

TWENTY-SEVENTH ANNUAL



TestConX™

Archive

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Testing AI High Pin Count Devices using MEMS Elastomer Sockets

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Testing Challenges

AI devices are built for large-scale parallel processing with specific features enclosed in a large package which creates a challenge of contacting 10's of thousand of BGA balls with the contact pads on the elastomer.

How Big are AI Packages

4,000 pins: 55mm X 55mm, 3025mm²
 9,400 pins: 88mm X 76mm, 6688mm²
 16,400 pins: 118mm X 116mm, 13,688mm²
 19,000 pins: 120mm X 118mm, 14,160mm²
 22,500 pins: 150mm X 150mm, 22,500mm²
 30,000 pins: 175mm X 170mm, 29,750mm²

What is Device Warpage

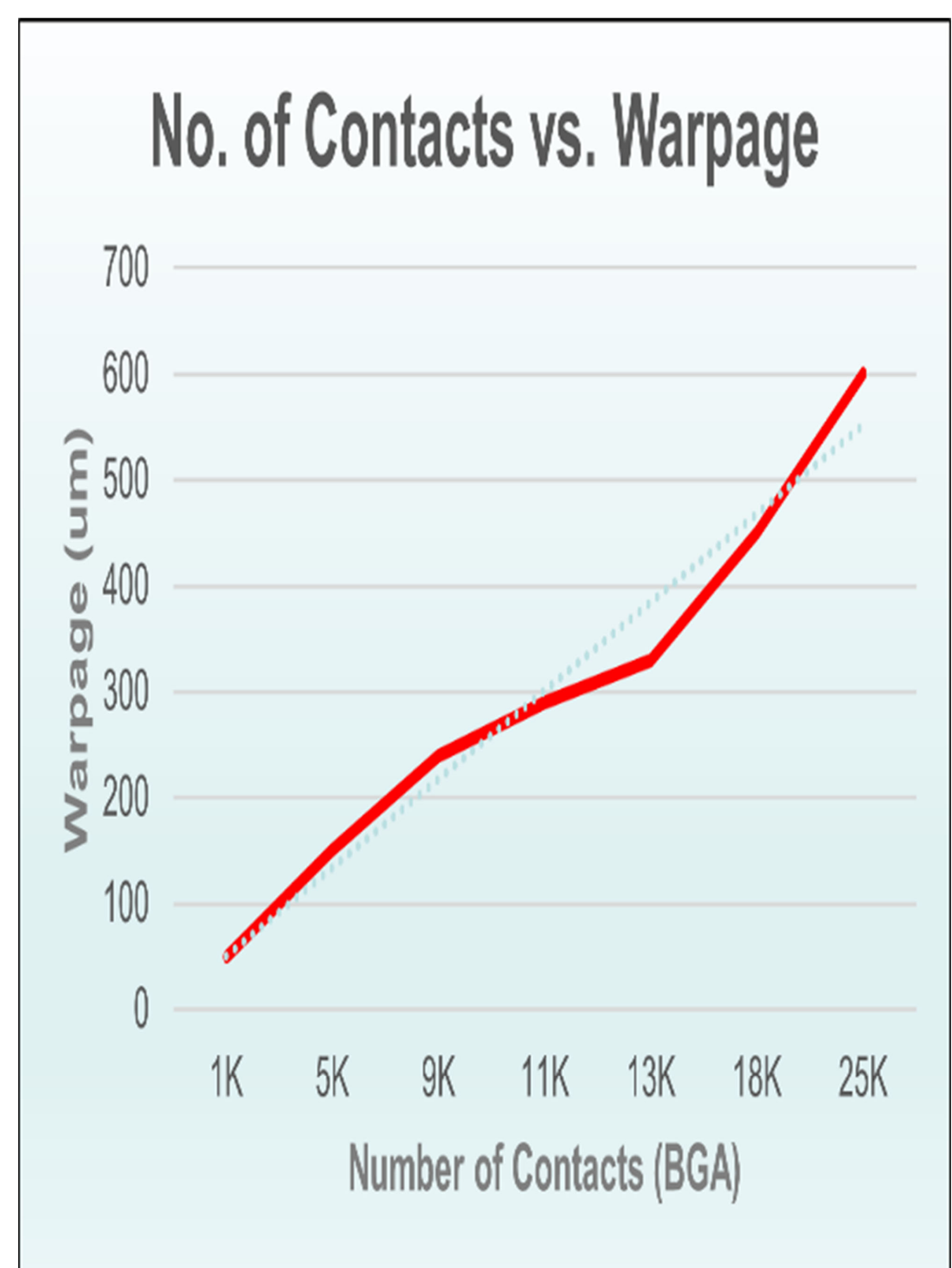
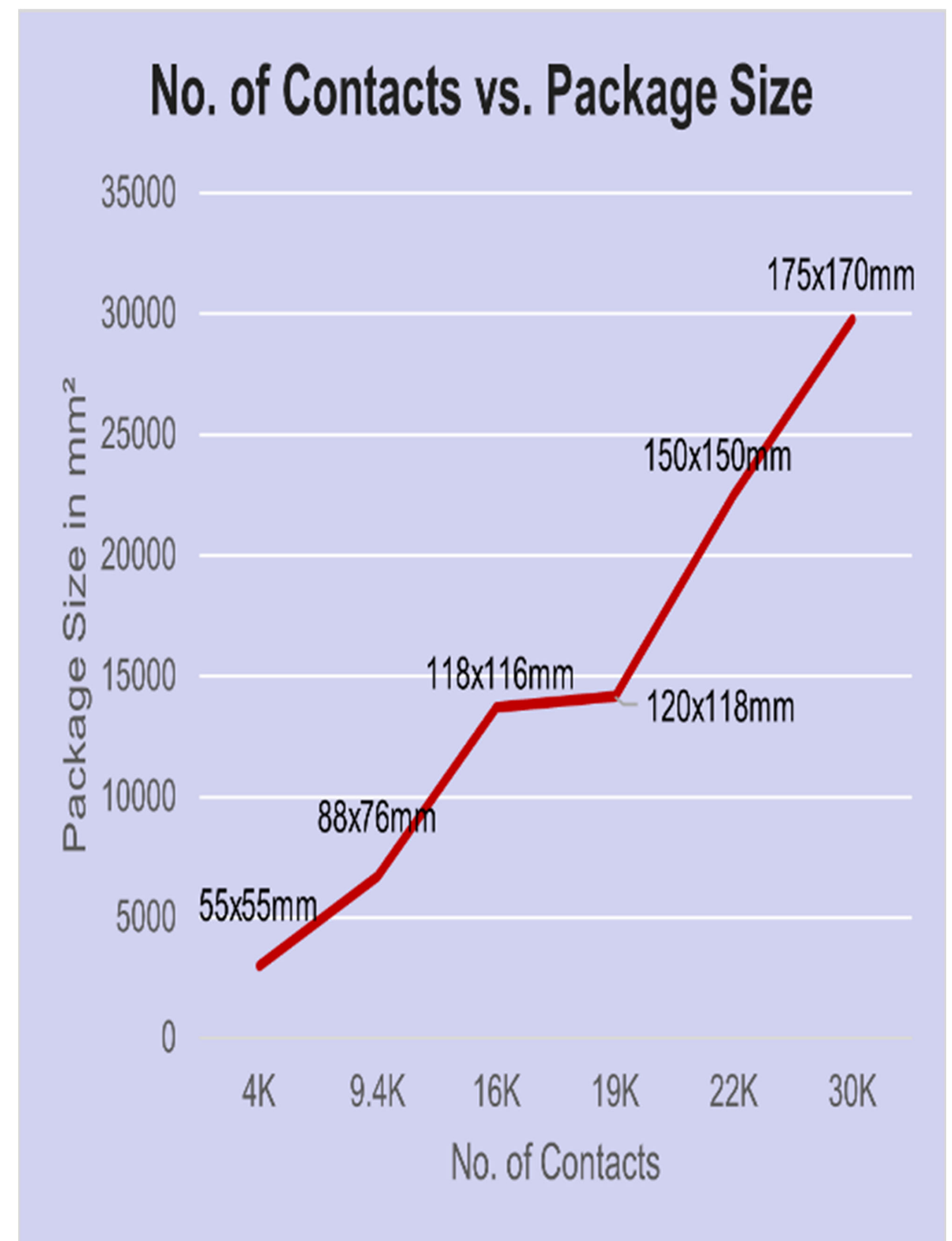
Irregular or distorted semiconductor devices which can result in DC and functional failures due to poor connection and contact pad misalignment.

Common Causes of Device Warpage

- Manufacturing process
- Thermal stress
- Uneven metal/mass
- Moisture
- Design Flaws
- Asymmetrical Design

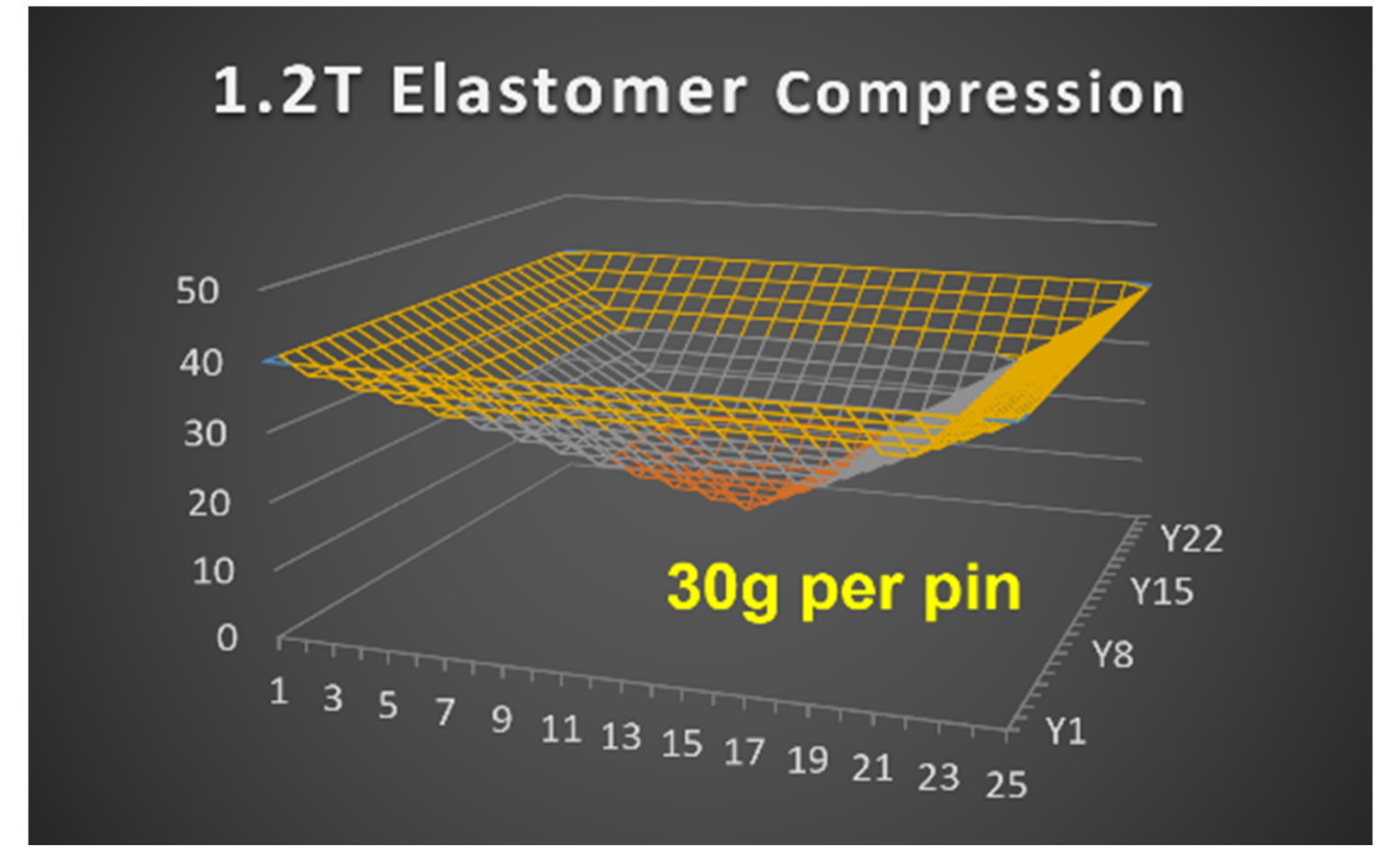
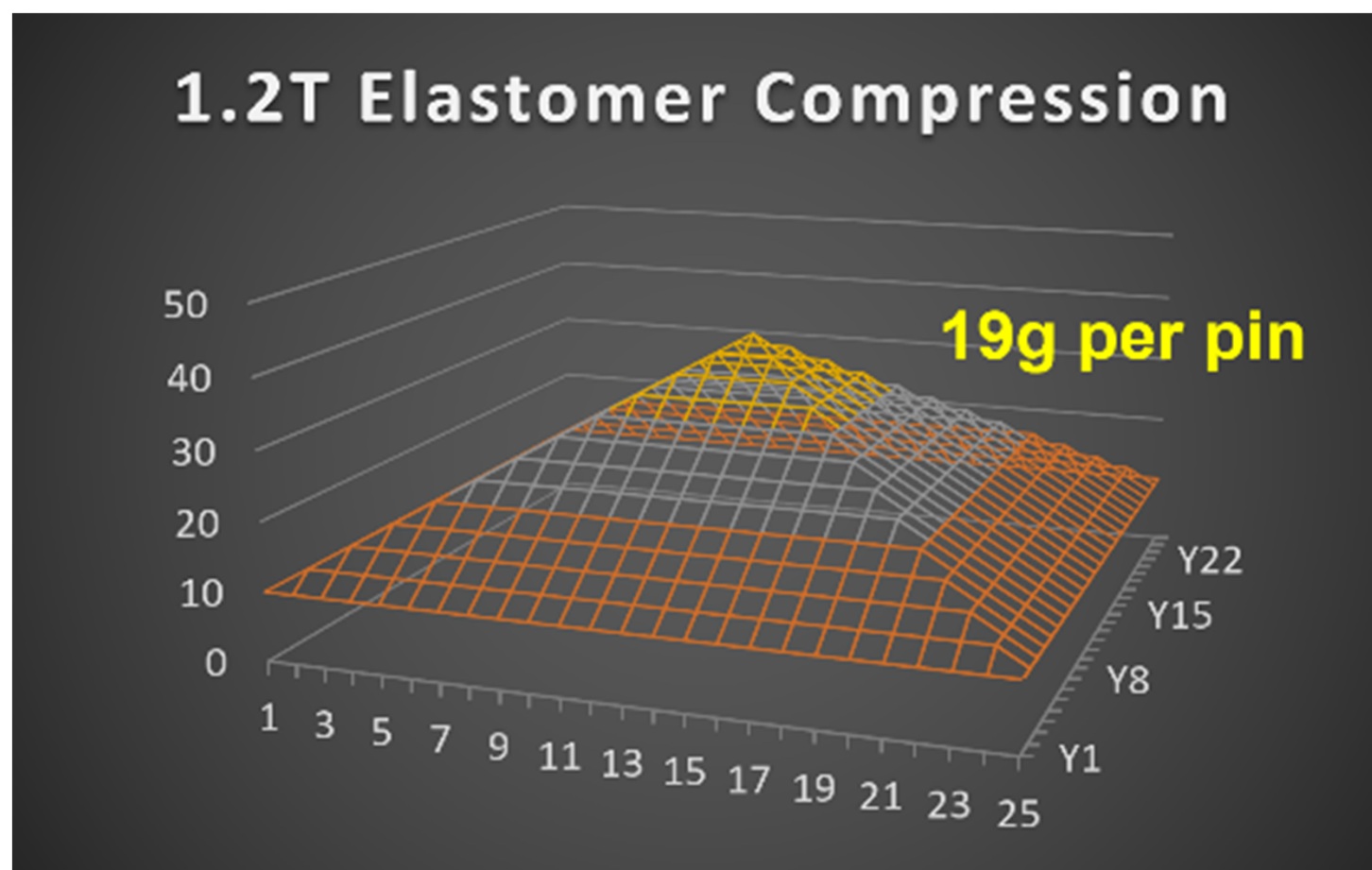
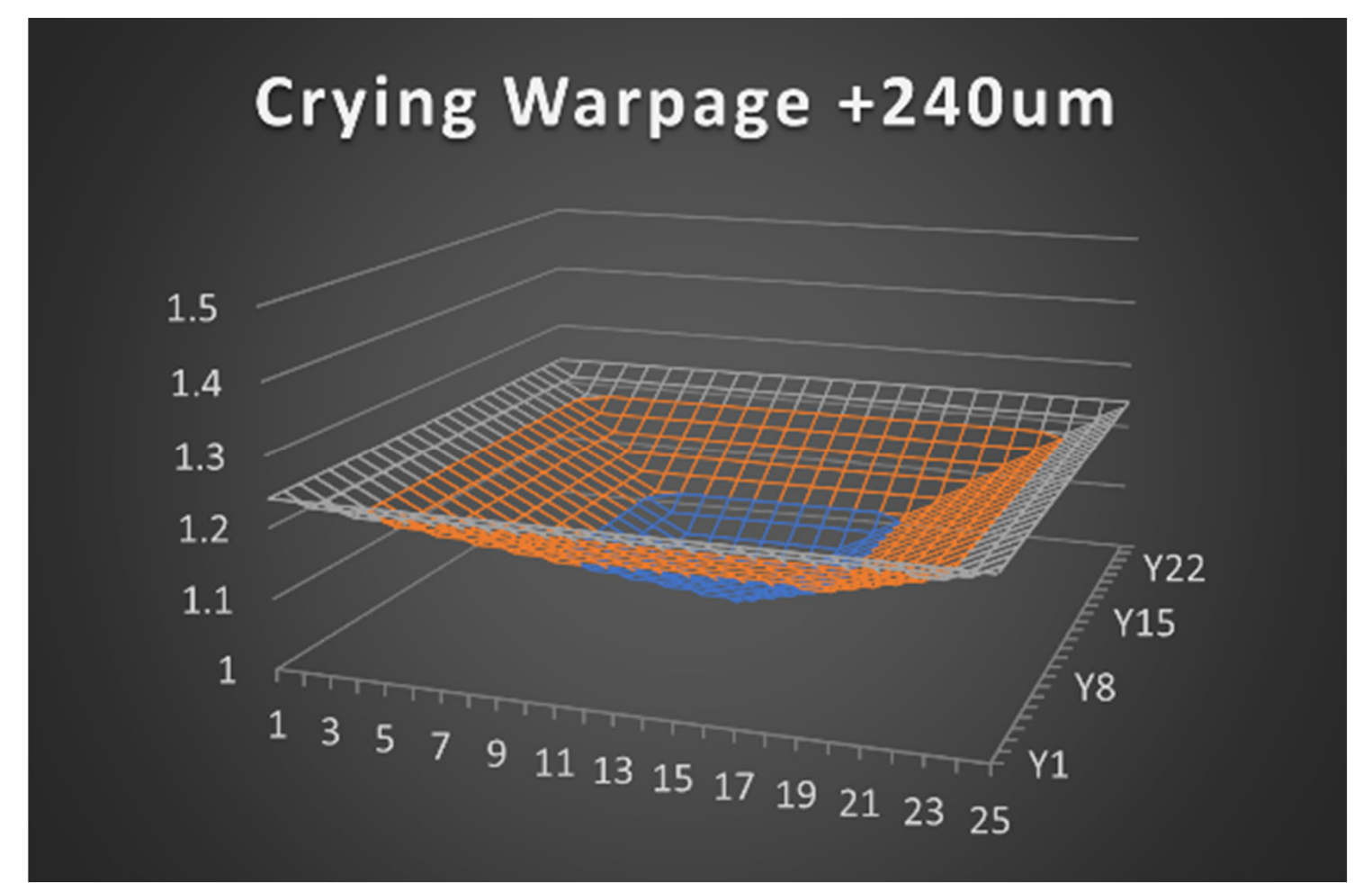
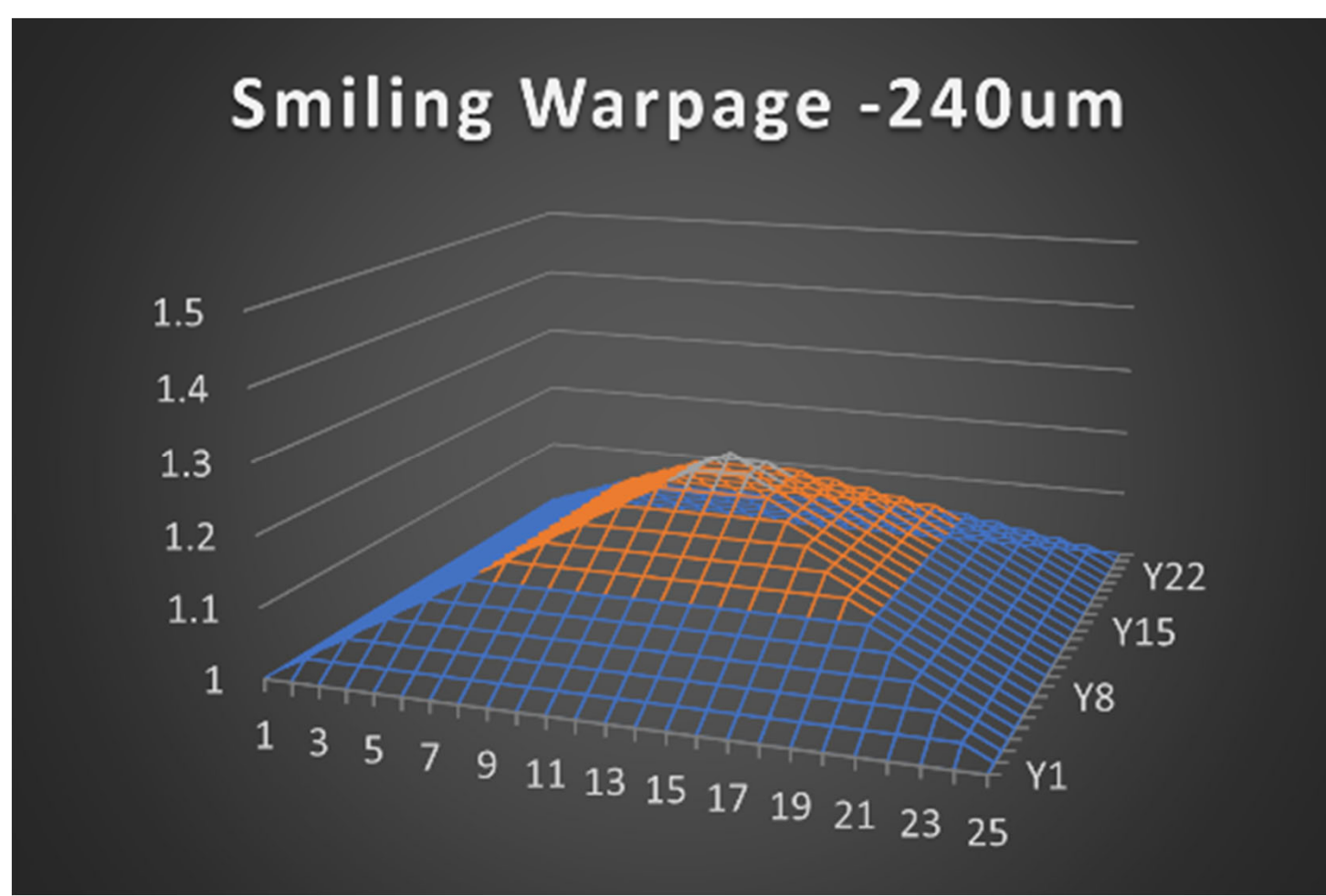
How Testing is Affected

- DC failure
- Functional failure
- Heavy load to the handler pusher
- Some parts of DUT not contacted
- Some parts of DUT bent
- High contact force at DUT
- Cracked dies
- Short lifespan of test devices



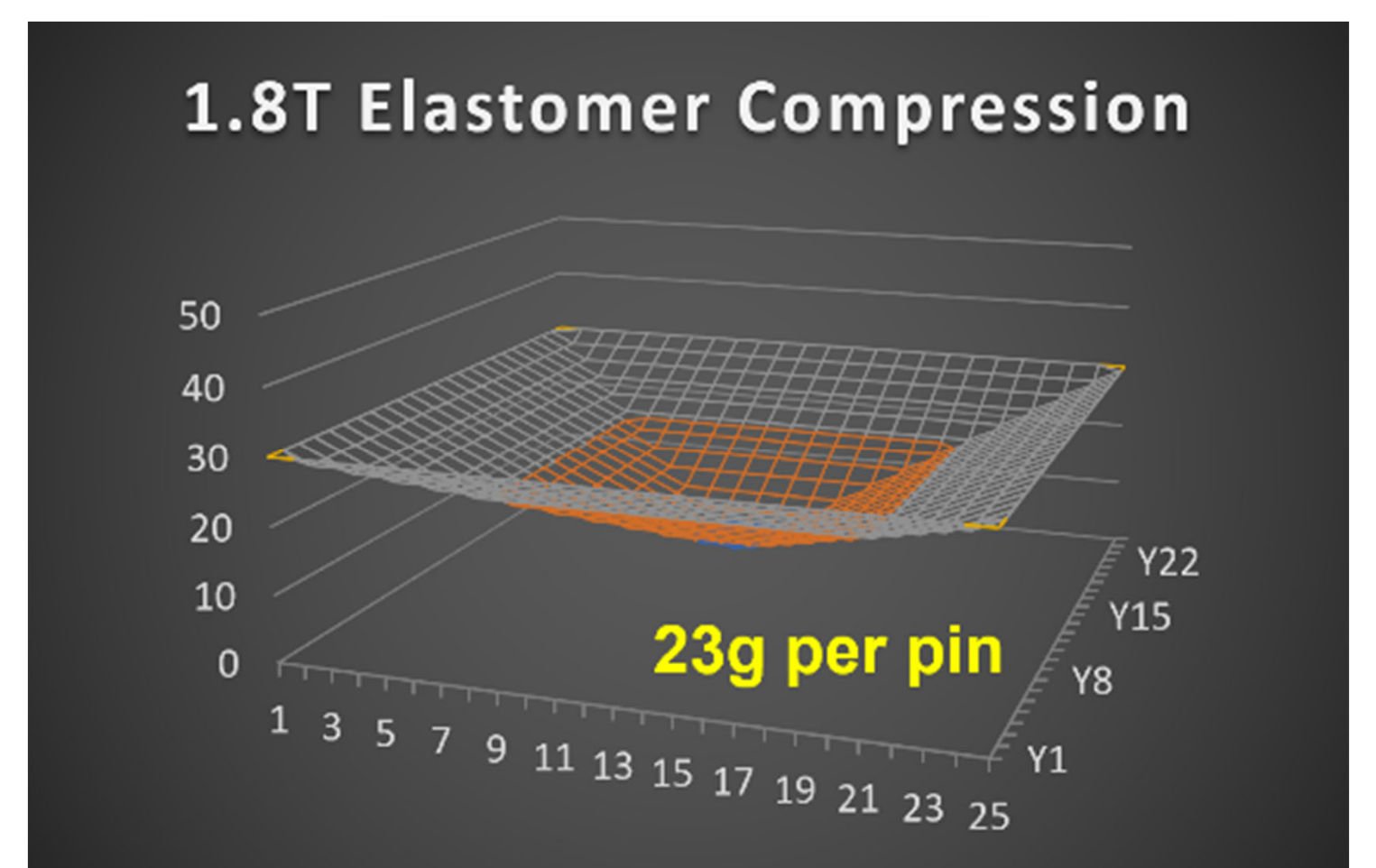
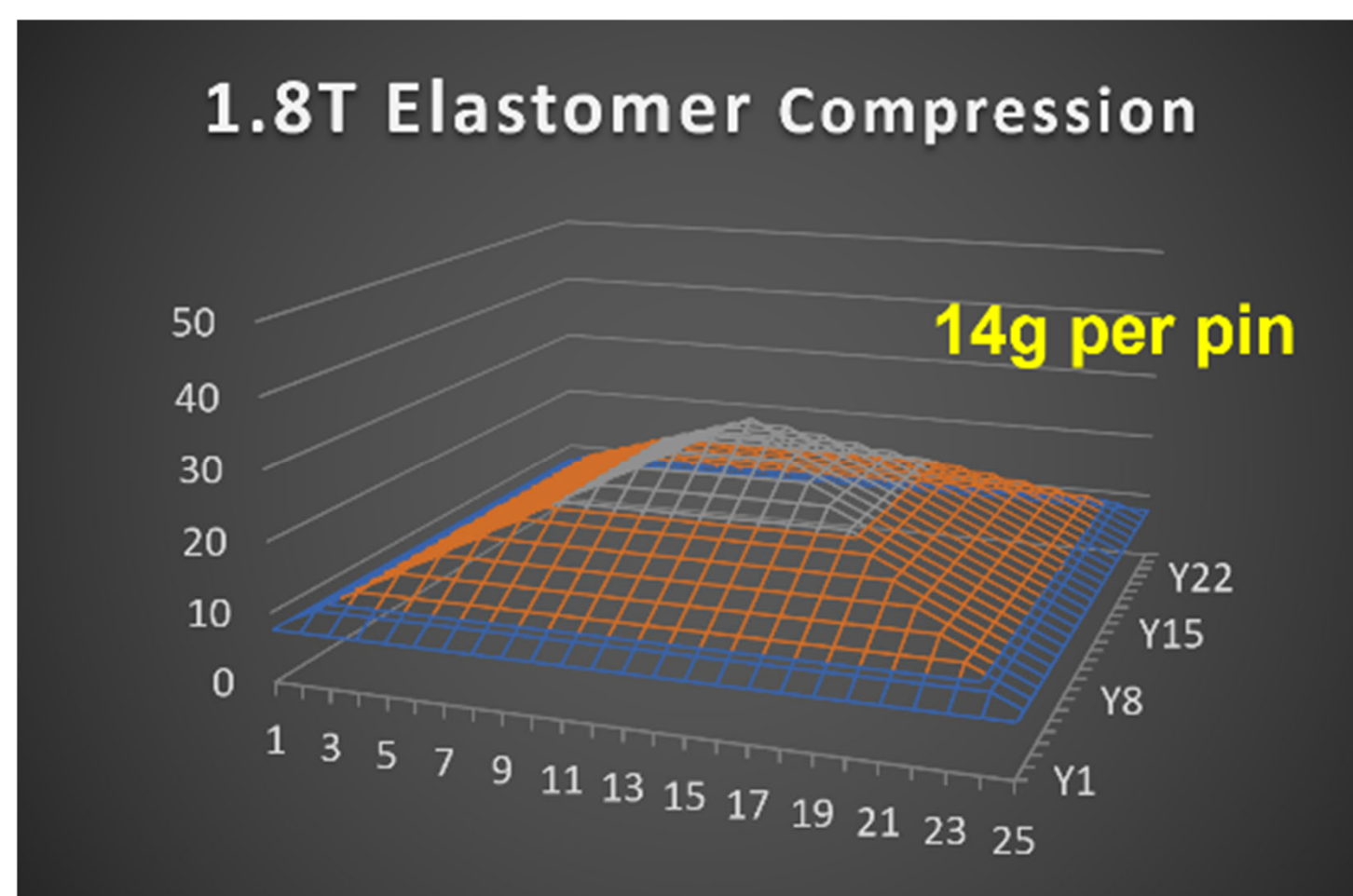
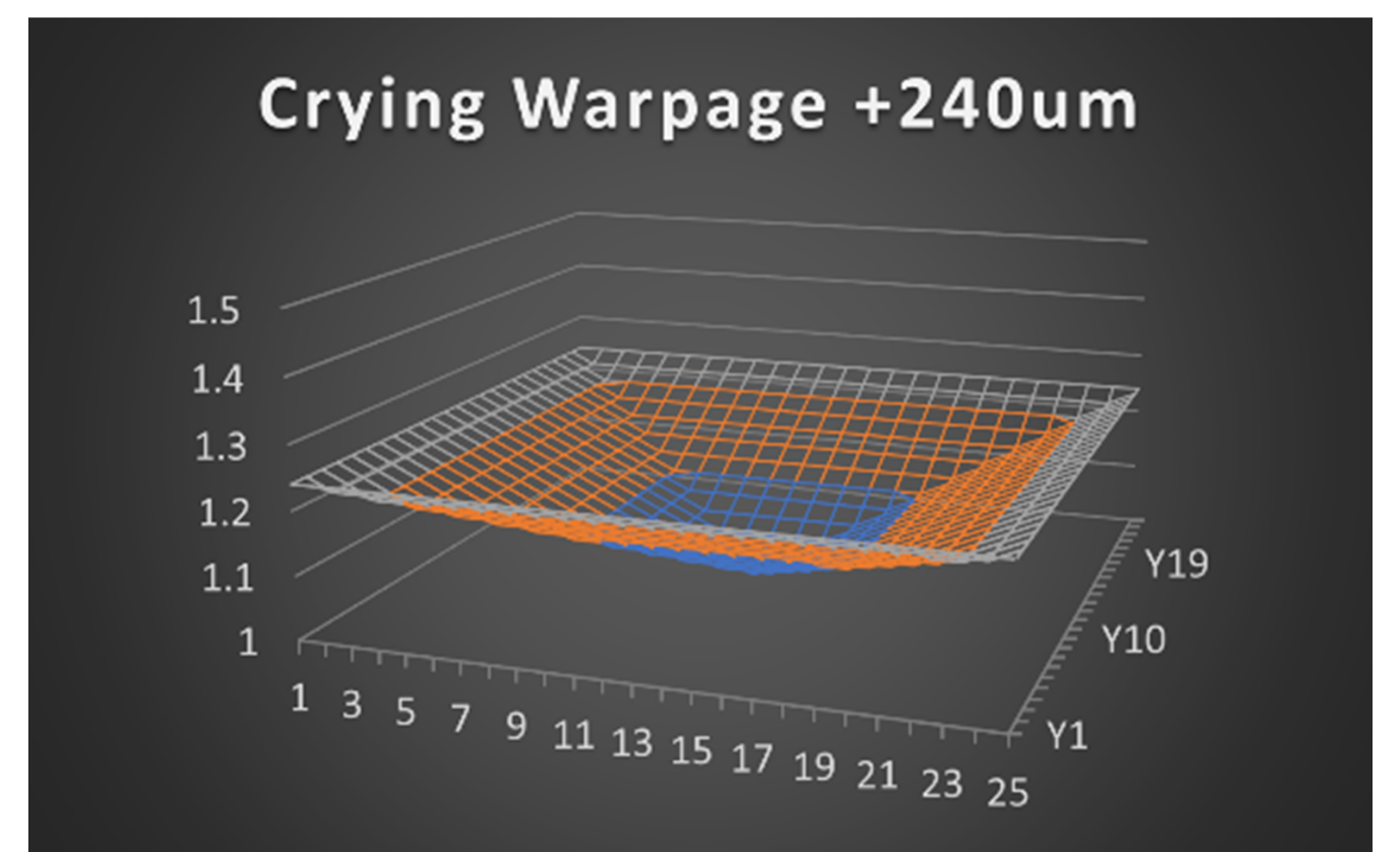
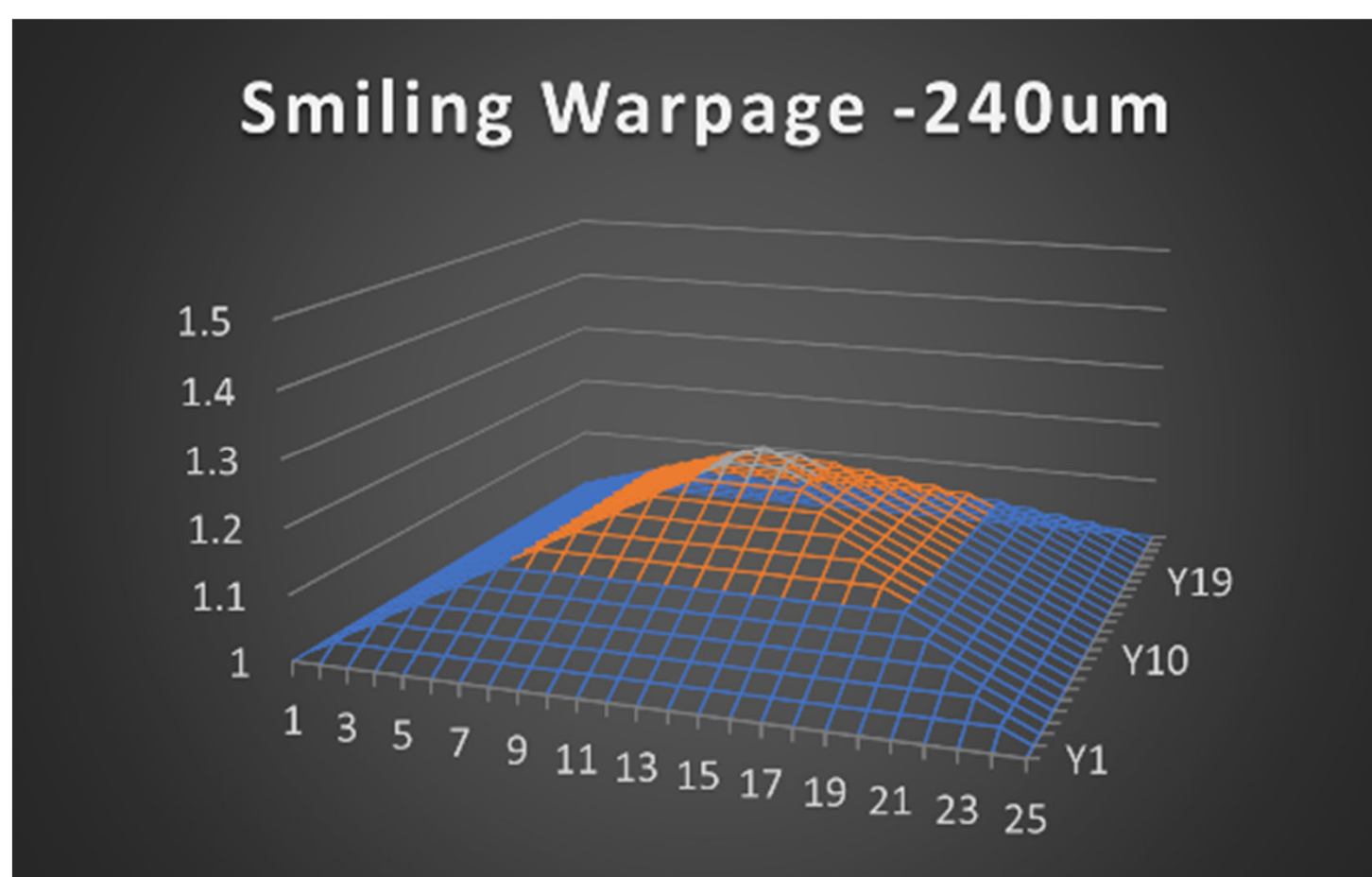
Case Study #1:

Warpage 240um
Elastomer thickness 1.2T



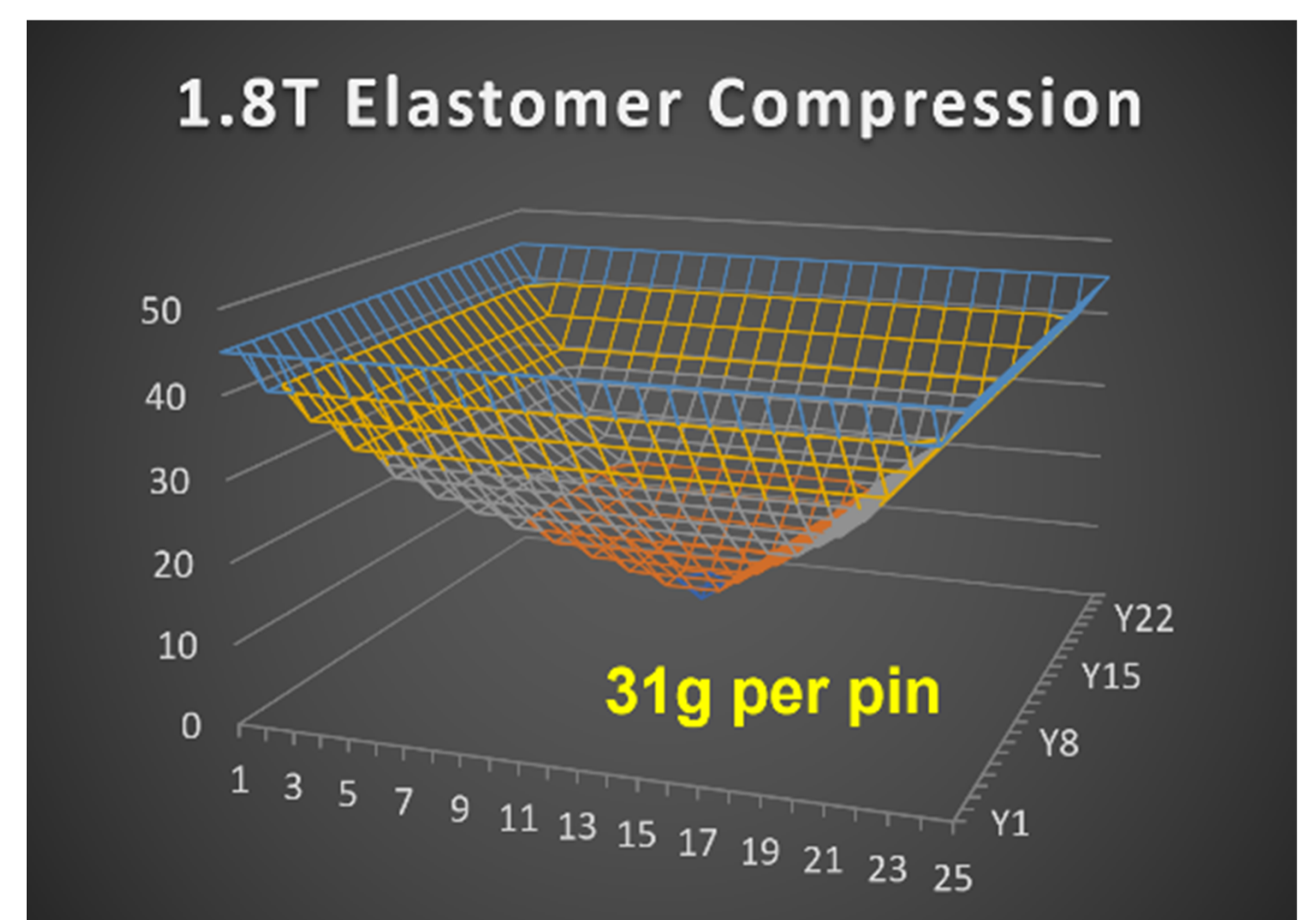
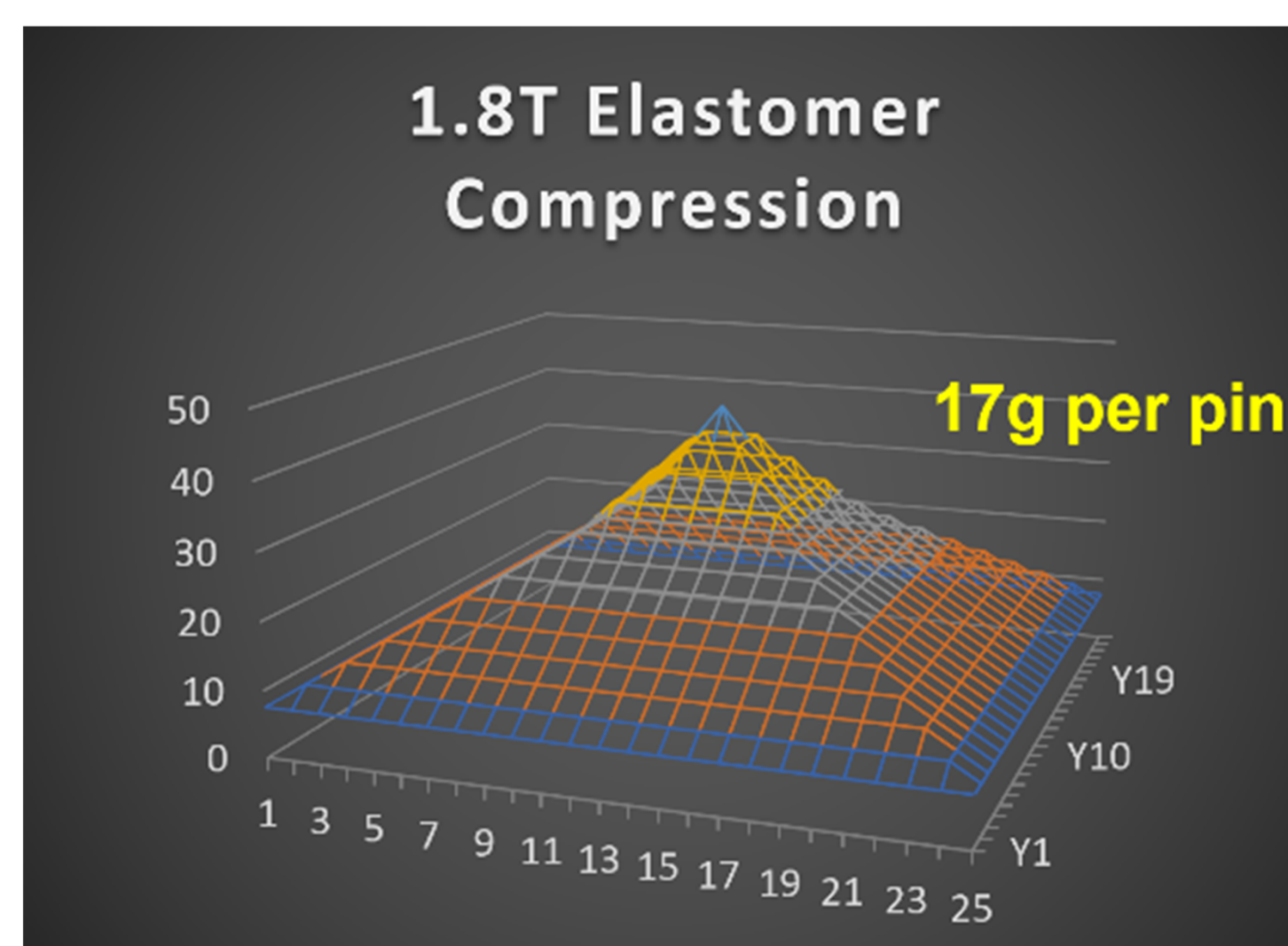
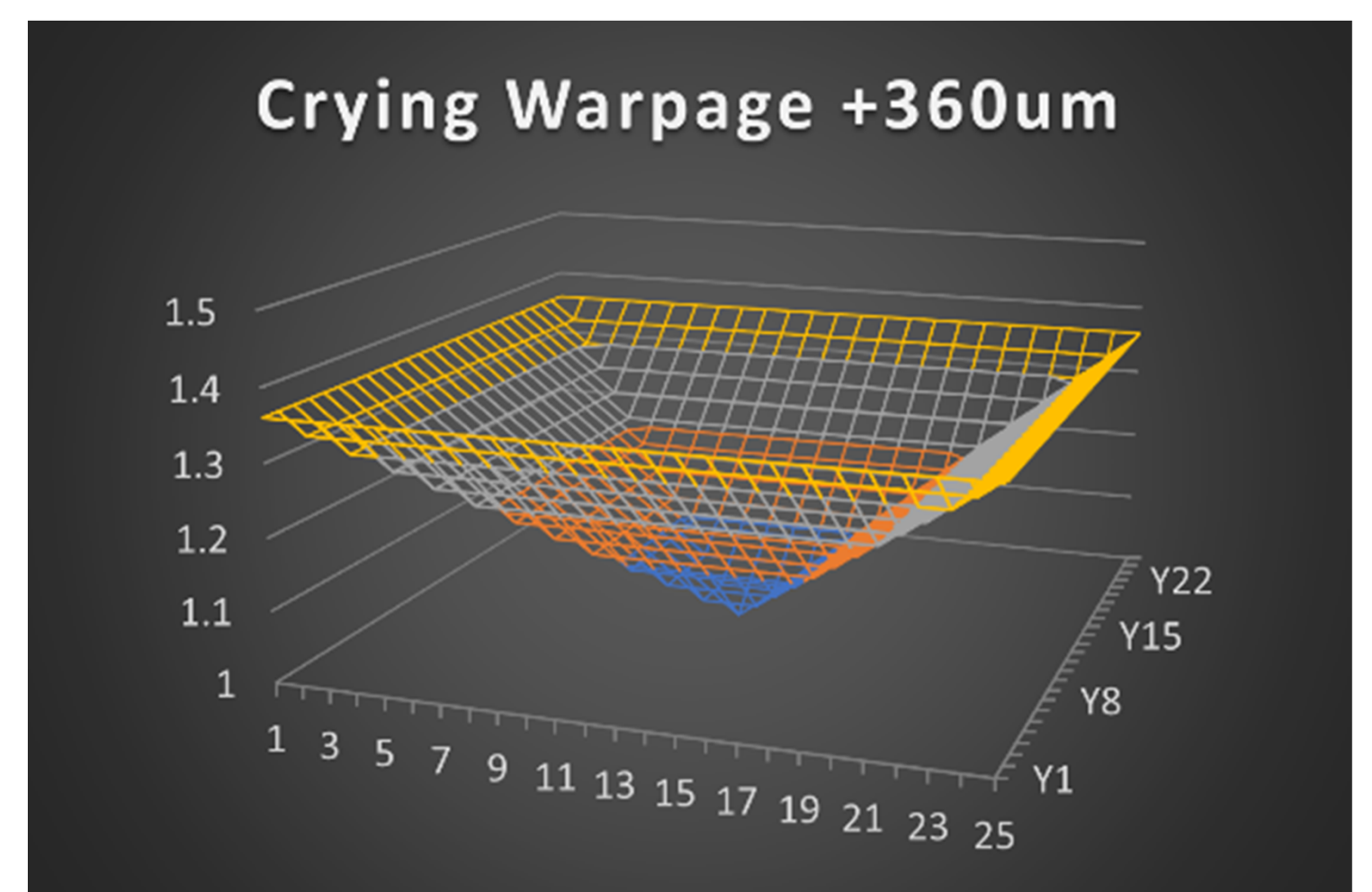
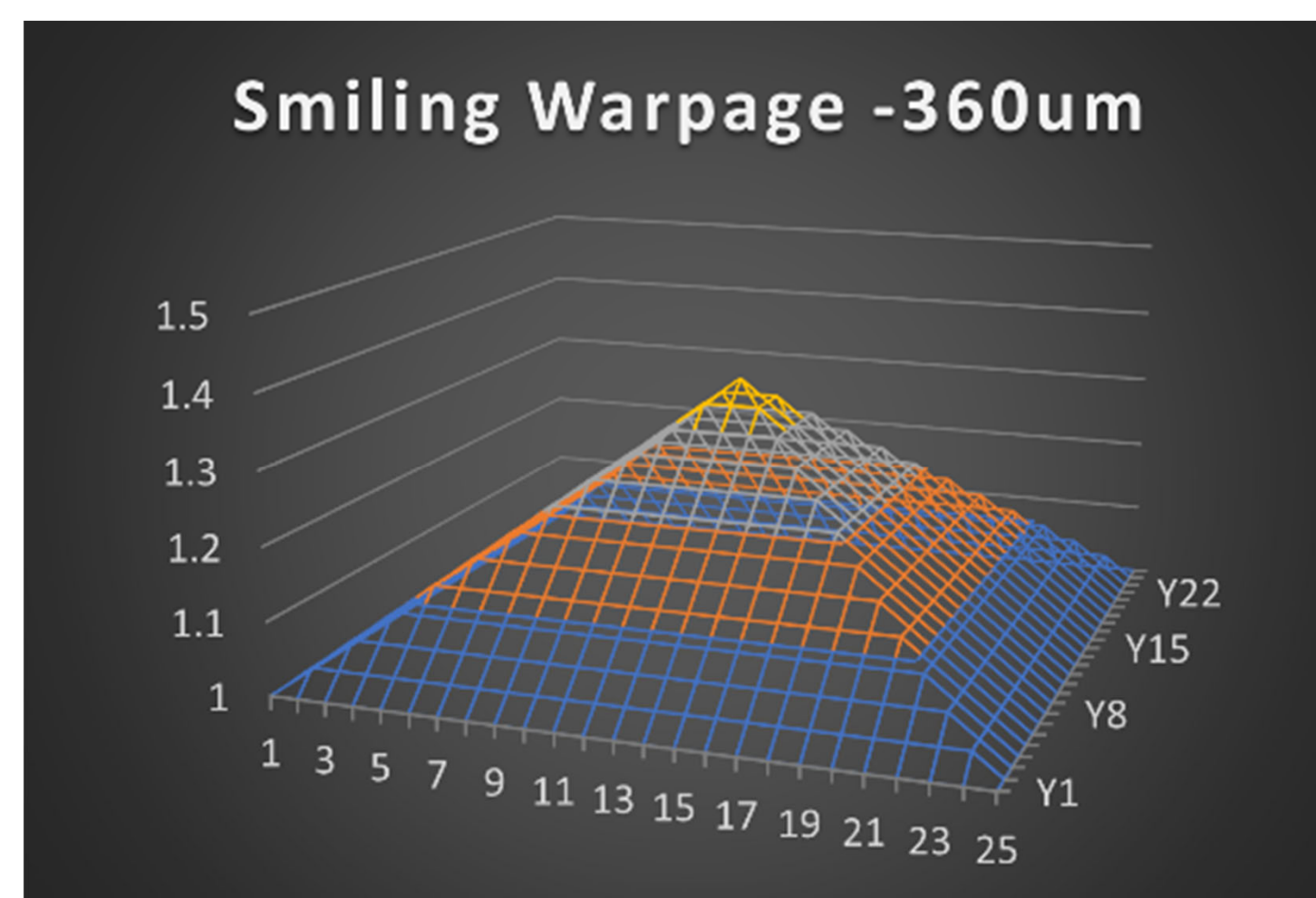
Case Study #2:

Warpage 240um
Elastomer thickness 1.8T



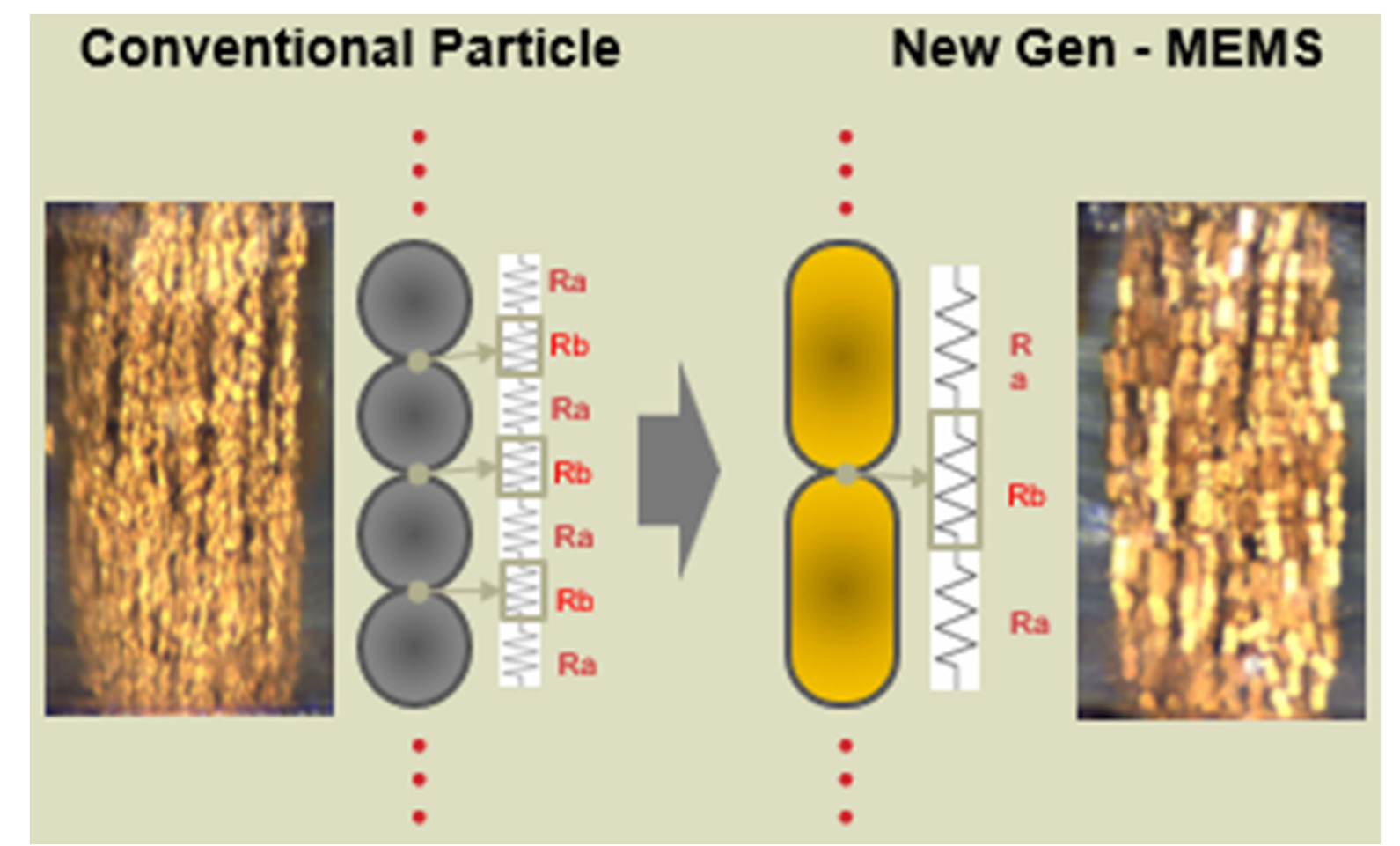
Case Study #3:

Warpage 360um
Elastomer thickness 1.8T

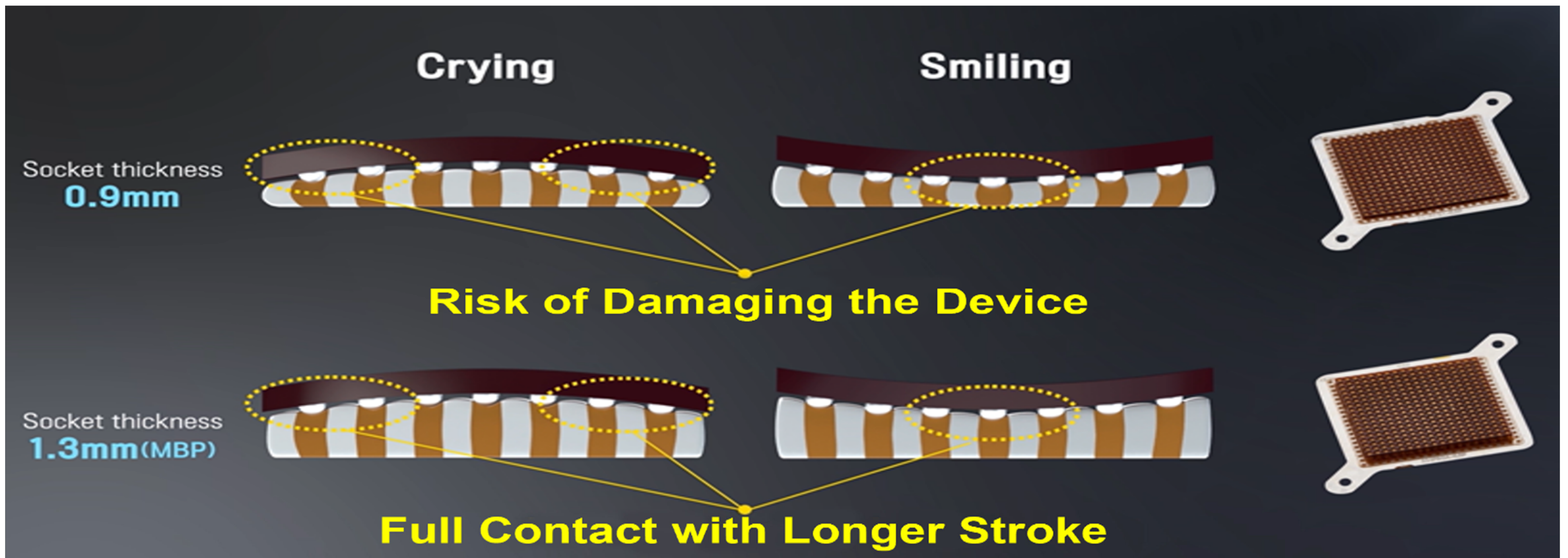


How to Resolve

- Higher Stroke
- Lower Contact Force Throughout
- Reduced number of particles in a column for lower CRES
- Lower inductance for high-speed testing

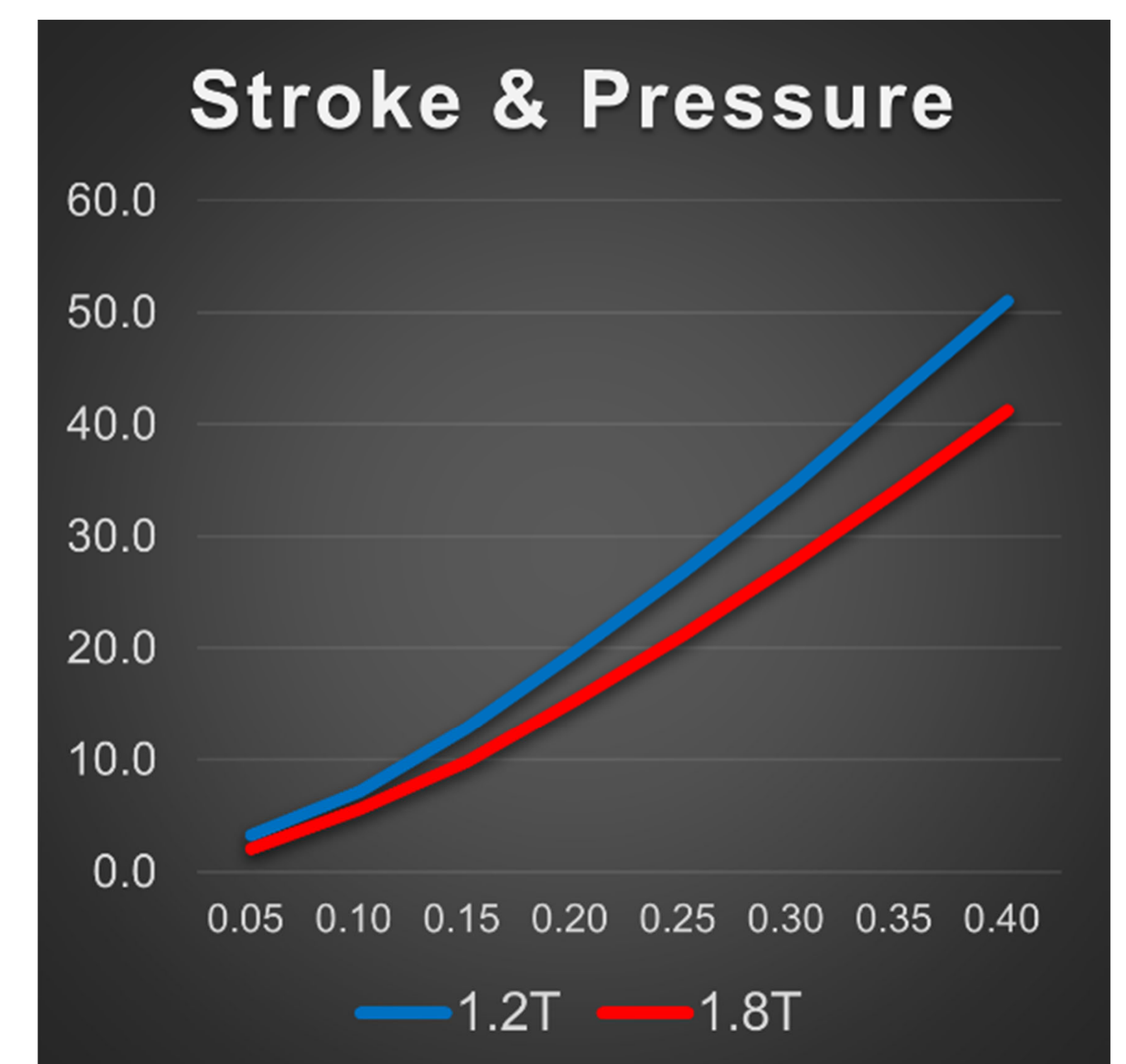


Conventional 0.9mm Thickness vs. MEMS 1.3mm Thickness



Reduced Pressure with Higher Stroke

- Reduced CRES with larger contact area
- Enhanced lifespan for the elastomer
- Less burden for the handler pusher
- Prevented device damages
- Reduced pin-to-pin CRES variation
- Reduced contact force
- Unlimited elastomer thickness



Conclusion

AI devices created a new challenge of testing with the requirements of high pin count devices. Smiling or Crying type of bending caused the device to fail due to open contacts. Excessive force on the DUT caused another issue of cracking the dies. To resolve the issues, higher stroke with thicker elastomer using MEMS particles reduced the DUT pressure, CRES, inductance, and lifespan of test devices without sacrificing the benefits of currently available elastomers.

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