



# isola

B - D E 1 0 4

***DURAVER<sup>®</sup>-E-Cu***  
***quality 104***  
***quality 104 KF***  
***quality 104 TS***



# Epoxy fibre glass laminate (FR-4)

Circuit boards for computers, communications systems, industrial electronics and electronic devices in aviation and automotive systems, as well as in measurement and control instrumentation must meet stringent requirements.

Requirements which must be met not only as regards the electrical and mechanical properties, but also in terms of dimensional stability and surface quality.

DURAVER®-E-Cu quality 104, 104 KF and 104 TS are glass reinforced laminates based on epoxy resin and adjusted to absorb UV light. Their mechanical strength – particularly their flexural strength and impact strength – is far greater than that of a phenolic or epoxy paper laminate.

The favourable electrical properties remain constant over a long period of time, even under adverse ambient conditions.

## *Thermal and chemical stability*

### DURAVER®-E-Cu quality 104

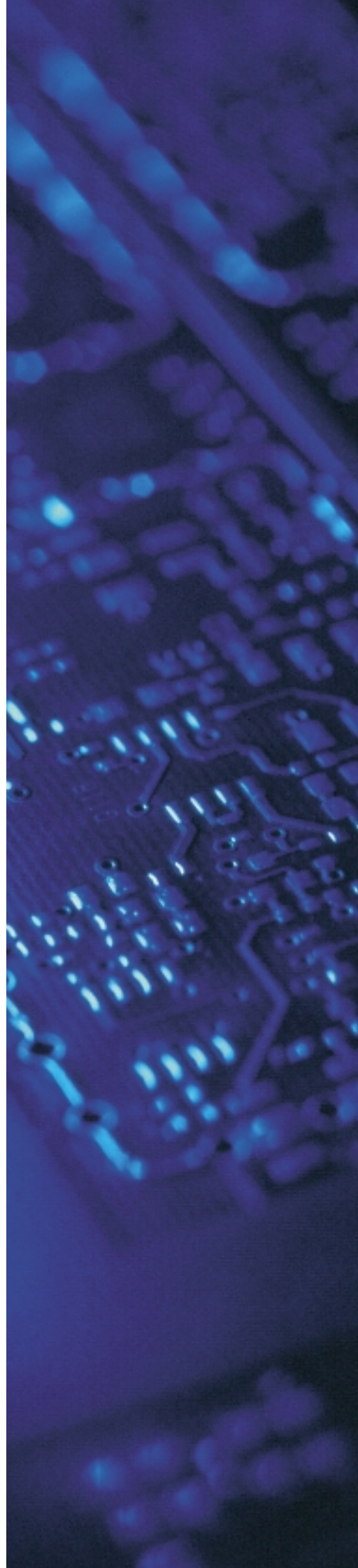
Quality 104 corresponds to NEMA-Quality FR-4 and meets the requirements for flammability class V-0 in accordance with UL 94 (Underwriters' Laboratories, Standard for Safety). The glass transition temperature ( $T_g$ ) equals approx. 135 °C. The laminate is pressed under vacuum, thus yielding significant qualitative advantages which cannot be achieved with conventional bonding technology, such as high dimensional stability, uniform sheet

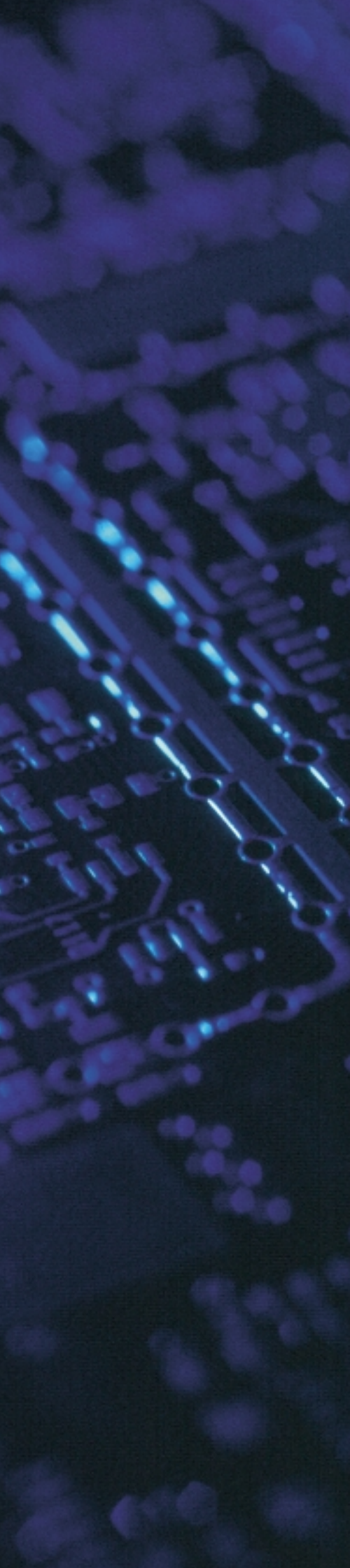
thickness and little surface ripple. The laminate displays very high thermal and chemical stability.

Laminates of this quality are identified by the manufacturer's code "i". Correspondingly identified qualities are not damaged when processed by conventional methods and the characteristic values of the materials are not impaired by such work.

#### DURAVER®-E-Cu quality 104 Standard Thickness

Nominal thickness	IPC 4101		
	Class K	Class L	Class M
mm			
0.80	± 0.165	± 0.100	± 0.075
1.00	± 0.165	± 0.100	± 0.075
1.20	± 0.190	± 0.130	± 0.075
1.50	± 0.190	± 0.130	± 0.075
1.60	± 0.190	± 0.130	± 0.075
2.00	± 0.230	± 0.180	± 0.100
2.40	± 0.230	± 0.180	± 0.100
3.20	± 0.300	± 0.230	± 0.140





## ***track resistant***

# **DURAVER®-E-Cu quality 104 KF**

Tracking can easily occur in a damp, dusty or corrosive environment, such as in dishwashers and washing machines. Quality 104 KF with high tracking resistance (CTI 400) is available as a special quality for such circuit board applications. In accordance with UL 94 (Underwriters' Laboratories, Standard for Safety) the laminate meets the requirements for flammability class V-0.

Laminates of quality 104 KF are identified with the manufacturer's code "i".

### **Testing the tracking resistance**

In order to obtain a standard for assessing the tracking resistance in accordance with practical requirements, the CTI value (or PTI value for short tests) is determined in accordance with DIN IEC 112.

To test the CTI value, a conductive test solution is applied in droplets between two platinum electrodes 4 mm apart and connected to a variable AC voltage.

The voltage value at which 50 droplets does not produce a creepage current in five specimens is determined. Creepage currents similarly must not occur in five additional specimens exposed to 100 droplets at a voltage 25 V below the first value. The resultant voltage value represents the CTI value, the figure being equal to the test voltage applied. DURAVER®-E-Cu quality 104 KF passes the CTI test at an AC voltage of 400 V.

For the short PTI test, an agreed number of specimens must withstand 50 droplets at only one voltage.

### **DURAVER®-E-Cu quality 104 KF Standard Thickness**

Nominal thickness	IPC 4101		
	Class K	Class L	Class M
mm			
1.00	± 0.165	± 0.100	± 0.075
1.50	± 0.190	± 0.130	± 0.075
1.60	± 0.190	± 0.130	± 0.075
2.00	± 0.230	± 0.180	± 0.100

*heat resistant*

## DURAVER®-E-Cu quality 104 TS

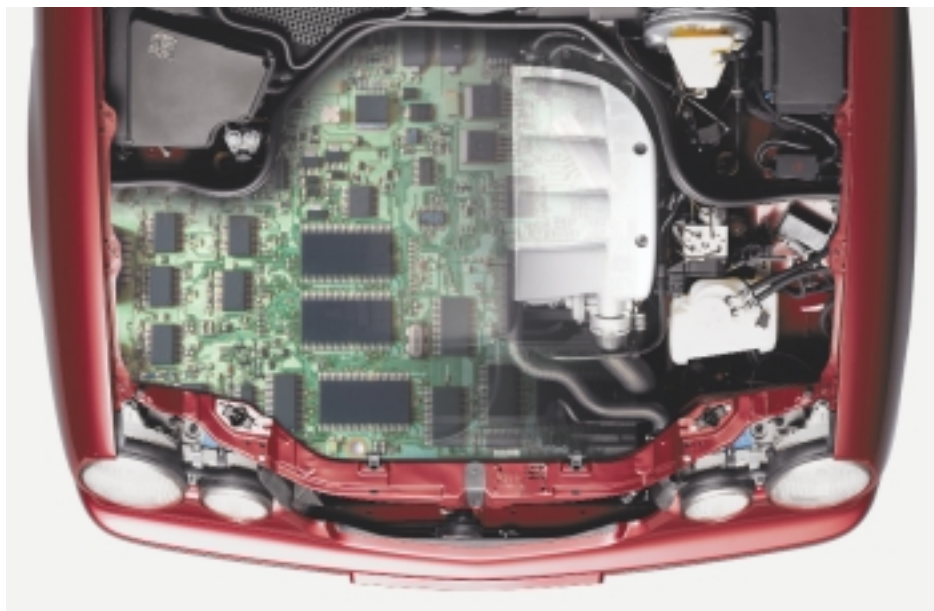
The requirements imposed with regard to the heat resistance of base materials are also rising constantly. The reasons are due not only to the manufacture of subassemblies, but also to the final use for which the circuit board is required. Soldering processes in particular must be considered critical in the manufacture of subassemblies.

New, leadfree solders with higher melting temperatures will be used in future, with the result that the base material must consequently display greater heat resistance.

In automotive electronic systems, circuit boards are increasingly being positioned in the engine compartment. The intense heat radiated in this area

imposes high thermal stresses on the base material. The material is additionally subjected to thermal shocks here and conventional FR-4 qualitys frequently come up against their load limits in such situations.

With the quality 104 TS, Isola has been able to develop a resin formulation with significantly improved thermal stability. In the so-called "T<sub>260</sub> Test", the time required for delamination at 260 °C is in excess of 60 minutes. A standard FR-4 material is delaminated after only 15 minutes at this temperature. In all other respects, quality 104 TS displays the same favourable properties as a standard FR-4 quality.



Source: Daimler Chrysler AG/Isola AG

### DURAVER®-E-Cu quality 104 TS Standard Thickness

Nominal thickness	IPC 4101		
	Class K	Class L	Class M
mm			
0.80	± 0.165	± 0.100	± 0.075
1.00	± 0.165	± 0.100	± 0.075
1.20	± 0.190	± 0.130	± 0.075
1.50	± 0.190	± 0.130	± 0.075
1.60	± 0.190	± 0.130	± 0.075
2.00	± 0.230	± 0.180	± 0.100
2.40	± 0.230	± 0.180	± 0.100
3.20	± 0.300	± 0.230	± 0.140



# Delivery forms and approvals

## Standard sheet sizes

1165 mm x 1070 mm  
1225 mm x 925 mm  
1225 mm x 1070 mm  
1285 mm x 1070 mm

Tolerance: + 3 mm / - 0 mm  
Other sizes on request.

## Standard copper cladding

18 microns, 35 microns and 70 microns,  
one-sided or two-sided.  
Other thicknesses on request.

## Copper foils

Electrodeposited copper foils of maximum purity (at least 98.8%) are used exclusively. These foils are treated on the side in contact with the base material in order to guarantee optimum adhesion.

## Approvals

Underwriters' Laboratories Inc. (UL)  
File No. E41625

## Panels

Panels are supplied cut to specifications, on request also with mechanically profiled edges and rounded corners.

Tolerances:  $\leq 300 \text{ mm} \pm 0.5 \text{ mm}$   
 $> 300 \text{ mm} \pm 0.8 \text{ mm}$

Angular deviation:  
 $\pm 0.40 \text{ mm}/100 \text{ mm}$  edge length

$\pm 0.15 \text{ mm}/100 \text{ mm}$  edge length  
for profiled edges

Various forms of identification are also available, such as laser marking, embossing or ink-jet printing (also as barcode). Pre-cut panels greatly improve the logistics and also reduce the risk of damage to the surface.

# Technical data

## DURAVER®-E-Cu quality 104, -104 KF, -104 TS

Data sheet No.:	IPC-4101/21
Core material:	E-glass fabric
Resin system:	Epoxy, flame retardant
UL-File No.:	E41625, V-0 acc. to 94

### Explanations:

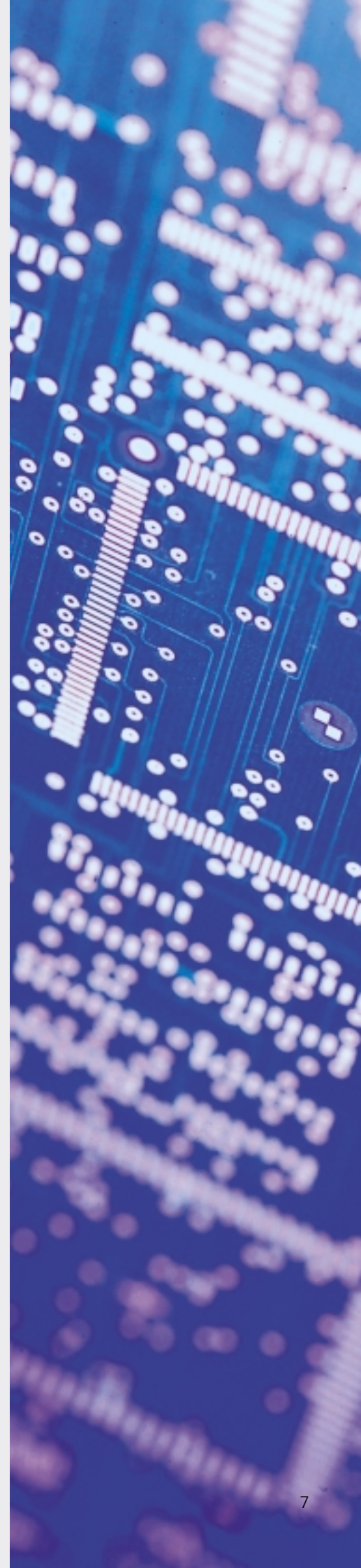
C = preconditioning in humidity chamber  
E = preconditioning at temperature

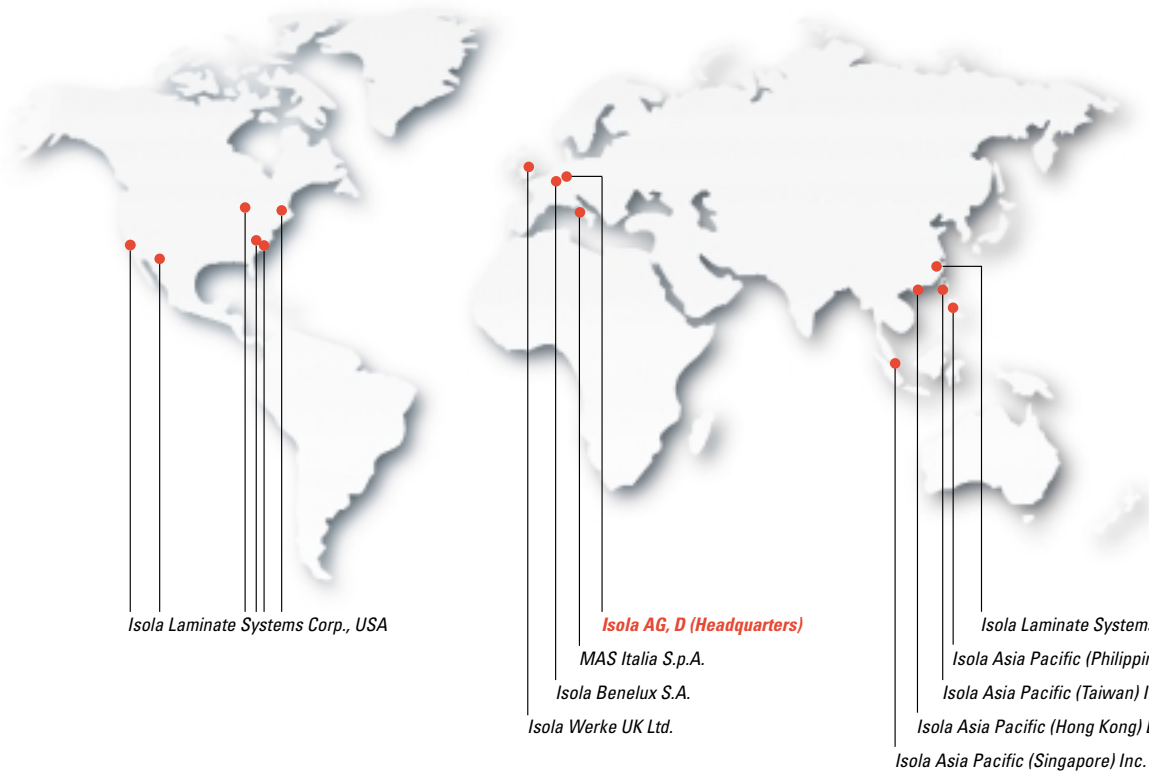
The figures following the letter symbols indicate with the first digit the duration of the preconditioning in hours, with the second digit the preconditioning temperature in °C and with the third digit the relative humidity.

Properties	Unit	Specification
		≥ 0.78 mm
<b>1. Peel Strength</b> , minimum		
A. Low profile copper foil and very low profile copper foil - all copper weights > 17 microns	N/mm	–
B. Standard profile copper foil (35 microns)		
1. After thermal stress	N/mm	1.05
2. At 125 °C	N/mm	0.70
3. After process solutions	N/mm	0.80
C. All other foil-composite	N/mm	–
<b>2. Volume Resistivity</b> , minimum		
A. C-96/35/90	MΩ · cm	–
B. After moisture resistance	MΩ · cm	1.0 · 10 <sup>6</sup>
C. At elevated temperature E-24/125	MΩ · cm	1.0 · 10 <sup>3</sup>
<b>3. Surface Resistivity</b> , minimum		
A. C-96/35/90	MΩ	–
B. After moisture resistance	MΩ	1.0 · 10 <sup>4</sup>
C. At elevated temperature E-24/125	MΩ	1.0 · 10 <sup>3</sup>
<b>4. Moisture Absorption</b> , maximum		
<b>5. Dielectric Breakdown</b> , minimum		
<b>6. Permittivity @ 1 MHz</b> , maximum		
<b>7. Loss Tangent @ 1 MHz</b> , maximum		
<b>8. Flexural Strength</b> , minimum		
A. Length direction	N/mm <sup>2</sup>	415
B. Cross direction	N/mm <sup>2</sup>	345
<b>9. Flexural Strength @ Elevated Temperature</b> length direction, minimum	N/mm <sup>2</sup>	–
<b>10. Thermal Stress @ 288 °C</b> , minimum		
A. Unetched	s	≥ 10
B. Etched	s	≥ 10
<b>11. Electric Strength</b> , minimum	V/mm	–
<b>12. Flammability</b>		
A. Average burn time, maximum	s	5
B. Individual burn time, maximum	s	10
<b>13. Glass Transition Temperature (T<sub>g</sub>) DSC</b>	°C	–
<b>14. Coefficient of Thermal Expansion (α) TMA</b>		
Weft direction (below T <sub>g</sub> /above T <sub>g</sub> )	ppm/K	–
Warp direction (below T <sub>g</sub> /above T <sub>g</sub> )	ppm/K	–
Vertical (below T <sub>g</sub> /above T <sub>g</sub> )	ppm/K	–

All the data contained in this technical information have been carefully compiled. In view of the variety of conditions prevailing in practice, as well as the different process and application technologies used, the data and information contained herein can only serve as guideline values and do not give rise to any rights under warranty terms.

Quality 104 Isola-Value ≥ 0.78 mm	Quality 104 KF Isola-Value ≥ 0.78 mm	Quality 104 TS Isola-Value ≥ 0.78 mm
–	–	–
2.00	1.80	1.40
1.90	1.60	1.20
2.00	1.80	1.35
–	–	–
–	–	–
8.0 · 10 <sup>8</sup>	8.2 · 10 <sup>8</sup>	6.8 · 10 <sup>7</sup>
8.0 · 10 <sup>6</sup>	7.9 · 10 <sup>6</sup>	9.9 · 10 <sup>6</sup>
–	–	–
4.0 · 10 <sup>6</sup>	4.1 · 10 <sup>6</sup>	3.4 · 10 <sup>6</sup>
7.0 · 10 <sup>4</sup>	3.5 · 10 <sup>4</sup>	1.5 · 10 <sup>6</sup>
0.25	0.14	0.16
45	45	42
4.6 - 4.9	4.6 - 4.9	4.6 - 4.9
0.019	0.020	0.021
600	580	550
480	460	450
–	–	–
≥ 10	≥ 10	≥ 10
≥ 10	≥ 10	≥ 10
–	–	–
3	4	3
6	6	6
135	135	135
16/14	16/14	16/14
13/7	13/7	13/7
70/280	70/280	70/280





ASIA

**Isola Asia Pacific (Hong Kong) Ltd.**

Unit 2506-19, Tower 1, Metroplaza  
 223 Hing Fong Road, Kwai Chung, N.T., Hong Kong  
 Phone: +8 52 / 24 18 - 13 18  
 Fax: +8 52 / 24 18 - 15 33  
 E-mail: asia@isolaAG.com  
 Internet: www.isolaAG.com

EUROPE

**Isola AG**

52348 Düren  
 Germany  
 Phone: +49 (0) 24 21/ 80 80  
 Fax: +49 (0) 24 21/ 80 81 64  
 E-mail: europe@isolaAG.com  
 Internet: www.isolaAG.com

USA

**Isola Laminate Systems Corp.**

230 North Front Street  
 La Crosse, WI 54601, USA  
 Phone: +1 6 08 / 7 84 - 60 70  
 Fax: +1 6 08 / 7 84 - 77 53  
 E-mail: usa@isolaAG.com  
 Internet: www.isolaAG.com

10/01 - 09112046