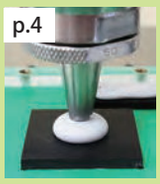
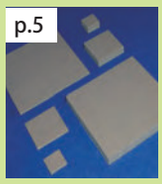
KITAGAWA GmbH

Thermal Management Solutions

Product Lines

Silicone-Free Thermal Interface Materials

p.4

COOLPROVIDE™ /CPVG

p.5

COOLPROVIDE™ /CPSH, CPVH

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COOLPROVIDE™ /CPVT, CPVP

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COOLPROVIDE™ /C P LK, CPSS

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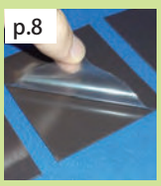
COOLPROVIDE™ /EMPV4, 5

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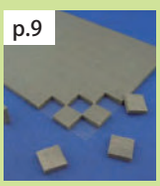
COOLPROVIDE™ /CPAG

KGS
First Solution Proposer

Silicone-Based

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COOLPROVIDE™ /SPVS, SPV

Special Thermal Interface Materials

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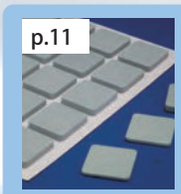
CERACOLD /CECD

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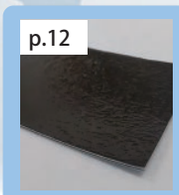
GRAPHITE HYBRID SHEET/GHS-25

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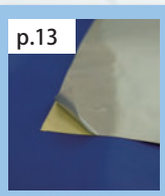

HEATSPREADER SHEET /HSD

Icons

Thermal+EMC
Dual Function Thermal and EMC
EMI Suppression and Thermal Pad

Solid Phase Change Gel
Phase-Change
Upon application high-viscosity gel-like material works as a gap-filler

High Conductivity
High Thermal Conductivity (3W/m·K or higher)*
High heat dissipation from ICs
*Hot wire method

High damping
Dual Function Vibration Damper and Thermal
Suppress vibration frequency and transfer heat

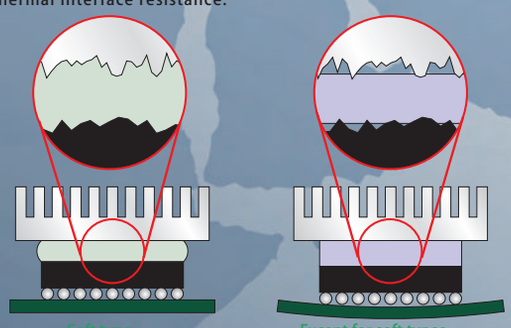
Soft type
For devices containing modules affected by pressure and compression

Ultra Soft
Ultra Soft
(ASKER C 3 or less)

Super Soft
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.

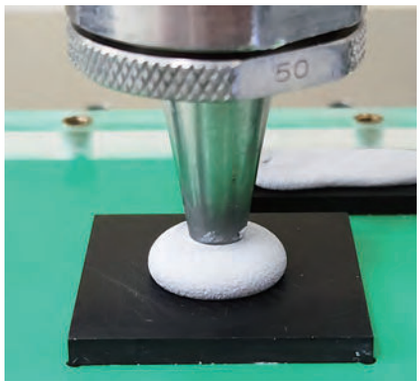


Low load
Reduces compression load (stress) on sensitive components ; prevents unintended bowing or damage

Product Spotlight

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 1 mm 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 compliable (ASKER C 0) material layered between thin permanent PET film and light tacky layer for easy handling.
- Operating temperature: -40 ~ 125℃
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.

GRAPHITE HYBRID SHEET / GHS-25

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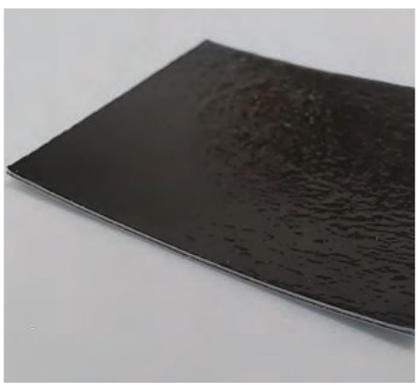

Stacked layers work together to prevent hot spots and returned heat to the device.

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.
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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.
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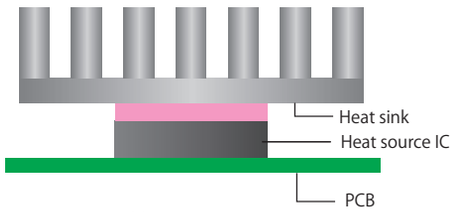
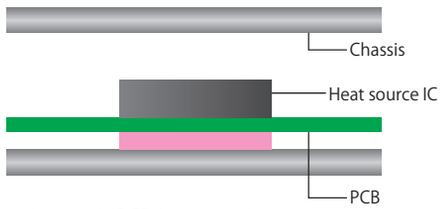
[Handling Procedures]

- ●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℃ (Recommended temperature is 25℃).
- ●Due to the inherent tackiness of our products, removal after heating or compressing may be challenging.

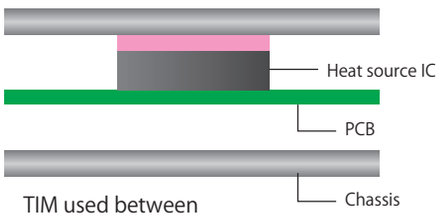
Applications



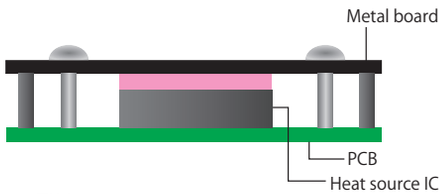
TIM used between
heat source and heat sink



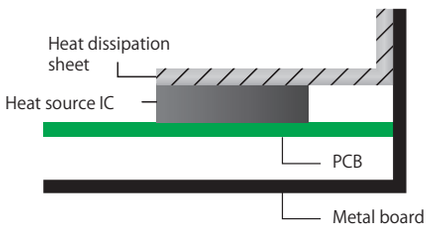
TIM underneath PCB between heat source
and metal chassis



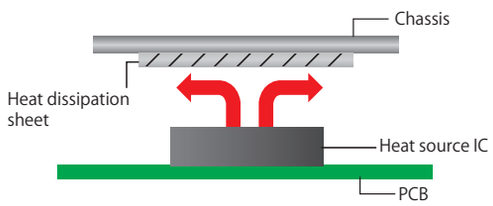
TIM used between
heat source and metal chassis



TIM used between
heat source and metal board



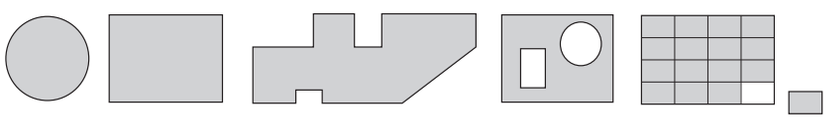
Heat spreader used for module where
temperature difference is not permitted



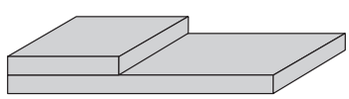
Heat spreader used for chassis
where heat remains

Secondary processing

Cutting (Round, square, special shape, kiss-cutting, etc.)



Customized cutting for multi-layered products



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 2.5／3.0／3.5／4.0	1.0／1.5／2.0 2.5／3.0／3.5／4.0	0.5／1.0／1.5／2.0 2.5／3.0／3.5／4.0	2.0／3.0／4.0	0.10／0.15 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 00	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	PCL:0 (600V or higher) (t=3.0mm)	PCL:0 (600V or higher) (t=3.0mm)	PCL:0 (600V or higher) (t=3.0mm)	PCL:0 (600V or higher) (t=3.0mm)	PCL: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	℃	—	-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 ３.0／4.0／5.0／6.0	1.0／2.0／3.0／4.0	1.0／1.5／2.0	1.0／1.5／2.0 2.5／3.0／3.5	1.0／1.5／2.0 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 00	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	PCL:0 (600V or higher) (t=3.0mm)	PCL:0 (600V or higher) (t=4.0mm)	PCL:0 (600V or higher) (t=3.0mm)	PCL:2 (350V) (t=3.5mm)	PCL: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	℃	—	-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 2.5／3.0／4.0	3.0／4.0	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	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 00	ASTM D 2240	33	33	Durometer type A 64*5	Durometer type A 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	PCL:0 (600V or higher) (t=3.0mm)	PCL: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-1equivalent(t2.0mm) V-0 equivalent(t3.0 - 5.0mm)
Operating temp	℃	—	-40～100	-40～100	-10～100	-10～100
Available max. dimension*2	mm	—	200×500	200×500	335×335*6	335×335*6

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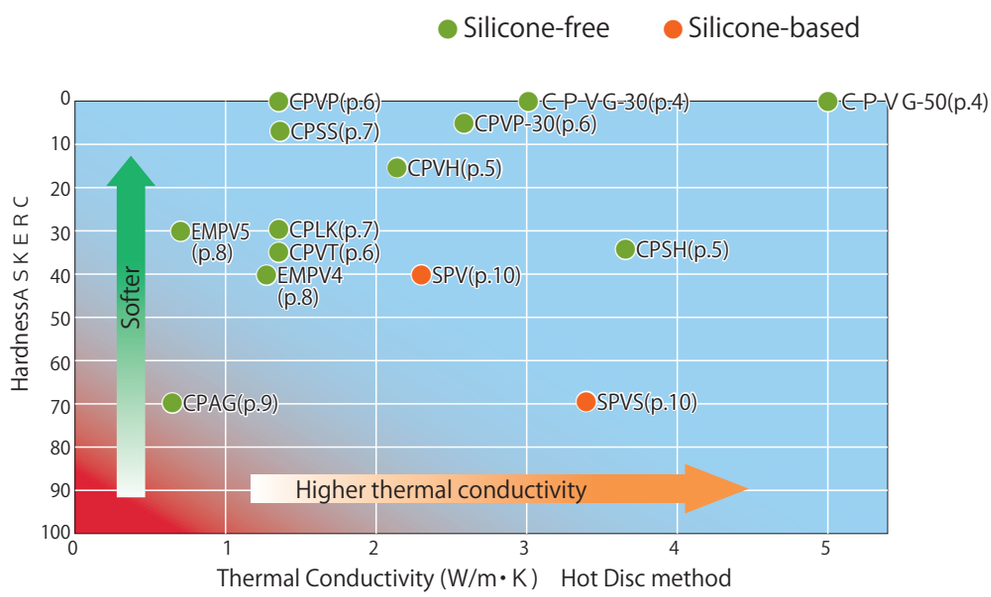
Properties of Thermal Conductive Materials (Silicone-Based)

(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)	5.0	3.0
		ISO22007-2 (Hot Disc method)	3.4	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	PCL:0 (600V or higher) (t=4.0mm)	PCL:0 (600V or higher) (t=3．0 mm)
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(t 0.5mm)
Operating temp	℃	—	-20～125	-20～125
Available max. dimension*2	mm	—	200×500	215×500

Comparison of Product Series



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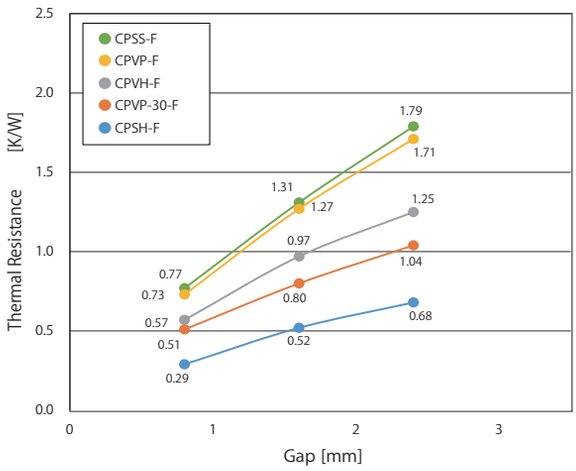
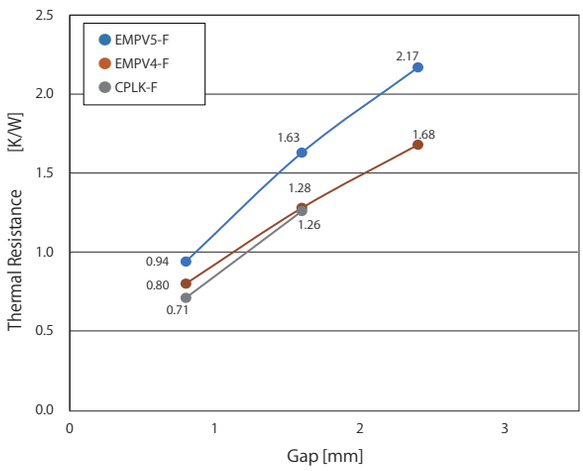
Thermal resistance measurement (In accordance with ASTM D5471)

Thermally conductive pad



Dual-function thermal + EMC 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 1mm, 2mm, and 3mm thick pads
* No option for 3mm thick CPLK. Therefore, 2.4 mm gap data is N/A.
Heater Output: 20 W

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

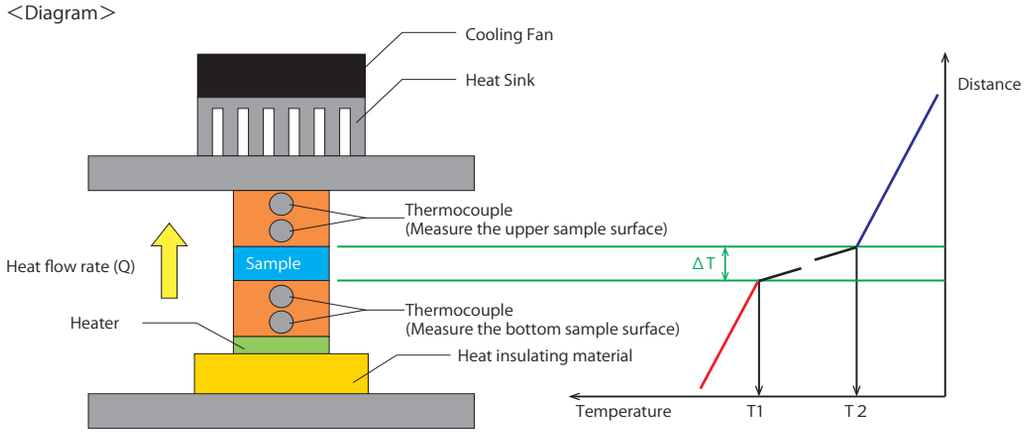
Features

■ 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 tharmal pad thickness.
3. Calculate the thermal resistance and apparent thermal conductivity using the above measurements and the sample dimensions.

＜Diagram＞



Thermal Resistance R ＝ ΔT/Q

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

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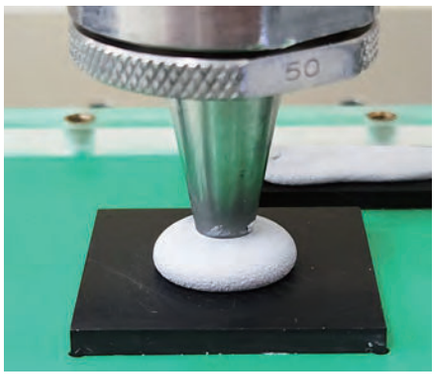
COOLPROVIDE™ / CPVG

High Conductivity



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

Features

- Useful to fill gaps between heat spreaders and ICs of various heights.
  CPVG-30: GAP 1 mm 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

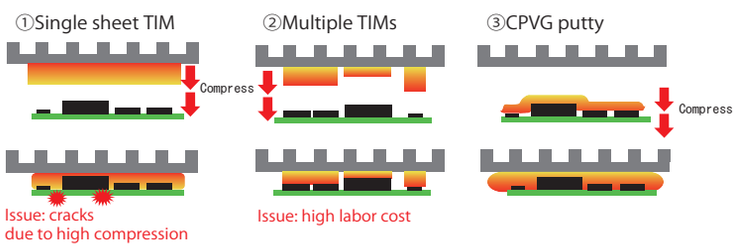
【Heat cycle test conditions / High-temperature test conditions】
- Temperature：125℃
- Time: 1000h
- Test Method: Test sample sandwiched between aluminum and glass plates

(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	℃/W	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]	Pa・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	1MHz	—	Company standard	9.25	13.2
Loss tangent	1MHz	—	Company standard	0.06	0.07
Shelf Life (25℃)		—	Company standard	6 months after delivery	6 months after delivery
Flammability		—	UL94	V-0 equivalent	V-0 equivalent
Operating temp		℃	—	-40 ～ 125	-40 ～ 130
Supply format		—	—	Cartridge 330ml	20L Pail (Net content：17kg)

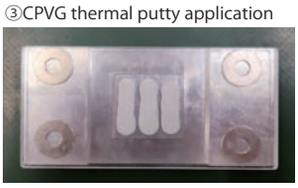
*1) Sample size：□25mm

Benefits of CPVG (Putty TIM)



	①	②	③	
Workability: components	○	×	○	→ Easy positioning of heat dissipation components
IC Load	×	△	○	→ Spreads to fill the gap upon compression, reducing the load on the IC

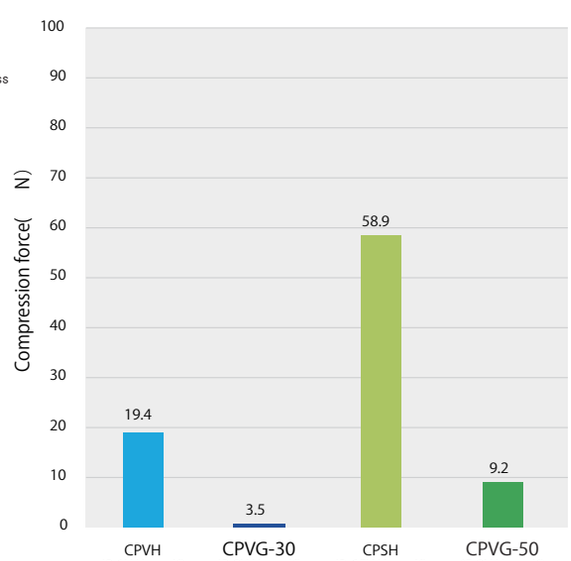
③CPVG thermal putty application



③CPVG thermal putty installation

＊We can help verifiy 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.

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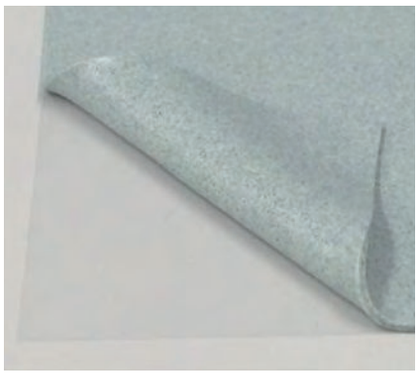
COOLPROVIDE™ / CPSH



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

Features

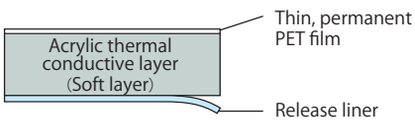
- High performance (5W/m・K) and soft (ASKER C 32) silicone-free Thermal conductive sheet. Crowds out air bubbles to reduce thermal resistance.
- Silicone-free TIM generates no siloxane gas and has less oil bleeding.
-

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

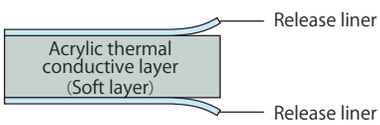
Test type	Unit	Standard	CPSH-F	CPSH
Thermal Conductivity	W/m・K	JIS R 2616 (Hot-wire method)	5.0	5.0
		ISO22007-2 (Hot Disc method)	3.65	3.65
Color	—	—	Light green	Light green
Thickness	mm	—	0.5／1.0／1.5／2.0 2.5／3.0／3.5／4.0	1.0／1.5／2.0 2.5／3.0／3.5／4.0
Specific Gravity	—	JIS Z 8807	2.89	2.89
Hardness＊1	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	PCL:0 (600V or higher) (t=3.0mm)	PCL: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) 0.5F ： ASKER C 55　＊4) 0.5F：V-0 equivalent

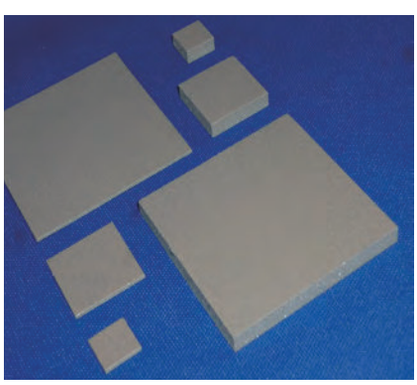
One-side tacky type／CPSH-F



Both-side tacky type／C P S H



COOLPROVIDE™ / CPVH



3W/m・K soft (ASKER C 15) thermal pad

Features

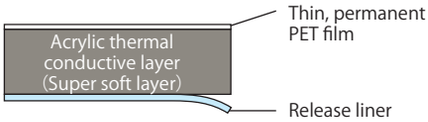
- Soft and compilable (ASKER C 15) silicone free thermal pad helps to crowd out air bubbles and reduce thermal resistance.
- Soft and compilable (ASKER C 15) silicone free thermal pad helps to crowd out air
- bubbles and reduce thermal resistance.
- Silicone-free TIM generates no siloxane gas and has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

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

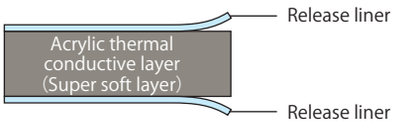
Test type	Unit	Standard	CPVH-F	CPVH
Thermal Conductivity	W/m・K	JIS R 2616 (Hot-wire method)	3.0	3.0
		ISO22007-2 (Hot Disc method)	2.1	2.1
Color	—	—	Brown	Brown
Thickness	mm	—	0.5／1.0／1.5／2.0 2.5／3.0／3.5／4.0	2.0／3.0／4.0
Specific Gravity	—	JIS Z 8807	2.33	2.33
Hardness＊1	ASKER C	JIS K 7312	15	15
	Shore 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	PCL:0 (600V or higher) (t=3.0mm)	PCL: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



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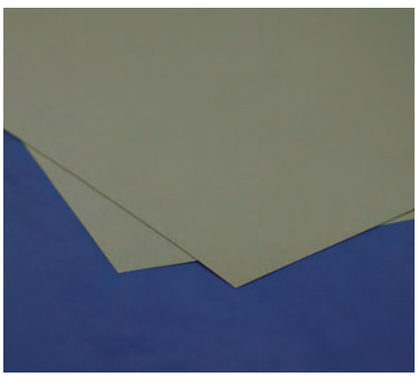
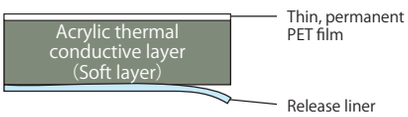
COOLPROVIDE™ / CPVT



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 compliable (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	PCL:0 (600V or higher) (t=3.0mm)
Dielectric constant	1MHz	—	Company standard	6.69
Loss tangent	1MHz	—	Company standard	0.08
Flammability		—	UL94	—
Operating temp		℃	—	-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

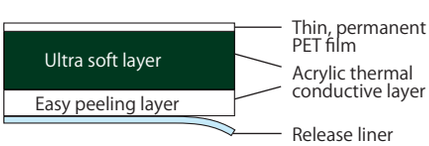
＊CPVP : 2.0W/m・K

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

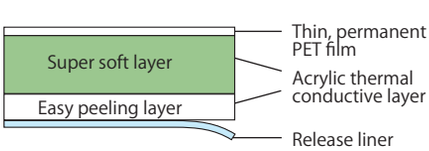
Features

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

CPVP-F



CPVP-30-F



(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	PCL:0 (600V or higher) (t=3.0mm)	PCL:0 (600V or higher) (t=4.0mm)
Dielectric constant	1MHz	—	Company standard	１１．３	11.9
Loss tangent	1MHz	—	Company standard	０．０４	0.01
Flammability		—	UL94	V-0	V-0
Operating temp		℃	—	-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.

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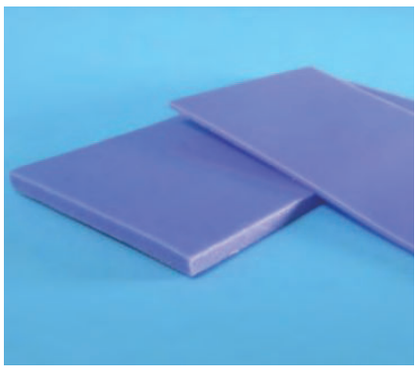
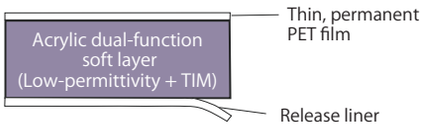
COOLPROVIDE™ / CPLK



Dual Function Noise Suppression t hermal conductive sheet

Features

- CPLK's low permittivity 5.4/1MHz has a significant effect on noise reduction.
- Low-dielectric t hermal 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.

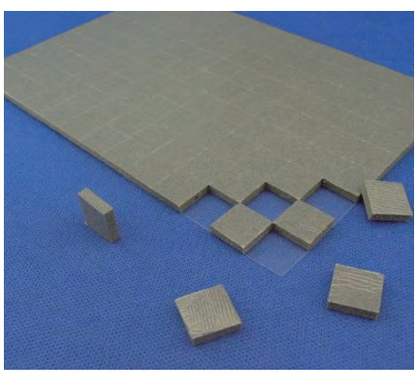


(The values are measured values, but not the product specifications or guaranteed.)

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	PCL: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

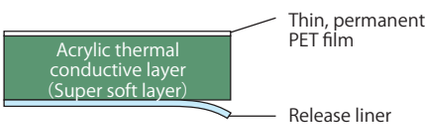


Super low hardness (ASKER C 8) Thermal Pad

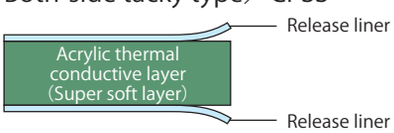
Features

- 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.

One-side tacky type／CPSS-F



Both-side tacky type／CPSS



(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	PCL:0 (600V or higher) (t= 3.0mm)	PCL: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.

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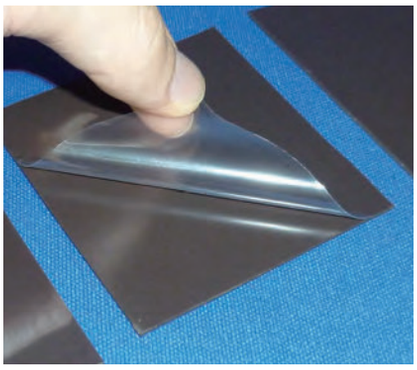
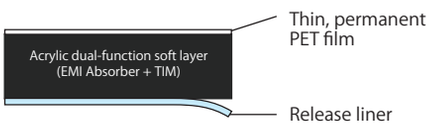
COOLPROVIDE™/ EMPV4



Dual-function high permeability EMI absorber thermal conductive sheet

Features

- Achieved both low hardness (Asker C 40) and high permeability (μ' = 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.

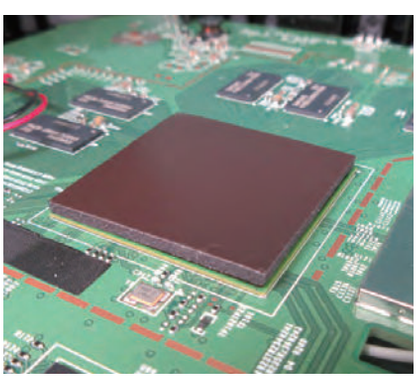


(The values are measured values, but not the product specifications or guaranteed.)

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	PCL:2 (350V) (t=3.5mm)
Dielectric constant	1MHz	—	Company standard	12.7
Loss tangent	1MHz	—	Company standard	0.13
Flammability		—	UL94	V-0 equivalent
Perme-ability	10MHz	—	—	13
Operating temp		℃	—	-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.

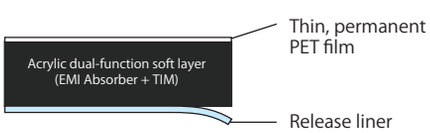
COOLPROVIDE™/ EMPV5



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 ~ +110C
- 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	2．6 9
Hardness*1		ASKER C	JIS K 7312	3 0
		Shore 00	ASTM D 2240	6 0
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	PCL:2 (350V) (t=3.0mm)
Dielectric constant	1MHz	—	Company standard	7．4
Loss tangent	1MHz	—	Company standard	0．0 8
Flammability		—	UL94	V-0 equivalent
Perme-ability	10MHz	—	—	7
Operating temp		℃	—	-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.

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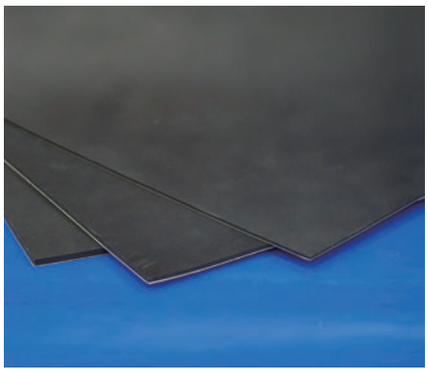
THERMAL DAMPER/ CPAG

High damping



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

Features

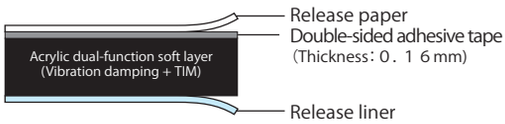
- Dual function thermal conductive and vibration damping sheet.
- Excellent vibration control. (loss factor 0.9)
- Custom profiles can be provided upon request.
- Silicone-free, no siloxane outgassing.

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

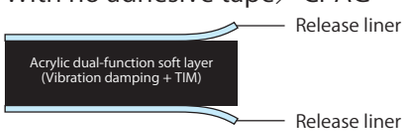
Test type	Unit	Standard	CPAG-T	CPAG
Thermal Conductivity	W/m・K	JIS R 2616 (Hot-wire method)	—	0.8
		ISO22007-2 (Hot Disc method)	Min. 0.5 (Soft layer:0.72)	0.72
Color	—	—	Black	Black
Thickness	mm	—	0.5／1.0／2.0 3.0／4.0／5.0	0.5／1.0／2.0 3.0／4.0／5.0
Specific Gravity	—	JIS Z 8807	Min. 1.57 (Soft layer:1.67)	1.67
Hardness※1	ASKER C	JIS K 7312	70	70
	Durometer typeA	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 1MHz	—	Company standard	—	—
Loss tangent 1MHz	—	Company standard	—	—
Flammability	—	UL94	—	V-1equivalent(t2.0mm) V-0 equivalent(t3.0-5.0mm)
Loss Factor	—	Half-power bandwidth method	0.9	0.9
Operating temp	℃	—	-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



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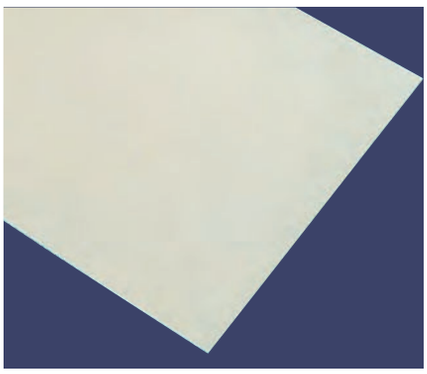
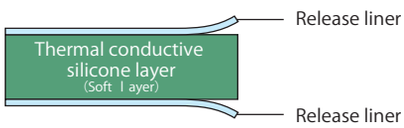
COOLPROVIDE™ / SPVS



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℃

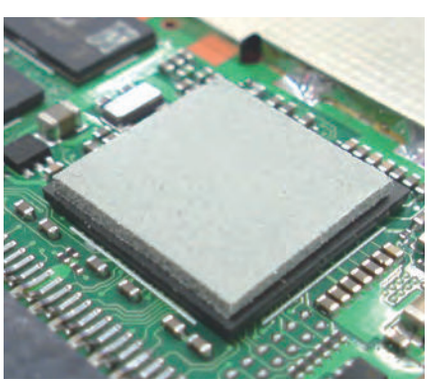


(The values are measured values,but not the product specifications or guaranteed.)

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 00	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	PCL:0 (600V or higher) (t=4.0mm)
Dielectric constant	1MHz	—	Company standard	13.7
Loss tangent	1MHz	—	Company standard	0.06
Flammability		—	UL94	V-0 *3
Operating temp		℃	—	-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

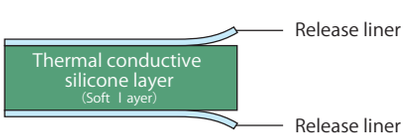
COOLPROVIDE™ / SPV



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 00	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	PCL:0 (600V or higher) (t=3．0 mm)
Dielectric constant	1MHz	—	Company standard	35.1
Loss tangent	1MHz	—	Company standard	0.07
Flammability		—	UL94	V-1(t 0.5mm)
Operating temp		℃	—	-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.

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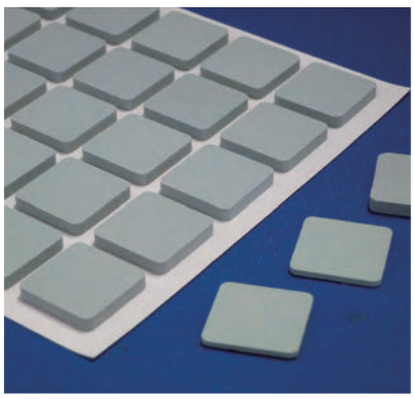
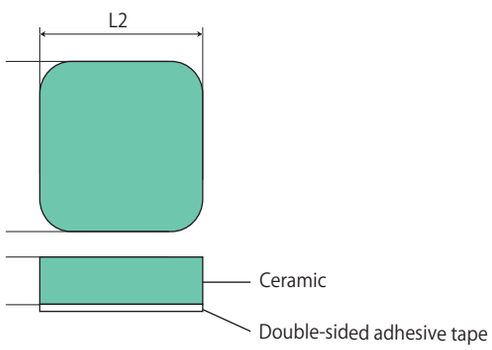


Porous ceramic-based heat sink for excellent heat dissipation

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)

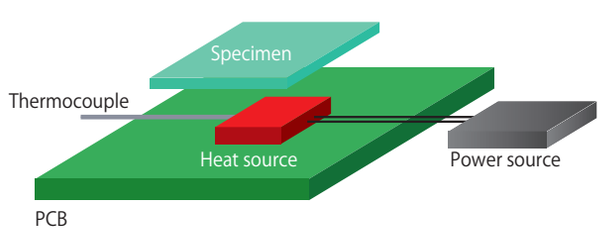
Part Number	Thickness:t	L1	L2
CECD-1.5-020020T	1.5	20	20
CECD-3.0-020020T	3.0	20	20
CECD-3.0-040040T	3.0	40	40

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

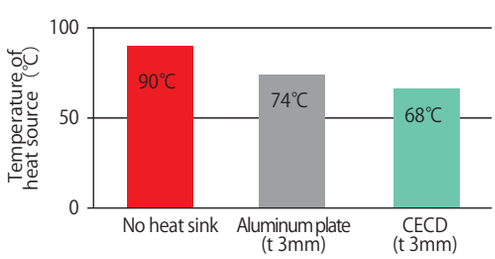
Test type	Unit	Standard	C E C D
Thermal Conductivity	W/m･K	JIS R 2616 (Hot-wire method)	11.5
Color	—	—	G r e e n
Specific Gravity	—	JIS Z 8807	1.95
Volume Resistivity	Ω･cm	JIS K 6911 compliant	≧10^8
Operating temp	℃	—	-40～125

Heat dissipation efficiency

Heat conductive characteristics



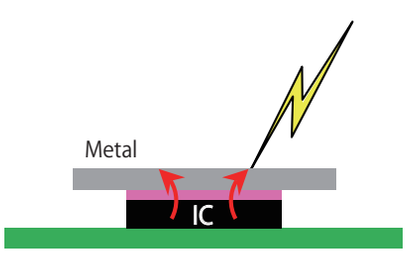
Comparison of Heat Sink Efficiency



〈Test conditions〉
Heat source: □10mm(1.6W)
Specimen dimensions: □20mm(t3mm)

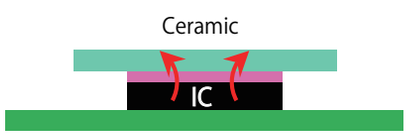
EMI noise issues with metal heat sink

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



Metal heat sink

CECD ceramic heat sink is electrically insulating.
CECD is not affected by electrostatic coupling and does not function as an antenna to radiate noise.



CERACOLD

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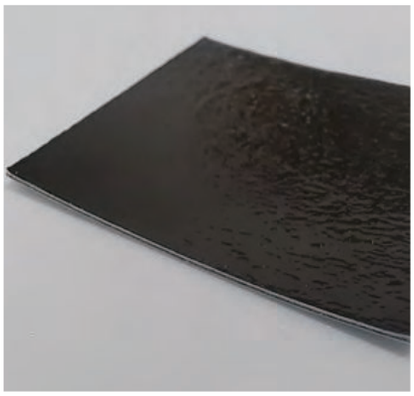
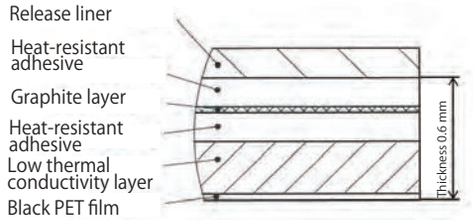
GRAPHITE HYBRID SHEET / GHS-25



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.

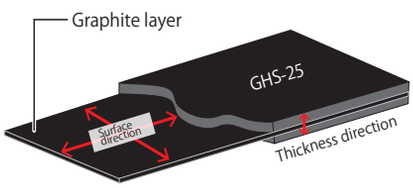


(The values are measured values, but not the product specifications or guaranteed.)

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

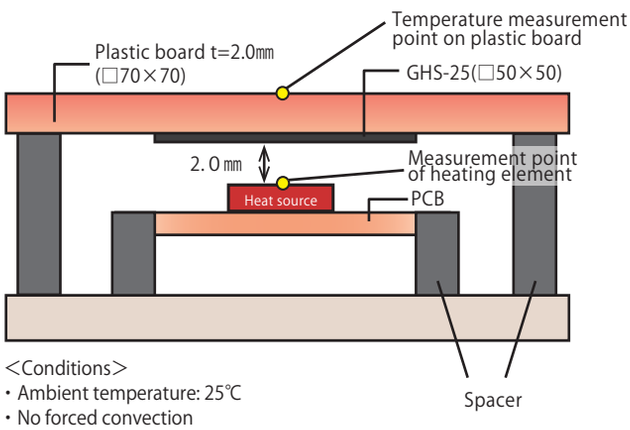
＊1) Please refer to Figure1 on the right for the thermal conductivity measurement direction

Figure1: Thermal Conductivity Measurement Direction



Performance comparison

Thermal analysis model



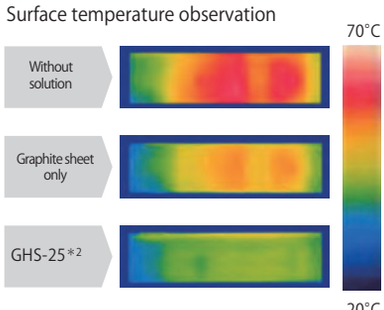
＜Conditions＞
- Ambient temperature: 25℃
- No forced convection
- Air buoyancy considered
- Analysis software: Femtet

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)

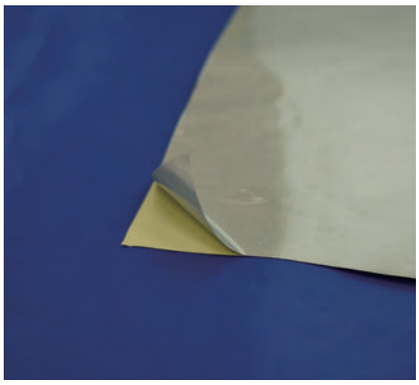
Application Example

Surface temperature observation



＊2) When GHS-25 was applied, CPU temperature was reduced by 3.2℃ as compared to no thermal solution.

HEAT SPREADER SHEET / HSD

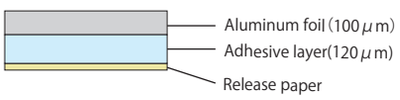


Thin and flexible heat spreading sheet for superior thermal management

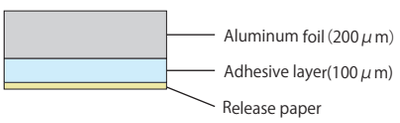
Features

- 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

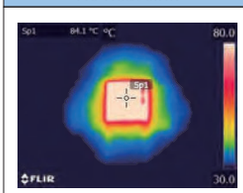
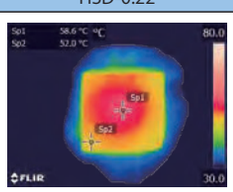
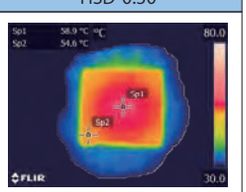
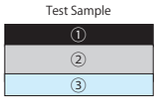


(The values are measured values, but not the product specifications or guaranteed.)

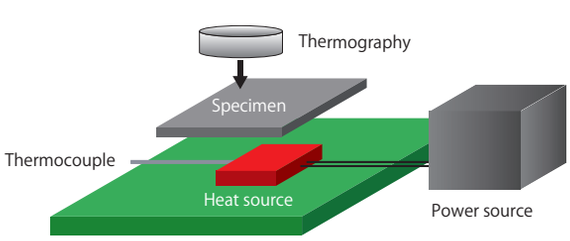
Test type	Unit	Standard	HSD-0.22	HSD-0.30
Thickness	mm	—	0.22	0.30
Surface Thermal Conductivity	W/m･K	JIS R 2616 (Hot-wire method)	221(aluminum)	
Adhesion	N/25mm	JIS Z 0237:2009	＞16	＞11
Flammability	—	UL	—	—
Operating temp	℃	—	-20～100	

Heat Dissipation Effect

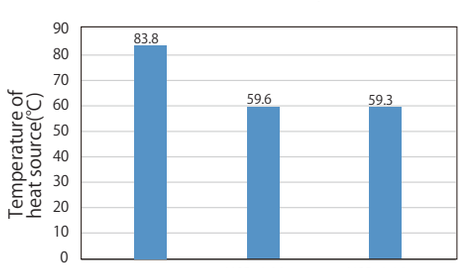
heat distribution

No heat sink	HSD-0.22	HSD-0.30
		
Test Sample 	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

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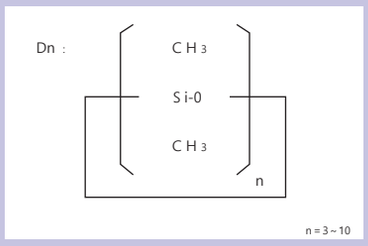
Terminologies

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.



<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 · d) / (ΔT · S)
Where: d / ΔT = constant

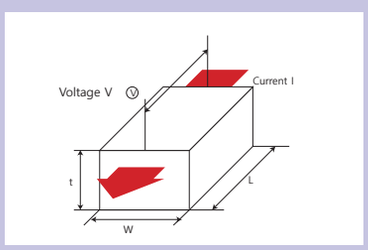
<Thermal Resistance>
Ability to resist flow of heat

- Depending on distance of the heat source, area, and surface conformity, the resistance value of the same pad varies.
- 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): ℃ / W = d / (λ · S)

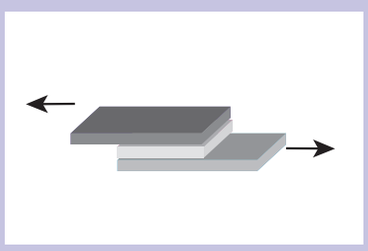
Volume resistivity (JIS K 6911 compliant)

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 ($1cm^3$) is referred as volume resistivity, which is a material property and is measured in [Ω·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·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.



1. Scope of Application

1.1 The latest version of these General Terms and Conditions of Delivery and Payment (GTC) shall apply to all deliveries and other services provided by us.

1.2 Conflicting or deviating general terms and conditions of the Customer shall not apply unless Kitagawa GmbH has explicitly consented to their validity in writing. The GTC of Kitagawa GmbH shall also apply if Kitagawa GmbH performs the services for the Customer without reservation in the knowledge of conflicting or deviating terms and conditions of the Customer.

1.3 Individual contractual agreements between Kitagawa GmbH and the customer that deviate from the GTC require the written form.

1.4 These GTC of Kitagawa GmbH apply exclusively to entrepreneurs within the meaning of Section 310 (1) BGB (German Civil Code). The GTC shall apply accordingly to pre-contractual relationships.

2. Conclusion of the Contract

2.1 The offers of Kitagawa GmbH are subject to change. The ordering of goods by the customer shall be deemed a binding contractual offer, whereby the customer also acknowledges the applicability of these GTC.

2.2 A contract between Kitagawa GmbH and the customer is only concluded in accordance with the content of the order confirmation in written or text form by Kitagawa GmbH or by delivery of the goods or provision of the agreed service by Kitagawa GmbH. A mere confirmation of receipt does not constitute acceptance or the conclusion of a contract.

2.3 The customer is bound to his order for three weeks. Kitagawa GmbH reserves the right to deviate from the customer's specifications in the order confirmation. This shall constitute a new offer which the customer must accept within a period of two weeks. After this deadline, it expires.

2.4 The product descriptions which are available on the website of Kitagawa GmbH or which are contained in the sales and advertising catalogs of Kitagawa GmbH (including, but not limited to, prices, technical information, etc.) are subject to change and non-binding. Kitagawa GmbH is entitled to change the design and manufacture of its products at any time without prior notice. This also applies to goods already ordered, provided that this does not result in the contractually agreed quality of the goods being undercut and the change is reasonable for the customer. The modification of contractual goods already delivered cannot be demanded retrospectively.

2.5 Insofar as Kitagawa GmbH provides the customer with drafts, illustrations, drawings, data, documents, calculations etc. (documentation) relating to the goods offered or presents the respective project at the customer's request, Kitagawa GmbH expressly reserves the right of ownership and copyright to this documentation as well as to the entire stock of goods and the projects developed. Neither the documentation nor the details of the range of goods or the development may be passed on to third parties, made public, copied, reproduced or

used in any other way without the written and express permission of Kitagawa GmbH.

2.6 The customer is obliged to return the documentation to Kitagawa GmbH upon written request. If a contract is concluded, Kitagawa GmbH will provide the customer with the documentation free of charge.

3. Delivery Periods and Delay

3.1 The delivery time of the goods shall be determined by the written order confirmation of Kitagawa GmbH.

3.2 Specified delivery periods shall commence upon dispatch of the written order confirmation. In the event that the customer is obliged to make advance payment, the delivery period shall start upon the customer's contractual advance payment being received by Kitagawa GmbH.

3.3 If the customer requests changes to the contractually agreed services after the order has been confirmed in writing, Kitagawa GmbH shall be entitled to extend the delivery period appropriately if necessary.

3.4 If Kitagawa GmbH is unable to comply with binding delivery deadlines through no fault of its own, Kitagawa GmbH shall inform the customer of this without culpable delay and at the same time notify the customer of the expected new delivery deadline if delivery will still be possible.

Kitagawa GmbH shall not be liable for failures or delays in the fulfillment of its obligations which have become practically impossible due to circumstances beyond the control of Kitagawa GmbH. These circumstances include in particular
a) natural disasters
b) acts of terrorism
c) labor disputes or work stoppages
d) war
e) official measures or orders
f) epidemics, pandemics or the outbreak of communicable diseases
g) quarantines
h) national or regional emergencies
i) or other reasons beyond the reasonable control of Kitagawa GmbH in particular force majeure of any other kind, regardless of whether they are similar to the aforementioned or not.

Kitagawa GmbH shall give written notice of non-performance or delay in performance due to above reasons as soon as possible. All delivery dates affected by the above reasons shall be suspended for its duration. If possible and reasonable, Kitagawa GmbH will not cancel the corresponding obligations and deliveries, but will reschedule them as soon as this is possible after the force majeure has ceased.
Equivalent to this are cases in which Kitagawa GmbH does not receive its deliveries on time or in the correct form.

3.5 If a delivery date promised by Kitagawa GmbH is not met for reasons for which Kitagawa GmbH is responsible, the customer shall be entitled to set Kitagawa GmbH a grace period of two weeks after expiry of the agreed delivery period by means of a registered letter. After fruitless expiry of this period, the customer shall be entitled to withdraw from the contract. Compensation for delay due to slight negligence on the part of Kitagawa GmbH is excluded.

3.6 Kitagawa GmbH is entitled to make partial deliveries if this appears necessary for speedy processing and the partial delivery is not exceptionally unreasonable for the customer. Partial delivery is deemed reasonable in particular if the customer can use the partial performance - even without the subsequent deliveries - as intended.

4. Dispatch and Passing of Risk

4.1 Delivery shall be ex works. This is also the contractual place of performance. At the customer's request and expense, the goods shall be dispatched to another destination (sale to destination).

4.2 Kitagawa GmbH is entitled to determine the type of dispatch (in particular transport company, dispatch route, packaging etc.) itself. The transport packaging and all other packaging in accordance with the German Packaging Ordinance will not be taken back unless explicitly agreed otherwise in writing. The customer is obliged to dispose of the disposable packaging at his own expense.

4.3 The risk of accidental loss and accidental deterioration of the goods shall pass to the customer at the latest upon handover. If the customer is in default, this shall be deemed equivalent to handover.

4.4 In the case of sale to destination, the risk of accidental loss and accidental deterioration of the goods as well as the risk of delay shall already pass to the customer upon handover of the goods to the transport company or the person otherwise selected and designated to carry out the dispatch.

4.5 The rights of the customer pursuant to Section 9 of these GTC and the statutory rights of Kitagawa GmbH, in particular in the event of an exclusion of the obligation to perform due to impossibility, unreasonableness of performance, etc., shall remain unaffected.

4.6 If the customer fails to cooperate as required, is in default of acceptance or Kitagawa GmbH's performance is delayed for other reasons for which the customer is responsible, Kitagawa GmbH is entitled to demand compensation in in line with the resulting damage, including additional expenses (e.g. storage costs).

5. Price

5.1 The prices in euros are based on the respective order confirmation from Kitagawa GmbH plus statutory VAT from the agreed place of delivery. Unless otherwise agreed, the prices notified to the customer shall apply ex warehouse plus statutory VAT.

5.2 In the case of sale to destination, the customer shall bear the transportation costs ex warehouse. Transport insurance shall only be taken out at the request and expense of the customer.

6. Payment Conditions

6.1 Unless explicitly agreed otherwise, the invoice amount shall be payable without any deductions 30 days after the due date and delivery of the invoice. Receipt of payment by Kitagawa GmbH shall be decisive for the timeliness of payment. Checks shall only be accepted on account of performance.

6.2 Upon expiry of the payment period, the customer shall be in default without the need for a separate reminder. Interest shall be charged on the purchase price during the period of default at the applicable statutory default interest rate (Section 288 (2) BGB). Kitagawa GmbH reserves the right to assert further claims for damages caused by default.

6.3 If the customer is in arrears with payment, Kitagawa GmbH reserves the right to demand advance payments or the provision of security before making further deliveries. The same shall apply if the financial circumstances of the customer give cause for concern as to whether the payment obligations will be properly fulfilled.

6.4 The customer may only offset Kitagawa GmbH's claim against legally established or undisputed counterclaims. The customer is only authorized to exercise a right of retention to the extent that his counterclaim is based on the same contractual relationship.

7. Retention of Ownership

7.1 All goods shall remain the property of Kitagawa GmbH until full payment of all present and future claims arising from the purchase contract and from the business relationship with Kitagawa GmbH.

7.2 The customer shall be entitled to resell the goods subject to retention of title in the ordinary course of business. In this case, the customer hereby assigns to Kitagawa GmbH all claims resulting from the resale, irrespective of whether the goods have been further processed or not. Kitagawa GmbH hereby accepts this assignment. Without affecting Kitagawa GmbH's right to demand payment, the customer is authorized to demand payment on the assigned claims. For this purpose, Kitagawa GmbH shall not demand payment on the assigned claims provided that the customer fulfills all his payment obligations and there is no threat of insolvency or similar proceedings or default of payment.

7.2 The customer shall be entitled to resell the goods subject to retention of title in the ordinary course of business. In this case, the customer hereby assigns to Kitagawa GmbH all claims resulting from the resale, irrespective of whether the goods have been further processed or not. Kitagawa GmbH hereby accepts this assignment. Without affecting Kitagawa GmbH's right to demand payment, the customer is authorized to demand payment on the assigned claims. For this purpose, Kitagawa GmbH shall not demand payment on the assigned claims provided that the customer fulfills all his payment obligations and there is no threat of insolvency or similar proceedings or default of payment.

7.3 The goods subject to Kitagawa GmbH's retention of ownership may not be pledged to third parties or assigned as security before the secured claims have been paid in full. The customer shall inform Kitagawa GmbH immediately in writing if and insofar as third parties seize the goods belonging to Kitagawa GmbH.

7.4 By processing the goods subject to retention of title sold, the customer does not acquire ownership of the wholly or partially manufactured items; the processing is carried out free of charge exclusively for Kitagawa GmbH as processor within the meaning of § 950 BGB. Should this retention of ownership nevertheless expire due to any circumstances, the customer and Kitagawa GmbH hereby agree that ownership of the goods shall be transferred to Kitagawa GmbH upon processing, that Kitagawa GmbH accepts this transfer of ownership and that the customer shall remain the custodian of the goods free of charge. If Kitagawa GmbH's retained goods are processed or inseparably mixed with

items still owned by third parties, Kitagawa GmbH shall acquire co-ownership of the new items or mixed stock. The extent of the co-ownership is determined by the ratio of the invoice value of the reserved goods delivered by Kitagawa GmbH to the invoice value of the other goods.

7.5 The customer is authorized to collect the assigned claim in his own name. However, Kitagawa GmbH shall be entitled to revoke this direct debit authorization at any time, in particular if the customer does not meet his contractual obligations to Kitagawa GmbH (in particular if he is in default of payment), insolvency proceedings or application to open such proceedings have been filed or any other deficiency in his ability to pay is apparent. In the event of revocation, the customer shall be obliged to provide or hand over to Kitagawa GmbH all information and documents necessary to assert the assigned claims and to disclose the assignments to his customers. In the event of default of payment by the customer, Kitagawa GmbH is entitled to notify the customer's purchasers about the assignment.

7.6 The customer is obliged to provide Kitagawa GmbH at any time with information on the whereabouts of the goods subject to retention of title and on the claims arising from their resale. The customer is obliged to notify Kitagawa GmbH in writing of any access by third parties to the goods subject to retention of title or to the claims assigned to Kitagawa GmbH and to inform the third party of the rights of Kitagawa GmbH. Furthermore, the customer is obliged to support Kitagawa GmbH in asserting and enforcing its rights against third parties, in particular to take the necessary immediate legal action/remedies to protect the rights of Kitagawa GmbH at its own expense.

7.7 If the customer fails to meet his contractual obligations to Kitagawa GmbH (in particular in the event of non-payment of the purchase price due), Kitagawa GmbH shall be entitled to withdraw from the contract in accordance with the statutory provisions and to demand the return of the goods on the basis of the retention of title and the withdrawal.

7.8 The customer is obliged to treat the delivered goods subject to retention of title with care. In particular, he shall be obliged to insure the reserved goods adequately at his own expense against destruction, damage by fire, water, burglary or theft. The customer hereby assigns his insurance claims in this respect to Kitagawa GmbH. Kitagawa GmbH hereby accepts the assignment and declares the reassignment to the customer with the proviso that this becomes effective if and as soon as the retention of title has expired.

7.9 Insofar as the claims of Kitagawa GmbH as a whole are secured beyond doubt by more than 125% by the assignments or reservations declared above, the surplus of the outstanding amounts or the reserved goods within the meaning of Section 7.1 above shall be released by Kitagawa GmbH at the request of the customer at its discretion.

8. Warranty

8.1 Kitagawa GmbH warrants for a period of twelve months that the goods are free of defects upon passing of risk. This warranty shall commence upon delivery of the goods.

8.2 Drawings, illustrations, dimensions, weights and/or other performance data are non-binding and do not constitute a quality agreement or warranty. Unless explicitly agreed otherwise, they describe the general condition of the goods, but not their individual properties. Changes within the meaning of section 2.4 of the GTC do not constitute a defect in the goods.

8.3 No warranty shall be provided in the event of improper use, non-compliance with assembly or operating instructions, incorrect installation, incorrect operation, etc. Likewise, no warranty shall be provided for cases of damage caused by the operation of the goods together with devices whose compatibility has not been explicitly confirmed in writing by Kitagawa GmbH.

8.4 The customer's claims for defects presuppose that he has complied with his statutory duties of inspection and notification of defects (Section 377 HGB (German Commercial Code)). If a defect is discovered during the inspection or later, Kitagawa GmbH must be notified of this in writing without delay. The notification shall be deemed immediate if it is made within two weeks of delivery or later discovery, whereby the timely dispatch of the notification shall suffice to meet the deadline. Irrespective of these obligations to inspect and give notice of defects, the customer must notify Kitagawa GmbH in writing of obvious defects (including incorrect and short deliveries) within two weeks of delivery, whereby the timely dispatch of the notification is also sufficient to meet the deadline.

8.5 If the customer fails to properly inspect the goods or to report defects, Kitagawa GmbH's liability for the unreported defect shall be excluded and Kitagawa GmbH's performance shall be deemed to have been provided free of defects.

8.6 In the event of defects, the warranty is provided at the discretion of Kitagawa GmbH for subsequent performance through free rectification or replacement delivery. The customer is obliged to give Kitagawa GmbH the time and opportunity required for the subsequent performance owed, in particular to allow Kitagawa GmbH to inspect the defective goods. If the rectification of defects also fails at the second attempt or if the second replacement delivery is also defective or if Kitagawa GmbH does not fulfill its obligation to make a subsequent delivery or replacement delivery within a reasonable period of time, the customer is entitled to reduce the purchase price or withdraw from the contract. The right of withdrawal is excluded if the defect is insignificant.

8.7 If the customer's request for rectification of defects proves to be unjustified, Kitagawa GmbH shall be entitled to demand reimbursement from the customer of the costs incurred for subsequent performance.

8.8 Claims of the customer for damages or compensation for useless expenses shall only exist in accordance with the following Section 9 of these GTC and are excluded beyond this.

9. Liability

9.1 Kitagawa GmbH is only liable in the event of willful intent or gross negligence.

9.2 In the event of ordinary negligence, the Kitagawa GmbH is only liable for damages caused by loss of life, physical injury or harm to health, and for damages from a breach of a material contractual obligation (cardinal obligations). In the case of the latter, however, Kitagawa GmbH's liability is limited to compensation of foreseeable, typically damages.

9.3 In the absence of a warranted characteristic of the goods, liability shall be limited to the damage to be expected in the normal course of events. Further claims due to defective goods are excluded.

9.4 Otherwise, any liability of Kitagawa GmbH beyond this, in particular for indirect and consequential losses, lost profit, unrealized savings etc., is excluded. This excludes consequential damages due to a breach of cardinal obligations.

9.5 The customer may withdraw from or terminate the agreement due to a breach of obligations that does not consist of a defect of the product only insofar as the Kitagawa GmbH is responsible for this breach.

9.6 Claims from the customer according to the Produkthaftungsgesetz (German Product Liability Act) are unaffected.

10. Limitation Period

10.1 By way of deviation from Sec. 438 (1) No. 3 BGB, the general limitation period for claims to quality and title defects is one year from delivery.

10.2 The above limitation periods under commercial law also apply to contractual and non-contractual claims from the customer for damages based on a defect in the goods, unless applying the regular statutory limitation periods would in the specific case lead to a shorter limitation period.

10.3 The limitation periods of the Produkthaftungsgesetz are unaffected.

11. Miscellaneous

11.1 The Customer shall not be entitled to assign rights and obligations arising from the contract concluded with Kitagawa GmbH to third parties without the prior consent of Kitagawa GmbH, with the exception of the cases regulated within the GTC.

11.2 These GTCs and all contractual relationships between the Kitagawa GmbH and its customers are subject to German law under exclusion of the UN CISG.

11.3 The exclusive place of jurisdiction for all disputes and types of proceedings arising from or in connection with the contractual relationship between the parties is Offenbach am Main.

11.4 The invalidity of individual provisions of these GTC of Kitagawa GmbH shall not affect the validity of the remaining provisions. Ineffective provisions shall be deemed to be replaced by such effective provisions as are suitable to realize the economic purpose of the omitted provision as far as possible.

11.5 The German version of this General Terms of Conditions shall be binding. The English Version shall only serve for information purposes.

KITAGAWA GmbH
Birkenwaldstrasse 38
D-63179 Obertshausen
FR-Germany
Telefon +49-6104-60009-0
Telefax +49-6104-60009-40

GTC Kitagawa GmbH
(As of: February 2024)

Global Network

KITAGAWA INDUSTRIES CO., LTD.
695-1, Higashiorido, Mukui-cho, Inazawa City,
Aichi Prefecture 492-8446, Japan
Tel: 81-587-34-3561 Fax: 81-587-34-3109
http://www.kitagawa-ind.com

KITAGAWA INDUSTRIES America, Inc.
2860 Zanker Road, Suite#102 San Jose,
California 95134, U.S.A.
Tel: 1-408-971-2055 Fax: 1-408-971-6033
http://www.kgs-ind.com

KITAGAWA GmbH
Birkenwaldstr 38, 63179 Obertshausen, Germany
Tel: 49-6104-60009-0 Fax: 49-6104-60009-40
http://www.kitagawa.de

KITAGAWA ELECTRONICS (SINGAPORE) PTE. LTD.
2 Bulim Lane 1, #03-11/12 Bulim Square,
Singapore 648115
Tel: 65-6560-6511
http://www.kitagawa.com.sg

KITAGAWA ELECTRONICS (THAILAND) CO., LTD.
999/100 Moo 15, Bangsaothong, Bangsaothong,
Samutprakarn 10570, Thailand
Tel: 66-2-182-5264

SHANGHAI KITAGAWA INDUSTRIES CO., LTD.
9F NO.7 Bldg No.77 3rd West Fu Te Road,
China (Shanghai) Pilot Free Trade Zone,
Shanghai 200131, China
Tel: 86-21-5865-2766 Fax: 86-21-5064-4018

KITAGAWA TECHNOLOGY (SHENZHEN) CO., LTD.
Room09-10, 11/F., O ce Tower, Shun Hing Square
DI Wang Commercial Center, 5002 Shen Nan Dong
Road, Shenzhen City 518002, China
Tel: 86-755-2396-3200 Fax: 86-755-2396-3490

KITAGAWA INDUSTRIES (H.K.) LIMITED
Unit J, 15th Floor, Ever Gain Centre, 43-57 Wang Wo
Tsai Street, Tsuen Wan, New Territory, Hong Kong
Tel: 852-2612-1161 Fax: 852-2612-1686
http://www.kitagawa.com.hk

KITAGAWA INDUSTRIES (TAIWAN) CO., LTD.
7F, No.75, Hsin Tai Wu Rd., Sec.1, Hsi Chih Dist.,
New Taipei City, Taiwan, 221
Tel: 886-2-2698-8833 Fax: 886-2-2698-3355
http://www.kgtw.com.tw

KITAGAWA GmbH

Birkenwaldstraße 38
63179 Obertshausen Germany
Telefon: +49 6104 60009-0
Telefax: + 49 6104 60009-40
E-Mail: sales@kitagawa.de

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