ROGERS CORPORATION

Fabrication Notes

RO1200™ and RO1200BP™
Extremely Low Loss Digital Laminate and Bondply

Material Description:
RO1200™ product family includes copper clad ceramic filled, woven glass reinforced polytetrafluoroethylene (PTFE) cores and unreinforced ceramic filled PTFE bondply layers. RO1200 cores are available in thicknesses ranging from 0.003″ to 0.010″ and clad with 18 or 36 micron (0.5, 1 oz and 2 oz/sq ft) reverse-treat or 18, 36, or 72 micron rolled copper foils. The RO1200BP™ bondply layers, available in thicknesses of 0.002″, 0.003″, 0.004″, and 0.005″, can also be stacked to yield thicker copper plane:copper plane spacing. The RO1200 core and bondply materials are engineered to offer exceptional electrical performance and mechanical stability for the most demanding high speed applications.

These guidelines are offered to provide fabricators with basic information on processing multilayer test vehicles using RO1200 core and RO1200BP bondply materials. These guidelines will be updated as new processing information is developed. For the most current and specific processing information, please contact a Rogers Technical Service or Sales Representative.

Storage:
RO1200 core and RO1200BP bondply layers can be stored indefinitely at ambient conditions. A FIFO 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 test circuits.

INNER-LAYER PREPARATION:

Tooling:
RO1200 materials are compatible with many tooling systems. Choosing whether to use round or slotted pins, external or internal pinning, standard or centerline (Multiline) tooling, and pre vs. post- etch punching would depend upon the capabilities and preferences of the circuit facility and the final registration requirements. In general, slotted pins, a centerline tooling format, and post-etch punching will meet most needs. Whichever approach is used, it is good practice to retain copper around tooling holes. Generally speaking, it is advised to keep copper around tooling holes on both sides of cores clad using 18 micron copper foil and on one side only when processing cores clad using 36 or 72 micron copper foils.

Venting patterns typically used for high flow epoxy glass material systems are not appropriate for RO1200BP bondplies. A venting profile in which copper dots on opposing layers interlock instead of stack vertically is preferred for signal layers. The copper dots can be 0.0150″ in diameter and spaced on 0.300″ to 0.350″ centers. A nearly solid starburst pattern is recommended for venting plane layers. The venting channels on opposing sides of plane over plane inner-layers should be offset such that at one side of the core has retained copper cladding. Vertically stacked copper frames around low pressure areas (example, IPC coupons and x-ray accessible fiducials) should be avoided whenever possible.

Advanced Connectivity Solutions
100 S. Roosevelt Avenue, Chandler, AZ 85226
Tel: 480-961-1382, Fax: 480-961-4533 www.rogerscorp.com

Scaling:
It is recommended to run a first article to determine potential material movement through inner-layer preparation and multilayer bonding. As starting points, 0.15 mils/inch to 0.45mils/inch of growth is expected in the 18″ and 24″ core directions when bonding RO1200 cores using RO1200BP bondply.

Surface Preparation for Photoresist Application:
A chemical process consisting of organic cleaners and a microetch is the preferred method for the preparation of copper surfaces prior to coating with liquid or film photoresist. A conveyorized spray system using an abrasive substance suspended in a liquid carrier can be used to prepare copper surfaces at the slight risk of some registration control. Mechanical scrubbing of thin RO1200 cores should be avoided. Whether leaderboards are required would be dependent upon the core thickness and the capability of the processing equipment. Care should be taken when removing tape if leader boards were required.

Photoresist Application:
RO1200 materials are compatible with most methods of applying liquid and film photoresist.

DES Processing:
Developers and strippers compatible with the photoresist system of choice should be used. RO1200 materials are compatible with any copper etching system.

Oxide Treatment:
Traditional black and brown oxide deposits typically lack the reliability to survive exposure to the bond temperatures required to press RO1200BP (700F) bonded MLBs. Many oxide alternatives such as Bondfilm™ from Atotech and Multibond™ from MacDermid can be used. It is best to use the process recommended by the supplier of the oxide alternative system.

BONDING:

Final Preparation:
Special pretreatments of etched surfaces using sodium or plasma processes shouldn't be necessary if care was taken to protect the substrate surface after copper etch. Inner-layers should be baked at 110C to 125C for 30 to 120 minutes to ensure removal of volatile substances prior to MLB bonding. The recommended bake may need to be modified per recommendation of the oxide alternative supplier.

Multilayer Bond Cycle:
RO1200BP bonding would require a 4-6F/Min ramp to 700F, a 60-90 minute dwell at temperature, a 2F/Min cool to 600F, and cooling under pressure until package temperature is <350F. Applied pressure would be 500 PSI, but could be decreased or increased further depending upon copper fill and scaling requirements.
Single use double-ply 970-J Fiberfrax® or other high temperature capable press pads should be used on the top and bottom of the press stack. A source for Fiberfrax press pads is:

Unifrax Corporation
2351Whirlpool Street
Niagara Falls, NY 14305-2413
Telephone: 716-278-3800

Conformal padding should not be used against panel surfaces.
Traditional release layers such as skived PTFE films should not be used against stainless steel separator plates. Thick aluminum foil or double-shiny copper foil can be used as release layers between the panel being pressed and the stainless steel separator plates.
A two hour post bake at 125-150C will help relieve dimensional stresses prior to drilling.

PTH & OUTER LAYER PROCESSING:

Drilling:
Multilayers are most commonly drilled in stacks of one. 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. Chip loads of 0.00075″ to 0.00125″ per revolution and surface speeds of 75 to 125 SFM are recommended when drilling holes between 0.0079″ and 0.0197″ in diameter. Peck drilling is recommended for MLBs thicker than 0.030″. Retract rate should be between 300 and 400 IPM. Drill optimization tests are underway. For the time being, hit counts should be based upon drilling 40 inches of material (example: 40 / 0.125 = 320 hits when drilling 0.125″ thick MLB).

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 deburr is necessary (and slight), a chemical microetch process is preferred. If mechanical processing is required, a hand pumice scrub is preferred over a suspended abrasive spray system which, in turn, is preferred over a conveyorized mechanical deburr or planarization process.

Hole Preparation:
Drilled panels should be processed twice through a pressure wash with a flip in between applications to remove debris from the holes. Sodium or plasma treatments required prior to metal deposition. Bake required after sodium treatment. It is preferred, but not required, to skip chemical desmear prior to metallization of the hole walls.
A recommended plasma cycle for treating PTFE materials is:

Gases:	70/30 or 80/20 H2/N2, NH3, N2, or He
Pressure:	100 mTORR pump down
	50 mTORR operating
Power:	4000 Watts
Frequency:	40 KHz
Voltage:	500-600V
Cycle time:	10-30 minutes

Metallization:
RO1200 materials are compatible with traditional electroless copper and direct deposit metallization processes. In the case of electroless copper, a double-deposition process is recommended to reduce the risk of hole wall voids. The recommended double deposition process includes running panels through the standard

process through copper deposition, returning the panels to the pre-catalyst baths, and re-running through the remainder of the process including second exposures to catalyst and copper deposition. 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 pattern plating and outer-layer processing.

PTH Plating & Outer-Layer Imaging:
Standard equipment and chemical processes are used to acid Cu plate, image, Sn plate, and SES circuit patterns onto RO1200 panels. Care should be taken to preserve the post-etch dielectric surface. The topography that remains on etched surfaces after copper removal promotes improved adhesion to solder masks.

Solder Mask Processing:
Properly prepared RO1200 material surfaces are compatible with most imageable solder masks. Materials should be rinsed and baked prior to solder mask application. Materials can be rinsed at room temperature, but rinsing in warm or hot water for 20-30 minutes is preferred. The rinses should be followed by 60-90 minute bake @110C-125C. It is acceptable after bake to process the layers through a conveyorized chemical surface cleaning process ending with an in-line forced hot air dry.

Final Surfaces:
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 lased depending upon preference, tolerances, and edge quality requirements. Parameters for routing are provided below:

Chip Load:	0.00125" to 0.00250"/rev
	32mm – 64 mm/rev
Speed:	200-300 sfm
	61-92 m/min
Peripheries:	Conventional cut
Internal cutouts:	Climb cut
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

Revised 1296 051717 **Publication #92-538**

Advanced Connectivity Solutions
100 S. Roosevelt Avenue, Chandler, AZ 85226
Tel: 480-961-1382, Fax: 480-961-4533 www.rogerscorp.com