Assembly Note

Reflow at high temperature

Rev.0.1

This assembly note is dedicated to specific assembly of Silicon Capacitors, with two or more pads, as well as IPD (Integrated Passive Devices), by reflow with high temperature soldering material. By high temperature, we consider materials with a liquidus point over 250°C. For more information about general reflow procedures for Silicon Capacitors, please have a look at the Assembly Note “Silicon Capacitors assembly by reflow”. This document is non-exhaustive. Customers with specific attachment requirements or attachment scenarios that are not covered by this document should contact Murata Integrated Passive Solutions (mis@murata.com).

1. Introduction

The general way of working presented in the Assembly Note “Silicon Capacitors assembly by reflow”, remains valid for high temperature except for the soldering material that will be presented in this document. So please be sure to also have this document available with you.

Especially for the manual handling of Silicon Capacitors, metal tweezers cannot be used even for high temperature applications. Please refer to the dedicated application “Recommendations to handle bare dies”.

2. Soldering material selection

Murata suggests Gold-Tin eutectic (Au80Sn20) solder paste to assemble Silicon Capacitors by reflow, please find more details in the next section. However, for some specifically authorized applications, Lead-Tin (Sn5Pb95) usage is also possible and described below.

For other materials or for other assembly procedures related to high-temperature, for instance non-eutectic gold-tin alloys, please read carefully your reference datasheet, the material usage notice to define your own reflow profile and contact Murata.

If your application doesn’t have any high-temperature or high-reliability requirements, Murata advises to use regular reflow with SAC305 or equivalent, described in the Assembly Note “Silicon Capacitors assembly by reflow”.

3. Reflow process using high-temperature material

High-temperature reflow needs to be achieved above 300°C due to elevated liquidus points of the materials. Also, solder pastes dedicated to those applications contain specific fluxes. Please don’t mix high-temperature related materials with materials suitable for lower temperatures during reflow.
Flux removes oxidation, maintains surface cleanliness and facilitates solder spread during attachment operations. The flux must be compatible with the soldering temperature and soldering times. In case of water soluble flux, please refer to the solder paste supplier for the cleaning and flux removal. Flux residues could be responsible for current leakage or short circuits. For optimum results, clean the circuits immediately after reflow.

Murata recommends convection reflow but vapor phase reflow and infrared reflow could be also used. The reflow must be carried out in accordance with the JEDEC standards.

3.1. Gold-Tin eutectic solder paste (Au80Sn20)

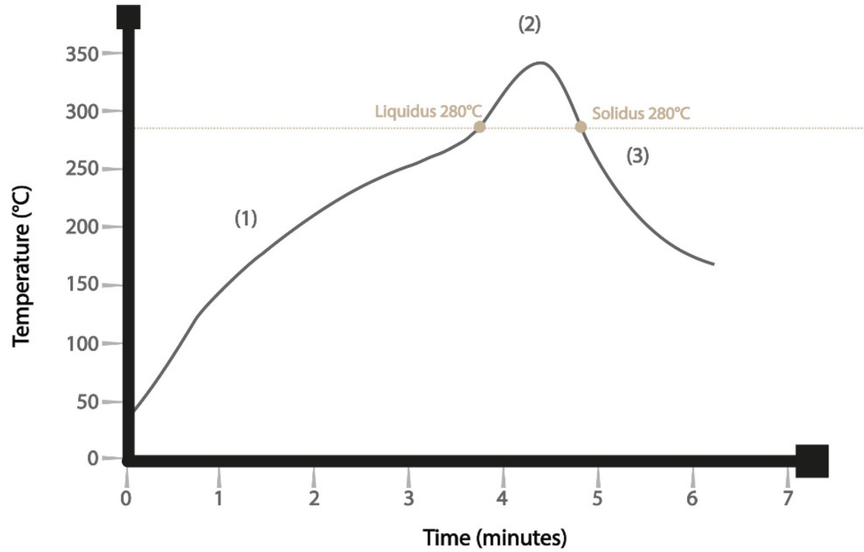

Figure 1: Au80Sn20 advised profile for reflow

This alloy has a liquidus/solidus point at 280°C. Please see Comments on reflow profiles section below for additional information. Values included in the comments section will prevail on the chart.

3.2. For authorized applications only, Tin-Lead (Sn5Pb95)

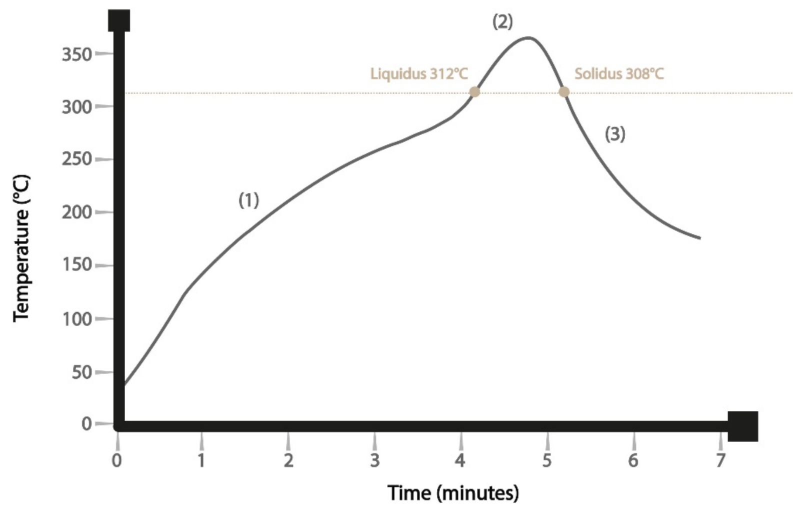

Figure 2: Sn5Pb95 advised profile for reflow

This alloy has a liquidus point at 312°C and a solidus at 308°C. Please see Comments on reflow profiles section below for additional information. Values included in the comments section will prevail on the chart

3.3. Comments on reflow profiles

Those profiles will serve as a general guidelines in establishing a reflow profile for your process when using a forced air convection oven. Other reflow technologies including, but not limited to infrared, hot plate or induction, may require significant changes as may varying board geometry's and densities.

Heating Stage (1):

A linear ramp rate of 1–2°C/second allows gradual evaporation of volatiles and helps minimize defects such as solder balling/beading and bridging as a result of hot slump. It also prevents unnecessary depletion of fluxing capacity when using higher temperature alloys.

Liquidus Stage (2):

A minimum peak temperature of 40–50°C above the melting point of the solder alloy is usually needed to achieve excellent wetting and spread to form a quality solder joint. The time above liquidus (TAL) should remain between 45 and 80 seconds. A peak temperature and TAL above these recommendations can result in excessive intermetallics formation that can decrease solder joint reliability and lead to increased difficulty in repair on precious metal surfaces. A ramp rate of 2.5 to 3.5°C/second from liquidus to peak temperature is recommended to quickly reach the peak. A ramp rate of 2 to 3°C/second from peak temperature to solidus is also recommended.

Cooling Stage (3):

This stage refers to the temperature range from peak temperature to approximately 50°C below the liquidus temperature where the cooling rate has a negligible effect. A rapid cool down between 2 and 3.5°C/second is desired to form a fine-grain structure. Slow cooling will form a large-grain structure, which typically exhibits poor fatigue resistance. If excessive cooling of >4°C/second is used, both the components and the solder joint can be stressed due to a high CTE mismatch.

4. Cleaning after reflow

Murata advises to use soft cleaning products, even for high-temperature soldering materials. No clean is also an option. If a cleaning is necessary after reflow, water-based cleaning is highly preferred. For optimum results, clean the circuits immediately after reflow. For more questions, please contact Murata.

Revision history

Revision	Date	Description	Author
0.1	<31/03/2021>	<Document creation>	<C Muller>

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