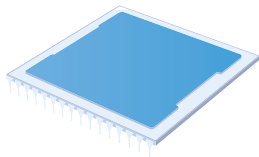


Denka



Thermal Interface Materials

MATERIALS STOCKED, CONVERTED AND DISTRIBUTED BY



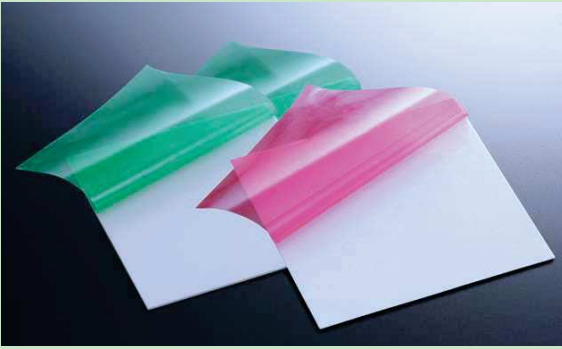


DENKA

materials

for Thermal Solution

DENKA THERMALLY CONDUCTIVE SPACER



DENKA THERMALLY CONDUCTIVE SPACER is a "pad type" material. It has superior softness and is suitable for filling various gap sizes. It is recommended for portable base stations, digital gadgets, automotive and other applications.

p.04

THERMALLY
CONDUCTIVE
SPACER

DENKA THERMALLY CONDUCTIVE GREASE

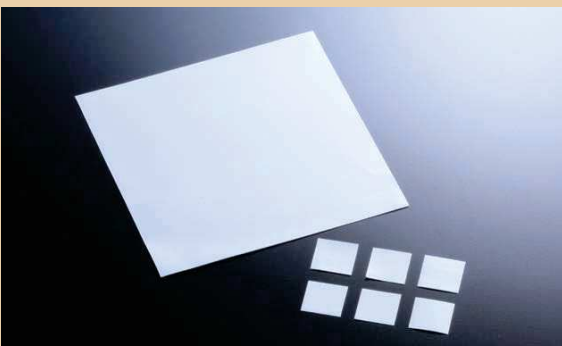


DENKA THERMALLY CONDUCTIVE GREASE can be applied flexibly. Customers can decrease thermal resistance by spreading our grease in a thin layer. Thermal Grease is highly prized in areas such as server systems and in automotive application.

p.12

THERMALLY
CONDUCTIVE
GREASE

DENKA THERMALLY CONDUCTIVE SHEET



DENKA THERMALLY CONDUCTIVE SHEET maintains its insulating properties throughout comprehensive testing, while also featuring ease in handling. It's suitable for automotive parts or electronic power supplies.

p.16

THERMALLY
CONDUCTIVE
SHEET

Item	unit	FSL-HR	FSL-HM (Under Development)	FSL-HS (Under Development)	FSL-H	FSL-BH	Test method
color	—	Gray	Gray	Gray	Gray	Light Blue	—
Thickness	mm	1.0 1.5 2.0 2.5 3.0	0.5	1.0 1.5 2.0 2.5 3.0	0.5 1.0 1.5 2.0	0.3 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	Thickness gauge
Tolerance	%	± 10	± 16	± 10	± 10	± 10	—
Thermal conductivity	W/mK	8	7	5	5	4	ASTM D5470
Hardness	—	40	45	8	35	30	Asker C
Compressibility	%	15	10	30	9	10	0.1MPa
Specific gravity	—	3.3	3.3	3.1	3.1	2.8	25°C
Low molecule siloxane	ppm	250	400	500	300	600	Σ D5-10
Dielectric breakdown Voltage	kV/mm	10	10	During measurement	10	10	JIS C2110
Flame retardancy	—	V-1	V-1 Equivalence	More than 1.5mm : V-0Equivalence Less than 1.5mm : V-1Equivalence	V-0	V-0	UL-94 File No. E49895
Relative permittivity	—	8.3	8.2	During measurement	7.9	6.9	JIS K6249@1MHz
Breaking strength	MPa	0.2	0.25	During measurement	0.27	0.18	JIS K6251
Elongation	%	40	30	During measurement	82	100	JIS K6251
Young's Modulus	MPa	0.2	0.4	During measurement	0.1	0.07	JIS K6251
Volume resistance	Ω · cm	1 × 10 ¹²	1 × 10 ¹²	During measurement	1 × 10 ¹³	1 × 10 ¹³	JIS K6911
Surface tack	—	Both side	Both side	Both side	One or both side	One or both side	—

Item	unit	FSL-B	FSL-D	FSL-BS	FSL-F3	Test method
color	—	Light Blue	Light Blue	Light Blue	Light Gray	—
Thickness	mm	0.3 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	0.3 0.5 1.0 1.5 2.0 2.5 3.0 4.0	0.5 0.75 1.0 1.5 2.0 2.5 3.0 3.5 4.0	0.3 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	Thickness gauge
Tolerance	%	± 10	± 10	± 10	± 10	—
Thermal conductivity	W/mK	4	3	3	2	ASTM D5470
Hardness	—	25	30	8	15	Asker C
Compressibility	%	15	15	30	25	0.1MPa
Specific gravity	—	2.8	2.7	2.8	1.7	25°C
Low molecule siloxane	ppm	450	50	450	650	Σ D5-10
Dielectric breakdown Voltage	kV/mm	10	10	10	10	JIS C2110
Flame retardancy	—	V-0	V-0	V-0	More than 1.5mm : V-0 Less than 1.5mm : V-1	UL-94 File No. E49895
Relative permittivity	—	7.1	6.6	7.2	4.5	JIS K6249@1MHz
Breaking strength	MPa	0.15	0.23	0.05	0.25	JIS K6251
Elongation	%	149	111	324	218	JIS K6251
Young's Modulus	MPa	0.042	0.087	0.011	0.064	JIS K6251
Volume resistance	Ω · cm	1 × 10 ¹³	1 × 10 ¹³	1 × 10 ¹³	1 × 10 ¹³	JIS K6911
Surface tack	—	One or both side	One or both side	One or both side	One or both side	—

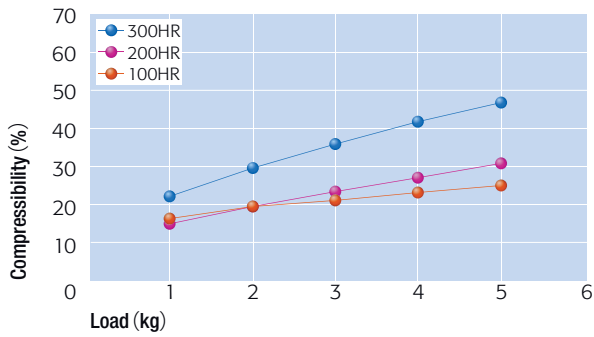


FSL-HR has highest thermal conductivity in our lineup, at 8W/mK.

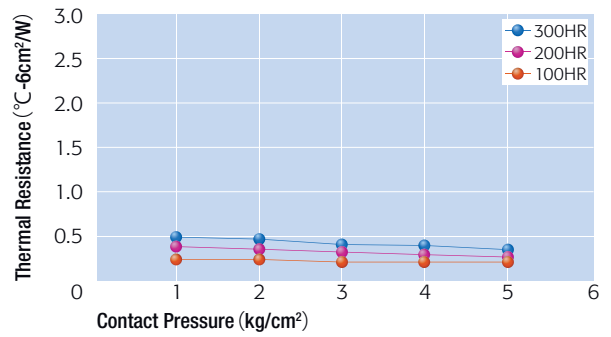
Product Characteristic

Product Data

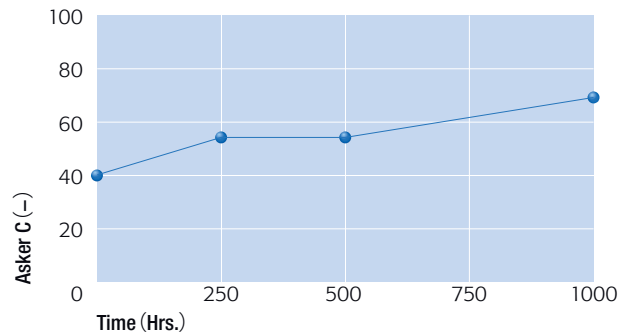
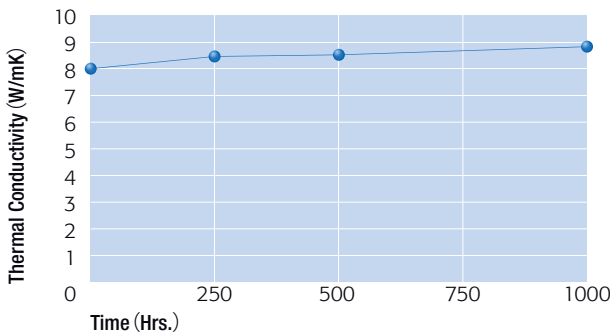
Load vs Compressibility



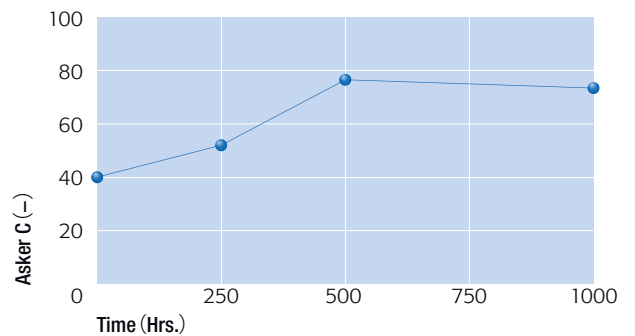
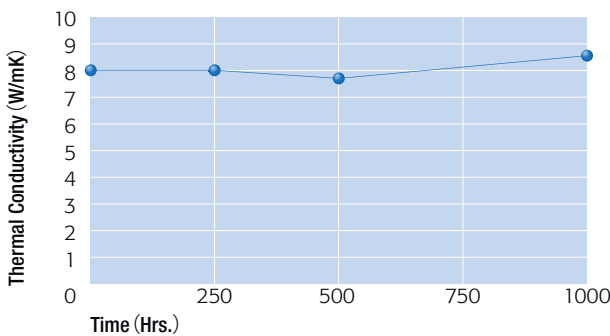
Contact Pressure vs Thermal Resistance



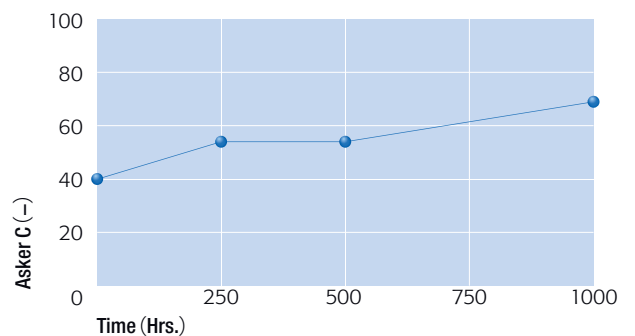
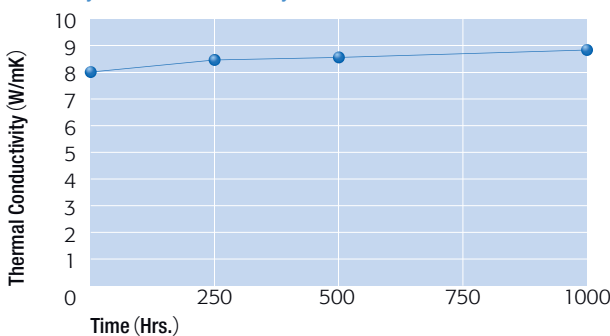
Heat-resistant reliability (100°C) *FSL100HR



Heat-resistant reliability (125°C) *FSL100HR



Humidity-resistant reliability (85°C/85%) *FSL100HR



DENKA THERMALLY CONDUCTIVE SPACER FSL-H

Thermal conductivity

5 W/mK

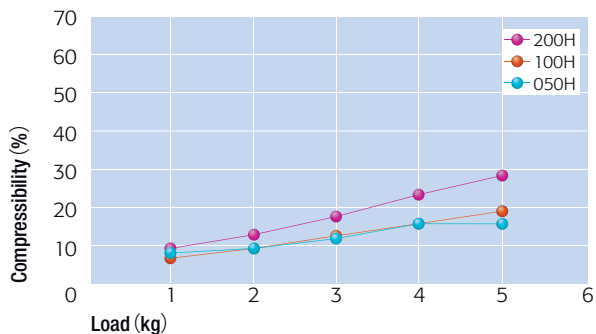
THERMALLY CONDUCTIVE SPACER FSL-H

Product Characteristic

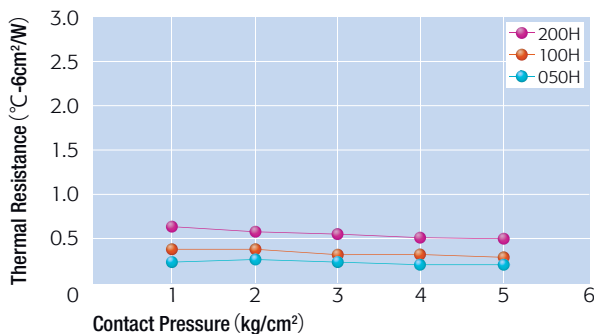
FSL-H features high thermal conductivity at 5W/mk, and also reverts to its original state after unloading.

Product Data

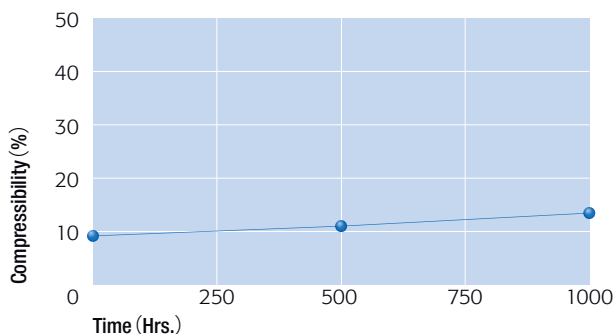
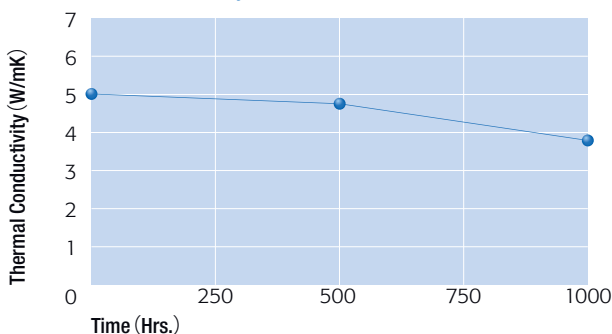
Load vs Compressibility



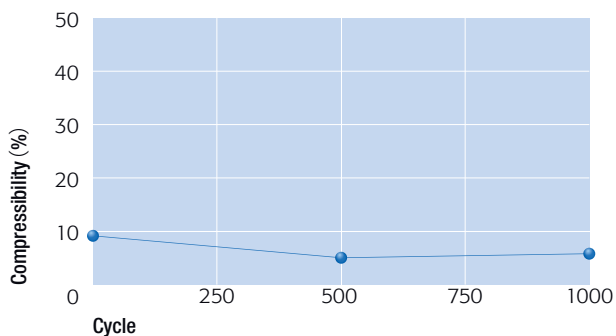
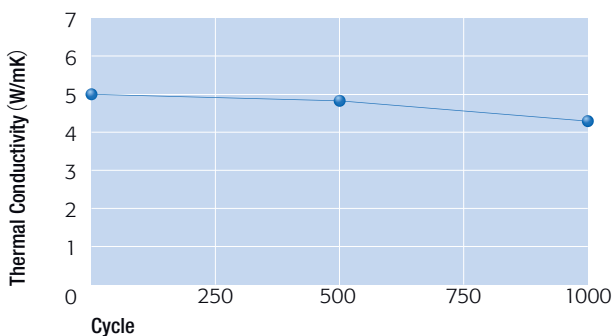
Contact Pressure vs Thermal Resistance



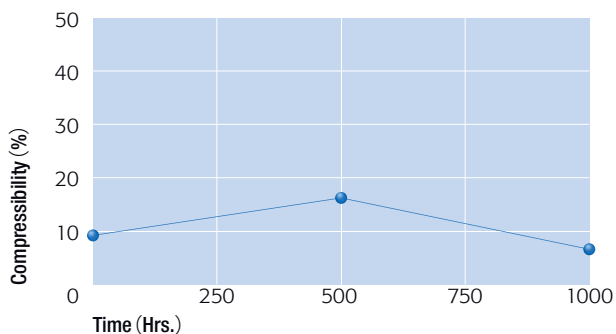
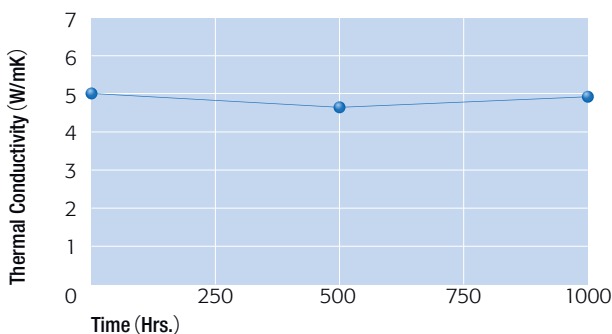
Heat-resistant reliability (150°C) *FSL100H

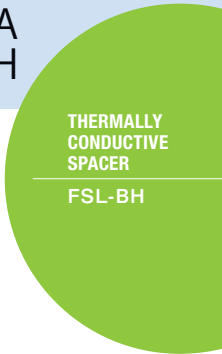


Heat-cycle resistant reliability (-40°C↔+125°C) *FSL100H



Humidity-resistant reliability (85°C/85%) *FSL100H





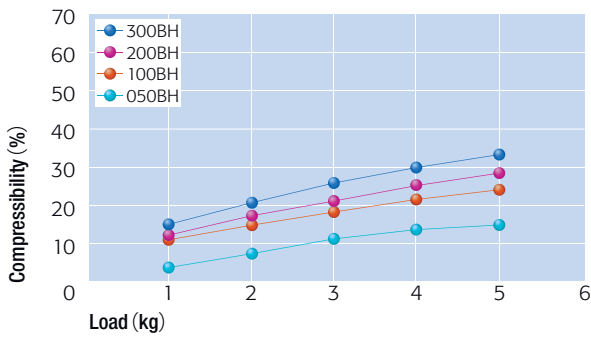
FSL-BH is harder than standard FSL-B grade, making it suitable for producing thicker pads.

Product Characteristic

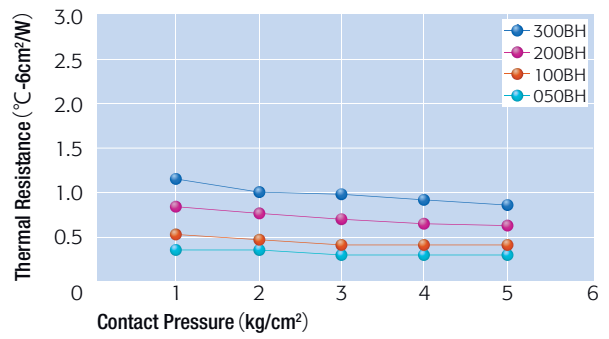
THERMALLY CONDUCTIVE SPACER
FSL-BH

Product Data

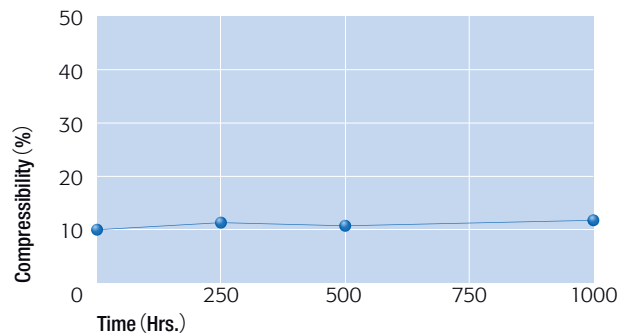
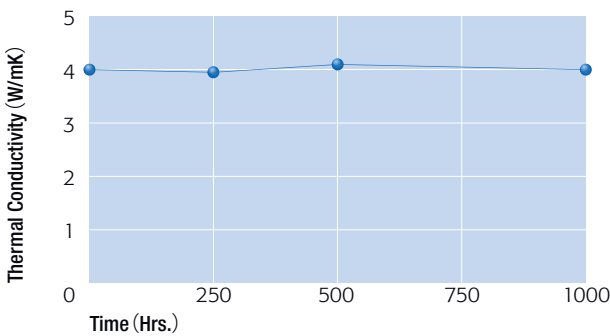
Load vs Compressibility



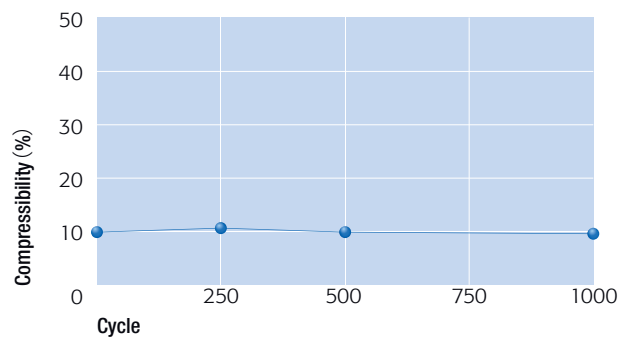
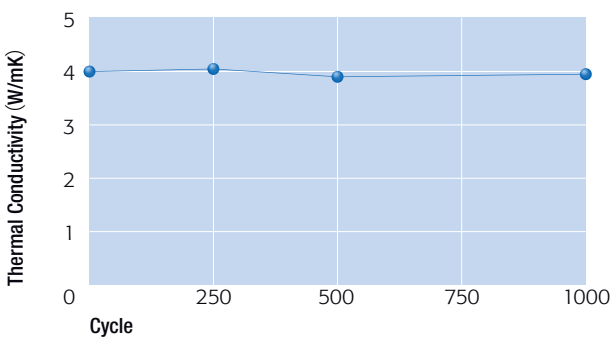
Contact Pressure vs Thermal Resistance



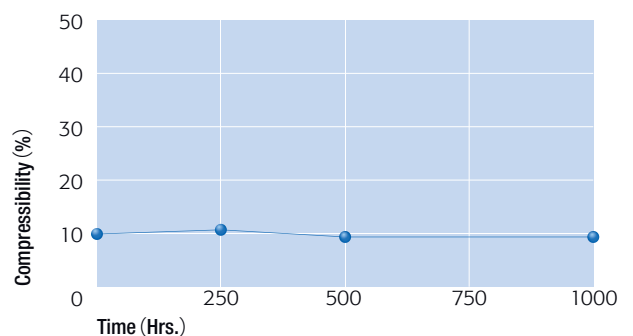
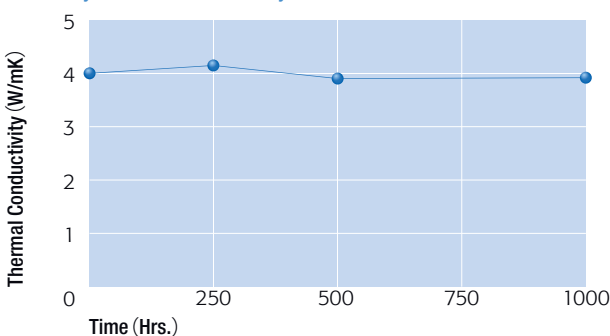
Heat-resistant reliability (150°C) *FSL100BH



Heat-cycle resistant reliability (-40°C⇄+125°C) *FSL100BH



Humidity-resistant reliability (85°C/85%) *FSL100BH



DENKA THERMALLY CONDUCTIVE SPACER FSL-B

Thermal conductivity

4 W/mK

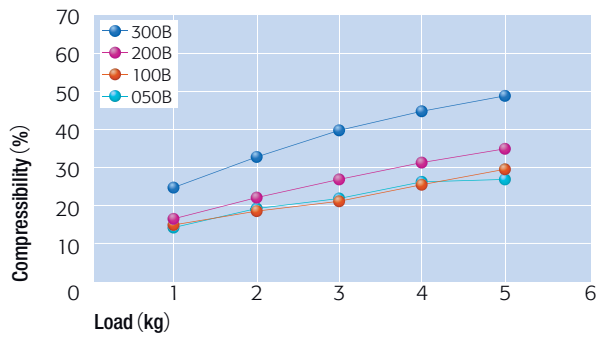
THERMALLY CONDUCTIVE SPACER FSL-B

Product Characteristic

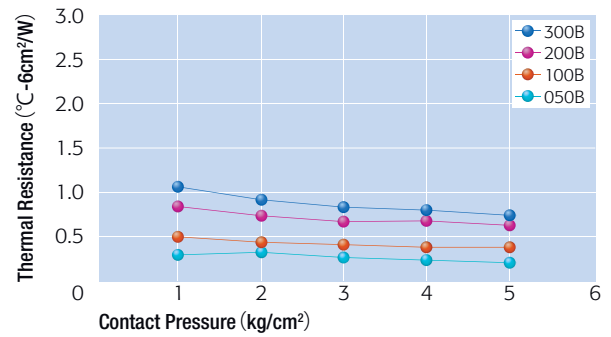
FSL-B is Denka's economy grade, featuring excellent balance between thermal conductivity and computability.

Product Data

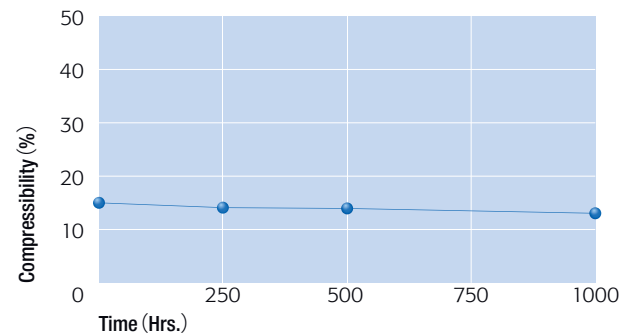
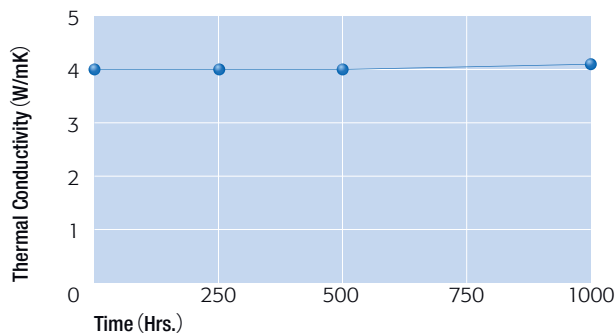
Load vs Compressibility



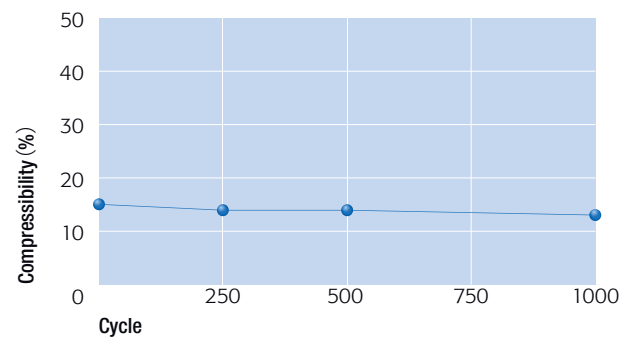
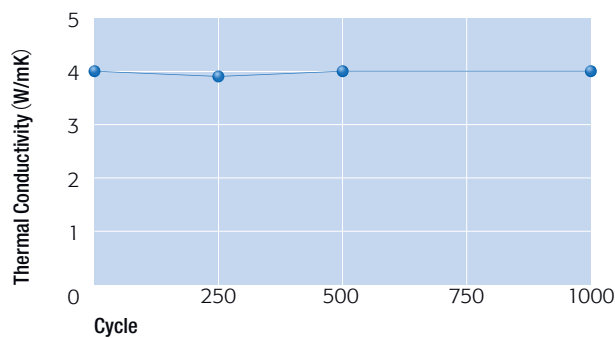
Contact Pressure vs Thermal Resistance



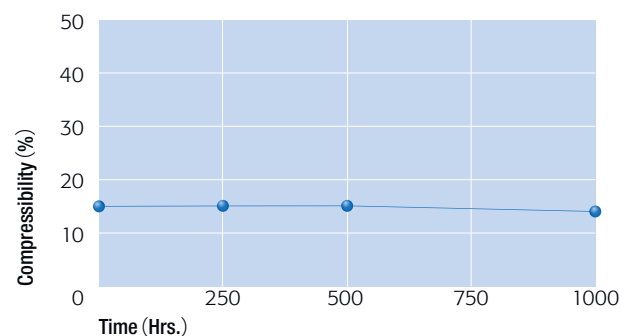
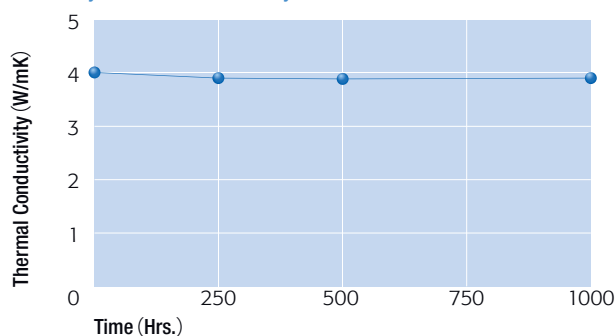
Heat-resistant reliability (150°C) *FSL100B



Heat-cycle resistant reliability (-40°C⇄+125°C) *FSL100B



Humidity-resistant reliability (85°C/85%) *FSL100B



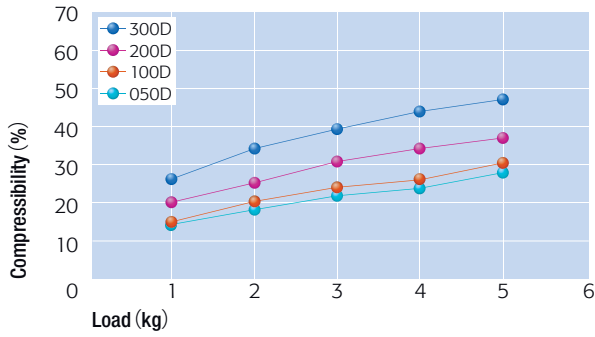


FSL-D contains less Low molecule siloxane and has high reliability.

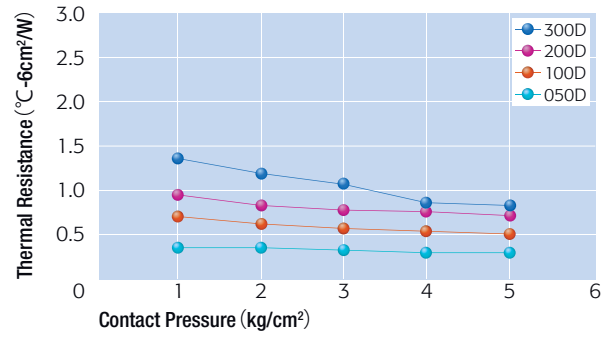
Product Characteristic

Product Data

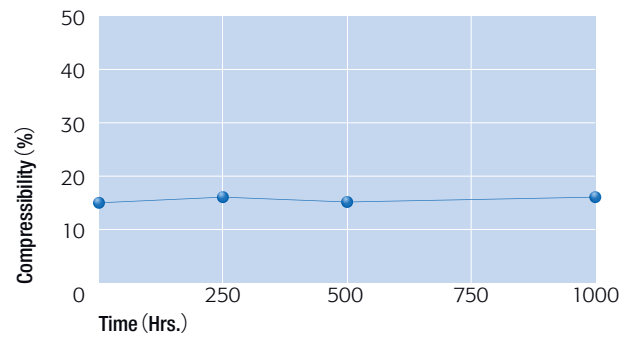
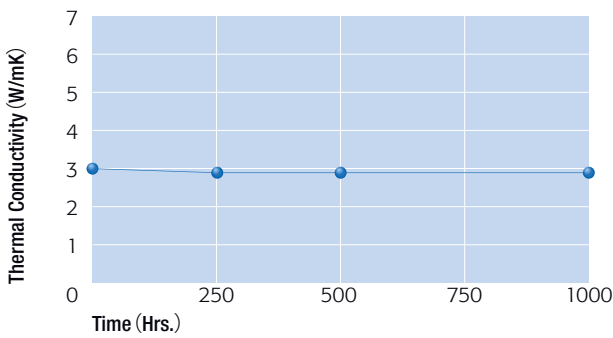
Load vs Compressibility



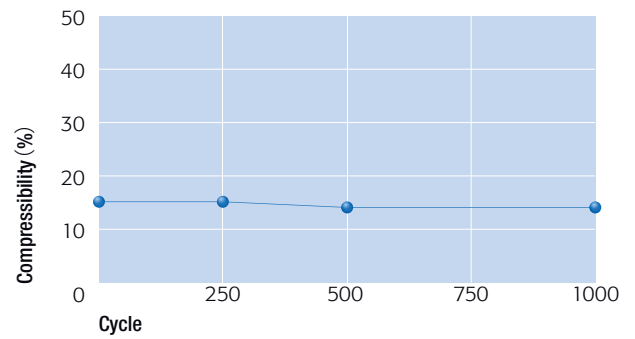
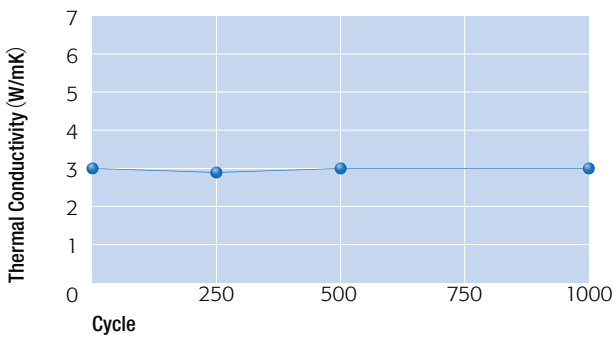
Contact Pressure vs Thermal Resistance



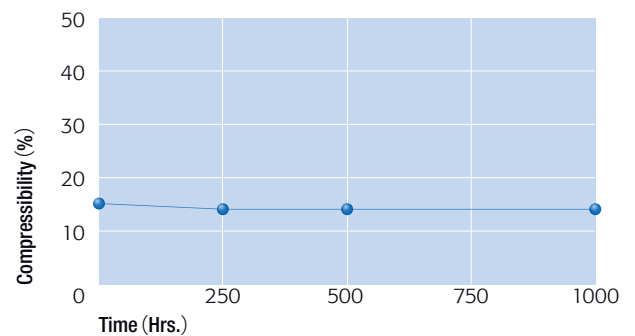
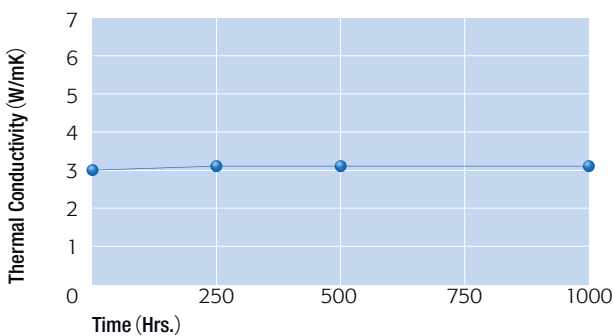
Heat-resistant reliability (150°C) *FSL100D



Heat-cycle resistant reliability (-40°C⇄+125°C) *FSL100D



Humidity-resistant reliability (85°C/85%) *FSL100D

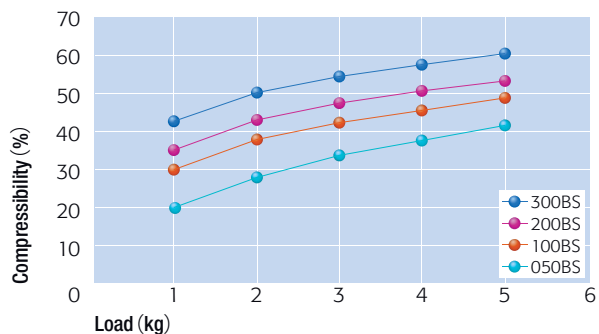


Product Characteristic

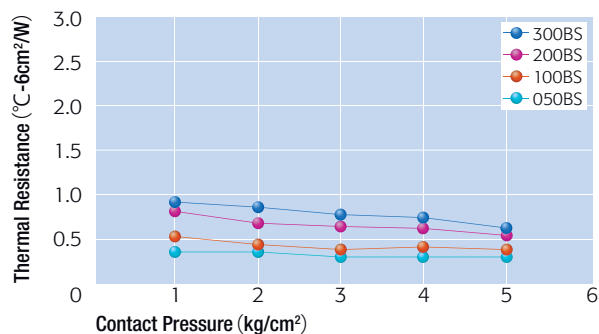
FSL-BS is the softest grade in our thermally conductive spacer lineup, with compressibility of 30%. It is recommended in applications which require both high thermal conductivity and compressibility, such as in portable base stations, and automotive.

Product Data

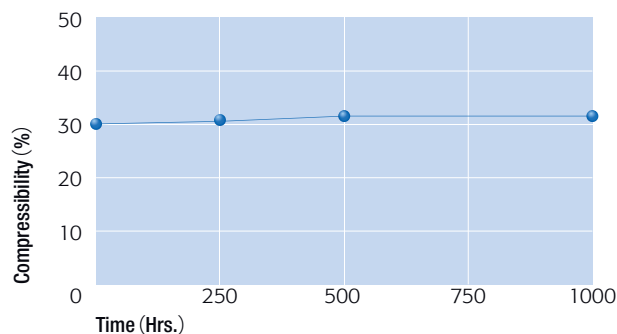
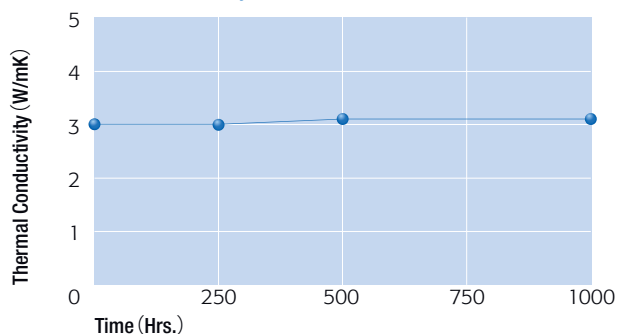
Load vs Compressibility



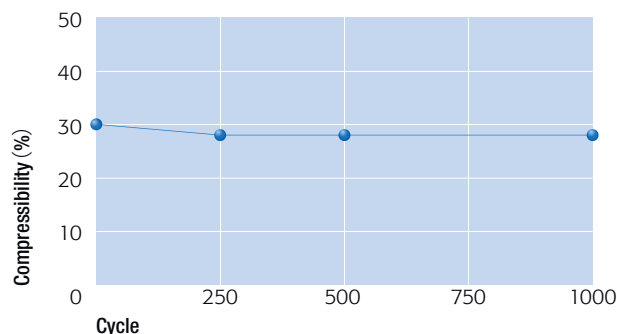
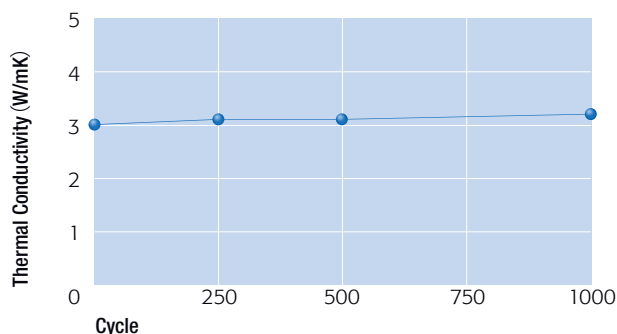
Contact Pressure vs Thermal Resistance



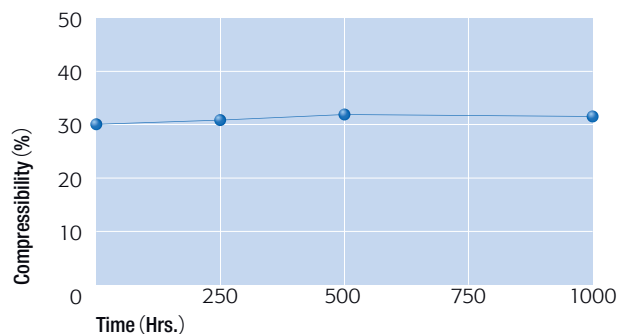
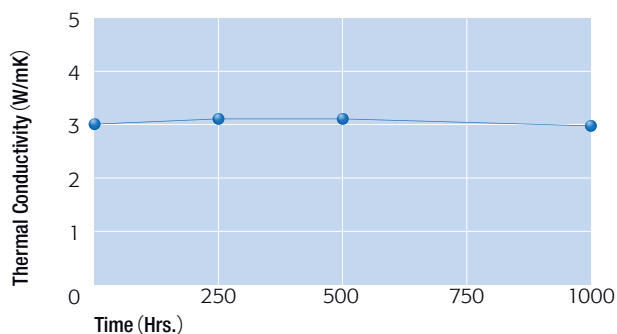
Heat-resistant reliability (150°C) *FSL100BS



Heat-cycle resistant reliability (-40°C↔+125°C) *FSL100BS



Humidity-resistant reliability (85°C/85%) *FSL100BS



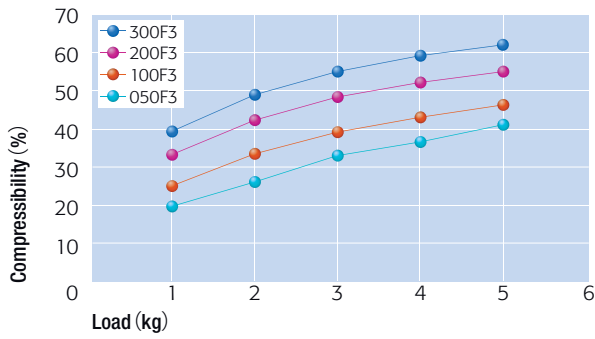


Thermal conductivity of FSL-F3 is 2W/mK. It is utilized in gadgets such as automotive, and tablet PC's.

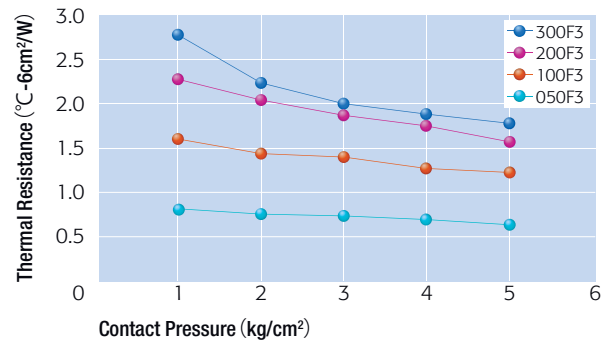
Product Characteristic

Product Data

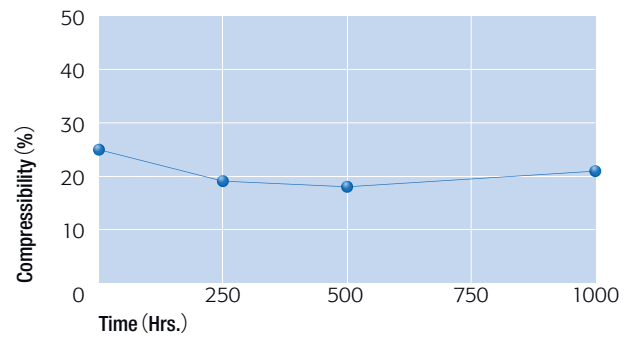
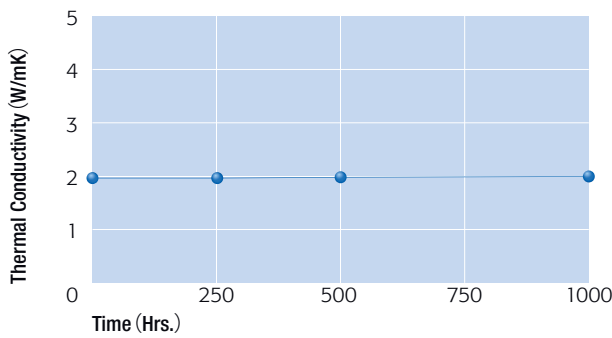
Load vs Compressibility



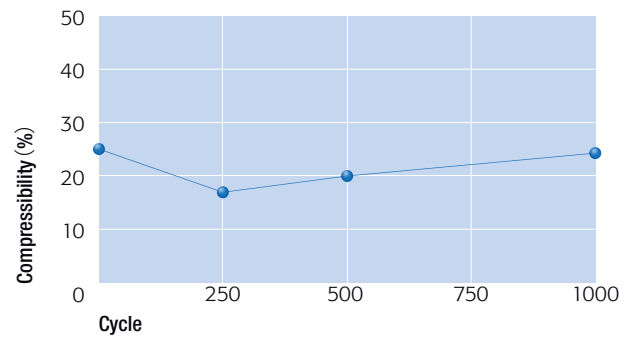
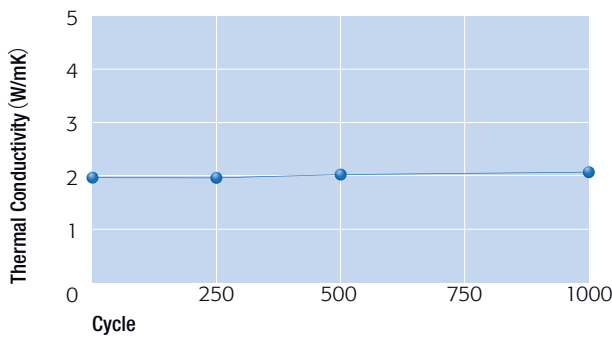
Contact Pressure vs Thermal Resistance



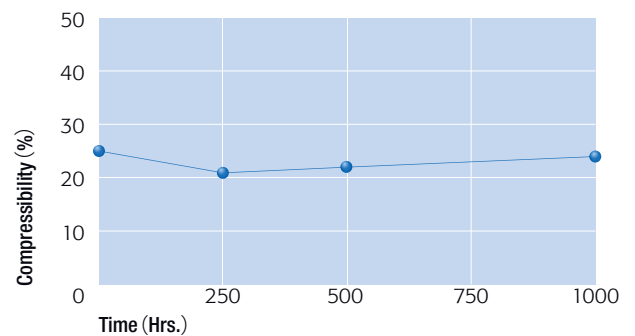
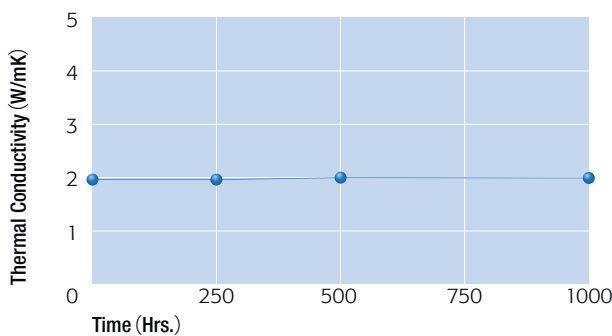
Heat-resistant reliability (150°C) *FSL100F3



Heat-cycle resistant reliability (-40°C⇄+125°C) *FSL100F3



Humidity-resistant reliability (85°C/85%) *FSL100F3



Item	unit	GFC-V2 (Under Development※2)	TSG-W55 (Under Development)	FCR-H	TSG-A3 (Under Development)	GFC-PF3	Test method
Color	—	Gray	White	Gray	Gray	White	Visual
Thermal resistance(BLT)	°C · cm ² /W	0.12	During measurement	0.30	During measurement	0.29	ASTM D5470
Thermal resistance(0.1mm)	°C · cm ² /W	0.21	During measurement	0.50	During measurement	0.53	ASTM D5470
Thermal conductivity ※1	W/mK	6.2	5.5	3.3	3	3	ASTM D5470
Bond Line thickness	μm	72	75	72	75	52	—
Viscosity	Pa · s	280	450	500	350	22	Share rate 10 (s ⁻¹) @25°C
Specific gravity	—	2.7	3.5	3.1	3.1	3.1	Calculation
Dielectric breakdown voltage	kV/mm	—	> 10	7	> 10	> 10	JIS C2110
Volume resistance	Ω · cm	—	During measurement	1.1 × 10 ¹⁴	During measurement	1 × 10 ¹⁴	JIS K6911
Low molecule siloxane	ppm	< 100	< 100	< 200	< 100	< 100	Σ D5-10
Weight loss	wt%	During measurement	< 0.1	0.03	During measurement	0.05	150°C-24Hrs.
Oil separating property	%	0	During measurement	0	During measurement	0	JIS K2220 130°C, 100Hrs.
Useful temperature range	°C	-40~125	-40~150	-40~130	-40~150	-40~150	—

Item	unit	GFC-S (Under Development)	GFC-Z1 (※2)	GFC-N8	GFC-L1 (Under Development)	Test method
Color	—	Gray	Gray	Gray	White	Visual
Thermal resistance(BLT)	°C · cm ² /W	During measurement	0.07	0.07	0.11	ASTM D5470
Thermal resistance(0.1mm)	°C · cm ² /W	During measurement	0.65	0.8	1.7	ASTM D5470
Thermal conductivity ※1	W/mK	2	2.0	1.5	0.6	ASTM D5470
Bond Line thickness	μm	75	7	7	3	—
Viscosity	Pa · s	900	240	450	60	Share rate 10 (s ⁻¹) @25°C
Specific gravity	—	2.5	2.6	2.9	2.5	Calculation
Dielectric breakdown voltage	kV/mm	> 10	—	7	8	JIS C2110
Volume resistance	Ω · cm	1 × 10 ¹⁴	—	1 × 10 ¹³	1 × 10 ⁸	JIS K6911
Low molecule siloxane	ppm	< 100	< 100	< 200	< 100	Σ D5-10
Weight loss	wt%	0.05	0.3	0.05	0.4	150°C-24Hrs.
Oil separating property	%	0	0.1	0	0	JIS K2220 130°C, 100Hrs.
Useful temperature range	°C	-40~150	-40~100	-40~125	-40~125	—

※ 1. Thermal conductivity isn't including contact resistance.

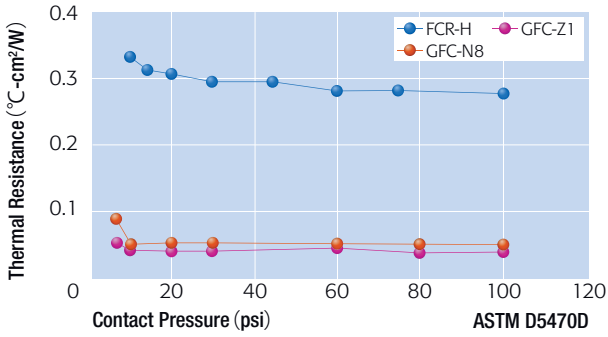
※ 2. GFC-Z1 and GFC-V2 are one part greases that used conductive fillers.

DENKA THERMALLY CONDUCTIVE GREASE is a liquid-type TIM, and features high heat radiation properties together with high reliability. GFC-N8 is our premium grade with high resistance properties for pump-out and bleed-out.

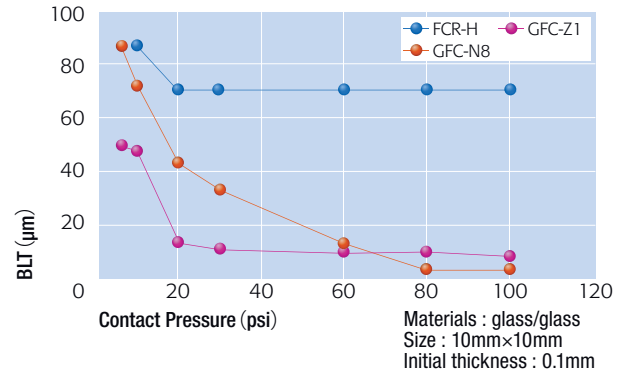
Product Characteristic

Product Data

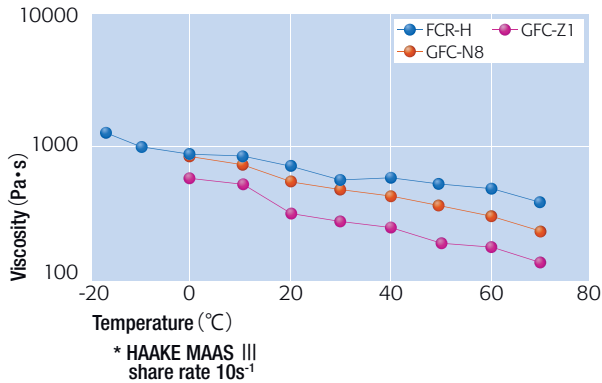
Contact pressure vs Thermal Resistance



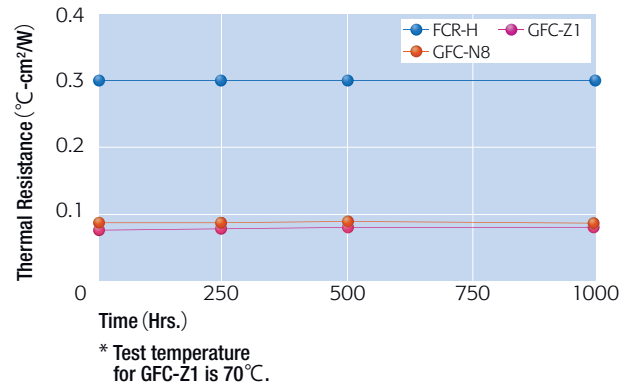
Contact pressure vs BLT



Temperature vs Viscosity



Resistance heat test (@130°C)



DENKA HIGH RELIABILITY ONE PART GREASE TSG-A3 / TSG-W55

THERMALLY
CONDUCTIVE
GREASE













TSG-A3
TSG-W55

Product Characteristic

TSG-A3, TSG-W55 is no need to cure, and it is difficult to cause falls, cracks, and oil bleed. High reliability and high thermal solution one part grease. Applicable to areas requiring long-term reliability.

Recommended for fields that require long-term reliability, such as in-vehicle and 5G base stations.

Crack & Slip test

Products	Test method	Dispensing thickness	500cycle	1,000cycle	3,000Cycle
TSG-A3	-40°C (30min) ⇔ 150°C (30min) Vertical placement Aluminum × Glass	2.0mm (Slip test)			
	-40°C (30min) ⇔ 150°C (30min) Horizontal placement Aluminum × Glass	0.2mm (Crack test)			
TSG-W55	-40°C (30min) ⇔ 150°C (30min) Vertical placement Aluminum × Glass	2.0mm (Slip test)			
	-40°C (30min) ⇔ 150°C (30min) Horizontal placement Glass × Glass	0.2 mm (Crack test)			

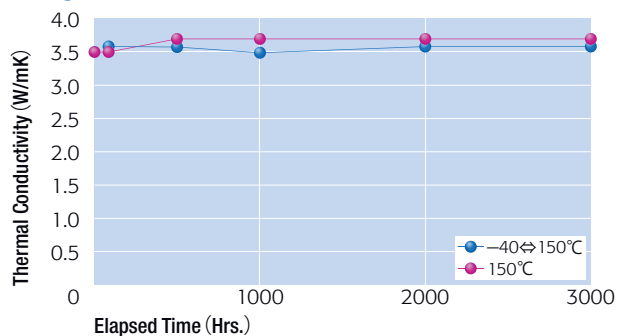
Oil bleed test

	TSG-A3	TSG-W55
Oil bleed test results		
Amount of bleed (mm)	3.0	0.5

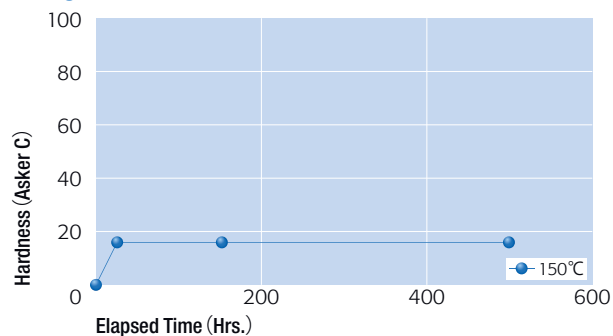
0.24cc of grease applied on ground glass, and evaluated the amount of oil bleed after 24hr under a 150°C atmosphere.

Product Data

Changes in thermal characteristics over time (TSG-A3)



Changes in hardness over time (TSG-W55)



TWO PART THERMALLY CONDUCTIVE GREASE

DENKA

It is a product that has the good points of grease and pad. Although it is liquid when applied, there is no concern about pump out because it hardens and becomes a pad-like shape.

Product Characteristic

THERMALLY
CONDUCTIVE
GREASE

GFC-R1
GFC-R8
GFC-R15
GFC-NH1

Item	unit	GFC-R1		GFC-R8 (Under Development)		GFC-R15 (Under Development)		GFC-NH1 (Under Development)		Test method
		A Black	B White	A Black	B White	A Black	B White	A Black	B White	
Color	—									Visual
Thermal conductivity	W/mK	3.0		3.6		4.0		2.0		ASTM D5470
BLT	μm	72		72		30		72		—
Viscosity	Pa · s	A 100	B 100	A 110	B 130	A 140	B 140	A 50	B 50	Share rate 10 (s ⁻¹) @25°C
Specific gravity	—	3.0		3.2		2.9		2.8		—
Mix ratio	—	1:1								—
Pot life@25°C	h	2.5		0.6		2-2.5		1.0		Rheometer
Cure time@25°C	h	≤24		≤24		≤24		≤24		Rheometer
Hardness	—	30		50		42		11		Asker C
Volume resistance	Ω · cm	1.0×10 ¹³		1.0×10 ¹³		1.0×10 ¹³		During measurement		JIS K6911
Dielectric breakdown voltage	KV/mm	>10		>10		5.0		During measurement		JIS C2110
Low molecule siloxane	ppm	< 100		< 100		< 100		< 1000		Σ D3-10
Weight loss	wt%	0		0		0		During measurement		150°C — 24Hrs.
Useful temperature range	°C	-40~150		-40~150		-40~150		-40~150		—

※ Thermal conductivity isn't including contact resistance.

THERMALLY CONDUCTIVE SHEET grade lineup

Item	unit	BFG20	BFG30	BFG45	BFG80	Test method
color	—	Light Green	White	White	White	—
Thickness	mm	0.20±0.05	0.30±0.05	0.45±0.05	0.80+0.20/-0.05	—
Reinforced layer	—	Reinforced with glass fiber				—
Thermal resistance TO-3	°C/W	0.18	0.20	0.25	0.36	Denka method
Thermal resistance TO-3P	°C/W	0.37	0.42	0.51	0.77	Denka method
Thermal conductivity TO-3	W/mK	4.1				Denka method
Withstand voltage	AC kV	1.0	3.0	4.0	5.0	JEM 1021
Dielectric breakdown voltage	AC kV	3.0	6.5	9.0	>10	JIS C2110
Volume resistivity	Ω · cm	1.9×10 ¹⁵	2.4×10 ¹⁵	3.3×10 ¹⁵	4.1×10 ¹⁵	JIS K6271
Dielectric constant	—	3.6				1MHz
Flammability	UL94	V-0				FileNo.E49895
Specific gravity	g/cm ³	1.7				—
Tensile strength	MPA kgf/cm ²	25 260	20 200	14 140	9 90	JIS K6251
Tear strength	kN/m kgf/cm	117 120	88 90	59 60	39 40	JIS K6252
Hardness	Durometer A	88				JIS K6253
Foldability	φ mm	1.2	1.2	3.1	>5	—

Item	unit	BFG20A	BFG30A	BFG45A	BFG80A	Test method
color	—	White				—
Thickness	mm	0.20±0.05	0.30±0.05	0.45±0.05	0.80+0.20/-0.05	—
Reinforced layer	—	Reinforced with glass fiber				—
Thermal resistance TO-3	°C/W	0.12	0.15	0.19	0.30	Denka method
Thermal resistance TO-3P	°C/W	0.28	0.29	0.32	0.66	Denka method
Thermal conductivity TO-3	W/mK	5.0				Denka method
Withstand voltage	AC kV	1.0	3.0	4.0	5.0	JEM 1021
Dielectric breakdown voltage	AC kV	3.0	6.0	9.0	>10	JIS C2110
Volume resistivity	Ω · cm	1.7×10 ¹⁵	7.9×10 ¹⁵	9.2×10 ¹⁵	8.9×10 ¹⁵	JIS K6271
Dielectric constant	—	3.3				1MHz
Flammability	UL94	V-0				FileNo.E49895
Specific gravity	g/cm ³	1.7				—
Tensile strength	MPA kgf/cm ²	9 96	8 84	5 69	4 41	JIS K6251
Tear strength	kN/m kgf/cm	41 42	37 38	36 29	28 19	JIS K6252
Hardness	Durometer A	90	90	89	88	JIS K6253
Foldability	φ mm	1.0	1.2	1.2	3.1	—

※The values of thermal conductivity are the estimates including contact resistance at 1mm thick.

※Thermal resistance TO-3

Clipped thermally conductive sheet between a model heater (TO-3 shape) and heatsink (Cu plate).

After tightened a torque and applied voltage as prescribed, thermal resistance is calculated from temperature difference between a model heater and a heatsink.

※Thermal resistance TO-3P

Clipped thermally conductive sheet between a transistor package (TO-3P, TO-3PL, TO-220 shape) and heatsink (Radiator fin).

After tightened a torque and applied electric pressure as prescribed, thermal resistance is calculated from temperature difference between a model heater and a heatsink.

Thermal
conductivity

1.4-5.0
W/mK

THERMALLY
CONDUCTIVE
SHEET

Item	unit	BS20	BS30	BS45	BS80	Test method
color	—	Light Green	Green	Green	Green	—
Thickness	mm	0.20±0.05	0.30±0.05	0.45±0.05	0.80+0.20/−0.05	—
Reinforced layer	—	Reinforced with glass fiber				—
Thermal resistance TO-3	°C/W	0.19	0.21	0.26	0.37	Denka method
Thermal resistance TO-3P	°C/W	0.40	0.45	0.54	0.79	Denka method
Thermal conductivity TO-3	W/mK	3.9				Denka method
Withstand voltage	AC kV	1.0	3.0	4.0	5.0	JEM 1021
Dielectric breakdown voltage	AC kV	3.0	5.1	7.8	>10	JIS C2110
Volume resistivity	Ω · cm	1.8×10 ¹⁵	2.6×10 ¹⁵	2.5×10 ¹⁵	1.8×10 ¹⁵	JIS K6271
Dielectric constant	—	3.5				1MHz
Flammability	UL94	V-0				FileNo.E49895
Specific gravity	g/cm ³	1.7	1.6	1.6	1.6	—
Tensile strength	MPA kgf/cm ²	25 260	18 180	13 130	9 90	JIS K6251
Tear strength	kN/m kgf/cm	117 120	88 90	59 60	39 40	JIS K6252
Hardness	Durometer A	88	89	89	88	JIS K6253
Foldability	φ mm	Completely foldable	Completely foldable	Completely foldable	0.1	—

Item	unit	M20	M30	M45	M80	Test method
color	—	Yellow				—
Thickness	mm	0.20±0.05	0.30+0.10/−0	0.45±0.05	0.80+0.20/−0.05	—
Reinforced layer	—	Reinforced with glass fiber				—
Thermal resistance TO-3	°C/W	0.43	0.64	0.8	1.07	Denka method
Thermal resistance TO-3P	°C/W	0.86	1.27	1.59	2.10	Denka method
Thermal conductivity TO-3	W/mK	1.4				Denka method
Withstand voltage	AC kV	1.0	3.0	4.0	5.0	JEM 1021
Dielectric breakdown voltage	AC kV	2.4	5.5	8.5	>10	JIS C2110
Volume resistivity	Ω · cm	1.7×10 ¹⁵	1.7×10 ¹⁵	2.8×10 ¹⁵	2.6×10 ¹⁵	JIS K6271
Dielectric constant	—	4.0				1MHz
Flammability	UL94	V-0				FileNo.E49895
Specific gravity	g/cm ³	1.9	1.9	2.0	2.0	—
Tensile strength	MPA kgf/cm ²	28 290	24 240	26 270	20 200	JIS K6251
Tear strength	kN/m kgf/cm	127 130	98 100	107 110	68 70	JIS K6252
Hardness	Durometer A	91	91	90	90	JIS K6253
Foldability	φ mm	0.8	1.2	2.5	1.5	—

BFG
Series

BFG-C

Product Characteristic

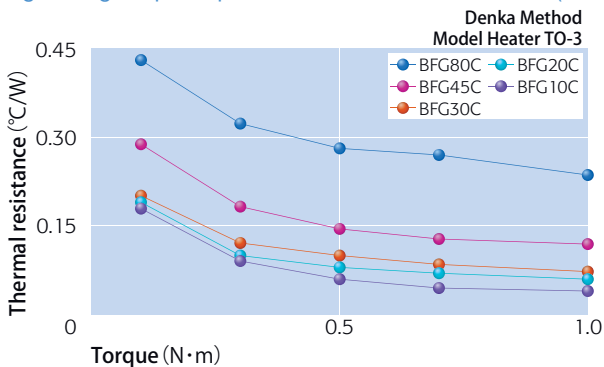
BFG-C has excellent thermal conductivity(8W/m·K) and electrical insulation properties, so that it can be said to be ideal for heat dissipation material (TIM) used with semiconductors such as transistors, DCDC converters, OBC. It also has excellent dielectric properties and is suitable for high-frequency communication applications such as 5G and ADAS.

Item	unit	BFG-C (Under Development)				Test method
		BFG20C	BFG30C	BFG45C	BFG80C	
color	—	Light Blue				—
Thickness	mm	0.20±0.05	0.30±0.05	0.45±0.05	0.80+0.2/-0.1	—
Reinforced layer	—	Reinforced with glass fiber				—
Thermal resistance	°C/W	0.50	0.64	0.84	1.60	ASTM D5470
Thermal resistance TO-3	°C/W	0.08	0.11	0.14	0.23	Denka method
Thermal conductivity	W/mK	8				Denka method
Withstand voltage	AC kV	1.0	3.0	4.0	5.0	JEM 1021
Dielectric breakdown voltage	AC kV	4.2	8.6	>10	>10	JIS C2110
Specific gravity	g/cm ³	1.6				—
Dielectric constant	—	3.0				1MHz
Tensile strength	MPa	9.1	6.6	4.6	4.2	JIS K6251
Tear strength	kN/m	45	37	29	18	JIS K6252
Hardness	Durometer A	85				JIS K6253
Flammability	UL94	V-0 Equivalence				—

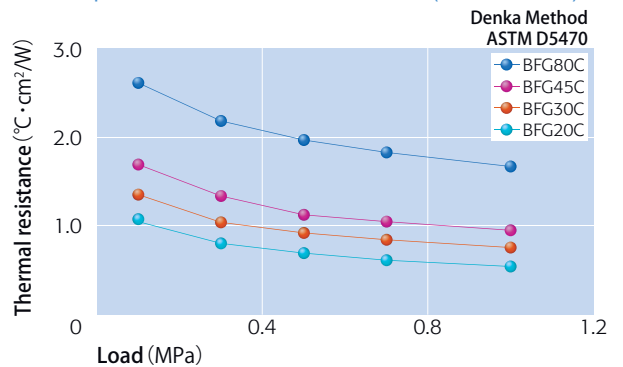
※ The values of thermal conductivity are the estimates including contact resistance at 1mm thick.

Product Data

Tightening torque dependence on thermal resistance (TO-3)



Load dependence on thermal resistance (ASTM D5470)

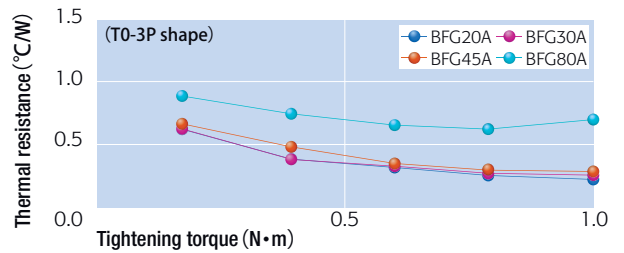
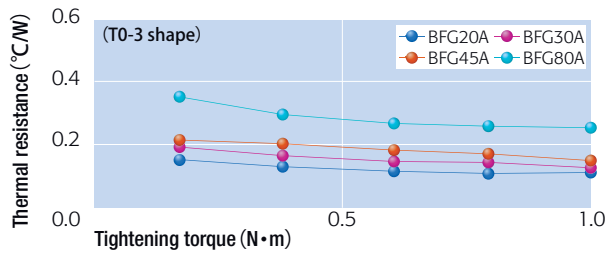


BFG-A is insulating heat conductive sheet with high thermal conductivity (5W/mK).

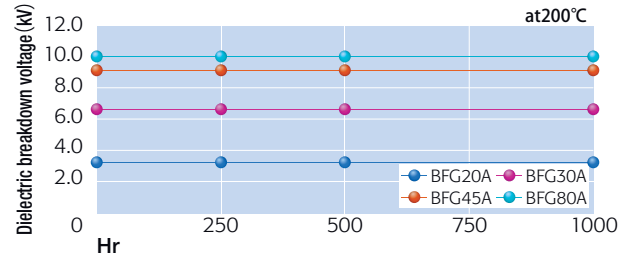
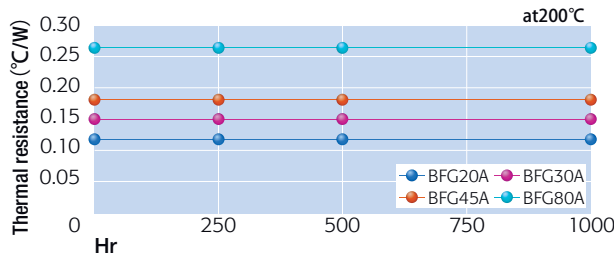
Product Characteristic

Product Data

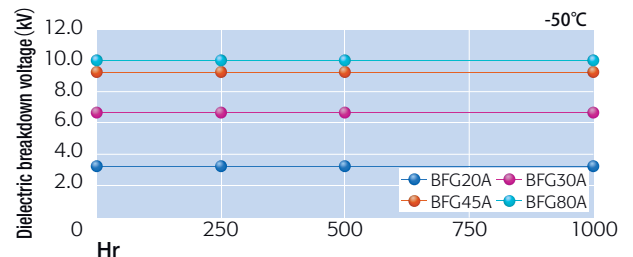
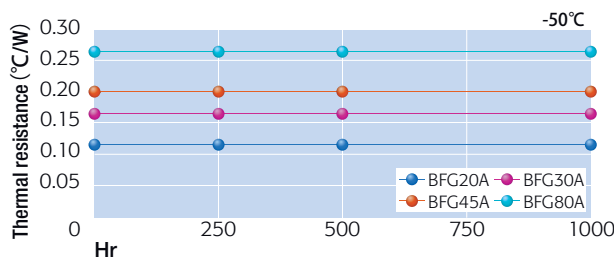
Relation between tightening torque and thermal resistance



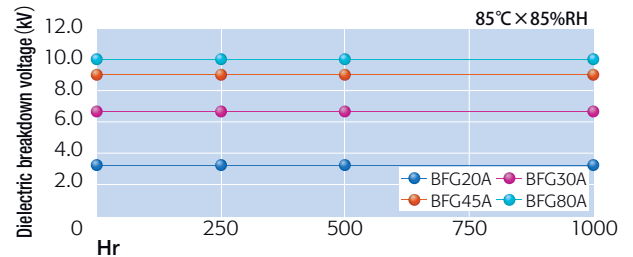
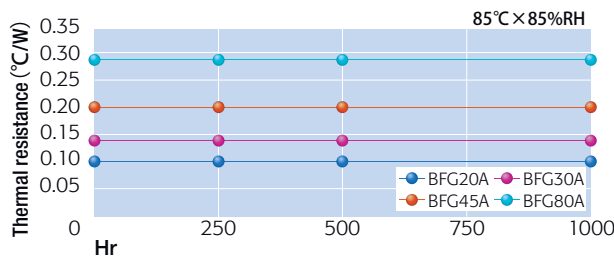
Physical properties change after high temperature treatment (200°C)



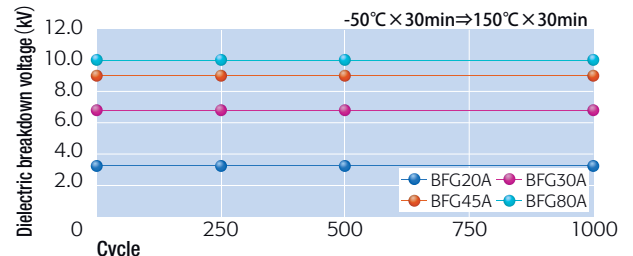
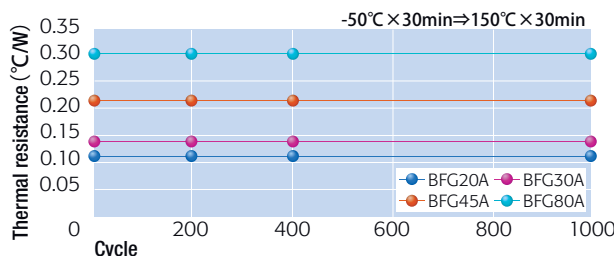
Physical properties change after low temperature treatment (-50°C)



Physical properties change after 85°C×85%RH treatment



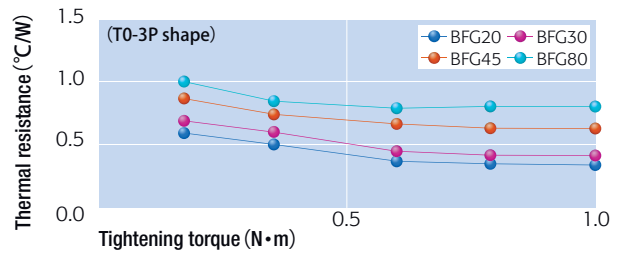
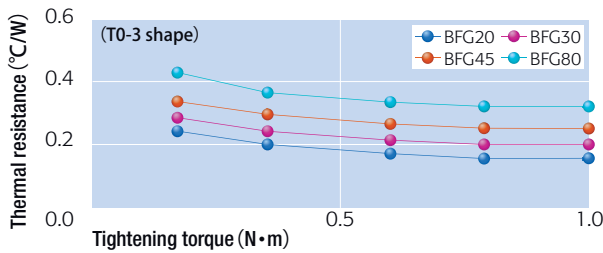
Physical properties change after heat cycle treatment (-50°C⇔150°C)



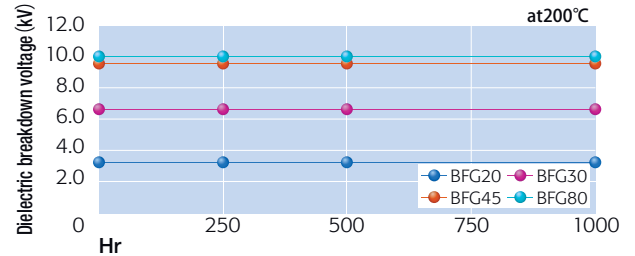
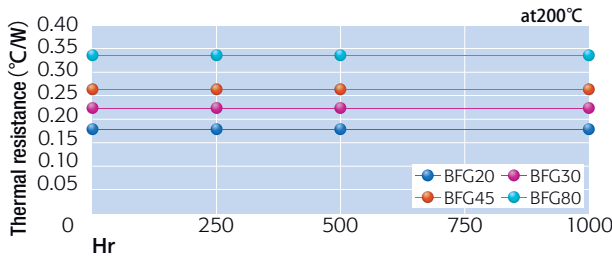
BFG grade is a sheet that has superior insulation & thermal conduction with a reinforcement layer (fiber glass). It is designed to support a number of applications.

Product Data

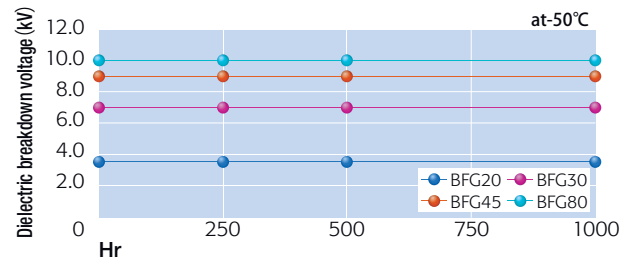
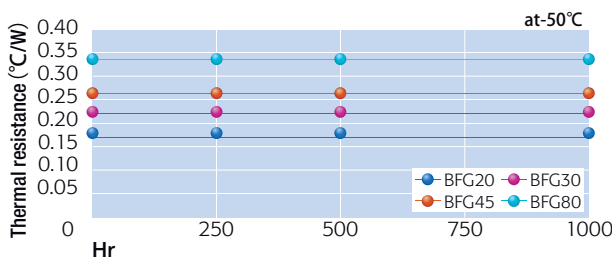
Relation between tightening torque and thermal resistance



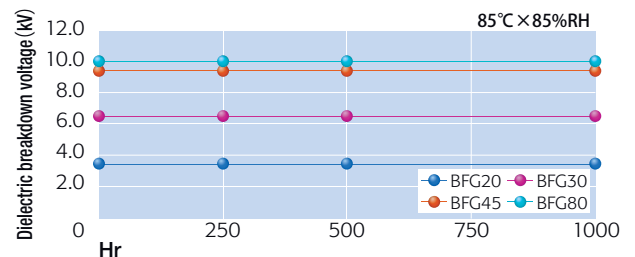
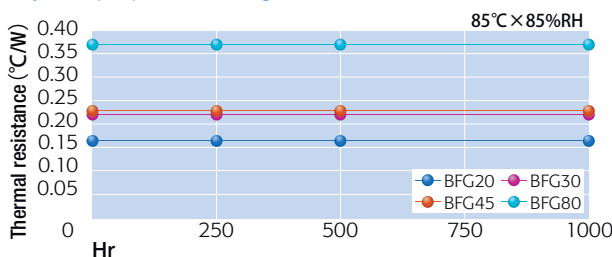
Physical properties change after high temperature treatment (200°C)



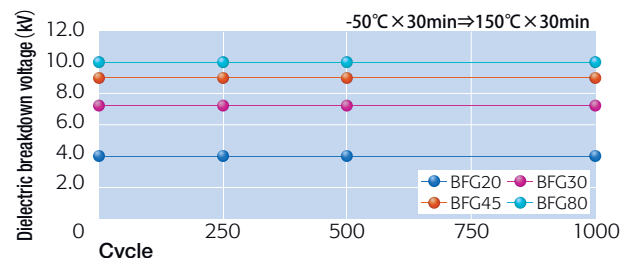
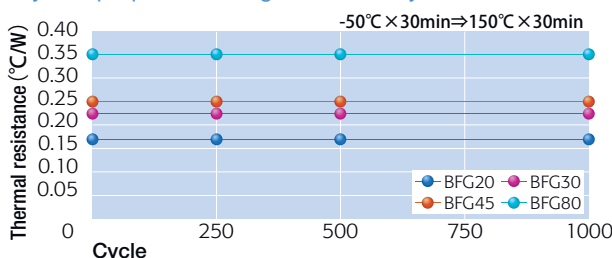
Physical properties change after low temperature treatment (-50°C)



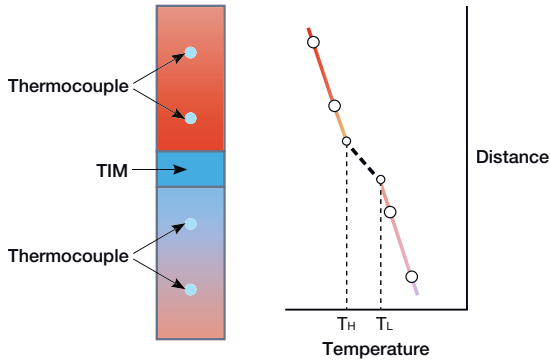
Physical properties change after 85°C×85%RH treatment



Physical properties change after heat cycle treatment (-50°C⇔150°C)



Method of determination for Thermal resistance (ASTM D5470)



After clipping TIM by Copper jig, heating up from upper side.

The relation between distance from lower copper and temperature is described as chart.

Thermal resistance can be calculated by TH and TL.

$$\text{Thermal resistance} = \frac{T_H - T_L}{\text{Heat flow ratio}}$$

$$\text{Thermal conductivity} = \frac{\text{Thickness of TIM}}{\text{Thermal resistance} \times \text{dimension of TIM}}$$

Method of determination for Thermal resistance

Thermal resistance of TO-3 Type

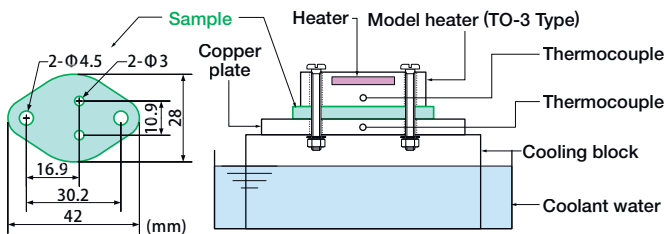
(Product No. : B-1)

◆ Test method (Denka method)

Clipped thermally conductive sheet between a model heater (TO-3 shape) and heatsink (Cu plate).

After tightened a torque and applied voltage as prescribed, thermal resistance is calculated from temperature difference between a model heater and a heatsink.

<Outline dimensions of sample>



[Test conditions]

Tightening torque : 0.5N·m (5.1kgf·m)

Applied voltage : 15W

$$\text{Thermal resistance } (^{\circ}\text{C}/\text{W}) = \frac{\text{Temperature of heater } T_1 - \text{Temperature of cooling block } T_2}{\text{Applied Power (W)}} + \text{Interface resistance}$$

$$\text{Thermal conductivity } (\text{W}/\text{m}\cdot\text{k}) = \frac{\text{Thickness (m)}}{\text{dimension (m}^2\text{)} \times \text{Thermal resistance } (^{\circ}\text{C}/\text{W})}$$

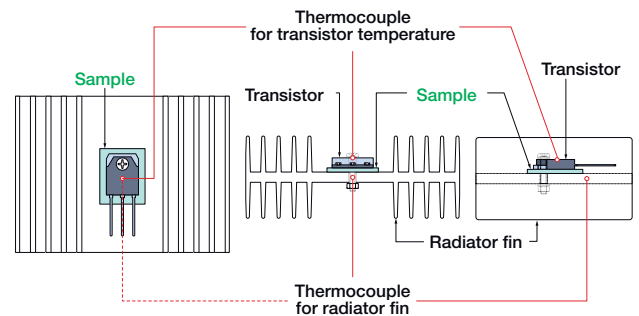
Thermal resistance after mounted

(Product No. : D-1, D-3, D-6 etc.)

◆ Test method (Denka method)

Clipped thermally conductive sheet between a transistor package (TO-3P, TO-3PL, TO-220 shape) and heatsink (Radiator fin).

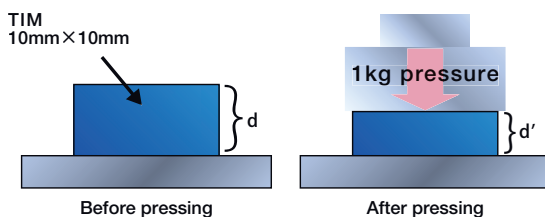
After tightened a torque and applied electric pressure as prescribed, thermal resistance is calculated from temperature difference between a model heater and a heatsink.



$$\text{Thermal resistance } (^{\circ}\text{C}/\text{W}) = \frac{\text{Temperature of transistor} - \text{Temperature of heatsink}}{\text{Applied Power (W)}} + \text{Interface resistance}$$

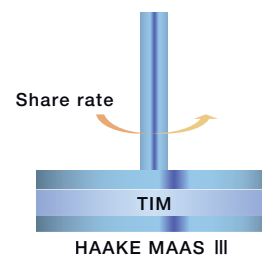
Though we used heatsink applied for ordinal electric power supply, we can change it and do remeasurement as customers' requirement.

Method of Compressibility

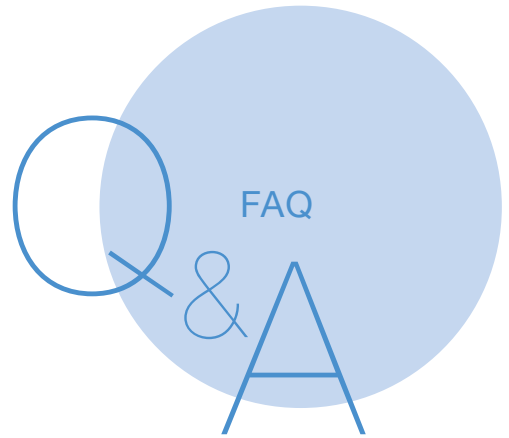


$$\text{Compressibility}(\%) = \frac{d - d'}{d} \times 100$$

Method of Viscosity



Measuring Viscosity when the rate of rotation is "d γ /dt=10" and the thickness of TIM is 0.3mm by using HAAKE MAASIII.



Q What kind of filler is Denka using?

A Denka utilizes inorganic fillers, such as BN and Al₂O₃, that we produce in-house.

Q What is the expiration date for DENKA TIM?

A 6 months after ETD date.

Q What are the points to remember when storing?

A Please keep away from direct daylight and preserve under room temperature.

Q Do DENKA TIM products contain environmentally hazardous substances?

A Denka does not intentionally utilize or include environmentally hazardous substances in TIM products.

Q What is the most suitable compressibility for DENKA THERMALLY CONDUCTIVE SPACER?

A We recommend 10%, but you can use by compressing over 10%.

Q Is there Non-adhesive type of DENKA THERMALLY CONDUCTIVE SPECER?

A Non-adhesive process can be applied only one side.

Q What is the thinnest thickness for expanding DENKA THERMALLY CONDUCTIVE GREASE?

A Please refer to the value of "BLT" in this catalog.

Q Is it possible to supply grease by syringe-type?

A Yes. Denka also supplies grease in syringe packaging.

Q What is the most recommended torque pressure of DENKA THERMALLY CONDUCTIVE SHEET?

A 5kg-cm.

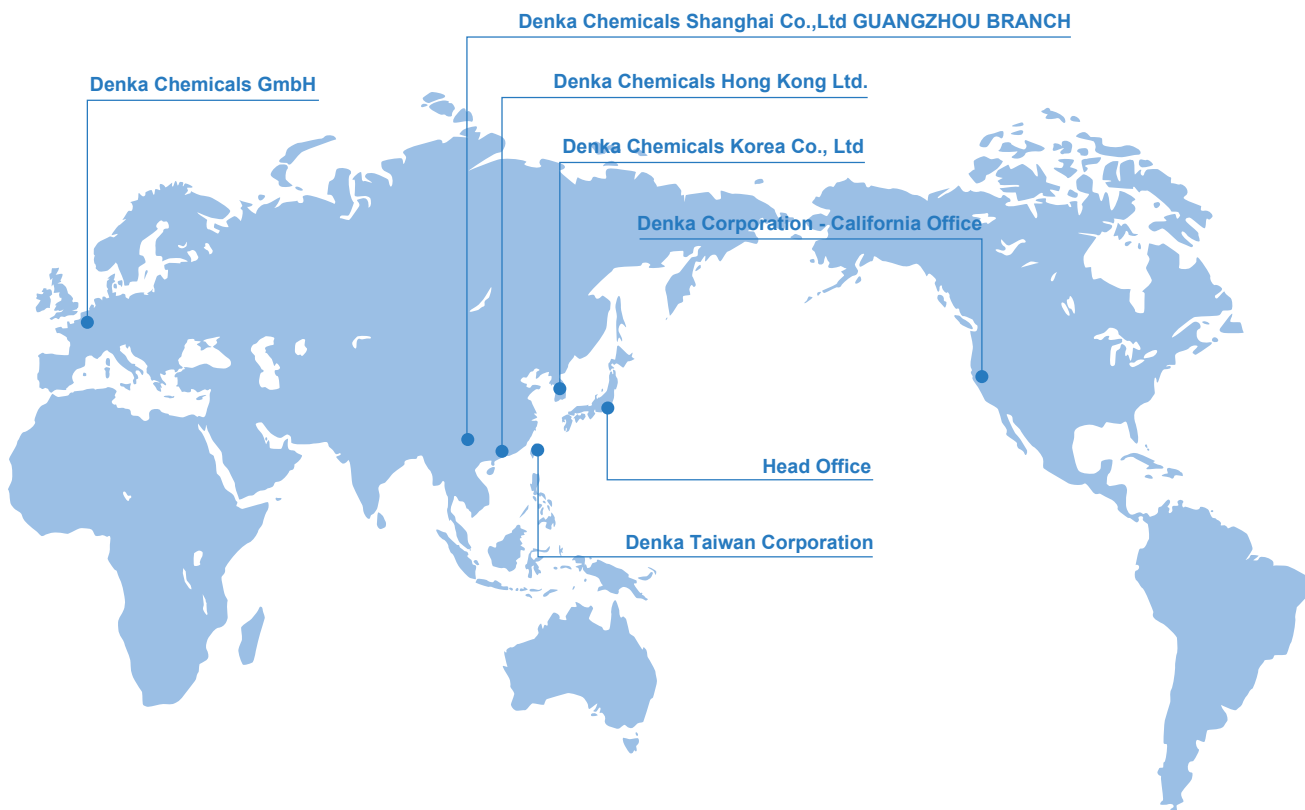
Q What is the way to decrease thermal resistance of DENKA THERMALLY CONDUCTIVE SHEET?

A We recommend to increase contact between sheet and other materials, or by using grease.

Q What is the difference between "Dielectric breakdown voltage" and "Dielectric withstanding voltage"?

A Dielectric breakdown voltage: The voltage value when breakdown happens
Dielectric withstanding voltage : The maximum voltage value DENKA assures insulating property

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NOTICE

All properties in this catalog are typical values and should not be used for writing specification. Denka makes no warranty or representation as to the entire accuracy or completeness of the Product information in this catalog.

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