Thermal Management Technologies

-Innovative Products and Engineering-

- Features-

- *High specific energy storage*
- *Passive thermal control*
- *Conductive and integral structural container to efficiently spread heat into the PCM*
- *Ability to enhance PCM thermal conductivity to further enhance performance when necessary*
- *Packages configured to customer requirements*
- *Materials available to cover a wide-range of applications*
- *Configurable with a thermal strap for direct heat removal*

Thermal Storage Units

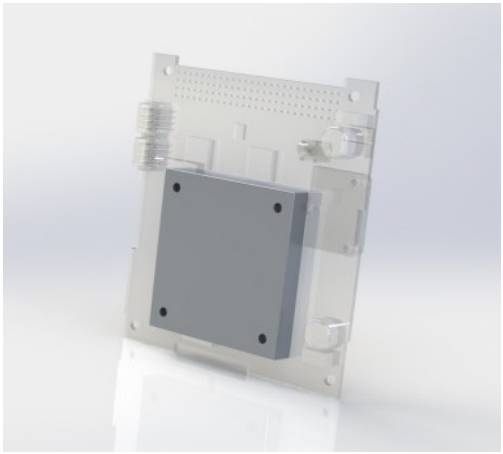
- Controlling Temperatures in Applications from the Laboratory to Space

Isothermal, compact, energy dense phase-change thermal storage units for thermal management

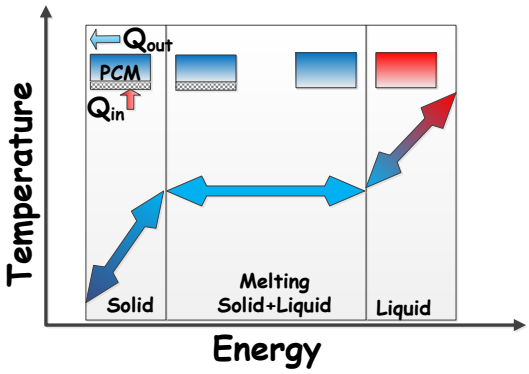
Thermal Storage Units

Systems often struggle with temperature transients due to high heat, short duty cycle electronics or environment changes. Our team has developed phase change material thermal storage units (TSU) to facilitate thermal control and energy management. Each device is designed to limit temperature gradients within the container and maximize stored energy within the package. Proper design allows the user to reduce temperature peaks in their application, hold stable temperatures, or store thermal energy for future use.

Custom units are developed for specific application conditions to support thermal management requirements.



Example 44 °C, 2100 J CubeSat



Applications:

Thermal storage units are used in a wide variety of applications to provide a passive means of storing thermal energy for component protection or storing energy for future use. Applications for thermal storage units include, but are not limited to:

Heat sinks
Electronics
Energy storage
Thermal protection
Stable temperature
Spacecraft
Temperature control
Thermal oscillation damping

Thermal Storage Unit Design:

TMT has developed methodology and tools to design and fabricate thermal storage units. Application and design of devices are tuned to customer requirements. Typical considerations include desired phase-change temperature, temperature stability, power in and time on (stored energy), interfaces, and method for removing heat.

Contact TMT to discuss your application

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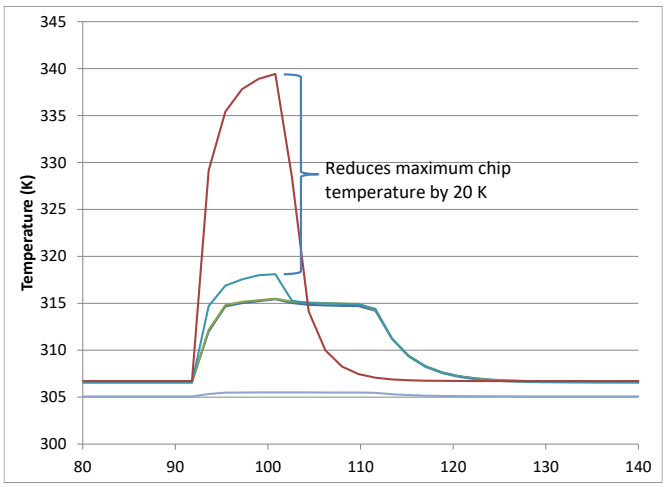
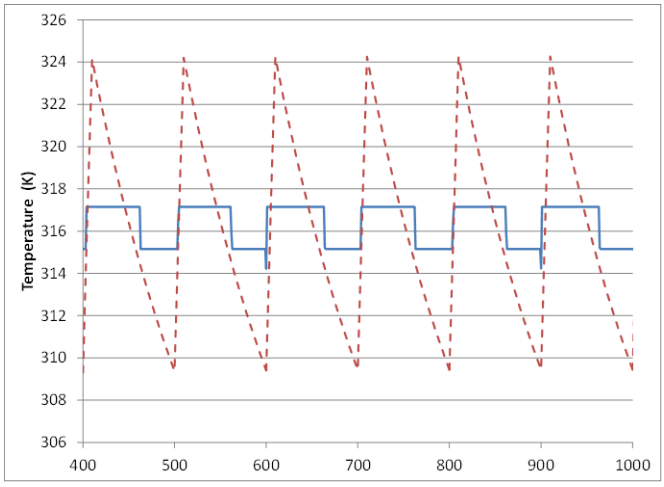
Application Examples

Temperature Control

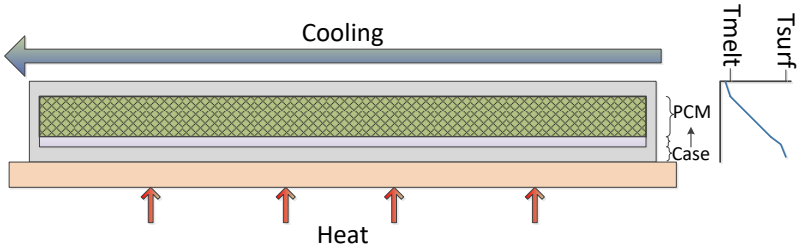


PCB simulation with and without PCM on board (10 min on-transient)

Damping of Temperature Oscillations



Pulsed heat absorber simulation with (——) and without (- - -) PCM



Typical design application illustrating case, temperature drift from melting point, heat input, and device cooling

Sample of available Phase Change Materials

Material	Phase Change Temperature (°C)	Liquid Density (gm/ml)	Heat of Fusion (J/gm)	Liquid Specific Heat (J/gm-°C)	Solid Specific Heat (J/gm-°C)
Dodecane	-12.	0.750	211.	2.15	1.69
Tridecane	-6	0.756	196.*	2.16	1.59
Tetradecane	5.5	0.771	228.	2.19	2.11
Hexadecane	16.7	0.774	237.	2.31	1.80
Octadecane	28.	0.774	244.	2.33	1.88
Eicosane	36.4	0.778	247.	2.46	1.92
Docosane	44.	0.763	249.*	2.15	1.69
Octacosane	61.6	0.779	253.	2.20	1.59

Note: Properties are for reference only. Values should be verified for actual design.
* Material has a solid phase transition combined with solid-liquid transition

Testing TMT can perform a wide variety of analysis and testing on TSUs and thermal systems as an added service

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