

BEYOND BA20 PIPELINEZERO PROCESSOR

OVERVIEW

The Beyond BA20 PipelineZero Embedded Processor implements a small, ultra-low-power, and very processing-efficient 32-bit processor, ideal for energy-sensitive deeply embedded applications such as wearable electronics, Internet of Things (IoT) sensors, wireless communication, and other mixed-signal ICs.

Thanks to its PipelineZero™ architecture, the BA20 core delivers a high processing efficiency with a tiny silicon footprint. True single-cycle instruction execution of the BA2 ISA, zero-delay branches, no pipeline-stalling overheads, and an optional hardware multiply unit enable the BA20 to operate with efficiency as high as 3.41 CoreMarks/MHz. With no pipeline stages in the instruction execution path the BA20 uses a minimal number of flip-flops and a simplified CPU control, so its processing efficiency comes without a silicon area penalty. For example, in a 40G technology the BA20 occupies about 10,000 gates, or approximately 0.01mm².

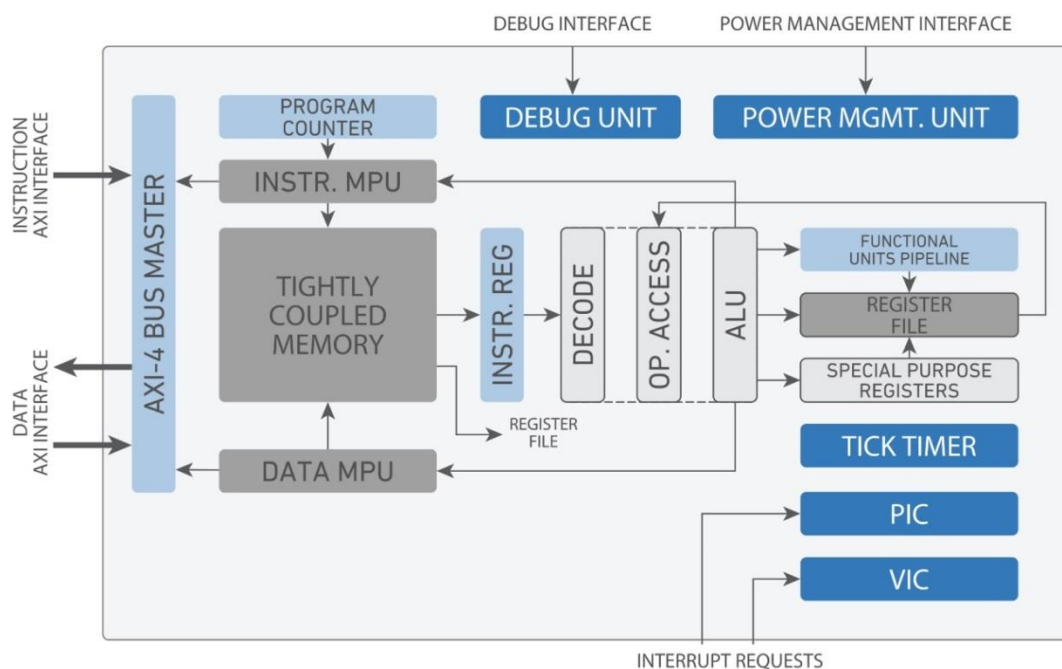
KEY BENEFITS

- 2.17 DMIPS/MHz; 60+ MHz on TSMC 65nm LP
- The most energy-efficient 32-bit processor currently available, consuming just 2uW/MHz on a 40G technology
- Small silicon footprint (less than 10k gates)
- Easy debugging and software development
- Competitive licensing options

APPLICATIONS

- Wearable electronics
- Internet of Things sensors
- Wireless communications ICs (e.g. Bluetooth, Zigbee, GPS)
- Wireless, battery-powered, or ultra-low-cost devices
- Housekeeping / helper processor

BLOCK DIAGRAM



FEATURES

Ultra-Low Power CPU

- Small silicon footprint (less than 10k gates) for lower leakage and dynamic CPU power
- One stage pipeline for most instructions
- BA2 Extreme Code Density for lower instruction fetching energy
- Advanced power management
 - Dynamic clock gating and power shut-off of unused units
 - Software- and hardware-controlled clock frequency
 - Wake-up on tick timer or external interrupt

Processing Efficiency

- 2.17 DMIPS/MHz
- 2uW/MHz and 10K gates (0.01mm²) in 9-track 40G
- 60+ MHz on TSMC 65nm LP

Preintegrated Subsystems

- Microcontroller peripherals such as GPIO, UART, Real-Time Clock, Timers, I2C, and SPI
- Memory controllers, interconnect IP, and more

Optional Processor Units

- Programmable Vectored Interrupt Controller Unit
- Memory Protection Unit
- Timer unit
- Debug unit
 - Software PC breakpoints
 - Hardware PC breakpoints, hardware data watchpoints
 - Single stepping
 - Debug control by software or external debugger
 - Trace port support
- ROM patching unit
- Floating Point Unit
- Hardware Multiplier/Divider

Easy Software Development

- Non-intrusive JTAG debug/trace for both CPU and system
- Complex chained watchpoint and breakpoint conditions
- BeyondStudio™ complete IDE for Windows or Linux based on industry-standard Eclipse
- Ported libraries and operating systems

THE BA2 INSTRUCTION SET

The BA2 instruction set provides extreme code density without compromises on performance, ease of use, or scalability. It features:

- A linear, 32-bit address space
- Variable length instructions: 16, 24, 32, or 48 bits
- Simple memory addressing modes
- A configurable number of 12 to 32 general purpose registers
- Efficient flow-control, arithmetic, and load/store instructions
- Floating point and DSP extensions

RELATED PRODUCTS

The BA2x Processor Family includes a set of royalty-free, pre-configured products intended for different applications:

- [The Beyond BA22-DE 32-bit Embedded Processor](#), 32-bit Deeply Embedded Processor, a 4- or 5-stage pipelined processor for deeply embedded applications that use on-chip instruction and data memories.
- [The Beyond BA21 Low Power Processor](#), for deeply embedded applications use on-chip instruction and data memories.



Beyond Semiconductor is addressing challenges of systemic complexity in today's electronic devices, empowering its customers to create new experiences for end users.

Initially known for its processor expertise, Beyond quickly gained acceptance among top semiconductor companies and evolved into global company leveraging processing, software and system-wide view competence to provide its customers with effectively designed IP and ASICs.

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