MOMENTIVE
performance materials

The science behind the solutions.

Silicone Materials for LED Lighting Applications

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From high-performance LED chip packaging encapsulants to thermal management materials and adhesives for lighting assemblies, Momentive provides a broad range of innovative silicone solutions to be considered for LED Lighting applications.

Typical Applications:
- Residential LED light bulbs
- LED light rails
- Street lamps
- Automotive lighting
- LCD backlight units
- Traffic signals

Potential Material Solutions:
- LED encapsulants
- Room temperature cure adhesives
- Thermally conductive gels, gap fillers
- Thermally conductive low bleed greases
- Thermally conductive curable compounds

LED Packaging

InvisiSil* LED Encapsulants

InvisiSil silicone encapsulants can help deliver high refractive index and light transmittance to effectively transmit light emitted from LEDs. Their long-term resistance to yellowing and delamination can help contribute to durability and reliability of devices, making them excellent candidates to consider for a wide variety of LED packages.

Typical Properties		XE14-C2860	IVS4546	IVS4622	IVS4742
Type		2 Part Heat Cure	2 Part Heat Cure	2 Part Heat Cure	2 Part Heat Cure
Appearance, Color		Transparent Gel	Transparent Rubber	Transparent Rubber	Transparent Rubber
Mixing Ratio ((A):(B) by weight)		100:100	100:100	100:100	100:100
Viscosity (23°C)	Pa·s	0.8	4.2	2.4	4.2
Refractive Index (N_D25)		1.51	1.41	1.41	1.41
Cure Condition	°C/h	80/1	150/1[1]	150/1[1]	150/1[1]
Penetration		35	-	-	-
Hardness (Type A)		-	49	55	71
Elongation	%	-	130	100	70
Adhesive Strength (PPA)	MPa	-	3.2	3.2	2.7

[1]Step cure (80°C@90min~120min, 150°C`1h) recommended.

Typical property values should not be used as specifications

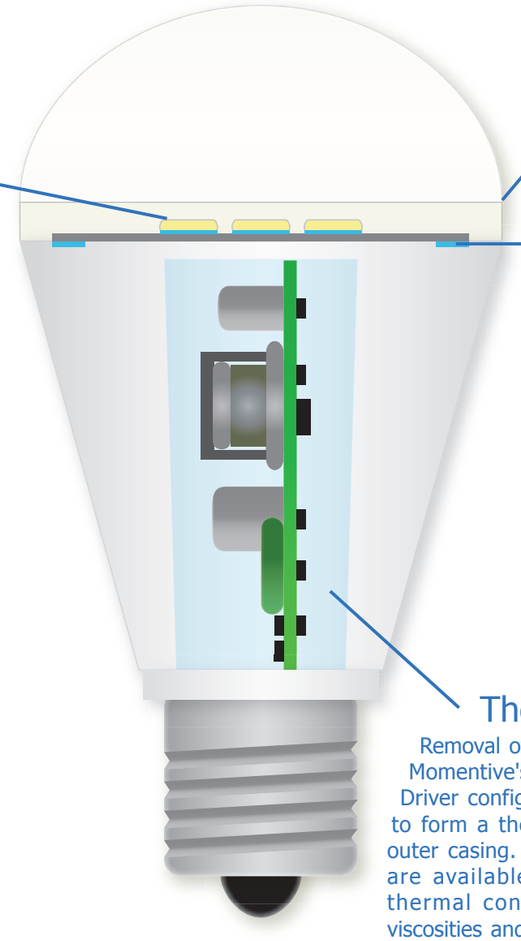
Lens Fabrication Materials

Momentive provides moldable silicone materials that can help promote high transparency and mechanical strength, making them excellent candidates to consider for injection molding systems that maximize the benefits of LIM processing.

Typical Properties		IVSM4500
Type		2 Part Heat Cure
Appearance, Color		Transparent Resin
Mixing Ratio ((A):(B) by weight)		100:100
Viscosity (23°C)	Pa·s	30
Pot Life (23°C)	h	24
Refractive Index (N_D25)		1.42
Transmittance (1.4~2mm: 400n, 80nm)	%	93.9, 94.6
Cure Condition	°C/h	150/1
Hardness (Type D)		50
Young's Modulus	MPa	80
CTE	1/K	$2.2x10^{-4}$
Shrinkage	%	2.5

Typical property values should not be used as specifications

*InvisiSil is a trademark of Momentive Performance Materials Inc.



Residential Lighting

Globe Cap Adhesives

Momentive's condensation cure adhesives cure at room temperature to typically form a strong adhesive bond to most substrates used in Globe Caps in LED lamps. The short tack-free times of these materials can contribute to faster process speeds in high volume applications, and can provide the additional benefits of a low volatile siloxane formulation.

Typical Properties		TN3085	TN3005	TN3305
Features		Fast tack-free, strong adhesion, flame retardancy & thermally conductive	Fast tack-free, strong adhesion, paste	Fast tack-free, strong adhesion, flowable
Type		1 Part	1 Part	1 Part
Color		White	White, Clear	White, Clear
Viscosity (23°C)	Pa·s	Paste	Paste	47
Tack Free Time	min	7	6	9
Hardness (Type A)		46	22	14
Tensile Strength	MPa	2.3	1.8	1.5
Elongation	%	150	330	400
Adhesive Strength	MPa	1.3	1.2	1.0
Volatile Siloxane (D_3-D_{10})	ppm	100	100	100
Flammability Rating		V-0 equivalent	HB equivalent	HB equivalent

Typical property values should not be used as specifications

Thermal Gels, Curable Compounds, Greases

Momentive offers a selection of room / low temperature cure TIMs and thermal greases to serve as the thermal interface between LEDs, aluminum or FR-4 bases, and light bulb housings. These repairable materials wet-out the thermal surfaces and can be used in reduced bond lines to help minimize thermal resistance in the assembly.

Typical Properties		TIA221G	TIG300BX	TIG210BX	TIS380C
Features		High thermal conductivity, tacky adhesion, fast heat cure or RT cure	High thermally conductive, low-bleed grease	Thermally conductive low bleed grease	Room temperature (condensation) cure thermal compound
Type		2 Part RT Cure	Non-Curing	Non-Curing	1 Part RT Cure
Color		Gray	Gray	Gray	Gray
Mixing Ratio (A:B by weight & volume)		100:100	-	-	-
Viscosity (23°C)	Pa·s	71	200	250	200
Cure Condition (room temp)	h	2	-	-	2 (surface cure)
Thermal Conductivity	W/m·K	2.1	3.0	2.1	3.8
Thermal Resistance[2] (BLT)	mm²·K/W	-	20 (45µm)	26 (50µm)	18 (50µm)
Volume Resistivity	MΩ·m	$4.8x10^6$	$5x10^3$	$1x10^6$	-
Volatile Siloxane (D_3-D_{10})	ppm	<200 (D_4-D_{10})	30	<100	40

Typical property values should not be used as specifications

Thermally Conductive Gels for Driver Heat Dissipation

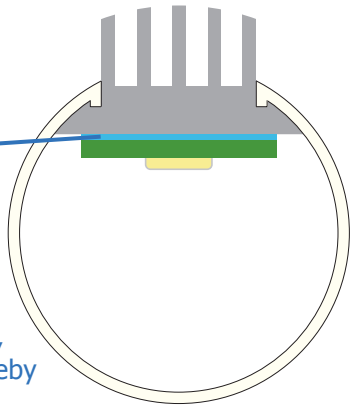
Removal of heat from the Driver is a key factor in extending the service life of LED bulbs. Momentive's liquid-dispensed thermally conductive materials typically conform to complex Driver configurations and cure to form a thermal path to the outer casing. These materials are available in a variety of thermal conductivity levels, viscosities and curing profiles to help meet the specific needs of various designs.

Key Features:
- Good thermal conductivity
- Can be cured at room temperature
- Good flowability - conforms to complex shapes
- Easy to use 1:1 mix ratio by both weight & volume
- Fast cure - fast production cycles
- Soft TIM - provides stress relief for delicate components

Typical Properties		TIA221G	TIA216G	TIA208G
Features		High thermal conductivity, tacky adhesion, fast heat cure or RT cure	Low viscosity, tacky adhesion, fast/RT cure	Low viscosity, tacky adhesion, fast/RT cure
Type		2 Part Heat Cure	2 Part Heat Cure	2 Part Heat Cure
Color		Gray	Gray	Gray
Mixing Ratio (A:B by weight & volume)		100:100	100:100	100:100
Pot Life (23°C)	h	-	0.5	0.5
Viscosity (23°C)	Pa·s	71	7.8	7.7
Cure Condition (room temp)	h	2	6	16
Cure Condition (heated)	°C/h	70/0.5	70/0.5	70/0.5
Thermal Conductivity	W/m·K	2.1	1.6	0.8
Hardness (Type E)		40	40	35
Volume Resistivity	MΩ·m	$4.8x10^6$	$4.8x10^6$	$4.8x10^6$
Dielectric Strength	20kV/mm	20	20	20
Volatile Siloxane (D_4-D_{10})	ppm	<200	<200	<200
Flammability Rating		V-0 equivalent	V-0 equivalent	V-0 equivalent

Typical property values should not be used as specifications

Tube-type LED Lighting & Street Lamps



Thermal Gels, Curable Compounds, Greases

Minimizing thermal resistance in the package through the use of heat sinks and effective thermal interface materials is important for long and reliable service life of LEDs. Momentive offers a selection of room / low temperature cure TIMs and thermal greases to serve as the thermal interface between aluminum or FR-4 bases and heat sinks. These repairable materials wet-out the thermal surfaces, can be used in reduced bond lines and, because they are liquid-dispensed, allow for only the necessary amounts to be used, thereby creating opportunities for material cost and productivity benefits.

Typical Properties		TIA221G	TIG400BX	TIG300BX	TIG210BX	TIS380C
Features		High thermal conductivity, tacky adhesion, fast heat cure or RT cure	High thermally conductive, low-bleed grease	High thermally conductive, low-bleed grease	Thermally conductive low bleed grease	Room temperature (condensation) cure thermal compound
Type		2 Part RT Cure	Non-Curing	Non-Curing	Non-Curing	1 Part RT Cure
Property (uncured)		Flowable	Paste	Paste	Paste	Semi-Flowable
Color		Gray	Gray	Gray	Gray	Gray
Mixing Ratio ((A):(B) by weight)		100:100	-	-	-	-
Viscosity (23°C)	Pa·s	71	350	200	250	200
Cure Condition (room temp)	h	2	-	-	-	2 (surface cure)
Thermal Conductivity	W/m·K	2.1	4.0	3.0	2.1	3.8
Thermal Resistance^2 (BLT)	mm^2·K/W	-	17 (55µm)	20 (45µm)	26 (50µm)	18 (50µm)
Volume Resistivity	MΩ·m	4.8x10^6	3x10^3	5x10^3	1x10^6	-
Volatile Siloxane (D_3-D_{10})	ppm	<200 (D_4-D_{10})	30	30	<100	40

Typical property values should not be used as specifications

Other Electronic Solutions from Momentive Performance Materials

Thermal Management
12-page brochure provides detailed information on silicone materials used for thermal management applications in electronics and microelectronics. Includes SilCool* greases adhesives, encapsulation and potting gels, and curable compounds.

LED Packaging
Provides opto-electronic solutions for LED Packages and Assemblies. Includes InvisiSil* LED encapsulants, Glob Top, Lens fabrication materials, Die Attach adhesives, and Dot Matrix assembly materials.

Assembly & Device
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.

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