

GaN MMIC Technology

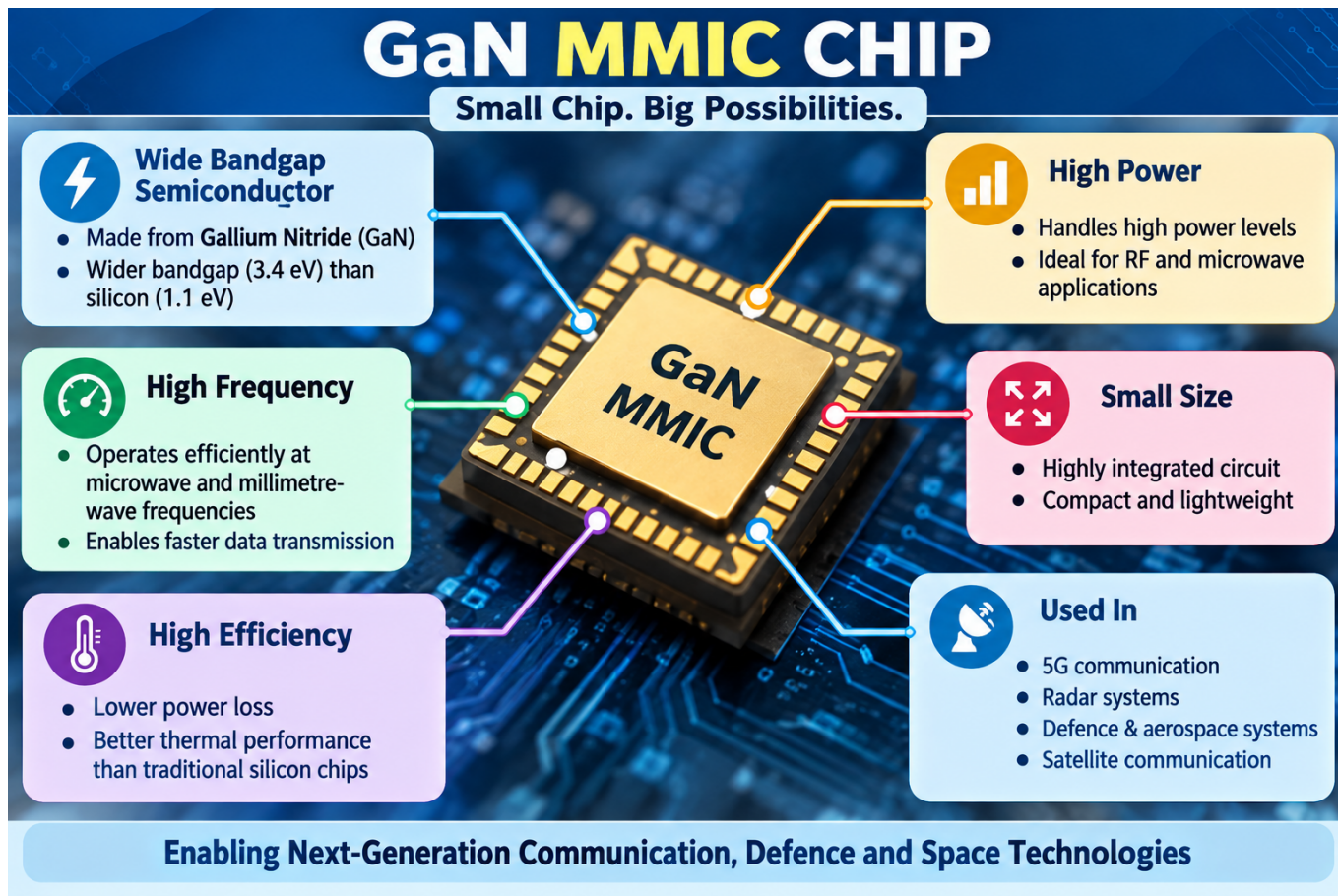
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Why in News?

The Defence Research and Development Organisation (DRDO) has successfully demonstrated and implemented indigenous Gallium Nitride (GaN) Monolithic Microwave Integrated Circuit (MMIC) technology.

GaN MMIC Technology

- **Gallium Nitride (GaN)** - A wide-bandgap semiconductor material superior to traditional Silicon (Si) and Gallium Arsenide (GaAs) for high-frequency and high-power applications.
- **MMIC (Monolithic Microwave Integrated Circuit)**- An integrated circuit device operating at microwave frequencies (300 MHz to 300 GHz), combining active functions (amplifiers, switches) onto a single semiconductor substrate.
- **Performance Benchmark**- A single indigenous GaN chip measuring just 3.5 mm×3 mm delivers up to **30 Watts of power**.
- It operates at speeds up to **300 times faster** than conventional silicon.
- **India** joins an elite group of nations, including the US, Russia, France, Germany, South Korea, and China possessing native GaN MMIC design and fabrication technology.



Key Technical Highlights

- **Developed primarily by** - DRDO's Solid State Physics Laboratory (SSPL) in New Delhi, with pilot production capabilities established at the Gallium Arsenide Enabling Technology Centre (GAETEC) in Hyderabad.
- **Frequency Coverage**
 - **S-Band**- Designed, fabricated, and demonstrated S-band GaN High Electron-Mobility Transistor (HEMT) power bars, Power Amplifiers, Low Noise Amplifiers (LNA), and switch MMICs.
 - **X-Band** - Successfully demonstrated and implemented GaN MMIC technology for applications extending up to the **X-band (8 to 12 GHz)**.
- **Substrate Technology** - Built using indigenous processes for growing and manufacturing **4-inch diameter Silicon Carbide (SiC)** substrates (GaN-on-SiC), providing exceptional thermal dissipation.

Strategic Applications

- **Next-Generation Radars** - Transmit/Receive (T/R) modules powered by GaN MMICs generate significantly higher RF output power, expanding detection ranges, enhancing target tracking, and shrinking physical array sizes in Active Electronically Scanned Array (AESA) radars.
- **Electronic Warfare (EW)** - Enhances airborne and naval EW jammers capable of generating high-power directional jamming signals across wide bandwidths to blind hostile radar networks.
- **Space & Guided Missiles** - Provides high-power density, thermal tolerance, and radiation hardness for compact radar seekers in precision-guided missiles and satellite communication (SatCom) payloads.

- **Strategic Autonomy** - Eliminates critical reliance on foreign imports and bypasses Western denial regimes/export-control restrictions (such as ITAR) governing high-end semiconductor components.

Reference

[Economic Times | GaN technology](#)

