Customer Process Guidelines

AirPrime WS Series

SIERRA WIRELESS

WA_DEV_WISMO_PTS_001
003
February 2, 2011

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Document History

Version	Date	Updates
001	June 16, 2010	Creation
002	July 8, 2010	Update of 3.2.2 - area under the module
003	February 2, 2010	Update of the recommended pad and of the stencil thickness; removal of targeted levels for ESD and MSL levels Modification to 3.2.2 - component free area, antenna pad and area under the module Update to 2.3.1 - Change of the orientation of the module inside the T&R

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1. Introduction

1.1. Overview

This document provides guidelines for the industrial assembly of the AirPrime WS (WISMO®) Series components on an application.

1.2. Reference Documents

[1] WISMO218 Product Technical Specification & Customer Design Guidelines
Reference: WA_DEV_W218_PTS_002

[2] WISMO228 Product Technical Specification and Customer Design Guideline
Reference: WA_DEV_W228_PTS_002

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

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

2. Handling

2.1. Storage and Handling of the AirPrime WS Series

2.1.1. Storage Condition

AirPrime WS Series units can be stored in their sealed, original packages, between -40°C and +85°C over the course of up to 1 year.

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

2.1.2. ESD

The AirPrime WS Series unit is ESD sensitive, specifically as follows:

- Level class 2 for HBM (2KV)
- Level class B for MM (200V)
- Level class III for CDM (500V)

It is recommended to use standard ESD precautions, as described in the following norm:

- JEDEC standard JESD625-A, Requirements for Handling Electrostatic Discharge-Sensitive (ESDS) Devices.

2.1.3. Moisture Sensitivity

The AirPrime WS Series product is sensitive to moisture absorption:

- MSL 3, 250 °C, 2 reflows allowed on customer PCB including one for rework of the component

Caution: *If tape & reel vacuum pack is open for more than 168h, material should be baked at 40°C for 13 days.*

It is recommended to follow the standard MSL procedure, as described in the following norm:

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

2.2. Component Package

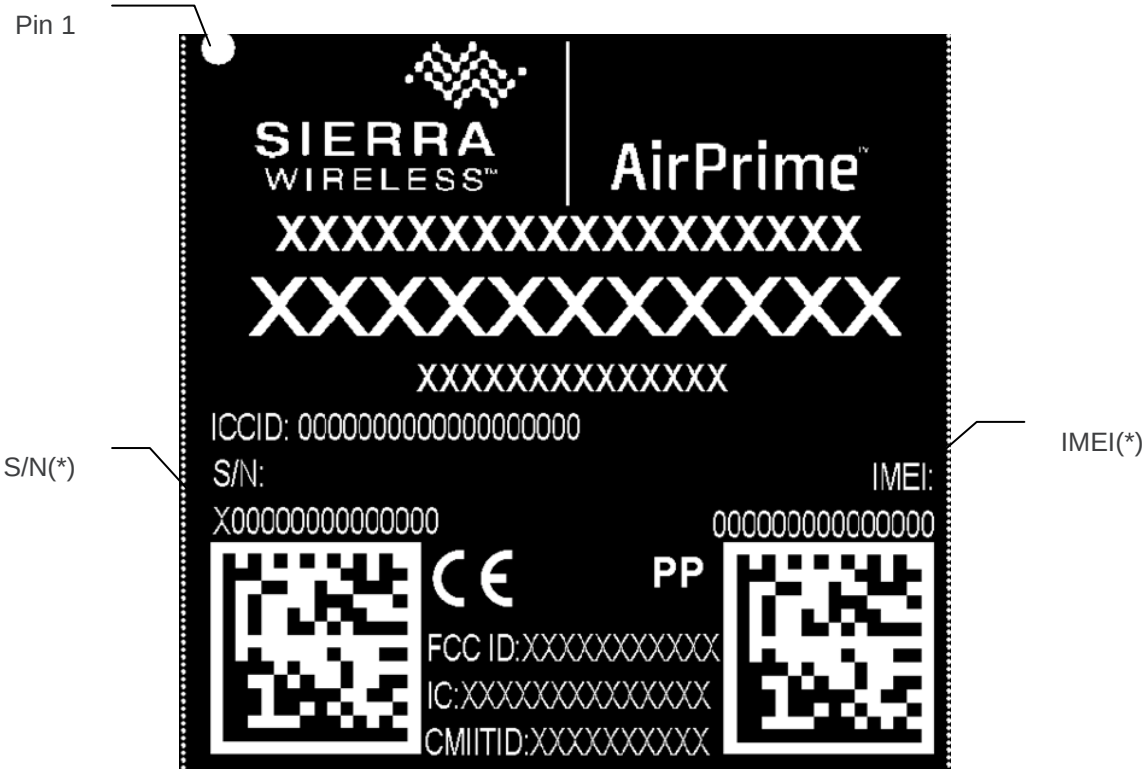
2.2.1. Package Description

The AirPrime WS Series of modules is an LLCC 46 pins, 25 x 25 x 2.8 mm, pitch 1.5 mm.

Leadless Chip Carriers (LLCC) packages are characterized by external connections consisting of metallized inset terminations (castellations), making the package looking like a miniature castle.

For additional information, refer to documents [1] WISMO218 Product Technical Specification & Customer Design Guidelines and [2] WISMO228 Product Technical Specification and Customer Design Guideline.

2.2.2. Marking Description



(*): data matrix bar code

Figure 1. AirPrime WS Series module label

2.3. Component Packing

2.3.1. Packing Description

The AirPrime WS Series product is delivered in tape and reel.

Quantity per tape & reel is 250.

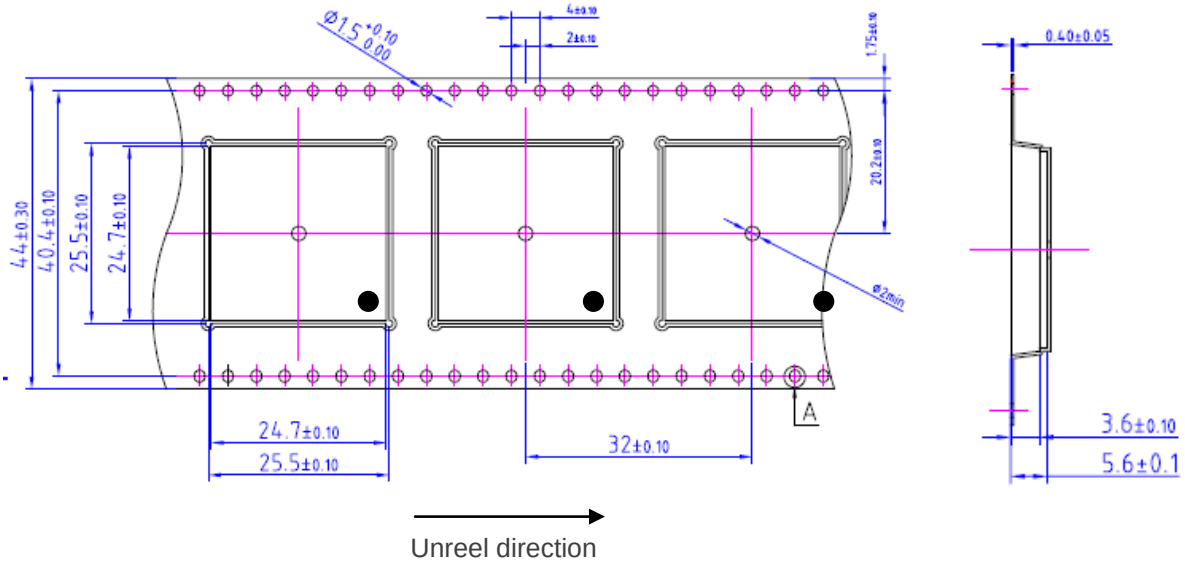


Figure 2. Packing description

Figure 3. Packing picture

2.4. Packing Label

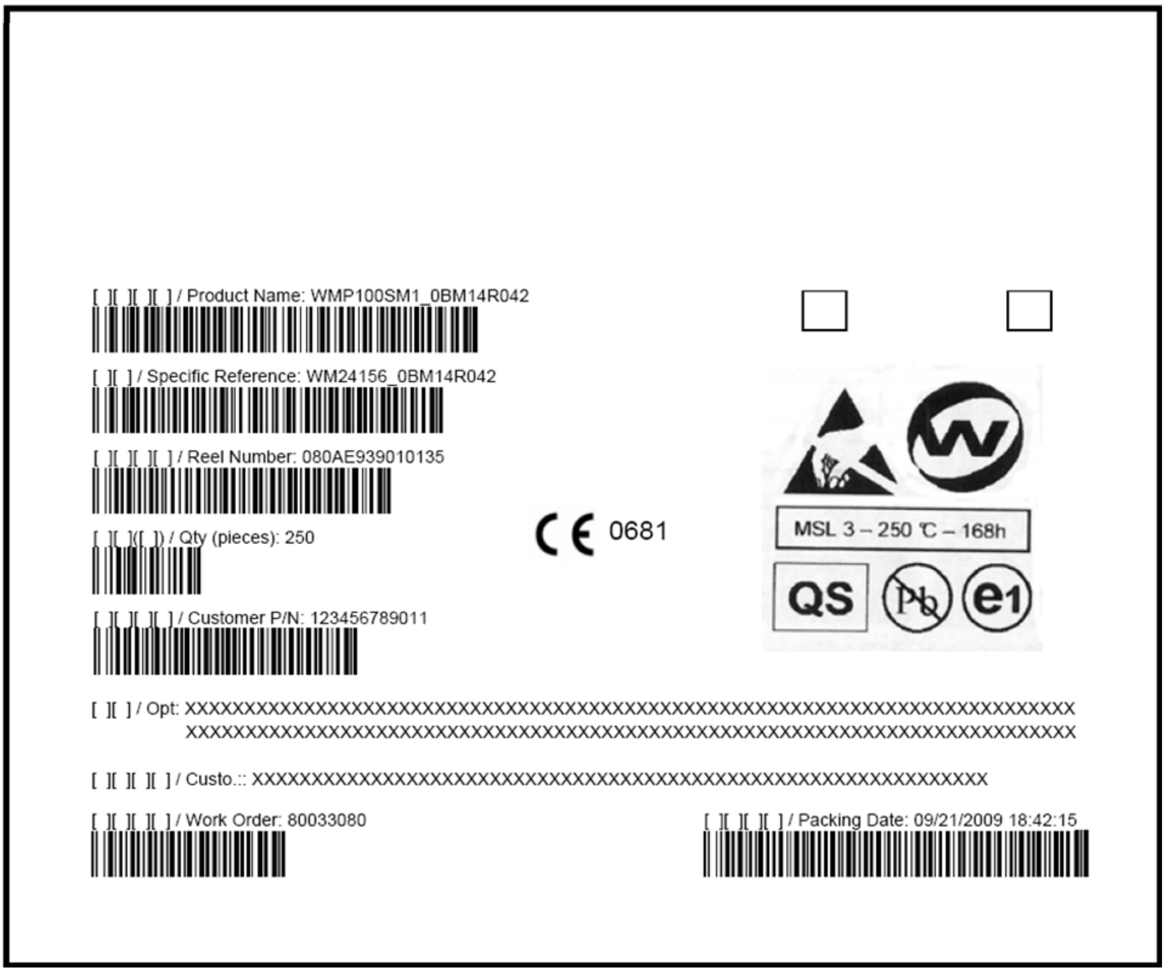


Figure 4. Packing label

3. SMT Assembly Process

This section gives recommendations for the industrial assembly of the WISMO® on the application.

The AirPrime WS Series units should be assembled by reflow process.

3.1. Lead-Free Process

In compliance with directive 2002/95/CE, Sierra Wireless products do not contain the following hazardous substances:

- mercury (Hg),
- lead (Pb),
- cadmium (Cd),
- hexavalent chromium (Cr+6),
- polybrominated diphenyl ether (PBDE),
- polybrominated biphenyl (PBB).

The AirPrime WS Series modules are manufactured with RoHS compliant components and processes.

3.2. PCB Design Requirements

3.2.1. PCB Surface Finish

The PCB surface finish recommended is Electroless Nickel, immersion Gold.

Organic Solderability Preservative (OSP) may also be used.

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

3.2.2. Land Pad

In order to produce high assembly yields and a reliable solder joint, the land pad design should be as follows:

Note: Copper pads are presented in red.

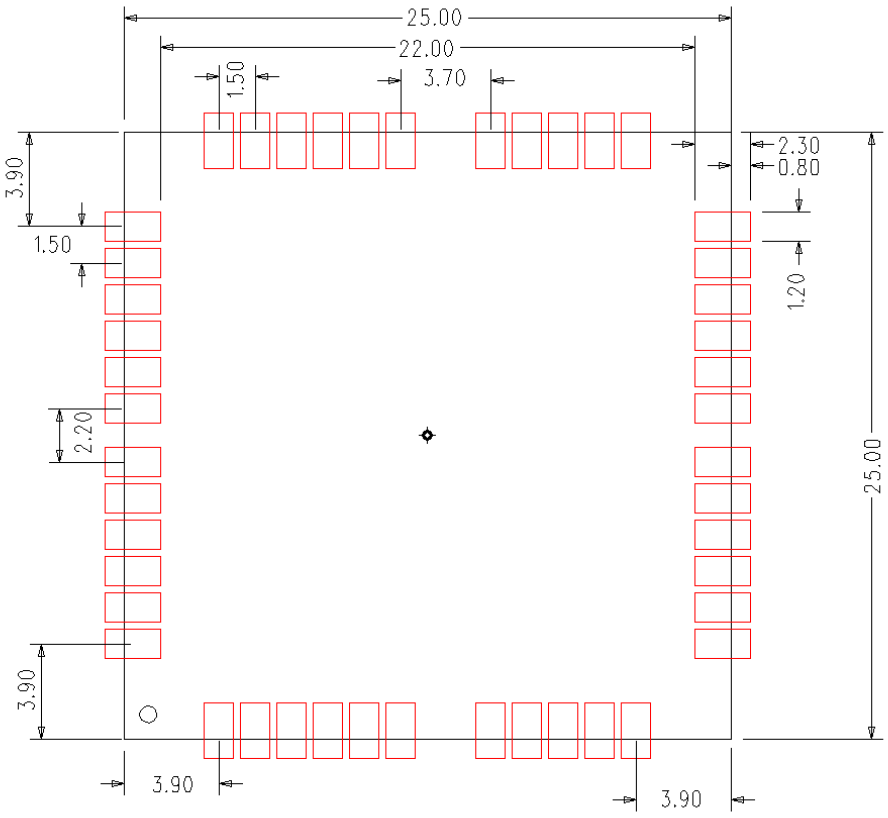


Figure 5. Pad layout

Caution: *The antenna pad should be adapted according to RF constraints, based on customer layout.*

This curve on Figure 6 is resulting of several simulations result using TxLine from MicroWave Office with H as input parameters and with the following constants:

- H is the dielectric thickness between top layer and ground layer under the antenna.
- Er = 4.2
- T = 25µm
- Copper conductivity = 5.88E+07 S/m
- Pitch = 1.5 mm

So, regarding its PCB stack-up (dielectric thickness), the customer should modify the antenna pad width W

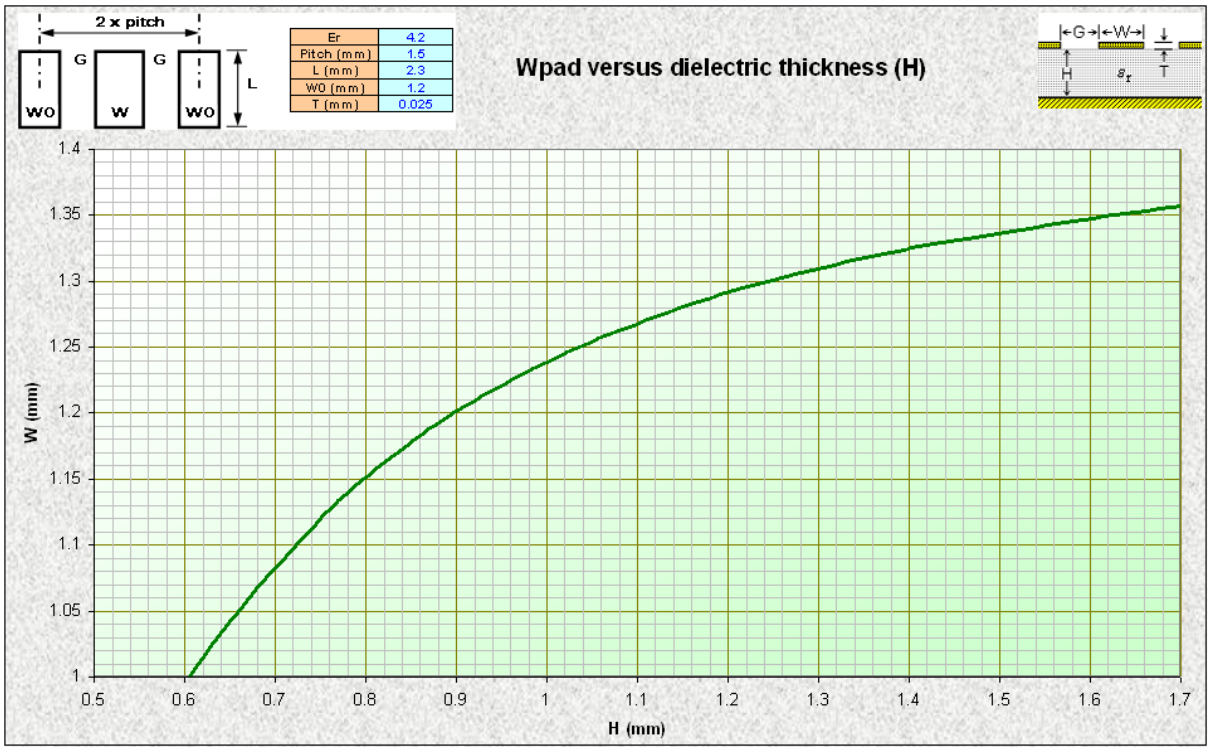


Figure 6. Antenna pad width versus dielectric thickness

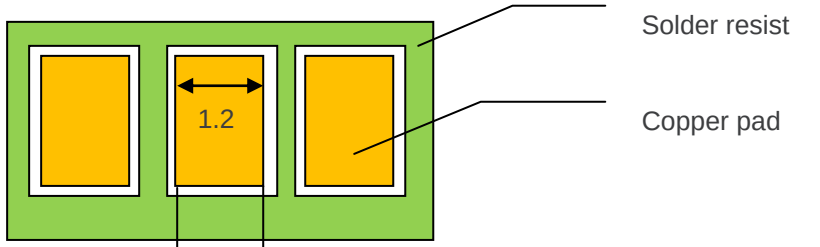
Therefore, PCB inner layers should be removed under the antenna pad (with the same pattern/opening window as proposed on top layer) and ensure 0.6mm minimum distance under the antenna pad.

Example:

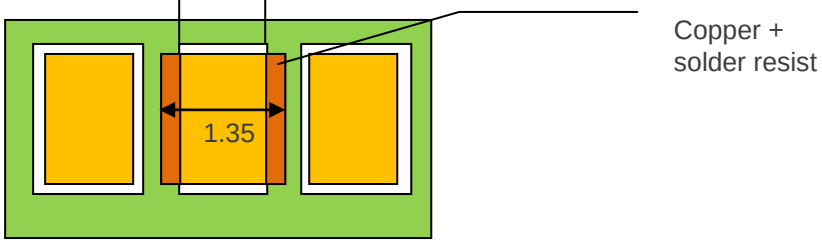
If H=1.6 mm then the pad width becomes 1.35 mm in order to keep a 50 ohms pad impedance. Then the antenna pad will be solder define: copper size is 1.35 x 2.3 mm, but solder mask is 1.2 x 2.4 mm, in order not to impact the soldering quality.

If H=0.6 mm then the pad width becomes 1.0 mm in order to keep a 50 ohms pad impedance. The antenna pad will be 1.0 x 2.3 mm. The two adjacent GND pads can be set up at 1.1 mm.

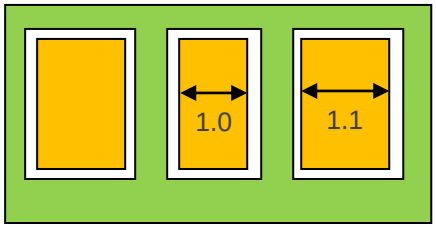
Original pad:



H=1.6 mm



H=0.6 mm



Caution: *It is recommended to have a ground area under the AirPrime WS series module. The ground pad should be covered by solder resist.*

Micro-via into this ground area is permitted for GND connection only, and must not be located under WISMO® test points location.

It is forbidden to have any isolated signal/ track, hole or via (except GND micro-via) under the AirPrime WS series module.

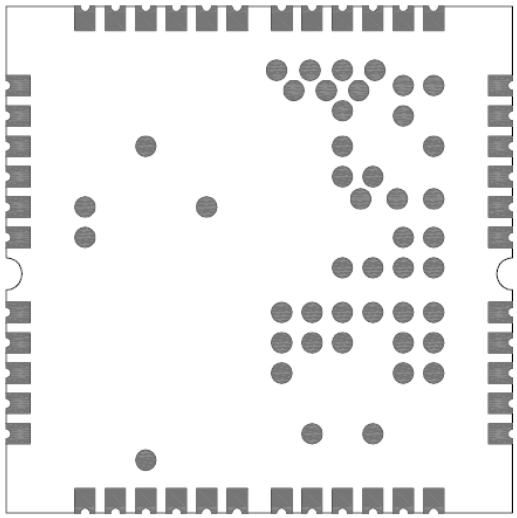


Figure 7. Bottom view of the test point locations

Exact location of the test points is available in the PTS.

It is recommended to let a component-free area of 2.2 mm around the module (due to the stencil dimension)

The recommended manufacturing tolerance for copper pad is ± 30 µm.

3.3. Solder Mask

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

Since 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 that the metal pad size also improve the reliability of solder joints, as this limits the stress concentration at the solder-to mask corner interface.

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

4. Board Mounting Guideline

4.1. Stencil Design

The recommended stencil thickness is 125 µm.

In order to guarantee enough solder quantity, it is advised to increase the size of the stencil apertures.

Here is a proposed stencil design:

Note: Copper pads are presented in red, stencil pads are represented in blue.

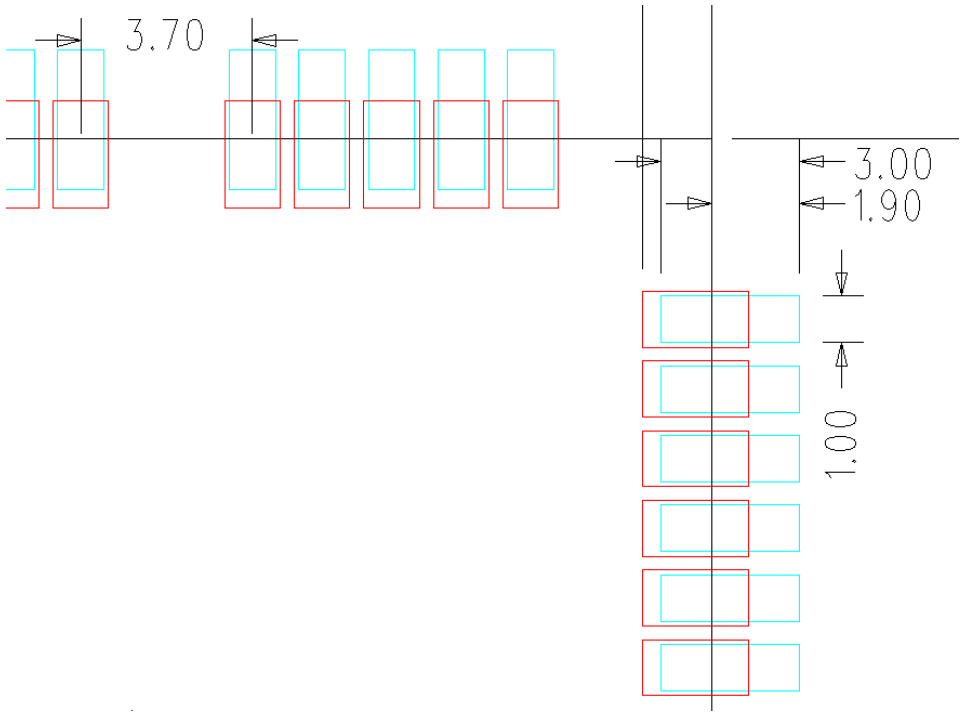


Figure 8. Stencil design

Nickel electroformed stencil is recommended to guarantee a good release of the solder paste. The recommended manufacturing tolerance for stencil aperture is ± 10 µm.

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

4.2. Solder Reflow Profile

Lead-free SMT reflow profiles should be used to surface mount the AirPrime WS Series 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.

Peak Temperature	250°C max

2 reflows are allowed on the customer PCB including one for rework of the component

Example of reflow profile:

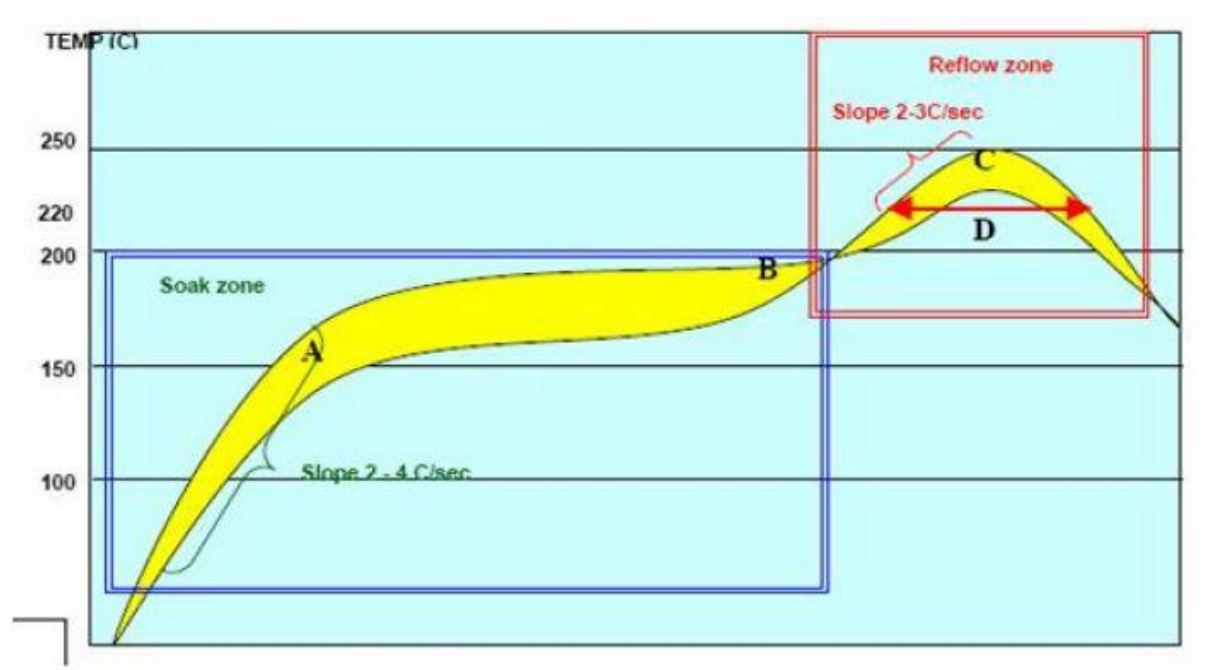


Figure 9. Example of reflow profile

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

5. Rework Guidelines

Due to its package (LLCC with castellations), rework of the AirPrime WS Series module is easy, and some solutions are presented in this chapter.

Rework tools and operating parameters are customer/application specific. Rework tools, heating profiles and rework process should be characterized for optimum results.

Prior to any rework, if the component floor life has been exceeded, it is highly recommended to bake the PCB in order to remove moisture from the assembly (see paragraph 6 - Board rework of the document IPC / JEDEC J-STD-033A. If possible for the PCB and the other components of the board, apply 125°C during 7 hours.). The pre-baking process will prevent damage to any component due to moisture vapor pressures caused during reflow.

5.1. Retouch

Retouch is done by:

- using hot air gun with 380±20°C for preheat during 10-20s, and
- using solder iron for touch-ups.

Maximum heater temperature: 385°C

Recommended contact time: 10 sec maximum

5.2. Rework

Prior to the removal, the shielding of the AirPrime WS Series module must be glued to the WISMO® substrate, by using glue able to withstand reflow profile.

5.2.1. Use of Hot Air Gun and Solder Iron

5.2.1.1. Component Removal

Use of hot air gun is possible for removal of the component.

Hot air gun temperature: 365°C

Recommended time: 60 to 90 sec

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

5.2.1.2. 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.

5.2.1.3. Resoldering of the New WISMO®

Re-soldering can be done as retouch process, by using hot air gun for preheating and solder iron for soldering.

5.2.2. Use of Rework Machine

5.2.2.1. Component Removal

The step is the reflow of 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 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.*

5.2.2.2. 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.

5.2.2.3. 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 which has same thickness and apertures as the stencil used for original attachment.

5.2.2.4. New Component 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 50x to 100x.

As the component leads are visible, manual component placement can also be done.

5.2.2.5. New Component Soldering

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

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