

# 22FDX®

## 22nm FD-SOI Technology

### Highlights

- 22nm FD-SOI technology
  - + Manufactured in state-of-the-art fab in Dresden, Germany; Upcoming fab in Chengdu, China
  - + Includes ultra-low-power with 0.4V operation
  - + Transistor back-gate biasing for energy-efficient trade-off between performance and power
  - + Integrated RF for reduced system cost and low RF power back-gate feature to further reduce RF power up to ~50%
  - + World-class Fmax, self gain; very low noise figure at mmWave; FET stacking for single-chip integration of high-Pout/high-PAE PA and switches
- Low power embedded applications
  - + Automotive (ADAS,IVI)
  - + IoT, Wearables
  - + Networking and WiFi
  - + 5G: <6GHz and mmWave handset solutions, backhaul, base stations
  - + LEO satellite communications
  - + mmWave radar
  - + Mobile Applications Processors
- Comprehensive design ecosystem
  - + Leverages bulk digital design flows and existing EDA tools
  - + Fully enabled with foundation IP and application-specific complex IP
- Complete services and support
  - + Design starter kit, MPWs, prototyping
  - + Advanced packaging and test solutions, including 2.5D/3D products

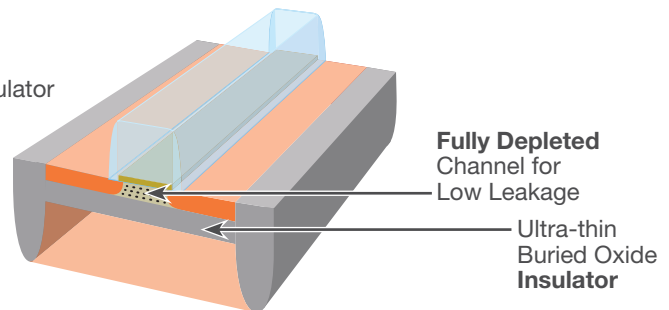
### Enabling *Connected Intelligence*

GLOBALFOUNDRIES 22FDX® 22nm FD-SOI (Fully-Depleted Silicon-On-Insulator) process technology platform delivers cost effective performance for connected and low power embedded applications.

22nm FD-SOI transistor technology delivers FinFET-like performance and energy-efficiency at the cost of 28nm planar technologies, including up to 70% lower power vs. 28nm. The simultaneous high Ft, high self gain and high current efficiency of 22FDX enables efficient, ultra low power RF/analog designs.

#### FD-SOI

- Fully-Depleted Silicon-On-Insulator
- Planar process similar to bulk



### Target Applications and Platform Solutions

5G, LTE and 802.11ac/ax/ad	IoT / Wearables	Mid/low-tier Apps Processor	Automotive mmWave Radar, MCU, ADAS
Enables new RF architectures <ul style="list-style-type: none"> <li>• 35-50% die shrink</li> <li>• 40-50% lower power for RF Tx/Rx (vs. 28nm)</li> </ul>	Low power operation down to 0.4V <ul style="list-style-type: none"> <li>• 1pA/cell standby</li> <li>• 80% lower total power (vs. 40nm)</li> </ul>	Full-node scaling benefits in PPAC vs. 28nm <ul style="list-style-type: none"> <li>• &lt;60% power @ iso-perf.</li> <li>• ~1.3X perf. @ iso-power</li> <li>• ~70% area</li> </ul>	High Pout for long-range radar @77GHz in single-chip auto radar system for low latency, lower power, and lower cost
Integrated mmWave PA with high PSAT via SOI-stacking	High performance (RF) LDMOS for integrated PA and switch & power management	Adaptive body bias enables additional PPAC gains by compensating for process/temp variability	GLOBALFOUNDRIES AutoPro™ Service Package
Highest ft/fmax for 5G/mmWave	Fully integrated & versatile eMRAM for storage & compute	Roadmap to 12nm FD-SOI for next-gen designs	Automotive G2/G1 including eMRAM

## Technology Overview

- Four core device Vt's (FBB, RBB & eLVT)
- Two I/O Vt's @ 1.2V/1.5V/1.8V
- Full set of active and passive devices
- LDMOS (3.3V/5.0V/6.5V)
- Low power: 0.4V to 0.8V Vnom
- Reference flow for back-gate biasing
- RF BEOL /w ultra thick metal stacks
- Standard temperature range: -40°C to 125°C

## IP Overview

The 22FDX Platform IP portfolio includes a wide range of silicon-proven high performance, power-optimized solutions for a broad set of applications.

Foundation IP					
Standard Cell	Low Power/Performance/Dense/Low Leakage Libraries				
Memory	HP/HD/ULL SRAM, Register File, ROM				
GPIO	1.2-1.8V/3.3V, ESD				
Body Bias	Body Bias Generator, Dynamic Body-bias Controller				
Interface IP					
DDR3/4	LPDDR3/4	USB2/3.x	PCIe	SATA	
SERDES	MIPI D-PHY/M-PHY	HDMI 2.0	LVDS	XAUI	
Wireless Connectivity IP			Non-volatile Memory IP		
BLE	WiFi	NB-IoT	Cat-M1	OTP	eFuse
Analog IP				Core IP	
PLL	ADC/DAC	Video DAC	Audio CODEC	LS	RISC-V
RTC	Temp Sensor	Process Monitor	POR/BOR	Regulator	

Contact GF for IP availability.

## Application-optimized Solutions

- RF Analog**
  - Integrated RF and analog with high fT/fMAX
  - WiFi & BT combo, LTE transceivers
  - Low power 5G and mmWave technologies
- Ultra Low Leakage**
  - Ultra-low static leakage (~1pA/μm)
  - ULL SRAM with <1pA/cell leakage
  - IoT, Wearables, Smartcard applications
- Ultra Low Power**
  - Flexible power options as low as 0.4V
  - Consumer, mobile, Auto IVI applications
- eMRAM**
  - Fully integrated, versatile memory for storage and compute for IoT and MCU (in development)
- Automotive**
  - Grade 1 for under-the-hood automotive/ industrial (in development); Grade 2

## Architected for Effective Back-gate Biasing

Technology back-gate biasing feature enables dynamic tradeoffs between power, performance and leakage and provides the greatest design flexibility.

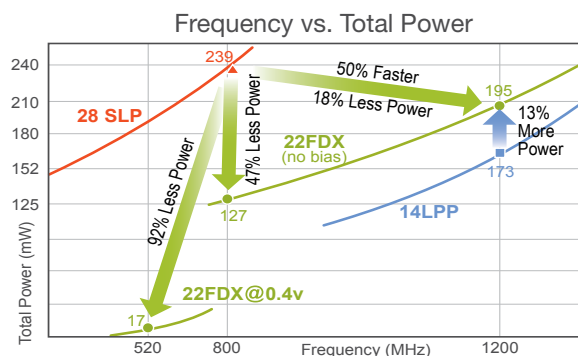
### Forward Body Bias (FBB)

- 50% lower power at same frequency (vs 28nm)
- Up to 40% faster performance at same power (vs 28nm)

### Reverse Body Bias (RBB)

- Reduces leakage to 1pA/micron in standby mode

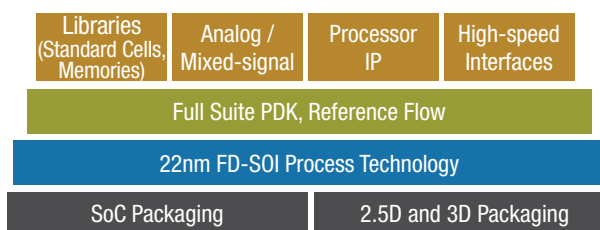
## High Performance and Low Power



## Design and Manufacturing Ecosystem with FDXcelerator™ Partner Program

GLOBALSOLUTIONS is the sum of our internal resources and ecosystem partners, combined to efficiently enable the fastest time-to-volume.

The FDXcelerator Partner Program facilitates FDX™ SoC design, reduces time to market and minimizes development costs.



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