High efficiency rates predicted for GaN devices by 2022

Aafreen Shaikh of Market Research Future highlights growth in the GaN device sector, detailing opportunities in the market.

Gallium nitride (GaN) has become synonymous with its use in the production of semiconductor power devices and their growing implementation in transistors. They have also been increasingly incorporated into RF components and light-emitting diodes (LEDs) over the past few decades. The demand for GaN semiconductor devices is expected to gather momentum, with revenue rising at a compound annual growth rate (CAGR) of 8% to $25bn in 2023, according to a report published by Market Research Future.
The incorporation of zinc and aluminum in the production of gallium nitride provides certain qualities such as the high-power-density abilities of GaN, together with the better thermal conductivity and low RF losses of silicon carbide (SiC). As gallium nitride is suitable for use in high-power devices that can operate at high temperature, global demand is seen to be on an upward growth curve.

Application range for GaN devices

The price restriction for certain electronics applications has increased the reliance on GaN semiconductor devices. Although GaN is relatively new in semiconductor manufacturing, it is gaining popularity in applications that entail transmitting signals over long distances or at high power, such as satellite communications, radar and base transceiver stations [BTS], to name a few. The increasing use of GaN devices is also inspiring application in the renewable energy sector. Renewable energy sources are increasingly being harnessed due to the dearth of scalable solutions that can meet the growing energy needs globally.

The implementation of GaN power transistors in the renewable energy industry greatly helps in enabling the design of cheaper, less complex and more efficient energy storage systems that would not have been possible with the use of silicon as a material base. As GaN components are a feasible option to resolve some of the problems existing in renewable energy systems, demand for GaN devices is expected to rise. Moreover, the steady increase in the usage of vertical GaN structures is expected to broaden the applications of GaN devices and will also offer a robust basis for scaling production in the coming years.

Production gains from GaN devices

The cost incurred in manufacturing GaN devices is inherently lower than the cost of manufacturing a silicon-based MOSFET device, since GaN devices can be made using standard silicon manufacturing techniques in the same fabrication plants that are presently producing traditional silicon-based devices, and the resulting devices have a better degree of functionality.

The transition in demand from silicon to GaN for semiconductor production is primarily due to new advanced all-GaN integrated circuits that are essential to the integration of passive devices. GaN's ability to conduct electrons more than 1000 times more efficiently than silicon, while being able to be mass produced at a lower cost than silicon, is a critical factor that is buoying the growth in GaN devices.

These qualities have increasingly contributed to their application in the military and space industries. The use of RF cell-phone base stations and military radars is expected to grow in the coming years due to the heightened possibility of conflict in different regions of the world. Even though GaN electronics is a quickly evolving area with active research globally, the market is growing at a relatively slow pace.

Conversely, the market for GaN semiconductor devices is expected to weather specific challenges on its growth path. The challenges identified with the use of GaN are that the material is difficult to fabricate and purify, and is a couple of years late in terms of its cost-effective production and the consequent reduction in the costs associated with its use in a range of devices. The popularity of GaN devices is lagging in terms of the quality that can be achieved from it. Nevertheless, the high breakdown field, which allows GaN devices to function at much higher voltages than other semiconductor devices, is a crucial factor that will lead to appealing innovations in the coming years, concludes the report. ■

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