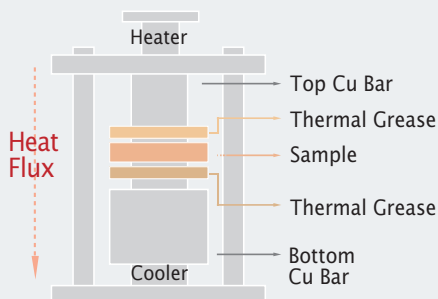


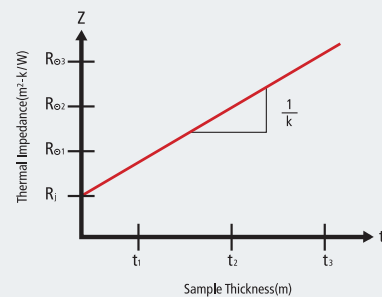
Thermal Conductivity Measuring Method

[ASTM D5470]

HEAT FLOW METHOD



THERMAL IMPEDANCE



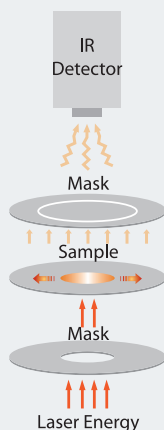
$$Z_{\theta} = \frac{t}{k \cdot A} + R_j$$

k : Thermal conductivity
 t : Sample thickness
 A : Sample area
 R_j : Contact thermal resistance

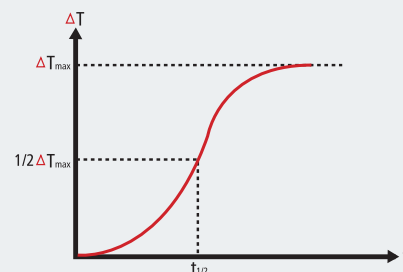
Thermal Conductivity Measuring Method

[Laserflash, ASTM E1461]

LASERFLASH METHOD



THERMAL DIFFUSIVITY



$$\lambda = \alpha \cdot C_p \cdot \rho$$

λ : Thermal conductivity
 α : Thermal diffusivity
 C_p : Heat capacity
 ρ : Density



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Thermal Conductive Material

THERMAL CONDUCTIVE MATERIAL

DongHyun Electronics provides the best thermal solution with advanced technologies and broad products range.

THERMAL CONDUCTIVE MATERIAL

TP Series are heat dissipation sheet, transferring heat quickly from the heat source to low temperature area.

List of Product

■ Soft Type

- Standard Type : TP-S series
- Super Soft Type : TP-SS series
- Ultra Soft Type : TP-US series

■ Hard Type

- TP-H series

■ High Thermal Conductive Type

- Hard Type : TP-H
- Soft Type : TP-S

■ Siloxane-Free Type

- TP-SSF series

■ Reinforced Type

- Hard Type : TP-HG series
- Soft Type : TP-SG series

■ Dual Functional Type

- Hard Type : TM-H series
- Soft Type : TM-S series

■ Multilayer Ceramic Coating Type

- Thermal Spreading Film
- Multi-Functional Film



Application

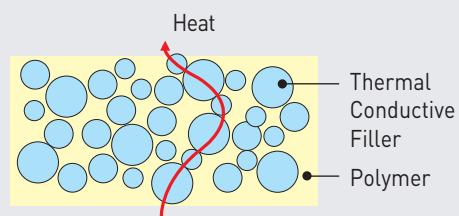
- Computer
- Smart Device(Smart phone, Tablet PC)
- FPD Device (PDP, LCD, LED..)
- Digital Camera / Camcorder
- DVD / Audio
- LED lighting
- Home appliances
- Communication device
- Magnetic Power device
- Mass storage device
- Automobile
- Solar cells



Thermal Conductive Mechanism

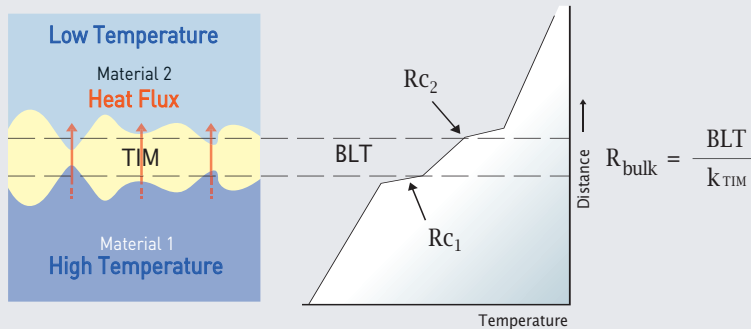
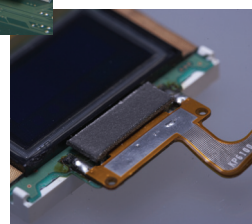
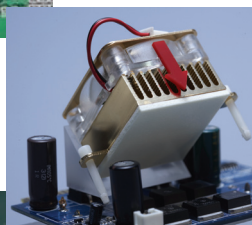
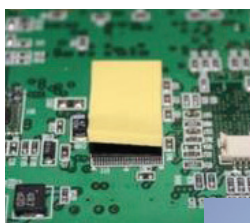
Principle

(Q : Heat Flow)



Thermal Contact Resistance

Thermal Interface Materials



Material (Ceramics)	k (W/mK)	Material (Polymers)	k (W/mK)
AlN	180	Epoxy	0.300
SiC	115	Silicone	0.160
Alumina	36	Water	0.610
BN	60	Ethanol	0.166
Quartz	1.38	Air	0.026
Glass	1.0	Hydrogen	0.181
MgO	26	Foam	0.024

Heat Conduction Equation

$$Q = k \cdot A \cdot \Delta T / d$$

Heat Transfer Speed(Q)

K : Thermal Conductivity of TIM

A : Contacting Area

ΔT : Temperature Difference

d : Distance Between Materials(BLT*)

*BLT: Bond Line Thickness

THERMAL CONDUCTIVE MATERIAL

■ Soft Type

Soft type series have very low hardness and are specially designed for the shock absorbing and vibration damping applications. Soft and self sticky property allow the pads to be applied to large sized heat dissipating devices.

Soft Type

Specifications

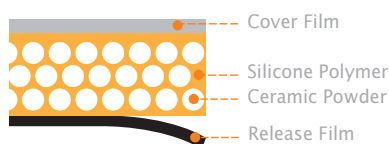
Item	TP-S10	TP-S15	TP-S20	TP-S25	TP-S30
Mechanical					
Color	Black	Gray	Yellow	Purple	Light Gray
Thickness (mm)	0.2 ~ 5.0			0.3 ~ 5.0	
Standard Size (mm x mm)	210 x 297, 300 x 300				
Hardness (Asker C/Shore 00)	25/55	25/55	25/55	25/55	25/55
Tensile Strength (MPa)	>0.2	>0.2	>0.2	>0.2	>0.2
Use Temp. (°C)	-60℃~ 200℃				
Base Polymer	Silicone				
Electrical					
Dielectric Breakdown Voltage (kV)	>5				
Volume Resistivity (Ω • cm)	>10 ¹³				
Thermal					
Thermal Conductivity (W/mK)	1.0	1.5	2.0	2.5	3.0
Flame Rating (UL94)	V-0 [File No. : E258204]				

Application

Flat Panel Displays (LED, LCD, PDP)
Power Devices (SMPS, Inverter, Converter)
Automotive Electronic Parts
(Reactor Module, Lighting)

Features

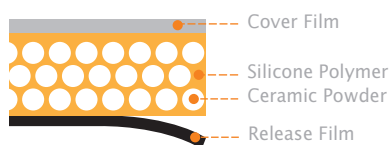
Thermal conductivity : 1.0 ~ 3.0 W/mK
Self sticky property
Very low hardness
Electrically insulating



Super Soft Type

Specifications

Item	TP-SS10	TP-SS15	TP-SS20	TP-SS25	TP-SS30
Mechanical					
Color	Black	Gray	Yellow	Purple	Light Gray
Thickness (mm)	0.2 ~ 5.0			0.3 ~ 5.0	
Standard Size (mm x mm)	210 x 297, 300 x 300				
Hardness (Asker C/Shore 00)	15/30	15/30	15/30	15/30	15/30
Tensile Strength (MPa)	>0.1	>0.1	>0.1	>0.1	>0.1
Use Temp. (°C)	-60℃~ 200℃				
Base Polymer	Silicone				
Electrical					
Dielectric Breakdown Voltage (kV)	>5				
Volume Resistivity (Ω・cm)	>10 ¹³				
Thermal					
Thermal Conductivity (W/mK)	1.0	1.5	2.0	2.5	3.0
Flame Rating (UL94)	V-0 [File No. : E258204]				



Ultra Soft Type

Specifications

Item	TP-US10	TP-US15	TP-US20	TP-US25	TP-US30
Mechanical					
Color	Red/Black	Red/Gray	Red/Yellow	Red/Purple	Red/Light Gray
Thickness (mm)	0.5 ~ 5.0				
Standard Size (mm x mm)	210 x 297, 300 x 300				
Hardness (Asker C/Shore 00)	5/10	5/10	5/10	5/10	5/10
Tensile Strength (MPa)	>0.1	>0.1	>0.1	>0.1	>0.1
Use Temp. (℃)	-60℃~ 200℃				
Base Polymer	Silicone				
Electrical					
Dielectric Breakdown Voltage (kV)	>5				
Volume Resistivity (Ω・cm)	>10 ¹³				
Thermal					
Thermal Conductivity (W/mK)	1.0	1.5	2.0	2.5	3.0
Flame Rating (UL94)	V-0 [File No. : E258204]				



■ Hard Type

Hard type series are designed as insulating materials for electronic components and devices. TP-H materials have sufficient dielectric strength and withstand high voltage. These materials are for applications where optimal heat transfer is required.

Specifications

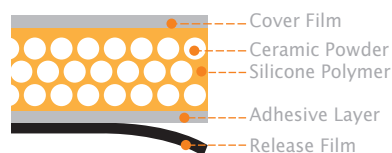
Item	TP-H10	TP-H15	TP-H20	TP-H25	TP-H30
Mechanical					
Color	Blue	Yellow	Red	Purple	Light Yellow
Thickness (mm)	0.2 ~ 3.0			0.1 ~ 3.0	
Standard Size (mm x mm)	210 x 297, 300 x 300				
Hardness (Shore A)	45	50	55	55	40
Tensile Strength (MPa)	1.0	2.0	1.5	1.0	0.5
Use Temp. (°C)	-60°C ~ 200°C				
Base Polymer	Silicone				
Electrical					
Dielectric Breakdown Voltage (kV)	>5				
Volume Resistivity (Ω • cm)	>10 ¹³				
Thermal					
Thermal Conductivity (W/mK)	1.0	1.5	2.0	2.5	3.0
Flame Rating (UL94)	V-0 [File No. : E258204]				

Application

CPUs, Graphic Cards
High Power Components
(Power Transistor)
Wireline/Wireless Communication Devices

Features

Thermal conductivity : 1.0 ~ 3.0 W/mK
Low thermal impedance
High breakdown voltage
Electrically insulating



■ High Thermal Conductive Type

High thermal conductive type series are specially designed for high power electronic devices such as power transistor, high power LED, medical devices, etc. These materials certify excellent electrical insulating property at the same time.

Specifications

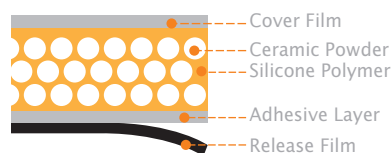
Item	TP-S60	TP-H60
Mechanical		
Color	Pink	Red
Thickness (mm)	1.0~3.0	0.1~0.3
Standard Size (mm x mm)	210 x 297, 300 x 300	
Hardness	35(Asker C)	90(Shore A)
Tensile Strength (MPa)	>0.2	>2.0
Use Temp. (°C)	-40℃~ 200℃	0℃~ 120℃
Base Polymer	Silicone	Urethane
Electrical		
Dielectric Breakdown Voltage (kV)	>5	
Volume Resistivity (Ω・cm)	>10 ¹³	
Thermal		
Thermal Conductivity (W/mK)	6.0	6.0
Flame Rating (UL94)	V-0 (equivalent)	

Application

High power semiconductors
High power LED components
Medical instruments

Features

Thermal conductivity : 6.0 W/mK
Low siloxane or siloxane free
Flexibility
Excellent electrical insulating



THERMAL CONDUCTIVE MATERIAL

■ Siloxane-Free Type

Siloxane free type series are specially designed for siloxane sensitive electronics fields. High thermal conductivity and electrically insulating properties allow the pads to be applied to various high reliable electronic devices, automotive modules or aerospace modules.

Specifications

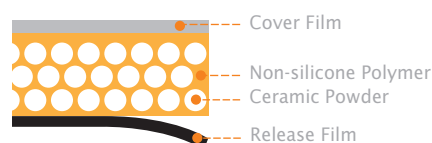
Item	TP-S15SF	TP-S25SF	TP-S30SF
Mechanical			
Color	Brown	Purple	Light Gray
Thickness (mm)	1.0 ~ 3.0		
Standard Size (mm x mm)	210 x 297, 300 x 300		
Hardness (Asker C)	30	30	30
Tensile Strength (MPa)	>0.2	>0.2	>0.2
Use Temp. (℃)	0℃~ 120℃		
Base Polymer	EPDM	Acryl	
Electrical			
Dielectric Breakdown Voltage (kV)	>5		
Volume Resistivity (Ω・cm)	>10 ¹³		
Thermal			
Thermal Conductivity (W/mK)	1.5	2.5	3.0
Flame Rating (UL94)	V-0 [File No. : E258204]		

Application

High power semiconductors
High power LED components
Medical instruments

Features

Thermal conductivity : 1.5 ~ 2.5 W/mK
No low molecular siloxane volatile
No silicone bleed
Electrically insulating



■ Reinforced Type

Reinforced type series are designed as insulating materials for electronic components and devices requiring high tensile strength. Fiber glass reinforced materials have sufficient mechanical strength for die-cut or screwing work.

Specifications

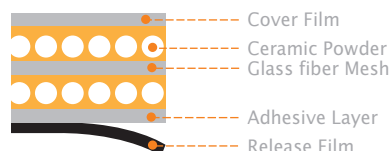
Item	TP-HG10	TP-HG15	TP-SG20	TP-SG25	TP-SG30
Mechanical					
Color	Black	Pink	Dark Gray	Purple	Light Gray
Thickness (mm)	0.3 ~ 3.0				
Standard Size (mm x mm)	210 x 297, 300 x 300				
Hardness (Asker C)	85	85	60	70	65
Tensile Strength (MPa)	>10.0		>4.0		
Use Temp. (°C)	-60°C ~ 200°C				
Base Polymer	Silicone				
Electrical					
Dielectric Breakdown Voltage (kV)	>5				
Volume Resistivity (Ω • cm)	>10 ¹³				
Thermal					
Thermal Conductivity (W/mK)	1.0	1.5	2.0	2.5	3.0
Flame Rating (UL94)	V-0 [File No. : E258204]				

Application

Automotive Electronics
High Power Components (Power Transistor)
Military and Aerospace Electronics

Features

Thermal conductivity : 1.0 ~ 3.0 W/mK
High tensile strength
High breakdown voltage
Electrically insulating



■ Dual Functional Type

Dual functional type series are designed as high thermal conductive and EMI absorbing materials. The high thermal conductivity and EMI absorbing properties allow the pads to be applied to various electronic mobile devices, specially suitable for high frequency image transferring digital instruments.

Specifications

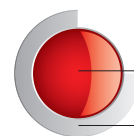
Item	TM-H20	TM-S15	TM-S25HV
Mechanical			
Color	Black	Light Black	Black
Thickness (mm)	0.2~1.0	0.5~3.0	0.5~3.0
Standard Size (mm x mm)	200X297, 300X300		
Hardness	90(Shore A)	25(Asker C)	25(Asker C)
Tensile Strength (MPa)	> 0.2	> 0.2	> 0.2
Use Temp. (°C)	-40°C ~ 130°C	-60°C ~ 200°C	
Base Polymer	Acryl	Silicone	
Electrical			
Dielectric Breakdown Voltage (kV)	> 0.25	> 0.25	> 3.0
Volume Resistivity (Ω・cm)	10 ⁹	10 ¹⁰	10 ¹²
Thermal			
Thermal Conductivity (W/mK)	2.0	1.5	2.5
Flame Rating (UL94)	V-0 [File No. : E258204]		

Application

Camcorders, Digital Cameras
Flat Panel Displays (PDP, LCD, LED)
Automotive Electronics

Features

Thermal conductivity : 1.5 ~ 2.5 W/mK
EMI absorbing property
High breakdown voltage (optionally)
Electrically insulating



EMI Absorbing Material
Ceramic Insulator Layer
Dual functional filler

■ MCC(Multilayer Ceramic Coating) Type Heat Spreading Film

Heat spreading films are composed of ceramic layer, metal or graphite layer and adhesive layer. The unique structure leads high heat spreading performance. Structure-originated high anisotropy of thermal conductivity, the ratio of through-plane thermal conductivity to in-plane thermal conductivity, is suitable for high heat generating and slim electronic devices, such as smartphone, tablet PC, OLED TV, etc.

Specifications

Item	TS-C30	TS-C50	TS-G50
Mechanical			
Surface Color	gray	gray	gray
Thickness (mm)	0.03	0.05	0.05
Standard Size (mmxmm)	200X600		
Adhesion Strength (gf/inch)	> 1,000		
Use Temp. (°C)	-20°C ~ 120°C		
Electrical			
Vertical Resistance (Ω)	>10 ⁹		
Thermal			
Thermal Conductivity (in-plane, W/mK)	200	250	700
Thermal Conductivity (through-plane, W/mK)	2.0	2.3	2.5
Flame Rating (UL94)	V-0 [equivalent]		

Application

Smart mobile devices(Smartphone, tablet PC)
Slim and curved OLED TV set

Features

Thermal conductivity (in-plane) : 200 ~ 500 W/mK
Thermal conductivity (through-plane) : 2 ~ 5 W/mK
Excellent electrical insulating
High reliability

