

# Phononic Visual Brand Language

# Phononic

SECTION

01

## Brand Story

Vision 01.3 / Mission 01.4

SECTION

02

## Principles

Branding Principles 02.5 / Voice 02.6

SECTION

03

## Design System

Logo 03.8 / Typography 03.14 / Color 03.18  
Iconography 03.23 / Imagery 03.24

SECTION

04

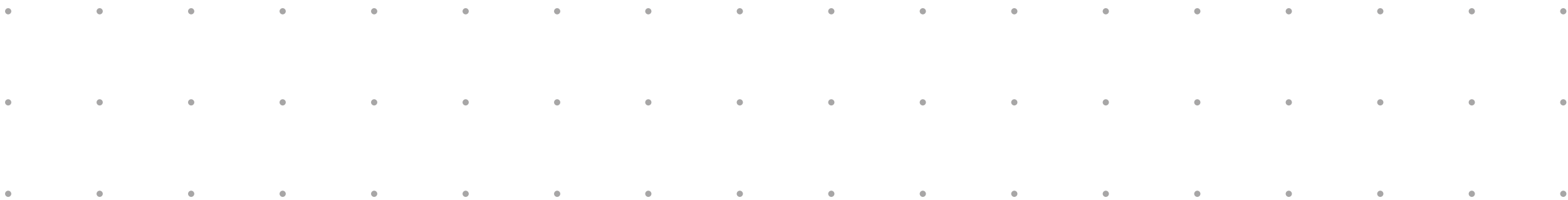
## Campaign Examples

Video 04.31 / Website 04.33 / Animation 04.35 / Advertising 04.36  
eBook + White paper 04.37 / Infographic + Data sheet 04.38 / Experiential 04.39

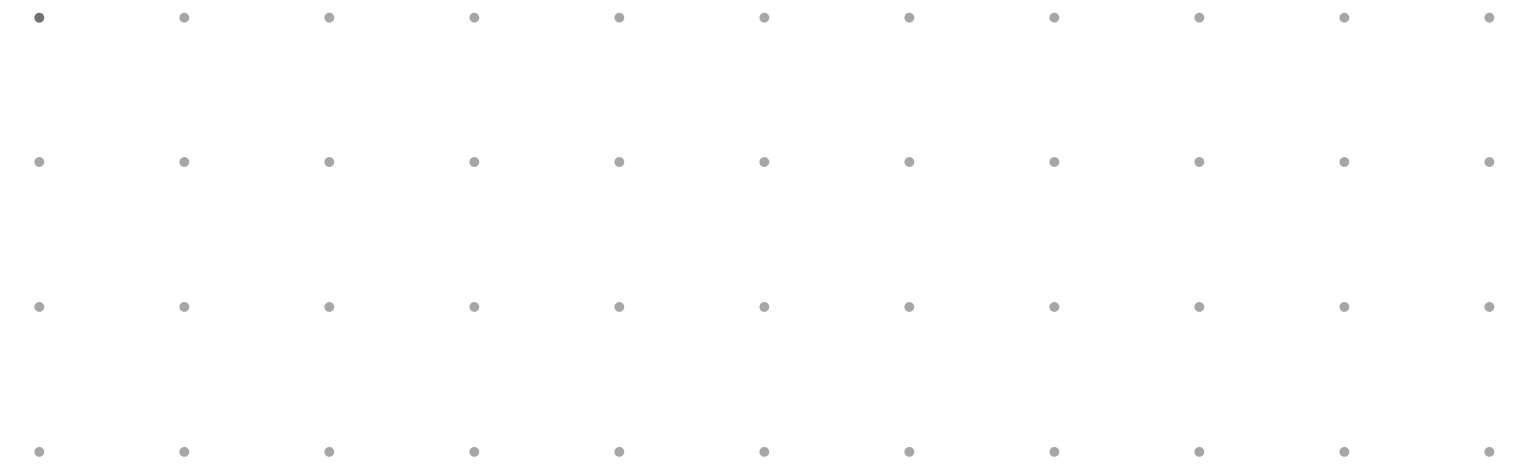
# Realizing the potential of a truly disruptive technology.

Today more than ever there is an increased demand for innovative and sustainable solutions for today's challenges. It's time for Phononic to demonstrate how our disruptive cooling and heating technology enables and builds sustainable solutions for a healthier planet.

As champions of the Phononic brand, it's our responsibility to ensure all elements of our brand represent our company's mission and commitment to innovation and sustainability / Environmental, Social and Governance [ESG].



# Our Mission.



Our world can no longer be limited by outdated ways of thinking. To truly make an impact today, you need more than just a brilliant idea. You need the defining element that can bring this idea to life.

At Phononic, we are reimagining how we cool and heat in ways never thought possible. Our technology is transforming industries and creating new markets with innovative solid state solutions **that disrupt traditional business models.**

We make transformative ideas real by co-creating with engineers, designers and industry leaders. We are the critical element of innovation **needed** to radically change what it means to be efficient, effective and sustainable.

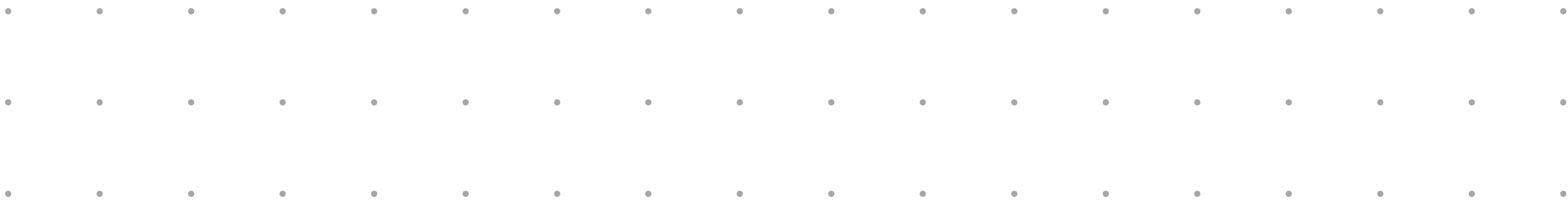
It all starts with a chip and a design that creates new possibilities for cooling and heating. This **powerful platform** is spurring innovation and upending the status quo – ultimately bringing new products to life.

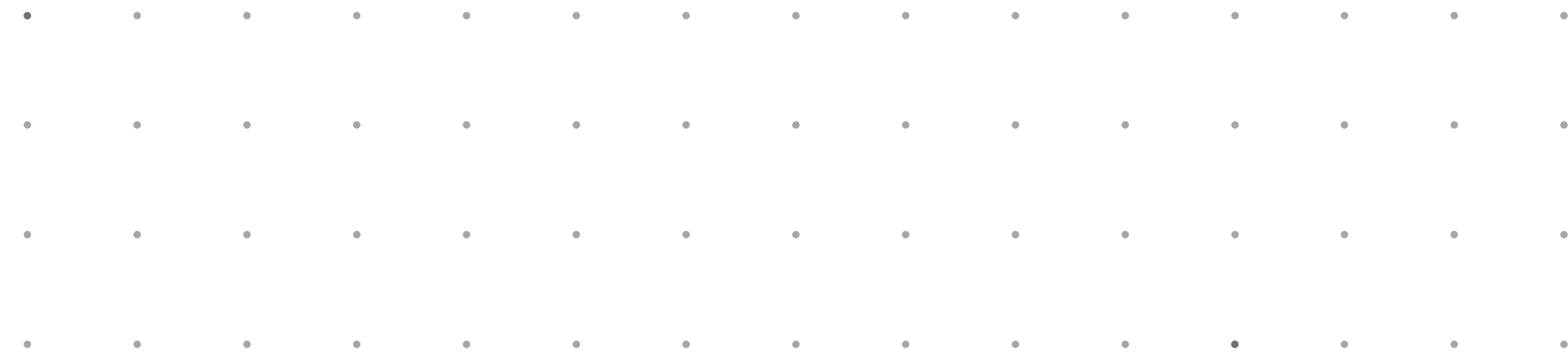
At Phononic, we're developing foundational technology to revolutionize cooling and heating, and we strive for even greater things: building solutions that create a **positive societal impact** for today and tomorrow, with the **promise** to change the world.



# Branding principles.

Branding is more than a logo. It is the experience a customer has as they engage with us. It is how we build customer loyalty, how we differentiate ourselves from competitors, and how we define the value we provide.





# What we are.

Our brand principles and tone of voice have a lasting effect on how we appear to others.

We're astute  not arrogant

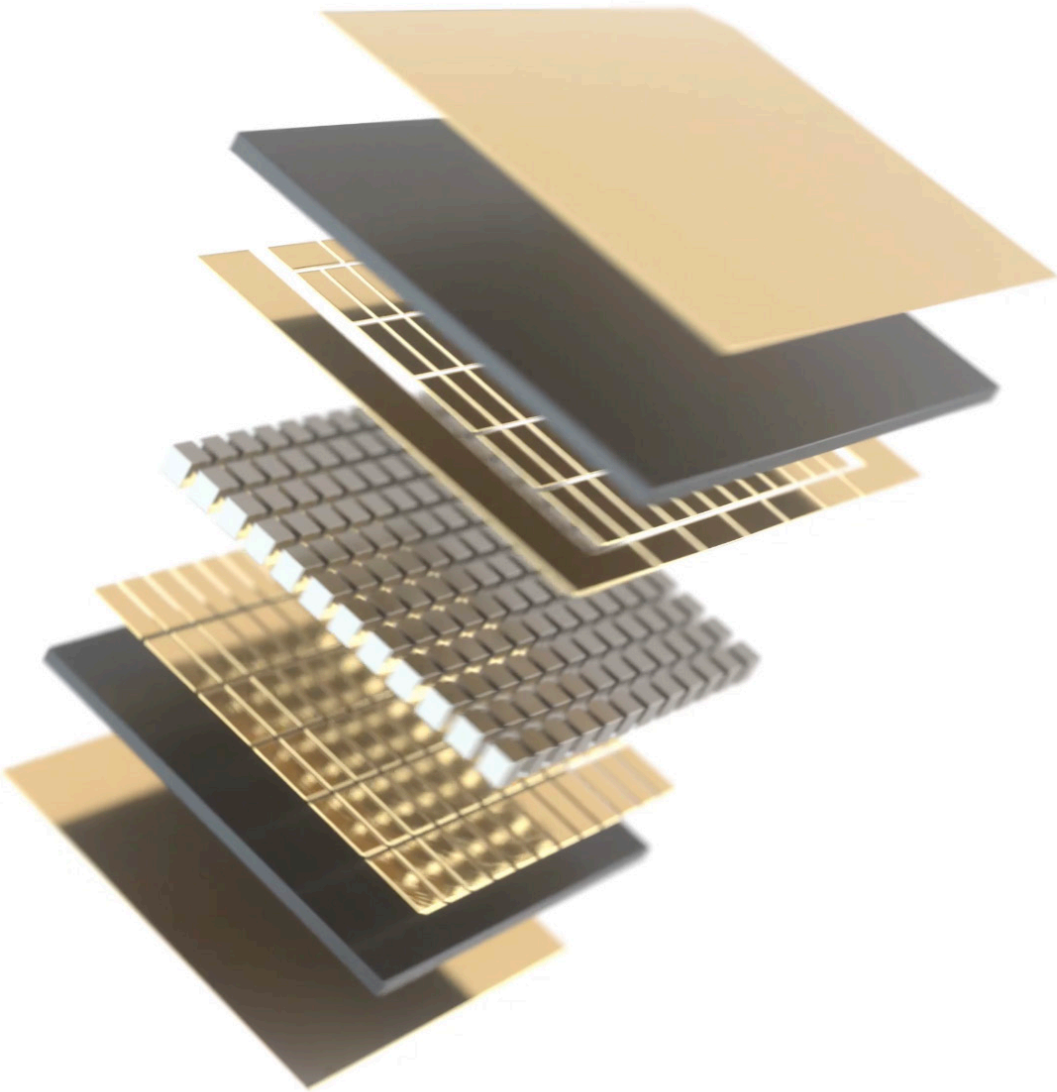
We're optimistic  not lofty

We're smart  not overly technical

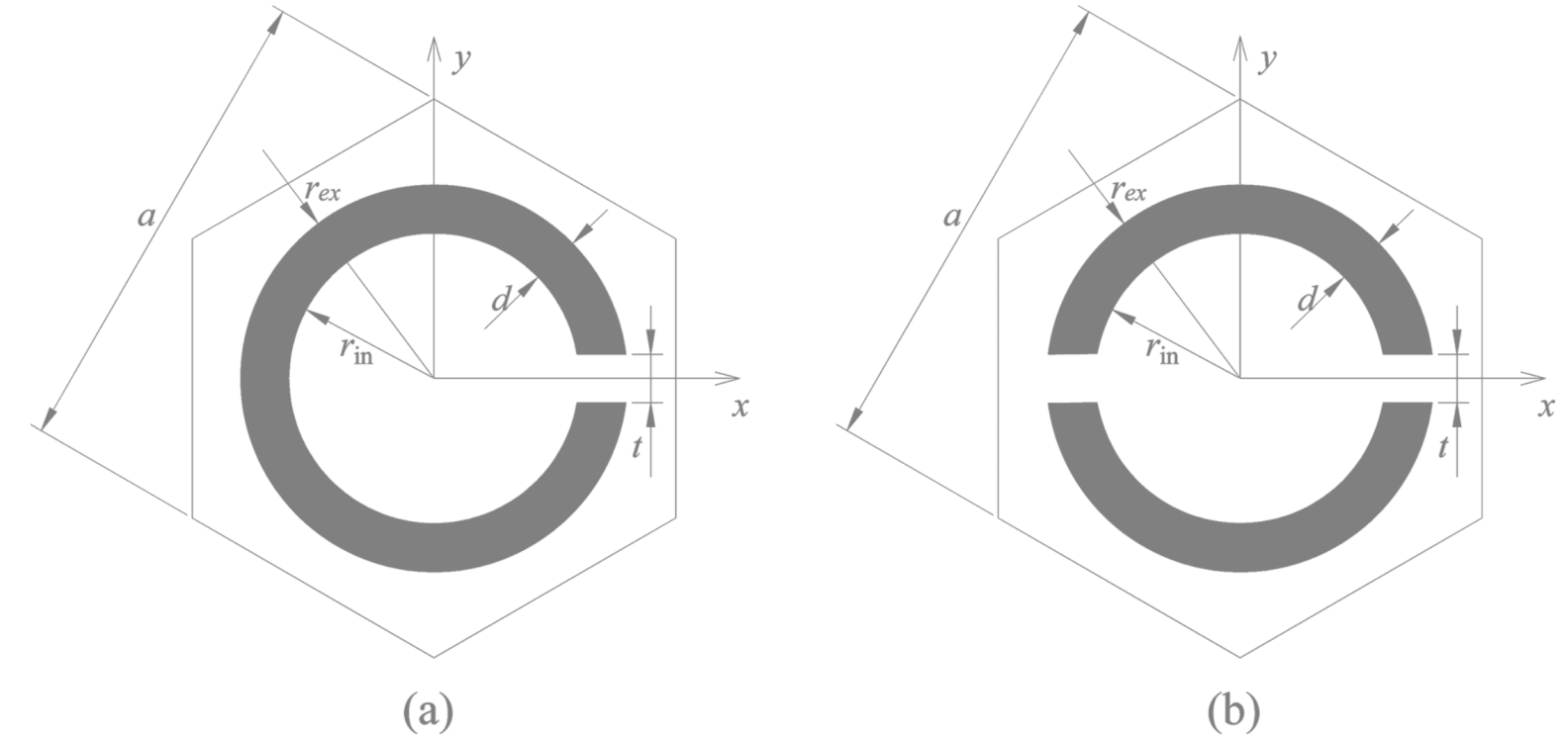
We're visionary  not grandiose

# Design System.

Our design system makes it easy to bring the Phononic brand to life across all touch points.



# Logo inspiration.



The diagram on the right shows a band gap. A band gap represents a frequency range that acoustic waves cannot propagate within a periodic structure.

Thermoelectric cooling is achieved by using the Peltier effect. The Peltier effect refers to the thermoelectric phenomenon of the transfer of heat energy that occurs between two materials when an electric current passes through. This phenomenon results in the addition or removal of heat. This exchange of heat and energy can be represented by two half circles like the diagram on the right.

# Logo.

The Phononic logo is inspired by our solid state cooling and heating technology, which is the heart of our brand. The wordmark comprises simple, functional geometric forms that make it elegant and easy to read.

PHONONIC



# Logo with tagline.

The Phononic logo is also provided as a lockup with the tagline.  
It should not be altered in any way.

PHONONIC  
THE ELEMENT OF INNOVATION

# Logo formats.

The Phononic logo is built for ultimate flexibility depending on how it is used. Multiple formats are provided for the best possible reproduction quality.

PHONONIC

PHONONIC

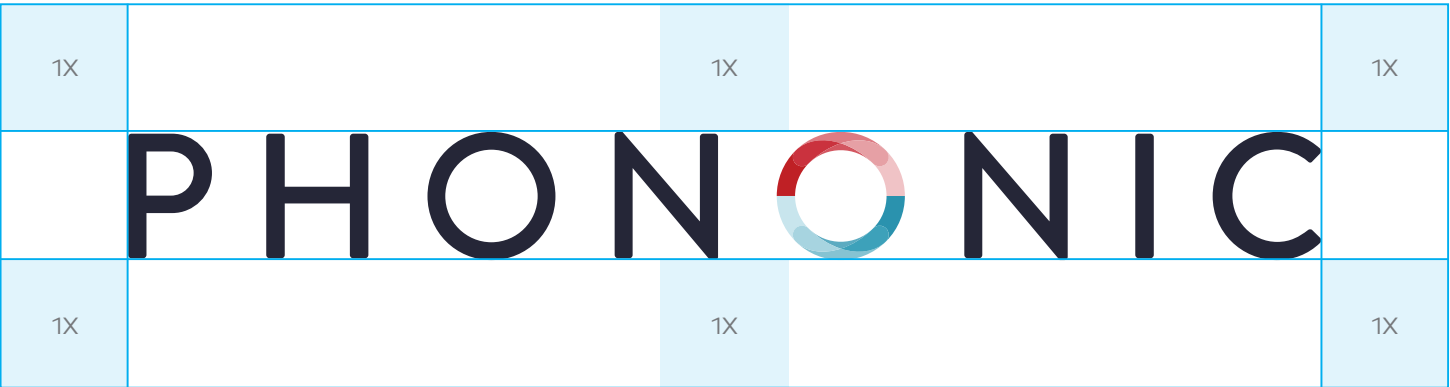
PHONONIC

PHONONIC

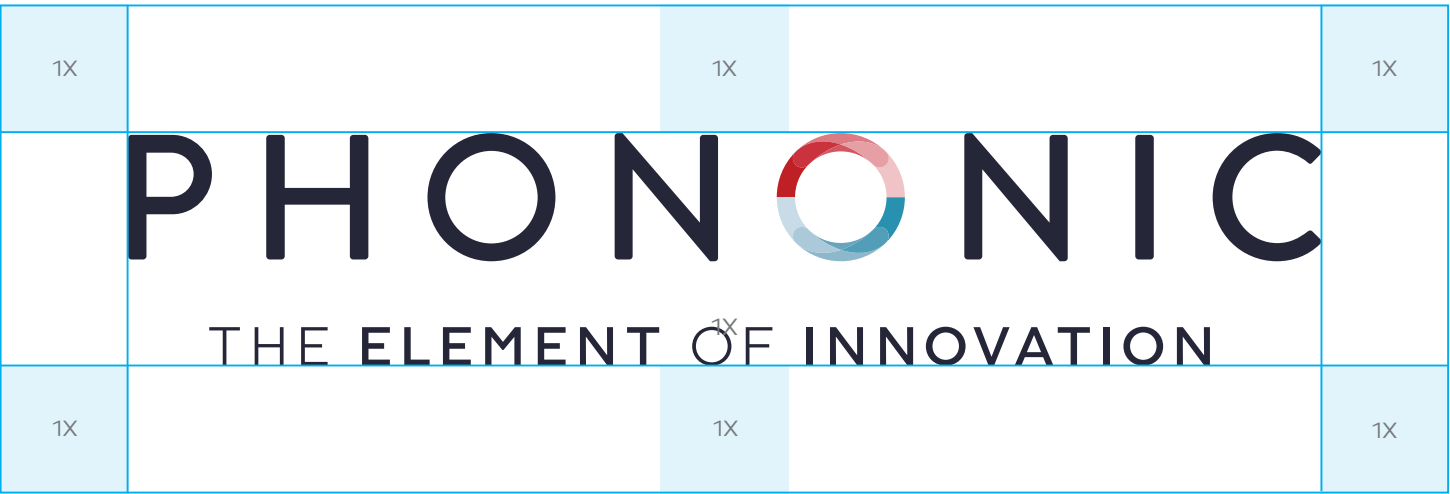
# Logo clear space.

Clear space is equal to the size of the "O" in Phononic.

LOGO



LOGO with TAGLINE



# Things to avoid.

**Do not** recreate or edit the logo

**Do not** add effects such a drop shadow to the logo

**Do not** stretch or distort the logo

**Do not** outline the logo

**Do not** place the logo on busy background that makes it hard to read

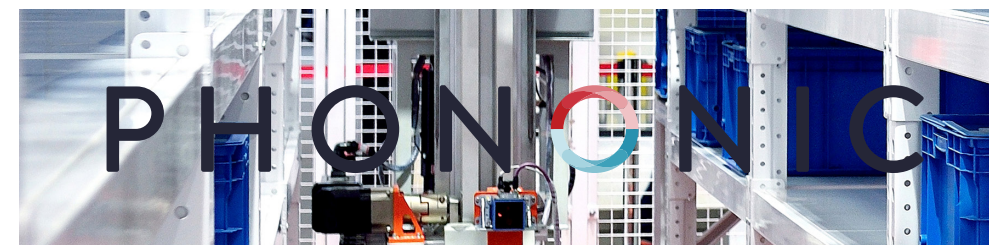
**Do not** add a name to the logo

PHONONIC

PHONONIC

PHONONIC

PHONONIC



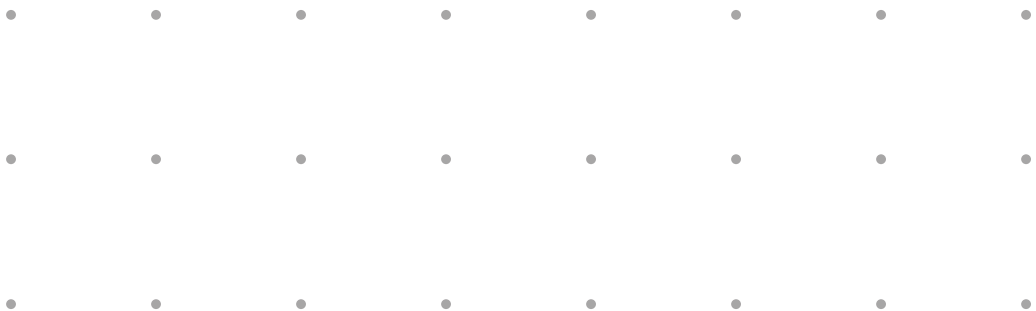
PHONONIC

Life Sciences and Healthcare

# Typography.

Our typeface is Italian Plate No. 2 Expanded.

- Light
- Regular
- Medium
- Demibold
- Bold**
- Extrabold**
- Black**



Italian Plate  
No. 2 Expanded  
Extrabold

A B C D E F G H  
I J K L M N O P Q  
R S T U V W X Y Z  
1 2 3 4 5 6 7 8 9 0

Italian Plate  
No. 2 Expanded  
Light

A B C D E F G H  
I J K L M N O P Q  
R S T U V W X Y Z  
1 2 3 4 5 6 7 8 9 0



# Typography.

Italian Plate No. 2 Expanded is used in various weights for headlines, subheads, body copy, and captions.

Italian Plate  
No. 2 Expanded  
Light, 9/12pt

Italian Plate  
No. 2 Expanded  
Extrabold, 18/22pt

Italian Plate  
No. 2 Expanded  
Demibold, 12/15pt

Italian Plate  
No. 2 Expanded  
Regular, 9/12pt

## Customers are demanding convenience & sustainability

Grocery supply chains are some of the most complex in the industry. Product shelf life, fragility and temperature requirements present unavoidable challenges, yet groceries serve one of the most ubiquitous demands of any supply chain. Not to mention, recent events are driving the exponential growth in fulfillment across numerous sectors, including grocery. And it's not slowing down — it's accelerating. By 2025, online grocery sales will account for 21.5% of total grocery sales; at an estimated 250 billion dollars, this is a 60% increase from 2020 estimates. [Supermarket News, 2020]. With over 50% of U.S. households projected to do all of their grocery shopping online within 10 years [Progressive Grocer, 2018], grocers are ramping up cold chain operations as quickly as possible to meet the demand.

Given the demand, how can cold chain integrity be maintained across the entire fulfillment ecosystem?

OVER  
50%

of U.S. households will do all of their grocery shopping online within 10 years.

## INTRODUCING THE INTELLIGENT ACTIVELY-COOLED TOTE

It's the first truly comprehensive solution for active, portable freezing and cooling, driving cold chain integrity across the entire fulfillment ecosystem.



## TO PUT IT SIMPLY

The Phononic tote delivers unmatched cold chain integrity across the entire fulfillment ecosystem with the most sustainable cooling technology available. Phononic's system does not use harmful Global Warming Potential (GWP) refrigerants and instead uses just CO2 and water, making it non-toxic and non-flammable, unlike other "natural" or low-GWP refrigerants currently in use. Developed through rigorous thermal, mechanical and electrical engineering, the tote's semiconductor-based cooling technology reaches new levels of reliability and efficiency.

# Typography Substitutions.

When necessary, Century Gothic can be substituted when software or application requires a universal font, for example: PowerPoint.

Regular  
Bold

. . . . .  
. . . . .  
. . . . .

Century Gothic  
Bold

A B C D E F G H I  
J K L M N O P Q  
R S T U V W X Y Z  
1 2 3 4 5 6 7 8 9 0

Century Gothic  
Regular

A B C D E F G H I  
J K L M N O P Q  
R S T U V W X Y Z  
1 2 3 4 5 6 7 8 9 0

# Typography Substitutions.

When Italian Plate No. 2 is not available, Century Gothic can be used in various weights for headlines, subheads, body copy, and captions.

Century Gothic  
Bold, 32pt

## Current Grocery Delivery Methods

Store vehicle with tri-temperature zones for last mile delivery

### Process for Tri-Temp truck pick-up and delivery:

- A worker stages ambient order totes on pallets or carts, totes then get loaded into trucks and temp dividers are placed in correct positions prior to beginning the delivery route.

Century Gothic  
Bold, 15pt

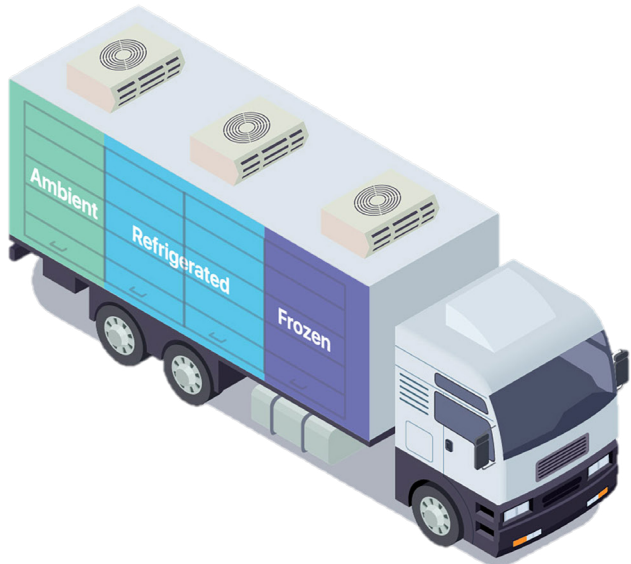
### Common issues with Tri-Temp trucks for delivery:

- Loss of real estate in truck due to 4ft airflow requirements for temp control
- Increased labor for truck set up and delivery
- Temperature variability in cooling/freezing areas
- Truck upfitting expense, maintenance costs for reefers, short life span
- Difficulty of delivery with large vehicle in urban areas
- Loss of flexibility to optimize routes

Century Gothic  
Regular, 15pt

### Phononic's solution:

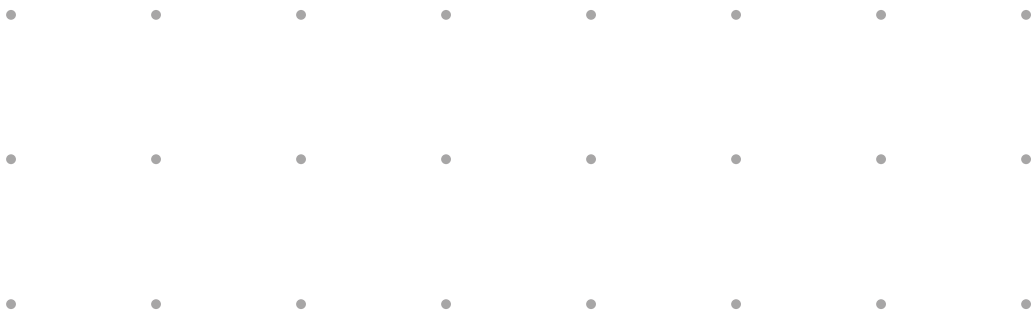
- Improve real estate in delivery vehicles and reduce labor needs
- Flexibility for varying orders – improve order assortment
- Maintenance costs from reefers are eliminated



PHONONIC

# Color.

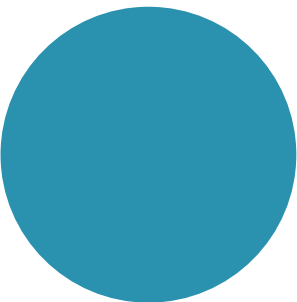
Our color palette echoes the cooling and heating innovation at the core of the company’s technology. Neutral colors like grey and dark blue complement the vibrancy of the red and blue. Secondary colors should be used sparingly.



## Foundation colors

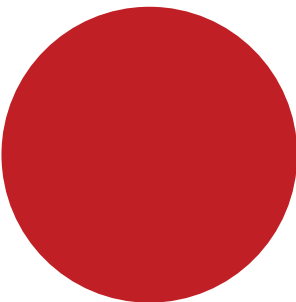
### Phononic blue

**PMS** 7697C  
**CMYK** 73/33/30/2  
**RGB** 37/145/175  
**HEX** 2591AF



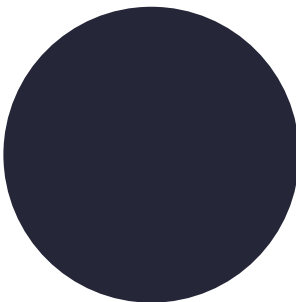
### Phononic red

**PMS** 7621C  
**CMYK** 14/100/100/12  
**RGB** 191/16/28  
**HEX** BF101C

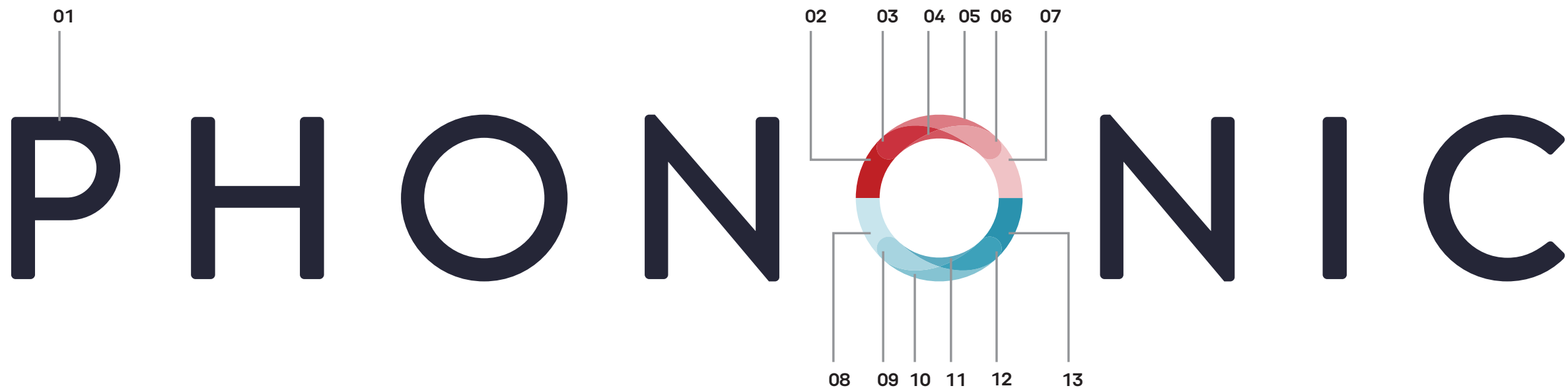


### Phononic navy

**PMS** 532C  
**CMYK** 81/73/56/69  
**RGB** 40/40/56  
**HEX** 1B1E29



# Color.



<b>01</b> <b>PMS</b> 532C <b>CMYK</b> 81/73/56/69 <b>RGB</b> 40/40/56 <b>HEX</b> 1B1E29	<b>02</b> <b>PMS</b> 100% 7621C <b>CMYK</b> 14/100/100/12 <b>RGB</b> 191/16/28 <b>HEX</b> BF101C	<b>03</b> <b>PMS</b> 80% 7621C <b>CMYK</b> 11/80/80/10 <b>RGB</b> 201/52/62 <b>HEX</b> C9343E	<b>04</b> <b>PMS</b> 67% 7621C <b>CMYK</b> 9/67/67/8 <b>RGB</b> 210/88/96 <b>HEX</b> D125860	<b>05</b> <b>PMS</b> 55% 7621C <b>CMYK</b> 8/55/55/7 <b>RGB</b> 220/124/130 <b>HEX</b> DC7C82	<b>06</b> <b>PMS</b> 40% 7621C <b>CMYK</b> 6/40/40/5 <b>RGB</b> 229/159/164 <b>HEX</b> E59FA4	<b>07</b> <b>PMS</b> 25% 7621C <b>CMYK</b> 4/25/25/3 <b>RGB</b> 239/195/198 <b>HEX</b> EFC3C6	<b>08</b> <b>PMS</b> 25% 7697C <b>CMYK</b> 18/8/8/1 <b>RGB</b> 200/227/235 <b>HEX</b> C8E3EB
<b>09</b> <b>PMS</b> 40% 697C <b>CMYK</b> 29/13/12/1 <b>RGB</b> 168/211/223 <b>HEX</b> A8D3DF	<b>10</b> <b>PMS</b> 55% 7697C <b>CMYK</b> 40/18/17/1 <b>RGB</b> 135/195/211 <b>HEX</b> 87C3D3	<b>11</b> <b>PMS</b> 70% 7697C <b>CMYK</b> 51/23/21/1 <b>RGB</b> 92/173/195 <b>HEX</b> 5CADC3	<b>12</b> <b>PMS</b> 82% 7697C <b>CMYK</b> 60/27/25/2 <b>RGB</b> 69/161/187 <b>HEX</b> 45A1BB	<b>13</b> <b>PMS</b> 100% 7697C <b>CMYK</b> 73/33/30/2 <b>RGB</b> 37/145/175 <b>HEX</b> 2591AF			



# Gradients.

Gradients add depth and movement, and bring an extra dimension to imagery. They should be used sparingly, as they are a supporting element in Phononic's visual brand language.

Gradients are built as linear gradients, set on a 20° angle.

**Phononic orange/purple gradient**



**RGB** 240/73/45

**RGB** 46/49/146

**Phononic cyan/cobalt gradient**



**RGB** 28/208/219

**RGB** 31/20/152

# Gradients.

Gradients are built as linear gradients, set on a 20° angle.

Phononic green/blue gradient

\*FOR USE WITH SUSTAINABILITY ONLY



RGB 188/216/106

RGB 65/194/210

# Patterns and elements.

Patterns and elements add an additional layer of interest, and create a distinct rhythm within design. These details can be used as repeating elements for headers and footers, and to enliven white space.

Phononic line pattern —  VISUAL BRAND LANGUAGE

Phononic dot pattern — 

# Patterns and elements.

Phononic swoosh (datasheet)

A comprehensive solution for portable, active cooling and freezing, delivering unmatched cold chain integrity as well as strong ROI and labor savings across the entire Cold Chain Fulfillment Ecosystem.™

Phononic's patented solid-state cooling technology offers unprecedented performance and value not achievable with compressor-based systems or other thermoelectric solutions.



in both fixed and mobile implementations

- Low carbon footprint – eliminates dry ice and gel pack consumables costs


**Features**

- Lightweight and portable
- Refrigerator and freezer versions
- Ultra-low, non-toxic and nonflammable GWP refrigerants
- IoT ready
- Wireless contact charging
- Shock and flame resistant
- Minimal (<2°C) rise in exhaust air temperature
- Low power consumption

**Applications**

- Chilled/Frozen storage in fulfillment centers
- Order staging and storage for curbside or locker pickup
- Transport and delivery

Phononic swoosh (website)

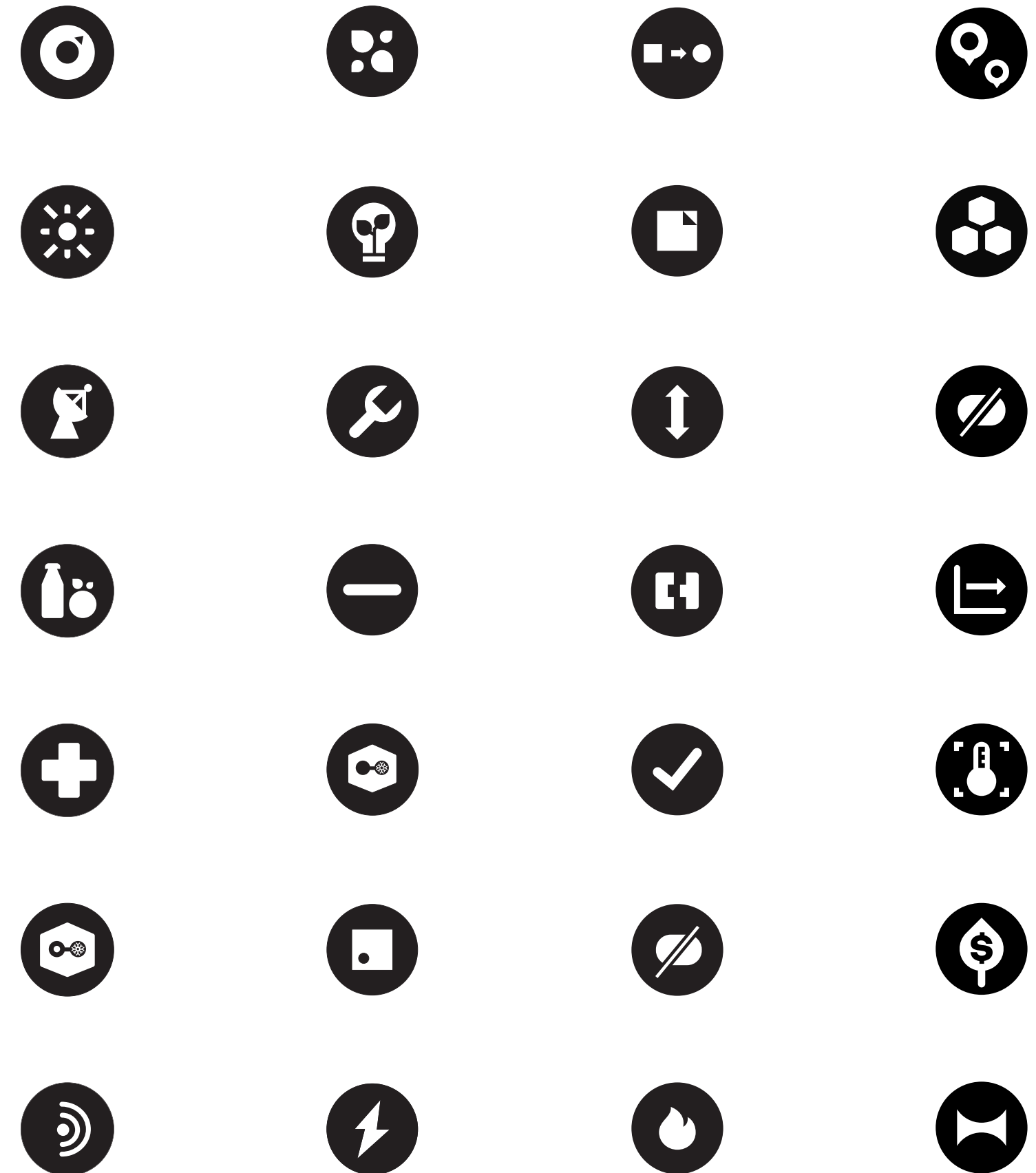


**This is solid-state innovation.**

Our world-class team has engineered an entirely new thermoelectric approach that's powerful, flexible, and efficient. Phononic's Solid-State Heat Pumps and integrated system design are transforming cooling and heating for countless industries and creating new markets, with the potential to change the world.

# Iconography.

A large library of iconography has been created to quickly and graphically communicate the applications and benefits of Phononic technology. These icons are only part of the library, please contact Marketing for additional icons.





# Iconography.

A large library of iconography has been created to quickly and graphically communicate the applications and benefits of Phononic technology. These icons are only part of the library, please contact Marketing for additional icons.



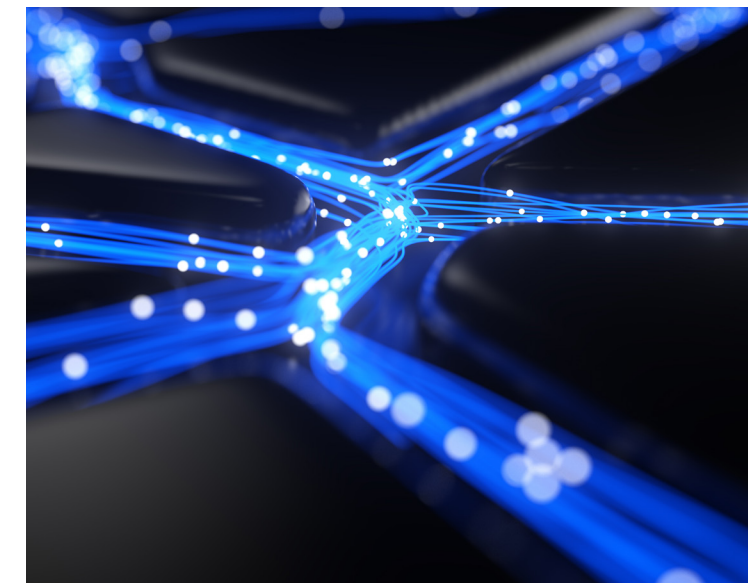
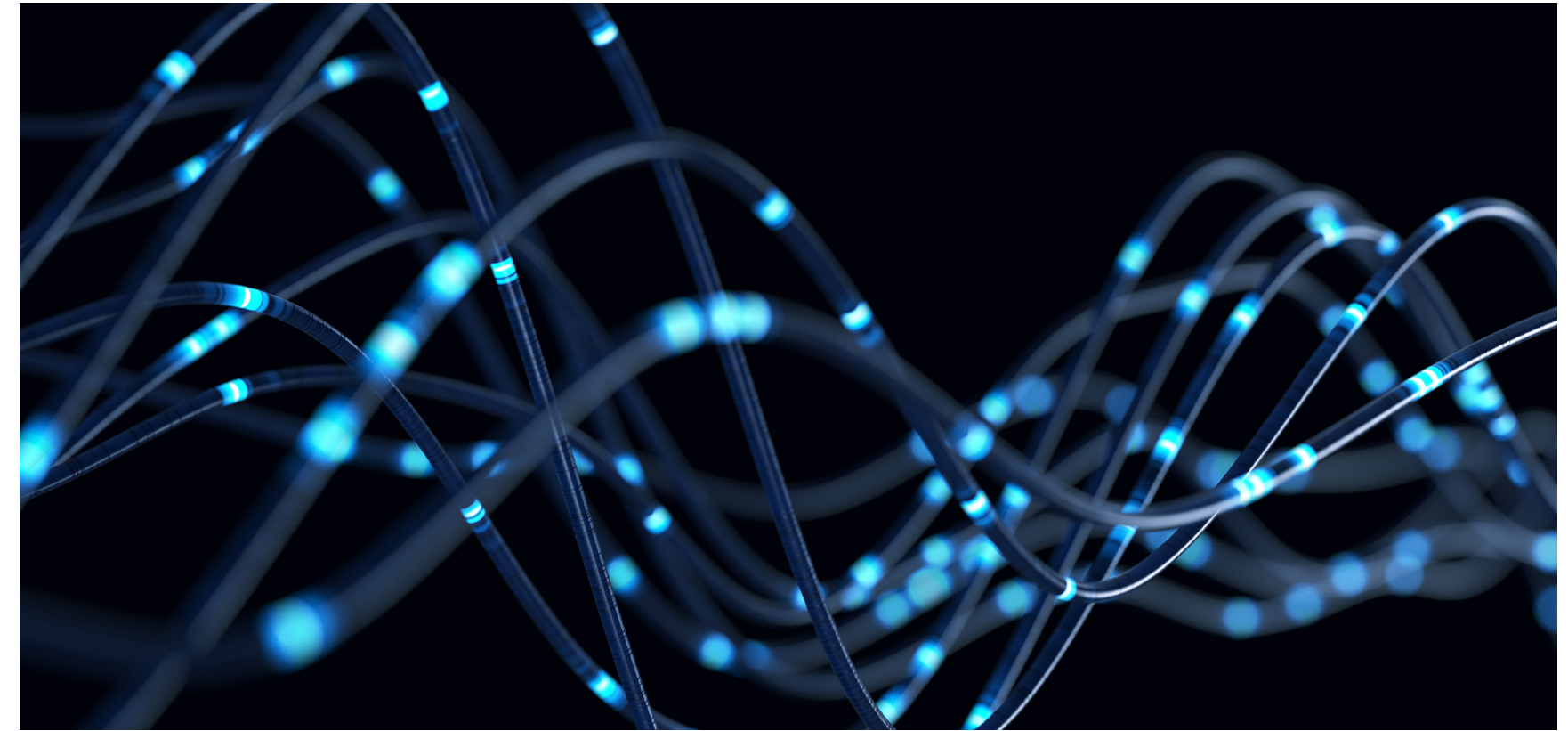
GWP<1

Phononic's solid-state solution uses only CO<sub>2</sub> and water, delivering a Global Warming Potential of one or less



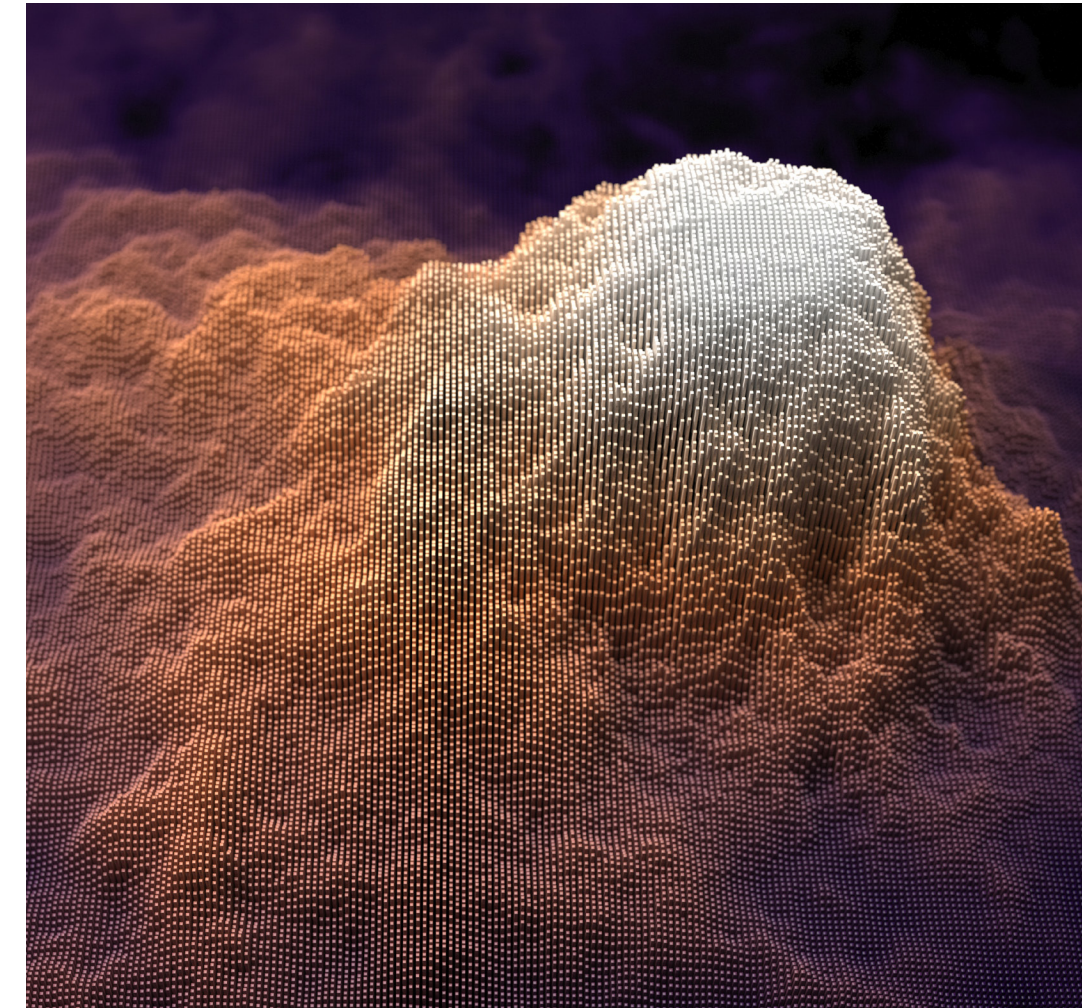
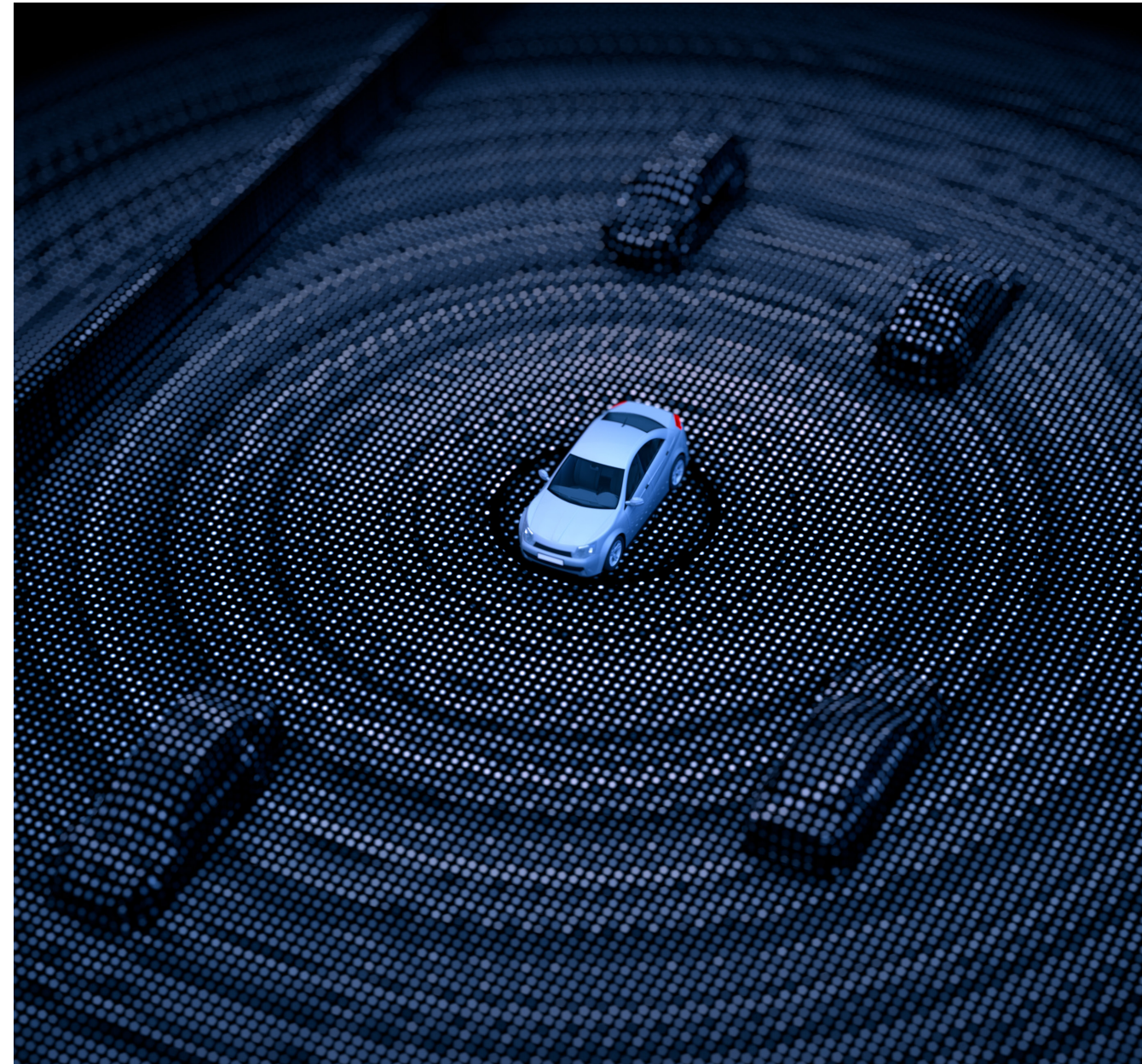
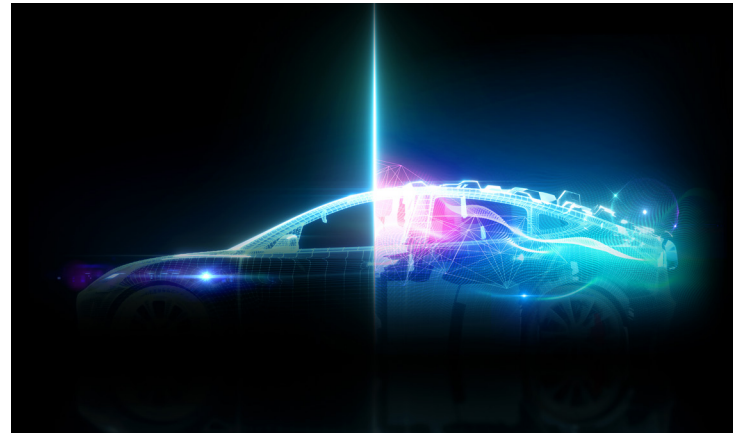
# Imagery.

Imagery is one of our most powerful design assets. We have a collection of imagery that is unique for each business unit and consistently communicates our brand story.



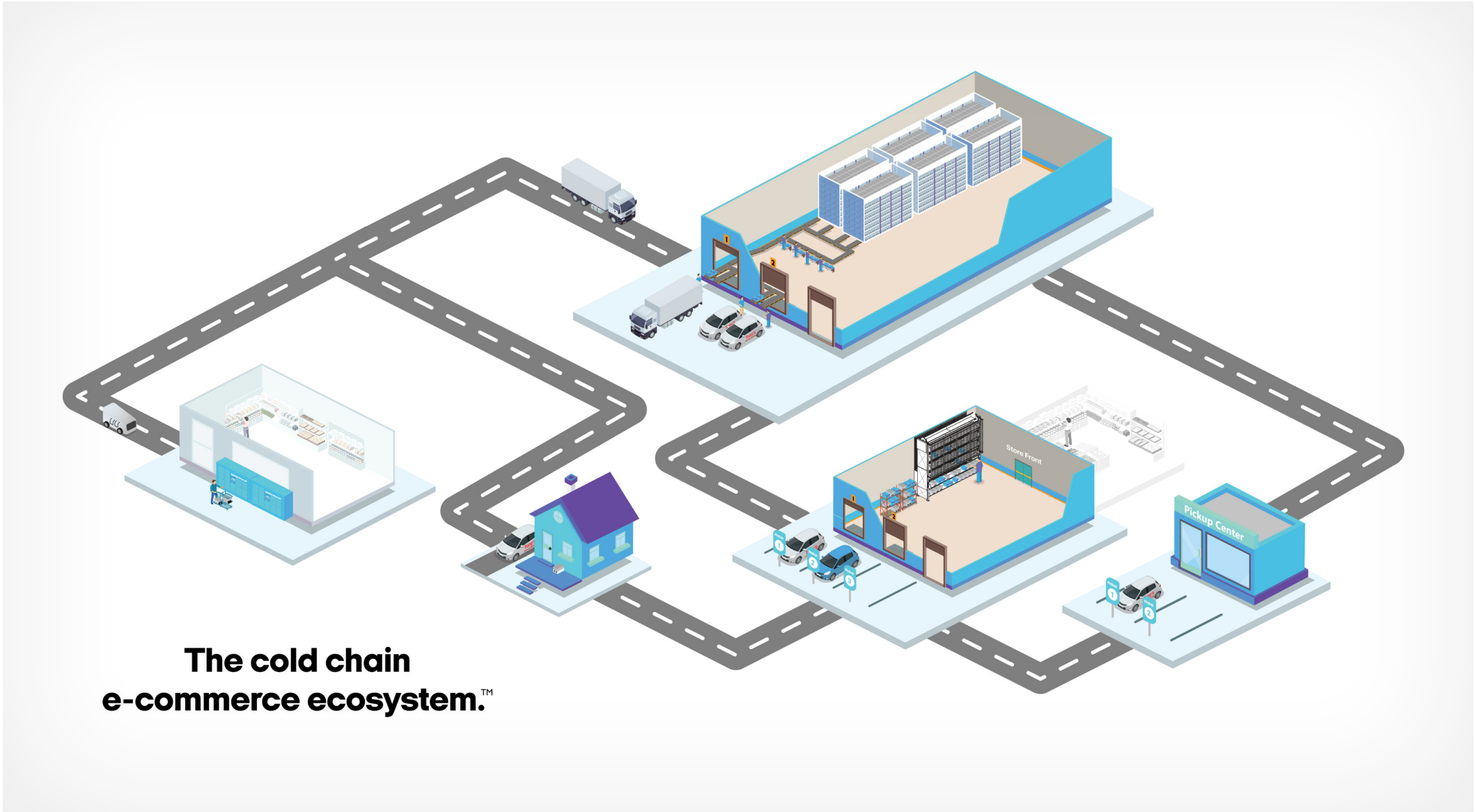


# Imagery.





# Imagery.





# Imagery.



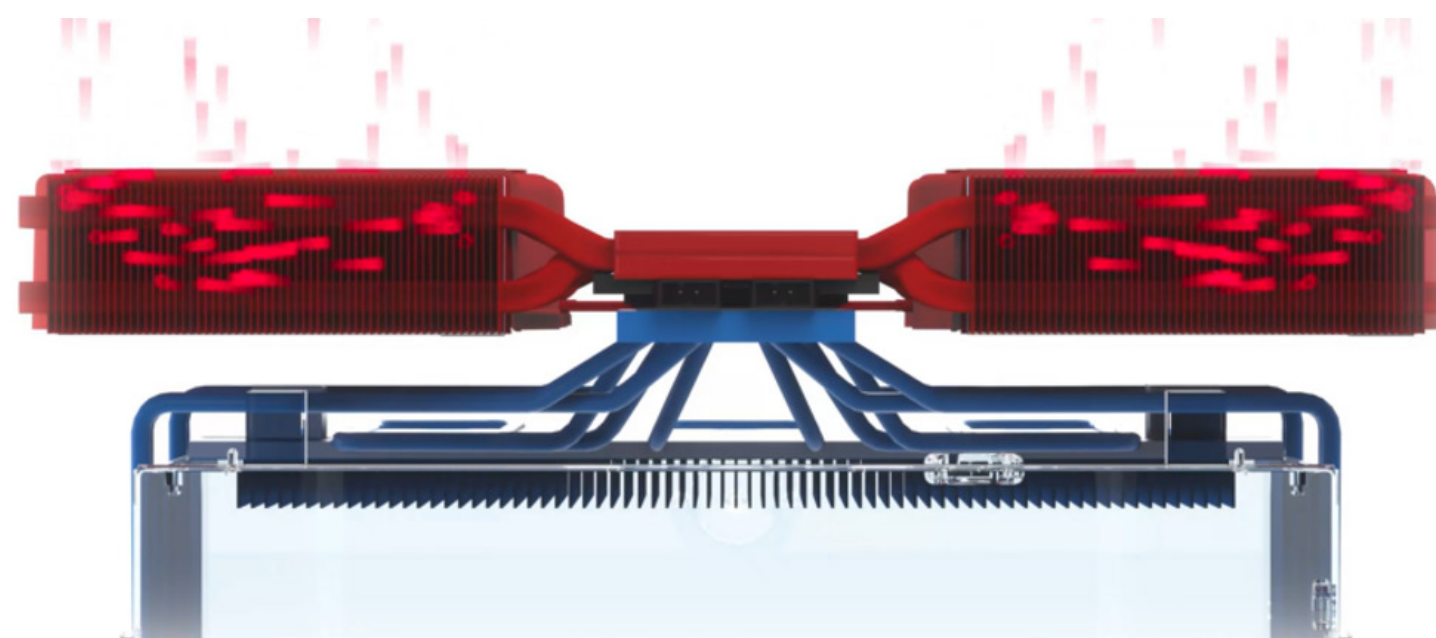
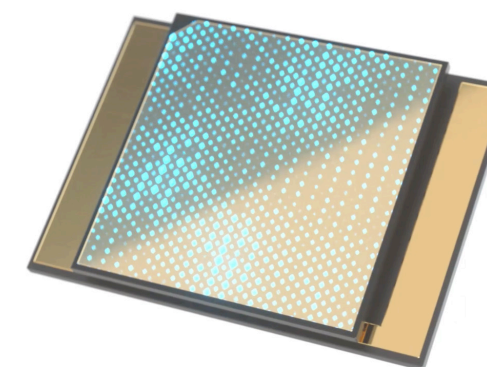
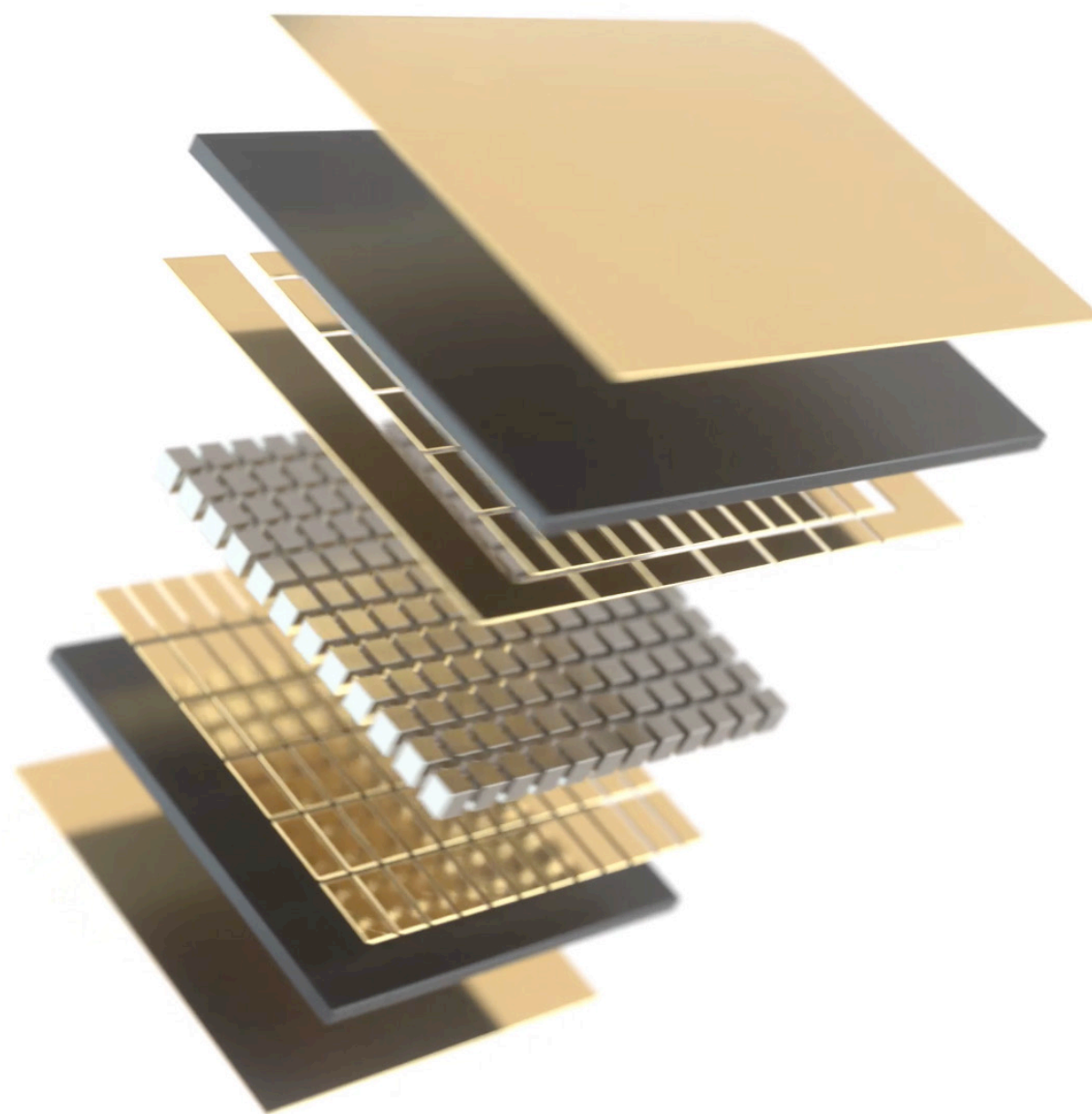
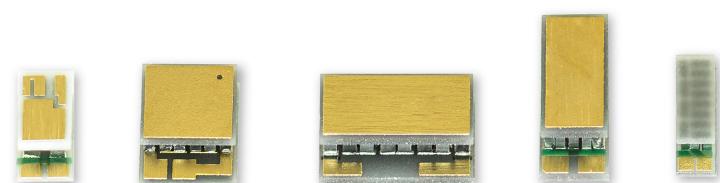
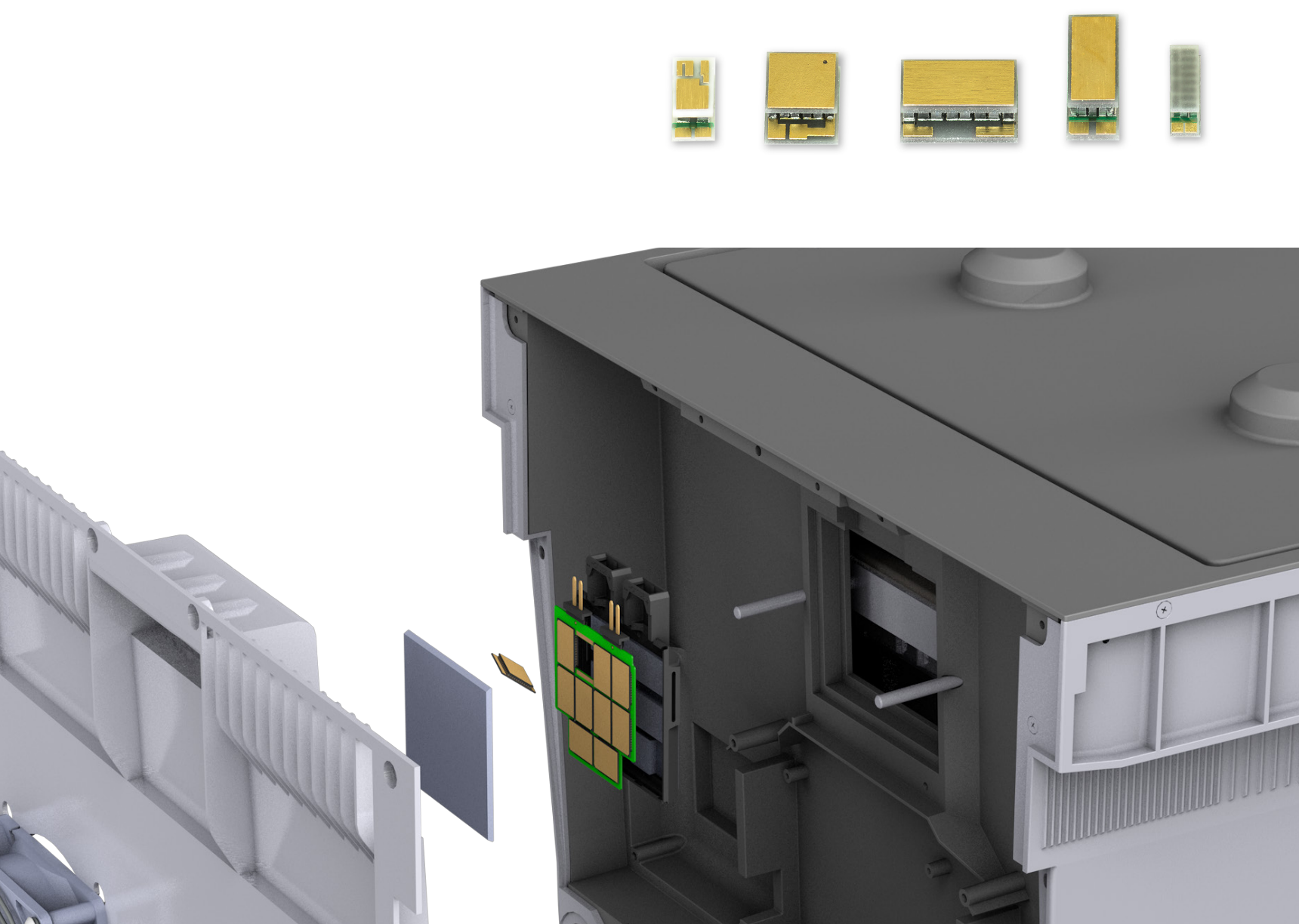


# Imagery.





# Imagery.



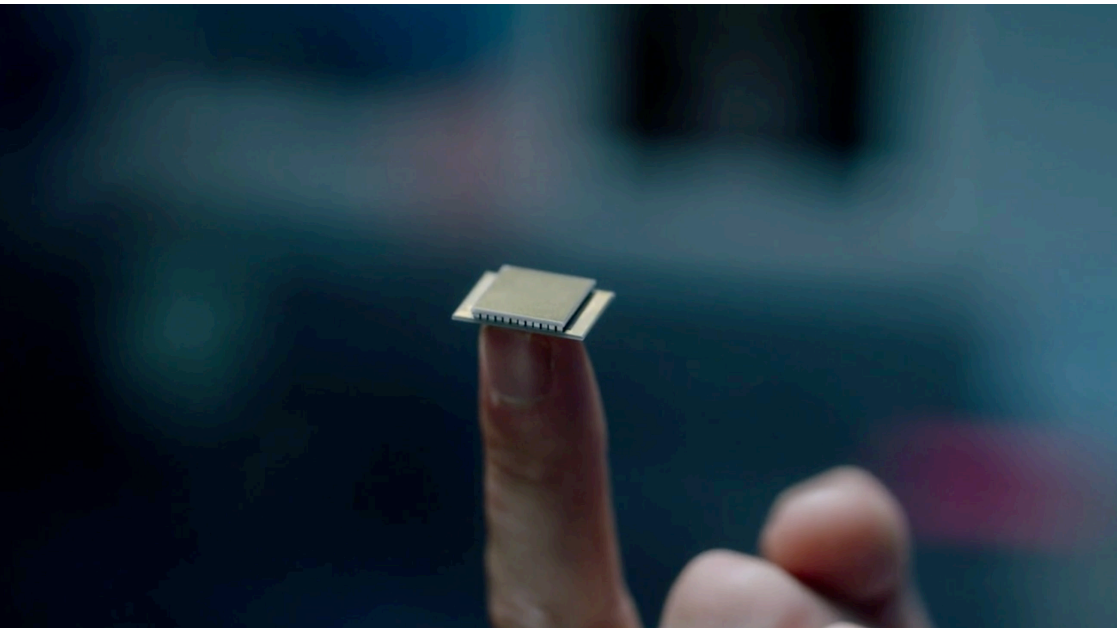
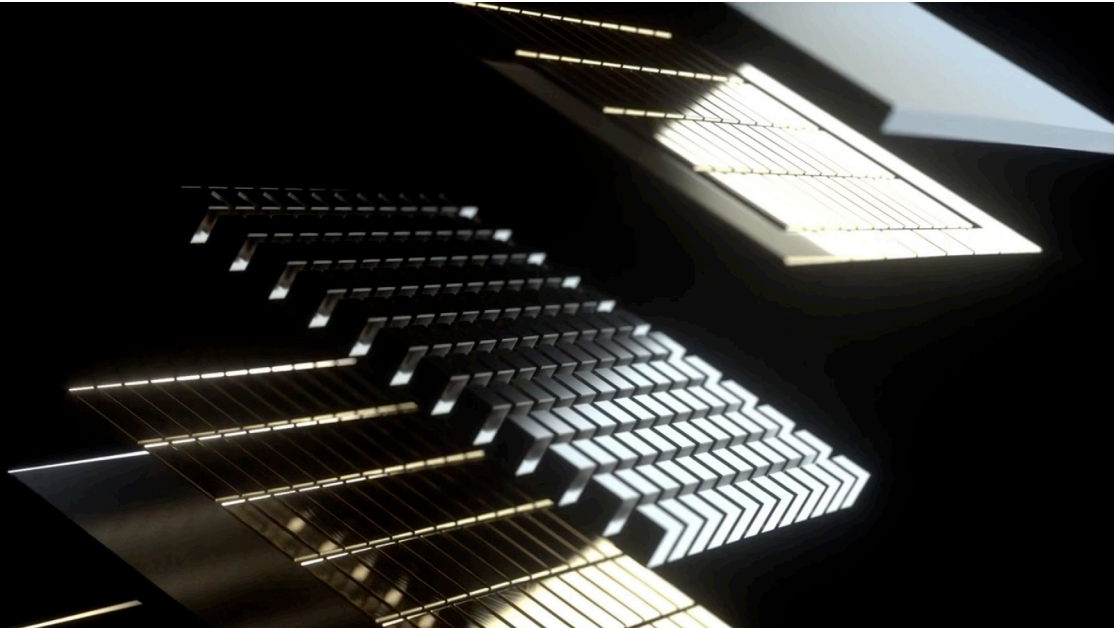
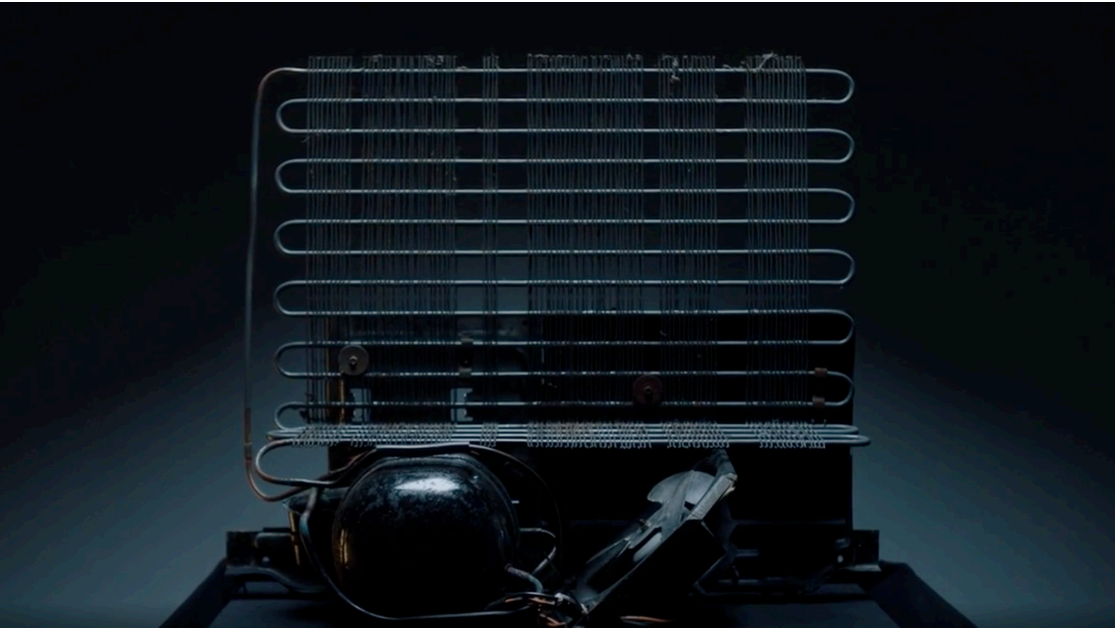
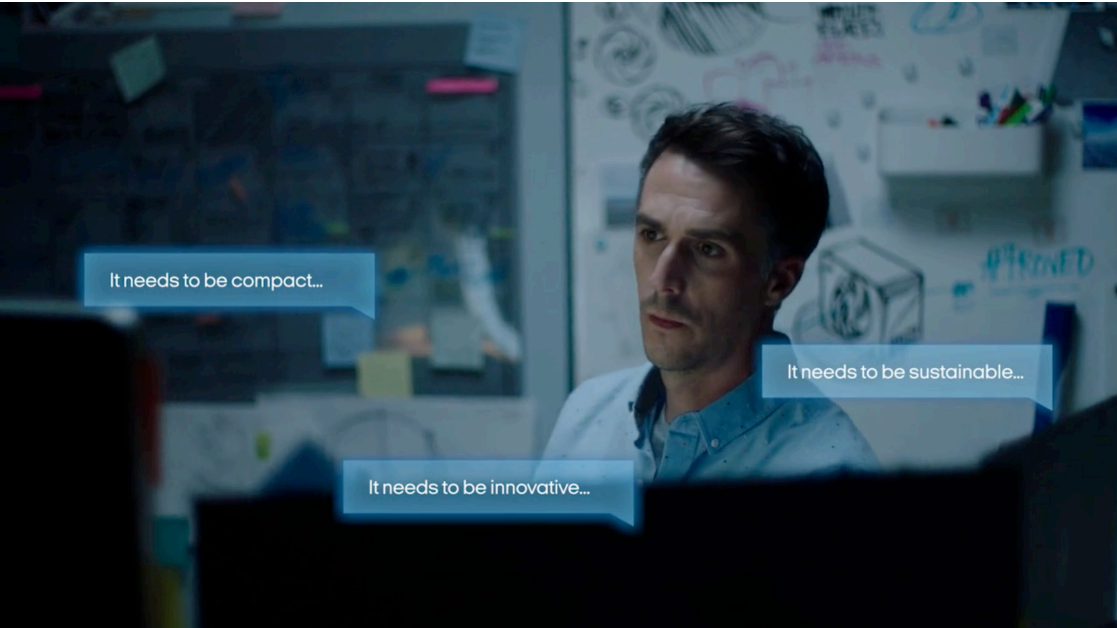


# Campaign Examples.

This is how our design system comes to life, and creates a consistent and instantly recognizable brand look and feel.



# Video.



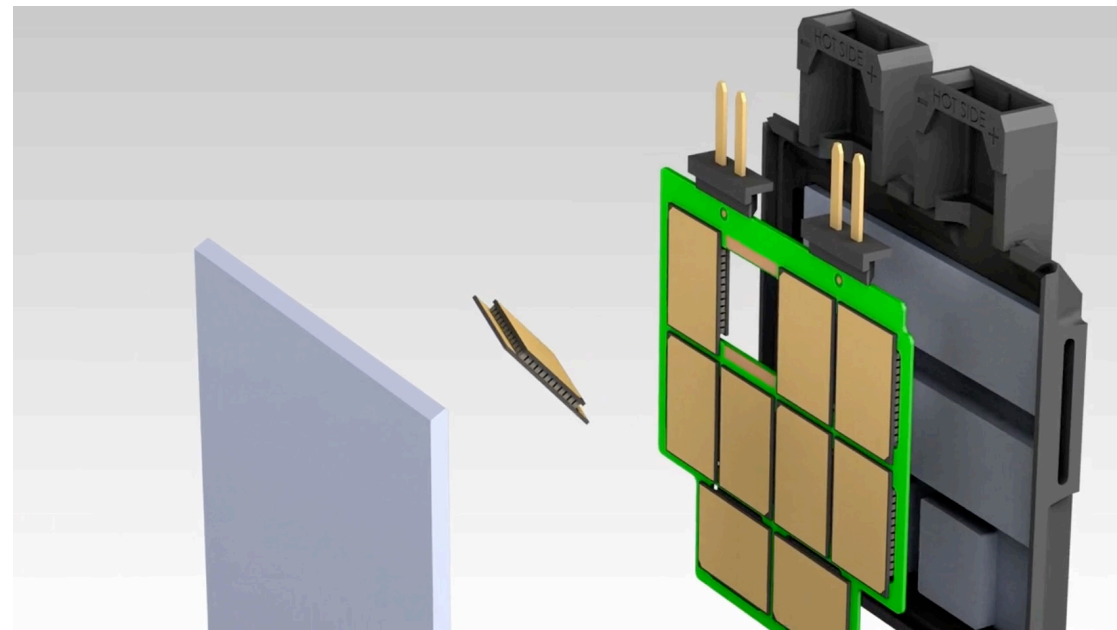


# Video.

**How has cold-chain e-commerce fulfillment evolved, and what are the technological advances driving innovation?**



Real-time insight

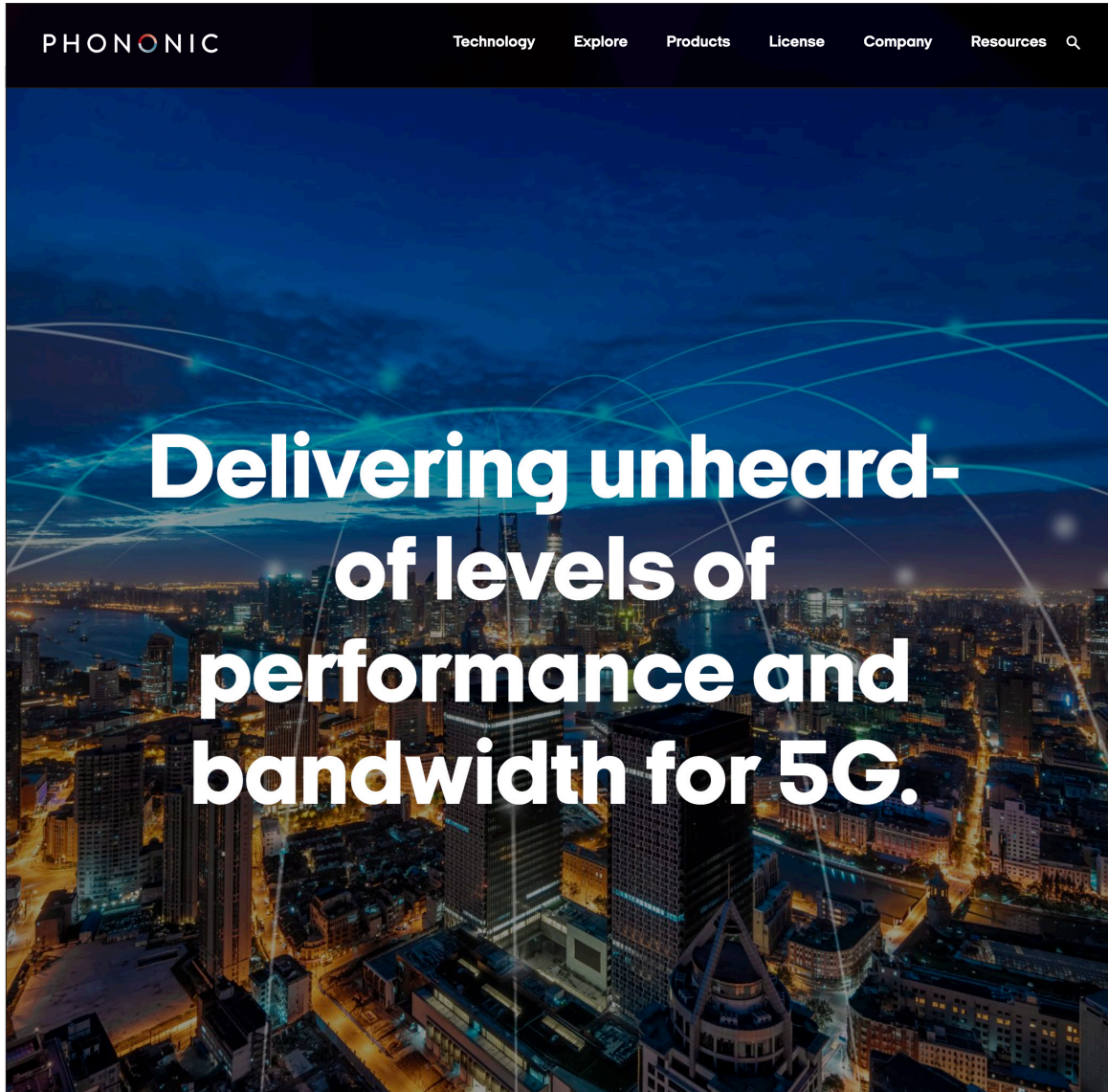
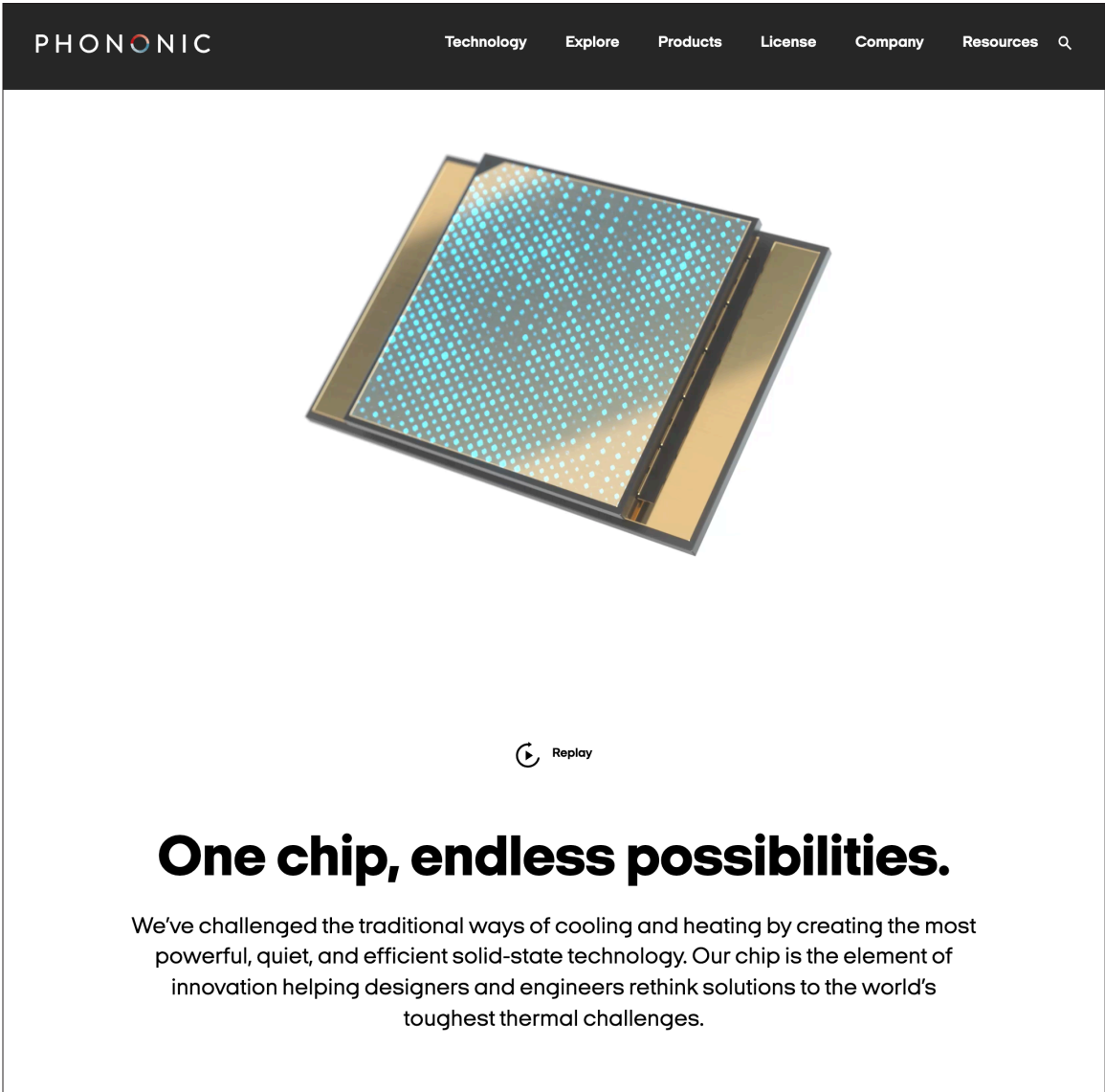
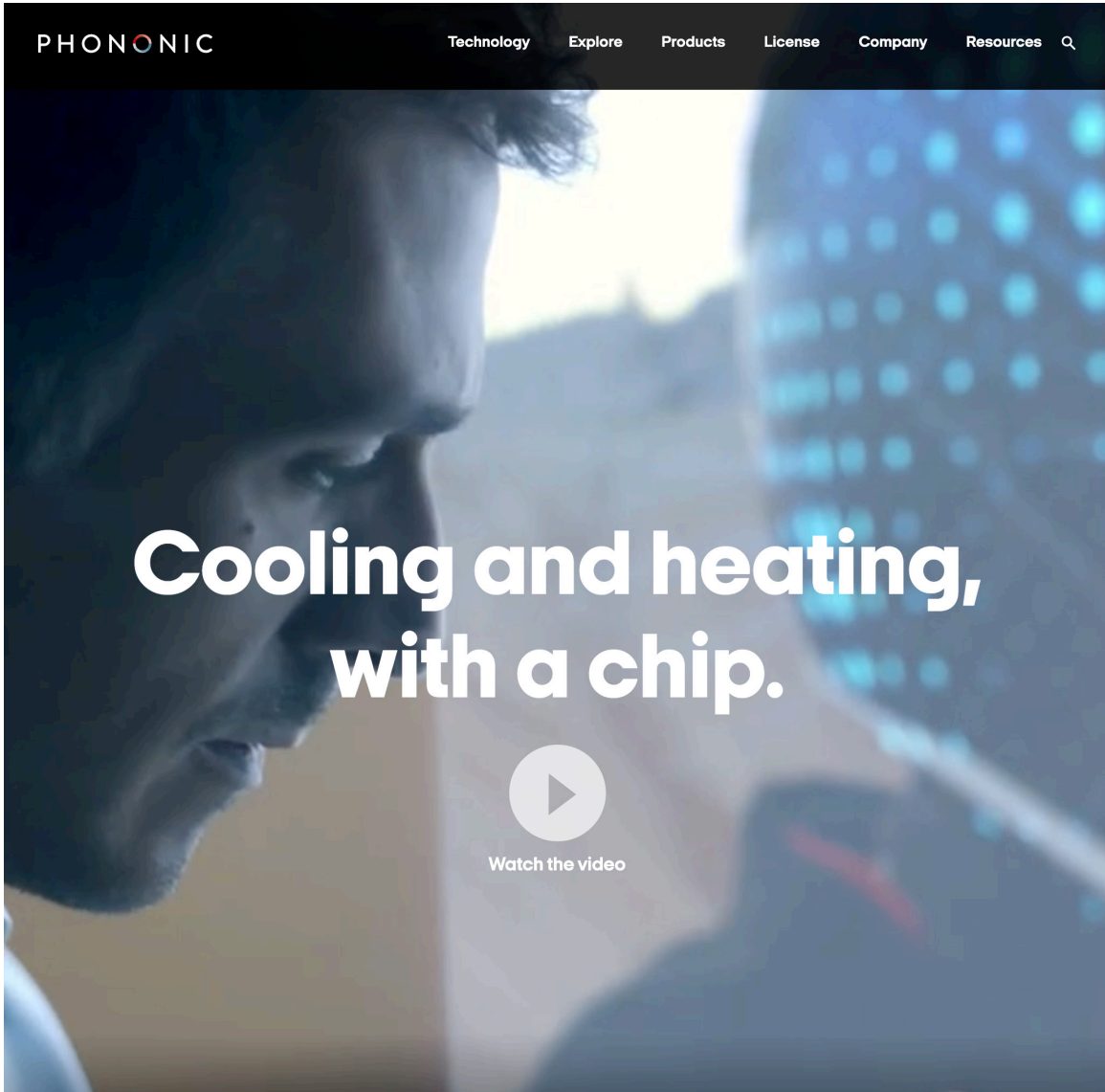


**PHONONIC**  
THE ELEMENT OF INNOVATION

[phononic.com](http://phononic.com)



# Website.



- - 
  - 
  - 
  - 
  - 
  -
- - 
  - 
  - 
  - 
  - 
  -
- - 
  - 
  - 
  - 
  - 
  -

# Website.

PHONONIC

TechnologyExploreProductsLicenseCompanyResources

The Phononic Platform.

Thermoelectrics have been around for over a century, yet nobody has perfected it—until now. We've integrated the engineering disciplines of pumping heat, moving heat, and controlling heat to create a whole new thermoelectric system that's powerful, flexible, and efficient.

Pumping Heat

+

Moving Heat

+

Controlling Heat

=

Your Solution

Moving heat.

The integration of our passive two-phased heat transport systems with Phononic's Solid-State Heat Pumps allows for the creation of systems with low inherent thermal losses, enabling system designs of unparalleled efficiency and capability.

Learn more >

Pumping heat.

Our compact, modular solid-state semiconductor can be designed to meet a wide range of heat pumping needs. Highly scalable while maintaining high efficiencies, it can be integrated into a fully ruggedized Solid-State Heat Pump for the most demanding applications.

Learn more >

PHONONIC

TechnologyExploreProductsLicenseCompanyResources

Explore > Optoelectronics

Phononic in Optoelectronics

In an increasingly connected and autonomous world, our TECs make the most demanding optical communications applications possible.

Benefits.

Low power consumption

Realize up to 30% lower power consumption in your cooled optoelectronics package with a Phononic TEC.

High heat pumping density

Our TECs deliver 60% better heat pumping density, even in a small footprint.

Superior quality and reliability

We assemble our TECs in a US-based production facility that is certified towards ISO 9001:2015 and 14001:2015 standard requirements to ensure industry-leading quality and exceptional reliability.

Enabling non-hermetic packaging

Phononic's ReefTEC™ platform is over 5X more reliable in extreme, condensing environments than both traditional, hermetic-rated TECs and other non-hermetic protection approaches.

PHONONIC

TechnologyExploreProductsLicenseCompanyResources

Explore the potential of Phononic technology

Our solid-state technology is the element of innovation that's creating solutions for the world's toughest thermal challenges. See how, together, we can push the boundaries of what's possible.

5G Wireless

With innovative thermoelectric technology platforms created expressly for the unique needs of optical communications applications, Phononic leads the industry in TECS for 5 applications.

Learn more >

Automotive LiDAR

Active cooling of the precisely-tuned lasers and detectors inside LiDAR sensors ensures high sensitivity, reduced interference, high reliability, and perfect operation in a broad temperature range of the LiDAR sensor's light engine.

Learn more >

Food & beverage

With Phononic's solid-state refrigerators, retail stores can maximize product placement and elevate the shopping experience.

Learn more >

Furniture & bedding

Our solid-state technology can be integrated into furniture and bedding to offer greater temperature stability and comfort.

Learn more >

Healthcare

Our medical-grade refrigerators are enabling hospitals, pharmacies, and medical offices to deliver a safer, more reliable standard of care.

Learn more >

Last mile & cold chain

Temperature stability is everything when it comes to last mile delivery and cold chain transport. With solid-state technology, delivery and transport can be streamlined with greater control and monitoring capabilities to ensure the right temperature at the right time.

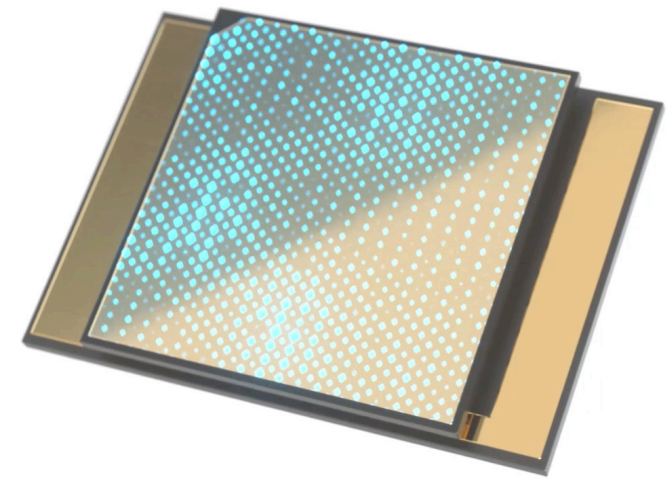
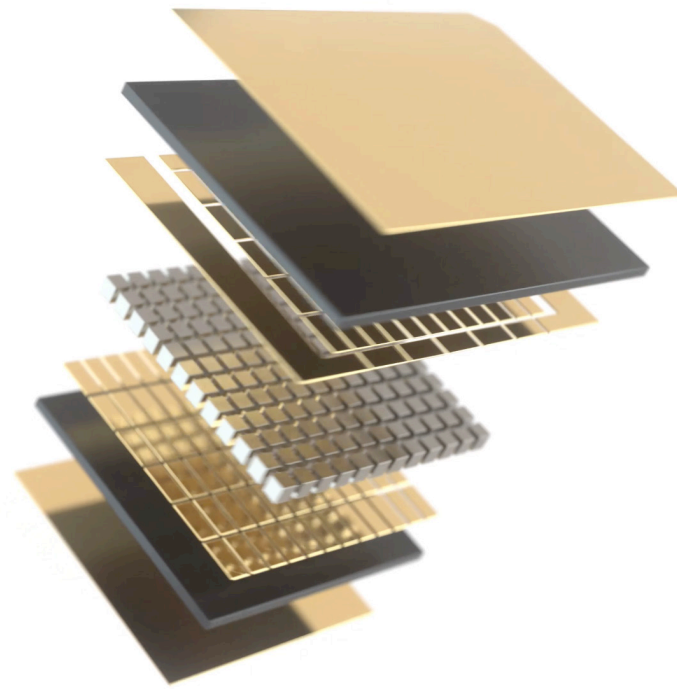
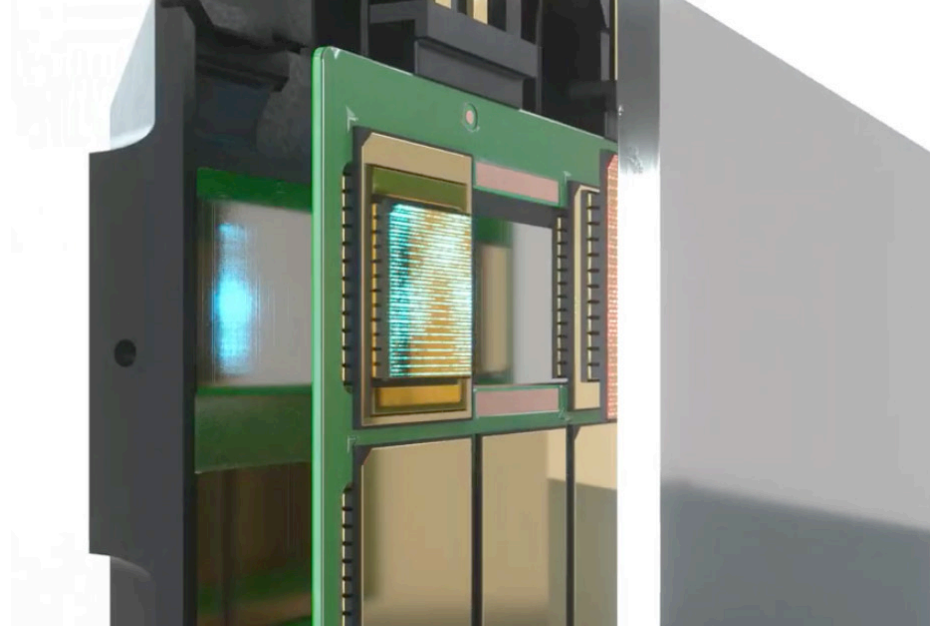
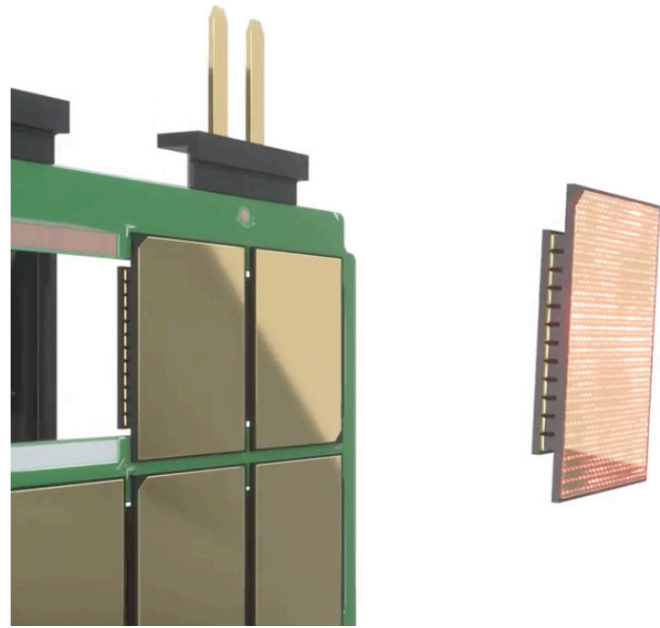
Learn more >

36

//////



# Animation.

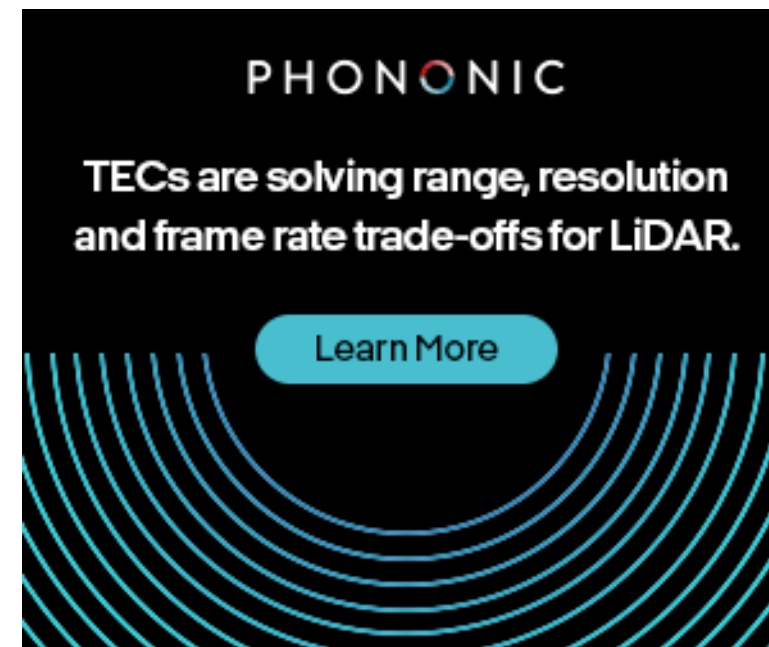


# Advertising.

PHONONIC

TECs are solving range, resolution  
and frame rate trade-offs for LiDAR.

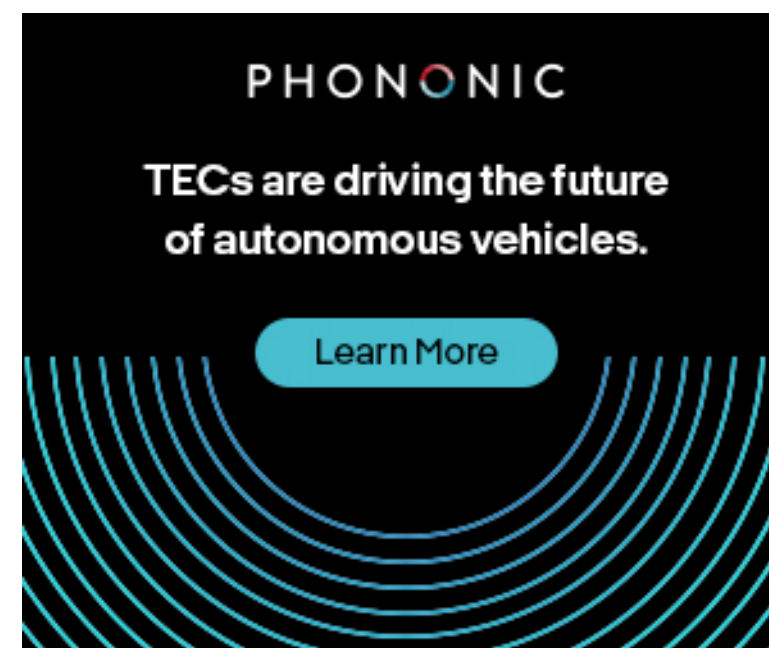
[Learn More](#)

A square advertisement with a black background. At the top is the PHONONIC logo. Below it is the text 'TECs are solving range, resolution and frame rate trade-offs for LiDAR.' in white. At the bottom is a teal button with the text 'Learn More'. The background features a series of concentric teal arcs, representing LiDAR sensor range-finding.

PHONONIC

TECs are driving the future  
of autonomous vehicles.

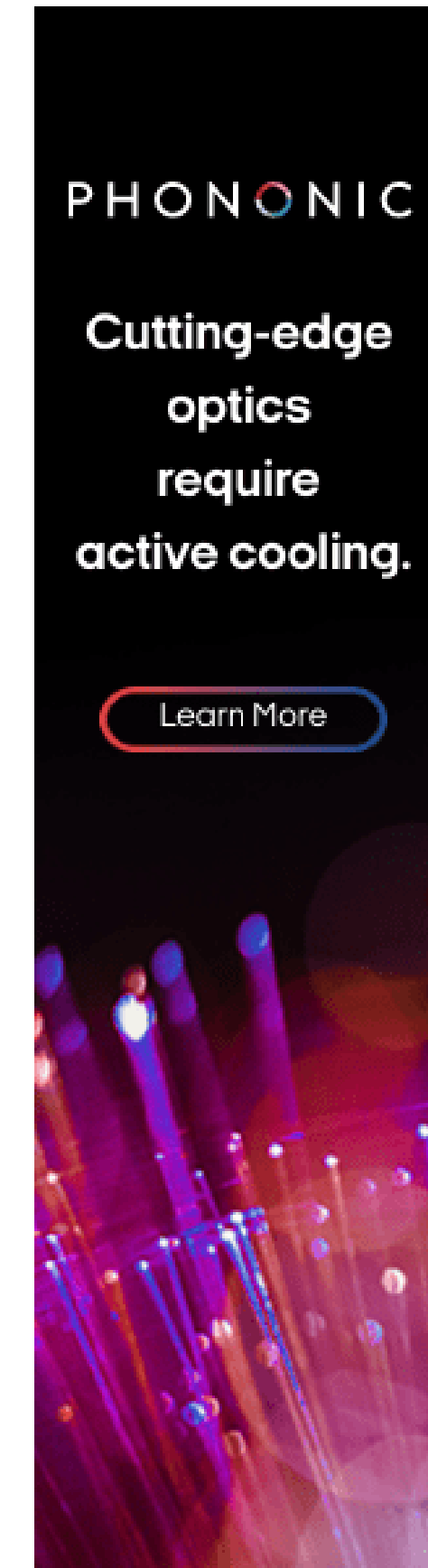
[Learn More](#)

A square advertisement with a black background. At the top is the PHONONIC logo. Below it is the text 'TECs are driving the future of autonomous vehicles.' in white. At the bottom is a teal button with the text 'Learn More'. The background features a series of concentric teal arcs, representing LiDAR sensor range-finding.

PHONONIC

Cutting-edge  
optics  
require  
active cooling.

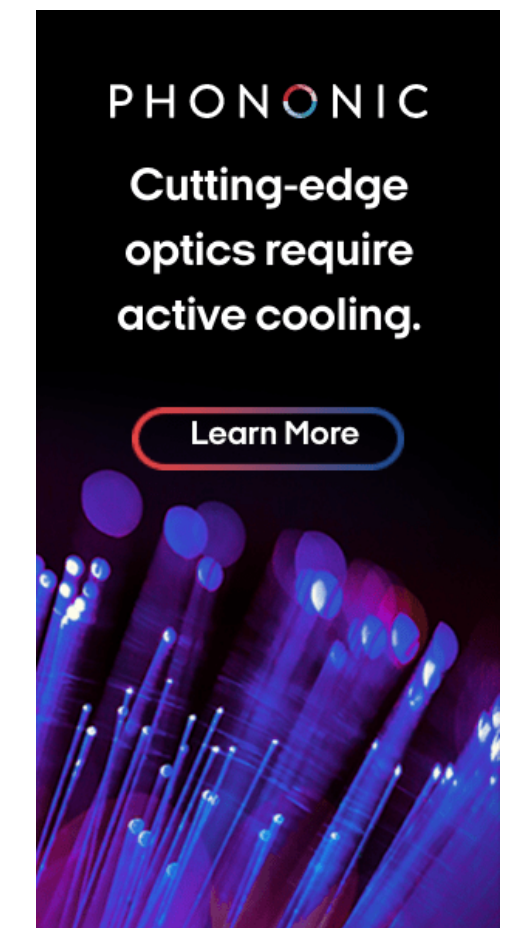
[Learn More](#)

A vertical rectangular advertisement with a black background. At the top is the PHONONIC logo. Below it is the text 'Cutting-edge optics require active cooling.' in white. At the bottom is a blue button with the text 'Learn More'. The background features a close-up of glowing optical fibers in shades of purple, blue, and red.

PHONONIC

Cutting-edge  
optics require  
active cooling.

[Learn More](#)

A vertical rectangular advertisement with a black background. At the top is the PHONONIC logo. Below it is the text 'Cutting-edge optics require active cooling.' in white. At the bottom is a blue button with the text 'Learn More'. The background features a close-up of glowing optical fibers in shades of purple, blue, and red.



# eBook + White paper.

////// EBOOK : cold chain fulfillment

PHONONIC

### Driving Innovation Across the Cold Chain Fulfillment Ecosystem™

Totes are available in both a refrigerator and freezer version, using color to quickly distinguish between the two. The tote has wireless control charging and one Wi-Fi and IoT capable, offering real-time insight into your cold chain automation process and leading to an increase in operational efficiencies. So whether you're running a fulfillment operation in a manual environment or need a cooled vessel within a center-fulfillment center, the Intelligent Actively-Cooled Tote from Phononic is the perfect solution.



////// 6 : cold chain fulfillment

PHONONIC

### What is the Intelligent Actively-Cooled Tote?

**Strong ROI**  
Reduces cost by eliminating the need for in-temperature storage capital expense, in both fixed and mobile implementations and reduces fulfillment complexity and labor cost.

**Unsurpassed sustainability**  
Totes are available in both a refrigerator and freezer version, using color to quickly distinguish between the two. The tote has wireless control charging and one Wi-Fi and IoT capable, offering real-time insight into your cold chain automation process and leading to an increase in operational efficiencies. So whether you're running a fulfillment operation in a manual environment or need a cooled vessel within a center-fulfillment center, the Intelligent Actively-Cooled Tote from Phononic is the perfect solution.

**Flexible**  
Transforms your OPEX and CAPEX so it's based on real-time demand and allows for flexibility in scaling chilled and frozen storage as demand fluctuates.

**Demand-based energy savings**  
Cools or freezes only the number of customer orders needed based on demand, rather than an entire cooler, warehouse or transport truck.

**Versatile**  
One common solution solves multiple use cases: Storage, Pick-and-Pack (Manual, Semi-Automated, Automated), Curbside Pickup, Delivery and Unassisted Delivery and Hub & Spoke.

**Scalable**  
Increases the flexibility to scale with operational needs. Kick off with one container or grow to 3,000+ in a tote without cooling rooms, freezer warehouses or in-temperature trucks.

**Real-time insights**  
The tote has wireless control charging and one Wi-Fi and IoT ready, offering real-time insight into your cold chain automation process, leading to an increase in operational efficiencies.

**Compressor-free**  
The elimination of the compressor combined with Phononic's patented refrigeration and heating technology reduces thermal volume while keeping the container compact.

**Improved customer experience**  
Strengthens customer loyalty by ensuring order freshness and a positive experience with ever-evolving e-commerce platforms.

PHONONIC



### Who can benefit from the Intelligent Actively-Cooled Tote?

**Personal Shoppers**  
Due to strict cold chain compliance regulations, personal shopper associates must adhere to specific time limits while picking chilled or frozen products. By using an actively-cooled refrigerated tote, they can complete their entire route without having to return to the backroom due to a time constraint or concerns over product quality.

**Grocery Store Retailers**  
Our totes' universal dimensions work in conjunction with automated vertical storage and existing picking systems, as well as shelves and pick carts, so retailers can more easily optimize their existing space. Plus, as the ratio between the number of ordered, chilled and frozen products fluctuates, mobile totes allow for on-demand filling, whereas conventional solutions — like reach-in cases — are more stagnant.

**Consumers**  
Now, more than ever, we're seeing an increase in the number of retailers adopting and expanding their Buy Online, Pick-up in Store (BOPIS) solutions. Like in-store, drive-up pick-up and lockers. As the need for refrigerated versus frozen locker space fluctuates, these totes can accommodate needs by plugging into however many spaces are necessary. Most retailers that have stock with ambient lockers, which only help with dry goods or GM products, require an associate to retrieve perishables from another area.

**Delivery Drivers**  
Consumers rely on passive cooling solutions like gel or ice packs to maintain temperature control, which is not reliable or sustainable. With our totes, drivers can report their overall delivery radius and acquire previously unattainable cost efficiencies by optimizing routes through batched orders.

### What does the future of cold chain fulfillment look like?

The Intelligent Actively-Cooled Tote allows for a more seamless operation within major fulfillment centers and automated supermarkets. So instead of spending its temperature budget on having to build refrigerated and frozen warehouses, our totes can store perishable goods. Plus, solid-state cooling technology creates a more sustainable, friendly, ambient work environment and can even lead to easier maintenance and decreased energy costs.

////// WHITE PAPER : optoelectronics

PHONONIC

### How TEC Advancements Can Mitigate LiDAR Application Tradeoffs

High-performance, high-range LiDAR sensors absolutely require a cooled laser source. Without it, there are constant performance tradeoffs between range, which delivers speed in decision making, resolution, which is important for perception, and frame rate, which is the frequency at which a new image can be created.

Phononic TECs deliver the wavelength stability and control needed for lasers and detectors that function at the desirable 1550nm operating wavelength. They can also be used to enhance the performance of shorter wavelength sources. What's more, by using our TECs to actively cool a detector, you can reduce their signal-to-noise ratio (SNR) by increasing the operating temperature range and ensuring more light is detected per pixel.

Active element cooling is especially important for long-range perception. To ensure a LiDAR sensor points a target everywhere, high resolution is needed. At 1550nm Frequency Modulated Continuous Wave (FMCW), Phononic TECs can help manufacturers reach a range of 200m+ and accurately render images that onboard processors can easily evaluate. TECs allow designs to meet ASIL-Q100, ISO and 10k-reliability standards while achieving IATF 16949 certification.

PHONONIC TEC BENEFITS

- Enhanced LiDAR sensor performance
- Low power consumption
- High heat pumping density
- Extended sensor reliability

////// 3 : optoelectronics

PHONONIC

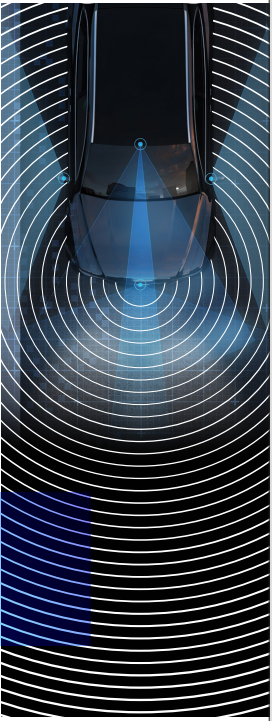
### NO REQUIREMENT LEFT BEHIND

#### How Phononic TECs enhance all critical requirements in LiDAR sensors

High-performance, high-range LiDAR sensors absolutely require a cooled laser source. Without it, there are constant performance tradeoffs between range, which delivers speed in decision making, resolution, which is important for perception, and frame rate, which is the frequency at which a new image can be created.

Phononic TECs deliver the wavelength stability and control needed for lasers and detectors that function at the desirable 1550nm operating wavelength. They can also be used to enhance the performance of shorter wavelength sources. What's more, by using our TECs to actively cool a detector, you can reduce their signal-to-noise ratio (SNR) by increasing the operating temperature range and ensuring more light is detected per pixel.

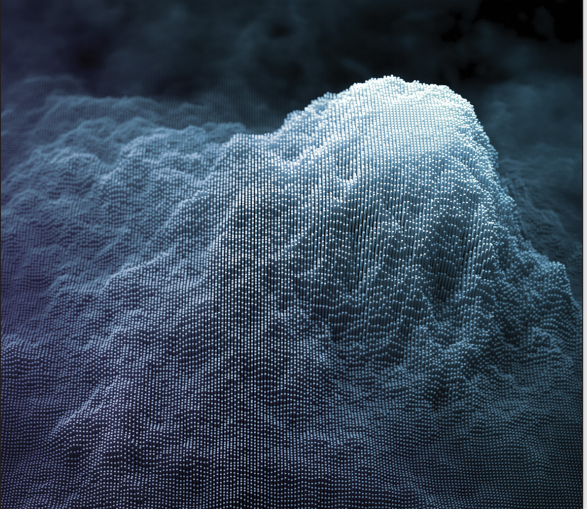
Active element cooling is especially important for long-range perception. To ensure a LiDAR sensor points a target everywhere, high resolution is needed. At 1550nm Frequency Modulated Continuous Wave (FMCW), Phononic TECs can help manufacturers reach a range of 200m+ and accurately render images that onboard processors can easily evaluate. TECs allow designs to meet ASIL-Q100, ISO and 10k-reliability standards while achieving IATF 16949 certification.



### See the future safely with reliable eye safety

One of the biggest issues with moving LiDAR toward high performance and high range is eye safety. Shorter wavelengths present a significant danger to the eyes. But when the wavelength is longer, an optically safe 1550nm laser source is also capable of operating at a much higher optical power. Phononic TECs make this possible, giving LiDAR a substantially longer range without exposing passengers and pedestrians to dangerous light.

1550nm high-powered and fiber lasers require cooling, not only do TECs do this inexpensively, they also allow onboard systems to control operating temperatures, which can vary widely in the different environments where autonomous vehicles operate. This feature is important for lower power lasers and detection schemes, such as those found in FMCW-based sensors, which require strict control of wavelength and temperature control.



# Infographic

# + Data sheet.



Optoelectronics

PHONONIC

Infographic

The Future of Optical Communications is Cooled

Our world has changed...

The pandemic has catalyzed a long-term acceleration of network bandwidth for internet service and content providers

We're seeing the impact

Increased network bandwidth is driving unprecedented demand for high-speed optical components. Increasingly, telecommunications providers are looking up to find solutions to meet the demand for high-speed optical components. This is driving new innovations and accelerating bandwidth expansion across the Internet.

It's time to go cooled

Increasing datacenter demands are requiring extremely high performance and increasing the need for cooled optics

Higher per-lane speed requires cooling

A recent generation jump for telecommunication providers that accelerated 100G and beyond 200G datacenter demands has led to increased demand. The units are able to handle high-speed optical components, but the high-speed optical components will require cooling to ensure the datacenter will become more efficient.

Signal Rate (Gbps)

Thermal Resistance

This is where we come in

Phononic's full line of Thermoelectric Coolers (TECs) are the ideal solution for cooling lasers used in high-speed optical components to ensure TOSA performance is met at high yield across the entire operating temperature range.

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

Cost-effective solutions for multi-channel laser products

Application-specific designs, ready for high-volume manufacturing

Design your next cooled component with us

See how

1 : cold chain fulfillment

PHONONIC

Technical Data Sheet

Intelligent Actively-Cooled Tote

A comprehensive solution for portable, active cooling and freezing, delivering unmatched cold chain integrity as well as strong ROI and labor savings across the entire Cold Chain Fulfillment Ecosystem.™

Benefits

- Delivers portable chilled and frozen capacity throughout the cold chain
- Increases the flexibility to scale on demand with operational needs
- Improves customer experience by ensuring order freshness
- Reduces fulfillment complexity and labor cost
- Eliminates the need for tri-temp storage capital expense, in both fixed and mobile implementations
- Low carbon footprint – eliminates dry ice and gel pack consumables costs

Features

- Lightweight and portable
- Refrigerator and freezer versions
- Ultra-low, non-toxic and nonflammable GWP refrigerants
- IoT ready
- Wireless contact charging
- Shock and flame resistant
- Minimal (<2°C) rise in exhaust air temperature
- Low power consumption

Applications

- Chilled/Frozen storage in fulfillment centers
- Order staging and storage for curbside or locker pickup
- Transport and delivery

Phononic, Inc. 801 Capital Drive, Durham, NC 27713 | phononic.com

Copyright © 2022 Phononic, Inc. All rights reserved.

Food & Beverage

PHONONIC

Revitalizing Category Profits for C-Stores

Phononic Merchandising Freezer and Refrigerator

- Place on C-Store checkout counter
- Drive impulse sales for single serve items
- Compact, sustainable and vibration free

Ice Cream Unit Sales

Average sustained sales increase up to 115%

Profit per sq.ft

Achieve up to \$1200/sq. ft

Create a profit / sq. ft leader for your C-Store

Source: Bottom Quartile, Top Quartile, Beverages. <https://www.capitalpress.com/company/news/2019/store-sales>. Ice Cream Average. <https://www.convenience.org/Media/NACS-Magazine/2016/February/2016-Features4>

Find the right solution with Phononic

Contact us to learn more

801 Capital Drive, Durham, NC 27713 • 844.478.4202

[phononic.com/contact](mailto:phononic.com/contact) / [www.phononic.com](https://www.phononic.com)

PHONONIC



# Experiential.

