

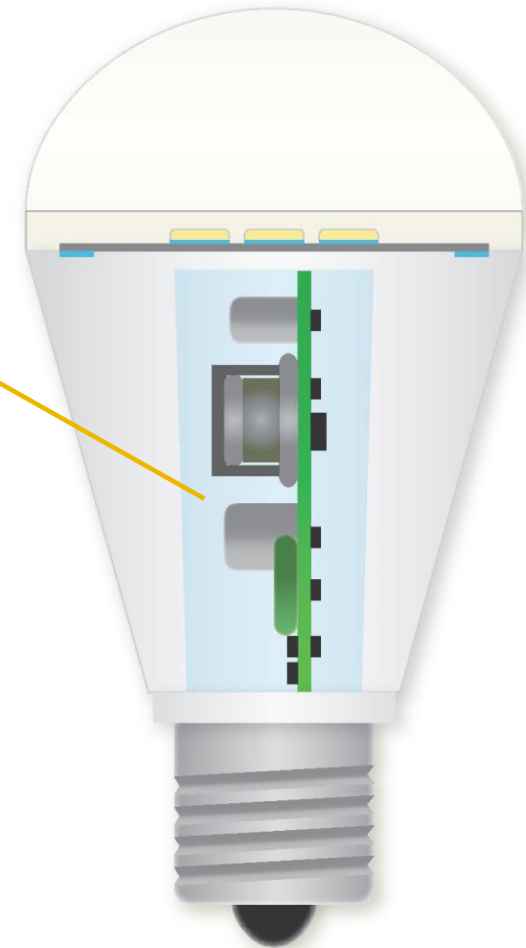
LED Lighting Product Selector Guide

Sept.2012

LED Light Bulbs – Driver Thermal Management

- Thermally Conductive Gels for Heat Removal
- 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.
- **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

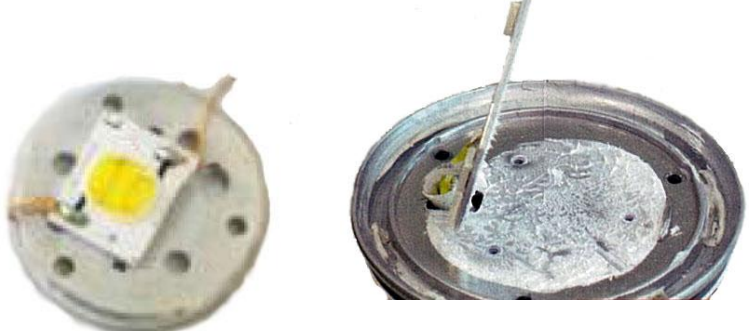
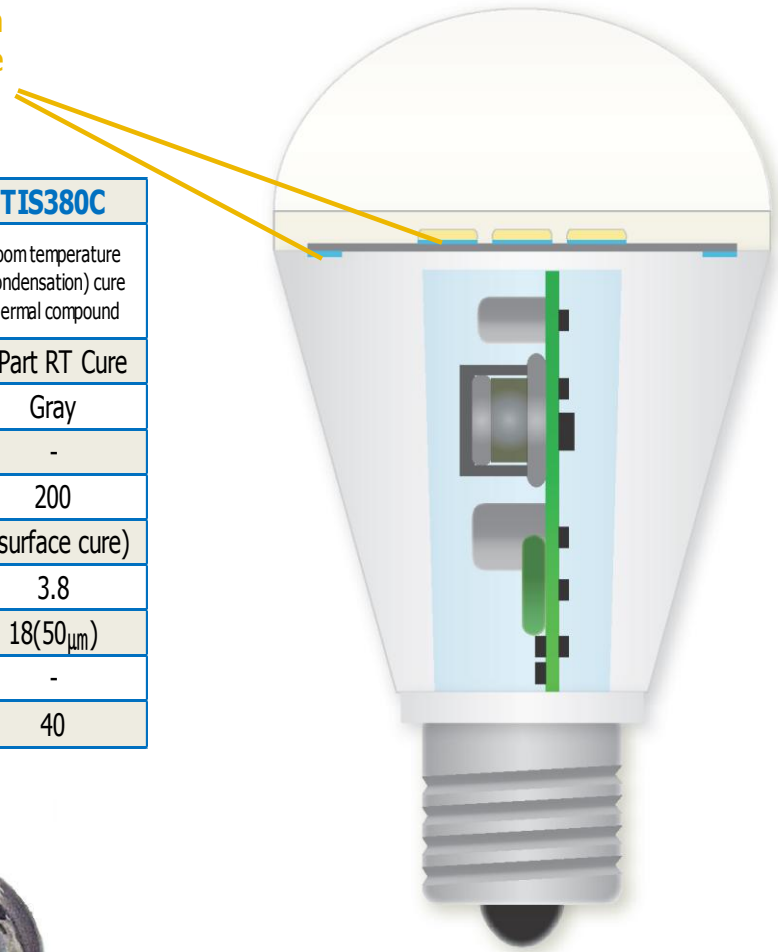
| Typical Properties | TIA222G | TIA216G | TIA207G |
|---|--|--|--|
| Features | High thermal conductivity, tacky adhesion, fast heat cure or RT cure | High thermal conductivity, tacky adhesion, fast heat cure or RT cure | Low viscosity, tacky adhesion, fast heat/RT cure |
| Type | 2 Part Heat Cure | 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 | 4 | 0.5 | 3 |
| Viscosity(23°C) Pa.S | 20 | 8 | 6 |
| Cure Condition (room temp) h | 24 | 4 | 24 |
| Cure Condition (heated) °C/h | 70/0.5 | 70/0.5 | 70/0.5 |
| Thermal Conductivity W/mK | 2.1 | 1.6 | 0.7 |
| Hardness (Type E) | 45 | 45 | 40 |
| Volume Resistivity MΩ.m | 4.8x10 ⁶ | 4.8x10 ⁶ | 2.8x10 ⁶ |
| Dielectric Strength 20kV/min | 20 | 18 | 26 |
| Volatile Siloxane(D ₄ -D ₂₀) ppm | <200 | <200 | - |
| Flammability Rating | V-0 | V-0 | V-0 equivalent |



LED Light Bulbs – Thermal Interface LED Board

- 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 | TIA222G | TIG830SP | TIG210BX | TIS380C |
|---|---|--|---------------------------------------|---|
| Features | High thermal conductivity, tacky adhesion, fast heat /RT cure | High thermally conductive grease, screen-printable | 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 | 20 | 200 | 250 | 200 |
| Cure Condition (room temp) h | 24 | - | - | 2(surface cure) |
| Thermal Conductivity W/mK | 2.1 | 4.1 | 2.1 | 3.8 |
| Thermal Resistance mm ² K/W | - | 8(20 μ m) | 26(50 μ m) | 18(50 μ m) |
| Volume Resistivity M Ω ·m | 4.8x10 ⁶ | 1x10 ³ | 1x10 ⁶ | - |
| Volatile Siloxane(D ₃ -D ₂₀) ppm | <200(D ₄ -D ₂₀) | <100 | <100 | 40 |



LED Light Bulbs – Globe Cap Adhesive

- 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.
- **Key Features:**
 - ✓ Room temperature cure
 - ✓ Fast tack-free
 - ✓ Low volatile formulation
 - ✓ Adhesion

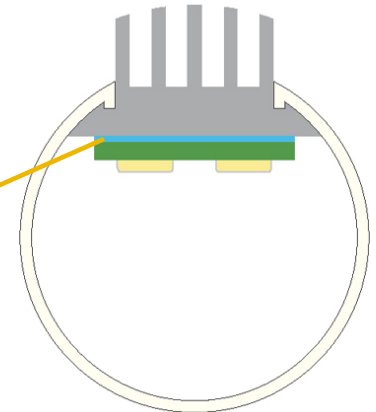
| Typical Properties | TN3085 | TN3005 | TN3305 |
|--|--|--|---|
| Features | Fast tack-free, strong adhesion, flame retardancy & thermally conductive | Fast tack-free, strong adhesion, paste | Fast tack-free, strong adhesion, flowable |
| Type | 1 Part | 1 Part | 1 Part |
| Color | White | White, Clear | White, Clear |
| Viscosity (23°C) | Pa-s | Paste | Paste |
| Tack Free Time | min | 7 | 6 |
| Hardness (Type A) | | 46 | 22 |
| Tensile Strength | MPa | 2.3 | 1.8 |
| Elongation | % | 150 | 330 |
| Adhesive Strength | MPa | 1.3 | 1.2 |
| Volatile Siloxane (D ₃ -D ₁₀) | ppm | 100 | 100 |
| Flammability Rating | V-0 equivalent | HB equivalent | HB equivalent |



LED Tubes & Street Lamps – Heat Sink Interface



- Thermal Interface Material between LED Rail / Board and Heat Sink
- 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.
- While fabricated pads can be used, liquid dispensed alternatives provide various advantages.
 - ✓ Thin bond lines (lower thermal resistance)
 - ✓ Automated processes
 - ✓ Reduce air-entrapment (contributes to lower thermal resistance)
 - ✓ Ability to apply only the amount of material needed in specific locations (hot spots)



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| 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 | 20 | 200 | 250 | 200 |
| Cure Condition (room temp) h | 24 | - | - | 2(surface cure) |
| Thermal Conductivity W/mK | 2.1 | 4.1 | 2.1 | 3.8 |
| Thermal Resistance mm ² K/W | - | 8(20 μ m) | 26(50 μ m) | 18(50 μ m) |
| Volume Resistivity M Ω ·m | 4.8x10 ⁶ | 1x10 ³ | 1x10 ⁶ | - |
| Volatile Siloxane(D ₃ -D ₂₀) ppm | <200(D ₄ -D ₂₀) | <100 | <100 | 40 |

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