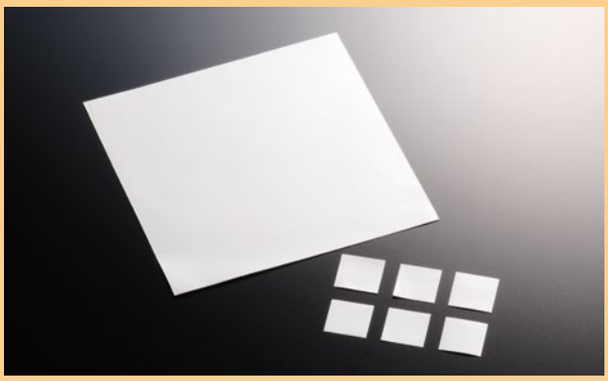
Thermal Interface Materials

DENKA materials

for Thermal Solution

DENKA THERMALLY CONDUCTIVE SHEET



p.06
THERMALLY CONDUCTIVE SHEET

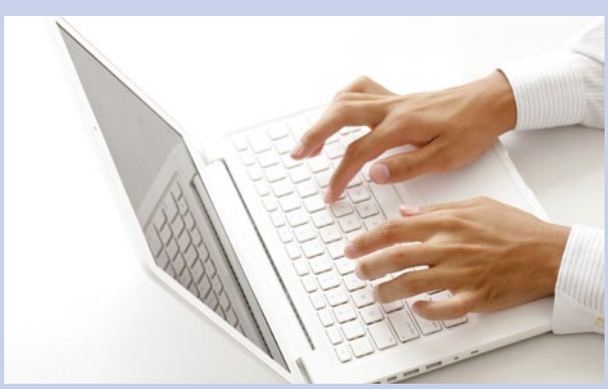
DENKA THERMALLY CONDUCTIVE SHEET maintains its insulating properties throughout comprehensive testing, while also featuring ease in handling. It's suitable for automotive parts or electronic power supplies.

DENKA THERMALLY CONDUCTIVE SPACER

p.11
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.

DENKA THERMALLY CONDUCTIVE GREASE



p.20
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.

THERMALLY CONDUCTIVE SHEET

DENKA

THERMALLY CONDUCTIVE SHEET

grade lineup

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	℃/W	0.43	0.64	0.8	1.07	Denka method
Thermal resistance TO-3P	℃/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
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
Foldamability	ϕ mm	0.8	1.2	2.5	1.5	—

Item	unit	BS20	BS30	BS45	Test method
Color	—	Light Green	Green	Green	—
Thickness	mm	0.20±0.05	0.30±0.05	0.45±0.05	—
Reinforced layer	—		Reinforced with glass fiber		—
Thermal resistance TO-3	℃/W	0.19	0.21	0.26	Denka method
Thermal resistance TO-3P	℃/W	0.40	0.45	0.54	Denka method
Thermal conductivity TO-3	W/mK		3.9		Denka method
Withstand voltage	AC kV	1.0	3.0	4.0	JEM 1021
Dielectric breakdown voltage	AC kV	3.0	5.1	7.8	JIS C2110
Dielectric constant	—		3.5		1MHz
Flammability	UL94		V-0		FileNo.E49895
Specific gravity	g/cm^3	1.7	1.6	1.6	—
Tensile strength	MPA kgf/cm^2	25 260	18 180	13 130	JIS K6251
Tear strength	kN/m kgf/cm	117 120	88 90	59 60	JIS K6252
Hardness	Durometer A	88	89	89	JIS K6253
Foldamability	ϕ mm	Completely foldable	Completely foldable	Completely foldable	—

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	℃/W	0.18	0.20	0.25	0.36	Denka method
Thermal resistance TO-3P	℃/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
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
Foldamability	ϕ mm	1.2	1.2	3.1	>5	—

Thermal conductivity 1.4-10.0 W/mK

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	℃/W	0.12	0.15	0.19	0.30	Denka method
Thermal resistance TO-3P	℃/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
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
Foldamability	ϕ mm	1.0	1.2	1.2	3.1	—

Item	unit	BFG20C New products	BFG30C New products	BFG45C Under Development	Test method
Color	—	Light Blue			—
Thickness	mm	0.20±0.05	0.30±0.05	0.45±0.05	—
Reinforced layer	—	Reinforced with glass fiber			—
Thermal resistance TO-3	℃/W	0.08	0.11	0.14	Denka method
Thermal resistance TO-3P	℃/W	0.50	0.64	0.84	ASTM D5470
Thermal conductivity TO-3	W/mK	8			Denka method
Withstand voltage	AC KV	1.0	3.0	4.0	JEM 1021
Dielectric breakdown voltage	AC KV	4.2	8.6	>10	JIS C2110
Dielectric constant	—	3.0			1MHz
Flammability	UL94	V-0			FileNo.E49895
Specific gravity	g/cm^3	1.6			—
Tensile strength	MPA kgf/cm^2	9.1	6.6	4.6	JIS K6251
Tear strength	kN/m kgf/cm	45	37	29	JIS K6252
Hardness	Durometer A	85			JIS K6253

Item	unit	BFG20D Under Development	BFG30D Under Development	BFG45D Under Development	Test method
Color	—	White			—
Thickness	mm	0.20±0.05	0.30±0.05	0.45±0.05	—
Reinforced layer	—	Reinforced with glass fiber			—
Thermal resistance TO-3	℃/W	0.07	0.09	0.11	Denka method
Thermal conductivity TO-3	W/mK	10			Denka method
Withstand voltage	AC KV	1.0	3.0	4.0	JEM 1021
Dielectric breakdown voltage	AC KV	3.0	6.0	8.0	JIS C2110

※ The values of thermal condutivity 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.
※ Flame retardancy is obtained in original sized sheet.
※ These are typical values and are not guaranteed values.

DENKA
HIGH THERMALLY CONDUCTIVE SHEET BFG

Thermal conductivity 4.1 W/mK

BFG Series

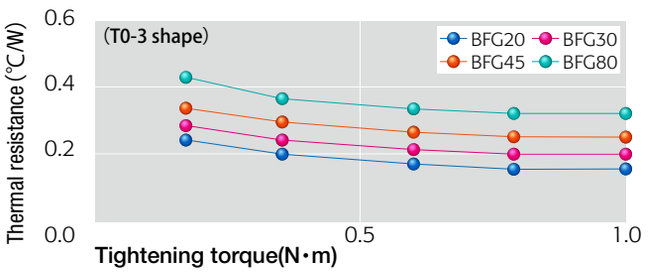
BFG

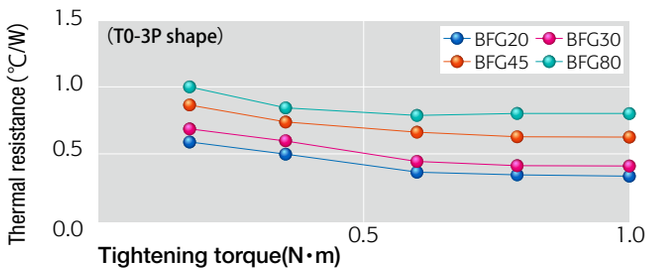
Product Characteristic

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

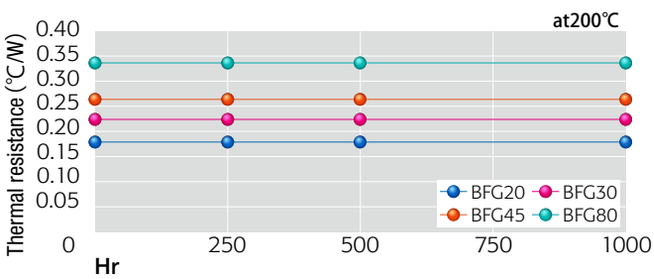
Product Data

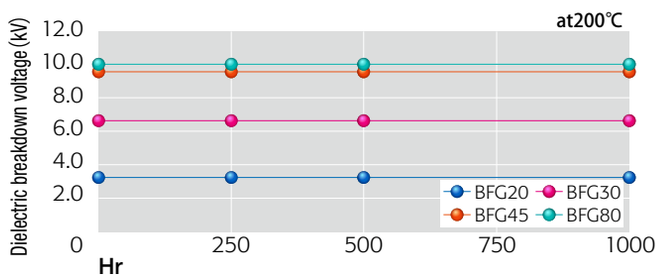
Relation between tightening torque and thermal resistance



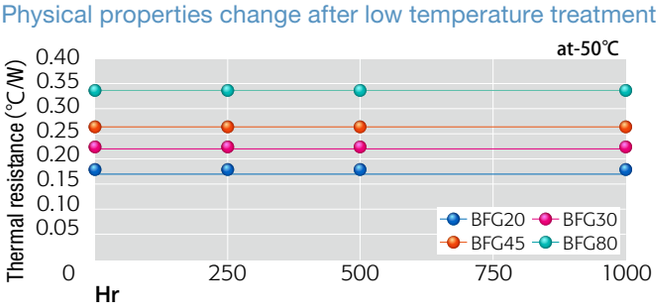


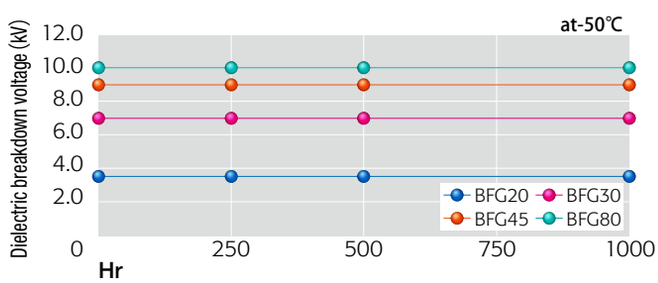
Physical properties change after high temperature treatment (200℃)



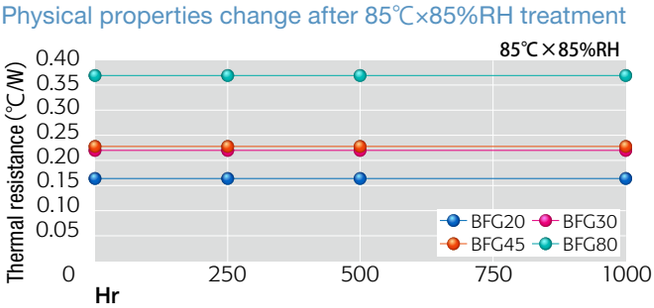


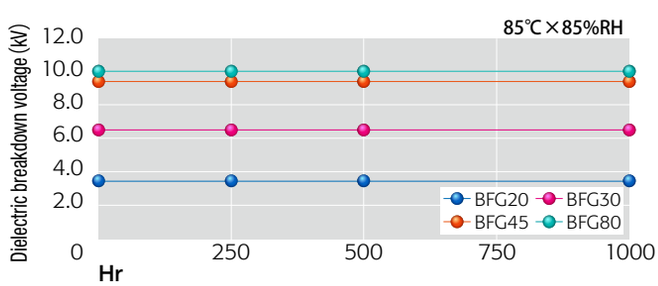
Physical properties change after low temperature treatment (-50℃)



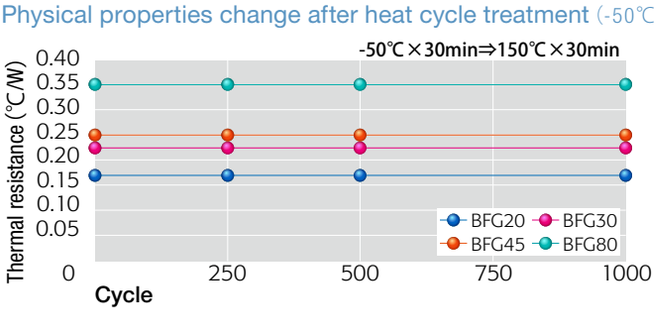


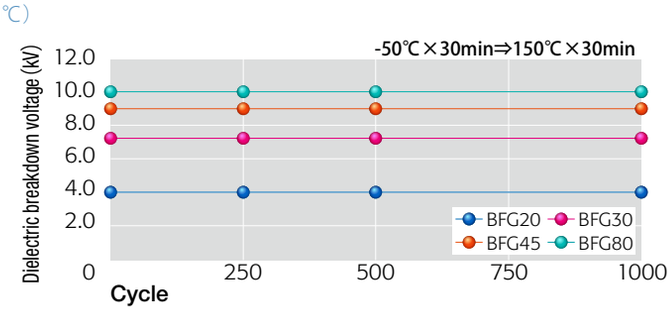
Physical properties change after 85℃×85%RH treatment





Physical properties change after heat cycle treatment (-50℃⇄150℃)





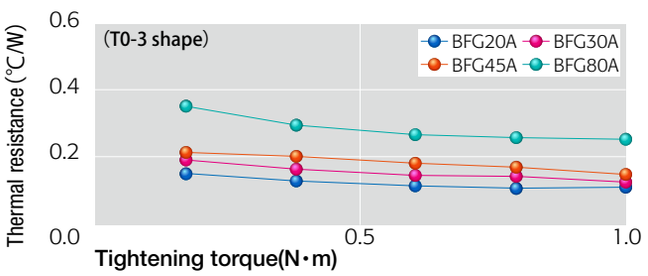
DENKA THERMALLY CONDUCTIVE SHEET BFG-A

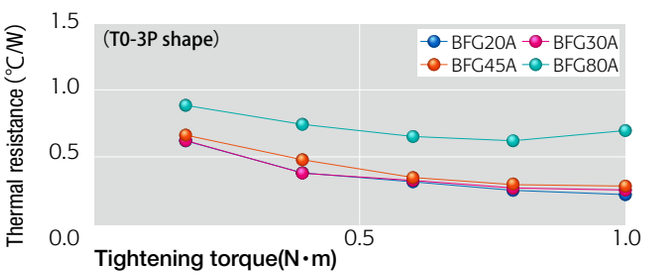
BFG-A is insulating heat conductive sheet with high thermal conductivity (5W/mK).

Product Characteristic

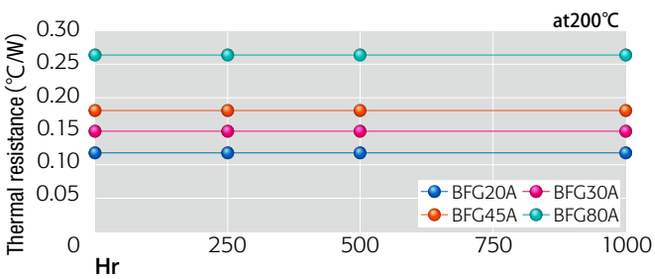
Product Data

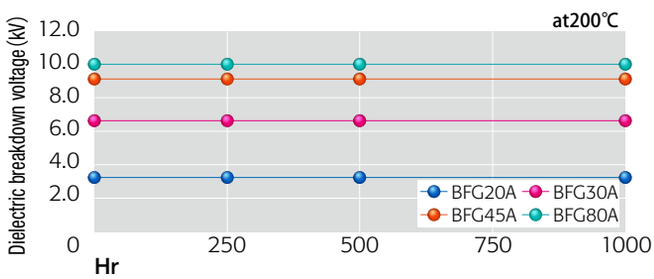
Relation between tightening torque and thermal resistance



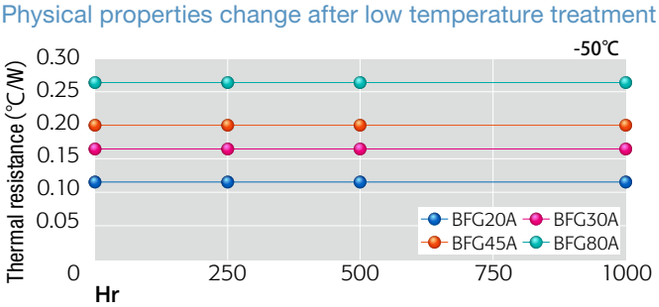


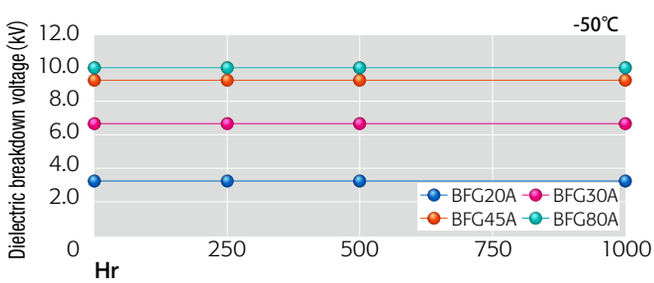
Physical properties change after high temperature treatment (200℃)



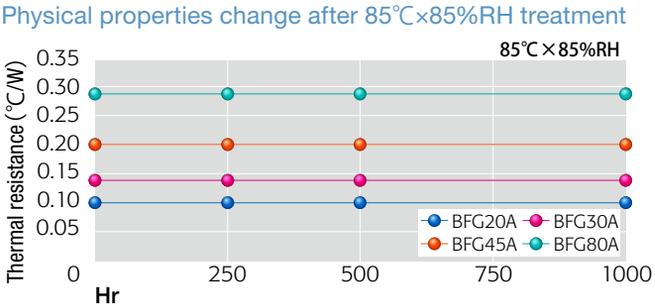


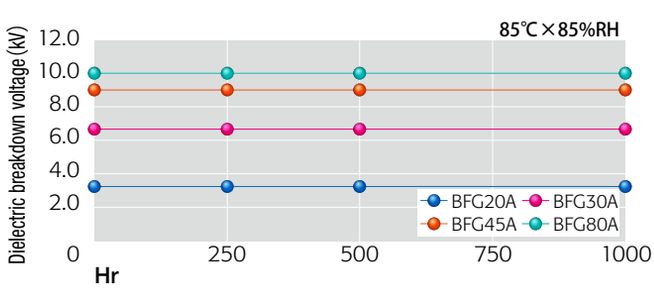
Physical properties change after low temperature treatment (-50℃)



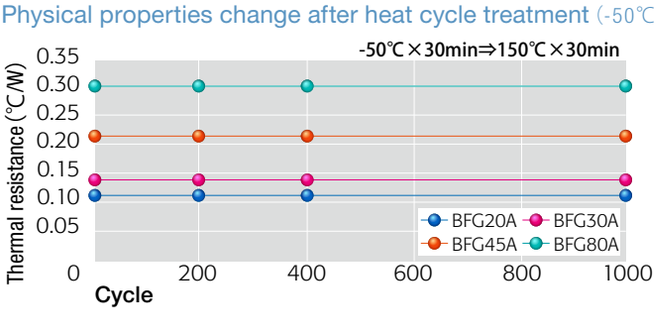


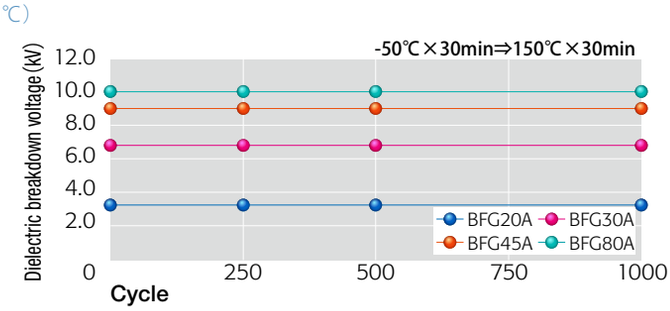
Physical properties change after 85℃×85%RH treatment





Physical properties change after heat cycle treatment (-50℃⇄150℃)





DENKA
HIGH THERMALLY CONDUCTIVE SHEET BFG-C

Thermal conductivity 8 W/mK

BFG Series

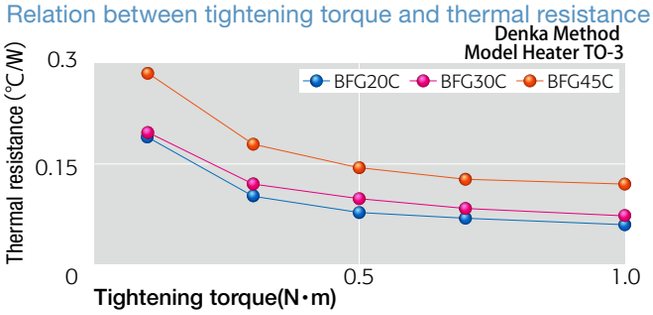
BFG-C

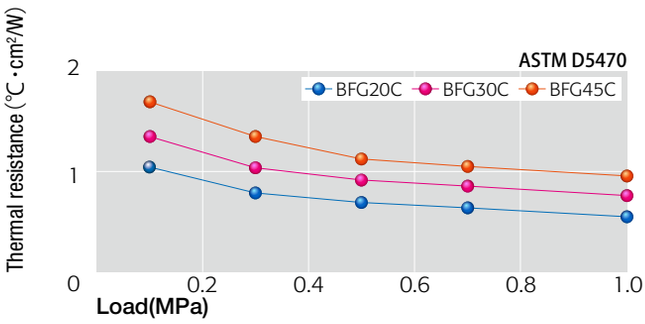
Product Characteristic

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.

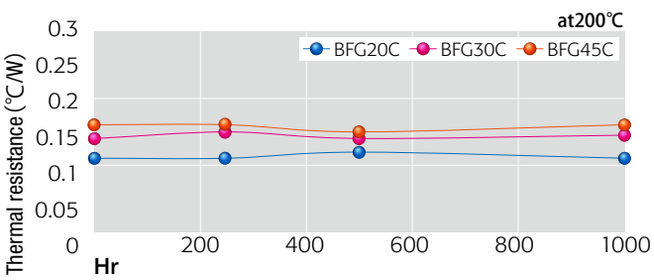
Product Data

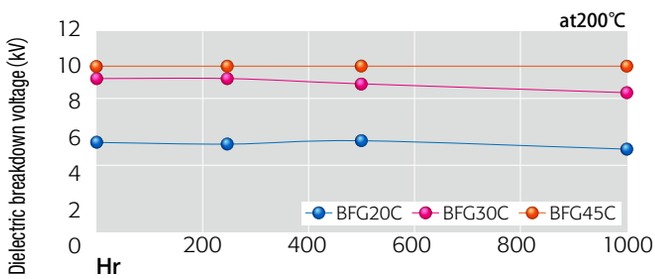
Relation between tightening torque and thermal resistance



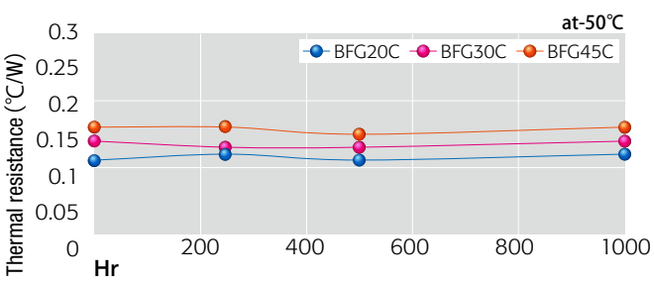


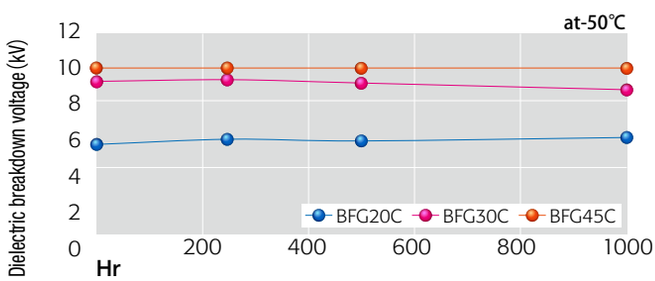
Physical properties change after high temperature treatment (200℃)



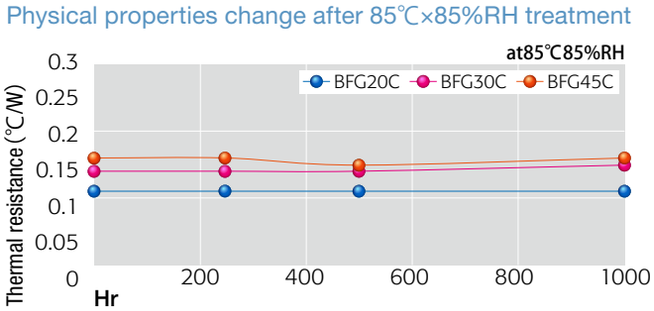


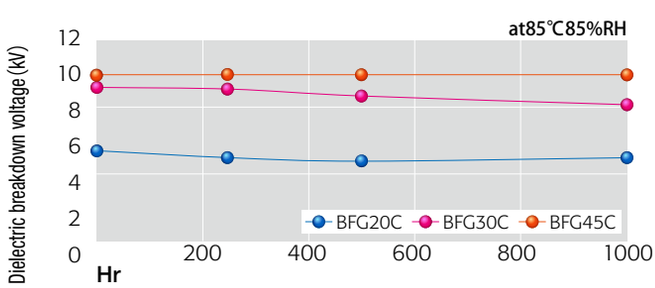
Physical properties change after low temperature treatment (-50℃)



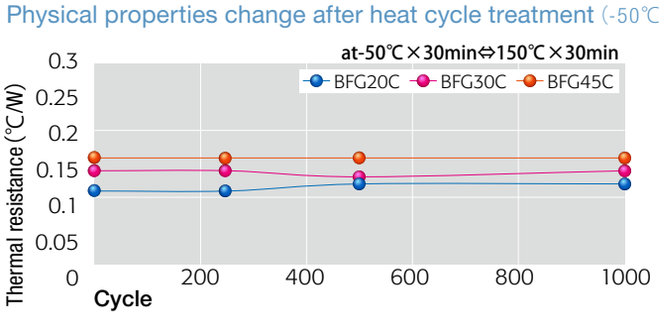


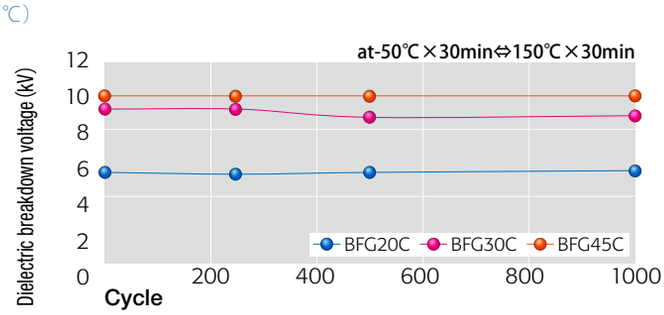
Physical properties change after 85℃×85%RH treatment





Physical properties change after heat cycle treatment (-50℃⇄150℃)





2-8 W/mK Thermal conductivity

THERMALLY CONDUCTIVE SPACER
grade lineup

Item	unit	FSL-F3	FSL-BS (High resilience)	FSL-D	FSL-B	FSL-BH	Test method
color	—	Light Gray	Light Blue	Light Blue	Light Blue	Light Blue	—
Thickness	mm	0.3 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	0.5 0.75 1.0 1.5 2.0 2.5 3.0 3.5 4.0 5.0	0.3 0.5 1.0 1.5 2.0 2.5 3.0 4.0	0.3 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	Thickness gauge
Tolerance	%	± 10	± 10	± 10	± 10	± 10	—
Thermal conductivity	W/mK	2	3	3	4	4	ASTM D5470
Hardness	—	15	8	30	25	30	Asker C
Compressibility	%	25	30	15	15	10	0.1MPa
Specific gravity	—	1.7	2.8	2.7	2.8	2.8	25℃
Low molecule siloxane	ppm	650	450	50	450	600	ΣD5-10
Dielectric breakdown Voltage	kV/mm	10	10	10	10	10	JIS C2110
Flame retardancy	—	More than 1.5mm：V-0 Less than 1.5mm：V-1	V-0	V-0	V-0	V-0	UL-94 File No. E49895
Relative permittivity	—	4.5	7.2	6.6	7.1	6.9	JIS K6249@1MHz
Breaking strength	MPa	0.25	0.05	0.23	0.15	0.18	JIS K6251
Elongation	%	218	324	111	149	100	JIS K6251
Young's Modulus	MPa	0.064	0.011	0.087	0.042	0.07	JIS K6251
Volume resistance	Ω・cm	1×10^{13}	1×10^{13}	1×10^{13}	1×10^{13}	1×10^{13}	JIS K6911
Surface tack	V	—	600	—	—	600	IEC60112

Item	unit	FSL-H	FSL-MS (Under Development)	FSL-HD (Under Development)	FSL-HM	FSL-HR	Test method
color	—	Gray	Blue	Blue	Gray	Gray	—
Thickness	mm	0.5 1.0 1.5 2.0	1.5 2.0 3.0	1.5 2.0 3.0	0.5	1.0 1.5 2.0 2.5 3.0	Thickness gauge
Tolerance	%	± 10	10	10	± 16	± 10	—
Thermal conductivity	W/mK	5	5	7	7	8	ASTM D5470
Hardness	—	35	10	35	45	40	Asker C
Compressibility	%	9	30	20	10	15	0.1MPa
Specific gravity	—	3.1	3.2	3.3	3.3	3.3	25℃
Low molecule siloxane	ppm	300	10	10	400	250	ΣD5-10
Dielectric breakdown Voltage	kV/mm	10	6.2	8	10	10	JIS C2110
Flame retardancy	—	V-0	V-0 Equivalence	V-0 Equivalence	V-0	More than 3mm：V-0 Less than 3mm：V-1	UL-94 File No. E49895
Relative permittivity	—	7.9	—	—	8.2	8.3	JIS K6249@1MHz
Breaking strength	MPa	0.27	0.05	0.1	0.25	0.2	JIS K6251
Elongation	%	82	—	—	30	40	JIS K6251
Young's Modulus	MPa	0.1	—	—	0.4	0.2	JIS K6251
Volume resistance	Ω・cm	1×10^{13}	7.3×10^{12}	2.6×10^{12}	1×10^{12}	1×10^{12}	JIS K6911
Surface tack	V	—	—	—	—	—	IEC60112

※ Flame retardancy is obtained in original sized sheet. ※These are typical values and are not guaranteed values.

DENKA THERMALLY CONDUCTIVE SPACER FSL-BS with high resilience

THERMALLY CONDUCTIVE SPACER

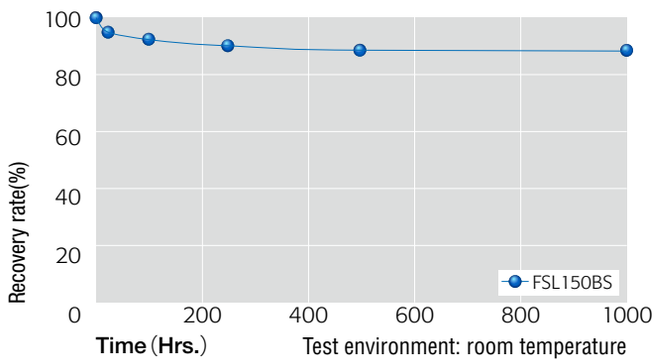
FSL-BS

Product Characteristic

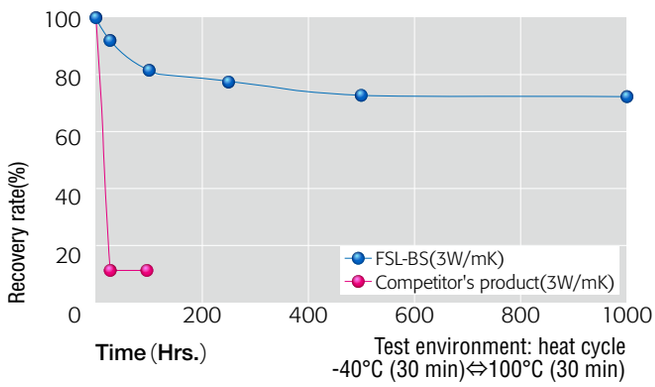
High resilience is required to follow repeated compression and release in environments with strong vibrations.
FSL-BS maintains high resilience even in harsh environments and ensures effective heat dissipation for devices.

Product Data

Comparison of restorability at room temperature



Comparison of resilience in heat cycle test

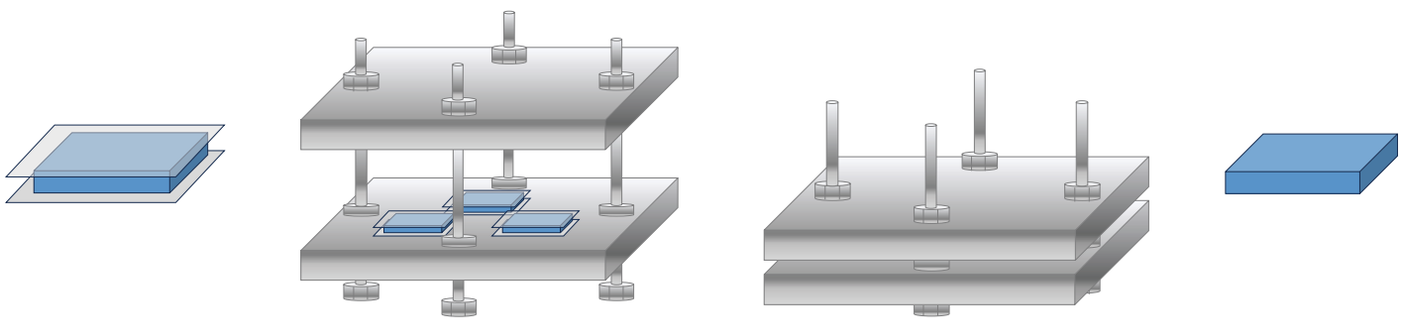


Resilience test method

◆Compression set test : JIS K 6262_2013

Step 1. Cut out a 2cm x 2cm test piece and sandwich it between Teflon sheets.
Step 2. Place three test pieces between a smooth aluminum plate and a steel plate to compress them.
Step 3. Fix the compressed state of the specimens with screws and nuts.
Step 4. Release specimens after keeping them in the test environment for the specified time.
Step 5. 30 minutes after release, measure the thickness of the three specimens and calculate the median value.

Definition • Compression set = (Thickness before test - Thickness after test) / (Thickness before test - Thickness before test x (1 - Compressibility ratio / 100)) x 100 • Recovery rate=100-compression permanent set



Step 1 Step 2 Step 3, 4 Step 5

DENKA THERMALLY CONDUCTIVE SPACER FSL-F3

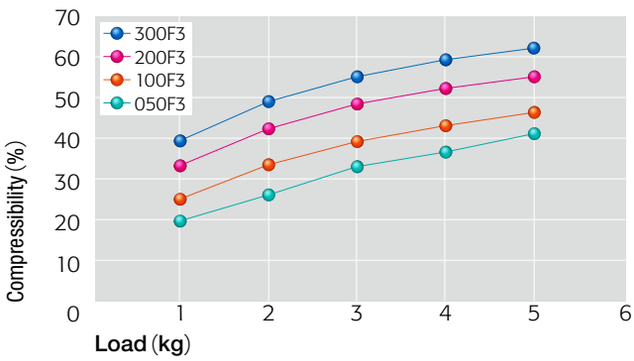
THERMALLY CONDUCTIVE SPACER
FSL-F3

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

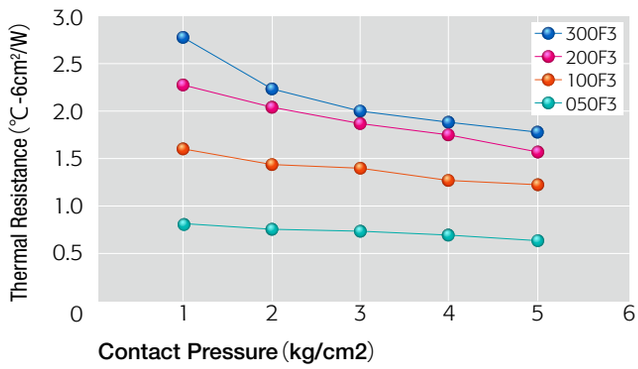
Product Characteristic

Product Data

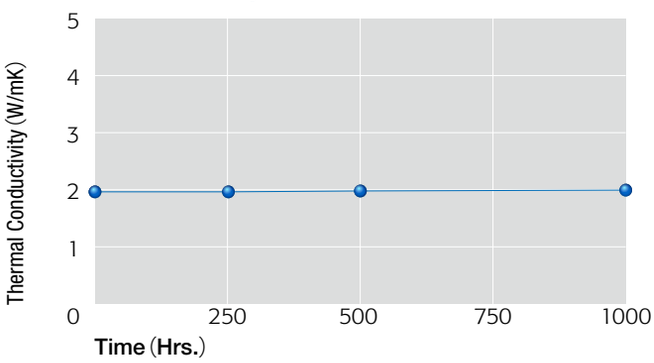
Load vs Compressibility

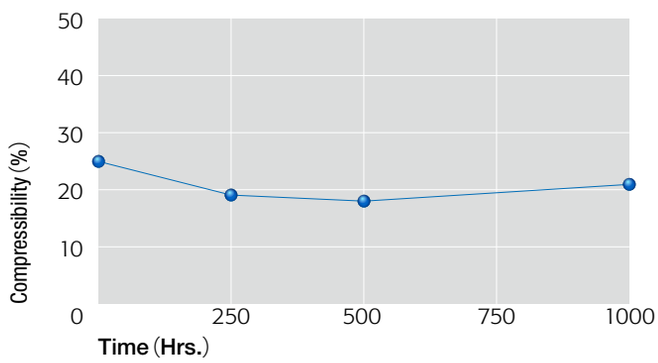


Contact Pressure vs Thermal Resistance

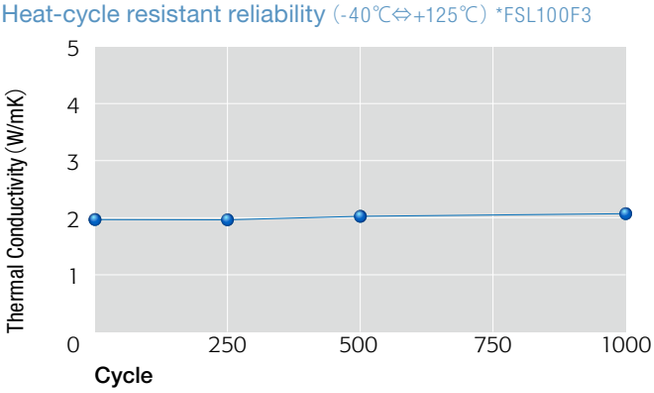


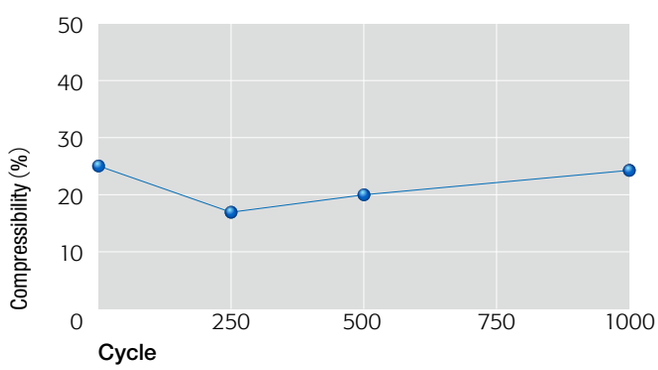
Heat-resistant reliability (150℃) *FSL100F3



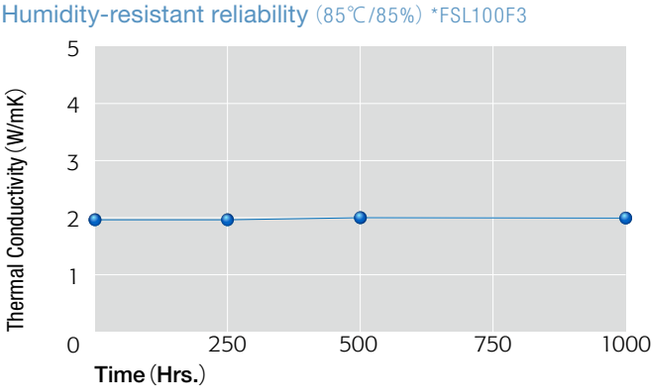


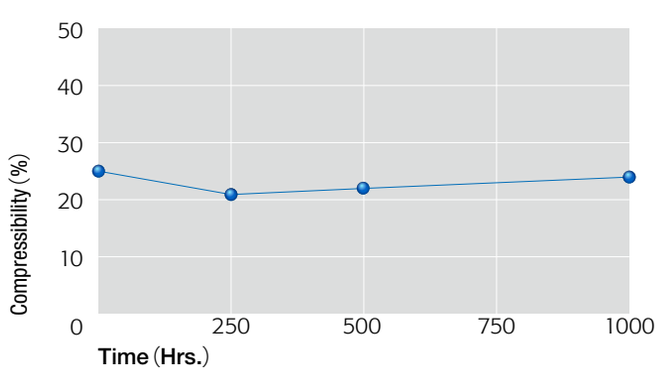
Heat-cycle resistant reliability (-40℃⇔+125℃) *FSL100F3





Humidity-resistant reliability (85℃/85%) *FSL100F3





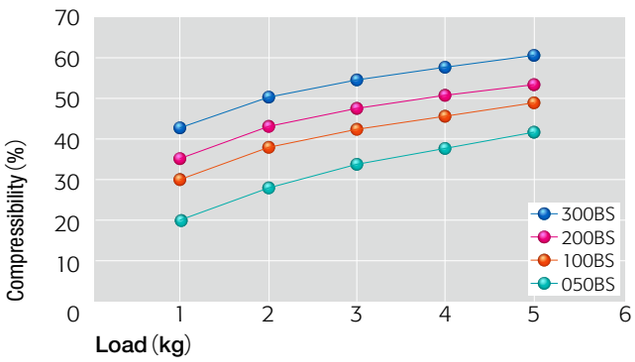
DENKA
THERMALLY CONDUCTIVE SPACER FSL-BS

Product Characteristic

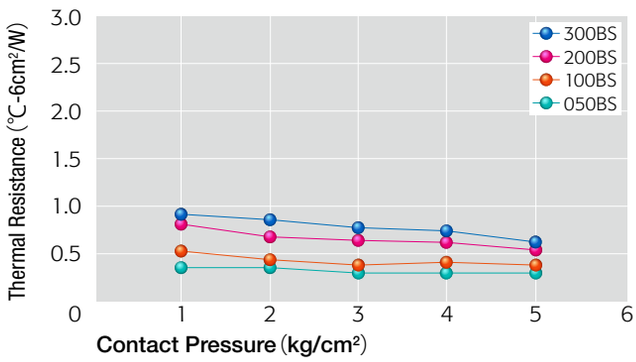
FSL-BS is the softest grade in our thermally conductive spacer lineup, with compressibility of 30%. It is recommended in applications which require both high thermal conductivity and compressibility, such as in portable base stations, and automotive. It also maintains high resilience even in harsh environments and ensures heat dissipation of the device.

Product Data

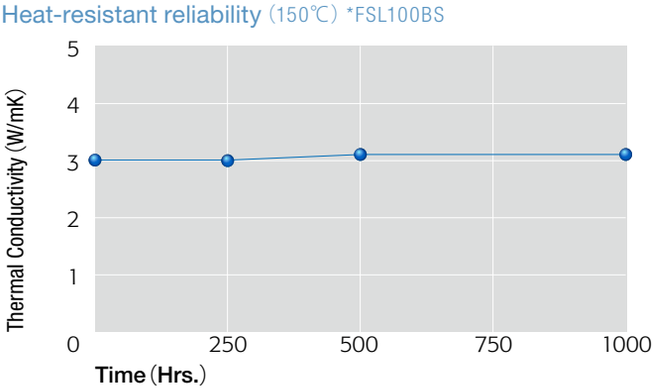
Load vs Compressibility

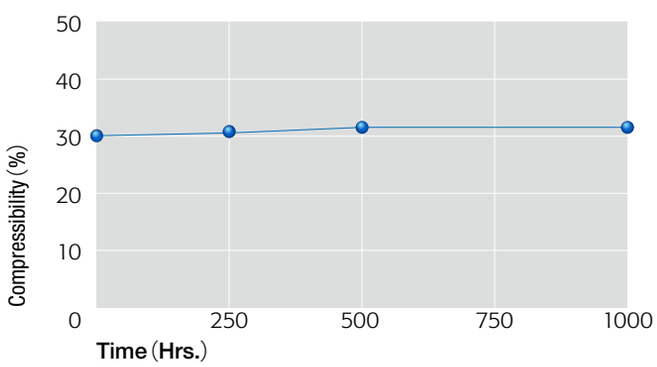


Contact Pressure vs Thermal Resistance

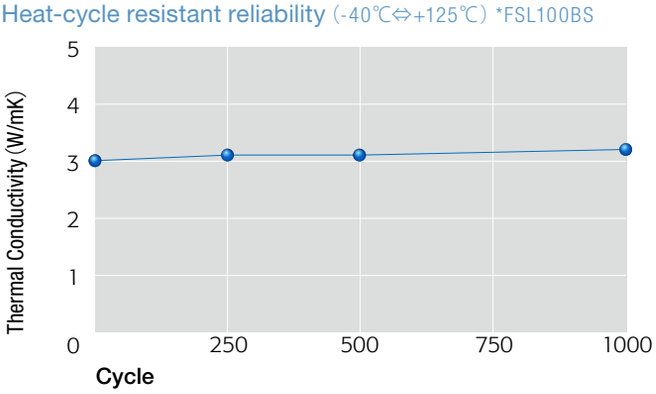


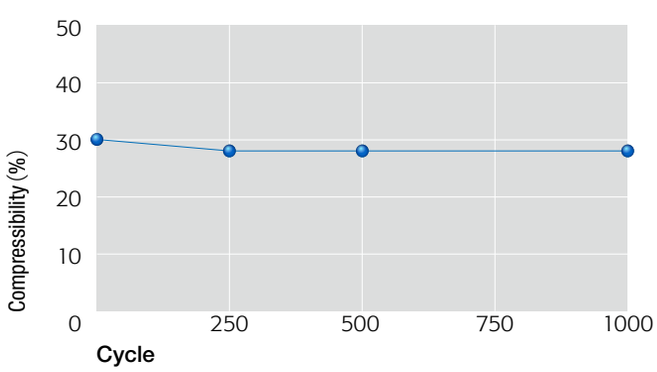
Heat-resistant reliability (150℃) *FSL100BS



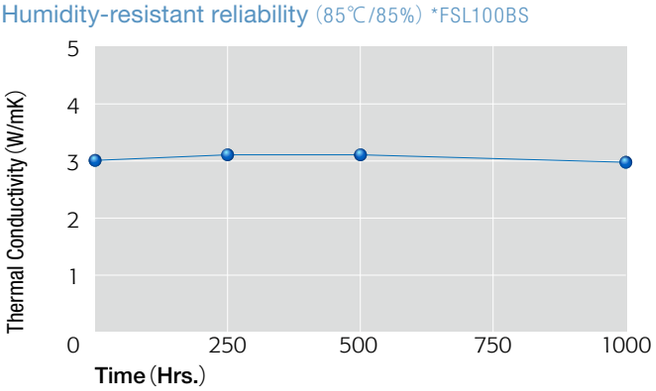


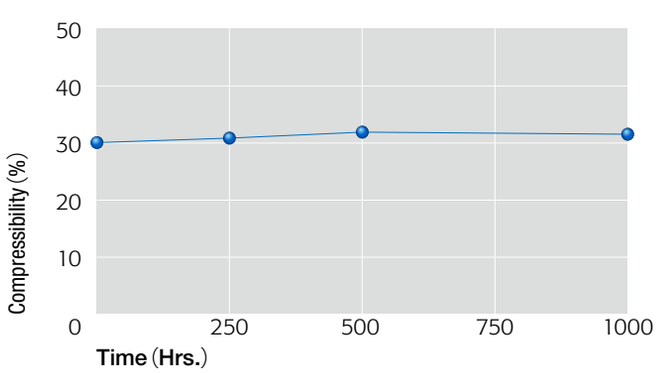
Heat-cycle resistant reliability (-40℃⇔+125℃) *FSL100BS





Humidity-resistant reliability (85℃/85%) *FSL100BS





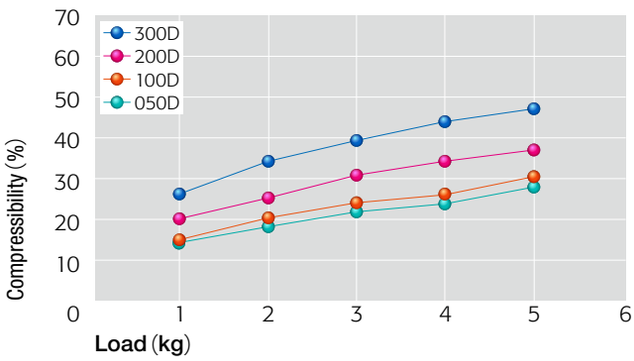
DENKA THERMALLY CONDUCTIVE SPACER FSL-D

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

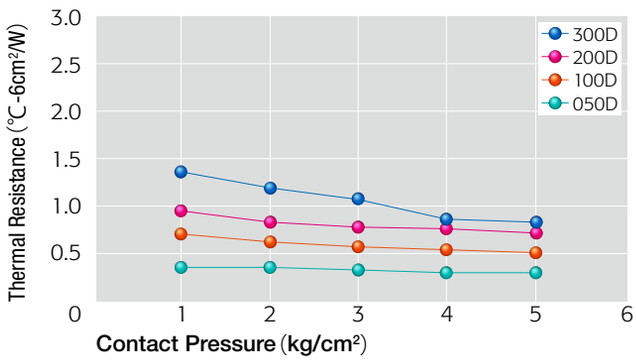
Product Characteristic

Product Data

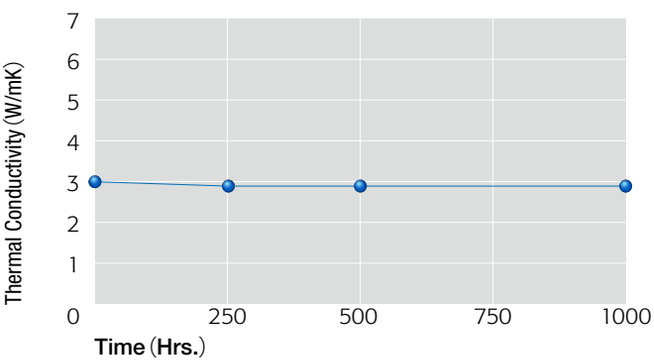
Load vs Compressibility

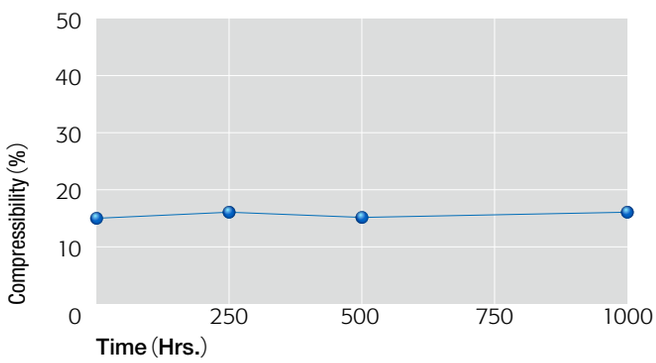


Contact Pressure vs Thermal Resistance

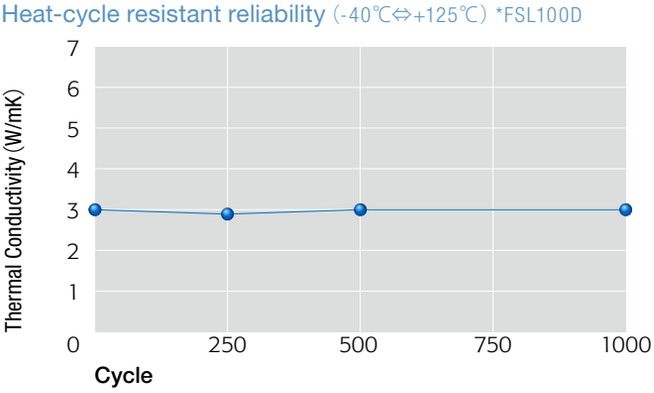


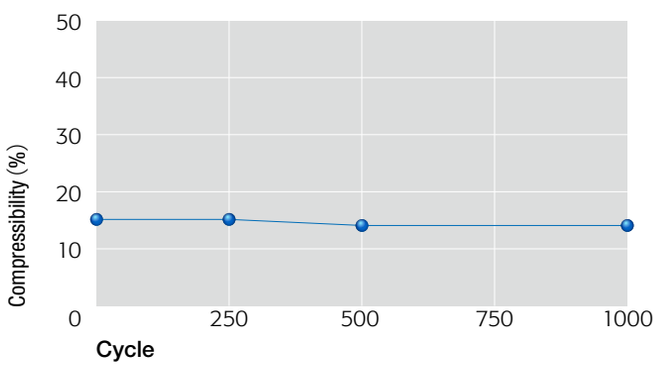
Heat-resistant reliability (150℃) *FSL100D



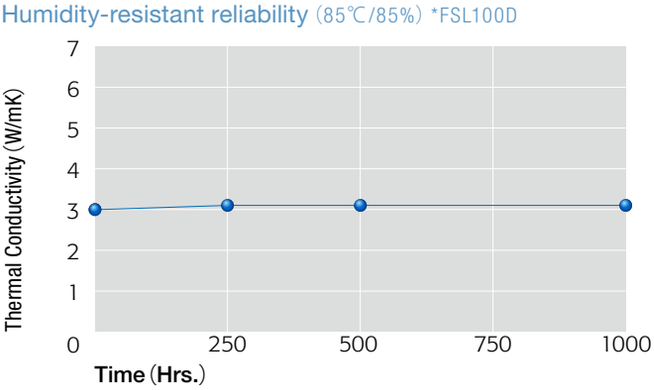


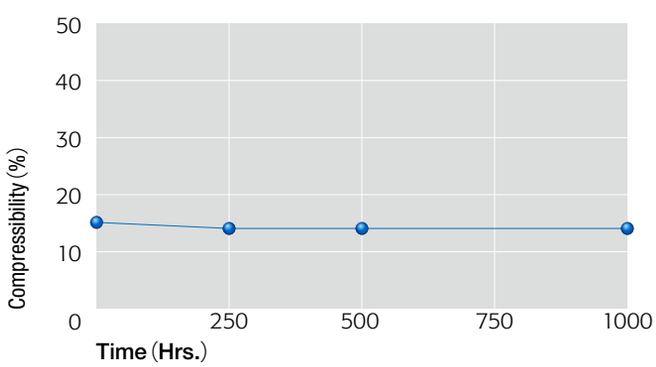
Heat-cycle resistant reliability (-40℃⇔+125℃) *FSL100D





Humidity-resistant reliability (85℃/85%) *FSL100D





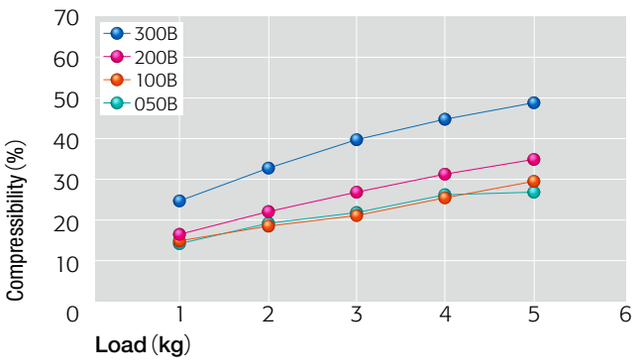
DENKA
THERMALLY CONDUCTIVE SPACER FSL-B

Product Characteristic

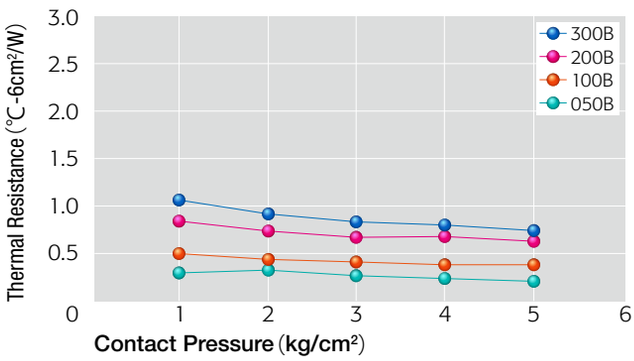
FSL-B is Denka's economy grade, featuring excellent balance between thermal conductivity and computability.

Product Data

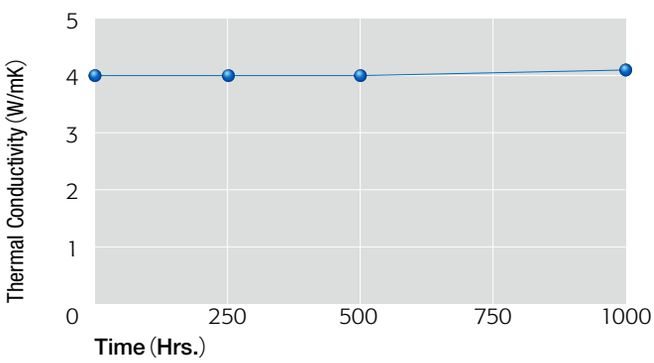
Load vs Compressibility

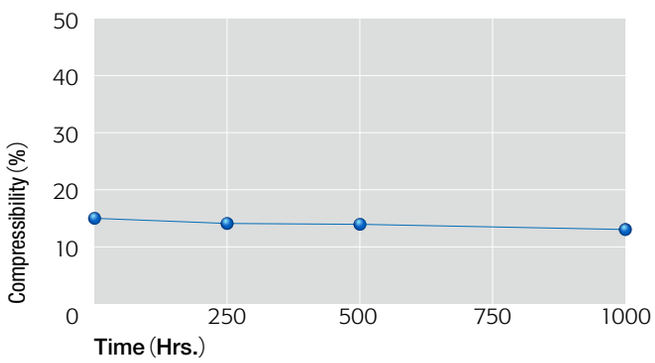


Contact Pressure vs Thermal Resistance

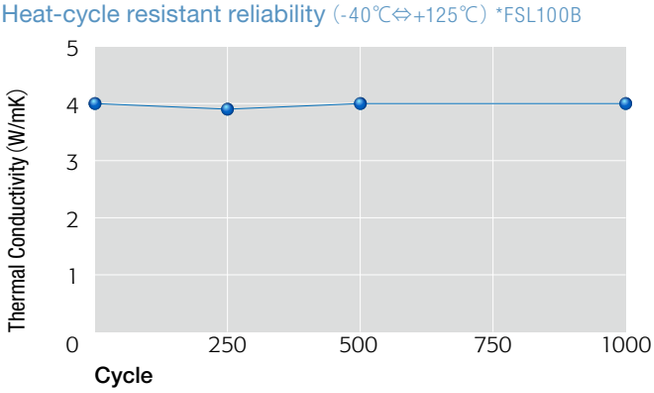


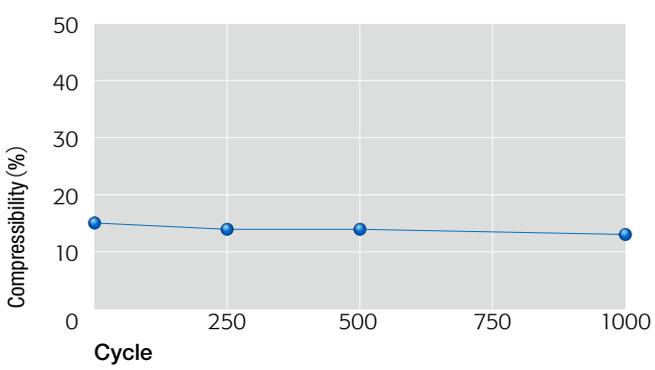
Heat-resistant reliability (150℃) *FSL100B



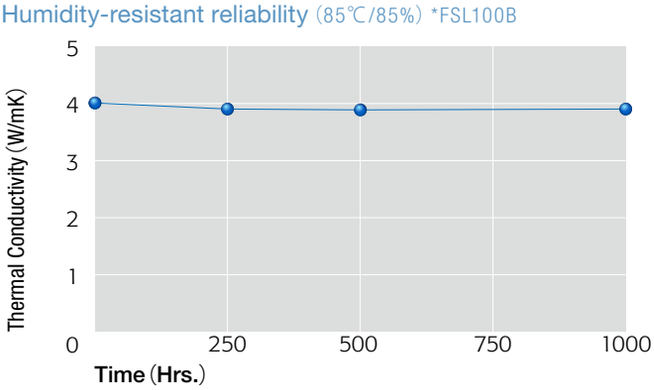


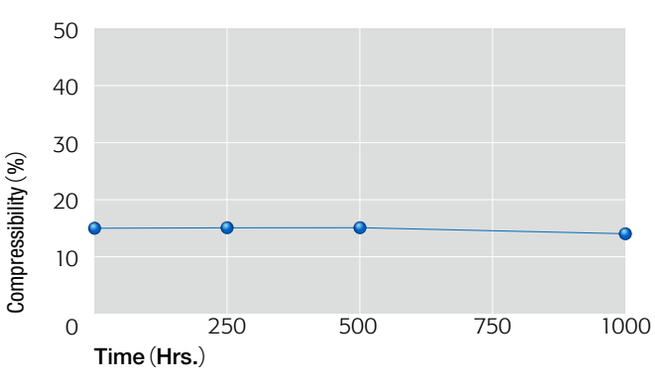
Heat-cycle resistant reliability (-40℃⇔+125℃) *FSL100B





Humidity-resistant reliability (85℃/85%) *FSL100B





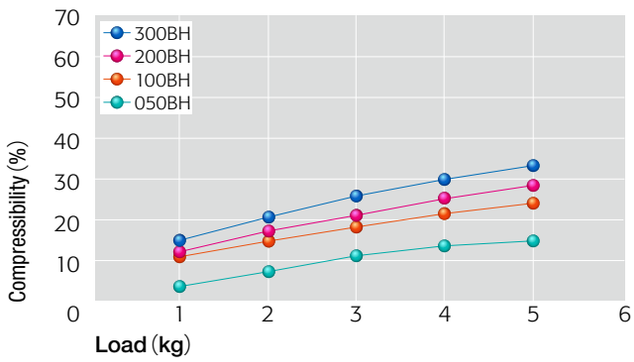
DENKA THERMALLY CONDUCTIVE SPACER FSL-BH

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

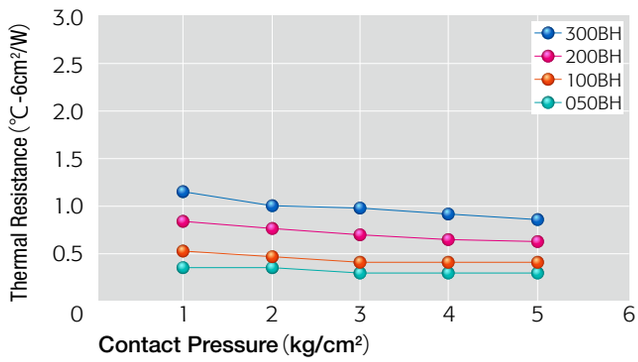
Product Characteristic

Product Data

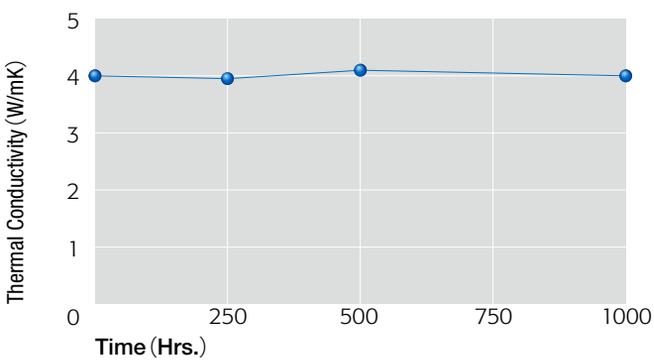
Load vs Compressibility

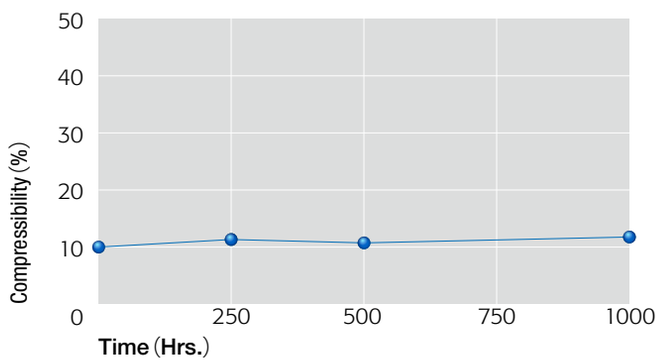


Contact Pressure vs Thermal Resistance

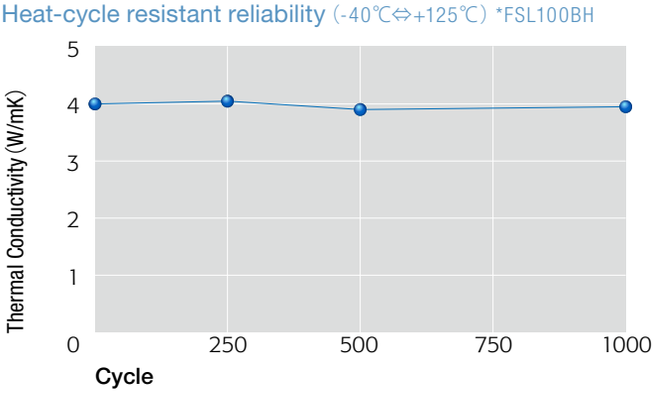


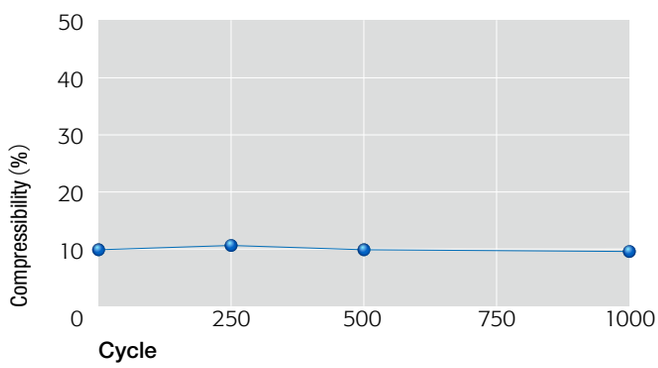
Heat-resistant reliability (150℃) *FSL100BH



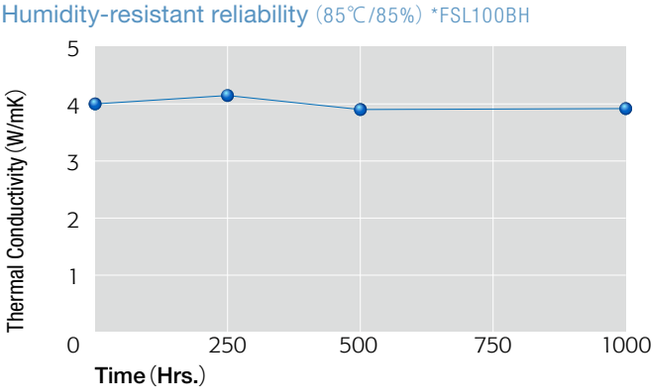


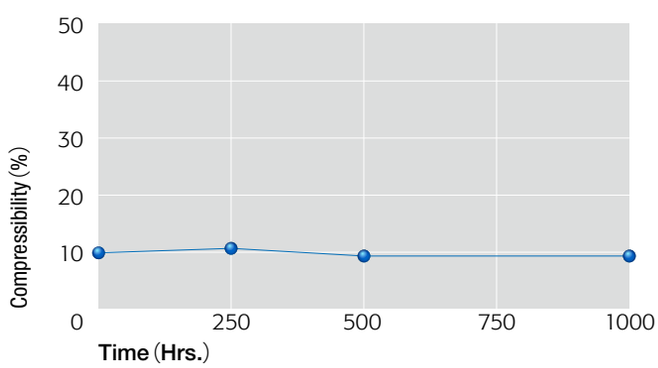
Heat-cycle resistant reliability (-40℃⇔+125℃) *FSL100BH





Humidity-resistant reliability (85℃/85%) *FSL100BH





DENKA
THERMALLY CONDUCTIVE SPACER FSL-H

Thermal conductivity 5 W/mK

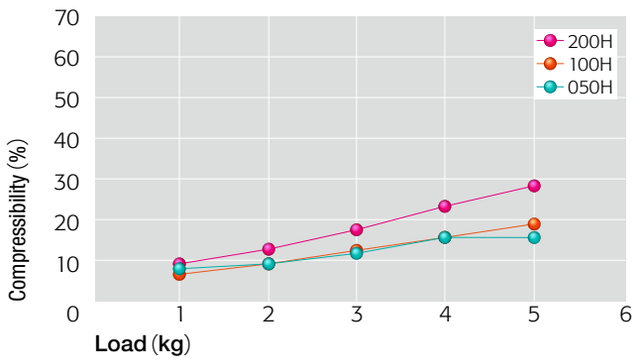
THERMALLY CONDUCTIVE SPACER
FSL-H

Product Characteristic

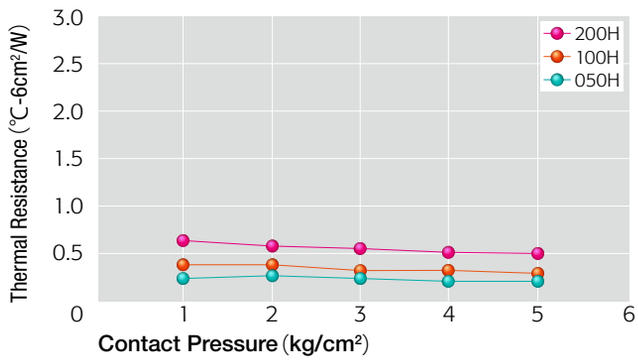
FSL-H features high thermal conductivity at 5W/mk, and also reverts to its original state after unloading.

Product Data

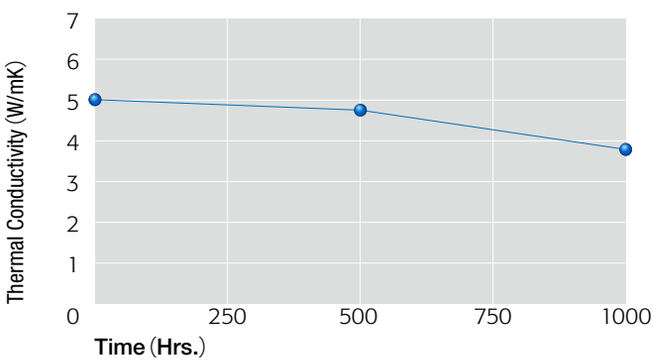
Load vs Compressibility

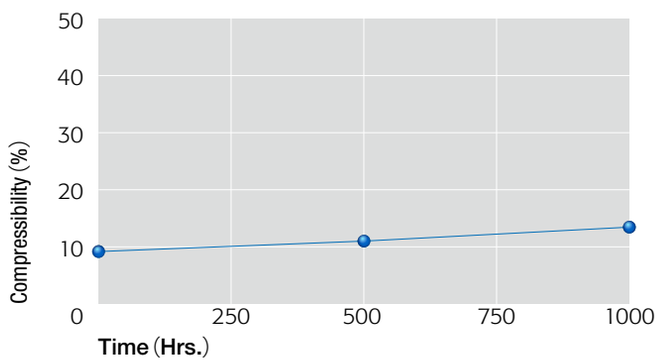


Contact Pressure vs Thermal Resistance

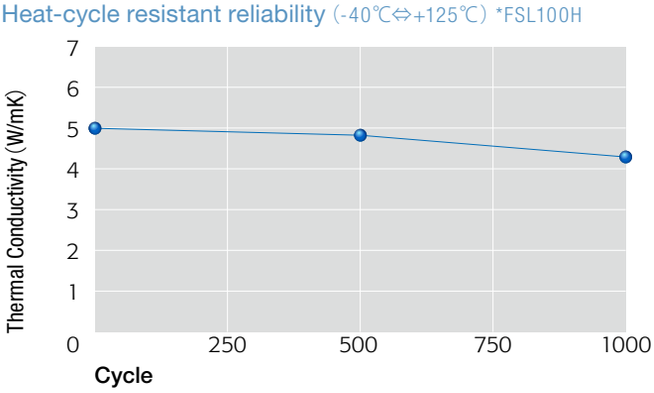


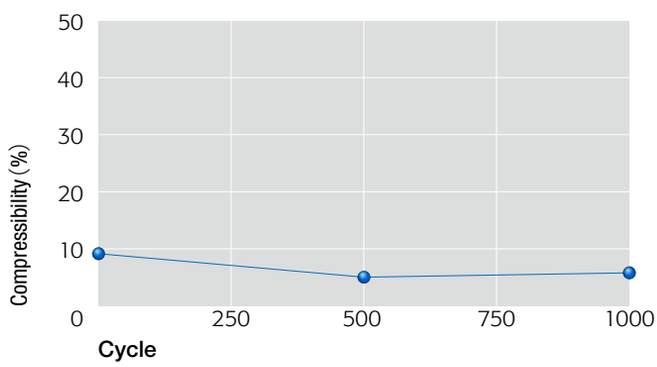
Heat-resistant reliability (150℃) *FSL100H



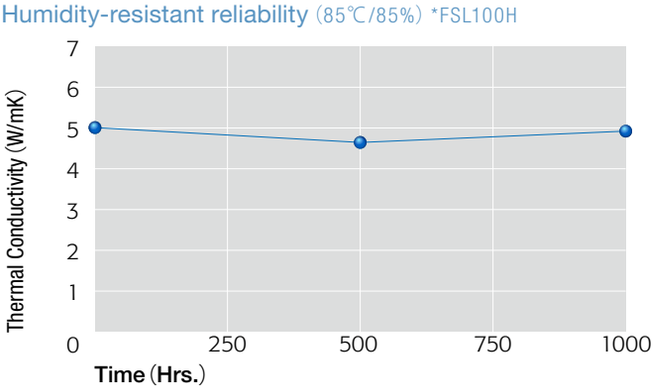


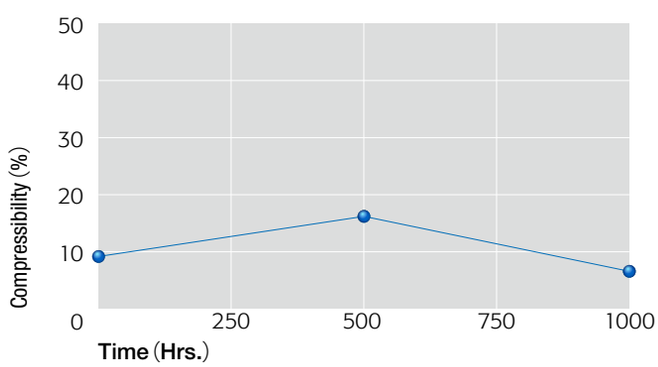
Heat-cycle resistant reliability (-40℃⇔+125℃) *FSL100H





Humidity-resistant reliability (85℃/85%) *FSL100H





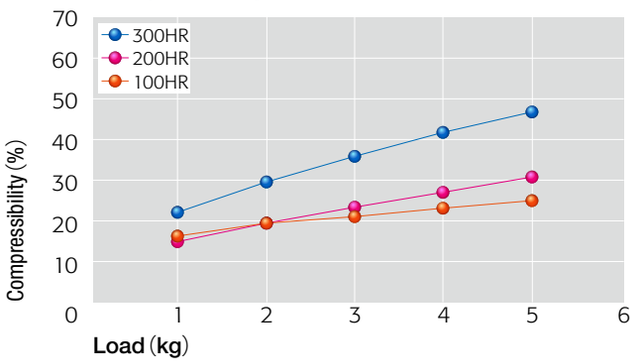
DENKA THERMALLY CONDUCTIVE SPACER FSL-HR

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

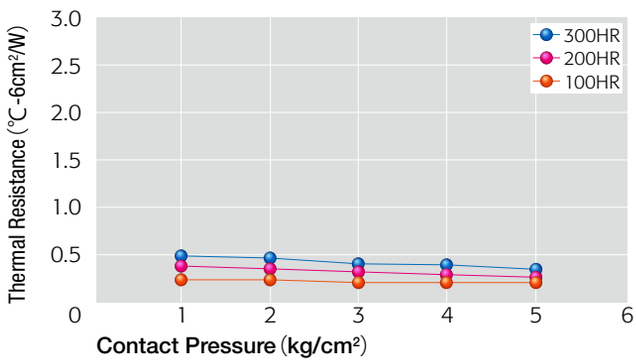
Product Characteristic

Product Data

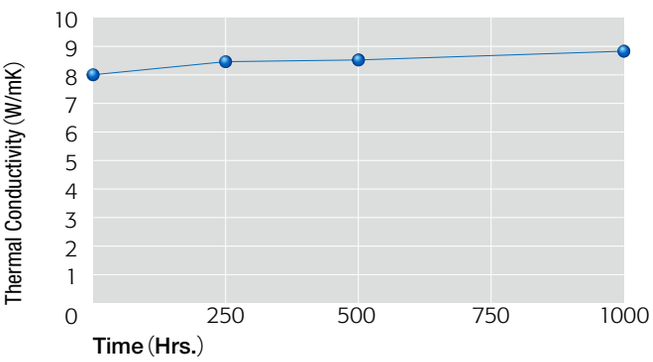
Load vs Compressibility

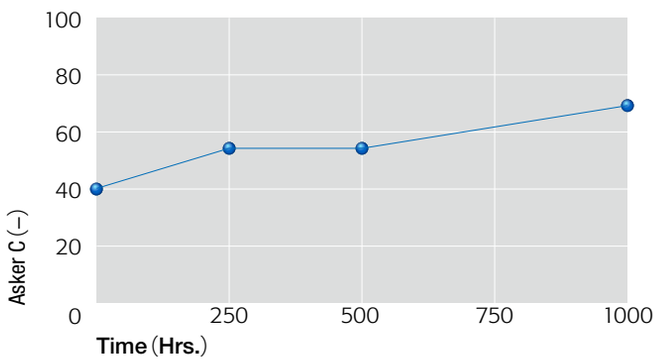


Contact Pressure vs Thermal Resistance

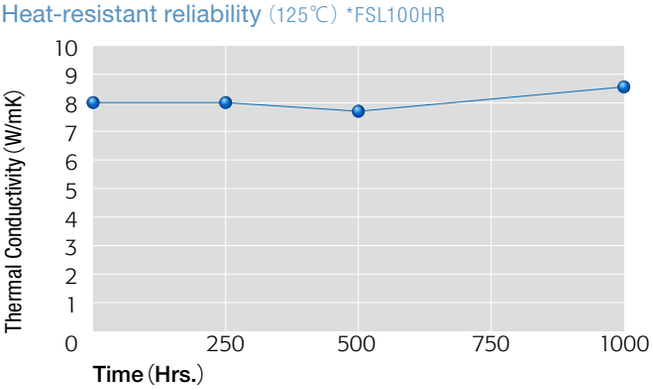


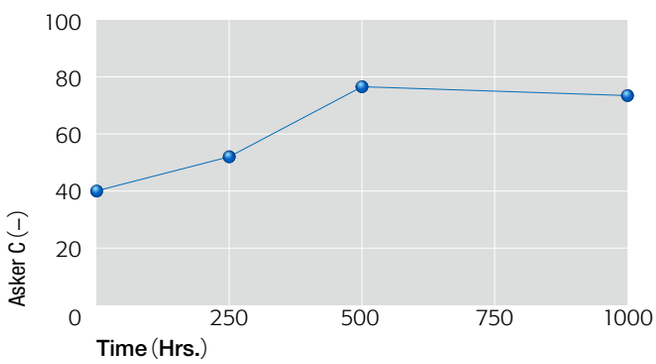
Heat-resistant reliability (100℃) *FSL100HR



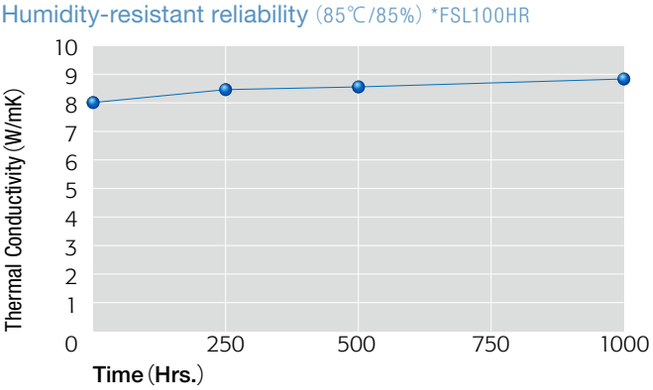


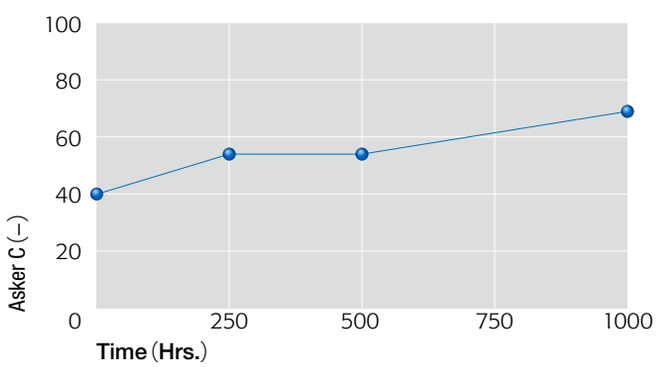
Heat-resistant reliability (125℃) *FSL100HR





Humidity-resistant reliability (85℃/85%) *FSL100HR





THERMALLY CONDUCTIVE GREASE (ONE PART TYPE)
grade lineup

Thermal conductivity 1.5-8.5 W/mK

Item	unit	GFC-N8	GFC-S	GFC-PF3	FCR-H	TSG-W55 (Under Development)	TSG-W80 (Under Development)	Test method
Color	—	Gray	Gray	White	Gray	White	White	Visual
Thermal resistance(BLT)	℃・cm^2/W	0.07	0.52	0.29	0.30	0.22	0.43	ASTM D5470
Thermal resistance(0.1mm)	℃・cm^2/W	0.8	0.68	0.53	0.50	0.22	—	ASTM D5470
Thermal conductivity ※1	W/mK	1.5	2	3	3.3	6.5	8.5	ASTM D5470
Bond Line thickness	μm	7	75	52	72	80	250	—
Viscosity	Pa・s	450	900	22	500	700	500	Share rate 10 (s^{-1}) @25℃
Specific gravity	—	2.9	2.5	3.1	3.1	3.5	3.3	Calculation
Dielectric breakdown voltage	kV/mm	7	> 10	> 10	7	> 10	> 10	JIS C2101
Volume resistance	Ω・cm	1×10^{13}	1×10^{14}	1×10^{14}	1.1×10^{14}	During measurement	During measurement	JIS C2101
Low molecule siloxane	ppm	< 200	< 300	< 100	< 200	< 100	< 300	Σ D5-10
Weight loss	wt%	0.05	0.05	0.05	0.03	< 0.1	0	150℃-24Hrs.
Useful temperature range	℃	−40～125	−40～150	−40～150	−40～130	−40～150	−40～150	—

※ Thermal conductivity isn't including contact resistance.
※ These are typical values and are not guaranteed values.

THERMALLY CONDUCTIVE GREASE (TWO PART TYPE)
grade lineup

Item	unit	GFC-R1		GFC-R55 (Under Development)		Test method
Color	—	A Black	B White	A Pink	B White	Visual
Thermal conductivity	W/mK	3.0		5.5		ASTM D5470
BLT	μm	72		90		—
Viscosity	Pa・s	A 100	B 100	A 90	B 90	Share rate 10 (s^{-1}) @25℃
Specific gravity	—	3.0		3.4		—
Mix ratio	—	1:1				—
Pot life@25℃	h	2.5		2		Rheometer
Cure time@25℃	h	≦24		<24		Rheometer
Hardness	—	30		50		Asker C
Volume resistance	Ω・cm	1.0×10^{13}		1.0×10^{13}		JIS K6911
Dielectric breakdown voltage	KV/mm	>10		>10		JIS C2110
Low molecule siloxane	ppm	< 100		< 300		Σ D3-10
Weight loss	wt%	0		0		150℃−24Hrs.
Useful temperature range	℃	−40～150		−40～150		—

※ Thermal conductivity isn't including contact resistance.
※ These are typical values and are not guaranteed values.

1.5-8.5 W/mK Thermal conductivity

DENKA THERMALLY CONDUCTIVE GREASE (ONE PART TYPE)

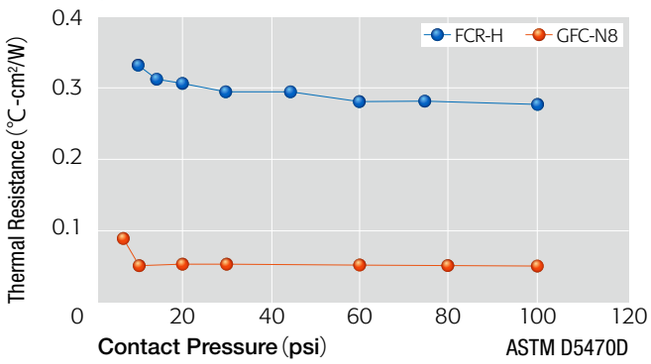
THERMALLY CONDUCTIVE GREASE
FCR-H
GFC-N8

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.

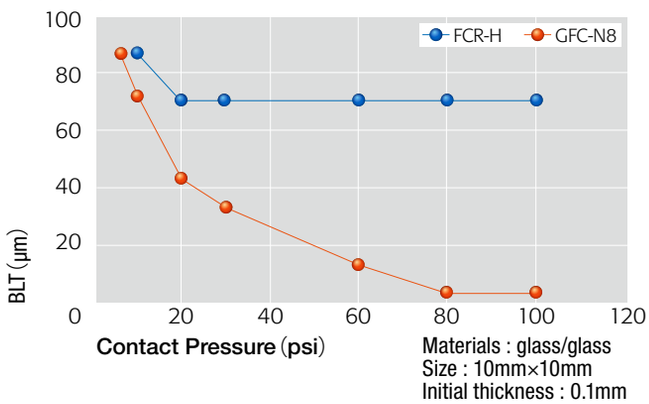
Product Characteristic

Product Data

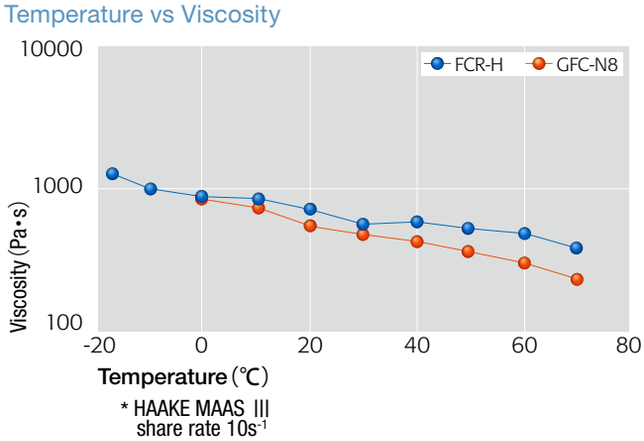
Contact pressure vs Thermal Resistance



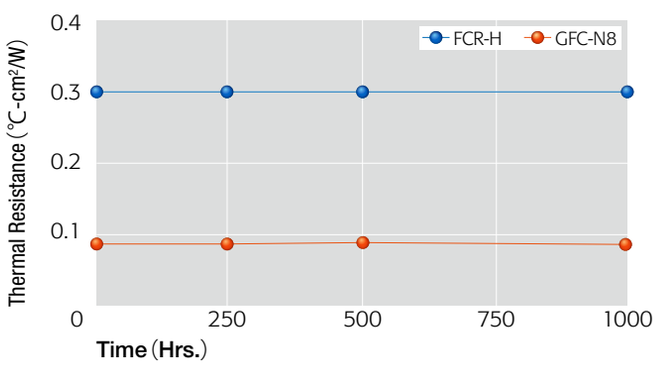
Contact pressure vs BLT



Temperature vs Viscosity

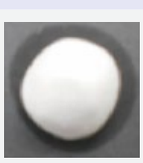


Resistance heat test (@130℃)



TSG-W55, TSG-W80 is no need to cure, and it is difficult to cause falls, cracks, GREASE 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.

THERMALLY CONDUCTIVE GREASE
TSG-W55
TSG-W80

Products	Slip test			Oil bleed test
TSG-W55	500h	2,000h	3,000h	0.5mm
				
TSG-W80	300h	1,000h	2,000h	1.5mm
				

※ Test method of Slip test : -40℃(30min)⇔150℃(30min), Vertical placement, Aluminum×Glass, Dispensing thickness : 2.0mm
※ Test method of Oil bleed test : 0.24cc of grease applied on ground glass, and evaluated the amount of oil bleed after 24h under a 150℃ atmosphere.

DENKA
TWO PART THERMALLY CONDUCTIVE GREASE

THERMALLY CONDUCTIVE GREASE

GFC-R1
GFC-R55

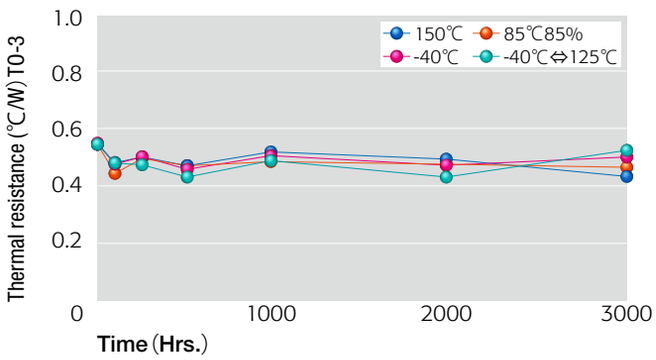
Product Characteristic

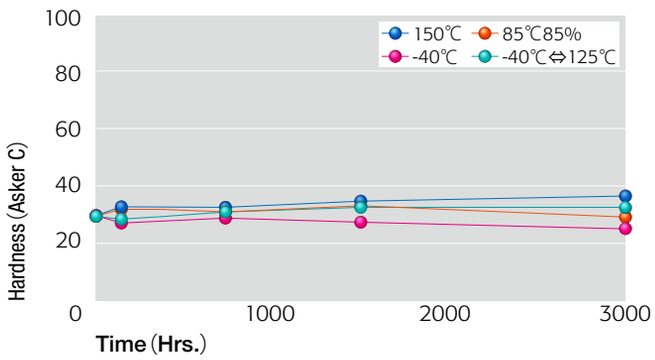
This product combines the advantages of grease and pads. While it is initially liquid when applied, it hardens into a pad-like shape, preventing concerns about pump-out.

GFC-R1

Reliability test

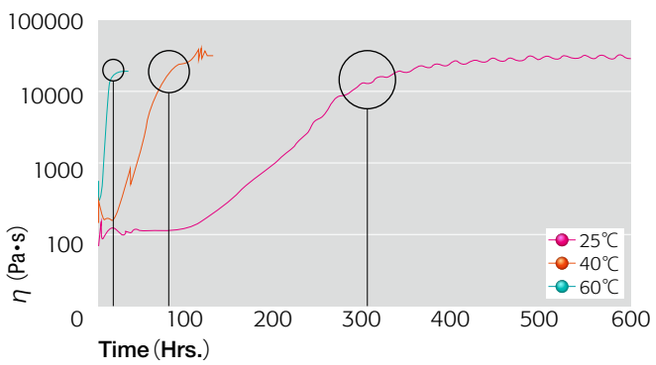
- Mix Agent A and Agent B at a 1:1 ratio to make a 1 mm sheet, and place it under various temperature conditions.
- After a specified period, remove the sheet and measure its thermal resistance and hardness (Asker C).





Curing behavior

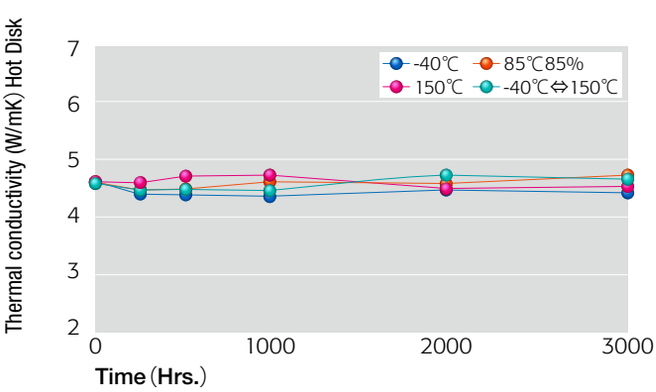
Share rate: 0.1 (1/s)
sample thickness: 0.3mm



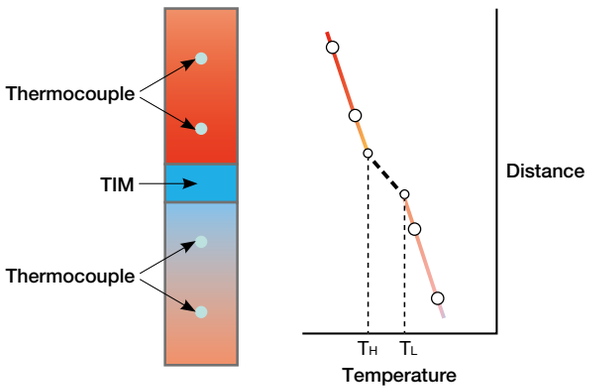
GFC-R55

Reliability test

- Mix Agent A and Agent B at a 1:1 ratio to make a 3mm sheet → place it under various temperature conditions.
- After a specified period, remove the sheet and measure its thermal conductivity (hot disk method).



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 T_H and T_L.

$$\text{Thermal resistance} = \frac{T_H - T_L}{\text{Heat flow ratio}} \qquad \text{Thermal conductivity} = \frac{\text{Thickness of TIM}}{\text{Thermal resistance} \times \text{dimension of TIM}}$$

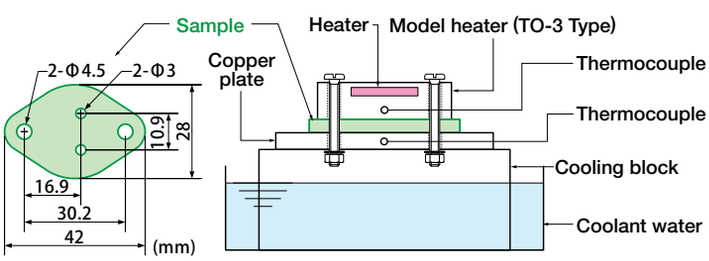
Method of determination for Thermal resistance

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 power 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

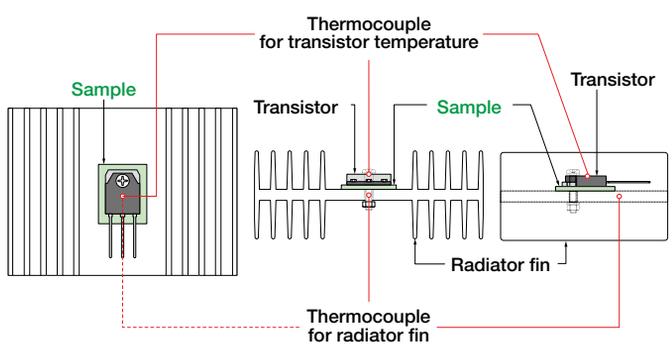
$$\text{Thermal resistance (℃/W)} = \frac{\text{Temperature of heater T1} - \text{Temperature of cooling block T2}}{\text{Applied power (W)}} + \text{Interface resistance}$$

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

Thermal resistance after mounted (Product No. : D-1, D-3, D-6 etc.)

◆Test method (Denka method)

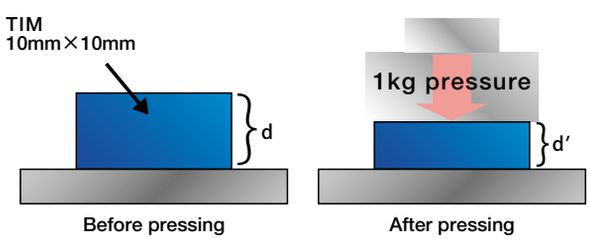
Clipped thermally conductive sheet between a transistor package (TO-3P, TO-3PL, TO-220 shape) and heatsink (Radiator fin).
After tightened a torque and applied power as prescribed, thermal resistance is calculated from temperature difference between a model heater and a heatsink.



$$\text{Thermal resistance (℃/W)} = \frac{\text{Temperature of transistor} - \text{Temperature of heatsink}}{\text{Applied power (W)}} + \text{Interface resistance}$$

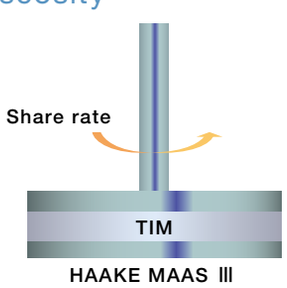
Though we used heatsink applied for ordinal electric power supply, we can change it and do remeasurement as customers' requirement.

Method of Compressibility

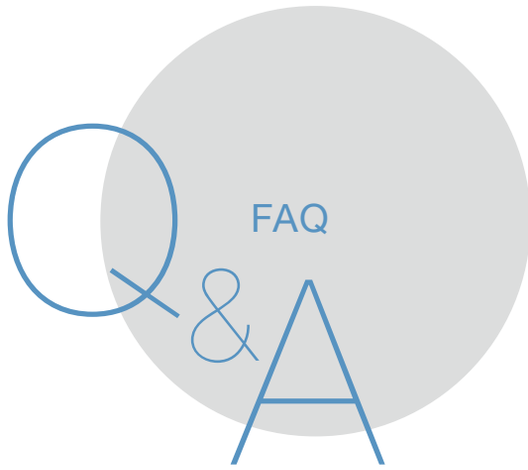


$$\text{Compressibility(\%)} = \frac{d - d'}{d} \times 100$$

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.

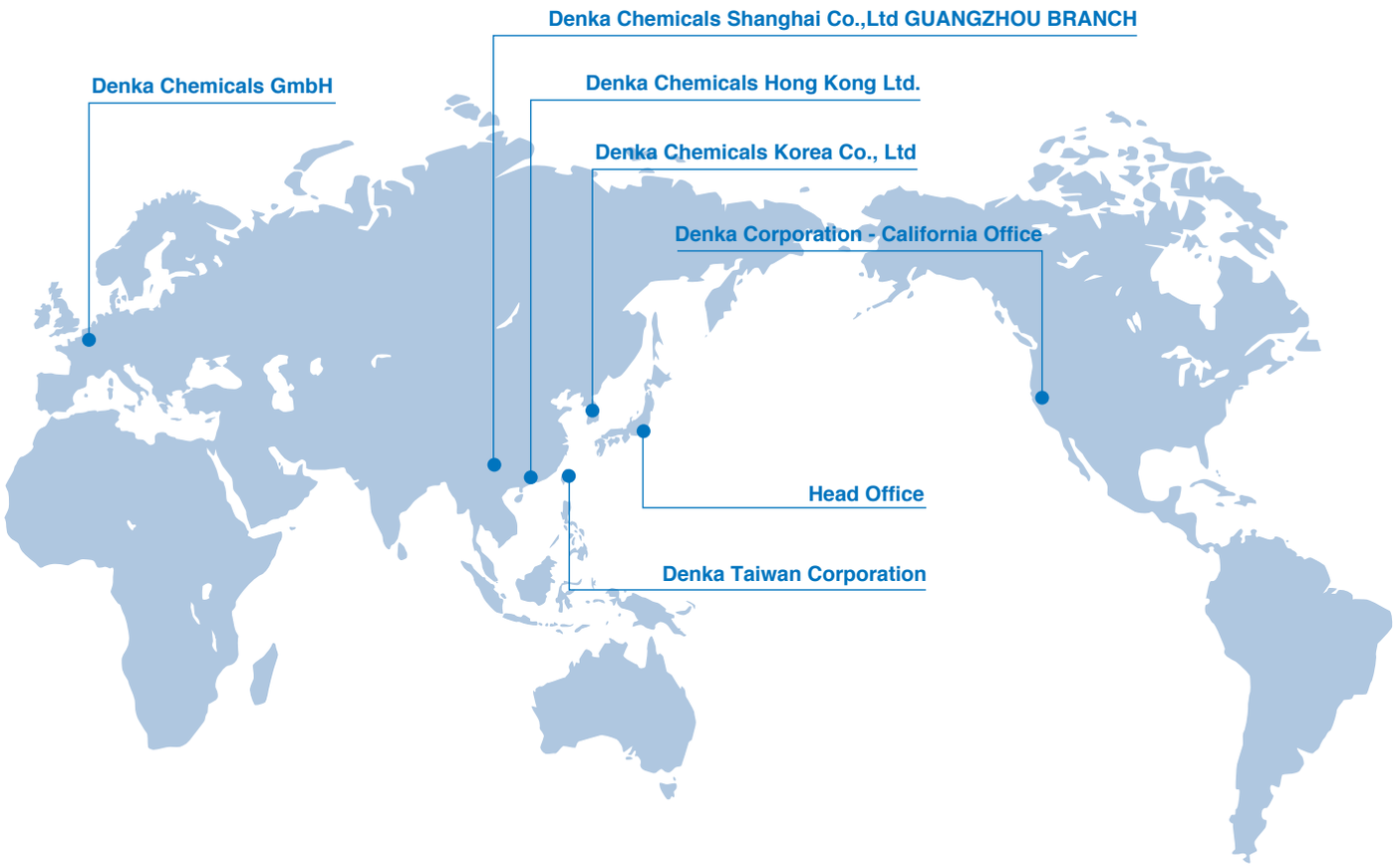
Q What is the way to decrease thermal resistance of DENKA THERMALLY CONDUCTIVE SHEET?

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

■ TIM sales offices



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