

ATmega328 GPIO Bitwise Operations Cheat Sheet

Registers

DDRx: Set pin direction (0 = input, 1 = output)
PORTx: Write to output pin / enable pull-up resistor
PINx: Read input pin state
(x = B, C, or D for PORTB, PORTC, PORTD)

Bitwise Operators

| : Set (turn ON) specific bits
& : Check or clear (mask) specific bits
~ : Invert bits (used for clearing)
^ : Toggle specific bits
<< : Shift bit left (used for creating bit masks)

Common GPIO Operations

Set pin as output : `DDRB |= (1 << PB5);`
Set pin as input : `DDRB &= ~(1 << PB5);`
Set pin HIGH (output) : `PORTB |= (1 << PB5);`
Set pin LOW (output) : `PORTB &= ~(1 << PB5);`
Toggle pin state : `PORTB ^= (1 << PB5);`
Enable pull-up resistor : `PORTB |= (1 << PB5);`
Disable pull-up resistor : `PORTB &= ~(1 << PB5);`
Read pin state : `if (PINB & (1 << PB5)) { /* Pin HIGH */ }`

Example: Blinky LED on PB5

```
#define F_CPU 16000000UL
#include <avr/io.h>
#include <util/delay.h>

int main(void) {
    DDRB |= (1 << PB5);    // Set PB5 as output

    while (1) {
        PORTB ^= (1 << PB5); // Toggle PB5
        _delay_ms(500);
    }
}
```