1. THE PREFACE

This product is use IPC-4101 Standards as a reference, and Shengyi made some changes according to the product characteristics of the actual situation as to making it more suitable for the Shengyi mmWave Product use.

2. COPPER CLAD LAMINATE

Store Condition

Packed with original forms on the platform or on the appropriate frame, avoiding stress, prevent sheet deformation caused by inappropriate storage which it may impact the subsequent PCB processes.

Storage Environment

Sheets should be stored in ventilated, dry, at room temperature under environment control, avoiding direct sunlight, rain and avoid erosion of corrosive gas (stored environment directly affect the quality of material).
For Double side copper-clad boards (cores), to minimize shifting as to avoid scratching the surface of the product, with a suitable environment and condition for storage, the shelf life can be up to two years.

Operation Manual

Wear clean gloves and carefully operate the cores. Copper foil collisions, sliding will cause damage of the cores. Bare hands action will cause contamination to copper foil surface. These defects are likely to cause adverse effects.

Use Recommendations

1. Baking on the cores should be carried out before use to eliminate internal stress. Baking conditions should be 150~160°C/4~6 hours OR 170~180°C/2~4 hours;

2. After brown/black Oxide treatment, it is recommended to bake 120°C/30-60min as to remove any surface moisture before press lamination process. Material should be used as soon as possible.

3. After drilling, it's recommend to baking for 4-6 hours at 190°C

4. New drilling bit is recommended to use when drilling. To ensure a good quality of hole wall. The life of new drills and drilling head should be limited to reduced life of 300~1000 hits(suggested 500 hits). Recommend to slower the terminal velocity 10~30%, test out to until optimum drilling parameters. Other drilling parameters should be based on a general FR-4 of drilling parameters.

Table 1: Drilling Parameters

Diameter		Spindle Speed	Infeed	Chipload	Retract Rate	hit count
(inch)	(mm)	(krpm)	(ipm)	(mil/rev)	(ipm)	
0.0100	0.25	95	45	0.47	500	500
0.0210	0.50	85	95	1.12	1000	500
0.0260	0.65	70	96	1.37	1000	500
0.0330	0.80	57	92	1.61	1000	500
0.0335	0.85	53	90	1.70	1000	500
0.0374	0.95	48	84	1.75	1000	500
0.0394	1.00	46	80	1.74	1000	500
0.0413	1.05	44	78	1.77	1000	500
0.0433	1.10	42	75	1.79	1000	500
0.0512	1.30	38	73	1.92	1000	500
0.0551	1.40	36	73	2.03	1000	500
0.1201	3.05	20	33	1.65	1000	500
0.1260	3.20	20	32	1.60	1000	500

Note: Drilling parameters should be adjusted depending on hole size, layer count, panel thickness, stack count and stack height etc.

5. Punching is not suitable for PCB profiling process, routing is recommended with reduced routing speed. Try to avoid sudden vibration during routing process which it may cause board edge detonation problem.

6. Etching rate for desmearing of the material is smaller than the most of the existing lead-free FR-4 materials. To achieve a better desmearing it's recommended to use the following conditions:
   a) First, Plasma desmear then followed by one more regular chemical desmear process.
   b) If Plasma desmearing is not available, it's recommended to extend the standard chemical desmear process (that is, 2 times desmear process) or increased operating temperatures to optimize the effect of desmearing.

   Further adjust conditions as needed according to the inspection results on PTH quality.

Table 2: Plasma Parameters

	Gas Flow Rate (L/min)			Mode	Watts	Time (min)	Temp	Flow Rate	Pres-sure	Plasma
Parameter	O2	N2	CF4					(SLM)	mTorr	Mode
Seg 1	2.25	0.25	0.00	V	9000	45.0	80.0	2.50	250	Conductance
Seg 2	2.46	0.24	0.30	P	6500	15.0	105.0	3.00	220	Conductance
Seg 3	2.50	0.00	0.00	P	5000	5.0	100.0	2.50	250	Conductance

Process	Weight loss(mg/cm2)
One Plasma	0.2~0.4
Twice Plasma	0.4~0.8

Table 3: Desmear Parameters

Process	Reagent type	Temp. (C)	Time (min)
Swelling	alkaline	65-85	5-10
Etching	permanganate	70-85	10-15

Process	Reagent type	Temp. (C)	Time (min)
Swelling	organic solvent	35-40	6-10
Etching	permanganate	70-85	10-15

Process	Weight loss(mg/cm2)
One Desmear	0.01~0.02
One Desmear+One Plasma	0.2~0.4

Note: One plasma and one desmear is recommendable.

Design Recommendations

Due to Fiberglass structure and weft density differences, when manufacturing it's recommended to use symmetrical PCB construction stackup.

Selected dielectrics and to the adjacent cores must be compatible in bonding, weft and grain directions, as to avoid warpage and deformations.

3. PREPREGS

Storage Condition

Levels stored in original packaging form, avoiding stress, prevent sheet deformation caused by inappropriate storage condition.

Leftover or cut Prepregs should pack and seal with vacuum foil packaging and put it back in the original packaging tray.

Storage Environment

Prepreg sealed packaging should be stored in free of UV irradiation environment, specific storage conditions and the storage period as follows:

Condition 1. At a temperature of <5°C relative humidity <50% when stored, storage period for 6 months.

Condition 2. At a temperature of <20°C, relative humidity <50% when stored, storage period for 3 months.

Note: Relative humidity affect prepreg quality the most, pay special attention on weather (conduct dehumidification process is necessary for wet weather).

Cutting Guideline

Cutting the best way is left to professional staff wear clean gloves during operation, prevent the pollution of prepreg surface; operation must be careful to prevent prepreg wrinkle or crack, to avoid affect prepregs.

Prepregs Use Recommendations

1. If moving from a low temperature storage space to a higher temperature or ambient temperature storage space, it must go through the temperature settle process, (8 - 24 hours, settle time is varies depending on temperature variation in between two storage conditions). Open package after temperature settle process is completed as to avoid affecting the quality and adhesion of prepregs.
2. For PP package stored in above conditions 1 or 2, after open is required to complete the use as soon as possible, for packages opened more than 3 Day, it must re-inspect and insure quality before use.
3. Leftover or cut Prepregs should pack and seal with vacuum foil packaging and put it back in the above stated storage condition 1 or 2.

Press Recommendations

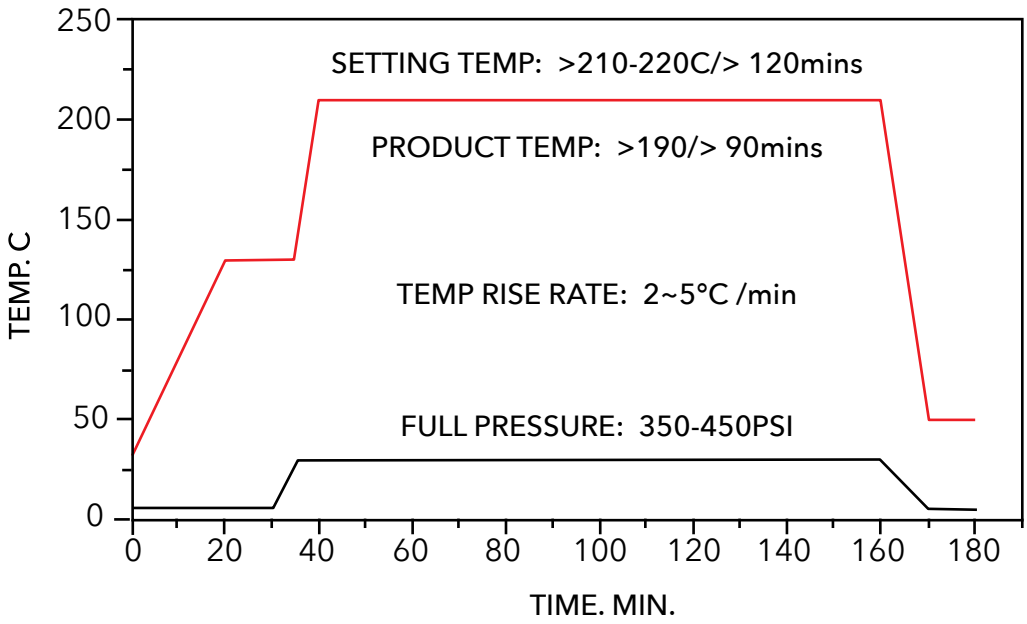
1. Vacuum press.
2. Press lamination suggested heating rate 2~5°C /min (material temperatures 140~180°C in the region).
3. Lamination pressure setting, outer material temperature at about 130°C when increasing pressure (Note: The full pressure to use is 350-450PSI).
4. Curing temperature of material temperature 200-205°C, and keep at this temperature at above 90min.
5. The net dimensional movement of laminate after etch, oxide and lamination processes is typically shrinkage. This shrinkage is due to the relaxation of stresses that were induced when the laminate was pressed as well as shrinkage contribution from the resin system and glass fabric. mmWave is reinforced by low Dk Glass, whose shrinkage is larger than the CCLs with normal E-glass yet. The specific data table as follow:

Table 4: Shrinkage Ratio

Configuration	Copper thickness	Direction	Shrinkage Ratio (‰)	
			E-glass	Low Dk-glass
Signal/Signal	1 Oz/1 Oz	Warp	0.10~0.30	0.60~0.80
		Weft	0.10~0.30	0.10~0.30
Signal/Ground	1 Oz/1 Oz	Warp	0.10~0.30	0.60~0.80
		Weft	0.10~0.30	0.10~0.30
Ground/Ground	1 Oz/1 Oz	Warp	0.10~0.30	0.60~0.80
		Weft	0.10~0.30	0.10~0.30

Further adjust conditions as needed according to the board thickness, layer count, copper thickness and stack construction etc.

6. Press condition



PCB Design Recommendations:

1. A different resin system with a large variation in resin density, therefore, even with the same resin content (RC) if a different resin, the dielectric thickness will vary. A specific resin content (RC) for an actual dielectric thickness should consult with Technical Service Engineer.
2. Before vacuum seal packing, backing PCBs is recommended. Backing condition should 145-150C/2 hours. Minimize stacking when backing as to avoid uneven heat distribution.

3. For finished PCBs, basing on the differences of PCB constructions, the packing and storage condition, the shelf life should change accordingly. Normal shelf life should be finishing assembly within 3 months. After expiration of shelf life, baking is recommended and the condition should be 150C/4-6 hours or 170C/2-4 hours.
4. Summary
   While using the Shengyi mmWave material, if you have any questions and suggestions, please feel free to contact Shengyi, and Shengyi will provide you with an efficient and effective technical services.

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