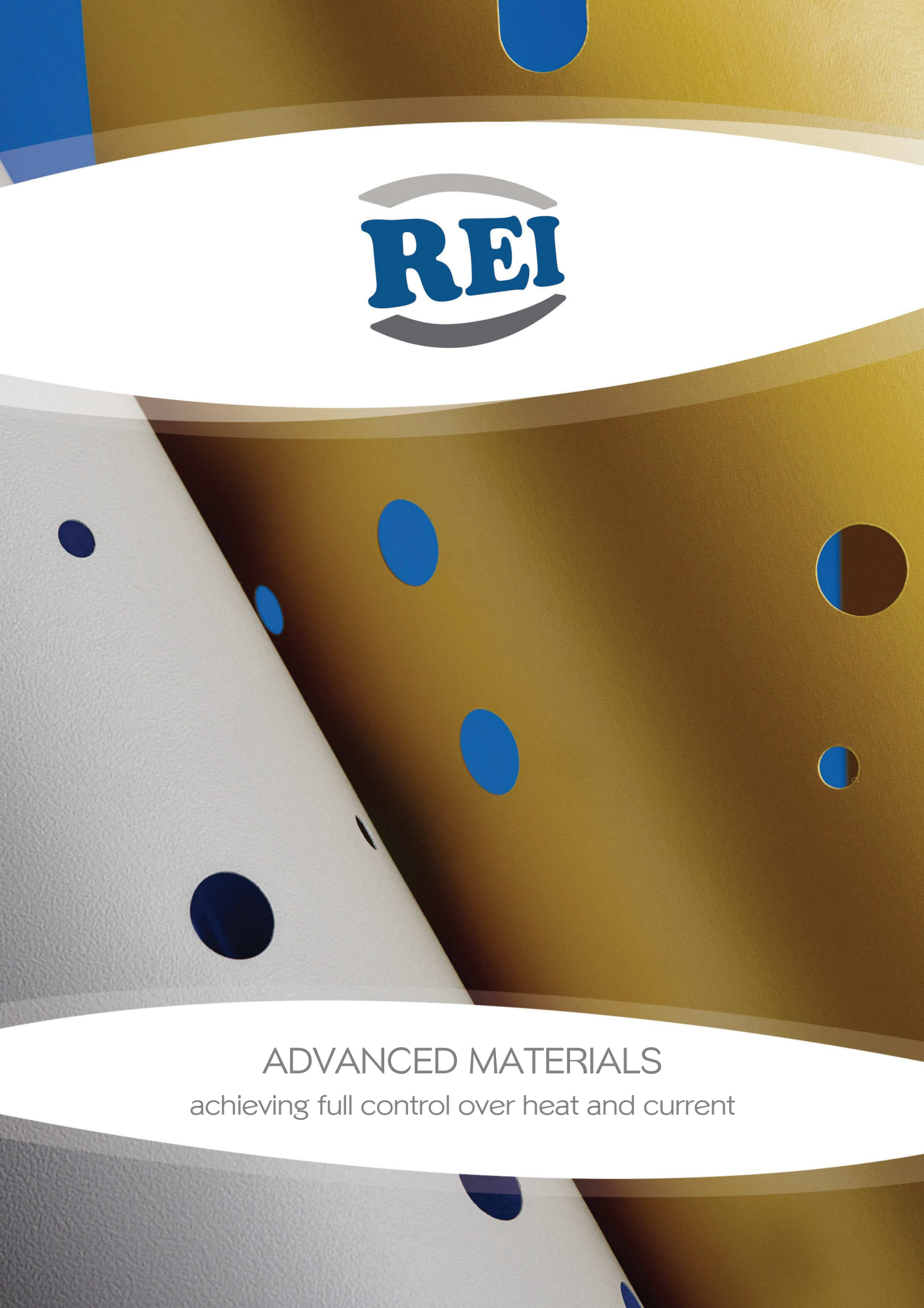


REI

ADVANCED MATERIALS

achieving full control over heat and current

Table of Contents

Caps and Tubes

TCb series Caps and TTa series Tubes are very good thermally conductive and electrically insulating components, that provide a very high protection of delicate electronic components against electrical discharges.

TCb series Caps

TTa series Tubes

TYPICAL PROPERTIES

TCb series Caps

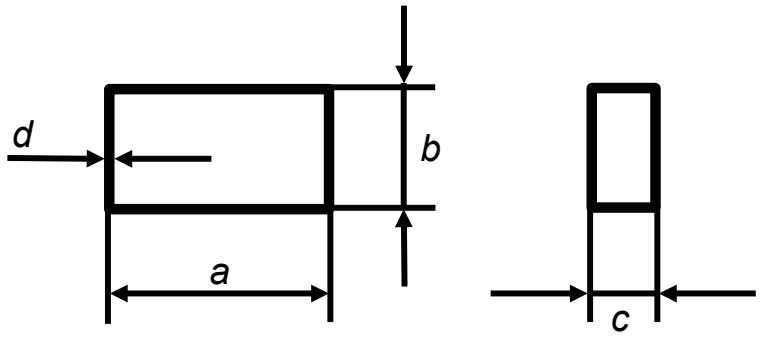
Item	test method	unit	value
Color	-	-	green
Specific gravity	ASTM D-792	g/ cm³	2,33
Hardness	ASTM D-2240	Shore A	55 ± 5
Thermal conductivity	ASTM D-5470	W/(m·K)	1.8
Operating temperature	EN344	°C	-40 .. +200
Flammability	UL94	-	V-0 level
Breakdown voltage	ASTM D-149	KV/mm	4.0
Thermal resistance	ASTM D-5470	K/W	0.2

TTa series Tubes

Item	test method	unit	value
Color	-	-	grey
Specific gravity	ASTM D-792	g/ cm³	1.7 ± 0.1
Hardness	ASTM D-2240	Shore A	80
Thermal conductivity	ISO 22007-2	W/(m·K)	1.0
Operating temperature	EN344	°C	-40 .. +200
Flammability	UL94	-	V-0 level
Breakdown voltage	ASTM D-149	KV/mm	≥10
Dielectric constant	ASTM D-150	-	3.43 @ 1MHz
Elongation	ASTM D-412	%	150
Tensile strength	ASTM D-412	kg/ cm²	≥30

SPEC DIAGRAPH

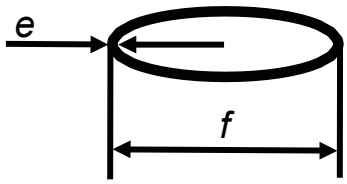
TCb series Caps



Dimensions	unit	TO-220A	TO-3PA
a	mm	21.5 ± 0.5	28.5 ± 0.5
b	mm	11.5 ± 0.5	17.5 ± 0.5
c	mm	5.9 ± 0.3	5.9 ± 0.3
d	mm	0.6 ± 0.1	0.6 ± 0.1

Other sizes available on request

TTa series Tubes



Dimensions	unit	TO-220B	TO-3PA
e	mm	0.6 ± 0.1	0.6 ± 0.1
f	mm	13 ± 0.5	20.5 ± 0.5

Other diameters available on request

Electrically Insulating films (Garfilm®)

Garfilm® is a polyester film with excellent physical, chemical and electrical properties. EM6-type has been expressly developed to be used as an insulator in electrical machines up to class B (130°C). Because of its outstanding properties, dielectric and mechanical, EM6 is the right product for motor insulation (slot insulation and closure).

These materials are supplied according to the customer's drawing.

TYPICAL PROPERTIES

Item	test method	unit	EM6	EM6
General				
Nominal thickness	-	*mm*	0.25	0.35
Color	-	-	white	
Density	*ASTM D-1505*	*g / cc*	1.4	
Water absorption (max)	*ASTM D-570*	*%*	0.6	
Properties thermal				
Shrinkage with heat (MD)(1)	*ASTM D-1204*	*%*	1	
Shrinkage with heat (TD)(2)	*ASTM D-1204*	*%*	0.4	
Melung point	*DTA*	*°C*	255	
Properties electrical				
Breakdown voltage (on 2” brass electrod)	*ASTM D-149*	*KV*	19.5	22.5
Surface resistivity	*ASTM D-257*	*Ω*	10^{12}	
Volume resistivity	*ASTM D-257*	*Ω·cm*	10^{16}	
Dielectric constant(3)	*ASTM D-150*	-	3.3	
Dissipation factor(3)	*ASTM D-150*	-	0,003	

(1) Machine Direction @ 150°C for 30 minutes. (2) Transverse Direction @ 150°C for 30 minutes. (3) 50Hz, 25°C.

Nomex® Films

These materials are supplied according to the customer's drawing.DuPont™ Nomex® paper is an electrical-insulation paper for high temperatures (UL homologated up to 220°C) with high dielectric strength, mechanical toughness, flexibility and resilience, very good chemical compatibility.

Nomex® T410 is the base type, mechanically more resistant and with stronger dielectric properties.

Nomex® T411 is the uncalendered version of T410.

Following is an example of properties measured on typical 0,3..0,58 thick materials.

These materials are supplied according to the customer's drawing.

TYPICAL PROPERTIES

Item	test method	unit	T410	T411	T411
Nominal thickness	-	*mm*	0.30	0.38	0.58
Dielectric strength – AC rapid rise(1)	*ASTM D-149*	*KV / mm*	32.00	9.00	9.00
Dielectric strength – Full wave impulse	*ASTM D-3426*	*KV / mm*	-	16.00	16.00
Dielectric constant at 60 Hz	*ASTM D-150*	-	2.90	1.30	1.30
Dielectric constant at 1 Khz	*ASTM D-150*	-	-	1.40	1.40
Dissipation factor at 60 Hz ($x10^{-3}$)	*ASTM D-150*	-	7.00	3.00	3.00
Dissipation factor at 1 Khz ($x10^{-3}$)	*ASTM D-150*	-	-	5.00	5.00
Flammability(2)	*UL94*	-	V-0	V-0	V-0
Density	-	*g / cc*	1.00	0.31	0.31

(1) Using 50mm electrodes, rapid rise; corresponds with IEC 243-1 subclause 9.1 except for electrode set-up of 50mm.
(2) File no. E34739.

Kapton® Films

The polymide electrical-insulation film is produced by casting method, which has excellent low&high temperature resistance, atomic radiation resistance and dielectric property widely used for insulation in H-class motor, electrical apparatus and other purpose electronic engineering.

These materials are supplied according to the customer's drawing.

TYPICAL PROPERTIES

Item	test method	unit	value				
Standard thickness	-	μm	25	40	50	75	100
Density	-	g / cm³	1.4 ± 0.02				
Tensile strength	portrait	M Pa	≥ 135				
	landscape		≥ 115				
Dielectric strength AC rapid rise(1)	MD(1) & TD(2)	%	≥ 35				
Contraction rate	@ 150 °C	%	≤ 1				
	@ 400 °C		≤ 3				
Breakdown strength	average value	MV / m	≥ 150			≥ 130	≥ 110
	individual value		≥ 100			≥ 80	≥ 70
Surface resistivity	@ 200 °C	Ω	≥ 1 ·10¹³				
Volume resistivity	@ 200 °C	Ω·m	≥ 1 ·10¹⁰				
Relative dielectric constant	@ 48 – 62 Hz	-	3,5 ± 0,4				
Dissipation factor	@ 48 – 62 Hz	-	≤ 4 ·10⁻³				
Long-term heat resistance temperature index	-	-	≥ 180				

(1) Machine Direction. (2) Transverse Direction.

Mylar® A films

Mylar® A films are tough, general purpose electrically-insulating films that are transparent in 48 .. 92 gauge and translucent in heavier gauges. They have a rough surface to provide ease of handling, good adhesion, and processability. They are used for a broad range of industrial applications.

Mylar® A films have balanced tensile properties and excellent resistance to moisture and most chemicals. They can withstand temperature extremes from -100°F to 300°F. Mylar® does not become brittle with age under normal conditions, because it contains no plasticizers. UL 94 VTM-2 approvals are available for many gauges, and under recognition for many others. Following is an example of properties measured on typical 0.25 .. 0.35mm thick materials.

These materials are supplied according to the customer's drawing.

TYPICAL PROPERTIES

Item	test method	unit	0.1 mm width Type A	0.25 mm width Type A	0.35 mm width Type A
Nominal thickness	-	*mm*	0.100	0.254	0.350
Dielectric strength - minimum [KV_{AC}]	*ASTM D-149*	*KV / mm*	11.75	19.00	20.00
Dielectric constant at 50 Hz	*ASTM D-150*	-	3.30		
Dielectric constant at 1 Khz	*ASTM D-150*	-	3.25		
Dissipation factor at 50 Hz	*ASTM D-150*	*(x 10^{-3})*	2.50		
Dissipation factor at 1 Khz	*ASTM D-150*	*(x 10^{-3})*	5.00		
Tensile strength (1)	*ASTM D-882*	*MPa*	MD 190 TD 200	MD 190 TD 200	MD 190 TD 190
Modulus (1)	*ASTM D-882*	*MPa*	MD 3700 TD 3900	MD 3100 TD 3500	MD 2950 TD 3200
Elongation (1)	*ASTM D-882*	*%*	MD 150 TD 120	MD 210 TD 170	MD 240 TD 200
Flammability (2)	*UL94*	-	VTM-2		

(1) measurements are carried on either in the Machine Direction , and in the Transversal Direction
(2) UL File no. E93687

Neoprene

Neoprene sheets show a very good conformability and thermal insulation, so they can be used to create a thermal path preventing the heat from going where it could affect or even damage crytical components.

These materials are supplied according to the customer's drawing.

TYPICAL PROPERTIES

Item	test method	unit	index value
Color	-	-	black
Cellular structure	-	-	closed
Thickness	-	*mm*	2 .. 8
Density	*ASTM D-3575*	*g / cm³*	0,150 ± 0,025
Thermal Conductivity	-	*W / (m·K)*	0.04
Hardness	*ASTM D-2240*	*Shore00*	50 ± 5
50% compression set(1)	*ASTM D-1056*	*%*	25.00
Water absorption	*ASTM D-1056*	*%*	2 , < 5
Flammability	*UL94*	-	HF1-class

(1) 22hrs @ T_{amb}

Adhesives

Adhesives are used to help the assembly of many different materials. Amongst the most commonly used materials in our assemblies, we have S-4210VS and S-4615LBG adhesives.

S-4210VS is a modified, solvent free acrylic adhesive. The VS-adhesive has an excellent direct tack and continuous adhesive strength. Good dynamic and static shear strength. On most surfaces, no plasticizer migration. Good temperature, UV and age-resistance. Maximum temperature resistance is
+120°C for long term usage, and up to 200°C for short term usage.

S-4615LBG is a solvent-free modified, acrylic based on aqueous dispersions. It has an excellent tack combined with a high adhesive strength on difficult surfaces such as foams, PE- and PP- films.

These materials are supplied according to the customer's drawing.

TYPICAL PROPERTIES

Item	unit	S-4210VS	S-4615LBG
Support	g/m²	12 (now-woven)	PES / PVA scrim
Interliner	g/m²	90 (yellow release paper)	90 (yellow release paper)
Thickness	mm	0,1	0,15
Adesive strength (AFERA 4001)	N/25mm	13	24
Adesive weight	g/m²	90 (yellow release paper)	140
Temperature resistance	°C	-40 .. +120 (long term usage)	-40 .. +95 (in accordance with ATP trial regulation 07)
		-40 .. +200 (short term usage)	

Gapfillers

The FRG and FRNG series are thermally conductive and electrically insulating soft and thick pads, especially designed for the thermal match of surfaces with planarity problems. The FRNG series has a non-silicone composition, that besides less compressibility offers the absence of silicone-oil release, even under high pressures.
Key mechanical characteristics of these materials are the low modulus of the polymer substrate and the glass fiber reinforcement.
These materials are supplied according to the customer's drawing either, or as base sheets.

Features & benefits:

- *low hardness of the paste service;*
- *enhanced resistance to puncture, shear and tear resistance;*
- *electrical insulation;*
- *ROHS and UL to meet the environmental requirements.*

Typical applications:

- *communications industry;*
- *power transfer device;*
- *semiconductor or magnetic body and the heat sink;*
- *xenon lamp ballast;*
- *mobile devices.*

Item	test method	unit	FRG	FRNG
Color	-	-	Light yellow + pink	
Thickness	*ASTM D-374*	*mm*	0,5 .. 7	
Specific gravity	*ASTM D-792*	*g / cm³*	1.80	2.10
Hardness	*ASTM D-2240*	*Shore 00*	25 ± 5	40 ± 5
Tensile strength	*ASTM D-412*	*kgf / cm²*	8	1.5
Elongation	*%*	-		350
Continuous use temp.	*EN344*	*°C*	-30 .. +200	-30 .. +130
Volume resistivity	*ASTM D-257*	*Ω·cm*	$1 \cdot 10^{11}$	$> 1 \cdot 10^{12}$
Diel.Breakdown Voltage	*ASTM D-149*	*KV / mm*	6	8
Flame rating	*UL-94*	-	V-0	V-0
Thermal conductivity	*ASTM D-5470*	*W / (m·K)*	0.8	0.8

Thermal Tapes

The RTCT series is a range of thermally and electrically insulating, adhesive, acrylic tapes used in the mechanical assemblies of electronic devices, between heat sinks and the power devices. RTCT materials are used with the target of a strong bonding together with a low thermal resistance, which can effectively replace thermal grease and mechanical fastening.
These materials are supplied according to the custom conductive er's drawing either, or as base sheets or rolls.

Features & benefits:

- *Strong and reliable bonding of the electronic assemblies.*
- *High thermal conductivity and mechanical performance, also for pressure sensitive components.*

Typical applications:

- *Mechanical assembly of encapsulated chips onto heat sinks.*
- *Mechanical assembly of the heatsink onto the power supply circuit board or the vehicle control unit.*
- *Effective replacement of hot melt adhesives, screws and buckles.*

Item	test method	unit	**RTCT**	**RTCT-B**
Color	-	-	White	White
Thickness	*ASTM D-374*	*mm*	0.1 .. 0.508	0.1 .. 0.508
Specific gravity	*ASTM D-792*	*g / cm³*	1.8 ± 0.1	1.7 ± 0.1
Adhesion strength	*ASTM D-412*	*g / cm²*	186	186
Breakdown voltage	*ASTM D-149*	*KV / mm*	7	7
Thermal conductivity	*ASTM D5470*	*W / (m·K)*	1.5	0.7
Continuous use temp	*EN 344*	*°C*	-40 .. +180	-40 .. +180

Storage and guarantee period

To maintain the best performance of this material, the temperature should be kept in the range 23°C ± 5°C, as well as the product should better be stored in the original package, with relative humidity under 60% ± 10%. In addition, in addition, the product should be used within three years, from the manufacturing date.

Thermal Pads

The TCPB pads are high performance, soft silicon material, designed with good thermal conductivity, electrically insulation and coherent winding.
These materials are supplied according to the customer's drawing either, or as base sheets or rolls.

Features & benefits:

- *high compressibility, soft and flexible, designed for applications in low-stress application environment;*
- *good thermal conductivity;*
- *electrical insulation;*
- *meet with the environmental requirements of ROHS and UL;*
- *natural stickiness.*

Typical applications:

- *laptop;*
- *communication hardware equipment;*
- *high-speed hard disk drive equipment;*
- *automobile engine control mould;*
- *micro processor, memory chip and graphics processor,*
- *mobile equipment.*

Item	test method	unit	TCPB23	TCPB30	TCPB45	TCPB80
Color	-	-	Pink/Grey	Grey	Grey	Grey
Thickness	*ASTM D-374*	*mm*	0.23± 0.03	0.3± 0.03	0.45± 0.03	0.8± 0.03
Specific gravity	*ASTM D-792*	*g / cm³*	1.6 .. 1.8			
Hardness	*ASTM D-2240*	*Shore A*	85			
Tensile strength	*ASTM D-412*	*kg / cm²*	> 180			
Continuous use temp.	*EN344*	*°C*	-500.. +200			
Breakdown voltage	*ASTM D-149*	*KV / mm*	>10			
Flame rating	*UL-94*	-	V-0 level			
Thermal conductivity	*ASTM D-5470*	*W / (m·K)*	0.8			

Graphite Thermal Interfaces

For their outstanding performances and ease of use, graphite interfaces are becoming more and more popular as thermally conductive interfaces in led-lighting and power electronic assemblies, provided that there's no need for electrical insulation (since graphite is electrically conductive too).
The very high in-plane thermal conductivity gives a very good heat-spreading for all of those components that have a punctual heat-generation but that need to operate in the same conditions for
the overall behaviour of the system.
These materials are supplied according to the customer's drawing either, or as base sheets. Adhesive types are available, for an easier application (GSA-AD type).

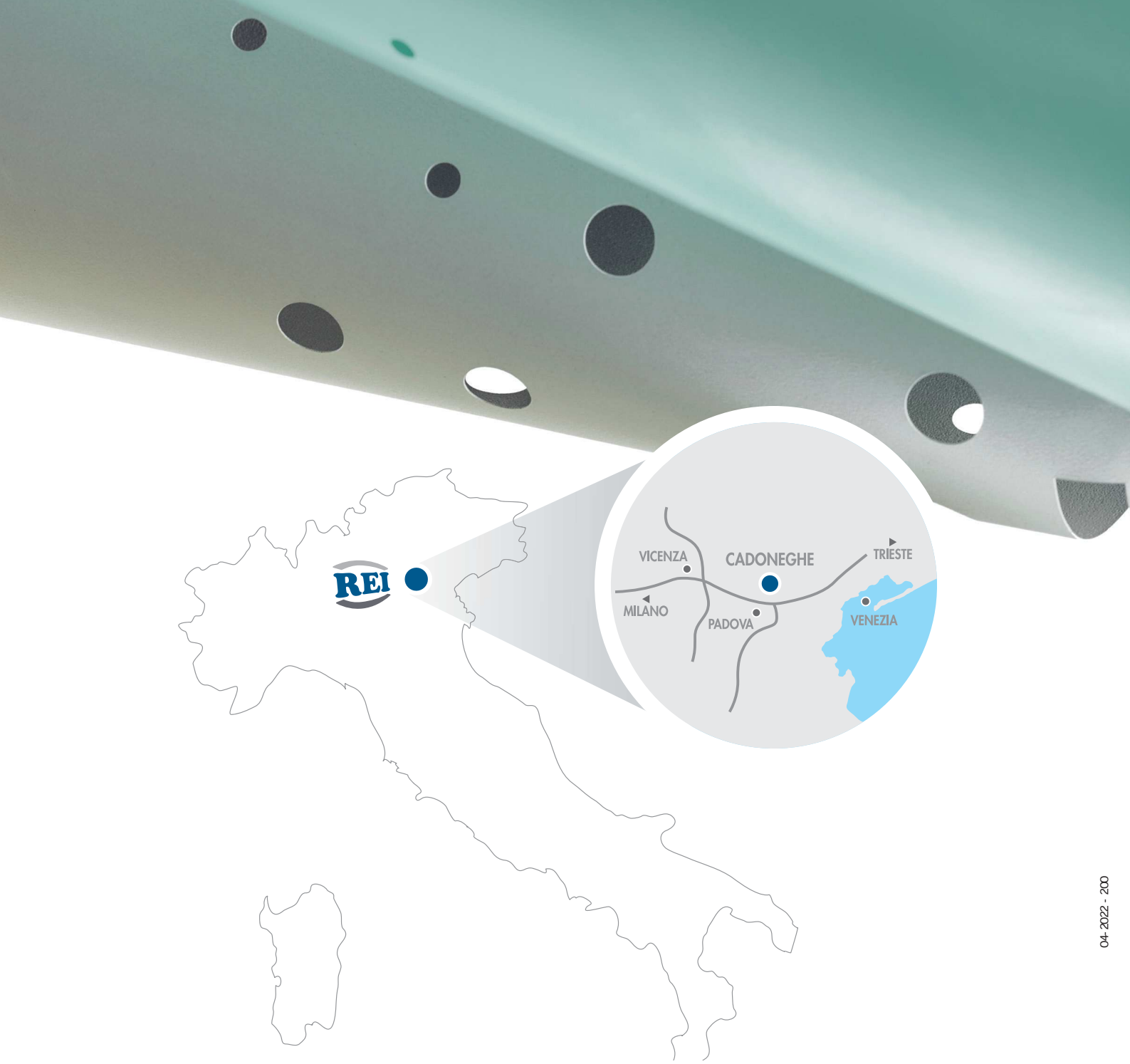
Features & benefits:

- *extremely high thermal conductivity;*
- *light weight;*
- *easy to use in electronic assemblies;*
- *electrical conductivity;*
- *meet with the environmental requirements of ROHS and UL;*

Typical applications:

- *led-lighting;*
- *cooling of thermo-electric modules;*
- *mobile equipment;*
- *connection between heat sinks;*
- *heatsinking power components (IC, CPU, MOS, IGBT);*
- *LCD-TV, notebook computers;*

Item	test method	unit	**GSA**
Color	-	-	Blue / Laterite
Material			Natural Graphite
Thickness	*ASTM D-374*	*mm*	0.1 .. 1.0
Specific gravity	*ASTM D-792*	*g / cm³*	1.5
Hardness	*ASTM D-2240*	*Shore A*	80
Tensile strength	*ASTM F-152*	*4900 Kpa*	715 PS
Continuous use temp.	*EN344*	*°C*	-40 .. +400
Breakdown voltage	*ASTM D-149*	*KV / mm*	> 5
Flame rating	*UL-94*	-	V-0
Thermal conductivity (through thickness)	*ASTM D-5470*	*W / (m·K)*	20
Thermal conductivity (in plane)	*ASTM D-5470*	*W / (m·K)*	300



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