The Impact of Nitrogen for a Robust High Yield Soldering Process

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Associate Director of the Advanced Process Laboratory
About the Presenter

Denis is the Associate Director of the Universal Instruments’ Advanced Process Laboratory. He started his career in the electronics manufacturing world after earning his Doctorate in Chemistry from Binghamton University. His current focus is identifying the critical needs in emerging technologies and electronics assembly processes in order to develop specific research and development projects. Denis has authored hundred’s of peer reviewed articles, several books and presented to thousands of his peers on the results of his research over the past 15 years.

Denis volunteers his time serving on the board of the Surface Mount Technology Association. For the past 7 years, his focus is on implementing new programs that deliver leading edge technology solutions for the user and speaking at SMTA chapter events all over the world.
Advanced Process Laboratory
Binghamton, NY

Founded in 1987
- First and most complete Advanced Process Laboratory in the industry generally accessible to customers

APL is made up of 3 interactive groups
- Area Consortium
- Process Support
- Failure Analysis

Founded 1st Consortium - 1992
Complete Analytical Laboratory
Full process development and production capability
ITAR Compliant
ISO 9001 Certified
Soldering 5500 years ago

Joining of tools and ornamentals

Alloys:
AuCu, AgCu and PbCu
(Hard soldering >300 C)

Egyptian Tomb Thebe, Egypt
Dated: 1475 BC
Roman Soldering Technology - 2000 Years Ago

Romans introduced SnPb for soldering lead sheets together for transporting water in the aqueducts.

Cu and Au also used

Vitruvius: "Water conducted through earthen pipes is more wholesome than through lead."
Highly sophisticated process controls and optimization of process based on materials used.
Today’s Agenda

The assembly yield of a specific electronic PCB will depend on the interaction of two variables:

• Materials
• Process

This presentation will focus on the use of nitrogen in soldering processes.

• A look at Materials and the Impact of Nitrogen
• Case Study 1 – The impact of nitrogen on OSP and Optimized Processes for the Hole Fill
• Case Study 2 – The impact of nitrogen in the assembly process for a Package on Package
• Case Study 3 – The Impact of Nitrogen on the assembly process for 01005
# Quality in Today’s Market

## Notebooks and Laptops

<table>
<thead>
<tr>
<th>Brand</th>
<th>Fewer</th>
<th>Repairs and serious problems</th>
<th>More</th>
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<tbody>
<tr>
<td>Lenovo (IBM)</td>
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<tr>
<td>Compaq</td>
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<td>Sony</td>
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<td>Apple</td>
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Data are based on 75,578 responses to our Annual Product Reliability Survey, conducted by the Consumer Reports National Research Center. Data have been adjusted to eliminate differences solely linked to the age and the usage of the product.

**Source:** Consumer Reports
Materials and the Impact of Nitrogen
Content

Impact of materials on going to higher temperatures:
- Profile
- Alloys
- Paste
- Experiments on materials with the use of nitrogen
Due to the higher temperatures and longer time, there is a greater chance for oxidation of metal surfaces. Consequently making it harder to solder.
Design a Reflow Profile

Materials:
- Solder paste specification
- Component specifications

Process:
- Through put (Cycle time)
- Thermal mass of the assembly
- Atmosphere
The SnAgCu Alloy

Ternary Eutectic composition:
Sn - 3.5 Ag - 0.9 Cu
Melting point: 217°C

All alloys in the green area have a melting range <10°C.

Nemi: Sn3.9Ag0.6Cu
Jeida: Sn3.0Ag0.5Cu
Soldertec, Ideals: Sn3.8Ag0.7Cu
Impact on materials: Solderpaste particle sizes

10 types of solder paste evaluated.

DIN 32 513:
- ✔️ 85% minimum between 20 and 45 µm.
- ✔️ 10% maximum between 15 and 25 µm.
- ✔️ 3% maximum < 15 µm.
- ✔️ 3% maximum between 45 and 50 µm.
- ✔️ None larger than 50 µm.

J-STD-005:
- ✔️ 80% between 25 and 45 µm.
- ✔️ 10% maximum < 10 µm.
- ✔️ Less than 1% larger than 45 µm.
- ✔️ None larger than 50 µm.

USL = 50 µm  
LSL = 10 µm  
Cp = 1.45
Flux Compatibility Issues

Reflow Profiles are designed around material restrictions such as component, board, and flux specifications. Deviations from the recommended specifications can result in solder defects.
Determine to Use Air or Inert Atmosphere

Lab tests shows improved wetting, SnAgCu paste

**Advantage:**
- Nitrogen will improve wetting

**Disadvantages:**
- Costs
- Tombstone defects
# Nitrogen Impact on Surface Tension

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<tr>
<th>Alloy</th>
<th>$T_{sol}$</th>
<th>$T_{liq}$</th>
<th>Surface Tension (at $T_{liq} + 50$ °C) (mN/mm)</th>
<th>Intermetallic Phases</th>
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<tr>
<td>Sn (pure)</td>
<td>232</td>
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<td>Air: 417, Nitrogen: 464</td>
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<td>Sn-37Pb</td>
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## Solderpaste Reflow Atmosphere Profile Average Wetting Angle

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<th>Solderpaste</th>
<th>Reflow Atmosphere</th>
<th>Profile</th>
<th>Average Wetting Angle</th>
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<td>Ramp Soak Ramp</td>
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<td>Direct Ramp</td>
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<td></td>
<td>Air</td>
<td>Ramp Soak Ramp</td>
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<td></td>
<td></td>
<td>Direct Ramp</td>
<td>24.4</td>
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<tr>
<td>Sn/3.5Ag</td>
<td>Nitrogen</td>
<td>Ramp Soak Ramp</td>
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<td></td>
<td></td>
<td>Direct Ramp</td>
<td>20.5</td>
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<td>Air</td>
<td>Ramp Soak Ramp</td>
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<td>Direct Ramp</td>
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<td>Air</td>
<td>Ramp Soak Ramp</td>
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<tr>
<td></td>
<td></td>
<td>Direct Ramp</td>
<td>9.2</td>
</tr>
</tbody>
</table>

Average Wetting Angle Measured by Cross Section Analysis
Wettability Tests and Analysis

Air (Cu more discoloured)

Nitrogen improves wetting.

Nitrogen protects board finishes through multiple reflow passes.

Nitrogen does not remove the micro-cracks of the SnAgCu surface.

Nitrogen increased tombstone risk.

Less oxidation on the Cu coupon.

Levels of 500 to 1000 ppm are normally sufficient to let the flux perform well.

Nitrogen (some dewetted visible)
Nitrogen and Spreading

Solder spread test.
Sn3.5Ag0.75Cu

With nitrogen the spread characteristics of the lead-free solder paste improves.
Nitrogen and Solder Ball Test

Solder balling test on ceramic.
Sample 7: Sn3.0Ag0.5Cu

No significant differences in between air and nitrogen atmosphere.
The nitrogen prevents however oxidation of the surfaces that need to be soldered.
Nitrogen and Miniaturisation

No-clean lead-free solder pastes are compatible to solder in air atmosphere.

Bad coalescence of lead-free solder paste reflowing small solder paste deposits, e.g. fine pitch flip chip, 0201 and smaller.

Corrective action:
Use nitrogen, or
Apply more solder paste.

Small solder deposits, so activators will evaporate fast. Oxidation of solder balls.
Conclusions

Nitrogen has a positive effect on:

• Improving the wetting of the paste to pads and component terminations.
• Decreases the wetting angle
• Improves the flux residue left behind after the reflow process.
• Improves the coalescing of the particles in the solder paste.
• Improves the spreading of the paste on copper pads.

• Ultimately, nitrogen prevents the formation of metal oxides on the surfaces of the pads, components terminations/bumps/leads and paste allowing for improved yields.
Case Study 1 – The Impact of Nitrogen on OSP and Optimized Processes for the Hole Fill
Focus on Solutions

Characterize the theoretical efficacy of OSP surface finish
- Soldering in an air environment degrades most surface finishes thereby affecting its solderability.
- To maintain the integrity of the coating under several thermal processes, nitrogen might be required.
  - Varying oxygen concentrations
  - Nitrogen supply methods

Effect of misprint cleaning on the OSP chemistry.

Develop a relationship between the efficacy of OSP chemistry to the manufacturing reality of soldering both surface mount components and through hole joints.
- Exposure of boards to the most complex manufacturing process: curing, double sided lead free reflow, wave soldering.
- Investigating process parameters in reflow and wave soldering.
- Characterizing the influence board complexity and specific design features.

Recommend the use of a specific atmosphere and delivery method by developing a model “cookbook” that allows end users to select specific materials in order to develop a material specific soldering process.
Why Manufacturers Use OSP

Increase popularity due to lead free requirements.
Cost effective.
Proven solder joint reliability.
  • What you see is what you get.
Temporary layer of protection from oxidation of the Cu surface.
OSP is penetrated and dissolved by flux and temperature.
Able to withstand multiple thermal excursions such as reflow, wave, and rework processes.

Visual Inspection - Impact of...

Washing Process: change in color - from light brown to dark brown.
Nitrogen Process: no visible difference in color at any oxygen content or profile used.
Air Process: Major differences. Worse discoloration when profile 2 for pre-conditioned boards.
Impact of Atmosphere on OSP Thickness

Initial OSP Thickness = 0.39 microns
Significant effects of Oxygen Content and Supply Method.
Mean analysis on Profile yields no impact to OSP thickness. However...
Loss of OSP

Results shown are for Reflow Only atmosphere control.

OSP thickness reduction exhibits a slight effect based on profile.
- Profile temperature exerts an inconsistent loss in OSP.
- Use of an air atmosphere results in the highest consumption of OSP.

Average reduction in OSP thickness 48.4% in N\textsubscript{2} and 59.5% in Air.
Less OSP thickness reduction compared to full tunnel configuration.
Impact of Cleaning on OSP Thickness

Main Effects Plot for Thickness
Data Means - 1 Wash

Main Effects Plot for Thickness
Data Means - 2 Wash

- Significant reduction in OSP thickness when coupons subjected to either 1 or 2 wash cycles.

1 Wash + Reflow

2 Wash + Reflow
Solderability testing was performed in order to confirm impact of atmosphere on OSP efficacy.

- **BGA Coupons** were used to characterize solderability.
  - 256 solder pads per coupon.
  - 30 mil diameter.
  - Solder mask defined pads.
  - Coated with Entek Plus HT OSP.
  - Six (6) coupons per soldering atmosphere.
- **Coupons processed utilizing Profile 2.**
- **Selected two soldering atmospheres:**
  - Full tunnel <100ppm O₂
  - Air
- **Coupons were then dipped in a rosin based flux for 1 minute. Post fluxing coupons were individually submerged into molten solder (Sn/3.9%Ag/0.6% Cu) for 5 seconds.**
- **Coupons were then cooled and rinsed with alcohol.**
- **Characterization of solderability was accomplished by counting the number of unsoldered pads.**
Solderability Results

A total of 1280 opportunities exist from the five BGA coupons.

AIR results
- 41 pads not soldered
- $8.2 \pm 5$ average defects/board
- 3.2% defects

$N_2$ results
- 17 pads not soldered
- $3.4 \pm 2$ average defects/board
- 1.3% defects

OSP thickness measurements showed a decrease of 18.5% from coupons processed under <100 ppm $O_2$ versus those processed under ambient conditions.
- This confirms the significance of OSP thickness measurement as a benchmark for the OSP efficacy.
When Theory Meets Reality…

OSP thickness measurements were taken and analyzed. Interactions described. However, OSP efficacy can only be measured by performing various soldering operations under controlled conditions.

This investigation aims to develop a bridge and understanding between the relationship of OSP thickness and through hole penetration.

An identical experimental with no wash cycles was performed utilizing the Flextronics Test Board.

Flextronics Test Board
16 layers, FR4 board
93 and 125 mil thick
Cu OSP: Entek Plus HT
Use of N$_2$ yielded acceptable joints. Air did not.

Acceptable hole fill. 75% as per IPC 610D.
Can We Achieve Acceptable Joints Under Air Atmosphere?

Main Effect Plot for TH - 125 mil thick Board - Alcohol Flux - 21% - Pin Connector

Yes BUT under specific process conditions and board designs.
Influence of Reflow Atmosphere on Through Hole Penetration - 93 mil

Main Effect Plot for TH - 93mil thick Boards

- Both N₂ and Air yield acceptable joints.
Effects of Process Parameters

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<th>0.094</th>
<th>0.135</th>
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<td>O</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Board Finish</td>
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</tr>
<tr>
<td>Atmosphere</td>
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</tr>
<tr>
<td>Conveyor Speed</td>
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<td>Preheat</td>
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<td>Flux Quantity</td>
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<tr>
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<td>+</td>
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<td>Chip Wave</td>
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<tr>
<td>Solder Temperature</td>
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<td>+</td>
</tr>
<tr>
<td>Pin Complexity</td>
<td>0</td>
<td>+</td>
<td>+</td>
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</table>

Source: iNEMI Wave Soldering Project
Findings

The reflow soldering ambient has a significant effect on the degradation of OSP thickness. After 2 refloows, the thickness is reduced by an average of 50.6% under N\textsubscript{2} conditions versus 59.5% under ambient conditions.

For the solderability test, coupons reflowed in air were characterized having less solderability compared to those reflowed in N\textsubscript{2}.

Coupons subjected to the washing and reflow cycle(s) were characterized having OSP thickness reduction of up to 90%.

Use of N\textsubscript{2} in reflow process for 125 mil thick Cu OSP boards is necessary to achieve > 75% T/H penetration. For 93 mil thick boards, N\textsubscript{2} is beneficial but not necessary.

As for materials,

- The alcohol based flux was more robust than the VOC free flux.
- Optimal T/H design depends on component types.
Material Impact on Through Hole Penetration

Materials are affected by the process that they are exposed to. Yield is directly affected.

It is possible to model through-hole penetration based on process attributes and material selection.
BOTTOM LINE

Use of some N₂ exerts a positive influence on OSP thickness, efficacy, and ultimately joint formation.

Ensure your printing process is accurate and precise to avoid the need for washing misprints.
Case Study 2 - The impact of nitrogen in the assembly process for a Package on Package
Project

**Background:**
Stacked package technology allows for ever increasing functionality coupled with miniaturization. Through-molded-via PoP provides opportunity for much better warpage control, often a limiting factor in stacked package assembly.

**Scope:**
To evaluate the process and materials for robust 0.4mm pitch TMV PoP assembly. Specifically evaluate multiple dip materials and reflow atmosphere for good soldering.

**Metrics:**
- Assembly yields and Solder joint Formation
- Reliability
  - Drop/shock (JEDEC JESD22-B111)
  - Temp Cycling (-40/125 °C)
Through-Molded Via

Traditional “flange” style PoP.

- Bottom package overmold is concentrated at center of device, with pads for top package soldering.
Through-Molded Via

Traditional “flange” style PoP.
- Bottom package overmold is concentrated at center of device, with pads for top package soldering.

TMV Style PoP
- Bottom package overmold extends to edges of package
Through-Molded Via

Traditional “flange” style PoP.
- Bottom package overmold is concentrated at center of device, with pads for top package soldering.

TMV Style PoP
- Bottom package overmold extends to edges of package
- Vias in the overmold are necessary for connection of the top package
Through-Molded Via

Traditional “flange” style PoP.
- Bottom package overmold is concentrated at center of device, with pads for top package soldering.

TMV Style PoP
- Bottom package overmold extends to edges of package
- Vias in the overmold are necessary for connection of the top package
- Solder balls provide the via fill

*Illustration does not necessarily represent actual product of TMV technology
TMV Assembly

- Assembly process requires attachment of solder ball to solder ball
- Top Package must be dipped into flux or solder paste
  - Sensitive to Material Selection
Test Vehicle

Amkor TMV Components

- **Bottom Package: TMVPSvfBGA**
  - 620 I/O
  - 0.4mm pitch
  - SAC125Ni

- **Top Package: SCSP 200LD**
  - 200 I/O,
  - 0.5mm pitch
  - SAC105
Test Board

Standard layout per JEDEC drop/bend methods.  
0.8mm thick  
4-layer  
CuOSP & ENIG versions  
NSMD Pads  
  • 8.2 mil actual diameter  
3 daisy chain nets:  
  • Bottom  
  • Top Corner  
  • Top Middle
Component Warpage

- Lower overall magnitude
  - <50 µm
- Excellent matching
- JEIDA standard 7306
- At 0.5 mm pitch
- Max warpage 110 microns

![Graph showing warpage vs temperature for FBGA200 (top) and PSTMV620 (bottom)]
Dipping Materials

- 7 Materials were evaluated for top package soldering.
  - 2 Fluxes
  - 5 Pastes varying alloy, powder and metal content
  - 2 Vendors

<table>
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<th>ID</th>
<th>Material Type</th>
<th>Alloy</th>
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<tr>
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</table>
Dipping Strategy

• Our target was to transfer material to 50% ball height

• To simplify analysis, only film thickness was varied
  • Other parameters could be adjusted
    – Insertion/extraction speeds
    – Dwell time in film
    – Placement force
    – Nozzle Design
Dip Examples

Flux had no issue achieving 50%
Had to balance thickness with component yield from film
Assembly Study

Metrics:

- Component Yields after reflow
  - Separated by Bottom and Top Package

Reflow Conditions

- Average Ramp: 1.0 °C/s
- Peak Temp: 242-245 °C
- Environment
  - Air
  - N₂ (<50 ppm O₂)
Assembly Yields

Yields are reported on a per device basis. 30 devices were assembled for each condition.

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<th>Material Type</th>
<th>Powder Size</th>
<th>Metal Content</th>
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<td>C</td>
<td>Paste, HF</td>
<td>SAC305</td>
<td>Type 5</td>
<td>80%</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Paste, HF</td>
<td>SAC305</td>
<td>Type 5</td>
<td>80%</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Paste, HF</td>
<td>SAC305</td>
<td>Type 5</td>
<td>79%</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Paste, HF</td>
<td>SAC305</td>
<td>Type 6</td>
<td>79%</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Paste, HF</td>
<td>SAC105</td>
<td>Type 5</td>
<td>79%</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>Bottom</td>
<td>All</td>
<td>Paste</td>
<td>SAC305</td>
<td>Type 5</td>
<td>80</td>
<td>210</td>
<td>0</td>
</tr>
</tbody>
</table>

Air Reflow Atmosphere

Nitrogen Reflow Atmosphere
Assembly Yields

![Bar Graph for Assembly Yields](image)

- Material ID: A, B, C, D, E, F, G
- Yields: 0%, 20%, 40%, 60%, 80%, 100%
- Methods: Air Reflow, N2 Reflow
Defects: Bottom Package

• Bottom device opens were always traced back to insufficient paste transfer
  • 100% solder paste inspection caught these defects prior to assembly
  • 4/210 in Air
  • 0/210 in N2 even when insufficient paste was transferred
Defects: Top Package

Defects were only observed in Air reflow

• X-Ray analysis reveals non-coalesced TMV solder balls.
  • “snowman” appearance
• Defect is consistent on all visible TMV joints
• Defect only observed on assemblies reflowed in air atmosphere using a paste dip process
• Flux dipped process shows much more columnar form of the TMV joint

Flux A: Non-HF
Air Reflow

Paste C: SAC305 Type 5
Air Reflow
Defects: Top Package

Paste C:
SAC305 Type 5
Air Reflow

Paste C:
SAC305 Type 5
N₂ Reflow

N₂ reflow results in more columnar TMV joint: Better coalescing
Defects: Top Package

Paste C: SAC305 Type 5
Air Reflow

Paste C: SAC305 Type 5
N2 Reflow
Defect Analysis

- Flux dipping provides much more flux per volume than paste dipping.
- Flux can easily wet to TMV solder ball during placement.
- Paste provides only limited contact with TMV solder ball
  - requires good wetting action to coalesce.
Summary

- TMV assembly is greatly dependent on dip process and materials.
- Standard dip rules apply
  - Machine set up is required to optimize material transfer
  - Balance quality with throughput

- Air reflow: Better solder joint formation occurs with Flux dipping.
  - Flux has better chance to wet to TMV solder ball, better wetting action
  - Paste dip has limited flux, poor wetting occurs and “snowman” joints are formed
    - Nitrogen required for paste dipping
  - Cleaning the TMV device prior to assembly achieved more acceptable yields in air

- N2 reflow: easily achieve 100% yields with all materials tested
Case Study 3 – The Impact of Nitrogen on the Assembly Process for 01005
A Challenge Based on Necessity

Chip caps and resistors are among the smallest, simplest and perhaps the least expensive parts in a printed circuit assembly.

However, they require the most attention by perhaps the most expensive investment of the assembly process: the placement machine. Printing and reflow also exert significant influences on the end result.

Developing a process that includes capability for the assembly of 0201 and 01005 components does not have to be a complicated exercise.

Using specific design rules for substrates and stencils, consistent materials, and the proper tools, an acceptable process can be developed.
01005 Component

How small is it?

Size Comparison

01005s mixed with black pepper.
## Shrinking Footprint

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Capacitor Footprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1206)</td>
<td>3216 3.2 mm x 1.6 mm in 1970</td>
</tr>
<tr>
<td>(0603)</td>
<td>1608 1.6 mm x 0.8 mm in 1983</td>
</tr>
<tr>
<td>(0402)</td>
<td>1005 1.0 mm x 0.5 mm in 1990</td>
</tr>
<tr>
<td>(0201)</td>
<td>0603 0.6 mm x 0.3 mm in 1997</td>
</tr>
<tr>
<td>(01005)</td>
<td>0402 0.4 mm x 0.2 mm in 2004</td>
</tr>
</tbody>
</table>

- In spite of having equal capacitance the footprint in 1997 is approximately 1/6 of the size in 1990.

And the 01005 has a footprint of 0.08 mm\(^2\) vs. 5.12 mm\(^2\) of a 1206 capacitor. That is a reduction of 98.5%.

The 01005 has a footprint of 44% of that of an 0201.
0201 - 01005 Component Usage Now

**IPHONE 3GS**
0201 / 01005 Assembly Issues

Printing: Small apertures
  - Stencil clogging, insufficient deposits, deposit size variation, alignment

Placement: Small passives
  - Component size variation
  - Packaging; tapes, feeders, ESD
  - Nozzles, nozzle contamination
  - Speed, placement accuracy, pick issues, placement order

Reflow: Tolerance to above imperfections?
Not All Components Are created Equally

Capacitor (Murata)

Resistor (KOA)

Resistor (Matsushita)

Resistor (Hokuriku)

Outline and electrode vary by each maker.
They can influence recognition, placement accuracy and pick-up rate.
Nozzles

0201

01005
Solder Paste Printing

**Type 3**
- Pad size: 11x11
- 5 mil space between pads
- Aperture size: 11x11
- Stencil thickness: 4 mil
- Area ratio: .69

**Type 4**
- Pad size: 8.8 round
- .4mm pitch
- Aperture size: 9.5 square
- Stencil thickness: 3 mil
- Area ratio: .79

**Type 5**

*What if... Stencil 4 mil = .59 ratio*
Typical Solder Joint Defects

- **Insufficient solder volume**
- **Excessive solder volume**
- **Component misalignment**

**Component**

**PCB**

**Solder joint**

**Component attachment pad**

**Attachment pad**

**Mis-placed component**

**Solder paste**
Typical Defects

Open solder joints (tombstone)

Solder beads (solder balls)

Solder bridges
Typical Defects
Tombstoning 0201 vs 01005

Top Soldered Terminations  |  Bottom Soldered Terminations

0201  

01005  

$N_2$ reflow comparison. Resistors only. Caps may act differently.
Solder Paste Reflow for 01005

- Air or Nitrogen. Process window tighter for Air. The smaller particle sizes required for 01005 oxidize very quickly and easily resulting in a very small process window in an air atmosphere. Nitrogen provides a larger process window.
- Orientation has little effect on defect rates
Assembly Defects by Attachment Pad Width and Assembly Process Type

- No-Clean, Air Reflow
- Water-Soluble, Air Reflow
- No-Clean, Nitrogen Reflow

Number of Solder Joint Defects vs. Pad Width (mils)
0201 Experiment Data

Assembly Defects by Attachment Pad Spacing and Assembly Process Type

Number of Solder Joint Failures

Attachment Pad Spacing (mils)

- No-Clean, Air Reflow
- Water-Soluble, Air Reflow
- No-Clean, Nitrogen Reflow
Conclusions

Assembly of 01005 components is greatly influenced by materials chosen including: paste type, particle size of the paste, printing parameters, pick and place parameters, and reflow process.

Nitrogen provides the assembler with a larger process window.
Thank You!

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