

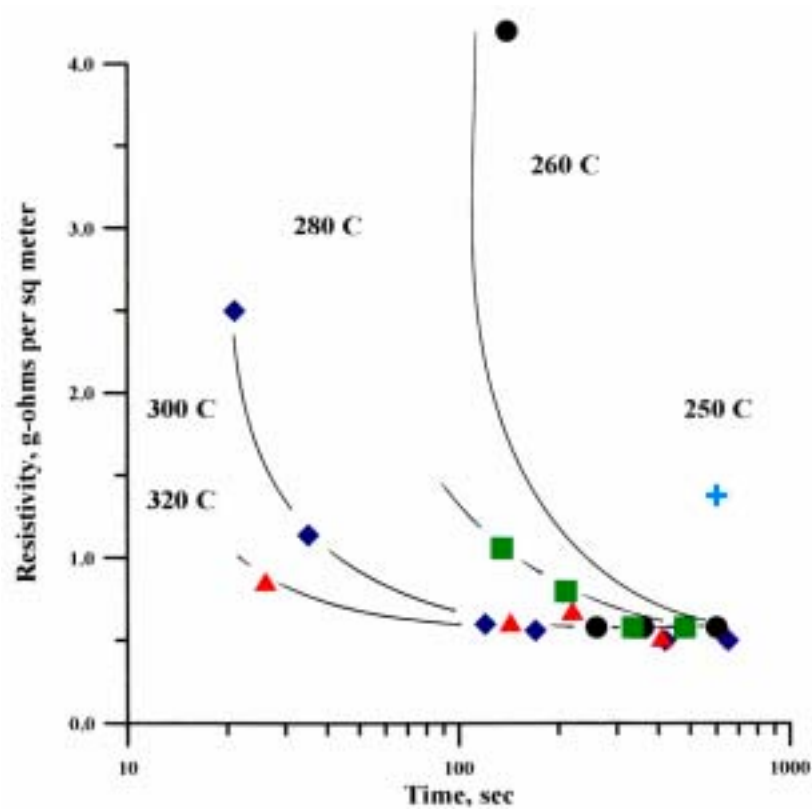
Rapid Response Computer Aided Manufacture of Printed Wiring Boards

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Parmod® Rapid Response Technology

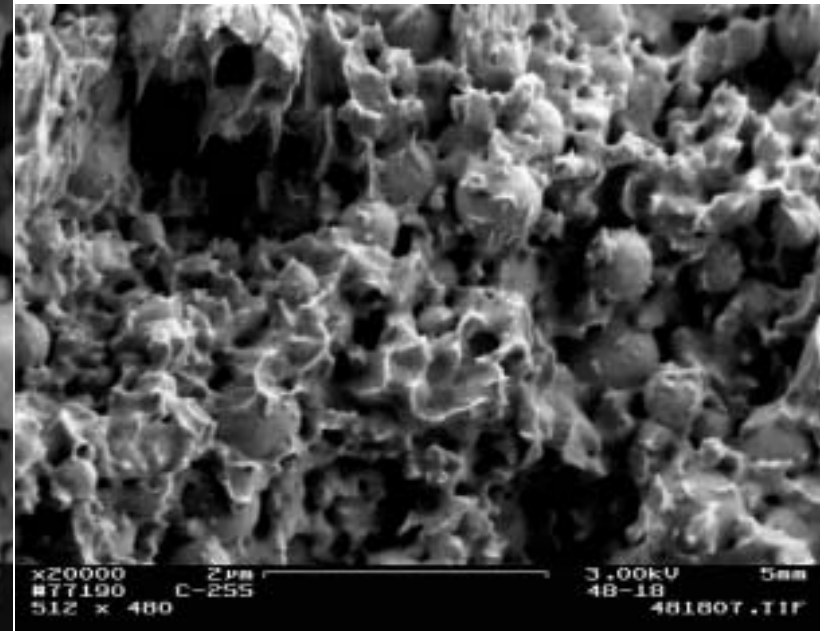
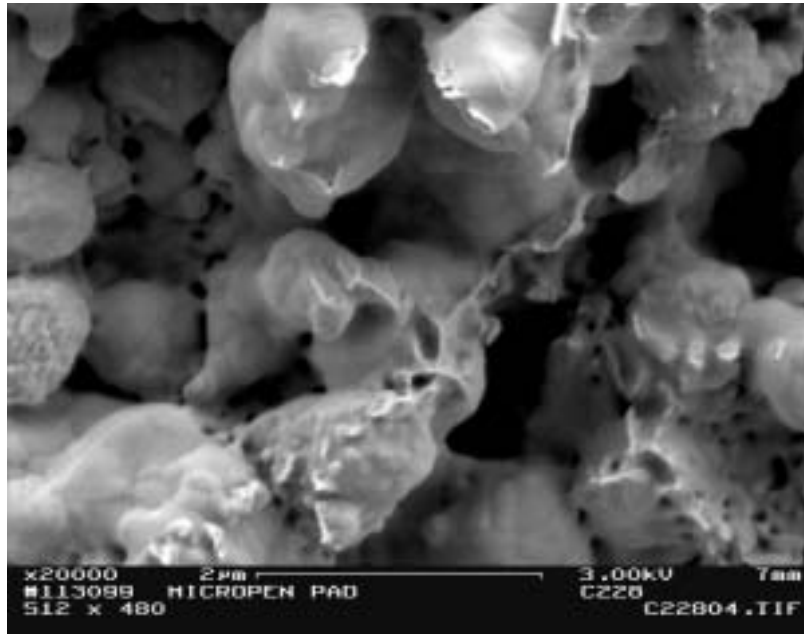
- Parmod® mixtures consist of particulates and a reactive organic medium
- Formulated as inks and pastes for direct printing on polymer substrates
- Cured by heating to 200-300°C
- Chemically welds the particulates into a continuous single phase

Time-Temperature Behavior for Parmod® Copper



Resistivity as a Function of Time at Various Temperatures - Cu

Microstructure of Parmod Copper



Advantages

- Permits novel processing for Rapid Response
 - Simple screen-printing process
 - CAD production of screens
 - 24 hour turnaround
- Inks are customized for the application
 - No wet processing
 - No waste, no hazard
 - Faster cycle time

Process Comparison

Punch

Drill

Smear removal

Plate & Etch

Hole metallization

Rack

Clean & condition

Rinse

Microetch

Rinse

Sulfuric acid

Rinse

Parmod®

Hole metallization

Screen print

Blow out excess

Hole Metallization, Continued

Preactivate

Activate (palladium)

Rinse

Post activate

Rinse

Electroless copper (copper sulfate and Formaldehyde, 20 minutes)

Rinse

Scrub

Rinse

Copper flash plate (copper sulfate)

Dry

Circuit Patterning

Pattern plating

Pumice scrub

Laminate dry film resist

Expose

Develop (sodium carbonate)

Rack

Acid clean

Rinse

Microetch

Rinse

Sulfuric acid

Rinse

Copper plate (copper sulfate 50 minutes)

Parmod®

Screen print side 1

Dry

Screen print side 2

Cure (300°C, 6minutes, nitrogen)



Pattern Plating, Continued

Drag rinse

Water rinse

Fluoborate acid

Tin-lead plate

Drag rinse

Etch (copper chloride-regenerate or dispose)

Strip resist (sodium hydroxide)

Rinse

Dry

Photoimageable solder mask

Laminate

Expose

Develop

Strip

Parmod®

Finish

Screen print legends

HASL or OSP

Nickel-gold plate

Rout & singulate

Test

Pack & ship

Screen printed solder mask

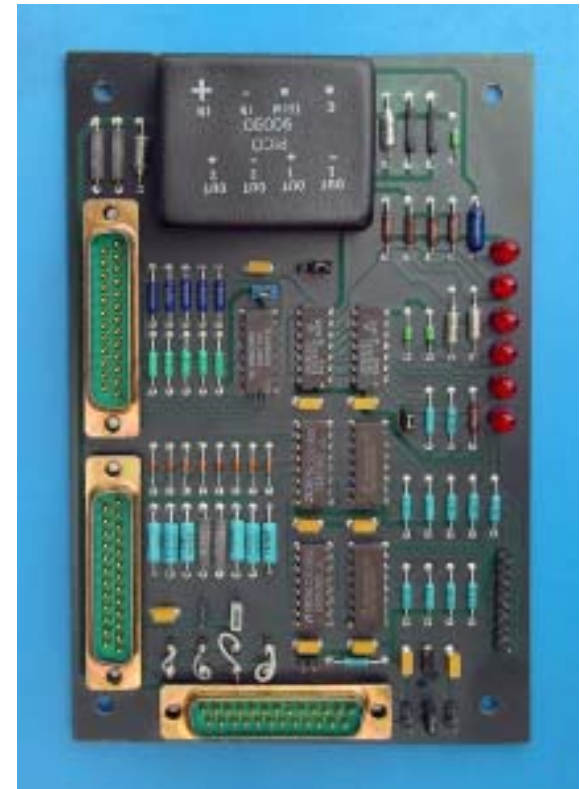
Cure



Parmod® Rapid Response – Rigid Boards

-2 sided RMP-454A Board for the U.S. Army

- Achieved good adhesion to the board
- Parmod® metallization of through holes
- Demonstrated electrical functionality in military test setup
- Mechanical durability to be determined

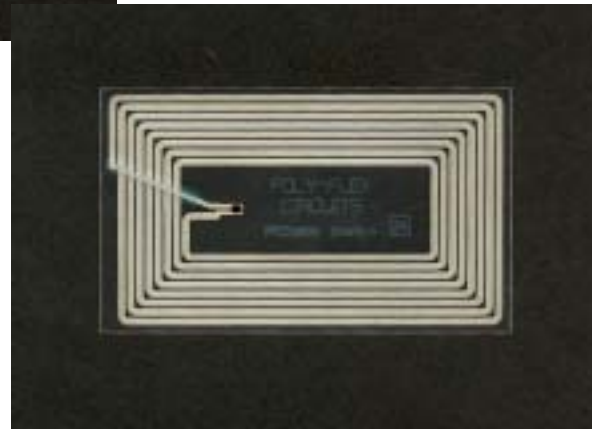


Parmod® Rapid Response – Flex Substrates

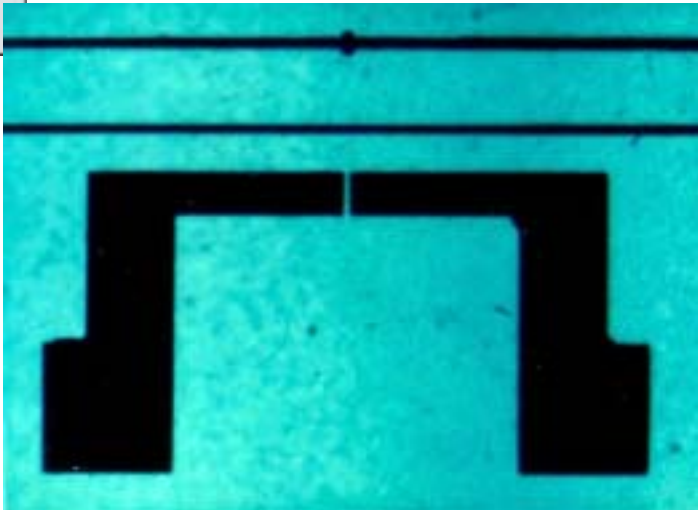
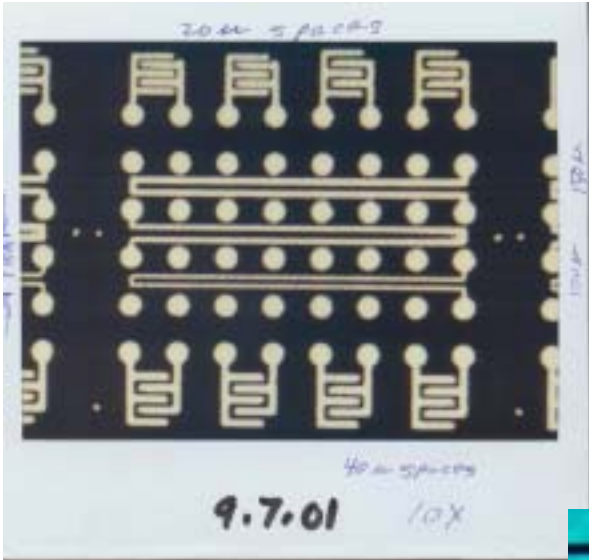
- Medical electronic application
- Prepared single sided prototypes on Kapton® EKJ
- Met customer technical specifications
- Met cost target
- Since cost reduced 2X



RFID



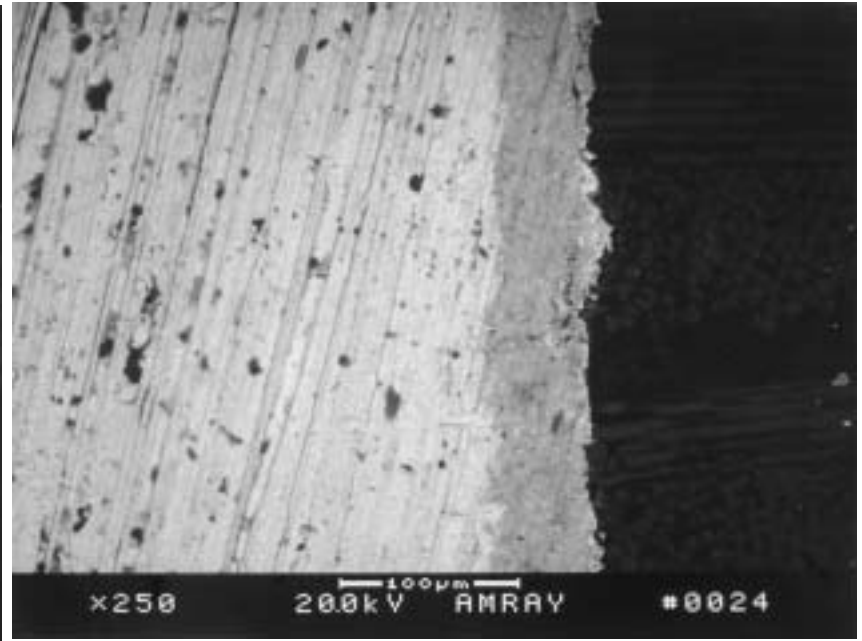
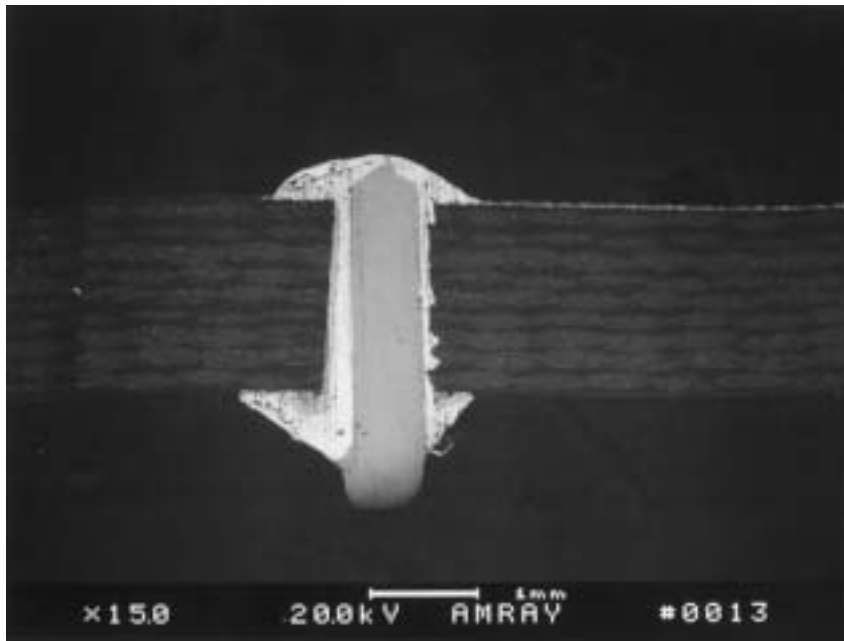
HDIS



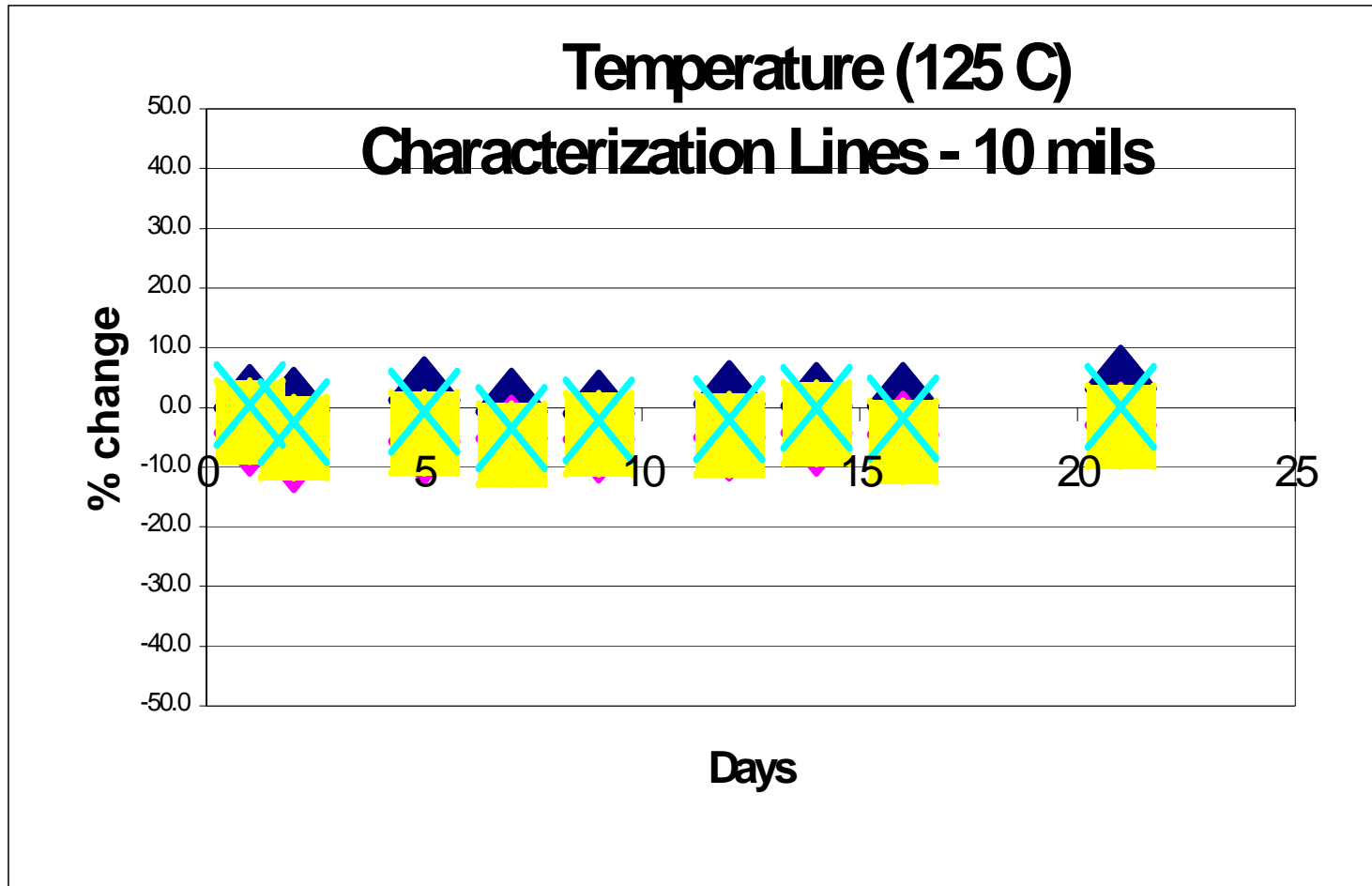
Performance Validation

- Hole metallization
- Accelerated life testing of traces
 - Temperature 125° C
 - Temperature humidity 85°C/85% RH
- Thermal shock
 - Solder dipping at 260°C, 20 seconds

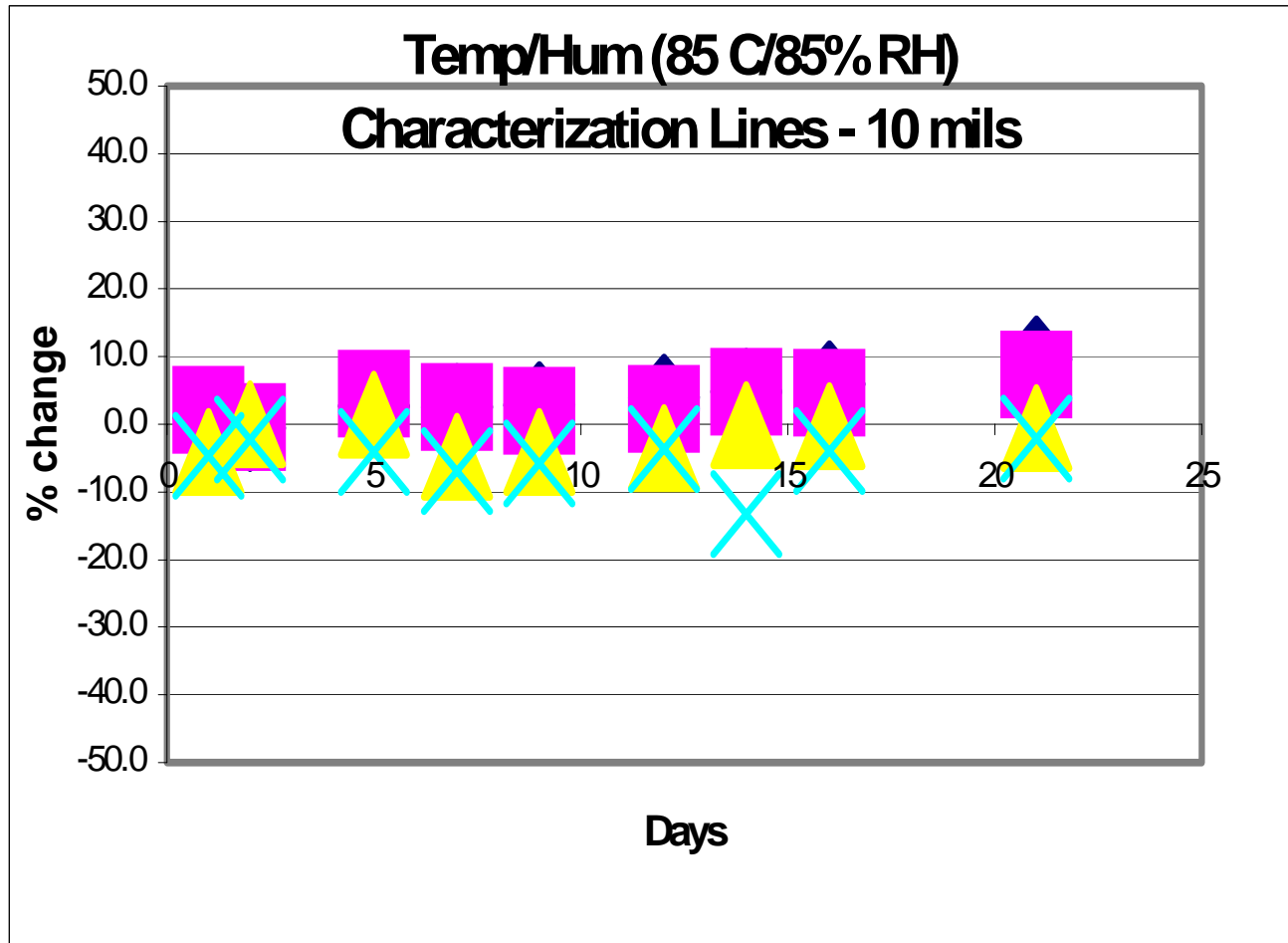
Cross Section of Through Hole with Lead



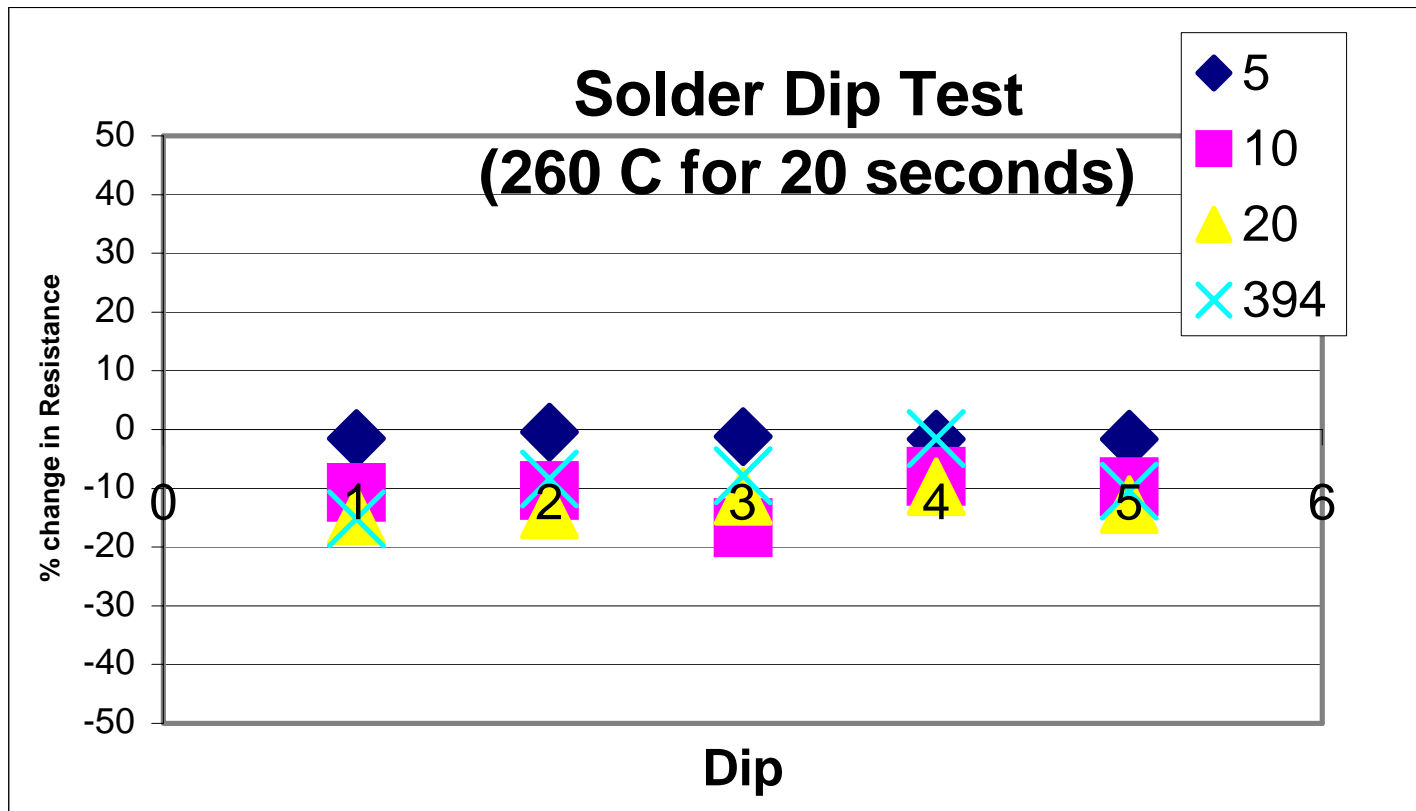
Resistance Change as a Function of Time at 125C



Resistance Change as a Function of Time at 85C and 85% RH



Resistance Change as Function of Solder Dip



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