

GORE® Thermal Insulation
for Mobile Devices



TURN UP THE PERFORMANCE,
TURN DOWN THE HEAT.

GORE® Thermal Insulation:
Enhanced heat spreading
for an enhanced user experience.

Together, improving life

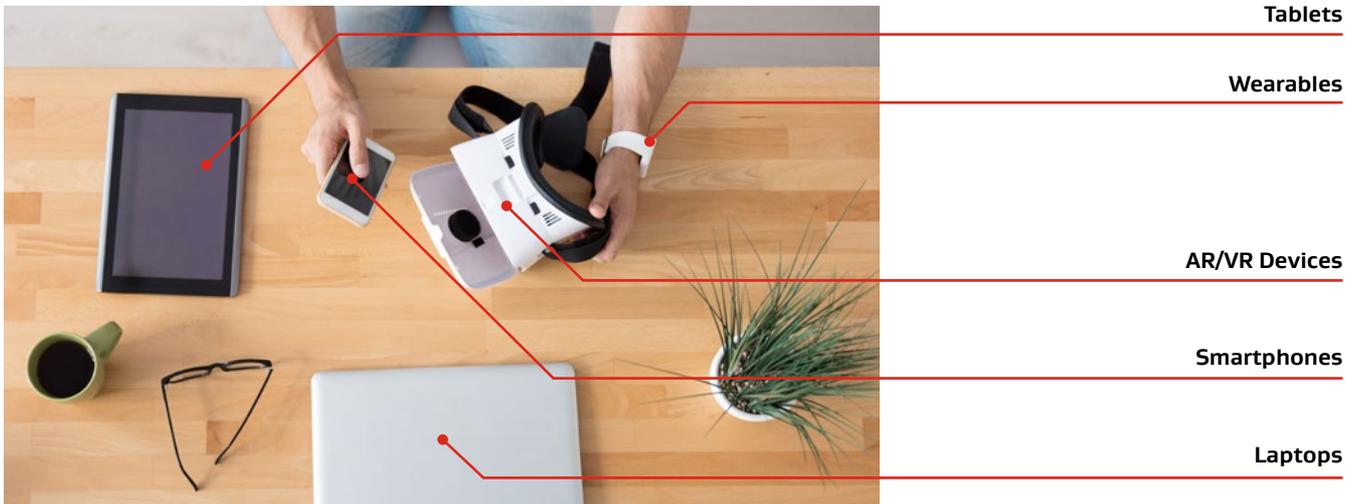


GORE® Thermal Insulation: Enhanced Thermal Spreading for Mobile Devices

Improve performance, reduce hot spots

The demand for greater performance, functionality, and smaller form factors is increasing, thermal challenges in mobile devices, particularly as many powered components are generating more heat in smaller spaces. More heat generation requires advanced thermal solutions to spread heat more evenly across the device surface and reduce hot spots.

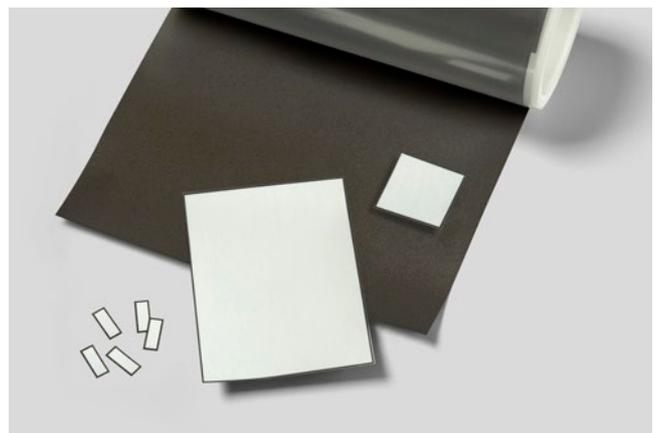
Application areas



Thermal engineers use graphite, heat pipes and vapor chambers to spread and dissipate heat across a larger area to improve device performance. These solutions have a high thermal spreading ratio defined by the thermal conductivity in-plane (k_{xy}) divided by thermal conductivity through-plane (k_z). Despite a high spreading ratio, heat spreaders have relatively high k_z compared to insulators. They are often designed using an air gap with low k_z at the system level to improve the spreading ratio. As heat spreading requirements increase, these thermal solutions can still fail to reduce hot spots due to an insufficient spreading ratio within the available space.

Now, with GORE® Thermal Insulation, you can improve the effectiveness of your heat spreading solutions. With a k_z significantly lower than air, enabled by premium aerogel technology, GORE® Thermal Insulation will improve the heat spreading ratio and outperform system level air gaps. It can be used independently or in conjunction with heat spreaders to create a higher performing thermal solution.

GORE® Thermal Insulation can be combined with graphite material



Including GORE® Thermal Insulation in thermal designs increases effectiveness of thermal spreading.

GORE® Thermal Insulation is a new thermal management solution that increases the designer's ability to direct heat by greater control of z-axis thermal conductivity. More control means superior spreading options that enable components to perform at higher levels for longer, accommodate shrinking form factors, and/or meet surface temperature requirements.

Basic Spreading

Graphite & Air

Enhanced Spreading

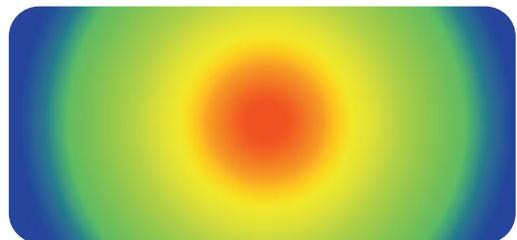
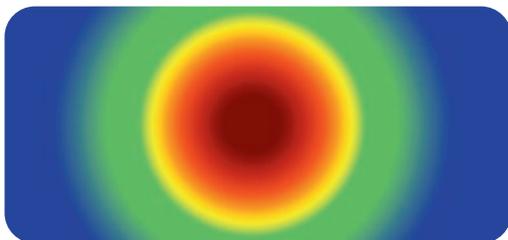
Graphite & GORE® Thermal Insulation (GTI)

Side View – Thermal Solution



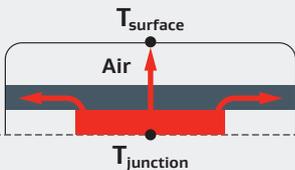
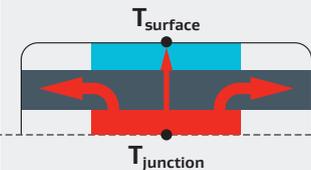
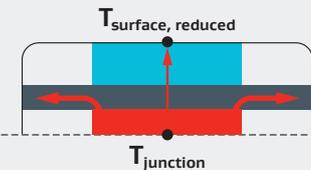
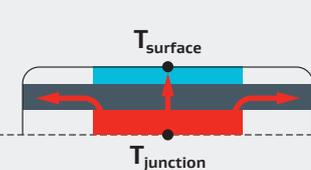
One of many possible configurations

Top View – Hotspot



We can help you beat the heat

Improve your existing solution without compromises

GORE® Thermal Insulation Addresses Common Challenges			
CURRENT STATE	PERFORMANCE NOT OPTIMIZED	HOTSPOT	DEVICE THICKNESS
<p>Without GORE® Thermal Insulation</p> <ul style="list-style-type: none"> Components are throttled to maintain junction and surface temperatures below required thresholds Thermal engineers battle surface hot spots when device functionality is added and/or devices are designed thinner Air gaps are difficult to maintain as devices are designed thinner 	<p>Increase Performance</p> <ul style="list-style-type: none"> With a k_z lower than air, thinner GORE® Thermal Insulation can replace the air gap, allowing for more graphite to be included Delay throttling of performance by moving heat away from the heat source and blocking heat from device surface Enable components to operate at higher power for longer time 	<p>Reduce Hotspot Temperatures</p> <ul style="list-style-type: none"> Reduce surface temperatures by 1–6 °C (depending upon system power and insulation thickness) 	<p>Thinner Product Design</p> <ul style="list-style-type: none"> Enable thinner designs while maintaining performance by replacing an air gap with thinner insulation 
Legend	 <p>GORE® Thermal Insulation Heat Spreader Heat Source</p>	 <p>Increased Heat Transfer Decreased Heat Transfer</p>	

Additional Benefits of using GORE® Thermal Insulation:

Electrically Insulative

- Provides a physical barrier between device components
- Does not create electrical short circuits or EM/RF interference

Ease of Integration

- Can be combined with graphite or heat pipes to optimize performance
- Easy to install with 7 thickness options and ability to customize shape

Development Support

- Gore engineers are available to support with design guidance, modeling and integration from early design cycle through commercialization

GORE® Thermal Insulation

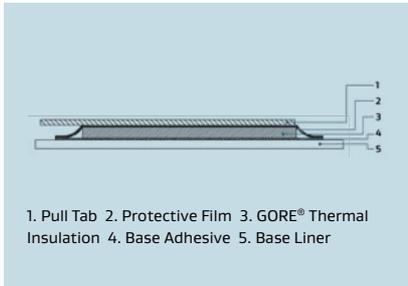


Figure 1: GORE® Thermal Insulation cross section

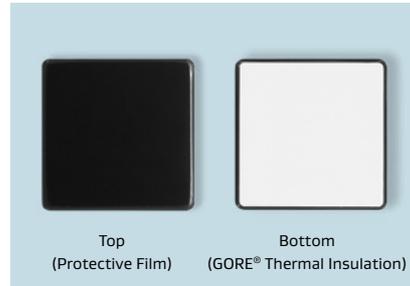


Figure 2: GORE® Thermal Insulation surface images

GORE® Thermal Insulation reduces surface “hot spots” and enables enhanced device performance for a better user experience.

TECHNOLOGY EXPERTISE

- High loading of aerogel to obtain low conductivity
- Consistent distribution of aerogel enables consistent conductivity
- Consistent thickness across a range of thicknesses from 100–530 µm

Material data*

CHARACTERISTIC	0.10 mm	0.12 mm	0.17 mm	0.23 mm	0.28 mm	0.38 mm	0.53 mm
Insulation thickness available ^a	0.10 mm	0.12 mm	0.17 mm	0.23 mm	0.28 mm	0.38 mm	0.53 mm
Adhesive encapsulation width (minimum) ^b	1 mm	1 mm	1 mm	1 mm	1 mm	1 mm	1.5 mm
Thermal conductivity (k) ^c	0.021 W/m•K			0.020 W/m•K			
Compression @ 100 kPa (14.5 psi)	13%			8%			
Specific heat capacity ^d	1.8 J/g °C						
Bulk density	0.37 g/cc						
Operating temperature ^e	–40 °C to 100 °C						
Protective cover film	Black PET						
Adhesive type	Acrylic						
RoHS ^f	Meets threshold requirements						
Max part size	100 mm × 200 mm						

^a Nominal thickness based on reported values of thickness of each component of the stack-up.

^b Nominal minimum width.

^c Nominal conductivity value based on a modified version of ASTM C518.

^d Nominal heat capacity measured according to ASTM E2716 Method B at 75 °C.

^e Alternate adhesives required to exceed 100 °C.

^f To the best of our knowledge, the product listed above does not have any restricted substances above the maximum concentration values listed in RoHS Directive 2011/65/EU and meets the substance restrictions of Article 4 of RoHS Recast including Commission Delegated Directive 2015/863.

*All values based on nominal characteristic and do not represent the specification and tolerance.



By Your Side from Design to Manufacture

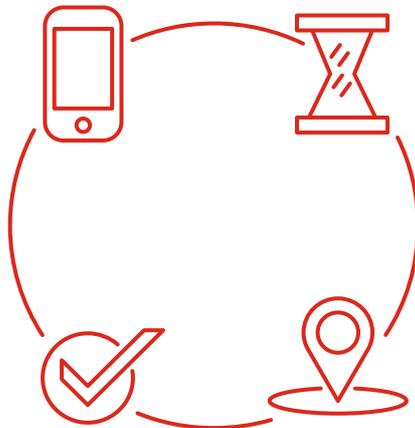
Leading OEMs select Gore because our products and services help develop differentiated and innovative products with low development and supply chain risk in a fast-paced, highly competitive market.

GLOBAL MOBILE SUPPLIER

Decades of proven track record as a preferred venting partner of global top OEMs in wide range of applications – from smartphone, smartwatch, earphone, Bluetooth speaker, camera, and tablet to wireless radio.

RELIABLE PERFORMANCE

To ensure products are “fit for use”, every Gore product must adhere to the highest standards of quality, performance and reliability. Through a comprehensive understanding of end-use applications and requirements, our products do what we say they will do.



FAST RESPONSE DESIGNS

The mobile electronics industry develops and releases new products quickly. Gore supports this need for quickness with designs and prototypes to ensure engineering teams can meet their project timelines.

SUPPLY SECURITY

Working with the world’s largest and most challenging mobile electronic supply chains, we’ve become experts at supplying high volume, fast ramp products with the timing and quality required for success.

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W. L. Gore & Associates is a global materials science company dedicated to transforming industries and improving lives. Since 1958, Gore has solved complex technical challenges in demanding environments — from outer space to the world’s highest peaks to the inner workings of the human body. With more than 13,000 Associates and a strong, team-oriented culture, Gore generates annual revenues of \$4.8 billion.

Contact Us

For additional assistance, please contact a Gore representative.

INTERNATIONAL CONTACTS

Australia	+61 2 9473 6800	Mexico	+52 81 8288 1281	W. L. Gore & Associates, Inc. 401 Airport Road · Elkton, MD 21921 · USA · Phone: +1 410 506 7812 (USA) · Toll free: +1 800 523 4673 · Fax: +1 410 506 8749 · Email: thermal@wlgore.com gore.com/thermal
Benelux	+49 89 4612 2211	Scandinavia	+46 31 706 7800	
China	+86 21 5172 8299	Singapore	+65 6733 2882	
France	+33 1 5695 6565	South America	+55 11 5502 7800	
Germany	+49 89 4612 2211	Spain	+34 93 480 6900	
India	+91 22 6768 7000	Taiwan	+886 2 2173 7799	
Italy	+39 045 6209 240	United Kingdom	+44 1506 460123	
Japan	+81 3 6746 2570	USA	+1 410 506 7812	
Korea	+82 2 393 3411			

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