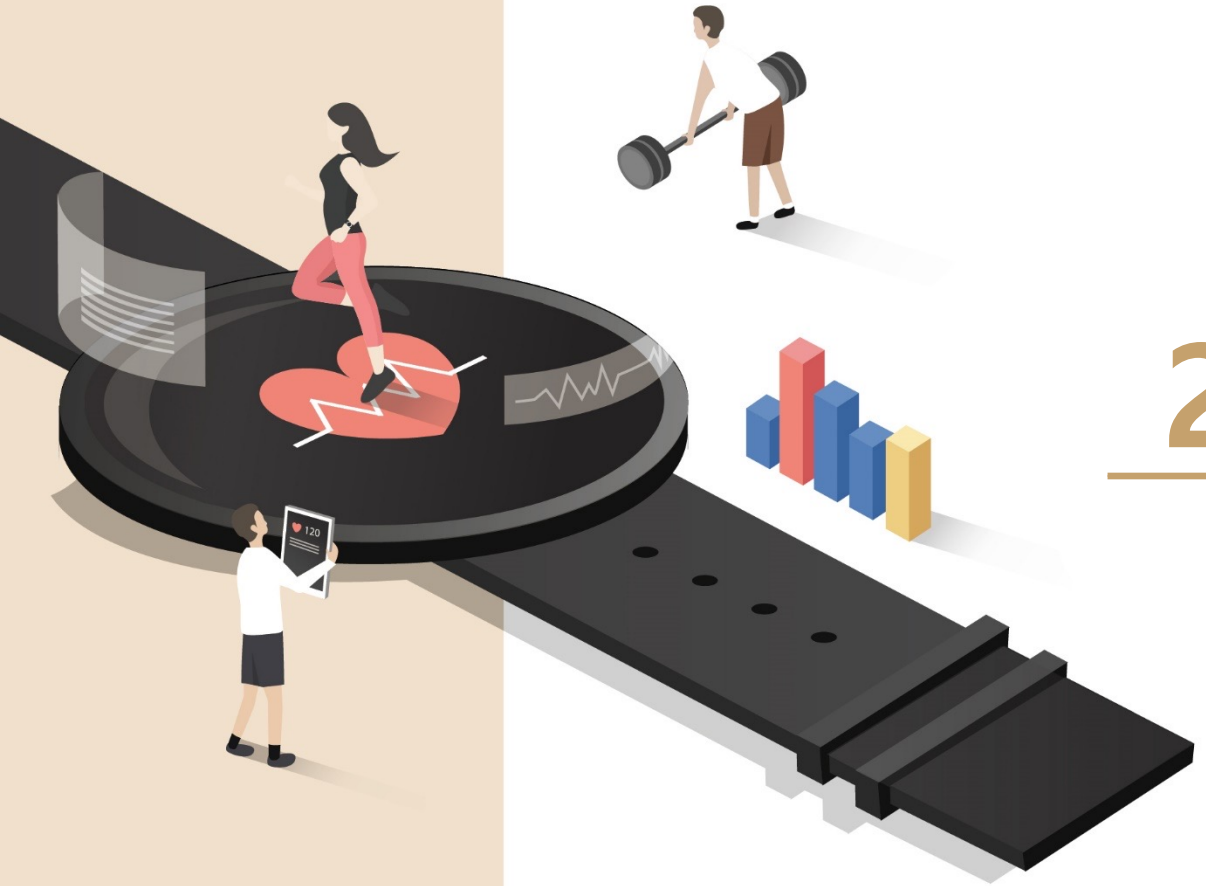
Mobile System Engineering, Dankook University

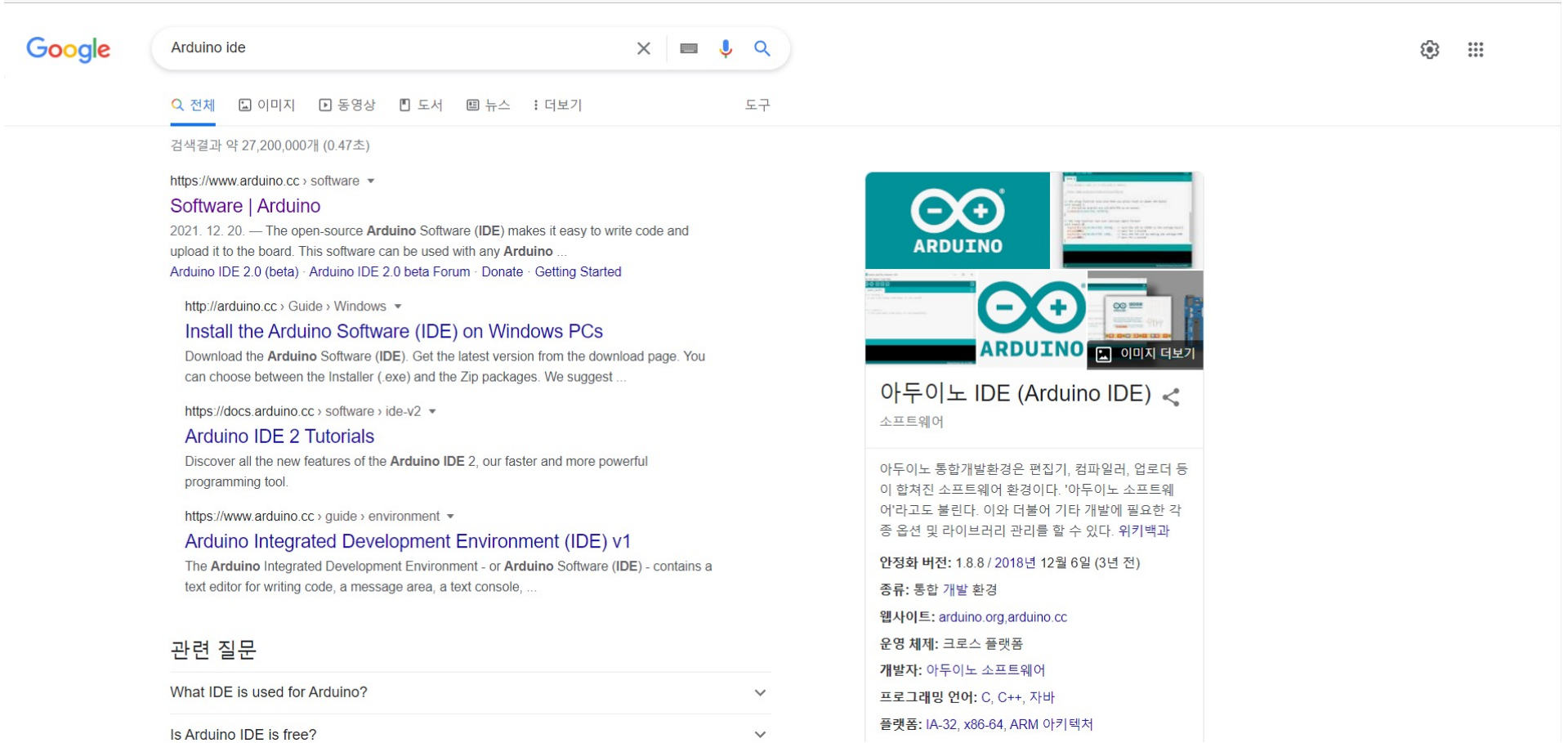
Basic Mobile Lab II

DKU 단국대학교 DANKOOK UNIVERSITY



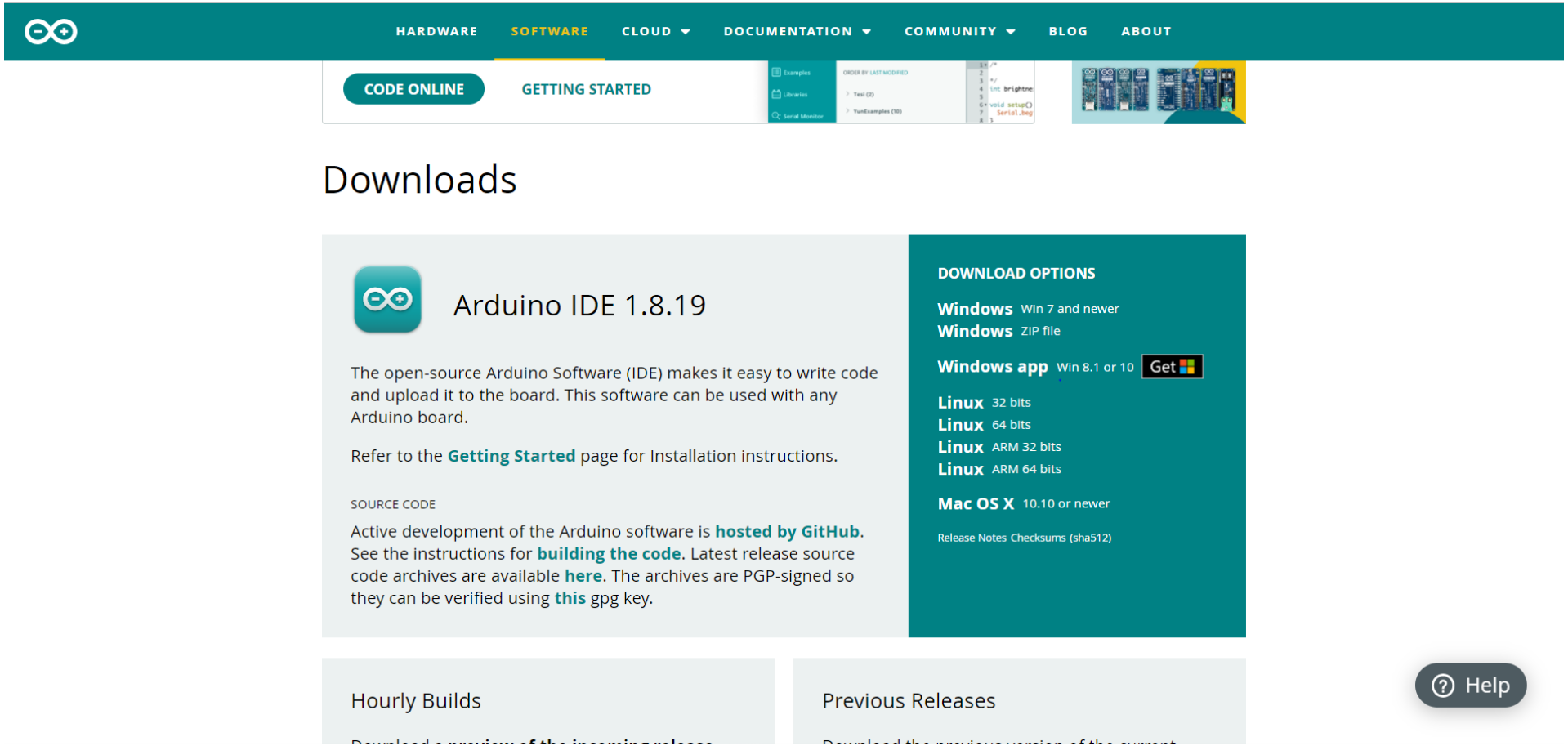
2 PWM Experiment

1 PWM Experiment



1. Search ‘Arduino IDE’ on Google
2. Click ‘Software | Arduino’

2 PWM Experiment

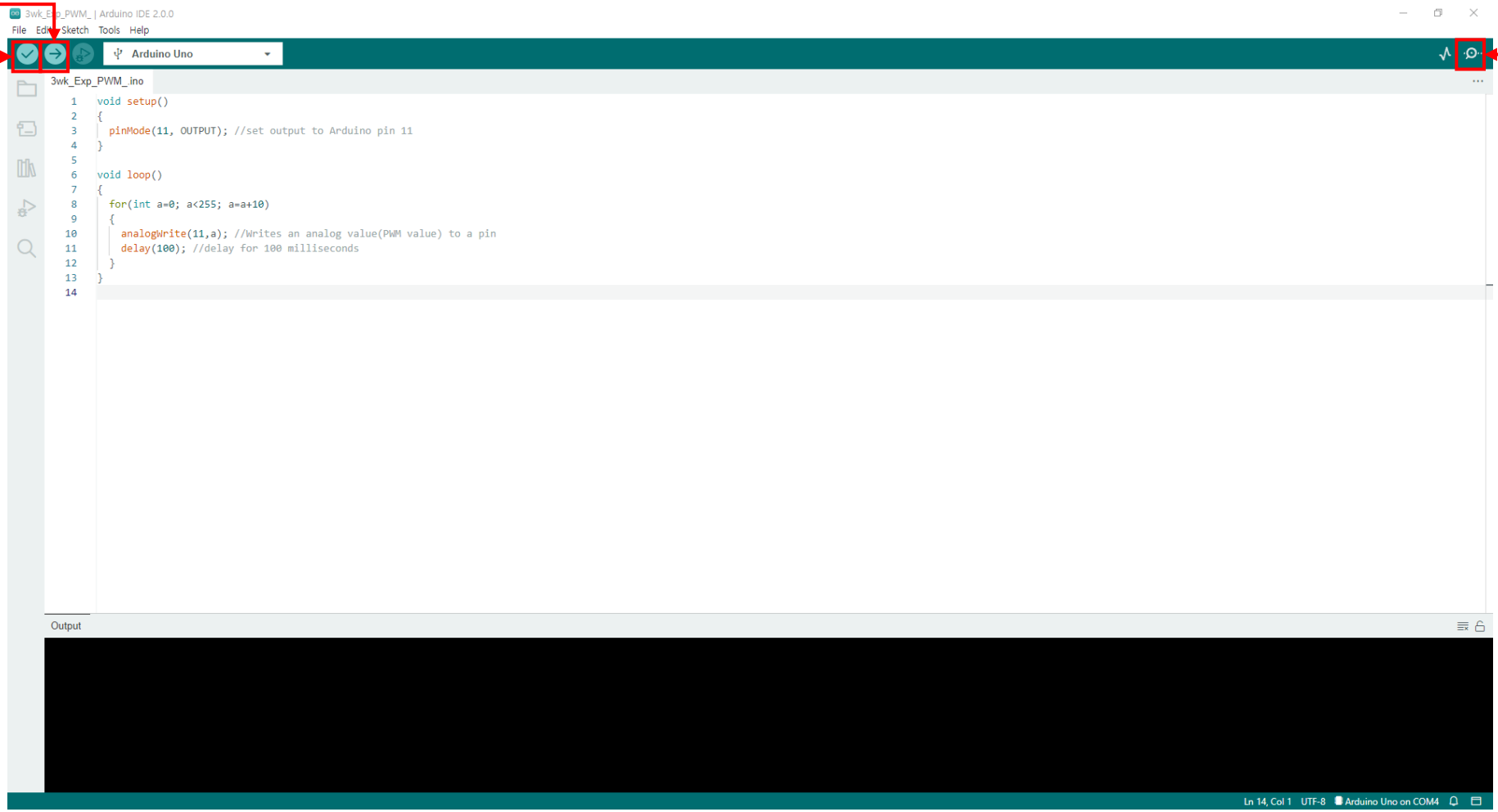


3. Download and install it

3 PWM Experiment

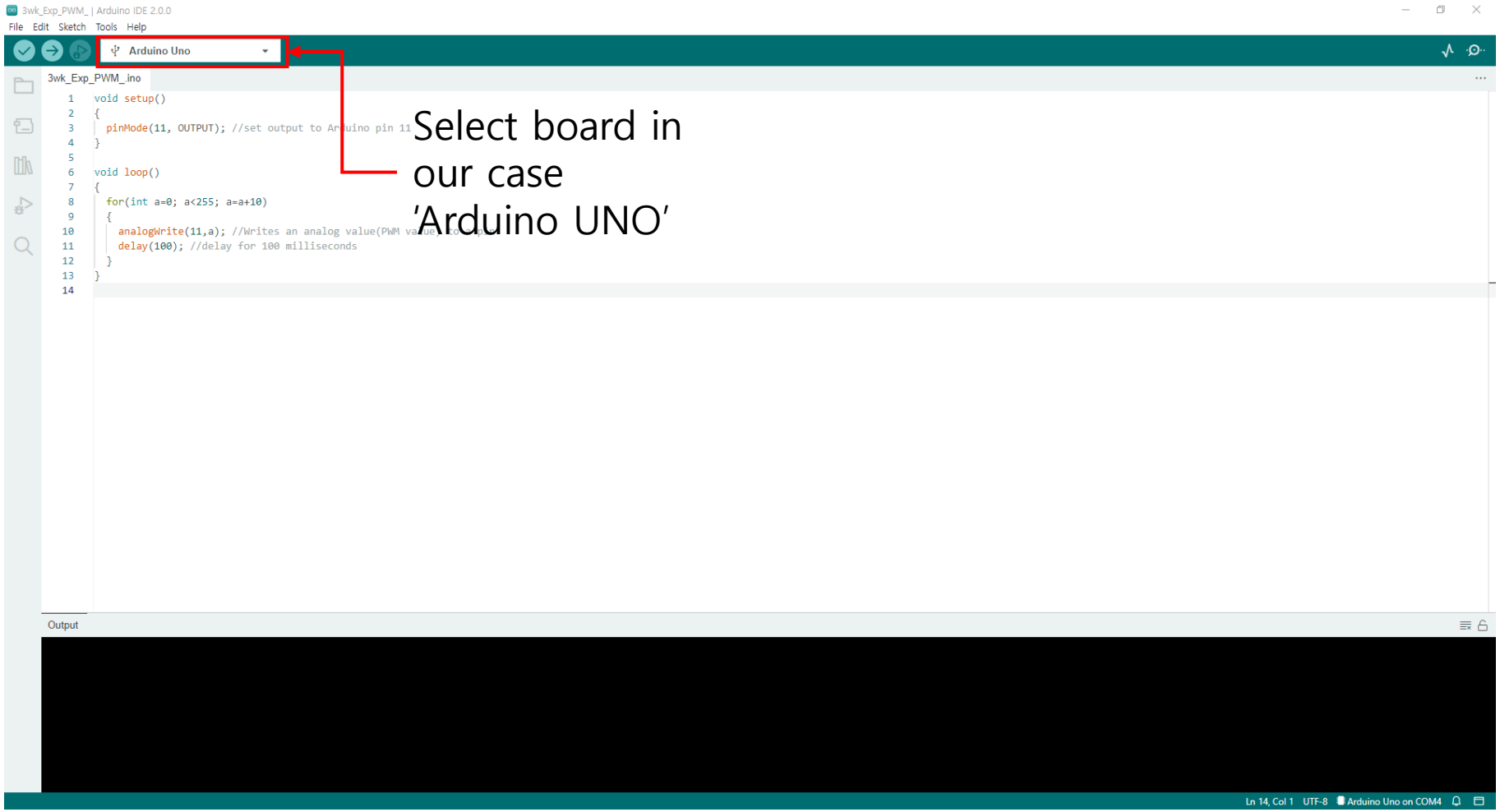
Upload

Compile

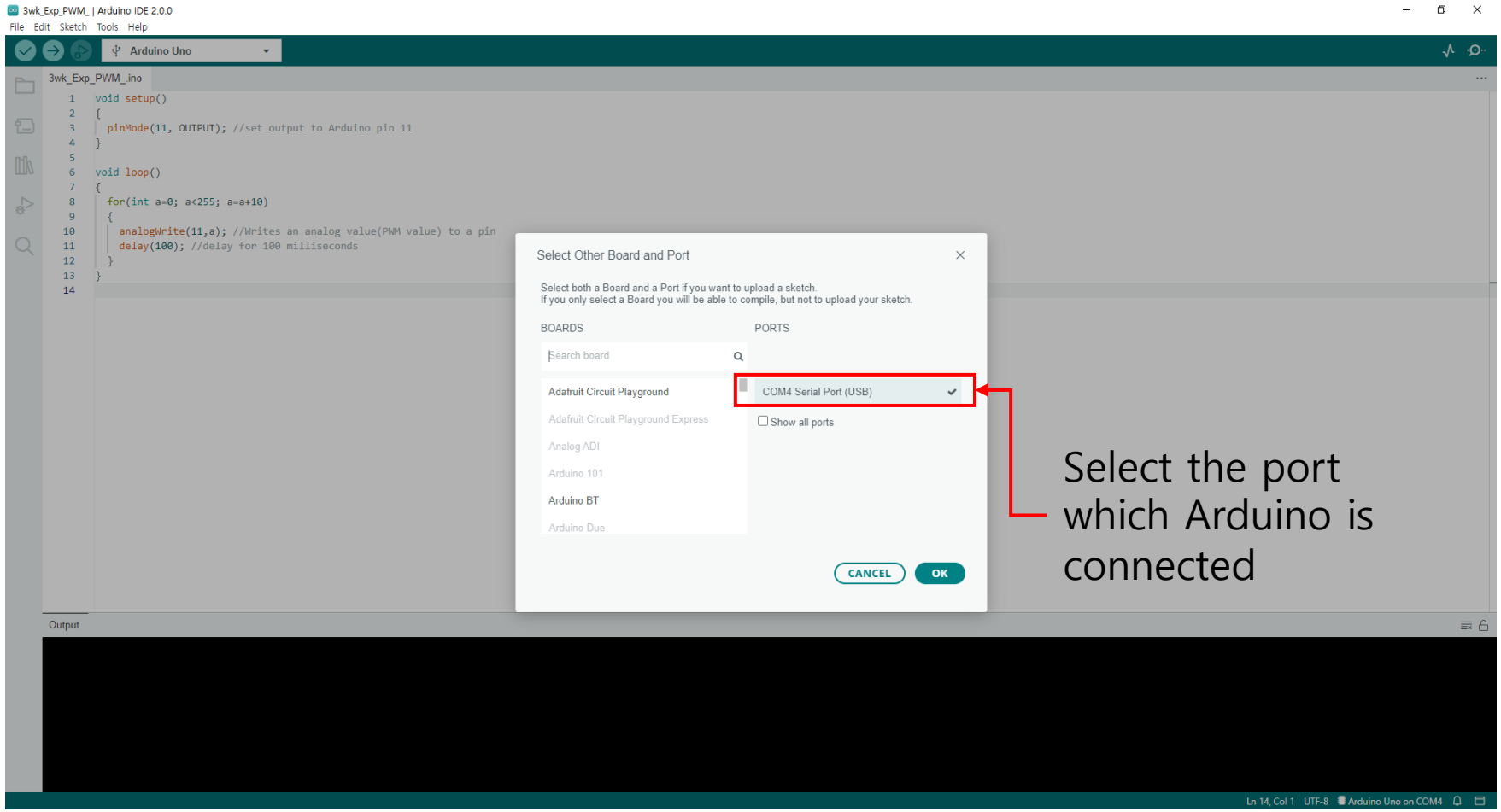


Serial monitor

3 PWM Experiment



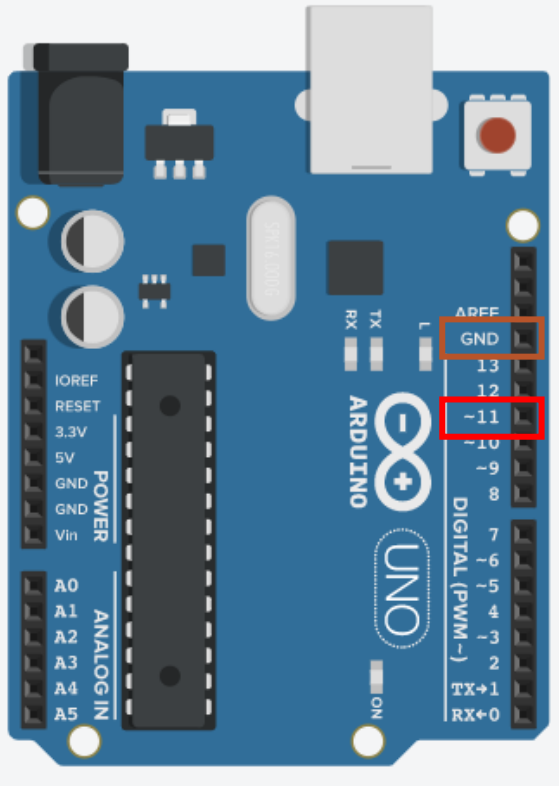
3 PWM Experiment



Select the port which Arduino is connected

If there is no port to choose, call me.

4 PWM Experiment



GND -> LED (-) pin
~11 -> LED (+) pin

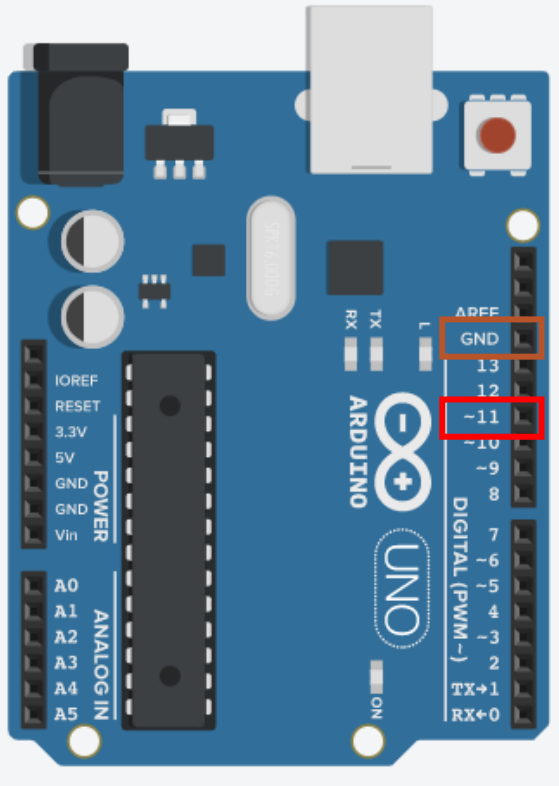
```
void setup()
{
  pinMode(11, OUTPUT); //set output to Arduino pin 11
}

void loop()
{
  for(int a=0; a<255; a=a+10)
  {
    analogWrite(11,a); //Writes an analog value(PWM value) to a pin
    delay(100); //delay for 100 milliseconds
  }
}
```

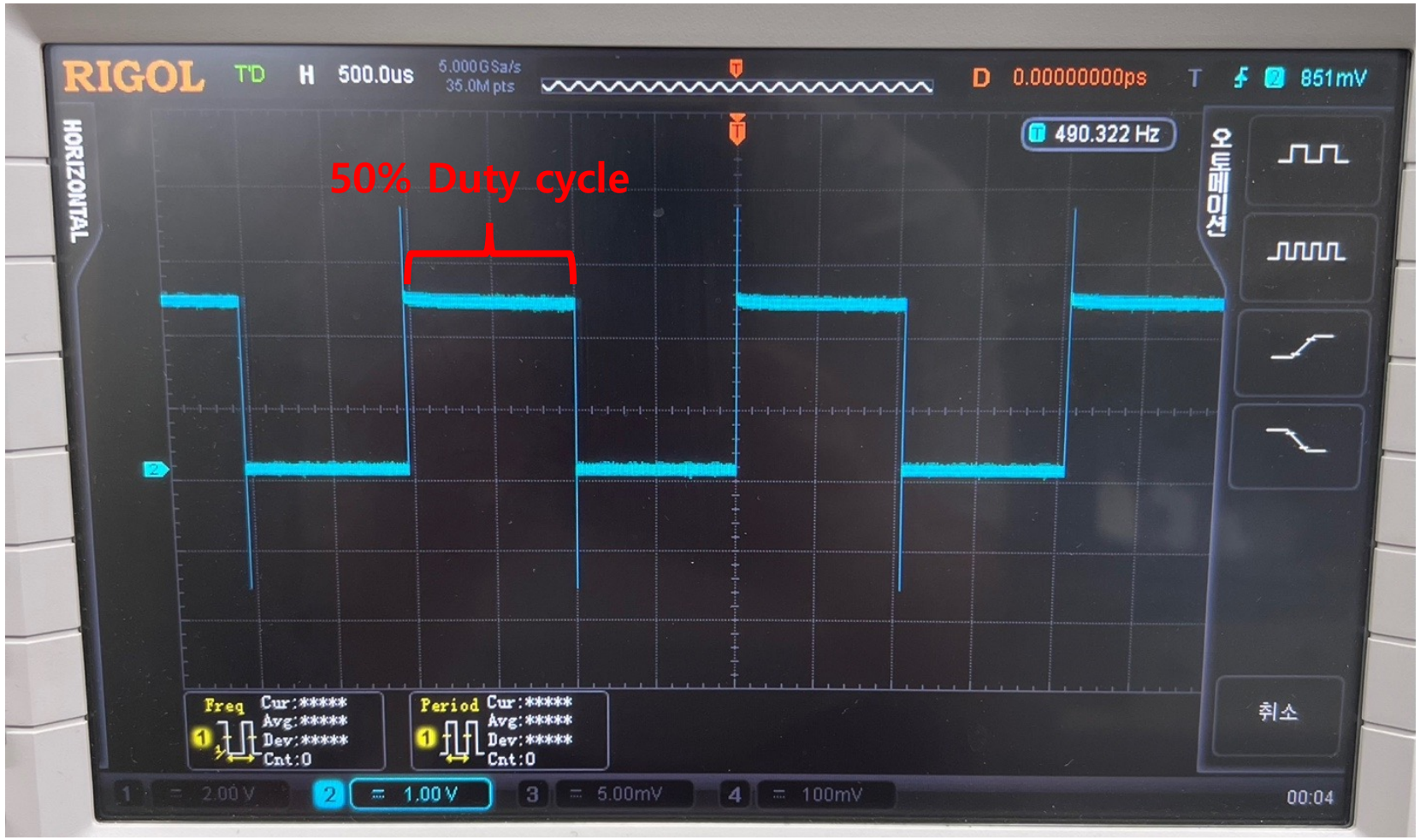
Arduino PWM range is **8 bit(0~255)**

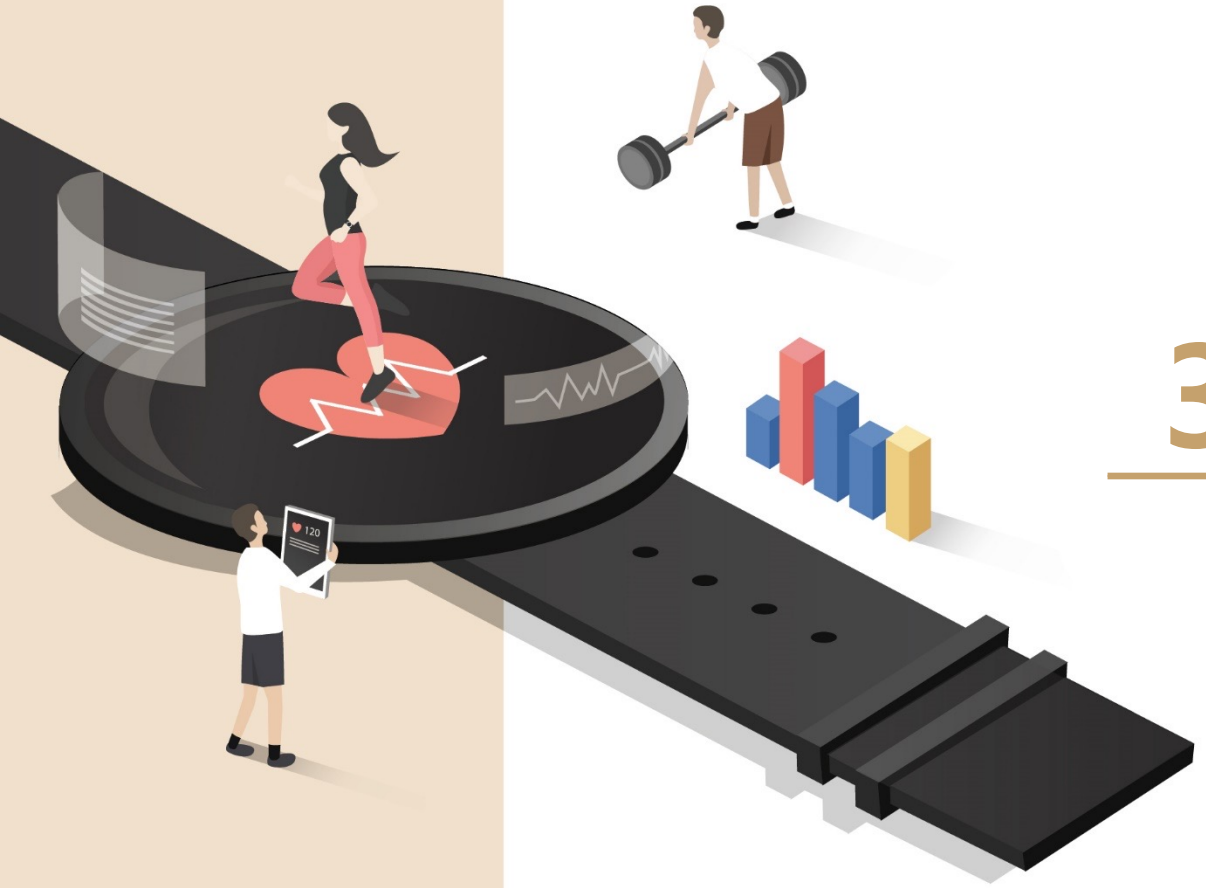
If you got an error while uploading, call me

5 PWM Experiment



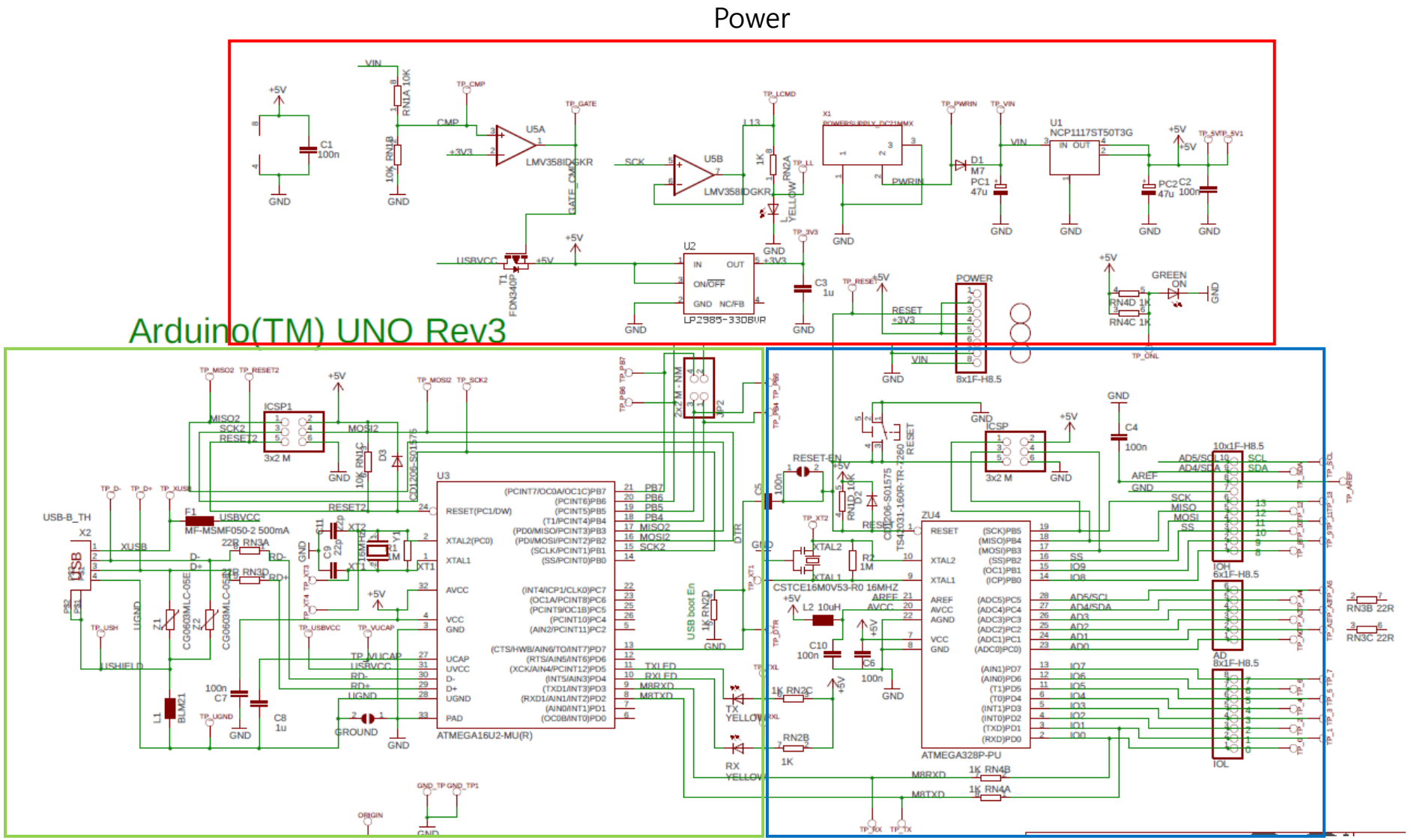
GND -> Probe GND
~11 -> Probe hook



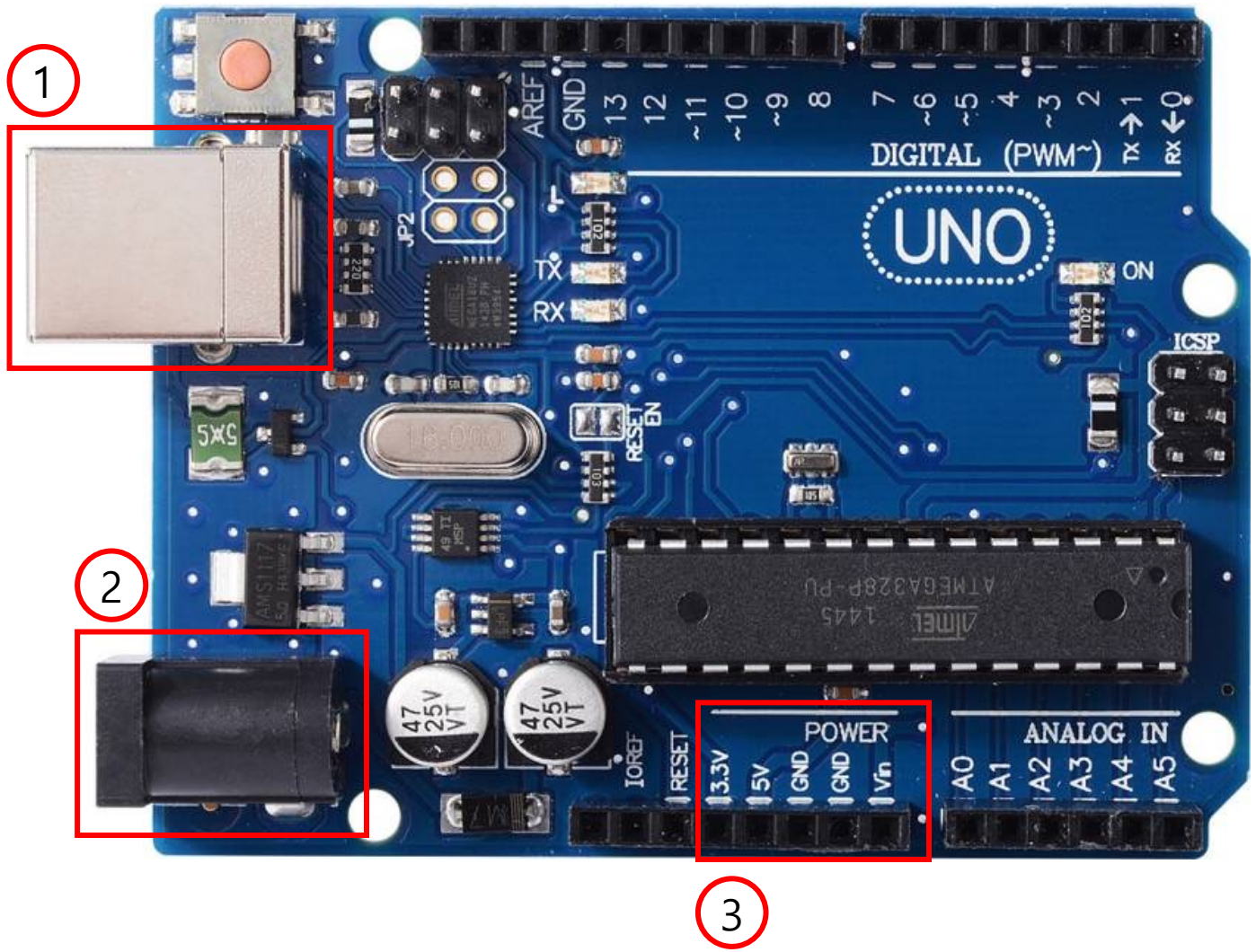


3 Arduino UNO Rev3 Schematic

1 Arduino UNO Rev3 schematic

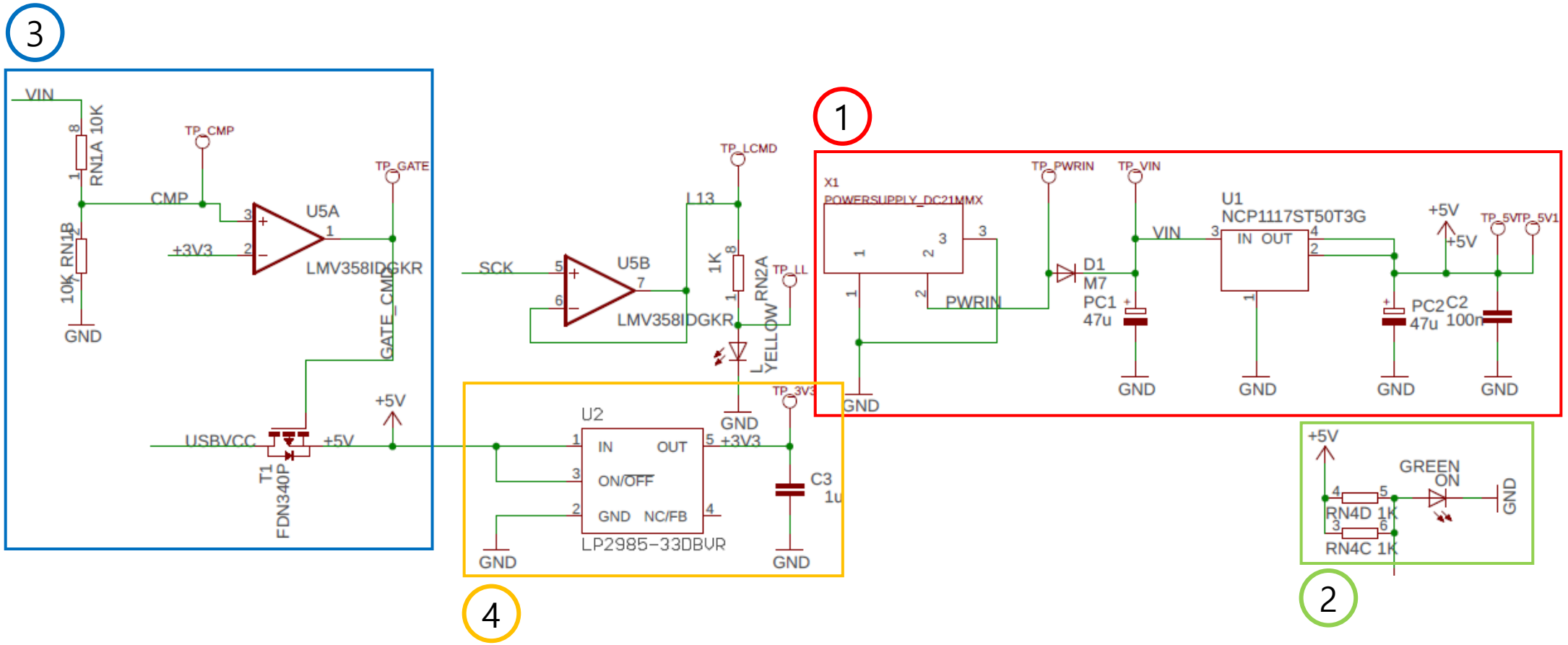


2 3 ways to power Arduino



1. USB port(5V)
2. DC jack(7~12V)
3. Vin pin(7~12V)

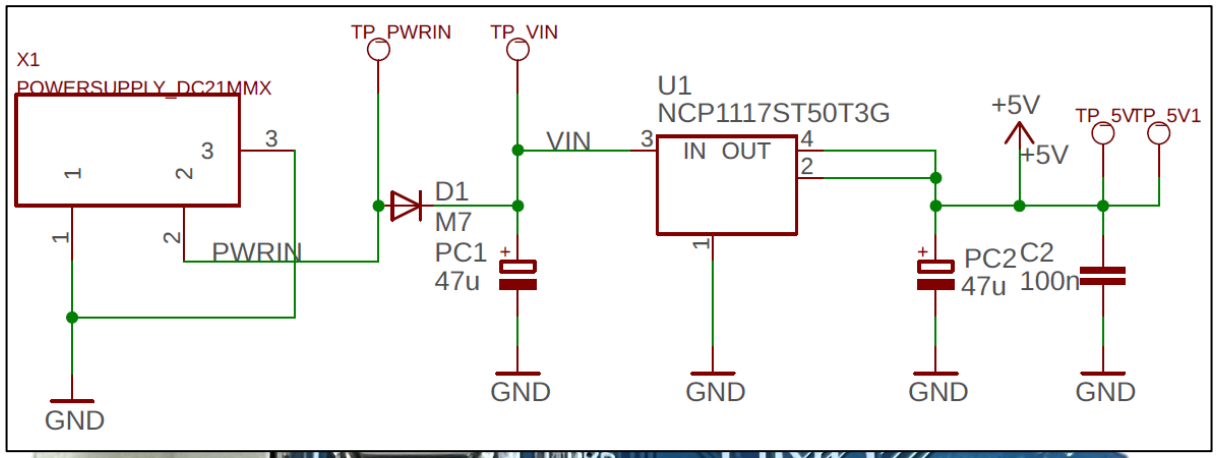
3 Arduino auto power supply schematic

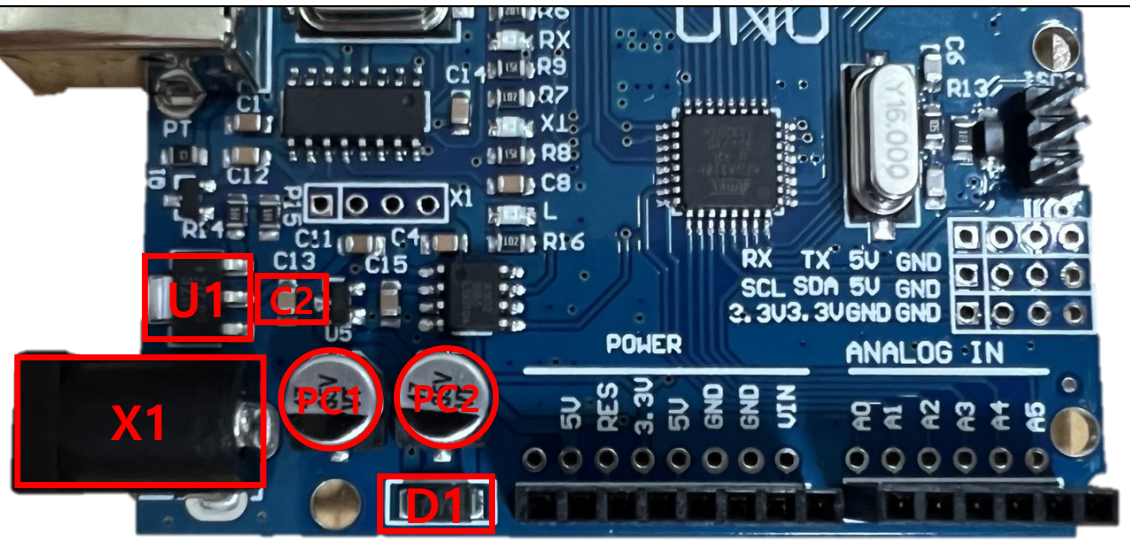


1. DC jack power
2. Power supply indicator LED
3. Power source switching circuit
4. DC 3.3V regulator

Vin, USBVCC power

4 DC jack power



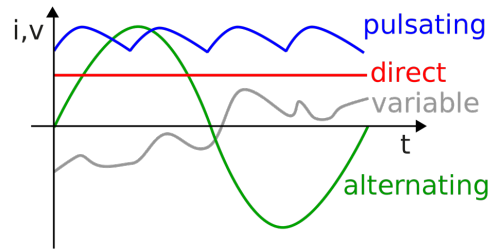


1) X1: DC power input 7~12V
2) D1: reverse voltage protection diode
   - Forward bias: Anode -> Cathode (Switch on)
   - Reverse bias: Cathode -> Anode (Switch off)
   - Voltage drop: 0.6-0.7V
3) PC1/PC2: Polarized condenser(=Capacitor)
4) U1: 5V regulator – output constant voltage
5) C2: Non-polarized Capacitor

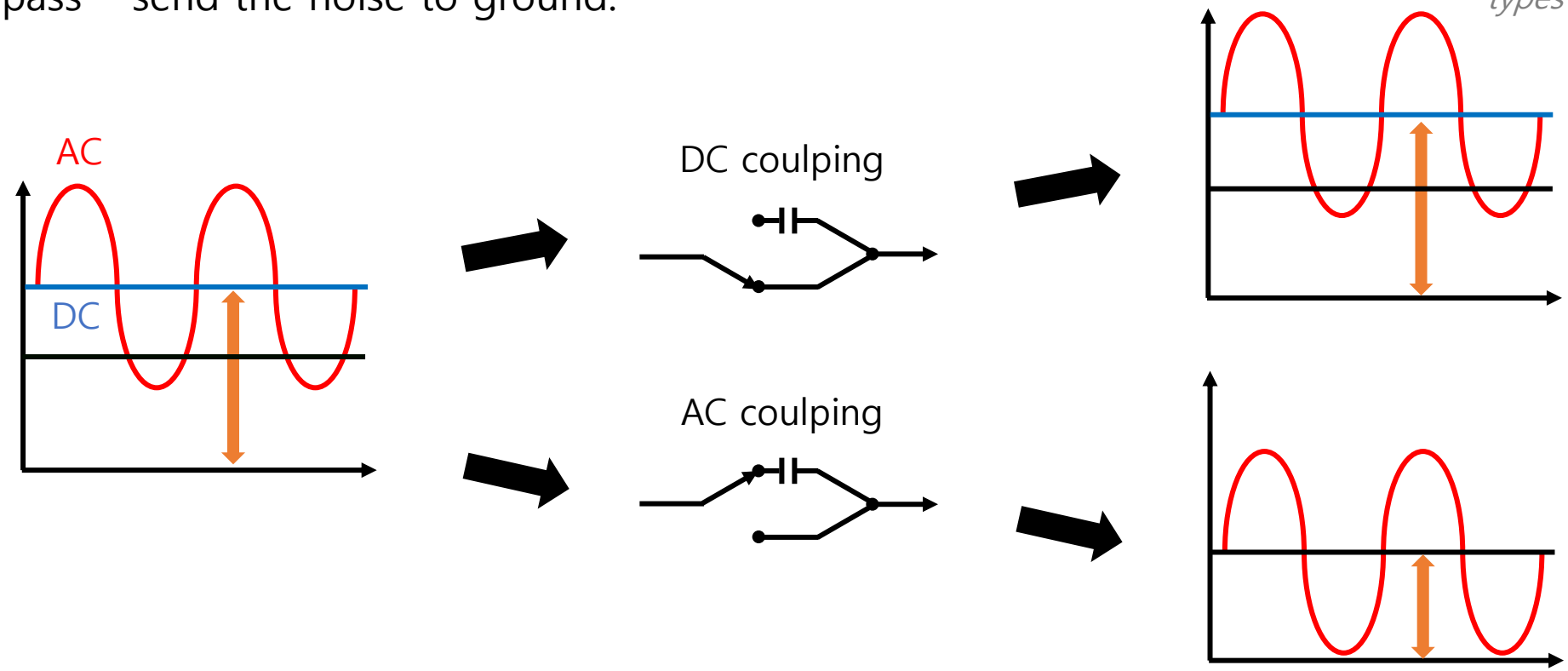
5 DC jack power

Uses of Capacitor

1) coupling – only AC signals pass through a mixture of DC signal and AC signal.
2) energy storage
3) smoothing – make a pulsating signal into a constant DC average voltage
4) bypass – send the noise to ground.



types of electric current



6 DC jack power

Uses of Capacitor

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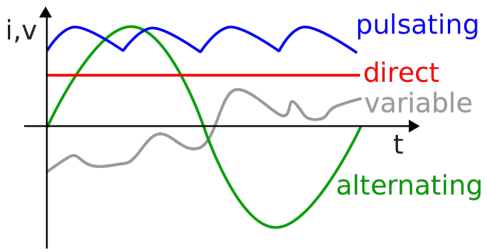
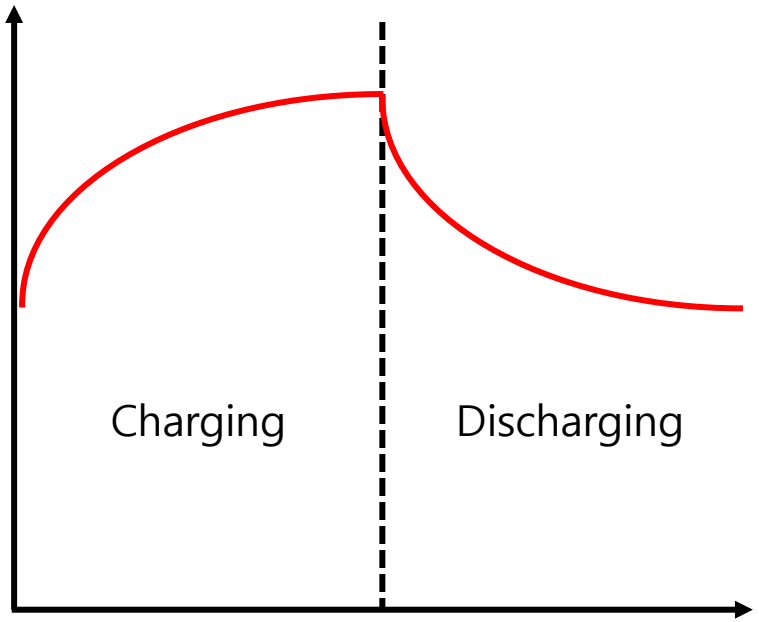


types of electric current



7 DC jack power

Uses of Capacitor

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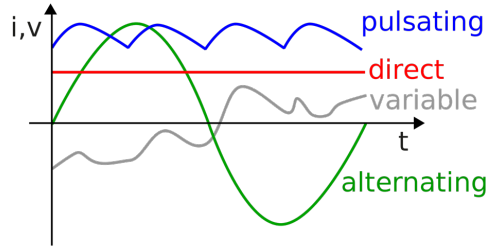
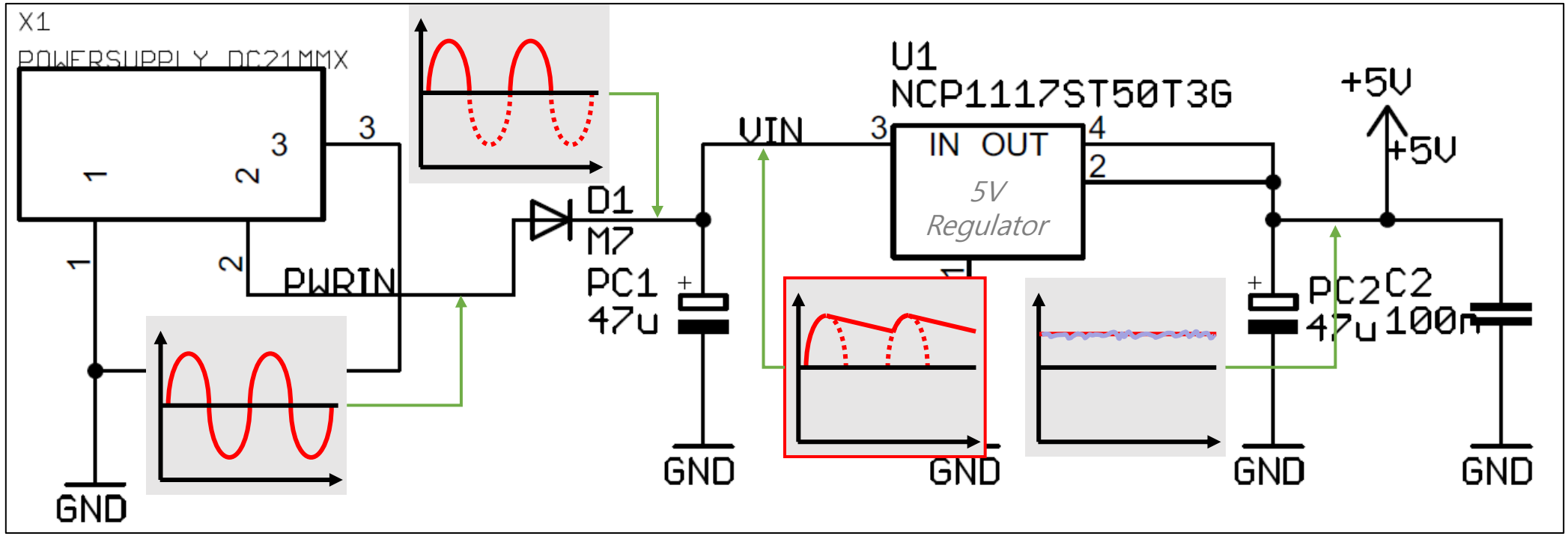


types of electric current



8 DC jack power

Uses of Capacitor

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2) energy storage
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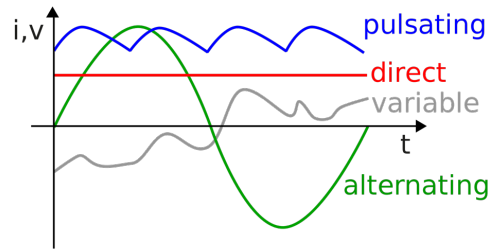
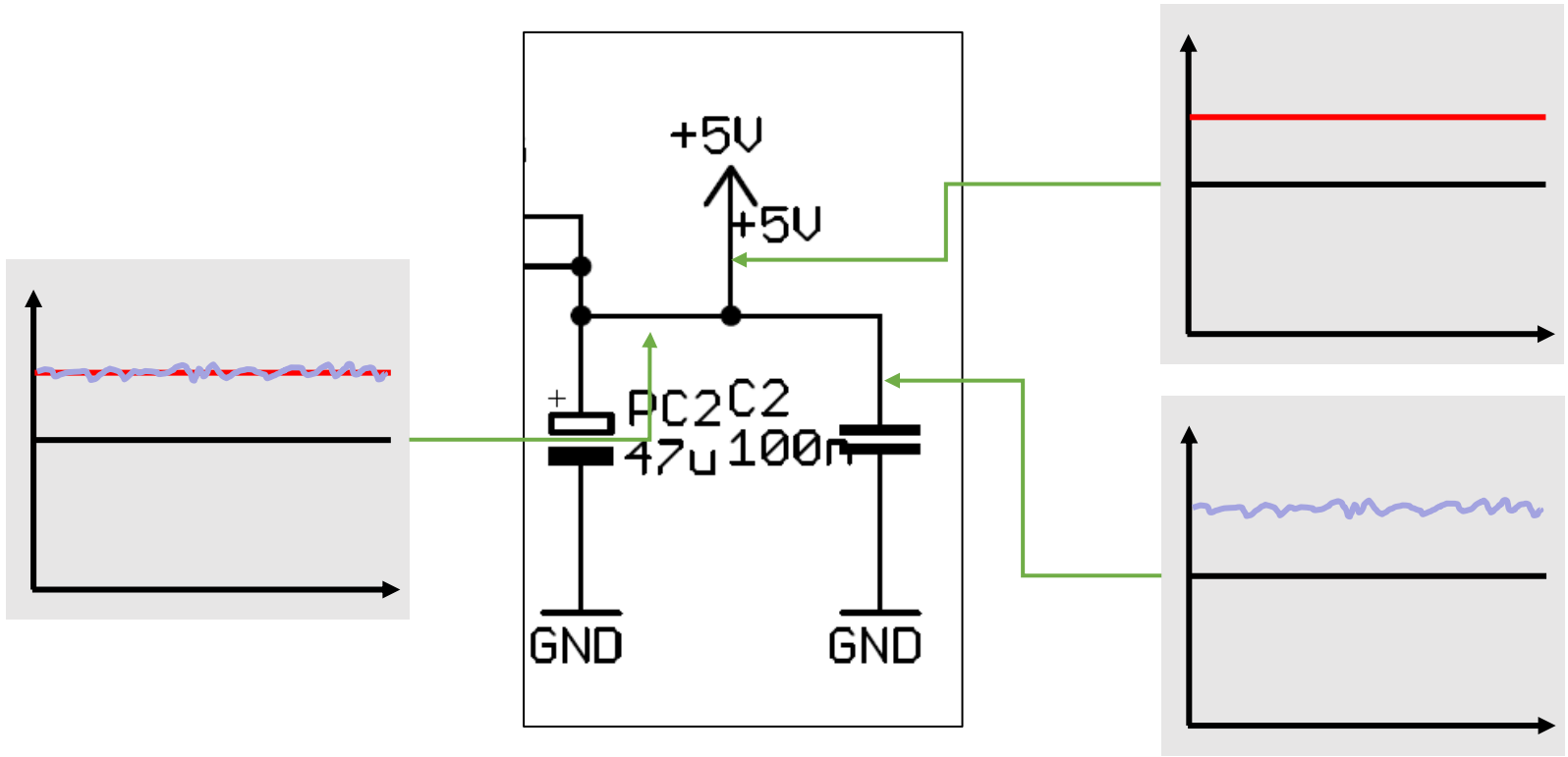
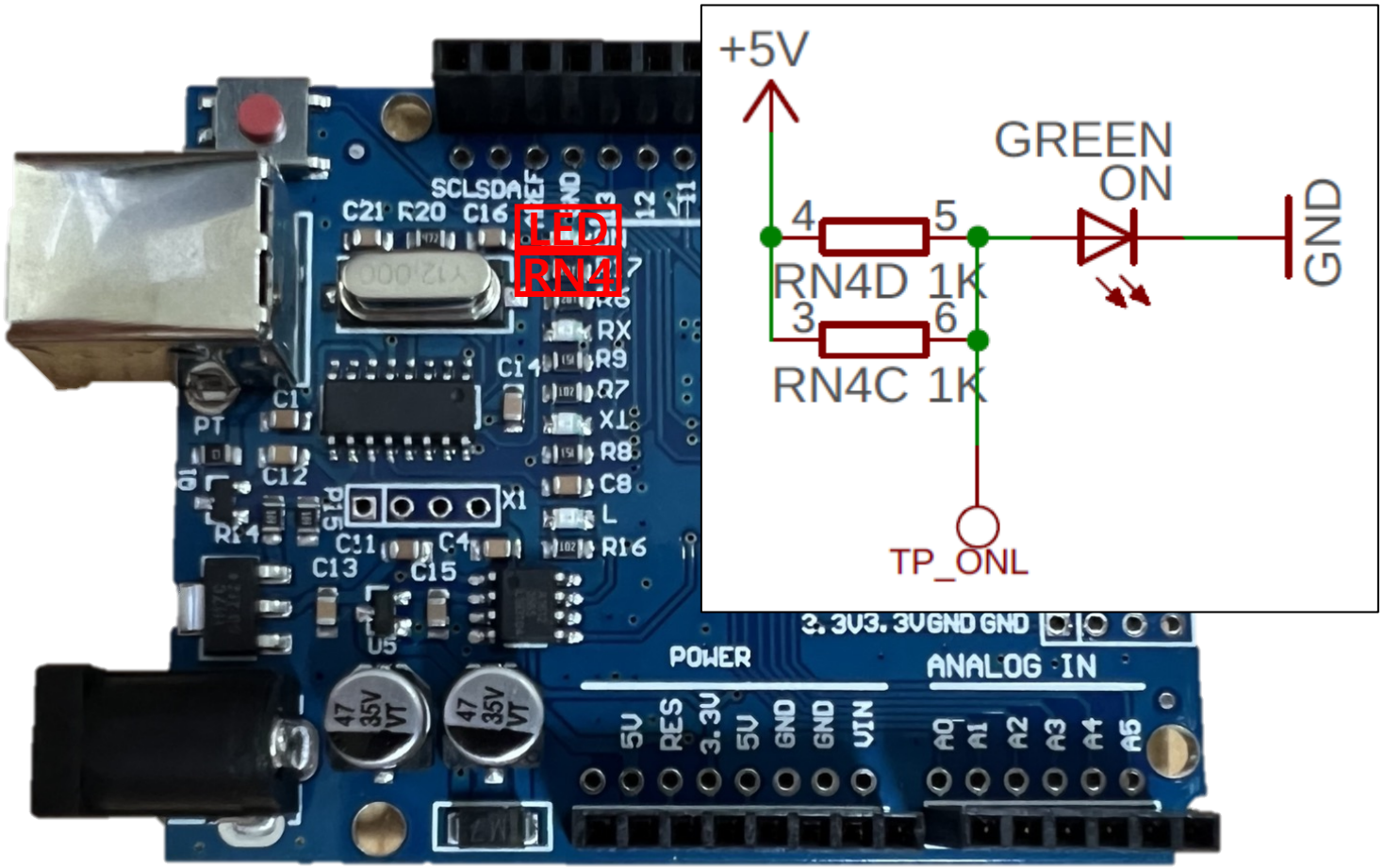
4) bypass – send the noise to ground.



types of electric current

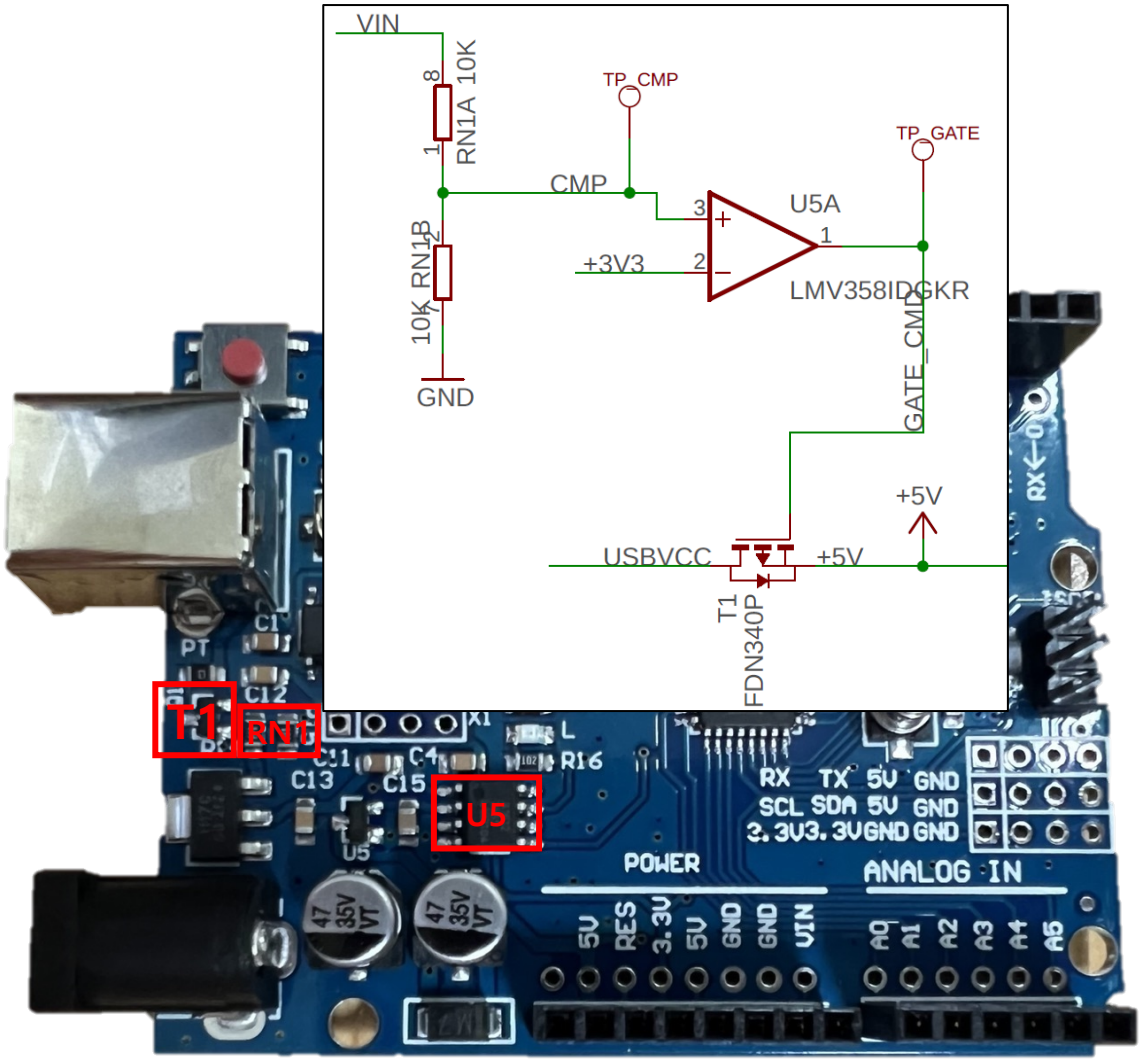


9 Power supply indicator LED



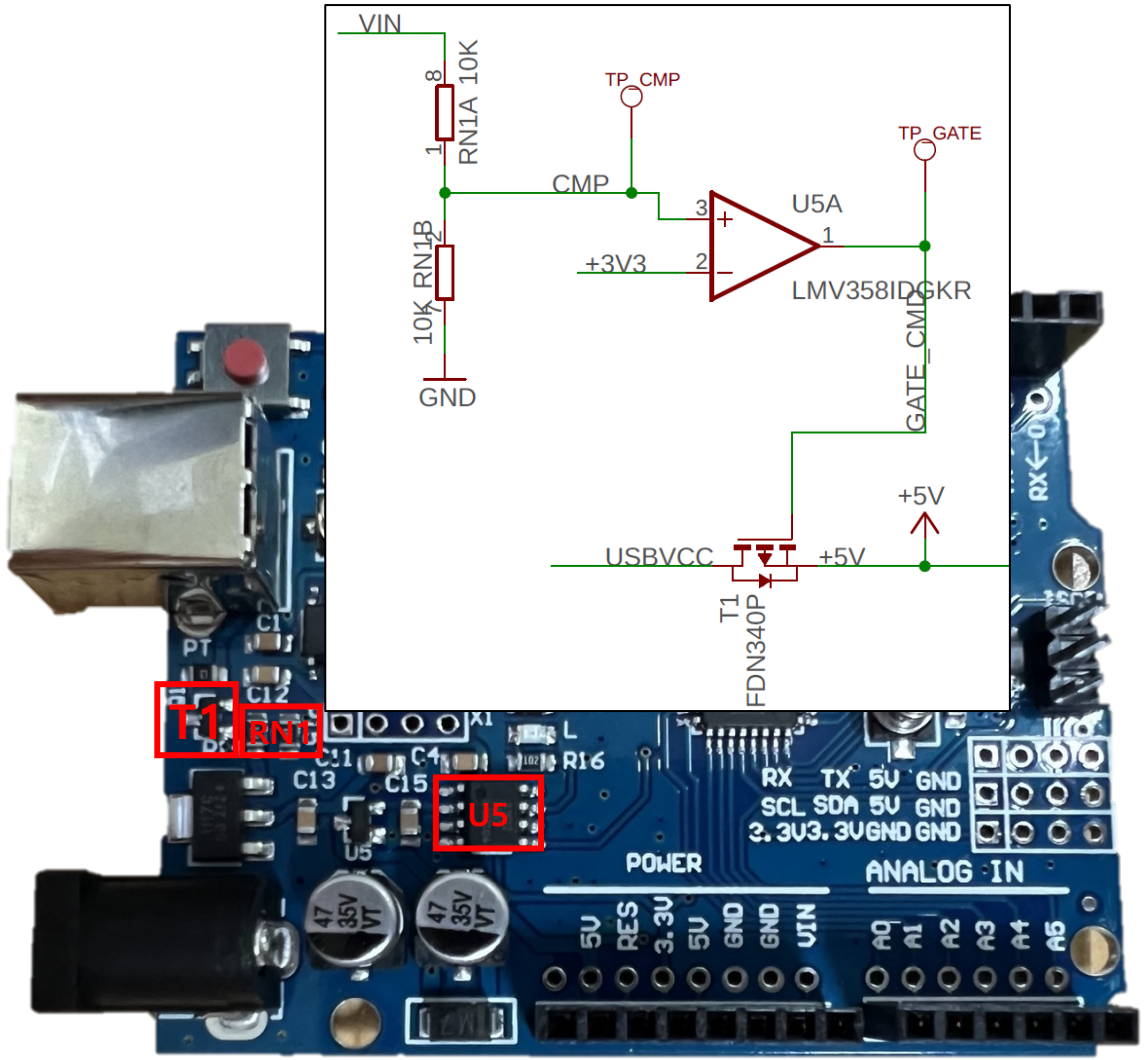
When DC 5V comes from regulator, indicator LED blinks.

10 Power source switch



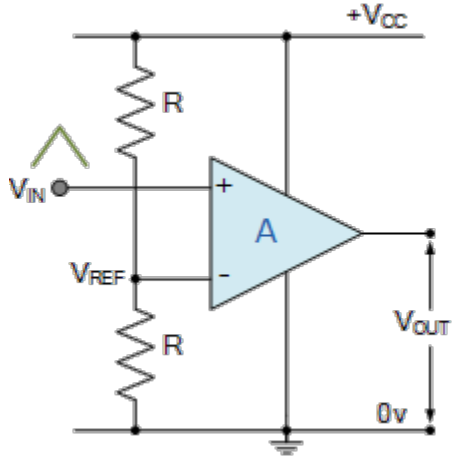
1) U5: Comparator
2) T1: P-channel MOSFET

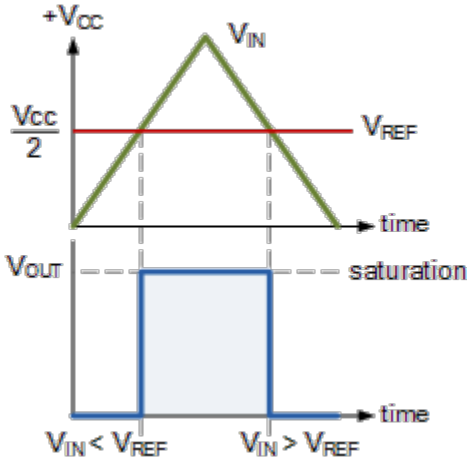
11 Power source switch



Comparator

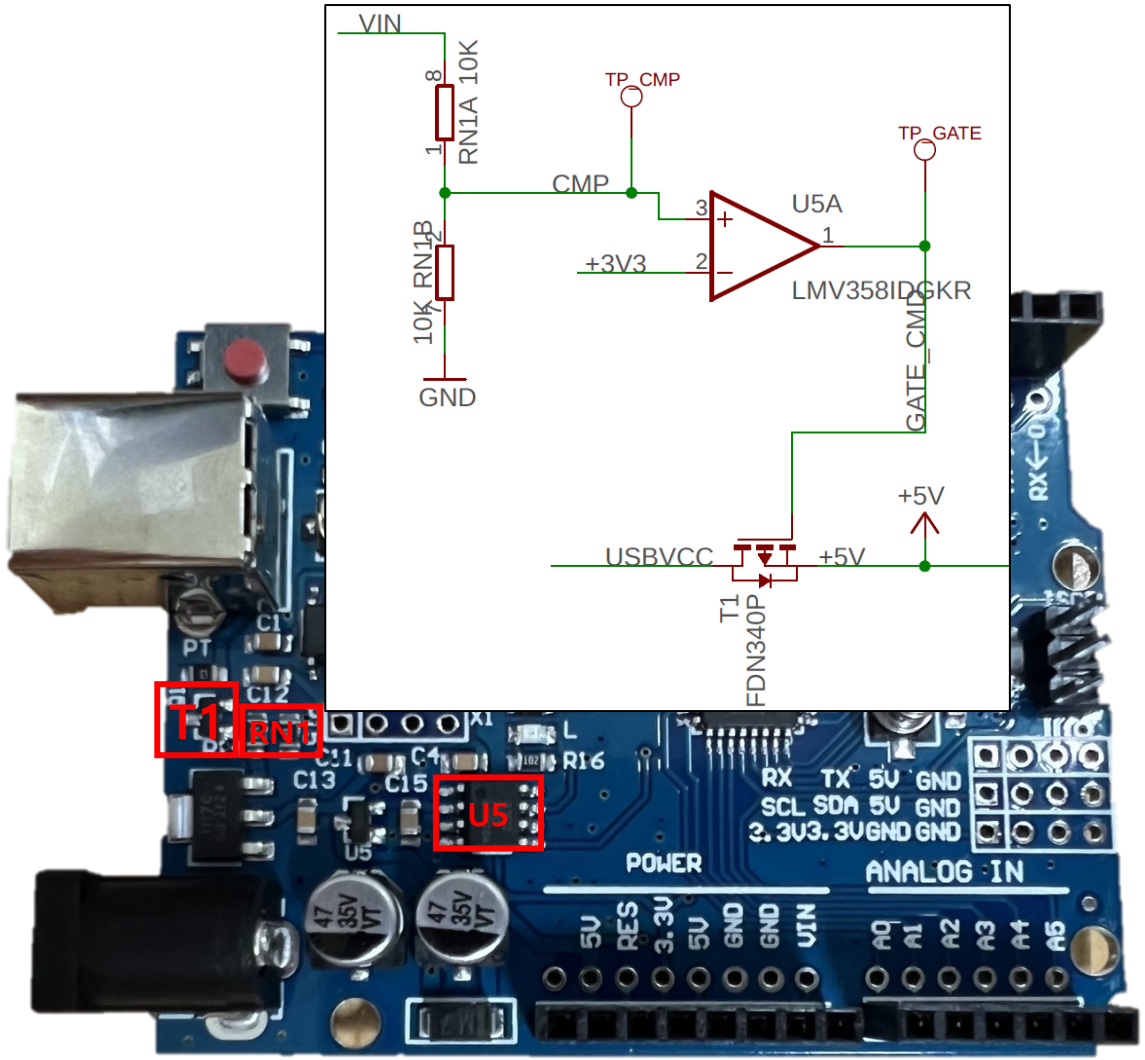
: A device that compares two voltages or currents and outputs a digital signal indicating which is larger.





$$V_{out} = \begin{cases} 1, \ if \quad V_{in} > V_{REF} \\ 0, \ if \quad V_{in} < V_{REF} \end{cases}$$

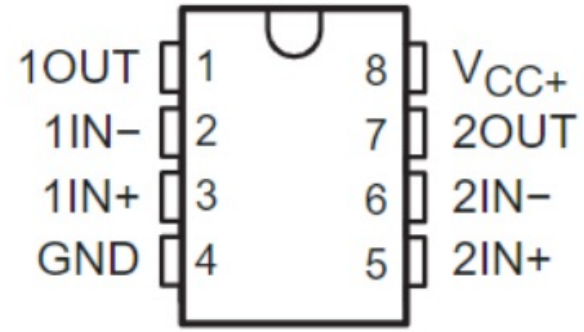
12 Power source switch



Comparator

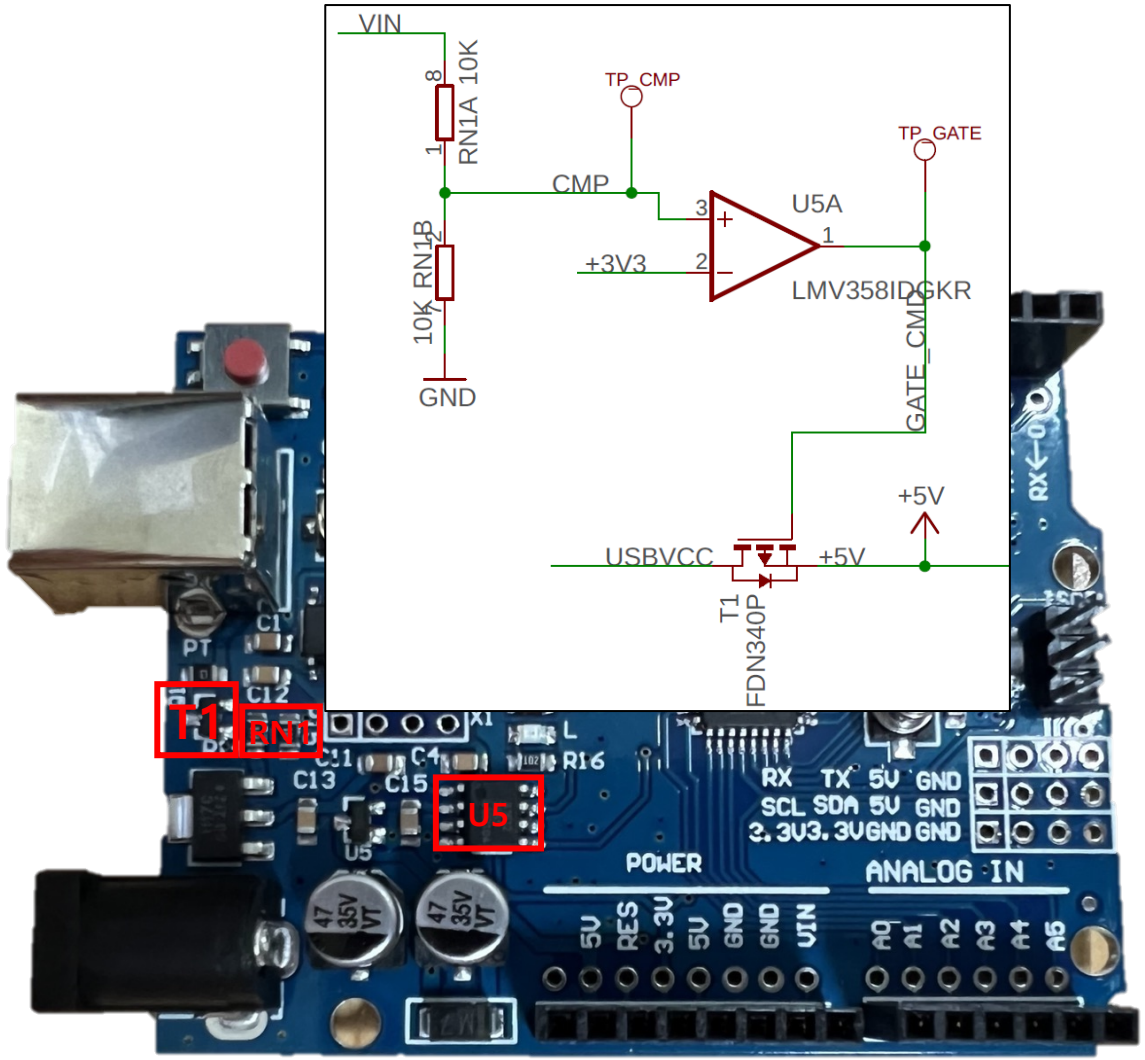
: A device that compares two voltages or currents and outputs a digital signal indicating which is larger.

LMV358 . . . D (SOIC), DDU (VSSOP), DGK (MSOP), OR PW (TSSOP PACKAGE (TOP VIEW)



[LMV358IDGKR Datasheet, PDF - Alldatasheet]

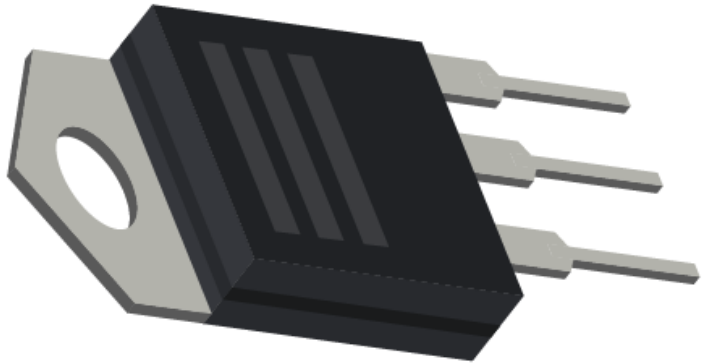
13 Power source switch



MOSFET(Metal-Oxide-Semiconductor-Field-Effect Transistor)

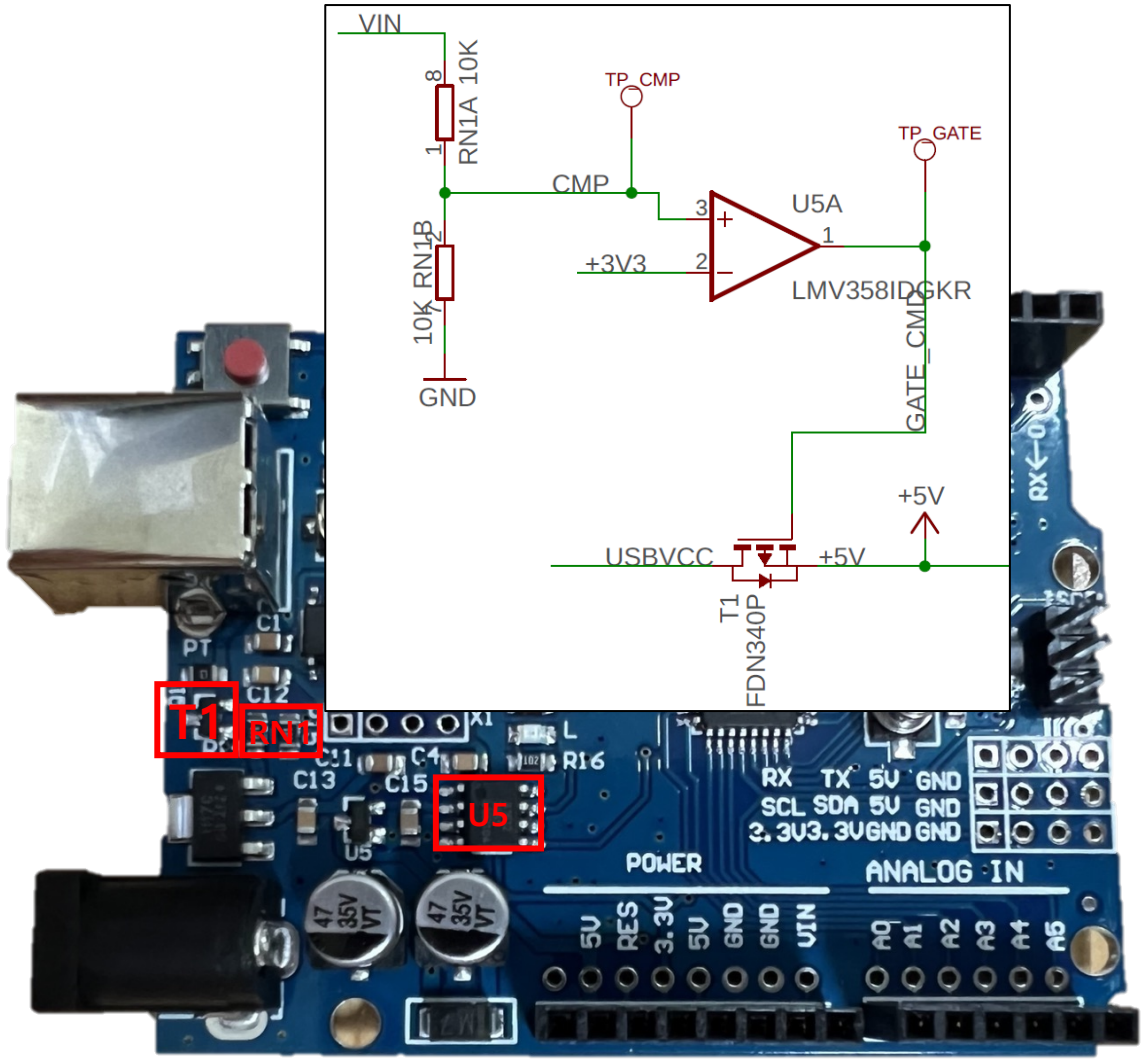
: electronic devices used to switch or amplify voltages in circuits.

- Source
- Gate
- Drain
- Body

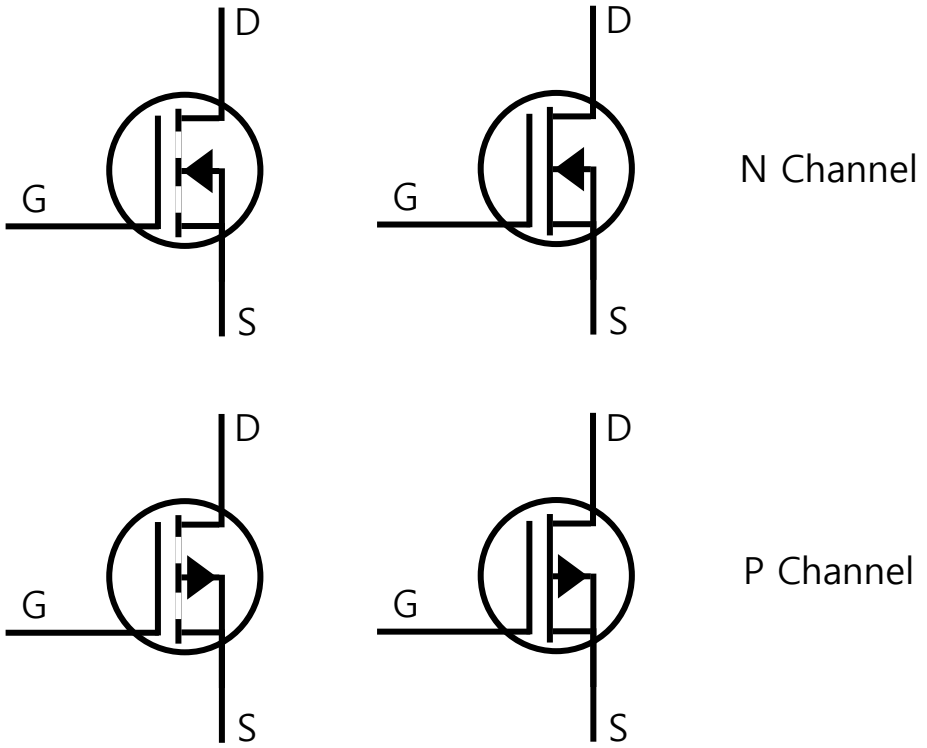


[FDN340P Datasheet, PDF - Alldatasheet]

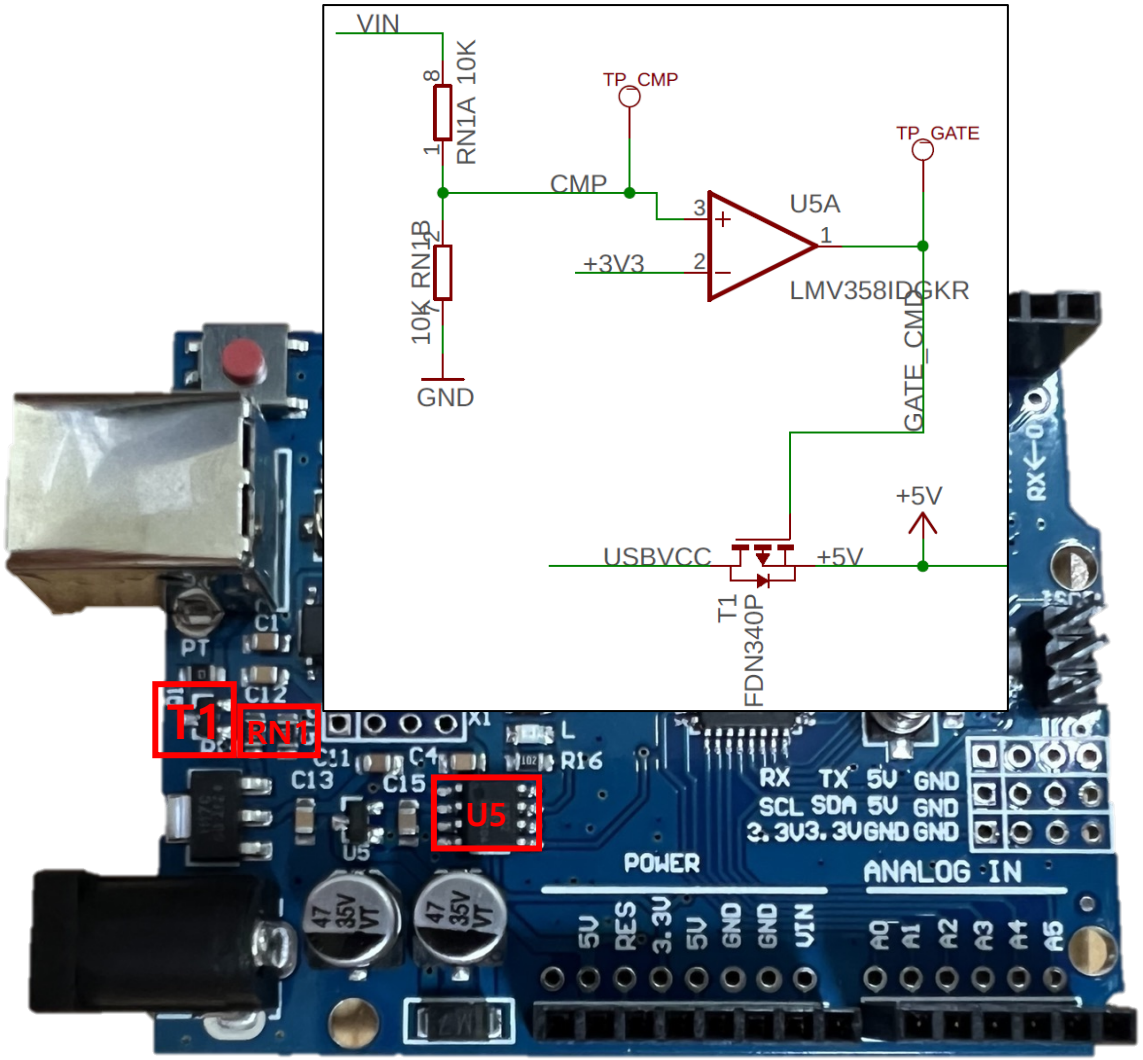
14 Power source switch



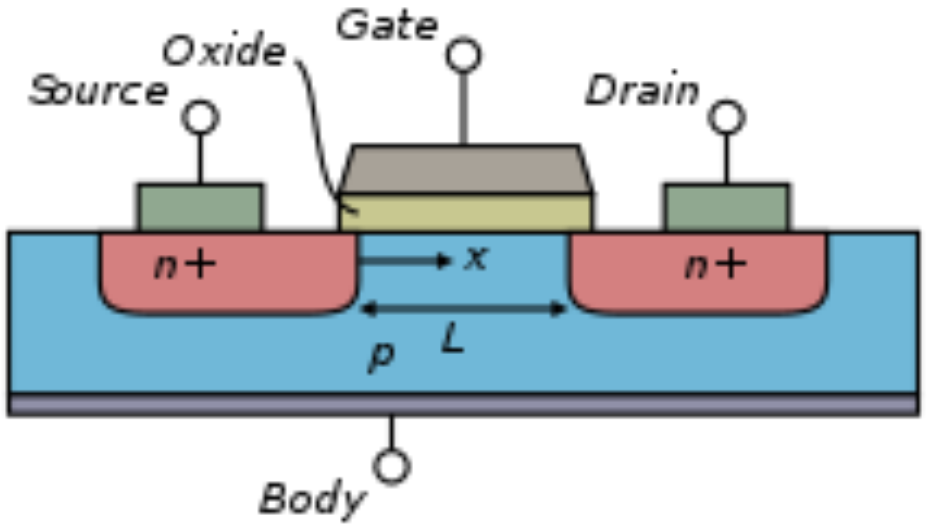
MOSFET types



15 Power source switch

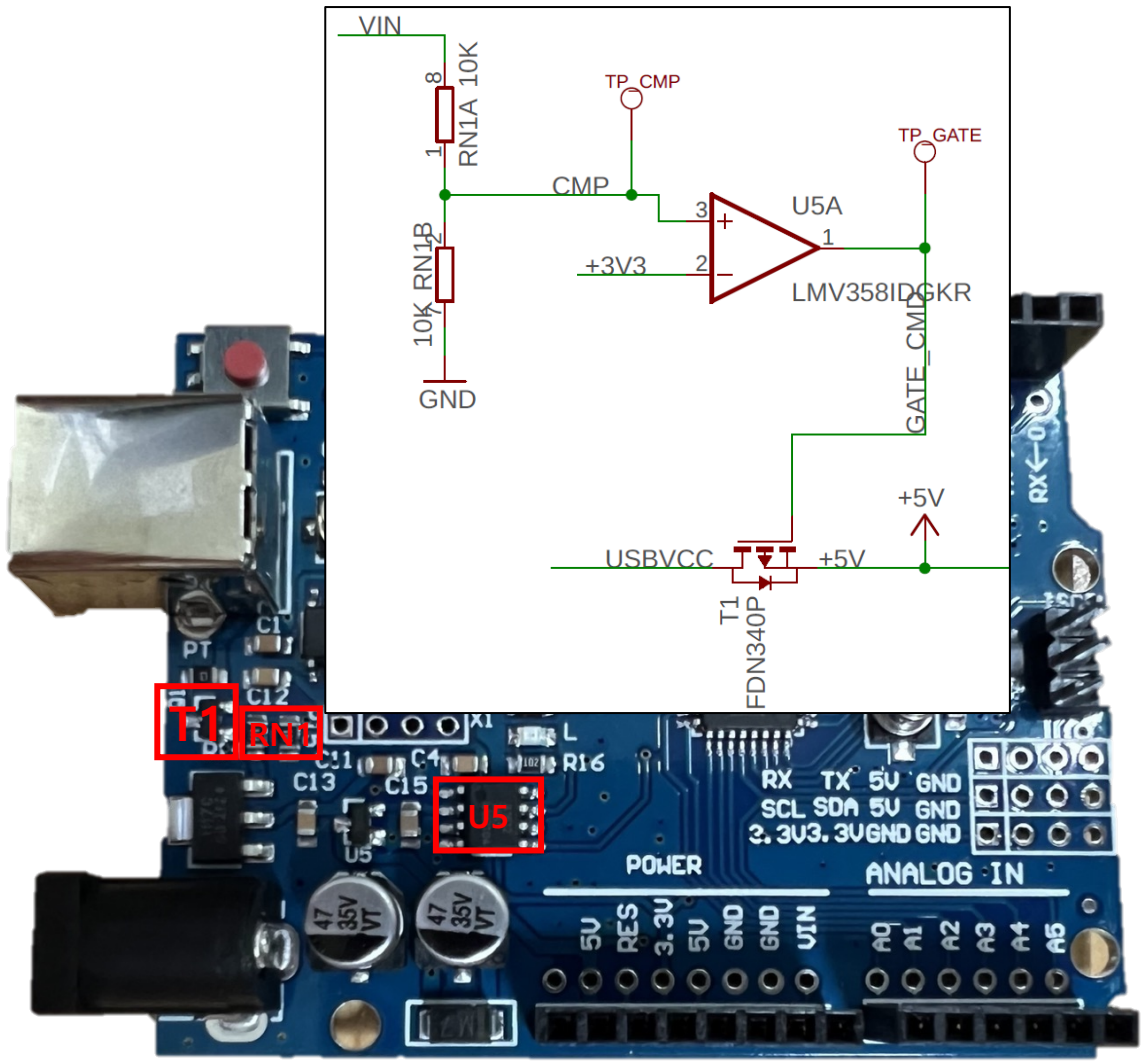


Enhancement mode MOSFET

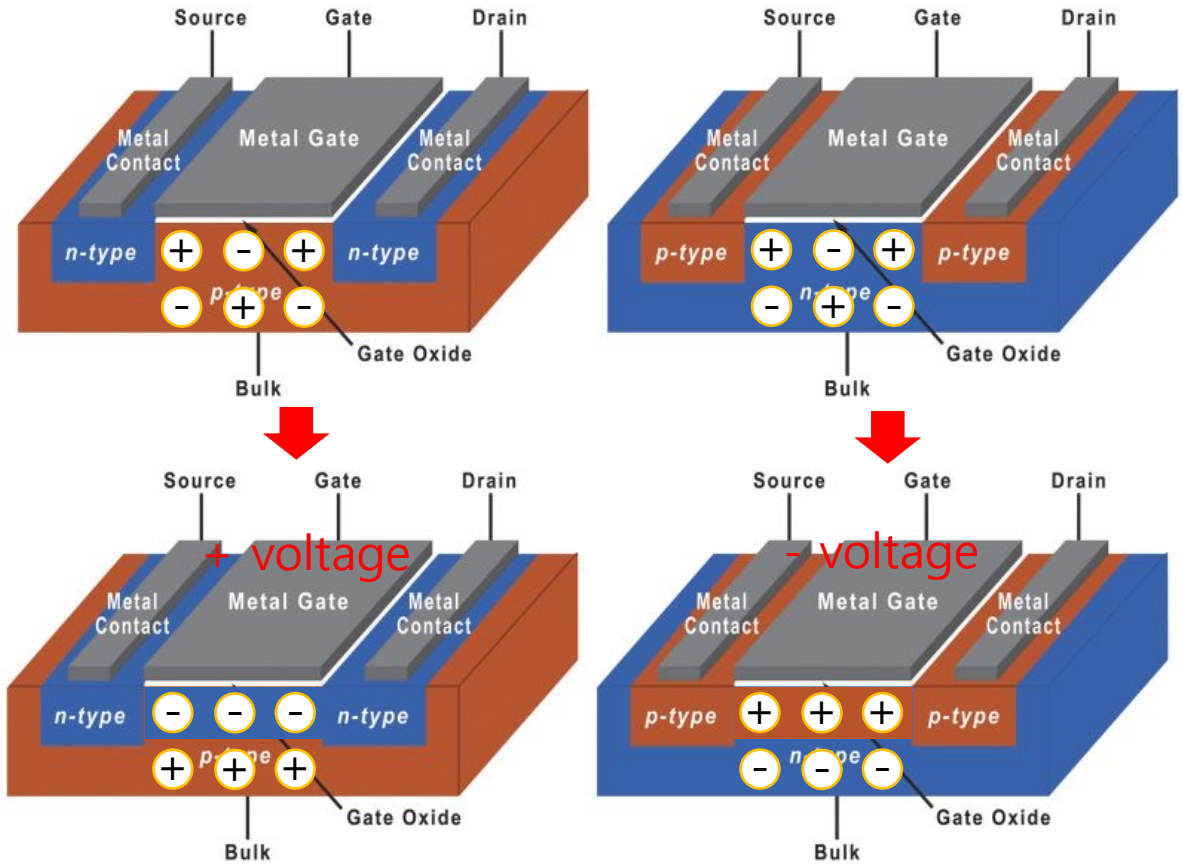


N-MOSFET

16 Power source switch



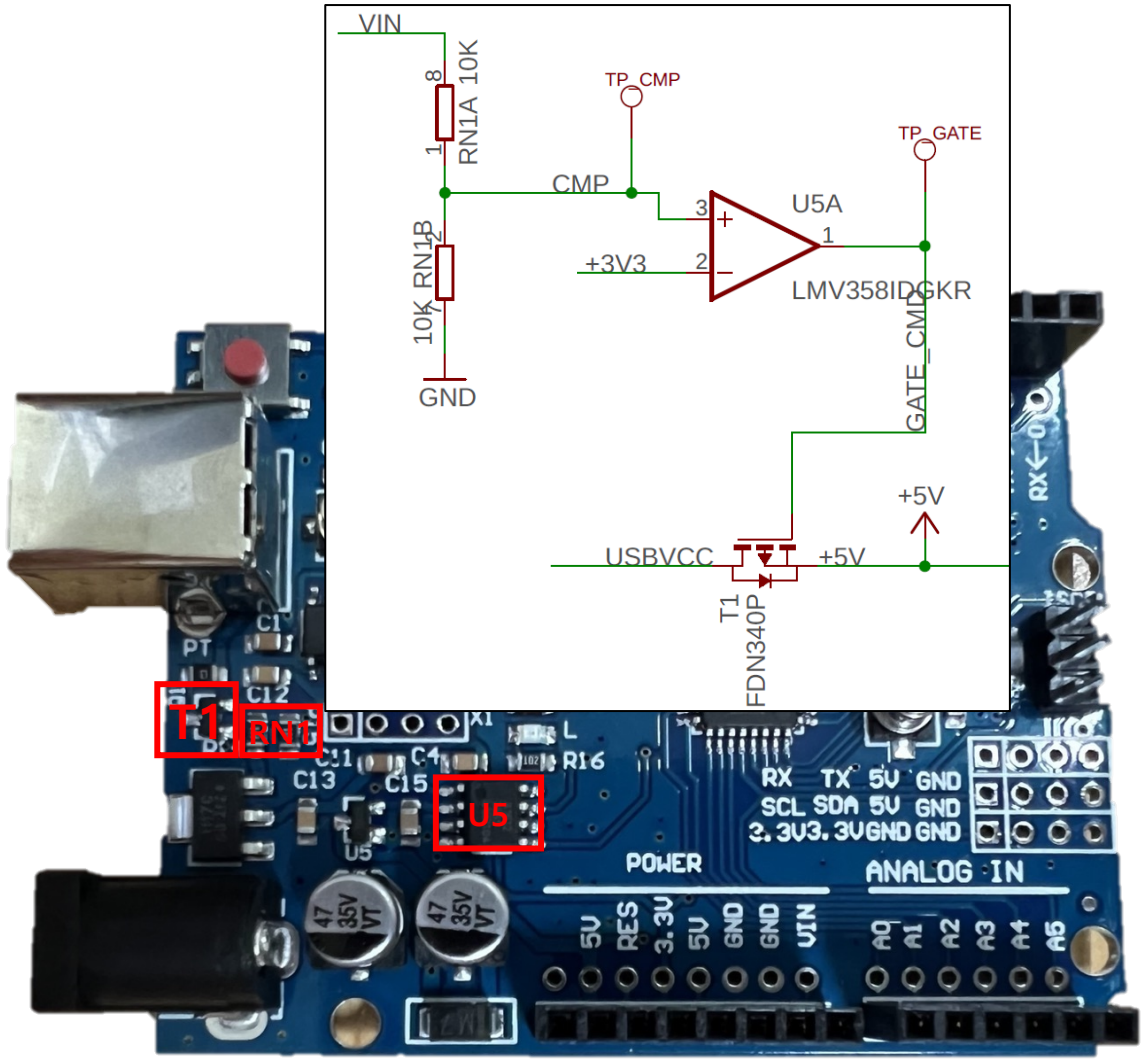
Enhancement mode MOSFET



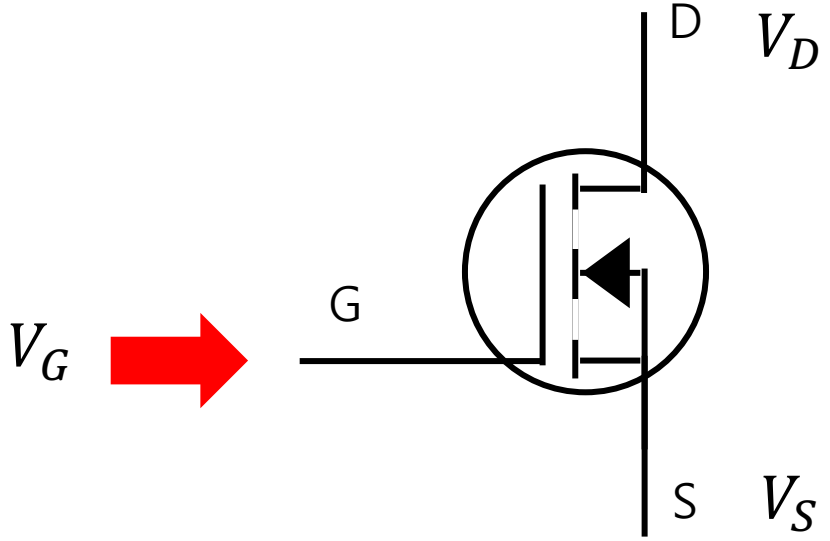
N-MOSFET

P-MOSFET

17 Power source switch



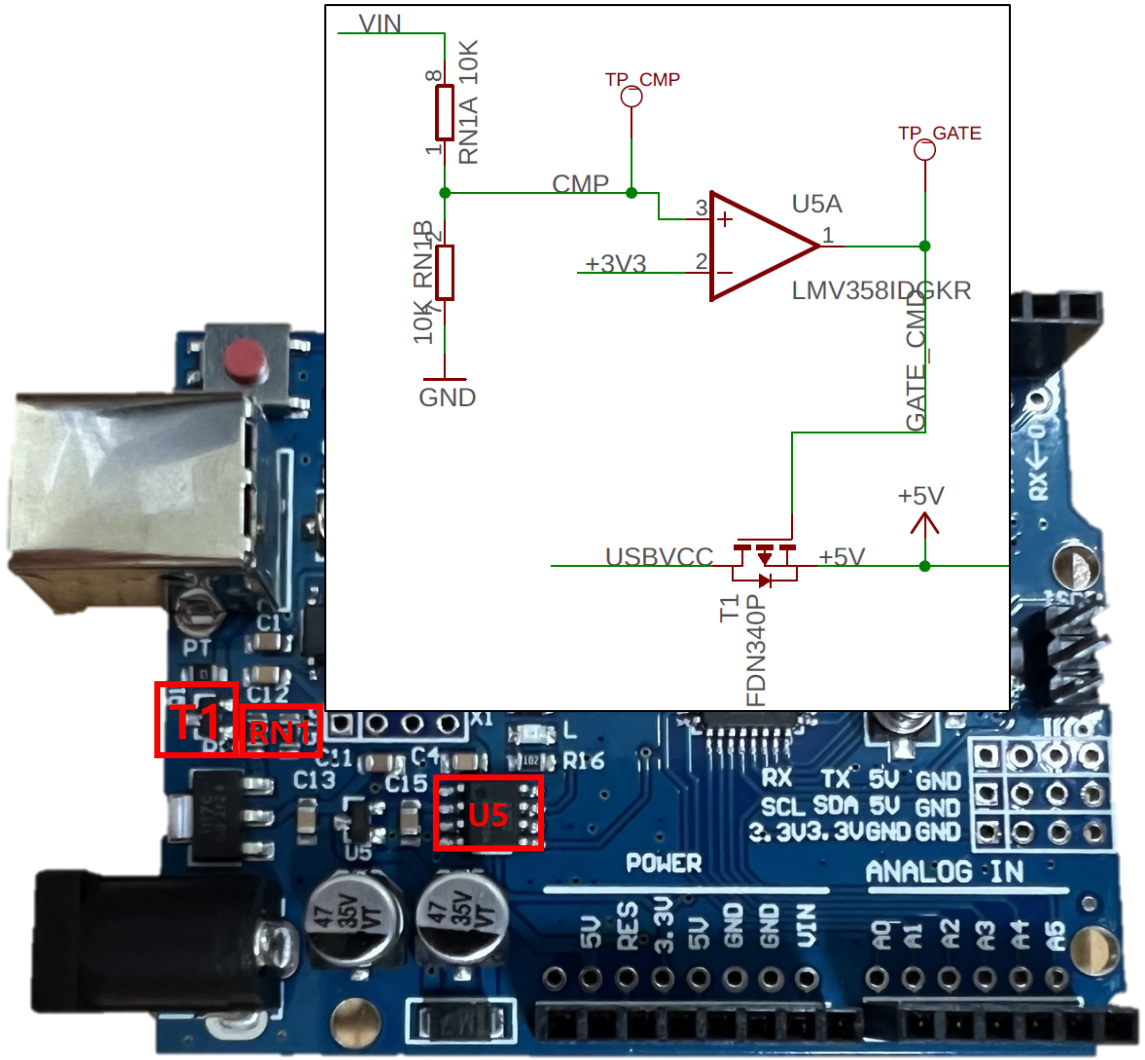
N-channel MOSFET



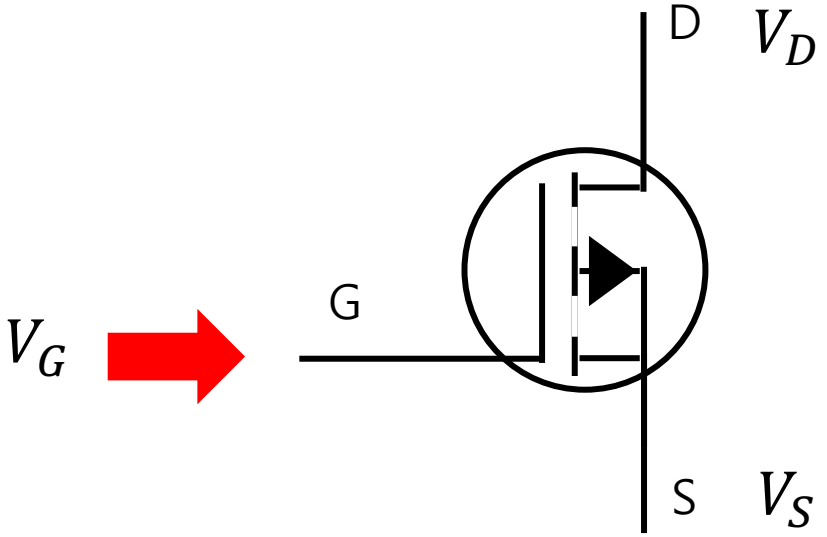
$$V_{GS(th)} = V_G - V_S > 0$$

$$\Rightarrow V_D,\ V_S \text{ Current flow}$$

18 Power source switch



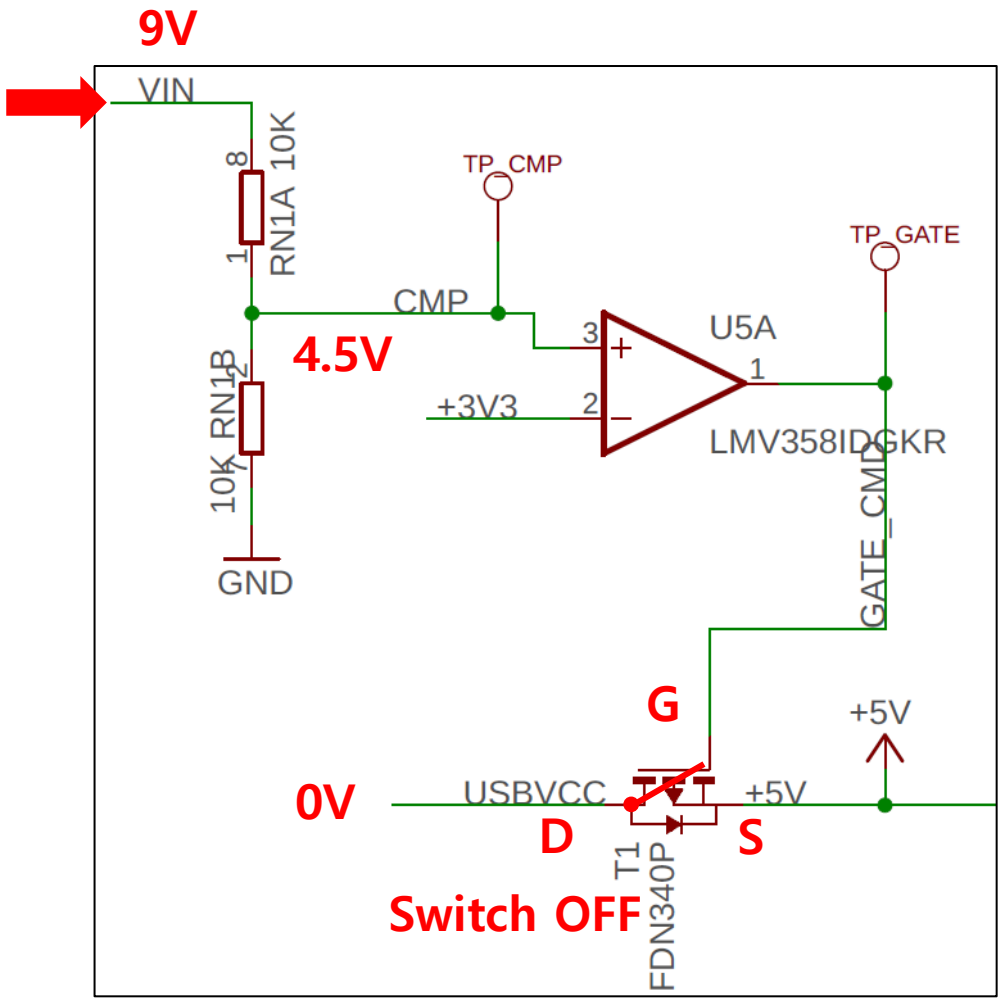
P-channel MOSFET



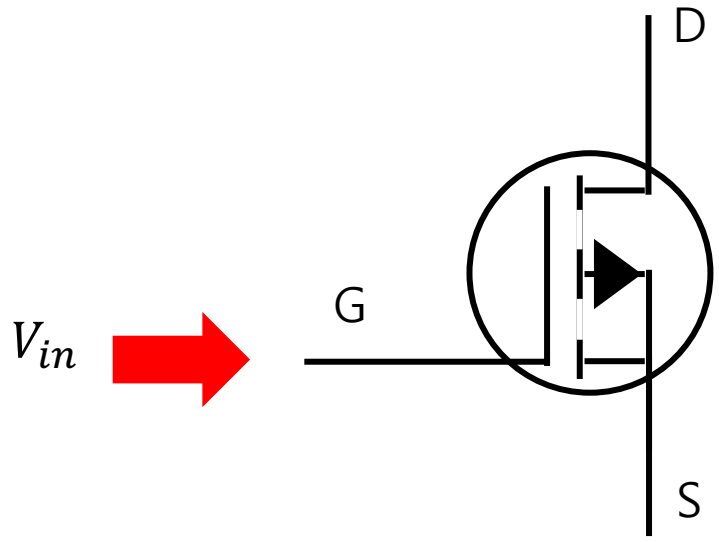
$$V_{GS(th)} = V_G - V_S < 0$$

$$\Rightarrow V_D,\ V_S \text{ Current flow}$$

19 Power source switch



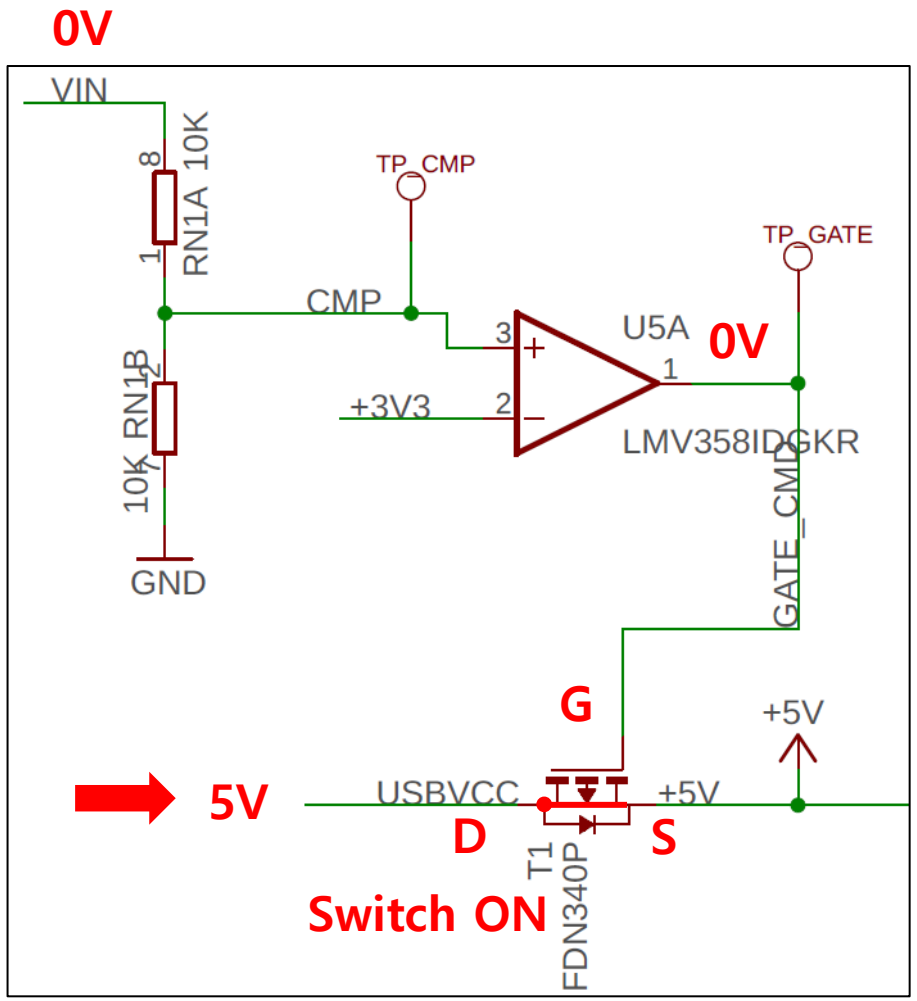
1. V_{in}



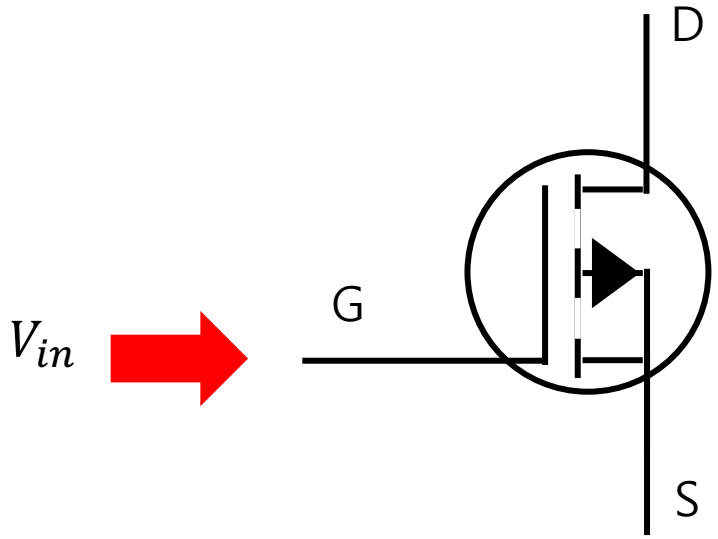
$$V_{GS(th)} = V_G - V_S > 0$$

$\Rightarrow V_D,\ V_S$ Current flow X

20 Power source switch



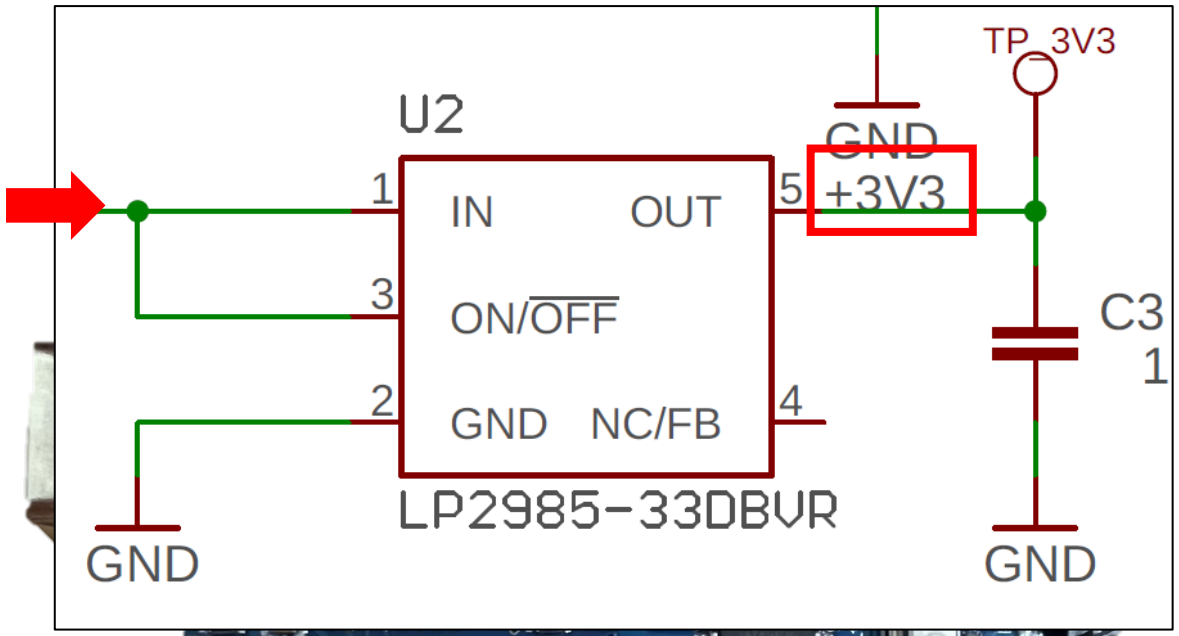
2. USBVCC

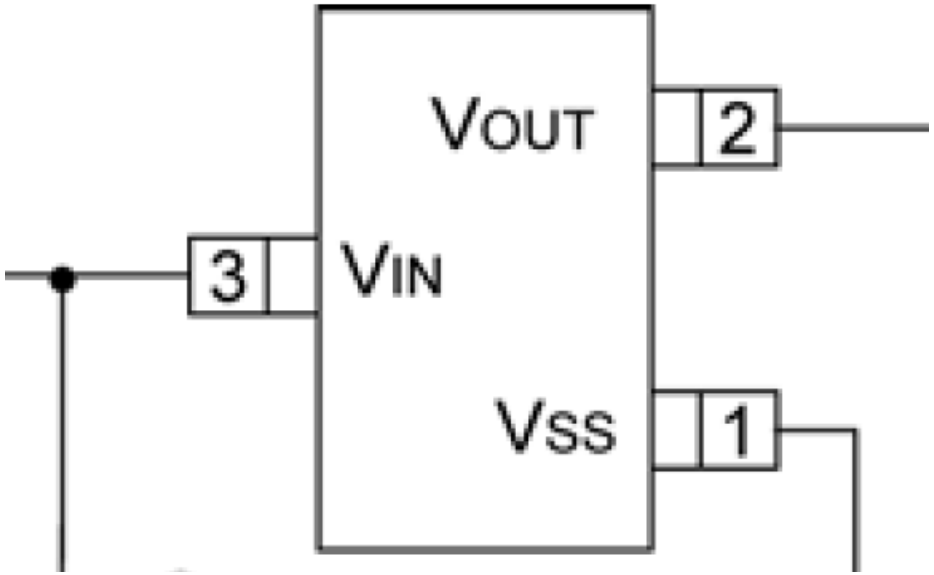


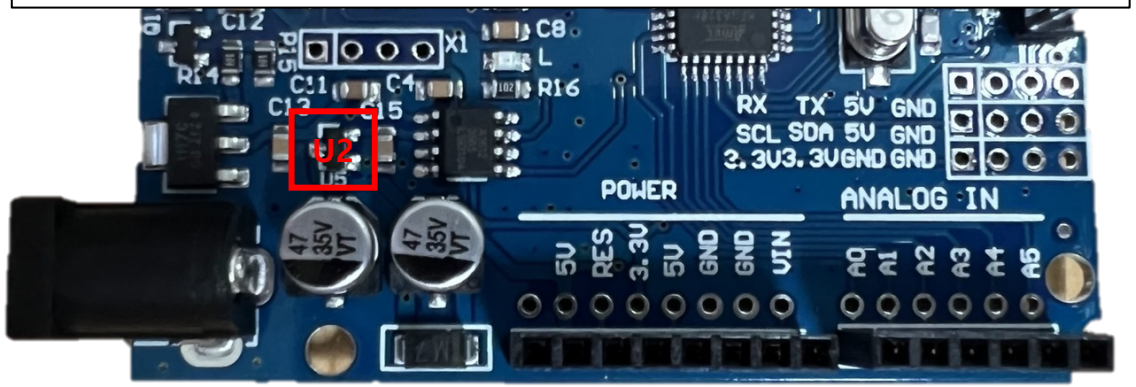
$$V_{GS(th)} = V_G - V_S < 0$$

$$\Rightarrow V_D,\ V_S \text{ Current flow}$$

21 3.3V Regulator







SC662K Datasheet, PDF - Alldatasheet