

CAST

BA21

32-bit Low-Power Deeply Embedded Processor

Features

Low-Power 32-bit Processor

- Small silicon footprint (less than 10k gates) for lower leakage and dynamic CPU power
- Two-stage pipeline architecture
- 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

- 2.77 Coremarks/MHz
- From 150 MHz (TSMC 65nm LP)

Optional Processor Units

- Programmable Vectored Interrupt Controller Unit
- Memory Protection Unit
- Timer Unit
- Debug Unit
 - MDB support
 - Trace port support
- ROM patching Unit
- Floating Point Unit
- Hardware Multiplier/Divider

Available Pre-Integrated Platforms

- Microcontroller peripherals such as GPIO, UART, Real-Time Clock, Timers, I2C, and SPI
- Memory controllers, interconnect IP, and more
- Reference Design Board for evaluation or rapid development start

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 under Eclipse
- Ported libraries and operating systems

Implements a 32-bit low-power processor that delivers better performance than most processors of its size. Designed for deeply-embedded systems or as an auxiliary processor in larger systems, it is an especially effective choice for wireless communication, analog peripherals management, or other mixed-signal functions in energy-and cost-sensitive applications.

This royalty-free 32-bit processor core is binary-compatible with other members of the silicon-proven BA2x processor family. Its BA2 instruction set is relatively simple and extremely compact, offering system area and energy savings benefits. Programming is facilitated with the included C/C++ tool chain, Eclipse IDE, architectural simulator, and ported C libraries, RTOSs, and OSs.

Processor Description

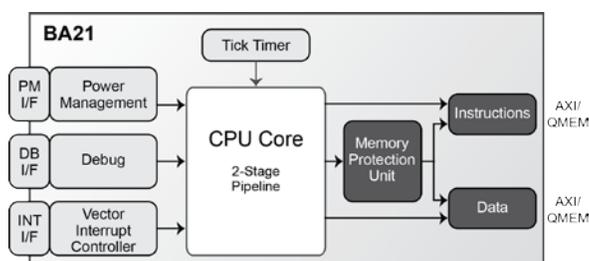
The two-stage pipelined architecture minimizes standby/idle power and run-time energy consumption. The small silicon footprint of the CPU, and the smaller code-memory requirement (resulting from extreme code density of the BA2 instruction set), are critical for minimizing leakage currents during idle or standby modes and reducing dynamic power consumption. Furthermore, the processor allows for sophisticated power management, enabling dynamic clock-gating or power-shut-off of unused units, and software or hardware controller dynamic frequency scaling of the bus and the CPU.

Delivering more processing power per MHz than most processors in its class, the BA21 can be configured to operate at low frequencies to further save power, or to meet the most demanding embedded processing requirements, or any optimum combination of both. Its processing capabilities can be enhanced further with a hardware multiplier/divider unit and an IEEE 754 compliant floating-point unit. Timely responses to interrupts are facilitated by a vectored interrupt controller, and an optional memory protection unit can be used to protect application code and/or data from corruption. The core supports reach debug capabilities including trace.

The system interface uses two AMBA® AXI4 buses, one for data and one for instructions, both of configurable data width. Two tightly-coupled quick memory (QMEM) buses allow fast access for time-critical code and data, and can be used for inter-core communication in a multi-core architecture

Additional microcontroller peripherals may be ordered for pre-integration and delivery with the core, individually or in a complete platform. IP Integration Services are also available to help integrate any BA2x processor configuration with memory controllers, image compression, or other CAST IP cores.

Block Diagram



Applications

The royalty-free, energy-efficient BA21 processor can be employed as a replacement for existing 8-bit and 16-bit processor market, or used as secondary, housekeeping or peripheral controller processor in complex SoC designs, and it suitable for a wide-range of deeply embedded applications such as:

- Mixed signal embedded processing
- Wireless communications ICs (e.g. Bluetooth, Zigbee, GPS)
- Industrial Microcontrollers
- Wireless, battery-powered, or ultra-low-cost devices.

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

Customizable Platforms

The BA21 processor can be delivered pre-integrated with typical microcontroller peripherals such as UARTs, timers and serial communication cores, or with memory controllers and interconnect IP cores. Contact CAST Sales for details.

Support and Services

The core as delivered is warranted against defects for 90 days from purchase. Thirty days of phone and email technical support are included, starting with the first interaction. Additional maintenance and support options are available.

IP Integration Services are also available to help minimize time to market for BA21-based systems.

Deliverables

The core is available for ASICs in synthesizable Verilog source code, and includes everything required for successful implementation. The core is delivered with software development tools Windows and Linux, with an Eclipse IDE interface.

Related Products

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

- **BA25** 32-bit Application Processor, for demanding systems running applications on general-purpose operating systems such as Linux and Android.
- **BA22-AP** 32-bit Basic Application Processor, for embedded applications that may need to run a full OS.
- **BA22-CE** 32-bit Cache-Enabled Embedded Processor, for deeply embedded systems using off-chip instruction and data memories and possibly running an RTOS; 5-stage pipeline, caches but no MMU.
- **BA22-DE** 32-bit Deeply Embedded Processor, for deeply embedded applications that use on-chip instruction and data memories.

Platforms

- **BA2x-AXI-PP** Pre-integrated peripherals platform for the AMBA3 AXI bus.
- **BA2x-AHB-PP** Pre-integrated peripherals platform for the AMBA2 AHB/APB buses.

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BEYOND 
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The BA21 core is sourced from
Technology Partner Beyond Semiconductor