

GaN reliability for power and RF devices- what are the key issues and how to resolve?

Brief summary: GaN has recently emerged as an excellent material for the fabrication of both RF and power transistors. RF transistors are already in widespread use in satellite, radar and communication fields. Power transistors are now rapidly finding application in the next-generation power conversion systems with 600-650V transistors already commercially available.

The present success of GaN is a testament to the good intrinsic reliability of the technology. This has been achieved by an understanding of key failure modes and mechanisms. A market transformation is now underway, and the next step is one of high-volume reliability. The aim of this workshop is to understand which are the still-open issues: is charge trapping still impacting operation? What are the main reliability concerns? What are the acceleration laws? How are the different operating regimes (off-state, on-state, semi-on) impacting reliability? What are the pathways for industrial-level reliability? Which testing procedures must be used for reliability estimation/assessment? Are there any learnings from the (longstanding) RF GaN experience that can be applied to power GaN?

This workshop will address these questions, by stimulating the discussion on the key issues that presently limit the reliability and the performance of GaN-based HEMTs. It will be a natural lead-in for the subsequent workshop on WBG reliability synergies and standardization.

Moderators



Sandeep Bahl is a distinguished member of technical staff in the High Voltage Power Business Unit of Texas Instruments. He has extensive experience with semiconductor technology development, and has worked on both silicon and compound semiconductor technologies. His present focus is to bring reliable GaN products to market, and to develop the methodology to know that they will be reliable under actual-use conditions. Sandeep helped kickoff the standardization effort of the GaN industry and is presently participating on the JC70 reliability committee as a task-group co-chair. He has served as chair of the

Power and Compound Semiconductor subcommittee of the International Electron Devices meeting (IEDM) and of his local San Francisco/Santa Clara valley IEEE chapter. He is presently serving as chair of the IRPS Wide Bandgap Committee. Sandeep graduated with a PhD in Electrical Engineering from the Massachusetts Institute of Technology.



Matteo Meneghini received his PhD in Electronic and Telecommunication Engineering (University of Padova), working on the optimization of GaN-based LED and laser structures.

He is now assistant professor at the Department of Information Engineering at the University of Padova. His main interest is the characterization, reliability and simulation of compound semiconductor devices (LEDs, Laser diodes, HEMTs).

Within these activities, he has published more than 200 journal and conference proceedings papers.

During his activity, he has cooperated and/or co-published with a number of semiconductor companies and research centers including:

- OSRAM-OptoSemiconductor (Germany)
- Panasonic Corporation (Japan)
- Universal Display Corporation (USA).
- NXP (The Netherlands)
- ON Semiconductors (Belgium/USA)
- Sensor Electronic Technologies (USA)
- IMEC (Belgium)
- Infineon (Austria)
- Fraunhofer IAF (Germany)
- University of Cambridge (UK)
- University of California at Santa Barbara (USA)
- University of Wien (Austria)

Meneghini is a Senior Member of IEEE and a member of the SPIE. He – together with his colleagues - won several best paper awards at international conferences (including ESREF 2009, IWN 2012, ESREF 2012, ESSDERC 2013). He is/has been involved in the technical program committee of several conferences including IEEE-IEDM, IEEE-IRPS, ESSDERC, ESREF.