



IPC-T-51

# Terms and Definitions for the Design and Manufacture of Printed Electronics

Developed by D-64a Printed Electronics Terms and Definitions  
Task Group

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

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# Terms and Definitions for the Design and Manufacture of Printed Electronics

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## 1 SCOPE

This standard provides terms and definitions for the design and manufacture of printed electronics.

**1.1 Purpose** The purpose of this standard is to provide common terminology regarding printed electronics.

The reader is encouraged to also reference IPC-2291, IPC-2292, IPC-4591, IPC-4592, IPC-6901, IPC-6902, IPC-9204 and IPC-9257, which have additional industry-approved terms and definitions.

**1.2 3D Printed Electronics Types** It is the understanding of the IPC Printed Electronics Committee that electronics manufacturers have several definitions for 3D Printed Electronics. Because these descriptions are the result of years of time and investment by various market segments, the IPC Printed Electronics Committee will not define one term for 3D printed electronics.

To better help industry identify and describe the various processes for producing 3D printed electronics, the IPC Printed Electronics Committee has established three initial types for 3D printed electronics.

Type 1 – Using printed electronics processes on a planar substrate

Type 2 – Using printed electronics processes on a nonplanar substrate

Type 3 – Using printed electronics processes to fully build and functionalize a device in a 3D space

As additional 3D printed electronics types are described by industry, they will be added to the 3D Printed Electronics Types.

## 2 APPLICABLE DOCUMENTS

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

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

**IPC-2291** Design Guideline for Printed Electronics

**IPC-2292** Design Standard for Printed Electronics on Flexible Substrates

**IPC-4591** Requirements for Printed Electronics Functional Materials

**IPC-4592** Requirements for Printed Electronics Functional Dielectric Materials

**IPC-6901** Application Categories for Printed Electronics

**IPC-6902** Qualification and Performance Specification for Printed Electronics on Flexible Substrates

**IPC-9204** Guideline on Flexibility and Stretchability Testing for Printed Electronics

**IPC-9257** Requirements for Electrical Testing of Flexible Printed Electronics

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<sup>1</sup> www.ipc.org

**3 TERMS AND DEFINITIONS FOR PRINTED ELECTRONICS****C****Coating**

The process of uniformly depositing (blade, slot die, spray, etc.) a fluid functional material over a substrate or device, generally with limited patternability compared to printing.

**Conductive Ink**

A fluid composition of organic compounds and conductive particles that forms a solid, electrically conductive substance after undergoing a postprocess such as drying, curing or sintering.

**Conductive Paste**

A high-viscosity, shear thinning conductive ink.

**Conformability**

The degree to which printed electronics can be shaped to match the physical form of the object on, or in, which it is included and retain functionality.

**Contamination**

Foreign materials which may disrupt the performance of printed electronics.

**Creaseability**

The degree to which printed electronics can be pressed across a fold and retain functionality.

**Crossover**

An electrically insulated material printed on top of one or more circuit traces for the purpose of electrically isolating the underlying circuit traces from the circuit traces passing over it.

**Curing**

A chemical reaction causing the polymerization (cross-linking) of lower molecular weight organic compounds into higher molecular weight polymers.

**Curing, Light**

The use of light to drive polymerization reactions.

**Curing, Moisture**

The use of humidity and temperature to drive polymerization reactions.

**Curing, Thermal**

The use of heat energy to drive polymerization reactions.

**D****Diluent**

A liquid which is added to a material to assist in the deposition of materials by diluting or reducing the viscosity.

**Drying**

A thermal process during which volatiles are evaporated.

**E****Elasticity**

The ability of a printed electronic device or material to resume its normal shape after being stretched or compressed.

**Encapsulation**

The process of protecting printed electronic constructions via polymeric compounds (e.g., encapsulants).

**F****Flexibility**

The degree to which printed electronics can be bent and retain functionality. Also sometimes referred to as bendability.

**Functional Material**

A compound which serves an electrical, electronic, electromechanical, chemical or other nongraphic functionality in printed electronics.

**H****Heat Transfer Process**

The use of heat and pressure to transfer printed electronics from a carrier to a substrate.

**Hysteresis**

The permanent deformation of a material after strain is removed.

**I****Ink**

A material containing a functional material and a vehicle that can be deposited via a printing process.

**L****Liquid Metal**

A conductive alloy that is permanently in a liquid or gel state across its operating temperature.

**M****Machine Direction (Web Direction)**

The direction in which the substrate flows during processing, or the circumferential direction of a roll of substrate.

**Margin Area**

The border surrounding the printed area on a substrate.

**Modulus (Elastic Modulus or Young's Modulus)**

A mechanical property that measures the stiffness of a solid material. It defines the relationship between stress (force per unit area) and strain (proportional deformation) in a material in the linear elasticity regime of a uniaxial deformation.

**Moisture Vapor Transmission Rate (MVTR)**

The amount of water vapor which passes through a unit area of a material (typically a film) during a period of time under specified temperature and humidity conditions. Also known as Water Vapor Transmission Rate (WVTR).

**N****Nonvolatile Content**

Components of a compound that do not evaporate during processing (see volatile organic compounds (VOCs)).

**P****Pliability**

The degree to which printed electronics are soft and easily deformed and retain functionality.

**Print Registration**

The degree of alignment of a printed pattern relative to its intended position with regard to other features.