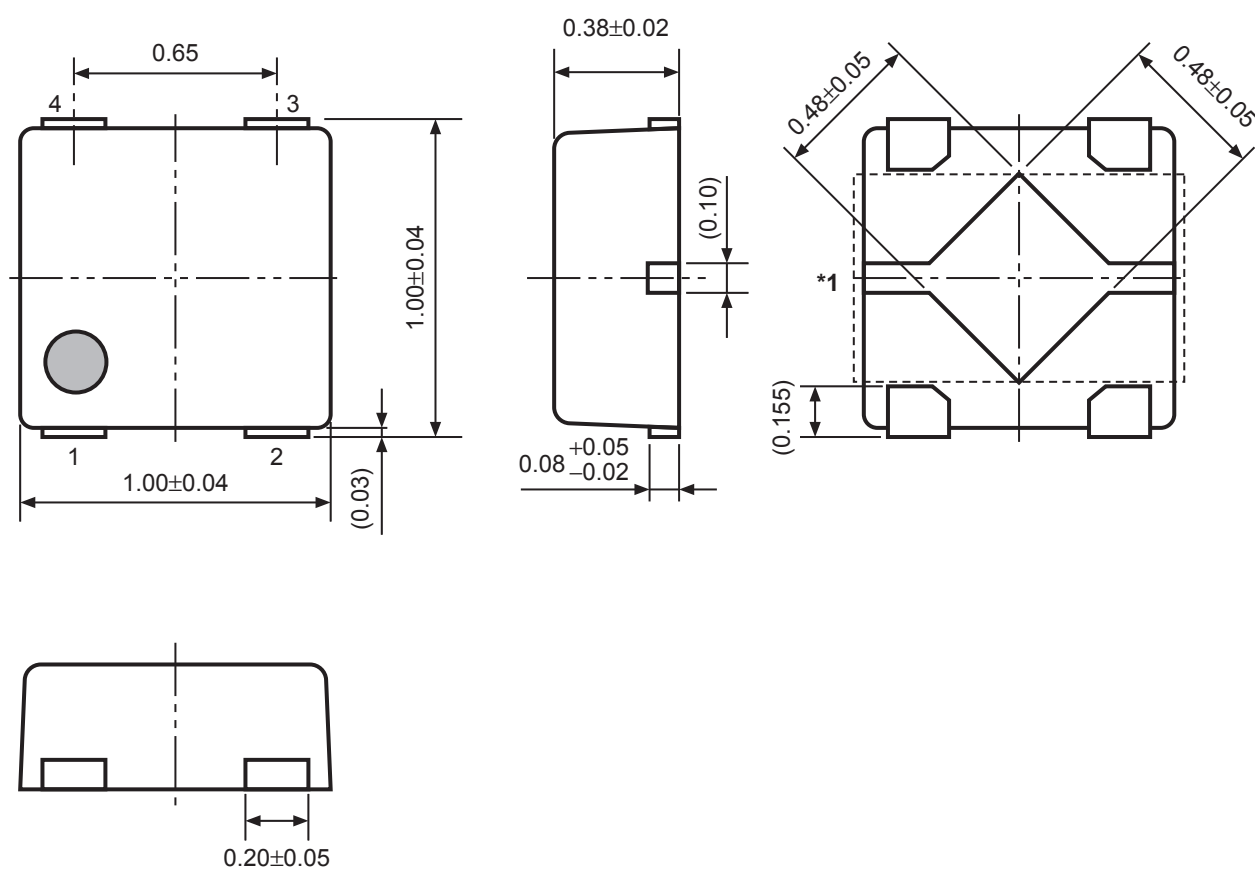


Unit: mm

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

Figure 1 Dimensions of HSNT-4(0808)

1. 2. 2 HSNT-4(1010)

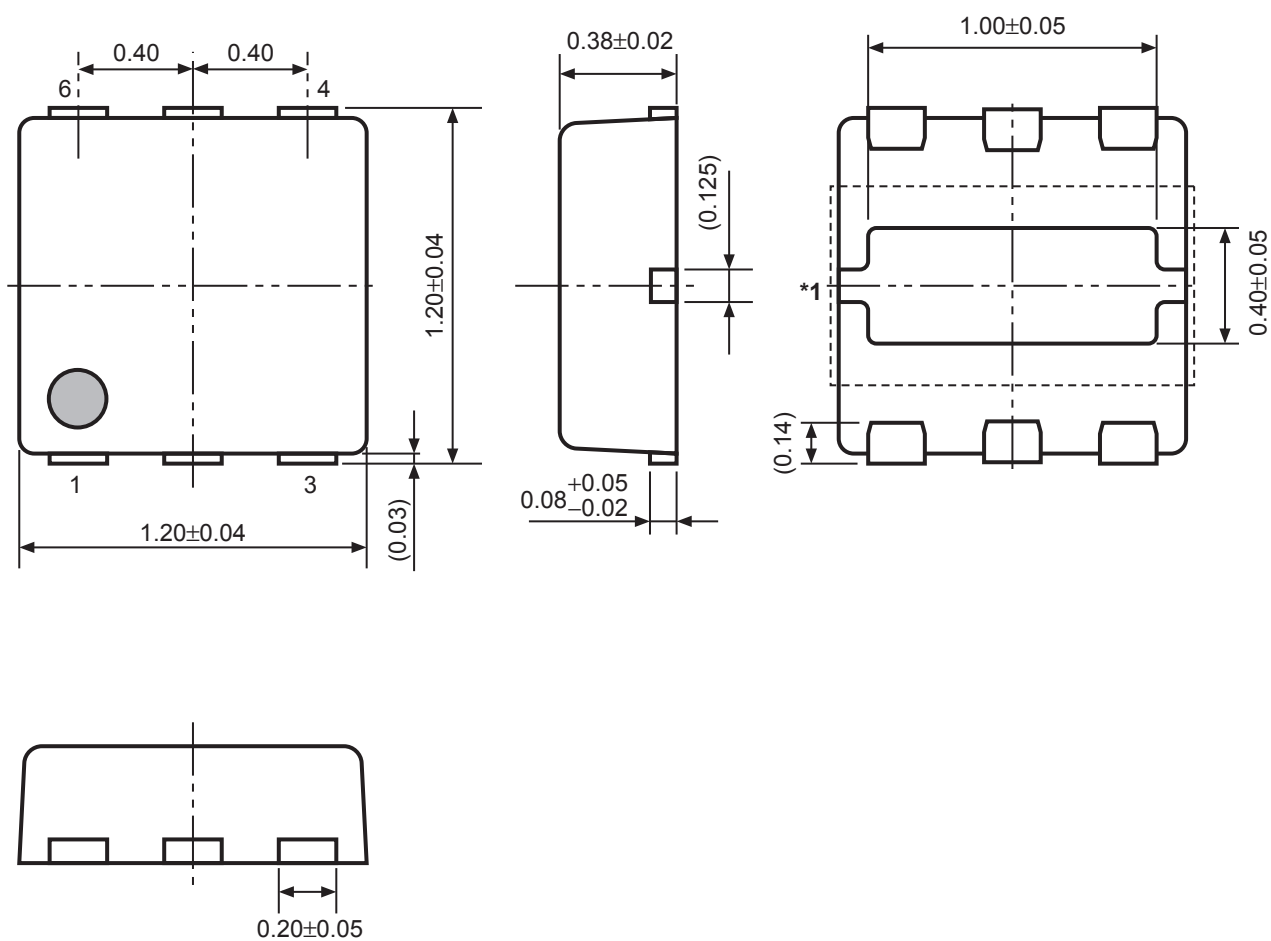


Unit: mm

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

Figure 2 Dimensions of HSNT-4(1010)

1. 2. 3 HSNT-6(1212)



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

Figure 3 Dimensions of HSNT-6(1212)

2. Components and materials of HSNT package

The HSNT package mounts the IC on a Cu lead frame, and uses an epoxy-based resin molded structure.
The outer lead soldered to the printed circuit board is Sn 100% plated.

Table 2 Package, Tape and Reel Materials

Package and Reel Component	Material / Quality
Molding resin	Epoxy-based resin
Lead frame	Cu
Surface processing on pins	Sn 100%
Bonding wire	Au (at least 99.99% pure)
Die bonding agent	Epoxy-based resin with Ag filler
Embossed tape	PS
Cover tape	PET
Reel	PS

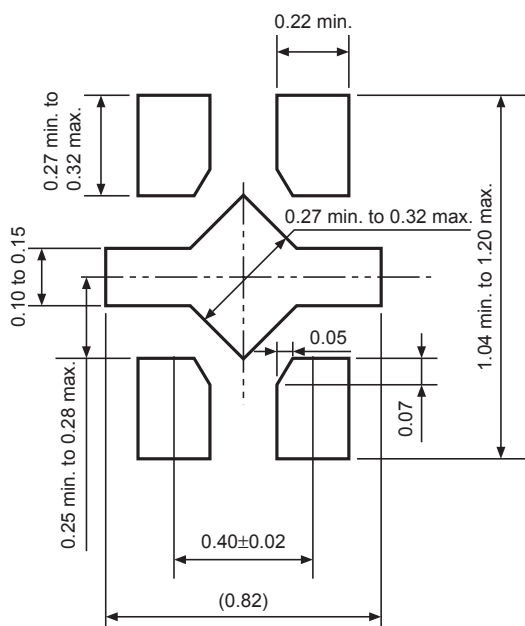
3. Recommended land dimensions for each HSNT package and recommended mask aperture dimensions for solder printing

3.1 Recommended land dimensions and recommended mask aperture dimensions

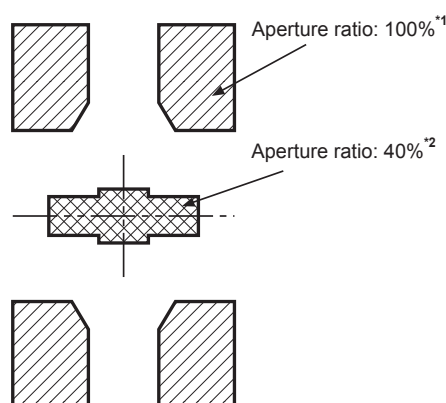
The figures below show the recommended land dimensions and solder printing mask dimensions for each package.

Caution The dimension values in the figures are not design values for circuit board land and masks, but finished dimensions. Design the figures according to the following dimensions with reference to the circuit board and mask manufacturing tolerances.

3.1.1 HSNT-4(0808)



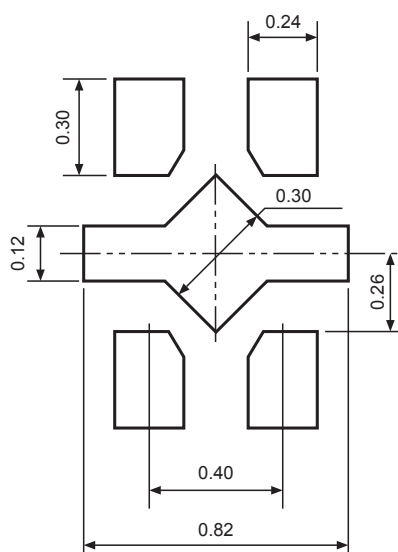
Unit: mm



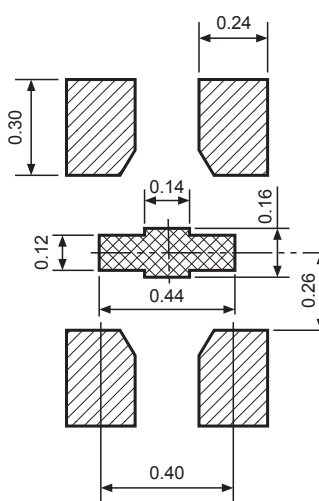
Unit: mm

Figure 4 HSNT-4(0808) Recommended Land Dimensions

Figure 5 HSNT-4(0808) Recommended Mask Aperture Dimensions



Unit: mm



Unit: mm

Figure 6 HSNT-4(0808) Recommended Land Dimensions Example

Figure 7 HSNT-4(0808) Recommended Mask Aperture Dimensions Example

3.1.2 HSNT-4(1010)

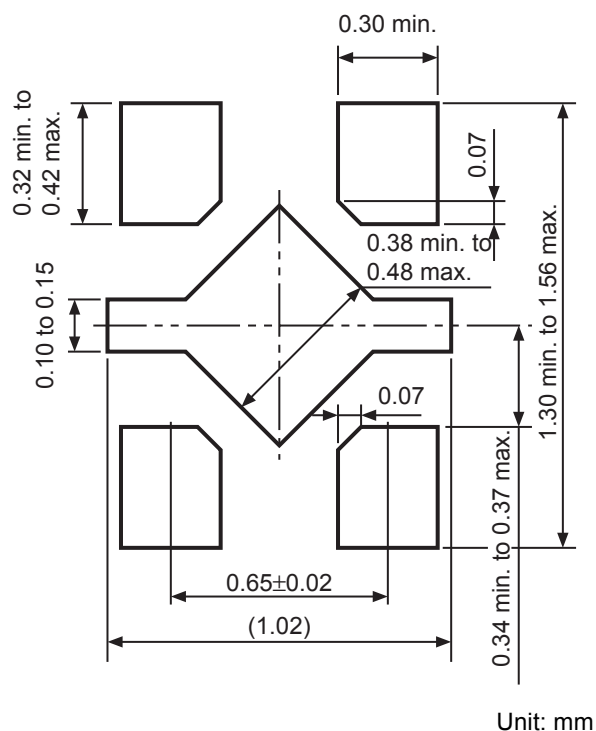
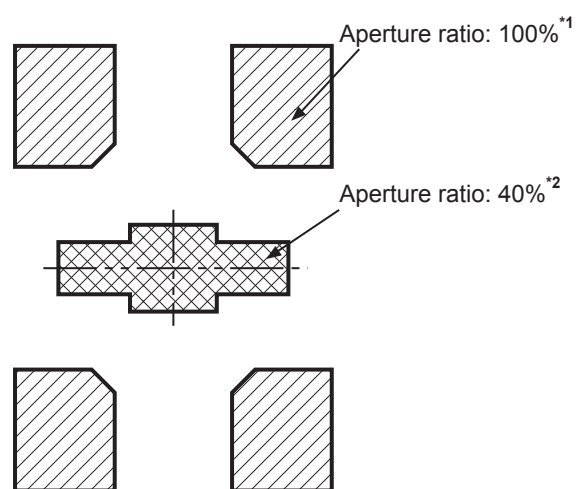


Figure 8 HSNT-4(1010) Recommended Land Dimensions



*1. Aperture ratio of the lead mounting part is 100%.
*2. Aperture ratio of the heat sink mounting part is 40%.

Remark Mask thickness: t0.10 mm to 0.12 mm

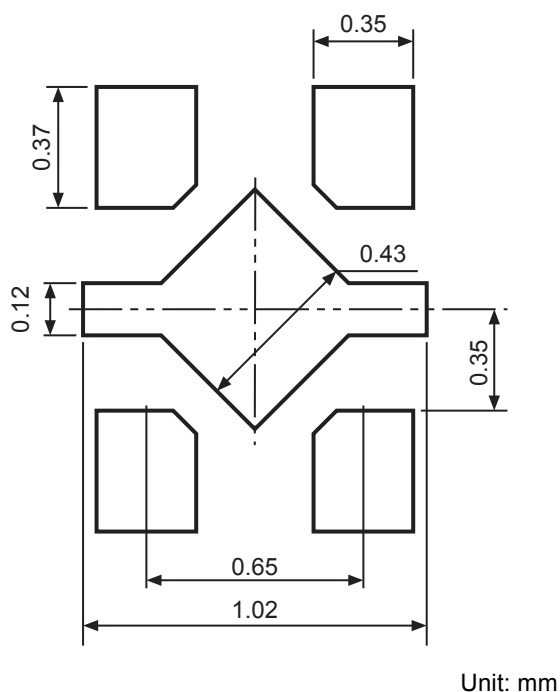


Figure 10 HSNT-4(1010) Recommended Land Dimensions Example

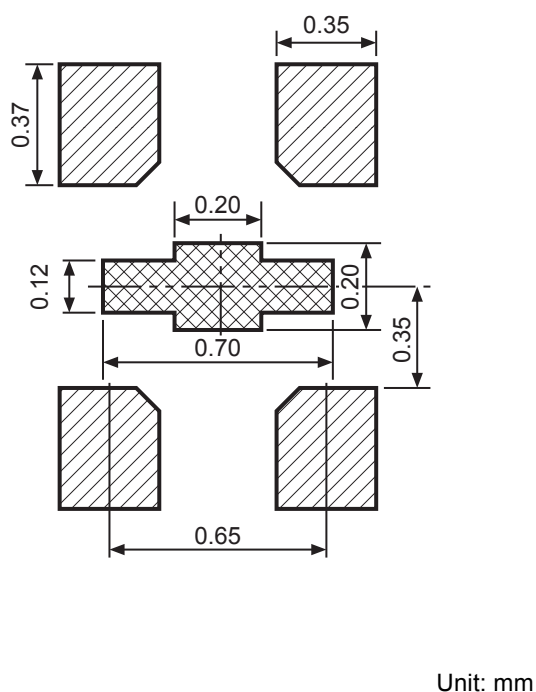
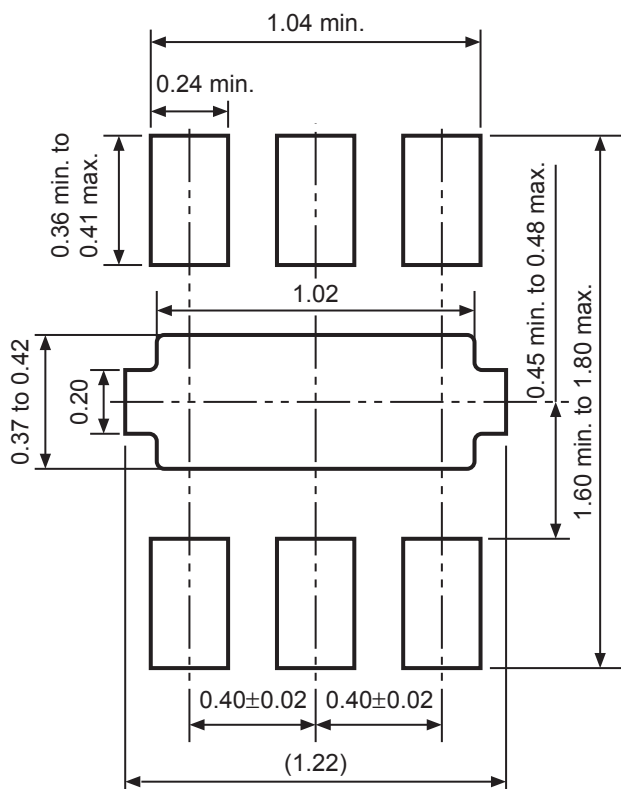


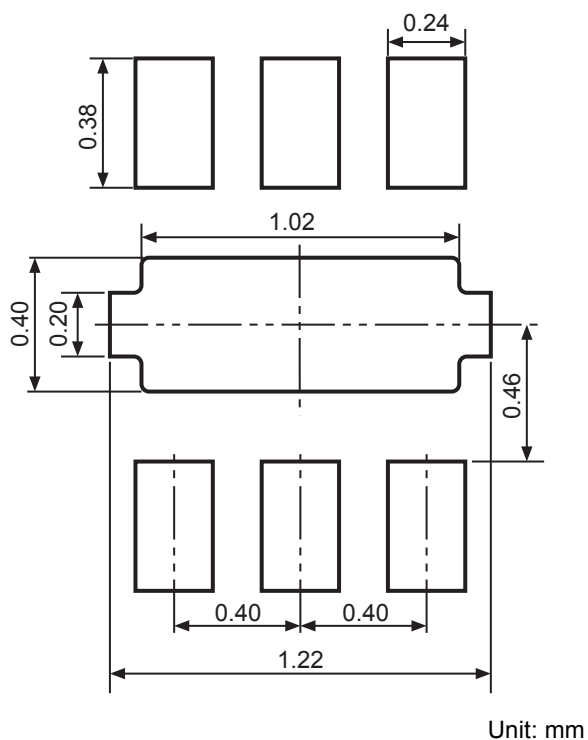
Figure 11 HSNT-4(1010) Recommended Mask Aperture Dimensions Example

3.1.3 HSNT-6(1212)



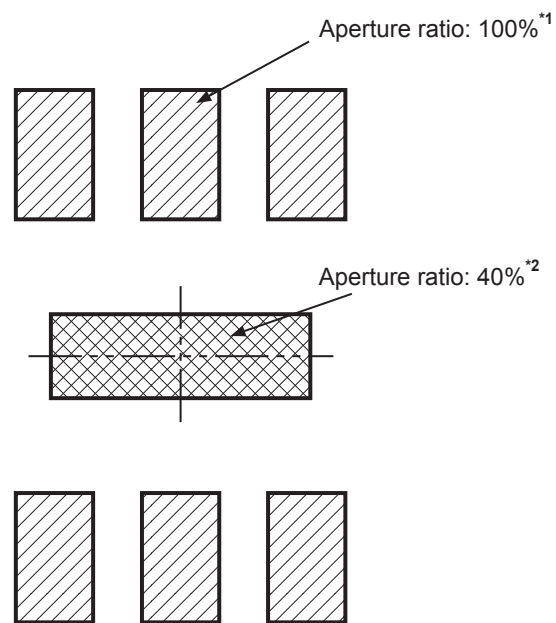
Unit: mm

Figure 12 HSNT-6(1212) Recommended Land Dimensions



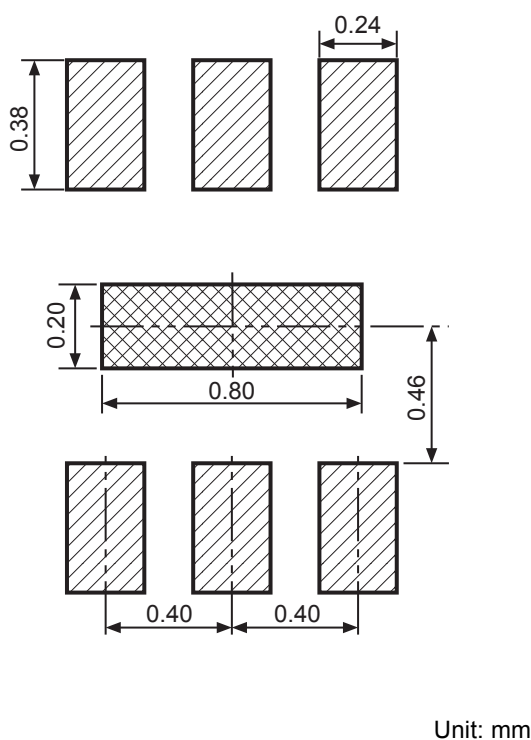
Unit: mm

Figure 14 HSNT-6(1212) Recommended Land Dimensions Example



Unit: mm

Figure 13 HSNT-6(1212) Recommended Mask Aperture Dimensions



Unit: mm

Figure 15 HSNT-6(1212) Recommended Mask Aperture Dimensions Example

- *1. Aperture ratio of the lead mounting part is 100%.
*2. Aperture ratio of the heat sink mounting part is 40%.

Remark Mask thickness: t0.10 mm to 0.12 mm

4. Handling and mounting methods

4.1 Storage

Like other plastic packages, the 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.

4.2 Cautions when mounting

4.2.1 Printing process

The 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

A mask aperture ratio of 100% is recommended to ensure sufficient solder.

- Aperture ratio of heat sink mounting part

It is recommended to reduce the mask aperture ratio to approximately 40%.

If a large volume of solder is printed onto this part, the package may float, and the mounting failure may occur.

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

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

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

Use of a mask with a smoothed mask aperture wall surface and good solder releasability is recommended.

(3) Cream solder

Use a cream solder with good printability.

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

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

4. 2. 2 Mounting process

The 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.

4. 2. 3 Reflow process

The HSNT package is very small and light, so it may be affected by temperature variations and airflow in the reflow oven.

Make sure the temperature is applied to each HSNT package lead evenly. Moreover, optimize the airflow.

It is confirmed that the HSNT package can be mounted in an air atmosphere, but if a more stable mounting situation is desired, a nitrogen atmosphere is recommended (oxygen concentration: 1000 ppm or less is recommended).

4.3 Rinsing of HSNT package

When using no-clean flux, flux cleaning rinsing is not necessary.

However, when carrying out rinsing for the purposes of eliminating contamination from surface-mounting or removing remaining required flux, the rinsing method may adversely affect products.

The followings are points to note and recommended conditions for rinsing.

4.3.1 Rinsing conditions (reference examples)

Rinsing solvent

- Ethyl alcohol, Isopropyl alcohol, Hexane, Purified water

Ultrasonic cleaning conditions

- Frequency: 24 kHz to 36 kHz
- Output: 150 W to 400 W / 10 liters
- Time: 2 minutes to 3 minutes

Immersion rinsing conditions

- Fluid temperature: 60°C or lower

4.3.2 Points to note

- Ensure the object being rinsed does not resonate.
- Do not use chlorinated solvents.
- Do not expose the products to a high temperature, and do not heat or cool the products rapidly.
- Complete rinsing quickly.

Caution The above rinsing conditions are not guaranteed conditions. Confirm the effect of rinsing on samples before rinsing products.

4. 4 Other special notes

- Design the printed circuit board with a flat surface for mounting the HSNT package.
This is a flat lead type package, 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 soldering.
Also pay much attention to printed circuit board curvature.
- Lead soldering appearance
Cu, which is the lead frame material, is exposed on the lead cut surface.
Solder may not wet on this area, but this is not an issue with actual use.
There is not difference in mounting strength based on if there is any solder wetting on the lead cut surface.
Mounting evaluations implemented by our company is cleared.
Refer to "**5. 1 Mounting evaluation results of HSNT package (reference values)**".
- When mounting this package on the perimeter of the circuit board, do not subject to any shock during the circuit board splitting process.
The package solder connection could be damaged by any vibration or curvature during circuit board splitting.
- Even if mounted exactly as noted in this user's guide, satisfactory mounting results may not be obtained depending on customer mounting conditions (mounting equipment, circuit board, mask conditions, reflow conditions, solder material, etc.).
In such cases, it is necessary to adjust the mounting conditions to achieve the mounting status required by the customer.
This user's guide proposes recommended conditions based on our company's evaluation results.

5. Evaluation results of HSNT package

5.1 Mounting evaluation results of HSNT package (reference values)

5.1.1 Mounting evaluation results of HSNT package (reference values)

Table 3 Mounting Evaluation Results of HSNT Package (Reference Values)

Evaluation Item	Result	Main Condition
(1) Solderability	○ (r/n = 0/5) Wetting time = 3 s or less	Wetting Balance Method Solder: Sn-3.0Ag-0.5Cu Solder vat temperature: 245°C
(2) Push strength test for soldering joint	○ (r/n = 0/5) HSNT-4(0808) : 20 N HSNT-4(1010) : 22 N HSNT-6(1212) : 40 N Values are reference values.	Test methods are based on EIAJ ET-7403. Criteria: No peeling, etc., when 10 N pressure is applied for 10 seconds (visual inspection) Reference data: Pressed with jig from side of package to test for breaking strength (Data: n = 5).
(3) PCB bending test (constant stress method)	○ (r/n = 0/5) HSNT-4(0808) : Pass HSNT-4(1010) : Pass HSNT-6(1212) : Pass	Bend amount: 1 mm, PCB thickness: 1 mm Repetitions: 5000 Bend span: 90 mm (refer to JEITA ET-7409) Criteria: Resistance value fluctuation must not exceed twice the initial value. Must be without visual defects.
(4) PCB bending limit test (step stress method)	○ (r/n = 0/5) HSNT-4(0808) : Pass HSNT-4(1010) : Pass HSNT-6(1212) : Pass	Maximum bend amount: 3 mm, PCB thickness: 1 mm Bend span: 90 mm (refer to JEITA ET-7409) Criteria: Resistance value fluctuation must not exceed twice the initial value. Must be without visual defects.
(5) Drop test	○ (r/n = 0/5) HSNT-4(0808) : Pass HSNT-4(1010) : Pass HSNT-6(1212) : Pass	HSNT mounting boards are fixed to a 100-g jig. Dropped 16 times from a 170 cm height (6 times on bottom side, 2 times each on the other 5 sides) Drop surface: Concrete or steel plate Criteria: Resistance value fluctuation must not exceed twice the initial value. Must be without visual defects.
(6) Mounting reliability	○ (r/n = 0/22) HSNT-4(0808) : Pass HSNT-4(1010) : Pass HSNT-6(1212) : Pass	Temperature cycle: -40°C to 125°C, 1000 cycles Resistance value after testing must not exceed twice the initial value. Must be without visual defects.

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
Single-sided FR4
Thickness = 1.0 mm
Surface processing of mounting land: Gold plating
- Packages are preprocessed before each test (before PCB mounting).
Preconditioning = 105°C, 100%, 1.2 atm, 8 hours
- Print mask
Mask thickness: 100 μm
Aperture ratio: Refer to "3.1 Recommended land dimensions and recommended mask aperture dimensions".
- Reflow conditions
Refer to "5.1.2 Reflow profile for HSNT package at mounting evaluation" for profile.
Atmosphere: Air
- Solder
Composition: Sn-3Ag-0.5Cu Solder particle diameter: 15 μm to 25 μm

5. 1. 2 Reflow profile for HSNT package at mounting evaluation

Reflow conditions vary depending on factors such as the reflow oven and the specifications of printed circuit board to be used. The following figure shows the reflow profile used by ABLIC Inc. when evaluating mounting.

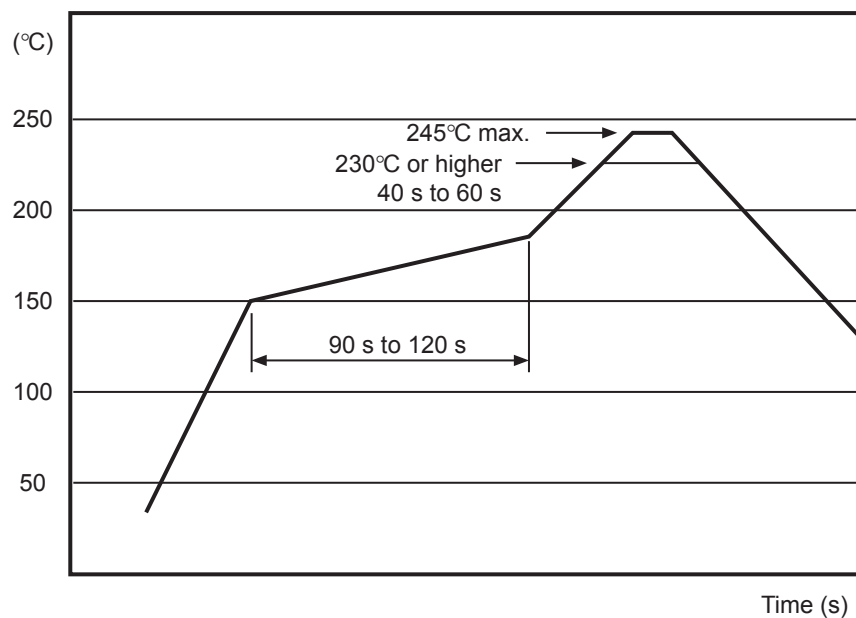


Figure 16 Reflow Profile for Mounting Evaluation

5.2 Reliability testing results of HSNT package

5.2.1 Reliability testing results of HSNT package

Table 4 shows some reliability testing results of the HSNT package.

Reliability testing results for each product can be downloaded from our company's website.

Select desired series names on the "**Datasheet Search**" page.

Table 4 Reliability Testing Results of HSNT Package

Test Item	Test Condition	Criteria	Result
High temperature storage	Ta = 150°C, 1000 h	Must meet product standards.	Pass
Low temperature storage	Ta = -65°C, 1000 h		Pass
Temperature cycle (gas phase)	Ta = 150°C ⇔ -65°C, 30 minutes each, 200 cycles		Pass
Thermal shock (liquid phase)	Ta = 150°C ⇔ -65°C, 5 minutes each, 100 cycles		Pass
Solder thermal resistance (reflow)	T = 260°C max., 10 s, 3 times (Refer to reflow profile for thermal resistance evaluation)	Must meet product standards. Must be without visible defects.	Pass
Whisker 1 (room temperature storage)	Ta = 30°C, RH = 60%, 4000 h	Whisker length must be 50 μm or less.	Pass
Whisker 2 (temperature cycle)	Ta = -40°C ⇔ 85°C, 1500 cycles		Pass
Whisker 3 (high-temperature high-humidity storage)	Ta = 55°C, RH = 85%, 4000 h		Pass

5. 2. 2 Reflow profile for HSNT package for thermal resistance evaluation

Compatible with 260°C max. for up to 10 seconds.

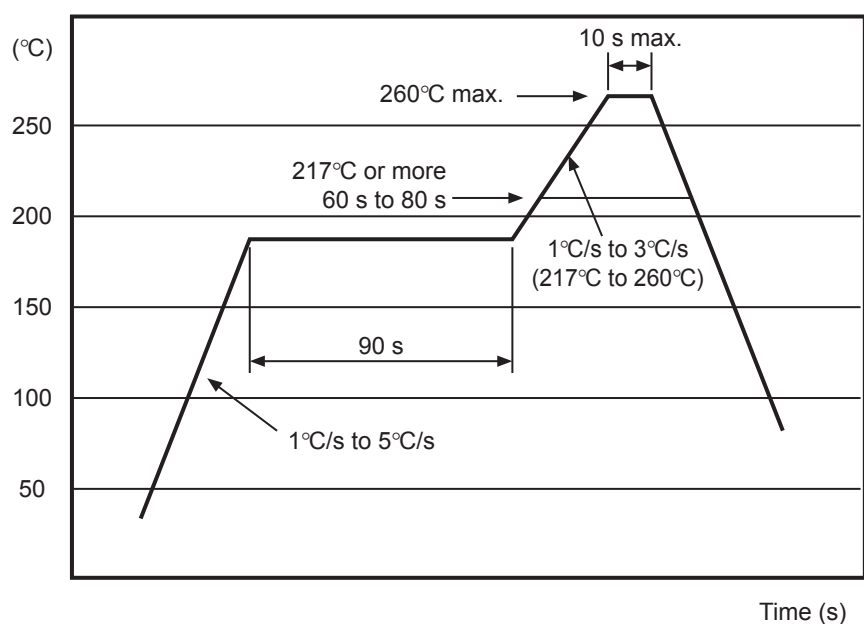


Figure 17 Reflow Profile for Thermal Resistance Evaluation

Remark Preheated parts will actually be a slight slope.

5.3 Thermal resistance and power dissipation of HSNT package (reference values)

5.3.1 Thermal resistance of HSNT-4(0808), HSNT-4(1010) and HSNT-6(1212) when using a JEDEC standard PCB

Table 5 HSNT θ_{ja} Measurement Values

Package	θ_{ja}	Evaluation PCB
HSNT-4(0808)	298°C/W	JEDEC standard PCB 114.3 mm × 76.2 mm × t1.6 mm 4 layers
HSNT-4(1010)	294°C/W	
HSNT-6(1212)	208°C/W	

5.3.2 Power dissipation of HSNT-4(0808), HSNT-4(1010) and HSNT-6(1212)

(1) Power dissipation of HSNT-4(0808) when using a JEDEC Standard PCB

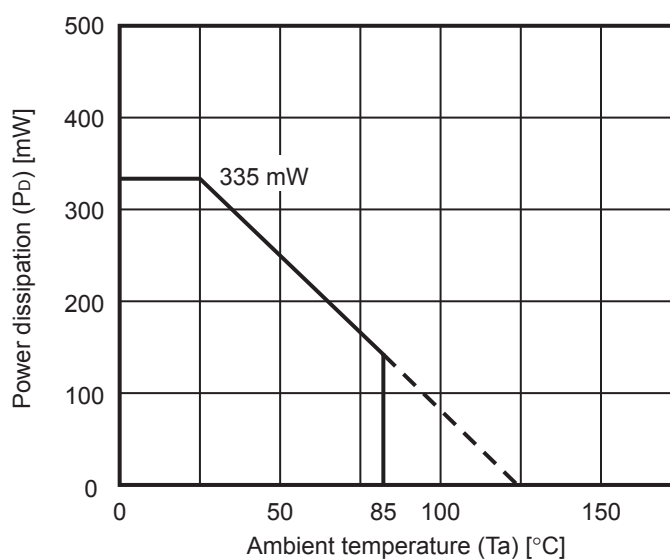


Figure 18 Power Dissipation of HSNT-4(0808) (JEDEC Standard PCB)

(2) Power dissipation of HSNT-4(1010) when using a JEDEC standard PCB

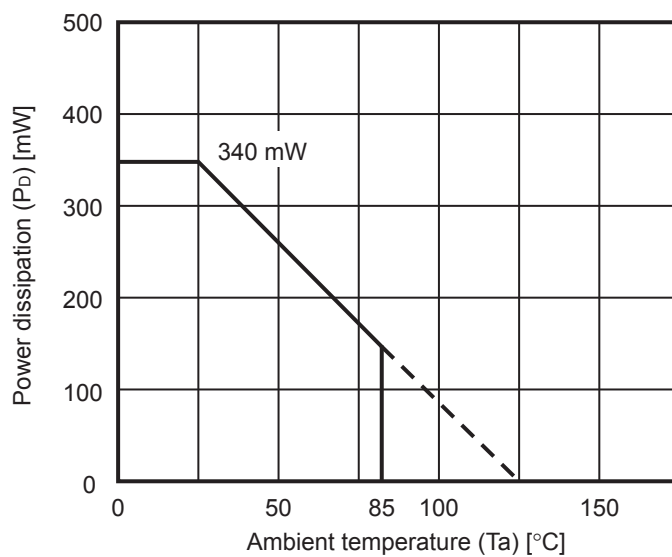


Figure 19 Power Dissipation of HSNT-4(1010) (JEDEC Standard PCB)

(3) Power dissipation of HSNT-6(1212) when using a JEDEC standard PCB

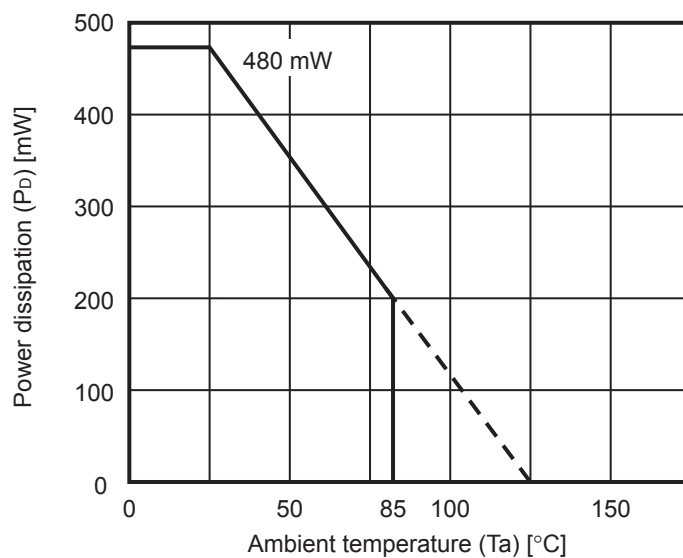


Figure 20 Power Dissipation of HSNT-6(1212) (JEDEC Standard PCB)

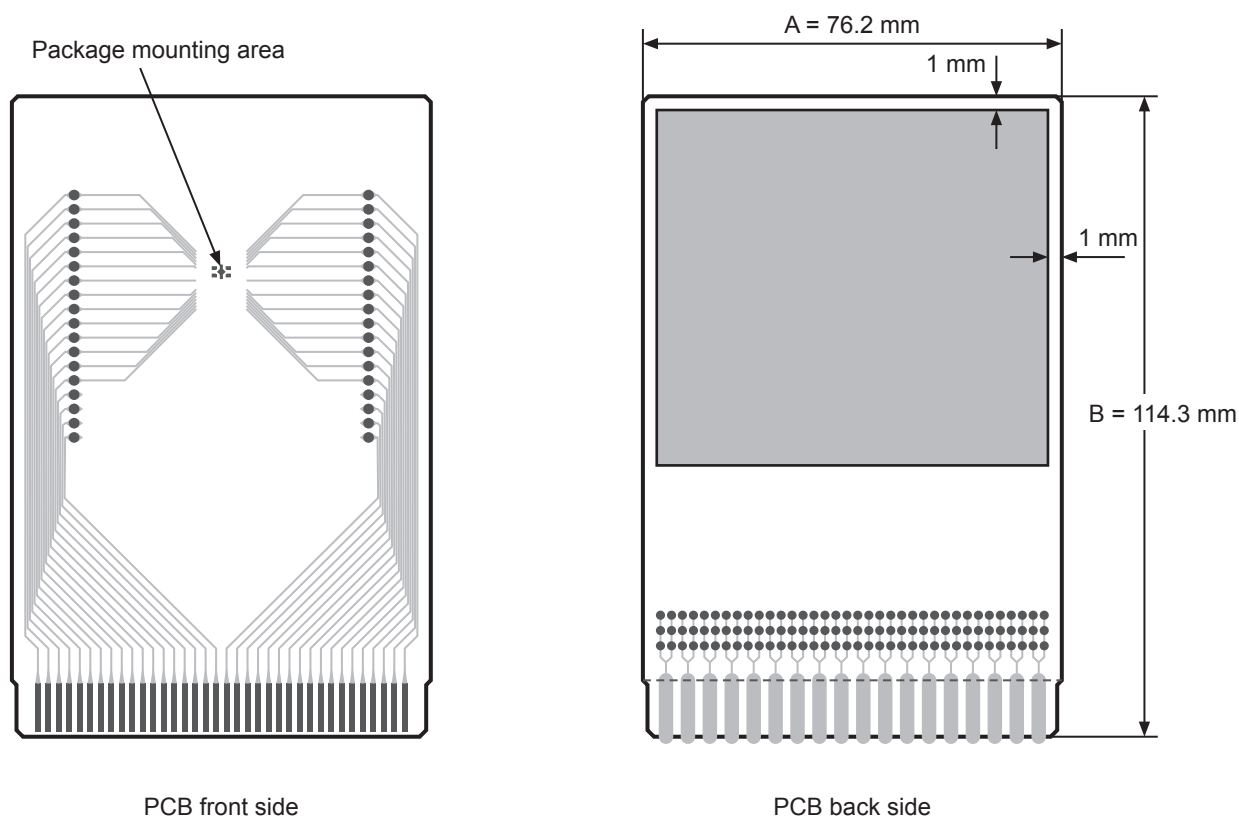


Figure 21 JEDEC STANDARD No.51-7 Compliant Printed Circuit Board

Table 6

Item	Specification
PCB size	76.2 mm × 114.3 mm × t1.6 mm
PCB layer	4 layers
Copper foil thickness	Layer 1 (front side) and layer 4 (back side) = 70 μm Layer 2 and layer 3 = 35 μm
Copper foil size	74.2 mm × 74.2 mm (layer 2 to layer 4)

(4) High heat radiation evaluation PCB

Figure 22 shows the measurement results of the power dissipation of each HSNT package using high heat radiation PCB (Refer to **Figure 23**).

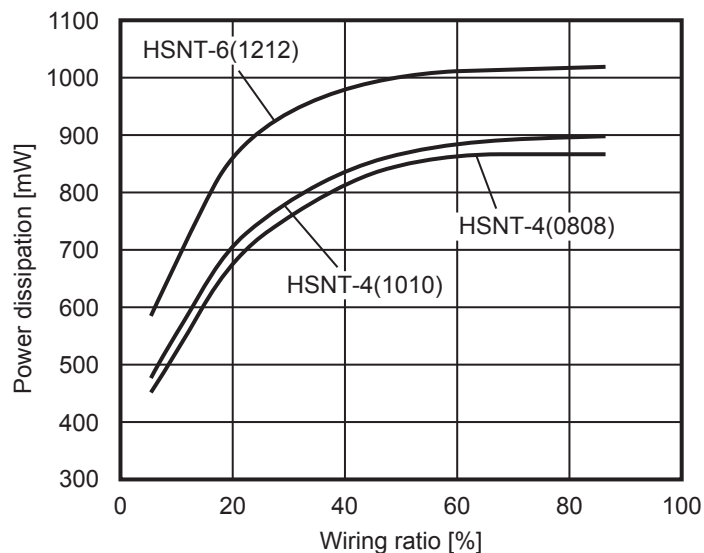


Figure 22 Power Dissipation with High Heat Radiation PCB

PCB specifications: Size: 40 mm × 40 mm × t0.8 mm
Wiring ratio: Adjusted by Cu pattern area (Refer to **Figure 23**)
PCB composition: 4 layers (Cu thickness: 50 μm / 35 μm / 35 μm / 50 μm)
Via: None
PCB material: FR-4

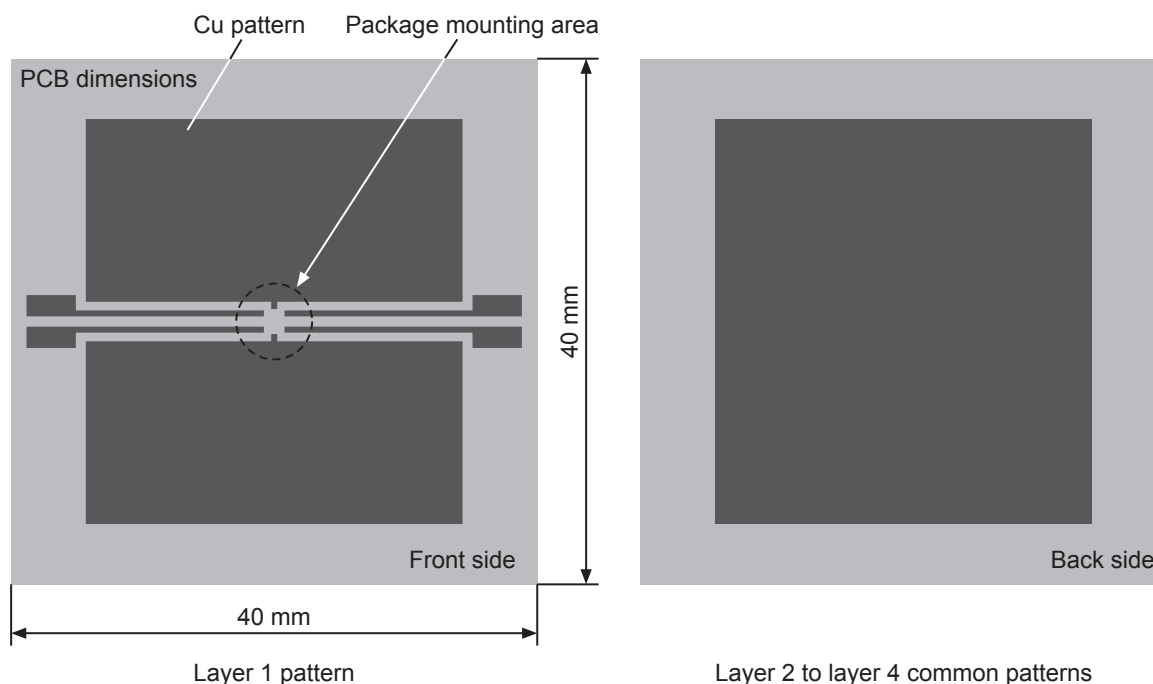
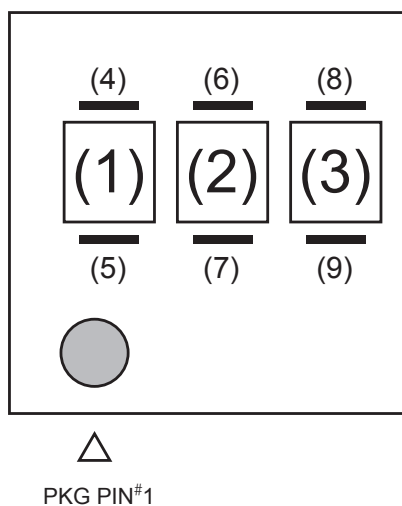


Figure 23 High Heat Radiation PCB

6. Marking specifications

Marking specifications of the HSNT package are shown below.

6. 1 Marking specifications of HSNT-4(0808)



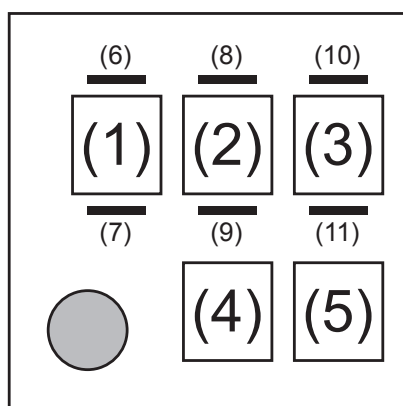
(1) to (3) : Product code

(4) , (5) : Year of assembly (bar)

(6) to (9) : Month of assembly (bar)

Figure 24 Marking Specifications of HSNT-4(0808)

6. 2 Marking specifications of HSNT-4(1010)



PKG PIN#1

(1) to (3) : Product code

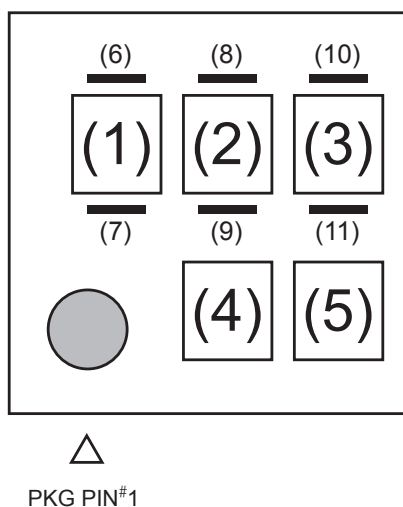
(4) , (5) : Lot No.

(6) , (7) : Year of assembly (bar)

(8) to (11) : Month of assembly (bar)

Figure 25 Marking Specifications of HSNT-4(1010)

6. 3 Marking specifications of HSNT-6(1212)



(1) to (3) : Product code

(4) , (5) : Lot No.

(6) , (7) : Year of assembly (bar)

(8) to (11) : Month of assembly (bar)

Figure 26 Marking Specifications of HSNT-6(1212)

7. Packing specifications

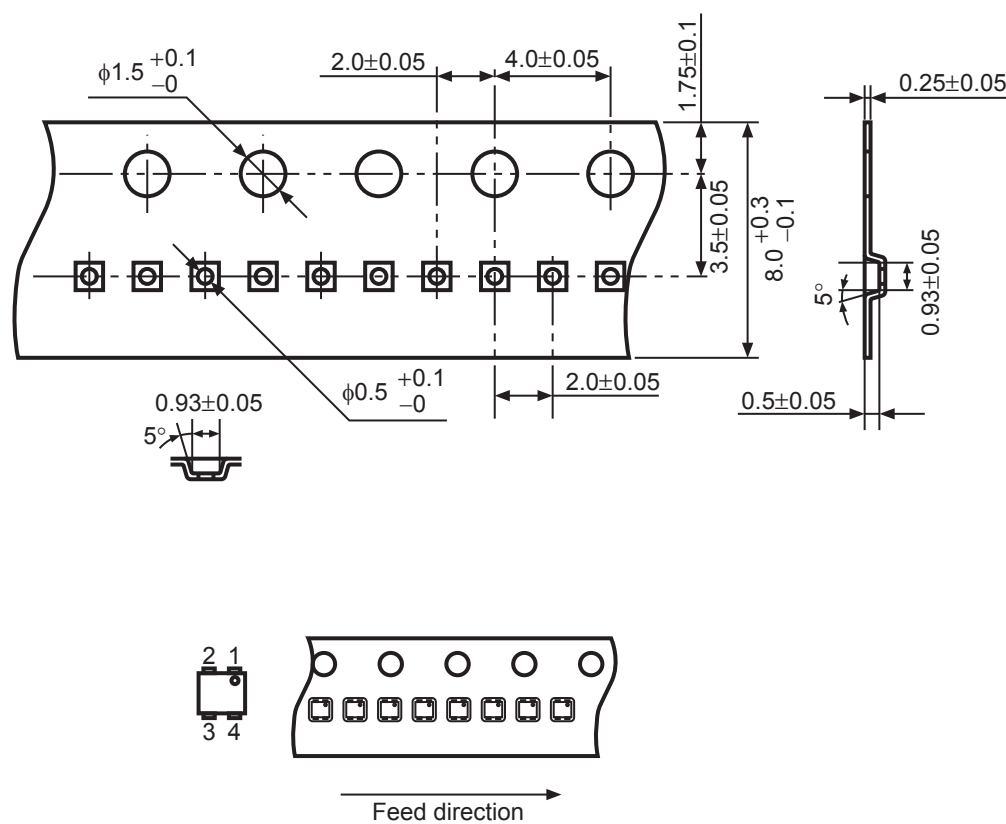
The reel specifications and packing form of the HSNT package are shown below.

7.1 Packed units

HSNT-4(0808), HSNT-4(1010): 10000 / reel
HSNT-6(1212): 5000 / reel

7.2 Embossed tape specifications

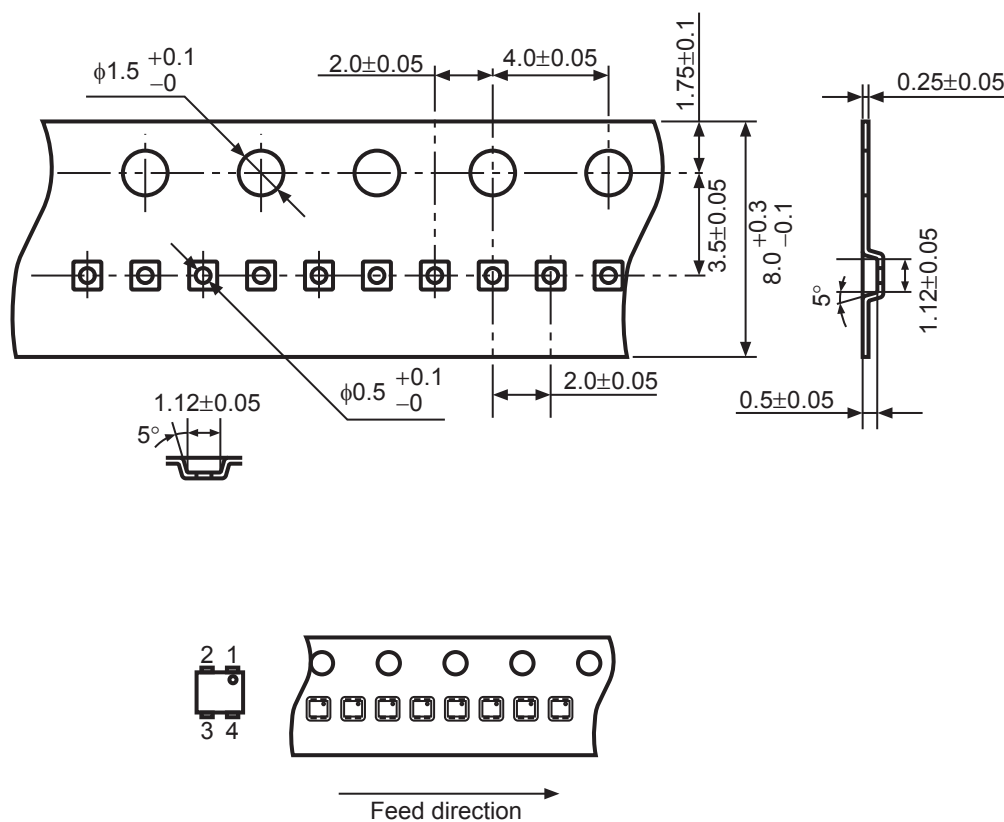
7.2.1 Tape drawing of HSNT-4(0808)



Unit: mm

Figure 27 Tape drawing of HSNT-4(0808)

7. 2. 2 Tape drawing of HSNT-4(1010)



Unit: mm

Figure 28 Tape Drawing of HSNT-4(1010)

7.2.3 Tape drawing of HSNT-6(1212)

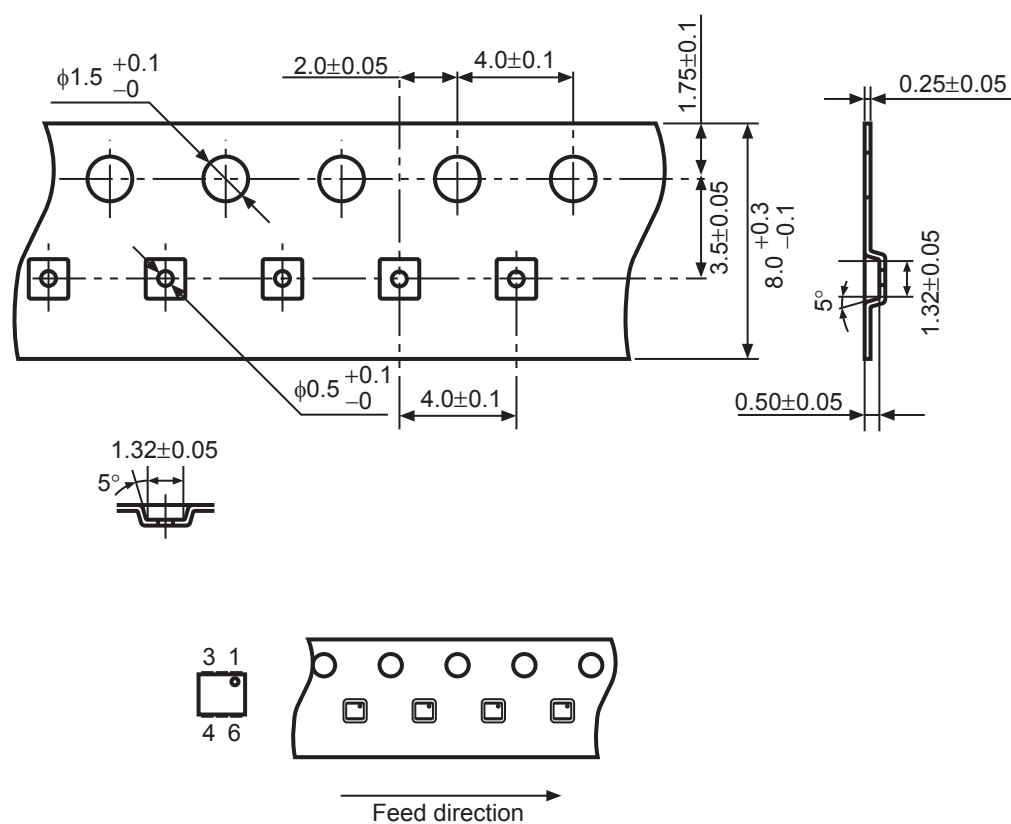


Figure 29 Tape Drawing of HSNT-6(1212)

Unit: mm

7.3 Reel specifications

The reel drawings of HSNT-4(0808), HSNT-4(1010) and HSNT-6(1212) are shown below.

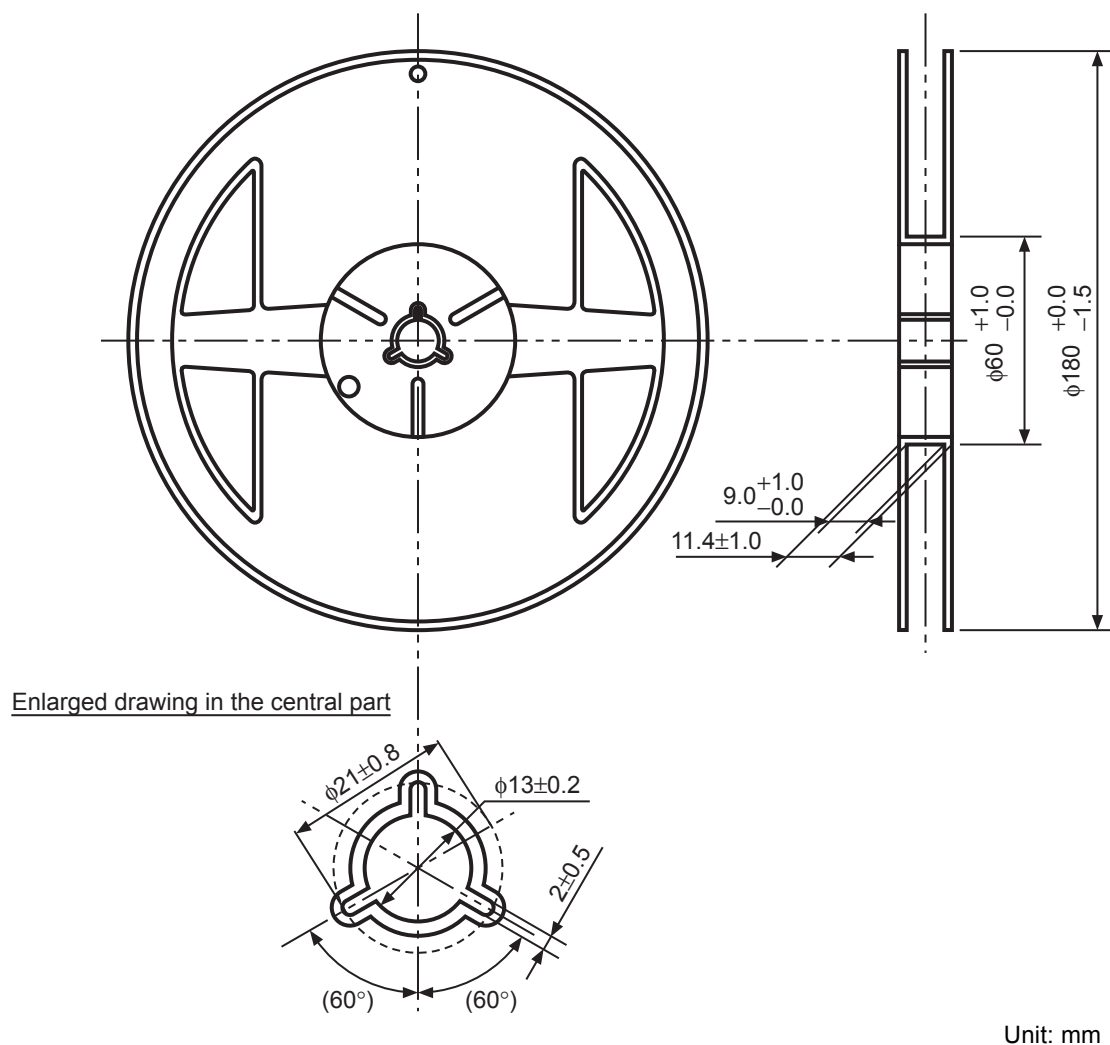


Figure 30 Reel Drawings of HSNT-4(0808), HSNT-4(1010) and HSNT-6(1212)

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2.4-2019.07