Semiconductor Diode

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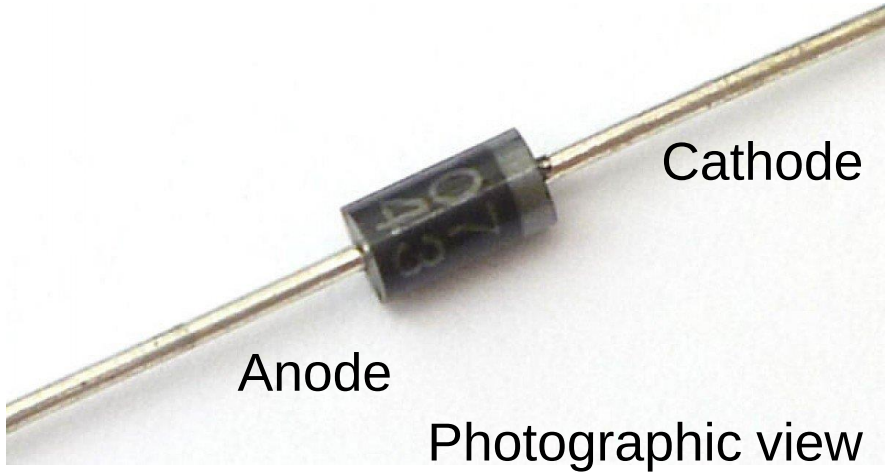
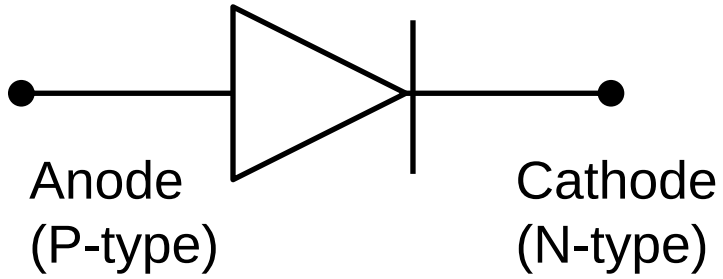
SEMICONDUCTOR DIODE:



Photographic view



Symbolic representation

A semiconductor diode is simply a PN junction.

It offers very low resistance when forward biased and very high resistance when reverse biased.

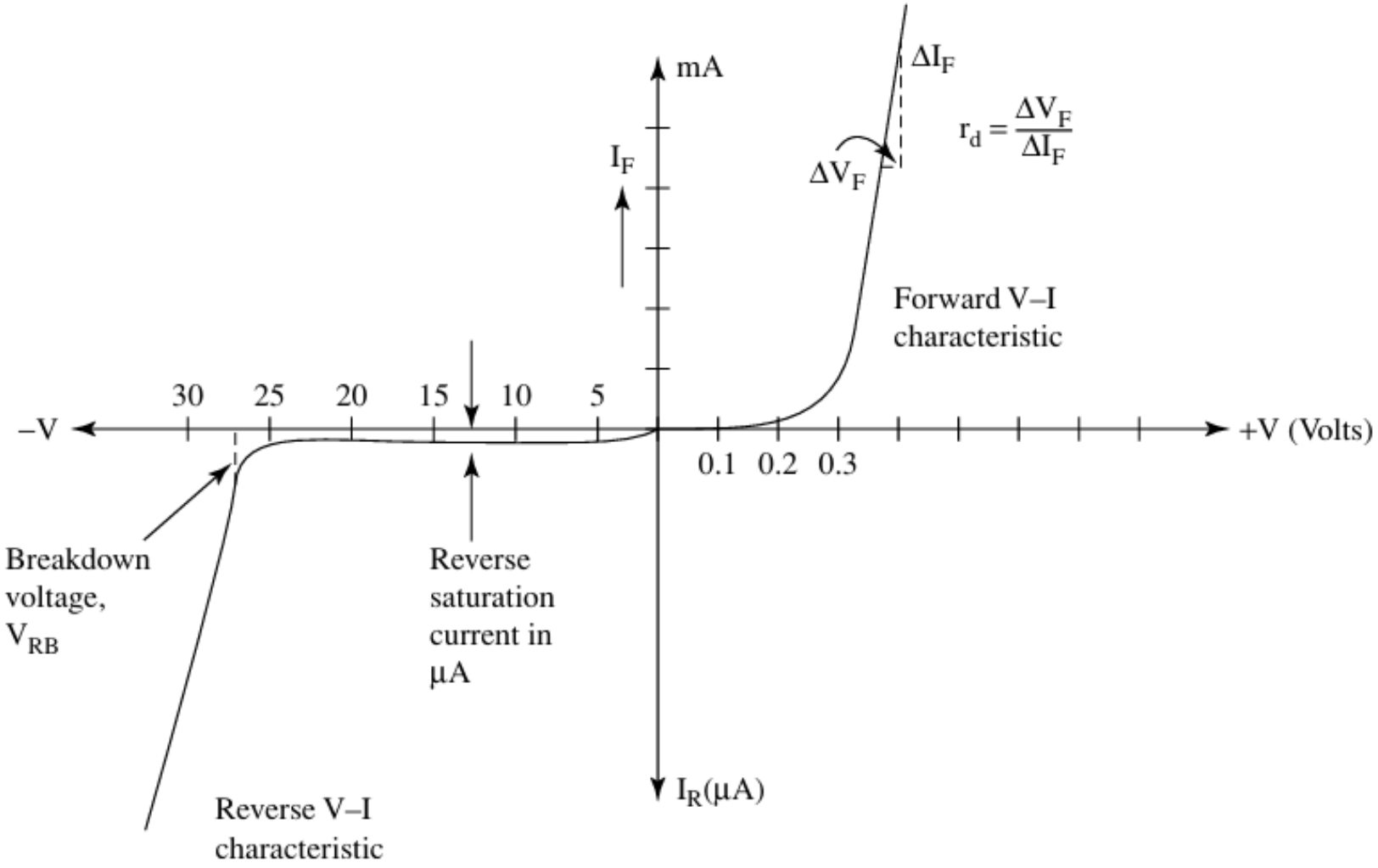
The P-side is called anode.

The N-side is called cathode.

A very high forward current or a very high reverse voltage can damage the diode.

Maximum permissible forward current and and maximum permissible reverse voltage can be noted from the data sheet provided by the manufacturer.

VOLT-AMPERE CHARACTERISTICS OF A DIODE:



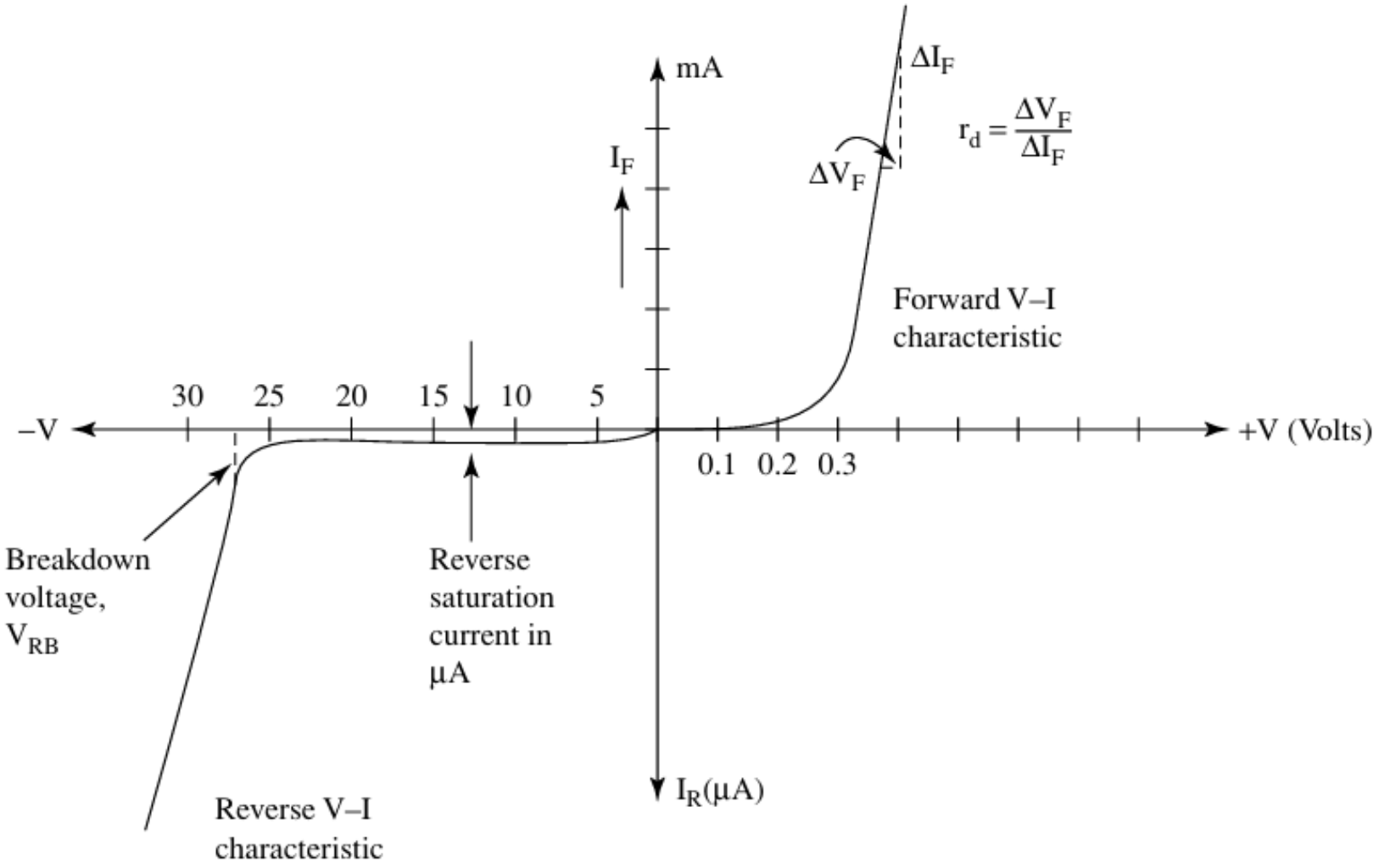
When a PN junction diode is forward biased, if the applied voltage is gradually increased, at a small value of forward voltage the forward current is negligible.

At a voltage near 0.3 V, the current suddenly increases (for germanium diode).

This voltage at which the forward current starts increasing is called the cut-in voltage of the diode.

For silicon diode, the cut-in voltage is approximately 0.7 V.

VOLT-AMPERE CHARACTERISTICS OF A DIODE:

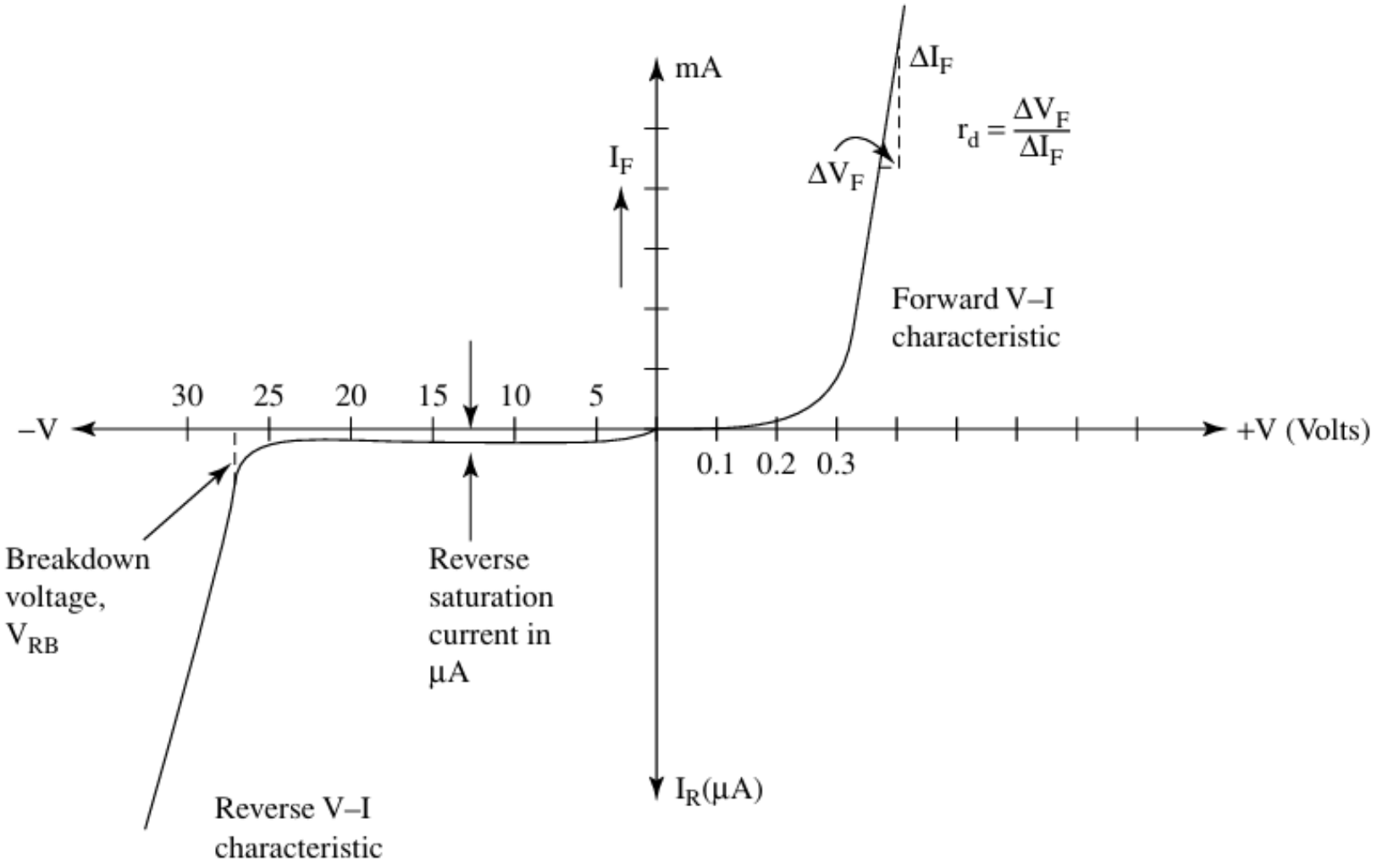


Under the reverse-biased condition, the junction resistance is very high and ideally no current should flow.

But due to minority charge carriers, a negligibly small current of the order of microamperes will flow.

This current is called leakage current or reverse saturation current of the diode.

VOLT-AMPERE CHARACTERISTICS OF A DIODE:

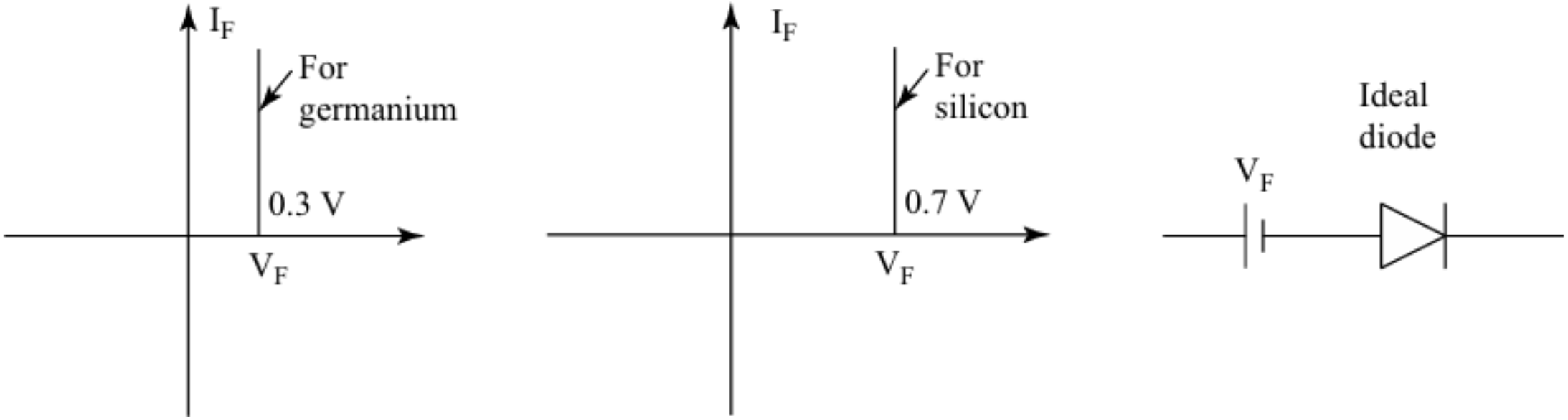


However, if the reverse voltage is increased to a large value, at one stage, the PN junction will break down with a sudden rise in reverse current.

The reverse voltage at which the diode breaks down and a large reverse current starts flowing is called the breakdown voltage.

At this reverse breakdown voltage, current continues to increase.

AN IDEAL DIODE:



An ideal diode will have zero forward resistance and infinite reverse resistance.

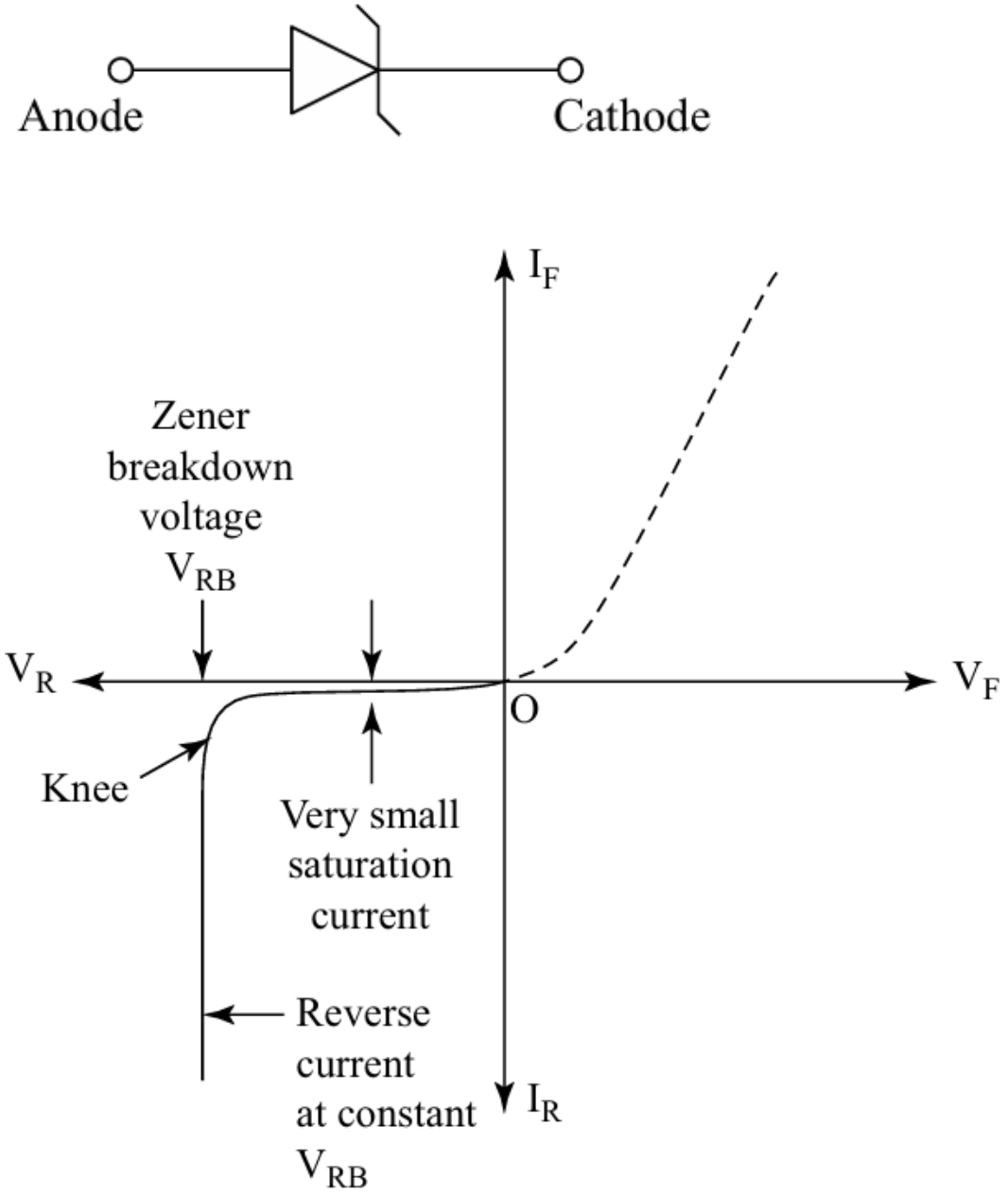
For an ideal diode, $I_R = 0$ and $V_F = 0$.

An ideal diode is difficult to realize.

If we ignore the reverse current I_R and assume that forward voltage drop, V_F as constant at 0.3 V for germanium and 0.7 V for silicon, the equivalent circuit can be drawn.

In the equivalent circuit of a practical diode, $V_F = 0.3$ V for the germanium diode and 0.7 V for the silicon diode.

ZENER DIODE:



It is a PN junction diode doped heavily.

This diode is specially designed for voltage regulation.

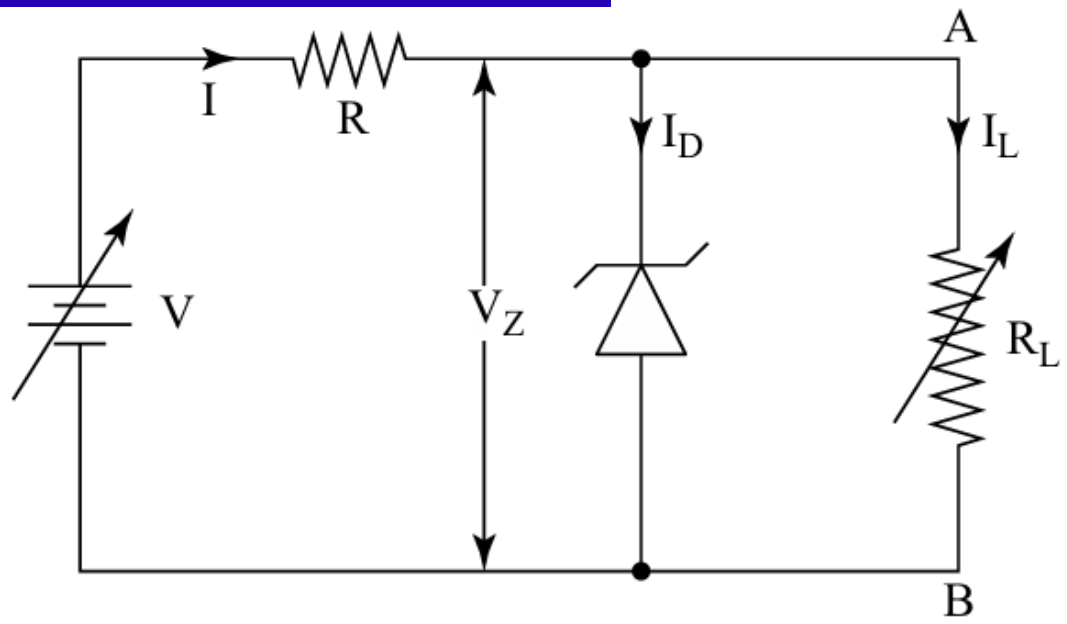
The forward V–I characteristic of a zener diode is the same as an ordinary diode.

But its characteristic changes when it is connected in reverse bias.

It has a very sharp breakdown voltage.

Under reverse breakdown condition, the voltage across the Zener diode remains almost constant.

ZENER DIODE AS VOLTAGE REGULATOR:



A voltage regulator maintains nearly constant voltage output across the load over a wide range of variation of load current.

The zener diode used in the circuit maintains a constant voltage across the load terminals A and B.

This is achieved by operating the zener diode in the breakdown region.

In this region, the voltage across it changes only very slightly over a wide variation of zener current.

The zener breakdown voltage should be lower than the applied voltage.

Thank You