

18장 쌍극 트랜지스터



► Transistor

- A transistor is produced when a third layer is added to a semiconductor.
- It can amplify power, current, or voltage.
- Also called a junction transistor or transistor

► Transistor

- Can be constructed of germanium or silicon.
- Silicon is more popular.
- Consists of three alternately doped regions.
- The regions are arranged two ways.
 - § P-type material is sandwiched between two N-type materials, NPN transistor.
 - § N-type material is sandwiched between two P-type materials, PNP transistor.

► Transistor

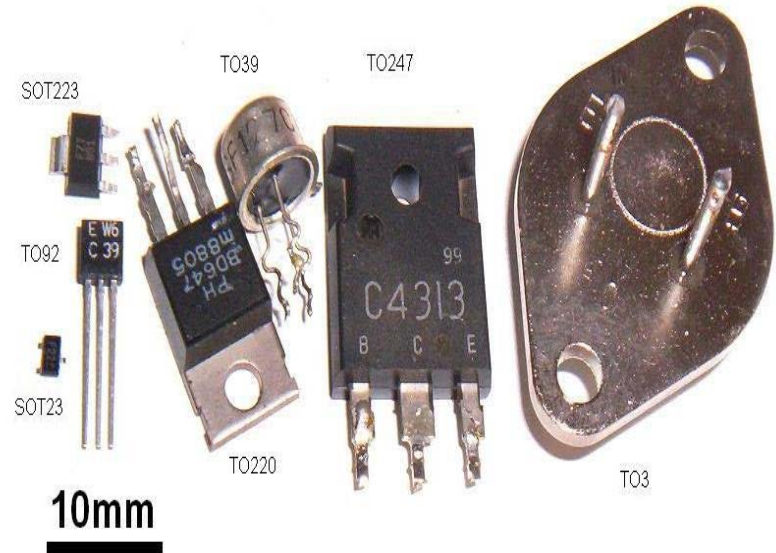
- Transistors are classified according to:
 - § type (either NPN or PNP).
 - § material used (germanium or silicon).
 - § **major use (switching, high or low power).**
- Transistors are identified by a number.
 - § Begins with 2N and up to four more digits.
 - § Identifies the device as a transistor.
 - § Indicates that it has two junctions.

History of Transistors

[1947] A Transistor was firstly developed by William Shockley, John Bardeen, and Walter Brattain. And they won Nobel prizes for it in 1956.



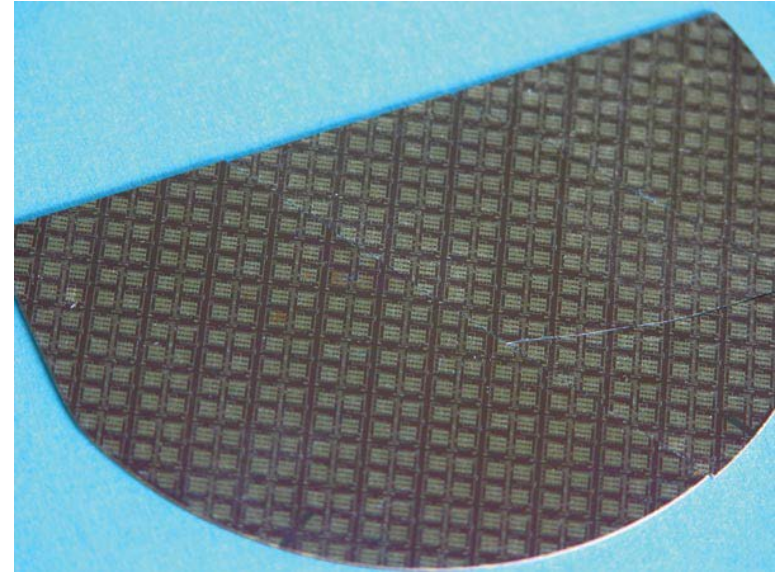
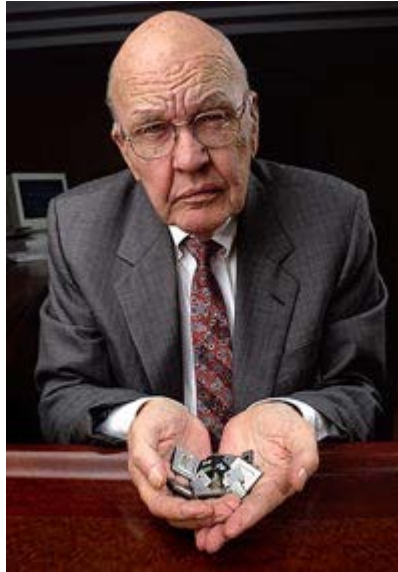
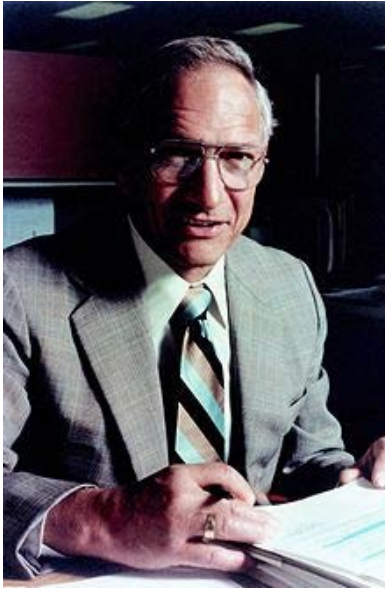
John Bardeen, William Shockley and Walter Brattain at Bell Labs, 1948



Assorted discrete through-hole transistors

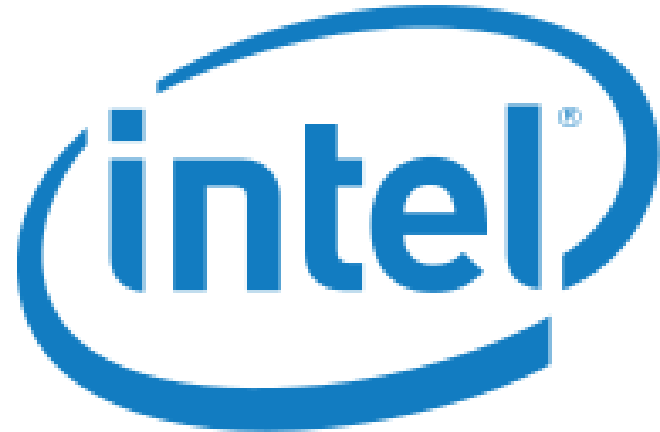
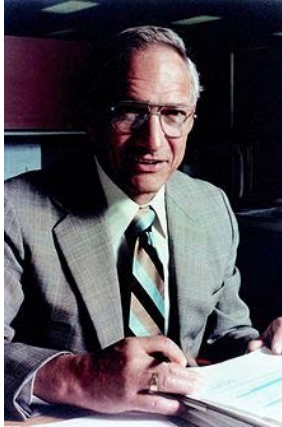
History of Transistors

[1958] IC was developed by Robert Noyce and Jack Kilby. And they won Nobel prizes for it in 2000.

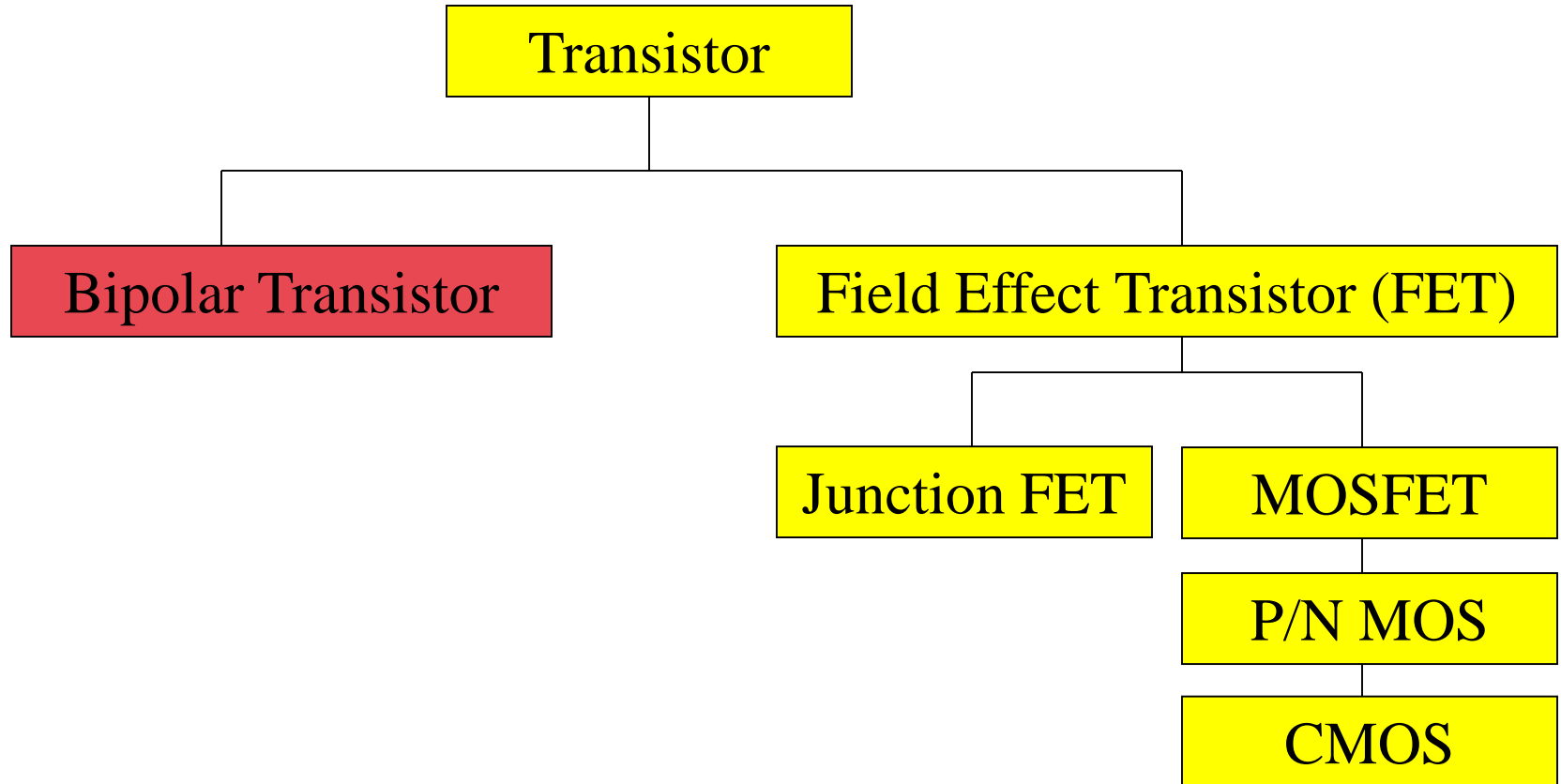


History of Transistors

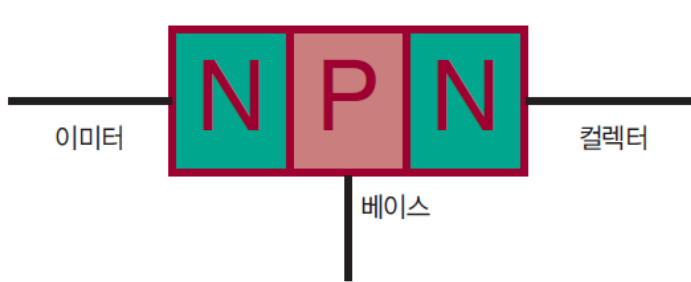
[1968] Robert Noyce and Gordon Moore founded a "Intel" company



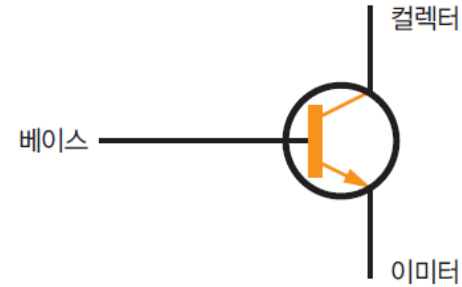
History of Transistors



Bipolar Transistor



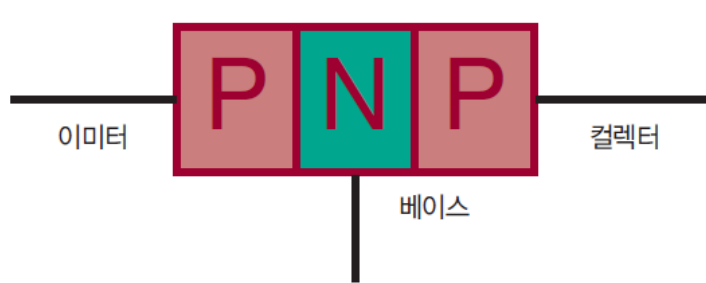
(A) NPN 트랜지스터의 블록 다이어그램



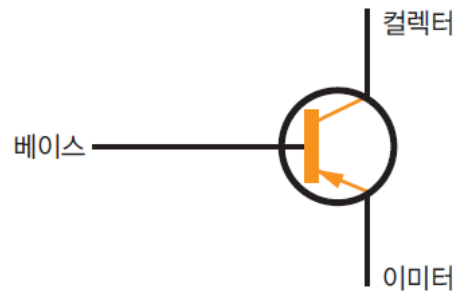
(B) NPN 트랜지스터의 기호

NPN transistor block diagram and symbol

Bipolar Transistor



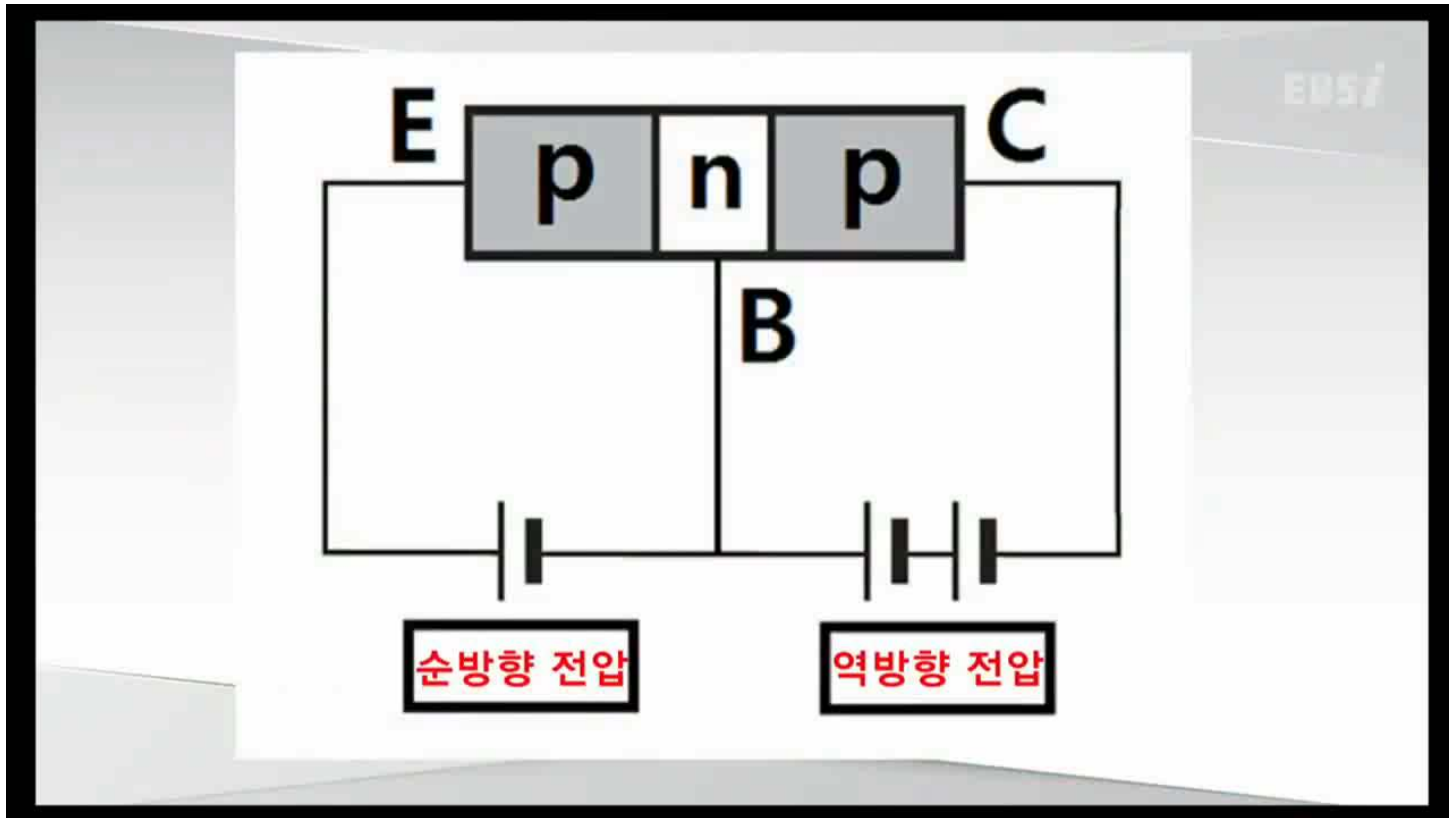
(A) PNP 트랜지스터의 블록 다이어그램



(B) PNP 트랜지스터의 기호

PNP transistor block diagram and symbol

Bipolar Transistor Operation

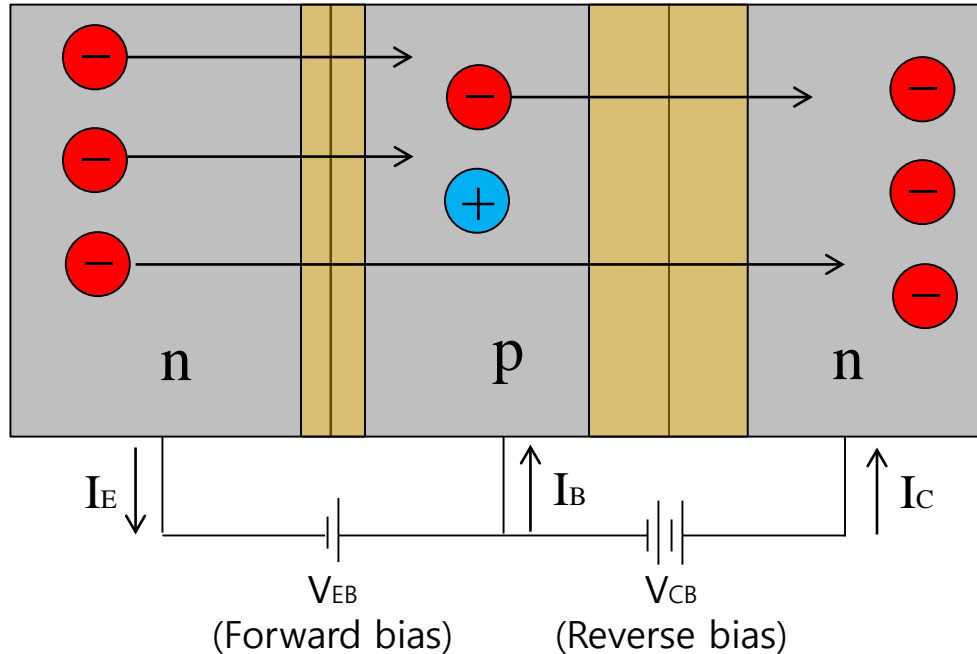


§ Basic functions of a transistor are:

- to provide current amplification of a signal.
- to switch a signal.

§ A transistor must be properly biased.

- The emitter junction is forward biased.
- The collector junction is reverse biased.



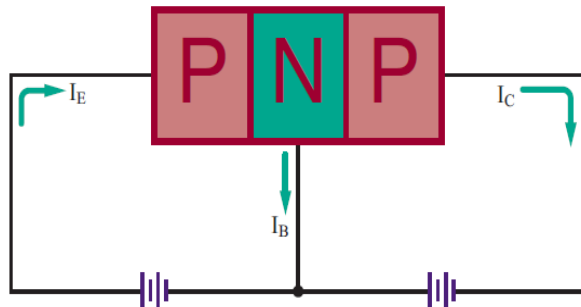
V_{CB} : low current flows

$V_{CB} + V_{EB}$: high current flows

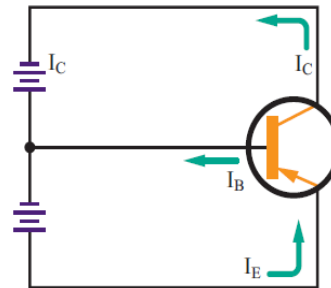
Amplification rate = I_C / I_B

Bipolar Transistor Operation

PNP 트랜지스터

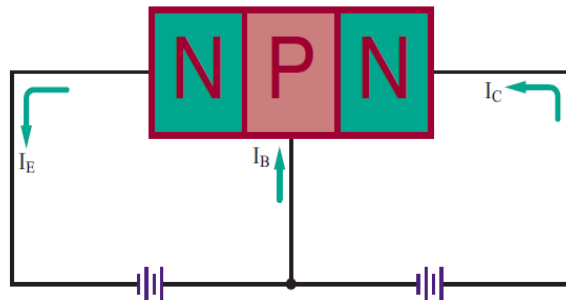


(A) PNP 트랜지스터의 블록 다이어그램

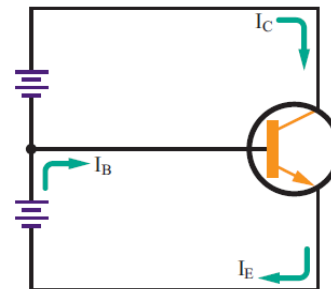


(B) PNP 트랜지스터의 회로도

NPN 트랜지스터



(A) NPN 트랜지스터의 블록 다이어그램



(B) NPN 트랜지스터의 회로도