Not Just Chips

April 4-6, 2023

MEPTEC
THE NEXT GENERATION

www.meptec.org

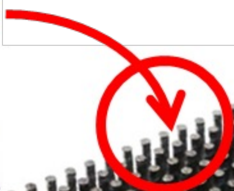
Challenges to Develop a Reliable Lead Free Solder Column to Replace Solder Balls in Large Heterogeneous Packages

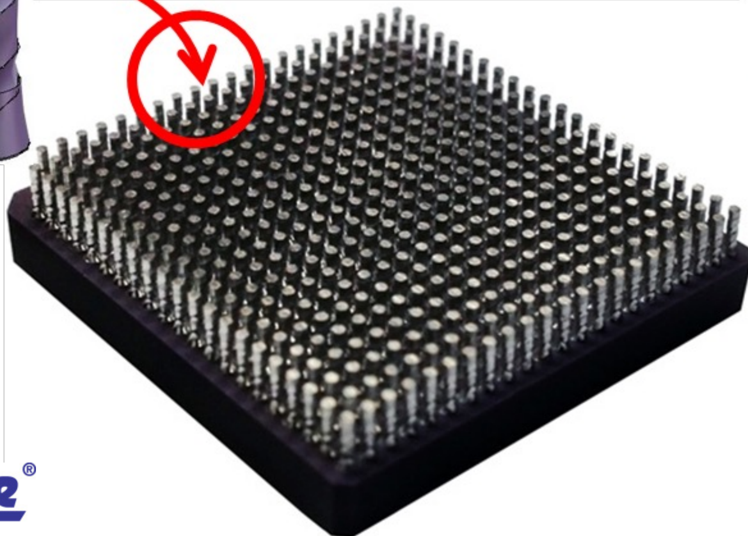
Braided Column

Martin Hart – TopLine Corporation

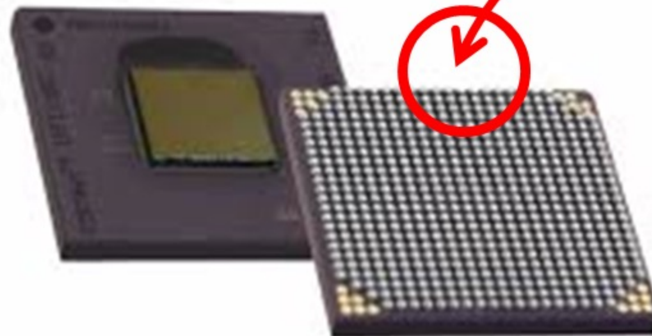
Solder Balls are subject to failure (delamination) caused by excessive stresses inherently found in super-sized heterogeneous 2.5D packages

Solder Column



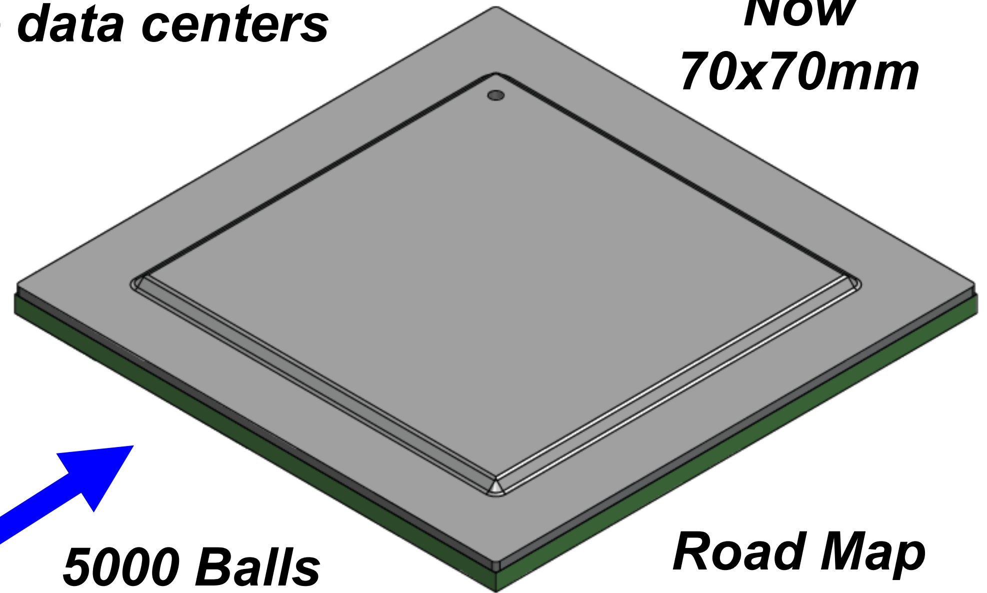


Solder Ball



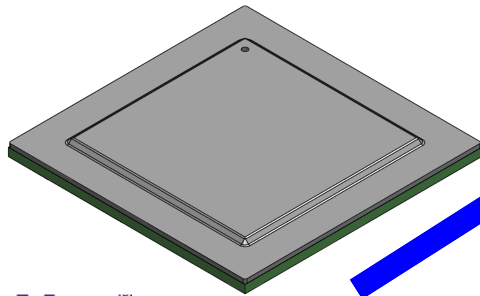
TopLine®

The growth trend is to make larger and larger BGA processors for hyperscale data centers



Now
70x70mm

5 Years Ago
Size: 45x45mm



5000 Balls

Road Map
100x100mm
10,000 balls

2000 Balls

TopLine®

Package designers are constrained by available solutions to mitigate stresses inside humongous sized 2.5D processors.

Typical design tricks:

- ***Copper Balancing***
- ***Low CTE Organic Materials***
- ***Stiffeners***
- ***Other Secret Sauce***

Solder columns (instead of solder balls) could be a reliable solution to tame destructive stresses.

TopLine®

Legacy: ***Tin-Lead (SnPb) Solder Columns have a 40 year track record for reducing stress in connecting large ceramic FPGA and ASIC packages to PC Boards for the Defense and Aerospace market.***

Next Gen: ***Make Lead Free (RoHS) solder columns that provide adequate stress relief in very large commercial packages.***

TopLine®

What we are doing:

We are developing a next generation Lead Free solder column with an exoskeleton copper braided sleeve to replace solder balls for use on large sized Heterogeneous 2.5D processors.

Ready :

Engineering samples Q3 – 2023
Production ready Q1 - 2024

TopLine®

Solder Column relative size

Magnification 200X

Column Length 1.0mm ~ 2.2mm

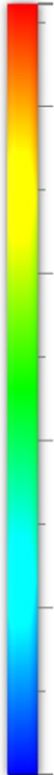
16 strands 1.0 mil copper wire braided over Lead Free solder core

Shown before Solder Coating

TopLine®

TopLine®
Patents:
US 10,477,698 B1
CN 1118822899 B
Braided Solder Columns

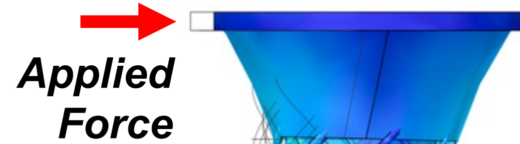
Max Strain

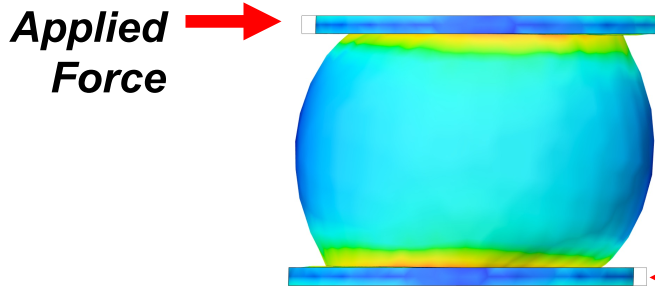


Min Strain

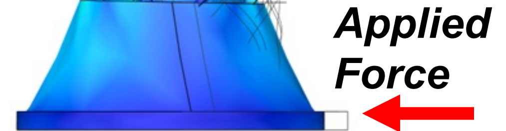
Finite Element Analysis Comparison Bend Strain Ball vs Column

***Observation:* Columns absorb stress and distribute the load more evenly than balls.**





Applied Force



TopLine®

Benefits of Braided Solder Columns compared to solder balls:

- Columns are non-collapsible and absorb package strain.
- Balls collapse and fail under strain as packages get larger.
- Columns have unique 16 strand copper sleeve construction.
- Columns lower thermal impedance carries heat from package.
- Columns have potential to reduce need for package heat sink.
- Columns reduced stress between the package and the PCB.

TopLine®

Summary:

Column technology supports the market trend for scaling up the size of 2.5D chips to 100mm x 100mm while maintaining package reliability.

TopLine®

***Take away:* Columns have the potential to increase package life over more thermal cycles.**

Let's continue the conversation !

Contact: Martin Hart

hart@topline.tv

COPYRIGHT NOTICE

This presentation in this publication was presented at the **Not Just Chips** (April 4-6, 2023). The content reflects the opinion of the author(s) and their respective companies. The inclusion of presentations in this publication does not constitute an endorsement by MEPTEC or the sponsors.

There is no copyright protection claimed by this publication. However, each presentation is the work of the authors and their respective companies and may contain copyrighted material. As such, it is strongly encouraged that any use reflect proper acknowledgement to the appropriate source. Any questions regarding the use of any materials presented should be directed to the author(s) or their companies.

www.meptec.org

MEPTEC
THE NEXT GENERATION