GN011 Application Note

Soldering Recommendations for GaN*PX*® and PDFN Packaged Devices

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GaN Systems Inc.

Overview

This guide provides an overview of the recommended guideline for soldering GaN Systems' embedded GaN*PX*® and PDFN packaged E-HEMTs on a PCB.

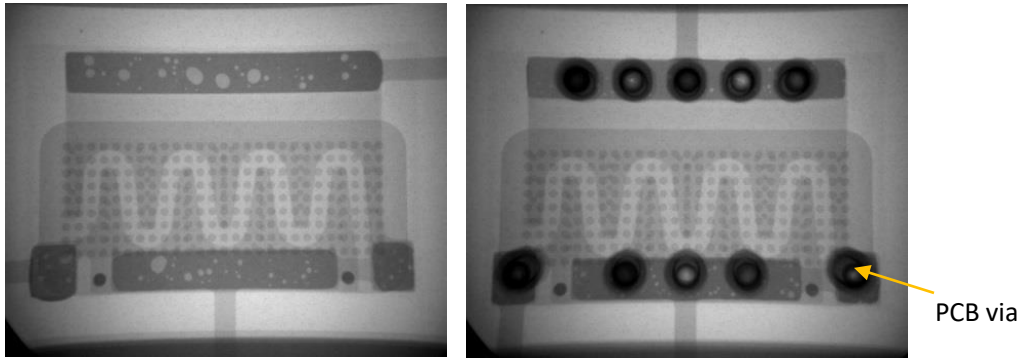
Outline:

- Stencil Design
- Solder Paste and Flux
- Soldering Profile
- Hand soldering/Desoldering

Stencil Design

The stencil design has a significant effect on minimizing solder voids and solder ball formation. Here are GaN Systems' recommendations:

- Break down the stencil aperture for the pads into a series of smaller segments.
- The aperture separation distance plays a significant role in minimizing voids. A larger aperture separation distance provides more room for the volatiles to escape the solder during the reflow process.
- A smaller paste volume results in less voiding and solder ball formation compared to larger paste volumes. Recommendations:
  - *thickness 4 mil (100 um) stencil: 70 -75% solder paste coverage*
  - *thickness 5 mil (125 um) stencil: 55 - 60% solder paste coverage*

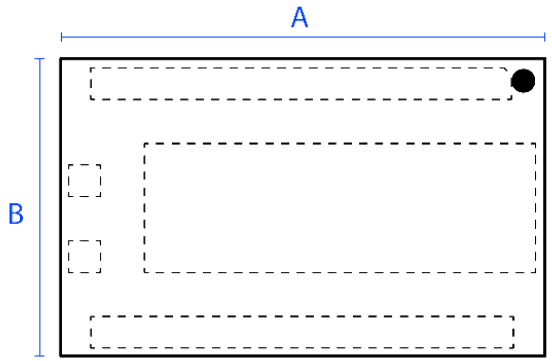


Accepted examples: minimum voiding (< 20%) achieved using the recommended stencil design

Stencil Design Example – GS61008P

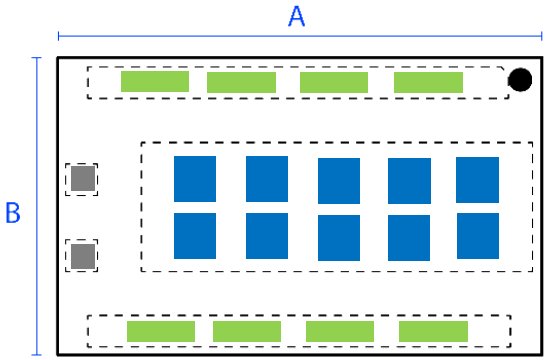
Land patterns

Top



Stencil apertures

Top



To calculate the dimension of stencil aperture:

In this example,

- thickness of stencil: 100 um
- solder paste coverage: 70%
- total area of stencil apertures on each pad: pad area x 70%
- area of single aperture on each pad: (pad area x 70%) ÷ (Qty of apertures on each pad)
- the dimension of stencil aperture is derived based on the above calculated single aperture's area

Dimension of stencil aperture

- 0.5 x 0.5 mm
- 1.43 x 0.5 mm
- 0.97 x 0.97 mm

Solder Paste and Flux

- The influence of paste, when coupled with the reflow profile, becomes a significant factor. Choose the one with low voiding and less volatiles.
  - **Solder paste recommendation: Indium 6.4 water soluble SAC 305**

- When soldering GaN*PX*® packaged devices, the overall cleanliness of the final assembly is critical. Leakage resistance in the megaohm range after assembly may distort or otherwise compromise the results of the test. For high temperatures (>100°C) and high humidity applications, even no-clean solders may still require a cleaning step to ensure proper operation (to be performed within 4 hours after the reflow).

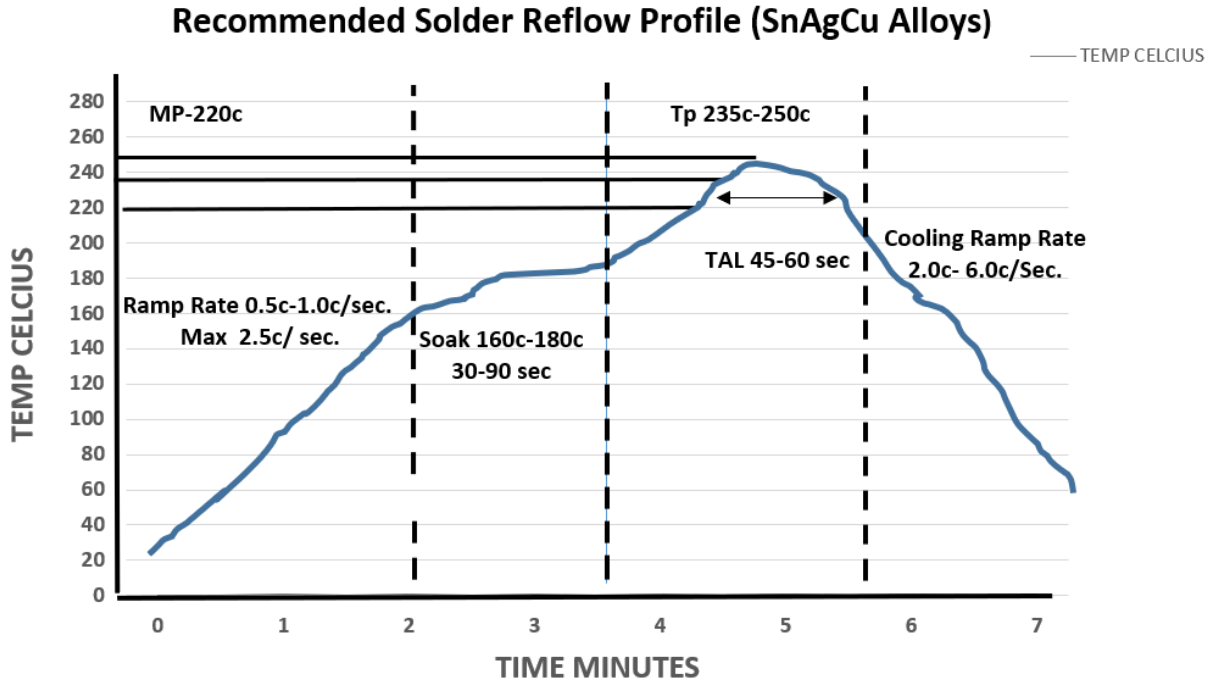
- Do not use solder paste with active or acid-based flux. Due to the low clearance under GaN*PX*® packages, the residue from these fluxes is difficult to remove and can degrade the solder joints and device performance over time.

- It is highly recommended to avoid routing high field traces directly underneath GaN*PX*® top-cooled parts. This practice mitigates against possible electromigration and solder mask isolation issues during high temperature/voltage operations.

Soldering Profile

GaN Systems' recommends using the reflow profile IPC/JEDEC J-STD-020 REV D.1, shown below.

- This profile uses the Indium 6.4 water-soluble SAC305.
- The expected voiding level is typically <20%.
- The profile is designed with a longer soak to burn off excess flux or moisture trapped under the devices.



Reference: documents.indium.com/qdynamo/download.php?docid=3010

Hand Soldering/Desoldering

This slide shows recommended procedures for hand soldering/desoldering.

Hand soldering:

1. Attach a thermocouple close to the device pads for temperature monitoring.
2. Apply solder paste and flux to all the pads on the PCB. Alternatively, the pads can be pre-tinned using standard solder with solder flux added after pads are tinned.
3. Place the device on the board and align it properly.
4. Preheat the board to about 100-120°C using pre-heating station or hot plate. Apply a small force on top of the device to hold it down and use hot air gun to blow hot air from the top until the temperature reaches 260-280°C. Apply heat for 20-30 seconds.
5. Remove the force and heat.
6. Clean excess flux after it has cooled.

Desoldering:

1. Preheat the board to 100-120°C using a pre-heating station or hot plate.
2. Use a hot air gun to blow hot air at 260-280°C. Use tweezer to remove device once it is loose.

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