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The application of TIMs in the electronic industry

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Catalog

- What is TIMs?
- Application of TIMs

What is TIMs?

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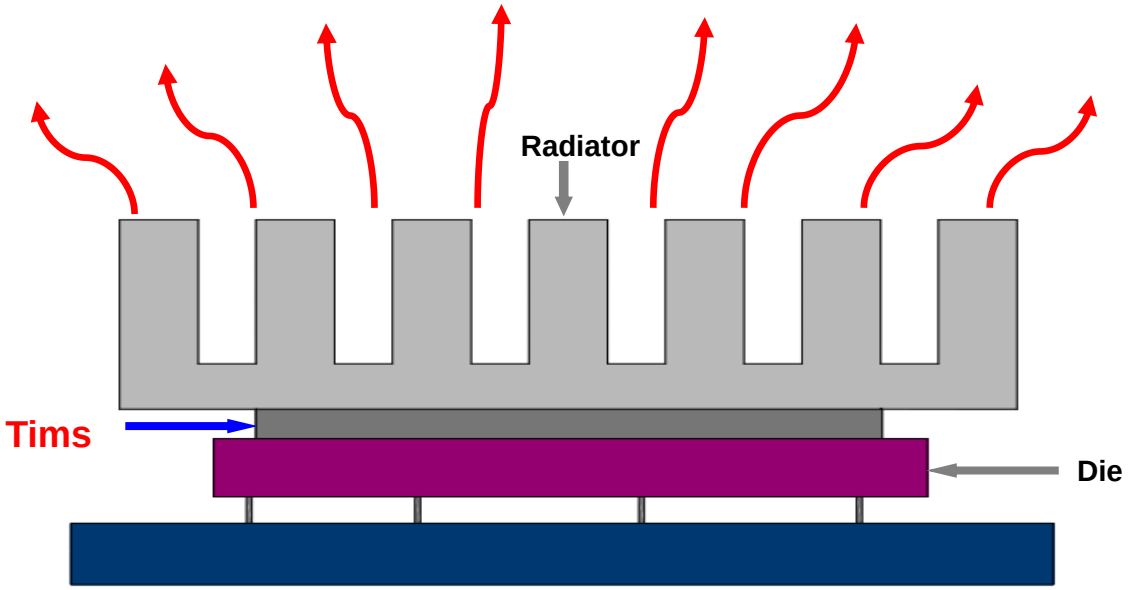
Electronic system is m
ore integration,
the thickness of electr
onic product
is more and more thin

Performance is getting
higher and higher,
power is getting bigger
and bigger

Cooling
requirements

High efficient thermal
transmission medium
(TIMs: Thermal
Interface Materials)



What is TIMs?

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Three modes of thermal transmission

- ### Radiation

  The temperature balance can be achieved by using radiation and absorbing infrared rays between objects without any medium.

- ### Conduction

  By direct contact between objects, thermal energy is transferred from high temperature to low temperature directly in an atomic vibration mode.

- ### Convection

  The heat is transmitted by the fluid as the medium, with the heat expansion and contraction and fluidity of the fluid.

What is TIMs?

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Principle of heat conduction

Fourier's law（Heat conduction law）

- In the heat conduction process, the heat transfer through a given section in unit time is directly proportional to the temperature change rate and section area perpendicular to the direction of the cross section, and the direction of heat transfer is opposite to the direction of temperature rise.

What is TIMs?

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Principle of heat conduction

Fourier's law（Heat conduction law）

$$Q=(K\times A\times \triangle T)/d$$

Q：Heat flow , the unit is W
K：Thermal conductivity , the unit is W/m · k
A：contact area , the unit is m^2
△T：The temperature difference between the heat inflow surface and the outflow surface , the unit is ℃
d：Thickness, the unit is m

$$K=(Q\times d)/(A\times \triangle T)$$

Thermal conductivity :
A physical quantity describing the thermal conductivity of a material is an natural characteristic of a single material, independent of the size and shape of the material.

What is TIMs?

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Principle of heat conduction

Thermal resistance

- Thermal resistance refers to the heat transfer between two points inside the body through heat conduction. The capacity of material per unit area and per unit thickness to prevent heat flow is called thermal resistance.

- The unit is ℃-in^2/W.

- Thermal resistance is the combination of thermal conductivity and the shape of the object, which reflects the thermal conductivity of the object. It is an important index for evaluating the thermal conductivity of the final form or working form.

What is TIMs?

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Principle of heat conduction

Thermal resistance and Thermal conductivity

- The thermal conductivity of the same material with the same section area and different length is the same, but the thermal resistance of the two ends is different.

- The same material is designed to be a different shape, but between the different geometric structures, the two heat resistance may be the same.

What is TIMs?

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Interface

- The interface between phase and phase, that is, the contact surface between two phases.

- Characteristic

Smooth / Roughness?

Thick / Thin?

Level / Uneven?

Other performance requirements?

What is TIMs?

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Design for thermal Interface

Present situation	Solution
➢Flat surface ➢Requirements for different thermal conductivity ➢The thickness of the interface is greater than 0.2mm	Using solid thermal gap pad
➢Flat surface ➢Requirements for different thermal conductivity ➢The thickness of the interface is less than 0.2mm ➢An uneven, unspecified surface	Using thermal putty or thermal grease
➢An uneven, unspecified surface	Using thermal gap phase change materials with special morphologic
➢A surface with a burr or a front	Using solid thermal gap pad with fabric coated silicone rubber
➢Requirements for bonding or sealing	Using thermal adhesive

What is TIMs?

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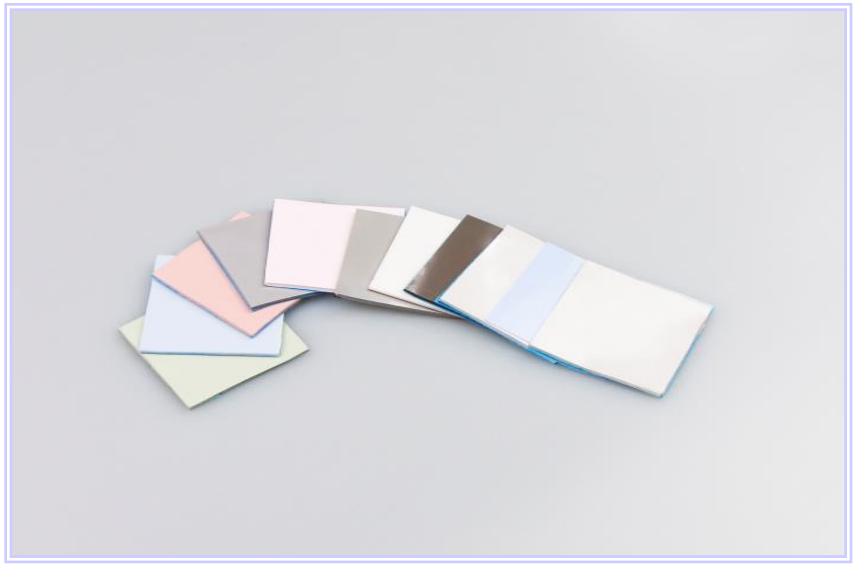
Design for thermal Interface

Physical Form	Solid	Paste	Liquid State	Special Morphologic
Thermal Materials	Thermal Gap Pad	Thermal Putty Thermal Grease	Thermal Adhesive	Thermal Gap Phase Change Materials



What is TIMs?

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Thermal Gap Pad

It is mainly composed of silicon resin and ceramic powder, which is made by mixing, rolling and vulcanization.

What is TIMs?

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Thermal Gap Pad

Features

- A wide range of thermal conductivity, insulation products can be less than 10W/m·k, non insulation heat conduction material can be about 30W/m·k, small thermal resistance.
- Good insulation, meet the requirements of the electronic industry.
- Naturally tacky, good flexibility and shock absorption.
- Good weather resistance, the use of temperature range of -50℃~200℃, excellent reliability.
- Meeting the requirements of miniaturization and ultra-thin gap design, the processing is convenient.
- Different surface treatment for choose, such as single surface tacky, back coating, mixed glass fiber, and many of shapes for selection, sheet form (block or abnormity), coil form and so on, and the thickness range is 0.15mm~20mm.
- High fire resistance.
- Green environmental materials.

What is TIMs?

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Thermal Gap Pad

Size

- Standard Size is 18"×18" or 18"×9“.
- The thickness is 0.15mm~8mm，can be superimposed to more than 20mm, can be cut for all kinds of dimensions.

Operation description

- Thermal pad with thickness below 0.5mm needs composite glass fiber to increase strength
- Can choose back coating with no substrate/substrate double-sided tape, PE film, silicone cloth and other composite materials

Application area

Communication equipment / storage equipment / optoelectronic industry / consumer electronics / power equipment / security camera / TV / Wearable devices / electric vehicle.

What is TIMs?

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Thermal Gap Pad

Item \ Application	LED	Mobile Phone	Set Top Box	Communication Base Station	Electric Vehicle Lithium Battery Pack	Charging Point	Security Camera	Military Equipment
Thickness mm	＜0.5	0.15~0.5	0.5~5.0	0.5~5.0	0.5~3.0	0.5~3.0	0.3~3.0	0.5~8.0
Thermal Conductivity W/m·K	＜2.0	＜3.0	＜3.0	＜5.0	＜2.5	＜4.0	＜3.0	5~8
Hardness Shore OO	＜70	＜70	＜50	＜50	＜40 low density	＜40	＜40	＜60

What is TIMs?

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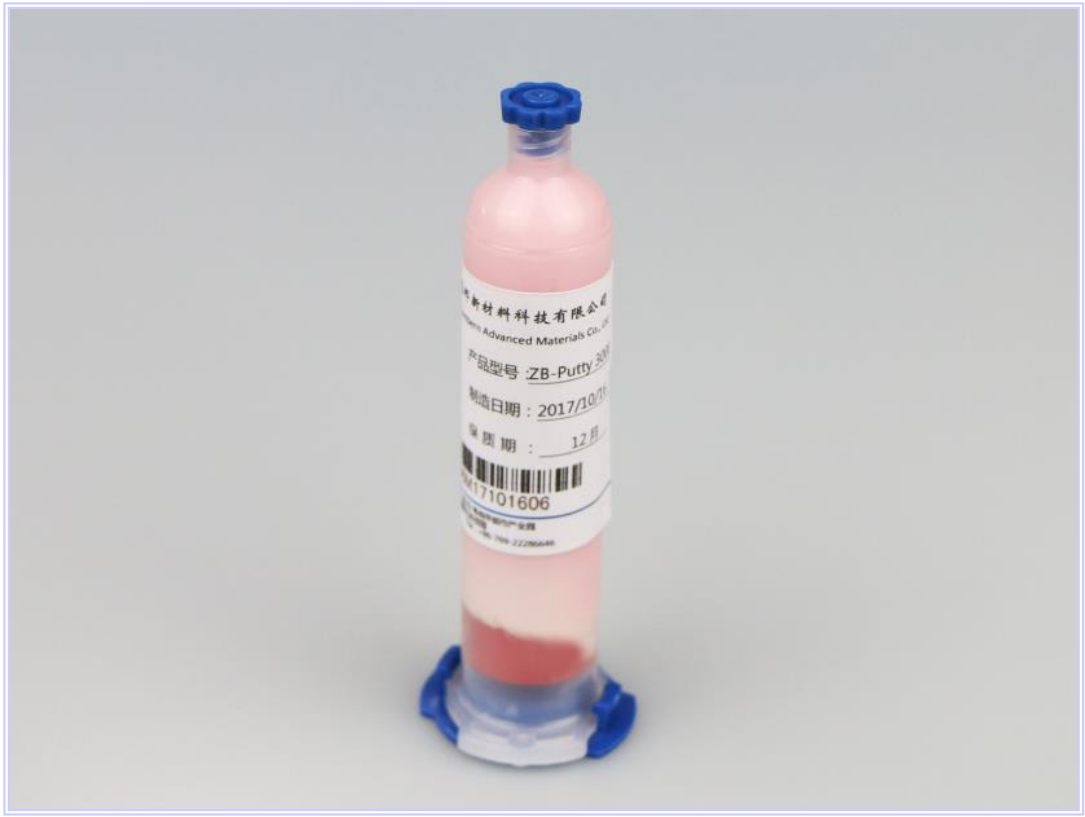
Thermal Putty

Thermal Putty is composed of silicon resin and conductive powder mixing into paste, conductive materials with non-curing process.



What is TIMs?

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Thermal Putty

Features

- Excellent thermal conductivity 3.3~4.2W/m·k, low thermal resistance.
- Single component not cured pasty conductive material.
- Excellent wettability and excellent weather ability.
- Good insulation, high fire resistance.
- Excellent thixotropy, the minimum binding thickness is 0.1mm, design for filling gaps with larger tolerance.
- Forming with shape, suitable for irregular cavity and uneven surface like ceramics and radiator, excellent surface adhesion characteristics.
- Flowing with pressure, can be painted by hand or dispenser.

What is TIMs?

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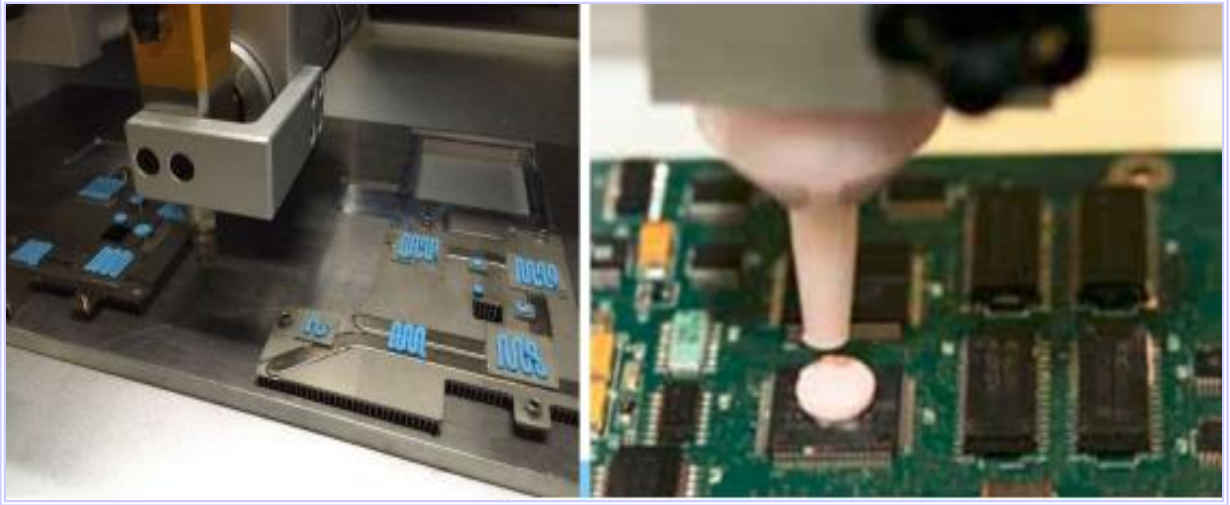
Thermal Putty

Application area

Semicomductors to hear spreader / Chassis walks to power resistor / LED lamps /Thermoelectric cooling device / High performance CPU, Graphics cards.

Packing

Syringe ,30cc or 300cc /pcs



What is TIMs?

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Thermal Putty

Item \ Model	ZB-Putty3000	ZB-Putty4000
Color	Pink	Gray
Extrusion Rate @90psi, 1“ g/min	19	15
Thermal Conductivity W/m·k	3.3	4.2
Thermal Resistance @50psi ℃-in²/W	0.05	0.06
Temperature Range / ℃	-50~200	-50~200
Storage Condition / ℃	8~28	8~28
Shelf Life / months	24	24

What is TIMs?

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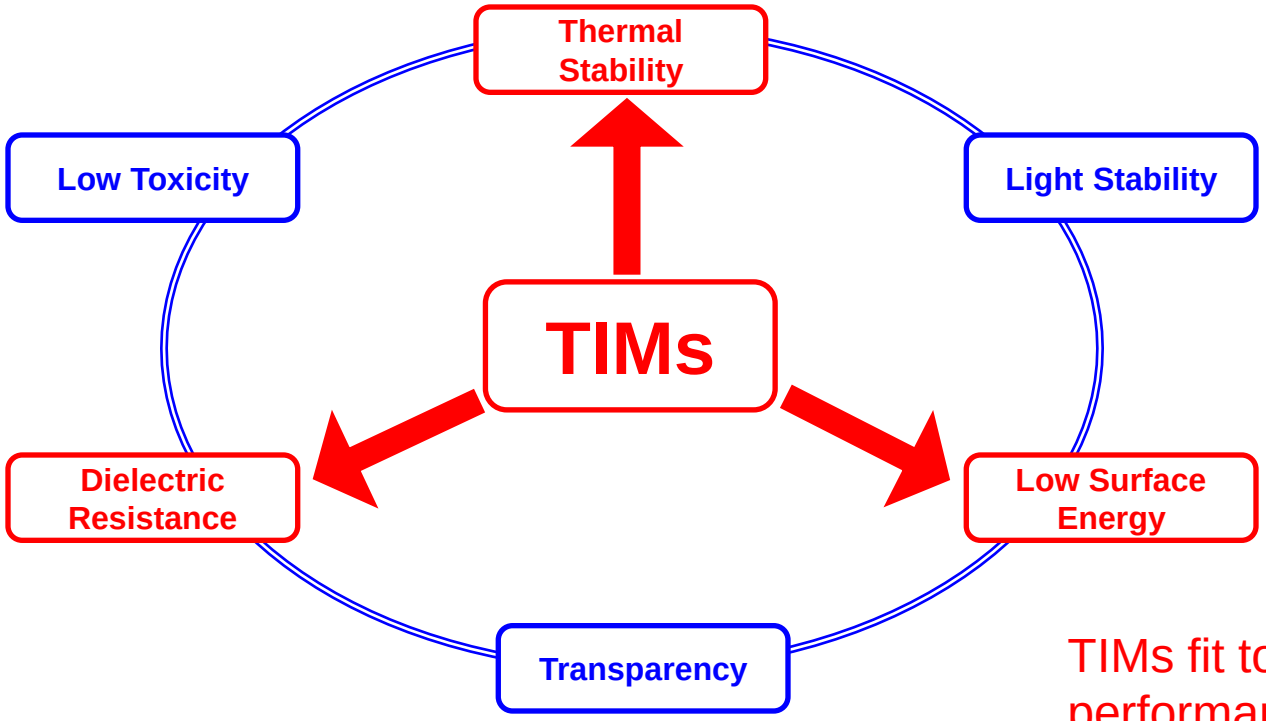
Why choose organosilicon to make TIMs?

Organosilicon refers to the polymer and its derivatives of polydimethylsiloxane（ PDMS ）. The related composites of silicone polymers are also called organosilicon or organosilicon materials.



TIMs fit to there from six key performance of PDMS

What is TIMs?

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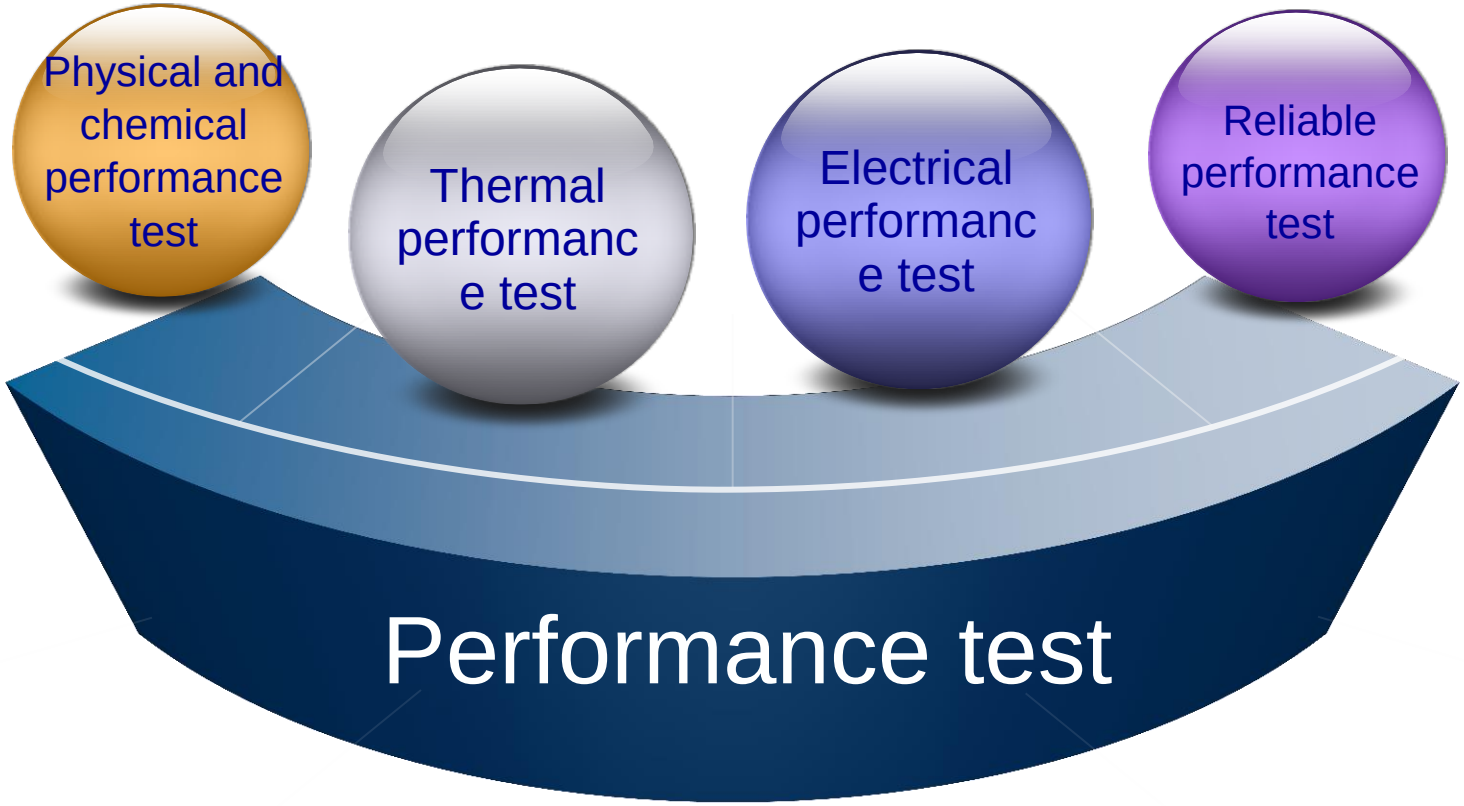

What is TIMs?

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Core test

- Physical and chemical performance test

1. Shore Hardness
2. Real Density
3. Viscosity

- Thermal performance test

1. Thermal Conductivity
2. Thermal Resistance

- Electrical performance test

1. Dielectric Breakdown Voltage
2. Surface Resistivity
3. Volume Resistivity

What is TIMs?

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Thermal performance test

Steady state methods

- Guarded hot plate apparatus
- Heat flow meter method

Transient methods

- Line thermal source method
- Plane thermal source method
- Laser method

What is TIMs?

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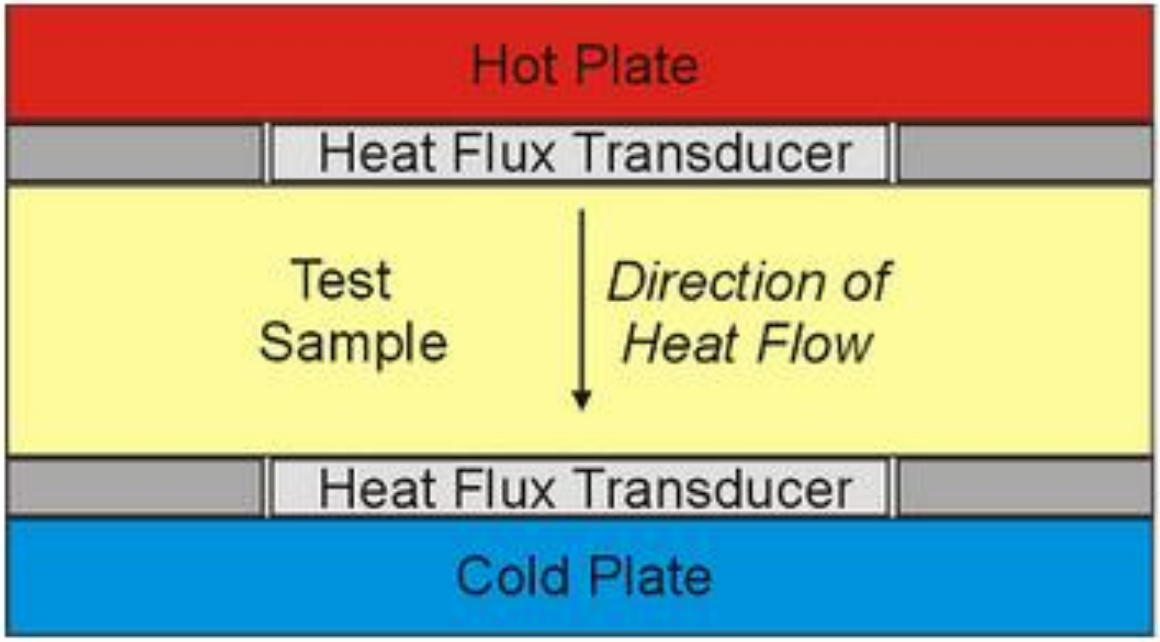
Thermal performance test

Heat flow meter method

- ASTM-D5470
- GB/T 10295-2008



Application of TIMs

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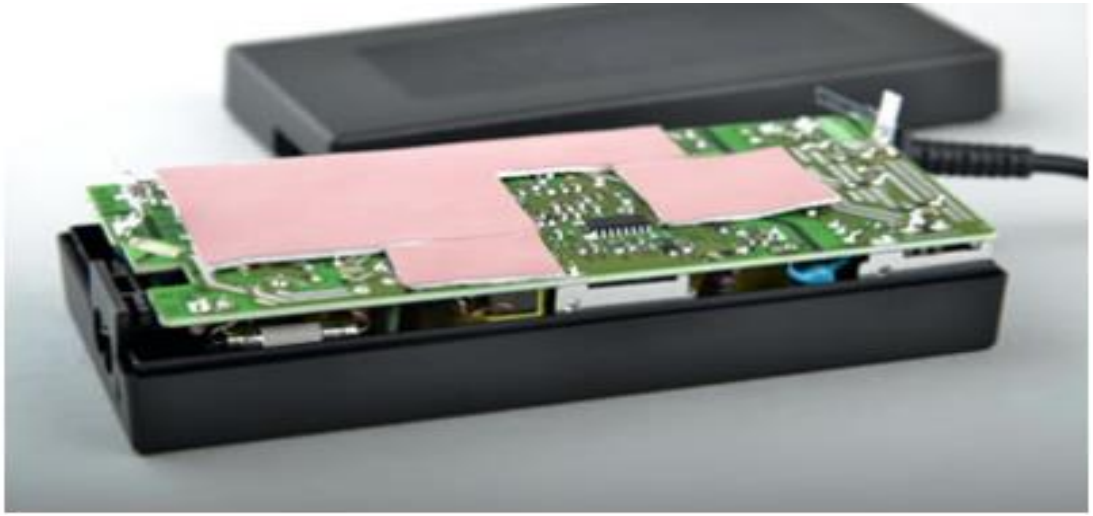
- Power Supply

Application	TIMs	Demand characteristics
Master Chip	Thermal gap pad or thermal grease	Thermal Conductivity 2.0W/m·K
IGBT (MOS)	Thermal grease with silicon cloth，thermal gap pad with glass fiber，thermal conduction cap	Thermal Conductivity 1.0W/m·K
PCB of transformer	Thermal adhesive	Bonding fixation and thermal conduction
The bottom of the PCB board	Thermal gap pad with silicon cloth，other thermal materials with glass fiber	Thermal Conductivity 1.5W/m·K
Embedment	Thermal conductivity encapsulants	Used in outdoor environment, requiring thermal conduction, fixed and waterproof functions

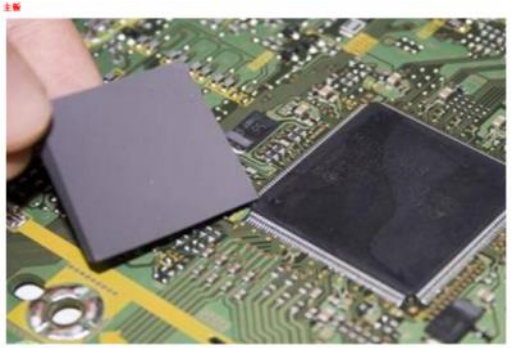
Application of TIMs

SUOREC®

- Power Supply



Thermal gap pad with silicon cloth to prevent needle piercing



Thermal gap pad on master chip

Application of TIMs

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- LED Lamps

Application	TIMs
LED street lamps	Thermal gap pad, thermal putty, Thermal conductivity encapsulants
LED fluorescent lamps and panel lamps	Thermal conduction double sided tape
LED spotlights, downlights	Thermal gap pad (0.23mm), thermal putty, Thermal conductivity encapsulants

Application of TIMs

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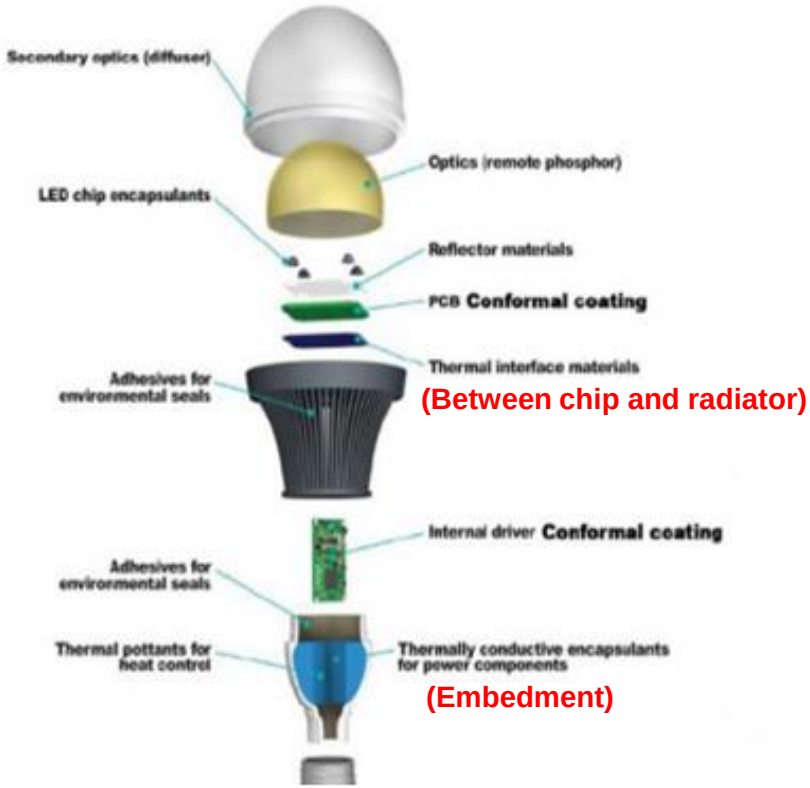
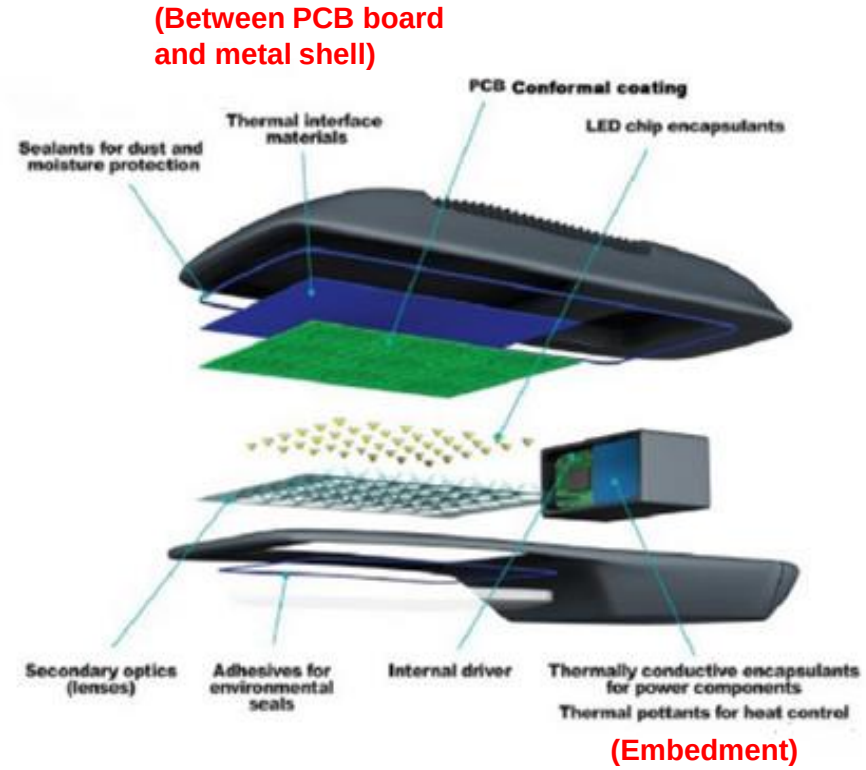
- LED Lamps



LED bulbs



LED street lamps

Application of TIMs

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- Security Camera

Box Camera

Speed Dome camera

Dome Camera

Cylindrical camera

Application of TIMs

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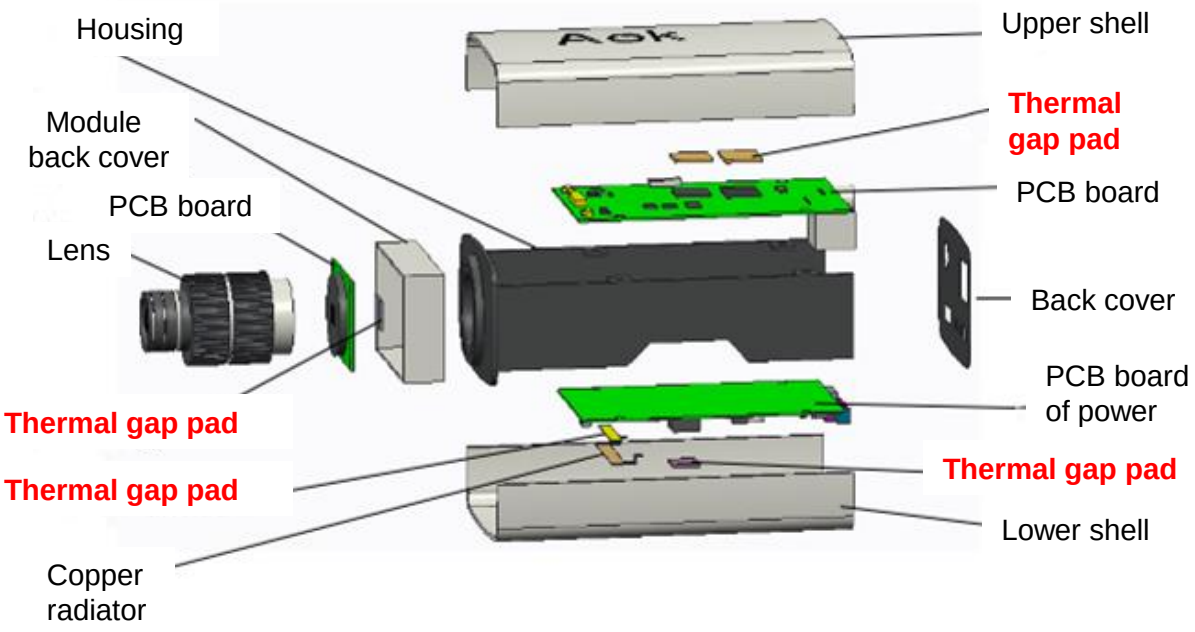
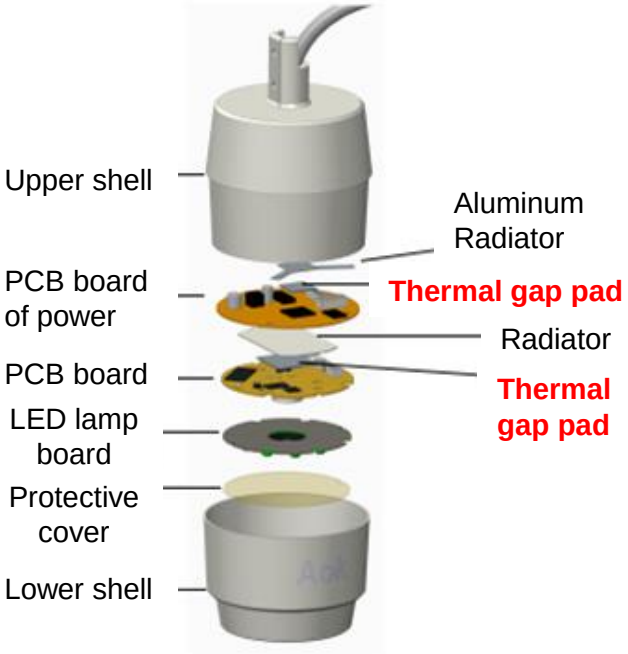
- Security Camera



Box Camera

Cylindrical camera



Application of TIMs

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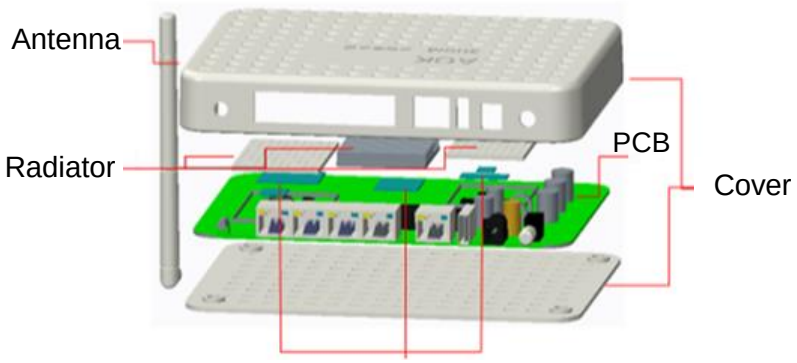
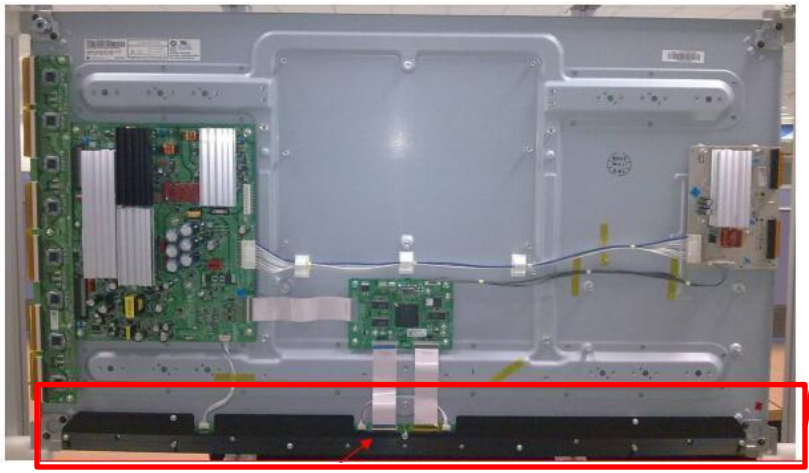
- Domestic Appliance

Wireless router

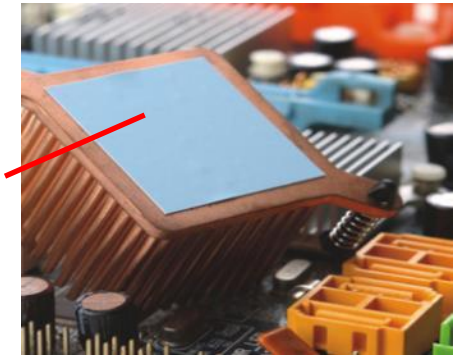


Thermal gap pad



Thermal gap pad

TV back cover



Thermal gap pad

Thermal grease

CPU of PC

Application of TIMs

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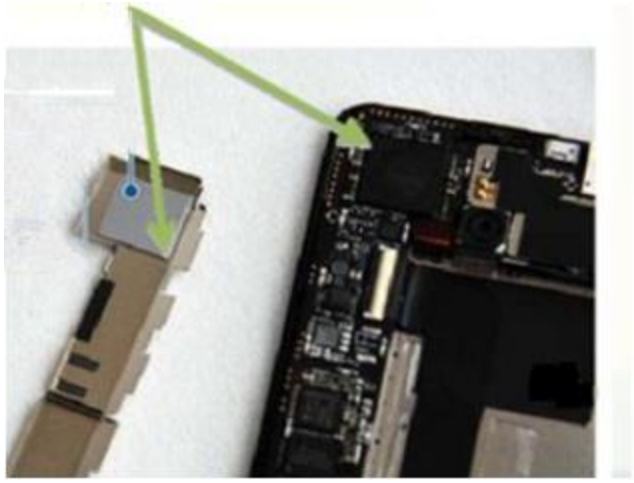
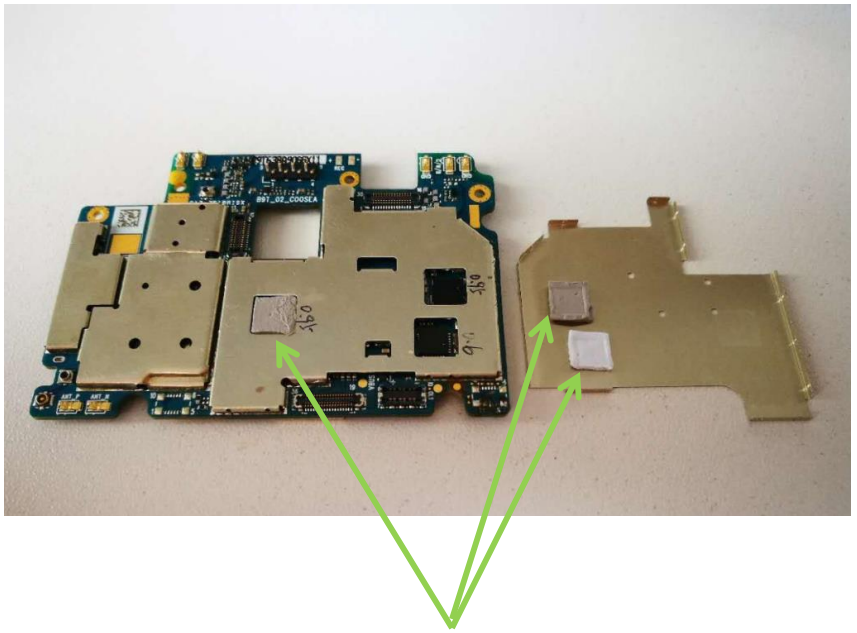
- Mobile phone

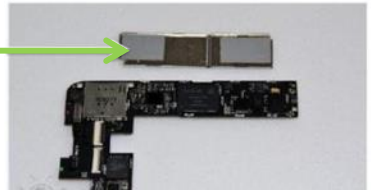
Thermal gap pad





Thermal gap pad

Thermal gap pad



Between chip and shielding case

Application of TIMs

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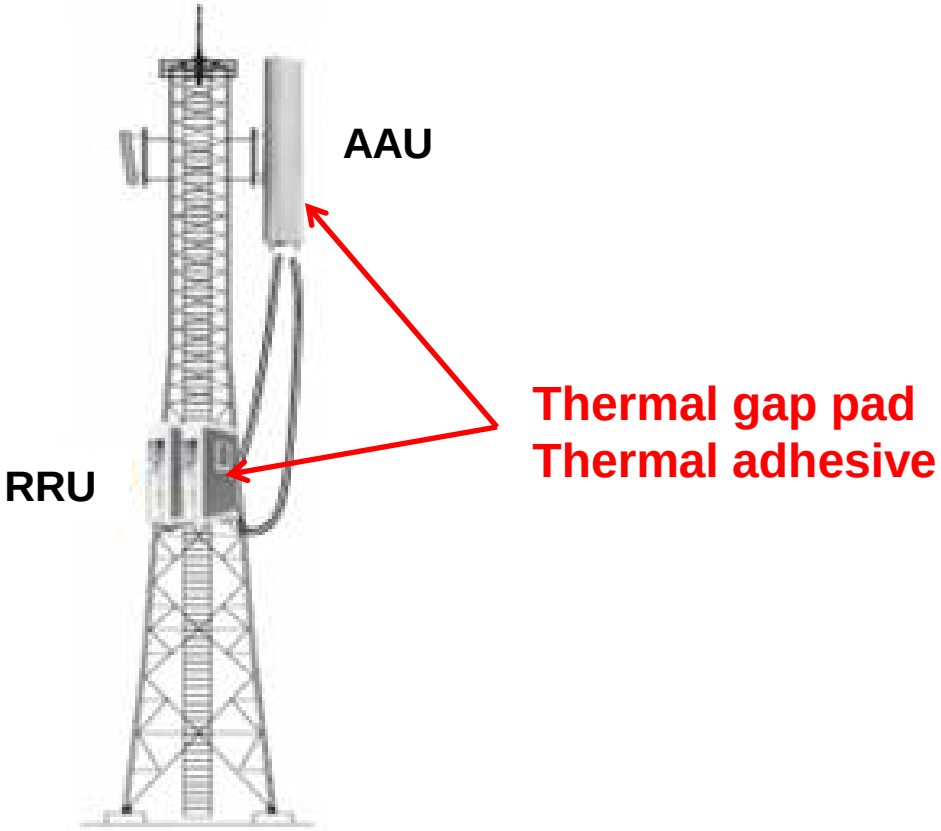
- Telecommunication base station



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THANK YOU