Shin-Etsu Silicone Product Guide

4th WEARABLE EXPO

-Wearable Devices & Technology Expo-

Shin-Etsu Silicone

Shin-Etsu Silicone Making Wearable Equipment More Reliable

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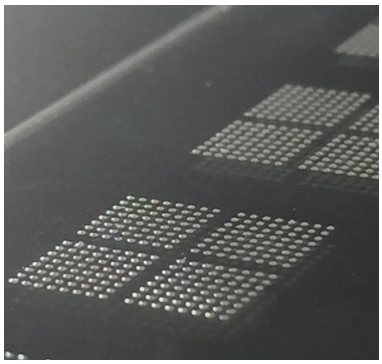
Low Elasticity Silicone Die-bond

KER-6020 Series / KER-3500-P2 / SCR-3400-S7

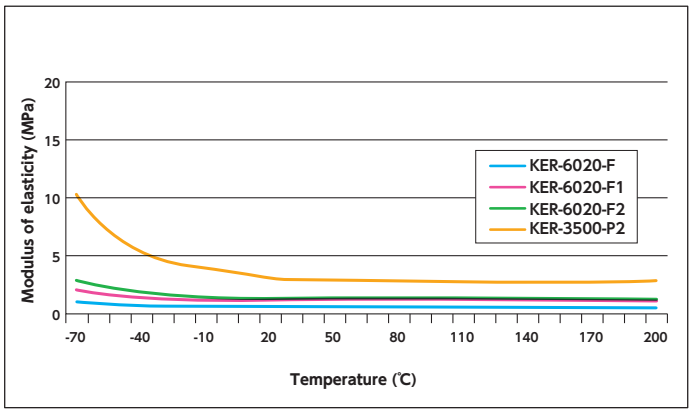
Features

- Rubber elasticity remains consistent from -60℃ to +200℃.
- Consistent application reproducibility can contribute to improved chip mounting accuracy.
- Products available in different viscosities, for a variety of packaging formats.



Application example

■Temperature dependency and modulus

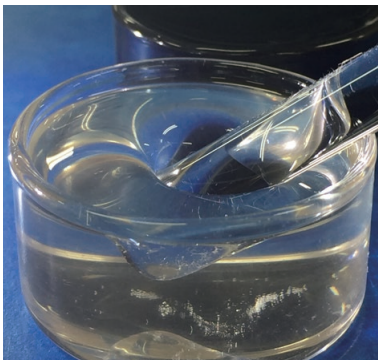


Silicone Gel for Protecting Electrodes

FE-74 / FE-73-BK / KER-6201 / KER-6201-BK / KER-2201 / FE-78-A/B

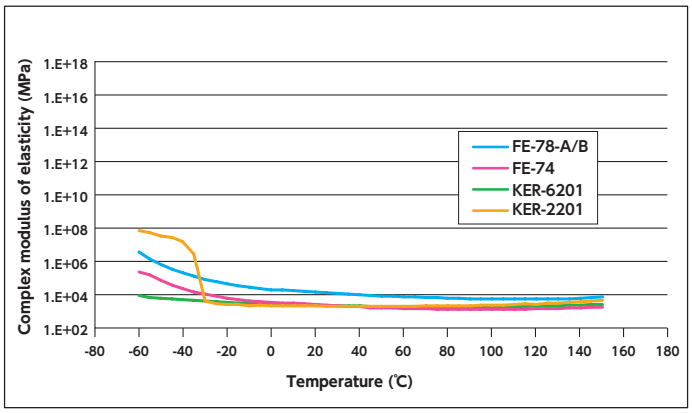
Features

- Gel state remains consistent from -60℃ to +150℃.
- Consistent, precise application using a dispensing or jetting system.
- Solves a variety of issues related to waterproofing specifications of pressure sensors, etc.



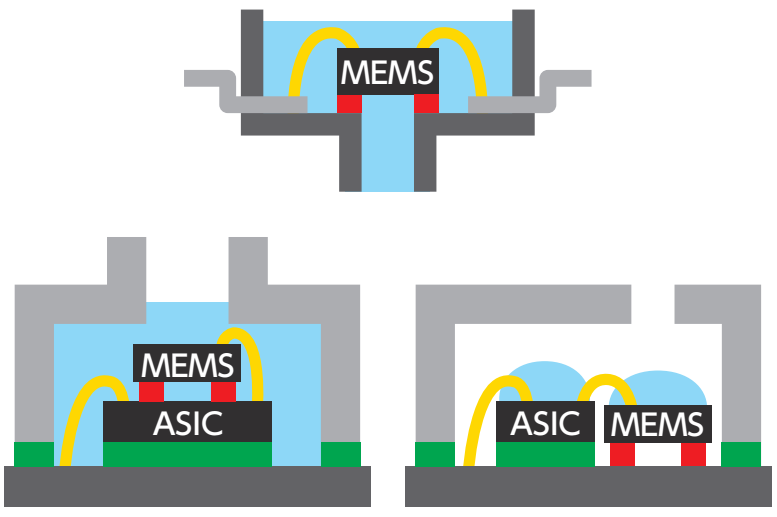
Silicone gel cured samples

■Temperature dependency and modulus

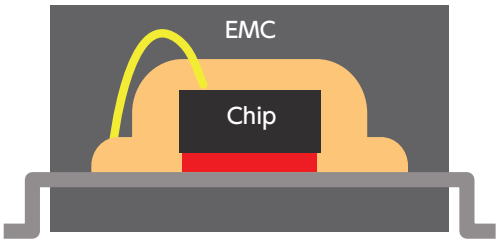


Application examples and product line up

1. Stress sensors, angle/acceleration sensors, MEMS microphones, etc.



2. Epoxy resin molded packages



■Low Elasticity Silicone Die-bond
■Gel for Protecting Electrodes
■Organic Modified Silicone Adhesive
■Polyimide Silicone Silver Paste
■Polyimide Silicone Primer

Low Elasticity Silicone Die-bond

Product list

Parameter \ Product name		KER-6020-F	KER-6020-F1	KER-6020-F2	KER-6020-F2W	KER-3500-P2	KER-3600-D2	FER-3850-D1
Before curing	Appearance	Creamy white translucent			White	Grayish-black	Black	White
	Viscosity at 23℃ Pa•s	23	69	100	100	47	40	65
	Thixotropic ratio (BH7-10/20)	1.3*	1.5	1.6	1.6	-	-	-
	Storage temperature	-10℃ ~ 10℃	-10℃ ~ 10℃	-10℃ ~ 10℃	-10℃ ~ 10℃	-10℃ ~ 10℃	0℃ ~ 5℃	-10℃ ~ 10℃
Standard curing conditions		150℃ × 1h	150℃ × 1h	150℃ × 1h	150℃ × 1h	150℃ × 30min	100℃ × 30min	120℃ × 1h
After curing	Density at 23℃ g/cm³	1.06	1.07	1.09	1.09	1.74	1.20	1.41
	Hardness Durometer A	20	26	31	28	62	41	24
	Elongation at break %	220	230	200	250	100	190	230
	Tensile strength MPa	1.1	1.8	1.7	2.0	5.6	3.0	0.4
	Tensile lap-shear strength MPa	0.3	0.8	1.0	1.0	1.6	1.2	1.5
	Die shear strength (Si/Ag) gf	330	398	560	560	720	-	-
	Coefficient of linear expansion at 23℃ ppm/℃	480	400	360	360	280	-	310
	Modulus of elasticity at 30℃ MPa	0.7	1.1	1.4	1.4	3.1	-	-
	Volume resistivity TΩ•m	53.9	47.7	35.5	35.5	7.3	-	-
	Dielectric breakdown strength kV/mm	25	29	26	26	26	-	-
	Relative permittivity 50Hz	2.9	2.9	3.1	3.1	4.3	-	-
	Dielectric dissipation factor 50Hz	4.9 × 10^{-4}	5.8 × 10^{-4}	6.8 × 10^{-4}	6.8 × 10^{-4}	6.8 × 10^{-4}	-	-

* (BH6-10/20)

(Not specified values)

Polyimide Silicone Silver Paste

Product list

Parameter \ Product name		SMP-2840
One point		Crack resistance
Before curing	Appearance	Gray
	Viscosity at 23℃ Pa•s	30
	Non-volatile content (volume ratio) Wt %	86 (50)
	Solvent	Polyethylene glycol dimethyl ether
	Density at 23℃ g/cm³	3.4
	Storage temperature	-40℃ ~ -20℃
Standard curing conditions		100℃ × 2h + 150℃ × 1h
After curing	Density at 23℃ g/cm³	5.6
	Tg ℃	185
	Coefficient of linear expansion (α1/α2) ppm/℃	40 / 160
	Volume resistivity Ω•cm	5.8 × 10^{-5}
	Thermal conductivity W/m•K	1.0
	Thermal resistance (BLT) mm²•K/W	8 (7μm)
	Die shear strength (Si / Ag) gf	2,200

(Not specified values)

Organic Modified Silicone Adhesive

Product list

Parameter \ Product name		SCR-3400-S7
One point		Strong adhesion, high hardness
Before curing	Appearance	Translucent to white
	Viscosity at 25℃ (BH-viscometer) Pa•s	7
	Storage temperature	-10℃~10℃
Standard curing conditions		150℃×2h
After curing	Density at 23℃ g/cm³	1.16
	Hardness Shore D	78
	Coefficient of linear expansion (α1/α2) ppm/℃	120 / 200
	Tg ℃	80
	Thermal conductivity W/m•K	0.2
	Tensile lap-shear strength (Al/Al) MPa	9.6
	Die shear strength Ag/□33mil (0.834mm) Chip MPa	28

(Not specified values)

Silicone Gel for Protecting Electrodes

Product list

Parameter \ Product name			FE-74	FE-73-BK	FE-78-A / B
One point			Oil and solvent resistance	Black, oil and solvent resistance	Two-component, oil and solvent resistance
Before curing	Appearance		Colorless slightly cloudy	Black	A/B: Colorless transparent
	Viscosity at 23℃	Pa•s	0.7	2.5	A : 0.8 B : 0.6
	Mixed viscosity at 23℃	Pa•s	-	-	0.7
	Specific gravity at 25℃		1.21	1.28	A/B : 1.22
	Storage temperature		-10℃ ~ 10℃	-10℃ ~ 10℃	0℃ ~ 30℃
Standard curing conditions			125℃ × 2h	125℃ × 2h	100℃ × 2h
After curing	Penetration 1/4 cone		90	65	65
	Volume resistivity	TΩ•m	0.02	0.02	0.005
	Dielectric breakdown strength kV/mm		14	14	14
	Relative permittivity 50Hz		7.0	7.0	7.0
	Dielectric dissipation factor 50Hz		1×10^{-1}	2×10^{-1}	1×10^{-2}
	Complex shear modulus 10Hz	Pa	1,200	6,000	13,000

(Not specified values)

Parameter \ Product name			KER-6201	KER-6201-BK	KER-2201
One point			Cold resistance	Black, cold resistance	Degasses easily
Before curing	Appearance		Colorless slightly cloudy	Black	Colorless transparent
	Viscosity at 23℃	Pa•s	0.8	0.8	0.8
	Specific gravity at 25℃		0.98	0.98	0.97
	Storage temperature		-10℃ ~ 10℃	-10℃ ~ 10℃	-10℃ ~ 10℃
Standard curing conditions			100℃ × 2h	100℃ × 2h	100℃ × 2h
After curing	Penetration 1/4 cone		90	90	65
	Volume resistivity	TΩ•m	8.0	2.0	10
	Dielectric breakdown strength kV/mm		14	14	14
	Relative permittivity 50Hz		3.0	2.8	3.0
	Dielectric dissipation factor 50Hz		5×10^{-4}	3×10^{-4}	5×10^{-4}
	Complex shear modulus 10Hz	Pa	2,200	2,200	2,000

(Not specified values)

Polyimide Silicone Primer

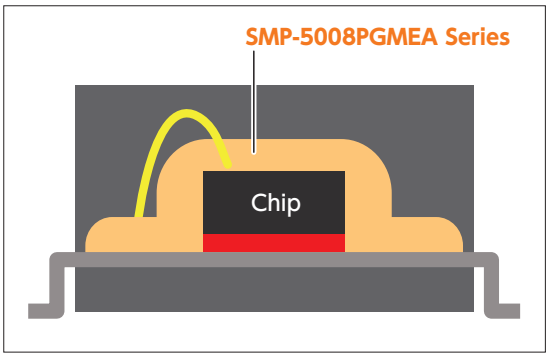
SMP-5008PGMEA Series

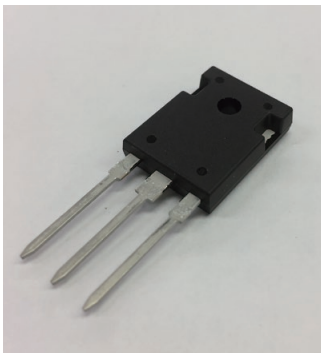
Features

●Excellent adhesion to epoxy molding resins and metal frames
●Products available in different viscosities for a variety of packaging formats
●Cures to become an elastic film. Can be effective as a stress-relieving layer.

Application examples

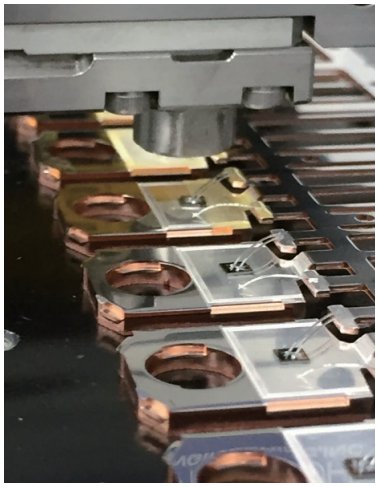
●For ICs in power & logic circuits, capacitors, sensors, thermistors, etc.

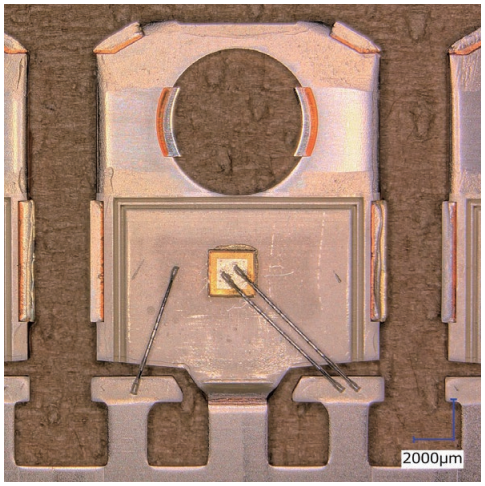


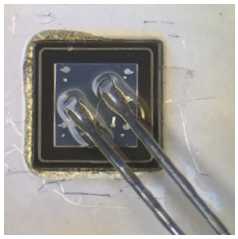


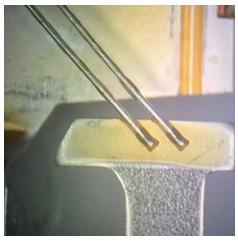
Instructions for use

●Apply using jetting system, pressurized dispenser, spraying, dipping, etc.



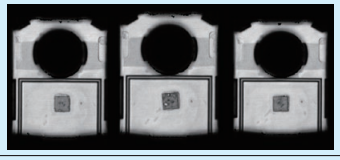
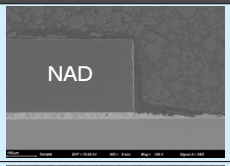
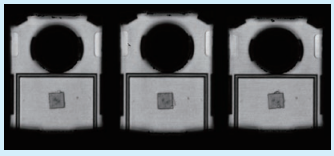
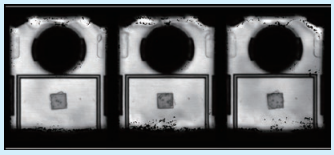
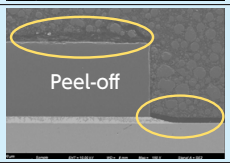






Evaluating adhesion to lead frames & epoxy molding resins

●**Moisture/reflow sensitivity test (MSL-1)** : 85℃ / 85%RH×168h ⇒ Reflow cycle performed 3 times
●**Package** : TO-247 (Substrate: AMB Cu-SiN, Chip: SiC-SBD)

Appearance / Conditions	Before testing	After testing	
	SAT results	SAT results	SEM images of cross sections
Treated with SMP-5008PGMEA			
Untreated			

Polyimide Silicone Primer

Product list

Parameter \ Product name			SMP-5008PGMEA	SMP-5008PGMEA-M1	SMP-5008PGMEA-M3
Before curing	Appearance		Reddish brown		
	Viscosity at 25℃	Pa•s	0.3	1.0	3.0
	Non-volatile content 105℃×3h	wt%	30	32.7	33.5
	Specific gravity at 25℃		1.03	1.03	1.03
	Solvent		Propylene glycol monomethylether acetate		
Standard curing conditions			50℃×30min+100℃×1h+150℃×2h		
After curing	Tensile strength	MPa	20	13	14
	Elongation at break	%	360	290	290
	5% weight reduction temperature	℃	360	420	380
	Modulus of elasticity at 25℃	MPa	200	100	150
	Tg	℃	120	90	98
	Coefficient of liner expansion at 25℃	ppm	200	250	242
	Volume resistivity	TΩ•m	45	58	71
	Dielectric breakdown strength	kV/mm	14	14	14
	Relative permittivity 50Hz		2.5	2.4	2.8
	Dielectric dissipation factor 50Hz		3.4×10^{-3}	3.2×10^{-3}	3.2×10^{-3}
	Moisture absorption ratio 85℃ / 85%RH × 24h	%	< 0.1	< 0.1	< 0.1

(Not specified values)

Thermally Conductive Silicone Greases

G-77X Series / G-1000 / CLG Series / SDP Series

Features

●CLG Series: one-component, non-curing greases with excellent resistance to pump-out.

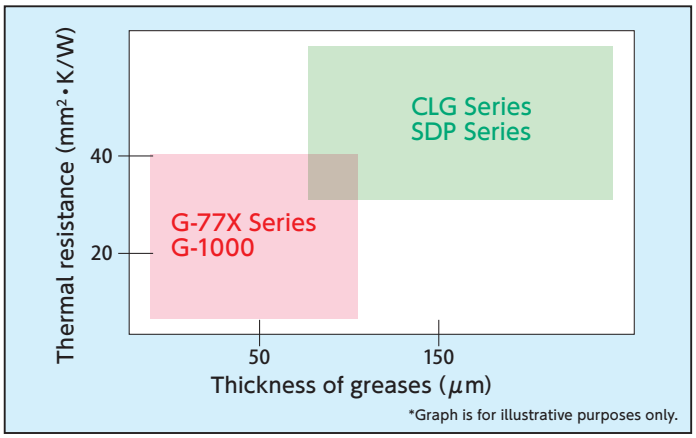
●SDP Series: two-component, addition-cure greases with thermal conductivities up to 6.5 W/m•K.

●G-77X Series: can achieve very thin bond lines for lower thermal resistance.

Product type

Product name	G-77X Series	G-1000	CLG Series NEW	SDP Series NEW
Type	One-component			Two-component
	Non-curable type	Curable type (Addition, condensation)	Non-curable type	Curable type (Addition)
Features	Low thermal resistance		Gap filler	

Relationship between thermal resistance and thickness of greases



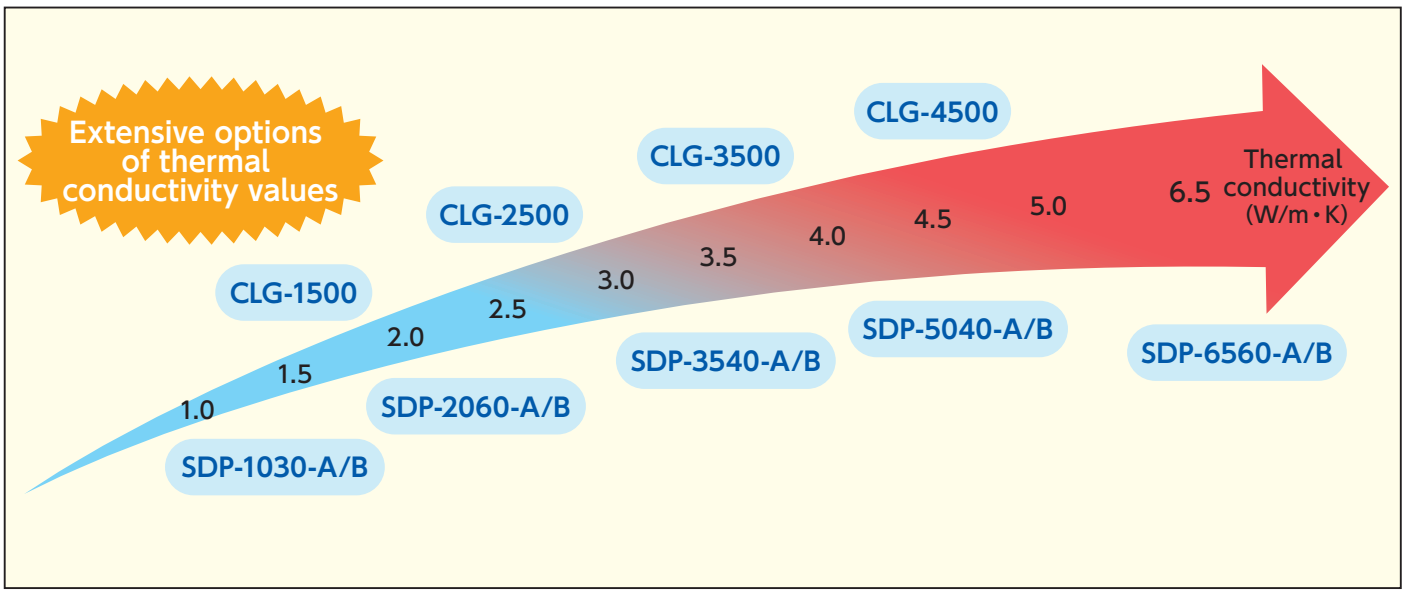
*Graph is for illustrative purposes only.

Pump-out test results of gap filler

Product name	CLG Series
Test result	 No pump-out and creeping detected Thickness :2mm

Test conditions : -40℃×30min ⇔125℃×30min, Test pieces are placed vertically.

Ranking of gap filler and thermal conductivity



Thermally Conductive Silicone Greases

Product list

Parameter \ Product name	G-775	G-776	G-777	G-779	G-1000
Appearance	White				
Specific gravity at 25℃	3.4	2.9	3.2	3.2	3.04
Viscosity at 25℃ Pa•s	500	60	140	160	80
Hardness after curing Asker C	-	-	-	-	40
Thermal conductivity W/m•K	3.6	1.3*	3.3	3.0	2.4
Dielectric breakdown strength 0.25mm kV	2.5	2.9	3.2	3.2	3.6
Use temperature range ℃	−40～+150	−40～+200	−40～+200	−40～+200	−40～+180
Volatile content 150℃×24h %	0.26	3.10	0.1	0.18	0.58
Low-molecular-weight siloxane content ΣD_3-D_{10} ppm	<300	<100			

* Value after evaporation of solvent.

(Not specified values)

Parameter \ Product name	CLG-1500	CLG-2500	CLG-3500	CLG-4500
Appearance	White			
Specific gravity at 25℃	2.6	2.9	3.1	3.2
Viscosity at 25℃ Pa•s	500	500	250	550
Thermal conductivity W/m•K	1.5	2.9	3.5	4.8
Dielectric breakdown strength kV/mm	9.6	6.2	8.9	4.7
Use temperature range ℃	−40～+180			
Low-molecular-weight siloxane content ΣD_3-D_{10} ppm	<300			

(Not specified values)

	Parameter \ Product name	SDP-1030-A/B	SDP-2060-A/B	SDP-3540-A/B	SDP-5040-A/B	SDP-6560-A/B
Before curing	Appearance	A:White / B:Pale blue		A:White / B:Gray	A:Grayish white / B:Pink	
	Viscosity * at 25℃ Pa•s	A:102 B:55	A:99 B:71	A:103 B:72	A:181 B:162	A:282 B:288
	Mix ratio	100:100				
	Mixed viscosity * at 25℃ Pa•s	74	81	89	169	284
	Pot life at 23℃ min	240				
	Specific gravity at 25℃	A/B:2.45	A/B:2.87	A:3.08 / B:3.07	A:3.25 / B:3.26	A/B:3.20
Standard curing conditions		25℃×24h				
After curing	Hardness Shore OO	32	57	44	42	61
	Tensile strength MPa	0.3	0.3	0.1	0.1	0.1
	Elongation at break %	480	70	40	30	20
	Dielectric breakdown strength kV/mm	19	18	20	21	20
	BLT μm	7	107	105	108	155
	Thermal resistivity (BLT) mm²•K/W	11.4	52.7	33.9	23.5	25.8
	Thermal conductivity W/m•K	1.1	2.3	3.5	5.1	6.5
	Low-molecular-weight siloxane content ΣD_3-D_{10} ppm	<300				

* Malcom viscometer 10 rpm

(Not specified values)

Visible Light Shield Silicone Encapsulant

AIR-7050-A/B

Features

●Shielding light wavelength up to 650 nm.
Light wavelength over 700nm is transmissive.
●Dicing process is possible due to high hardness.
●High elongation provides high reliability

Visible light shielding

Application examples

●Infrared devise encapsulant

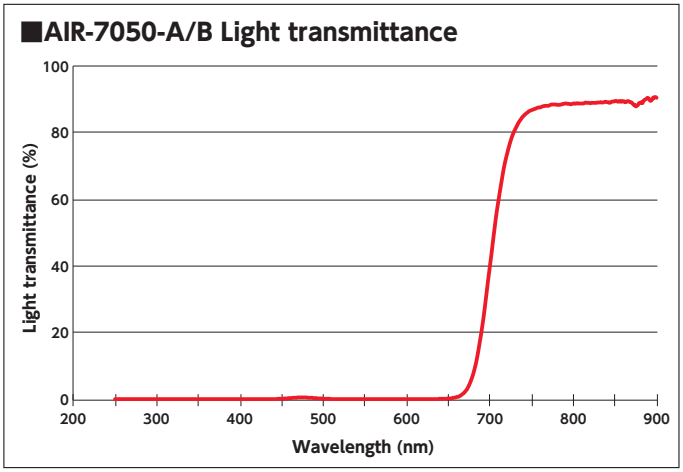
General properties

Parameter \ Product name			AIR-7050-A/B
Before curing	Appearance		A: Colorless slightly cloudy B: Black
	Viscosity at 25℃	Pa•s	A:7.5 / B:0.1
	Mix ratio		A:1 / B:9
	Mixed viscosity at 25℃	Pa•s	0.2
Standard curing conditions			100℃×1h⇒150℃×4h
After curing	Hardness Durometer D		45
	Elongation at break	%	220
	Tensile lap-shear strength (Al/Al)	MPa	3.9
	Tg	℃	33
	Coefficient of linear expansion ppm	α1	70
		α2	370

(Not specified values)

Light transmittance data

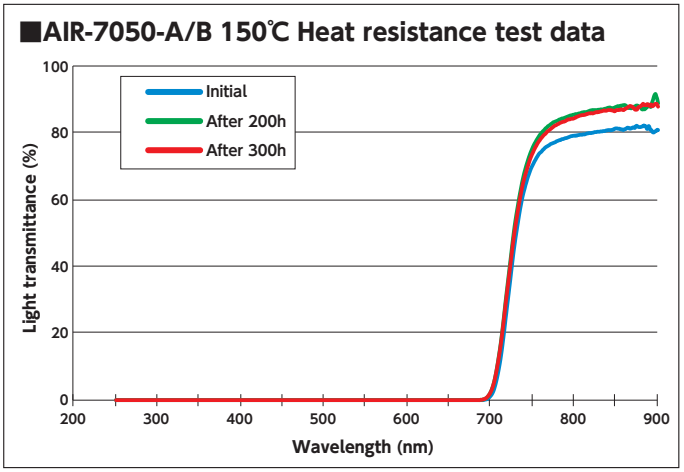
■AIR-7050-A/B Light transmittance



※Film thickness 0.4mm

Heat resistance data

■AIR-7050-A/B 150℃ Heat resistance test data



※Film thickness 2.0mm

UV Cure Silicones

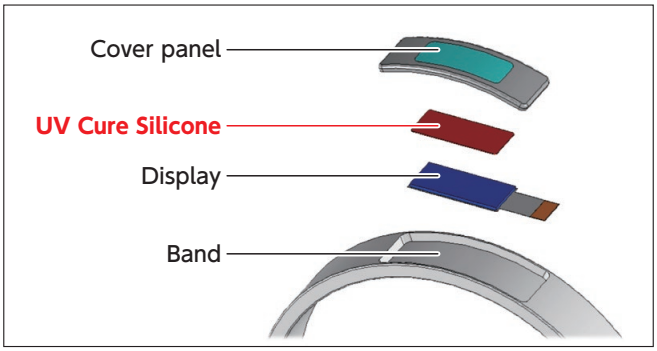
Types and features of UV cure silicones

Cure type	Features
Radical reaction	Rapid cure
Platinum addition reaction	Delayed cure
Radical + condensation reaction	Curable in the shade

Application examples

●Touch panels lamination

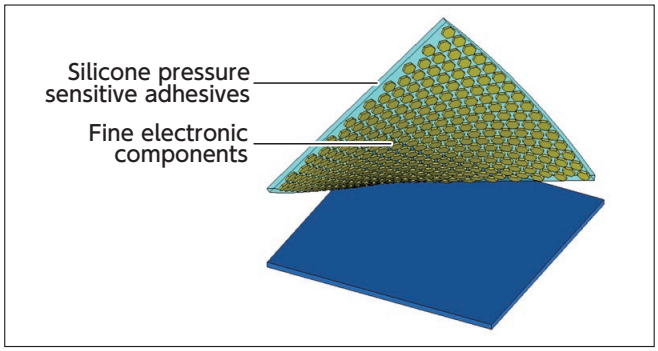
Products : Optical bonding silicones
Cure type : **Platinum addition reaction**



Car navigation system touch panels

●μ-LED transfer silicone pad

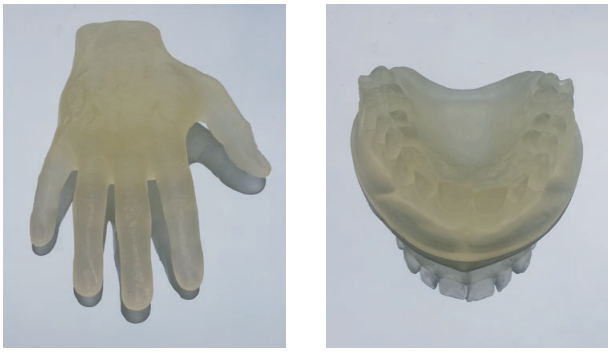
Products : UV cure silicone pressure sensitive adhesives
Cure type : **Radical reaction**



Display

●3D printer molding

Products : UV cure molding silicones
Cure type : **Radical reaction**



Examples of molded parts

●Setting electrical parts

Products : UV cure silicone sealing materials
Cure type : **Radical reaction**
Platinum addition reaction
Radical + condensation reaction

Digital single lens reflex

Optical Bonding Siilcones

KER-4550 / KER-4531 / KER-4532 / KER-4580

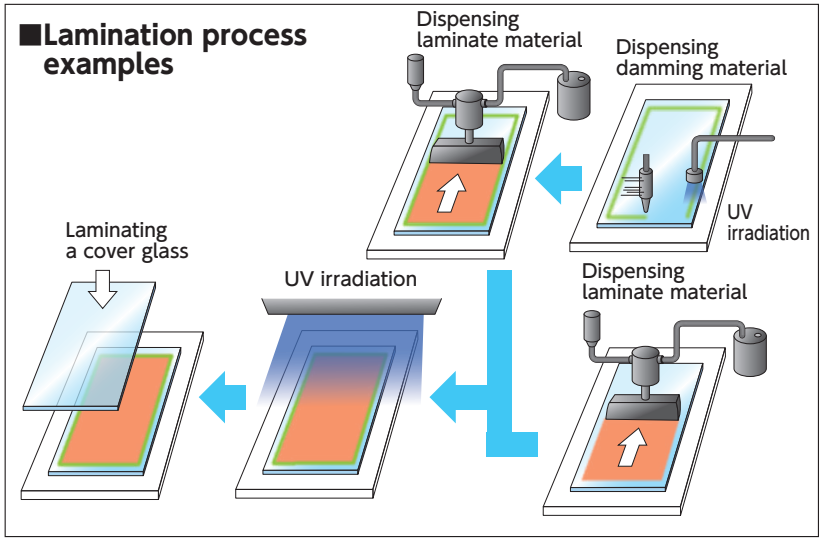
Features

●Can be processed after UV irradiation

●Heating will reduce cure time.

Application examples

●Laminating touch panels etc..

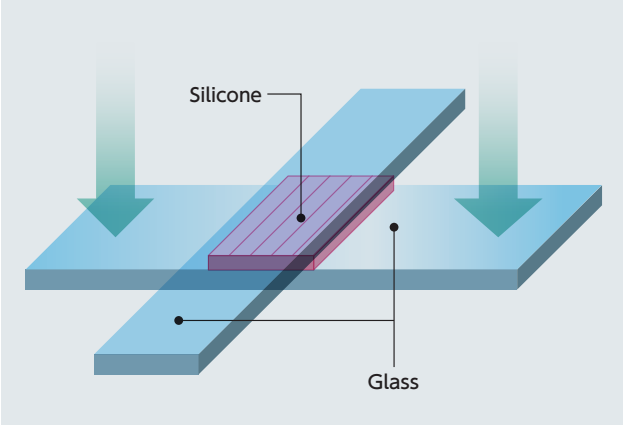


Product list

Parameter \ Product name			KER-4550	KER-4531	KER-4532	KER-4580
Brief description			Low viscosity	Medium viscosity	High viscosity	Thixotropic
Before curing	Cure type		Addition			
	Appearance		Colorless transparent	Colorless transparent	Colorless transparent	Colorless slightly cloudy
	Viscosity at 25℃	Pa•s	10	25	95	4.8
	Refractive index		1.40	1.41	1.41	1.44
Recommended curing conditions	UV light source		Metal halide lamp			
	Illuminance	mW/cm²	100			
	Irradiation time	sec	30			15
	Estimated light intensity	mJ/cm²	3,000			1,500
After curing	Hardness (penetration)		30	30	35	40
	Cross adhesion strength (Glass / Glass)	MPa	0.27	0.36	0.30	-

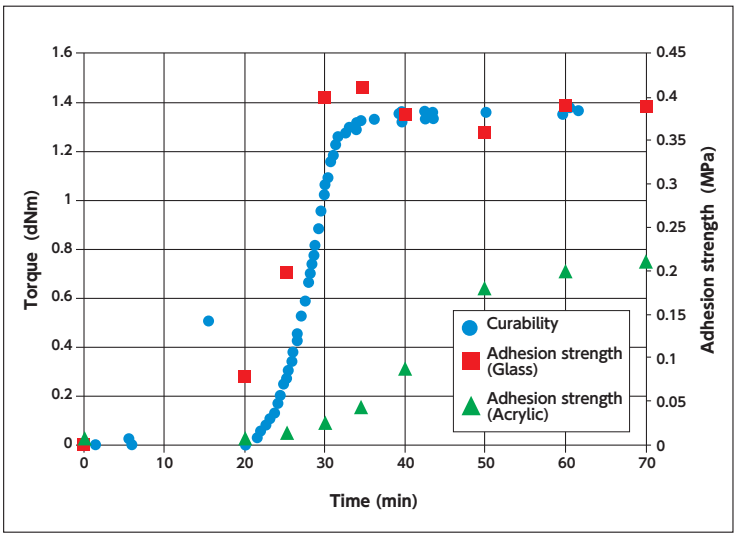
(Not specified values)

Cross adhesion strength measurement method



Test method:
Two sheets of glass are stuck together in a cross shape, then the force required to pull them apart is measured.
Adhesion area : 500 mm² (25mm×20 mm)
Application thickness : 230μm
Pulling speed : 5 mm/min

Curability of UV addition type



UV Cure Silicones for Molding

KED-1P / KED-2P / KED-3P

Features

●Rapid cure using UV irradiation

●Hardness can be adjusted by mixing KED-1P and KED-2P

●Can be molded since adhesion is not developed.

Examples of molded parts

Application examples

●Molding resins

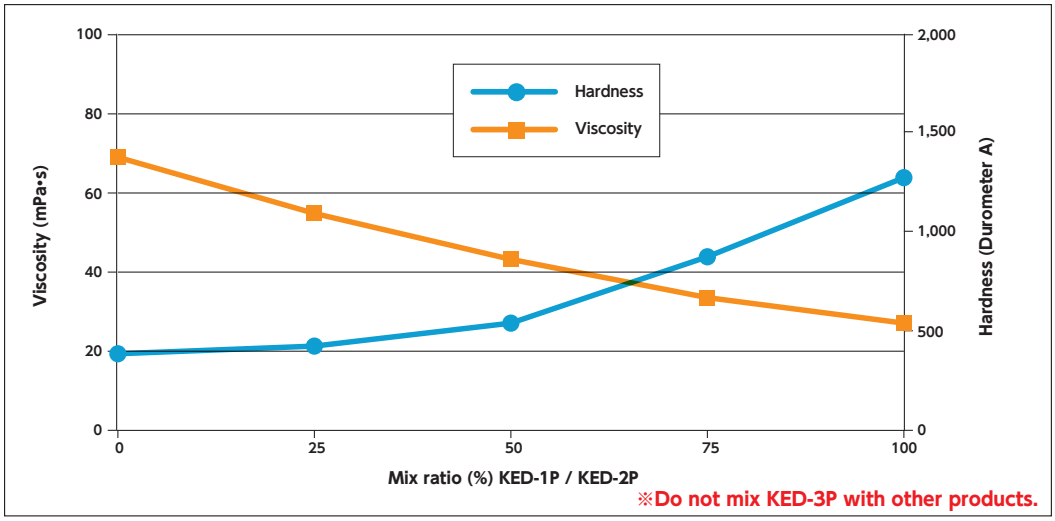
Product list

項目 ＼ 製品名			KED-1P	KED-2P	KED-3P
Brief discriptions			High viscosity, low hardness	Low viscosity, high hardness	Low viscosity, very low hardness
Before curing	Cure type		Radical		
	Appearance		Pale yellow transparent		
	Viscosity	mPa•s	1,380	540	610
	Refractive index		1.46	1.46	1.45
Recommended curing conditions	UV light source			Metal halide lamp	
	Illuminance	mW/cm²	100 (365nm monitor)		
	Irradiation time	sec	40		
	Estimated light intensity	mJ/cm²	4,000		
After curing	Density at 23℃	g/cm³	1.04	1.06	1.03
	Hardness Durometer A		19	64	10
	Tensile strength	MPa	1.2	6.5	0.6
	Elongation at break	%	230	310	230
	LED-UV applicability		365nm/405nm		

(Not specified values)

Properties depend on blend ratio

Hardness can be adjusted by mixing KED-1P and KED-2P.



※Do not mix KED-3P with other products.

UV Cure Silicone Pressure Sensitive Adhesives

STP-101-UV / STP-102-UV / STP-103-UV / STP-104-UV

Features

- Rapid cure
- Wide product lineup for adhesive strength and hardness
- Stable adhesion and restorability

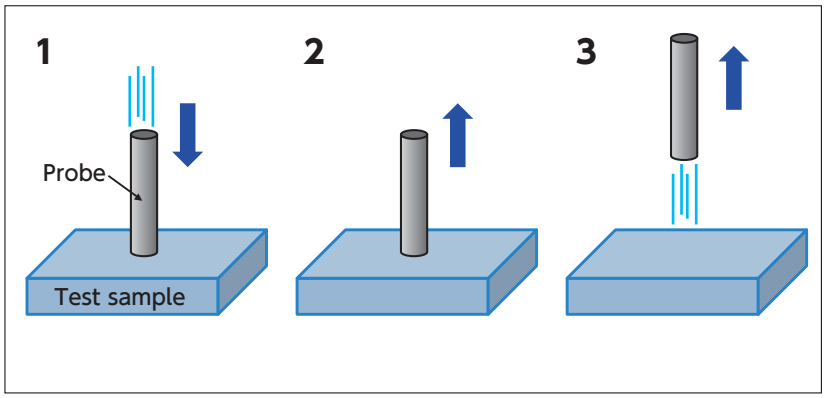
Product list

Parameter \ Product name			STP-101-UV	STP-102-UV	STP-103-UV	STP-104-UV
Before curing	Cure type		Radical			
	Appearance		Pale yellow transparent			
	Viscosity	mPa·s	510	1,650	170	290
	Refractive index		1.42	1.42	1.43	1.43
Recommended curing conditions *	UV light source		LED-UV(365nm)			
	Illuminance	mW/cm²	100			
	Irradiation time	sec	80			
	Estimated light intensity	mJ/cm²	8,000			
After curing	Density at 23℃	g/cm³	1.06	1.08	1.05	1.08
	Hardness Durometer A		20	24	28	37
	Tensile strength	MPa	1	2.8	2.8	4.1
	Elongation at break	%	190	250	210	240
	Adhesive strength 200mm/min	MPa	0.41	1.3	0.62	2.07
	Curing shrinkage ratio	%	0.9	0.8	1.7	2

*Under N2 atmosphere.

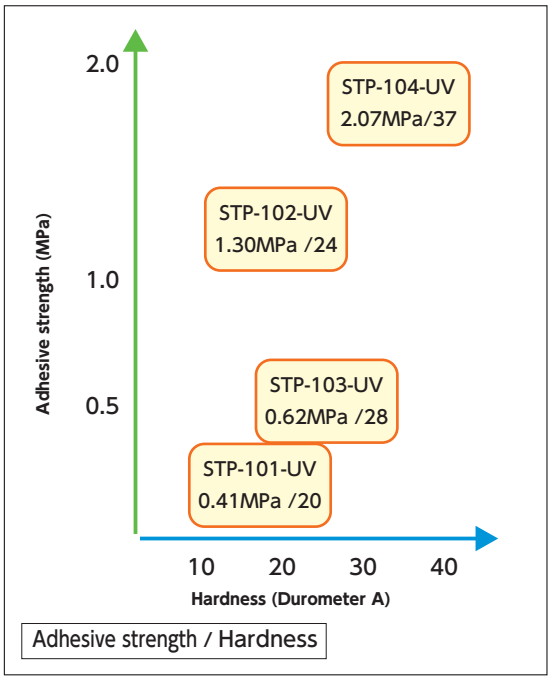
(Not specified values)

Adhesive strength measurement method



Test method :
1.Place the silicone sample on the stage and apply a probe to the sample with 1.0 MPa force for 15 sec.
2. Pull the probe from the sample at constant rate (200 mm/min).
Maximum stress is measured while pulling the probe from the sample.
The maximum strength equals adhesive strength.

Ranking of products



UV Cure Silicone Sealing Materials

KER-4700-UV / SMP-7004-3S / KER-4410 / KE-4835

Features

●From 3 curing types, you can choose products suitable for your application and production process.

●These products have unique silicone features

(e.g. heat and cold resistance or electrical insulation property etc..)

Application examples

●Setting electrical parts (e.g. VCM of digital cameras)

●Liquid gaskets etc..

Types and features of UV cure silicones

Curing type	Advantages	Disadvantages	Cure inhibition factors
Radical reaction	Instantly cures after UV irradiation	If UV rays do not reach applied parts, the parts will not cure. Nitrogen atmosphere is recommended.	Oxygen
Platinum addition reaction	Delay curing Workable under ambient atmosphere	Cold storage	Sulfur, phosphorus, nitrogen compounds or acid, alcohol etc..
Combination of radical and condensation reaction	Regions not exposed to UV will cure with moisture.	Storage stability Cold storage	Oxygen

Product list

Parameter \ Product name		KER-4700-UV	SMP-7004-3S	KER-4410	KE-4835
Cure type		Radical	PI-Si Radical	Addition	Radical + condensation
Appearance		Pale yellow transparent	Yellow transparent	Colorless slightly cloudy	Milky white translucent
Viscosity Pa•s		0.05	2	59	6
Recommended curing conditions	UV light source	Metal halide lamp	Metal halide lamp	LED-UV(365nm)	Metal halide lamp
	Illuminance mW/cm²	100	36	100	100
	Irradiation time sec	10	55	30	20
	Estimated light intensity mJ/cm²	1,000	1,980	3,000	2,000
Curing condition after UV irradiation		-	-	80℃×1h	23℃/50%RH×3days
Hardness Durometer A		92	180MPa*	15	27
Tensile lap-shear strength MPa•s Thickness 2mm		7.9(Glass/Glass)	NA	7.9(Al/Al)	0.3(Glass/Glass)
Note		Cure inhibition occurs with oxygen.	-	-	Releases by-product gas during cure.

*Elasticity

(Not specified values)

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The Development and Manufacture of Shin-Etsu Silicones are based on the following registered international quality and environmental management standards.

Gunma Complex	ISO 9001 ISO 14001 (JCQA-0004 JCQA-E-0002)
Naoetsu Plant	ISO 9001 ISO 14001 (JCQA-0018 JCQA-E-0064)
Takefu Plant	ISO 9001 ISO 14001 (JQA-0479 JQA-EM0298)

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