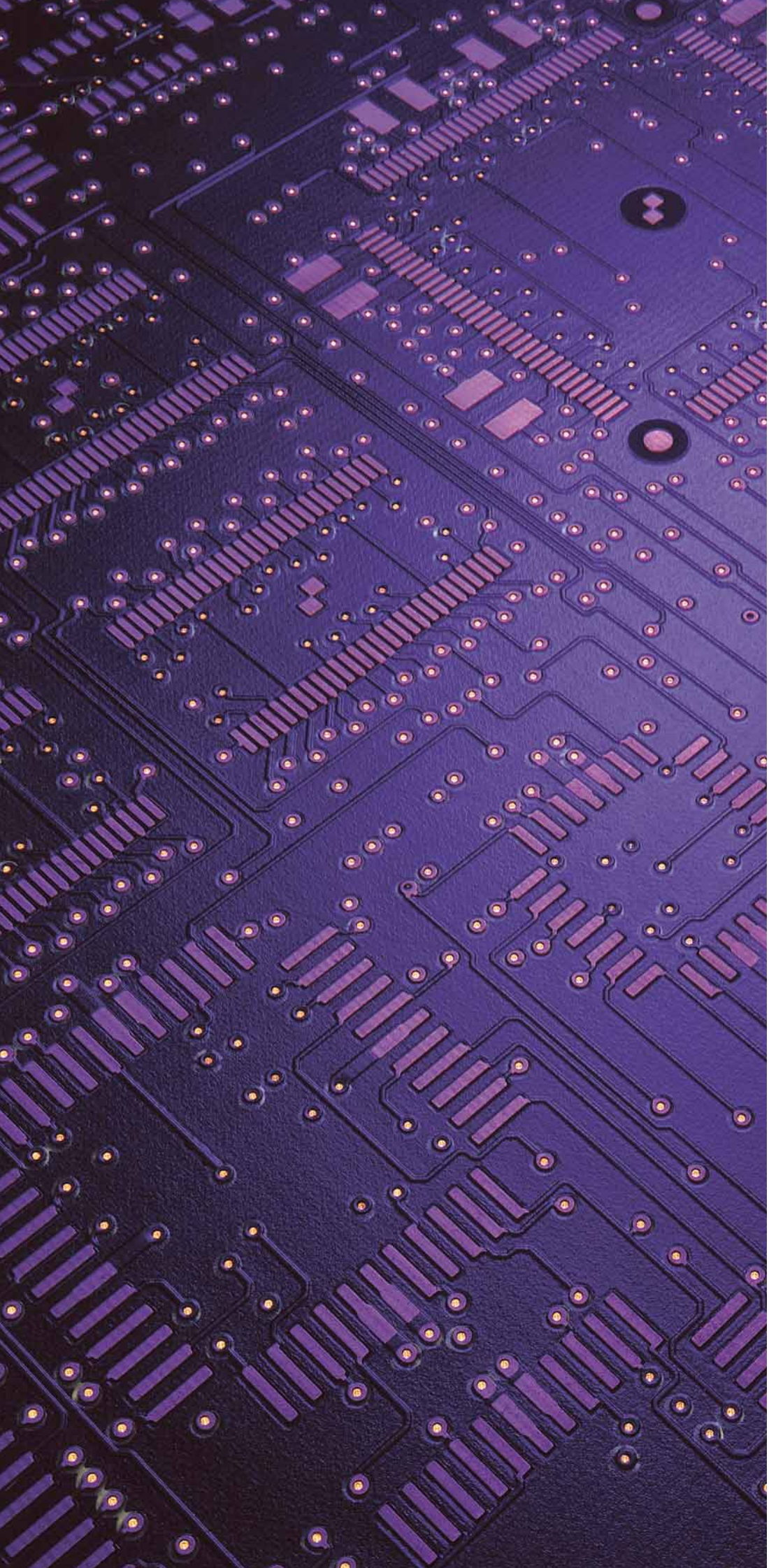


isola

B-DE 104/3

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

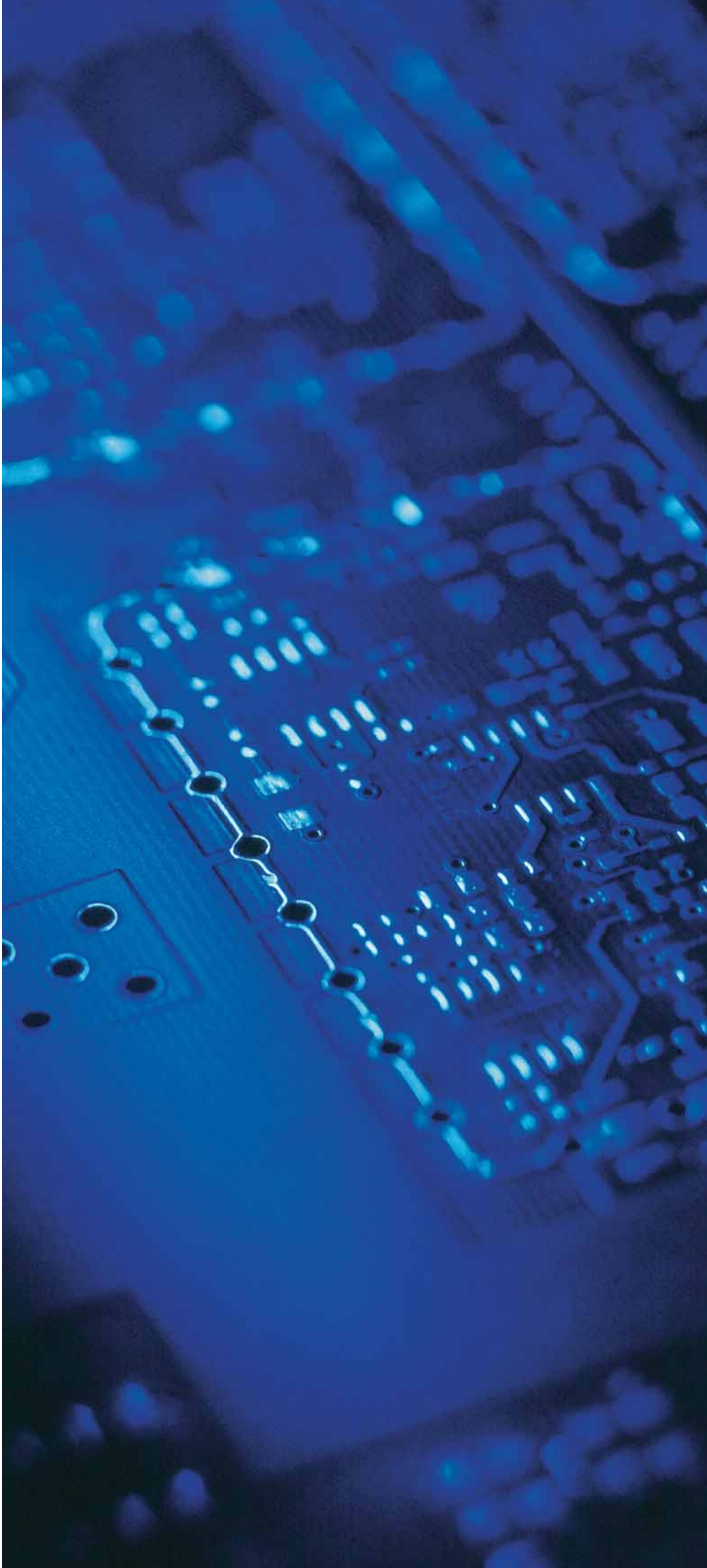
Epoxy fibre glass laminate (FR-4)

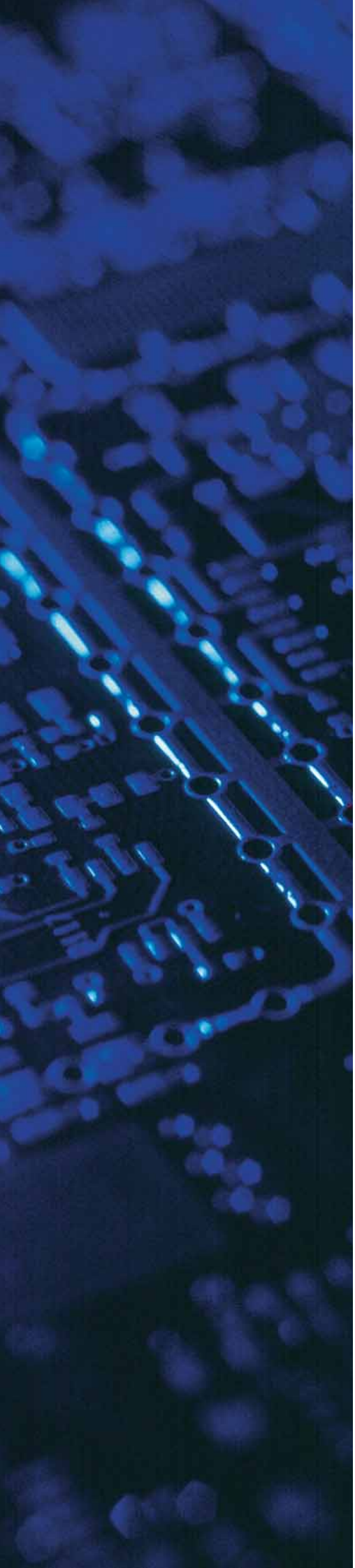
Circuit boards for computers, communications systems, industrial electronics and electronic devices in aviation and automotive systems, as well as in measurement and control instrumentation must meet stringent requirements.

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.

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





Thermal and chemical stability

DURAVER®-E-Cu quality 104

DURAVER®-E-Cu 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 uniform sheet thickness and little surface ripple. The laminate displays very high thermal and chemical stability.

DURAVER®-E-Cu quality 104 Standard Thickness

Nominal thickness	Thickness tolerance	
mm	IPC-4101A cl. L	IPC-4101A cl. M
0.80	± 0.100	± 0.075
1.00	± 0.100	± 0.075
1.20	± 0.130	± 0.075
1.55	± 0.130	± 0.075
2.00	± 0.180	± 0.100
2.40	± 0.180	± 0.100
3.20	± 0.230	± 0.130

Other thicknesses on request.

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. DURAVER®-E-Cu 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.
For the building of multilayers a tracking resistant prepreg type is available (see also brochure B-DE 104 ML/3).

DURAVER®-E-Cu quality 104 KF Standard Thickness

Nominal thickness	Thickness tolerance	
mm	IPC-4101A cl. L	IPC-4101A cl. M
1.55	± 0.130	± 0.075

Other thicknesses on request.

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. Conventional FR-4 qualitys frequently come up against their load limits in such situations.

With DURAVER®-E-Cu quality 104 TS, Isola has been able to develop a resin formulation with significantly improved thermal stability. In the so-called "T_{260} Test", the time required for delamination at 260 °C is in excess of 60 minutes.
Additionally, quality 104 TS displays the same favourable properties as a standard FR-4 quality.

Source: Daimler Chrysler AG/Isola GmbH

DURAVER®-E-Cu quality 104 TS Standard Thickness

Nominal thickness	Thickness tolerance	
mm	IPC-4101A cl. L	IPC-4101A cl. M
0.80	± 0.100	± 0.075
1.00	± 0.100	± 0.075
1.20	± 0.130	± 0.075
1.55	± 0.130	± 0.075
2.00	± 0.180	± 0.100
2.40	± 0.180	± 0.100
3.20	± 0.230	± 0.130

Other thicknesses on request.

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

Typical copper foil thicknesses (18, 35, 70 µm) correspond to IPC-4562, grade 3 (HTE-quality).

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

Panels

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

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

Specification Sheet #:	IPC-4101A/21
Reinforcement:	woven E-glass
Resin system:	primary: difunctional epoxy • secondary: multifunctional epoxy
Flame Retardant Mechanism:	bromine epoxy resin • minimum UL 94 requirement: V-1
Fillers:	inorganic filler in DE 104 KF
ID Reference:	UL/ANSI: FR-4 • ANSI: FR-4/21
Glass Transition (T_g):	110 °C - 150 °C

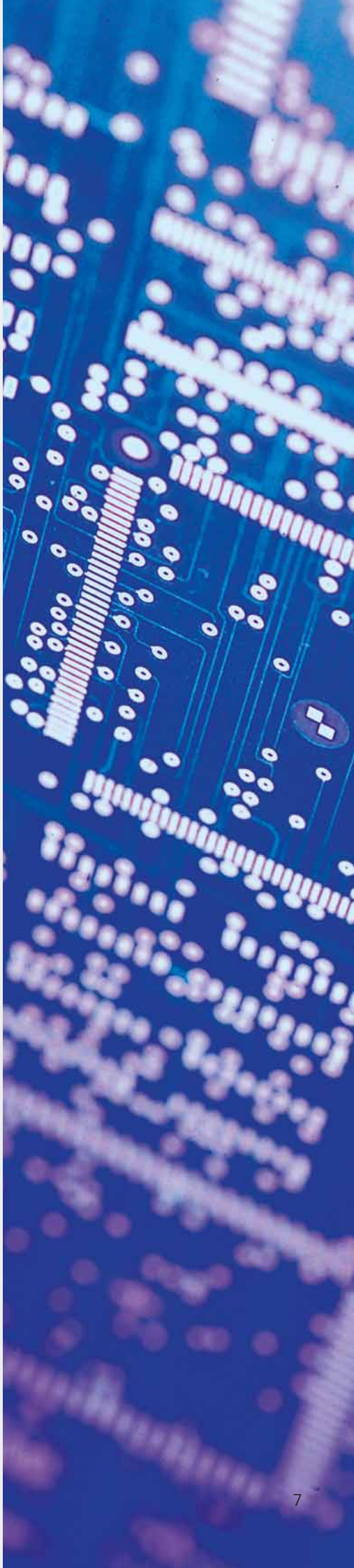
Explanations:
C = preconditioning in humidity chamber
E = preconditioning at temperature

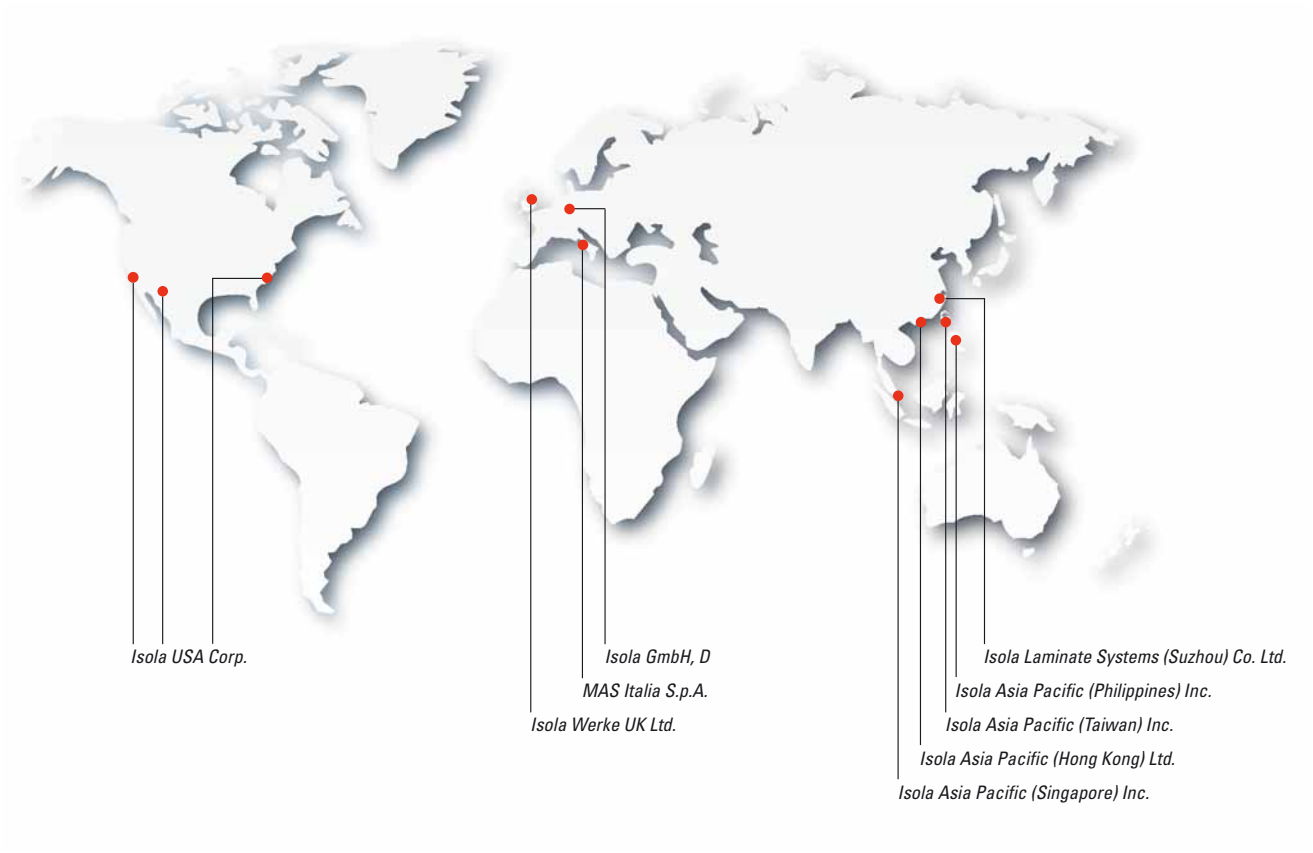
The figures following the letter symbols indicate with the first digit the duration of the preconditioning in hours, with the second digit the preconditioning temperature in °C and with the third digit the relative humidity.

Properties	Unit	Specification
1. Peel Strength, minimum		
A. Low profile copper foil and very low profile copper foil - all copper weights > 17 µm	N/mm	0.70
B. Standard profile copper foil (35 µm)		
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	n/a
2. Volume Resistivity, minimum		
A. C-96/35/90	MΩ · cm	n/a
B. After moisture resistance	MΩ · cm	$1.0 \cdot 10^6$
C. At elevated temperature E-24/125	MΩ · cm	$1.0 \cdot 10^3$
3. Surface Resistivity, minimum		
A. C-96/35/90	MΩ	n/a
B. After moisture resistance	MΩ	$1.0 \cdot 10^4$
C. At elevated temperature E-24/125	MΩ	$1.0 \cdot 10^3$
4. Moisture Absorption, maximum	%	0.80
5. Dielectric Breakdown, minimum	kV	40
6. Permittivity @ 1 MHz, maximum		5.4
7. Loss Tangent @ 1 MHz, maximum		0.035
8. Flexural Strength, minimum		
A. Length direction	N/mm²	415
B. Cross direction	N/mm²	345
9. Flexural Strength @ Elevated Temperature		
length direction, minimum	N/mm²	n/a
10. Thermal Stress @ 288 °C, minimum		
A. Unetched	s	≥ 10
B. Etched	s	≥ 10
11. Electric Strength, minimum	kV/mm	n/a
12. Flammability	class	V-1
13. Glass Transition Temperature (T_g) DSC	°C	110-150
14. Coefficient of Thermal Expansion (α) TMA		
Weft direction (below T_g/above T_g)	ppm/K	–
Warp direction (below T_g/above T_g)	ppm/K	–
Vertical (below T_g/above T_g)	ppm/K	–

*not applicable **measured at 1.55 mm laminate

Laminate thickness ≥ 0.50 mm			
Quality 104 Isola-Value	**Quality 104 KF Isola-Value**	**Quality 104 TS Isola-Value**	**Unit**
n/a*	n/a	n/a	N/mm
2.00	1.80	1.40	N/mm
1.90	1.60	1.20	N/mm
2.00	1.80	1.35	N/mm
n/a	n/a	n/a	N/mm
n/a	n/a	n/a	MΩ · cm
$8.0 \cdot 10^8$	$8.2 \cdot 10^8$	$6.8 \cdot 10^7$	MΩ · cm
$8.0 \cdot 10^6$	$7.9 \cdot 10^6$	$9.9 \cdot 10^6$	MΩ · cm
n/a	n/a	n/a	MΩ
$4.0 \cdot 10^6$	$4.1 \cdot 10^6$	$3.4 \cdot 10^6$	MΩ
$7.0 \cdot 10^4$	$3.5 \cdot 10^4$	$1.5 \cdot 10^6$	MΩ
0.16**	0.13**	0.12**	%
45	45	42	kV
4.6 - 4.9	4.6 - 4.9	4.6 - 4.9	
0.019	0.020	0.021	
600	580	550	N/mm^2
480	460	450	N/mm^2
n/a	n/a	n/a	N/mm^2
≥ 10	≥ 10	≥ 10	s
≥ 10	≥ 10	≥ 10	s
n/a	n/a	n/a	kV/mm
V-0	V-0	V-0	class
135	135	135	°C
16/14	16/14	16/14	ppm/K
13/7	13/7	13/7	ppm/K
70/280	70/280	70/280	ppm/K





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