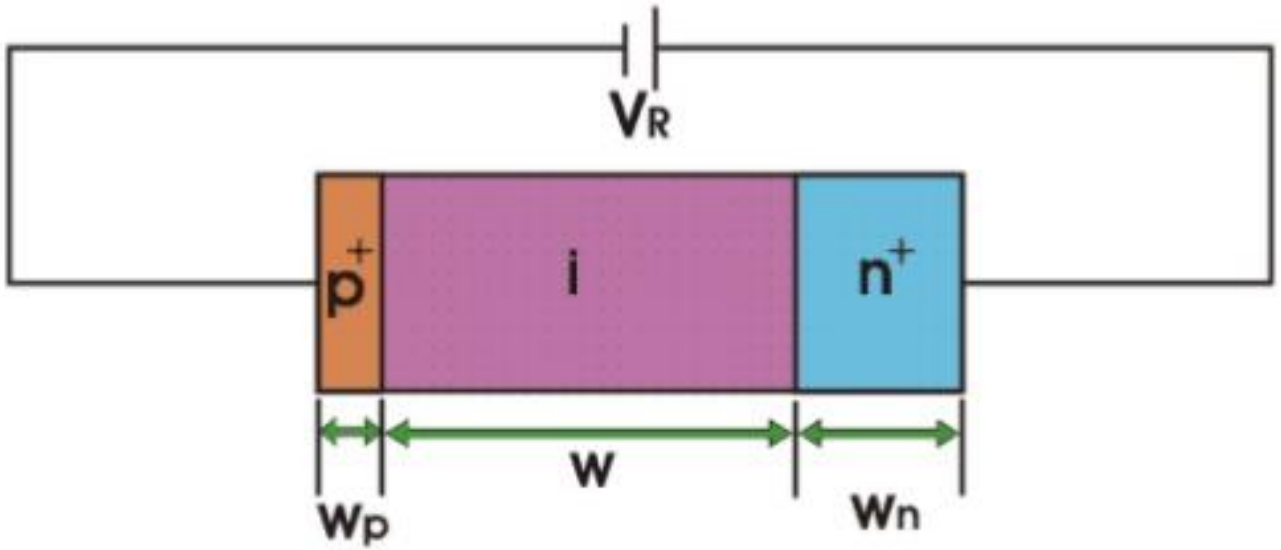
PIN DIODE

❖PIN diode consists of heavily doped P and N regions separated by a wide intrinsic region.



- The intrinsic layer is a lightly doped n-type semiconductor.
- The derived from the construction (p-intrinsic-n).
- Although gallium arsenide is used in the construction of PTN diodes, silicon tends to be the main material.
- The reasons for this are easier fabrication, higher powers handled and higher resistivity of intrinsic region.

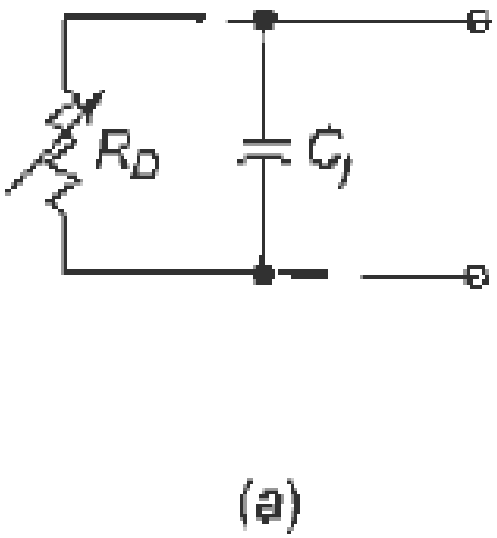
When the bias is varied on a PIN diode, its microwave resistance changes from a typical value of 5 to 10 k ohm under negative bias.

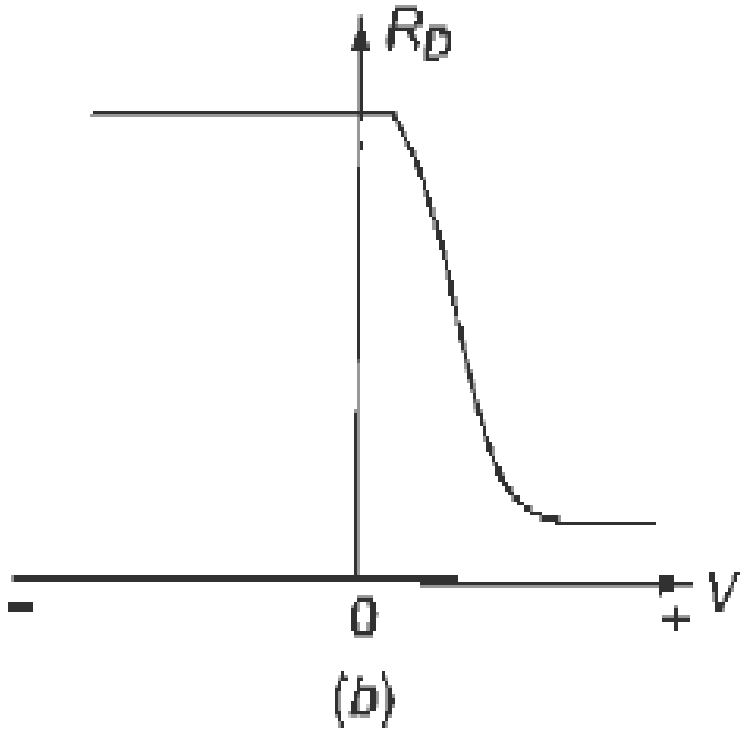
When the bias is positive R:1 to 10 ohm

Thus, if the diode is mounted across a 50-ohm coaxial line, it will not significantly load the line when it is back-biased, so that power flow will be unaffected.

When diode is forward-biased, its resistance becomes very low, so that most of the power is reflected and hardly any is transmitted.

The diode is acting as a switch.





Equivalent Ckt

Resistance variation with Bias

Gunn Diode

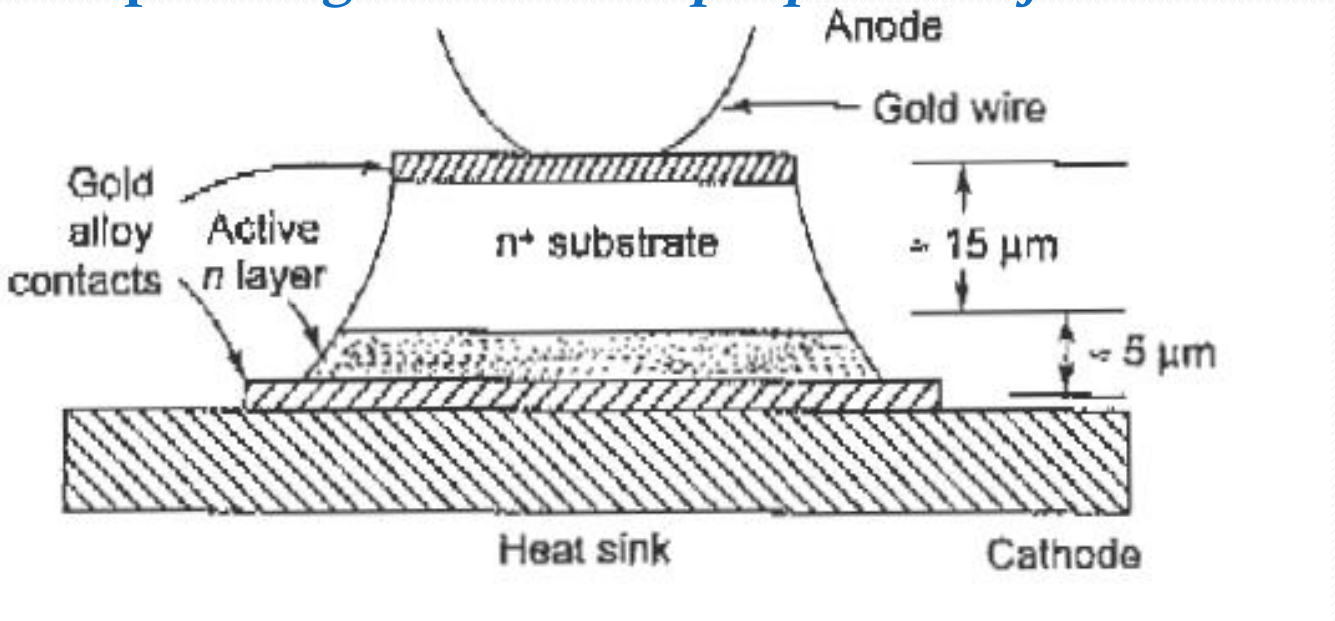
Gunn discovered the *transferred electron effect*,

Gunn Effect

Useful in the generation of microwave oscillations in bulk semiconductor materials.

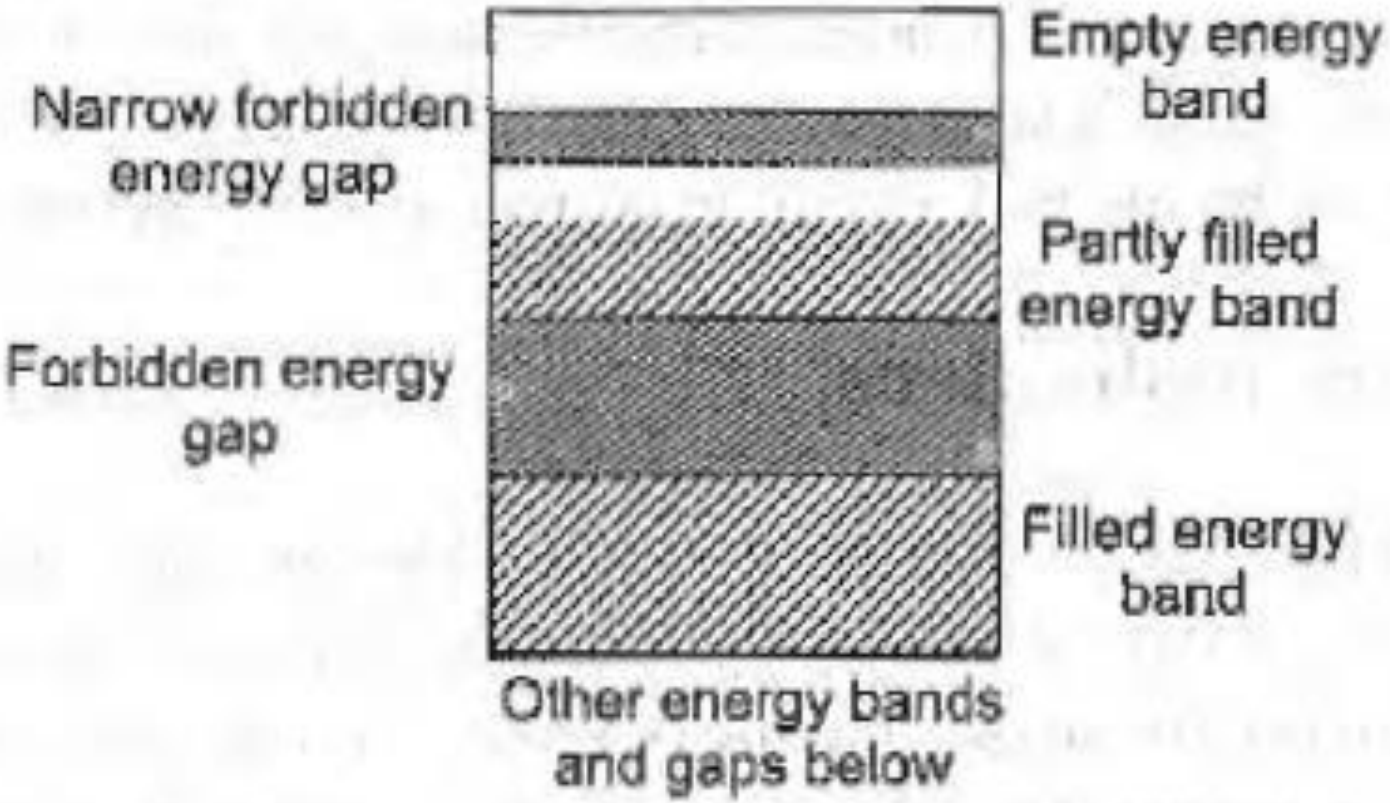
It is exhibited by *gallium arsenide and indium phosphide, but cadmiııı telturide and iıdiıım arsenide have also* subsequently been found to possess it.

It was first instance of useful semiconductor device operation depending on the *bulk properties of a material.*



If a relatively small de voltage is placed across a thin slice of gallium arsenide, then negative resistance will manifest itself under certain conditions. These consist merely of ensuring that the voltage gradient across the slice is in excess of about 3300 V /cm. Oscillations will then occur if the slice is connected to a suitably tuned circuit. It is seen that the voltage gradient across the slice of GaAs is very high. The electron velocity is also high, so that oscillations will occur at microwave frequencies.

Important energy levels in gallium arsenide.



Characteristics of GUNN DIODE