IEC TR 61189-3-914

Edition 1.0 2017-03

TECHNICAL REPORT

colour inside

Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 3-914: Test method for thermal conductivity of printed circuit boards for high-brightness LEDs – Guidelines

IEC TR 61189-3-914:2017-03(en)

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FOREWORD

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IEC TR 61189-3-914, which is a technical report, has been prepared by IEC technical committee 91: Electronics assembly technology.

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

Enquiry draft	Report on voting
91/1378/DTR	91/1403/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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61189 series, published under the general title *Test methods for electrical materials, printed boards and other interconnection structures and 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 "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Development of this technical report has been discussed at TC 91 Plenary meeting in Dongguan, China, October 30, 2015 as per 91/1343A/RM dated on January 22, 2016.

This document was developed as a supplementary document to the IEC 61189-3-913. Therefore, this document has been developed as technical report.

This document is given for information only.

TEST METHODS FOR ELECTRICAL MATERIALS, PRINTED BOARDS AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

Part 3-914: Test method for thermal conductivity of printed circuit boards for high-brightness LEDs – Guidelines

1 Scope

This document specifies the detailed procedures and precautions for IEC 61189-3-913.

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, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 61189-3-913, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 3-913: Test method for thermal conductivity of electronic circuit boards for high-brightness LEDs*

EIA/JEDEC STD 51-2, *Integrated circuits thermal test method – Environmental conditions – Natural convection (still air)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60194 apply, unless otherwise specified.

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

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

4 Test condition

4.1 Standard condition

Unless otherwise specified, tests should all be operated under the following standardized conditions in accordance with the IEC 60068-1:2013, Clause 4:

- temperature: 15 °C to 35 °C;
- relative humidity: 25 % to 75 %;
- atmospheric pressure: 86 kPa to 106 kPa.

If there is any doubt concerning the testing results under standardized condition, or upon a request to check the atmospheric condition, the re-examination should be operated under atmosphere in accordance with IEC 60068-1:2013.

If the standardized atmosphere is difficult to provide, testing under non-standardized atmosphere is acceptable as long as the atmospheric condition does not affect the testing results.

4.2 Specified condition

The specified condition should be in accordance with the condition specified in IEC 60068-1:2013, Clause 4:

- temperature: 20 °C ± 2 °C;
- relative humidity: 60 % to 70 %;
- atmospheric pressure: 86 kPa to 106 kPa.

5 Pre-condition

Pre-conditioning should be in accordance with a) or b) below:

a) leave the specimen for 24 h in the standard condition;

b) leave the specimen for 60 min in a thermostat chamber at 85 °C ± 2 °C and then leave the specimen for 24 h ± 4 h in the standard atmospheric condition.

NOTE This test element group (hereafter referred to as TEG) chip includes a heater with a temperature measuring sensor. In this document, the TEG chip indicates a chip with a temperature measuring sensor.

6 Heat dissipation characteristics

6.1 General

For the test method for thermal conductivity of a printed circuit board (hereafter referred to as PCB) for high-brightness LEDs, the following factors are considered.

- The test method is applied to evaluate the relativity of both heat transfer and thermal conductivity of PCBs consist of heterogeneous materials as shown in Figure A.2 in Annex A which describes the heat transfer coefficient parameter as X-axis and thermal conductivity parameter as Y-axis.
- The IEC 61189-3-913 employs a TEG chip as the heat source to replicate the heat generated by LED chips.
- Heat dissipation characteristics of PCBs depend not only on the thermal conductivity of the material properties, but also on the structure.
- In addition, convection and radiation from the specimen surface should be considered as factors to affect the testing results.
- Considering the anisotropic nature of the heat dissipation of PCBs, different test methods are employed for the plane (horizontal) and across the thickness (vertical) direction. The combination of these tests should replicate a realistic environment.
- A TEG chip is employed with following considerations:
  - measuring a small heat source such as an LED with thermocouples;
  - accuracy of the designated thermal emissivity may affect the measurement results of the radiation thermometer.
- The size of the specimen and the power of the heat source are based upon the general application of LEDs and PCBs.

- Considerations concerning the selection of materials:
  - select materials with a large thermal conductivity for the PCB across the thickness (vertical) heat radiation structure for edge lighting and alternative LED lights to fluorescent lamps as shown in Figure 1;
  - select materials with a large heat transfer coefficient for the PCB in the horizontal direction (direction of plane) as shown in Figure 2.

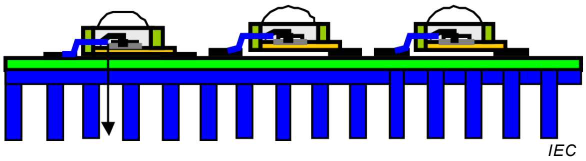

Figure 1 – Example of PCB with large thermal conductivity

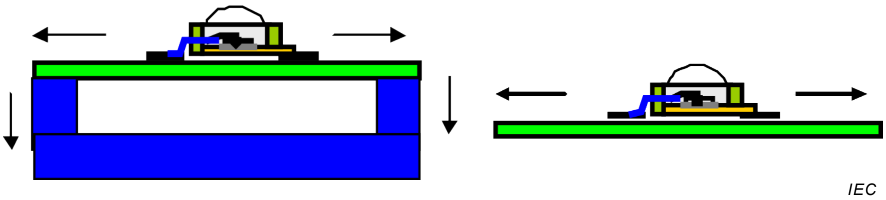

Figure 2 – Examples of PCBs with large heat transfer coefficients

6.2 Measurement of thermal resistance on the plane

a) Equipment

- Use the equipment specified in EIA/JEDEC STD 51-2 (*Integrated circuits thermal test method – environment conditions – natural convection (still air)*), or equivalent.
- Set a specimen and a thermocouple at the centre of the chamber.
- The chamber should be a cubic shape and a side of the chamber should be 30 cm.
- The schematic diagram of the equipment is shown in Figure 3.