RF/mmW/5G Workshop

RF/mmW devices; GaN, SiGe or Si? Which will offer the best solution for 5G? (Power/Reliability/Cost)

Moderators:

- Fernando Guarin (GlobalFoundries), Si-SiGe
- Farid Medjdoub (IEMN CNRS), GaN

Background

Given the power, cost structure and integration required for mmW 5G deployment, what gaps remain for Silicon and SiGe to be viable solutions? The market for cellphones, Base Stations and IoT solutions is predicted to explode in the near future. Many companies are in the process of designing their mmW solutions for 5G. In this session we will review the most likely technologies that will dominate the sizable 5G market. Most key players in the industry realize that there is a sizable opportunity for Si and SiGe technology solutions as we transition from the few antennas required in 4G to the multi element antenna array solutions, hence the power requirements have been reduced to a range that is well suited for Silicon and Silicon Germanium technology offerings. Will this be sufficient to displace the proven and well-entrenched RF mmW solutions offered by III-V?

Which solution will win in the market from the perspective of?

- Power
- Cost / Integration
- Reliability

Discussion Topics

- Operating lifetime requirements
    - EOL, should it be 10 years, 3 years, X years?
    - Duty cycle 100%?
- Power requirements for 5G (Linearity/Efficiency) (Handsets and Basestations)
- Translating reliability behavior from device to circuit level – what matters to the end users?
    - Reliability simulator requirements
- Appropriate methods for testing and characterizing RF reliability?
    - Circuit benchmarks, PA, LNA, and Switches
    - Scaled DC measurements
    - Setting up device level tests to accurately reflect circuit level benchmarks
        - Associated impact for various classes of circuits/IP blocks.
- Thermal
    - TCAD modeling
    - Self-heating
    - simulation vs. practical usage

Dr. Fernando Guarín is a Distinguished Member of Technical Staff at Global Foundries in East Fishkill New York where he is currently leading the reliability team involved in the qualification of GlobalFoundries 5G mmW technology offerings, particularly 45RFSOI.

From 1980 until 1988 he worked in the Military and Aerospace Operations division of National Semiconductor Corporation. In 1988 he joined IBM's microelectronics division where he worked in the reliability physics and modeling of Advanced Bipolar, CMOS and Silicon Germanium BiCMOS technologies. He retired from the IBM Semiconductor Research Development Center SRDC in 2016 after 27 years with the reliability group where he was a Senior Member of Technical Staff. He earned his BSEE from the "Pontificia Universidad Javeriana", in Bogotá, Colombia, the M.S.E.E. degree from the University of Arizona, and the Ph.D. in Electrical Engineering from Columbia University, NY. He has been actively working in semiconductor reliability for over 38 years. He has authored 15 patents, one trade secret, five book chapters and over 2000 citation for his publications.

Dr. Guarín is an IEEE Fellow, Distinguished Lecturer for the IEEE Electron Device Society EDS, where he has served in many capacities including; member of the IEEE's EDS Board of governors, chair of the EDS Education Committee, Secretary for EDS. He was the EDS President 2018-2019 and is currently the Jr. Past president of EDS.

Dr. Farid Medjdoub is a CNRS senior scientist and leads a team focused on wide bandgap material and devices at IEMN in France since 2014. He received his Ph.D. in Electrical engineering from the University of Lille in 2004. Then, he moved to the University of Ulm in Germany as a research associate before joining IMEC as a senior scientist in 2008. Multiple state-of-the-art results have been realized in the frame of his work. Among others, world record thermal stability up to 1000°C for a field effect transistor, best combination of cut-off frequency / breakdown voltage or highest lateral GaN-on-silicon breakdown voltage using a local substrate removal have been achieved.

His research interests are the design, fabrication, characterization, and simulation of innovative wide bandgap devices. He is author and co-author of more than 170 papers in this field. He holds several patents deriving from his research. He serves as an Editor for Superlattices and Microstructures journal. He is also a reviewer for various journals and is a TPC member in several conferences. He is part of the H2020 review panel for wide bandgap specific calls. Starting from 2019, he is leading the Nitride power activities within the French national network called GaNexT.