



isola

B-IS400 - IS420/3

IS400

IS420

PCL370HR

Temperature resistant
mid and high T_g -
base materials with
low z-axis expansion

**CAF
ENHANCED**

Temperature-resistant base materials with low z-axis expansion

IS400, IS420 and PCL370HR

The demands relating to the reliability of printed circuit boards are increasing. Major influences besides the actual layout and design are the thermal attributes of the base materials such as the glass transition temperature T_g , time to delamination at 260 °C (T_{260}) and 288 °C (T_{288}) thermal decomposition temperature (T_D) and the thermal expansion behaviour in the z-axis. In many cases the reliability of printed circuit boards is determined by destructive tests, especially in automobile applications.

Typical terms are:
-40 °C up to +125 °C / > 500 cycles or
-40 °C up to +140 °C / \geq 1.000 cycles.

It has been demonstrated that only base materials with a low expansion in the z-axis are able to pass these tests.

The base material qualities IS400, IS420 and PCL370HR comply with these requirements without restrictions.

For predictable reliability of printed circuit boards these materials offer excellent performance in order to prevent barrel cracks, corner cracks, resin recession and other failure mechanisms.

Typical Applications

- High layer count multilayers
- Industrial electronics
- Automobile electronics
- Fine-line structures
- High temperature electronics

IS400 – Special properties

- High thermal resistance:
 T_g approx. 150 °C
 T_{260} > 60 min
 T_{288} > 5 min
 T_D approx. 330 °C
- Low z-axis expansion
 $\alpha_z = 40\text{-}45$ ppm/K @ RT-120 °C
- TCT > 1.000 cycles / -40 °C up to +140 °C
- Low absorption of water
- Smooth surface
- Dimensionally stable
- CAF-enhanced

IS420 – Special properties

- High thermal resistance:
 T_g approx. 165 °C
 T_{260} > 60 min
 T_{288} > 15 min
 T_D approx. 340 °C
- Smooth surface
- Dimensionally stable
- CAF-enhanced
- Low z-axis expansion
 $\alpha_z = 35\text{-}40$ ppm/K @ RT-120 °C
- TCT > 3.000 cycles / -40 °C up to +140 °C
- Low absorption of water

IS400 Standard Prepregs

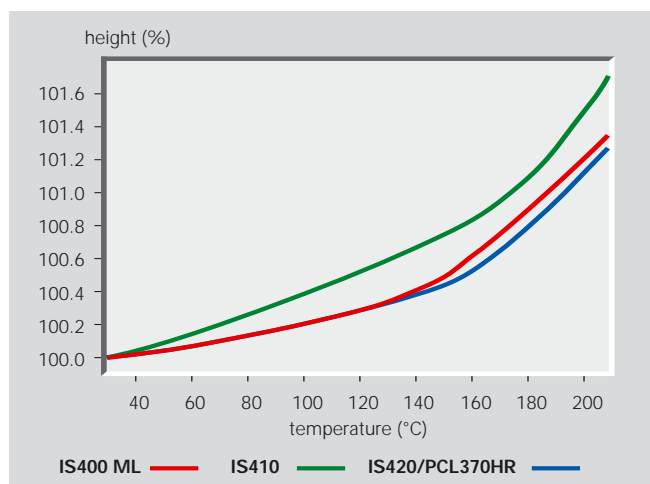
Type	Resin content %	Viscosity Pa · s	Gel time s	Scaled flow mm/Prepreg
106 FZ01	74 ± 3	38 ± 10	70 ± 15	0.048 ± 0.005
1080 FZ01	65 ± 3	38 ± 10	70 ± 15	0.061 ± 0.008
2116 FZ01	53 ± 3	38 ± 10	70 ± 15	n/a
2125 FZ01	55 ± 3	38 ± 10	70 ± 15	n/a
7628 FZ01	46 ± 3	38 ± 10	70 ± 15	n/a

IS400 Standard Laminate Thickness

Nominal thickness		Thickness tolerance		Mean resin content %	Construction
mm	inch	IPC-4101B cl. B mm	IPC-4101B cl. C mm		
0.100	0.004	± 0.018	± 0.013	46	1 x 2116
0.125	0.005	± 0.025	± 0.018	48	1 x 2165
0.150	0.006	± 0.025	± 0.018	48	1 x 2157
0.200	0.008	± 0.038	± 0.025	45	1 x 7628M
0.250	0.010	± 0.038	± 0.025	48	2 x 2165
0.300	0.012	± 0.050	± 0.038	48	2 x 2157
0.360	0.014	± 0.050	± 0.038	41	2 x 7628M
0.540	0.021	± 0.064	± 0.050	41	3 x 7628M
0.710	0.028	± 0.064	± 0.050	41	4 x 7628M
0.900	0.035	± 0.100	± 0.075	41	5 x 7628M

Nominal thickness		Thickness tolerance		Mean resin content %
mm	inch	IPC-4101B cl. L mm	IPC-4101B cl. M mm	
1.550	0.061	± 0.130	± 0.075	43

Comparison of expansion in z-direction



IS420 Standard Prepregs

Prepreg type	Resin content %	Viscosity Pa · s	Gel time s	Scaled flow mm/Prepreg
106	72 ± 3	30 ± 15	80 ± 20	0.048 ± 0.008
1080	64 ± 3	30 ± 15	80 ± 20	0.058 ± 0.008
2113	57 ± 3	30 ± 15	80 ± 20	0.081 ± 0.008
2116	57 ± 3	30 ± 15	80 ± 20	0.099 ± 0.008
7628	46 ± 3	30 ± 15	80 ± 20	0.173 ± 0.008

IS420 Standard Laminate Thicknesses

Nominal thickness		Thickness tolerance		Mean resin content %	Construction
mm	inch	IPC-4101B cl. B mm	IPC-4101B cl. C mm		
0.075	0.003	± 0.018	± 0.013	64	1 x 1080
0.100	0.004	± 0.018	± 0.013	48	1 x 2116
0.125	0.005	± 0.025	± 0.018	49	1 x 2165
0.150	0.006	± 0.025	± 0.018	49	1 x 2157
0.200	0.008	± 0.038	± 0.025	45	1 x 7628M
0.250	0.010	± 0.038	± 0.025	49	2 x 2165
0.300	0.012	± 0.050	± 0.038	49	2 x 2157
0.360	0.014	± 0.050	± 0.038	42	2 x 7628
0.510	0.021	± 0.064	± 0.050	42	3 x 7628
0.710	0.028	± 0.064	± 0.050	42	4 x 7628
0.910	0.035	± 0.100	± 0.075	42	5 x 7628

Nominal thickness		Thickness tolerance		Mean resin content %
mm	inch	IPC-4101B cl. L mm	IPC-4101B cl. M mm	
1.550	0.061	± 0.130	± 0.075	45

Raw materials

The same types of E-glass-fabric are used as for all our base materials.

Typical copper foil thicknesses (18, 35, 70 µm) correspond to IPC-4562, grade 3 (HTE-quality). For laminates with a substrate ≤ 0.1 mm VLP foils with HTE properties are used.

Laminates are only available with double sided copper cladding.

Supply forms and storage

The laminates are produced in standard sheet size: 1225 x 1070 mm warp.

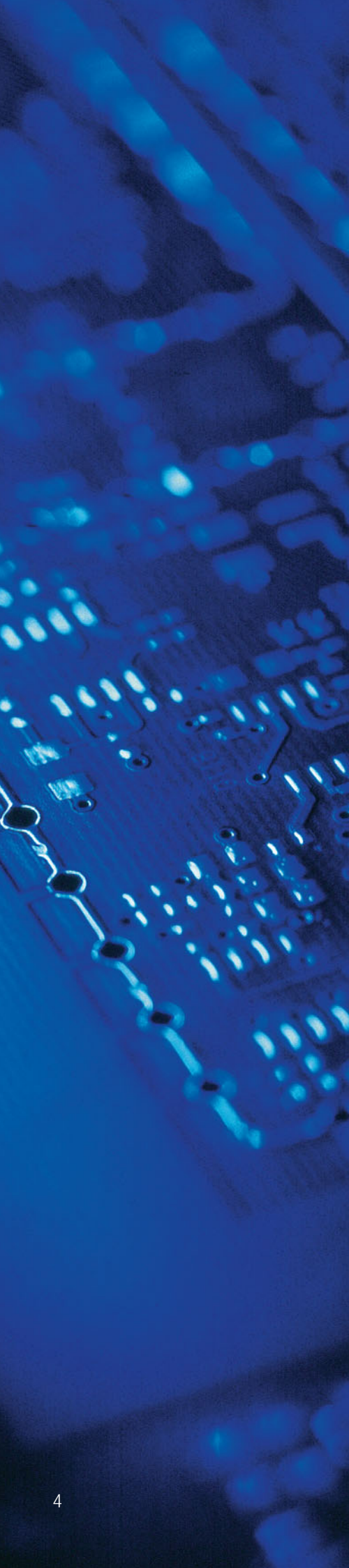
Prepregs are available with a standard roll width of approx. 1250 mm (location oriented).

Laminate and prepreg panels are cut to specification.

For pin-lam technology, tooling holes are punched in the prepreg panels as specified. A variety of punch tools are available for this purpose.

The prepregs can be stored for six months at < 5 °C or for three months at < 20 °C and relative humidity of < 50 %. When removing chilled product from storage, take appropriate steps to prevent condensation.

Current product information can also be obtained from our website www.isola-group.com



PCL370HR – Special properties

- High thermal resistance:
 T_g approx. 170 °C
 T_{260} > 60 min
 T_{288} > 10 min
 T_D approx. 340 °C
- Low z-axis expansion
 $\alpha_z = 35-40$ ppm/K @ RT-120 °C
- TCT > 1.000 cycles/- 40 °C up to +140 °C
- Low absorption of water
- Smooth surface
- Dimensionally stable
- CAF-enhanced

PCL370HR Standard Prepregs

Type	Resin content %	Viscosity Pa · s	Gel time s	Scaled flow mm/Prepreg
106	76 ± 3	35 ± 15	80 ± 20	0.048 ± 0.008
1080	66 ± 3	35 ± 15	80 ± 20	0.058 ± 0.008
2113	60 ± 3	35 ± 15	80 ± 20	0.081 ± 0.008
2116	57 ± 3	35 ± 15	80 ± 20	0.099 ± 0.008
7628	45 ± 3	35 ± 15	80 ± 20	0.183 ± 0.008

PCL370HR Standard Laminate Thickness

Nominal thickness		Thickness tolerance		Mean resin content %	Construction
mm	inch	IPC-4101B cl. B mm	IPC-4101B cl. C mm		
0.075	0.003	± 0.018	± 0.013	66	1 x 1080
0.100	0.004	± 0.018	± 0.013	47	1 x 2116
0.125	0.005	± 0.025	± 0.018	49	1 x 2165
0.150	0.006	± 0.025	± 0.018	49	1 x 2157
0.200	0.008	± 0.038	± 0.025	45	1 x 7628M
0.250	0.010	± 0.038	± 0.025	49	2 x 2165
0.300	0.012	± 0.050	± 0.038	49	2 x 2157
0.360	0.014	± 0.050	± 0.038	42	2 x 7628
0.510	0.021	± 0.064	± 0.050	40	3 x 7628
0.710	0.028	± 0.064	± 0.050	42	4 x 7628
0.910	0.035	± 0.100	± 0.075	43	5 x 7628M

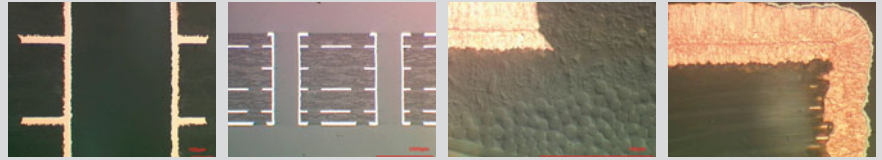
Nominal thickness		Thickness tolerance		Mean resin content %
mm	inch	IPC-4101B cl. L mm	IPC-4101B cl. M mm	
1.550	0.061	± 0.130	± 0.075	43

Processing Recommendations

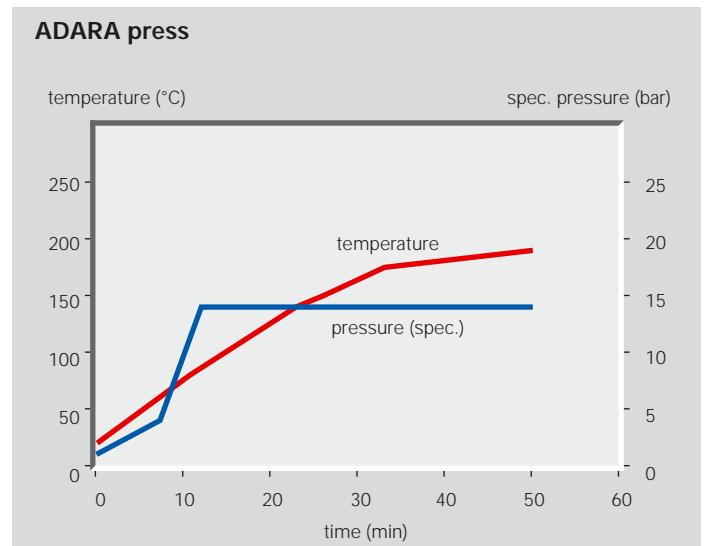
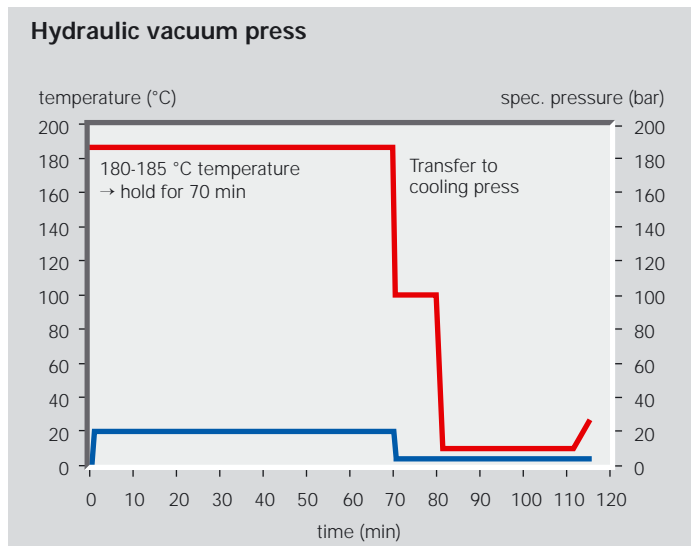
IS420 and PCL370HR should be pressed for 120 minutes at 190 °C and IS400 for 70 minutes at 180 – 185 °C to assure a complete curing of the resin matrix. A post baking of the laminates is not required. We recommend to use copper foil of the type HTG for the multilayer production. As with all filled base materials adapted drill parameters are essential.

Cross Sections

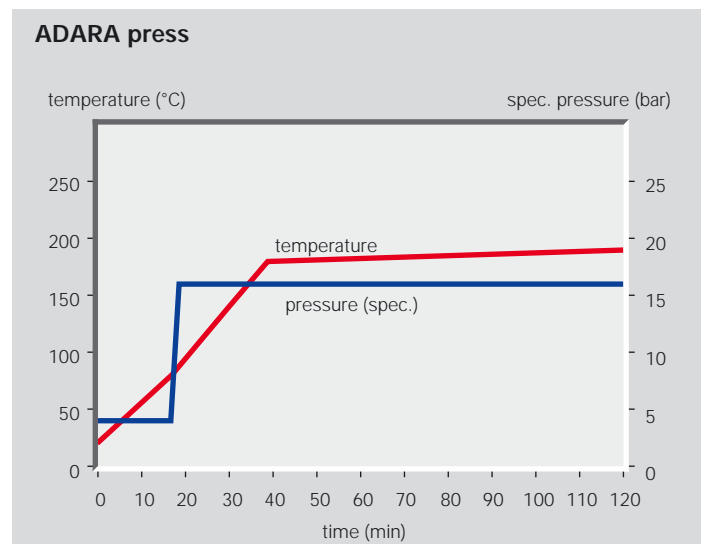
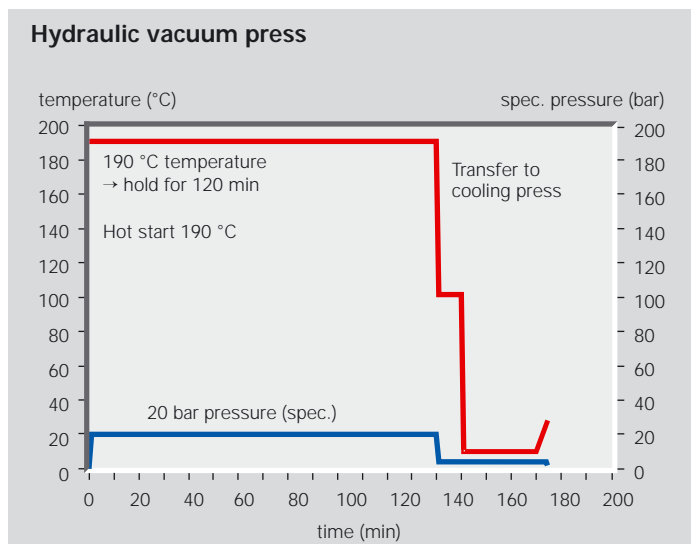
Hole diameter 0.35 mm after 3x reflow, 1.000 thermal cycles -40/+140 °C.



Recommended press parameters IS400



Recommended press parameters IS420/PCL370HR



Technical Values

IS400

Specification Sheet #:	IPC-4101B/97
Reinforcement:	woven E-glass
Resin system:	primary: difunctional epoxy · secondary: multifunctional epoxy
Flame Retardant Mechanism:	brominated epoxy resin · minimum requirement: V-0
Fillers:	inorganic filler
ID Reference:	UL/ANSI: FR-4 · RoHS-compliant
Glass Transition Temperature (T _g):	110 °C – 150 °C

Explanations:

C = preconditioning in humidity chamber

E = preconditioning at temperature

The figures following the letter symbols indicate with the first digit the duration of the preconditioning in hours, with the second digit the preconditioning temperature in °C and with the third digit the relative humidity.

Properties	Units	Laminate thickness < 0.50 mm		Laminate thickness ≥ 0.50 mm	
		Specification	Isola-Value	Specification	Isola-Value
1. Peel Strength , minimum					
A. Low profile copper foil and very low profile copper foil – all copper weights >17 µm	N/mm	0.70	n/a*	0.70	n/a*
B. Standard profile copper foil (35 µm)					
1. After thermal stress	N/mm	0.80	> 1.0	1.05	> 1.4
2. At 125 °C	N/mm	0.70	> 1.0	0.70	> 1.0
3. After process solutions	N/mm	0.55	> 1.1	0.80	> 1.4
C. All other foil composite	N/mm	n/a*	n/a*	n/a*	n/a*
2. Volume Resistivity , minimum					
A. C-96/35/90	MΩ · cm	1.0 · 10 ⁶	2.3 · 10 ⁷	n/a*	n/a*
B. After moisture resistance	MΩ · cm	n/a*	n/a*	1.0 · 10 ⁶	2.4 · 10 ⁸
C. At elevated temperature E 24/125	MΩ · cm	1.0 · 10 ³	3.1 · 10 ⁷	1.0 · 10 ³	2.7 · 10 ⁷
3. Surface Resistivity , minimal					
A. C-96/35/90	MΩ	1.0 · 10 ⁴	5.4 · 10 ⁷	n/a*	n/a*
B. After moisture resistance	MΩ	n/a*	n/a*	1.0 · 10 ⁴	7.9 · 10 ⁶
C. At elevated temperature E 24/125	MΩ	1.0 · 10 ³	6.0 · 10 ⁷	1.0 · 10 ³	3.4 · 10 ⁶
4. Moisture Absorption , maximum	%	n/a*	n/a*	0.80	0.10**
5. Dielectric Breakdown , minimum	kV	n/a*	n/a*	40	49
6. Permittivity @ 1 MHz , maximum					
(Laminate or prepreg as laminated)		5.4	4.8 - 5.1	5.4	4.8 - 5.1
7. Loss Tangent @ 1MHz , maximum					
(Laminate or prepreg as laminated)		0.035	0.018	0.035	0.013 - 0.015
8. Flexural Strength , minimum					
A. Length direction	N/mm ²	n/a*	n/a*	415	530
B. Cross direction	N/mm ²	n/a*	n/a*	345	450
9. Flexural Strength @ Elevated Temperature , length direction, minimum	N/mm ²	n/a*	n/a*	n/a*	n/a*
10. Thermal Stress at 288 °C , minimum					
A. Unetched	s	≥ 10	≥ 10	≥ 10	≥ 10
B. Etched	s	≥ 10	≥ 10	≥ 10	≥ 10
11. Electric Strength , minimum (Laminate or prepreg as laminated)	kV/mm	30	42	n/a*	n/a*
12. Flammability	class	V-0	V-0	V-0	V-0
13. Glass Transition Temperature (T_g) DSC	°C	110 - 150	140 - 150	110 - 150	140 - 150
14. Coefficient of Thermal Expansion (CTE) TMA					
Fill direction (below T _g / above T _g)	ppm/K	–	–	–	15/12
Warp direction (below T _g / above T _g)	ppm/K	–	–	–	12/5
Vertical (below T _g / above T _g)	ppm/K	–	–	–	45/220

Tests are carried out in accordance with IPC-650 test methods.

*not applicable **measured at 1.55 mm laminate

Technical Values

IS420

Specification Sheet #:	IPC-4101B/98
Reinforcement:	woven E-glass
Resin system:	primary: epoxy · secondary: multifunctional epoxy
Flame Retardant Mechanism:	brominated epoxy resin · minimum requirement: V-0
Fillers:	inorganic filler
ID Reference:	UL/ANSI: FR-4 · ANSI: FR-4/98 · RoHS-compliant
Glass Transition Temperature (T _g):	150 °C – 200 °C

Explanations:

C = preconditioning in humidity chamber
E = preconditioning at temperature

The figures following the letter symbols indicate with the first digit the duration of the preconditioning in hours, with the second digit the preconditioning temperature in °C and with the third digit the relative humidity.

Properties	Units	Laminate thickness < 0.50 mm		Laminate thickness ≥ 0.50 mm	
		Specification	Isola-Value	Specification	Isola-Value
1. Peel Strength , minimum					
A. Low profile copper foil and Very Low Profile copper foil all copper weights >17 µm	N/mm	0.70	n/a*	0.70	n/a*
B. Standard profile copper foil (35 µm)					
1. After thermal stress	N/mm	0.80	1.0	1.05	1.1
2. At 125 °C	N/mm	0.70	1.0	0.70	1.1
3. After process solutions	N/mm	0.55	0.9	0.80	1.0
C. All other foil composite		n/a*	n/a*	n/a*	n/a*
2. Volume Resistivity , minimum					
A. C-96/35/90	MΩ · cm	1,0 · 10 ⁶	2,6 · 10 ⁷	n/a*	n/a*
B. After moisture resistance	MΩ · cm	n/a*	n/a*	1,0 · 10 ⁴	6,5 · 10 ⁷
C. At elevated temperature E 24/125	MΩ · cm	1,0 · 10 ³	1,8 · 10 ⁷	1,0 · 10 ³	2,4 · 10 ⁷
3. Surface Resistivity , minimum					
A. C-96/35/90	MΩ	1,0 · 10 ⁴	2,9 · 10 ⁶	n/a*	n/a*
B. After moisture resistance	MΩ	n/a*	n/a*	1,0 · 10 ⁴	1,1 · 10 ⁶
C. At elevated temperature E 24/125	MΩ	1,0 · 10 ³	3,8 · 10 ⁷	1,0 · 10 ³	1,5 · 10 ⁶
4. Moisture Absorption , maximum	%	n/a*	n/a*	0.80	0.08**
5. Dielectric Breakdown , minimum	kV	n/a*	n/a*	40	44
6. Permittivity @ 1 MHz , maximum					
(Laminate or prepreg as laminated)		5.4	5.1	5.4	4.9
7. Loss Tangent @ 1MHz , maximum					
(Laminate or prepreg as laminated)		0.035	0.014	0.035	0.012
8. Flexural Strength , minimum (as of 0.79 mm thickness)					
A. Length direction	N/mm ²	n/a*	n/a*	415	570
B. Cross direction	N/mm ²	n/a*	n/a*	345	420
9. Flexural Strength @ Elevated Temperature , length direction, minimum	N/mm ²	n/a*	n/a*	n/a*	n/a*
10. Thermal Stress at 288 °C , minimum					
A. Unetched	s	≥ 10	≥ 10	≥ 10	≥ 10
B. Etched	s	≥ 10	≥ 10	≥ 10	≥ 10
11. Electric Strength , minimum (Laminate or prepreg as laminated)	kV/mm	30	40	n/a*	n/a*
12. Flammability	class	V-0	V-0	V-0	V-0
13. Glass Transition Temperature (T_g) DSC	°C	150-200	170	150-200	170
14. Coefficient of Thermal Expansion (CTE) TMA					
Fill direction (below T _g / above T _g)	ppm/K	–	–	–	15/12
Warp direction (below T _g / above T _g)	ppm/K	–	–	–	12/5
Vertical (below T _g / above T _g)	ppm/K	–	–	–	40/200

Tests are carried out in accordance with IPC-650 test methods.

*not applicable **measured at 1.55 mm laminate

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Technical Values

PCL370HR

Specification Sheet #:	IPC-4101B/98
Reinforcement:	woven E-glass
Resin system:	primary: epoxy · secondary: multifunctional epoxy
Flame Retardant Mechanism:	brominated epoxy resin · minimum requirement: V-0
Fillers:	inorganic filler
ID Reference:	UL/ANSI: FR-4 · ANSI: FR-4/98 · RoHS-compliant
Glass Transition Temperature (T _g):	150 °C – 200 °C

Explanations:

C = preconditioning in humidity chamber
E = preconditioning at temperature

The figures following the letter symbols indicate with the first digit the duration of the preconditioning in hours, with the second digit the preconditioning temperature in °C and with the third digit the relative humidity.

Properties	Units	Laminate thickness < 0.50 mm		Laminate thickness ≥ 0.50 mm	
		Specification	Isola-Value	Specification	Isola-Value
1. Peel Strength , minimum					
A. Low profile copper foil and Very Low Profile copper foil all copper weights > 17 µm	N/mm	0.70	n/a*	0.70	n/a*
B. Standard profile copper foil (35 µm)					
1. After thermal stress	N/mm	0.80	1.0	1.05	1.1
2. At 125 °C	N/mm	0.70	1.0	0.70	1.1
3. After process solutions	N/mm	0.55	0.9	0.80	1.0
C. All other foil composite		n/a*	n/a*	n/a*	n/a*
2. Volume Resistivity , minimum					
A. C-96/35/90	MΩ · cm	1,0 · 10 ⁶	2,6 · 10 ⁷	n/a*	n/a*
B. After moisture resistance	MΩ · cm	n/a*	n/a*	1,0 · 10 ⁴	6,5 · 10 ⁷
C. At elevated temperature E 24/125	MΩ · cm	1,0 · 10 ³	1,8 · 10 ⁷	1,0 · 10 ³	2,4 · 10 ⁷
3. Surface Resistivity , minimum					
A. C-96/35/90	MΩ	1,0 · 10 ⁴	2,9 · 10 ⁶	n/a*	n/a*
B. After moisture resistance	MΩ	n/a*	n/a*	1,0 · 10 ⁴	1,1 · 10 ⁶
C. At elevated temperature E 24/125	MΩ	1,0 · 10 ³	3,8 · 10 ⁷	1,0 · 10 ³	1,5 · 10 ⁶
4. Moisture Absorption , maximum	%	n/a*	n/a*	0.80	0.08**
5. Dielectric Breakdown , minimum	kV	n/a*	n/a*	40	44
6. Permittivity @ 1 MHz , maximum					
(Laminate or prepreg as laminated)		5.4	5.1	5.4	4.9
7. Loss Tangent @ 1MHz , maximum					
(Laminate or prepreg as laminated)		0.035	0.014	0.035	0.012
8. Flexural Strength , minimum (as of 0.79 mm thickness)					
A. Length direction	N/mm ²	n/a*	n/a*	415	510
B. Cross direction	N/mm ²	n/a*	n/a*	345	430
9. Flexural Strength @ Elevated Temperature , length direction, minimum	N/mm ²	n/a*	n/a*	n/a*	n/a*
10. Thermal Stress at 288 °C , minimum					
A. Unetched	s	≥ 10	≥ 10	≥ 10	≥ 10
B. Etched	s	≥ 10	≥ 10	≥ 10	≥ 10
11. Electric Strength , minimum (Laminate or prepreg as laminated)	kV/mm	30	40	n/a*	n/a*
12. Flammability	class	V-0	V-0	V-0	V-0
13. Glass Transition Temperature (T_g) DSC	°C	150-200	180	150-200	180
14. Coefficient of Thermal Expansion (CTE) TMA					
Fill direction (below T _g / above T _g)	ppm/K	–	–	–	15/12
Warp direction (below T _g / above T _g)	ppm/K	–	–	–	12/5
Vertical (below T _g / above T _g)	ppm/K	–	–	–	40/225

Tests are carried out in accordance with IPC-650 test methods.

*not applicable **measured at 1.55 mm laminate

USA

Isola USA S.a.r.l.
(Headquarters)
3100 W. Ray Road, Suite 301
Chandler, AZ 85226, USA
Phone: +1/4 80 / 8 93 65 27
Fax: +1/4 80 / 8 93 14 09
E-mail: info@isola-usa.com

EUROPE

Isola GmbH
52353 Düren
Germany
Phone: +49 (0) 24 21/ 80 80
Fax: +49 (0) 24 21/ 8 08 80
E-mail: info-dur@isola-group.com

MAS Italia s.r.l.
Via S. Sebastiano 21
I-51032 Bottegone (PT)
Phone: +39 / 05 73 / 92 22 31
Fax: +39 / 05 73 / 92 22 65
E-mail: info-bot@isola-group.com

Isola Fabrics s.r.l.
Via Matteotti, 120
I-20047 Brugherio (MI)
Phone: +39 / 039 / 2 89 16 47
Fax: +39 / 0 39 / 2 89 16 90
E-mail: info@isola-fabrics.com

ASIA

Isola Asia Pacific
(Hong Kong) Ltd.
Unit 3512 - 3522, 35/F
No. 1 Hung To Road, Kwun Tong,
Kowloon, Hong Kong
Phone: +8 52 / 24 18 - 13 18
Fax: +8 52 / 24 18 - 15 33
E-mail: asia@isola-group.com