



DPA Results From 2019

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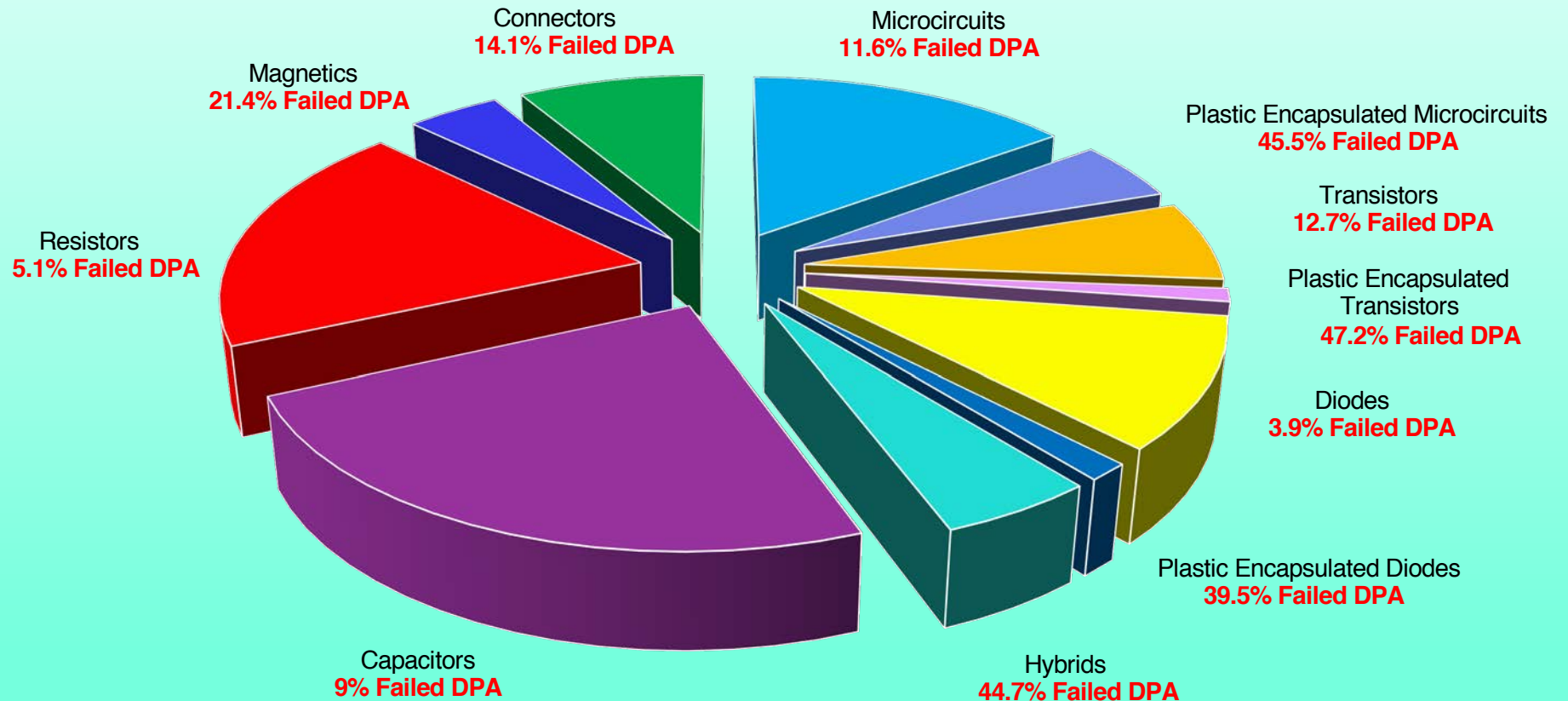
Presented to: SPWG

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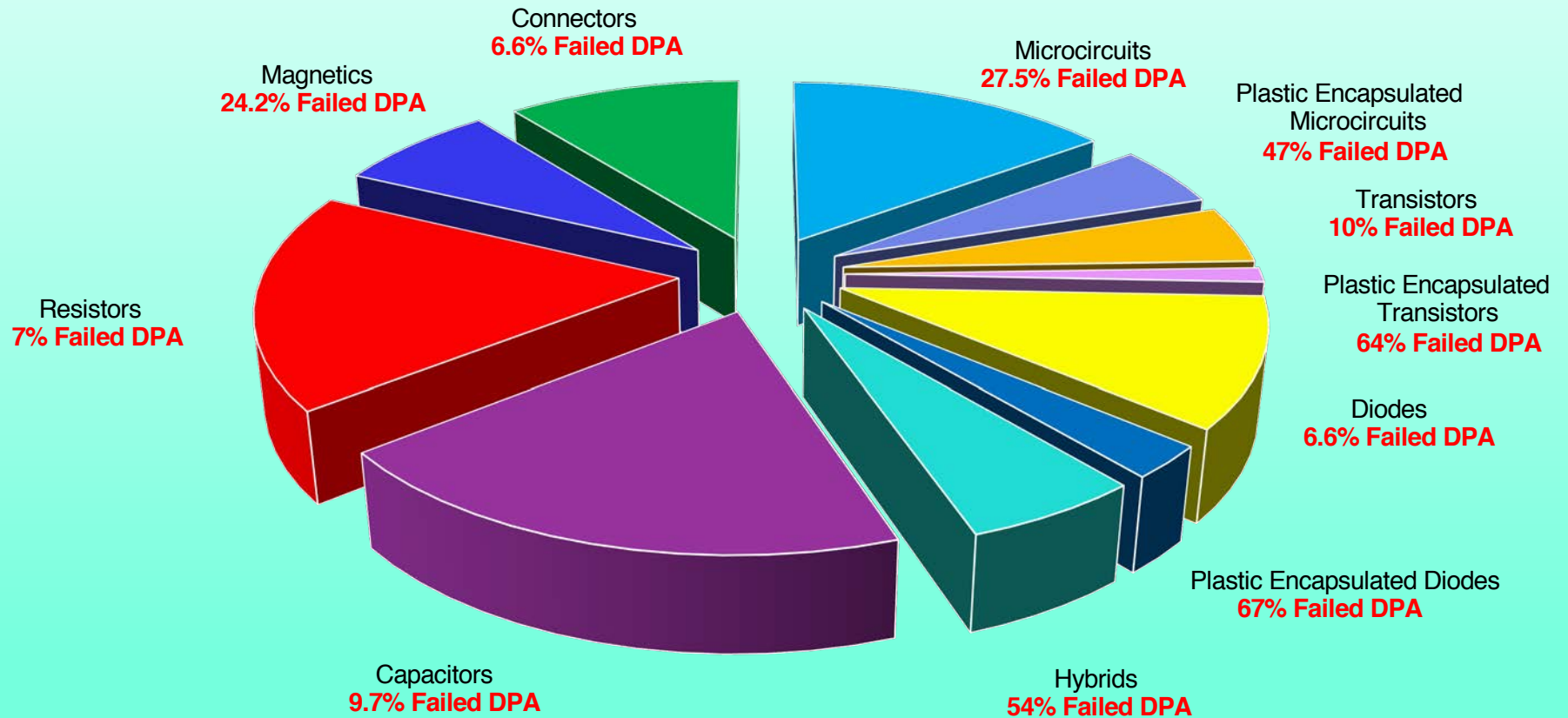
DPA RESULTS FROM 2019



DPA Failure Rate within part type distributions. A total of 3781 DPAs were performed, of which 523 or 13.8% failed.



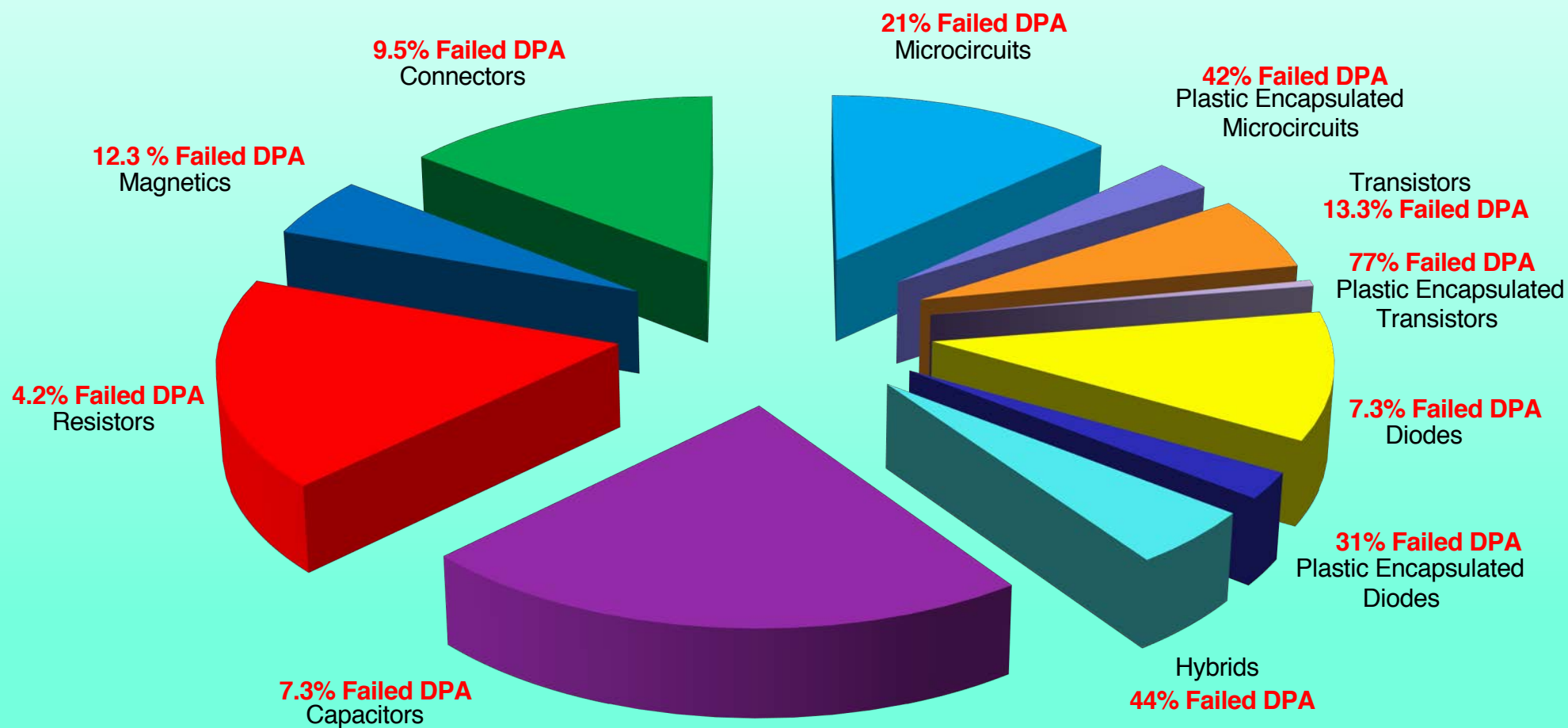
DPA RESULTS FROM 2018



DPA Failure Rate within part type distributions. A total of 2469 DPAs were performed, of which 483 or 20% failed.

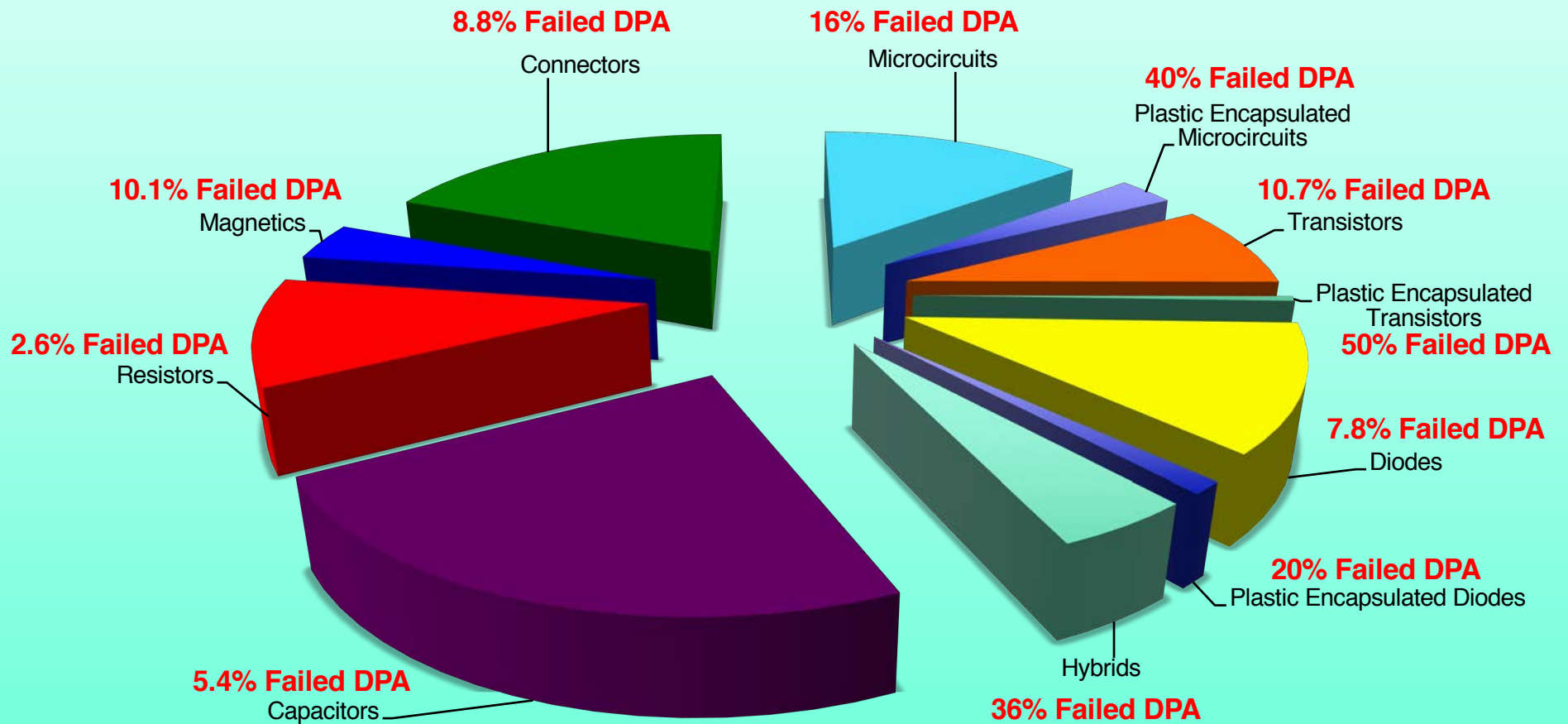


DPA RESULTS FROM 2017



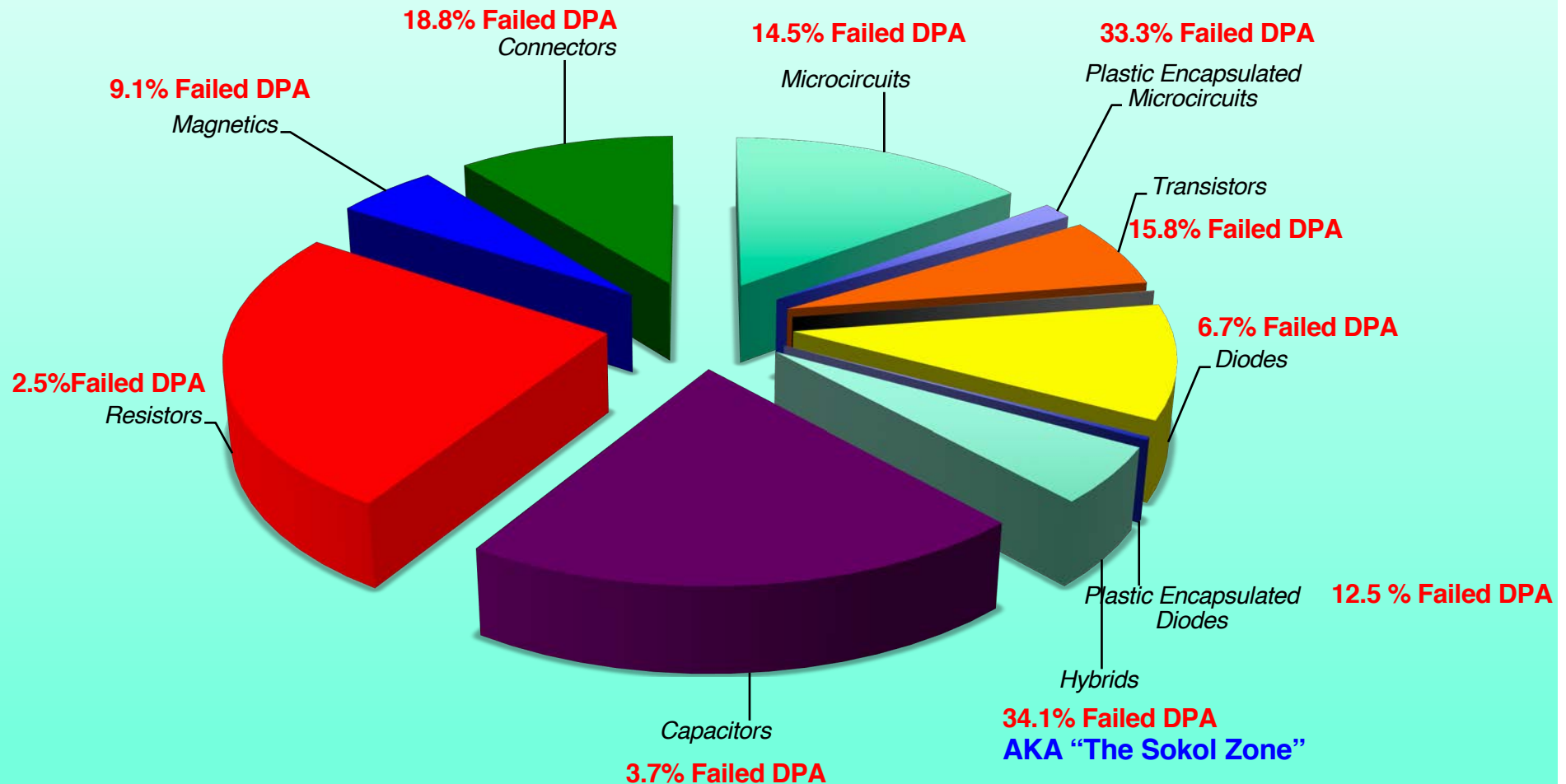
DPA Failure Rate within part type distributions. A total of 3011 DPAs were performed, of which 423 or 14% failed.

DPA RESULTS FROM 2016



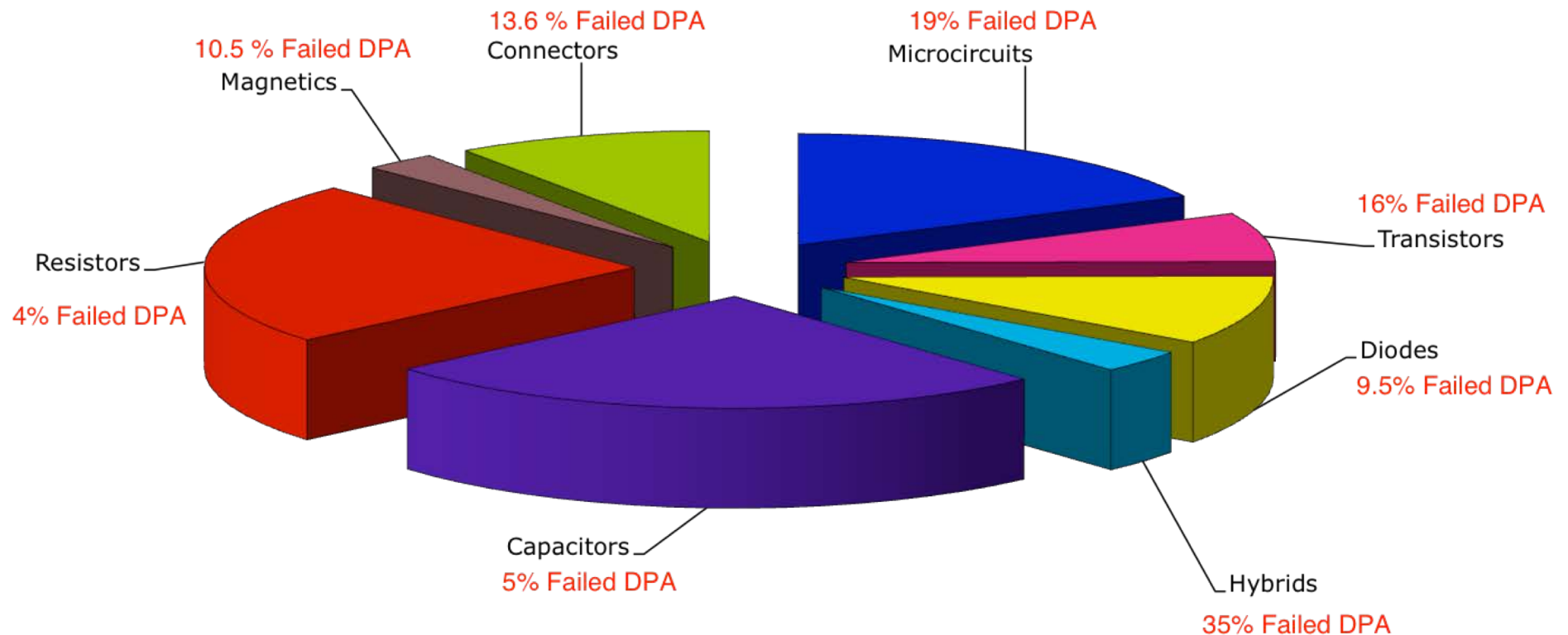
DPA Failure Rate within part type distributions. A total of 2430 DPAs were performed, of which 278 or 11.4 % failed.

DPA RESULTS FROM 2015



DPA Failure Rate within part type distributions. A total of 3264 DPAs were performed, of which 352 or 10.8% failed.

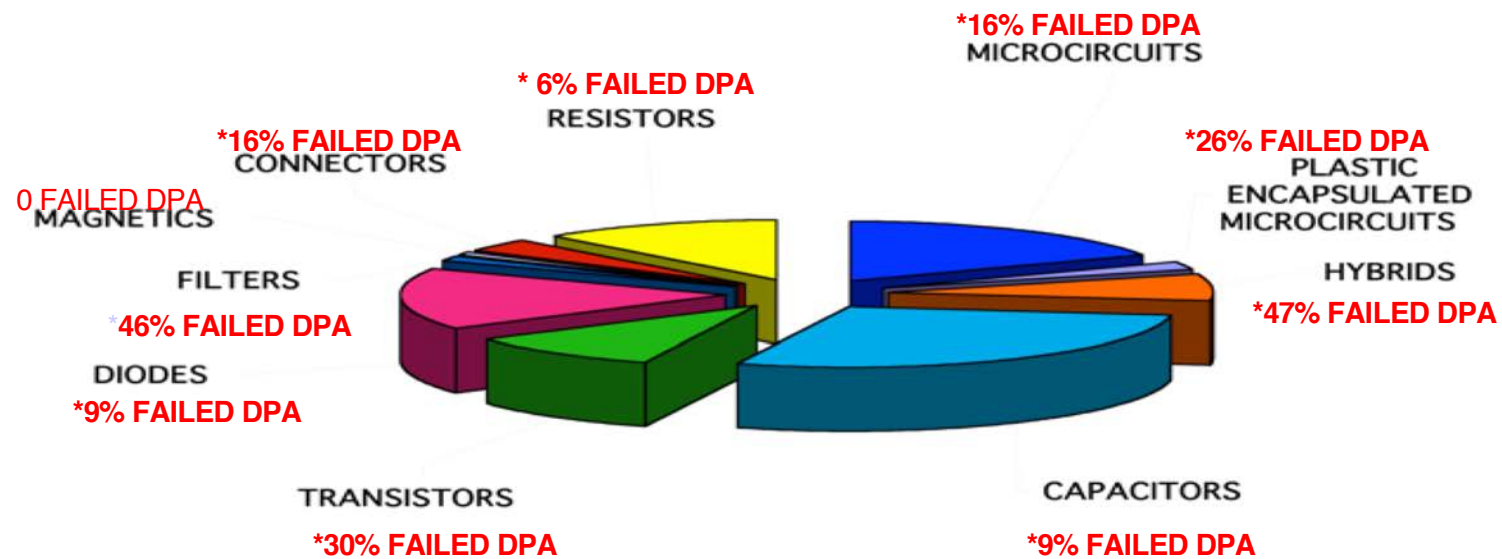
DPA Results From 2010



DPA Failure rate within part type distributions. A total of 4593 DPAs were performed, of which 507 or 11% failed.



2005 DPA RESULTS



DPA FAILURE RATES WITHIN PART TYPE DISTRIBUTIONS.
OVERALL DPA FAILURE RATE WAS JUST UNDER 19%
BASED UPON 2067 DPA'S PERFORMED



DPA Results Highlights

- Microcircuits trended down to a 20% failure rate overall (675 DPAs performed, 135 failed DPA) from 27.5% in 2018.
- Of these 675 DPAs, 167 were PEMs of which 76 failed for a failure rate of 45.5%. The main causes for these DPA failures were C-SAM (38), External PMA (29), SEM (21), Internal Visual Cross-section (9), Internal Visual (8), Ball Shear (3), External Visual (1), and Glassivation Integrity (1).
- Looking at just the Hermetic Microcircuits, 508 DPAs were performed with 59 Failures noted for a 11.6% DPA Failure Rate (down 50%). The main causes of the failures were RGA (16 ~1/3 the 2018 rate), Radiography (16), Internal Visual (15), PIND (8). SEM (5), Pre-SEM (1), Bond Pull (1), and External PMA (1).



DPA Results Highlights

- Transistors trended down to a 17.6% overall failure rate from 20.8% in 2018. (256 DPAs performed, 45 failed DPA).
- Of these 256 DPAs, 36 were PETs of which 17 failed for a failure rate of 47.2%. The main causes of DPA failure were External PMA (15), C-SAM (9), Internal Visual Cross-section (3), and SEM (1).
- Looking at just the Hermetic Transistors, 220 DPAs were performed with 28 Failures noted for a 12.7% DPA Failure Rate. The main causes of the failures were Internal Visual (13), PIND (5), RGA (5), Radiography (3), SEM (3), External Visual (2), Bond Pull (1)Pre-SEM (1), Solderability (1), and Hermeticity (1).



DPA Results Highlights (Cont.)

- Hybrids exhibited a 46.6% overall failure rate trending down from 54% in 2018 (174 DPAs performed, 81 failed DPA). The primary drivers were Internal Visual (45), Internal PMA (11), SEM (12), RGA (8), X-Ray (16), PIND (2), Bond Pull (10), External PMA (7), Pre-SEM (2), External Visual (2), and Hermeticity (2).



DPA Results Highlights (Cont.)

- Diodes trended way down with an overall 7.9% failure rate in 2019 (406 DPAs performed, 32 failed DPA).
- Of these 406 DPAs, 48 were PEDs of which 19 failed for a failure rate of 39.5% (way down from 2018). The cause of these DPA failures were C-SAM (16), External PMA (12), X-Ray (5), Internal Visual Cross-section (3), and Internal Visual (3).
- Looking at just Glass Bodied Diodes, 296 DPAs were performed with 10 Failures noted for a 3.4% failure rate. The leading causes of failure were Internal Visual Paint Removed (4), Internal Visual Cross-section (3), RGA (3), HERM (2), Solderability (2), External PMA (1), and Scribe and Break (1).
- Metal Can Diodes had 33 DPAs performed with 3 failures noted for a 9.1% failure rate. The leading causes of failure were RGA (3), and X-Ray (1).



DPA Results Highlights (Cont.)

- Resistor failure rate trended down to 5.1% from 7% in 2018. (647 DPAs performed, 33 failed DPA).
- Chip Resistors had 506 DPAs performed with 20 failures for a 4% failure rate (more COTS tested). The causes of failure were External PMA (14), Internal Visual Depot (6), Solderability (2), and External Visual (2).
- The balance of 141 Resistors had 13 failures for a 9.2% failure rate. The causes were Internal Visual (9), Radiography (2), and Dimensions (2).



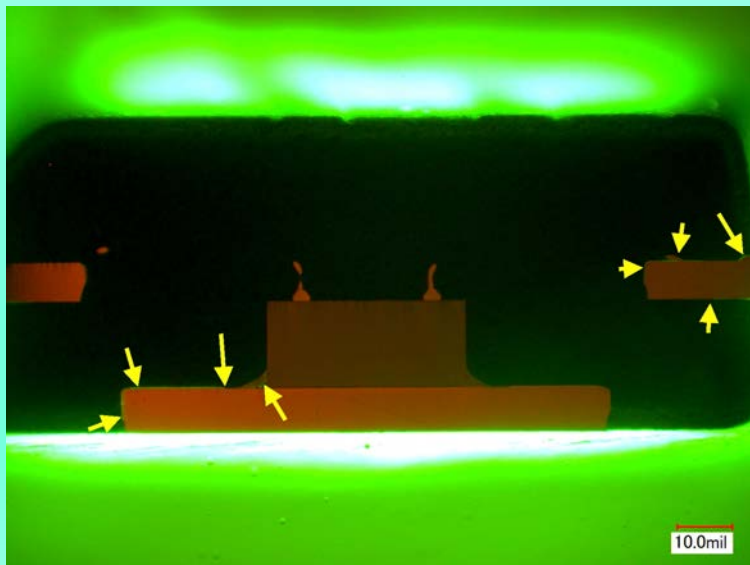
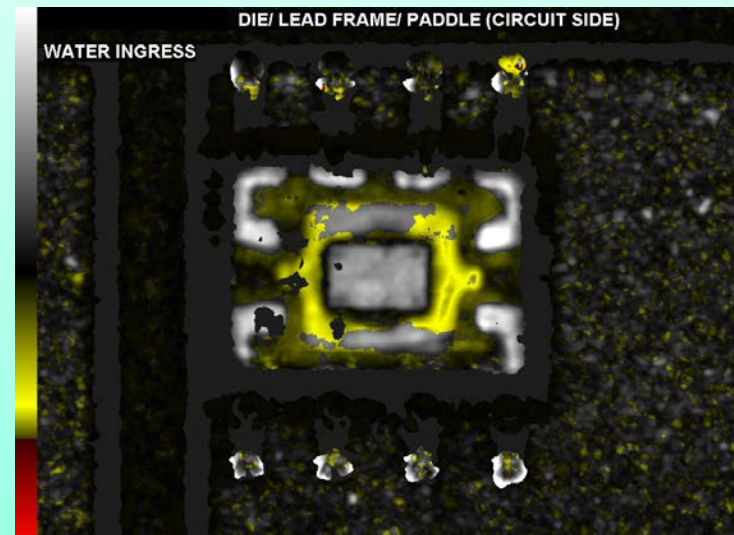
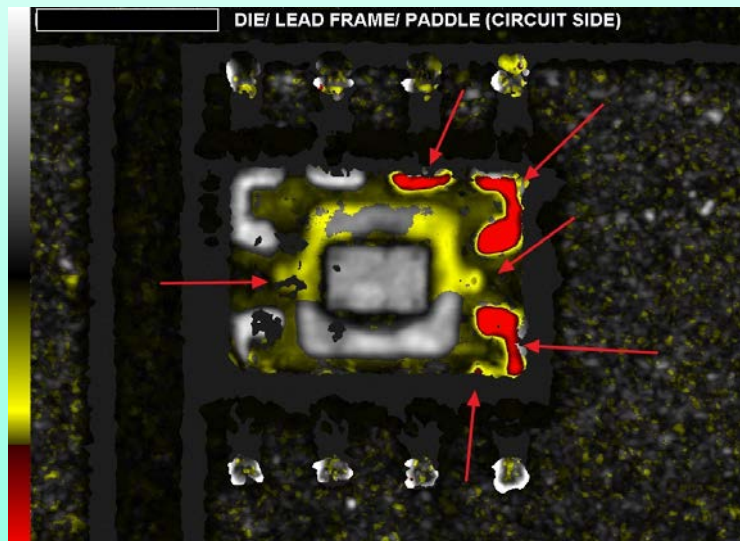
DPA Results Highlights (Cont.)

- Capacitors stayed flat with a 9% failure rate (819 DPAs performed, 74 failed DPA) from 9.7% in 2017.
- 530 Ceramic Chip Capacitor DPAs were performed with 34 failures for a 6.4% failure rate. Causes were External PMA (24-more COTS parts DPA'd), IV Cross-section (9), Dimensions (3), Solderability (1), and External Visual (1).
- 134 Tantalum Chip Capacitor DPAs were performed with 24 failures for a 17.9% failure rate. Causes were Internal Visual Cross-section (24) and External PMA (4).
- 99 Fixed Ceramic Capacitor DPAs were performed with 6 failures or a 6.1% failure rate. Causes were Internal Visual Cross-section (5), and High Temp Solder (1).
- 12 Solid Tantalum capacitors were performed with 5 failures for a 41.7% failure rate. Causes were IV Cross-section (4) and IV Disassembled (1).
- 33 Wet Tantalum Capacitor DPAs were performed with 0 failures.

DPA Results Highlights (Cont.)

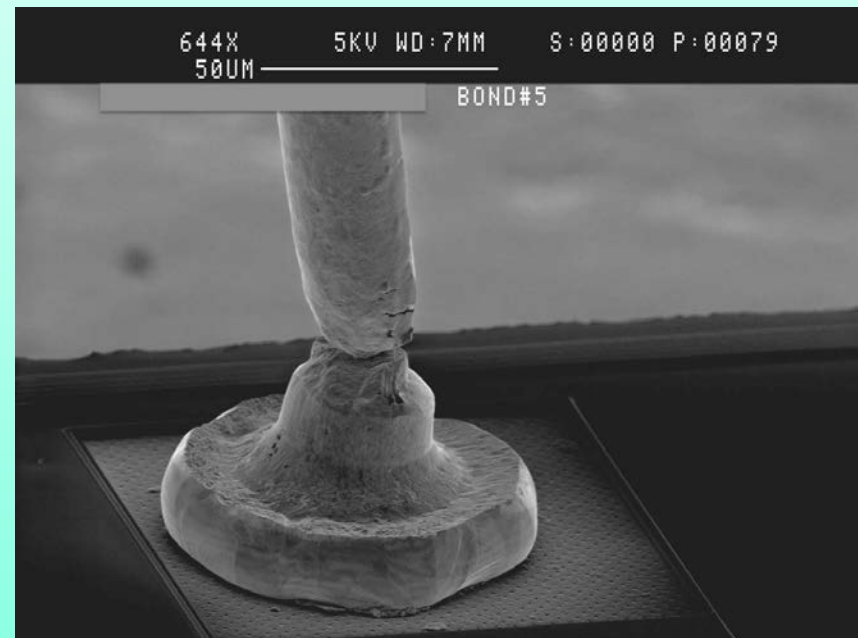
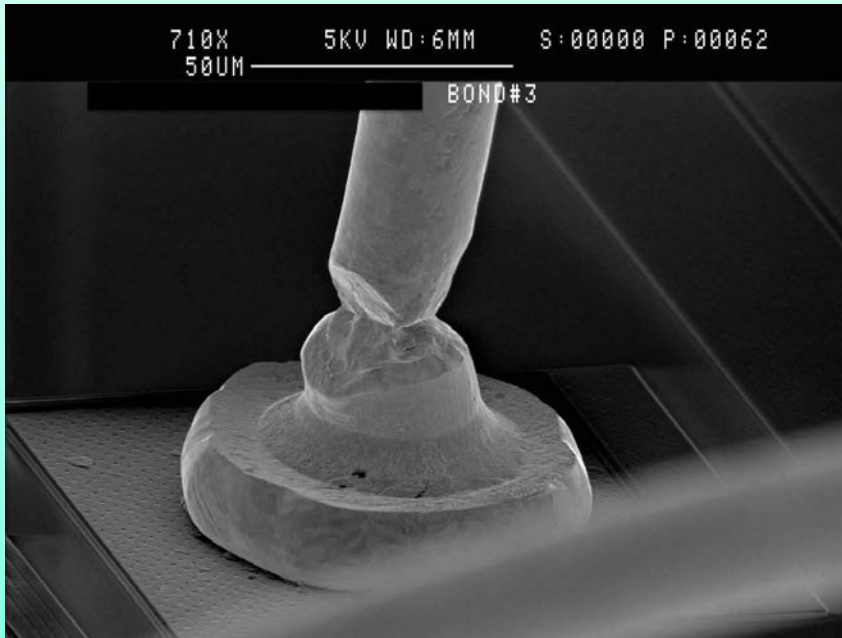
- Connectors trended up to a 14.1% failure rate in 2019 (291 DPAs performed, 41 failed DPA). The main causes of failure were: Plating Thickness (23), Internal Visual Cross-sectioned (14), Internal PMA (14), Plating Adhesion (3), Dimensions (3), Electrical (3), Contact Retention (3), External PMA (3) Internal Visual (2), and External Visual (1),
- Magnetics stayed flat at 21.4% failure rate at DPA from 24.1% in 2018 (145 DPAs performed, 31 failed DPA). The causes were X-Ray (15), Solderability (7), External PMA (4), High Temp Solder (5), and Dimensions (1).

DPA Findings Photo Gallery



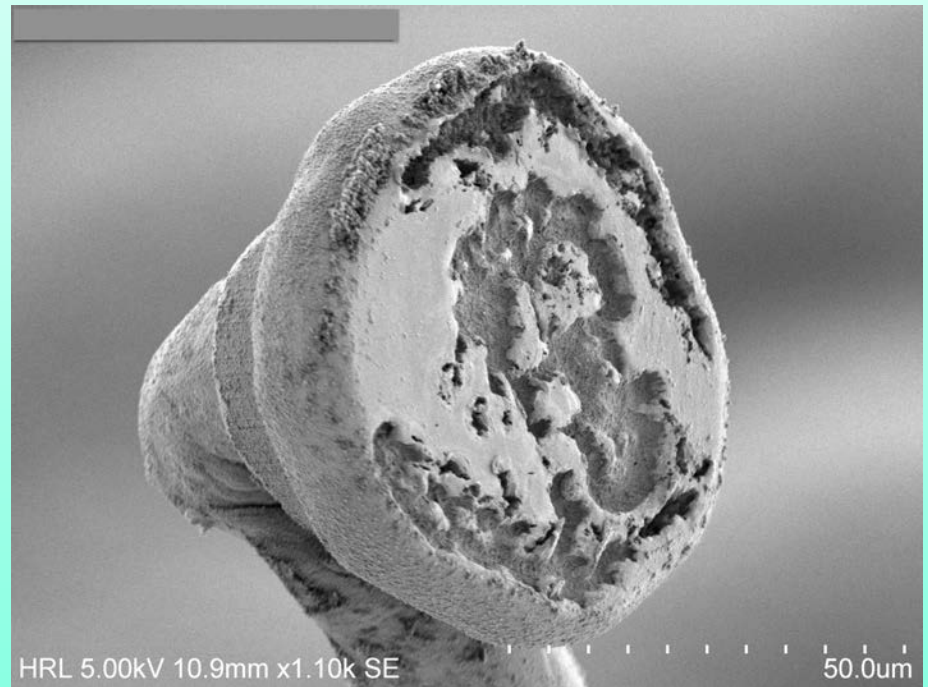
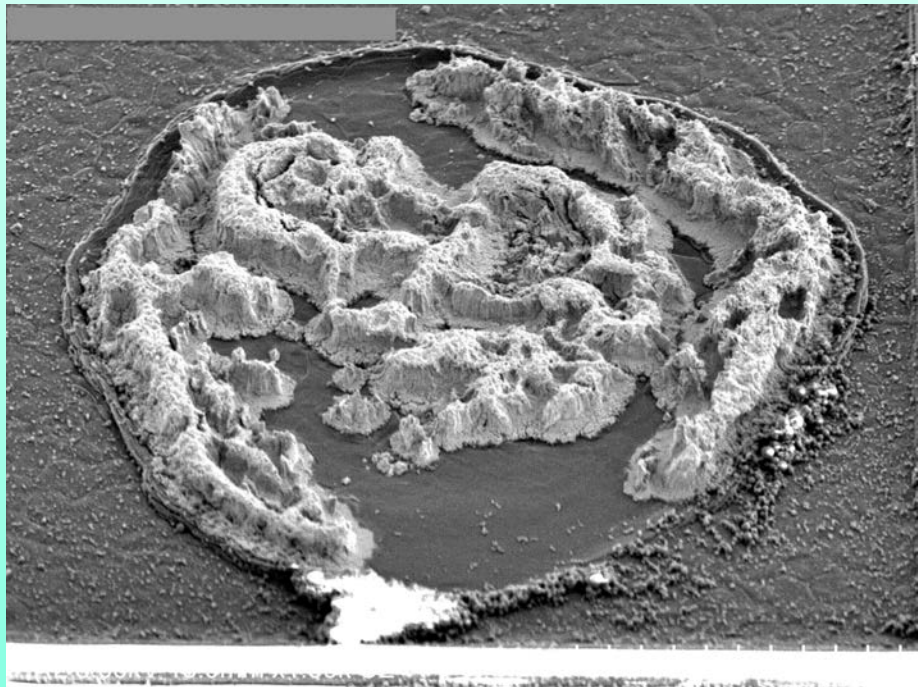
An excellent example of Moisture Ingress over time in the bath at C-SAM. Note in Cross-section there is Dye Penetration noted exactly where seen in C-SAM.

DPA Findings Photo Gallery



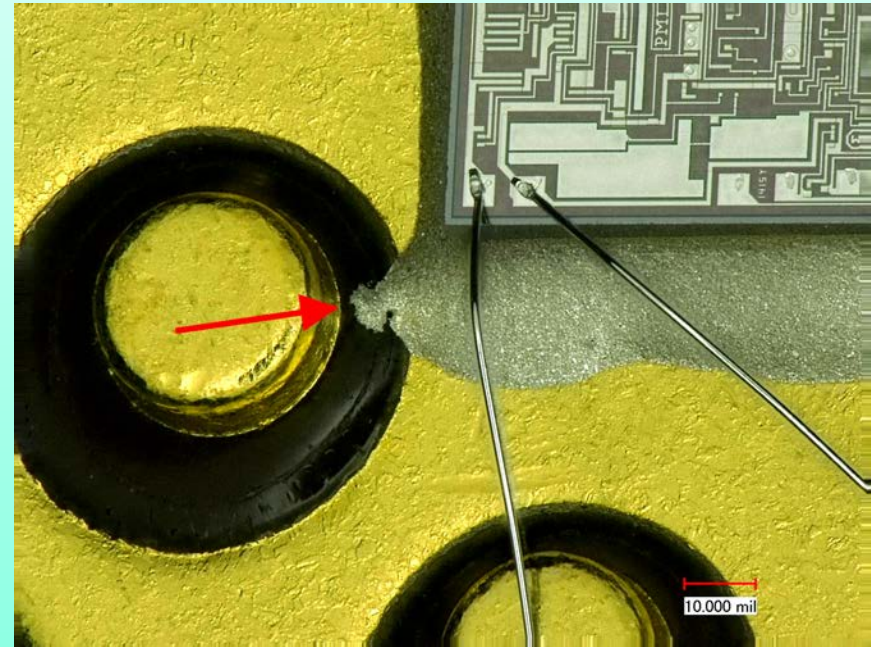
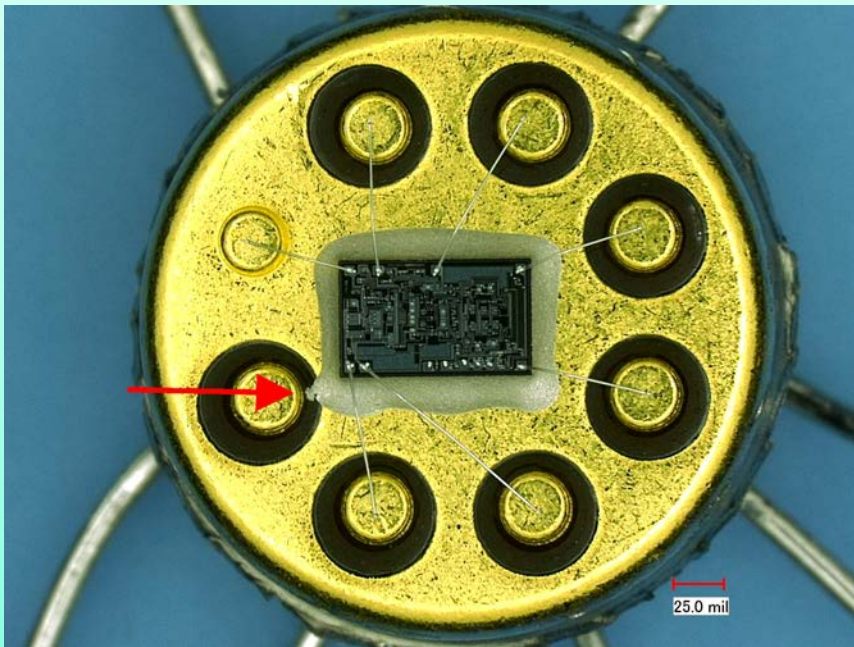
These unique deformations were caught due to a single failure at Bond Pull in a standard DPA of a Hermetic Microcircuit. Turns out to affect multiple lots. Surprisingly, these pulled at over 1 gram!

DPA Findings Photo Gallery



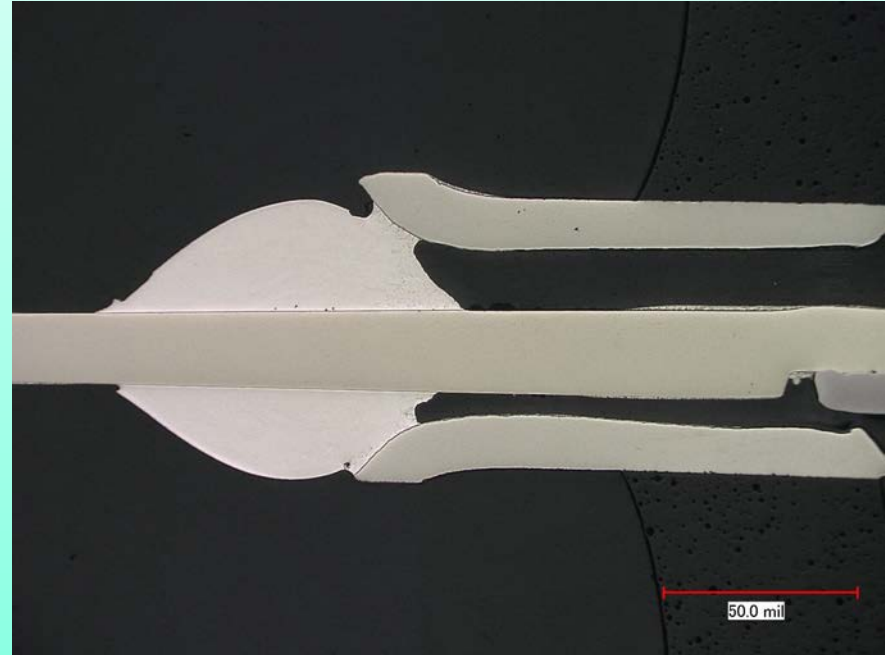
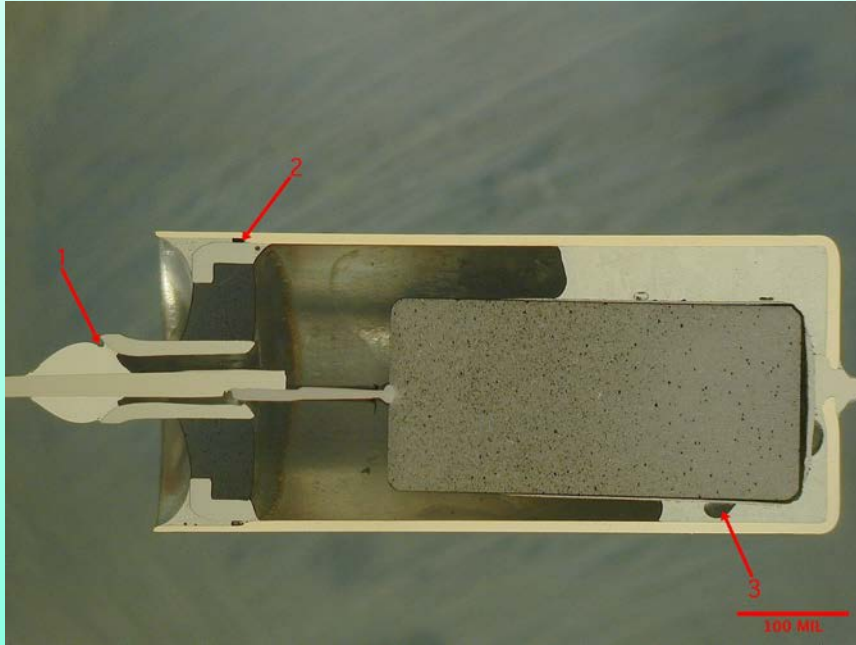
Beautiful example of an intermetallics failure at Bond Pull of a gold wire in a PEM. Yet, it still pulled at 2 grams.

DPA Findings Photo Gallery



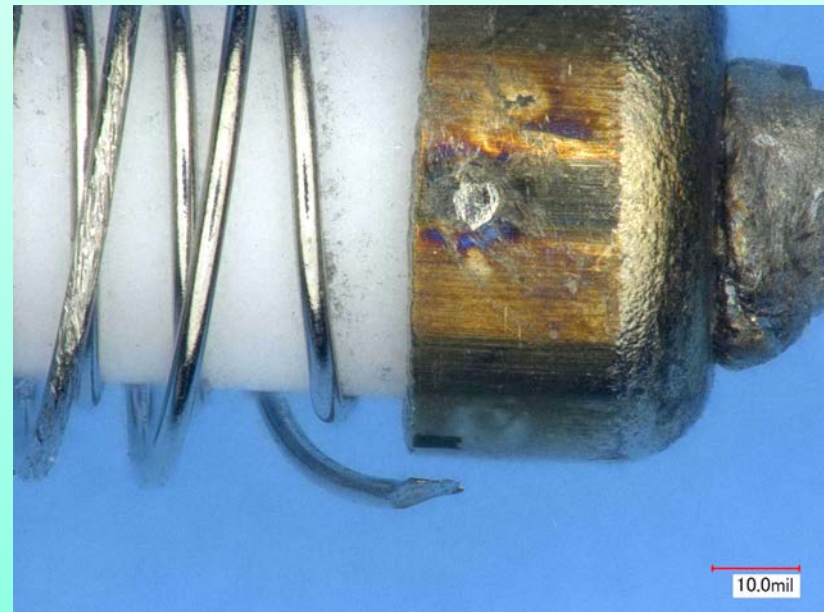
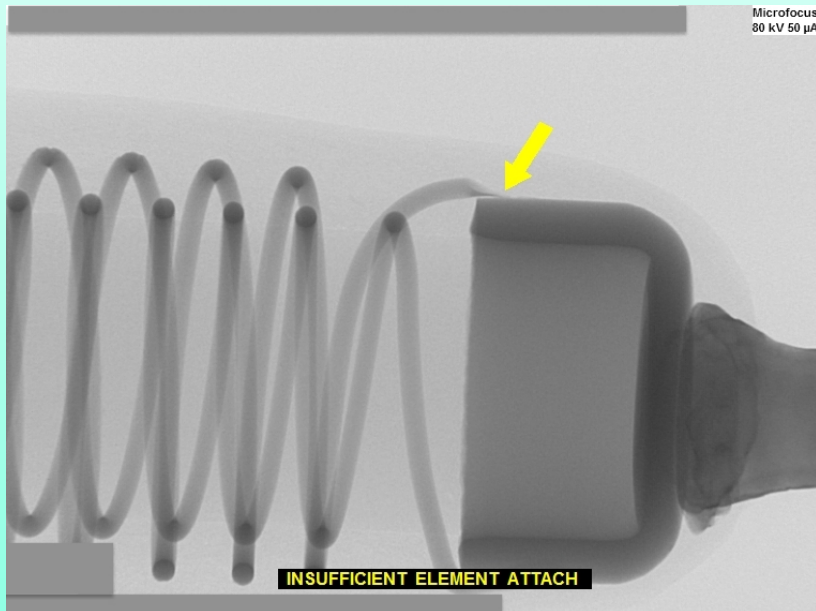
If you ever wonder why we still do DPA....
Stuff Happens!!
A great example of Die Attach that got away
and almost shorted the device out.

DPA Findings Photo Gallery



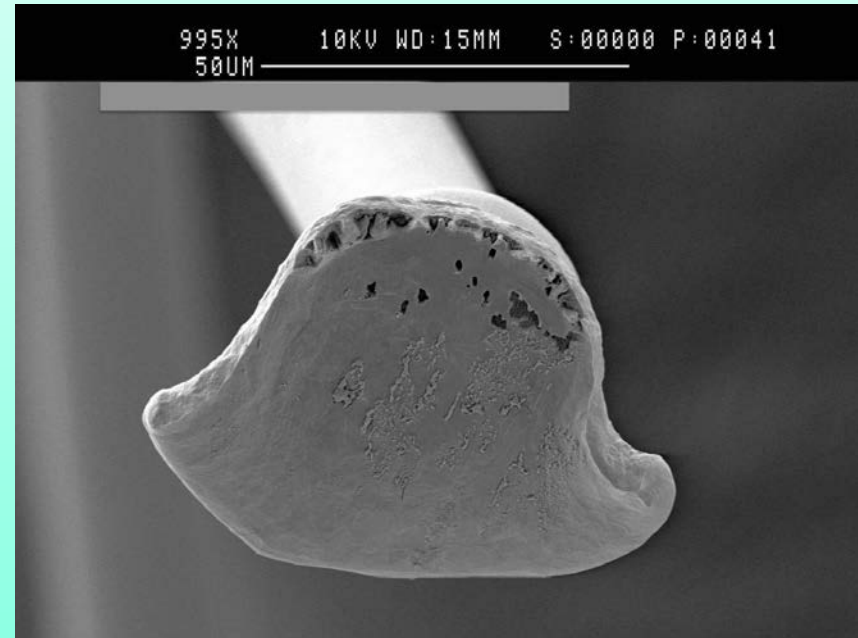
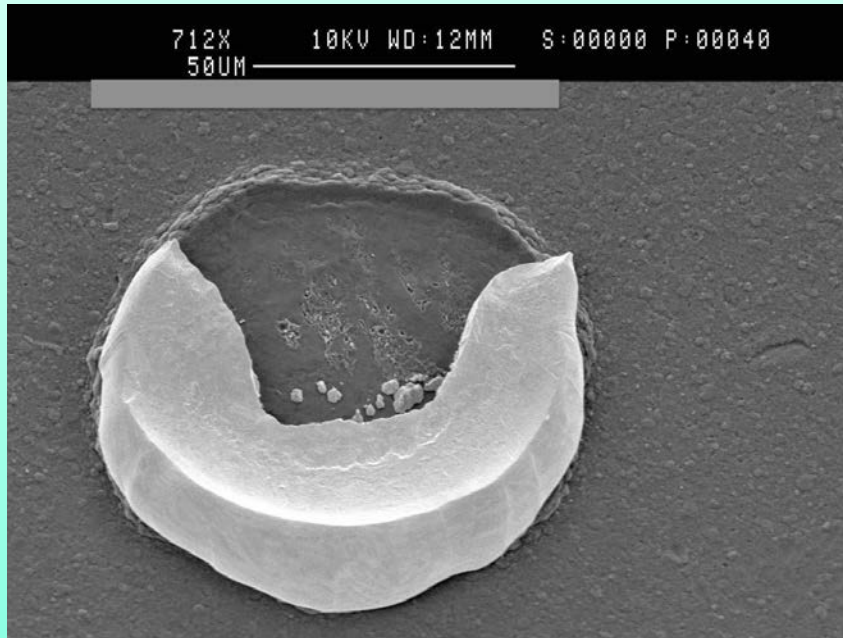
It's surprising what gets caught at DPA!
Barely Hermetic.....

DPA Findings Photo Gallery



Even the simplest parts have problems.

DPA Findings Photo Gallery



Just when you think you've seen everything!
This bond lifted in a very inexplicable manner.
Still, it was a greater than 6 gram pull.



Trends

- Parts are still failing DPA!
- We are seeing DPA failures that were “solved” years ago..... indicating that the folks building the parts have moved on, been right sized, or the vendor has changed hands and lost the recipe (maybe all of these).
- Hybrid Reject rates are still high again this year at 47%.

In Closing

“History doesn’t repeat itself, but it often times rhymes”.

Mark Twain