RISC-V Embedded Processor IP Cores

Efficient, Reliable, and Royalty-Free

Features	BA51 Ultra-Low-Power	BA53 Low-Power & Fast	EMSA5 Base	EMSA5-FS Functional Safety
ISA	**RV32 [I/E]**	**RV32 [I/E]**	**RV32 [I/E]**	**RV32 [I/E]**
ISA Extension Options				
Compressed Instr. (C)	Yes	Yes	Yes	Yes
Multiplication & Division (M)	Yes	Yes	Yes	Yes
Code Size Reduction (Zc)*	Yes	Yes	No	No
Single Precision Floating Point (F)	Yes	Yes	Yes	Yes
Double Precision Floating Point (D)	Yes	Yes	Yes	Yes
Atomic Instructions (A)	Yes	Yes	Yes	Yes
User-Level Interrupts (N)	Yes	Yes	No	No
Control & Status Reg. (Zcsr)	Yes	Yes	Yes	Yes
Instruction Fence (Zicsr)	Yes	Yes	Yes	Yes
Vector Instructions	On-Request	On-Request	Yes**	Yes**
Custom Instructions	**Yes** (option)	**Yes** (option)	**No**	**No**
Architecture	**Harvard**	**Harvard**	**Harvard**	**Harvard**
Pipeline Stages	**2**	**5**	**5**	**5**
Instruction TCM	**Yes**	**Yes**	**Yes**	**Yes**
Data TCM	**Yes**	**Yes**	**Yes**	**Yes**
Instruction Cache	**Yes** (option)	**Yes** (option)	**Yes** (option)	**Yes** (option)
Data Cache	**No**	**No**	**Yes** (option)	**Yes** (option)
Hardware Multiplier	**Yes** (option)	**Yes** (option)	**Yes** (option)	**Yes** (option)
Hardware Divider	**Yes** (option)	**Yes** (option)	**Yes** (option)	**Yes** (option)
Memory Protection Unit (MPU)	**Yes** (option)	**Yes** (option)	**Yes** (option)	**Yes** (option)
Floating Point Unit (FPU)	**HP*, SP, DP**	**HP*, SP, DP**	**SP, DP**	**SP, DP**
SoC Bus Protocol	**AXI4**	**AXI4**	**AHB-Lite**	**AHB-Lite**
Dual Core Lockstep	**No**	**No**	**No**	**Yes** (option)
Triple Modular Redundancy	**No**	**No**	**No**	**Yes** (option)
ISO 26262	**-**	**-**	**-**	**ASIL-D**
Coremarks / MHz	**3.00**	**2.53**	**2.43**	**2.43**
Fmax @ 22nm	**400 MHz**	**1 GHz**	**800 MHz**	**500 MHz**
Area @ in Eq. Gates	**16k**	**30k**	**23k**	**77k**
RV JTAG & Trace	**Yes** (option)	**Yes** (option)	**Yes** (option)	**Yes** (option)
Configurable Subsystem	**Yes** (option)	**Yes** (option)	**Yes** (option)	**Yes** (option)
Royalty-Free Licensing	**Yes**	**Yes**	**Yes**	**Yes**

* Non ratified RV ISA extension

** Partial support