

# N4350-13 RF & N4380-13 RF

## General Processing Guidelines

### Microwave Performance, Modified Epoxy

N4350-13 RF and N4380-13 RF are enhanced epoxy systems specifically designed for RF and Microwave applications that required tightly controlled electrical properties while also providing the reliability and competitiveness of an epoxy material.

### Material Handling & Storage

Store laminates flat in a dry environment. Do not bend, scratch or dent laminate.

Store prepreg flat, with a storage temperature of <72° F (<23°C) and ≤50% RH.

For extended prepreg storage, reduce storage temperature to <41° F (<5°C).

Reseal opened bags of unused prepreg.

### Copper & Surface Preparation

Prepare copper surface for photo resist application according to the following options:

The type of copper surface preparation employed should relate to the foil type as specified below:

- **Reverse Treat Foil (RTFoil®):** Chemical clean followed by a light tack clean.
- **Shiny Copper Foil:** Chemical and / or Mechanical clean followed by a light tack clean.
- **Double Treat Foil:** Chemical clean followed by a light tack clean.

Note: Chemical clean consists of a mild cleaner to remove soils followed by a mild acid to remove the passivation.

### Bond Enhancing Treatments

One of the following options can be used successfully:

- Option 1: Brown oxide with DMAB (dimethylamino borane) reduction.

- Option 2: Brown oxide with controlled dissolution post-treatment.
- Option 3: Peroxysulfuric oxide alternative or white (Sn) oxide.

Note: The brown oxide deposit should be tested using a weight loss test. Thick oxide deposits tend to yield poor thermal resistance. The oxide deposit should not exceed 0.4 mg/cm<sup>2</sup>.

### Inner Layer Drying

Inner layers should be oven dried to remove absorbed moisture. Absorbed moisture in the inner layer can affect the curing properties of the prepreg. Conveyorized warm air drying is usually not effective in removing absorbed moisture from the etched layer.

	Recommendations
<b>Signal layers</b>	230°F (110°C) in vertical racks with minimum 0.5" (12 mm) separation for 30 minutes
<b>Plane layers and plated sub-lam layers</b>	230°F (110°C) in vertical racks with minimum 0.5" (12 mm) separation for 60 minutes

Note:

- 1) If inner layers are baked horizontally in stacks of 1-2" (25-50mm) extend time to at least 90 minutes.
- 2) Check with oxide supplier if using DMAB oxide reducer. Excessive exposure to heat may re-oxidize the reduced treatment.
- 3) Drying temperatures below 212°F (100°C) are not effective in removing absorbed moisture from the layer.

## Lay-up

For best results, use inner layers within 2 hours after drying. Rebake inner layers if not used within 24 hours.

## Lamination

For best results, fully cure in vacuum assisted hydraulic press

	Recommendations
<b>Vacuum Gauge Pressure</b>	A minimum of 28.5" Hg (965 mbars) for 15-30 minutes before applying heat & pressure.
<b>Heat Up Rate*</b>	4 - 8°F (2 - 4 °C) per minute
<b>Critical Range</b>	180 – 280°F (80 – 140°C)
<b>Pressure</b>	275 - 350 psi (19 - 25 bar)
<b>Cure Time, Temp</b>	90 minutes @ 380 °F (90 minutes @ 193 °C)
<b>Cool Down Rate</b>	7°F (4°C) per minute or less until stack reaches 260°F (127°C)
<b>Breakdown</b>	After panels have cooled below 150°F (65 °C)

\*Note: Heat rise is usually controlled by using an acceptable thermal lagging such as kraft paper or press pads. Alternately the heat rise can be controlled by ramping the platen temperature about 5 – 10 °F (5 °C) higher than book temperatures and controlling the heat up rate through the critical temperature range.

## Drilling

Typical Drill Parameters	Recommendations	
<b>Drill Sizes</b>	0.010" – 0.018" (0.25 – 0.46 mm)	0.020" - 0.040" (0.5 – 1.0 mm)
<b>Surface Speed</b>	300 – 400 SFM (91– 122 m/min.)	350-450 SFM (107 – 138 m/min.)
<b>Chip Load</b>	0.5 – 1.5 mils/rev (12 – 38 µm/rev)	1.0 – 2.5 mils/rev (25 - 63 µm/rev)
<b>Maximum Hit Count</b>	500 - 1000	750 – 1200
<b>Typical Stack Height</b>	0.045" – 0.100" (1.1 – 2.5 mm)	0.045" – 0.100" (1.1 - 2.5 mm)

Note: Undercut drills are recommended for small hole drills < 0.0185" (0.47 mm). Peck drilling is recommended for panel thicknesses greater than .100" (2.5mm). Lubricated entry and/or back-up materials may be used to reduce the heat generation during drilling.

Drilling parameters should be adjusted depending on hole size, layer count, panel thickness, copper content and stack height. For specific feed and speed parameters, contact your drill supplier or AGC'S technical representative. Detailed typical drilling parameters are available for many products. Please contact us at [agc-ml.info-maltmaterial@agc.com](mailto:agc-ml.info-maltmaterial@agc.com).

## Post Drill Bake

An annealing bake of the drilled panel is recommended for optimal hole wall performance. Panels should be baked in a preheated oven at 356°F (180°C) for 2-4 hours. Allow the panels to cool at a rate less than 8°F/min (4.5°C/min).

## Hole Cleaning (Resin Smear Removal)

Plasma desmear or a plasma desmear followed by a mild permanganate desmear is preferred. Solvent swell and permanganate etch processes can be used but care should be taken to limit the activity and contact times of both solvent and permanganate baths.

### Plasma: Typical desmear conditions

Temperature	Gas mixture	Power	Time
80± 2°C	10%CF <sub>4</sub> , 80% O <sub>2</sub> , 10% N <sub>2</sub>	4000 W	15-20 min

Note: Depending on the amount of resin removal required, a preheat cycle and an oxygen burn cycle for ash removal may be necessary. Excessive etch-back (> 1.0 mil) of this material is not recommended as it may adversely affect wicking in the hole wall. See your technical representative for additional information.

### Chemical Desmear:

Type	Temp (°F /°C)	Time
Butyl / hydroxide solvent	173 ± 5 / 78 ± 2	4 - 6 min.
Alkaline Permanganate oxidizer	175 ± 5 / 79 ± 2	8 - 12 min.

Note 1: Cyclic amine solvent swellers such as n-methyl pyrrolidone (NMP) are not recommended.

Note 2: Control hydroxyl concentration in the permanganate bath below 1.05N (42 g/l for NaOH)

## Routing

Typical Drill Parameters	Recommendations
Stack Height	0.250" (≤6.25 mm)
Tool Size	0.093" (2.4 mm)
Feed Rate	60 IPM (1.5 m/min.)
Speed	24K RPM

Note : When V-scoring, please ensure that care is used when removing the break away tabs to avoid damaging the PCB.

These guidelines can provide only basic and reference information for PCB fabricators. Because of different environment, equipment, tooling and so on, in all instances, the user shall determine suitability in any given conditions or applications. For more detailed processing information, please contact with the AGC engineer or sales representative.