

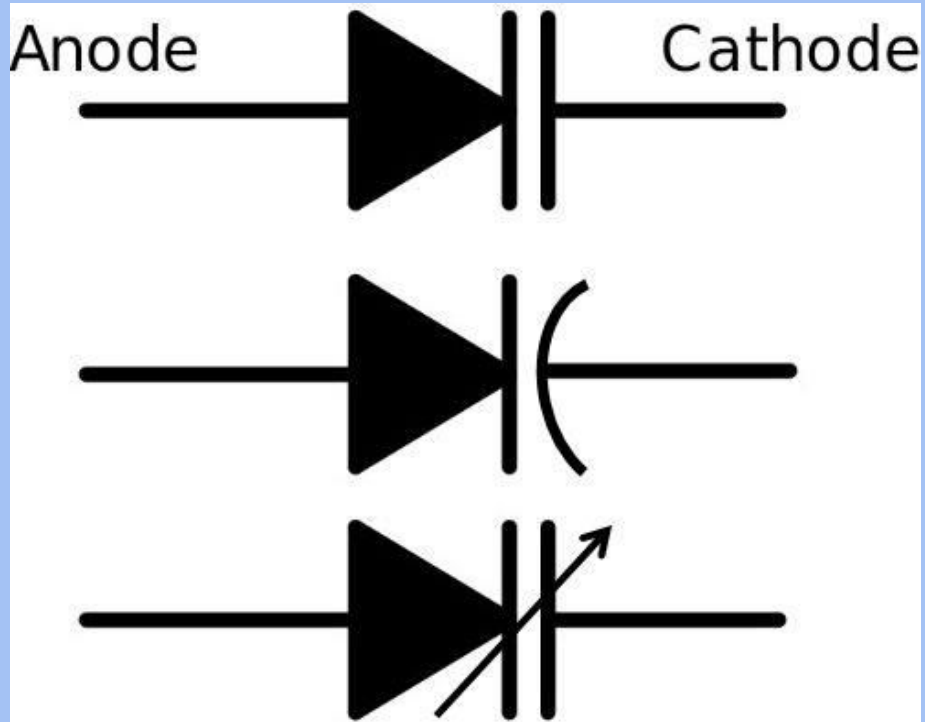
# **Varactor Diode:** **Introduction, Symbol, Working,** **Characteristics Curve**

**Elementrix Classes**

# Introduction

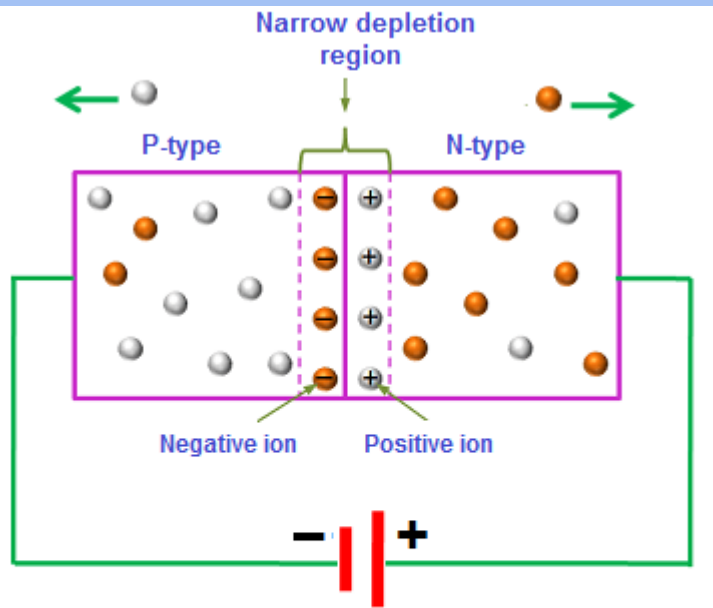
- ❑ A varactor diode is a voltage-dependent component whose output depends on the input voltage. It is used as a variable capacitor whose capacitance is controlled by adjusting the applied reverse voltage.
- ❑ Varactor diode is also sometimes referred to as varicap diode, tuning diode, variable reactance diode, or variable capacitance diode.

# Symbol of Varactor Diode



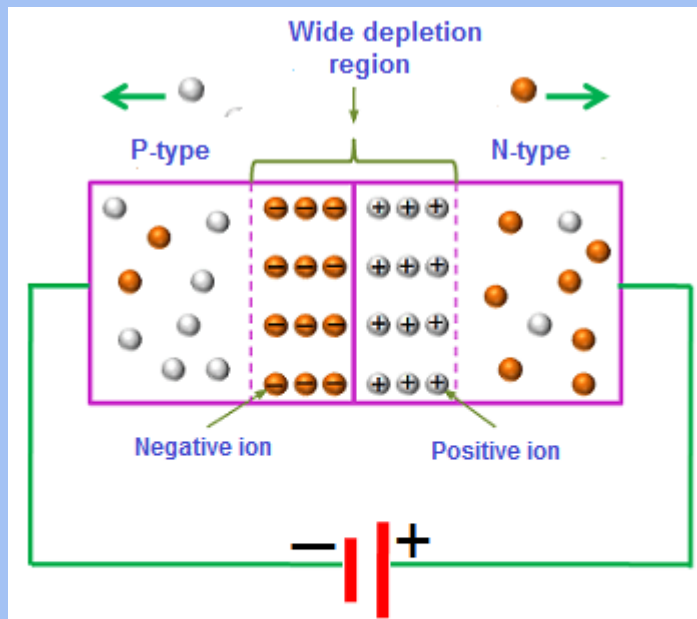
# Working

- A varactor diode operates based on the variation of its capacitance in response to changes in the applied reverse bias voltage. The capacitance is inversely proportional to the width of the depletion region within the diode. By adjusting the reverse bias voltage, the depletion region width changes, causing the capacitance to vary. This voltage-controlled capacitance is utilized in applications such as voltage-controlled oscillators (VCOs) for precise frequency tuning in radio-frequency circuits. Varactor diodes are operated in reverse bias and find significant use in RF and microwave applications where frequency control is critical.



Low reverse bias voltage  
Large capacitance

Free electron ●  
Hole ●



High reverse bias voltage  
Small capacitance

Free electron ●  
Hole ●

Therefore we can calculate the capacitance of the varactor diode using a variable capacitor formula. The expression for the junction capacitance of the varactor diode is given by

$$C_j = \frac{\epsilon \cdot A}{d}$$

Where,

$C_j$  = Junction capacitance

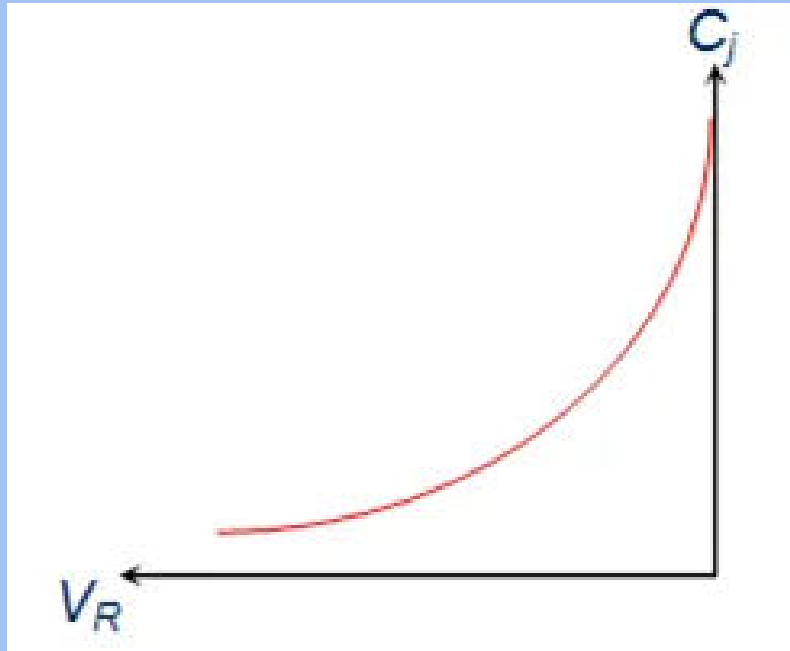
$\epsilon$  = permittivity of the semiconductor

$A$  = cross-sectional area of the junction

$d$  = width of the depletion region

# Characteristics Curve

The characteristic curve shows the relationship between the capacitance and the reverse bias voltage of the varactor diode.



पढ़िए और पढ़ाइये

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