

N4000-13 – Dielectric Properties Table

04/03/03

LAMINATE

Thickness	&	Tolerance	Construction			RC%	1 MHz IPC-TM-650 2.5.5.3	1 GHz IPC-TM-650 2.5.5.9	2.5GHz IPC-TM-650 2.5.5.5	10GHz IPC-TM-650 2.5.5.5
0.0020	±	0.0005	1	106		68.3%	3.42 ± 0.11	3.32 ± 0.10	3.31 ± 0.09	3.27 ± 0.10
0.0025	±	0.0005	1	1080		55.2%	3.71 ± 0.14	3.61 ± 0.14	3.56 ± 0.12	3.54 ± 0.13
0.0030	±	0.0005	1	1080		61.2%	3.57 ± 0.10	3.47 ± 0.10	3.44 ± 0.09	3.40 ± 0.09
0.0040	±	0.0005	1	1080	+ 1 106	56.9%	3.67 ± 0.09	3.57 ± 0.09	3.52 ± 0.08	3.50 ± 0.08
0.0040	±	0.0005	1	2113		53.8%	3.75 ± 0.10	3.64 ± 0.10	3.59 ± 0.09	3.57 ± 0.09
0.0050	±	0.0007	1	1080	+ 1 1080	55.2%	3.71 ± 0.11	3.61 ± 0.10	3.56 ± 0.09	3.54 ± 0.10
0.0050	±	0.0007	1	2116		51.0%	3.82 ± 0.12	3.71 ± 0.12	3.65 ± 0.10	3.64 ± 0.11
0.0050	±	0.0007	1	2113	+ 1 106	52.0%	3.80 ± 0.12	3.69 ± 0.11	3.63 ± 0.10	3.61 ± 0.11
0.0055	±	0.0007	2	1080		58.4%	3.63 ± 0.09	3.53 ± 0.08	3.49 ± 0.08	3.46 ± 0.08
0.0060	±	0.0007	2	2113		42.7%	4.07 ± 0.14	3.95 ± 0.13	3.87 ± 0.12	3.86 ± 0.12
0.0060	±	0.0007	1	2116	+ 1 106	50.0%	3.85 ± 0.11	3.74 ± 0.10	3.68 ± 0.09	3.66 ± 0.10
0.0060	±	0.0007	1	1080	+ 1 2113	51.4%	3.81 ± 0.10	3.70 ± 0.10	3.64 ± 0.09	3.63 ± 0.09
0.0060	±	0.0007	1	106	+ 1 2116	50.0%	3.85 ± 0.11	3.74 ± 0.10	3.68 ± 0.09	3.66 ± 0.10
0.0070	±	0.001	2	2113		48.8%	3.88 ± 0.13	3.77 ± 0.13	3.71 ± 0.11	3.69 ± 0.12
0.0075	±	0.001	1	7628		41.0%	4.13 ± 0.16	4.01 ± 0.16	3.92 ± 0.14	3.91 ± 0.15
0.0080	±	0.001	2	2116		42.3%	4.08 ± 0.15	3.96 ± 0.14	3.88 ± 0.13	3.87 ± 0.13
0.0080	±	0.001	1	2116	+ 1 2113	47.8%	3.91 ± 0.12	3.80 ± 0.12	3.73 ± 0.11	3.72 ± 0.11
0.0090	±	0.001	1	2116	+ 1 2116	47.0%	3.93 ± 0.11	3.82 ± 0.11	3.75 ± 0.10	3.74 ± 0.10
0.0100	±	0.001	2	2116		51.0%	3.82 ± 0.09	3.71 ± 0.09	3.65 ± 0.08	3.64 ± 0.08
0.0100	±	0.001	1	7628	+ 1 1080	44.3%	4.02 ± 0.11	3.90 ± 0.11	3.82 ± 0.10	3.81 ± 0.10
0.0110	±	0.001	2	106	+ 1 7628	47.7%	3.91 ± 0.09	3.80 ± 0.09	3.73 ± 0.08	3.72 ± 0.08
0.0120	±	0.0015	2	1080	+ 1 7628	44.7%	4.00 ± 0.14	3.89 ± 0.13	3.81 ± 0.12	3.80 ± 0.12
0.0130	±	0.0015	2	2113	+ 1 7628	40.2%	4.15 ± 0.15	4.03 ± 0.14	3.94 ± 0.13	3.94 ± 0.13
0.0140	±	0.0015	2	2113	+ 1 7628	43.2%	4.05 ± 0.12	3.93 ± 0.12	3.85 ± 0.11	3.84 ± 0.11
0.0140	±	0.0015	2	7628		38.1%	4.23 ± 0.15	4.10 ± 0.14	4.00 ± 0.13	4.01 ± 0.13
0.0150	±	0.0015	2	7628		41.0%	4.13 ± 0.13	4.01 ± 0.12	3.92 ± 0.11	3.91 ± 0.12

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0.0160	±	0.0015	2	2116	+ 1	7628	43.0%	4.06 ± 0.11	3.94 ± 0.11	3.86 ± 0.10	3.85 ± 0.10	
0.0170	±	0.0015	2	7628	+ 1	1080	41.7%	4.10 ± 0.11	3.98 ± 0.11	3.90 ± 0.09	3.89 ± 0.10	
0.0180	±	0.0015	2	7628	+ 1	2113	41.3%	4.12 ± 0.11	4.00 ± 0.10	3.91 ± 0.09	3.90 ± 0.10	
0.0180	±	0.0015	2	1080	+ 2	7628	39.9%	4.16 ± 0.11	4.04 ± 0.11	3.95 ± 0.10	3.95 ± 0.10	
0.0190	±	0.0015	2	7628	+ 1	2116	41.2%	4.12 ± 0.10	4.00 ± 0.10	3.91 ± 0.09	3.90 ± 0.09	
0.0190	±	0.0015	2	1080	+ 2	7628	42.2%	4.08 ± 0.10	3.97 ± 0.09	3.88 ± 0.08	3.88 ± 0.09	
0.0200	±	0.002	2	7628	+ 1	7628	35.9%	4.31 ± 0.15	4.18 ± 0.14	4.07 ± 0.13	4.08 ± 0.14	
0.0200	±	0.002	2	2113	+ 2	7628	39.4%	4.18 ± 0.13	4.06 ± 0.13	3.96 ± 0.11	3.96 ± 0.12	
0.0200	±	0.002	2	1080	+ 2	7628	44.3%	4.02 ± 0.11	3.90 ± 0.11	3.82 ± 0.10	3.81 ± 0.10	
0.0210	±	0.002	2	7628	+ 1	7628	38.1%	4.23 ± 0.13	4.10 ± 0.13	4.00 ± 0.11	4.01 ± 0.12	
0.0210	±	0.002	2	2116	+ 2	7628	37.6%	4.24 ± 0.14	4.12 ± 0.13	4.02 ± 0.12	4.02 ± 0.12	
0.0220	±	0.002	2	7628	+ 1	7628	40.0%	4.16 ± 0.12	4.04 ± 0.11	3.94 ± 0.10	3.94 ± 0.11	
0.0220	±	0.002	2	2113	+ 2	7628	43.4%	4.05 ± 0.11	3.93 ± 0.10	3.85 ± 0.09	3.84 ± 0.10	
0.0240	±	0.002	2	7628	+ 1	7628	+ 1	2116	37.0%	4.27 ± 0.12	4.14 ± 0.12	4.04 ± 0.11
0.0250	±	0.002	2	2116	+ 1	7628	+ 1	7628	44.8%	4.00 ± 0.09	3.89 ± 0.09	3.81 ± 0.08
0.0250	±	0.002	2	7628	+ 1	7628	+ 1	2116	38.7%	4.20 ± 0.11	4.08 ± 0.11	3.98 ± 0.10
0.0250	±	0.002	2	1080	+ 2	7628	+ 1	7628	39.4%	4.18 ± 0.11	4.06 ± 0.10	3.96 ± 0.09
0.0260	±	0.002	2	7628	+ 1	7628	+ 1	2116	40.4%	4.15 ± 0.10	4.03 ± 0.10	3.93 ± 0.09
0.0260	±	0.002	2	2113	+ 3	7628			37.4%	4.25 ± 0.11	4.13 ± 0.11	4.02 ± 0.10
0.0280	±	0.002	2	2116	+ 2	7628	+ 1	7628	37.7%	4.24 ± 0.10	4.12 ± 0.10	4.01 ± 0.09
0.0280	±	0.002	2	7628	+ 2	7628			38.1%	4.23 ± 0.10	4.10 ± 0.10	4.00 ± 0.09
0.0300	±	0.002	2	7628	+ 2	7628	+ 1	1080	38.6%	4.21 ± 0.09	4.08 ± 0.09	3.99 ± 0.08
0.0300	±	0.002	2	2116	+ 3	7628			40.6%	4.14 ± 0.09	4.02 ± 0.08	3.93 ± 0.08
0.0310	±	0.003	2	7628	+ 2	7628	+ 1	2113	38.5%	4.21 ± 0.13	4.09 ± 0.13	3.99 ± 0.11
0.0310	±	0.003	2	1080	+ 4	7628			37.7%	4.24 ± 0.14	4.11 ± 0.13	4.01 ± 0.12
0.0020	±	0.0005	1	106					68.3%	3.42 ± 0.11	3.32 ± 0.10	3.31 ± 0.09
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0.0040	±	0.0005	1	2113				53.8%	3.75 ± 0.10	3.64 ± 0.10	3.59 ± 0.09	3.57 ± 0.09
0.0050	±	0.0007	1	1080	+	1	1080	55.2%	3.71 ± 0.11	3.61 ± 0.10	3.56 ± 0.09	3.54 ± 0.10
0.0050	±	0.0007	1	2116				51.0%	3.82 ± 0.12	3.71 ± 0.12	3.65 ± 0.10	3.64 ± 0.11
0.0050	±	0.0007	1	2113	+	1	106	52.0%	3.80 ± 0.12	3.69 ± 0.11	3.63 ± 0.10	3.61 ± 0.11
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0.0060	±	0.0007	2	2113				42.7%	4.07 ± 0.14	3.95 ± 0.13	3.87 ± 0.12	3.86 ± 0.12
0.0060	±	0.0007	1	2116	+	1	106	50.0%	3.85 ± 0.11	3.74 ± 0.10	3.68 ± 0.09	3.66 ± 0.10
0.0060	±	0.0007	1	1080	+	1	2113	51.4%	3.81 ± 0.10	3.70 ± 0.10	3.64 ± 0.09	3.63 ± 0.09

PREPREG RESIN CONTENT

				1MHz			1 GHz		
Mean	Min	Max		Mean	Min	Max	Mean	Min	Max
75	72	78	106	3.26	3.33	3.18	3.16	3.23	3.08
65	62	68	1080	3.51	3.59	3.44	3.41	3.49	3.34
58	55	61	2113	3.69	3.77	3.62	3.59	3.67	3.52
55	52	58	2116	3.77	3.85	3.69	3.67	3.75	3.59
43.5	42	45	7628	4.07	4.11	4.03	3.97	4.01	3.93

PREPREG RESIN CONTENT

				2.5 GHz			10 GHz		
Mean	Min	Max		Mean	Min	Max	Mean	Min	Max
75	72	78	106	3.07	3.15	3.00	3.05	3.12	2.98
65	62	68	1080	3.32	3.40	3.25	3.30	3.37	3.22
58	55	61	2113	3.50	3.57	3.42	3.47	3.54	3.39
55	52	58	2116	3.57	3.65	3.50	3.54	3.61	3.47
43.5	42	45	7628	3.86	3.90	3.83	3.82	3.86	3.79

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