



## Soldering Resistance and Moisture Sensitivity Level (MSL) Classification of STMicroelectronics Lead-Free Devices

The reliability of electronic components is validated using Moisture Sensitivity Level (MSL) tests because board mounting processes, especially solder reflow (for Surface Mount Devices - SMD), involve a high-moisture vapor pressure inside plastic packages and high temperatures.

In 1999, the first clear statement was framed, and accepted, world-wide, and issued as the joint IPC/JEDEC J-STD-020-A specification.

A second edition of the specification was released in July 2002 (IPC/JEDEC J-STD-020-B) that took into account the higher temperatures required for Lead-free board soldering (considering SnAgCu eutectic solder with a melting temperature of 218°C). See [Table 1](#).

STMicroelectronics Surface Mount Lead-free Devices were qualified using the conditions defined in IPC/JEDEC J-STD-020-B for Lead-free packages and most of the smallest devices were qualified at 260°C peak soldering temperatures following specific customer requirements.

In some cases a change in package materials was implemented to improve robustness versus soldering resistance.

The distinction between large and small packages is justified by their thermal inertia. During soldering the temperature of larger packages rises less than that of smaller packages.

**Table 1. Lead-free Soldering Profile Peak Temperature versus Package Size (J-020B)**

Body Thickness ≥ 2.5 mm	Body Volume ≥ 350 mm <sup>3</sup>	Body Thickness < 2.5 mm and Volume < 350 mm <sup>3</sup>	Body Thickness < 2.5 mm and Volume < 350 mm <sup>3</sup>
245°C	245°C	250°C	260°C as anticipation and for specific customer requests

In July 2004, the standard was revised (IPC/JEDEC J-STD-020-C). More detailed and, in some cases, more severe conditions were defined (see [Table 2](#)).

The humidity storage conditions, associated floor life, soldering conditions, profiles and control methods are all detailed inside the IPC/JEDEC J-STD-020 standard. IPC/JEDEC J-STD-020 standard can be obtained from IPC or from JEDEC organizations and web sites:

1. Typically the MSL test includes a one week long humidity storage and three soldering simulations in convection reflow oven with a temperature profile defined accurately for the Package Top Body temperature. Devices are then inspected, tested electrically and then controlled with an Acoustic Scanning Microscope to check adhesions inside the packages and especially the IC surface bounding to the molding compound and the wire bonding interfaces.
2. The humidity storage used is directly linked to the floor life of the devices and to the packing mode (dry packing or unsealed packing).
3. The Soldering resistance and Moisture Sensitivity Level test is done as the first step of the device qualification procedure to ensure that the device reliability includes the soldering process performed by ST customers. MSL level and warranted peak soldering profiles are indicated on the packing labels of components and data are available upon request.

## AN2033 - APPLICATION NOTE

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Several STMicroelectronics packages are already compliant with the new standard revision, however for some packages new assessments are required, and for sensitive products the new standard revision may imply MSL downgrading and the need for qualifying new package materials.

ST has undertaken to become fully compliant to JEDEC J-STD-020C before the end of 2005.

**Table 2. New Conditions for Lead-free Soldering Profile Peak Temperature (J-020C)**

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

## CONCLUSION

STMicroelectronics Lead-free devices are suitable for soldering with Lead-free board mounting processes and are all compliant with IPC/JEDEC J-STD-020-B .

Compliance to newly released IPC/JEDEC J-STD-020-C is under validation and may require up to end of 2005 for the most sensitive devices and packages.

## REVISION HISTORY

**Table 3. Document Revision History**

Date	Version	Revision Details
09-Nov-2004	1.0	First Issue

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