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## Revision Record

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<th>Issue</th>
<th>Changes</th>
<th>Date</th>
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</thead>
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<tr>
<td>V1.0</td>
<td>Initial draft</td>
<td>2015-08</td>
</tr>
<tr>
<td>V1.1</td>
<td>Added stencil design suggestions for N710 and N703</td>
<td>2016-11</td>
</tr>
<tr>
<td>V1.2</td>
<td>Added stencil design suggestions for N720</td>
<td>2017-06</td>
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1 Overview

With the higher requirements for the reduction size and cost of M2M devices, the M2M market gradually accepts the industrial SMD modules using BGA, LGA, and other packages. SMT process helps the module applications to reduce the cost on connectors between boards, modules and traditional antennas, minimize the height and size of the PCB, and increase the long-term reliability of the signal connections. But similar to other SMD devices, SMD modules need to be processed by reflow soldering and should withstand higher temperatures of 245°C±5°C. Therefore, the requirements for the packing, storage, manufacturing, and maintenance of SMD modules are higher.

Neoway has launched several models of SMD modules: N720, N703, N10, M590E, CM180, M660, WM620, etc., which have been widely applied in electrical power industry, handheld devices, IoV, and surveillance industry.

SMD modules are sensitive to humidity and these modules are refloowed or soldered with heat guns after they get damp, the IC or PCB might be cracked due to the vapor explosion, resulting in physical damage. Therefore, need to comply with the requirements for storage, manufacturing, and fixing techniques of moisture-sensitive components when reflow soldering or disassembling the modules.
2 Material Storage

Neoway SMD modules meet moisture sensitivity level 3 requirements. Specific moisture sensitivity information is printed on the labels on the external packing and the internal aluminum foil bag.

With the complete aluminum foil packing (no breakage or leak), the modules can be stored for 120 days in an environment with a temperature of 18 °C to 28 °C and humidity lower than 60%.
3 Precautions for SMT Soldering

3.1 Confirming the Incoming Material

Neoway modules are manufactured and packaged strictly in compliance with the process for moisture-sensitive components. Each module is packaged with vacuum aluminum foil bag, drier, and humidity indicator card to control humidity. Before mounting the modules, avoid moisture and confirm humidity conditions of the module in the following process.

3.1.1 Product Package

To ensure the surface mount quality of Neoway modules, Neoway adopts the vacuum package for all of our modules so that customers can avoid surface mount issues and function faults caused by moisture modules. Customers need to check the module packages before surface mounting. If the module package is damaged or exposed to air, bake the modules to avoid PCB blistering, BGA chipset and RF PA chipset damage.

3.1.2 Manufacturing Data

After receiving the modules, check the manufacturing data. If the modules are beyond the storage period or has been exposed to moisture, bake them before surface mount. Use them directly if the modules are within storage period and the humidity indicator card does not change color at 10%.

3.1.3 Humidity Indicator Card

We have processed modules that require reflow soldering in compliant with moisture-sensitivity level 3 and put humidity indicator cards into the package.

Before mounting Neoway modules, check the humidity indicator card. If the card has changed color at the position of 10%, bake the modules first.

3.1.4 Baking Conditions

Neoway modules should be baked in the following conditions:

<table>
<thead>
<tr>
<th>Conditions</th>
<th>125°</th>
<th>90°/5%RH</th>
<th>40°/5%RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>24 hours</td>
<td>48 hours</td>
<td>30 days</td>
</tr>
<tr>
<td>Remarks</td>
<td>Do not use the original tray.</td>
<td>Do not use the original tray.</td>
<td>Use the original tray.</td>
</tr>
</tbody>
</table>

Users can also set the baking conditions based on the actual situation by referring to the criteria of the moisture-sensitivity level 3 and components with a thickness of 1.4 mm to 2.0 mm.

⚠️ CAUTION

The original ESD tray can bear a temperature lower than 50 °C and is only used for packing.
3.1.5 Out-of-Bag Time

The out-of-bag time of Neoway modules is 48 hours. If the modules are not used after removing packages, vacuum pack them again and put them into drying cabinet. If modules are exposed to air for more than 48 hours after packages are removed, bake them before using them. Modules should be baked for long time after being exposed to moisture, so please complete surface mount of all modules of which packages have been removed if possible.

3.1.6 Repairing

To desolder the module after SMT, complete removing the module within 48 hours if possible. Otherwise, the module must be baked before removing it.

For modules returned from the customers, repairing personnel must bake them in compliance with the backing conditions list in 3.1.4 before removing them for repairing. If the modules have been exposed to moisture for long time, prolong the baking time as required, for example, 125 °C/36 hours.

For precaution about removing a module to return to Neoway, please refer to Neoway Module Fixing Instruction.

3.2 SMT Stencil Design Suggestions

3.2.1 For M590, CM180, M660, WM620

During the reflow soldering of the modules, some customers encountered insufficient solders and voids within joints. These issues are caused by insufficient solder on pad or PCB deformation. Comply with the following improvement suggestions:

- Use step stencil and increase the thickness of the area where the module is placed to 0.15 mm to 0.25 mm.
- Expand the holes of the stencil.
In the above figure, the red part indicates the solder pad of the module, the blue part indicates the solder pad of customer’s PCB, and the orange part indicates the hole of the stencil. The following value ranges are recommended:

- a: 0.4 mm to 0.8 mm (the great value facilitates manual soldering during R&D commissioning.)
- b: 0.2 mm to 0.3 mm
- c: 0.1 mm to 0.2 mm
- d: not less than 0.3 mm (the hole should be 20% to 50% larger than the soldering pad of the customer PCB.)
- e: larger than 0.8 mm

### 3.2.2 For N710, N703

N710 and N703 reserve 8 GND pads. Reserve only 4 symmetrical holes on stencil for GND pads. Though more GND connections can provide better electrical features, the difficulty of soldering and maintenance is increased due to fast radiating.

To avoid the faulty soldering or short circuit caused by insufficient solder paste, PCB distortion, or excess solder paste during reflow, following the suggestions below:

- **Use step stencils**, of which recommended thickness at module area is 0.20 mm. Adjust the value based on actual solder paste thickness and production conditions. Products must follow the process of pilot production, ramp up, mass production.

- **For stencil holes**, refer to the module package. The following values are recommended and users can adjust according to experience:

  Figure A shows the dimensions of one pad on N710 or N703. Figure B shows the stencil hole, which is as wide as the module pad and 0.2 to 0.5 mm longer.

For 8 GND pads in the middle of the pad, reserve 4 symmetrical holes on the stencil.

Recommended stencil pattern:
Green lines indicate pads and red lines indicate recommended stencil holes. The red areas are adjustable based on adopted techniques.

### 3.2.3 For N720

N720 adopts LGA package, which does not provide exterior pads on sides for soldering. It is difficult to identify faulty soldering and short circuit by visual inspection. To ensure SMT quality, follow the suggestions below:

- Stencil holes for function pins occupy 90% of the pads and align the center in width, reserve 0.2 mm and extend 0.15 in length.

- Stencil holes for GND pins occupy 80% of the pads and align the center.
• Stencil thickness: 0.15 mm ~ 0.2 mm
• Use SAC305 lead-free solder paste
• Temperature requirements:
  - Soaking zone: 150-180 °C, Time: 60-100 s
  - Reflow zone: >220 °C, Time: 60-80 s
  - Peak temperature: 235-250 °C

**NOTE**

If the stencil or other conditions cannot be determined during production, contact Neoway for suggestions.

### 3.3 SMT Temperature Curve

Other SMT materials such as BGA chipset, capacitors, and resistors are also connected to PCB through soldering joints. These solder joints will be melted in high temperature. If the solder tin of components inside the module are completely melted, those components will be displaced once the module encounters any vibration. Therefore, please note the following items:

• Use Alpha solder paste or other big brands.
• **Do not place or solder the modules manually.** Use professional SMT equipment to mount the modules.
• **Strictly control the pressure and speed during SMT.**
• To avoid vibration when passing modules through the reflow oven, use ovens with conveyor belt rather than stencils to heat modules.
• Use an 8-zone reflow oven and control the oven temperature during the production. Improper oven temperature curve will result in high fault rate after reflow soldering though the...
solder is melt properly in the oven. Because components are displaced or short circuit is formed after tin melting of BGA. After adjusting the oven temperature, the soldering quality is guaranteed and the passing rate are increased.

Table 3-1 Typical module issues after passing through ovens

<table>
<thead>
<tr>
<th>Issue</th>
<th>Picture</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB blistering</td>
<td><img src="image1.jpg" alt="Image" /></td>
<td>The PCB is exposed to moisture and is not baked before passing through the oven.</td>
</tr>
<tr>
<td>BGA short circuit</td>
<td><img src="image2.jpg" alt="Image" /></td>
<td>The CPU pin of the module is not soldered properly (bridging or voids within solder joints) due to vibration when the module passes through oven.</td>
</tr>
<tr>
<td>BGA displacement</td>
<td><img src="image3.jpg" alt="Image" /></td>
<td>The CPU of the module is displaced because of vibration and over high temperature in oven.</td>
</tr>
</tbody>
</table>
• Prepare oven conveyor to ensure the soldering quality.
  If the mother board is too thin or long, it is easy to get distorted or warped, resulting faulty soldering or insufficient solder paste. Oven conveyor can help reduce the issues.
4 Reference Oven Temperature

Figure 4-1 SMT furnace temperature curve