

Brief

TECs for Non-hermetic Laser Packages





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Challenges in the market:

Optical component and module suppliers are under heavy pressure to reduce costs, and they need to innovate to meet cost reduction targets without sacrificing performance or reliability. Sales price and	cost-per-bit of cutting-edge optical components are dropping by double-digit percentages each year. Unlike traditional telecom providers, hyperscale datacoms order huge volumes at large discounts, contributing to price	erosion. Going “uncooled” just isn’t an option anymore for cutting-edge applications, but new technologies like non-hermetic laser packages enable dramatic TOSA cost reductions, which will help companies stay on track to	achieve aggressive cost reduction goals. Today’s manufacturers are seeking non-hermetic alternatives for cooled laser packages, but many of these solutions may fall short in reliability testing, or in the actual case.
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Can implement for a range of application-specific designs.
Phononic’s ReefTEC™ platform is truly a drop-in replacement for a hermetic TEC.

4 Ways ReefTEC™ Can Improve Your Laser Package Design



Designed to Reduce Costs:
Save up to 50% on TOSA package costs




Proven Reliability:
5X better reliability/survivability




No Impact on Performance:
Non-hermetics that deliver equivalent results




Consistency at High Volumes:
Automation for mass production with perfect quality



Phononic’s ReefTEC is the solution:
Enables cost reductions: Because optical transceiver manufacturers need to dramatically reduce cost per bit and designers need to innovate their approach. Hermetically sealing a gold box laser package is expensive, but non-hermetic packaging can save optical component designers 20% to 50% on package costs.



Engineered to last: Other non-hermetics are still in R&D, but we are leveraging our experience with refrigerators and countless hours of reliability testing to solve for the root cause of failure in condensing environments, instead of patching up condensation failure modes with quick fixes. This guarantees that when you design in our non-hermetic TEC, you’ll get a solution that passes reliability targets and offers much better survivability compared to hermetic solutions.



No compromises on performance: Some approaches to non-hermetic TECs are short-term fixes that are impossible to quality check, and attempt to cover up failure modes in non-condensing environments. They also drastically degrade cooling performance, increasing power consumption. Our non-hermetic ReefTEC platform delivers the same best-in-class performance and quality of our hermetics TECs.

Addressing condensation and environmental challenges:

The environmental challenges facing cooled, non-hermetic packages are very different from those facing hermetically-sealed packages. Humidity, condensation, corrosion, and even ice can severely impact laser performance and reliability. Condensation inside the package, which happens when the laser Chip-On-

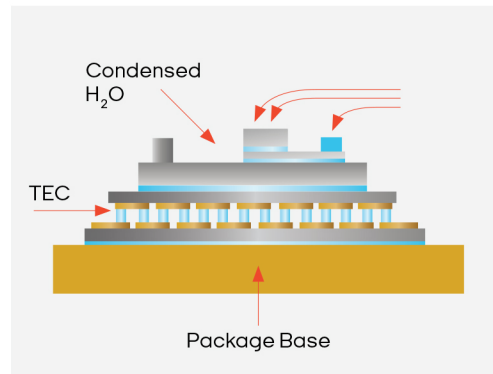
Carrier [CoC] assembly is cooled below the dew point, is a major concern. It can lead to corrosion, create electrical shorting pathways and interrupt coupling of the laser's light emission to the optical fiber, degrading TOSA performance. This can degrade laser slope efficiency or increase coupling losses, which in turn reduce data transmission rates, reach and the usable lifetime of the laser.

ReefTEC
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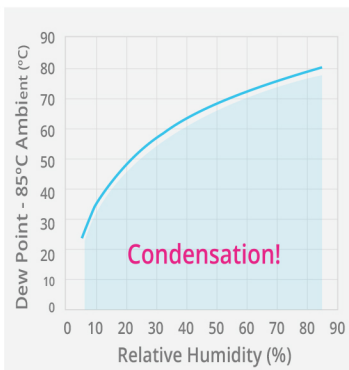
Considerations:

Both operating and reliability testing conditions must be evaluated.

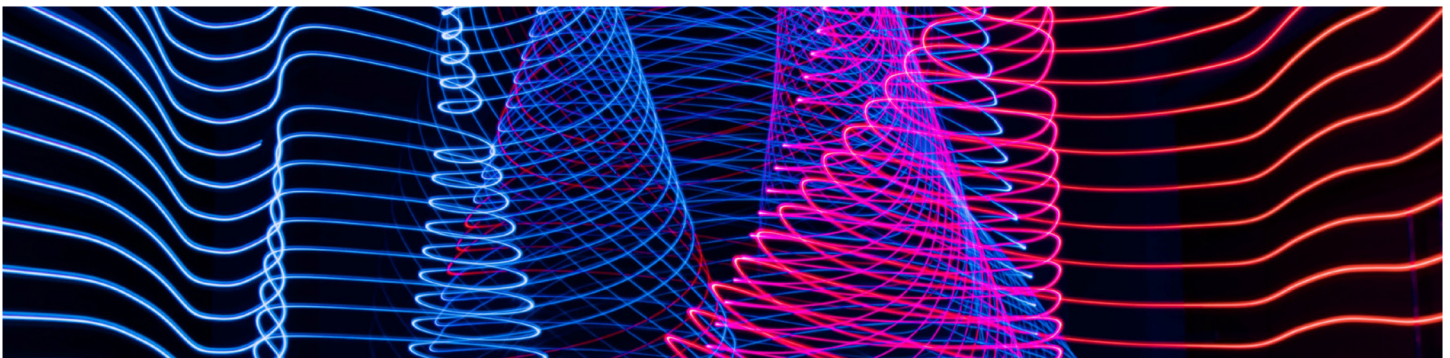
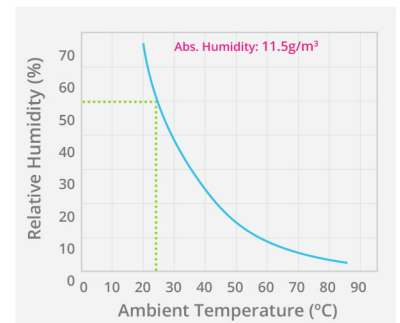
While un-cooled non-hermetic laser packages are relatively straightforward – the laser generates heat during operation, so it is always above ambient temperature [and dew point] – cooled non-hermetics can operate at conditions where the laser assembly is far enough below ambient temperature to condense moisture from the air. Water can collect on the cooled side, and all over the laser diode assembly. Condensation can lead to the performance issues listed above.



Relative humidity also depends on ambient temperature. Air with a fixed absolute humidity [grams of water per cubic meter of air] will see relative humidity decrease with increased temperature. While typical datacenter conditions are at relatively low risk of condensation, outdoor conditions like those for wireless access infrastructure are at somewhat higher risk. Package manufacturers should consider and design for absolute humidity inside the package.



Standard Temperature, Humidity, Bias [THB] reliability testing at 85°C/85% needs to account for use cases where condensation is likely. Since relative humidity will be much lower in a real world 85° ambient use case, one should consider temporary condensation. Two common situations are cold start conditions, where the laser package temporarily operates below dew point, and applications where the TEC cold side is lower than the dew point but the laser diode assembly remains above. In reliability testing for cold starts of 5 minutes once per day, ReefTEC demonstrates a >10 year service life, while even coated hermetic TECs last <3 years.



Phononic is reimagining cooling and heating in ways never thought possible. Its breakthrough solid-state technology is transforming industries and creating new markets with innovative solutions that disrupt antiquated business models and incumbent technologies. Phononic is the critical element of innovation needed to radically change what it means to be efficient, effective and sustainable. The company has been named to the 2016, 2017 and 2019 CNBC Disruptor 50 lists, received the US EPA's 2017 Emerging Tech Award, R&D 100 Award and more.