



GLOBALFOUNDRIES RF Business Unit

November 2015



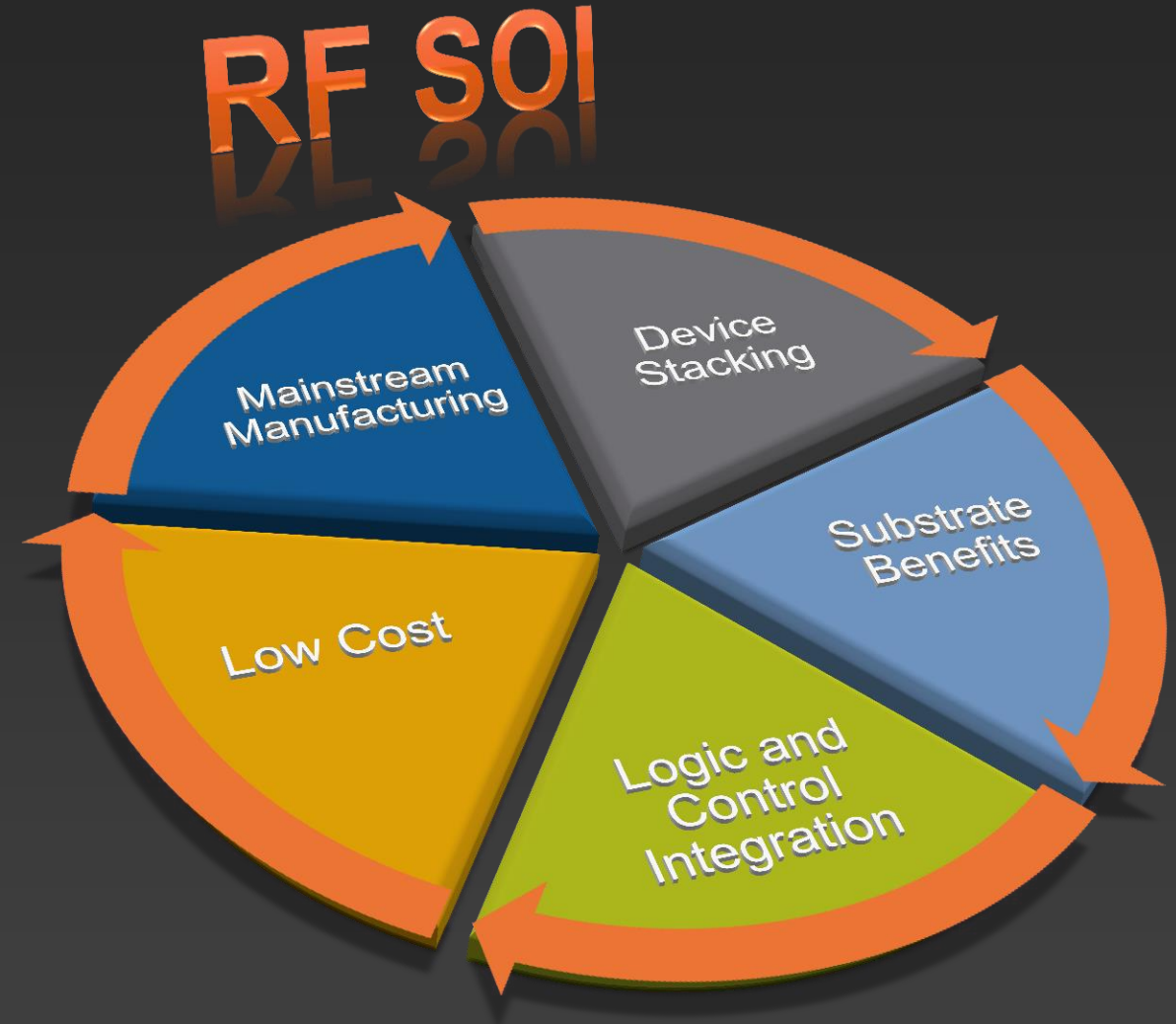
RF Business Unit outlook is strong

- Standards evolution & consumer desires creating greater demand for devices that can support data rich content, and the GLOBALFOUNDRIES portfolio is uniquely positioned to support
- These requirements are driving greater RF system complexity and performance challenges in all segments
- RF SOI has emerged as THE technology for RF FEM integration, providing performance and cost advantage to our customers
 - >17B GLOBALFOUNDRIES SOI chips in the market
- GF SiGe technologies addressing a wide range of applications in high performance RF – from Power amplifiers to Automotive Radar – billions of devices in the market
- GLOBALFOUNDRIES is investing in technology & capacity to support the growth in these markets and technologies



Why RF SOI?

- Device stacking:
 - Overcomes silicon Johnson Limit
- Substrate benefits for RF:
 - Reduced parasitics \Rightarrow higher Q and lower loss
 - Increased isolation/linearity
- Logic and control integration:
 - MIPI interface now standard
- Low cost:
 - Better economics than III-V
- Mainstream silicon manufacturing:
 - Readily available capacity



Source: FDSOI and RFSOI Forum - February 27, 2015

Why Now?

Performance

- Continuous device improvement (Ron*Coff vs. BVds)
- Design community experience increasing



Substrate Advancement

- Improved harmonics \Rightarrow better linearity
- Multiple sources
- 200mm and 300mm



Manufacturing Maturity / Cost

- Leverages mainstream manufacturing (200mm and 300mm)
- Improved economics over III-V technologies



Integration Potential

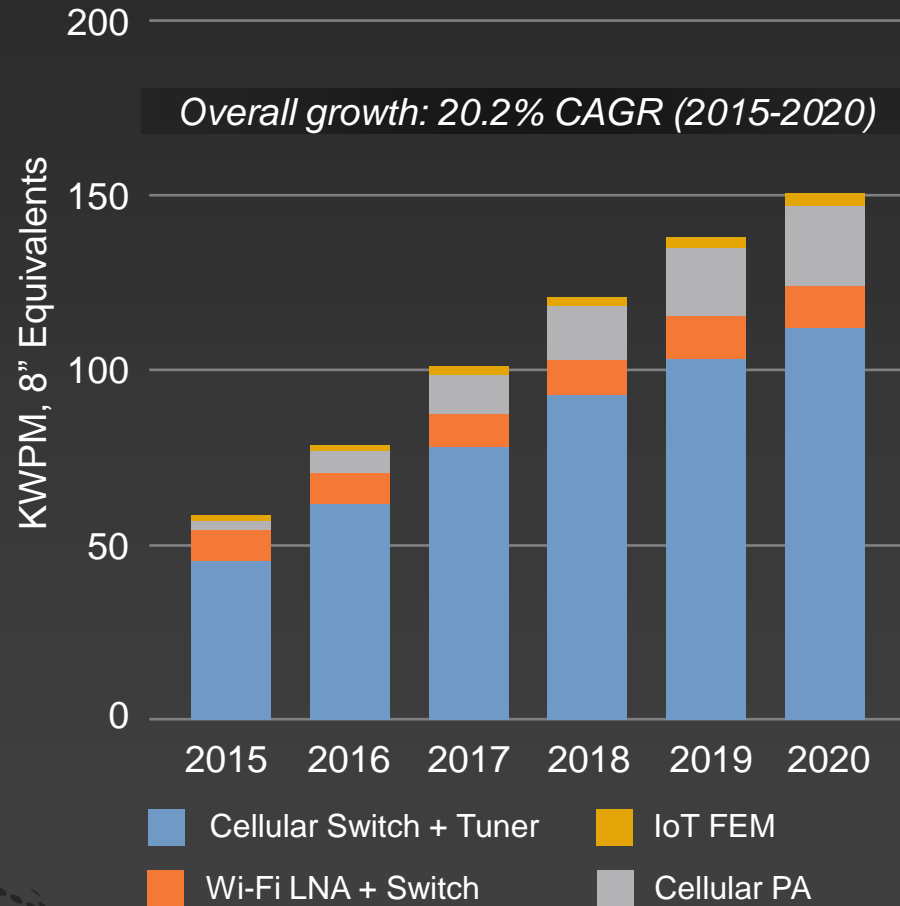
- Growing digital content
- RF functional innovation (PA, tuners, filters)
- Migration to 300mm



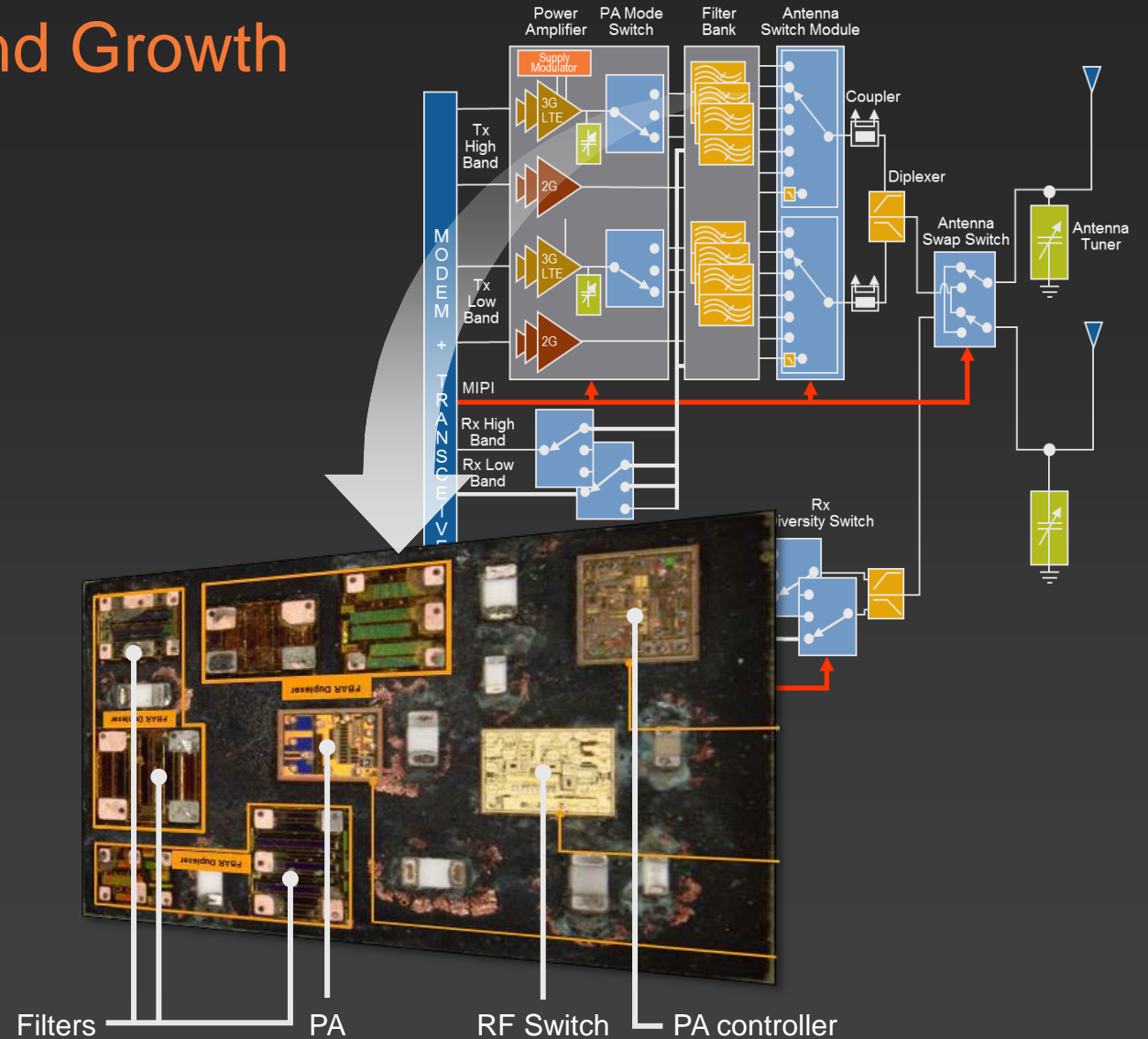
Technology Platform for RF FEM Innovation

RF SOI Application Adoption and Growth

RF SOI Market SAM by Application

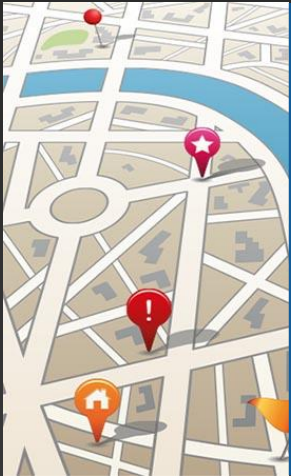


Source: Internal GLOBALFOUNDRIES marketing data



Source: TechInsights Teardown Report.; SOITEC White Paper, Feb 2013

GLOBALFOUNDRIES RF SOI Value Proposition



Roadmap

Continuous device/feature improvement aligned with needs of the market

Technology Leadership

Best in class PDK, models and design enablement for ease of design / TTM



Manufacturing Scale

Multiple manufacturing locations; 200mm and 300mm

Technical Support

Worldwide technical support team



GLOBALFOUNDRIES technology and manufacturing roadmap



Looking Ahead to 5G... GLOBALFOUNDRIES 45nm RF SOI

5G is the next evolution of the mobile network:

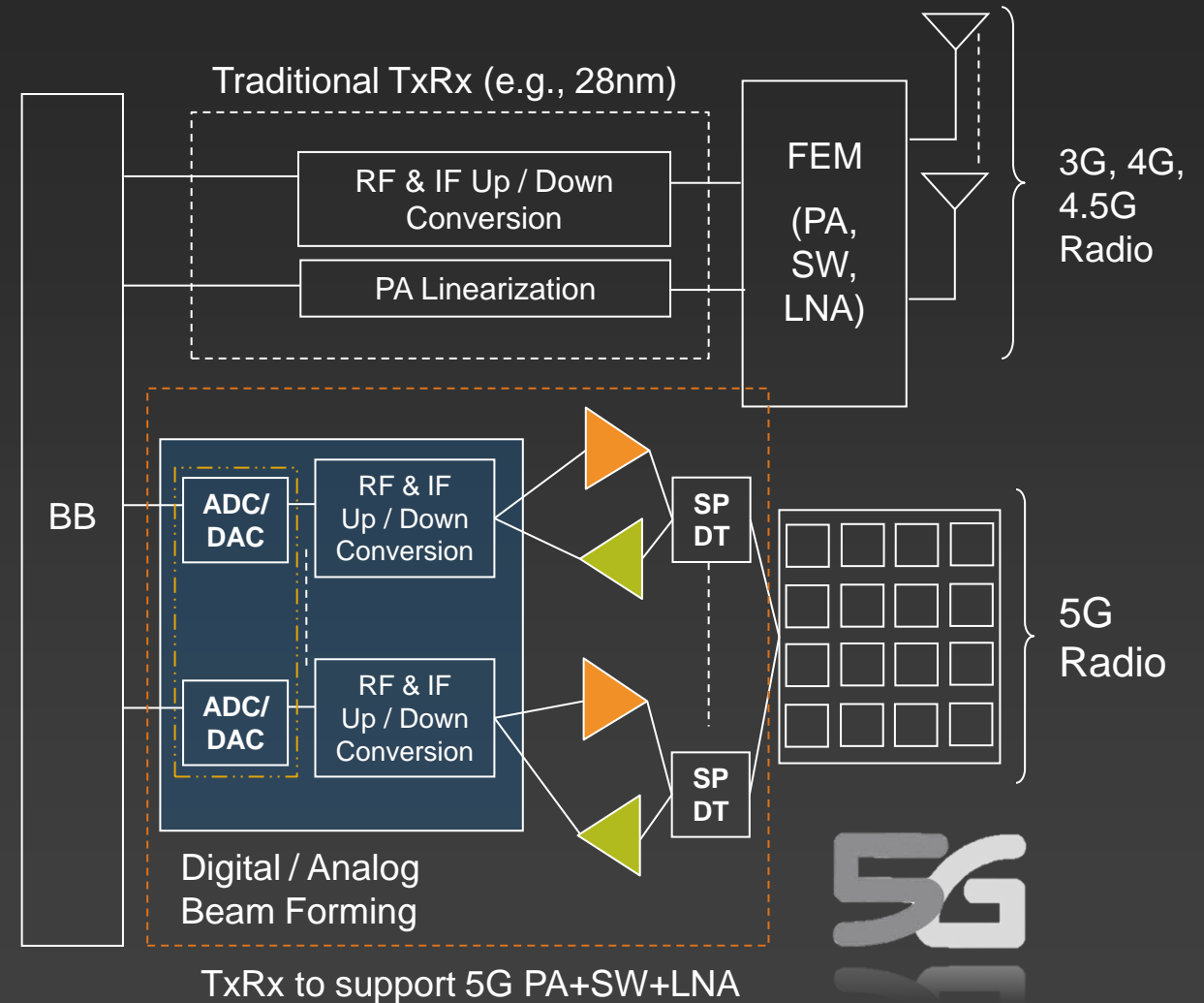
- Coexistence with 4G/LTE systems
- Millimeter wave for short range & high bandwidth
- Tight coupling between transceiver & FEM/phased array to support beam steering

GLOBALFOUNDRIES 45nm RF SOI well suited to support transceiver/FEM integration for 5G:

- Intrinsic device f_T is in excess of 485GHz!!

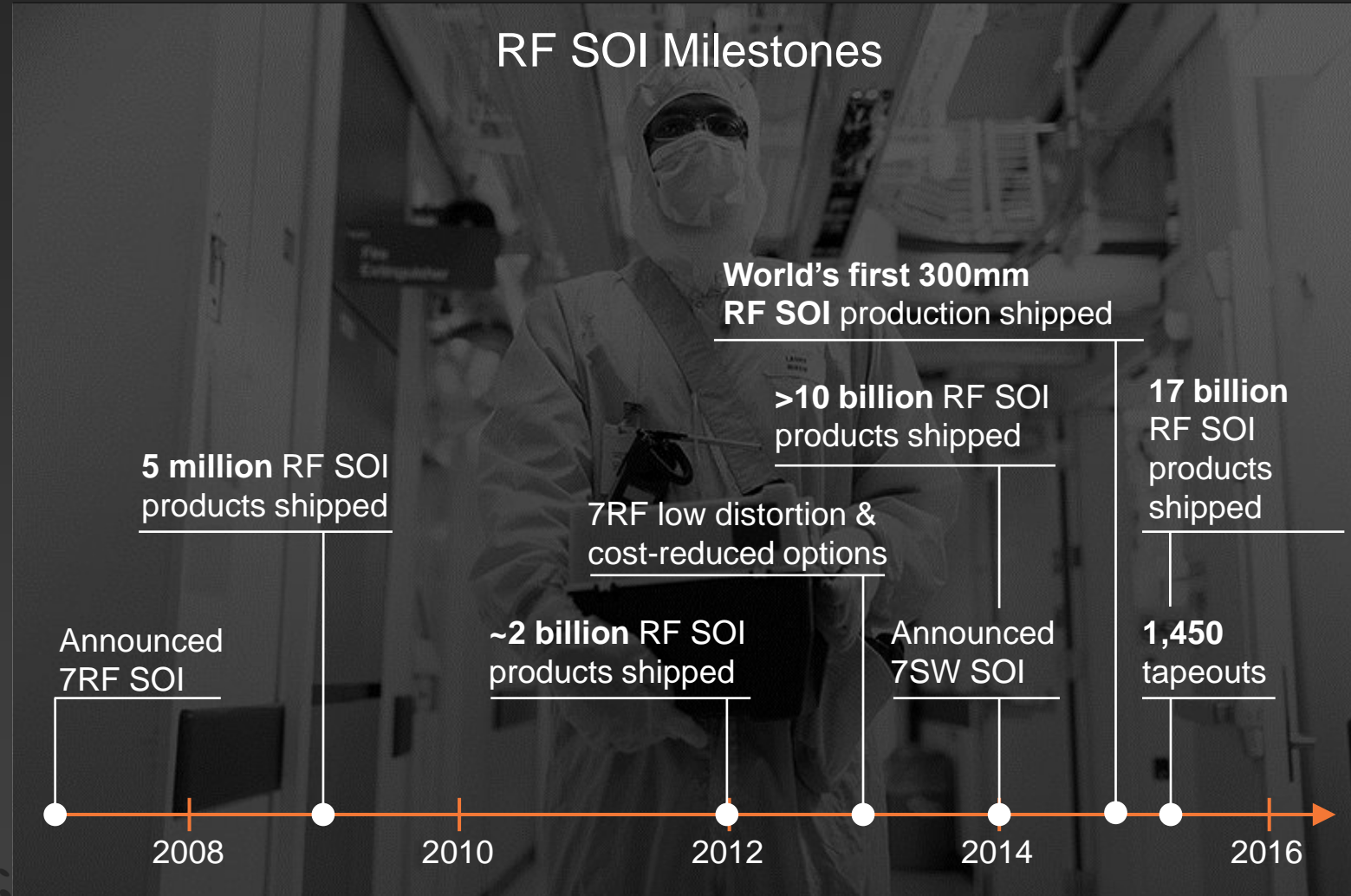
45nm RF SOI has been extensively evaluated for RF/FEM/mmWave building blocks:

- LNA, switches, multipliers, power amplifiers & mixers
- High efficiency mmWave signal amplification
- Low insertion loss & high isolation for reduced noise



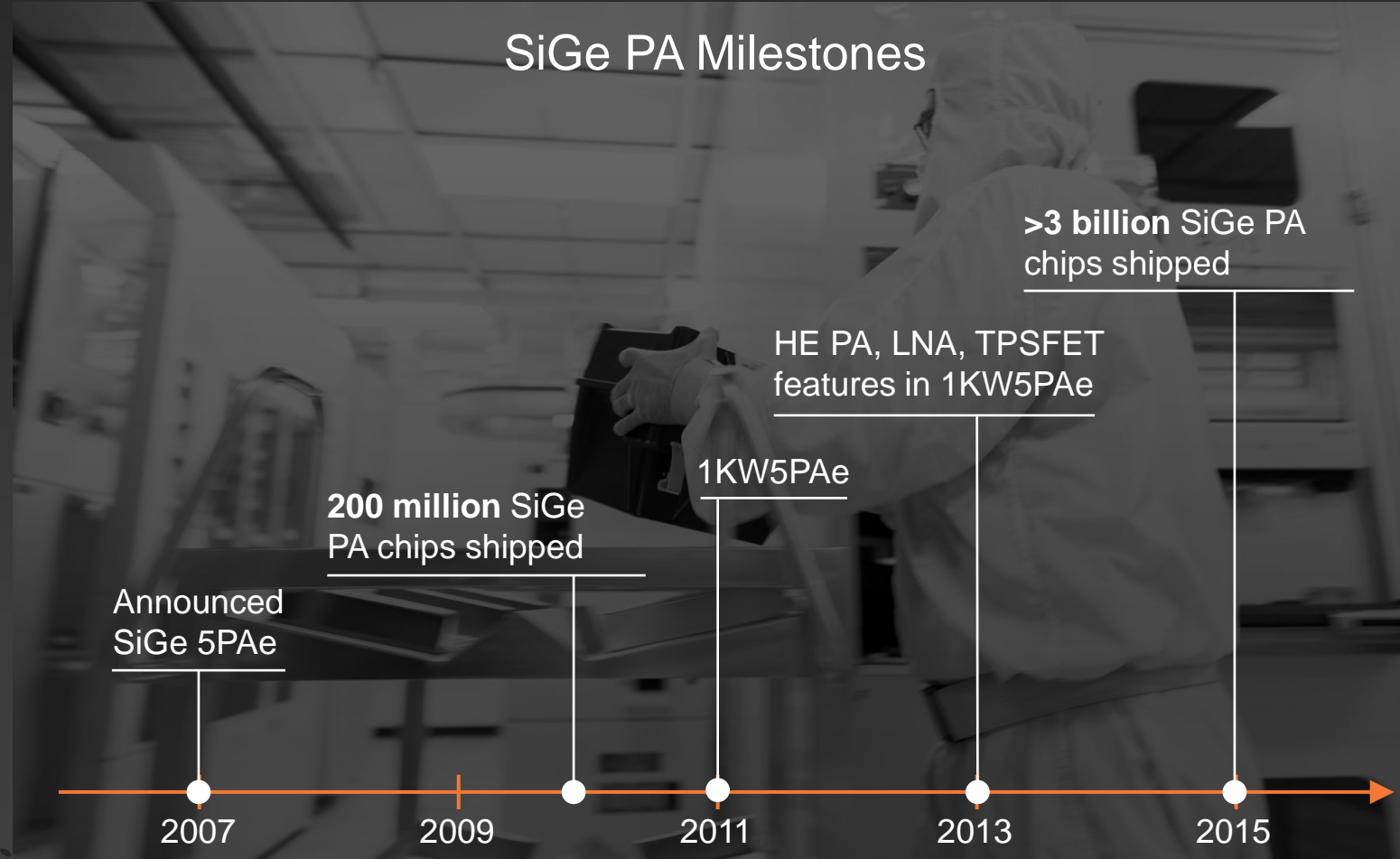
Source: GLOBALFOUNDRIES Product Planning and RF Marketing

GLOBALFOUNDRIES RF SOI – a History of Leadership



- Engagements with more than 80% of the world's top front-end module suppliers
- High-volume production for nearly a decade and more than 16 billion RF SOI products shipped to date
- Experience in both 200mm and 300mm manufacturing with multiple fab locations across the globe
- Continued device and technology innovation to meet the needs of an evolving market

SiGe PA Technologies—Replacing GaAs in Mobile Applications



Widespread customer adoption, with top mobile supplier engagements

More than 3 billion SiGe power amplifier (PA) chips shipped

Strong silicon presence in Wi-Fi, now moving into cellular

Thank you



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