

## Advanced PCB Materials

### Product Selection Guide

*This Selection Guide provides a sampling of the thousands of product configurations Taconic offers. If your design requires a specialized laminate or prepreg, please contact Taconic to discuss your application.*

## Taconic High Performance Materials - Typical Values

Part #	Composition	Dk	Df	Volume Resistivity Mohm/cm	Surface Resistivity Mohm	Flex Strength K psi		Moisture Absorption %	k <sub>r</sub> W/(mK)	CTE * ppm/°C			Peel Strength lbs/in 1 oz Cu
						MD	CD			x	y	z	
TLY-5A	PTFE - Glass	2.17 <sup>(a)</sup>	0.0009 <sup>(a)</sup>	10 <sup>10</sup>	10 <sup>9</sup>	14	13	<0.02	0.22	20	20	280	12
TLP-5	PTFE - Glass	2.20 <sup>(a)</sup>	0.0009 <sup>(a)</sup>	10 <sup>7</sup>	10 <sup>7</sup>	>12	>10	<0.02	0.22	20	20	280	10
TLY-5	PTFE - Glass	2.20 <sup>(a)</sup>	0.0009 <sup>(a)</sup>	10 <sup>10</sup>	10 <sup>8</sup>	14	13	<0.02	0.22	20	20	280	12
TLY-3	PTFE - Glass	2.33 <sup>(a)</sup>	0.0012 <sup>(a)</sup>	10 <sup>10</sup>	10 <sup>8</sup>	14	13	<0.02	0.22	20	20	280	12
TLX-0, 9, 8, 7, 6	PTFE - Glass	2.45-2.65 <sup>(a)</sup>	0.0015-0.0021 <sup>(c)</sup>	10 <sup>10</sup>	10 <sup>8</sup>	>23	>17	<0.02	0.22	9	12	140	12
TLA-6	PTFE - Glass	2.65	0.0017	10 <sup>12</sup>	10 <sup>14</sup>	13	12	0.02	0.19	9	12	140	>10
TSM-26, 29, 30	PTFE Ceramic - Glass	2.60 <sup>(c)</sup> , 2.94 <sup>(c)</sup> , 3.00 <sup>(c)</sup>	0.0014 <sup>(c)</sup> , 0.0013 <sup>(c)</sup> , 0.0013 <sup>(c)</sup>	10 <sup>8</sup>	10 <sup>7</sup>	>7	>6	0.03	0.27	23	28	78	8
<i>fastFilm</i> <sup>TM</sup> 27 (FF-27) <sup>‡</sup>	PTFE Ceramic Film	2.70	0.0012	10 <sup>8</sup>	10 <sup>8</sup>	4	4	0.03	0.34	29	28	112	16
TLC-27, 30, 32, 338, 35	PTFE - Glass	2.75 - 3.50 <sup>(a)</sup>	0.0023 - 0.0037 <sup>(c)</sup>	10 <sup>8</sup>	10 <sup>8</sup>	24	19	<0.02	0.24	9	12	70	12
TSM-DS	PTFE Ceramic - Glass	2.85 <sup>(a)</sup>	0.0010 <sup>(a)</sup>	10 <sup>8</sup>	10 <sup>8</sup>	15	8	0.04	0.45	11	18	57	8
TLE-95	PTFE - Glass	2.95 <sup>(a)</sup>	0.0026 <sup>(a)</sup>	10 <sup>9</sup>	10 <sup>7</sup>	>24	>18	<0.02	0.28 <sup>(c)</sup>	9	12	70	12
RF-30	PTFE Ceramic - Glass	3.00 <sup>(b)</sup>	0.0014 <sup>(b)</sup>	10 <sup>9</sup>	10 <sup>8</sup>	20	16	0.02	0.20	11	21	208	10
TLF-34, 35	PTFE - Glass	3.40 <sup>(b)</sup> , 3.50 <sup>(b)</sup>	0.0020 <sup>(c)</sup>	10 <sup>9</sup>	10 <sup>8</sup>	19	15	0.02	0.36	21	23	85	>10
RF-35	PTFE Ceramic - Glass	3.50 <sup>(b)</sup>	0.0018 <sup>(b)</sup>	10 <sup>9</sup>	10 <sup>8</sup>	>22	>18	0.03	0.32 <sup>(c)</sup>	19	24	64	10
RF-35A2	PTFE Ceramic - Glass	3.50 <sup>(b)</sup>	0.0016 <sup>(b)</sup> , 0.0017 <sup>(c)</sup>	10 <sup>8</sup>	10 <sup>8</sup>	24	15	0.03	0.29	10	13	106	12
RF-35P	PTFE Ceramic - Glass	3.50 <sup>(b)</sup>	0.0022 <sup>(b)</sup>	10 <sup>7</sup>	10 <sup>7</sup>	>28	>16	0.03	0.33 <sup>(c)</sup>	15	15	110	10
RF-60A	PTFE Ceramic - Glass	6.15 <sup>(d)</sup>	0.0038 <sup>(a)</sup>	10 <sup>8</sup>	10 <sup>8</sup>	>18	>15	0.02	0.40	9	8	69	8
CER-10 (0.0620")	PTFE Ceramic - Glass	10.00 <sup>(d)</sup>	0.0035 <sup>(a)</sup>	10 <sup>8</sup>	10 <sup>9</sup>	>17	>16	<0.04	0.63	13	15	46	9
Prepregs/Bonding Films													
<i>fastRise</i> <sup>TM</sup> 27 (FR-27) <sup>‡</sup>	Prepreg/Thermoset	2.70 <sup>(c)</sup>	0.0014 <sup>(c)</sup>	10 <sup>8</sup>	10 <sup>8</sup>			0.08	0.25	59	70	72	6
<i>fastRise</i> <sup>TM</sup> DS (FR-DS) <sup>‡</sup>	Prepreg/Thermoset	2.96	0.0018	10 <sup>8</sup>	10 <sup>6</sup>	>17	>8	0.10	0.36	11	17	66	
TPG-30, 35	Prepreg/Thermoset	3.00 <sup>(c)</sup> , 3.50 <sup>(c)</sup>	0.0038 <sup>(c)</sup> , 0.0050 <sup>(c)</sup>	10 <sup>8</sup>	10 <sup>9</sup>	20	15	0.13	0.25	21	23	108	13
<i>fastRise</i> <sup>TM</sup> 77 (FR-77) <sup>‡</sup>	Prepreg/Thermoset	7.70	0.0034	10 <sup>5</sup>	10 <sup>5</sup>	>15	>7	0.10	0.43	10	17	62	

\* CTE values vary by temperature range of measurement. Please inquire for specific product temperature range.

UL Rating for all products: 94 V-O except products designated with <sup>‡</sup>

- <sup>(a)</sup> Measured by IPC-TM-650 method 2.5.5.5 (stripline resonator) at 10 GHz
- <sup>(b)</sup> Measured by IPC-TM-650 method 2.5.5.5.1 (modified stripline) at 1.9 GHz
- <sup>(c)</sup> Measured by IPC-TM-650 method 2.5.5.5.1 (modified stripline) at 10 GHz
- <sup>(d)</sup> Measured by IPC-TM-650 method 2.5.5.6 (full sheet resonant)
- <sup>(e)</sup> Measured by ASTM E1461

Copper Cladding							
Copper Designation	Surface Roughness $R_{MS}$ Treated side		Surface Roughness $R_{MS}$ Untreated side		Description	Thickness	
	Microinches	Microns	Microinches	Microns		Mils	Micrometers
RH	16	0.4	7	0.2	Rolled-Annealed 1/2 oz	0.7	17.5
R1	11	0.3	7	0.2	Rolled-Annealed 1 oz	1.4	35.0
CLH	13	0.3	20	0.5	Reverse Treated Electrodeposited 1/2 oz	0.7	17.5
CL1	13	0.3	25	0.6	Reverse Treated Electrodeposited 1 oz	1.4	35.0
CEH	19	0.5	13	0.3	High Ductility Very Low Profile Electrodeposited 1/2 oz	0.7	18.0
CE1	19	0.5	13	0.3	High Ductility Very Low Profile Electrodeposited 1 oz	1.4	35.0
CVH (CH)	27	0.7	11	0.3	Very Low Profile Electrodeposited 1/2 oz	0.7	17.5
CV1 (C1)	25	0.6	11	0.3	Very Low Profile Electrodeposited 1 oz	1.4	35.0
C2	77	2.0	8	0.2	Electrodeposited 2 oz	2.8	70.0

Ohmega Ply<sup>®</sup>, Ticer<sup>®</sup> and other resistive films available upon request. Please contact Taconic for availability.

Heavy Metal Cladding - Available Upon Request				
Heavy Metal	Specific Gravity	$k_T$ W/m/K	CTE ppm/°C	Machinability
Brass	8.5	120	20	Very Good
Copper	8.9	390	17	Good
Aluminum	2.7	180	24	Fair

## Specialty Products

**TRF** - Low loss, thermally stable laminates for satellite radio, antenna and RFID applications.

TRF Laminates				
Material	Dk	Df	Thickness	
			inches	mm
TRF-43	4.3	0.0035	0.0080 - 0.1200	0.20 - 3.05
TRF-45	4.5	0.0035	0.0080 - 0.1200	0.20 - 3.05

**TacLam<sup>®</sup> & TacPreg<sup>®</sup>** are available in thin-core constructions for high speed digital, RF multilayer and military applications.

TacLam <sup>®</sup> Laminates			
Material	Dk	Thickness	
		inches	mm
TLG-29	2.90	Increments of 0.0100	Increments of 0.254
TLG-30	3.00	0.0040, 0.0080, 0.0120	0.10, 0.20, 0.30

Flex Materials			
Material	Dk	Thickness	
		inches	mm
HyRelex <sup>®</sup> TF-260	2.60	0.0017, 0.0030	0.04, 0.08
fastFilm <sup>™</sup> FF-27	2.70	0.002 - 0.007*	0.05 - 0.18
HyRelex <sup>®</sup> TF-290	2.90	0.0023, 0.0035	0.06, 0.09

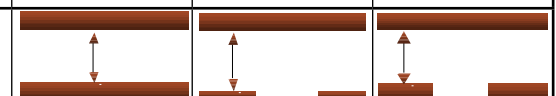
\*Available in other increments of 2 and 3 mil prepreg thicknesses.

**TacLamplus<sup>®</sup>** is a cost-effective, laser ablatable, non-reinforced microwave substrate that is ideal for very low loss structures, MMIC packaging and mm-wave sensors.

TacLamplus <sup>®</sup>			
Material	Dk	Thickness	
		inches	mm
TacLamplus <sup>®</sup>	2.10	Increments of 0.0020	Increments of 0.0500

Specialty Multilayer Bonding Materials			
Material	Dk	Thickness	
		inches	mm
FEP	2.00	0.0020	0.0500
HT-1.5	2.35	0.0015	0.0380
TPN	3.00	0.0045, 0.0050	0.1143, 0.1270

fastRise <sup>™</sup> Pressed Thickness (mil)			
FR-27-0030-25	3.5	2.13	1.82
FR-27-0040-25 FR-27-0040-50	4.9	3.74	3.51
FR-27-0045-35	5.8	4.61	4.23
FR-27-0050-40	6.1	5.50	4.85



0.5 oz. Cu, 50% removal      1 oz. Cu, 50% removal

## Common Thicknesses & Tolerances

Additional thicknesses & tolerances are available upon request

Product	Available Thickness		Thickness Tolerance	
	(inches)	(mm)	(inches)	(mm)
TLY-3, 5, 5A	0.0050 (TLY-3, 5)	0.13	+/- 0.0005	+/- 0.01
	0.0100	0.25	+/- 0.0007	+/- 0.02
	0.0200	0.51	+/- 0.0015	+/- 0.04
	0.0310	0.79	+/- 0.0020	+/- 0.05
	0.0620	1.58	+/- 0.0020	+/- 0.05
	0.0930	2.36	+/- 0.0030	+/- 0.08
TLX (TLT)-6, 7, 8, 9, 0	0.0050	0.13	+/- 0.0005	+/- 0.01
	0.0100	0.25	+/- 0.0007	+/- 0.02
	0.0200	0.51	+/- 0.0015	+/- 0.04
	0.0310	0.79	+/- 0.0020	+/- 0.05
	0.0620	1.58	+/- 0.0020	+/- 0.05
	0.1250	3.18	+/- 0.0030	+/- 0.08
TLA-6	0.0370	0.94	+/- 0.0020	+/- 0.05
	0.0570	1.45	+/- 0.0020	+/- 0.05
	0.0770	1.96	+/- 0.0030	+/- 0.08
TLC-27	0.0145	0.37	+/- 0.0010	+/- 0.03
TLE-95	0.0035	0.09	+/- 0.00025	+/- 0.01
	0.0052	0.13	+/- 0.0005	+/- 0.01
	0.0100	0.25	+/- 0.0007	+/- 0.02
	0.0200	0.51	+/- 0.0015	+/- 0.04
TLG-29, 30	0.0100	0.25	+/- 0.0007	+/- 0.02
	0.0200	0.51	+/- 0.0020	+/- 0.04
TLC-30, 32	0.0200	0.51	+/- 0.0015	+/- 0.04
	0.0310	0.79	+/- 0.0020	+/- 0.05
	0.0450	1.14	+/- 0.0020	+/- 0.05
	0.0620	1.58	+/- 0.0020	+/- 0.05
	0.0930	2.36	+/- 0.0030	+/- 0.08
RF-30	0.0100	0.25	+/- 0.0007	+/- 0.02
	0.0200	0.51	+/- 0.0015	+/- 0.04
	0.0300	0.76	+/- 0.0020	+/- 0.05
	0.0600	1.52	+/- 0.0020	+/- 0.05
TSM-26*, 29, 30	0.0035*	0.09	+/- 0.0020	+/- 0.05
	0.0050	0.13	+/- 0.0005	+/- 0.02
	0.0070*	0.18	+/- 0.0020	+/- 0.05
	0.0100	0.25	+/- 0.0010	+/- 0.03
	0.0105*	0.27	+/- 0.0020	+/- 0.05
	0.0200	0.51	+/- 0.0020	+/- 0.04
	0.0300	0.76	+/- 0.0020	+/- 0.05
	0.0600	1.52	+/- 0.0020	+/- 0.05
	0.0600	1.52	+/- 0.00196	+/- 0.050
TLF-34, 35	0.0100	0.25	+/- 0.00098	+/- 0.025
	0.0200	0.51	+/- 0.00196	+/- 0.050
	0.0300	0.76	+/- 0.00196	+/- 0.050
	0.0400	1.02	+/- 0.00196	+/- 0.050
	0.0500	1.27	+/- 0.00196	+/- 0.050
	0.0600	1.52	+/- 0.00196	+/- 0.050

Product	Available Thickness		Thickness Tolerance	
	(inches)	(mm)	(inches)	(mm)
RF-35	0.0100	0.25	+/- 0.0007	+/- 0.02
	0.0200	0.51	+/- 0.0015	+/- 0.04
	0.0300	0.76	+/- 0.0020	+/- 0.05
	0.0600	1.52	+/- 0.0030	+/- 0.08
RF-35A2	0.0100	0.25	+/- 0.0010	+/- 0.02
	0.0200	0.51	+/- 0.0020	+/- 0.05
	0.0300	0.76	+/- 0.0020	+/- 0.05
RF-35P	0.0020	0.05	+/- 0.0005	+/- 0.01
	0.0040	0.10	+/- 0.0005	+/- 0.01
	0.0060	0.15	+/- 0.0005	+/- 0.01
	0.0080	0.20	+/- 0.0007	+/- 0.02
RF-41	0.0600	1.52	+/- 0.0020	+/- 0.05
	0.1250	3.18	+/- 0.0035	+/- 0.09
RF-43	0.0100	0.25	+/- 0.0010	+/- 0.03
	0.0200	0.51	+/- 0.0015	+/- 0.05
	0.0300	0.76	+/- 0.0015	+/- 0.04
	0.0620	1.58	+/- 0.0020	+/- 0.05
RF-45	0.1250	3.18	+/- 0.0035	+/- 0.09
	0.0200	0.51	+/- 0.0015	+/- 0.04
	0.0310	0.79	+/- 0.0020	+/- 0.05
	0.0620	1.58	+/- 0.0020	+/- 0.05
	0.1250	3.18	+/- 0.0035	+/- 0.09
RF-60A	0.0100	0.25	+/- 0.0010	+/- 0.02
	0.0250	0.64	+/- 0.0020	+/- 0.05
	0.0310	0.79	+/- 0.0020	+/- 0.05
	0.0500	1.27	+/- 0.0030	+/- 0.08
	0.0600	1.52	+/- 0.0030	+/- 0.08
	0.1250	3.18	+/- 0.0040	+/- 0.10
	0.1250	3.18	+/- 0.0040	+/- 0.10
Cer-10	0.0110	0.28	+/- 0.0010	+/- 0.03
	0.0250	0.64	+/- 0.0020	+/- 0.05
	0.0300	0.76	+/- 0.0020	+/- 0.05
	0.0470	1.19	+/- 0.0030	+/- 0.08
	0.0620	1.58	+/- 0.0030	+/- 0.08
	0.1250	3.18	+/- 0.0040	+/- 0.10

Standard Sizes (Additional Sizes Available)			
Typical Size		Long Laminates	
Inches	mm	Inches	mm
36 W x 48 L	914 W x 1220 L	36 W x 60 L 36 W x 76 L 36 W x 102 L	914 W x 1524 L 914 W x 1930 L 914 W x 2590 L

All reported values are typical and should not be used for specification purposes. In all instances the user shall determine suitability in any given application. The above information creates no express or implied warranties. Ohmega Ply<sup>®</sup> is a registered trademark of Ohmega Technologies, Inc. Ticer<sup>®</sup> is a registered trademark of Ticer Technologies.

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