Modules

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Customer Process Guidelines

RC71XX

December 2024

41114682 Rev. 2

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Contact Information

Sales information and technical support, including warranty and returns	Web: sierrawireless.com/company/contact-us/ Global toll-free number: 1-877-687-7795 6:00 am to 5:00 pm PST
Corporate and product information	Web: sierrawireless.com

Revision History

Revision Number	Release Date	Changes
1	February 2024	Creation
2	December 2024	Updated 5.4 Washing and Potting

Contents

1: Introduction

1.1 Overview

This document presents guidelines for the industrial assembly of a Semtech RC71xx Series Embedded Module on an application.

Note: In this document, RC71xx refers to RC7110 and RC7120.

Note: Semtech modules are shipped factory-programmed, with industry or mobile operator approved firmware, according to the specific SKU ordered. Periodically, newer firmware versions become available and can include new features, bug fixes, or critical security updates. Semtech strongly recommends that customers establish their own production capability for updating module firmware on their assembled end platform, in the event that a newer firmware must be installed before deployment. Semtech also recommends customers design their products to support post-deployment FOTA upgrades using the AirVantage cloud platform.

2: Handling

2.1 Storage and Handling of the RC71xx Module

2.1.1 Storage Condition

Semtech RC71xx embedded modules can be stored in their sealed, original packages (Tape and Reel (T&R) sealed in a vacuum bag), for up to 18 months.

The storage temperature range for individual RC71xx modules is -40°C to +85°C. However, when packed in T&R, the storage temperature range is decreased to -40°C to +40°C due to the T&R packaging material.

Tip: *For optimal results, the recommended storage temperature is +20°C ± 10°C.*

2.1.2 ESD

The RC71xx module is ESD-sensitive.

For ESD level details, refer to the "EMC and ESD Recommendations" section of *[1] RC71xx Product Technical Specification*.

It is recommended to use standard ESD precautions, as described in the following standards:
- *[2] JEDEC standard: Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices (JESD625-A)*
- *[3] ANSI/ESD S20.20: Protection of Electrical and Electronics Parts, Assemblies and Equipment*

2.1.3 Moisture Sensitivity

The RC71xx module is sensitive to moisture absorption:
- MSL 3, 245°C, 1 or 2 reflows allowed on customer PCB. See additional details in 5.3 Solder Reflow Profile.

Caution: *If a T&R vacuum pack is open for more than 168 hours, the material should be baked at 40°C for 13 days. If the modules have been removed from the T&R vacuum pack and placed on a tray, baking conditions are 24 hours at 85°C.*

It is recommended to follow the standard MSL procedure, as described in the following standard:
- *[4] IPC/JEDEC J-STD-033A - Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices*

2.2 Module Package

2.2.1 Package Description

The RC71xx module is a scalable QFN (Quad Flat No leads) package, 22x23 mm, pitch 0.8 mm, with 239 terminals.

The terminals include:

- 66 inner signal pads
- 91 outer signal pads
- 8 mechanical corner pads
- 9 signal pads for debug port (reserved)
- 1 polarity mark
- 64 ground pads

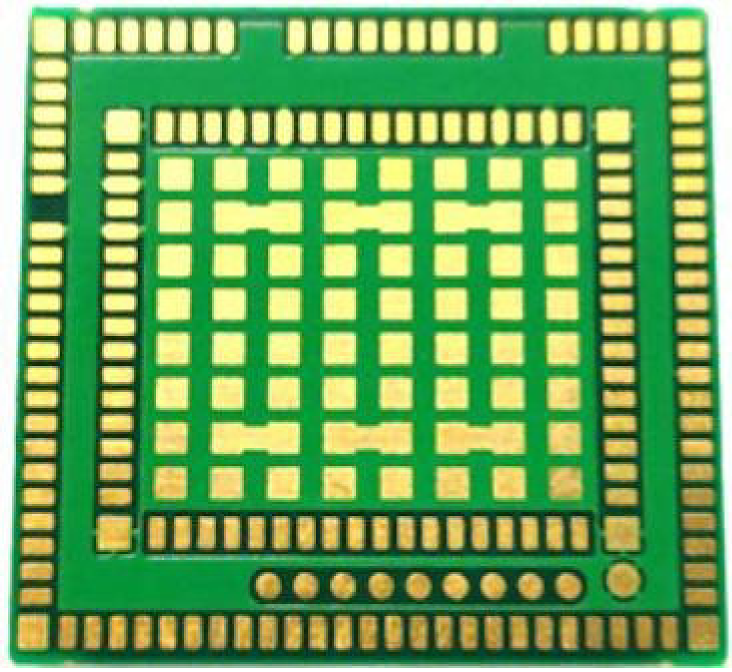


Figure 2-1: RC71xx Module — Bottom View

PCB material is FR4. Plating is NiAu (Nickel (3–8 µm), Gold (0.03–0.13 µm)).

For additional information, refer to *[1] RC71xx Product Technical Specification*.

2.2.2 Marking Description

Label/marking contents and methods on the module may differ between each variant of the product family. The marking method is laser-marking.

Common laser-marking contents include:

- Model Name, Serial Number and IMEI (both letters and data matrix barcode)
- Fabrication Country
- Relevant regulatory compliance markings and identification codes (e.g., CE logo, FCC ID number, IC ID number, etc.)
- Pin 1 indicator for solder-down modules

The examples below are not contractual and do not show the exact contents of the product. Label contents may also be rearranged to fit any additional specific needs to a customer or market segment, and can change without notice at the sole discretion of Semtech.

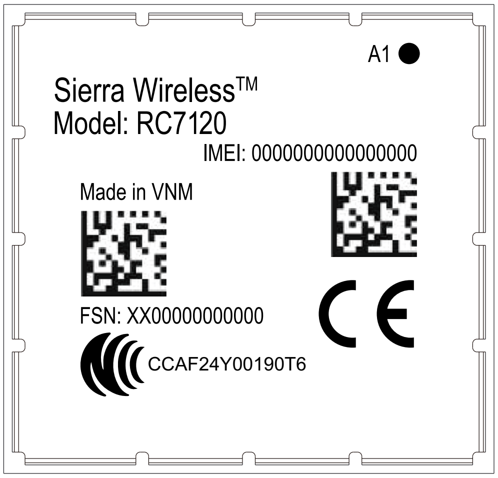


Figure 2-2: RC7120 Product Marking Example with CE logo—Laser-etched

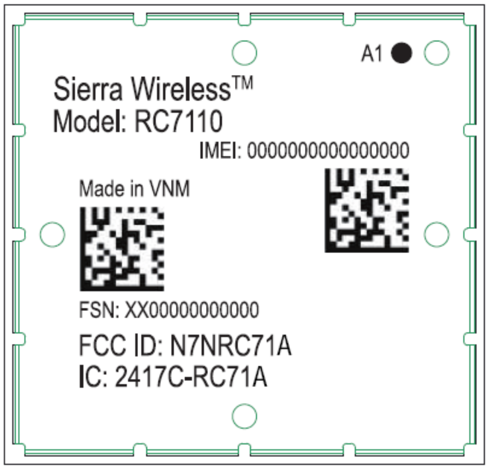


Figure 2-3: RC7110 Product Marking Example with FCC ID—Laser-etched

2.3 Module Packing

2.3.1 Packing Description

The RC71xx module is delivered in tape and reel. Quantity per tape & reel is 500.

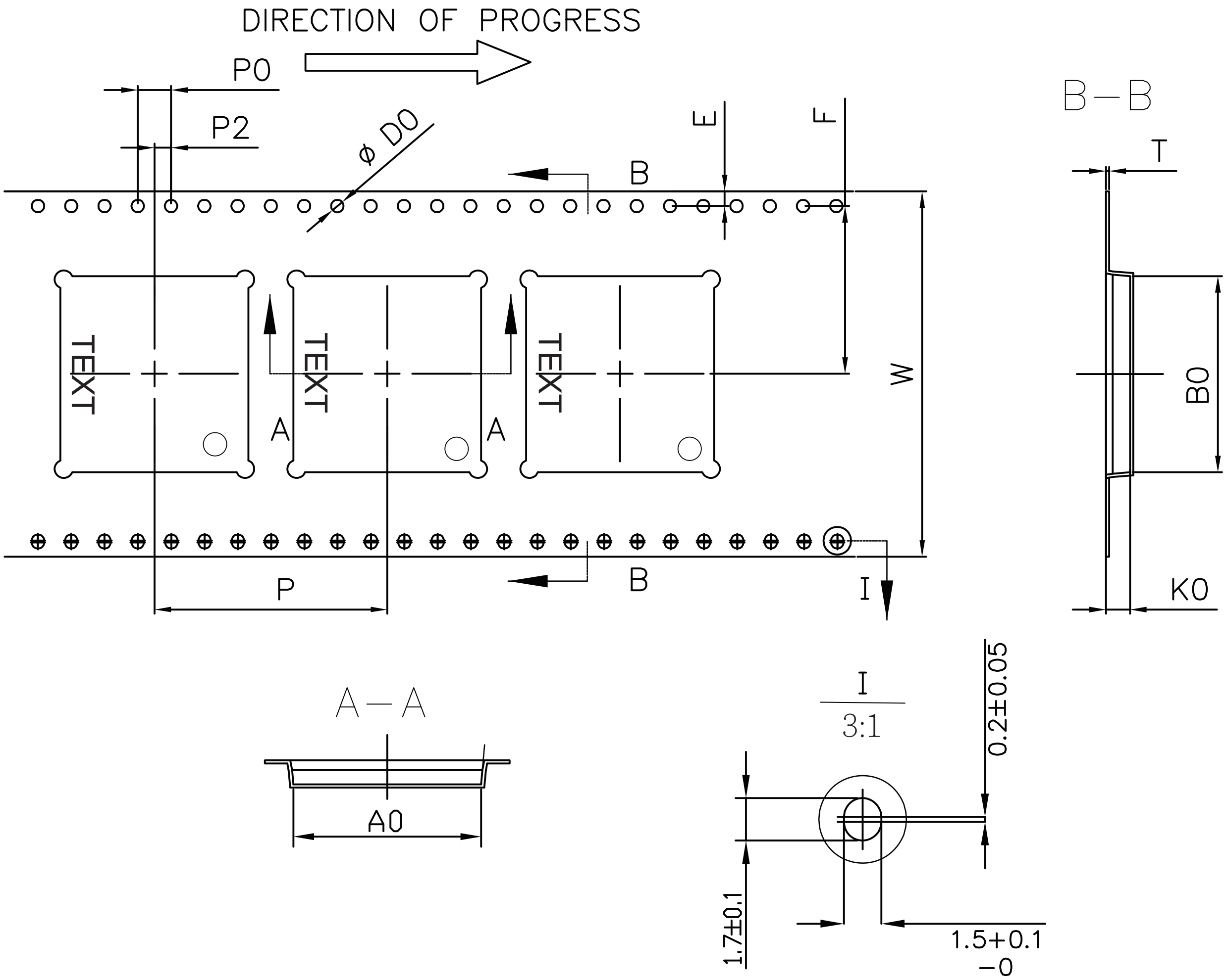
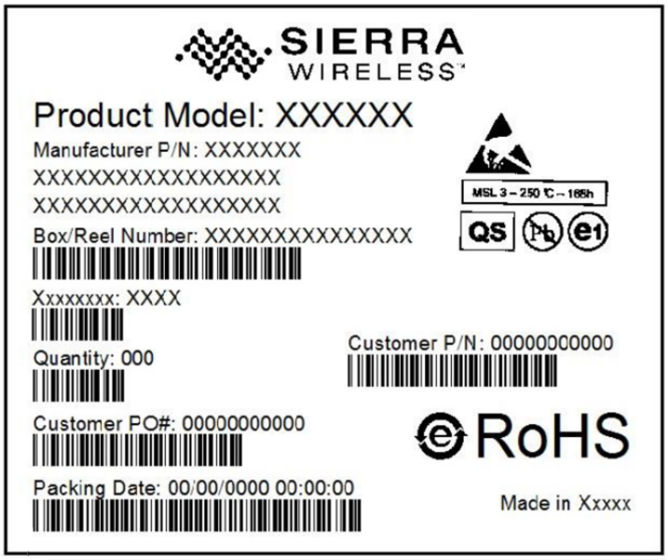


Figure 2-4: RC71xx Tape and Reel

P	P0	P2	W	∅D0	E	F	A0	B0	K0	T
28 mm	4.0 mm	2.0 mm	44.0 mm	1.5 mm	1.75 mm	20.2 mm	22.6 mm	23.6 mm	2.9 mm	0.4 mm

2.3.2 Packing Labels



SIERRA WIRELESS

Product Model: XXXXXX

Manufacturer P/N: XXXXXXX

XXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXX

Box/Reel Number: XXXXXXXXXXXXXXX

Xxxxxxxx: XXXX

Quantity: 000

Customer P/N: 00000000000

Customer PO#: 00000000000

Packing Date: 00/00/0000 00:00:00

MSL 3 – 250 ℃ – 168h

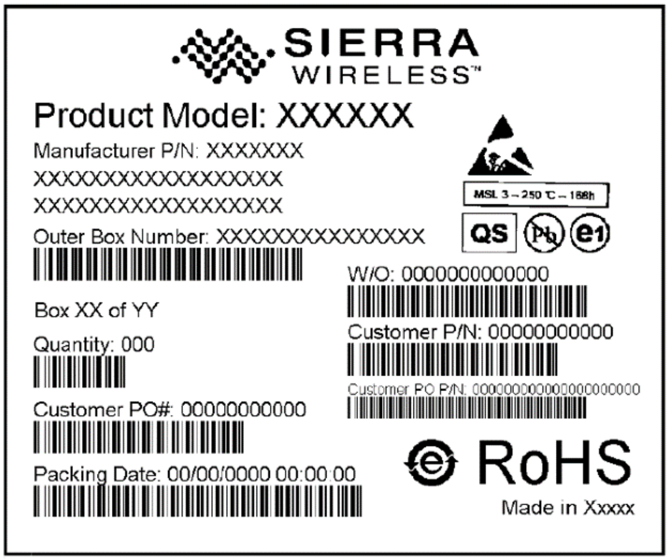
QS

RoHS

Made in Xxxxx

Figure 2-5: Packing label — Reel / Vacuum Bag / Box

The packing label shown in Figure 2-5 will be placed on the reel, on the vacuum bag, and on the box that contains the vacuum bag.



SIERRA WIRELESS

Product Model: XXXXXX

Manufacturer P/N: XXXXXXX

XXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXX

Outer Box Number: XXXXXXXXXXXXXXX

W/O: 0000000000000

Box XX of YY

Customer P/N: 00000000000

Quantity: 000

Customer PO P/N: 00000000000000000000000

Customer PO#: 00000000000

Packing Date: 00/00/0000 00:00:00

MSL 3 – 250 ℃ – 168h

QS

RoHS

Made in Xxxxx

Figure 2-6: Packing label — Shipping Carton

The packing label shown in Figure 2-6 will be placed on the shipping carton that contains the box.

3: RC71xx Module Firmware

If the RC71xx is tested before, during, or after the assembly process and firmware corruption is detected, uncorrupted firmware can be installed by performing a full firmware update over the module's USB or UART1 interfaces.

Note— To perform the update over the module's USB Serial COM port, the platform containing the RC71xx must have the module's TP1 pin connected to a control mechanism that will assert TP1. For details, refer to the *[1] RC71xx Product Technical Specification,* section "TP1 (Boot Pin)".

4: Customer Product Design

4.1 PCB Surface Finish

The PCB surface finish recommended is Electroless Nickel, immersion Gold. Organic Solderability Preservative (OSP) may also be used.

Caution: *Hot Air Solder Leveled finish (HASL) is not recommended. The process does not give consistent solder volumes on each pad because of poor pad flatness.*

4.2 Module footprint

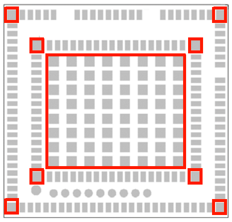
4.2.1 Footprint

To produce high assembly yields and a reliable solder joint, the footprint on the customer application board must match Figure 4-1 on page 13.

Important:

- The 64 central pads and the 8 corner pads are ground pads.
- Manufacturing tolerance for copper pads: 30 µm

Mechanical drawings of the RC71xx module's footprint (including dimensions and pitch) are available in *[1] RC71xx Product Technical Specification*.



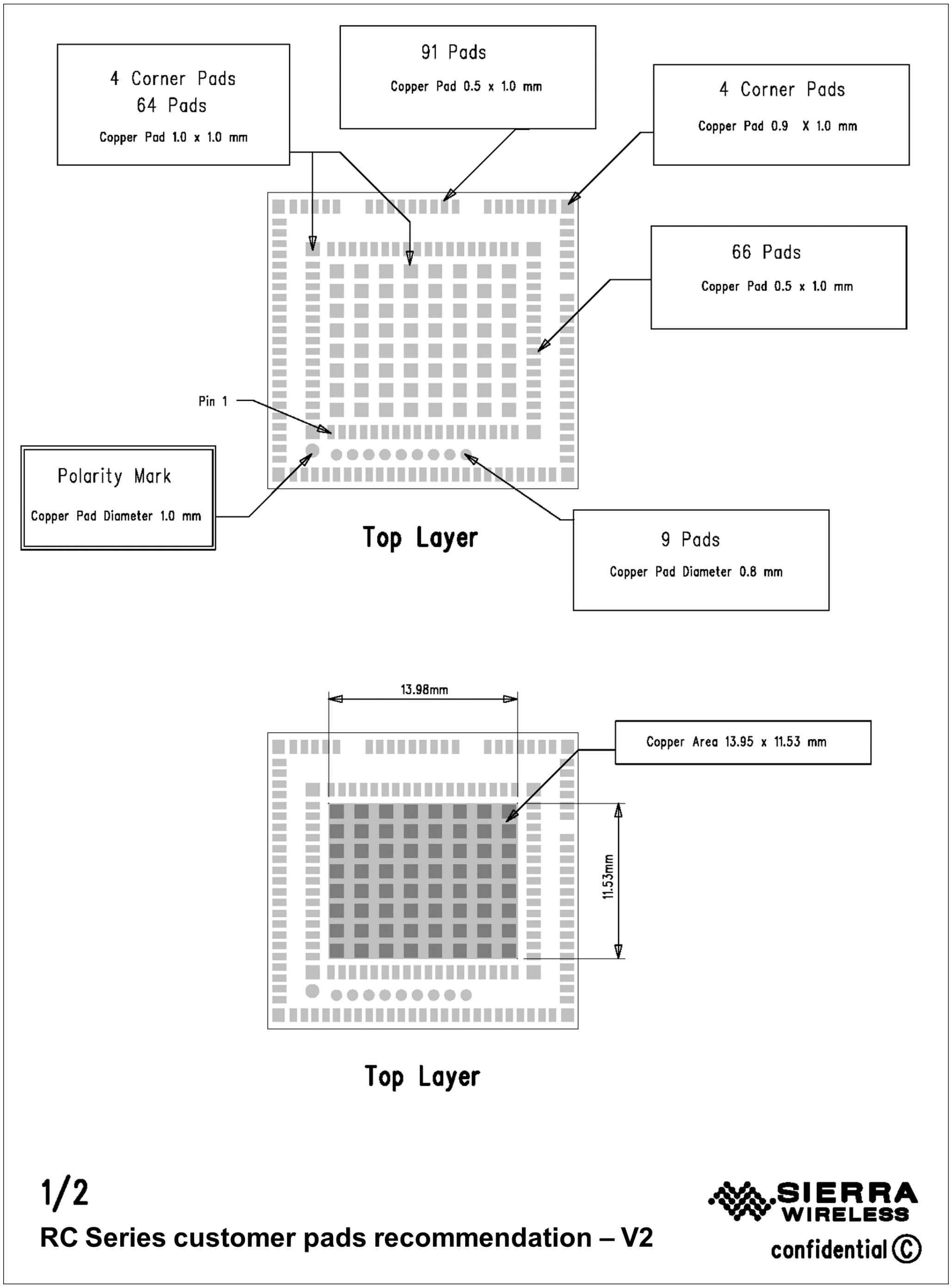


Figure 4-1: RC71xx Product Footprint Recommended

4.2.2 Solder Mask

The pads on the printed circuit board are either Solder Mask Defined (SMD) or Non-Solder Mask Defined (NSMD).

Since the copper etching process has tighter control than solder masking process, NSMD pads are preferred over SMD pads.

Moreover, NSMD pads with solder mask opening larger than the metal pad size also improve the reliability of solder joints, as this limits the stress concentration at the solder-to-mask corner interface.

For the external pads, the solder mask opening should be 100–150 µm larger than the pad, resulting in 50–75 µm clearance between the copper pad and solder mask. This allows for solder mask registration tolerances, depending upon the PCB fabricator's capabilities.

For the 64 ground pads, SMD pads should be used if a copper ground area is under the RC71xx module, as described in 4.3 Layout Recommendations.

Recommended solder mask thickness on top copper is 10–30 µm.

Refer to Figure 5-1 on page 16 for a recommended solder resist and paste mask layout.

4.3 Layout Recommendations

Semtech layout recommendations include:

- Include a GROUND area under the RC71xx module. This ground area should be a whole area of copper with proper ground vias to provide a good grounding system between the application and the embedded module, and improved thermal dissipation. It should be covered by solder resist on the non-soldered area.

  The ground vias may be micro-vias, filled or unfilled. Through-holes can be used between each of the 64 ground pads (under the solder resist).
- There should not be any SIGNAL trace or hole / micro-via under the module.
- Customers should place a copper pad under the Polarity mark to avoid any risk of short circuits between it and the customer layout. This mark eases visual confirmation of the module's correct orientation.
- The Polarity mark should not be soldered (there is no stencil aperture for the Polarity mark).
- The antenna pad and its track should be adapted according to RF constraints, based on customer layout. Refer to *[1] RC71xx Product Technical Specification* for more details.
- Leave a component-free area of 2 mm around the RC71xx module for accessing the surrounding components.

5: Board Mounting Guidelines

5.1 Lead-Free Process

In compliance with directive 2011/65/CE and its amendments, Semtech products do not contain the following hazardous substances:

Table 5-1: List of Restricted Substances

Substance Name	Limit
Lead	0.1%
Mercury	0.1%
Cadmium	0.01%
Hexavalent chromium	0.1%
Polybrominated biphenyls (PBB)	0.1%
Polybrominated diphenyl ethers (PBDE)	0.1%
Bis(2-ethylhexyl) phthalate (DEHP)	0.1%
Butyl benzyl phthalate (BBP)	0.1%
Dibutyl phthalate (DBP)	0.1%
Diisobutyl phthalate (DIBP)	0.1%

RC71xx modules are manufactured with RoHS-compliant components and processes.

This section presents information and recommendations for the industrial assembly of the RC71xx module on the application.

Note: RC71xx products should be assembled by reflow process.

5.2 Stencil Design

The recommended stencil thickness is 125 μm.

The proposed stencil design is presented in Figure 5-1 on page 16.

It is highly recommended to monitor the solder paste height, registration and proper placement during the squeegee printing.

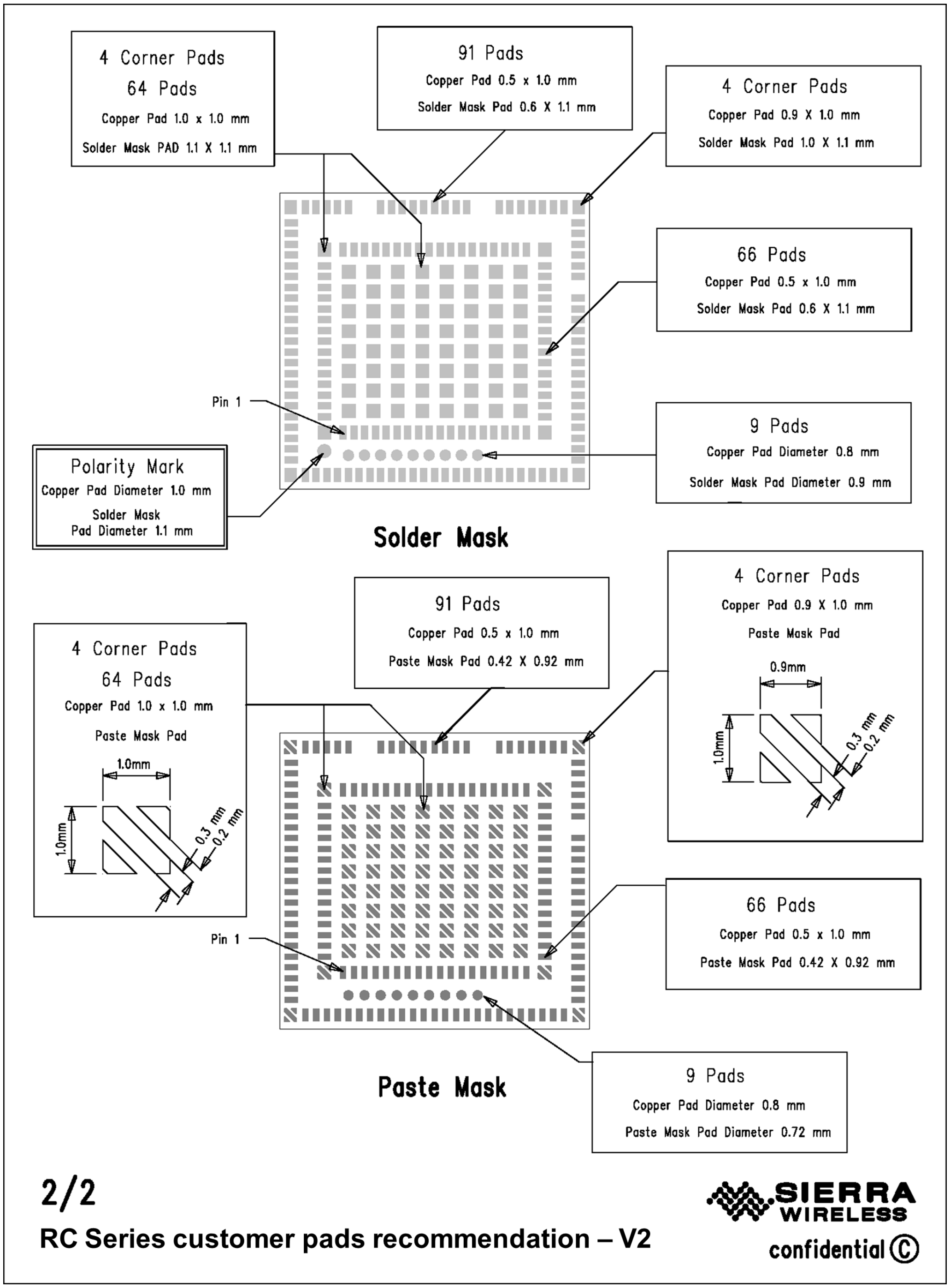


Figure 5-1: RC71xx Product Solder — Customer stencil aperture pattern Recommended

5.3 Solder Reflow Profile

Lead-free SMT reflow profiles should be used to surface-mount the RC71xx module.

The reflow profile depends on PCB density and type of solder paste being used. The paste manufacturer's recommendation should also be considered to determine the proper reflow profile.

Table 5-2: Solder Reflow Profile is a mandatory requirement to ensure reliable assembly.

Table 5-2: Solder Reflow Profile

Peak Temperature	245°C
Number of reflow cycles	2

Caution: *It is recommended to use only one reflow cycle for module assembly.*

If repairs or other rework are performed on the customer board near the RC module, care must be taken to ensure the module is not reflowed.

Figure 5-2 is an example of reflow profile.

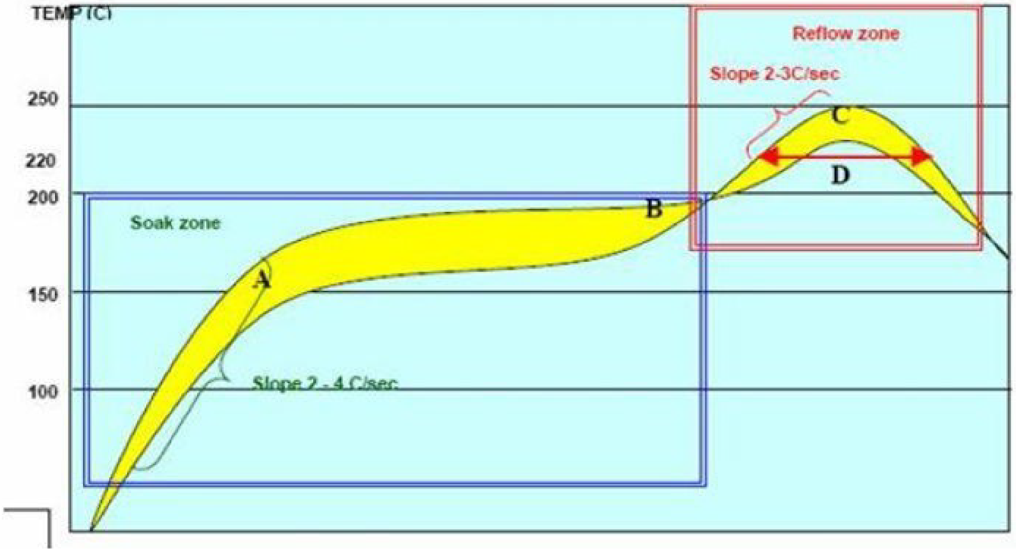


Figure 5-2: Recommended Example Reflow Profile

Additional recommendations are presented in the table below for consideration.

Table 5-3: Solder Reflow Profile Considerations

Factor	Recommendation
Max slope at soak zone	2–4 °C/sec
Max slope at reflow zone	2–3 °C/sec
Soak time (between A (150°C) and B (190°C))	60–120 sec
Reflow time (D: over 220°C)	40–60 sec
Max temperature (C)	235–245 °C
Cooling down slope	1–3 °C/sec

Note: It is recommended to perform reflow under nitrogen atmosphere.

5.4 Washing and Potting

Water wash is not recommended with Semtech modules, due to difficulty in ensuring a proper drying under the shield.

Use of ultrasonic process shall be avoided as it can damage the quartz crystal components.

Semtech has not performed potting qualification tests on RC71xx modules. Customers should pay attention to RF tracks since the ε_{air} (epsilon-air) will be different below the potting compared to an open-air design. After potting a module, RF performance should be rechecked to guarantee that no degradation compared to nominal values occurred.

As the potting/coating process varies depending on a customer's need, it is the customer's responsibility to ensure the selected material and process parameters are compatible with the RC71xx module. The customer should take precautions to prevent ingress of potting/coating material under the shield. If a customer's potting/coating process is found to have contributed to a failure, the unit will not be covered under warranty. Units returned for failure analysis must have all potting/coating material removed and the FSN marking must be visible. The shield cannot be removed and no heat treatment should be used during the potting/coating material removal.

6: Rework Guidelines

Rework tools and operating parameters are customer/application specific. Rework tools, heating profiles and the rework process should be tailored to these specific needs for optimum results.

Prior to any rework, if the component floor life has been exceeded, it is highly recommended to pre-bake the PCB to remove moisture from the assembly. (See *[4] IPC/JEDEC J-STD-033A - Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices*, section 6 BOARD REWORK. If possible, for the PCB and the other components of the board, apply the same baking as per 2.1.3 Moisture Sensitivity.) The pre-baking process will prevent damage to any component due to moisture vapor pressures caused during reflow.

Prior to removing the component, the shielding and the module's PCB layers should be glued together using glue able to withstand reflow profile. Glue should not touch the customer board; usage of adhesive tape (PI) on the PCB helps to avoid glue drop on the PCB.

Figure 6-1: Glue deposit on RC module (Example)

6.1 Module Removal

This step consists of reflowing the solder joints attaching components to the PCB. Ideally, the reflow profile for part removal should be the same as the one used for part attachment. However, the time above liquidus can be reduced as long as the reflow is complete.

In the removal process, it is recommended that the board should be heated from the bottom side using convective heaters and hot gas, or hot air or IR should be used on the top side of the component. Special nozzles or IR lens should be used to direct the heating in the component area and heating of adjacent components should be minimized.

Excessive hot airflow should also be avoided, as this causes the component to overheat.

Once the joints have reflowed, the vacuum lift-off should be automatically engaged for pick-up during the transition from reflow to cool down.

Warning: *If heating conditions are not properly controlled during manual hot removal from PCB assembly, package integrity can be damaged from overheating.*

6.2 Pad Redress

Once the component has been removed, the site and pads need to be cleaned properly. It is better to use the combination of a blade style conductive tool and a fluxed desoldering braid.

Once the residual solder has been removed, the land pads should be cleaned with a solvent. The solvent is usually specific to the type of solder paste used in the original assembly and the paste manufacturer's recommendations should be followed.

6.3 Solder Paste Deposit

Once the PCB is properly cleaned and inspected, solder paste should be applied on the solder land (on the component itself or on the customer PCB) with a mini-stencil that has the same thickness and apertures as the stencil used for original attachment.

6.4 New Module Placement

A slip-beam optical system should be used to align the component to the PCB. This method will display an image of the land pad overlaid on the mating footprint and aid in proper alignment. Similar to paste printing, the alignment should be done under magnification of 50–100x.

6.5 New Module Soldering

The reflow profile developed during original attachment or removal should be used to attach the new module.

A: References

For more details, several references can be consulted, as detailed below.

A.1 Web Site Support

Check source.sierrawireless.com for the latest documentation available.

Reference Documents

[1] RC71xx Product Technical Specification
Reference number: 41114670

[2] JEDEC standard: Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices (JESD625-A)

[3] ANSI/ESD S20.20: Protection of Electrical and Electronics Parts, Assemblies and Equipment

[4] IPC/JEDEC J-STD-033A - Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices