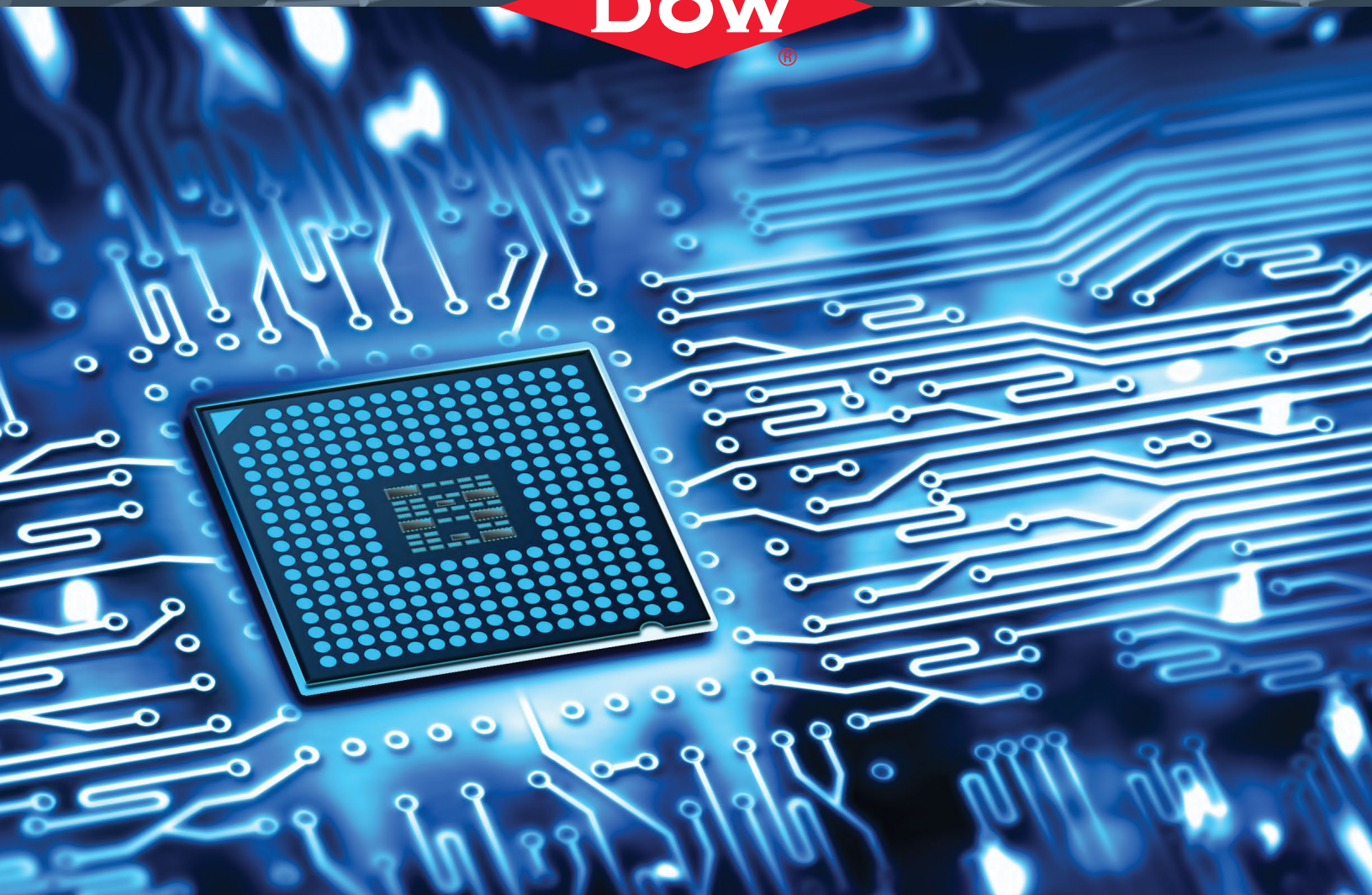
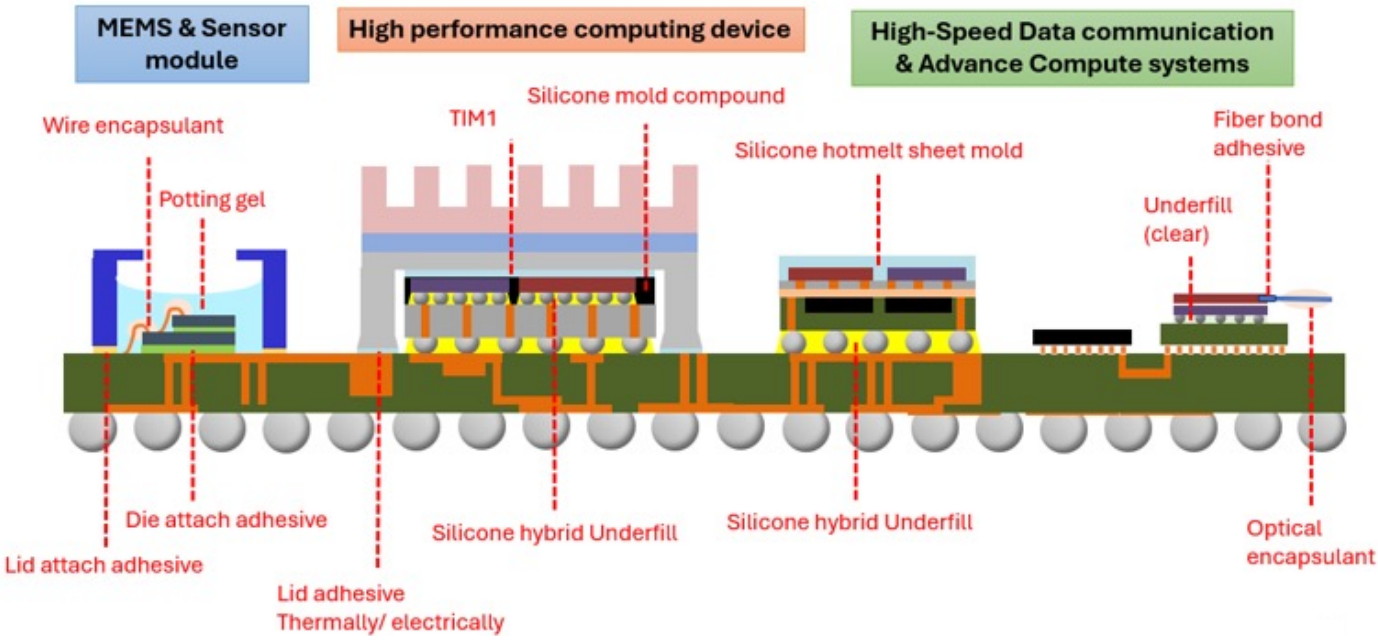
CONSUMER ELECTRONICS

Sensing the market growth in Advanced Semiconductor Packaging

Product/Portfolio guide

DOW®





Dow silicone solutions for Micro-Electro-Mechanical Systems (MEMS) and advanced semiconductor packaging can help optimize designs, drive new innovations and meet stringent performance requirements. Compared with organics such as epoxies and polyurethanes, Dow's silicone-based materials more effectively meet the demands of thermal stress relaxation, stability over broad temperature and frequency ranges, low moisture uptake, high purity and reliability.

Adhesive & Sealing Materials: Adhesives that mechanically secure dies and lids while protecting packages from thermal, mechanical, and environmental stress; available in non-conductive, thermally conductive, and electrically conductive options, including silicone-hybrid systems for balanced strength and stress relief.

Protection & Encapsulation Materials: Encapsulants, potting gels, and molding compounds provide electrical insulation, low-stress protection, chemical resistance, and long-term reliability for semiconductor, MEMS, and sensor devices, including PFAS-free solutions and hot-melt formats for high-throughput processing.

Thermal Management Materials: In-package thermal interface materials designed to manage warpage and thermal stress, enabling reliable heat dissipation for AI, HPC, and advanced packaging architectures.

Optical Materials: Advanced silicone and hybrid adhesives for PIC/EIC attach, fiber bonding, and optical encapsulation in co-packaged optics, enabling precise alignment, low optical loss, low stress, UV or low-temperature curing, and stable performance under thermal cycling.

Process & Property Flexibility: Broad tunability in viscosity, CTE, modulus, curing mode (UV / thermal), and adhesion to support next-generation packaging, panel-level processes, and tight-tolerance optical systems.

DOWSIL™ silicone technology

Key properties and application benefits

Key properties	Benefits in the application
Low modulus over wide ranges of temperature	– Ability to absorb stress during temperature cycle caused by CTE mismatch
Thermal stability	– Stable electrical and mechanical properties over wide temperature and frequency ranges – Adhesion strength performance at high reflow temperature; high-temperature reliability
Low level of ionic impurities	– Ultraclean; high purity; compatible with microelectronic processing – Reduced risks of ionic contamination causing corrosion
Efficient adhesion	– Flexible to use for a broad range of substrate materials and interconnects
Low moisture uptake	– Prevent issue during reflow temperature – Stable dielectric constant during operation
Accelerated heat cure	– Minimal by-products and minimal shrinkage for enhanced reliability

Drive Semiconductor Packaging innovation with successful silicone technologies

MEMS/Sensor module

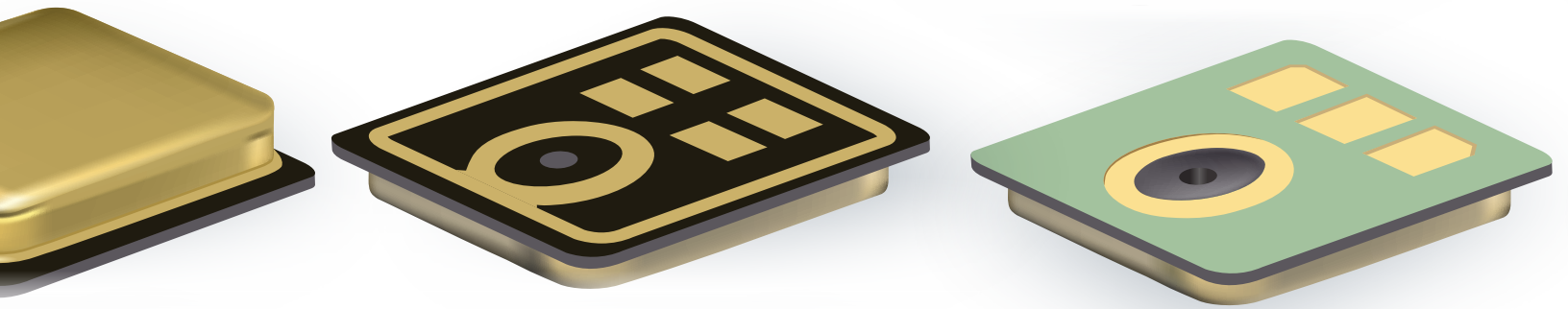
MEMS and sensor modules are compact, highly sensitive devices that require robust protection without compromising performance or accuracy. Silicone-based materials play a critical role in these packages by providing low-stress encapsulation, electrical insulation, and environmental protection, helping preserve sensor sensitivity under thermal cycling, vibration, and harsh operating conditions. With tunable modulus, excellent chemical and thermal stability, and precise dispensability, silicone solutions enable reliable packaging for a wide range of MEMS and sensor applications across consumer, automotive, and industrial electronics.

High performance computing

For high performance computing and AI devices, Thermal Interface Material 1 (TIM1) and lid adhesive solutions enable thermal and mechanical reliability in advanced packages. The continued increase in processor power density and package size will require TIM1 materials that deliver high thermal conductivity, low bond line thickness, and stable coverage to efficiently transfer heat from the die to the lid. Lid adhesives ensure robust attachment and warpage control, maintaining package integrity under severe CTE mismatch and thermal cycling. Together, optimized TIM1 and lid adhesive systems support low thermal resistance, improved reliability, and long-term performance for large-die AI accelerators, GPUs, and high-end server processors.

High speed data communication & advanced compute system

High speed data communication and advanced compute systems require semiconductor packaging materials that enable ultra-fast signal transmission, low loss of power, and high reliability. By offering excellent dielectric performance, thermal stability, and mechanical compliance, silicone-based materials like optical encapsulants, adhesives, silicone hybrids, and hot melt films enable the continued scale up of AI accelerators, data centers, and co-packaged optics. These materials support short-reach interconnects, precise optical alignment, and robust system integration—helping achieve higher bandwidth, improved energy efficiency, and long-term reliability in next-generation compute architectures.



Why choose Dow Performance Silicones?

Dow has been a global leader in silicone-based technology for more than 70 years. Headquartered in Michigan, USA, Dow maintains manufacturing sites, sales and customer service offices, and research and development laboratories in every major geographic market worldwide to ensure that you receive fast, reliable support for your processing and application development needs. We can help you drive design innovation and process efficiency.

Unique product technology

Our substantial silicone legacy – showcased though the DOWSIL™ and SILASTIC™ brand names that encompass more than 7,000 silicone products and services – offers a portfolio with breadth and performance that few companies can match.

Extensive know-how

We multiply our product value with deep in-house knowledge and experience and an extended network of industry resources.

Collaborative culture

We work closely with you to help reduce time and cost at every stage of your new-product development.

Stability

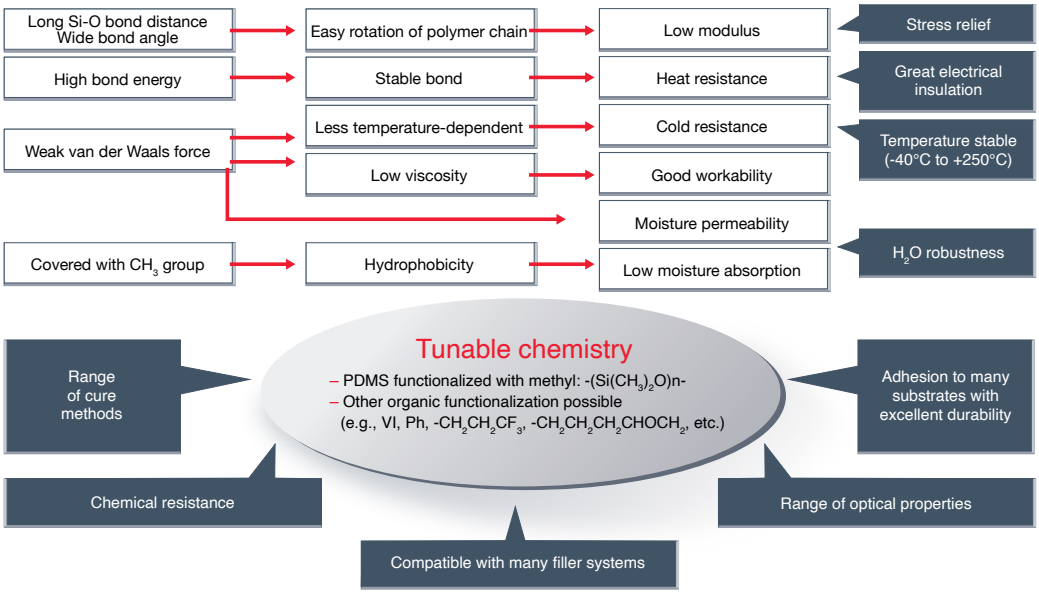
For more than seven decades, we have been a global leader, investing in manufacturing and quality to help fuel your innovations through a consistent supply of effective silicone products.

DOWSIL™

silicones by DOW

Characteristics of silicones

When compared to organic materials, DOWSIL™ silicones offer superior stress management while keeping a low and stable modulus over a wide temperature range for sensing accuracy. Silicones also offer chemical and thermal reliability for environmental protection of “open package” sensors.



Bond length
- Si – O : 1.64 Å
- C – C : 1.53 Å

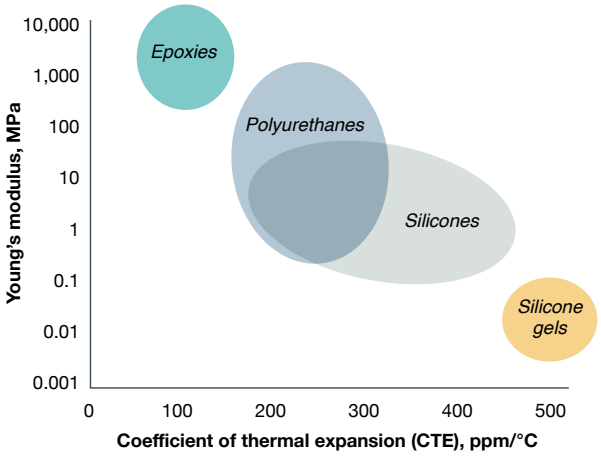
Bond angle
- Si – O – Si : 130-150°
- C – C – C : 112°

Barrier to rotation
- $H_3Si – OH$: 0.4 kcal/mol
- $H_3C – CH_3$: 2.9 kcal/mol

Bond energy
- Si – Si : ~51 kcal/mol
- Si – O : ~106 kcal/mol
- C – O : ~81 kcal/mol
- C – C : ~85 kcal/mol

W. Noll, “Chemistry and technology of Silicones,” Academic Press, London (1968)

Silicone vs. organics: Impact on thermal stress



$$\sigma_{th} = E \alpha dT$$

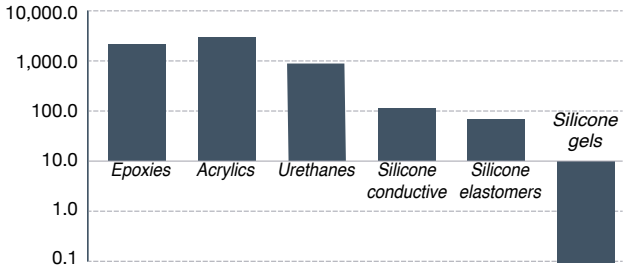
Coeff. thermal expansion:
αsilicone = 3 ~ 10 x αepoxy

Young’s modulus:
Esilicone = 0.1 ~ 0.001 x Eepoxy

Thermal stress:
σepoxy = 1 ~ 100 x σsilicone

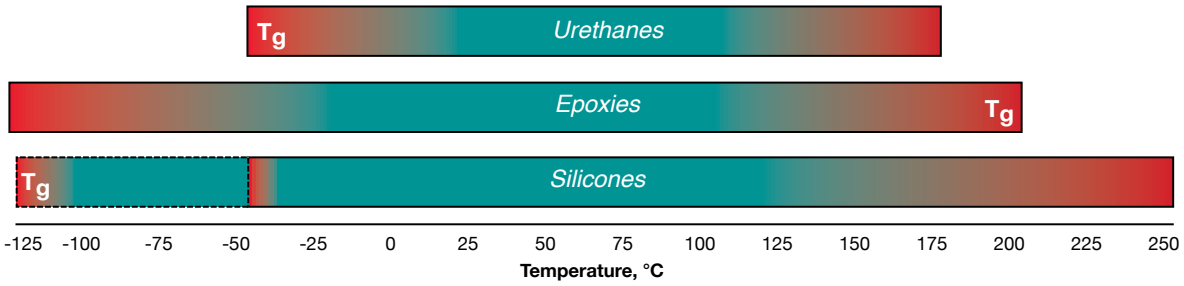
– Lower thermal stress in silicone gels

Relative thermal stress for 25°C to 125°C



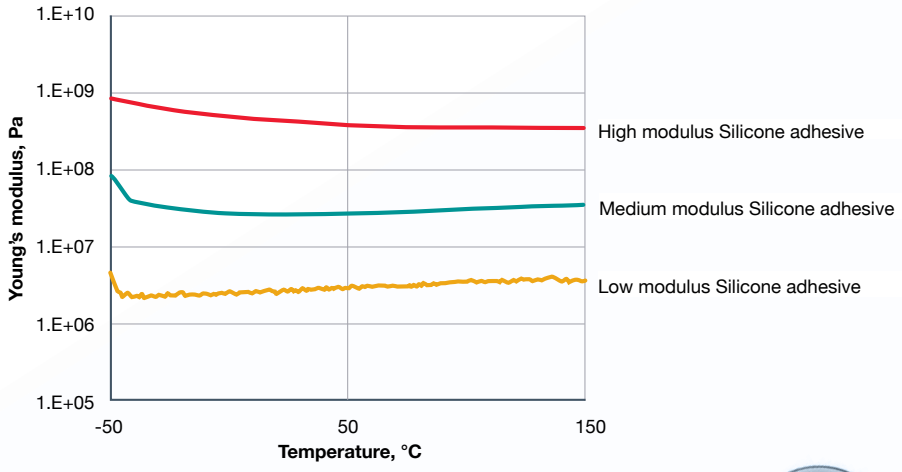
DOWSIL™ silicones by DOW

Silicone vs. organics: Usable temperature range



- Operating temperature should not exceed the material's Tg. Otherwise, changes in material properties, such as modulus, may lead to performance variation.
- Silicones typically have two transitions at low temperature (-40 ~ -50°C and -110 ~ -120°C)
  - Silicone use above T_g exhibits little change in properties
- Moisture/humidity is an important factor affecting performance
  - Silicones have low water/moisture absorption, unlike organics
  - Water saturation point ~ 0.15 wt.% in silicones vs. >1 wt.% in organics (some can have >5 wt.%)

Stable modulus over wide temperature range (after cured)



Adhesives

Product name	Key features	Color	Curing	Density	Viscosity	Thixotropic index	Modulus	Hardness	CTE	Die Shear	Pot life
		—	—	g/cm³	mPa.s	—	MPa	Shore	ppm/K	MPa	Hours
DOWSIL™ ME-2010	High modulus Good light transmission	Translucent	150°C/ 120min	1.1	23,000	2.0	150	D 57	190	8.2	>48
DOWSIL™ ME-1180	Jet dispensable Good stress relief	Translucent	130°C/ 60min	1.1	5,600	5.2	24	D 18	230	5.5	>48
DOWSIL™ ME-1070	High thixotropy High adhesion strength	Black	150°C/ 30min	1.2	37,000	4.8	12	A 74	250	11	>48
DOWSIL™ 7920-LV	Jet dispensable High adhesion strength	Black	150°C/ 60min	1.2	22,000	4.0	7.2	A 68	259	9.0	>48
DOWSIL™ ME-1140	Jet dispensable Excellent stress relief	Translucent, Black*	130°C/ 60min	1.0	5,400	5.4	2.0	A 39	300	3.8	>48
DOWSIL™ ME-1030	Outstanding stress relief Very low volatile content	Translucent	150°C/ 120min	1.1	14,000	4.2	1.7	A 28	310	0.8	>48
DOWSIL™ ME-1015*	Low modulus Higher elongation	Black	150°C/ 60min	1.1	76,000	4.2	0.6	A 20	280	2.4	>48
DOWSIL™ ME-1445	Relatively high modulus High adhesion strength	Black	150°C/ 120min	1.7	169,000	2.0	62	D 45	138	4.2	>48
DOWSIL™ XX-2735*	Ultra low modulus	Black	125°C/ 5min	1.2	250,000	2.8	0.3	A 20	255	2.5	>48
DOWSIL™ ME-1439	Thermally conductive Low VOC, low outgassing	Gray	150°C/ 60min	2.7	54,000	1.7	82	D 39	75	5.0	24

*Sample under development

Electrically Conductive Adhesive

Product name	Key features	Color	Curing	Density	Viscosity	Thixotropic index	Modulus	Hardness	CTE	Volume resistivity	Die Shear	Pot life
		—	—	g/cm³	mPa.s	—	MPa	Shore	ppm/K	ohm·cm	MPa	Hours
DOWSIL™ EC-8425	Electrically conductive EMI Shielding	Tan	125°C/30min 150°C/10min	2.5	400,000	NA	320	D 40	110	5.0E-03	2.5	16
DOWSIL™ ME-1800	Electrically conductive	Gray	150°C/ 120min	4.4	150,000	2.0	380	A 81	125	1.0E-04	3.9	12
DOWSIL™ ME-1850	Electrically conductive Fine dispensing	Gray	150°C/ 120min	4.3	36,000	2.5	350	A 86	157	1.0E-04	2.5	12

Glob top/Wire encap

Product name	Key features	Color	Curing	Density	Viscosity	Thixotropic index	Modulus	Hardness	CTE	Pot life
		—	—	g/cm^3	mPa.s	—	MPa	Shore	ppm/K	Hours
DOWSIL™ ME-1180	Jet dispensable Good stress relief	Clear, Black*	130°C/ 60min	1.1	5,600	5.2	24	D 18	230	>48
DOWSIL™ 7920-LV	Jet dispensable High adhesion strength	Black	150°C/ 60min	1.2	22,000	4.0	7.2	A 68	259	>48
DOWSIL™ ME-1140	High thixotropy Excellent stress relief	Clear, Black	130°C/ 60min	1.0	5,400	5.4	2.3	A 39	300	>48
DOWSIL™ ME-4139	High thixotropy for glob top Excellent stress relief	Dark gray	150°C/ 60min	1.2	45,000	3.3	1.5	A 28	320	>48
DOWSIL™ ME-4135	Jet dispensable Excellent stress relief	Black	130°C/ 60min	1.0	3,050	4.1	1.7	A 32	290	24
DOWSIL™ ME-4132	Outstanding stress relief Excellent stress relief	Black	70°C/60min+ 150°C/120min	1.0	4,870	3.0	2.1	A 33	325	>48

*Sample under development

Potting Gel

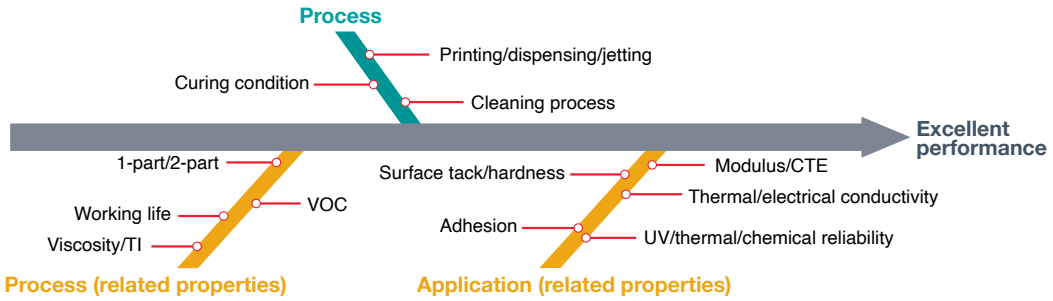
Product name	Key features	Color	Curing	Density	Viscosity	Thixotropic index	Penetration	Dielectric strength	Pot life
		—	—	g/cm^3	mPa.s	—	mm/10	KV/mm	Hours
DOWSIL™ X3-6211	UV cure	Clear	365 nm 4 J/cm^2	1.0	900	NA	50	17	>168 w/o UV
DOWSIL™ ME-4039	2-part gel, Range of hardness possible by adjusting mixing ratio	Clear	150°C/ 120min	1.0	A: 5,400 B: 2,200	NA	50 (1:1)	22	>168
DOWSIL™ ME-4200*	Cold resistance	Clear, Black	150°C/ 60min	1.0	5,000	1.5	70	19	72
DOWSIL™ ME-4202*	Cold resistance High adhesion strength	Clear	150°C/ 120min	1.0	1,800	1.0	70	20	72h

*Sample under development

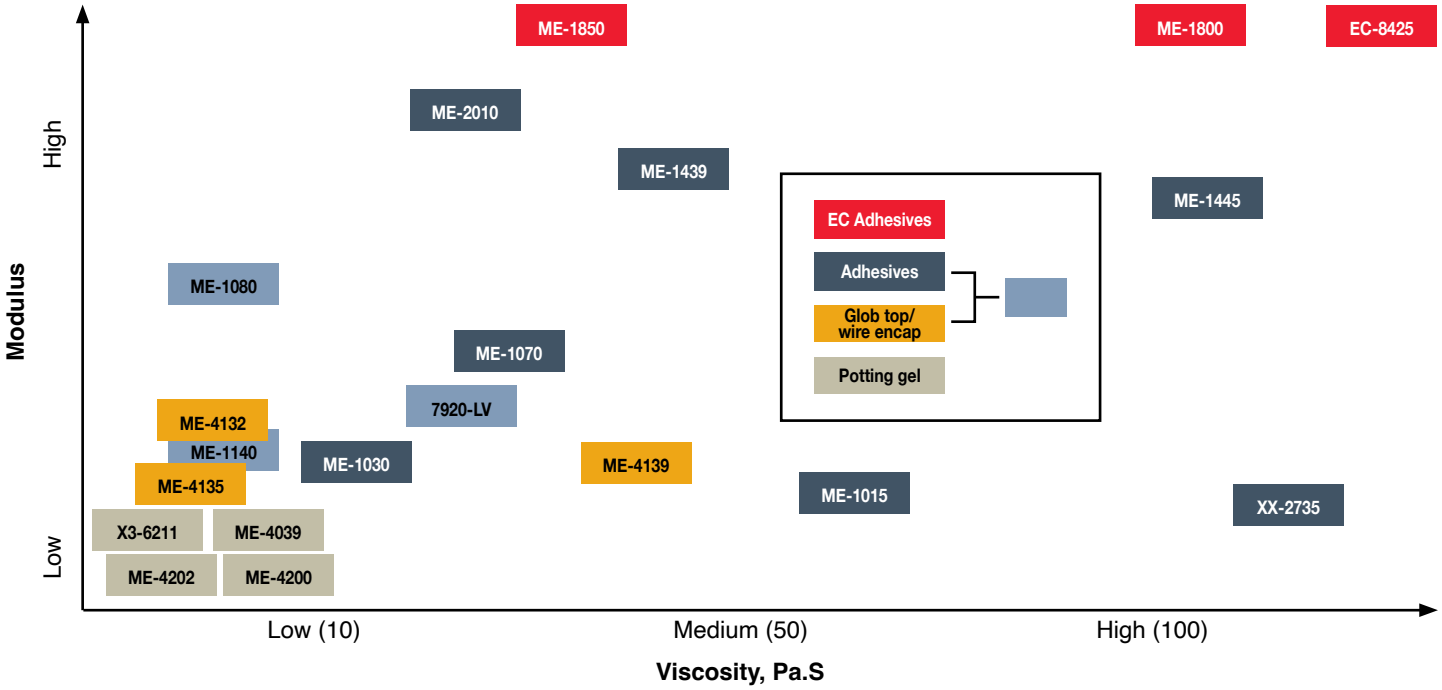
Product selection guidelines

Successful, effective DOWSIL™ silicone products can meet key design requirements for advanced MEMS sensors and actuators that are being widely used across most industries. Some of the basic guidelines for product selection are provided here.

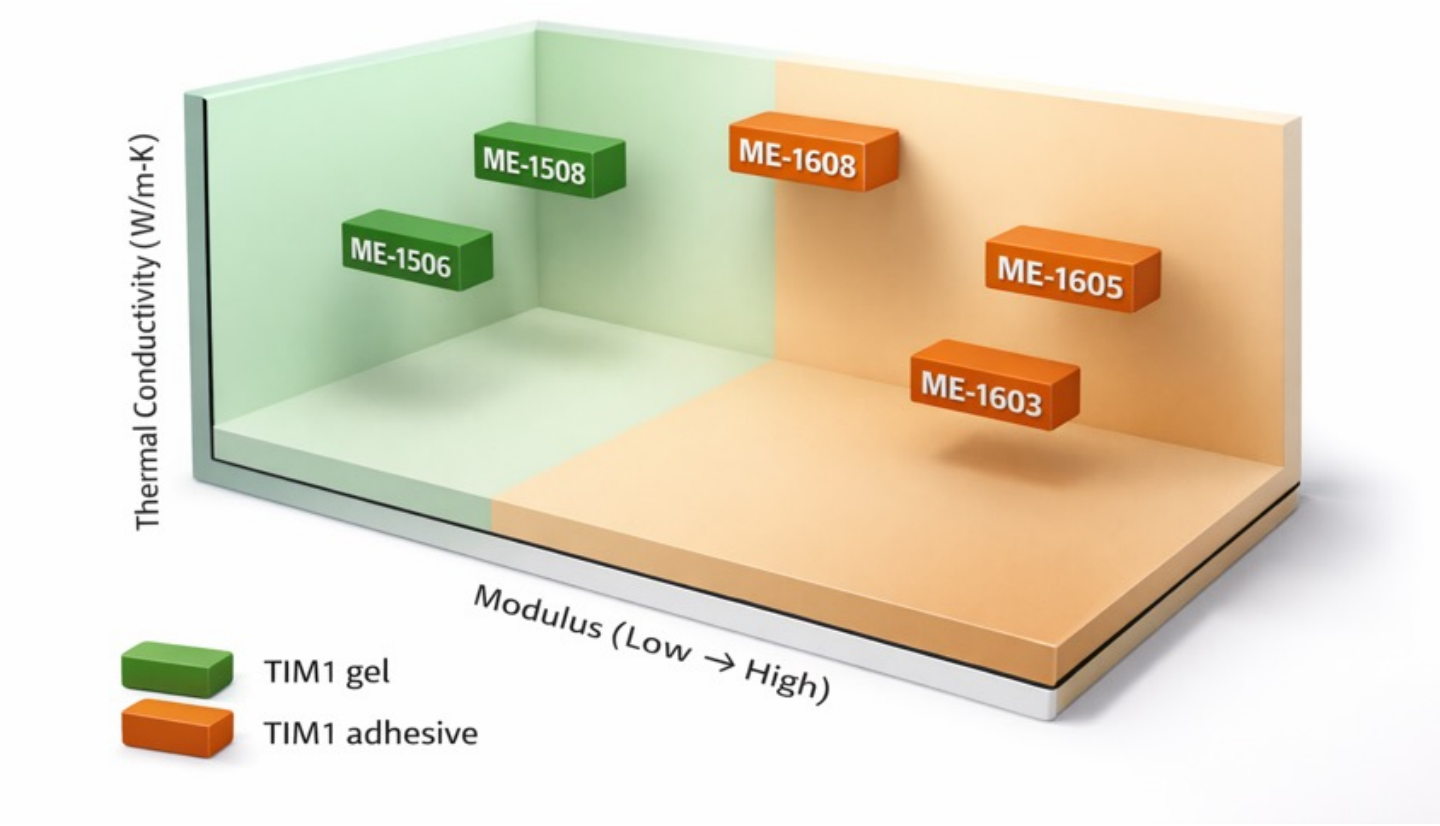
Key pillars for technology choice



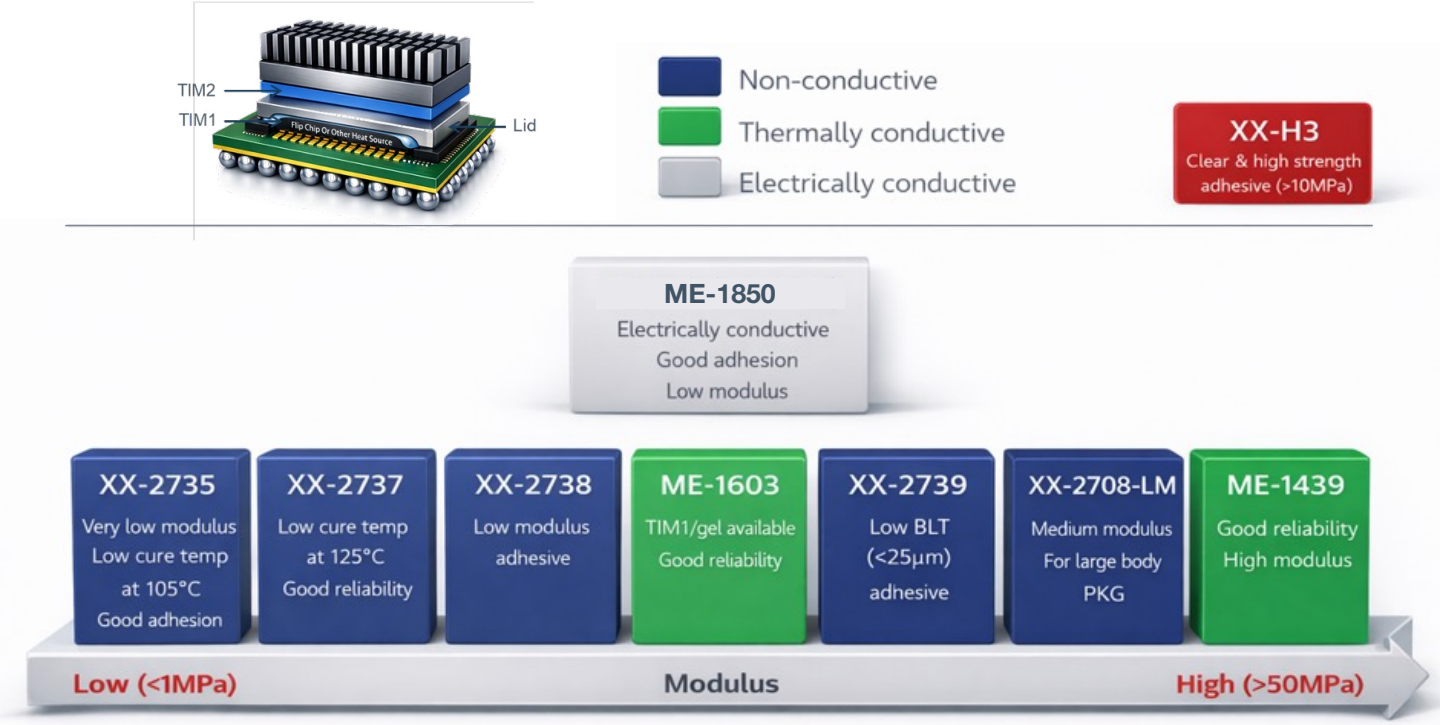
Selection on material property



TIM1



Lid adhesives



Silicone Hotmelt Cartridge (SHC)

Silicone Hotmelt Cartridge (SHC) is a curable adhesive in cartridge for hot dispensing.

Unique features of SHC include:

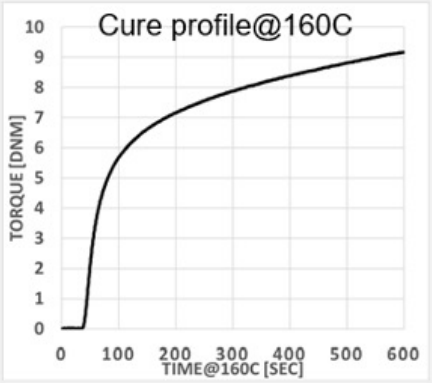
- No limitation on thickness, width, and length, unlike SHF.
- Excellent stress dissipation, despite relatively large modulus.
- Excellent adhesion to many substrates.

SHC is suitable for instant bonding or modling applications.

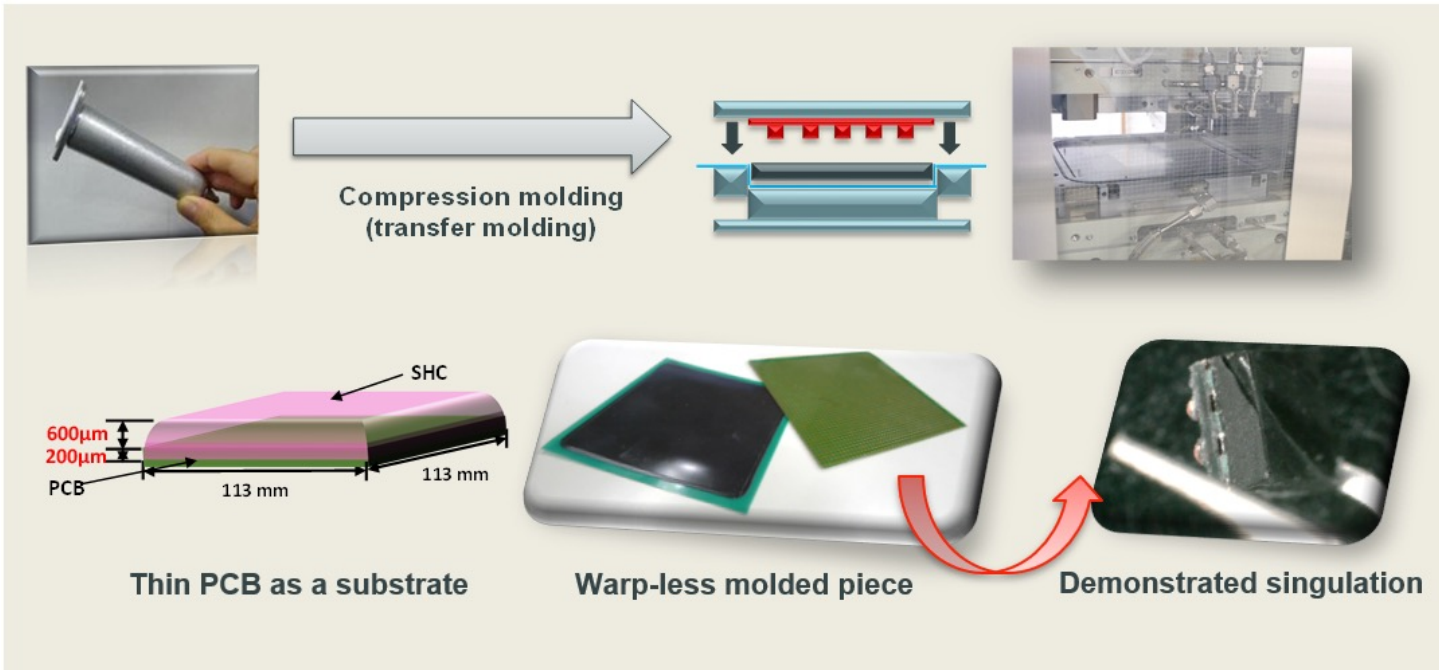


General properties	Unit	SHC (developmental)
viscosity@25C	Pas	>5,000
viscosity@100C	Pas	9-10
Gelation time@160C	sec	48
Tensile modulus	MPa	30-40
Tensile strength	MPa	3.5-4.0
Tensile elongation	%	400-500
CTE	ppm/K	230

Thermosetting Characteristics



Mold applications



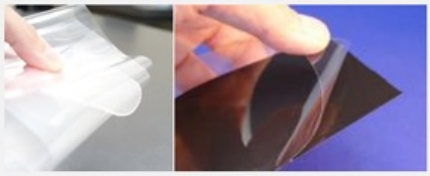
Silicone Hotmelt Film (SHF)

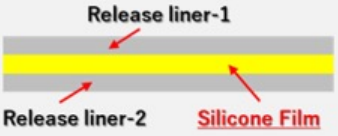
Silicone Hotmelt Film (SHF) is a curable adhesive film designed for dry-film lamination process (400mmx400mm).

Unique features of SHF include:

- Typical film thickness (range: 50-150 µm) providing excellent BLT control.
- Excellent stress dissipation, despite relatively large modulus.
- Excellent adhesion to many substrates.

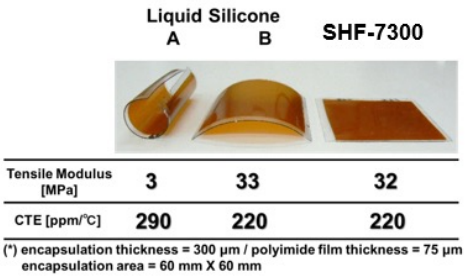
SHF is suitable for large area adhesion to 2 substrates with different CTE.





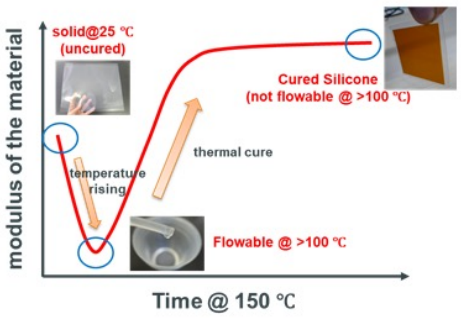
Technical needs	Target	SHF-7300	TC-SHF (developmental)	PL-SHF (developmental)
Thickness control	Excellent	Excellent	Excellent	Excellent
Low temp. stability	-100C	-100C	-100C	-100C
High temp. stability	>200C	200C	200C	>250C
Stress dissipation	Excellent	Excellent	Excellent	Excellent
Durability against chemicals	Excellent	Excellent	Excellent	Excellent
Thermal conductivity	>2 W/mK	0.2 W/mK	2 W/mK	0.5 W/mK
Durability against plasma	Excellent	poor	Poor-good	Excellent

Stress dissipation

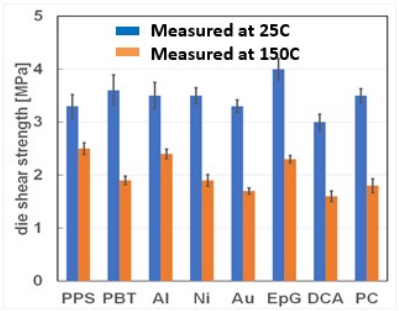


(*) encapsulation thickness = 300 µm / polyimide film thickness = 75 µm
encapsulation area = 60 mm X 60 mm

Thermosetting Characteristics



Adhesion strength



PPS=PolyPhenyleneSulfide
Al=Aluminum
Au=Gold
DCA=Die-Cast Aluminum
PBT=PolyButyleneTerephtalate
Ni=Nickel
EpG=Epoxy Glass
PC=PolyCarbonate

General Properties

General properties	Unit	SHF-7300
viscosity@25C	Pas	>5,000
viscosity@100C	Pas	40-50
Gelation time@160C	sec	48
Tensile modulus	MPa	40-60
Tensile strength	MPa	4.0-5.0
Tensile elongation	%	600-800
CTE	ppm/K	230





How can we help you today?

A broad selection of successful, effective DOWSIL™ silicone materials is available to meet the demanding performance requirements for MEMS sensors and actuators being used in a diverse range of applications. Dow can help enable innovative design and processing options for MEMS development customers serving consumer and automotive electronics industries. Tell us about your performance, design and manufacturing challenges. Let us put our silicon-based materials and application knowledge and our processing experience to work for you.

Learn more

Dow offers much more than just an industry-leading portfolio of advanced design and assembly materials for MEMS sensors and actuators. As your dedicated innovation leader, we bring process and application experience, collaborative problem-solving, a reliable global supply base, and world-class customer service. To find out how Dow can support your MEMS design and application needs, visit **dow.com/electronics.**

Images: cover – dow_60011886804; dow_56231613198, Page 4 – dow_40458252925, Page 12 —dow_64765848299, dow_61864548498

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