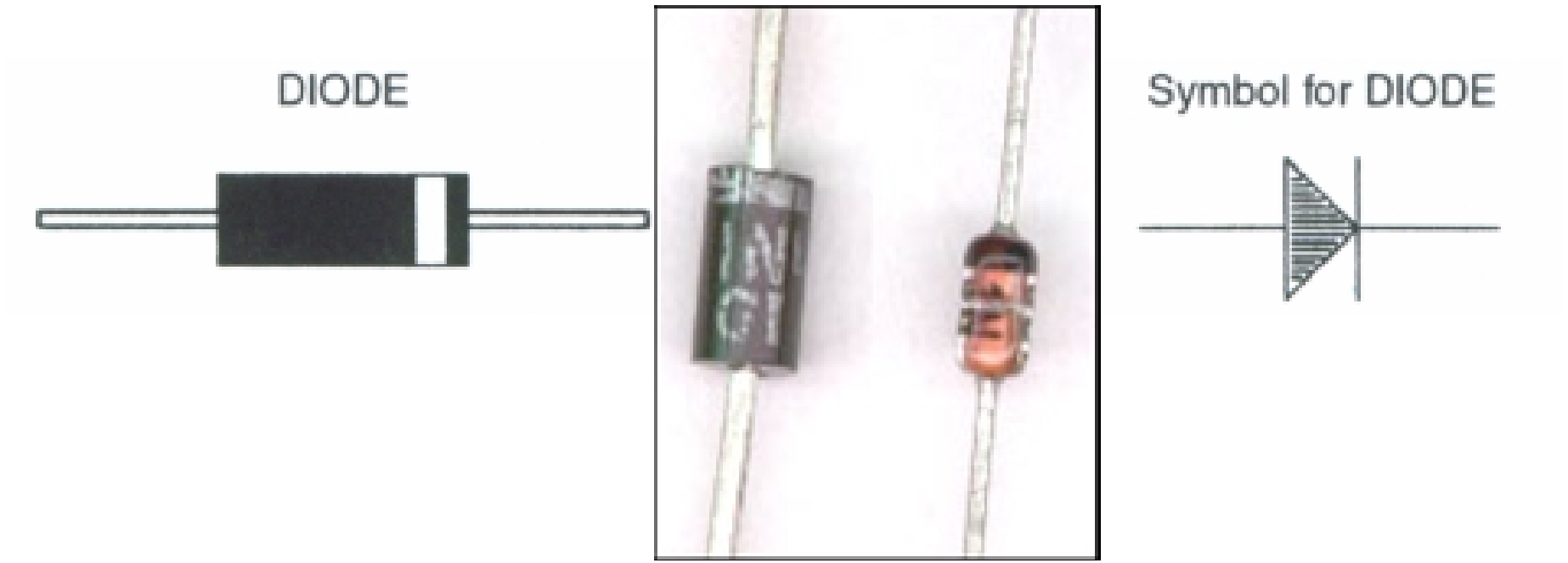
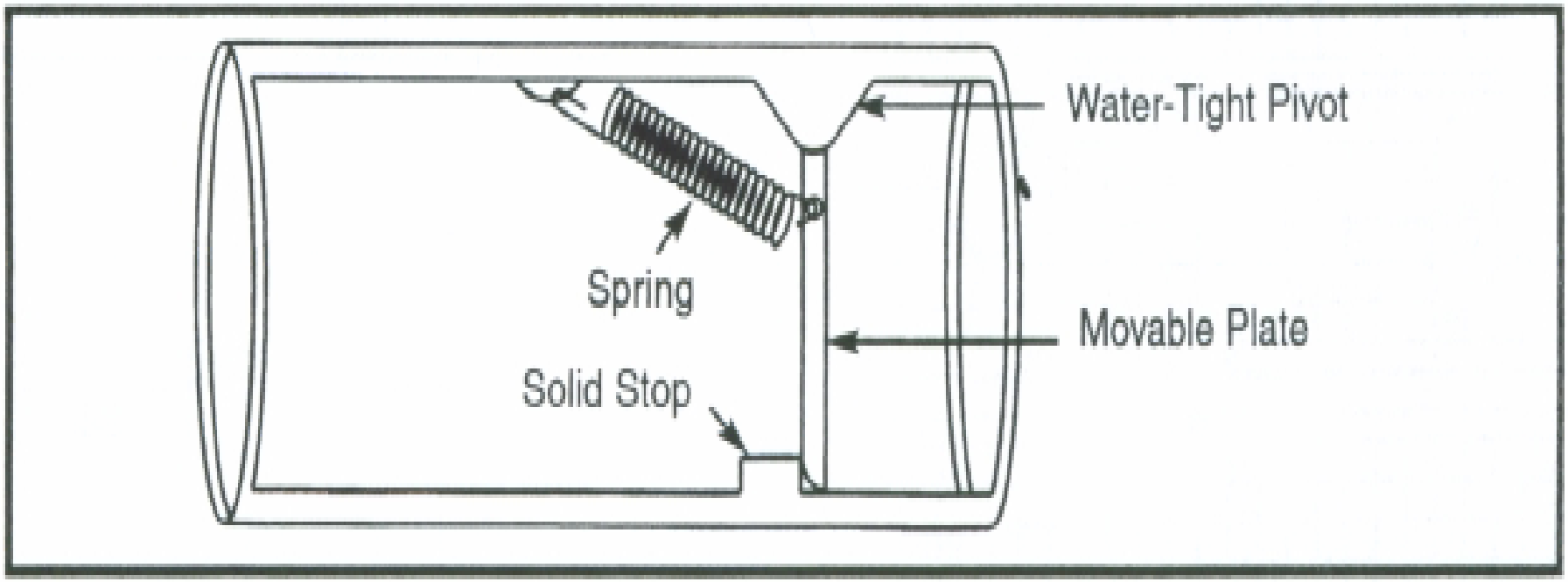
Lecture 3

Diode

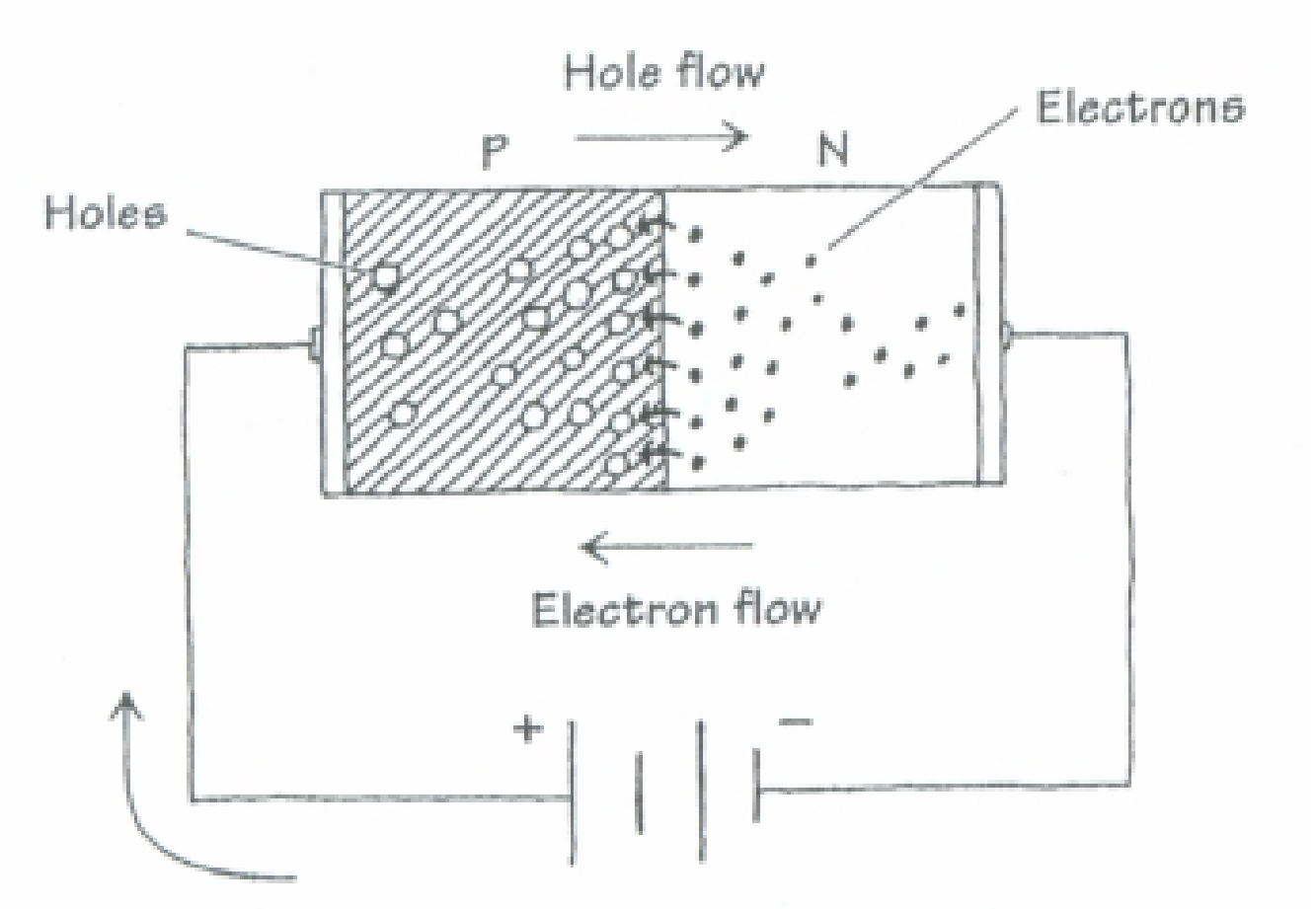


A diode is an semiconductor component that, in general, will pass current in only one direction

Water Analogy of Diodes

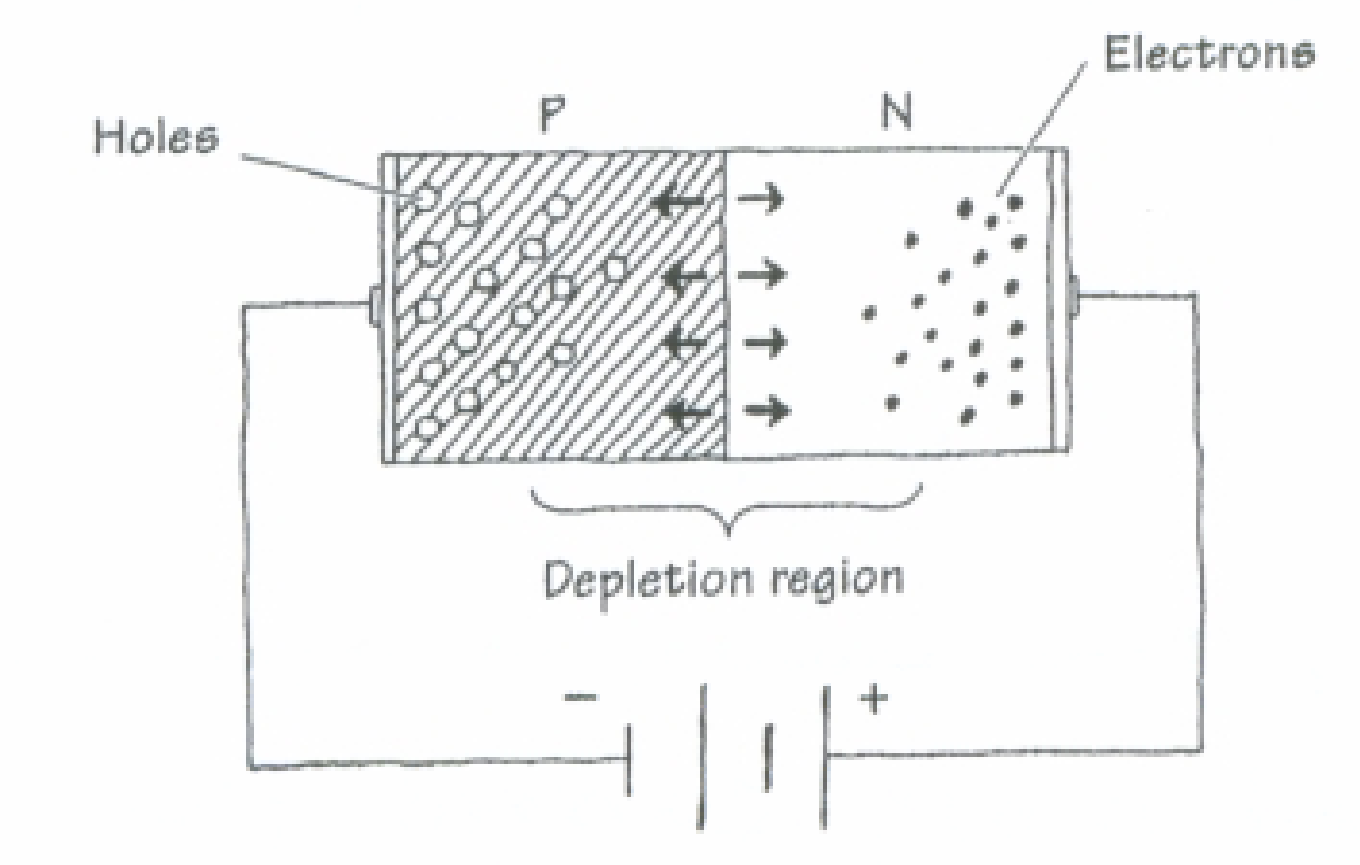


Diode: How it Works



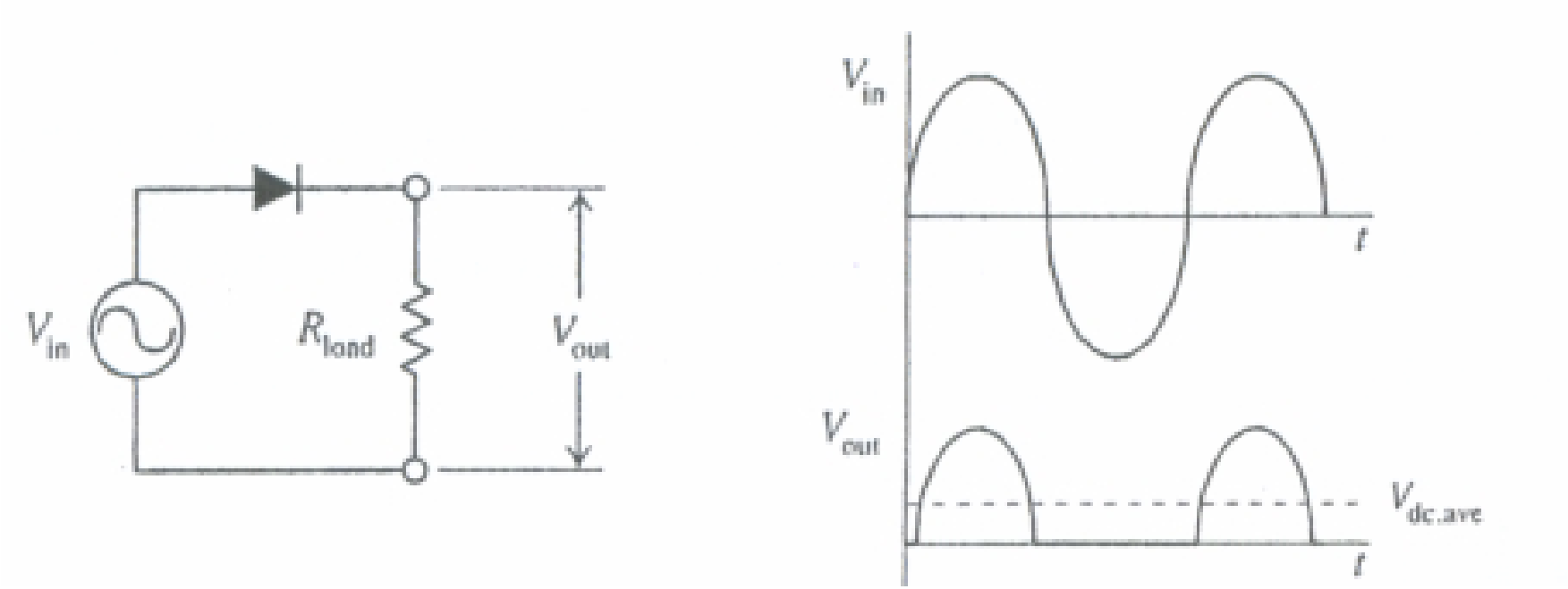
Forward-biased (“open door”)

Diode: How it Works



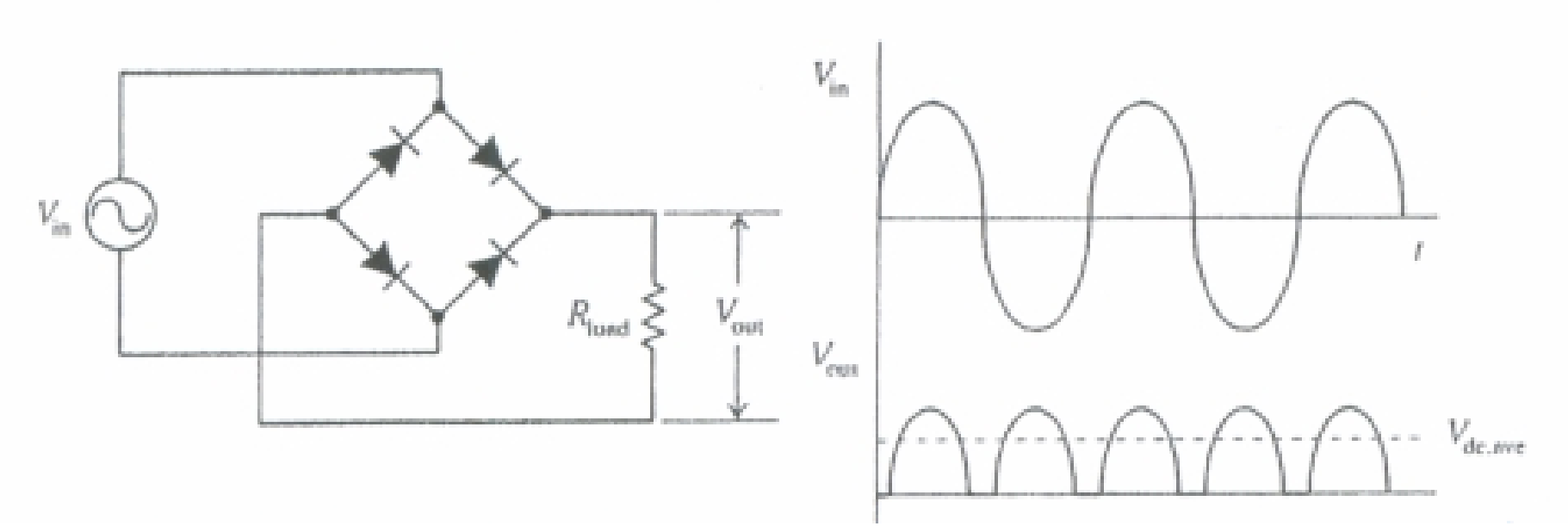
Reverse-biased (“closed door”)

Diode Applications 1



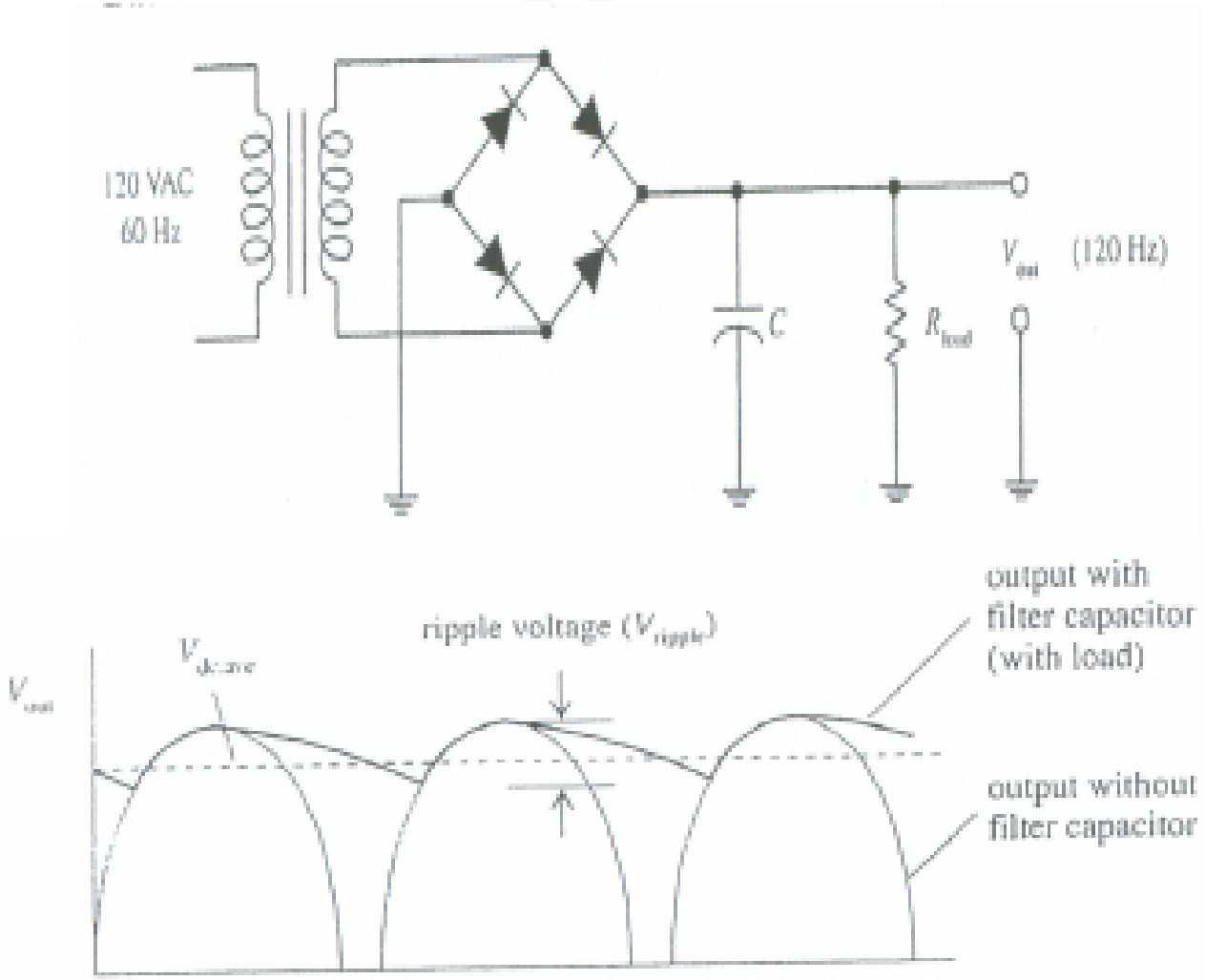
Half-Wave Rectifier

Diode Applications 2



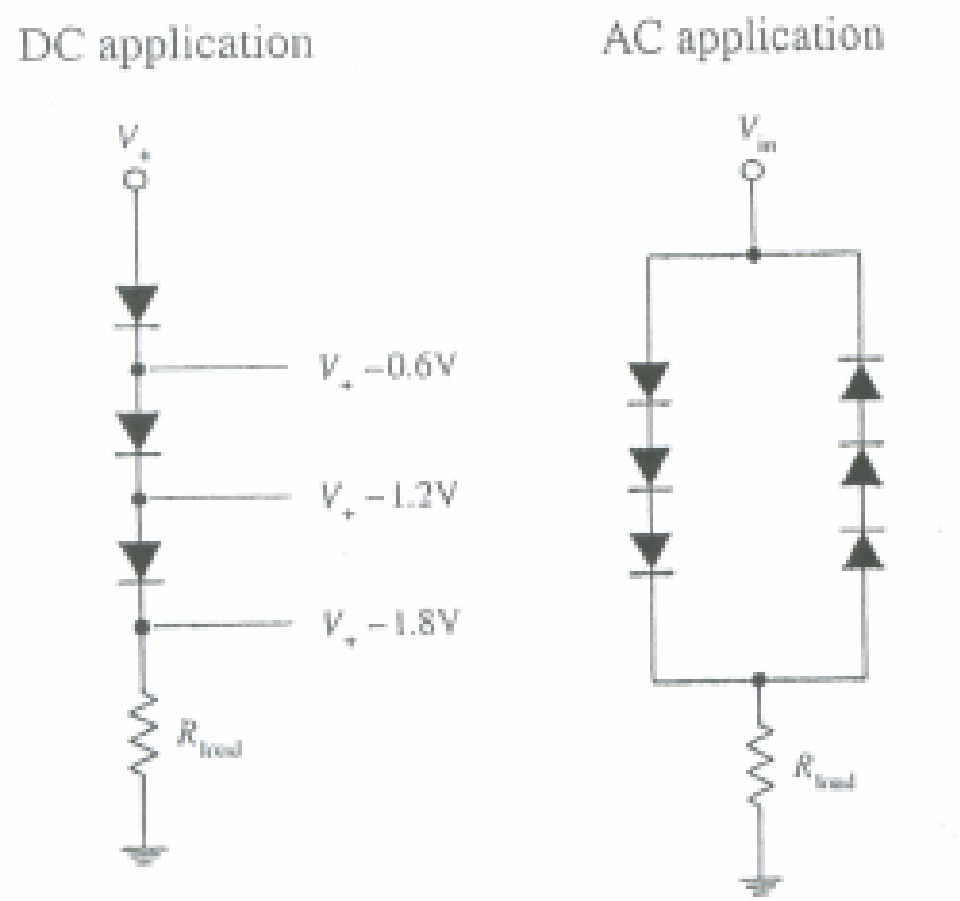
Full-Wave Bridge Rectifier

Diode Applications 3



Basic AC-DC Power Supply

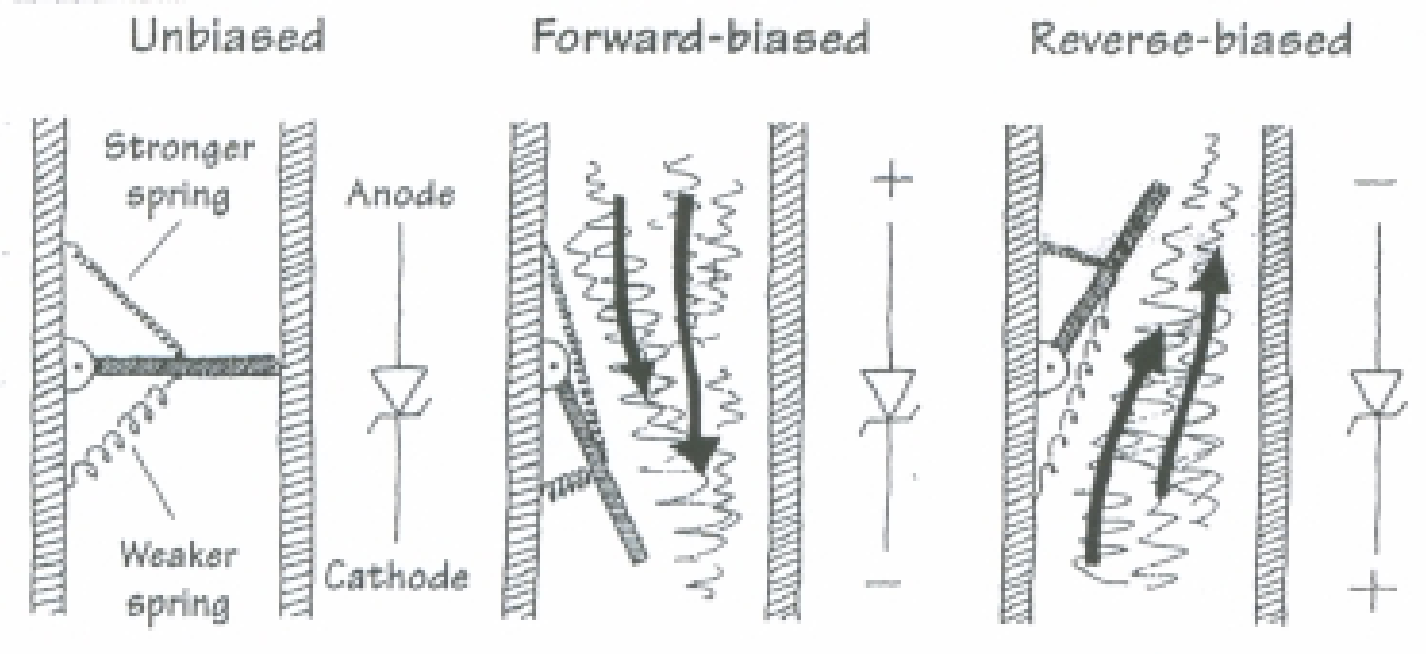
Diode Applications 4



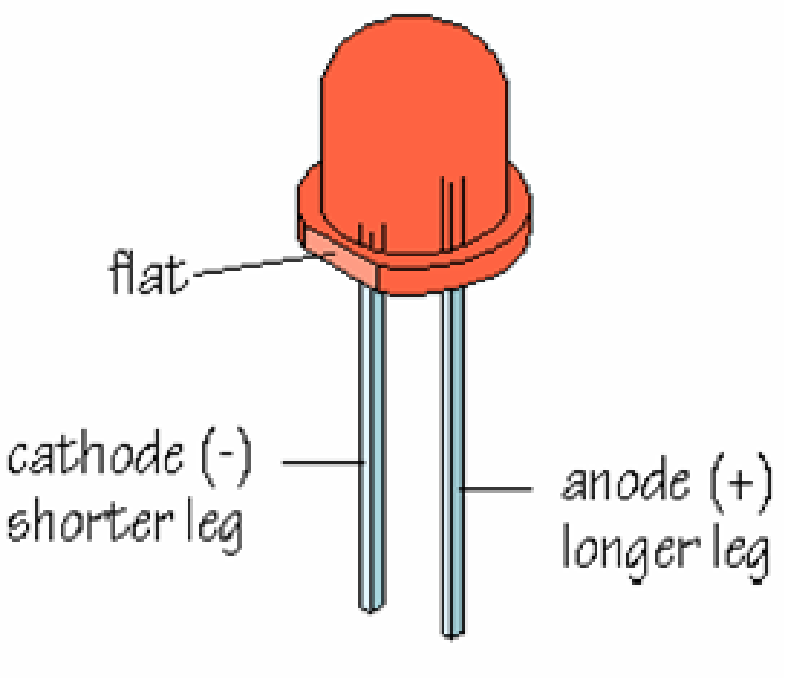
Voltage Dropper

Zener Diode

Acts as a pn-junction diode but it also has the ability to conduct in the reverse-biased direction when a specific breakdown voltage is reached



LED

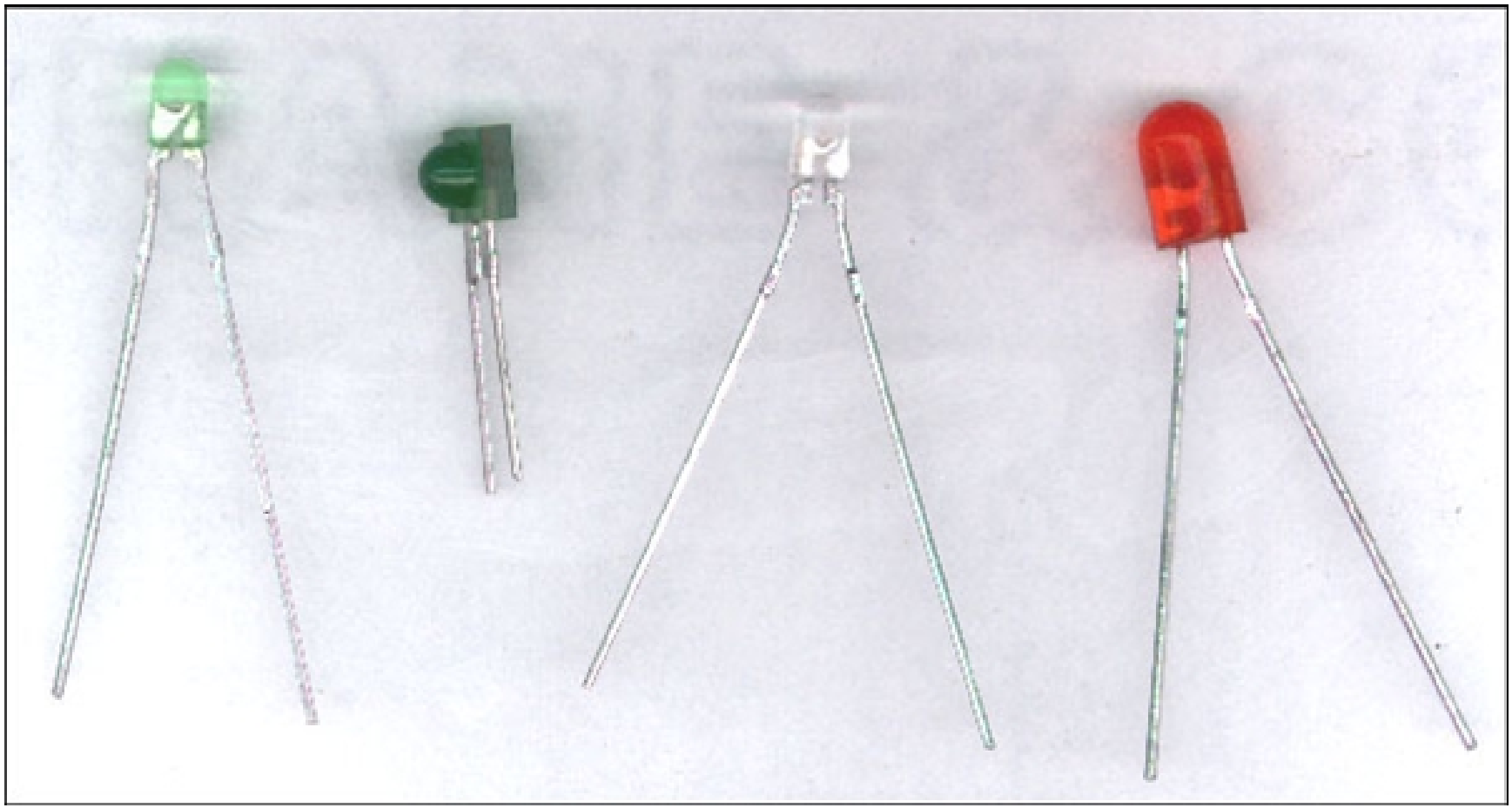


Light-emitting diode

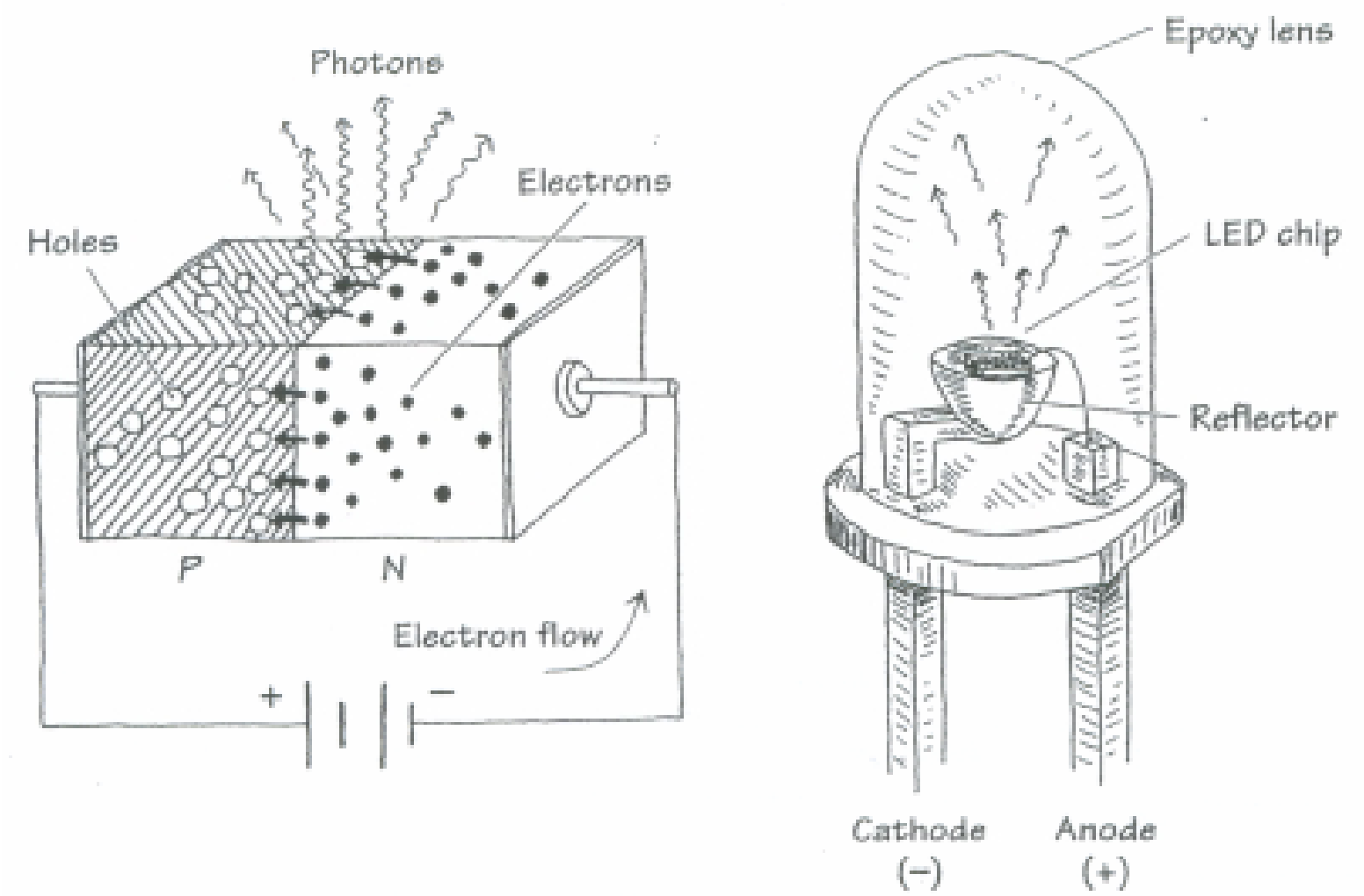
Semiconductor

Has polarity

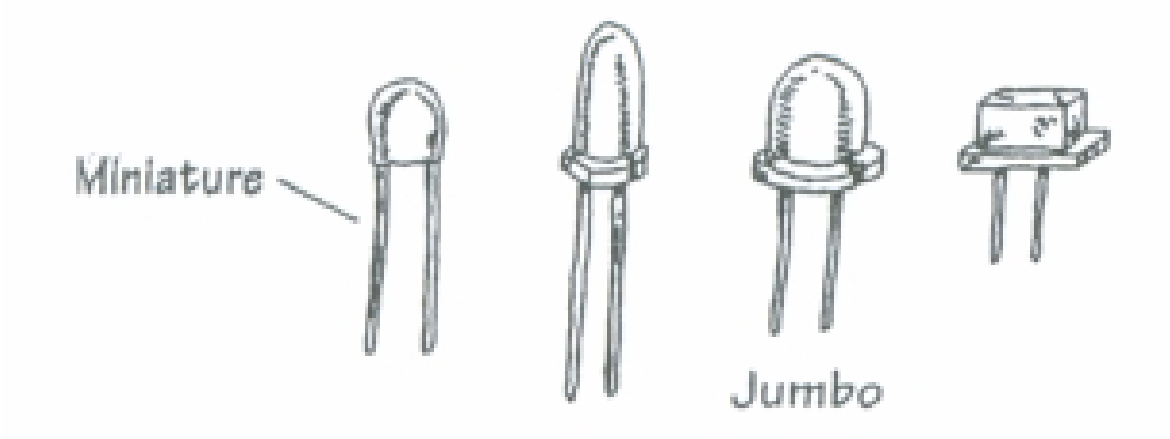
LEDs



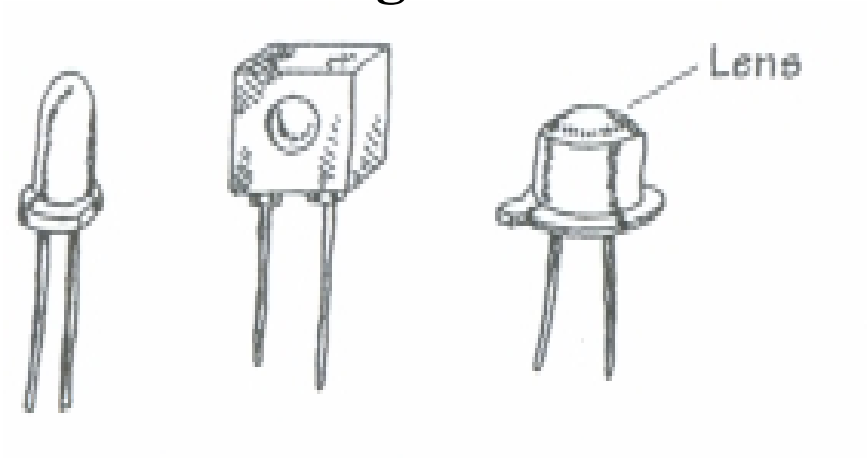
LED: How It Works



Kinds of LEDs 1



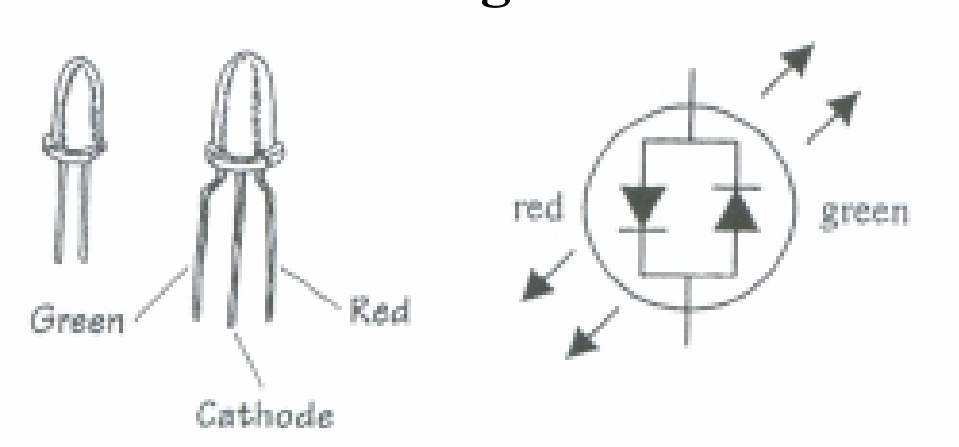
Visible-Light LEDs



Infrared LEDs

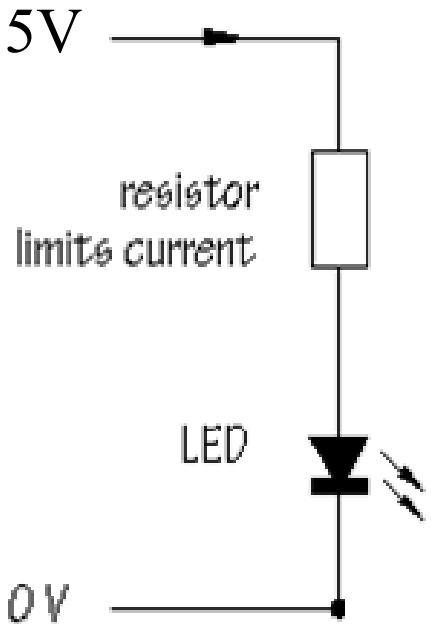
Kinds of LEDs 2

Blinking LEDs



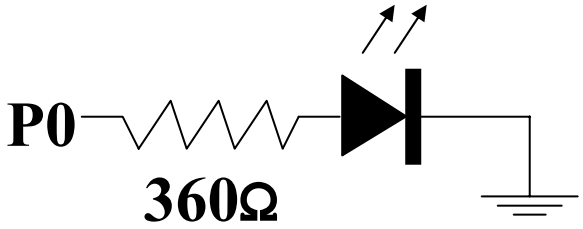
Tricolor LEDs

How to Connect LED

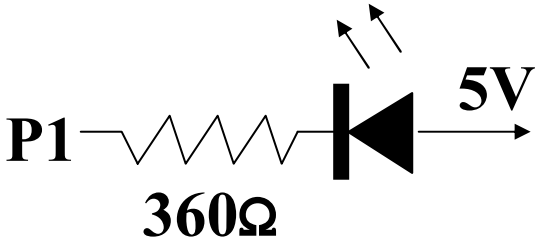


- Requires 1.5~2.5V
  and 10 mA
- To prevent overloading, use resistor (470Ω)

Connect LED to BS2

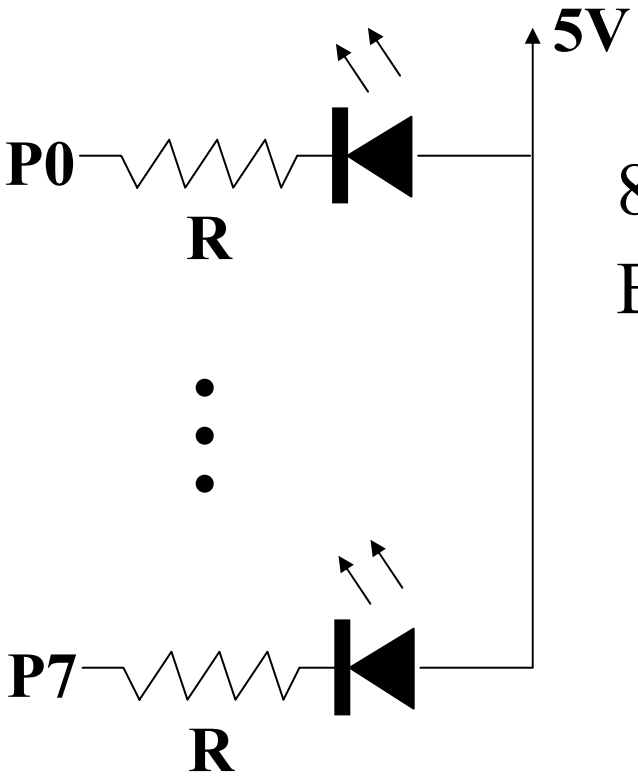


LED is on when P0 is high



LED is on when P1 is low

Connect Multiple LEDs to BS2



8 LEDs are connected to BS2

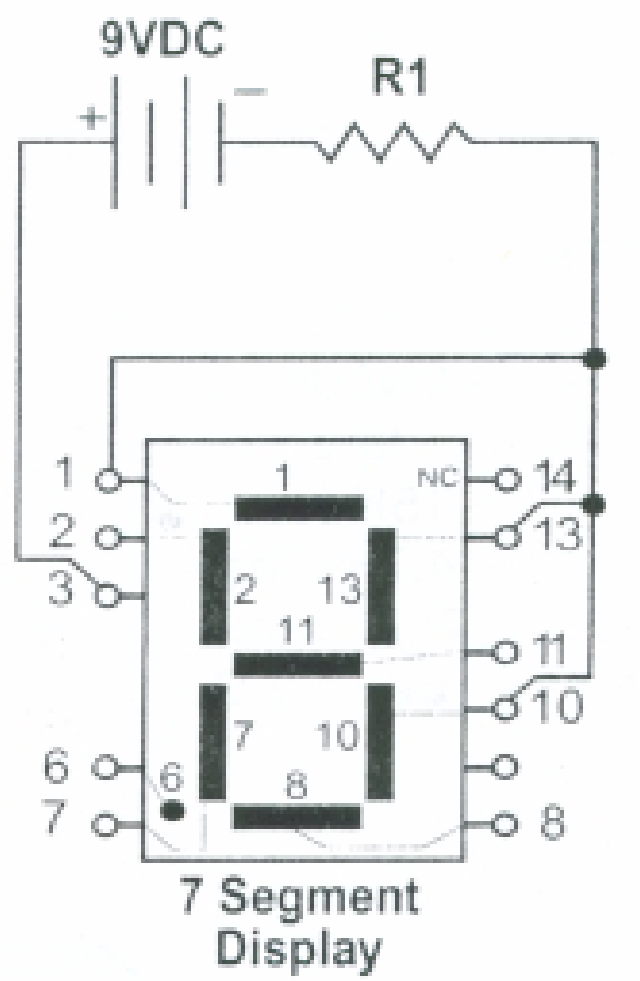
Each I/O/pin (P0-P7) is allowed to sink 6.25mA

$$R = \frac{V}{I} = \frac{3.6}{6.25 \times 10^{-3}} = 576\Omega$$

7 Segment LEDs

- 7 Light-emitting diodes in one
- Display any single-digit number (0–9)

7 Segment LED Circuit



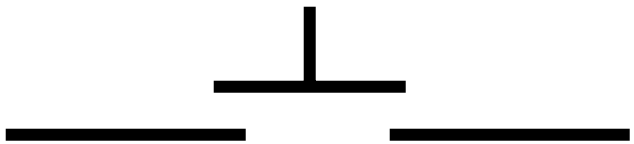
Number	Segments
0	1, 2, 7, 8, 10, 13
1	10, 13
2	1, 7, 8, 11, 13
3	1, 8, 10, 11, 13
4	2, 10, 11, 13
5	1, 2, 8, 10, 11
6	1, 2, 7, 8, 10, 11
7	1, 13, 10
8	1, 2, 7, 8, 10, 11, 13
9	1, 2, 10, 11, 13
Decimal Point	6 and 9

LED Experiments

Experiments	Chapters
What's micro controller	1
Basic A and D	
Earth measurements	
Robotics	
StampWorks	1, 2, 3, and 4
Others	

Lecture 4

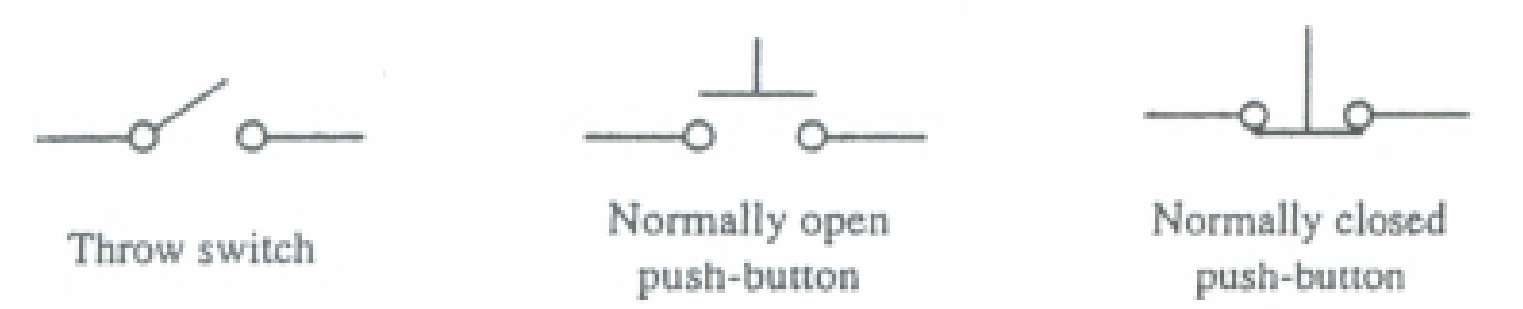
Button/Switch



Symbol

Switches 1

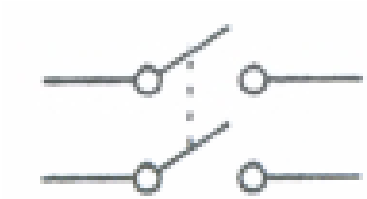
SPST switches (Single Pole, Single Throw)



SPDT switches

Switches 2

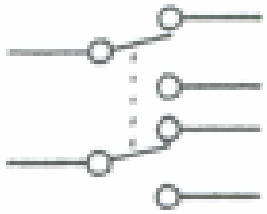
DPST switches



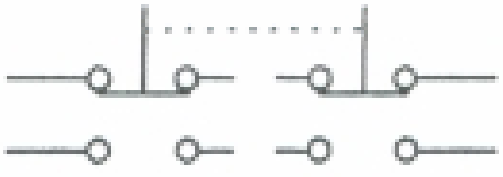
Throw switch

Normally open
push-button

DPDT switches



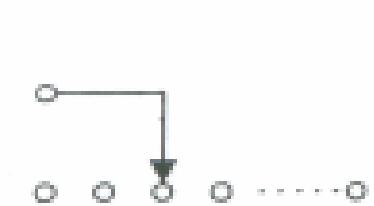
Throw switch



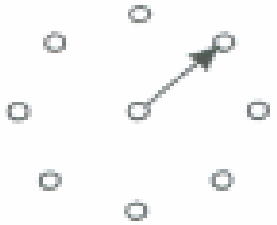
Normally open/closed
push-button

Switches 3

SP(n)T switches

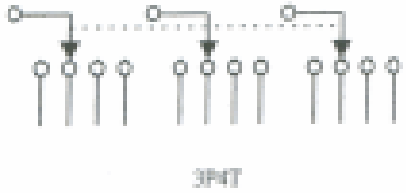


Multiple contact slider switch

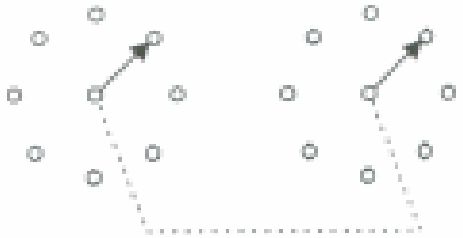


Multiple contact rotary switch (SP8T)

(n)P(m)T switches

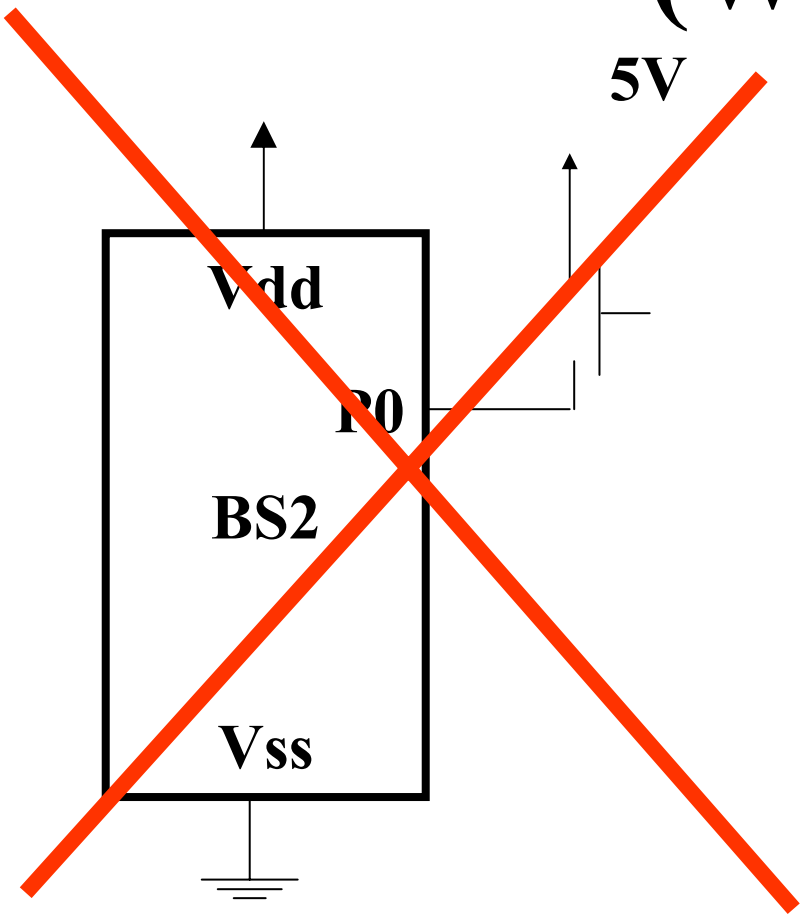


3P4T



2-deck rotary (DP8T)

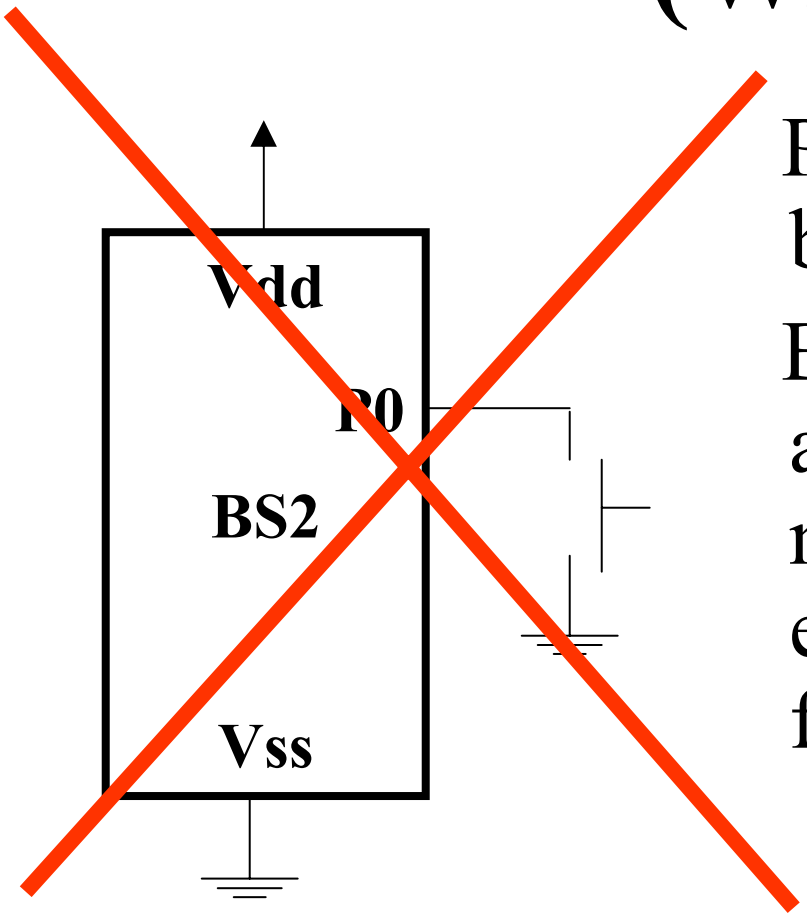
Button Connection 1 (Wrong)



BS2 will get damaged when P0 is pulled high since the current limit through pin is violated

$$I = \frac{V}{R} = \frac{5}{0} = \infty$$

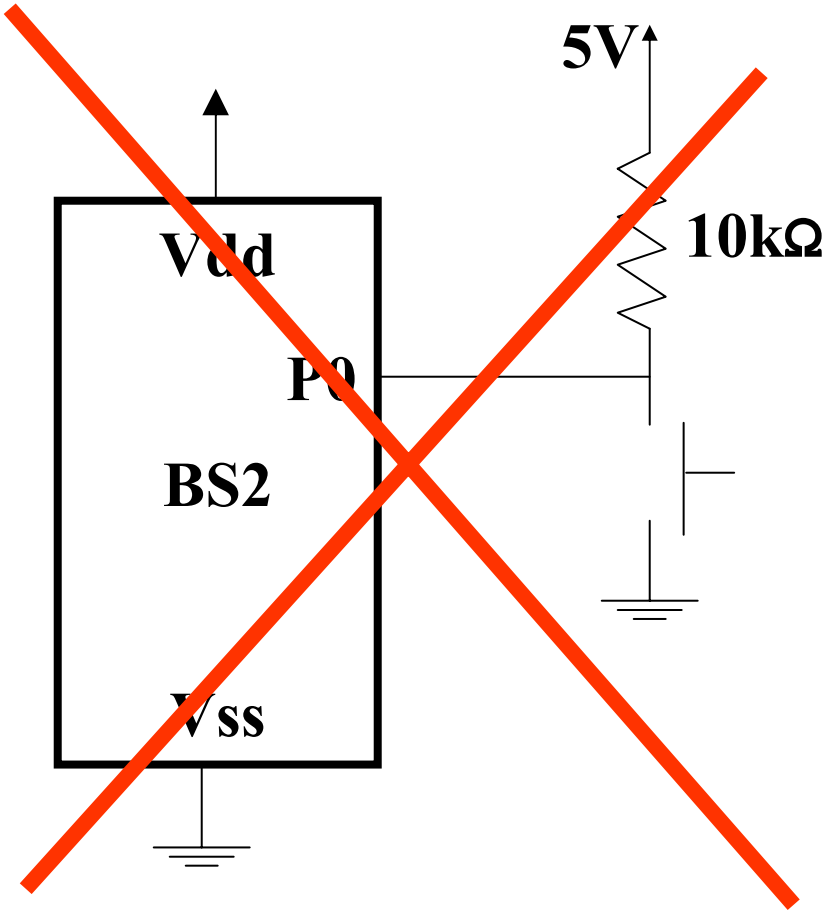
Button Connection 2 (Wrong)



P0 is pulled low when the button is pressed

But P0 is not connected to anywhere when the button is not pressed then P0 could be either high or low so called a floating input condition

Button Connection 3 (Wrong)



- Button is not pressed

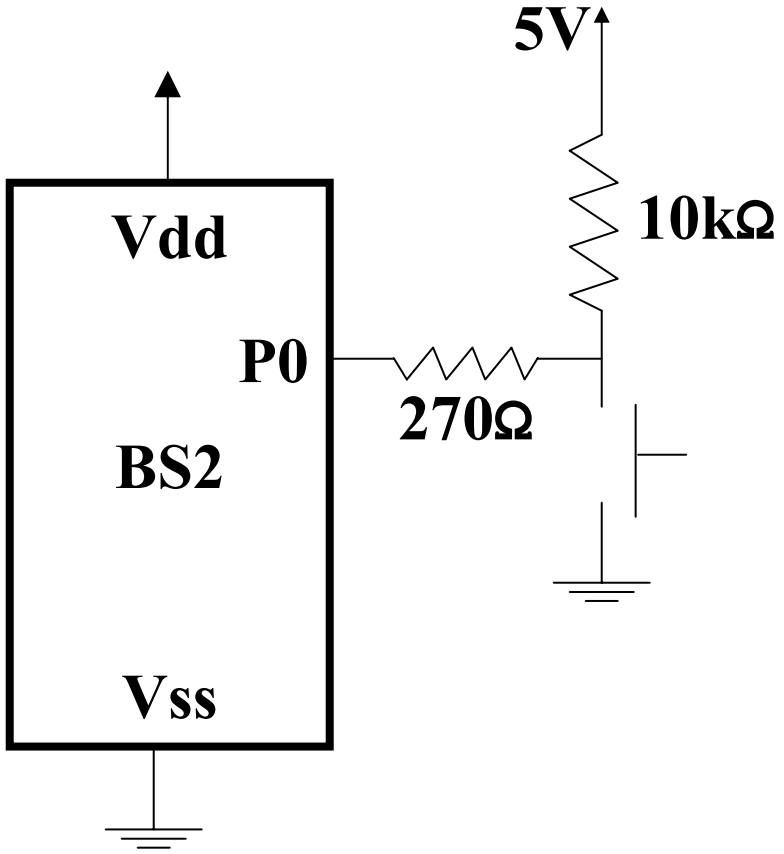
  P0 is pulled high
- Button is pressed

  P0 is pulled low
- By mistake, P0 is used as a output when the button is pressed

  then …

Button Connection 1

(Pull up resistor)



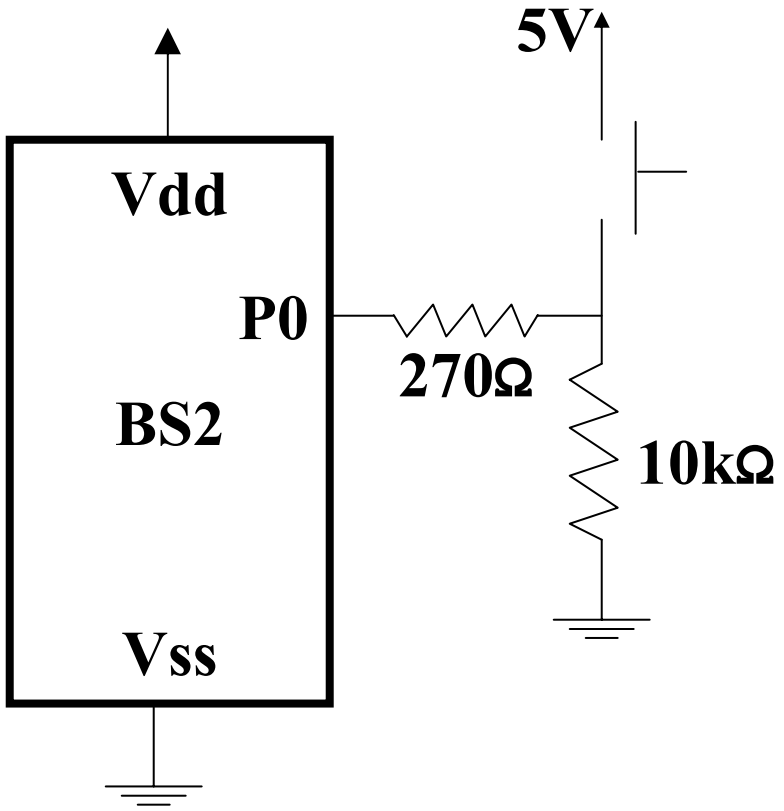
- Button is not pressed

  P0 is pulled high
- Button is pressed

  P0 is pulled low
- 270Ω is for protecting I/O pin
- Preferred

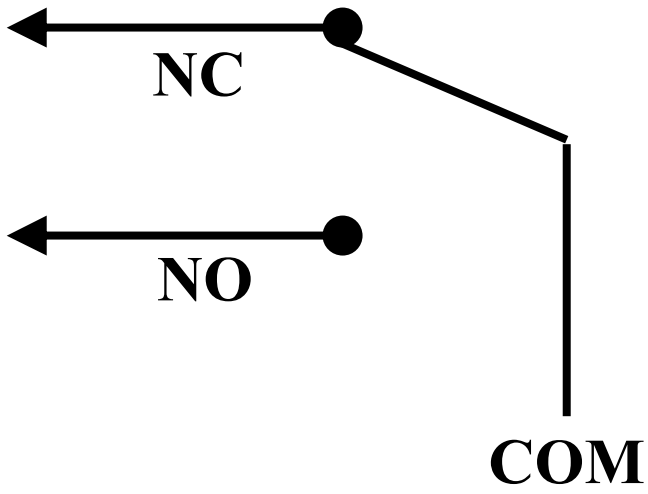
Button Connection 2

(Pull down resistor)



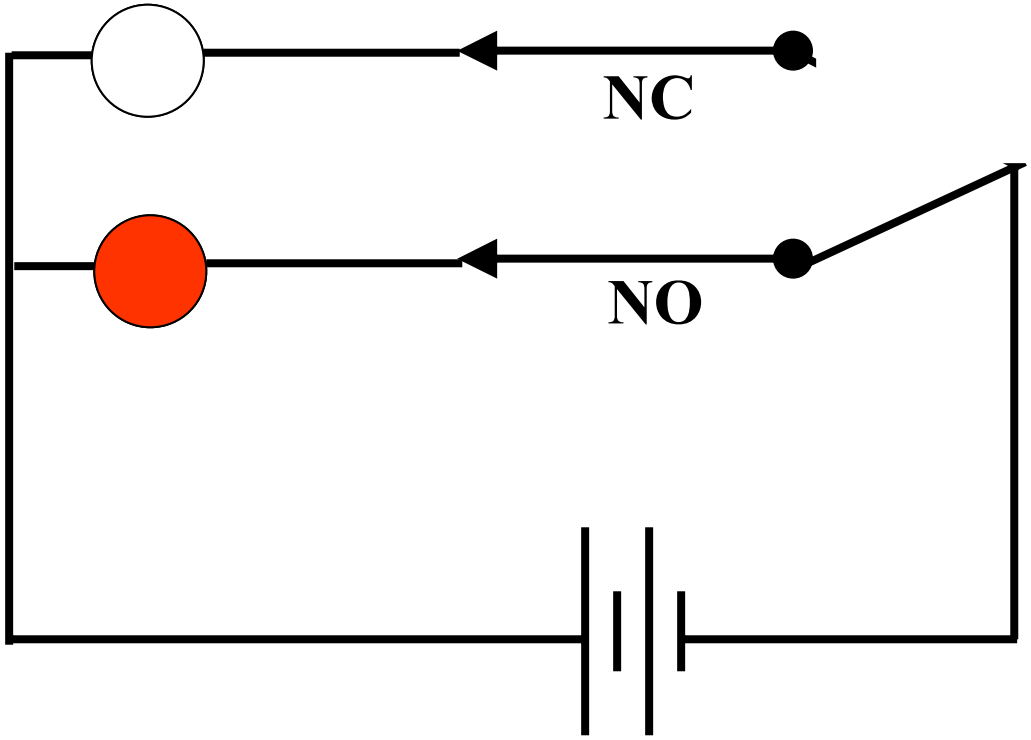
- Button is not pressed
  P0 is pulled low
- Button is pressed
  P0 is pulled high
- 270Ω is for protecting I/O pin

Limit Switch



SPDT limit switch

Limit Switch



Button Experiments

Experiments	Chapters
What's micro controller	2
Basic A and D	2
Earth measurements	
Robotics	
StampWorks	6, 8, 9, and 10
Others	

Simple Project

Problem 2: Recently, at a local primary school a young student was left behind on the school premises at the end of the school day. The student was rescued after his parents' frantic efforts to locate him. Following this incident, the school hired a safety consultant to recommend solutions to prevent recurrence of such incidents. The safety consultant has suggested that the school implement the following solution to keep real-time count of individuals on school's premises.

Simple Project -Cont.

Individuals will enter and exit the school from two separate gates. A pressure sensitive pad at the entrance gate will register entrance by an individual whenever it is depressed. Another pressure sensitive pad at the exit gate will register exit by an individual whenever it is depressed. A microcontroller will continuously monitor the two pressure pads. You are to develop a prototype real-time people counting system. Use two buttons to mimic the pressure pads and write a program that will provide real-time people count. What are some of the drawbacks of the above solution? How can this solution be further improved?