SMI Packaged Part Handling

Introduction

This application note was created to help customers with best handling practices for prevention of accidental damage to Silicon Micro-Structures Inc. (SMI) pressure sensors. SMI follows industry standards such as JEDEC, EIAJ, IPC, RoHS, and REACH when designing and manufacturing pressure sensors. For more information about these industry standards, please refer to their corresponding documentation. This application note describes many of the best methods for handling of SMI sensors, but is not all inclusive. For more information about exact part being used, please refer to the data sheet of the respective SMI sensor. If there are any questions about the application of SMI sensors, please contact the SMI sales team (sales@si-micro.com).

SMI Packaged Parts

A. General Precautions

1. **ESD Safety**

   Like many ceramic and SOIC compliant packages, SMI sensors are susceptible to Electrostatic Discharge (ESD). Therefore SMI suggests creating a certified Electrostatic Discharge Protected Area (ESA) when handling SMI sensors. Please use ESD compliant equipment when testing, using, and moving or handling SMI sensors to prevent parts from being damaged by ESD. At minimum an ESD band and grounding surface mat should be used when working with SMI pressure sensors. Refer to Association Connecting Electronics Industries (IPC) document IPC-A-610 for details.

2. **Package Handling**

   SMI sensors fit within JEDEC industry footprint standards of wide body SOIC-16, SOIC-8, and SMI CerDip packages. JEDEC industry standards of handling should be applied to use of SMI sensors. When using SMI sensors take caution as to not bend or break sensor leads. Breaking or bending leads can cause inability to use the sensor. Proper handling will ensure that the sensor gives accurate readings.

   For package dimensions, please refer to sensor data sheet for the external dimensions of the package. Some SMI packages have long ports, for these packages

do not apply force beyond maximum side load force. For sensor maximum side load force, please refer to sales team at sales@si-micro.com. For the soldering footprint, please refer to SMI footprint package App Note (#40AN0005).

3. **Shipping Packaging**
   SMI uses both tubes and reels to ship sensors to customers. All SMI sensors are shipped with ESD safe packaging material to prevent against ESD. Both tubes and reels help prevent damage and issues with delivery.

4. **Storage Temperatures**
   SMI sensors should be stored in a dry environment. Storing sensors at temperature outside of the storage temperature range may cause parts to become damaged. For the sensor's storage temperature range, please refer to the respective sensor data sheet. SMI complies with the industry standard moisture sensitivity level (MSL) ratings. SMI sensors are compliant with MSL 1 or MSL 3. Please check the data sheet or the shipped sensor packaging for the appropriate MSL ratings.

B. Operation Recommendations

1. **Applied Pressure**
   SMI sensors are sensitive to overpressure. Therefore applying pressure outside of the specified sensor range may damage the device. The respective sensor data sheet lists limits for both proof pressure and burst pressure. Pressure applied directly or indirectly can affect performance and damage the sensor. Uncontrolled pressure may flex sensor die beyond burst pressure and cause the sensor die to break. Caution should always be taken when applying pressure to a sensor as to prevent a surge in unwanted pressure.
   Please refer to the exact product data sheet to determine the appropriate pressure range for the SMI sensor.

2. **Air Quality**
   SMI parts are specified for clean dry air only. When using SMI parts ensure that the system does not allow contaminates. Chemical residues from vapors or liquids can cause contamination. If clean dry air is not used, small particles can accumulate within sensor. Depending on the material of these contaminates, the overall performance of the sensor may degrade over time. Debris and large particles can damage sensor membrane and alter part performance. Please ensure only clean dry air is used when using SMI pressure sensors to prevent damage and to facilitate accurate readings. If the use of non-clean dry air is needed, backside pressure may be applied to certain SMI sensors. Please contact SMI sales team to determine which sensors can be used in this method.

3. **Supply Current/Voltage**
   All SMI sensors have a specific operating supply voltage and supply current. Operating the sensors outside the maximum ratings for supply voltage and supply current can cause permanent damage to the device. SMI's sensor families are specified for a variety of voltages and currents. Please refer to the SMI data sheet of the sensor to determine the appropriate supply voltage and current.

C. Soldering and Mounting

1. **Soldering Temperature and Profile**
   SMI sensors are RoHS compliant. The JEDEC compliant solder reflow profile for lead-free packages is recommended. This reflow soldering profile can be used on SMI's SOIC-16 and SOIC-8 packages. SMI suggests using this industry standard when applying SMI sensors into user's systems. Users may optimize their own parameters to achieve the desired reflow outcome. SMI assumes no responsibly for adjustment outside of industry compliant specifications. Refer to the JEDEC J-STD-020D for complete details (http://www.jedec.org/download/search/jstd020d.pdf). The chart and graph below show the suggested reflow solder profile and parameters for SMI sensors.

JEDEC J-STD-020D.1 Table 5-2 is reproduced here. Figure 5-1 describes the various zones of heating.

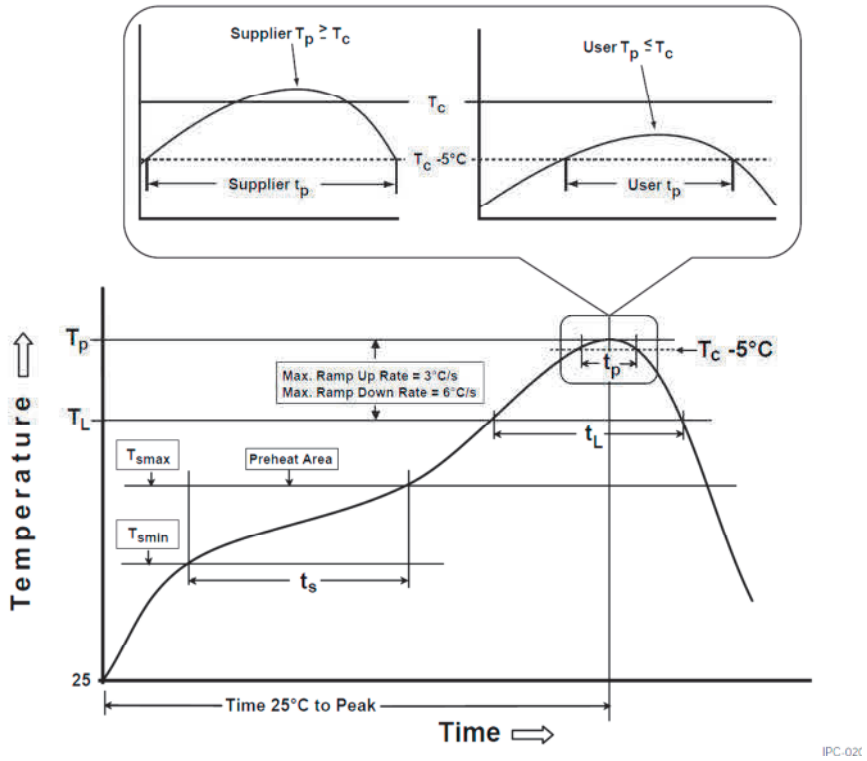

Figure 5-1 - Solder Temperature Profile.

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak Temperature Min (T_{smin}) Temperature Max (T_{smax}) Time (t_s) from (T_{smin} to T_{smax})	 100 °C 150 °C 60-120 seconds	 150 °C 200 °C 60-120 seconds
Ramp-up rate (T_L to T_p)	3 °C/second max.	3 °C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body temperature (T_p)	For users T_p must not exceed the Classification temp in Table 4-1. For suppliers T_p must equal or exceed the Classification temp in Table 4-1.	For users T_p must not exceed the Classification temp in Table 4-2. For suppliers T_p must equal or exceed the Classification temp in Table 4-2.
Time (t_p)* within 5 °C of the specified classification temperature (T_c), see Figure 5-1.	20* seconds	30* seconds
Ramp-down rate (T_p to T_L)	6 °C/second max.	6 °C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.		

Table 5-2 - SMI RoHS Solder Parameters.

For more information on SMI RoHS, please refer to SMI document 40SP0115.

2. PCBA Mount

When using surface mounting SMI SOIC or SMI CerDip through-hole packages, the use of No-Clean (NC) flux is recommended. Using No-Clean flux will prevent the need of cleaning by pressure spray or other cleaning methods. These methods of post soldering cleaning may damage the sensor. If cleaning of PCB is needed, water soluble flux can be used. It is recommend that sensor hole or port is covered to prevent contamination and damage. SMI does not suggest rework of surface mounted sensors, but if required, manual de-soldering is suggested to prevent damaging of sensor. Be careful as to not to exceed the temperature range of the part. This may melt package components or damage the sensor die. Please ensure that the sensor package properly sits within the PCB footprint to achieve proper connection. For soldering footprints, please refer to SMI footprint package App Note (#40AN0005).

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