



isola

B-IS400 - IS420/2

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

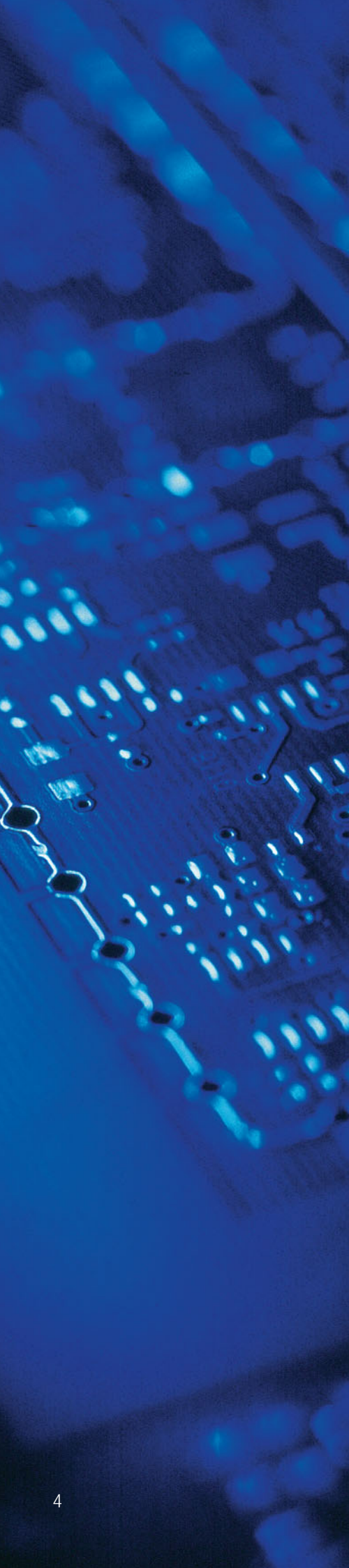
IS400 Standard Prepregs

| 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 |



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 ml/Prepreg |
|------|--------------------|---------------------|---------------|---------------------------|
| 106 | 74 ± 3 | 40 ± 10 | 85 ± 15 | 1.9 ± 0.3 |
| 1080 | 66 ± 3 | 40 ± 10 | 85 ± 15 | 2.3 ± 0.3 |
| 2113 | 57 ± 3 | 40 ± 10 | 85 ± 15 | 3.2 ± 0.3 |
| 2116 | 55 ± 3 | 40 ± 10 | 85 ± 15 | 3.9 ± 0.3 |
| 7628 | 46 ± 3 | 40 ± 10 | 85 ± 15 | 7.2 ± 0.3 |

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 | 63 | 1 x 1080 |
| 0.100 | 0.004 | ± 0.018 | ± 0.013 | 46 | 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 | 49 | 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 | 41 | 2 x 7628 |
| 0.540 | 0.021 | ± 0.064 | ± 0.050 | 41 | 3 x 7628 |
| 0.710 | 0.028 | ± 0.064 | ± 0.050 | 41 | 4 x 7628 |
| 0.900 | 0.035 | ± 0.100 | ± 0.075 | 41 | 5 x 7628M |

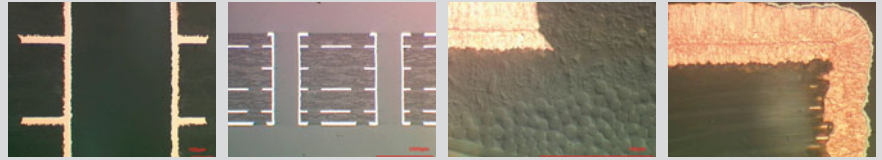
| Nominal thickness | | Thickness tolerance | | Mean resin content % |
|-------------------|-------|-----------------------|-----------------------|-------------------------|
| mm | inch | IPC-4101B cl. L mm | IPC-4101B cl. M mm | |
| 1.550 | 0.061 | ± 0.130 | ± 0.075 | 42 |

Processing Recommendations

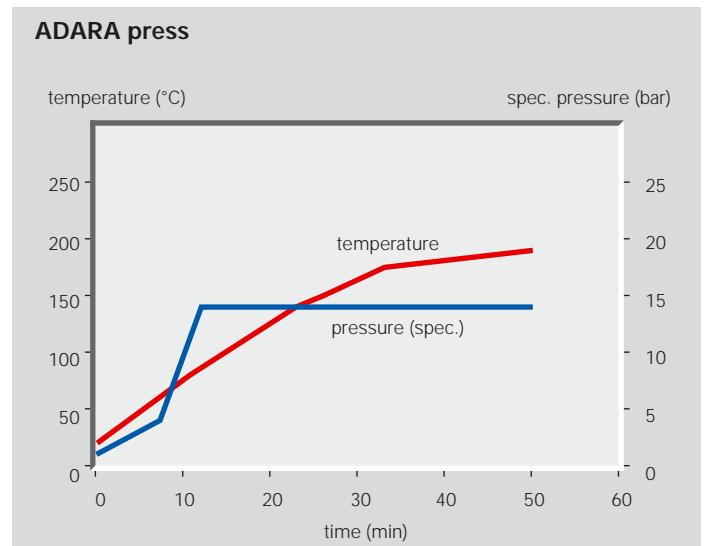
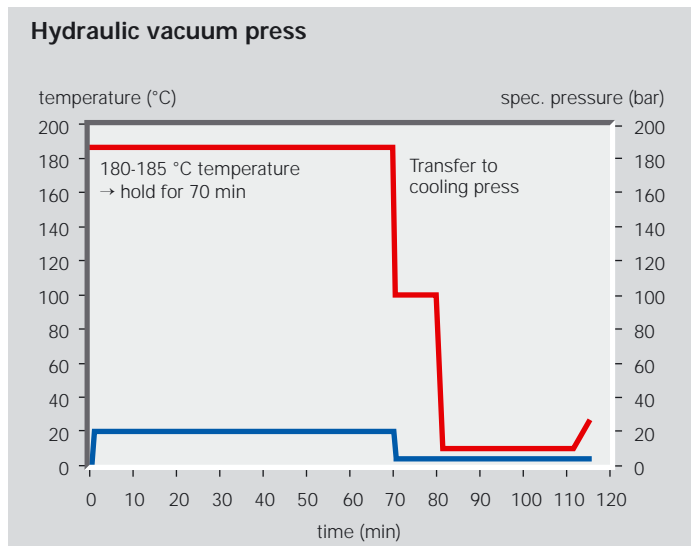
IS420 and PCL370HR should be pressed for 120 minutes at 190 °C and IS400 for 70 minutes at 180 – 185 °C to assure a complete curing of the resin matrix. A post baking of the laminates is not required. We recommend to use copper foil of the type HTG for the multilayer production. As with all filled base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

Cross Sections

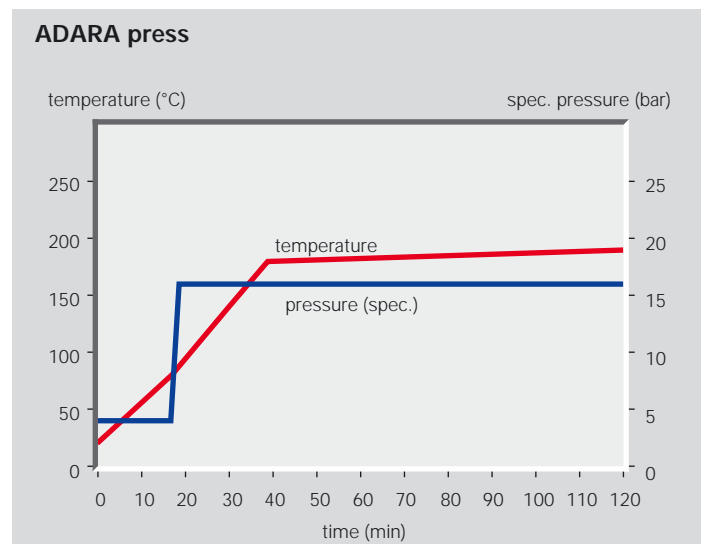
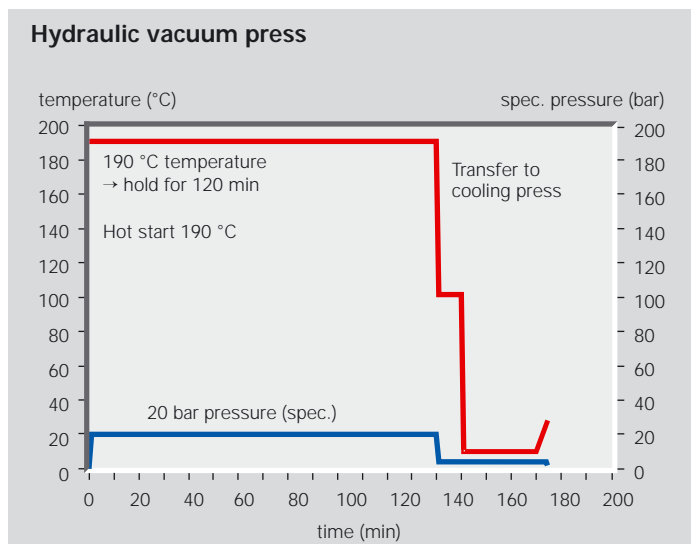
Hole diameter 0.35 mm after 3x reflow, 1.000 thermal cycles -40/+140 °C.



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

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