GORE® Thermal Insulation
for 5G mmWave antennas

TURN UP THE PERFORMANCE, TURN DOWN THE HEAT.

GORE® Thermal Insulation
for 5G mmWave antennas:
Enhanced heat spreading
for an enhanced user experience.

Together, improving life

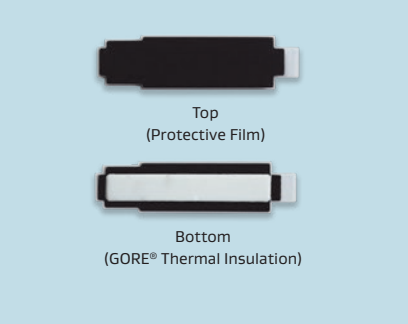
Reduce 5G Antenna Hot Spots

A Thermal Insulator that's Better than Air

Today's sophisticated 5G mmWave antenna modules incorporate power amplifiers that generate heat close to the edge of the device. It is difficult to reduce these hotspots as traditional thermal management techniques such as graphite spreaders cannot be used due to their high RF interference. With many components in such a small space, there is limited space available to utilize large air gaps to prevent surface hot spots. The large heat load combined with limited thermal management options leads to most 5G mmWave signals being throttled within a minute of use.

GORE® Thermal Insulation for 5G mmWave antennas is designed to fit on top of 5G mmWave antenna modules to prevent surface hot spots with minimal RF interference. They are available in 5 different thicknesses which can be provided in custom shapes or designed to fit the most commonly used Qualcomm® modules*. These parts feature insulation that blocks heat better than air and has extremely low RF signal transmission loss. GORE® Thermal Insulation for 5G mmWave antennas helps maintain 5G signal duration by reducing surface temperatures for a superior user experience.

Figure 1: GORE® Thermal Insulation for 5G mmWave antennas



Why use GORE® Thermal Insulation to Maximize 5G mmWave Antenna Performance?

HOTSPOT REDUCTION

- Thermal conductivity at 0.020 W/mK reduces heat flow by 23% compared to an air gap at 25°C (0.026 W/mK)
- Heat can be redirected to the back-side of the module where graphite can be used to spread heat without interrupting the 5G signal

MAINTAIN INTEGRITY OF SIGNAL

- Longer duration of 5G mmWave signal before needing to throttle
- Minimal signal loss across mmWave frequencies ensured by low dielectric constant

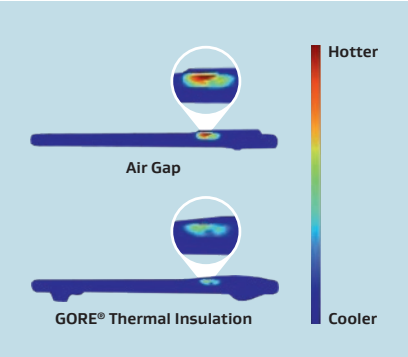
FEWER DROPPED SIGNALS

- Electrically insulative barrier prevents the antenna module from touching the case when there are small air gaps

EASY TO FIT AND INSTALL

- Available in 6 different thicknesses which can be provided in custom shapes or designed to fit the most commonly used Qualcomm® modules
- Replace a thicker air gap with a thinner insulation to save space

Figure 2: GORE® Thermal Insulation significantly reduces smartphone 5G mmWave antenna hot spots



Customer testing shows a surface temperature reduction of 1 – 4°C is achievable.

Closer Look at GORE® Thermal Insulation for 5G mmWave Antennas

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

**Qualcomm is a trademark or registered trademark of Qualcomm Incorporated.*

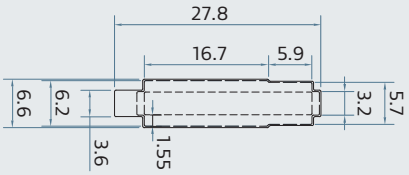
MATERIAL DATA*

CHARACTERISTIC						
Dielectric constant[a]	1.46					
Loss tangent[a]	0.017					
Typical signal loss with 350 µm part	< 0.3 dB					
Insulation thickness available[b]	0.10 mm	0.12 mm	0.23 mm	0.28 mm	0.38 mm	0.53 mm
Adhesive encapsulation width (minimum)[c]	1 mm	1 mm	1 mm	1 mm	1 mm	1 mm
Thermal conductivity (k)[d]	0.021 W/m•K		0.020 W/m•K			
Compression @ 100 kPa (14.5 psi)	13%		8%			
Specific heat capacity[e]	1.8 J/g °C					
Bulk density	0.37 g/cc					
Operating temperature[f]	-40 °C to 100 °C					
Protective cover film	Black PET					
Adhesive type	Acrylic					
RoHS[g]	Meets threshold requirements					
Max part size	100 mm × 200 mm					

[a] Nominal values representative of frequency range from 6 GHz to 70 GHz.
[b] Nominal thickness based on reported values of thickness of each component of the stack-up.
[c] Nominal minimum width.
[d] Nominal conductivity value based on a modified version of ASTM C518.
[e] Nominal heat capacity measured according to ASTM E2716 Method B at 75 °C.
[f] Alternate adhesives required to exceed 100 °C.
[g] 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.*

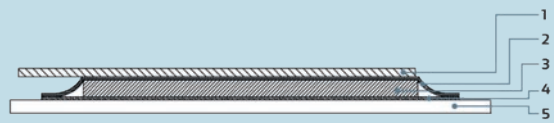
Reference design for 5G mmWave antenna part**

Nominal thickness[a]	0.28 mm
Adhesive encapsulation width (minimum)[b]	1 mm
Dimensions	

[a] Nominal thickness based on reported values of thickness of each component of the stack-up.
[b] Nominal minimum width.

***Could fit a Qualcomm QTM545 module, product of Qualcomm Technologies Inc. and/or its subsidaries.*

Figure 3: GORE® Thermal Insulation cross section



1. Pull Tab 2. Protective Film 3. GORE® Thermal Insulation 4. Base Adhesive 5. Base Liner

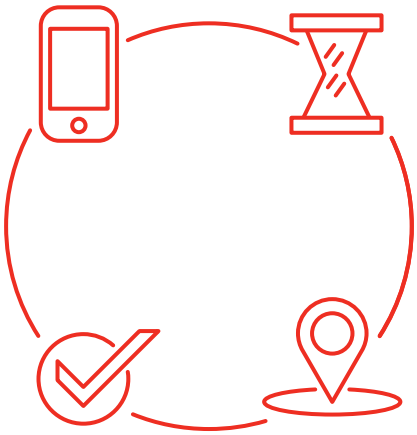
With ultra-low thermal conductivity and dielectric constant, GORE® Thermal Insulation prevents throttling of 5G data rates by reducing surface temperatures and minimizing 5G signal interference.

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.



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.

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.

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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Contact Us

For additional assistance, please contact a Gore representative.

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PEV-132-DSH-US-R3-JULY22