

Semiconductors

Course 251: Semiconductors

Describes semiconductor operation, various diodes, and transistors. Stresses proper environmental conditions, minimizing electrostatic discharge (ESD) and radio frequency interference (RFI). Discusses printed circuit board (PCB) and integrated circuit (IC) technology. Identifies semiconductor packages. Explains how to interpret manufacturers' spec sheets and analyze circuit performance by Q points and characteristics.

TPC Training is accredited by IACET to offer **0.5 CEU** for this program.



Lesson 1: Introduction to Semiconductors

Topics

Electron Flow and Semiconductors; Semiconductor Materials; Structure of Semiconductors; Semiconductor Doping; Conventional vs Electron Flow; Junction Diodes; Diode Characteristic Curves; Diode Specifications; Light-Emitting Diodes; Photoelectric Devices

Objectives

- Discuss the basic structure of a semiconductor atom and the movement of free electrons and holes.
- Discuss the purification and doping of semi-conductors.
- Describe the p-type region, n-type region, and junction of a pn junction diode.
- Discuss the characteristic curves and specification ratings of a diode.
- Describe the operation of a light-emitting diode, a photoconductive device, and a photovoltaic device.

Lesson 2: Environmental Conditions

Topics

Semiconductors and the Environment; Temperature Protection; Electrostatic Discharge (ESD); Controlling Static Electricity; Wrist Straps; Work Area; Static-Free Workstation; Tools and Techniques; Shipping and Receiving Semiconductors; Line Power Conditioning; Radio Frequency Interference (RFI); Electromagnetic Interference (EMI)

Objectives

- Discuss the importance of various environmental conditions to semiconductor operation.
- Discuss the effect of ESD on semiconductor devices and list several ways of preventing ESD in any work area.
- Discuss the requirements of a static-free workstation, and the proper techniques for using tools at the workstation.
- Describe ways to minimize ESD problems during packing and shipping.
- Explain how power conditioning prevents line power problems.
- Describe ways of preventing damage from radio frequency interference (RFI) and electromagnetic interference (EMI).

Lesson 3: Printed Circuit Boards

Topics

Printed Circuits; Printed Circuit Boards; Materials for Boards and Conductors; Single-Sided PCBs; Double-Sided PCBs; Multilayer PCBs; Mounting Components; Surface Mount Technology; Soldering; PCB Connectors; Mounting PCBs; Repairing PCBs; PCB Surface Contamination and Corrosion

Objectives

- Discuss the advantages of PCBs over direct wiring.
- Explain why both flexible boards and rigid boards are used for printed circuits, and discuss the advantages and disadvantages of each.
- Explain how single-sided, double-sided, and multilayer boards are made.
- Describe the three classes of surface mount assemblies.
- Compare various soldering methods and discuss the advantages and disadvantages of each.
- Describe PCB connectors and mountings.
- Discuss PCB repair techniques and limitations.

Lesson 4: Transistors and Integrated Circuits

Topics

Purpose of Transistors; Structure of Transistors; Schematic Symbols; Performance Curves; Transistor Connections; Transistor Characteristics; Transistor Specifications; Transistor Switching; Integrated Circuits; Classifying ICs by Structure; Classifying ICs by Function; Other IC Classifications

Objectives

- Describe the differences between an npn transistor and a pnp transistor and identify the schematic symbol for each.
- Discuss transistor performance in the active region, saturation region, and cutoff region.
- Explain how the three kinds of transistor connections affect circuit values.
- Discuss four common transistor characteristics.
- Discuss various ways of classifying integrated circuits.

Lesson 5: Packages and Performance Analysis

Topics

Semiconductor Packages; Lead Identification; Mounting Components on Chassis and PCBs; Replacement Methods; Manufacturers' Data Sheets; Maximum Ratings; Electrical Characteristics; Transistor Operating Points; Analysis of Characteristics

Objectives

- Describe several kinds of semiconductor packages.
- Explain how to identify leads.
- Describe methods for mounting components on PCBs and chassis.
- Explain how to use manufacturers' data sheets.
- Discuss the analysis of circuits by Q points and by characteristics.