MATERION

Whitepaper

# *High-Power RF Packages and Microwave Circuits Powering Advanced Transportation*

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Materion has developed an innovative new range of RF packages, GenPack™ to meet your engineering demands for low thermal resistance. Our products provide very low RF loss for RF and microwave microelectronics packaging. Materion's team of experts integrate flanges of advanced materials to achieve the highest-power density requirements for EV and autonomous driving, flying taxis, aerospace, semiconductors, military and other advanced electronic systems.

**INNOVATION PROFILE:** Next Gen RF Packaging

The world's largest R&D supplier of advanced high-powered radio frequency packaging.

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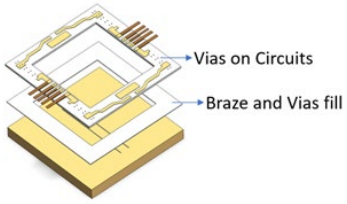



## TECHNOLOGICAL CHALLENGE

The idea of automated, connected, environmentally friendly, boundless travel is a surging global megatrend. Organizations like Tesla, NASA and others are continually rolling out new projects to redefine "Advanced Mobility." What does it all mean for the future of high-power RF packages and microwave circuits that are the backbone functionality of this unique technology?

These varying modes of digital transportation need non-disrupted telecommunication signals to function properly. EV cars, autonomous vehicles, miliary, and flying taxis all use 5G or IoT connectivity. The power signals coming from the dies used in these vehicles must not fail for any reason. However, retained heat in the dies will cause a slowdown in communication signals, and potentially cause vehicle failure with catastrophic consequences. These lifesaving devices must be protected from environmental fluctuations in temperature, pressure, wind, dust, or debris.

## THE GenPack® SOLUTION

A fail-safe package providing the utmost hermeticity is crucial to operations. This is where Materion's next-gen RF packaging solutions come in. Using the right electronic packaging is essential to protecting intricate circuitry and components inside various electric vehicles, aerospace equipment and satellites, high-end telecommunications base stations and towers, among other high-tech innovations. Engineers today who are trying to get into GaN facing challenges to handle high volume production. The market has been overly reliant on traditional silicon dies, which are becoming outdated and do not meet high power needs as efficiently.

Materion engineers have discovered an innovative method for mass production of next-generation RF packaging that can handle strict variances in technology for advanced mobility needs.

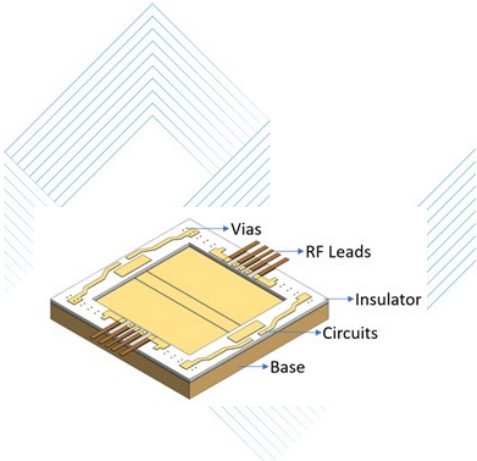
GaN and related dies that are used on RF package will benefit from Materion's GenPack next-generation RF packaging solutions.

These dies will also need a solid thermal managed material. Additionally, the hermetic insulators can handle circuits to offer a complete package solution to end-use customers.

## BENEFITS

Materion's GenPack RF packaging meets a set of requirements that include electrical performance, hermeticity, cost, size, and proper shielding. These more-robust metal and mixed material packages are better suited for semiconductors or power transistors expected to deliver higher output-power levels. GenPack RF packages also provide compatibility with other components used in system and support testing. Additional benefits include:

- Advanced thermal management for safe packaging of add-on electric components
- Lightweight, high-strength materials that are resilient and reliable in the harshest environmental conditions – even in space
- In-house design, prototyping, testing and custom production capabilities




Next Gen RF package

Materion is also developing an RF Signal Test tool and equipment to provide a development advantage over other suppliers, deepening its market penetration to become the single supplier of choice. Materion has filed a patent for this groundbreaking testing method.

## THE MATERION DIFFERENCE

GenPack is designed to surpass traditional RF packages in many ways. It replaces lower-temperature operating components such as FR4 or glass-reinforced epoxy laminate material, screen-printed circuit patterns or processes, wider RF gates and drains (leads) with higher resistance.

GenPack RF Packages adapt to much higher thermal conductive substrates with lighter weight. Material varieties of thermal spreaders such as copper, copper-molybdenum, copper laminates, CMC, silver diamond composites, copper diamond composites can be designed into the Next-Gen RF Packages heat spreader or bases.

Different materials using Alumina Oxide, Aluminum Nitride and others could be incorporated to form an insulative material with multiple hundreds of vias, separating the base from feedthroughs. Organic-free electrical circuit patterns could also be laid on these insulative materials, which enhances lower-resistance components.

Along with enhanced thermal spreaders and insulative materials, GenPack RF packages can also adapt to the narrowest lead frames.

| GenPack Component | Material |
|---|---|
| Flange | CuW, Cu, Silver Diamond, Copper diamonds, CuMo |
| Insulators | Alumina Oxide, Aluminum Nitride, Silicon Nitride |
| Braze | AgCu, AuGe, AuSn |
| Cover | LCP with epoxy |

## IN CONCLUSION

Materion is the partner of choice to enable safer, more customized and energy-efficient transportation – wherever the destination. Through our expertise, deep understanding of our customers' challenges and passion for problem-solving, we design groundbreaking solutions that shape the future, helping achieve what was once impossible in RF packaging technology.

For more information, please contact me at ramesh.k@materion.com and connect with me on LinkedIn.

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