Customer Process Guidelines

AirPrime SL Series

SIERRA WIRELESS®

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Consult our website for up-to-date product descriptions, documentation, application notes, firmware upgrades, troubleshooting tips, and press releases: www.sierrawireless.com

Document History

Version	Date	Updates
001	June 4, 2010	Creation
002	August 6, 2010	Updated: • Pin 1 location (2.3.1) • Packing label (2.3.2) • Land pad description (3.2.2 and 3.3)
003	April 28, 2011	Updated T&R orientation, packing label, SL8 height and add of SL501x series
4.0	July 08, 2013	Added: • SL9 and SL3 series information • Figure 1 AirPrime SL6087 and SL8080T Product Label Example
		Updated (common) footprint.
5.0	September 06, 2013	Added a note and updated the warning in section 3.2.2 Footprint; updated section 4.1 Stencil Design
6.0	July 02, 2014	Updated (back) to dedicated footprint (3.2.2 and 4.1), updated product list (1.2)
7.0	March 04, 2015	Updated: • 2.1.2 ESD • 2.2.2 Marking Description • 2.3.1 Packing Description (changed pin 1 location to fit with actual product) • 5 Rework Guidelines
8.0	May 04, 2015	Updated section 2.2.2 Marking Description
8.1	June 05, 2015	General rephrasing to sync data presentation with other CPGs

Contents

List of Figures

1. Introduction

1.1. Overview

This document presents guidelines for the industrial assembly of an AirPrime SL Series Intelligent Embedded Module on an application.

1.2. Reference Documents

[1] AirPrime SL3010T Product Technical Specification and Customer Design Guidelines

Reference: 4112902

[2] AirPrime SL5011 Product Technical Specification and Customer Design Guidelines

Reference: 4110802

[3] AirPrime SL6087 Product Technical Specification and Customer Design Guidelines

Reference: 4111952

[4] AirPrime SL808x, SL808xT & SL808xBT Product Technical Specification and Customer Design Guidelines

Reference: 4111992

[5] AirPrime SL808xT, SL808xBT, SL808xBTA Product Technical Specification and Customer Design Guidelines

Reference: 4115145

[6] AirPrime SL809x Product Technical Specification and Customer Design Guidelines

Reference: 4111941

[7] AirPrime SL9090 Product Technical Specification and Customer Design Guidelines

Reference: 4111766

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

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

[10] 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 SL Module

2.1.1. Storage Condition

AirPrime SL Series units can be stored in their sealed, original packages, for up to 1 year.

They can withstand a storage temperature range between -40°C to +85°C; nevertheless, when packed into T&R, the upper storage temperature is decreased to +40°C due to T&R packaging material.

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

2.1.2. ESD

The AirPrime SL Series unit is ESD sensitive. For ESD levels, refer to each product technical specification document listed in section 1.2 Reference Documents.

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

- JEDEC standard JESD625-A, Requirements for Handling Electrostatic Discharge-Sensitive (ESDS) Devices
- ANSI/ESD S20.20: Protection of Electrical and Electronics Parts, Assemblies and Equipment

2.1.3. Moisture Sensitivity

The AirPrime SL Series product is sensitive to moisture absorption:

- MSL 3, 245 °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. If parts are on tray, baking conditions are 24 hours minimum at 85°C.*

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

- 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 SL module is a scalable QFN (quad flat no lead) package, 25 x 30 mm, pitch 1.25 mm, with 74 terminals.

The SL6087 is 2.65 mm in height; the SL3010T and SL5011 are 2.5 mm in height; and the SL80xx and SL9090 are 2.4 mm in height.

The number of ground pads varies depending on the SL series variant.

PCB material is FR4; plating is NiAu (3 µm < Nickel < 8 µm and 0.05 < Gold < 0.13 µm).

For additional information, refer to the corresponding Product Technical Specification of each product as listed in section 1.2 Reference Documents.

2.2.2. Marking Description

Label/marking contents and marking methods on the module may differ between each variant of the product family. The marking method can be via paper label or laser-marking.

Common label contents include:

- Model Name
- Serial Number and IMEI or MEID Number (both letters and data matrix bar code)
- Fabrication Country
- Relevant regulatory compliance markings and identification codes (this may be a CE logo, FCC ID number, IC ID number, etc.)
- and Pin 1 indicator for solder-down modules

The examples below are not contractual and don't show the exact contents of the label. Label contents may also be moved around to fit any additional customer-specific need or market segment and can change without notice at the sole discretion of Sierra Wireless.

* Data matrix bar code

Figure 1. AirPrime SL6087 and SL8080T Product Label Example

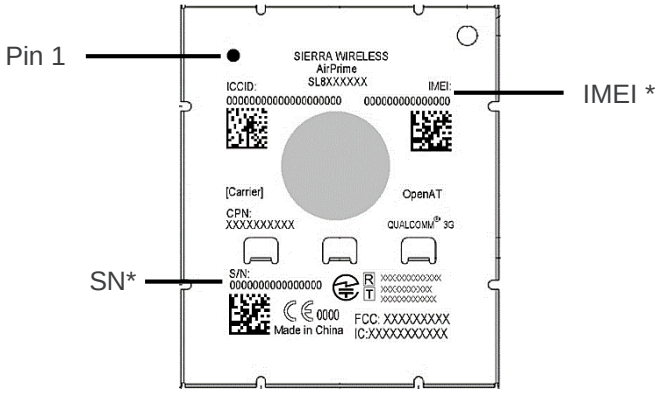

Figure 2. AirPrime SL8xxx Product Marking Example

2.3. Component Packing

2.3.1. Packing Description

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

Quantity per tape & reel is 250.

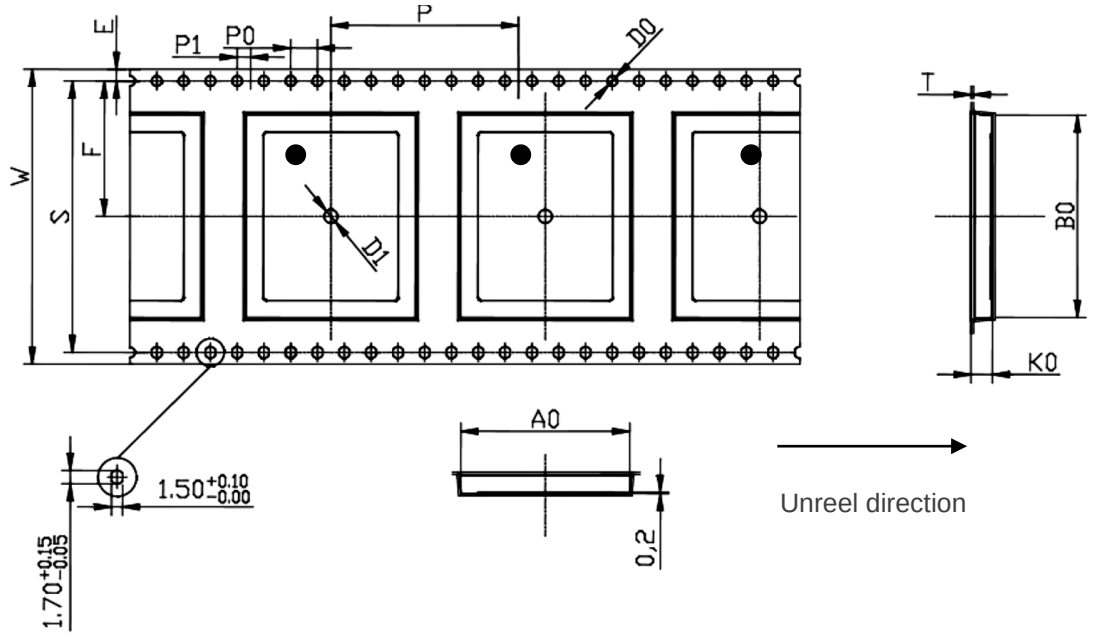

Figure 3. Packing Description

Table 1. Dimensions

P	P0	W
32.0 mm	4.0 mm	44.0 mm

2.3.2. Packing Label

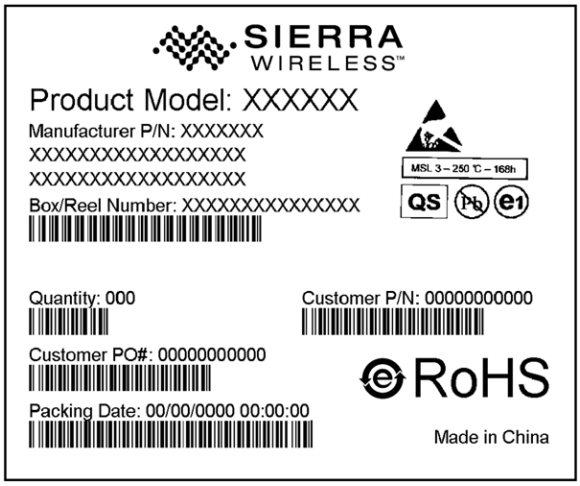

Figure 4. Packing Label

3. SMT Assembly Process

This section presents information and recommendations for the industrial assembly of the AirPrime SL Series products on the application.

Note: The SL products should be assembled by reflow process.

3.1. Lead-Free Process

In compliance with directive 2011/65/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 SL 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.

Caution: *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. Footprint

In order to produce high assembly yields and a reliable solder joint, the footprint on customer application board should match the figure presented below.

Footprint version V2d is compatible for all SL series modules.

Footprint version V2b is recommended for customers using an SL module (SL3010T, SL5011, SL80xx and/or SL9090) that don't need compatibility with the SL6087.

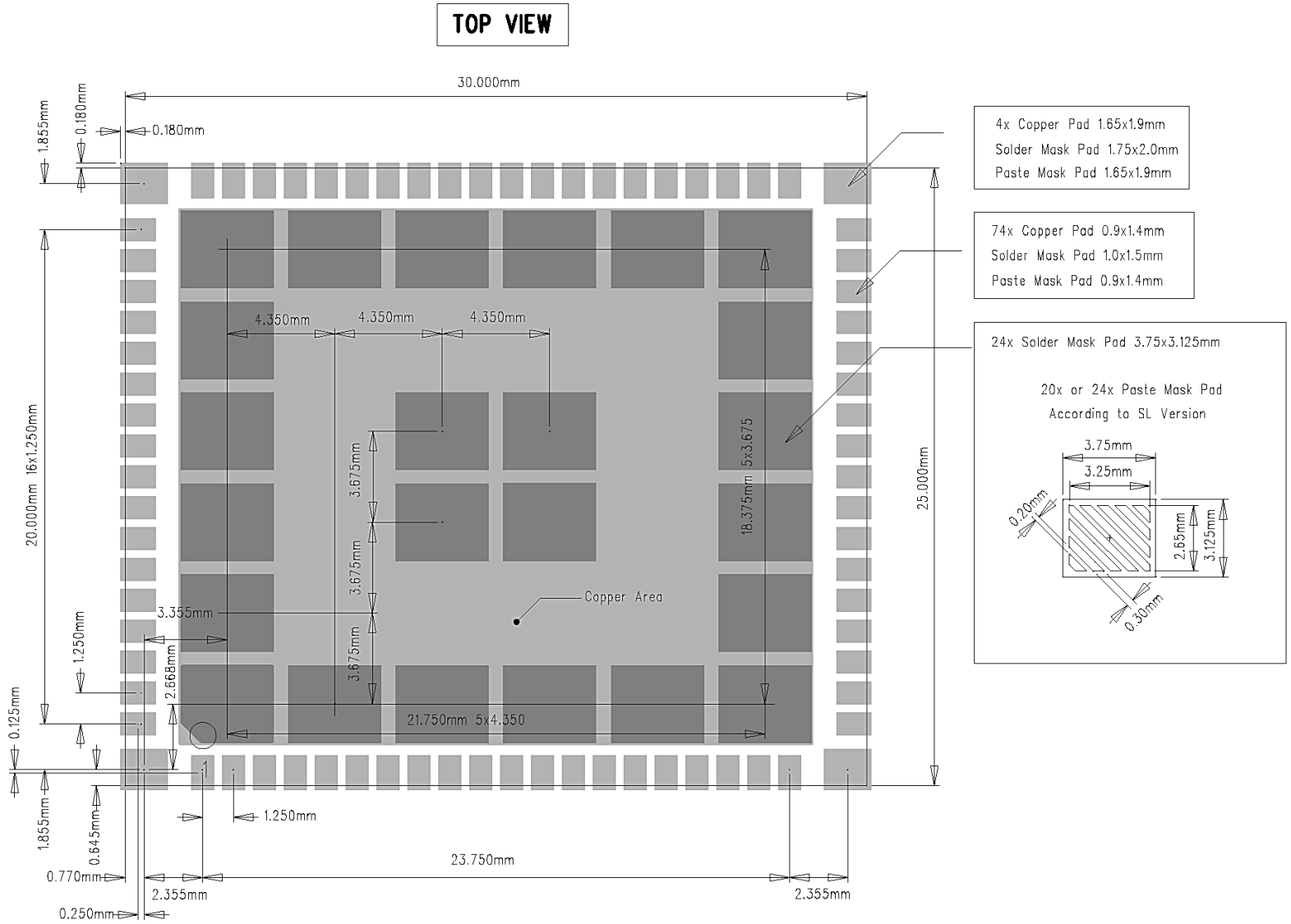

Figure 5. Pad Layout Version V2d

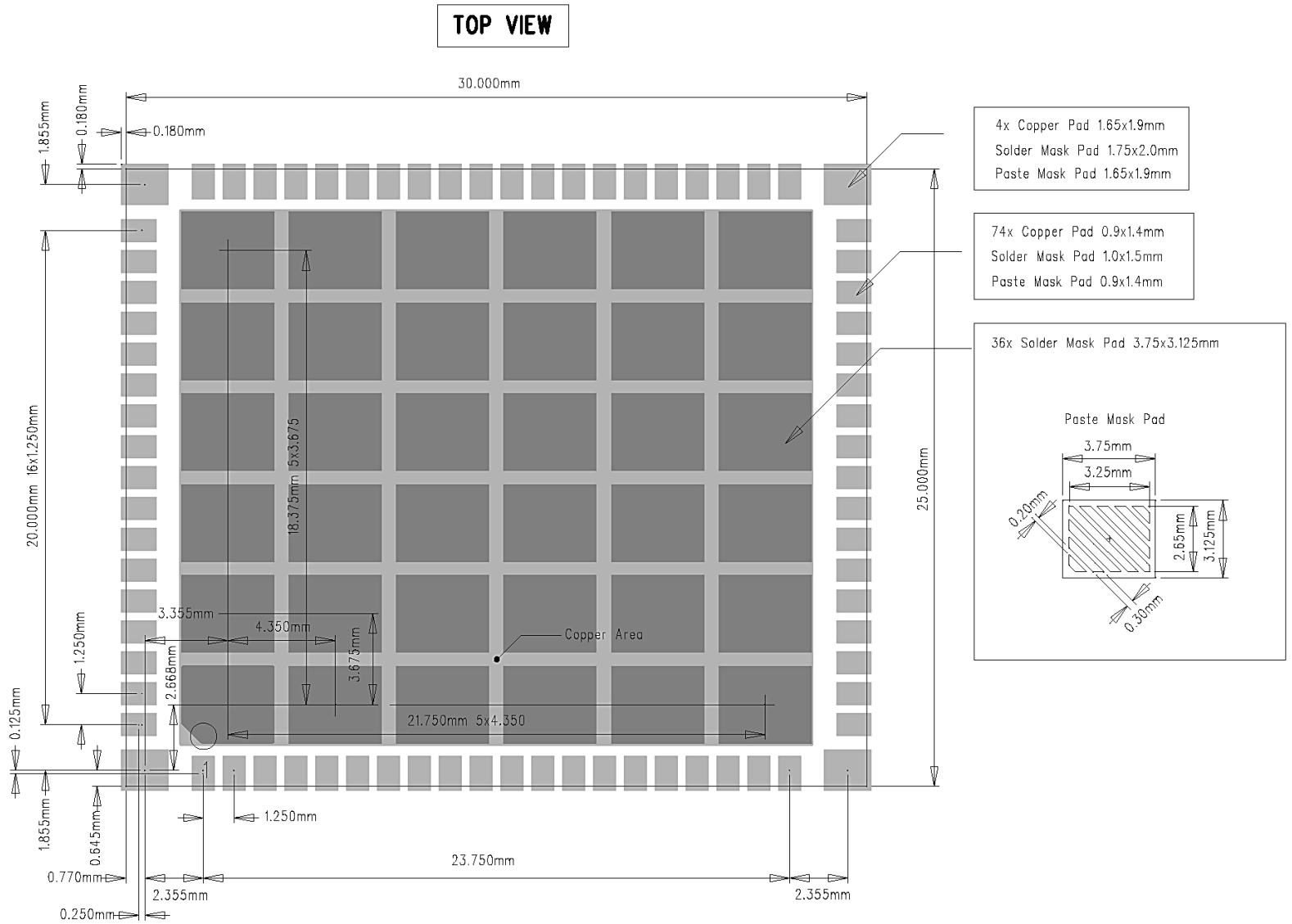

Figure 6. Pad Layout Version V2b

Note: The 24 inner pads and the 4 corner pads are ground pads.

The 4 inner pads are not soldered on the SL6087.

3.2.3. Layout Recommendations

Sierra Wireless' layout recommendations include:

- A GROUND area under the SL series module. This ground area should be a whole area of copper (shown in light grey) with proper ground vias to provide a good grounding system between the application and the embedded module and improve thermal dissipation. It should be covered by solder resist on the non-soldered area (apertures on solder resist are show in dark grey).

  The ground vias may be filled or unfilled micro-vias, If using through-holes, it is suggested to place them out of the soldered ground pads, close to each pad corner.
- Leave a component-free area of 2 mm around the AirPrime SL unit.
- Manufacturing tolerance for copper pad is ± 30 µm.
- There shouldn't be any SIGNAL trace or hole/micro-via under the AirPrime SL Series product.
- Additionally for SL6087 modules, test points should not be soldered on the customer board, and the ground vias should not be placed in the test points' location (refer to the figure below).

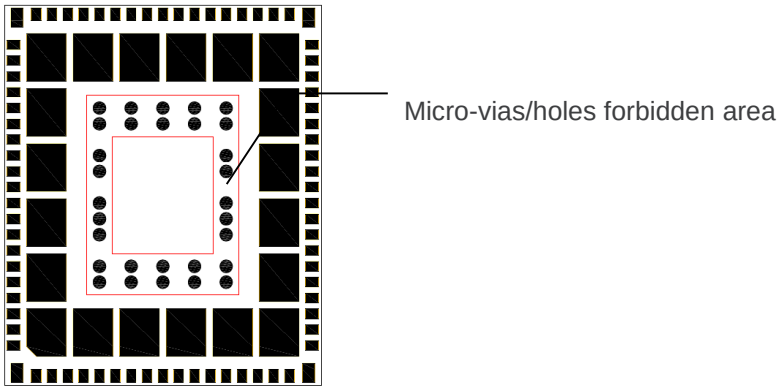

Figure 7. SL6087 Test Points Location (bottom view)

3.3. 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 external pads, 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.

For ground pads, SMD should be used if a copper ground area is under the AirPrime SL series module.

Recommended solder mask thickness on top copper is 10 to 30 µm

4. Board Mounting Guidelines

4.1. Stencil Design

The recommended stencil thickness is 125 µm.

The proposed stencil (paste mask) design is presented in Figure 5 above.

For the ground pads (3.75x3.125mm), version V2d, the stencil for SL6087 has 20 apertures, while there are 24 apertures for the other SL products. In full array matrix (version V2b), the stencil has 36 apertures.

Table 2. Aperture per Stencil

Stencil	Aperture	Ref
SL6087	20	Figure 5 (v2d)
Other SL series (SL3010T, SL5011, SL80xx and SL9090)	36	Figure 6 (v2b)
Other series that need compatibility with SL6	24	Figure 5 (v2d)

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 SL Series product.

The reflow profile has a strong impact on the void occurrence for the ground pads. A recommended profile is presented in Figure 8.

Nevertheless, 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	245°C max

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

The figure below is an example of reflow profile.

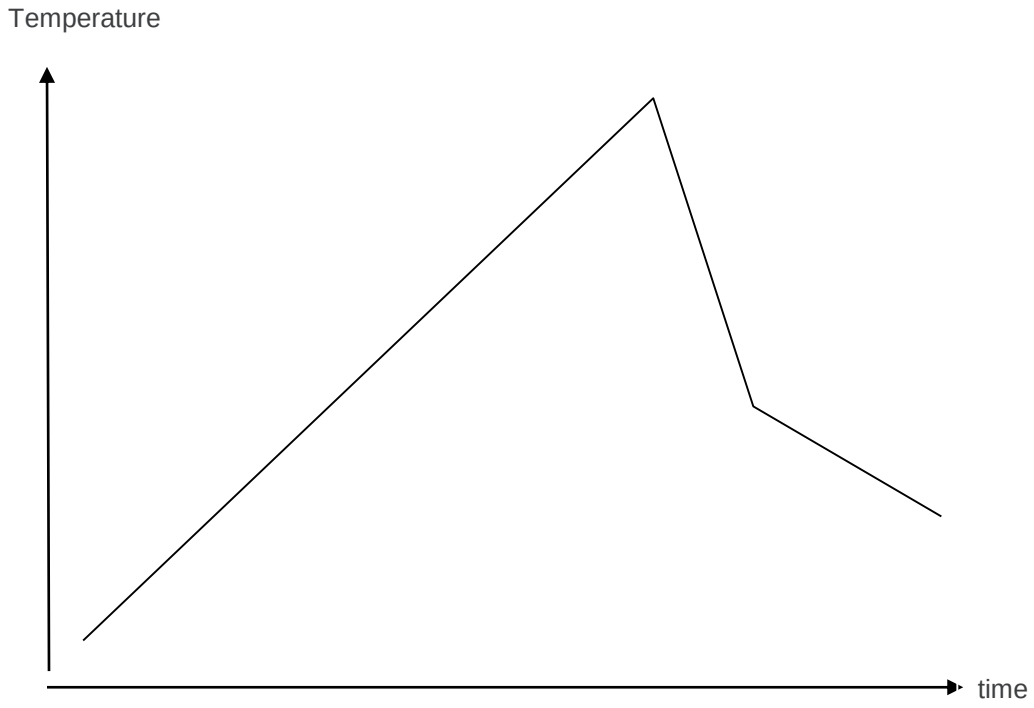

Figure 8. Recommended Reflow Profile

Additional recommendations are presented in the table below for consideration.

Factor	Recommendation
Soak time (40°C to T max)	Approximately 300 sec
Reflow time (over 220°C)	40 to 60 sec
Max temperature (C)	235 – 245°C
Cooling down slope	1 to 3°C / sec

5. 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 bake the PCB in order to remove moisture from the assembly (see JEDEC J-STD-033 paragraph 6 - Board rework. If possible for the PCB and the other components of the board, apply the same baking conditions as per section 2.1.3).

The pre-baking process will prevent damage to any component due to moisture vapor pressures caused during reflow.

Prior to removal, the metal shielding of the AirPrime SL Series product must be glued to the SL substrate by using glue able to withstand reflow profile.

5.1. Component Removal

The 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.*

5.2. 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.

5.3. 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.

5.4. 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.

5.5. New Component Soldering

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

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