METHOD 2017.8

INTERNAL VISUAL (HYBRID)

1. PURPOSE. The purpose of this test is to visually inspect the internal materials, construction, and workmanship of hybrid, multichip and multichip module microcircuits.

1.1 SCOPE. This test is for both Class H (Class level B) and Class K (Class level S) quality levels, SAW and hybrid/multichip/multichip module microcircuits. The following types of microcircuits may be inspected:

a. Passive thin and thick film networks.

b. Active thin and thick film circuits.

c. Multiple circuits, including combinations, stacking or other interconnections of 1.1.a and 1.1.b.

This test will normally be used on microelectronic devices prior to capping or encapsulation on a 100 percent inspection basis to detect and eliminate devices with internal defects that could lead to device failure in normal application. It may also be employed on a sampling basis prior to capping to determine the effectiveness of the manufacturers quality control and handling procedures.

2. APPARATUS. The apparatus for this test shall include optical equipment capable of the specified magnification(s) and visual standards/aids (gages, drawings, photographs, etc.) necessary to perform an effective examination and enable the operator to make objective decisions as to the acceptability of the device being examined. Adequate fixturing shall be provided for handling devices during examination to promote efficient operation without inflicting damage to the units.

3. PROCEDURE.

a. General. The device shall be examined in a suitable sequence of observations within the specified magnification range to determine compliance with the specified test condition.

b. Sequence of inspection. The order in which criteria are presented is not a required order of examination and may be varied at the discretion of the manufacturer. Where obscuring mounting techniques (e.g., beam lead devices, stacked substrates, components mounting in holes or cutaways, flip chip devices, packaged devices) are employed, the inspection criteria contained herein that cannot be performed after mounting shall be conducted prior to mounting the element or substrate. The inspection criteria of 3.1.1 may be performed at the option of the manufacturer prior to element attachment.

c. Inspection control. In all cases, examination prior to final preseal inspection shall be performed under the same quality program that is required at the final preseal inspection station. Care shall be exercised after inspections (see 3.b), to ensure that defects created during subsequent handling will be detected and rejected at final preseal inspection. Devices examined to 3.1 criteria shall be inspected and prepared for sealing in a 100,000 (0.5 ☒m or greater) particles/cubic foot controlled environment (class 8 of ISO 14644-1) for Class H (Class level B) and 100 (0.5 ☒m or greater) particles/cubic foot controlled environment (class 5 of ISO 14644-1) for Class K (Class level S), except that the allowable relative humidity shall be less than 65 percent. During the time interval between internal visual inspection and preparation for sealing, devices shall be stored in a 1000 (0.5 ☒m or greater) particles/cubic foot controlled environment (class 6 of ISO 14644-1). Devices shall be in covered containers when transferred from one controlled environment to another.

d. Reinspection. When inspection for product acceptance or quality verification of the visual requirements herein is conducted subsequent to the manufacturer's successful inspection, the additional inspection may be performed at any magnification specified by the applicable test condition, unless a specific magnification is required by the acquisition document. Where sample inspection is used rather than 100 percent reinpsection, the sampling plans of MIL-PRF-38534 or Appendix A of MIL-PRF-38535 shall apply.

e. Exclusions. Where conditional exclusions have been allowed, specific instruction as to the location and conditions for which the exclusion can be applied shall be documented in the assembly inspection drawing.

f. Definitions.

(1) Active circuit area includes all areas of functional circuit elements, operating metallization or connected combinations thereof excluding beam leads.

(2) Add-on substrate is a supporting structural material into and/or upon which glassivation, metallization and circuit elements are placed and the entire assembly is in turn placed on, and attached to the main substrate.

(3) Attachment media is defined as the material used to effect the attachment of an element to an underlying surface (e.g., adhesive, solder, alloy).

(4) Bonding site is a metallized area on a substrate or element intended for a wire or ribbon interconnecting bond.

(5) Cold solder joint is defined as a solder joint whose appearance is "grainy" or "dull". Where a "grainy" or "dull" appearance is characteristic of certain solder materials (e.g., AuSn, etc.), this criteria shall not be rejectable for these materials.

(6) Compound bond is one bond on top of another.

(7) Conductive attach is the process and materials used for the attachment that also provides an electrical contact or thermal dissipation path (e.g., solder, eutectic, solder-impregnated epoxy).

(8) Dielectric attach is the process and materials used for attachment that does not provide electrical contact or thermal dissipation considerations.

(9) Edge metallization is the metallization that electrically connects the metallization from the top surface to the opposite side of the substrate; also called wrap around metallization.

(10) Element is a constituent of a hybrid microcircuit; such as integral deposited or screened passive elements, substrates, discrete or integrated electronic parts including dice, chips and other microcomponents; also mechanical piece parts as cases and covers; all contributing to the operation of a hybrid microcircuit.

(11) Electrically common is satisfied when two or more conductive surfaces or interconnects are of equal DC voltage/signal potential.

(12) End terminated or wrap around elements are those elements which have electrical connections on the ends (sides) and/or bottom of their bodies.

(13) Foreign material is defined as any material that is foreign to the microcircuit of any non-foreign material that is displaced from its original or intended position within the microcircuit package. Conductive foreign material is defined as any substance that appears opaque under those conditions of lighting and magnification used in routine visual inspection. Particles shall be considered embedded in glassivation when there is evidence of color fringing around the periphery of the particle.

(14) Glassivation is the top layer(s) of transparent insulating material that covers the active area including metallization, except bonding pads and beam leads. Crazing is the presence of minute cracks in the glassivation.

(15) Insulating layer is a dielectric layer used to isolate single or multilevel conductive and resistive material or to protect top level conductive resistive material.

(16) Intermetallics (Purple Plague) is one of several gold-aluminum compounds formed when bonding gold to aluminum and activated by re-exposure to moisture and high temperature (>340°C). Purple plague is purplish in color and is very brittle, potentially leading to time-based failure of the bonds. Its growth is highly enhanced by the presence of silicon to form ternary compounds.

(17) Mechanical strength tests are tests, such as Mechanical Shock or Constant Acceleration, which demonstrate adequate attachment process and materials.

(18) Non-monometallic compound bond consists of two lead bonds, made of dissimilar metals, which are stacked one on top of the other (i.e., the interface between the two lead bonds are made up of dissimilar metals such as an aluminum lead bond stacked on top of a gold lead bond or vice-versa.

(19) Operating metallization (conductors) is all metal or any other material used for interconnections except metallized scribe lines, test patterns, unconnected functional circuit elements, unused bonding pads and identification markings.

(20) Original design separation is the separation dimension or distance that is intended by design.

(21) Original width is the width dimension or distance that is intended by design (i.e., original metal width, original diffusion width, original beam width, etc.).

(22) Passivation is the silicon oxide, nitride, or other insulating material that is grown or deposited directly on the die prior to the deposition of the final metal layers.

(23) String is a filamentary run-out or whisker of polymer material.

(24) Substrate is the supporting structural material into and/or upon which the passivation, metallization, and circuit elements are placed.

(25) Tuning is the adjustment of signals from an RF/Microwave circuit by altering lines or pads; adding, deleting or manipulating wires/ribbons; and/or changing resistance, inductance or capacitance values to meet specific electrical specifications.

(26) Through hole metallization is the metallization that electrically connects the metallization on the top surface of the substrate to the opposite surface of the substrate.

(27) Unused component or unused deposited element is one not connected to a circuit or connected to a circuit path at one and only one point. A connection may be made by design or by visual anomaly.

(28) Void is any region in the material (interconnects, bonding sites, etc.) where underlying material is visible that is not caused by a scratch.

(29) Visible line is defined as 0.5 mil at 60X magnification.

g. Interpretations. References herein to "that exhibits" shall be considered satisfied when the visual image or visual appearance of the device under examination indicates a specific condition is present and shall not require confirmation by any other method of testing. When other methods of test are to be used to confirm that a reject condition does not exist, they shall be approved by the acquiring activity.

h. Foreign material control. The manufacturer shall perform an audit on a weekly basis for the presence of foreign material on the die surface, or within the package. This audit may be satisfied during routine internal visual inspection. If the presence of any type of foreign material/contamination is discovered, the manufacturer shall perform the necessary analysis on a sample of suspect devices to determine the nature of the foreign material. The manufacturer shall then document the results of his investigation and corrective actions to eliminate the foreign material and shall make this information available to the Government QAR, the acquiring activity, or the qualifying activity, as required. Corrective action responses shall be obtained within a maximum of ten (10) working days of discovery. The intent of this procedure is to require investigation and resolution of foreign material/contamination problems which do not have effective screening or detection methodology, but that could cause degradation and eventual failure of the device function. Repetitive findings without obvious improvements require escalation to Director of Manufacturing and Director of Quality Assurance, or their equivalents, to continue processing.

3.1 Examination. Internal visual examination as required in 3.1.1 through 3.1.9 shall be conducted on each SAW, hybrid/multichip microcircuit, or microwave hybrid microcircuit. The magnifications required for each inspection shall be those identified in the particular test method used (i.e., 2010, 2017, or 2032 of MIL-STD-883 and 2072, 2073 of MIL-STD-750).

3.1.1 Active and passive elements. All integrated circuit elements shall be examined in accordance with MIL-STD-883, method 2010.

Class H (Class level B Monolithic)	Class K (Class level S Monolithic)

Method 2010; Para. 3.1.1: Metallization defects.

Method 2010; Para. 3.1.2: Diffusion and passivation layer(s) faults.

Method 2010; Para. 3.1.3: Scribing and die defects.

Method 2010; Para. 3.2.5: Foreign material.

Method 2010; Para. 3.1.4: Glassivation defects.

Method 2010; Para 3.1.6: Film resistors defects.

Method 2010; Para. 3.1.7: Laser trimmed film resistor defects.

Transistor and semiconductor diode elements shall be examined in accordance with MIL-STD-883, method 2010 (paragraphs referenced above) or the identified paragraphs of MIL-STD-750, methods 2072 and 2073 as indicated below. Passive elements (including substrates) shall be examined in accordance with MIL-STD-883, method 2032.

Visual Inspection	MIL-STD-750 Method 2072	MIL-STD-750 Method 2073	MIL-STD-883 Method 2010
Die metallization defects	4.1.1	4.1.3, 4.1.5	3.1.1
Diffusion and passivation layer(s)	4.1.2	4.1.2	3.1.2
Scribing and die defects	4.1.3	4.1.1, 4.1.4	3.1.3

3.1.2 Element attachment (assembly), "magnification 10X to 60X". Figures 2017-1 and 2017-2 are example visual representations of attachment media types.

NOTE: Rejection criteria are not to be derived from these examples but rather from the specific criteria paragraphs that follow.

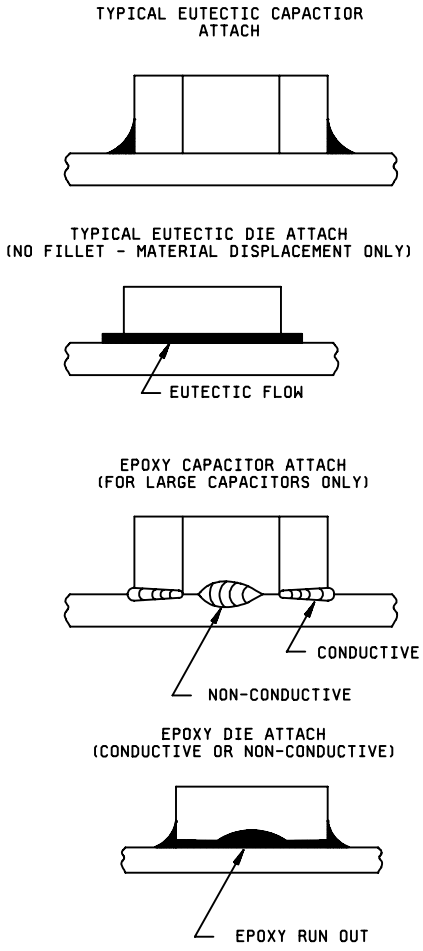


FIGURE 2017-1. Element attachments.

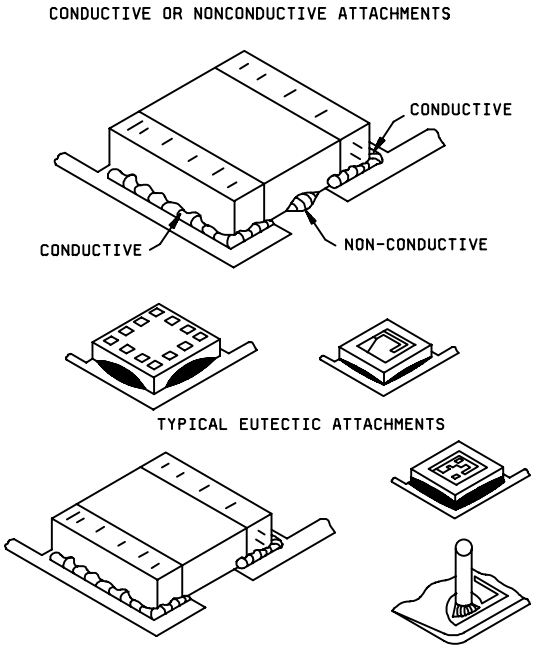


FIGURE 2017-2. Element attachments.

Class H	Class K
Note: Mechanical strength or Radiography may be used to verify attachment in lieu of visual criteria.	Dielectric attachment may be assessed through Mechanical Strength Testing. For conductive attachment, the Qualifying Activity may approve alternate methods for verifying attachment integrity.

No device shall be acceptable that exhibits:

a. For non-end terminated elements, attachment media not visible around at least 50 percent of the perimeter unless it is continuous on two full nonadjacent sides of the element.

NOTE: The criteria of paragraph 3.1.2.a shall not apply when attachment material is applied directly to more than 50 percent of the element attach area by use of a method such as preforms or printing.

b. End terminated elements that do not have conductive attachment media visible around at least 50 percent of the visible bonding pad perimeter on each end termination. For dielectric attachment of end terminated elements (i.e., where the body of the element between the end terminations is attached), the criteria of (a) above applies.	End terminated elements that do not have conductive attachment media visible around at least 75 percent of the visible bonding pad perimeter on each end termination. For dielectric attachment of end terminated elements (i.e., where the body of the element between the end terminations is attached), the criteria of (a) above applies.

c. Glass substrates or transparent die, when viewed from the bottom, which exhibit attach area less than 50 percent.

NOTE: This criterion may be employed in lieu of 3.1.2.a.

d. Flaking of the attachment media material.

e. Balling of the solder or alloy material that does not exhibit a fillet. (see Figure 2017-3)

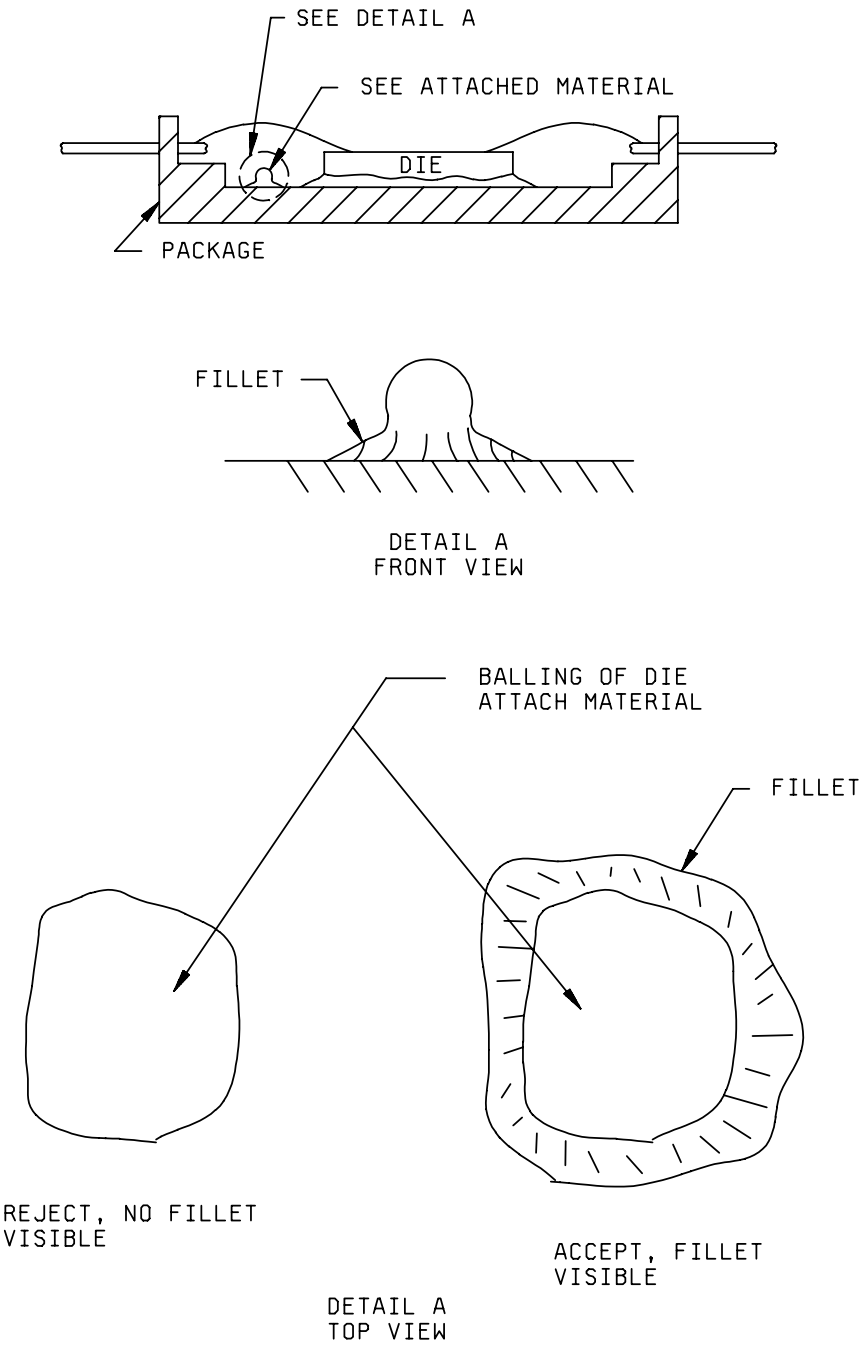


FIGURE 2017-3. Balling of die attach material.

Class H Class K

f. Conductive attachment media which comes closer than 1.0 mil to any functional metallization or element which is not electrically common.

g. Cracks in the surface of the attachment media greater than 5.0 mils in length or 10 percent of the contact periphery, whichever is greater.

NOTE: Irregularities such as fissures or pullback at the edges of the adhesive are not considered cracks. (see Figure 2017-3a)

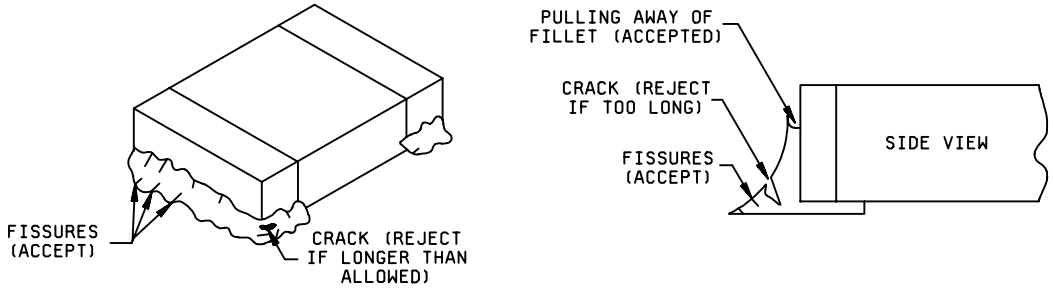


FIGURE 2017-3a. Adhesive irregularities and cracks.

h. Adhesive strings where the diameter of the string at the point of attachment is less than 50 percent of the maximum length of the string. (see Figure 2017-3b)

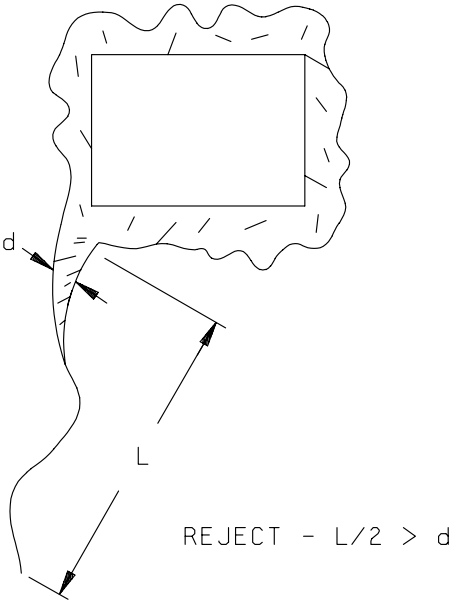


FIGURE 2017-3b. Adhesive String Criteria.

Class H Class K

i. For element connection to a package post lead, attachment media visible for less than 25 percent of the post perimeter. When the post also serves for substrate attachment, media shall be visible for no less than 50 percent of the post perimeter. (see Figure 2017-3C)

j. Cold solder joints.

k. For thin film NiCr only, nonconductive adhesive material that covers more than 10 percent of the active area of deposited resistor material.

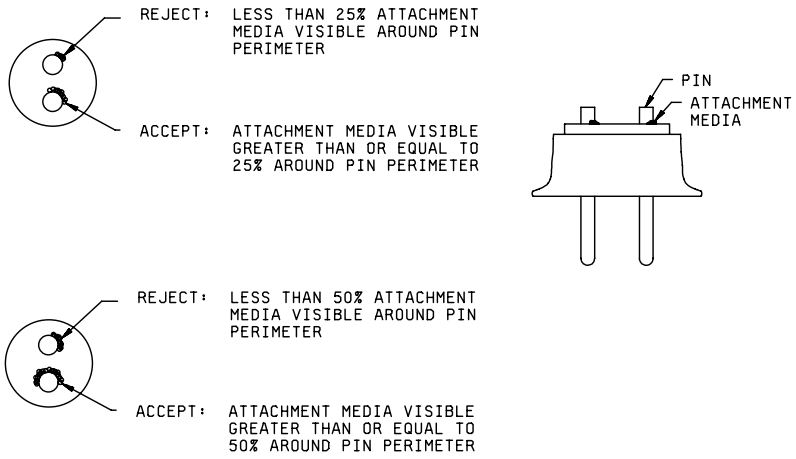


FIGURE 2017-3c. Package Post Criteria.

3.1.3 Element orientation. Element not located or oriented in accordance with the applicable assembly drawing of the device. Elements whose bond and electrical configuration is symmetrical may be rotated unless otherwise stated in the assembly drawings.

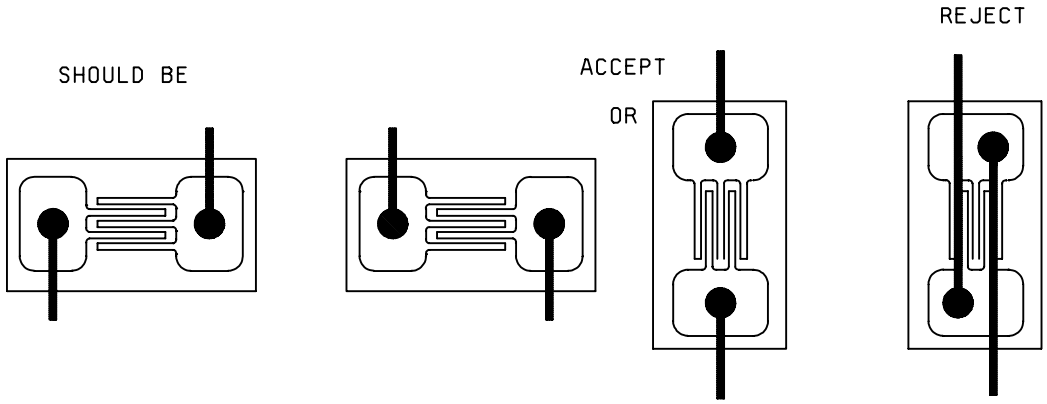


FIGURE 2017-3d. Acceptable Symmetrical Element Orientation.

Class H Class K

3.1.4 Separation. Elements shall not overhang the edge of the substrate. A minimum clearance of 1.0 mil shall be maintained between any uninsulated portion of the element and any non-common conductive surface.

3.1.5 Bond inspection, magnification 30X to 60X. This inspection and criteria shall be the required inspection for the bond type(s) and location(s) to which they are applicable when viewed from above.

Note: Wire tail shall not be considered part of the bond when determining physical bond dimensions.

3.1.5.1 Ball bonds. No device shall be acceptable that exhibits:

a. Ball bond diameter less than 2.0 times or greater than 5.0 times the wire diameter.

b. Ball bonds where the wire exit is not completely within the periphery of the ball.

c. Ball bonds where the wire center exit is not within the boundaries of the bonding site.

3.1.5.2 Wire wedge bonds. No device shall be acceptable that exhibits: (see Figure 2017-4a)

a. Ultrasonic and thermosonic wedge bonds that are less than 1.0 times or greater than 3.0 times the wire diameter in width or less than 0.5 times the wire diameter in length or no evidence of tool impression.

b. Devices with thermocompression wedge bonds that are less than 1.2 times or greater than 3.0 times the wire diameter in width or less than 0.5 times the wire diameter in length or no evidence of tool impression.

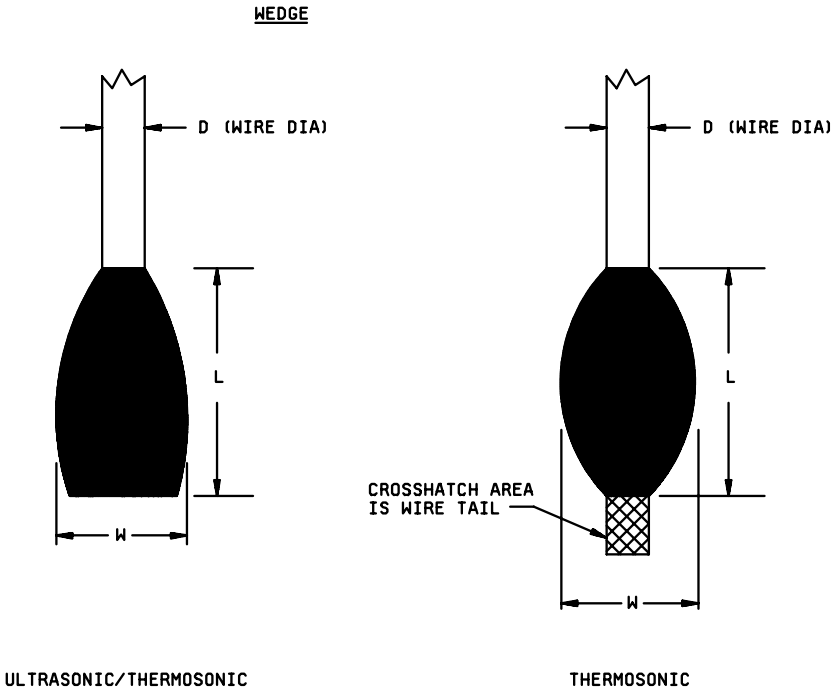


FIGURE 2017-4a. Bond Dimensions.

Class H Class K

3.1.5.3 Tailless bonds (crescent). No device shall be acceptable that exhibits:

* a. Tailless bonds that are less than 1.2 times or greater than 5.0 times the wire diameter in width. (see Figure 2017-4b).

b. A tailless bond of a gold wire bonded on the aluminum pads of a die.

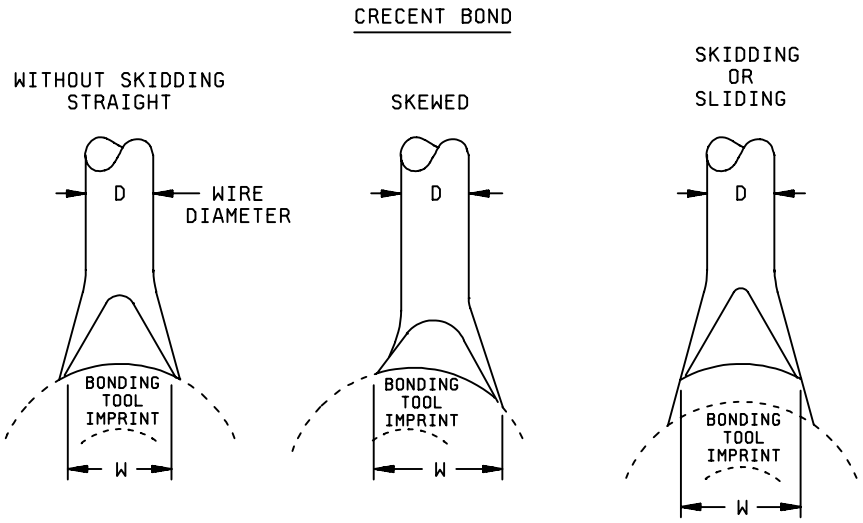


FIGURE 2017-4b. Bond Dimensions.

3.1.5.4 Compound bond. No device shall be acceptable that exhibits the following:

NOTE: Broken or lifted bonds as a result of electrical troubleshooting or tuning shall be considered rework and shall not apply to the 10 percent repair limitation.

Class H Class K

a. One bond used to secure two common wires. (see Figure 2017-5)

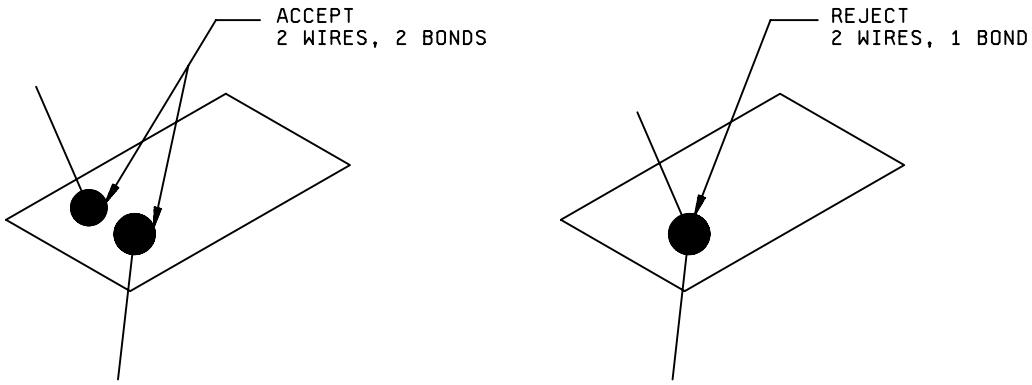


FIGURE 2017-5. One bond used to secure two common wires.

b. More than one bond on top of original bond.

NOTE: When required by design and based on a justifiable technical need, and with the approval of the qualifying or acquiring activity, additional compound bonds may be allowed in addition to the limitations of a and b above. Demonstration of acceptable N+1 bond stacks (N = maximum number of compound bonds allowable by the manufactures process) and establishment of necessary process controls shall be required for approval.

c. Compound bond where the contact area of the second bond with the original bond is less than 75 percent of the bottom bond.

d. Non-monometallic compound bond (i.e., between dissimilar metals, excluding the bond pad metallization).

3.1.5.5 Beam lead. This inspection and criteria shall apply to the completed bond area made using direct tool contact. No device shall be acceptable that exhibits:

a. Bonds which do not exhibit 100 percent bond/weld impression(s) across the width of the beam lead.

NOTE: Gaps between bonds/welds on the beam lead caused by the natural footprint of a bond/weld tip (i.e., split tip, etc.), are acceptable provided the total of all gaps does not exceed 25 percent of the beam lead width.

b. Complete or partial beam separation from the die.

c. Bonds on the substrate where the tool impression is not visible on the beam.

d. Beam lead width increased by greater than 60 percent of the original beam width.

Class H Class K

e. Bonds where the tool impression length is less than 1.0 mil (see Figure 2017-6)

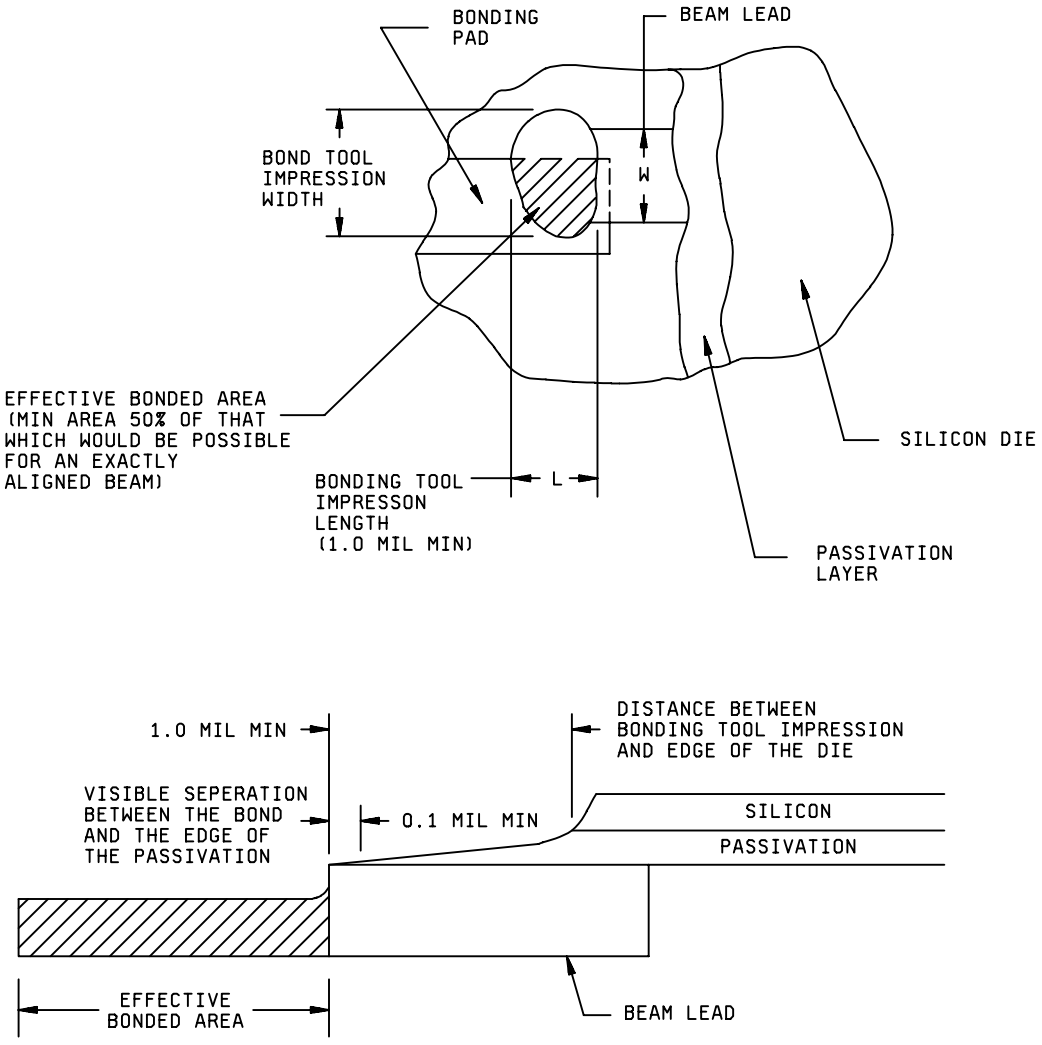


FIGURE 2017-6. Beam Lead Area and Location.

Class H Class K

f. Bonding tool impression less than 1.0 mil from the die edge (see Figure 2017-6).

g. Effective bonded area less than 50 percent of that which would be possible for an exactly aligned beam (see Figure 2017-6).

h. Any tears in the beam lead between the bond junction nearest the die body and the die or in the bonded area of the beam lead within a distance equal to 50 percent the beam lead width (see Figure 2017-7).

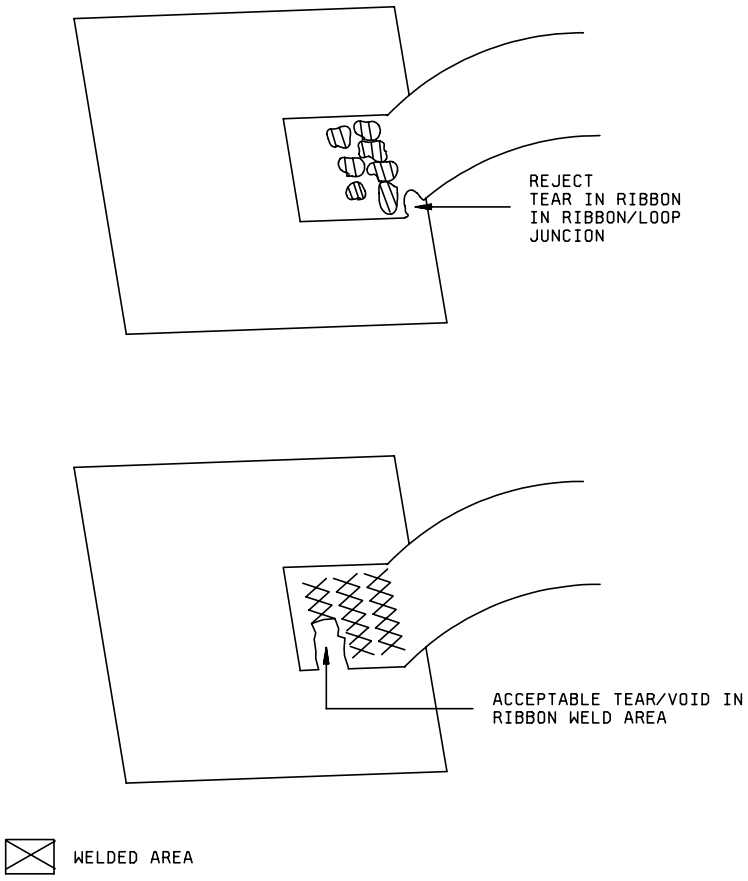


FIGURE 2017-7. Acceptable/rejectable tears or voids in ribbon weld area.

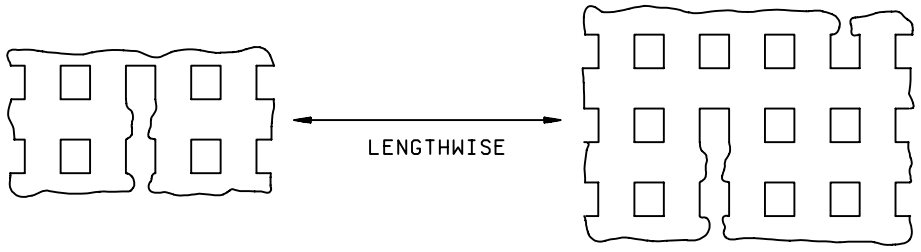
i. An absence of visible separation between the bond and the edge of the passivation layer (see Figure 2017-6).

j. An absence of visible separation between a beam lead and non-electrically common metallization. This criteria applies for both glassivated and unglassivated metallization.

3.1.5.6 Mesh bonding. No device shall be acceptable that exhibits the following:

a. Less than 50 percent of the bond is on substrate metallization.

Class H	Class K
b. The number of continuous strands along the mesh is less than 50 percent of lengthwise strands through each section. (see Figure 2017-8a).	
c. Less than one continuous conducting path(s) through a bond (see Figure 2017-8b).	Less than two continuous conducting path(s) through a bond (see Figure 2017-8b).



REJECT: LESS THAN HALF OF THE LENGTHWISE STRANDS ARE CONTINUOUS (2 OF 3 STRANDS ARE DISCONTINUOUS)

ACCEPT: 2 (HALF) OR MORE OF THE LENGTHWISE STRANDS ARE CONTINUOUS THROUGH EACH SECTION

FIGURE 2017-8a. Criteria for strands along the mesh.

REJECT: NO CONTINUOUS PATH THROUGH THE MESH BETWEEN BONDS

ACCEPT: AT LEAST ONE CONTINUOUS PATH THROUGH THE MESH BETWEEN BONDS

FIGURE 2017-8b. Criteria for continuous conducting paths.

Class H	Class K

3.1.5.7 Ribbon bonds. No device shall be acceptable that exhibits the following:

a. Any tears in the ribbon at the junction between the ribbon loop and bond/weld.

b. Bonds which do not exhibit 100 percent bond/weld impression(s) across the width of the ribbon overlapping underlying metallization.

NOTE: Gaps between welds on the ribbon caused by the natural footprint of a weld tip (i.e., split tip, etc.) are acceptable provided the total of all gaps do not exceed 25 percent of the ribbon width.

c. Effective bonded area less than 50 percent of that which would be possible for an exactly aligned ribbon.

d. Bond tails longer than one ribbon width or 10.0 mils, whichever is less, or bridging adjacent metallization.

e. The unbonded end of a ribbon bond tuning stub longer than one ribbon width of 10.0 mils, whichever is less, that is not secured by polymer adhesive.

3.1.5.8 General. No device shall be acceptable that exhibits:

	Class H	Class K
	a. Bonds on the die where less than 50 percent of the bond is within the unglassivated bonding site.	a. Monometallic bonds on the die where less than 50 percent of the bond is within the unglassivated bonding site. Bimetallic bonds on the die where less than 75 percent of the bond is within the unglassivated bonding site.
*	b. Any metal that is displaced, as a result of bonding from its original position on the bonding pad (shooting metal) that reduces the separation between unglassivated operation metallization or scribe line to less than 0.25 mils or 50 percent design separation, whichever is less.	b. Any metal that is displaced, as a result of bonding from its original position on the bonding pad (shooting metal) that reduces the separation between unglassivated operation metallization or scribe line to less than 0.25 mils or 50 percent design separation, whichever is less.

* c. Bonds on the package post or substrate that are not completely within the bonding site.

NOTE: For cases where the substrate bonding site is smaller than 1.5 times the minimum bond size, bonds on the substrate where less than 50 percent of the bond is within the bonding site.

* d. Bonds placed so that the wire exiting from a bond crosses over another bond, except by design, in which case the clearance shall be 2.0 wire diameters minimum (common bonds are excluded from this criteria).

* e. An absence of a visible line of separation between non-electrically common bonds.

* f. An absence of a visible line of separation between a bond and non-electrically common metallization. This criteria applies to both glassivated and unglassivated metallization.

* g. Wire bond tails that extend over or make contact with any noncommon, unglassivated active metal.

* h. Wire bond tails that exceed two wire diameters in length at the bonding pad or four wire diameters in length at the package post.

* i. Bonds on element attach media or on contaminated or foreign material.

Class H Class K

* j. Any lifted or peeling bond.

* k. Intermetallic formation extending completely around the metallic interface of any bond between dissimilar metals.

* l. Wedge, crescent or ball bonds at the point where metallization exits from the bonding pad that do not exhibit a line of undisturbed metal visible between the periphery of the bond and at least one side of the entering metallization stripe.

* NOTE: Criteria of 3.1.5.8 (l) can be excluded when the entering conductor is >2 mils in width and the bond pad dimension on the entering conductor side is >3.5 mils.

NOTE: For Class H only, the requirements for a visual line of metal can be satisfied when an acceptable wire tail obscures the area of concern, provided the following condition exists. Bond is located more than 0.1 mil from the intersecting line of the entering metallization stripe and the bonding pad and there is no visual evidence of disturbed pad metallization at the bond and wire tail interface.

* NOTE: Criteria 3.1.5.8 (l) is not applicable to interdigitated (Lange) couplers or when the interface between a thermosonic/ultrasonic (i.e., non-thermocompression) bond and underlying metal is monometallic.

l. Polymeric adhesive which may be material or residue as evidenced by discoloration within 5.0 mils of the outer periphery of a wire bond.

m. Tearing at the junction of the wire and bond. The junction is the line of deformation of the wire at the bonding site.

3.1.6 Internal leads (e.g., wires, ribbons, beams, wireloops, ribbon loops, beams, etc.), "magnification 10X to 60X". No device shall be acceptable that exhibits:

a. Within the first 5.0 mils of wire from the die surface for ball bonds, or 10.0 mils for wedge bonds, any wire that comes closer than 1.0 mil to any non-common conductive surface (e.g., unglassivated operating metallization, unpassivated edge of conductive die).

NOTE: Insulated wires and electrically common wires are excluded from this criteria.

b. After the first 5.0 mils of wire from the die surface for ball bond(s), or 10 mils for wedge bonds, any wire that comes closer than two wire diameters to any non-common, uninsulated conductive surface (e.g., unglassivated operating metallization, unpassivated edge of conductive die).

NOTE: Insulated wires and electrically common wires are excluded from this criteria.

c. Nicks, cuts, crimps, scoring, sharp bends, or neckdown in any lead that reduces the lead diameter/width by more than 25 percent.

d. Missing or extra lead(s) not in conformance with bonding diagram.

NOTE: Leads designated for tuning on the bonding diagram are excluded.

e. Any lead making a straight line run from bond to bond that has no arc, unless specifically allowed by the bonding diagram.

f. Wire(s) crossing wire(s) with a separation of less than 2 lead widths. Common or insulated conductors and insulated wires are excluded.

g. Complete or partial separation of the lead from the body of the element.

h. Excessive loop height such that the wire would contact the lid when it is installed.

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3.1.7 Screw tabs and through hole mounting, magnification 3X to 10X. No device shall be acceptable that exhibits:

a. Misaligned tabs.

b. Missing or broken tabs.

c. Cracks emanating from mounting holes.

d. Loose substrates.

e. Missing or loose screws.

3.1.8 Connector and feedthrough center contact soldering, magnification 10X to 30X. No device shall be acceptable that exhibits:

a. Less than 50 percent of center contact overlaps onto metallized pattern (see Figure 2017-9).

b. Center contact to substrate protrudes over onto circuit less than 1 diameter of a round pin or the width of a flat pin (see Figure 2017-10).

c. Voids in solder (see Figure 2017-11a).

d. Cracked solder joint (see Figure 2017-11b).

e. Poor adhesion of solder to center contact or substrate (see Figure 2017-11b).

f. Insufficient or excess solder (see Figures 2017-11c through 2017-11e).

g. Less than full coverage of solder along the length of the center contact and the metallization.

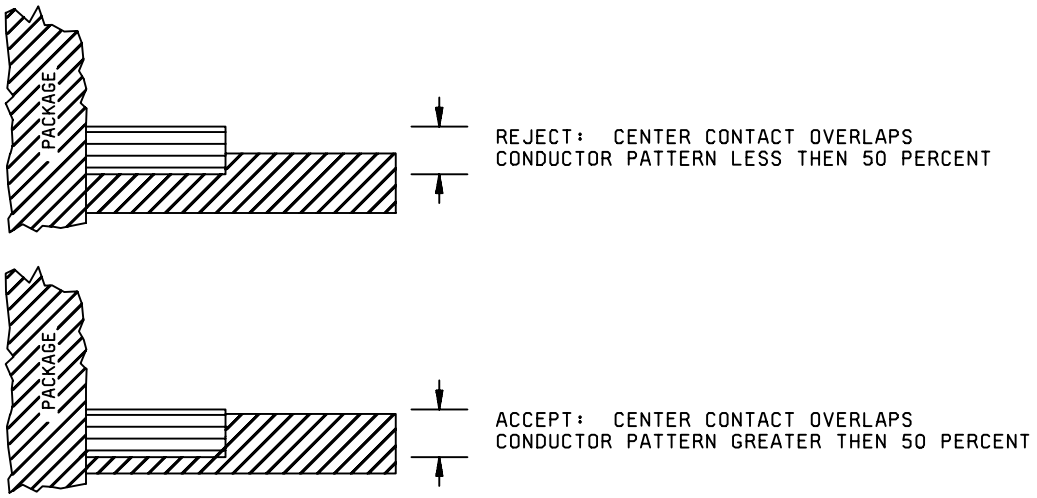

FIGURE 2017-9 Center contact orientations to substrate.

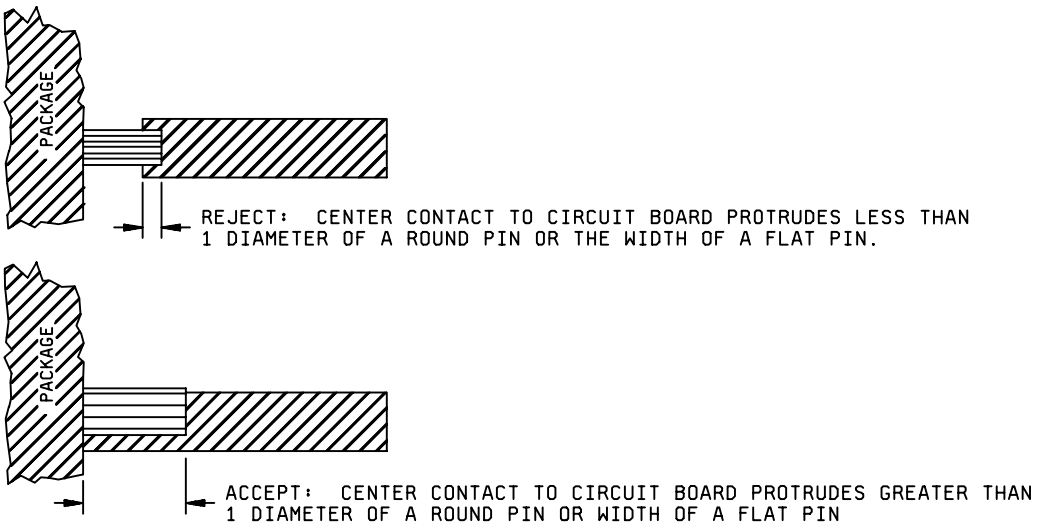

FIGURE 2017-10. Center Contact overlap to substrate.

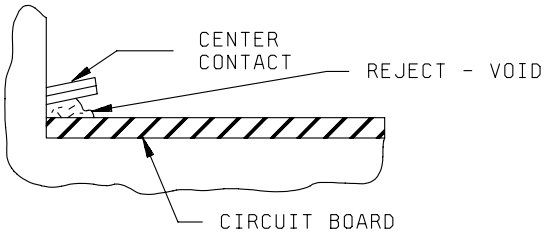

FIGURE 2017-11a. Void criteria.

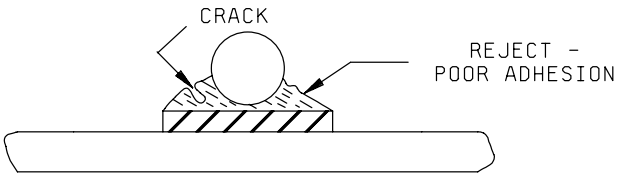

FIGURE 2017-11b. Crack/adhesion criteria.

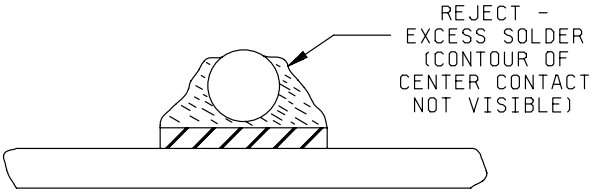

FIGURE 2017-11c. Excess solder criteria.

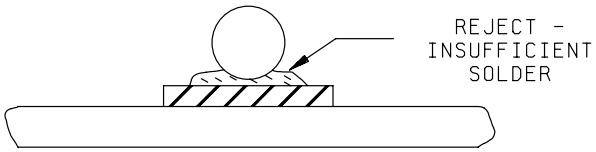

FIGURE 2017-11d. Insufficient solder criteria.

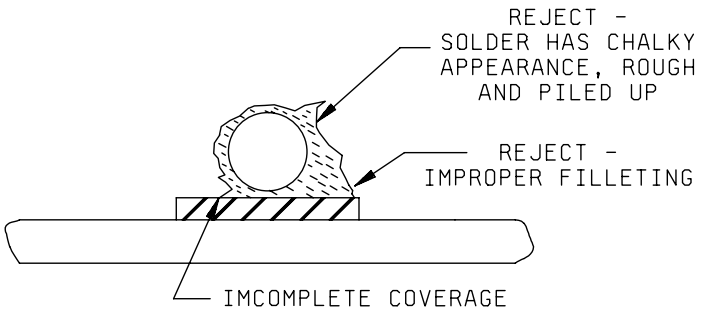

FIGURE 2017-11e. Solder criteria.

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3.1.9 Package conditions, "magnification 10X to 60X". No device will be acceptable that exhibits:

a. Unattached foreign material within the package or on the seal flange.

NOTE: All foreign material shall be considered to be unattached unless otherwise verified to be attached. Verification of attachments of foreign material whose longest dimensions are greater than 75 percent of the closest unglassivated conductive spacing shall be accomplished by a light touch with an appropriate mechanical device (i.e., needle, probe, pick, etc.). Verification of attachments of smaller material can be satisfied by suitable cleaning process approved by the acquiring activity. All foreign material or particles may be verified as attached with a nominal gas blow (approximately 20 psig).

NOTE: Semiconductor chips shall be considered foreign particles.

b. Attached foreign material that bridges metallization paths, two package leads, lead to package metallization, functional circuit elements, junctions, or any combination thereof.

c. Liquid droplets or any chemical stain that bridges any combination of unglassivated operating metallization.

d. Physical damage or contamination (eutectic or polymer material) that prevents adequate sealing of the seal surface.

e. Presence of any residual flux.

NOTE: Use 10X to 15X magnification.

f. Foreign material in melt that does not exhibit a fillet.

4. SUMMARY. The following details shall be specified in the applicable acquisition document:

a. Test condition (see 3).

b. Where applicable, gages, drawings and photographs that are to be used as standards for operator comparison (see 2).

c. Where applicable, specific magnification if other than that specified (see 3).