Two Print Stencils Systems

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Abstract
The Two print stencils process has been a very useful tool in SMT Assembly and Package Assembly. It is also useful in Assemblies that require mixed technologies; including SMT / Through Hole, SMT / Glue attach components, Packages requiring die attach / SMT assembly. The concept is to print with a first print stencil which is thinner than the second print stencil. The second print stencil has relief pockets formed anywhere that the first stencil printed. It is useful for several applications:

Printing Solder Paste for Through-Hole and SMT
Printing Glue and Solder Paste
Printing Flux and Solder Paste
Printing Solder Paste for SMT and RF Shields
Printing Reservoir Solder Paste for multi-level boards
Printing Solder Paste and Reservoir Flux

Each of these applications will be discussed in this presentation.

Introduction
One of the first requirements (mid 1990's) for Two Print stencils was Intrusive Reflow of a fully populated Pin-Grid-Array. The volume of solder paste required to form a sufficient fillet for the Through-Hole required a very thick stencil, so thick that a normal step stencil was not a practical solution. The first print stencil was 6 mils thick and printed solder paste for the SMT devices. The second print stencil was 16 mils thick and had a relief pocket 10 mils deep for the first print solder paste. Not long after that, there was an application for printing solder paste first, then glue for large chip components that needed to be glued during second pass reflow. In the late 1990's a microprocessor package assembly required a thin layer of flux to be printed for die attach, then solder paste for decoupling capacitors. A two print process having a 2 mil thick first print stencil for the flux and a 6 mil thick stencil for the SMT chip components with relief pocket for the flux worked well for this application. In 2007 an application appeared for printing into a two level board where the SMT component pads were recessed 12 mils below the top surface of the PCB. The SMT pads were very close to the walls of the recessed area. A step stencil was manufactured that fit into the board cavity with a reservoir for paste above the apertures. The paste was delivered to the SMT pads by Reservoir printing. Very recently, an application for assembling die attach and 01005 on the same substrate presented itself. The stencil design for this application required a two print process involving flux reservoir printing. Stencils for these application opportunities will be described in this presentation.

Stencil Design for Intrusive Reflow of Through- Hole Components
Sometimes it is desirable to by-pass the wave solder operation and print solder paste for both SMT and Through-Hole devices(1). After solder paste is printed both the SMT and Through-Hole devices are placed and both reflowed at the same time. The first task in designing a stencil for this application is to determine the amount of solder paste required to fill solder paste in and around the pins and form a proper solder fillet around the pins. The first option is to see if enlarging the stencil aperture to overprint around the Through-Hole will provide sufficient solder; if not, then look at a step-up stencil with overprint; if still insufficient look at a Two Print Stencil Process. Figure 1 shows solder paste bricks printed on the PCB for an Axial Resistor Through-Hole for an overprinted aperture in a 6 mil thick stencil. The stencil provided sufficient solder paste for good solder fill around the pin and good pin fillet as evidences in Figure 2 (an X-RAY cross section of the pin in the PCB after reflow). In the case of a fully populated Through-Hole connector the amount of paste overprint is limited. This is shown in Figure 3 where the overprint aperture is limited to 85 mils square on a 100 mil pitch. In this case a Two Print Stencil system may be required which is shown in Figure 4. The paste delivered is made up of two parts; hole fill paste and overprint paste. Both components are shown in the X-RAY picture shown in Figure 5. This sequence shows paste printed in (1), pin placed in the Through-Hole (2) and Pin with solder after reflow. Pin to Hole ratio is also important as seen in Figure 6 Pin-to-Hole ratios of .56 and less were exhibiting voids.

Printing Glue and Solder Paste
There are some applications where heavy parts like large Chip components or SMT leaded components are placed on the back side of the PCB in a single reflow operation. These large components may need to be glued. When stencil printing glue, a Two Print Stencil Process must be used. An example of this type of stencil is shown in Figure 7. Printed glue and solder paste for an 0805 is shown in Figure 8.There are also applications where radial through hole are protruding through the

PCB and it is desirable to print glue for the discrete devices before wave soldering. In this case very thick stencils with glue reservoirs are convenient [(2)].

Printing Flux and Solder Paste

Assembly of flip Chip and Surface Mount Components on the same substrate may require a Two Print Stencil System. FC attach may be achieved by placing the bumped die in a thin layer of flux, a thin layer of conductive polymer, or a thin layer of solder paste. Normal thickness for these layers is 2 mils or less. The first print stencil prints this layer and the second print stencil prints the SMD paste and has a relief pocket for the first print. This is illustrated in /figures 9 and 10. The second print stencil normally has a relief pocket chemically etched into the stainless steel stencil foil and then has the apertures laser-cut in the foil. It is also possible to construct a 3-D Electroform stencil for the second print stencil. In this case the relief pocket is grown on a mandrel with the relief pocket machined into the surface of the mandrel. Such a stencil is shown in Figure 11. There are a couple of requirements that drive the need to use this type of stencil. A relatively high relief pocket can be formed in a thin stencil. A thin stencil ~ 2-3 mils thick may be required to print small chip components like 0201 and 01005 but the relief pocket may need to be 3-4 mils high for good clearance from the first print.

Printing Solder Paste for SMT and RF Shields

RF Shields may exhibit co-planarity problems. Normally additional solder paste height is required to compensate for this problem. In small handheld devices other very small components are often positioned very close to the RF Shield. This renders a normal step stencil impractical. The Two Print Stencil System is one possible solution for this application[(3)]. The 1st print stencil is shown in Figure 12, a 2 mil thick Electroform stencil for the very small SMD's. Figure 13 shows the 2nd print stencil for the RF Shield, a 7 mil thick stainless steel stencil with a 5 mil deep chem.-etched relief with laser-cut apertures. Figure 15 shows solder paste deposits for the RF shield and the .3mm pitch uBGA.

Printing Reservoir Solder Paste for multi-level boards

A recent design involved a circuit board with built in EMI shielding on one side and a laminated 20 mil thick ground plane creating multiple recessed pockets of circuitry as shown in Figure 16. In the past, depositing solder paste on uneven surfaces has been accomplished using dispensing methods. An alternative approach would be to use traditional printing methods as a means for providing sufficient solder paste for reliable solder joints. In this case the surface mount pads are located in multiple irregular shaped pockets 20 mils below the top surface. The stencil design[(4)] is a 25 mil thick stencil with both chem.-etch down and chem.-etch up pockets 20 mil thick leaving 5 mils of stencil over the recessed pads , which is shown in Figure 17. Apertures the same size of the pads would lead to excessive solder deposits so circular apertures were staggered over the pads, which are shown in Figure 18. The squeegee side view of the stencil is shown in figure 19 and the contact (board side) view is shown in Figure 20. Reservoir Print results are seen in Figure 21.

Printing Solder Paste and Reservoir Flux

The present application calls for assembly of FC as well as very small chip components, 0201 and 01005. Normally the printing of flux for FC and paste for chip component and SMT devices could be accomplished by a normal two print stencil. However in this case the paste stencil for 01005 requires a 2 mil thick stencil which leaves no room for a flux relief pocket on the bottom side of the stencil. The Flux reservoir printing process is a two print stencil process but the printing sequences are reversed[(5)]. The "first stencil" is 2 mils thick and is used to print solder paste for the SMT and 01005 devices. The "second stencil" is 8 mils thick with a 5 mil etch relief pocket on the contact side for clearance of the "first print" from the "first stencil". The reservoir pocket is etched down 6 mils leaving 2 mils thickness for the flux apertures. Figure 22 shows the substrate with the FC pads and 0201 and 01005 chip capacitors. Figure 23 summarizes the stencil design showing both squeegee and contact side views. Four different aperture designs (Trial 1 – Trial 4) were tested. Four different sets of apertures were used: oblongs: 84 x 160 microns, 89 x 160 microns, 93 x 160 microns and 97 x 160 microns. Trial 2 gave acceptable flux transfer as seen in Figure 23 which shows paste printed with the 1st print stencil and flux printed with the 2nd print stencil, note the paste bricks are unaffected by the 2nd print.

Conclusions

The Two Print Stencil System has demonstrated an effective printing process for Surface Mount Assembly Including:

- Through Hole / SMT Assembly
- SMT / Flip Chip Assembly
- FR Shield / SMT Assembly
- SMT / Glue Chip Component Assembly
- Multi-Level SMT Assembly
- 01005 / Die Attach Assembly
- Other applications not mentioned in this paper including printing lead free and tin lead on the same PCB

1-"Lead Free Intrusive Reflow" W. Coleman and G. Oxx, APEX 2007

2- “Metal Stencils for Adhesive Printing”, W Coleman and A. Wadhwa, APEX 2002
3- “Stencil Options for Printing Solder Paste for .3mm pitch CSPs and 01005” Chip Components, W. Coleman and C. Anglin, APEX 2010
4- “Reservoir Solder Paste Printing”. M. Burgess and J. Robbins, SMTAI 2007
5- Flux Reservoir stencil Printing”. W. Coleman and M. Read, SMTAI 2012

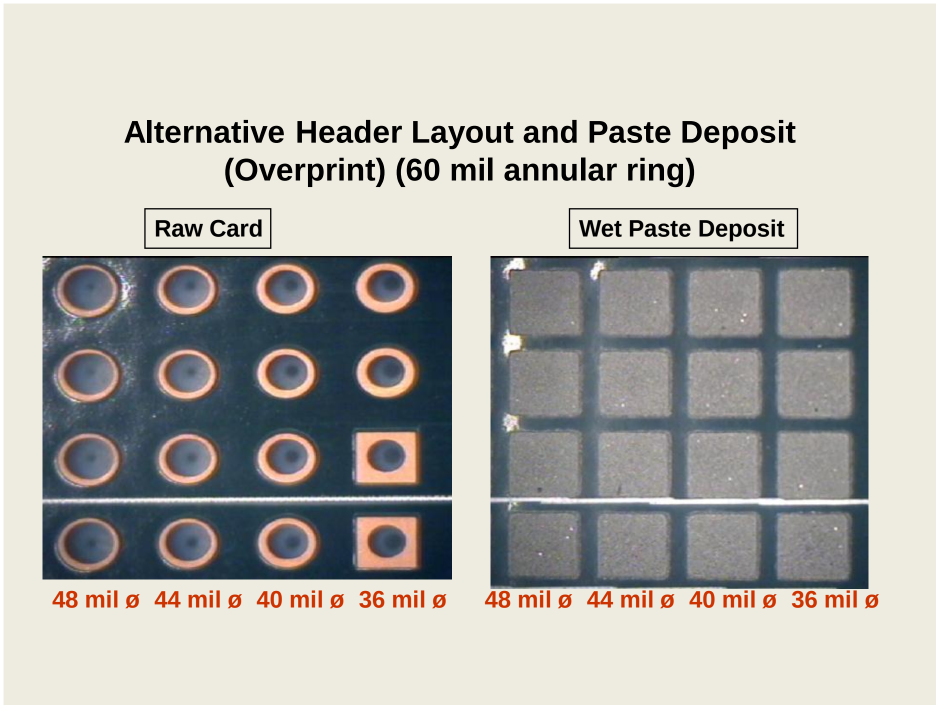


Figure 1 Overprint for Through-Hole Device

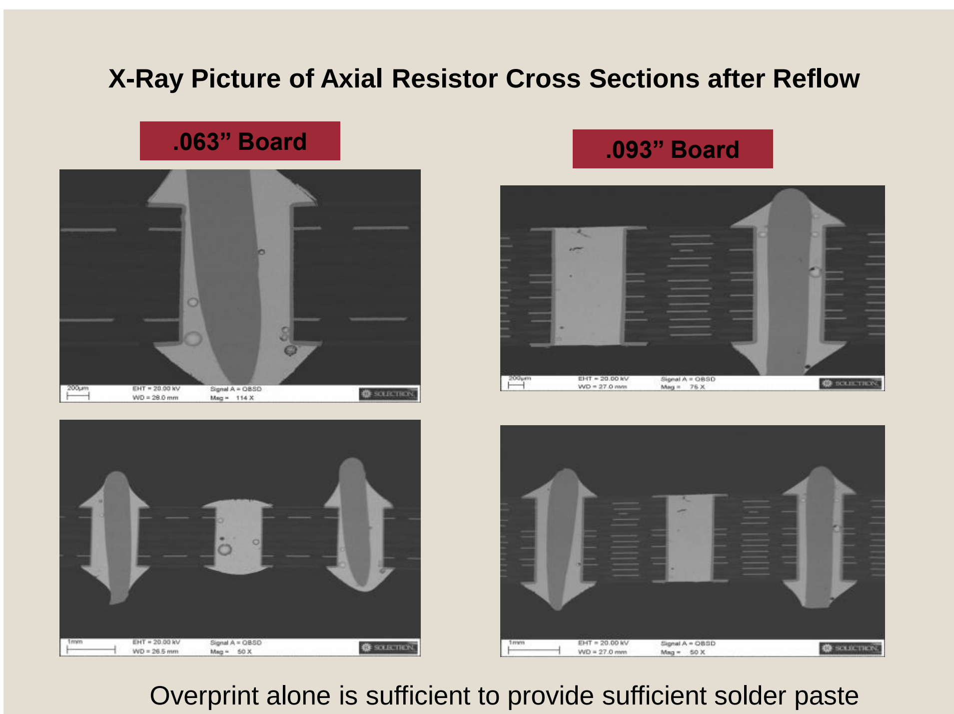


Figure 2 X-Ray of Pin-In-Hole showing sufficient solder fill

Alternative Header Layout and Paste Deposit (Overprint Constraints) (60 mil annular ring)

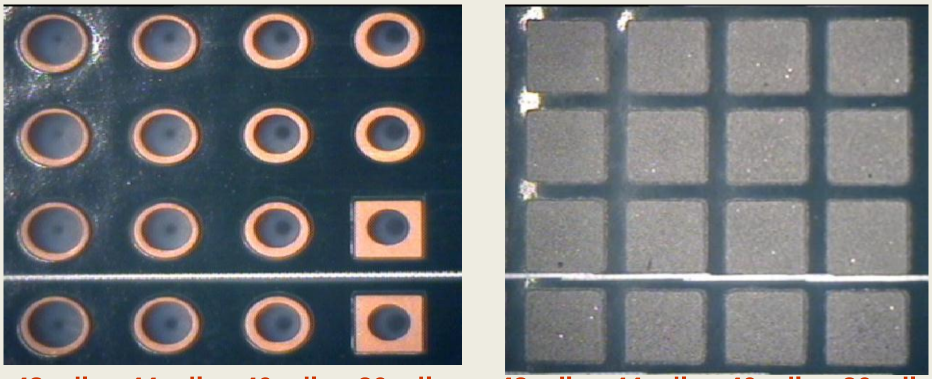


Figure 3 Print of 85 mil square paste bricks (100 mil pitch) for 2nd Print Stencil

Two Print Stencil (typically 12-20 mils thick) for printing solder paste for Intrusive Reflow of Through-Hole components.

Relief pockets on bottom side for clearance of SMT solder paste.

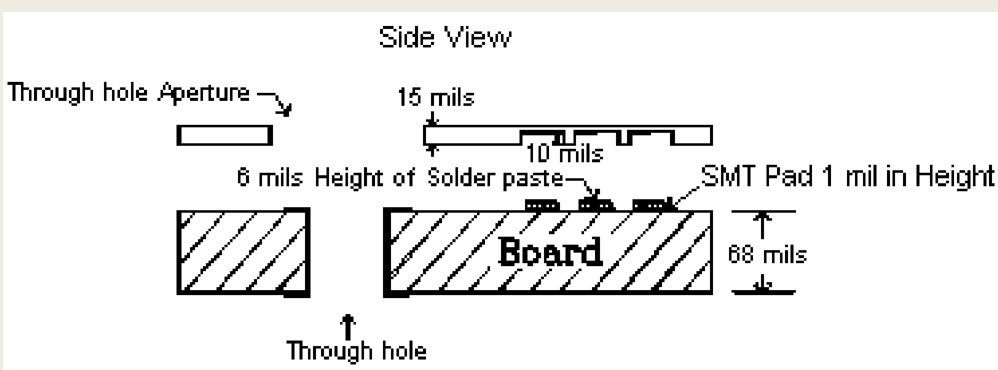


Figure 4 2nd Print Stencil (Chem-Etch / Laser-Cut)

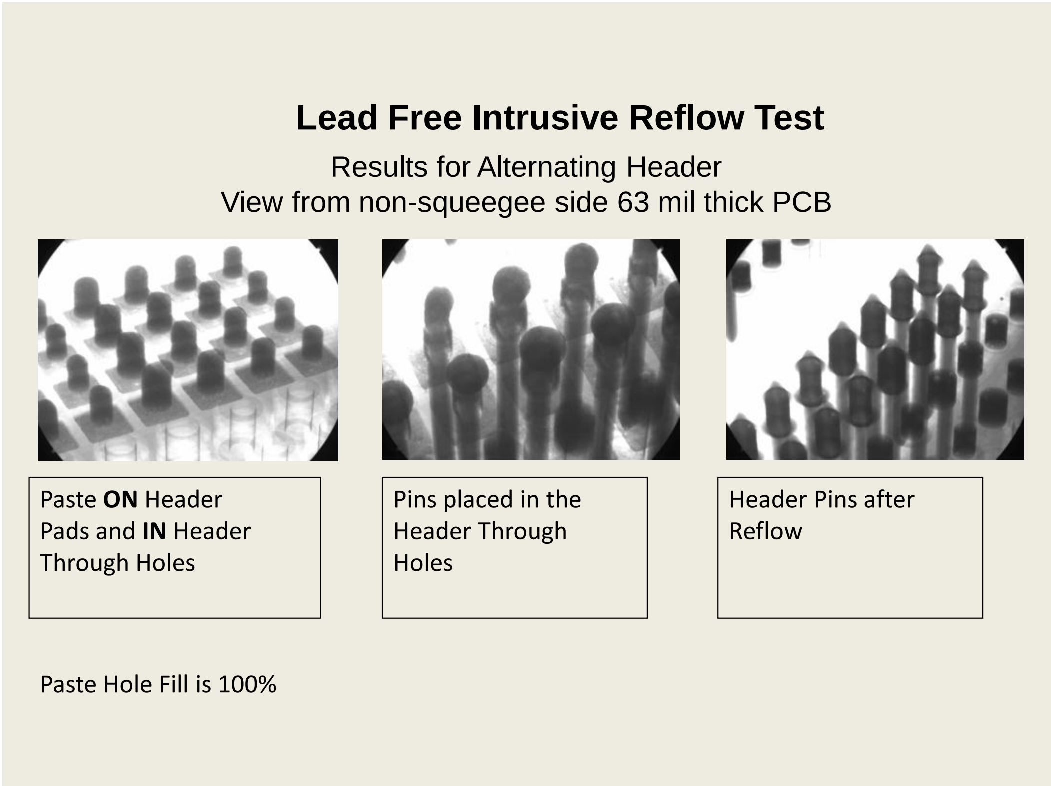


Figure 5 X –Ray view after print, after pin placement, after reflow

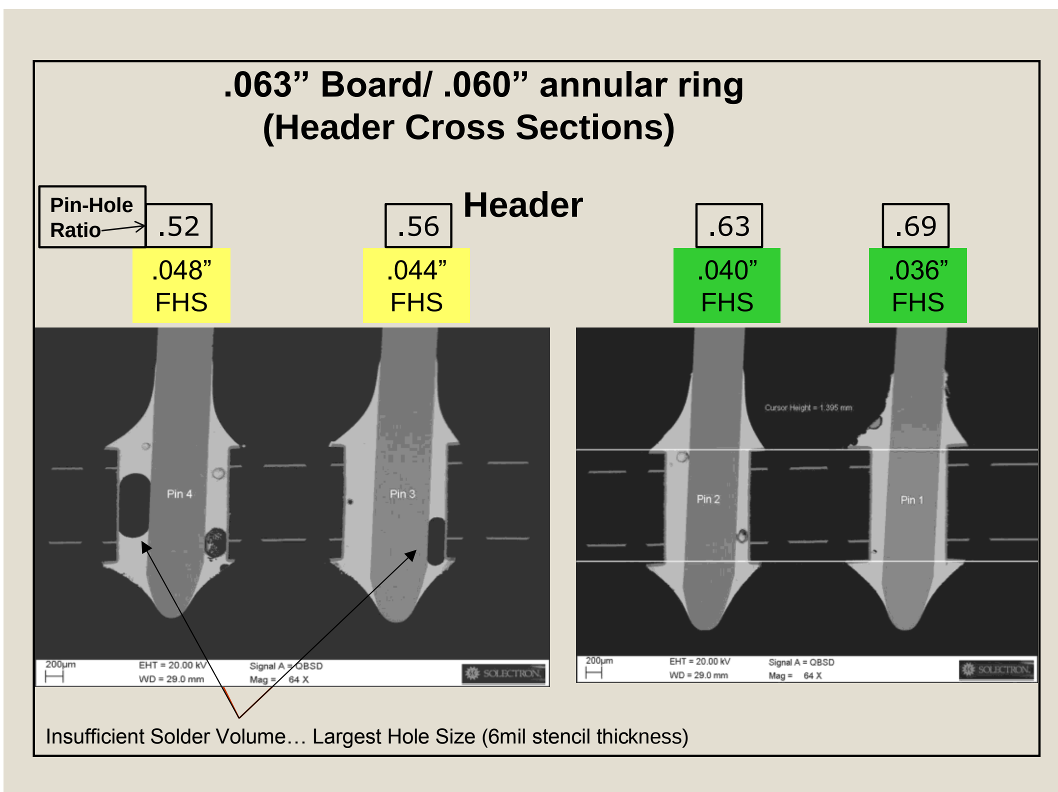


Figure 6 Pin-In-Hole after reflow showing voiding for small Pin-Hole ratio's

Two Print Stencil for printing Glue for Chip Components after Solder paste. Stencil is 20 mils thick with a 15 mil deep relief pocket

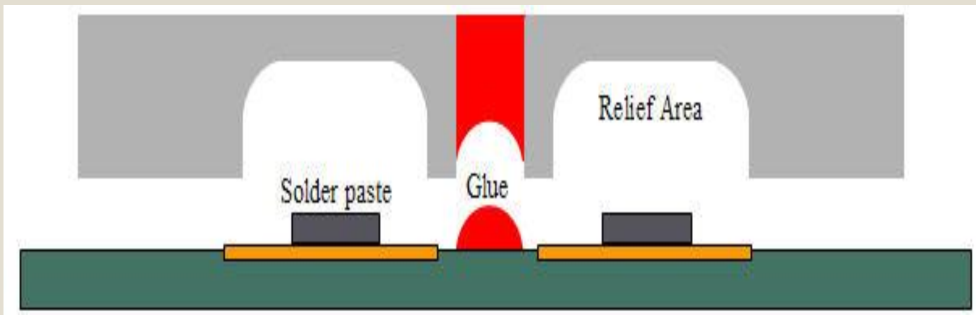


Figure 7 Printing Glue and Solder Paste for Chip Components

Picture showing Glue and Solder Paste for an 0805 Chip Component

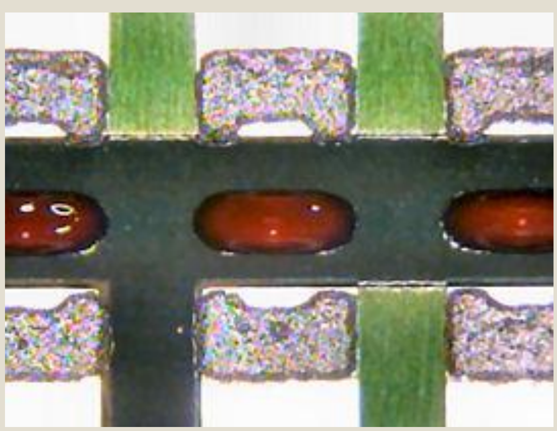


Figure 8 Printed Paste (1st stencil) and Glue (2nd stencil)

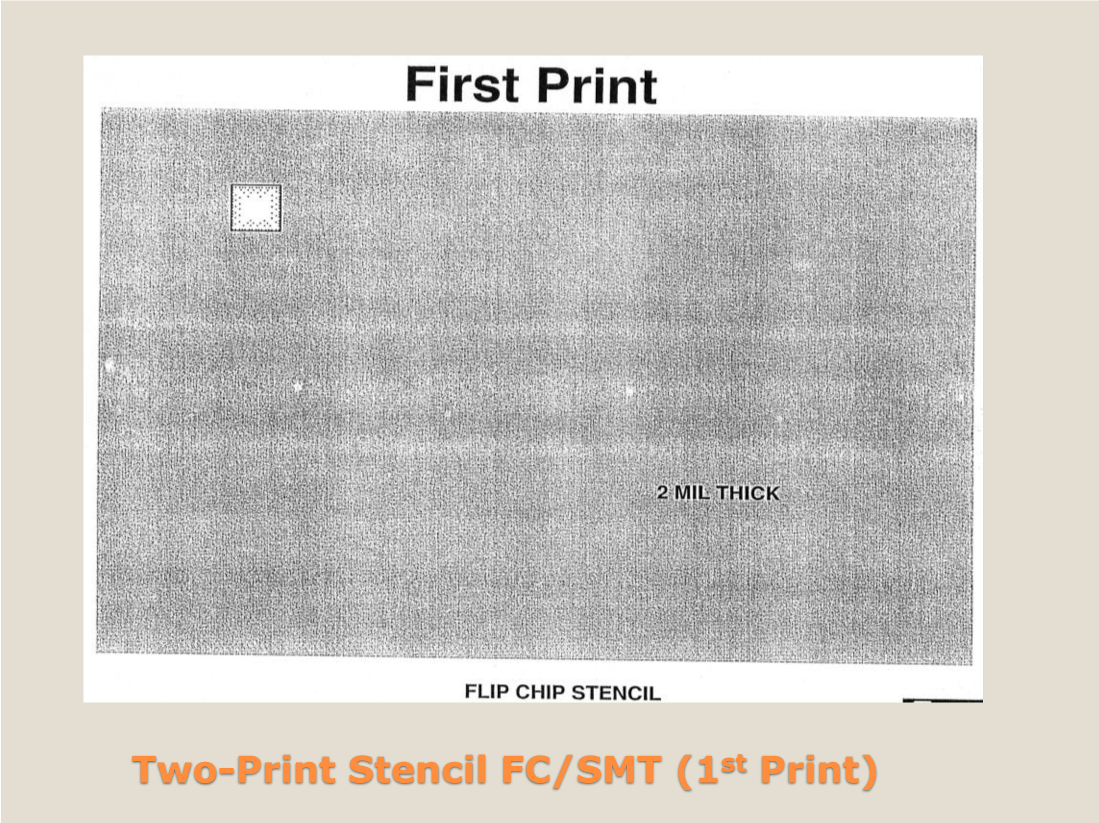


Figure 9 1st Print Stencil for Flip Chip

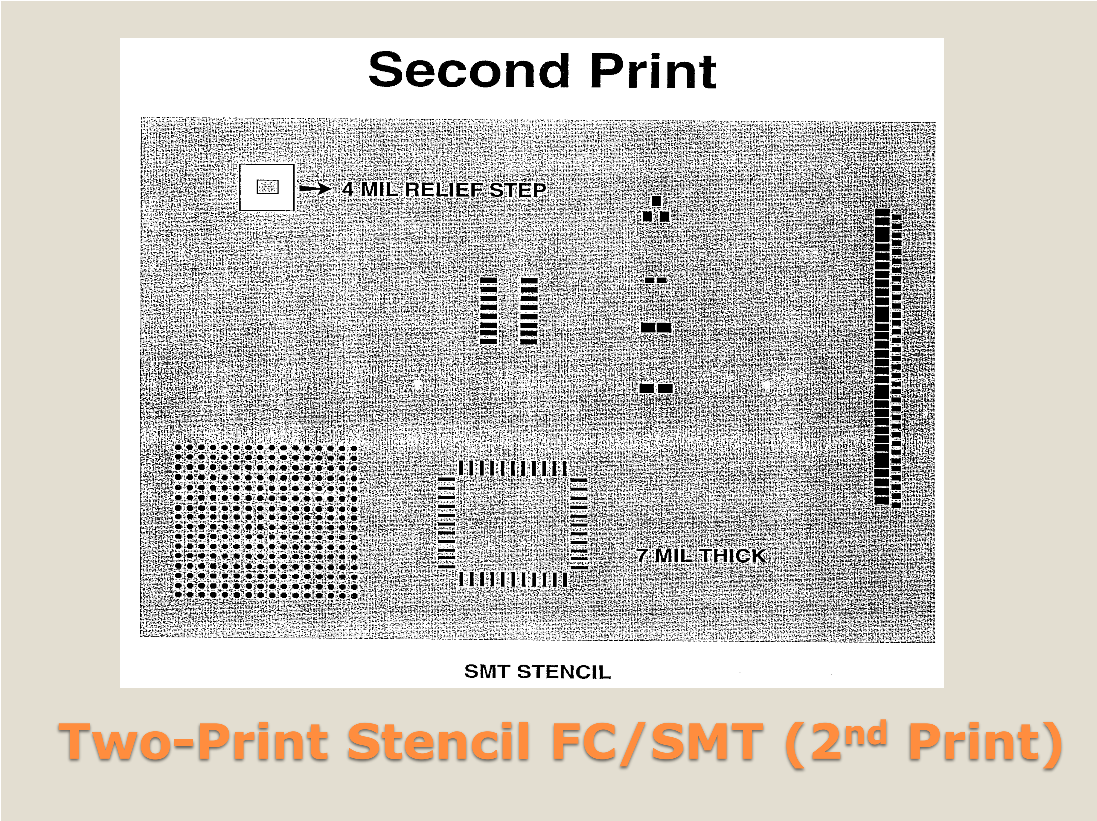


Figure 10 2nd Print Stencil

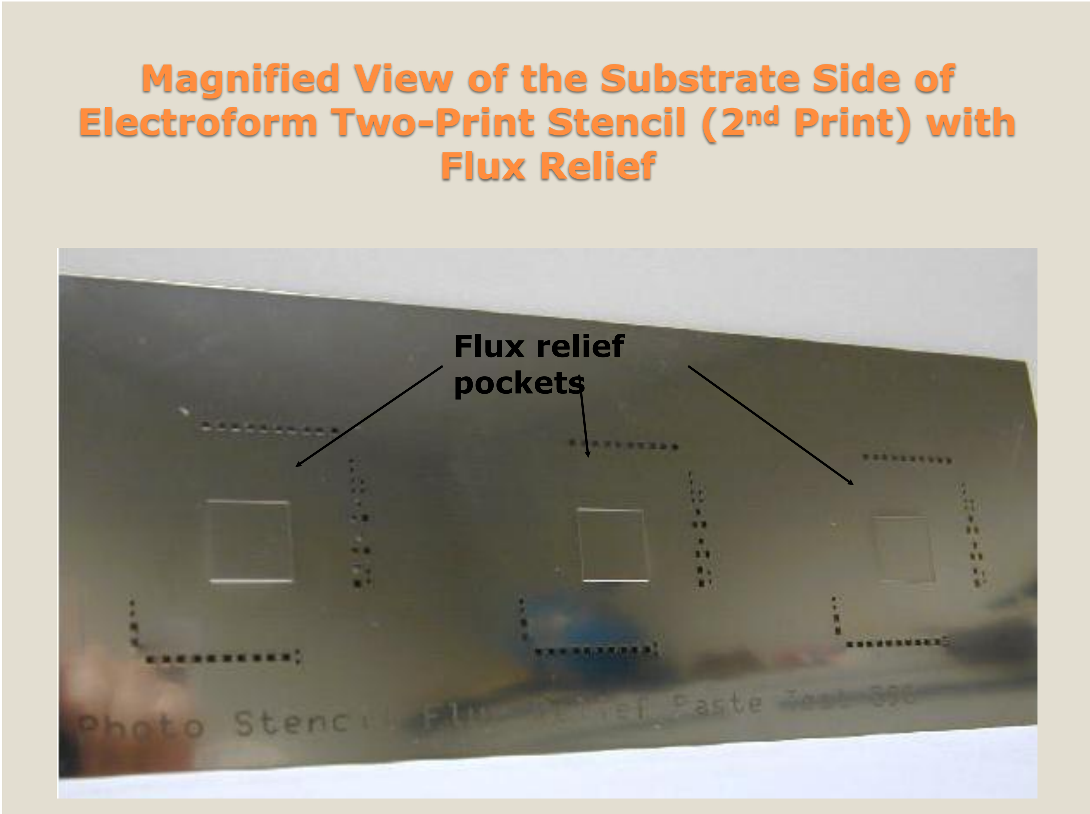


Figure 11 3-D Electroform for the 2nd print stencil for printing small Chip Components

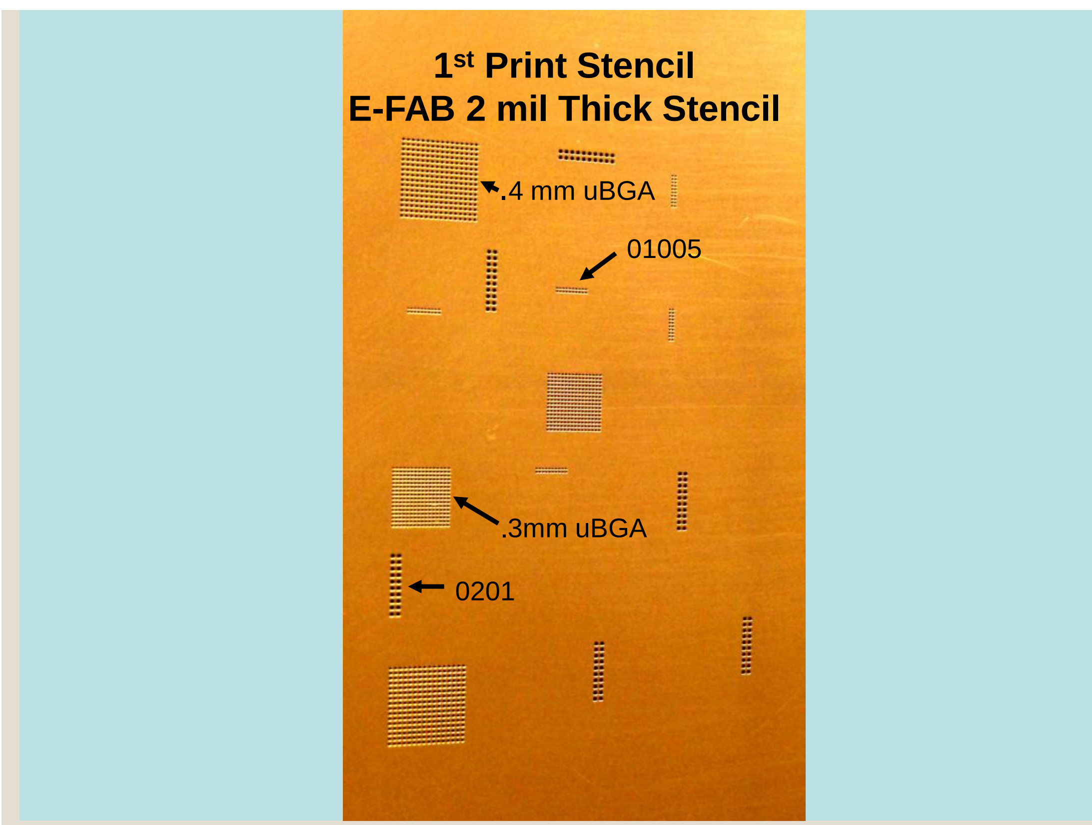


Figure 12 1st Print Stencil for SMT (small components)

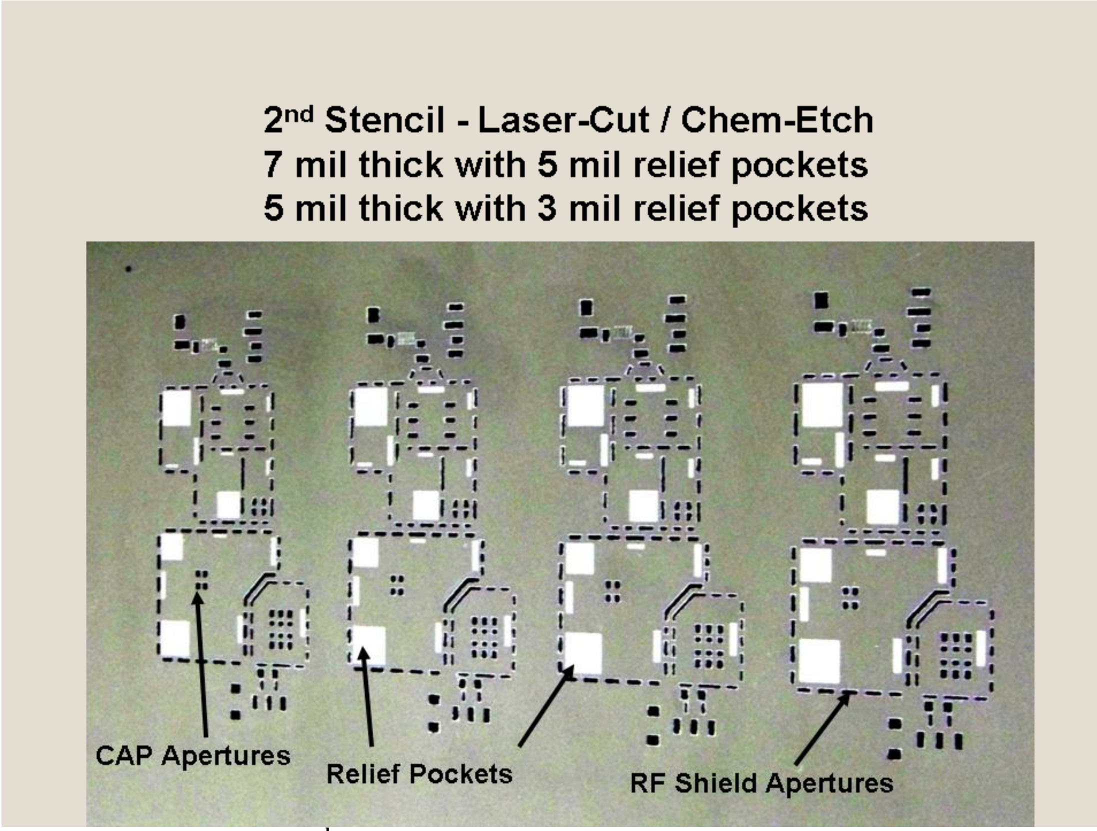


Figure 13 2nd Print Stencil for RF Shields and Large Components

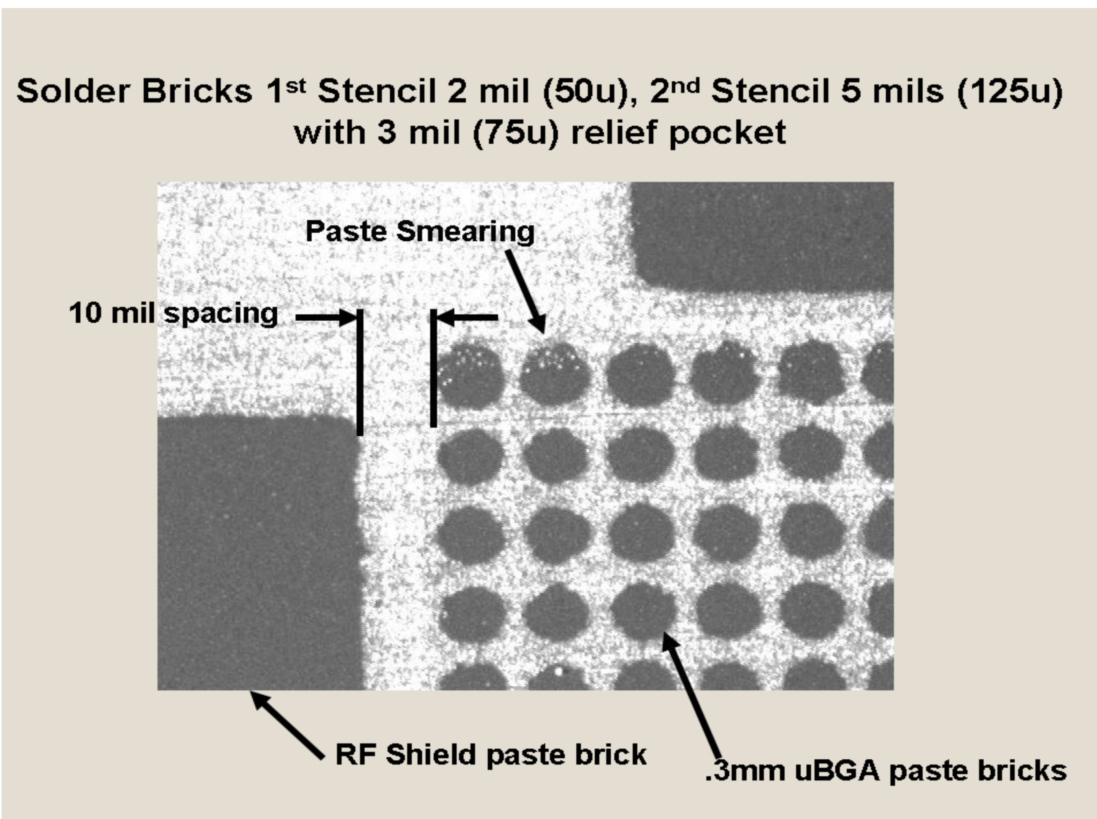


Figure 14 Solder Paste Bricks after 1st and 2nd Print showing paste smearing

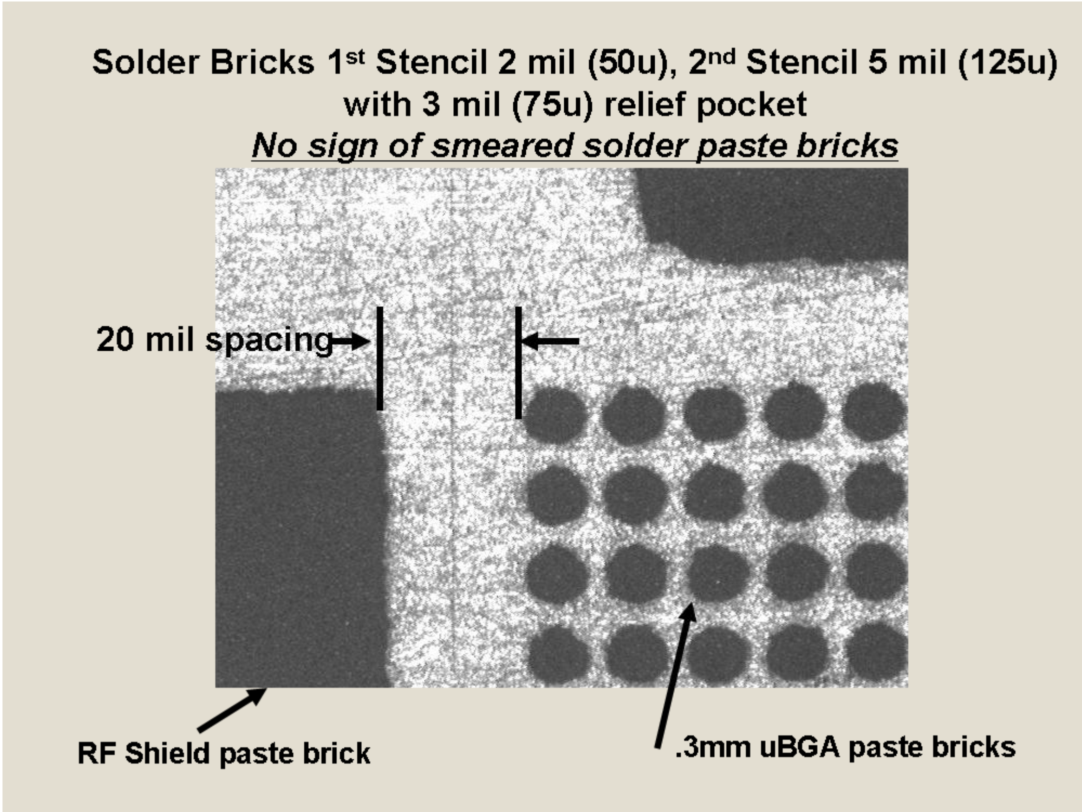


Figure 15 Solder Paste Bricks after 1st and 2nd Print showing no paste smearing

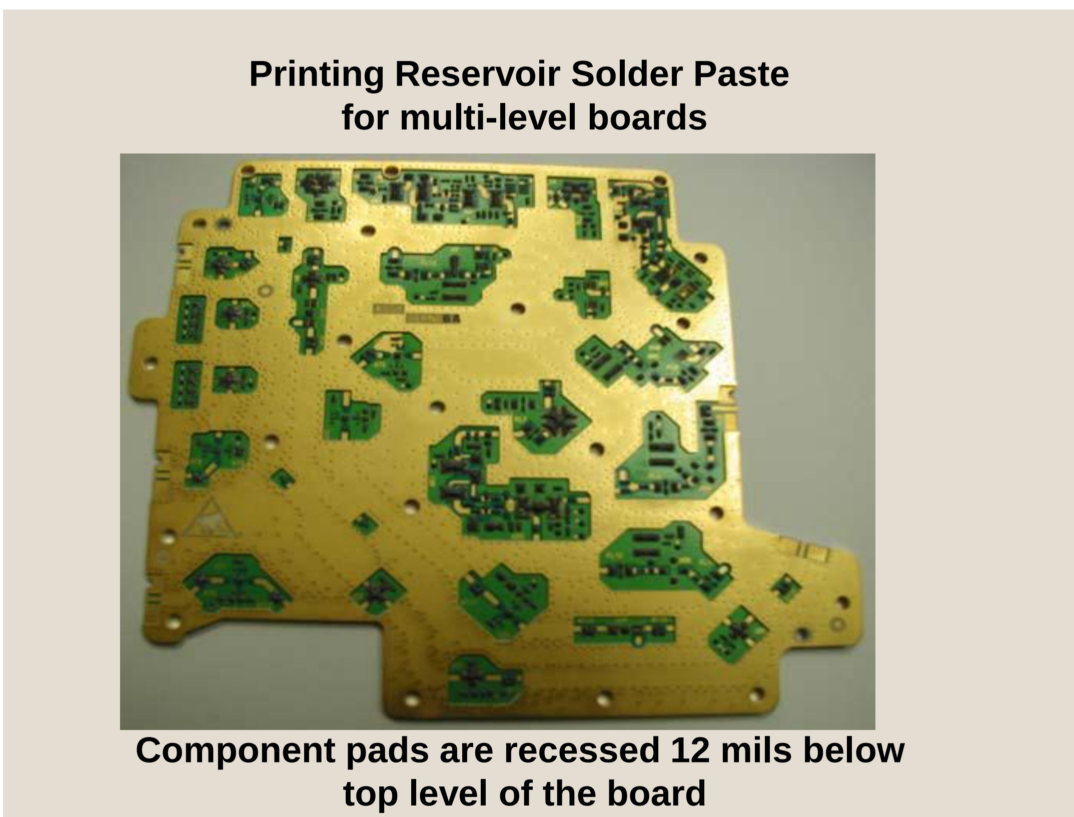


Figure 16 Recessed Multi-Level Board

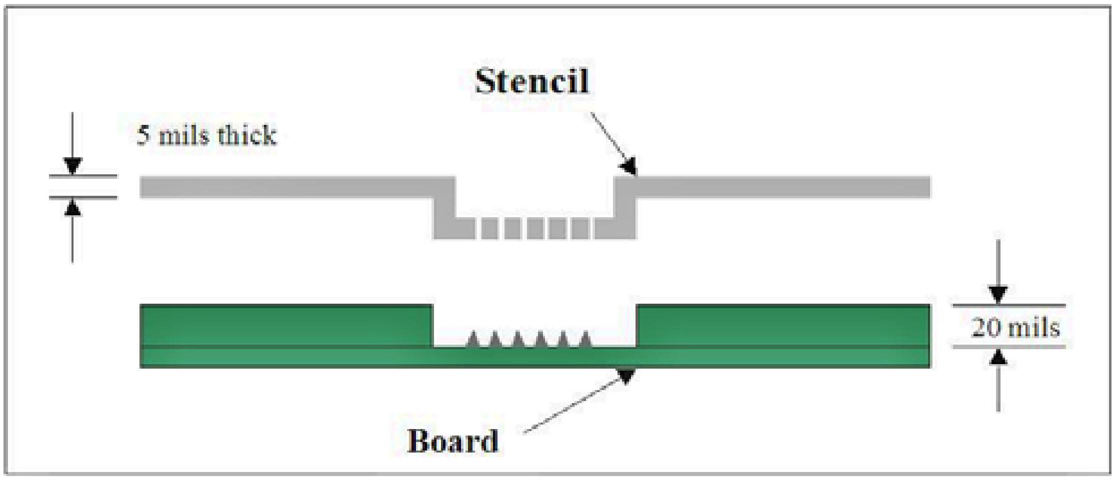


Figure 17 Stencil Design for Paste Reservoir Printing

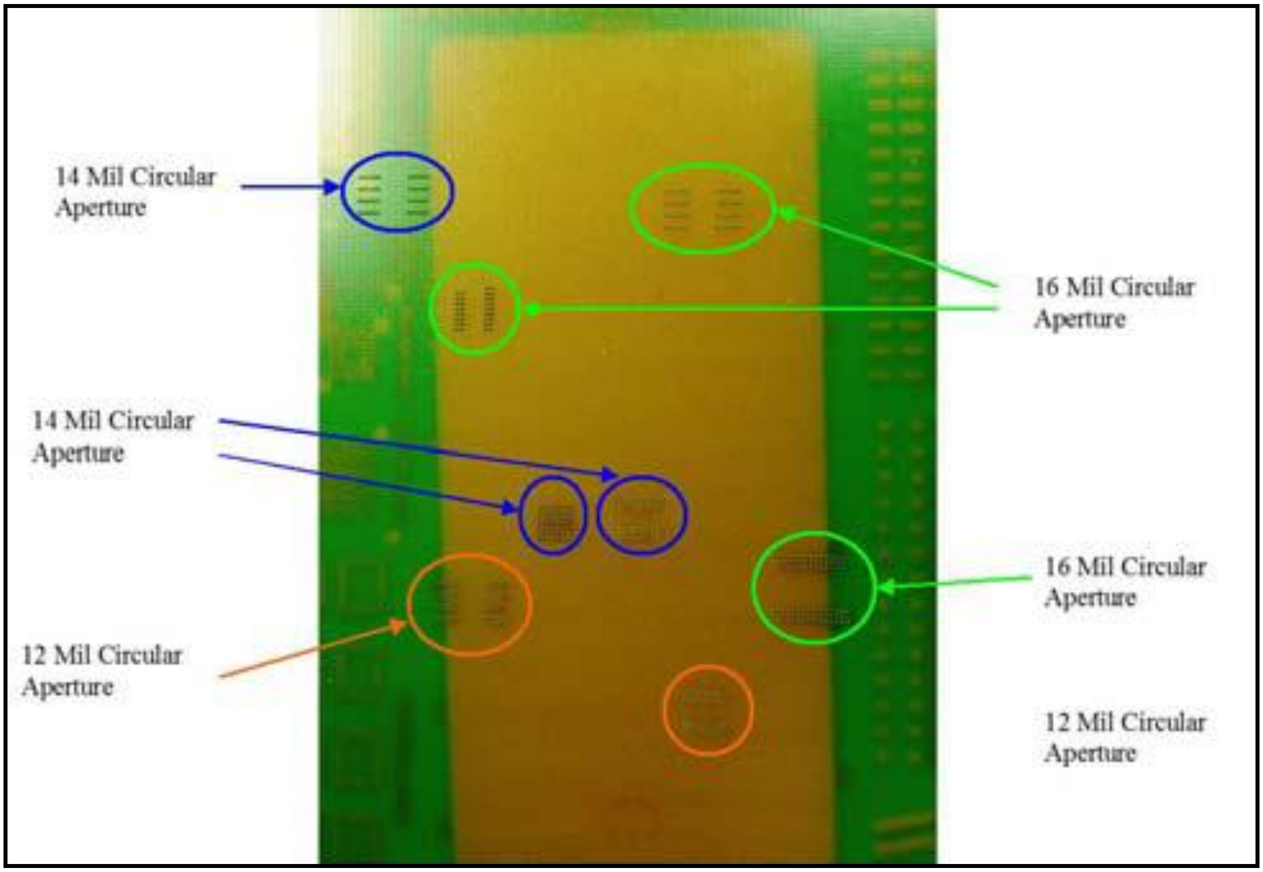
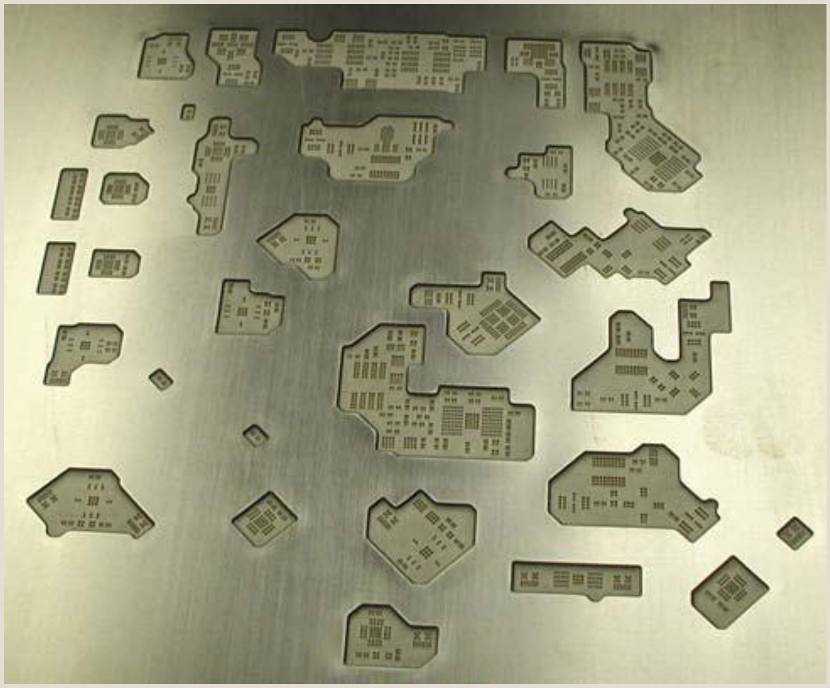


Figure 18 Test Aperture Design to determine best paste coverage on the pads



Squeegee Side view of Paste Reservoir Stencil

Figure 19 Squeegee View of Paste Reservoir Stencil showing reservoir pockets with apertures

Contact Side view of Paste Reservoir Stencil

Figure 20 Contact View showing raised areas which fit into PCB cavity

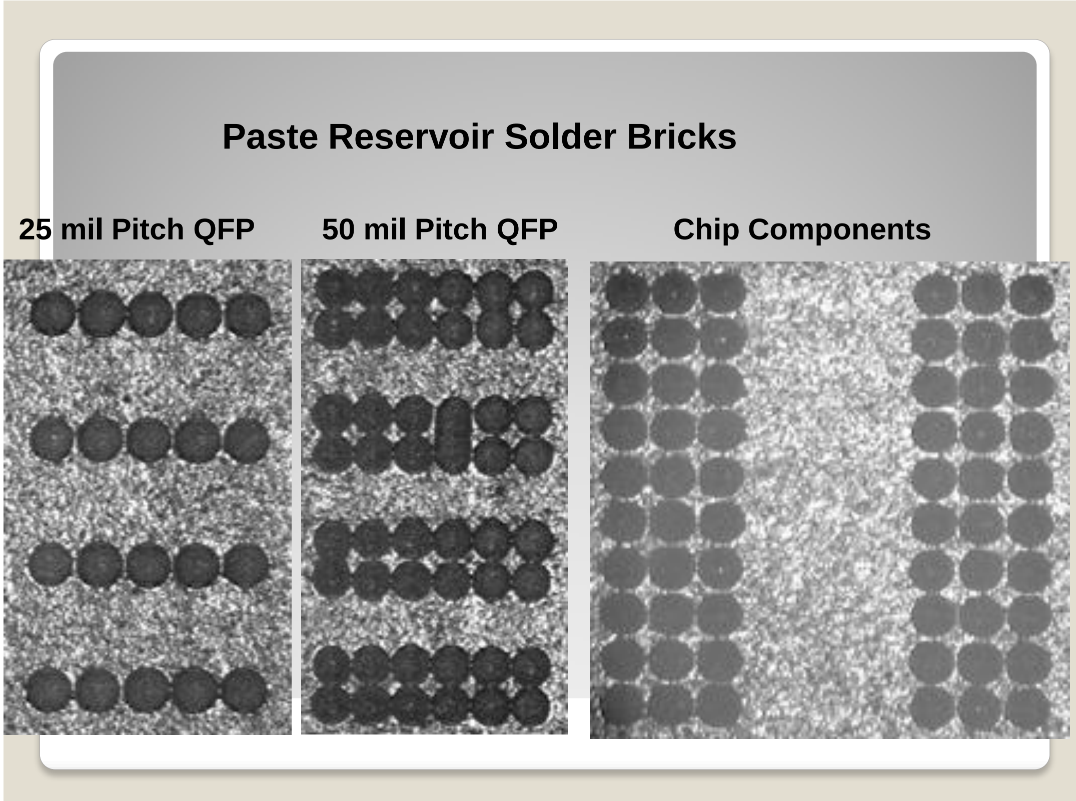


Figure 21 Solder Bricks using circular apertures for pitch parts and chip components

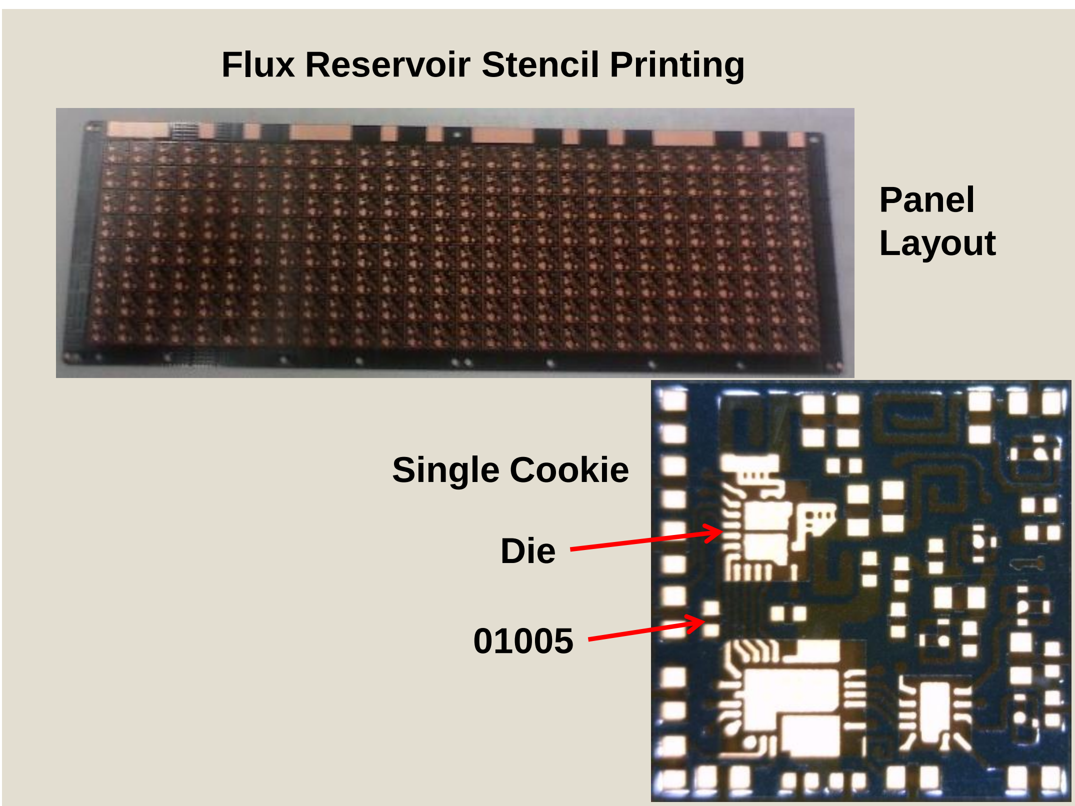


Figure 22 Substrate having both Flip Chip and 01005 chip components

Stencil Design

Stencil #	Cut Method	Polish	Stencil Thickness	Aperture Shape	Aperture Openings				Topside Cavity Depth	Stencil Thicknes in Cavity	Bottom Relief Height	Gerber Scaling	
					Trial 1	Trial 2	Trial 3	Trial 4				X	Y
3544861	Laser	electropolished, nickel plated, nanocoated	8	Circle	3.35x6.3 mils	3.50x6.3 mils	3.65x6.3 mils	3.80x6.3 mils	6 mil	2 mil	5 mil	-2.37 (.999673)	-.61 (.999732)
Dimensions in Microns:			200		85x160	89x160	93x160	97x160	150	50	125		

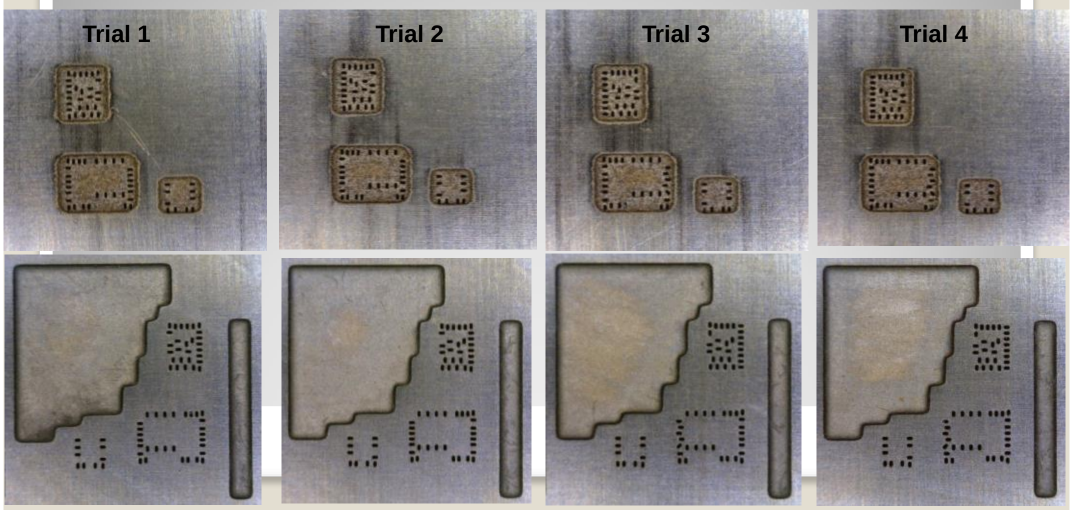


Figure 23 Stencil for Reservoir Flux printing with 4 different test apertures

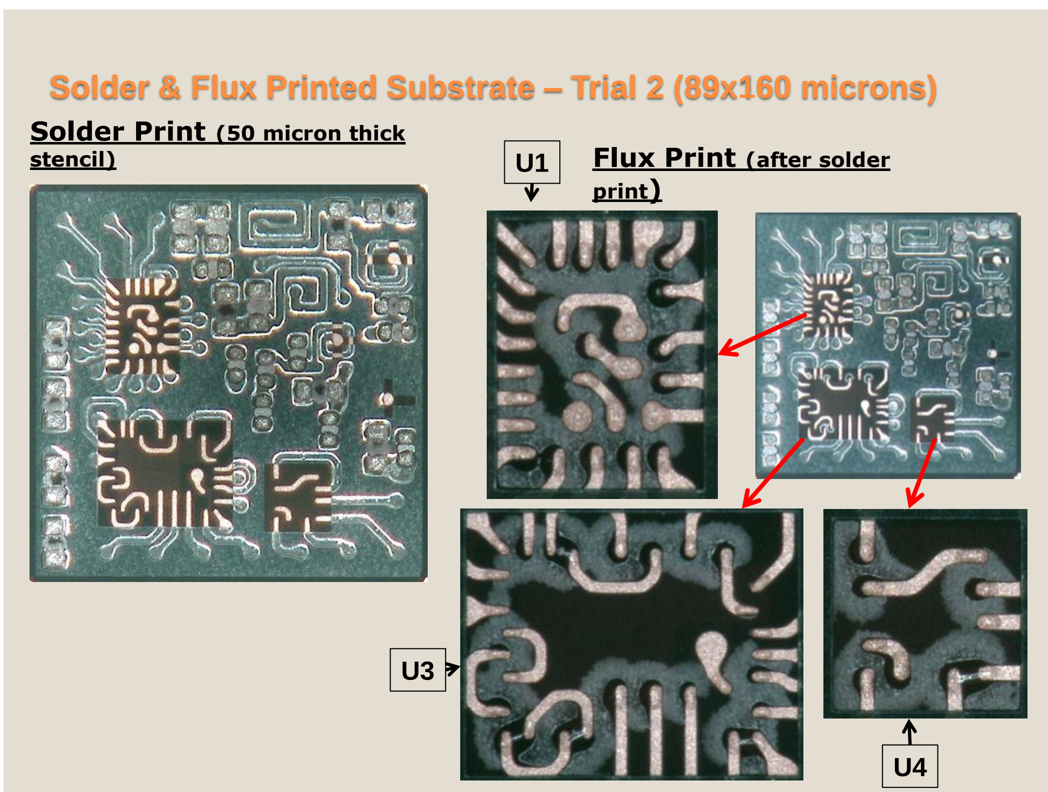


Figure 24 Solder paste print (1st stencil) and Flux print (2nd stencil)

Two Print Stencil Systems

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Two-Print Stencil Process

- Print with 1st stencil
- Print with 2nd stencil which has a relief pocket anywhere paste printed with 1st stencil
- Place components into 1st and 2nd printed paste
- Reflow all components

Advantages:

- Print different paste in 1st and 2nd print (flux / paste, type 5 paste / type 3 paste, paste / glue)
- Optimize print for 1st and 2nd print independently
- Flat print surface vs. step print surface

Disadvantage:

- Requires two in-line Printers

Two Print Stencils have been used for:

- **Printing Solder Paste for Through-Hole and SMT**
- **Printing Glue and Solder Paste**
- **Printing Flux and Solder Paste**
- **Printing Solder Paste for SMT and RF Shields**
- **Printing Reservoir Solder Paste for multi-level boards**
- **Printing Solder Paste and Reservoir Flux**

Examples of Two Print Stencil Process

1- Intrusive Reflow of TH for Full Array Connector

2- Paste and Glue Printing for gluing large Chip Components

3- Printing Flux and Solder Paste for Flip Chip / SMT

4-Printing Solder Paste for SMT devices and RF Shields

5-Printing Reservoir Solder Paste for multi-level boards

6- Printing Solder Paste and Reservoir Flux for and die attach and 01005 Chip Component Assembly

1- Pin in Paste or Intrusive Reflow

- First determine how much solder paste needed
- Can TH be overprinted to achieve required volume
- If not can Step Stencil with overprint do the job
- If not Two-Print Stencil needed to do the job

How much Solder Paste required????

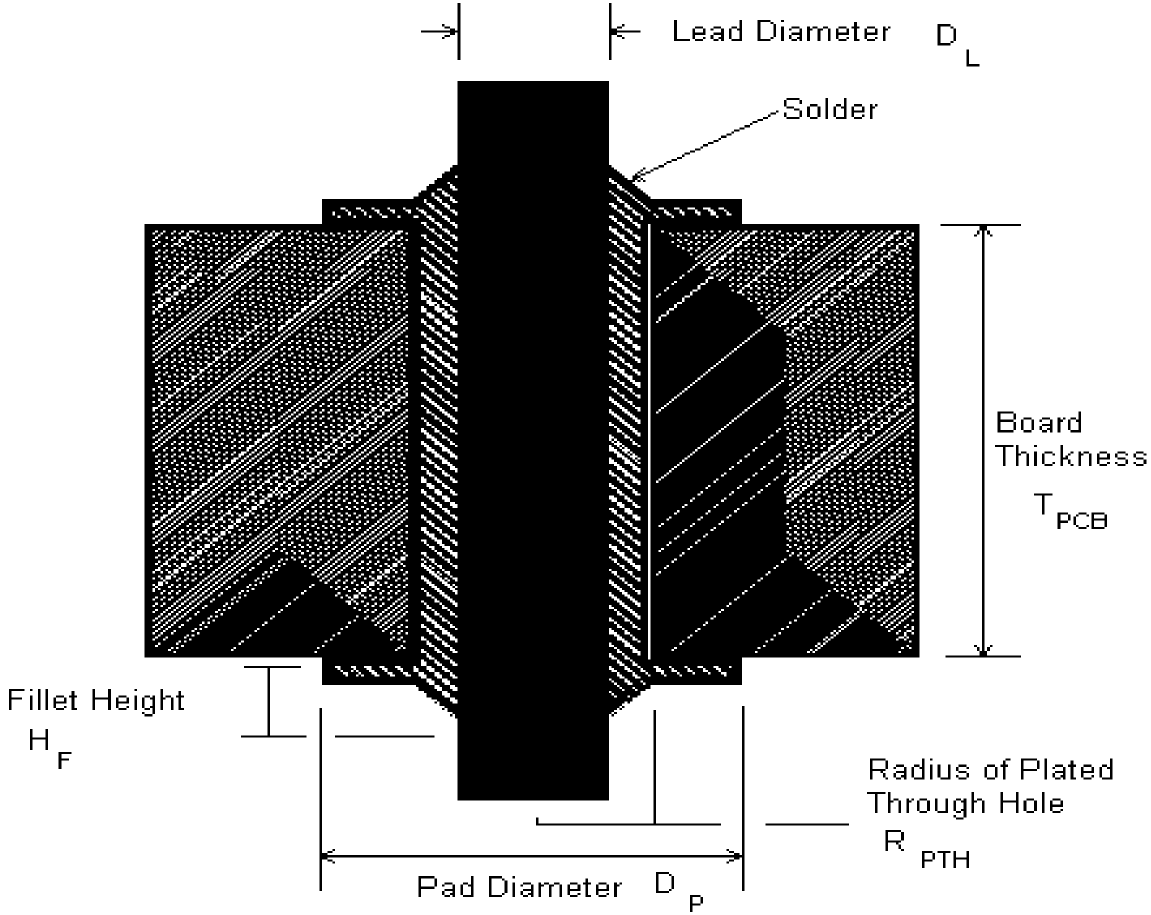


Figure 1 CROSS SECTION VIEW

Solder Paste volume Requirement

Paste Delivered is made up of two components:

Paste printed by the stencil aperture on and around the hole

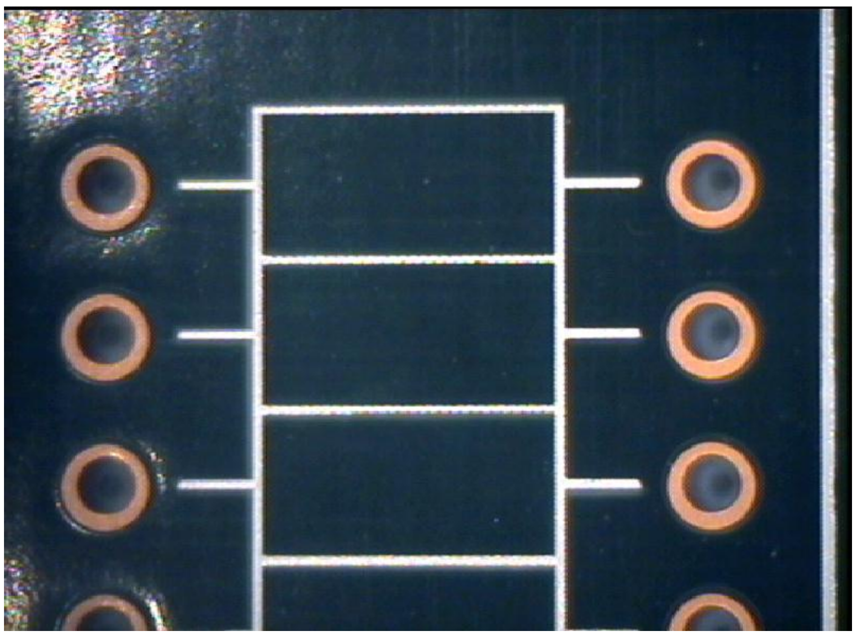
Paste forced into the barrel of the through hole

$$V = T_S (L_O \times W_O) + V_H = S \{T_B (A_H - A_P) + (F_T + F_B) + V_P\}$$

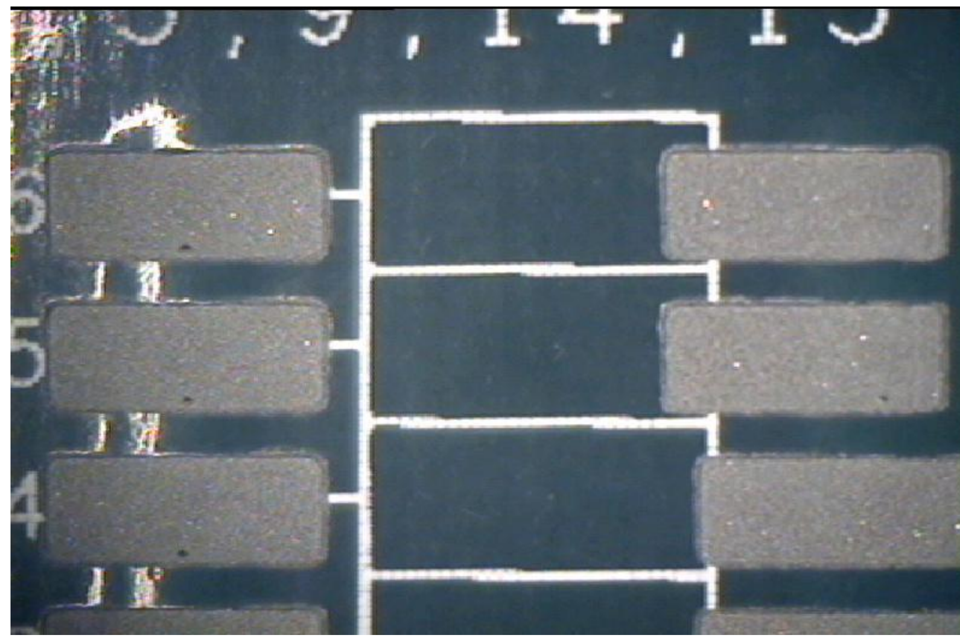
V	= volume of solder paste required
V_P	= solder volume left on the top and bottom board pad
S	= solder paste shrink factor
A_H	= cross-sectional area of the through-hole
A_P	= cross-sectional area of the through-hole pin
T_B	= thickness of the board
F_T+F_B	= total fillet volume required
T_S	= thickness of the stencil
L_O	= length of overprint aperture
W_O	= width of the overprint aperture
V_H	= solder paste filling the hole during the printing operation

Example of Single Level or Step Stencil for Overprinting TH Axial Resistor Layout and Paste Deposit

Raw Card

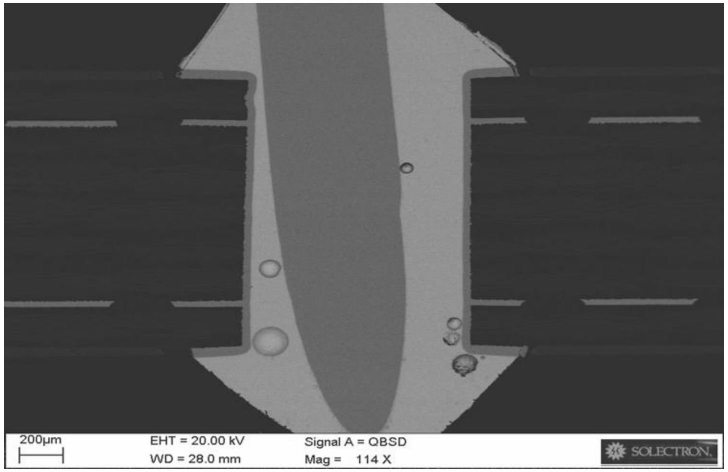


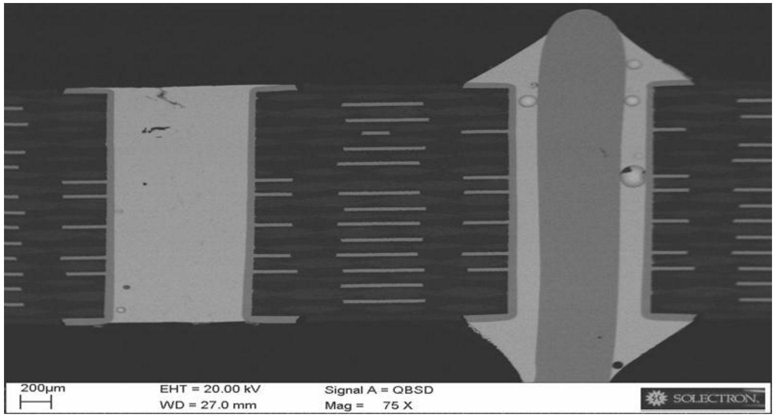
Wet Paste Deposit

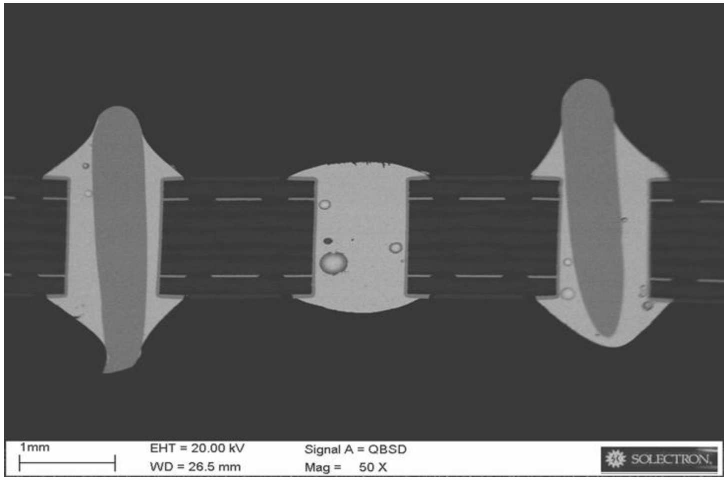


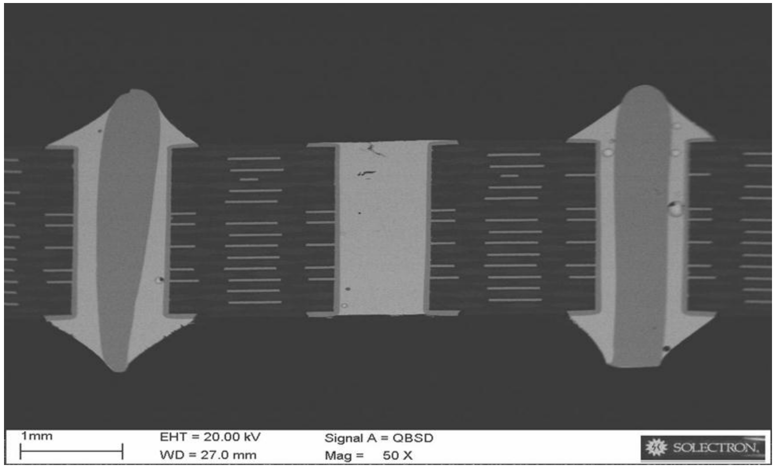
X-Ray Picture of Axial Resistor Cross Sections after Reflow

.063" Board | **.093" Board**



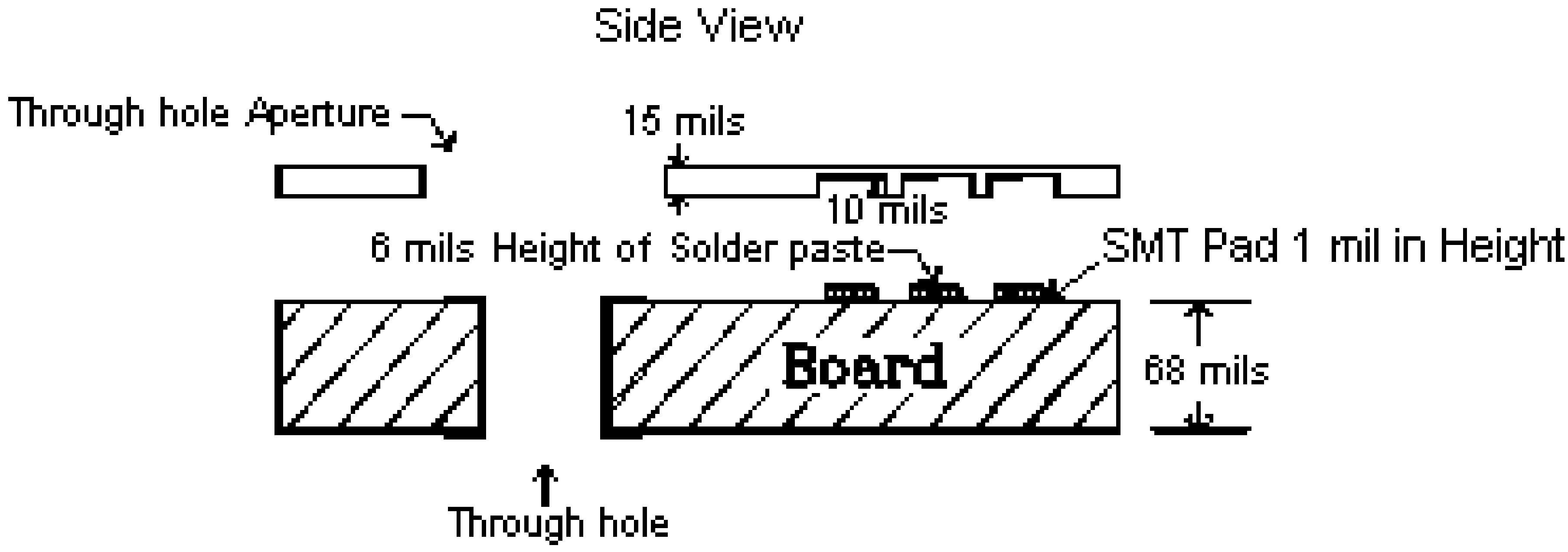






Overprint alone is sufficient to provide sufficient solder paste

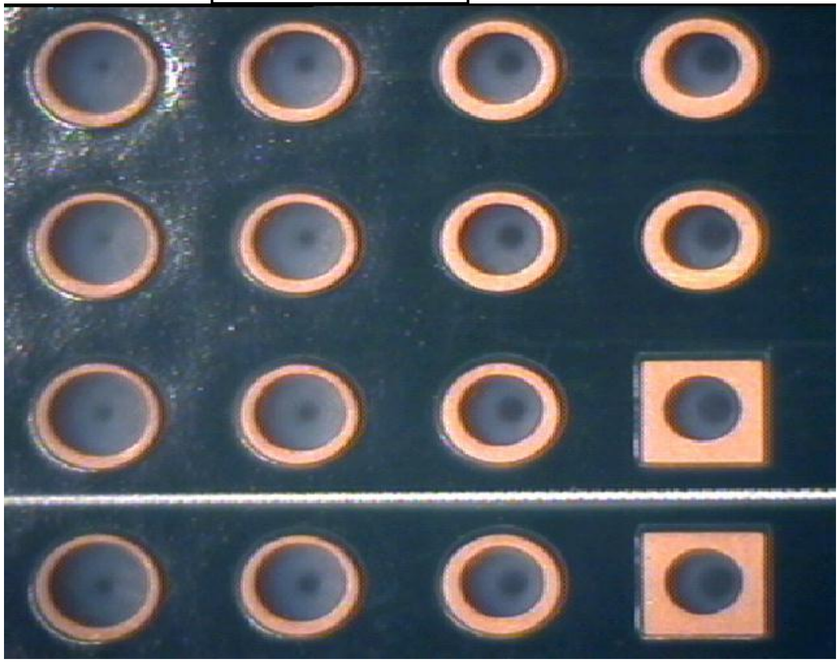
Two Print Stencil (typically 20 mils thick) for printing Solder paste for Intrusive Reflow of Through-Hole components.
Relief pockets on bottom side for clearance of SMT solder paste.



Example of Full-Array Connector with Overprint Constraints

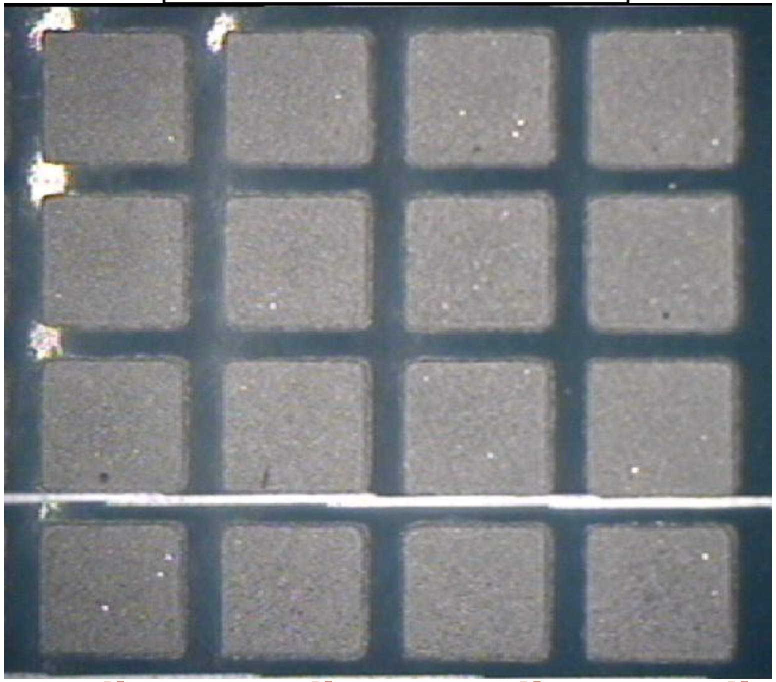
Alternative Header Layout and Paste Deposit (Overprint limited to 85 mils square on 100 mil centers)

Raw Card



48 mil ø 44 mil ø 40 mil ø 36 mil ø

Wet Paste Deposit

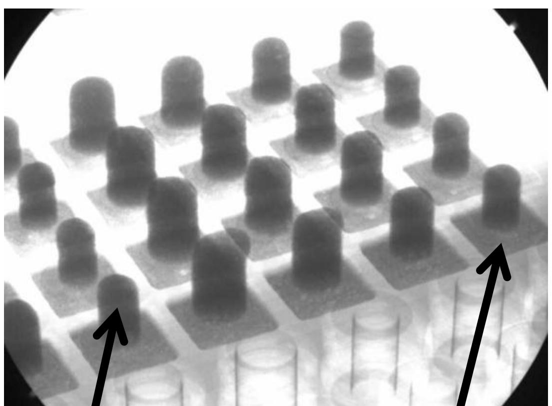


48 mil ø 44 mil ø 40 mil ø 36 mil ø

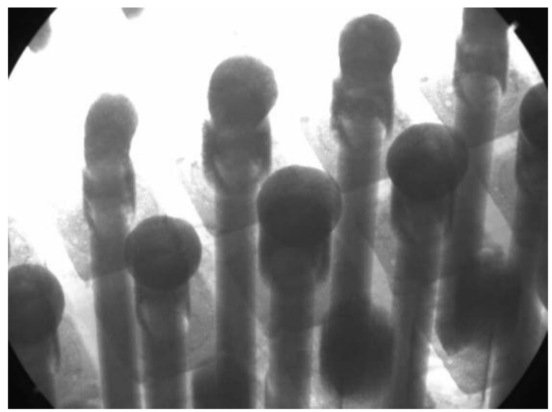
Step-Up or Two Print Stencil may be required to achieve sufficient paste volume

X-Ray View of (1) Overprint Paste and Paste in Hole, (2) Pins placed in TH, (3) Pins after Reflow

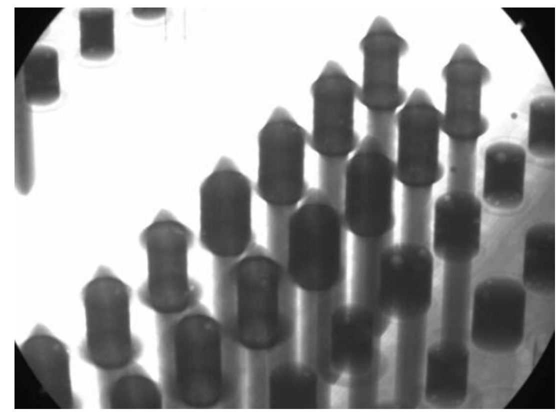
Results for Alternating Header
View from non-squeegee side 63 mil thick PCB



1
Overprint
Paste



2
Pins in Paste



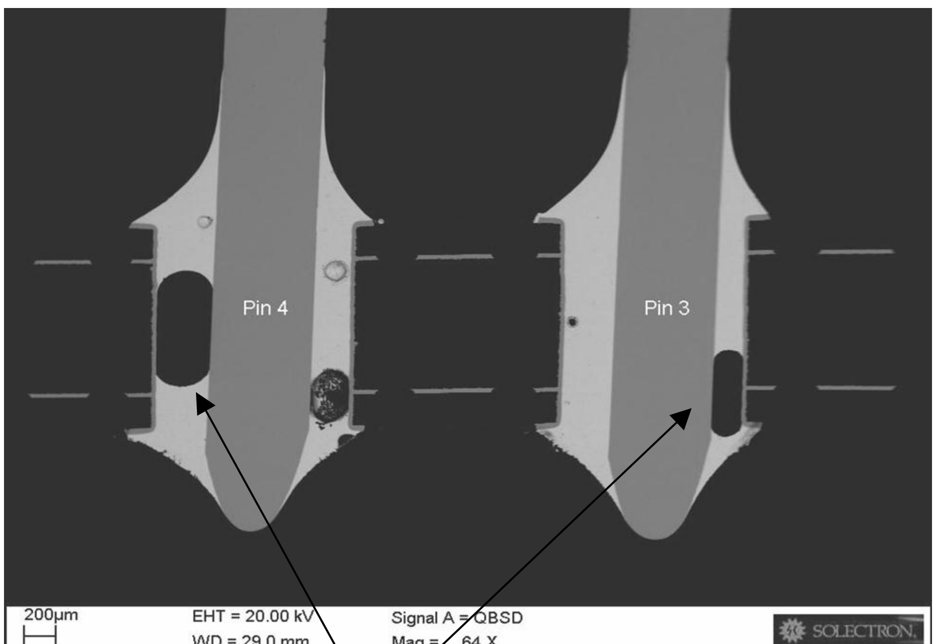
3
After Reflow

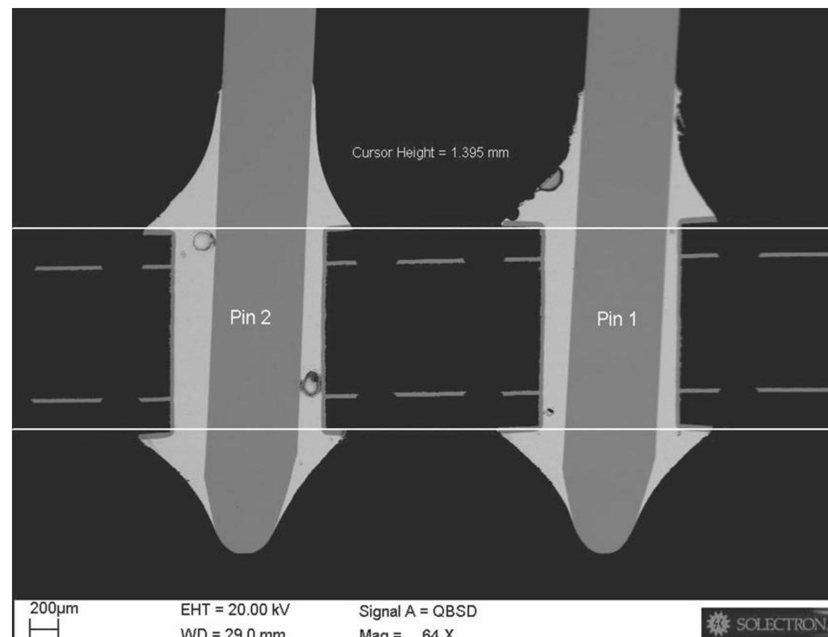
.063” Board/ .060” annular ring (Header Cross Sections)

Header

Pin–Hole Ratio →

.52	.56	.63	.69
.048” FHS	.044” FHS	.040” FHS	.036” FHS



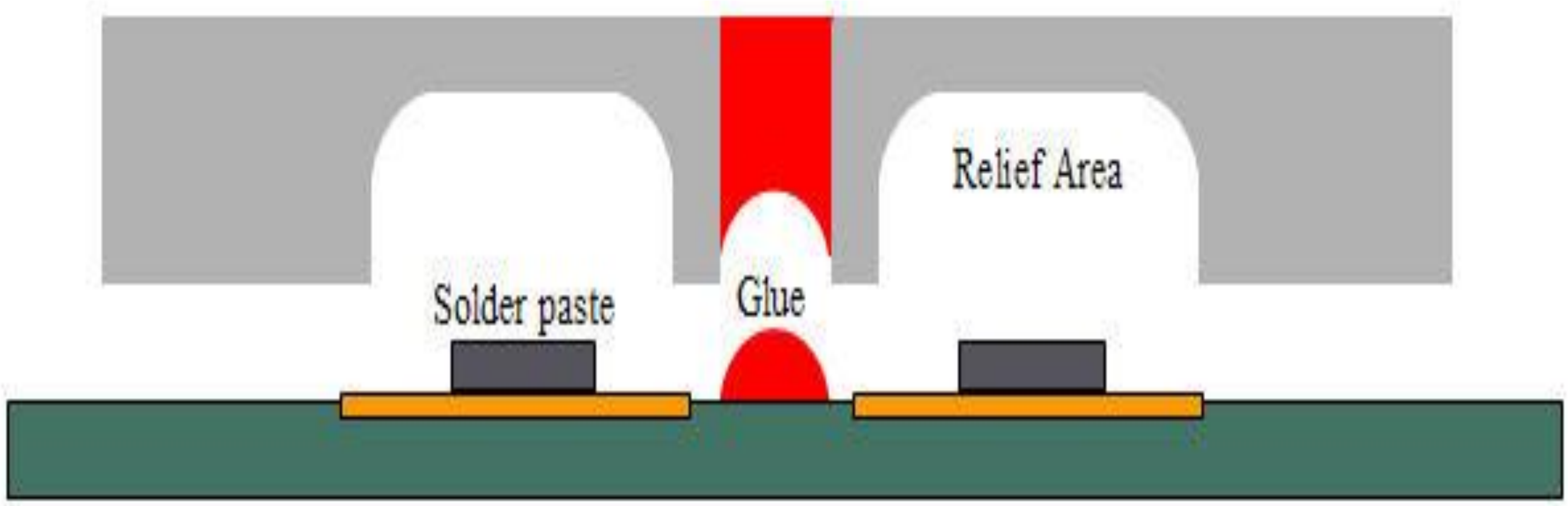


Voiding

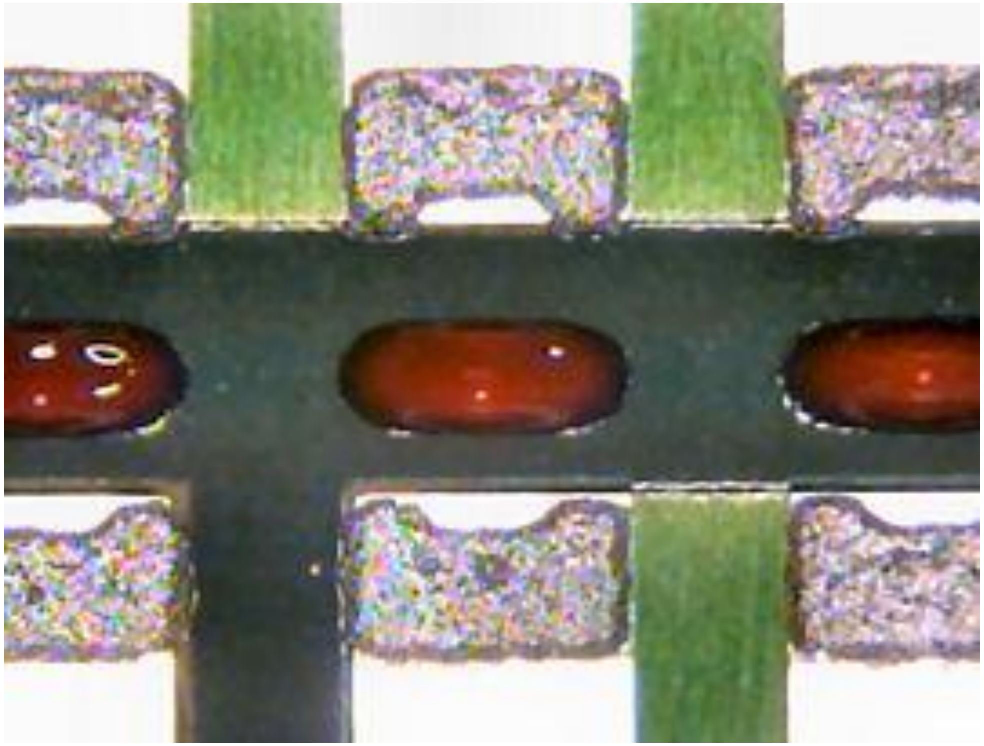
Insufficient Solder Volume… Largest Hole Size (6mil stencil thickness)

Example 2

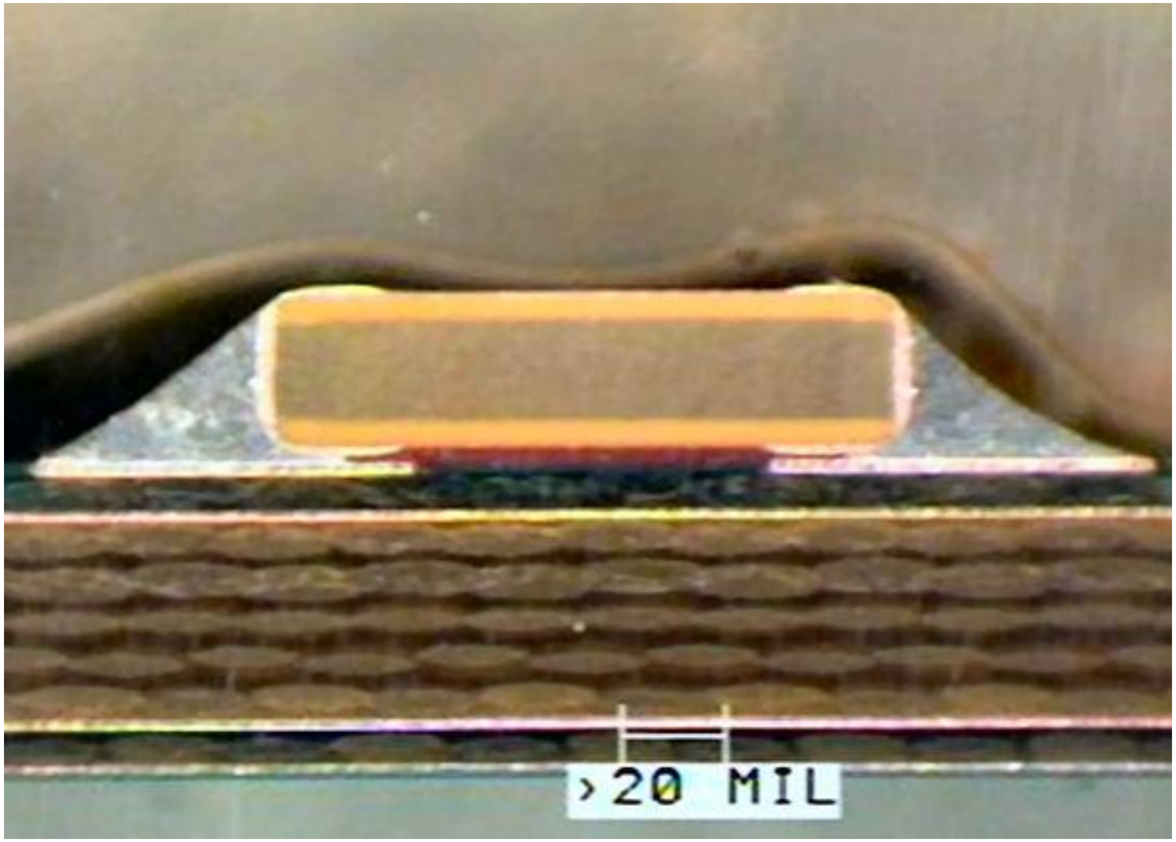
Two Print Stencil for printing Glue for Chip Components after Solder paste. Stencil is 20 mils thick with a 15 mil deep relief pocket



Picture showing Glue and Solder Paste for an 0805 Chip Component



Cross Section showing Glue under the Chip Component



Example 3

Two-Print Stencil FC/SMD

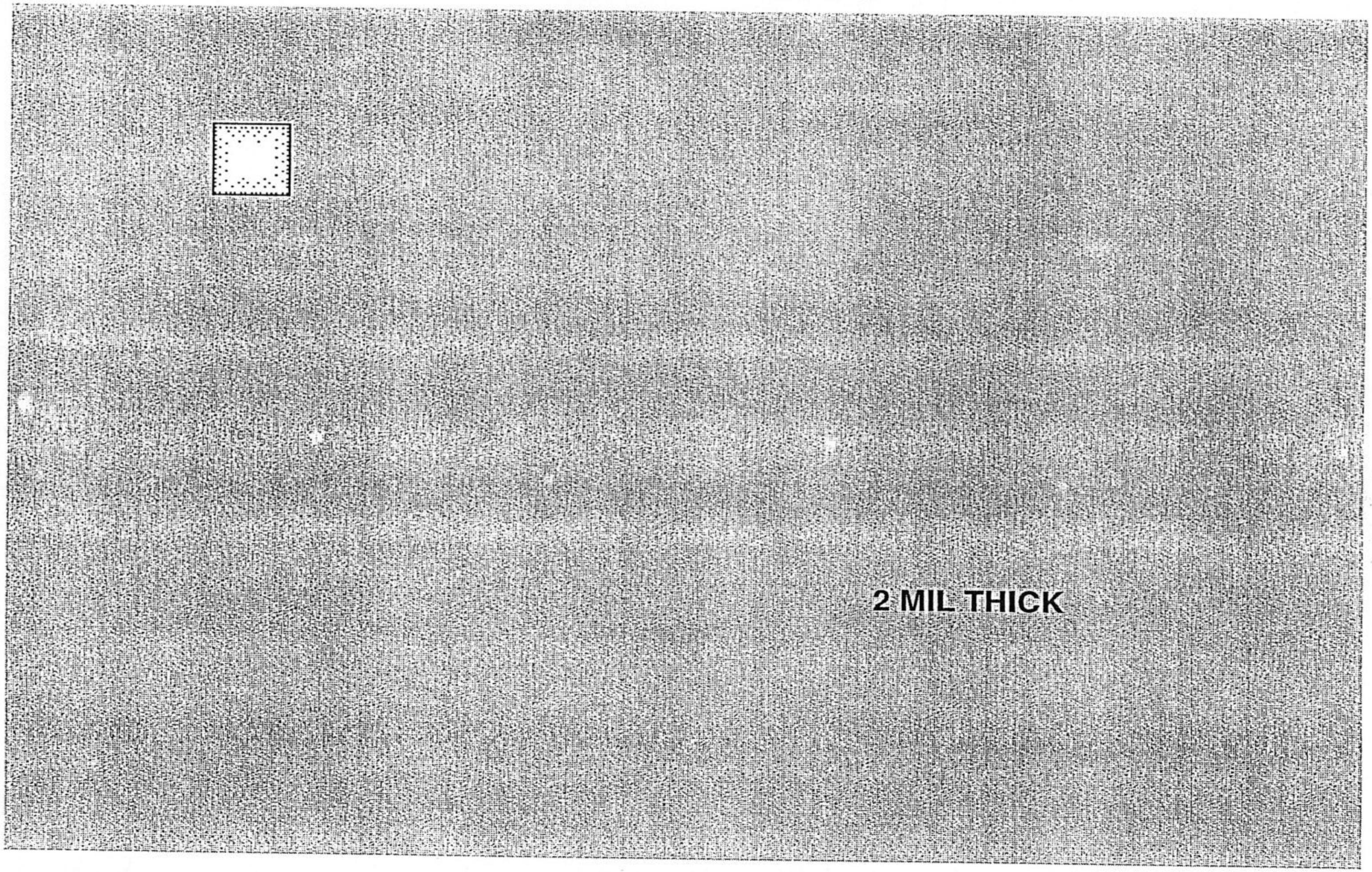
1st Print 2 mil thick stencil prints solder paste or conductive polymer

2nd Print Relief etch stencil prints solder paste or conductive polymer

1st Print	2nd Print
FLIP CHIP	SMD
Solder Paste	Solder Paste
Conductive Polymer	Solder Paste
Flux	Solder Paste
Conductive Polymer	Conductive Polymer

Two-Print Stencil FC/SMT

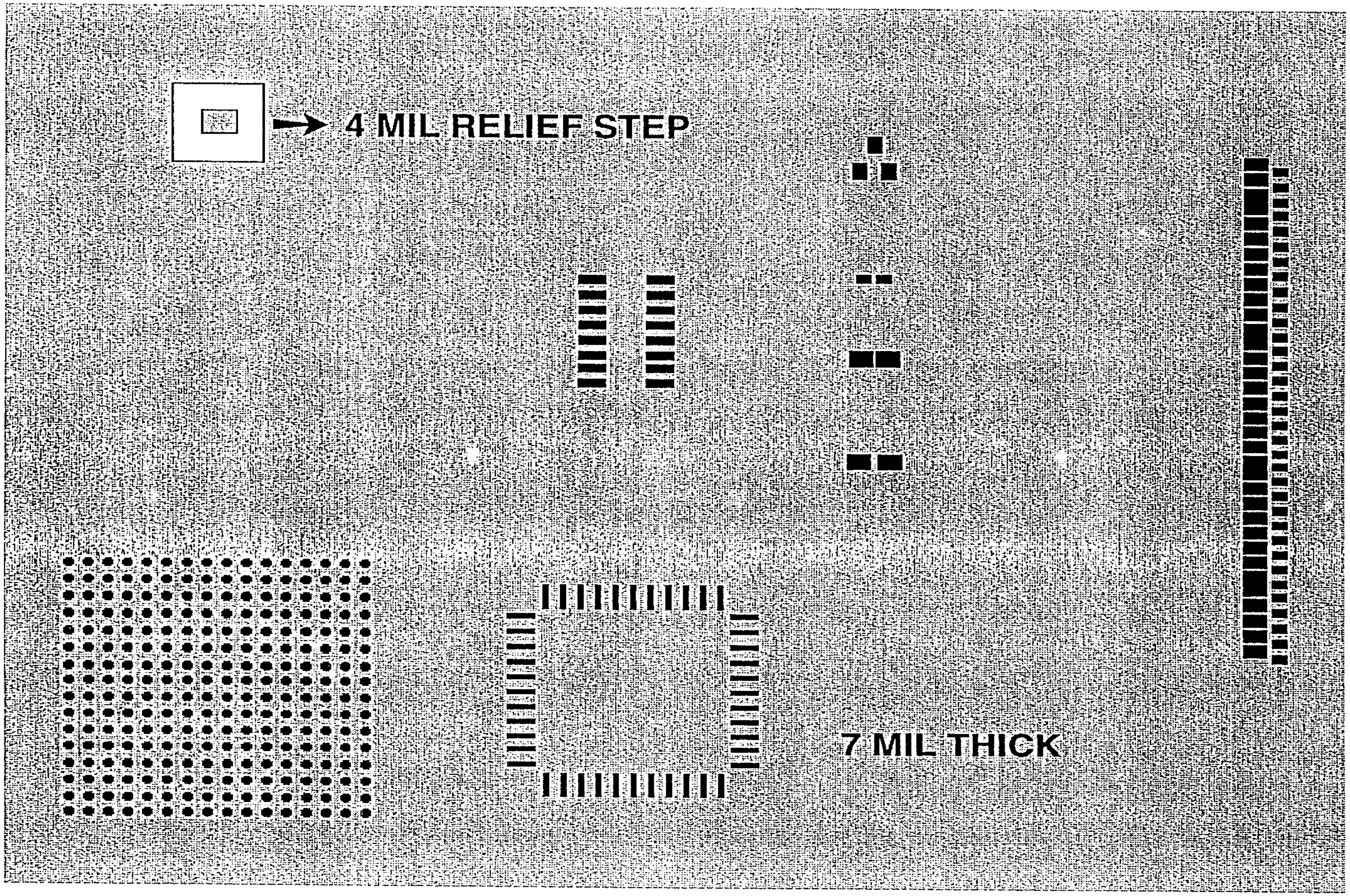
First Print



FLIP CHIP STENCIL

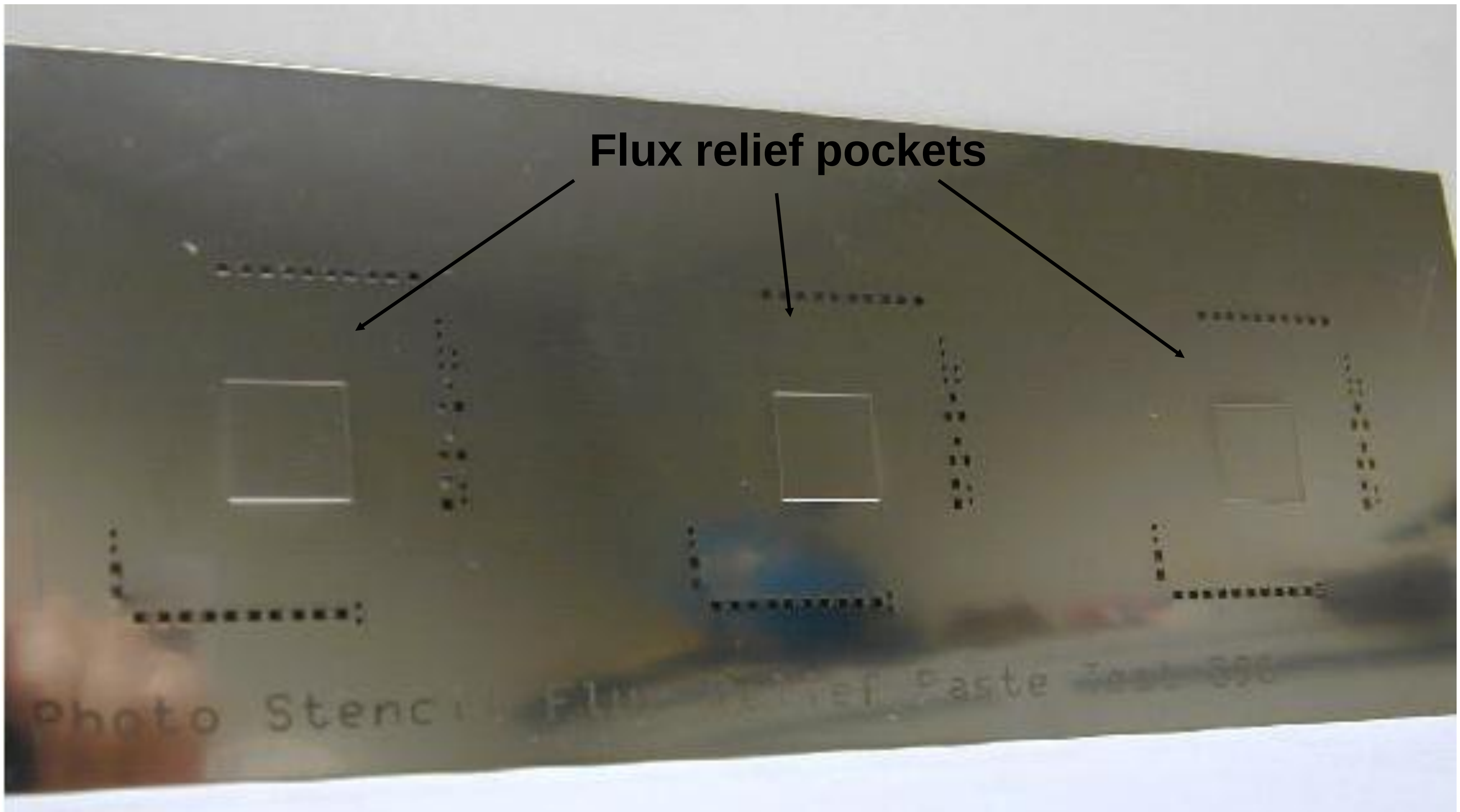
Two-Print Stencil FC/SMT

Second Print



SMT STENCIL

Magnified View of the Substrate Side of 3D Electroform Two-Print Stencil (2nd Print) showing Flux Relief Step-Up Pocket and apertures for small Chip Components



Example 4

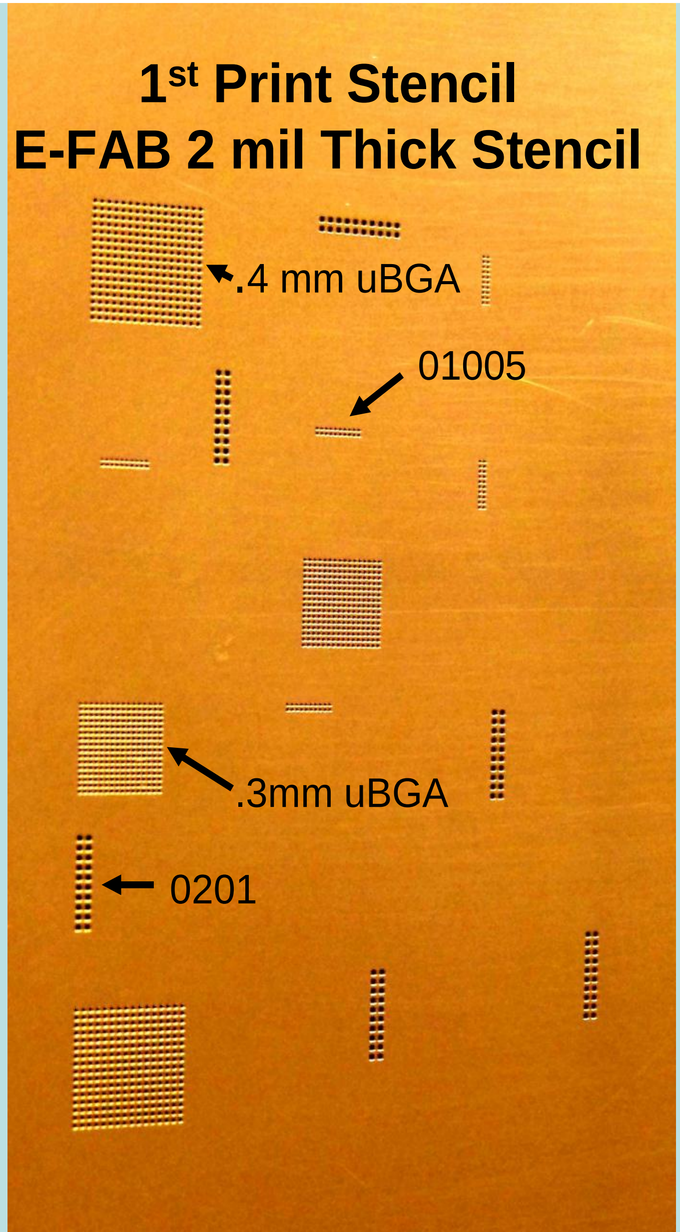
Two Print Stencil for Miniature devices (when 01005 and .3 mm CSP coexist on a board with RF Shields, SMT connectors and other large devices.

Print miniature device apertures with thin stencil (50-75u)

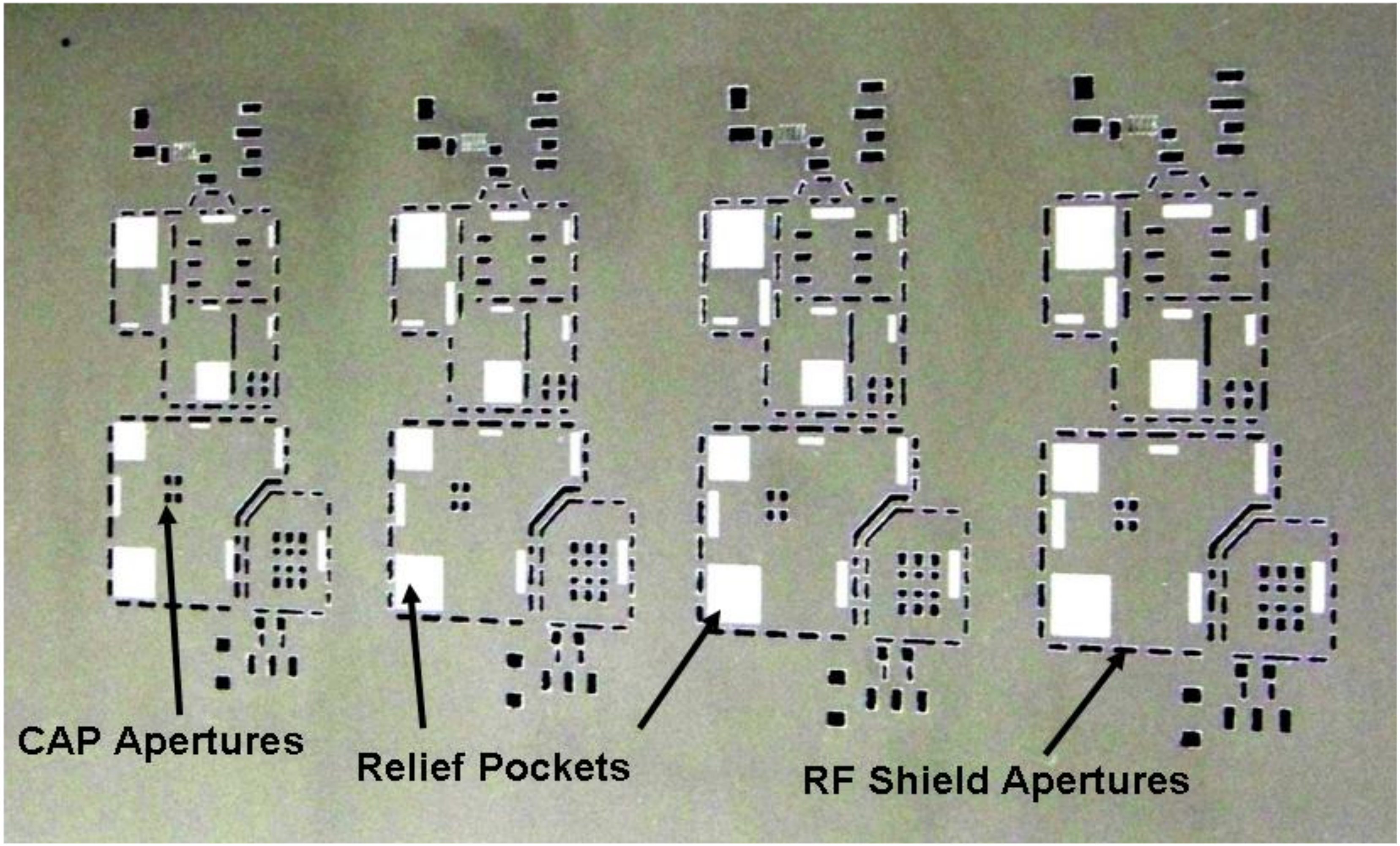
Print other devices with thick stencil (125 to 200u) with relief pockets on bottom side of stencil.

Two Print is driven by Area Ratio for the small devices requiring thin stencils and RF Shields requiring thick stencils because of co-planarity issues.

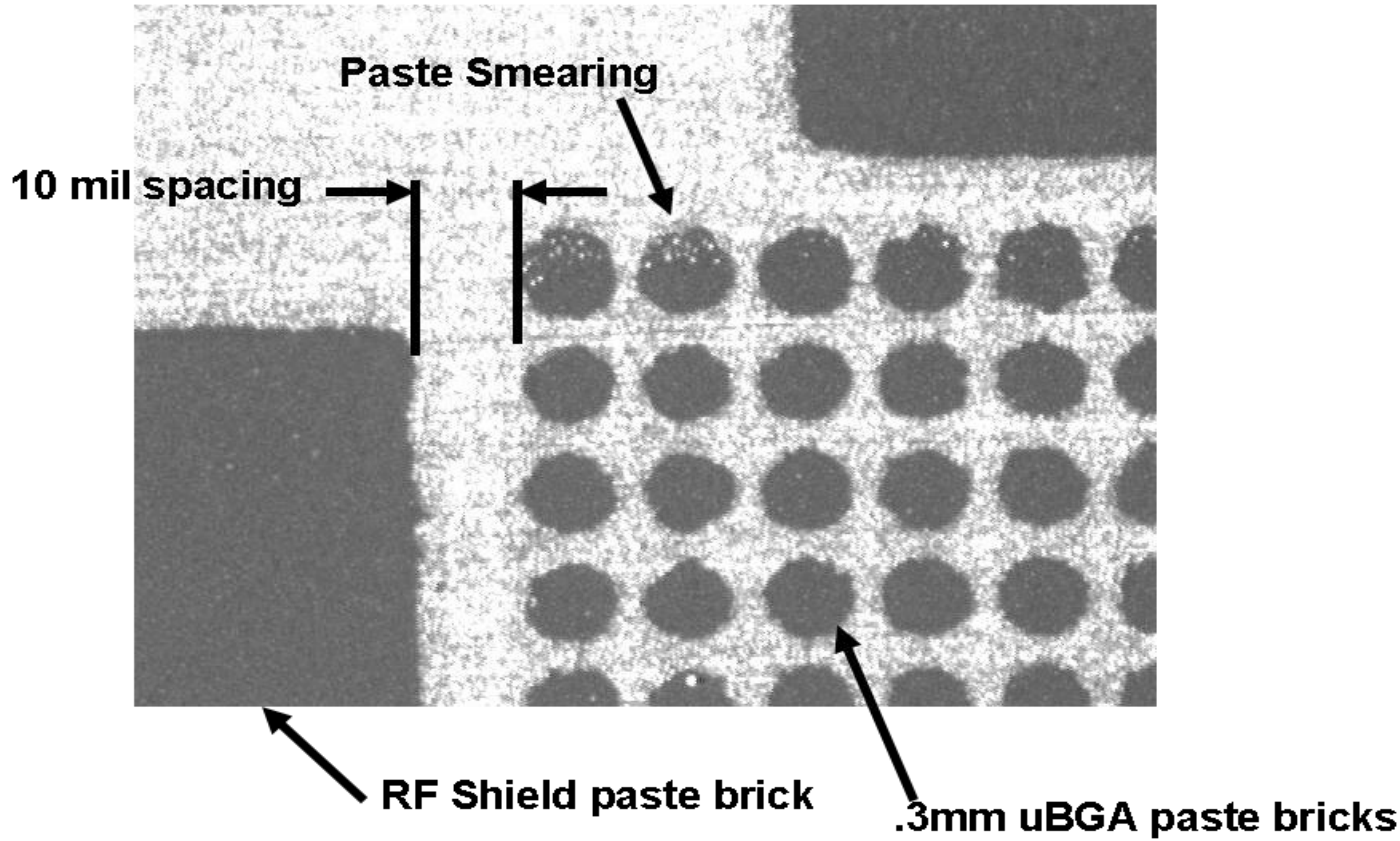
1st Print Stencil
E-FAB 2 mil Thick Stencil



2nd Stencil - Laser-Cut / Chem-Etch
7 mil thick with 5 mil relief pockets
5 mil thick with 3 mil relief pockets

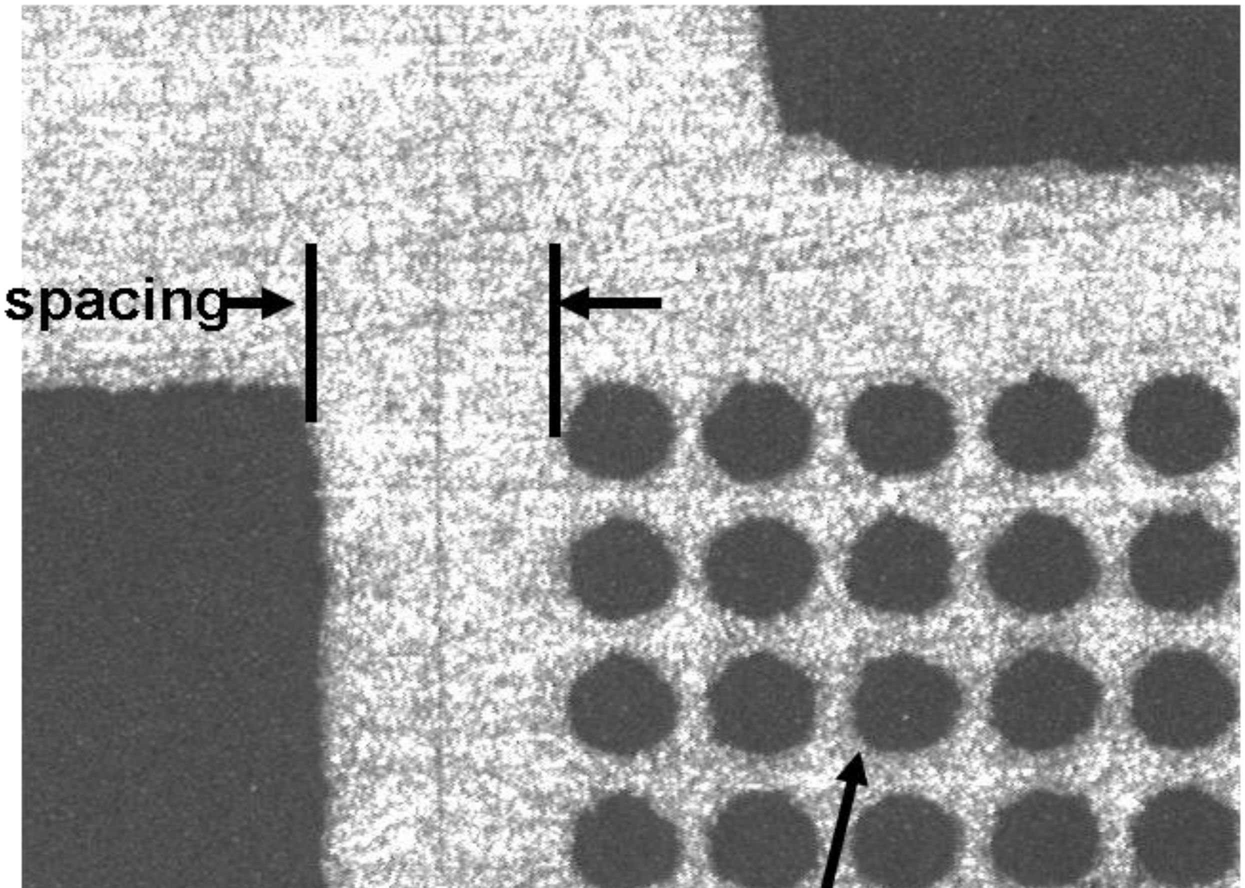


Solder Bricks 1st Stencil 2 mil (50u), 2nd Stencil 5 mils (125u) with 3 mil (75u) relief pocket



Solder Bricks 1st Stencil 2 mil (50u), 2nd Stencil 5 mil (125u) with 3 mil (75u) relief pocket

No sign of smeared solder paste bricks



General Design Guidelines for Two Print Stencils

Minimum Spacing between apertures in 1st and 2nd stencil

- 10 mils (250um) – lower limit with slight paste smear
- 20 mils (500um) no sign of paste smearing
- 15 mils (375um) not tested but no smear problem expected

Minimum relief pocket height for clearance of 1st print paste brick

- 1st print stencil thickness + 1 mil (25um)

Thickness of 1st stencil

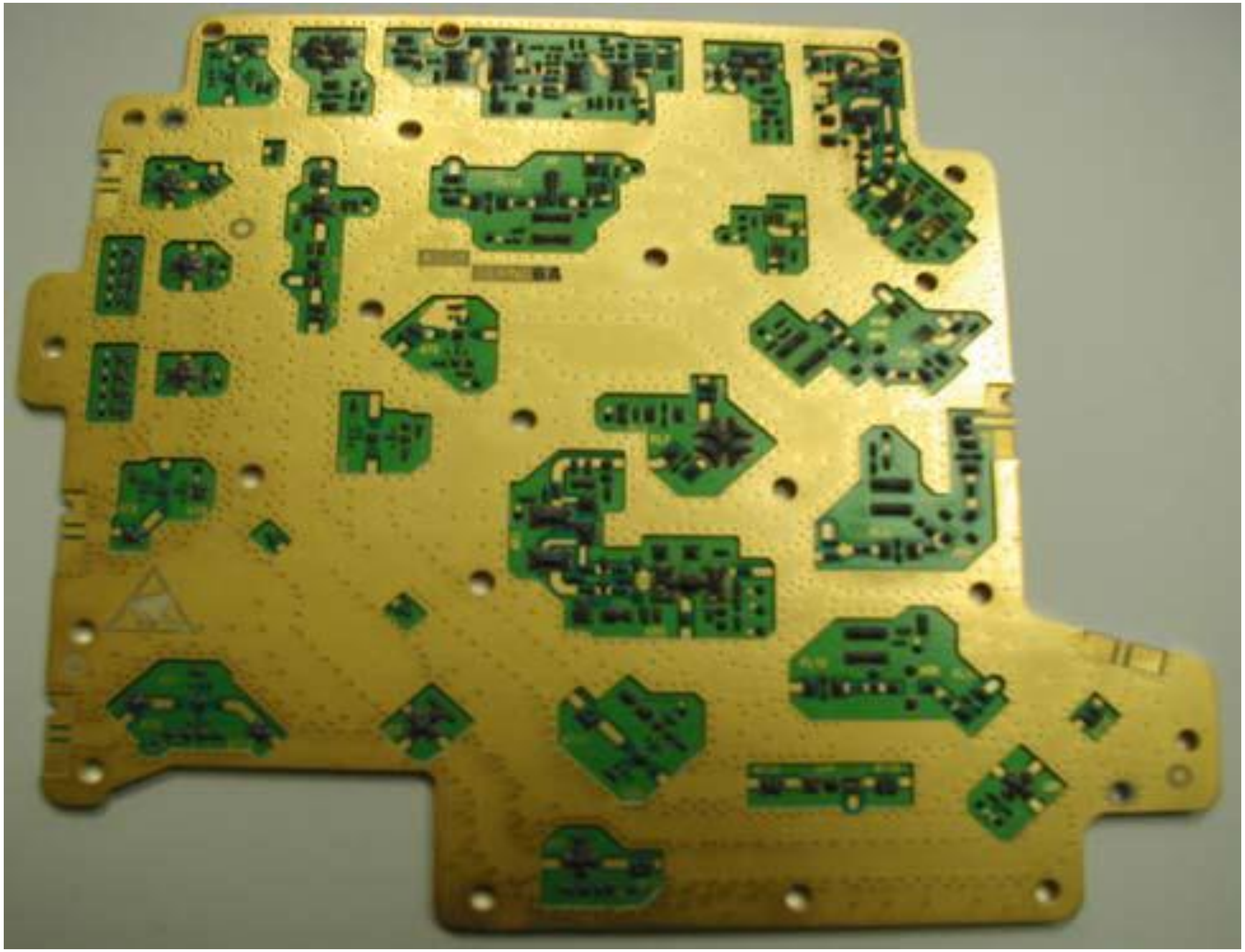
- Determined by Area Ratio and Paste Volume required

Thickness of 2nd Stencil

- Determined by height and volume of solder brick required

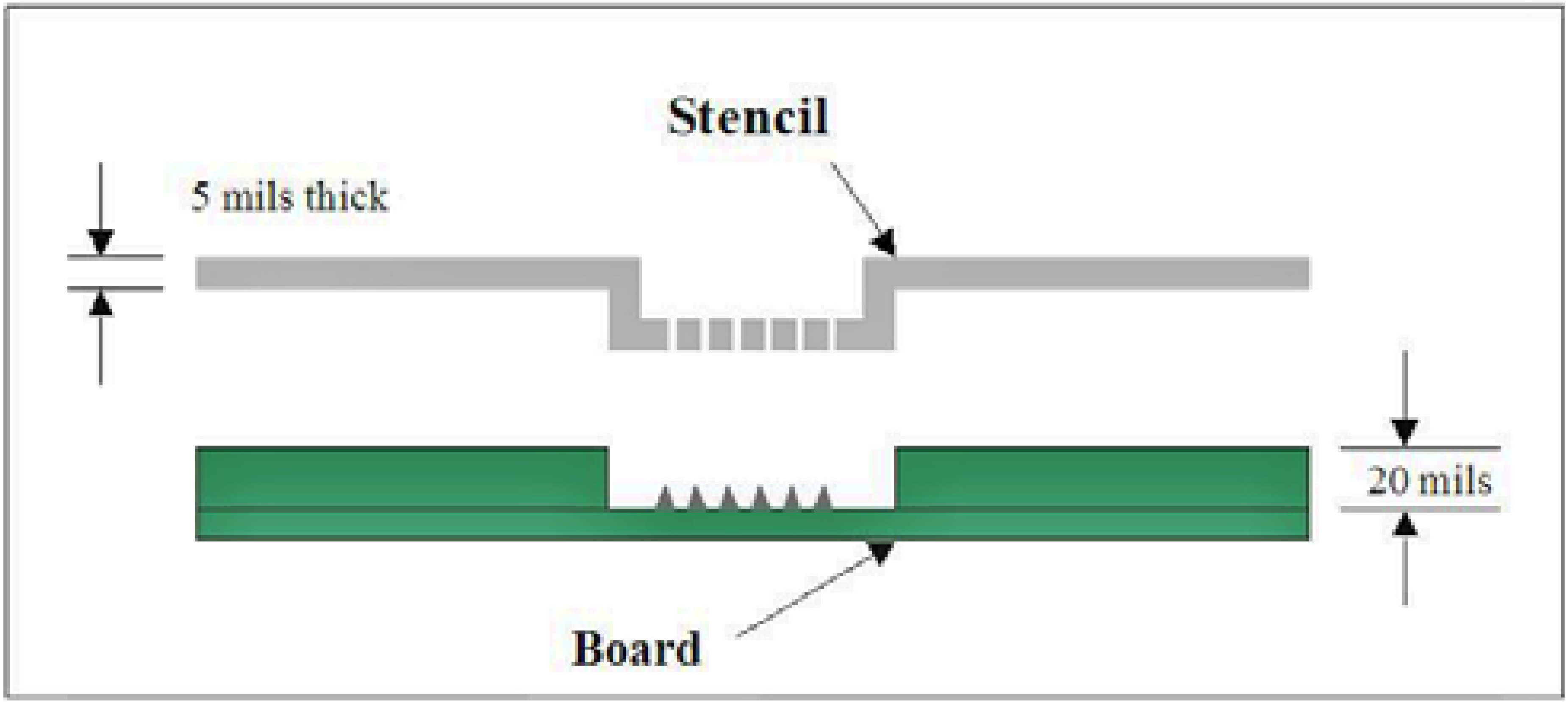
[5 mil (125um) to 10 mil (250 um)]

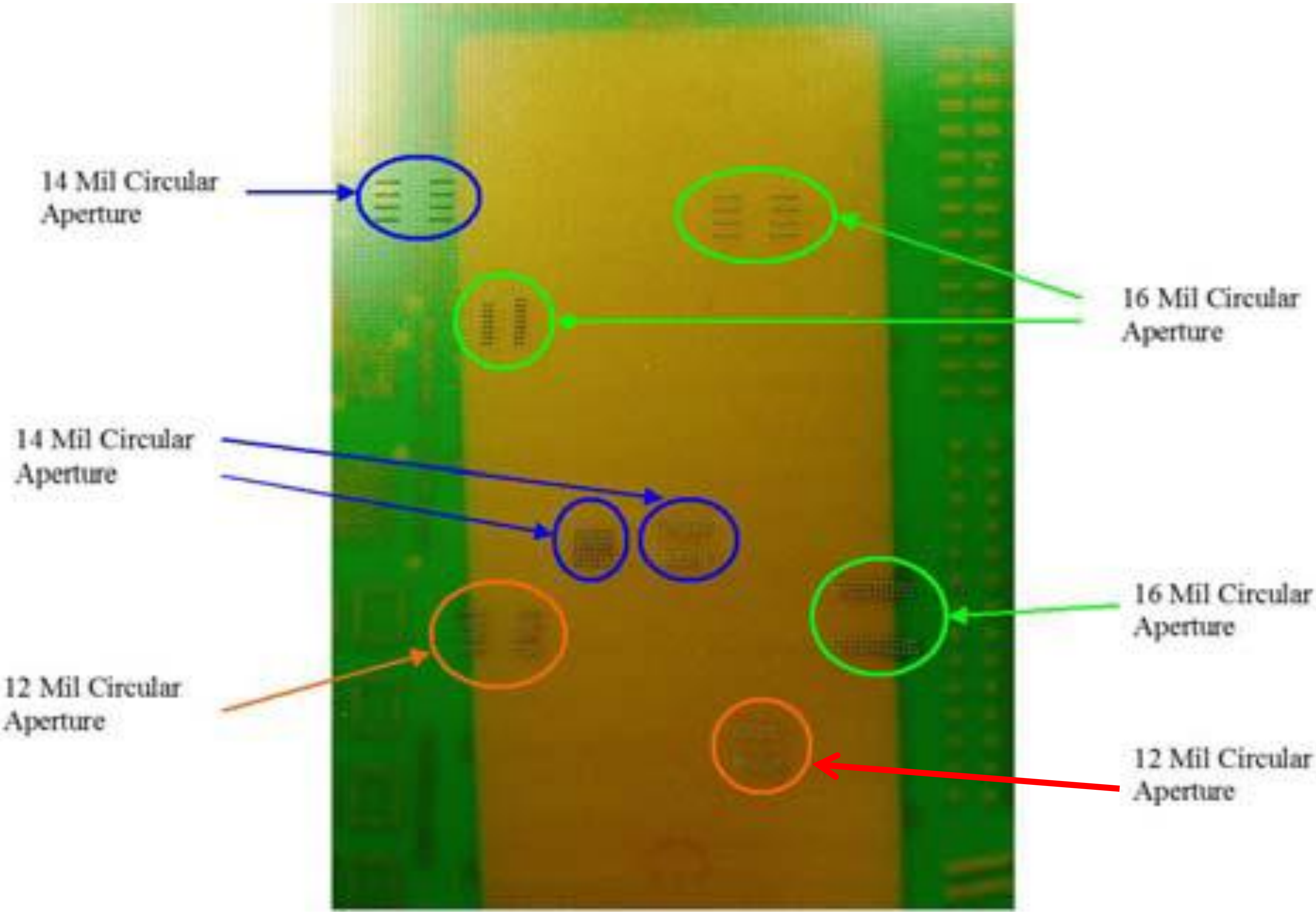
5-Printing Reservoir Solder Paste for multi-level boards



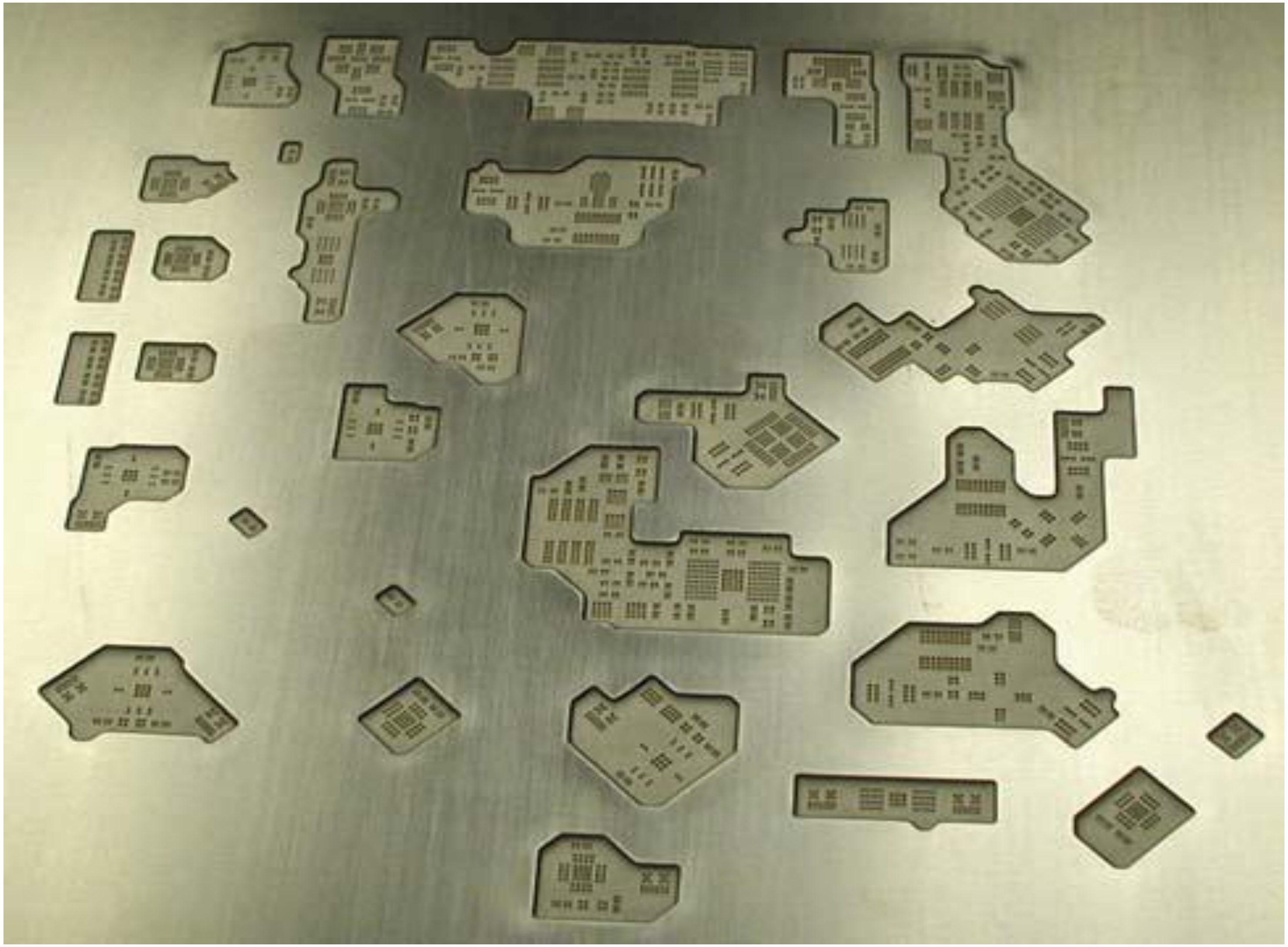
Component pads are recessed 12 mils below top level of the board

Paste Reservoir Stencil Design

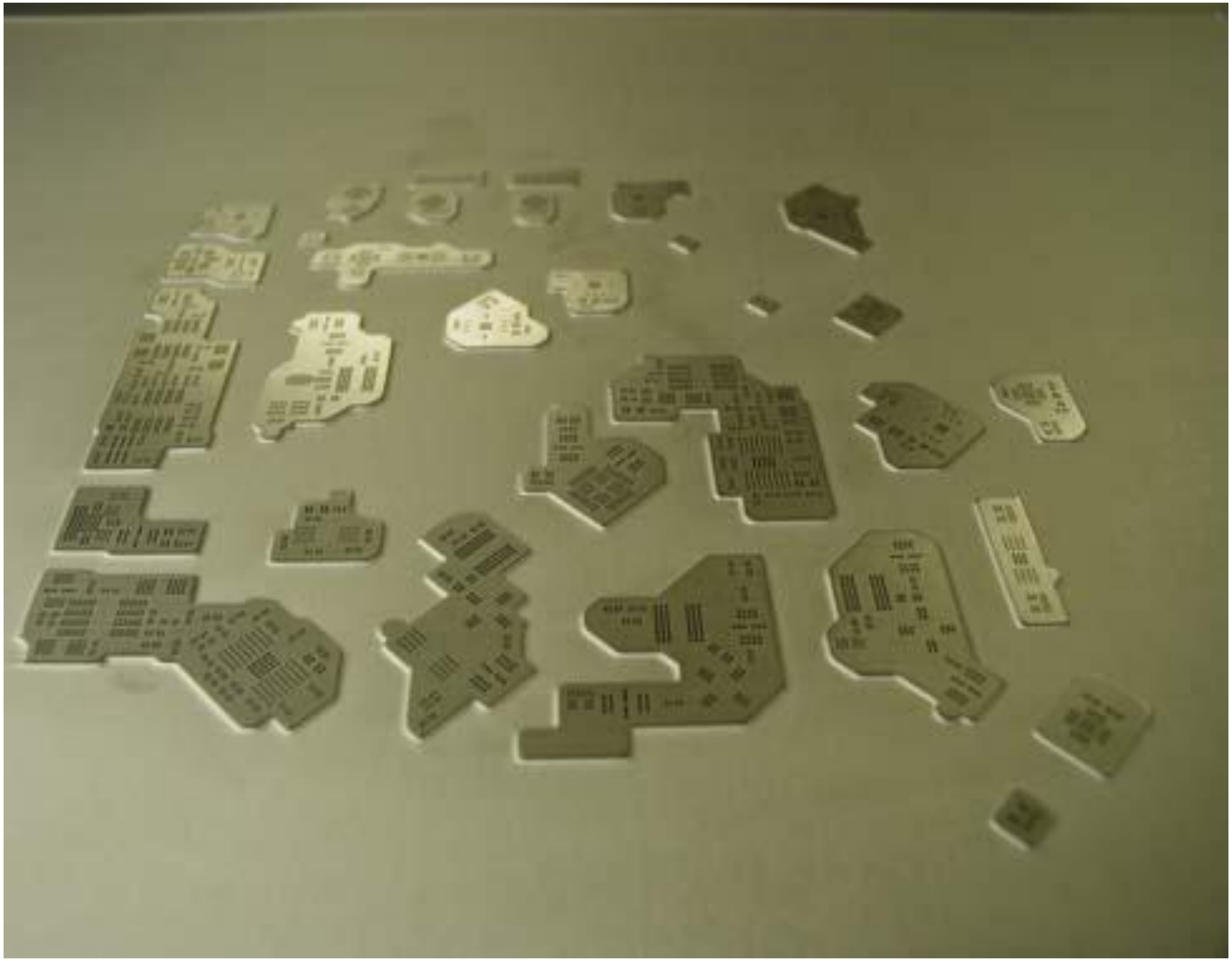



14 Mil Circular Aperture
16 Mil Circular Aperture
14 Mil Circular Aperture
16 Mil Circular Aperture
12 Mil Circular Aperture
12 Mil Circular Aperture

Squeegee Side view of Paste Reservoir Stencil

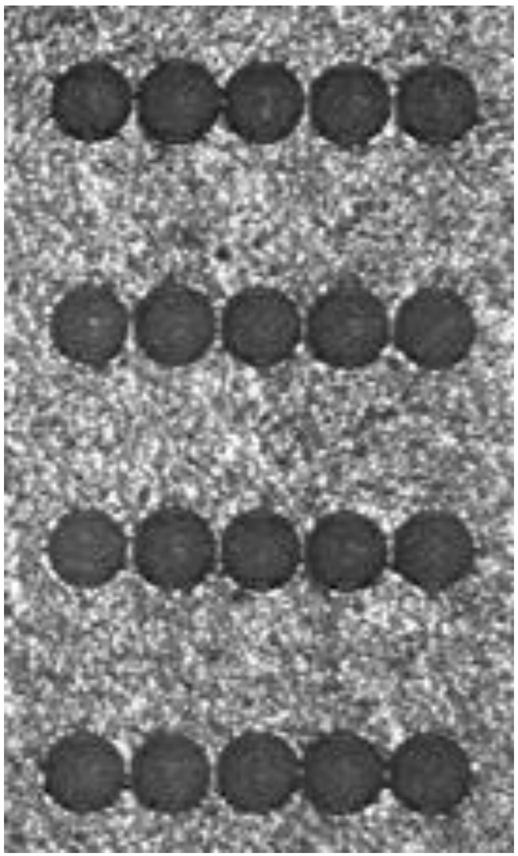


Contact Side view of Paste Reservoir Stencil

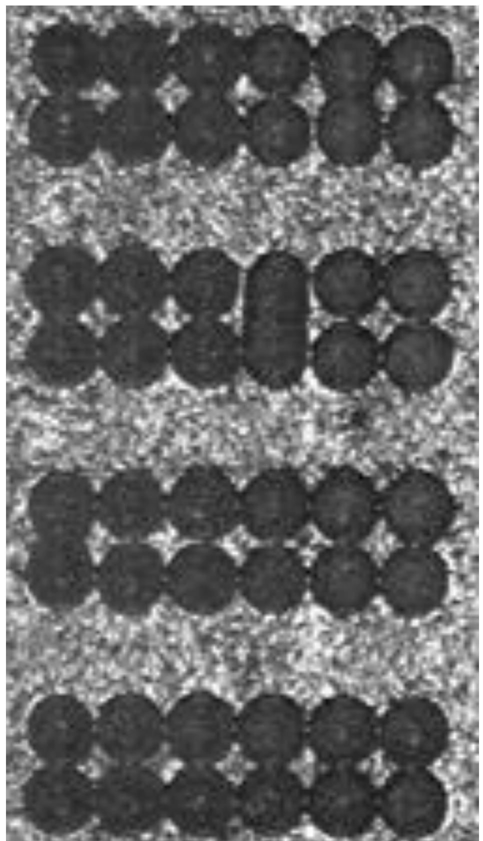


Paste Reservoir Solder Bricks

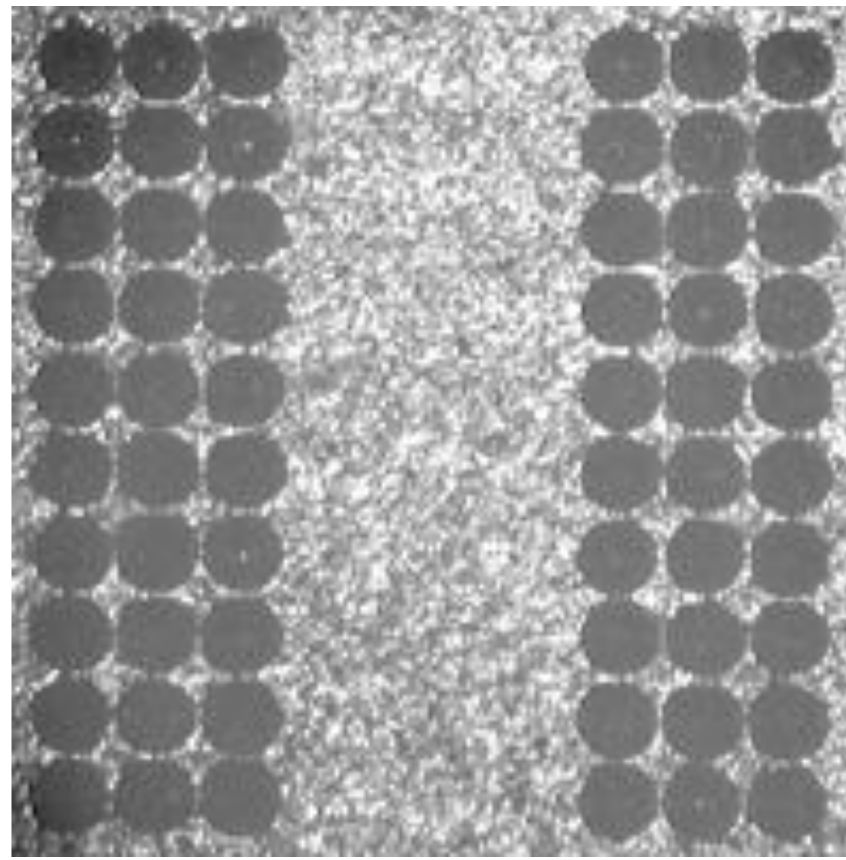
25 mil Pitch QFP



50 mil Pitch QFP



Chip Components

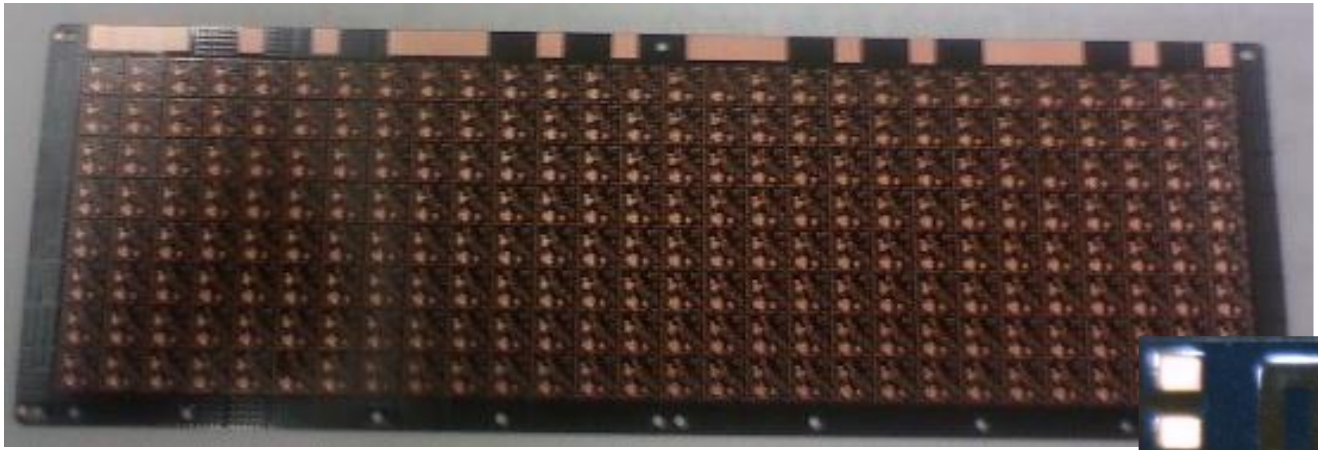


Reservoir Paste printing limited to 25 mil pitch using 5 mil Thick Stencil

Step on Board must be clean; no pre-preg

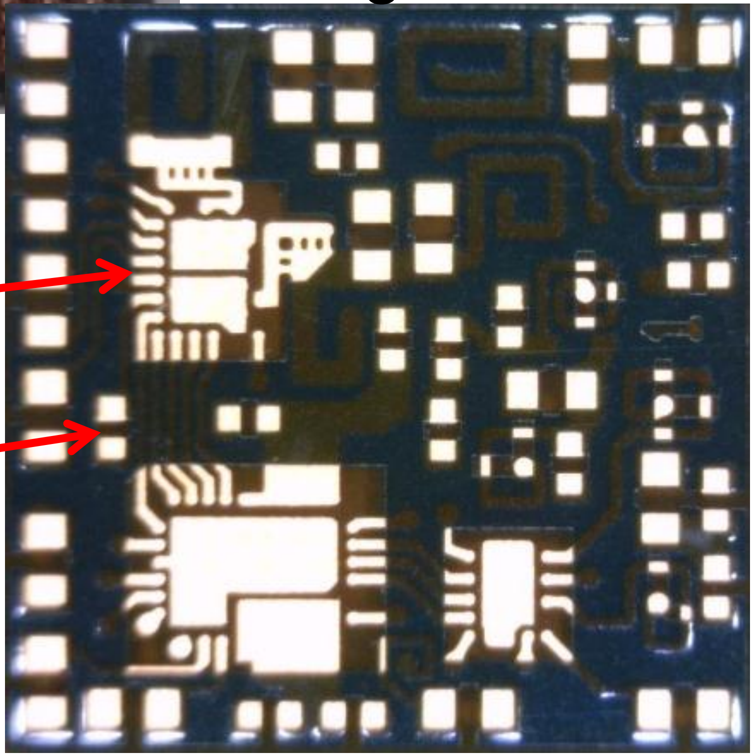
Recent tests on 12 mil thick stencil with a 10 mil reservoir and 2 mil thick for stencil apertures showed good solder bricks for apertures 7.5 mils wide by 20 mils long for die attach in a 12 mil cavity substrate.

6- Flux Reservoir Stencil Printing



Panel Layout

Single Cookie



Die

01005

Flux Reservoir Stencil Printing is driven by:

- 01005 require 2 mil thick stencil for acceptable Area Ratio to yield good paste transfer.

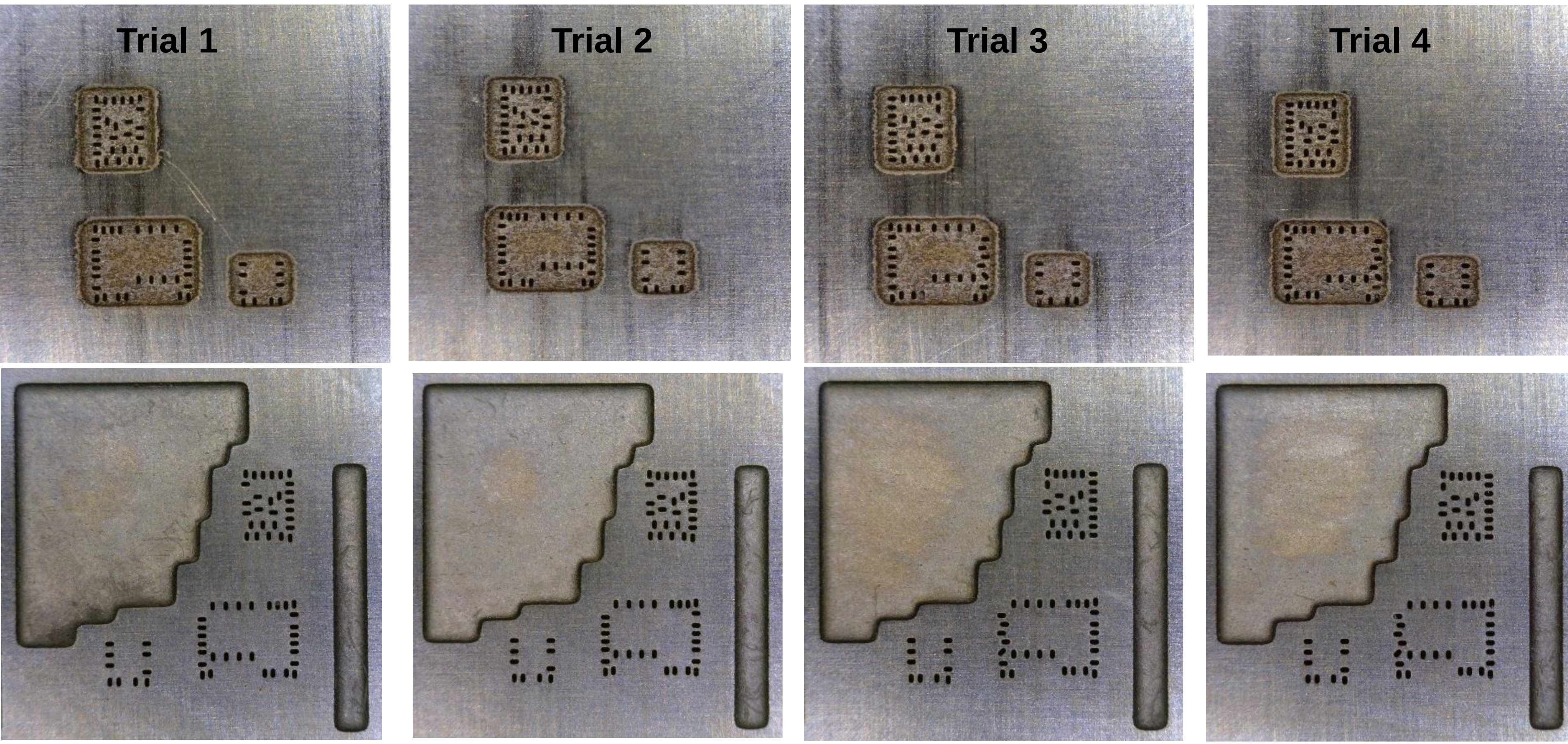
- Flux thickness must also be controlled to prevent flux bridging between die bumps.

- Normal Two Print Stencil will not work since both 1st and 2nd Print Stencil require thin Print thickness.

- Solution is to print 01005 paste bricks with 2 mil thick 1st stencil. The 2nd stencil has relief pockets for 1st stencil print and a reservoir for with apertures for the flux print.

Stencil Design

Stencil #	Cut Method	Polish	Stencil Thickness	Aperture Shape	Aperture Openings				Topside Cavity Depth	Stencil Thicknes in Cavity	Bottom Relief Height	Gerber Scaling	
					Trial 1	Trial 2	Trial 3	Trial 4				X	Y
3544861	Laser	electropolished, nickel plated, nanocoated	8	Circle	3.35x6.3 mils	3.50x6.3 mils	3.65x6.3 mils	3.80x6.3 mils	6 mil	2 mil	5 mil	-2.37 (.999673)	-.61 (.999732)
Dimensions in Microns:			200		85x160	89x160	93x160	97x160	150	50	125		

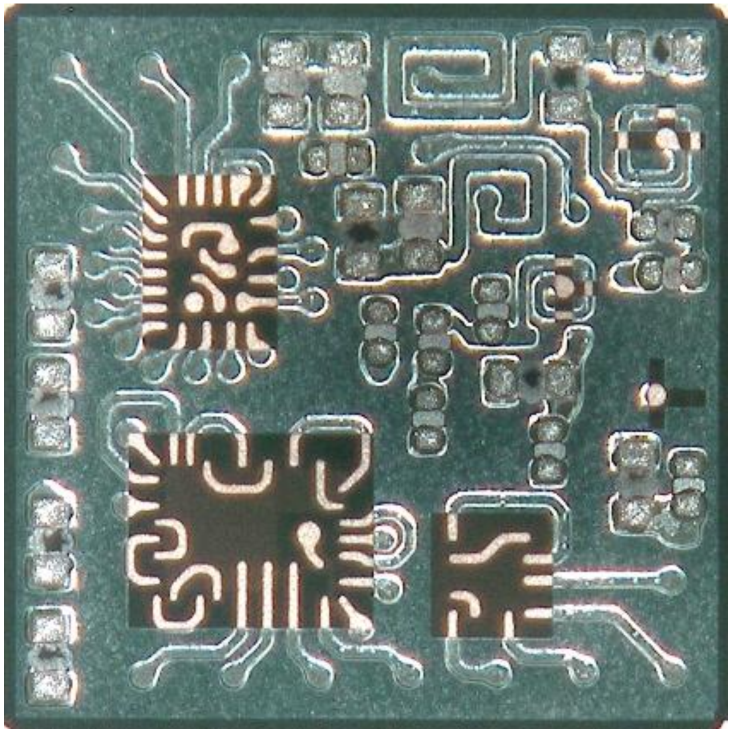


Printer Set-Up

- Speedline MPM 2000 Printer
  - Using squeegee blade assembly
  - Using thinner than normal stainless steel blades
  - Print speed: 2 in/sec
  - Force: 30
- Flux
  - Printable Tacky Flux 2

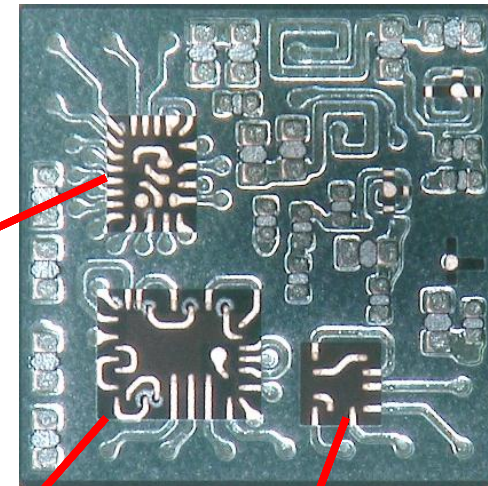
Solder & Flux Printed Substrate – Trial 2 (89x160 Microns)

Solder Print (50 micron thick stencil)

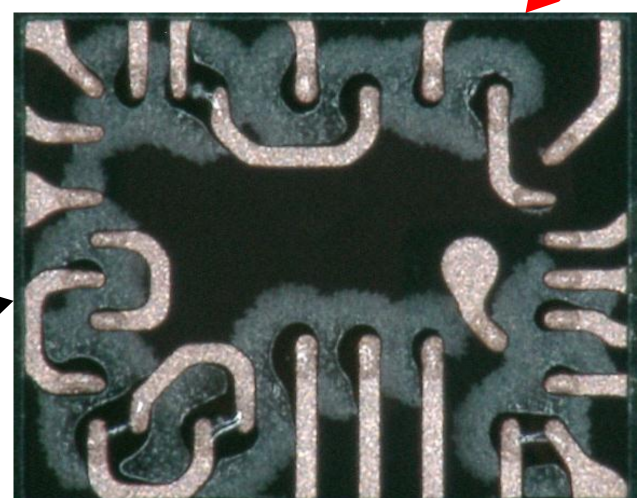


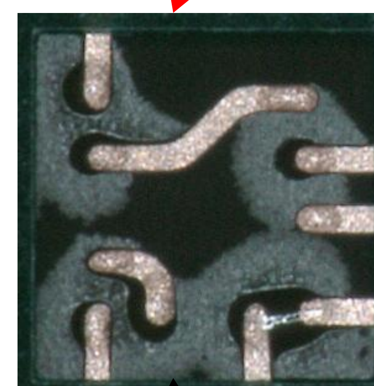
Flux Print (after solder print)

U1



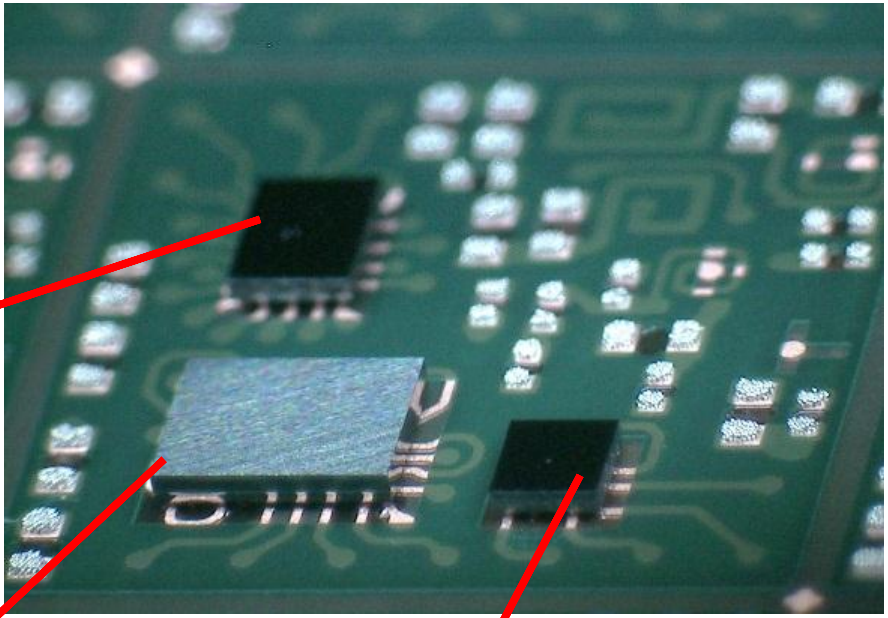
U3

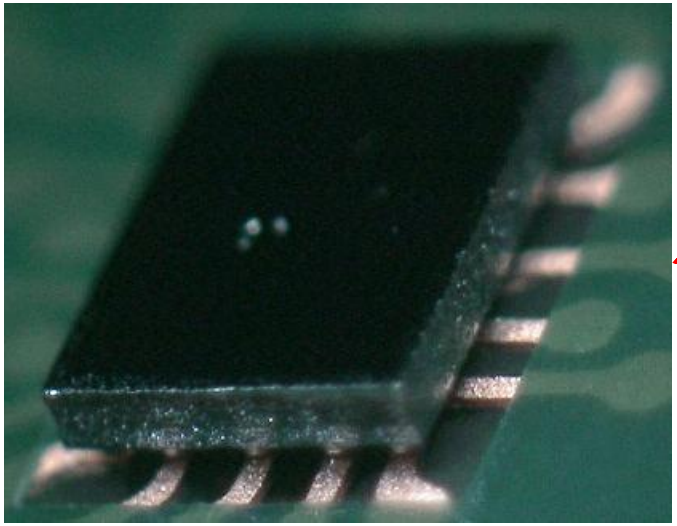


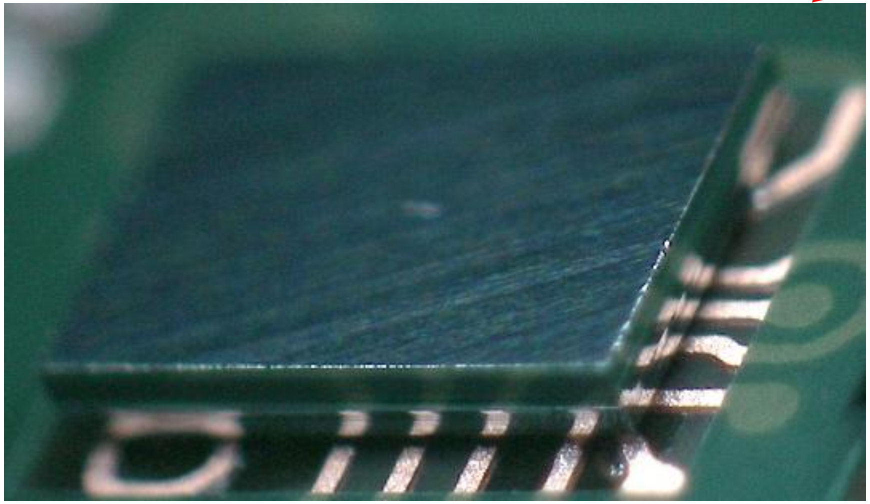


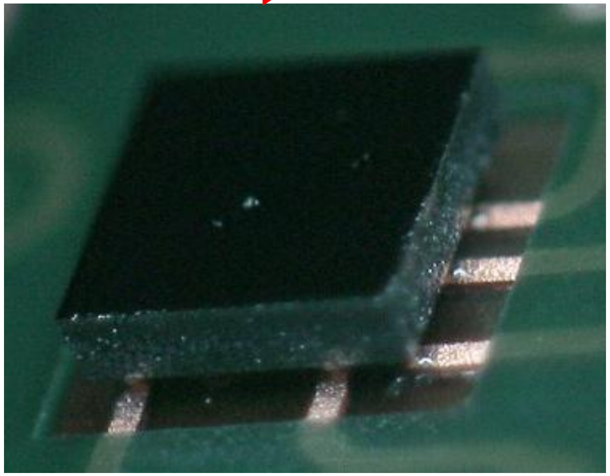
U4

Placed Flip-Chip Die Before Reflow

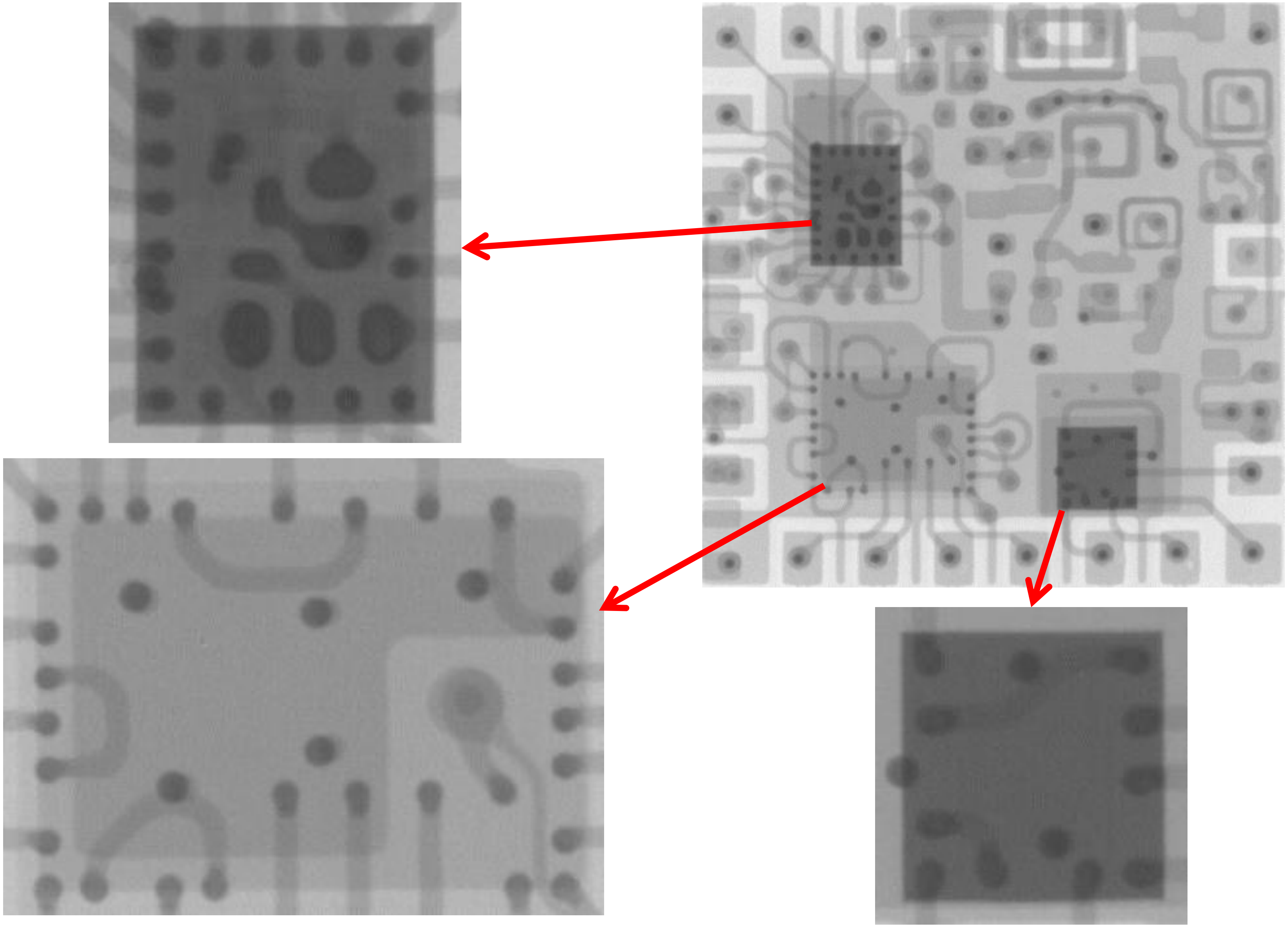




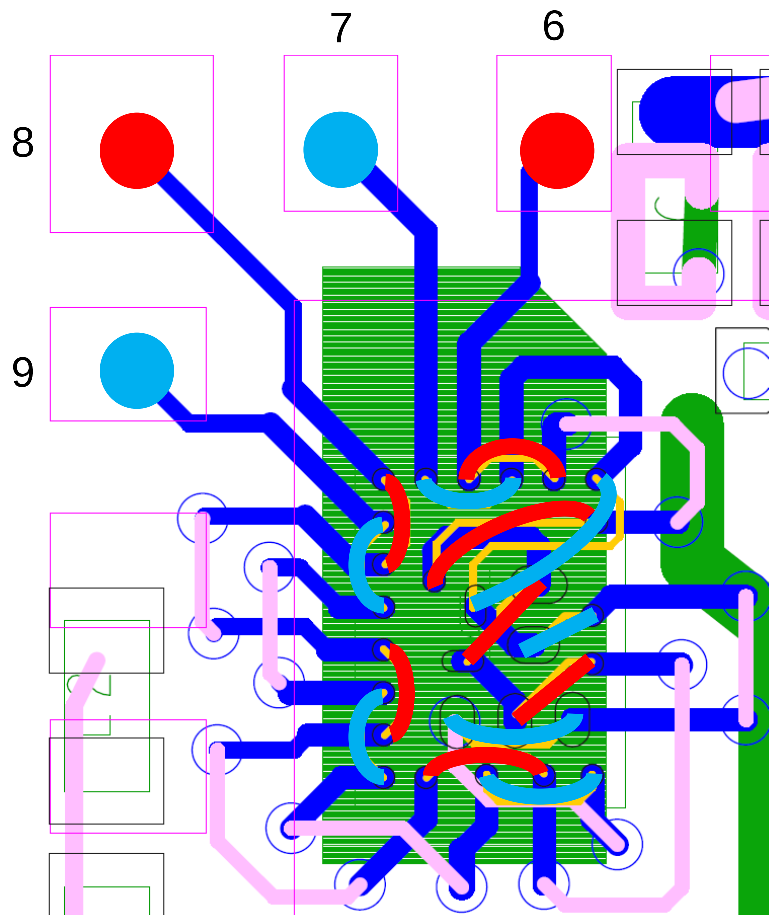


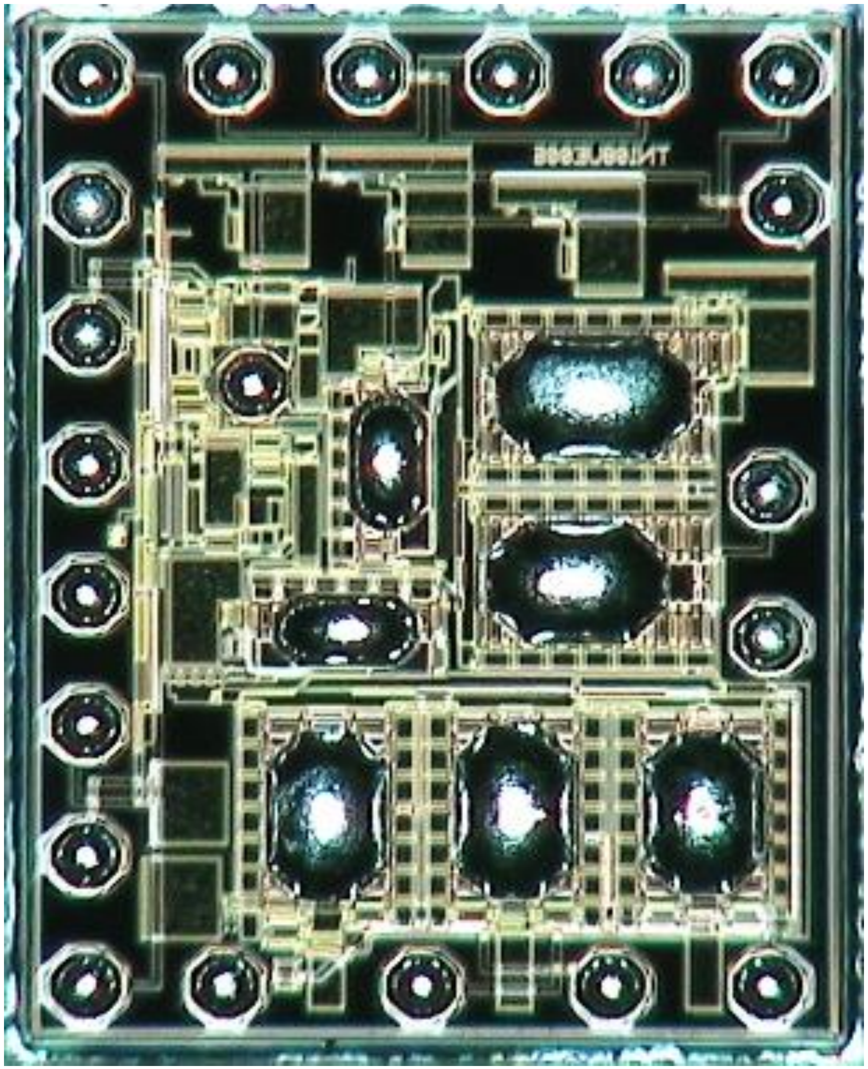


X-Ray Post reflow



U1 Daisy Chain Path

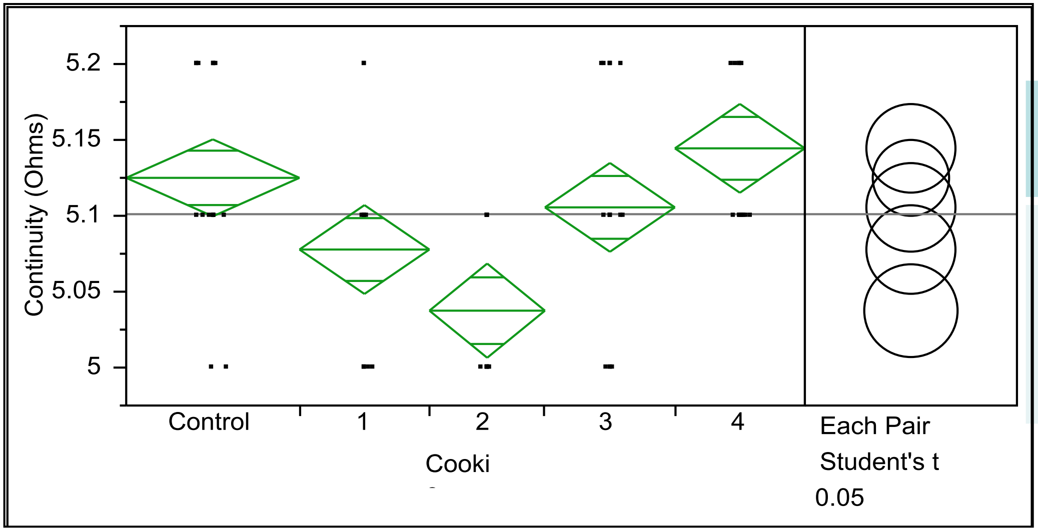




Die-Path	I/O PIN	I/O PIN
U1-1	6	8
U1-2	7	9

Continuity Results for Die U1 & U4

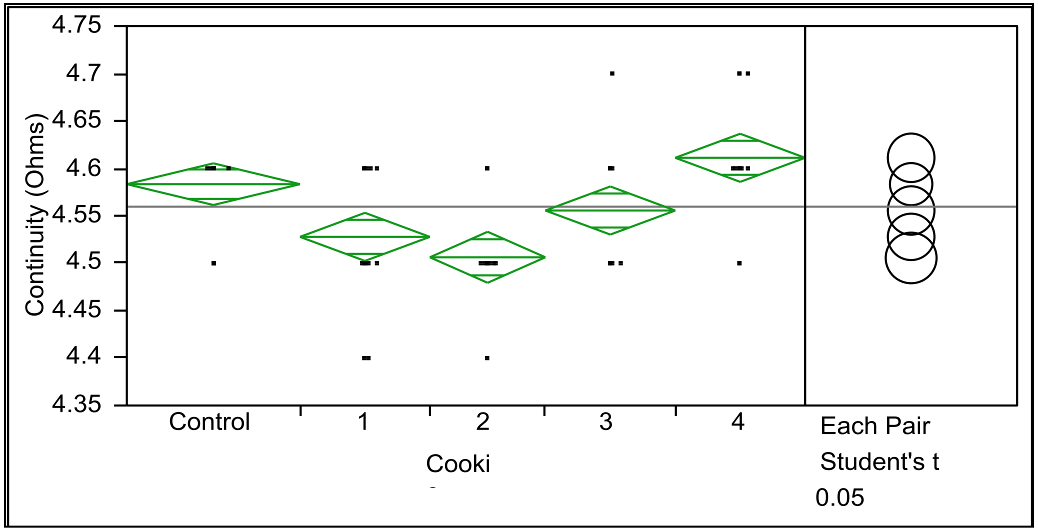
U1



Contr ol	Cookie 1	Cooki e 2	Cookie 3	Cooki e 4
Flux Dipped	85um x 160um	89um x 160u m	93um x 160um	97um x 160um

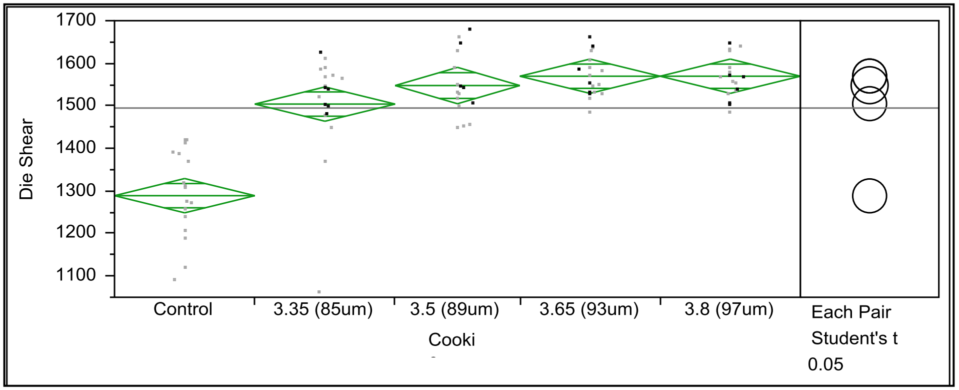
U4

89um wide aperture opening showed least resistance on both circuits post reflow

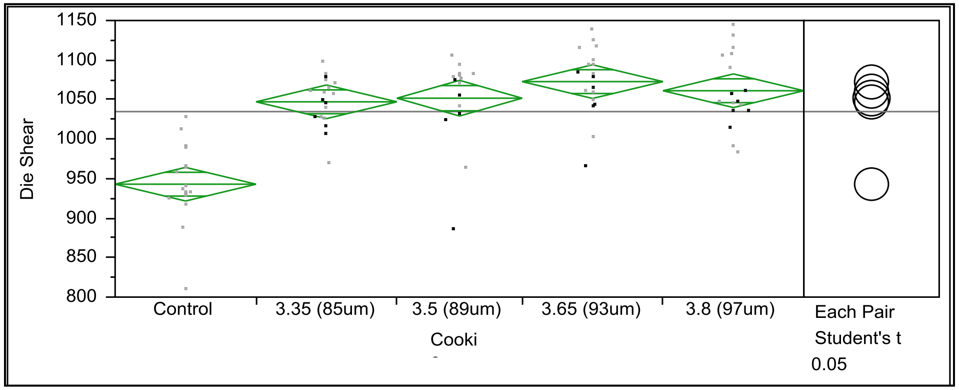


Die Shear Results

U1 Die Shear

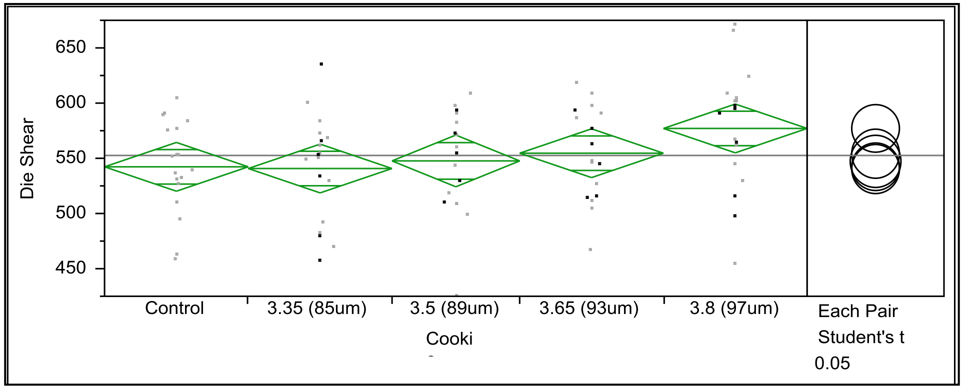


U3 Die Shear



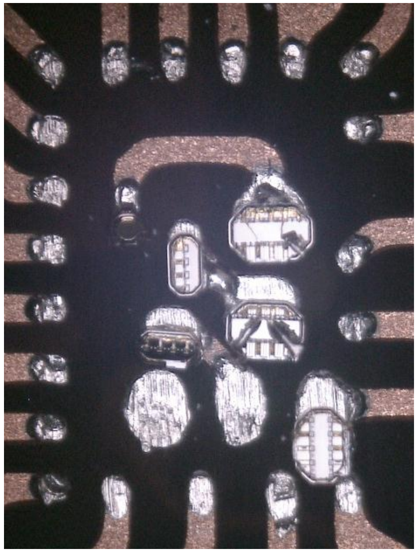
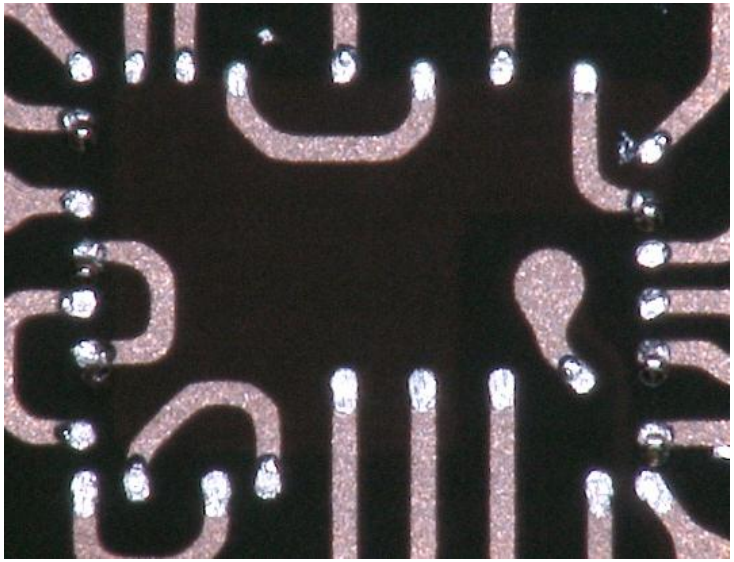
- All die shears were either the same or higher than the control (flux dipped) die shears
- There does not appear to be any statistically significant difference in die shear based upon aperture openings
- Shear failure modes were the same for all, a mix of solder to PCB and bump to die

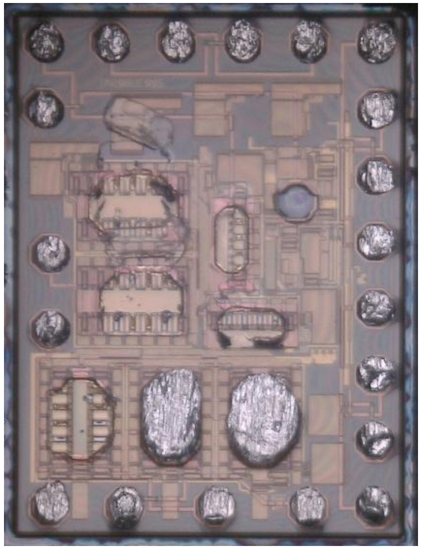
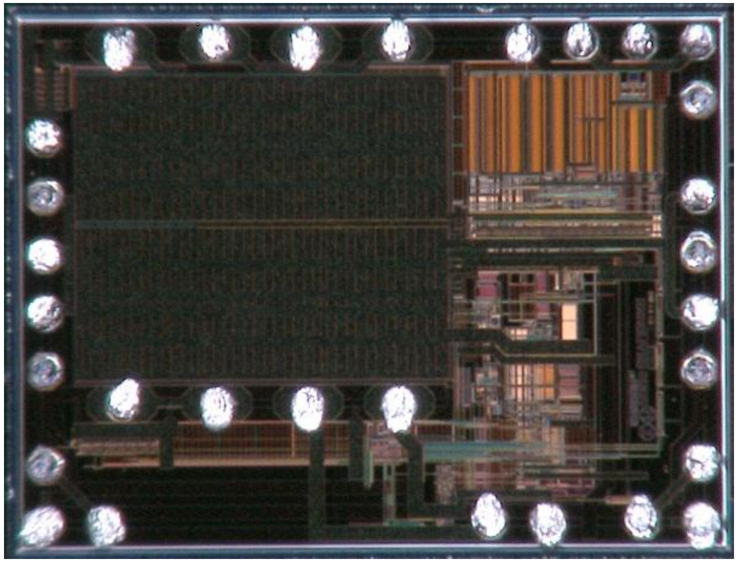
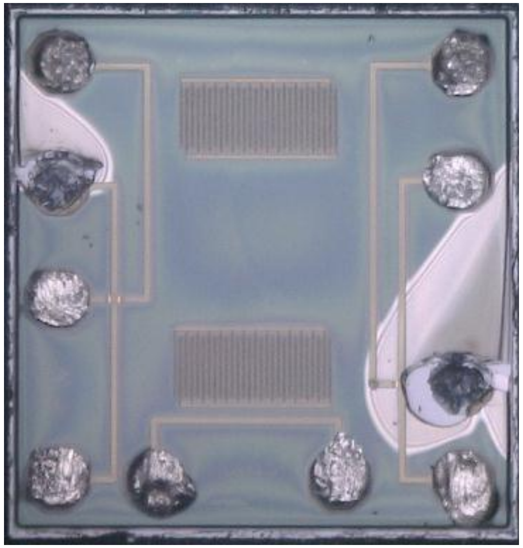
U4 Die Shear



Die Shear Pictures – Control (Flux Dipped)

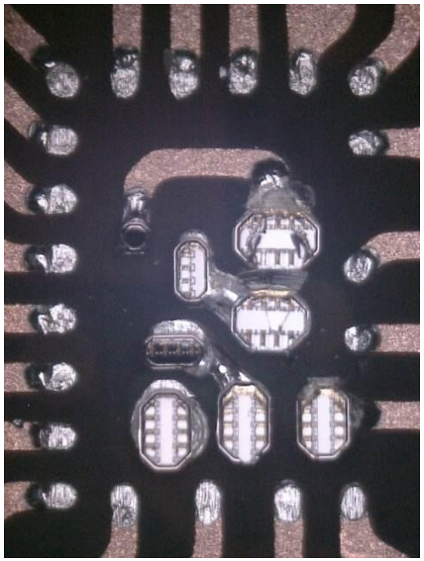
U1 **U3** **U4**

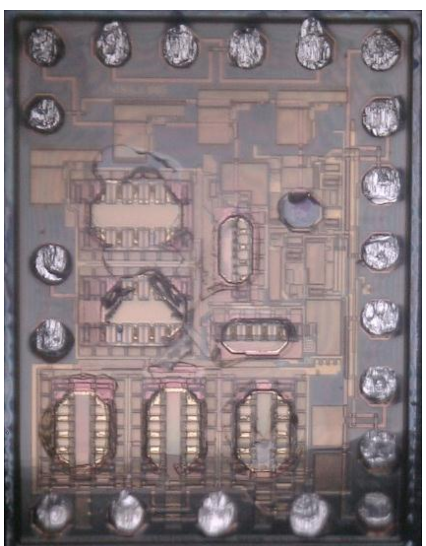



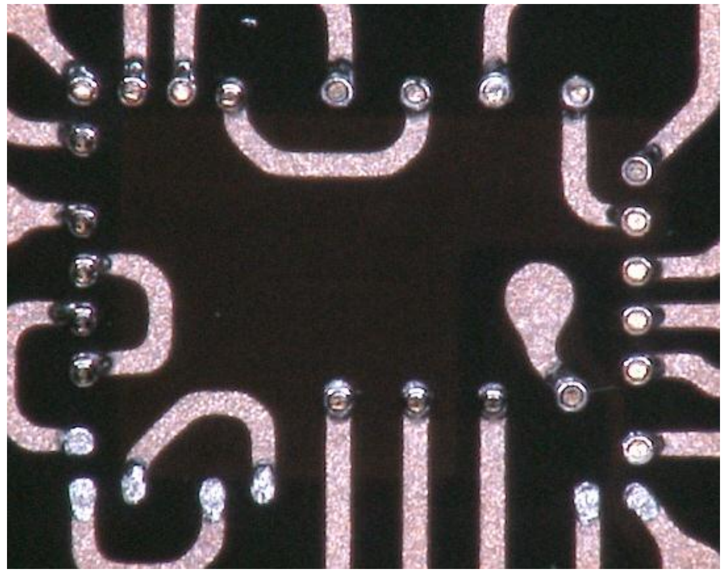
Die Shear Pictures – Cookie 2 (89um x 160um)

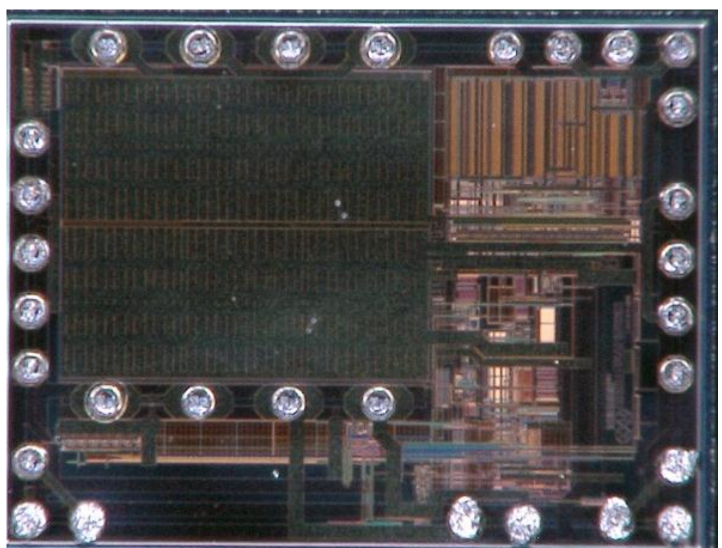
U1



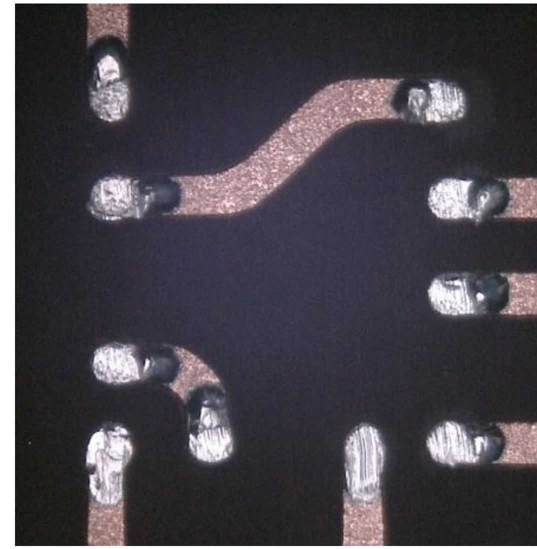


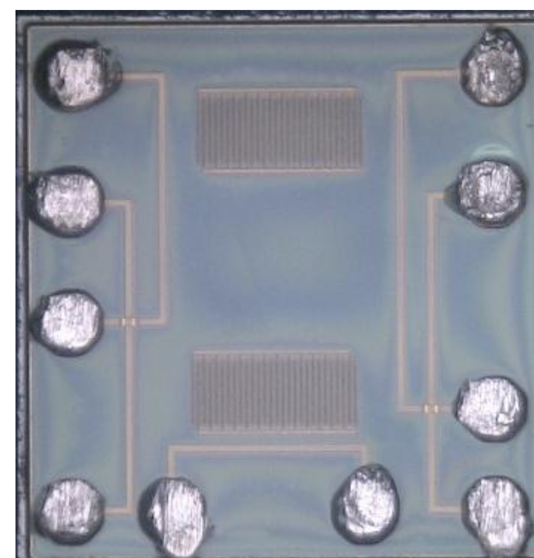
U3





U4





Summary: Flux Reservoir Stencil Printing

- With the use of slotted apertures it is possible to use cavity designed stencils for flux printing post paste print.
- For continuity measurements flux printing yielded a lower resistance value than the standard flux dip control parts – this may vary depending on design.
- Shear values were either the same or slightly better using flux printing compared to standard flux dip approach.

Conclusion:

- Flux printing after paste printing for HVM of Flip-chip components on a SMT line is feasible through the assembly.
- Further work needs to be done to validate reliability of assembled modules.
- Pick and placement rates still need to be validated out of T&R on an SMT line verses using a die attach platform to place flip-chip die.

Two Print Stencil Process Overall Conclusion

Effective printing process for Surface Mount Assembly Including :

- **Through Hole / SMT Assembly**
- **SMT / Flip Chip Assembly**
- **FR Shield / SMT Assembly**
- **SMT / Glue Chip Component Assembly**
- **Multi-Level SMT Assembly**
- **01005 / Die Attach Assembly**
- **Printing Lead Free and Tin Lead Paste on same PCB**

Thank you

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bcoleman@photostencil.com **email**