New Product Introduction

LOCTITE® ABLESTIK ABP 8303A

Conductive Die Attach Paste

Content

- ☐ Product Introduction or Quick Overview
- ☐ Value Message and Proposition
- ☐ Basic Material Properties
- ☐ Internal Evaluation Data
- ☐ Application Case Histories

Product Introduction or Quick Overview
LOCTITE®ABLESTIK ABP 8303A

- LOCTITE®ABLESTIK ABP 8303A silver filled, conductive die attach adhesive. It’s low outgassing, minimal RBO, low moisture absorption, high die shear strength and low stress makes it suitable for large die size and high reliability applications

LOCTITE®ABLESTIK ABP 8303A

Value Message and Proposition

- Applicable to wide die size range (2 mm x 2 mm – 7 mm x 7 mm)
- Suitable for different L/F and die backside surfaces
- Excellent workability, i.e. good dispensing, long open time/stage time
- No RBO, low outgassing, no discolor to Cu L/F
- Low Stress, High reliability, Automotive Grade 0 capable
- High Volume Manufacturing Ready Material

LOCTITE®ABLESTIK ABP 8303A

Basic Material Properties

Property	ABP 8303A	Property	ABP 8303A
Chemistry	BMI Hybrid	Weight Loss on Cure%, by TGA	2.8
Filler type	Silver	Bulk Thermal Conductivity (W/mK)	0.6
Density, g/ml	3.5	Volume R (Ohm cm)	0.062
Viscosity @ 25ºC (cps), 5rpm, CP51	10,500	Bond joint resistance, Au to Au, ohm	0.0012
Thixotropic Index, 0.5rpm/5rpm	4.6	Tg by TMA	30
Work Life @ 25ºC	24hrs	CTE1/CTE2 (ppm/ºC)	70/180
Recommended Storage Temperature	-40 ºC	Modulus @260ºC (MPa)	140
Storage Life (@ -40ºC)	1 year	Elongation % @ break, RT	5
Recommended Cure profile	30min ramp to 175ºC hold 60min, N2		

LOCTITE®ABLESTIK ABP 8303A

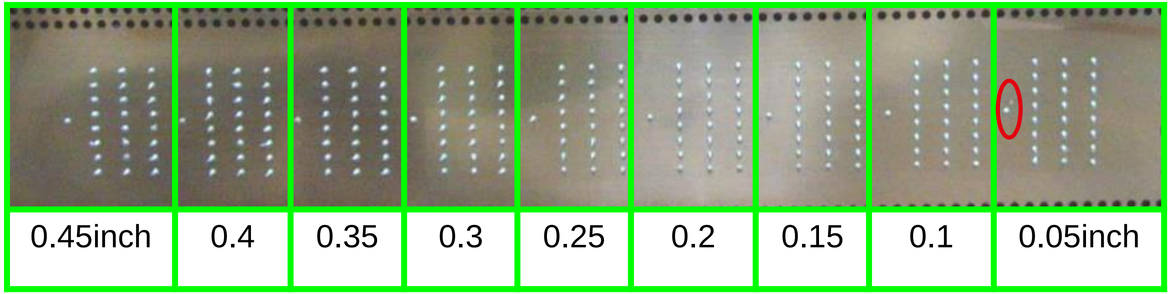
Internal Evaluation Plan

- Dot Dispensing
- Resin Bleed Out
- Adhesion Strength
- Warpage
- Workability: Open / Stage Time
- Pre-condition
- Thermal Cycle Testing (TCT)

LOCTITE®ABLESTIK ABP 8303A

Dot Dispensing - Henkel Test Methodology

- Henkel has standard dot dispensing method: totally dispense 9 groups with the same parameters except different retract distance. This testing simulates different UPH from low to high, output is total defective dot quantity



Retract distance reducing, UPH increasing

Nozzle: EFD 22G

Machine: Camalot FX-D

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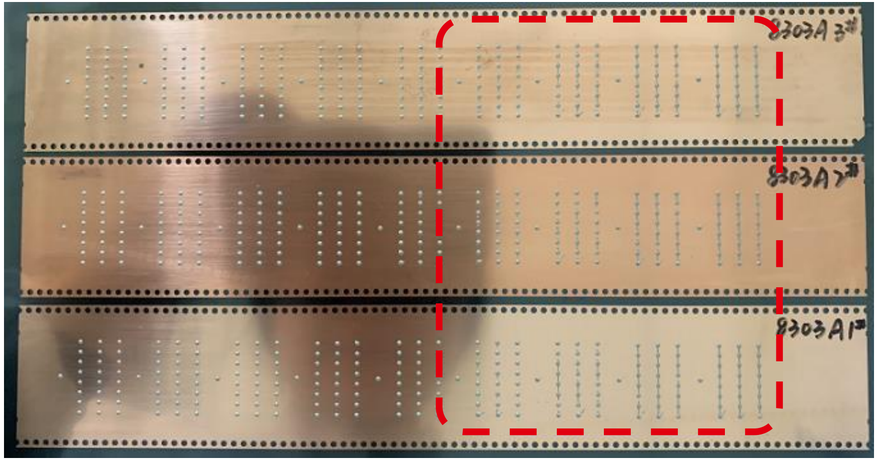
Internal Evaluation Data – Dot Dispensing

- By visual inspection, 8303A has good dispensing tailing status, from group #6, more and more tailing dots



ABP 8303A

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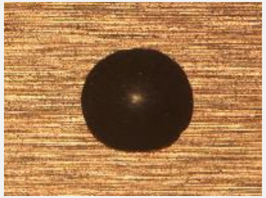
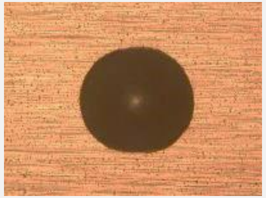
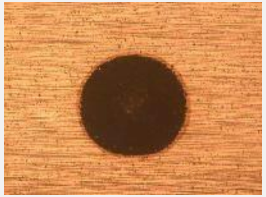
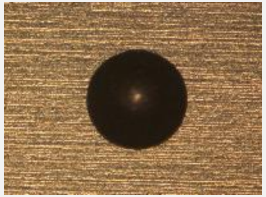
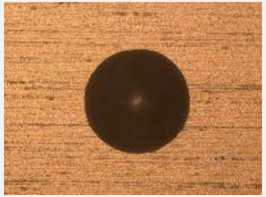
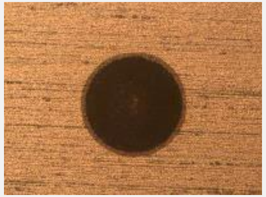
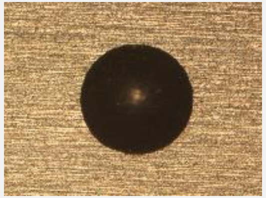
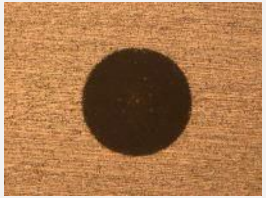
Resin Bleed Out (RBO)

- No RBO on Cu, Ag & PPF leadframe

L/F	0min	2hrs	Cured
Cu			
Ag			
PPF			

LOCTITE®ABLESTIK ABP 8303A

Adhesion Strength - Test Flow

Die bond
Datacon 2200 EVO

↓

Cure
30min ramp to 175C, hold 1hr, N2

↓

Xray & RT DSS

↓

HT DSS
260C

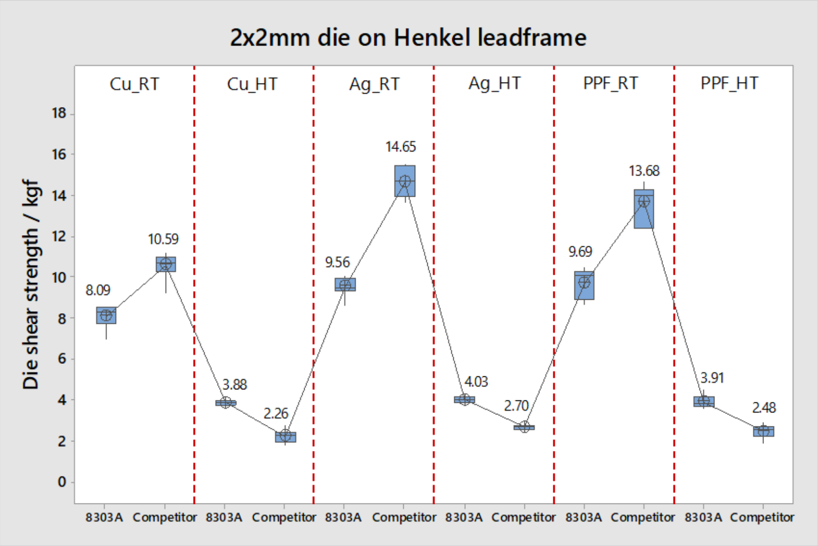
Die size (mm)	Leadframe	BLT (um)	Adhesion test condition
2x2	Henkel QFN PPF/Cu/Ag	25	RT
			HT DSS
7x7	Henkel QFN PPF/Cu/Ag	40	HT DSS

- Die bond:
  Datacon 2200EVO

- Die shear:
  Dage 4000

LOCTITE®ABLESTIK ABP 8303A

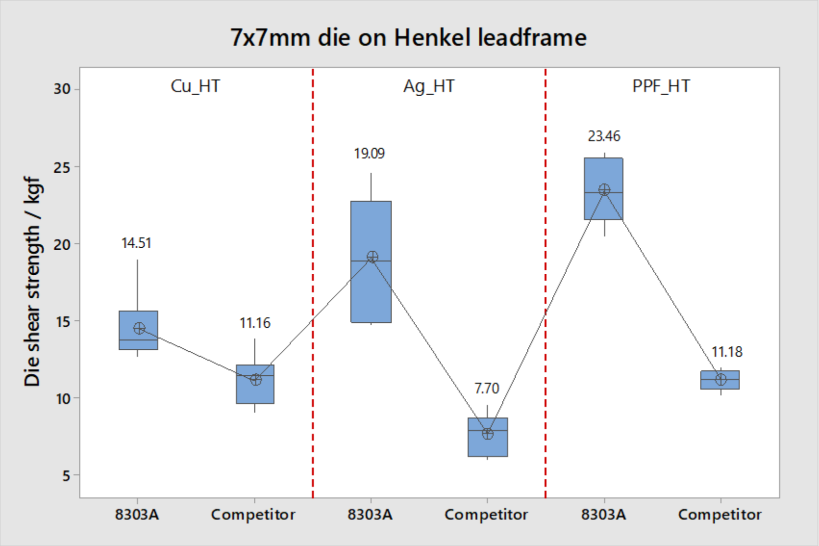
Adhesion Strength - RT & 260C HTDSS, Die Size 2 x 2 mm



Paste		8303A	
Condition		RT	HT DSS
	Fail mode	Cohesive	Cohesive
Cu	**Picture**		
	Fail mode	Cohesive	Cohesive
Ag	**Picture**		
	Fail mode	Cohesive	Cohesive
PPF	**Picture**		

LOCTITE®ABLESTIK ABP 8303A

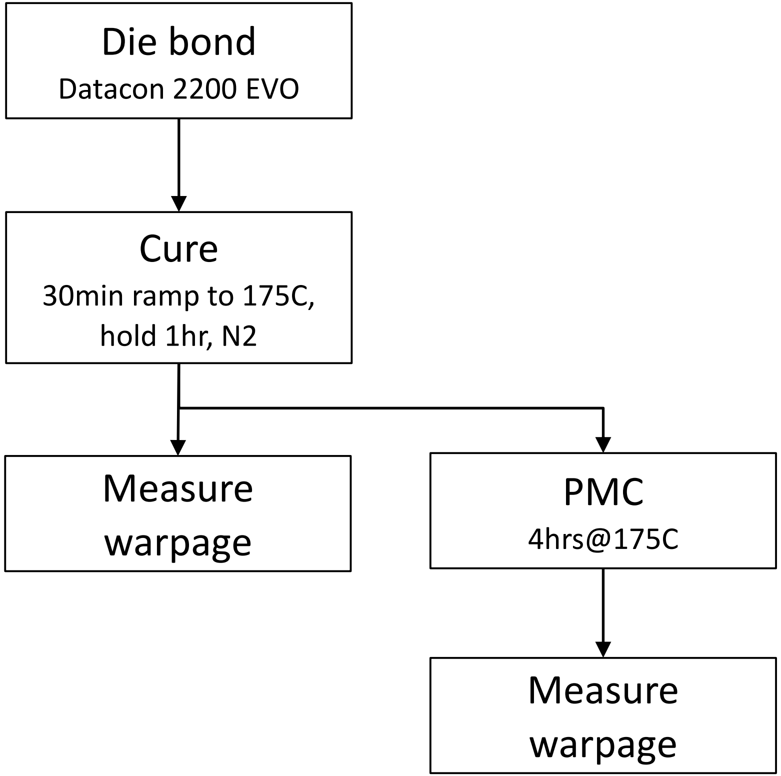
Adhesion Strength - 260C HTDSS, Die Size 7 x 7 mm



Paste		8303A
Condition		HT DSS
	Fail mode	Partial Co.
Cu	Picture	
	Fail mode	Partial Co.
Ag	Picture	
	Fail mode	Partial Co.
PPF	Picture	

LOCTITE®ABLESTIK ABP 8303A

Warpage - Test Flow



Die bond
Datacon 2200 EVO

Cure
30min ramp to 175C,
hold 1hr, N2

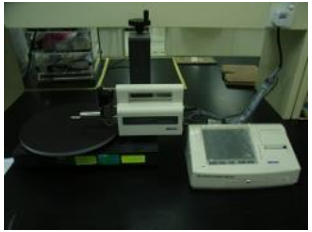
Measure warpage

PMC
4hrs@175C

Measure warpage

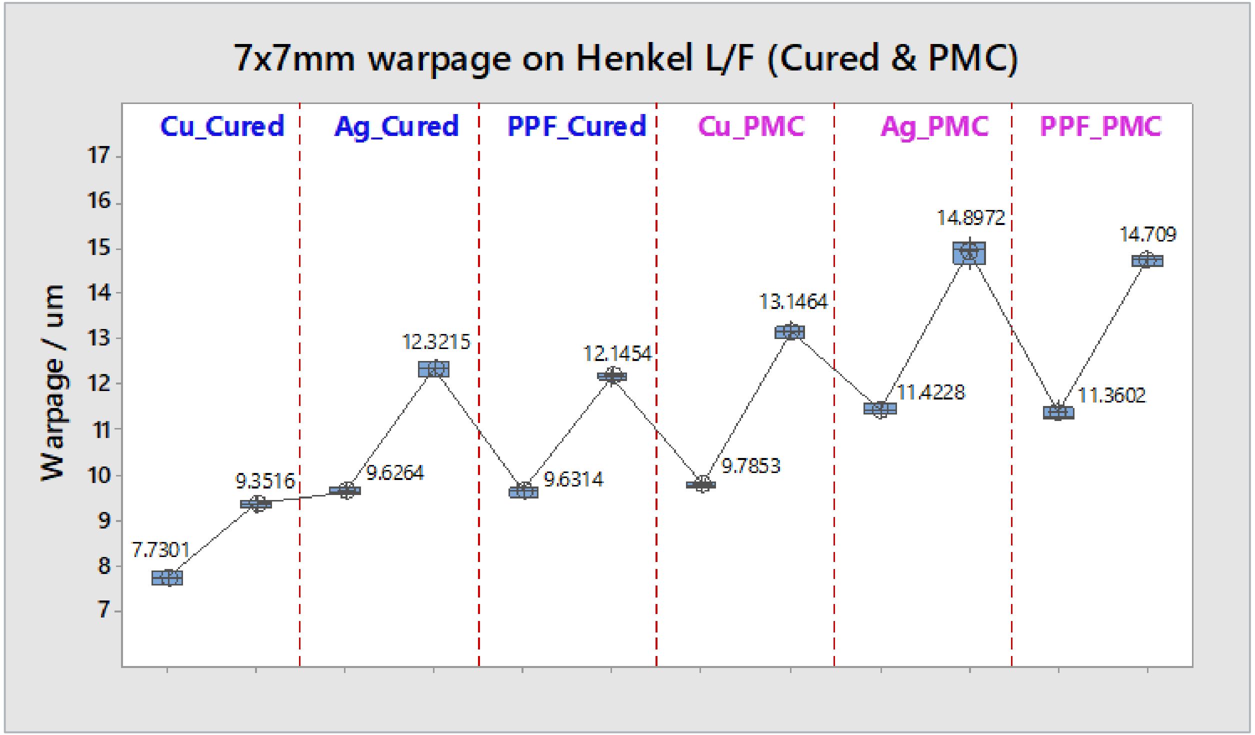
- Die size: 7x7mm, 380um thickness
- L/F: Henkel L/F
- BLT: 40um
- Die bonder: Datacon 2200EVO

- Warpage tester: Profilometer



LOCTITE®ABLESTIK ABP 8303A

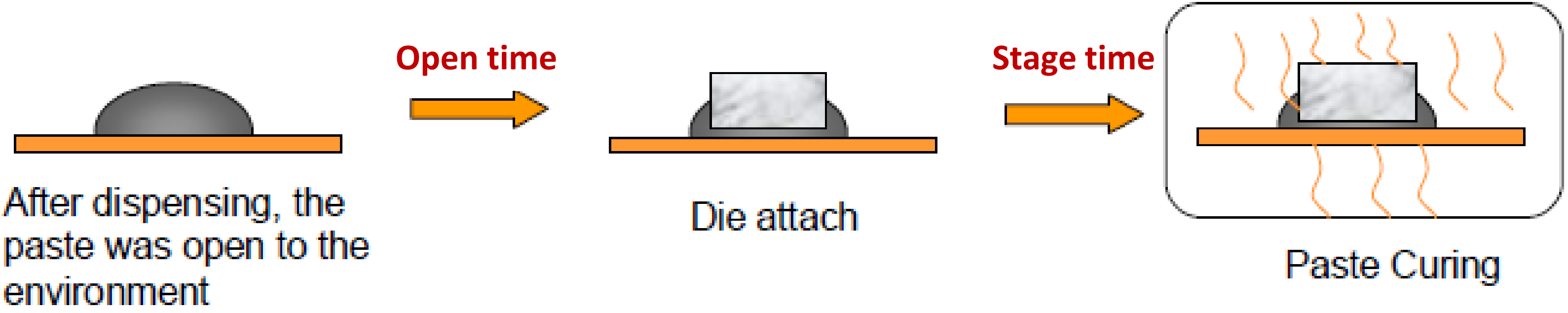
Warpage - Die Size 7 x 7 mm



LOCTITE®ABLESTIK ABP 8303A

Workability : Open / Stage Time Test - Description

- **Open time:** the time after dispensing and before DA, at that moment the paste was open to the environment
- **Stage time:** the time after DA and before curing



LOCTITE®ABLESTIK ABP 8303A

Workability : Open Time Test - Test Flow

Dispensing
Datacon 2200 EVO

Wait
Several mins @ RT

Die bond
Datacon 2200 EVO

Check fillet
Microscope, X-Ray

Cure
60min @ 175C, N2

Adhesion test
260C HTDSS

- Die size: 2x2mm, 380um thickness
- Dispensing patter: cross
- Nozzle: EFD 25G
- L/F: Cu
- Bond force: 70g
- Bond time: 50ms

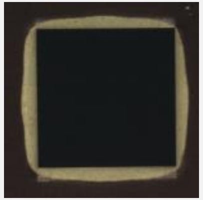
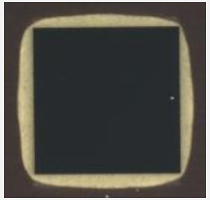
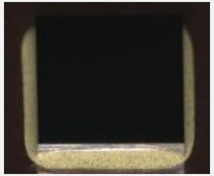
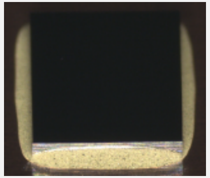
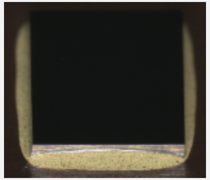
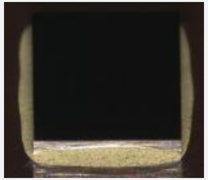
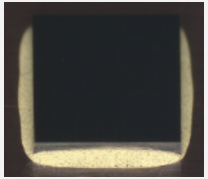
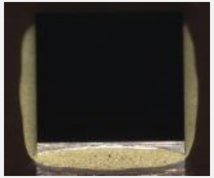
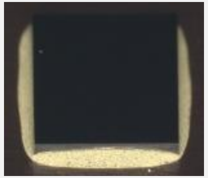
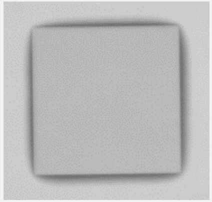
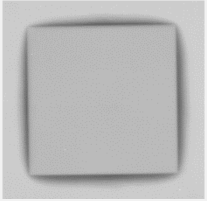
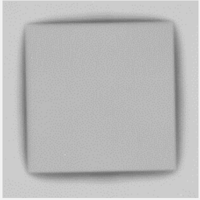
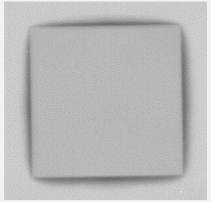
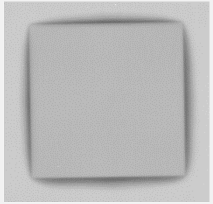
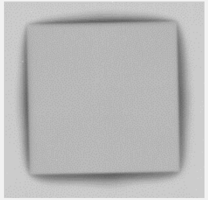
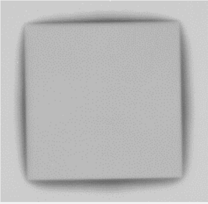
- Die bond:
  Datacon 2200EVO

- Die shear:
  Dage 4000

- X-Ray:
  Phoenix

LOCTITE®ABLESTIK ABP 8303A
Workability : Open Time Test - Fillet Inspection

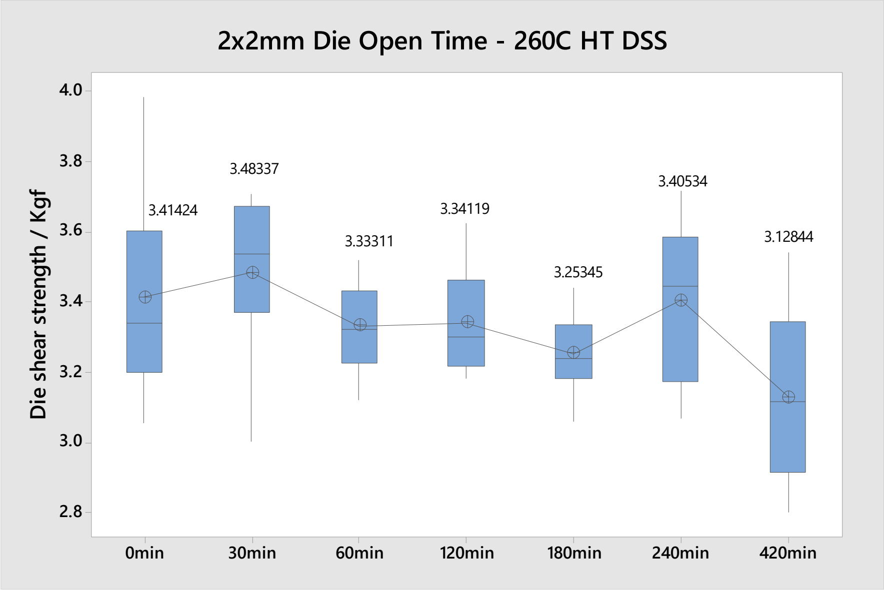
- No wetting issue and void free even 420min open time

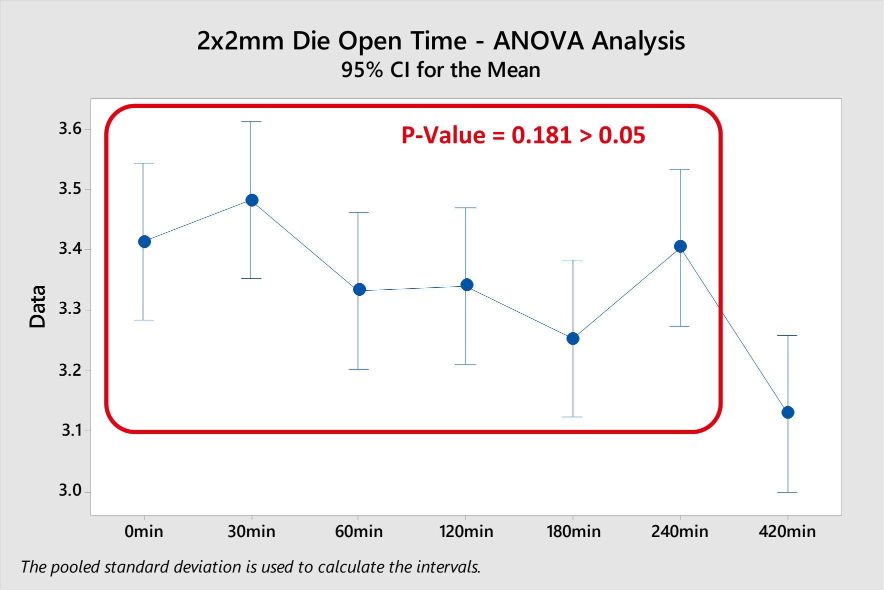
Open Time	0min	30min	60min	120min	180min	240min	420min
Top view							
Side view							
X-Ray							

LOCTITE®ABLESTIK ABP 8303A

Workability : Open Time Test - Adhesion

- No significant HTDSS reduction within 240min, slight decline at 420min. So for 2x2mm die size, the open time should be above 240min at least



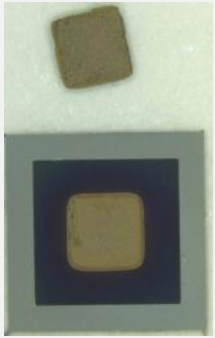
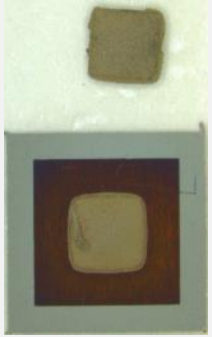
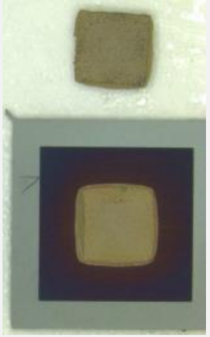
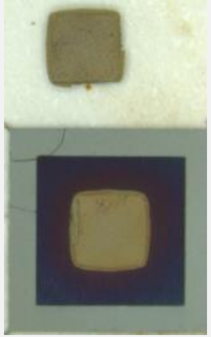
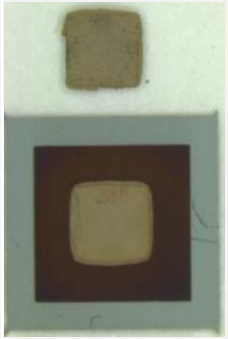
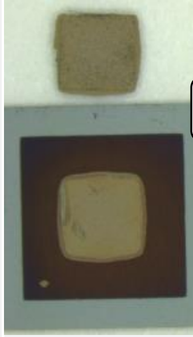
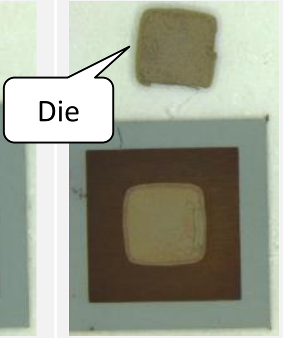


The pooled standard deviation is used to calculate the intervals.

LOCTITE®ABLESTIK ABP 8303A

Workability : Open Time Test - Adhesion Fail Mode

- No HTDSS fail mode change even 420min open time

Open time	**0min**	**30min**	**60min**	**120min**	**180min**	**240min**	**420min**
Fail mode	Cohesive	Cohesive	Cohesive	Cohesive	Cohesive	Cohesive	Cohesive
Picture							

LOCTITE®ABLESTIK ABP 8303A

Workability : Stage Time Test - Test Flow

Dispensing
Datacon 2200 EVO

Die bond
Datacon 2200 EVO

Wait
Several mins @ RT

Cure
60min @ 175C, N2

Check void
X-Ray

Adhesion test
260C HTDSS

- Die size: 2x2mm, 380um thickness
- Dispensing patter: cross
- Nozzle: EFD 25G
- L/F: Cu
- Bond force: 70g
- Bond time: 50ms

- Die bond:
  Datacon 2200EVO

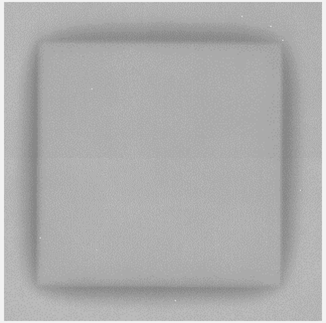
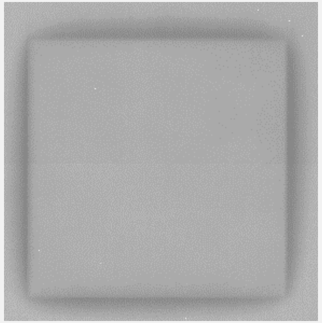
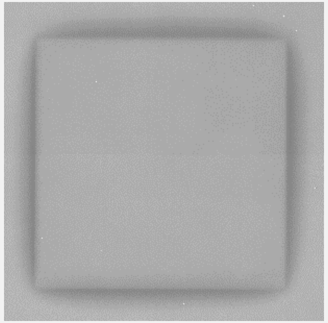
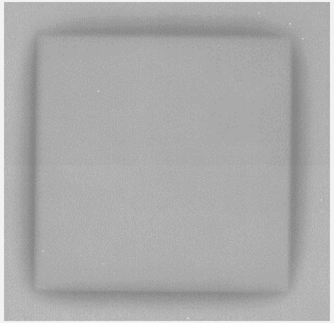
- Die shear:
  Dage 4000

- X-Ray:
  Phoenix

LOCTITE®ABLESTIK ABP 8303A

Workability : Stage Time Test - Void Check

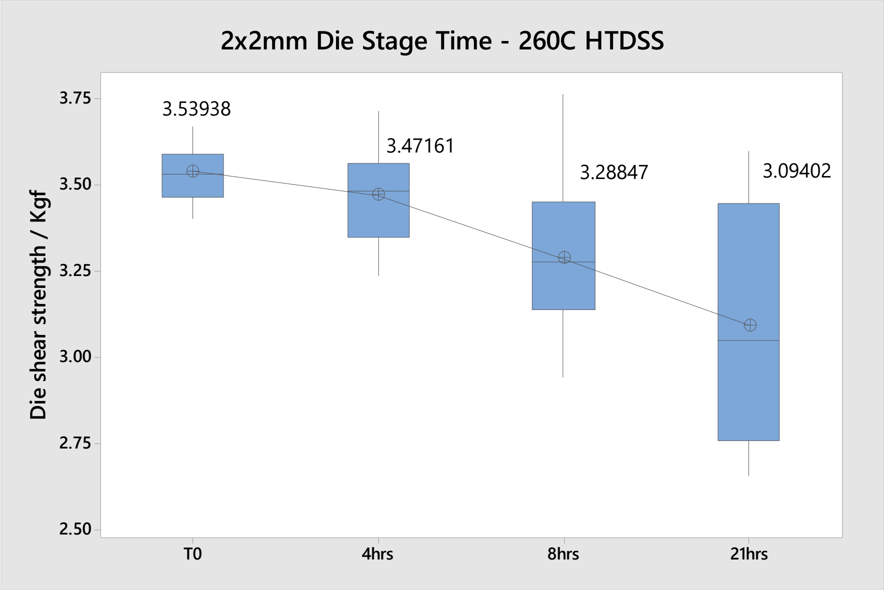
- Void free even 21hrs stage time

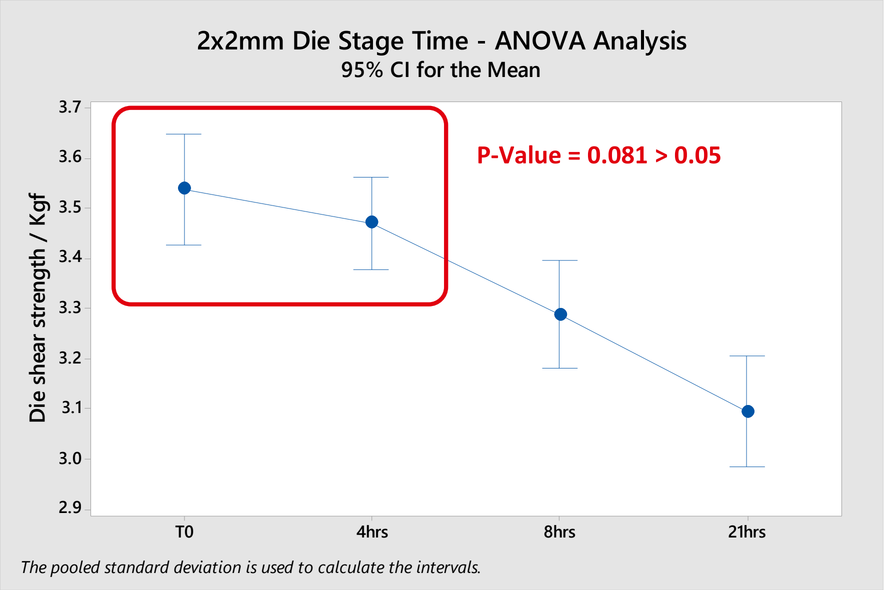
Stage Time	0min	4hrs	8hrs	21hrs
X-Ray				

LOCTITE®ABLESTIK ABP 8303A

Workability : Stage Time Test - Adhesion

- No significant HTDSS changing until 4hrs stage time. HTDSS declines only 7% after 8hrs and 13% after 21hrs, so 8303A can keep very strong adhesion in long stage time



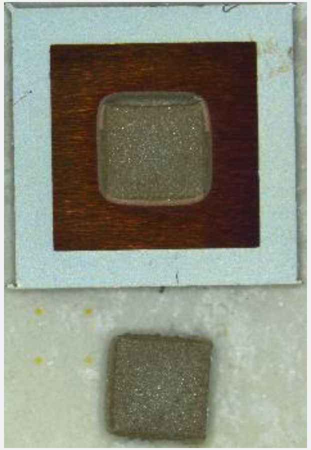
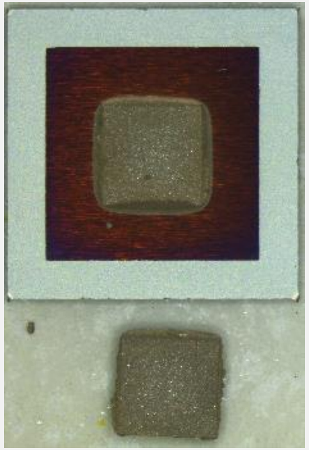
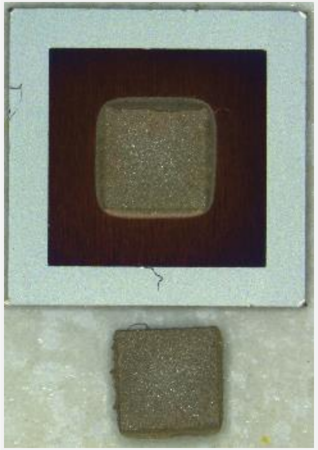
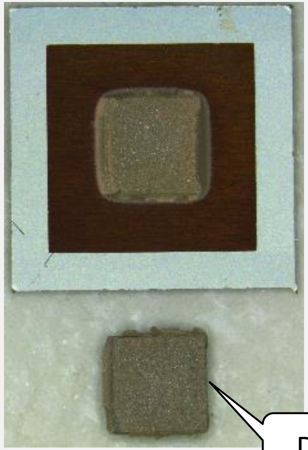


P-Value = 0.081 > 0.05

The pooled standard deviation is used to calculate the intervals.

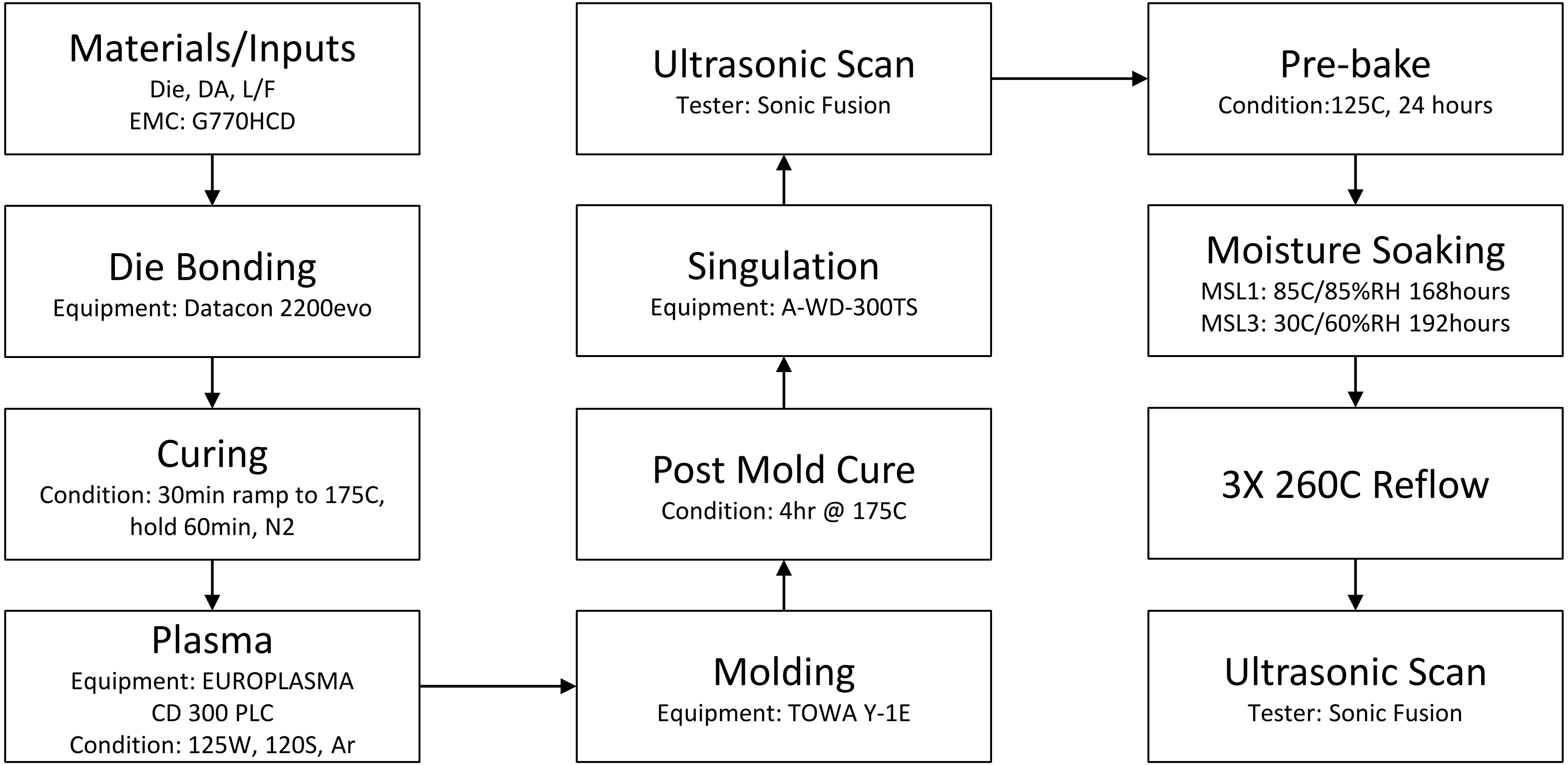
LOCTITE®ABLESTIK ABP 8303A
Workability : Stage Time Test - Adhesion Fail Mode

- No HTDSS fail mode changing even 21hrs stage time

Stage Time	0min	4hrs	8hrs	21hrs
Fail mode	Cohesive	Cohesive	Cohesive	Cohesive
Picture				

LOCTITE®ABLESTIK ABP 8303A

Pre-condition - Test Flow



Materials/Inputs
Die, DA, L/F
EMC: G770HCD

Die Bonding
Equipment: Datacon 2200evo

Curing
Condition: 30min ramp to 175C, hold 60min, N2

Plasma
Equipment: EUROPLASMA CD 300 PLC
Condition: 125W, 120S, Ar

Molding
Equipment: TOWA Y-1E

Post Mold Cure
Condition: 4hr @ 175C

Singulation
Equipment: A-WD-300TS

Ultrasonic Scan
Tester: Sonic Fusion

Pre-bake
Condition:125C, 24 hours

Moisture Soaking
MSL1: 85C/85%RH 168hours
MSL3: 30C/60%RH 192hours

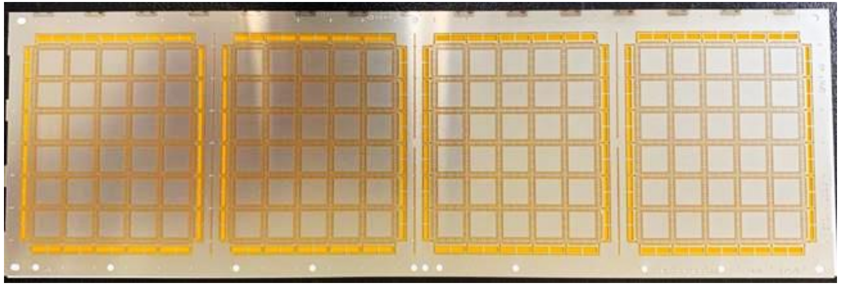
3X 260C Reflow

Ultrasonic Scan
Tester: Sonic Fusion

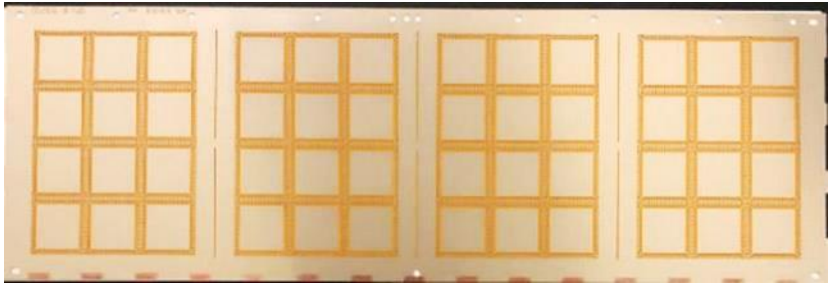
LOCTITE® ABLESTIK ABP 8303A

Pre-condition - Test Plan

PKG	Die size (mm)	Paste	Wet BLT (um)	L/F	Remark
QFN 7x7	2x2	8303A	25+/-5	Cu, Ag, PPF	8303A reliability 22ea / leg
QFN 12x12	7x7		45+/-5		



QFN 7x7 L/F layout



QFN 12x12 L/F layout

LOCTITE®ABLESTIK ABP 8303A

Pre-condition - Test Result

Pre-con	PKG	Die size	L/F	ABP 8303A
MSL3	QFN 7x7	2x2 mm	Cu	**Pass**
			Ag	**Pass**
			PPF	**Pass**
	QFN 12x12	7x7 mm	Cu	**Pass**
			Ag	**Pass**
			PPF	**Pass**
MSL1	QFN 7x7	2x2 mm	Cu	**Pass**
			Ag	Fail (22 / 22)
			PPF	Fail (22 / 22)
	QFN 12x12	7x7 mm	Cu	Fail (20 / 22)
			Ag	Fail (22 / 22)
			PPF	Fail (22 / 22)

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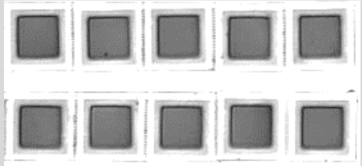
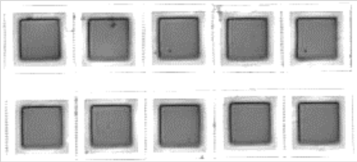
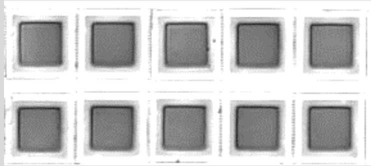
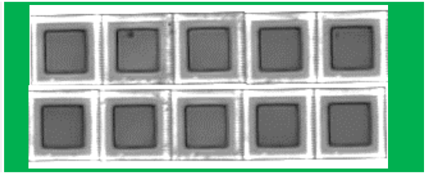
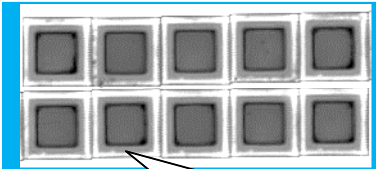
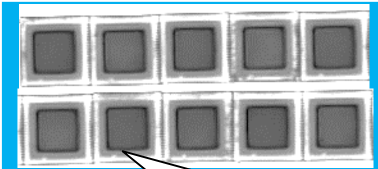
Thermal Cycle Testing (TCT)

Material		**7x7mm die (Pre-con MSL3)**		
		Cu	**Ag**	**PPF**
8303A	**Before**			
	After			

Die edge & corner slight delam

Die edge & corner slight delam

Test condition
-65C ~ 150C,
1000 cycles

LOCTITE® ABLESTIK ABP 8303A

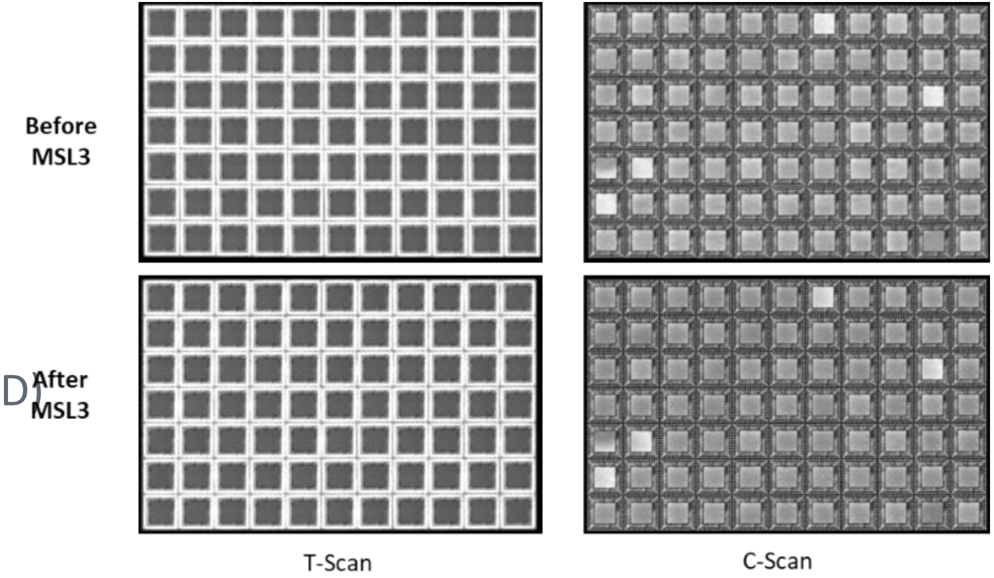
Internal Evaluation - Key Takeaways

- Excellent dot dispensability
- ABP 8303A has significantly high HT DSS
- Significantly low warpage
- Good open time even for small die applications (240 min for 2 mm x 2 mm)
- Pass MSL1 for die size 2 mm x 2 mm on Cu LF
- Pass MSL3 for die size 7 mm x 7 mm on Cu, Ag, PPF
- ABP 8303A has great TCT

LOCTITE® ABLESTIK ABP 8303A

Application Case Histories

- Application: Logical IC
- Package Type: QFN 7x7
- Die Pad: Cu Leadframe
- Die Size: 4.4mm x 4.4mm x 6mils(t)
- ESEC Needle Dispensing, 0.25 mm (ID)
- MSL3 260C



LOCTITE®ABLESTIK ABP 8303A

External Evaluation or Reliability Data

Customer	Evaluation type	PKG	Die size (mm)	Die pad	Reliability
A	Dummy	QFN	6x6	Cu	**MSL3 pass**
	Dummy	QFN	0.5x0.5~8x8	Cu, rough PPF	Ongoing
B	Dummy	QFP	4.4x4.4	Cu	**MSL3 pass**
	Real device	QFP	4.4x4.4	Cu	**MSL3 pass**
C	Dummy	QFP	3.5x3.5	Cu & Ag	**MSL1 pass**
	Dummy	QFP	6x6	Cu	**MSL1 pass**
D	Dummy	QFN	1x1~5x5	Cu	**MSL3 pass**

Thank You