

Lead Free Printed Circuit Board Manufacturing Process Improvements

As printed circuit boards industry has moved to lead-free assembly processing, the performance demands on the “lead-free compatible” printed circuit boards have significantly increased. The typical increase in assembly temperatures from tin-lead to lead-free alloys is 50 C and represents a new set of challenges in the printed circuit board fabrication and assembly processing. The increase in assembly temperatures magnifies the impact of residual moisture (vapor pressure) and Coefficient of Thermal Expansion (CTE) mismatches within the construction of the printed circuit board. Residual Moisture in the Printed Circuit Board is critical for performance of printed circuit board. The vapor pressure of water is 225 PSI at 200 °C and it increases to 575 PSI at 250°C temperature. This results in a 2.5 times increase in stresses present at the laminate interfaces (resin-glass, resin-resin, resin-oxide, and resin-copper). (Source: ISOLA LEAD-FREE PWB & ASSEMBLY GUIDELINES... Rev 1: 1-10-07)

Layer Stack up

All laminate materials have some degree of CTE value mismatch. As per Isola’s recommendation Saturn is using combination of laminates with less degree of CTE mismatch to minimize stresses whenever possible.

Prepreg Storage Room

As per Isola’s recommendation, Prepreg storage temperature is kept less than 68 °F and relative humidity 50% to minimize moisture absorption. Also, we have doubled prepreg storage capacity.



Figure 1: Prepreg storage room

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Oxide & Oxide replacement process optimization

As per Isola's recommendation, Saturn has started baking IS410 inner layer core material at 100 °C for 30 minutes to remove any absorbed moisture.



Figure 2: Inner layer baking oven installed in Multilayer lamination room

Saturn uses cobra bond process to coat copper surface of inner layer and provide microcrystalline finish, which enhances bonding strength of laminates. The cobra bond solution promotes the formation of a brown copper-organic coating, which enhances surface for resin bonding. We have optimized cobra bond process by changing replenisher A concentration from 5% to 3% and sulfuric acid concentration from 5 % to 6%.

Multilayer Lamination Recipes Changes

Saturn has revised multilayer lamination recipes to accommodate minimum of 75 minutes of curing at 365 °F and pressure drop to 50 psi from 275 psi after 30 minutes at curing temperature. Reduction in pressure relieves stress and expels moisture, which helps in subsequent lead free processing.

Packaging of Printed Circuit Boards

Saturn is using vacuum seal packaging of final product. Additionally, Saturn is putting desiccant pack in IS410 material printed circuit board packages to minimize moisture absorption by final product.