85NT
PROCESSING GUIDELINES

85NT – HIGH TG POLYIMIDE ON AN ARAMID FIBER REINFORCEMENT

Arlon's 85NT combines the high temperature performance and thermal stability of Arlon's 85N Polyimide on nonwoven aramid reinforcement. 85NT is engineered using this customized substrate for maximum control of CTE for SMT applications**.**

85NT PREPREGS

85NT is designed at a nominal resin content of 49% to provide a CTE value in-plane of 7-9 ppm/ºC as unclad material. Final CTE will depend on board and construction, copper content. The low resin content of 85NT will affect resin flow and applications requiring via hole fill may require higher resin contents or combined with the glass reinforced 85N.

85NT prepreg as supplied has a nominal resin flow of 8% (IPC TM-650 2.3.17). The degree of chemical advancement of this resin is equivalent to that of a 1080 glass with a nominal 35% flow -the restriction in physical flow is due to the nonwoven character of the reinforcement.

The permeability of the nonwoven aramid fabric and the random orientation of the reinforcement act as a flow restrictor allowing the resin to be retained while encapsulating inner layer details. This results in improved thickness uniformity across the panel and more precision in the manufacture of controlled impedance boards.

85NT LAMINATE PRODUCTS

Non-woven laminates are produced with Arlon's 85N Non-MDA Polyimide resin, identical to that supplied in prepreg to ensure total compatibility in bonding layers. The unique combination of aramid reinforcement with a high performance Non-MDA polyimide allows the material to be used as an economical replacement for other more costly methods of producing high density, high performance CTE controlled packages.

For additional technical information on 85NT laminate and prepreg including nominal prepreg pressed thicknesses for the various grades and resin contents, see the technical data sheet available at www.arlonemd.com.

ARLON
ELECTRONIC MATERIALS

PROCESSING RECOMMENDATIONS

CONTROL MOISTURE AT ALL CRITICAL STEPS

Aramid reinforcements are sensitive to humidity and moisture. Water may be absorbed as a result of uncontrolled storage conditions as well as wet processing operations. Moisture must be removed prior to the multilayer lamination process as well as subsequent thermal excursions of plasma etch, solder reflow, wave soldering, hot air leveling, solder mask baking or thermal stress testing. If moisture is not removed, multilayer boards may exhibit delamination or blistering, and electrical performance properties may deteriorate. The most critical step is removal of moisture from laminates and prepregs prior to lamination.

PREPREG STORAGE CONDITIONS

85NT is supplied in vapor barrier vacuum bags to minimize additional exposure to atmospheric humidity during shipment and storage. Once original factory supplied bags are opened, a vacuum desiccation cycle of 8 to 12 hours at 29+ inches of vacuum is recommended for preparation of prepreg for lamination. When mineral desiccants are used care must be taken to keep them refreshed and dry as aramid materials may "compete" with the desiccant for available moisture.

INNER-LAYER PROCESSING

As received laminates do not require prebaking prior to Imaging as Tgs are fully developed and do not require stress relief. Conventional copper cleaning operations prior to dryfilm are acceptable, though care Is needed during mechanical scrubbing to ensure the copper is not distorted which could change dimensional stability, CTE properties or induce warpage.

85NT are compatible with conventional alkaline and cupric chloride etching chemistries as well as aqueous resist strippers. Aramid fiber composites will absorb moisture more readily than e-glass materials, so laminates (as also true of prepregs) need to be thoroughly dried prior to lamination.

Inner layers processed with brown oxides provide good adhesion to 85NT prepregs. Other oxide alternatives have also provided acceptable results.

ARTWORK COMPENSATION

Some adjustment may be required depending on the size and direction, residual copper circuit density, and tooling scheme used. This is the shrinkage that is expected after lamination. Growth is commonly seen in individual inner layer details after etch due to the release of the stress caused by the copper and core CTE mismatch and to any moisture absorption by the exposed layers. For 85NT, because the in-plane movement is less due both to the nature of the aramid substrate and the lower resin content, it is recommended that test layers be made using no more than

SUMMARY OF LAMINATION RECOMMENDATIONS

- Heat Up Rate 4.5°C to 6.5°C (8°F to 12°F) per minute
- Control Heat Up 100°C to 150°C (210°F to 300°F)
- Vacuum 29 inches
- Cure in press 3 hours 218°C-221°C (425°F-430°F)
- Cool at <10 degrees F/min
- Lamination Pressure psi (bar) (5.5ºC)

Panel Size		Pressure	
in.	mm	psi	kg/cm2
12 x 18	305 x 457	300	21
16 x 18	406 x 457	350	25
18 x 24	457 x 610	400	27

CURING 85NT MULTILAYER BOARDS

Full cure of polyimide is necessary to achieve optimum material properties. This polyimide requires at least 3 hours of cure above 218ºC (425°F) to complete cross-linking of the resin matrix. Long cures at lower temperatures will not fully cure 85N resin. Actual cure time may also be dependent on laminate thickness, number of laminates per book and the weight and distribution of copper layers or metal cores. We recommend full cure in the press.

Note: It is suggested that designs for avoid use of 2 ounce copper power and ground planes if finished board CTE is an issue – large amounts of heavy copper will skew the CTE toward the value of pure copper which is 17 ppm/ºC.

The cure of the multilayer board is typically evaluated by ThermoMechanical Analysis (TMA). Once a process is established and tested for a given board design, cure results should be expected to be in the 235°C to 250°C range. When polyimide boards are properly cured, physical properties such as strength and toughness, chemical resistance and interlaminar strength will allow a robust process window for board fabrication through drilling, routing and thermal excursions such as reflow and soldering.

DRILLING

Because of the smoother laminate surface and softer fibers than E-glass, there is less drill wander with small drilled holes. This results in less breakout in annular ring pads. There is also less primary angle drill wear which may allow longer drill life.

We do NOT recommend the use of aluminum or aluminum-Clad entry or backup materials. Aluminum can become stuck on tip and cutting edges of the drill. The reinforcement is not as abrasive as glass and will not knock off the aluminum, leaving a drill point that will not cut cleanly.

Aramid fibers can block drill flutes when drilling small holes in thick boards or high stacks. Some of the following can be considered to reduce drill breakage: high strength carbide drills, reduced stack height, reduced drill withdrawal rate, peck drilling or high point angle drills.

A small orifice pressure foot is available on some types of drilling machines. An orifice of 3.5 mm (0.140") will keep the pressure on the entry material near the hole being drilled. This helps keep the material in solid contact with the board and reduces the chance of burrs and volcanoing. The pressure of the pressure foot should be at least 10 pounds. Do not allow the pressure foot to lift off of the stack, if possible, during the program. Any vibration will cause rough holes. Keep all debris out of the area between the entry and the board.

A drill template could also improve pressure applied near the hole. Drill a 1.6 mm piece of entry or FR-4 with slightly oversized holes; about 0.020 inch larger than the required final drill diameter.

The use of undercut drills are recommended for sizes less than 0.020 inch. These have increased flute volume for better evacuation of the debris and fibers.

Lubricated entry or backup materials are recommended to improve evacuation of the debris and fibers. This evacuation is key to improving hole wall quality.

The recommended backup material is a melamine coated phenolic/paper material. Other backup products with a hard surface that breaks up easily during drilling should work as well.

See attached Drill Table for starting drilling parameters. Testing should be done first as individual board design will affect results.

HOLE CLEANING

For hole wall adhesion and etchback to have reliable interconnections, plasma offers the best plated through hole adhesion. Standard desmear and electroless operations can provide excellent copper adhesion and PTH reliability. Bake boards for 2 hours at 250°F to 275°F minimum to remove moisture and for improved consistency in plasma etchback. Avoid permanganate systems that use DMF or NMP as swell solvents as these may be absorbed and not readily surrendered by the aramid fibers. No glass etch is necessary as nonwoven aramid is a 100% organic reinforcement.

ELECTROPLATING

Due to the constraint of CTE in the X-Y plane to 7-12 ppm/ºC, in the finished PWB,the tradeoff in constrained core materials such as 85NT is that the Z-axis expansion will be higher than would be expected in a glass reinforced material. While experience is that the homogeneous nature of the distribution of the fibers in nonwoven aramid actually tends to increase PTH reliability (there being no fiber bundles intersecting hole walls to generate stress risers) the absolute CTE in the Z direction will be 90-130 ppm/˚-C. Attention to plating baths should be directed at providing minimum elongation of 17-20% at 45,000 to 50,000 psi tensile strength. Plating to 1.5 mils (0.038 mm) will improve PTH reliability.

ROUTING / FABRICATION

As previously mentioned, aramid fibers are softer than glass, so routing with a continuous cutting edge in a counter-clockwise profile provides a smoother finished edge. A 0.093 inch double fluted “end mill” type router is recommended at a speed of 30,000 rpm and a feed rate of 25 ipm. A rigid backing material such as phenolic or FR-4 placed on top of the panel stack with a good solid pressure foot will reduce fibrous edges. Do not use a brush type pressure foot, as this does not supply sufficient pressure to maintain intimate surface contact and eliminate vibration. Kraft paper placed against the board surface has also been demonstrated to reduce edge fuzz.

ASSEMBLY

Due to the moisture absorption of aramid fibers and polyimide resin over time, it is important to remove moisture by baking boards prior to any thermal excursions that are part of assembly (reflow, etc), or thermal testing. Drying times and temperatures may need to be adjusted to account for the amount of copper cladding remaining on cap and innerlayer materials.

DESIGN CRITERIA

Contact Arlon directly to discuss design recommendations to optimize performance of 85NT materials.

NOTE: The data provided herein is believed to be reliable but is provided for reference purposes only and is not intended to be process specific for any particular job. Determination of the suitability of any Arlon product for a specific end application is solely the responsibility of the purchaser. Arlon recommends careful engineering evaluation of any product before adopting in production PWBs, as the recommendations contained herein are starting points, and production conditions and/or circuit configurations may require process adjustments for optimization in either process yields or final board performance.

Drill Table

Retract Rate = 500

0.118" (.30 mm) to 0.785" (#47) Diameters

Bit Size	Decimal (in.)	Recommended Cutting Speed		Recommended Infeed Rates		Maximum Recommended Hit Count	Maximum Recommended Land Wear
		RPM	SFPM	IPM	MILCHIP		
.30mm	0.0118	113297	350	64	0.6	1000	0.0005
83	0.0120	111408	350	66	0.6	1000	0.0005
82	0.0125	106952	350	66	0.6	1000	0.0005
81	0.0130	102839	350	66	0.6	1000	0.0005
80	0.0135	99030	350	66	0.7	1000	0.0005
.35mm	0.0138	96877	350	67	0.7	1000	0.0005
79	0.0145	92200	350	66	0.7	1000	0.0005
1/64	0.0156	85699	350	63	0.7	1000	0.0005
.40mm	0.0158	84614	350	65	0.8	1000	0.0005
78	0.0160	83556	350	66	0.8	1000	0.0005
.45mm	0.0177	75531	350	62	0.8	1000	0.0005
77	0.0180	74272	350	62	0.8	1000	0.0005
.50mm	0.0197	67863	350	59	0.9	1000	0.0005
76	0.0200	66845	350	59	0.9	1000	0.0005
75	0.0210	63662	350	58	0.9	1000	0.0005
.55mm	0.0217	61608	350	58	0.9	1000	0.0005
74	0.0225	59418	350	57	1.0	1000	0.0005
.60mm	0.0236	56648	350	56	1.0	1000	0.0005
73	0.0240	55704	350	57	1.0	1000	0.0005
72	0.0250	53476	350	56	1.0	1000	0.0005
.65mm	0.0256	52223	350	56	1.1	1000	0.0005
71	0.0260	51419	350	56	1.1	1000	0.0005
.70mm	0.0276	48438	350	54	1.1	1000	0.0007
70	0.0280	47746	350	54	1.1	1000	0.0007
69	0.0292	45784	350	53	1.2	1000	0.0007
.75mm	0.0295	45319	350	54	1.2	1000	0.0007
68	0.0310	43126	350	52	1.2	1000	0.0007
1/32	0.0312	42849	350	53	1.2	1000	0.0007
.80mm	0.0315	42441	350	54	1.3	1000	0.0007
67	0.0320	41778	350	54	1.3	1000	0.0007
66	0.0330	40512	350	53	1.3	1000	0.0007
.85mm	0.0335	39908	350	53	1.3	1000	0.0007
65	0.0350	38197	350	52	1.4	1000	0.0007
.90mm	0.0354	37766	350	52	1.4	1000	0.0007
64	0.0360	37136	350	53	1.4	1000	0.0007
63	0.0370	36132	350	52	1.4	1000	0.0007
.95mm	0.0374	35746	350	52	1.5	1000	0.0007
62	0.0380	35182	350	52	1.5	1000	0.0007
61	0.0390	34280	350	52	1.5	1000	0.0007
1.00mm	0.0394	33932	350	52	1.5	1000	0.0007

Drill Table (continued)

Retract Rate = 500

0.118" (.30 mm) to 0.785" (#47) Diameters

Bit Size	Decimal (in.)	Recommended Cutting Speed RPM	SFPM	Recommended Infeed Rates		Maximum Recommended Hit Count	Maximum Recommended Land Wear
60	0.0400	33423	350	52	1.6	1000	0.0007
59	0.0410	32607	350	52	1.6	1000	0.0007
1.05mm	0.0413	32370	350	52	1.6	1000	0.0007
58	0.0420	31831	350	52	1.6	1000	0.0007
57	0.0430	31091	350	52	1.7	1000	0.0007
1.10mm	0.0433	33081	375	56	1.7	750	0.0007
1.15mm	0.0453	31620	375	54	1.7	750	0.0007
56	0.0465	30804	375	54	1.7	750	0.0007
3/64	0.0469	30541	375	54	1.8	750	0.0007
1.20mm	0.0472	30347	375	54	1.8	750	0.0009
1.25mm	0.0492	29114	375	53	1.8	750	0.0009
1.30mm	0.0512	27976	375	51	1.8	750	0.0009
55	0.0520	27546	375	51	1.9	750	0.0009
1.35mm	0.0531	26975	375	51	1.9	750	0.0009
54	0.0550	26044	375	50	1.9	750	0.0009
1.40mm	0.0551	25996	375	50	1.9	750	0.0009
1.45mm	0.0571	25086	375	49	2.0	750	0.0009
1.50mm	0.0591	24237	375	48	2.0	750	0.0009
53	0.0595	24074	375	49	2.0	750	0.0009
1.55mm	0.0610	23482	375	48	2.0	750	0.0009
1/16	0.0625	22918	375	47	2.1	750	0.0009
1.60mm	0.0630	24252	400	51	2.1	500	0.0009
52	0.0635	24061	400	51	2.1	500	0.0009
1.65mm	0.0650	23506	400	50	2.1	500	0.0009
1.70mm	0.0669	22838	400	49	2.2	500	0.0009
51	0.0670	22804	400	50	2.2	500	0.0009
1.75mm	0.0689	22175	400	49	2.2	500	0.0009
50	0.0700	21827	400	49	2.2	500	0.0009
1.80mm	0.0709	21550	400	49	2.3	500	0.0009
1.85mm	0.0728	20987	400	48	2.3	500	0.0009
49	0.0730	23546	450	55	2.3	300	0.0009
1.90mm	0.0748	22980	450	54	2.3	300	0.0009
48	0.0760	22617	450	53	2.4	300	0.0009
1.95mm	0.0768	22381	450	53	2.4	300	0.0009
5/64	0.0781	22009	450	53	2.4	300	0.0009
47	0.0785	21896	450	53	2.4	300	0.0009

ELECTRONIC MATERIALS

...Challenge Us!

For samples, technical assistance and customer service, please contact Arlon Electronic Materials at the following locations:

NORTH AMERICA:

Arlon EMD, 9433 Hyssop Drive, Rancho Cucamonga, CA
Tel: (909) 987-9533 • Fax: (909) 987-8541

FRANCE:
CCI Eurolam
9, rue Marcelin Bertholet
92160 Antony, France

Phone: (33) 146744747
Fax: (33) 146666313

GERMANY:
CCI Eurolam
Otto-Hahn-Str. 46 63303
Dreiech Germany

Phone: (49) 610339920
Fax: (49) 6103399229

UK & SCANDINAVIA:
CCI Eurolam – UK
Ulness Walton Lane
Leyland, PR26 8NB, UK

Phone: (44) 1772452236
Fax: (44) 1772456859

ISRAEL:
Tech Knowledge, Ltd. 159 Yigal Alon Street,
Tel Aviv 6744367, Israel

Phone: (972) 36958117
Fax: (972) 36917117

ITALY:
Dralmi,SAS
Via Cellini 5
20129 Milano Italy

Phone: (39) 025460507
Fax: (39) 0255013199

TAIWAN:
Advantic Technology Inc. (ATI)
9F No. 493 Wen-zhong Rd,
Taoyuan County 330,
Taiwan (R.O.C.)

Phone: (886) 3-3260047
Fax: (886) 3-3260063

SINGAPORE:
C.T.S. Industries Pte Ltd
47 Kaki Bukit Place
Singapore 416225

Phone: (65) 6276 3328
Fax: (65) 6276 3336

JAPAN:
Nakao Corp.
12-8 Nihonbashi Hisamatsu-Cho Tokyo
103-0005 Japan

Phone: (81) 336623201
Fax: (81) 336617118

KOREA
UniMicrotek Co. Ltd.
478 Baekbeom-Ro, Bupyeong-Gu
Incheon, Korea

Phone: (82) 32-424-1776
Fax: (82) 505-720-1785

CHINA:
Zack Peng
Room 6A, Unit 2, Bldg 2
Jin Cheng Shi Dai, Tian Road
Shenzhen, China 518103

Phone: (86) 75528236491
Fax: (86) 75528236463

INDIA:
Synertec
301 Raheja Chambers,12 Museum Rd
Bangalore, India 560001

Phone: (91) 80-25585432
Fax: (91) 80-25588565

Ver 1.**4**