

**LAIRD TFLEX<sup>™</sup> SF10  
ENHANCES THERMAL  
MANAGEMENT IN  
OPTICAL INTERCONNECTS**

## Abstract

As data centers scale to meet the increasing demands of AI and cloud computing, effective thermal management in optical interconnects has become a critical requirement. A major hardware manufacturer for data centers recently faced significant production challenges due to volatile migration from silicone-based thermal interface materials (TIMs), leading to lens fogging in optical transceivers.

To resolve this, the manufacturer partnered with Laird to implement **Tflex™ SF10**, a high-performance, silicone-free thermal gap filler. This application note explores how Tflex™ SF10 enhances optical interconnect reliability, improves thermal performance, and ensures long-term operational stability.

## Introduction

The miniaturization and increased power density of optical transceivers create significant thermal challenges for data center operators and equipment manufacturers. The customer, a global leader in computing solutions, faced production delays due to the limitations of traditional silicone-based TIMs, which caused volatile migration issues that led to lens fogging and optical degradation.

To address this challenge, the customer required a high-conductivity, non-silicone TIM that could maintain optimal performance while preventing contamination. Laird's Tflex™ SF10 emerged as the ideal solution, providing exceptional thermal properties while eliminating silicone migration concerns.

## The Challenges

### Oil Bleed and Lens Fogging Issues

- Silicone-based TIMs caused volatile migration, leading to lens fogging and optical degradation.
- Production lines were halted for over a month, causing significant order backlogs.

### High Thermal Performance Needs

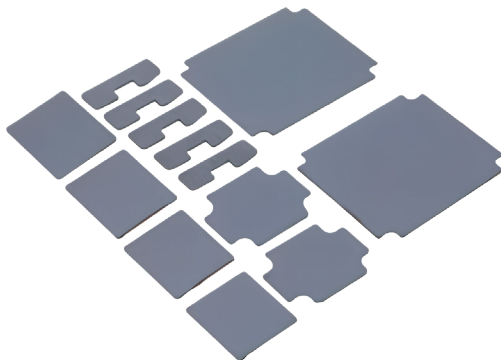
- Optical transceivers operate at high data rates, generating substantial heat.
- A thermal conductivity of at least 10 W/mK was required for effective heat dissipation.

### Reliability Concerns

- Long-term material stability was critical to prevent TIM degradation.
- The TIM needed to maintain consistent performance across power cycles.

### Scalability and Rapid Implementation

- Customer required a quick ramp-up to meet high production demands.
- The solution had to be easily integrated into existing manufacturing processes.



## The Solution

Laird's Tflex™ SF10 is a high-performance, silicone-free thermal gap filler engineered to meet the stringent requirements of optical transceivers. It eliminates the silicone oil migration issues associated with traditional TIMs while maintaining superior thermal conductivity.

### Key Features of Tflex™ SF10

- **Silicone Free Formulation:** Eliminates silicone based migration and volatilization which are often associated with detrimental lens fogging.
- **High Thermal Conductivity:** 10 W/mK for optimal heat dissipation.
- **Low Shore Hardness:** Minimizes mechanical stress on fragile optical components.
- **Excellent Deflection Properties:** Ensures consistent performance with minimal applied pressure.

### Tflex™ SF10 Specifications

Parameter	Specification
Thermal Conductivity	10 W/mK
Shore Hardness	Low (minimizes stress on components)
Silicone Oil Migration	Eliminated (Silicone-Free)
Operating Temperature Range	-40°C to +125°C
Compliance	REACH, RoHS, UL 94 V-0 Compliant
Application Method	Custom die-cut pads, automated dispensing

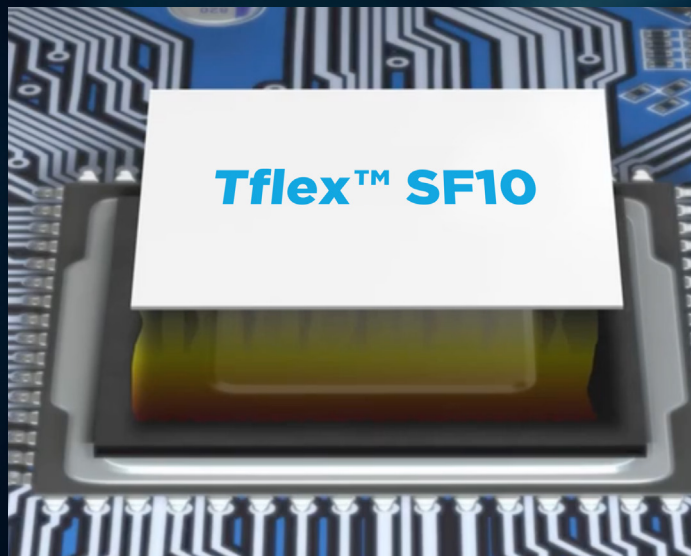
## Implementation and Testing Collaboration with Customer

Laird engineers worked closely with the customer team to customize and validate Tflex™ SF10 for optical transceiver applications.

- Conducted extensive oil bleed and fogging tests to meet the customer’s stringent optical clarity requirements.

## Testing and Benchmarking Against Competitors

- The customer performed side-by-side comparisons with existing TIMs.
- Tflex™ SF10 eliminated silicone oil migration while maintaining superior thermal properties.



- Accelerated aging tests demonstrated long-term reliability.

## Scaling Up for Production

- Laird expanded manufacturing capabilities, adding new equipment and personnel.
- Production was scaled to a second site in Tianjin, China, ensuring supply chain resilience.

## Performance Metrics and Test Results

Test Parameter	Improvement with Tflex™ SF10
Oil Bleed	Reduced (vs. severe in silicone TIMs)
Optical Performance	Improved lens fogging (vs. previous contamination issues)
Thermal Conductivity	10 W/mK (exceeds industry standards)
Long-Term Stability	Minimal degradation over power cycles
Manufacturing Efficiency	Seamless integration, no process disruptions

## Benefits for Manufacturer Improved Optical and Thermal Performance

- Lower operating temperatures ensured consistent transceiver efficiency.
- Improved lens fogging, preventing optical signal degradation.

## Manufacturing Efficiency and Scalability

- Immediate usability reduced rework and production delays.
- Seamless integration into existing optical transceiver production lines.

## Long-Term Reliability

- No silicone oil bleed ensures stable operation across extended deployment cycles.
- Long-term material integrity minimizes maintenance and replacements.

## Best Practices for Implementation

### Application Guidelines

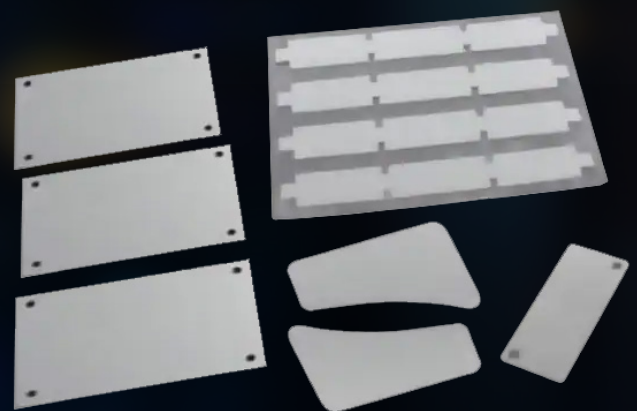
- **Early Engagement:** Collaborate with Laird engineers early in the design process.
- **Custom Testing:** Conduct application-specific tests for optimized performance.
- **Mechanical Tolerance Considerations:** Ensure precise gap sizing for best performance.
- **Accelerated Aging Tests:** Validate long-term material stability and reliability.

## Future Expansion and Additional Applications

The customer's success with Tflex™ SF10 in optical transceivers led to its adoption across multiple product lines, including:

- 100G SFP modules to 800G OSFP modules.
- AI accelerators for cloud computing.
- High-performance server CPUs and GPUs.
- Silicon photonics devices.

The TIM's high thermal conductivity and cleanliness make it a prime candidate for additional high-power data center applications.



## Laird's Collaborative Approach

The success of Tflex™ SF10 highlights Laird's commitment to collaborative problem-solving. Laird provided the client with:

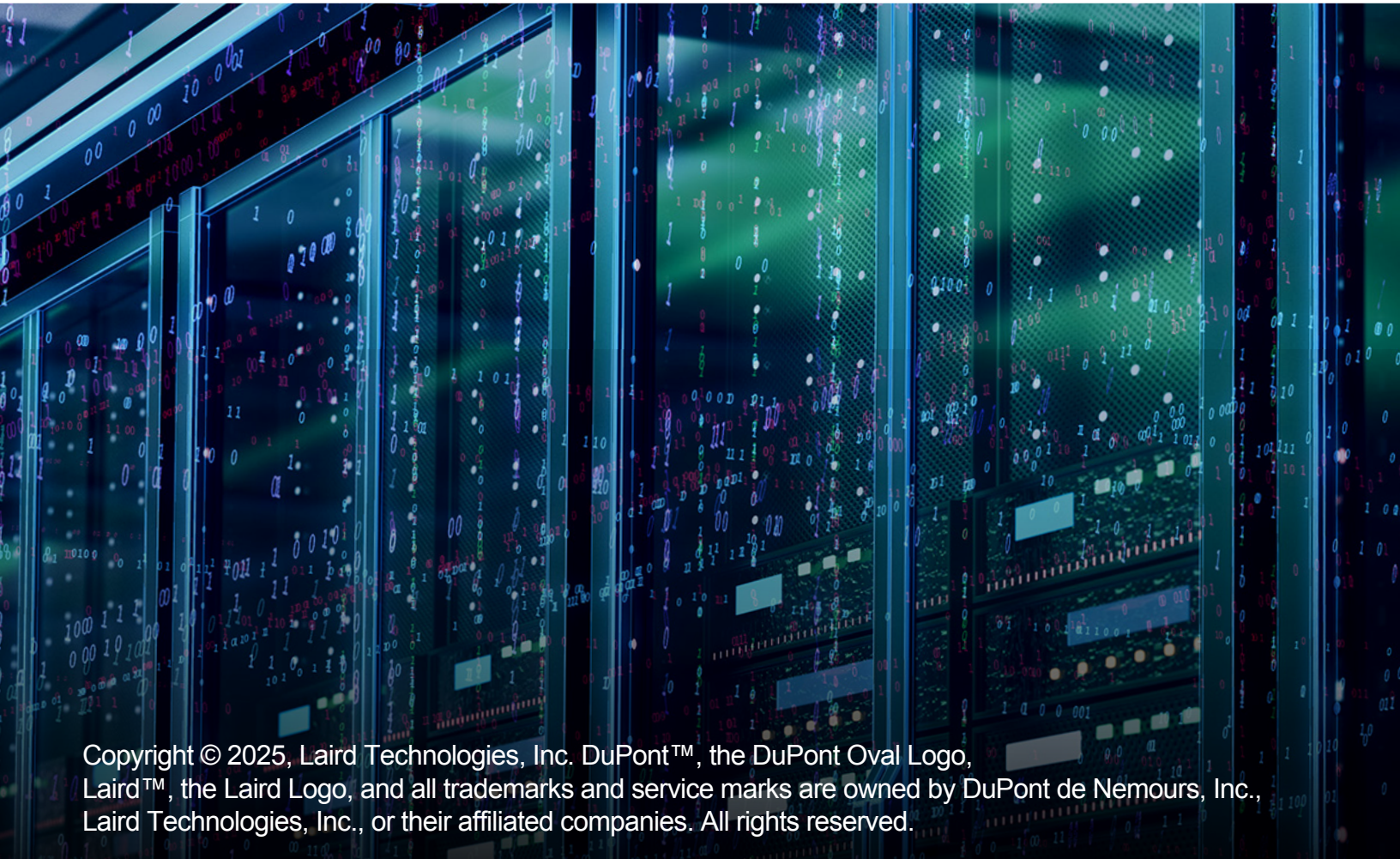
- Rapid response to production challenges.
- Custom testing and quality assurance processes.
- Scalable manufacturing solutions.
- Ongoing engineering support for future applications.

## Conclusion

Laird Tflex™ SF10 has proven to be an industry-leading thermal solution for optical transceivers, helping the customer overcome critical production and performance challenges. The silicone-free formulation, high thermal conductivity, and long-term stability make it a gold standard for optical and data center applications.

For engineers developing next-generation data center technologies, Tflex™ SF10 provides a field-tested, high-performance solution.

Contact Laird's experts today to explore how our advanced thermal management solutions can enhance your designs and optimize operational efficiency.



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