



SNS COLLEGE OF ENGINEERING

Kurumbapalayam(Po), Coimbatore – 641 107



DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING



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UNIT III: SEMICONDUCTORS DEVICES AND APPLICATIONS

1. An atom is made up of
 - A) Protons. B) Neutrons. C) Electrons. D) all of the above
2. The maximum number of electrons in each shell of an atom is
 - A) 2. B) $2n^2$ where n is the number of the shell. C) 4. D) 8.
3. An n-type semiconductor material
 - A) is intrinsic. B) Has trivalent impurity atoms added. C) Has pentavalent impurity atoms added. D) Requires no doping.
4. A diode conducts when it is forward-biased, and the anode is connected to the _____ through a limiting resistor.
 - A) Positive supply B) negative supply C) cathode D) anode
5. The wide end arrow on a schematic indicates the _____ of a diode.
 - A) Ground B) direction of electron flow C) cathode D) anode
6. The term bias in electronics usually means
 - A) The value of ac voltage in the signal. B) The condition of current through a pn junction. C) The value of dc voltages for the device to operate properly. D) The status of the diode.
7. Doping of a semiconductor material means
 - A) that a glue-type substance is added to hold the material together. B) that impurities are added to increase the resistance of the material. C) that impurities are added to decrease the resistance of the material. D) that all impurities are removed to get pure silicon.



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8. The forward voltage across a conducting silicon diode is about
- A) 0.3 V. B) 1.7 V. C) -0.7 V. D) 0.7 V.
9. You have an unknown type of diode in a circuit. You measure the voltage across it and find it to be 0.3 V. The diode might be
- A) a silicon diode. B) a germanium diode. C) a forward-biased silicon diode.
- D) a reverse-biased germanium diode.
10. A reverse-biased diode has the _____ connected to the positive side of the source, and the _____ connected to the negative side of the source.
- A) Cathode, anode B) cathode, base C) base, anode D) anode, cathode
11. The movement of free electrons in a conductor is called
- A) Voltage. B) Current. C) Recombination. D) Equilibrium.
12. A silicon diode is forward-biased. You measure the voltage to ground from the anode at _____, and the voltage from the cathode to ground at _____.
- A) 0 V, 0.3 V B) 2.3 V, 1.6 V C) 1.6 V, 2.3 V D) 0.3 V, 0 V
13. There is a small amount of current across the barrier of a reverse-biased diode. This current is called
- A) forward-bias current. B) Reverse breakdown current. C) Conventional current.
- D) Reverse leakage current.
14. The boundary between p-type material and n-type material is called
- A) a diode. B) a reverse-biased diode. C) a pn junction. D) a forward-biased diode.
15. Reverse breakdown is a condition in which a diode
- A) is subjected to a large reverse voltage. B) is reverse-biased and there is a small leakage current. C) has no current flowing at all. D) is heated up by large amounts of current in the forward direction.
16. As the forward current through a silicon diode increases, the voltage across the diode



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- A) Increases to a 0.7 V maximum. B) Decreases. C) is relatively constant.
D) Decreases and then increases.
17. Which statement best describes an insulator?
- A) A material with many free electrons. B) A material doped to have some free electrons. C) A material with few free electrons. D) No description fits.
18. As the forward current through a silicon diode increases, the internal resistance
- A) Increases. B) Decreases. C) Remains the same. D) Decreases and then increases
19. A silicon diode measures a low value of resistance with the meter leads in both positions. The trouble, if any, is
- A) The diode is open. B) The diode is shorted to ground. C) The diode is internally shorted. D) the diode is working correctly.
20. Single-element semiconductors are characterized by atoms with ____ valence electrons.
- A) 3 B) 4 C) 5 D) 2
21. Effectively, how many valence electrons are there in each atom within a silicon crystal?
- A) 2 B) 4 C) 8 D) 16
22. What occurs when a conduction-band electron loses energy and falls back into a hole in the valence band?
- A) Doping B) Recombination C) Generation D) None of the above
23. What types of impurity atoms are added to increase the number of conduction-band electrons in intrinsic silicon?
- A) Bivalent B) Octavalent C) Pentavalent D) Trivalent
E) none of the above
24. What factor(s) do(es) the barrier potential of a pn junction depend on?



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- A) Type of Semi-Conductive Material B) The Amount of Doping C) The Temperature
D) All of The Above
25. Under normal conditions a diode conducts current when it is
- A) Reverse-Biased. B) Forward-Biased. C) Avalanched. D) Saturated.
26. For a forward-biased diode, as temperature is _____, the forward current _____ for a given value of forward voltage.
- A) Decreased, increases B) Increased, increases C) Increased, decreases
D) Decreased, decreases
27. For a forward-biased diode, the barrier potential _____ as temperature increases.
- A) decreases B) remains constant C) increases
28. An ideal diode presents a(n) _____ when reversed-biased and a(n) _____ when forward-biased.
- A) open, short B) short, open C) open, open D) short, short
29. The most common type of diode failure is a(n) _____.
- A) open B) short C) resistive
30. How many orbiting electrons does the germanium atom have?
- A) 4 B) 14 C) 32 D) 41
31. How many valence electrons does a silicon atom have?
- A) 1 B) 2 C) 3 D) 4
32. One eV is equal to _____ J.
- A) 6.02×10^{23} B) 1.6×10^{-19} C) 6.25×10^{18} D) 1.66×10^{-24}
33. Which of the following elements is most frequently used for doping pure Ge or Si?
- A) Boron B) Gallium C) Indium D) All of the above



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34. The diffused impurities with _____ valence electrons are called donor atoms.
A) 4 B) 3 C) 5 D) 0
35. In what state is a silicon diode if the voltage drop across it is about 0.7 V?
A) No bias B) Forward bias C) Reverse bias D) Zener region
36. What unit is used to represent the level of a diode forward current I_F ?
A) pA B) nA C) A D) mA
37. Which of the following ratings is true?
A) Si diodes have higher PIV and narrower temperature ranges than Ge diodes.
B) Si diodes have higher PIV and wider temperature ranges than Ge diodes.
C) Si diodes have lower PIV and narrower temperature ranges than Ge diodes.
D) Si diodes have lower PIV and wider temperature ranges than Ge diodes.
38. It is not uncommon for a germanium diode with an I_S in the order of 1–2 A at 25°C to have leakage current of 0.1 mA at a temperature of 100°C.
A) True B) False
39. Calculate static resistance R_D of a diode having $I_D = 30$ mA and $V_D = 0.75$ V.
A) 25 B) 40 C) 0.04 D) 0.025
40. Calculate I_D if $R_D = 30$ and $V_D = 0.84$ V.
A) 28 mA B) 0.028 mA C) 2.8 A D) 280 A
41. Refer to Figure 1.27. Calculate the dynamic resistance r_d of a diode having $I_D = 27.5$ mA.
A) 0 B) 2 C) 5 D) 26
42. Determining r_d to a high degree of accuracy from a characteristic curve is very accurate.



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- A) True B) False
43. The _____ diode model is employed most frequently in the analysis of electronic systems.
- A) ideal device B) simplified C) piecewise-linear
44. Calculate the power dissipation of a diode having $I_D = 40$ mA.
- A) 28 mW B) 28 W C) 280 mW D) Undefined
45. Which capacitance dominates in the reverse-bias region?
- A) Depletion B) Conversion C) Diffusion
- D) None of the above
46. Which capacitance dominates in the forward-bias region?
- A) Diffusion B) Transition C) Depletion D) None of the above
47. At what kind of operating frequency is a capacitor represented in parallel with the ideal diode?
- A) Low frequency B) Moderate frequency C) Mid frequency
- D) Very high frequency
48. What is the value of the transition capacitance for a silicon diode when $V_D = 0$?
- A) 1 pF B) 3 pF C) 5 pF D) 10 pF
49. Which of the following devices can check the condition of a semiconductor diode?
- A) Digital display meter (DDM) B) Multimeter C) Curve tracer
- D) All of the above
50. What does a high resistance reading in both forward- and reverse-bias directions indicate?
- A) A good diode B) An open diode C) A shorted diode D) A defective ohmmeter

ANSWERS:



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1. All of the above
2. $2n^2$ where n is the number of the shell.
3. has pentavalent impurity atoms added.
4. positive supply
5. anode
6. the value of dc voltages for the device to operate properly.
13. reverse leakage current.
14. a pn junction.
15. is subjected to a large reverse voltage.
16. is relatively constant.
17. A material with few free electrons.
18. decreases.
19. the diode is internally shorted.
20. 4
28. open, short
29. open
30. 32
31. 4
32. 1.6×10^{-19}
33. All of the above
34. 5
35. Forward bias
43. simplified
44. 28 mW
45. depletion
46. Diffusion
47. Very high frequency
48. 3 pF
49. All of the above
7. that impurities are added to decrease the resistance of the material.
8. 0.7 V.
9. a germanium diode.
10. cathode, anode
11. current.
12. 2.3 V, 1.6 V
21. 8
22. recombination
23. pentavalent
24. all of the above
25. forward-biased.
26. increased, increases
27. decreases
36. mA
37. Si diodes have higher PIV and wider temperature ranges than Ge diodes.
38. True
39. 25
40. 28 mA
41. 2
42. False



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50. An open diode