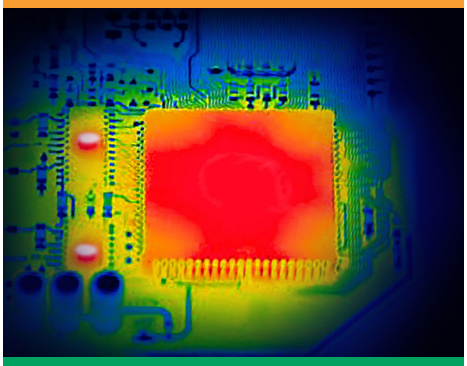
ROGERS CORPORATION

Data Sheet

92ML(TM) StaCool™ Laminates



92ML™ StaCool(TM) thermally enhanced laminates and prepregs from Rogers Corporation are specifically engineered and manufactured to meet the demands of high power applications.

92ML 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.

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 thermally challenging applications.

The relatively high Tg value of 160°C in combination with a low Z-axis coefficient of thermal expansion of 22ppm/°C (<Tg) and 175ppm/C (>Tg) ensure that the 92ML materials survive lead free solder exposures and board reliability testing.

92ML StaCool(TM) laminates are 92ML laminates offered in combination with an aluminum plate to form an insulated metal substrate (IMS). In this configuration, the product has an integrated heat sink that can be machined and formed to serve as a mechanical chassis in the final application. This 92ML StaCool laminate is characterized as having a high level of thermally stable adhesion to the aluminum substrate. 92ML StaCool laminate withstands over 5 minutes of 288°C solder exposure enabling sufficient time for final product to be assembled without issues.

The 92ML StaCool laminates are available with up to 4oz copper cladding; thick enough to meet today's most demanding power distribution requirements. 92ML StaCool materials are useful in high power and high operating temperature applications such as LED modules, automotive lighting, power devices, etc.

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 Tg 160°C, Td>350°C

- Compatible with Lead-Free Solder Processing

MOT>140°C (>3mils) MOT>150°C (>4mils)

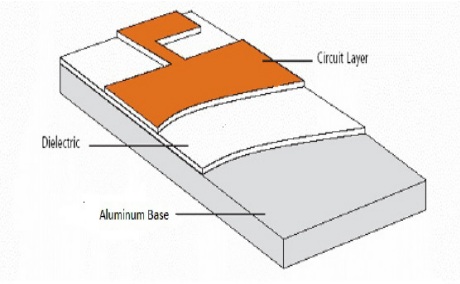
- Thermally Stable Laminate

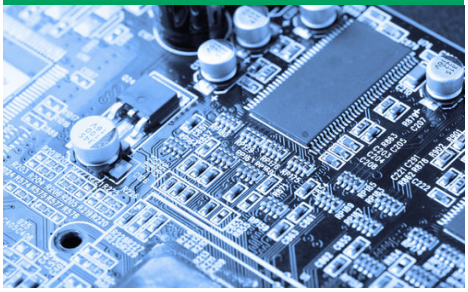
UL-94 V-0, Halogen-free

- Environmentally Friendly Composition

Typical Applications:

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





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

Property	Typical Value 92ML	Direction	Units	Condition	Test Method
Thermal Properties					
Thermal Conductivity	2.3	X/Y	W/mK		ASTM E1461
	1.7	Z			
	1.6	Z	W/mK		ASTM D5470-12
Thermal Resistance	0.5	Z	K/W	0.008" thickness	ASTM D5470-12
Thermal Impedance	0.2	Z	K-in^2/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	4.9x10^9	Z	Mohm-cm	96hrs, 35°C, 90%RH	IPC TM-650 2.5.17.1a
Surface Resistivity	9.9x10^7	Z	Mohms	96hrs, 35°C, 90%RH	IPC TM-650 2.5.17.1a
Electrical Strength	1,607	Z	V/mil	48H, 50°C Water	IPC TM-650 2.5.6.2
Breakdown Voltage	45		kVAC	48H, 50°C Water	IPC TM-650 2.5.6
Arc Resistance	186		Seconds	48H, 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	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		%	24H, 23°C Water	IPC TM-650 2.6.2.1
Specific Gravity	2.26		g/cm^3	23°C, 50% RH	ASTM D792 Method A
Agency Ratings					
UL RTI Electrical	140		C	0.38mm thickness	UL 746B
UL RTI Mechanical	160			0.38mm thickness	
UL Flammability	V-0		class	24H, 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.

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92ML StaCool laminates are available in the following dielectric configurations:

Laminate Type	Dielectric Thickness (inches)	Thickness Tolerance (inches)	Construction Code	Prepreg Type		
				104 88%	106 90%	1080 85%
SC92	0.0030	+/- 0.0007"	A	1		
SC92	0.0040	+/- 0.0007"	A		1	
SC92	0.0060	+/- 0.001"	A			1
SC92	0.0060	+/- 0.001"	B	2		
SC92	0.0080	+/- 0.0015"	A		2	

92ML StaCool laminates are available with the following aluminum options:

Clad Code	Alloy	Temper	Thickness, Inches	Thickness Tolerance, inches	Thermal Conductivity W/mK	Coefficient of Thermal Expansion, ppm/C	Density, g/cc	Modulus of Elasticity, Gpa	Ultimate Tensile Strength		Tensile Yield Strength		Brinell Hardness	Elongation %
									MPa	KSI	MPa	KSI		
AL1	6061	T6	0.040	+/-0.004	167	23.4	2.7	70	345	50	290	42	95	13
			0.059	+/-0.006										
			0.079	+/-0.008										
AL2	5052	H32	0.040	+/-0.004	138	23.7	2.7	70	228	33	193	28	60	12
			0.059	+/-0.006										
			0.079	+/-0.008										

Standard Thickness	Standard Panel Size	Standard Copper Cladding	Standard Aluminum Plate
See table above Other thicknesses may be available. Contact customer service for additional information.	12" X 18" (305 X457 mm) 24" X 18" (610 X 457 mm) Contact customer service for additional panel sizes available.	1 oz. (35µm) electrodeposited copper foil (H1)	0.040" (1.0mm) 0.059" (1.5mm) 0.079" (2.0mm) 5052 and 6061 alloys
		2 oz. (70µm) electrodeposited copper foil (H2)	
		3 oz. (105µm) electrodeposited copper foil (H3)	
		4 oz. (140µm) electrodeposited copper foil (H4)	

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