



Designation: F3290 – 17

Standard Guide for Handling and Application of a Membrane Switch or Printed Electronic Device to its Final Support Structure¹

This standard is issued under the fixed designation F3290; 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 guide covers proper handling and application of a flexible circuit membrane switch, or printed electronic assembly to its final support structure to avoid mechanical or electrical failure.

1.2 Damage of internal tactile devices or surface mount device (SMD) components can occur with excessive flexing or bending during lamination, repositioning, from uneven support surface, air entrapment, or pressing keys when unsupported.

1.3 Design considerations and material selection can impact the membrane switch or the printed electronic device's ability to endure the mechanical stress that can occur in handling, application and use. These should be considered as early as possible in the design phase.

1.4 Recent advancements in printed electronic polymer materials have shown increased reliability from flexing and creasing, replacing copper flex circuits in many cases.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- F2749 Test Method for Determining the Effects of Creasing a Membrane Switch or Printed Electronic Device
- F2750 Test Method for Determining the Effects of Bending a Membrane Switch or Printed Electronic Device
- F3147 Test Method for Evaluating the Reliability of Surface Mounted Device (SMD) Joints on a Flexible Circuit by a

Rolling Mandrel Bend

3. Terminology

3.1 *Definitions:*

3.1.1 *membrane switch (MS)*, *n*—a momentary switching device in which at least one contact is on, or made of, a flexible substrate.

3.1.2 *printed electronic device (PED)*, *n*—electrically functional device manufactured primarily using an additive process, with or without attached conventional or other electronic components, often in flexible format.

4. Summary of Guide

4.1 This guide provides recommendations or best practices to prevent damage to membrane switches or printed electronic devices from unsupported use or excessive stress during the application to the final supporting structure.

5. Significance and Use

5.1 Membrane switches or printed electronic devices are tested for function and aesthetically inspected by the manufacturer before release to the end user. The user can unknowingly damage the device beyond repair prior to, or during, the application (laminating) process.

5.2 Awareness and proper techniques are essential to the end user and this guide should be noted on all drawings, quality control documentation, and assembly instructions. Proper training and practice must be provided to work area supervisors and their staff.

5.3 Concerning materials choice, consistency, and design in use, it is important to know what to look for and how to design for durability and to test for or prevent potential failures, or both.

5.4 Component failure due to handling damage is one of the most common causes of customer complaints. It is the end user's responsibility to ensure that the product is not damaged during installation

5.5 In the event of component failures a comparison of pre- and post-assembly test performance may help determine the cause of failure. Even if an acceptable change is noted, it may be the result of the unit being over stressed and the application

¹ This test method is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.18 on Printed Electronics.

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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.

process should be reviewed and changed if necessary. It is important to determine if the change or failure is one that should have withstood the application process, or whether the application process is causing undue stress. Bend, Crease, and Mandrel Testing in accordance with Test Methods F2749, F2750, and F3147 may be necessary to determine the root cause and location of failure.

6. Procedure

6.1 Handling During Testing before Applying to Final Support Structure:

6.1.1 If unit to be tested includes SMD components that are susceptible to ESD damage, use anti-static bags and wrist bands. For example, some white and blue LEDs are very susceptible to ESD damage.

6.1.2 Never store or operate a membrane switch or printed electronic device outside of its specified storage or operating temperature and humidity ranges, or combination thereof.

6.1.3 It is the responsibility of the user to manage the shelf life of the membrane switch or printed electronic device (or their subcomponents, for example, adhesives) that has not been attached to its final support structure.

6.1.4 Do not actuate the switches (keys/buttons) of a membrane switch or printed electronic device while holding in your hands or in an unsupported position. Actuating a membrane switch or printed electronic device in this manner can cause damage to the switch.

6.1.5 When testing, the membrane switch assembly or printed electronic device should be positioned flat on a rigid surface such as a table or test fixture.

6.1.6 Take caution when positioning the membrane switch or printed electronic device's connector into the test device. Avoid undue mechanical stress on flex tail or connector when attaching to test fixture.

6.1.7 Do not actuate switches with a hard, pointed object (like a pen, stylus, screwdriver, etc.) as this can cause permanent damage. A human finger or an elastic tip actuator are recommended for actuating switches.

6.2 Application to Final Support Structure:

6.2.1 The mating surface should be thoroughly clean and free of dust/debris, lubricants, mold-release, surfactants, etc. prior to application of the membrane switch or printed electronic device. Clean if necessary using a lint-free cloth with appropriate cleaner, for example, isopropyl alcohol (IPA). Ensure that the cleaner evaporates completely prior to application of the membrane switch or printed electronic device.

6.2.2 Dust and other contamination can cause witness marks on the viewing surface. Lubricants, mold-release, etc. can prevent the mounting adhesive from achieving an adequate bond, causing the membrane switch or printed electronic device to release almost immediately or over time.

6.2.3 Inspect mounting surface for convex or concave defects which can cause undesirable switch operation, as well as cosmetic defects.

6.2.4 Prior to application of the membrane switch or printed electronic device, make sure to remove any protective masking that may be present on the underside of any display window. Once the membrane switch or printed electronic device is mounted, removing the masking can prove to be difficult and damaging to the device.

6.2.5 Excessive bending or flexing of the membrane switch assembly or printed electronic device will cause internal damage (premature failure or collapsed domes and fractured joints of surface mount LEDs, etc.). See Fig. 1. Refer to Test Methods F2749, F2750, and F3147 to test for durability at extreme conditions and performance/compatibility of the selected material set – for example, ink, adhesive, substrate, and SMD land design.

6.2.6 When mounting the membrane switch or printed electronic device, the choice of starting position depends on many factors and is application specific. It is typically best to start with the side/end where the flex tail exits. If there are LEDs or switches in this area, extreme care should be taken or consider starting in a different location. Remove a strip (approximately 1/2 in. to 3/4 in. wide) of the rear adhesive's release liner and bend the liner back onto itself. Remember to completely remove the release liner from the tail insert piece (if

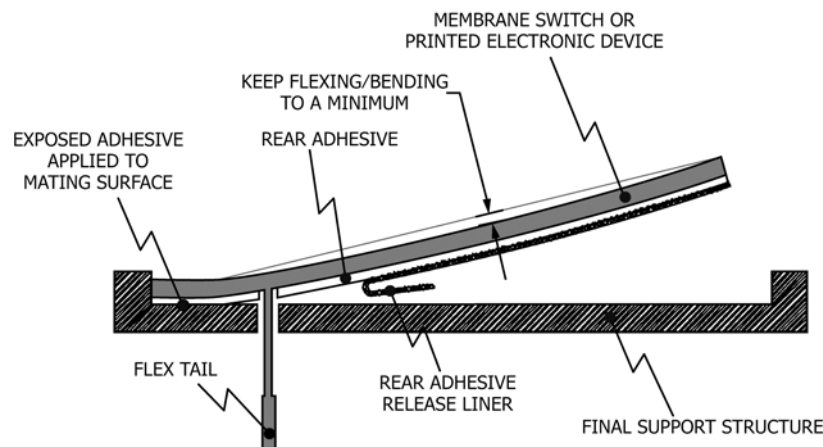


FIG. 1 Application to Final Support Structure