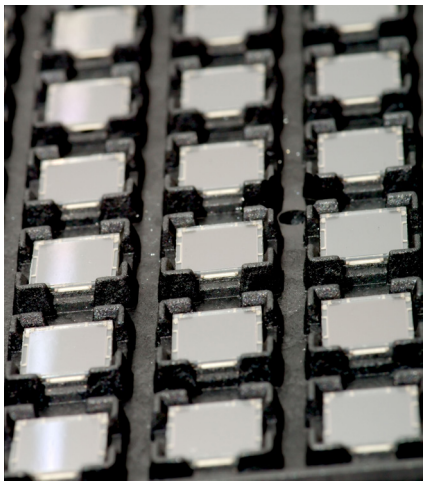
Handling and Soldering of MLP (SMT) Devices

Introduction

This document applies to the following SensL '-SMT' and '-MLP' parts:

- MicroFX*-100NN†-SMT
- MicroFX*-300NN†-SMT
- MicroFX*-600NN†-SMT
- MicroFX*-100NN†-MLP
- MicroFX*-300NN†-MLP
- MicroFX*-600NN†-MLP

** X represents one of the SensL silicon families, either C, R, B or M.*
† NN is the microcell size in microns.



This document contains information on the handling, storage and soldering of the MLP and SMT parts, as well as the schematics of the tapes and reels that they are shipped in. For the remainder of this document, 'MLP' will be used to cover all sensors that have either the MLP or SMT suffix in the part number.

Applicable Documents

IPC/JEDEC J-STD-020; IPC/JEDEC J-STD-033.

Safe Handling of Sensors

- When unpacking, care should be taken to prevent dropping or misorienting the sensors. The specific items contained in the package and the type of packaging will depend on the parts ordered.
- Remember that the SiPM is a sensitive optoelectronic instrument; always handle the sensor as carefully as possible.
- SiPM sensors are ESD sensitive. The following precautions are recommended:
    - Ensure that personal grounding, environmental controls and work surfaces are compliant with recommendations in JESD625.
    - Ensure that all personnel handling these devices are trained according to the recommendations in JESD625.
    - Devices must be placed in an ESD approved carrier during transport through an uncontrolled area.
- The sensor should be disconnected from the bias supply when not in use.
- See the 'Cleaning' section on page 3 for advice on exposure to cleaning agents.

Surface Condition

The surfaces of the clear MLPs are susceptible to damage. By following the guidance in this document, damage to the surface during the handling and assembly process can be avoided.

Excessive manual handling and contact with hard or contaminated tool surfaces will result in scratching, permanent contamination and other cosmetic damage. However, such damage to the package surface does not impact the sensor performance or reliability. This Tech Note shows that surface scratching is tolerable and has a negligible impact on the measured responsivity of the sensor.

Storage Conditions

MLP packaged devices are moisture sensitive. If not stored correctly moisture can diffuse into the package from atmospheric humidity. Surface mount soldering of the MLP packages to PCB exposes the entire package body to temperatures up to 260°C. Rapid expansion of any trapped moisture during this process could result in package cracking, delamination of critical interfaces within the package, or damaged bond wires.

To avoid this, parts are shipped in moisture barrier bags (MBB) according to the J-STD-033 standard. Unopened MBBs should be stored at a temperature below 40°C with humidity below 90%RH (Relative Humidity). After the MBB has been opened, the devices must be reflow soldered within a period of time depending upon the moisture sensitivity level (MSL). SensL MLP sensors from Tape & Reel are MSL 3 and cut tape MLP are MSL 4 (see Table 1 for details). All MLP shipped on a tray do not have an MSL rating and must be baked prior to placement on PCB. Please discuss this with your contract manufacture for their recommended baking cycle which adheres to IPC/JEDEC J-STD-20 MSL Classification. Note the temperature of the bake should not exceed the recommended operating temperature of the product listed in product's datasheet.

MLP shipping format	MSL	Exposure time	Condition	Calculated shelf life in sealed bags*	Peak package body temperature
Tape and reel	3	168 hours	≤30°C/60% RH	24 months (<40°C and <90% RH)	260°C
Cut tape and partial reels	4	72 hours	≤30°C/60% RH	12 months (<40°C and <90% RH)	260°C
Gel pack or waffle pack	N/A	Indefinite	Sensors shipped in a tray always require a bake (according to J-STD-20) prior to reflow soldering	N/A	N/A

Table 1, MSL definitions applicable to SensL MLP parts (reference J-STD-20).

** Calculated shelf life is based on the packing date at the manufacturer. This 'bag seal date' is displayed on the reel's Moisture Sensitivity Label, the location of which can be found on pages 5,7 and 9 of this document. SensL guarantees that reels will ship with a minimum of 3 months left before the expiry date of the MBB (according to the packing date and shelf life on the label).*

The parts must also be baked (according to J-STD-033, table 4.1) if any of the following occurs:

1. The parts are not reflow soldered within the applicable exposure time of opening the MBB (see Table 1).
2. The MBB is expired (according to the packing date and shelf life on the label).
3. The humidity indicator card (HIC) shows the moisture level within the MBB has increased beyond the required level.

Rebake Conditions

If any of the three conditions on page 2 occurs then a rebake is required, according to J-STD-033, table 4.1. The information in Table 2 should also be taken into account.

Condition	Rebake procedure if the exposure time exceeds the floor life expectation by...	
	> 72 hours	< 72 hours
Not on tape	33 hours at 90°C	23 hours at 90°C
On tape	13 days at 40°C	9 days at 40°C

Table 2, Rebake procedures for MLP devices on tape and not on tape.

Solder Reflow Conditions

The MLP package is compatible with standard reflow solder processes (J-STD-20) and so is ideal for high-volume manufacturing. MLP products must be mounted according to specified soldering pad patterns. Recommended solder footprints are given in the relevant product CAD, which is linked to from the datasheet (e.g. C-Series or R-Series). If the MLP part is being assembled into an array, the advice in the SMT Array Tech Note should be followed.

Solder paste (we recommend using no-clean solder paste) must be evenly applied to each soldering pad to insure proper bonding and positioning of the component. After soldering, allow at least three minutes for the component to cool to room temperature before further operations.

Solder reflow conditions must be in compliance with J-STD-20, table 5.2. This is summarized in Figure 1. The number of passes should not be more than 2.

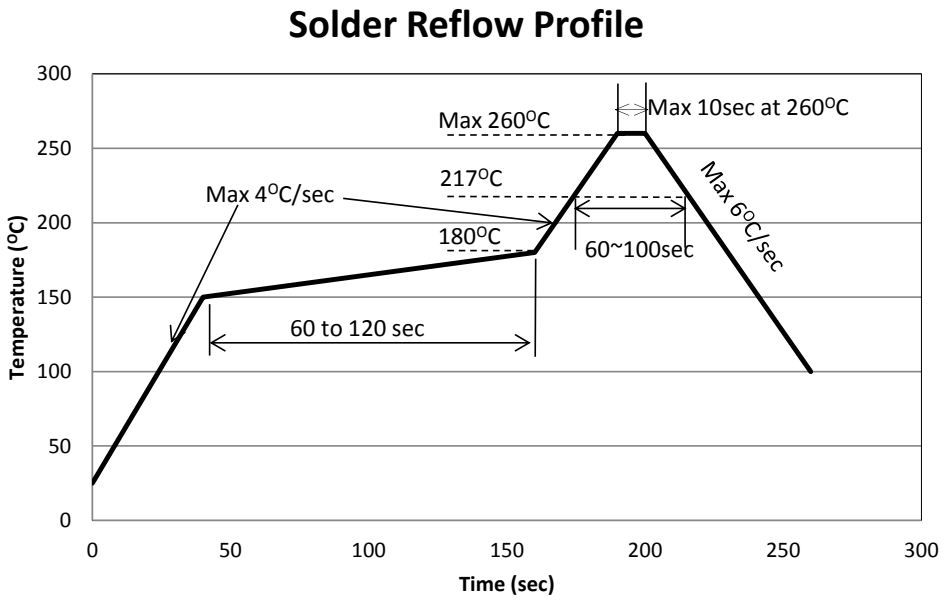


Figure 1, Solder reflow profile

Cleaning

Exposure to solvents such as **concentrated** isopropyl alcohol (propan-2-ol) or commercial flux removal fluids such as Fluxene will cause severe, irreversible damage to the MLP packages. If cleaning is necessary, a 20% solution of isopropyl alcohol can be used.

Compounds such as optical grease may be difficult to remove using only dilute isopropyl alcohol. Additional cleaning may be done by agitating with a nylon brush in warm soapy water (for example, 20% solution of a regular dish washing detergent in water at 60ºC). Drying stains from the solution can then be removed using a 20% dilute isopropyl alcohol solution. The components can be baked for up to 33 hours at 90ºC in order to dry them out. The user should take care to ensure other components built onto the PCB can withstand the cleaning and baking.

In order to minimise the requirement for such cleaning agents, we recommend using no-clean solder flux.

It is important to allow the PCB to cool to room temperature after reflow and before flux cleaning in order to avoid excessive thermal shock.

Rework of the MLP Packages

Manual rework of clear MLP packages after reflow soldering is not recommended. Manual removal of surface mount components from a PCB involves heating to temperatures above 250˚C for long periods (>60 seconds) with minimal process controls. Such treatment will result in internal damage to the package and increased failure rate. This is especially true for SiPM components made with clear mold compound due to its relatively high rate of thermal expansion.

It is possible to remove, discard and replace components where the packing density is sufficiently low to prevent excessive heating of adjacent components during removal of the component of interest. Rework of densely packed components (such as an array) can be achieved using semi-automated equipment such as Metcal APR-5000. Such equipment enables control of the reflow profile and removal of the component using a vacuum collet.

CAD FILES

Links to the full CAD files, which include the sensor CAD, the solder footprint and the tape and reel CAD, can be found in the appropriate datasheets:

C-Series datasheet

R-Series datasheet

www.sensl.com
sales@sensl.com
+353 21 240 7110 (International)
+1 650 641 3278 (North America)