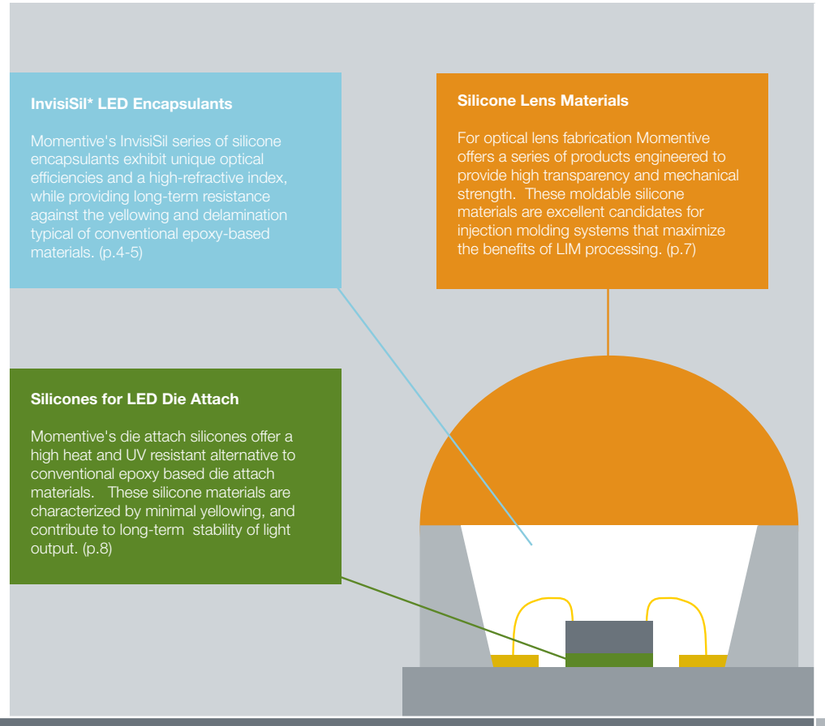
MOMENTIVE™

Silicone Material Solutions for LED Packages and Assemblies

LED Packaging and Assembly Solutions from Momentive Performance Materials

The growth of optoelectronic devices and LEDs in segments such as handheld devices, mobile phones, display backlights, automotive, and electronic signs, has led to an increase in demand for enhanced performance and long-term reliability. Designers of LEDs and optoelectronic devices will find a range of silicone material solutions from Momentive, that are excellent candidates to address a wide array of challenges facing the LED industry.



Glob Top Encapsulants

Momentive's Glob Top encapsulants exhibit good light transmittance, and are formulated to provide consistent dispensing performance and material flow to form a dome shape. Component designers with chip-mounting and wire-bonding capabilities can benefit from the process simplicity that these materials offer in LED Glob Top packaging applications. (p.6)

Dot Matrix and LED Assembly Materials

LED dot matrix potting materials are available in room temperature and heat-accelerated alternatives. The low viscosities of these potting materials make them great materials of choice for potting applications in intricate Dot Matrix applications and LED Assemblies. (p.9)

Silicone Advantages

Performance Comparison

	Silicone	Epoxy
Thermal Resistance	Excellent	Fair
UV Resistance	Excellent	Poor
Hardness	Good	Excellent
Adhesion Strength	Good	Excellent
Thermal Expansion	Fair	Good
Moisture Absorption	Good	Fair
Moisture Permeability	Fair	Good

The chemical structure of silicone provides several advantages over conventional materials used in optoelectronic applications. The backbone structure of polydimethylsiloxane consists of silicon (Si) and oxygen (O). The siloxane bond (Si-O) is inorganic and has a higher bond energy of (444kJ/mol) than either carbon (C) - carbon (C) bond (356kJ/mol), or carbon (C) - oxygen (O) bond (339kJ/mol). This bond energy difference is ascribed as one of the contributing factors to the better thermal stability of silicone over that of epoxy resin. The inorganic siloxane bond of silicone materials and its resultant bond energy, contributes to stable performance under harsh operating conditions. This is manifest in performance advantages to epoxy resins under some usage conditions.

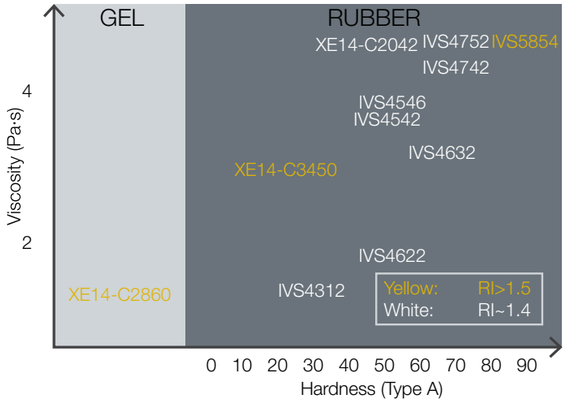
*InvisiSil is a trademark of Momentive Performance Materials Inc.

InvisiSil* LED Encapsulants

InvisiSil series, silicone encapsulants deliver high refractive index & light transmittance to effectively transmit light emitted from LEDs. They help contribute to durability and reliability of devices through their long-term resistance to yellowing and delamination of encapsulant from the substrate. They also provide low viscosities that make them candidates for a wide variety of LED packages such as small SMD packages, larger power packages, and multi-chip COB packages.

Key Features

- Selection from a range of refractive index
- up to 1.53 (n_D^{25})
- High light transmittance (>98%, 400-800nm)
- Good workability
- High purity
- Adhesion to PPA, LCP



Product Details		High Refractive Index		
		XE14-C2860	XE14-C3450	IVS5854
Components		2 Part	2 Part	2 Part
Cure Type		Heat Cure	Heat Cure	Heat Cure
Property		Gel	Rubber	Resin
Viscosity	(A) Pa·s	0.9	6.7	8.1
	(B) Pa·s	0.6	2.2	4.3
Mixing Ratio	(A:B)	100:100	20:100	10:100
Viscosity (mixed) @23°C	Pa·s	0.8	2.5	4.5
Refractive Index	n_D^{25}	1.51	1.53	1.53
Curing Condition	°C/h	80/1	150/1[1]	150/1[2]
Transmittance (1mm: 400nm, 800nm)	%	98, >99	98, >99	98, >99
Penetration		35	-	-
Hardness (Type A)		-	29	46 (Type D)
Specific Gravity @23°C		-	1.11	1.18
Adhesion Strength (PPA)	MPa	-	0.2	1.9
CTE	1/K	-	2.6×10^{-4}	1.0×10^{-4}, 2.2×10^{-4}

Packaging: XE14-C2860 A & B 500g bottles. XE14-C3450 A 100g, B 500g bottles. IVS4854 A 50g, B 500g bottles. [1] Step cure (90min@80°C, 1h@150°C) recommended for package dispensing applications. [2] Step cure (2h@100°C, 1h@120°C, 1h@150°C) recommended for package dispensing applications. Typical property values should not be used as specifications

		Normal Refractive Index							
		IVS4312	XE14-C2042	IVS4542	IVS4546	IVS4622	IVS4632	IVS4742	IVS4752
Components		2 Part	2 Part	2 Part	2 Part	2 Part	2 Part	2 Part	2 Part
Cure Type		Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure
Property		Rubber	Rubber	Rubber	Rubber	Rubber	Rubber	Rubber	Rubber
Viscosity	(A) Pa·s	1.2	6.2	5.7	6.1	4.2	7.5	14	7.0
	(B) Pa·s	0.8	4.4	3.2	3.3	1.5	1.4	2.4	4.0
Mixing Ratio	(A:B)	100:100	100:100	100:100	100:100	100:100	100:100	100:100	100:100
Viscosity (mixed)	@23°C Pa·s	1.0	4.9	3.8	4.2	2.4	3.2	4.2	5.0
Refractive Index	n_D^{25}	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Curing Condition	°C/h	150/1[1]	150/1[1]	150/1[1]	150/1[1]	150/1[1]	150/1[1]	150/1[1]	150/1[1]
Transmittance (1mm: 400nm, 800nm)	%	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99
Hardness (Type A)		29	43	48	49	55	64	71	72
Tensile Strength	MPa	0.8	6.0	6.6	7.1	7.2	9.0	11	4.6
Elongation	%	110	170	110	130	100	80	70	90
Specific Gravity @23°C		0.99	1.02	1.03	1.03	1.04	1.05	1.05	1.05
Adhesion Strength (PPA)	MPa	0.3	3.0	3.7	3.2	3.2	1.5	2.7	3.1
CTE	1/K	3.3×10^{-4}	2.8×10^{-4}	2.8×10^{-4}	2.8×10^{-4}	2.8×10^{-4}	2.8×10^{-4}	2.7×10^{-4}	2.7×10^{-4}

Packaging: 500g Bottles [1] Step cure (90min@80°C, 1-2 h@150°C) recommended for package dispensing applications
Typical property values should not be used as specifications

InvisiSil Series Transmittance

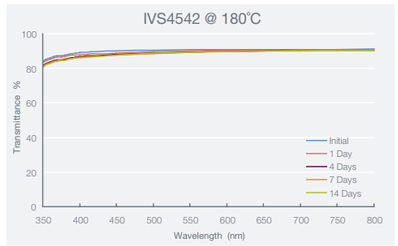
Thermal Stability

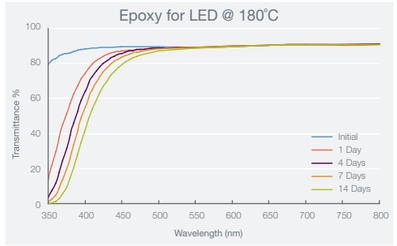
InvisiSil LED Encapsulants help contribute to long-term thermal stability of LEDs. This is represented in thermal stability tests conducted using IVS4542 and LED grade epoxy resins. Tests were performed by exposing both materials, sandwiched between glass plates, to 180°C temperatures. While the transmittance of IVS4542 remained stable under prolonged periods of heat exposure, epoxy resins demonstrated deterioration in transmittance over time accompanied by yellowing of the encapsulant material.

UV Stability

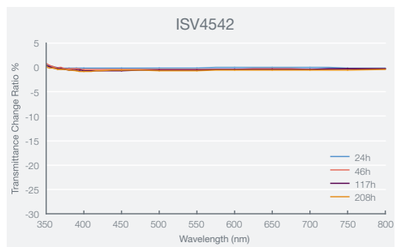
InvisiSil LED Encapsulants also help contribute to long-term UV stability of LEDs. This is represented in UV stability tests conducted using IVS4542 and LED grade epoxy resins. Tests were performed by exposing both materials, sandwiched between glass plates, to black lamp UV light. Change in transmittance against initial spectra values were measured. IVS4542 silicone encapsulant demonstrated stable performance, while LED epoxy resins generated results suggesting lower UV stability.

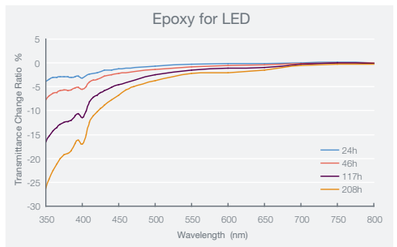
Transparency Performance[1]



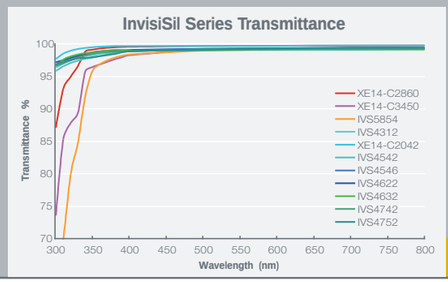


Test Conditions: IVS4542 and epoxy resin cured in glass sandwich specimens and exposed to 180°C temperatures for specified time intervals





Test Conditions: IVS4542 and epoxy resin cured in glass sandwich specimens and exposed to UV lamp: Black light, 100mJ/cm²/min at 365nm detector



[1] Transmittance measured using 1mm cured film

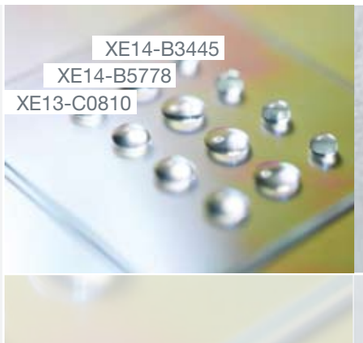
Glob Top Encapsulants

Momentive's Glob Top encapsulants exhibit good light transmittance, and are excellent candidates to provide consistent dispensing performance and material flow to form a dome shape for COB (chip on board) encapsulation. Component designers with chip-mounting and wire-bonding capabilities can benefit from the process simplicity that these materials offer in LED COB packaging applications.

Product Details					
			XE14-B3445	XE14-B5778	XE13-C0810
Components			2 Part	2 Part	1 Part
Cure Type			Heat Cure	Heat Cure	Heat Cure
Property			Rubber	Rubber	Gel
Appearance			Translucent	Translucent	Translucent
Viscosity	(A)	Pa·s	70	5.5	-
	(B)	Pa·s	55	5.0	-
Mixing Ratio	(A:B)		100:100	100:100	-
Viscosity (mixed) @23°C		Pa·s	63	14	14
Pot Life @23°C		h	72	8	-
Refractive Index		n_D^{25}	1.41	1.41	1.41
Curing Condition		°C/h	150/1	80/2	150/1
Transmittance (1mm: 400nm, 800nm)		%	69, 86	79, 92	69, 85
Hardness (Type A)			70	16	24
Specific Gravity @23°C			1.10	1.02	1.02
Tensile Strength		MPa	-	0.5	-
Elongation		%	-	190	170
Adhesion Strength (Al)		MPa	3.5	0.3	0.6
Thermal Conductivity		W/m·K	0.20	0.17	0.18
CTE		1/K	2.7×10^{-4}	2.3×10^{-4}	3.0×10^{-4}
Volume Resistivity		MΩ·m	1×10^{7}	2×10^{5}	2×10^{7}
Dielectric Strength		kV/mm	24	24	21
Dielectric Constant (60Hz)			2.8	2.7	2.6
Dielectric Loss (60Hz)			0.001	0.001	0.003
Ionic Content (Na, K, Cl)		ppm	<2, <2, <5	<2, <2, <5	<2, <2, <5

Packaging: 500g Bottles
Typical property values should not be used as specifications

1Transmittance measured using 0.6mm liquid film

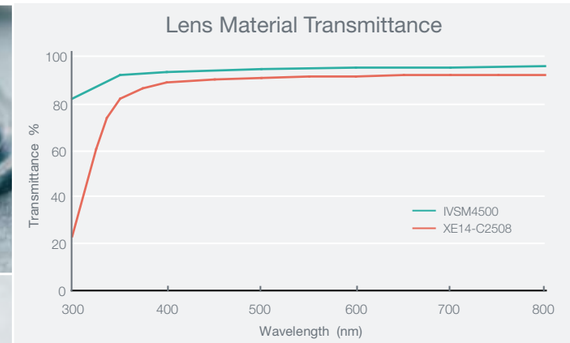


Lens Fabrication Materials

For optical lens fabrication Momentive offers a series of products engineered to provide high transparency and mechanical strength. These moldable silicone materials are excellent candidates for injection molding systems that maximize the benefits of LIM processing.

Product Details				
			IVSM4500	XE14-C2508[1]
Components			2 Part	2 Part
Cure Type			Heat Cure	Heat Cure
Property			Resin	Resin
Appearance			Transparent	Transparent
Viscosity	(A)	Pa·s	300	90
	(B)	Pa·s	50	500
Mixing Ratio	(A:B)		100:100	100:10
Viscosity (mixed) @23°C		Pa·s	30	100
Pot Life @23°C		h	24	24
Curing Condition		°C/h	150/1	180/1
Refractive Index		n_D^{25}	1.42	1.53
Transmittance (1mm: 400nm, 800nm)		%	93.9, 94.6	87.8, 91.3
Hardness (Type A)			50	68
Young's Modulus		MPa	80	-
Tensile Strength		MPa	4.7	-
Elongation		%	<5	-
CTE		1/K	2.2×10^{-4}	-
Shrinkage		%	2.5	-

Packaging: 1kg can, 18kg pail [1] Experimental grade
Typical property values should not be used as specifications.



1Transmittance measured using 1.4~2.0mm liquid film

Die Attach Silicones

Momentive's die attach silicones offer a high heat and UV resistant alternative to conventional epoxy based die attach materials. These silicone materials are characterized by minimal yellowing, and contribute to long-term stability of light output.

Product Details		
		XE13-C2476
Characteristic		Electro-Insulative
Components		1 Part
Cure Type		Heat Cure
Property		Rubber
Appearance		Translucent
Viscosity @23°C	Pa·s	30
Curing Condition	°C/h	150/1
Thermal Conductivity	W/m·K	0.20
Specific Gravity @ 23°C		1.15
Hardness		58 (Type D)
Adhesive Strength (Al)	kV/mm	3.0
Volume Resistivity	MΩ·m	$1.0x10^7$
Refractive Index	(n_D^{25})	1.42
Ionic Content (Na, K, Cl)	ppm	<2, <2, <5

Packaging: 10ml Syringe

Typical property values should not be used as specifications

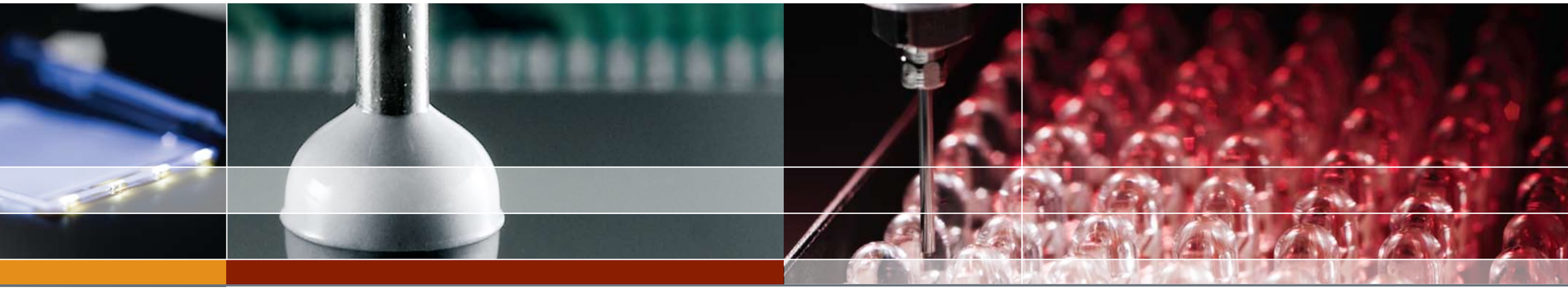
Dot Matrix and Assembly Materials

LED dot matrix potting materials are available in room temperature and heat-accelerated alternatives. The low viscosities of these potting materials make them excellent materials of choice for intricate Dot Matrix applications and LED Assemblies for a variety of industries ranging from signage, automotive, to lighting. These silicone materials provide enchanced weatherablility performance, especially in locations with high salt air concentrations, and represent a smart alternative to conventional epoxy or urethane materials.

Product Details		Dot Matrix Materials		LED Assembly Materials		
		XE12-B2543	XE14-C0447	TSE3032	TSE3033	RTV615
Components		2 Part	2 Part	2 Part	2 Part	2 Part
Cure Type		Room Temp.	Heat Cure	Heat Cure	Heat Cure	Heat Cure
Property		Rubber	Rubber	Rubber	Rubber	Rubber
Appearance		Translucent	Translucent	Translucent	Translucent	Translucent
Viscosity @23°C	(A) Pa·s	1.8	1.9	4.2	1.1	4.3
	(B) Pa·s	-	1.7	0.7	0.8	-
Mixing Ratio	(A:B)	100:2	100:100	100:10	100:100	100:10
Viscosity (mixed) @ 23°C	Pa·s	-	1.7	4.0	0.9	4.0
Pot LIfe @ 23°C		2	2	4	6	4
Curing Condition	°C/h	23/72	80/1	100/1	150/0.5	100/1
Specific Gravity @ 23°C		1.11	0.99	1.02	1.01	1.02
Hardness (Type A)		28	15 (Type E)	35	30	44
Tensile Strength	MPa	0.8	-	4.5	1.0	6.3
Elongation	%	130	-	210	130	120
Adhesion Strength	MPa	0.42 (Al)	adhesive	-	0.3 (glass)	-

Typical property values should not be used as specifications

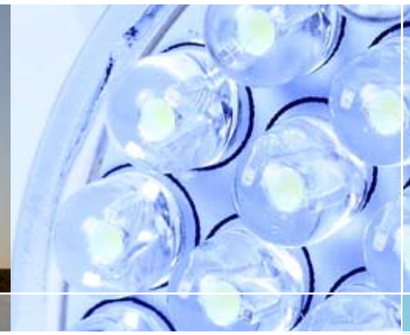
Packaging									
	30g bottle	100g bottle	1lb (454g)	500g bottle	1kg can	10 lb (4.5kg)	15 kg pail	18kg pail	44lb (22kg)
XE12-B2543 (A)					•			•	
XE12-B2543 (B)	•			•					
XE14-C0447 (A)							•		
XE14-C0447 (B)							•		
TSE3032 (A)					•		•		
TSE3032 (B)		•		•			•		
TSE3033 (A)					•			•	
TSE3033 (B)					•			•	
RTV615 (A:B Kit)			•			•			•



Product Availability

Product Availability by Region[1]					
	Japan	Korea	China	US	Europe
XE14-C2860	•		•	•	•
XE14-C3450	•	•	•		•
IVS5854	•	•	•		•
IVS4312	•	•	•	•	•
XE14-C2042	•	•	•		•
IVS4542	•	•	•	•	•
IVS4546	•	•	•		•
IVS4622	•	•	•		•
IVS4632	•	•	•	•	•
IVS4742	•	•	•		•
IVS4752	•	•	•		•
XE14-B3445	•	•	•	•	•
XE14-B5778	•	•	•	•	•
XE13-C0810	•		•	•	•
IVSM4500	•	•	•	•	•
XE14-C2508	•				
XE13-C2476	•				
XE12-B2543	•				
XE14-C0447	•	•	•	•	
TSE3032	•	•	•	•	•
TSE3033	•	•	•	•	•
RTV615	•	•	•	•	•

[1] Contact a Momentive Performance Materials sales representative for availability in countries and regions not listed



Other Electronic Solutions from Momentive Performance Materials

12-page brochure provides detailed information on silicone materials used for thermal management applications in electronics and micro-electronics. Includes SilCool* grease & adhesives, and conventional grades for adhesion, encapsulation and potting.

Comprehensive package of adhesion, sealing, coating, and encapsulation / potting solutions for a wide range of silicone applications in electric and electronic devices and component assemblies.

*SilCool is a trademark of Momentive Performance Materials Inc.

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Technical subject matter in this publication is described and protected by one or more of the following U.S. Patents and their foreign counterpart patents and/or patent applications: U.S. Patent Nos. 7,411,007; 7,388,049; 7,387,784; 7,381,769; 7,374,771; 7,241,835; 7,217,777; 6,759,479; 6,538,061; 6,531,540; 6,475,568; 6,444,745; 6,291,563; 6,207,782; 5,981,681; and 5,807,956. Other U.S. and foreign patents and/or patent applications not listed covering the subject matter may be relevant.

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