

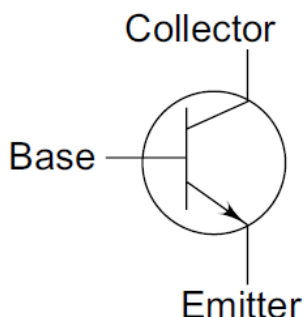
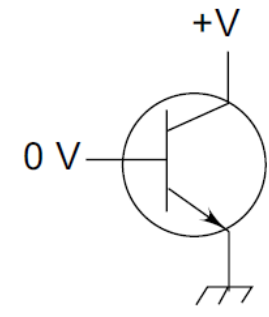
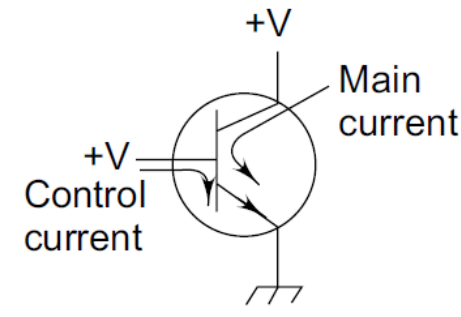
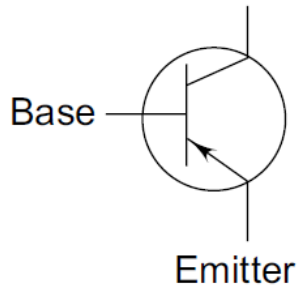
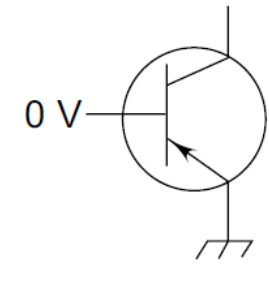
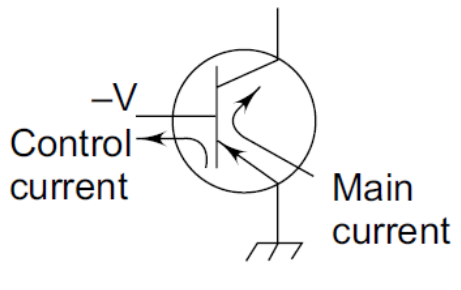
# Electrical and Electronic Drawing

## Electronic Components - Part 4

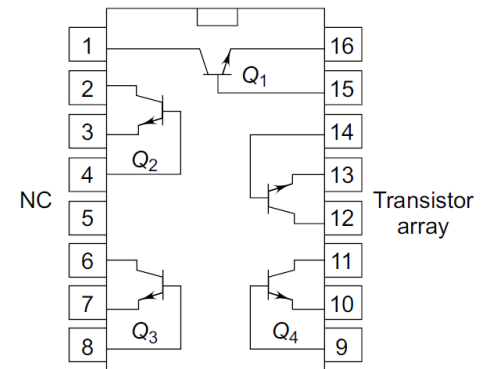
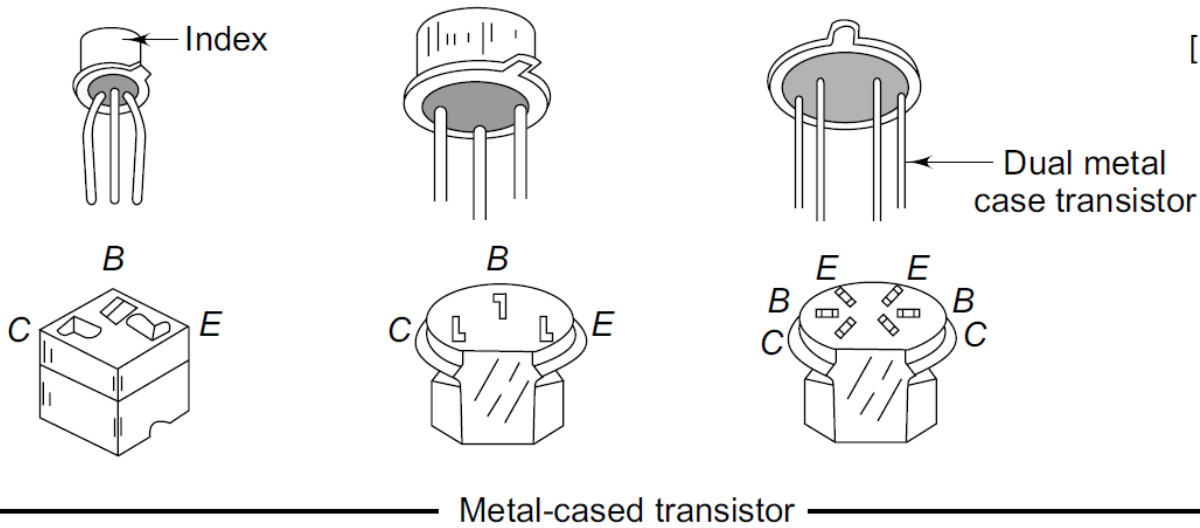
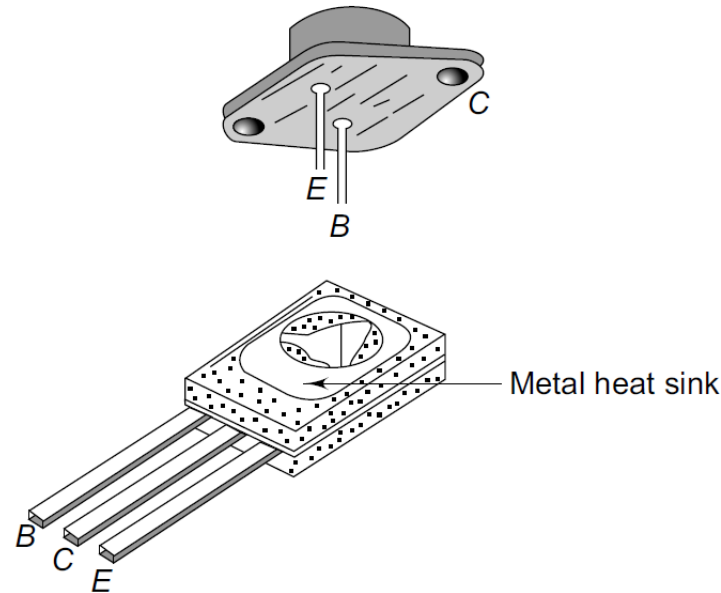
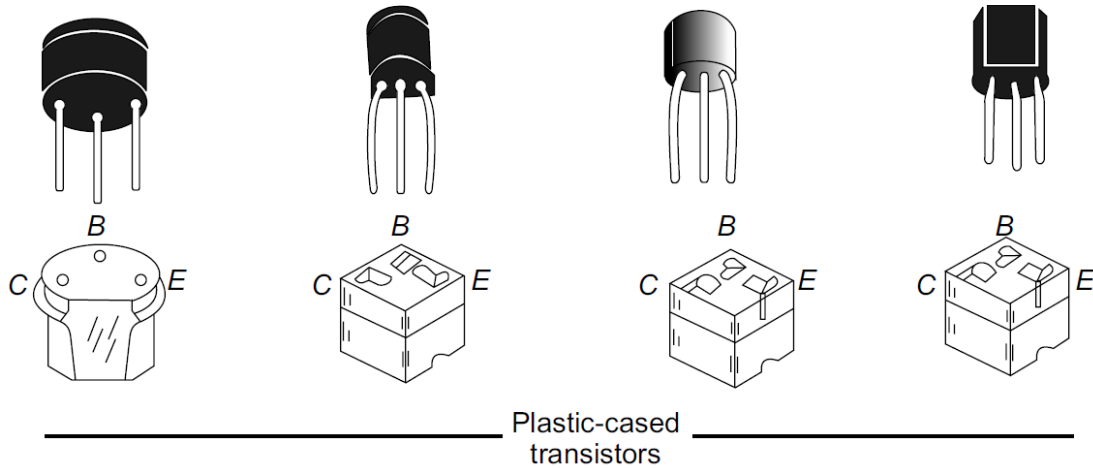
Prof. Yasser Mostafa Kadah

# Transistors

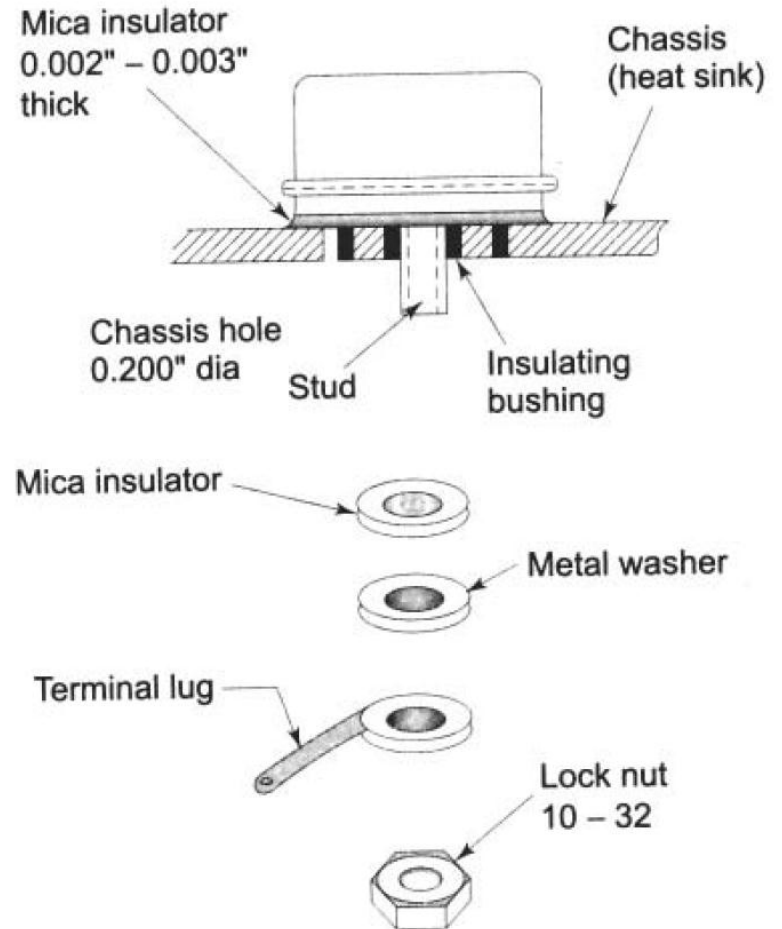
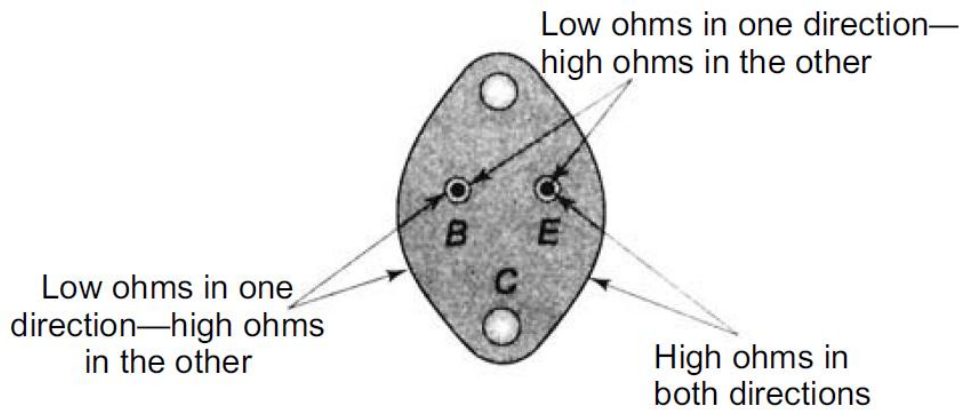
- Bipolar junction transistors (BJT)

Type	Cutoff	Conduction
<p>NPN</p> 		
<p>PNP</p> 		

# Transistors

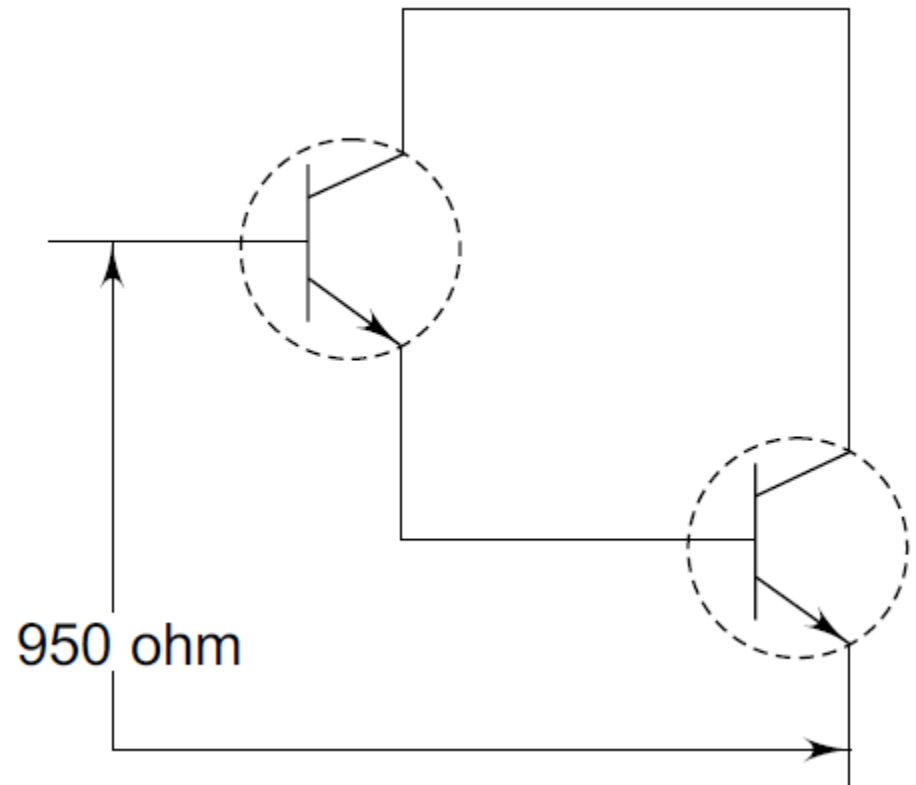
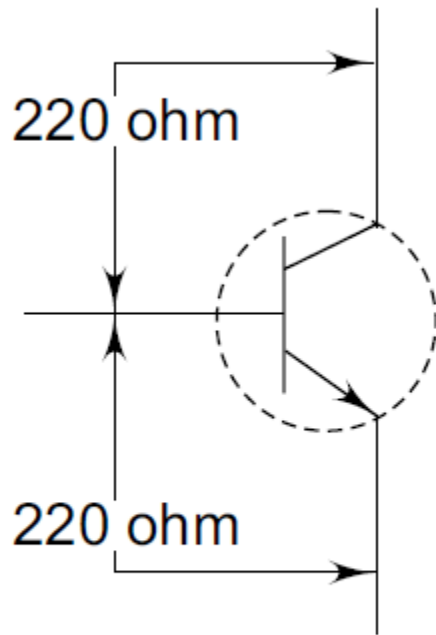


# Power Transistors

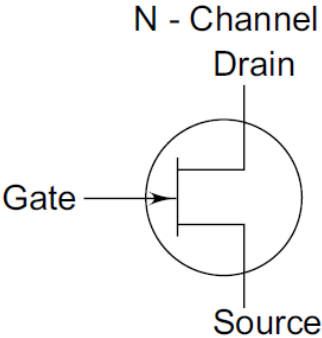
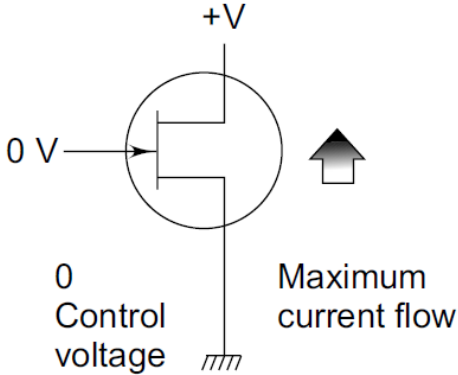
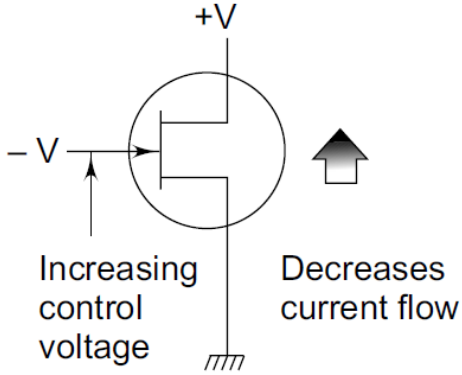
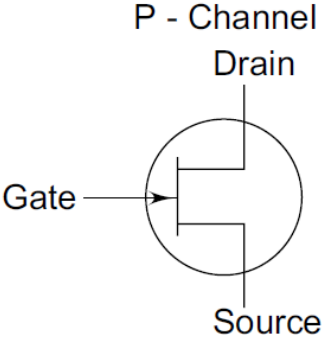
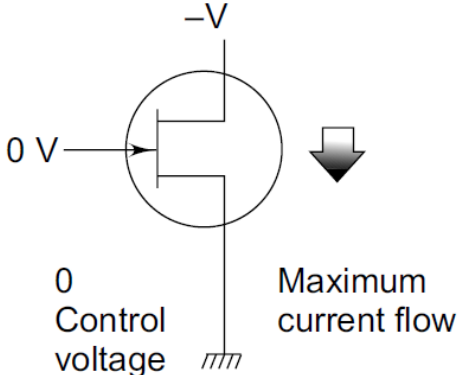
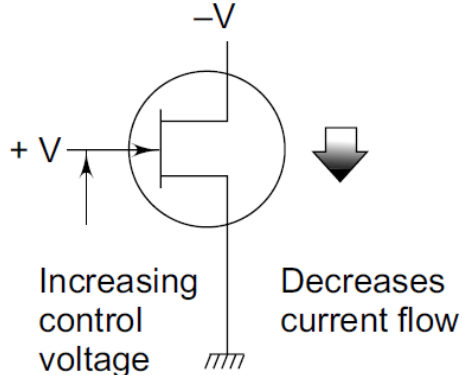


# Darlington Pair Transistors

- Higher current gain



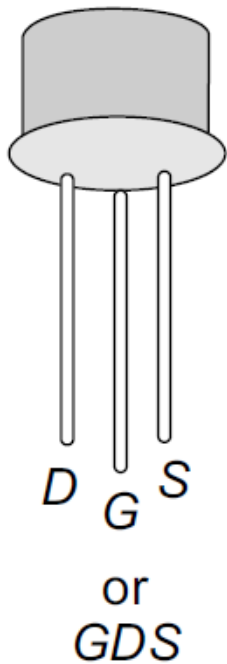
# Field-Effect Transistor (FET)

Type		
<p>N - Channel</p>  <p>Drain</p> <p>Source</p> <p>Gate</p>	 <p>+V</p> <p>0 V</p> <p>0 Control voltage</p> <p>Maximum current flow</p>	 <p>+V</p> <p>-V</p> <p>Increasing control voltage</p> <p>Decreases current flow</p>
<p>P - Channel</p>  <p>Drain</p> <p>Source</p> <p>Gate</p>	 <p>-V</p> <p>0 V</p> <p>0 Control voltage</p> <p>Maximum current flow</p>	 <p>-V</p> <p>+V</p> <p>Increasing control voltage</p> <p>Decreases current flow</p>

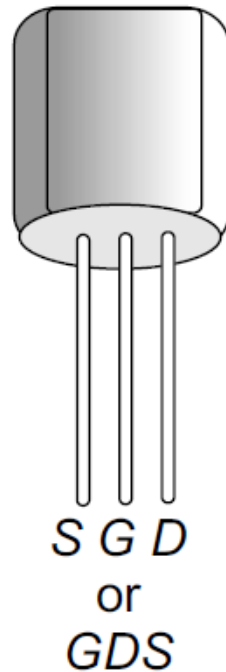
# Field-Effect Transistor (FET)

Field effect transistors

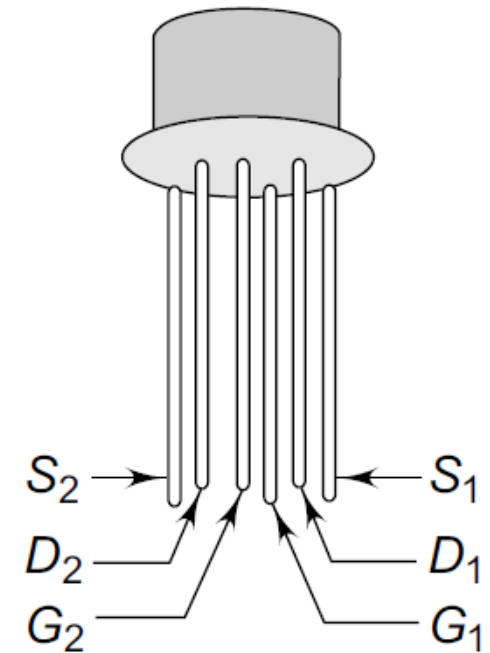
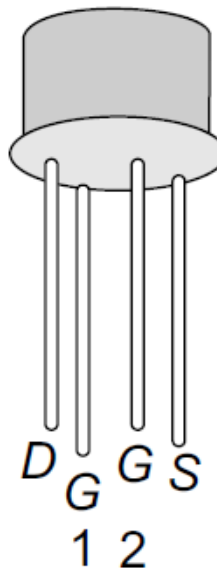
Metal case



Black plastic



Metal case



# Transistor Type Numbers

- Joint Electron Device Engineering Council (JEDEC)
  - Digit, letter, serial number, (suffix),
  - Letter is always 'N', the serial number runs from 100 to 9999 (arbitrary), optional suffix indicates the gain (hfe) group of the device.

A = low gain

B = medium gain

C = high gain

No suffix = ungrouped (any gain)

- Examples: 2N904, 2N3819, 2N2221A



# Transistor Type Numbers

- Japanese Industrial Standard (JIS)
  - Digit, two letters, serial number, (suffix)

SA = PNP HF transistor

SB = PNP AF transistor

SC = NPN HF transistor

SD = NPN AF transistor

SJ = P-channel FET/MOSFET

SK = N-channel FET/MOSFET

- Examples: 2SA1187, 2SB646, 2SC733.

# Transistor Type Numbers

- Pro-electron System (European)

- Two letters, (letter), serial number, (suffix)

- First letter: material

A = Germanium (Ge)

B = Silicon (Si)

C = Gallium Arsenide (GaAs)

R = Compound materials

- Second letter: device application

C = Transistor, AF, small signal

D = Transistor, AF, power

F = Transistor, HF, small signal

L = Transistor, HF, power

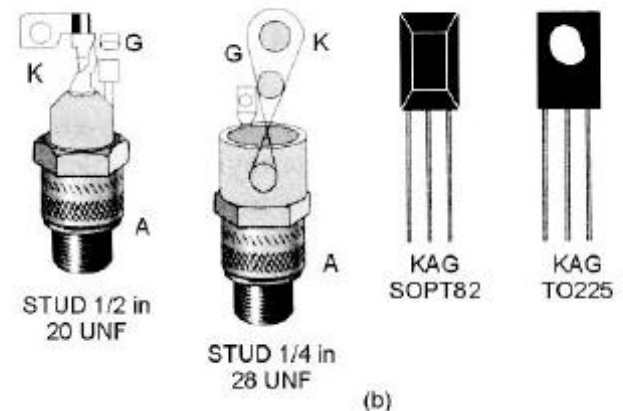
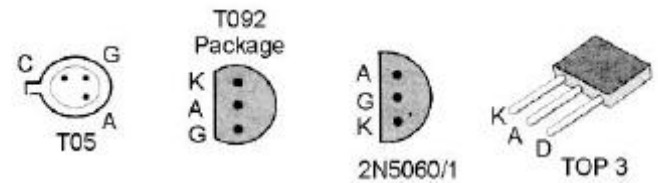
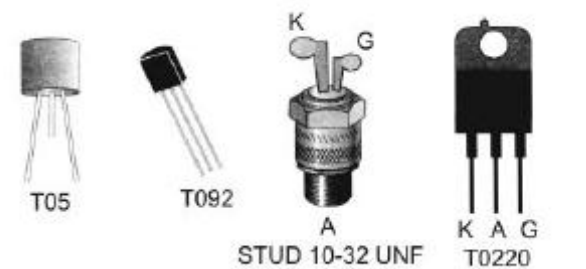
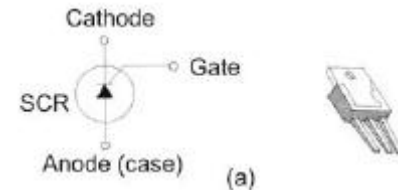
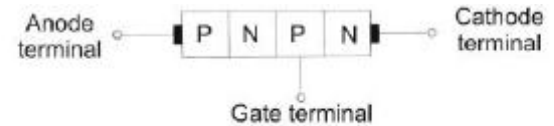
U = Transistor, power, switching

- Suffix: like JEDEC

- Examples: BC108A, BAW68, BF239, BFY51

# Thyristors

- Silicon-controlled rectifier (SCR) (reverse blocking triode thyristor)
- Triac (bidirectional triode thyristor)
- Four-terminal thyristor (bilateral switch)



# Operational Amplifiers (Op Amps)

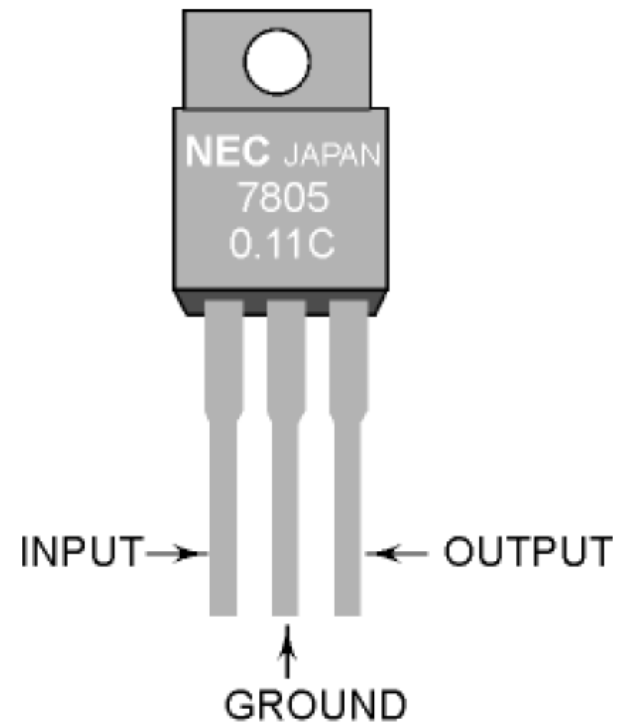
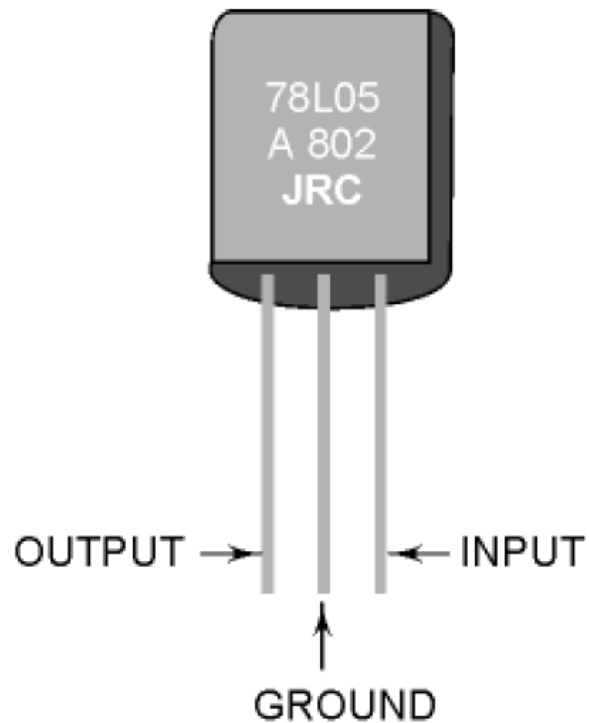
- Package type

D	=	Dual in-line package (hermetic, ceramic);
F	=	Flat pack;
H	=	Metal can package;
J	=	Metal power package (TO-66 outline);
K	=	Metal power package (TO-3 outline);
P	=	Dual-in line package (moulded);
R	=	Mini DIP (hermetic, ceramic);
T	=	Mini DIP (moulded); and
U	=	Power package (moulded, TO-220 outline).

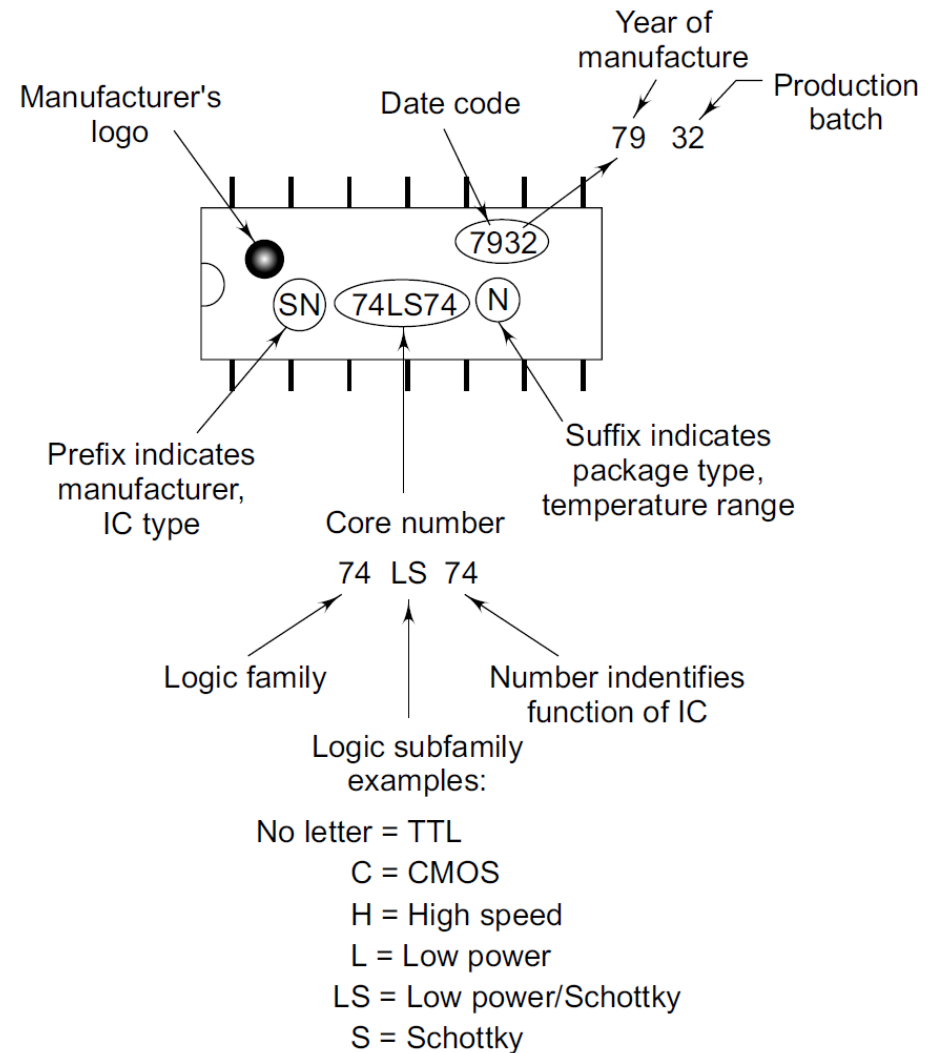
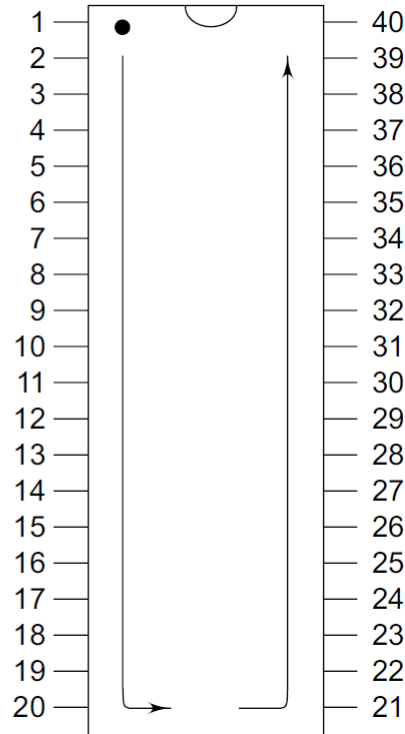
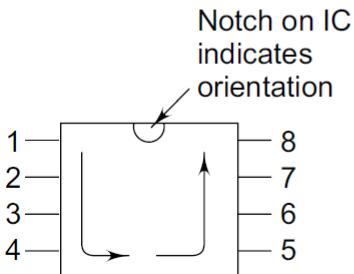
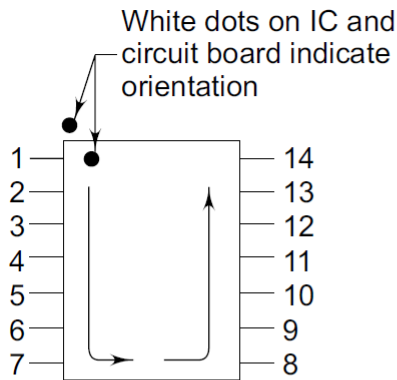
- Temperature range

C	=	Commercial	0 °C to + 70 °C
M	=	Military	- 55 °C to + 125 °C
			- 55 °C to + 85 °C
V	=	Industrial	- 20 °C to + 85 °C
			- 40 °C to + 85 °C

# Voltage Regulators



# Digital Integrated Circuits



# Assignments

- Visit Digikey Corp. web site ([www.digikey.com](http://www.digikey.com)) and select sample 10 component values for the different types/packages discussed in this lecture. Report the specifications (including catalog page number and picture) of each and include your comments about the cost of different types.