ROGERS CORPORATION

Fabrication Notes

XT/duroid® 8000 and XT/duroid 8100
Ultra-Thin High Frequency, High Speed Laminates Fabrication Guidelines

Material Description: XT/duroid® 8000 and XT/duroid 8100 are unique thin core material systems made using ceramic powders, a high Tm non-PTFE resin system, and, in the case of XT/duroid 8100 laminate, woven glass reinforcement. The materials are intended for use in double-sided circuits and are compatible in multi-layer constructions with many copper clad laminate and adhesive systems.

These guidelines were developed to provide fabricators with basic information on double-sided and multi-layer processing. A Rogers' technical service or sales representative should be contacted for more detailed information pertaining to handling of cores through inner-layer processing and selection of compatible adhesive systems for use in multi-layer designs.

Storage: XT/duroid 8000 and XT/duroid 8100 copper clad cores can be stored indefinitely at ambient conditions. A first-in-first-out inventory system is recommended as is a method of record keeping that would allow tracking of material lot numbers through PWB processing and delivery of finished circuits.

INNER LAYER PREPARATION:

Tooling: XT/duroid 8000 and XT/duroid 8100 materials are compatible with many tooling systems. Choosing whether to use round or slotted pins, external or internal pinning, standard or multiline tooling, and pre vs. post-etch punching would depend upon the capabilities and preferences of the circuit facility, the final registration requirements, and the standard practices associated with the adhesive system selected for multi-layer bonding. In general, slotted pins, a multiline tooling format, and post-etch punching will meet most needs. Whichever approach is used, it is good practice to retain copper around tooling holes.

Surface Preparation for Photoresist Application: A chemical process consisting of organic cleaners and a microetch is the preferred method of preparing copper surfaces for coating with liquid or film photoresist. Mechanical scrubbing should be avoided.

Photoresist Application: Liquid or dry film photoresist can be applied using traditional dip or spray coating, screening, or roll lamination processes.

DES Processing: Developers, strippers, and copper etchants used to process epoxy glass materials will also work with
XT/duroid 8000 and XT/duroid 8100. Leader boards or support frames may be required to process thin layers through conveyorized systems.

Oxide Treatment: XT/duroid 8000 and XT/duroid 8100 laminates are compatible with most oxide and oxide alternative processes. It is best to use the surface preparation technique that is recommended by the supplier of the adhesive system chosen to bond together the multi-layer board. Layers should be baked for 30 to 60 minutes at 125°C to 150°C (257°F to 302°F) prior to booking of multi-layers.

BONDING:

Multi-layer Adhesive System: XT/duroid 8000 and XT/duroid 8100 cores are compatible with a broad range of thermosetting (FR-4, RO4400™ prepreg, etc...) and thermoplastic (3001 bonding film, and FEP, etc...) adhesive systems. Many factors, such as electrical performance, flow characteristics, ease of processing, and bond temperature requirements are considered when making the best overall choice. Rogers' technical service engineers (TSE's) understand the trade-offs and, if asked, will help in the down-selection process.

Multi-layer Bond Cycle: The press cycle is determined by the requirements of the chosen adhesive system. Cooling under pressure is required when using thermoplastic (meltable) films.

PTH & OUTER LAYER/DOUBLE-SIDED CIRCUIT PROCESSING

Drilling: Multi-layers are most commonly drilled in stacks of one; double-sided circuits can be stacked. Phenolic composite boards are recommended for entry (0.010" to 0.030" thick) and exit (>0.060") layers. Sheeted aluminum and metal coated phenolic boards can also be used as entry layers.

New carbide drills are highly recommended. Standard or undercut styles can be used. Recommended chip loads (0.001" to 0.003" per revolution) and surface speeds (150 to 300 SFM) vary with tool diameter with slower infeeds and speeds being associated with finer diameter drills. Retract rate when drilling multi-layer boards should be between 300 and 500 IPM. Below is a quick reference table that provides recommended parameters for commonly used drill diameters. Spindle speed may be increased slightly from the recommended values to resolve birdnesting issues.

Tool life should be based upon inspection of cross-sectioned holes. The "twelve inch rule," which suggests changing a tool after drilling 12" of substrate, is a good place to start when setting tool life. For example, initial hit count when drilling a 0.060" thick board would be 12"/0.060" = 200 holes.

Tool Diameter		Spindle Speed (kRPM)	Infeed		Retract	
(in)	(mm)	(RPM)	(IPM)	(m/min)	(IPM)	(m/min)
0.0079	0.20	72500	72.5	1.8	300	7.6
0.0098	0.25	68200	88.7	2.3	300	7.6
0.0138	0.35	55400	83.1	2.1	300	7.6
0.0197	0.50	48200	96.4	2.4	400	10.2
0.0256	0.65	37200	74.2	1.9	400	10.2
0.0295	0.75	32200	64.4	1.6	400	10.2
0.0394	1.00	24100	48.2	1.2	400	10.2
0.0492	1.25	20000	40.0	1.0	400	10.2
0.0625	1.59	20000	40.0	1.0	400	10.2
0.1250	3.18	20000	40.0	1.0	400	10.2

Deburring: The use of flat, rigid entry materials, conservative drilling parameters, and limited hit counts with new drills should minimize the risk of copper burring. When drilled properly, cores should be ready for subsequent processing. If debur is necessary (and slight), a chemical microetch process is preferred. If mechanical processing is required, a light hand pumice scrub is preferred over a suspended abrasive spray system which, in turn, is preferred over a conveyorized mechanical debur or planarization process.

Hole Preparation: Double-sided and multi-layered constructions will require a double plasma cycle where the first cycle will desmear the resin system and the second cycle will improve the wettability of exposed resin surfaces and therefore render it more compatible with copper deposition.

A recommended dual-cycle plasma cycle is recommended below:

Seg	CF4	O2	N2	He	Press	Temp	Freq	Power	Flow	Time
	%	%	%	%	mtorr	C	KHz	KW	SLM	Min
1	0	80	20	0	250	90	40	4.5-8.5	2.5	See Note
2	10	80	10	0	240	99	40	4.0	2.5	15
3	0	0	0	100	250	99	40	4.0	2.5	30

Note: Segment 1 time as required to reach temperature.

Note: Additional information available at www.marchplasma.com

Depending upon extent of etchback realized during the plasma process, XT/duroid 8100 holes may require a glass etch following the plasma process.

Metallization: Properly treated XT/duroid 8000 and XT/duroid 8100 materials are compatible with traditional electroless copper and direct deposit metallization processes. The plasma treatment process served as an effective bake that negates the need for additional baking. Materials sitting around longer than 48 hours after plasma processing should be exposed again to the He treatment portion of the plasma cycle. A flash plate build-up of 0.0001" to 0.0003" (0.0025mm-0.0076mm) of copper is recommended to better support hole walls through preparation for outer-layer processing.

PTH Plating & Outer-Layer Imaging: Standard equipments and chemical processes are used to plate, image, and etch circuit patterns onto XT/duroid 8000 and XT/duroid 8100 materials. Care should be taken to preserve the post-etch laminate surface. The topography that remains after copper removal promotes improved adhesion to solder masks. Materials should be rinsed and baked prior to solder mask application. Rinsing in warm or hot water for 20-30 minutes followed by 60 minutes @125°C (257°F) should be sufficient, especially if the bake is done under vacuum.

Final Surfaces: XT/duroid 8000 and XT/duroid 8100 materials are compatible with most LPI solder masks. Epoxy solder masks are preferred if the application requires selective silk screening. Most final metal surfaces (ENIG, Sn, Ag, Ni/Au, OSP, etc...) can be applied without special issue or consideration. A bake, as was described prior to solder mask application, should be performed prior to HASL or reflow exposures.

Final Circuitization: Individual circuits can be routed, punched, or lasered depending upon preference, tolerances, and edge quality requirements. Parameters for routing are provided below:

Chip Load:	0.00125" to 0.00250"/rev.
	32mm - 64mm/rev.
Speed:	200-300 sfm
	61-92 m/min
Peripheries	Conventional Cut
Internal Cutouts Climb	
Tool type	Carbide double fluted spiral-up endmill
Exit/Entry	Phenolic or composite board
Tool life	20-30 linear feet
	6-9 meters

Pre-rout vacuum channels in backer board
Double pass (opposite directions) when cleanest edge quality is required

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