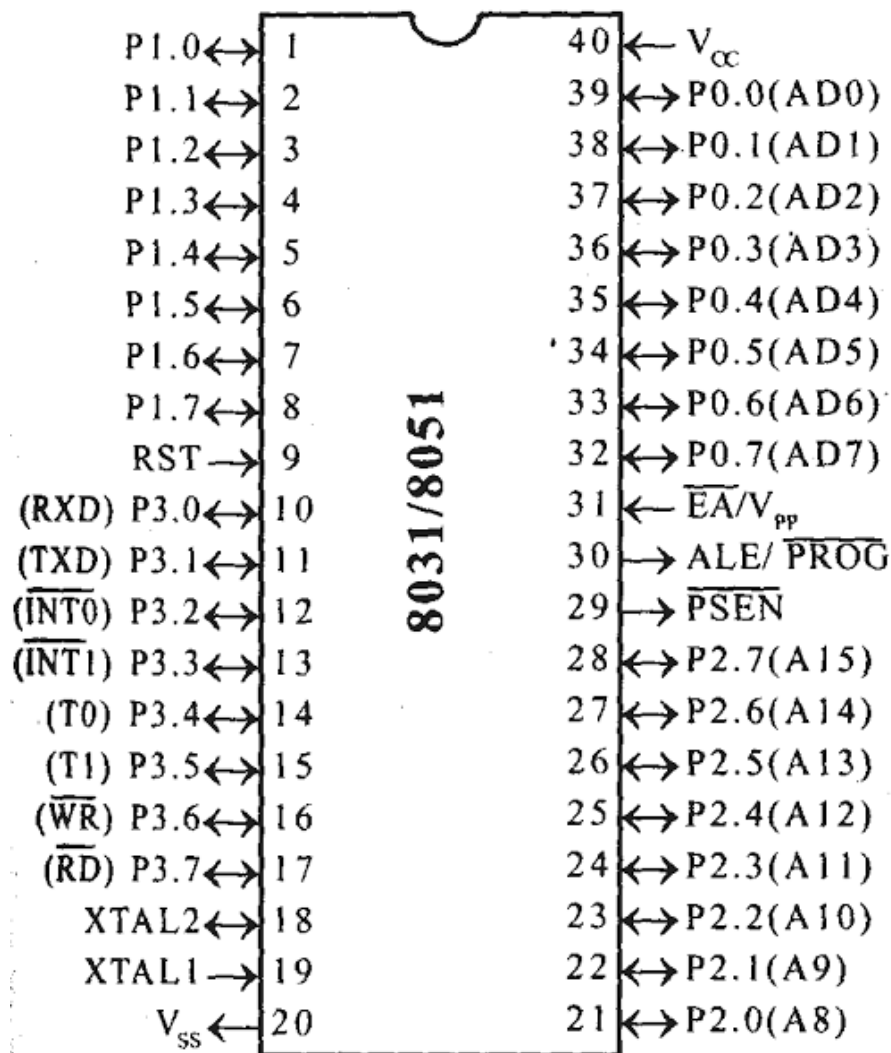# PINS AND SIGNALS OF 8031/8051 MICROCONTROLLER

• The INTEL 805 F is an 8-bit microcontroller with 128 byte internal RAM and 4kb internal ROM.

• The INTEL 8031 is same, as 8051 except that it does not have internal ROM.

• The 8051 is a pin 40 pin IC available in Dual-In line package (DIP).

• Requires a single power supply of +5V.

• Its maximum internal clock frequency rating is 12 MHz.

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         P1.0 ←→  1          40  ← V_cc
         P1.1 ←→  2          39  ←→ P0.0(AD0)
         P1.2 ←→  3          38  ←→ P0.1(AD1)
         P1.3 ←→  4          37  ←→ P0.2(AD2)
         P1.4 ←→  5          36  ←→ P0.3(AD3)
         P1.5 ←→  6          35  ←→ P0.4(AD4)
         P1.6 ←→  7          34  ←→ P0.5(AD5)
         P1.7 ←→  8          33  ←→ P0.6(AD6)
         RST  →   9     1    32  ←→ P0.7(AD7)
   (RXD) P3.0 ←→ 10     5    31  ← EA/V_pp
   (TXD) P3.1 ←→ 11     0    30  → ALE/PROG
  (INT0) P3.2 ←→ 12     8    29  → PSEN
  (INT1) P3.3 ←→ 13     /    28  ←→ P2.7(A15)
    (T0) P3.4 ←→ 14     1    27  ←→ P2.6(A14)
    (T1) P3.5 ←→ 15     3    26  ←→ P2.5(A13)
    (WR) P3.6 ←→ 16     0    25  ←→ P2.4(A12)
    (RD) P3.7 ←→ 17     8    24  ←→ P2.3(A11)
        XTAL2 ←→ 18          23  ←→ P2.2(A10)
        XTAL1 →  19          22  ←→ P2.1(A9)
         V_ss ←  20          21  ←→ P2.0(A8)
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Pin Diagram for 8051/8031 microcontroller

Pins/Signal	Descriptions
P0.7 - P0.0	Port-0 input/output pins.
P1.7 - P1.0	Port-1 input/output pins.
P2.7 - P2.0	Port-2 input/output pins.
P3.7 - P3.0	Port-3 input/output pins.
$\overline{RST}$	Reset input
XTAL1, XTAL2	Pins for crystal connection. The signal at XTAL2 can be used as clock signal for peripherals.
$\overline{PSEN}$	Program store enable. Used as read control or enable for external program memory.
ALE/$\overline{PROG}$	Address Latch Enable or program pulse input during EPROM/ROM programming.
$\overline{EA}/V_{PP}$	External Access or Programming voltage.
V_{CC}	Power supply (+5V)
V_{SS}	Power supply ground (0V)

Signals of 8031/8051 microcontroller

Port pins	Alternate signal	Description
P0.7 - P0.0	AD7 - AD0	Multiplexed low byte address/data.
P2.7 - P2.0	A15 - A8	High byte address
P3.7	$\overline{RD}$	External memory read control signal
P3.6	$\overline{WR}$	External memory write control signal
P3.5	T1	External input to timer 1
P3.4	T0	External input to timer 0
P3.3	$\overline{INT1}$	External interrupt 1
P3.2	$\overline{INT0}$	External interrupt 0
P3.1	TxD	Serial data output
P3.0	RxD	Serial data input

Alternate functions of port pins

Ports: (pin 1 to 8, pin 10 to 17, pin 21 to 28 and pin 32 to 39)

• The 8031/8051 microcontroller has 32 I/O pins and they are organized as four numbers of 8-bit parallel port.

• The ports are denoted as port-0, port-1, port-2 and port-3. Each port can be used as either 8-bit parallel port or 8 numbers of 1-bit ports.

• The ports behave as latches during output operation and behave as buffers during input operation.

• Port-1 can be used only for I/O operation

• When external memory is employed, the port-0 function as multiplexed low byte address or data lines, and port-2 function as high byte address lines. Therefore for accessing external memory the microcontroller uses 16-bit address and access the memory in bytes. Hence the addressable memory space is 64 kb (2^{16} = 64kb).

• The 8031/8051 allows the external memory to be organized as two banks of 64 kb. One is program/code memory and the other is data memory.

PSEN (low signal): pin 29

• The signal PSEN (low) is used as read control/enable for program memory.

RD (low signal) and WR (low signal): pin 17 and pin 16

• The port pin P3.7 function as read control and the port pin P3.6 function as write control for data memory.

• When two external memory banks are not desirable, the PSEN (low) and RD (low) should be externally ANDed to provide a single read control signal. In such cases the controller will access a common memory space (of maximum capacity 64 kb) for program and data.

• ALE is used to demultiplex the low byte address or data using an external latch.

EA (Low)/Vpp : pin 31

• When the microcontroller access program from external memory, then this pin is low. ie. EA (low) is enabled.

• When the microcontroller access program from internal memory, then this pin is high. At that time this

pin is used to supply programming voltage +12V to EPROM/ROM.

XTAL 1 AND XTAL2: PIN 19 AND PIN18

•   The XTAL 1 and XTAL2 pins are provided for external quartz crystal connection, in order to generate the required clock for the microcontroller. The maximum frequency of quartz crystal that can be connected to 8031/8051 microcontroller is 12 MHz.

RST (low): pin 9

•   The RST(low) signal is used to reset the microcontroller in order to bring the controller to a known state.

Register	Content after reset	Register	Content after reset
PC	00_H	SP	07_H
ACC	00_H	TCON	00_H
B	00_H	TH0	00_H
PSW	00_H	TL0	00_H
DPTR	0000_H	TH1	00_H
P0-P3	FF_H	TL1	00_H
IP	$xxx00000_B$	SCON	00_H
IE	$0xx00000_B$	SBUF	Indeterminate
TMOD	00_H	PCON	$0xxx00000_B$

Contents of register after reset

INTERRUPTS: pin 12 to 15

•   The 803 1/8051 has five interrupts.

•   In this two interrupts are external interrupt as INT0 (Low), INT1 (Low) and the remaining three are internal interrupts as timer-0, timer-1 and serial port.

•   All interrupts are maskable and vectored interrupts.

Interrupt	Vector address	Normal priority
External interrupt-0	0003_H	highest
Timer-0 interrupt	$000B_H$	
External interrupt-1	0013_H	
Timer-1 interrupt	$001B_H$	
Serial port interrupt	0023_H	lowest

Vector address and priority of interrupts