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Standard Practice for Nondestructive Pull Testing of Wire Bonds[1]

This standard is issued under the fixed designation F 458; 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.

ϵ[1] NOTE—Unit of measurement statement was added editorially in March 1995.

1. Scope

1.1 This practice covers nondestructive testing of individual wire bonds made by either ultrasonic, thermal compression or thermosonic techniques. The test is destructive to nonacceptable wire bonds but is designed to avoid damage to acceptable wire bonds.

NOTE 1—Common usage at the present time considers the term "wire bond" to include the entire interconnection: both welds and the intervening wire span.

1.2 The practice covers wire bonds made with small-diameter (from 0.0007 to 0.003-in. (18 to 76-µm)) wire of the type used in integrated circuits and hybrid microcircuits.

1.3 This practice can be used only when the loop height of the wire bond is large enough to allow a suitable hook for pulling to be placed under the wire.

1.4 While the procedure is applicable to wire of any composition and metallurgical state, criteria are given only for gold and aluminum wire.

1.5 A destructive pull test is used on wire bonds of the same type and geometry to provide the basis for the determination of the nondestructive pulling force to be used in this practice. This may only be used if the sample standard deviation, s, of the pulling forces required to destroy at least 25 of the same wire bonds tested by the destructive pull-test method is less than or equal to 0.25 of the sample average, $\bar{x}$. If $s > 0.25\ \bar{x}$, this practice may not be used.

NOTE 2—If $s > 0.25\ \bar{x}$, some aspect of the bonding process is out of control. Following corrective action, the destructive pull-test measurements should be repeated to determine if the $s \leq 0.25\ \bar{x}$ criterion is met.

1.6 The nondestructive wire-bond pull test is to be performed before any other treatment or screening following bonding and at the same point in processing as the accompanying destructive test. Preferably, this is done immediately after bonding.

1.7 The procedure does not ensure against wire-bond failure modes induced after the test has been performed.

1.8 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.9 *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:*

F 219 Methods of Testing Fine Round and Flat Wire for Electron Devices and Lamps[2]

F 459 Test Methods for Measuring Pull Strength of Microelectronic Wire Bonds[2]

3. Summary of Practices

3.1 The use of nondestructive wire-bond pull tests is predicated on data obtained from destructive pull tests on typical samples selected from a lot. The maximum safe nondestructive pull-force levels are determined as a function of the metallurgical properties of the wire and from the calculated mean (x) and standard deviation (s) of the destructive pull-test data determined in accordance with Test Methods F 459.

3.2 The maximum safe nondestructive bond-pull force is then applied as a screen for individual wire bonds to identify all bonds with pull strength below the predetermined level of acceptability.

4. Significance and Use

4.1 The nondestructive wire-bond pull test provides a screen for evaluating wire-bond quality and is capable of detecting weak or nonadherent bonds.

4.2 The test is not destructive to acceptable wire bonds.

4.3 This practice provides a procedure for identifying a bonding situation that requires corrective action.

4.4 The purpose of this practice is to identify wire bonds that may fail during subsequent screening procedures or field operation.

4.5 The procedure is to be applied after bonding and before any further treatment.

5. Interferences

5.1 As the force levels of the nondestructive wire-bond pull

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[1] This practice is under the jurisdiction of ASTM Committee F-1 on Electronics and is the direct responsibility of Subcommittee F01.07 on Wire Bonding.

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[2] *Annual Book of ASTM Standards*, Vol 10.04.