

What is a soft processor?

A soft processor is an Intellectual Property (IP) core implemented using the logic primitives of the FPGA. Key benefits include configurability to trade between price and performance, faster time to market, easy integration with the FPGA fabric, and avoiding obsolescence.

How do I purchase the MicroBlaze™ soft processor core?

The MicroBlaze parameterized netlist is licensed as part of the Xilinx Embedded Development Kit (EDK). This full-featured product is provided with source file encryption. To purchase the EDK, visit www.xilinx.com/edk.

Non-encrypted VHDL source files for Xilinx FPGAs can be purchased separately.

What is the license for MicroBlaze?

The MicroBlaze soft processor is included with the Xilinx Embedded Development Kit (EDK) and is shipped under the Xilinx Core Site License agreement. This license allows you to use MicroBlaze in an unlimited number of Xilinx FPGA designs at the licensed site without any additional royalties.

What is the MicroBlaze performance? How many Dhrystone MIPS can it achieve?

MicroBlaze performance depends on processor configuration and the target FPGA architecture and speed grade. See the latest MicroBlaze performance table (link last three words to sell sheet).

How many logic resources does MicroBlaze use?

Depending on the configured options and target FPGA, MicroBlaze uses between about 800 and 2600 look-up tables (LUTs).

How many MicroBlaze processors can run on a single FPGA device?

The number of MicroBlaze processors on a single FPGA is only limited by the size of the FPGA. With the MicroBlaze Debug Module (MDM), you can debug eight MicroBlaze processors simultaneously.

Can I create my own peripheral or coprocessor?

Yes. The MicroBlaze soft processor includes several configurable interfaces that allow you to connect custom peripherals and coprocessors. Xilinx Platform Studio, part of the EDK, includes wizards that simplify the creation of such peripherals and coprocessors.

What kinds of peripherals are available for use with MicroBlaze?

The Embedded Development Kit comes with a standard set of peripherals including timers, UARTs, interrupt controllers, GPIOs, and external flash and memory controllers. A few complex cores require one time

licensing, but they are available for time limited evaluation at no extra cost. The Xilinx Platform Studio development tool included in the EDK provides wizards for creating and integrating your own peripherals.

What types of memory does MicroBlaze support?

The MicroBlaze standard peripheral set includes SDR, DDR, DDR2, SRAM and Flash controllers.

What sort of compilers and debugging tools are available for MicroBlaze?

The Embedded Development Kit (EDK) includes the full GNU suite including a C compiler, debugger, and assembler as well as all of the standard libraries (depending on the supported I/O devices). EDK includes a software development kit with an Eclipse based IDE. For debugging, the Xilinx Chipscope Pro™ on-chip FPGA logic analyzer can be purchased separately.

What operating systems have been ported to MicroBlaze?

The Mentor Nucleus, ThreadX, Micrium uC/OS-II and uITron are some of the partners support the Xilinx MicroBlaze soft processor core.

Can multiple MicroBlaze processors communicate easily?

Yes. They can use messaging through shared memory, or the direct point to point Fast Simplex Links (FSLs) for inter-processor communication. In MicroBlaze v5.00 core, the Processor Version Register contains: Processor ID, configuration/user/processor info (e.g. cache size etc), version number and other internal information for identifying a particular MicroBlaze core in a multi-core system.

What is the MicroBlaze FPU?

The MicroBlaze soft processor provides an optional IEEE-754 compatible single-precision Floating-Point Unit (FPU). The tightly integrated design combines performance, low latency, and low cost. The MicroBlaze FPU is a configurable part of both MicroBlaze v4.00 and v5.00 processor cores and is included at no extra cost.

Why would I want to use the MicroBlaze FPU?

Many embedded processing applications are floating point intensive. For such applications, executing floating point operations in software is expensive. Using the MicroBlaze FPU for such applications provides a huge boost in performance (in some cases up to 40x speedup over software floating-point).

Is the MicroBlaze FPU IEEE-754 compliant?

The MicroBlaze FPU is IEEE-754 compatible, but not fully compliant. It deviates from the standard in certain infrequent corner cases:

- An operation on a quiet NaN will return a fixed NaN, not one of the operands.
- Only round-to-nearest mode is supported.
- Denormalized operands are not supported. If exceptions are enabled, a denormal exception will be generated. Otherwise a quiet NaN will be returned.
- Denormalized results are flushed to zero.

If necessary these corner cases can be handled using software libraries called from exception handlers.

Can I reduce the size of the FPU by only selecting individual operations?

No. The only configuration option supported for the FPU is whether or not FPU exceptions are used. Individual operations such as fadd and fsub cannot be configured separately.

Do I need any special floating point libraries to use the FPU?

No. Floating point operations are part of the MicroBlaze ISA and are automatically recognized by the compiler. The compiler will automatically direct any operation on the C data type 'float' to the FPU.

Does the MicroBlaze core support user-defined instructions?

User-defined instructions are fairly complex solutions for hardware acceleration. The MicroBlaze processor uses a more robust and versatile co-processor solution to achieve the same objective. The low latency Fast Simplex Link (FSL) connects up to eight co-processors, each of which can naturally perform more than one custom function. A co-processor function can also go beyond the two operands and single result that normally limits user-defined instructions. Finally, there is less risk of harming the processor's maximum frequency with a co-processor since it is not part of the pipeline.

Does the MicroBlaze core have branch prediction?

Branch prediction is employed on architecture with long pipelines in which branches are resolved late in the pipeline. In the MicroBlaze core, however, branches are resolved in the third stage. As a result, a taken branch can have at most a two-cycle penalty. Even this two-cycle penalty is reduced by the automatic use of branches with delay slot instructions by the compiler. Therefore, the MicroBlaze core has a zero cycle penalty on not taken branches, and a one cycle penalty on taken branches with a delay slot instruction.

What's new with the MicroBlaze core for EDK8.2?

- Two MicroBlaze cores supported
 - o MicroBlaze v4.00 and MicroBlaze v5.00
- Size-optimized MicroBlaze v4.00 core
 - o Ideal for cost-focused applications
- Performance-optimized MicroBlaze v5.00 core
 - o Fewer cycles per instruction (CPI) for performance critical applications
 - o Higher maximum clock frequency

- EDK eases processor selection Base System Builder automatically selects:
 - o Size-optimized MicroBlaze v4.00 for Spartan
 - o Performance-optimized MicroBlaze v5.00 for Virtex

What's new with the MicroBlaze v5.00 core?

- 5 pipeline stages
 - o Better performance- fewer cycles per instruction (CPI)
- Option to set 4- or 8-word cache lines
- Option to set MSR reset value
- Optional Processor Version Register
- Backward compatible with MicroBlaze v4.00

Why use a 5-stage MicroBlaze core?

The MicroBlaze v5.00 is the latest MicroBlaze core (EDK 8.2). This core is an ideal choice for performance-focused MicroBlaze applications. It is 100% binary backward-compatible with previous MicroBlaze core releases. The additional pipeline stages help lower the clock per instruction (CPI) which improves the overall processor performance to 1.15 DMIPS/MHz. The MicroBlaze v5.00 core is the preferred MicroBlaze processor core for Virtex™-II, Virtex-II Pro, Virtex-4 and Virtex-5 architectures.

What about the 3-stage MicroBlaze core? What type of application is this good for?

The MicroBlaze v4.00 is the smaller MicroBlaze processor core and is an ideal choice for cost-focused MicroBlaze applications. The 3-stage MicroBlaze v4.00a core remains available with Virtex™-II, Virtex-II Pro, Spartan™-3, Spartan-3E, and Virtex-4 architectures. MicroBlaze v4.00 core is also the preferred MicroBlaze core for Vx, VxE, Spartan-II, and Spartan-IIE.

Where can I get additional information on MicroBlaze?

Visit www.xilinx.com/microblaze for more information.