

Quick Cooler

Thermal Interface Materials



Hard Pad Type Series

TP-H1000 : Low Thermal Conductivity (0.5~1.5 W/mK)

TP-H2000 : Medium Thermal Conductivity (2.0~2.5 W/mK)

TP-H3000 : High Thermal Conductivity (≥ 3.0 W/mK)

Soft Pad Type Series

TP-S1000 : Low Thermal Conductivity (1.0 W/mK)

TP-S2000 : High Thermal Conductivity (2.0~2.5 W/mK)

TP-S3000 : Specially High Thermal Conductivity (≥ 3.0 W/mK)

Thermal + EMI Absorbing Hybrid Type Series

Siloxane & Halogen Free

NS-T2 : Medium Thermal Conductivity (2.5 W/mK)

NS-T3 : High Thermal Conductivity (3.0 W/mK)

Thermal Grease Type Series

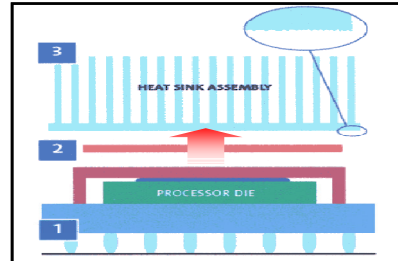
TG-3 : Medium Thermal Conductivity (3.0 W/mK)

CSC THERMAL CONDUCTIVE PAD

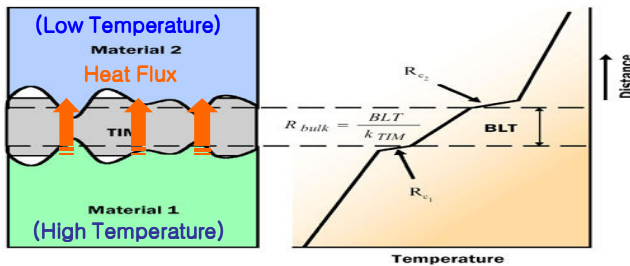
Introduction to Thermal Interface Material

Mechanism of Heat Transfer

- ① Heat transfer in semiconductor package : materials and design problems
- ② Heat transfer from TIM to heat sink : function of TIM
- ③ Heat transfer from heat sink to air : function of cooler



Heat Transfer Rate

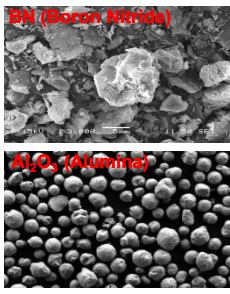


Heat Transfer Rate Q :
(Fourier equation)

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

k : Thermal conductivity of TIM
A : Contact area
ΔT : Temperature gradient
d : Contact distance

Composition of TIM



Ceramic fillers

+ Polymer
(Silicone/Acrylic)

Precision Compounding Technique
: surface modification, powder blending

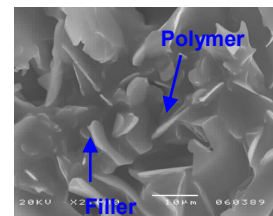
High Density Sheet or Grease!



Thermal Conductivity(k) of Various Materials

Material	k(W/mK)	Material	k(W/mK)	Material	k(W/mK)
CNT	2,000	AlN	180	Epoxy	0.300
Ag	427	SiC	115	SI rubber	0.160
Cu	398	Alumina	36	Water	0.610
Al	237	BN	60	Ethanol	0.166
Al alloy	120	Quartz	1.38	Air	0.026
Si	148	Glass	1.0	Hydrogen	0.181
Fe	79	MgO	26	Styrofoam	0.024

Cross-section of TIM

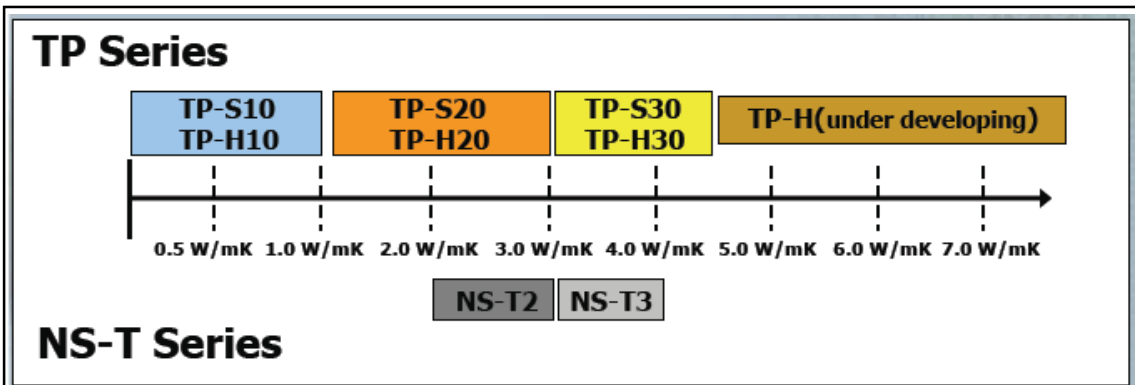


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CSC THERMAL CONDUCTIVE PAD

CSC's THERMAL INTERFACE MATERIALS		
	Characteristics	Standards
Thermal	Use Temperature (°C)	-
	Thermal Conductivity (W/mK)	ASTM D 5470
Electrical	Volume Resistivity (Ω·cm)	ASTM D 257
	Breakdown Voltage (kV)	ASTM D 149
Mechanical	Specific Gravity (g/cc)	ASTM D 792
	Hardness (Shore A)	ASTM D 2240
	Tensile Strength (kgf/cm ²)	ASTM D 412
	Elongation (%)	ASTM D 412



NS-T Series

T (A) – (S/H) 0000

T : Changsung Thermal Solution
 (A) : Product Type
 ex.) P - Pad, G - Grease Type
 NS : Noise Suppressor

(S/H) : Sheet Type
 ex.) S : Soft Pad, H : Hard Pad
 0000 : Thermal Conductivity/Thickness
 ex.) 1010 : 1 W/mK, 1.0 mm(T)
 3017 : 3 W/mK, 1.7 mm(T)

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CSC THERMAL CONDUCTIVE PAD

TP-H1000 Series

Description & Applications

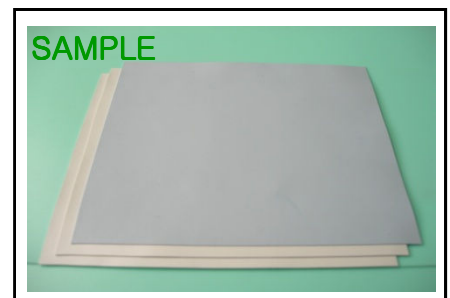
TP-H1000 is designed as a cost effective thermally conductive material. The soft and conformable properties allows the pad to apply to various heating devices. Primary use is to electrically isolate power sources from heat sinks.

- Power Electronics (SMPS, Converter)
- Automotive Electronics (ABS)
- Power Semiconductors



Main Features

- Thermal conductivity = 0.5 ~ 1.5 W/mK
- Enhanced mechanical properties
- Conformable hardness
- Electrically insulating



Specifications

ITEM	TP-H1000	METHOD
Mechanical		
Color*	Light Blue	Visual
Thickness (mm)	0.1 ~ 5.0	ASTM D374
Density (g/cc)	1.80	ASTM D792
Hardness (Shore A)	45	ASTM D2240
Tensile Strength (kgf/cm ²)	37.6	ASTM D412
Use Temp. (°C)	-60 ~ 200	-
Electrical		
Dielectric Breakdown Voltage (V)	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹³	ASTM D257
Thermal		
Thermal Conductivity (W/mK)	1.0	ASTM C518-98 (Modified)
Flame Rating (UL94)	V-0	File No. E258204

※ Pad color can be adjustable upon request

CSC THERMAL CONDUCTIVE PAD

TP-S1000 Series

Description & Applications

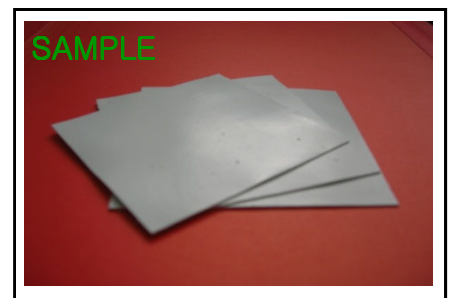
TP-S1000 gel type has a very low hardness and is specially designed for the shock absorbing and vibration dampening applications. The soft and self sticky properties allows the pads to apply to large sized heat dissipating devices.

- Telecommunication Devices (Router)
- Power Industries (SMPS)
- Flat Panel Displays (PDP, LCD)



Main Features

- Thermal conductivity = 0.5 ~ 1.0 W/mK
- Self sticky properties
- Very low hardness
- Electrically insulating



Specifications

ITEM	TP-S1000	METHOD
Mechanical		
Color*	Gray	Visual
Thickness (mm)	0.1 ~ 5.0	ASTM D374
Density (g/cc)	1.83	ASTM D792
Hardness (Shore 00)	7	ASTM D2240
Tensile Strength (kgf/cm ²)	2	ASTM D412
Use Temp. (°C)	-60 ~ 200	-
Electrical		
Dielectric Breakdown Voltage (V)	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹³	ASTM D257
Thermal		
Thermal Conductivity (W/mK)	1.0	ASTM C518-98 (Modified)
Flame Rating (UL94)	V-0	File No. E258204

※ Pad color can be adjustable upon request

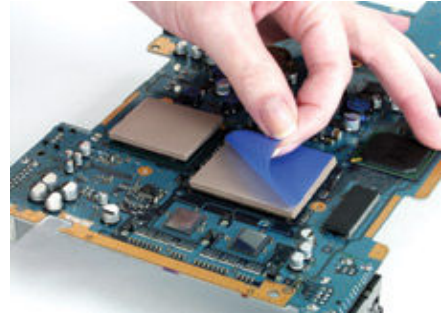
CSC THERMAL CONDUCTIVE PAD

TP-H2000 Series

Description & Applications

TP-H2000 is designed as a cost effective and high thermal conductive materials. The high thermal conductivity and mechanical properties allows the pads to apply to various electronic components. These applications also typically have low mounting pressures for component clamping.

- Chip Modules (Memory, Ceramic Component)
- High Power Components (Power Transistor)
- Power Transfer Devices



Main Features

- Thermal conductivity = 2.0 ~ 2.5 W/mK
- High thermal performance & cost effective solution
- Medium conformability
- Electrically insulating



Specifications

ITEM	TP-H2000	METHOD
Mechanical		
Color*	Pink	Visual
Thickness (mm)	0.1 ~ 5.0	ASTM D374
Density (g/cc)	1.98	ASTM D792
Hardness (Shore A)	54	ASTM D2240
Tensile Strength (kgf/cm ²)	27.2	ASTM D412
Use Temp. (°C)	-60 ~ 200	-
Electrical		
Dielectric Breakdown Voltage (V)	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹³	ASTM D257
Thermal		
Thermal Conductivity (W/mK)	2.0	ASTM C518-98 (Modified)
Flame Rating (UL94)	V-0	File No. E258204

※ Pad color can be adjustable upon request

CSC THERMAL CONDUCTIVE PAD

TP-S2000 Series

Description & Applications

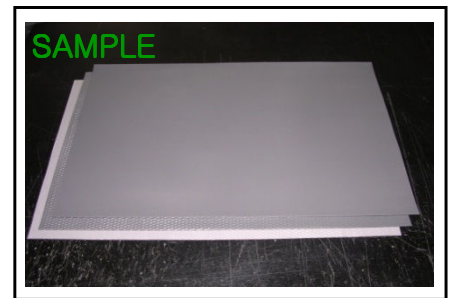
TP-S2000 gel type is recommended for low stress applications that require a mid to high thermally conductive interface material. The conformable nature allows the pad to fill in air voids and air gaps between main boards and metal chassis with stepped topography, high stack-up tolerances.

- Set-top Boxes (SD/HD)
- Mass Storage Devices (CDROM/DVD)
- Graphic Cards and Processors



Main Features

- Thermal conductivity = 2.0 W/mK
- Self sticky properties
- Conformable low hardness
- Electrically insulating



Specifications

ITEM	TP-S2000	METHOD
Mechanical		
Color*	Gray	Visual
Thickness (mm)	0.1 ~ 5.0	ASTM D374
Density (g/cc)	2.5	ASTM D792
Hardness (Shore 00)	10	ASTM D2240
Tensile Strength (kgf/cm ²)	2	ASTM D412
Use Temp. (°C)	-60 ~ 200	-
Electrical		
Dielectric Breakdown Voltage (V)	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹³	ASTM D257
Thermal		
Thermal Conductivity (W/mK)	2.0	ASTM C518-98 (Modified)
Flame Rating (UL94)	V-0	File No. E258204

※ Pad color can be adjustable upon request

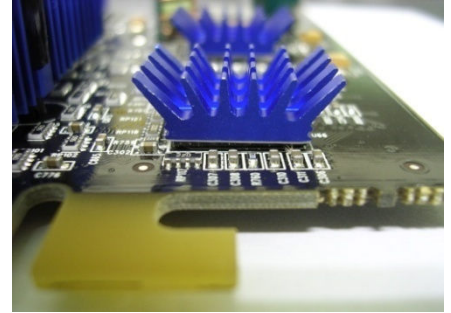
CSC THERMAL CONDUCTIVE PAD

TP-H3000 Series

Description & Applications

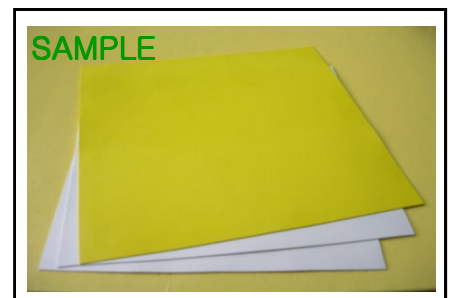
TP-H3000 is designed as a specially high thermal conductive materials. The high thermal conductivity allows the pads to apply to high-end electronic devices. These material is for applications where optimal heat transfer is requirement.

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



Main Features

- Thermal conductivity = 3.0 ~ 3.5 W/mK
- Specially high thermal performance
- Moderate hardness
- Electrically insulating



Specifications

ITEM	TP-H3000	METHOD
Mechanical		
Color*	Beige	Visual
Thickness (mm)	0.2 ~ 5.0	ASTM D374
Density (g/cc)	2.20	ASTM D792
Hardness (Shore A)	79	ASTM D2240
Tensile Strength (kgf/cm ²)	16.1	ASTM D412
Use Temp. (°C)	-60 ~ 200	-
Electrical		
Dielectric Breakdown Voltage (V)	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹³	ASTM D257
Thermal		
Thermal Conductivity (W/mK)	3.0	ASTM C518-98 (Modified)
Flame Rating (UL94)	V-0	File No. E258204

※ Pad color can be adjustable upon request

CSC THERMAL CONDUCTIVE PAD

TP-S3000 Series

Description & Applications

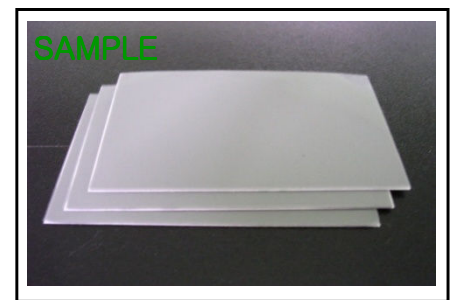
TP-S3000 has exceptionally low interfacial resistance to adjacent surfaces. Featuring a soft, very low hardness specially designed to comply to unique contours and topography and is ideal for fragile components.

- Memory Modules (DDR, S-RAM)
- Microprocessors
- BGA Packages



Main Features

- Thermal conductivity = 3.0 W/mK
- Self sticky properties
- Conformable low hardness
- Electrically insulating



Specifications

ITEM	TP-S3000	METHOD
Mechanical		
Color*	Light Gray	Visual
Thickness (mm)	0.1 ~ 5.0	ASTM D374
Density (g/cc)	2.7	ASTM D792
Hardness (Shore 00)	20	ASTM D2240
Tensile Strength (kgf/cm ²)	2	ASTM D412
Use Temp. (°C)	-60 ~ 200	-
Electrical		
Dielectric Breakdown Voltage (V)	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹³	ASTM D257
Thermal		
Thermal Conductivity (W/mK)	3.0	ASTM C518-98 (Modified)
Flame Rating (UL94)	V-0	File No. E258204

※ Pad color can be adjustable upon request

CSC THERMAL CONDUCTIVE EMI ABSORBING PAD

NS-T Series

Description & Applications

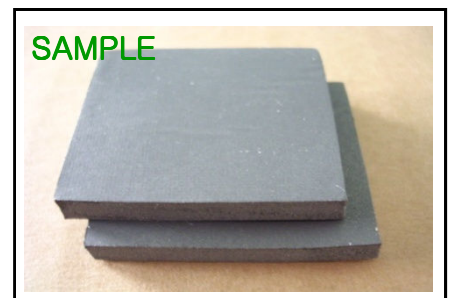
NS-T grade is designed as a high thermal conductive and EMI absorbing materials. The high thermal conductivity and EMI absorbing properties allows the pads to apply to various electronic mobile devices, specially suitable for high frequency image transferring digital instruments.



- Camcorders, Digital Cameras
- PDP, LCD devices
- Mobile Phones, DVDs

Main Features

- Thermal conductivity = 2.0 ~ 3.0 W/mK
- High thermal performance
- Power loss = 0.1~0.4 (@ 1 GHz/1 mm(T))
- Electrically insulating



Specifications

ITEM	NS-T2	NS-T3	METHOD ITEM
Mechanical			
Color	Black	Gray	Visual
Thickness (mm)	0.1 ~ 5.0	0.1 ~ 5.0	ASTM D374
Density (g/cc)	3.3	2.8	ASTM D792
Hardness (Shore A)	92	92	ASTM D2240
Tensile Strength (kgf/cm ²)	13.2	16.5	ASTM D412
Use Temp. (°C)	-40 ~ 130	-40 ~ 130	-
Electrical			
Dielectric Breakdown Voltage (V)	> 6,000	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹¹	10 ¹¹	ASTM D257
Thermal & EMI			
Thermal Conductivity (W/mK)	2.5	3.0	ASTM C518-98 (Modified)
Power loss (@ 1 GHz/1 mm(T))	0.40	0.15	Microstripline
Flame Rating (UL94)	V-0	V-0	File No. E258204

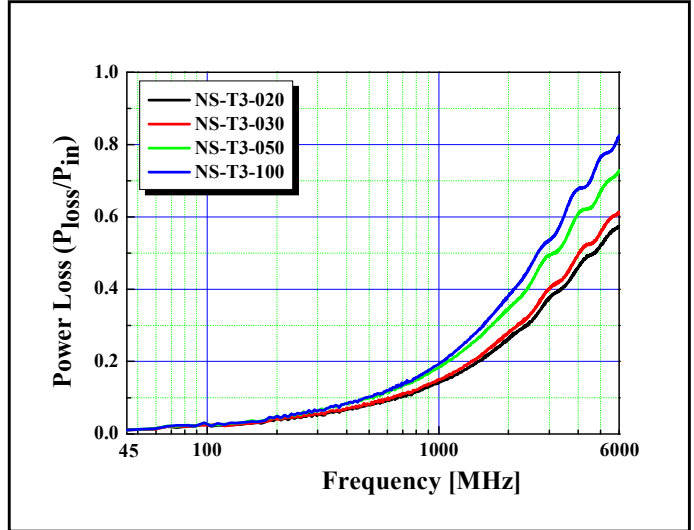
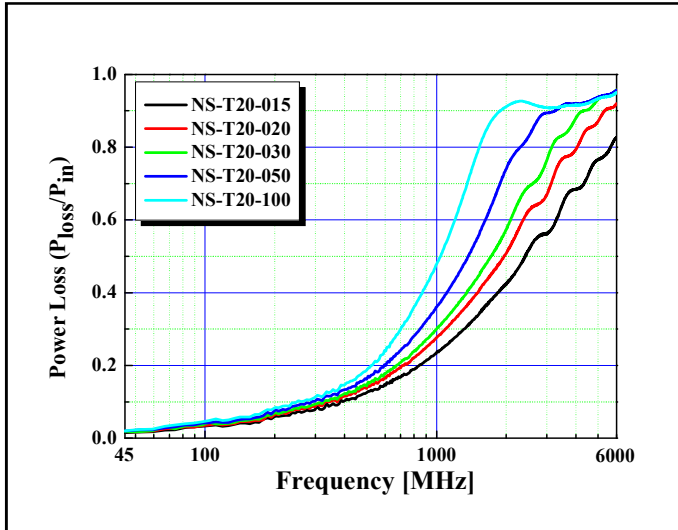
※ siloxane free products

CSC THERMAL CONDUCTIVE EMI ABSORBING PAD

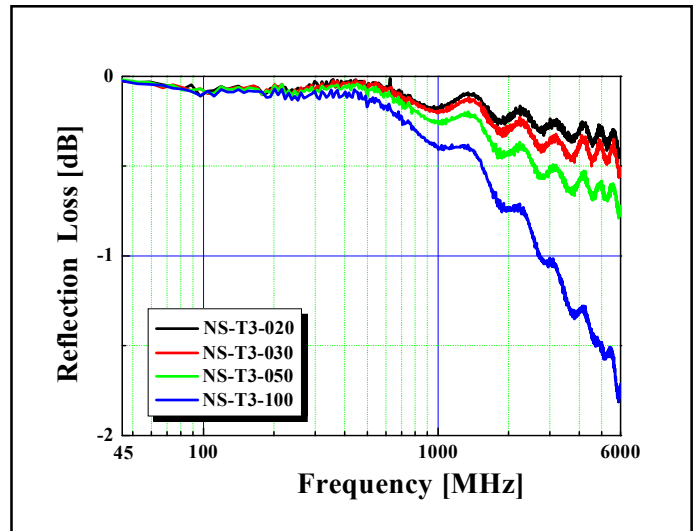
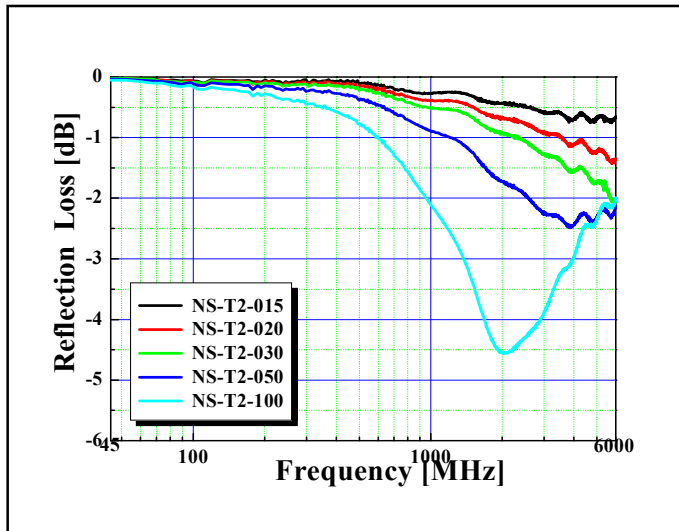
NS-T Series

EMI Absorbing Properties

■ Power Loss (by Microstripline Method)



■ Reflection Loss (by 39D-Method)



※ Instrument : HP Network Analyzer PNA 8364A

CSC THERMAL CONDUCTIVE COMPOUND

Thermal Grease TG-3

Description & Applications

TG-3 thermal grease is a one-component type high thermally conductive compound specially designed. Using fine size fillers, the bond line thickness can be minimized under 1 mil. The cross linking of silicone polymer inhibits the pump-out problems.

- Flip Chip Devices (CPU, Memory)
- CPU for Graphic Cards
- High Wattage Packages (Highly Integrated BGA)



Main Features

- High Thermal conductivity = 3.0 W/mK
- Excellent Reworkability
- Short Curing Time and Long Working Time
- Good Reliabilities (Temperature & Humidity)



Specifications

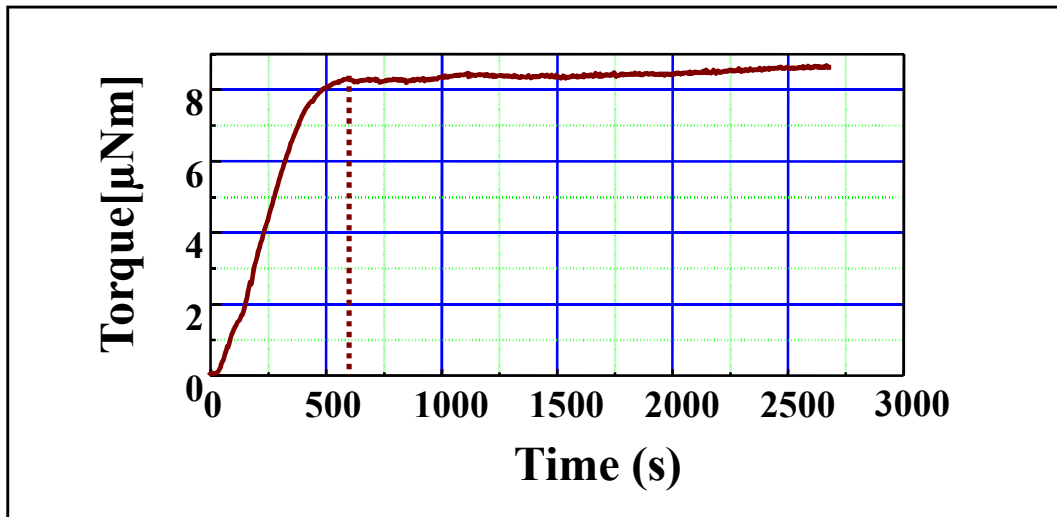
ITEM	TG-3	METHOD
Mechanical		
Viscosity (cps @ 20 rpm)	185,000	Brookfield DV++ #14 Spindle
Color	Gray	Visual
Specific Gravity (g/cc)	2.8	ASTM D792
Curing Condition (°C/min.)	150/10	Rheometer
Working Time (°C/hours)	25/24	Rheometer
Shelf Life (°C/months)	-30/6	Rheometer
Hardness (Shore 00 as cured)	10	ASTM D2240
Coefficient of Thermal Expansion (ppm/°C)	75	TMA
Glass Transition Temperature (°C)	-100	DSC
Use Temperature	-60~200	-
Electrical		
Dielectric Breakdown Voltage (V)	> 6,000	ASTM D149
Volume Resistivity (Ω · cm)	10 ¹³	ASTM D257
Thermal		
Thermal Conductivity (W/mK)	3.2	ASTM C518-98 (Modified)
Flame Rating (UL94)	V-0	File No. E258204

CSC THERMAL CONDUCTIVE COMPOUND

Thermal Grease TG-3

Curing Profile

TG-3 thermal grease is specially designed for fast curing. And after complete curing, mechanical properties of the cured compound are not changed. The curing condition can be controlled as to customers request.



Storage Condition

The recommended storage condition of TG-3 thermal grease is $-10^{\circ}\text{C} \sim -30^{\circ}\text{C}$. But preferable condition is -30°C . And in this recommended storage condition, approximately 6 months of shelf life is guaranteed.

Thawing Procedure

Thermal grease containing syringes must be maintained as vertical orientation with the syringe tip facing down. Never lay syringes horizontally under any circumstances.

Before use, the thermal grease must be allowed to thaw naturally to room temperature (usually 25°C) by placing the syringe in a vertical position in ambient environment.

The complete thaw time depends on the syringe volume. 30 cc syringe's thaw time is typically 60 minutes \sim 80 minutes depends on the ambient condition.

CSC THERMAL & ELECTRO-CONDUCTIVE SHEET

ES-L Series

Description & Applications

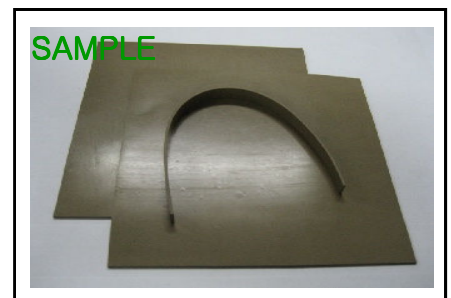
ES-L thermal and electro-conductive sheet is developed for the applications of highly reliable electronic devices, such as touch type mobile phones. And it's high thermal conductivity and low hardness allows this product to apply other digital devices.

- Keypad of Mobile Phones
- EMI Shielding for LCD Panel
- EMI Shielding for Electronic Housing



Main Features

- Excellent Electrical Conductivity = 0.1 $\Omega \cdot \text{cm}$
- High Thermal Conductivity = 1.9 W/mK
- Moderate Hardness
- Excellent Flexibility



Specifications

ITEM	ES-L	METHOD ITEM
Mechanical		
Color	Brown	Visual
Thickness (mm)	0.2 ~ 3.0	ASTM D374
Density (g/cc)	4.1	ASTM D792
Hardness (Shore A)	70	ASTM D2240
Tensile Strength (kgf/cm ²)	40	ASTM D412
Use Temp. (°C)	-55 ~ 150	-
Electrical		
Volume Resistivity ($\Omega \cdot \text{cm}$)	0.1	ASTM D257
Thermal & EMI		
Thermal Conductivity (W/mK)	1.9	ASTM C518-98 (Modified)