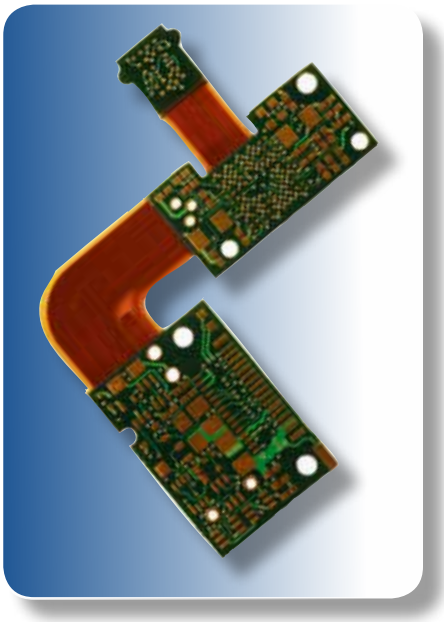
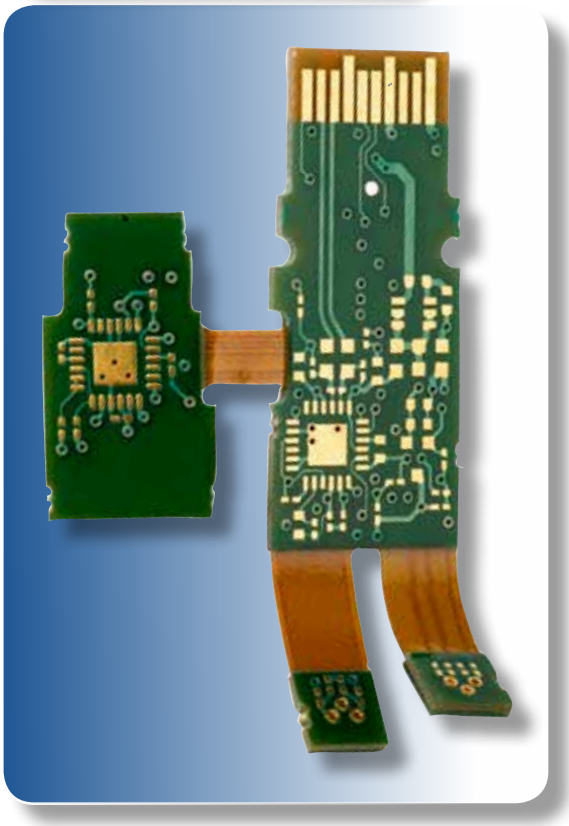
# 51N

## Multifunctional, High Tg Epoxy Low-Flow Prepreg





51N-LF is a non-DICY multifunctional epoxy low-flow prepreg system designed to provide high reliability through lead-free solder operations. The high decomposition temperature and high thermal stability of this material is ideal for use in complex rigid-flex fabrication and assembly operations where minimum resin flow is required.

### Features:

- Decomposition temperature > 350°C is ideally suited for lead-free solder processing and offers significant improvement over traditional FR-4 Epoxy systems.
- Multifunctional epoxy resin system with a Glass transition temperature (Tg) of 170°C for optimized thermal cycling PTH reliability
- Improved bond adhesion over multiple thermal excursions results in better reliability through reflow and rework operations.
- Best-in-class thermal performance for an epoxy system with T260 > 60 minutes, T280 > 30 minutes and T300 = 15 minutes
- Electrical and mechanical properties meet the requirements of IPC-4101B/124 prepreg, modified to be “Low-Flow”
- Compatible with lead-free solder processing
- RoHS/WEEE compliant

### Typical Applications:

- Bonding multilayer rigid-flex boards
- Finished PCB assemblies requiring excellent thermal stability
- Dielectric insulators
- Other applications where minimal and uniform resin flow is required

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## Typical Properties:

| Property | Units | Value | Test Method |
|---|---|---|---|
| ***1. Electrical Properties*** | | | |
| Dielectric Constant | | | |
| @ 1 MHz | - | 4.2 | IPC TM-650 2.5.5.3 |
| @ 1 GHz | - | 4.1 | IPC TM-650 2.5.5.9 |
| Dissipation Factor | | | |
| @ 1 MHz | - | 0.02 | IPC TM-650 2.5.5.3 |
| @ 1 GHz | - | 0.02 | IPC TM-650 2.5.5.9 |
| Volume Resistivity | | | |
| C96/35/90 | MΩ-cm | $2.6 \times 10^7$ | IPC TM-650 2.5.17.1 |
| E24/125 | MΩ-cm | $3.3 \times 10^7$ | IPC TM-650 2.5.17.1 |
| Surface Resistivity | | | |
| C96/35/90 | MΩ | $2.9 \times 10^7$ | IPC TM-650 2.5.17.1 |
| E24/125 | MΩ | $4.0 \times 10^6$ | IPC TM-650 2.5.17.1 |
| Electrical Strength | Volts/mil (kV/mm) | 1000 (39.4) | IPC TM-650 2.5.6.2 |
| Dielectric Breakdown | kV | | IPC TM-650 2.5.6 |
| Arc Resistance | sec | >120 | IPC TM-650 2.5.1 |
| ***2. Thermal Properties*** | | | |
| Glass Transition Temperature (Tg) | | | |
| TMA | °C | 166 | IPC TM-650 2.4.24 |
| DSC | °C | 170 | IPC TM-650 2.4.25 |
| Decomposition Temperature (Td) | | | |
| Initial | °C | 354 | IPC TM-650 2.3.41 |
| 5% | °C | 368 | IPC TM-650 2.3.41 |
| T260 | min | >60 | IPC TM-650 2.4.24.1 |
| T288 | min | >30 | IPC TM-650 2.4.24.1 |
| T300 | min | 15 | IPC TM-650 2.4.24.1 |
| CTE (X,Y) | ppm/°C | 13-15 | IPC TM-650 2.4.41 |
| CTE (Z) | | | |
| < Tg | ppm/°C | 44 | IPC TM-650 2.4.24 |
| > Tg | ppm/°C | 245 | IPC TM-650 2.4.24 |
| z-axis Expansion (50-260°C) | % | 2.6 | IPC TM-650 2.4.24 |
| ***3. Mechanical Properties*** | | | |
| Peel Strength to Copper (1 oz/35 micron) | | | |
| After Thermal Stress | lb/in (N/mm) | 6.7 (1.2) | IPC TM-650 2.4.8 |
| At Elevated Temperatures | lb/in (N/mm) | 6.7 (1.2) | IPC TM-650 2.4.8.2 |
| After Process Solutions | lb/in (N/mm) | 6.4 (1.1) | IPC TM-650 2.4.8 |
| Young's Modulus | Mpsi (GPa) | 2.6 (18) | IPC TM-650 2.4.18.3 |
| Flexural Strength | kpsi (MPa) | 84 (578) | IPC TM-650 2.4.4 |
| Tensile Strength CD/MD | kpsi (MPa) | 6.5 (45) | IPC TM-650 2.4.18.3 |
| Poisson's Ratio | - | | ASTM D-3039 |
| ***4. Physical Properties*** | | | |
| Water Absorption (0.062") | % | 0.15 | IPC TM-650 2.6.2.1 |
| Specific Gravity | g/cm3 | 1.35 | ASTM D792 Method A |
| Thermal Conductivity | W/mK | 0.25 | ASTM E1461 |
| Flammability | class | Meets V0 | UL-94 |

*Results listed above are typical properties, provided without warranty, expressed or implied, and without liability. Properties may vary, depending on design and application. Arlon reserves the right to change or update these values.*

## Availability:

| Arlon Part Number | Glass Style | Resin % | Pressed Thickness | Flow Range |
|---|---|---|---|---|
| 51N0672 | 106 | 72 | 0.0022” | 60—120 mils |
| 51N0666 | 106 | 66 | 0.0017” | 60—120 mils |
| 51N8065 | 1080 | 65 | 0.0032” | 60—120 mils |
| 51N8060 | 1080 | 60 | 0.0027” | 60—120 mils |

## Recommended Process Conditions:

Process inner-layers through develop, etch, and strip using standard industry practices. Use brown oxide on inner layers. Adjust dwell time in the oxide bath to ensure uniform coating. Bake inner layers in a rack for 60 minutes at 225°F - 250°F (107°C - 121°C) immediately prior to lay-up. Vacuum desiccate the prepreg for 8 - 12 hours prior to lamination.

Lamination Cycle:

1) Pre-vacuum for 30 - 45 minutes

2) Control the heat rise to 8°F - 12°F (4.5°C - 6.5°C) per minute between 150°F and 300°F (65°C and 150°C)

3) Lamination Pressure:  150-300 PSI (11-21 Kg/cm2) depending on complexity

4) Product temperature at start of cure = 360°F (182°C).

5) Cure time at temperature = 90 minutes

6) Cool down under pressure at ≤ 10°F/min (6°C/min)

Drill at 350-400 SFM. Undercut bits are recommended for vias 0.023” (0.9cm) and smaller

De-smear using alkaline permanganate or plasma with settings appropriate for multifunctional epoxy systems.

Conventional plating processes are compatible with 51N-LF

Standard profiling parameters may be used; chip breaker style router bits are not recommended

Bake for 1 - 2 hours at 250°F (121°C) prior to solder reflow or HASL

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## NORTH AMERICA:

Arlon LLC
Electronic Substrates
9433 Hyssop Drive
Rancho Cucamonga, CA 91730
Tel: (909) 987-9533
Fax: (909) 987-8541

Arlon LLC
Microwave Materials
1100 Governor Lea Road
Bear, DE 19701
Tel: (800) 635-9333
Outside U.S. & Canada: (302) 834-2100
Fax: (302) 834-2574

## NORTHERN EUROPE:

Arlon LLC
44 Wilby Avenue
Little Lever
Bolton, Lancashire BL31QE
United Kingdom
Tel: (44) 120-457-6068
Fax: (44) 120-479-6463

## SOUTHERN CHINA:

Arlon LLC
Room 601, Unit 1, Bldg 6
Liyuan, Xincun Shahe
Shenzhen, China 518053
Tel: (86) 755-269-066-12
Fax: (86) 755-26910475

## NORTHERN CHINA:

Arlon LLC
Room 11/401, No. 8
Hong Gu Road
Shanghai, China 200336
Tel/Fax: (86) 21-6209-0202

## SOUTHERN EUROPE:

Arlon LLC
6 cours des Juilliottes
94700 Maisons-Alfort France
Phone : (33) 1 84 23 41 51
Fax: (33) 9 55 62 43 26

**www.arlon-med.com**