



Standard Test Method for Determining the Effect of an ESD Discharge on a Membrane Switch or Printed Electronic Device¹

This standard is issued under the fixed designation F1812; 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 is used to determine the electrostatic discharge (ESD) shielding effectiveness of a membrane switch assembly or printed electronic device. This test method may be used to test a membrane switch or printed electronic device to destruction, that is, to determine its maximum ESD shielding effectiveness, or it may be used to test the ability of a membrane switch or printed electronic device to withstand a predetermined level of exposure.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 *discharge pulse count*—number of applied discharges.

2.1.2 *discharge pulse interval*—time duration between applied voltage.

2.1.3 *ESD (electrostatic discharge) event*—detection of applied charge at input/output (I/O) points.

2.1.4 *I/O points*—specified conductive area, location, or circuitry, typically all circuit paths, traces and wires.

3. Significance and Use

3.1 Nearly all electronic devices are susceptible to possible damage or degradation from ESD encountered in their operating environments. The sensitivity of the equipment, the potential consequences of a malfunction, and the expected environmental conditions all impact the level of ESD protection needed.

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3.2 ESD shielding effectiveness test may be destructive, and units that have been tested should be considered unreliable for future use.

4. Interferences

4.1 The following parameters may affect the results of this test:

4.1.1 Temperature may affect the tendency of an ESD event to occur,

4.1.2 Relative humidity may affect the tendency of an ESD event to occur,

4.1.3 Barometric pressure may affect the tendency of an ESD event to occur, and

4.1.4 The composition of the work bench may influence the test results.

5. Apparatus

5.1 Discharge Probe.

5.2 *ESD Simulator*—Commercially available device for applying required or specified voltages, monitoring for ESD event and selecting various voltage levels, and probes for contact or air discharge.

6. Procedure: Direct Application of Discharge

6.1 Pretest Setup:

6.1.1 Place switch on a nonconductive surface, or as specified.

6.1.2 If applicable, connect the ESD shield, ground trace, or ground plane to earth ground.

6.1.3 Connect all circuitry pin inputs or outputs to the ESD generating device's ground.

6.1.4 Ambient laboratory conditions to be within:

6.1.4.1 Relative humidity 30 to 60 %,

6.1.4.2 Temperature 15 to 35°C, and

6.1.4.3 Atmospheric pressure 680 to 1060 mbar or otherwise specified.

6.2 In Process:

6.2.1 Accumulation of charge on the membrane switch or printed electronic device must be dissipated between successive tests.

6.2.2 Set the initial voltage level to 2Kv. Set discharge pulse interval as specified.

6.2.3 Place discharge tip perpendicular, and in contact, with switch surface at the specified point.

6.2.4 Trigger the ESD discharge and monitor.

6.2.5 Check the ESD discharge event to I/O points.

6.2.6 If no ESD event occurs, discharge accumulated voltage on surface to earth ground.

6.2.7 Reset and increase test voltage to next level in accordance with **Table 1** (or as specified). Repeat **6.2.3 – 6.3**.

6.3 If ESD discharge event is noted, report and terminate test.

6.4 Repeat **6.2.1 – 6.3** for other test points.

7. Procedure: Air Gap Discharge

7.1 Pretest Setup:

7.1.1 Position switch on a nonconductive surface, or as specified.

7.1.2 If applicable, connect the ESD shield, ground trace, or ground plane to earth ground.

7.1.3 Connect all circuitry pin in or outputs to the ESD generating device's ground.

7.1.4 Ambient laboratory conditions to be within:

7.1.4.1 Relative humidity to be between 30 to 60 %, and

7.1.4.2 Temperature 15 to 35°C, and

7.1.4.3 Atmospheric Pressure 680 to 1060 mbar or otherwise specified.

7.2 In Process:

7.2.1 Set the initial voltage level to 2Kv. Set discharge pulse interval as specified.

7.2.2 Place contact air discharge tip 2 in. (50.8 mm) away from, and perpendicular to switch surface at the specified point.

7.2.3 Trigger the ESD discharge and monitor.

7.2.4 Check for ESD discharge event at specified I/O points.

7.3 If no ESD event occurs, discharge accumulated voltage on surface to earth ground.

7.3.1 Reset and increase test voltage to next level in accordance with **Table 1** (or as specified). Repeat **7.2.1 – 7.4**.

7.4 If ESD discharge event is noted, report and terminate test.

7.5 Repeat **7.1.1 – 7.1.4** for other test points.

8. Report

8.1 Report the following information:

8.1.1 Humidity,

8.1.2 Temperature,

8.1.3 Atmospheric pressure,

8.1.4 Description of I/O points,

8.1.5 Description of apparatus,

8.1.6 Description of test points,

8.1.7 Description of unit under test (UUT),

8.1.8 Maximum voltage data,

8.1.9 Type of test (contact or air),

8.1.10 Physical description of damage (if applicable),

8.1.11 Date,

8.1.12 Time,

8.1.13 Operator,

8.1.14 Discharge pulse count,

8.1.15 Discharge pulse interval, and

8.1.16 Description of probe.

9. Precision and Bias

9.1 *Precision*—It is not possible to specify the precision of the procedure in Test Method F1812 for measuring ESD because inter-laboratory studies have proven inconclusive due to insufficient participating laboratories with the appropriate equipment.

9.2 *Bias*—No information can be presented on the bias of the procedure in Test Method F1812 for measuring ESD because no standard sample is available for this industry.

10. Keywords

10.1 ESD; membrane switch; printed electronic device; shielding

TABLE 1 Voltage Levels

| | |
|---------|-------|
| Contact | Air |
| 2 Kv | 2 Kv |
| 4 Kv | 4 Kv |
| 6 Kv | 8 Kv |
| 8 Kv | 15 Kv |

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