METRIC
Designation: F 769M – 95

Standard Test Method for Measuring Transistor and Diode Leakage Currents [Metric][1]

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1. Scope

1.1 This test method covers the measurement of leakage currents of transistors and diodes. These procedures are intended for the measurement of currents in the range from 10^{-11} to 10^{-3} A.

1.2 This test method may be used with either a virtual-ground current meter or a resistance-shunt current meter.

1.3 *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. Terminology

2.1 *Definitions:*

2.1.1 *resistance-shunt meter*—a meter that determines current by measuring the voltage generated across shunt resistors by the current.

2.1.2 *virtual-ground meter*—a meter employing feedback to the amplifier in such a way as to make the meter input appear to be at ground potential.

3. Summary of Test Method

3.1 A junction whose leakage is to be determined is reverse-biased with a power supply. A current meter is placed in series with the junction and the appropriate range is selected on the meter. The current is read directly from the meter readout.

4. Significance and Use

4.1 Knowledge of diode and transistor leakage currents is very important to the circuit designer. Proper transistor biasing depends on accurate leakage current data. In addition, these currents are of special interest to the radiation effects community because leakage current is affected by total dose.

5. Interferences

5.1 Noise generated by thermal agitation in the various resistances in the test circuit sets an ultimate limit of instrument resolution. The noise current generated in a current meter shunt resistor is proportional to the inverse square root of the resistance, so a high shunt resistance value is desirable.

5.2 Other sources of noise are a–c signals propagating through the power supply or imposed on the test leads. A meter with a high a–c rejection ratio and with high common mode rejection ratio will be less sensitive to such forms of noise. A shielded test fixture may be required for proper measurement of low currents.

5.3 All components associated with very high resistance circuitry should be mechanically rigid. Movement of a coaxial cable can produce piezoelectric and triboelectric effects in the cable which result in voltages across the current meter inputs.

5.4 When working with a high resistance source, all leakage paths must be high in comparison to the circuit resistance. Phenolic or rubber insulation, for example, may have a resistance of only $10^{9}\Omega$, causing large errors in measurements with circuit resistances of greater than $10^{8}\Omega$.

5.5 Circuits employing a feedback picoammeter can have measurement errors which result from offset current, offset voltage, drift, and time constants in the amplifier. Amplifier time constants are of particular importance whenever the annealing rate of an irradiated device approaches the sampling rate of the current meter.

5.6 The voltage drop across a resistance-shunt type ammeter for a given current varies with the range selected. Therefore, a range which gives maximum meter resolution will also introduce maximum voltage drop error. An excellent way of determining the input resistance of an ammeter is by direct measurement using a transistor curve tracer. A range should be selected which has

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

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