GPIO

ATmega1284P

Networks and Embedded Software

Module 4.3.3

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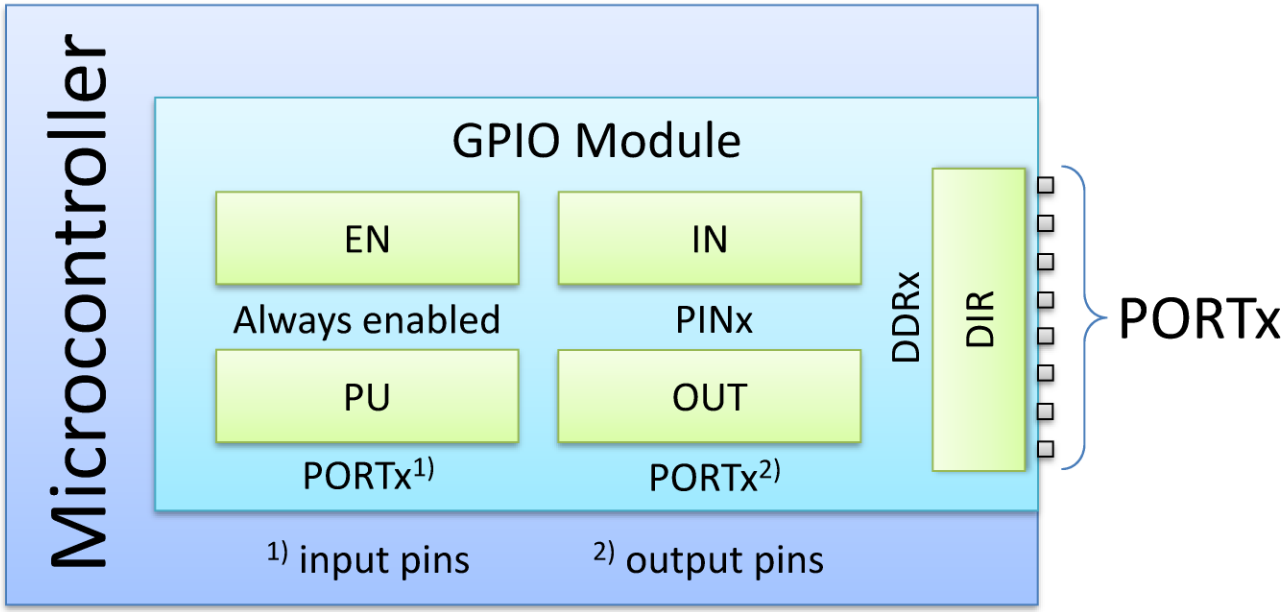
GPIO (1)

- Implementation
  - Pins per Port: 8
  - Name of Ports: A, B, C, D
  - Naming Scheme: REGx
  - Enabling: Enabled by default

GPIO (2)

- Register Mapping



x: A,B,C,D

GPIO (3)

- DDR: Data Direction Register

7	6	5	4	3	2	1	0
DDR[7:0]							

  - Bit 7:0 – DDR: Data Direction
    - 0: pin configured for input
    - 1: pin configured for output
  - Naming Scheme
    - DDRxn (x: port name, n: bit position)

GPIO (4)

- PORT: Data Output Register

7	6	5	4	3	2	1	0
PORT[7:0]							

  - Bit 7:0 – PORT: Data Output Value
    - 0: pin is driven low (outputs 0)
    - 1: pin is driven high (outputs 1)
  - Naming Scheme
    - PORTxn (x: port name, n: bit position)

GPIO (5)

- PORT: Pull-Up Enable Register

7	6	5	4	3	2	1	0
PORT[7:0]							

  - Bit 7:0 – PORT: Pull-Up Enable
    - 0: pull-up resistor is disabled
    - 1: pull-up resistor is enabled
  - Register PORT has two functions
    - DDR[n] = 0: pull-up resistor control
    - DDR[n] = 1: output value

GPIO (6)

- PIN: Data Input Value Register

7	6	5	4	3	2	1	0
PIN[7:0]							

  - Bit 7:0 – PIN: Data Input Value
    - 0: pin indicates low voltage (input is 0)
    - 1: pin indicates high voltage (input is 1)
  - Naming Scheme
    - PINxn (x: port name, n: bit position)

GPIO (7)

- Configuration Example
  - Active low LED on pin 0 and 1 of port A
  - Initialization

Initialisation is often done by assignment

    - Data direction is output
      - DDRA = ((1 << DDRA0) | (1 << DDRA1));
    - Initial state: LED 0 -> on, LED 1 -> off
      - PORTA = (1 << PORTA1);

GPIO (8)

- Configuration Example (continued)
  - Operation
    - Switch LED 0 off and LED 1 on
      - PORTA |= (1 << PORTA0);
      - PORTA &= ~(1 << PORTA1);

Change is done by bit manipulation

GPIO (9)

- Configuration Example
  - Active low button on pin 0 of port A
  - Initialization
    - Data direction is input
      - DDRA = 0x00;
    - Activate pull up resistor
      - PORTA = (1 << PORTA0);

GPIO (10)

- Configuration Example (continued)
  - Operation
    - Read the active low button
      - if (!(PINA & (1 << PINA0))) {…}

The button is active low. So we have to **test** (&) if the **bit** is **logically not** (!) set.

GPIO (11)

- Register Summary (continued)

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
PORTx	**PORTx7**	**PORTx6**	**PORTx5**	**PORTx4**	**PORTx3**	**PORTx2**	**PORTx1**	**PORTx0**
DDRx	**DDRx7**	**DDRx6**	**DDRx5**	**DDRx4**	**DDRx3**	**DDRx2**	**DDRx1**	**DDRx0**
PINx	**PINx7**	**PINx6**	**PINx5**	**PINx4**	**PINx3**	**PINx2**	**PINx1**	**PINx0**
MCUCR	JDT	BODS	BODSE	PUD	-	-	IVSEL	IVCE
EICRA	-	-	ISC21	ISC20	ISC11	ISC10	ISC01	ISC00
EIMSK	-	-	-	-	-	INT2	INT1	INT0

GPIO (12)

- Interrupt Summary

Source	Description
INT0_vect	External interrupt vector 0
INT1_vect	External interrupt vector 1
INT2_vect	External interrupt vector 2