AN6280

Application note

Guideline and mounting instruction for STMicroelectronics STPAK sintering process

Introduction

The STPAK package is intended to be assembled with an innovative process called "sintering" that allows excellent performance in terms of electrical and thermal resistivity (by far much better that any Pb or Sn alloy soldering).

The sintering process is based on silver nanoparticles compenetrating under temperature and pressure. To facilitate this process, it is recommended that both surfaces involved in the bonding are silver finished.

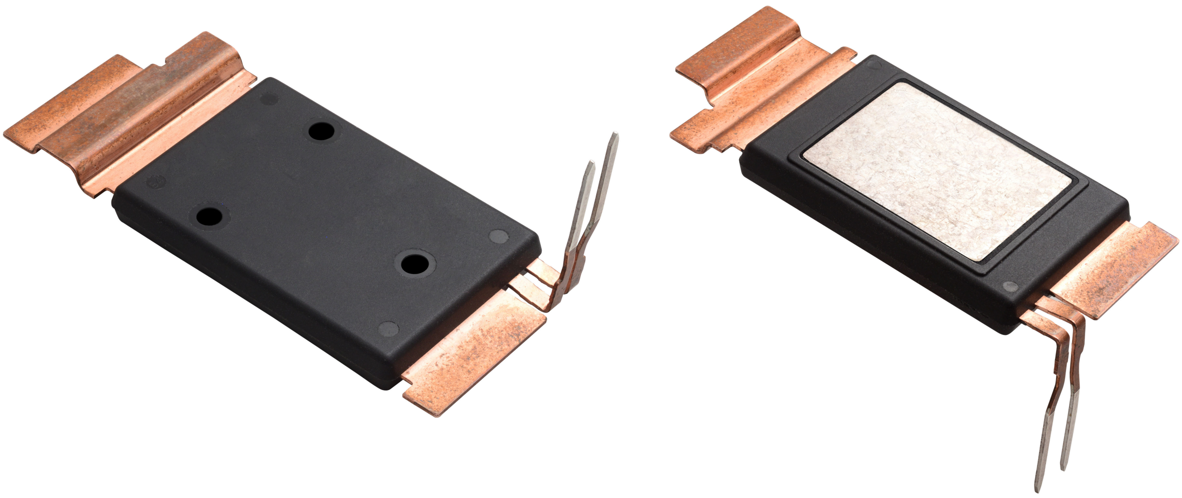
This note presents general guidelines and suggestions for robust and reliable sintering assembly of the STPAK packages, especially proper sintering temperature profile and relevant advantages.

1 Package description

1.1 Package description

STPAK is one of the newest STMicroelectronics packages (Figure 1). Being especially designed for the automotive domain and specifically for traction inverter, it is thought to be mounted through innovative mounting techniques. STPAK is designed to be assembled through sintering onto a dissipating plate that is part of a more complex cooling system (that is liquid cooling). Backside soldering is not part of this application note, but being a feasible option, is described in a dedicated note. Package sintering process it confirmed to emphasize thermal performances as well as superior reliability under temperature swing. For this reason, ST recommends sintering mounting as the preferred solution for STPAK.

Figure 1. STPAK packages in its typical design



1.2 Thermal performance

The thermal resistance of a semiconductor assembly is the parameter that characterizes its resistance to the heat flow generated by the junction during operation. A temperature exceeding the maximum junction temperature curtails the electrical performance and may damage the device. STPAK is designed and best used with liquid cooling systems.

The maximum dissipated power capability is:

$$Pmax. = \frac{T_{jmax.} - T1}{R_{th(j-l)}} \quad (1)$$

Where:

- $T_{j\ max.}$ is the maximum junction temperature of the semiconductor in degrees Kelvin (K)
- T_l is the liquid temperature in degrees Kelvin (K)
- $R_{th(j-l)}$ is the thermal resistance between the junction and liquid (K/W). $R_{th(j-l)}$ considers all materials between the junction and liquid.

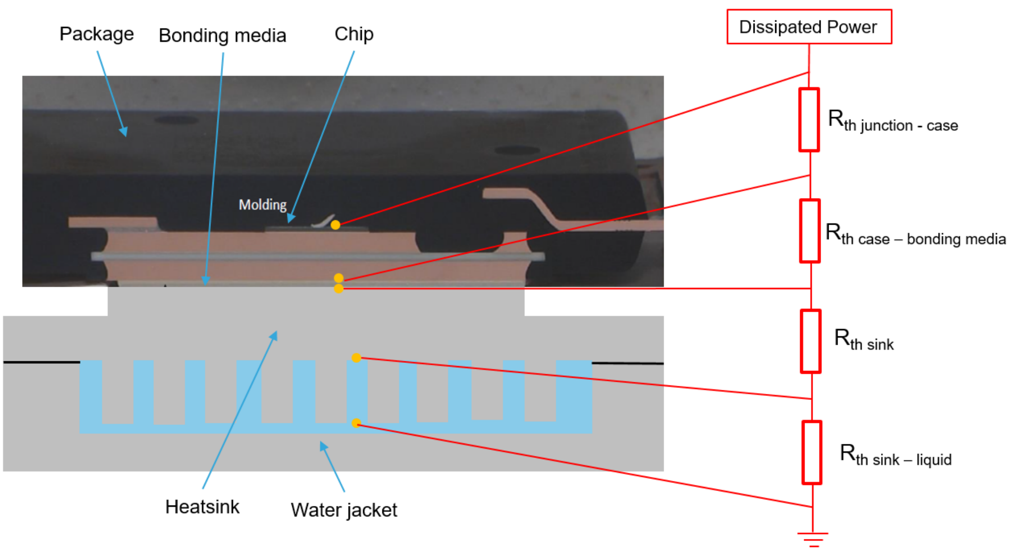
The overall thermal performance of a package with a heatsink is characterized by a junction-to-liquid thermal resistance R_{thJ-L}. The R_{thJ-L} can be calculated with the following equation (see Figure 2):

$$R_{th(J-L)} = R_{th(J-c)} + R_{th(c-s)} + R_{thS} + R_{th(S-L)} \quad (2)$$

Where:

- R_{thJ-L} is the thermal resistance junction-to-liquid (K/W)
- R_{thJ-C} is the thermal resistance junction-to-case (K/W)
- R_{thC-S} is the thermal resistance case-to-sink (K/W)
- R_{thS} is the thermal resistance sink (K/W)
- R_{thS-L} is the thermal resistance sink-to-liquid (K/W).

Figure 2. STPAK in its typical stack



When mounting the package on a heatsink, it is important to consider the interface resistance that is represented by: $R_{thC\text{-}bonding\ media}$.

In real applications and with standard TIM or soldering, there is a small air gap because of these three factors:

- Package and heatsink are never perfectly flat with TIM mounting
- Misalignment of the package due to imperfect mounting with TIM mounting.
- Significant voids in soldering mounting.

Sintering media and the pressure sintering process ensure the best contact between the package and heatsink as the thickness can be very thin, contact resistivity (both electrical and thermal) is negligible; void presence is much lower compared to a traditional soldering process. Only minor porosity may be the outcome of the sintering process, but its contribution is negligible, and sintering media thermal conductivity is typically > 200 W/mK, much higher than traditional Pb or Sn-based alloys.

2 Sintering site requirements and STPAK backside importance

2.1 Heatsink requirements

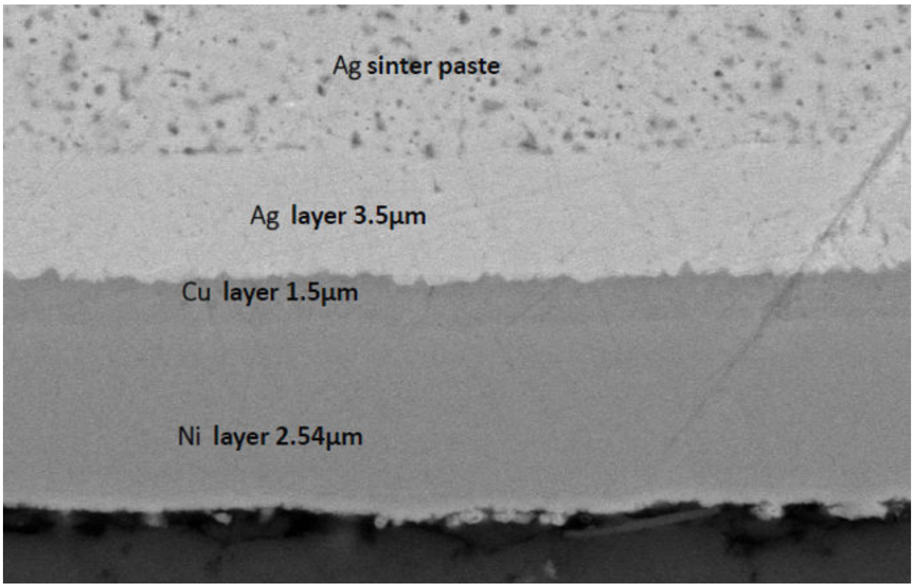
The contact area of the package and the heatsink must be free of particles, damage, and any other contamination. Due to the peculiarity of the sintering process, where the package is placed on a conformal and soft paste, there is no particular requirement for the roughness and planarity of the heatsink (both at the package side and inverter side). What is important is the cleanliness of the surfaces (Ag plated) to guarantee sinterability.

As a general indication, we recommend the following surface conditions for both surfaces:

- Heatsink roughness: Rz ≤ 10 µm
- Heatsink flatness: ≤ ± 50 µm (typically a value of 2 µm/mm across the diagonal of the heatsink)

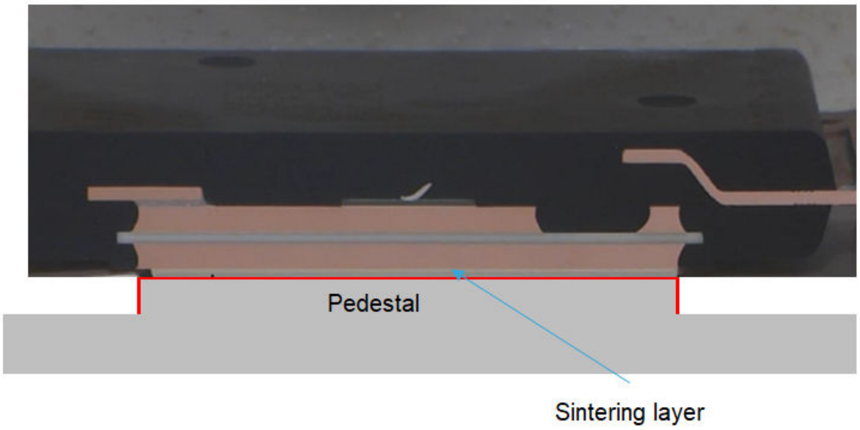
For a reliable package sintering process, the heatsink also needs to be coated in silver to ensure the most reliable sintering joint. The suggested stack is below in Figure 3:

Figure 3. Heat sink suggested stack



In addition to the above requirement of plating structure of the heat sink, ST suggests having a protruded area (called pedestal) where to sinter STPAK (Figure 4). Pedestal dimensions are suggested to be equal to the STPAK backside sinterable area. This optimizes the heat flow and minimizes any possible mechanical stress during the sintering process.

Figure 4. STPAK typical cross section mounted on pedestal



2.2 STPAK backside importance

STPAK silver plated backside plays a paramount important role. In silver sintering, backside silver is not only there to protect from any oxidation. Silver is a structural layer to the package to heatsink bonding.

Any damage, scratch, mishandling may lead to exposed copper that is prone to oxidation if exposed to air and temperature. Sintering does not take place easily on copper oxide. In Figure 5 a picture representing, on the left side, a STPAK parts damaged onto the sintering backside area after mishandling.

Based on our experience, sintering process is very resilient and robust process and sintering may take place anyway, but reliability may be impacted. Picture on the right end side shows an intact STPAK.

A damaged area of the STPAK below 10% of the total sinterable area is in general safe without any measurable degradation in sinter strength.

Figure 5. Example of STPAK parts damaged (left side), intact STPAK (right side)

3 Sintering media selection and deposition suggestions

3.1 Sintering media recommendation

Several suppliers offer sintering paste materials suitable for package sintering. As an alternative, sintering films can also be used.

We recommend using sintering paste.

In this case, the dispensed thickness may depend on the targeted final value of the sintered paste. In general, depending on the material selected, the final thickness of the sintered material is about one-third of the initial paste thickness.

Another significant advantage of paste versus film is the tackiness of the paste, which allows the direct deposition of the STPAK package on the paste before the subsequent process with a low risk of undesired movements.

This eliminates the need for any additional heat tacky agent. Standard robotics can be used, removing the need for complex pick-and-place equipment.

Many pastes are specifically designed to allow the drying process with the component already placed on wet paste. Drying is achieved with standard ovens commonly used in the market with typical drying times. A nitrogen atmosphere is recommended during drying as well as during sintering.

A small pressure can be applied to ensure good tackiness and initial flatness of the wet paste without damaging the STPAK during the attachment process.

Specific material recommendations can be provided upon request.

3.2 Sintering media deposition

Sintering paste can be deposited either by printing (using stencil printing technology equipment available on the market) or hybrid dispensing (using, for instance, a flat nozzle tool).

The advantages of these processes are:

1. Serial process with high UPH and produces uniform streak-free deposits
2. Capable of creating deposits of well-controlled thickness up to 500 microns and above depending on the material selected
3. Suitable for large area and pedestal direct printing.

4 Sintering process

4.1 Quick recap of what is silver sintering

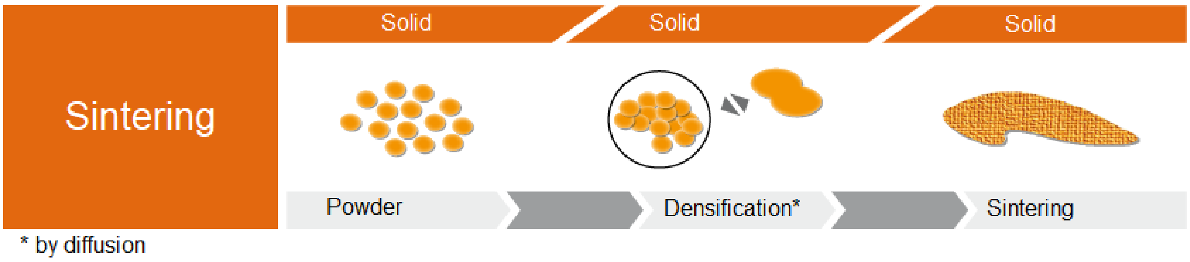
Silver sintering has become an excellent alternative to soldering, especially for high-temperature applications. The increase in operating temperature requires new soldering alloys with even higher melting points, which can be detrimental to solder joint reliability.

Silver sintering, on the contrary, is a solution that only requires moderate process temperature (< 230 °C) and pressure (< 15 MPa). Sintering is a combined surface, volume, and grain boundary diffusion process. Several processes, including densification, grain growth, and pore growth/coarsening, take place in parallel.

Silver sintering exploits Ag thermal conductivity > 200 W/mK. The recommended sintering joint thickness is in the range of 50 to 100 µm, although lower thicknesses are also possible. Ag melting temperature is 961 °C, making it very stable within the working range of the product. Being a same-material joint, it is very stable in reliability and intermetallic-free.

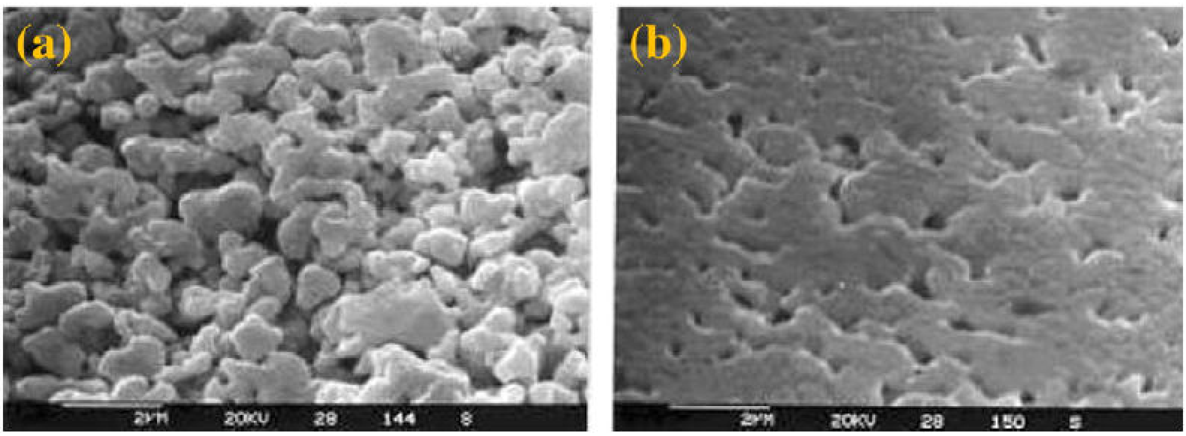
The resulting advantages are improved heat dissipation from the device and increased reliability.

Figure 6. Basic schematic of the sintering process



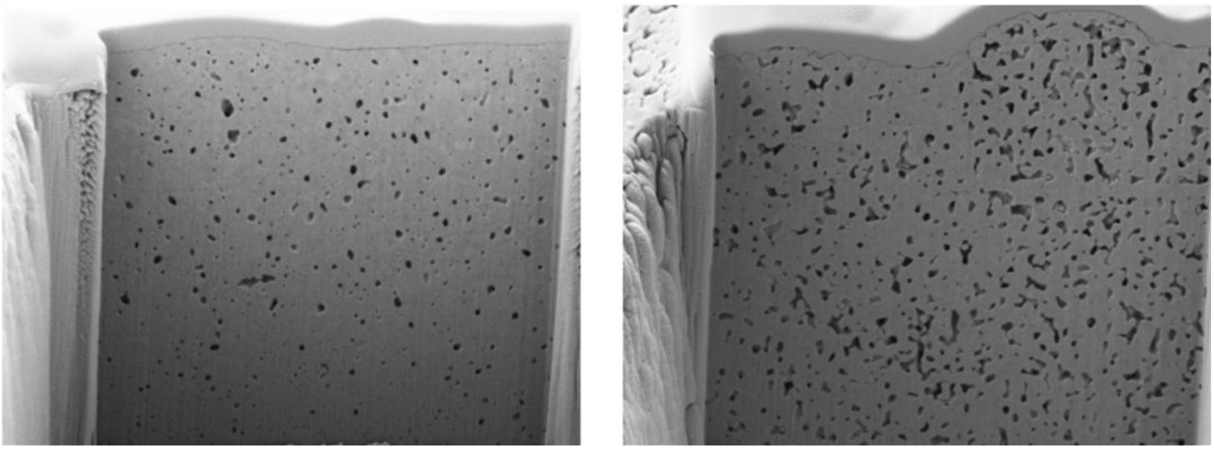
Silver media paste, but also film, is essentially silver powder mixed with additives such as thinner, binder, dispersant, and solvents. The particle size of silver powder ranges from a few nanometers to micrometers. Reducing the particle size results in a higher specific surface area (more particle surface per powder volume), thus accelerating the diffusion process. In pastes, typically the additives and organic residues are removed by applying heat treatment before the final sintering process (the so-called drying process).

Figure 7. SEM picture of sintering media before (a) and after (b) pressure



Note: Nanosilver (a) and after (b) pressure sintering at 250 °C and 10 MPa

Figure 8. **FIB picture of sintering layer porosity. Lower porosity leads to higher performances**



4.2 Precautions and preparatory process before sintering

As with any high-temperature process, the pressure sintering process must follow the procedures for non-hermetic packages that require moisture absorption control.

In general, STPAK is delivered in tubes under a dry bag procedure (with desiccant and hermetic sealing under vacuum) as per JEDEC moisture sensitivity level procedures. Under these conditions, the moisture content is kept at a very low level, maintained over time by the shipping precautions taken.

ST suggests assembling STPAK under controlled relative humidity ambient and within one day after the packing is unsealed. If the hermetic sealing is broken or the parts remain exposed to manufacturing ambient conditions for more than seven days, the parts must be submitted to a drying cycle to restore the original moisture content conditions.

The recommended drying conditions are:

- Condition A: drying at 125 °C in N2 for a minimum of 12 hours to achieve almost 100 % moisture removal
- Condition B: drying at 150 °C in N2 for a minimum of 8 hours to achieve almost 100 % moisture removal.

Note that the shipping media cannot withstand such temperatures, so the parts need to be placed in a metallic tray and then in a dedicated oven. N2 is mandatory to prevent exposed copper parts from being oxidized. Lower temperatures, associated with longer times, can also be used, but they may not ensure complete removal of embedded moisture.

4.3 Sintering equipment and tools

The sintering process is a relatively slow but powerful process. High pressure is delivered onto the STPAK molding compound body. Direct metal contact with the plastic may damage the STPAK if the package shows tilting, misplacing, or uneven paste thickness among packages.

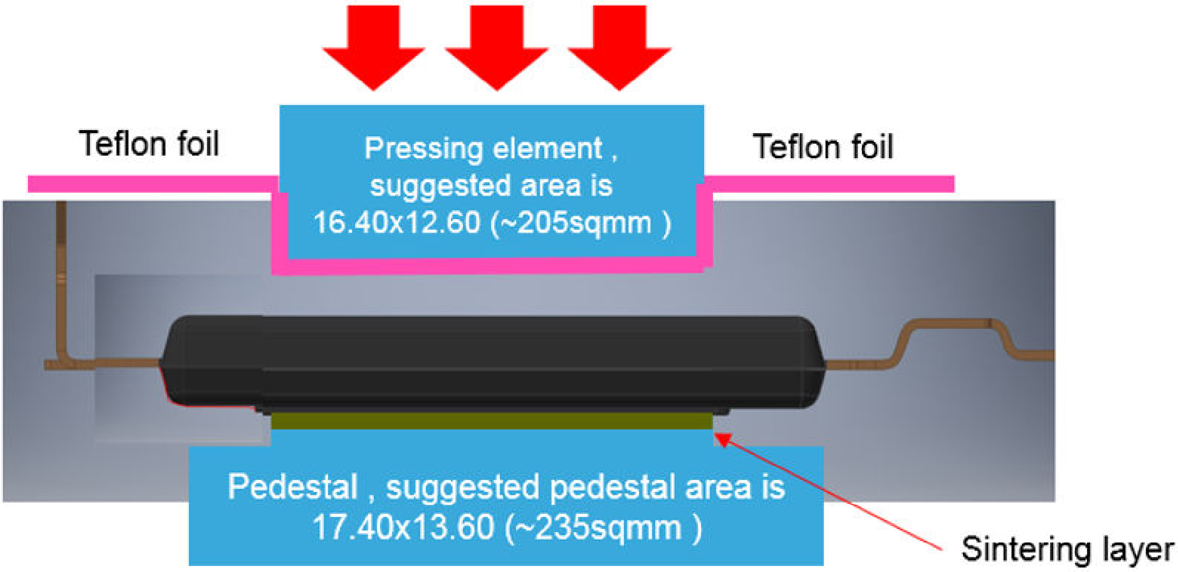
To reduce the risk of damaging the package, ST recommends delivering sintering pressure through a single pressing element (one for every STPAK that is simultaneously sintered) that is independently controlled in terms of pressure and force. In this way, the applied pressure is consistently applied to any STPAK, allowing a good homogeneous sintering process within the same inverter.

ST also suggests that the pressing tool dimensions of any single STPAK should be slightly smaller than the expected area of the sintered final area. In this way, the risk of anomalous bending of the package (or part of the package) should be avoided.

Especially, if many STPAKs are sintered simultaneously, ST recommends adding a Teflon™ foil between the steel pressing element and the plastic body of the package. This foil helps equalize natural slight thickness differences and absorb some surface irregularities of foreign materials present during the sintering process.

To prevent any heavy oxidation of the copper-exposed parts of the STPAK, ST recommends that the pressure sintering machine is equipped with an N2 protective environment in the high-temperature area.

Figure 9. Sintering assembly profile (pedestal and pressing element dimensions are just indicative)



5 Sintering process

The core of the sintering process involves applying pressure and temperature to the system to induce the sintering mechanism. This mechanism entails the mutual penetration of silver nanoparticles into a compact layer of material, resulting in the soldering of the back of the STPAK and the pedestal of the inverter.

An ideal recommended profile should include several steps: drying process, sintering process, and cooling. The detailed definitions of these process steps depend on the material (sinter paste) and equipment (sintering press) used.

Considering state-of-the-art equipment and the most commonly used sinter paste supplier, the ST basic recommended sintering profile steps are the following:

1. Drying station. Warm-up step: Raise STPAK parts temperature from room temperature to the 110-140 °C range within 2 to 5 minutes
2. Drying station: Hold parts in this temperature range for an additional 4 to 5 minutes for complete paste soaking
3. Move the parts to the sintering station: The bottom sintering press should ensure a maximum temperature of the sintering pastes of 220 °C +5 / -0 °C
4. Once the temperature of STPAK reaches about 200 °C (ideally within 2 minutes max), close the top sintering press and apply pressure ranging from 10 to 15 MPa on each single STPAK
5. The top press temperature is recommended at 100 °C max to reduce the stress on the STPAK
6. Hold pressure and temperature for about 3 to 4 minutes
7. Move the system to the cooling station: Cooling can be done using natural convection cooling; no need for a forced cooling station even if it can speed up the process
8. The system can be moved out of the sintering press once the temperature is below 70°C.

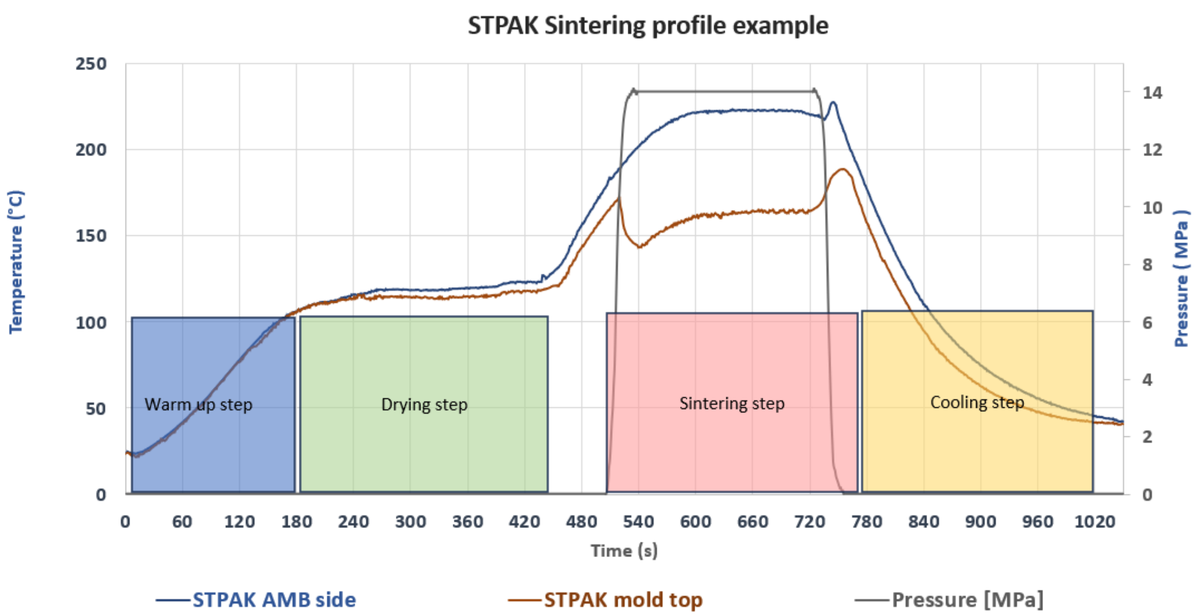
A possible representation of a sintering profile is shown in Figure 10, where the various segments combine to generate an ideal sintering process.

The graph shows the key temperature profile at the sintering area (represented as STPAK AMB side). The package top temperature is also shown, as it is interesting to see how the relatively cold top press may help to keep the molding compound relatively cold.

The graph below is not purely indicative, as it may depend on at least three factors:

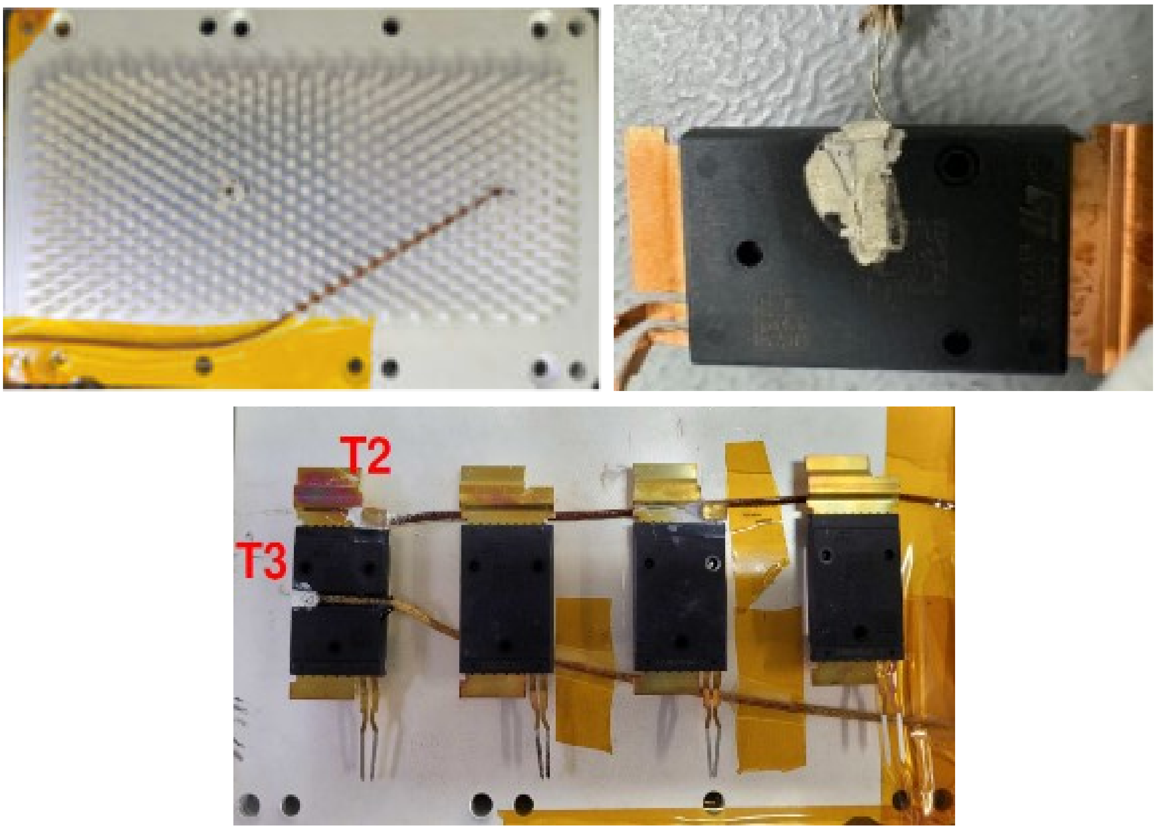
- The sintering paste properties and characteristics
- The thermal impact of the base plate used mainly geometry, weight, and material composition
- The characteristics of the sintering press machine tool and handling.

Figure 10. Example of sintering temperature (package top and bottom) and pressure profile



The best way to obtain a reliable temperature profile (if the pressure sintering equipment does not have such kind of capability) is to prepare a dedicated baseplate and package with a thermocouple well positioned at the interface of interest (Figure 11).

Figure 11. **Example of thermocouple preparation for proper temperature profile measurement**



6 How to make sure STPAK is correctly sintered

STPAK is best sintered when shear force to remove it from off the baseplate is generally above the 40 MPa.

Failure mode needs to be cohesive. It means to sinter media residuals need to be found on both the interfaces involved: the STPAK backside as well as baseplate sintering plane.

Adhesive failures means complete detachment of the sintering pastes from one of the two interfaces is not accepted. No native silver layer from STPAK and baseplate must be removed during test.

Shear test is the best method, destructive though, to deem good sinter quality. The suggestion is to make sure baseplate clamping during the test is effective as the results may be affected by any shift.

Due to the huge torque force that may be applied during a shear test, it may happen that such force may damage and destroy the package itself. This failure mode is accepted as it indicated a very strong sinterization.

An alternative to shear, and a non-destructive method, a thermal impedance test may be used. Thermal impedance determines if the sintered layer is well made, and the joint is strong and correctly compacted. In that sense, it is an indirect measurement of the robustness of the joint sinter.

Figure 12. Example of baseplate outcome after sintering torque test evaluation

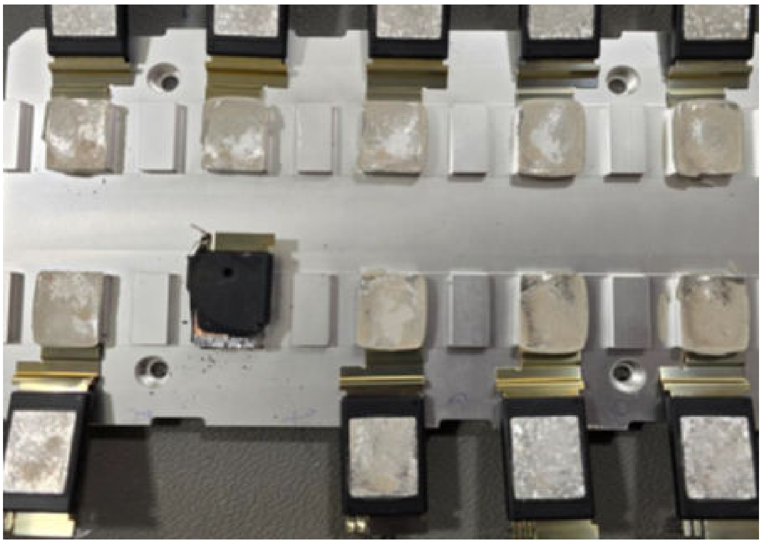


Figure 13. Example of cohesive (good) adhesion, on the left, and bad (adhesive) on the right

7 High Power bus bars welding (Drain / source connection)

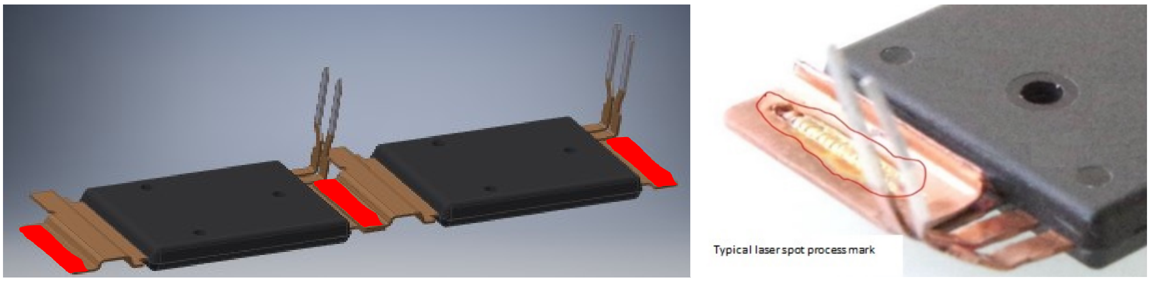
Here is a list of suggestions on how to connect power bus bars. Customers should avoid overstressing the bus bar and plastic body with excessive heat, mechanical stress, or chemical agents.

7.1 Examples of bus bars connection

DRAIN and SOURCE bus bars come in fully raw Cu plating. Suggested assembly methods are:

- Laser spot (tested, in production)
- Ultrasonic welding (suggested, not tested in ST)
- Soldering (not tested in ST)
- Resistance welding (not tested in ST).

Figure 14. **Example of laser welded bus bars areas**

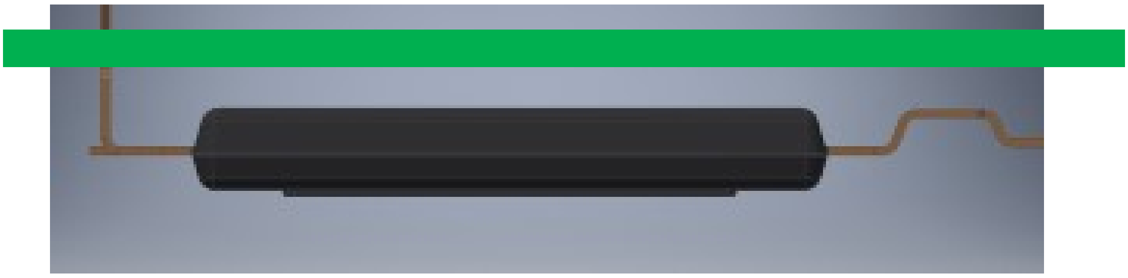


In order to guarantee the best planarity during sintering manufacturing, it is preferred to perform the high power bus bars welding after the STPAK sintering process on the inverter.

8 Lower power pin lead soldering

STPAK low power pins are typically soldered through wave soldering as a standards THD package.

Figure 15. **Schematic of possible STPAK interconnection on PCB**



8.1 Lower power pin lead bending

STPAK leads come pre-formed in an upright position to engage a top PCB. Manual lead bending is not recommended. If low power pins need to be formed, ST does not take any responsibility for the lead integrity after customer rework. We always suggest using a bending tool and avoiding manual bending of pins. In any case, the following guidelines should be observed:

- Keep the minimum distance between the package body and bending to 2.5 mm. The leads must not be bent directly at the edge of the package plastic body
- The minimum bend radius must be equal to or greater than the lead thickness “T”
- For bending, use a clamping tool to ensure that mechanical forces such as pulling and shearing do not occur between the leads and the package body. Relieve the part of the lead between the point of bending and the package of tensile stress during the bending process. Avoid slippage due to weak clamping or weakening of the lead due to overly strong clamping
- A properly designed clamping tool helps to ensure that the shapes of the bends are consistently reproducible
- Do not exceed the tensile strength of the leads from the clamping to the point where the bending force is applied by using too much force. This maximum force mainly depends on the cross-sectional area of the lead. A typical maximum force is 20 N.

8.2 Selective wave soldering

Wave soldering is a large-scale soldering process by which electronic components are soldered to a PCB to form an electronic assembly. The name is derived from the fact that the process uses a tank to hold a quantity of molten solder. The components are inserted into or placed on the PCB, and the loaded PCB is passed across a pumped wave or cascade of solder. The solder wets the exposed metallic areas of the board (those not protected with solder mask), creating a reliable mechanical and electrical connection.

For STPAK, only the leads that extend through the drill holes in the PCB contact the hot solder. The body of the package is heated indirectly only by the hot leads.

Immersion of the whole package body into the molten solder is not recommended since STPAK is not designated for such a process.

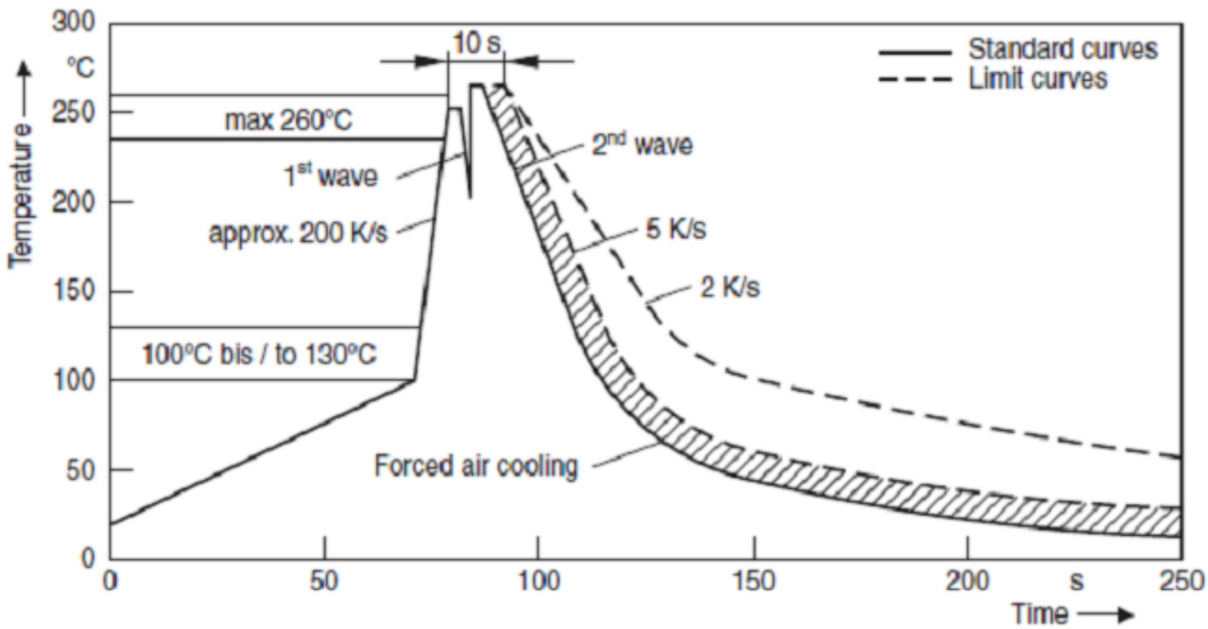
There are many types of wave-soldering machines, but their basic components and principles are the same. A standard wave-soldering machine consists of three zones: the fluxing zone, the preheating zone, and the soldering zone. A fourth zone, the cleaning zone, may be used depending on the type of flux applied.

Dual-wave soldering is the most commonly used wave-soldering method (see below for a typical wave-soldering profile). The peak temperatures, ramp rates, and times used depend on the materials and the wave-soldering equipment.

The first wave has a turbulent flow and therefore guarantees wetting of nearly all shapes of leads and board pads, but also creates an increased number of unwanted solder bridges. These solder bridges have to be removed by the second, laminar wave.

When using lead-free solder alloys, a nitrogen atmosphere is recommended.

Figure 16. Typical dual-wave soldering profile



9 Cleaning

After the soldering process, flux residues can be found around the solder joints. However, if the solder joints must be cleaned, the cleaning method (for example, ultrasonic, spray, or vapor cleaning) and solution must be selected with consideration of the packages to be cleaned, the flux used (rosin-based, water-soluble, etc.), and environmental and safety aspects. Removing and drying even small residues of the cleaning solution should also be done thoroughly.

10 Inspection

After component placement, a visual inspection can be done by automated optical inspection (AOI). It is used to check if the mounting is done completely and if severe misplacements have occurred. Sometimes the correct orientation of the component can also be checked.

After soldering, the solder joint meniscus of the leads of through-hole device (THD) packages can be inspected by an optical microscope or automated optical inspection (AOI). Acceptable solder joints are described in international standards such as IPC-A-610.

Automatic X-ray inspection (AXI) is the only reasonable method for efficient inline control. AXI systems are available as 2D and 3D solutions. They usually consist of an X-ray camera module and the hardware and software needed for inspection, control, analysis, and data transfer routines. These systems enable the user to reliably detect soldering defects such as poor soldering, bridging, voiding, and missing parts. For the acceptability of electronic assemblies, refer to the IPC-A-610C standard.

Lead-free (SnAgCu) solder joints typically do not have a bright surface. Lead-free solder joints are often dull and grainy. These surface properties are caused by the irregular solidification of the solder, as the solder alloys are not exactly eutectic. This means that SnAgCu solders do not have a melting point but a melting range of several degrees. Although lead-free solder joints have this dull surface, this does not mean that lead-free joints are of lower quality or weak. It is therefore necessary to teach the inspection recipe how these lead-free joints look, or to adjust optical inspection systems to handle lead-free solder joints.

11 Rework

Package sintering is an irreversible process. This means that if something goes wrong with a single unit, that unit cannot be replaced.

If a defective component is observed after board assembly, the interconnection of this specific device can be reworked, if possible, without being removed.

Repair of single solder joints is generally possible but requires proper tools. For example, repairing the solder joint of an exposed die pad cannot be done with a soldering iron.

Whatever rework process is applied, it is important to recognize that heating a board and components above 200°C may result in damage. As a precaution, every board with its components must be baked before rework. For details, refer to the international standard J-STD-033.

In any case, mechanical, thermal, or thermo-mechanical overstress must be avoided, and rework must be done according to JEDEC J-STD-033A, IPC-7711, and IPC-7721.

12 Coating of assembled PCB's

In some applications, coatings are used to prevent damage due to external influences such as:

- Mechanical abrasion
- Vibration
- Shock
- Moisture
- Hand perspiration
- Chemicals and corrosive gases.

These influences may cause the following:

- Electrical leakage due to moisture
- Corrosion that leads to the degradation of conductor paths, solder joints, and other metallized areas, or the formation of electrical leakage paths. These can eventually result in electrical shorts or open contacts.
- Mechanical damage to conductor paths, solder joints, and components. This damage can lead to electrical failures.

Coatings act as electrically isolating and impervious covers that adhere well to different PCB materials. In any case, chemical, electrical, mechanical, and thermo-mechanical interaction between the coating and the PCB and its components must be considered. Coatings can affect component reliability.

13 Coating of assembled PCB's

13.1 ESD protective measures

Semiconductors are typically electrostatic discharge-sensitive devices (ESDS) that require specific precautionary measures for handling and processing. Static discharges caused by human touch or processing tools may cause high-current or high-voltage pulses, which may damage or even destroy sensitive semiconductor structures. Integrated circuits (ICs) may also be charged by static during processing. If discharging occurs too quickly (hard discharge), it may cause peak loads and damage. ESD protective measures must therefore prevent contact with charged parts as well as the charging of ICs. Protective measures against ESD include proper procedures for handling, processing, and packing of ESDS. A few hints are provided below on handling and processing.

13.1.1 ESD protective measures in the workplace

Standard marking of ESD-protected areas:

- Access controls with a wrist strap and footwear testers
- Air conditioning
- Dissipative and grounded floor
- Dissipative and grounded working and storage areas
- Dissipative chairs
- Ground bonding point for wrist strap
- Trolleys with dissipative surfaces and wheels
- Suitable shipping and storage containers
- No sources of electrostatic fields.

13.1.2 Equipment for the personal

- Dissipative or conductive footwear or heel straps
- Suitable garments made of fabrics that do not generate excessive static electricity
- Wrist strap with a safety resistor
- Volume conductive gloves or finger cots.

13.1.3 Production installations and processing tools

- Machine and tool parts are made of dissipative or metallic materials
- No materials have thin insulating layers for sliding tracks
- All parts are reliably connected to ground potential
- There is no potential difference between individual machine and tool parts
- There are no sources of electrostatic fields.

Our recommendations are based on the internationally applicable standards.

13.2 Packing of components

You can refer to product and package specifications and our sales department to get information about which packaging is available for a given product.

13.3 Storage and transportation conditions

Improper transportation and unsuitable storage of components can lead to several problems during subsequent processing, such as poor solderability, delamination, and package cracking.

13.4 Handling damage and contamination

Any mechanical damage during automatic or manual handling of components (in or out of the component packaging) that may harm package leads or body must be avoided. In particular, unintentional bending of leads may cause a loosening in the package body, which can result in electrical malfunction. Along with other factors, any contamination applied to a component or packaging may cause:

- Solderability problems
- Corrosion
- Electrical shorts (due to conductive particles).

Appendix A Acronyms, abbreviations and reference documents

Table 1. Acronyms

Acronym	Name
Pb	Lead
Sn	Tin
Ag	Silver
CTE	Coefficient of thermal expansion
AMB	Active metal brazing
MSL	Moisture sensitivity level
PCB	Printed circuit board
ESD	Electrostatic discharge
TIM	Thermal interface materials
UPH	Unit per hour
AOI	Automatic optical inspection
AXI	Automatic X-ray inspection

Table 2. Reference document

Document name	Document title
IEC 60721-3-0	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; introduction.
IEC 60721-3-1	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; Section 1: Storage.
IEC 60721-3-2	IEC 60721-3-2: Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; Section 2: Transportation
IEC 61760-2	IEC 61760-2: Surface mounting technology - Part 2: Transportation and storage conditions of surface mounting devices (SMD) - Application guide
IEC 62258-3	IEC 62258-3: Semiconductor dies products - Part 3: Recommendations for good practice in handling, packing, and storage
ISO 14644-1	Clean rooms and associated controlled environments - Part 1: Classification of airborne particulates.
IPC-A-610G	Requirements for soldered electrical and electronic assemblies, Nov 2017.
JEDEC J-STD-033D	Handling, packing, shipping, and use of moisture/reflow sensitive surface mount devices, Apr 2018.
JESD 22A104E	JEDEC standard thermal cycling, Oct 2014.
JEDEC 625-B	Requirements for handling electrostatic-discharge sensitive (ESDS) devices, Dec 2011.

Revision history

Table 3. **Document revision history**

Date	Revision	Changes
04-Mar-2025	1	Initial release.

Contents