Solder Columns
For CCGA
Ceramic Substrates

- Pb90/Sn10 Plain
- Pb80/Sn20 Copper Wrap
- Micro-Coil Spring
- New Types Innovation
History of Solder Column Development

1980’s
- IBM
  Pb90/Sn10 Wire & Cast

1982
- Raychem
  Pb80/Sn20 Copper Wrap

1999
- NGK
  Pb90/Sn10 Interposer

2012
- NASA
  Micro-Coil Spring

2014
- TOPLINE
  New Columns

Brief review 34-years of solder column development.
Poor Reliability with Solder Ball

Large temperature swings - create major stress between large ceramic array and PCB board.

CTE Mismatch ~10 ppm/°C

A better way is needed.
Pb90 Columns Absorb Stress Caused by CTE Mismatch

CTE Mismatch ~10 ppm/°C

Stretch-Shrink Movement

CERAMIC Package
Al₂O₃ Substrate
CTE ~ 7 ppm/°C

Columns Absort Twisting

Organic PC Board
Polyimide / FR4
CTE ~ 17 ppm/°C

Stretch-Shrink Movement
-55°C ~ +125°C

Solder columns are more reliable than solder-balls.
Pb80 Columns with Cu Ribbon Absorb Stress Caused by CTE Mismatch

CERAMIC Package
Al₂O₃ Substrate
CTE ~ 7 ppm/°C

Cu Ribbon
Columns Absorb Twisting

Organic PC Board
Polyimide / FR4
CTE ~ 17 ppm/°C

Stretch-Shrink Movement
-55°C ~ +125°C

Copper ribbon adds additional support.
Pb80 Columns with Cu Ribbon
Produced by TopLine

Photo provided by TopLine
Micro-Coil Springs Test Vehicle survived 50,000g shock 8-times in the lab before failure versus 4-times for Pb90/Sn10 Column

Photo provided by NASA
Micro-Coil Springs
Attached to CCGA Daisy Chain

Photo provided by NASA
Micro-Coil Springs Size Comparison

Photo provided by TopLine

Size
0.020” x 0.050”
0.51 x 1.27mm
Micro-Coil Springs Survive PCB Deflection At 1500g Drop Test

Photo provided by NASA
NASA Micro-Coil Spring
Technology Transfer to TopLine

July 15, 2013

Reply to Attn of: ZP30

Mr. Martin Hart
Topline Corporation
17595 Harvard Ave., Suite 509
Irvine, CA 92614 USA

RE: Exclusive License Agreement DE-469, NASA Case Number MFS-32744-1 entitled
Interconnect Device and Assemblies Made Therewith.

Dear Mr. Hart,

Please find enclosed the executed Exclusive License Agreement (DE-469) between NASA and Topline
Corporation. The effective date of the license agreement is July 1, 2013. The exclusive license covers
the NASA invention described as the Micro-coil Spring “Interconnect Device and Assemblies Made

We look forward to working with Topline Corporation regarding this license. We wish you
much success in commercializing the invention. Please call me if you have any questions, my
telephone number is (256) 544-5226.

Cordially,

Sammy Ayers
Manager, Licensing and Commercialization

Enclosure (1)
Benchtop Tool-Set
Produced by TopLine

Simplified system for attaching solder columns and Micro-Coil Springs to ceramic or plastic LGA

Going into Reflow Oven
Pin-Pack™ Cassette System (Patent Pending)
Loaded with Solder Columns or Micro-Coil Springs.
Quick placement of columns.

Gravity Feed System.
Transfer 1752 Columns to CCGA substrate in 1 minute.
Without vacuum. Without vibration. Without power.
# New Type Columns

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<th>Application</th>
<th>Solution</th>
<th>Availability</th>
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<tr>
<td>1</td>
<td>Columns for small pitch arrays 0.5mm ~ 0.8mm</td>
<td>Small diameter $\varnothing$ .010-Inch (0.254mm)</td>
<td>Available Now</td>
</tr>
<tr>
<td>2</td>
<td>Columns with wider reflow process window for easier rework.</td>
<td>Cu Ribbon Wrap with Pb90/Sn10 Core (Better than Pb80/Sn20)</td>
<td>Available Now</td>
</tr>
<tr>
<td>3</td>
<td>Columns with enhanced thermal resistance. Heavy copper.</td>
<td>3x Improvement over Pb90/Sn10 Columns</td>
<td>Ready Q4- 2014</td>
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<td>Applications: Jared Wilson Jared @ TopLine.tv Tel (800) 776-9888 CEO: Martin Hart Hart @ TopLine.tv</td>
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