

# Government Working Group

## Justification for Opposing Proposed Change to MIL-STD-883 Intended Seal Width Requirement

Presented at the JEDEC JC13 Task Group 15-02 X-Ray Seal Voids Meeting

January 24, 2017

# Acronyms

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<b>2D</b>	<b>Two Dimensional</b>
<b>3D-CT</b>	<b>Three Dimensional - Computer Tomography</b>
<b>AMRDEC</b>	<b>Aviation and Missile Research, Development, and Engineering Center</b>
<b>DLA</b>	<b>Defense Logistics Agency Land and Maritime</b>
<b>GWG</b>	<b>Government Working Group</b>
<b>JEDEC</b>	<b>Joint Electronic Device Council</b>
<b>MIL-STD</b>	<b>Military Standard</b>
<b>MSFC</b>	<b>Marshall Space Flight Center</b>
<b>NASA</b>	<b>National Aeronautics and Space Administration</b>
<b>NEPAG</b>	<b>NASA Electronic Parts Assurance Group</b>
<b>NRO</b>	<b>National Reconnaissance Office</b>
<b>NSWC</b>	<b>Naval Surface Warfare Center</b>
<b>SMC</b>	<b>Space and Missile Center</b>
<b>SSTC-G12</b>	<b>Solid State Technical Committee</b>
<b>TM</b>	<b>Test Method</b>

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**GWG was established in January 2017**

- **Purpose:** To discuss in detail government topics from NEPAG which require additional in-depth technical solutions
- **Objective:** To establish a one-government stance applicable to both terrestrial and space programs
- **Scope:** Attendees represent 6 government agencies and DLA Land and Maritime
  - Air Force SMC/The Aerospace Corporation
  - Air Force – Wright-Patterson
  - Army AMRDEC (abstained)
  - NASA Centers
  - Navy – NSWC Crane Division
  - NRO/The Aerospace Corporation

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## • MIL-STD-883K Change 2 TM2012.10 Lid Seal Voids Requirements

- From paragraph 3.10.2.2 Unacceptable construction:
  - Any device wherein the integral lid seal is not continuous or is reduced from its designed sealing width by more than 75 percent.
  - Width reduction to less than 75% may be the result of either a single void or a combination of voids in the same width area (see figure 2012-7).
- Fillets are not included in the designed (intended) sealing width.

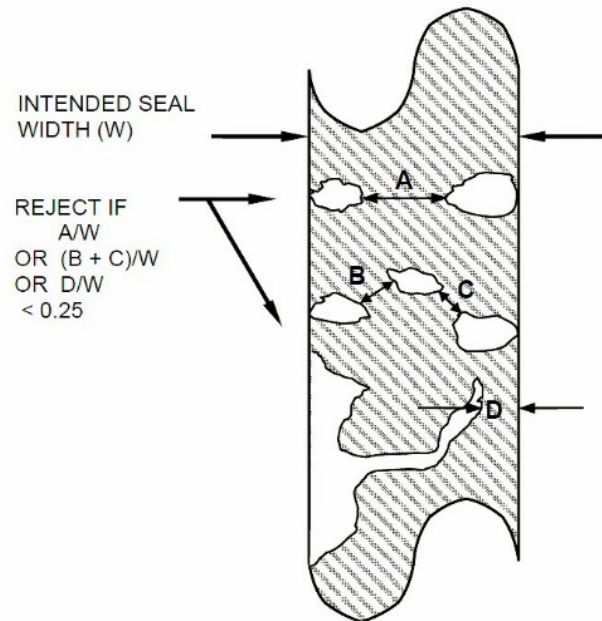


FIGURE 2012-7. Lid seal voids and rejection criterion.

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## • MIL-STD-750 TM2076 Lid Seal Voids Requirements

- 1.1.1 Designed sealing width. The metalized area where the package lid overlaps the package base (see figure 2076–7).
- 1.1.2 Seal fillet. Exuded seal material, usually concave in shape, which extends from the edge of the package lid to the point of tangency of the package base (see figure 2076–7).
- 3.8.2.3.2 Defective seal (see figure 2076–2). Any device wherein the lid seal (including the seal fillet when present) is not continuous or is reduced from its designed sealing width by more than 75 percent. The designed sealing width may be reduced by multiple voids (not to include pin hole voids).

**NOTE:** Expulsion resulting from the final sealing operation is not considered extraneous material as long as it can be established that it is continuous, uniform, and attached to the parent material and does not exhibit a ball, splash, or tear-drop configuration.

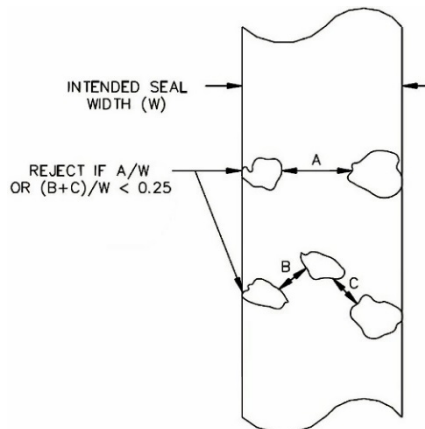


FIGURE 2076-2. Lid seal voids and rejection criterion (drawing).

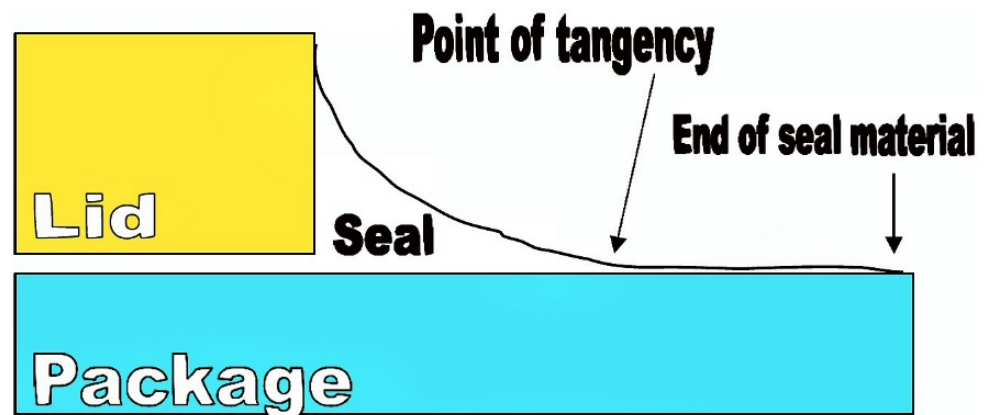


FIGURE 2076-7. Design sealing width and seal fillet graphic.

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## • Justification Not to Allow Inclusion of Fillet in Intended Lid Seal Width

- DLA Land and Maritime has no history of why fillet was included in the seal width for MIL-STD-750 product (requirement inserted in TM2076 in 1/3/2012)
  - M750 has significantly tighter leak rates than M883 and some believe the fillet inclusion was a compromise since tighter leak rates and this change were made in the same timeframe.
- The fillet is not a design feature of the seal process.
  - Fillet width is not a controlled process.
    - Fillet forms when solder flows out from under the lid during the sealing process, and tapering of the fillet results in a non-uniform seal width (see figures on Slide 8).
    - Solder pullback severity can negate the seal effectiveness of the fillet.
    - Microcrack(s) not distinguished in x-rays may compromise seal integrity as they can propagate to a void area when part is placed on board or during box level and system level testing.

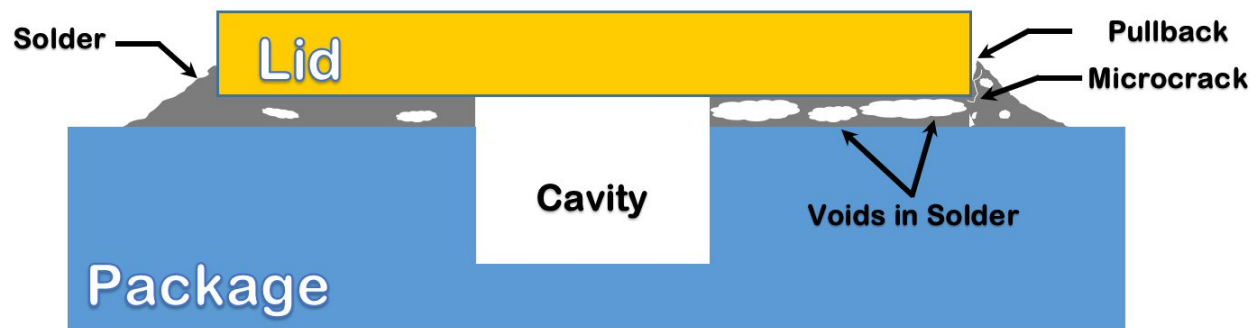
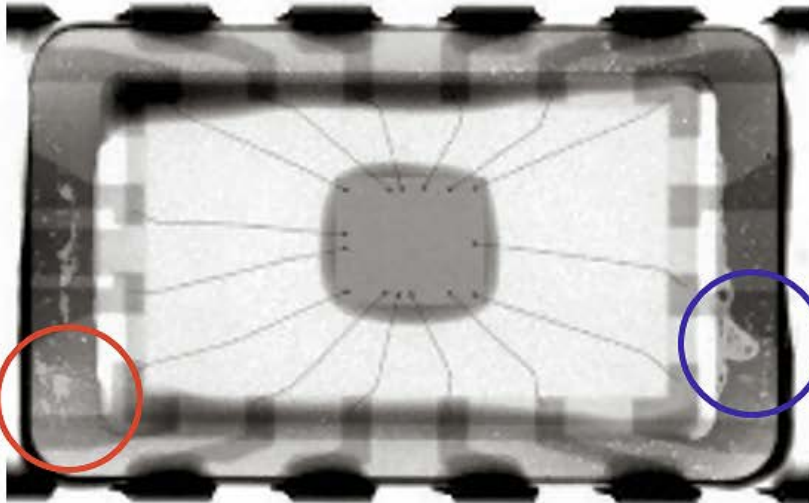


Figure illustrating voids, solder pullback, and microcrack in lid seal

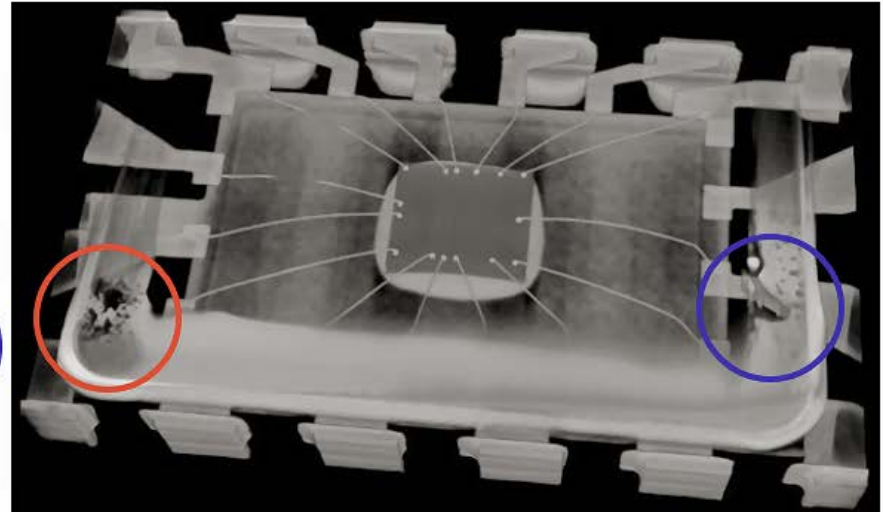
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## • Example 1: Excessive Voiding Underneath Lid

- Voids may reduce sealing width underneath the lid by more than 75% and also contact the fillet.
  - Microcrack(s), not distinguished in x-ray, may compromise seal integrity as they can propagate to a void area.
- The current lid seal requirements would fail this device, yet pass if the fillet is included in the intended seal width.



2D Image

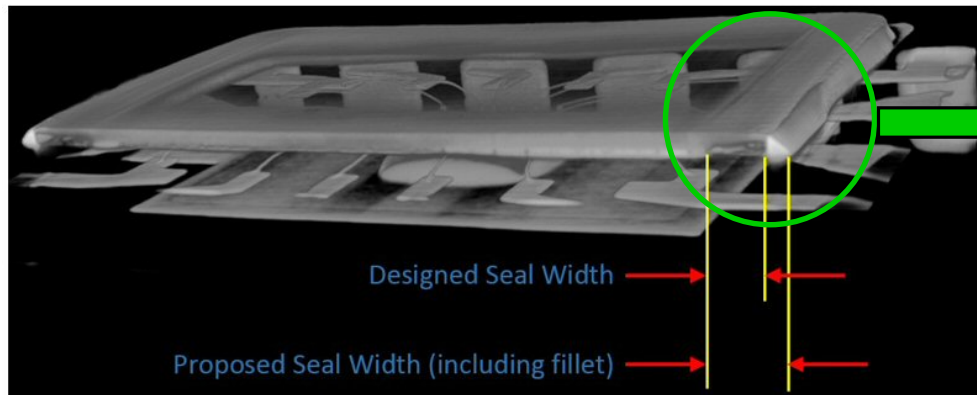
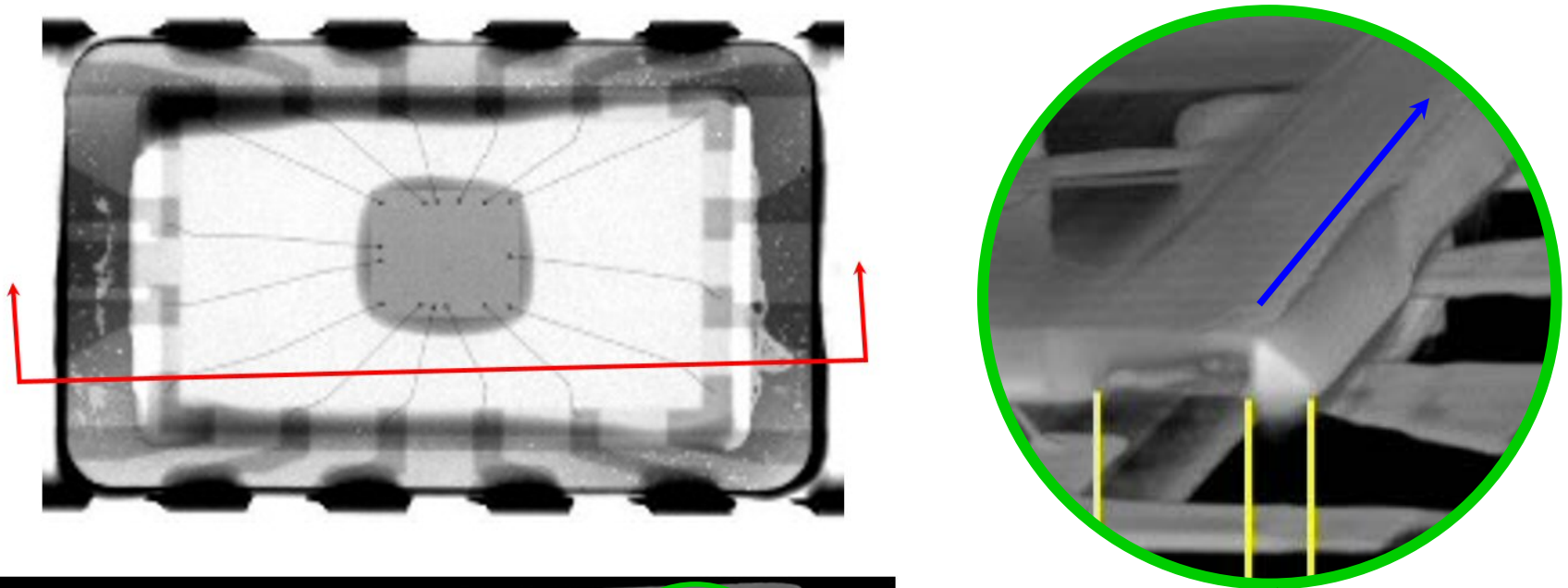


3D-CT Image

This part was a randomly selected sample and had this void issue. Because this part was randomly selected, it is highly probable that there are other parts with similar issues.

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- **Example 1: Excessive Voiding Underneath Lid (continued)**
  - The current lid seal requirements would fail this device, yet it would pass if the fillet is included in the intended seal width.



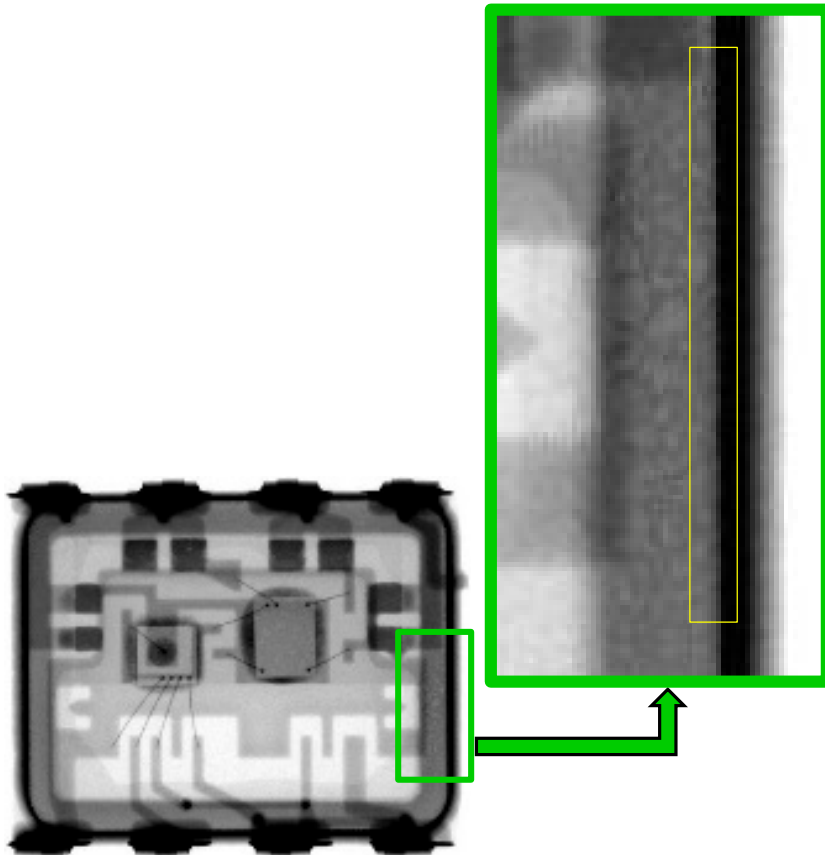
Darkened areas in the designed seal width are voids and the fillet width tapers (blue arrow).



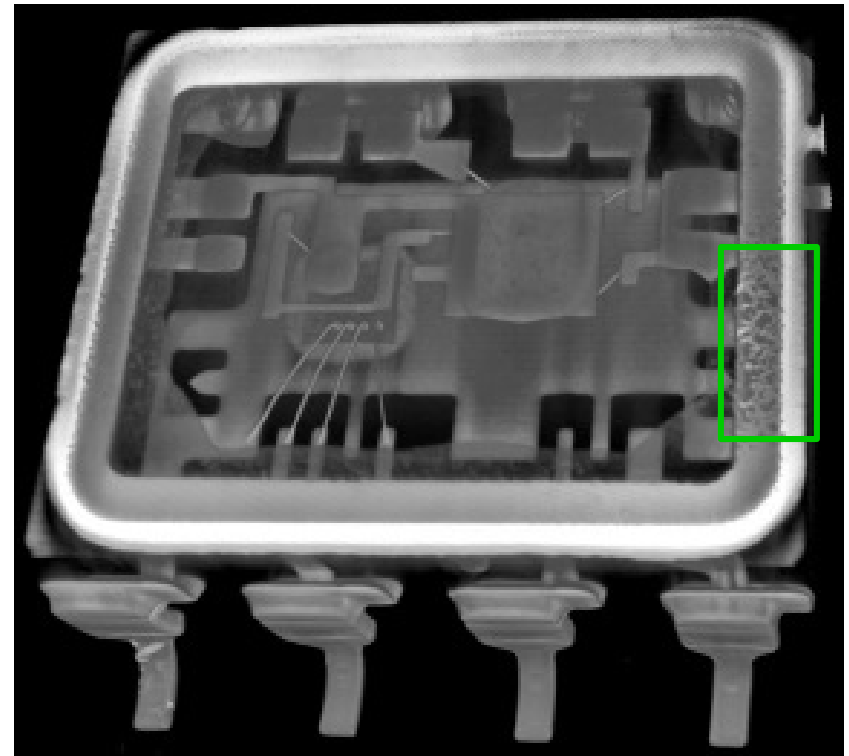
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## • Example 2: Excessive Voiding Underneath Lid

- Voids reduce sealing width underneath the lid by more than 75% and pinholes exist in fillet area next to the lid. Note that the pinholes are not clearly detected in the 2D x-ray image (yellow box) due to the thick, x-ray dense solder of the fillet.



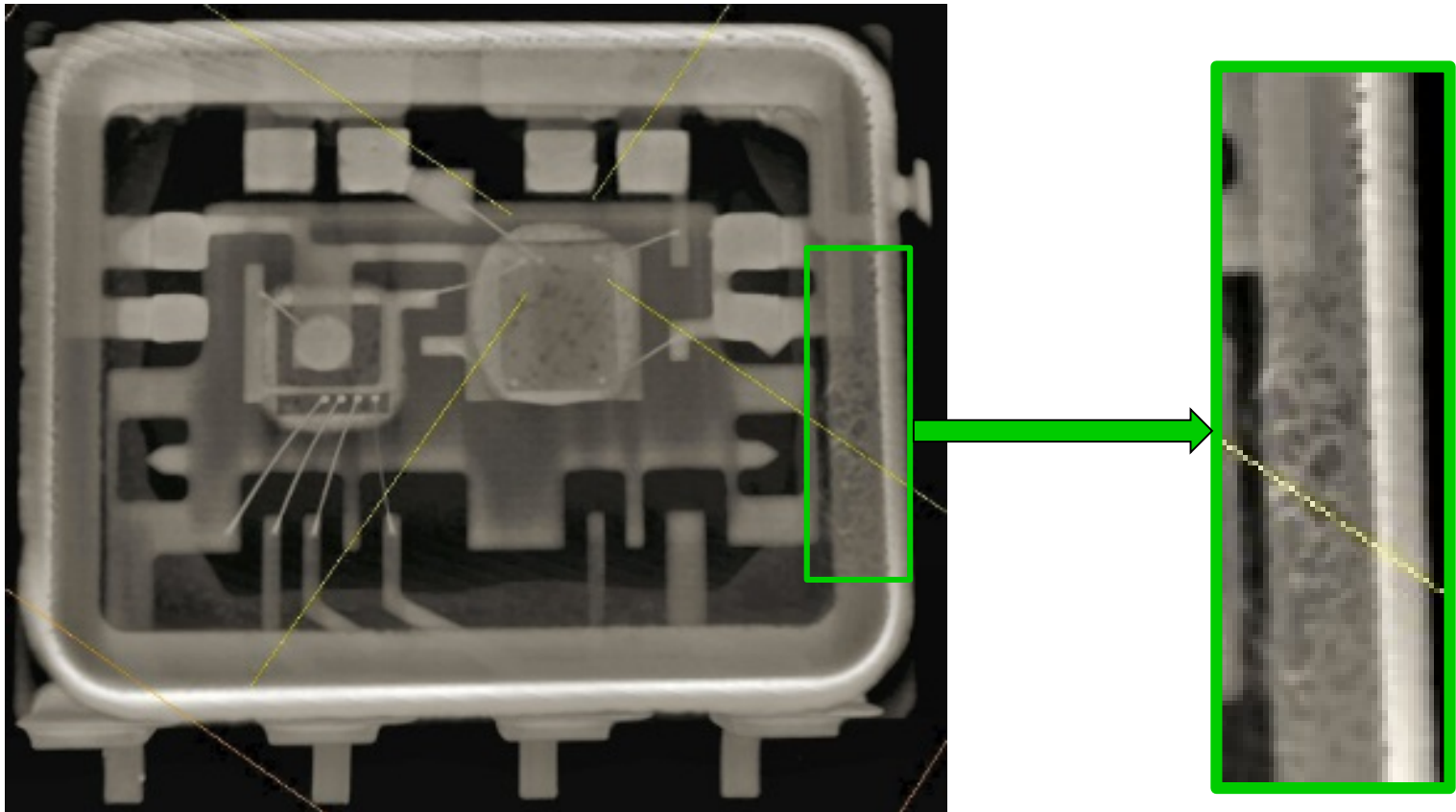
2D Image



3D-CT Image

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- **Example 2: Excessive Voiding Underneath Lid (continued)**
  - Another 3D-CT image of the device shown on Slide 9. This part would fail the current criteria, but would pass if the fillet was included in the design width. Note the pinholes in the fillet next to the edge of the lid, which provides a potential leak path.



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## • Conclusion

- The GWG does not support the inclusion of the fillet as part of the intended fillet width in MIL-STD-883 TM2012.
  - The formation of the fillet is not a design feature of the seal process. Fillets form when solder flows out from under the lid during the seal process.
  - In most if not all cases, the fillet width by itself would meet the 25% required seal width.
  - Most 2D x-ray images do not reveal pullback or pin holes in the fillet next to the outer edge of the lid due to the thickness of the x-ray dense fillet.
- The GWG recommends the fillet allowance stated in MIL-STD-750 TM2076 be removed.
  - Even though TM1071 leak rate limits are tighter than those given in MIL-STD-883 TM1014 (with the exception of space level hybrid microcircuits), these tests are performed on pristine product, which does not take into consideration mechanical shock/vibration/thermal stress induced during handling, installation, board/box/system level testing, and end use.

# Questions?

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