

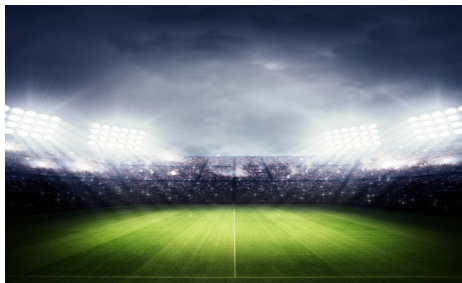
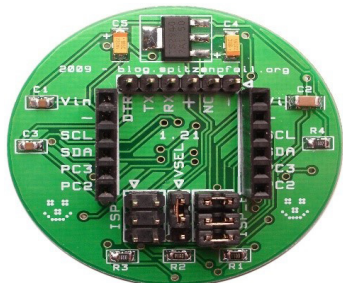
## 92ML<sup>™</sup> Laminates and Prepregs

92ML<sup>™</sup> thermally enhanced laminates and prepregs from Rogers Corporation are specifically engineered and manufactured to meet the demands of high power applications.

92ML<sup>™</sup> materials are halogen-free, flame retardant, thermally conductive epoxy based prepregs and laminates. They provide a low-cost, lead-free solder compatible system with enhanced heat transfer characteristics.

These materials are ideal for multilayer applications requiring thermal management throughout the entire board. The laminates are available with up to 4oz copper cladding; thick enough to meet today's most demanding power distribution requirements. The high thermal conductivity of up to 3.5 W/mK (in-plane) in combination with the relative ease and familiarity of epoxy based systems makes this material an ideal candidate for applications such as motor controllers, power supplies, converters, automotive electronics, etc.

The relatively high T<sub>g</sub> value of 160°C in combination with a low Z-axis coefficient of thermal expansion of 22ppm/°C (<T<sub>g</sub>) and 175ppm/C (>T<sub>g</sub>) ensure that the 92ML<sup>™</sup> materials survive lead free solder exposures and board reliability testing. The excellent rheological characteristics of the prepregs enable a high degree of resin flow; a critical element of high power multi-layer board processing.



### Data Sheet

#### Features and Benefits:

Thermal Conductivity= 2.0 W/m-K,  
6-10x that of FR-4

- Reduces Surface Temperature, Eliminates Hot-Spots and Improves Heat Sink Performance

High T<sub>g</sub> 160°C, T<sub>d</sub>>350°C

- Compatible with Lead-Free Solder Processing

MOT>140°C (>3mils) MOT>150°C (>4mils)

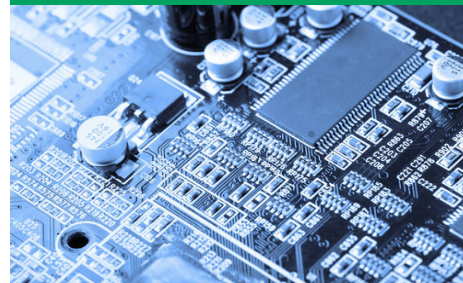
- Thermally Stable Laminate

UL-94 V-0, Halogen-free

- Environmentally Friendly Composition

#### Typical Applications:

- Motor Controllers
- Power Supplies
- Converters
- Automotive Electronics
- LED Modules
- Lighting



Property	Typical Value 92ML	Direction	Units	Condition	Test Method
Thermal Properties					
Thermal Conductivity	2.3	X/Y	W/mK	23°C	ASTM E1461
	1.7	Z			
		1.6	Z	W/mK	50°C
Thermal Resistance	0.5	Z	K/W	0.008" thickness	ASTM D5470-12
Thermal Impedance	0.2	Z	°K-in²/W	0.008" thickness	ASTM D5470-12
Glass Transition Temperature (Tg)	164	-	°C	-	IPC TM-650 2.4.25
Decomposition Temperature, (Td)	404	-	°C	5% wt loss	IPC TM-650 2.4.26
Maximum Operating Temperature	150	-	°C	0.003" thickness	UL 746B
	150			0.004" thickness	
Solder Float	9.3	-	Minutes	288°C	IPC TM-650 2.6.8.1
Time-to-Delamination	6.8	-	Minutes	300°C	IPC TM-650 2.4.24.1
Electrical Properties					
Dielectric Constant	5.28	Z	-	1MHz	IPC TM-650 2.5.5.3
Dissipation Factor	0.011	Z	-	1MHz	IPC TM-650 2.5.5.3
Volume Resistivity	4.9x10⁹	Z	Mohm-cm	96 Hours, 35°C, 90%RH	IPC TM-650 2.5.17.1a
Surface Resistivity	9.9x10⁷	Z	Mohms	96 Hours, 35°C, 90%RH	IPC TM-650 2.5.17.1a
Electrical Strength	1,607	Z	V/mil	48 Hours, 50°C Water	IPC TM-650 2.5.6.2
Breakdown Voltage	45	-	kVAC	48 Hours, 50°C Water	IPC TM-650 2.5.6
Arc Resistance	186	-	Seconds	48 Hours, 50°C Water	IPC TM-650 2.5.1
Mechanical Properties					
Peel Strength	7.6 (1.3)	-	lb/in (N/mm)	Condition B	IPC TM-650 2.4.8
CTE (<Tg)	18/18	X/Y	ppm/°C	50-125°C	IPC TM-650 2.4.24
	27	Z			
CTE (>Tg)	164	Z	ppm/°C	200-260°C	IPC TM-650 2.4.24
% Z-Axis Expansion	1.9	Z	%	50-260°C	IPC TM-650 2.4.24
Flexural Strength	32.7 (225)	-	kpsi (MPa)	23°C, 50% RH	IPC TM-650 2.4.4
Flexural Modulus	2.6 (18)	-	Mpsi (Gpa)	23°C, 50% RH	IPC TM-650 2.4.4
Tensile Strength	16.5 (114)	MD	kpsi (MPa)	23°C, 50% RH	IPC TM-650 2.4.18.3
	14.1 (97)	CMD			
Physical Properties					
Water Absorption	0.12	-	%	24 Hours 23°C Water	IPC TM-650 2.6.2.1
Specific Gravity	2.26	-	g/cm³	23°C, 50% RH	ASTM D792 Method A
Agency Ratings					
UL RTI Electrical	140	-	°C	0.38 mm thickness	UL 746B
UL RTI Mechanical	160			0.38 mm thickness	
UL Flammability	V-0	-	class	24 Hours, 125°C	UL-94
Comparative Tracking Index (CTI)	0/600	-	-	-	ASTM D3638/IEC60112
Solder Limit Rating (CCL)	20	-	Seconds	288°C	UL 746E
Solder Limit Rating (MCL)	30	-	Seconds	300°C	UL 796

**NOTE:**

Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corporation.

## Availability

92ML laminates are available in the following configurations:

Laminate Type	Dielectric Thickness (inches)	Thickness Tolerance (inches)	Construction Code	Prepreg Type		
				104 88%	106 90%	1080 85%
92ML	0.0030	+/- 0.0007"	A	1		
92ML	0.0040	+/- 0.0007"	A		1	
92ML	0.0060	+/- 0.001"	A			1
92ML	0.0060	+/- 0.001"	B	2		
92ML	0.0080	+/- 0.0015"	A		2	
92ML	0.0100	+/- 0.0015"	A		1	1
92ML	0.0120	+/- 0.002"	A			2
92ML	0.0140	+/- 0.002"	A		2	1
92ML	0.0160	+/- 0.002"	A		1	2
92ML	0.0180	+/- 0.002"	A	2	3	
92ML	0.0200	+/- 0.0025"	A		2	2
92ML	0.0240	+/- 0.0025"	A		4	1
92ML	0.0280	+/- 0.0025"	A		1	4
92ML	0.0300	+/- 0.0025"	A		3	3
92ML	0.0400	+/- 0.004"	A		1	6
92ML	0.0500	+/- 0.005"	A		2	7
92ML	0.0600	+/- 0.005"	A			10

92ML prepreg material are available in the following configurations:

Prepreg Part Description	Glass Style	Resin Content, % (Typical)	Nominal Pressed Thickness
92ML 104/88	104	88	3.2mils
92ML 106/90	106	90	4.2mils
92ML 108/85	1080	85	6.0mils

Standard Thicknesses		Standard Panel Sizes	Standard Claddings
<b>Laminate:</b> 0.0030" (0.08mm) +/- 0.0007" 0.0040" (0.10mm) +/- 0.0007" 0.0060" (0.15mm) +/- 0.0010" 0.0080" (0.20mm) +/- 0.0015"  *Additional non-standard laminate thicknesses available from 0.010" - 0.030" in increments of 0.002" and 0.030" - 0.060" in increments of 0.010"	<b>Bondply:</b> 0.0032" 104/88% 0.0042" 106/90% 0.0060" 1080/85%	12" X 18" (305mm X 457mm) 24" X 18" (610mm X 457mm)  *Additional panel sizes available	<u>Electrodeposited Copper Foil</u> 1 oz. (35µm) H1/H1 2 oz. (70µm) H2/H2  *Additional claddings, such as heavy metal, are available

\*Contact Customer Service or Engineering to inquire about additional available product configurations

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