



Designation: D3380 – 22

Standard Test Method for Relative Permittivity (Dielectric Constant) and Dissipation Factor of Polymer-Based Microwave Circuit Substrates¹

This standard is issued under the fixed designation D3380; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method permits the rapid measurement of apparent relative permittivity and loss tangent (dissipation factor) of metal-clad polymer-based circuit substrates in the X-band (8 GHz to 12.4 GHz).

1.2 This test method is suitable for testing PTFE (polytetrafluorethylene) impregnated glass cloth or random-oriented fiber mats, glass fiber-reinforced polystyrene, polyphenyleneoxide, irradiated polyethylene, and similar materials having a nominal specimen thickness of $\frac{1}{16}$ in. (1.6 mm). The materials listed in the preceding sentence have been used in commercial applications at nominal frequency of 9.6 GHz.

NOTE 1—See **Appendix X1** for additional information about range of permittivity, thickness other than $\frac{1}{16}$ in. (1.6 mm), and tests at frequencies other than 9.6 GHz.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.12 on Electrical Tests.

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2. Referenced Documents

2.1 ASTM Standards:²

D150 Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation
D1711 Terminology Relating to Electrical Insulation
D2520 Test Methods for Complex Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials at Microwave Frequencies and Temperatures to 1650 °C
D6054 Practice for Conditioning Electrical Insulating Materials for Testing (Withdrawn 2012)³

2.2 IPC Standards:⁴

IPC-TM-650 Test Methods Manual Method 2.5.5.5.
IPC-MF-4562 Metal Foil for Printed Wiring Applications.

2.3 IEEE Standards:⁵

Standard No. 488.1 Standard Digital Interface for Programmable Instrumentation.
Standard No. 488.2 Standards, Codes, Formats, Protocols and Common Commands for Use with ANSI and IEEE Standard 488.1.

3. Terminology

3.1 *Definitions*—See Terminology D1711 for the definitions of terms used in this test method. See also Test Methods D2520, D150, and IPC TM-650 for additional information regarding the terminology.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *D*—a symbol used in this test method for the dissipation factor (loss tangent).

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from IPC, 3000 Lakeside Drive, Suite 309S, Bannockburn, IL 60015.

⁵ Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., P.O. Box 1331, Piscataway, NJ 08854-1331, <http://www.ieee.org>.

*A Summary of Changes section appears at the end of this standard