PD IEC/TR 60068-3-12:2014

BSI Standards Publication

Environmental testing

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

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National foreword

This Published Document is the UK implementation of IEC/TR 60068-3-12:2014. It supersedes PD IEC/TR 60068-3-12:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/501, Electronic assembly technology & Printed Electronics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Essais d'environnement – Partie 3-12: Documentation d'accompagnement et guide – Méthode d'évaluation d'un profil de température possible de brasage sans plomb par refusion

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FOREWORD

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IEC TR 60068-3-12, which is a technical report, has been prepared by IEC technical committee 91: Electronics assembly technology.

This second edition cancels and replaces the first edition published in 2007 and constitutes a technical revision.

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

- the content has been adapted to the state-of-the-art of reflow-oven technology and termination finishes;
- minor language adjustments were performed.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
91/1158/DTR	91/1177/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

ENVIRONMENTAL TESTING –

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

1 Scope

This part of IEC 60068, which is a technical report, presents two approaches for establishing a possible temperature profile for a lead-free reflow soldering process using SnAgCu solder paste.

This process covers a great variety of electronic products, including a large range of package sizes (e.g. molded active electronic components, passive components and electromechanical components).

Study A addresses requirements needed in the production of high-reliability electronic control units (ECU), as for example in automotive electronics. These requirements include measurement and production tolerances.

Study B represents consumer electronics products and includes reflow oven capability, board design and package sizes.

2 Basics

The process temperature for SnPb solder paste has a wide margin due to the liquid temperature of the solder alloy. During reflow soldering, temperature differences between components exist but are not critical. The process temperature of SnAgCu solder paste is about 20 K to 30 K higher than SnPb solder paste. Furthermore, the temperature difference between components (ΔT) becomes wider and sometimes the heat resistance temperature of components can become critical.

To avoid soldering failures which could be very harmful in safety-related applications and also generate higher failure costs, the capability of the soldering process is very important. A compromise between the temperature requirements of highly reliable solder joints and the limited solder-heat resistance of the electronic components has to be sought. In addition, the different aspects of mass production have to be considered. To achieve a reliable solder joint, the conventional reflow soldering process with eutectic SnPb solder paste is usually performed at a minimum peak temperature of about 203 °C at the coldest solder joint (i.e. at least 20 K above the liquid temperature of SnPb T_{liquid} = 183 °C).

The selected lead-free solder is SnAgCu with a melting point at around T_{liquid} = 217 °C [1] [1]. It is a generally preferred material for lead-free reflow and wave soldering in mass production [2]. Using SnAgCu solder paste, it is not possible to solder the coldest solder joints at least 20 K above the liquid temperature (T_{liquid} = 217 °C), which would result in minimum temperatures of 237 °C. When the coldest solder joint is 237 °C, the temperature spread between small and large components, small semiconductor, and passive components, as well as the printed circuit board (PCB), will be too large for the components to survive the heat impact. Despite the aim to achieve a relatively low temperature at the coldest solder joint, the reliability of the solder joint has to be assured.

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1 Numbers in square brackets refer to the Bibliography.