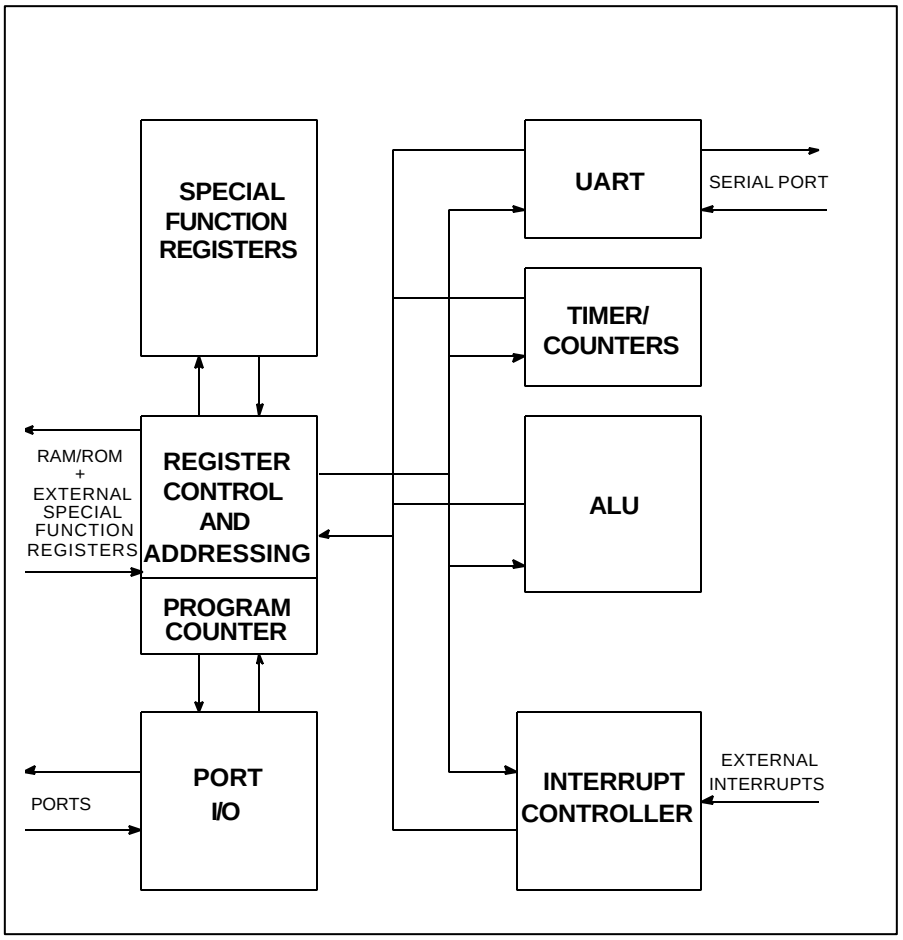
Inventra™ M8051 8-Bit Microcontroller

Soft Core (RTL IP)

D A T A S H E E T



M8051 Block Diagram

Overview

The M8051 is a high performance 8-bit microcontroller.

This microcode-free design is software compatible (including instruction execution times) with industry standard discrete devices, having all their core features, and the additional features corresponding to the Intel 8051/8031/ 80C51BH/80C31BH/87C51 parts except that ONCE mode and Program Lock are not supported.

Major Product Features:

- Software compatible with Intel 8051, 8031, 80C51, 80C31 and 87C51
- Up to 64K bytes of external Data Memory
- Up to 256 bytes of internal Data Memory
- Up to 64K bytes of RAM or ROM Program Memory
- Memory Download mode
- Two 16-bit timer/counters
- Full-duplex serial port
- Power-saving modes
- Support for External SFRs, five of which may be bit-addressable
- Fully synthesizable
- Scan test ready

Deliverables:

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

Related Products:

- M8051W High speed/Low power implementation
- M8051EW High-speed implementation with on-chip debug
- M8052 microcontroller

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Design Features

SERIAL PORT AND TIMER/COUNTERS: These are important features of both the original device and the M8051, simplifying the system design required for a range of possible applications. The serial port is full duplex. It is also receive buffered, allowing the next byte to be received before the previous byte has been read from the receive register.

DATA & PROGRAM MEMORY: The M8051 can address internal Data Memory of up to 256 bytes and internal Program RAM or ROM of up to 64K bytes via the functional interconnect signals. The M8051 can also address up to 64K bytes of external Data RAM, and 64K bytes of external Program ROM via the I/O ports.

PROGRAM MEMORY DOWNLOAD (DLM) MODE: Program Memory may be implemented in RAM, and read/write access to this memory is provided so that it may be "downloaded" from the Master CPU.

MEMORY SIZE REGISTER: The function of this register is to allow a configurable internal memory size for the device. The minimum allowed is 256 bytes, the maximum is 64K bytes.

EXTERNAL SPECIAL FUNCTION REGISTERS: Up to 106 external special function registers (ESFRs) may be added to the M8051 core. ESFRs are memory mapped into Direct Memory between addresses 80 hex and FF hex in the same manner as core SFRs and may occupy any address that is not occupied by a core SFR. ESFRs located at C0, C8, D8, E8 or F8 will be bit-addressable.

Signal Description

The M8051 has 163 external signals: 55 inputs and 108 outputs.

PROCESSOR INPUTS		
SIGNAL	**TYPE**	**DESCRIPTION**
NEA	Input	Not External Access, enables the program counter value onto Port 0 and Port 2 pins
NX1	Input	Clock Input from oscillator
NX2	Input	Clock Input from oscillator, stoppable in Idle mode
AI[7:0]	Input	Input Port 0 Data bits 7 to 0
BI[7:0]	Input	Input Port 1 Data bits 7 to 0
CI[7:0]	Input	Input Port 2 Data bits 7 to 0
DI[7:0]	Input	Input Port 3 Data bits 7 to 0
RST	Input	Used to reset status flags and set PC to zero
ALEI	Input	ALE input, used to select Download mode
PSEI	Input	PSEN input, used to select Download mode

PROCESSOR OUTPUTS		
SIGNAL	**TYPE**	**DESCRIPTION**
OA[7:0]	Output	Output Port 0 Data bits 7 to 0
OB[7:0]	Output	Output Port 1 Data bits 7 to 0
OC[7:0]	Output	Output Port 2 Data bits 7 to 0
OD[7:0]	Output	Output Port 3 Data bits 7 to 0
AE[7:0]	Output	Bidirectional control lines for Port 0 Data
BE[7:0]	Output	Bidirectional control lines for Port 1 Data
CE[7:0]	Output	Bidirectional control lines for Port 2 Data
DE[7:0]	Output	Bidirectional control lines for Port 3 Data
ALE	Output	Address Latch Enable
NPSEN	Output	External Program Memory Enable
NALEN	Output	Bidirectional control line for ALE and PSEN
XOFF	Output	Oscillator disable signal. Used in Power Down mode to stop the device oscillator
IDLE	Output	Idle mode clock qualifier. Used externally in Idle mode to stop the NX2 clock input to the core
FUNCTIONAL INTERCONNECT SIGNALS		
M[15:0]	Output	Program Memory Address lines
MD[7:0]	Input	Program Memory Data Bus
NMOE	Output	Program Memory Output Enable, active low
NMWE	Output	Program Memory Write Strobe, active low
DLM	Output	Download mode, for loading Program Memory
FA[7:0]	Output	Register File Address lines
FO[7:0]	Output	Register File Data Outputs
FI[7:0]	Input	Register File Data Inputs
NFOE	Output	Register File Output Enable, active low
NFWE	Output	Register File Write Strobe, active low
NSFROE	Output	External SFR Output Enable, active low
NSFRWE	Output	External SFR Write Strobe, active low
NESFR	Input	Not External SFR Acknowledge, active low

Note: The functional interconnect signals allow the end user to choose the appropriate memory blocks for each implementation and to configure internal Program memory as downloadable RAM if required.

Power-Saving Modes

The M8051 has two “power-saving” modes: Idle mode and Power Down mode. In Idle mode, the clock to the CPU is stopped but the timer/counters and the serial port are still active. In Power Down mode, the clock to the entire M8051 is stopped.

Reference Technology Gate Count: 9500

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.	Interrupt Sources	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	✓	✓	✓	✓	5/14	✓	2/4	1/2/4/8	0/4	0/2/3	0/1	✓	✓	
M8051EW	2	0-1M	0-1M	0-256	✓	✓	✓	✓	5/14	✓	2/4	1/2/4/8	0/4	0/2/3	0/1	✓	✓	✓

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