

# RO4400™ Series Bondply Data Sheet

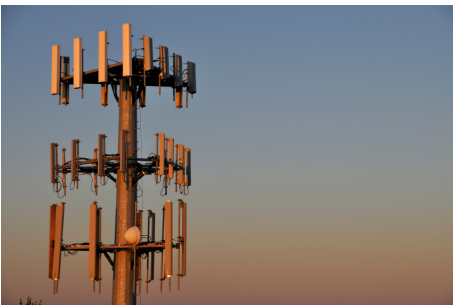
## RO4450F™ RO4450T™ and RO4460G2™ Bondply

RO4000<sup>®</sup> dielectric materials have long been used in combination with FR-4 cores and bondplys as a means to achieve a performance upgrade of standard FR-4 multi-layer designs. RO4003C™, RO4350B™, RO4360G2™, RO4835™, RO4835T™, and RO4000 LoPro<sup>®</sup> glass reinforced hydrocarbon/ceramic laminates have been used in layers where operating frequency, dielectric constant, or high-speed signal requirements dictate the need for high performance materials. FR-4 cores and bondply are still commonly used to inexpensively form less critical signal layers.

The RO4400™ bondply family is comprised of four grades based on the RO4000 series core materials, and are compatible in multi-layer constructions with RO4000 laminates. A high postcure Tg makes RO4400 series bondply an excellent choice for multi-layers requiring sequential laminations as fully cured RO4400 bondplys are capable of handling multiple lamination cycles. In addition, FR-4 compatible bond requirements permit RO4400 bondply and low flow FR-4 bondply to be combined into non-homogeneous multi-layer constructions using a single bond cycle.

RO4450F™ bondply has demonstrated improvement in lateral flow capability and is becoming the first choice for new designs or as a replacement in designs that have difficult fill requirements. RO4460G2™ bondply provides designers with a 6.15 Dk bonding layer that, just as the other RO4400 bonding materials, exhibits excellent Dk control while maintaining a low z axis expansion for plated through hole reliability. The RO4450T™ bondply has similar lateral flow capability as RO4450F bondply, and offers designers a spread glass reinforced bonding material in multiple thickness options where flexibility is needed for high multilayer board count designs.

Each of the bondplys are recognized by Underwriter Laboratories with the UL 94 V-0 flame rating, and are compatible with lead-free processes.



PROPERTY <sup>(1)</sup>	TYPICAL VALUES		DIRECTION	UNITS	CONDITION	TEST METHOD
	RO4450F	RO4460G2				
Thickness	4 (0.101)	4 (0.101)	Z	mils (mm)	-	-
Glass	1080	1080	-	-	-	-
Resin Content	80	79	-	%	-	-
Dielectric Constant, $\epsilon_r$	3.52 ± 0.05	6.15 ± 0.15	Z	-	10 GHz - 23°C	IPC-TM-650 2.5.5.5
Dissipation Factor, tan $\delta$	0.004	0.004	Z	-	10 GHz - 23°C	IPC-TM-650 2.5.5.5
Dielectric Strength	1000	1000	Z	V/mil	23°C/50% RH	IPC-TM-650 2.5.6.2
Volume Resistivity	8.93 X 10 <sup>8</sup>	9.1 X 10 <sup>8</sup>	-	M $\Omega$ -cm	23°C/50% RH	IPC-TM-650 2.5.17.1
Surface Resistivity	1.03 X 10 <sup>7</sup>	1.5 X 10 <sup>8</sup>	X,Y	M $\Omega$	23°C/50% RH	IPC-TM-650 2.5.17.1
Thermal Conductivity	0.65	0.67	Z	W/m/K	80°C	ASTM C518
Moisture Absorption	0.09	0.13	-	%	48 hrs immersion 0.060" sample temperature 50°C	ASTM D570
Tg	>280	170	-	°C TMA	-60°C - 300°C @ 10°C/min	IPC-TM-650 2.4.24.3
Td	390	405	-	°C TGA	-	ASTM D3850
Density	1.83	2.22	-	gm/cm <sup>3</sup>	23°C	ASTM D792
Copper Adhesion	4.0 (0.70)	5.0 (1.04)	Z	pli (N/mm)	½ oz. EDC After Solder Float	IPC-TM-650 2.4.8
Coefficient of Thermal Expansion	19 17 50	15 18 43	X Y Z	ppm/°C	-55 to 280°C	IPC-TM-650 2.4.41
Color	White	White	-	-	-	-
Flammability	V-0	V-0	-	-	-	UL94
Lead-Free Process Compatible	Yes	Yes	-	-	-	-

Notes:

<sup>(1)</sup>Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corporation. Rogers UL file number is E102763B.

STANDARD THICKNESS:	STANDARD SIZE:
RO4450F 0.0040" (0.101mm) RO4460G2 0.0040" (0.101mm)	24" X 18" Sheets (610 mm X 457 mm) Contact Customer Service for other available sizes.

	TYPICAL VALUES <sup>(1)</sup> - RO4450T			DIRECTION	UNITS	CONDITIONS	TEST METHOD
	3 (0.076)	4 (0.101)	5 (0.127)				
<b>Electrical Properties<sup>(1)</sup></b>							
Dielectric Constant, $\epsilon_r$	3.23 ± 0.05	3.35 ± 0.05	3.28 ± 0.05	Z	-	10 GHz - 23°C	IPC-TM-650 2.5.5.5
Dissipation Factor, $\tan \delta$	0.0039	0.0040	0.0038	Z	-	10 GHz - 23°C	IPC-TM-650 2.5.5.5
Volume Resistivity	2.9 X 10 <sup>9</sup>	1.4 X 10 <sup>9</sup>	2.3 X 10 <sup>9</sup>	-	MΩ-cm	23°C/50% RH	IPC-TM-650 2.5.17.1
Surface Resistivity	2.5 X 10 <sup>8</sup>	1.0 X 10 <sup>7</sup>	1.7 X 10 <sup>8</sup>	X, Y	MΩ	23°C/50% RH	IPC-TM-650 2.5.17.1
Electrical Strength	1020	1040	990	Z	V/mil	23°C/50% RH	IPC-TM-650 2.5.6.2
<b>Thermal Properties<sup>(1)</sup></b>							
Td	406	408	405	-	°C TGA	2 hrs @ 105°C	IPC-TM-650 2.3.40
Tg	170	170	170	-	°C TMA	-60°C - 300°C @ 10°C/min	IPC-TM-650 2.4.24.3
Coefficient of Thermal Expansion	20	15	19	X	ppm/°C	-55°C - 288°C	IPC-TM-650 2.4.41
Coefficient of Thermal Expansion	21	16	20	Y	ppm/°C	-55°C - 288°C	IPC-TM-650 2.4.41
Coefficient of Thermal Expansion	57	58	62	Z	ppm/°C	-55°C - 288°C	IPC-TM-650 2.4.41
Thermal Conductivity	0.50	0.55	0.53	Z	W/m/°K	80°C	ASTM D5470
<b>Mechanical Properties<sup>(1)</sup></b>							
Copper Adhesion	4.8 (0.84)	4.5 (0.79)	4.9 (0.86)	Z	pli (N/mm)	½ oz. EDC After Solder Float	IPC-TM-650 2.4.8
<b>Physical Properties<sup>(1)</sup></b>							
Glass	106	1078	1078	-	-	-	-
Resin Content	82	75	80	-	%	-	-
Color	White	White	White	-	-	-	-
Flammability	V-0	V-0	V-0	-	-	-	UL94
Moisture Absorption	0.11	0.11	0.10	-	%	48 hrs @ 50°C	IPC-TM-650 2.6.2.1
Lead-Free Process Compatible	YES	YES	YES	-	-	-	-

Notes:

<sup>(1)</sup>Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corporation.

RO4400 Bondply thickness tolerance is +/-0.0006" based on Rogers' parameters and equipment that presses the materials between two flat surfaces. Values may vary depending on how non-planar the PCB layers are.

STANDARD THICKNESS: RO4450T	STANDARD SIZE:
0.003"(0.076 mm) 0.004"(0.101 mm) 0.005"(0.127 mm)	24" X 18" sheets (610 mm X 457 mm) Contact Customer Service for other available sizes.



The information contained in this data sheet is intended to assist you in designing with Rogers' circuit materials and prepreg. It is not intended to and does not create any warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose or that the results shown on this data sheet and processing guide will be achieved by a user for a particular purpose. The user is responsible for determining the suitability of Rogers' circuit materials and prepreg for each application.

Prolonged exposure in an oxidative environment may cause changes to the dielectric properties of hydrocarbon based materials. The rate of change increases at higher temperatures and is highly dependent on the circuit design. Although Rogers' high frequency materials have been used successfully in innumerable applications and reports of oxidation resulting in performance problems are extremely rare, Rogers recommends that the customer evaluate each material and design combination to determine fitness for use over the entire life of the end product.

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