

## Optimized core for 32-bit microcontroller and embedded applications

### Baseline Specifications

<b>Product</b>	MIPS32® M4K™ core
<b>Process</b>	130nm
<b>Frequency</b> (MHz) (Worst case)	100 - 228
<b>Max. Performance</b> (DMIPS)	369
<b>Power</b> (mW/MHz) Core only	0.07 - 0.21
<b>Core area</b> (mm <sup>2</sup> )	0.19 - 0.64

<b>Product</b>	MIPS32® M4K™ core
<b>Process</b>	90nm
<b>Frequency</b> (MHz) (Worst case)	200 - 414
<b>Max. Performance</b> (DMIPS)	671
<b>Power</b> (mW/MHz) Core only	0.04 - 0.15
<b>Core area</b> (mm <sup>2</sup> )	0.12 - 0.53

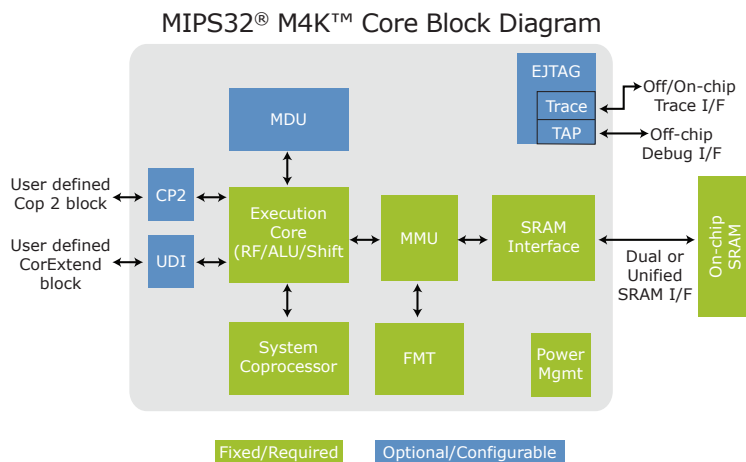
#### Notes:

Frequency, power consumption and size depend upon configuration options, synthesis, silicon vendor, process and cell libraries; for 130nm, worst case is slow silicon, 1.08V, 125C; typical case is typical silicon, 1.2V, 25C; for 90nm, worst case is slow silicon, 0.9V, 125C; typical case is typical silicon, 1.0V, 25C

Quoted speeds don't contain OCV, clock jitter and design margin

# MIPS32® M4K™

The MIPS32® M4K™ core sets a new standard for 32-bit synthesizable cores. Optimized for embedded designs and controller applications, it features high frequency, small die area and very low power consumption. A wide range of configurable features allow designers to optimize the core's performance while reducing die size, power consumption and total system cost.



### MIPS32 M4K Core Highlights

- Using the 5-stage pipeline, the M4K core offers more than 400 MHz in frequency and greater than 1.5 DMIPS/MHz in performance.
- The M4K core has a build-time configurable external SRAM interface optimized for cacheless operation, enabling increased system performance and deterministic operation.
- The M4K core has built-in architectural features that enable reduced power consumption without affecting frequency or performance.
- CorExtend™ capabilities enable designers to create highly-differentiated SoC designs by adding their own instructions.
- The highly-configurable and synthesizable core enables flexibility for designers to include only those features necessary for their application.
- A rich environment of software and hardware tools support ease of design and verification.
- MIPS16e™ code compression allows designers to reduce the memory requirements for their applications by as much as 40%.
- BIST, scan and Enhanced JTAG (EJTAG) debug with trace (PDtrace™ and iFlowtrace™) and fast download enable quick and easy debugging.

### Key Applications:

- Digital home: DTV, MoCA-based subsystems for cable modems, set-top boxes (STBs) and residential gateways (RGW)
- 32-bit microcontrollers: automotive and industrial control systems
- Portable devices: digital cameras, GPS receivers, MP3 players and mobile broadband applications
- Wireless networking: Bluetooth, UWB and wireless HD multimedia

## Features

### MIPS32-enhanced (Release 2) architecture

- 5-stage pipeline
- 1, 2, 4 or 8 sets of thirty-two 32-bit general-purpose registers
- Memory management unit with simple fixed mapping translation (FMT)
- Bit field manipulation instructions
- Vectored interrupts and support for external interrupt controller
- Atomic interrupt enable/disable

### User-defined instruction-set adds (CorExtend) extensions

- Maintains full MIPS32 compatibility
- Supported by industry-standard development tools
- Single- or multi-cycle instructions

### MIPS16e code compression

- 16-bit encodings of 32-bit instructions to improve by as much as 40%
- Special PC-relative instructions for efficient loading of addresses and constants
- SAVE & RESTORE macro instructions for setting up and tearing down stack frames within subroutines

### SRAM interface

- Single- or multi-cycle transaction latency
- Support for semaphores to control access to shared resources
- Separate or unified instruction and data memory interface

### Multi-core support

- External lock indicator enables multiprocessor semaphores
- External sync indicator allows memory ordering

### Integer multiply/divide unit (MDU)

- Fast or area-efficient, configurable at build time
- Maximum issue rate of one 32x16 multiply per clock (fast MDU)
- Maximum issue rate of one 32x32 multiply every other clock (fast MDU)

### General purpose coprocessor (COP2) interface

- 32-bit interface to an external coprocessor

### Power control

- Minimum frequency: 0 MHz
- Power-down mode (triggered by WAIT instruction)
- Support for software-controlled clock divider
- Support for extensive use of local gated clocks

### EJTAG debug

- Support for single stepping
- Complex breakpoints and triggers, configurable at build time
- PC and data tracing (PDtrace)
- iFlowtrace mechanism for instruction addresses - compact trace block and efficient trace compression
- Cross-CPU breakpoint support

### Development tools

- MIPS Navigator™ ICS - IDE, software toolkit, MIPSsim™, EJTAG and PDtrace probes
- CodeSourcery - SG++ toolchains for MIPS

Exceptional performance  
density and design flexibility  
for microcontrollers,  
networking and wireless  
applications

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