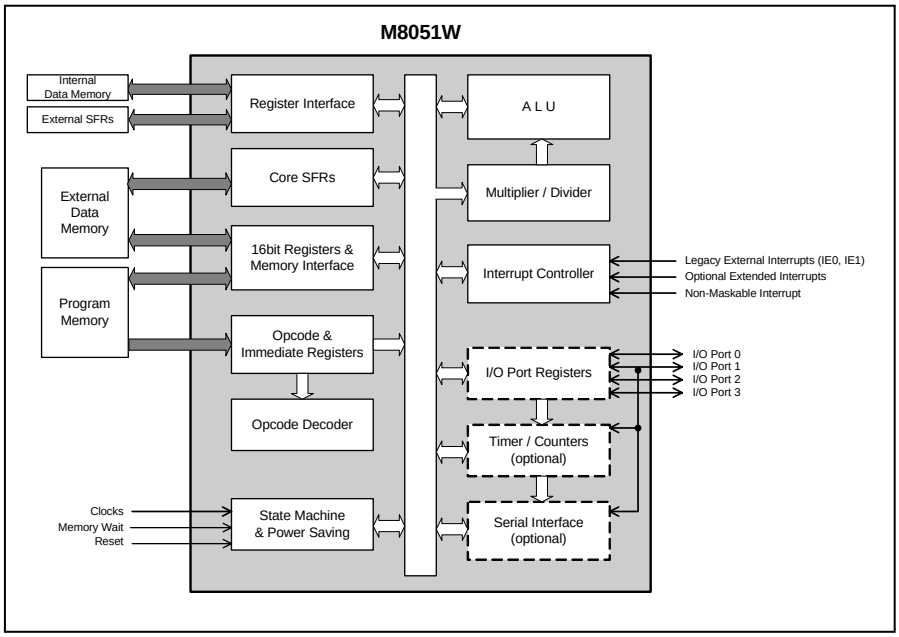
M8051W
Fast 8-bit Microcontroller

Soft Core (RTL IP)

D A T A S H E E T



M8051W Block Schematic

Overview

The M8051W is an exceptionally high performance version of this popular 8-bit microcontroller, requiring just two clocks per machine cycle rather than the 12 clocks per cycle of the industry standard device while keeping functional compatibility with the standard part. This allows the M8051W to run up to six times faster than the standard part for the same power consumption - or to have one sixth of the power consumption when run at the standard speed.

The microcode-free design is software compatible with industry standard discrete devices, having all their core features, as well as additional features corresponding to the Intel 8051/8031/80C51BH/80C31BH/87C51 parts and equivalent 8052 parts. The IP is supported by many 3rd-party C compilers and assemblers. For example, Mentor Graphics uses the C51 compiler from Keil Software for internal development and testing.

The design also features support for both up to 1 Mbyte of Program Memory and up to 1 Mbyte of External Data Memory.

The M8051W can be configured to suit a wide range of user requirements. For example, it can be configured to work with either synchronous or asynchronous memory; it can have separate Program and External Data Memory interfaces or a single multiplexed interface; and it can offer either one, two, four or eight data pointers and up to 24 maskable interrupts at two or four levels of interrupt priority.

Wait state support is provided for slow memory devices.

Major product features:

- Two clocks per machine cycle architecture
- Up to 1 Mbyte of external Data Memory, accessible by a choice of interfaces
- Up to 256 bytes of Internal Data Memory
- Up to 1 Mbyte of RAM or ROM Program Memory, accessible by a choice of interfaces
- Support for synchronous and asynchronous Program, External Data & Internal Data Memory
- Wait states support for slow Program and External Data Memory
- Software compatible with Intel 8051, 8031, 87C51 and 8052 equivalents
- 2 or 3 16-bit timer/counters (optional)
- Full-duplex serial port (optional)
- Intel-compatible I/O ports
- Max 25-source, 2 or 4-level interrupt controller; choice of handling scheme
- Option of 1, 2, 4 or 8 data pointers
- Support for user-defined SFRs
- Separate demultiplexed memory interface ports
- Fully synthesizable
- Scan test ready

Deliverables:

- Verilog & VHDL source code
- Synthesis script for Design Compiler
- Verilog & VHDL testbenches
- Reference technology netlist
- Product Specification & User Guide

Related Products:

- M8051EW Fast 8-bit Microcontroller with On-Chip Debug

Design Features

TWO CLOCK MACHINE CYCLES: This represents the most important feature of the M8051W design, allowing the device either to run at up to six times the speed at the same power consumption or to use one sixth of the power when running at the standard speed.

All instructions have zero-wait-state execution times that are exactly one sixth those of the standard part.

INTERRUPT STRUCTURE: Support is provided for up to 25 separate interrupt sources under two handling schemes, 'Standard' and 'Grouped Priority'. The Vector locations of the interrupts are identical to those used by the Keil Software C51 compiler, allowing their use in conjunction with this compiler.

POWER-SAVING MODES: The M8051W has two power-saving modes: Power Down mode and Idle mode. In Power Down mode, the clock to the entire M8051W is stopped. In Idle mode, the clock to the CPU is stopped but the timer/counters, interrupt controller and serial port remain active.

The peripheral clock driving the interrupt controller, the timer/counters and the serial interface is half the frequency of the core (CPU) clock i.e. once per machine cycle, giving further power savings over the standard 12-state part.

SERIAL PORT AND TIMER/COUNTERS: The inclusion of an optional serial port and timer/counters within the M8051W design simplifies the system design required for a range of possible applications. The serial port is full duplex. It is also receive buffered.

DATA & PROGRAM MEMORY: The M8051W can address up to 1M bytes of Program RAM or ROM and up to 256 bytes of internal Data Memory (implemented as dual-port RAM in the target technology).

The M8051W can also address up to 1M bytes of external Data RAM. This external Data memory is accessed through either the program memory interface or a dedicated memory bus rather than via the I/O ports. The 32 port pins are therefore used exclusively for peripheral I/O.

Slow external data and program memory may assert a memory wait signal to stall CPU activity, whilst leaving peripheral functions unaffected.

Each program and data memory interface may be configured to support either asynchronous or synchronous memory devices.

Note: Two methods are offered for addressing memory above the standard 64Kbytes. One is a built-in 'Memory Extension' scheme. The alternative approach is to use standard code banking techniques. Many standard 8051 assemblers and C compilers (including the Keil compiler recommended above) support code banking.

USER-DEFINED SPECIAL FUNCTION REGISTERS: Depending on the core configuration, up to 119 'External' special function registers (ESFRs) may be added to the M8051EW core, up of 11 which may be bit-addressable.

ESFRs are memory mapped into Direct Memory between addresses 80 hex and FF hex in the same manner as core SFRs and may occupy most addresses not occupied by a core SFR.

Reference Technology Gate Count (Intel-compatible implementation): 8160 (excluding ROM and RAM)

THE M8051 FAMILY OF MICROCONTROLLER CORES

Design	Clocks/ machine cycle	Program Space	Ext. Data Space	Int. Data Bytes	Multiplexed Prog + Data Memory	Synch. Memory Support	Memory Wait States Support	Program Memory Write Instr.	Maskable Interrupt	Non-Maskable Interrupt	Interrupt Levels	Data Pointers	I/O Ports	Timer Counters	UART	Memory Banking	Interface for Extra SFRs	JTAG I/F + Debug s/w
M8051	12	0-64K	0-64K	0-256	✓				5		2	1	4	2	1	✓	✓	
M8052	12	0-64K	0-64K	0-256	✓				6		2	1	4	3	1	✓	✓	
M8051W	2	0-1M	0-1M	0-256	✓	✓	✓	✓	5 – 24	✓	2/4	1/2/4/8	0/4	0/2/3	0/1	✓	✓	
M8051EW	2	0-1M	0-1M	0-256	✓	✓	✓	✓	5 – 24	✓	2/4	1/2/4/8	0/4	0/2/3	0/1	✓	✓	✓

© 1998-2005 Mentor Graphics Corporation, All Rights Reserved.
™Mentor Graphics and Inventra are trademarks of Mentor Graphics Corporation.
All other trademarks are the property of their respective owners.

Corporate Headquarters
Mentor Graphics Corporation
8005 S.W. Boeckman Road
Wilsonville, OR 97070 USA
Phone: 503-685-7000
North American Support Center
Phone: 800-547-4303
Fax: 800-684-1795

Silicon Valley Headquarters
Mentor Graphics Corporation
1001 Ridder Park Drive
San Jose, California 95131 USA
Phone: 408-436-1500
Fax: 408-436-1501

European Headquarters
Mentor Graphics (Deutschland)
Arnulfstrasse 201
80634 München
Germany
Phone: 49-89-57096-0
Fax: 49-89-57096-400

Pacific Rim Headquarters
Mentor Graphics (Taiwan)
Room 1603, 16F,
International Trade Building
No.333, Section 1, Keelung Road
Taipei, Taiwan, ROC
Phone: 886-2-27576020
Fax: 886-2-2756027

Japan Headquarters
Mentor Graphics Japan Co., Ltd.
Gotenyama Hills
7-35, Kita-Shinagawa 4-chome
Shinagawa-Ku, Tokyo 140
Japan
Phone: 81-3-5488-3030
Fax: 81-3-5488-3031

05/05 PD-40091.011-FO