



**THE DATASHEET OF
NFW31SP506X1E4L**



Chip EMIFIL for Signal Line NFW31SP□□□X1E4L

Reference Specification

1. Scope

This reference specification applies to Chip EMIFIL for signal line NFW31S series.

2. Part Numbering

| | | | | | | | | |
|------------|-----------|----------------------|----------|----------------------|-----------------|------------------|-----------|-------------------------------|
| NF | W | 31 | SP | 106 | X | 1E | 4 | L |
| Product ID | Structure | Dimension (L × W) | Features | Cut-off Frequency | Characteristics | Rated Voltage | Electrode | Packaging Code [L: Taping] |

3. Rating

3-1. Common Rating

| | |
|-----------------------|--------------|
| Rated Voltage | 25 V(DC) |
| Withstanding Voltage | 62.5 V(DC) |
| Rated Current | 200 mA |
| Insulation Resistance | 1000 MΩ min. |
| Line Impedance | 50 Ω |

3-2. Individual Rating

* 6dB max.

| Customer Part Number | MURATA Part Number | Insertion Loss (dB min.) | | | | | | | | | |
|----------------------|--------------------|--------------------------|--------|--------|---------|---------|---------|---------|---------|---------|-------|
| | | 10 MHz | 20 MHz | 50 MHz | 100 MHz | 150 MHz | 200 MHz | 300 MHz | 400 MHz | 500 MHz | 1 GHz |
| | NFW31SP106X1E4L | * | 5 | 25 | 25 | - | 25 | - | - | 30 | 30 |
| | NFW31SP206X1E4L | - | * | 5 | 25 | - | 25 | - | - | 30 | 30 |
| | NFW31SP506X1E4L | - | - | * | 10 | - | 30 | - | - | 30 | 30 |
| | NFW31SP107X1E4L | - | - | - | * | - | 5 | - | - | 20 | 30 |
| | NFW31SP157X1E4L | - | - | - | - | * | - | 10 | 20 | 30 | 30 |
| | NFW31SP207X1E4L | - | - | - | - | - | * | - | - | 10 | 30 |
| | NFW31SP307X1E4L | - | - | - | - | - | - | * | - | 5 | 15 |
| | NFW31SP407X1E4L | - | - | - | - | - | - | - | * | - | 10 |
| | NFW31SP507X1E4L | - | - | - | - | - | - | - | - | * | 10 |

• Operating Temperature : -40 to +85 °C

• Storage Temperature : -55 to +85 °C

4. Standard Testing Condition

< Unless otherwise specified >

Temperature: Ordinary Temp 15 °C to 35 °C

Humidity: Ordinary Humidity 25 %(RH) to 85 %(RH)

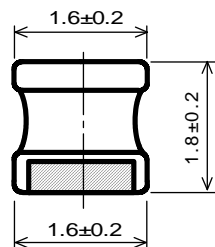
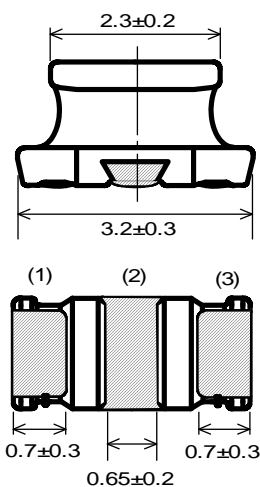
<In case of doubt >

Temperature: 20 °C ± 2 °C

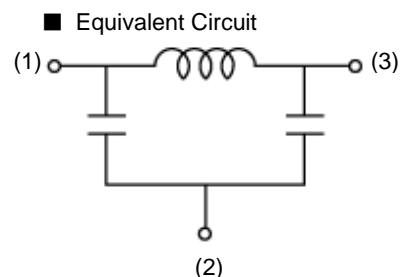
Humidity: 60 %(RH) to 70 %(RH)

Atmospheric pressure: 86 kPa to 106kPa

5. Style and Dimensions



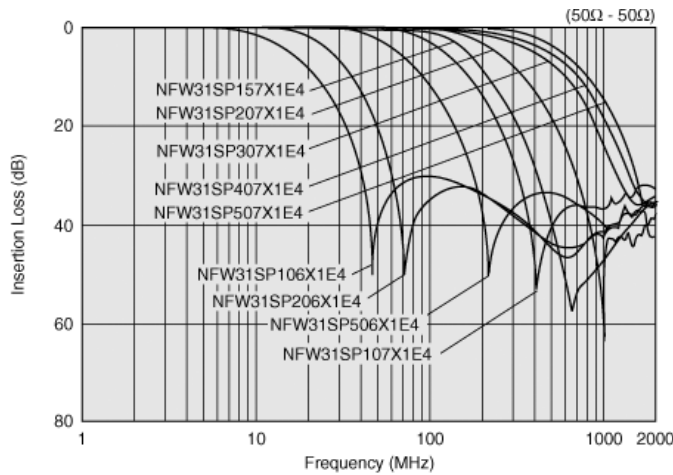
■ : Electrode
(in mm)



- (1) Input (Output) Terminal
(2) Ground Terminal
(3) Output (Input) Terminal
• No polarity.

■ Unit Mass(Typical value)
0.030g

■ Insertion Loss Characteristics (I.L.) (Typ.) (50Ω system)



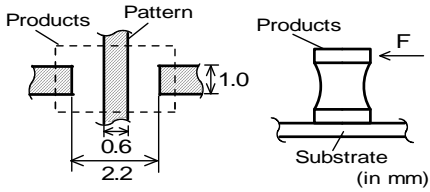
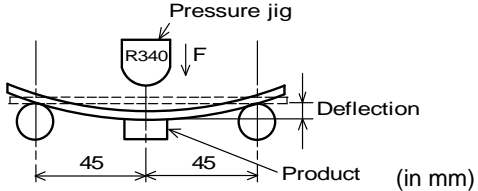
6. Marking

No Marking

7. Electrical Performance

| No. | Item | Specification | Test Method | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 7.1 | Insulation Resistance(I.R.) | Meet item 3. | DC rated voltage : 25 V (Between input (or output) terminal and ground terminal.) The charge time : 60 ± 5 seconds (Through the protect resistance of 1MΩ) | | | | |
| 7.2 | Withstanding Voltage | No damage. | DC rated voltage : 62.5 V (Between input (or output) terminal and ground terminal.) Testing Time : 1 to 5 seconds Limit the charging current: 10 mA max. | | | | |
| 7.3 | Insertion Loss Characteristics (I.L.) | Meet item 3. | <p>Measured by the following circuit (Fig 1. Table 1)</p> <p>* 1 Connect to terminals of network analyzer</p> <p>Fig.1</p> <p>• Network Analyzer:MS620J(ANRITSU) or the equivalent</p> <p><u>Table 1</u></p> <table border="1"> <thead> <tr> <th>Cable, Connector and Measuring Condition</th> <th>Line Impedance</th> </tr> </thead> <tbody> <tr> <td>Impedance of Cable : 50Ω Impedance of connector : 50Ω • I.L. shall be measured after connecting signal terminals T1, T2 to (1), (2) in Fig.1 respectively.</td> <td>50Ω</td> </tr> </tbody> </table> | Cable, Connector and Measuring Condition | Line Impedance | Impedance of Cable : 50Ω Impedance of connector : 50Ω • I.L. shall be measured after connecting signal terminals T1, T2 to (1), (2) in Fig.1 respectively. | 50Ω |
| Cable, Connector and Measuring Condition | Line Impedance | | | | | | |
| Impedance of Cable : 50Ω Impedance of connector : 50Ω • I.L. shall be measured after connecting signal terminals T1, T2 to (1), (2) in Fig.1 respectively. | 50Ω | | | | | | |

8. Mechanical Performance

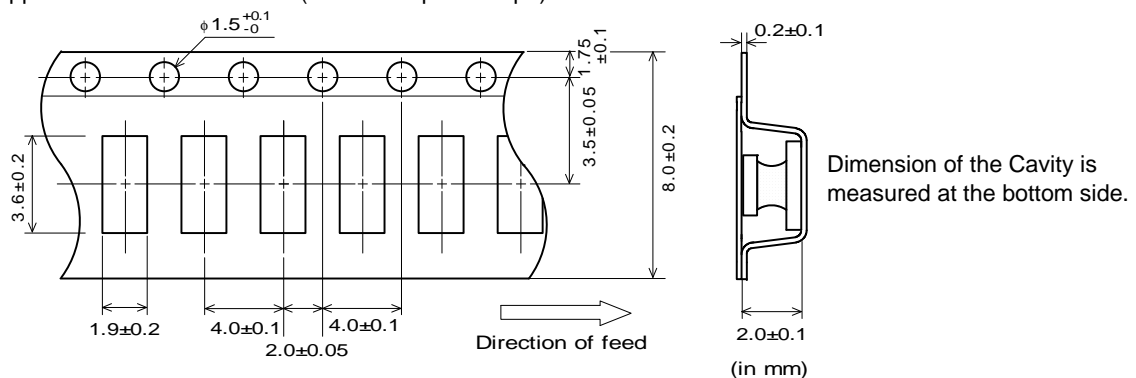
| No. | Item | Specification | Test Method | | | | | | | | | | |
|----------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------|------------|----------------------|------------|------|--------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8.1 | Appearance and Dimensions | Meet item 5. | Visual Inspection and measured with Slide Calipers. | | | | | | | | | | |
| 8.2 | Bonding Strength | Products shall be no failure after tested. | It shall be soldered on the substrate. Applying Force(F) : 4.9 N Applying Time: 5 ± 1 s  | | | | | | | | | | |
| 8.3 | Solderability | The electrodes shall be at least 90% covered with new solder coating. | Flux : Ethanol solution of rosin, 25 (wt)% Pre-heat : 150 ± 10 °C, 60 to 90 s Solder : Sn-3.0Ag-0.5Cu Solder Temperature : 240 ± 3 °C Immersion Time : 3 ± 1 s Immersion and emersion rates : 25 mm / s | | | | | | | | | | |
| 8.4 | Resistance to soldering heat | Meet Table 2. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="2">Table 2</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No damage.</td> </tr> <tr> <td>Withstanding Voltage</td> <td>No damage.</td> </tr> <tr> <td>I.R.</td> <td rowspan="2">Meet item 3.</td> </tr> <tr> <td>I.L.</td> </tr> </tbody> </table> | Table 2 | | Appearance | No damage. | Withstanding Voltage | No damage. | I.R. | Meet item 3. | I.L. | Flux: Ethanol solution of rosin, 25(wt)% Pre-heat: 150 ± 10 °C, 60 to 90 s Solder: Sn-3.0Ag-0.5Cu Solder Temperature: 270 ± 5 °C Immersion Time: 10 ± 1 seconds Immersion and emersion rates : 25 mm / s Then measured after exposure in the room condition for 4 to 48 hours. Initial values : Then measured after heat treatment (150°C (+0°C,-10°C), 1 hour) and exposure in the room condition for 4 to 48 hours. | |
| Table 2 | | | | | | | | | | | | | |
| Appearance | No damage. | | | | | | | | | | | | |
| Withstanding Voltage | No damage. | | | | | | | | | | | | |
| I.R. | Meet item 3. | | | | | | | | | | | | |
| I.L. | | | | | | | | | | | | | |
| 8.5 | Bending Strength | Products shall be no failure after tested. | It shall be soldered on the Glass-epoxy substrate. (100 × 40 × 1.6 (mm))  Deflection : 2.0 mm (for NFW31SP106/206 : 1.0 mm) Keeping Time : 10 seconds Speed of Applying Force : 1.0 mm / s | | | | | | | | | | |
| 8.6 | Vibration | Meet table 3. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="2">Table 3</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No damage</td> </tr> <tr> <td>Withstanding Voltage</td> <td>No damage</td> </tr> <tr> <td>I.R.</td> <td>100MΩ min.</td> </tr> <tr> <td>I.L.</td> <td>Meet item 3.</td> </tr> </tbody> </table> | Table 3 | | Appearance | No damage | Withstanding Voltage | No damage | I.R. | 100MΩ min. | I.L. | Meet item 3. | It shall be soldered on the substrate. Oscillation Frequency : 10 to 55 to 10Hz for 1 minute Double Amplitude : 1.5 mm Testing Time : A period of 2 hours in each of 3 Mutually perpendicular directions. (Total 6 hours) |
| Table 3 | | | | | | | | | | | | | |
| Appearance | No damage | | | | | | | | | | | | |
| Withstanding Voltage | No damage | | | | | | | | | | | | |
| I.R. | 100MΩ min. | | | | | | | | | | | | |
| I.L. | Meet item 3. | | | | | | | | | | | | |

9. Environmental Performance (It shall be soldered on the substrate.)

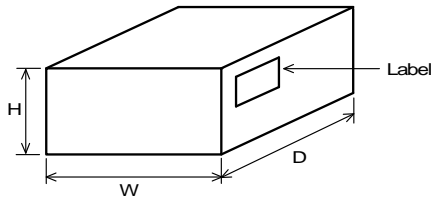
| No. | Item | Specification | Test Method |
|-----|-------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.1 | Temperature Cycle | Meet table 3. | 1 Cycle: 1 step : - 40 °C (+ 0°C, - 3°C) / 30 minutes 2 step : Room Temperature / within 5 minutes 3 step : +85 °C (+ 3°C, - 0°C) / 30 minutes 4 step : Room Temperature / within 5 minutes Total of 10 cycles Then measured after exposure in the room condition for 4 to 48 hours. Initial values: Then measured after heat treatment (150°C (+0°C,-10°C), 1 hour) and exposure in the room condition for 4 to 48 hours. |
| 9.2 | Humidity | | Temperature : 40 ± 2 °C Humidity : 90 to 95 %(RH) Time : 1000 h (+ 48h , - 0h) Then measured after exposure in the room condition for 4 to 48 hours. |
| 9.3 | Heat Resistance | | Temperature : 85 ± 2 °C Time : 1000 h (+ 48h , - 0h) Then measured after exposure in the room condition for 4 to 48 hours. |
| 9.4 | Cold Resistance | | Temperature : -55 ± 2 °C Time : 500 h (+ 24h , - 0h) Then measured after exposure in the room condition for 4 to 48 hours. |
| 9.5 | Humidity Load | | Temperature : 40 ± 2 °C Humidity : 90 to 95 %(RH) Test Voltage : Rated Voltage Time : 500 h (+ 24h , - 0h) Then measured after exposure in the room condition for 4 to 48 hours. |
| 9.6 | Heat Life | | Temperature : 85 ± 3 °C Test Voltage : Rated Voltage × 200% Time : 1000 h (+ 48h , - 0h) Charge Current: 10mA max. Then measured after exposure in the room condition for 4 to 48 hours. |

10. Specification of Packaging

10.1. Appearance and Dimensions (8mm-wide plastic tape)



10.8. Specification of Outer Case



| Outer Case Dimensions (mm) | | | Standard Reel Quantity in Outer Case (Reel) |
|----------------------------|-----|----|---------------------------------------------|
| W | D | H | |
| 186 | 186 | 93 | 5 |

* Above Outer Case size is typical. It depends on a quantity of an order.

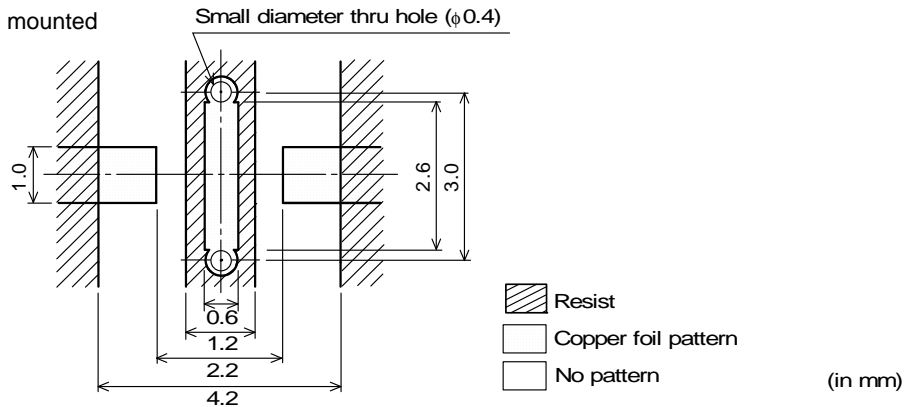
11. Standard Land Dimensions

The chip EMI filter suppresses noise by conducting the high-frequency noise element to ground.

Therefore, to get enough noise reduction, feed through holes which is connected to ground-plane should be arranged according to the figure to reinforce the ground-pattern.

(a) Standard land dimensions

- Side on which chips are mounted



12. Caution

Limitation of Applications

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

- (1) Aircraft equipment (2) Aerospace equipment (3) Undersea equipment (4) Power plant control equipment (5) Medical equipment (6) Transportation equipment (automobiles, trains, ships, etc.) (7) Traffic signal equipment (8) Disaster prevention / crime prevention equipment (9) Data-processing equipment (10) Applications of similar complexity or with reliability requirements comparable to the applications listed in the above

13. Notice

This product is designed for solder mounting.

Please consult us in advance for applying other mounting method such as conductive adhesive.

13.1. Flux and Solder

| | |
|--------|---------------------------------------------------------------------------------------------------------------------------------|
| Flux | Use rosin-based flux, but not highly acidic flux (with chlorine content exceeding 0.2(wt) %). Do not use water-soluble flux. |
| Solder | Use Sn-3.0Ag-0.5Cu solder |

13.2. Note for Assembling

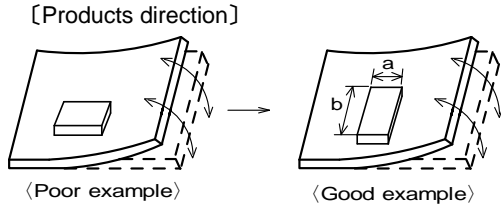
< Thermal Shock >

Pre-heating should be in such a way that the temperature difference between solder and products surface is limited to 100 °C max. Also cooling into solvent after soldering should be in such a way that the temperature difference is limited to 100 °C max.

13.3. Attention Regarding P.C.B. Bending

The following shall be considered when designing P.C.B.'s and laying out products.

- (1) P.C.B. shall be designed so that products are not subject to the mechanical stress for board warpage.



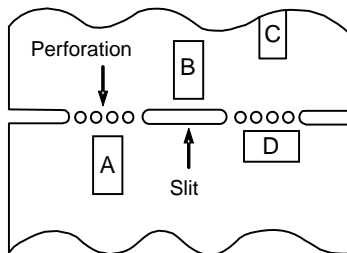
Products shall be located in the sideways direction (Length: $a < b$) to the mechanical stress.

- (2) Components location on P.C.B. separation.

It is effective to implement the following measures, to reduce stress in separating the board.

It is best to implement all of the following three measures; however, implement as many measures as possible to reduce stress.

| Contents of Measures | Stress Level |
|--------------------------------------------------------------------------------------------|--------------|
| (1) Turn the mounting direction of the component parallel to the board separation surface. | $A > D$ *1 |
| (2) Add slits in the board separation part. | $A > B$ |
| (3) Keep the mounting position of the component away from the board separation surface. | $A > C$ |

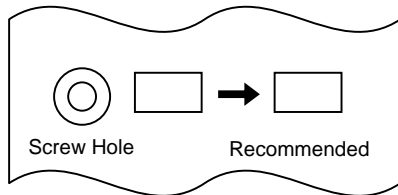


*1 $A > D$ is valid when stress is added vertically to the perforation as with Hand Separation.

If a Cutting Disc is used, stress will be diagonal to the PCB, therefore $A > D$ is invalid.

- (3) Mounting Components Near Screw Holes

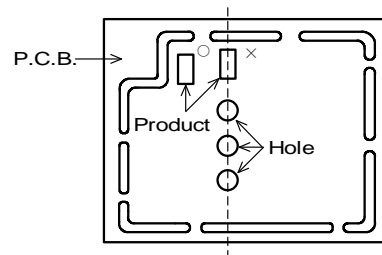
When a component is mounted near a screw hole, it may be affected by the board deflection that occurs during the tightening of the screw. Mount the component in a position as far away from the screw holes as possible.



13.4. Attention Regarding P.C.B. Design

< The Arrangement of Products >

- P.C.B. shall be designed so that products are far from the portion of perforation.
- The portion of perforation shall be designed as narrow as possible, and shall be designed so as not to be applied the stress in the case of P.C.B. separation.
- Products shall not be arranged on the line of a series of holes when there are big holes in P.C.B.. (Because the stress concentrate on the line of holes.)

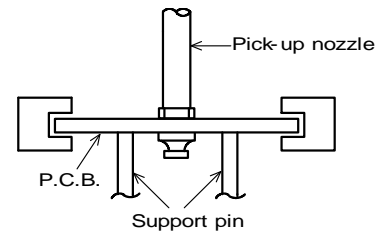


< Products Placing >

- Support pins shall be set under P.C.B. to prevent causing a warp to P.C.B. during placing the products on the other side of P.C.B.

< P.C.B. Separation >

- P.C.B. shall not be separated with hand.
- P.C.B. shall be separated with the fixture so as not to cause P.C.B. bending.



13.5. Standard Soldering Conditions

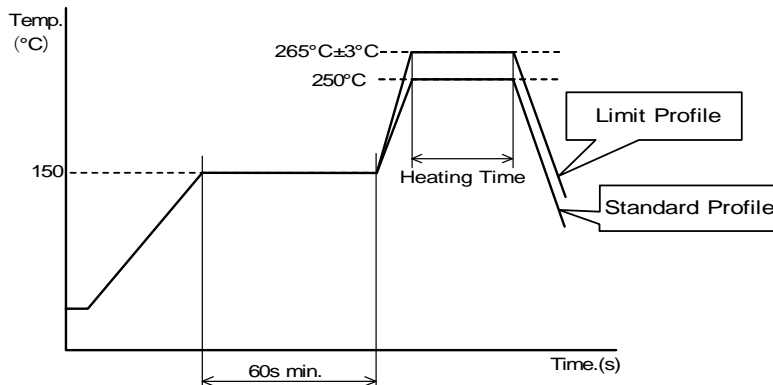
On flow soldering (e.g. double wave soldering), use the product in consideration of the conditions of solder, and solder temperature and immersion time (melting time) because longer soldering time may cause the corrosion of the electrode.

On dipping soldering, use the product in consideration of the conditions of solder, solder temperature, flux, and preheat and so on because de-wetting may be caused.

Standard soldering profile and the limit soldering profile is as follows.

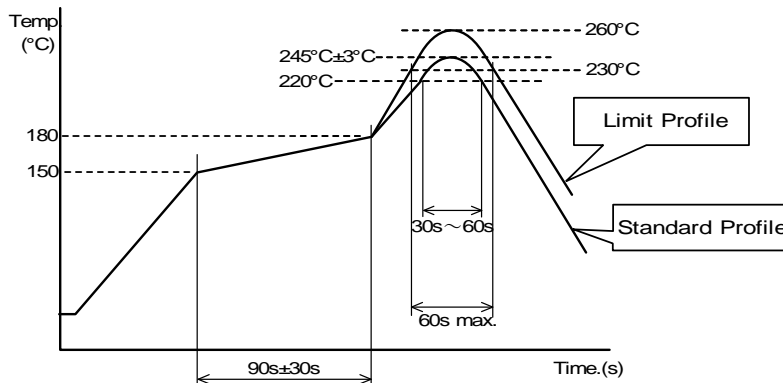
The excessive soldering conditions may cause leaching of the electrode and/or resulting in the deterioration of product quality.

< Flow Soldering Profile >



| | Standard Profile | Limit Profile |
|---------------|------------------|----------------------|
| Pre-heating | 150°C , 60s min. | |
| Heating | 250°C , 4s ~ 6s | 265°C ± 3°C, 5s max. |
| Cycle of flow | 2 times | 1 time |

< Reflow Soldering Profile >

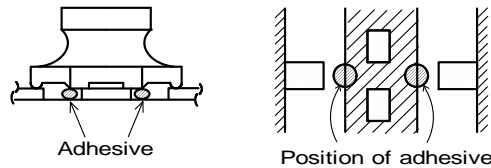


| | Standard Profile | Limit Profile |
|------------------|---------------------------|------------------------|
| Pre-heating | 150°C ~ 180°C , 90s ± 30s | |
| Heating | above 220°C , 30s ~ 60s | above 230°C , 60s max. |
| Peak temperature | 245°C ± 3°C | 260°C , 10s |
| Cycle of reflow | 2 times | 1 time |

13.6. Printing of Adhesive (Flow Soldering)

Adhesive amount shall be about 0.2 mg per chip to obtain enough adhesive strength.

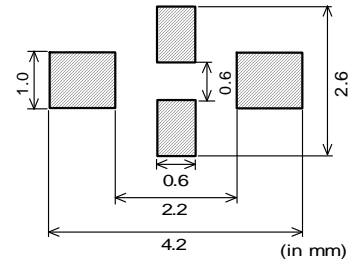
The adhesive position is as follows.



13.7. Solder paste printing for reflow

<Standard printing pattern of solder paste. >

- Standard thickness of solder paste should be 150 to 200 μm .
- Use the solder paste printing pattern of the right pattern.
- For the resist and copper foil pattern, use standard land dimensions.



13.8. Reworking with Soldering iron

The following conditions shall be strictly followed when using a soldering iron.

- Pre-heating : 150°C, 1 min
- Tip temperature : 350°C max.
- Soldering time : 3(+1,-0) s
- Soldering iron output : 30W max.
- Tip diameter : ϕ 3mm max.
- Times : 2times max.

Note :Do not directly touch the products with the tip of the soldering iron in order to prevent the crack on the ceramic material due to the thermal shock.

13.9. Cleaning Conditions

Products shall be cleaned on the following conditions.

- (1) Cleaning temperature shall be limited to 60 °C max. (40°C max. for IPA.)
- (2) Ultrasonic cleaning shall comply with the following conditions with avoiding the resonance phenomenon at the mounted products and P.C.B..

Power: 20W / l max. Frequency: 28kHz ~ 40kHz Time: 5 minutes max.

(3) Cleaner

1. Cleaner

- Isopropyl alcohol (IPA)

2. Aqueous agent

- PINE ALPHA ST-100S

(4) There shall be no residual flux and residual cleaner after cleaning.

In the case of using aqueous agent, products shall be dried completely after rinse with de-ionized water in order to remove the cleaner.

(5) Other cleaning

Please contact us.

13.10. Operating Environment

Do not use this product under the following environmental conditions, on deterioration of the performance, such as insulation resistance may result from the use.

- (1) in the corrodible atmosphere (acidic gases , alkaline gases, chlorine, sulfur gases, organic gases and etc.)
- (2) in the atmosphere where liquid such as organic solvent, may splash on the products.

13.11. Resin coating

In case of coating/molding products the products with the resin, an open circuit issue may occur by mechanical stress caused by the resin, amount/cured shape of resin, or operating condition etc. Some resin contains some impurities or chloride possible to generate chlorine by hydrolysis under some operating condition may cause corrosion of wire of coil, leading to open circuit. So, please pay your careful attention when you select resin in case of coating/molding the products with the resin. Prior to use the coating resin, please make sure no reliability issue is observed by evaluating products mounted on your board.

13.12. Caution for use

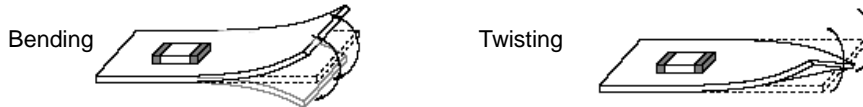
Sharp material such as a pair of tweezers or other material such as bristles of cleaning brush, shall not be touched to the winding portion to prevent the breaking of wire.

Mechanical shock should not be applied to the products mounted on the board to prevent the breaking of the core.

13.13. Handling of a substrate

After mounting products on a substrate, do not apply any stress to the product caused by bending or twisting to the substrate when cropping the substrate, inserting and removing a connector from the substrate or tightening screw to the substrate.

Excessive mechanical stress may cause cracking in the product.

**13.14. Storage condition****(1) Storage period**

Use the products within 12 months after delivered.

Solderability should be checked if this period is exceeded.

(2) Storage environment condition

· Products should be stored in the warehouse on the following conditions.

Temperature: -10 ~ +40°C

Humidity: 15 ~ 85% relative humidity

No rapid change on temperature and humidity

· Don't keep products in corrosive gases such as sulfur, chlorine gas or acid, or it may cause oxidization of electrode, resulting in poor solderability.

· Products should be stored on the palette for the prevention of the influence from humidity, dust and so on.

· Products should be stored in the warehouse without heat shock, vibration, direct sunlight and so on.

· Products should be stored under the airtight packaged condition.

(3) Delivery

Care should be taken when transporting or handling product to avoid excessive vibration or mechanical shock.

14.  Notes

(1) Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.

(2) You are requested not to use our product deviating from the reference specifications.

(3) The contents of this reference specification are subject to change without advance notice. Please approve our product specifications or transact the approval sheet for product specifications before ordering.

Looking for pricing, stock, or lifecycle information?

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- ✓ Shortage Management
- ✓ Alternative Solution
- ✓ Excess Inventory Management