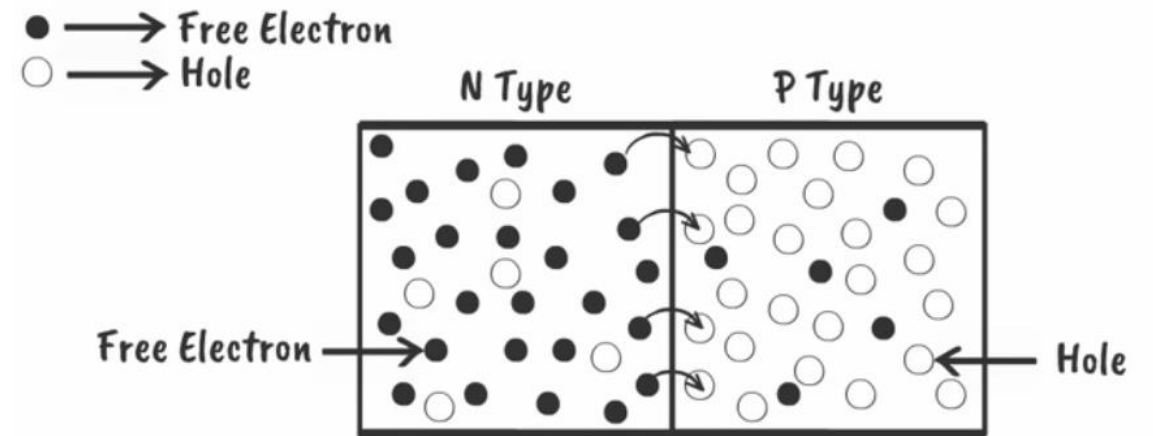
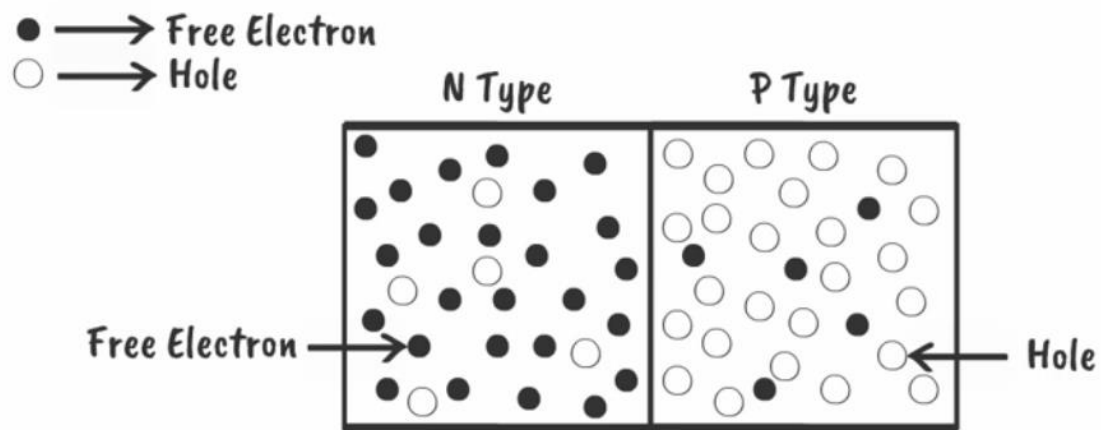




# **Introduction to basic Electronic devices and Electronic Components Part 2**

Instructed By: Mr. Supun Dissanayaka  
Bhavat Ngamdeevilaisak

# Light Emitting Diode (LED)

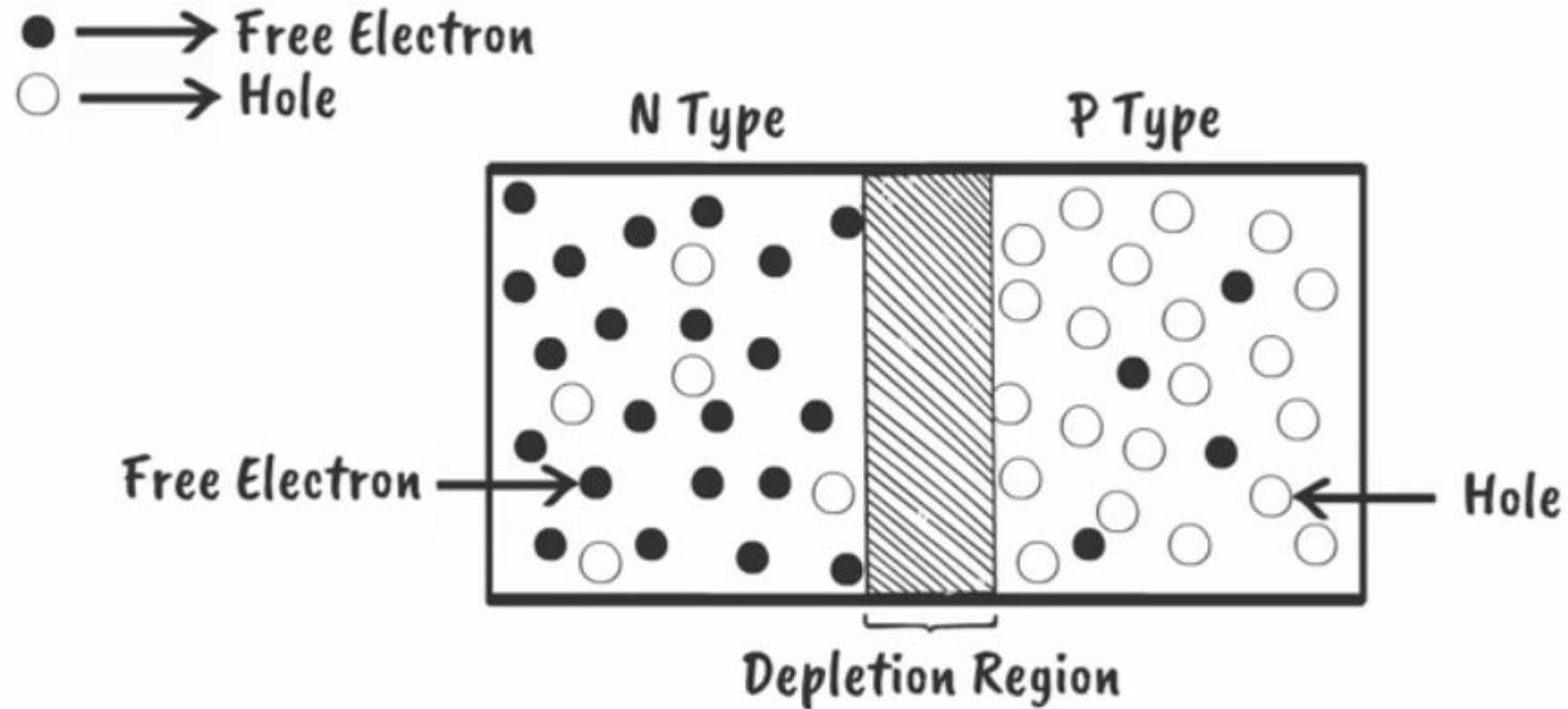


Formation of a diode

Thermal excitation  
Or Doping

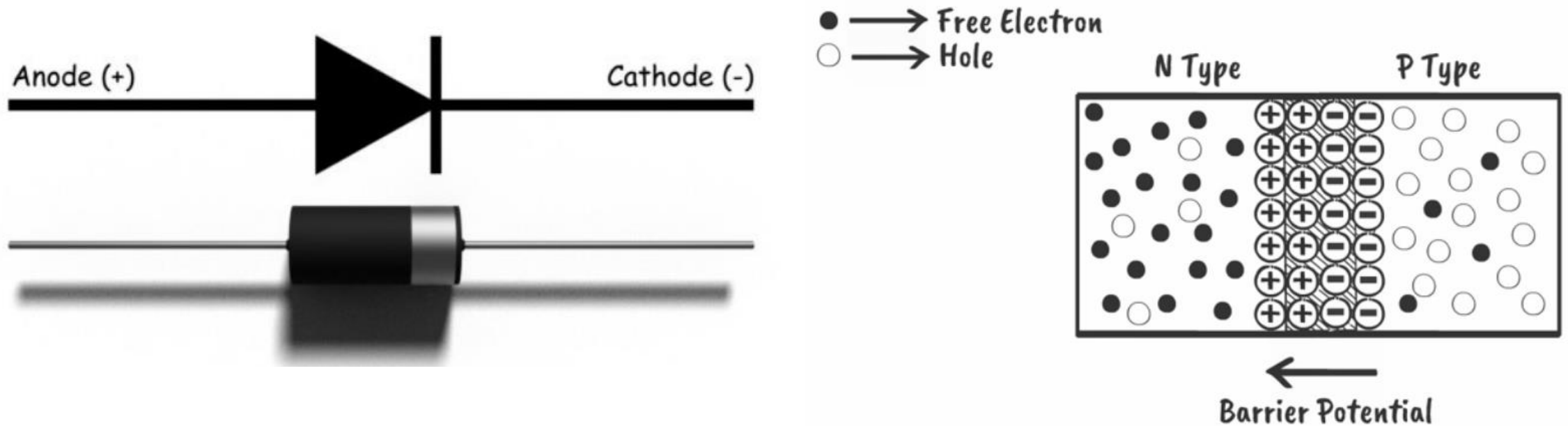


# Light Emitting Diode (LED)



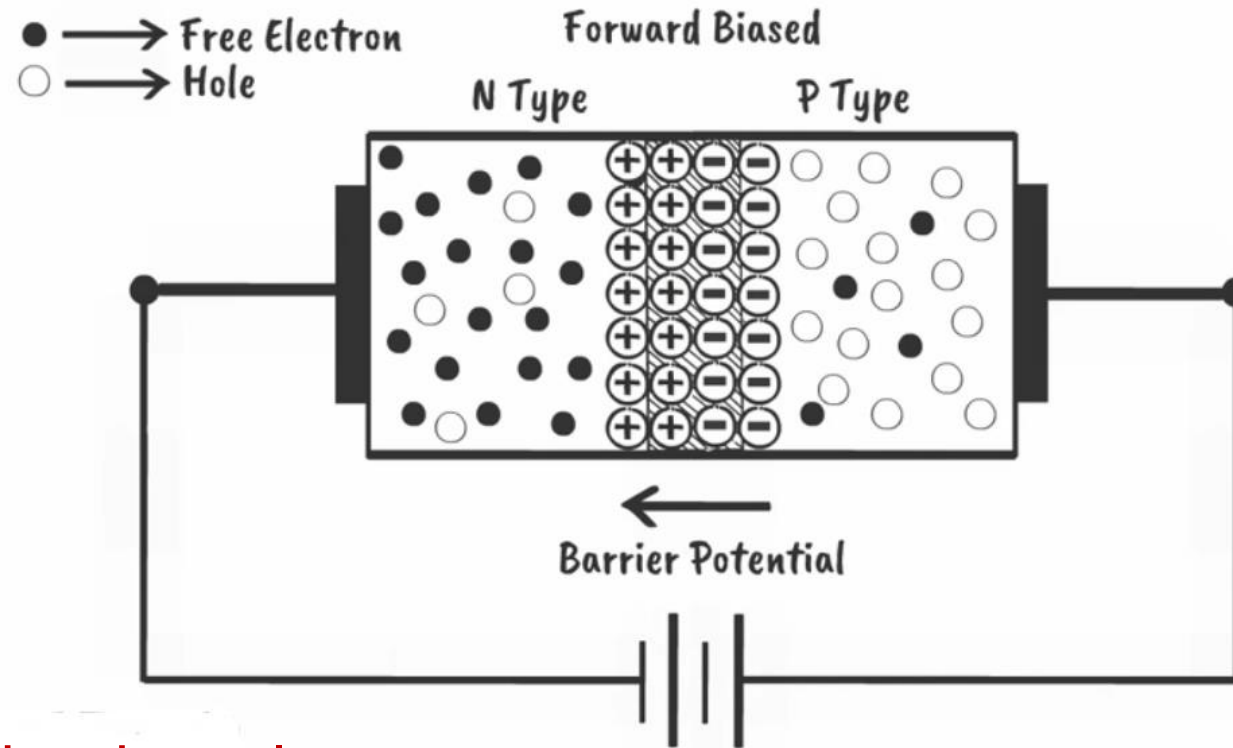
Working principle of a diode

# Light Emitting Diode (LED)



Working principle of a diode

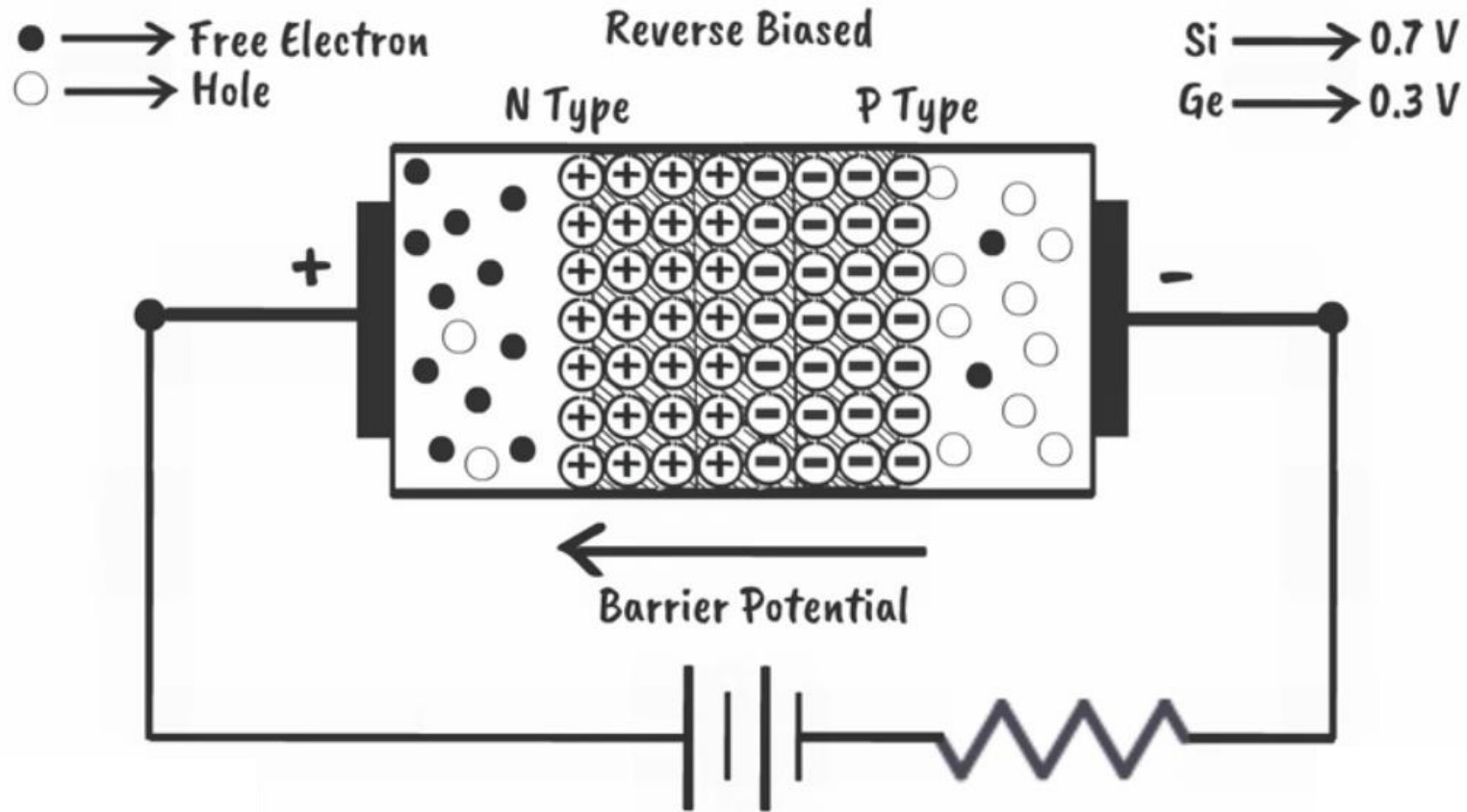
# Light Emitting Diode (LED)



Applied Voltage > barrier voltage

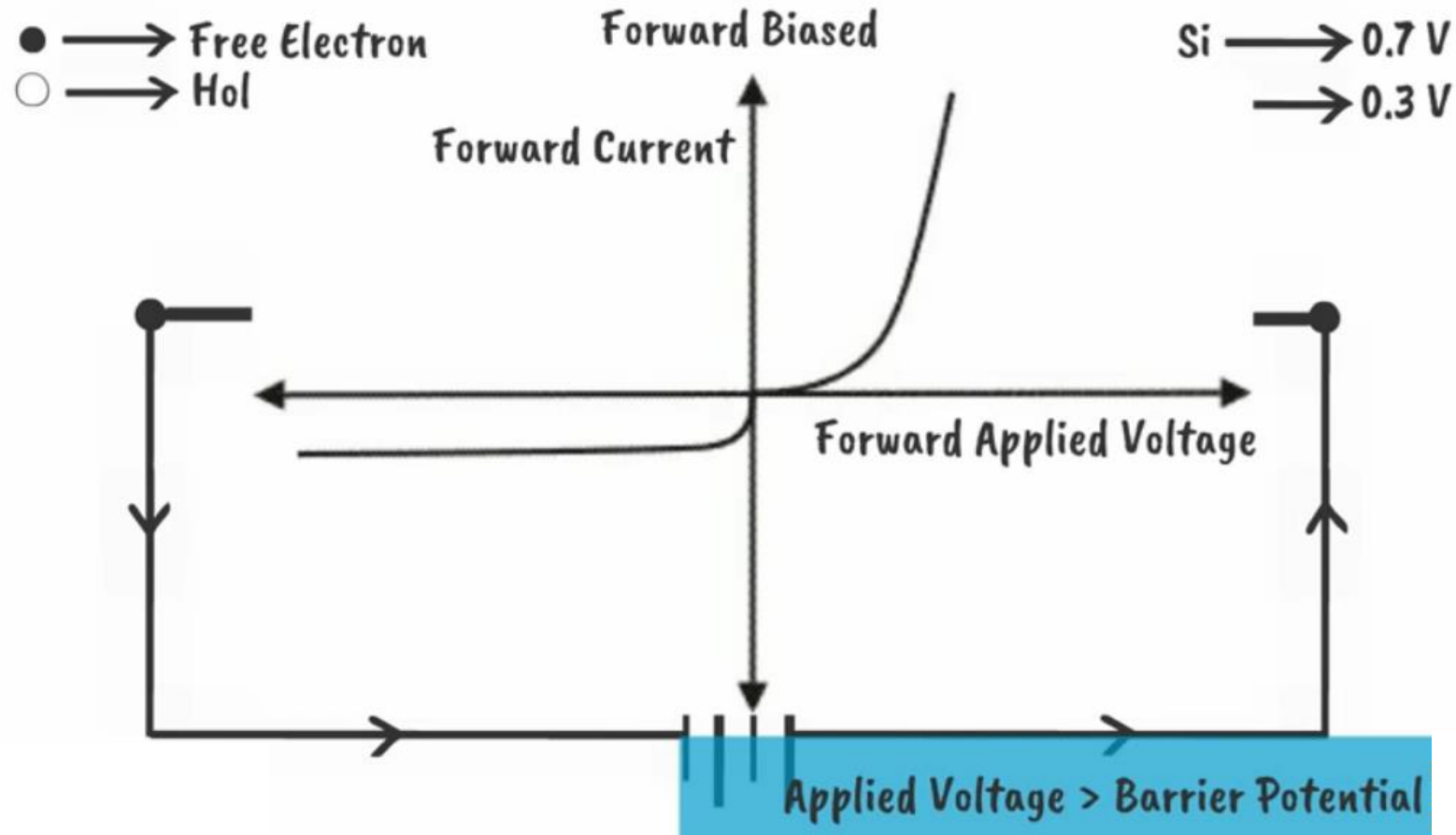
Forward biased diode

# Light Emitting Diode (LED)



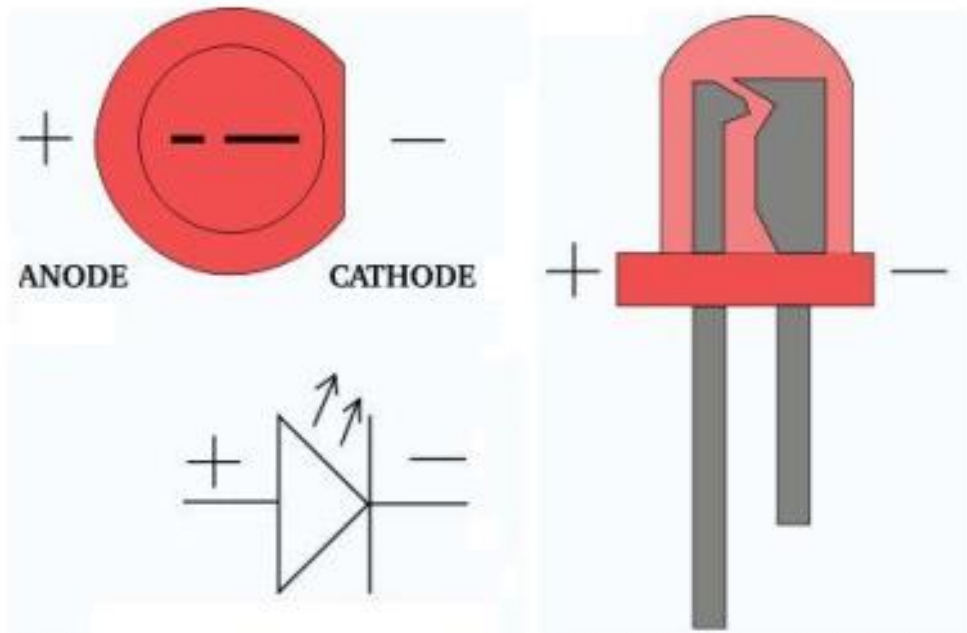
Reverse biased diode

# Light Emitting Diode (LED)



Reverse biased diode

# Light Emitting Diode (LED)



## 5mm LED (Red)

### Typical Specifications

- Forward Voltage: 1.8-2.4V (Typical: 2.0V)
- Forward Current: 20mA
- Suggested Current: 16-18mA



## 5mm LED (White, Blue, Green)

### Typical Specifications

- Forward Voltage: 3.2-3.6V (Typical: 3.2V)
- Forward current: 20mA

Light emitting diode



# LED resistor calculation

$$R = \frac{(V_s - V_f)}{I_f}$$

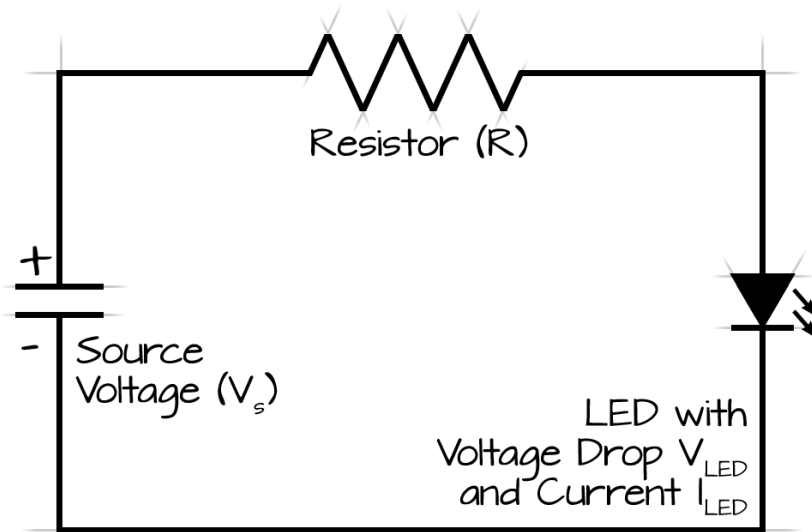
Where:

$V_s$  is source voltage

$V_f$  is LED forward voltage

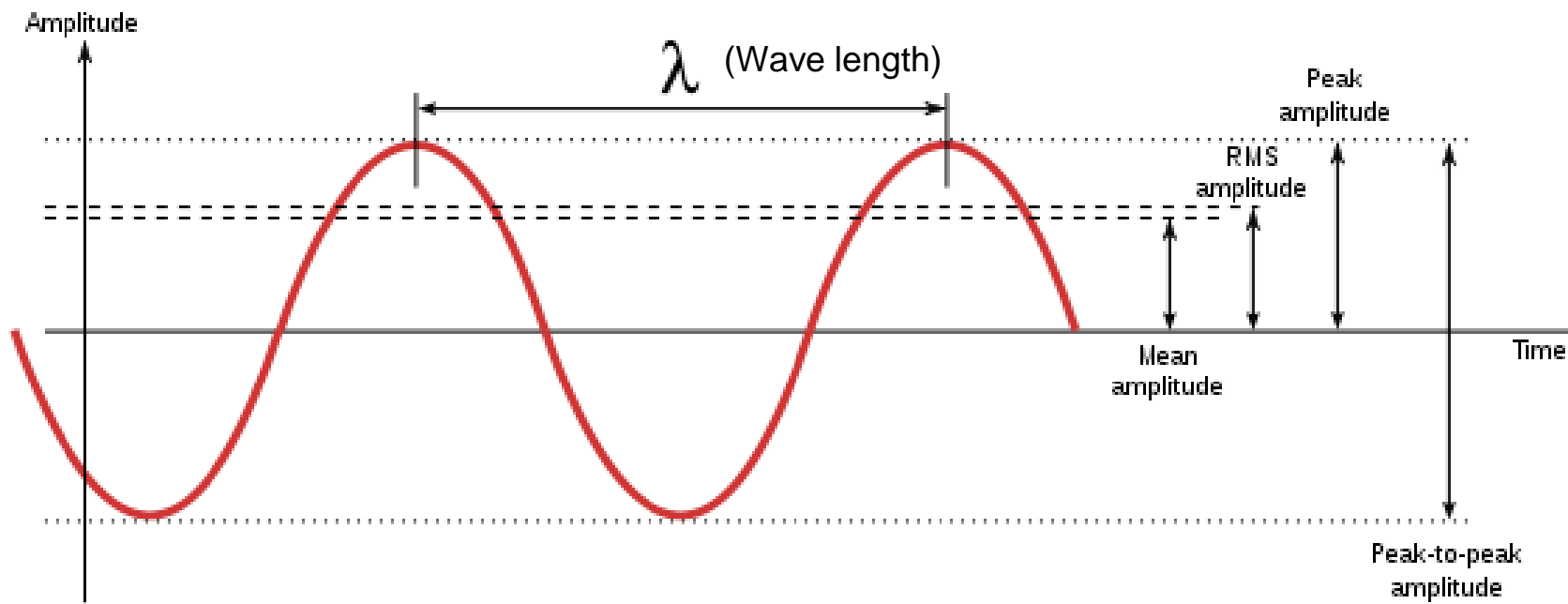
$I_f$  is LED forward current

$R$  is a series resistor



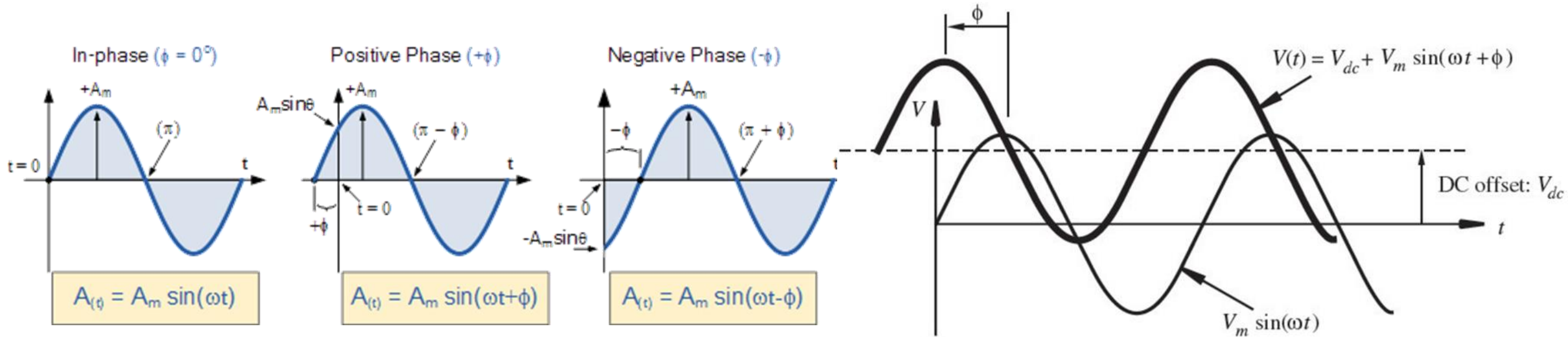
LED Color	Forward Voltage(V) @ 20mA		Dominant wavelength(mm)K @ 20mA	
	Min	Typ	Min	Typ
Red	2.1	2.4	620	630
Yellow	2.1	2.4	580	590
Green	3.4	3.8	520	530
Blue	3.4	3.8	460	465
White	3.4	3.8	6000	6500
Warm- White	3.4	3.8	3000	3500

# Function Generator



Waveform Characteristics

# Function Generator (Contd.)

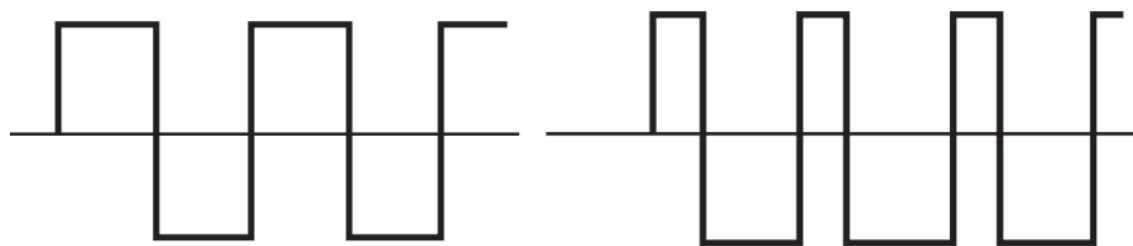


$$\omega = 2\pi f \text{ (f : Cycles per second)}$$

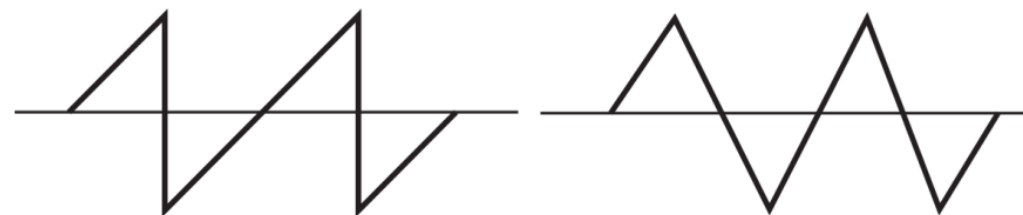
$$f = \frac{1}{T} \text{ (T : time period)}$$

Waveform Characteristics

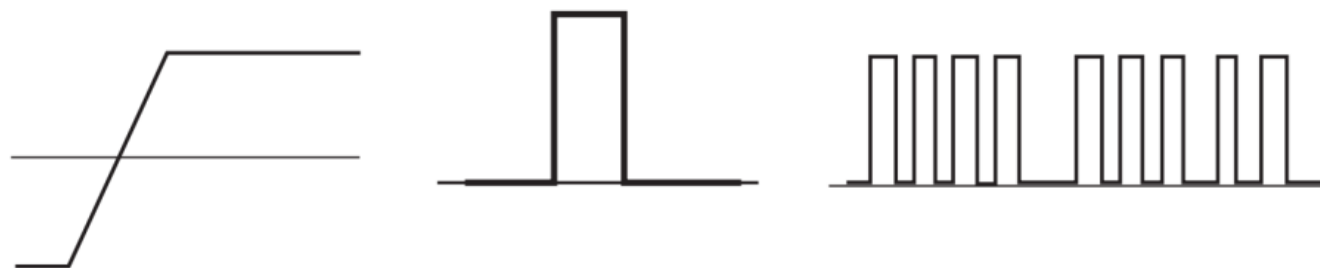
# Function Generator (Contd.)



Square and rectangular waves

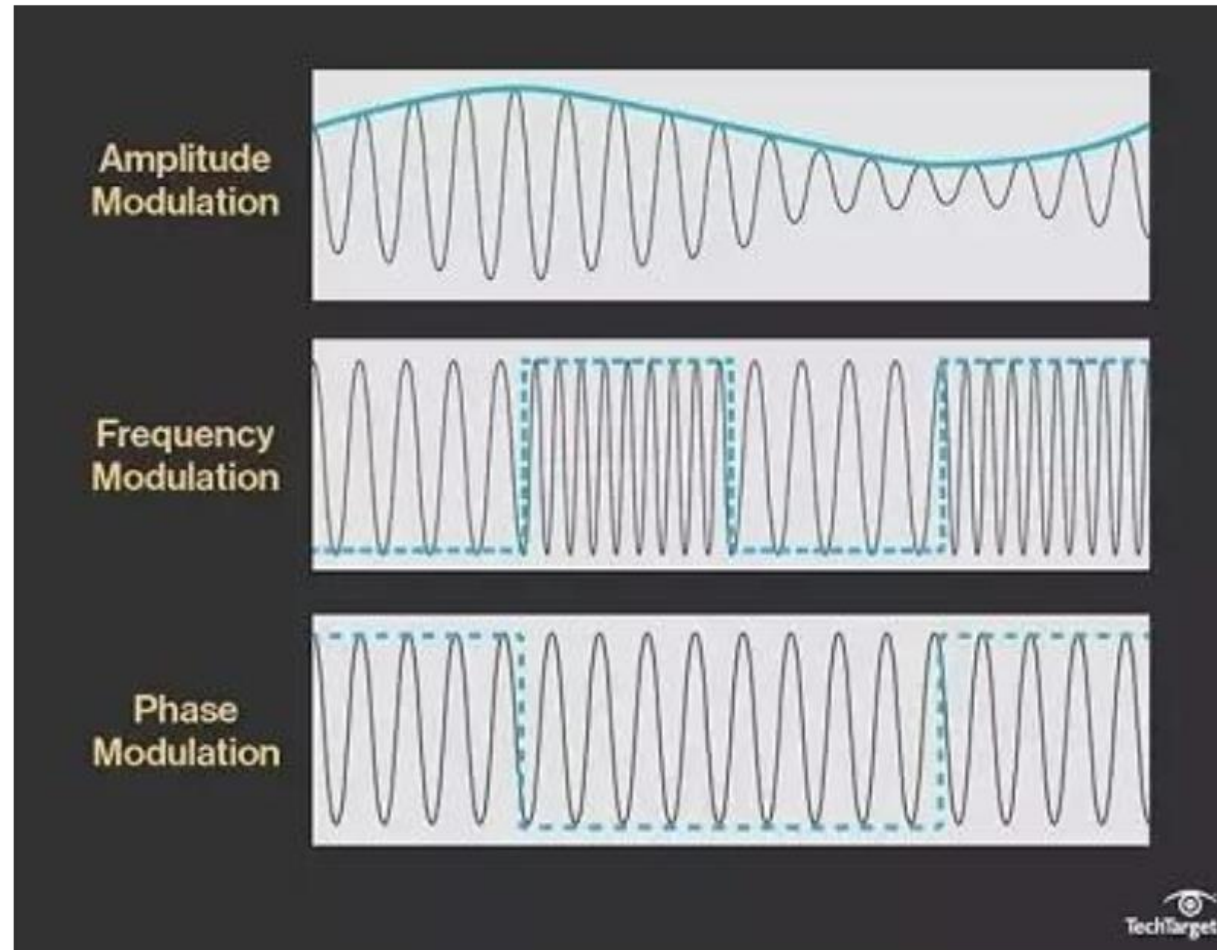


Saw tooth and triangular waves



Step, pulse and pulse train

# Function Generator (Contd.)



Complex waveforms

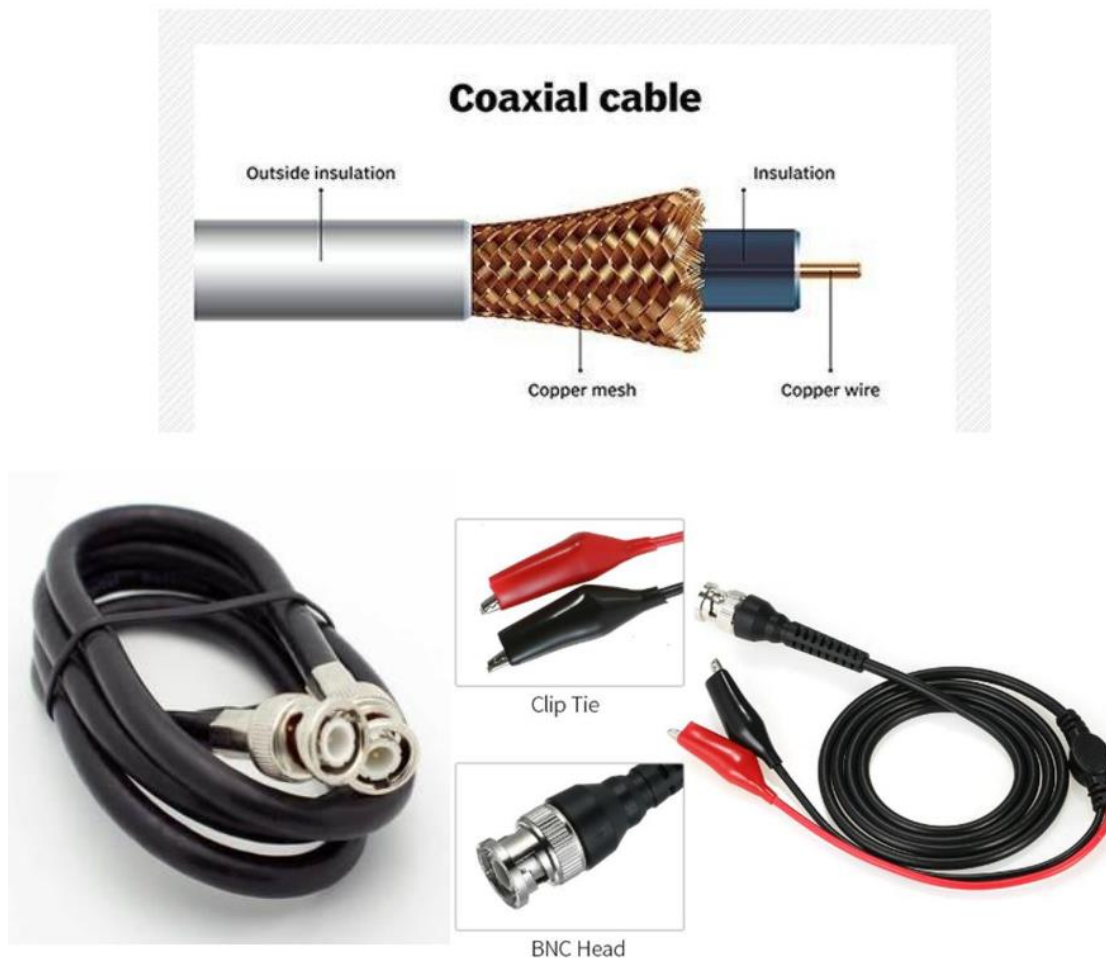
# Function Generator (Contd.)



Function Generator

$$\text{dB} = 10\log_{10}[P_2/P_1]$$

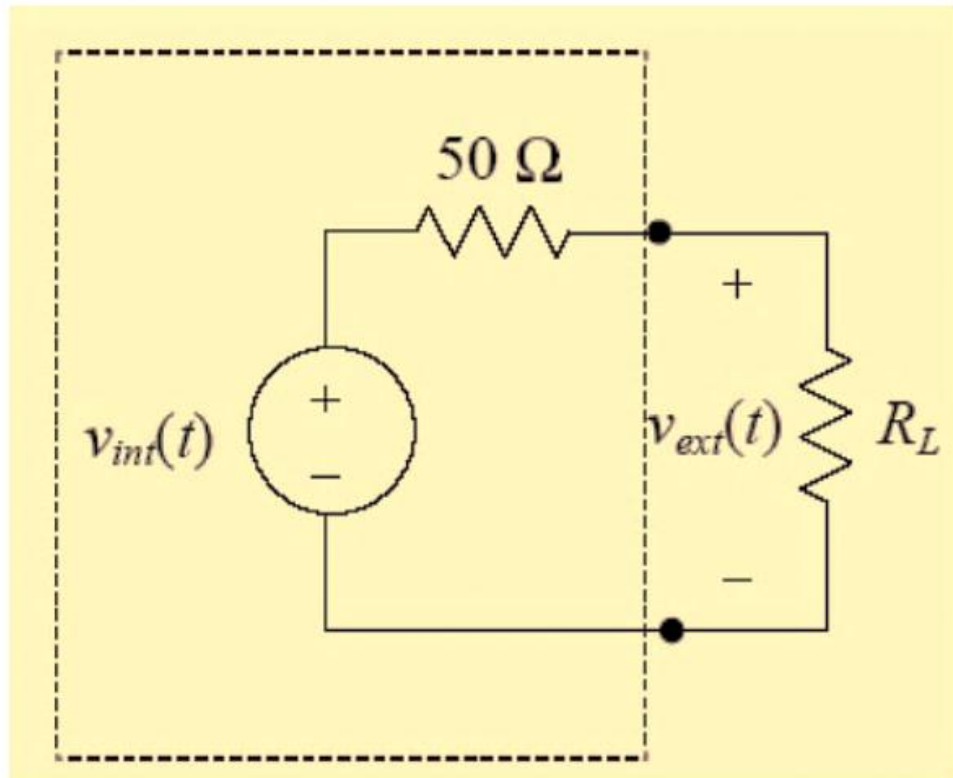
# Function Generator (Contd.)



Coaxial cable and Bayonet Neill–Concelman (BNC)



# Function Generator (Contd.)



Function generator output

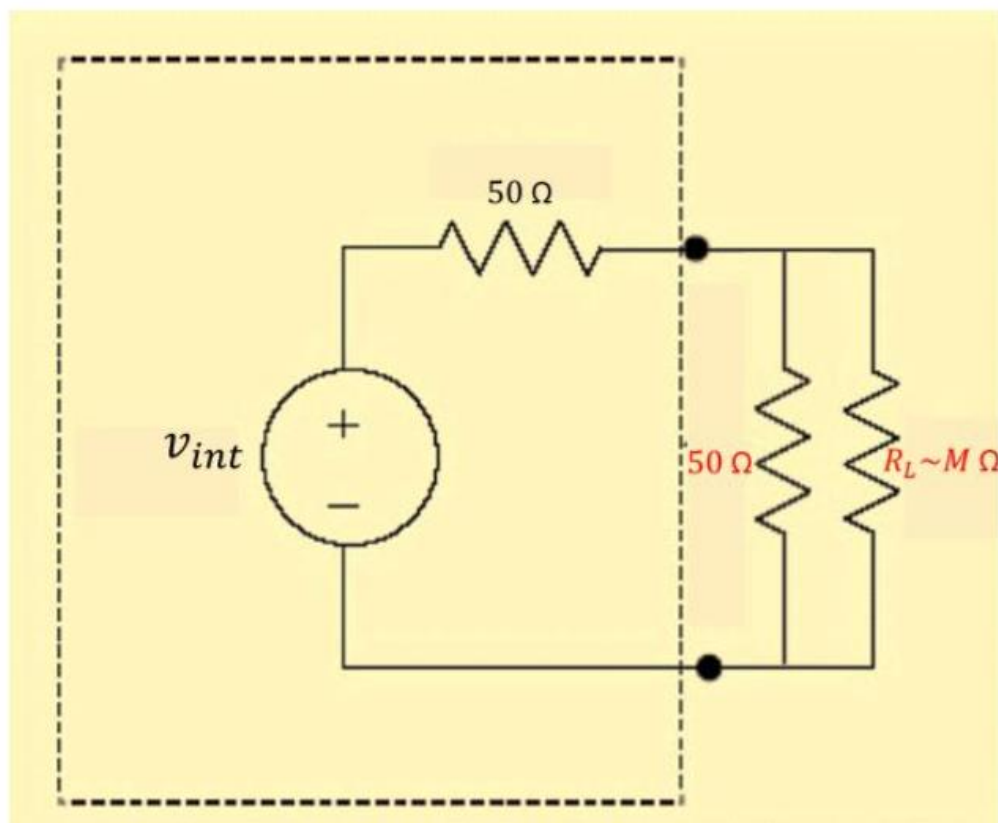
$$V_{int} = I \times R_{int} + I \times R_L$$

$$V_{ext} = \frac{V_{int} \times R_L}{(R_L + 50)}$$

$$V_{ext} = \frac{V_{int} \times 50}{(50 + 50)}$$



# Function Generator (Contd.)



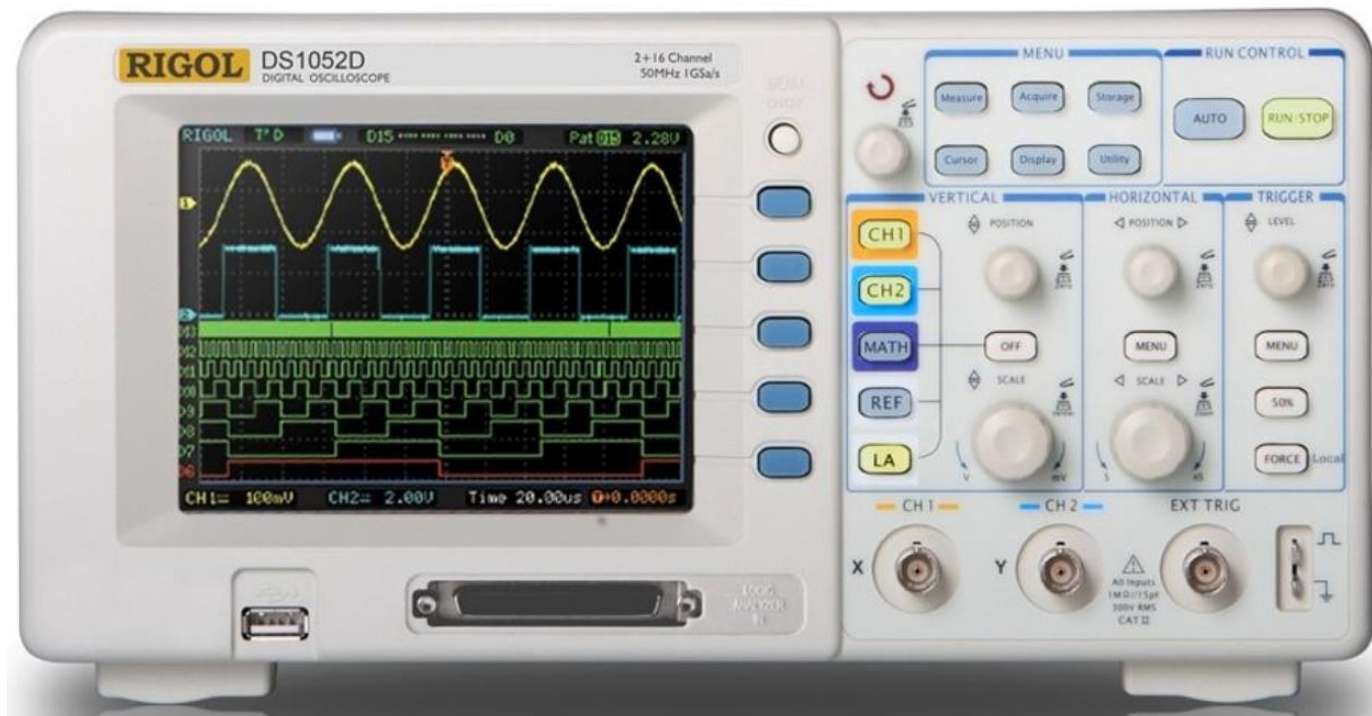
Function generator output  
(corrected) : **High Z**

$$V_{int} = I \times R_{int} + I \times R_L$$

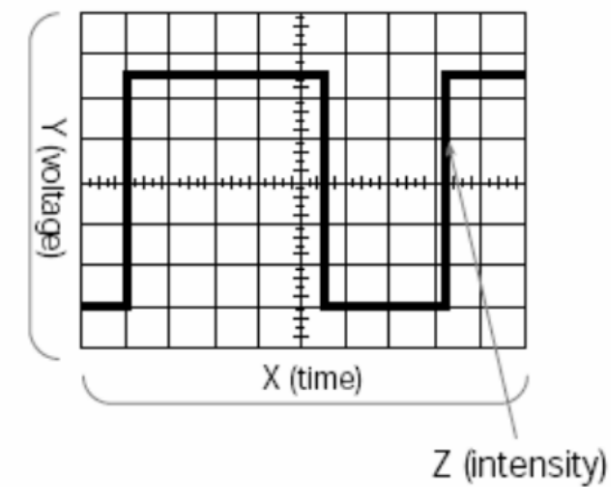
$$R_{L,t} = \frac{R_{L,img} \times R_L}{(R_{L,img} + R_L)}; R_{L,t} = \frac{50 \times R_L}{(50 + R_L)}$$

$$V_{ext} = \frac{V_{int} \times R_{L,t}}{(R_{L,t} + 50)}$$

# Oscilloscope



Y (voltage)  
X (time)  
Z (intensity)



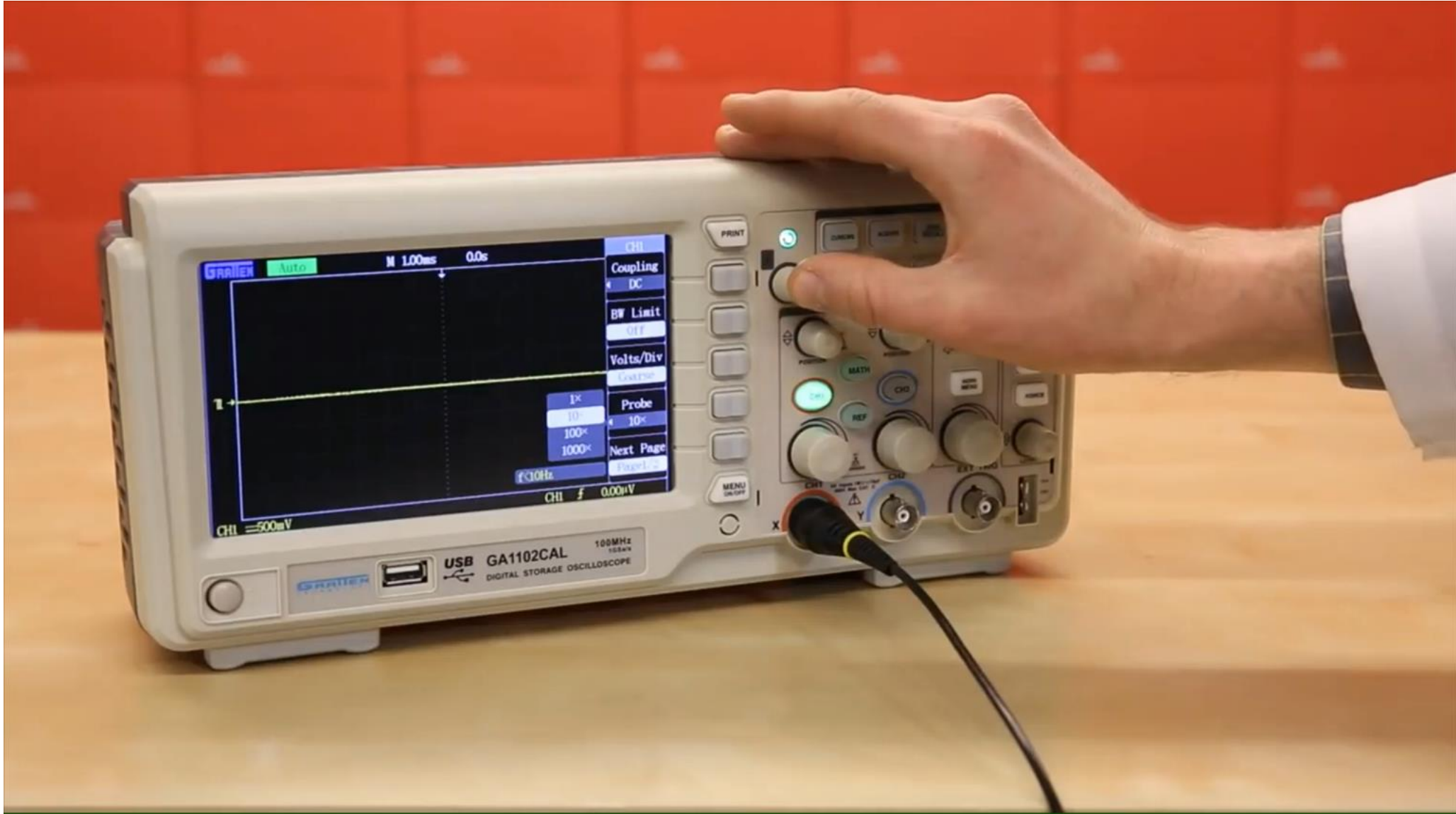
The Oscilloscope & its uses

# Oscilloscope (Contd.)



Systems in your oscilloscope

# Oscilloscope (Contd.)



# Oscilloscope (Contd.)



Scope probes

Thanks for your patience...