

# TECHNICAL REPORT



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**Environmental testing –  
Part 3-12: Supporting documentation and guidance – Method to evaluate a  
possible lead-free solder reflow temperature profile**



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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ENVIRONMENTAL TESTING –

**Part 3-12: Supporting documentation and guidance –  
Method to evaluate a possible lead-free solder reflow temperature profile**

## FOREWORD

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IEC TR 60068-3-12 has been prepared by IEC technical committee 91: Electronics assembly technology. It is a Technical Report.

This third edition cancels and replaces the second edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Extended purpose

Guidance is added on how to create a reflow profile considering the tolerances resulting from the accuracy of the measuring equipment, preparation method and specifications of the component manufacturers (components, PCB, solder paste, etc.).

## b) Distinction from existing standards

The envelope profile given in this document does not represent a temperature-time profile for the qualification of materials but defines the reflow process limits for the soldering of electronic assemblies.

The schematic temperature-time-limit curves of the envelope profile are derived from generally valid findings (literature data). Additionally, tolerance considerations are given for all envelope points of the envelope profile.

In contrast to IEC TR 60068-3-12:2014, the creation of the envelope profile is not primarily linked to a concrete example.

## c) Subclause 8.2 presents an approach for establishing a possible temperature profile for a lead-free reflow soldering process using SnAgCu solder paste that is taken from IEC TR 60068-3-12:2014.

## d) Synergies with existing standards

Limit values and tolerances from standards and guidelines for the qualification of materials are included in this document and are listed as examples in the references.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
91/1776/DTR	91/1804/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

A list of all parts in the IEC 60068 series, published under the general title *Environmental testing*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
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- amended.

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## INTRODUCTION

The enormous variety of materials and components processed in SMT requires to consider their thermal properties, especially in reflow soldering.

Since the second edition essentially limited its focus to lead-free soldering, there is a need to extend the contents in order to cover state of the art reflow soldering processes in general.

Reflow soldering is a joining process using an additional metal (solder) with a liquidus temperature of 450 °C or less, in which solder paste or preforms are reflowed (see ISO 857-2:2005).

Reflow soldering can be carried out with the technical processes of convection (air or nitrogen), condensation (vapour phase), radiation (e.g. infrared) or contact heat as well as with the help of low pressure (vacuum).

The goal of a qualified reflow soldering process is to create high quality and reliable solder joints at product level. It is important to avoid soldering defects and damage to components and printed circuit board.

In addition to the requirements for the formation of reliable solder joints, the specifications of the connection partners and the production requirements (temperatures, final layers, alloys, etc.), an adequate process control is an important factor. Primarily the resistance of the components and circuit boards to solder heat, as well as the specifications of the solder paste and/or flux, need to be considered. The sum of these physical limits is a theoretical temperature-time curve for a specific product (see DVS 2613).

This document is intended for engineers (e.g. development, manufacturing technology, work preparation) and operators (production) responsible for the creation and release of temperature-time ( $T-t$ ) profiles for reflow soldering in surface mount technology.

This document initially was prepared by the German DKE GUK 682.2 "Thermal joining technology in electronics".