

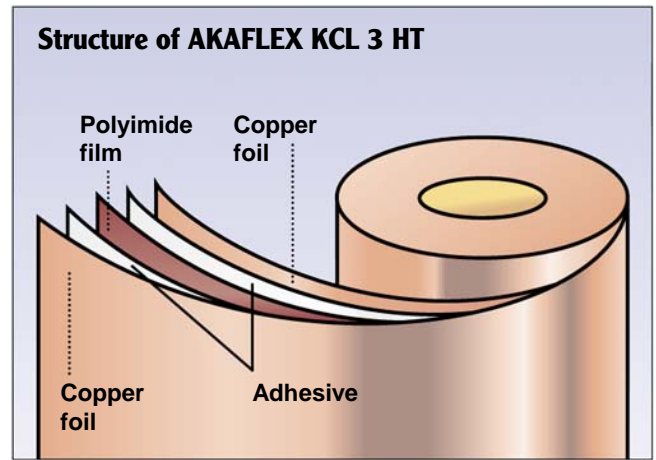
# AKAFLEX® KCL HT: Copper laminates on a polyimide-film backing for flexible printed circuits

## The AKAFLEX® KCL HT programme

AKAFLEX KCL HT is available from KREMPEL as

- ✓ two-layer laminates and
- ✓ three-layer laminates.

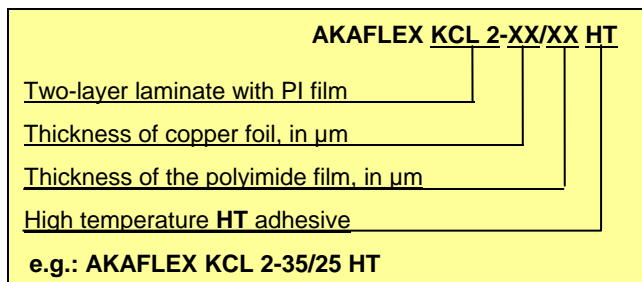
Polyimide film (PI) is used as the backing material for the copper. This is laminated with electrolytic (ED) copper foil on one or both sides. A modified epoxy system characterised by very good temperature stability has been developed for the HT product family. In combination with polyimide film, the bonding system used here reaches a temperature index per UL 796 of 150 °C. AKAFLEX KCL HT is **halogen-free** and meets the requirements of **UL 94V-0** for **flame retardance**. The material is compatible with all soldering processes and suitable for surface mounting techniques.



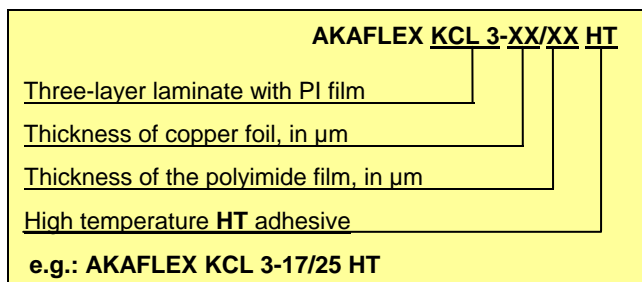
®

### Standard types of AKAFLEX KCL HT

#### Designation for a two-layer laminate



#### Designation for a three-layer laminate



Standard type designation	Thickness of copper foil	Thickness of polyimide film
<b>Two-layer laminates</b>		
KCL 2- 5/25 HT*	5 µm	25 µm
KCL 2- 9/25 HT*	9 µm	25 µm
KCL 2-17/25 HT	17 µm	25 µm
KCL 2-17/50 HT	17 µm	50 µm
KCL 2-35/25 HT	35 µm	25 µm
KCL 2-35/50 HT	35 µm	50 µm
KCL 2-35/75 HT	35 µm	75 µm
KCL 2-35/125 HT*	35 µm	125 µm
KCL 2-70/25 HT*	70 µm	25 µm
KCL 2-70/50 HT*	70 µm	50 µm
<b>Three-layer laminates</b>		
KCL 3-17/25 HT	17 µm	25 µm
KCL 3-17/50 HT	17 µm	50 µm
KCL 3-35/25 HT	35 µm	25 µm
KCL 3-35/50 HT	35 µm	50 µm

**Other types  
on request**

5.2.1

\* Datasheet being developed

All values stated are to be seen as typical values. We reserve the right to introduce changes within the framework of further technical development. We do not accept any obligations or liabilities in respect of this information. Status: 06/2007  
August Krempel Soehne GmbH+Co. KG · P.O.Box 1240 D-71655 Vaihingen · Tel. (+49) 7042 915-0 · e-mail: info@krempel.com

## Processing AKAFLEX® KCL HT

AKAFLEX KCL HT can be processed »reel to reel« by screen-printing or photolithography and the standard etching and cleaning techniques. The technical advantages in manufacturing are assured in this way.

A comprehensive range of **coverlays** for **mechanical protection** of the etched circuits is available from KREMPEL. Diverse **bonding films** are also available for manufacturing **multilayer** circuits.

We use modified **epoxy-resin adhesives** only. This means that no special plasma treatment is necessary in the manufacture of flexible multilayer circuits.

## Quality assurance

All AKAFLEX products are subject to the procedures of on-going quality control as defined in the Quality Assurance Handbook of August Krempel Soehne. This quality assurance system is certified as meeting the requirements of ISO 9001 and ISO/TS 16949. For AKAFLEX KCL HT, testing is performed on the master reels according to the methods of IPC-TM 650. The test results are evaluated in accordance with IPC-4204/2. The AKAFLEX KCL HT types also have UL 94V-0 recognition.



**Certified according to ISO 9001, ISO/TS 16949 and UL 94V-0**

## Availability of AKAFLEX® KCL HT

- ✓ **Standard reel width:**  
610 mm, 500 mm or 305 mm;  
other widths on request
- ✓ **Standard reel length:**  
100 m;  
other lengths on request
- ✓ **Format:**  
As requested by the customer
- ✓ **Packaging:**  
Reels suspended in robust corrugated-cardboard cartons
- ✓ **Standard cores:**  
Inside diameter 76 mm
- ✓ **Certificate:**  
Test certificate according to EN 10 204 - 2.2

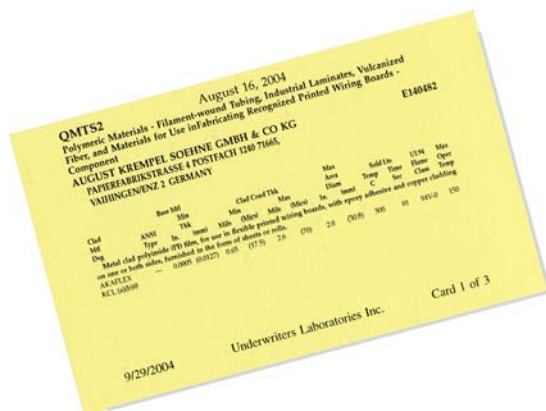
**halogenfree**

**Technical data for AKAFLEX® KCL 2-17/25 HT**  
**17 µm copper foil / 25 µm polyimide film**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9	> 0.7	> 1.3	N/mm	> 7.4	lb/in
- after solder dip	2.4.9	> 0.525	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9	> 0.7	> 1.3	N/mm	> 7.4	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 2000	cycles	> 2000	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C)</b>	2.2.4 Method C	< 0.2	0.09	%	0.09	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
<b>at 288 °C</b>	2.4.13 B	> 10	> 180	sec	> 180	sec
<b>at 300 °C</b>	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D 150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable

DBD = Data Being Developed



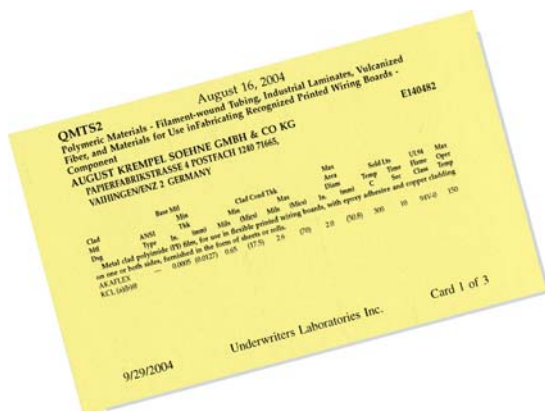
**halogenfree**

**Technical data for AKAFLEX® KCL 2-17/50 HT**  
**17 µm copper foil / 50 µm polyimide film**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9	> 0.7	> 1.3	N/mm	> 7.4	lb/in
- after solder dip	2.4.9	> 0.525	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9	> 0.7	> 1.3	N/mm	> 7.4	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 700	cycles	> 700	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C)</b>	2.2.4 Method C	< 0.2	0.08	%	0.08	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
<b>at 288 °C</b>	2.4.13 B	> 10	> 180	sec	> 180	sec
<b>at 300 °C</b>	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D 150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable

DBD = Data Being Developed

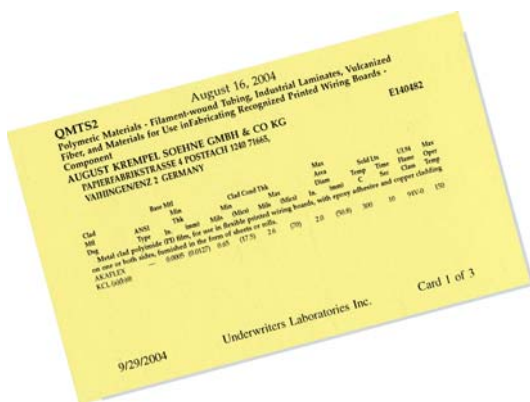


**Technical data for AKAFLEX® KCL 2-35/25 HT**  
**35 µm copper foil / 25 µm polyimide film**

**halogenfree**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9	> 1.4	> 1.5	N/mm	> 8.6	lb/in
- after solder dip	2.4.9	> 1.225	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9	> 1.4	> 1.5	N/mm	> 8.6	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 400	cycles	> 400	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C)</b>	2.2.4 Method C	< 0.2	0.1	%	0.1	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
<b>at 288 °C</b>	2.4.13 B	> 10	> 180	sec	> 180	sec
<b>at 300 °C</b>	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D 150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable  
DBD = Data Being Developed

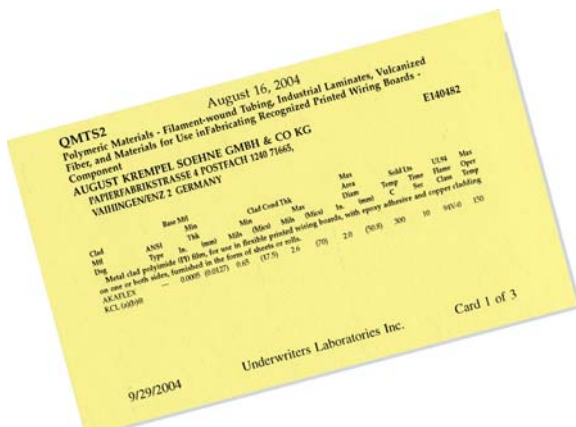


**Technical data for AKAFLEX® KCL 2-35/50 HT**  
**35 µm copper foil / 50 µm polyimide film**

**halogenfree**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9	> 1.4	> 2.1	N/mm	> 12.0	lb/in
- after solder dip	2.4.9	> 1.225	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9	> 1.4	> 1.5	N/mm	> 8.6	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 400	cycles	> 400	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C)</b>	2.2.4 Method C	< 0.2	0.05	%	0.05	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
at 288 °C	2.4.13 B	> 10	> 180	sec	> 180	sec
at 300 °C	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D 150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable  
DBD = Data Being Developed

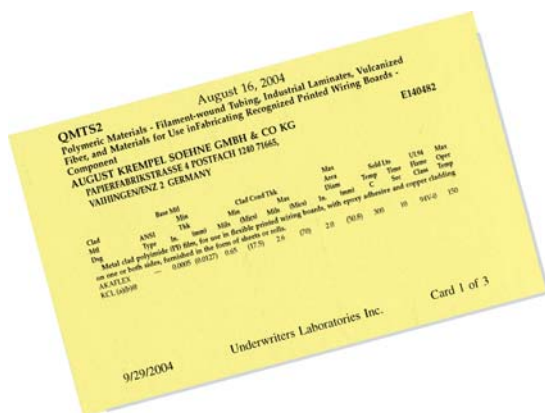


**halogenfree**

**Technical data for AKAFLEX® KCL 2-35/75 HT**  
**35 µm copper foil / 75 µm polyimide film**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9	> 1.4	> 2.4	N/mm	> 13.7	lb/in
- after solder dip	2.4.9	> 1.225	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9	> 1.4	> 1.7	N/mm	> 9.7	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 400	cycles	> 400	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C)</b>	2.2.4 Method C	< 0.2	0.05	%	0.05	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
<b>at 288 °C</b>	2.4.13 B	> 10	> 180	sec	> 180	sec
<b>at 300 °C</b>	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D 150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable  
DBD = Data Being Developed

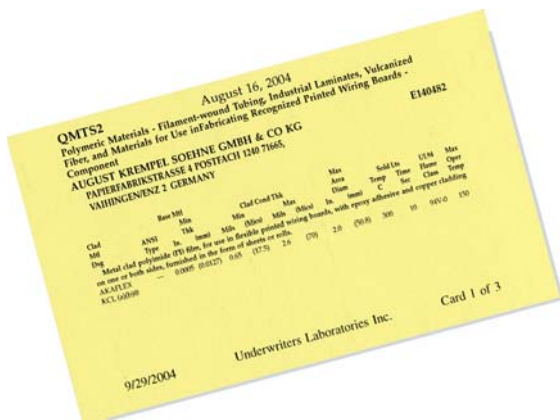


**halogenfree**

**Technical data for AKAFLEX® KCL 3-17/25 HT**  
17 µm copper foil / 25 µm polyimide film / 17 µm copper foil

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9 B	> 0.7	> 1.3	N/mm	> 7.4	lb/in
- after solder dip	2.4.9 D	> 0.525	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9 F	> 0.7	> 1.3	N/mm	> 7.4	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 100	cycles	> 100	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C/300°F)</b>	2.2.4 Method C	< 0.2	0.1	%	0.1	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
at 288 °C	2.4.13 B	> 10	> 180	sec	> 180	sec
at 300 °C	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D-150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable  
DBD = Data Being Developed



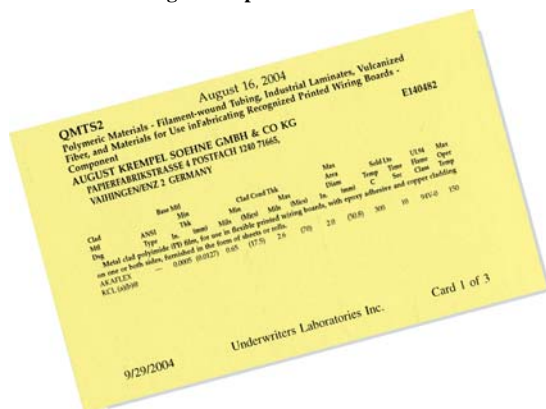


**Technical data for AKAFLEX® KCL 3-17/50 HT**  
17 µm copper foil / 50 µm polyimide film / 17 µm copper foil

**halogenfree**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9 B	> 0.7	> 1.3	N/mm	> 7.4	lb/in
- after solder dip	2.4.9 D	> 0.525	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9 F	> 0.7	> 1.3	N/mm	> 7.4	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 100	cycles	> 100	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C/300°F)</b>	2.2.4 Method C	< 0.2	0.1	%	0.1	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
at 288 °C	2.4.13 B	> 10	> 180	sec	> 180	sec
at 300 °C	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D-150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable  
DBD = Data Being Developed

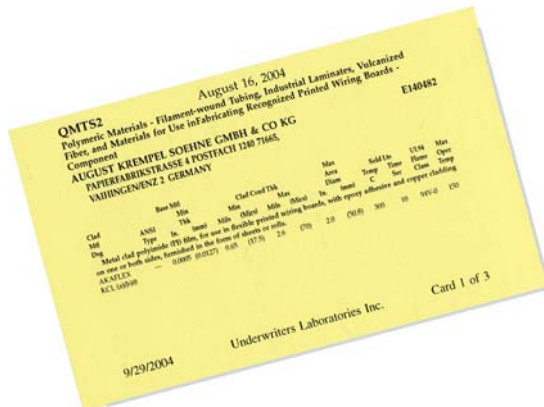


**Technical data for AKAFLEX® KCL 3-35/25 HT**  
35 µm copper foil / 25 µm polyimide film / 35 µm copper foil

**halogenfree**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9 B	> 1.4	> 2.1	N/mm	> 12.0	lb/in
- after solder dip	2.4.9 D	> 1.225	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9 F	> 1.4	> 2.0	N/mm	> 11.4	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 40	cycles	> 40	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C/300°F)</b>	2.2.4 Method C	< 0.2	0.04	%	0.04	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
at 288 °C	2.4.13 B	> 10	> 180	sec	> 180	sec
at 300 °C	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D-150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable  
DBD = Data Being Developed



## Technical data for AKAFLEX® KCL 3-35/50 HT

35 µm copper foil / 50 µm polyimide film / 35 µm copper foil

**halogenfree**

Laminate properties	Test method IPC-TM 650	IPC-4204/2 May 2002	Typical values			
<b>Peel strength</b>						
- as delivered	2.4.9 B	> 1.4	> 2.1	N/mm	> 12.0	lb/in
- after solder dip	2.4.9 D	> 1.225	> 1.25	N/mm	> 7.1	lb/in
- after temperature cycling	2.4.9 F	> 1.4	> 2.0	N/mm	> 11.4	lb/in
<b>Tensile strength</b>	2.4.19	> 165	> 165	N/mm <sup>2</sup>	>23.9x10 <sup>3</sup>	psi
<b>Failure strain</b>	2.4.19	> 25	> 45	%	> 45	%
<b>Initial tear strength</b>	2.4.16	> 5	> 5	N	> 17.6	oz
<b>Flexural strength</b>	2.4.3 Equipment per 2.4.3.1 Test mandrel d=2 mm	N/A	> 35	cycles	> 35	cycles
<b>Dimensional stability (after etching and 30 min. at 150 °C/300°F)</b>	2.2.4 Method C	< 0.2	0.05	%	0.05	%
<b>Solder-bath stability at 260 °C</b>	2.4.13 A	N/A	N/A	sec	N/A	sec
<b>at 288 °C</b>	2.4.13 B	> 10	> 180	sec	> 180	sec
<b>at 300 °C</b>	2.4.13 B	--	> 180	sec	> 180	sec
<b>Solder-bath stability at 260 °C without pre-drying</b>	2.4.13 72h at 65%rh	--	> 10	sec	> 10	sec
<b>Temperature index</b>	UL 796	DBD	150	°C	300	°F
<b>CTI (Comparative Tracking Index)</b>	DIN IEC 60112	--	175	--	175	--
<b>Dissipation factor (at 1 MHz)</b>	ASTM D-150	< 0.04	< 0.03	--	< 0.03	--

N/A = Not Applicable

DBD = Data Being Developed

