Diode and It's Applications

LECTURE 2

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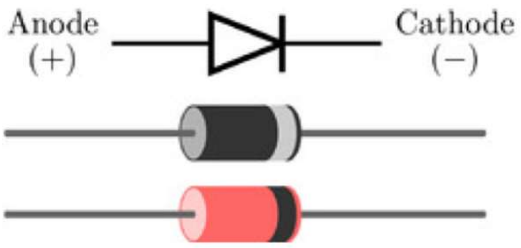
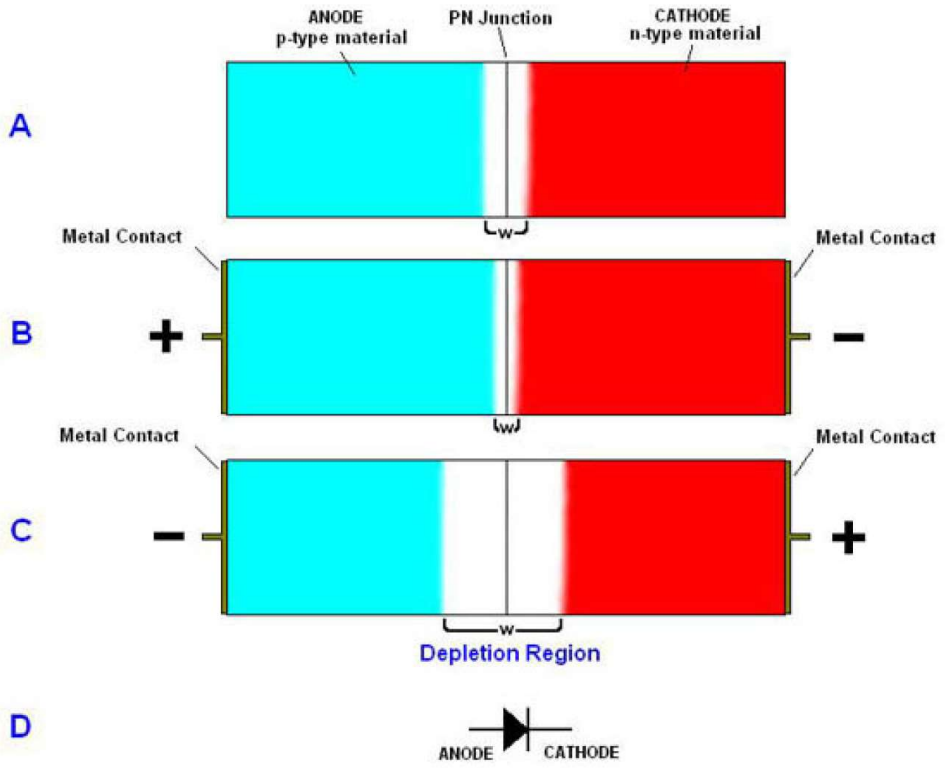
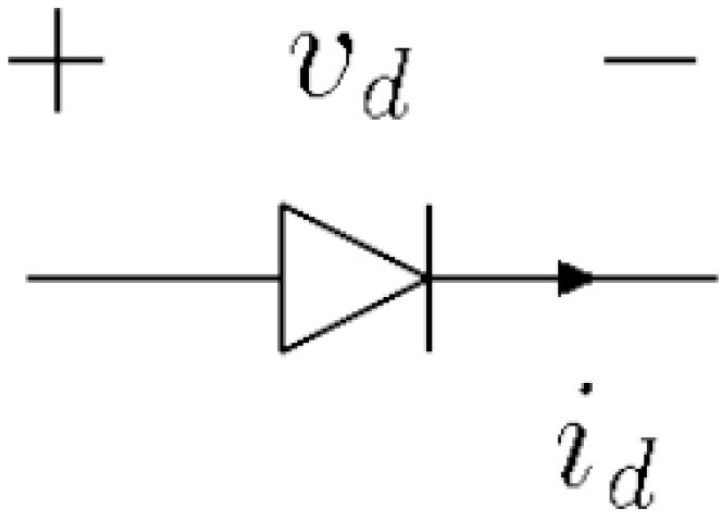
Diode





Note **: *Depletion region*** is formed from a conducting region by removal of all free charge carriers, leaving none to carry a current

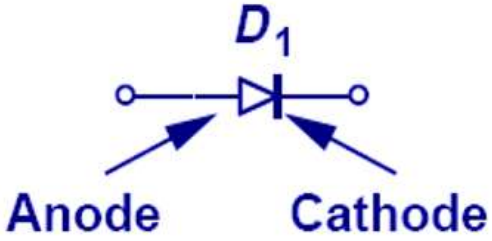


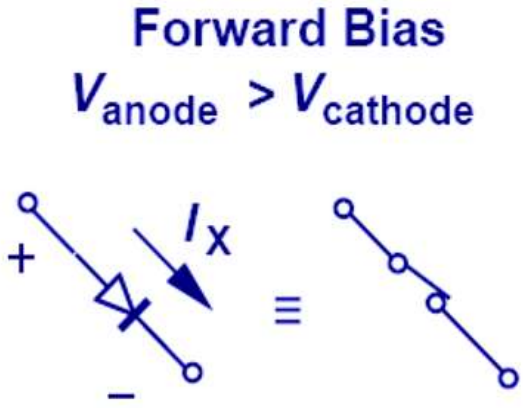
— a unidirectional device that allows current to flow in one direction but not the other.

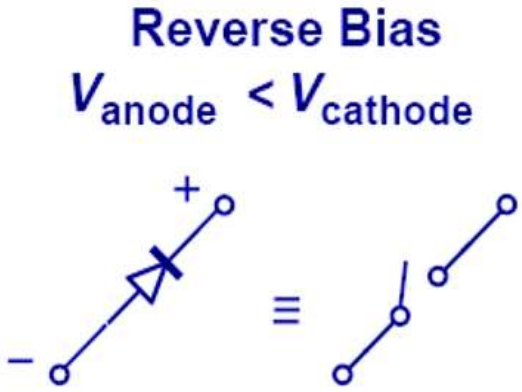
Ideally, we regard a diode as short circuit when voltage applied to it in the forward manner is positive.

Simple View of Diode (no Physics)

Diode Model – Ideal

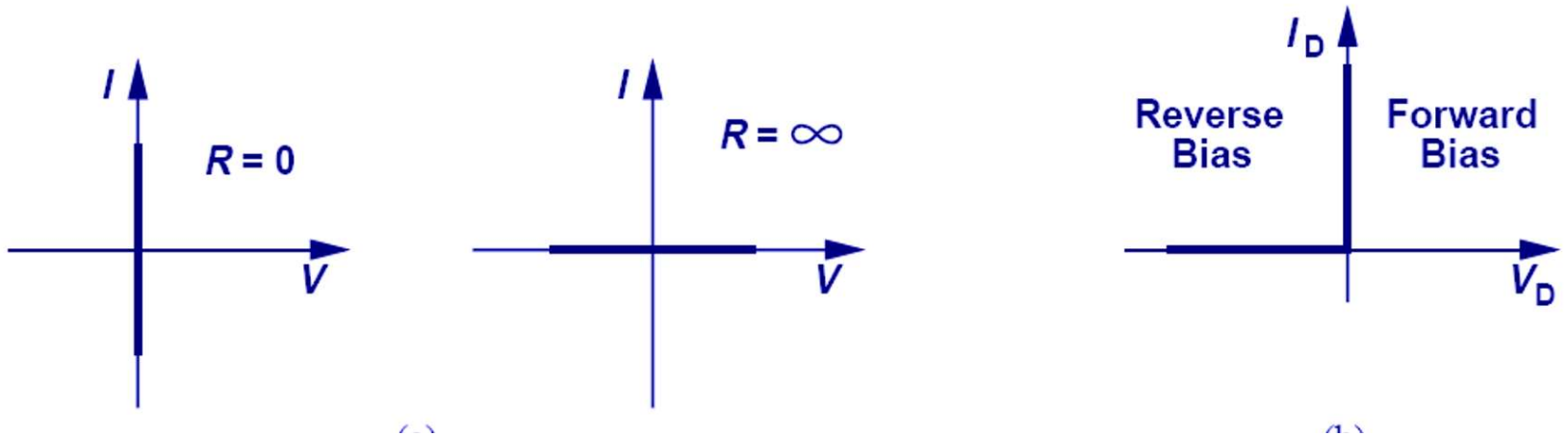






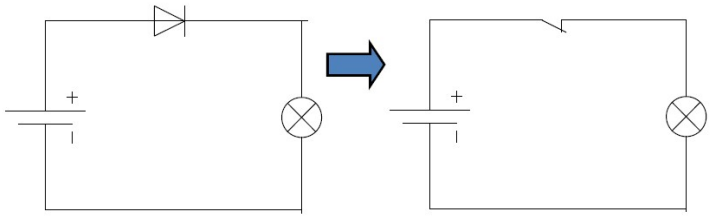
IV Characteristics of an Ideal Diode

$$R = 0 \Rightarrow I = \frac{V}{R} = \infty \qquad R = \infty \Rightarrow I = \frac{V}{R} = 0$$



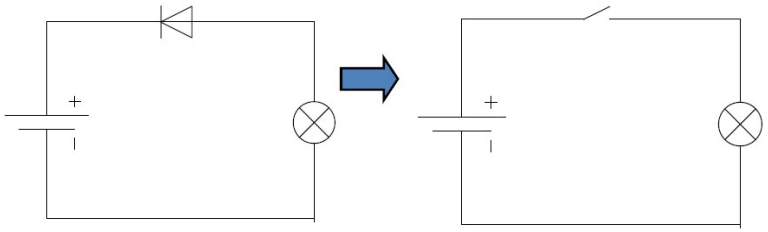
Ideal Diode

Forward biased – ON switch



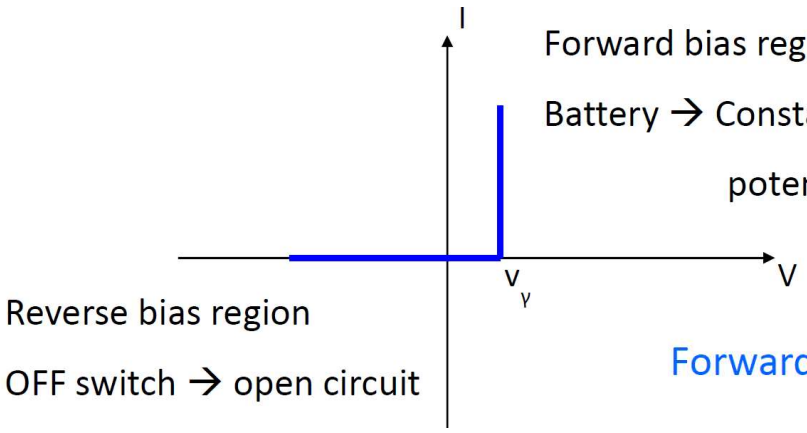
Replace the diode with an ON (Closed) switch

Reveres biased – OFF switch



Replace the diode with an OFF (Open) switch

Diode Model – Nearly Ideal



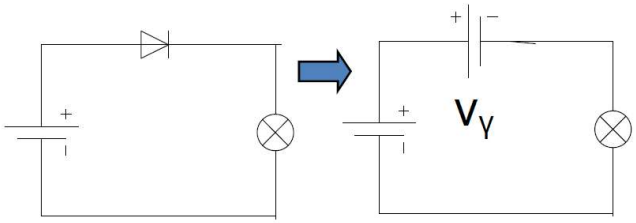
Forward bias region

Battery → Constant barrier potential

Reverse bias region

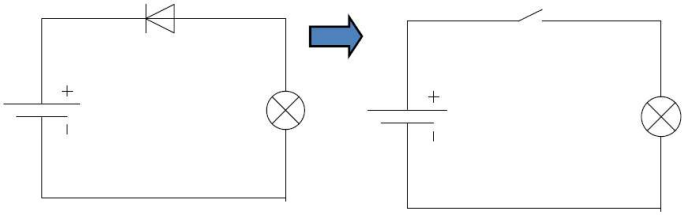
OFF switch → open circuit

Forward biased – Battery



Replace the diode with a battery of V

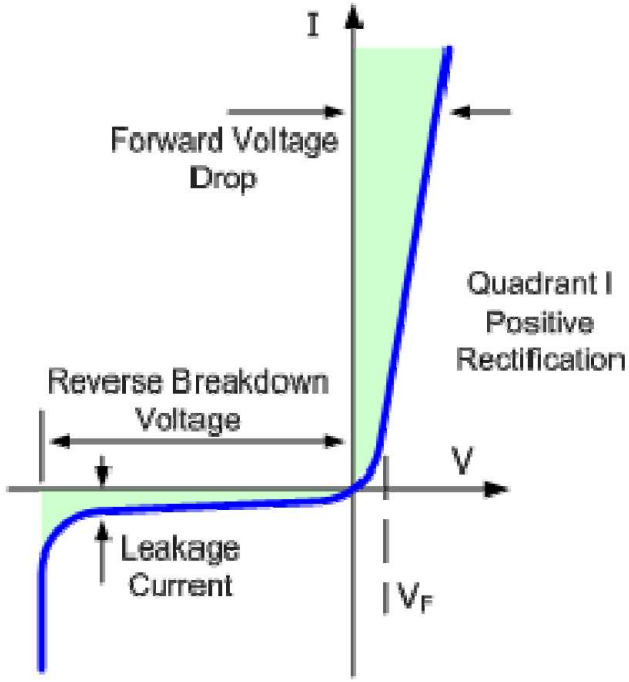
Reveres biased – Open circuit



Replace the diode with a OFF (Open) switch

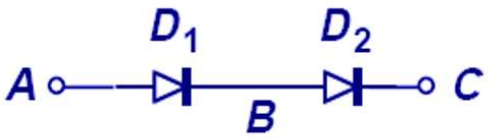
Diode Model – Real

Real I-V characteristics of the p-n junction

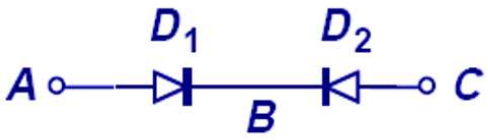


Diodes in Series

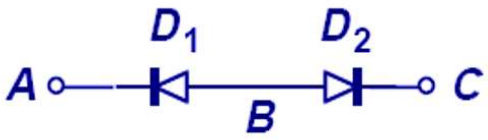
For the circuits below, which can conduct current from A to C ?



(a)



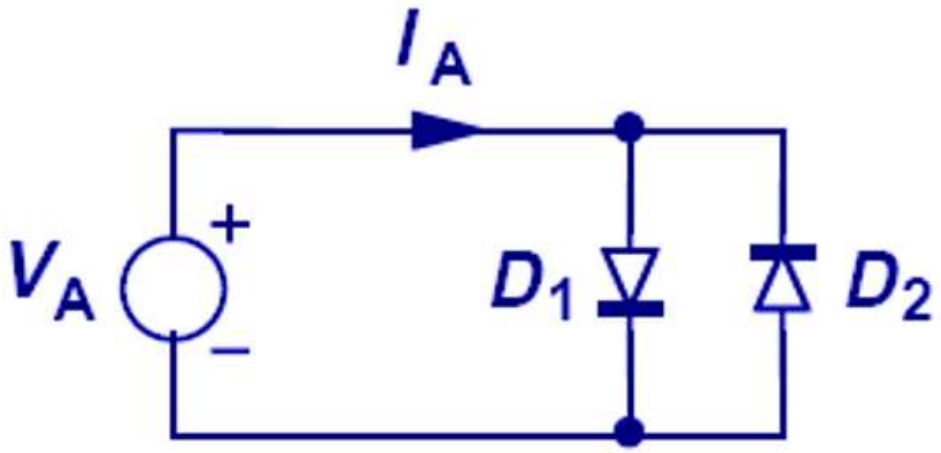
(b)



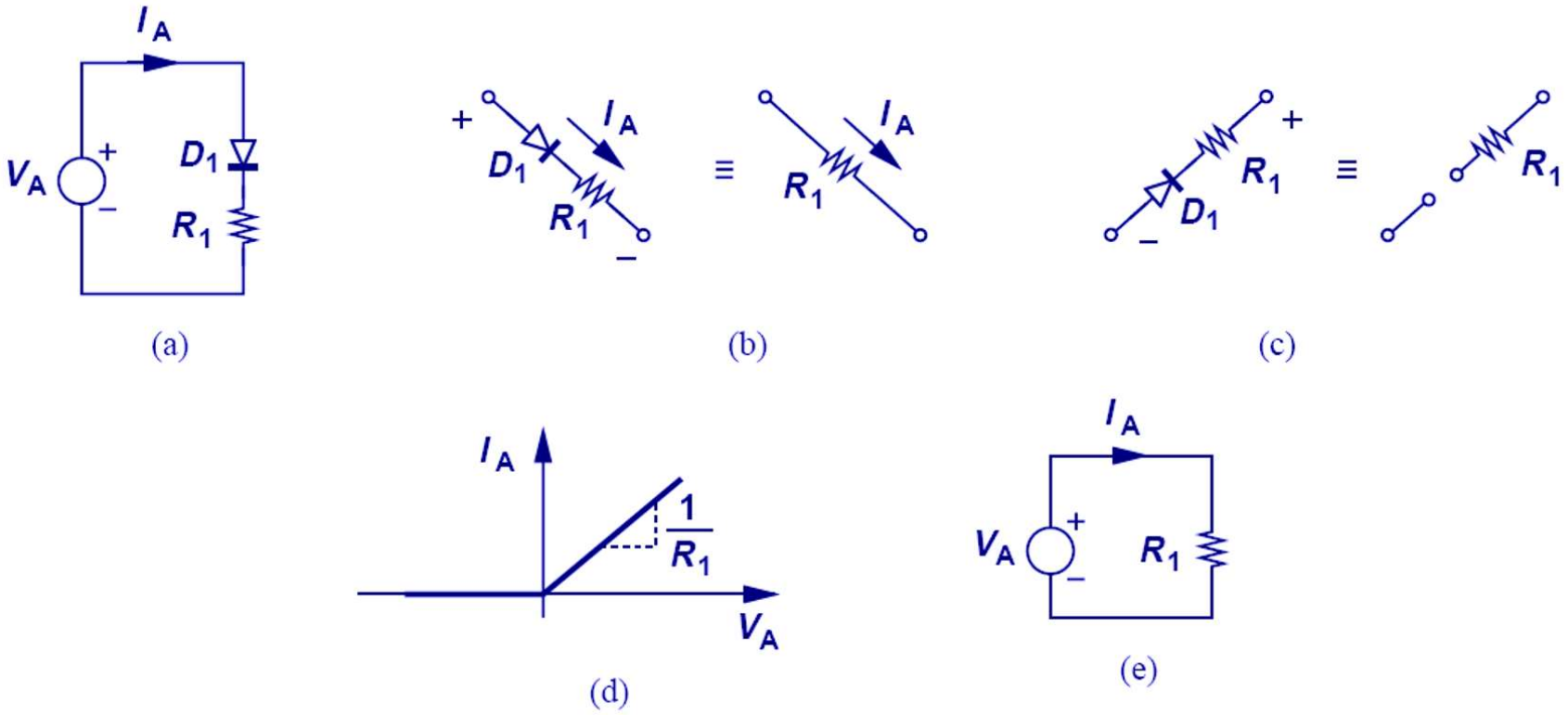
(c)

Anti-Parallel Ideal Diodes

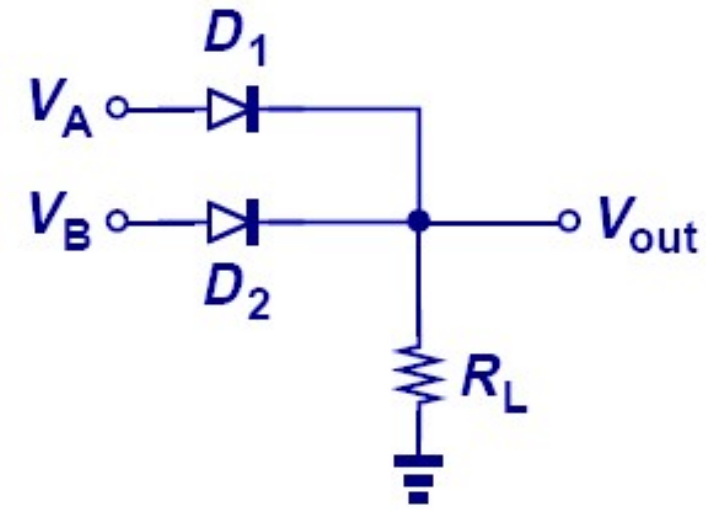
Draw the I-V Characteristic Curve



Diode-Resistor Combination



Diode Implementation of OR Gate



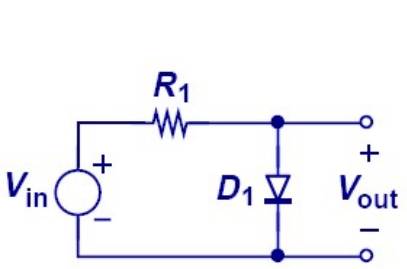
The circuit above shows an example of diode-implemented OR gate.

V_{out} can only be either V_A or V_B, not both.

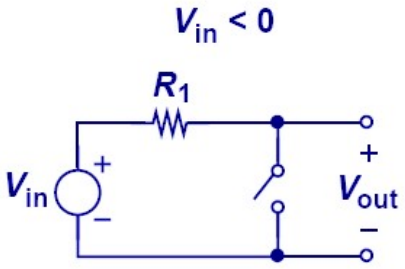
Input/Output Characteristics

When V_{in} is less than zero, the diode opens, so $V_{out} = V_{in}$.

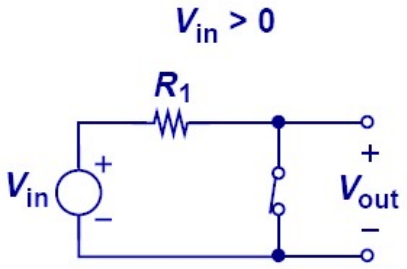
When V_{in} is greater than zero, the diode shorts, so $V_{out} = 0$.



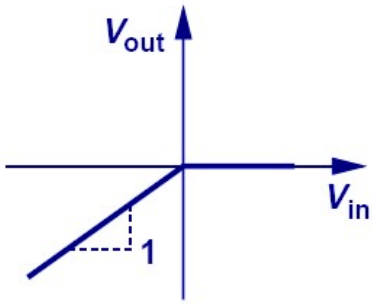
(a)



(b)



(c)



(d)

Clipper Circuit

A clipper circuit prevents the output waveform from exceeding the certain level and the same time it does not distort the remaining part of the waveform.

With position of the diode, it can be classified into

Series Clipper Circuit

Parallel Clipper Circuit

Parallel Clipper Circuit

Example :

Parallel Clipper Circuit with Biasing Voltage

Example :

Series Clipper Circuit

Example :

Serial Clipper Circuit with Biasing Voltage

Example :

Thank You