# Lecture 2

# Power Electronics Application

- **Power Electronics defined as the application of solid-state (devices) electronics for the control and conversion of electric power.**
- **Power electronics have already found an important place in modern technology and are now used in a great variety of high-power product, including heat controls, light controls, electric motor control, power supplies, vehicle propulsion system and high voltage direct current (HVDC) systems.**

# POWER ELECTRONIC SWITCHING DEVICES

1. **Uncontrolled turn on and off (Power Diode)**
2. **Controlled turn on uncontrolled turn off (Thyristors)**
3. **Controlled turn on and off characteristic (Power Transistor, BJT, MOSFET, GTO, IGBT)**
4. **Continuous gate signal requirement (BJT, MOSFET, IGBT)**
5. **Pulse gate requirement (SCR***(Silicon-Controlled Rectifier*) **, GTO)**
6. **Bidirectional current capability (TRIAC)**
7. **Undirectionalcurrent capability (SCR, GTO, BJT, MOSFET, IGBT)**

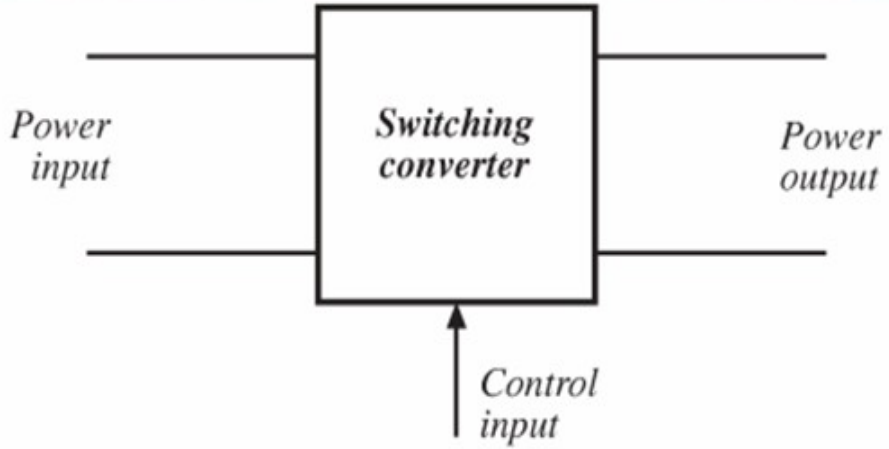
- **Diode Rectifiers. A diode rectifier circuit converts AC voltage into a fixed DC voltage. The input voltage to rectifier could be either single phase or three phase.**

- **AC to DC Converters. An AC to DC converter circuit can convert AC voltage into a DC voltage. The DC output voltage can be controlled by varying the firing angle of the thyristors. The AC input voltage could be a single phase or three phase.**

- **AC to AC Converters. This converters can convert from a fixed ac input voltage into variable AC output voltage. The output voltage is controlled by varying firing angle of TRIAC. These type converters are known as AC voltage regulators.**

- **DC to DC Converters . These converters can converte a fixed DC input voltage into variable DC voltage or vice versa. The DC output voltage is controlled by varying of duty cycle.**

# 1.1 Introduction to Power Processing




| | |
|---|---|
| *Dc-dc conversion:* | Change and control voltage magnitude |
| *Ac-dc rectification:* | Possibly control dc voltage, ac current |
| *Dc-ac inversion:* | Produce sinusoid of controllable magnitude and frequency |

# 1.2 Several applications of power electronics

Power levels encountered in high-efficiency converters

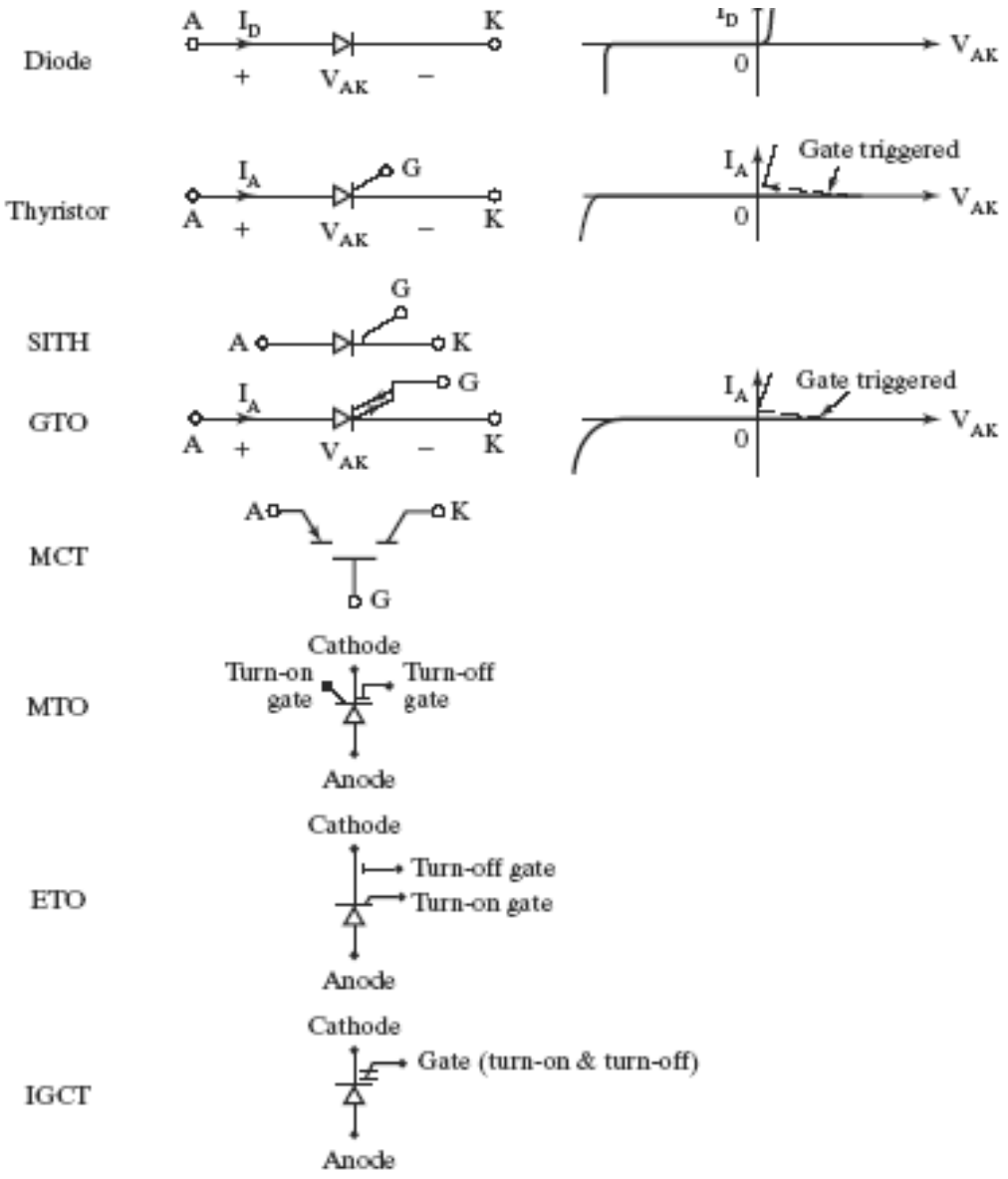
- less than 1 W in battery-operated portable equipment
- tens, hundreds, or thousands of watts in power supplies for computers or office equipment
- kW to MW in variable-speed motor drives
- 1000 MW in rectifiers and inverters for utility dc transmission lines

# 1.3 Elements of power electronics

Power electronics incorporates concepts from the fields of

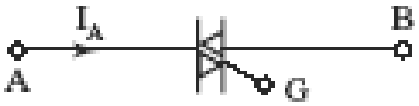
- analog circuits
- electronic devices
- control systems
- power systems
- magnetics
- electric machines
- numerical simulation

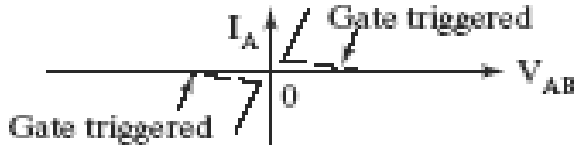
# Devices Symbols and Characteristics



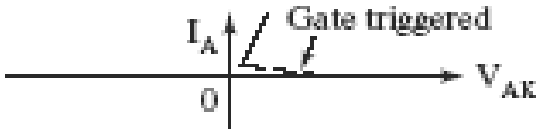
# Devices Symbols and Characteristics

TRIAC

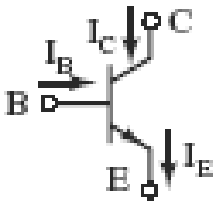


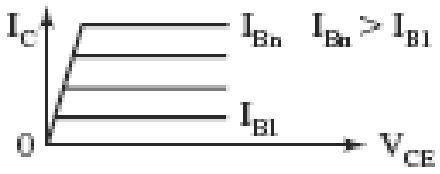




LASCR

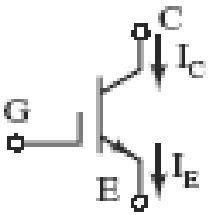



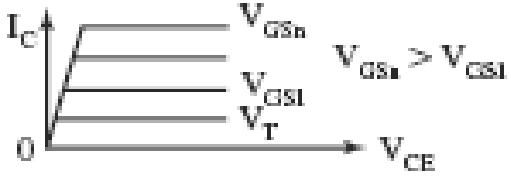

NPN BJT



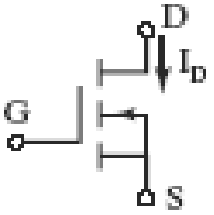




IGBT




N-Channel MOSFET





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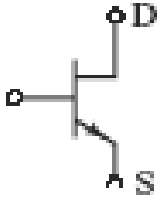


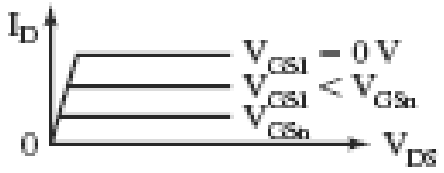

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- **http://nptel.ac.in/courses/108101038/3**