



Introducing LF620 Solder Paste Engineering Manual



Global Distributor of Henkel LOCTITE
(800) 888-0698 info@ellsworth.com



Introduction

Manual Outline:

- Product Description
- Features & Benefits
- Print Processing Window
- Print Abandon Time Testing
- Slump Testing
- Tack-Life Force
- Reflow Processing Window
- Reflow Performance Testing
- Voiding Data
- Specifications and Standards Testing
- Product Summary

Introduction

LF620 Product Description

- Henkel's Multicore™ LF620 solder paste is a halide-free, no clean, Pb-free solder paste.
- This product has a broad processing window for various print conditions and reflow profiles.
- It is resistant to humid environmental conditions and also exhibits minimal hot slump.
- LF620 solder paste has been formulated to give low voiding in CSP via-in-pad joints.
- Excellent solderability over a wide range of reflow profiles in air and nitrogen and across a wide range of surface finishes including Ni/Au, Immersion Sn, Immersion Ag and OSP Copper.
- LF620 has a high tack force to resist component movement during high speed placement.
- Long printer abandon times are not an issue.
- The paste demonstrates excellent resistance to high temperatures and relative humidity.

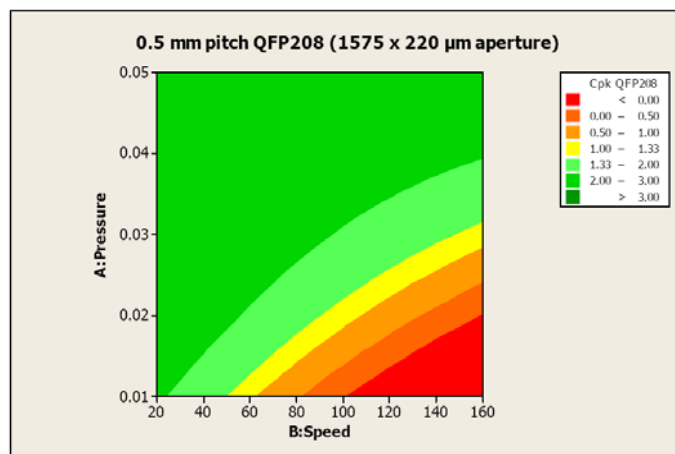
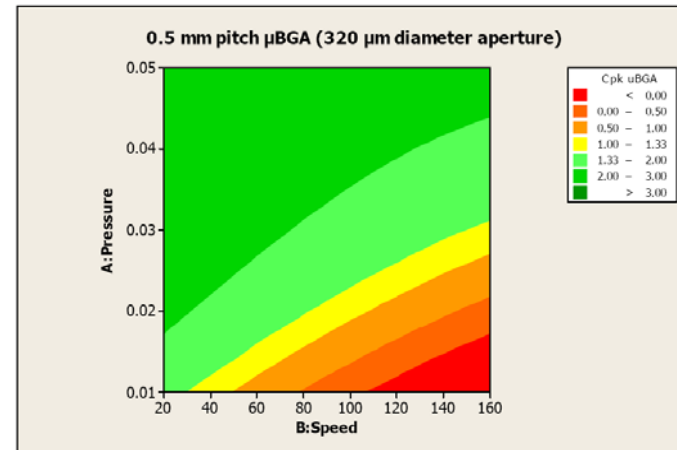
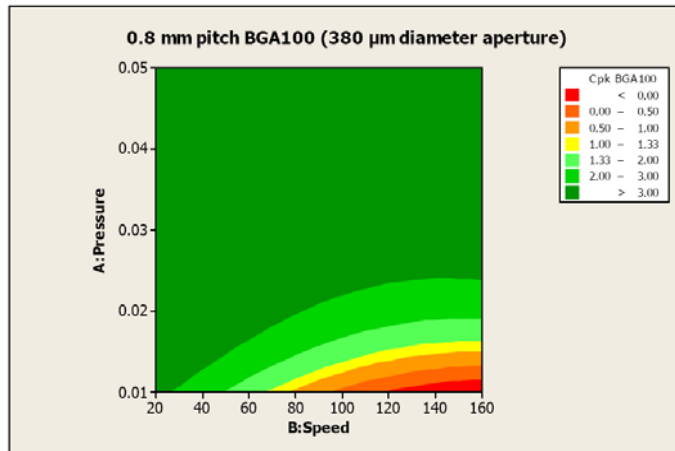
Introduction

LF620 Features & Benefits

Product Attribute	Process Benefit
Excellent coalescence after 8 hours exposure to 23°C/50%RH	Reduced process variation due to environmental factors, a particular advantage in high temperature/humidity conditions
Negligible hot slump	Minimizes bridging & mid-chip solder balling
Colorless residues	Improves speed & ease of post reflow inspection
Low voiding	Reduced risk of bridging on small pitch CSPs & BGAs, reduced risk of decreased joint reliability
Halide free flux classification: ROL0	High reliability of finished assembly without cleaning

Operating Parameters

Printing: Process Window



With correct adjustments to the squeegee pressure, Henkel's Multicore™ LF620 solder paste can be printed at speeds of 20 – 160mm/s

Operating Parameters

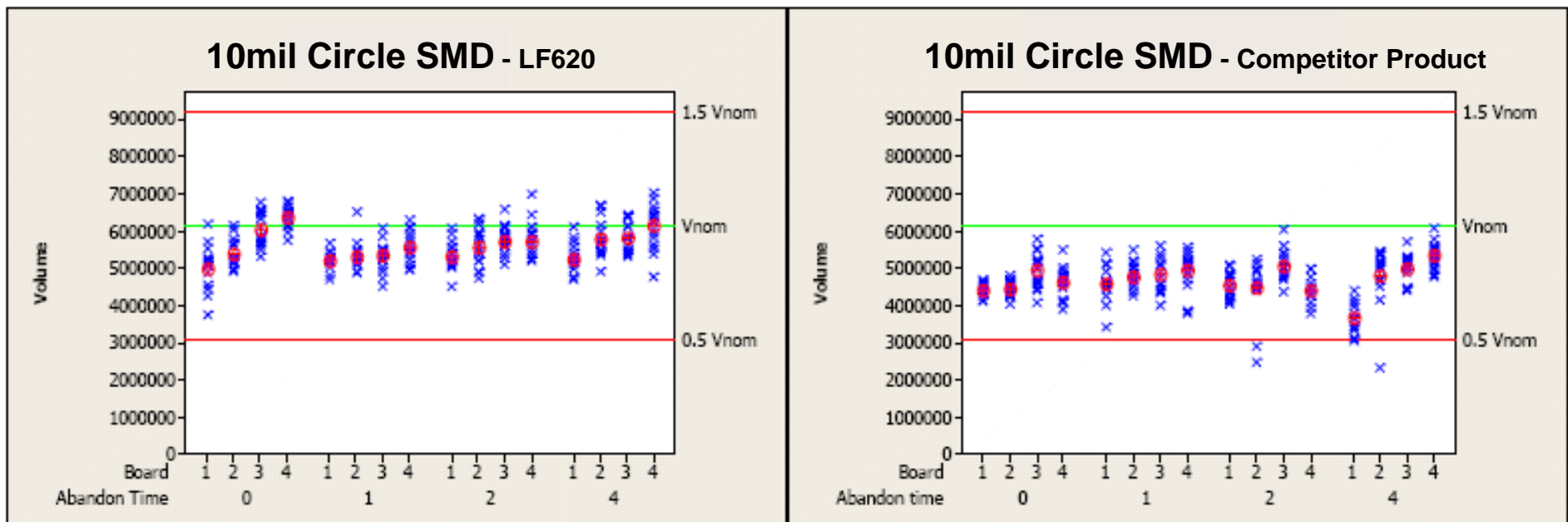
Printing: Abandon time test conditions and results

- Testing was carried out at 2 different print speeds:
2 and 4 inch/second.
- 4 boards printed→1 hour abandon→4 boards printed→1
hour abandon→4 boards printed→2 hour abandon→ 4
boards printed.
- Paste volumes were measured by a Cybertoptics SE300.
- A competitor's product was used for comparison purposes.
- After abandon times, both pastes showed only minor
decreases in volumes on some apertures, and volumes
recovered on subsequent prints.

Operating Parameters

Printing: Abandon time results

LF620 vs. a competitor's product

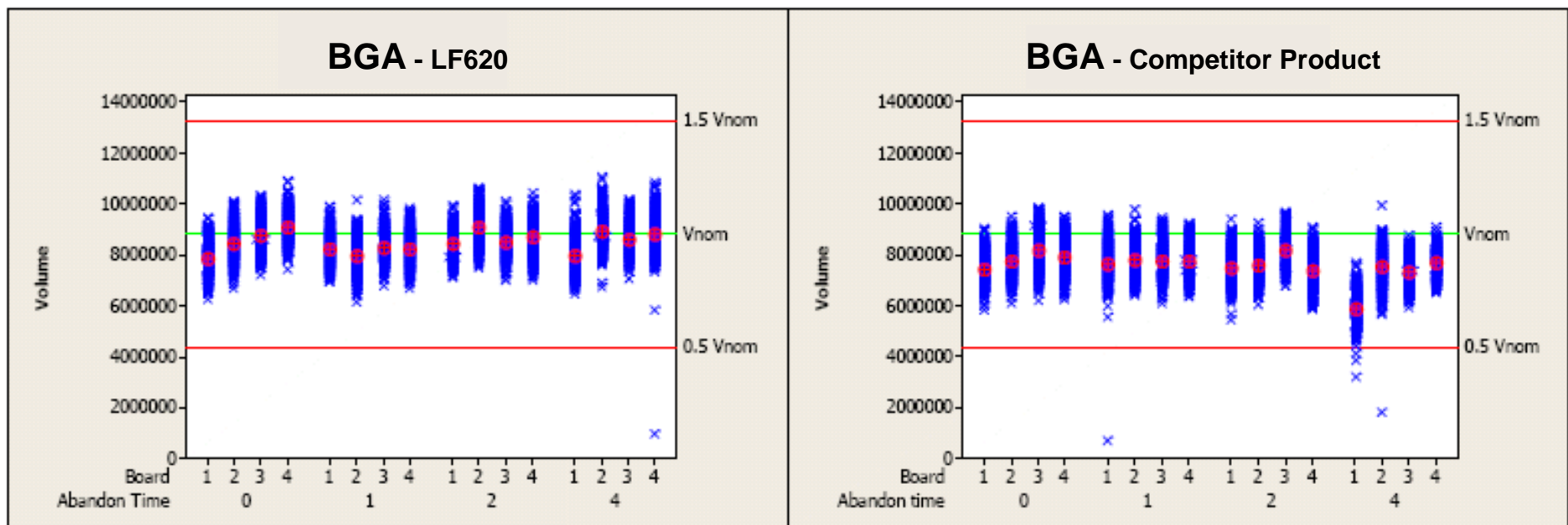


Print volume vs. abandon time
(2 inch/sec Print Speed)

Operating Parameters

Printing: Abandon time results

LF620 vs. a competitor's product

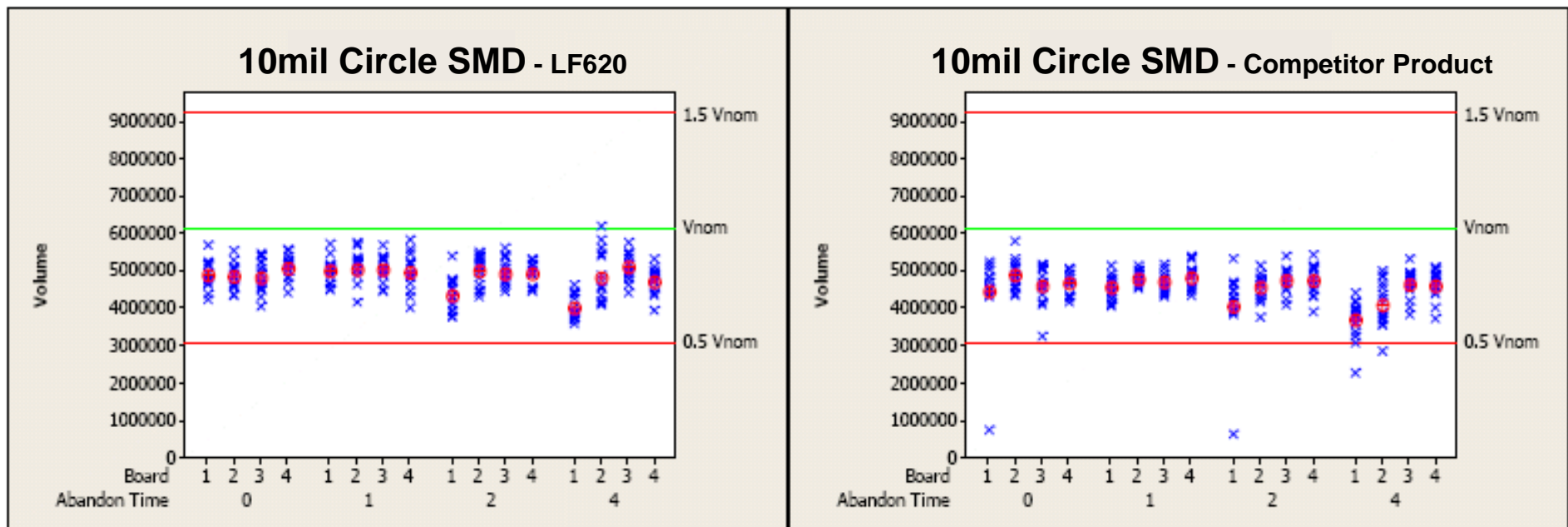


Print volume vs. abandon time (2 inch/sec Print Speed)

Operating Parameters

Printing: Abandon time results

LF620 vs. a competitor's product

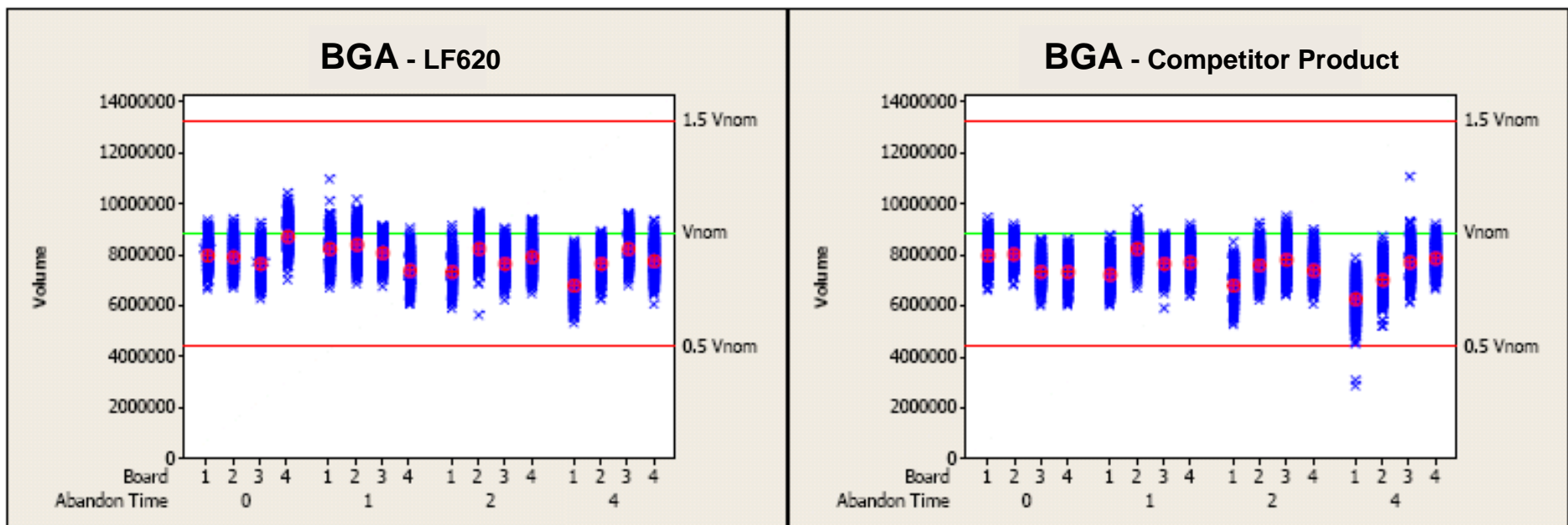


Print volume vs. abandon time (4 inch/sec Print Speed)

Operating Parameters

Printing: Abandon time results

LF620 vs. a competitor's product

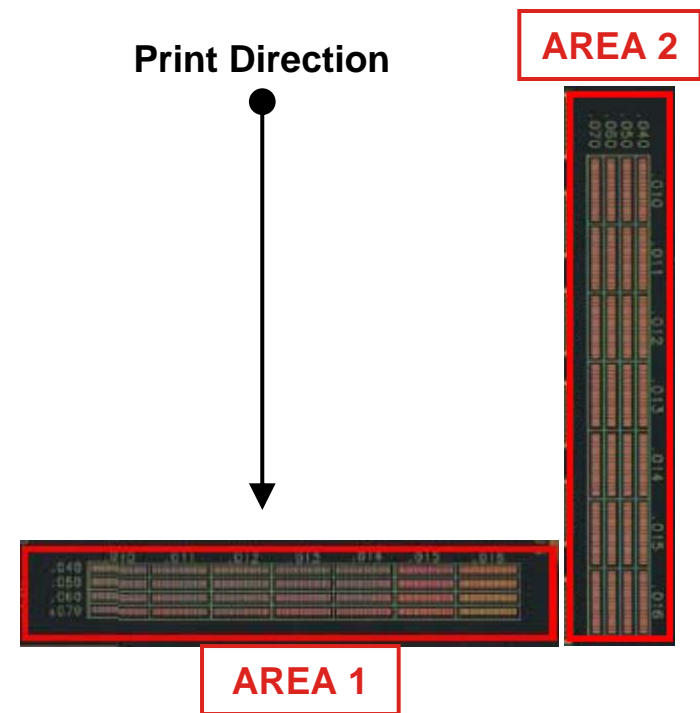


Print volume vs. abandon time (4 inch/sec Print Speed)

Operating Parameters

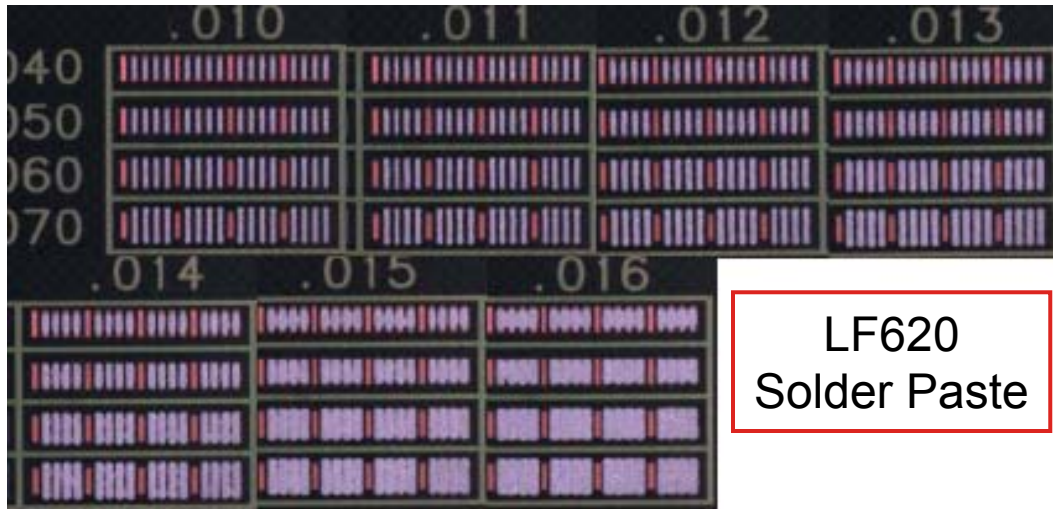
Printing: slump testing conditions

- Both LF620 and a competitor's paste were stencil printed onto test boards.
- Boards were then conditioned in a box oven for 10 minutes at 150°C.
- The areas indicated as 1 and 2 were then examined for slump.
- Print directional factor was assessed.



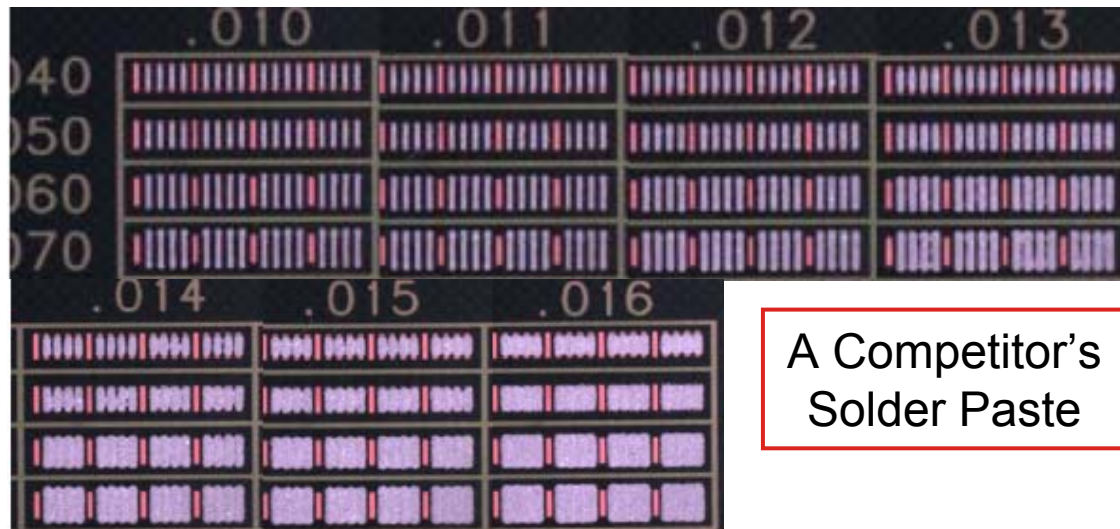
Operating Parameters

Printing: AREA 1 slump testing results



LF620
Solder Paste

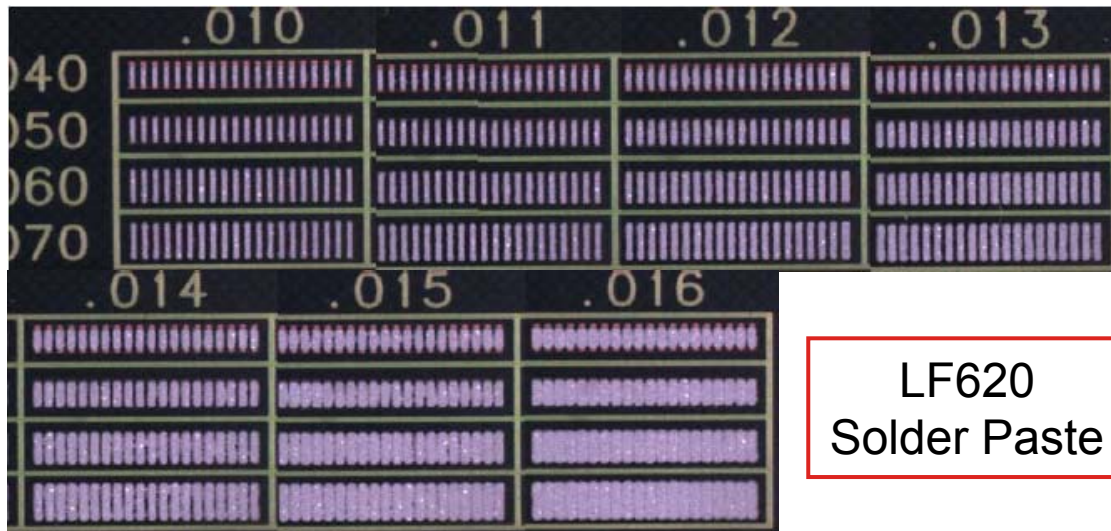
Less slumping and bridging of printed pads was observed with LF620 as compared to a competitor's paste.



A Competitor's
Solder Paste

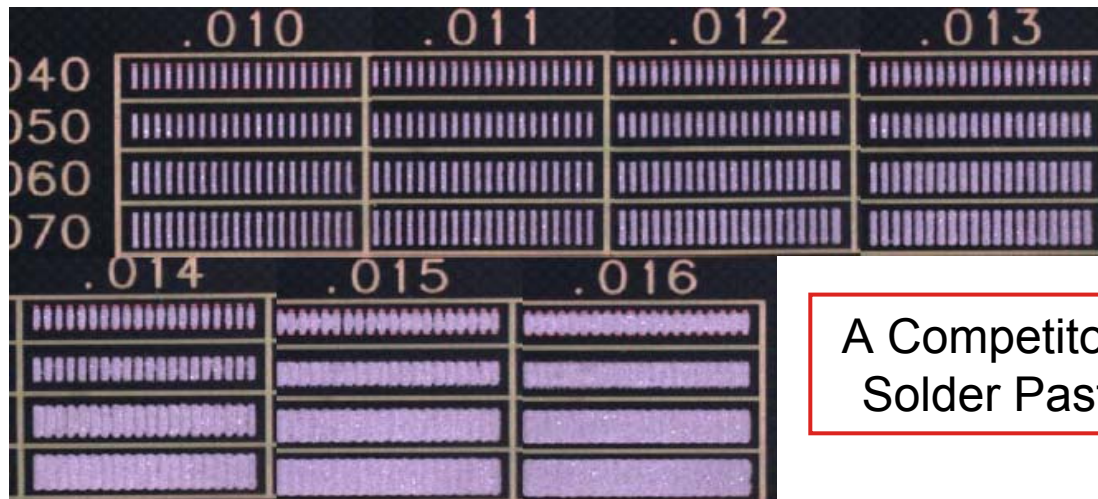
Operating Parameters

Printing: AREA 2 slump testing results



LF620
Solder Paste

Less slumping and bridging of printed pads was observed with LF620 as compared to a competitor's paste.

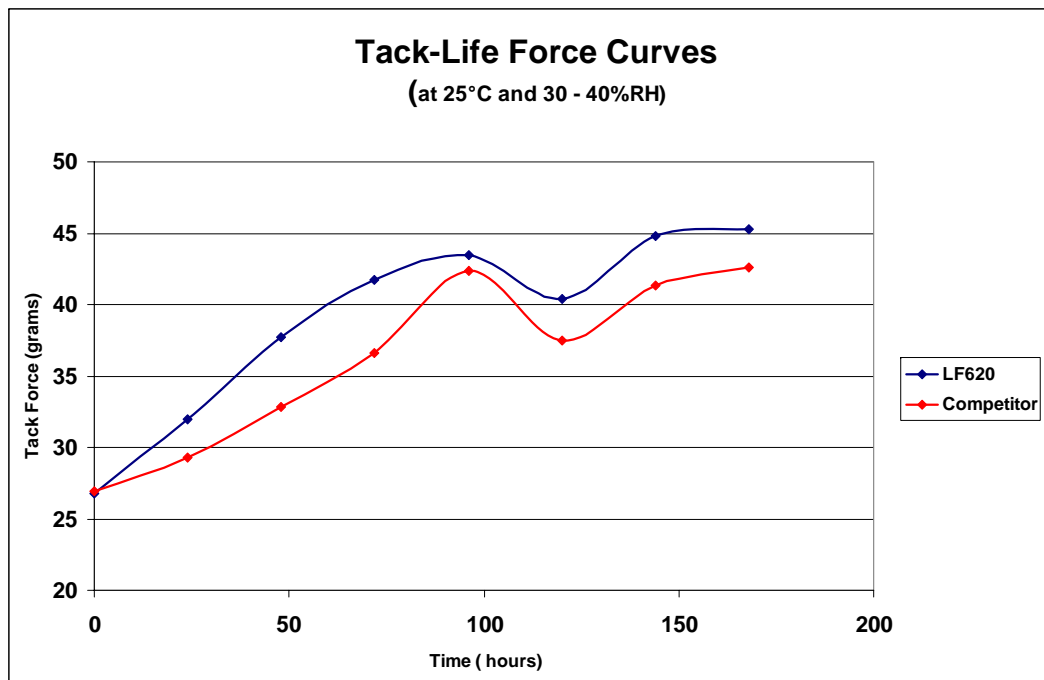


A Competitor's
Solder Paste

Operating Parameters

Tack-Life Force:

- Test performed using IPC test method and a Malcom Tackiness Tester TK.1.
- Each data point represents an average of 10 test sites (0.25mm thick), stencil printed samples onto ceramic substrates.
- The test probe diameter is 5.1mm.

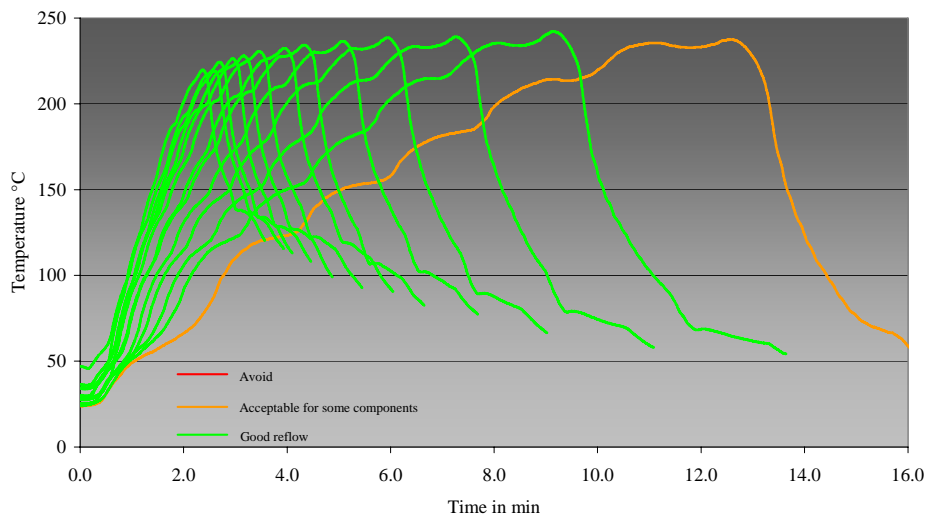


Operating Parameters

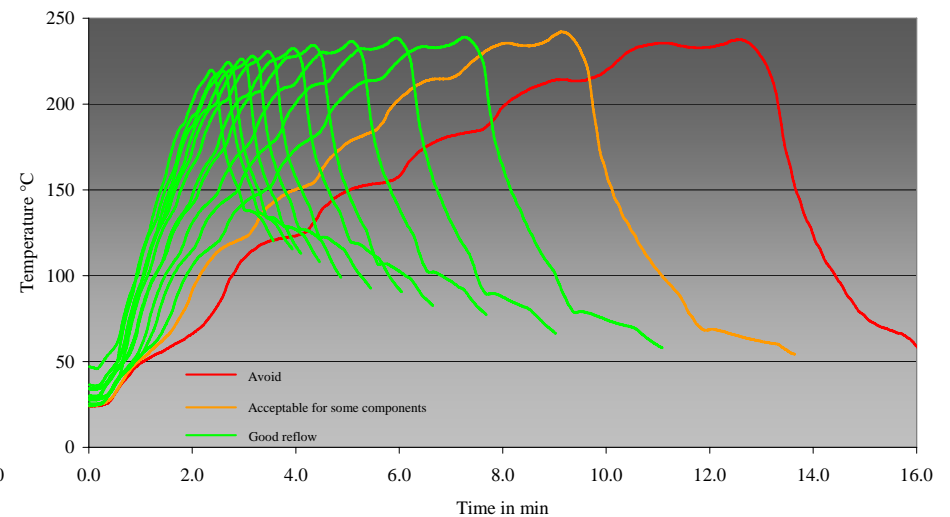
Reflow: Process Window - Linear

Henkel's Multicore™ LF620 solder paste accommodates a wide reflow processing window using linear type profiles.

96SCLF620AGS88.5V Reflow Process Window - Linear - Larger than 0.5mm Pitch Areas



96SCLF620AGS88.5V Reflow Process Window - Linear - 0.5mm Pitch and Below

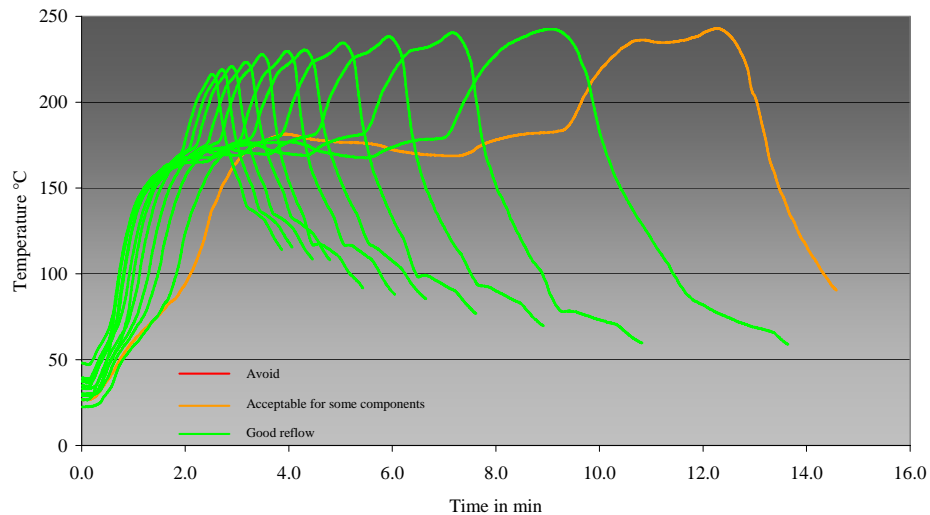


Operating Parameters

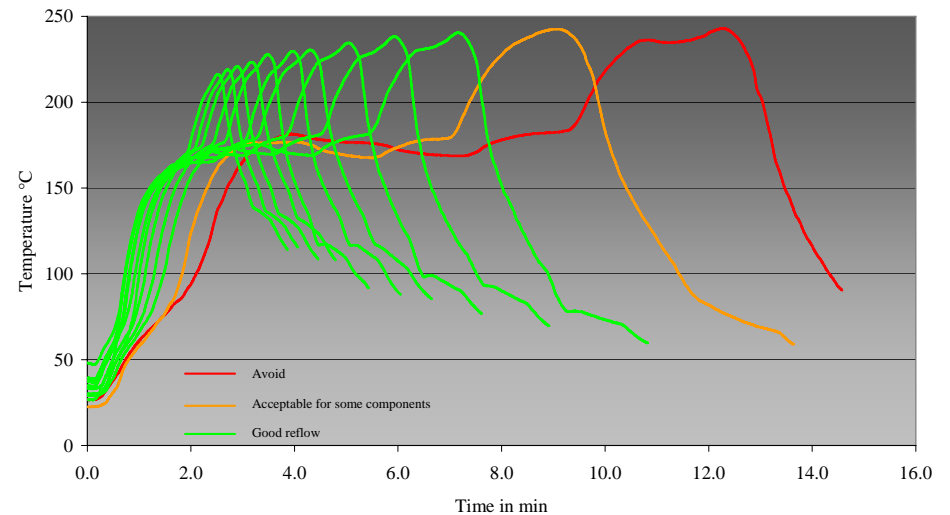
Reflow: Process Window - Soak

Henkel's Multicore™ LF620 solder paste accommodates a wide reflow processing window using soak type profiles.

96SCLF620AGS88.5V Reflow Process Window - Soak - Larger than 0.5mm Pitch Areas

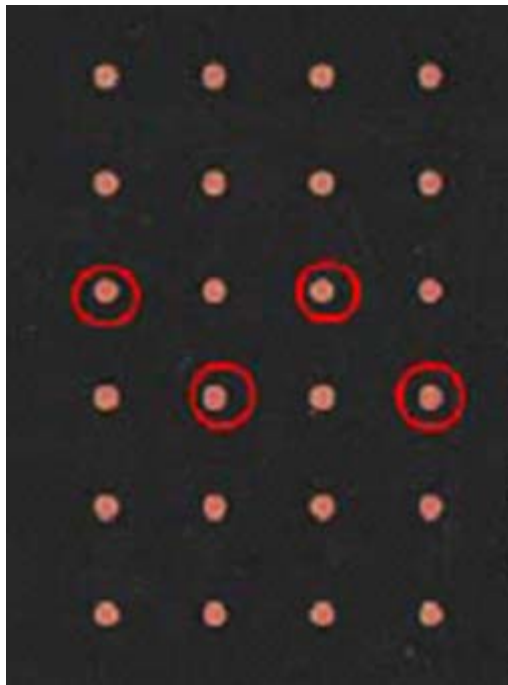


96SCLF620AGS88.5V Reflow Process Window - Soak - 0.5mm Pitch and Below Areas



Operating Parameters

Reflow: Solder balling and humidity resistance test conditions

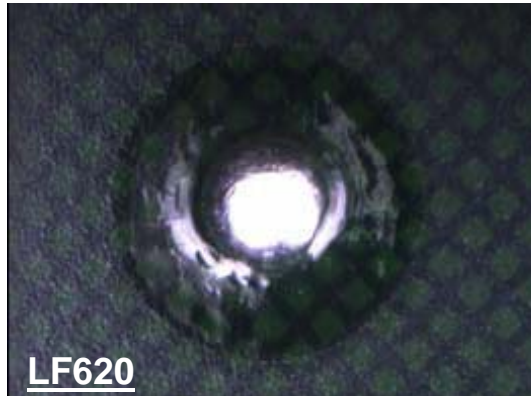


Test pads used for solder balling test

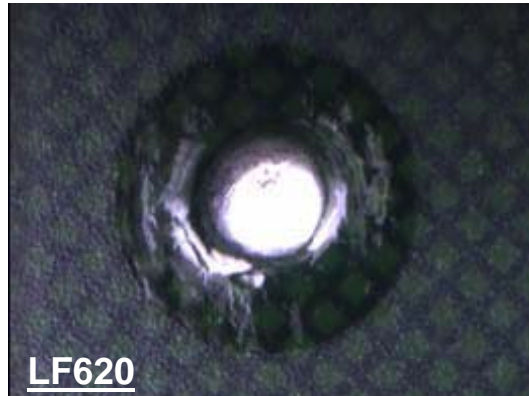
- Testing was performed on virgin and pre-reflowed test boards.
- Solder paste was overprinted onto circular pads.
- Solder balling test was performed at time =0
- Solder balling test was also conducted:
 - 2 hours/ambient lab (21°C 34%RH)
 - 1 hour/high humidity (30°C 90%RH)

Operating Parameters

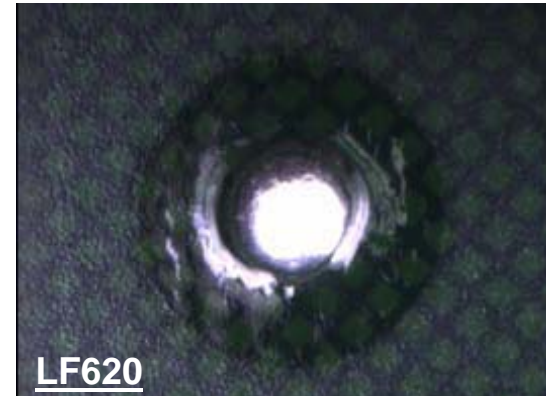
Reflow: Solder balling and humidity resistance performance



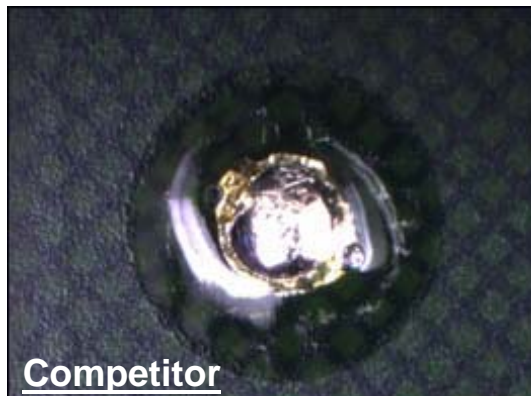
Immediate Reflow



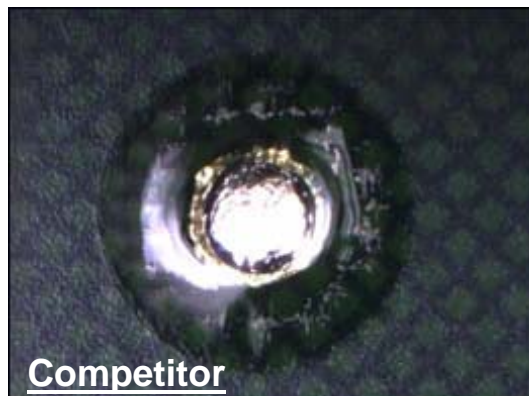
Humid 1 Hour



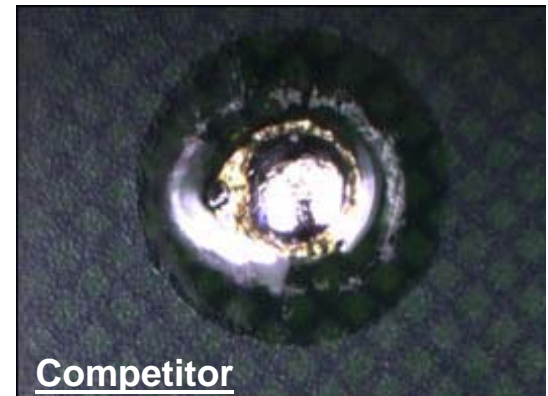
Ambient 2 Hours



Immediate Reflow



Humid 1 Hour



Ambient 2 Hours

Operating Parameters

Reflow: Solder balling and humidity resistance summary

- LF620 and a competitor's paste showed similar levels of solder balling between virgin and pre-reflowed boards.
- LF620 and a competitor's paste showed similar levels of solder balling subjected to different exposure conditions.
- It can be observed in the photographs that the yellow tinted residue left by the competitor product is noticeably cracked on both the overprinted area and surrounding the central ball.
- It was observed that the competitor's product residue also contains large air bubbles situated around the central ball.
- These visual residue effects were not observed with LF620.

Operating Parameters

Reflow: Component Coalescence Test Conditions



Test board 0201 array

- The test was performed on at 0201 passive component attach area of the test board.
- LF620 was compared to a competitor's paste.
- Test boards were stencil printed (4mil thick), then pick and place populated components.
- 100 components were tested per profile.
- Several reflow profiles were used, which varied slightly in length and peak temp.

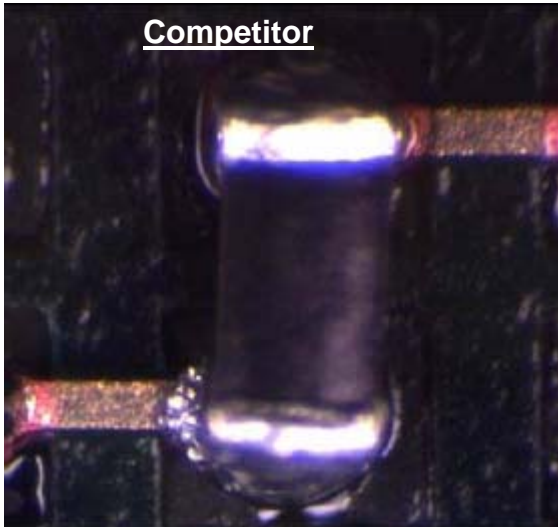
Operating Parameters

Reflow: Component Coalescence Test Results

96SCLF620AGS88.5V



Competitor









- LF620 shows excellent performance on 0201.
- No non-coalesced particles observed.
- Some non-coalesced particles are observed with the competitor's paste on the 0201 areas.
- LF620 shows good fine-pitch coalescence performance.

Operating Parameters

Reflow: Wetting test results

Circular pattern printed onto treated and non-treated Au finished pad
The LF620 paste shows better wetting than the competitor's paste

Board Condition	96SCLF620AGS88.5V	Competitor
Virgin Board		
Pre-reflow once		
Pre-reflow three times		



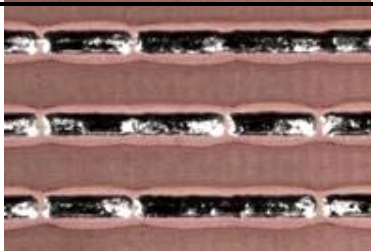

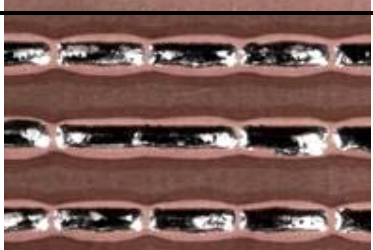
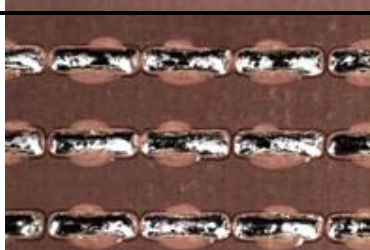
Paste page 22



Operating Parameters

Reflow: Wetting test results

Incremental pattern printed onto treated and non-treated Cu finished pad
The LF620 paste shows better wetting than the competitor's paste

Board Condition	96SCLF620AGS88.5V	Competitor
Virgin Board		
Pre-reflow once		
Pre-reflow three times		

Operating Parameters

Residue: Pin Testing

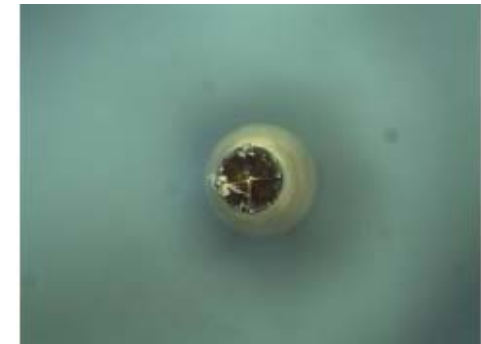
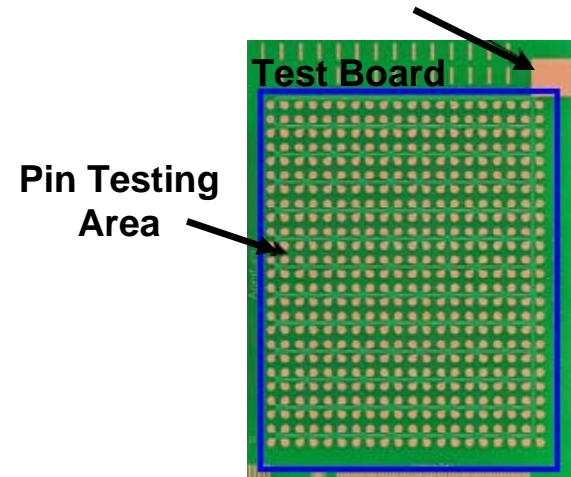
TEST CONDITIONS

- Solder paste was printed using 5 mil thick stencil.
- A typical 4min (RT→Peak) lead free reflow profile was used.
- Test time intervals were T=0, 2, 7, 24hrs post reflow.
- A typical 4-point plain crown probe was used for pin testing.
- 1000 sites were tested for electrical continuity at each time interval.
- Visual observation of probe tip appearance was documented after 500 hits at each time interval.

TEST RESULTS

- 100% electrical continuity recorded for all boards.
- Slight residue on pinhead was observed, with no impact on test results.

Electrical Contact Point

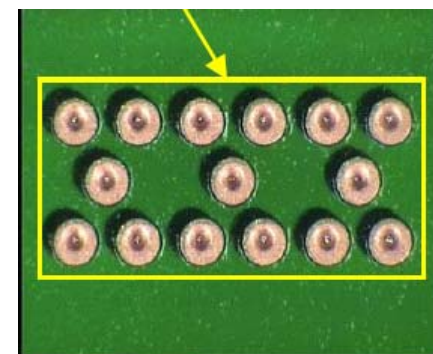
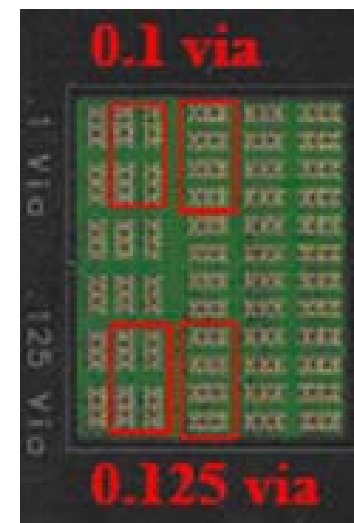


Typical probe tip appearance:
post testing

Operating Parameters

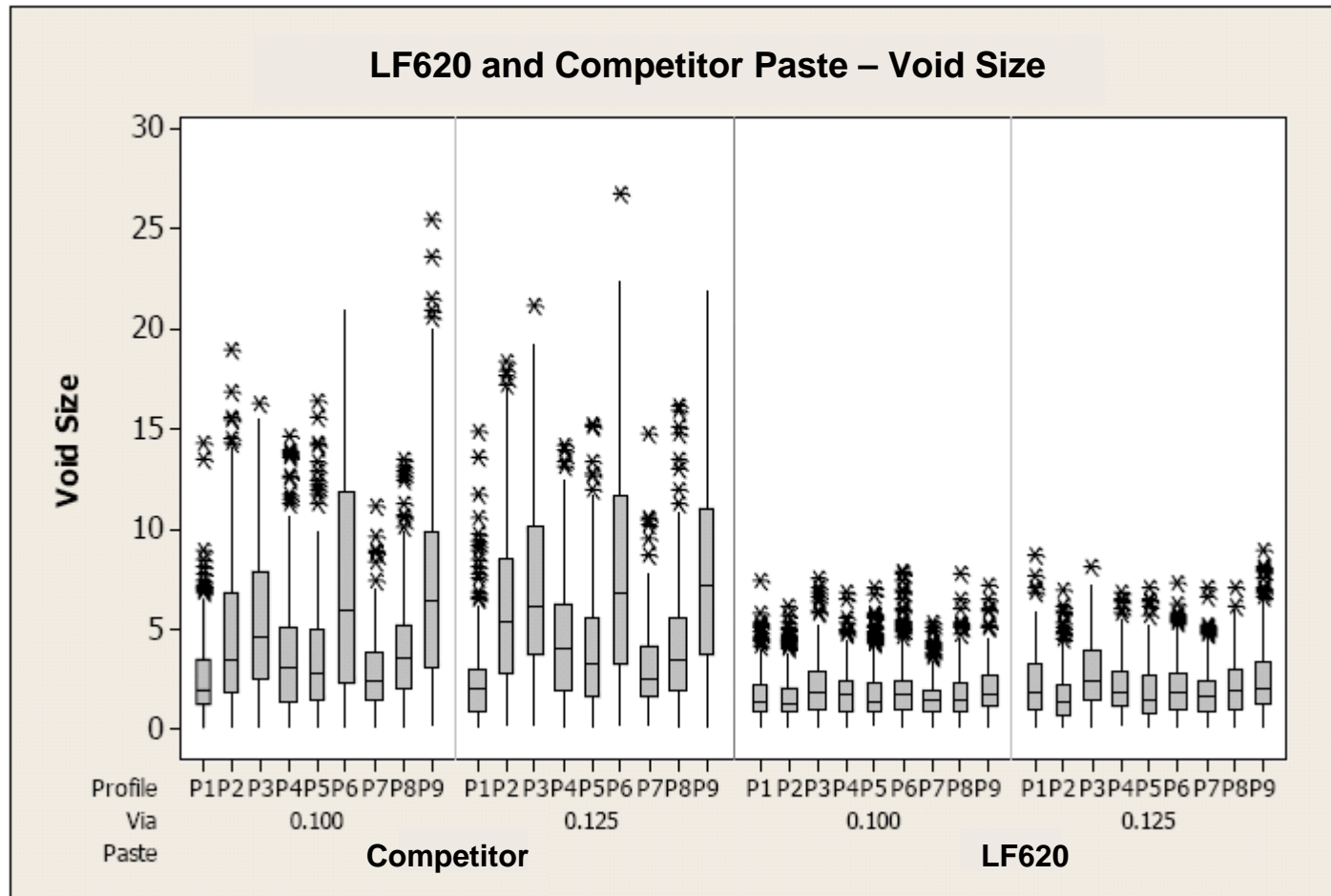
Voiding: Test conditions

- MPM Accela printer used to stencil print LF620 and a competitor's paste.
- Sixteen BGA components were placed on pads containing both 0.1 and 0.125 via sizes (eight components per via size).
- The populated boards were then reflowed using various reflow thermal profiles, which varied slightly in length and peak temp.
- Voiding underneath the BGA components was measured using an X-TEK Revolution X-ray machine.
- Record void size and percent data.



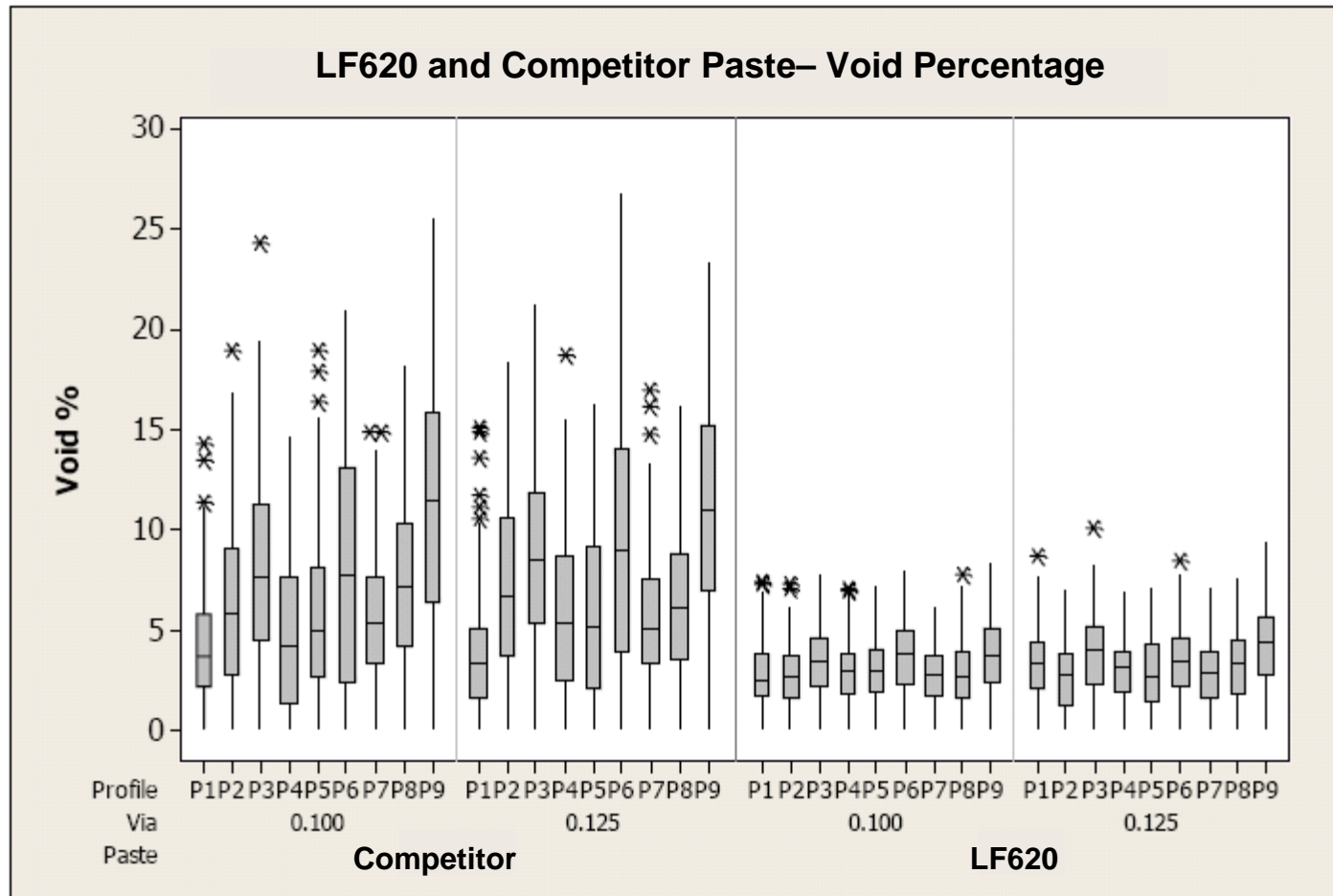
Operating Parameters

Voiding: Void Size Results



Operating Parameters

Voiding: Void Percent Results



Operating Parameters

Voiding: Conclusions

- The size of the via does not appear to have a significant effect on voiding.
- Boards reflowed using profiles with higher peak temperature (245°C) have a slightly higher percentage of voids and void size.
- LF620 shows significantly less voiding than the competitor's product after reflow through all of the indicated profiles.

Reliability and Spec Testing

Standard	Test	Result
ANSI/J-STD 004	Cu Corrosion	Pass
	Cu mirror	Pass
	Halides	Pass – Halide free
	SIR	Pass
Telcordia GR-78 CORE	Cu mirror	Pass
	Halides	Pass – Halide free
	SIR	Pass
	Electromigration	Pass

J-STD 004 designation: ROL0

LF620 Solderpaste: Performance Summary

- A wide print processing window, accommodating various print speeds and print parameters.
- Long printer abandon times for any equipment down time.
- Good slump resistance on fine pitch pads.
- High tack force to resist component movement during high speed placement.
- Excellent solderability over a wide range of reflow profiles in air and nitrogen.
- Wettability to a wide range of surface finishes including Ni/Au, Immersion Sn, Immersion Ag and OSP Copper.
- Low voiding in BGA joints.
- Additional product specific information may be obtained from the Technical Data Sheet.



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