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Copper Clad Laminate (CCL) - Technical Data Sheet

[Thermal Properties]

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	Tg (Glass Transition Temperature)				Td (Decomposition Temperature)	T-288 (Time to Delamination)	CTE				Thermal Conductivity		Max. Operating Temperature	Z Expansion
Condition	DMA	DMA	TMA	DSC	TGA 5% Loss	TMA	X Axis a1	Y Axis a1	Z Axis a1	Z Axis a2	As received	As received	As received	As received
	As received	As received	As received	As received	As received	As received	As received	As received	As received	As received				
Test method	IPC-TM-650 2.4.24.4	IPC-TM-650 2.4.24.2	IPC-TM-650 2.4.24C	IPC-TM-650 2.4.25C	IPC-TM-650 2.3.40 (TGA)	IPC-TM-650 2.4.24.1	IPC-TM-650 2.4.41.2	IPC-TM-650 2.4.41.2	IPC-TM-650 2.4.24	IPC-TM-650 2.4.24	ASTM E 1461	ASTM D 5470	UL 796	IPC-TM-650 2.4.24.5
Unit	℃	℃	℃	℃	℃	min	ppm/℃	ppm/℃	ppm/℃	ppm/℃	W/m·K	W/m·K	℃	%
DS-7402		165	145		380	>10	15	14	38	230	0.4~0.5		130	2.8
DS-7402M		165	145		370	>5	15	14	39	235	0.4~0.5		130	2.9
DS-7402BS (DF)	185		150	169	360	>20	18~21	18~21	90~100	350~400	0.3~0.4		130	4.5~6.5
DS-7402LC		175	155		360	>15	11	10	19	150	0.6		130	1.5
DS-8402H	190		165		380	>60	15	14	35	230	0.4~0.5		130	2.6~2.8
DS-8402H BS (DFL)	200		165		400	20	19~23	19~23	70~100	350~400	0.3			
DS-8502LC		280	230		430	>120	10	9	20	120	0.6		130	1.3
DS-8502SQ	260		200		420	>120	9~10	9~10	20~25	<150	0.5			<1.3
DS-8502SQN	260		200		420	>120	9~10	9~10	20~25	<150	0.5			<1.3
DS-9530					510	>120	25	23	30		0.5		180	
DSR-1000	160~180				345~360	>60 (260℃)	11~14	11~14	90~140	280~380	0.35~0.45			
DSF-900LC		280			360	>60	25	25	25	65	0.5			<1.2
DSF-900SQ		190			400	>120	25	25	25	65	0.5			1
DST-9000		130			380	30	30	30	30	105	1.3		160	
DST-9000HT		180			410	120	25	25	25	55	3		155	
DSflex-600		320			>500		22~25	22~25			0.2		130	
DSflex-600P		350			>500		18~22	18~22			0.2		130	
DSflex-600U		330			>500		18~22	18~22			0.2		200	
DSflex-600D		330			>500		22~25	22~25			0.2		130	
DSflex-600UY		260			>500		25~28	25~28			0.2		130	
DSflex-600UF (DS)		280			>500		18~22	18~22			0.2		130	
DSflex-600UK (SS)		280			>500		18~22	18~22			0.2		130	
DSflex-900		340			>500		22~25	22~25			0.2		130	

	Tg (Glass Transition Temperature)				Td (Decomposition Temperature)	T-288 (Time to Delamination)	CTE				Thermal Conductivity		Max. Operating Temperature	Z Expansion
Condition	DMA	DMA	TMA	DSC	TGA 5% Loss	TMA	X Axis a1	Y Axis a1	Z Axis a1	Z Axis a2	As received	As received	As received	As received
	As received	As received	As received	As received	As received	As received	As received	As received	As received	As received				
Test method	IPC-TM-650 2.4.24.4	IPC-TM-650 2.4.24.2	IPC-TM-650 2.4.24C	IPC-TM-650 2.4.25C	IPC-TM-650 2.3.40 (TGA)	IPC-TM-650 2.4.24.1	IPC-TM-650 2.4.41.2	IPC-TM-650 2.4.41.2	IPC-TM-650 2.4.24	IPC-TM-650 2.4.24	ASTM E 1461	ASTM D 5470	UL 796	IPC-TM-650 2.4.24.5
Unit	℃	℃	℃	℃	℃	min	ppm/℃	ppm/℃	ppm/℃	ppm/℃	W/m·K	W/m·K	℃	%
DS-7409DJL2+	220		170		380	120	15	15	47		0.4	0.7		2.3
DS-7409DJN2+	220		170		380	120	15	15	47		0.4	0.7		2.3
DS-7409DJN+	220		170		380	120	15	15	47		0.4	0.7		2.3
DS-8502HQN	240		180		420	>120	13~14	13~14	25~30	<200	0.5			<1.6
DS-8502HQ	240		180		420	>120	13~14	13~14	25~30	<200	0.5			<1.6
DS-7409DV (N)	225		180	190	400	120	16	16	45	270	0.4	0.7		
DS-7409DV (NT)	225		180	190	400	120	16	16	45	270	0.4	0.7		
DS-7409DV (T)	225		180	190	400	120	16	16	45	270	0.4	0.7		
DS-7409DV (C)	225		180	190	400	120	16	16	45	270	0.4	0.7		
DS-7409DJG (N)	220		170		400	120	16	16	45	230~240	0.4	0.7		2.3
DS-7409DJG (S)	220		170		400	120	16	16	45		0.4	0.7		2.3
DS-7409DJG	220		170		400	120	16	16	45		0.4	0.7		2.3
DS-7409DXG	280		230		430	120	10	9	20	120	0.6	0.8		
RAPIDON-10W (N)	200		170		400	120	13	13	25	100	1	1.2		
RAPIDON-10W	200		170		400	120	13	13	25	100	1	1.2		
DS-7409DX (C)	220		175	185	365	60	16	16	35	260	0.4			
DS-7409S (N)	190		165	170	350	120	16	15	50	280				
DS-7402H	200		170	180	380	30	15	14	40	260	0.4			
DS-7402HD	210		180		380	>120	14	14	30	120	0.6			
DS-7409HG (FQ)	200		170		380	>120	3	3	12	50	0.7			
DS-7409HG (ZL)	300		270		380	>120	2	2	8	40	0.9			
DS-7409HG (X)	260		230		380	>120	5	5	12	50	0.8			
DS-7409HG (LE)	240		210		380	>120	8	8	20	80	0.7			
DS-7409HG (I)	270		240		380	>120	3	3	9	40	0.9			
DS-7409HG (Z)	270		240		380	>120	3	3	9	40	0.9			
DS-7409HG (KN)	250		220		380	>120	10	10	20	90	0.7			
DS-7409HG (JQ)	260		230		380	>120	7	10	15	60	0.8			
DS-7409HG (ZS)	280		250		380	>120	2	2	8	40	0.9			
DS-7409HG (IQ)	260		230		380	>120	7	10	15	60	0.8			

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[Mechanical Properties]

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	Young's Modulus	Flexural Strength	Storage Modulus	Tensile Strength		Peel Strength			Elongation	Dimensional Stability		Density	Poisson Ratio
Condition	As Received	As Received	DMA	As Received	-	As Received /STD Toz	As Received /VLP Toz	ED/RA, >12um(>Toz)	As Received	After Etching (B-A)	After Heating (C-A)	-	-
Test method	IPC-TM-650 2.4.18.3	IPC-TM-650 2.4.4B	IPC-TM-650 2.4.24.4	IPC-TM-650 2.4.18.3	IPC-TM-650 2.4.19C	IPC-TM-650 2.4.8C	IPC-TM-650 2.4.8C	IPC-TM-650 2.4.9.1	IPC-TM-650 2.4.19C	IPC-TM-650 2.2.4C	IPC-TM-650 2.2.4C	-	-
Unit	GPa	MPa	GPa	MPa	MPa	Kgf/cm	Kgf/cm	-	%	%	%	g/cm^3	-
DS-7402	24~25					1.15 (Hoz)						1.9	0.15~0.17
DS-7402M	24~25					1.25 (Hoz)						1.87	0.15~0.17
DS-7402BS (DF)	15~18	350~400	12~14		200~230	1			3~5			1.55~1.65	0.15~0.17
DS-7402LC	32~33					1.05 (Hoz)						2.03	0.15~0.17
DS-8402H	22~24					1 (Hoz)						1.87	0.15~0.17
DS-8402H BS (DFL)	13~16	320~370			180~220		0.7		1.0~3.0			1.4~1.6	
DS-8502LC	29~30					0.95 (Hoz)						1.96	0.19~0.21
DS-8502SQ	28~32	500~550				1 (1oz)							
DS-8502SQN	28~32	500~550				1 (1oz)	0.7						
DS-9530	0.8			4.5		1	0.8		80	-0.05	-0.09	2.1	
DSR-1000	10~14		10~14				0.7~0.8						
DSF-900LC	10						0.7					1.7~1.8	0.3
DSF-900SQ	10		10				0.7					1.65~1.75	0.28
DST-9000						2.2 (1oz)							
DST-9000HT						1.5 (1oz)							
DSflex-600	6.9			210				>1	30	<±0.1	<±0.1	1.42	0.34
DSflex-600P	4.6			180				>1.2	100	<±0.1	<±0.1	1.42	0.34
DSflex-600U	6.2			390				>1.2	65	<±0.1	<±0.1	1.42	0.34
DSflex-600D	4.2			290				>1.2	70	<±0.1	<±0.1	1.42	0.34
DSflex-600UY	7.7			185				>1	15	<±0.1	<±0.1	1.42	0.34
DSflex-600UF (DS)	7.5			280				>1.2	80	<±0.1	<±0.1	1.42	0.34
DSflex-600UK (SS)	7.5			280				>1.2	80	<±0.1	<±0.1	1.42	0.34
DSflex-900	5.7			300				>1	50	<±0.1	<±0.1	1.42	0.34

	Young's Modulus	Flexural Strength	Storage Modulus	Tensile Strength		Peel Strength			Elongation	Dimensional Stability		Density	Poisson Ratio
Condition	As Received	As Received	DMA	As Received	-	As Received /STD Toz	As Received /VLP Toz	ED/RA, >12um(>Toz)	As Received	After Etching (B-A)	After Heating (C-A)	-	-
Test method	IPC-TM-650 2.4.18.3	IPC-TM-650 2.4.4B	IPC-TM-650 2.4.24.4	IPC-TM-650 2.4.18.3	IPC-TM-650 2.4.19C	IPC-TM-650 2.4.8C	IPC-TM-650 2.4.8C	IPC-TM-650 2.4.9.1	IPC-TM-650 2.4.19C	IPC-TM-650 2.2.4C	IPC-TM-650 2.2.4C	-	-
Unit	GPa	MPa	GPa	MPa	MPa	Kgf/cm	Kgf/cm	-	%	%	%	g/cm^3	-
DS-7409DJL2+						1							
DS-7409DJN2+						1							
DS-7409DJN+						1							
DS-8502HQN	25~26					0.8 (Hoz)							
DS-8502HQ	25~26					0.8 (Hoz)							
DS-7409DV (N)	22~24	450~470				1.2	1						
DS-7409DV (NT)	22~24	450~470				1.2	1						
DS-7409DV (T)	22~24	450~470				1.2	1						
DS-7409DV (C)	22~24	450~470				1.2	1						
DS-7409DJG (N)						1	0.8						
DS-7409DJG (S)	21~23					1	0.8						0.16~0.18
DS-7409DJG	21~23					1	0.8						0.16~0.18
DS-7409DXG	24~27					1						1.71	0.17~0.19
RAPIDON-10W (N)	15		15				0.75 (HVLP Toz)						0.17
RAPIDON-10W	15		15				0.75 (HVLP Toz)						0.17
DS-7409DX (C)						1.2	1						
DS-7409S (N)	26					1.7							
DS-7402H						1.6							
DS-7402HD	24		26				0.75					1.7	0.2
DS-7409HG (FQ)	26		28				0.7					2	0.16
DS-7409HG (ZL)	33		35				0.75					2.1	0.19
DS-7409HG (X)	29		31				0.75					2	0.195
DS-7409HG (LE)	27		29				0.75					2.1	0.2
DS-7409HG (I)	31		33				0.7					2.1	0.194
DS-7409HG (Z)	31		33				0.7					2.1	0.194
DS-7409HG (KN)	26		28				0.7					1.9	0.185
DS-7409HG (JQ)	26		28				0.7					2.07	0.185
DS-7409HG (ZS)	32		34				0.8					2.09	0.194
DS-7409HG (IQ)	27		28				0.7					2.07	0.185

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[Electrical Properties]

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	Dk (Dielectric Constant)				Df (Dissipation Factor)				Surface Resistace	Volume Resistance	Comparative Tracking Index	Dielectric Breakdown
Condition	1GHz		10GHz		1GHz		10GHz		As Received	As Received	As Received	AC
Test method	2.5.5.9	SPDR	2.5.5.5	SPDR	2.5.5.9	SPDR	2.5.5.5	SPDR	2.5.17.1A	2.5.17.1A	IEC 60112	2.5.6.2A
Unit	-	-	-	-	-	-	-	-	MΩ	MΩ/cm	-	kV/mm
DS-7402	4.33				0.013				>1.00E+8	>1.00E+9	4	>30
DS-7402M	4.25				0.013				>1.00E+8	>1.00E+9	4	>30
DS-7402BS (DF)	3.8				0.016				>1.00E+6~1.00E+7	>1.00E+7~1.00E+8	4	>30
DS-7402LC	4.23				0.007				>1.00E+08	>1.00E+9	4	>30
DS-8402H	3.4 (RC 70%)		3.6 (RC 70%)		0.008 (RC 70%)		0.012 (RC 70%)		5.00E+7~5.00E+8	1.00E+7~1.00E+8	4	>30
DS-8402H BS (DFL)	3.3		3.2		0.003		0.0039		1.00E+06	5.00E+06		>0.8
DS-8502LC	3.4 (RC 70%)		3.5 (RC 70%)		0.005 (RC 70%)		0.007 (RC 70%)		>1.00E+8	>1.00E+9	4	>30
DS-8502SQ	3.4 (RC 70%)		3.3 (RC 70%)		0.0015 (RC 70%)		0.003 (RC 70%)		1.00E+09	1.00E+10		
DS-8502SQN	3.2 (RC 70%)		3.1 (RC 70%)		0.001 (RC 70%)		0.0025 (RC 70%)		1.00E+09	1.00E+10		
DS-9530	3		3		0.0013		0.0013		1.00E+14	1.00E+15		
DSR-1000	3.7		3.6		0.008		0.009		1.00E+06	5.00E+06		>0.8
DSF-900LC	3.1		3.1		0.004		0.006		>1.00E+6~1.00E+7	>1.00E+7~1.00E+8		>30
DSF-900SQ	3		3		0.0022		0.0025		>1.00E+6~1.00E+7	>1.00E+7~1.00E+8		>30
DST-9000	5.6				0.017				>1.00E+6	>1.00E+8	0	12
DST-9000HT	6				0.015				>1.00E+6	>1.00E+8	0	6
DSflex-600		3.5		3.4		0.006		0.008	>1.00E+13	>1.00E+14	3	>5
DSflex-600P		3.3		3.2		0.006		0.008	>1.00E+13	>1.00E+14	3	>5
DSflex-600U		3.5		3.4		0.005		0.007	>1.00E+13	>1.00E+14	3	>5
DSflex-600D		3.4		3.3		0.005		0.007	>1.00E+13	>1.00E+14	3	>5
DSflex-600UY		3.5		3.4		0.002		0.0025	>1.00E+13	>1.00E+14	3	>5
DSflex-600UF (DS)		3.5		3.4		0.002		0.0025	>1.00E+13	>1.00E+14	4	>5
DSflex-600UK (SS)		3.5		3.4		0.002		0.0025	>1.00E+13	>1.00E+14	4	>5
DSflex-900		3.3		3.2		0.005		0.007	>1.00E+13	>1.00E+14	3	>5

	Dk (Dielectric Constant)				Df (Dissipation Factor)				Surface Resistace	Volume Resistance	Comparative Tracking Index	Dielectric Breakdown
Condition	1GHz		10GHz		1GHz		10GHz		As Received	As Received	As Received	AC
Test method	2.5.5.9	SPDR	2.5.5.5	SPDR	2.5.5.9	SPDR	2.5.5.5	SPDR	2.5.17.1A	2.5.17.1A	IEC 60112	2.5.6.2A
Unit	-	-	-	-	-	-	-	-	MΩ	MΩ/cm	-	kV/mm
DS-7409DJL2+	2.93		2.84		0.0004		0.0011					
DS-7409DJN2+	2.93		2.84		0.0004		0.0011					
DS-7409DJN+	3.23		3.14		0.0006		0.0014					
DS-8502HQN	3.5		3.4		0.001		0.0025		>1.00E+9	>1.00E+10		
DS-8502HQ	3.7		3.6		0.0015		0.003		>1.00E+9	>1.00E+10		
DS-7409DV (N)	3.35		3.26		0.001		0.0025		>1.00E+9	>1.00E+10		
DS-7409DV (NT)	3.35		3.26		0.001		0.0025		>1.00E+9	>1.00E+10		
DS-7409DV (T)	3.65		3.56		0.0015		0.003		>1.00E+9	>1.00E+10		
DS-7409DV (C)	3.65		3.56		0.0015		0.003		>1.00E+9	>1.00E+10		
DS-7409DJG (N)	3.3				0.0009				>1.00E+9	>1.00E+10		
DS-7409DJG (S)	3.6				0.0014				>1.00E+9	>1.00E+10		
DS-7409DJG	3.6				0.0014				>1.00E+9	>1.00E+10		
DS-7409DXG	3.81		3.8		0.004		0.006					
RAPIDON-10W (N)	4.1		3.7		0.0012		0.0025					
RAPIDON-10W	4.3		3.9		0.0015		0.003					
DS-7409DX (C)	3.8				0.004				1.00E+09	1.00E+09		
DS-7409S (N)	4.3				0.016				1.00E+09	1.00E+10		
DS-7402H	4.4		4.3		0.013		0.014		1.00E+09	1.00E+10		
DS-7402HD	3.5		3.4		0.007		0.008		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (FQ)	4		3.9		0.011		0.012		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (ZL)	4.1		4		0.009		0.01		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (X)	4.2		4.1		0.008		0.009		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (LE)	4.2		4.1		0.007		0.008		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (I)	4.1		4		0.009		0.01		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (Z)	4.1		4		0.009		0.01		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (KN)	3.5		3.4		0.003		0.004		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (JQ)	4.4		4.3		0.01		0.011		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (ZS)	4.2		4.1		0.01		0.011		5.00E+7~5.00E+8	1.00E+7~1.00E+8		
DS-7409HG (IQ)	4.3		4.5		0.009		0.01		5.00E+7~5.00E+8	1.00E+7~1.00E+8		

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[Others]

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	Water Absorption		Flammability
Condition	D-24h/23°C	D-2h/100°C	-
Test method	IPC-TM 2.6.2.1A	-	UL94
Unit	%	%	-
DS-7402	0.11		V-0
DS-7402M	0.13		V-0
DS-7402BS (DF)	0.2~0.4		V-0
DS-7402LC	0.1		V-0
DS-8402H	0.08		V-0
DS-8402H BS (DFL)	0.1~0.3		V-0
DS-8502LC	0.15		V-0
DS-8502SQ	0.15		V-0
DS-8502SQN	0.15		V-0
DS-9530	0.02	0.02	V-0
DSR-1000	0.4~0.6		V-0
DSF-900LC	0.5		V-0
DSF-900SQ	0.25		V-0
DST-9000	0.5		V-0
DST-9000HT	0.1		V-0
DSflex-600	1.1		VTM-0
DSflex-600P	1.1		VTM-0
DSflex-600U	1.1		VTM-0 (12,20um)
DSflex-600D	1.1		VTM-0
DSflex-600UY	0.6		VTM-0
DSflex-600UF (DS)	0.7		VTM-0 (12,25um)
DSflex-600UK (SS)	0.7		VTM-0 (12,25um)
DSflex-900	1.1		VTM-0

	Water Absorption		Flammability
Condition	D-24h/23°C	D-2h/100°C	-
Test method	IPC-TM 2.6.2.1A	-	UL94
Unit	%	%	-
DS-7409DJL2+	0.06		V-0
DS-7409DJN2+	0.06		V-0
DS-7409DJN+	0.06		V-0
DS-8502HQN	0.12		V-0
DS-8502HQ	0.12		V-0
DS-7409DV (N)	0.12		V-0
DS-7409DV (NT)	0.12		V-0
DS-7409DV (T)	0.12		V-0
DS-7409DV (C)	0.12		V-0
DS-7409DJG (N)	0.08		V-0
DS-7409DJG (S)	0.08		V-0
DS-7409DJG	0.08		V-0
DS-7409DXG	0.15		V-0
RAPIDON-10W (N)	0.12		V-0
RAPIDON-10W	0.12		V-0
DS-7409DX (C)	0.13		V-0
DS-7409S (N)	0.15		V-0
DS-7402H	0.13		V-0
DS-7402HD	0.3	0.35	V-0
DS-7409HG (FQ)	0.3	0.35	V-0
DS-7409HG (ZL)	0.3	0.35	V-0
DS-7409HG (X)	0.3	0.35	V-0
DS-7409HG (LE)	0.3	0.35	V-0
DS-7409HG (I)	0.3	0.35	V-0
DS-7409HG (Z)	0.3	0.35	V-0
DS-7409HG (KN)	0.2	0.3	V-0
DS-7409HG (JQ)	0.3	0.35	V-0
DS-7409HG (ZS)	0.3	0.35	V-0
DS-7409HG (IQ)	0.3	0.35	V-0