



News Release

Amkor Empowers RF Front-End Cellular Innovations with Advanced SiP

Highlights

- Amkor is advancing the evolution of 5G RF module design
- Amkor DSMBGA enables integration of more components
- The advanced packaging market for 5G RF Front End Module (FEM) projected to reach US \$2.3B by 2026
- Amkor continues to innovate in advanced SiP technologies

TEMPE, Ariz., August 10th, 2021 — Amkor Technology, Inc. (Nasdaq: AMKR), a leading provider of outsourced semiconductor assembly and test (OSAT) services, is advancing the evolution of 5G RF module design, characterization and packaging technology.

With the introduction of 5G, cellular frequency bands have increased considerably, requiring innovative solutions for the packaging of RF front-end modules for smartphones and other 5G-enabled devices. Amkor's double-sided, molded ball grid array (DSMBGA) is a prime example of such solutions. Expanding on years of experience in delivering world-class, advanced System in Package (SiP) technology, Amkor was the first OSAT to offer DSMBGA and continues to pave the way for further breakthroughs.

"With our DSMBGA platform, we've established a preferred advanced packaging solution for this domain," said Giel Rutten, Amkor President and Chief Executive Officer. "Applying leading-edge design rules for 3D component placement and double-sided molding—together with conformal and compartmental shielding and in-line RF testing—delivers best-in-class integration levels in a small form factor in a high yield manufacturing process."

The advanced packaging market for 5G RF FEM is projected to reach US \$2.3 billion by 2026, representing a 30% compound annual growth rate (CAGR) according to Yole Développement (Yole), SA, an industry consulting firm¹.

"There has been a change in frequencies with the arrival of 5G, adding frequency bands above 3 GHz in FR1, and mmWave in FR2," according to Antoine Bonnabel, Technology & Market Analyst, RF Devices and Technology at Yole. "This and the system-level trend have had a profound impact on both the number of components, and the technology platforms on which they are built."²

¹ Source : [5G Packaging Trends for Smartphones 2021 report](#), Yole Développement, 2021

² Source : [Cellular RF Front-End Technologies for Mobile Handset 2021 report](#), Yole Développement, 2021



News Release

This growing number of new frequencies, combined with the variety of multiplexing methods, significantly increases the complexity of the RF front end. Integration using SiP allows customers to design, tune and test RF sub-systems, allowing for a reduction in design iterations and an accelerated time-to-market.

Amkor's double-sided packaging technology has vastly increased the level of integration for RF front-end modules used in smartphones and other mobile devices. Common RF front-end modules consist of an LNA (low noise amplifier), power amp, an RF switch, RF filters and duplexers.

Amkor's advanced SiP design rules and innovative DSMBGA technology enable the integration of additional components—such as antenna tuners and passive components—where device motherboard real estate is at a premium. This creates the most advanced and compact RF front-end module on the market today.

With additional power amplification and filtering circuitry, DSMBGA improves signal integrity and reduces losses, resulting in improved Rx/Tx amplification—which translates into reduced system power requirements.

Amkor also applies state-of-the-art conformal and compartmental shielding for EMI isolation and attenuation and implements in-line RF testing to deliver the most robust and cost-effective assembly technology in the industry.

In addition to its formidable SiP capacity and DSMBGA technology, Amkor has developed an extensive toolset to maximize performance and to address the sophisticated packaging formats required to productize 5G applications. Some of these tools include Antenna in Package (AiP), substrate-embedded die, wafer-level SiP and a variety of RF shielding options.

This toolset, combined with the company's expertise in RF module design, characterization and bench test, uniquely positions Amkor to serve customers who want to outsource the challenges (including substantial investment) associated with combining multiple ICs with advanced package assembly and test technologies for 5G networks.

As demand for packages that support 5G increases, Amkor supports this growth with the successful implementation of DSMBGA technology. Amkor has been in high-volume markets with DSMBGA for more than a year and is a leader in RF package design, integration and test. Amkor continues to innovate in DSMBGA and other advanced SiP technologies to capture opportunities in the RF market. To learn more about Amkor's capabilities in SiP and DSMBGA, visit <https://amkor.com/dsmbga>

About Amkor Technology, Inc.

Amkor Technology, Inc. is one of the world's largest providers of outsourced semiconductor packaging and test services. Founded in 1968, Amkor pioneered the outsourcing of IC packaging and test and is now a strategic manufacturing partner for the world's leading semiconductor companies, foundries and



News Release

electronics OEMs. Amkor's operational base includes production facilities, product development centers and sales and support offices located in key electronics manufacturing regions in Asia, Europe and the USA. For more information, www.amkor.com.

###

Contacts

Investor Relations

Jennifer Jue

Senior Director, Investor Relations and Finance

480-786-7594

Media Relations

Debi Polo

Director, Marketing Communications

480-786-7653

Social Media: @amkortechology