NMK322 - Microcontroller

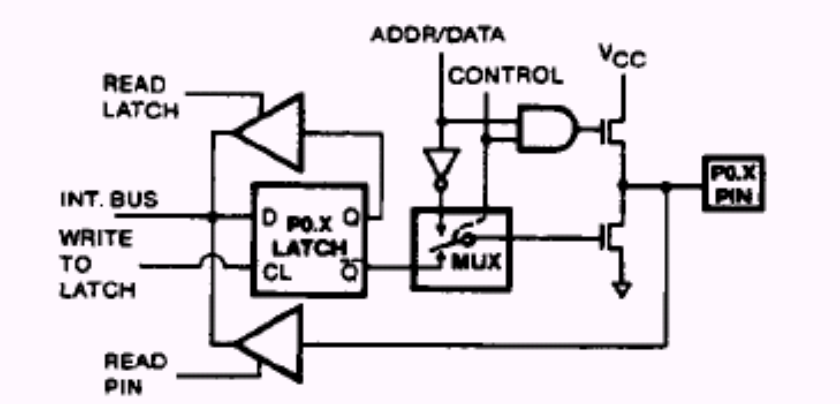
Lecture 04 – 8051 I/O (GPIO)

8051 Input-Output Port

- 4 bi-directional 8-bits I/O Ports
  - each with output driver (register) & input buffer
  - each port assigned an address in SFR (P0=0x80 , P1=0x90 , P2=0xA0 , P3=0xB0)
  - ‘default’ mode: output port
- dual (alternate) functions for some ports
  - P0/P2 as Address/Data bus (external memory)
  - P3 as control lines (bus / timer / counter)
    - P3.0/P3.1 as serial lines (RX/TX)
- not exclusive for 8-bit access
  - each bit/pin is independent

8051 Port P0

- output is open-drain
  - needs external pull-up resistor (e.g. 10K)
- input share same pin
  - latch should be at logic 1 (high)
- dual function
  - ADDRDATA lines for external memory
  - multiplexed as in 8085



P0 as ADDRDATA

- for external code/data memory access
- designated AD0-AD7
  - multiplexed lower byte address (A0-A7) and data (D0-D7)
- ALE pin used to signal address
  - ALE=1 should P0 carries address
  - used to hold A0-A7 in external latch

Using P0

- As output
  - e.g. toggling alternate bits 01010101
  - assume arbitrary delay required

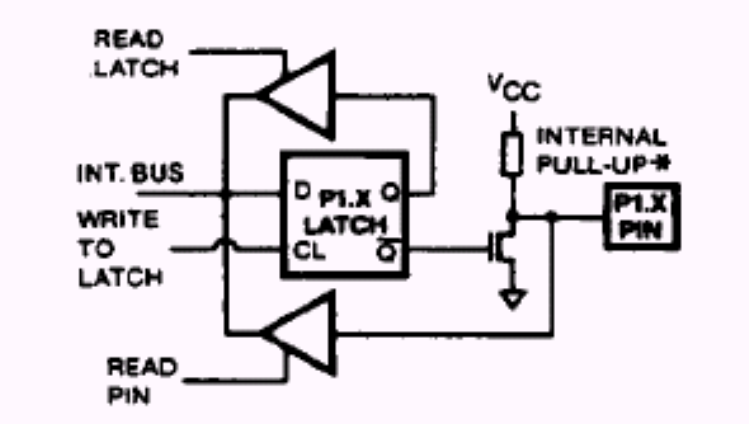
```
P0 = 0x55;
while (1) {
  delay();
  P0 = ~P0;
}
```

- As input
  - ‘copy’ P0 to P1
  - set P0 to bit 1 to ‘configure’ as input

```
P0 = 0xFF;
while (1) {
  P1 = P0;
}
```

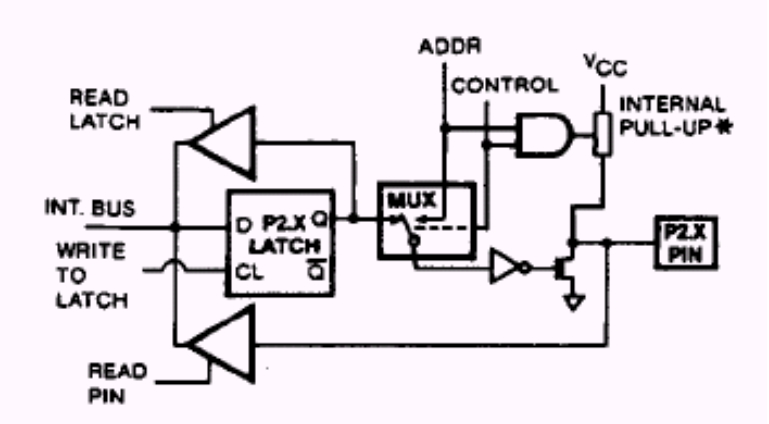
8051 Port P1

- output has internal pull-up resistor
  - external pull-up not needed
- input share same pin
  - if not connected, will be read as logic 1
- no dual function



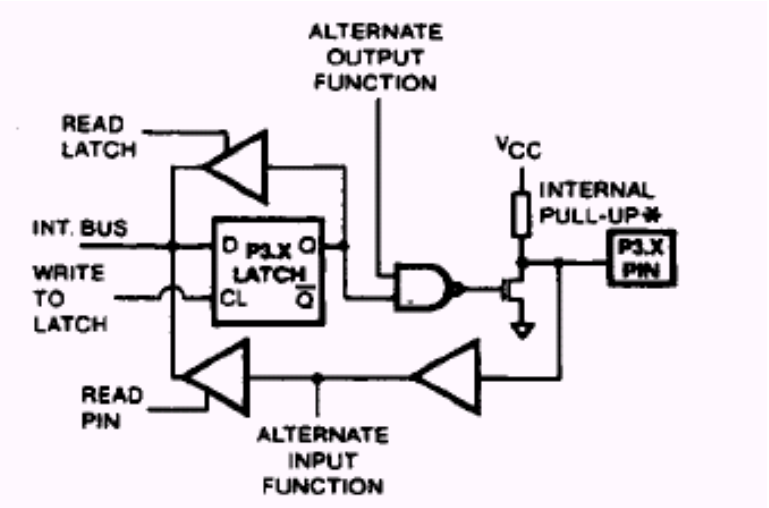
8051 Port P2

- output has internal pull-up resistor
  - external pull-up not needed
- input share same pin
  - if not connected, will be read as logic 1
- dual function
  - ADDR(A8-A15) lines for external memory



8051 Port P3

- output has internal pull-up resistor
  - external pull-up not needed
- input share same pin
  - if not connected, will be read as logic 1
- dual function
  - various functions



P3 Dual (Alternate) Functions

MSB LSB

P3.7	P3.6	P3.5	P3.4	P3.3	P3.2	P3.1	P3.0
$\overline{RD}$	$\overline{WR}$	T1	T0	$\overline{INT1}$	$\overline{INT0}$	TXD	RXD

P3.7	Read Signal (EA)	P3.3	External Interrupt
P3.6	Write Signal (EA)	P3.2	External Interrupt
P3.5	Timer 1 external input	P3.1	Serial Output
P3.4	Timer 0 external input	P3.0	Serial Input

End of Lecture04