45RFSOI
Advanced 45nm RF SOI Technology

Future-ready RF Offering for mmWave and 5G Applications

The GLOBALFOUNDRIES (GF) 45nm RF SOI foundry technology, 45RFSOI, is targeted for high performance, next-generation mobile communications, including:

- Integrated millimeter wave (mmWave) front-end modules (FEMs) and beam formers for 5G base stations and smartphones
- Phased array front ends for internet broadband satellite ground and space applications
- Radar and high-performance wired and wireless applications

45RFSOI takes advantage of a 45nm, partially-depleted SOI server-class technology base extensively evaluated for use in mmWave applications and in high volume production at multiple GF fabs since 2008. RF-centric enablement, device and technology additions to this baseline technology, including thick copper and dielectric back-end-of-line (BEOL) features, enable 45RFSOI to handle the demanding performance requirements of 5G solutions.

Highlights

- Leverages a 45nm partially depleted SOI technology:
  + Enhanced with high-performance RF features
  + Built on a mature, server-class silicon technology in production at multiple GF fabs since 2008
- Optimized for next-generation RF and mmWave applications:
  + 5G integrated front ends and beam formers
  + Broadband satcom phased array terminals
  + Radar and high-performance wired and wireless applications
- Comprehensive design enablement:
  + Full RF PDK
  + RF-centric devices and features
  + mmWave modeling and enablement
  + RF-friendly metal stacks with thick top Cu levels for transmission line design
  + Comprehensive digital standard-cell library, I/Os and reference flows
- Complete services and supply chain support:
  + Regularly scheduled MPWs
  + Packaging and RF test services

Strain engineering boosts NFET and PFET mobility
Reduced perimeter and junction parasitics enable faster FETs
Buried oxide provides good electrical isolation between CMOS transistors and enables FET stacking
High resistivity substrate makes lower insertion loss transmission lines and higher Q passives possible, critical to achieving higher performance in power amps, switches, low noise amplifiers and phase shifters

The RF-centric enhancements available in 45RFSOI build on the inherent advantages of its SOI technology base and combine to help you optimize RF performance by enabling:

- A high $f_t/f_{max}$ (305/380GHz) to meet 5G mmWave operating frequencies
- Device stacking for high voltage handling and high output power
- High linearity and improved noise isolation and harmonics suppression
Enabling Differentiation Across Applications

By using 45RFSOI, chip designers can leverage the collective benefits of RF-centric features, device stacking, an optimized BEOL and a high-resistivity substrate to develop differentiated products—across a range of 5G base station, backhaul, satellite and smart-phone FEM applications.

Evaluation process design kits are available now. Frequent MPW runs through The MOSIS Service of the USC Information Sciences Institute are available and enable fast prototyping so you can evaluate results in hardware early.

45RFSOI Comprehensive Design Enablement

45RFSOI at a Glance

<table>
<thead>
<tr>
<th>Standard Features</th>
<th>Optional Features</th>
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<tbody>
<tr>
<td>• High resistivity substrate</td>
<td>• SRAMs</td>
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<tr>
<td>• Four BEOL stack options</td>
<td>• Wire bond or solder bump terminals</td>
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<td>• RF interconnect transmission lines</td>
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<tr>
<td>• Electrically programmable fuse</td>
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<td>• Primitive and hierarchical ESD elements</td>
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FETs

- Thin gate oxide 0.9V/1.0V floating body regular V (RVT) FETs
- Multiple voltage threshold options (thin gate oxide FETs only): High V (HVT), super-high V (SVT), ultra-high V (UVT)
- Analog FETs: Floating body and body contacted
- Thick gate oxide 1.5V/1.8V FETs: Floating body and body contacted

Resistors

- N+ silicide resistor
- P+ poly silicon
- P+ high resistivity poly silicon

Capacitors

- Vertical natural capacitor
- Thick oxide decoupling capacitors
- High-Q MIM capacitor
- High-density MIM capacitor

Inductors

- BEOL inductors: Spiral and symmetrical

Varactors and Diodes

- Thin oxide varactor
- Thick oxide forward bias annular diode

Advanced 45nm RF SOI vs. Bulk CMOS Performance*

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<tr>
<th>NFET Technology Node (nm)</th>
<th>f_{max} (GHz)</th>
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| 45nm SOI vs. 28nm Bulk CMOS | 45RFSOI f_{max} compared to GF 28nm, 40nm and 65nm bulk CMOS technologies.

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