

## RoHS COMPLIANCE



RoHS compliance is becoming an industry standard and Moog is dedicated to helping our customers achieve this goal. Moog offers materials and surface finishes that comply with the RoHS requirements. Moog understands the requirements of the RoHS Directive and strives to ensure that our printed circuit boards comply.

The RoHS Directive stands for “the restriction of the use of certain hazardous substances in electrical and electronic equipment”. This Directive bans placement of new electrical and electronic equipment containing more than agreed levels of lead and other hazardous materials from reaching the EU market. As the market continues toward RoHS and WEEE compliant product, it is crucial that proper care be taken during each phase of product realization from design and layout to manufacturing and final assembly.

# DESIGN AND ASSEMBLY CONSIDERATIONS

## Controlled Impedance

Be aware that as materials change controlled impedance parameters may change as well. Variation in electrical properties from one laminate type to another may change a working design into a marginal design, or even a non-functional one.

## Copper Plane Layout

RoHS / WEEE / LFAC laminates are vulnerable to stresses that may generate warp. In order to control these stresses, it is recommended that copper planes be designed such that they are equally distributed, in the X, Y and Z-Axis. Maintaining even distribution across the board will help prevent "hot spots" where the copper will actually have an increased heat sink effect that could lead to localized failure.

## Packaging and Moisture Removal

Bare PCBs will be shipped to you in "moisture proof" packaging. If boards are removed for inspection or to assemble part of a shipment, they should be resealed before being returned to storage. Regardless of shelf times and storage conditions, laminate manufacturers recommend that boards be baked prior to assembly to remove any residual moisture.

## Directives

What are the WEEE, RoHS and LFAC Directives?

### WEEE - Waste of Electrical and Electronic Equipment

WEEE is the European Community's directive to control the generation, collection and disposal of electrical and electronic waste.

### RoHS - Restriction of Hazardous Substances

RoHS is a directive adopted by the European Union to set restrictions on various types of materials used in the manufacturing of electrical and electronic equipment. Substances restricted by RoHS include:

- Cadmium
- Hexavalent Chromium
- Lead
- Mercury
- PolyBrominated Biphenyls (PBB)<sup>1</sup>
- PolyBrominated Biphenyl Ethers (PBBE or PBDE)<sup>1</sup>

<sup>1</sup>PBB, PBBE and PBDE are flame retardants used in some plastics

### LFAC – Lead Free Assembly Compatible

A generic term used to describe raw materials that are designed to withstand the rigorous assembly process associated with RoHS and WEEE compliant product.

## Material Selection and Manufacturing Considerations

While the majority of Printed Circuit Board (PCB) materials are free of the substances associated with these directives, there is a great deal involved in manufacturing a product that will withstand the higher temperatures associated with lead free assembly. It is critical that the material being used perform well with regard to:

- Glass Transition Temperature (Tg) – The temperature at which a material changes from a rigid to a softened state

- Decomposition Temperature (Td) – The temperature at which a materials weight has been decreased by 5%
- Coefficient of Thermal Expansion (CTE) – The measurement of a materials movement in response to temperature change

The selected material must withstand assembly temperatures as much as 50°C higher than traditional tin-lead product. Higher temperatures greatly magnify overall sensitivity to residual moisture and material CTE mismatches. For example, the vapor pressure of water at 200°C is 225 PSI; at 250°C the pressure increases to 575 PSI (well over double the pressure). Failure to select a compatible material could result in delamination, warp, and through hole failure during the final assembly process due to the stress exerted on the board by entrapped moisture.

Given the hygroscopic nature of these materials, they must be stored and processed in a manner that will minimize moisture absorption. Other manufacturing considerations include extended bake cycles, bond enhancement optimization and careful packaging and storage of finished PCBs.

Material Offerings					
Material	Type	Tg	Td	CTE*	DK @ 2 / 5 / 10 GHz
FR408	Glass reinforced / modified epoxy	180°C	370°C	65 / 220	3.65 / 3.63 / 3.63
IS410	Glass reinforced / epoxy	180°C	350°C	65 / 250	3.76 / 3.69 / 3.69
P95	Glass reinforced / polyimide	260°C	416°C	65 / DNA	3.76 / 3.74 / 3.74
370HR**	Glass reinforced / filled epoxy sys.	180°C	340°C	45 / 220	4.04 / 3.92 / 3.92
IS415**	Glass reinforced / modified epoxy	200°C	370°C	65 / 225	3.70 / 3.68 / 3.68

\* CTE designated as Z axis parts per million - Pre Tg / Post Tg

\*\* Materials being established for future use at Moog

Final Finish Considerations			
Finish Type	Pros	Cons	Shelf Life
Electroless Nickel / Immersion Gold (ENIG)	- Flat surface - Highly conductive - Robust reflow capabilities - Good corrosion resistance - Suitable for wire bonding	- Cost	24 months
Electrolytic Nickel / Gold	- Flat surface - Highly conductive - Robust reflow capabilities - Good hardness and wear resistance	- Cost	16 months
Immersion Silver	- Flat surface - Highly conductive - Robust reflow capabilities	- Cost - Requires careful handling and storage to prevent tarnishing	16 months

Times and temperatures vary for pre-bake per final finish.

- Immersion Silver - 150°C for 4 hours (silver may tarnish slightly, but solderability will not be affected)
- Nickel / Gold - 150°C for 4 hours
- Electroless Nickel / Immersion Gold (ENIG) - 150°C for 4 hours



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