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Guidelines for MEMS pressure sensor assembly process

1 Introduction

This document gives general guidelines for soldering and assembling a MEMS pressure sensor. This is adapted to the product series of MEMS pressure in LGA package forms, like PBM200 and PBM210. Owing to the pressure sensor is born to stress sensitive, proper precautions should be adopted and kept in mind. The MEMS pressure sensor can sense the pressure applied on the sensing device surface and transfer it to digital signals. Except for the stress resulted from pressure, unexpected stress was introduced through mechanical coupling. It is expected that the performance and accuracy of sensor are degraded. This document try to give some hints so the sensor could perform as it is.

2 Soldering guidelines

According to IPC/JEDEC standard J-STD-020, the PBM210 was classified as MSL 1 (moisture sensitivity level). The devices should be treated properly as the requirement of J-STD-030 (Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices).

The device is compatible with Pb-free soldering process and can withstand 260°C peak temperature. There are several figures and tables as the followings picked from J-STD-020 standard. This could be a guide to solder reflowing process. Moreover detailed information is available through referring to the document of J-STD-020 standard.

Mechanical stress coupled with PCB board could influence the accuracy of the sensor and result in offset shift. Therefor the thickness of the solder after reflowed to be 50µm at least is urged to minimize the mechanical coupling.

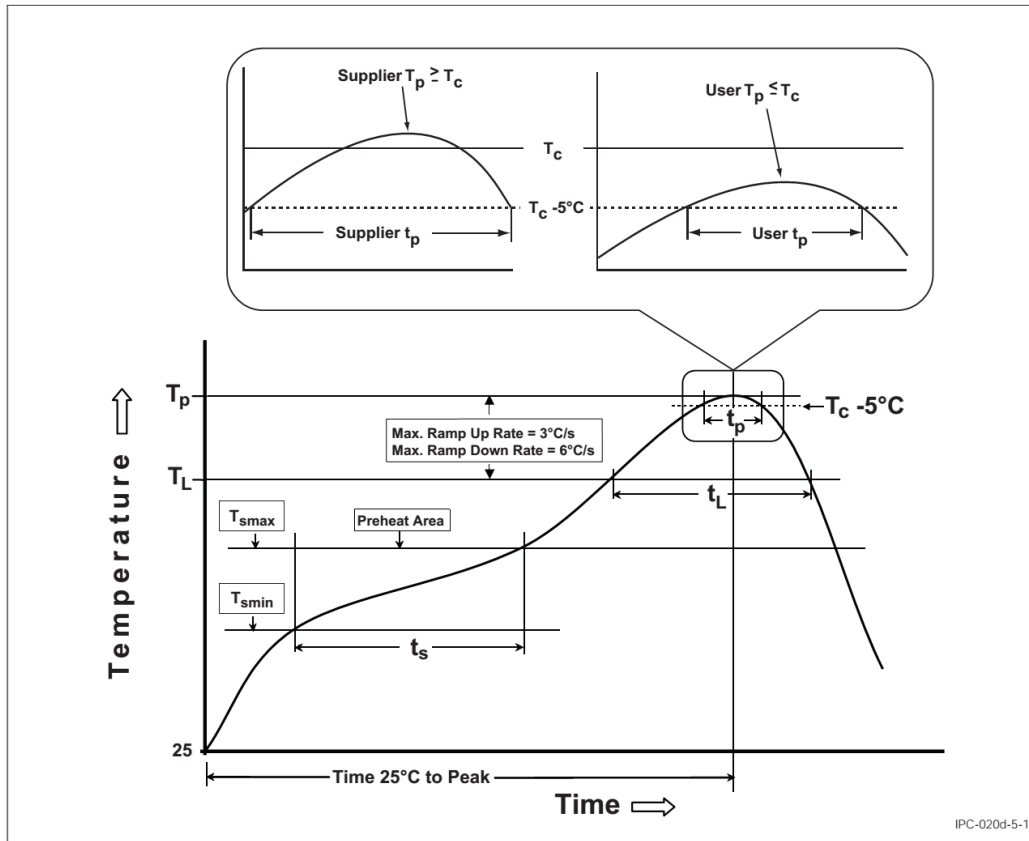


Figure 5-1 Classification Profile (Not to scale)

Table 5-2 Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak		
Temperature Min (T_{smin})	100 °C	150 °C
Temperature Max (T_{smax})	150 °C	200 °C
Time (t_s) from (T_{smin} to T_{smax})	60-120 seconds	60-120 seconds
Ramp-up rate (T_L to T_p)	3 °C/second max.	3 °C/second max.
Liquidous temperature (T_L)	183 °C	217 °C
Time (t_L) maintained above T_L	60-150 seconds	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.		

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Table 4-1 SnPb Eutectic Process - Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 4-2 Pb-Free Process - Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ 350 - 2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

There is a venting hole on the metal lid of the sensor for measuring air pressure. In order to make sure the sensor to work properly. Several key points have to be reminded as the followings:

- No clean flux is recommended for soldering process.
- Liquid came into contact with the sensor through venting hole may cause the sense to be out of order.
- In case of cleaning or washing was needed, the device shall be protected properly to prevent liquid penetrating through venting hole.

3 Assembly and mounting recommendations

The MEMS pressure as PBM series is a precision digital pressure measurement device. High stress sensitivity contribute to air pressure sensing but also be influenced easily by stress came from the sensor package. Following the given recommendations helps to achieve the specified performance:

- Considering the product housing design, it is necessary to keep ventilation of the sensor after assembling.
- The clearance above the metal lid should keep 0.1mm as least.
- Prevent liquid to come into contact with the sensor.
- The pressure sensor chip is sensitive to light and the accuracy of the sensor can be influenced. The position of venting hole was designed to minimize this effect. But it is still recommended to prevent light exposure of the sensor.
- Regarding PCB layout design, make sure the sensor away from high power and fast heating components.

4 Storage

- This device is moisture/reflow sensitive. While handling and use this device, please follow the instruction of JEDEC standard J-STD-033B.
- The shelf life is 5 years while kept in dry packing by device manufacturer.

5 Document history and modification

Rev.	Description	Date
0.1	First edition (Preliminary)	2014/6/25
1.0	Added: Notices of device storage	2015/5/26
1.1	Modified:	2015/10/29

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