THERMAL CAPACITOR
FAQ

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What is Thermal Capacitor?

A thermal capacitor is a device designed to store thermal energy in a similar way to how an electrical capacitor stores electrical energy.

Thermal capacitor contains PCM. What is a PCM?

PCM stands for Phase Change Material and denotes any material that absorbs or releases heat in conjunction with a change in state (e.g. from solid to liquid or liquid to gas). The phase change may occur in response to a change in temperature or pressure of the PCM's surroundings. This gives the PCM the ability to absorb, store, and release heat which can be very useful in thermal control systems.

What is the lifespan of Thermal Capacitors? Do they need to be replaced after each use?

An ultimate lifetime limit has not been determined. KULR PCM heatsinks have survived over 10 years in space and many thousands of thermal cycles without failure. Our PCMs are designed to be expendable as the majority of our PCM products will perform for thousands of cycles without a measurable change in performance.

I have heard that PCM heatsinks tend to break after repeated use. Is this a problem with KULR PCM devices?

An improperly designed PCM device is vulnerable to breakage due to the volume change of the PCM on cycling and some PCM materials are susceptible to degradation over time. KULR has overcome these issues through our unique core material design and careful selection of PCMs.

Since PCMs used in Thermal Capacitors need to be recharged, how long does it take for this period? Can the recharge period be accelerated?

The recharge time depends on the temperature gradient driving the heat transfer as well as the thermal conductivity of the PCM device. The PCM conductivity is a design variable that can be tailored to the application.

Are the PCM materials used in Thermal Capacitors toxic or relative? Should this be "reactive"?

Our usual PCM materials are non-toxic and non-corrosive.

How much heat can KULR's Thermal Capacitors absorb relative to its weight and size?

The specific heat capacity of a PCM device depends greatly on the particular application due to variations in size, shape, and mounting requirements. PCM is often integrated into structural components. This reduces system mass and volume but burdens the PCM with structural performance requirements. A typical latent heat capacity for a PCM heatsink would be in the range of 150 Joules/gram or about 140 Joules/cm3.

What is the thinnest width a KULR Thermal Capacitor be manufactured at?

KULR has made heatsinks as thin as a few millimeters for some applications.

Can KULR Thermal Capacitors operate in cold temperatures when not in use?

Yes. Our typical materials of construction are suited to cryogenic temperatures.

What happens if KULR Thermal Capacitors are heated beyond phase change?

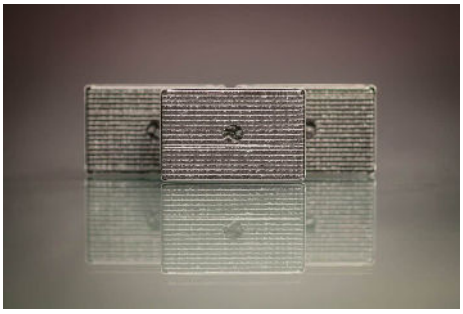
The PCM device will have a maximum temperature set by manufacturing parameters. This maximum is tailored to the needs of the application. Heating above the design maximum temperature would damage the unit. Raising the maximum temperature rating will marginally decrease the allowable fill fraction of PCM in the housing.

Do all KULR Thermal Capacitors use a solid to liquid phase change?

The majority of our PCMs utilize a sold/liquid phase change but some involve vaporization where best suited to the application.

Could a solid material change to liquid and then to vapor?

This would be an unusual use condition due to the wide temperature spread between melting and boiling in most materials. Melting heatsinks are designed for cyclic use while a vaporizing heatsink would be single use unless combined with a reservoir.



In what housing conditions do I need to store my Thermal Capacitor in?

Our typical PCM housings are hermetically sealed metal containers. Aluminum is the most common choice, though copper and stainless steel are also used. Using the provided containers is an efficient way to house your PCM.

Do we need to provide our own housing?

Our customers often choose to provide the housing for a variety of reasons, but KULR can also make the housing or have it fabricated by our manufacturing partners.

Does KULR install the PCMs and housing?

The typical PCM device is a self-contained unit. Installation is usually a simple mounting operation that is performed by the customer. KULR can assist when needed.

Is KULR's Thermal Capacitor pressure and vacuum resistant?

KULR's PCM products are tolerant to pressures ranging from hard vacuum to modest external pressures. KULR can design the enclosure to meet high temperature pressure requirements.

Can KULR's Thermal Capacitor work in reverse, storing heat and releasing it into a system?

Yes. This application is less common, but the PCM device works just as well to deliver heat as to absorb heat.

Does humidity affect KULR's Thermal Capacitor function?

Our PCM heatsinks are typically tolerant to non-condensing humidity. Tolerance to wet conditions may be included in the design.

Are there any existing or recommended systems for monitoring KULR's Thermal Capacitors?

Most PCM heatsinks are passive and can operate without controls, but temperature sensors may be installed to monitor the state of the PCM if the application dictates.

What type of system testing is provided by KULR?

Testing varies according to customer desires. Most commonly, KULR will run the PCM device through at least one thermal cycle to verify performance as an acceptance test. KULR will often perform additional testing (in-house or outsourced)

to include thermal cycling and environmental testing such as temperature range verification, shock, vibration, an acoustic. System level testing is usually performed by the customer/integrator.

Does KULR's Thermal Capacitors need to be directly mounted to the heat source or is convection feasible?

PCM heatsinks are most effective when directly coupled to the heat source or the heat is transferred through use of a working fluid or cold plate.