Application Note

NOVOSENSE

Welding of MEMS Pressure Sensor

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ABSTRACT

The pressure sensors of NOVOSENSE are high-precision products, and attention should be paid to the welding specifications. Due to the compact structure and limited thermal capacity of the product, it is necessary to avoid the influence of surrounding thermal. Thermal deformation may damage the sensor or weaken its performance. Besides, it's also very important to prevent the flux from entering the product during welding process.

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1.Introduction

Product packaging of NOVOSENSE pressure sensors is divided into SMD (surface mounted devices) and DIP (dual inline packaging). Welding methods can be divided into manual soldering, wave soldering and reflow soldering. Wave soldering is used to solder DIP devices, and reflow soldering is used to solder SMD chips.

2.Classification of welding methods

The recommended welding methods of the NOVOSENSE's existing pressure sensors:

Table 2.1 Welding Classification

Welding Method	Product Name
Manual Soldering	All
Wave Soldering	NSPGD1
Reflow Soldering	NSPDSx, NSPGS5, NSPGS2

3.Manual soldering

The joints of components and parts need to be welded, and the quality of welding has a great impact on the quality of production. Before welding, one of the advance preparations is to treat the electronic components. Soldering components with electric soldering iron is a basic assembly process, which is important in ensuring the quality of electronic products.

3.1. Welding precautions

a)The welding should preferably adopt rosin, rosin oil or acid free flux. Do not use acid flux, or the welding place will be corroded.

b)Install the capacitor on the power terminal of the sensor and stabilize the power supply voltage to maintain the superimposed noise resistance. It is recommended to adopt 100nF in parallel. Before welding, refer to the ESD enhancement application circuit design of each product specification.

c)The operating temperature of the soldering iron head needs to be between 260 °C and 300 °C (30 W), and the welding time of contact with the product pins should be within 5 seconds.

d)Keep the welding position and soldering iron head clean.

e)If the product needs to be reworked, please complete the rework in one go. Keep the temperature of the solder head below the standard stated in the specifications. When reworking, use a flat solder head and do not add flux.

3.2. Good solder joint appearance

a)The surface of welding joints with good welding quality should be clean, smooth and has metallic luster. If there is dirt on the surface and residue after welding, it may corrode the lead wire, bonding pad and printed circuit board of components. If moisture is absorbed, it may cause a local short circuit or leakage accident.

b)The surface of the solder joint should be free of burrs, gaps, dragging tin, etc. Otherwise, it will affect the aesthetics of the solder joint, bring unexpected harm and even produce tip discharge with high-voltage circuits, resulting in damage to electronic products.

c)There should be no abnormality on the surface of the solder joint, or it may cause false soldering of the solder joint,making the joint unreliable.

d)Lap welding and touch welding are not permitted in order to prevent a short circuit.

e)The amount of solder should be appropriate, neither too much nor too little. The surface of the solder joint should be flat with a semi-bow concave, the junction of the weldment should be a smooth transition, and the contact angle should be small. Only in this way can it be a qualified solder joint.

4.Wave soldering

4.1. Welding precautions

a)Please keep the wave solder tank temperature below 255 °C and complete the soldering within 5 seconds.

b)Since the MEMS pressure sensor is sensitive to temperature, it is recommended to verify the parameters of the wave soldering equipment in small batches, and then produce in large quantities after confirming product performance.

Table 4.1 Wave Soldering Parameters

Wave Soldering Condition		Lead–free Assembly
Preheat	Temperature (Min)	110°C
	Temperature (Max)	130°C
	Time (min to max)	60~120s
Preheat average Ramp-up Rate		1~3 °C/s
Wave soldering Peak Temperature		250~255°C
Time of Peak Temperature		<5s
Chain speed		1000~1300mm/min

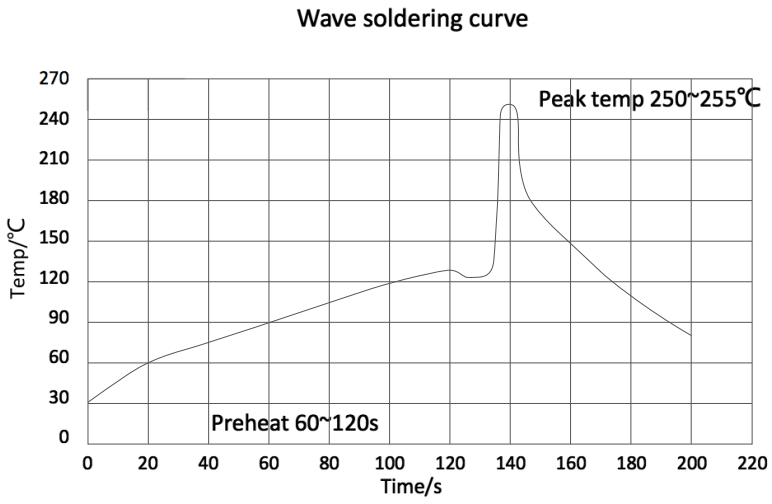

Figure 4.1 Wave Soldering Curve

4.2. Rework soldering

a)Please use the 260~300 °C soldering iron tip to complete the repair in one go.

b)Electrostatic protection should be provided during repair, and the sensor pins should not be directly touched by hands to prevent electrostatic damage.

5.Reflow soldering

5.1. Welding precautions

a)Please keep reflow temperature below 240°C.

b)Since the MEMS pressure sensor is sensitive to temperature, it is recommended to verify the parameters of the wave soldering equipment in small batches, and then produce in large quantities after confirming product performance.

Table 5.1 Soldering Parameters

Reflow Condition		Lead–free assembly
Preheat	Temperature Min (Ts)(min)	150°C
	Temperature Max (TS)(max)	180°C
	Time (min to max) (TS)	60 – 150 s
Average Ramp-up Rate (Liquidus Temp) (TL) to peak		2°C/s (max)
TS (max)to TL – Ramp-up Rate		2°C/s (max)
Reflow	Temperature (TL) (Liquidus)	210°C
	Time (min to max) (TL)	60 – 120 s
Peak Temperature (TP)		240°C
Time within 5°C of actual peak Temperature (TP)		12 – 30 s
Ramp-down Rate		6°C/s (max)
Time 25°C to Peak Temperature (TP)		230 s (Max)
Do not exceed		240°C

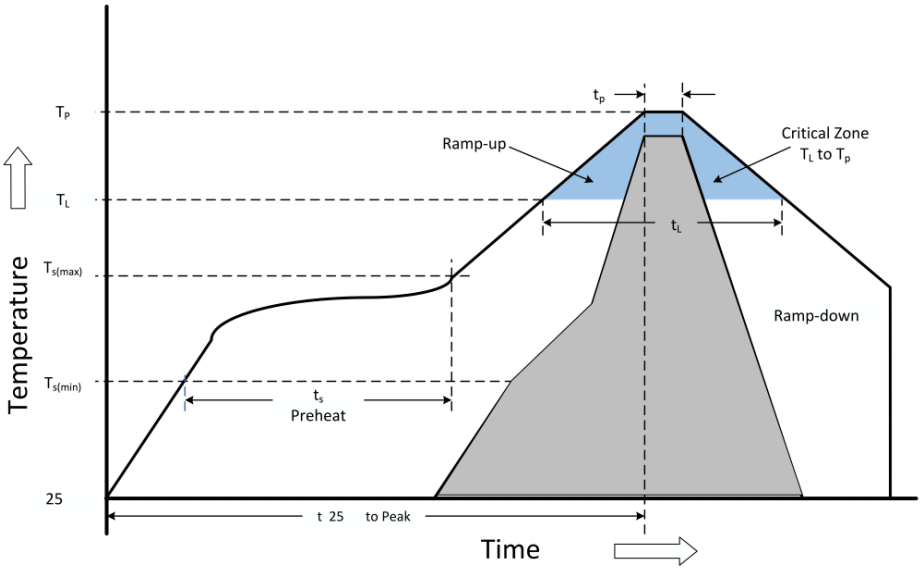

Figure 5.1 Reflow Soldering Curve

5.2. Rework soldering

a)Please use the 260~300°C soldering iron tip to complete the repair in one go.
b)Electrostatic protection should be provided during repair, and the sensor pins should not be directly touched by hands to prevent electrostatic damage.

6.Storage requirements

a)Before and after welding, try to install a static bag and an anti-static turnover box for storage, so as to avoid the direct exposure of pins to the air, and prevent the oxidation of products.
b)The products must be stored in a clean, ventilated warehouse without corrosive gas. The indoor temperature should be about 25 °C, and the relative humidity should between 20% and 70%, the lower the better. However, considering the electrostatic protection ability, this can be reduced to a certain extent. For products with different humidity sensitivity requirements, the humidity requirements will differ and should be considered differently.
c)Material stacking requirements: only one kind of material can be placed on a pallet. It is forbidden to stack things directly on the material so as to prevent the weight from crushing the product.

7.Case sharing

NSPDS5 products pass the reflow curve that meets the welding requirements and the too-high reflow curve respectively. The retest accuracy at room temperature after reflow is as follows:

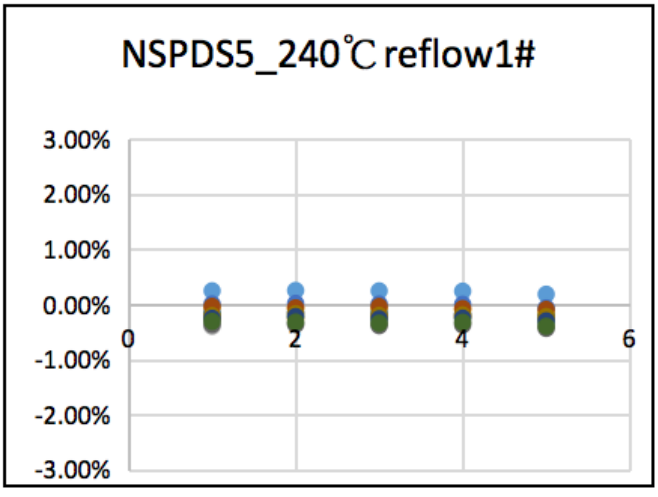

Figure 7.1 Test retest accuracy with standard temperature reflow

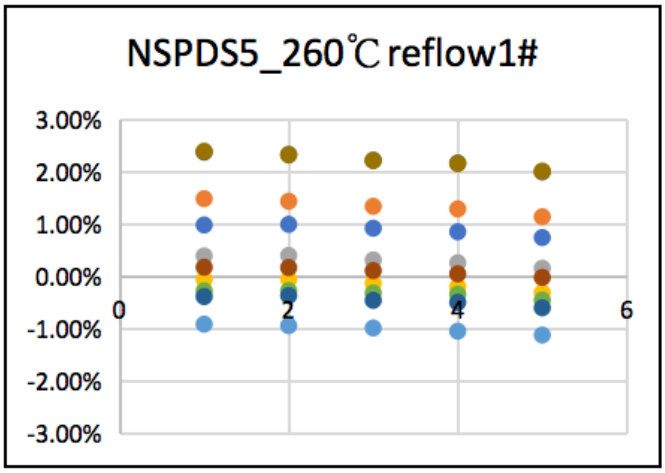

Figure 7.2 Test retest accuracy at reflux above standard temperature

In conclusion, the unqualified reflux welding can affect the product precision error.
(Experimental product No: NSPDS5F001DT02)

8.Revision history

Revision	Description	Author	Date
1.0	Initial version	Eddie Lv	2023/08/22

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