

JEDEC STANDARD

Inspection Criteria for Microelectronic Packages and Covers

JESD9C

(Revision of JESD9B, May 2011)

MAY 2017

JEDEC SOLID STATE TECHNOLOGY ASSOCIATION



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Published by
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INSPECTION CRITERIA FOR MICROELECTRONIC PACKAGES AND COVERS

Contents

	Page
Foreword	ii
1 Scope	1
2 Normative Reference	1
3 Terms and Definitions	2
4 General Requirements	10
4.1 Quality System	10
4.2 Quality and Screening	10
4.3 Order of Precedence	10
4.4 Optical Inspection Magnification	10
4.5 Controlling Dimension	10
5 Insulator Criteria (Metal Packages: Glass-to-metal and Ceramic-to-metal Seals)	11
5.1 Insulator Bubbles	11
5.2 Insulator Cracks, Chip-outs, Crazeing	13
5.3 Insulator Climb, Overflow, Splatter	17
5.4 Other Insulator Conditions	19
6 Braze Criteria (Metal Packages)	21
6.1 Undercut Braze, Non-continuous Braze, Misalignment	21
6.2 Porous and Peeling Braze	22
6.3 Braze Run-out	23
6.4 Braze Climb	24
7 Leads (Metal and Ceramic Packages)	26
7.1 Lead Nicks, Pits, Voids, Indentations, Scratches, Over-etching, Protrusions	26
7.2 Lead Surface Finish	29
7.3 Off-center, Bent, Angled, or Broken Leads	31
8 General Package Criteria (Metal Packages)	34
8.1 Package Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs	34
8.2 Package Surface Finish	40
9 General Cover Criteria (Metal Covers)	42
9.1 Cover Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs	42
9.2 Cover Surface Finish	45
10 General Package Criteria (Ceramic Packages: Non-metallized Areas)	46
10.1 Ceramic Chip-outs, Cracks, Delamination, Separation, Voiding, Protrusions, Fins	46
11 Metallization Criteria (Ceramic Packages)	50
11.1 General	50
11.2 Contact Pad Metallization	50
11.3 Seal Area Metallization	53
11.4 Bonding Area Metallization	57
11.5 Die Attach Area	61
11.6 Braze Pad Metallization	64
11.7 Castellated Metallization	66
12 Lead Attachment (Ceramic Packages)	67
12.1 Lead to Braze Pad Attachment	67
12.2 Lead to Pad Misalignment	69
Annex A (informative) Index of Figures	70
Annex B (informative) Differences between revisions	73

Foreword

The purpose of this JEDEC standard is to verify the workmanship and requirements of microelectronic packages and covers (lids) intended for use in fabricating hybrid microelectronic circuits / microcircuits (hereafter referred to as “microcircuits”). It is applicable for use by the package manufacturer (i.e., package components), and the microcircuit manufacturer (i.e., from incoming inspection of package components through final inspection of the completed microcircuit).

This standard also encompasses and replaces JESD27, *Ceramic Package Specification for Microelectronic Packages*. It is meant to be used in conjunction, and to not contradict, with MIL-STD-883, Test Method 2009: External Visual. This standard provides the package manufacturer, microcircuit manufacturer, and microcircuit customer a complete set of microelectronic package workmanship inspection requirements.

INSPECTION CRITERIA FOR MICROELECTRONIC PACKAGES AND COVERS

(From JEDEC Board Ballot JCB-11-23 and JCb-17-05, formulated under the cognizance of the JC-13.5 Committee on Hybrid Microcircuit Technology)

1 Scope

This standard establishes the inspection criteria for metal and ceramic hermetic packages, individual feed throughs, and covers (lids).

2 Normative Reference

The following normative documents contain provisions that, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

MIL-PRF-38534, *Hybrid Microcircuits, General Specification for*

MIL-PRF-38535, *Microcircuits, General Specification for*

MIL-STD-883, *Test Method Standard, Microcircuits*

Military Standards are available in electronic format from: <http://quicksearch.dla.mil/>.

3 Terms and Definitions

For the purpose of this standard, the terms, definitions, and symbols of MIL-PRF-38534, MIL-PRF-38535, and MIL-STD-883 and the following shall apply and shall be used in the applicable procurement documentation:

- 3.1 annular ring:** The metallization pad area around the top or bottom of a castellation hole.
- 3.2 base:** The bottom main support area of a package.
- 3.3 base metal:** The unplated main metal material of which the metal package, lead, or braze is constructed.
- 3.4 blistering:** Detachment of material from the surface creating a bubble-like shape.
- 3.5 bonding (critical) area:** The surface on a lead or package to which wires will be bonded (i.e., the wirebond area).
- NOTE 1 This term is not to be confused with the “die bond area” which is specified as the “die attach area” in this standard.
- NOTE 2 The critical wire bond area on a ceramic package is a metallization trace whose length is 0.015 inches (0.381 mm) and whose width is 80% of the width of the designed wirebond trace, as specified in the applicable procurement document.
- 3.6 bonding trace; wirebond trace:** A metallized path on a package or substrate to which a bond wire is wirebonded.
- 3.7 braze:** A metallic material used to join two metals or metallized components.
- 3.8 braze climb:** The distance from the surface of the package to the top of the braze line on a lead, not including braze flash.
- 3.9 braze flash:** The braze material that has flowed over or out of the designed contained braze area and is less than 0.001 inches (0.0254 mm) thick.
- 3.10 braze run-out:** The braze material that has flowed over or out of the designed contained braze area, not including braze flash.
- 3.11 braze, undercut:** The braze material recessed from the package surface at the interface of the package wall and the package base.
- 3.12 bubble, subsurface:** A bubble in the glass-to-metal seal that is below the top surface of the seal and is not open or can not be opened with a wood probe.

3 Terms and Definitions (cont'd)

3.13 bubble, surface; open-surface bubble: A bubble in the glass-to-metal seal that is at the top surface of the seal and is either open or can be opened with a wood probe.

3.14 castellation: A semicircular or crown-shaped metallized surface.

3.15 chip-out: An area where a crack has allowed a portion of the insulator to break away leaving a void in the insulator at the metal interface.

3.16 concentric: Having a common center point.

3.17 corrosion: The breaking down or destruction of a material, especially a metal, through a chemical reaction.

NOTE The most common form of corrosion is rusting, which occurs when iron combines with oxygen and water.

3.18 cover: A lid that is soldered, seam-sealed, projection-welded, etc. to the package to create a hermetically sealed microcircuit.

3.19 crack, circumferential: A crack that appears on the surface of an insulator and follows the shape of the package hole.

3.20 crack, meniscus: A crack confined to the meniscus area of the seal above the average low point of the insulator.

3.21 crack, radial: A crack that appears on the surface of the insulator and either starts at the package and extends towards the lead or starts at the lead and extends towards the package propagating past the average low point of the insulator.

3.22 crazing: Multiple minute cracks that appear on the surface of the insulator.

3.23 delamination: The detachment of a sheet-like layer of material from a surface.

3 Terms and Definitions (cont'd)

3.24 die (attach) area: An area of a package used for die placement and typically located on the bottom inside surface of the base of the package.

NOTE For ceramic package cavities, the die attach area is defined as the area that is within a 0.020-inch (0.508-mm) perimeter from the die attach cavity wall (Figure 3.24-1).

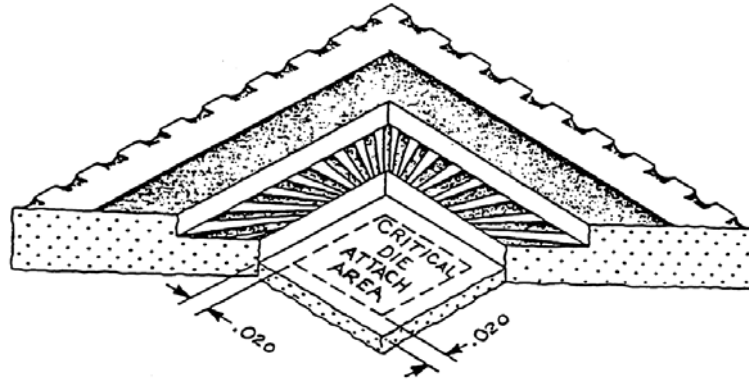


Figure 3.24-1 — Critical die attach area in a ceramic package cavity

3.25 eyelet: A ring of metal used as the outside member of a hermetic lead seal to hold a feed-through in place, typically soldered into the package.

3.26 fin: A fine feather edge protrusion occurring at an edge.

3.27 fin, hanging: A fin that can be moved with a probe but is still connected to the surface.

3.28 flaking: The detachment of a sheet-like layer of material from a surface.

3.29 foreign material: Any adhering material or residue not intentionally added or included in the piece part composition by design.

3.30 heat sink: A heat exchange material, typically metal or ceramic, designed to absorb and dissipate excess heat from one or more devices in a circuit.

3.31 indentation: A notch or deep recess in a surface.

3.32 insulator: A lead seal material (typically matched glass, compression glass, or brazed ceramic) that electrically isolates a lead from the package and creates a hermetic seal.

3.33 insulator climb: The amount of insulator measured from the surface of the package to the top of the insulator line on the lead.

3 Terms and Definitions (cont'd)

3.34 insulator overflow: The insulator that flows over or out of the designed contained insulator area, typically the package hole.

3.35 insulator splatter: Small particles of the insulator that adhere to the surfaces of the package or lead during fusing and remain attached after cleaning or plating or both.

3.36 insulator webbing: The joining of overflow between adjacent seals.

3.37 lead: The flexible, semi-flexible, or solid/rigid conductor leading out from the microcircuit and used for electrical and mechanical connections.

NOTE 1 Leads may be classified as round (pin, nail-head pin, terminal, etc.) and flat (etched or stamped planar, etc.).

NOTE 2 Leads are typically surrounded by an insulator for electrical connections isolated from the metal package or brazed directly to the metal package for electrical (ground) connections to the package. They are typically brazed directly to the braze pad for electrical connections to a ceramic package.

NOTE 3 Leads projecting to the exterior of the package are called "outside" leads. Leads projecting into this area are called "inside" leads.

3.38 lead head: On a ceramic package, the portion of the lead meant to be brazed to the braze pad.

3.39 meniscus: The area of the insulator that wicks / wets up the lead above the average low point of the seal at the lead and package (on both sides of the seal) at the lead and/or package interface (Figure 3.39-1).

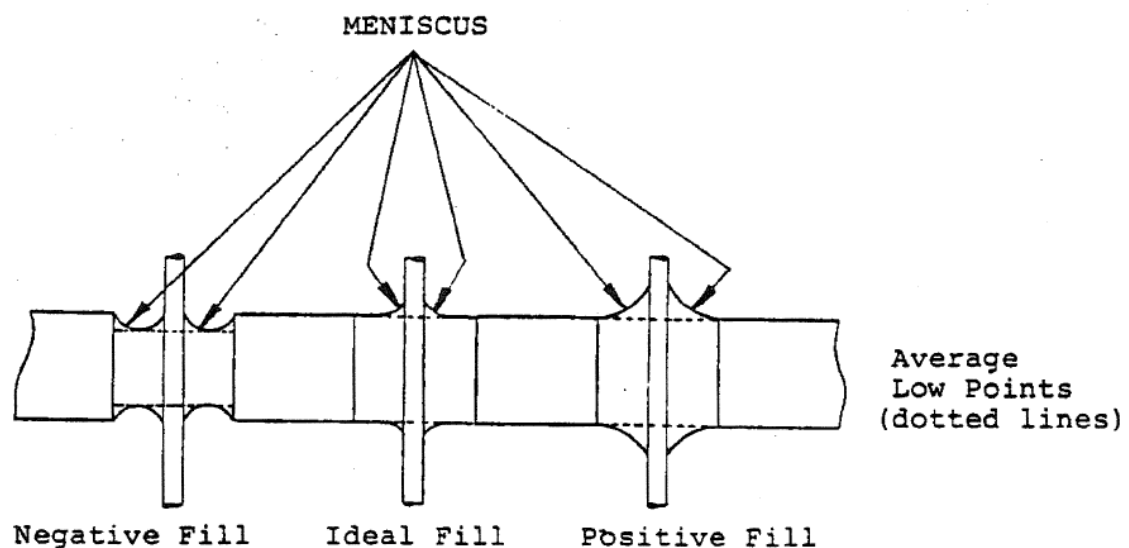


Figure 3.39-1 — Meniscus

3 Terms and Definitions (cont'd)

3.40 mounting surface; seating plane: The external area of the package on which the package will mount to the end application PCB, heat sink, etc.

NOTE This is typically the base on the external, opposite side of the package cavity die attach or substrate attach area.

3.41 nick: A small notch, groove, chip, dent, etc. cut into or existing in a surface and typically due to mechanical damage.

3.42 package: The body of the device, case, header, housing, etc.

3.43 package exterior: The exterior of the package that will be exposed to the usage and storage environment.

3.44 package hole: A hole in the package intended by design, typically an external mounting hole or feed-through hole filled with a glass or ceramic seal.

3.45 package interior; package cavity: The interior of the package that will become the sealed cavity containing and protecting the product circuitry connected to the leads extending to the interior of the package.

3.46 pad, braze: A metallized pad on the ceramic microcircuit package used to braze a lead for electrical and mechanical connections.

3.47 pad, contact: A metallized pad on the outer edge of the ceramic microcircuit package used for electrical and mechanical connections, typically a castellation.

3.48 peeling: The detachment of a sheet-like layer of material from a surface.

3.49 pit: A hollow or indentation in a surface, typically caused by a chemical attack.

3.50 plating: A thin coating of metal applied to the base metal or another plating layer by mechanical, chemical, or electrochemical means.

3.51 polymer: Any of various chemical compounds made of smaller, identical molecules (called monomers) linked together, typically used as adhesives for microelectronics assembly.

3.52 protrusion: A raised portion that protrudes or projects from a surface, typically indigenous with the surface material.

3.53 protrusion, hanging: A protrusion that can be moved with a probe but is still connected to the surface.

3 Terms and Definitions (cont'd)

- 3.54 protrusion, solid:** A protrusion that cannot be moved with a probe.
- 3.55 procurement document:** A document (SCD, specification, statement of work, purchase order, etc.) that defines the requirements (mechanical, electrical, etc.) for the item being procured.
- 3.56 rework:** To process again or renew for reuse or acceptability.
- 3.57 scratch:** A slight injury, mar, or mark, usually thin and shallow.
- 3.58 seal, glass-to-metal:** The glass material, typically matched glass or compression glass, that surrounds the lead, holds the lead in place in the package, and electrically isolates the lead from the package creating a hermetic seal.
- 3.58a seal, glass-to-metal, compression:** A mechanically bonded seal in which residual compressive stresses of the metal package around the glass creates a mechanical seal at the glass to metal interface.
- 3.58b seal, glass-to-metal, matched:** An oxide bonded seal in which matched thermal expansion of metal and glass rely on metal oxide formation to form oxide bonds with the glass.
- 3.59 seal, ceramic-to-metal:** The ceramic material metallized at the package and lead interfaces and brazed to the package and the lead. The ceramic holds the lead in place in the package, creates a hermetic seal, and electrically isolates the lead from the package.

3 Terms and Definitions (cont'd)

3.60 seal (critical) area: The package-to-insulator seal hole edge or sealing surface on either the package or the cover where the package and cover are soldered, seam-welded, projection-welded, etc. together and create a hermetic seal.

NOTE Specific critical seal surface areas for special package styles are specified as:

a) Projection-weld packages: The delta-shaped (Δ) weld projection (Figure 3.60-1a).

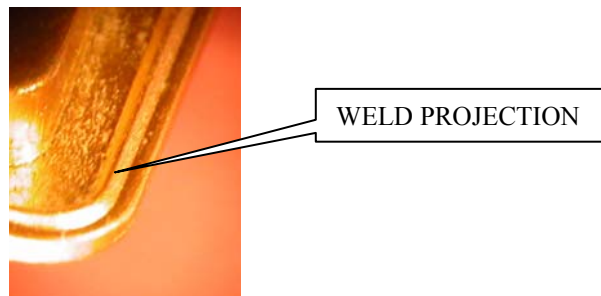


Figure 3.60-1a — Critical seal area of a projection-weld package

b) Seam-weld packages: The outer 25% of the package seal surface (Figure 3.60-1b).

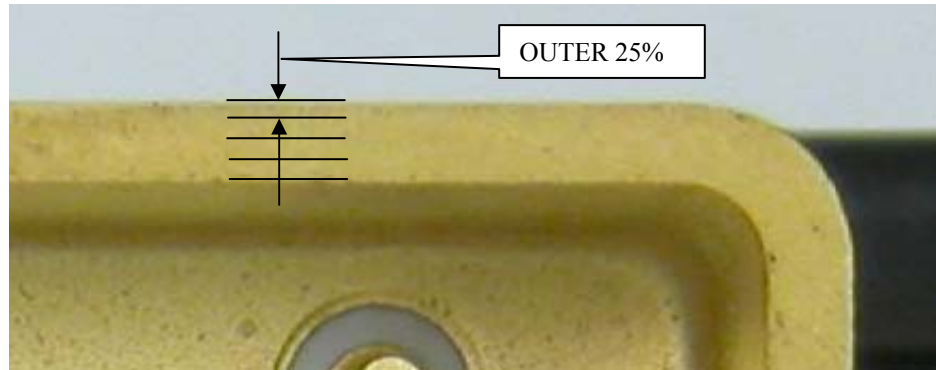


Figure 3.60-1b — Critical seal area of a seam-weld package

3.61 sidewall: One of the walls of a package creating a cavity.

NOTE Sidewalls are typically brazed to a base of similar material or a solid block of material is machined to create a cavity with solid sidewalls.

3.62 staining: A discoloration produced by foreign matter having penetrated into or chemically reacted with a material, typically not easily removed.

3.63 standoff: An insulator or support that supports an item above a surface.

3 Terms and Definitions (cont'd)

3.64 substrate (attach) area: An area of package used for substrate placement, typically on the bottom inside surface of the base of the package.

3.65 surface finish roughness: The texture or roughness of a surface.

3.66 tie bar: Additional metal, at the outside ends of the leads, that connects together the individual leads to protect the leads from bending or damage and/or to aid in holding during assembly, plating, or handling operations.

NOTE Tie bars are incorporated into the lead frame design and can be manufactured by stamping, etching, or welding methods.

3.67 underplating: Any plating layer between the outermost plating layer and the base metal.

NOTE The underplating is typically nickel.

3.68 void: A hollow or indentation in a surface, typically an absence of intended material such as plating or metallization.

3.69 weld projection: The delta-shaped (Δ) projection that welds to the package/cover to create a hermetic seal.

4 General Requirements

4.1 Quality System

The manufacturer of microelectronic packages and covers in compliance with this standard shall have production and test facilities that are controlled by a documented quality system.

4.2 Quality and Screening

Quality and screening shall be in accordance with MIL-PRF-38534 and MIL-PRF-38535 unless otherwise specified in the procurement documentation.

4.3 Order of Precedence

In the event of conflict between the requirements of this standard and other requirements, the following shall apply in order of precedence:

- 1) Procurement Documentation
- 2) Detail Package and Specification
- 3) This Standard

4.4 Optical Inspection Magnification

Devices shall be examined at 1.5X to 10X magnification. Devices may be examined with a magnification anywhere in the range of 1.5X to 10X, however, acceptable product must be capable of passing all criteria when examined at 10X magnification. Individual glass seals shall be examined at 7X to 10X magnification. Magnification up to 30X may be used to evaluate an anomaly.

4.5 Controlling Dimension

All dimensions are specified in inches and millimeters (mm). The controlling (non-bracketed) dimension is inches.

5 Insulator Criteria (Metal Packages: Glass-to-metal and Ceramic-to-metal Seals)

5.1 Insulator Bubbles

- 5.1.1** Rejectable Condition: Open surface bubbles that exceed 0.005 inches (0.127 mm) diameter (Figure 5.1-1). For packages with a glass filled header (i.e., TO-5), open surface bubbles that exceed 0.010 inches (0.254 mm) diameter, or an open surface bubble that exceeds 0.005 inches (0.127 mm) diameter situated closer than 0.010 inches (0.254 mm) to a lead. Use the longest X-Y dimension to specify the diameter.

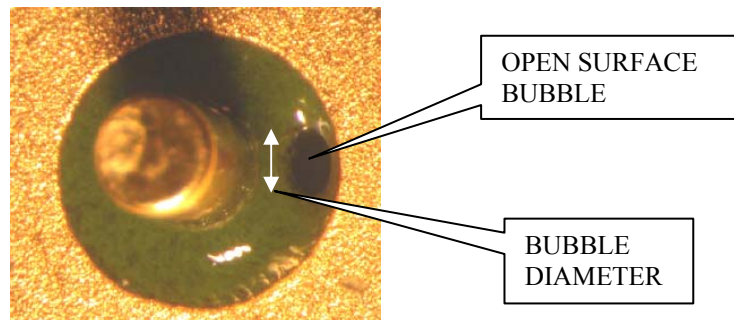


Figure 5.1-1 — An open surface bubble

- 5.1.2** Rejectable Condition: Open surface bubbles or subsurface bubbles that are joined in strings or clusters (interconnecting) and cover greater than 2/3 of the insulator between the lead and package (Figure 5.1-2).

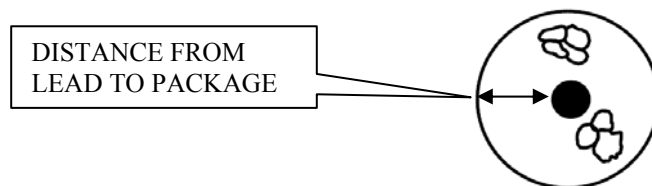


Figure 5.1-2 — Interconnecting open surface bubbles

- 5.1.3** Subsurface bubbles close to the surface that can be probed open with a wood probe shall be classified as surface bubbles and the above criteria shall apply.

5.1 Insulator Bubbles (cont'd)

- 5.1.4** Rejectable Condition: Subsurface bubbles in a line that cover greater than $2/3$ of the insulator between the lead and package (Figure 5.1-3).

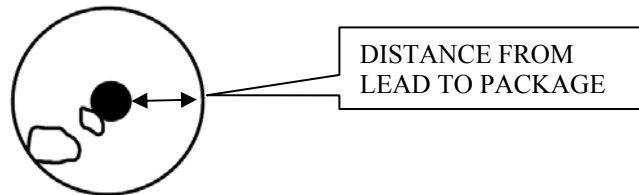


Figure 5.1-3 — Subsurface bubbles in a line

- 5.1.5** Rejectable Condition: Multiple subsurface bubbles that cover greater than $1/3$ of the insulator area (Figure 5.1-4).



Figure 5.1-4 — Multiple subsurface bubbles

- 5.1.6** Rejectable Condition: Single subsurface bubble that covers greater than $2/3$ of the insulator between the lead and package (Figure 5.1-5).

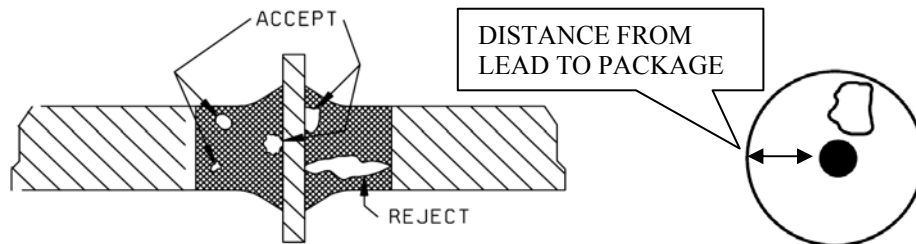


Figure 5.1-5 — A single subsurface bubble

5.2 Insulator Cracks, Chip-outs, Crazing

- 5.2.1** Rejectable Condition: In ceramic insulators, all cracks, including but not limited to radial and circumferential cracks (Figure 5.2-1). If ceramic insulator surface cracking is inherent due to stresses resulting from the package design, proof of long term reliability and customer approval is required.

In glass insulators, cracks confined to the meniscus area of the insulator are acceptable (meniscus area is defined in 3.39).

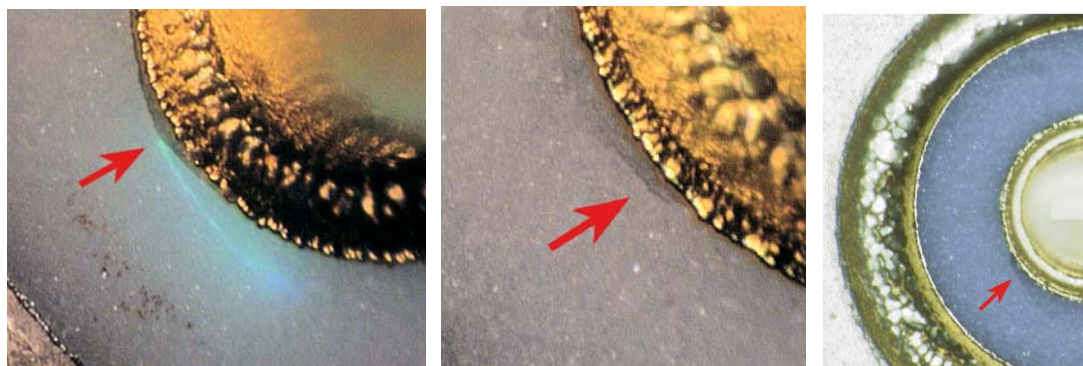


Figure 5.2-1 — Cracks in ceramic insulators

- 5.2.2** Rejectable Condition: Any single circumferential crack (crack crosses or is outside of the edge / low point of the meniscus) that do not lie completely within a single quadrant (i.e., extends beyond 90° arc or rotation about the lead) or any overlapping / intersecting circumferential cracks that do not lie completely within a single quadrant (Figure 5.2-2).

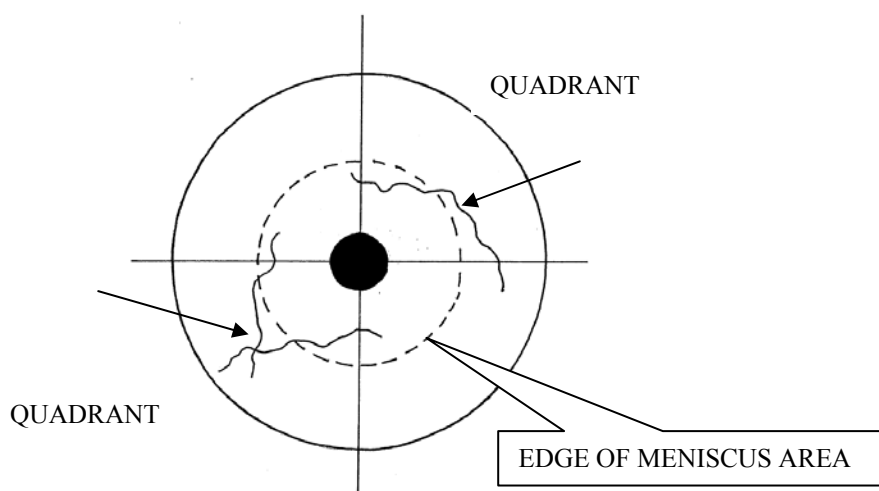


Figure 5.2-2 — Circumferential cracks

5.2 Insulator Cracks, Chip-outs, Crazing (cont'd)

5.2.3 Rejectable Condition: Radial cracks not confined to the meniscus that occur on the same seal on both the inside and outside of the package.

5.2.4 Rejectable Condition: Radial cracks that do not originate at the lead (Figure 5.2-3).

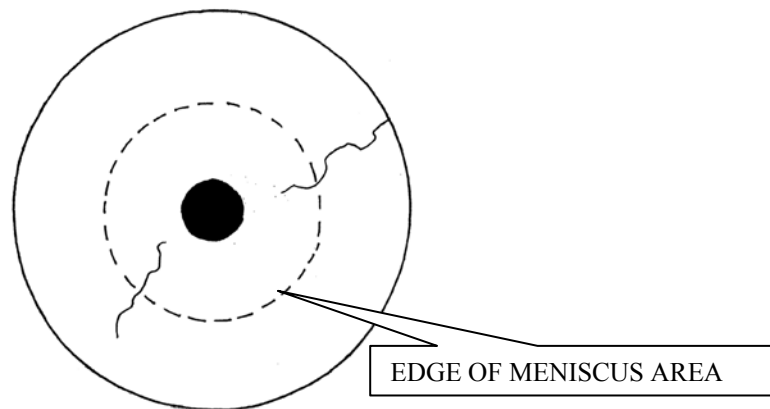


Figure 5.2-3 — Radial cracks not originating at the lead

5.2.5 Rejectable Condition: Three or more radial cracks originating at the lead that extend beyond the edge / low point of the meniscus (Figure 5.2-4).

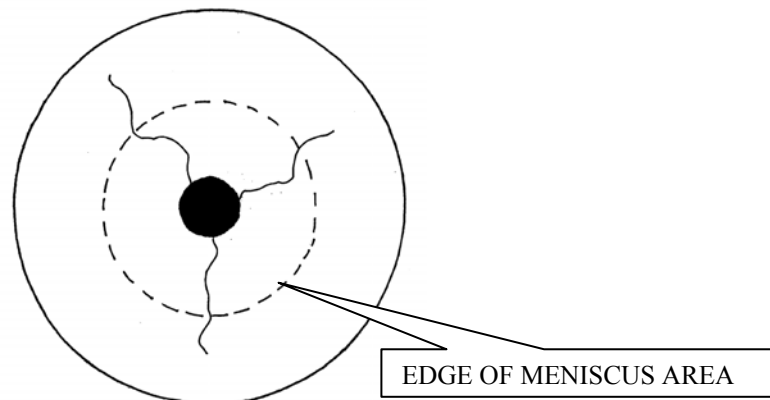


Figure 5.2-4 — Radial cracks originating at the lead that extend beyond the edge/low point of the meniscus

5.2 Insulator Cracks, Chip-outs, Crazing (cont'd)

- 5.2.6** Rejectable Condition: Two or more radial cracks originating at the lead that extend beyond the edge / low point of the meniscus and lie within a single quadrant (i.e., do not extend beyond 90° arc or rotation about the lead from each other) (Figure 5.2-5).

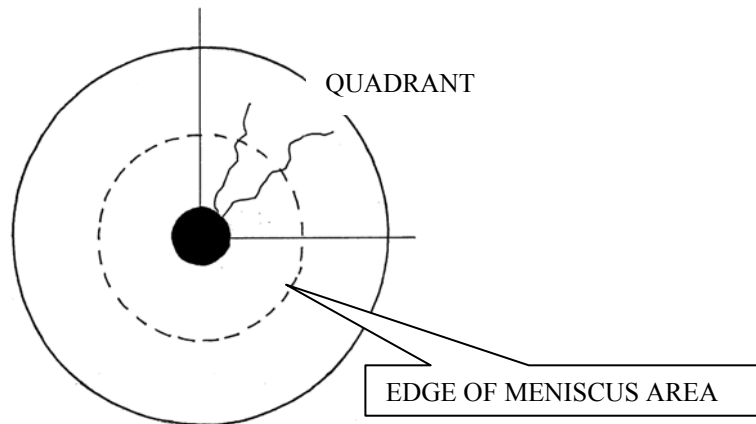


Figure 5.2-5 — Radial cracks originating at the lead that extend beyond the edge/low point of the meniscus to the package and that lie in a single quadrant

- 5.2.7** Rejectable Condition: Crazing of insulator surface (Figure 5.2-6).



Figure 5.2-6 — Crazing

- 5.2.8** Molded glass appearance, due to fixturing confinement, is acceptable (Figure 5.2-7).

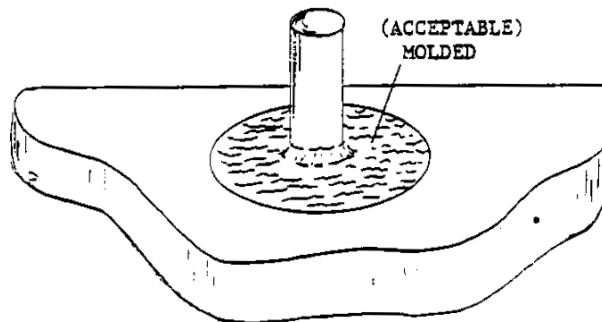


Figure 5.2-7 — Molded glass

5.2 Insulator Cracks, Chip-outs, Crazing (cont'd)

5.2.9 Rejectable Condition: Chip-outs which expose more than 0.010 inches (0.254 mm) base metal on the lead or penetrate the insulator below the meniscus plane (Figure 5.2-8).

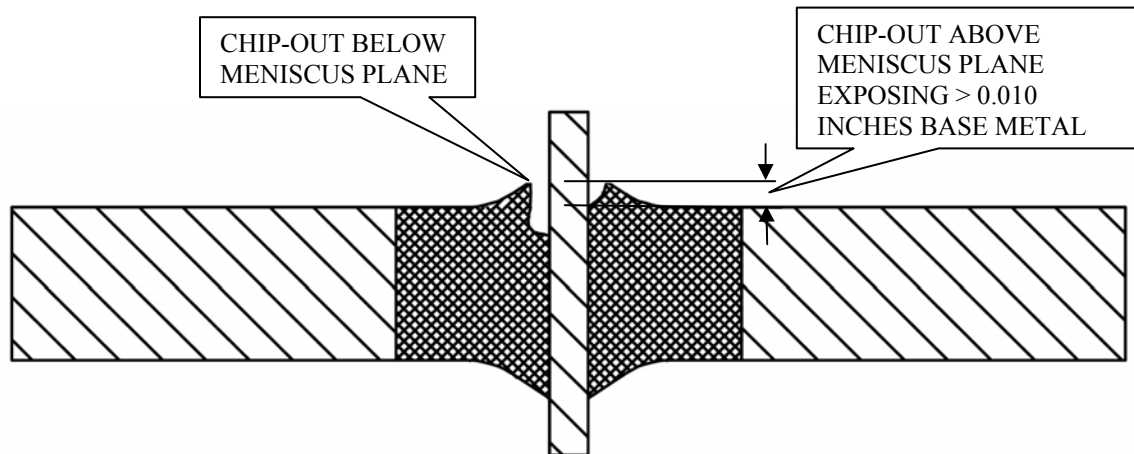


Figure 5.2-8 — Insulator chip-outs

5.2.10 Rejectable Condition: Chip-outs that cover greater than 50% of the insulator distance between the lead and package (Figure 5.2-9).

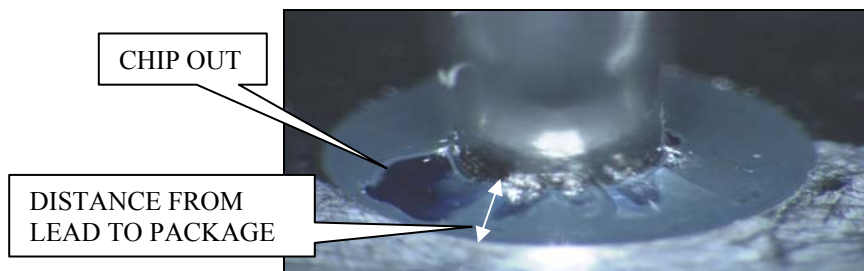


Figure 5.2-9 — An insulator chip-out over 50% of the lead-to-package distance

5.3 Insulator Climb, Overflow, Splatter

- 5.3.1** Rejectable Condition: Insulator climb that exceeds 0.015 inches (0.381 mm) (Figure 5.3-1).

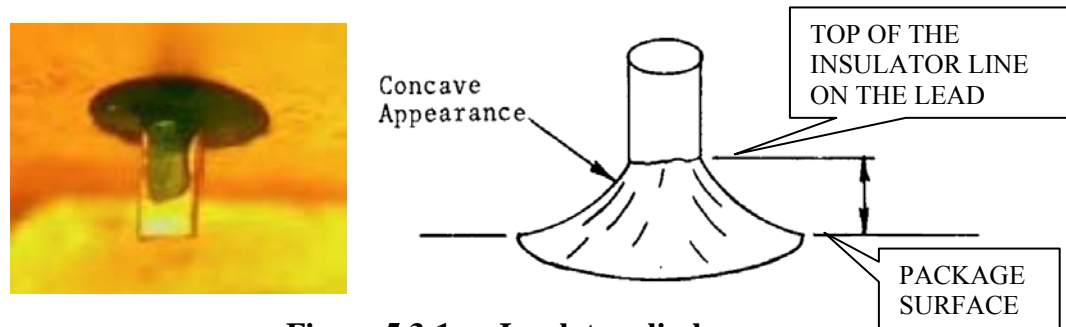


Figure 5.3-1 — Insulator climb

- 5.3.2** Rejectable Condition: Insulator that exhibits non-uniform wicking/wetting or negative meniscus at the lead and or package interface. Compression glass sealed packages that require brazing above the glass working point after sealing, may exhibit non-uniform wicking/wetting that does not violate the minimum glass fill requirements in 5.3.4 herein (Figure 5.3-2).

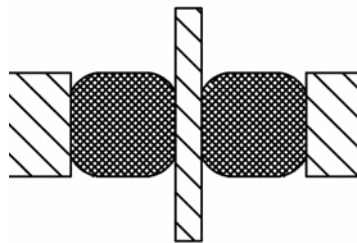


Figure 5.3-2 — Negative meniscus

- 5.3.3** Rejectable Condition: Insulator climb that is hyperbolic (Figure 5.3-3).

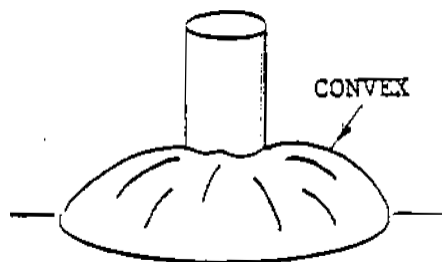


Figure 5.3-3 — Hyperbolic insulator climb

5.3 Insulator Climb, Overflow, Splatter (cont'd)

5.3.4 Rejectable Condition: Recessed insulator depth on both sides of the package added together ($A + B$) exceeds $1/3$ of the case thickness (Figure 5.3-4).

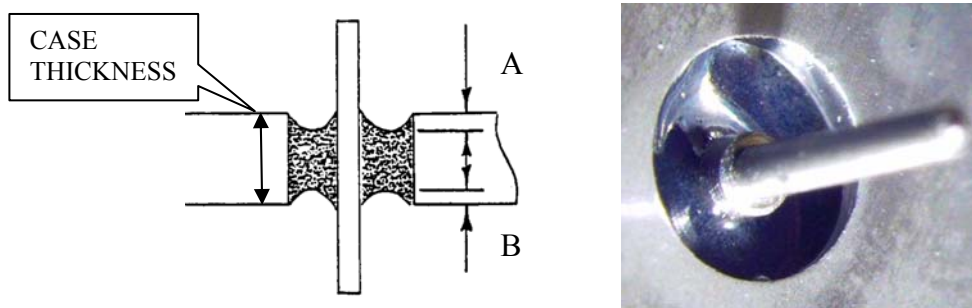


Figure 5.3-4 — Recessed insulators

5.3.5 Rejectable Condition: Insulator overflow that exceeds 0.015 inches (0.381 mm) with the exception of webbing on the inside of planar lead packages (Figure 5.3-5a and Figure 5.3-5b).

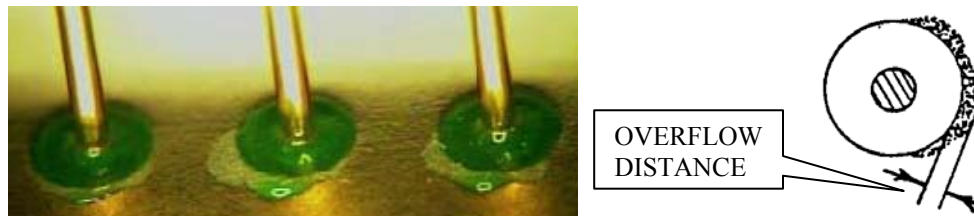


Figure 5.3-5a — Insulator overflow

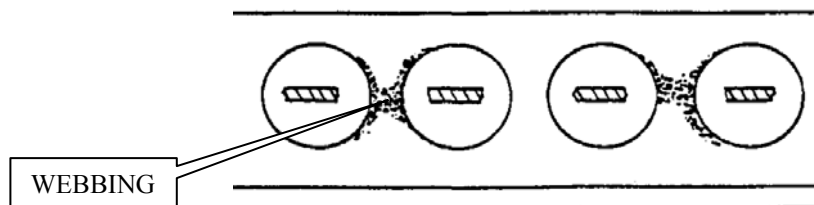


Figure 5.3-5b — Insulator webbing
(acceptable on inside of planar lead packages)

5.3 Insulator Climb, Overflow, Splatter (cont'd)

- 5.3.6** Rejectable Condition: Insulator splatter anywhere on plug-in platform or circular (i.e., TO style) packages or the inside base of sidewall packages with the exception of the underside of the nail-head pin (when present) (Figure 5.3-6).

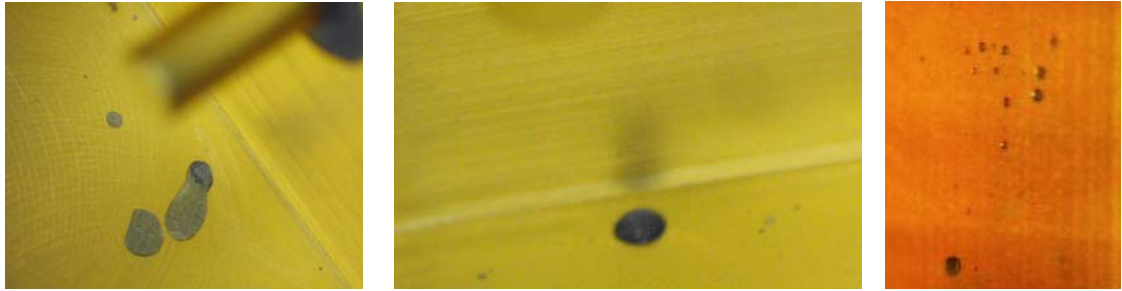


Figure 5.3-6 — Insulator splatter

- 5.3.7** Rejectable Condition: Insulator splatter on internal sidewalls that exceeds 0.010 inches (0.254 mm) diameter. Use the longest X-Y dimension to specify the diameter (Figure 5.3-6).

5.4 Other Insulator Conditions

- 5.4.1** Rejectable Condition: Embedded foreign material or inclusions on the insulator surface unless the affected lead passes insulation resistance test in accordance with MIL-STD-883, Test Method 1003, Condition 600V_{DC} / 100nA maximum (Figure 5.4-1).



Figure 5.4-1 — Embedded foreign material in insulators

5.4 Other Insulator Conditions (cont'd)

- 5.4.2** Rejectable Condition: Embedded plating on the insulator surface which reduces the isolation between the lead and package by more than 50%. Plating that can be removed from the surface of the insulator with a probe shall not be classified as embedded and shall be removed completely or the package rejected (Figure 5.4-2).

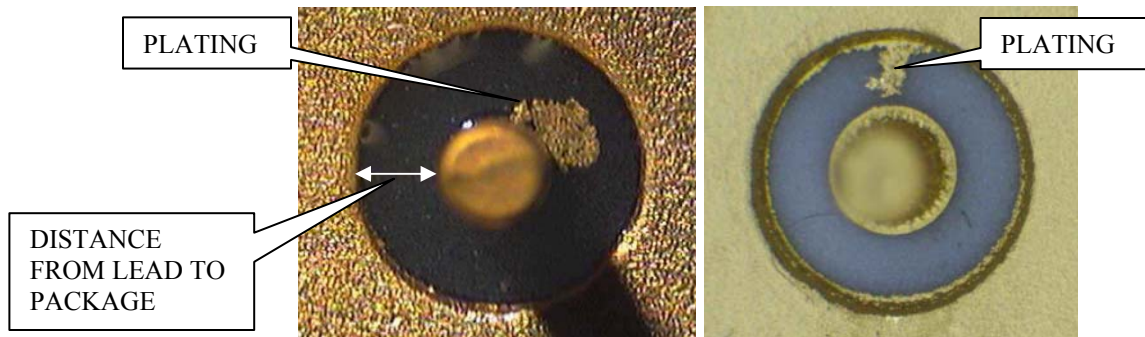


Figure 5.4-2 — Plating on insulator surfaces

- 5.4.3** Rejectable Condition: Enhancement or rework of a seal by use of a polymer or other foreign material (Figure 5.4-3).

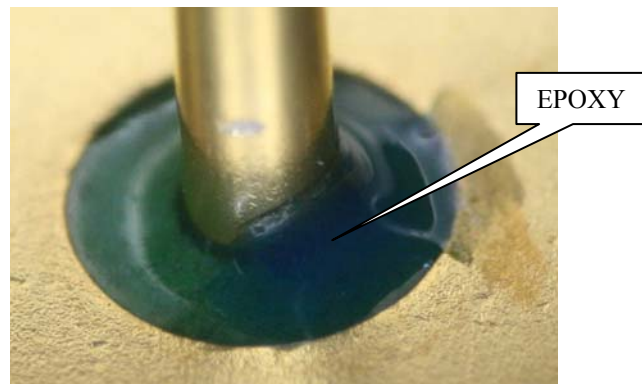


Figure 5.4-3 — Seal enhancement or rework

6 Braze Criteria (Metal Packages)

6.1 Undercut Braze, Non-continuous Braze, Misalignment

- 6.1.1** Rejectable Condition: Undercut braze on the outside interface of the package wall and base that exceeds 0.005 inches (0.127 mm) in depth or 1/3 of the nominal package wall thickness in depth at the corners (Figure 6.1-1).

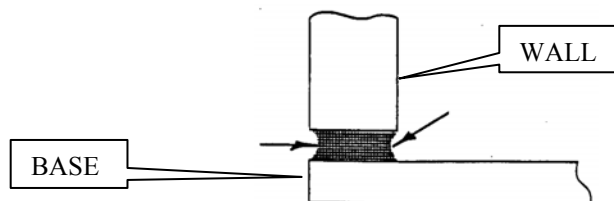


Figure 6.1-1 — Undercut braze

- 6.1.2** Rejectable Condition: Undercut braze on the inside interface of the package wall and base that exceeds 0.007 inches (0.178 mm) in depth (Figure 6.1-1).
- 6.1.3** Rejectable Condition: Undercut braze on metal heat sinks or ceramic standoffs on the exterior of a package where the bottom of the recessed area is not visible (Figure 6.1-2).

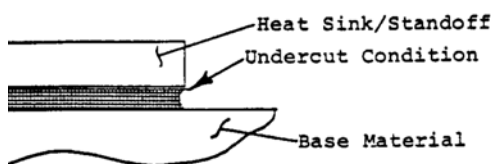


Figure 6.1-2 — Undercut braze on an exterior heat sink / standoff

- 6.1.4** Rejectable Condition: Braze material on the interface of the package wall and base that is not continuous and the void under-cuts the frame surface so that the bottom of the braze void is not visible (Figure 6.1-3).

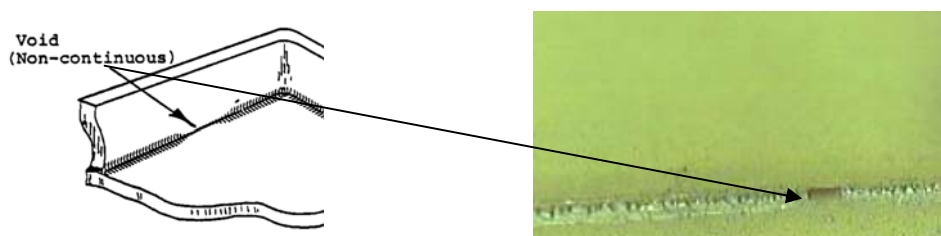


Figure 6.1-3 — Undercut braze on the package base to wall interface

6.1 Undercut Braze, Non-continuous Braze, Misalignment (cont'd)

6.1.5 Rejectable Condition: Undercut braze on brazed or welded ground leads where braze flow is not visible 360 degrees around the lead (Figure 6.1-4).

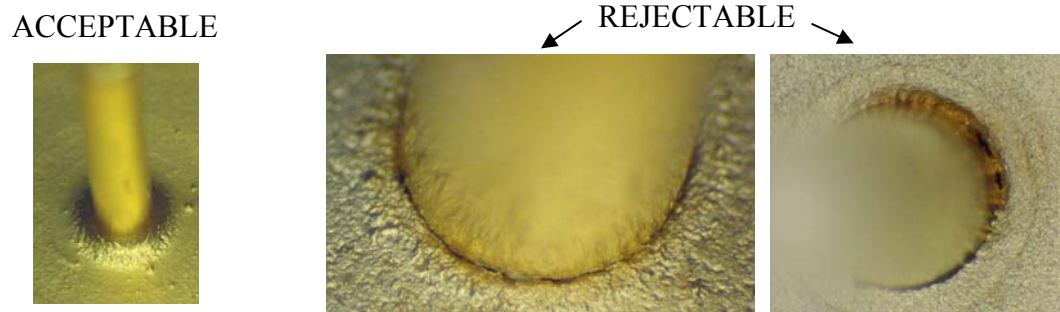


Figure 6.1-4 — Undercut braze on brazed ground pins

6.2 Porous and Peeling Braze

6.2.1 Rejectable Condition: Porous braze (pits or random holes in the braze material) or spongy appearance of braze where bottom of pits are not visible (Figure 6.2-1).

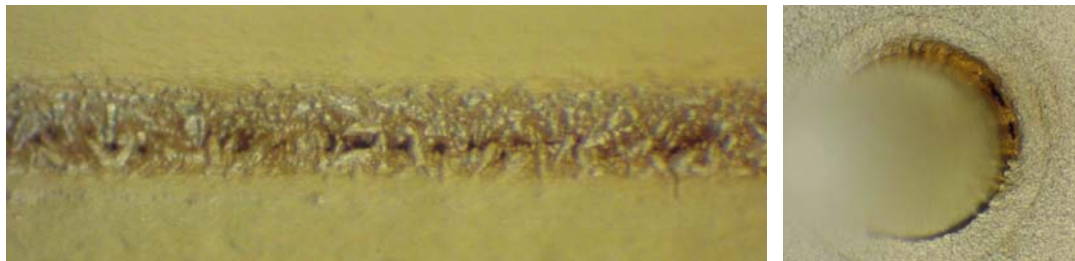


Figure 6.2-1 — Porous braze

6.2.2 Rejectable Condition: Separation or peeling of the braze material from the package, lead, insulator or from the braze material itself (Figure 6.2-2).

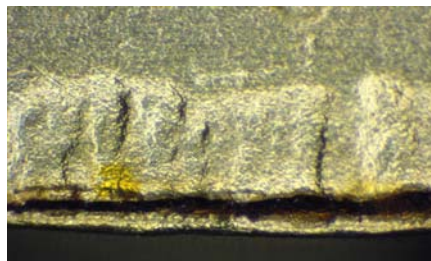


Figure 6.2-2 — Braze separation

6.2 Porous and Peeling Braze (cont'd)

- 6.2.3** Rejectable Condition: Misalignment of the brazed package wall and base which cause the overall maximum outside dimensions specified in the procurement document to be exceeded (Figure 6.2-3).

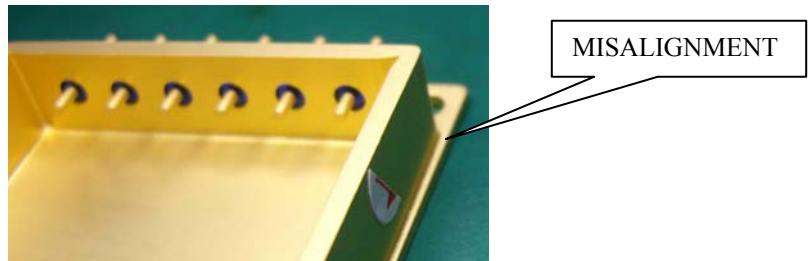


Figure 6.2-3 — Brazed package wall and base misalignment

6.3 Braze Run-out

- 6.3.1** Rejectable Condition: Run-out past the braze fillet that exceeds 0.010 inches (0.254 mm) in thickness or exceeds the maximum package dimension per the procurement document (Figure 6.3-1).

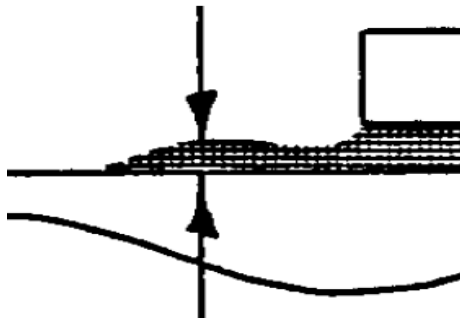


Figure 6.3-1 — Braze run-out

6.4 Braze Climb

6.4.1 Rejectable Condition: Braze climb that exceeds 0.015 inches (0.381 mm) (Figure 6.4-1).

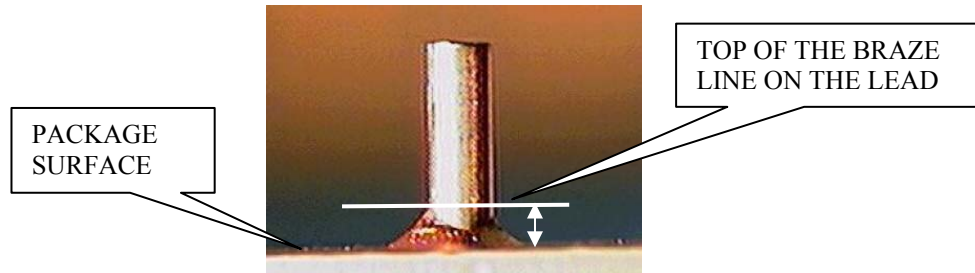


Figure 6.4-1 — Braze climb

6.4.2 Nail-head leads may have braze up to the bottom of the head on the underside, provided the top is free of braze.

6.4.3 Rejectable Condition: Braze on bonding areas or critical seal areas.

6.4 Braze Climb (cont'd)

- 6.4.4** Rejectable Condition: Excessive braze that increases the diameter of the lead beyond the maximum diameter allowed per the applicable procurement document. This is to be measured on the lead 0.015 inches (0.381 mm) from the package surface (Figures 6.4-1 and 6.4-2a). Repair or rework of excessive braze at the ceramic seal is rejectable (Figure 6.4-2b).

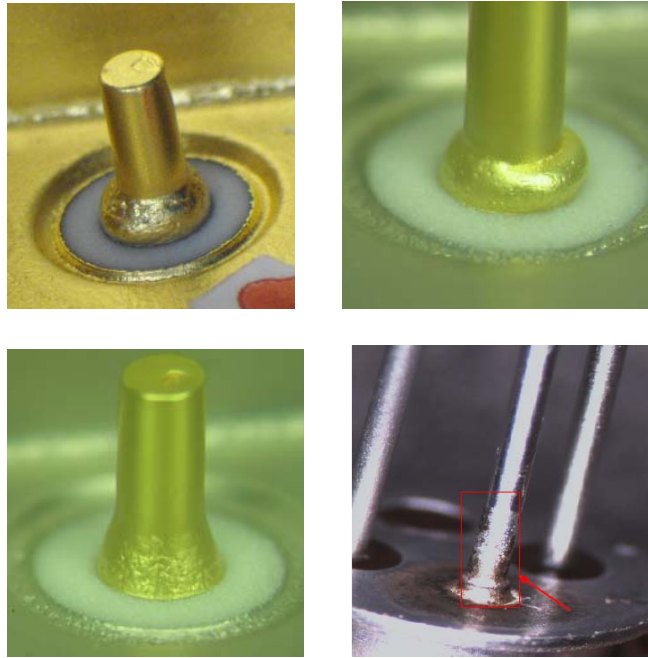


Figure 6.4-2a — Excessive braze

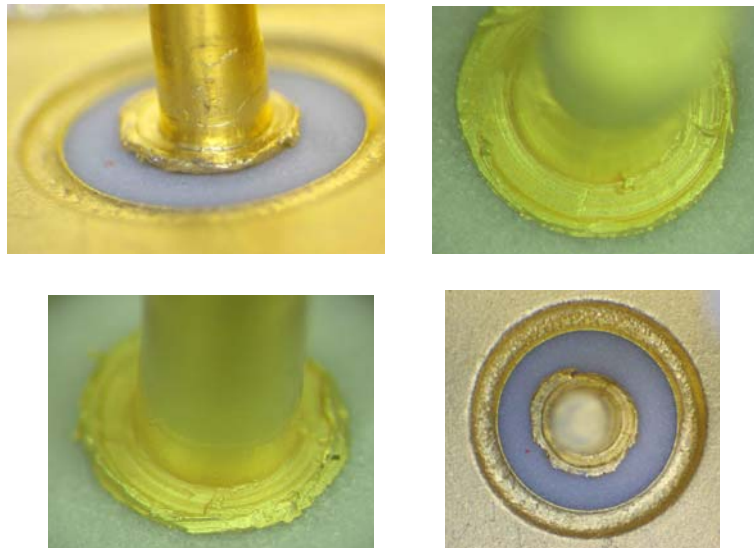


Figure 6.4-2b — Repair or rework of excessive braze

6.4 Braze Climb (cont'd)

- 6.4.5** Rejectable Condition: A nail-head ground lead with the nail-head not seated on the package surface, elevated on a neck of braze (Figure 6.4-3).

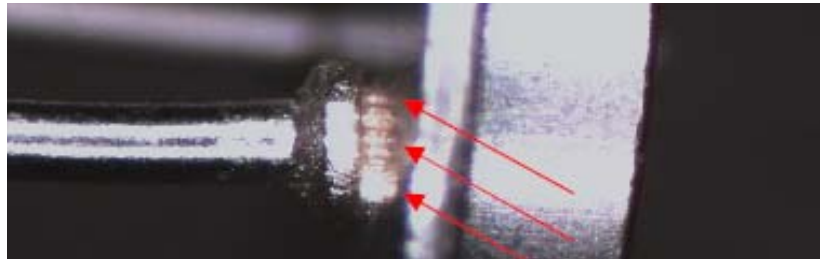


Figure 6.4-3 — Nail-head ground lead elevated on a neck of braze

7 Leads (Metal and Ceramic Packages)

7.1 Lead Nicks, Pits, Voids, Indentations, Scratches, Over-etching, Protrusions

- 7.1.1** Rejectable Condition: Planar leads with nicks, pits, voids, indentations, or scratches visible on three surfaces. Planar leads with over-etching, nicks, pits, voids, indentations, or scratches greater than 25% of the cross sectional area or 0.003 inches (0.076 mm) deep or 0.005 inches (0.127mm) in diameter, whichever is greater. Use the longest X-Y dimension to specify the diameter (Figure 7.1-1).

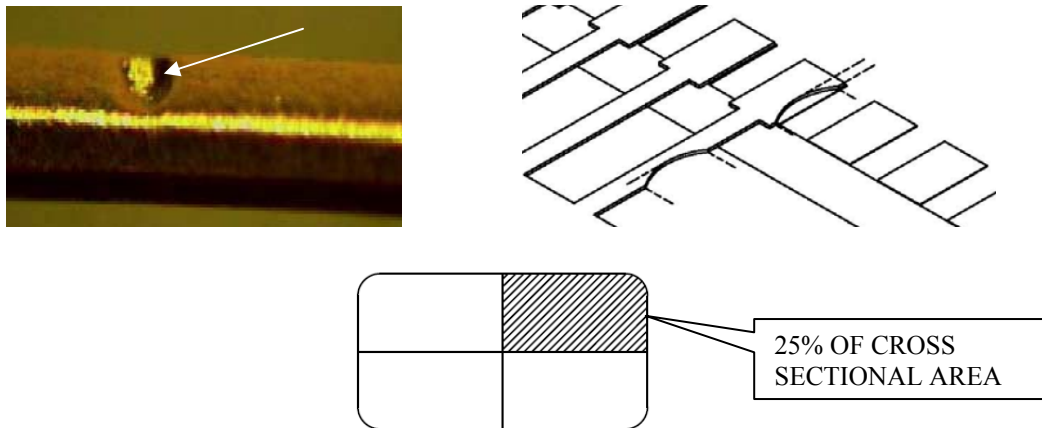


Figure 7.1-1 — Lead pit, cross sectional area, and over-etching of a planar lead

7.1 Lead Nicks, Pits, Voids, Indentations, Scratches, Over-etching, Protrusions (cont'd)

- 7.1.2** Rejectable Condition: Planar leads with nicks, pits, voids, indentations, or scratches on inside leads in the bonding area (top or side) (Figure 7.1-2).

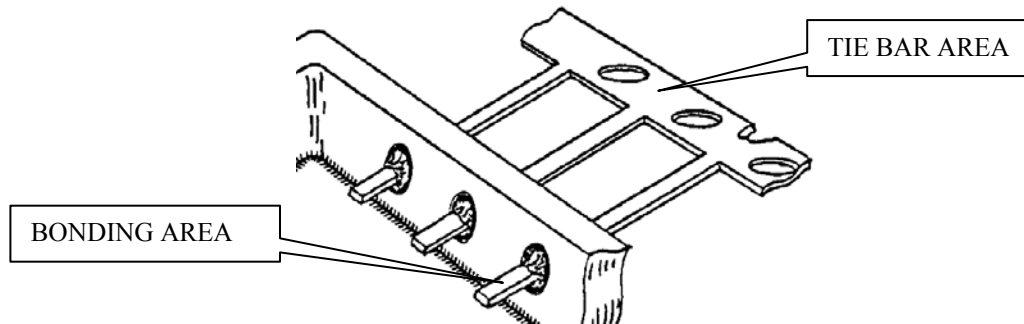


Figure 7.1-2 — Planar lead bonding and tie bar area

- 7.1.3** Planar leads may have nicks, pits, voids, indentations, or scratches in the tie bar area (Figure 7.1-2).
- 7.1.4** Planar leads may have nicks, pits, voids, indentations, or scratches on the bottom of inside leads, provided they do not interfere with wire bonding.
- 7.1.5** Rejectable Condition: When specified as used for wirebonding in the applicable procurement document, round leads with less than a continuous 80% bonding area (top) free of nicks, pits, voids, indentations, or scratches (Figure 7.1-3).

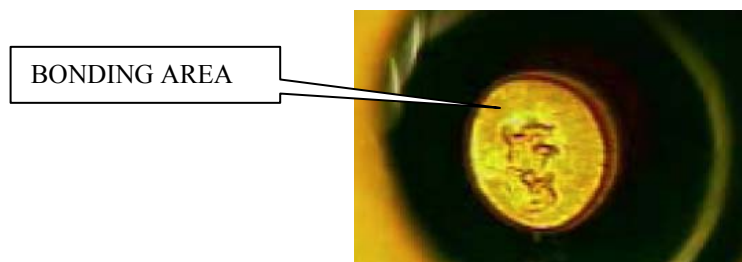


Figure 7.1-3 — Pitting in round lead bonding area

7.1 Lead Nicks, Pits, Voids, Indentations, Scratches, Over-etching, Protrusions (cont'd)

- 7.1.6** Rejectable Condition: Round leads with nicks, pits, voids, indentations, or scratches that decrease the diameter of the lead beyond the minimum diameter allowed per the applicable procurement document. (Figure 7.1-4).

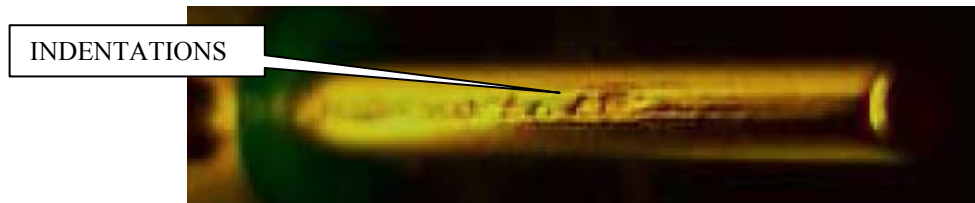


Figure 7.1-4 — Indentations in a round lead

- 7.1.7** Rejectable Condition: Nicks, pits, voids, indentations, or scratches that expose base metal over more than 5% of the non-bonding area of the lead surface area. Exposed base metal on the cut lead ends (outside) is acceptable and does not count in the 5% (Figure 7.1-5).

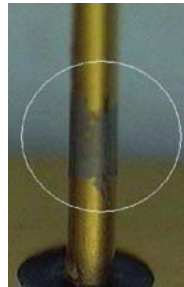


Figure 7.1-5 — Exposed lead base metal

- 7.1.8** Rejectable Condition: When specified as used for wirebonding in the applicable procurement document, any leads with protrusions in the bonding area which project more than 0.001 inches (0.0254 mm) (Figure 7.1-6)

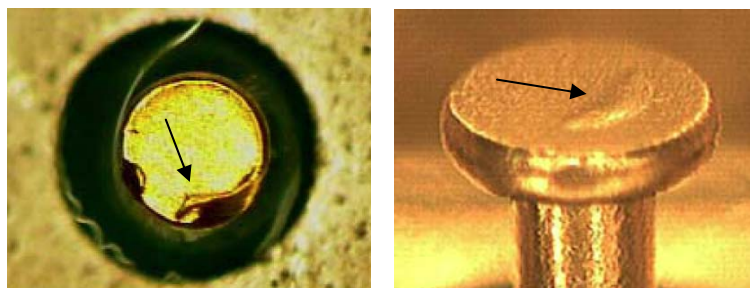


Figure 7.1-6 — Lead bonding area protrusions

7.1 Lead Nicks, Pits, Voids, Indentations, Scratches, Over-etching, Protrusions (cont'd)

- 7.1.9** Rejectable Condition: Planar leads with protrusions which increase the diameter or width of the lead more than 25% beyond the maximum diameter or width allowed per the applicable procurement document. Round leads with protrusions which increase the diameter of the lead beyond the maximum diameter or width allowed per the applicable procurement document (Figure 7.1-7). Burrs from trimming on external leads are acceptable.

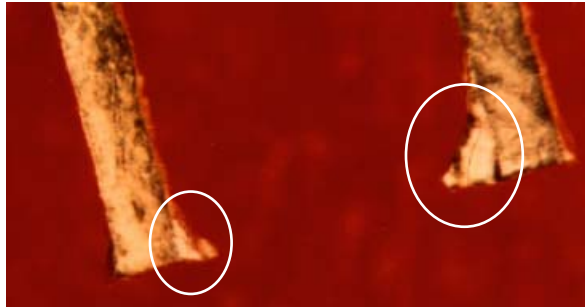


Figure 7.1-7 — Lead protrusions
(Photo used with written permission of Chipworks, Inc.)

- 7.1.10** Rejectable Condition: Hanging lead protrusions that can be moved with a probe (Figure 7.1-8).

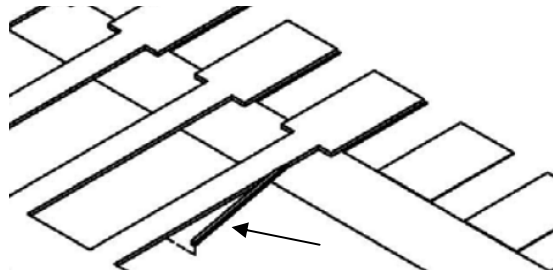


Figure 7.1-8 — A hanging lead protrusion

7.2 Lead Surface Finish

- 7.2.1** Rejectable Condition: When specified as used for wirebonding in the applicable procurement document, planar leads which do not exhibit a Ra 32 microinch surface finish roughness or better over at least an 80% continuous bonding area.
- 7.2.2** Rejectable Condition: When specified as used for wirebonding in the applicable procurement document, round leads which do not exhibit at least a Ra 32 microinch surface finish roughness or better over at least an 80% or a 0.010 inches (0.254 mm) diameter continuous bonding area for lead diameters greater than or equal to 0.018 inches (0.457 mm) or over at least an 80% continuous bonding area for lead diameters less than 0.018 inches (0.457 mm).

7.2 Lead Surface Finish (cont'd)

- 7.2.3** Rejectable Condition: Any leads not free of foreign material or other adherent deposits. Foreign material that can be removed from the lead with a probe shall be removed completely or the package shall be rejected (Figure 7.2-1).

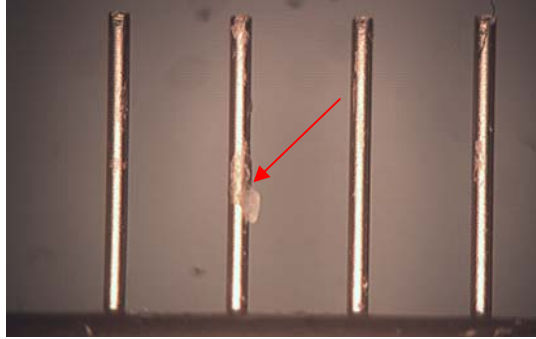


Figure 7.2-1 — Foreign material on a lead

- 7.2.4** Rejectable Condition: Any leads with peeling or flaking plating (Figure 7.2-2).

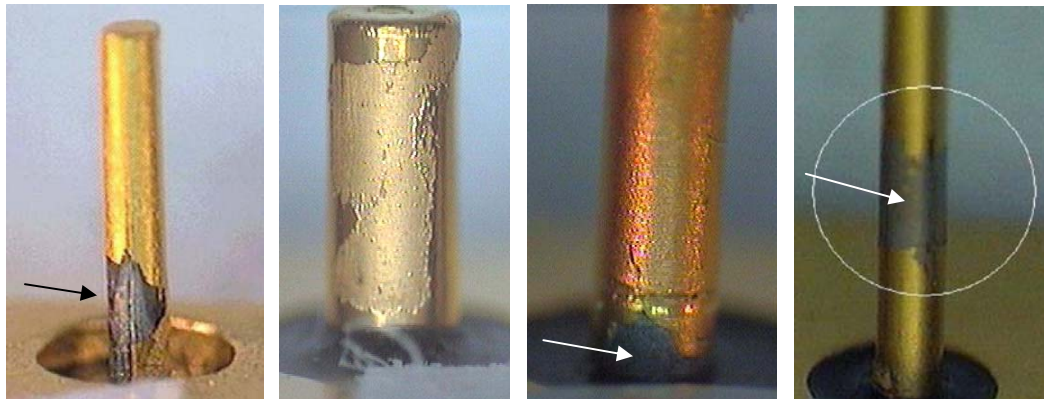


Figure 7.2-2 — Peeling or flaking lead plating

7.3 Off-center, Bent, Angled, or Broken Leads

- 7.3.1** Rejectable Condition: Off-center leads where the distance between the lead and the package seal hole wall is less than 0.005 inches (0.127 mm) for holes greater than or equal to 0.033 inches (0.838 mm) in diameter and less than 0.003 inches (0.076 mm) for holes less than 0.033 inches (0.838 mm) in diameter. If the off-center distance does not fall within the rejectable range above, but the lead center is not concentric with the package seal hole center to within 0.005 inches (0.127 mm), the affected lead must pass insulation resistance test in accordance with MIL-STD-883, Test Method 1003, Condition 600V_{DC} / 100nA maximum (Figures 7.3-1a and 7.3-1b).

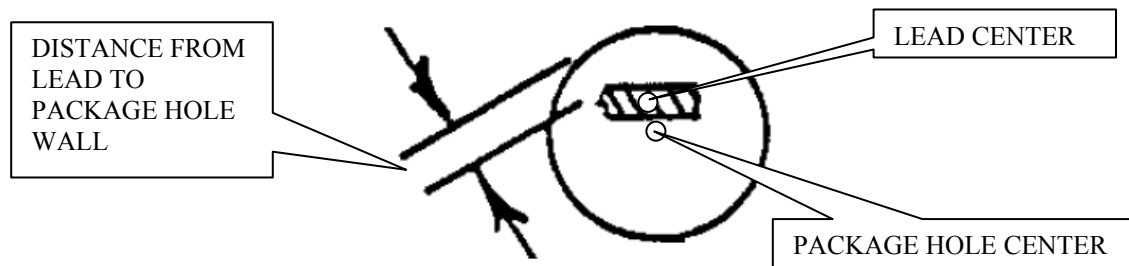


Figure 7.3-1a — An off-center planar lead

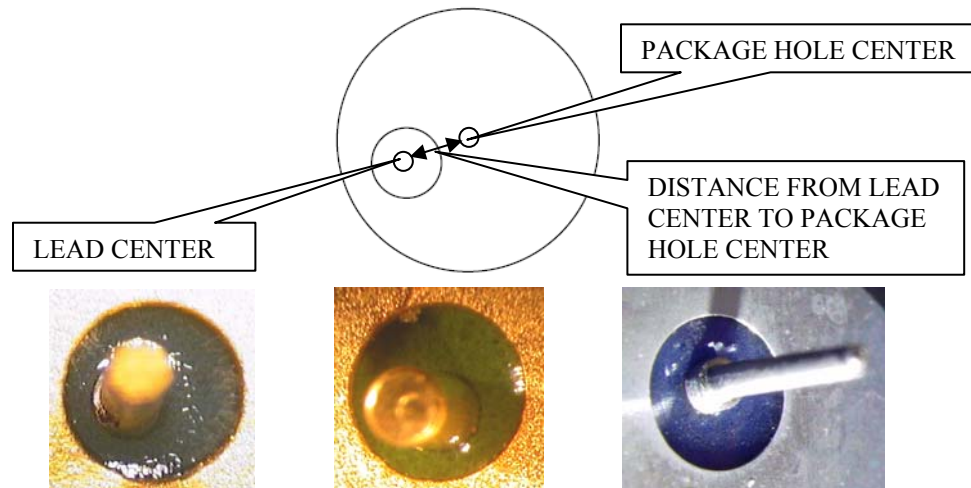


Figure 7.3-1b — Off-center round leads

7.3 Off-center, Bent, Angled, or Broken Leads (cont'd)

- 7.3.2** Rejectable Condition: Angled or bent inside round leads with a maximum height of 0.035 inches (0.889 mm) where the angle or drift from where the lead exits the seal to the top of the lead is greater than 0.005 inches (0.127 mm) or 3 degrees; or with a height of 0.036 inches (0.914 mm) or greater where the angle or drift from where the lead exits the seal to the top of the lead is greater than 0.007 inches (0.178 mm) or 5 degrees. Measurements are to be taken from the side of the lead (Figure 7.3-2).

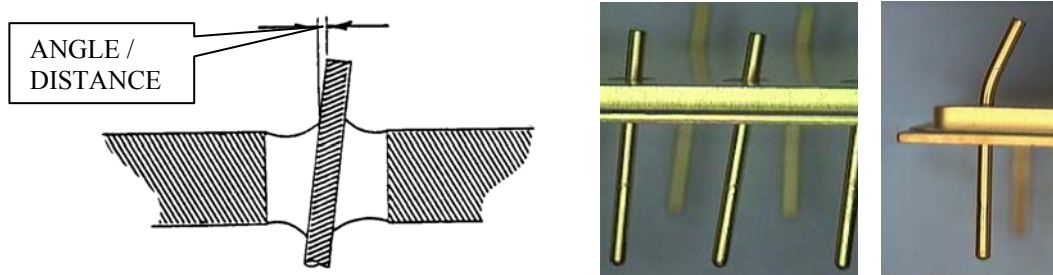


Figure 7.3-2 — Angled inside round leads

- 7.3.3** Rejectable Condition: Angled or bent outside round leads where the lead is bent or twisted greater than 20° from the normal lead plane. Measurements are to be taken from the side of the lead (Figure 7.3-3).

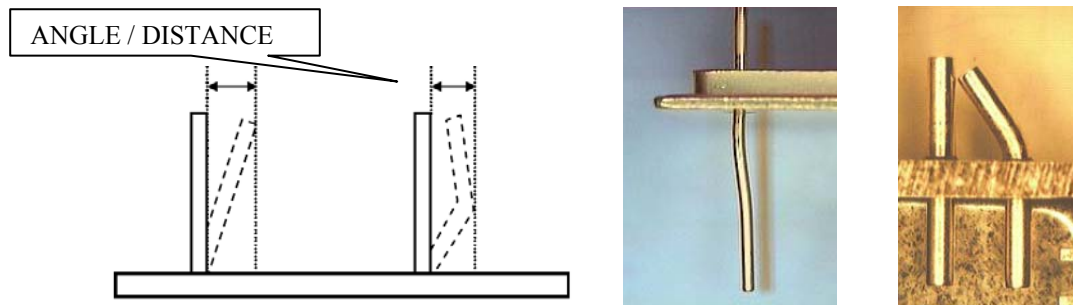


Figure 7.3-3 — Angled and bent outside round leads

7.3 Off-center, Bent, Angled, or Broken Leads (cont'd)

- 7.3.4** Rejectable Condition: Bent or angled inside planar leads where the angle or drift in any configuration is greater than 0.002 inches (0.051 mm) per 0.015 inches (0.381 mm) of width (Figure 7.3-4).

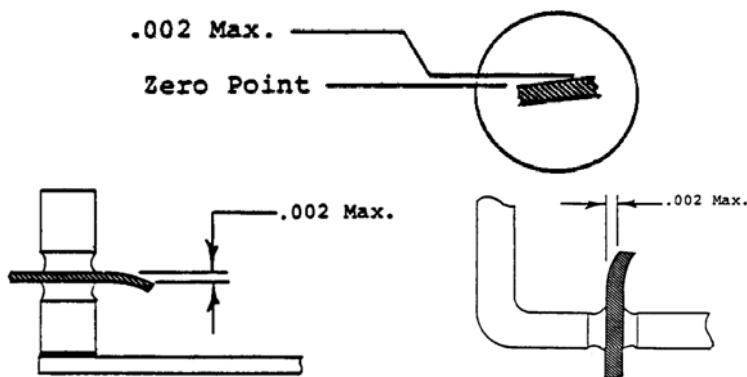


Figure 7.3-4 — Maximum angle of drift for 0.015 inches (0.381 mm) wide lead

- 7.3.5** Rejectable Condition: Bent or angled outside planar leads where kinks or permanent deformation occur that violate the lead dimensional and visual requirements when the leads are straightened by hand. For metal packages, the insulator must remain visually acceptable after straightening per Clause 5 (Figure 7.3-5).

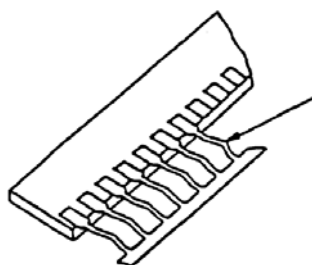


Figure 7.3-5 — A permanently kinked planar lead

- 7.3.6** Rejectable Condition: Broken leads (Figure 7.3-6).

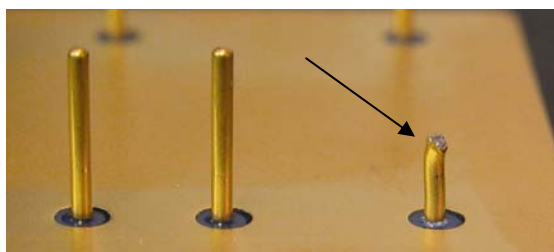


Figure 7.3-6 — A broken lead

8 General Package Criteria (Metal Packages)

8.1 Package Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs

- 8.1.1** Rejectable Condition: Nicks, pits, voids, indentations, on projection weld package critical cover seal area (the “Δ” shaped weld projection) that exceed 50% of the weld projection depth or exceed 0.020 inches (0.508 mm) in diameter. Use the longest X-Y dimension to specify the diameter (Figure 8.1-1).

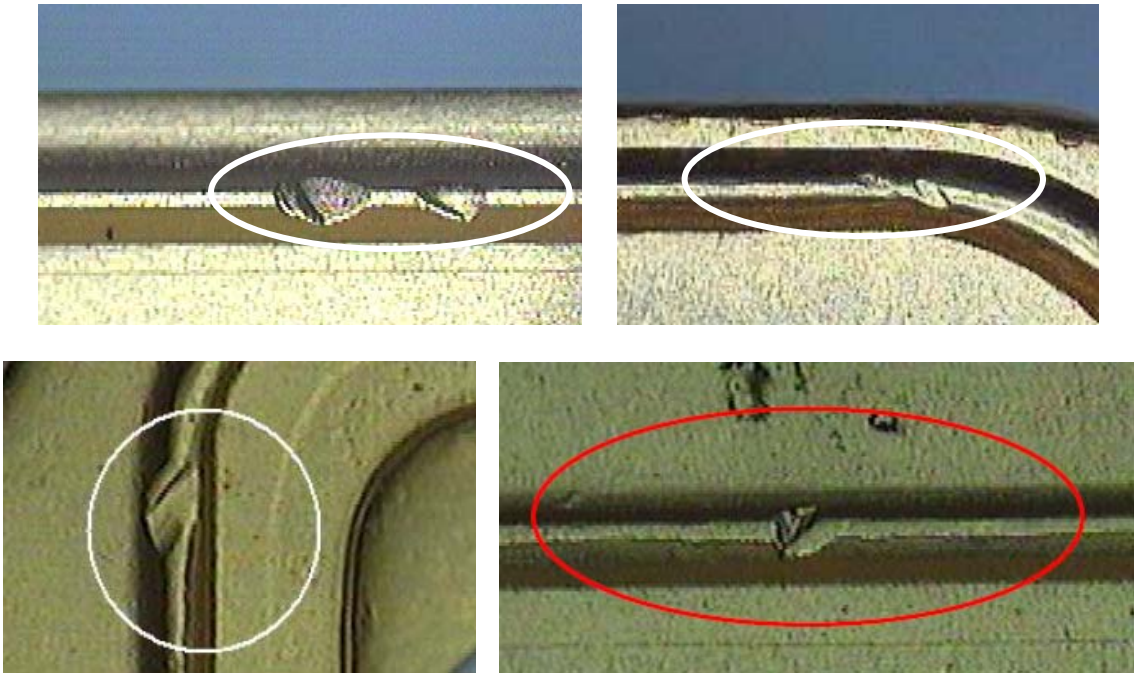


Figure 8.1-1 — Nicks, pits, voids, indentations, on projection-weld package critical seal areas

8.1 Package Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs (cont'd)

- 8.1.2** Rejectable Condition: Nicks, pits, voids, or indentations on all other package types critical seal areas that exceed 0.001 inches (0.025 mm) deep *and* exceed 0.005 inches (0.127 mm) in diameter. Use the longest X-Y dimension to specify the diameter (Figure 8.1-2).

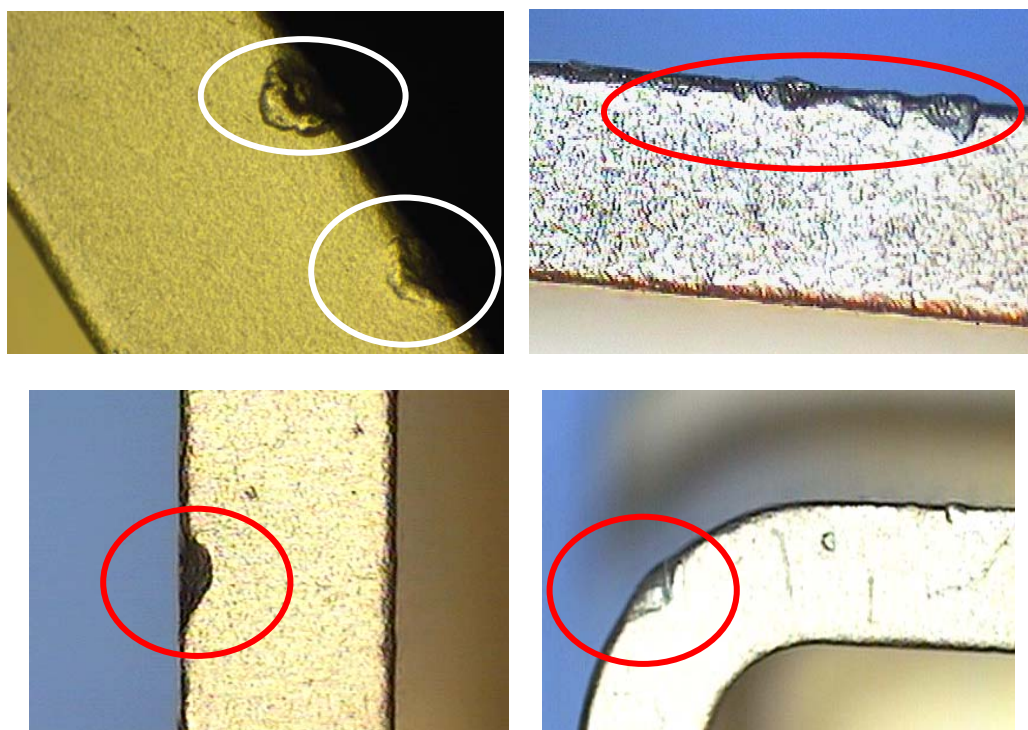


Figure 8.1-2 — Nicks, pits, voids, and indentations on seam-weld package critical seal areas

- 8.1.3** Rejectable Condition: Nicks, pits, voids, or indentations in the substrate area (inside base area) that exceed 0.010 inches (0.254 mm) deep or exceed 0.002 inches (0.051 mm) deep and 0.020 inches (0.508 mm) in diameter. Use the longest X-Y dimension to specify the diameter (Figure 8.1-3).

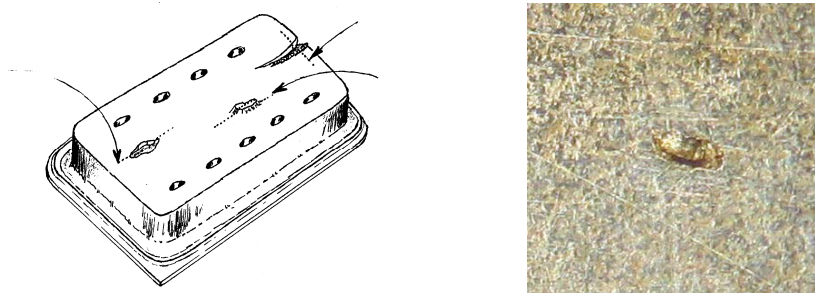


Figure 8.1-3 — Nicks, pits, voids, and indentations in substrate areas

8.1 Package Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs (cont'd)

- 8.1.4** Rejectable Condition: Nicks, pits, voids, or indentations on all remaining general areas (other than the critical seal or substrate areas) that exceed 0.010 inches (0.254 mm) deep or exceed 0.005 inches (0.127 mm) deep and 0.020 inches (0.508 mm) in diameter. Use the longest X-Y dimension to specify the diameter (Figure 8.1-4).

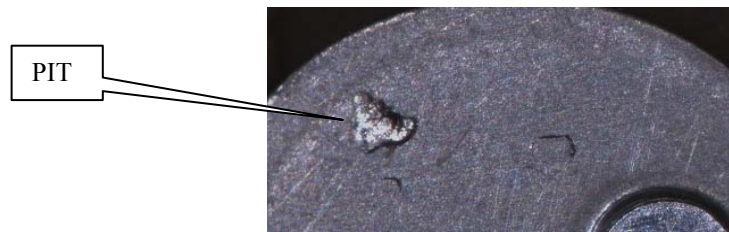


Figure 8.1-4 — Nicks, pits, voids, and indentations, in a general package area

- 8.1.5** Rejectable Condition: Nicks, pits, voids, indentations, mars, or scratches which expose base metal in any area of the package. Exposed under-plating is acceptable. For non-ferrous alloy packages, exposed base metal is only acceptable when specifically permitted by the procurement document (Figure 8.1-5).



Figure 8.1-5 — Exposed base metal on packages

- 8.1.6** Rejectable Condition: Hanging protrusions that can be moved with a probe (Figure 8.1-6).



Figure 8.1-6 — Hanging protrusions

8.1 Package Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs (cont'd)

- 8.1.7** Rejectable Condition: Solid protrusions on the critical seal area (other than the package hole) which project more than 0.001 inches (0.025 mm) (Figure 8.1-7).



Figure 8.1-7 — Solid protrusions in critical seal areas

- 8.1.8** Rejectable Condition: Solid protrusions in the substrate area or die attach area (inside base area) which project more than 0.001 inches (0.025 mm) (Figure 8.1-8).



Figure 8.1-8 — Solid protrusions in substrate areas

- 8.1.9** Rejectable Condition: Solid protrusions around the package lead seal hole that violate the maximum package dimension per the procurement document or the distance between the lead and the protrusion is less than 0.005 inches (0.127 mm). If the affected lead passes insulation resistance test in accordance with MIL-STD-883, Test Method 1003, Condition 600V_{DC} / 100nA maximum, this condition is acceptable (Figure 8.1-9).

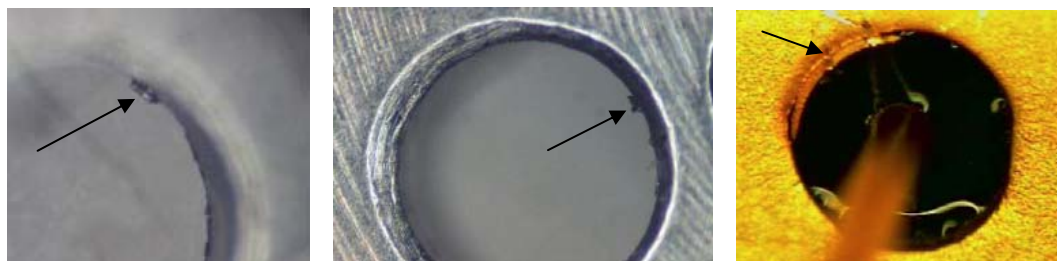


Figure 8.1-9 — Solid protrusions around package holes

8.1 Package Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs (cont'd)

8.1.10 Rejectable Condition: Solid protrusions on the inside or non-critical area of the seal ring which project more than 0.001 inches (0.025 mm) above the seal surface or project more than 0.005 inches (0.127 mm) into the package cavity from the seal surface (Figure 8.1-10).

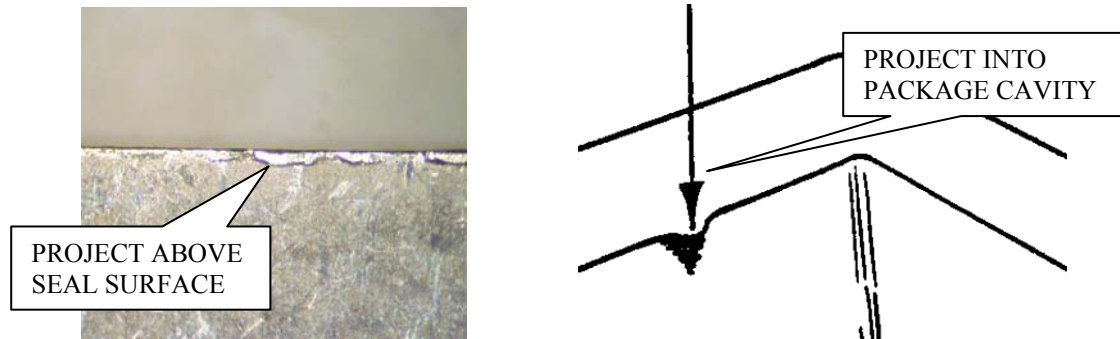


Figure 8.1-10 — Solid protrusions around inside seal rings in non-critical seal areas

8.1.11 Rejectable Condition: Solid protrusions on the bottom (mounting surface) of the package which project more than 0.002 inches (0.051 mm) (Figure 8.1-11).

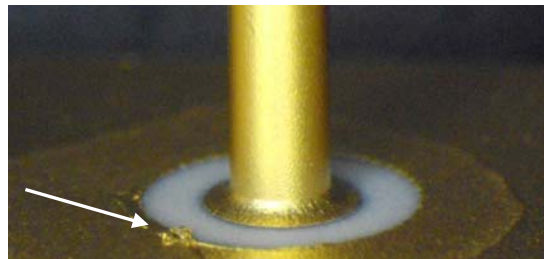


Figure 8.1-11 — Solid protrusions on a mounting surface

8.1.12 Rejectable Condition: Solid protrusions on all remaining general areas (other than specified above) which project more than 0.005 inches (0.127 mm) or which increase the package dimension past the extents allowed per the applicable procurement document (Figure 8.1-12). Dimples, embossed ID symbols, etc. are acceptable if by design and specified on the applicable procurement document.



Figure 8.1-12 — Solid protrusions in general package areas

8.1 Package Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs (cont'd)

8.1.13 Rejectable Condition: Any metallization or foreign material not intended by design which reduces the isolation between any metal or metallized parts by more than 50% (Figure 8.1-13).

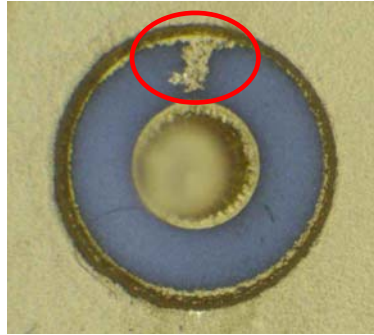


Figure 8-1-13 — Metallization not intended by design

8.1.14 Rejectable Condition: Broken or cracked metal packages (Figure 8.1-14).

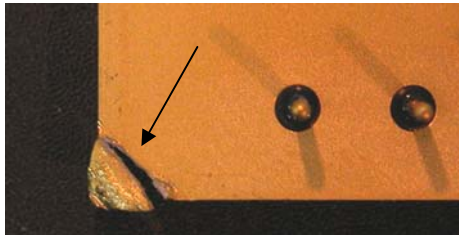


Figure 8-1-14 — A broken metal package

8.2 Package Surface Finish

- 8.2.1** Rejectable Condition: Embedded foreign material or inclusions. If adherence is in question, the package may be subjected to a clean filtered gas stream (vacuum or expulsion) of approximately 20 psig (Figure 8.2-1).

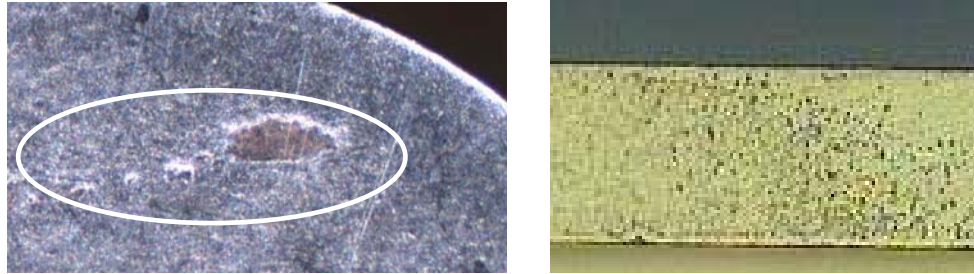


Figure 8.2-1 — Embedded foreign material on packages

- 8.2.2** Rejectable Condition: Missing plating, peeling, flaking, pitting, blistering, corrosion, or de-lamination. Discoloration or variation in color that does not exhibit these conditions is acceptable. Unplated threads of blind 4-40 or smaller holes are acceptable unless otherwise specified in the procurement document (Figure 8.2-2).

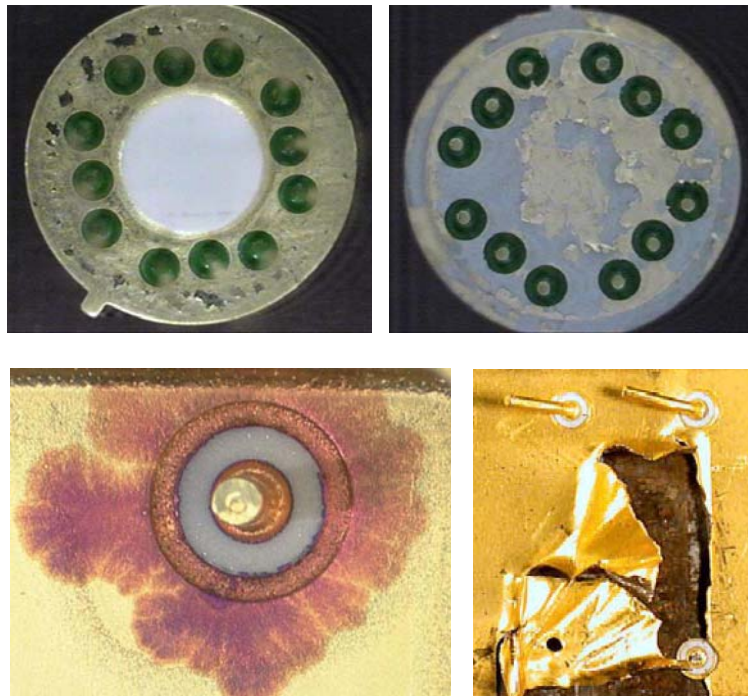


Figure 8.2-2 — Flaking plating, corrosion, and de-lamination on packages

8.2 Package Surface Finish (cont'd)

- 8.2.3** Rejectable Condition: General package surfaces (excluding leads, critical seal areas, or wirebond areas) which do not exhibit at least a Ra 63 microinch surface finish roughness or better (Figure 8.2-3).

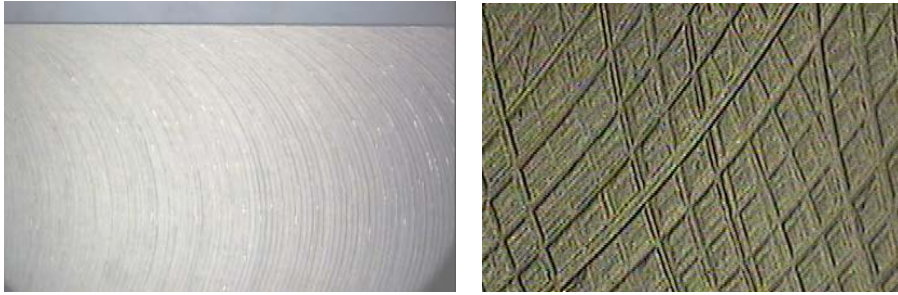


Figure 8.2-3 — General package area surface roughness

- 8.2.4** Rejectable Condition: Critical machined package surfaces (critical seal areas or substrate areas) with surface steps (cutter mismatch) not intended by design which exceed 0.001 inches (0.025 mm). General machined packaged surfaces with surface steps (cutter mismatch) not intended by design must meet package tolerances (Figure 8.2-4).



Figure 8.2-4 — Machined surface steps

9 General Cover Criteria (Metal Covers)

9.1 Cover Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs

- 9.1.1** Rejectable Condition: Nicks, pits, voids, or indentations on projection weld cover critical cover seal area (the “Δ” shaped weld projection) that exceed 50% of the weld projection depth or exceed 0.020 inches (0.508 mm) in diameter. Use the longest X-Y dimension to specify the diameter (Figure 9.1-1).

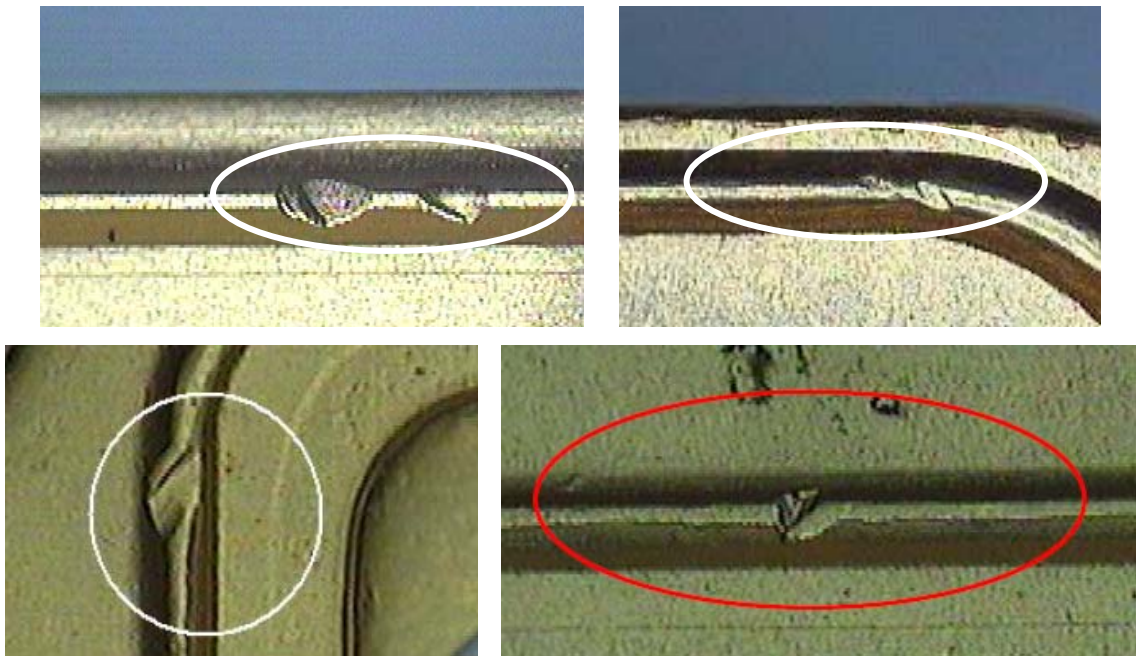


Figure 9.1-1 — Nicks, pits, voids, and indentations on projection-weld cover critical seal areas

- 9.1.2** Rejectable Condition: Nicks, pits, voids, or indentations on critical cover seal area (the seal surface or flange) that exceed 0.001 inches (0.025 mm) deep *and* exceed 0.005 inches (0.127 mm) in diameter. Use the longest X-Y dimension to specify the diameter (Figure 9.1-2).



Figure 9.1-2 — Nicks, pits, voids, and indentations on cover critical seal areas

9.1 Cover Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs (cont'd)

- 9.1.3** Rejectable Condition: Nicks, pits, voids, or indentations on all remaining general areas (other than the critical seal area) that exceed 25% of the material thickness in depth and 0.015 inches (0.381 mm) in diameter. Use the longest X-Y dimension to specify the diameter (Figure 9.1-3).



Figure 9.1-3 — Nicks, pits, voids, and indentations on general cover areas

- 9.1.4** Rejectable Condition: Nicks, pits, voids, indentations, mars, or scratches which expose base metal on any area of the cover. Exposed under-plating is acceptable. Exposed base metal on outside trimmed edges is acceptable (Figure 9.1-4).

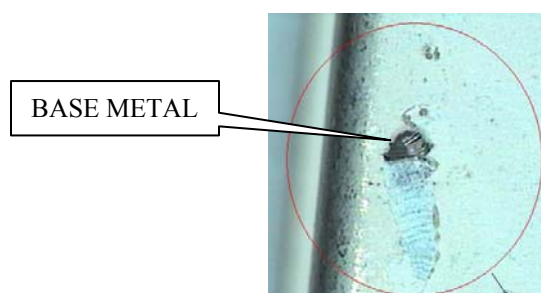


Figure 9.1-4 — Exposed base metal on a cover

- 9.1.5** Rejectable Condition: Solid protrusions on the critical seal area which project more than 0.001 inches (0.025 mm) (Figure 9.1-5).

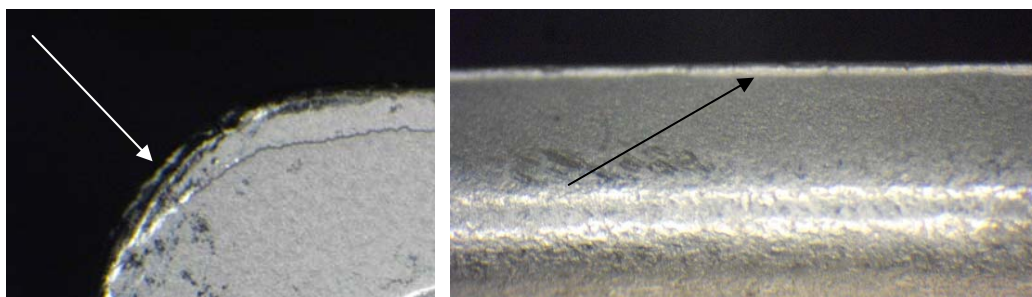


Figure 9.1-5 — Solid protrusions in cover critical seal areas

9.1 Cover Nicks, Pits, Voids, Indentations, Scratches, Protrusions, Chip-outs (cont'd)

- 9.1.6** Rejectable Condition: Solid protrusions in all remaining general areas which project more than 0.005 inches (0.127 mm) or which increase the package dimension past the extents allowed per the applicable procurement document (Figure 9.1-6).



Figure 9.1-6 — Solid protrusions in general cover areas

9.2 Cover Surface Finish

- 9.2.1** Rejectable Condition: Embedded or adhered foreign material or inclusions. If adherence is in question, the cover may be subjected to a clean filtered gas stream (vacuum or expulsion) of approximately 20 psig (Figure 9.2-1).

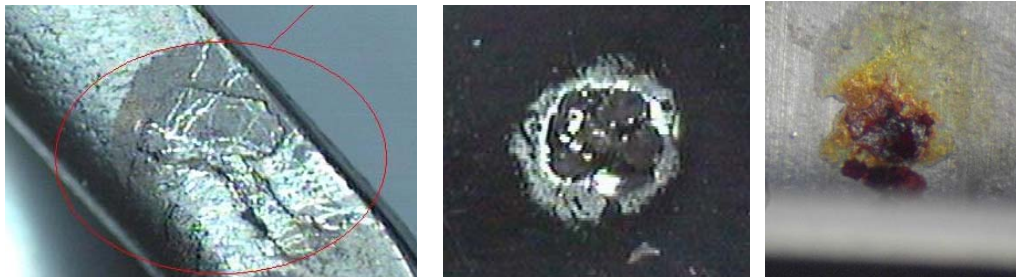


Figure 9.2-1 — Embedded foreign material on covers

9.2 Cover Surface Finish (cont'd)

- 9.2.2** Rejectable Condition: Missing plating, peeling, flaking, pitting, blistering, corrosion, or surface staining. Discoloration or variation in color that does not exhibit these conditions is acceptable (Figure 9.2-2).

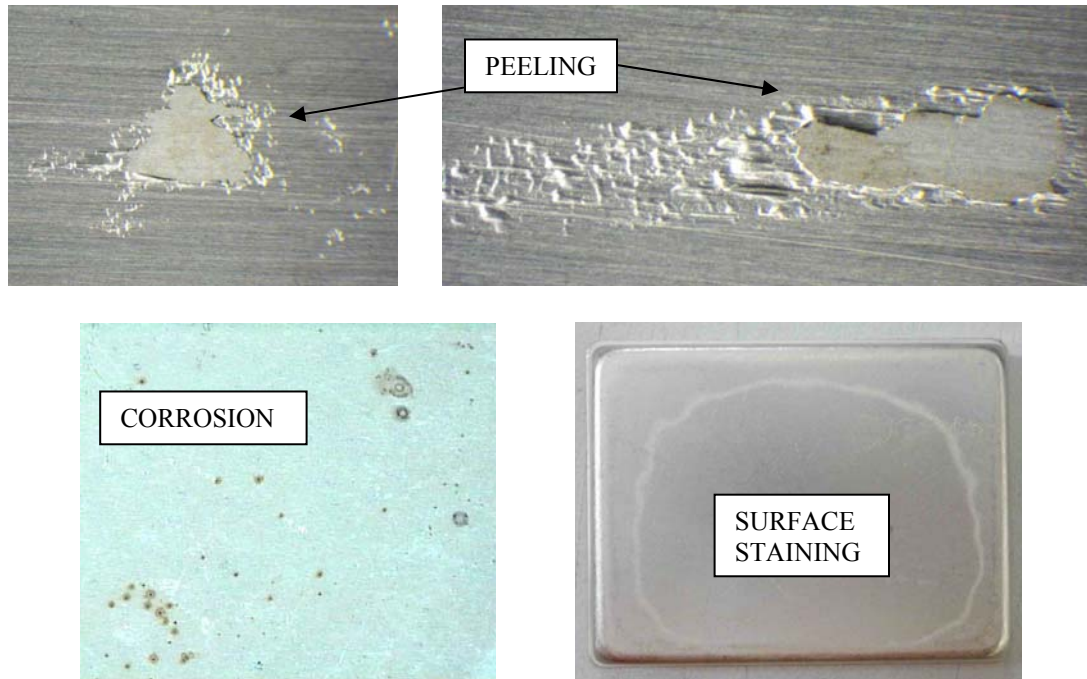


Figure 9.2-2 — Peeling, corrosion, and surface staining on covers

- 9.2.3** Rejectable Condition: Cover surfaces which do not exhibit at least a Ra 63 microinch surface finish roughness or better (Figure 9.2-3).

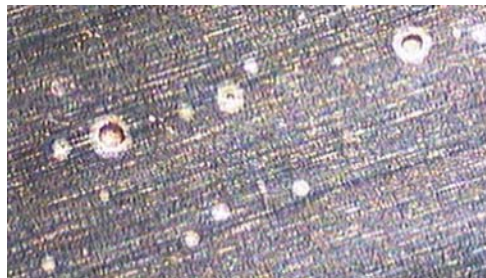


Figure 9.2-3 — Cover surface finish roughness and pitting

10 General Package Criteria (Ceramic Packages: Non-metallized Areas)

10.1 Ceramic Chip-outs, Cracks, Delamination, Separation, Voiding, Protrusions, Fins

10.1.1 Rejectable Condition: Ceramic chip-outs greater than or equal to 0.060 inches (1.525 mm) in diameter and have a depth greater than 25% of the thickness of the affected package element (wall, base, lid, etc.). Use the longest X-Y dimension to specify the diameter (Figure 10.1-1).

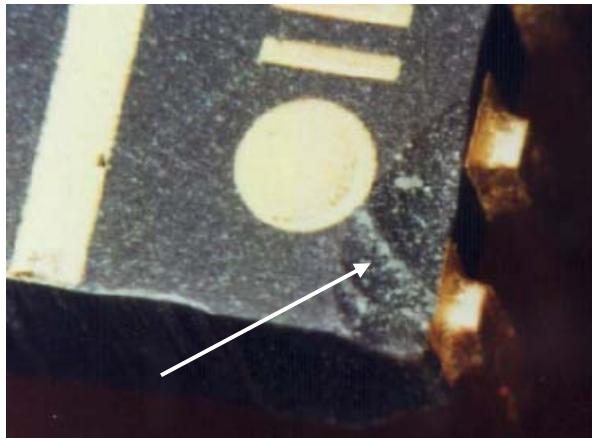


Figure 10.1-1 — A ceramic chip-out
(Photo used with written permission of Chipworks, Inc.)

10.1.2 Rejectable Condition: Ceramic chip-outs that cover greater than 50% of the distance between leads and/or pads (Figure 10.1-2).

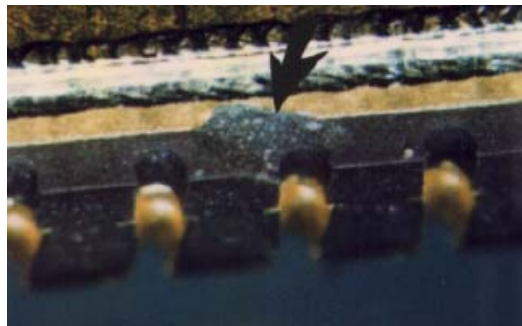


Figure 10.1-2 — A ceramic chip-out over 50% of the lead and/or pad distance
(Photo used with written permission of Chipworks, Inc.)

10.1 Ceramic Chip-outs, Cracks, Delamination, Separation, Voiding, Protrusions, Fins (cont'd)

10.1.3 Rejectable Condition: Ceramic chip-outs that undercut a metallized area (Figure 10.1-3).

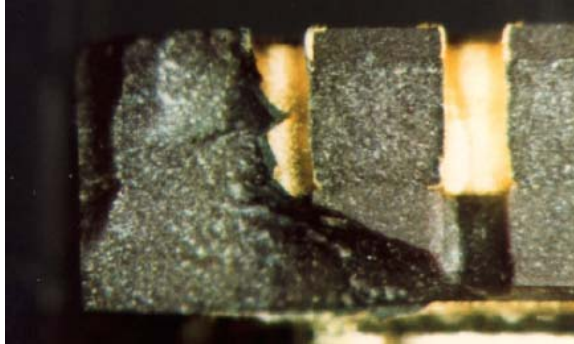


Figure 10.1-3 — A ceramic chip-out under a metallized area
(Photo used with written permission of Chipworks, Inc.)

10.1.4 Rejectable Condition: Ceramic cracks, delaminations, separation, or voiding (Figure 10.1-4).

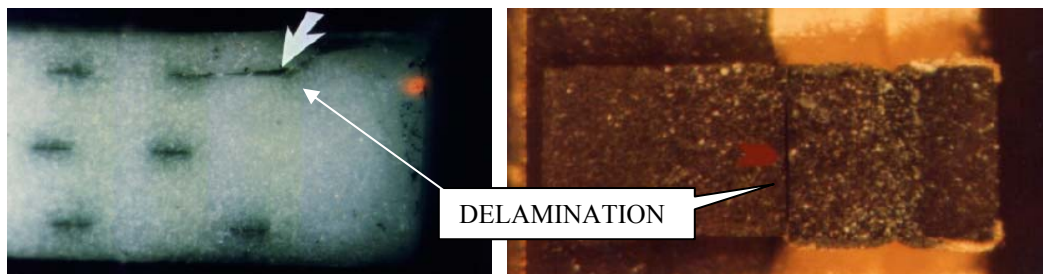
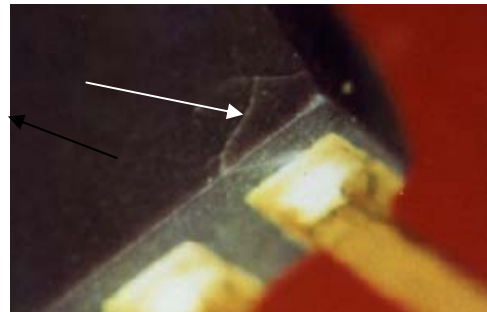
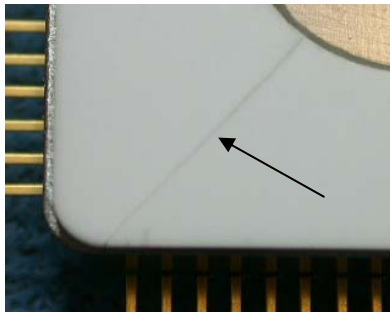


Figure 10.1-4 — Cracked ceramic packages
(Photos on right and bottom used with written permission of Chipworks, Inc.)

10.1 Ceramic Chip-outs, Cracks, Delamination, Separation, Voiding, Protrusions, Fins (cont'd)

10.1.5 Edge rounding due to multilayer construction or slight layer misalignment is acceptable (Figure 10.1-5).

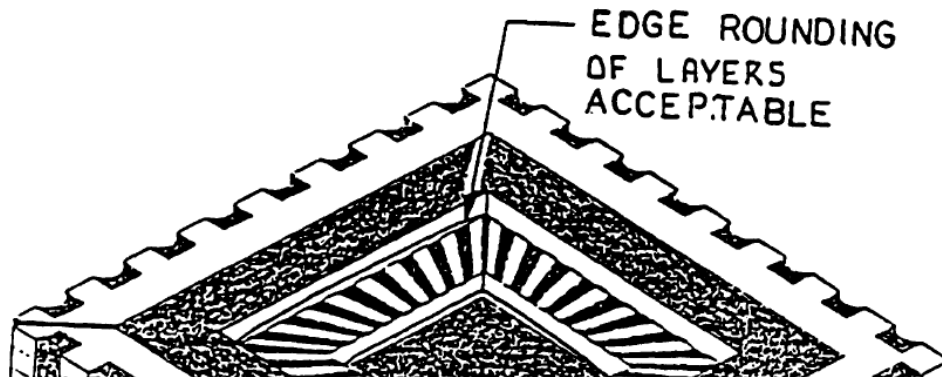


Figure 10.1-5 — Edge rounding

10.1.6 Rejectable Condition: Solid ceramic protrusions on the bottom (mounting surface) of the package which extend beyond the seating plane (Figure 10.1-6).

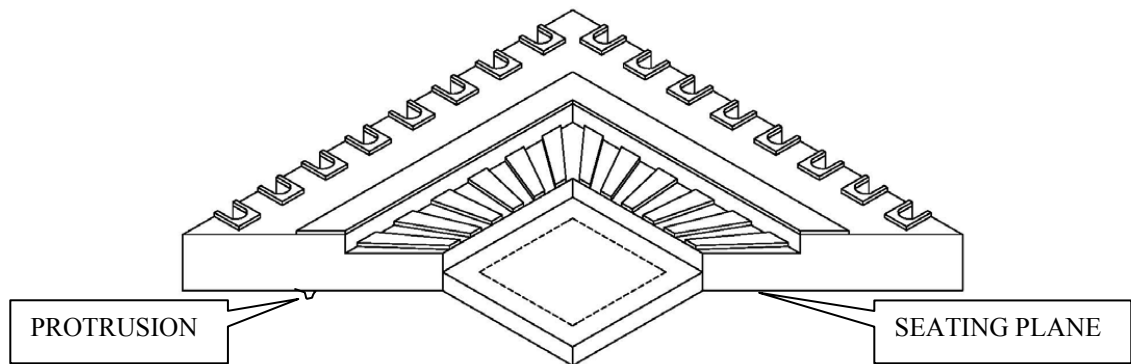


Figure 10.1-6 — A solid ceramic protrusion on a mounting surface

10.1 Ceramic Chip-outs, Cracks, Delamination, Separation, Voiding, Protrusions, Fins (cont'd)

10.1.7 Rejectable Condition: Solid ceramic protrusions on all remaining general areas (other than specified above) which project more than 0.002 inches (0.051 mm), exceed 0.015 inches (0.381 mm) in diameter, or cause the package to exceed the maximum dimensions allowed per the applicable procurement document. No more than one projection per surface or on each side. Use the longest X-Y dimension to specify the diameter (Figure 10.1-7).

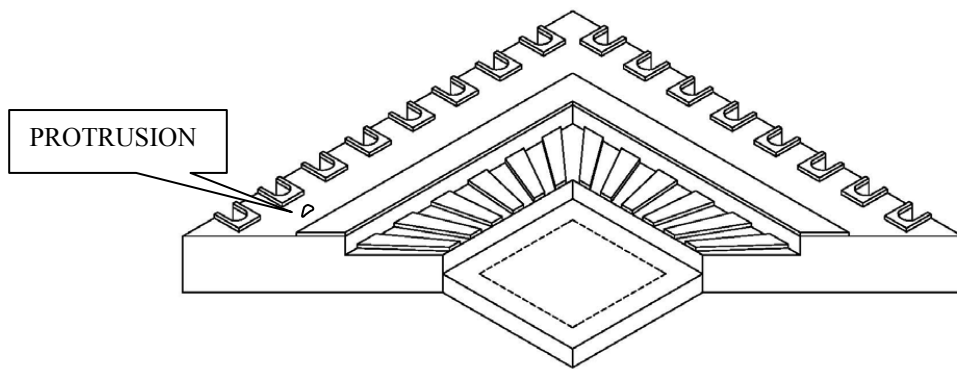


Figure 10.1-7 — A solid ceramic protrusion in a general area

10.1.8 Rejectable Condition: Fins which project more than 0.005 inches (0.127 mm), exceed 0.015 inches (0.381 mm) in length, or cause the package to exceed the maximum dimensions allowed per the applicable procurement document. No more than one fin per side (Figure 10.1-8).

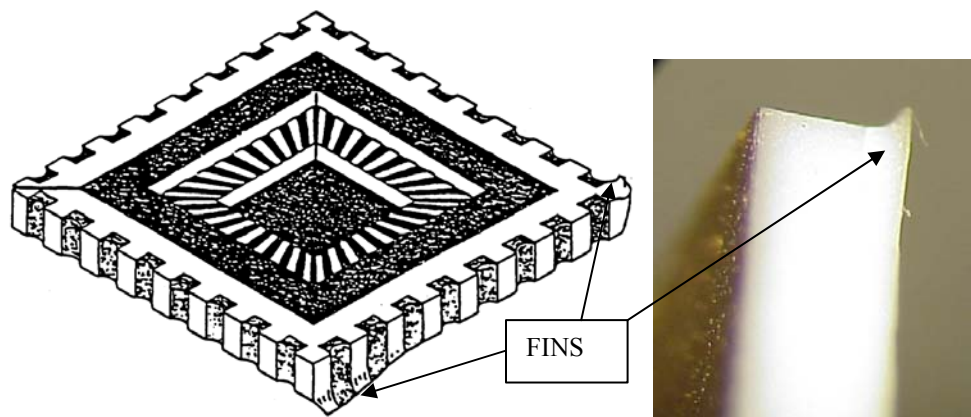


Figure 10.1-8 — Fins on the outside of a package

10.1.9 Rejectable Condition: Hanging fins that can be moved with a probe (Figure 10.1-8).

11 Metallization Criteria (Ceramic Packages)

11.1 General

11.1.1 Rejectable Condition: Peeling, flaking, or lifting metallization (Figure 11.1-1).

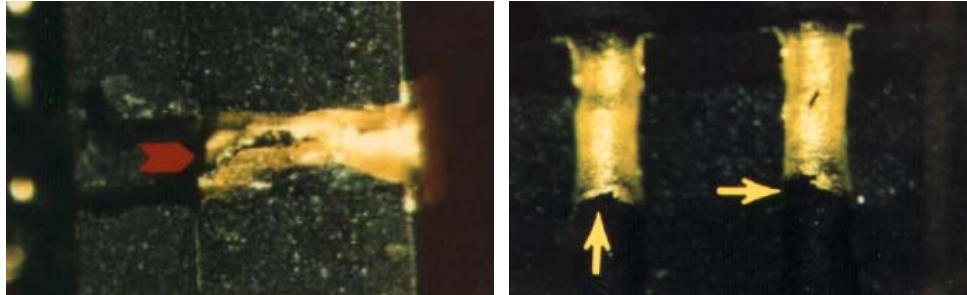


Figure 11.1-1 — Peeling, flaking, and lifting metallization
(Photos used with written permission of Chipworks, Inc.)

11.2 Contact Pad Metallization

11.2.1 Rejectable Condition: Protrusions which project more than 0.002 inches (0.051 mm) (Figure 11.2-1).



Figure 11.2-1 — A protrusion on a contact pad
(Photo used with written permission of Chipworks, Inc.)

11.2.2 Rejectable Condition: Hanging protrusions that can be moved with a probe (Figure 11.2-1).

11.2.3 Rejectable Condition: Protrusions that are not fully plated.

11.2 Contact Pad Metallization (cont'd)

11.2.4 Rejectable Condition: Metallization voids which exceed 0.005 inches (0.127 mm) in diameter. No more than five metallization voids per package side and no more than one metallization void per contact pad. Use the longest X-Y dimension to specify the diameter (Figure 11.2-2).

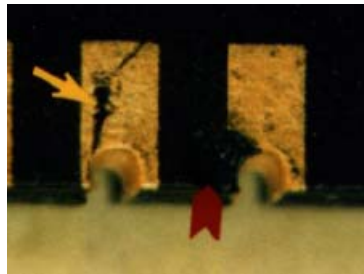


Figure 11.2-2 — Metallization voids on contact pads
(Photo used with written permission of Chipworks, Inc.)

11.2.5 Rejectable Condition: Pits or depressions which exceed 0.002 inches (0.051 mm) in depth (Figure 11.2-3).

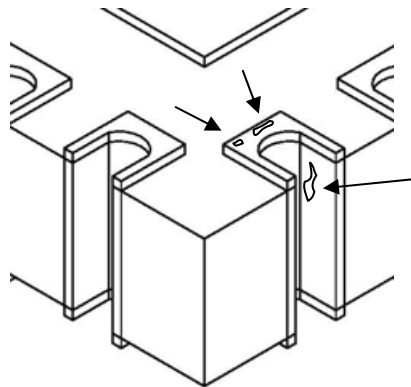


Figure 11.2-3 — Pits or depressions on a contact pad

11.2 Contact Pad Metallization (cont'd)

11.2.6 Rejectable Condition: Any smeared or bridged metallization or foreign material not intended by design which reduces the isolation between contact pads or between contact pads and any other metal or metallized parts by more than 50% or cause the package to not meet the electrical isolation requirements specified in the applicable procurement document. (Figure 11.2-4).

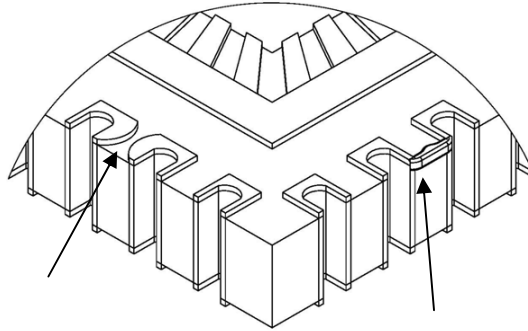


Figure 11.2-4 — Smeared metallization

11.2.7 Rejectable Condition: Metallized areas or conductor paths which are reduced by more than 50% of the design width specified in the applicable procurement document (Figure 11.2-5).

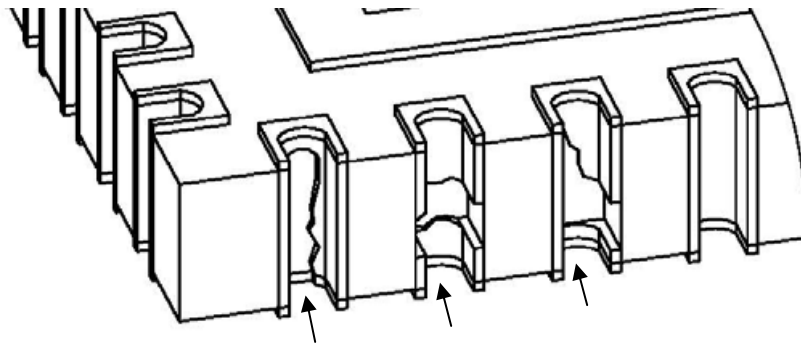


Figure 11.2-5 — Reduced width contact pad metallization

11.3 Seal Area Metallization

11.3.1 Rejectable Condition: Protrusions which project more than 0.001 inches (0.025 mm) (Figure 11.3-1).

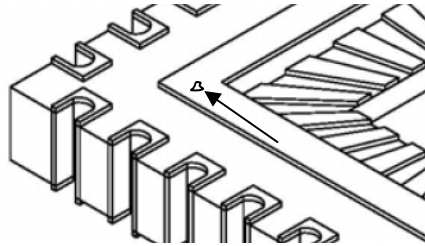


Figure 11.3-1 — A protrusion in a seal area

11.3.2 Rejectable Condition: Any cluster of protrusions which reduce the seal area width by more than 25% of the design width specified in the applicable procurement document (Figure 11.3-2). A cluster of protrusions bounded by their outermost perimeter shall represent one defect.

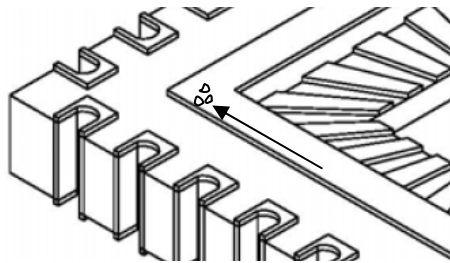


Figure 11.3-2 — Multiple close seal area protrusions

11.3.3 Rejectable Condition: Protrusions which reduce the seal area width by more than 25% of the design width specified in the applicable procurement document (Figure 11.3-3).

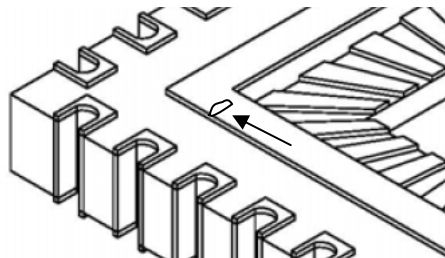


Figure 11.3-3 — A protrusion reducing the seal area metallization

11.3 Seal Area Metallization (cont'd)

11.3.4 Rejectable Condition: Hanging protrusions that can be moved with a probe (Figure 11.3-1).

11.3.5 Rejectable Condition: Protrusions that are not fully plated.

11.3.6 Rejectable Condition: Metallization voids which exceed 0.010 inches (0.254 mm) in diameter. No more than five metallization voids per package side. Use the longest X-Y dimension to specify the diameter (Figure 11.3-4).

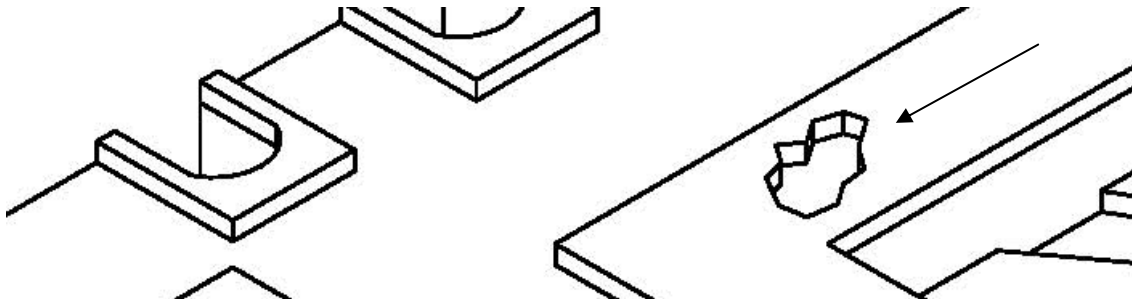


Figure 11.3-4 — A metallization void in the seal area

11.3.7 Rejectable Condition: Metallization voids closer than 0.100 inches (2.54 mm) to each other (Figure 11.3-5).

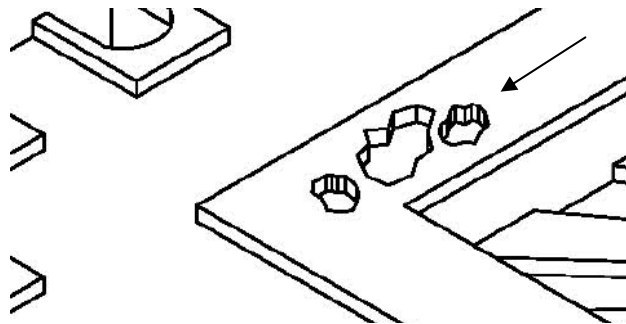


Figure 11.3-5 — Multiple close seal area metallization voids

11.3.8 Rejectable Condition: Metallization voids which reduce the seal area width by more than 25% of the design width specified in the applicable procurement document (Figure 11.3-4).

11.3 Seal Area Metallization (cont'd)

11.3.9 Rejectable Condition: Pits or depressions which exceed 0.002 inches (0.051 mm) in depth (Figure 11.3-6).

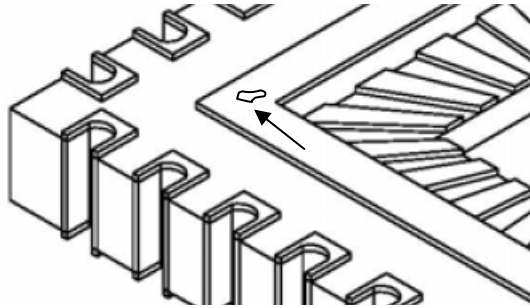


Figure 11.3-6 — A pit or depression in the seal area

11.3.10 Rejectable Condition: Pits or depressions closer than 0.100 inches (2.54 mm) to each other (Figure 11.3-7).

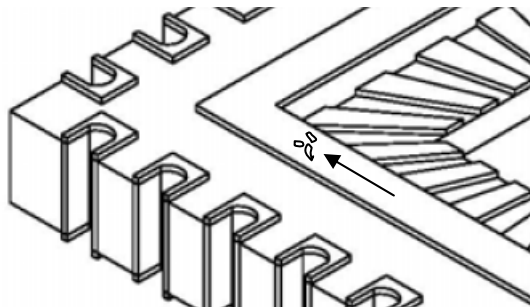


Figure 11.3-7 — Multiple close seal area pits or depressions

11.3.11 Rejectable Condition: Pits or depressions which reduce the seal area width by more than 25% of the design width specified in the applicable procurement document (Figure 11.3-8).

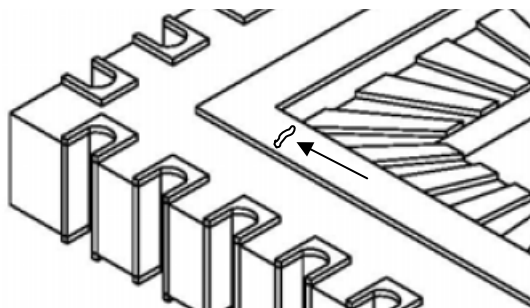


Figure 11.3-8 — A pit or depression reducing seal area width

11.3 Seal Area Metallization (cont'd)

- 11.3.12** Rejectable Condition: Any smeared or bridged metallization or foreign material not intended by design which reduces the isolation between the seal area and any other metal or metallized parts by more than 50% or cause the package to not meet the electrical isolation requirements specified in the applicable procurement document. (Figure 11.3-9).

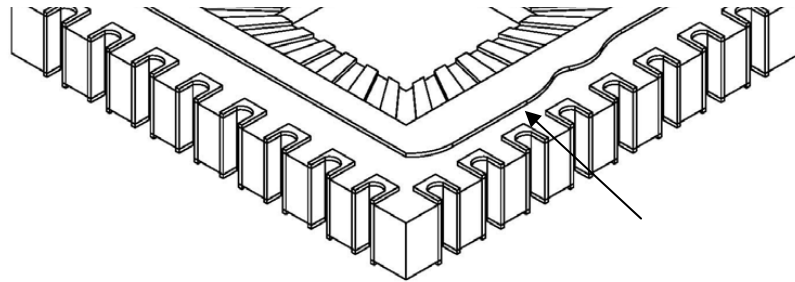


Figure 11.3-9 — Smeared seal area metallization

- 11.3.13** Rejectable Condition: Seal area metallization which is smeared more than 50% down the cavity wall (Figure 11.3-10).

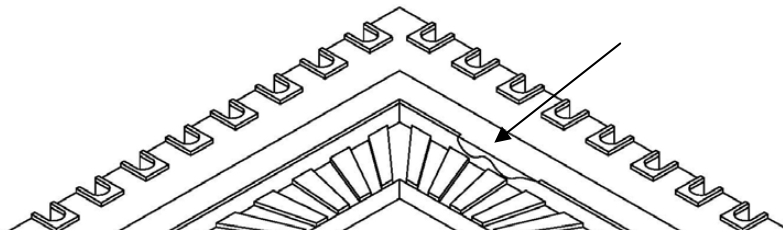


Figure 11.3-10 — Seal area metallization smeared down a cavity wall

- 11.3.14** Rejectable Condition: Smeared seal area metallization which cause seal area to exceed the maximum allowable dimensions specified in the applicable procurement document (Figure 11.3-9).

11.4 Bonding Area Metallization

11.4.1 Rejectable Condition: Critical bonding area located further than 0.025 inches (0.635mm) from the tip of the bonding trace (Figure 11.4-1).

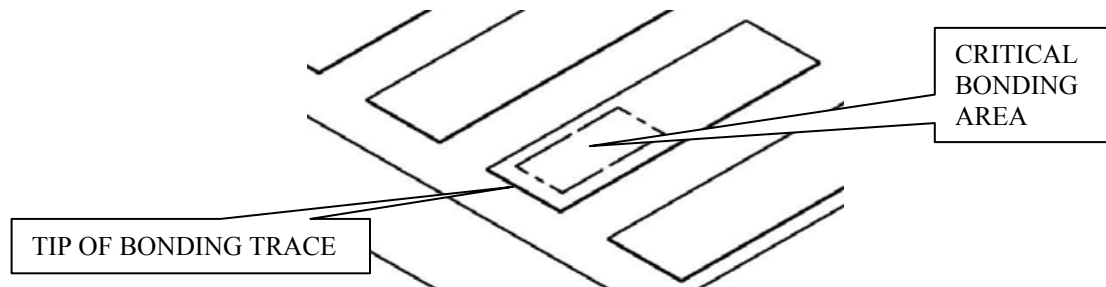


Figure 11.4-1 — The critical bonding area location

11.4.2 Rejectable Condition: Tip of bonding trace located further than 0.005 inches (0.127mm) from the edge of the ceramic layer (Figure 11.4-2).

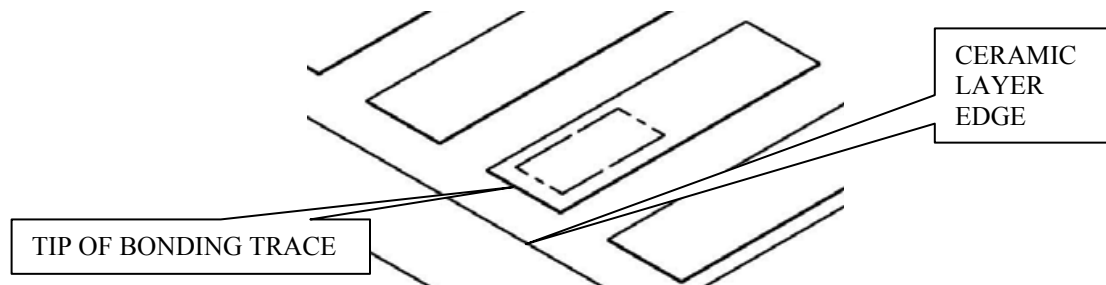


Figure 11.4-2 — The bonding trace tip location and pullback from ceramic layer edge

11.4.3 Rejectable Condition: Protrusions on the critical bonding area (Figure 11.4-3).

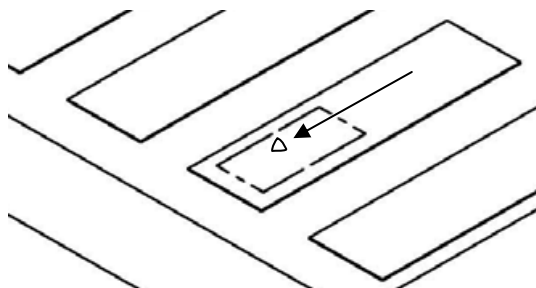


Figure 11.4-3 — A protrusion in the critical bonding area

11.4 Bonding Area Metallization (cont'd)

11.4.4 Rejectable Condition: Protrusions in all other areas of the bonding trace other than the critical bonding area which project more than 0.002 inches (0.051 mm) (Figure 11.4-4).

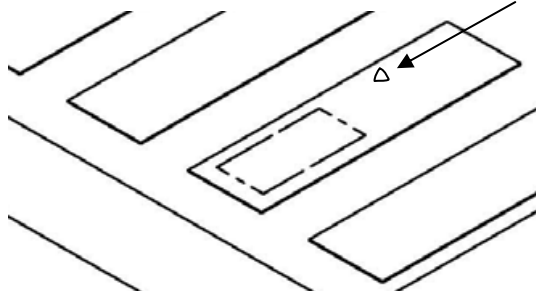


Figure 11.4-4 — A protrusion in the non-critical bonding area

11.4.5 Rejectable Condition: Hanging protrusions in all other areas of the bonding trace other than the critical bonding area that can be moved with a probe (Figure 11.4-4).

11.4.6 Rejectable Condition: Protrusions in all other areas of the bonding trace other than the critical bonding area that are not fully plated.

11.4.7 Rejectable Condition: Metallization voids in the critical bonding area (Figure 11.4-5).

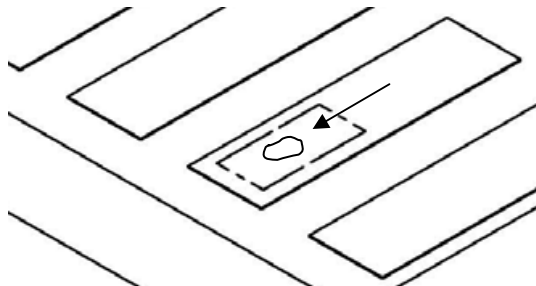


Figure 11.4-5 — A metallization void in the critical bonding area

11.4 Bonding Area Metallization (cont'd)

11.4.8 Rejectable Condition: Metallization voids in all other areas of the bonding trace other than the critical bonding area which exceed 0.005 inches (0.127 mm) in diameter. No more than one metallization void per bonding trace. Use the longest X-Y dimension to specify the diameter (Figure 11.4-6).

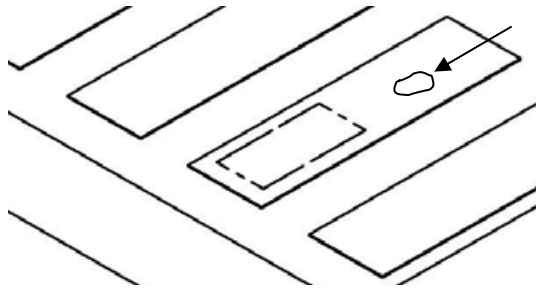


Figure 11.4-6 — A metallization void in the non-critical bonding area

11.4.9 Rejectable Condition: Metallization voids in all other areas of the bonding trace other than the critical bonding area which reduce the trace width more than 50% of the design width specified in the applicable procurement document (Figure 11.4-7).

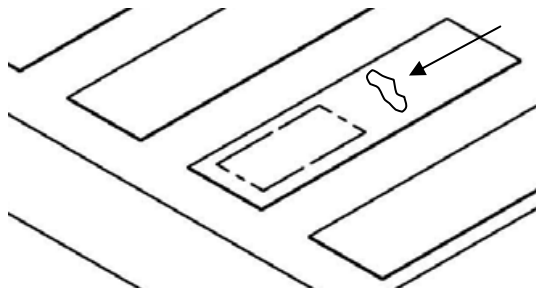


Figure 11.4-7 — A metallization void reducing bonding trace width

11.4.10 Rejectable Condition: Pits or depressions in the critical bonding area (Figure 11.4-8).

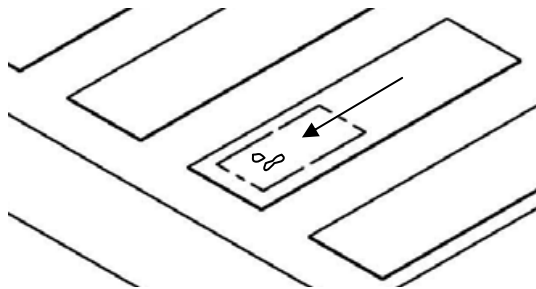


Figure 11.4-8 — Pits or depressions in the critical bonding area

11.4 Bonding Area Metallization (cont'd)

- 11.4.11** Rejectable Condition: Pits or depressions in all other areas of the bonding trace other than the critical bonding area which exceed 0.002 inches (0.051 mm) in depth (Figure 11.4-9).

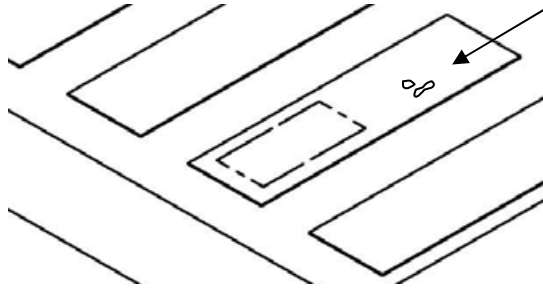


Figure 11.4-9 — Pits or depressions in the non-critical bonding area

- 11.4.12** Rejectable Condition: Any smeared or bridged metallization or foreign material not intended by design which reduces the isolation between wirebond pads or any other metal or metallized parts by more than 50% or cause the package to not meet the electrical isolation requirements specified in the applicable procurement document. (Figure 11.4-10).

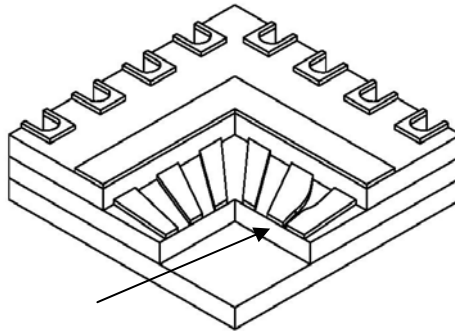


Figure 11.4-10 — Smeared wirebond area metallization

11.5 Die Attach Area

11.5.1 Rejectable Condition: Protrusions in die attach metallization area which project more than 0.002 inches (0.051 mm) (Figure 11.5-1).

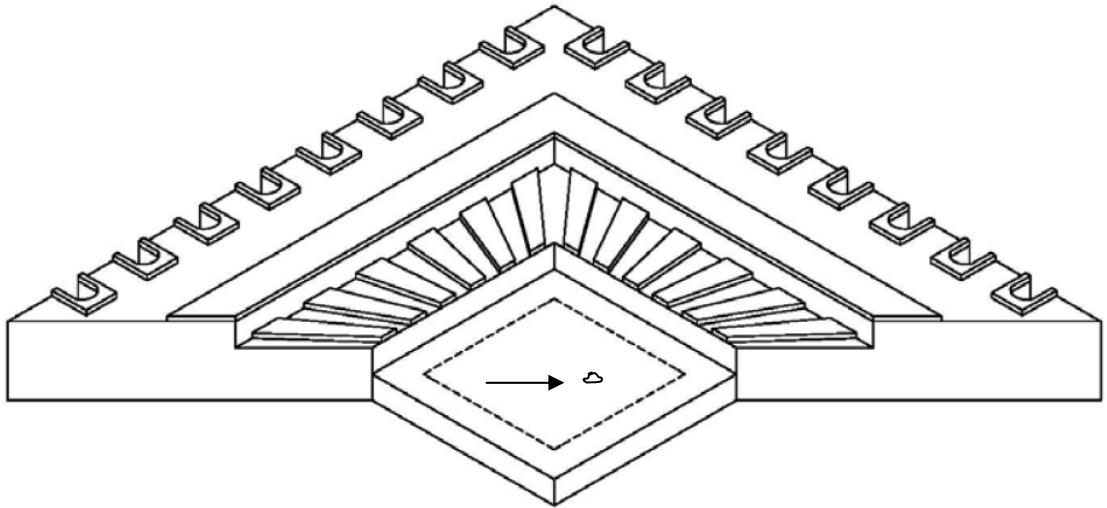


Figure 11.5-1 — A protrusion in the die attach metallization area

11.5.2 Rejectable Condition: Protrusions in die attach metallization area closer than 0.100 inches (2.54 mm) to each other (Figure 11.5-2).

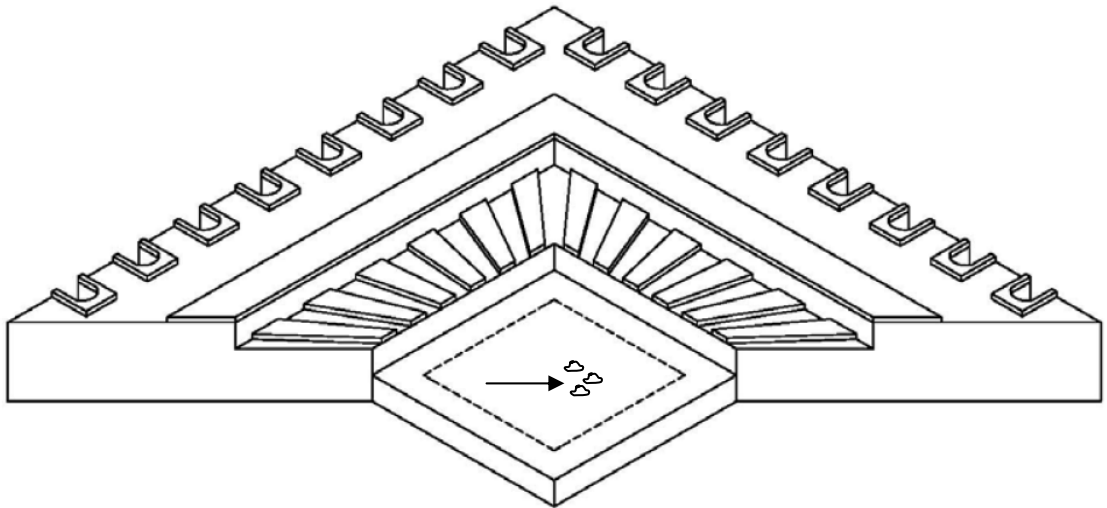


Figure 11.5-2 — Multiple close die attach metallization area protrusions

11.5 Die Attach Area (cont'd)

11.5.3 Rejectable Condition: Protrusions in die attach cavity but outside of die attach metallization area perimeter which project more than 0.002 inches (0.051 mm) (Figure 11.5-3).

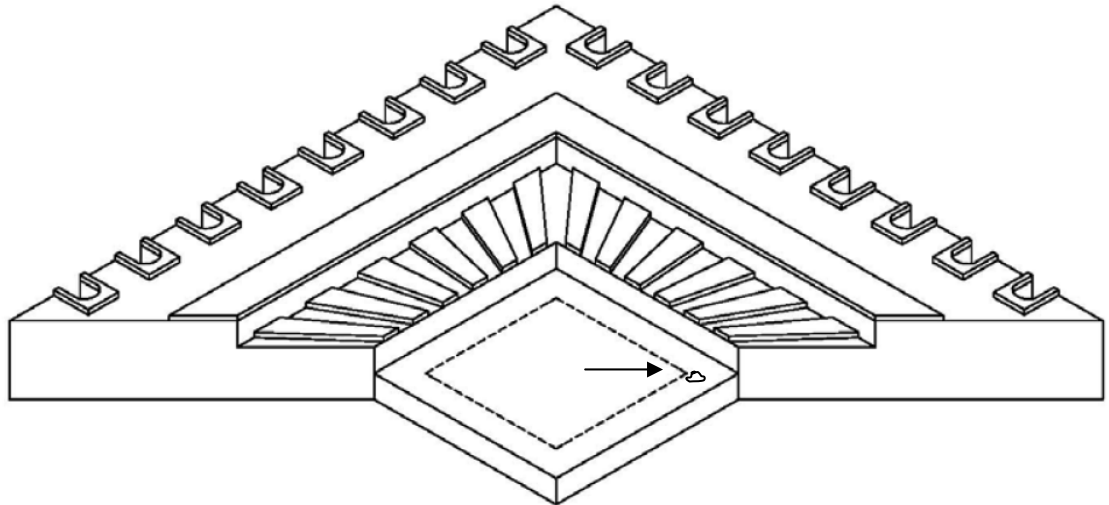


Figure 11.5-3 — A protrusion in the die attach cavity outside of the die attach metallization area perimeter

11.5.4 Rejectable Condition: Hanging protrusions in die attach cavity but outside of die attach metallization area perimeter that can be moved with a probe (Figure 11.5-3).

11.5.5 Rejectable Condition: Die attach area metallization voids which exceed 0.010 inches (0.254 mm) in diameter. No more than five metallization voids. Use the longest X-Y dimension to specify the diameter (Figure 11.5-4).

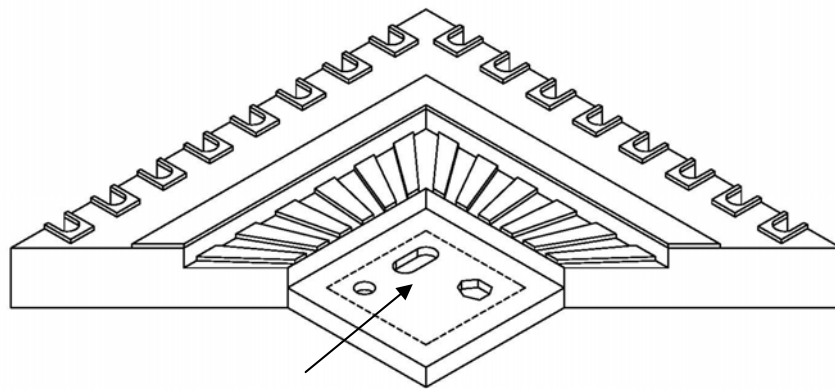


Figure 11.5-4 — Die attach area metallization voids

11.5.6 Rejectable Condition: Die attach area metallization voids closer than 0.100 inches (2.54 mm) to each other (Figure 11.5-4).

11.5 Die Attach Area (cont'd)

11.5.7 Rejectable Condition: Pits or depressions in die attach metallization area which exceed 0.002 inches (0.051 mm) in depth (Figure 11.5-5).

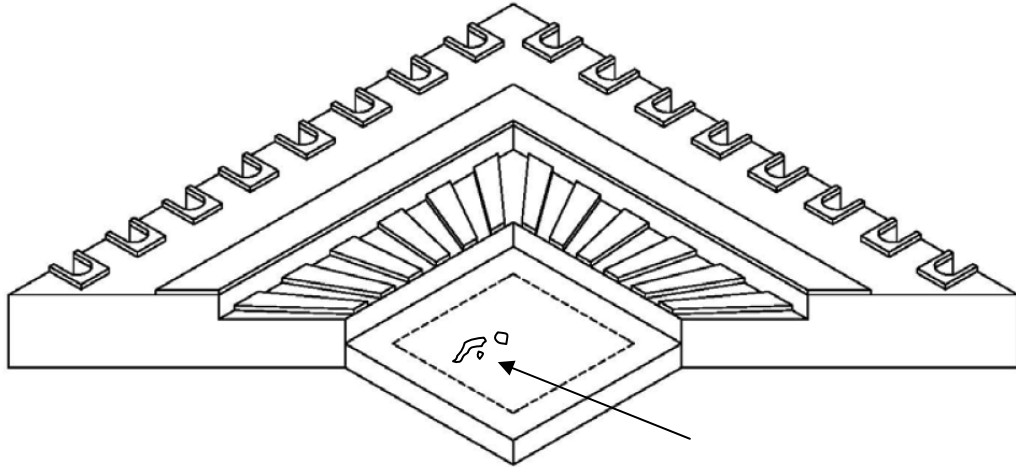


Figure 11.5-5 — Pits or depressions in the die attach metallization area

11.5.8 Rejectable Condition: Pits or depressions in the die attach metallization area closer than 0.100 inches (2.54 mm) to each other (Figure 11.5-5).

11.5.9 Rejectable Condition: Die attach area metallization which is smeared more than 50% up the cavity wall (Figure 11.5-6).

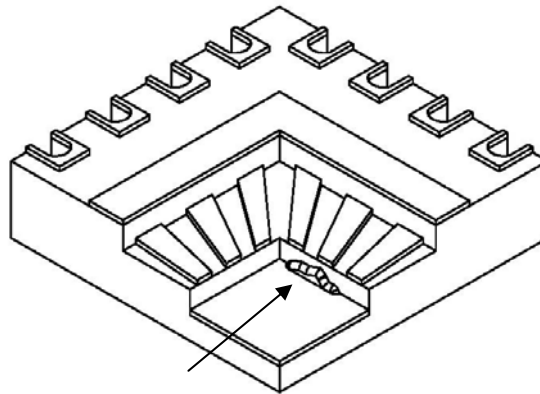


Figure 11.5-6 — Die attach area metallization smeared up a cavity wall

11.5.10 Rejectable Condition: Smeared die attach area metallization which causes the die attach area metallization to exceed the maximum allowable dimensions specified in the applicable procurement document.

11.6 Braze Pad Metallization

11.6.1 Rejectable Condition: Protrusions which project more than 0.002 inches (0.051 mm) (Figure 11.6-1).

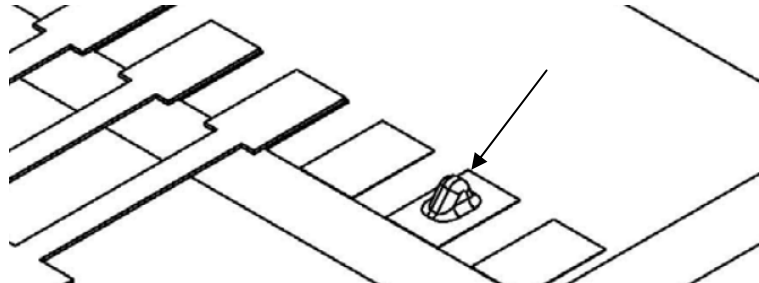


Figure 11.6-1 — A protrusion on a braze pad

11.6.2 Rejectable Condition: Hanging protrusions that can be moved with a probe (Figure 11.6-2).

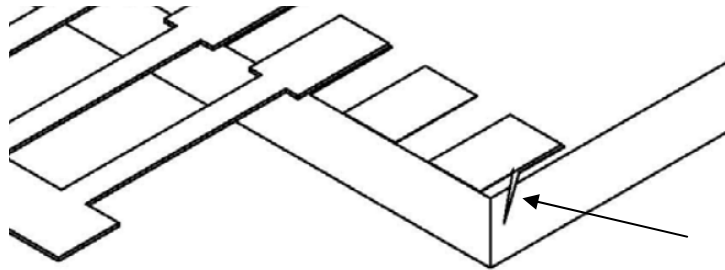


Figure 11.6-2 — A hanging protrusion on a braze pad

11.6.3 Rejectable Condition: Metallization voids which exceed 0.010 inches (0.254 mm) in diameter or reduce the braze pad width by more than 25% of the design width specified in the applicable procurement document. Use the longest X-Y dimension to specify the diameter (Figure 11.6-3).

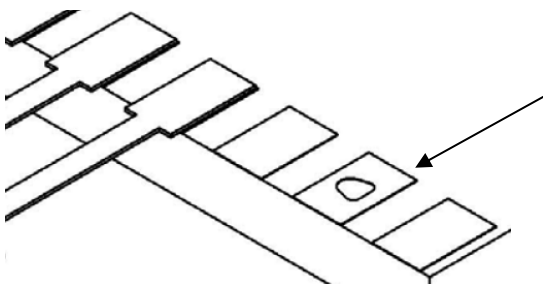


Figure 11.6-3 — A metallization void on a braze pad

11.6 Braze Pad Metallization

11.6.4 Rejectable Condition: Pits or depressions which exceed 0.002 inches (0.051 mm) in depth (Figure 11.6-4).

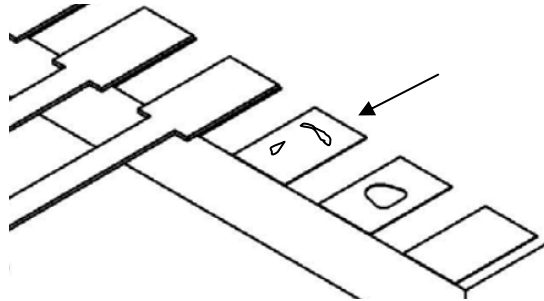


Figure 11.6-4 — Pits or depressions on a braze pad

11.6.5 Rejectable Condition: Any smeared or bridged metallization or foreign material not intended by design which reduces the isolation between braze pads or between braze pads and any other metal or metallized parts by more than 50% or cause the package to not meet the electrical isolation requirements specified in the applicable procurement document. (Figure 11.6-5).

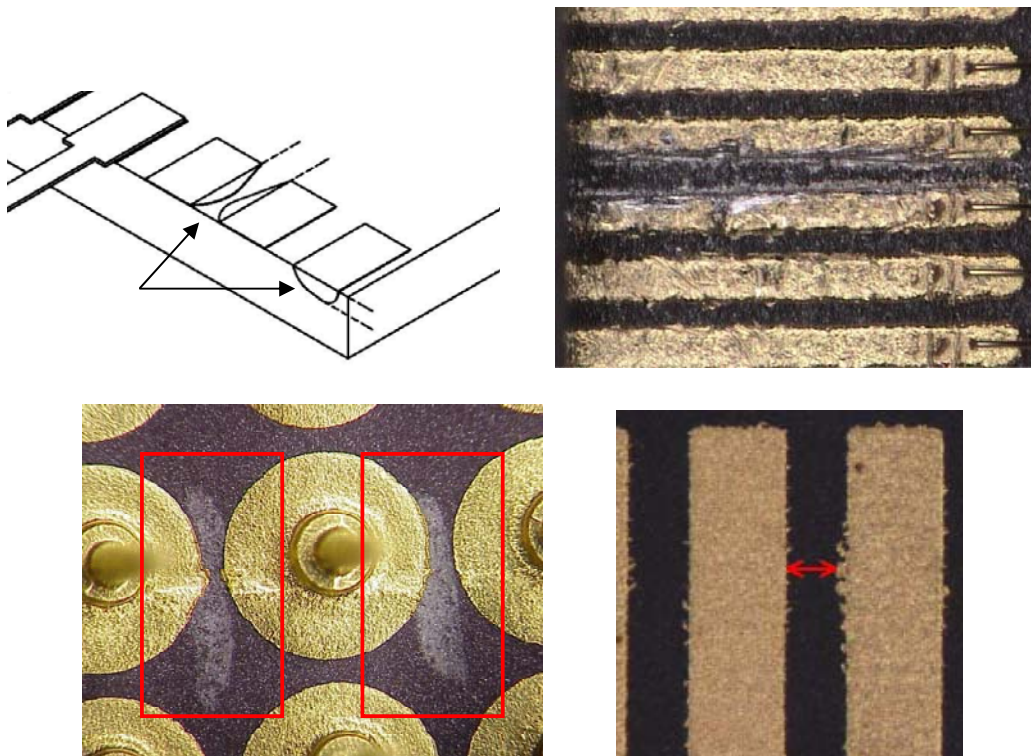


Figure 11.6-5 — Smeared braze pad metallization

11.7 Castellation Metallization

11.7.1 Rejectable Condition: Castellation metal, exclusive of the annular ring, not within the visually extended boundaries of the solder pad (Figure 11.7-1).

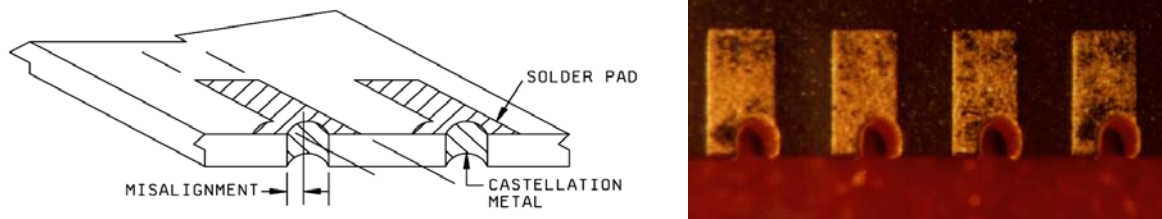


Figure 11.7-1 — Misaligned castellation metal
(Photo on right used with written permission of Chipworks, Inc.)

11.7.2 Rejectable Condition: Castellation configuration not in accordance with the following criteria. The castellation shall be roughly concave, confined by a 3-dimensional space traversing all castellated ceramic layers at the package edge. The surface of the castellation may be irregular (Figure 11.7-2). The “3-dimensional space” has these dimensions:

- Minimum width > 1/3 package terminal pad width.
- Minimum depth > 1/2 castellation minimum width.
- Length as designed.
- Maximum width < package terminal pad width.
- Maximum depth < 1/2 castellation maximum width.

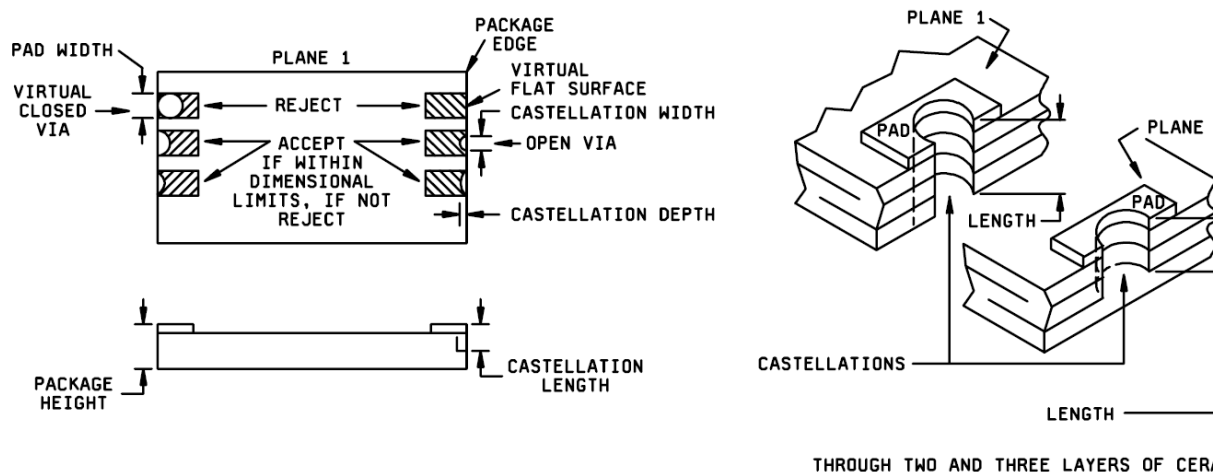


Figure 11.7-2 — Castellation configuration

12 Lead Attachment (Ceramic Packages)

12.1 Lead to Braze Pad Attachment

12.1.1 Rejectable Condition: Lead to pad attachment where braze fillet is visible on less than 75% of the perimeter of the lead head (Figure 12.1-1).

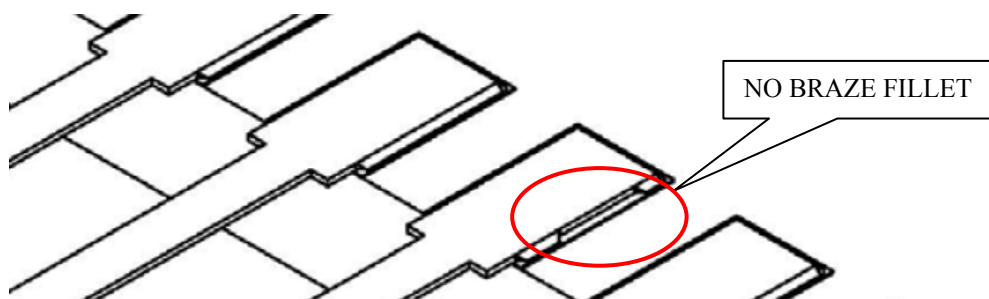


Figure 12.1-1 — Lead to pad braze attachment

12.1.2 Rejectable Condition: Lead to pad attachment where braze fillet on each side of the lead head is not at least 50% defect free (Figure 12.1-1).

12.1.3 Rejectable Condition: Braze material that increases the lead head dimensions to greater than 1.5 times the lead thickness above the design maximum between the seating plane and the ceramic package (Figure 12.1-2).

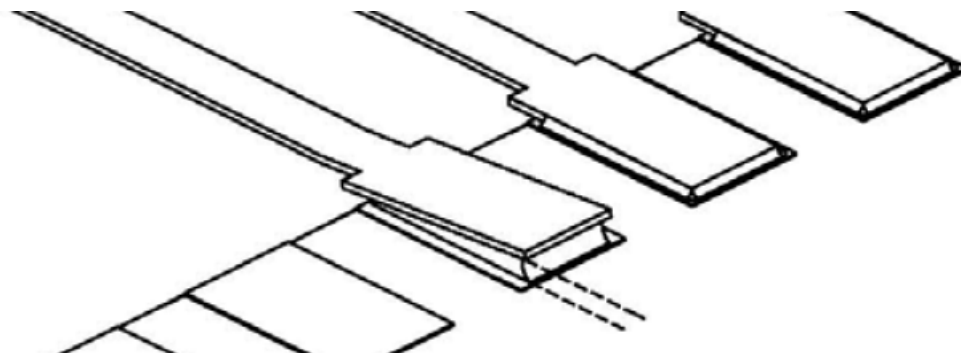


Figure 12.1-2 — Thickness increase on a lead head attributed to braze

12.1 Lead to Braze Pad Attachment (cont'd)

12.1.4 Rejectable Condition: Cracks in braze fillet or lead (Figure 12.1-3).

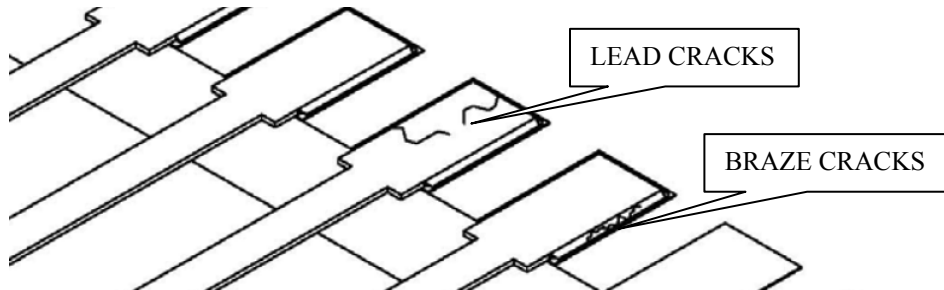


Figure 12.1-3 — Lead to pad braze attachment cracks and lead cracks

12.1.5 Rejectable Condition: Missing braze pad metallization under the lead head (Figure 12.1-4).

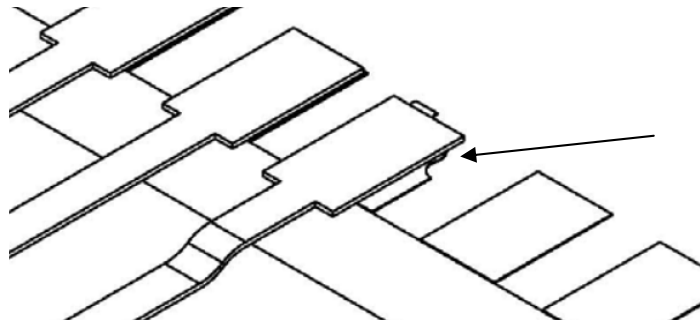


Figure 12.1-4 — Missing braze pad metallization under a brazed lead head
(Lead head shown lifted for clarity)

12.2 Lead to Pad Misalignment

12.2.1 Rejectable Condition: Misalignment where more than 25% of the lead head width overhangs the pad (Figure 12.2-1).

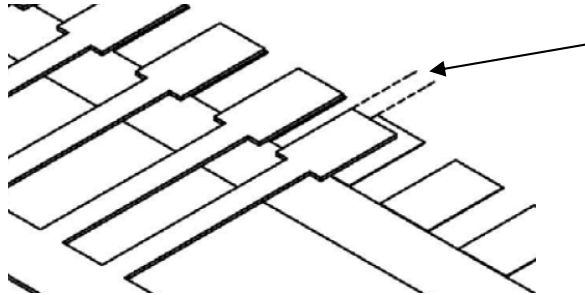


Figure 12.2-1 — Lead head to pad misalignment

12.2.2 Rejectable Condition: Misalignment that reduces the contact area of the nominal lead head to less than 75% of the nominal lead head surface area (Figure 12.2-2).

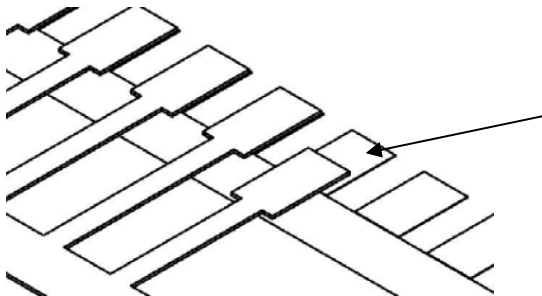


Figure 12.2-2 — Lead head to pad attachment misalignment

Annex A (informative) Index of Figures

Figures		Page
3.24-1	Critical die attach area in a ceramic package cavity	4
3.39-1	Meniscus	5
3.60-1a	Critical seal area of a projection-weld packages	8
3.60-1b	Critical seal area of a seam-weld package	8
5.1-1	An open surface bubble	11
5.1-2	Interconnecting open surface bubbles	11
5.1-3	Subsurface bubbles in a line	12
5.1-4	Multiple subsurface bubbles	12
5.1-5	A single subsurface bubble	12
5.2-1	Cracks in ceramic insulators	13
5.2-2	Circumferential cracks	13
5.2-3	Radial cracks not originating at the lead	14
5.2-4	Radial cracks originating at the lead that extend beyond the edge / low point of the meniscus	14
5.2-5	Radial cracks originating at the lead that extend beyond the edge / low point of the meniscus to the package and that lie in a single quadrant	15
5.2-6	Crazing	15
5.2-7	Molded glass	15
5.2-8	Insulator chip-outs	16
5.2-9	An insulator chip-out over 50% of the lead-to-package distance	16
5.3-1	Insulator climb	17
5.3-2	Negative meniscus	17
5.3-3	Hyperbolic insulator climb	17
5.3-4	Recessed insulators	18
5.3-5a	Insulator overflow	18
5.3-5b	Insulator webbing (acceptable on inside of planar lead packages)	18
5.3-6	Insulator splatter	19
5.4-1	Embedded foreign material in insulators	19
5.4-2	Plating on insulator surfaces	20
5.4-3	Seal enhancement or rework	20
6.1-1	Undercut braze	21
6.1-2	Undercut braze on an exterior heat sink / standoff	21
6.1-3	Undercut braze on the package base to wall interface	21
6.1-4	Undercut braze on brazed ground pins	22
6.2-1	Porous braze	22
6.2-2	Braze separation	22
6.2-3	Brazed package wall and base misalignment	23
6.3-1	Braze run-out	23
6.4-1	Braze climb	24
6.4-2a	Excessive braze	25
6.4-2b	Repair or rework of excessive braze	25
6.4-3	Nail-head ground lead elevated on a neck of braze	26
7.1-1	Lead pit, cross sectional area, and over-etching of a planar lead	26
7.1-2	Planar lead bonding and tie bar area	27
7.1-3	Pitting in round lead bonding area	27
7.1-4	Indentations in a round lead	28

Annex A (informative) Index of Figures (cont'd)

7.1-5	Exposed lead base metal	28
7.1-6	Lead bonding area protrusions	28
7.1-7	Lead protrusions	29
7.1-8	A hanging lead protrusion	29
7.2-1	Foreign material on a lead	30
7.2-2	Peeling or flaking lead plating	30
7.3-1a	An off-center planar lead	31
7.3-1b	Off-center round leads	31
7.3-2	Angled inside round leads	32
7.3-3	Angled and bent outside round leads	32
7.3-4	Maximum angle of drift for 0.015 inches (0.381 mm) wide lead	33
7.3-5	A permanently kinked planar lead	33
7.3-6	A broken lead	33
8.1-1	Nicks, pits, voids, and indentations on projection-weld package critical seal areas	34
8.1-2	Nicks, pits, voids, and indentations on seam-weld package critical seal areas	35
8.1-3	Nicks, pits, voids, and indentations in substrate areas	35
8.1-4	Nicks, pits, voids, and indentations in a general package area	36
8.1-5	Exposed base metal on packages	36
8.1-6	Hanging protrusions	36
8.1-7	Solid protrusions in critical seal areas	37
8.1-8	Solid protrusions in substrate areas	37
8.1-9	Solid protrusions around package holes	37
8.1-10	Solid protrusions around inside seal rings in non-critical seal areas	38
8.1-11	Solid protrusions on a mounting surface	38
8.1-12	Solid protrusions in general package areas	38
8.1-13	Metallization not intended by design	39
8.1-14	A broken metal package	39
8.2-1	Embedded foreign material on packages	40
8.2-2	Flaking plating, corrosion, and de-lamination on packages	40
8.2-3	General package area surface roughness	41
8.2-4	Machined surface steps	41
9.1-1	Nicks, pits, voids, and indentations on projection-weld cover critical seal areas	42
9.1-2	Nicks, pits, voids, and indentations on cover critical seal areas	42
9.1-3	Nicks, pits, voids, and indentations in general cover areas	43
9.1-4	Exposed base metal on a cover	43
9.1-5	Solid protrusions in cover critical seal areas	43
9.1-6	Solid protrusions in general cover areas	44
9.2-1	Embedded foreign material on covers	44
9.2-2	Peeling, corrosion, and surface staining on covers	45
9.2-3	Cover surface finish roughness and pitting	45
10.1-1	A ceramic chip-out	46
10.1-2	A ceramic chip-out over 50% of the lead and/or pad distance	46
10.1-3	A ceramic chip-out under a metallized area	47
10.1-4	Cracked ceramic packages	47
10.1-5	Edge rounding	48

Annex A (informative) Index of Figures (cont'd)

10.1-6	A solid ceramic protrusion on a mounting surface	48
10.1-7	A solid ceramic protrusion in a general area	49
10.1-8	Fins on the outside of a package	49
11.1-1	Peeling, flaking, and lifting metallization	50
11.2-1	A protrusion on a contact pad	50
11.2-2	Metallization voids on contact pads	51
11.2-3	Pits or depressions on a contact pad	51
11.2-4	Smeared metallization	52
11.2-5	Reduced width contact pad metallization	52
11.3-1	A protrusion in a seal area	53
11.3-2	Multiple close seal area protrusions	53
11.3-3	A protrusion reducing the seal area metallization	53
11.3-4	A metallization void in the seal area	54
11.3-5	Multiple close seal area metallization voids	54
11.3-6	A pit or depression in the seal area	55
11.3-7	Multiple close seal area pits or depressions	55
11.3-8	A pit or depression reducing seal area width	55
11.3-9	Smeared seal area metallization	56
11.3-10	Seal area metallization smeared down a cavity wall	56
11.4-1	The critical bonding area location	57
11.4-2	The bonding trace tip location and pullback from ceramic layer edge	57
11.4-3	A protrusion in the critical bonding area	57
11.4-4	A protrusion in the non-critical bonding area	58
11.4-5	A metallization void in the critical bonding area	58
11.4-6	A metallization void in the non-critical bonding area	59
11.4-7	A metallization void reducing bonding trace width	59
11.4-8	Pits or depressions in the critical bonding area	59
11.4-9	Pits or depressions in the non-critical bonding area	60
11.4-10	Smeared wirebond area metallization	60
11.5-1	A protrusion in the die attach metallization area	61
11.5-2	Multiple close die attach metallization area protrusions	61
11.5-3	A protrusion in die attach cavity outside of the die attach metallization area perimeter	62
11.5-4	Die attach area metallization voids	62
11.5-5	Pits or depressions in the die attach metallization area	63
11.5-6	Die attach area metallization smeared up a cavity wall	63
11.6-1	A protrusion on a braze pad	64
11.6-2	A hanging protrusion on a braze pad	64
11.6-3	A metallization void on a braze pad	64
11.6-4	Pits or depressions on a braze pad	65
11.6-5	Smeared braze pad metallization	65
11.7-1	Misaligned castellation metal	66
11.7-2	Castellation configuration	66
12.1-1	Lead to pad braze attachment	67
12.1-2	Thickness increase on a lead head attributed to braze	67
12.1-3	Lead to pad braze attachment cracks and lead cracks	68
12.1-4	Missing braze pad metallization under a brazed lead head	68
12.2-1	Lead head to pad misalignment	69
12.2-2	Lead head to pad attachment misalignment	69

Annex B (informative) Differences between JESD9C and JESD9B

This annex briefly describes most of the changes made to entries that appear in this standard, JESD9C, compared to its predecessor, JESD9B (May 2011). If the change to a concept involves any words added or deleted (excluding deletion of accidentally repeated words), it is included. Some punctuation changes are not included.

Clause	Description of change
Foreword	Removed second paragraph: “This standard implements a complete re-write and significant technical changes and information from the previous edition”.
2	Updated hyperlink to access Military Standards in electronic format, and removed mailing address.
3	3.43 and 3.45 Notes removed and moved to Note 3 in 3.37. 3.57 removed “caused by scratching”.
3	Add term and definitions 3.58a and 3.58b.
4.4	Added “Optical” to clause title.
5.3.2	Replace “Rejectable Condition: Insulator that exhibits non-uniform wicking / wetting or negative meniscus at the lead and or package interface (Figure 5.3-2).” with new text for clarification.
8.1.1	Removed “or scratches” from paragraph. Figure 8.1-1, removed “scratches” from title.
8.1.3	Added “0.002 inches (0.051 mm) deep and”. Figure 8.1-3, removed “scratches” from title.
8.1.4	Added “0.005 inches (0.127 mm) deep and”. Figure 8.1-4, removed “scratches” from title.
8.1.11	Changed “0.002 inches (0.051 mm)” to “0.002 inches (0.051 mm)” (NOTE If there is a special need for a specific product it can be specified by SCD or procurement document.)
8.2.4	Replaced “General machined package surfaces with surface steps (cutter mismatch) not intended by design which exceed 0.001 inches (0.025 mm)”.
9.1.1	Removed “scratches”. Figure 9.1-1, removed “scratches” from title.
9.1.2	Removed “scratches”. Figure 9.1-2, removed “scratches” from title.
9.1.3	Removed “scratches”. Figure 9.1-3, removed “scratches” from title.

B.1 Differenced between JESD9B and JESD9A/JESD27

This annex briefly describes most of the changes made to entries that appear in this standard, JESD9B, compared to its predecessors, JESD9-A (April 1987) and JESD27 (August 1993).

Clause	Description of change
--------	-----------------------

This is a complete rewrite of JESD9A and JESD27 and the changes are immense. See Foreword for more details.



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