Low-Component Standoff Reliability

The miniaturization trend and the high-density components Printed Circuit Board (PCB) assemblies are driving the industry to adopting low standoff components. Many newer leadless component packages have signal or power connections close to large thermal/electrical pad, such as Quad Flat No-leads (QFN's), Dual Flat No-leads (DFN) and Land Grid Array (LGA's). The large thermal/electrical pads are needed to remove heat produced by the component and the soldering of the pad to the PCB requires a relatively large volume of solder paste. The leadless components have very small clearances between the bottom of the component and the PCB. The small clearance will result in a considerable amount of flux ingredients being entrapped underneath the component between the thermal/electrical pad and the surrounding signal and power connections during the reflow process. The entrapped flux ingredients include unevaporated solvents, raw activators, rheological additives and fluxing reaction products. In the presence of entrapped solvent, the flux residue becomes liquid or semi-liquid and the activators can move around, and create an environment for electrochemical migration and dendrite growth in harsh environments.

The present IPC SIR testing methods for soldering materials do not address the electrochemical failure mechanism issues for entrapped flux residues under low standoff component and solder joints spacing below 0.5mm. The IPC-B-24 and the IPC-B-25A SIR test vehicles do not address the current and future solder joints spacing for the hand held electronic devices and the density components PCB assemblies. If flux entrapped underneath the component is hygroscopic may absorb moisture from the air and will allow electrochemical migration.

Kester developed a test vehicle to be more representative of the actual electronic assemblies and better for finding issues with electrochemical migration. The test vehicle is designed to obstruct the flux residue underneath the component and have uncovered comb patterns underneath the components.

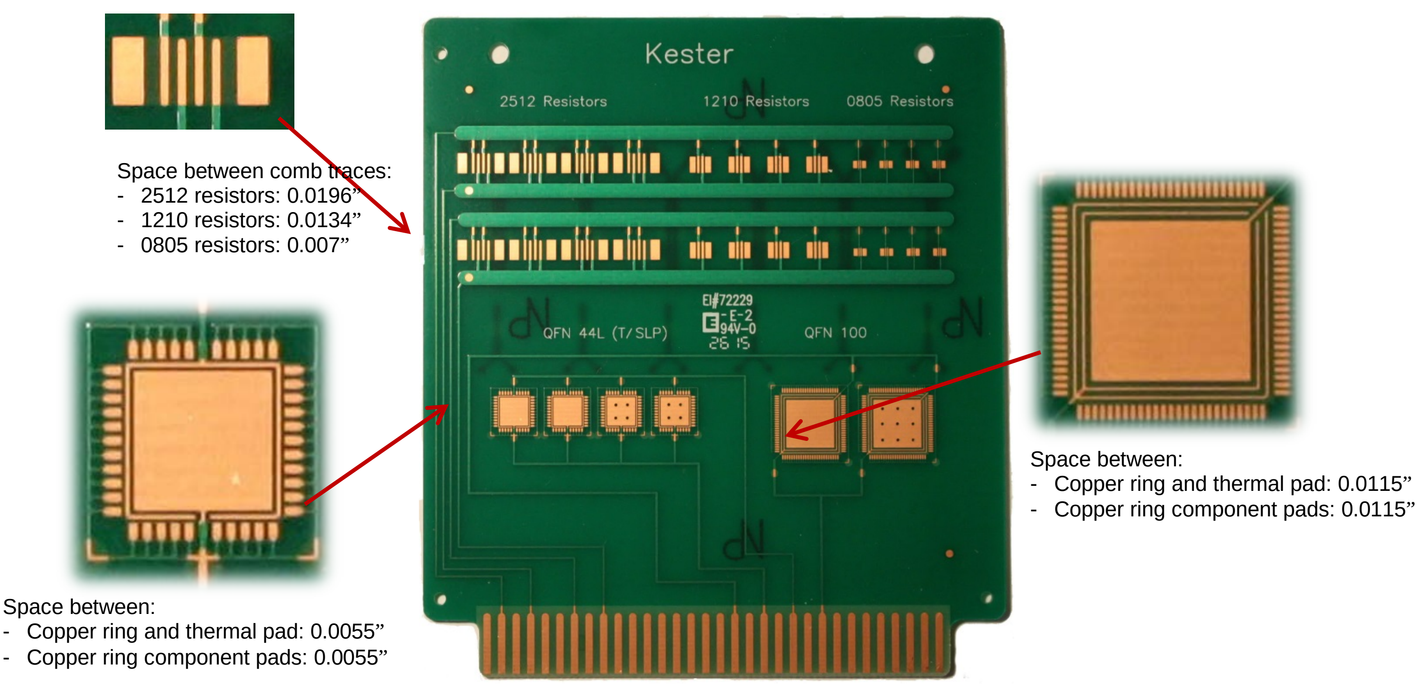

Figure 1: Test vehicle

Global Headquarters: 800 West Thorndale Avenue, Itasca, Illinois, 60143 USA
Phone: (+1) 630 616-4000 ■ Email: customerservice@kester.com ■ Website: www.kester.com

Assembly Conditions:

No-clean solder paste evaluation

- A no-clean SAC 305 alloy solder pastes were used to assemble the test boards
- 0.005" thick stainless steel stencil, was used to apply solder paste to the test boards
- The test boards were reflowed in convection oven in air atmosphere
- The test board reflow profile is shown in Figure 2

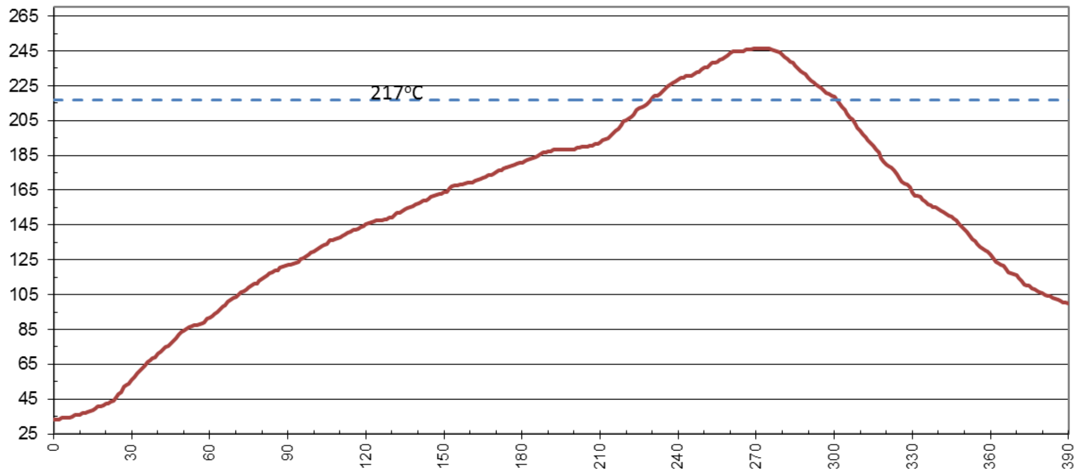

Figure 2: Reflow profile

Figure 3: Assembled Test Vehicle

No-clean solder paste and no-clean liquid flux combination evaluation (Combo test)

- A total quantity of 0.25ml no-clean liquid flux was applied on the surface of the assembly board
- The flux was applied in the component areas as shown in Figure 4
- The flux was air dry at room temperature

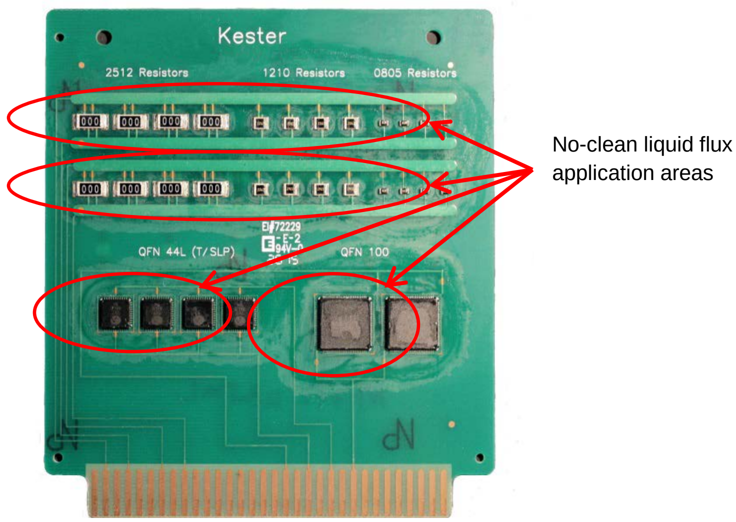

Figure 4: No-clean flux application on the top side of the board

Test Conditions:

- Bias: 8 volts
- Test voltage: 8 volts
- Relative Humidity: 85%
- Temperature: 85°C
- Measurement interval: 20 minutes

Results:
The test results are shown in Figures 5-11. The NP505-HR solder paste performed well in both tests (paste only test and combo test with NF372-TB liquid flux).

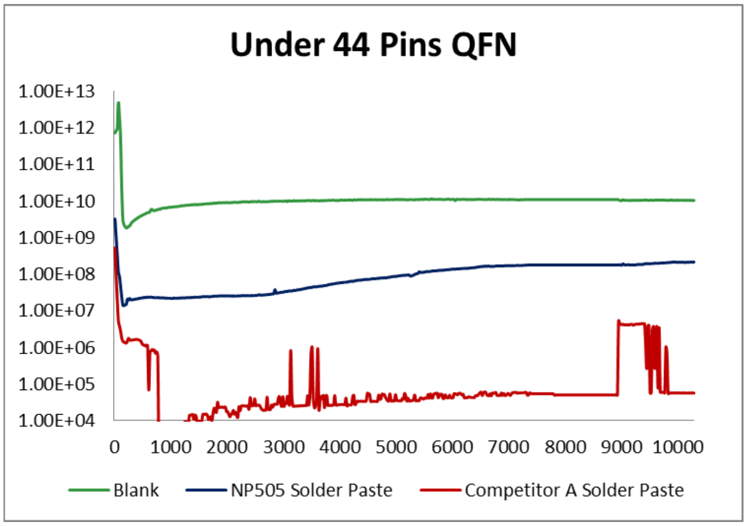

Figure 5: Under 44 pins QFN solder pastes test results

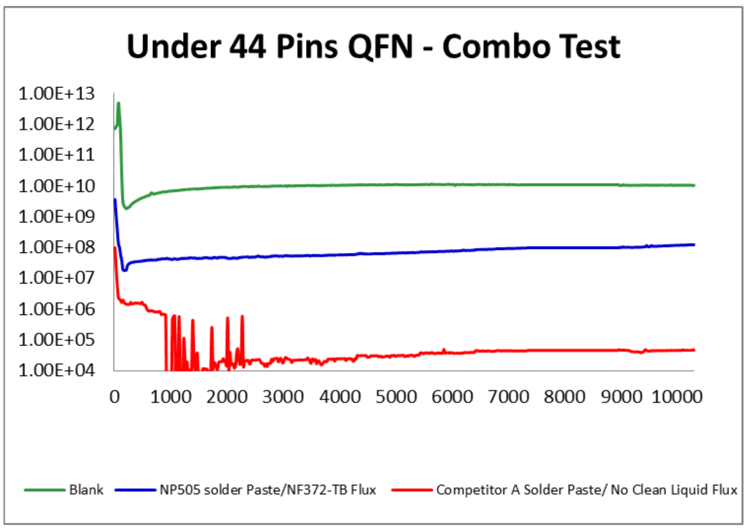

Figure 6: Under 44 pins QFN combo test results

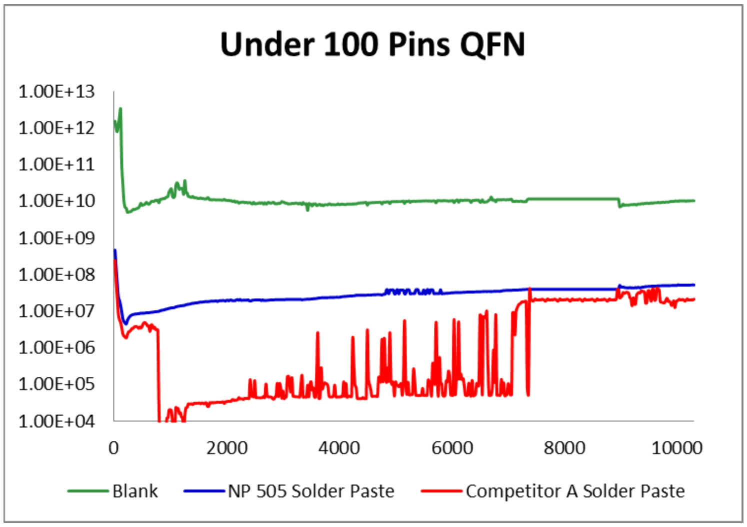

Figure 7: Under 100 pins QFN solder pastes test results

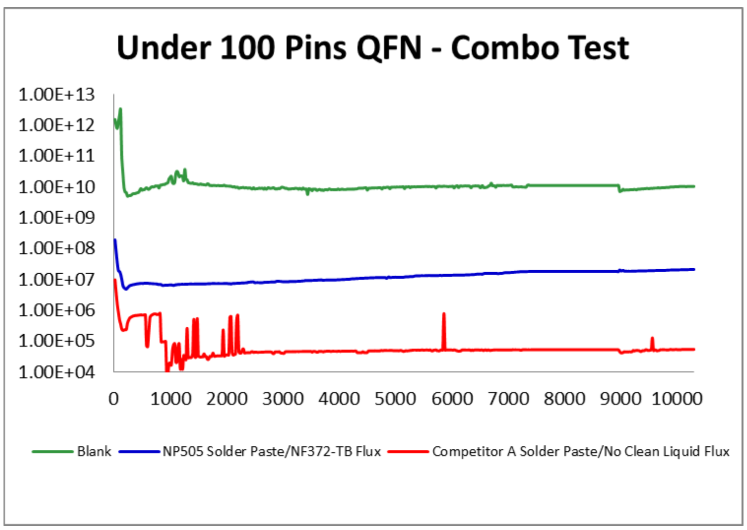

Figure 8: Under 100 pins QFN combo test results

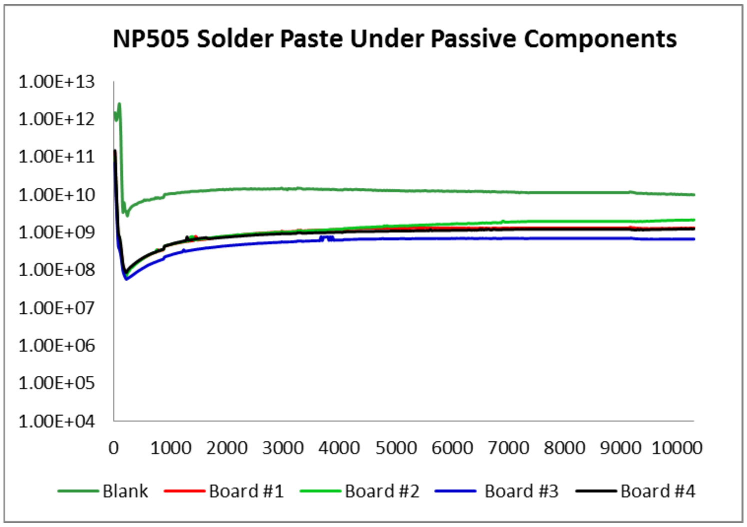

Figure 9: Under passive components NP505-HR solder pastes test results

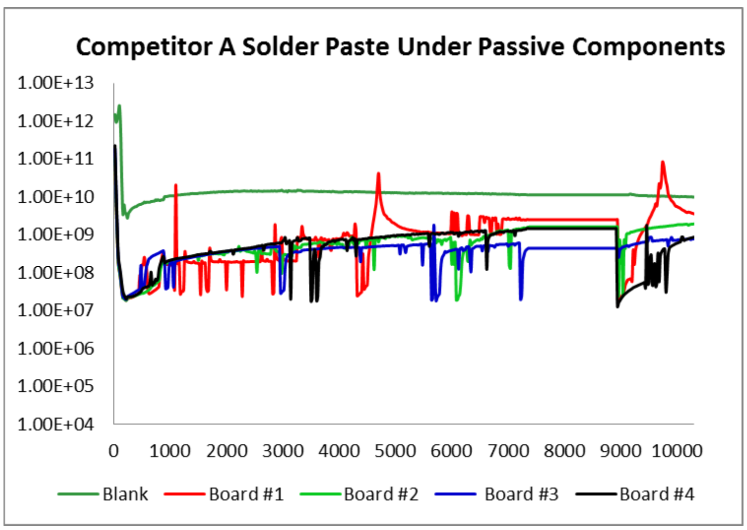

Figure 10: Under passive components competitor A solder pastes test results

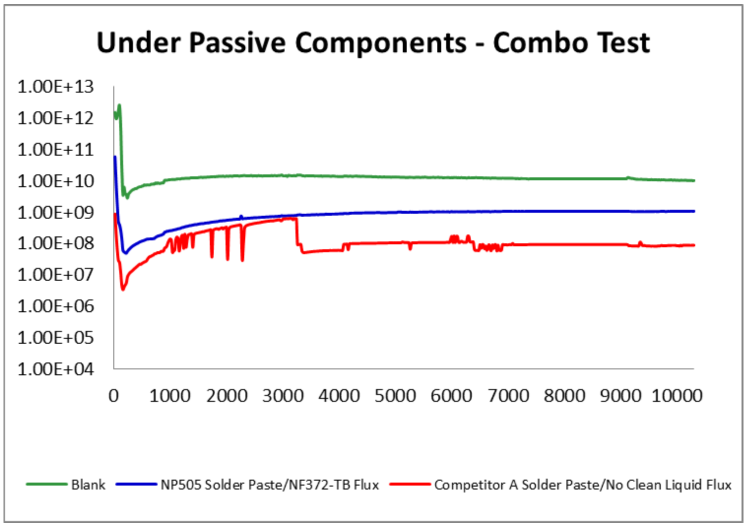

Figure 11: Under passive components combo test results