

What Do You Want on Your Tombstone?

Tony Lentz
FCT Assembly
tlentz@fctassembly.com

Outline/Agenda

- Introduction to Tombstoning
- Experiment Design
- Results
 - Experiment Results
 - Case Studies
- Conclusions & Recommendations
- Q & A

Introduction to Tombstoning

What Do You Want on Your Tombstone?



Not this kind
of tombstone

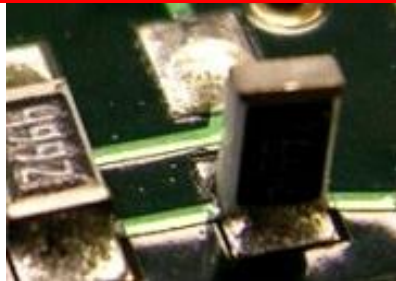


More like it!



Tombstoning Type Defects

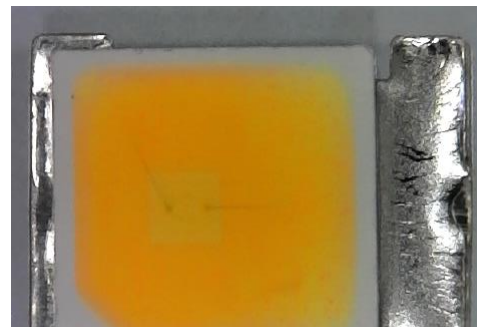
Tombstone



Drawbridge



Billboard

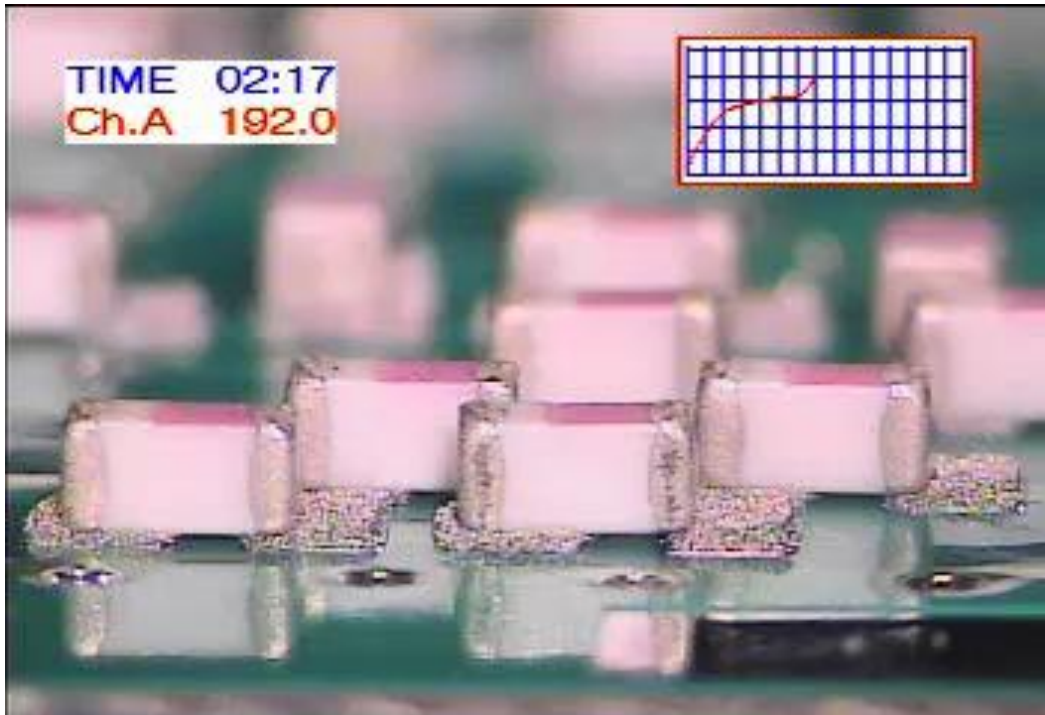


Skew

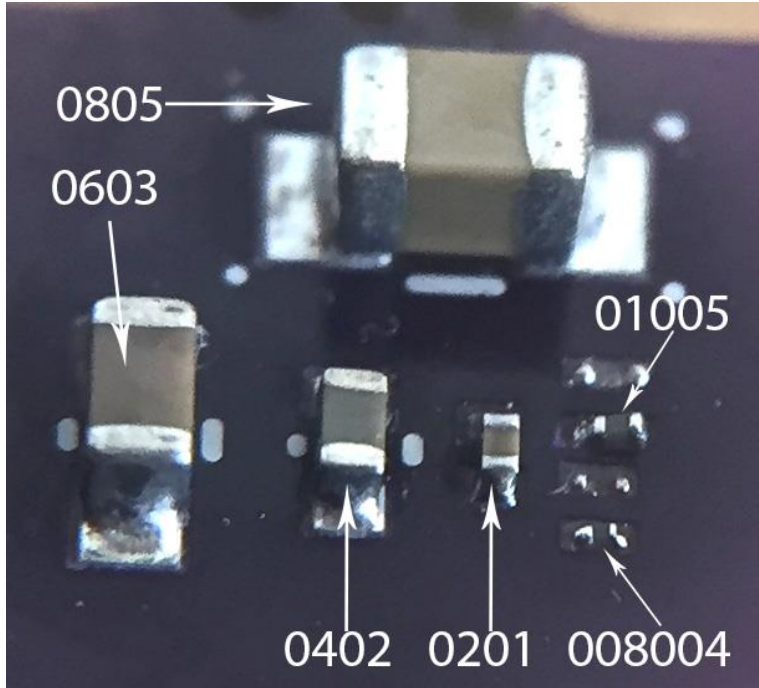
Tombstoning Causes

- Pad layout, Component lead layout, Solder paste print
- Placement shift or error
- Thermal differences in reflow from pad to pad

Tombstoning Causes

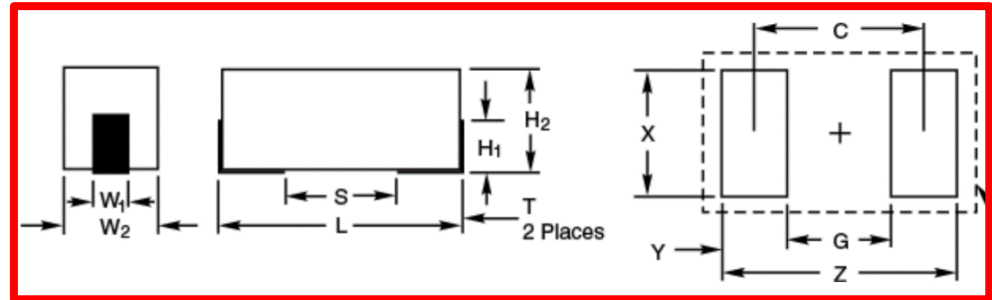
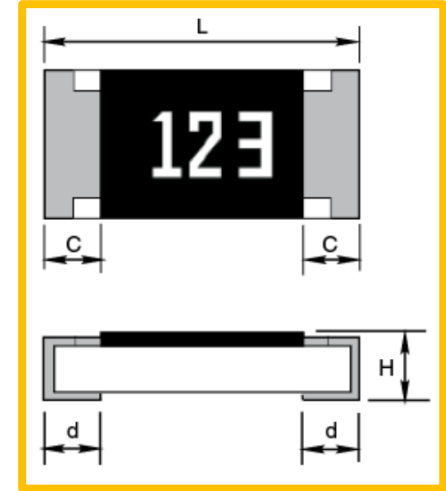


Components Susceptible



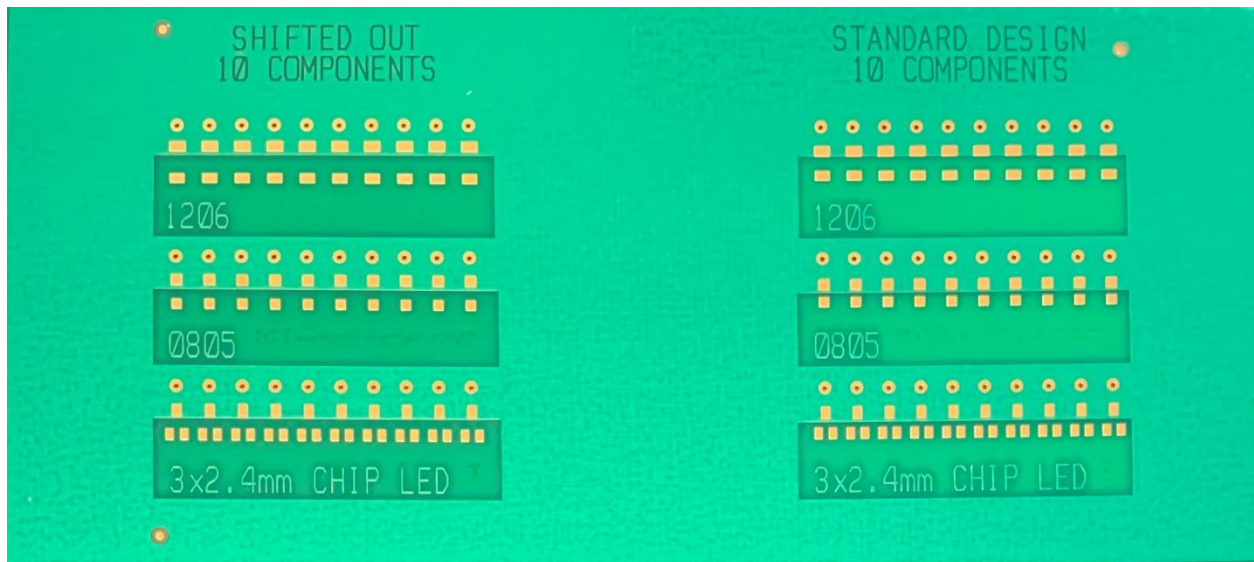
Resistors

Capacitors



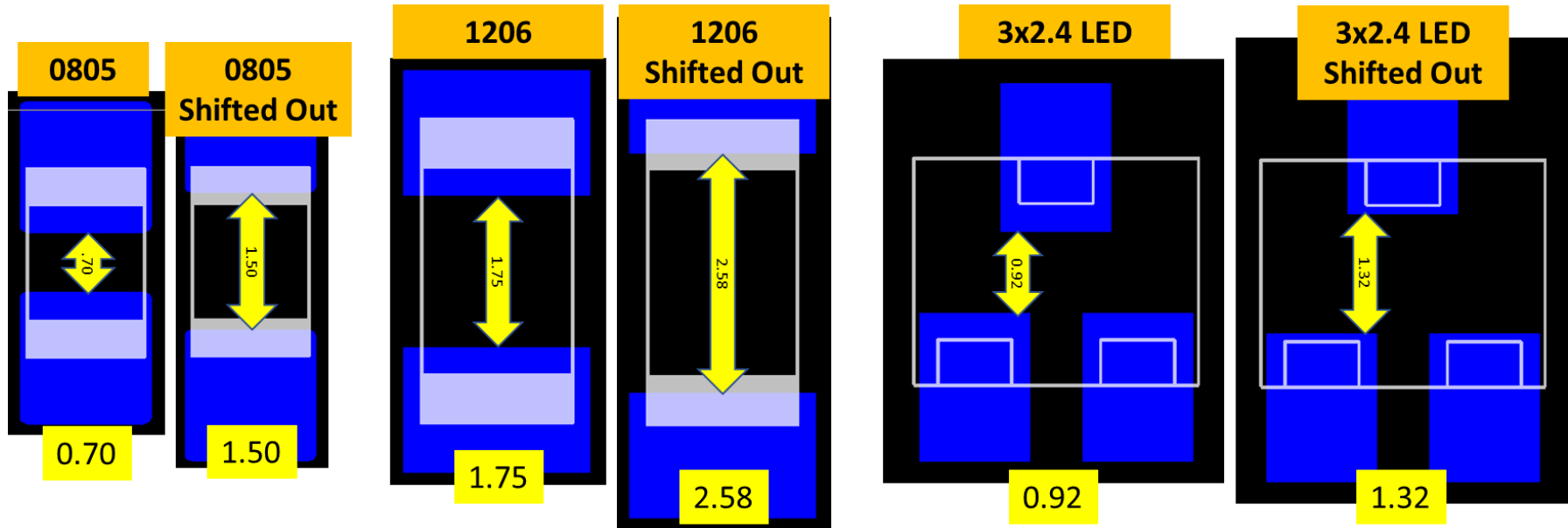
Experiment Design

Tombstone Test Board



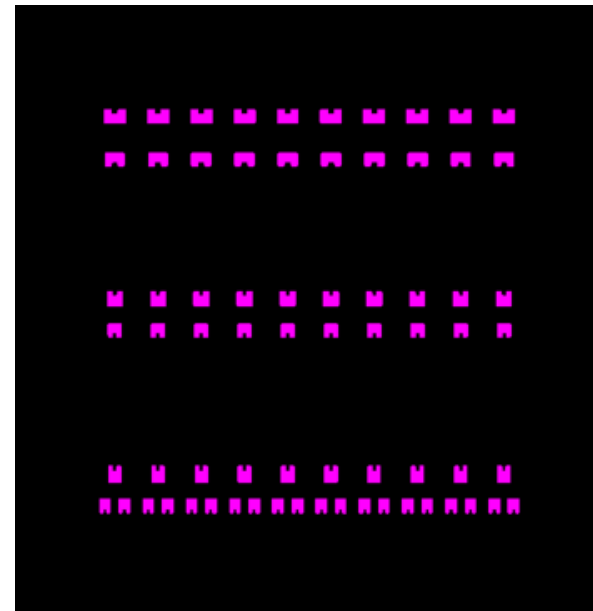
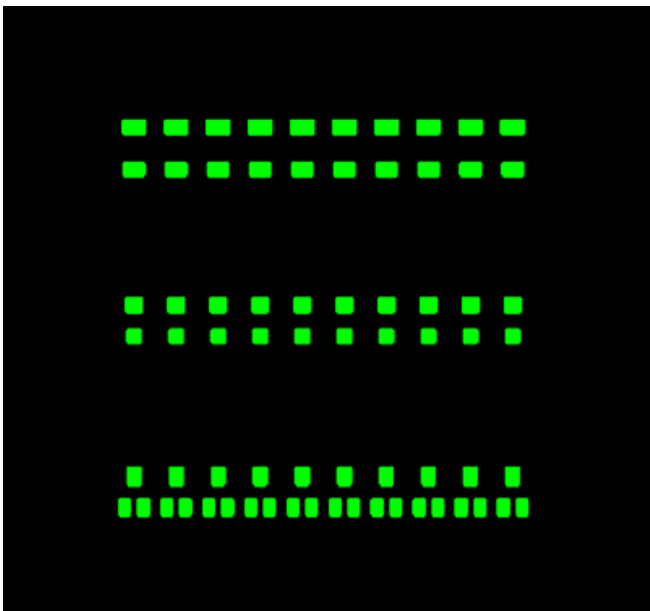
- SMOBC, 2 oz Cu, 0.059" FR-4, Plated Vias to Ground
- 1206, 0805, 3x2.4 mm LED, Two Pad Sets

Tombstone Test Board



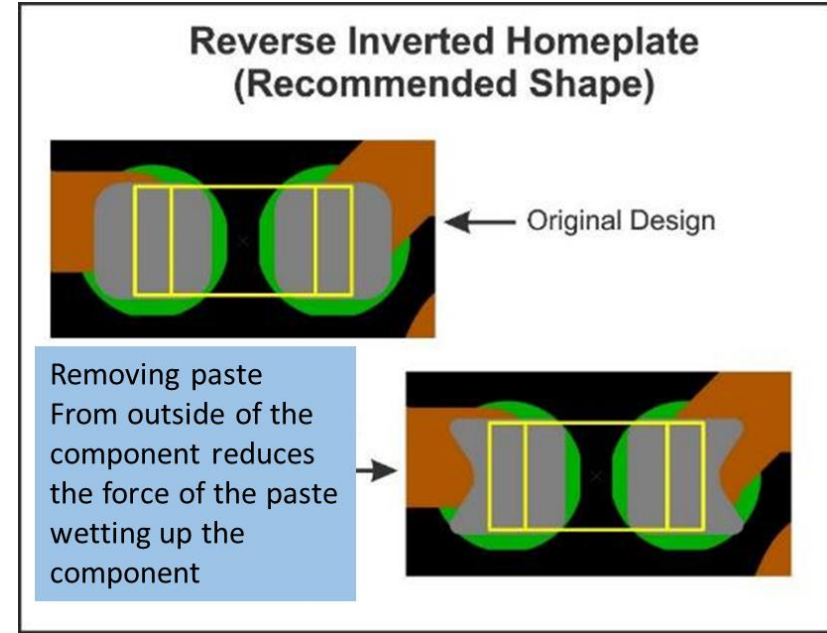
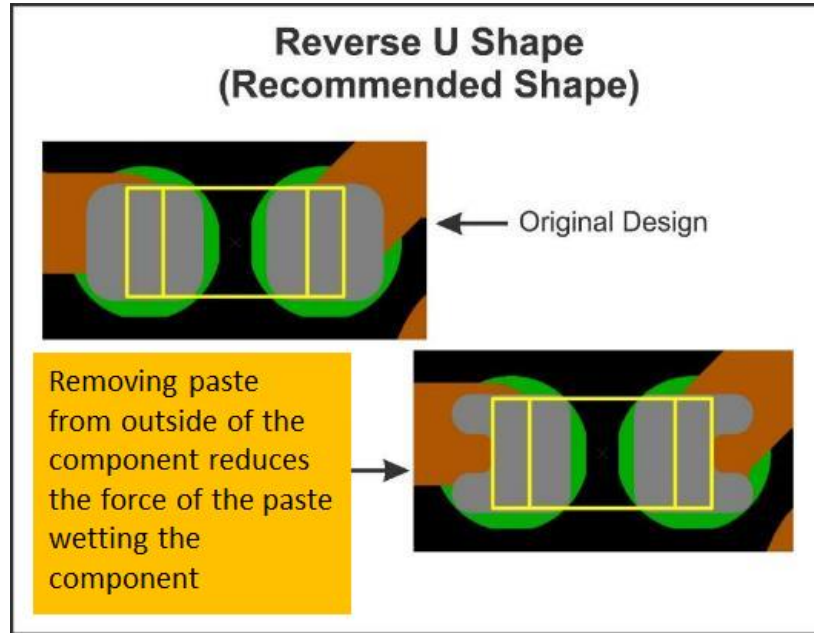
- Spacing for Normal & Shifted-Out Pad Sets (All Values in mm)

Tombstone Stencils



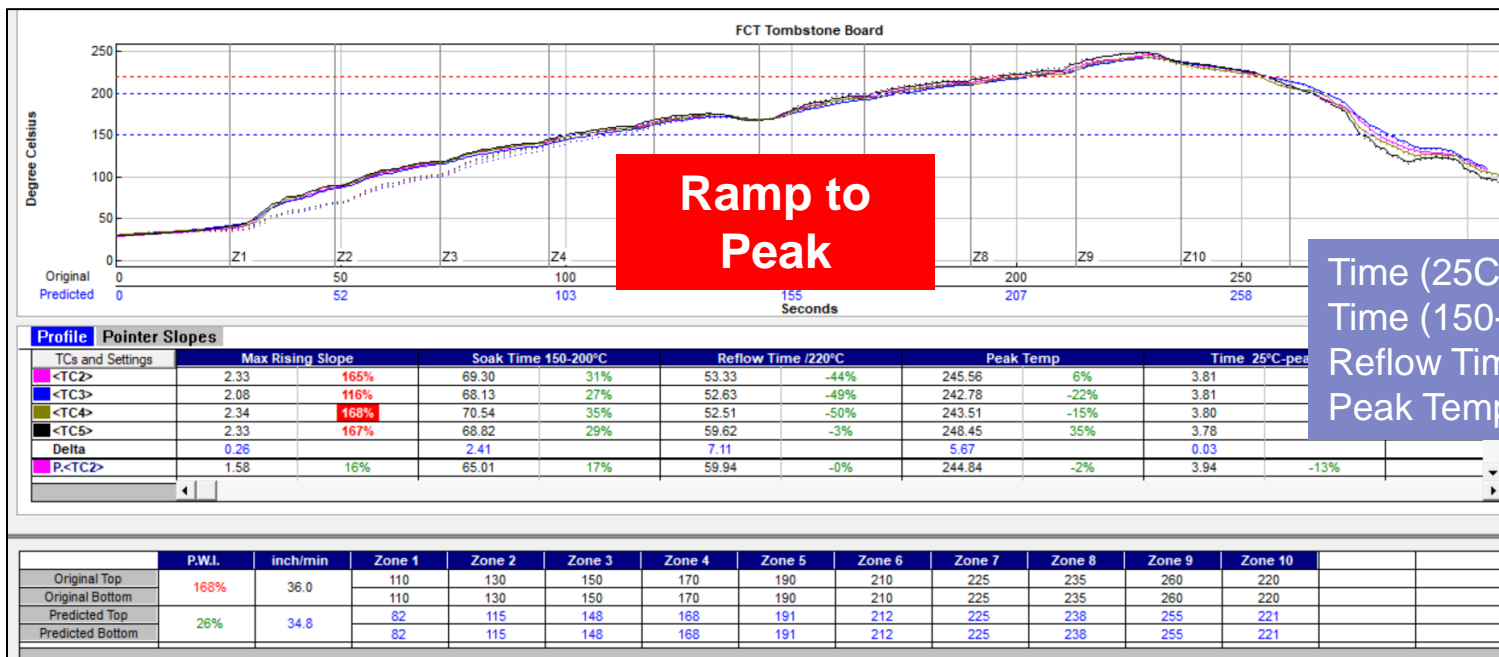
- Normal and Reverse U-Shape Aperture Designs
- 127 Microns (5 mils) Thick, No Nano-Coatings

Tombstone Stencils



- Aperture Design to Reduce Tombstoning

Reflow Profile



Time (25C-Peak) = 3.8 min
 Time (150-200C) = 68 s
 Reflow Time (>220C) = 55 s
 Peak Temp = 245C

Test Iterations

Test Iteration	Stencil	Alloy	Profile
A	Standard	SAC305	Ramp to Peak
B	Reverse U-Shape	SAC305	Ramp to Peak
C	Standard	SN100CV	Ramp to Peak
D	Standard + 50%	SN100CV	Ramp to Peak
E	Standard + 50%	SN100CV	Ramp to Peak

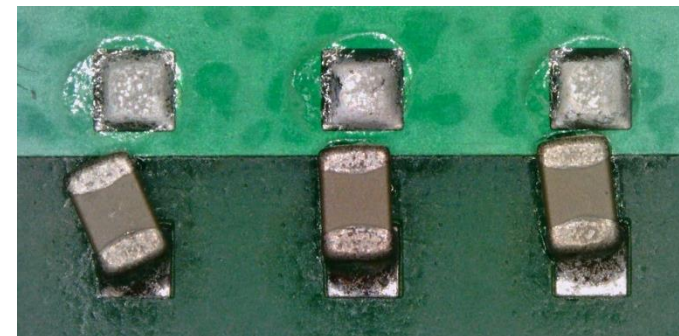
- Solder Paste is No-Clean Lead-Free (ROL0)
- Test E: Placed 0805s on 1206 pads

Results

Results

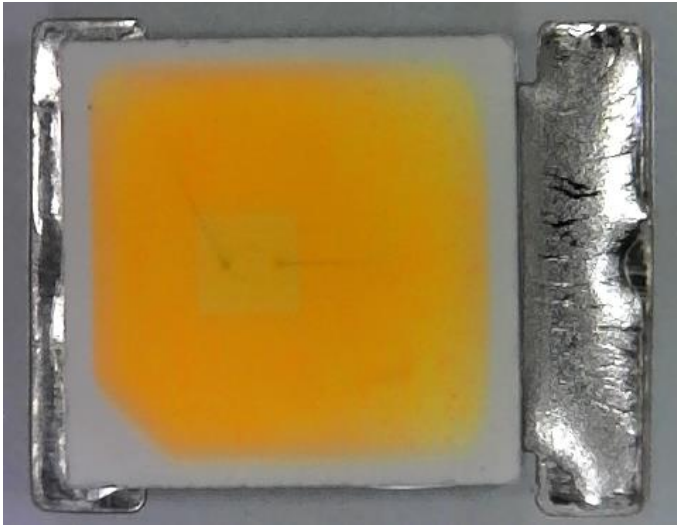
Iteration	1206 SO	1206 STD	0805 SO	0805 STD
A		0		0
B		0		0
C		0		0
D		0		0
E	N/A	N/A		N/A

Std CV
RU SAC



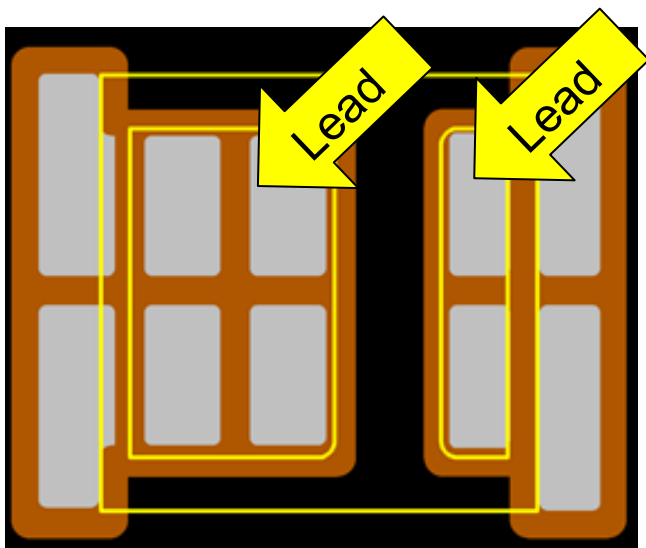
- SO = Shifted Out, STD = Standard
- No Defects With STD Pads or LED's

Field Case Study 1



- Paste Outside Body
 - ~95% Paste Coverage
- Shifted LED 25/320
- Towards Large Pad

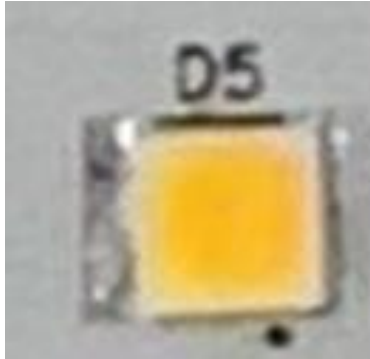
Field Case Study 1



- Added Soak Time **X**
- Modified Stencil Design
 - 95% Area to 50% Area
- Anti-Tombstoning Paste
 - 90% SAC + 10% SN100CV

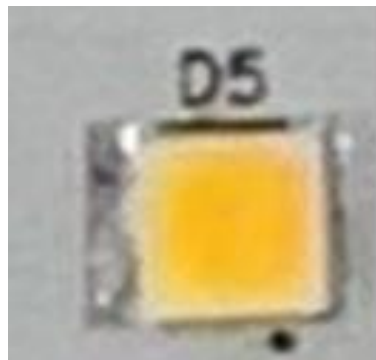
SOLVED

Field Case Study 2



- Shifted LED
- Towards Large Pad
- Relatively High Volume of Paste

Field Case Study 2



- Added Soak Time
 - +30 to 40s in 150-200°C
- Anti-Tombstoning Paste
 - 90% SN100CV+ 10% SAC

SOLVED

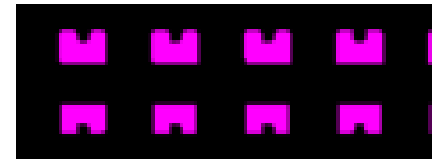
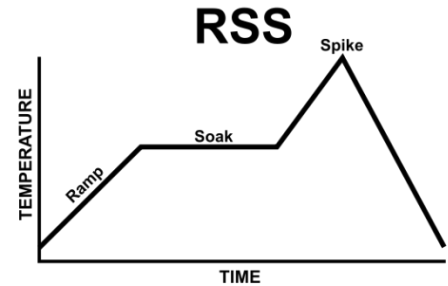
Conclusions & Recommendations

Conclusions

- Factors with Major Impact on Position
 - Pad Geometry Relative to the Component
 - Placement Shift or Error
 - Alloy
 - Stencil Design
- Minor Impact
 - Reflow Profile

Recommendations

- Add Soak Time to the Profile
- Modify the Stencil Design
- Minimize Placement Error
- Use Anti-Tombstoning Paste
- Use the Correct Pad Set



Acknowledgements

- Many thanks to Greg Smith of BlueRing Stencils!





Thank You!

Tony Lentz
FCT Assembly
tlentz@fctassembly.com

