Shin-Etsu

Shin-Etsu Silicone

RTV Silicone Rubber
for Electrical & Electronic Applications

Safe and eco-friendly

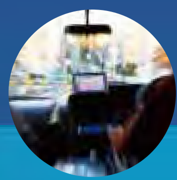
RTV Silicone Rubber

Making electrical & electronic equipment more reliable.

Electronic devices and electrical modules are constantly evolving in performance and functionality while becoming smaller and more lightweight. At the same time, “green design” has become the norm. These factors have created a demand for materials that offer higher quality, higher functionality and more eco-friendly properties.

- Improving the reliability of today’s safer, greener car electronics
- Boosting the reliability of next-generation energy systems including solar cells, wind power, and fuel cells
- Boosting the reliability of PCUs (Power Control Units), which are essential to making consumer electronics, hybrid vehicles, electric vehicles and railways more energy efficient; and that of power modules including power conditioners, which are critical components of alternative energy systems including solar and wind power
- Telecommunications and optoelectronics, including eco-friendly LEDs
- Thermal interface technologies that help protect electronic devices from heat

These and many other leading-edge technologies would not exist without RTV silicone rubber. At Shin-Etsu, we’re developing RTV rubber products that contribute to more comfortable living and to advancements in eco-friendly electronics technology.



CONTENTS

Silicones have an amazing array of properties.

Silicones consist of a main chain of inorganic siloxane linkages (Si-O-Si) plus side chains which contain organic groups. **Silicones are hybrid polymers that contain both inorganic and organic components.**

The main chain of a silicone consists of siloxane linkages which are stable and have a high bonding energy.

Compared to organic polymers, which have a carbon skeleton (C-C/bonding energy: 85 kcal/mol), silicones have superior **heat resistance and weatherability** (UV light, ozone). This is due to the greater stability of siloxane bonds, which have a bonding energy of 106 kcal/mol.

With their long bond length and high bond angle, siloxane bonds have weak intermolecular forces and move freely.

Siloxane bonds have a bond length of 1.64 Å and bond angle of 134°. Compared to carbon bonds (bond distance: 1.54 Å, bond angle: 110°), they have a long bond distance and high bond angle, and a low rotational energy barrier. As a result, siloxane bonds move more freely and intermolecular forces are weak. These characteristics manifest themselves in features of the silicone material, including **softness, gas permeability, cold resistance, and little change in viscosity due to temperature changes**.

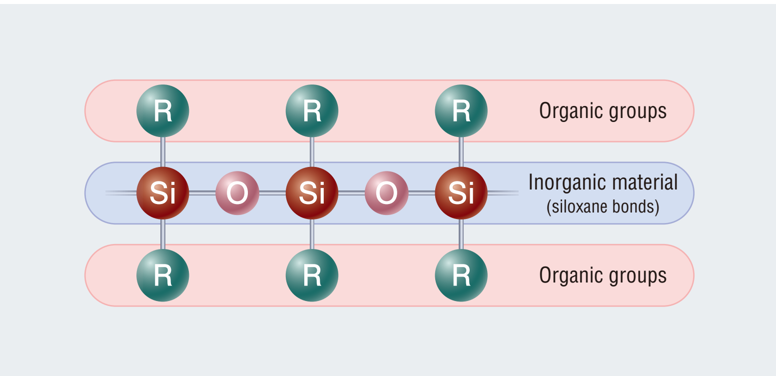
The molecules of silicone polymers are covered by hydrophobic methyl groups, and surface energy is low.

The backbone of a silicone polymer molecule is a twisted helical structure. The molecules are almost completely covered by hydrophobic methyl groups, and surface energy is low. This gives rise to unique properties including **water repellency and easy release**.

Moreover, silicones are low-polarity polymers, so they absorb **little moisture**.

Silicones: compounds which feature a main chain of siloxane bonds

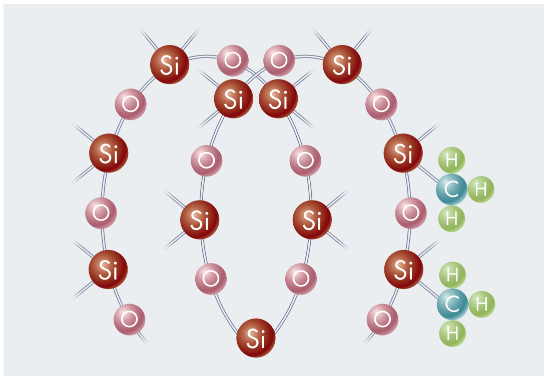
Features attributable to siloxane linkages



- Heat resistance
- Flame resistance
- Chemical stability
- Weatherability
- Radiation resistance
- Electrical properties

Si-O bonds: 106 kcal/mol
C-C bonds: 85 kcal/mol
C-O bonds: 76 kcal/mol

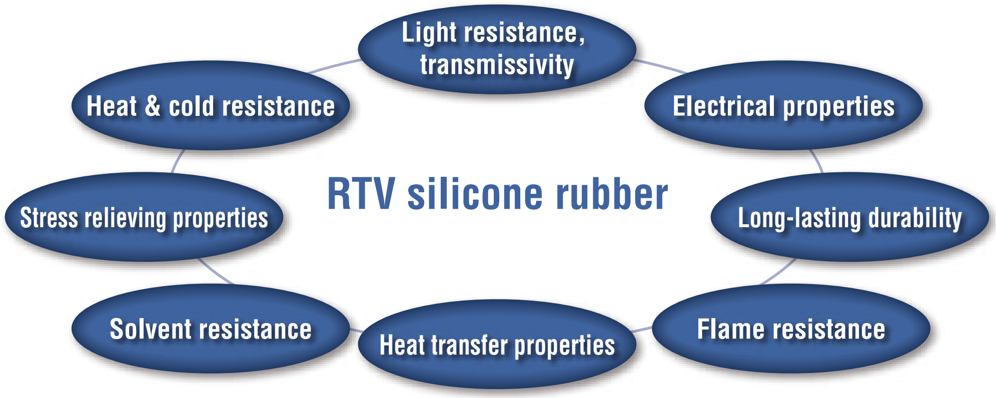
Features attributable to molecular structure



- Water repellency
- Release properties
- Cold resistance
- Compression characteristics

Helical (spiral) structure
Intermolecular forces are weak

Main property requirements for RTV silicone rubbers for electrical & electronic

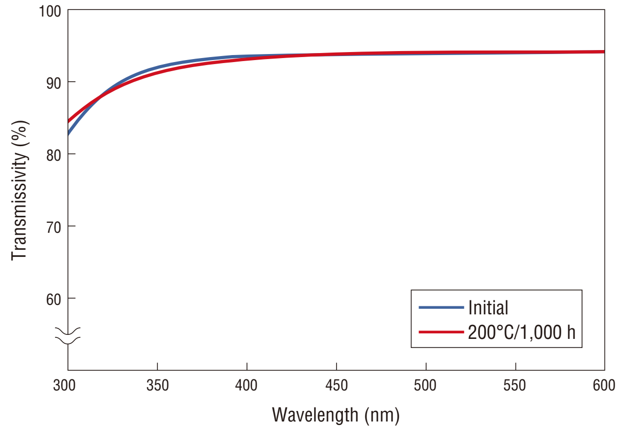


Feature 1

Light resistance & transmissivity

Silicone materials can be used for fastening and encapsulation of LEDs and other light receiving/emitting devices without harming the optical characteristics of the optical device.

Transmissivity of KER-2500-A/B after heat resistance test



KER-2500-A/B: cured at 100°C for 1 hr, then 150°C for 5 hrs. Thickness: 2 mm

Feature 2

Heat & cold resistance

Silicone can be used in temperatures from –50°C to +250°C. Even in continuous use, RTV silicone rubber offers stable performance in a wide temperature range (–40°C to +180°C) and does not lose its rubber elasticity.

Feature 3

Electrical properties

Silicone exhibits consistent electrical properties even when subjected to environmental changes (temperature, humidity, etc.). This makes silicone a good insulator for high voltage components of transformers and other equipment.

3-1. Tracking resistance of KE-3467 & KE-1867

Product name \ Voltage	300 V	800 V
KE-3467	Pass	Pass
KE-1867	Pass	Pass

(Not specified values)

How CTI value is measured
CTI is measured by dripping 50 drops of an electrolyte solution onto an insulating material at a rate of one drop every 30 seconds*, and the CTI value is the maximum voltage at which no tracking failure occurs. The larger the CTI value, the more resistant the material is to tracking.
* ASTM D 3638-85 (IEC 112)
Conditions stipulated in "Standard Test Method for Comparative Tracking Index of Electrical Insulating Materials".

3-2. Volume resistivity & dielectric breakdown strength of KE-3490 at 85°C/85% RH

	Initial	240 h	480 h	960 h	1,440 h
Volume resistivity TΩ·m	3.6	21	32	40	53
Relative permittivity 50 Hz	3.1	3.2	3.1	3.0	3.1
Dissipation factor 50 Hz	5×10^{-3}	4×10^{-3}	3×10^{-3}	3×10^{-3}	3×10^{-3}
Dielectric breakdown strength kV/mm	32	31	31	30	29

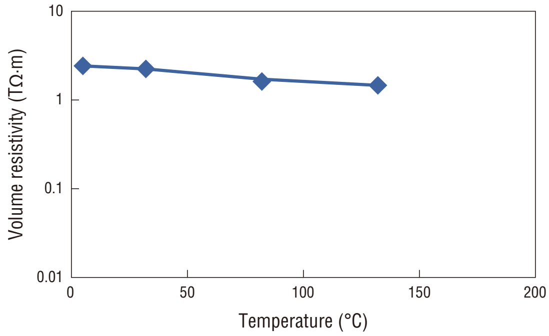
Cure conditions: 23°C/50% RH × 7 days. Durability conditions: 85°C/85% RH × prescribed time (Not specified values)

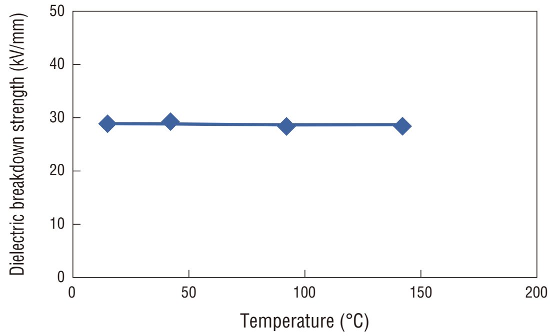
3-3. Volume resistivity & dielectric breakdown strength of KE-3490 after 150°C durability test

	Initial	150°C × 250 h	150°C × 500 h	150°C × 1,000 h
Volume resistivity TΩ·m	3.6	6.0×10^{1}	2.9×10^{2}	7.0×10^{2}
Dielectric breakdown strength kV/mm	32	29	30	29

(Not specified values)

3-4. Temperature dependency of volume resistivity and dielectric breakdown strength of KE1204A/B





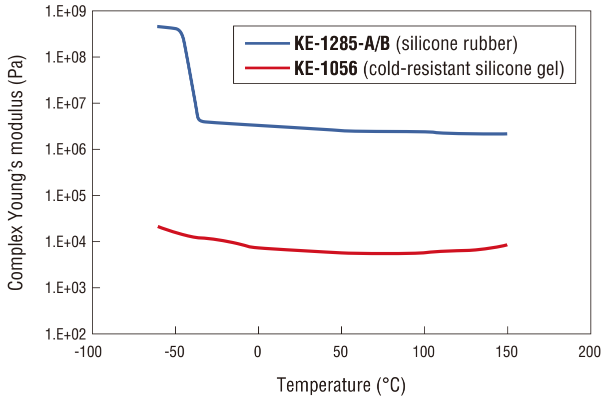
Feature 4

Stress relieving properties

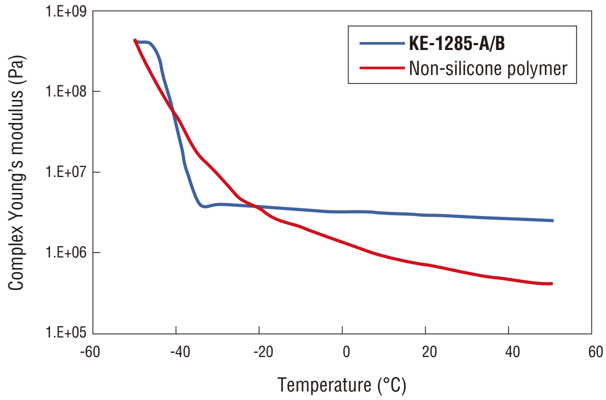
Silicone is used for potting and encapsulation of bonding wires and other components of power semiconductor modules.
Silicone protects electronic parts from stress and is effective across a wide temperature range.

4-1. Temperature dependency of complex Young's modulus of RTV silicone

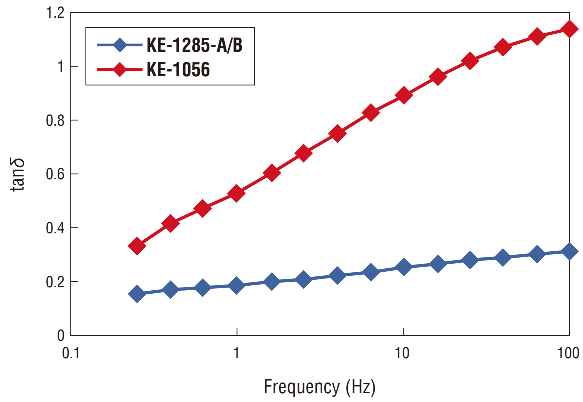
Silicone rubber vs. silicone gel

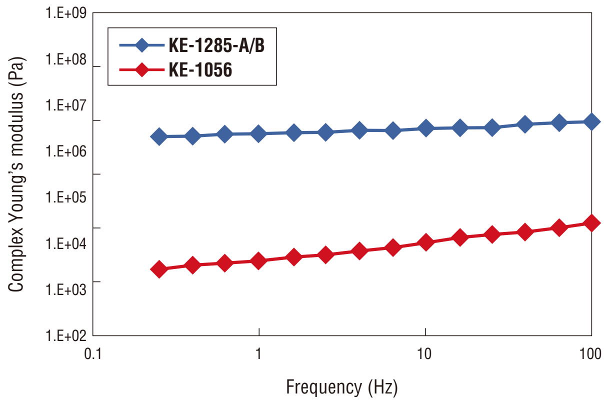


Silicone vs. non-silicone polymer



4-2. Tan δ at –20°C / Frequency dependence of complex Young's modulus





Feature 5

Long-lasting durability

5-1. Physical properties of KE-1285 after 150°C durability test

	Initial	150 h	300 h	500 h	650 h	800 h	1,000 h
Hardness Durometer A	56	58	61	63	63	63	64
Elongation at break %	140	120	110	120	110	100	90
Tensile strength MPa	2.8	2.9	3.0	3.3	3.3	3.3	2.8
Density g/cm^3	1.72	1.72	1.73	1.72	1.73	1.73	1.73
Tensile lap-shear strength (Al/Al) MPa	1.5	1.7	1.5	1.7	1.9	1.6	1.8
Volume resistivity TΩ·cm	6.5	8.6 × 10	9.6 × 10	1.0×10^2	1.5×10^2	8.0 × 10	1.8×10^2

(Not specified values)

5-2. Physical properties of KE-1285 after 85°C/85% RH durability test

	Initial	150 h	300 h	500 h	650 h	800 h	1,000 h
Hardness Durometer A	56	56	56	59	59	60	58
Elongation at break %	140	120	130	140	120	130	110
Tensile strength MPa	2.8	2.6	2.6	2.9	2.7	2.8	2.4
Density g/cm^3	1.72	1.72	1.72	1.72	1.72	1.72	1.72
Tensile lap-shear strength (Al/Al) MPa	1.5	1.5	1.4	1.7	1.5	1.4	1.4
Volume resistivity TΩ·cm	6.5	2.0 × 10	2.7 × 10	2.6 × 10	2.9 × 10	3.8 × 10	3.0 × 10

(Not specified values)

Feature 6

Solvent resistance

Change in volume of rubbers caused by various liquids (after 168 hr immersion)

(unit: %)

Liquid	Temperature °C	Nitrile			Chloroprene	Natural rubber	Styrene Butadiene	Butyl	Silicone*	Hypalon
		28%	33%	38%						
Gasoline	50	15	10	6	55	250	140	240	260	85
ASTM #1 oil	50	-1	-1.5	-2	5	60	12	20	4	4
ASTM #3 oil	50	10	3	0.5	65	200	130	120	40	65
Diesel oil	50	20	12	5	70	250	150	250	150	120
Formaldehyde	50	10	10	10	25	6	7	0.5	1	1.2
Ethanol	50	20	20	18	7	3	-5	2	15	5
Glycol	50	0.5	0.5	0.5	2	0.5	0.5	-0.2	1	0.5
Ethyl ether	50	50	30	20	95	170	135	90	270	85
Methyl ethyl ketone	50	250	250	250	150	85	80	15	150	150
Tricloroethylene	50	290	230	230	380	420	400	300	300	600
Carbon tetrachloride	50	110	75	55	330	420	400	275	300	350
Benzene	50	250	200	160	300	350	350	150	240	430
Aniline	50	360	380	420	125	15	30	10	7	70
Phenol	50	450	470	510	85	35	60	3	10	80
Cyclohexanol	50	50	40	25	40	55	35	7	25	20
Distilled water	100	10	11	12	12	10	2.5	5	2	4

* The values above are measured values for common dimethyl silicone rubber. Values will differ depending on the product.

Feature 7

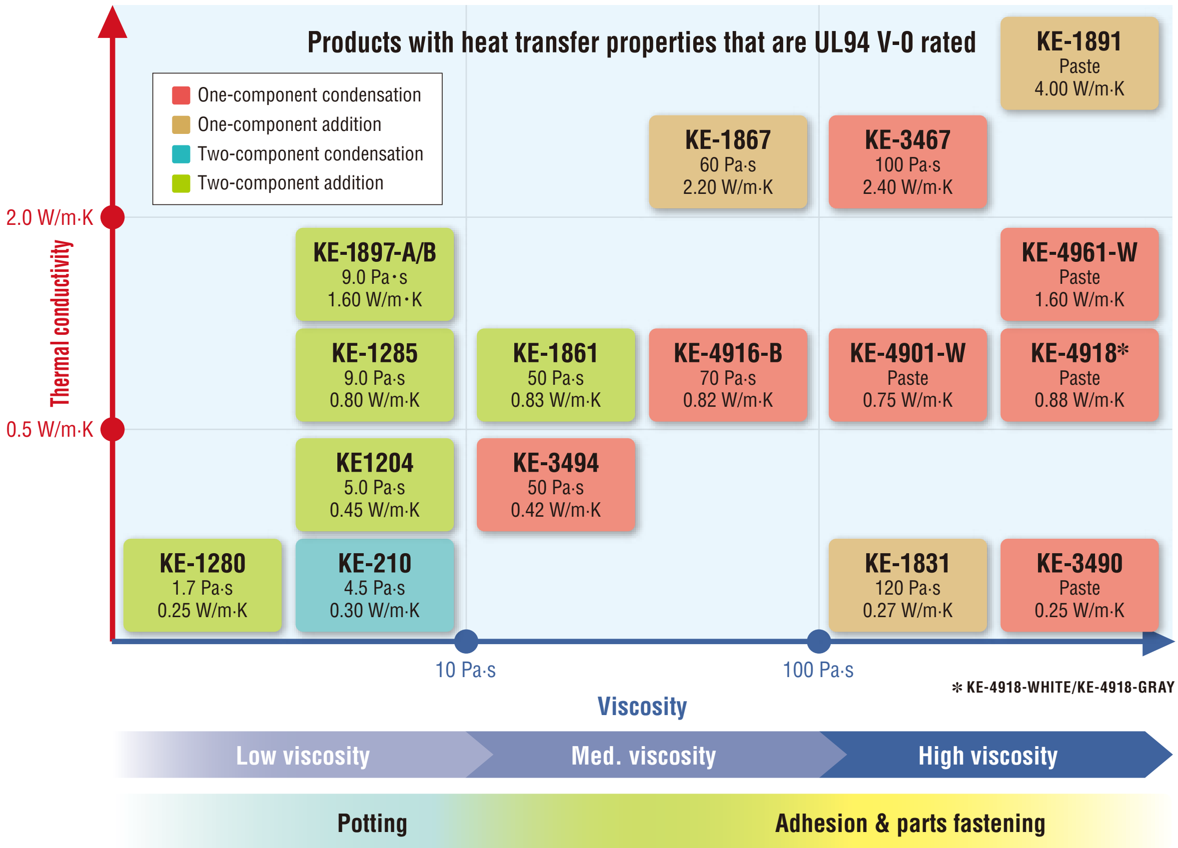
Flame resistance

There are many UL certified products on the market.
A product's UL certification can be checked by referring to the directory at the following page: http://iq.ul.com/iq/newiq/
Check the following UL file numbers for details.
UL file numbers: **E48923, E179895, E174951, E255646, E192980**

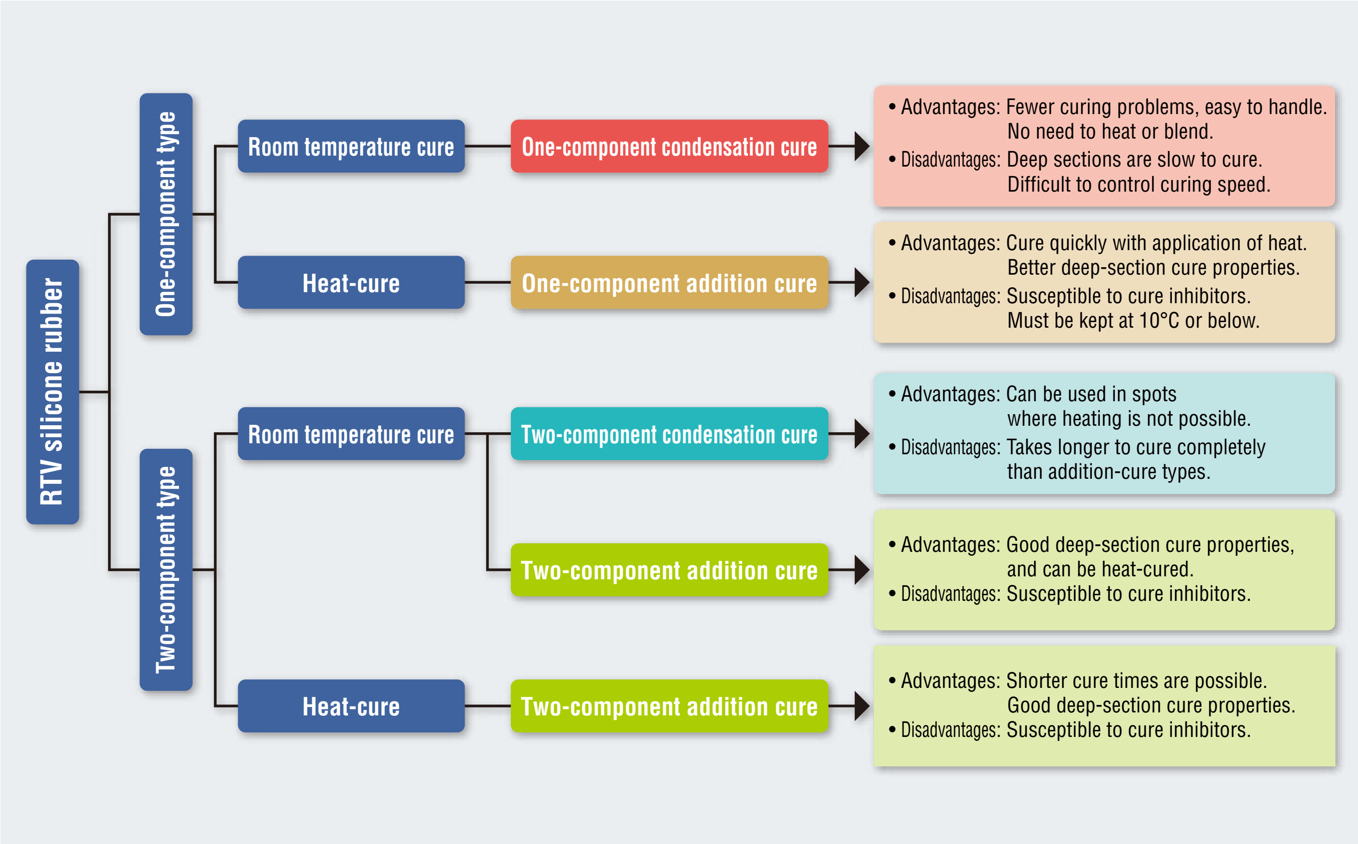
Feature 8

Heat transfer properties

Silicone can help transfer heat generated by electronic devices to heat sinks and housings.
Some Shin-Etsu products that have both flame resistance and heat transfer properties are presented below. Be sure to choose a product suitable for the intended use.



Types of RTV silicone rubber



Viscosity and workability

● Viscosity before curing

Generally speaking, RTV silicone rubber products start as a liquid and cure to become an elastic body.
The viscosity values listed in this catalog should provide a guideline as to workability.
Flowable, low viscosity products are suitable for potting and coating.
Medium viscosity products and non-flowable high viscosity products (paste consistency) are suitable for sealing and adhesion or fastening of parts.

Curing reactions

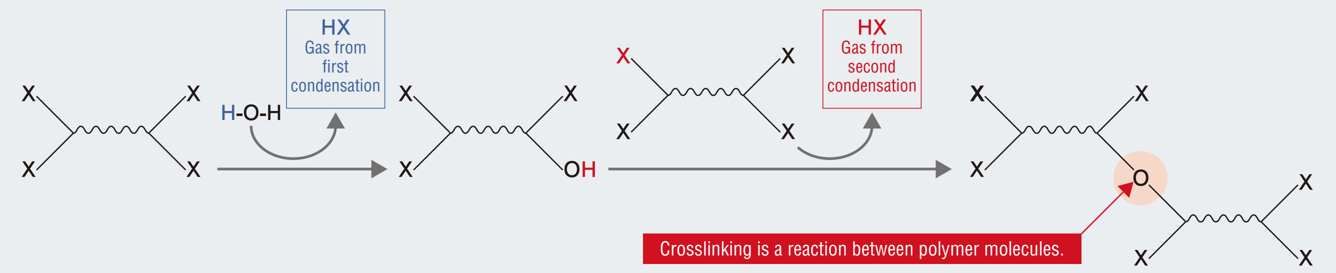
Some RTV silicone rubbers cure at room temperature, while others cure with the application of heat. And in each category, products are available in one-component and two-component formats. Furthermore, the curing reaction may be a condensation reaction or an addition reaction. Each has its own advantages.

When choosing an RTV silicone rubber product, the user must consider a range of factors. These include elements of workability such as viscosity and curing conditions, performance parameters such as hardness, flame resistance and thermal conductivity; and the advantages and disadvantages of the different types of curing reactions.

● Condensation reaction

These products release reaction byproducts (outgas) as they cure. Based on the type of reaction byproducts they release, products are categorized as alcohol-cure, acetone-cure, or oxime-cure products.
One-component condensation cure products cure by reacting with moisture in the air. The cure reaction starts at the surface in contact with the air and proceeds inward.
Curing speed is dependent on temperature and humidity. If thickness is 1 mm, it takes about 24 hours for the material to become a fully cured elastic body.
However, it takes about three days to achieve full mechanical strength, and can take up to seven days to achieve the desired electrical properties and other characteristics.
These products are generally not suitable for use as an adhesive for bonding materials together with a large contact area, but may be suitable in certain cases depending on the size and moisture permeability of the substrates.
Two-component condensation cure products cure when the main component and curing agent are mixed together. The reaction occurs throughout the material, and as is the case with one-component products, reaction byproducts are released.

Note: Irrespective of whether it is a one- or a two-component product, condensation-cure RTV silicone rubber products require moisture to cure, and outgas during the curing process. These products are thus not suitable for applications that involve airtight enclosures.

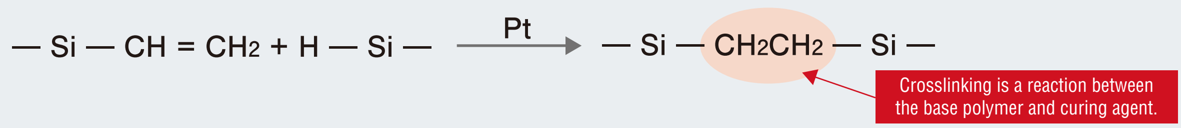


● Addition reaction

The base polymer (a silicone polymer which contains vinyl groups) reacts with the curing agent (a silicone polymer which contains hydrogen groups) with the aid of a platinum catalyst. It is through this hydrosilylation reaction that the material cures.

With addition-cure RTV silicone rubber products, the user has greater control over the cure time, which can be useful in terms of increasing productivity.

Note: However, contact with certain compounds can cause poor curing or adhesion, so these products must be used with a certain amount of care.



Cure inhibition

When using addition-cure RTV silicone rubber products, it is important that the user have a good understanding of the problem of cure inhibition.
The substances that can cause cure inhibition do so in one of the two following ways.

Causes of poor curing

1. The platinum catalyst forms complexes with certain other compounds, and the catalytic action is inhibited.
2. The curing agent becomes contaminated with substances it can react with, and the curing agent is consumed.

Cure inhibitors

- Organic compounds that contain elements which include nitrogen, phosphorus and sulfur.
- Ionic compounds of heavy metals such as tin, lead, mercury, bismuth and arsenic.
- Organic compounds that contain unsaturated groups, such as acetylene groups.

Substances that can react with curing agents

- Alcohol, water.
- Organic acids such as carboxylic acid.

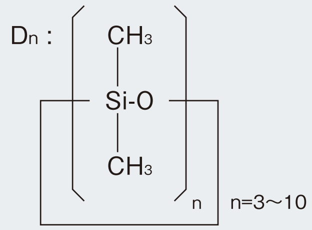
Specific examples of cure inhibition

- Organic rubber: vulcanized rubber, anti-aging agent (e.g. gloves).
- Epoxy & urethane resin: amine- and isocyanate-based curing agents.
- Condensation-cure RTV silicone rubber: use of tin-based catalysts in particular.
- Soft PVC: plasticizers, stabilizers.
- Solder flux.
- Engineering plastics: flame retardants, heat resistance improvers, UV absorbers.
- Moisture that has been absorbed by materials which are in contact with the uncured material.
- Outgassing from solder resist or PCB (caused by heating when curing the silicone).

Low-molecular-weight siloxane and electrical contact failures

● What is low-molecular-weight siloxane?

Low-molecular-weight (LMW) siloxane is shown in the chemical formula on the right. It is non-reactive cyclic dimethyl polysiloxane (generally D_3–D_{10}) that is volatile, meaning it will vaporize into the air during the cure process and even after curing.
It has been reported that, in certain conditions (described below), LMW siloxane can cause electrical contact failures.



● Reduced LMW siloxane products (designed to reduce incidence of electrical contact failures)

These are products in which LMW siloxane has been reduced to a prescribed level. LMW siloxane is known to cause electrical contact failures in certain conditions.
For most Shin-Etsu products, this means a ΣDn (n=3–10) of 300 ppm or less, or 500 ppm or less.
The risk of electrical contact failures is also affected by the conditions described below, so these products do not represent an absolute solution. Nonetheless, reduced LMW siloxane products are still recommended for electrical and electronic applications.

Amounts of LMW siloxane in regular products and reduced LMW siloxane products (sample data on uncured material)

D_n	**KE-45** (Regular product)	**KE-3490** (Reduced LMW siloxane product)
3	10 >	10 >
4	500	10 >
5	260	10 >
6	240	10 >
7	220	10 >
8	160	50
9	170	50
10	220	60
ΣDn (n=3–10)	1,770	160

KE-3490 is a reduced LMW siloxane product with ΣDn (n=3–10) controlled to 300 ppm or less. (Not specified values)

[GC conditions]	GC: gas chromatography
Device	Capillary gas chromatograph, Shimadzu model GC-14A
Column	DURABOND DB-1701
Column Temp.	50°C→300°C (15°C/min)
Inj. Temp.	300°C
Carrier Gas	He (30 cm/sec)
Detector:	FID
Injection volume:	2 μl
Extraction solvent:	acetone

● Electrical contact failures

A number of substances have been reported to cause contact failures. Contact failures may be caused by organic materials such as human body oils and organic gases, or inorganic materials such as hydrogen sulfide and ammonia gas.
Manufacturers of electrical and electronic equipment report that LMW siloxane can also cause contact failure at low voltages and low currents.

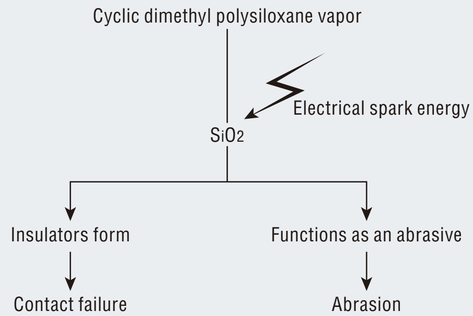
■ Relationship between load conditions and contact reliability

Effects of load on contact reliability (micro-relay)

	Load		Si present on contact surfaces (Y/N)	Contact resistance
1	DC1 V	1 mA	N	No increase observed
2	DC1 V	36 mA	N	Increase of several ohms
3	DC3.5 V	1 mA	N	No increase observed
4	DC5.6 V	1 mA	Y	No increase observed
5	DC12 V	1 mA	Y	Increase of several ohms, some readings of infinity
6	DC24 V	1 mA	Y	Readings of infinity were seen at around 1,500 cycles; at 3,000 cycles, all were infinity
7	DC24 V	35 mA	Y	Readings of infinity were seen at around 3,000 cycles; at 4,500 cycles, all were infinity
8	DC24 V	100 mA	Y	No increase observed
9	DC24 V	200 mA	Y	No increase observed
10	DC24 V	1 A	Y	No increase observed
11	DC24 V	4 A	Y	No increase observed

[Test conditions] Switching frequency: 1 Hz, Temp.: room temperature, Contact force: 13 g
Source: The Institute of Electronics, Information and Communication Engineers, Yoshimura and Itoh EMC76-41 Feb. 18, 1977.

■ Mechanism of contact failure



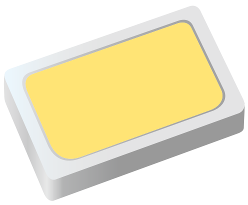
The main ingredient of RTV silicone rubber is dimethyl polysiloxane HO-[Si(CH_3)$_2$O]n-H, which has a degree of polymerization between 200 and 1,000. The dimethyl polysiloxane obtained in the normal manufacturing process does contain small amounts of cyclic products. This cyclic dimethyl polysiloxane is nonreactive and volatile, and thus will vaporize into the air during the cure process and even after curing. Under certain conditions, this vaporized cyclic dimethyl polysiloxane can cause contact failures, according to the mechanism shown above.

Main applications for RTV silicone rubber

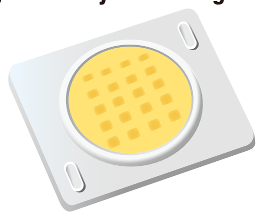
LED devices

Endowed with high resistance to light and heat, silicone resins have a range of uses in various types of LEDs. Silicones used in LEDs include LED encapsulants, die-bonding adhesives and damming materials. LED encapsulants are used to protect the chips and wires, as a binder for the phosphors, and for molding light guides and lenses. Die-bonding adhesives are used to attach the chips, and damming materials are used for COB applications. The Shin-Etsu product line also includes reflective molding materials for LED packages.

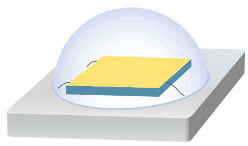
SMD



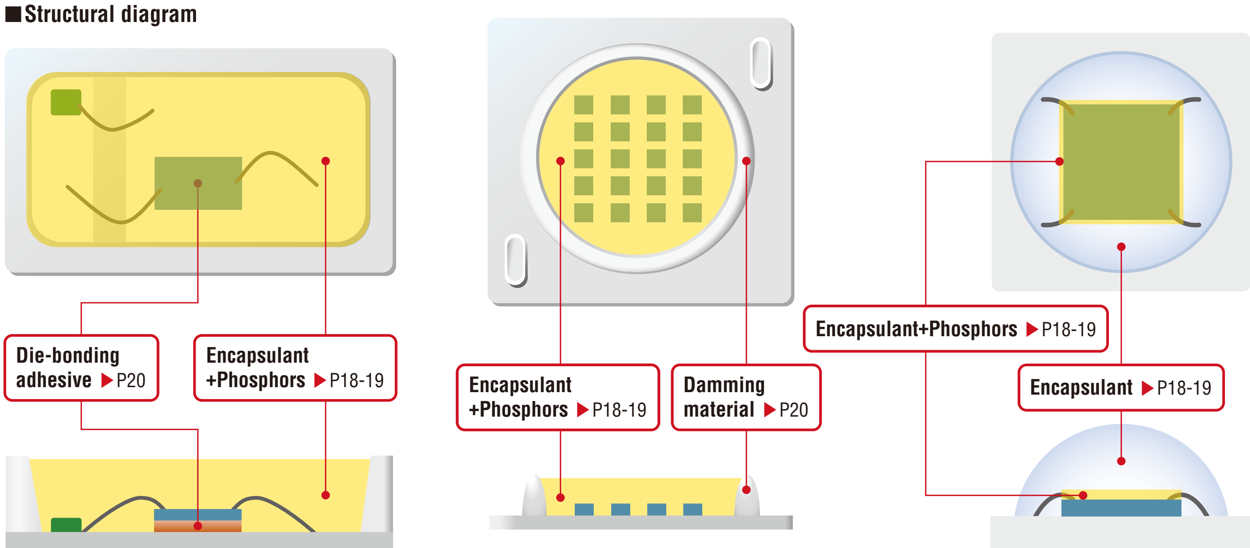
High-density mounting



Lens molding



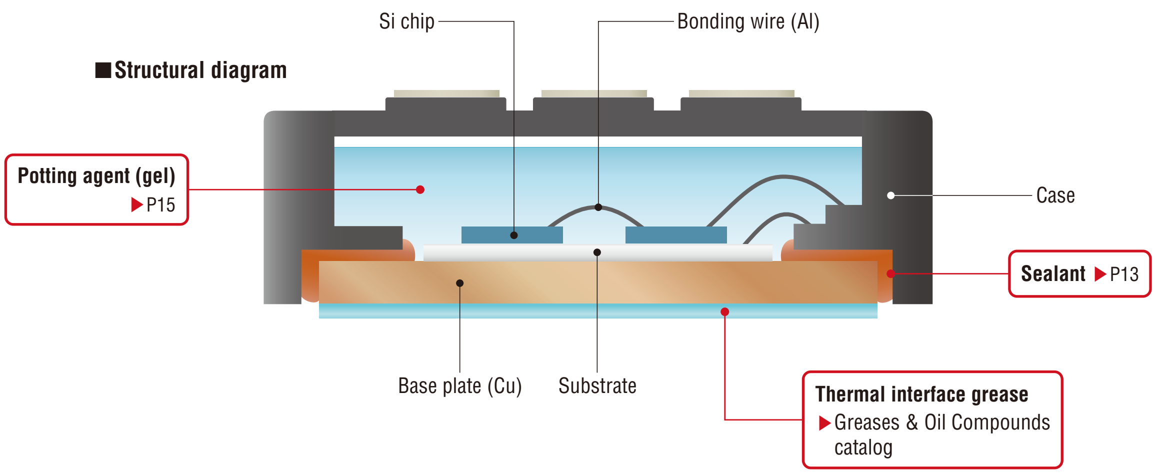
■Structural diagram



IGBT Modules

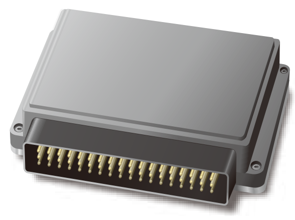
IGBT (Insulated Gate Bipolar Transistor) modules are a primary component of high-capacity inverters. In an IGBT module, a potting agent (gel) is used for electrical insulation and a sealant is used to bond the case to the base plate. In addition, a thermally conductive grease is used to help direct heat away from the IGBT module. For information on thermal interface greases, please see our Greases & Oil Compounds catalog.

■Structural diagram

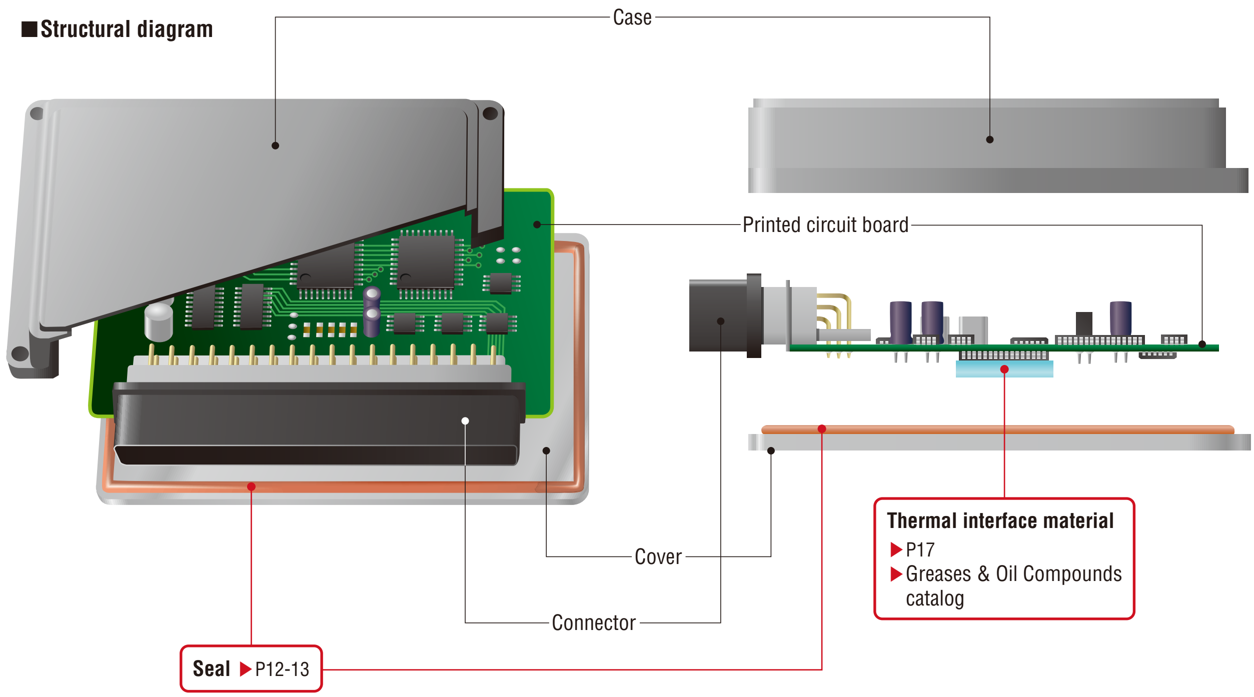


ECUs

ECUs (Electronic Control Units) have played a critical role in improving automotive performance. Various types of ECUs are installed in automobiles, where they control the engine, steering system, braking system and sensors. RTV silicone rubber is used to seal the waterproof cases that house the ECUs and as a thermal interface material to aid in cooling the heat-producing components on circuit boards, helping to improve the reliability of the automobile. Silicone grease is also used as a thermal interface material. For information on thermal interface greases, please see our Greases & Oil Compounds catalog.



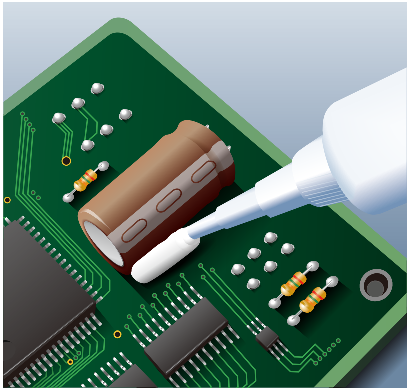
■ **Structural diagram**



Circuit board assemblies

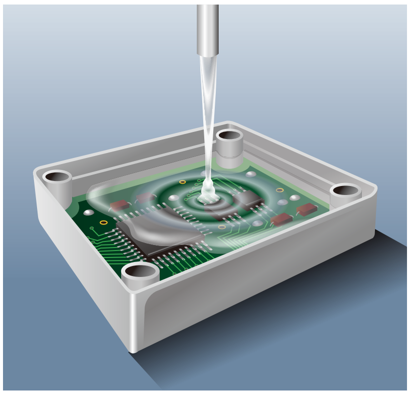
RTV silicone rubber is used for a variety of purposes in PCBs (Printed Circuit Boards). Sealants are used for bonding and attachment and as a thermal interface material for capacitors, transformers, coils and other electronic components. Potting agents are used to cover over the circuit board, where they provide waterproofing and electrical insulation and act as a thermal interface material. Coating agents are applied to part or all of the circuit board to protect components and circuits from moisture and metallic debris. And for power supply boards, which require a flame resistant material, products that meet UL94 V-0 requirements are used.

Attaching components



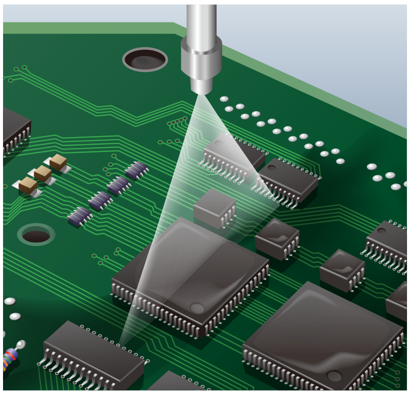
Sealants ▶P12

Potting circuit boards



Potting agents ▶P14-15

Coating circuit boards



Coating agents ▶P16

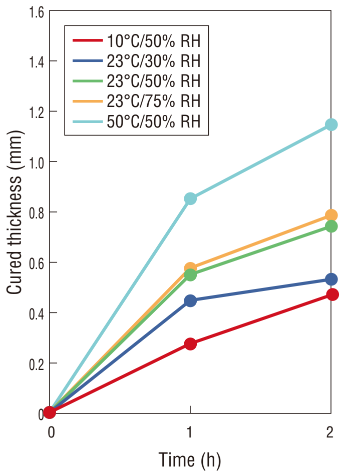
Product lists

Adhesives & Sealants

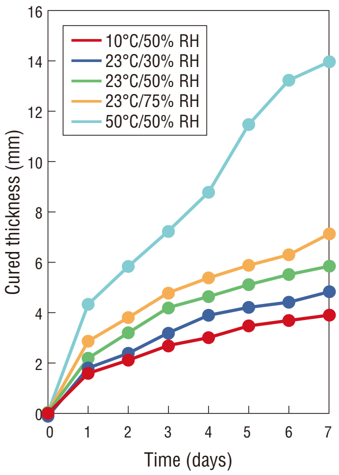
Cure system	One-component, condensation									
Product name	KE-3490	KE-3494	KE-3467	KE-3412	KE-4806-W	KE-4901-W	KE-4908-T	KE-4916-B	KE-4918	KE-4961-W
Brief description	Flame resistant, for attachment of power supply components	Flame resistant	Flame resistant, high thermal conductivity	High heat-resistant	Filler*1	Flame resistant, thermal interface material, for attachment of power supply components	High strength	Flame resistant, thermal interface material	Flame resistant, thermal interface material	Thermal interface material
By-product gas	Acetone	Acetone	Acetone	Acetone	Alcohol	Alcohol	Alcohol	Alcohol	Alcohol	Alcohol
Before curing										
Consistency	Paste	Med. viscosity	High viscosity	Med. viscosity	High viscosity	Paste	Paste	Med. viscosity	Paste	Paste
Appearance	Gray	Gray	White	Black	White	White	Translucent	Black	White/Gray	White
Viscosity Pa·s	—	50	100	90	150	—	—	70	—	—
Tack-free time min	3	8	4	6	7	8	20	7	4	1
Standard curing conditions	23±2°C/50±5% RH × 7 days									
After curing										
Density 23°C g/cm^3	1.18	1.40	2.90	1.06	1.05	1.59	1.08	1.62	1.68	2.34
Hardness Durometer A	43	35	91	40	24	53	40	62	66	80
Tensile strength MPa	2.5	2.5	3.6	2.7	1.5	2.6	4.8	2.4	2.3	3.9
Elongation at break %	350	250	30	270	350	120	600	60	60	60
Volume resistivity TΩ·m	3.0	3.0	5.9	6.0	40	3.4	10	3.0	7.0	1.0
Dielectric breakdown strength kV/mm	28	25	25	28	24	30	26	30	29	24
Relative permittivity 50 Hz	3.3	3.5	4.6	3.1	3.1	3.8	3.0	4.2	3.9	4.3
Dielectric dissipation factor 50 Hz	1×10^{-2}	1×10^{-2}	4×10^{-3}	1×10^{-2}	1×10^{-3}	2×10^{-1}	1×10^{-3}	1×10^{-1}	2×10^{-1}	1×10^{-1}
Thermal conductivity W/m·K	0.25	0.42	2.40	0.21	—	0.75	0.21	0.82	0.88	1.60
Tensile lap-shear strength (Al/Al) MPa	1.5	1.5	0.5	1.0	—	1.3	3.0	1.2	1.0	—
LMW siloxane content ΣD_3–D_{10} ppm	< 300	< 300	< 300	< 300	< 500	< 300	—*2	< 300	< 300	< 300
Flame resistance UL94	V-0	V-0	V-0	—	—	V-0	—	V-0	V-0	V-0

*1: Will not inhibit curing of addition-cure RTV silicone rubbers. *2: Not a reduced low-molecular-weight siloxane product. (Not specified values)

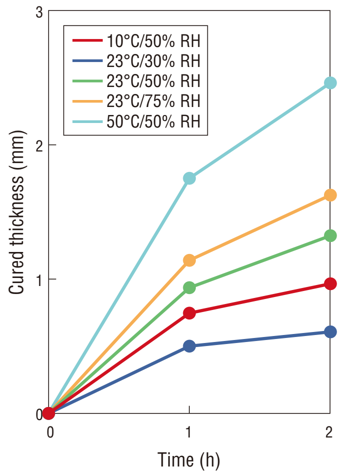
Effect of temperature & humidity on curing speed of KE-3490 (2 hours)



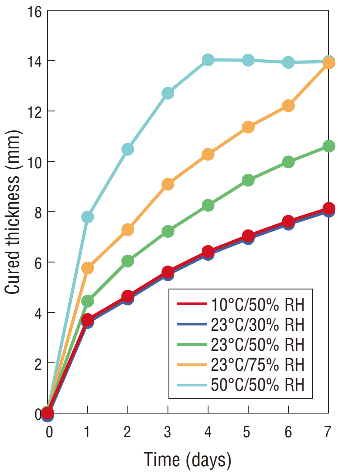
Effect of temperature & humidity on curing speed of KE-3490 (7 days)



Effect of temperature & humidity on curing speed of KE-3495-W (2 hours)



Effect of temperature & humidity on curing speed of KE-3495-W (7 days)



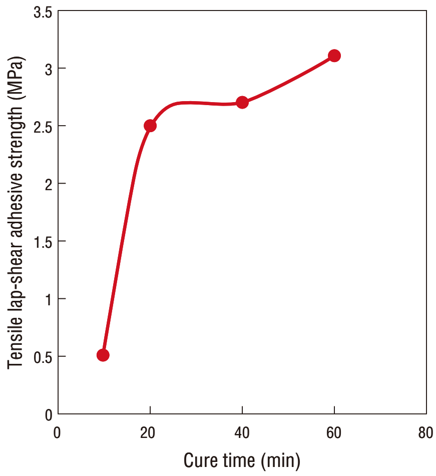
Adhesives & Sealants

Cure system	One-component, addition									
Product name	KE-1831	KE-1833	KE-1835-S	KE-1850	KE-1854	KE-1855	KE-1880	KE-1884	KE-1885	IO-SEAL-300
Brief description	Flame resistant	High heat-resistant	Good adhesion to plastics	High heat-resistant	High heat-resistant, thixotropic	High adhesive strength	High heat-resistant	Low temperature cure	Low temperature cure	Releases less acidic gas
Before curing										
Consistency	Paste	High viscosity	Paste	Paste	Paste	Paste	Med. viscosity	Med. viscosity	High viscosity	Paste
Appearance	Black	Reddish brown	White	Black	Black	Light gray	Reddish brown	White	White	White
Viscosity Pa·s	120	140	140	75	260	60	90	55	100	50
Standard curing conditions	120°C × 1 h							100°C × 1 h		
After curing										
Density 23°C g/cm^3	1.28	1.36	1.25	1.26	1.25	1.28	1.25	1.22	1.14	1.23
Hardness Durometer A	30	33	40	29	30	66	33	35	36	31
Tensile strength MPa	3.9	3.4	4.0	2.6	3.5	6.7	4.3	3.5	3.5	2.8
Elongation at break %	400	330	370	320	480	150	350	230	300	270
Volume resistivity TΩ·m	2.0	2.0	11	—	—	5.0	—	10	10	—
Dielectric breakdown strength kV/mm	25	25	29	—	—	25	—	25	25	—
Relative permittivity 50 Hz	3.5	3.5	3.3	—	—	3.5	—	3.1	3.1	—
Dielectric dissipation factor 50 Hz	5×10^{-3}	5×10^{-3}	5×10^{-3}	—	—	5×10^{-3}	—	1×10^{-3}	1×10^{-3}	—
Thermal conductivity W/m·K	0.27	—	—	—	—	0.27	—	—	—	—
Tensile lap-shear strength (Al/Al) MPa	2.3	1.8	3.0	1.2	1.8	3.5 (PPS/PPS) 3.6 (PBT/PBT)	2.3	1.6 (PBT/PBT)	2.0	1.5 (PPS/PPS) 1.3 (PC/PC)
LMW siloxane content ΣD_3–D_{10} ppm	—*	—*	—*	—*	—*	—*	—*	< 100	< 100	—*
Flame resistance UL94	V-0	—	HB	—	—	—	—	—	—	HB

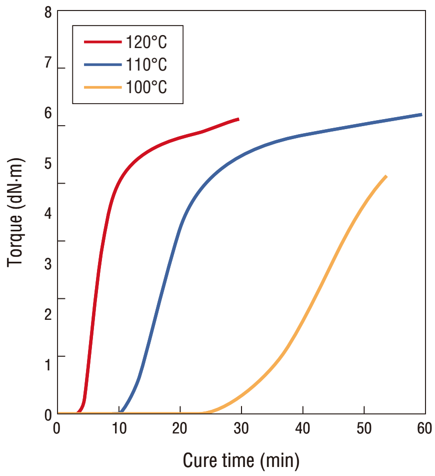
* Not a reduced low-molecular-weight siloxane product.

(Not specified values)

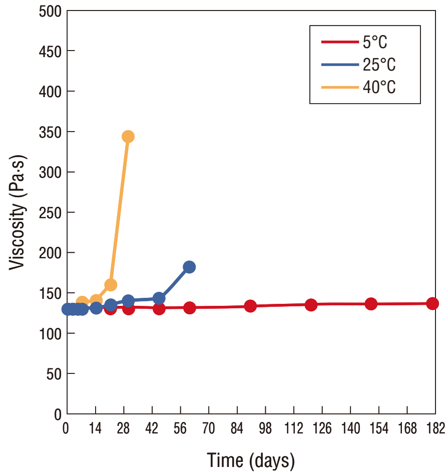
Relationship between cure speed and lap-shear adhesive strength of KE-1833 (120°C)



Cure speed and temperature of KE-1833



Storage stability of KE-1833



Potting agents (rubber)

Cure system	Two-component, condensation		Two-component, addition							
Product name	KE-200★	KE-210	KE1204 A/B	KE-1280-A/B	KE-1282-A/B	KE-1283-A/B*1	KE-1285-A/B	KE-1897-A/B	KE-109E-A/B	KE-106★
Brief description	Rapid cure, good deep section curability, for PV	Flame resistant, rapid cure, good deep section curability, for PV	Flame resistant	Flame resistant, low specific gravity	Low stress, low volatile content	For LED displays	Flame resistant, thermal interface material, low viscosity	Flame resistant, high thermal interface material, low viscosity	Low temperature cure	High strength
By-product gas	Acetone	Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Before curing										
Consistency	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity
Appearance	Colorless translucent	Black	A: Reddish brown B: Light gray	A: Black B: Translucent	A: Black B: Light gray	A: Black B: Creamy white	A: Gray B: Light gray	A: Gray B: White	A/B: Transparent	Transparent
Viscosity Pa·s	2.8	5.8	A:6/B:4	A:2/B:1.3	A:3.5/B:1.4	A:2.6/B:1.3	A:25/B:5	A:11/B:7	A/B:1	3.5
Mix ratio	100:10	100:10	100:100	100:100	100:100	100:100	100:100	100:100	100:100	100:10
Mixed viscosity Pa·s	2.2	4.5	5.0	1.7	2.6	1.5	9.0	9.0	1.0	3.3
Pot life min	35*2	25*2	480*3	480*3	240*3	300*3	900*3	1,440 h*3	240*3	120*3
Standard curing conditions	23±2°C/50±5% RH × 3 days		100°C × 15 min	120°C × 1 h	90°C × 2 h	80°C × 2 h	120°C × 1 h	120°C × 60 min	100°C × 1 h	150°C × 30 min
Curing agent	CX-200	CAT-210	NA	NA	NA	NA	NA	NA	NA	CAT-RG
After curing										
Density 23°C g/cm^3	1.01	1.24	1.54	1.01	1.32	0.96	1.72	2.61	1.00	1.02
Hardness Durometer A	25	32	70	24	11	12 (Asker C)	56	20	25	56
Tensile strength MPa	0.4	0.7	3.5	0.6	0.7	0.2	2.8	0.4	1.3	8.0
Elongation at break %	100	100	70	140	160	300	140	100	140	100
Volume resistivity TΩ·m	60	7.7	1.0	1.0	1.0	1.0	6.5	0.2	6.0	3.0
Dielectric breakdown strength kV/mm	20	25	27	25	24	25	26	25	23	23
Relative permittivity 50Hz	2.9	3.8	3.2	4.1	3.2	4.0	4.0	6.0	2.8	3.1
Dielectric dissipation factor 50Hz	3×10^{-3}	1×10^{-2}	1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-2}	0.6×10^{-2}	6×10^{-4}	5×10^{-3}
Thermal conductivity W/m·K	0.21	0.30	0.45	0.25	0.40	0.25	0.80	1.60	0.15	0.15
Tensile lap-shear strength (Al/Al) MPa	0.4	0.8	—	0.2	0.4	0.2	1.5	0.3	0.2	—
LMW siloxane content ΣD_3–D_{10} ppm	< 300	—*5	< 500	—*5	< 500	—*5	< 500	< 500	—*5	—*5
Flame resistance UL94	V-1	V-0	V-0	V-0	—	V-1	V-0	V-0	—	—

*1 Can be made a matte color by adding Liquid C *2 Time to reach non-fluid state *3 Time until viscosity doubles *4 Finger touch *5 Not a reduced low-molecular-weight siloxane product. (Not specified values)

★ KE-200 is also available in a fast-curing formulation (KE-200F).

★ KE-106 is also available in a fast-curing formulation (KE-106F).

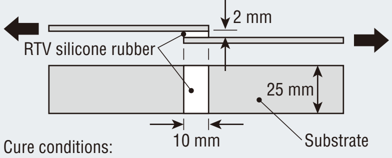
KE-1282-A/B: Effects of cure temperature and time on physical properties

Item \ Temperature, time	80°C		85°C		90°C		95°C		105°C	
	60 min	90 min	60 min	90 min	60 min	90 min	60 min	90 min	15 min	30 min
Hardness Durometer A	7	9	9	10	9	11	11	11	8	10
Tensile lap-shear strength (Al/Al) MPa	0.35	0.34	0.34	0.34	0.35	0.30	0.32	0.31	0.34	0.40

(Not specified values)

Tensile lap-shear strength test method

RTV silicone rubber samples were cured as described in the figure, then tested using a lap-shear strength tester.



Cure conditions:
Condensation-cure type 23±2°C/50±5% RH × 7 days
Addition-cure type 120°C × 1 h
RTV silicone rubber thickness: 2 mm
Bonding surface: 10 × 25 mm
Pull rate: 50 mm/min

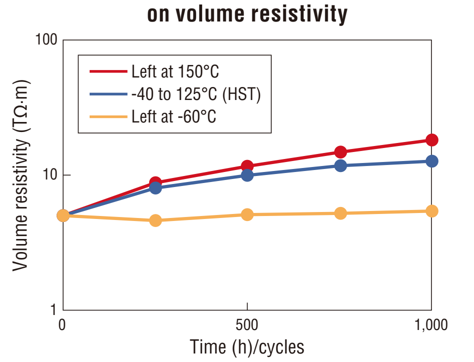
Potting agents (gel)

Cure system	One-component, addition					Two-component, addition				
Product name	KE-1014	KE-1056	KE-1057	KE-1061	KE-1062	KE-1011-A/B	KE-1012-A/B	KE-1013-A/B	KE-1051J-A/B	KE-1063-A/B
Brief description	Standard product, low viscosity	Cold resistant, high penetration	Standard product	Cold resistant, low viscosity	High heat-resistant, cold resistant	Low penetration	Standard product	For use as a binder	Room-temperature curing, high adhesion	High heat-resistant, cold resistant, high adhesion
Before curing										
Consistency	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	A/B: Low viscosity	A/B: Low viscosity	A/B: Low viscosity	A/B: Low viscosity	A/B: Low viscosity
Appearance	Pale yellow transparent	Slightly cloudy	Colorless transparent	Colorless transparent	Pale yellow, slightly cloudy	A/B: Colorless transparent	A/B: Colorless transparent	A/B: Colorless transparent	A/B: Colorless transparent	A/B: Pale yellow, slightly cloudy
Viscosity mPa·s	500	800	800	600	700	A:1,000/ B:800	A:1,000/ B:800	A:400/ B:380	A:800/ B:600	A:900/ B:600
Mix ratio	NA	NA	NA	NA	NA	100:100	100:100	100:100	100:100	100:100
Mixed viscosity	NA	NA	NA	NA	NA	900	900	400	700	800
Specific gravity 25°C	0.97	0.98	0.97	0.97	0.99	A/B:0.97	A/B:0.97	A/B:0.97	A/B:0.97	A/B:0.99
Pot life min	NA	NA	NA	NA	NA	240	240	120	60	240
Standard curing conditions	120°C×30 min	130°C×30 min	150°C×30 min	120°C × 30 min		100°C × 1 h	110°C×30 min	120°C × 1 h	23°C × 24 h	23°C × 24 h
After curing										
Penetration 1/4 cone	60	90	65	90	40	20	50	60	65	60
Tensile strength MPa	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Elongation at break %	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volume resistivity TΩ·m	2.0	8.0	10	3.0	2.0	10	8.0	5.0	10	8.0
Dielectric breakdown strength kV/mm	14	14	14	14	14	14	14	14	14	14
Relative permittivity 50Hz	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Dielectric dissipation factor 50Hz	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}
Thermal conductivity W/m·K	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Complex shear modulus 10Hz Pa	8,000	2,200	2,000	1,500	15,000	9,000	6,500	—	23,000	13,000
LMW siloxane content ΣD_3–D_{10} ppm	—*	—*	—*	—*	—*	—*	—*	< 300	—*	—*

* Not a reduced low-molecular-weight siloxane product.

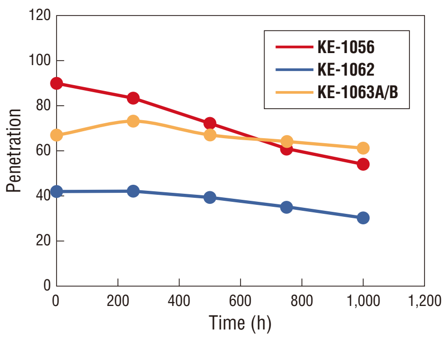
(Not specified values)

KE-1056: Effects of various types of aging on volume resistivity



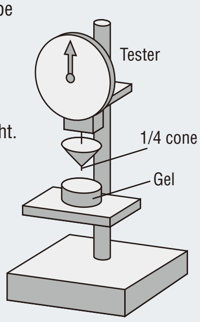
* HST (Heat Shock Test) conditions: -40°C (30 min)⟷125°C (30 min) /cycle

Heat resistance of silicone gels (200°C)



Hardness (penetration)

Silicone gels have moduli of elasticity of 10^5 Nm/m^2 or less, and thus cannot be measured with a regular rubber hardness tester. Hardness (penetration) is normally measured as shown in the figure at right. There is a correlation between penetration and modulus of elasticity.



Measurement method
Penetration test:
JIS K 2220, 1/4 cone
Total load: 9.38 g

Coating agents

Cure system	One-component, condensation						One-component, addition			
Product name	KE-3495	KE-3424-G	KE-4920-T★	KE-4921-W	KE-4970	KE-4971	KE-1842	KE-1844	KE-1886	KE-1871
Brief description	Rapid cure	Reduced low-molecular-weight siloxane, UL certified, electrode coating agent	Conformal coating	Conformal coating	Conformal coating	Conformal coating	Standard product	Low viscosity	Low temperature cure	Heat resistant
By-product gas	Acetone	Acetone	Alcohol	Alcohol	Alcohol	Alcohol	NA	NA	NA	NA
Before curing										
Consistency	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity
Appearance	Creamy white translucent/white	Gray	Pale yellow transparent	White	Pale yellow transparent	Pale yellow transparent	White	Blue	Creamy white	Pale yellow translucent
Viscosity Pa·s	5.5	20	1.5	0.9	0.25	0.6	4.0	1.2	12.0	1.0
Tack-free time min	11	6	7	5	20	5	NA	NA	NA	NA
Standard curing conditions	23±2°C/50±5% RH × 7 days						120°C × 1 h	150°C × 30 min	100°C × 1 h	150°C × 30 min
After curing										
Density 23°C g/cm³	1.03	1.32	0.98	1.01	0.98	0.98	1.00	1.04	1.03	1.01
Hardness Durometer A	30	50	25	30	34[*3]	20	13	25	29	27
Tensile strength MPa	1.1	4.0	0.5	0.5	—	—	0.4	1.7	2.9	2.2
Elongation at break %	200	180	150	70	—	—	200	160	160	180
Volume resistivity TΩ·m	4.0	40	12	—	10	10	1.0	18	10	29
Dielectric breakdown strength kV/mm	20	22	23	—	28	30	20	28	25	27
Relative permittivity 50 Hz	2.8	3.6	2.9	—	2.4	1.9	3.5	2.7	3.1	2.9
Dielectric dissipation factor 50 Hz	3×10^{-3}	8.8×10^{-3}	4×10^{-3}	—	1×10^{-3}	6×10^{-3}	5×10^{-3}	1×10^{-3}	1×10^{-3}	2×10^{-4}
Thermal conductivity W/m·K	0.21	0.40	0.17	—	—	—	—	—	—	—
Tensile lap-shear strength (Al/Al) MPa	0.3	0.4	—	0.2[*2]	—	—	0.2	0.3	0.8	0.2
LMW siloxane content ΣD_3–D_{10} ppm	< 300	< 300[*1]	< 300	< 300	< 300	< 300	—[*4]	—[*4]	< 100	—[*4]
Flame resistance UL746E	—	—	—	—	V-0	V-0	—	—	—	—

*1 KE-3424-G is a high grade product with a ΣDn (n: 3–20) content of less than 300 ppm. *2 Tested using glass/glass (Not specified values)
*3 Tested using 6 stacked 1mm sheets (not in accordance with JIS K 6249) *4 Not a reduced low-molecular-weight siloxane product.
★ KE-4920-T is also available in a UV fluorescent formulation (KE-4920-TUV), and in other colors: white (KE-4920-W) and black (KE-4920-B).

● Heat resistance evaluation & test method

Thermal conductivity (λ) and thermal resistance (R) are two values which describe the thermal properties of thermal interface materials. The higher its thermal conductivity and lower its thermal resistance, the more effective a material will be as a thermal interface. Heat dissipation from a heat-generating component is influenced not only by the thermal conductivity of the thermal interface silicone placed between the heat-generating part and the heatsink (etc.). It is also influenced to a large extent by thermal resistance, which is a function of the contact thermal resistance at the interfaces between the heat generator, silicone and heat sink and the thickness of the silicone itself.

At a given temperature, thermal conductivity is a value intrinsic to a particular substance. According to Fourier's Law, in a steady state, the proportionality constant is the thermal conductivity.

Thermal conductivity λ

$$Q = \lambda \frac{(T_1 - T_2)A}{L} \quad \text{Therefore} \quad \lambda = \frac{Q}{A} \times \frac{L}{(T_1 - T_2)}$$

Q: heat flow rate A: cross-sectional surface area L: distance of heat transfer
T_1: temperature at high side T_2: temperature at low side

Thermal resistance is the sum of contact resistance plus the resistance as heat flows (Q) from T_1 to T_2.

Thermal resistance R

$$R_o = \frac{T_1 - T_2}{Q} = \frac{L}{\lambda A} \quad \text{In reality} \quad R = R_o + R_s$$

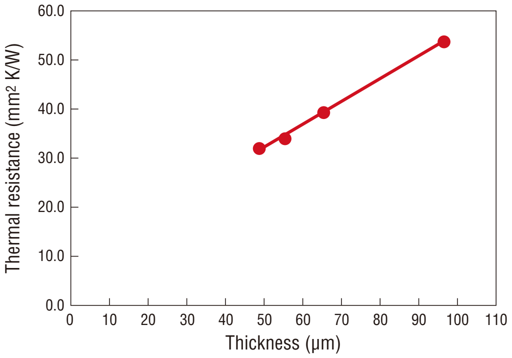
Ro: material's intrinsic thermal resistance Rs: contact thermal resistance

Thermal interface materials

Cure system	One-component, condensation					One-component, addition			Two-component, addition	
Product name	G-1000★	KE-3467	KE-4916-B	KE-4918	KE-4961-W	KE-1867	KE-1869	KE-1891	KE-1861-A/B	KE-1897-A/B
Brief description	Low hardness, high thermal conductivity	Flame resistant, high thermal conductivity	Flame resistant, thermal interface material	Flame resistant, thermal interface material	Thermal interface material	Flame resistant, high thermal conductivity	Thermal interface material, cold resistant	Flame resistant, high thermal conductivity	Flame resistant, thermal interface material	Flame resistant, high thermal interface material, low viscosity
By-product gas	Acetone	Acetone	Alcohol	Alcohol	Alcohol	NA	NA	NA	NA	NA
Before curing										
Consistency	Grease	High viscosity	Med. viscosity	Paste	Paste	Med. viscosity	Med. viscosity	Paste	Med. viscosity	Low viscosity
Appearance	White	White	Black	White/gray	White	Gray	Light gray	Gray	A/B: Light gray	A: Gray B: White
Viscosity Pa·s	80	100	70	—	—	60	30	—	A/B:50	A:11/B:7
Mix ratio	NA	NA	NA	NA	NA	NA	NA	NA	100:100	100:100
Mixed viscosity 23°C Pa·s	NA	NA	NA	NA	NA	NA	NA	NA	50	9.0
Tack-free time min	3	4	7	4	1	NA	NA	NA	NA	NA
Pot life 23°C min	NA	NA	NA	NA	NA	NA	NA	NA	300*1	1,440 h*1
Standard curing conditions	23±2°C/50±5% RH × 7 days					120°C × 1 h				120°C × 60 min
After curing										
Density 23°C g/cm³	3.04	2.90	1.62	1.68	2.34	2.92	2.52	3.06	2.22	2.61
Hardness Durometer A	40 (Asker C)	91	62	66	80	75	30*2	96	75	20
Tensile strength MPa	—	3.6	2.4	2.3	3.9	2.1	NA	4.8	6.4	0.4
Elongation at break %	—	30	60	60	60	60	NA	10	80	100
Volume resistivity TΩ·m	—	5.9	3.0	7.0	1.0	1.2	3.0	3.4	10	0.2
Dielectric breakdown strength kV/mm	14	25	30	29	24	23	24	25	25	25
Relative permittivity 50 Hz	—	4.6	4.2	3.9	4.3	6.7	5.3	—	4.0	6.0
Dielectric dissipation factor 50 Hz	—	4×10^{-3}	1×10^{-1}	2×10^{-1}	1×10^{-1}	4.5×10^{-3}	2×10^{-3}	—	1.6×10^{-3}	0.6×10^{-2}
Thermal conductivity W/m·K	2.40	2.40	0.82	0.88	1.60	2.20	1.10	4.00	0.83	1.60
Tensile lap-shear strength (Al/Al) MPa	—	0.5	1.2	1.0	—	1.0	—	0.8	1.0	0.3
LMW siloxane content ΣD_3–D_{10} ppm	10	< 300	< 300	< 300	< 300	< 300	—*3	< 500	—*3	< 500
Flame resistance UL94	—	V-0	V-0	V-0	V-0	V-0	—	V-0	V-0	V-0

*1 Time until viscosity doubles *2 Penetration: 1/4 cone *3 Not a low-molecular-weight siloxane product. (Not specified values)
★ Detailed data is available separately. This can be obtained from your Shin-Etsu Sales Department.

Relationship between application thickness and thermal resistance of KE-1867



UL94 flammability ratings criteria

Rating	Criteria
94V-0*	A set of 5 specimens is tested; the flaming combustion time of each specimen must not exceed 10 seconds, and total time of the set must not exceed 50 seconds.
94V-1*	A set of 5 specimens is tested; the flaming combustion time of each specimen must not exceed 30 seconds, and total time of the set must not exceed 250 seconds.
94HB	In this horizontal burning test, combustion must cease before the 100 mm reference mark.

* A rectangular test strip (width: 13.0 mm, length: 125 mm, thickness: as thin as is practical) is suspended vertically. A 20 mm flame is applied to the bottom for 10 seconds. The flame is then removed and the flaming combustion time is measured. When combustion ceases, the flame is again applied in the same manner and combustion time is measured again.

Flammability test Left: Silicone rubber Right: Organic rubber

LED encapsulants

Cure system	Two-component, addition								
Product name	**ASP-2010-A/B**	**KER-6110-A/B**	**ASP-1050P-A/B**	**ASP-1120-A/B**	**SCR-1012 A/B-R**	**SCR-1016 A/B**	**SCR-1018 A(S2)/B**	**FER-7061-A/B**	**FER-7110-A/B**
Brief description	High hardness, crack resistant	For compression molding	Crack resistant	High refractive index, low stress, rubber type	Low gas permeability	Low gas permeability	Low gas permeability, thixotropic	Low refractive index	Low refractive index
Category	Phenyl resin		Phenyl rubber		Modified silicone			Fluoro rubber	
Before curing									
Appearance	A/B: Colorless transparent to pale yellow transparent	A: Colorless transparent to creamy white translucent B: Colorless transparent	A: White B: Colorless transparent to creamy white translucent	A: Colorless transparent to pale yellow transparent B: Colorless transparent to creamy white translucent	A/B-R: Colorless transparent to pale yellow	A/B: Colorless transparent to pale yellow	A: White to creamy white B: Colorless transparent to pale yellow	A/B: Colorless transparent	A/B: Colorless transparent
Viscosity 23°C mPa·s	A:2,000/ B:2,500	A:1,000/ B:10,000	A:40,000/ B:3,600	A:1,600/ B:160	A:10,000/ B:1,000	A:10,000/ B:50	A:18,000/ B:50	A:24,000/ B:1,650	A:40,000/ B:2,000
Mix ratio	20:80	30:70	20:80	100:100	100:100	100:100	100:100	20:80	20:80
Mixed liquid viscosity 23°C mPa·s	2,300	3,500	4,500	450	3,000	350	600	2,500	3,600
Density 23°C g/cm^3	A:1.12/B:1.14	A:1.16/B:1.11	A:1.14/B:1.15	A:1.12/B:1.10	A:0.99/B:1.03	A:0.99/B:1.05	A:1.04/B:1.05	A:1.40/B:1.35	A/B:1.52
Refractive index 23°C/589 nm	A:1.59/B:1.55	A:1.52/B:1.54	A:1.56/B:1.54	A:1.58/B:1.53	A:1.54/B:1.47	A:1.54/B:1.51	A:1.54/B:1.51	A/B:1.38	A/B:1.36
Pot life 23°C h	8	8	24	24	8	8	8	8	8
Standard curing conditions	100°C × 2 h+ 150°C × 4 h	100°C × 2 h+ 150°C × 5 h	100°C × 2 h + 150°C × 4 h		100°C × 1 h + 150°C × 5 h			100°C × 1 h + 150°C × 2h	
After curing									
Hardness Shore D	55	38	NA	NA	75	70	73	NA	NA
Hardness Durometer A	NA	88	66	65	NA	NA	NA	65	40
Flexural modulus MPa	—	—	—	—	1,800	1,400	1,400	—	—
Flexural strength MPa	—	—	—	—	55	25	25	—	—
Tensile strength MPa	6.2	5.4	2.8	2.5	—	—	—	1.6	0.5
Elongation at break %	120	50	170	65	NA	NA	NA	50	30
Light transmissivity 400 nm/2 mm %	90	88	—	89	88	88	27	92	93
Softening point °C	20	20	15	20	75	40	40	-60	-30
Coefficient of linear expansion ppm $\alpha 1$	65	70	60	80	72	70	70	120	130
Coefficient of linear expansion ppm $\alpha 2$	410	190	480	250	190	220	220	310	330
Volume resistivity TΩ·m	—	260	260	—	300	160	160	4.2	2.1
Dielectric breakdown strength kV/mm	—	30.0	—	—	30.6	32.4	32.4	21.0	23.0
Relative permittivity 50 Hz	—	3.0	2.9	—	2.6	2.8	2.8	5.3	3.8
Dielectric dissipation factor 50 Hz	—	4×10^{-3}	4×10^{-3}	—	3×10^{-3}	2×10^{-3}	2×10^{-3}	1×10^{-1}	1×10^{-1}
Adhesion strength MPa PPA	2.5	2.4	1.9	1.1	5.5 (Substrate breaks)	5.6 (Substrate breaks)	5.6 (Substrate breaks)	0.6	0.2
Adhesion strength MPa Silver	3.8	4.0	1.5	1.3	5.1	10.0	10.0	0.6	0.2
Moisture absorption 85°C/85% RH/24 h %	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Water absorption 40°C/24 h %	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Oxygen permeability $cc/m^2 \cdot day$	190 (0.94 mm)	880 (0.92 mm)	340 (0.94 mm)	320 (0.88 mm)	250 (0.92 mm)	150 (0.92 mm)	150 (0.92 mm)	4,700 (0.95 mm)	10,000 (0.95 mm)

(Not specified values)

LED encapsulants

Cure system	Two-component, addition							One-component, addition		
Product name	KER-2500-A/B	KER-2500N-A/B	KER-2600-A/B	KER-2910-A/B	KER-6000-A/B	KER-6150-A/B	KER-6200-A/B	KER-6075-F	KER-6020-F	KER-6230-F
Brief description	High heat-resistant	For compression molding	Mid hardness, for lighting	Ultra heat-resistant, for lighting	Low hardness, high refractive index	Mid refractive index	High refractive index, gel	Thixotropic	For gold wire protection, thixotropic	For photocoupler, thixotropic
Category	Methyl rubber				Phenyl rubber		Phenyl gel	Phenyl rubber		Phenyl gel
Before curing										
Appearance	A/B: Colorless transparent	A/B: Colorless transparent	A/B: Colorless transparent	A/B: Colorless transparent	A: Colorless to pale yellow transparent B: Colorless transparent to creamy white translucent	A: Colorless to pale yellow transparent B: Colorless transparent to creamy white translucent	A/B: Pale yellow transparent	Creamy white translucent	Creamy white translucent	Translucent
Viscosity 23°C mPa·s	A:8,300/ B:2,700	A:8,500/ B:2,900	A:6,500/ B:5,500	A:5,280/ B:4,200	A:4,400/ B:2,000	A:5,000/ B:2,000	A:1,600/ B:1,400	34,000 (Non-fluid)	33,000 (Non-fluid)	25,000
Mix ratio	100:100	100:100	100:100	100:100	100:100	100:100	100:100	NA	NA	NA
Mixed liquid viscosity 23°C mPa·s	4,300	5,000	6,000	4,800	2,800	3,000	1,400	NA	NA	NA
Density 23°C g/cm³	A/B:1.06	A/B:1.06	A/B:1.02	A:0.98/B:1.00	A:1.09/B:1.08	A/B:1.08	A/B:1.08	1.14	1.05	1.04
Refractive index 23°C/589 nm	A/B:1.41	A/B:1.41	A/B:1.41	A/B:1.40	A:1.52/B:1.50	A/B:1.44	A/B:1.50	1.44	1.43	1.42
Pot life 23°C h	24	24	24	8	24	24	3	—	—	—
Standard curing conditions	100°C × 1 h + 150°C × 2 h						50°C × 4 h	100°C × 1 h + 150°C × 2 h		130°C × 30 min
After curing										
Hardness: Shore D	NA	NA	NA	NA	NA	NA	30 (Penetration)	NA	NA	40 (Penetration)
Hardness: Durometer A	70	70	47	20	22	50		80	21	
Flexural modulus MPa	—	—	—	—	—	—	—	—	—	—
Flexural strength MPa	—	—	—	—	—	—	—	—	—	—
Tensile strength MPa	10.0	10.0	6.0	0.6	0.1	5.7	NA	3.0	1.0	—
Elongation at break %	100	110	150	240	20	70	NA	30	180	—
Light transmissivity 400 nm/2 mm %	92	92	92	94	89	92	98*	90	76	—
Softening point °C	NA	—	—	-40	-40	NA	-40	NA	NA	—
Coefficient of linear expansion ppm: α1	—	—	—	—	—	—	—	—	—	—
Coefficient of linear expansion ppm: α2	250	250	390	560	500	310	350	250	240	400
Volume resistivity TΩ·m	16	14	10	—	100	—	0.5	580	400	3.0
Dielectric breakdown strength kV/mm	25.0	25.0	26.0	—	31.0	—	15.0	24.0	25.0	20.0
Relative permittivity 50 Hz	3.2	3.3	3.2	—	2.9	—	3.1	3.2	3.1	3.0
Dielectric dissipation factor 50 Hz	7×10^{-3}	7×10^{-3}	5×10^{-3}	—	2×10^{-4}	—	4×10^{-4}	5×10^{-3}	5×10^{-3}	5×10^{-4}
Adhesion strength MPa: PPA	3.0	3.0	2.4	0.3	0.1	0.8	NA	0.8	0.3	—
Adhesion strength MPa: Silver	1.4	2.5	2.0	0.3	0.1	0.7	NA	0.9	0.3	—
Moisture absorption 85°C/85% RH/24 h %	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	—	< 0.1	< 0.1	—
Water absorption 40°C/24 h %	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	—	< 0.1	< 0.1	—
Oxygen permeability cc/m²·day	31,000 (0.92 mm)	31,000 (0.92 mm)	35,000 (0.92 mm)	—	5,500 (0.91 mm)	19,600 (0.95 mm)	—	17,000 (0.92 mm)	—	—

* Optical path length: 10 mm. Measured in a quartz cell.

(Not specified values)

LED die-bonding adhesives, damming materials & reflector materials

Cure system	One-component, addition							
Product name	**KER-3000-M2**	**KER-3200-T7**	**X-32-2551**	**SMP-2840★**	**KER-2000DAM**	**KER-2020-DAM**	**KCR-H2800**	**KCR-4000W**
Brief description	Transparent	Thermal interface material	Transparent	Electrically conductive	Dams for high density mounting	Dams for high density mounting, highly thixotropic	Heat resistant	Low viscosity, Standard product
Category	Die-bond adhesive				Damming material		Reflector material	
	Insulator, transparent	Insulator, low thermal resistance	Insulator, transparent	Polyimide silicone	Methyl rubber	Methyl rubber	Organically modified silicone	Organically modified silicone
Before curing								
Appearance	Creamy white translucent	White	Creamy white transparent	Gray	White	White	White	White
Viscosity 23°C Pa·s	40	50	18	30	Non-fluid	Non-fluid	38	13
Solvent	Solventless	Isoparaffin	Solventless	Polyethylene glycol dimethyl ether	Solventless	Solventless	Solventless	Solventless
Non-volatile content wt%	99	95	99	86	—	—	—	—
Standard curing conditions	100°C × 1 h + 150°C × 2 h			180°C × 1.5 h	120°C × 1 h		150°C × 4 h	
After curing								
Density g/cm^3	1.15	2.45	1.13	5.6*2	1.10	1.20	1.94	1.66
Hardness Shore D	56	80	55	6.0 GPa (Modulus of elasticity)	NA	NA	76	77
Hardness Durometer A	NA	NA	NA		56	61	NA	NA
Flexural modulus MPa	270	350	260	—	—	—	—	—
Tensile strength MPa	—	—	—	—	6.1	5.7	—	—
Elongation at break %	—	—	—	—	140	120	—	—
Reflectance 450 nm/2 mm %	—	—	—	—	95	99	99	98
Coefficient of linear expansion ppm α1	—	—	—	40*3	—	—	—	—
Coefficient of linear expansion ppm α2	220	140	230	160*3	—	—	—	—
Thermal conductivity W/m·K	0.20	1.00	0.20	1.00	—	—	—	—
Thermal resistance mm^{2}K/W	15 (4 μm)	9 (9 μm)	—	8 (7 μm)	—	—	—	—
Volume resistivity TΩ·m	100	20	100	NA	—	—	—	—
Dielectric breakdown strength kV/mm	25	25	26	NA	—	—	—	—
Tensile lap-shear strength (Al/Al) MPa	3.9	3.6	4.2	NA	1.1	1.0	7.6	7.8
Die shear strength*1	2,100	2,000	2,100	2,200	NA	NA	—	—
Process suited for:	Stamping/ dispensing	Stamping/ dispensing	Stamping/ dispensing	Stamping	Dispensing/ screen printing	Dispensing/ screen printing	Compression/ injection/ transfer	Compression/ injection/ transfer

*1 Si chip (1 mm square, 0.35 mm thick) bonded to silver plating, curing conditions: 100°C × 1 h + 150°C × 2 h *2 Density before cured: 3.4 g/cm^3 *3 Glass transition point: around 185°C (Not specified values)

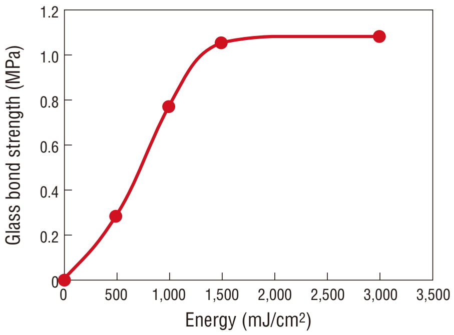
★ Detailed data is available separately. This can be obtained from your Shin-Etsu Sales Department.

UV curable products

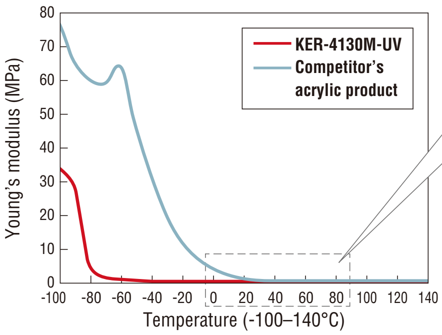
Cure system	UV+condensation			UV+heating		UV			
Product name	KE-4835	X-31-1273-2	X-31-1598-2	KER-4500	KER-4600	KER-4130M-UV	KER-4130H-UV	KER-4000-UV	SMP-7004★
Brief description	Low viscosity	Med. viscosity	Low viscosity	Low viscosity, filler material	High viscosity, damming material	Compatible with UV-LEDs, filling material	Compatible with UV-LEDs, damming material	For lens molding	Compatible with UV-LEDs, polyimide silicone
Reaction	UV+condensation			Addition		Radical			
By-product gas	Alcohol	Acetone	Acetone	NA	NA	NA	NA	NA	NA
Before curing									
Appearance	Creamy white translucent	Creamy white translucent	Creamy white translucent	Colorless transparent	Colorless transparent	Colorless transparent	Colorless transparent	Colorless transparent	Pale yellow transparent
Viscosity 23°C Pa·s	6.0	30	11	3.2	24	2.9	16.2	2.5	3.0
Refractive index 23°C/589 nm	NA	NA	NA	1.41	1.41	1.45	1.45	1.45	1.47
UV irradiation conditions mJ/cm^2	1,500	1,500	1,500	500	500	1,500	1,500	1,500	1,500
Standard curing conditions	23°C/50% RH × 3 days	23°C±2°C/50±5% RH × 7 days		+70°C × 2 h		—	—	—	—
After curing									
Density 23°C g/cm^3	1.01	1.09	1.06	0.97	0.97	1.04	1.06	1.15	0.98
Hardness Shore D	NA	NA	NA	NA	NA	NA	NA	70	NA
Hardness Durometer A	37	55	51	8	17	8	17	NA	NA
Flexural modulus N/mm^2	—	—	—	—	—	—	—	470	—
Flexural strength N/mm^2	—	—	—	—	—	—	—	14	—
Tensile strength MPa	0.7	1.5	2.0	0.2	0.4	0.3	0.4	—	6
Elongation at break %	80	50	70	190	230	140	100	—	160
Tensile lap-shear strength (glass) MPa	0.1	0.7	0.6	0.1	0.2	0.2	0.3	—	—
Young's modulus MPa	0.15	0.30	0.27	0.57	0.98	0.52	0.87	—	200
Cure shrinkage %	—	—	—	< 0.1	< 0.1	< 0.1	< 0.1	—	—
Bond strength (glass/glass) MPa	—	—	—	0.72	0.63	0.95	0.82	—	—
Light transmittance Thickness 300μm %	—	—	—	> 99	> 99	> 99	> 99	> 99	—

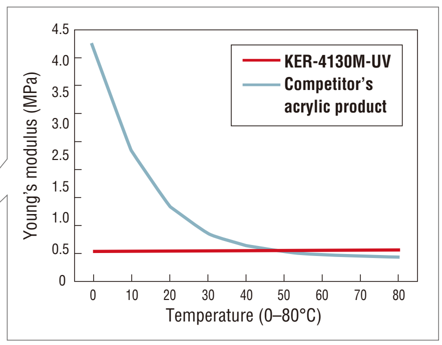
UV irradiation device: GS mini conveyor UV irradiation device, ASE model, made by Japan Storage Battery (now GS Yuasa) (Not specified values)
Actinometer: UIT-102 (365 nm monitor) made by Ushio Inc. ✻ Irradiation conditions: 500 mJ/cm^2=1 time pass
★ SMP-7004 is currently in development, so physical property values are subject to change. Detailed data is available separately. This can be obtained from your Shin-Etsu Sales Department.

UV curing characteristics of KER-4130M-UV (bond strength)



Temperature dependence of Young's modulus





Packaging options / Product index

Product name	Syringe	Glass bottle	Tube	Cartridge	Round can/ Square can	PE bottle (Ratchet)	JP can	RoHS★	Page
G-1000			200g	900g				○	P17
KE-3412				330ml			18kg	○	P12
KE-3424-G			120g	330ml				○	P16
KE-3467			250g	330ml				○	P12, 17
KE-3490			100g, 110g*, 200g	330ml				○	P12
KE-3494			100g, 110g*	330ml				○	P12
KE-3495			100g	330ml				○	P16
KE-4806-W			100g	330ml				○	P12
KE-4901-W				330ml				○	P12
KE-4908-T				330ml				○	P12
KE-4916-B				330ml			20kg	○	P12, 17
KE-4918				330ml			20kg	○	P12, 17
KE-4920-T			90g	330ml	1kg (Square can)		16kg	○	P16
KE-4921-W				330ml				○	P16
KE-4961-W			230g	330ml				○	P12, 17
KE-4970					1kg (Square can)		18kg	○	P16
KE-4971					1kg (Square can)		18kg	○	P16
KE-200					1kg		18kg	○	P14
CX-200 (KE-200 curing agent)		100g			900g (Square can)			○	P14
KE-210					1kg			○	P14
CAT-210 (KE-210 curing agent)		100g						○	P14
IO-SEAL-300					1kg		20kg	○	P13
KE-1014					1kg (Square can)		16kg (Square can)	○	P15
KE-1056						1kg	15kg (Square can)	○	P15
KE-1057					1kg (Square can)		16kg (Square can)	○	P15
KE-1061					1kg (Square can)		16kg (Square can)	○	P15
KE-1062					1kg (Square can)		16kg (Square can)	○	P15
KE-1831			100g		1kg		20kg	○	P13
KE-1833				330ml	1kg		20kg	○	P13
KE-1835-S					1kg		20kg	○	P13
KE-1842			100g		1kg		18kg	○	P16
KE-1844					1kg (Square can)		16kg	○	P16
KE-1850				330ml			18kg	○	P13
KE-1854					1kg		18kg	○	P13
KE-1855					1kg		18kg	○	P13
KE-1867		200g		330ml	1kg, 2kg		20kg	○	P17
KE-1869					1kg, 5.5kg			○	P17
KE-1871					1kg		15kg	○	P16
KE-1880				330ml	1kg		16kg	○	P13
KE-1884			100g		1kg		20kg	○	P13
KE-1885			100g		1kg		20kg	○	P13
KE-1886			100g	330ml	1kg		20kg	○	P16
KE-1891		300g			1kg, 3kg		20kg	○	P17
KCR-H2800	250g							○	P20
KCR-4000W				500g				○	P20
KER-2000DAM	30g, 50g							○	P20
KER-2020-DAM	30g							○	P20

■ One-component, condensation ■ Two-component, condensation ■ One-component, addition ■ Two-component, addition ■ UV cure

Product name	Syringe	Glass bottle	Tube	Cartridge	Round can/ Square can	PE bottle (Ratchet)	JP can	RoHS★	Page
KER-3000-M2	6g, 10g, 25g							○	P20
KER-3200-T7	10g							○	P20
KER-6020-F	30g							○	P19
KER-6075-F	30g							○	P19
KER-6230-F	30g							○	P19
SMP-2840						10g		○	P20
X-32-2551	6g							○	P20
ASP-1050P-A/B						A:200g/B:800g		○	P18
ASP-1120-A/B						A/B:1kg		○	P18
ASP-2010-A/B						A:100g × 2/B:800g		○	P18
FER-7061-A/B						A:100g × 2/B:800g		○	P18
FER-7110-A/B						A:100g × 2/B:800g		○	P18
KE-1011-A/B					A/B:1kg (Square can)		A/B:16kg (Square can)	○	P15
KE-1012-A/B					A/B:1kg (Square can)		A:16kg (Straight can) B:16kg (Square can)	○	P15
KE-1013-A/B					A/B:1kg (Square can)		A/B:16kg (Square can)	○	P15
KE-1051J-A/B					A/B:1kg (Square can)		A/B:18kg	○	P15
KE-106					1kg		18kg	○	P14
CAT-RG (KE-106 curing agent)		100g			1kg (Square can)			○	P14
KE-1063-A/B					A/B:1kg (Square can)		A/B:16kg (Square can)	○	P15
KE-109E-A/B					A/B:1kg		A/B:16kg (Square can)	○	P14
KE1204A/B					A/B:1kg		A/B:25kg	○	P14
KE-1280-A/B					A/B:1kg		A/B:18kg	○	P14
KE-1282-A/B					A/B:1kg		A/B:20kg	○	P14
KE-1283-A/B					A/B:1kg		A/B:9kg, 18kg	○	P14
KE-1285-A/B					A/B:1kg		A/B:20kg	○	P14
KE-1861-A/B					A/B:1kg		A/B:20kg	○	P17
KE-1897-A/B					A/B:1kg		A/B:10kg, 20kg	○	P14, 17
KER-2500-A/B						A/B:1kg		○	P19
KER-2500N-A/B						A/B:1kg		○	P19
KER-2600-A/B						A/B:1kg		○	P19
KER-2910-A/B						A/B:1kg		○	P19
KER-6000-A/B						A/B:1kg		○	P19
KER-6110-A/B						A:300g/B:700g		○	P18
KER-6150-A/B						A/B:1kg		○	P19
KER-6200-A/B						A/B:1kg		○	P19
SCR-1012A/B-R						A/B:1kg		○	P18
SCR-1016A/B						A/B:1kg		○	P18
SCR-1018A (S2)/B						A/B:1kg		○	P18
KE-4835				330ml				○	P21
KER-4000-UV		50g, 100g			1kg			○	P21
KER-4130H-UV		30g, 100g			1kg			○	P21
KER-4130M-UV		100g			1kg			○	P21
KER-4500		100g			1kg			○	P21
KER-4600		100g			1kg			○	P21
SMP-7004		50g, 100g, 500g						○	P21
X-31-1273-2				330ml				○	P21
X-31-1598-2			100g					○	P21

★ ○: This indicates that none of the six RoHS-prohibited substances (Cd, Cr6+, Hg, Pb, PBB, PBDE) are used intentionally as ingredients.
✻ Laminated tube

Packaging

We offer a variety of packaging options, based on product characteristics and for optimal usability.

Some of the available packaging options

Syringes

Glass bottles

Tubes/cartridges

1 kg cans

PE bottles

Metal cans (JP cans/round cans/square cans)

QMFZ2. Component — Plastics

File No.	Company Name	Grade	Thickness mm	Flame Class	HWI	HAI	RTI Elec.	RTI Mech.	HVTR	D495	CTI
E48923	SHIN-ETSU CHEMICAL CO., LTD.	**IO-SEAL-300**	1.5	HB	—	—	105	105	—	—	—
		KE1204A/B	0.89	V-0	0	0	105	105	0	0	0
		KE-1281A/B★	0.8	V-1	—	—	105	105	—	—	—
		KE-1285-A/B	6.0	V-0	—	—	105	105	—	—	—
		KE-1292A/B★	0.75	V-0	—	—	105	105	—	—	—
		KE-1831	0.75	V-0	3	0	105	105	0	4	0
			3.0	V-0	2	0	105	105			
		KE-1835-S	2.0-2.2	HB	—	—	105	105	—	—	—
		KE-1861-A/B	6.0	V-0	—	—	105	105	—	—	—
		KE-1862★	3.0	V-0	—	—	105	105	—	—	—
		KE-1867	0.8	V-0	—	—	105	105	—	—	—
		KE-1880	1.3	V-1	2	0	105	105	—	—	0
			2.4-2.6	V-0	1	0	105	105			
		KE-1891	2.0	V-0	—	—	105	105	—	—	—
		KE-1897	6.5	V-0	—	—	150	150	—	—	—
		KE-200/CX-200	1.5	HB	—	0	105	105	—	—	0
			3.0	HB	3	0	105	105			
			8.5	V-1	—	—	105	105			
		KE-200F★/CX-200	1.5	HB	—	0	115	115	—	—	0
			8.5	V-1	—	—	115	115			
		KE-210/CAT-210	3.0	V-0	1	0	105	105	—	—	0
			10.0	V-0	0	0	105	105			
		KE-210F★/CAT-210	3.0	V-0	1	0	105	105	—	—	0
			10.0	V-0	0	0	105	105			
		KE-225A/B★	3.0	V-0	0	0	105	105	—	—	0
		KE-3424-G	2.0	V-1	—	—	105	105	—	—	—
		KE-3466★	0.8-0.9	V-1	—	—	105	105	—	—	—
		KE-3467	0.8	V-1	—	—	105	105	—	—	—
			2.0-2.2	V-0	—	—	105	105			
		KE-3490	0.75	V-1	1	0	105	105	0	5	1
			1.5	V-1	0	—	105	105			
			3.0	V-0	0	0	105	105			
		KE-3494	0.75	V-1	0	0	105	105	0	5	2
			1.5	V-0	0	—	105	105			
			3.0	V-0	0	0	105	105			
		KE-4901-G★	2.0	V-0	1	0	105	105	0	—	0
			3.0	V-0	0	0	105	105			
		KE-4901-W	2.0	V-0	—	—	105	105	—	—	—
		KE-4916-B	2.0	V-0	—	—	105	105	—	—	—
		KE-4917-B★	1.5	V-0	—	—	105	105	—	—	—
		KE-4918-GRAY	2.0	V-0	1	0	105	105	—	—	—
		KE-4918-WHITE	2.0	V-0	1	0	105	105	—	—	—
		KER-6020-F	0.4	HB	—	—	105	105	—	—	—
E174951	SHIN-ETSU SILICONE TAIWAN CO., LTD.	**KE-1283 A/B/C**	6.0-6.6	V-1	—	—	105	105	—	—	—

QMJU2. Component — Coatings for use on Printed Wiring Boards

File No.	Company Name	Grade	Coating Material					Laminate		
			Min Thk mic	Max Thk mic	Flame Class	Elec Temp °C	Env Cond	Min Space	ANSI Type	Min Thk mm
E181060	SHIN-ETSU SILICONES OF AMERICA, INC.	**KE-4970**	255	323	V-0	130	Outdoor	0.74	FR-4,CEM-1,CEM-3	1.5
		KE-4971	246	457	V-0	130	Outdoor	0.78	FR-4,CEM-1,CEM-3	1.5

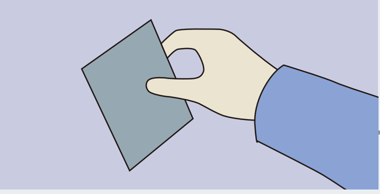
★ Product not featured in this catalog.

＊Not all of Shin-Etsu's UL certified products are shown in the list above.
For information on UL certification, go to http://iq.ul.com/iq/newiq/. Check the UL file numbers below for details.
Plastics: **E48923, E179895, E174951, E255646, E192980** Coatings for use on Printed Wiring Boards: **E181060**

Instructions for use

Usage instructions for one-component RTV silicone rubbers

Clean the application surface



Clean the surface of all rust, oil, dirt, grime and other substances that may interfere with adhesion using sandpaper or a solvent (toluene, xylene, other). When cleaning plastics with solvents, use caution as some solvents may damage plastics.

To save for later use

Tubes

Remove the nozzle and seal tightly. Clean residue out of the nozzle using a solvent.

Cartridges

Product should be used all at once if possible. If product remains, seal tightly before storage. If tightly sealed, the product can be kept for several days.

Tubes

Open the tube and load it into the dispenser cartridge .

Cartridges

Cut the nozzle tip and load the cartridge into the dispenser cartridge.

Application can be done by machine or by hand

Photo provided by Musashi Engineering Inc.

Usage instructions for two-component RTV silicone rubbers

Before use

Check the mix ratio carefully when using two-component RTV silicone rubber products. All ratios are given in parts by weight. Put the base polymer (A) into a container, followed by the curing agent (B). Mix thoroughly until evenly mixed throughout.

Be sure to deaerate the product after mixing. When using a planetary-centrifugal type mixer/deaerator, friction within the product can cause a sharp rise in temperature. Also be aware that with certain low viscosity products, there may be some settling of the fillers during storage. Before use, first agitate well to disperse the fillers and then proceed to mixing the two components.

To store

Be sure to seal the product tightly before storage. Use a solvent or other cleaning agent to clean stirrers, containers and other tools used in the mixing process after use.

Stir before use

Fillers may settle to the bottom of the container, so be sure to stir thoroughly with a suitable implement prior to use.

Weigh

Weigh out both the base polymer and curing agent.

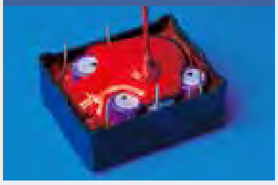
Combine

Mix

Combine the base polymer and curing agent, and mix until color is uniform and consistent.

Deaerate

Use



After mixing and deaeration, immediately pour into place.

Handling precautions

Handling precautions

1. One-component condensation-cure RTV silicone rubbers cure by reacting with moisture in the air, and curing starts at the surface. Curing speed is affected by temperature, humidity and other conditions. These products do not have particularly good deep-section cure properties, and are thus not suitable for adhesive applications in which the contact area is large. Additionally, if the product is used when humidity is above 100% and water droplets form on the rubber during the cure process, a hydrolysis reaction will proceed ahead of the crosslinking curing reaction, in which case the rubber may have reduced strength or exhibit surface tack after curing.

2. Although they are not featured in this catalog, certain one-component condensation-cure RTV silicone rubber products (including acetic acid-release and oxime-release types) may cause metal corrosion. Acetic acid-release types can cause rust, while oxime-release types can cause corrosion of copper-based metals in airtight conditions. The user should thus conduct a preliminary test with a sample to determine whether the product is suited to the intended application.

3. Condensation-cure RTV silicone rubbers will show a temporary decline in dielectric properties during the cure process. In most cases, however, the rubber will recover and exhibit its intrinsic dielectric properties when fully cured.

4. If these products come in contact with flux, they may not cure properly or may show reduced adhesiveness.

5. Condensation-cure RTV silicone rubber products should not be used in places where completely airtight conditions will be created.

6. Condensation-cure RTV silicone rubbers may yellow over time, but their other characteristics will not be affected.

7. Addition-cure RTV silicone rubber products may not cure properly if they are contaminated with or come in contact with certain cure-inhibiting substances (e.g. sulfur, phosphorus, nitrogen compounds, water, organometallic salts). See “Cure inhibitors” on p.8.

8. Addition-cure RTV silicone rubber products should not be used in high humidity conditions, as this can result in curing problems or poor adhesion.

9. Be aware that addition-cure RTV silicone rubber products release tiny amounts of hydrogen gas as they cure.

Precautions when using

1. Please contact your sales representative if you have any questions regarding the handling and use of these products.

2. Be sure to clean the substrate to remove dirt, grime, moisture and oil from the surface.

3. When using two-component products, be sure to measure, mix, stir and deaerate thoroughly. If these steps are not done properly, it may adversely affect the properties of the rubber.

4. When using an air gun applicator, be sure to set the pressure at a safe and suitable level, around 0.2–0.3 MPa MAX.

5. The products in the KE-200 series cure quickly at room temperature. When using these products, use of a special dispenser is recommended.

6. The curing agents for KE-200 and KE-210 undergo hydrolysis when exposed to moisture, meaning it is best to use the entire contents of the container soon after opening. Moreover, if the dispenser tank is being pressurized with air, be sure to use a dry air supply.

Safety and hygiene

1. Be sure there is adequate ventilation when using condensation-cure RTV silicone rubber products. As they cure, acetic acid-cure products release acetic acid; alcohol-cure products release methanol; oxime-cure products release methyl ethyl ketoxime (MEKO); and acetone-cure products release acetone. If you experience unpleasant symptoms when using these products, move to an area with fresh air.

2. Uncured RTV rubber may irritate skin and mucous membranes. Take care to avoid eye contact or prolonged contact with the skin. In case of accidental eye contact, immediately flush with water for at least 15 minutes and then seek medical attention. In case of skin contact, wipe off immediately with a dry cloth and then wash thoroughly with soap and water. Contact lens wearers must take special care when using RTV silicone rubber: if uncured RTV rubber enters the eye, the contact lens may become stuck to the eye.

3. Never touch or rub the eyes while working with these products. Users should wear safety glasses and take other appropriate steps to protect their safety.

4. These RTV silicone rubber products are classified as Class 4 Hazardous Materials or Designated Combustibles (combustible solids and synthetic resins) under the Fire Service Act of Japan. In your country, other laws may apply. Be sure that storage of these products is done in accordance with local laws with regard to labeling and other issues.

5. Keep out of the reach of children.

6. Be sure to read the Safety Data Sheets (SDS) for these products before use. SDS are available from the Shin-Etsu Sales Department.

Precautions related to storage

1. Store at room temperature (1–30°C), out of direct sunlight. Note that certain products must be kept at 1°–25°C. If the product label says “keep refrigerated”, it should be kept at temperatures of 10°C or below. Note that KER-3000-M2, KER-3200-T7, X-32-2551, KER-2000DAM, KER-2020-DAM, KCR-H2800 and KCR-4000W must be kept at between -10°C and 10°C. SMP-2840 must be kept at between -40°C and -20°C.

2. Once a cartridge has been opened, the entire contents should be used at one time whenever possible. If some remains, be sure to seal the cartridge completely.

Shin-Etsu Chemical Co., Ltd.

Silicone Division Sales and Marketing Department Ⅳ

6-1, Ohtemachi 2-chome, Chiyoda-ku, Tokyo, Japan
Phone : +81-(0)3-3246-5152 Fax : +81-(0)3-3246-5362

Shin-Etsu Silicones of America, Inc.

1150 Damar Drive, Akron, OH 44305, U.S.A.
Phone : +1-330-630-9860 Fax : +1-330-630-9855

Shin-Etsu do Brasil Representação de Produtos Químicos Ltda.

Rua Coronel Oscar Porto, 736 11º Andar - 114/115
Paraíso São Paulo - SP Brasil CEP: 04003-003
Phone : +55-11-3939-0690 Fax : +55-11-3052-3904

Shin-Etsu Silicones Europe B.V.

Bolderweg 32, 1332 AV, Almere, The Netherlands
Phone : +31-(0)36-5493170 Fax : +31-(0)36-5326459

Germany Branch

Rheingaustrasse 190-196, 65203 Wiesbaden, Germany
Phone : +49-(0)611-962-5366 Fax : +49-(0)611-962-9266

Shin-Etsu Silicone Taiwan Co., Ltd.

Hung Kuo Bldg. 11F-D, No. 167, Tun Hua N. Rd.,
Taipei, 10549 Taiwan, R.O.C.
Phone : +886-(0)2-2715-0055 Fax : +886-(0)2-2715-0066

Shin-Etsu Silicone Korea Co., Ltd.

GT Tower 15F, 411, Seocho-daero, Seocho-gu,
Seoul 137-856, Korea
Phone : +82-(0)2-590-2500 Fax : +82-(0)2-590-2501

Shin-Etsu Singapore Pte. Ltd.

4 Shenton Way, #10-03/06, SGX Centre Ⅱ, Singapore 068807
Phone : +65-6743-7277 Fax : +65-6743-7477

India Branch

712, 7th Floor, Ashoka Estate 24, Barakhamba Road,
New Delhi, India, 110001
Phone : +91-11-43623081 Fax : +91-11-43623084

Shin-Etsu Silicones (Thailand) Ltd.

7th Floor, Harindhorn Tower, 54 North Sathorn Road,
Bangkok 10500, Thailand
Phone : +66-(0)2-632-2941 Fax : +66-(0)2-632-2945

Shin-Etsu Silicone International Trading (Shanghai) Co., Ltd.

29F Junyao International Plaza, No.789,
Zhao Jia Bang Road, Shanghai 200032, China
Phone : +86-(0)21-6443-5550 Fax : +86-(0)21-6443-5868

Guangzhou Branch

B-2409, 2410, Shine Plaza, 9 Linhexi Road,
Tianhe, Guangzhou, Guangdong 510610, China
Phone : +86-(0)20-3831-0212 Fax : +86-(0)20-3831-0207

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JAB CM003
JAB CM009

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

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

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