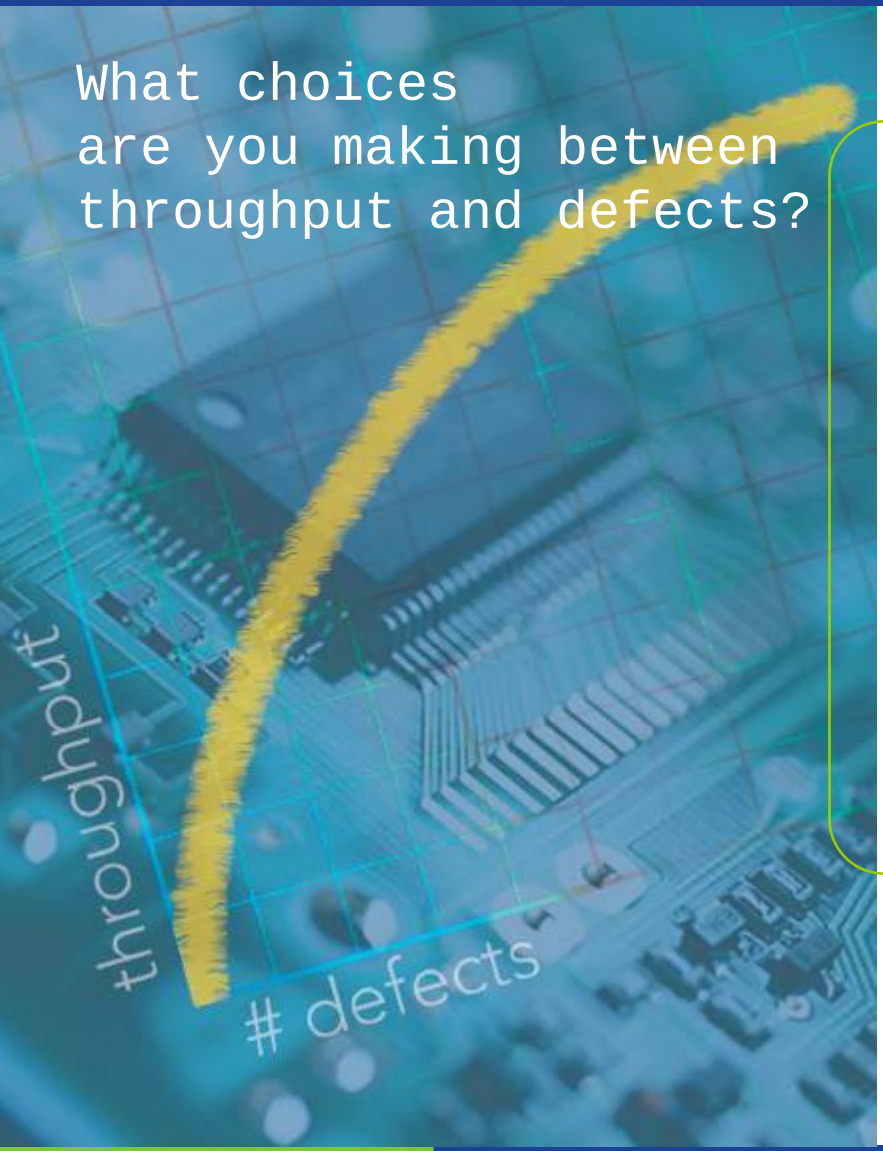

ALPHA® OM-350 Lead-Free Solder Paste

product guide

Cookson Electronics

How can solder paste positively affect your bottom line?

Reduced defects and customer complaints?

Higher first pass yields to increase your throughput and minimize rework costs?

Let’s have a conversation to see if OM-350 is the best choice for your surface mount process.

In today’s lean, competitive electronic assembly marketplace, isn’t it good to know that Alpha’s technical experts are there to help you make the best decision for your SMT application?

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Common Sources of Defects

Have you ever experienced any of these operational issues in your assembly process?

- Print Volume Repeatability over a wide range of print speeds?
- Poor wetting on OSP/copper pad finishes?
- Paste unable to withstand high soak reflow profiles?
- Paste dripping when used in paste in through hole applications?
- Passive component Tombstones?
- Mid-Chip Solder Balls?
- Cold Solder Joints with BGA Components?

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Consequences of Defects

- **Print Volume Repeatability over a wide range of print speeds?**
  - Inadequate solder paste volume leading to poor reliability and field failures
  - Excessive solder paste volume leading to bridging and electrical failures
- **Poor wetting on OSP/copper pad finishes?**
  - Weak solder joints, reduced drop shock resistance, increased warranty claims
- **Paste unable to withstand high soak reflow profiles?**
  - Cold solder joints with poor electrical and mechanical properties

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Consequences of Defects (cont.)

- **Paste dripping when used in paste in through hole applications?**
  - Increased costs from additional wave soldering step
  - Reduced joint reliability due to inadequate solder volume
- **Passive component Tombstones?**
  - Reduced daily throughput due to touch up and/or re-work
- **Mid-Chip Solder Balls?**
  - Reduced daily throughput due to touch up and/or re-work
- **Cold Solder Joints with BGA Components?**
  - Reduced daily throughput due to touch up and/or re-work
  - Field Electrical Failures if defect not detected during inspection

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Table of Contents

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1.2 Technical Performance Summary

ALPHA OM-350

Process Step	OM-350 Attributes	Performance Capability
Printing	Fine Feature Print Definition	Excellent print definition and consistant volumetric performance to 0.3mm (12 mil) circles and 0.4mm (16 mil) pitch rectangular QFP pads.
	Stencil Life	Excellent Print Volume Repeatability after 4 hours at 33% RH and 66% RH
	Print Consistancy	Repeatable volume deposition and low volume variability (Cp > 2.0) on 12 mil circles.
Print Cycle Time	Print Speed Range	25mm/second to 100mm/second (1 inch/second to 4 inches/second) down to 0.3mm (12 mil) circles across 0.10mm to 0.15mm (4 mil to 6 mil) thick stencils.
	Wet Bridging Resistance	Up to 5 prints per wipe at 0.4mm (16 mil) pitch with 0.125mm (5mil) thick stencil. > 20 prints/wipe at 0.5mm (20 mil) pitch with 0.125mm (5mil) thick stencil.
Reflow Yield	Vertical Wetting	Wetting force stability coefficient >0.95
	Resistance to Defects	Resists tombstones and mid-chip solder balls with 0.2 and 0.3mm print/placement shifts.
	Post Reflow Tackiness	Passes JIS Z 3197 Talc Test
	Flux Residue Cosmetics	No Observed Flux Burn on OSP Copper Finish
	Solder Spread	Full coverage of OSP coated pads after exposure to 2 previous reflow cycles. Reduced BGA Pillows after multiple reflow cycles.
	Random Solderballs	Passes IPC TM650 extended test from 4 hrs to 24 hrs
	Resistance to Voids	Exceeds requirements of IPC 7095 Class III for low voiding.
	Slump Resistance	Exceeds the requirements of IPC J-STD-005 and JIS-Z3284 for hot and cold slump.
Electrical Reliability	IPC SIR	Pass (7 days 85°C / 85%RH)
	Bellcore SIR	Pass (96 hours @ 35°C/85% RH)
	Bellcore Electromigration	Pass (500 hours @ 65°C/85% RH)
	JIS Electromigration	Pass (1000 hours @ 85°C/85% RH)
	HP Electromigration	Pass

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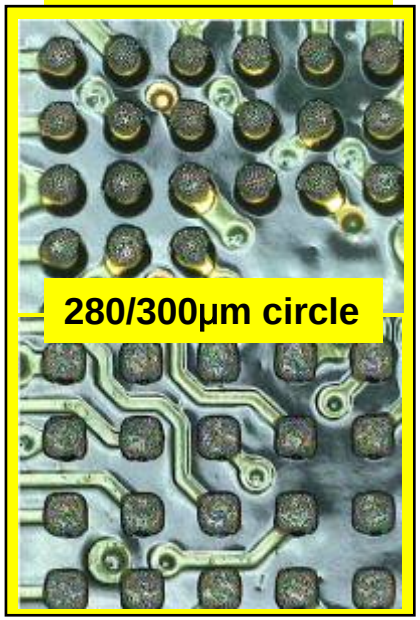
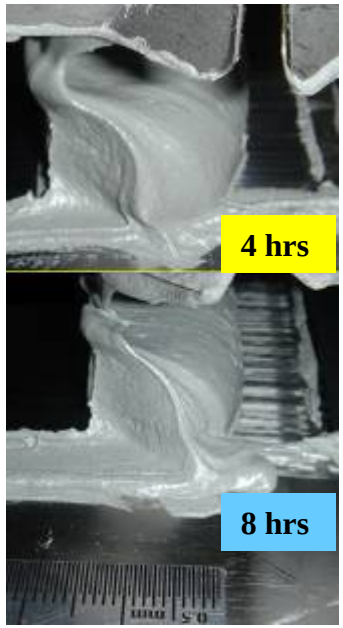
Long Stencil Life

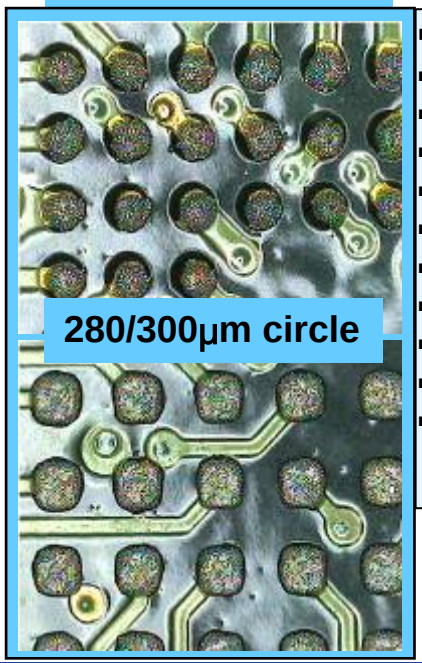
8 hours printing without replenishment

After 4 hours





After 8 hours



- Test Conditions:
- DEK 265 printer.
- 25 cm squeegee.
- 25 mm/sec speed.
- 0.3 to 8 mm separation speed.
- 0.1mm stencil thickness.
- 0.2 kg/cm pressure.
- 26-28°C/60-70% R.H.
- 3 prints per wipe.
- 26 seconds cycle time.
- Slow paste usage rate (only 50 board/hr=> paste is not continuously sheared).

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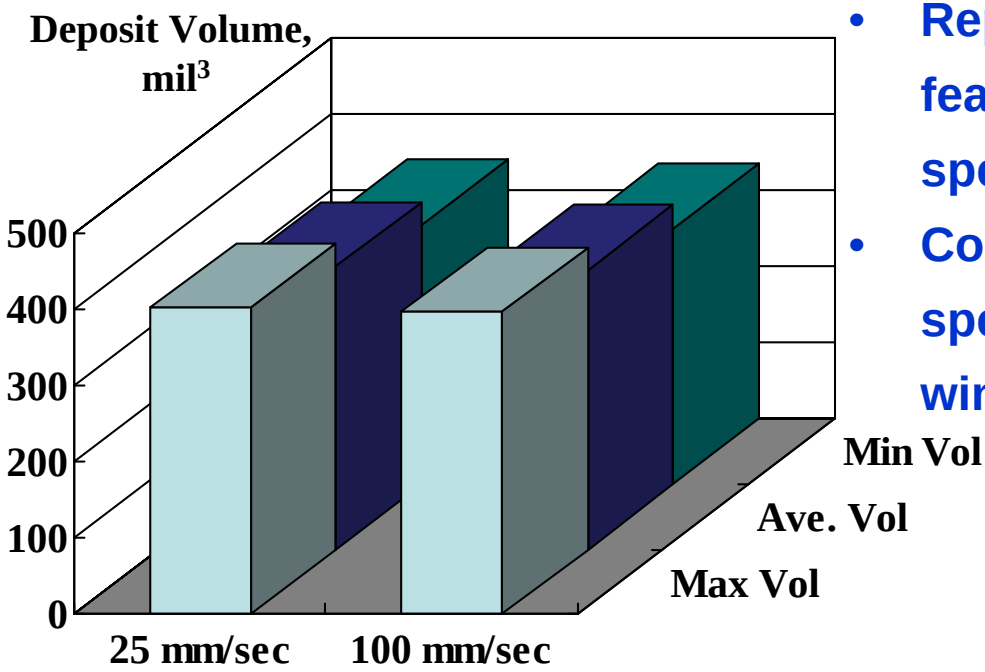
Deposit Volume vs Printing Speed (300µm circles)



Excellent Transfer Efficiency Processing Window

- Repeatable print deposit volumes of fine features (300 um circles) for print speeds between 25 and 100 mm/sec.
- Consistent transfer efficiency over print speed range indicates increased process window

Test Parameters

- Stencil Thickness: 0.1mm (4mil)
- Print Speed: 25 & 100 mm/sec (1 & 4 in/sec)
- Pressure: 0.22Kg/cm (1.25 lb/in)
- Separation speed: 5mm/sec (2"/sec)
- 45 printed each for low and hi printing speed.
- Average Deposit 380 mil^3.
  (Aperture volume = 452 mil^3).

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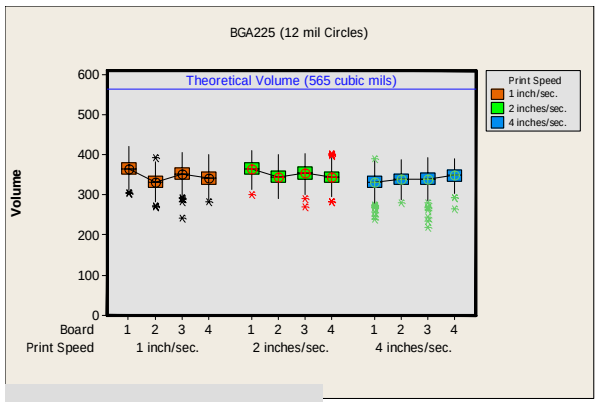
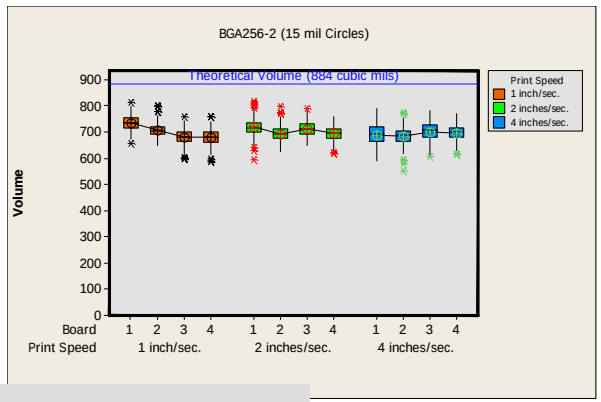
Print Capability

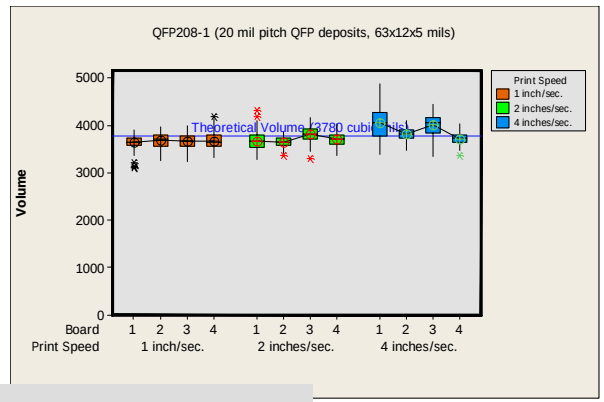
Reproducible paste deposit for various print speeds (25, 50, 100 mm/sec) at various aperture sizes



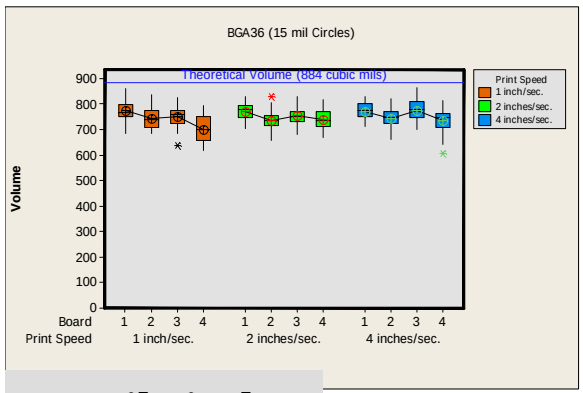
12 mil circle



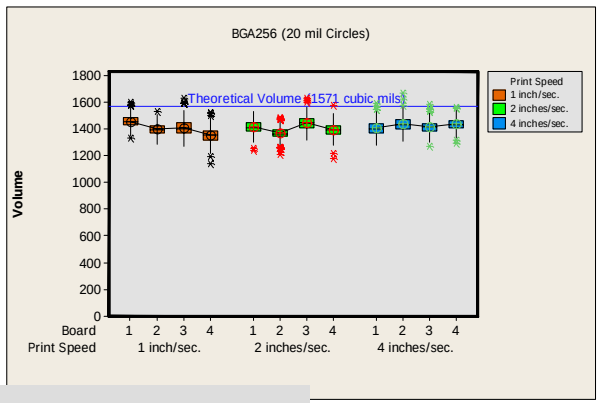
15 mil circle



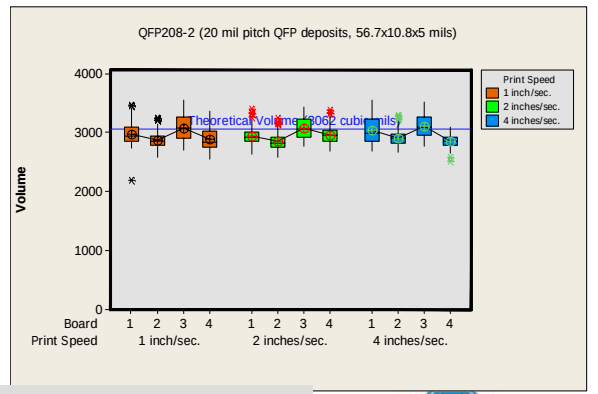
0.5mm QFP



15 mil circle



20 mil circle



0.5mm QFP

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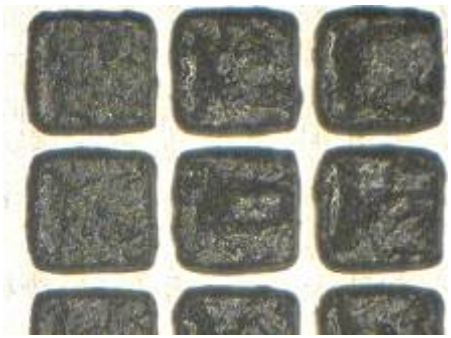
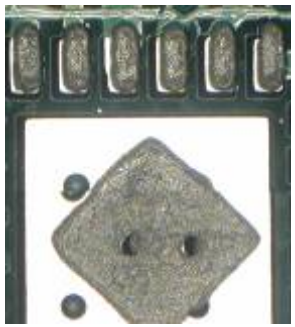
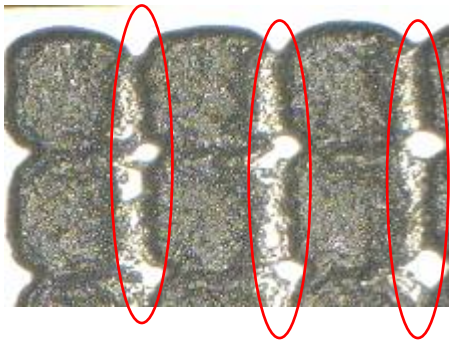
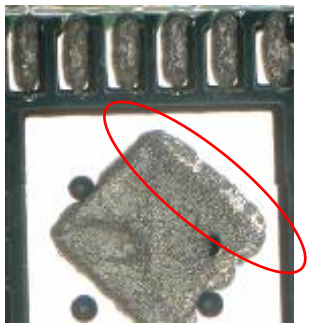
Print Capability

-Paste fill-in capability for large aperture
-100 mm/sec printing speed

	Large grounding pad	Heat sink Area
OM-350		
Competitive Product		

Enables Lower Defect Printing on Larger Features

- Printer: MPM 3000
- Stencil Thickness: 0.15 mm
- Pressure: 0.25 kg/cm
- Down-Stop: 2 mm
- Fast Separation

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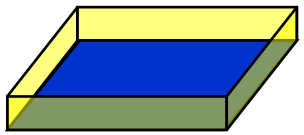
Basic Stencil Design Rules

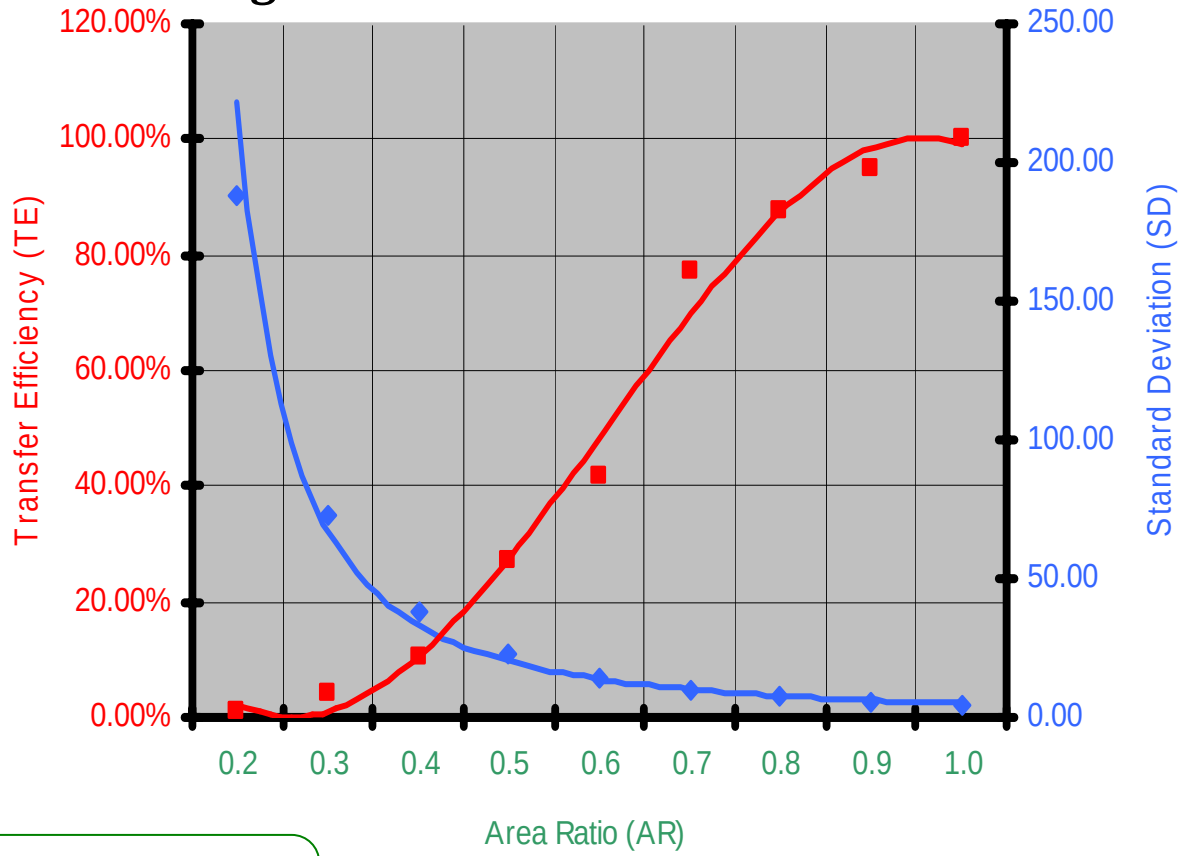
To Ensure High Yield Printing

$$\text{Area Ratio} = \frac{\text{Pad Area}}{\text{Wall Area}}$$

$$\text{Transfer Efficiency} = \frac{\text{Deposit Volume}}{\text{Aperture Volume}}$$



Recommended Area Ratio
> 0.66



**The higher the Area Ratio,
the higher the Transfer Efficiency,
the lower the Standard Deviation**

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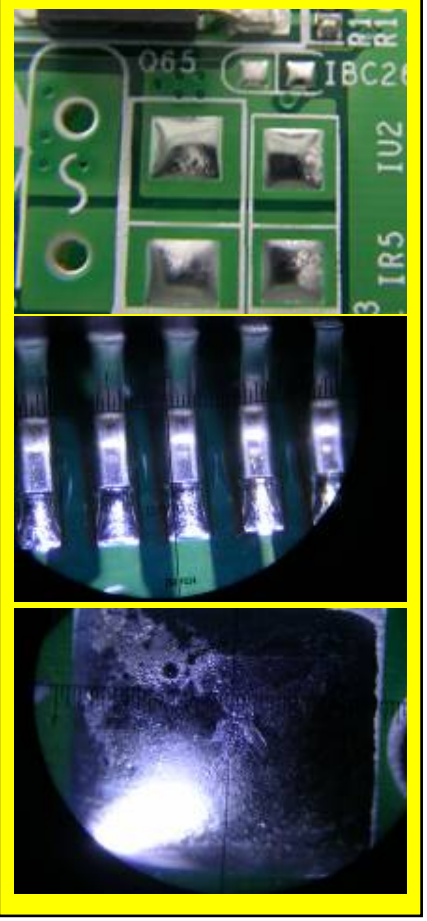
Summary

- OM-350 Reduced Defects
  - **Reduce Tombstoning**
  - **Eliminate Mid-Chip-Solder Ball**
  - **Prevent De-wetting**
  - **Prevent Head-on-Pillow (BGA cold solder)**
- Maximum Throughput and Yield
  - **Increased wetting speed**
  - **Wetting force stability at reflow temperature**
  - **Hot slump control**
  - **Optimal Paste Rheology**



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(Rhesca Solder Checker SAT5100)

Paste wetting characteristics:

T1: Time elapsed between "**wetting start B**" and time to achieve **2/3** of $\mathbf{F_{max}}$

T2: Time elapsed between "**wetting start B**" and time to achieve **86%** of $\mathbf{F_{max}}$

Wetting Stability (SB): Proportion of the **final wetting force (F_{end})** to F_{max}

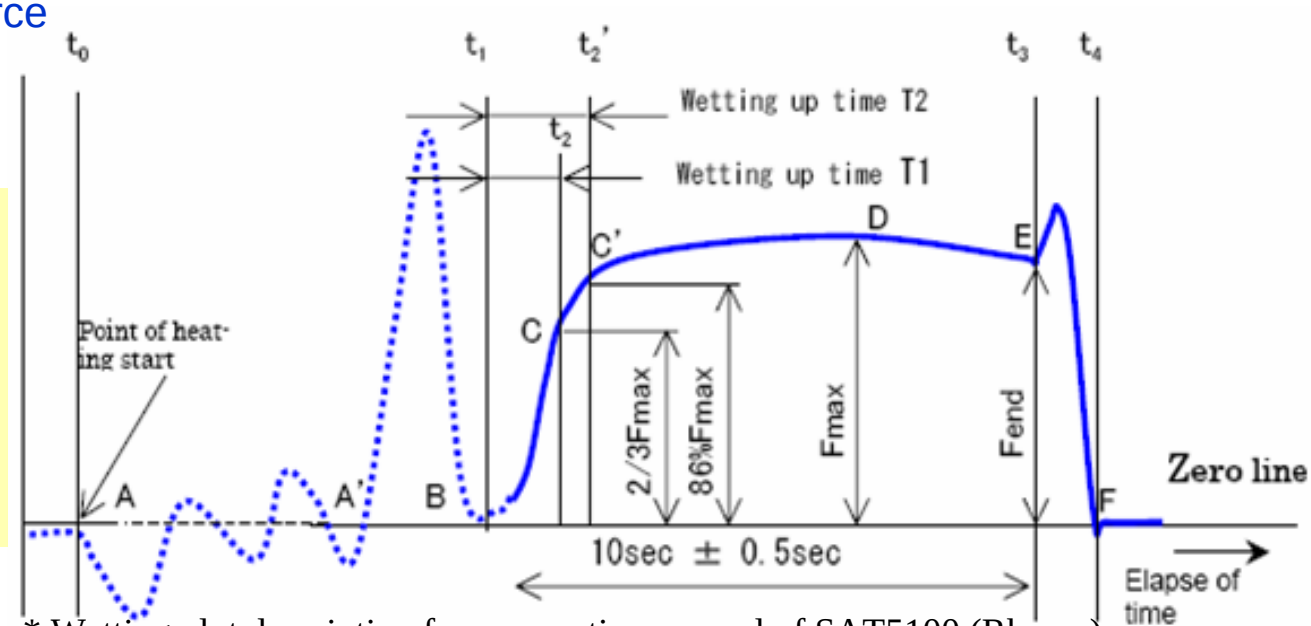
Fmax=> Max. wetting force

T1/T2=>

shorter for faster wetting.

SB=>

higher for stable wetting force (Max value = 1).



* Wetting plot description from operation manual of SAT5100 (Rhesca)

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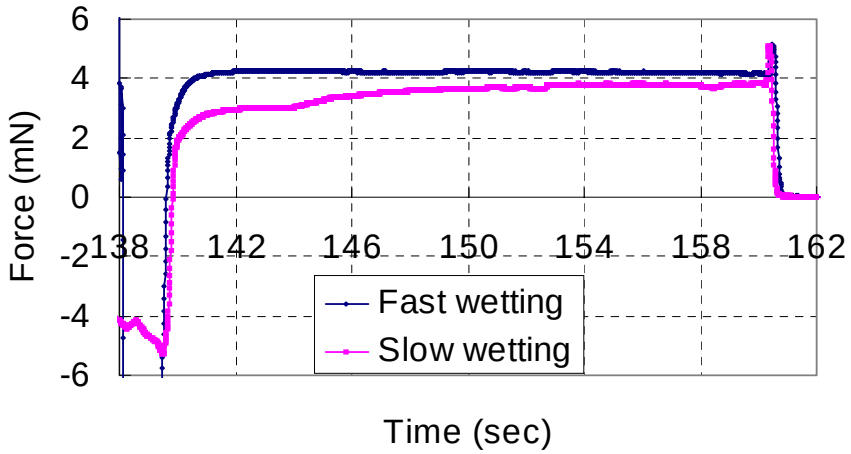
Wetting Speed

- Instrument: SAT5100 (Rhesca)
- Testing Condition
  - Ramp 25-150℃ at 3℃/s
  - Soak 150℃ 60 seconds
  - Copper board



	T1 (sec)	2/3Fmax (mN)	T2 (sec)	86%Fmax (mN)	Fmax (mN)	SB (Fend/Fmax)
OM-350	0.28	2.84	0.61	3.66	4.26	0.979
	0.29	2.92	0.55	3.79	4.38	0.986
Competitive Paste	0.76	2.43	3.07	3.13	3.64	0.948
	0.58	2.54	3.84	3.28	3.84	0.927

OM-350 exhibits shorter wetting time and higher wetting stability (SB).

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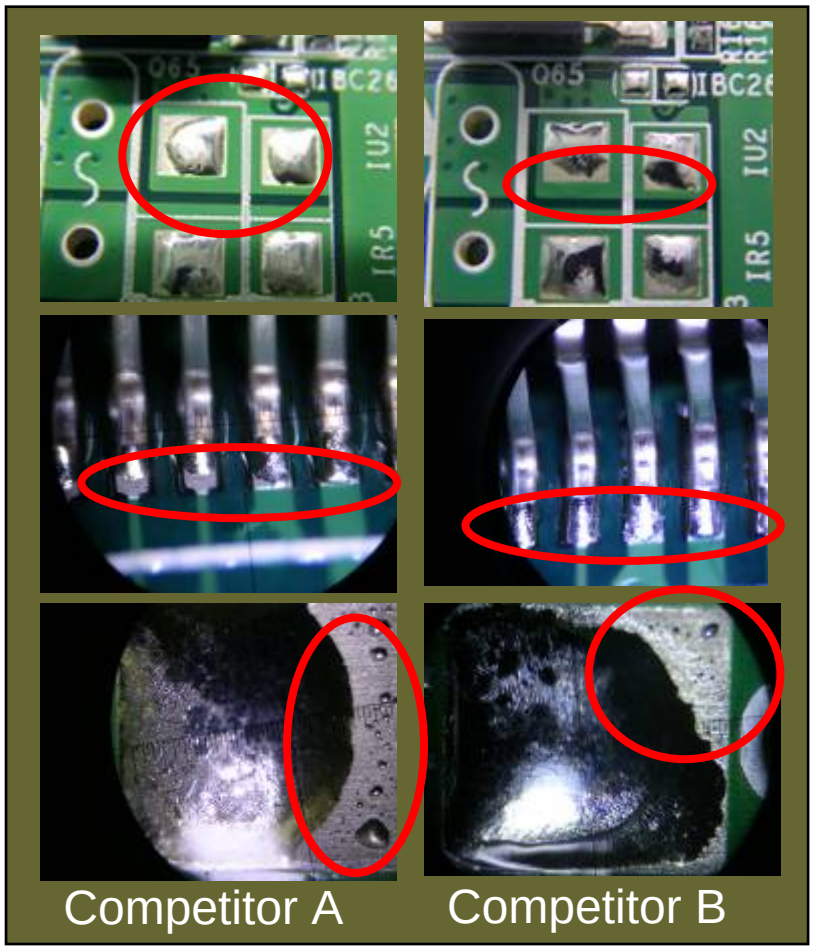
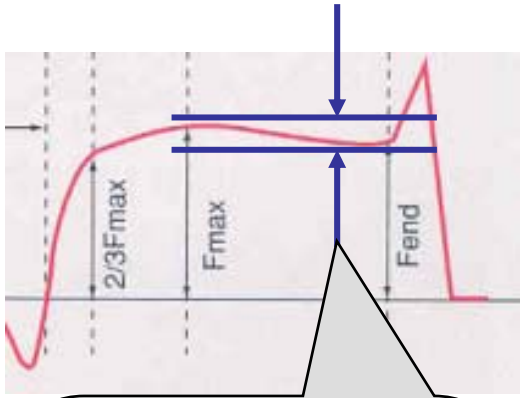
Wetting Force Stability (SB)

Competitive Pastes

SB<0.81 → Observed de-wetting



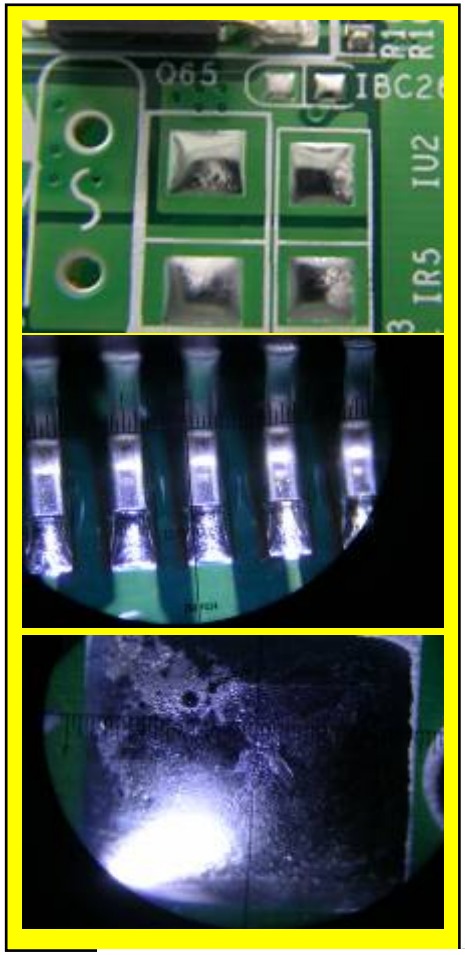


Greater decrease of wetting force = Lower SB.

Lower SB = lower QFP fillet height and increased de-wetting.

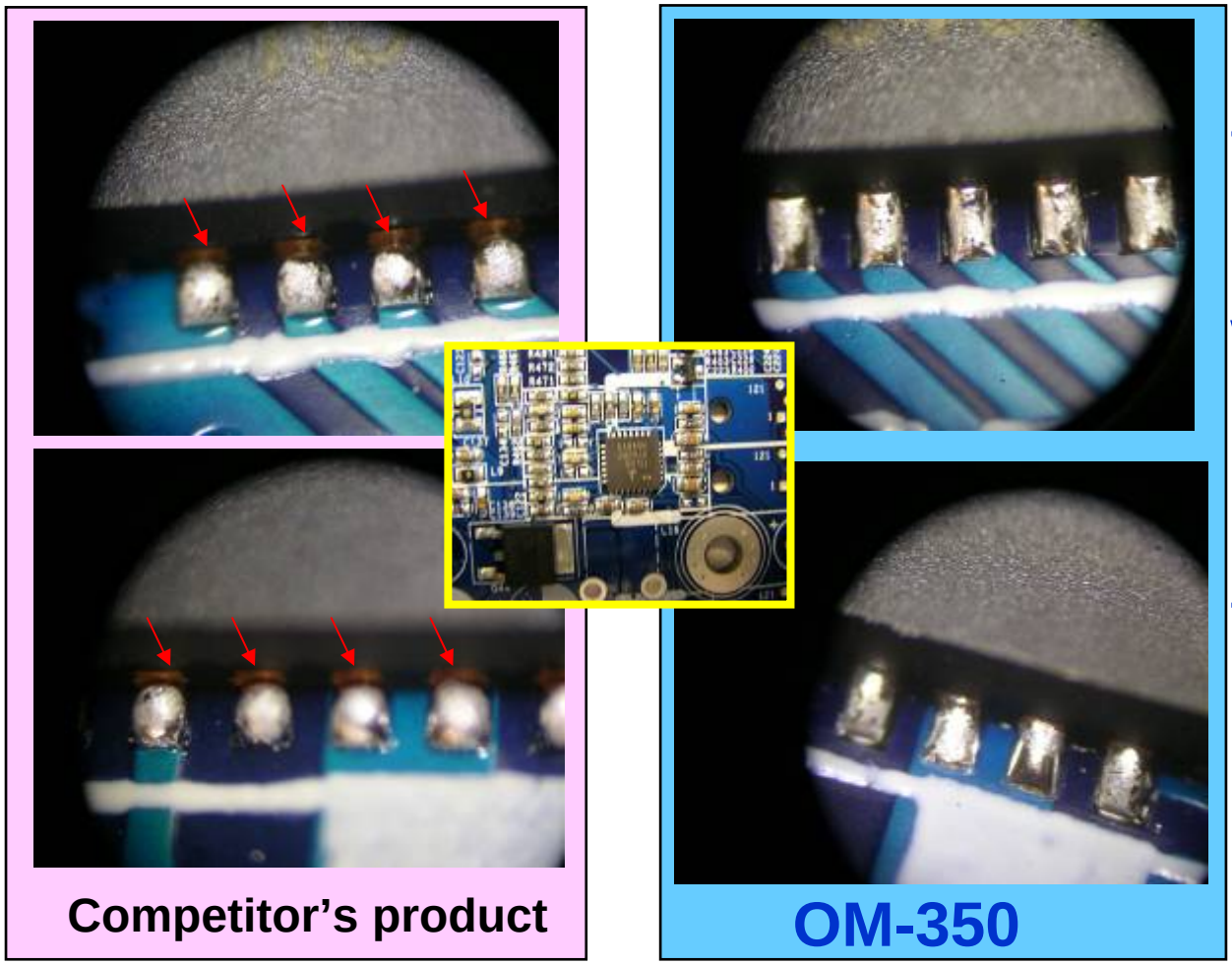
ALPHA OM-350

SB>0.95 → No de-wetting



Soldering Difficult Components

Superior Wetting Properties



Short wetting time (< 1 sec.) and Strong wetting force (SB >0.95) result in good fillet wetting.

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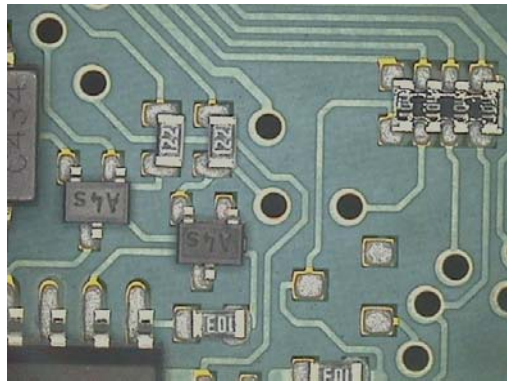
Reduce Tombstoning/MCSB Defects

ALPHA OM-350

Cause for these defects :

- Misalignment of the paste deposit or
- component placement.
- Slumping paste or too hard placement.
- Poor joint coalesce and slow wetting.
- Poor solderability of PWB pad or component
- surface.
- Powder quality & solder mask design.



- Activation system designed for high soak
- reflow compatibility and stable wetting force.
- Fast wetting and good coalesce.
- Design of thixotropic properties.
- Very low cold and hot slump.
- Ability to deal with low solderability surface.

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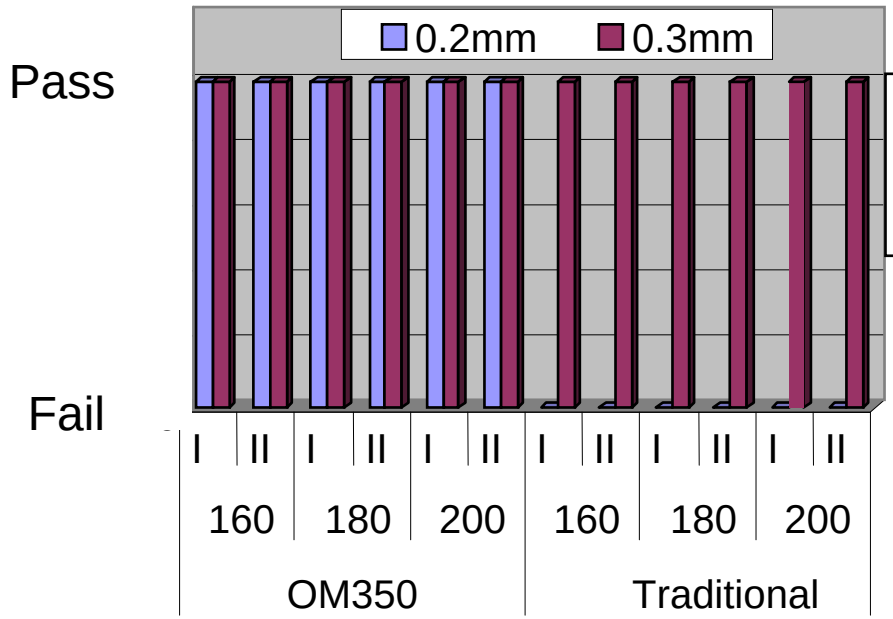
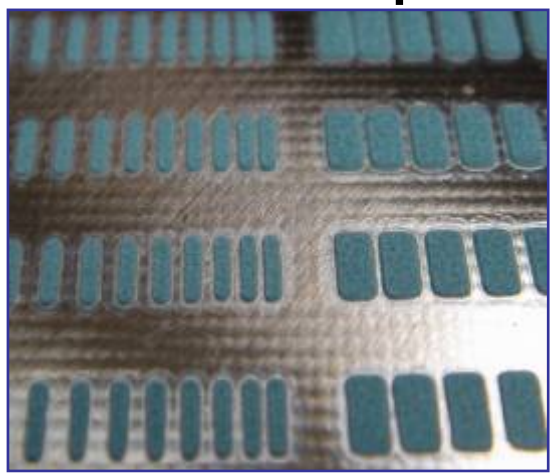
Excellent resistance to high temperature hot slump



Type I aperture, pass 0.2mm gap.

Type II aperture, pass 0.3mm gap.

200℃ Hot Slump Test



- Vehicle : 1.0mm T Copper surface multi-layer board
- Stencil ：150μm Thickness
- Aperture: Type I：3.0x0.7mm, Type II：3.0x1.5mm
- Heat applied ：Hot Plate 160℃, 180℃, and 200℃ for 60 seconds.
  (High temperature used for hot slump testes are relevant to soldering of Pb-free SAC alloys)

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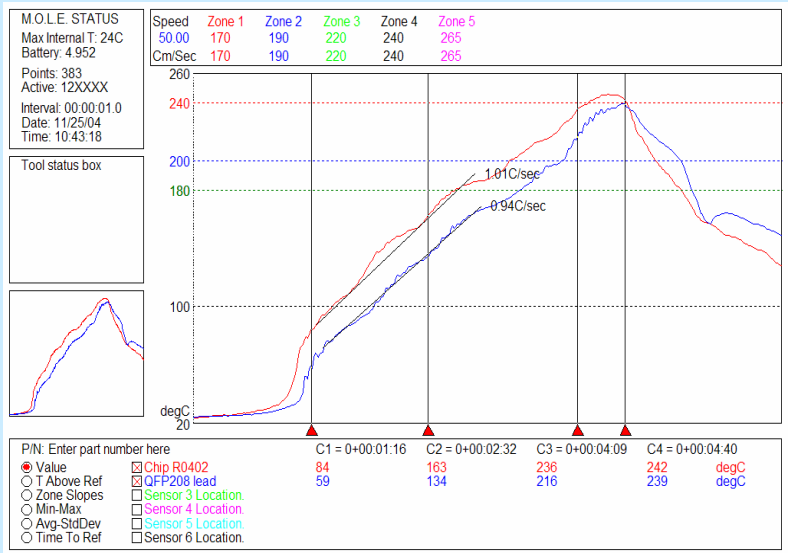
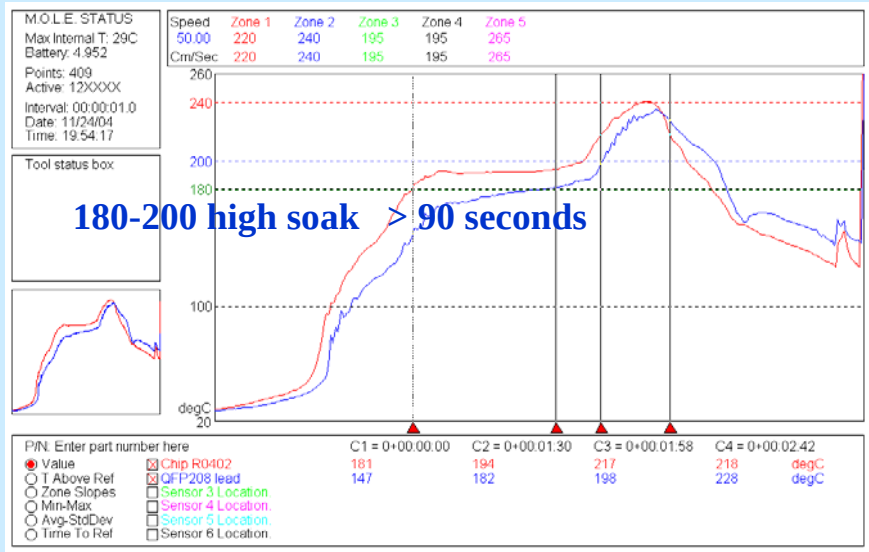
Straight Ramp and Soak Profiles

- Printer : MPM UP-3000
- Stencil : 130µm thickness, laser cut
- Chip components : **0402/ 0603/ 0805** inches **(1005/1608/2012 in mm)**
- Reflow profiles used:

Straight Ramp Profile



Soak Profile



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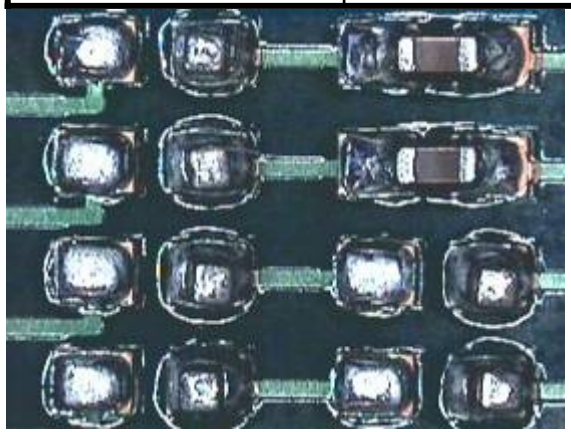
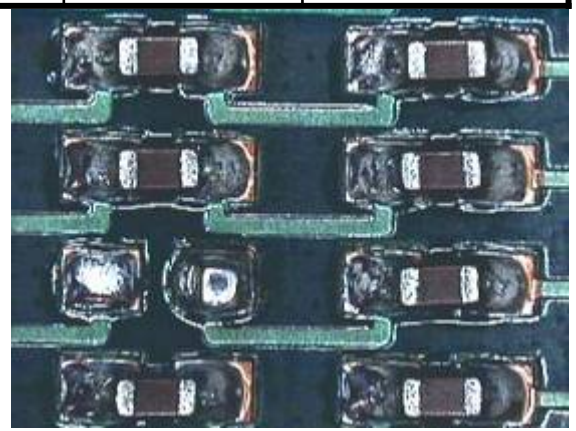
Anti-Tombstoning Performance

0402 Chip; Straight Ramp and Soak Reflow Profiles

Sample	Profile	Placement shift	Tombstones
Traditional paste	Straight Ramp	0.3mm	27
	Hi Soak	0.3mm	18
OM350	Straight Ramp	0.3mm	2
	Hi Soak	0.3mm	4



Competitive Paste



OM-350

75 % to 90% defect rate reduction with OM-350

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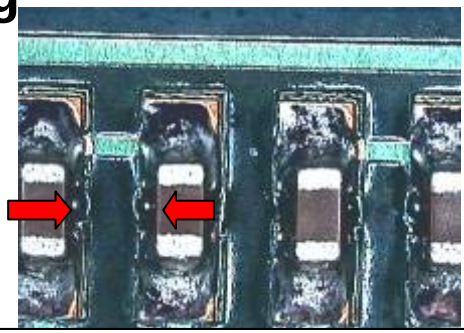
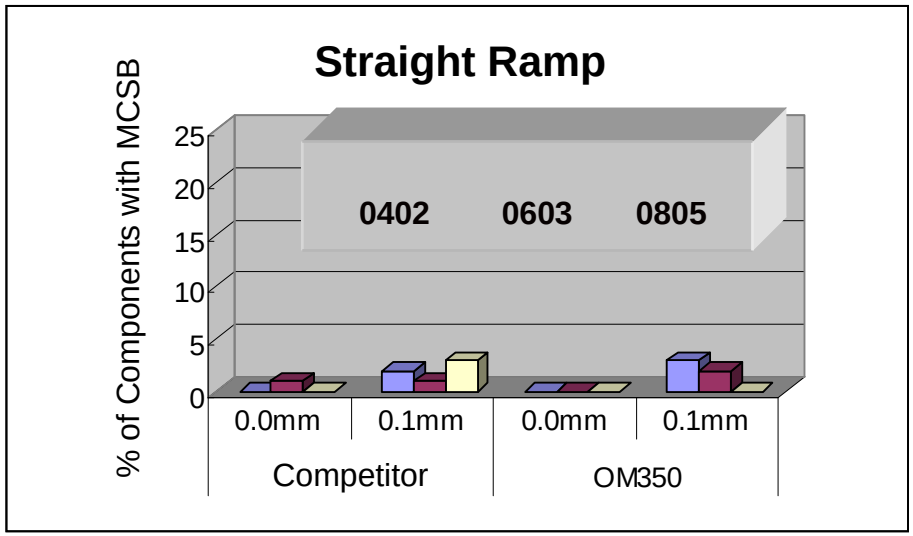
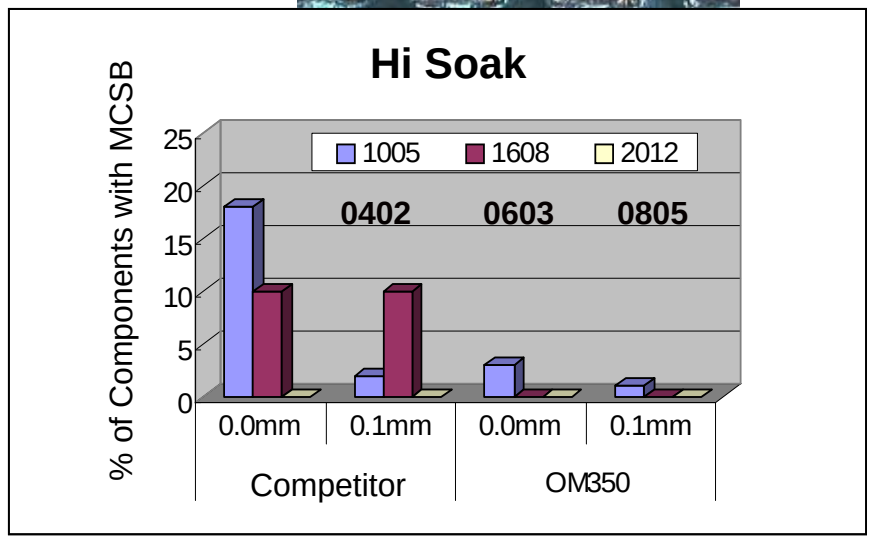
Mid-Chip Solder Ball Performance

Placement shift with Different profile setting

- **Placement Shift Definition:**
  0.0mm = No placement shift
  0.1mm = 0.1mm placement shift







OM-350 reduces MCSB defects. Effect magnified using high soak reflow profile.

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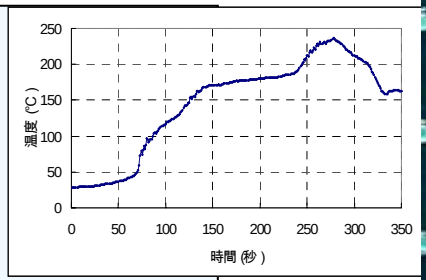
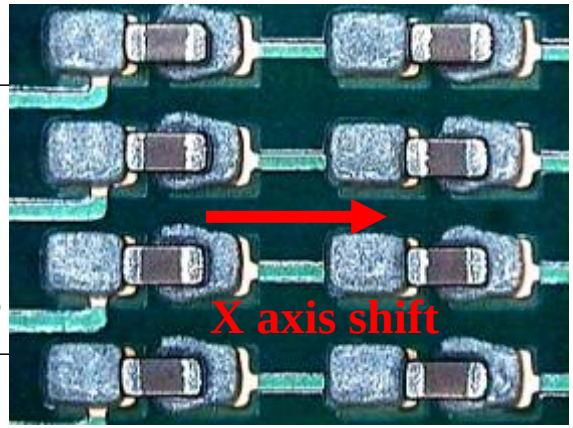
Tombstone & MCSB Evaluation

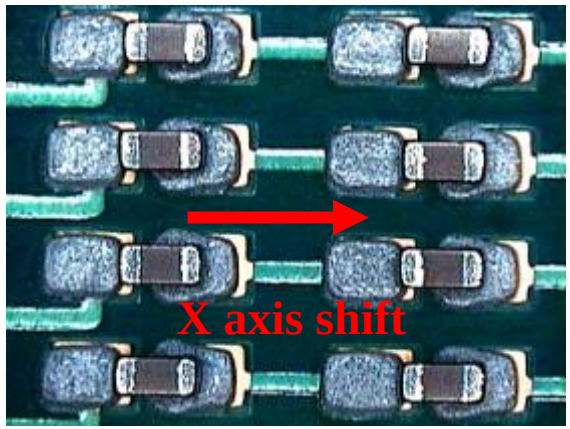
Using 0.2 & 0.3 mm Print Shift

- **Testing parameters**
  - MPM UP3000 printer
  - Printing Speed ：25mm/s
  - Separation speed ：0.5mm/s
  - Soak profile (see graph)
  - Thickness：100μm　Laser cut stencil
  - Printing Shift ：0.2mm, 0.3mm
  - Test Vehicle: Alpha CERF SMT board
- **Tombstoning**
  - **1005 (0402 mil) chip**
  - **X axis shift 40 pcs**
  - **Y axis shift 40 pcs**
- **MCSB**
  - **2125 (0805 mil) chip 100 pcs**
  - **1608 (0603 mil) chip 102 pcs**





0.3mm shift



0.2mm shift

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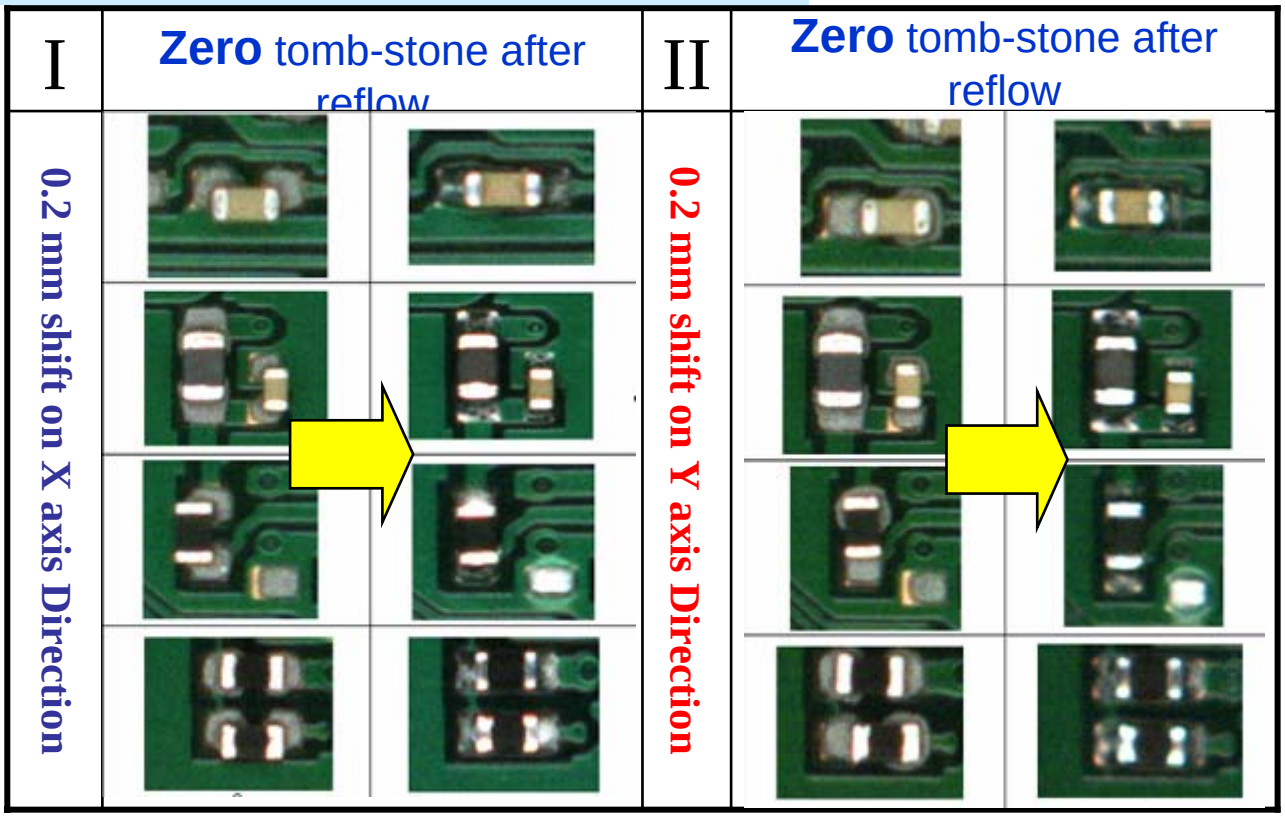
Anti-Tombstoning Performance

0402 chips; 0.2mm Placement Shift

- 0402 (inch) Resistors & Capacitors; 50 pcs each.
- 0.12 mm Thick Stencil ; 1:1 pad aperture design.
- N_2 reflow , Soak profile

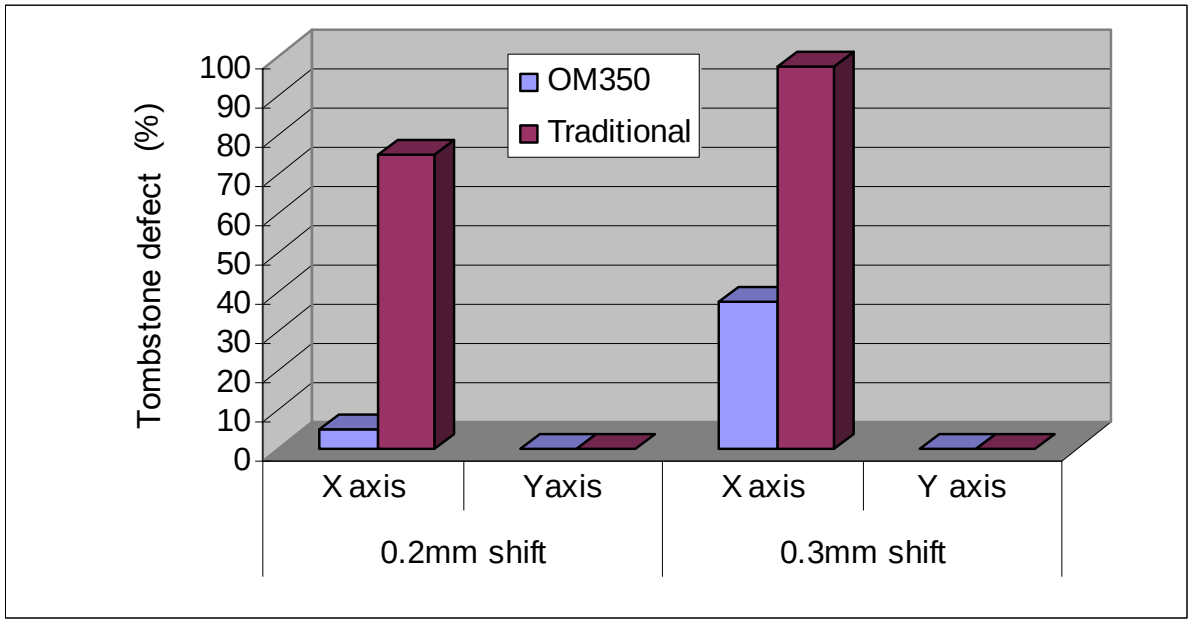
Zero defects for 0.2 mm placement shift

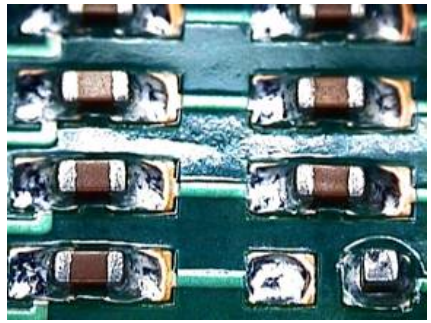


Cookson Electronics

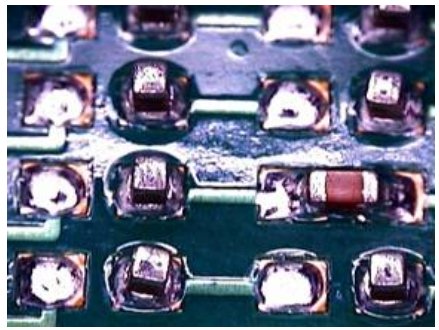
Tombstone Defect Reduction

0402 with 0.2mm & 0.3mm Printing shift





OM-350



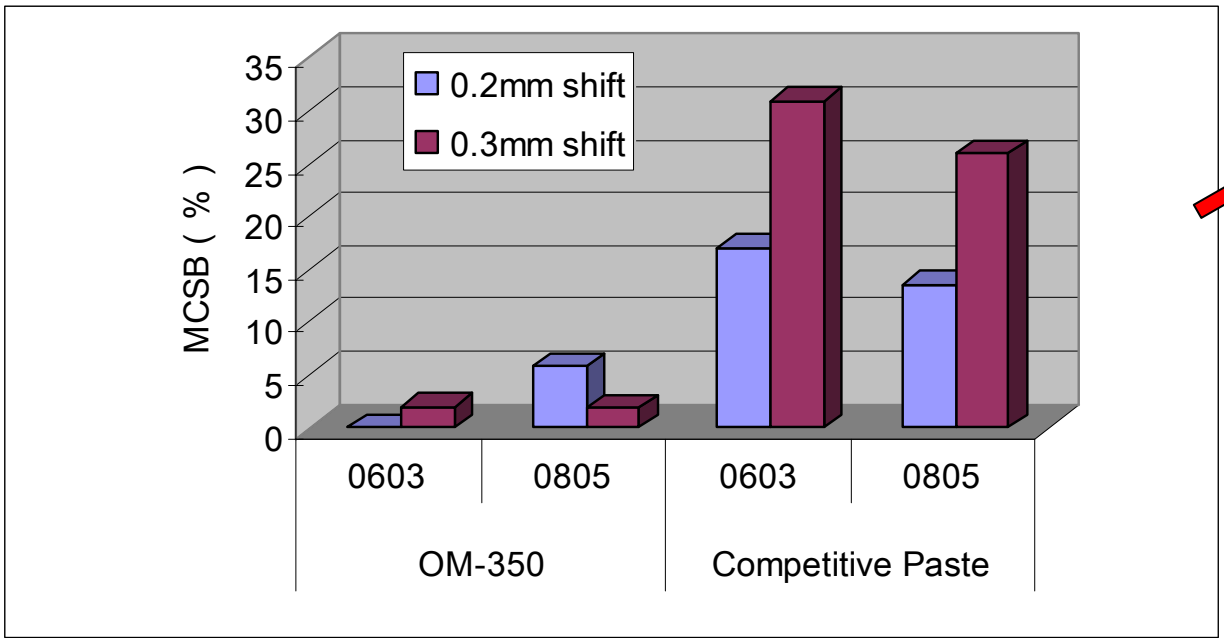
Traditional Paste

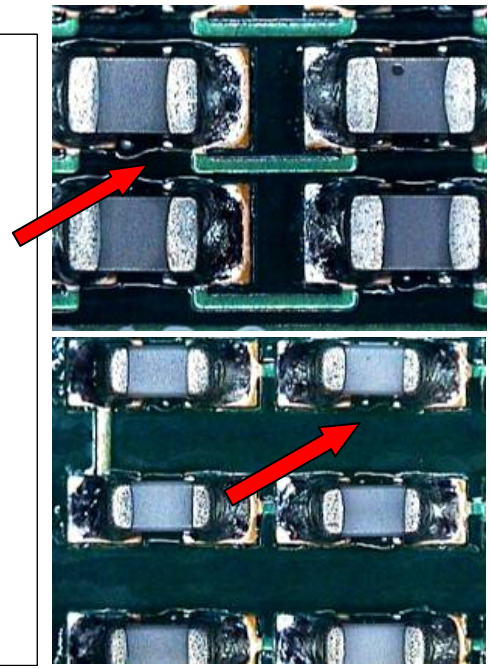
Wider Pick and Place Window Reduces Defects

Cookson Electronics

MCSB Performance

Printing shift for 0603/0805 chips



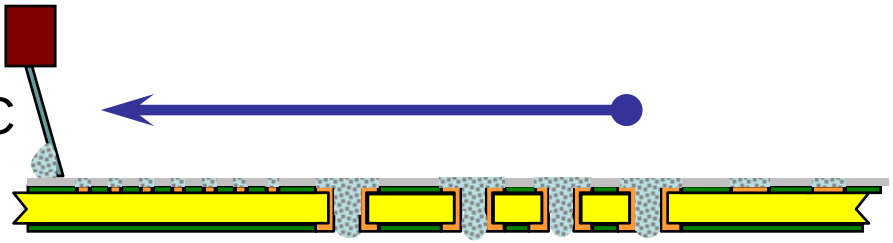


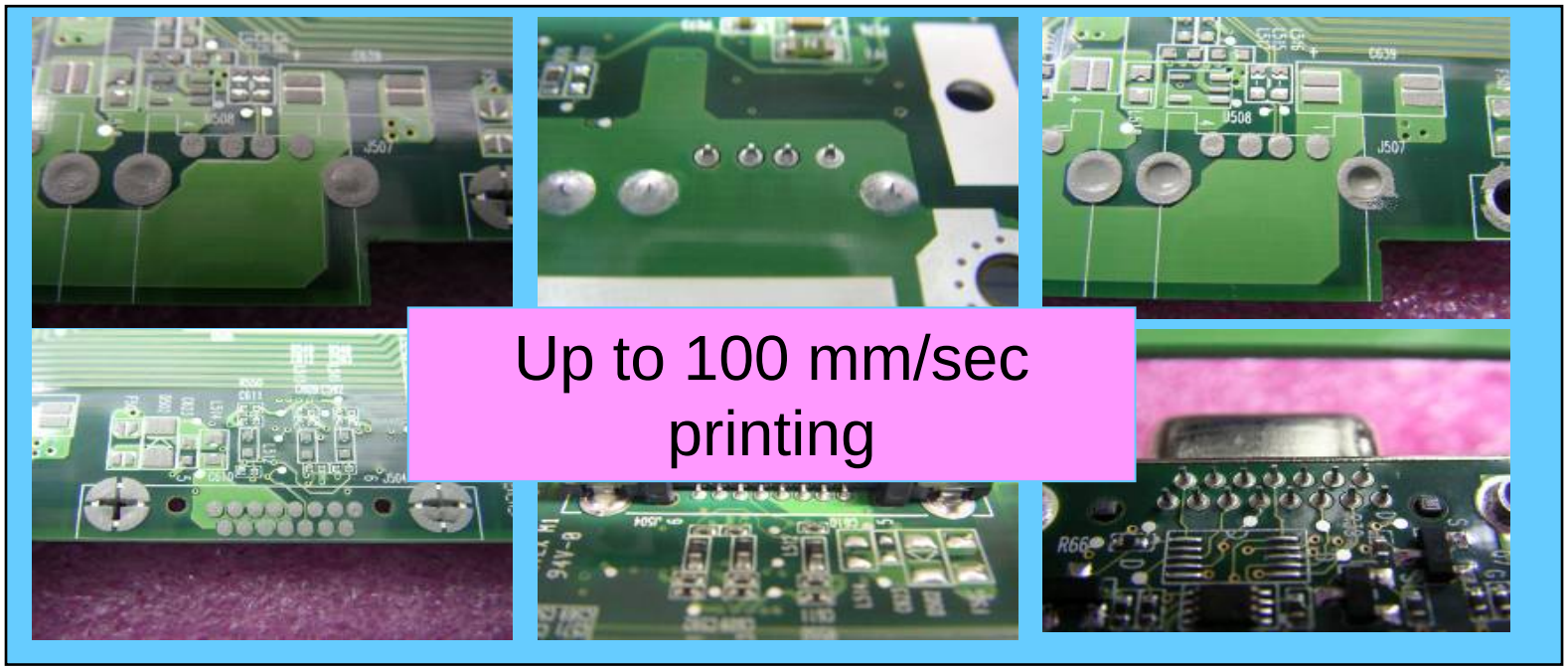
Reduced MCSB defects, even with stencil shift that allows paste to print on solder mask.

Cookson Electronics

Paste-in-Hole Performance

Edge side connector: Notebook PC





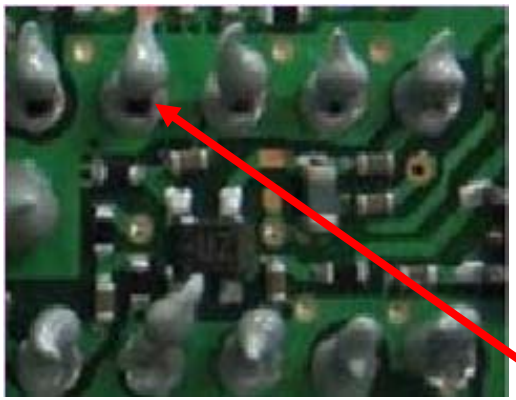
Up to 100 mm/sec printing

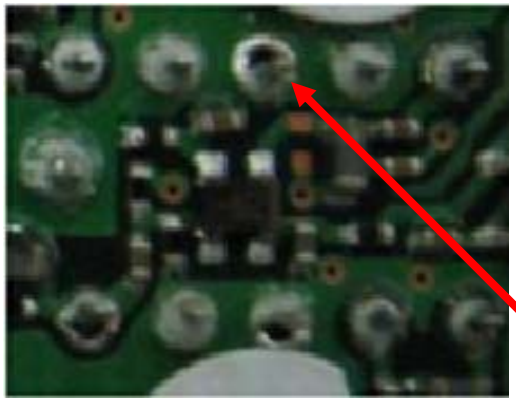
Full fusion and hole fillets with dual side reflow

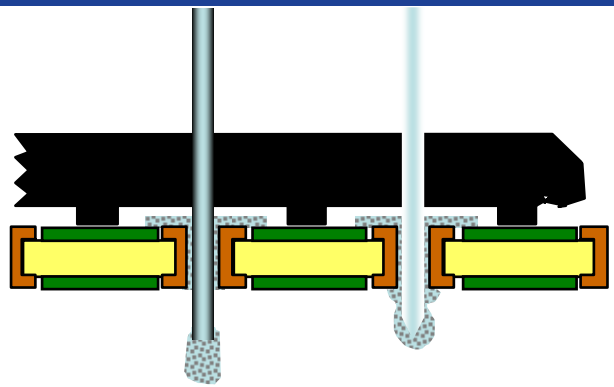
Cookson Electronics

Pin-in-Paste Application
Television Tuner Board

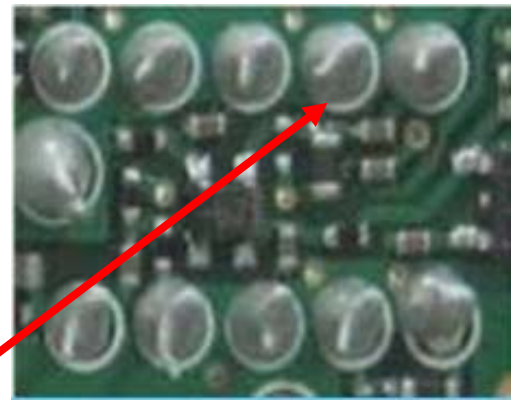
Competitive Paste

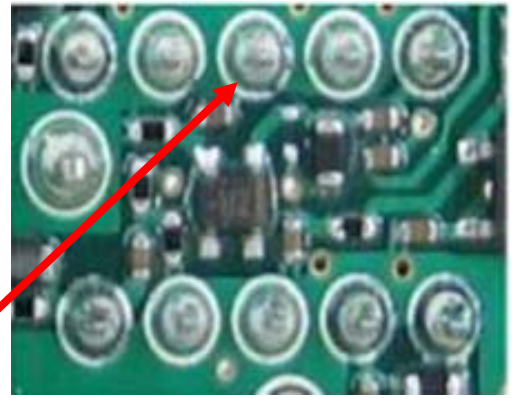






OM-350



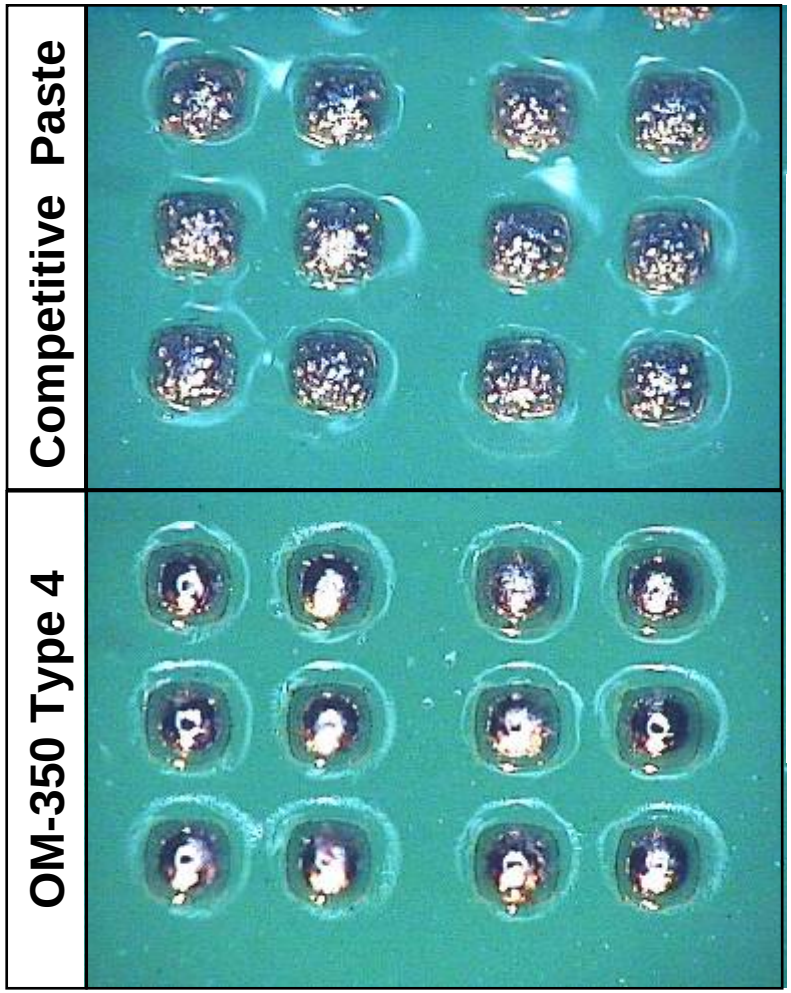


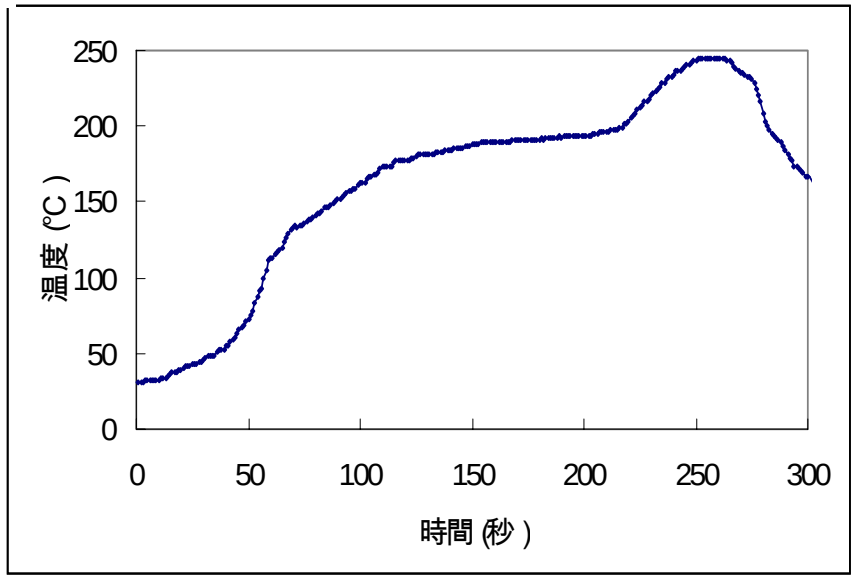
- OM-350 Paste not displaced during component insertion.
- After reflow, full solder fillets with no bridging.

Cookson Electronics

Fine Feature Coalescence

100 µm stencil; 200 µm circles



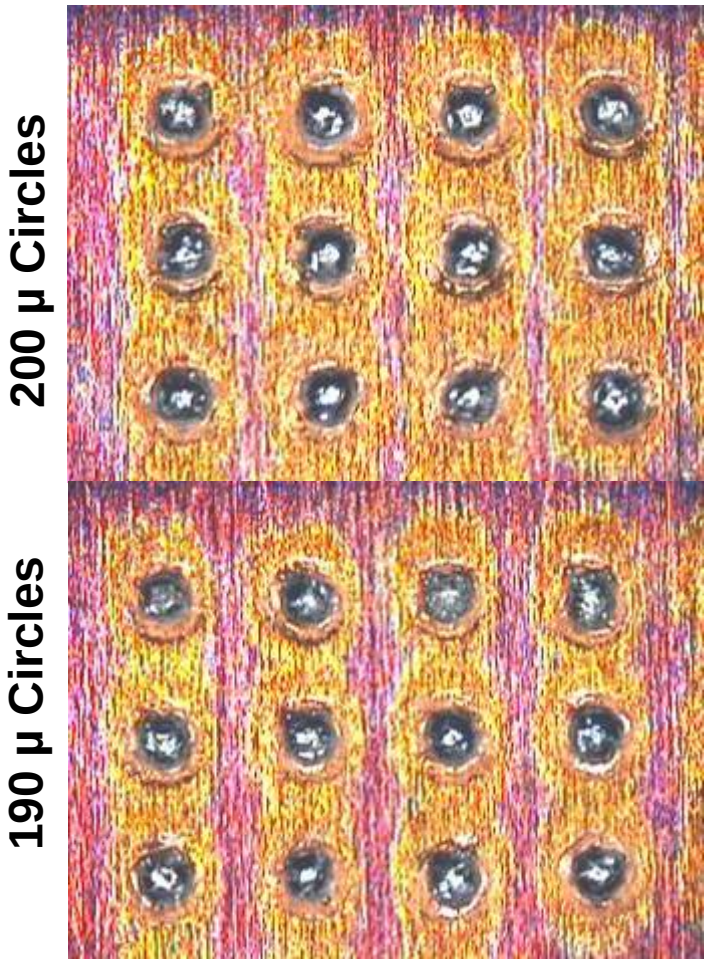


High Soak Reflow Profile

Cookson Electronics

Fine Feature Coalescence

80 µm stencil; 0.7C ramp

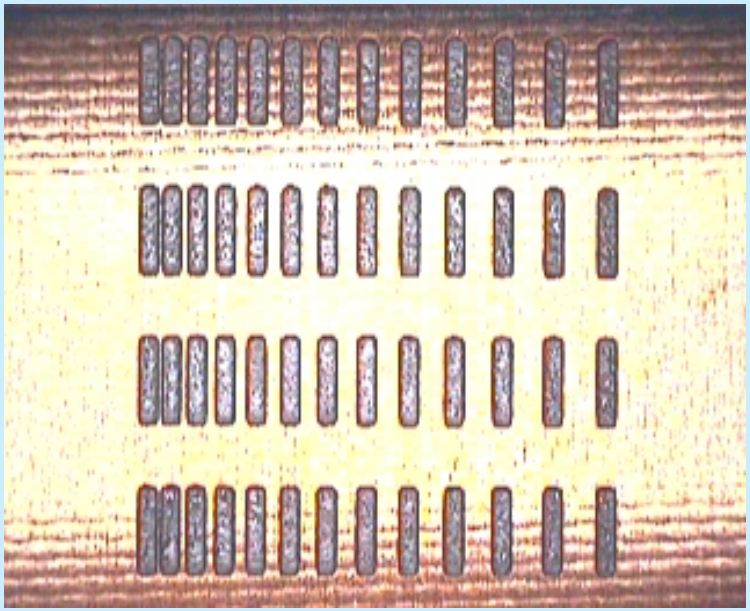


OM-350 paste achieves full coalescence under air reflow with either a high soak or long straight ramp profile, making it ideal for CSP component reflow applications.

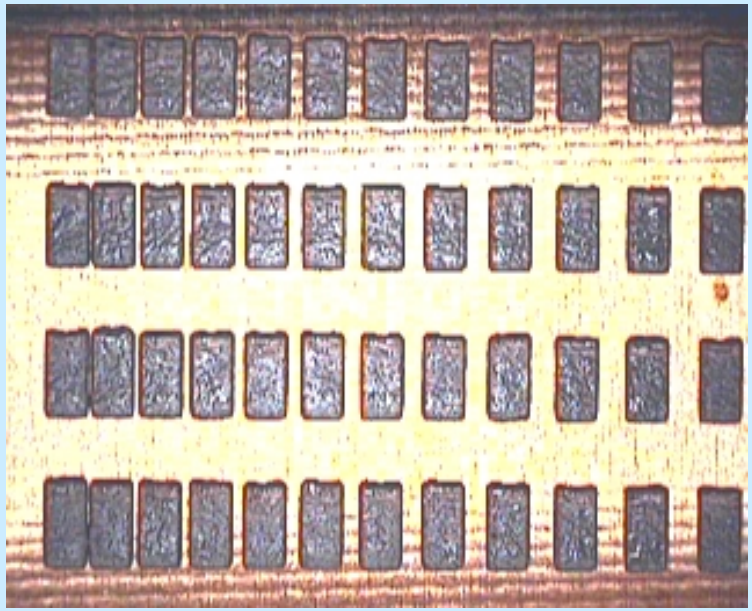
Cookson Electronics

Cold Slump Resistance

JIS-Z3284



0.2mm Pass

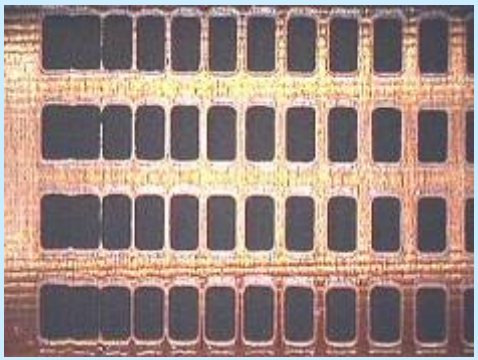


0.2mm Pass

Cookson Electronics

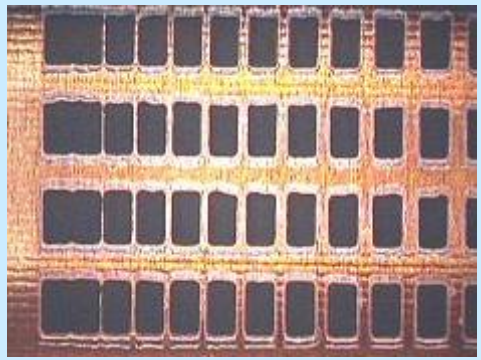
Hot Slump Resistance

- **Stencil : 200µ Thick**
- **Test : Hot plate 150°, 180° and 200°C for 60 seconds**
- **Modified JIS hot slump test to simulate most critical high soak profile.**



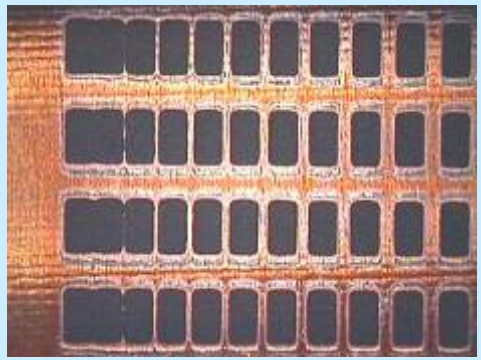
0.3mm Pass

150°C



0.2mm Pass

180°C



0.3mm Pass

200°C

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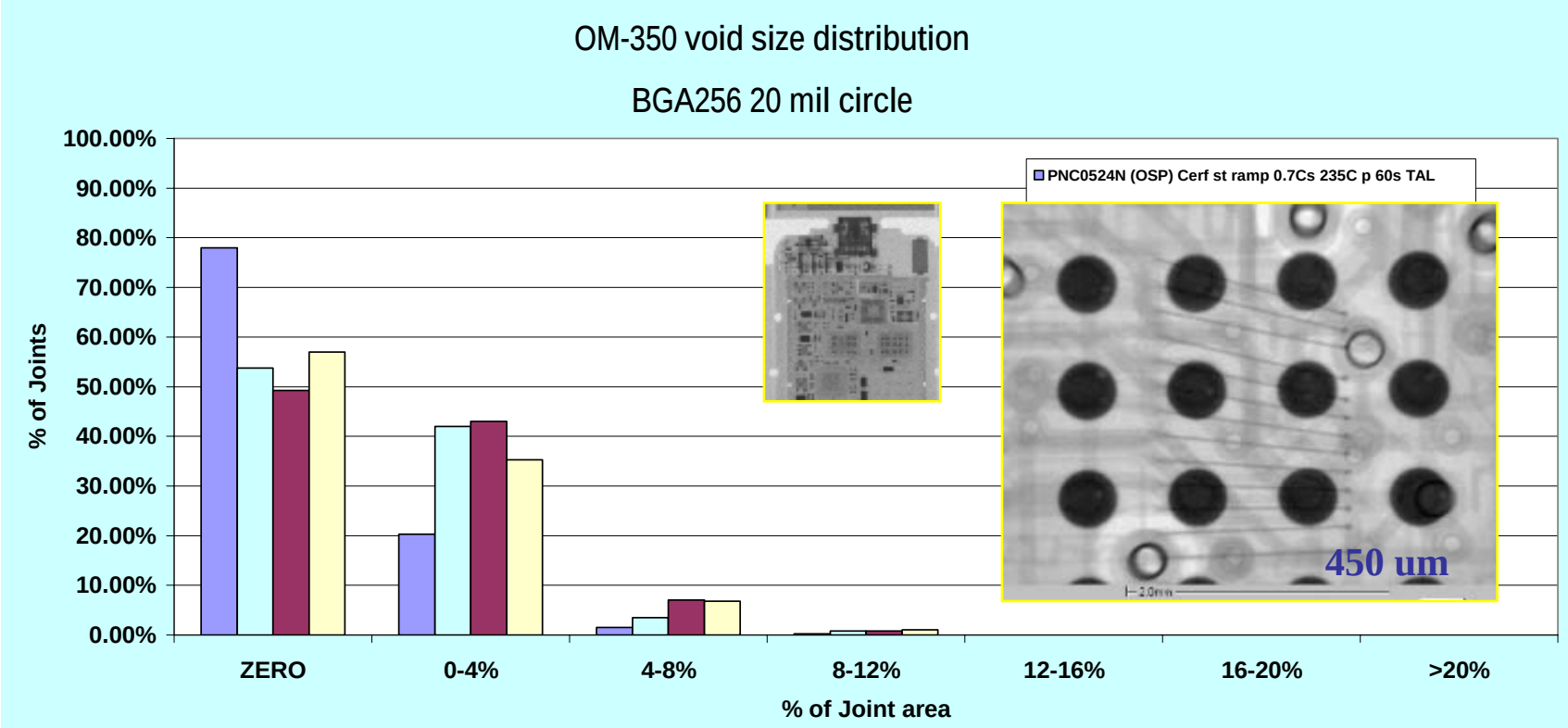
Voiding Resistance

Meets IPC-7095 Class III Using:

OSP or ENIG Finishes; Straight Ramp or Soak Reflow Profiles



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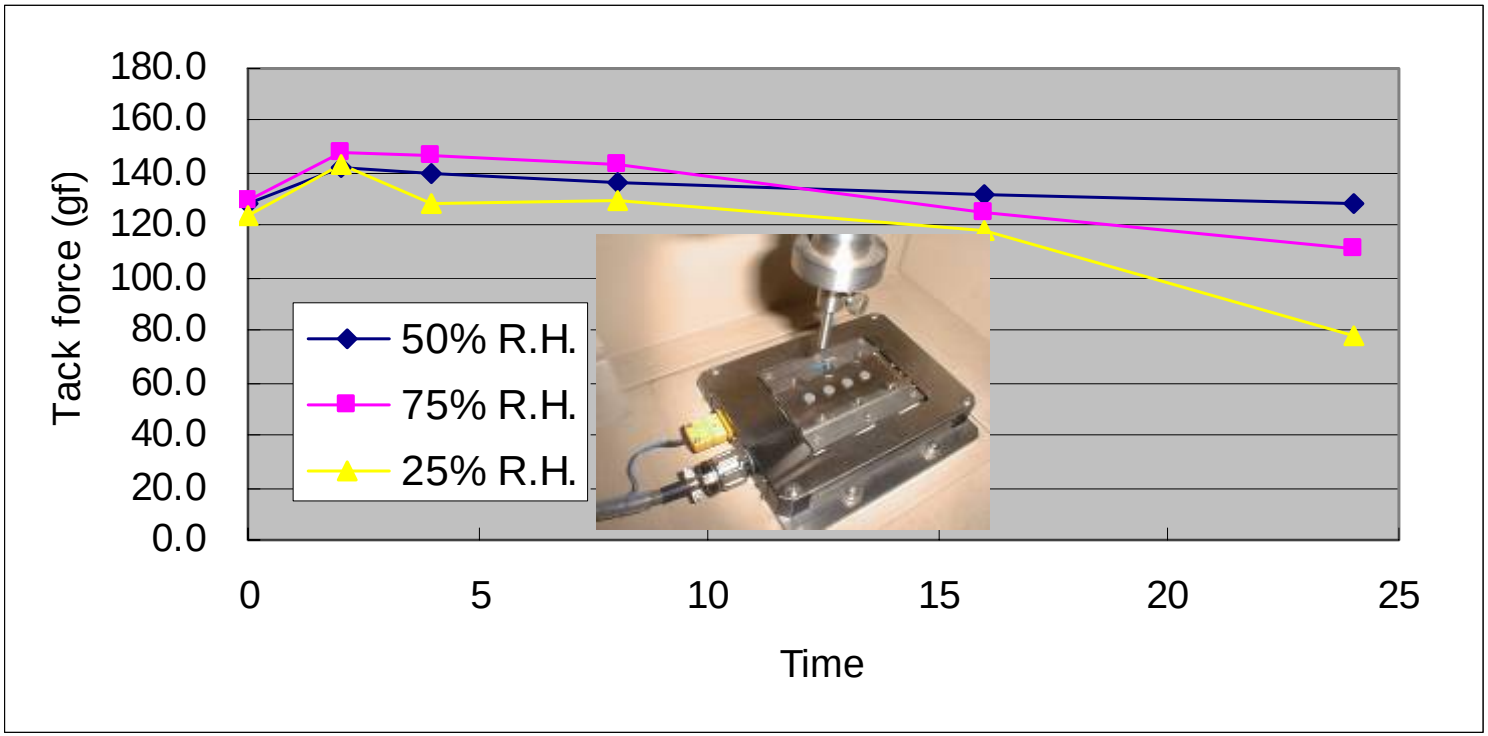
Tack Force

JIS 3284, 25deg C, 25/50/75%RH



Tack force >100 gf for 16 hours for all conditions.
24 hours tack life at 50% and 75% R.H.

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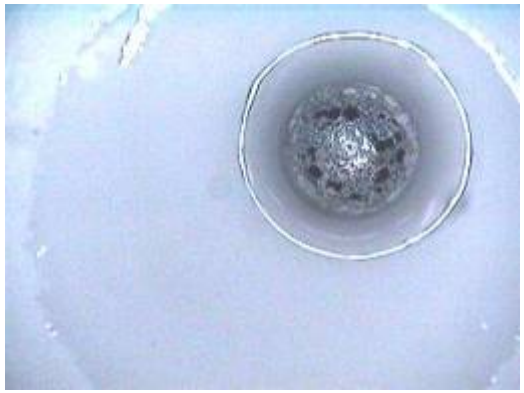
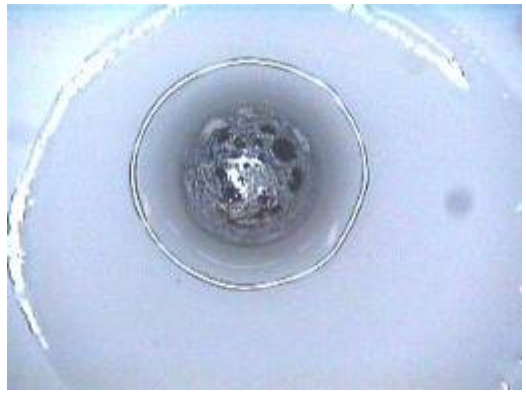
Solder Ball Test

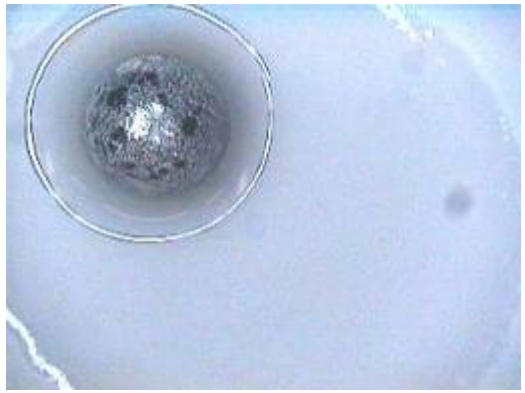
IPC TM650 extended test from 4 hrs to 24 hrs



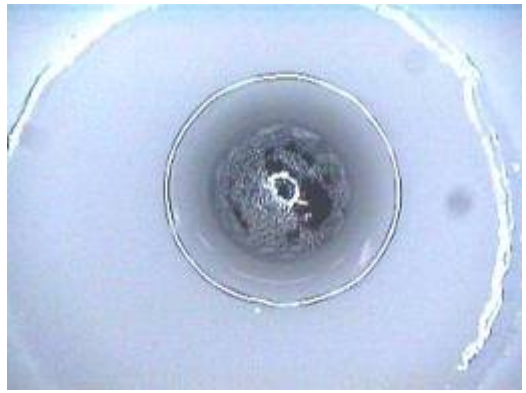
Initial



20%RH for 24hours



50%RH for 24hours



70%RH for 24hours

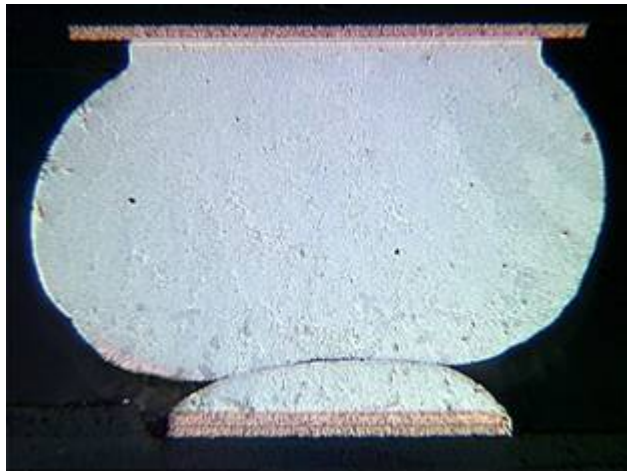
- Reflow : 170degC 1min – 245degC 5sec
- Storage temp : 22-25degC

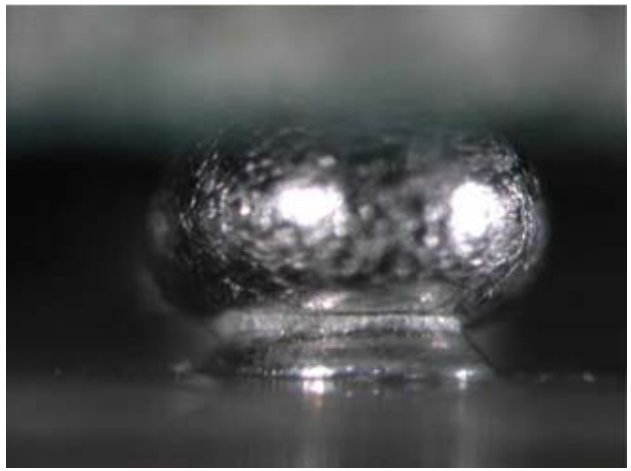
Cookson Electronics

Solving Head-on-Pillow
(BGA cold solder)

Cause for this defect :

- Thick oxide layer on Sphere/ball surface.
- Insufficient flux capability using high soak reflow profile
- Poor coalescence between paste and sphere.
- Contamination on PWB surface finish.





- Activator system designed for high soak reflow
- and strong wetting force.
- Fast wetting paste.
- Flux residue spreading pattern.
- Paste flux capable of removing surface finish
- contamination.

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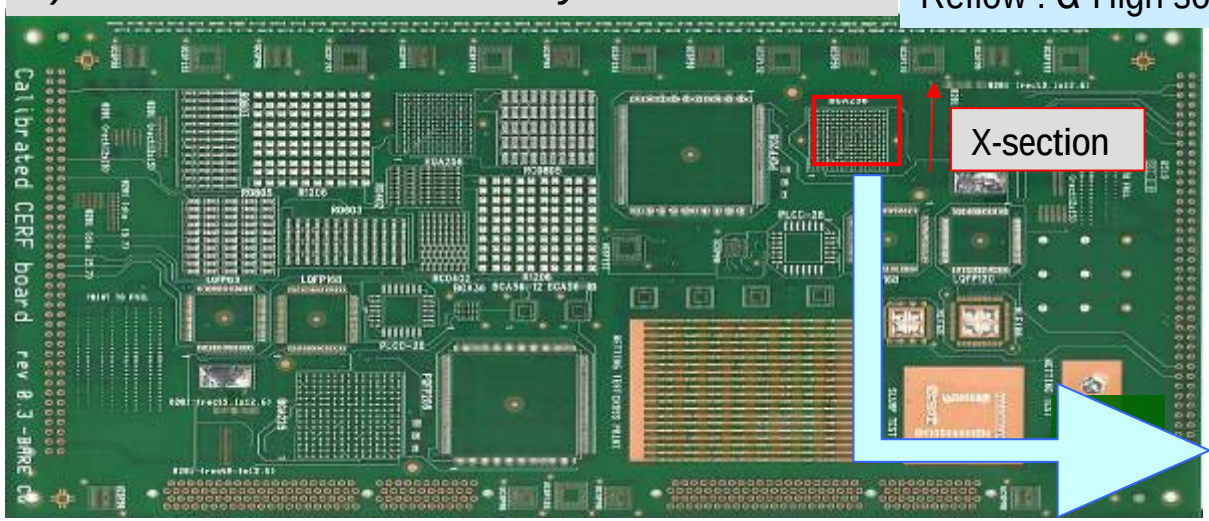
Head-on-Pillow Performance

Test Method

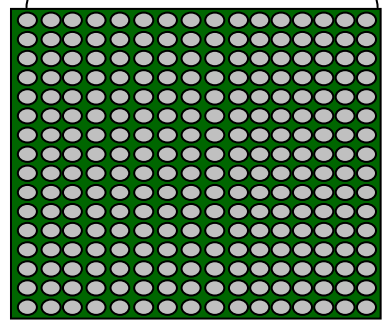
BGA package pre-aging

a) BGA sphere oxidation (125℃/24hr)
b) BGA aging (85℃85%/96hr)
c) 1 Prior BGA reflow cycle

Printer : MPM UP-3000
Vehicle : ALPHA SMT test board
Stencil : 130µm thickness, laser cut
Component : BGA 256
Reflow : α-High soak profile



16 ball per row



Test Procedure: Print paste; place pre-aged BGAs; reflow. 5 rows x 16 per row = 80 samples. Samples randomly selected, cross-sectioned and inspected using SEM.

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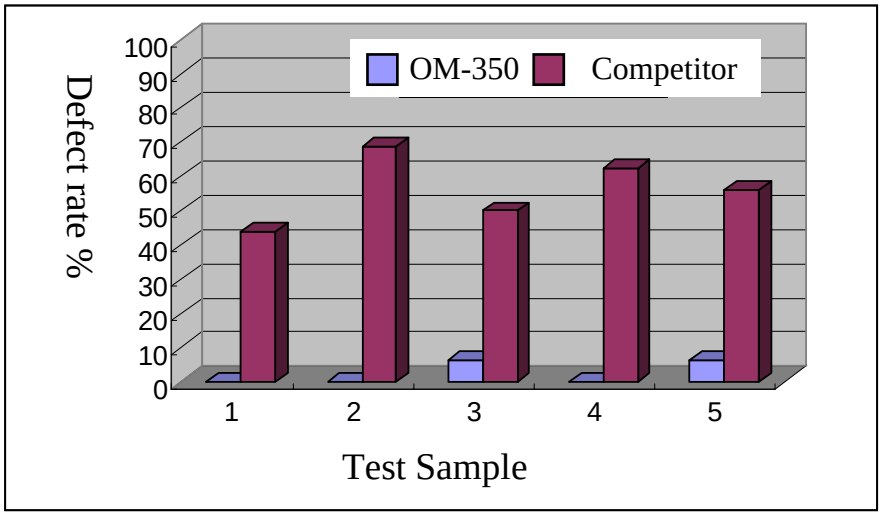
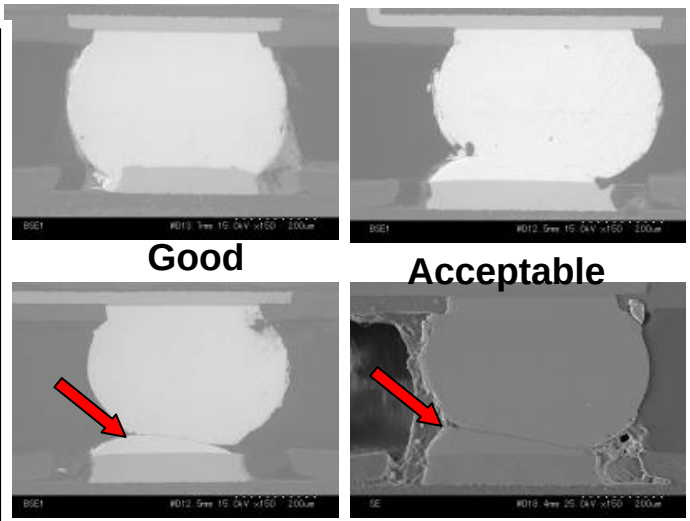
Head-on-Pillow Performance

Test Results





Head-on-Pillow defects

	1st row	2nd row	3rd row	4th row	5th row	summary	Defect %
Competitive Paste	7	11	8	10	9	45/80	56.3%
OM-350	0	0	1	0	1	2/80	2.5%

OM-350 reduced head-on-pillow defects by 95%!

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Reliability Summary Table

Chemical

• Cu corrosion	IPC J-STD 004 & JIS Z 3197-1986	PASS
• Cu mirror	IPC J-STD 004	PASS
• Ag Chromate paper test	IPC J-STD 004	No halides detected
• Ion Chromatograph	IPC TM-650	No halides detected
• Talc Test	JIS Z 3197	PASS

Electrical

• IPC SIR	7 day 85°C / 85%RH	PASS
• Bellcore SIR	96 hours @ 35°C/85% RH	PASS
• Bellcore Electromigration	500 hours @ 65°C/85% RH	PASS
• JIS Electromigration	1000 hours @ 85 °C/85% RH	PASS
• HP ECM test	EL-EN861-00	PASS

J-Standard Classification: ROL-0

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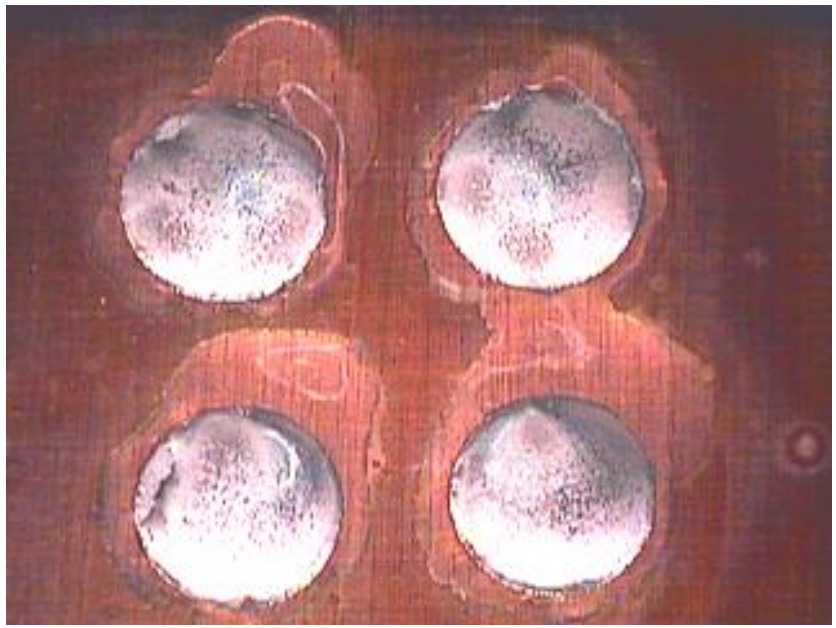
Talc Test

Passes JIS Z 3197 Talc Test

Pass : No talc left on top of residue



- Test method: Place 0.3 g of the solder paste on copper plate (50 X 50 X 0.5mm).
- Reflow for approximately 5 seconds using 245 ºC solder bath.
- After 30 min at RT, sprinkle talc powder, brush using soft brush and note remaining tack.

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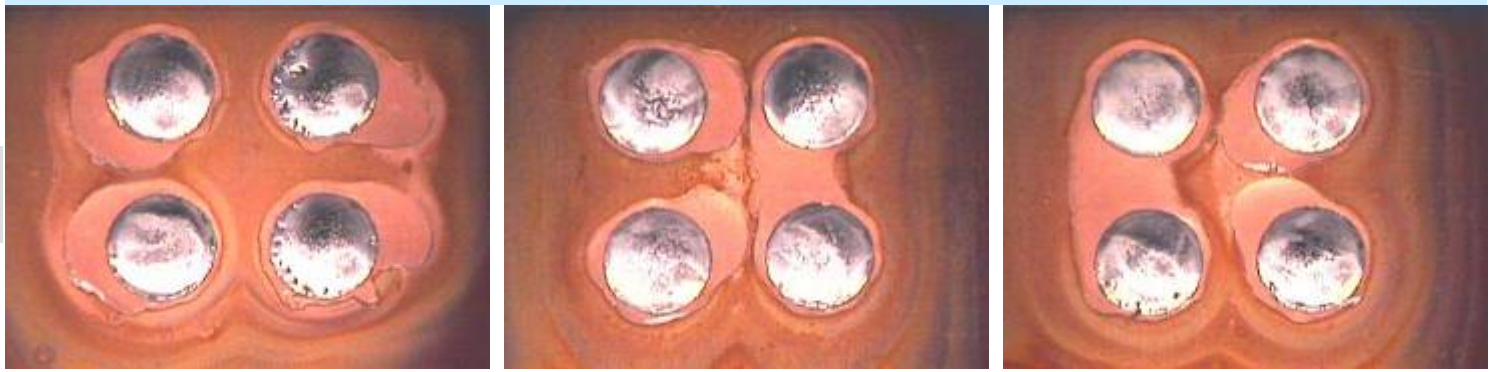
Electrical Reliability Data

Copper Corrosion Test JIS-3197 Method

Pass: No Discoloration

Initial



After 96hours @40°C 90% RH

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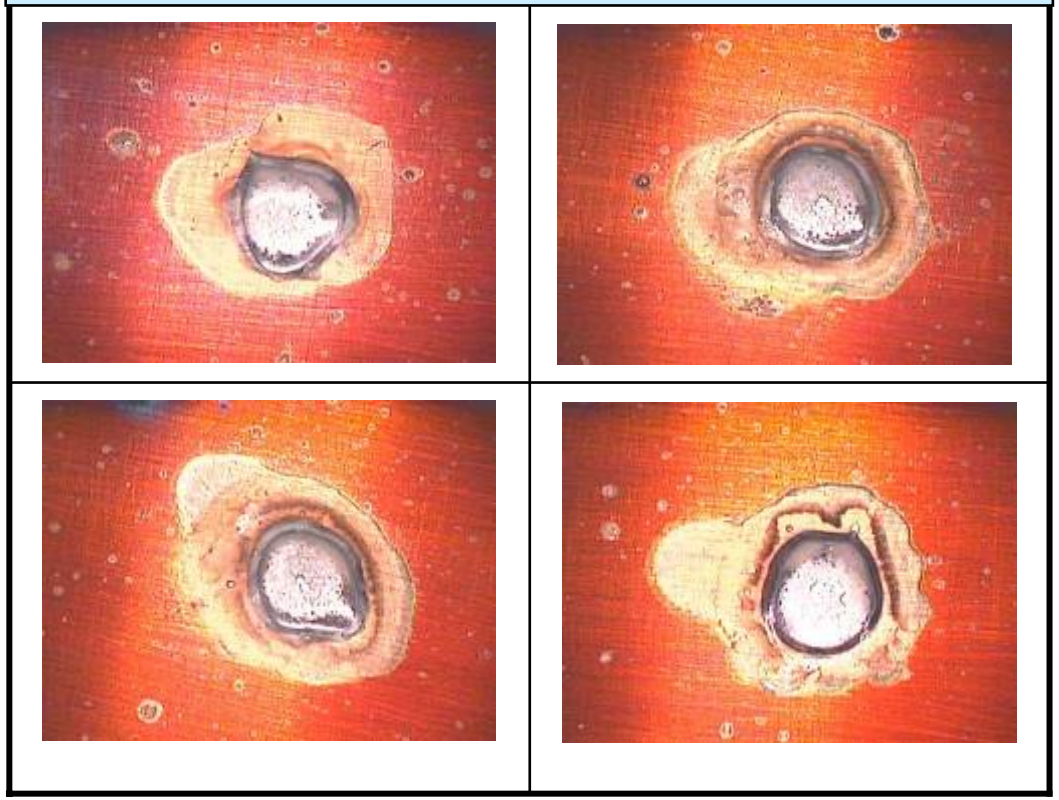
Chemical Reliability Data

OM-350: 40 °C; 90% RH 96 hours

PASS: No Discoloration



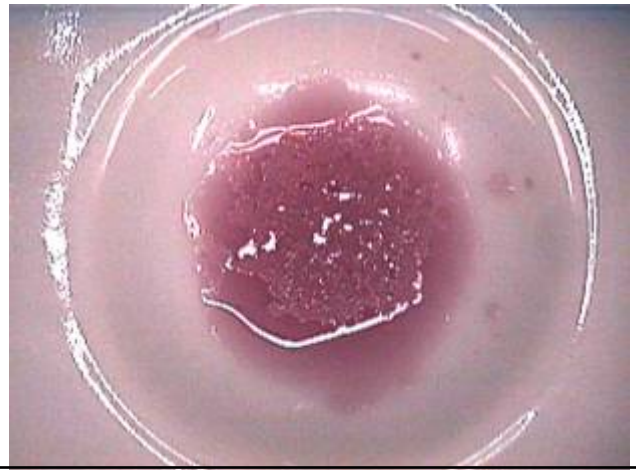
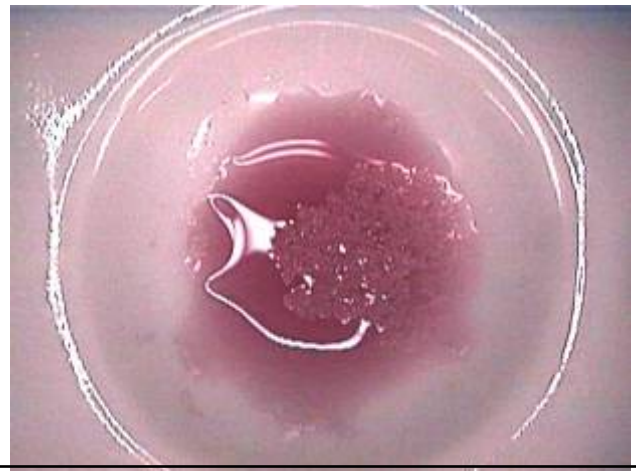
Reference

Cookson Electronics

Chemical Reliability Data

Fluoride Spot Test IPC TM-650 2.3.32

PASS: No Color change

	
Reference	**OM-350**

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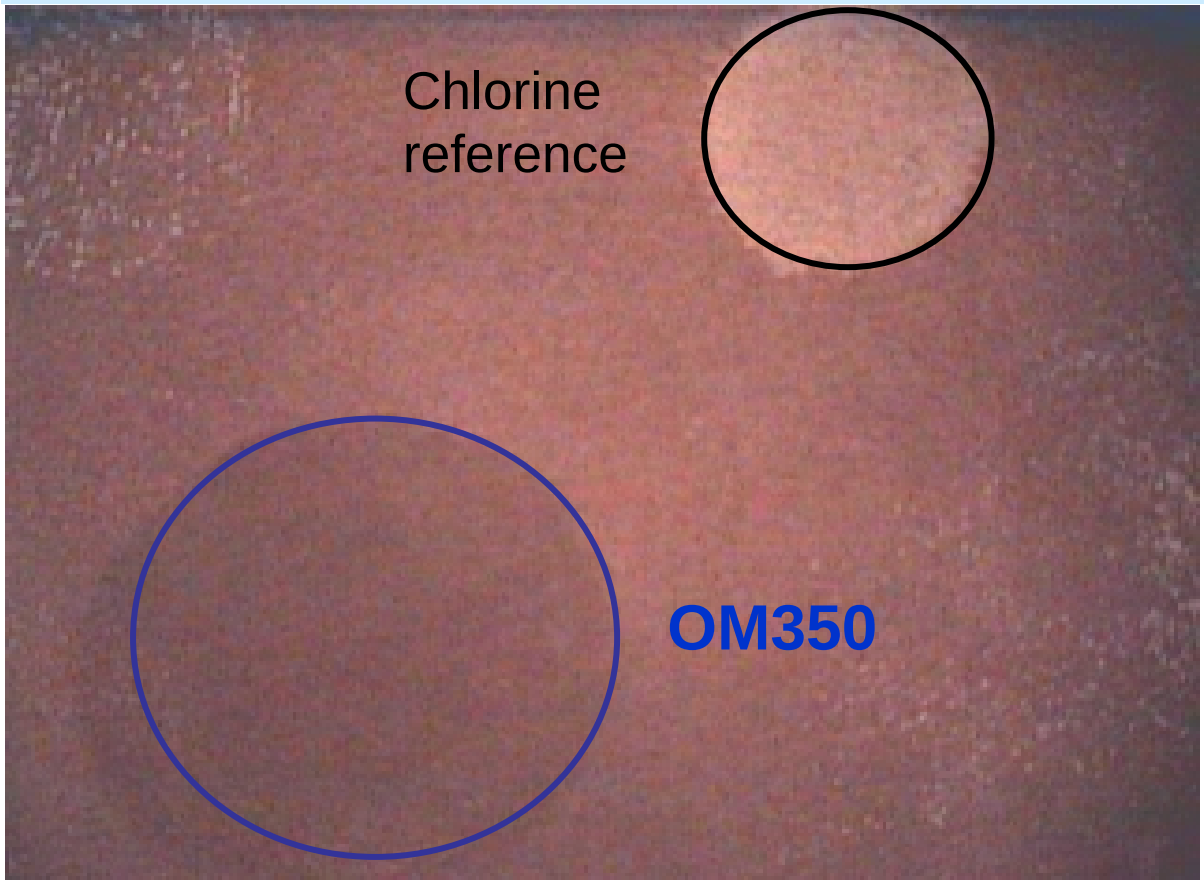
Chemical Reliability Data

Silver Chromate Test IPC TM-650 2.3.33

PASS: **No discoloration of the $AgCrO_3$ test paper**



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Chemical Reliability Data

Halide content test by Ion Chromatograph
IPC TM650 Method 2.3.28.1

Pass: No halides detected

Name of halide	OM-350 Paste flux Lot # 60122251FS
Fluoride	Not Detected (< 10 ppm)
Chloride	Not Detected (< 20 ppm)
Bromide	Not Detected (< 20 ppm)
Iodide	Not Detected (< 100 ppm)

DX120 Ion Chromatograph, Dionex

Cookson Electronics

Electrical Reliability Data

IPC J-STD-004 SIR Test

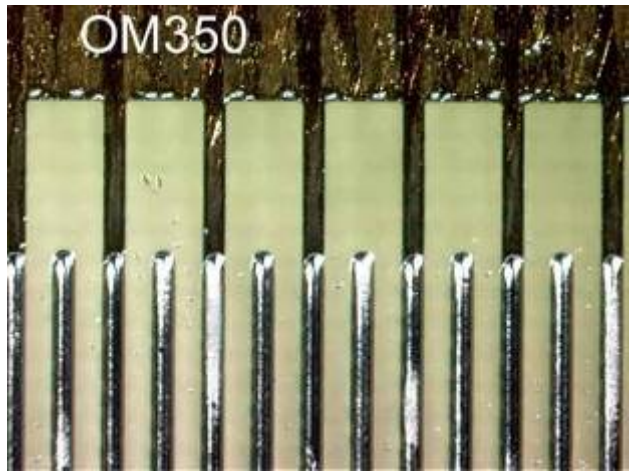
PASS

SIR TEST PER J-STD-004 Request:

****

Test #:0602-i Date: 1/17/2006 T/H/B 85C/85%RH/-48V
Tested by: K. Tellefsen P/F limit:
Reported by: K. Tellefsen 1.0E+08 ohms

MATERIAL TESTED/ CONDITION	SIR(ohms) (1 day)	SIR (4 days)	SIR (7 days)	COMMENTS
OM-350 SAC	1.7E+09	9.6E+08	2.1E+09	passed electrical
Reflowed paste	4.0E+09	1.9E+09	3.9E+09	and visual
	3.8E+09	9.9E+08	2.0E+09	requirements
uncleaned	1.3E+09	3.1E+09	5.9E+09	
	2.0E+08	9.8E+08	2.1E+09	
	2.2E+08	9.3E+08	1.9E+09	
	1.9E+08	8.7E+08	1.9E+09	
	2.0E+08	1.0E+09	2.2E+09	
	1.7E+08	9.1E+08	1.6E+09	
	1.7E+08	8.8E+08	1.9E+09	
	8.2E+08	1.3E+09	1.5E+09	
	1.1E+09	1.8E+09	1.9E+09	
Arithmetic mean:	1.2E+09	1.3E+09	2.4E+09	
Control boards	4.0E+09	2.1E+10	2.3E+10	
	5.0E+09	1.5E+10	1.7E+10	
	5.2E+09	1.1E+10	1.2E+10	
	6.3E+09	1.3E+10	1.3E+10	
	4.3E+09	1.7E+10	1.8E+10	
	4.2E+09	1.8E+10	1.9E+10	
	3.7E+09	1.3E+10	1.6E+10	
	5.8E+09	2.3E+10	2.4E+10	
	4.2E+09	1.9E+10	2.1E+10	
	4.6E+09	1.7E+10	1.8E+10	
	4.5E+09	1.2E+10	1.4E+10	
	6.1E+09	1.8E+10	1.9E+10	
Arithmetic mean:	4.8E+09	1.6E+10	1.8E+10	



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Electrical Reliability Data

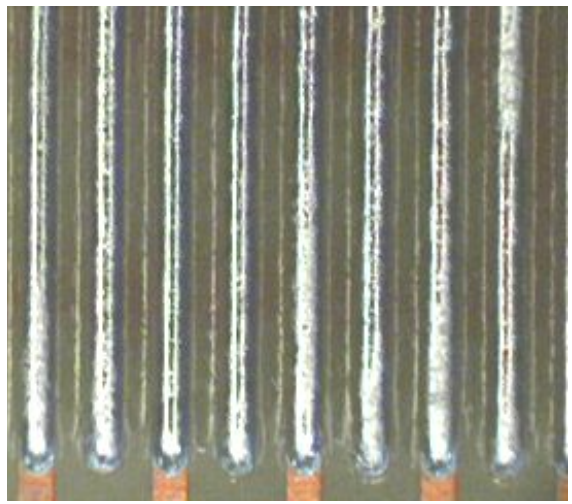
Bellcore SIR Test

PASS

SIR TEST REPORT – BELLCORE Request:
(per GR-78-CORE Issue 1, Sept 97)

Test #:0602-b Date: 1/5/05 T/H/B:35/85/-48
Tested by: K. Tellefsen Reported by: K. Tellefsen P/F limit:1E11 Ohms

MATERIAL TESTED/ CONDITION	SIR (1 day)	SIR (4 days)	COMMENTS
OM-350 SAC	6.7E+12	1.0E+13	Visually OK
Reflowed paste	8.2E+12	1.2E+13	
	2.2E+12	5.7E+12	
uncleaned	1.9E+12	1.3E+13	
	1.2E+12	5.8E+12	
	5.0E+11	1.0E+13	
	1.3E+12	3.1E+12	
	1.5E+12	7.1E+12	
	1.1E+12	1.1E+12	
	1.3E+12	8.7E+11	
	6.0E+11	1.7E+12	
	1.1E+12	2.9E+12	
Geometric mean:	1.6E+12	4.4E+12	
Control boards	8.3E+11	1.4E+12	
	8.2E+11	1.5E+12	
	9.7E+11	6.1E+12	
	9.7E+11	1.0E+12	
	5.3E+11	6.1E+11	
	6.1E+12	1.2E+12	
	1.6E+12	1.2E+12	
	1.8E+12	3.4E+12	
	4.8E+12	2.9E+12	
	9.5E+12	5.7E+12	
	4.1E+12	1.3E+12	
	6.8E+12	2.2E+12	
Geometric mean:	2.1E+12	1.9E+12	



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Electrical Reliability Data

Bellcore Electromigration Test PASS

Bellcore Electromigration
(per GR-78-CORE Issue 1, September 1997)
Request:

Test #0602-e Start date: 1/16/06 bias = 10 V T/H: 65/85
Tested by: K. Tellefsen Reported by: K. Tellefsen

MATERIAL TESTED/ CONDITION	SIR 96 hr.	SIR 500 hr.	COMMENTS bias
	6.3E+08	5.4E+09	Passed electrical
OM-350 SAC	6.5E+08	9.8E+09	and visual
Reflowed paste	7.9E+08	1.2E+10	requirements
uncleaned	5.6E+08	2.5E+09	
	1.4E+10	9.8E+09	
	6.8E+08	8.8E+09	
	8.6E+08	1.4E+10	
	5.4E+08	5.9E+09	
	4.8E+08	7.9E+09	
	7.0E+08	1.8E+10	
	3.7E+08	4.7E+09	
	5.1E+08	1.3E+10	Pass/Fail
	-----	-----	final >
Geometric mean:	7.8E+08	8.2E+09	initial/10
Controls	1.7E+10	8.8E+10	Passed electrical
IPC-B-25 pattern B	1.4E+10	6.2E+10	and visual
	1.5E+10	4.8E+10	requirements
	1.6E+10	5.3E+10	
	5.4E+09	3.2E+10	
	1.4E+10	3.4E+10	
	1.1E+10	3.3E+10	
	1.5E+10	4.6E+10	
	1.7E+10	4.5E+10	
	1.2E+10	4.2E+10	
	1.3E+10	3.9E+10	
	2.3E+10	3.8E+10	Pass/Fail
	-----	-----	final >
Geometric mean:	1.4E+10	4.5E+10	initial/10

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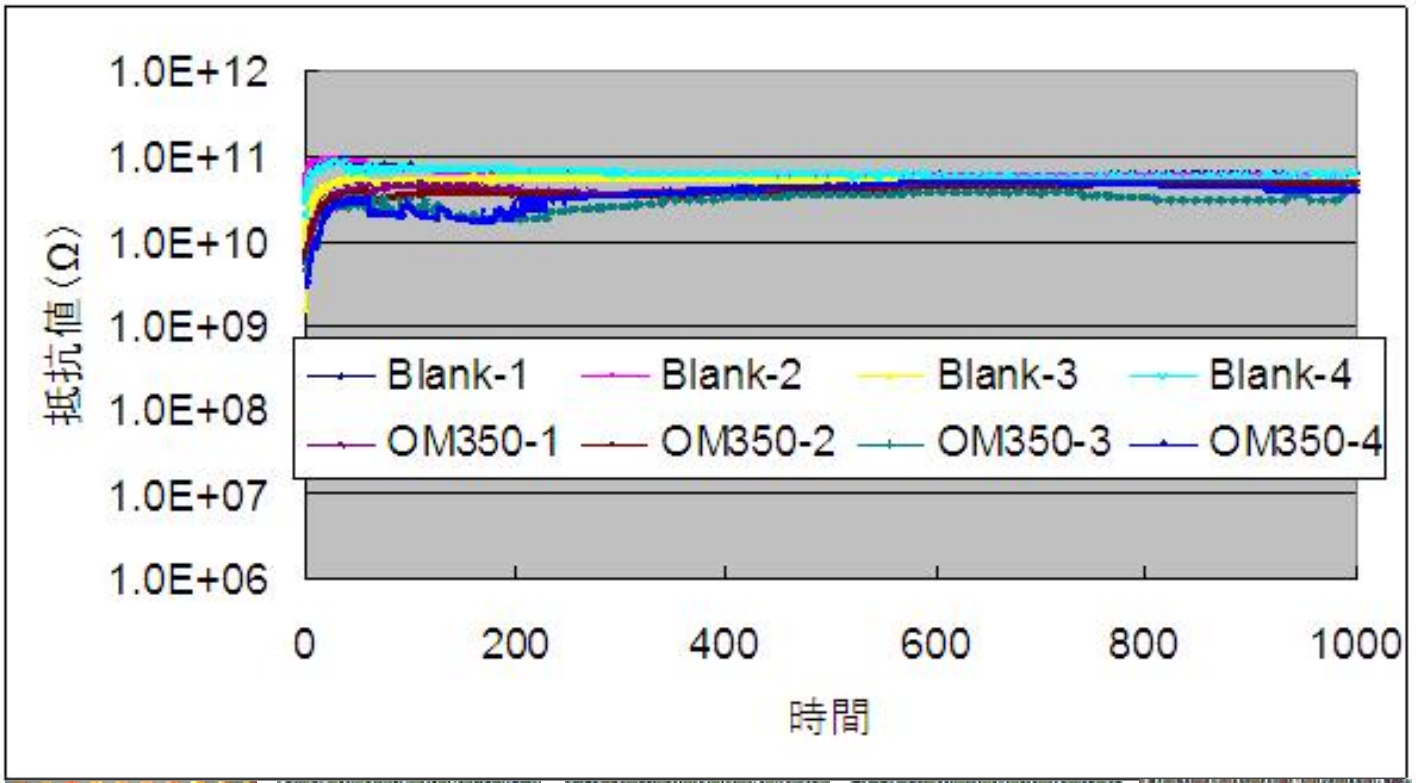
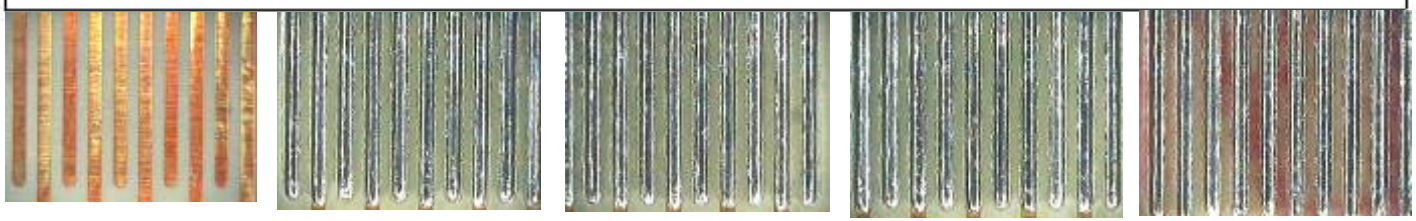
Electrical Reliability Data

JIS Z 3197 Migration Test

PASS





READINGS

>1.0X 10^{10} ohms

No migration for 1,000 hours test

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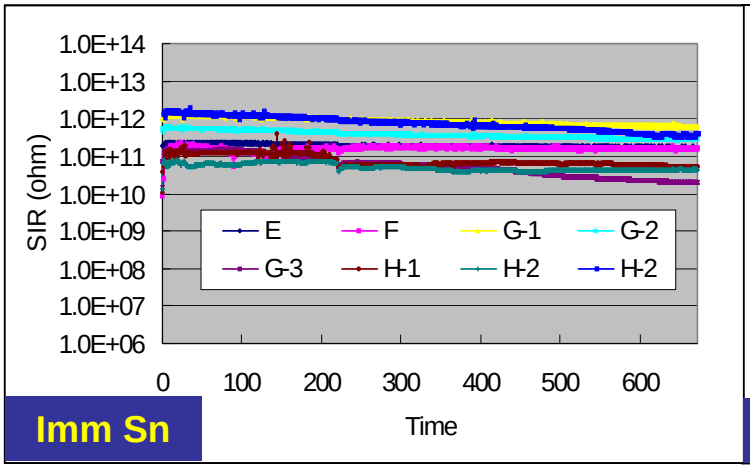
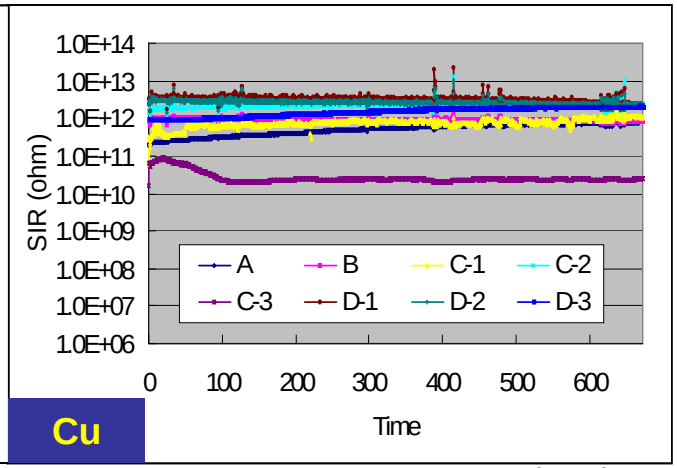
Electrical Reliability Data

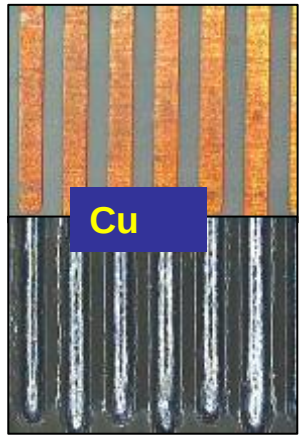
Hewlett-Packard ECM EL- EN861-00

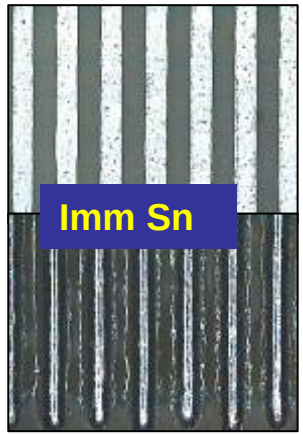
PASS

Part 1 Cu & Immersion Sn Surfaces









Unit : ohm

	A	B	C-1	C-2	C-3	D-1	D-2	D-3
0	1.92E+11	7.91E+11	3.05E+11	1.52E+12	1.55E+10	2.52E+12	2.46E+12	9.02E+11
672	7.98E+11	8.57E+11	1.07E+12	2.30E+12	2.37E+10	2.13E+12	2.25E+12	2.01E+12
	E	**F**	**G-1**	**G-2**	**G-3**	**H-1**	**H-2**	**H-2**
0	1.86E+11	6.94E+10	9.91E+11	4.99E+11	1.40E+10	3.71E+10	1.30E+10	1.21E+12
672	1.76E+11	1.61E+11	6.20E+11	2.78E+11	2.05E+10	5.14E+10	4.34E+10	4.12E+11

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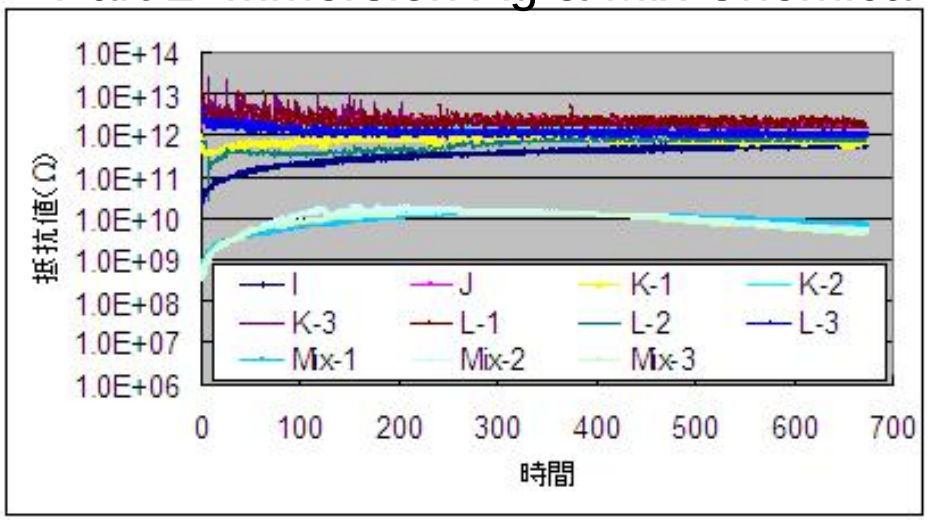
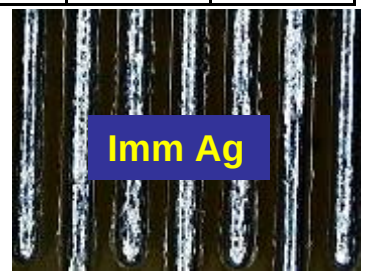
Electrical Reliability Data

Hewlett-Packard ECM EL- EN861-00 PASS

Part 2 Immersion Ag & Mix Chemical



Sample Group	Surface Finishi	Cleaned	Flux
I (as received control)	immersion Ag	No	No
J (clean cotrol)	immersion Ag	Yes	No
K (single side reflow)	immersion Ag	Yes	Yes
L (double side reflow)	immersion Ag	Yes	Yes
Mixed chemistries	immersion Ag	Yes	Yes



	I	J	K-1	K-2	K-3	
0	2.17E+10	1.47E+12	9.47E+11	2.03E+12	2.98E+12	
672	5.85E+11	1.75E+12	6.43E+11	1.02E+12	1.60E+12	
	L-1	L-2	L-3	Mix-1	Mix-2	Mix-3
0	6.22E+12	7.31E+11	2.18E+12	5.02E+08	3.62E+08	3.24E+08
672	1.70E+12	9.34E+11	9.84E+11	7.13E+09	5.07E+09	4.02E+09

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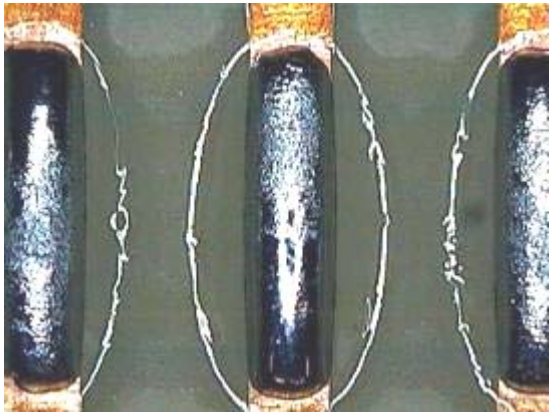
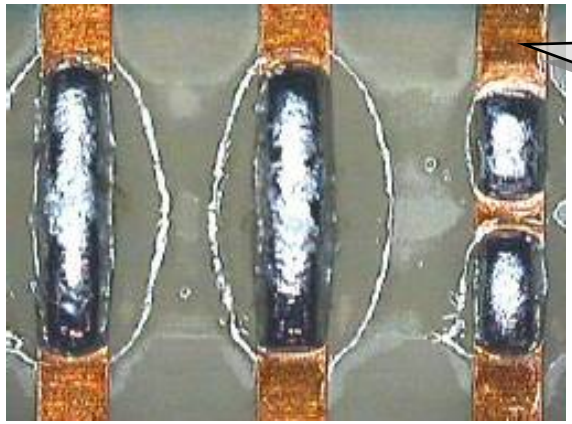
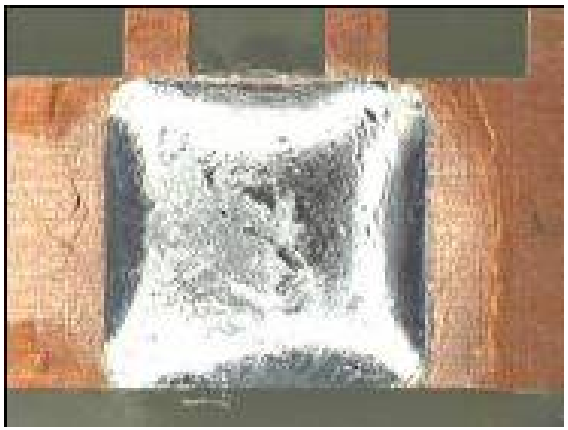
Flux Burn

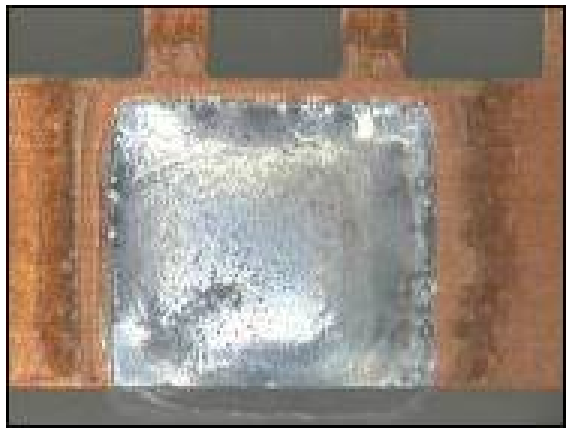




Flux Burn on adjacent copper Trace



OM-350



Competitive paste

OM-350 did not attack Cu surface

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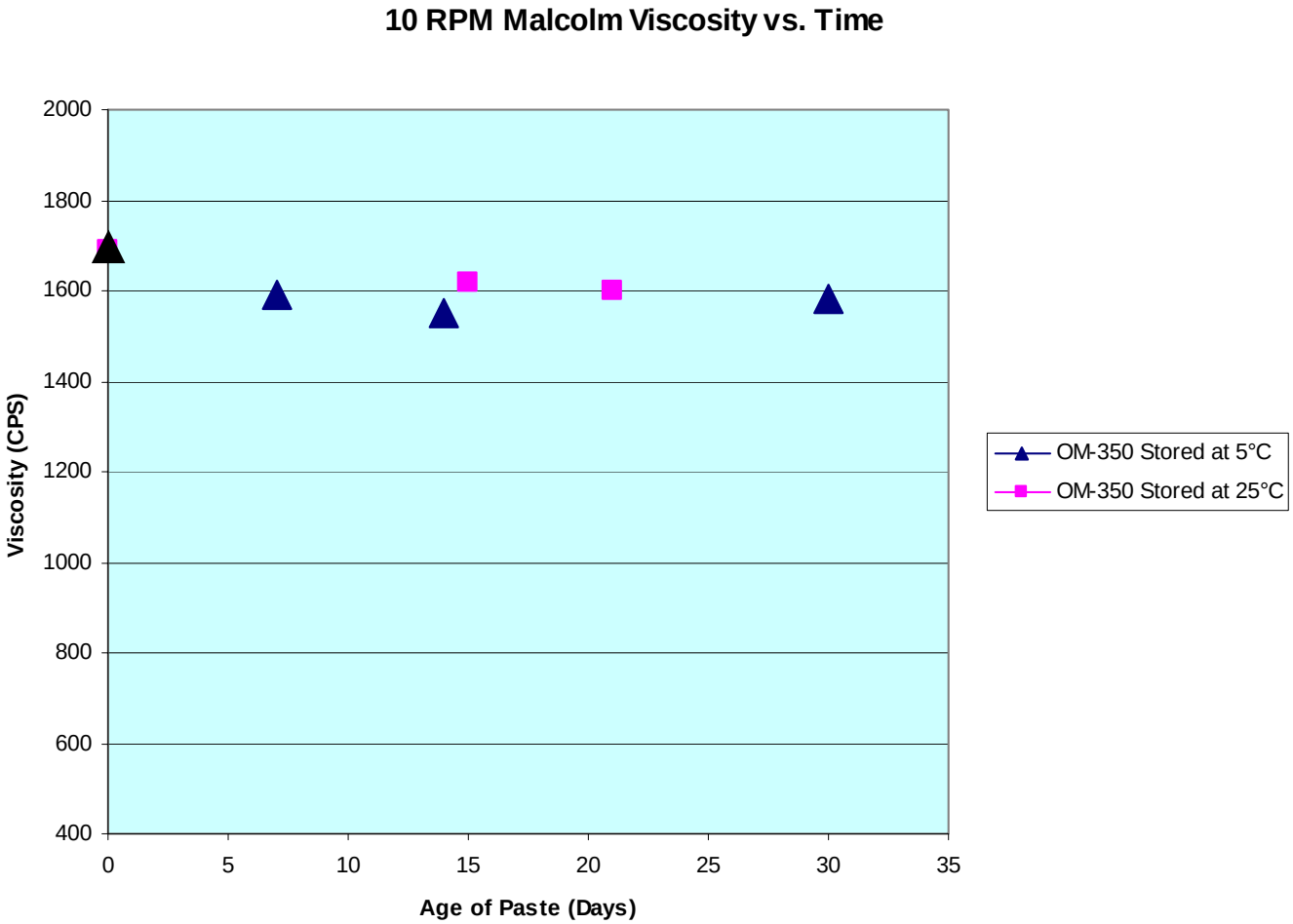
Shelf Life Data

Stable for Minimum 3 Weeks at 25°C



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OM-350 Solder Paste Benefit Summary

ALPHA OM-350

- Excellent printability provides high first pass manufacturing yield.
  - Well defined print deposits as small as 250 µm (using 100 µm stencil).
  - Flexibility of printer settings (print speed up to 100 mm/sec, fast or slow stencil release).
  - Long stencil life (up to 8 hours of printing without replenishment).
- Excellent wetting performance.
- High soak profile capability in air provides wide process window for sophisticated PWBA assemblies.
- Innovative formulation design provides solution to most challenging reflow issues,
  - Paste-in-Hole applications, e.g., notebook PC & TV tuners
  - Reduction in Tombstoning
  - Reduction in Mid-chip solder balls
  - Reduction in Head on Pillow effect (cold solder on BGA)
- Excellent stability for long shelf life and room temperature storage.
- This halide-free paste exceeded requirements of all reliability standards tested to date.

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