N-Series Non-Silicone, Low-Outgassing Thermal Interface Materials

N800 Series Non-Silicone Thermal Pad
N-putty Series Non-Silicone Thermal Putty

Engineered for Siloxane-Free, Low-Outgassing, and High-Reliability Electronic Systems

As AI servers, optical communications, precision optics, semiconductor equipment, low-Earth-orbit (LEO) satellites, and aerospace electronics continue to advance rapidly, thermal interface materials (TIMs) are expected to provide more than just high thermal conductivity. Material volatiles, low-molecular-weight siloxanes, and outgassing under vacuum conditions have increasingly become important factors affecting long-term system reliability.

The LiPOLY® N-Series is based on a non-silicone resin system, designed at the material level to avoid the potential volatilization, migration, and condensation issues associated with low-molecular-weight siloxanes found in conventional silicone-based TIMs. It provides an advanced thermal management solution for contamination-sensitive electronic, optical, and vacuum systems.

The N800 Series and N-putty Series offer two different thermal interface formats: compressible solid thermal pads and dispensable, highly conformable thermal putty, respectively. This allows customers to select the most suitable non-silicone TIM according to gap dimensions, contact pressure, assembly tolerances, and automated manufacturing requirements.

NON-SILICONE

Reduce low-molecular-weight siloxane contamination risks through material design.

LOW OUTGASSING

Designed for vacuum, optical, and contamination-sensitive environments.

HIGH RELIABILITY

Balancing thermal conductivity, interface conformity, and long-term stability.

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Why Do Advanced Electronic Systems Need Non-Silicone TIMs?

Conventional silicone-based thermal interface materials typically use silicone polymers or silicone oils as their base materials. Under elevated temperatures, prolonged operation, enclosed environments, or vacuum conditions, certain unreacted or low-molecular-weight siloxanes may volatilize and migrate.

01	02	03	04
Outgassing	**Migration**	**Condensation**	**Reduced Reliability**
High Temperature / Vacuum	Enclosed Spaces	Sensitive Surfaces	Long-Term Operation

These low-molecular-weight substances may potentially deposit on：

- Optical lenses and optical sensors
- Laser / LiDAR optical systems
- Relays, connectors, and electrical contacts
- Precision PCB contacts
- Camera modules
- Semiconductor manufacturing equipment
- High-frequency communication modules
- Vacuum / space electronics

Over long periods of operation, such contamination may contribute to reduced optical transmission, electrical contact contamination, surface deposits, or degradation of overall equipment reliability.

For this reason, the LiPOLY® N-Series adopts a non-silicone resin architecture to minimize the risk of low-molecular-weight siloxane contamination associated with conventional silicone-based TIMs.

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What Does “Siloxane-Free” Really Mean?

The LiPOLY® N800 Series and N-putty Series do not simply claim to contain “low silicone oil.” Instead, they are based on a fundamentally different Non-Silicone Resin System. According to the product specifications, the test result for low-molecular-weight siloxanes from D3 to D20 is：

N.D.
Not Detected

Specified Test：D3–D20 Total / Test Method：Gas Chromatography

This means that under the specified test conditions and analytical detection limits, D3–D20 low-molecular-weight cyclic siloxanes were not detected.

This represents a fundamental difference in material design compared with conventional silicone gap pads that merely reduce the amount of free silicone oil. As a result, the LiPOLY® N-Series is particularly suitable for equipment and systems where silicone contamination control is critical.

What Is ASTM E595?

Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment.

ASTM E595 is primarily used to evaluate the outgassing characteristics of non-metallic materials under elevated-temperature and vacuum conditions.

TML Total Mass Loss — **Typical aerospace screening criteria ≤ 1.0%**

TML measures the total mass loss of a material after exposure to specified elevated-temperature and vacuum conditions. A lower TML value generally indicates that a smaller amount of volatile or low-molecular-weight substances can be released from the material.

CVCM Collected Volatile Condensable Materials — **Typical aerospace screening criteria ≤ 0.10%**

CVCM measures the proportion of outgassed volatile substances that can re-condense on a lower-temperature surface. For optical systems, sensors, mirrors, lenses, and precision electronics, CVCM is particularly important, because these volatile substances may form contamination films on sensitive surfaces.

Therefore, ASTM E595 should not be regarded simply as a “high-temperature resistance test.” Rather, it is an important material-screening method for determining whether a material is suitable for vacuum, low-contamination, and high-reliability environments.

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How to Select Between the N800 Series and N-putty Series

Item	N800 Series	N-putty Series
Material Form	Thermal Pad	Thermal Putty
Resin System	Non-Silicone	Non-Silicone
Thermal Conductivity	**5–24 W/m • K**	**7–9 W/m • K**
Key Advantages	High thermal conductivity, die-cuttable	Highly conformable, dispensable
Gap Tolerance Capability	High	Very High
Automated Dispensing	—	✓
Precision Die-Cutting	✓	—
TML	**< 1.0%**	**< 1.0%**
CVCM	**< 0.1%**	**< 0.1%**
Low-Molecular-Weight Siloxanes	**D3–D20 N.D.**	**D3–D20 N.D.**
Primary Positioning	**High-Performance Gap Pad**	**High-Performance Gap-Filling Putty**

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Recommended Applications

The N800 Series and N-putty Series are particularly suitable for high-reliability systems where conventional silicone-based TIMs may present contamination concerns, including：

01
AI / HPC

GPU, ASIC, HBM peripheral components, VRM, power modules, and AI accelerators.

02
Optical Communications

800G / 1.6T optical transceivers, silicon photonics, laser drivers, DSPs, and optical modules.

03
Semiconductor Equipment

Wafer inspection systems, metrology equipment, vacuum equipment, and precision motion-control electronics.

04
Optical Systems

Cameras, LiDAR, lasers, precision sensors, projection systems, and precision optical equipment.

05
Automotive Electronics

ADAS, domain controllers, automotive cameras, radar systems, and power electronics.

06
Telecommunications

5G / 6G base stations, high-speed networking equipment, and edge-computing systems.

07
Satellite & Aerospace

Satellite electronics, payload electronics, communication modules, and other equipment highly sensitive to material outgassing and contamination.

CONTAMINATION-SENSITIVE
Shared Requirements Across Industries

Low-molecular-weight substance control, low outgassing, predictable interface thermal resistance, and long-term reliability.

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Beyond Thermal Management: Advancing Toward Contamination Control

Conventional TIMs are primarily evaluated based on thermal conductivity. However, next-generation high-reliability TIMs must simultaneously consider：

- Thermal Conductivity
- Thermal Resistance
- Siloxane Control
- Outgassing
- CVCM
- Reliability

Product Positioning

Low-Outgassing Non-Silicone Thermal Interface Materials

Siloxane-Free Thermal Management Solutions for Sensitive Electronics.

This represents one of the most important technical distinctions between the LiPOLY® N-Series and conventional silicone-based thermal interface materials.

LiPOLY®
Technology Statement

LiPOLY®
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- High Thermal Conductivity.
- Low Outgassing.
- No Detectable Low-Molecular-Weight Siloxanes.
  Built for Contamination-Sensitive Electronics.

LiPOLY® N-Series integrates high thermal performance with advanced low-contamination material technology, providing next-generation non-silicone thermal management solutions for AI, optical communications, semiconductor equipment, precision optics, satellite systems, and aerospace electronics.

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