Reflow Soldering

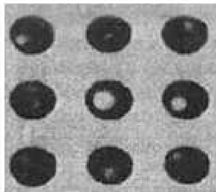
Reflow soldering is the main soldering method to connect surface mount devices (SMDs), Multi-Chip modules and hybrid components to circuit boards.

Use of nitrogen for inert soldering in the assembly of PCBs continues to increase worldwide in both wave and reflow soldering operations.

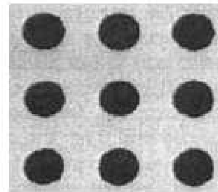
More and more, assemblers are recognizing the value of inert soldering in improving joint quality and yield while reducing sensitivity to process variables and fluctuations ('process window widening').

But whereas there seems to be little doubt in the minds of the user that nitrogen "improves" the wave soldering process, applying it in reflow equipment is often debated. This insecurity about the benefits of nitrogen certainly does not stem from a lack of information and research. The literature is full of indications about the how's and why's of nitrogen usage. All conclusions are the same: the advantages or necessity of N2 in reflow depends on the process! That is, nitrogen will always improve the process but the benefit value analysis will differ. For that matter, pre-evaluating and testing is important.

N2 Joint Cross Section



Voiding: Air



No Voiding: N2

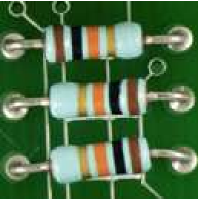
Benefits of N2 in a Reflow Soldering Process
Flexibility – Wider "Process Window"
Use Of Low Solids
Reduced Cleaning – Residues not Polymerized or Eliminated Cleaning
Reduced Automatic Testing False Fails
BGA Voiding
Reduced Defects / Increased Yield
Increased Joint Reliability
Aesthetic / Shiny joints

Proven Conditions than Benefit from Nitrogen

Integrated components assembly (BGA, CSP, COB, ...)
Fine-pitch
Non-reworkable components
Expensive assemblies
Multi-pass assemblies
Higher temperature processes
OSP / Bare copper boards
Low volume / Prototype
No-clean
Reliability is crucial
Lead-Free

Reflow Soldering of Pin-Through-Hole Components

The use of Pin-Through-Hole (PTH) connectors and power-related components both offering robustness have maintained the viability and need for the wave soldering process. Although very cost-effective, wave soldering poses real estate and flexibility limits on printed circuit boards. Large I/O components are restricted from the substrate side which will contact the wave.



Developments targeted at addressing this issue have led to process improvements and development such as selective soldering. Another process improvement is reflow soldering of through-Hole (ROT) components, also called pin-in-paste soldering or intrusive reflow. This technique provides board flexibility – large I/O components or connectors can be placed on both sides of the board – and eliminates the need for additional soldering equipment other than reflow soldering. Capital cost and overhead cost such as floor space, power, maintenance, etc. associated with wave soldering and selective soldering can be eliminated. With the ever-increasing pressure to reduce cost, this technology becomes extremely attractive.

ROT is not a new process but literature is not abundant on this topic. Recent reports, however, have proven that the joints formed under this method are reliable. Nevertheless, the implementation of such process represents a challenge and every process parameters must be optimized to ensure a high-yield process. The use of a nitrogen atmosphere for example has proven extremely useful in ROT. Nitrogen increases the wetting force and speed I- a critical parameter in the formation of ROT solder joint. Additionally, nitrogen produces smoother and shinier solder fillets with a stronger grain microstructure. Nitrogen intrusive reflow produces robust and consistent joint while lowering soldering defects.

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