# WHAT DO WE KNOW ABOUT TRANSISTORS?

### TRANSISTOR INVENTION

Invented on 23.12.47 by Bell Telephone Laboratories. Originally manufactured from Germanium

### SILICON TRANSISTOR

Originally manufactured from Germanium, transistor moved to the silicon

### TRANSISTOR IN CONSUMER GOODS

In 1960 the transistor started to be used in manufacturing of commertial devives

### MOOR'S LAW

The number of transistors per square inchon IC had doubled every year since the invention of the IC.

## THE TRANSISTOR IS A THREE-TERMINAL SEMICONDUCTOR DEVICE THAT CAN PERFORM SIGNAL SWITCHING AND AMPLIFYING

## A BIPOLAR JUNCTION TRANSISTOR IS A SEMICONDUCTOR DEVICE BASED ON TWO P-N JUNCTIONS, CHARACTERISED WITH AN AMPLIFICATION FEATURE

### APPLICATIONS:

- AMPLIFIERS
- HIGH-SPEED DIGITAL LOGIC
- TEMPERATURE SENSORS
- CONVERTERS

$$\alpha = \frac{I_c}{I_e}$$

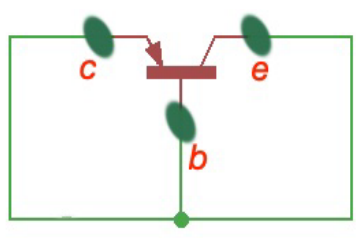
Amplification factor collectr-base

$$\beta = \frac{I_c}{I_b}$$

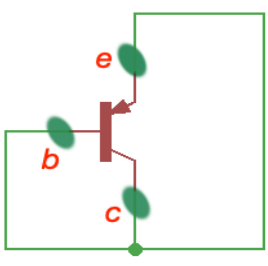
Amplification factor collector-emitter

$$I_e = I_c + I_b$$

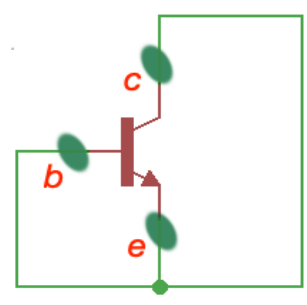
KL for BJT




Common-base BJT configuration




Common-collector BJT configuration




Common-emitter BJT configuration

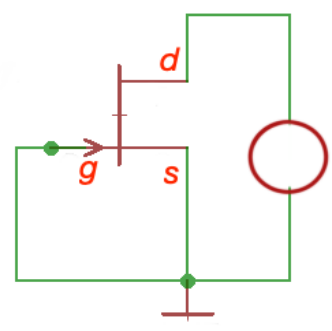
## A FIELD EFFECT TRANSISTOR IS A SEMICONDUCTOR DEVICE WHERE A GATE TERMINAL CAN BE MANIPULATED BY THE CHARGE FLOW ACROSS THE SEMICONDUCTOR CHANEL BETWEEN DRAIN AND SOURCE

### FET TYPES:

- JFET's use one-side p-n junction to separate body and gate
- MOSFET's use insulator to separate body and gate
- DGMOSFET is a MOSFET with two gates
- TFET is a tunnnelling FET
- MESFET is a transistor that combines FET and diode Schottky

$$I_D = I_{DSS}(1 - \frac{v_{GS}}{v_p})^2$$

$$v_{GS} = v_P(1 - \sqrt{\frac{I_D}{I_{DDS}}})$$




FET configuration

## MOSFET IS A FET EQUIPPED WITH FOUR TERMINALS, WITH BULK CONNECTED TO THE SOURCE

### OHMIC OPERATION REGION

$$R_{DS} = \frac{{v_{Th}}^2}{2I_{DSS}(v_{GS} - v_{Th})} \qquad i_{DS} = \frac{v_{DS}}{R_{DS}}$$

### SATURATION REGION

$$i_D = \frac{I_{DSS}}{{V_T}^2}(v_{GS} - v_{Th})^2$$

### MOSFET TYPES:

- Enhancement mode
- Depletion mode