PHONONIC

The Future of Optical Communications is Cooled.

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THE BIG QUESTION

How are we going to meet these increasing data rate demands while meeting high performance expectations?

A sudden shift to huge data rate demands

Internet service providers have been witnessing increased pressure on their networks for years. With more and more devices constantly accessing the internet in people's homes, combined with the increasing popularity of streaming services and data-heavy online gaming, these providers have been investing in their network nonstop to keep up with demand.

And then ... COVID-19 hit.

We became stuck indoors overnight — forced to isolate ourselves from the world we knew and the places we enjoyed — so we sought refuge online. We streamed movie after movie, show after show. We played games. We set up video chats with our friends and family. And when we realized the pandemic wasn't going away anytime soon, people all over the world went back to work from the safety and comfort of their homes — spending hours in video conferences, accessing servers remotely, quickly adapting to a new normal.

Now, the way we live and work has changed forever. The pandemic has catalyzed a long-term acceleration of network bandwidth. Internet providers are scrambling to manage the unprecedented pressure their networks are facing. Investments are being accelerated throughout the whole of their networks.

Likewise, content and platform providers have seen skyrocketing demand for their products, and they're working to scale up to handle the dramatic increase quickly. The quick, unexpected consumer demand for internet and content is driving fiber access into more and more locations, leading to unheard of bandwidth expansion across the internet.

The big question internet service and content providers face now is: How are we going to meet these increasing data rate demands while meeting high performance expectations and assure that these investments are scalable to even higher future requirements?

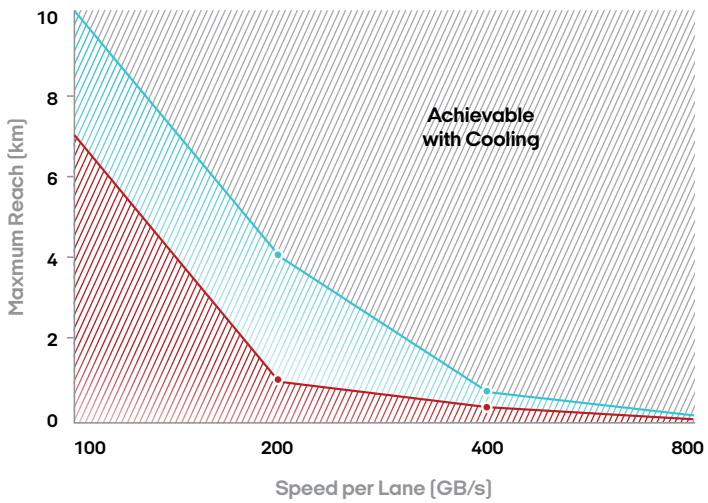
Cooling is the future of FOC

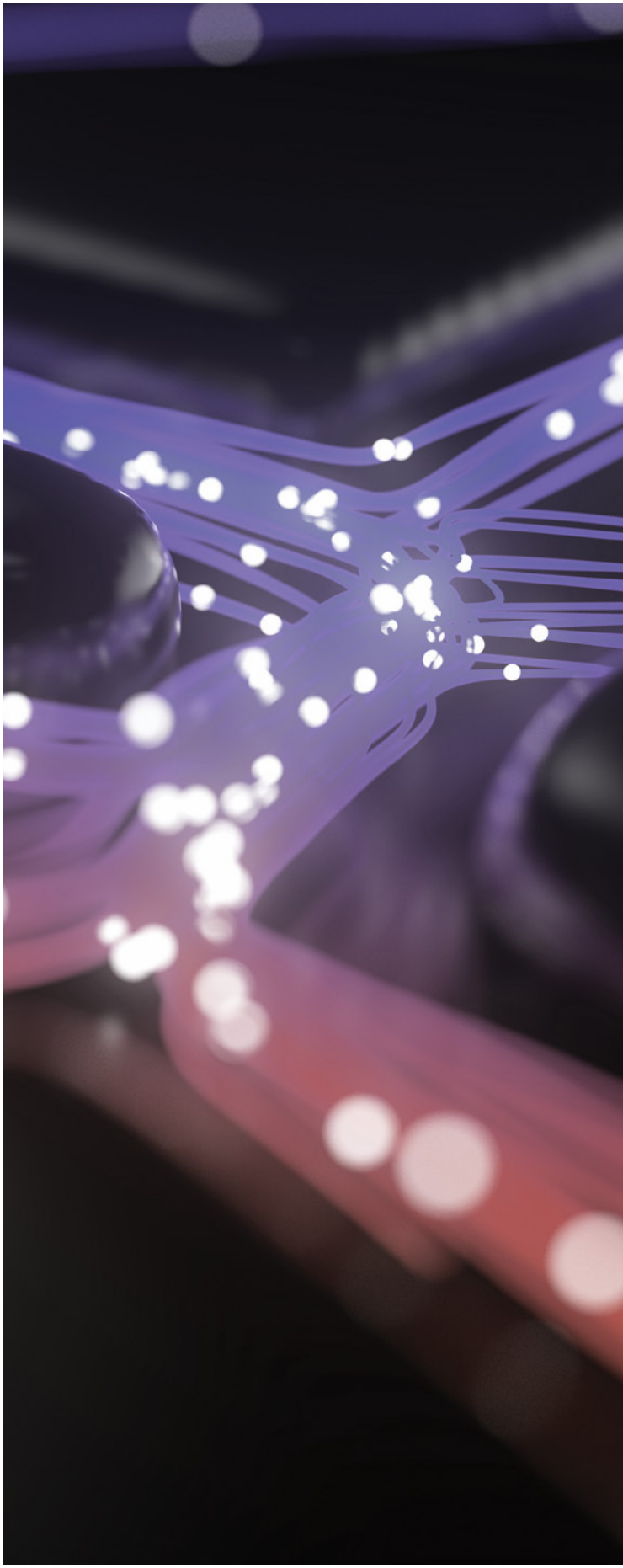
As the data rate demand continues to increase, so too does the need for extremely high performance. And while there was a time when lasers in transceivers would work within acceptable standards for short distances, that time is quickly passing. There is a clear need for an extended range, which requires higher power and thereby generates heat and more data per clock event (in which compressed data requires very accurate wavelength control in both DWDM and coherent modulation), which is highly affected by heat. This is where inexpensive, efficient thermoelectric coolers, or TECs, come into play.

It has been well established that current, cutting-edge and next-generation optical components require the active cooling capability of TECs — this cooling is what ensures wavelength control and maintains modulation frequency specifications. What's more, cooling is necessary in order to preserve signal integrity to achieve 200G+ per lane. As the modulation rate moves beyond 100G per lane, higher-order aptitude modulation schemes must be taken into account, such as pulse-amplitude modulation 4 (PAM-4) or even coherent transmission.

The fact is, the entire fiber optic cable industry is quickly approaching a tipping point. The need to go faster and farther inside the data center is growing, but the maximum distance you can go without cooling gets shorter every time you turn up the speed per lane. Soon, high-bandwidth lasers will need to be cooled even for short distances. It is crucial that any new communication designs must account for the ability to scale on demand without needing any redesigns or new products.

In fact, recent presentations given by data center optics experts demonstrate that uncooled electro-absorption modulated lasers (EMLs) will not be able to transmit 200G/lane beyond one kilometer due to chromatic dispersion — unless they are cooled. To even send high-bandwidth lasers for the shortest distances, the optics will need to be cooled. Equipment manufacturers that account for scalability in real time and adaptive bandwidth expansion through active cooling control will enjoy a competitive advantage in the marketplace.





Phononic TECs are the ideal solution to overburdened networks

Soon, all customers will need a TEC to control — and lock — wavelength temperature and modulation frequency. Ideal PAM-4 signals feature a modulated set of waveforms. The more exact the waveforms, the easier it is for the demodulator to clearly identify the data it needs to decode. Without TECs, wavelength drift and light interference can distort the waveforms, clouding up the data to a point where the demodulator can no longer decode the data properly.

Even more critical is coherent quadrature amplitude modulation (QAM). Some current systems employ 256 states, where 16 amplitude and 16 phase states are being transmitted at once. When the wavelengths are about 1nm apart, a drift of just 0.1nm/deg C can't be supported, and complete channel overlap will occur in just 10˚ C.

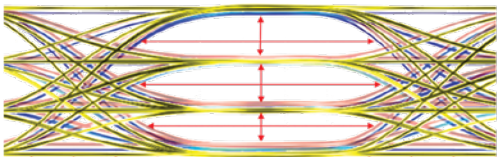
Phononic's full line of TECs are the ideal solution for cooling lasers used in high-speed optical components. They will ensure transmitter optical subassembly (TOSA) performance is met at a high yield across the full operating spectrum.

Phononic offers cost-effective solutions for multichannel laser packages through powerful TECs that deliver best-in-class power consumption to achieve high yield and low cost. What's more, our TECs are not straight-from-the-catalog, bulk-order coolers — we actively partner with our customers to develop application-specific designs ready for high-volume manufacturing. This ensures the TEC is designed to work for your system and not the other way around.

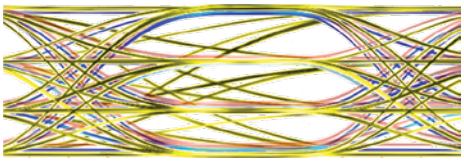
While some may look to avoid cooling by attempting to innovate their lasers, the processing scalability they depend upon to meet new cost targets ensures that cooled solutions will be cheaper (and better) than uncooled EMLs. Uncooled lasers and other temperature-sensitive circuits can, in theory, be designed to operate at higher temperatures, but these designs are expensive and are very application specific — they require redesigns for different operating conditions. By using Phononic TECs, you can adapt to different operating conditions by simply adjusting the operating voltage, making these designs scalable to future demands.

Partnering with Phononic will help you achieve cooling in your laser package for less than a dollar per lane. Don't pay a premium for uncooled EMLs. Come design your next cooled component with us.

Ideal PAM 4 signals



PAM 4 signals with laser wavelength drift



WHERE WE COME IN

Best-in-class power consumption achieves high yield and low cost

Cost-effective solutions for multi-channel laser packages: Achieve cooling for less than $1 USD per lane

Application-specific designs, ready for high-volume manufacturing