GPIO : General Purpose Input Output

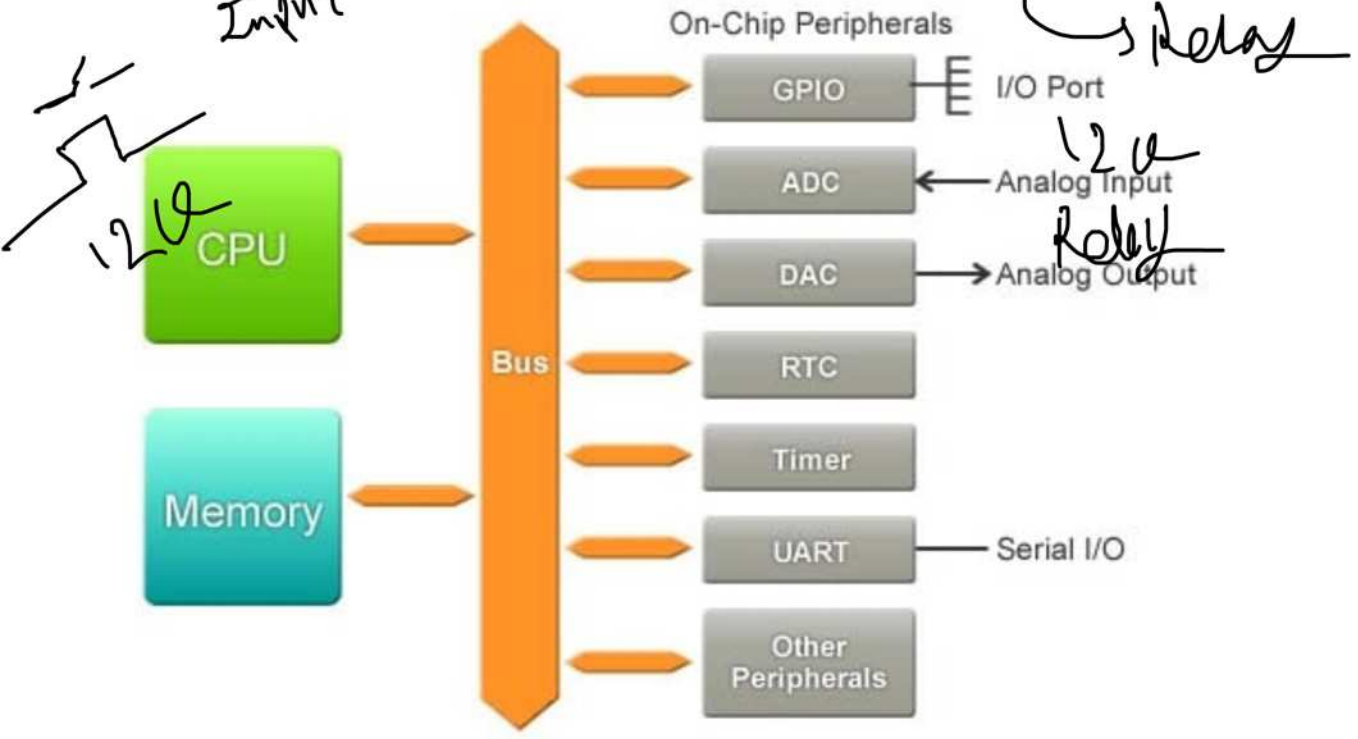
SMD

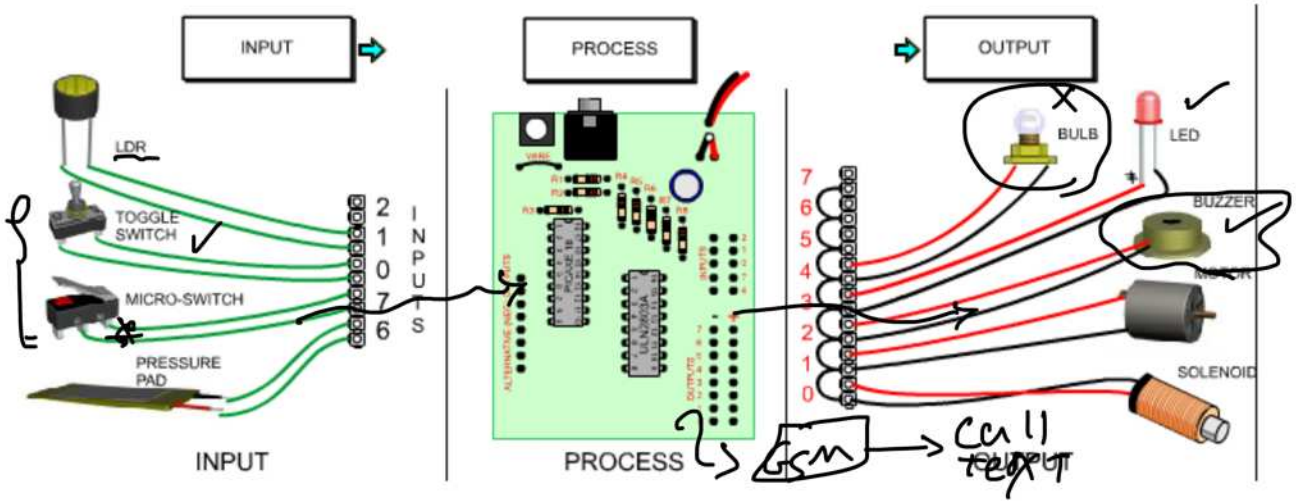
3.3V

Input

Output → LED

→ Relay





POTENTIAL INPUTS

TOGGLE SWITCH

This switch is traditional in looks and works by switching left to right. A simple' fail safe' switch that could be applied to my design.

LDR

This component could act as a light / dark sensor and be connected to the analogue input of a microcontroller circuit. This could be offered as an option for my design.

THERMISTOR

This thermistor could be connected to the analogue input of a microcontroller circuit, acting as a temperature sensor. This is an option for my circuit design.

MICRO-SWITCH

A miniature micro-switch could be used in my circuit. It could be used as a safety switch, turning off the power if the casing to the circuit is opened.

PRESSURE PAD

Pressure pads are often used as security switches in an alarm circuit. If pressure is applied to the switch, the circuit is activated. This may be a useful feature for my design.

POTENTIAL OUTPUTS

LED

LED outputs will provide adequate light / illumination for my design. They are low voltage which means low power consumption.

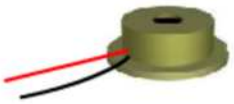
BULB

A bulb will offer more light than an LED but uses more power. Bulbs eventually fail and need replacing. I will avoid using bulbs unless they are really necesary.

SPEAKER

A speaker will provide sound for my circuit, if required. I will be able to program my circuit to play a tune through the speaker.

BUZZER



A buzzer will give a single tone, audio output. This could be used as a warning sound or to attract urgent attention.

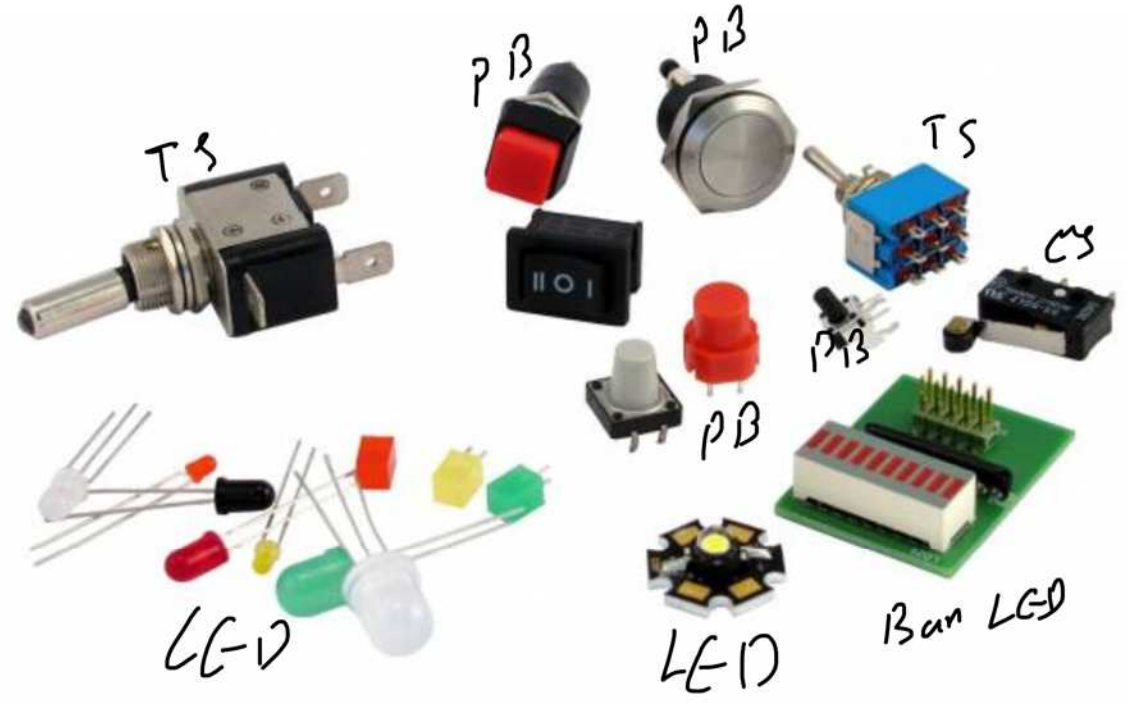
MOTOR

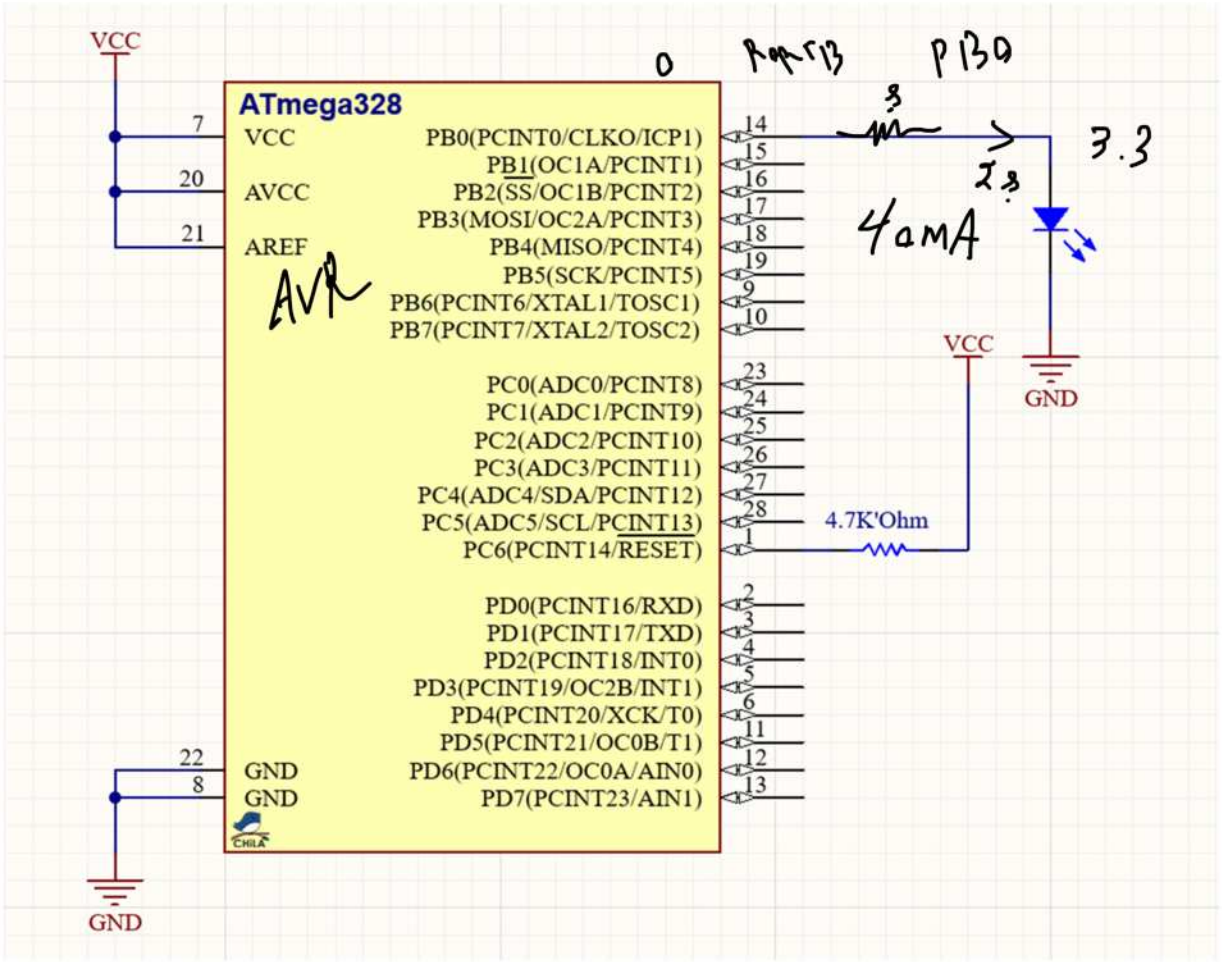
A motor (solar motor) will provide the output motion I require for my design. Solar motors are low voltage and work well with a range of circuits.

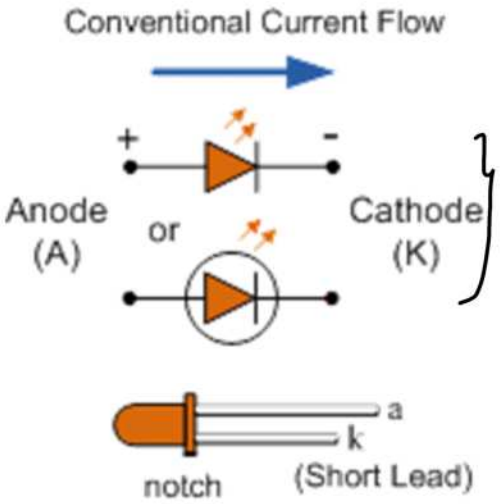
SOLENOID

A solenoid will give me the option of forwards and backwards movement. This will be important if my circuit pushes or pulls a lightweight mechanism.

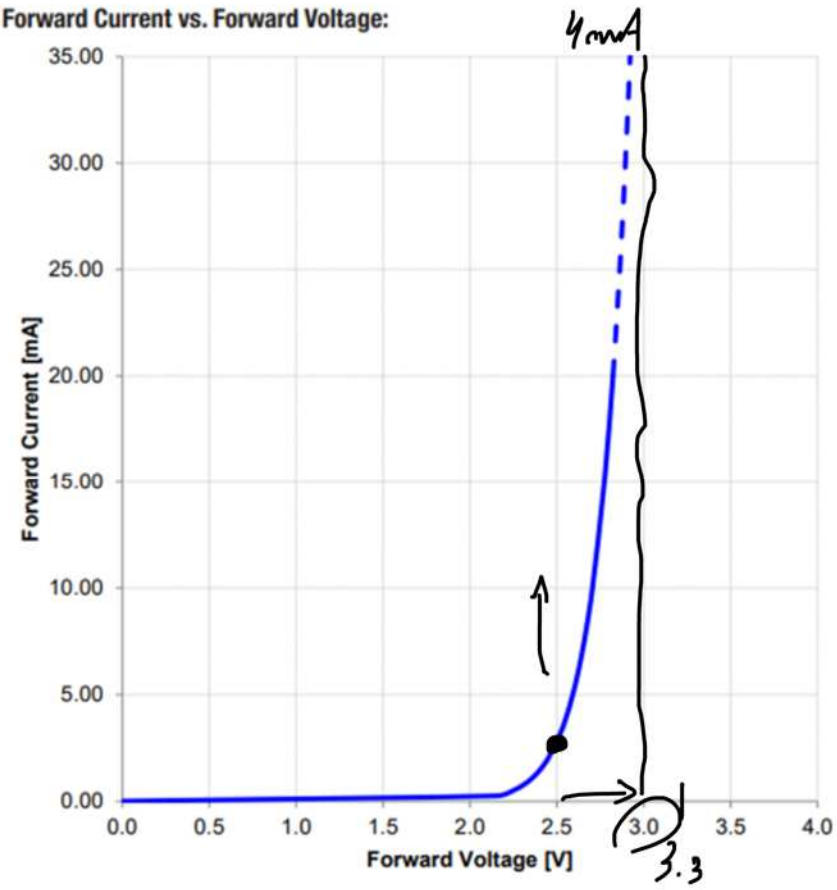
By Ryan







LED and its
I-V Characteristics



29.1 Absolute Maximum Ratings*

Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on any Pin except $\overline{\text{RESET}}$ with respect to Ground	-0.5V to V_{CC}+0.5V
Voltage on $\overline{\text{RESET}}$ with respect to Ground	-0.5V to +13.0V
Maximum Operating Voltage	6.0V
DC Current per I/O Pin	40.0mA
DC Current V_{CC} and GND Pins	200.0mA

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

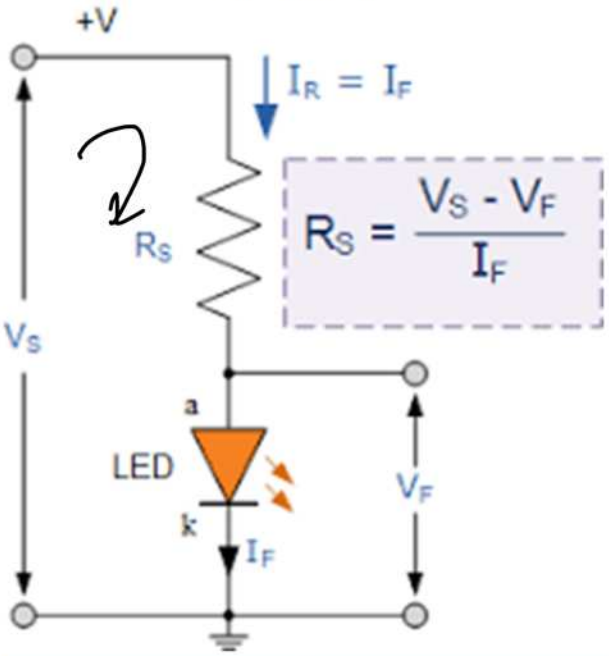
Mega 328 23 GPIO

20mA

$N_1 = \frac{200mA}{20mA} = 10$ LED|20mA

$N_2 = \frac{200mA}{10mA} = 20$ LED|10mA

$N_2 > N_1$



$$R_S = \frac{V_S - V_F}{I_F}$$

$v = Ri$

$i = \frac{v}{R}$ $R = \frac{v}{i}$

$Ri + v_f - v_s = 0$

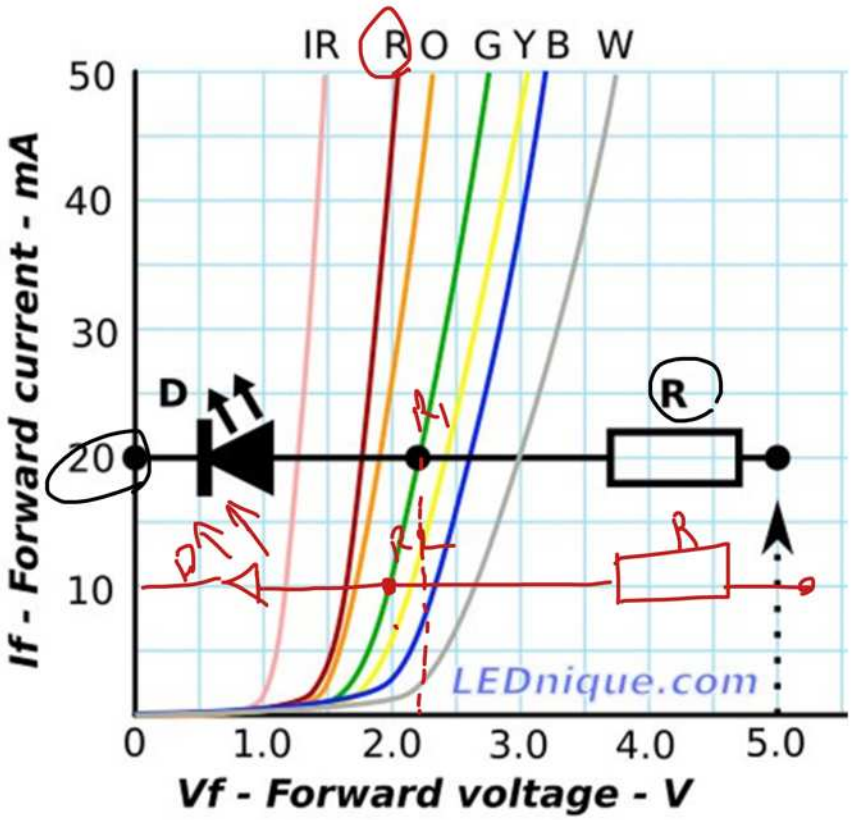
$\Rightarrow Ri = v_s - v_f \Rightarrow R = \frac{v_s - v_f}{i_f}$

3.3kΩ ✓ ✓

Color	Vf[V] at 20 mA	Material	Wavelength [nm]
Infrared	1.2	GaAs	850-940
Red	1.8	GaAsP	630-660
Amber	2	GaAsP	605-620
Yellow	2.2	GaAsP:N	585-595
Green	3.5	AlGaP	550-570
Blue	3.6	SiC	430-505
White	4	GaInN	450

$R = \frac{3.3 - 1.8}{20mA}$

$R = 75\Omega$



$$R = \frac{3.3 - V_f}{20mA} \qquad R_W < R_2$$

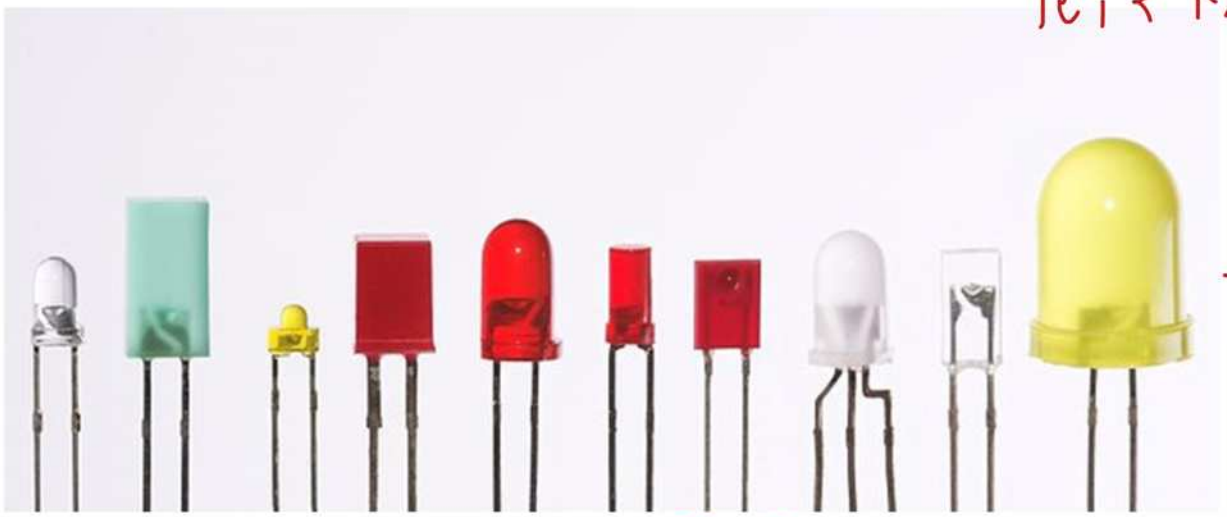
$$R = \frac{3.3 - V_f}{10mA}$$

$$R_1 = \frac{3.3 - 2.2}{20mA} \Rightarrow R_1 = 55\Omega$$

$$R_2 = \frac{3.3 - 2}{10mA} \Rightarrow R_2 = 130\Omega$$

Brig 1 > Brig 2

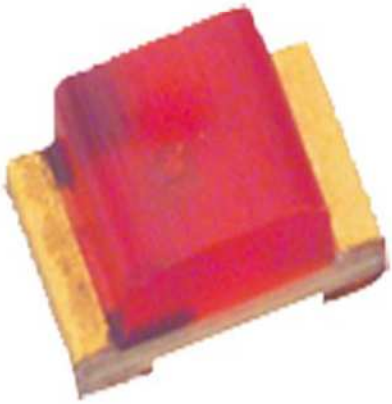
$R_1 < R_2$

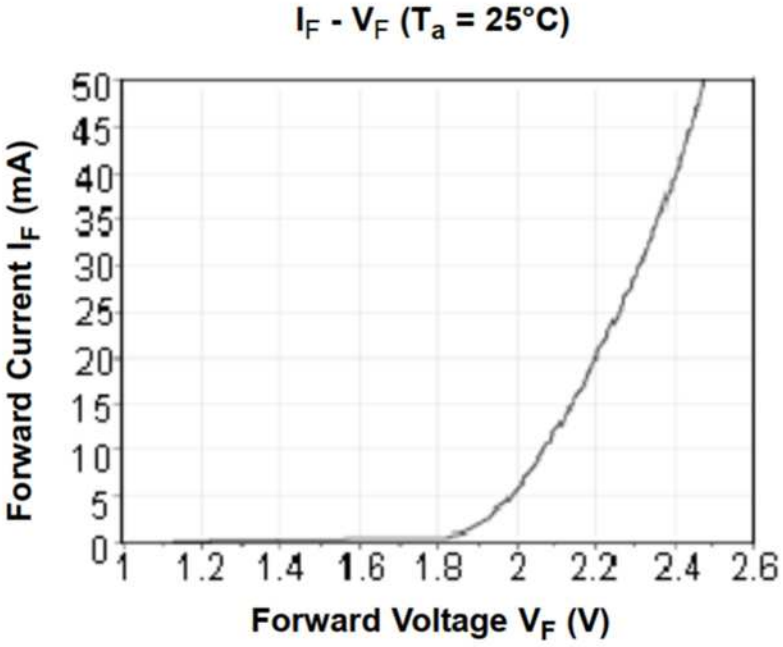


→ THT

SMT

V_f

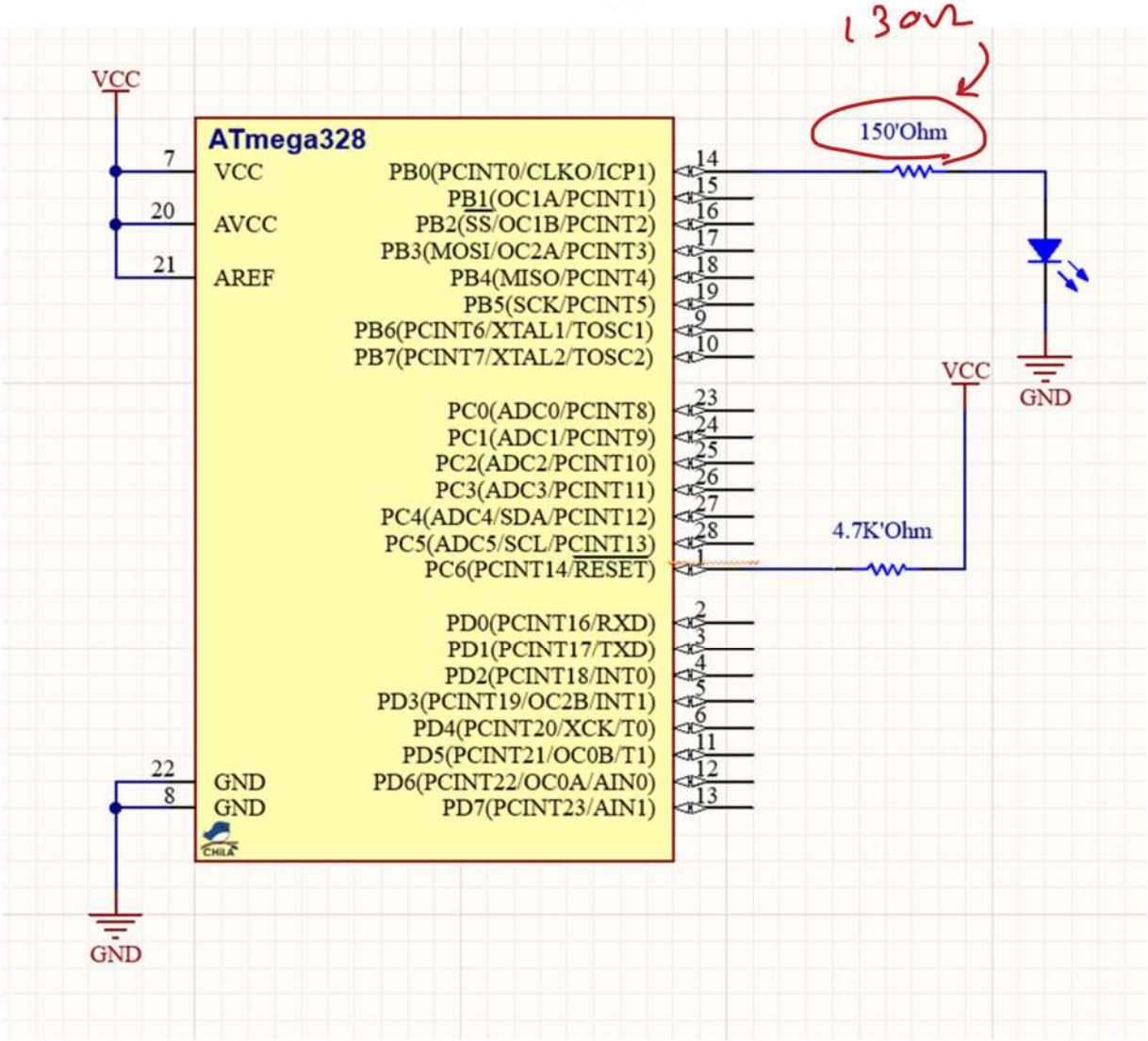


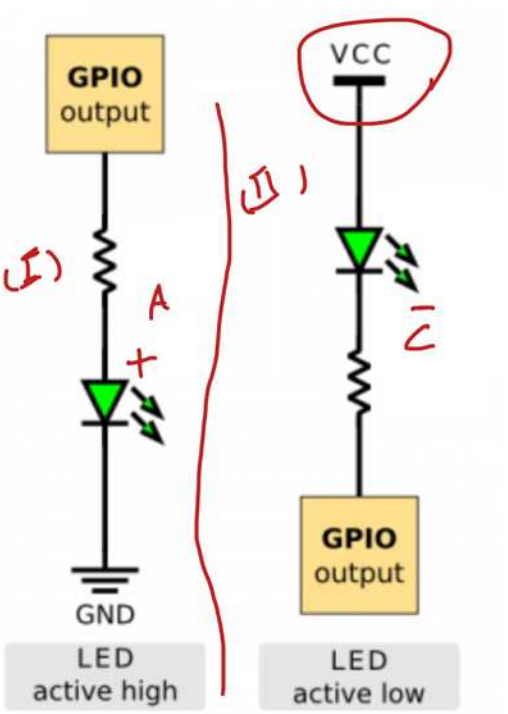


3.3 Red 08c5 470Ω

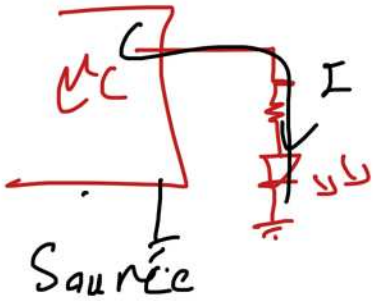
12 Red 5mm 1.5kΩ

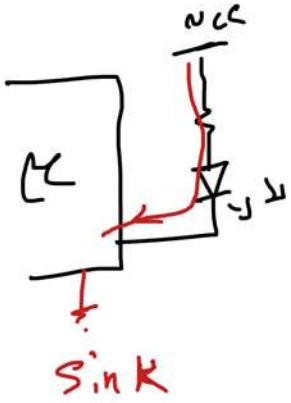
Wavelength Characteristics (T_a = 25°C)





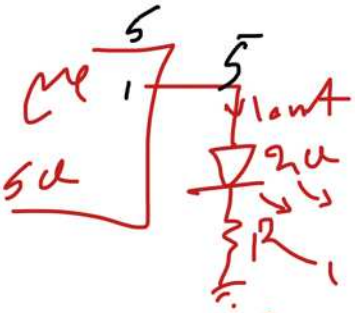
Sink Saurce

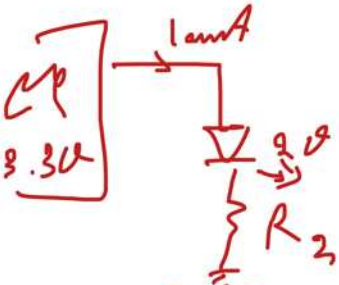




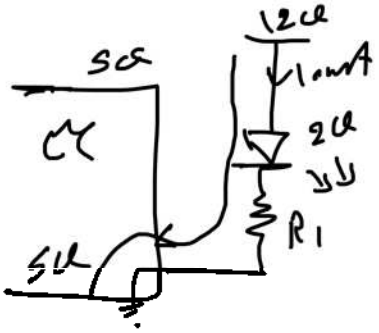
Saurce Sink

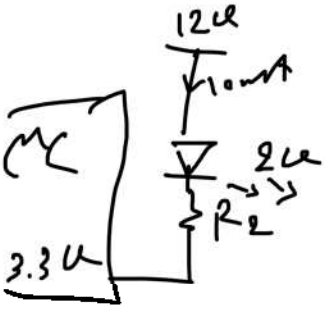
output
control
Saurce





$R_1 = \frac{5-2}{10mA} = 300\Omega$ $R_2 = \frac{3.3-2}{10mA} = 130\Omega$





Sink

GPIO I/O

control I/O

$R_1 = \frac{12-2}{10mA} = 1k\Omega$ $R_2 = \frac{12-2}{10mA} = 1k\Omega$