FLEXIBLE MATERIAL

IMS - MCCL

AISMALIBAR FLEXTHERM is a high technology thermal insulated metal substrate, also known as a metal core copper clad laminate, for use in the production of conformable metal printed circuit boards.

Its low thermal impedance allows the dissipation of temperature from the heating elements of a PCB into FLEXTHERM's metal core at an extremely efficient rate.

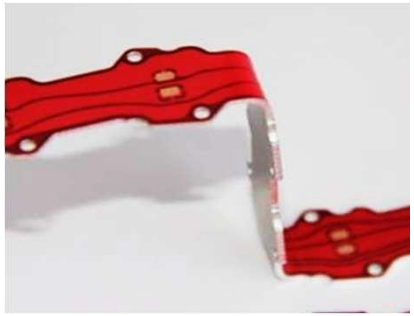
DESCRIPTION:

FLEXTHERM is ideal to produce conformable MPCB's which can be bent without compromising the initial dielectric strength between conductive layers. (Al and Cu).

FLEXIBLE AND COMFORMABLE

The flexible properties of this new material enable it to conform to both the negative and positive radius allowing the product to adapt to the ever changing demands of the industry.

Typical applications for FLEXTHERM are high power LED, power supply modules and the automotive industry.



FLEXTHERM®

DATA SHEET
FLEXTHERM

DS_160727

DESCRIPTION

Insulated Metal Substrate (IMS), based aluminum clad with RA copper foil on one or both sides. It is designed for the reliable thermal dissipation of circuitry.

FLEXTHERM is ideal for conformable MPCB manufacturing. It can be bent after MPCB production while maintaining the initial dielectric strength in between conductive layers (Al and Cu).

SPECIFICATIONS

- **Withstands Lead Free Soldering process**
- **Excellent for high temperature components applications**
- **Extremely low thermal impedance**
- **V-0 Granted**
- **Halogen Free**
- **High MOT values**
- **Produced with RA copper to grant conformable properties**

The material is supplied with a film on the aluminium side to protect it against wet PCB processes.

ROHS compliance directive 2002/95/EC and REACH N° 1907/2006 IPC-4101

STANDARD CONSTRUCTIONS

Aluminium thickness, µm (inch)	800 (0,032) - 1000 (0,039)– 1500 (0,059)	Aluminium Alloy / Treat	1050-3003 -5052-5754
Insulation thickness, µm	25 (0,98 mils) -35 (1.38 mils)	Dielectric thickness tolerance	± 8 µm (0.1 mils)
RA copper thickness, µm	35 (1oz) – 70 (2oz)		
Other constructions available upon request			

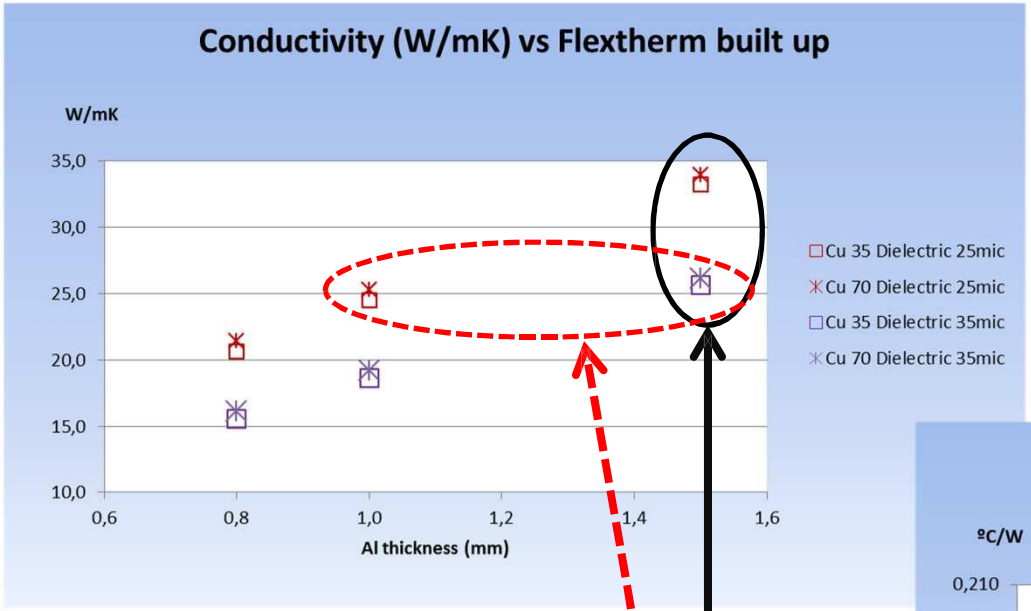
PROPERTIES 1500 µm Al / 25 µm dielectric / 35 µm Cu	TEST METHOD	UNITS	TYPICAL VALUES	Guaranteed values
Time to blister at 288°C, floating on solder (50 x 50 mm)	IEC-61189	sec	>60	>30
Copper Peel strength, after heat shock 20 sec/288°C	IPC-TM 650-2.4.8	N/mm (Lb/inch)	1,5 (16,0)	>1,0 (>10,3)
Dielectric breakdown voltage, AC **(1) Flextherm 25µm**	IPC-TM 650-2.5.6.3	kV	2	2
Dielectric breakdown voltage, AC **(1) Flextherm 35µm**			4	4
Thermal conductivity (dielectric layer)	ASTM-D 5470	W/mK (W/in·K)	0,7 (0,018)	0,6 (0,015)
Flammability, according UL-94, class	UL-94	Class	V-0	V-0
Thermal Impedance °C-m²/watt **Flextherm 25 µm**	Calculated	Kcm²/W (K in²/W)	0,36 (0,055)	0,42 (0,065)
Thermal Impedance °C-m²/watt **Flextherm 35 µm**			0,50 (0,078)	0,58 (0,090)
Maximum Operational Temperature		°C	140	130
Aluminium Thermal Conductivity	ASTM-D 5470	W/mK	135	130
Copper Thermal Conductivity	ASTM-D 5470	W/mK	375	380

(*) Values or parameters measured with a destructive method or limited size for the test sample must be considered as a representative values, and not as guaranteed values. They are not guaranteed over 100% of the material.

Thermal impedance profile

	THERMAL CONDUCTIVITY AND THERMAL IMPEDANCE										
	Composition				Dielectric layer				IMS (Aluminium+dielectric+copper)		
	Aluminium		Copper		Thickness		Cond.	Rth	Cond.		Rth
	mm	inch	mic	Onz	mic	(mil)	W/mK	ºC/W	W/mK	Kinch2/W	ºC/W
Flextherm 25mic	0,8	0,031	35	1					**20,6**	0,065	0,139
	0,8	0,031	70	2					**21,4**	0,065	0,139
	1	0,039	35	2	25	1,0	**0,7**	0,119	**24,5**	0,067	0,144
	1	0,039	70	2					**25,3**	0,067	0,144
	1,5	0,059	35	1					**33,3**	0,073	0,156
	1,5	0,059	70	2					**33,9**	0,073	0,157
Flextherm 35mic	0,8	0,031	35	1					**15,5**	0,087	0,187
	0,8	0,031	70	2					**16,1**	0,087	0,187
	1	0,039	70	2	35	1,4	**0,7**	0,167	**19,2**	0,089	0,192
	1	0,039	70	2					**19,2**	0,089	0,192
	1,5	0,059	35	1					**25,7**	0,095	0,204
	1,5	0,059	70	2					**26,2**	0,095	0,204

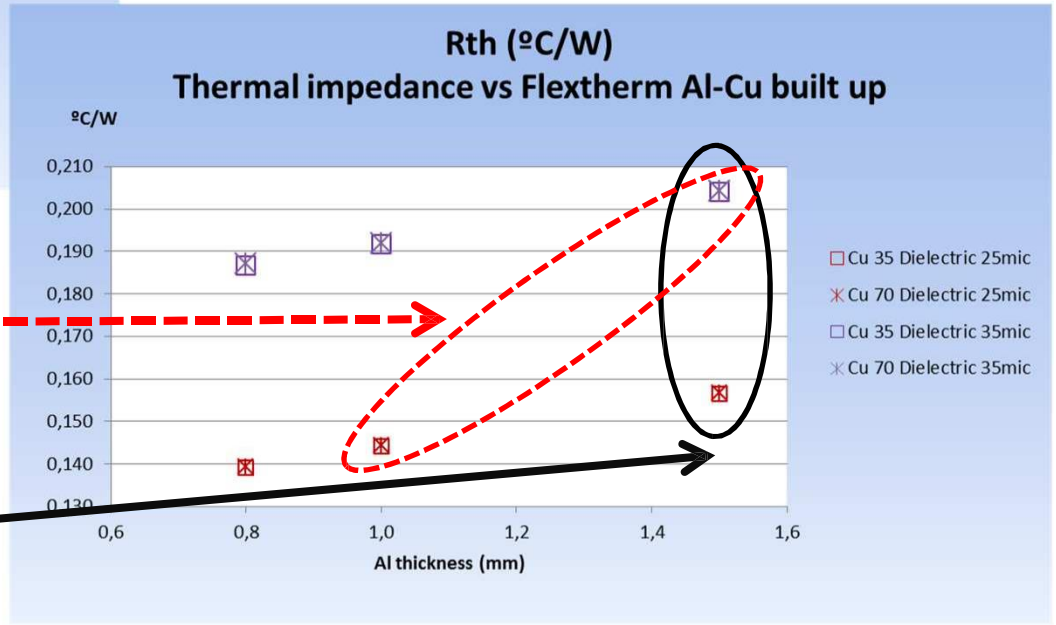
Thermal impedance profile



Thermal impedance is affected mainly by aluminum and dielectric thickness.

Copper thickness has practically no influence.

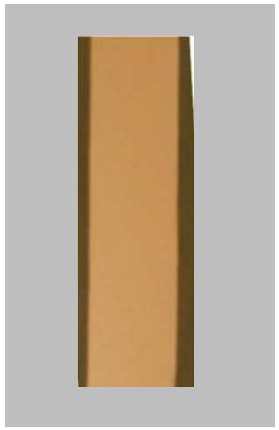
In spite of the thermal conductivity W/mK is higher or similar, due to the total thickness of the M-PCB, the final thermal resistance is worse.

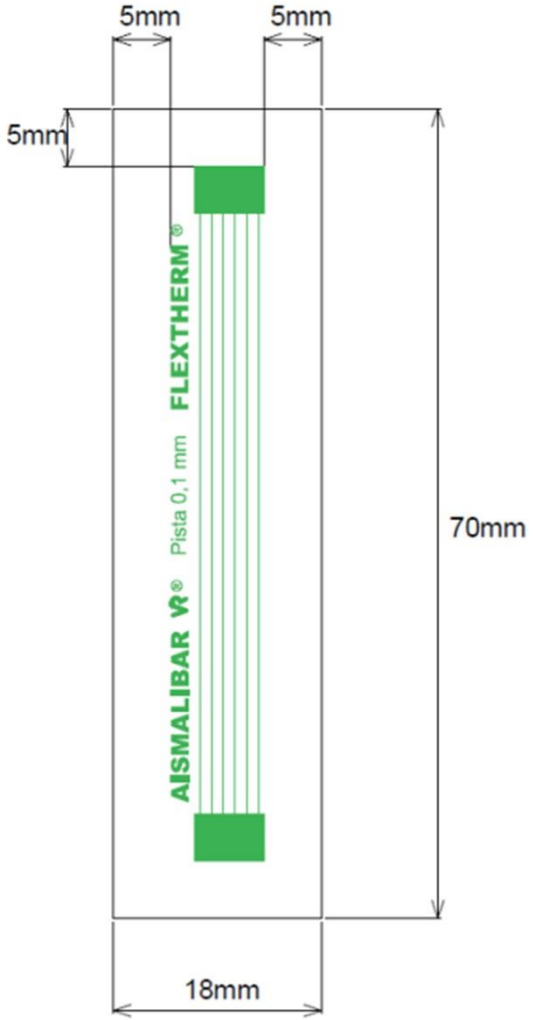


Bending test

Sample construction:

- Special design of the copper tracks has been carried out to evaluate the electrical isolation after several radios and bending angles.
- 35 and 70mic copper thickness were etched at 0,1mm to 1mm line width to study their fragility under positive and negative bending, as well as the tension produced over the dielectric layer at closed angles. Thinner the tracks, higher tension and more possibility for breaking the dielectric.
- Both dielectric thickness 25mic and 35mic, were tested.
- Full copper also was tested

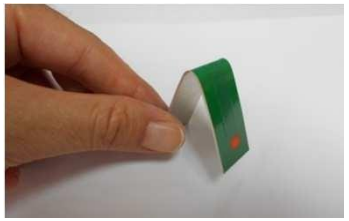




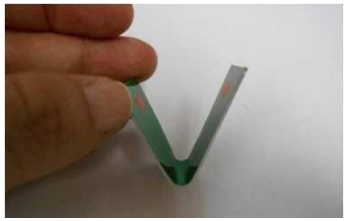
Bending test

Test:

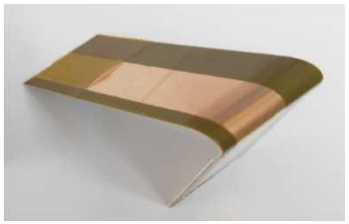
- Samples have been bended with positive and negative direction (copper inside and outside respectively).
- 1KV DC current is applied before and after bending (1KV maintenance 3sec).

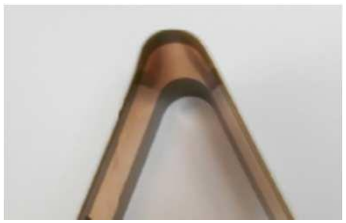


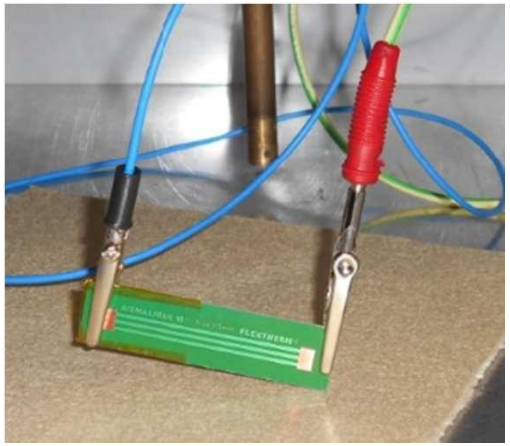
POSITIVE BENDING



NEGATIVE BENDING







Bending test

1KV DC 3sec ⓪ 0.0mA Perfect electrical isolation

Mechanical stress ⓪ NO defect under visual inspection over Al, dielectric layer and Cu

Only Positive bending at radius <1mm and >/=60º breaks mechanically

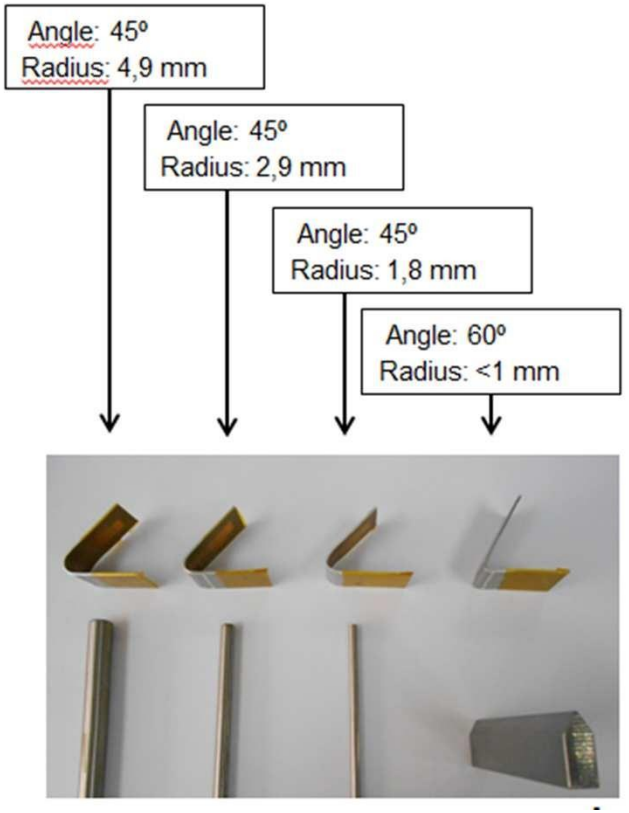
FLEXTHERM 0,8/35 - NEGATIVE BENDING

		Width Copper tracks (mm)				
Angle	Radius (mm)	0,2	0,3	0,4	0,5	1,0
45º	4,9	OK	OK	OK	OK	OK
	2,9	OK	OK	OK	OK	OK
	1,8	OK	OK	OK	OK	OK
60º	< 1	OK	OK	OK	OK	OK

FLEXTHERM 0,8/35 - POSITIVE BENDING

		Width Copper tracks (mm)				
Angle	Radius (mm)	0,2	0,3	0,4	0,5	1,0
45º	4,9	OK	OK	OK	OK	OK
	2,9	OK	OK	OK	OK	OK
	1,8	OK	OK	OK	OK	OK
60º	< 1	NOK	NOK	NOK	NOK	NOK
	(1) Copper tracks as well as dielectric layer breaks					

Note: Standard solder mask can have cracking problems.
Solder mask manufacturers can supply special solder mask for bendable porpoise.
Recommendation: PI cover layer is an ideal solution



Bending test

1KV DC 3sec ⓪ 0.0mA Perfect electrical isolation
Mechanical stress ⓪ NO defect under visual inspection over Al, dielectric layer and Cu

FLEXTHERM 1,5/70 - POSITIVE BENDING

		Width Copper tracks (mm)				
Angle	Radius (mm)	0,2	0,3	0,4	0,5	1,0
45º	4,9	OK	OK	OK	OK	OK
	2,9	OK	OK	OK	OK	OK

FLEXTHERM 1,5/70 - NEGATIVE BENDING

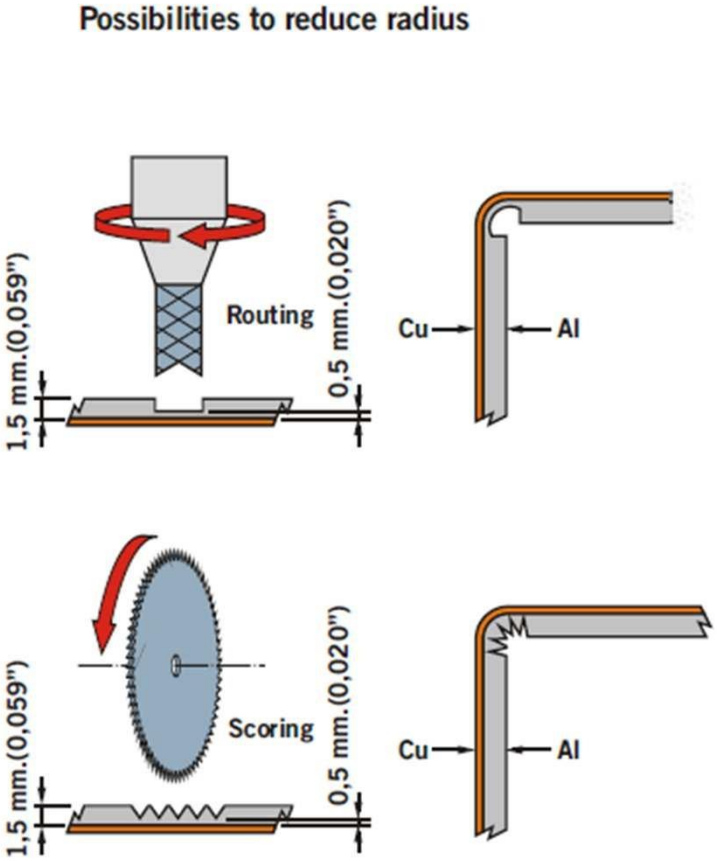
		Width Copper tracks (mm)				
Angle	Radius (mm)	0,2	0,3	0,4	0,5	1,0
45º	4,9	OK	OK	OK	OK	OK
	2,9	OK	OK	OK	OK	OK

To achieve smaller radius and reduced angles on FLEXTHERM AL 1,5mm and over it´s recommended to reduce Al thickness with scoring or depth control on Aluminium side.

Bending over 1,5mm

- To achieve radius <2,9mm and angles higher 45º on Flextherm AL 1,5mm and over 1,5mm it is recommended to reduce Al thickness with scoring or depth control.
-
- Functional copper and dielectric layer mechanical stress will be reduced avoiding problems

- Thickness of Aluminium after depth routing or scoring should remain in between 0,5mm and 0,8mm. Strength of Flextherm after depth routing or scoring would be the same as Flextherm AL 0,8mm,.(look previous results)



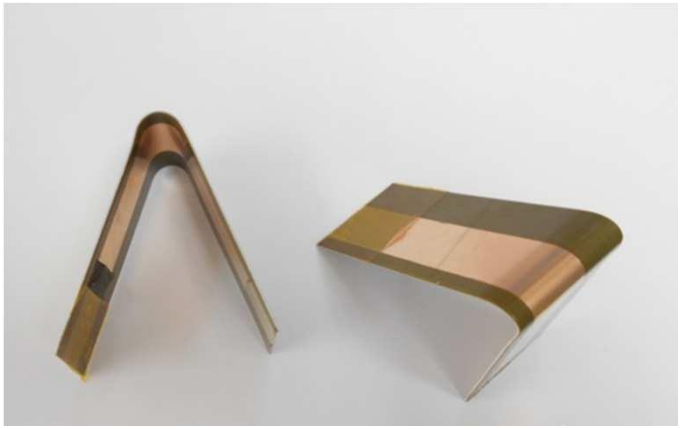
Bending test

1KV DC 3sec ⓪ 0.0mA Perfect electrical isolation

Mechanical stress ⓪ NO defect under visual inspection over Al, dielectric layer and Cu

FLEXTHERM 0,8/35

Angle	Radius (mm)	Negative bending	Positive bending
45º	4,9	OK	OK
	2,9	OK	OK
	1,8	OK	OK
60º	< 1	OK	OK



NEGATIVE BENDING POSITIVE BENDING

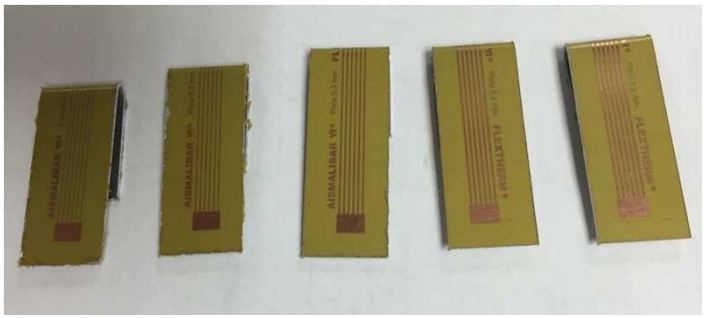
Additional Bending test (Angle 180º)

1KV DC 3sec ⓪ 0.0mA Perfect electrical isolation

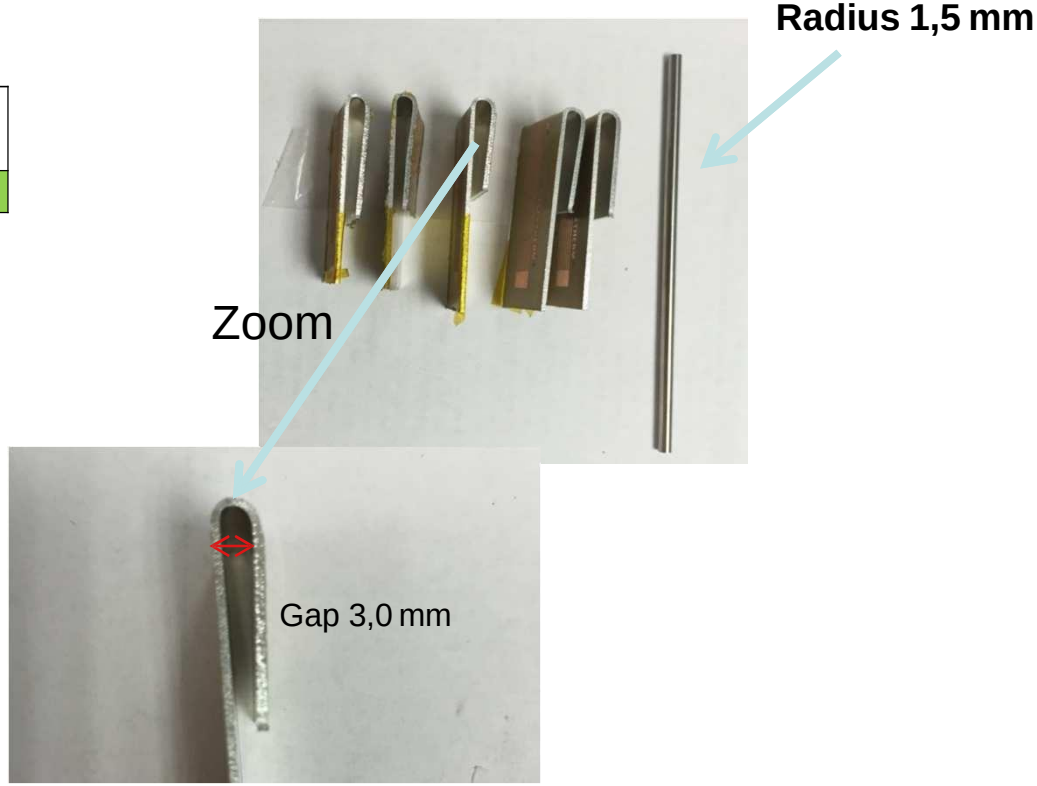
Mechanical stress ⓪ NO defect under visual inspection over Al, dielectric layer and Cu

FLEXTHERM 0,8/35

Angle	Radius (mm)	Positive bending	Prooftest (kV CC)
180º	1,5	OK	1



Copper Line: 0,1mm; 0,2mm; 0,3mm; 0,4mm and 0,5mm

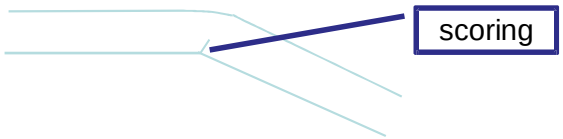


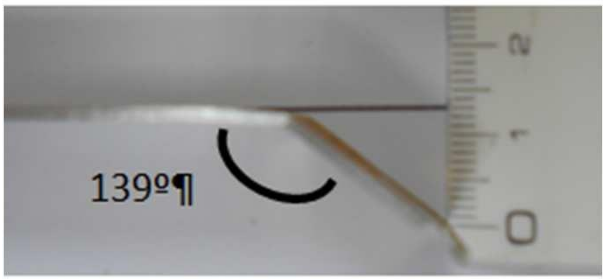
Bending test (scoring)

- Scoring was tested over FLEXTHERM AL 1,5/70 Aluminum/copper with 25mic and 35mic dielectric thickness.
- Copper line and space 0,5mm.
- Scoring was perform with standard blades at 60º angle tooth.
- Top achieve higher and better bending, scoring tools should be adapted over 60º

Results:

PASSED successfully 1KV DC. Smaller angle are not possible to achieve with a single V scoring line. Multiple scoring lines will be needed to decrease the angle.





Long term studies

Blistering Evaluation , Peel strength and Thermal conductivity over Flextherm laminates at three different long term conditions:

A) Change of temperature test IEC-60068 2-14
B) High temperature endurance test IEC 60068-2-2
C) Humidity storage IEC 60068-2-78

Results

After test condition, THERE IS NO degradation in the different layers. Values declared on the Flextherm TDS will remain after long term studies. (Important for Automotive industry)
Time to blistering , Peeling strength and Thermal conductivity properties are not affected after Long study test
Complete Fextherm stack up was not affected by reliability test.

Long term studies

A) High temperature endurance test IEC 60068-2-2
Ambient Temperature test: 125ºC
Test duration [hrs]: 2176

B) Change of temperature (IEC 60068 2-14)
Ambient temperature:
-40 to +125°C
Dwell time: 15min at -40°C
Dwell time: 15min +125°C
Temperature change: 10s
Number of cycles: 1004

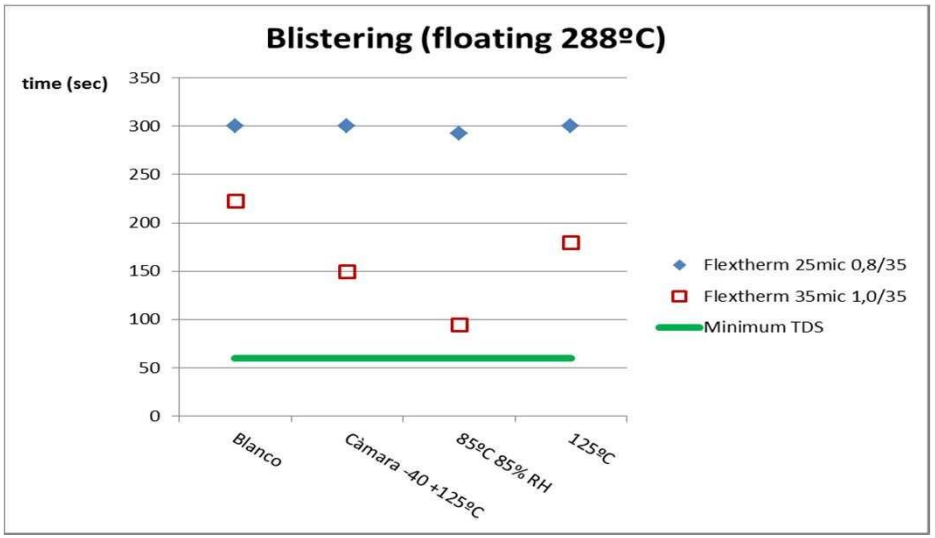
C) Humidity storage IEC 60068-2-78 DATA OF THE PCB
Humidity storage IEC 60068-2-78
Ambient temperature: +85°C
Relative humidity: 85%
Test duration [hrs]: 1485

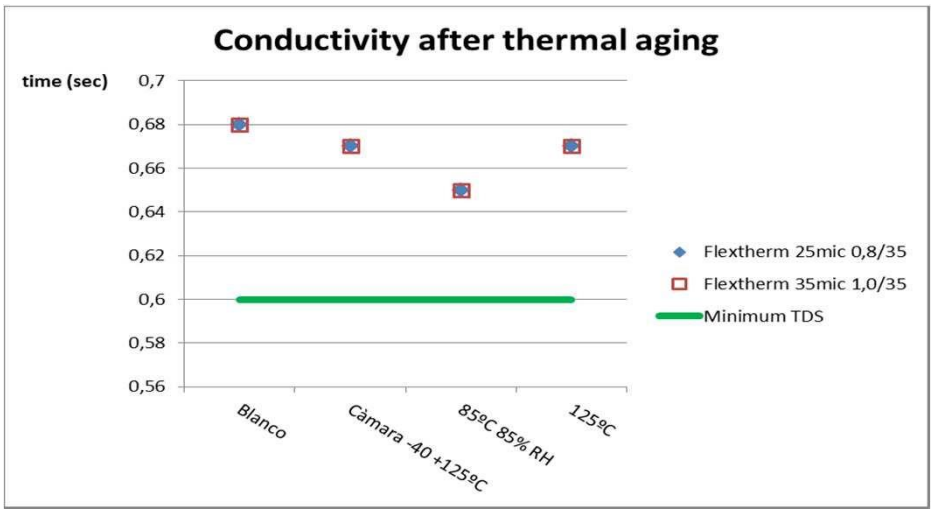
Test methods

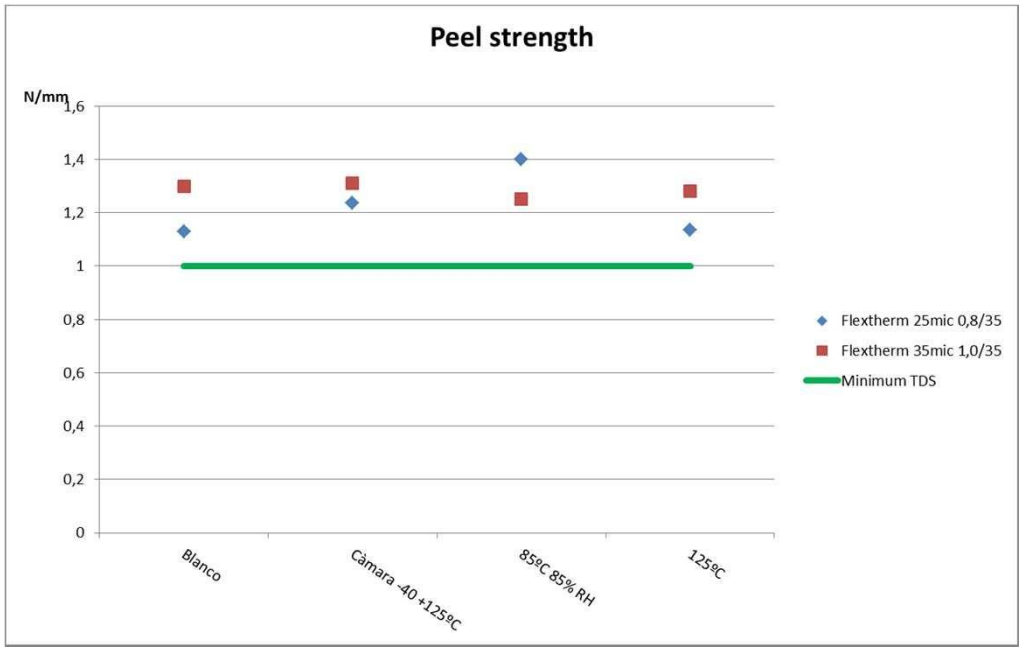
After aging the samples following the previous conditions A, B or C, it has been carried out the test under the International rules:

Time to blister	IEC-61189
Cooper peel strength (no thermal shock)	IPC-TM 650-2.4.8
Thermal conductivity	ASTM-D 5470
Visual inspection	IPC 4101

Long term studies







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Full cycle company








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