

## Reflow Soldering Pressure Sensors Application Note

The information contained herein is provided as a guideline and it is not intended to replace application design efforts. It is imperative that All Sensors' customers develop and validate their own solder processes. All Sensors claims no responsibility for the use of this information nor does it accept any responsibility for the output of our customers' soldering processes.

### Introduction

Proper reflow soldering of pressure sensors, especially surface mount technology (SMT) sensors, is essential to achieving the performance specified on the data sheet and the expected lifetime of the sensor. This application note provides tips that will address many of the potential issues that users of All Sensors pressure sensors should consider during the manufacturing process to avoid problems during assembly and during the life of the sensors. It specifically addresses automated soldering of surface mount pressure sensors using lead-free solder in a convection reflow soldering process.

### Aspects to Consider in Reflow Soldering

There are many variables in the reflow solder process including the different types of reflow soldering processes themselves. The processes have included radiation, conduction, convection and condensation/vapor-phase.

In the reflow process, the PCB with its SMT components is placed on a conveyor belt that passes through a temperature reflow profile with several temperature zones. The zones can be split into phases with different times, such as: pre-heat, peak ramp up, time above liquidus temperature and ramp down. In some instances, nitrogen may be used to help wetting. The Association Connecting Electronics Industries, formerly the Institute of Printed Circuits (IPC) and JEDEC Solid State Technology Association standard IPC/JEDEC J-STD-020E provides lead-free soldering recommendations [1].

### Pressure Sensor Specific Reflow Soldering

Reference these tips and example of convection reflow soldering to use as guidelines when developing and validating your own process.

**Tip 1:** Always avoid exposing sensors with pressure ports and/or vent holes to contamination.

**Tip 2:** Prior to solder reflow assembly or other high temperature processing, pressure sensors must be baked for 1 hour at 125°C within 24 hours to remove excessive humidity. Failure to do this can result in reduced adhesion of the plastic lids and/or lid deformations. **These failures are not covered by warranty.**

**Tip 3:** The peak reflow temperature should be high enough to melt the solder and achieve a consistently good solder joint and yet peak as low as possible.

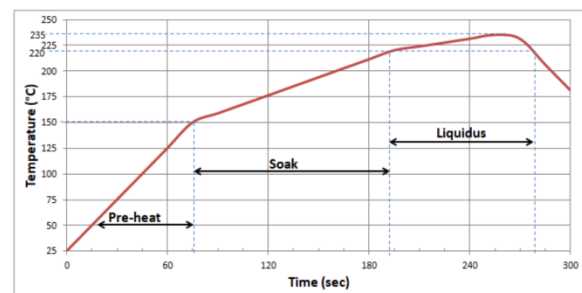
**Tip 4:** Customers should refer to their solder manufacturer's recommendation for a starting point to developing their own specific reflow profile.

**Tip 5:** Use RoHS-compliant solder alloys with tin-silver-copper (SnAgCu) that have a melting point of 217-221°C.

**Tip 6:** Prior to reflow soldering, make sure all components are placed flat onto the PCB and are level.

**Tip 7:** The temperature of All Sensors pressure sensors must never exceed 245°C.

Example of reflow profile using Lead Free solder paste with liquidus temperature of 220°C. Note, the temperature in the graph below is the temperature of the solder itself not the profile setting temperature.



## Considerations

Some Reflow solder process variables for design consideration are described below:

- Brands and models of reflow systems
- Accuracy of oven and probe calibration
- The maximum temperature the sensor is allowed to reach
- Solder paste used: Customers should refer to the datasheet of the solder paste
- Length, width, and height of the chamber area
- Proximity of the heating elements and temperature probes with respect to the sensors
  - Distance from heat element to the belt or track
  - Height of the sensor package with respect to the PCB
- Length and width of the PCBs as well as the frequency of how close the units are on the belt or track, the mass of other components on the PCB, as well as the proximity of those components to the sensor

## Troubleshooting

Customers need to validate their own equipment and reflow processes to avoid the following issues:

Table 1 Reflow Soldering Defects, Causes, and Preventions

Issue	Defect Type	Causes	Prevention
Melted Lids	Cosmetic and sometimes functional	Over temperature	Solder Profile Validation
Bubbled Lids	Cosmetic and sometimes functional	Trapped Moisture	Pre-Bake and Solder Profile
Lid Delamination	Pressure Leaks	Over temperature	Pre-Bake and Solder Profile
Poor Solder Joints	Improper device readings/output	Variety of issues (see J-STD for good definition)	Materials, environment, & proper soldering profile (see J-STD)
Adhesive Degradation	Pressure Leaks	Over temperature	Solder Profile Validation

**Tip 8:** Vapor phase reflow processes present unique challenges compared to other reflow methods. Customers should develop and validate their process carefully.

**Tip 9:** After reflow or other high temperature processes, wait for at least 48 hours (or as required by the data sheet) before performing any calibration operations.

**Tip 10:** Any cleaning process should use dry, non-corrosive air instead of steam, water or cleaning agents that may affect sensor performance. Perform spot cleaning as necessary only by hand. **DO NOT** wash or submerge device in cleaning liquid.

**Tip 11:** Manual point soldering with soldering iron and wave soldering should have a maximum temperature of 270°C and exposure duration less than 4 seconds.

## Summary

Each user/manufacturer must develop their own unique reflow profile and process. It is the responsibility of the customer to validate the output of their own soldering processes and reasonable variation in soldering process conditions and materials must be included in this validation.

## References

[1] IPC/JEDEC J-STD-020E December 2014, "JOINT INDUSTRY STANDARD Moisture/Reflow Sensitivity Classification for Nonhermetic Surface Mount Devices."