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# StratEdge White Paper, "Eutectic Die Attach Optimizes High Power GaN Devices," is Now Available

***Details how to reduce chip-to-package junction temperature to improve GaN chip efficiency and reliability***

**Santee, Calif — August 6, 2020** — StratEdge Corporation, leader in the design, production, and assembly of high-frequency and high-power semiconductor packages for microwave, millimeter-wave, and high-speed digital devices, announces that the white paper, "Eutectic Die Attach Optimizes High Power GaN Devices," is now available on the StratEdge website at http://stratedge.link/gan-devices-article. The article explains how the package in which the gallium nitride (GaN) device is attached, and the method used to attach the device to the package, can optimize the device's efficiency, performance, and reliability.

FEATURE ARTICLE

Eutectic Die Attach Optimizes High Power GaN Devices

by Casey Krawiec, Vice President of Global Sales, StratEdge Corporation

Gallium nitride (GaN) is widely used in applications for high-power devices operating at high frequencies. This is because of its ability to operate at high currents and high voltages. While much attention is given to GaN chips, what is often overlooked is the package in which the GaN device is attached and the way the chip is attached to the package. It's well known that GaN chip efficiency and reliability can be improved by creating a package environment that reduces chip-to-package junction temperatures.

GaN, especially GaN on silicon carbide (SiC), handles higher temperatures, so it allows designers to make circuits smaller. The GaN chip can produce much greater power density, but it's the job of the package to remove the heat that is generated. The goal is to increase the power output that a chip can achieve, thereby maximizing its performance. It is important to provide a more efficient way to dissipate the heat, so the chip isn't as likely to overheat and fail during normal operation.

One way to increase power is to run a chip at a cooler temperature. Devices operating at cooler temperatures last longer, have higher reliability, and perform more efficiently. The ability to perform at a higher output conserves energy, as the same amount of electricity generates greater power output and provides a cushion when operated at a normal rate. The challenge is finding a suitable package for GaN because of its higher power density and the need to dissipate the heat while maintaining maximum device performance.

A Two-pronged Approach

StratEdge began developing GaN packaging solutions in the early 2000s by creating packages specifically tailored for GaN devices and by perfecting the packaging assembly method and means of attachment. To optimize GaN device performance, a two-pronged approach was implemented:

- Create specialized packages that maximize heat removal
- Optimize the die-attach assembly technique to maximize thermal dissipation

To accomplish both, a thermally enhanced package with an extremely flat die attach surface was created and a revolutionary gold-tin (AuSn) eutectic die attach process using mechanical agitation and heat was employed. It was important to utilize commercially available materials and processes to meet package and assembly cost targets.

Package Technology for High-frequency Devices

There are many different styles of microelectronic packages. The materials, techniques, and processes used to create the package are influential in determining package performance. There are advantages and disadvantages for every packaging technology. If the device is a high-power device operating at high frequencies, however, there are fewer package choices. Common materials used in packages include hardened ceramic substrates, molded ceramic packages, and base materials with high thermal conductivity.

For high-frequency applications, ceramic substrates are usually post-fired ceramic metalized with thick film pastes. These packages are created by laser machining hardened ceramic. The accuracy of laser-machined post-fired ceramic is much tighter than what can be achieved with multilayer co-fired ceramic. The tighter tolerance on the package cavity enables the use of relatively short wire bonds in assembly, which is better for the electrical performance of the high-frequency chip. Many of the package designs have gold conductors on the ceramic. The thick-film conductors applied to the ceramic are subjected to high temperature firing. Gold germanium (AuGe) or copper silver (CuAg) braze materials are used for

StratEdge Corporation, Con't on pg 36



"The success of the package's performance is dependent on the base material used, the quality of the package construction, and the attachment process. By creating a package environment that reduces chip-to-package junction temperatures, GaN chip efficiency and reliability can be improved," explained Casey Krawiec, vice president of global sales at StratEdge. "StratEdge

research shows that thermal dissipation can be further maximized by optimizing the die-attach assembly process."

The paper "Eutectic Die Attach Optimizes High Power GaN Devices," by Casey Krawiec, details how StratEdge's post-fired ceramic package with a copper-molybdenum-copper (CMC) base, and its proprietary eutectic die attach method, results in a near void-free attachment that reportedly reduces junction temperatures by 20 degrees Celsius as compared to standard assembly methods using ceramic packages of alternate construction.

The paper is available in the July 2020 issue of *Microwave Product Digest*, and on the StratEdge website at http://stratedge.link/gan-devices-article.

For more information, contact StratEdge at info@stratedge.com, or visit our website at www.stratedge.com.

**About StratEdge**

StratEdge Corporation, founded in 1992, designs, manufactures, and provides assembly services for a complete line of high-frequency and high-power semiconductor packages operating from DC to 63+ GHz. StratEdge offers post-fired ceramic, low-cost molded ceramic, and ceramic QFN packages, and specializes in packages for extremely demanding gallium arsenide (GaAs) and gallium nitride (GaN) devices. Markets served include telecom for 5G, VSAT, broadband wireless, satellite, military, test and measurement, automotive, clean energy, and down-hole. All packages are lead-free and most meet RoHS and WEEE standards. StratEdge is ITAR registered and an ISO 9001:2015 certified facility located in Santee, California, near San Diego.

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