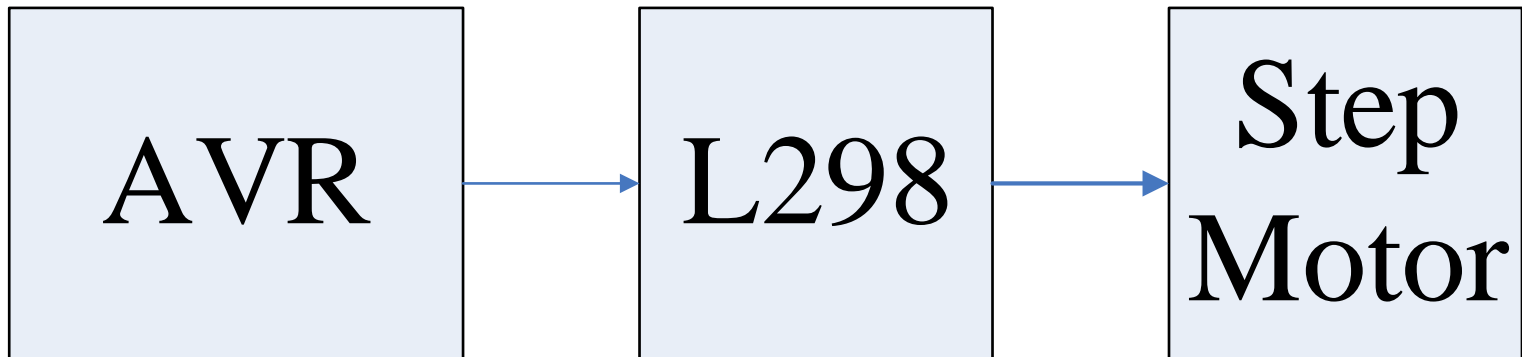


Stepper motor control

- Use AVR chip as main control unit , L298 As the driver chip . Control block diagram is as follows :



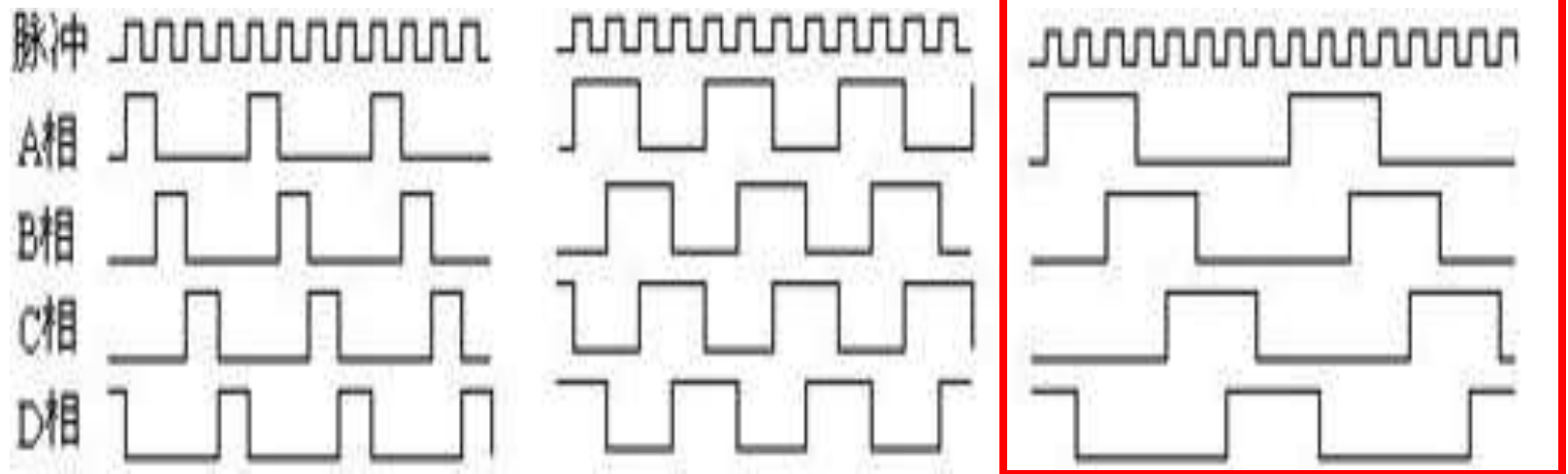


Stepper motor

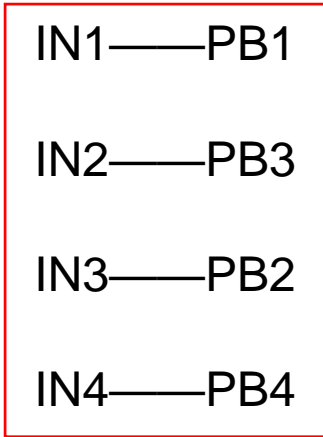
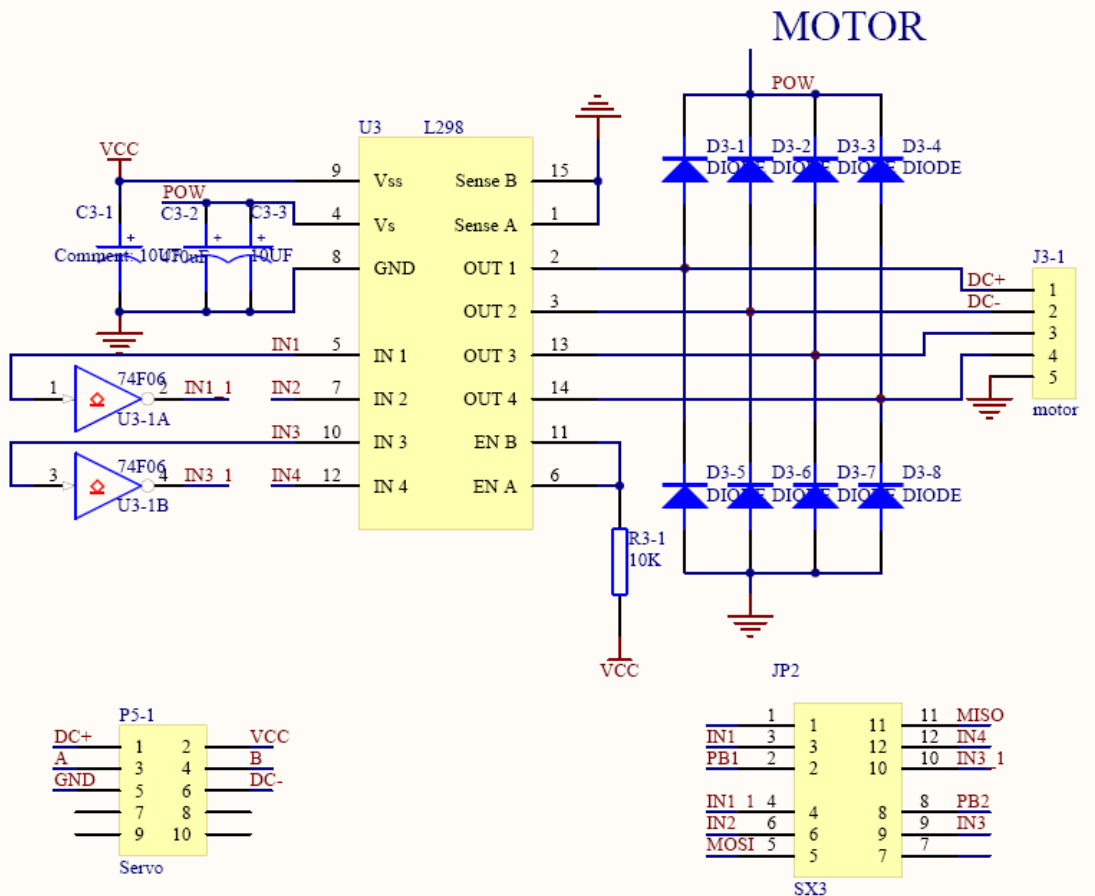
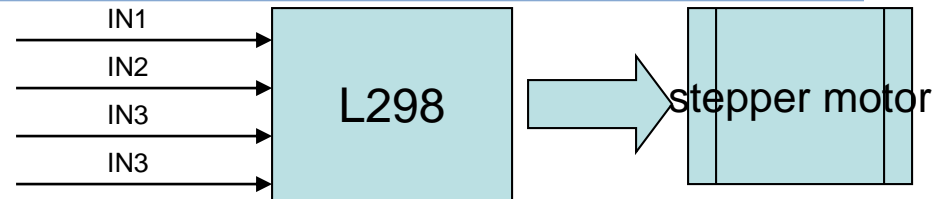
- **Displacement: proportional to the input pulse number strictly**
- **Rotating speed: proportional to the pulse frequency**
- **Direction: related to the winding way of**

Four phase eight beats circular distributor numerical tables as follows

No.	A	B	C	D	Dir
1	1	0	0	0	Reverse ↓ ↑
2	1	1	0	0	
3	0	1	0	0	
4	0	1	1	0	
5	0	0	1	0	
6	0	0	1	1	Forward ↓ ↑
7	0	0	0	1	
8	1	0	0	1	



Stepper motor module



Stepper motor layout

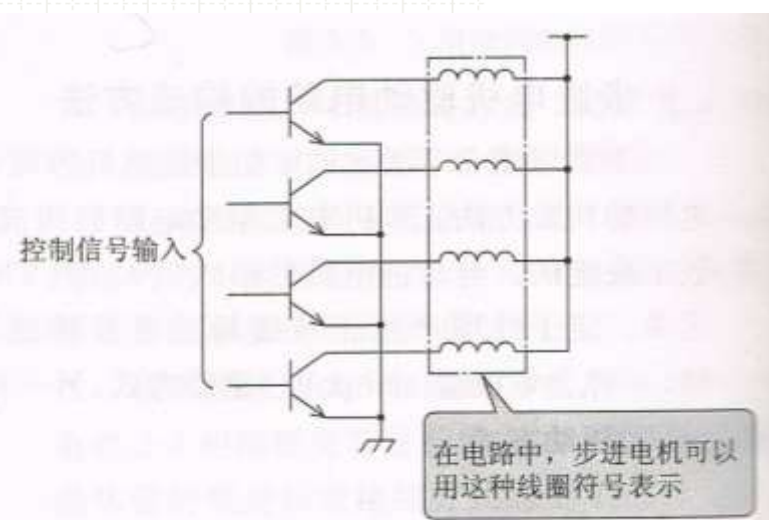
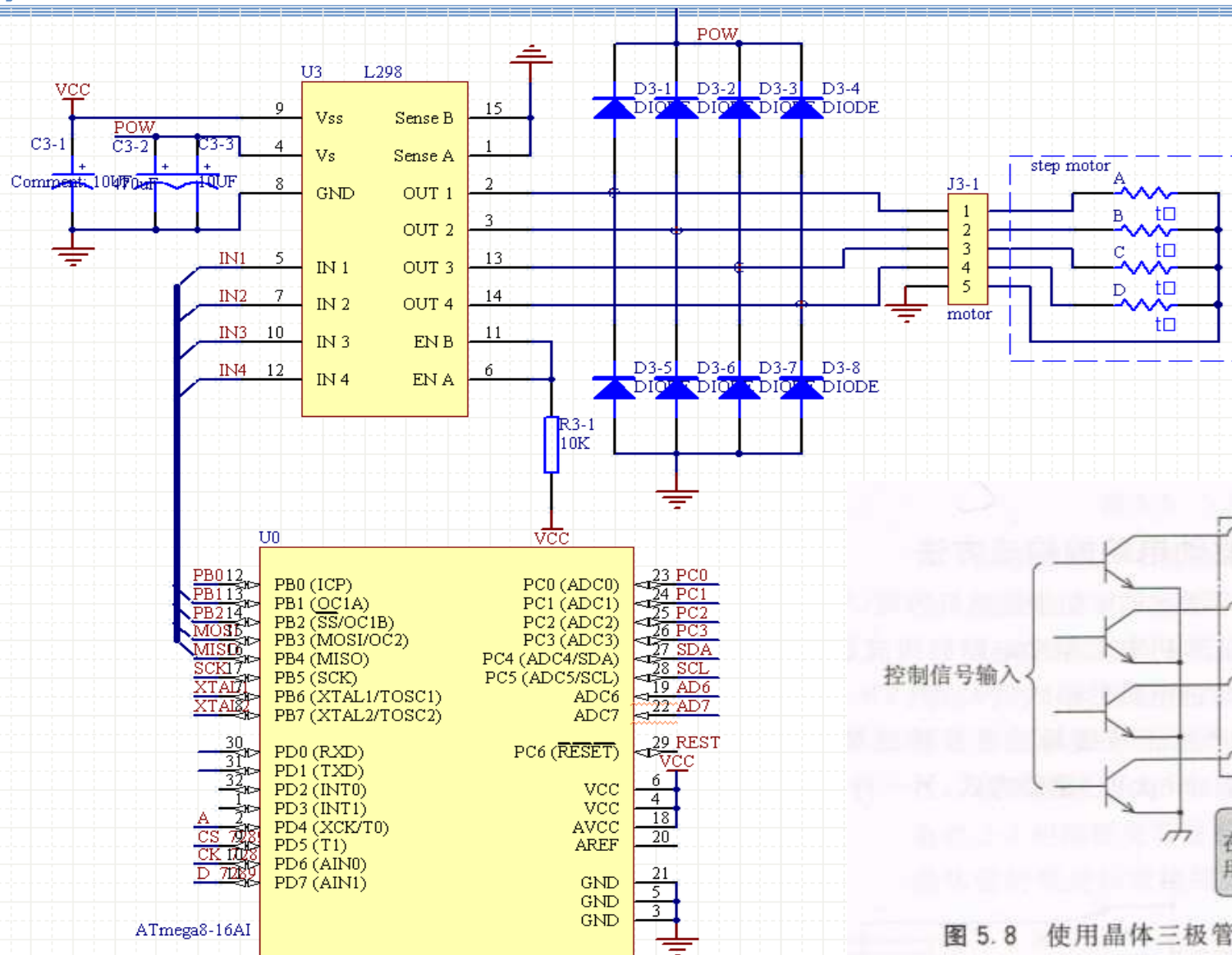
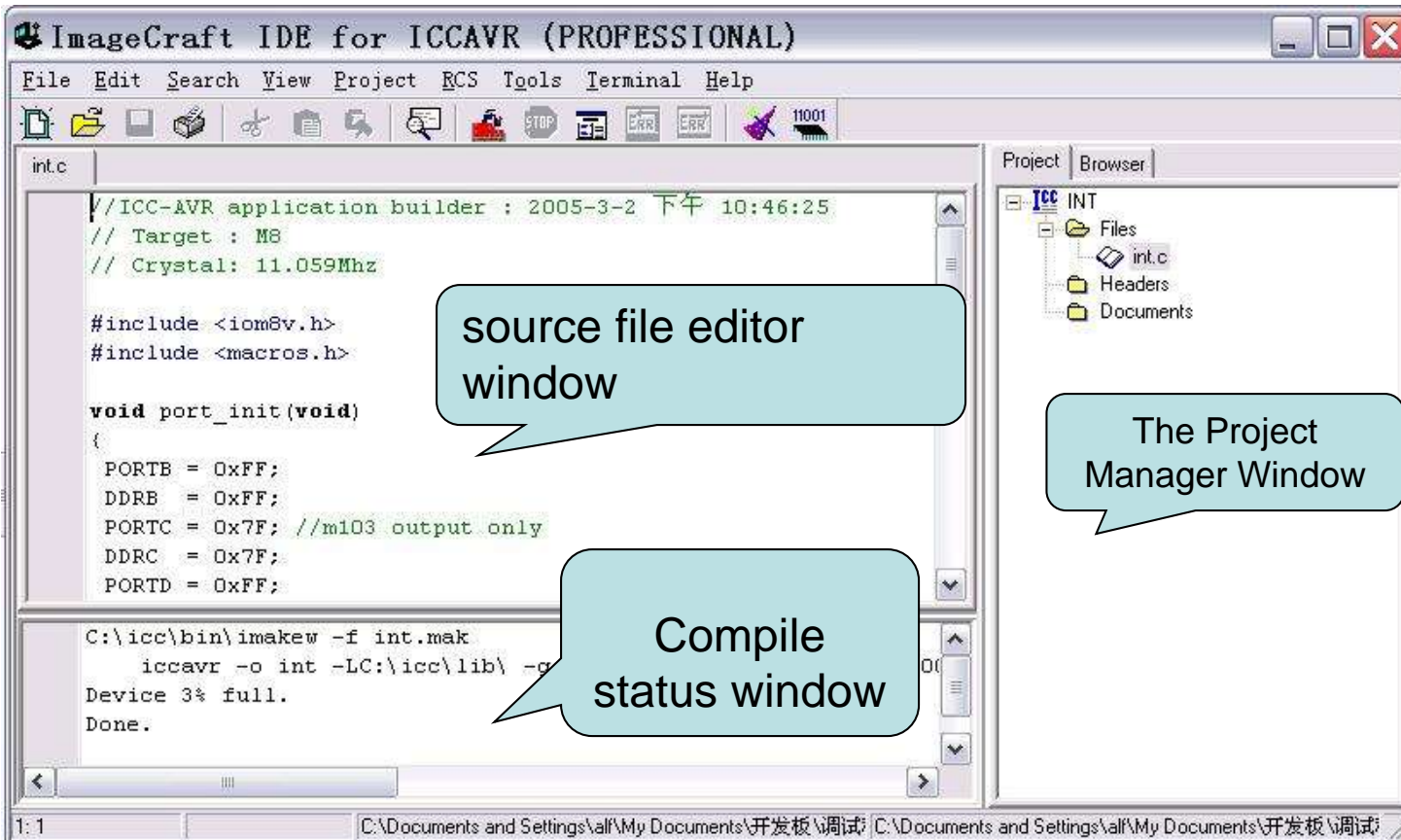
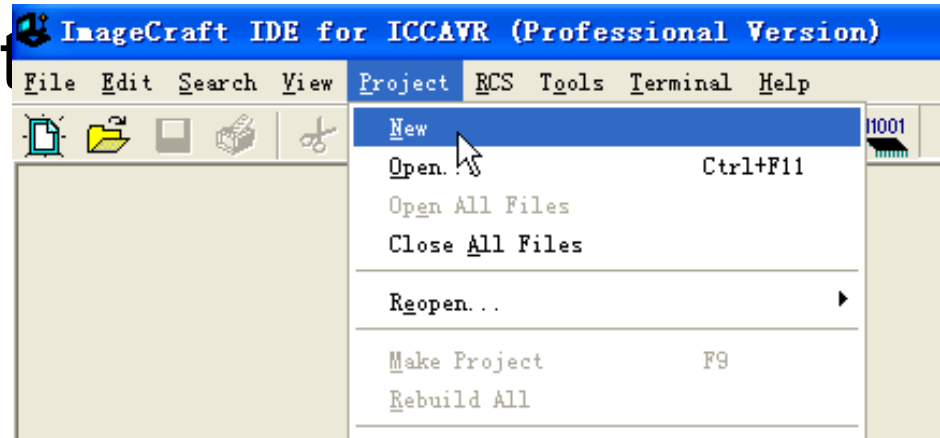


图 5.8 使用晶体三极管的单极型驱动电路

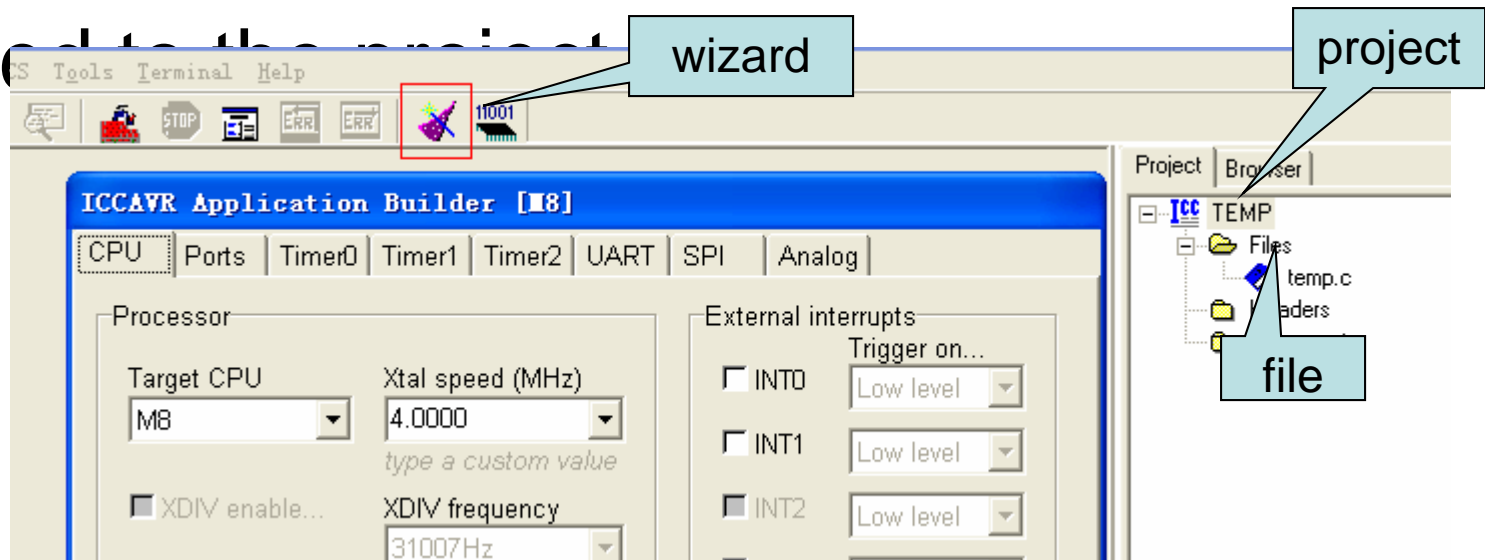
• ICCAVR main interface



- Build a new project



- The wizard is used to establish the file, added to the project



Choose the chip and XTL :

- as follows , the chip is Atmega64, XTL is 11.059MHz , External interrupt 4 (rising along the trigger)

ICCAVR Application Builder [M64]

CPU | Memory | Ports | Timer0 | Timer1 | Timer2 | Timer3 | UART | SPI | Analog

Processor

Target CPU: M64
Xtal speed (MHz): 11.059
type a custom value

PLL enable
 XDIV enable...
XDIV frequency: 85728Hz

Watchdog timer
 Enable
Prescale cycles: 16K

External interrupts

Trigger on...

INT0: Low level
 INT1: Low level
 INT2: Low level
Edge
 INT3: Low level

INT4: Rising edge

• I/Osetting

Port B								
	7	6	5	4	3	2	1	0
Direction	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Port C								
	7	6	5	4	3	2	1	0
Direction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Value	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Change	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Port D								
	7	6	5	4	3	2	1	0
Direction	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

```
(  
PORTB = 0xF5; //1111 0101  
DDRB = 0x03; //0000 0011  
PORTC = 0x7F; //m103 output only  
DDRC = 0x00;
```

select the corresponding state according to the need。
in the graphic :
PB0 output high level;
PB1 output low level;
PB3 is high resistance 。

Progisp

function: download the program from PC to MCU

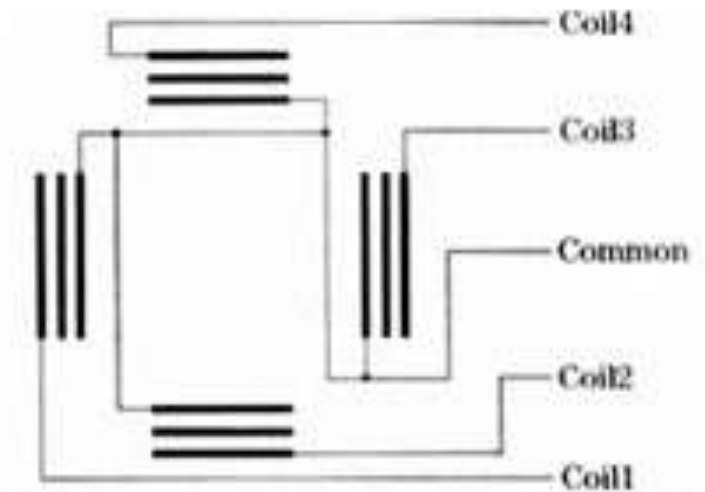


- Choose chip ATmega 8
- Set the programming options (choose the chip erase, programming FLASH, calibration FLASH) ->Load Flash->click automation

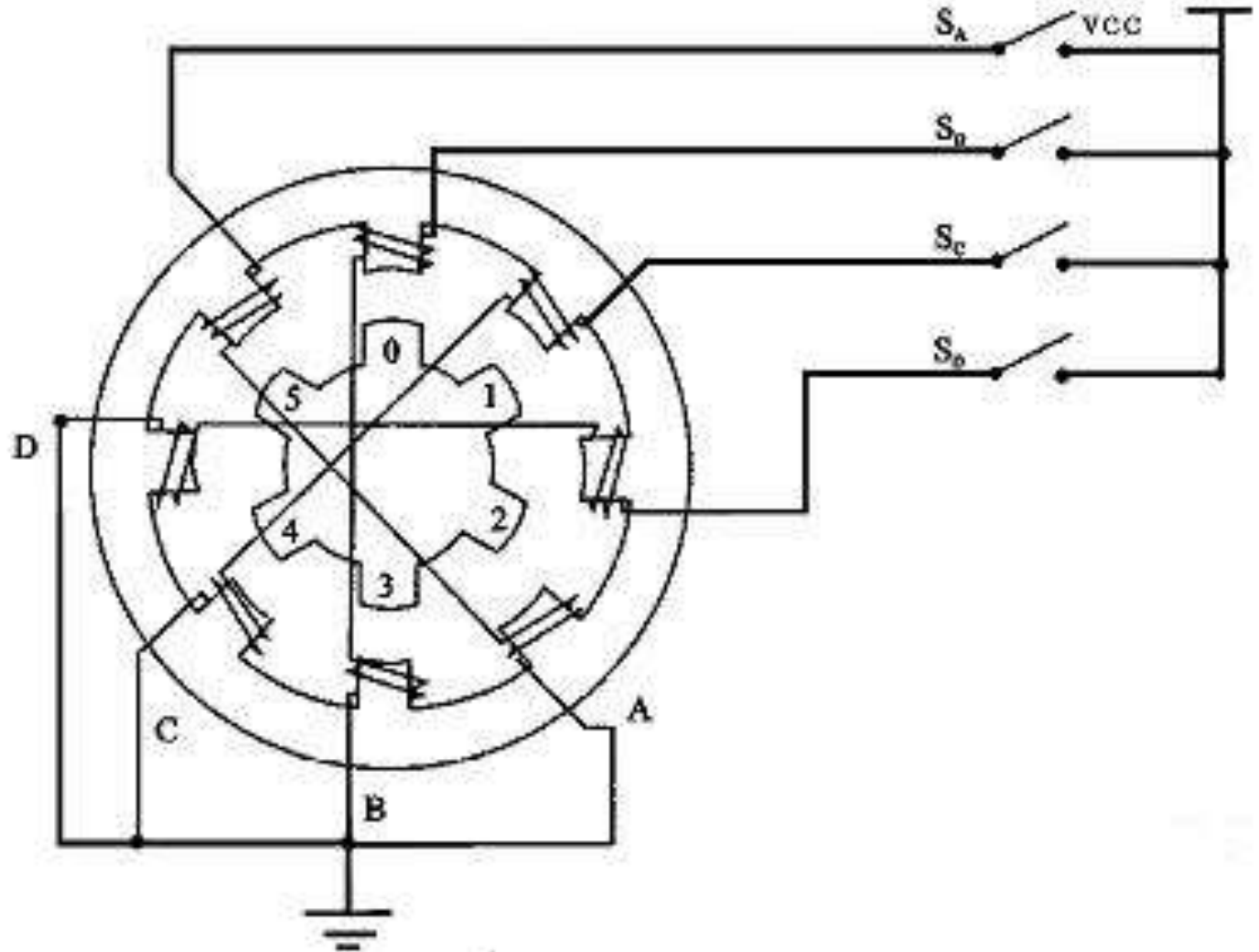


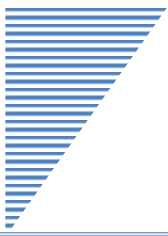
The stepper motor

24BYJ48A



Step motor schematics





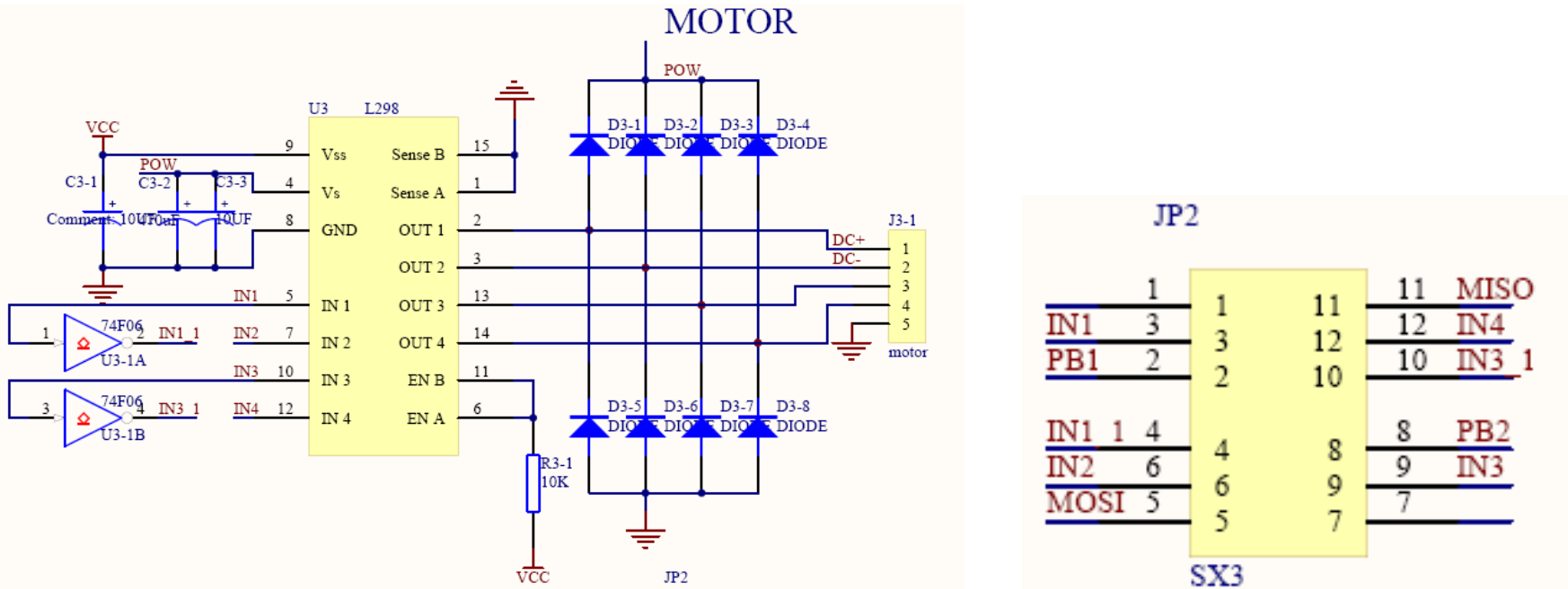
- **Stepper motor speed control**

Control stepping motor speed is to control pulse frequency or phase of the cycle.

Two way:

- ❖ **software delay: By calling the delay subroutine method, it takes up CPU time.**
- ❖ **Timer : By setting the TOCNT register.**

Stepper motor drive circuit



Jumpers: 3---2、6---5、9---8、12---11。

PB1(OC1A)、PB3(MOSI)、PB2(OC1B)、PB4(MISO) respectively control A、B、C、D phase.

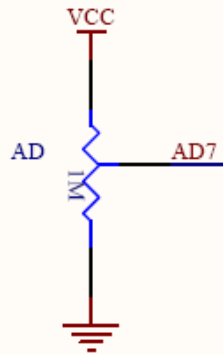


Three sets of control scheme

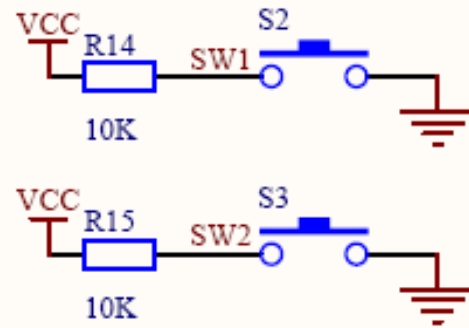
- Pure MCU program control
- Potentiometer and the button control
- upper computer control

AD sampling circuit and press buttons

AD



KEY



MCU AD samples analog voltage value to control the speed of the stepper motor.

Two buttons control the direction of stepping motor.



Four phase control

- 1、 Four phase four beat: **A->B->C->D->A**
- 2、 Four phase double four beat:
AB->BC->CD->DA->AB
- 3、 four phase eight beat:
A-> AB-> B->BC-> C-> CD -> D-> DA->A

Impulse generator

➤ Define 8 macro

```
#define A() (PORTB = 0B00000010)
```

```
#define B() (PORTB = 0B00001000)
```

```
#define C() (PORTB = 0B00000100)
```

```
#define D() (PORTB = 0B00010000)
```

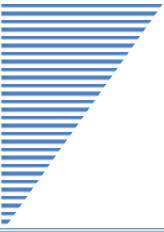
```
#define AB() (PORTB = 0B00001010)
```

```
#define BC() (PORTB = 0B00001100)
```

```
#define CD() (PORTB = 0B00010100)
```

```
#define DA() (PORTB = 0B00010010)
```

引脚 PB1: A相
PB3: B相
PB2: C相
PB4: D相



```
if(step == 0) A();  
else if(step == 1) AB();  
else if(step == 2) B();  
else if(step == 3) BC();  
else if(step == 4) C();  
else if(step == 5) CD();  
else if(step == 6) D();  
else if(step == 7) DA();  
step++;  
if(step == 8) step = 0;
```



What we do now

- **1、** What kind of pulse we need?
- **2、** How to generate the pulse ?
 - How to produce a certain number of pulse ?
 - How to produce the required frequency pulse ?

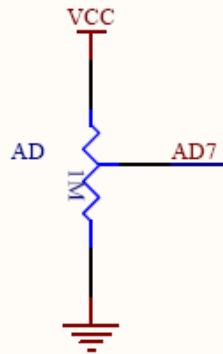


How to generate pulse signal

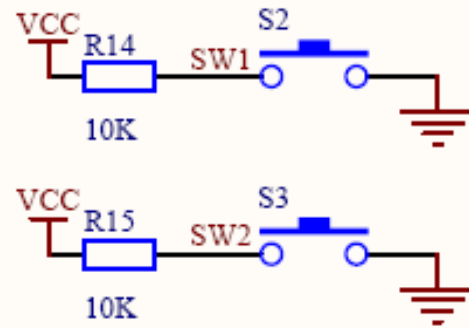
- **Timer of the MCU --- generate pulse**
 - Regularly produce beats
 - Use PWM function
- **Timer generates a certain number of pulse.**
- **Change winding current order in Overflow timer interrupt.**
- **Change the timing - to produce the required frequency pulse.**

AD sampling circuit and buttons

AD



KEY



MCU AD samples analog voltage value to control the speed of the stepper motor.

Two buttons control the direction of stepping motor.