Scaling & Diversification

Diversification

Precision Analog | Sensors | Biochips | NVM | HV | RF

Sense / Acquisition & Connectivity Functionality

Higher Value SoC & SIP Systems

Computational & Graphics Functionality

Leading-edge process nodes (16/14, 10/7...) enable digital / SoC compute and performance

Long-lasting shrink nodes (90, 40, 28...) enable mixed-signal integration for IoT
Embedded Processing – Yesterday’s Paradigm

- **MPU**
  - 40/28nm
  - High Performance, High-level OS, Graphics/Video/Display Processing

- **MCU**
  - 130/90nm
  - Low Power, Real-time OS, RF/NVM/Mixed-signal integration

- **16/14/10/7nm**
- **40/shrink**
Embedded Processing – Future

- **FD-SOI**: High Performance, Power Efficiency, Mixed-Signal, Broad Scalability
- **90 / 40**: Operations-led ‘sustaining’ Reuse existing foundry tooling
- **28/28shrink**: Next-gen back-end memories
- **16 / 14 / 10 / 7**: Computation & Machine Learning
- **Manufacturable Flash Processes**
The New Normal – Scalability of Embedded Processing

Ultra-low Power Dynamic & Static
ARM v8/v8m + GPU/DSP
ARM v7/v7m + 2D/3D
ARM v7m + Audio

Application Processors
i.MX 8
i.MX 8M
i.MX 8X
i.MX 6DQ+
i.MX 6UL/ULL
i.MX RT

MCU

i.MX 7ULP

i.MX 6UL/ULL

i.MX 6DQ+
i.MX 8

i.MX 8M

i.MX 8X

i.MX RT

i.MX 7ULP

i.MX 6UL/ULL

i.MX 6DQ+
i.MX 8

i.MX 8M

i.MX 8X

i.MX RT

i.MX 7ULP

i.MX 6UL/ULL

i.MX 6DQ+
Only few representative features shown here
Not final - subject to change
i.MX 7ULP – 28nm FD-SOI Low-Power Application Processor

Application Domain
- High-level OS
- 3D/2D graphics
- Camera & Display processing
- High-bandwidth peripherals

Real Time Domain
- Real-time OS
- Monitor & Response
- Sensor fusion
- Signal processing
- Low-bandwidth connectivity

ARM Cortex® - A7
with TrustZone
Instruction & Data Cache, L2 Cache

A7 connectivity
(UART, I²C, USB, SPI, GPIO, etc.)

Low-power 2D/3D Graphics

Display Interface

Camera Interface

External Memory Support

ARM Cortex® - M4
with DSP extensions
Cache, MPU, FPU

M4 connectivity
(UART, I²C, I²S, SPI, GPIO, etc.)

TCM

External Memory Support

Timers

Internal SRAM

Security

Security – Battery Domain
- Tamper Detection
- Secure RTC
- Secure Storage

Clock & Power Management
- Power Manager
- CLK/RST
- PLL/OSC

Timers

RDC & Secure Access

Security

Display Interface

Camera Interface

Analog Converters, Comparators

ARM Cortex®

Internal SRAM

Security

External Memory Support
FD-SOI Enabling Wide Dynamic Operating Range

- Outstanding Power-Perf demonstrated
  - Active mode @ 300MHz < 10mW
  - Deep-sleep with SRAM retained: < 2.5μW
  - Extremely low-leakage SRAM: ~ 0.5pA/bit

- Forward Body Bias (FBB) Expanded performance
- Reverse Body Bias (RBB) Lower leakage floor
- Dynamic biasing tunability - SoC & part-by-part
FD-SOI   Enabling High-Precision Analog and High-Perf. RF

• 3x lower variation in $R_{ON}$
• Dramatically improved analog switch designs

• Significantly tighter process and less mismatch
• Tighter designs with less trimming of analog designs

• Lowest power & high sampling frequencies
• ADCs for fast data sampling

Source: Conceptualized from Prof. Boris Murmann’s presentation @ SOI Consortium, April 2016
FD-SOI Enabling High-Precision Analog and High-Perf. RF

“If you believe the future is about mobility, about more communications and low power consumption and cost sensitive IoT chips where analog and RF is about 50% of the chip, then FD-SOI has a good future.” - Bich-Yen Nguyen, Senior Fellow, Soitec

Source: Conceptualized from Prof. Boris Murmann’s presentation @ SOI Consortium, April 2016
FD-SOI: Process Technology for the Next-Generation IoT

- High Performance
- Low-power
- High-precision Mixed-signal Integration
- Efficient RF Integration
- Optimized Cost