GPIO

ATxmega128A1

Networks and Embedded Software

Module 4.3.3

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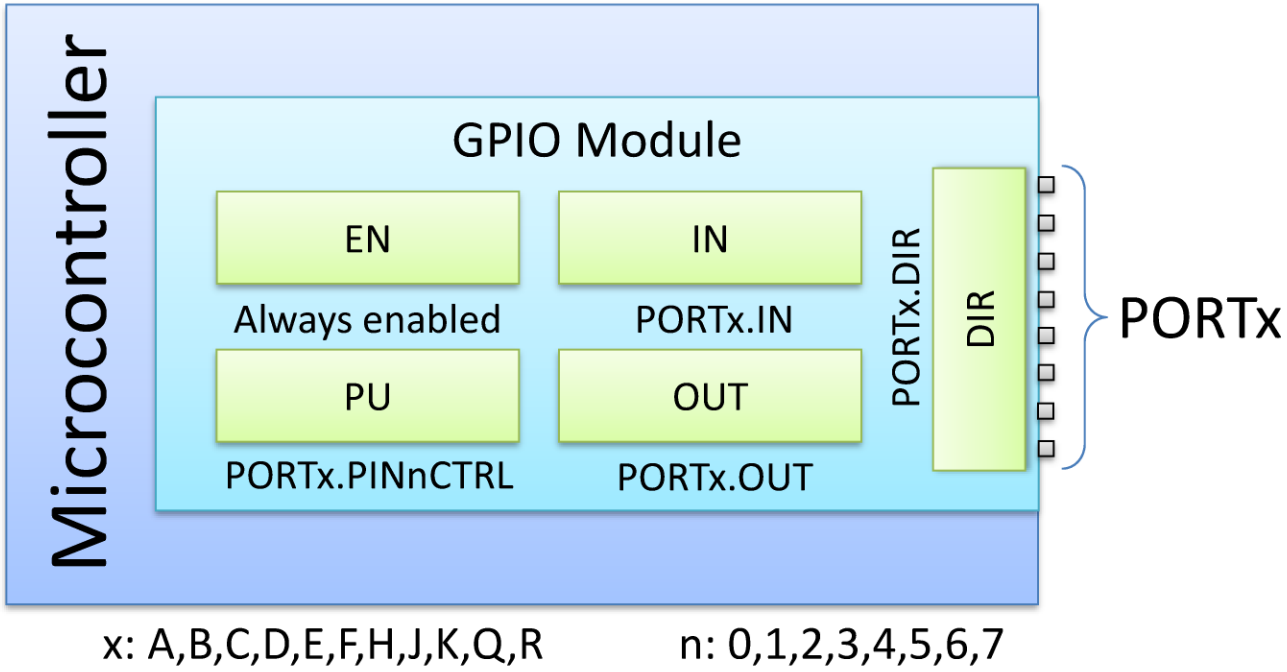
GPIO (1)

- Implementation
  - Pins per Port: 8
  - Name of Ports: A, B, C, D, E, F, H, J, K, Q, R
  - Naming Scheme: PORTx.REG
  - Enabled by default
  - Complex Pin Configuration
    - One configuration register per pin
    - Pull-up configuration, pin inversion, etc.

GPIO (2)

- Register Mapping



GPIO (3)

- DIR: Data Direction Register

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

  - Bit 7:0 – DIR: Data Direction
    - 0: pin configured for input
    - 1: pin configured for output
  - Naming Scheme
    - `PINn_bm` (n: bit position)

GPIO (4)

- OUT: Data Output Register

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

  - Bit 7:0 – OUT: Data Output Value
    - 0: pin is driven low (outputs 0)
    - 1: pin is driven high (outputs 1)
  - Naming Scheme
    - `PINn_bm` (n: bit position)

GPIO (5)

- IN: Data Input Register

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

  - Bit 7:0 – IN: Data Input Value
    - 0: pin indicates low voltage (input is 0)
    - 1: pin indicates high voltage (input is 1)
  - Naming Scheme
    - `PINn_bm` (n: bit position)

GPIO (6)

- PINnCTRL: Pin n Configuration Register

7	6	5	4	3	2	1	0
SRLEN	INVEN	OPC			ISC		

  - One Register per Pin
  - Bit 5:3 – OPC: Output and Pull Configuration
    - `PORT_OPC_PULLDOWN_gc`: enable pull-down resistor
    - `PORT_OPC_PULLUP_gc`: enable pull-up resistor

GPIO (7)

- Configuration Example
  - Active low LED on pin 0 and 1 of port A
  - Initialization
    - Data direction is output
      - PORTA.DIR = (PIN0_bm | PIN1_bm);
    - Initial state: LED 0 -> on, LED 1 -> off
      - PORTA.OUT = PIN1_bm;

Initialisation is often done by assignment

GPIO (8)

- Configuration Example (continued)
  - Operation
    - Switching LED 0 off and LED 1 on
      - PORTA.OUT |= PIN0_bm;
      - PORTA.OUT &= ~PIN1_bm;

Change is done by bit manipulation

GPIO (9)

- Configuration Example
  - Active low button on pin 0 of port A
  - Initialization
    - Data direction is input
      - Ports are input by default so nothing to do here
    - Activate pull up resistor
      - PORTA.PIN0CTRL = PORT_OPC_PULLUP_gc;

GPIO (10)

- Configuration Example (continued)
  - Operation
    - Reading the active low button
      - if (!(PORTA.IN & PIN0_bm)) {…}

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

GPIO (11)

- Register Summary

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
DIR	**DIR[7:0]**							
DIRSET	DIRSET[7:0]							
DIRCLR	DIRCLR[7:0]							
DIRTGL	DIRTGL[7:0]							
OUT	**OUT[7:0]**							
OUTSET	OUTSET[7:0]							
OUTCLR	OUTCLR[7:0]							
OUTTGL	OUTTGL[7:0]							

GPIO (12)

- Register Summary (continued)

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IN	**IN[7:0]**							
INTCTRL	-	-	-	-	INT1LVL		INT0LVL	
INT0MASK	INT0MASK[7:0]							
INT1MASK	INT1MASK[7:0]							
INTFLAGS	-	-	-	-	-	-	INT1IF	INT0IF
PIN0CTRL	SRLEN	INVEN	**OPC[2:0]**			ISC[2:0]		
…	…							
PIN7CTRL	SRLEN	INVEN	**OPC[2:0]**			ISC[2:0]		

GPIO (13)

- Interrupt Summary

Source	Description
PORTx_INT0_vect	PORTx interrupt vector 0
PORTx_INT1_vect	PORTx interrupt vector 1