



# Thermal Runaway Shield (TRS)

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## PRODUCT DESCRIPTION

Thermal Runaway Shield (TRS) patented by KULR Technology is highly effective in preventing thermal runaway incidents in storage, transportation, and built-in operational lithium-ion battery pack designs. Its exceptional performance is attributed to the phase change material's ability to absorb a significant amount of energy in liquid form and transform into vapor. When integrated into a battery pack, TRS creates a system with inherent passive propagation resistance and thermal runaway mitigation. Our patented technology enables the TRS liquid to circulate passively throughout the system, providing targeted relief to areas experiencing thermal stress, thereby reducing the risk of thermal runaway.

## FEATURES AND BENEFITS

- Excellent solution for TR probable environments
- Can be designed into a new system, or incorporated into an existing one
- Passively helps with propagation resistance

## TYPICAL APPLICATIONS

Used in battery applications where a PPR is needed.

## TYPICAL PROPERTIES

Property	Value	Test Method
Construction	Encapsulated Coolant	N/A
Maximum Energy Rating	Up to 2.1KWh (Standard Size)	DOT Approved TR Test
Thickness <sup>1</sup>	0.005in	Micrometer
Tensile Strength (at break)	>14 lbs	ASTM D882
Tear Strength (375F; 26psi; 1 sec)	>1.7lbs	ASTM689
Seal Strength (375F; 26psi; 1 sec)	12 lbs/in	ASTM D882
Puncture Strength	>25 lbs	TMS 101-C, Method A
Rupture Temperature	112°C	N/A

<sup>1</sup> Per layer of encapsulation material



Property	Value	Benefits
<u>Density</u>		
Bulk	0.7 g/cc	Low mass
Areal	0.13 g/cm <sup>2</sup>	
Electrical Conductivity	Surface nonconductive	No leakage currents from the battery
<u>Thermal Conductivity (x-y)</u>		
Standard version	0.4 W/m <sup>2</sup> /K	Enhanced version provides heat-spreading function
Enhanced version	25 W/m <sup>2</sup> /K	
Phase Transition Temperature	100°C	Good margin for thermal runaway shielding
Specific Heat	3.0 J/g/°C (up to 100°C)	Increased system thermal inertia
Thermal Energy Dissipation	1700 J/g at 100°C	High thermal dissipation per mass
Hardness	NA, pliable	Amenable to various cell arrangements tolerant of battery pack dimensional variations
CTE	NA, pliable	Minimal mechanical stress coupling
Damage on Freezing	None	Tolerant of cold temperatures

Resistance to Propane Torch in Open Air	Value	Benefits
Standard version	19 sec. for back face to reach 100C No sustained combustion after heat source removed. Cooled to 40C in 1 min.	Good resistance Fire safety
Enhanced version	54 sec. for back face to reach 100C No sustained combustion after heat source removed; cooled to 60C in 1 min.	Excellent resistance Fire safety

Durability and Reliability  
Envelope material Mullen burst = 57 psi. Seal strength = 12 lb./in. Assembled TRS's currently being evaluated under normal conditions of use.



## AVAILABILITY

Please contact KULR Technology Group for additional information.

## DISCLAIMER

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