TECs are driving the future of autonomous vehicles.

How TECs are solving range, resolution, frame rate and ambient interference issues in LiDAR.

LiDAR for autonomous vehicles is a groundbreaking technology that requires the absolute highest levels of performance and reliability to ensure their overall safety. Critical requirements of this technology like range, resolution, frame rate and interference immunity are all interconnected, and improvements to one feature often come at the expense of another. Until now.

In order to maximize the sensitivity of a LiDAR sensor — and avoid tradeoffs between interconnected requirements — active cooling and temperature control with TECs is a must. That's why today's LiDAR sensor manufacturers are using TECs to cool optical components to ensure the highest stability and reliability levels.

Phononic's TECs enhance all critical LiDAR sensor requirements

End the tradeoffs between range, resolution and frame rate

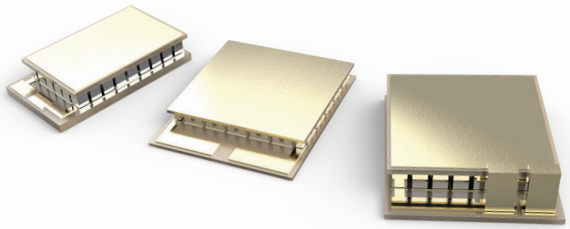
To achieve the range and resolution required for long-range LiDAR, cooled laser sources are a must. Our TECs deliver the wavelength stability and control needed for 1550nm, as well as for shorter wavelength sources. Plus, actively cooling detectors reduces their SNR, extending the operating temperature range and ensuring more light is detected per pixel.

Delivering reliable eye safety

Because eye safety is improved with longer wavelengths, 1550nm laser sources can operate at much higher optical powers, thus providing longer range for ToF-based sensors without posing a danger to pedestrians and passengers. TECs are absolutely necessary in the use of 1550nm high-power lasers and fiber lasers. And for the lower-power lasers and detection schemes used in FMCW-based sensors, strict wavelength/temperature control with a TEC is also required.

Ensuring immunity to ambient interference

The wavelength of edge-emitting lasers will drift 0.3–0.5nm/°C, which translates to a full 60nm of wavelength drift across the entire AEC-Q operating temperature range. Such a large wavelength drift renders any optical filter useless at blocking sunlight while also transmitting the laser light. By adding a Phononic TEC, sensor makers stabilize the wavelength drift of the laser across the operating temperature range. This enables the use of narrow band optical notch filters, which means very little ambient light is let in.



Benefits and features of TECs for LiDAR

Enhanced LiDAR sensor requirements

Phononic TECs cool critical LiDAR components to solve range, resolution and frame rate tradeoffs while providing enhanced wavelength stability.

Low power consumption and high heat-pumping density

Our TECs boast 30% lower power consumption than typical TEC performance, and they deliver 60% higher heat-pumping density.

Exceptional design and application support

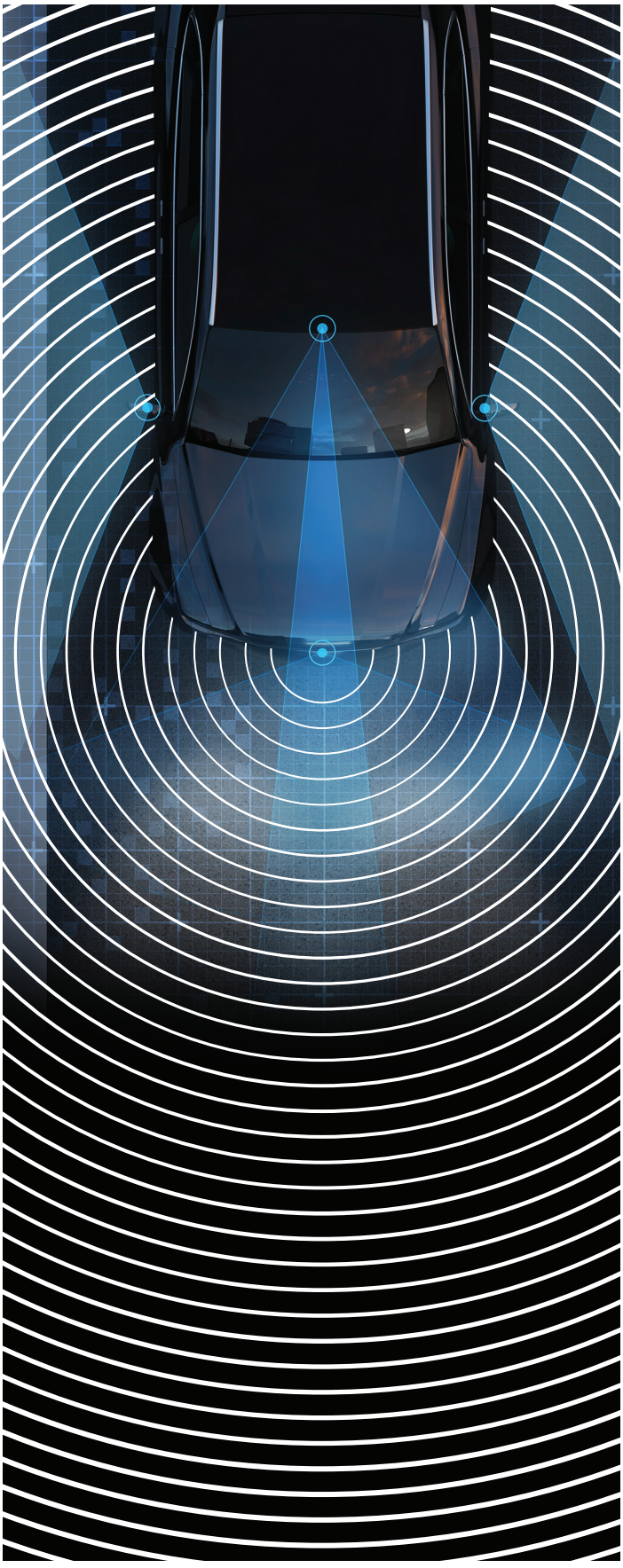
Phononic consults throughout the design process to ensure optimum thermal performance.

Enhanced sensor reliability

Our TECs extend reliability of sensitive semiconductor components in even the harshest environments.

Automotive-grade quality

With AEC-Q10x reliability standards and IATF 16949 certification, Phononic delivers the reliability and quality necessary for auto-grade demands. Our TECs also enable high-temperature operation up to 125˚ C — making an extreme environment for optical components much less taxing.



Considerations

High-level vehicle autonomy will require cooled lasers and detectors due to the stringent requirements around range, resolution, frame rate, field of view and eye safety. 1550nm and FMCW are practically necessary for achieving 200m+ range, and TEC cooling makes that possible. Our TECs can support the high heat loads of high-powered LiDAR lasers,and achieve the extreme reliability needed to insure a 15-year lifetime.

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