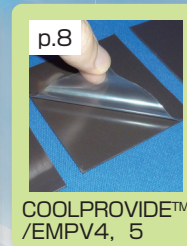
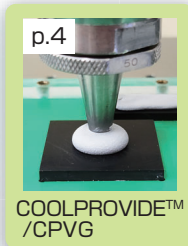


Thermal Management Solutions



Product Lines

Silicone-Free Thermal Interface Materials

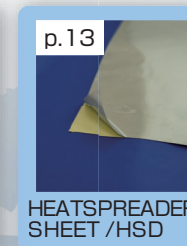
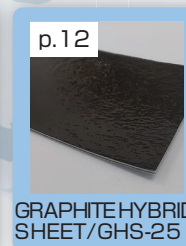
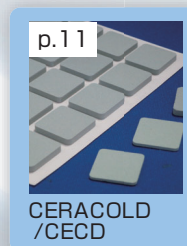


KGS
*First Solution
Proposer*

Silicone-Based



Special Thermal Interface Materials



Icons



Dual Function Thermal and EMC

EMI Suppression and Thermal Pad



Phase-Change

Upon application high-viscosity gel-like material works as a gap-filler



High Thermal Conductivity (3W/m-K or higher)*

High heat dissipation from ICs

*Hot wire method



Dual Function Vibration Damper and Thermal

Suppress vibration frequency and transfer heat

Soft type

For devices containing modules affected by pressure and compression



Ultra Soft

(ASKER C 3 or less)



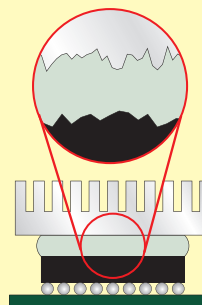
Super Soft

(ASKER C 3.1 to less than 20)

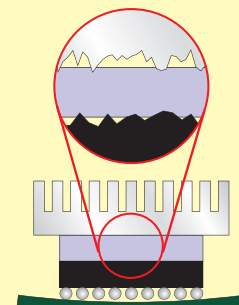
Features

Excellent conformability to uneven surfaces

High flexibility and excellent conformability minimize thermal interface resistance.



Soft type



Except for soft types

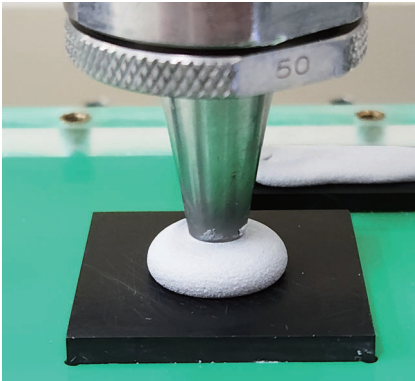
Low load

Reduces compression load (stress) on sensitive components ; prevents unintended bowing or damage

COOLPROVIDE™ / CPVG



P.4



Dispense-friendly,
no-drip, single-liquid thermal putty

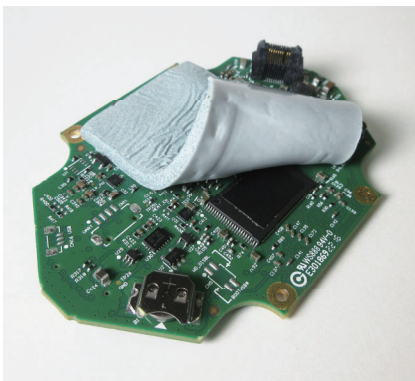
Features

- Useful to fill gaps between heat spreaders and ICs of various heights.
CPVG-30: GAP 1mm or less
CPVG-50: GAP 2mm or less
- Putty TIM applies very low force after compression. (10% or less as compared to thermal pads)
- Because the pre-crosslinked state provides structural stability, no curing process (such as heating or UV) is required and will not drip immediately after application.
- Applied using a manual caulking gun or an automated dispenser.
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

COOLPROVIDE™ / CPVP-30



P.6



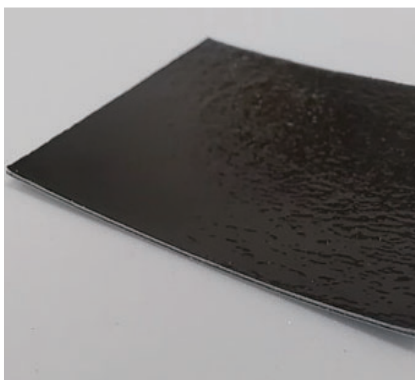
2-layer putty-like thermal pad with excellent
stress relief

Features

- Low compression force and excellent stress relaxation.
- Super compliant (ASKER C 0) material layered between thin permanent PET film and light tacky layer for easy handling.
- Operating temperature: -40 ~ 125°C
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

GRAPHITE HYBRID SHEET / GHS-25

P.12



Stacked layers work together to prevent
hot spots and returned heat to the device.

Features

- Ideal for attaching to the inside of plastic case of electronic devices.
- Low thermal conductivity layer reduces speed of heat transfer to graphite layer, prevents hot spots from occurring, and impedes heat reflection back to the heat source.
- One side heat-resistant adhesive tape.
- Addition of low heat reflection layer (Black PET film + Low thermal conductivity later) helps to reduce the temperature of heat source.

Safety Guidelines

Please review prior to using our products.

1. The contents or products described in this catalog may change without notice due to product improvements and specification updates.
2. All statements, specifications, properties, technical information, and recommendations herein are based on tests; however, the accuracy and completeness of the values are not guaranteed.
3. Before exporting any product featured in this catalog, ensure compliance with the "Foreign Exchange and Foreign Trade Law." If cargo falls under this regulation, an appropriate export license is necessary. Additionally, be aware that certain countries and regions have restrictions on the sale of these products.
4. KGS assumes no responsibility for any issues related to our intellectual property rights or third-party rights that arise after the use of any product listed in this catalog. Furthermore, KGS does not authorize the licensing of these rights.
5. The content of this catalog applies solely to products purchased directly from us or through authorized agencies. If no information regarding the applicable conditions is provided, or if the products were purchased from a third party, the conditions outlined in the catalog do not apply.
6. Products in this catalog may not be available for sale depending on country or region.
7. Products listed in this catalog are designed and tested for general-purpose applications commonly found in various electronic devices and equipment, such as AV systems, office equipment, computer peripherals, communication devices, home appliances, industrial robots, entertainment systems, personal-use devices, measurement/test units, and similar applications. They are intended for use under normal operating conditions in these general electronic devices and equipment.

This catalog does not guarantee the product's performance or quality, particularly if the product is intended for use in high-safety and high-reliability or other very unique applications, or in situations where device failure, malfunction, or misuse could pose risks or harm to human life and health, cause property damage, or have significant social impact. Please consult us before using our products in these cases, especially if your requirements exceed the product's normal performance range and conditions specified in the catalog, or if you have specific application requirements.

① aerospace equipment, ② transportation equipment (automobiles, trains, ships, and similar vehicles), ③ nuclear power-related equipment, ④ medical equipment, ⑤ military equipment, ⑥ underwater/submarine equipment, ⑦ power generation control equipment, ⑧ public information processing equipment, ⑨ transportation control equipment, ⑩ electric heating equipment, combustion equipment, ⑪ disaster prevention, crime prevention equipment, ⑫ various safety devices, ⑬ other usage deemed to be unique applications.

While designing the equipment to use the product in this catalog, please secure a protection or a backup in accordance with the intended use of the device.

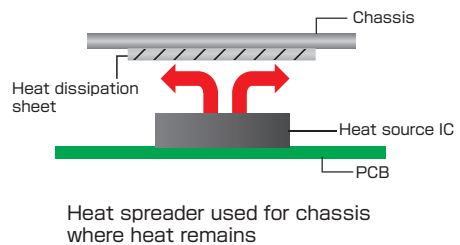
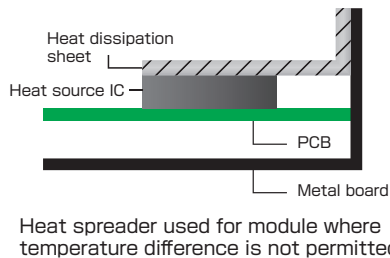
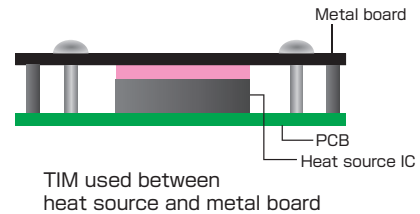
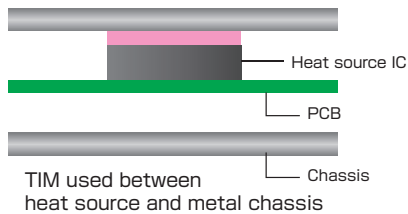
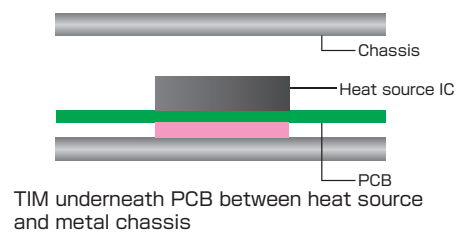
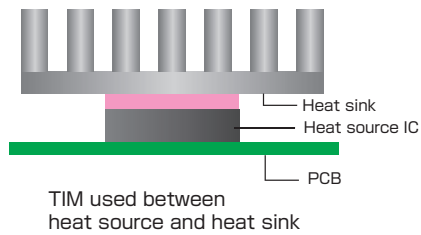
8. While we have implemented comprehensive measures to enhance the safety, quality, and reliability of our product, improper use may potentially result in personal injuries, fire hazards, or societal losses. Contact us for guidance on the correct use of our products.

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[Handling Procedures]

- During installation, avoid contact with the heating element to prevent any burns risks.
- Ensure the surface is free of dirt, dust, oil, or moisture before installing.
- Keep protective release liner in place until use to prevent contamination from debris and dust.
- Product thickness indicated in the catalog does not include the protective release liner.
- Store products at room temperature in a low humidity environment and avoid direct sunlight or UV rays.
- Phase-change gels must be stored below 35°C (Recommended temperature is 25°C).
- Due to the inherent tackiness of our products, removal after heating or compressing may be challenging.

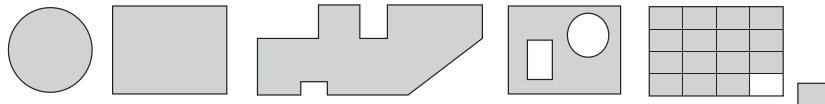
Applications



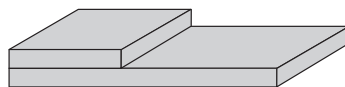
Secondary processing

Cutting

- Round, square, special shape, kiss-cutting, etc.



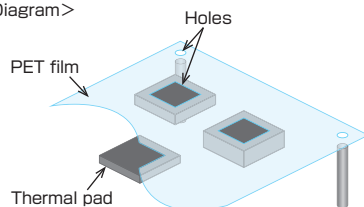
- Customized cutting for multi-layered products



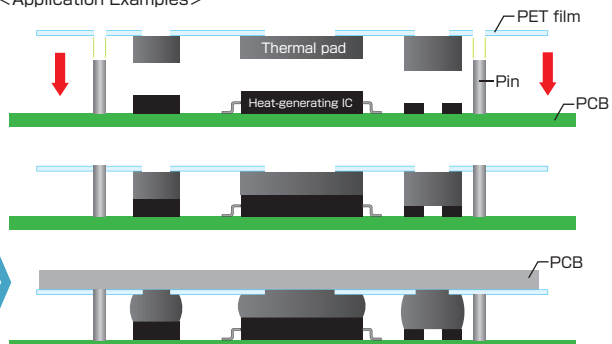
- Secondary process for easy assembly

We can offer multiple TIM pads pre-positioned on a carrier film. This allows for the simultaneous assembly of multiple TIM pads, even those varying in size, thickness, or type, resulting in a significant improvement in operational efficiency.

<Diagram>



<Application Examples>



By aligning the holes on the PET film and pin positions on the PCB, the TIMs can be applied to the ICs in their correct alignment.

Other processing

(Various other processes are possible. Please feel free to contact our sales.)

Properties of Thermal Conductive Materials (Silicone-Free)

(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	CPSH-F	CPSH	CPVH-F	CPVH	CPVT-F
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	5.0	5.0	3.0	3.0	2.0
		ISO22007-2 (Hot Disc method)	3.65	3.65	2.1	2.1	1.4
Color	—	—	Light green	Light green	Brown	Brown	Green
Thickness	mm	—	0.5/1.0/1.5/2.0	1.0/1.5/2.0	0.5/1.0/1.5/2.0	2.0/3.0/4.0	0.10/0.15
			2.5/3.0/3.5/4.0	2.5/3.0/3.5/4.0	2.5/3.0/3.5/4.0		0.20/0.25
Specific Gravity	—	JIS Z 8807	2.89	2.89	2.33	2.33	1.94
Hardness ¹⁾	ASKER C	JIS K 7312	32 ³⁾	32	15	15	34
	Shore OO	ASTM D 2240	64	64	47	47	—
Tensile strength	MPa	JIS K 6251	0.37	0.21	0.25	0.15	4.38
Elongation rate	%	JIS K 6251	10	20	4.0	74	4.9
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹¹	1.0×10 ¹¹	1.0×10 ¹¹	1.0×10 ¹¹	1.0×10 ¹³
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	2.2	2.0	3.1	2.9	11.1
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	1.4	1.2	2.1	1.9	5.0
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant	1MHz	Company standard	18.2	18.8	18.2	19.6	6.69
Loss tangent	1MHz	Company standard	0.01	0.01	0.08	0.08	0.08
Flammability	—	UL94	V-0 ⁴⁾	V-0 equivalent	V-0	V-0	—
Operating temp	°C	—	-40~125	-40~125	-40~125	-40~125	-20~100
Available max. dimension ²⁾	mm	—	200×500	200×500	200×500	200×500	190×490

Test type	Unit	Standard	CPVP-F	CPVP-30-F	CPLK-F	EMPV4-F	EMPV5-F
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	2.0	—	2.0	1.5	—
		ISO22007-2 (Hot Disc method)	1.4	2.5 or higher (Super soft layer:3.0)	1.4	1.3	0.8
Color	—	—	Dark green/White	Green/White	Purple	Black	Black
Thickness	mm	—	1.0/1.5/2.0	1.0/2.0/3.0/4.0	1.0/1.5/2.0	1.0/1.5/2.0	1.0/1.5/2.0
			3.0/4.0/5.0/6.0			2.5/3.0/3.5	2.5/3.0/3.5
Specific Gravity	—	JIS Z 8807	1.92	2.62	2.0	3.55	2.69
Hardness ¹⁾	ASKER C	JIS K 7312	0(Ultra soft layer)	7(Super soft layer)	30	40	30
	Shore OO	ASTM D 2240	—	18(Super soft layer)	60	70	60
Tensile strength	MPa	JIS K 6251	0.31	0.38	0.39	0.51	—
Elongation rate	%	JIS K 6251	7.5	7.9	9.1	16	—
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹¹	1.0×10 ¹¹	1.0×10 ¹¹	1.0×10 ¹²	1.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	9.1	4.4	6.6	6.0	8.8
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	8	3.5	3.0	4.2	5.0
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=4.0mm)	PLC:0 (600V or higher) (t=3.0mm)	PLC:2 (350V) (t=3.5mm)	PLC:2 (350V) (t=3.0mm)
Dielectric constant	1MHz	Company standard	11.3	11.9	5.40	12.7	7.4
Loss tangent	1MHz	Company standard	0.04	0.01	0.003	0.13	0.08
Flammability	—	UL94	V-0	V-0	V-0 equivalent	V-0 equivalent	V-0 equivalent
Operating temp	°C	—	-40~125	-40~125	-40~125	-40~110	-40~110
Available max. dimension ²⁾	mm	—	200×515	200×515	200×500	200×500	200×500

Test type	Unit	Standard	CPSS-F	CPSS	CPAG-T	CPAG
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	2.0	2.0	—	0.8
		ISO22007-2 (Hot Disc method)	1.4	1.4	0.5 or higher (Soft layer:0.72)	0.72
Color	—	—	Dark green	Dark green	Black	Black
Thickness	mm	—	1.0/1.5/2.0	3.0/4.0	0.5/1.0/2.0	0.5/1.0/2.0
			2.5/3.0/4.0		3.0/4.0/5.0	3.0/4.0/5.0
Specific Gravity	—	JIS Z 8807	1.92	1.92	1.57 or higher (Soft layer:1.67)	1.67
Hardness ¹⁾	ASKER C	JIS K 7312	8	8	70	70
	Shore OO	ASTM D 2240	33	33	Durometer typeA 64 ⁵⁾	Durometer typeA 64 ⁵⁾
Tensile strength	MPa	JIS K 6251	0.28	—	—	—
Elongation rate	%	JIS K 6251	8.9	—	—	—
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹²	1.0×10 ¹²	5.54×10 ¹¹	5.54×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	3.5	—	—	—
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	2.8	—	—	—
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)	—	—
Dielectric constant	1MHz	Company standard	14.6	—	—	—
Loss tangent	1MHz	Company standard	0.09	—	—	—
Flammability	—	UL94	V-2(t1.0 - 3.0mm) V-0(t4.0mm)	—	—	V-1 equivalent(t2.0mm) V-0 equivalent(t3.0 - 5.0mm)
Operating temp	°C	—	-40~100	-40~100	-10~100	-10~100
Available max. dimension ²⁾	mm	—	200×500	200×500	335×335 ⁶⁾	335×335 ⁶⁾

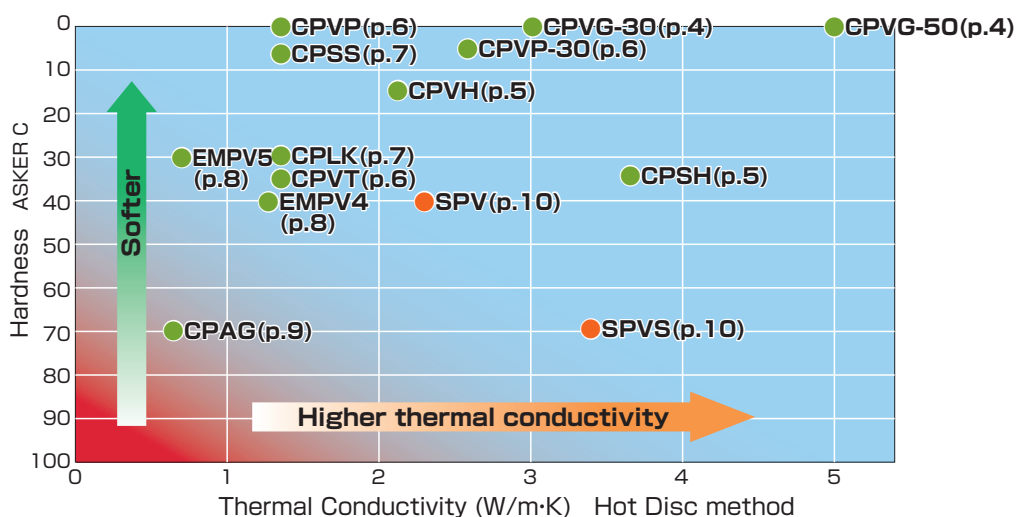
Properties of Thermal Conductive Materials (Silicone-Based)

(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	SPVS	SPV
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method) ISO22007-2 (Hot Disc method)	5.0 3.4	3.0 2.3
Color	—	—	Green	Green
Thickness	mm	—	0.5/1.0/1.5	0.5/1.0
Specific Gravity	—	JIS Z 8807	2.75	2.2
Hardness ^{*1}	ASKER C	JIS K 7312	70	40
	Shore 00	ASTM D 2240	86	69
Tensile strength	MPa	JIS K 6251	0.78	0.49
Elongation rate	%	JIS K 6251	16	59
Volume Resistivity	Ω·cm	JIS K 6911 compliant	3.0×10 ¹¹	2.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	3.2	0.69
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	1.8	0.3
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=4.0mm)	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant 1MHz	—	Company standard	13.7	35.1
Loss tangent 1MHz	—	Company standard	0.06	0.07
Flammability	—	UL94	V-0 ^{*7}	V-1 (t0.5mm)
Operating temp	℃	—	-20~125	-20~125
Available max. dimension ^{*2}	mm	—	200×500	215×500

Comparison of Product Series

● Silicone-free ● Silicone-based

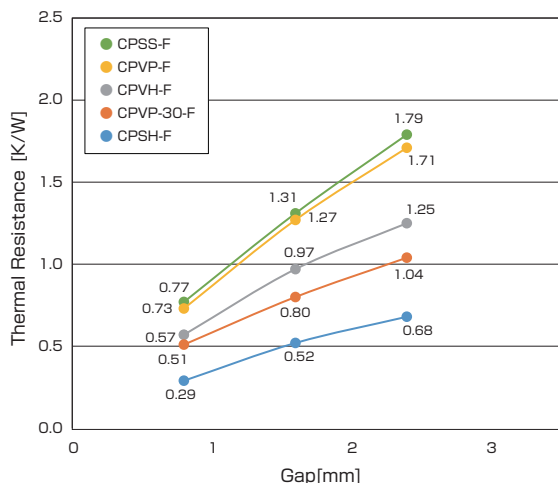


*1: Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked. *2: For usable dimensions, custom cuts, and material yield, contact your local sales department. *3: 0.5F : ASKER C 55 *4: CPSH-F 0.5F : V-0 equivalent. *5: JIS K 6253 compliant

*6: t=0.5 : 200×200 *7: t=1.5: V-0 equivalent

Thermal resistance measurement (In accordance with ASTM D5471)

Thermally conductive pad



(Unit:K/W)

Part NO.	Gap(mm)		
	0.8	1.6	2.4
CPSS-F	0.77	1.31	1.79
CPVP-F	0.73	1.27	1.71
CPVH-F	0.57	0.97	1.25
CPVP-30-F	0.51	0.80	1.04
CPSH-F	0.29	0.52	0.68
EMPV5-F	0.94	1.63	2.17
EMPV4-F	0.80	1.28	1.68
CPLK-F	0.71	1.26	—

【Test setup】

Measurements taken using our in-house thermal resistance measurement system (see photo)

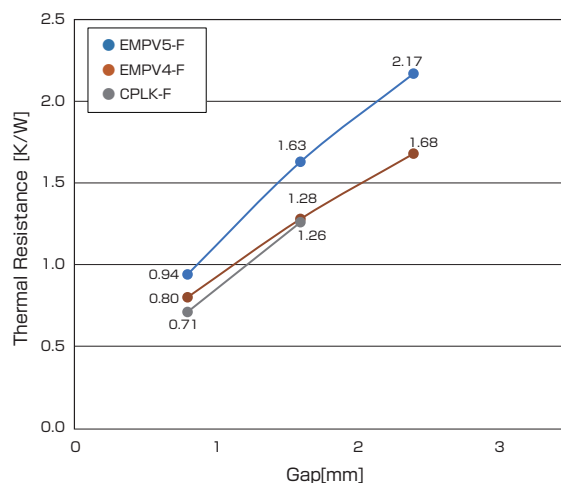
Sample Size: 25 mm × 25 mm

Thickness: Data represented is after 20% compression (recommended rate) of 1 mm, 2 mm, and 3 mm thick pads

* No option for 3 mm thick CPLK. Therefore, 2.4 mm gap data is N/A.

Heater Output: 20 W

Dual-function thermal + EMC pad



- In-house thermal resistance measurement equipment(In accordance with ASTM D5471)



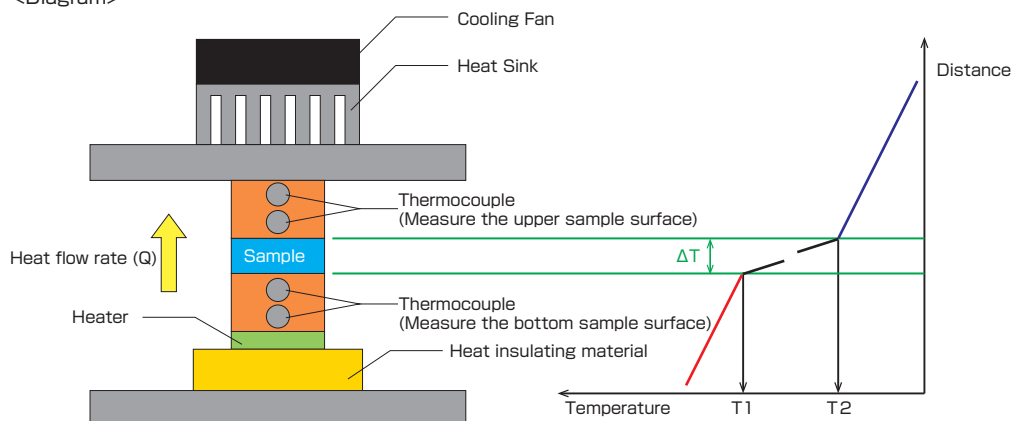
Features

- ASTM D5470 test method includes contact thermal resistance between the TIM and the measurement surface. Therefore, it can evaluate apparent effective thermal conductivity near actual use conditions.

Test Method

1. Place the thermal pad between the heating and cooling copper blocks.
2. Apply a constant heat flow from the bottom to the top. Measure the temperature difference between both sides of the sample. Measure thermal pad thickness.
3. Calculate the thermal resistance and apparent thermal conductivity using the above measurements and the sample dimensions.

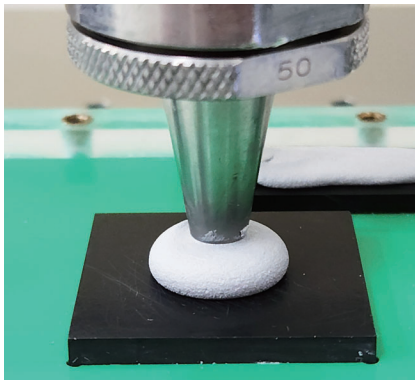
<Diagram>



$$\text{Thermal Resistance } R = \Delta T / Q$$

Q : Heat quantity (Amount of heat applied by the heater)

COOLPROVIDE™ / CPVG

Dispense-friendly,
no-drip, single-liquid thermal putty

Features

- Useful to fill gaps between heat spreaders and ICs of various heights.
CPVG-30: GAP 1mm or less
CPVG-50: GAP 2mm or less
- Putty TIM applies very low force after compression. (10% or less as compared to thermal pads)
- Because the pre-crosslinked state provides structural stability, no curing process (such as heating or UV) is required and will not drip immediately after application.
- Applied using a manual caulking gun or an automated dispenser.
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

Drip test

Products	Competitor's grease	CPVG-30	CPVG-50
Coating thickness	1.0mm	1.0mm	1.0mm
Results			
	Drip observed	No drip	No drip

[Heat cycle test conditions / High-temperature test conditions]

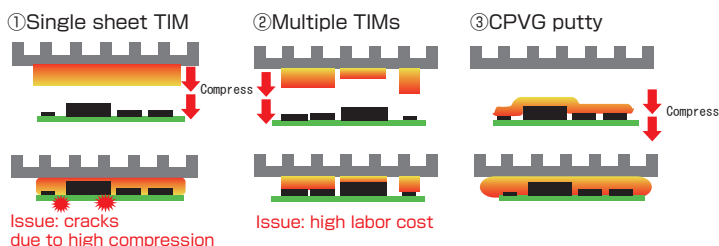
- Temperature : 125°C
- Time: 1000h
- Test Method: Test sample sandwiched between aluminum and glass plates

(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	CPVG-30-C	CPVG-50-P
Thermal Conductivity	W/m · K	ISO22007-2 (Hot Disc method)	3.0	5.0
Thermal resistance ^{*1}	t1.0mm	ASTM D5470	0.33	0.19
	t0.3mm		0.08	0.05
	t0.1mm		0.01	—
Color	—	—	White	White
Specific Gravity	—	JIS Z 8807	2.9	3.2
Viscosity	0.5[1/s]	ASTM D1824 compliant	3300	—
	1.0[1/s]		2500	—
	10rpm		600	1000
Recommended Thickness	mm	—	0.1 ~ 1.0	0.3 ~ 2.0
Volume Resistivity	Ω · cm	JIS K 6911 compliant	1.0 × 10 ⁹	1.0 × 10 ⁹
Breakdown voltage	kV/mm	JIS K 6911 compliant	8	3
Dielectric constant	1 MHz	Company standard	9.25	13.2
Loss tangent	1 MHz	Company standard	0.06	0.07
Shelf Life (25°C)	—	Company standard	6 months after delivery	6 months after delivery
Flammability	—	UL94	V-0 equivalent	V-0 equivalent
Operating temp	°C	—	-40 ~ 125	-40 ~ 130
Supply format	—	—	Cartridge 330ml	20L Pail (Net content : 17kg)

* 1) Sample size : □25mm

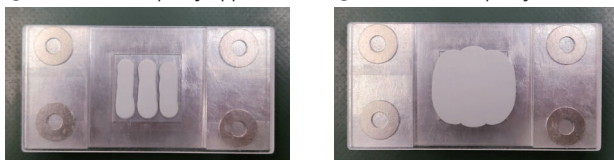
Benefits of CPVG (Putty TIM)



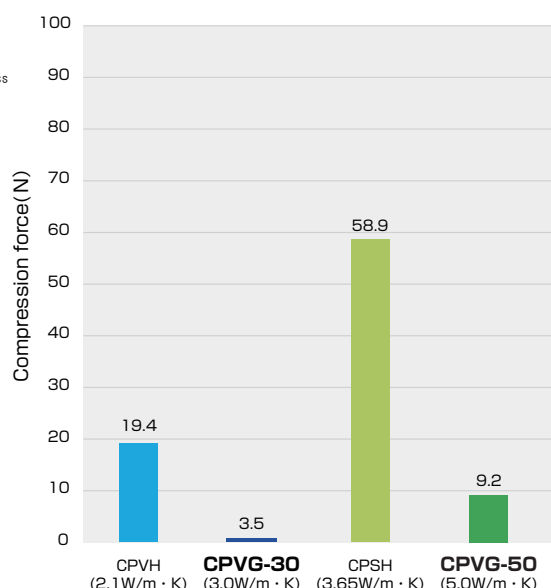
	①	②	③
Workability: components	○	×	○
IC Load	×	△	○

- Easy positioning of heat dissipation components
- Spreads to fill the gap upon compression, reducing the load on the IC

③CPVG thermal putty application ③CPVG thermal putty installation



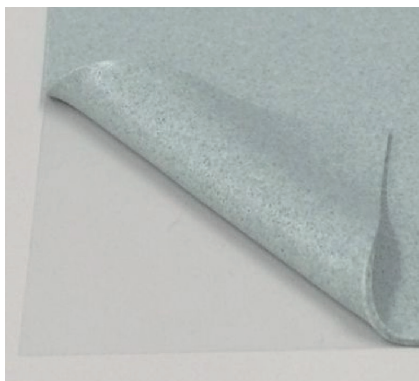
*We can help verify dispensing and application conditions.

Compression force comparison
with CPVG (Putty) and thermal pads

<Test conditions>

- Sample dimensions : □10mm × 10mm (t2mm)
- Compression rate : 20% compressed (t2mm → t1.6mm)
- * Maximum compression force at 20% compression is listed.
- * The thermal conductivity of each product is measured by the hot disk method.

COOLPROVIDE™ / CPSH



5W/m·K Silicone-Free Thermal conductive sheet

Features

- High performance (5W/m·K) and soft (ASKER C 32) silicone-free Thermal conductive sheet.
- Crowds out air bubbles to reduce thermal resistance.
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

(The values are measured values, but not the product specifications or guaranteed.)

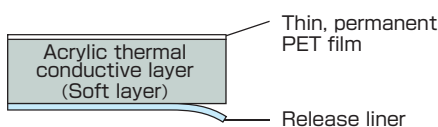
Test type	Unit	Standard	CPSH-F	CPSH
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	5.0	5.0
		ISO22007-2 (Hot Disc method)	3.65	3.65
Color	—	—	Light green	Light green
Thickness	mm	—	0.5/1.0/1.5/2.0	1.0/1.5/2.0
			2.5/3.0/3.5/4.0	2.5/3.0/3.5/4.0
Specific Gravity	—	JIS Z 8807	2.89	2.89
Hardness* ¹	ASKER C	JIS K 7312	32* ³	32
	Shore 00	ASTM D 2240	64	64
Tensile strength	MPa	JIS K 6251	0.37	0.21
Elongation rate	%	JIS K 6251	10	20
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹¹	1.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	2.2	2.0
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	1.4	1.2
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant	1MHz	Company standard	18.2	18.8
Loss tangent	1MHz	Company standard	0.01	0.01
Flammability	—	UL94	V-0* ⁴	V-0 equivalent
Operating temp	℃	—	-40~125	-40~125
Available max. dimension* ²	mm	—	200×500	200×500

*1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked

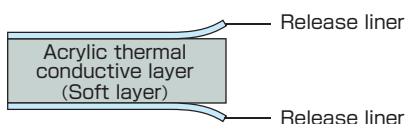
*2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

*3) 0.5 F : ASKER C 55 *4) 0.5F : V-0 equivalent

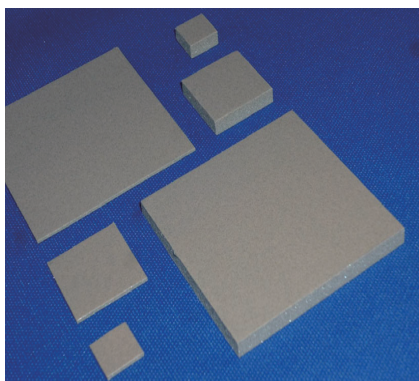
One-side tacky type / CPSH-F



Both-side tacky type / CPSH



COOLPROVIDE™ / CPVH



3W/m·K soft (ASKER C 15) thermal pad

Features

- Soft and compilable (ASKER C 15) silicone free thermal pad helps to crowd out air bubbles and reduce thermal resistance.
- Soft and compilable (ASKER C 15) silicone free thermal pad helps to crowd out air bubbles and reduce thermal resistance.
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

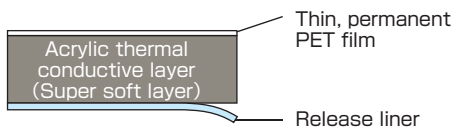
(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	CPVH-F	CPVH
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	3.0	3.0
		ISO22007-2 (Hot Disc method)	2.1	2.1
Color	—	—	Brown	Brown
Thickness	mm	—	0.5/1.0/1.5/2.0	2.0/3.0/4.0
			2.5/3.0/3.5/4.0	
Specific Gravity	—	JIS Z 8807	2.33	2.33
Hardness* ¹	ASKER C	JIS K 7312	15	15
	Shore 00	ASTM D 2240	47	47
Tensile strength	MPa	JIS K 6251	0.25	0.15
Elongation rate	%	JIS K 6251	4.0	74
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹¹	1.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	3.1	2.9
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	2.1	1.9
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant	1MHz	Company standard	18.2	19.6
Loss tangent	1MHz	Company standard	0.08	0.08
Flammability	—	UL94	V-0	V-0
Operating temp	℃	—	-40~125	-40~125
Available max. dimension* ²	mm	—	200×500	200×500

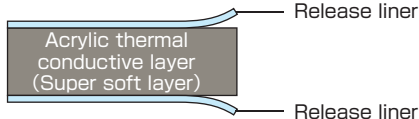
*1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked

*2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

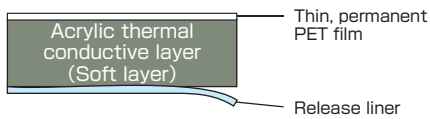
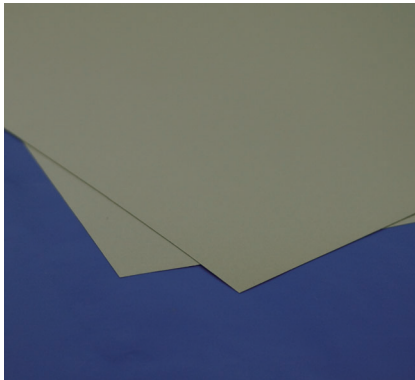
One-side tacky type / CPVH-F



Both-side tacky type / CPVH



COOLPROVIDE™ / CPVT



Ultra thin thermal conductive sheet is suitable for limited gap space such as in mobile applications.

Features

- Thickness ranging from 0.1mm~0.25mm at 0.05mm pitch minimizes PCB load.
- Self-tacky sheet provides easy workability compared to grease application.
- Super compliant (ASKER C 34) material minimizes thermal resistance.
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	CPVT-F
Thermal Conductivity	W/m-K	JIS R 2616 (Hot-wire method)	2.0
		ISO22007-2 (Hot Disc method)	1.4
Color	—	—	Green
Thickness	mm	—	0.10/0.15/0.20/0.25
Specific Gravity	—	JIS Z 8807	1.94
Hardness*1	ASKER C	JIS K 7312	34
	Shore 00	ASTM D 2240	—
Tensile strength	MPa	JIS K 6251	4.38
Elongation rate	%	JIS K 6251	4.9
Volume Resistivity	Ω-cm	JIS K 6911 compliant	1.0×10 ¹³
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	11.1
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	5.0
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant 1 MHz	—	Company standard	6.69
Loss tangent 1 MHz	—	Company standard	0.08
Flammability	—	UL94	—
Operating temp	°C	—	-20~100
Available max. dimension*2	mm	—	190×490

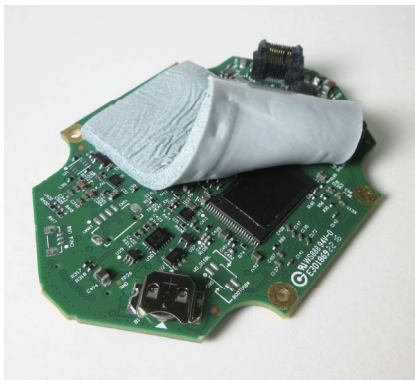
*1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.

*2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

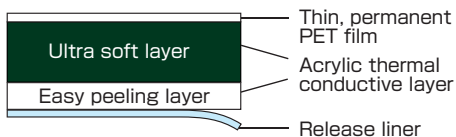
COOLPROVIDE™ / CPVP



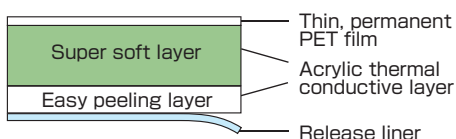
*CPVP : 2.0W/m-K



CPVP-F



CPVP-30-F



2-layer putty-like thermal pad with excellent stress relief

Features

- Low compression force and excellent stress relaxation.
- Super compliant (ASKER C 0) material layered between thin permanent PET film and light tacky layer for easy handling.
- Operating temperature: -40 ~ 125°C
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	CPVP-F	CPVP-30-F
Thermal Conductivity	W/m-K	JIS R 2616 (Hot-wire method)	2.0	—
		ISO22007-2 (Hot Disc method)	1.4	2.5 or higher (Super soft layer:3.0)
Color	—	—	Darkgreen/White	Green/White
Thickness	mm	—	1.0/1.5/2.0 3.0/4.0/5.0/6.0	1.0/2.0/3.0/4.0
Specific Gravity	—	JIS Z 8807	1.92	2.62
Hardness*1	ASKER C	JIS K 7312	0 (Ultra soft layer)	7 (Super soft layer)
	Shore 00	ASTM D 2240	—	18 (Super soft layer)
Tensile strength	MPa	JIS K 6251	0.31	0.38
Elongation rate	%	JIS K 6251	7.5	7.9
Volume Resistivity	Ω-cm	JIS K 6911 compliant	1.0×10 ¹¹	1.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	9.1	4.4
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	8	3.5
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=4.0mm)
Dielectric constant 1 MHz	—	Company standard	11.3	11.9
Loss tangent 1 MHz	—	Company standard	0.04	0.01
Flammability	—	UL94	V-0	V-0
Operating temp	°C	—	-40~125	-40~125
Available max. dimension*2	mm	—	200×515	200×515

*1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.

*2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

COOLPROVIDE™ / CPLK



Dual Function Noise Suppression thermal conductive sheet

Features

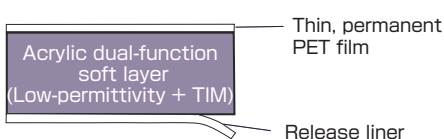
- CPLK's low permittivity 5.4/1 MHz has a significant effect on noise reduction.
- Low-dielectric thermal conductive sheet helps to reduce noise in GHz bands, which occurs by heat sink's resonance phenomena.
- Silicone-free generates no siloxane gas and oil bleeding.

(The values are measured values, but not the product specifications or guaranteed.)

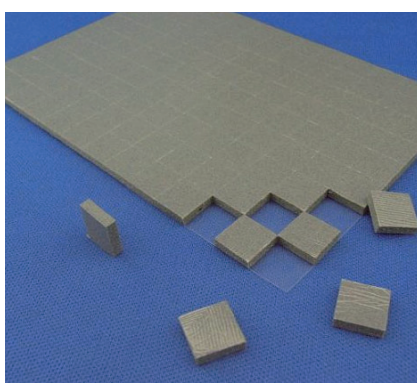
Test type	Unit	Standard	CPLK-F
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	2.0
		ISO22007-2 (Hot Disc method)	1.4
Color	—	—	Purple
Thickness	mm	—	1.0/1.5/2.0
Specific Gravity	—	JIS Z 8807	2.0
Hardness*1	ASKER C	JIS K 7312	30
	Shore 00	ASTM D 2240	60
Tensile strength	MPa	JIS K 6251	0.39
Elongation rate	%	JIS K 6251	9.1
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	6.6
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	3.0
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant 1MHz	—	Company standard	5.40
Loss tangent 1MHz	—	Company standard	0.003
Flammability	—	UL94	V-0 equivalent
Operating temp	℃	—	-40~125
Available max. dimension*2	mm	—	200×500

* 1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.

* 2) For usable dimensions, custom cuts, and material yield, contact your local sales department.



COOLPROVIDE™ / CPSS



Super low hardness (ASKER C 8) Thermal Pad

Features

- 2W/m·K and compilable (ASKER C 8) allows for less pressure on the heatsource, such as the IC or PCB.
- Allows for lower thermal resistance on an uneven surfaces.
- Silicone-free generates no siloxane gas and oil bleeding.

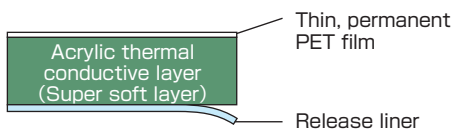
(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	CPSS-F	CPSS
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	2.0	2.0
		ISO22007-2 (Hot Disc method)	1.4	1.4
Color	—	—	Darkgreen	Darkgreen
Thickness	mm	—	1.0/1.5/2.0 2.5/3.0/4.0	3.0/4.0
Specific Gravity	—	JIS Z 8807	1.92	1.92
Hardness*1	ASKER C	JIS K 7312	8	8
	Shore 00	ASTM D 2240	33	33
Tensile strength	MPa	JIS K 6251	0.28	—
Elongation rate	%	JIS K 6251	8.9	—
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹²	1.0×10 ¹²
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	3.5	—
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	2.8	—
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant 1MHz	—	Company standard	14.6	—
Loss tangent 1MHz	—	Company standard	0.09	—
Flammability	—	UL94	V-2(t1.0 - 3.0mm) V-0(t4.0mm)	—
Operating temp	℃	—	-40~100	-40~100
Available max. dimension*2	mm	—	200×500	200×500

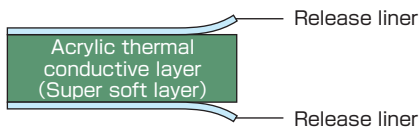
* 1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.

* 2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

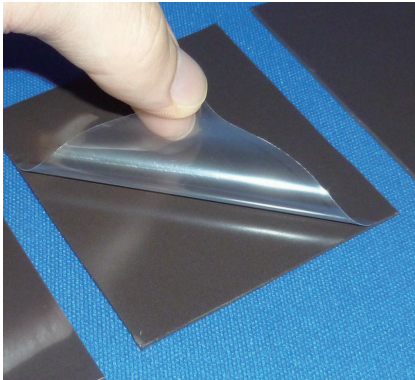
One-side tacky type / CPSS-F



Both-side tacky type / CPSS



COOLPROVIDE™/ EMPV4



Thin, permanent PET film
Acrylic dual-function soft layer (EMI Absorber + TIM)
Release liner

Dual-function high permeability EMI absorber thermal conductive sheet

Features

- Achieved both low hardness (Asker C 40) and high permeability ($\mu' = 13$) in a silicone-free sheet.
- Have excellent adhesion, performs heat conduction and MHz~GHz range electromagnetic wave attenuation simultaneously.
- Silicone-free generates no siloxane gas and oil bleeding.

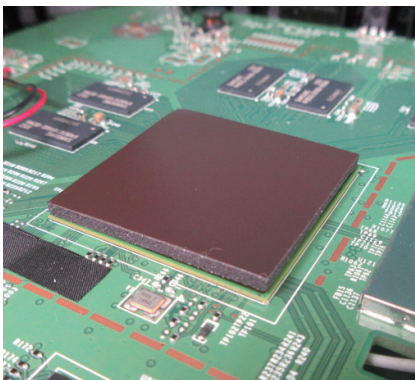
(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	EMPV4-F
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	1.5
		ISO22007-2 (Hot Disc method)	1.3
Color	—	—	Black
Thickness	mm	—	1.0 / 1.5 / 2.0 2.5 / 3.0 / 3.5
Specific Gravity	—	JIS Z 8807	3.55
Hardness* ¹	ASKER C	JIS K 7312	40
	Shore 00	ASTM D 2240	70
Tensile strength	MPa	JIS K 6251	0.51
Elongation rate	%	JIS K 6251	16
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹²
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	6.0
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	4.2
Tracking resistance	—	JIS C 2134	PLC-2 (350V) (t=3.5mm)
Dielectric constant	1 MHz	Company standard	12.7
Loss tangent	1 MHz	Company standard	0.13
Flammability	—	UL94	V-0 equivalent
Permeability	10MHz	—	13
Operating temp	°C	—	-40~110
Available max. dimension* ²	mm	—	200×500

*1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.

*2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

COOLPROVIDE™/ EMPV5



Thin, permanent PET film
Acrylic dual-function soft layer (EMI Absorber + TIM)
Release liner

Dual-function broadband EMI absorber thermal conductive sheet

Features

- Suppresses noise from 500MHz to 3GHz.
- Silicone-free generates no siloxane gas and oil bleeding.
- Operating temperature: -40 ~ +110°C
- Thermal conductivity: 0.8W/m·K
- Permeability @10MHz: 7

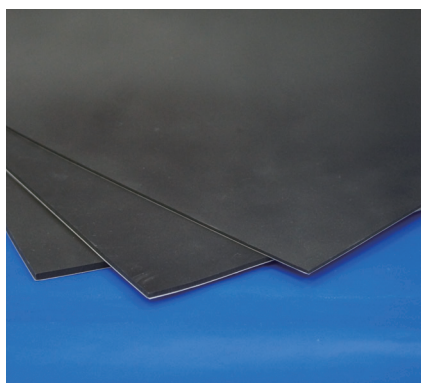
(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	EMPV5-F
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	—
		ISO22007-2 (Hot Disc method)	0.8
Color	—	—	Black
Thickness	mm	—	1.0 / 1.5 / 2.0 2.5 / 3.0 / 3.5
Specific Gravity	—	JIS Z 8807	2.69
Hardness* ¹	ASKER C	JIS K 7312	30
	Shore 00	ASTM D 2240	60
Tensile strength	MPa	JIS K 6251	—
Elongation rate	%	JIS K 6251	—
Volume Resistivity	Ω·cm	JIS K 6911 compliant	1.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	8.8
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	5.0
Tracking resistance	—	JIS C 2134	PLC-2 (350V) (t=3.0mm)
Dielectric constant	1 MHz	Company standard	7.4
Loss tangent	1 MHz	Company standard	0.08
Flammability	—	UL94	V-0 equivalent
Permeability	10MHz	—	7
Operating temp	°C	—	-40~110
Available max. dimension* ²	mm	—	200×500

*1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.

*2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

THERMAL DAMPER/ CPAG



Thermal conductive and vibration damping material (loss factor of 0.9)

Features

- Dual function thermal conductive and vibration damping sheet.
- Excellent vibration control. (loss factor 0.9)
- Custom profiles can be provided upon request.
- Silicone-free, no siloxane outgassing.

(The values are measured values, but not the product specifications or guaranteed.)

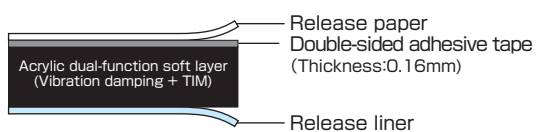
Test type	Unit	Standard	CPAG-T	CPAG
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	—	0.8
		ISO22007-2 (Hot Disc method)	Min. 0.5 (Soft layer: 0.72)	0.72
Color	—	—	Black	Black
Thickness	mm	—	0.5 / 1.0 / 2.0 3.0 / 4.0 / 5.0	0.5 / 1.0 / 2.0 3.0 / 4.0 / 5.0
Specific Gravity	—	JIS Z 8807	Min. 1.57 (Soft layer: 1.67)	1.67
Hardness* ¹	ASKER C	JIS K 7312	70	70
	Durometer type A	JIS K 6253	A 64	A 64
Tensile strength	MPa	JIS K 6251	—	—
Elongation rate	%	JIS K 6251	—	—
Volume Resistivity	Ω·cm	JIS K 6911 compliant	5.54×10 ¹¹	5.54×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	—	—
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	—	—
Tracking resistance	—	JIS C 2134	—	—
Dielectric constant	1 MHz	Company standard	—	—
Loss tangent	1 MHz	Company standard	—	—
Flammability	—	UL94	—	V-1 equivalent (t≤2.0mm) V-0 equivalent (t3.0-5.0mm)
Loss Factor	—	Half-power bandwidth method	0.9	0.9
Operating temp.	°C	—	-10~100	-10~100
Available max. dimension* ²	mm	—	335×335* ³	335×335* ³

*1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.

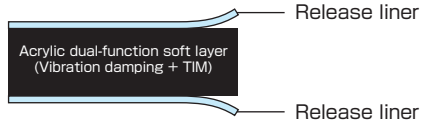
*2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

*3) t=0.5 : 200×200

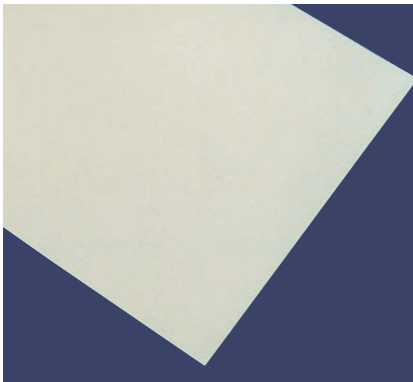
With adhesive tape / CPAG-T



With no adhesive tape / CPAG



COOLPROVIDE™ / SPVS

Silicone base 5W/m·K
thermal conductive sheet

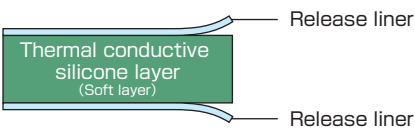
Features

- Minimal volatile, low-molecular weight siloxane gas for reduced PCB contact failure.
- Operating temperature range -20~125°C

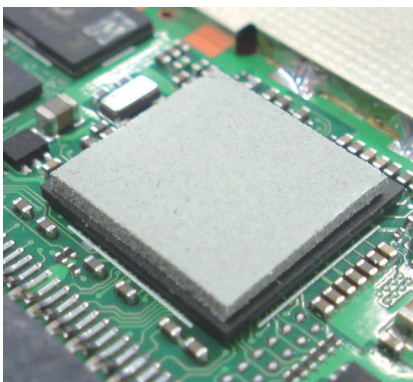
(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	SPVS
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	5.0
		ISO22007-2 (Hot Disc method)	3.4
Color	—	—	Green
Thickness	mm	—	0.5/1.0/1.5
Specific Gravity	—	JIS Z 8807	2.75
Hardness*1	ASKER C	JIS K 7312	70
	Shore OO	ASTM D 2240	86
Tensile strength	MPa	JIS K 6251	0.78
Elongation rate	%	JIS K 6251	16
Volume Resistivity	Ω·cm	JIS K 6911 compliant	3.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	3.2
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	1.8
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=4.0mm)
Dielectric constant	1MHz	—	Company standard
Loss tangent	1MHz	—	Company standard
Flammability	—	UL94	V-0*3
Operating temp	°C	—	-20~125
Available max. dimension*2	mm	—	200×500

* 1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.
* 2) For usable dimensions, custom cuts, and material yield, contact your local sales department. * 3) 1.5F: V-0 equivalent



COOLPROVIDE™ / SPV

Silicone base 3W/m·K
thermal conductive sheet

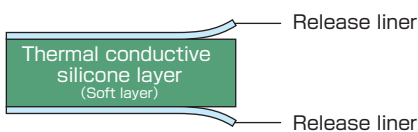
Features

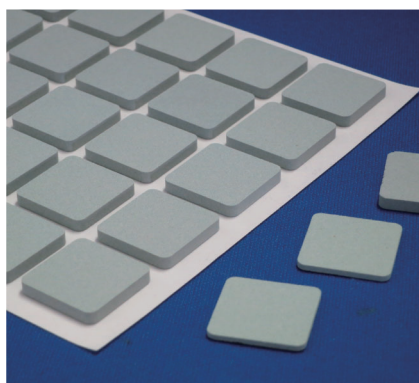
- Soft, high thermal conductive sheet.
- Minimal volatile, low-molecular weight siloxane gas for reduced PCB contact failure.

(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	SPV
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	3.0
		ISO22007-2 (Hot Disc method)	2.3
Color	—	—	Green
Thickness	mm	—	0.5/1.0
Specific Gravity	—	JIS Z 8807	2.2
Hardness*1	ASKER C	JIS K 7312	40
	Shore OO	ASTM D 2240	69
Tensile strength	MPa	JIS K 6251	0.49
Elongation rate	%	JIS K 6251	59
Volume Resistivity	Ω·cm	JIS K 6911 compliant	2.0×10 ¹¹
Breakdown voltage	kV/mm	JIS C 2110-1 compliant	0.69
Withstanding voltage	kV/mm	JIS C 2110-1 compliant	0.3
Tracking resistance	—	JIS C 2134	PLC:0 (600V or higher) (t=3.0mm)
Dielectric constant	1MHz	—	Company standard
Loss tangent	1MHz	—	Company standard
Flammability	—	UL94	V-1 (t0.5mm)
Operating temp	°C	—	-20~125
Available max. dimension*2	mm	—	215×500

* 1) Measured Ultra soft/Super soft/Soft layer, minimum 10mm stacked.
* 2) For usable dimensions, custom cuts, and material yield, contact your local sales department.

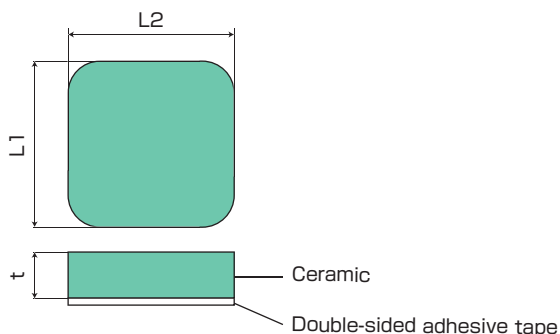




Porous ceramic-based heat sink for excellent heat dissipation

Features

- Larger surface area of porous ceramic heat sink improves thermal emissivity and heat dissipation compared to standard aluminum heat sinks.
- Ceramic heat sinks are approximately 30% lighter than aluminum heat sinks.
- Unlike metal heat sinks, ceramic heat sinks do not emit electromagnetic radiation.



(Unit:mm)

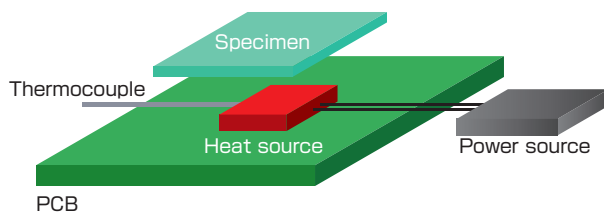
Part Number	Thickness:t	L1	L2
CECD-1.5-020020T	1.5	20	20
CECD-3.0-020020T	3.0	20	20
CECD-3.0-040040T	3.0	40	40

(The values are measured values, but not the product specifications or guaranteed.)

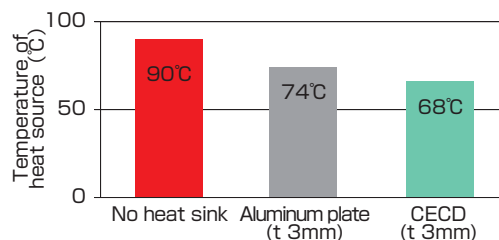
Test type	Unit	Standard	CECD
Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	11.5
Color	—	—	Green
Specific Gravity	—	JIS Z 8807	1.95
Volume Resistivity	$\Omega \cdot \text{cm}$	JIS K 6911 compliant	$\geq 10^9$
Operating temp	$^{\circ}\text{C}$	—	-40~125

Heat dissipation efficiency

Heat conductive characteristics



Comparison of Heat Sink Efficiency



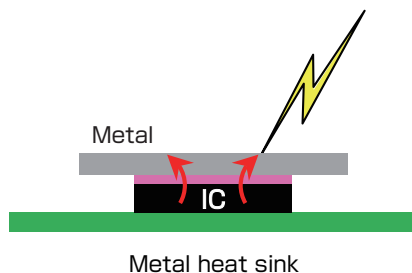
<Test conditions>

Heat source: □10mm(1.6W)

Specimen dimensions: □20mm(t3mm)

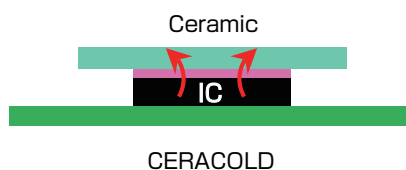
EMI noise issues with metal heat sink

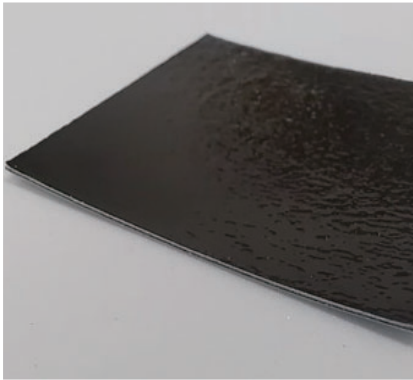
Stray capacitance occurs between the IC chip (noise source) and the heat sink (not grounded), which becomes an antenna and emits radiated noise.



CECD ceramic heat sink is electrically insulating.

CECD is not affected by electrostatic coupling and does not function as an antenna to radiate noise.

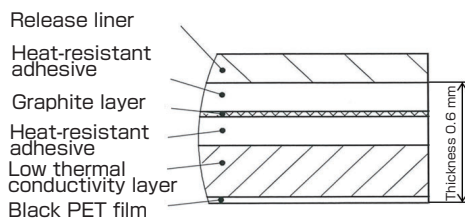




Stacked layers work together to prevent hot spots and returned heat to the device.

Features

- Ideal for attaching to the inside of plastic case of electronic devices.
- Low thermal conductivity layer reduces speed of heat transfer to graphite layer, prevents hot spots from occurring, and impedes heat reflection back to the heat source.
- One side heat-resistant adhesive tape.
- Addition of low heat reflection layer (Black PET film + Low thermal conductivity later) helps to reduce the temperature of heat source.

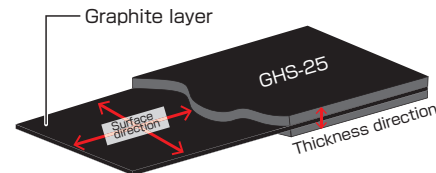


(The values are measured values, but not the product specifications or guaranteed.)

Test type	Unit	Standard	GHS-25
Thickness	mm	—	0.6
Thermal Conductivity (Thickness direction*: whole product)	W/m·K	Hot-wire method (Company standard)	3.0±1.0
Thermal Conductivity (Surface direction*: graphite layer only)	W/m·K	Laser flash method (ASTM E1461-13)	≥1,400
Operating Temperature	℃	—	-40~150

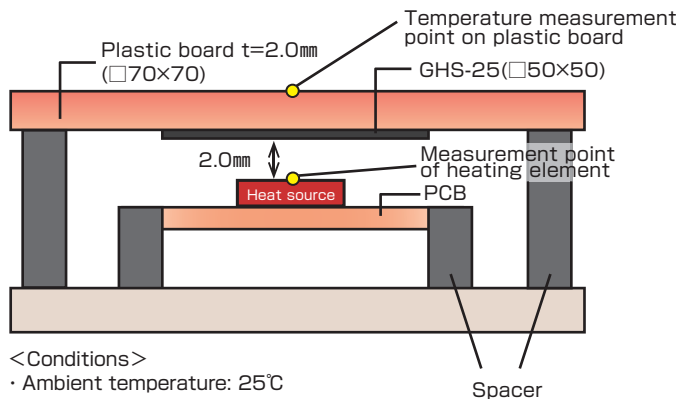
* 1) Please refer to Figure 1 on the right for the thermal conductivity measurement direction

Figure 1: Thermal Conductivity Measurement Direction



Performance comparison

Thermal analysis model

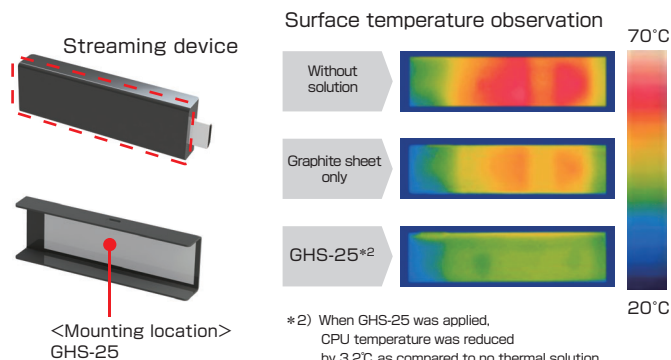


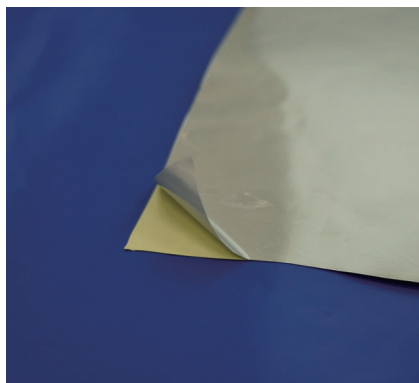
- <Conditions>
- Ambient temperature: 25℃
 - No forced convection
 - Air buoyancy considered
 - Analysis software: Femtet

Unit: ℃

	Heating element temperature	Plastic board temperature
No countermeasures	90.5	48.2
Graphite sheet only	103.7(+13.2)	39.6(-8.6)
GHS-25	83.6(-6.9)	35.9(-12.3)

Application Example



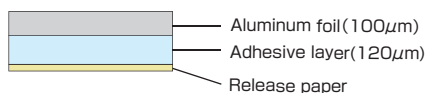


Thin and flexible heat spreading sheet for superior thermal management

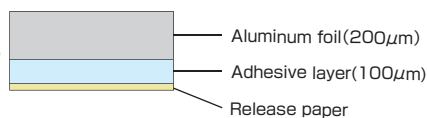
Features

- Aluminum heat spreader material with excellent thermal conductivity. (221 W/m·K)
- Spreads heat away from hot spots to cooler areas to prevent components from overheating.
- Optional electrically insulating mylar (PET) layer can be applied upon request.
- Ideal thermal solution for hot spots on space conscious applications such as mobile devices, tablets, routers, video streaming devices, etc.

HSD-0.22



HSD-0.30



(The values are measured values, but not the product specifications or guaranteed.)

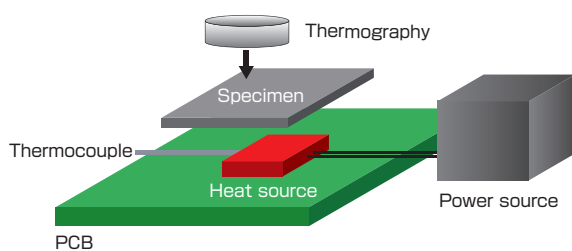
Test type	Unit	Standard	HSD-0.22	HSD-0.30
Thickness	mm	—	0.22	0.30
Surface Thermal Conductivity	W/m·K	JIS R 2616 (Hot-wire method)	221 (aluminum)	
Adhesion	N/25mm	JIS Z 0237:2009	>16	>11
Flammability	—	UL	—	—
Operating temp	°C	—	-20~100	

Heat Dissipation Effect

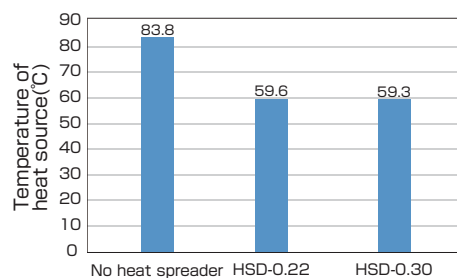
heat distribution

No heat sink	HSD-0.22	HSD-0.30
Test Sample	①	①
①	PET film(30μm)	PET film(30μm)
②	Aluminum foil(100μm)	Aluminum foil(200μm)
③	Adhesive layer(120μm)	Adhesive layer(100μm)

Testing method



HSD Series Heat Dissipation Effect



<Test conditions>

Heat source : □25mm(1.5W)

Specimen dimensions : □50mm

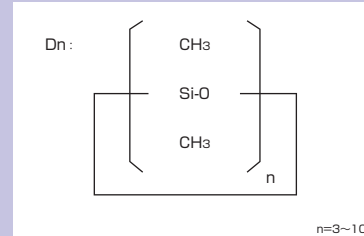
Low-molecular-weight siloxane

The number of dimethyl siloxane molecules in the sequence is often referred to as D3 (trimer), D4 (tetramer), or D5 (pentamer), and so on. The molecules up to D20 are called "low molecular weight cyclic siloxane". In particular, the total volume of D3 through D10 is used as a reference for the silicone's quality. (Referenced from Wikipedia)

<Disadvantages>

The low-molecular-weight siloxane is highly volatile. It readily evaporates at room temperature, which results in the following problems.

- Electric contact failure: Electrically insulative silica is deposited on metal, resulting in contact failures.
- Adverse effect on optical equipment: Siloxane gas adversely affects optical instruments and devices



Thermal conductivity and thermal resistance

Heat equation

Fourier's equation : $Q = \lambda \times ((\Delta T \cdot S)/d)$

Q : heat flow (W), λ : thermal conductivity(W/m·K), ΔT : temperature difference, S : cross sectional area of heat transfer area, d : distance

<Thermal Conductivity>

A measure of a material's ability to transfer heat

- The value of thermal conductivity does not change regardless of material size.
- Decreasing the thickness of an object will decrease its temperature difference.
 λ (thermal conductivity) = $(Q \cdot d)/(\Delta T \cdot S)$ * $d/\Delta T = \text{constant}$

<Thermal Resistance>

Ability to resist flow of heat

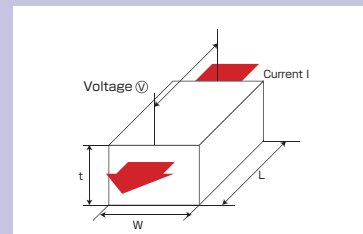
- Thermal resistance values vary depending on the distance from the heat source, the degree of contact, and the contact area, even when measuring the same TIM.
- The resistance will be decreased when the area is wider; a higher thermal conductivity material is used; and the distance/ thickness to heat source is reduced.
 $R1$ (thermal resistance) : $^{\circ}\text{C}/\text{W} = d/(\lambda \cdot S)$

Volume resistivity(JIS K 6911 compliant)

Electrical resistance is generally used as a measure of conductivity

(ease of electric conductance) of an object or material. Resistance of a certain material per cubic unit (1 cm³) is referred as volume resistivity, which is a material property and is measured in [$\Omega \cdot \text{cm}$].

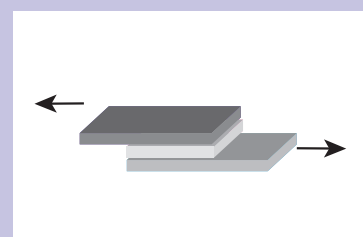
As shown in right diagram, the volume resistivity is calculated by measuring a voltage difference V (V) between two contacts across the cross section ($t \cdot W$) generated by a constant current I (A) flow.



Tensile lap-shear strength(JIS K 6850: ISO 4587 and ISO 1995 equivalent)

The shear strength testing determines the shear strength of adhesives by applying tensile force to the specimen to pull it apart along the plane of adhesion until the breakdown of the adhesive layer occurs.

It is calculated by dividing the force required to shear the specimen by the area of the sheared area.



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