



**IPC-9204**

# **Guideline on Flexibility and Stretchability Testing for Printed Electronics**

Developed by the Printed Electronics Test Method Development and Validation Subcommittee (D-65) of the Printed Electronics Committee (D-60) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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# Guideline on Flexibility and Stretchability Testing for Printed Electronics

## 1 SCOPE

This guideline describes flexibility and stretchability tests that may be used to evaluate printed electronics for flexible, stretchable and wearable applications.

**1.1 Purpose** This guideline describes tests which the IPC D-65 Printed Electronics Test Methods and Validation Subcommittee deemed appropriate for consideration for flexibility and stretchability testing of printable electronics. The descriptions of these tests were provided by members of the D-65 Subcommittee.

This guideline does not represent an endorsement of any of the described tests. It is intended only as an educational resource, especially for the smart textiles and wearable printed electronics markets, until standardized test methods are developed and approved.

The D-65 Subcommittee invites users, suppliers, test laboratories and other interested parties to submit additional tests or modifications to those explained herein for next revisions of this guideline.

This guideline also includes references to industry-approved test methods which can be used or adapted for flexibility and stretchability testing for printed electronics (see Section 5 and Appendix B).

## 2 APPLICABLE DOCUMENTS

The documents listed in this section are those which are referenced in the body of this guideline. Appendix B also provides a compendium of industry-approved test methods which may be adapted for flexibility and stretchability testing of printed electronics.

### 2.1 IPC<sup>1</sup>

**IPC-T-50** Terms and Definitions for Interconnecting and Packaging Electronic Circuits

**IPC-TM-650** Test Methods Manual

**IPC-6903** Terms and Definitions for the Design and Manufacture of Printed Electronics

### 2.2 ASTM<sup>2</sup>

**ASTM F392** Standard Practice for Conditioning Flexible Barrier Materials for Flex Durability

**ASTM D430** Standard Test Methods for Rubber Deterioration—Dynamic Fatigue

**ASTM D813** Standard Test Method for Rubber Deterioration—Crack Growth

**ASTM F2749** Standard Test Method for Determining the Effects of Creasing a Membrane Switch or Printed Electronic Device

**ASTM F2750** Standard Test Method for Determining the Effects of Bending a Membrane Switch or Printed Electronic Device

**ASTM D6182** Standard Test Method for Flexibility and Adhesion of Finish on Leather

1. [www.ipc.org](http://www.ipc.org)  
2. [www.astm.org](http://www.astm.org)