

# PowerPC 403GCX Embedded Controller

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## Highlights

### **Bus Interface**

- Bus compatible with 403GA, 403GB and 403GC
- Direct-connect peripheral/SRAM/ROM and DRAM interfaces
- Support for 8-, 16- and 32-bit devices
- Addressing for 512MB of main storage
- External bus master support
- IEEE 1149.1 (JTAG) compatible interface, for test, debug and real-time trace support
- DRAM Controller supports EDO DRAM
- Data bus parity on per byte basis
- New programmable bus modes

### **DMA Controller**

- Four independent DMA channels
- Buffered, fly-by, memory-to-memory, and burst modes
- Programmable for 8-, 16- and 32-bit transfers
- Data chaining

### **Interrupt Controller**

- Low latency interrupt handling (three cycles typical)
- Six external interrupt inputs (five regular, one critical)
- Dual level interrupt structure for robust debug

### **Power Management Capability**

- Dynamic power management and stand-by mode
- Support for connections to 3.3V and 5V peripherals

### **Instruction Fetch, Branch and Dispatch Unit**

- Four instruction prefetch queue
- Branch folding and static branch prediction
- Dispatches up to two instructions per cycle

### **Memory Management Unit**

- MMU is precache (cache tags are physical addresses)
- 8 page sizes (1K-16M by powers of 4) for efficient system memory use
- 64 entry fully associative TLB with software replacement
- 16 protection zones

### **Instruction and Data Caches**

- Separate caches: 16KB Instruction, 8KB Data
- Two-way set-associative
- Fetch-thru instruction cache
- Write-back data cache

### **Timers**

- 64-bit time base
- 32-bit programmable interval timer
- Fixed interval timer for system maintenance
- Watchdog timer for system error recovery

### **Serial Port**

- RS-232 serial communications
- Programmable to 1.5 Mb/s

## Product Description

The PowerPC 403GCX 32-bit RISC Embedded Controller is a clock-doubled design and is pin-compatible with the 403GA and 403GC. This provides an easy upgrade path when extra performance is needed.

The 403GCX processor core is tightly coupled to the internal 16KB instruction and 8KB data caches, reducing overhead for data transfers to and from main storage. Instruction queue logic minimizes pipeline stalls by managing branch prediction, branch folding and instruction prefetching. The high-speed multiplier can significantly improve application performance.

PowerPC 403GCX power consumption is minimized by a custom-designed low-power circuit library, 3.3V operation, and dynamic clocking. It is binary compatible with all IBM PowerPC microprocessors and embedded controllers.

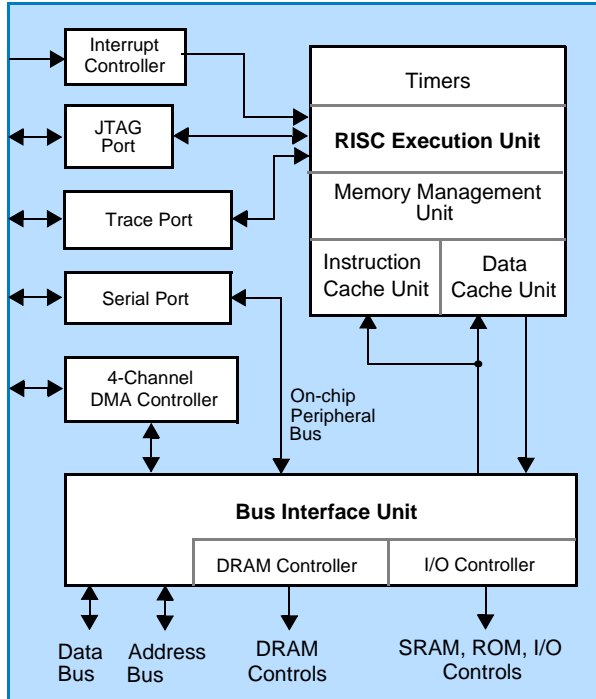
The 403GCX includes an integrated MMU featuring a fully associative TLB. Each entry provides a translation for a memory page, which can be one of several sizes. TLB replacement is managed by software, which can employ the optimum replacement strategy for a particular application.



## PowerPC 403GCX Specifications

|                       |   |
|-----------------------|---|
| Technology            | 0.45 $\mu$ m CMOS, 3 metal levels               |
| Number of Transistors | 1.82 million                                    |
| Max Case Temp. Range  | 0°C to 85°C                                     |
| Signal I/Os           | 126   |
| Power Supply          | 3.3V $\pm$ 5% (supports 5V I/Os)                |
| Performance           | 143K Dhrystones/sec @ 66MHz                     |
| Performance/Power     | 240 MIPS/W (Dhrystone 2.1)                      |
| Power Dissipation     | 340 mW @ 50MHz (typ.)<br>420 mW @ 66 MHz (typ.) |
| Packaging             | 160-pin plastic quad flat pack                  |
| Frequency (CPU / Bus) | 50/25MHz<br>66/33MHz                            |

The PowerPC 403GCX is supported by IBM and over 75 select third-party vendors in the PowerPC Embedded Tools\* program, offering a full range of embedded development tools, including compilers, debuggers, real-time operating systems, emulators, logic analyzers, and evaluation boards.



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