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TECHNICAL REPORT

colour inside

Printed board assemblies – Part 9: Electrochemical reliability and ionic contamination on printed circuit board assemblies for use in automotive applications – Best practices



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PRINTED BOARD ASSEMBLIES –

Part 9: Electrochemical reliability and ionic contamination on printed circuit board assemblies for use in automotive applications – Best practices

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IEC TR 61191-9 has been prepared by IEC technical committee 91: Electronics assembly technology. It is a Technical Report.

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

Draft	Report on voting
91/1811/DTR	91/1825A/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. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61191 series, published under the general title *Printed board assemblies*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
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- amended.

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INTRODUCTION

The document applies to electronic and electromechanical automotive circuit board assemblies. It describes current best practices for dealing with electrochemical reactions like migration or corrosion and ionic contamination on the surface of a printed circuit board as one failure mode under humidity load.

This document is an informative document which serves to illustrate the technically feasible options and provide a basis for customer and supplier agreements. It is not intended to be regarded as a specification or standard.

Related standards are gathered in the Bibliography.

PRINTED BOARD ASSEMBLIES –

Part 9: Electrochemical reliability and ionic contamination on printed circuit board assemblies for use in automotive applications – Best practices

1 Scope

This part of IEC 61191, which is a Technical Report, applies to electronic and electromechanical automotive circuit board assemblies and describes current best practices for dealing with electrochemical reactions like migration or corrosion and ionic contamination on the surface of a circuit board as one failure mode under humidity load. This document deals with the evaluation of materials and manufacturing processes for the manufacturing of electronic assemblies with focus on their reliability under humidity loads. The electrical operation of a device in a humid environment can trigger electrochemical reactions that can lead to short circuits and malfunctions on the assembly. In this context, a large number of terms and methods are mentioned, such as CAF (conductive anodic filament), anodic migration phenomena, dendrite growth, cathodic migration, ROSE (resistivity of solvent extract), ionic contamination, SIR (surface insulation resistance), impedance spectroscopy, etc., which are used and interpreted differently. The aim of the document is to achieve a uniform use of language and to list the possibilities and limitations of common measurement methods. The focus of the document is on the error pattern of electrochemical migration on the surface of assemblies with cathodic formation of dendrites.

Evaluation of different test methods of control units under high humidity load are not part of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60194-1, *Printed boards design, manufacture and assembly – Vocabulary – Part 1: Common usage in printed board and electronic assembly technologies*

IEC 60194-2, *Printed boards design, manufacture and assembly – Vocabulary – Part 2: Common usage in electronic technologies as well as printed board and electronic assembly technologies*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 60194-1, IEC 60194-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Terms and definitions related to management

3.1.1
design authority
individual, organization, company, contractually designated authority, or agency responsible for the design of electrical/electronic hardware, having the authority to define variations or restrictions to the requirements of applicable standards, i.e., the originator/custodian of the applicable design standard and the approved or controlled documentation

3.1.2
manufacturer
individual, organization, or company responsible for the assembly process and verification operations

3.1.3
production part approval process
PPAP
procedure in accordance to IATF 16949 [1] to regulate the sample submission process within the supply chain, primarily used for the series release of new parts

Note 1 to entry: The main objective of the procedure is the regulated start-up assurance with regard to quality and quantity of mass production.

3.1.4
user
individual, organization, company, or agency responsible for the procurement of electrical/electronic hardware and having the authority to define any variation or restrictions to requirements

EXAMPLE Originator/custodian of the contract detailing the requirements.

3.2 Technical terms and definitions

3.2.1
conductive anodic filament
CAF
migration which occurs along the monofilament of reinforcing material such as glass cloth in an inner layer part of a printed wiring board

3.2.2
no-clean
produced with a no-clean solder material and optimized process parameters throughout the entire process chain (e.g. design, printing, soldering), for which flux residues are usually not critical and removal of these residues is not necessary

Note 1 to entry: There could be additional requirements of customers.

3.2.3
resistivity of solvent extract
ROSE
analytical method to determine the integral contamination load on a CB or CBA causing electrical conductivity

3.2.4
surface insulation resistance
SIR
electrical resistance of an insulating material between a pair of contacts, conductors or grounding devices in various combinations, which is determined under specified environmental and electrical conditions