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# **INTERNATIONAL STANDARD**

**IEEE Std 1620.1™**

**Test methods for the characterization of organic transistor-based ring  
oscillators**



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## TEST METHODS FOR THE CHARACTERIZATION OF ORGANIC TRANSISTOR-BASED RING OSCILLATORS

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IEEE Std	FDIS	Report on voting
IEEE Std 1620.1™-2006	113/185/FDIS	113/195/RVD

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- withdrawn,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

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

# IEEE Standard for Test Methods for the Characterization of Organic Transistor-Based Ring Oscillators

Sponsor  
**Microprocessor Standards Committee**  
of the  
**IEEE Computer Society**

Approved 8 June 2006  
**IEEE-SA Standards Board**

**Abstract:** Recommended methods and standardized reporting practices for electrical characterization of printed and organic ring oscillators are covered. Due to the nature of printed and organic circuits, significant measurement errors can be introduced if the electrical characterization design-of-experiment is not properly addressed. This standard describes the most common sources of measurement error, particularly for high-impedance electrical measurements commonly required for printed and organic ring oscillators. This standard also gives recommended practices in order to minimize and/or characterize the effect of measurement artifacts and other sources of error encountered while measuring printed and organic ring oscillators.

**Keywords:** electrical characterization, high-impedance printing, organic transistor, printed electronics, ring oscillator



## IEEE Introduction

This introduction is not part of IEEE Std 1620.1-2006, IEEE Standard for Test Methods for the Characterization of Organic Transistor-Based Ring Oscillators.

This standard covers recommended methods and standardized reporting practices for electrical characterization of organic transistor-based ring oscillators. Due to the nature of organic transistors and circuitry, significant measurement errors can be introduced if not properly addressed. This standard describes the most common sources of measurement error and gives recommended practices in order to minimize and/or characterize the effect of each.

Standard reporting practices are included in order to minimize confusion in analyzing reported data. Disclosure of environmental conditions and design-of-experiment are included so that results can be appropriately assessed by the research community. These reporting practices also support repeatability of results, so that new discoveries may be confirmed more efficiently.

The practices in this standard were compiled from research and industry organizations developing organic transistor devices, materials, circuitry, and manufacturing techniques. These practices are based on standard operating procedures utilized in laboratories worldwide.

The development of this standard was initiated in 2004 to facilitate the evolution of organic transistor circuitry from the laboratory into a sustainable industry. Standardized characterization methods and reporting practices create a means of effective comparison of information and a foundation for manufacturing readiness.

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# Test Methods for the Characterization of Organic Transistor-Based Ring Oscillators

## 1. Overview

### 1.1 Scope

This standard describes a method for characterizing organic electronic transistor-based ring oscillators, including measurement techniques, methods of reporting data, and the testing conditions during characterization.

### 1.2 Purpose

The purpose of this standard is to provide a method for systematically characterizing organic transistor-based ring oscillators. This standard is intended to maximize reproducibility of published results by providing a framework for testing organic ring oscillators, whose unique properties cause measurement issues not typically encountered with inorganic-based circuitry. This standard stresses disclosure of the procedures used to measure data and extract parameters so that data quality may be easily assessed. This standard also sets guidelines for reporting data, so that information is clear and consistent throughout the research community and industry.

### 1.3 Electrical characterization overview

#### 1.3.1 Testing apparatus

Testing shall be performed using an electronic device test system with an accuracy and resolution of at least  $\pm 0.1\%$  of the measurement values for both signal level and timing or frequency measurements. In order to maintain the necessary accuracy, this test method requires that the instrumentation be calibrated against a known and appropriate set of standards [e.g., National Institute of Standards and Technology (NIST)]. These calibrations may be performed by the equipment user or as a service by the equipment vendor. Calibration is not performed against a known organic field-effect transistor (OFET), organic circuit, or other FET-type device; the basic instrument operations (e.g., voltage, current, and resistance) are calibrated