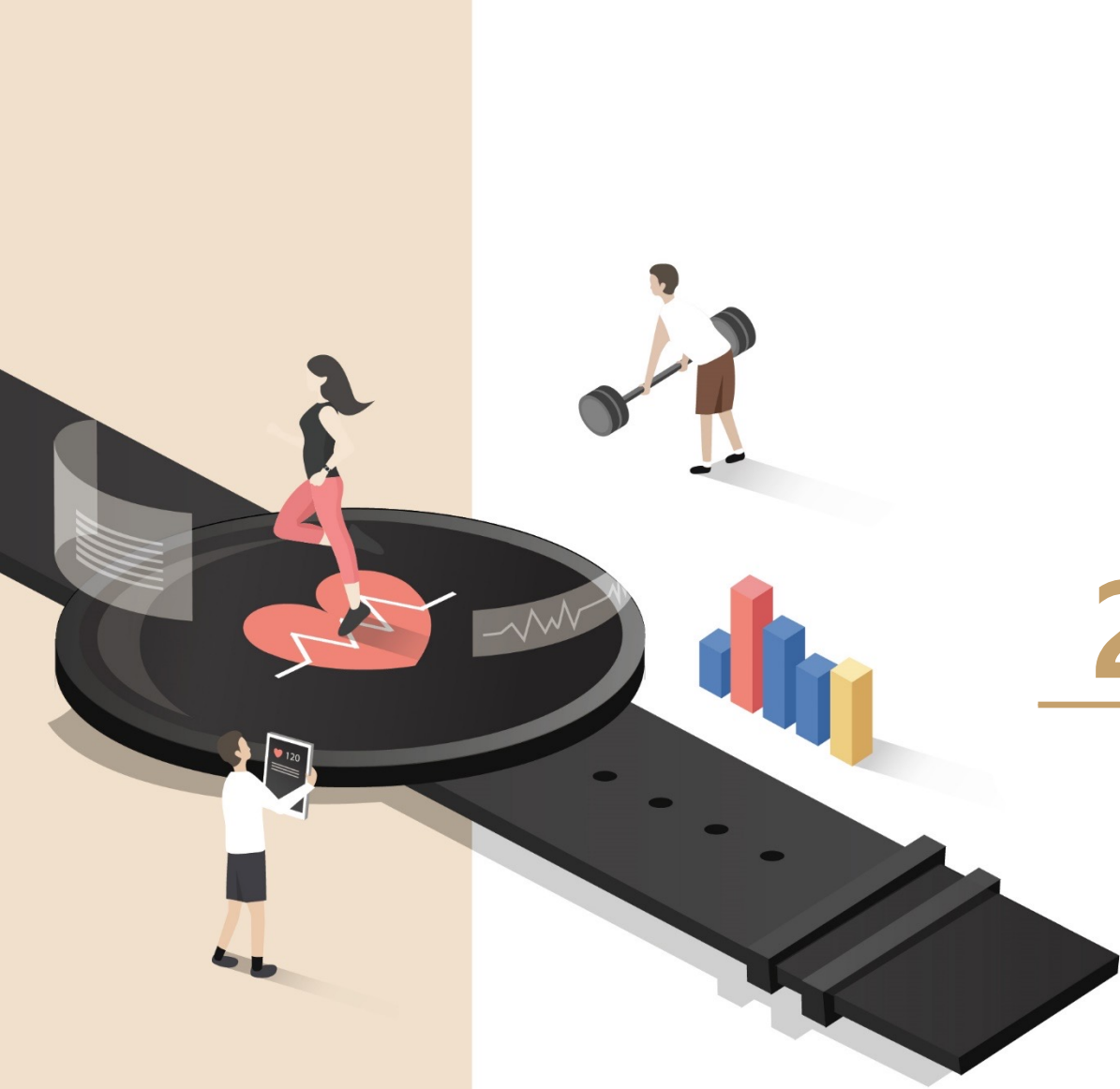




Mobile System Engineering, Dankook University

# Basic Mobile Lab II



## 2 PWM Experiment

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# 1 PWM Experiment



Arduino ide

전체

이미지

동영상

도서

뉴스

더보기

도구

검색결과 약 27,200,000개 (0.47초)

[https://www.arduino.cc > software](https://www.arduino.cc/software)

**Software | Arduino**

2021. 12. 20. — The open-source **Arduino** Software (**IDE**) makes it easy to write code and upload it to the board. This software can be used with any **Arduino** ...

[Arduino IDE 2.0 \(beta\)](#) · [Arduino IDE 2.0 beta Forum](#) · [Donate](#) · [Getting Started](#)

[http://arduino.cc > Guide > Windows](http://arduino.cc/guide/windows)

**Install the Arduino Software (IDE) on Windows PCs**

Download the **Arduino** Software (**IDE**). Get the latest version from the download page. You can choose between the Installer (.exe) and the Zip packages. We suggest ...

[https://docs.arduino.cc > software > ide-v2](https://docs.arduino.cc/software/ide-v2)

**Arduino IDE 2 Tutorials**

Discover all the new features of the **Arduino** IDE 2, our faster and more powerful programming tool.

[https://www.arduino.cc > guide > environment](https://www.arduino.cc/guide/environment)

**Arduino Integrated Development Environment (IDE) v1**

The **Arduino** Integrated Development Environment - or **Arduino** Software (**IDE**) - contains a text editor for writing code, a message area, a text console, ...

관련 질문

What IDE is used for Arduino?

▼

Is Arduino IDE is free?

▼

**아두이노 IDE (Arduino IDE)**

소프트웨어

아두이노 통합개발환경은 편집기, 컴파일러, 업로더 등이 합쳐진 소프트웨어 환경이다. '아두이노 소프트웨어'라고도 불린다. 이와 더불어 기타 개발에 필요한 각종 옵션 및 라이브러리 관리를 할 수 있다. 위키백과

안정화 버전: 1.8.8 / 2018년 12월 6일 (3년 전)

종류: 통합 개발 환경

웹사이트: [arduino.org](http://arduino.org), [arduino.cc](http://arduino.cc)

운영 체제: 크로스 플랫폼

개발자: 아두이노 소프트웨어


프로그래밍 언어: C, C++, 자바

플랫폼: IA-32, x86-64, ARM 아키텍처

1. Search 'Arduino IDE' on Google
2. Click 'Software | Arduino'

## 2 PWM Experiment



HARDWARESOFTWARECLOUDDOCUMENTATIONCOMMUNITYBLOGABOUT

[CODE ONLINE](#)[GETTING STARTED](#)

Examples

Libraries

Serial Monitor

ORDER BY LAST MODIFIED

1 Test (2)

2 YonExamples (18)

3


4 int\_brightne

5


6 void setup()

7 Serial.begin

8



### Downloads



#### Arduino IDE 1.8.19

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Refer to the [Getting Started](#) page for Installation instructions.


SOURCE CODE

Active development of the Arduino software is [hosted by GitHub](#). See the instructions for [building the code](#). Latest release source code archives are available [here](#). The archives are PGP-signed so they can be verified using [this](#) gpg key.

#### DOWNLOAD OPTIONS

**Windows** Win 7 and newer

**Windows** ZIP file

**Windows app** Win 8.1 or 10 

**Linux** 32 bits

**Linux** 64 bits

**Linux** ARM 32 bits

**Linux** ARM 64 bits

**Mac OS X** 10.10 or newer

[Release Notes](#) [Checksums \(sha512\)](#)

[Hourly Builds](#)[Previous Releases](#)

[Help](#)

### 3. Download and install it

### 3 PWM Experiment



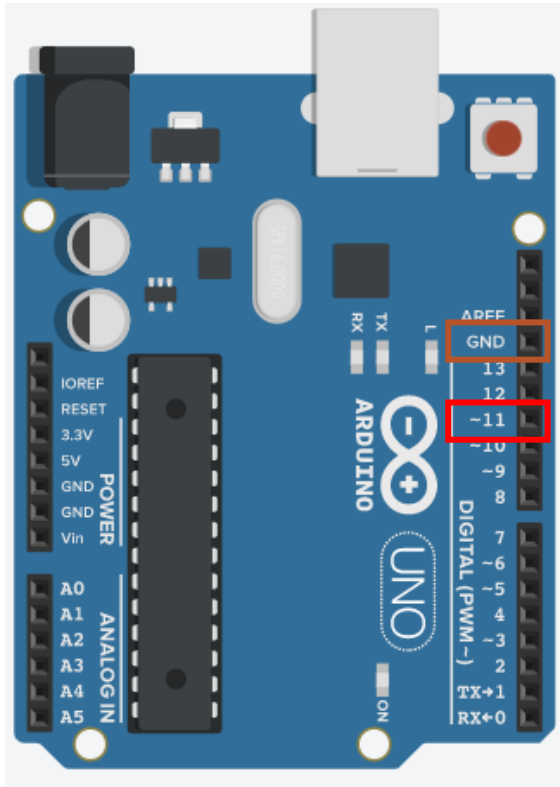
Upload

Compile

Serial monitor

```
1 void setup() {
2   // put your setup code here, to run once:
3
4 }
5
6 void loop() {
7   // put your main code here, to run repeatedly:
8
9 }|
```

## 4 PWM Experiment



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

```
3wk_Exp_PWM_

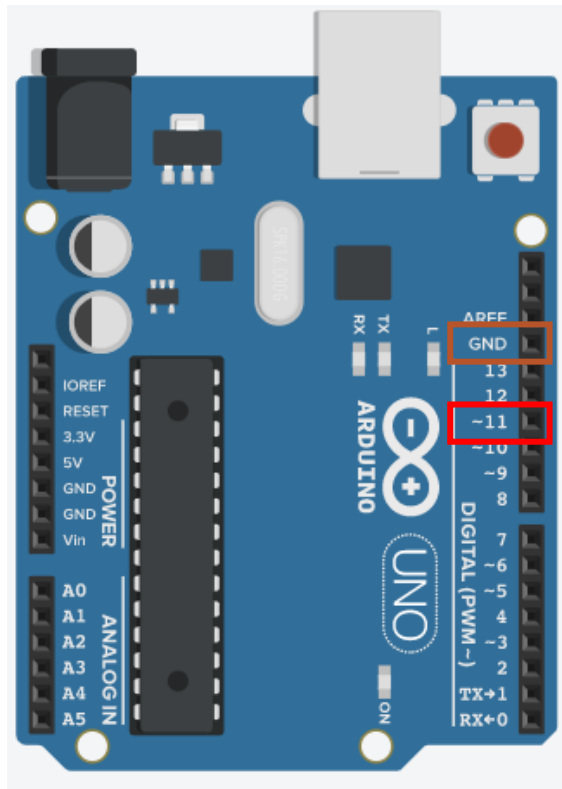
void setup()
{
  pinMode(11, OUTPUT); //set output to Arduino pin 11
}

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
  }
}
```

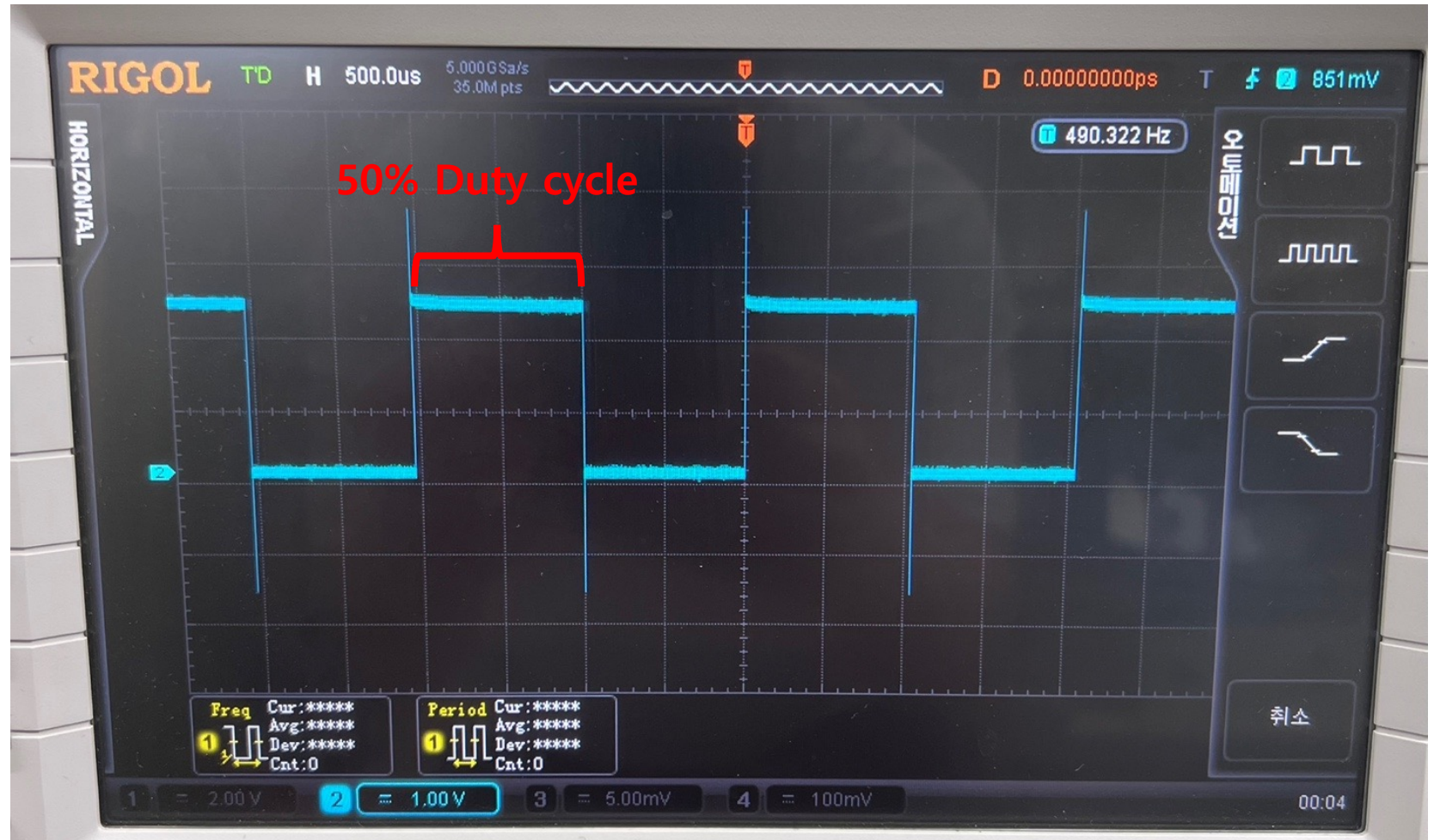
Arduino PWM range is **8 bit(0~255)**

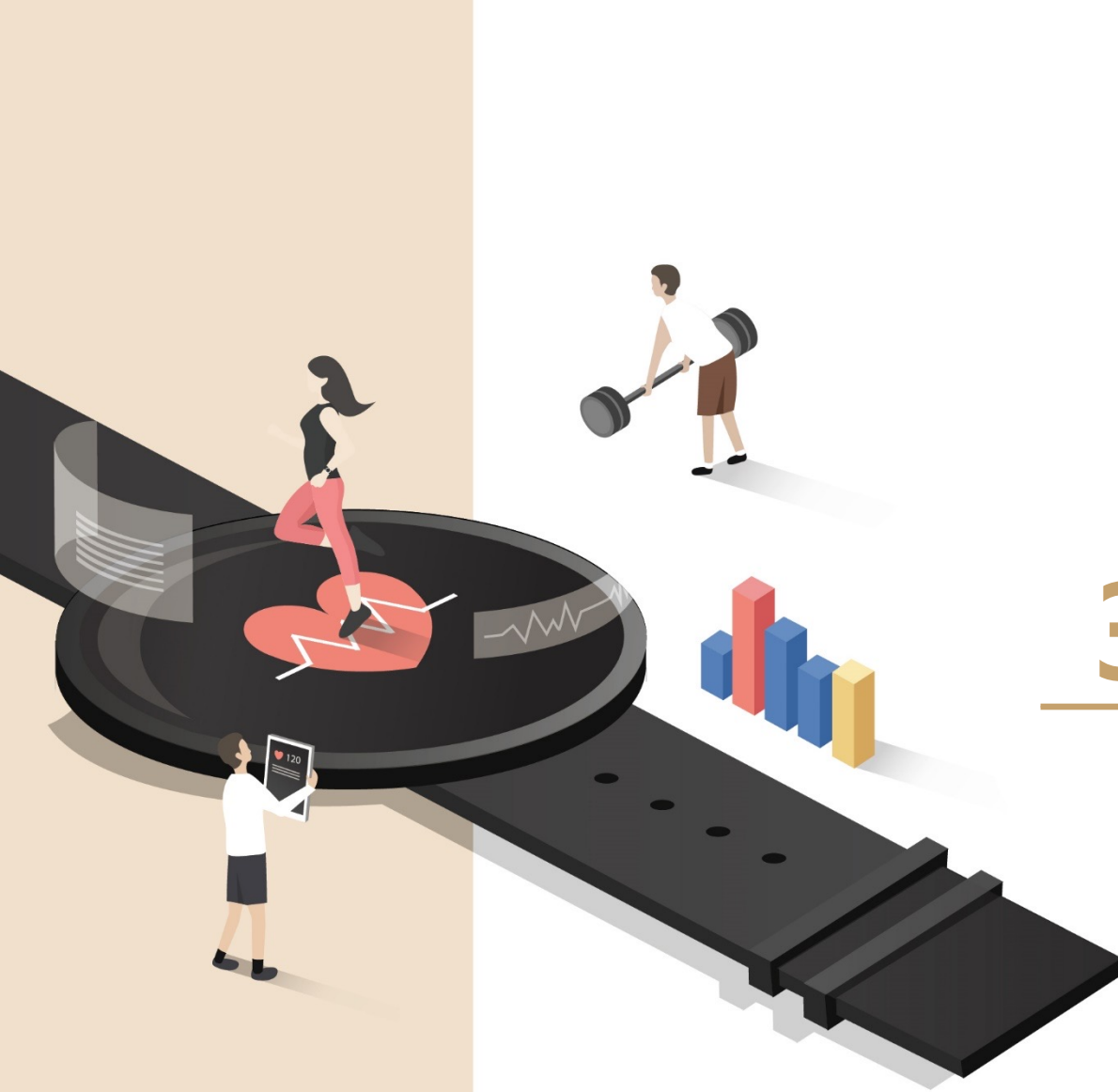


## 5 PWM Experiment



GND -> Probe GND  
~11 -> Probe hook



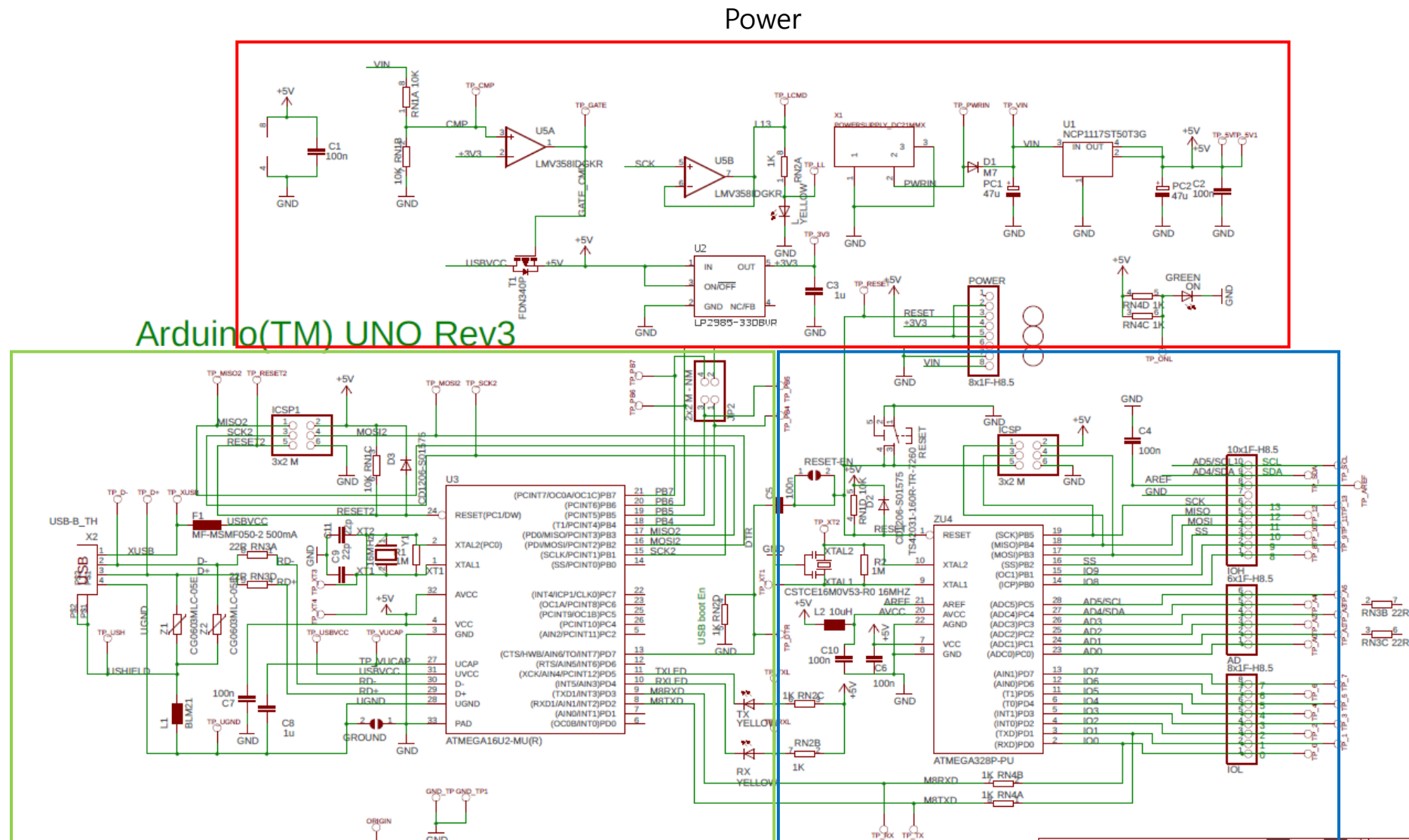


### 3 Arduino UNO Rev3 Schematic

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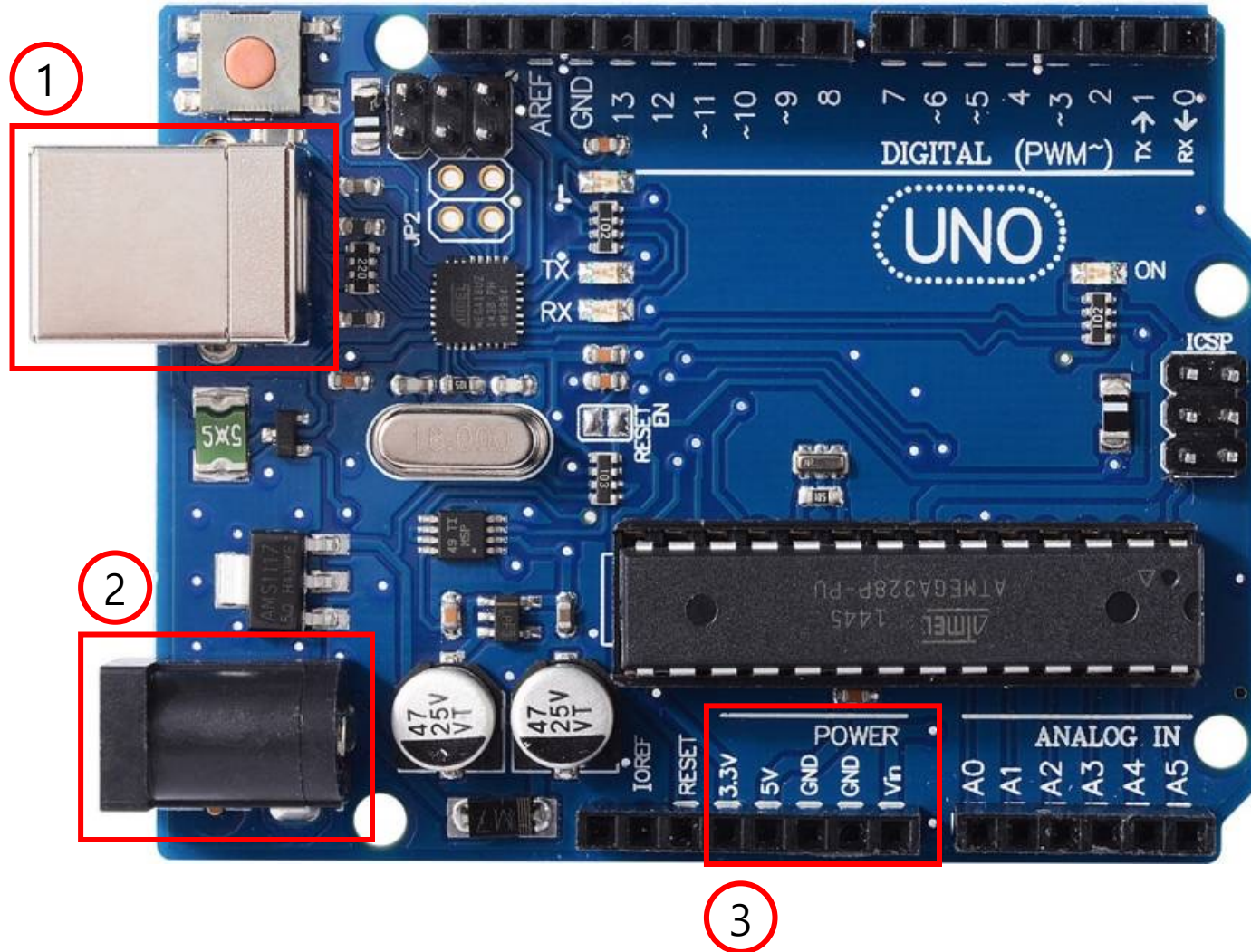
# 1 Arduino UNO Rev3 schematic



USB Bridge - Atmega16u2

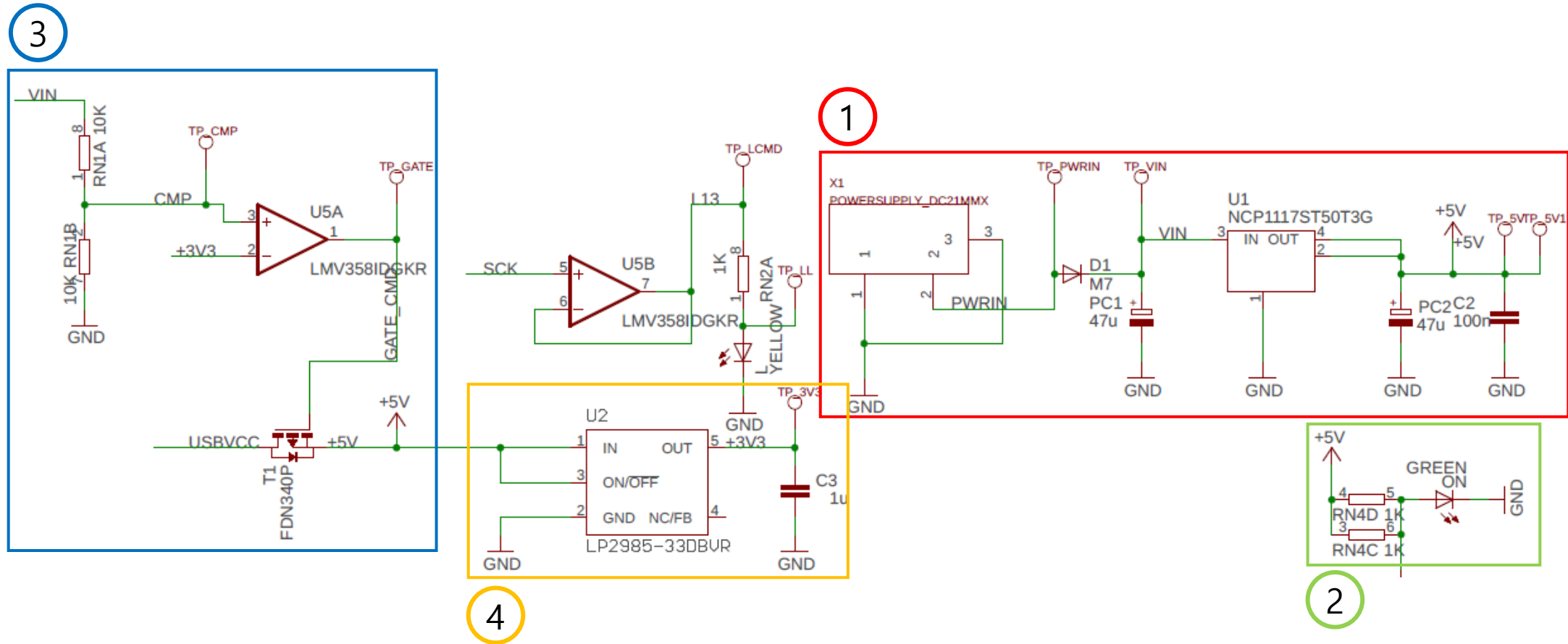
Microcontroller - Atmega 328p

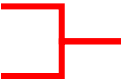
## 2 3 ways to power Arduino



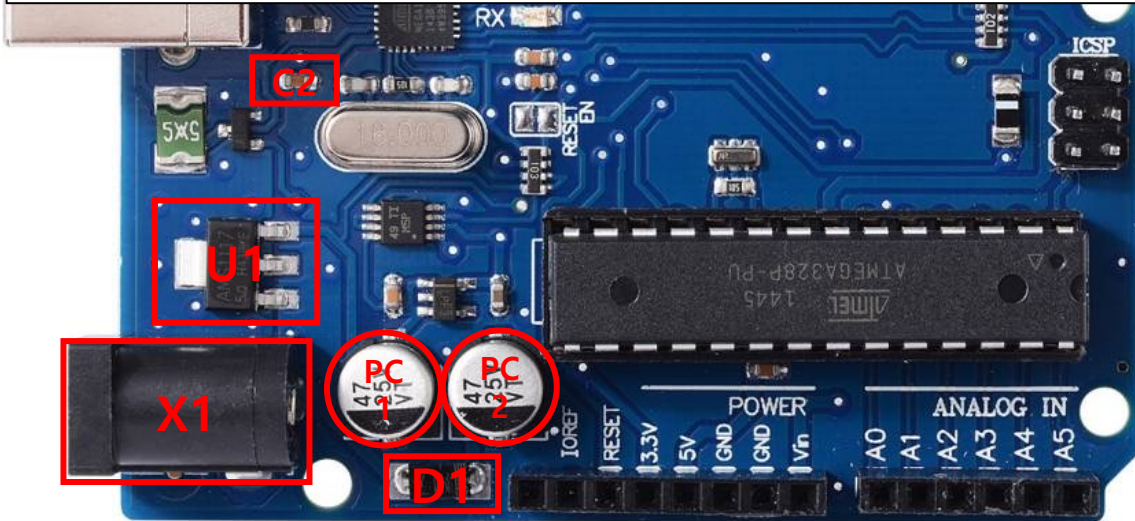
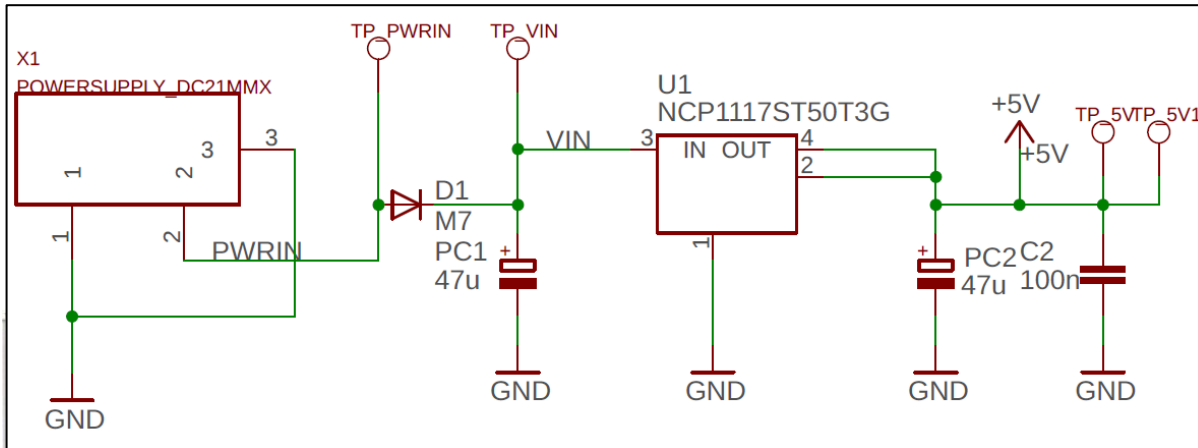
1. USB port(5V)
2. DC jack(7~12V)
3. Vin pin(7~12V)

# 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



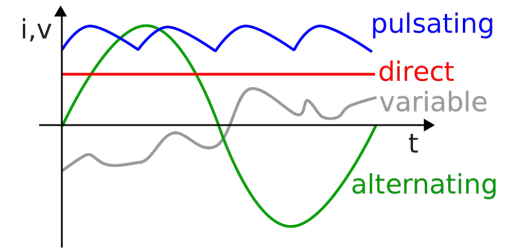
- 1) X1: DC power input 7~12V
- 2) D1: reverse voltage protection diode
  - Forward bias: Anode -> Cathode (Switch on)
  - Reverse bias: Cathode -> Anode (Switch off)
  - Voltage drop: 0.6-0.7V
- 3) PC1/PC2: Polarized condenser(=Capacitor)
- 4) U1: 5V regulator – output constant voltage
- 5) C2: Non-polarized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

## 5 DC jack power

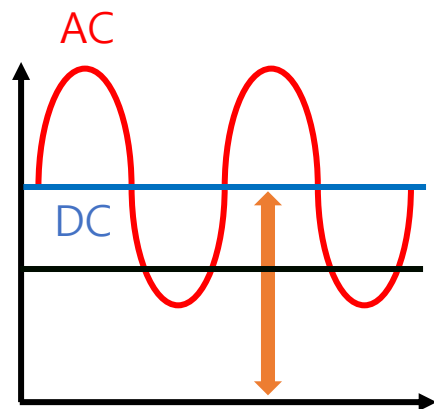


### Uses of Capacitor

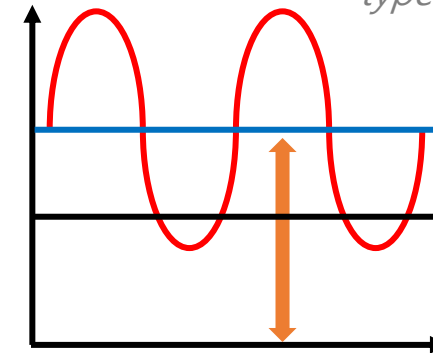
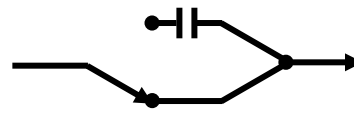
- 1) **coupling** – only AC signals pass through a mixture of DC signal and AC signal.
- 2) energy storage
- 3) smoothing – make a pulsating signal into a constant DC average voltage
- 4) bypass – send the noise to ground.



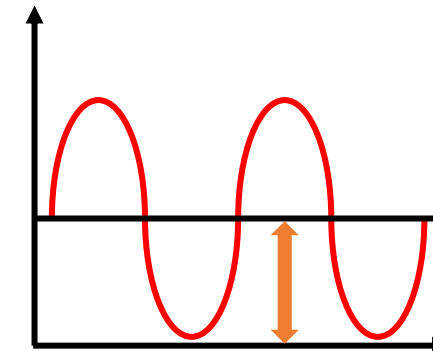
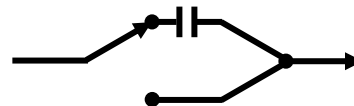
*types of electric current*



DC coupling



AC coupling



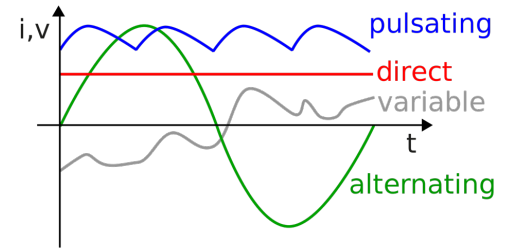


## 6 DC jack power

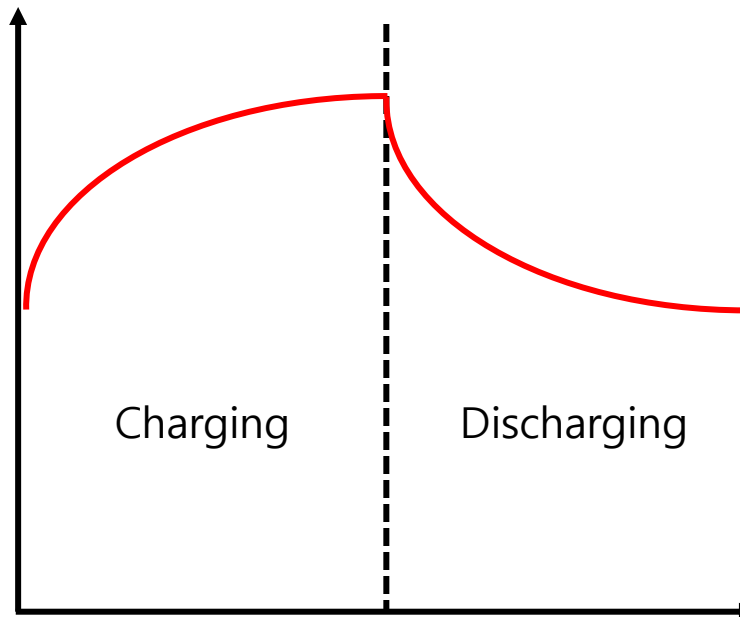


### Uses of Capacitor

- 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*



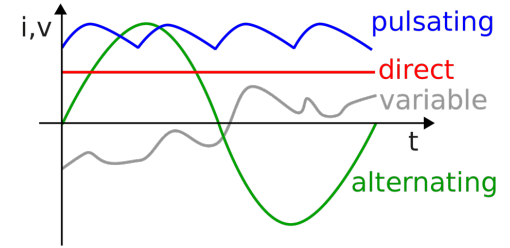


# 7 DC jack power

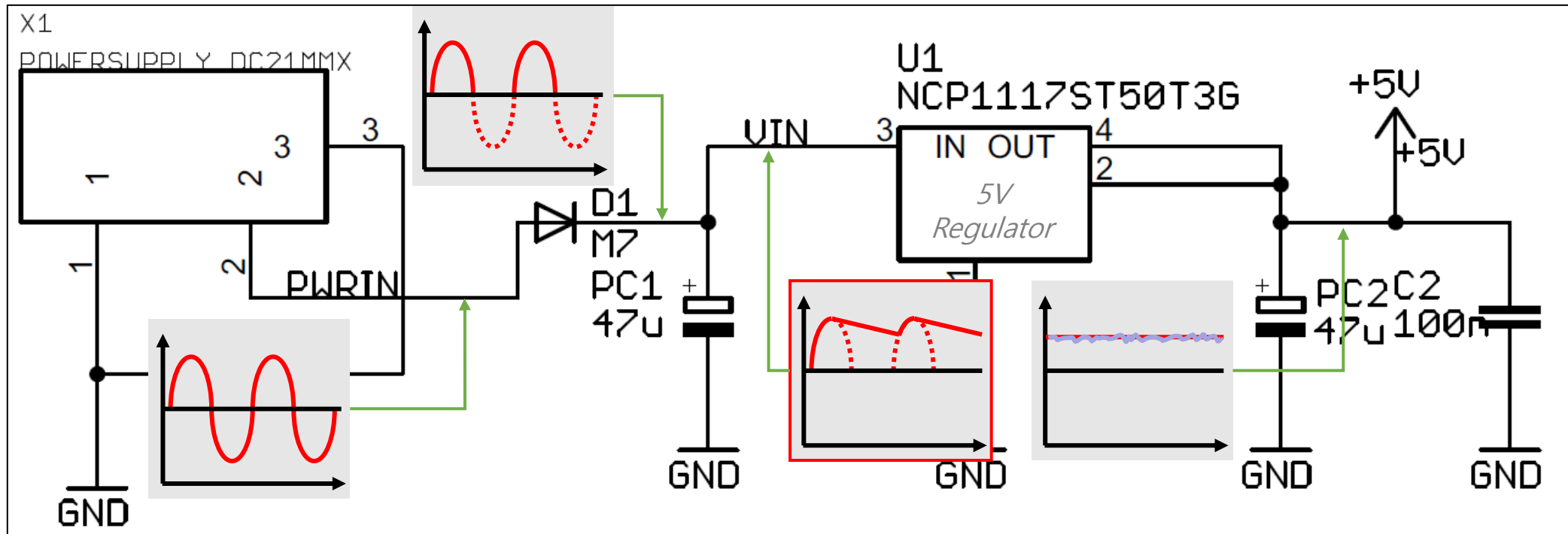


## Uses of Capacitor

- 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

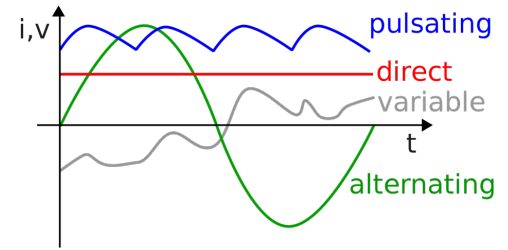


## 8 DC jack power

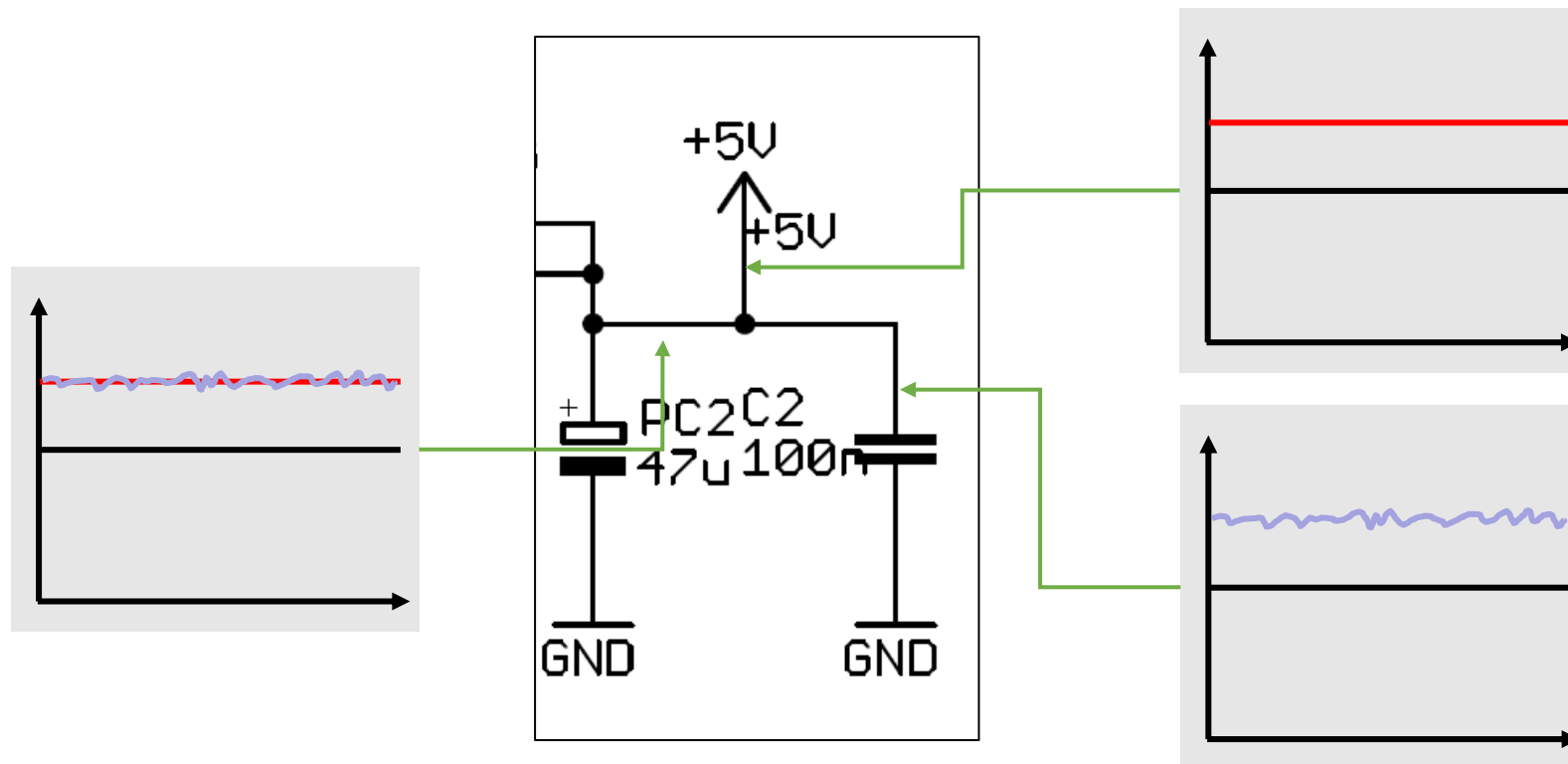


### Uses of Capacitor

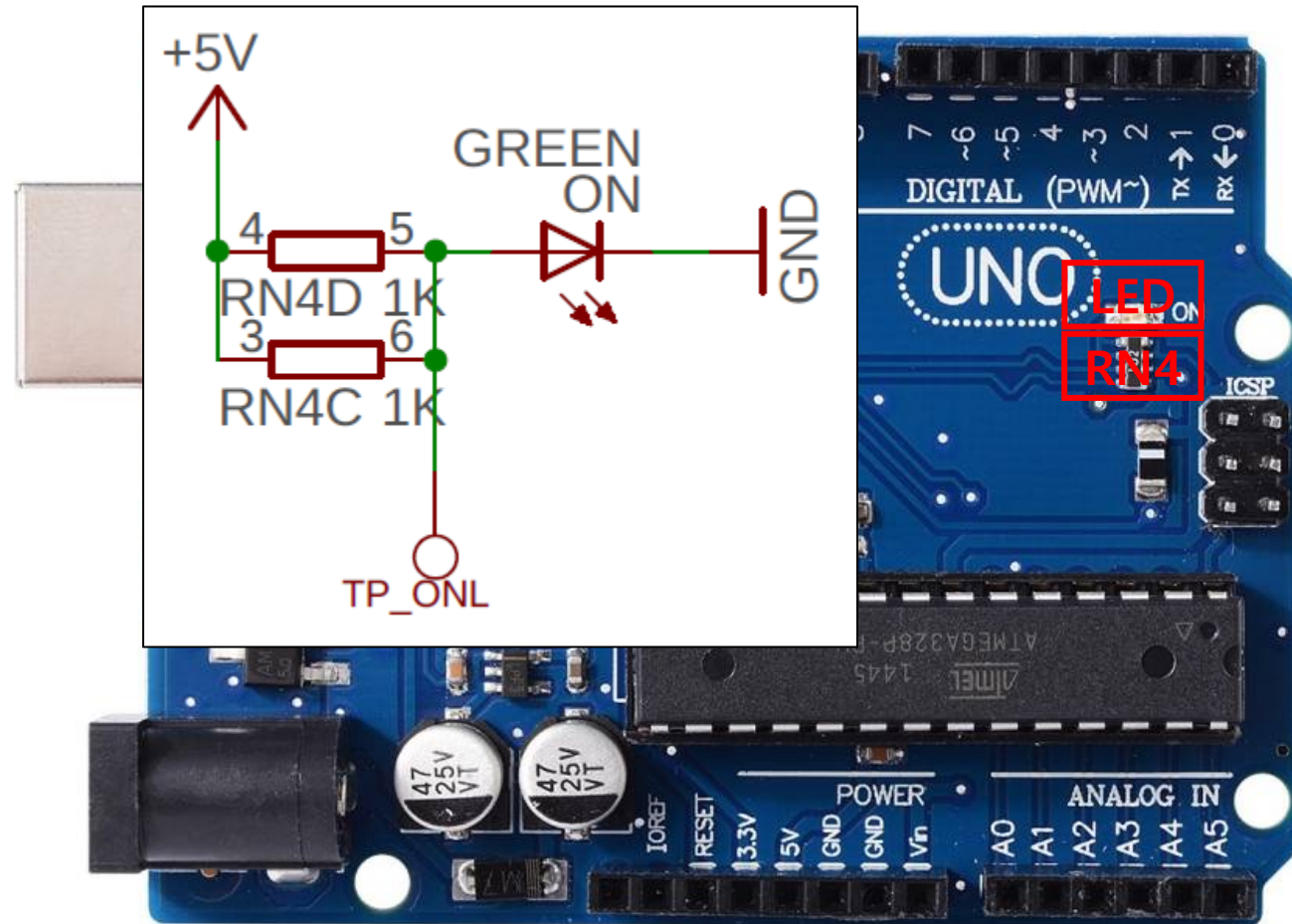
- 1) coupling – only AC signals pass through a mixture of DC signal and AC signal.
- 2) energy storage
- 3) smoothing – make a pulsating signal into a constant DC average voltage
- 4) **bypass** – send the noise to ground.



*types of electric current*

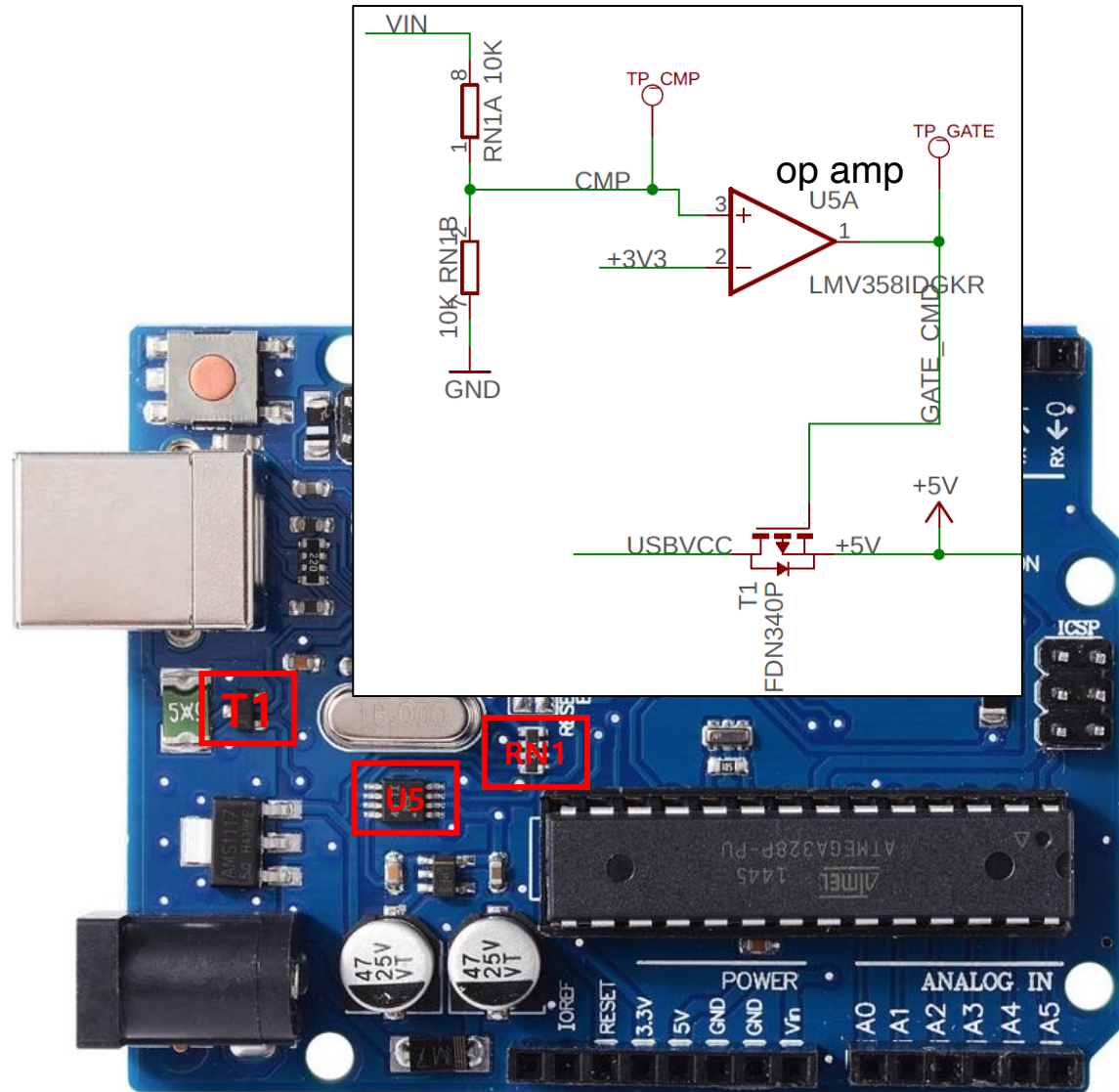


## 9 Power supply indicator LED



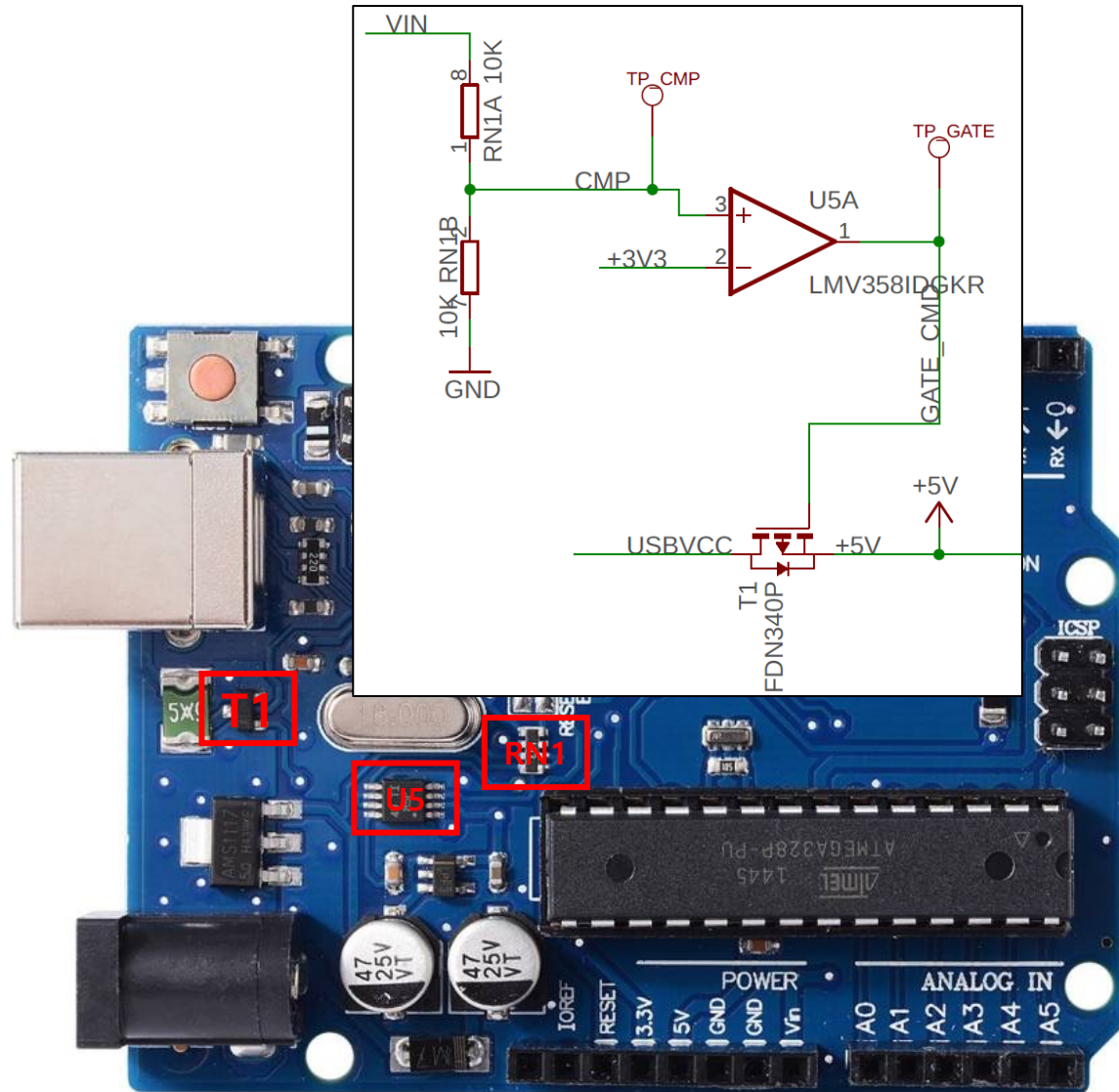
When DC 5V comes from regulator, indicator LED blinks.

# 10 Power source switch



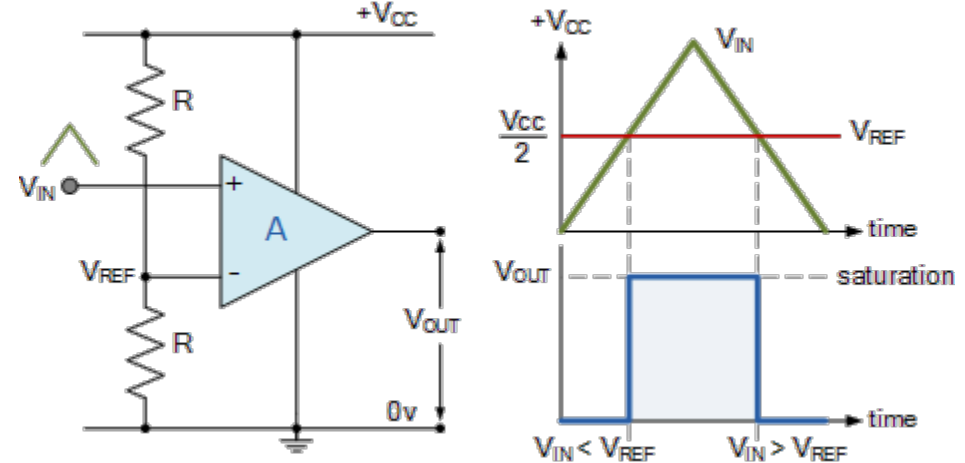
- 1) U5: Comparator
- 2) T1: P-channel MOSFET

# 11 Power source switch



## Comparator

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

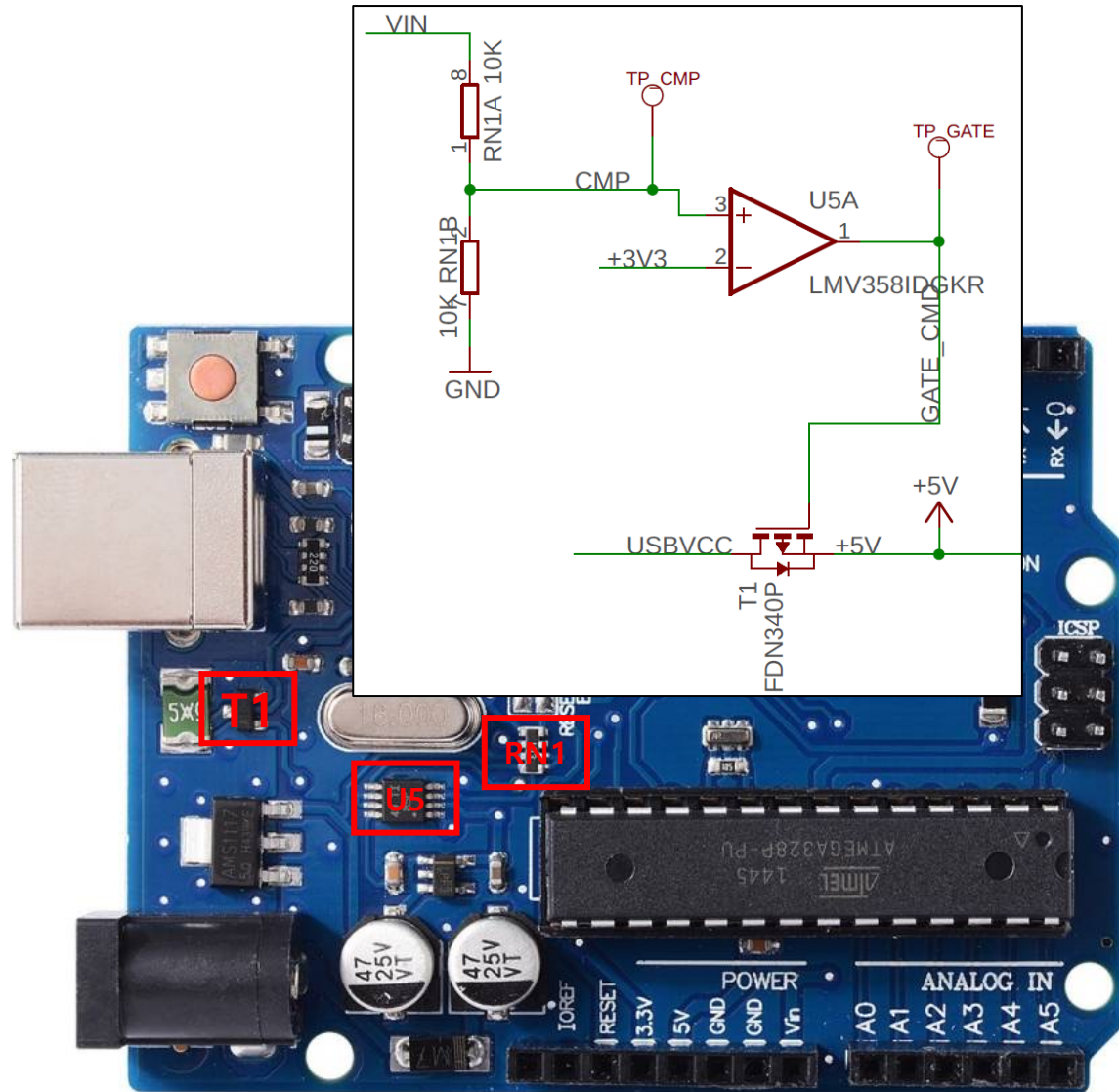


$$V_{out} = \begin{cases} 1, & \text{if } V_{in} > V_{REF} \\ 0, & \text{if } V_{in} < V_{REF} \end{cases}$$

3.3보다 크면 1  
작으면 0



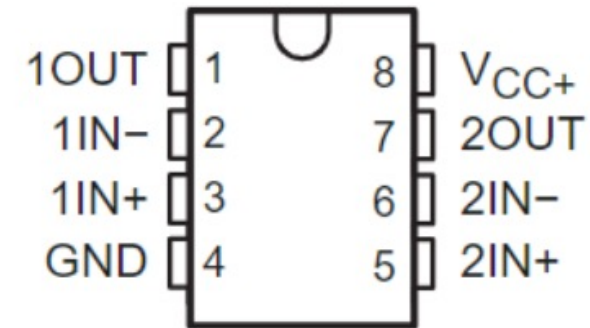
# 12 Power source switch



## Comparator

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

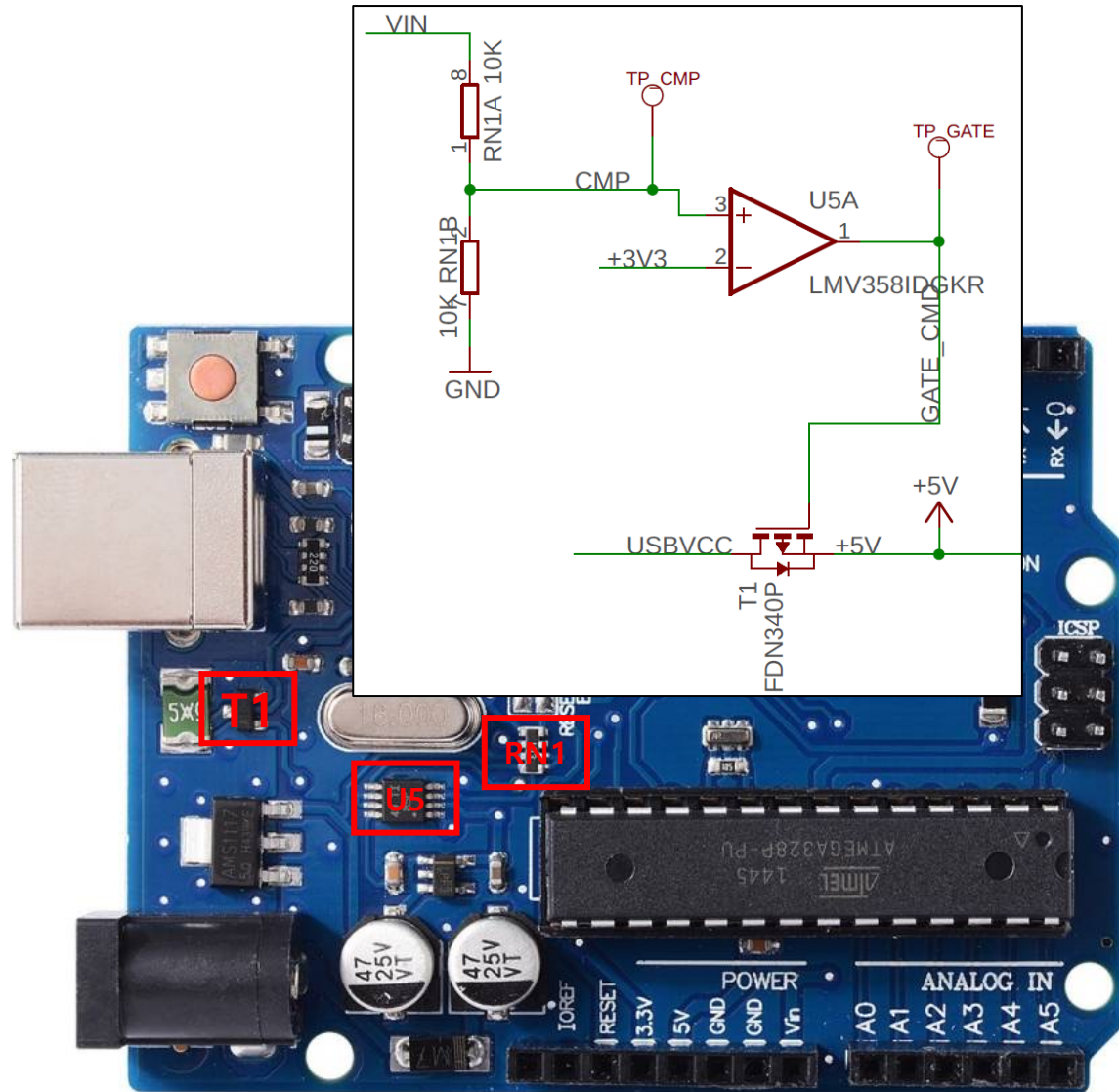
LMV358 . . . D (SOIC), DDU (VSSOP),  
DGK (MSOP), OR PW (TSSOP PACKAGE  
(TOP VIEW)



[LMV358IDGKR Datasheet, PDF - Alldatasheet](#)

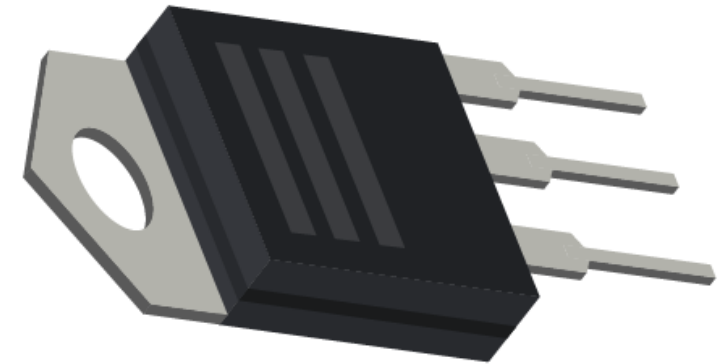


# 13 Power source switch



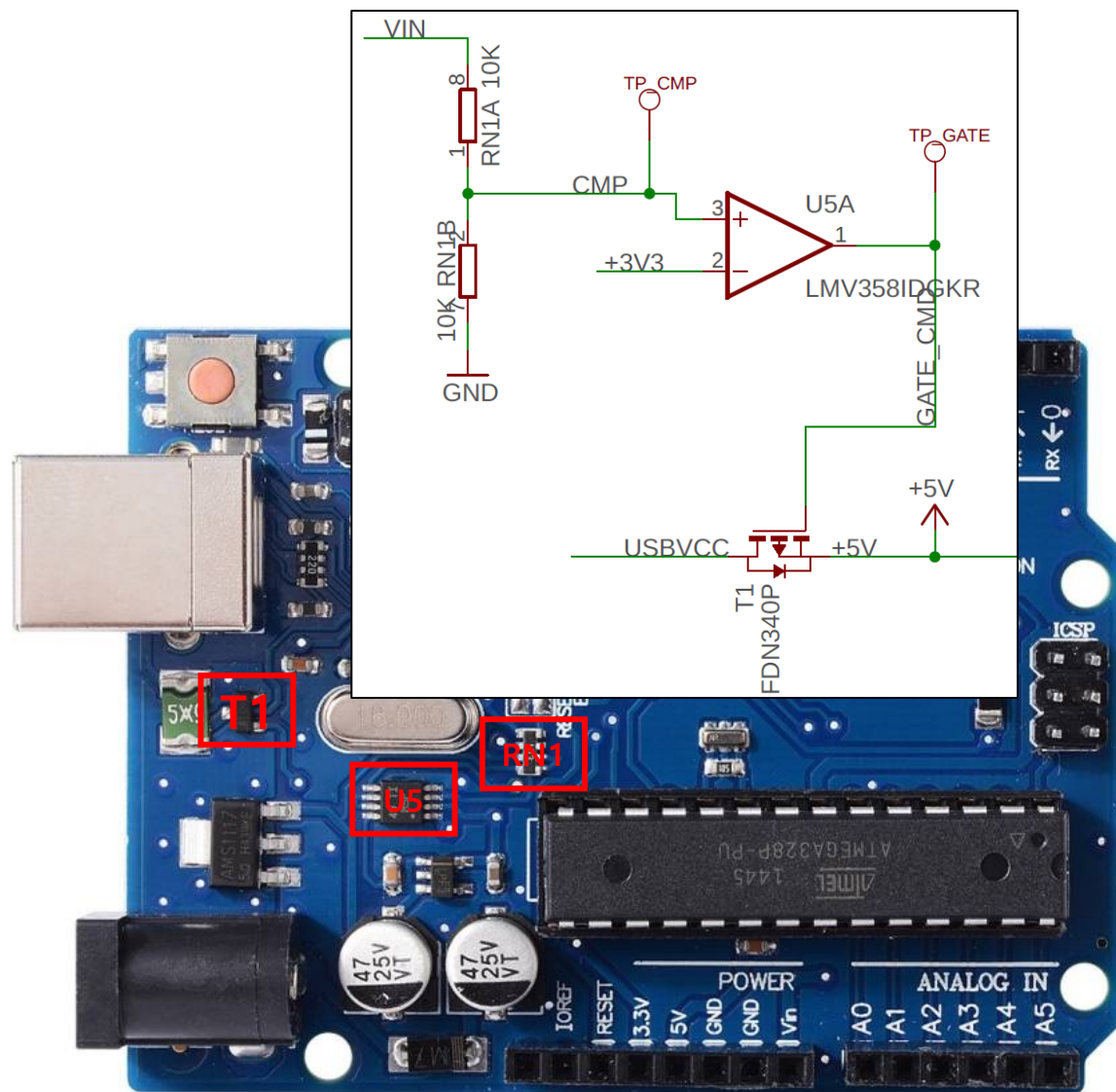
**MOSFET**(Metal-Oxide-Semiconductor-Field-Effect Transistor)  
: electronic devices used to switch or amplify voltages in circuits.

- Source
- Gate
- Drain
- Body

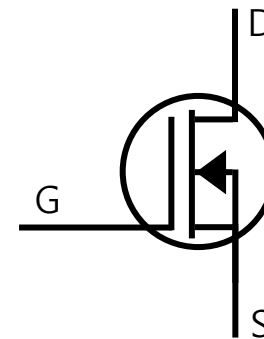
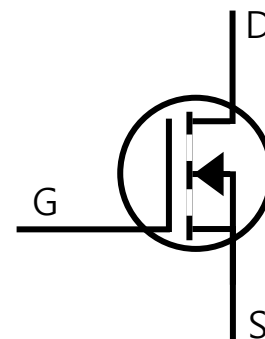


[FDN340P Datasheet, PDF - Alldatasheet](#)

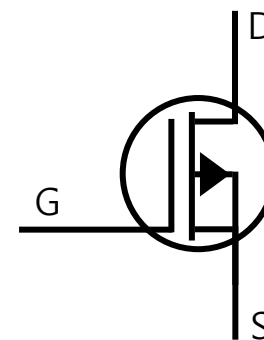
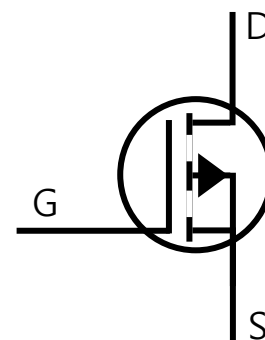
# 14 Power source switch



## MOSFET types



N Channel

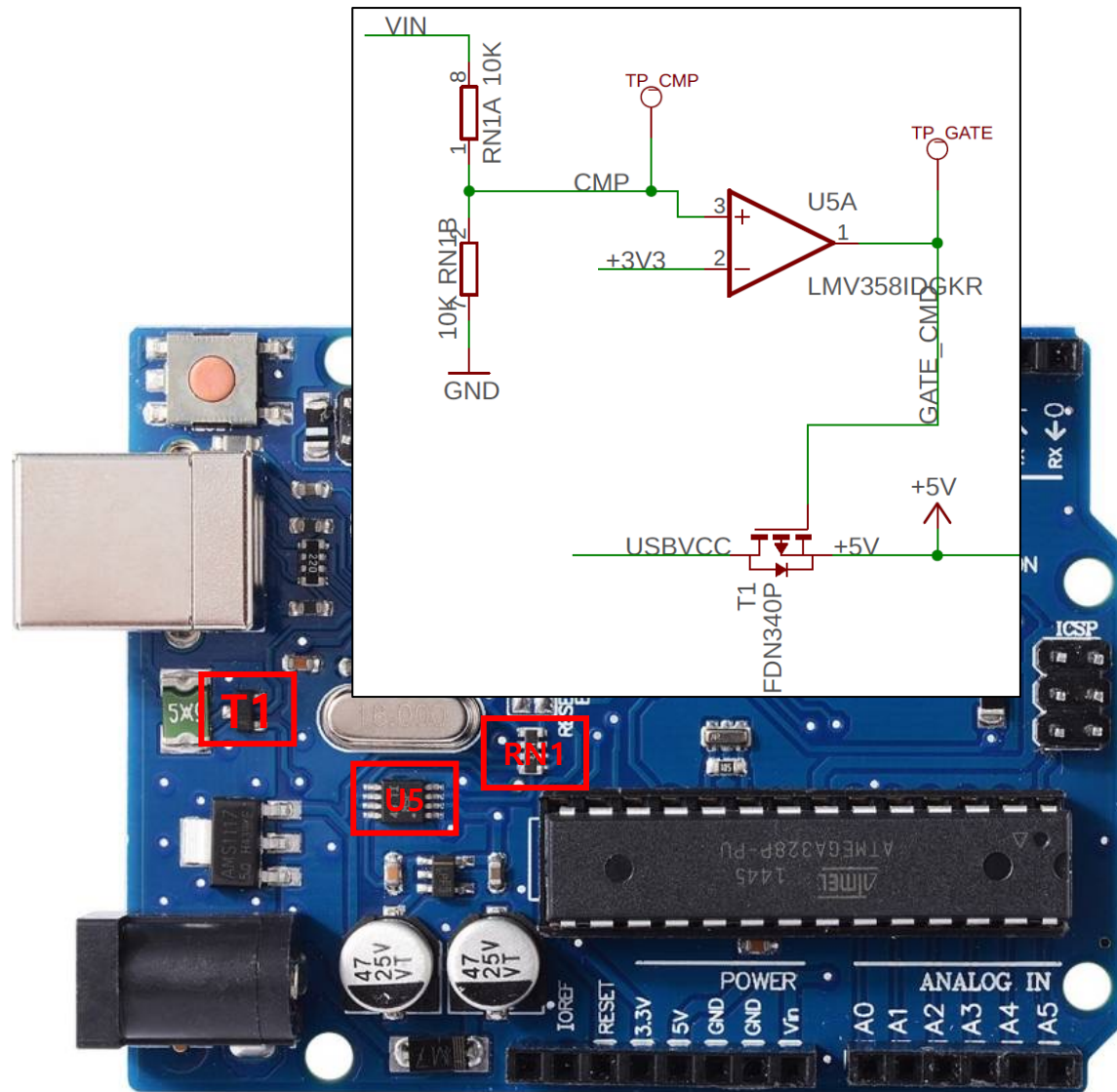


P Channel

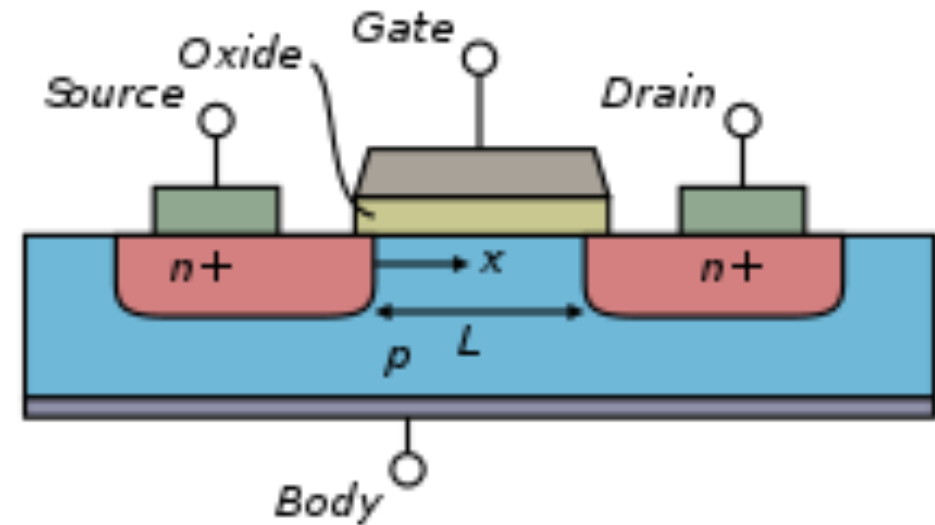
Enhancement  
mode

Depletion  
mode

# 15 Power source switch



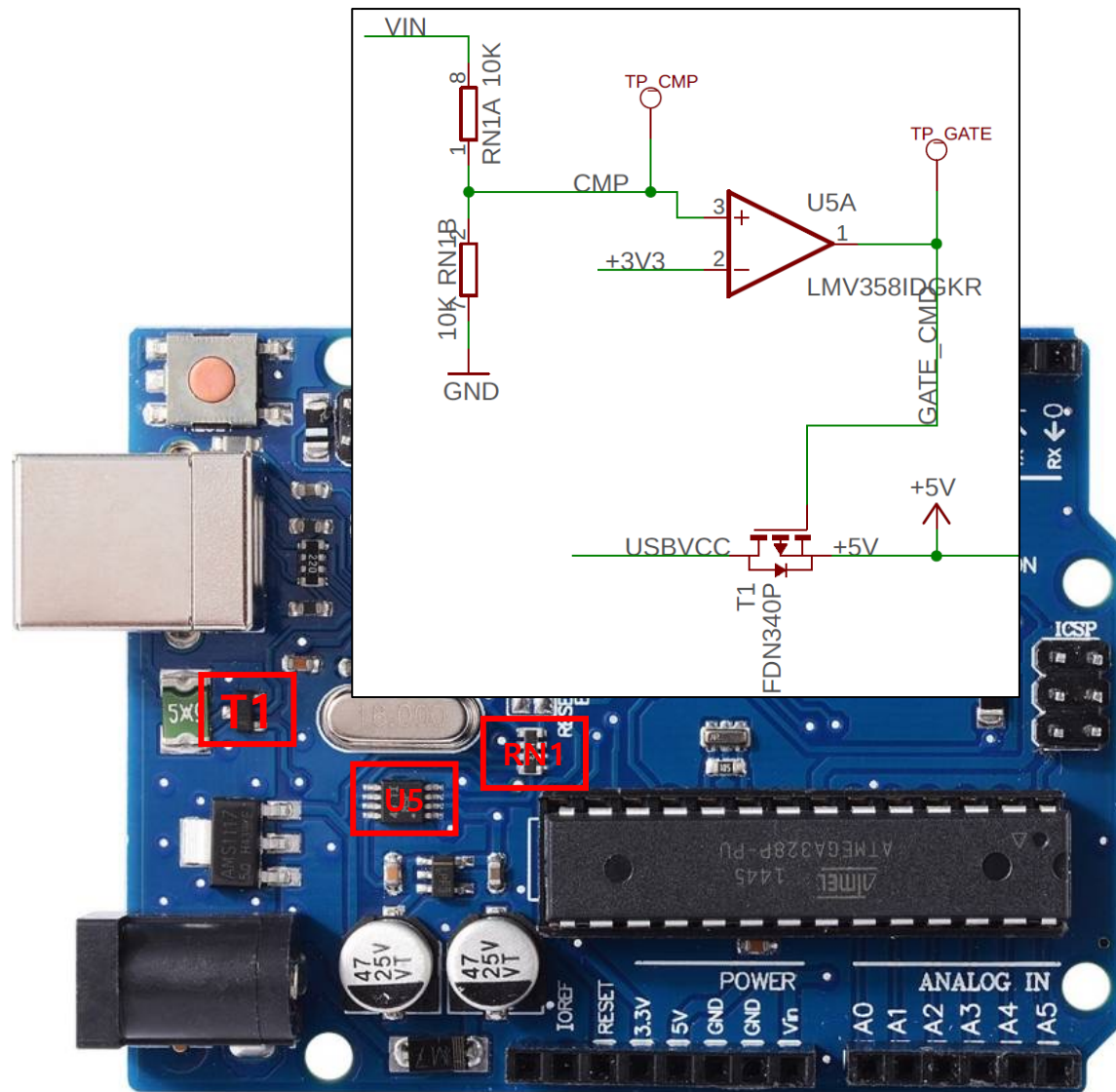
## Enhancement mode MOSFET



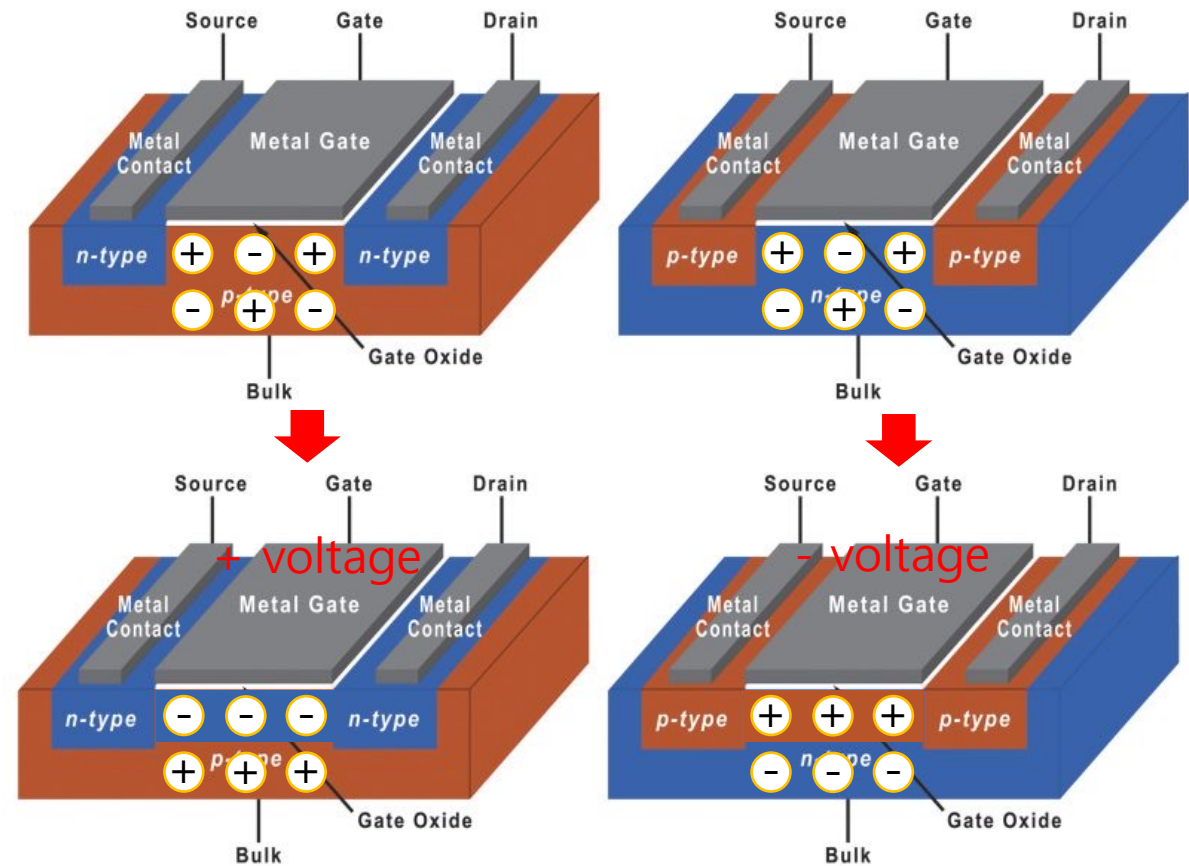
N-MOSFET



# 16 Power source switch



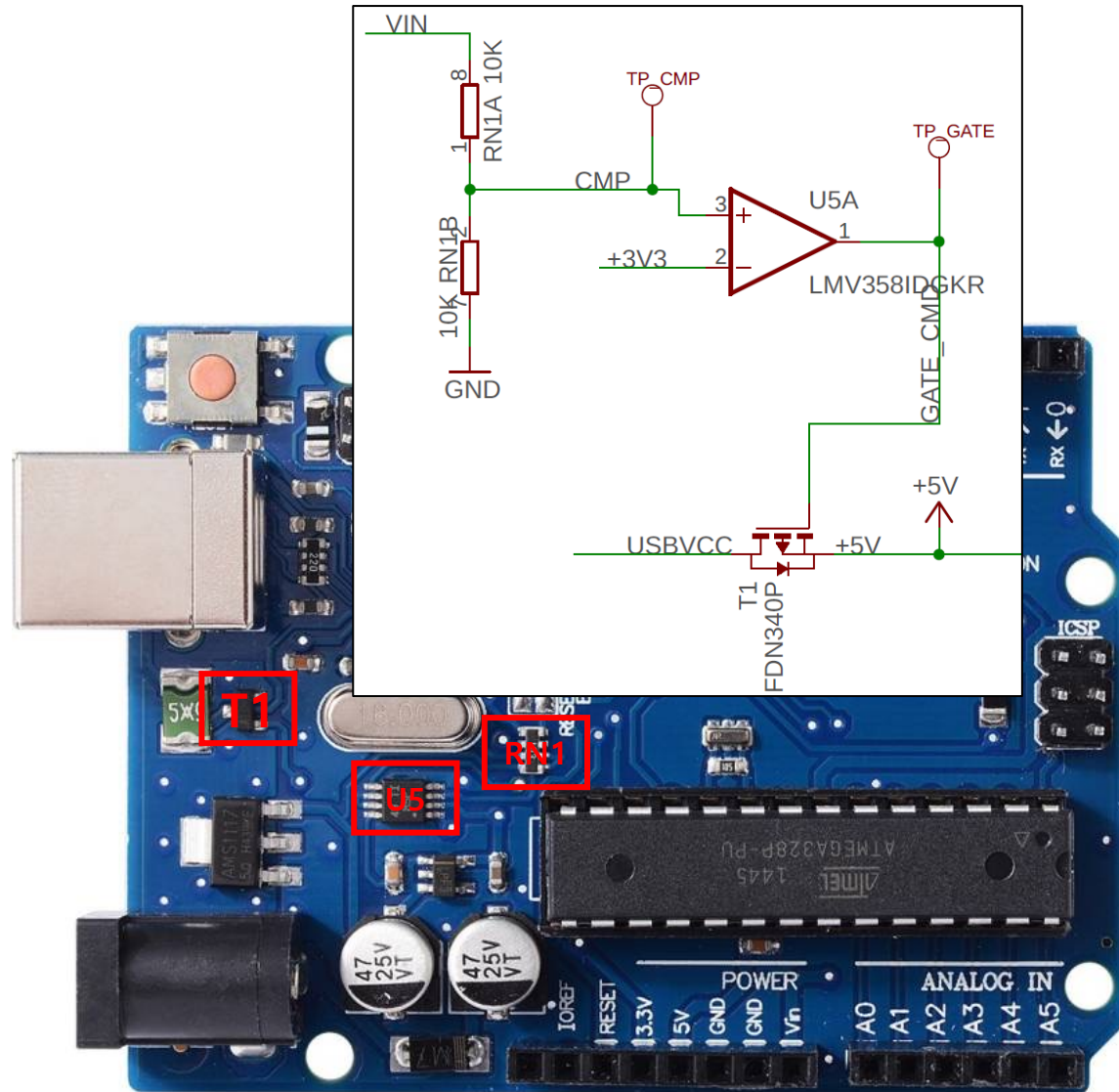
## Enhancement mode MOSFET



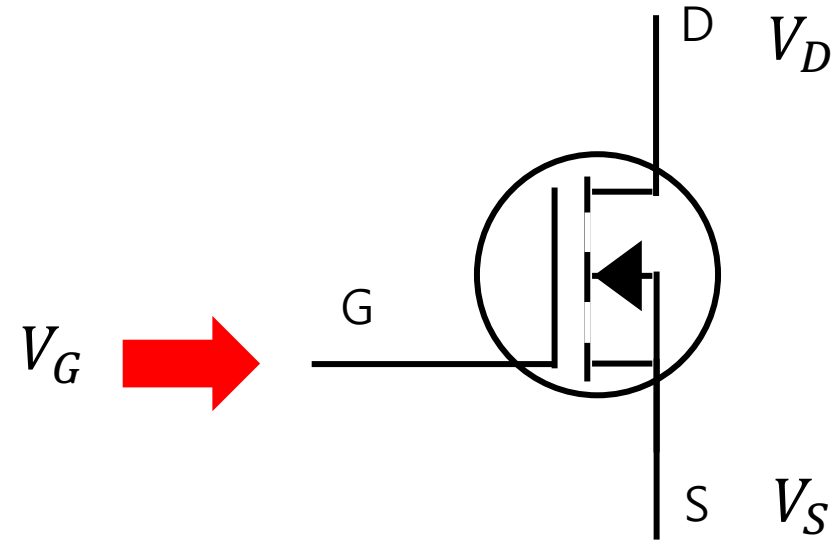
N-MOSFET

P-MOSFET

# 17 Power source switch

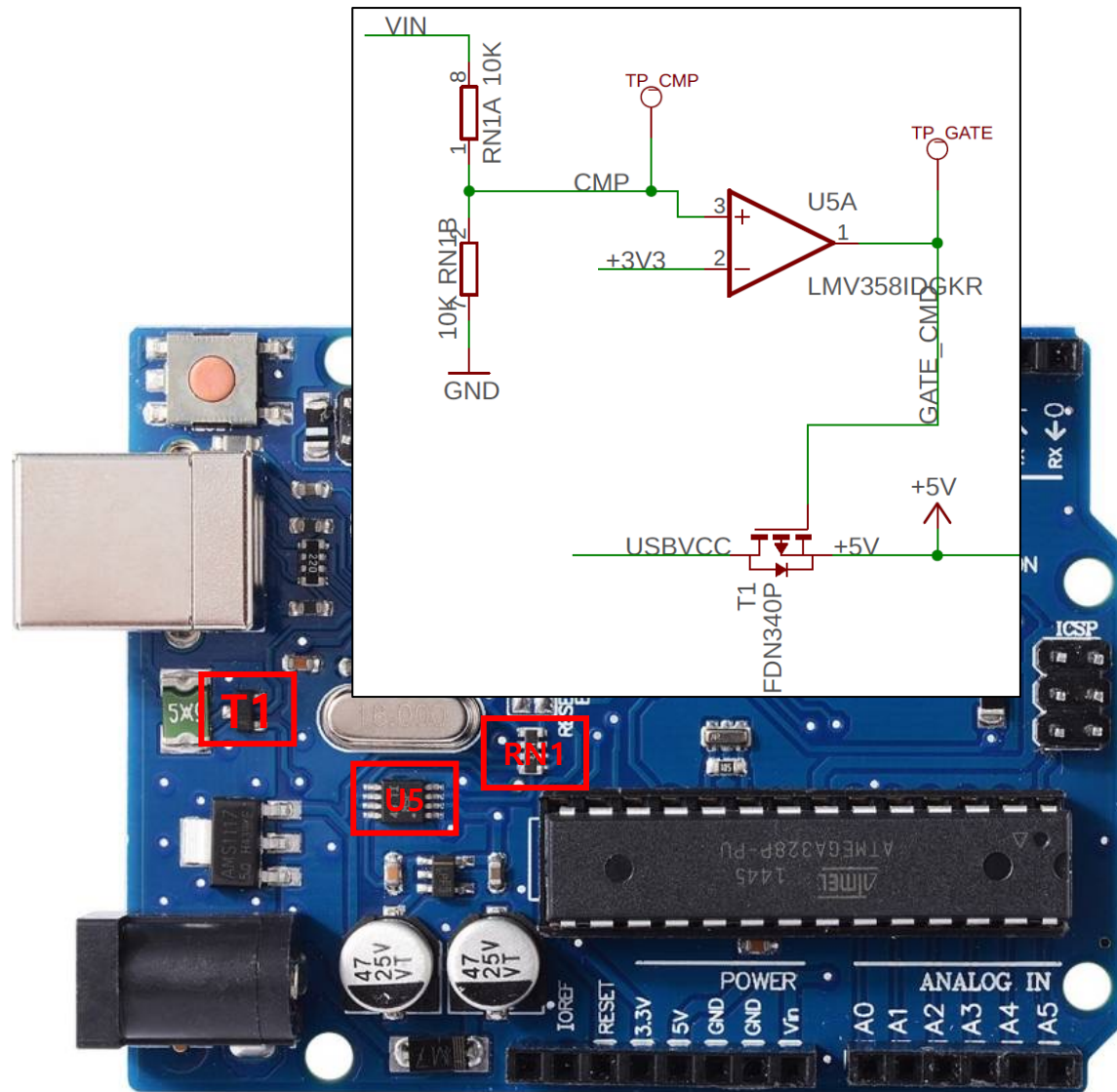


## N-channel MOSFET

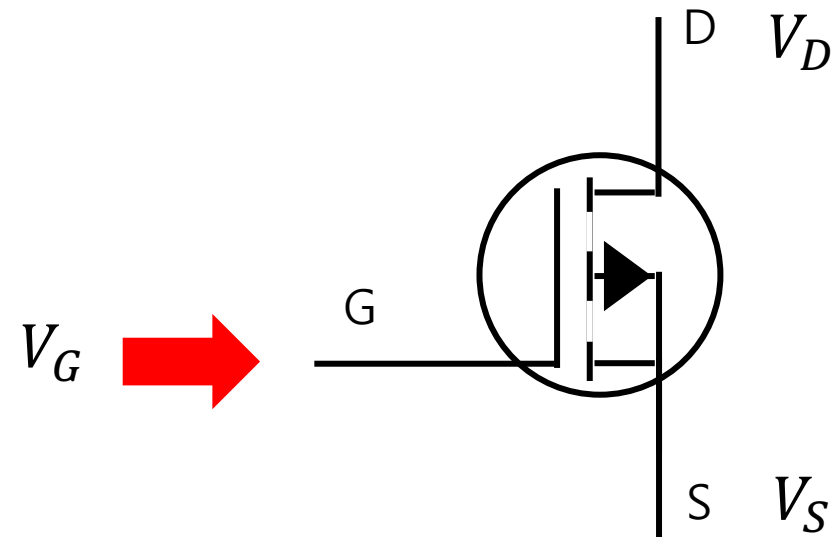


$$V_{GS(th)} = V_G - V_S > 0$$
$$\Rightarrow V_D, V_S \text{ Current flow}$$

# 18 Power source switch



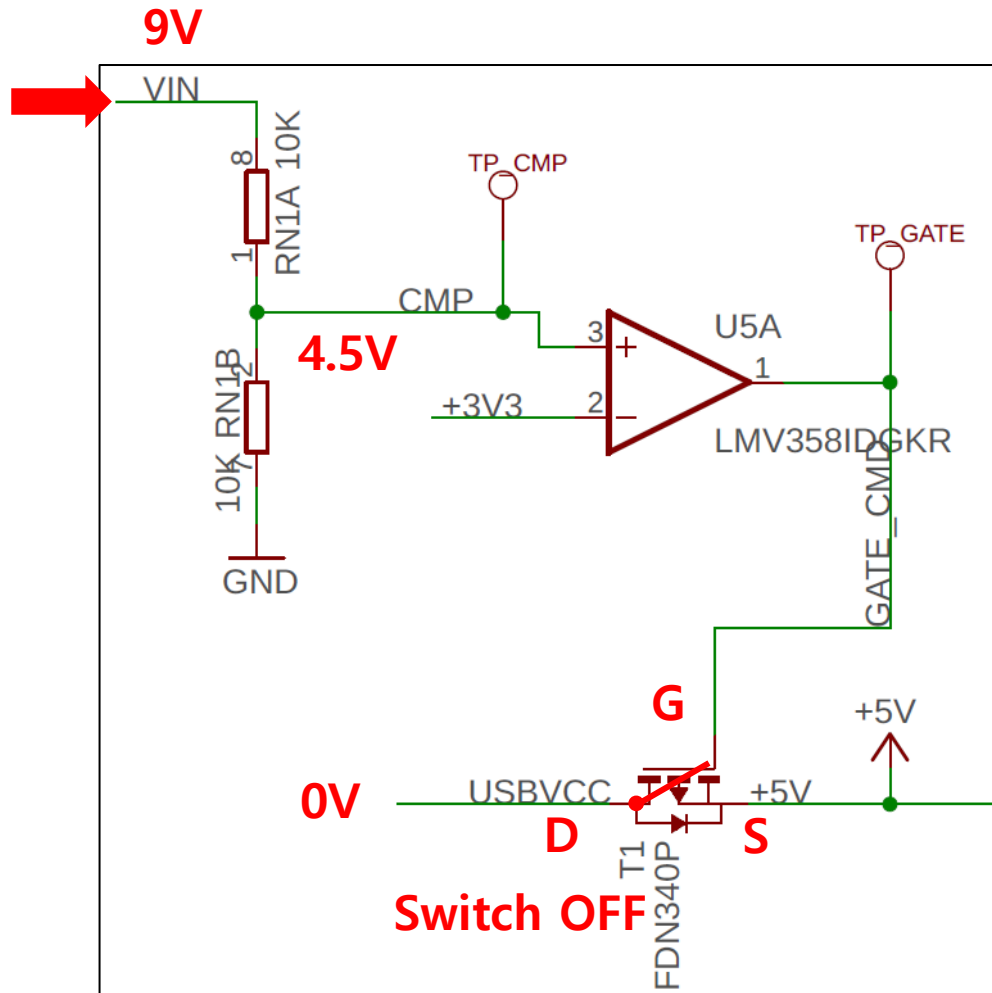
## P-channel MOSFET



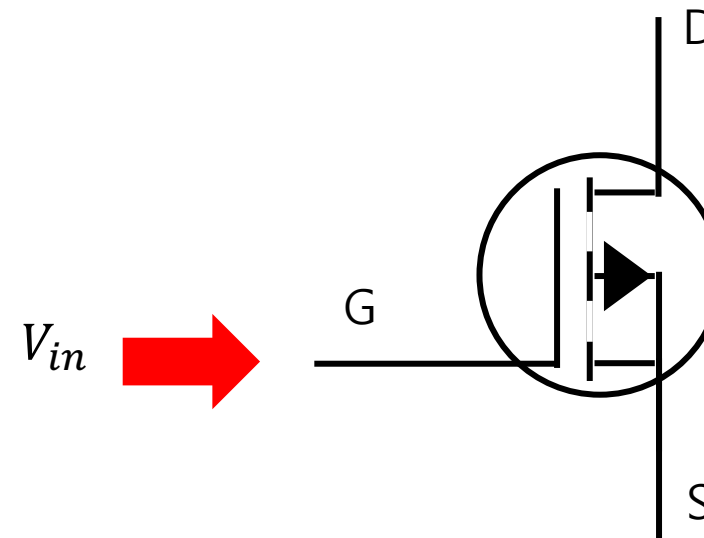
$$V_{GS(th)} = V_G - V_S < 0$$
$$\Rightarrow V_D, V_S \text{ Current flow}$$



# 19 Power source switch



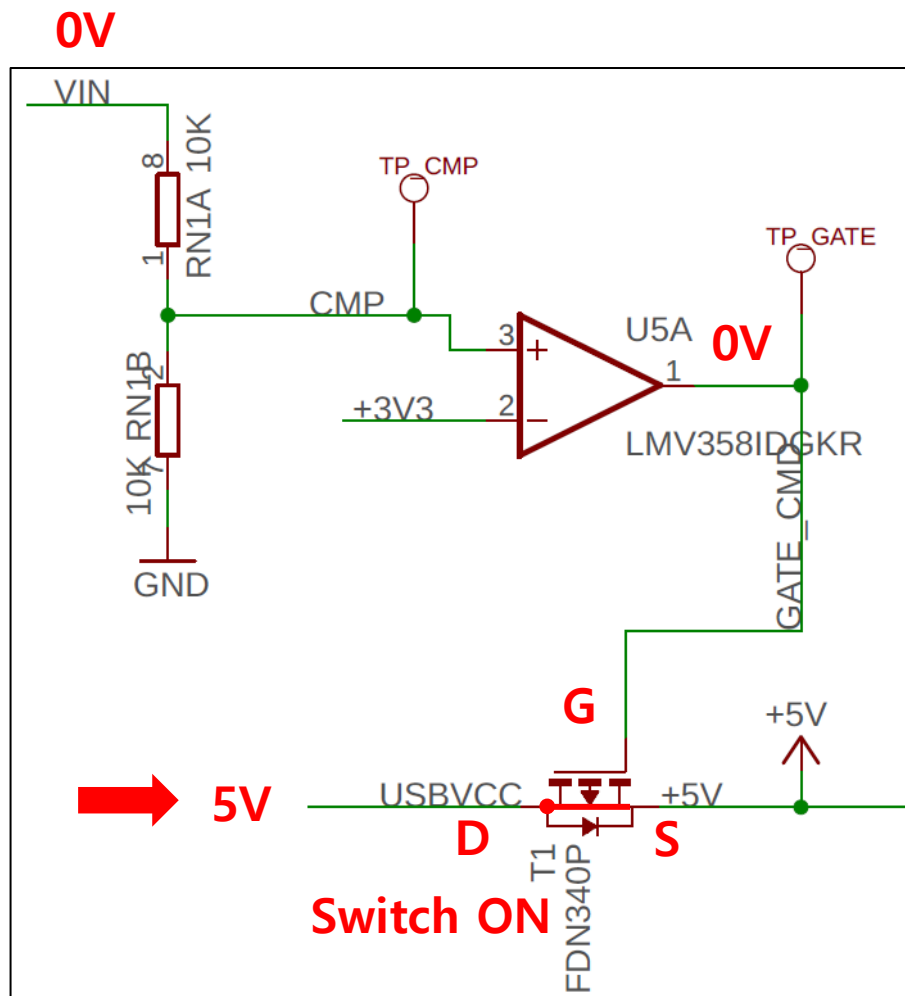
1.  $V_{in}$



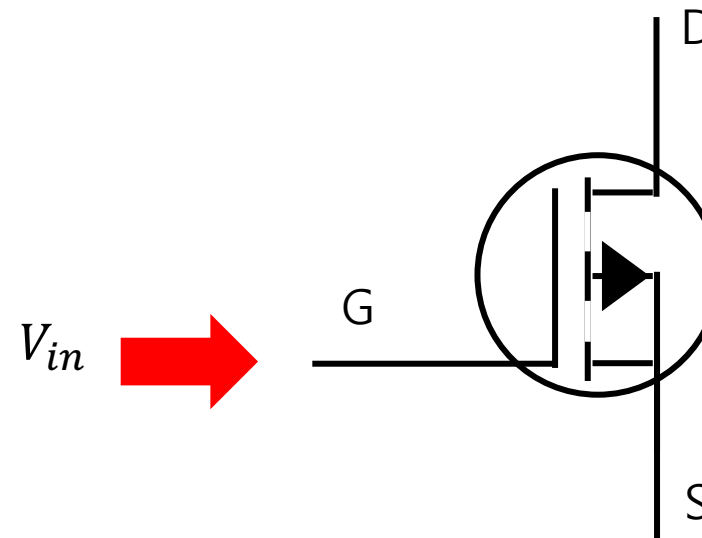
$$V_{GS(th)} = V_G - V_S > 0$$

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

## 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

