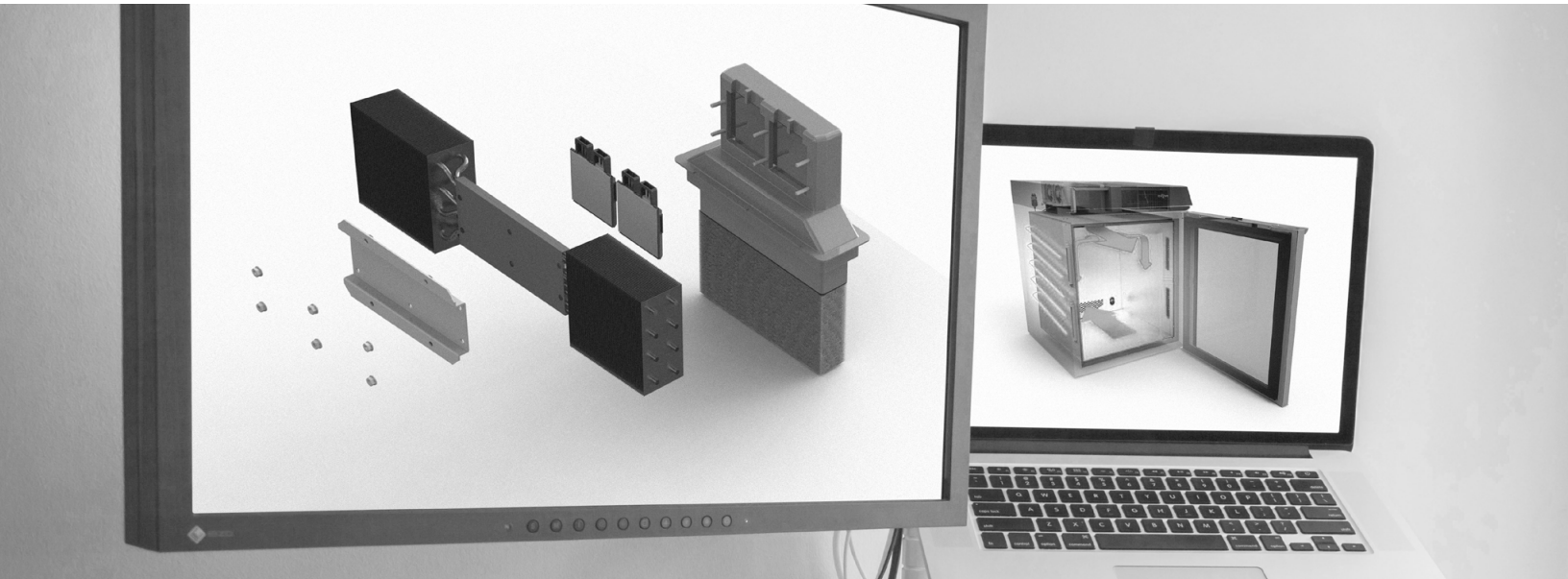


Brief

Design with Phononic for New Thermoelectric Possibilities

**Design with Phononic**

Together we can reinvent what's possible.

Thermal control is a challenging problem for today's product designer. Space constraints, mandates on refrigerant type, or energy usage restrictions mean that established technologies like compressors just don't fit in many applications or environments. Traditional thermoelectric chips offer a compact and environmentally friendly alternative, but they have limited performance and short lives. Through advanced engineering and materials science research, Phononic has broken the performance barriers allowing these devices to work in applications never before possible. Phononic's solid-state heat pumps [SHPs] keep popsicles frozen at the checkout station and keep vaccines perfectly cooled. And we can do

more than typical refrigerators and freezers – there's a world of applications that can benefit from designing with Phononic SHPs. Whether used in portable refrigeration and freezing for cold chain last mile deliveries, tucked into battery-powered wearables, or delivering climate control off the grid, Phononic technology enables groundbreaking product design.

What do you want to make cooler?

Our thermal design expertise brings your idea to life. Learn how we can design, optimize, reinvent, or co-create a new or existing product.

✚ Exploration

Research our line of thermal management components and thermal assemblies to understand their capabilities and potential applications. Our offer includes solid-state heat pumps that freeze down to -18°C , as well as sub-systems to enable mobile cooling in your customer container.

✚ Re-invention

If you are working on an existing product, we can optimize its form factor, thermal performance and reliability. In addition, designing with Phononic solid-state heat pumps can improve the efficiency and sustainability of your product.

✚ Co-creation

Have something brand new in mind? Our solid-state heat pumps enable applications the world has never seen before. Tell us what you're looking for and our world-class engineering team will work with you to evaluate, model and design the thermal system for a custom product, bringing your idea to life.

Three main things go into achieving excellent thermal performance, and our thermal engineering team has spent years optimizing each of these stages.

1. Pumping heat

Pumping heat is the process of pulling thermal energy from one side of the semiconductor chip to the other. Thermoelectric technology has been around for years, but our solid-state heat pumps have broken the barriers that have limited the performance of typical thermoelectric devices. That means they can be used instead of compressors and in more demanding applications that ever before. Our team can help you select the right one to integrate into your project to meet the needed performance specs.

2. Moving heat

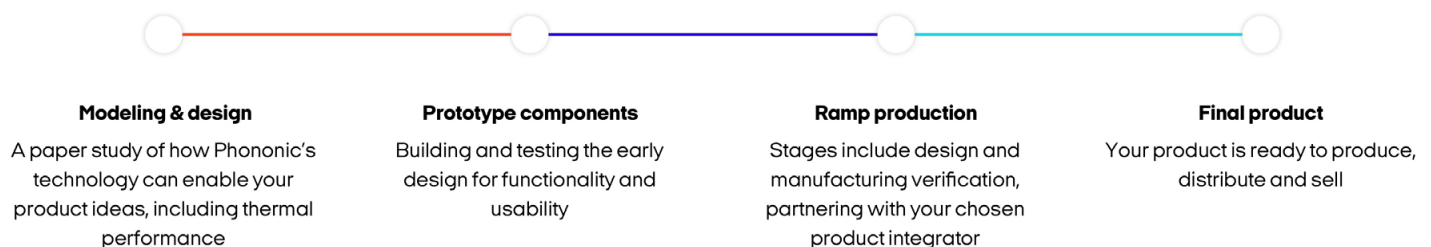
To maintain efficiency and performance, the heat that is driven by the solid-state heat pump has to move away from the semiconductor, and it has to stay away. Our compact solid-state heat pumps use a superconductive heatsink system to draw the heat out. What's more, Phononic has refined thermosiphon

systems to use only natural refrigerants, prevent reverse heat leak, and never require a compressor. Phononic's best practices can help guide your heat exchanger design to give your product increased capacity, heating and cooling in the same application, steady, near-ambient reject temps, and exceptional reliability.

3. Controlling heat

Maximum system efficiency gives maximum cooling, but most applications don't need to always run at full speed, all the time. Compressor-based systems deliver wide temperature swings, but Phononic's proprietary control systems enable precise temperature control, or custom temperature response profiles while maintaining system efficiencies not possible with standard thermoelectric devices. When a custom control algorithm is needed, it will be developed to meet product performance specs as part of the Design with Phononic process.

The design process.



Find the right solution with Phononic
Contact us to learn more