



CAST provides a range of 8051s with pre-integrated peripherals and versions to fit every project and every budget.

Super-Fast S8051XC3 is almost 27x faster than the original 8051, with a full set of configurable features and peripherals.

Tiny T8051XC3 is one of the smallest available—saving you power and expense—and ideal for many tasks with a 13.5x speed-up.

Mature R8051XC2 has been production-proven in ~100 devices.

Legacy L8051XC1 is timing-configurable to exactly match old MCUs for budget-saving replacements.

16-bit S80251XC3 is the fastest available, with the extra capacities of the 80251.

These low-risk, royalty-free 8051 MCUs offer simple integration, easy software development, a small silicon footprint, and low power consumption. They provide more than enough computation power for many modern applications—e.g., IoT, wearables, sensor modules, or SoC helpers—and features like very low latency can make them a better choice than many 32-bit processors.



They're also backed by more years of 8051 IP experience than any other sales, support, and engineering team in the industry, and CAST and our sourcing partner Silesia Devices are ready to help make you successful.

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Features	L8051XC1 Legacy	R8051XC2 Mature	T8051XC3 Tiny	S8051XC3 Super-Fast	S80251XC3 16-bit
Performance					
DMIPS/MHz vs Original 80C51	1x, 2x or 4x	12.1x	13.5x	26.85x	69.7x
8x8 Multiply (Cycles)	24 or 12	4	8	1 or 2	1
16x16 Multiply w/o MDU (Cycles)	50	50	67	32	1
16x16 Multiply with MDU (Cycles)	38	38	N/A	N/A	N/A
DPTR Arithmetic Acceleration	✓	✓	✓	✓	X
Advanced Execution Architecture	X	X	X	✓	✓
Memory					
Program/Data Address Space	64K Bytes	64KB or 8MB	64K Bytes	64KB or 8MB	16MB
Configurable Set of Peripherals	✓	✓	✓	✓	✓
24-bit DPTR	X	X	X	X	✓
Optional Extra 16-bit DPTRs	1 to 7	1 to 7	0 to 1	0 to 1	X
32-bit Code/Data Bus	X	X	X	✓	✓
Separate XDATA Bus	X	X	X	✓	✓
Peripherals: 80C51-Like					
TIMER 0 — 16-bit Counter/Timer	✓	✓	✓	✓	✓
TIMER 1 — 16-bit Counter/Timer	✓	✓	✓	✓	✓
SERIAL — Full duplex sync/async serial port	✓	✓	✓	✓	✓
GPIO 0 — 8-bit Parallel Port	✓	✓	✓	✓	✓
GPIO 1-3 — 8-bit Parallel Ports	✓	✓	✓	✓	✓
ISR — Interrupt Controller: 6 sources, 2 priority levels	✓	✓	✓	✓	✓
Peripherals: SAB80C515-Like					
TIMER 2 — 16-bit Counter/Timer/Event Counter & CCU	✓	✓	X	X	X
WDT — 15-bit Watchdog timer	✓	✓	X	X	X
MDU — 32-bit Multiplication Division Unit	✓	✓	✓	✓	X
ISR — Interrupt Controller: 18 sources, 4 priority levels	✓	✓	X	X	X
GPIO 4,5,6 — 8-bit Parallel Ports	✓	✓	✓	✓	✓
SERIAL 0 — Full duplex sync/async serial port	✓	✓	✓	✓	✓
SERIAL 1 — Full duplex sync/async serial port	✓	✓	✓	✓	✓
Peripherals: Dallas 80C530-Like					
RTC — Real time clock	✓	✓	✓	✓	✓
Peripherals: 80251-Like					
TIMER 2 — 16-bit Timer	X	X	✓	✓	✓
WDT — 14-bit Watchdog timer	✓	X	✓	✓	✓
PCA — Prog. Counter Array: 5 16-bit PWM channels	✓	X	✓	✓	✓
Peripherals: Proprietary					
MAC — 40-bit Multiply Accumulator Unit	X	X	X	✓	✓
PMU — Power Management Unit	✓	✓	✓	X	X
PMU/DFS — PMU w Dynamic Freq. Scaling	X	X	✓	✓	✓
I2C 0, 1 — I2C Master/Slave with SMBUS extension	✓	✓	✓	✓	✓
SPI_MS — SPI Master/Slave	✓	✓	✓	✓	✓
DMA — DMA Controller	✓	✓	X	✓	✓
OCDS — On Chip Debug Support (JTAG & Single-Wire)	✓	✓	✓	✓	✓
XWDT — Extended Watchdog Timer	X	✓	X	X	X
ISR — Interrupt Controller: 23 sources, 4 priority levels	X	X	✓	✓	✓
CAN Bus, LIN Bus, or LCD/TFT Display Controllers	✓	✓	✓	✓	✓
✓ = Included or user-configurable option ✓ = On request X = Not supported					
Note: Performance data correspond to maximum performance configuration, compared to 0.00941 DMIPS/MHz original 80C51					



The BA2x™ Processor Family gives you a spectrum of smart, royalty-free choices that feature:

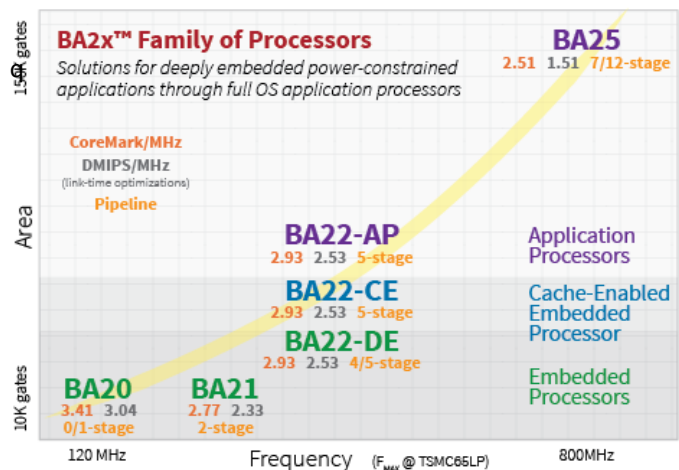
- Extreme code density,
- Very low power usage, and
- Competitive or better speed & area.

Dozens of successful customers have found that BA2x processors deliver the best-available combination of performance, area, cost, and energy efficiency. The newest member of the family, for example, uses a unique “zero-stage” pipeline for outstanding results in energy-sensitive systems like IoT, wearable, and mobile products:

BA20 PipelineZero™ Ultra-Low-Power offers hazard-free single-cycle execution, extreme code density, small area, and a power-saving architecture to yield one of the most performance- and energy-efficient 32-bit MPUs available.

Sourced from Beyond Semiconductor, BA2x Processors come with a customized IDE and software tool set for easy programming. Hardware debugging kits and complete reference design systems are available for rapid design and successful product deployment.

Contact CAST Sales to discuss how you might improve your next product by using BA2x Family Processors.



Features	BA20 PipelineZero Embedded	BA21 Low-Power Deeply Emd.	BA22-DE Deeply Embedded	BA22-CE Cache-Enabled	BA22-AP Application Processor	BA25 Adv. App. Processor
DMIPS/MHz	1.52/1.99/3.04 ⁴	1.49/2.33 ⁵	1.76/2.53 ⁶	1.76/2.53 ⁶	1.76/2.53 ⁶	1.51
CoreMarks/MHz	3.41	2.77	2.93	2.93 ⁶	2.93 ⁶	2.51
FMAX @ TSMC65LP	75 MHz	150 MHz	400 MHz	400 MHz	400 MHz	800 MHz
Equivalent Gates	From 10k	From 10k	From 15k	From 25k	From 35k	From 150k
BA2 Variable Length ISA	✓	✓	✓	✓	✓	✓
Pipeline Stages	1	2	4/5	5	5	7 ¹ /12
Out of Order Completion	✓	✓	X	X	X	✓
Branch Prediction Unit	X	X	X	✓ ²	✓ ²	✓
Memory Protection Unit	✓ ³	✓	✓ ²	✓ ²	✓	X
Number of GPRs	12-32	12-32	16-32	16-32	32	32
SoC Data Bus	AXI4 Lite ³	AXI4 Lite	AHB/WB/AXI4 ²	AHB/WB/AXI4 ²	AHB/WB/AXI4 ²	AXI4
SoC Instruction Bus	AXI4 Lite ³	AXI4 Lite	AHB/WB/AXI4 ²	AHB/WB/AXI4 ²	AHB/WB/AXI4 ²	AXI4
Hardware Multiplier and/or Divider	✓	✓	✓	✓	✓	✓
Multiply-Accumulate Unit	✓ ²	✓ ²	✓	✓	✓	✓
Floating Point Unit	✓ ²	✓ ²	✓	✓	✓	✓
DSP Extensions Acceleration	✓	✓	✓	✓	✓	✓
JTAG Debug Support	✓	✓	✓	✓	✓	✓
Embedded Tick Timer, PIC & PMU	✓	✓	✓	✓	✓	✓
Vectored Interrupt Controller	✓	✓	✓	✓	✓	✓
Tightly Coupled I/D Buses	✓	✓	✓	✓	✓	✓
Instr. & Data Caches	X	X	X	✓(L0)	✓(L0)	✓(L0/L1)
Instr. & Data MMU	X	X	X	X	✓(L0)	✓(L0/L1)
Configurable Peripherals Platform	✓	✓	✓	✓	✓	✓
Beyond Studio SW IDE & GCC SDK	✓	✓	✓	✓	✓	✓

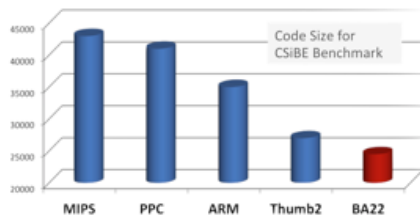
✓ = Supported ✓ = Optional X = Not Supported

- Notes: 1) Minimum for simple ALU instructions. 2) Feature can be made available upon request. 3) Work in progress. 4) DMIPS rating using GCC v4.9.1 and ground rules/optimizations/link-time optimizations. 5) DMIPS rating using GCC v4.9.1 and optimizations/link-time optimizations. 6) DMIPS rating for code running from tightly-coupled memories.

BA2x Extreme Code Density

BA2x Processors produce the most compact 32-bit code in the industry, decreasing memory size requirements dramatically lowering system-wide energy consumption. Their innovative techniques include:

- 18-, 24-, 32- or 48-bit-long instructions
- 32 GPRs (vs. 16)
- DSP & Floating-Point extensions



Silicon-Proven BA2x: Select Announced Licensees



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