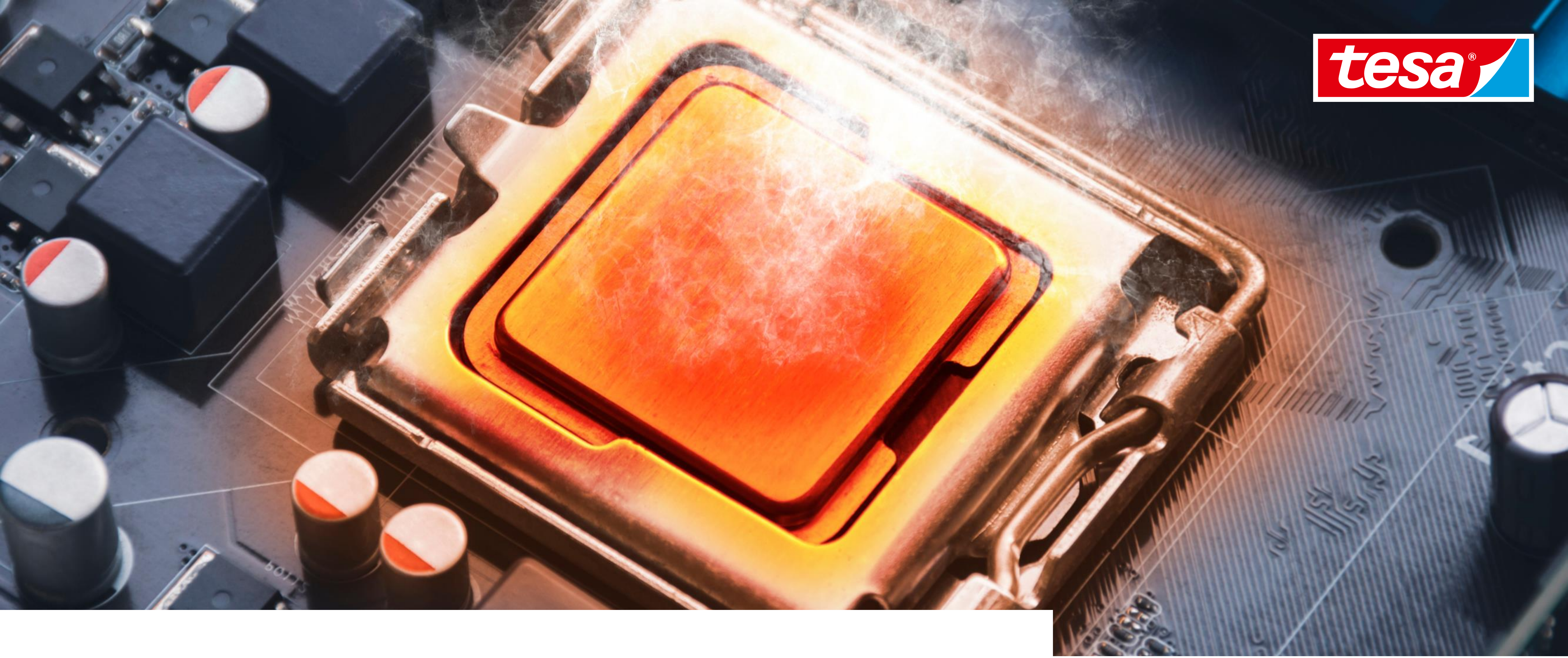
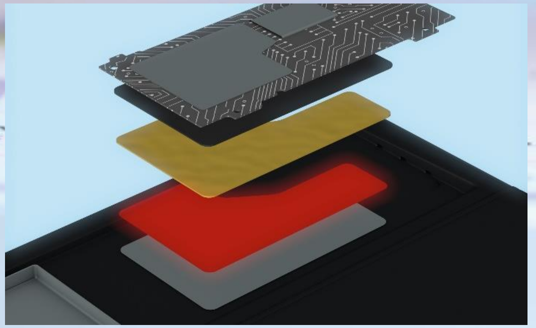


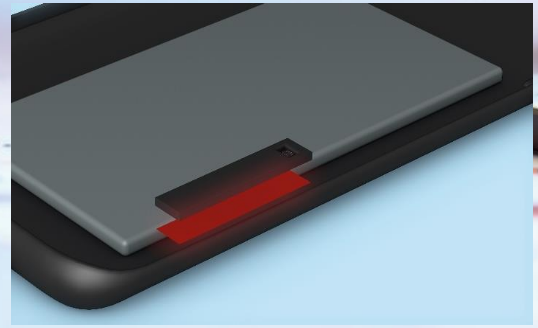
tesa® solutions for heat management

Thermally conductive tapes

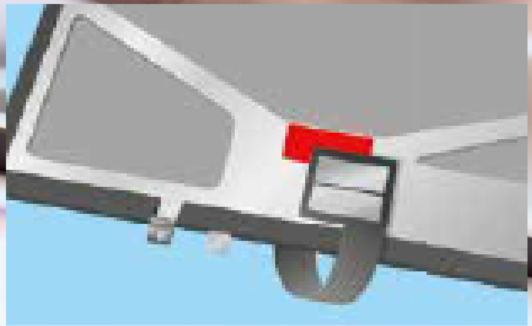
Introduction in key markets and applications



Vapor chamber/ heat pipes



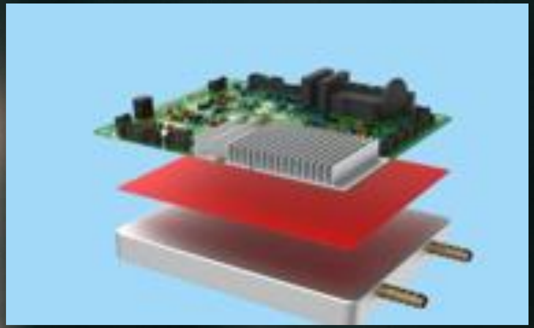
5G mmWave Antenna



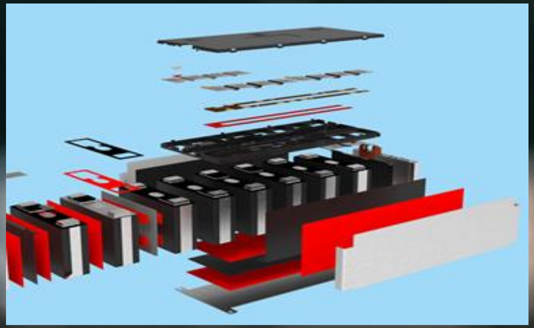
FPCs

Displays and Tablets

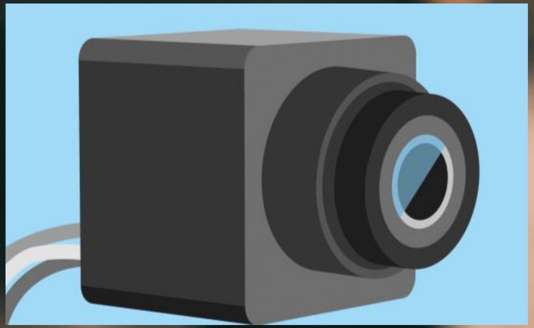
Human Machine Interfaces



Power electronics



Batteries



ADAS

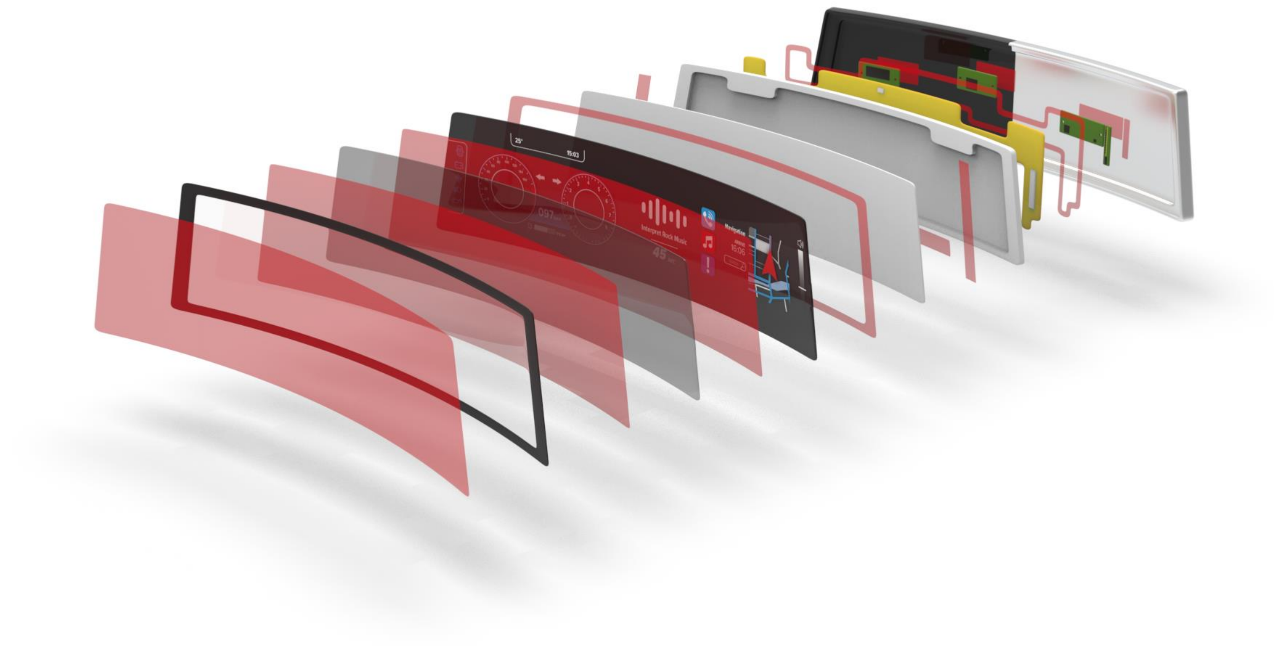
Display application

Conducting the heat from the PCBA to magnesium

- Secured heat transmission
- Thermal conductivity ≥ 0.7 W/mK
- Good bonding and surface wetting
- Design gap of ~100µm

Solution

- tesa® 58394
- Best combination to fulfil customer requirements



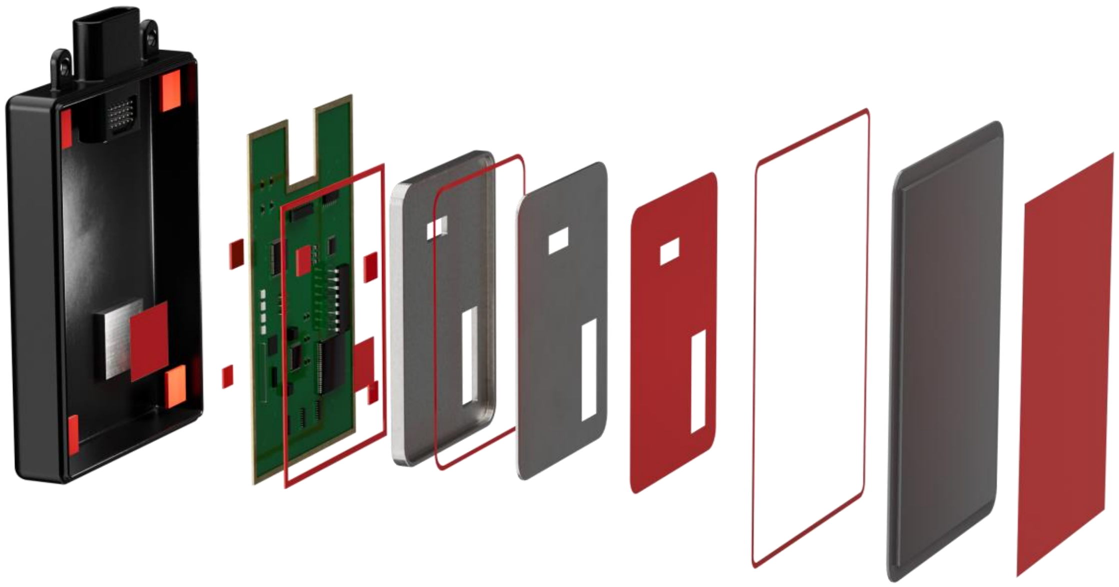
ADAS application

Conducting the heat from PCBA to heat sink

- Gap filling
- No leakage, stable formulation of adhesive
- High temperature performance (~125°C)

Solution

- tesa® 58326
- Best combination to fulfil customer requirements



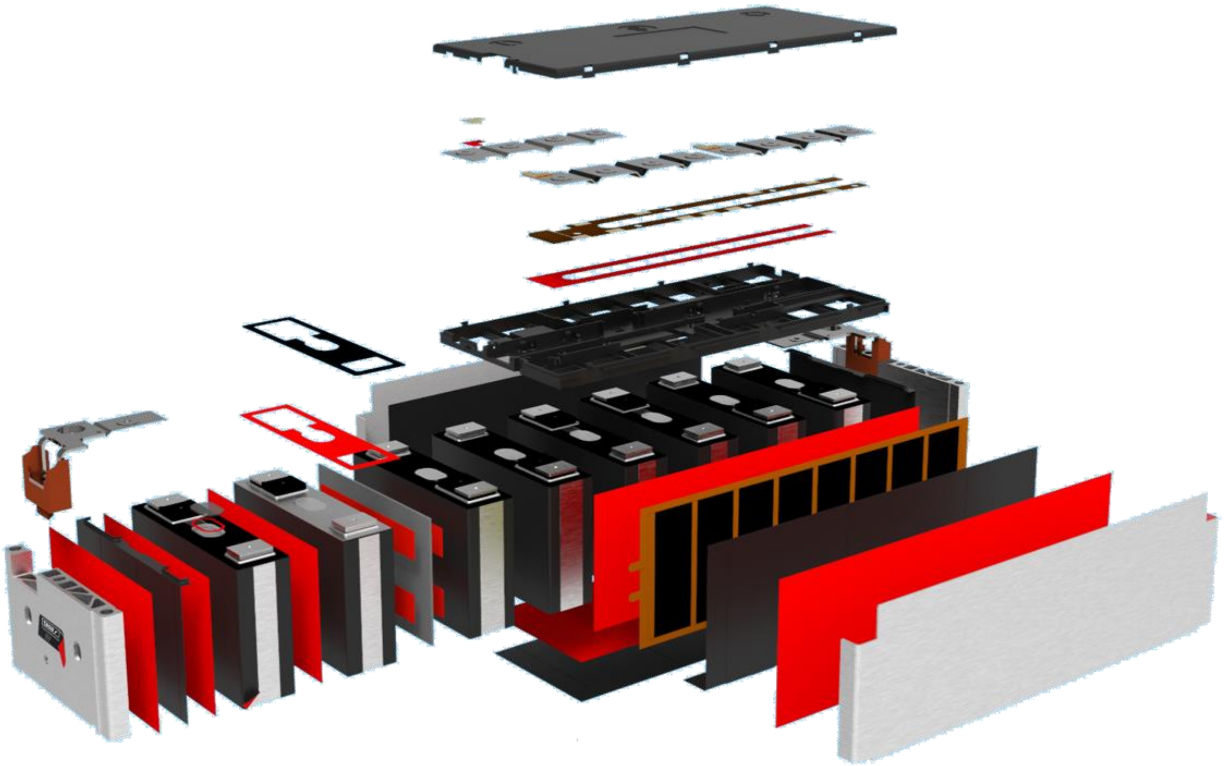
Battery application

Conducting the heat from the busbar

- Secured heat transmission
- Thermal conductivity > 1.5 W/mK
- Electrical insulation > 7 kV
- High gap filling of 3.7mm
- Good convertibility because of challenging shape

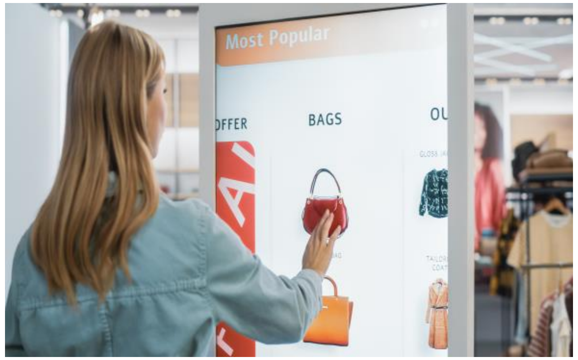
Solution

- Laminate of tesa® 58328
- Best combination to fulfil customer requirements

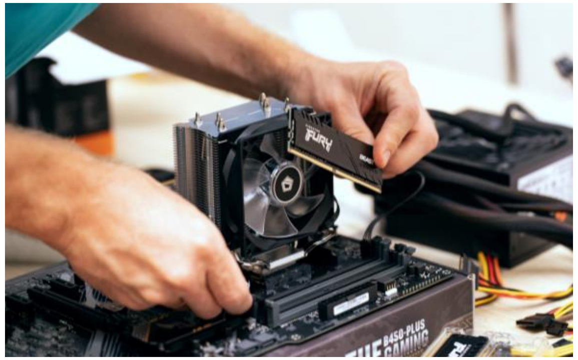


Other markets

LED Panel lights



LCD modules



IC / CPU modules

Charging stations

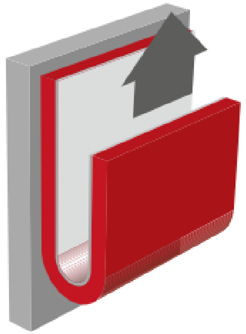
Mechanics of thermal transfer

Heat transfer

The heat transfer only happens at connected area between surfaces.

Ceramic fillers offer excellent thermal conductivity, along with electrical insulation and full fill the requirements of many applications dealing the heat transfer.

Key features affecting heat dissipation

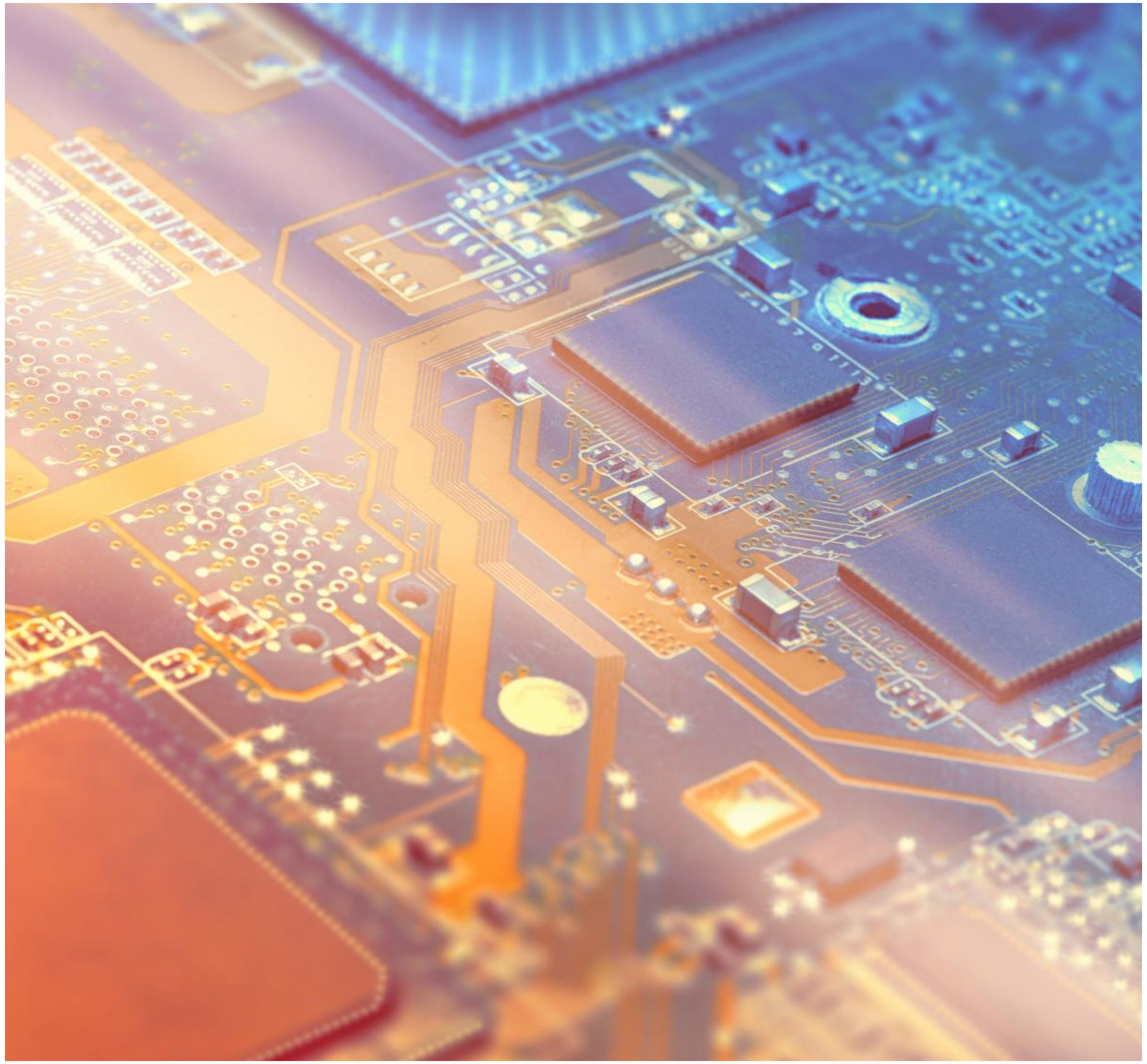


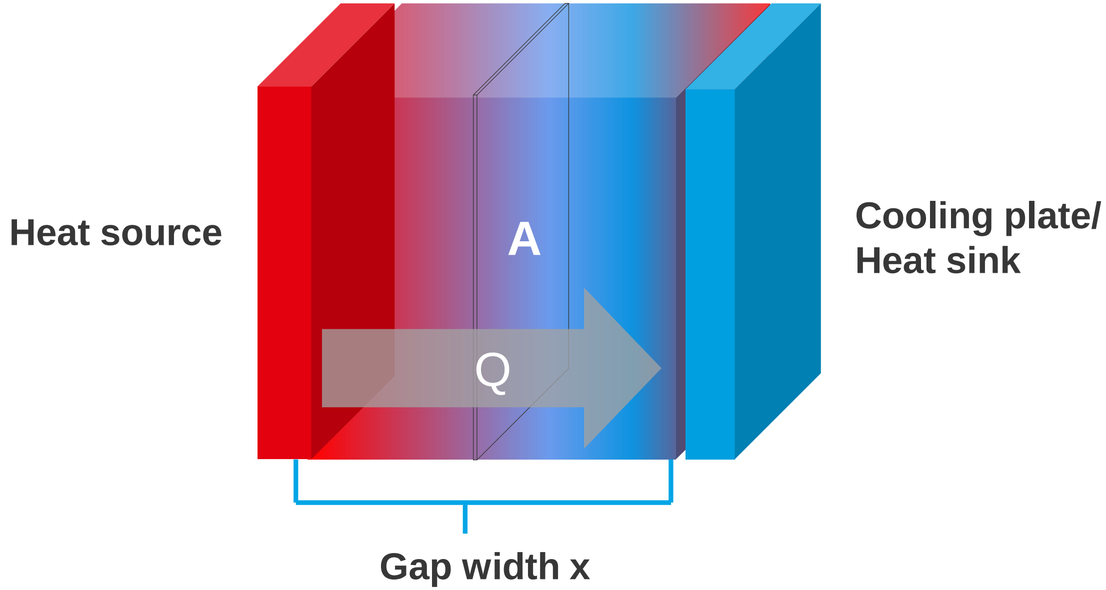
- Good bonding to ensure parts in connection

- Eliminate poor conductor of heat as much as possible, i.e, air

- High thermal conductivity material to ensure heat transfer efficiency

Thermal transfer





Heat flux **Q** can be described the key thermal performance when heat has to be transferred between two solid materials:

$$Q = k \, \Delta T \, \frac{A}{x}$$

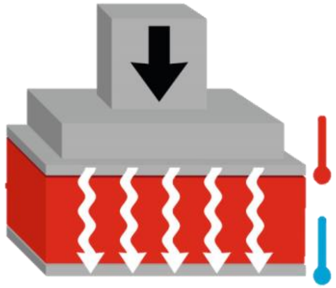
How to impact heat flow Q when the cooling system is fixed by design?

1. Increase material’s thermal transfer capability (k) or
2. Decrease the gap width to get better thermal resistance.

Key properties and product testing

Key properties

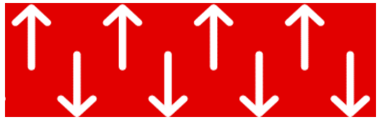
Focus



1. Heat transfer

High capability to transfer heat, defined by thermal conductivity and thermal impedance.

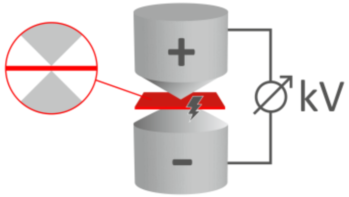
- Thermal conductivity up to >2 W/mK
- Thermal impedance up to <11 Kcm^2/W



2. Bonding & Wetting

Wide range peel force with great wetting performance for improved bonding.

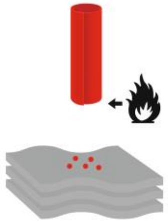
- Peel adhesion: 0.7 to 10.5 N/cm
- Wetting: 84 to 96%



3. Electrical insulation

Ceramic fillers enabling high electrical insulation feature.

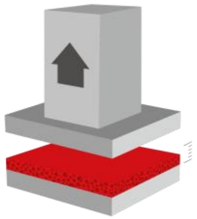
- Breakdown voltage up to > 13kV
- CTI 600



4. Flame retardancy

Ceramic fillers enabling high flame retardancy feature.

- UL 94-V2
- UL 94-V0



5. Compression

Defined compressibility for gap filling performance.

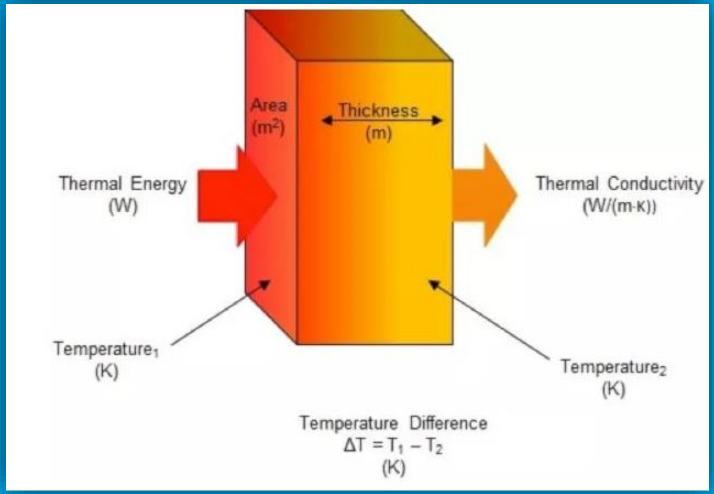
- Compression of 25%: 78 to 95kPa

Key properties

Thermal Conductivity

Material’s ability to transfer heat.

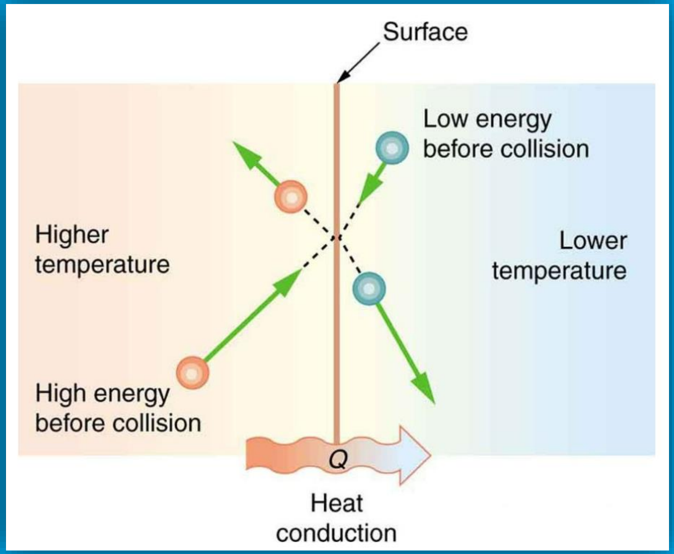
Intrinsic material property. Independent from material shape, size or thickness.



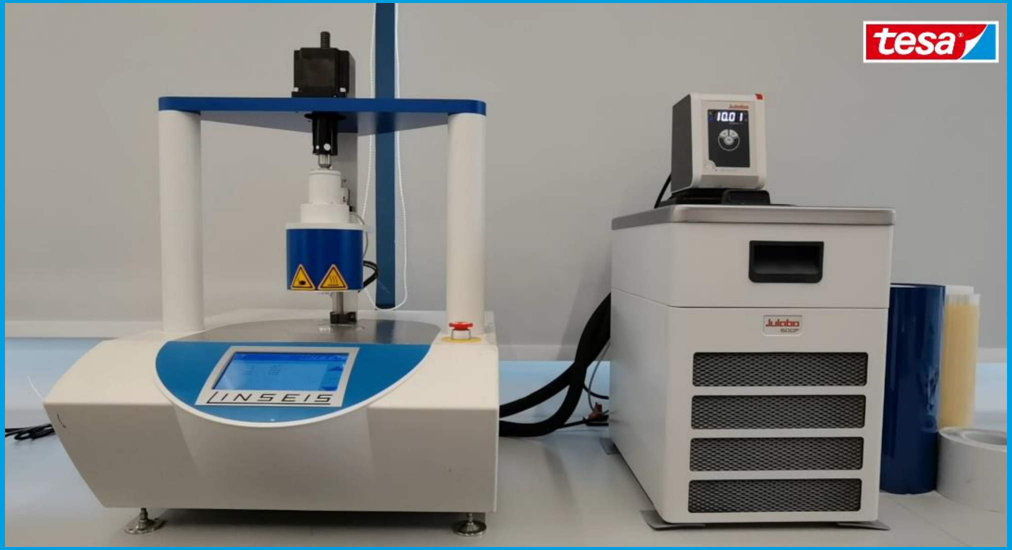
Thermal impedance

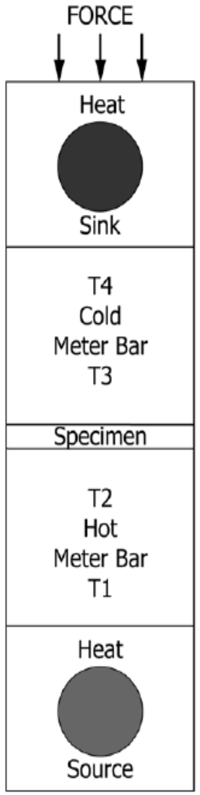
Material's resistance to heat transfer efficiency

Dependent on material shape, size and thickness.



Thermal Conductivity – Steady-state Method TIM tester





According to ASTM D5470

Description:

1. Set different testing temperature on specimen;
2. The thermal gradient imposed on the specimen by the temperature different between the two contacting surfaces (Hot meter bar & Cold Meter bar), which would cause the heat flow through the specimen.

Simple and fast way to test materials.

Other testing methods (e.g. laser method, Transient Plane Source (TPS) Method) lead to different results for thermal conductivity.

Test results from different methods can’t be compared directly.

Thermal Conductivity & Thermal Impendance

Product number	Thickness (µm)	Thermal conductivity (W/m·K) @0.2MPa	Thermal Impedance (Kcm²/W) @0.2MPa
tesa® 58394	125	0.7	2.4
tesa® 58395	250	0.8	3.9
tesa® 58398	400	0.8	5.8
tesa® 58399	800	0.8	11.7

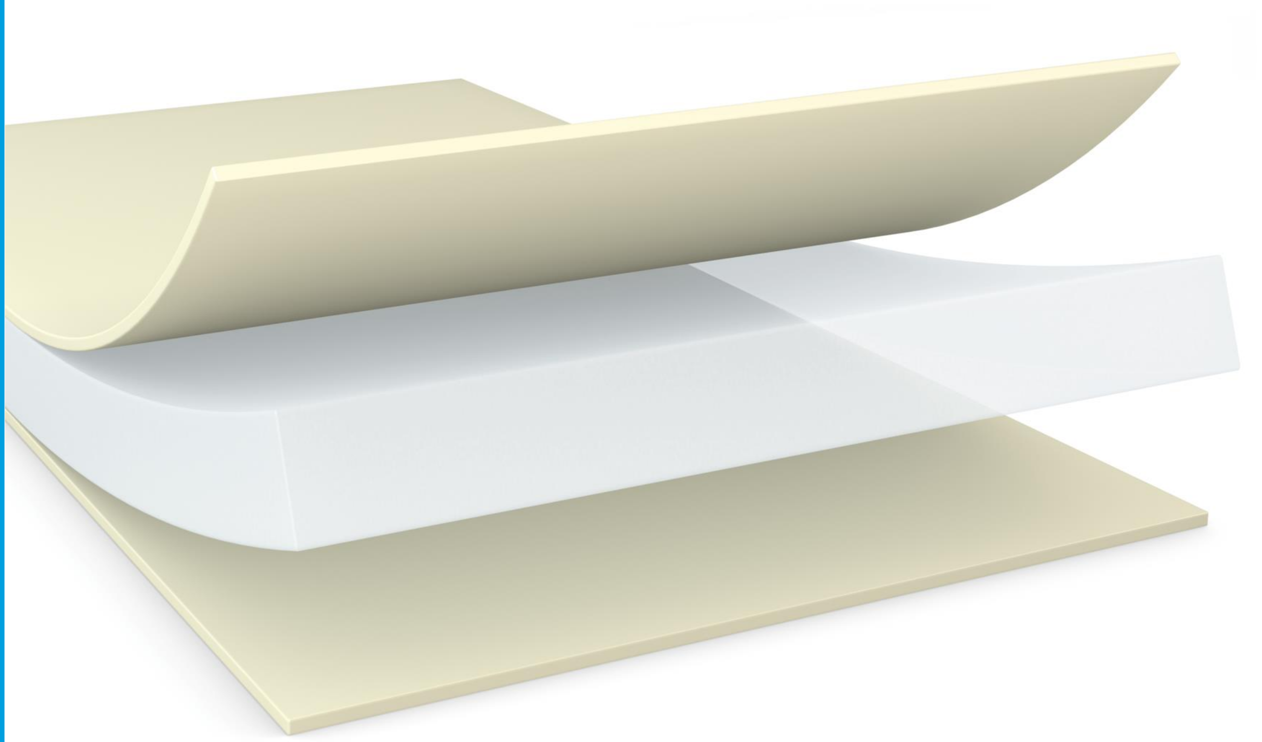
1. Thermal Impedance is increasing with increased thickness
2. Thermal Conductivity and Thermal Impedance are correlating
3. Both values need to be compared within the same product series/ formulation
4. To get an accurate result you need to measure it (and not calculate it from each other)

Test conditions	
Tests setup:	According to ASTM D5470
Storage Condition:	-40℃ 1008hrs 125℃ 1008hrs 85℃ 85% 1008hrs Thermal shock -40℃ ~ 125℃ 1008hrs
Test temperature:	50℃
Measurement unit:	W/m·K

Products

FACT SHEET.

- Acrylic based formulation with very good electrical insulation feature.
- Wide range of thicknesses and thermal conductivities.
- Excellent reliability performance at critical conditions.
- Good Flame retardancy.
- REACH, RoHS, Halogen-free.



tesa® product assortment

	Thickness	Thermal Conductivity	Thermal Impedance	Peel adhesion	Wetting	Breakdown Voltage	Flame retardancy	Compression	Comment
tesa® 60735	50 µm	0.7 W/mK	1.6 – 1.8 Kcm²/W	+++	+++	++	+	+	Lamination/ mounting Great bonding/ wetting Good conductivity
tesa® 5839x	125 – 800µm	0.8 W/mK	2.4 – 11.7 Kcm²/W	+++	+++	+++	++	++	Mounting Good conductivity Great el. Insulation
tesa® 5832x	1200 – 2000µm	> 2.0 W/mK	5.6 – 9.6 Kcm²/W	+	+++	+++	+++	+	Gap filling Great conductivity Great el. Insulation