



isola

B-DE 104i/ML/6

DURAVER[®]-E-Cu
quality 104i
quality 104i ML

Base materials
for high thermal
requirements

DURAVER[®]-E-Cu
quality 104 KF

Base materials with
high tracking
resistance

Thermal and chemical stability

DURAVER[®]-E-Cu quality 104i DURAVER[®]-E-Cu quality 104i ML

Increasing thermal requirements, especially in automotive electronics, have driven to the successful development of this base material. The excellent thermal resistance, due to a suitable resin system as well as due to a low coefficient of thermal expansion in the z-axis, enable a lifespan up to 1000 cycles at temperature change (- 40/+ 125 °C). At lead free reflow soldering 10 cycles could have been reached without any quality loss.

The glass transition temperature is at 135 °C (DSC). Time to delamination of the laminate at a temperature of 260 °C is > 60 minutes and the decomposition temperature T_d at 350 °C. Both qualities are listed as FR-4 and can be processed at standard parameters.

Quality Characteristics

Soldering bath resistance at 288 °C



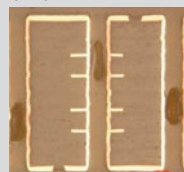
Cross Sections

Result after 10x lead free reflow soldering

drilling diameter
0.5 mm



0.25 mm



Result after 1000 cycles
TWT - 40 °C / + 125 °C

drilling diameter
0.5 mm



0.25 mm



DURAVER®-E-Cu quality 104i Standard Thicknesses

Nominal thickness mm	Thickness tolerance	
	IPC-4101B cl. L	IPC-4101B 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.

DURAVER®-E-Cu quality 104i ML Standard Constructions

Nominal thickness (Substrate without Cu)		Thickness tolerance		Construction	Average resin content %
mm	inch	IPC-4101B cl. B mm	IPC-4101B cl. C mm		
0.075	0.003	± 0.018	± 0.013	1 x 1080	64
0.100	0.004	± 0.018	± 0.013	1 x 2116	46
0.125	0.005	± 0.025	± 0.018	1 x 2165	49
0.150	0.006	± 0.025	± 0.018	1 x 2157	49
0.200	0.008	± 0.038	± 0.025	1 x 7628M	45
0.250	0.010	± 0.038	± 0.025	2 x 2165	49
0.300	0.012	± 0.050	± 0.038	2 x 2157	49
0.360	0.014	± 0.050	± 0.038	2 x 7628M	41
0.410	0.016	± 0.050	± 0.038	2 x 7628M	45
0.510	0.020	± 0.064	± 0.050	3 x 7628	41
0.560	0.022	± 0.064	± 0.050	3 x 7628M	41
0.610	0.024	± 0.064	± 0.050	3 x 7628M	45
0.710	0.028	± 0.064	± 0.050	4 x 7628M	41
0.900	0.035	± 0.100	± 0.075	5 x 7628M	41
1.000	0.039	± 0.100	± 0.075	5 x 7628M	45
1.080	0.042	± 0.130	± 0.075	6 x 7628M	41
1.200	0.047	± 0.130	± 0.075	6 x 7628M	45

Other thicknesses on request.

DURAVER®-E quality 104i ML

Prepreg type	Nominal thickness		Resin content %	Residual gel time @150 °C s	Viscosity Pa · s	Scaled Flow	
	mm	inch				mil/Prepreg	mm/Prepreg
106 AT05	0.058	0.002	75 ± 3	125 ± 20	35 ± 10	n/a	n/a
1080 AT05	0.078	0.003	65 ± 3	125 ± 20	35 ± 10	n/a	n/a
2125 AT05	0.105	0.004	55 ± 3	125 ± 20	35 ± 10	n/a	n/a
2116 AT05	0.119	0.005	53 ± 3	125 ± 20	35 ± 10	n/a	n/a
7628 AT05	0.200	0.008	47 ± 3	125 ± 20	35 ± 10	n/a	n/a
1080 AT99	0.098	0.004	74 ± 3	118 ± 20	45 ± 15	3.0 ± 0.3	0.077 ± 0.008
2116 AT99	0.138	0.006	60 ± 3	118 ± 20	45 ± 15	4.7 ± 0.3	0.120 ± 0.008
7628 AT99	0.217	0.009	51 ± 3	118 ± 20	45 ± 15	7.1 ± 0.3	0.180 ± 0.008

Other fabric types on request.

DURAVER®-E quality 104i KF ML

Prepreg type	Nominal thickness		Resin content %	Residual gel time s	Viscosity Pa · s	Scaled Flow	
	mm	inch				mil/Prepreg	mm/Prepreg
7628 KF13	0.203	0.008	48 ± 3	125 ± 20	-	-	-

Other fabric types on request.

Multilayer press parameters

The flow and polymerization behaviour of the prepregs used for multilayer production are decisively influenced by the following parameters:

- **Prepreg type**

- **Type of multilayer:**

Format, Construction, Layout

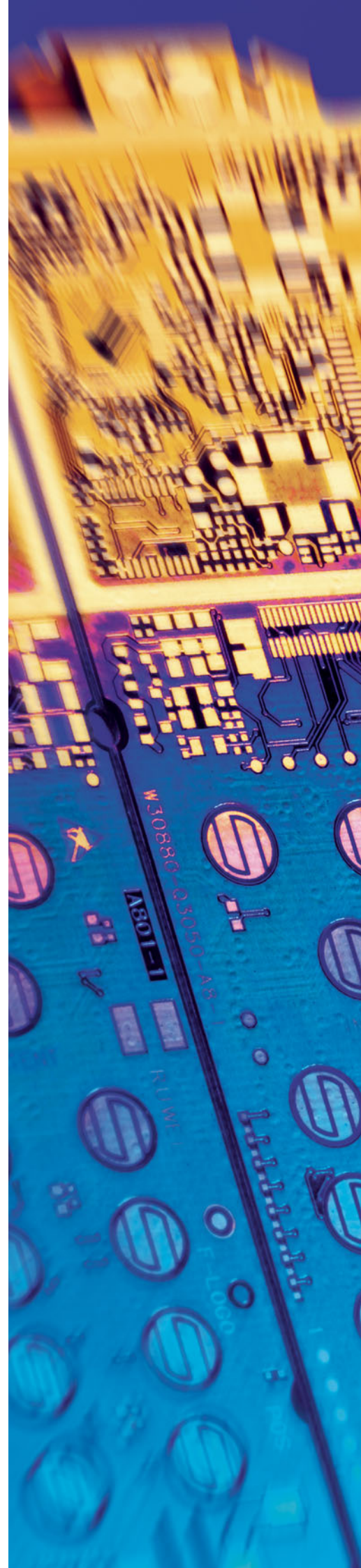
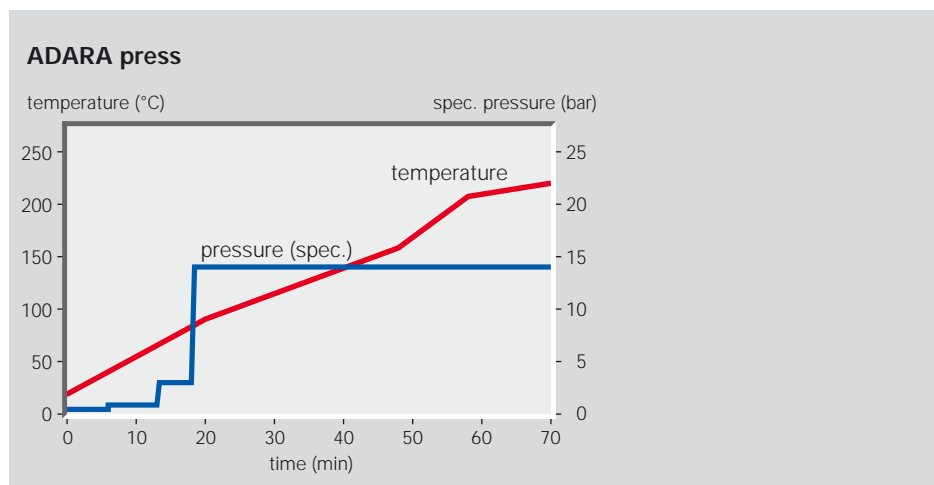
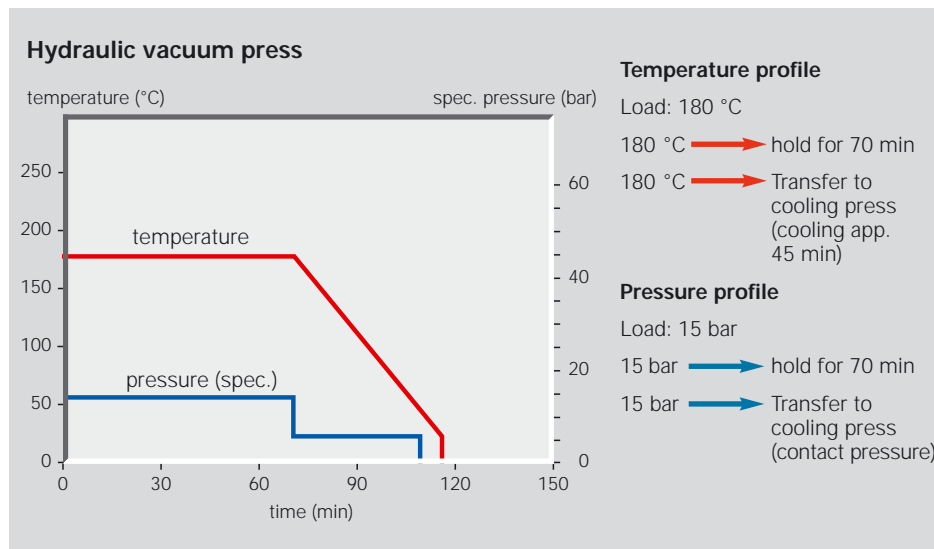
- **Package:**

Mould, Padding, Separating sheets, Package height

- **Press parameters:**

Temperature profile, Pressure profile, Vacuum support

Recommended press parameters



Supply forms and storage

Prepregs

DURAVER®-E quality 104i ML

Prepregs are supplied in rolls or panels.

Supply forms

Rolls:

Standard widths (tolerance ± 5.0 mm) 1250 mm (location oriented); other roll widths available on request.
Standard lengths approx. 150 - 300 m, depending on the type of fabric

Panels:

Produced to customer's specifications (tolerance ± 1.0 mm)

Correct handling and storage of the prepregs are essential prerequisites for trouble-free processing. Isola prepregs are tested in accordance with delivery specifications immediately before

being packaged. The test values obtained in such tests are stated on every package.

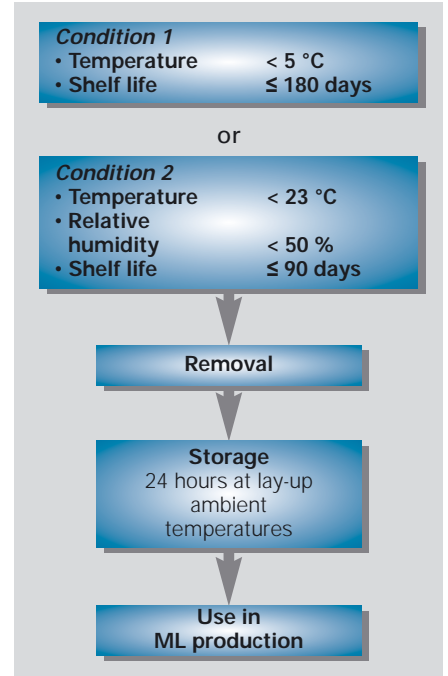
If required, the panels can also be tooled in accordance with specifications, i.e. provided with the reference system for pin-lam technology.

Various blanking tools are available.

Packing

To achieve a reduced handling on the one hand and thereby conditional low dust emerge by packing, we recommend to stack on plastic mini pallets, which can be used all the way to the multilayer lay up station. Thereby the cost for releasing the prepregs from stock will be minimized.

Technical notes for storage of prepregs



Supply forms

Laminates

DURAVER®-E-Cu quality 104i ML

One-sided and two-sided copper-clad laminates are available. Typical copper foil thicknesses (18, 35, 70 μ m) correspond to IPC-4562, grade 3 (HTE-quality).

Sheets

The laminates are produced in the following sheet sizes:

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

Tolerances: + 3.0 mm
- 0 mm

Panels

Panels are supplied cut to specification, with a minimum thickness of 0.25 mm. Mechanically profiled edges are available on request.

Various forms of identification are also available, such as laser marking, embossing or ink-jet printing (also as barcode).

On request the panels can be stacked on plastic mini pallets, which are suitable for a direct binding to the innerlayer production line. Thereby it is possible to reduce additional handling steps, which will have a positive impact on the copper surface quality.

Isola thin laminates are adjusted to absorb UV light. This property helps to reduce the pseudo-error rate in auto-optical inspections (AOI), particularly when using AOI laser scanners which operate with fluorescent methods. Undesired through-exposure (ghosting) on the opposite side is avoided when exposing the solder resist to UV light.

Important note for processing

The warp and weft of the laminates and prepregs must run in the same direction in the multilayers to be laminated. When ordering panels, it is therefore important to specify which value is to correspond to the warp direction.

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.

DURAVER®-E-Cu quality 104 KF Standard Thickness

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

Other thicknesses on request.

Delivery forms and approvals

Standard sheet sizes

1225 mm x 925 mm
1225 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).

Panels

Panels are supplied cut to specification. Mechanically profiled edges and rounded corners are available on request.

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

Approval

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

Technical Values

DURAVER® -E-Cu quality 104i ML

Specification Sheet #:	IPC-4101C/21
Reinforcement:	woven E-glass
Resin system:	primary: difunctional epoxy • secondary: multifunctional epoxy
Flame Retardant Mechanism:	brominated epoxy resin • minimum UL 94 requirement: V-0
Fillers:	inorganic
ID Reference:	UL/ANSI: FR-4 • ANSI: FR-4/21 • 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 microns	N/mm	0.70	1.20	0.70	n/a*
B. Standard profile copper foil (35 microns)					
1. After thermal stress	N/mm	0.80	1.20	1.05	1.20
2. At 125 °C	N/mm	0.70	1.10	0.70	1.10
3. After process solutions	N/mm	0.55	1.20	0.80	1.20
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	6.0 · 10 ⁶	n/a*	n/a*
B. After moisture resistance	MΩ · cm	n/a*	n/a*	1.0 · 10 ⁶	8.0 · 10 ⁸
C. At elevated temperature E-24/125	MΩ · cm	1.0 · 10 ³	7.2 · 10 ⁶	1.0 · 10 ³	1.0 · 10 ⁷
3. Surface Resistivity , minimum					
A. C-96/35/90	MΩ	1.0 · 10 ⁴	1.3 · 10 ⁶	n/a*	n/a*
B. After moisture resistance	MΩ	n/a*	n/a*	1.0 · 10 ⁴	4.0 · 10 ⁶
C. At elevated temperature E-24/125	MΩ	1.0 · 10 ³	3.7 · 10 ⁷	1.0 · 10 ³	7.0 · 10 ⁴
4. Moisture Absorption , maximum	%	n/a*	n/a*	0.80	0.16
5. Dielectric Breakdown , minimum	kV	n/a*	n/a*	40	45
6. Permittivity @ 1 MHz , maximum (Laminate or prepreg as laminated)		5.4	4.6 - 4.9	5.4	4.6 - 4.9
7. Loss Tangent @ 1MHz , maximum (Laminate or prepreg as laminated)		0.035	0.020	0.035	0.019
8. Flexural Strength , minimum					
A. Length direction	N/mm ²	n/a*	n/a*	415	600
B. Cross direction	N/mm ²	n/a*	n/a*	345	480
9. Flexural Strength @ Elevated Temperature, 150 °C 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	39	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	135	110 - 150	135
14. Coefficient of Thermal Expansion (CTE) TMA					
Fill direction (below T _g / above T _g)	ppm/K	–	–	–	17/12
Warp direction (below T _g / above T _g)	ppm/K	–	–	–	12/7
Vertical (below T _g / above T _g)	ppm/K	–	–	–	53/265

*not applicable

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

Our information and our eventual advice for the application of our products in any form (for instance oral, written or by tests) is given carefully and by the best of our knowledge but is not binding and is provided without making any representation or warranty, expressed or implied, and without any liability. The user is not released also in the case of our prior testing or if the use is based on our practical application advice from its sole responsibility to use our product and to insure the correct application, the condition and fitness of our product for this application as well as the condition and fitness of the product itself.

Technical data

DURAVER® -E-Cu quality 104 KF

Specification Sheet #:	IPC-4101C/21
Reinforcement:	woven E-glass
Resin system:	primary: difunctional epoxy · secondary: multifunctional epoxy
Flame Retardant Mechanism:	brominated epoxy resin · minimum UL requirement: V-0
Fillers:	inorganic
ID Reference:	UL/ANSI: FR-4 · ANSI: FR-4/21 · 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	Specification	Laminate thickness ≥ 0.50 mm
			Quality 104 KF 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*
B. Standard profile copper foil (35 µm)			
1. After thermal stress	N/mm	1.05	1.80
2. At 125 °C	N/mm	0.70	1.60
3. After process solutions	N/mm	0.80	1.80
C. All other foil-composite	N/mm	n/a*	n/a*
2. Volume Resistivity , minimum			
A. C-96/35/90	MΩ · cm	n/a*	n/a*
B. After moisture resistance	MΩ · cm	1.0 · 10 ⁶	8.2 · 10 ⁸
C. At elevated temperature E-24/125	MΩ · cm	1.0 · 10 ³	7.9 · 10 ⁶
3. Surface Resistivity , minimum			
A. C-96/35/90	MΩ	n/a*	n/a*
B. After moisture resistance	MΩ	1.0 · 10 ⁴	4.1 · 10 ⁶
C. At elevated temperature E-24/125	MΩ	1.0 · 10 ³	3.5 · 10 ⁴
4. Moisture Absorption , maximum	%	0.80	0.13**
5. Dielectric Breakdown , minimum	kV	40	45
6. Permittivity @ 1 MHz , maximum (Laminate or prepreg as laminated)		5.4	4.6 - 4.9
7. Loss Tangent @ 1MHz , maximum (Laminate or prepreg as laminated)		0.035	0.020
8. Flexural Strength , minimum			
A. Length direction	N/mm ²	415	580
B. Cross direction	N/mm ²	345	460
9. Flexural Strength @ Elevated Temperature length direction, minimum	N/mm ²	n/a*	n/a*
10. Thermal Stress @ 288 °C , minimum			
A. Unetched	s	≥ 10	≥ 10
B. Etched	s	≥ 10	≥ 10
11. Electric Strength , minimum (Laminate or prepreg as laminated)	kV/mm	n/a*	n/a*
12. Flammability	class	V-1	V-0
13. Glass Transition Temperature (T_g) DSC	°C	110-150	135
14. Coefficient of Thermal Expansion (α) TMA			
Weft direction (below T _g /above T _g)	ppm/K	-	16/14
Warp direction (below T _g /above T _g)	ppm/K	-	13/7
Vertical (below T _g /above T _g)	ppm/K	-	45/230
15. Tracking Resistance	V	-	400

Tests will be carried out in accordance with IPC-650 testmethods.

*not applicable **measured at 1.55 mm laminate

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