



Standard Test Method for Measuring MOSFET Drain Leakage Current [Metric]¹

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1. Scope

1.1 This test method covers the measurement of MOSFET (Note 1) drain leakage current.

NOTE 1—MOS is an acronym for metal-oxide semiconductor; FET is an acronym for field-effect transistor.

1.2 This test method is applicable to all enhancement-mode and depletion-mode MOSFETs. This test method specifies positive voltage and current, conventions specifically applicable to *n*-channel MOSFETs. The substitution of negative voltage and negative current makes the method directly applicable to *p*-channel MOSFETs.

1.3 This d-c test method is applicable for the range of drain voltages greater than 0 V but less than the drain breakdown voltage.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 178 Practice for Dealing with Outlying Observations²

3. Terminology

3.1 Definition:

3.1.1 *drain leakage current of a MOSFET*—the d-c current from the drain terminal when the relationship of the gate voltage to the threshold voltage is such that the MOSFET is in the OFF state.

4. Summary of Test Method

4.1 The drain current of the MOSFET under test is measured at a specified drain voltage with the MOSFET in the OFF condition.

4.2 Before this test method can be implemented, test conditions appropriate for the MOSFET to be measured must be selected and agreed upon by the parties to the test. Conditions will vary from one MOSFET type to another and are determined in part by the intended application. The following items are not specified by this test method, and shall be agreed upon between the parties to the test.

4.2.1 Permissible range of ambient temperature.

4.2.2 Drain to source voltage V_{DS} at which the measurement is to be made.

4.2.3 Gate to source voltage V_{GS} at which the measurement is to be made. For most MOSFETs, use a gate voltage approximately 5 V different from the saturated threshold voltage, in the direction of lesser drain current.

NOTE 2—To avoid the possibility of forward biasing the gate protection diodes, the gate should not be permitted to have a potential with respect to the substrate (or source, if no substrate connection is provided) of a sign opposite that of the drain potential with respect to the substrate (or source), unless the manufacturer's specifications expressly permit such a condition.

5. Significance and Use

5.1 The drain leakage current is a basic MOSFET parameter that must be determined for the design and application of discrete MOSFETs and MOS-integrated circuits. The drain leakage current of the MOSFET is utilized in circuit design to determine performance attributes such as power dissipation, noise margin, charge storage time, amplifier effects, etc., of digital and analog circuitry.

6. Interferences

6.1 Care must be taken to prevent electrical voltage over-stress damage to the gate dielectric as a result of device handling during the leakage current measurement. Under certain conditions, electrostatic discharge from the human body can result in permanent damage to the gate insulator.

6.2 Valid drain leakage current data will be obtained only if the magnitude of the drain voltage applied during the drain leakage current measurement is less than the drain-substrate junction breakdown voltage.

¹ This test method is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.11 on Quality and Hardness Assurance.

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² *Annual Book of ASTM Standards*, Vol 14.02.