

Semiconductors & Semiconductor Devices

EEE101 Introduction to Electrical-Electronics Engineering

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SEMICONDUCTORS AND SEMICONDUCTOR DEVICES

Pure semiconductors in nature: carbon (C); germanium (Ge); silicon (Si)

↓
discovered in 1886

{ in ashes of some
types of coal }

↓
in 1823

{ in SiO_2 form
in soil }

Doping: an operation to impurify a material

↳ 5-valent (5-valence) doping: arsenic, antimony
are used

↳ 3-valent (3-valence) doping: indium, gallium
are used

Example:

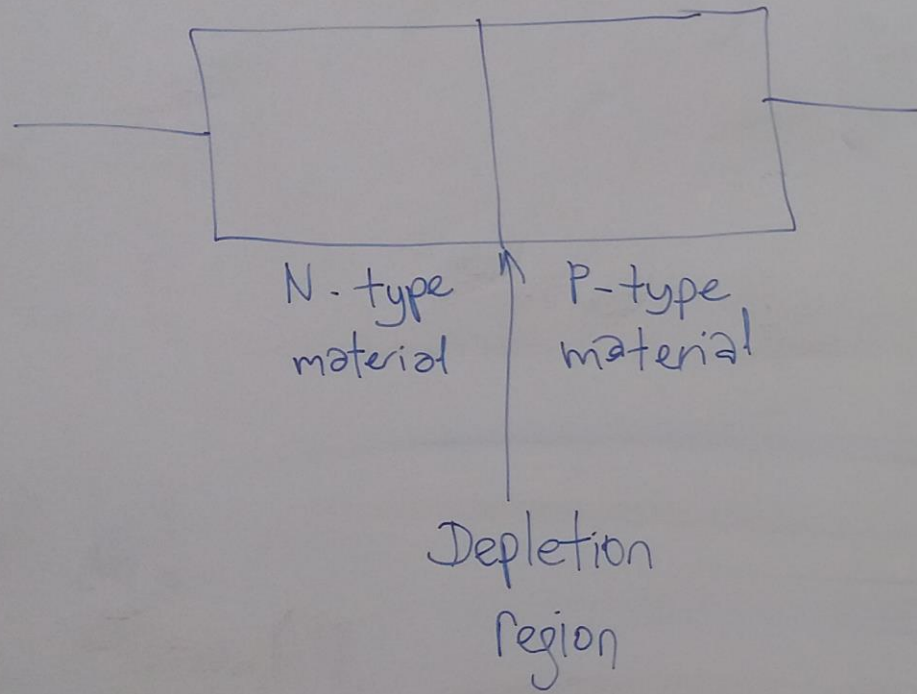
arsenic + silicon \rightarrow valence shell full
+
N-type carrier \leftarrow (1 electron)

gallium + silicon \rightarrow valence shell with
7 electrons

\equiv valence shell full
+

P-type carrier \leftarrow 1 hole

① PN Junction Diodes:



★ A device with two terminals

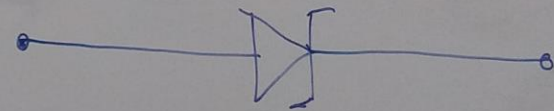
Schematic Symbol



★ Functionality: allows current flow in only one direction

①a Zener Diodes:

Schematic Symbol

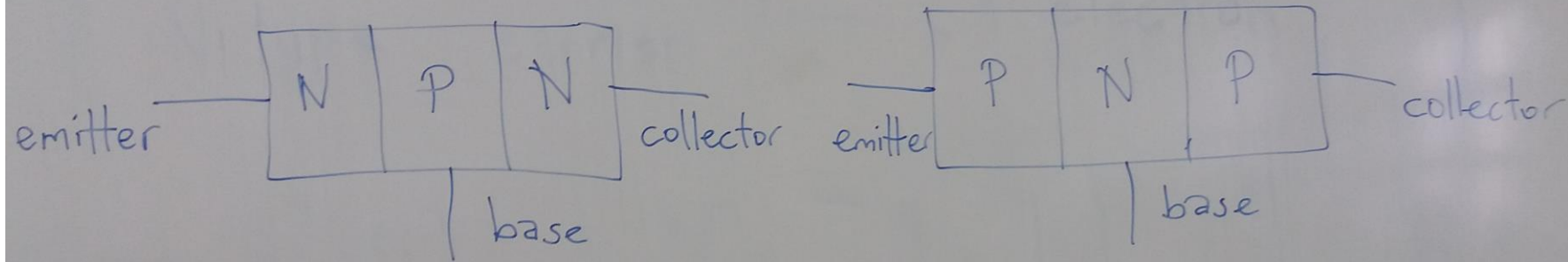


Breakdown Voltage; Zener Voltage

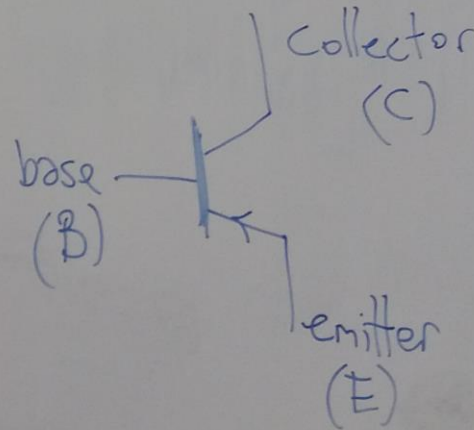
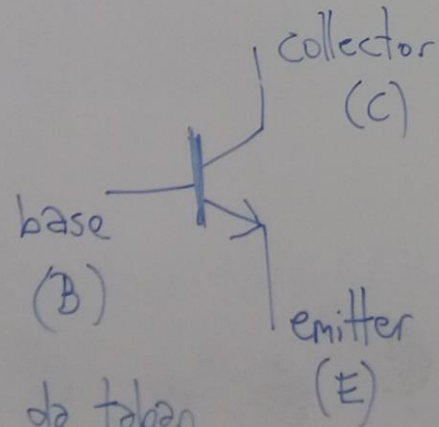
★ Functionality: allows current flow in one direction when breakdown voltage is exceeded.

② Transistors:

②a Bipolar Junction Transistors: (BJTs)



Schematic Symbols



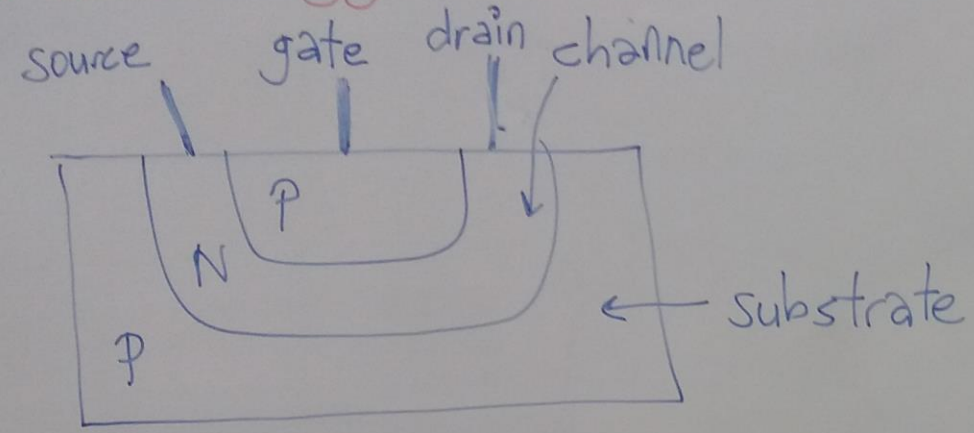
base: baz ya da taban

collector: kolektör ya da toplayıcı

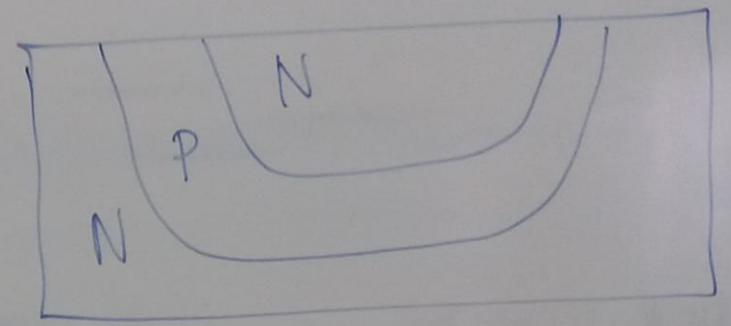
emitter: emitör ya da yayıcı

★ Applications: ① Amplification
② Switching

2b Field Effect Transistors: (FETs)

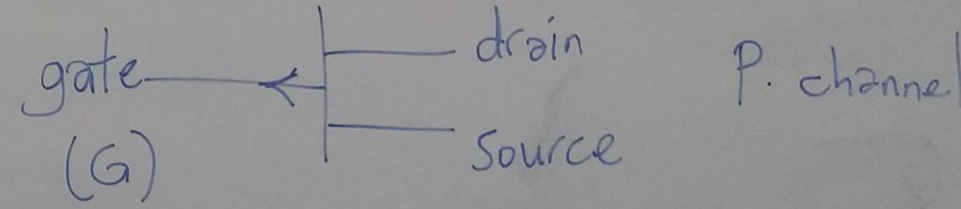
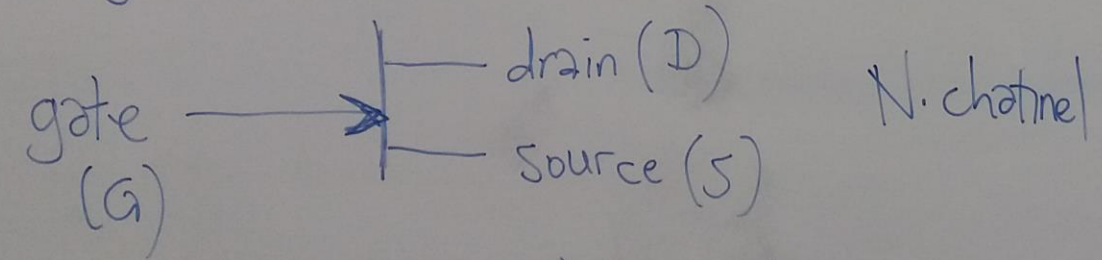


N-channel FET



P channel FET

Schematic Symbol



gate : geçit ya da kapı
 source : kaynak
 drain : diren ya da akçeç