

RF SOI for 4G Applications and Beyond

上海微技术工业研究院 2016/7/22

Outline

- ◆ RF SOI for cellular phone front end: From 2G to 4G
- ◆ 5G Characteristics and the Internet of Things
- ◆ SITRI and its collaborations with the industrial partners on RF SOI
- Summary

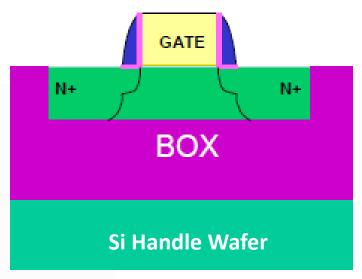


Introduction of RF SOI Technology

Si device layer

Buried oxide

Si handle wafer

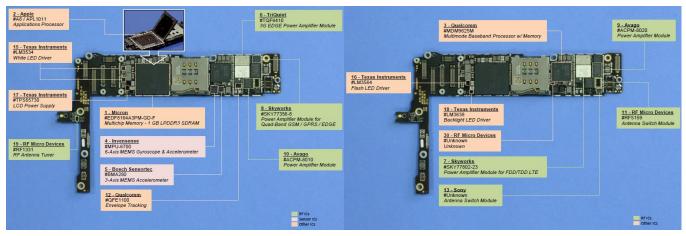


- Minimizes the parasitic capacitance from source/drain to the substrate and reduce substrate coupling
- Increases the device isolation to allow true device stacking for power handling and linearity
- Use high resistivity silicon substrate

RF Front-end Contents Increases from 2G to LTE

Source: Navian 2013

2.5 G smartphone	3G smartphone	LTE smartphone	LTE Adv smartphone
2007- 2008	2009- 2011	2012- 2015	2015-2018
2G 4 bands	2G 4 bands	2G 4 bands	2G 4 bands
	3G 4 bands	3G 6 bands	3G 6 bands
		LTE 2 bands	LTE 16 bands
2 PA & 1 SW	6 PA & 3 SW	5 PA & 9 SW	more
5 mm²	12 mm²	24 mm²	32 mm²



Sitiphone 6plus Tear down analysis:

http://www.sitrigroup.com/EngineeringServices/TearDownReport/17

Telecomm Signal Chain

Antenna

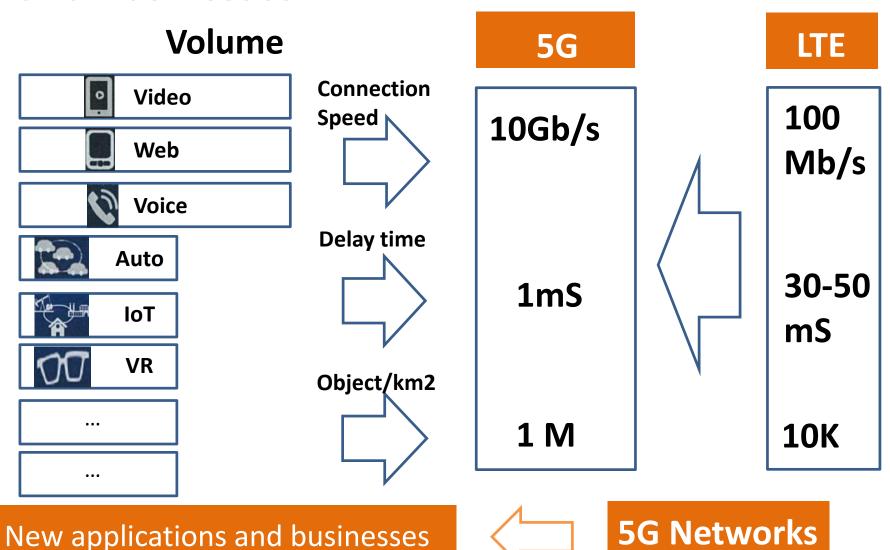
RF Frontend RF⇔IF

Analog Frontend/ Transceiver

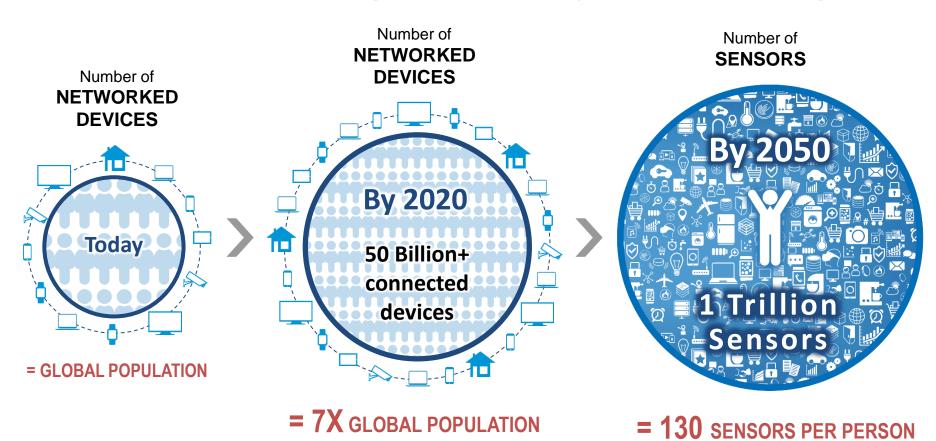
- More populations talking in the air → MIMO
- More frequency bands → high performance high-throw switches
 - → more low-throw switches
 - → more PAs, more filters
- System-in-Package (SIP) and module integration



From 4G LTE towards 5G: New Applications and Businesses



Internet of Things is Rapidly Proliferating

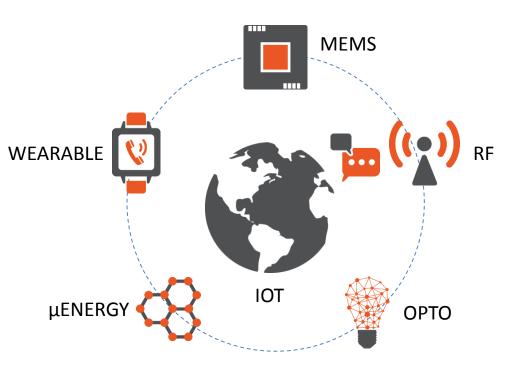


Providing a Significant Opportunity for Hardware Innovation



Source: http://www.infocity.az/

"More that Moore" Technologies are at the Heart of the Internet of Things





"More than Moore" technologies are costly and complex, requiring specialized IP, engineering expertise, manufacturing lines.



SITRI with RFSOI

Platform

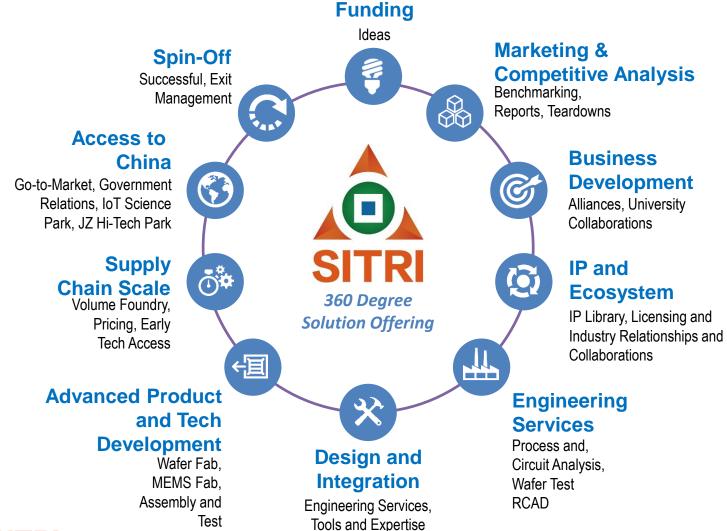
- Design Services
- Start-of-the-Art Facilities
- Engineering Services

Technology

- RFIC
- MEMS & Sensors
- IoT Solutions
- Smart Agriculture



SITRI Accelerates "More than Moore" thru 360° of Services, Resources and Support

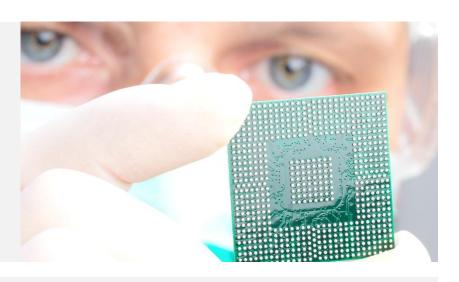


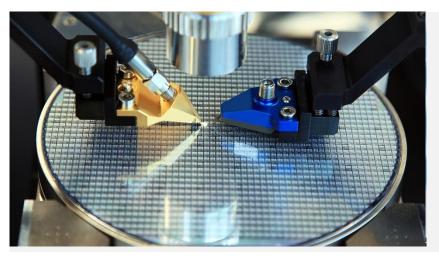


Delivering Advanced Technology Expertise and Manufacturing Capabilities

MtM Technology Focus

- MEMS and MEMS-based components and systems
- Advanced materials and structures
 - RF-SOI
 - III-V on silicon
 - Advanced magnetics
 - Piezoelectrics





Manufacturing and Supply Chain To Speed Time to Market

- Co-located design, integration and foundry ecosystem
- 4" MEMS and 8" MtM lines
- Partnerships with leading foundries for 8" CMOS integration, production transfer and ramp, test, measurement and packaging.
- Close connections to ZhangJiang Hi-Tech Park and Shanghai Science Authority



Positioning of SITRI 8-inch MtM R&D Line

The first 8" MtM R&D line of China, connecting to 8" foundry, provides process R&D platform, to help product company to develop advanced MtM products and realize mass production.



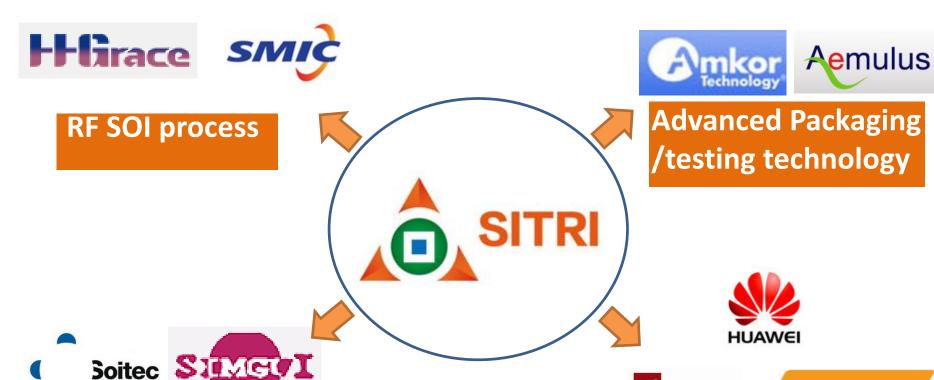
- Special market
- Traditional process
- MEMS discrete device
- High cost
- Small scale

- Consumer-, automotive electronics
- Advanced process
- MtM 3D integration
- MtM: MEMS, RF, magnetic, power, Si-based III-V, Photoelectricity integration, Bio chips, etc.



SITRI Collaborates with our Industrial Partners on RFSOI









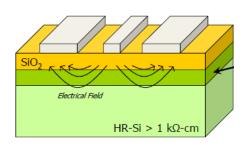
RF SOI substrate developments



RF Front-end for wireless communications

Collaborative Work with SOITEC on RF SOI substrates

Joint collaboration between SITRI and SOITEC for research and development of RF SOI technology solutions including device, circuit design and RF CMOS technology



Various substrates RF performance



High performance passive RF Devices

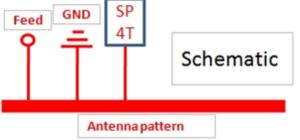
RF MEMS?
III-V on Silicon?
New technologies?

RF substrates for 5G applications

SITRI Tunable Antenna Developments







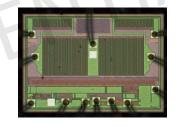
Working with antenna design and manufacturing house to jointly develop tunable antenna solutions

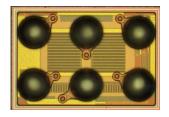


SITRI 提供高性能RF SOI 射频开关设计

◆ 应用于信号收发的射频开关芯片

- ✓ 应用于3GHz以下的开关。满足4G LTE 客户低损耗,高线性度, 高功率的开关要求。
- ✓ SPDT/SP3T/SP4T/SP5T/SP6T等
- ✓ QFN, LGA和WLCSP封装形式





◆ 应用于可调天线的射频开关芯片

- ✓ 提高手机天线在LTE low band 的性能。
- ✓ SPST/SPDT/SP4T
- ✓ LGA和WLCSP封装形式







Global Ecosystem Speeds Development and Market Access











SITRI The Center for "More than Moore" Solutions



Market Access

Creating a bridge to access a massive China end market for the Internet of Things



360 Degree Solution Offering

Providing funding, IP and product development, advanced technology development, market entry and volume production



"More than Moore" Expertise

Leading technical experts, cutting-edge IP and product development infrastructure for MtM technologies



Fast Commercialization

Activating local manufacturing and supply chain infrastructure to quickly commercialize new ideas





Accelerating The Innovation And Commercialization Of "More Than Moore" Solutions To Power The Internet Of Things



Relevant Events

2016.09.07 – Leti FD-SOI Design Service Seminar*

2016.09.08 - The Shanghai FD-SOI Forum 2016

2016.09.09 - 2016 International RF-SOI Workshop

2016.09.12~2016.09.14 - Sensor China Expo & Conference 2016

* Tentative

