

Thermal Management Solutions

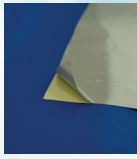
The background features a large, abstract graphic design. It consists of several thick, parallel lines that create a sense of depth and perspective. A central vertical line is orange, flanked by grey lines that appear to recede into the distance. The overall effect is clean, modern, and industrial.

CONTENTS

Heat dissipating materials -Heat spreader-

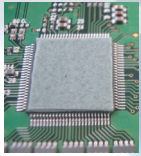


Ceramic Heat Sink
P1

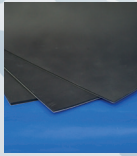


Heat spreading sheet
P2

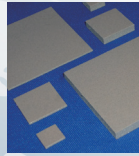
Thermally conductive materials Non-silicon type



Thermally
conductive sheet
P5-6

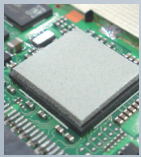


Thermally
conductive
vibration damping
sheet
P7



Thermally
conductive sheet
P 9

Thermally conductive materials Silicon type



Thermally
conductive sheet
P8

KGS
*First Solution
Proposer*

How to read markings



High thermal conductivity type

Generated heat from high heat generating device such as CPUs is released efficiently.



Soft (low hardness) type

Reduce the load of components that have issues of mechanical strength for required equipments to be smaller and thinner.



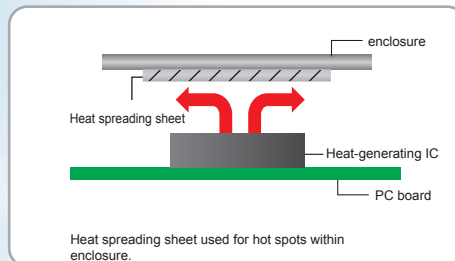
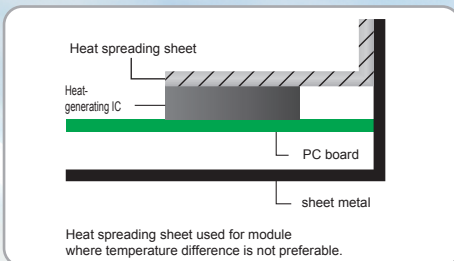
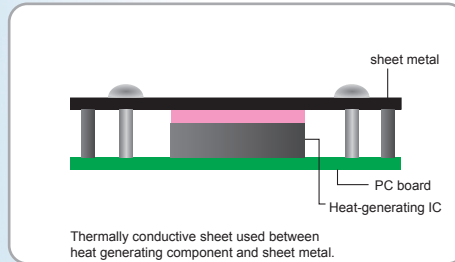
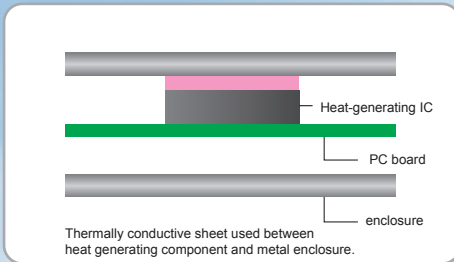
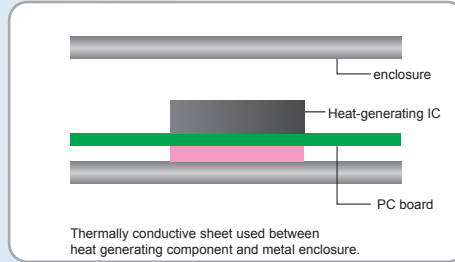
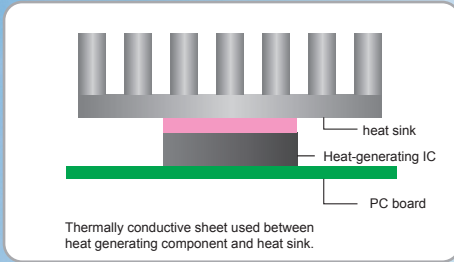
Phase transition type

Adhered tightly even for tiny gaps because of liquefaction in high viscosity.



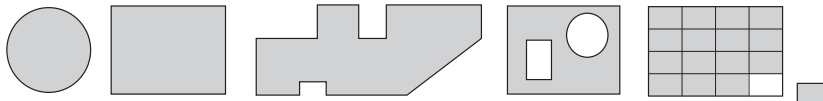
New product

Application example

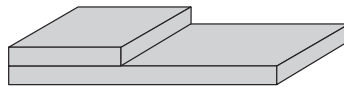


Secondary processing for expansion in application

Round, square and other custom profile as well as half-cutting.



Customized cutting for multi-layer product

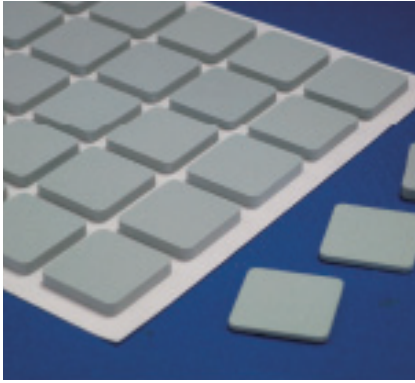


Another processing (Custom processing according to your application available.)

Please feel free to contact KGS sales.)

⚠️ [ANNOTATION]

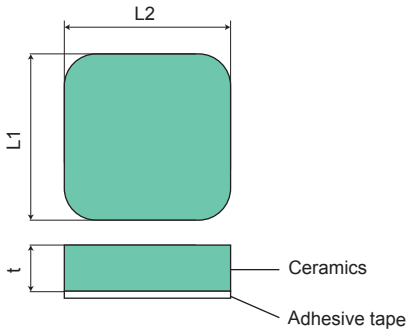
- DANGER OF BURNING. Avoid installation in extreme temperature condition of heating element.
- Wipe off oil, dust, moisture from mounting surface.
- Do not remove protective film until just before use due to prevent the surface from inserting oil and dust.
- The thickness in this brochure does not include protection film.
- Do not store products in the areas with conditions such as high temperature, humidity and direct sunlight.
Please storage CHANGE GEL under 35°C. (Recommend temperature: 25°C)
- All data shown in this brochure are not guaranteed values.
- The products with autohesion might be hard to remove when it is heat-compressed.
- Users are solely responsible for making preliminary tests to determine the suitability of products for their intended use.
- Descriptions and products shown in this brochure are subject to change without notice for the sake of improvements.
- Statements concerning possible or suggested uses made herein may not be relied upon, or be construed, as a guarantee of no patent infringement.
- Product might not be for sale by country or region.
- Thermal conductivity of all products is measured in Quick Thermal Conductivity Meter of Kyoto Electronics Manufacturing Co., Ltd. (QTM-500)
- It is prohibited reprint of the article in this brochure without prior written consent by Kitagawa Industries Co., Ltd.



Porous Ceramic Heat Sink with excellent insulation properties

Features

- "CECD" provides improved heat dissipation due to a greater surface area to contact with the air, and better thermal emissivity compared to aluminum.
- Around 30% lighter than aluminum.
- No electromagnetic waves emitted from "CECD" due to excellent insulation properties, unlike conventional metal heat sink.



Unit:mm

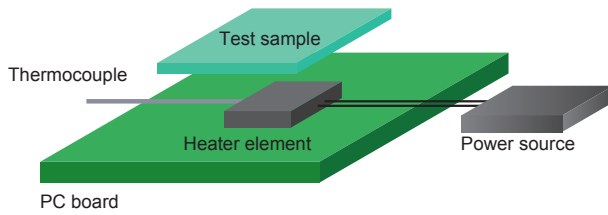
Part No.	Thickness t	L1	L2
CECD-1.5-020020T	1.5	20	20
CECD-3.0-020020T	3.0	20	20
CECD-3.0-040040T	3.0	40	40

Thermal conductivity	W/m·K	11.5
Special gravity	—	1.95
Volume resistivity	$\Omega \cdot \text{cm}$	$\geq 10^8$
Color	—	Green

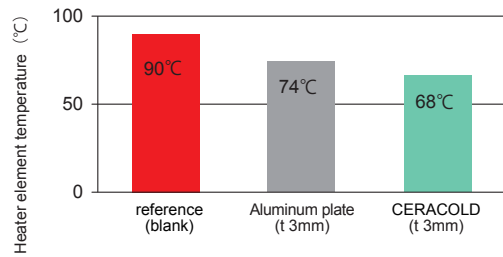
All specifications and characteristics shown herein are typical value, but are not guaranteed.

Heat dissipation effect

Thermally conductive characteristics



Heat dissipation effect of heat spreading sheet



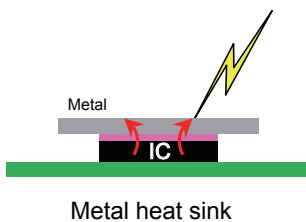
〈Measuring conditions〉

Heater element : □10mm (1.6W)

Dimensions : □20mm (t3mm)

EMC effect with heat sink

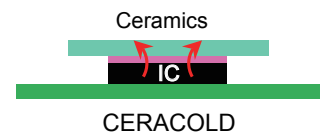
Disturbance noise is received through floating metal particles acting as antenna

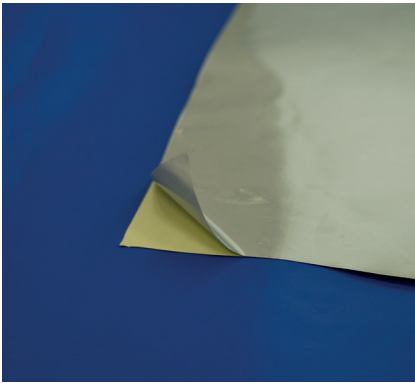


Noise current from IC is transmitted due to capacitive coupling

⇒Radiated noise

No issues with capacitive coupling or any disturbance noise due to excellent insulation properties



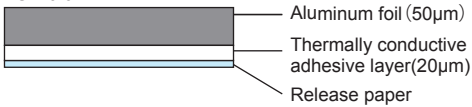


Thin and flexible heat spreading sheet for cooling hot spots.

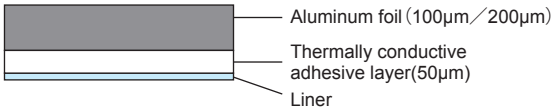
Features

- Excellent thermal conductivity on horizontal direction (λt : 221W/m·k).
- Due to its excellent flexibility, it can be applied to curved surfaces.
- Insulation film can be applied to add insulation property.
- Optimal thermal solution for hot spots on mobile devices such as tablets, routers and others.

HSD-0.07



HSD-0.15/0.25

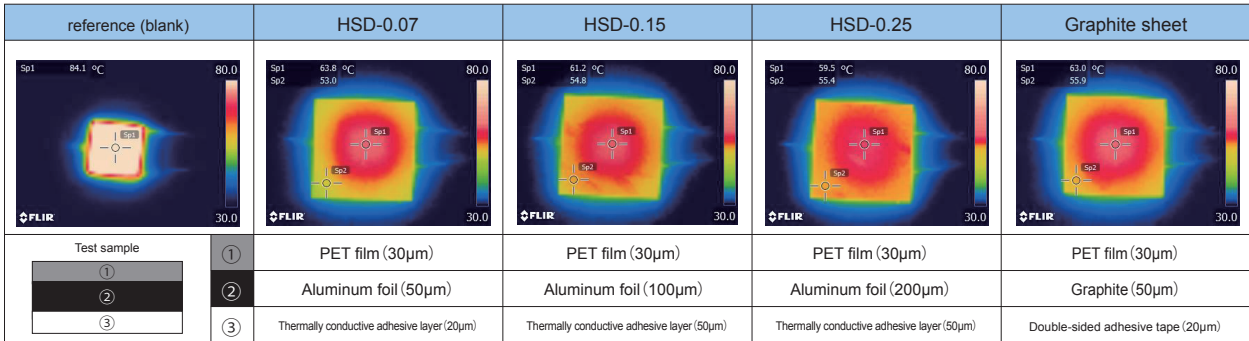


Part No.	Unit	HSD-0.07	HSD-0.15/0.25
Thickness	mm	0.07	0.15/0.25
Thermal conductivity (horizontal direction)	W/m·K	221(Aluminum)	
Adhesion	N/25mm	> 6	
Flammability	UL	UL510 Equivalent	UL94 VTM-0 Equivalent

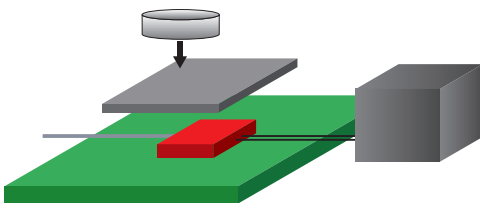
All specifications and characteristics shown herein are typical value, but are not guaranteed.

Heat dissipation effect

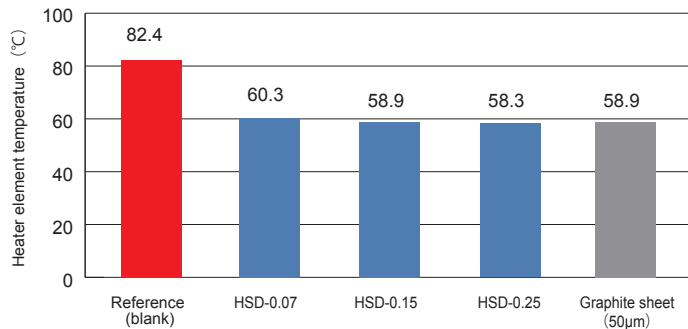
Heat distribution images



Testing method



Heat dissipation effect of heat spreading sheet



⟨Measuring conditions⟩
 Heater element : □25mm (1.3W)
 Test sample : □50mm

Thermally conductive sheet General characteristics

Part No.	Unit	CPVT	CPVS	CPVS-F	CPSS	CPSS-F	CPV	CPAG
Color	—	Green	Green		Dark Green		Gray	Gray
Thickness	mm	0.10/0.15 0.20/0.25	1.0/1.5 2.0/2.5	0.3/0.5/1.0 1.5/2.0/2.5	1.0/1.5/2.0 2.5/3.0/4.0	4.0	0.5/1.0 1.5/2.0/2.4	1.0/2.0 3.0/4.0/5.0
Thermal conductivity	W/m·K	2.0	2.0		2.0		> 0.8	0.8
Hardness	ASKER C	28	18		8		(54) Durometer A 30	(70) Durometer A 64
Volume resistivity	Ω·cm	1.0×10^{13}	5.3×10^{11}		1.0×10^{12}		5.0×10^{13}	5.54×10^{11}
Flammability	UL94	—	V-2 (t1.0 - t2.0)	V-2 (t0.5 - t2.0)	V-2 (t1.0 - t3.0)	V-0 (t4.0)	VTM-0 (t1.0)	V-1 Equivalent*3 V-0 Equivalent*4
Standard dimensions ^{*1*2}	mm	210 × 510	210 × 510		210 × 510		400 × 400	345 × 345

All specifications and characteristics shown herein are typical value, but are not guaranteed.

- *1) Effective dimensions are 5mm smaller on all sides than the standard dimensions.
 *2) Please contact your sales representative for effective product dimensions and areas.
 *3) V-1 Equivalent : t2.0mm
 *4) V-0 Equivalent : t3.0 mm, 4.0mm

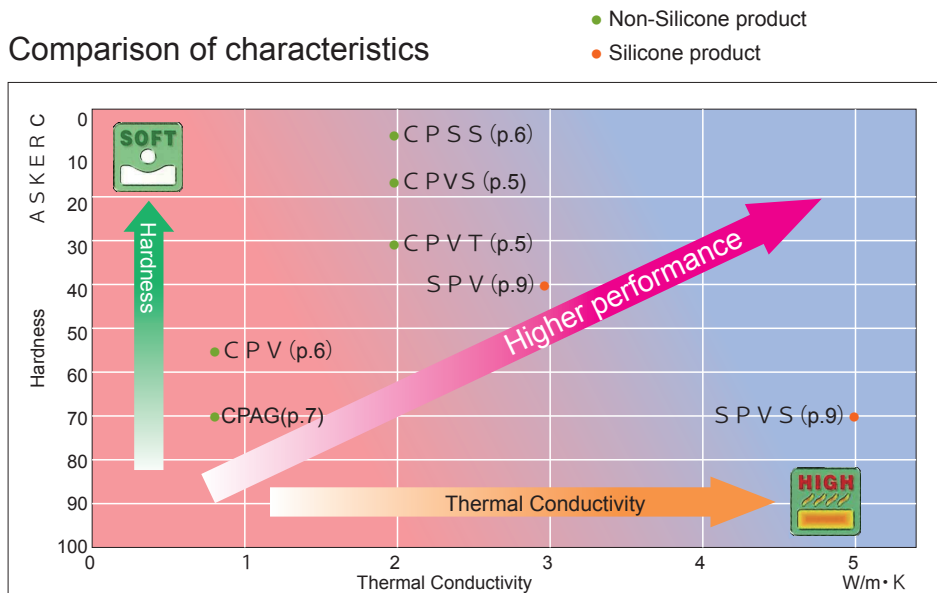
Thermally conductive materials Characteristics (Silicon type)

Thermally conductive sheet General characteristics

Part No.	Unit	SPV	SPVS
Color	—	Green	Green
Thickness	mm	0.5/1.0	0.5/1.0
Thermal conductivity	W/m·K	3.0	5.0
Hardness	ASKER C	40	70
Volume resistivity	$\Omega \cdot \text{cm}$	2.0×10^{11}	3.0×10^{11}
Flammability	UL94	V-1 Equivalent	V-0
Standard dimensions ^{1) 2)}	mm	210 × 510	210 × 510

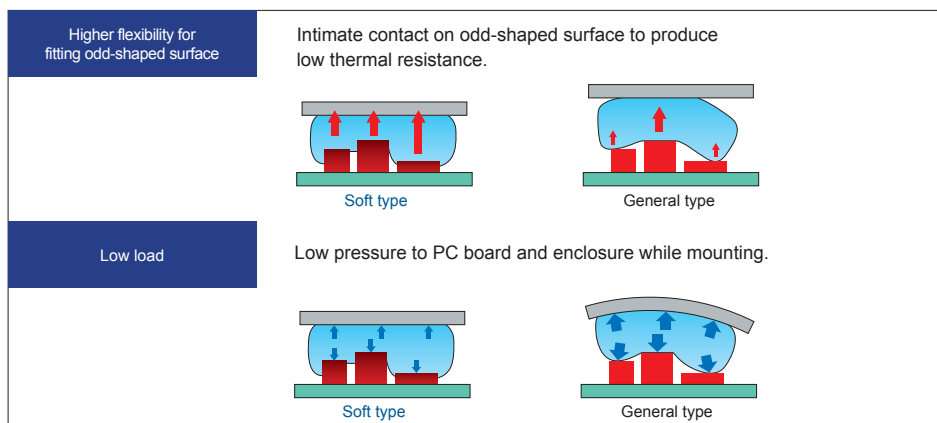
All specifications and characteristics shown herein are typical value, but are not guaranteed.

Comparison of characteristics

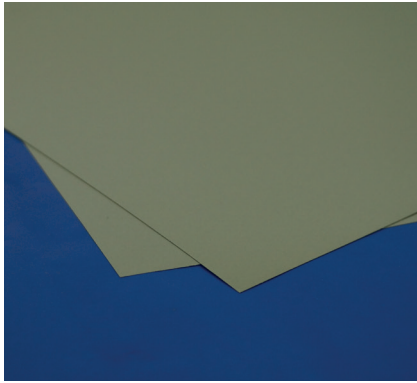


*Hardness of GP1 is shown that of substrate itself *Products of 0.25mm or less in thickness are not listed herein

Soft type (Low hardness type)



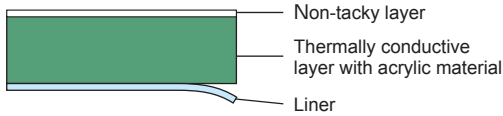
COOLPROVIDE / CPVT



Ultra-thin, thermally conductive sheet with single sided self-tackiness, suitable for mobile devices where clearance is limited.

Features

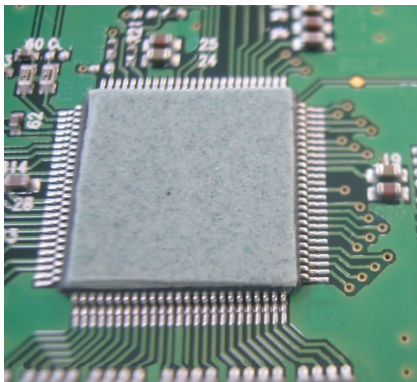
- Available thickness ranging from 0.1mm ~ 0.25mm at every 0.05mm pitch. Load to PC board can be minimized by choosing appropriate thickness.
- Sheet form with single sided self-tackiness provides better workability compared to grease.



Thickness	mm	0.10 / 0.15 / 0.20 / 0.25
Thermal conductivity	W/m·K	2.0
Hardness	ASKER C	28
Volume resistivity	Ω·cm	1.0 × 10 ¹³
Color	—	Green

All specifications and characteristics shown herein are typical value, but are not guaranteed.

COOLPROVIDE / CPVS

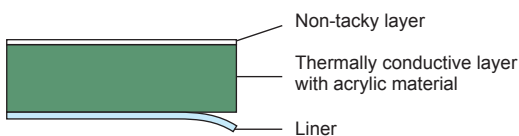


Thermal conductive sheet of low hardness (ASKER C18).

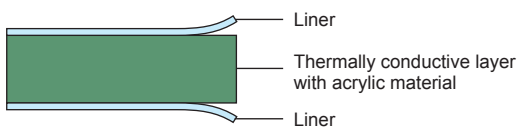
Features

- Low hardness (ASKER C18) is realized as a non-silicon Thermal conductive sheet.
- Because of excellent conformability, contact resistance can be reduced.
- Provides excellent vibration damping solution. (loss factor : 0.9)
- Pressure to electronic devices can be reduced after assembly because of excellent stress relief characteristics.

Single sided self-tackiness type / CPVS-F

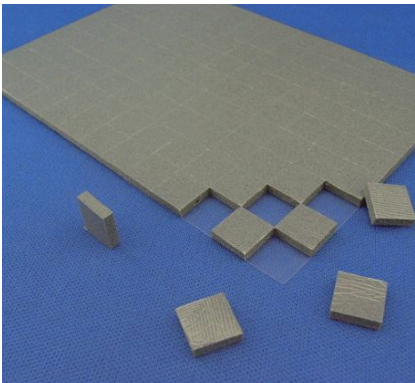


Double sided self-tackiness type / CPVS



Thickness	mm	CPVS-F	0.3 / 0.5 / 1.0 / 1.5 / 2.0 / 2.5
		CPVS	1.0 / 1.5 / 2.0 / 2.5
Thermal conductivity	W/m·K	2.0	
Hardness	ASKER C	18	
Volume resistivity	Ω·cm	5.3 × 10 ¹¹	
Loss factor	—	0.9	
Color	—	Green	
Flammability	UL94	V-2 ¹	

¹See page 3. All specifications and characteristics shown herein are typical value, but are not guaranteed.

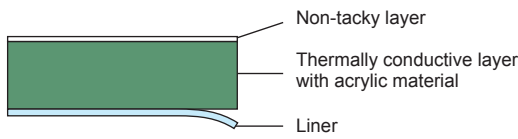


Sheet with high thermal conductivity of super low hardness (ASKER C8).

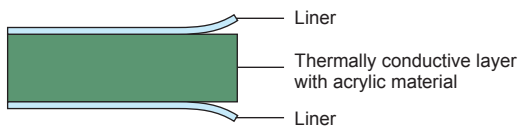
Features

- Because of excellent conformability, contact resistance can be reduced.
- Super low hardness (ASKER C8) is realized as a non-silicon thermally conductive sheet.
- Because of excellent flexibility and stress-strain relief characteristic like putty, loads to devices and printed circuit boards can be reduced after assembling.

Single sided self-tackiness type / CPSS-F



Double sided self-tackiness type / CPSS

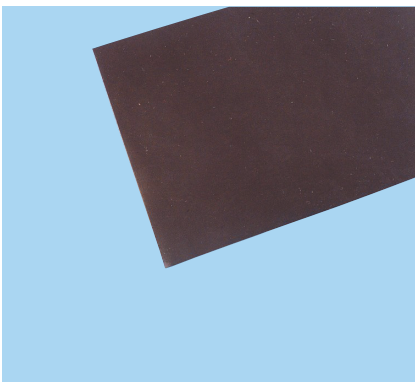


Thickness	mm	CPSS-F	1.0/1.5/2.0/2.5/3.0/4.0
		CPSS	4.0
Thermal conductivity	W/m·K	2.0	
Hardness	ASKER C	8	
Volume resistivity	$\Omega \cdot \text{cm}$	1.0×10^{12}	
Color	—	Dark Green	
Flammability	UL94	V-2 ²	

*1) Double sided self-tackiness type: t=4.0mm only.
 *2) t4.0mm : V-0
 All specifications and characteristics shown herein are typical value, but are not guaranteed.

Thermally conductive materials (Non-silicon type)

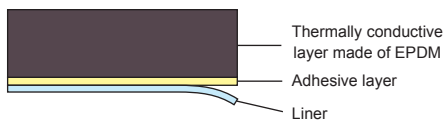
COOLPROVIDE / CPV



Thermal conductive sheet with wide variety of thickness.

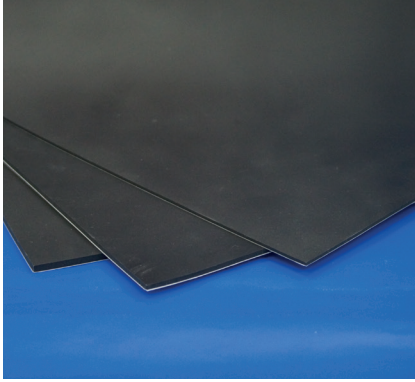
Features

- Non-silicone thermal conductive sheet with EPDM as a base material.
- Both of mechanical strength and flexibility are provided.
- 5 types for 0.5 mm to 2.4 mm are available.



Thickness	mm	0.5/1.0/1.5/2.0/2.4
Thermal conductivity	W/m·K	> 0.8
Hardness	Durometer Type A ¹⁾	A 30
Volume resistivity	$\Omega \cdot \text{cm}$	5.0×10^{13}
Color	—	Gray
Flammability	UL94	VTM-0 ²

*1) In conformity to JIS K 6253
 *2) VTM-0 : t1.0mm
 All specifications and characteristics shown herein are typical value, but are not guaranteed.



Non-silicone thermally conductive, vibration damping material with thermal conductivity and higher damping performance

Features

- Equipped with both thermal conductivity and higher damping performance.
- Non-silicone material
- Provides excellent vibration damping solution. (loss factor : 0.9)
- Provided in sheet form. Customized profiles are also available.



Thermally conductive layer with acrylic material

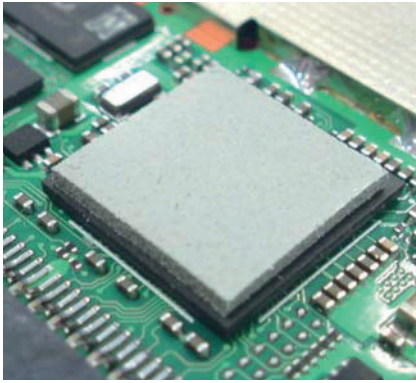
Thickness	mm	1.0/2.0/3.0/4.0/5.0
Thermal conductivity	W/m·K	0.8
Loss factor	—	0.9
Hardness	Durometer Type A ^{*1}	A 64
Volume resistivity	$\Omega \cdot \text{cm}$	5.54×10^{11}
Color	—	Gray
Flammability	UL94	V-1 Equivalent ^{*2} V-0 Equivalent ^{*3}

*1)In conformity to JIS K 6253

*2)V-1 Equivalent : t 2.0mm

*3)V-0 Equivalent : t 3.0mm, 4.0mm

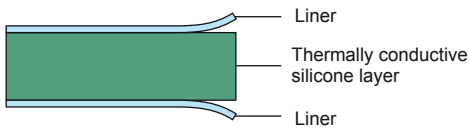
All specifications and characteristics shown herein are typical value, but are not guaranteed.



High thermal conductivity type : 3 W/mK

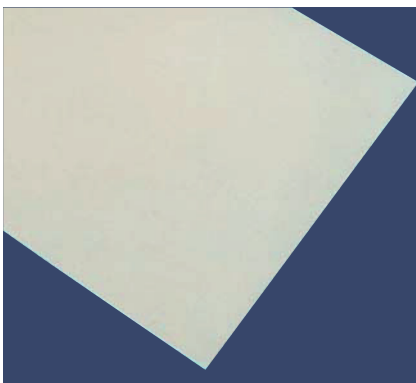
Features

- Sheet of high thermal conductivity with excellent flexibility
- Available for temporary fixing by autohesion
- Available in two thicknesses, 0.5mm and 1.0mm



Thickness	mm	0.5 / 1.0
Thermal conductivity	W/m·K	3.0
Hardness	ASKER C	40
Volume resistivity	$\Omega \cdot \text{cm}$	2.0×10^{11}
Color	—	Green
Flammability	UL94	V-1 Equivalent*

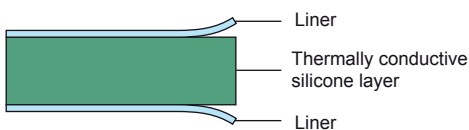
*V-1 Equivalent : t0.5mm
All specifications and characteristics shown herein are typical value, but are not guaranteed.



High thermal conductivity type : 5 W/mK

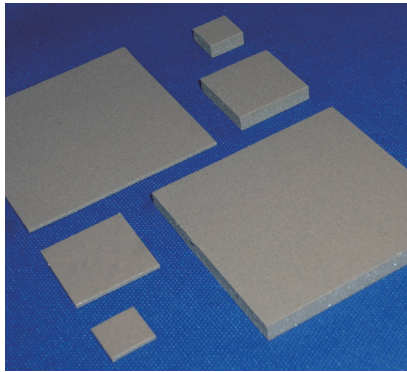
Features

- UL94 V-0 recognized product.
- Available for temporary fixing by autohesion
- Available in two thicknesses, 0.5mm and 1.0mm



Thickness	mm	0.5 / 1.0
Thermal conductivity	W/m·K	5.0
Hardness	ASKER C	70
Volume resistivity	$\Omega \cdot \text{cm}$	3.0×10^{11}
Color	—	Green
Flammability	UL94	V-0

All specifications and characteristics shown herein are typical value, but are not guaranteed.



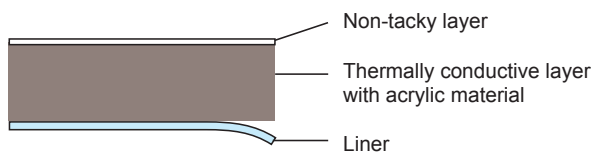
A non-silicon sheet with high thermal conductivity of super low hardness.

Features

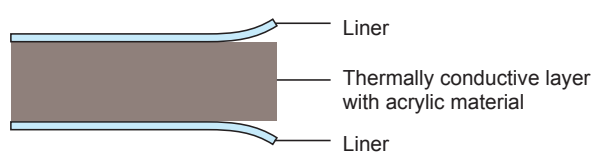
- Super low hardness (ASKER C 15) and high thermal conductivity (3W/m · K) are realized as a non-silicon thermally conductive sheet.
- Because of excellent contact property, contact resistance can be reduced.
- Because of a non-silicon material, siloxane is not contained.
- Because of excellent flexibility and stress relaxation property, loads to devices and printed circuit boards can be reduced after assembling.
- Recommended operating temperature range is $-40^{\circ}\text{C} \sim 125^{\circ}\text{C}$.
- Oil bleed is less, compared with silicone type.

Cross-section view

Single sided self-tackiness type / CPVH-F



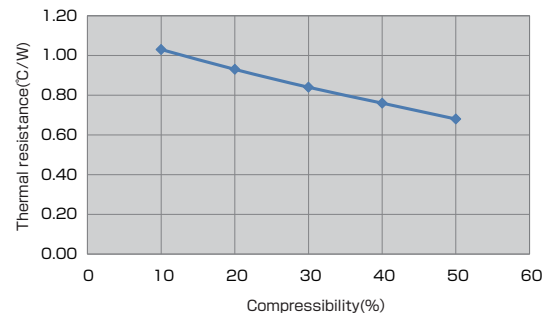
Double sided self-tackiness type / CPVH



Properties

Item	Unit	Standard	CPVH	
			CPVH-F	CPVH
Thickness	mm	—	0.5 / 1.0 / 1.5 / 2.0	2.5 / 3.0 / 3.5 / 4.0
			—	2.0 / 3.0 / 4.0
Thermal conductivity	W/m · K	JIS R 2616 (Hot-wire method)	3.0	
		ISO 22007-2 (Hot-disk method)	2.1	
Hardness	ASKER C	JIS K 7312	15	
Volume resistivity	$\Omega \cdot \text{cm}$	JIS K 6911	1.0×10^{11}	
Color	—	—	Brown	
Recommended operating temperature	$^{\circ}\text{C}$	—	$-40 \sim 125$	
Flammability	—	UL94	Equivalent to V-0(to be certified)	

Compressibility vs thermal resistance



<Measurement condition>
 Specimen size: $25\text{mm} \times 25\text{mm} \times 2\text{mm}$ / In conformity to ASTM D 5470
 Applied voltage : 20W

Terminology

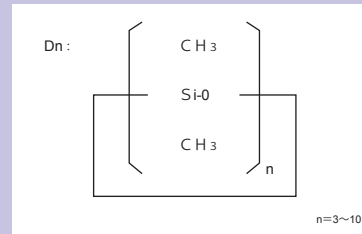
Low molecular weight siloxane

Labeled as D3 (trimer), D4 (tetramer) and D5 (pentamer) according to the amount of bonding molecular of Cyclic dimethyl (D-units: Molecular formula $\text{SiO}(\text{CH}_3)_2$). Up to D20 are called low molecular cyclic siloxane or simply low molecular siloxane. Among other things, D3~D10 are indices for silicone quality standard to avoid contact faults.

ATTENTION:

Due to its high volatility, low molecular siloxane evaporates into the atmosphere as vapor even at room temperature.

- Electrical or electric circuit failure:
Insulating silica is deposited which causes contact faults.
- Impact on optical equipment:
Optical characteristics change when low molecular siloxane is deposited onto optical components.



Thermal conductivity and thermal resistance

Thermal basic formula:

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

Q: Quantity of heat (W), λ : Thermal conductivity (W/m·K),
 ΔT : Temperature difference, S: Cross sectional area, d: Distance

Thermal conductivity:

Heat property of a material to conduct heat

* This value is not affected by surrounding environment such as equipment used.

* The thinner the material is, the smaller the temperature difference is.

λ (Thermal conductivity) = $(Q \cdot d) / (\Delta T \cdot S)$ * $d / \Delta T = \text{constant}$

Thermal impedance:

Heat property of a material to restrict a heat flow

* This value changes depending on a distance from a heat source, adhesion and area even the same thermally conductive pad is used.

* This value can be made small when the area is big, thermal conductivity is high and the distance (thickness) is short.

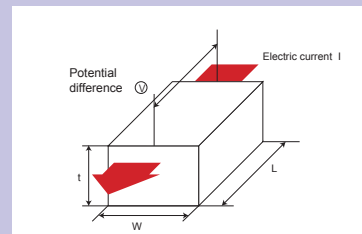
R_1 (Thermal impedance) : $^\circ\text{C}/\text{W} = d / (\lambda \cdot S)$

Volume resistivity (Compliance to JIS K 6911)

In general, electrical resistance is used to measure electrical conductivity (ability to conduct an electric current) of a substance (material).

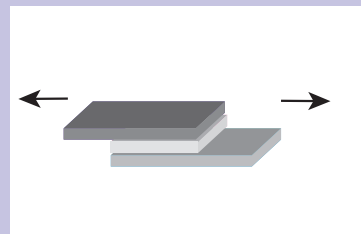
Volume resistivity is electrical resistance per unit volume (1cm x 1cm x 1cm) and is represented by ($\Omega \cdot \text{cm}$). Each material has a specific resistivity.

This value is calculated by measuring potential difference (V) between two electrodes which are apart by the distance of (L) when constant current I (A) is applied to cross sectional area (W x t) as indicated on the right.



Tensile shear strength (JIS K 6850)

To calculate tensile shear strength, the maximum stress, which breaks the bonding surface while materials are being pulled in a parallel direction to the bonding surface, is divided by the bonding surface area (shear area).



GENERAL TERMS OF DELIVERY AND PAYMENT

1. Scope

1.1 The following General Terms of Delivery and Payment shall be applicable – provided nothing to the contrary is stipulated in writing – to all of the deliveries and other performance effected by us.

1.2 Deviating General Terms of Business of the Purchaser shall not bind us.

1.3 Amendments and/or supplements to the following terms and to the additionally stipulated agreements upon the conclusion of the contract must be made in writing.

2. Conclusion of the Contract

2.1 The offers of Kitagawa GmbH are made without obligation.

2.2 A contract between Kitagawa GmbH and the Purchaser shall only come into effect in accordance with the contents of the written confirmation of order on the part of Kitagawa GmbH or through the delivery of the goods or the rendering of the agreed performance by Kitagawa GmbH.

2.3 The Purchaser shall be bound to its order for three weeks. Kitagawa GmbH reserves the right to deviate from the order specifications in the acceptance of the order if this is necessary for the fulfillment of the order and is acceptable for the Purchaser.

2.4. Kitagawa GmbH shall be entitled to effect an alteration to the goods at any time without prior notification insofar as this does not result in any shortfall of the contractually stipulated characteristics of the goods and the alteration is reasonable for the Purchaser. The alteration of already delivered contract cannot be subsequently demanded.

3. Delivery Terms

3.1 The delivery period of the goods shall be determined in accordance with the written confirmation of order of Kitagawa GmbH.

3.2 Indicated delivery periods shall run from the dispatch of the written confirmation or order. If the Purchaser is obliged to effect advance performance, then the delivery period shall commence with the receipt of the contractual advance performance of the Purchaser at Kitagawa GmbH.

3.3 If the Purchaser demands alterations to the contractually stipulated performance after a written confirmation of order has been effected, then Kitagawa GmbH shall be entitled to effect a reasonable extension to the delivery period if necessary.

3.4 In cases of force majeure, interventions by sovereign powers, natural disasters, war, revolts, strikes at its own company, at supply companies or at carriers, Kitagawa GmbH shall be entitled to make up the delivery after the cessation of the cause of the impediment and the delivery period shall be extended accordingly. The same applies if Kitagawa GmbH does not receive its own supplies in due time or in due form. There shall be no claims due to non-delivery or late delivery. This shall also be applicable if above indicated circumstances arise once the stipulated delivery period was already exceeded.

3.5 If a promised delivery date is not met by Kitagawa GmbH for reasons attributable to Kitagawa GmbH's fault, then the Purchaser shall be entitled to set Kitagawa GmbH a two-week subsequent period after the expiry of the stipulated delivery period by means of registered letter. The Purchaser

shall be entitled to withdraw from the agreement after the fruitless expiry of the period. Claims for damages, insofar as is legally permissible, as well as more extensive rights shall be excluded, provided the delay in delivery is neither due to intent nor gross negligence on the part of Kitagawa GmbH. This limitation of claims shall not apply in cases due to loss of life, bodily injury or damage of health. The burden of proof that intent or gross negligence is not applicable shall be borne by Kitagawa GmbH.

3.6 Kitagawa GmbH shall be entitled to effect part deliveries unless they should be unreasonable to be accepted by the Purchaser.

4. Shipment and passing of risk

4.1 Kitagawa GmbH shall undertake the shipments of the goods at the Purchaser's expense. Kitagawa GmbH shall select the forwarder/carrier to the best of its knowledge, without, however, assuming corresponding liability. Kitagawa GmbH shall award the shipping order on the customary terms in the sector in each case. Transport insurance shall only be taken out at the Purchaser's request and expense.

4.2 Risk shall pass when the goods leave the warehouse or upon the surrender of the goods to the forwarder/carrier. The risk shall also pass to the Purchaser, if the goods are ready for shipment and delivery is delayed or fails for other reasons attributable to the Purchaser.

4.3 Any transport damage which occurs must be asserted by the Purchaser in due time to the forwarder/carrier or its insurance company.

5. Prices

The prices are indicated in the respective confirmation of order or Kitagawa GmbH and are expressed net in EURO plus the statutory rate of V.A.T. exclusive of packing, freight, postage, delivery charges etc.

6. Payment Terms

6.1 Insofar as no other payment terms are indicated in the confirmation of order of Kitagawa GmbH, the invoices are payable after the invoice date within 30 days net without any discount. Decisive for effecting payment on time is the receipt of the payment at Kitagawa GmbH. Cheques shall only be accepted on account of performance.

6.2 If the Purchaser is a businessman, then it shall be in default upon the exceeding of the due date without a separate warning. Kitagawa GmbH shall be entitled to assert default interest to the amount of 8 percentage points above the basic rate of interest. The assertion of a more extensive loss caused by default remains reserved.

6.3 In the event that the Purchaser should be in default with payment, Kitagawa GmbH may upon its discretion request advance payment before

delivery of the goods. The same shall apply if the Purchaser's economic conditions give reason to concern regarding the due fulfillment of payment obligations.

6.4 The Purchaser shall only be entitled to set off the claims of Kitagawa GmbH against those claims which are undisputed or legally binding.

7. Warranty

7.1 Kitagawa warrants for the duration of 12 months that the goods contained not material or fabrication defects at the time the risks passes. This warranty ("Gewährleistung")

commences upon delivery of the goods.

7.2 Warranty shall not be effected in the case of improper utilization, faulty installation, incorrect operation etc. No warranty shall similarly be effected for losses which arise through the operation of the goods together with such appliances whose compatibility has not been expressly confirmed in writing by Kitagawa GmbH.

7.3 The Purchaser shall notify Kitagawa GmbH of any defects of the delivery in writing as soon as such defects are detected under conditions of normal business operations. Section 377 German Trade Code applies.

7.4 In the case of defects the warranty shall be effected at the option of Kitagawa GmbH by subsequent rectification or substitute delivery free of charge. If the subsequent rectification also fails on the second attempt or in if the second substitute delivery also contains defects or if Kitagawa GmbH does not meet its subsequent delivery or substitute delivery obligation within a reasonable period, then the Purchaser shall be entitled to a reduction of the purchase price or rescission of the contract.

7.5 Claims for damages caused by defects shall be excluded. This exclusion shall not apply in case a defect has been fraudulently concealed, in the event that life, body or health is injured and acts of Kitagawa GmbH with intention or gross negligence. In the case a guaranteed characteristic of the goods should be lacking, liability shall be restricted to the loss which is to be expected in accordance with the customary course of events. More extensive claims on account of the faulty nature of the goods shall be excluded. This shall also be applicable to the reparation of consequential losses and to the violation of ancillary contractual obligations.

GENERAL TERMS OF DELIVERY AND PAYMENT

7.6 The afore mentioned exclusion of liability shall also be applicable to claims in tort and in connection with the initiation, conclusion and processing of a contract, not, however, in the case of claims in accordance with the Product Liability Act.

8. Retention of Title

8.1 Kitagawa GmbH shall retain title to all goods until the payment in full of all receivables resulting from the business relations with Kitagawa GmbH. If the value of the collateral which is in existence in favour of Kitagawa GmbH should exceed the claims against the contract partner by more than 10 per cent in total, then Kitagawa GmbH shall be obliged to release collateral at the request of the Purchaser

8.2 The Purchaser shall be entitled to resell the goods subject to retention of title in customary business transactions. The Purchaser shall not, however, be entitled to pledge the goods subject to retention of title or to assign all claims to which it is entitled from a future sale of the goods subject to retention of title against its purchasers to Kitagawa GmbH by way of security.

8.3 In the case of the processing or reconstruction of the goods subject to retention of title by the Purchaser, this shall always be effected for Kitagawa GmbH. If the goods subject to retention of title are processed with other articles which do not belong to Kitagawa GmbH, then Kitagawa shall acquire co-ownership to the new article in proportion to the value of the goods subject to retention of title to the other processed articles at the time of processing. If the Purchaser sells the goods subject to retention of title together with other goods which do not belong to Kitagawa GmbH, or after joining or processing, then the assignment shall only be effected to the amount of the outstanding invoices sum of the respective goods subject to retention of title.

8.4 The Purchaser shall be entitled to collect the assigned receivable in its own name. Kitagawa GmbH shall, however, be entitled to revoke this collection authority at any time, especially in the case of default in payment by the Purchaser. In the case of revocation the Purchaser shall be obliged to provide Kitagawa GmbH with or to surrender to it all necessary information and documentation for the assertion of the assigned receivables and to disclose the assignments to its purchasers. In the case of default in payment by the Purchaser Kitagawa GmbH shall be entitled to notify its purchasers of the assignment.

8.5 The Purchaser shall be obliged to provide Kitagawa GmbH with information at any time on the whereabouts of the goods subject to retention of title and on the receivables arising from their resale. The Purchaser shall be obliged to inform Kitagawa GmbH in writing of a seizure by a third party of the goods subject to retention of title or of the receivables assigned to Kitagawa GmbH and it shall be obliged to draw the third party's attention to the rights of Kitagawa GmbH. The Purchaser shall furthermore be obliged to support Kitagawa GmbH upon the assertion and enforcement of its rights against this third party,

especially at its expense to lodge the necessary immediate remedies/appeals in order to safeguard the rights of Kitagawa GmbH.

8.6 In case of default in payment on the part of the Purchaser Kitagawa GmbH shall be entitled to take back the goods subject to retention of title. The Purchaser shall accordingly be obliged to surrender these goods. The taking back of the goods subject to retention of title does not constitute a withdrawal from the contract, unless Kitagawa GmbH expressly states such a withdrawal in writing.

8.7 The Purchaser shall be obliged to treat the delivered goods subject to retention of title with care. It shall especially be obliged to take out adequate insurance cover for the goods subject to retention of title at its own expense against loss or damage through fire, water, burglary or theft. The Purchaser hereby assigns its corresponding insurance claim to Kitagawa GmbH. Kitagawa GmbH hereby accepts this assignment and states the reassignment to the Purchaser with the proviso that this shall become effective if and as soon as the retention of title has expired.

9. Final Provisions

9.1 The Purchaser shall not be entitled to assign rights and obligations to third parties arising from the contract concluded with Kitagawa GmbH without the prior approval of Kitagawa GmbH.

9.2 The contractual relations between the contracting parties shall be subject to the Law of the Federal Republic of Germany. The provisions of the Convention on Contracts of the International Sale of Goods (CISG, Vienna Convention) shall not apply to the contract concluded with the Purchaser.

9.3 Venue for all disputes and types of proceedings arising from or in connection with the contractual relations between the parties shall be Darmstadt, Federal Republic of Germany, provided the Purchaser is a businessman.

9.4 Kitagawa GmbH shall be entitled to store and to use the personal data to which it has obtained access from the business relations with the Purchaser under the terms of the German Data Protection Act for its own business purposes.

9.5 If a provision of these General Terms of Business or of the contract concluded with the Purchaser should be or become ineffective, then this shall not affect the effectiveness of the remaining provisions of these General Terms of Business or of the concluded contract.

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Notice:

The specifications provided in this catalogue are believed to be accurate and reliable. Kitagawa GmbH reserves the right to make changes to specifications to improve manufacturing process performance and reliability.

This catalogue is intended for representation only and is not to form any part of any order. Engineering specifications are available upon request.

Any information/specification supplied by Kitagawa GmbH is based upon Kitagawa Industries laboratory test data and is believed to be reliable. It is recommended that our products are tested by the customer to ensure suitability for the intended application.

If any Kitagawa product is to be used in a life threatening application (such areas as Medical Automotive and Aerospace etc) the application must be discussed with Kitagawa GmbH and its written approval must be obtained.

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