



KNOWLEDGE PROBE ANSWER KEY: Switching Power Supplies

SMPS Basics and Switching Regulators

Objectives

1. Define switch mode power supply (SMPS).
2. Name the three basic types of SMPS.
3. Explain the difference between linear and switching power supplies.
4. State the purpose of a voltage regulator.
5. Explain the operation of a linear regulator.
6. Calculate the efficiency of a linear regulator.
7. Explain why switching regulators are more efficient than linear regulators.
8. Explain how off-on pulses can be used to produce a constant DC output.
9. Name three types of switching regulators.
10. State the typical frequency range of switching regulators.
11. Explain the characteristics and operation of buck regulators.
12. Define PWM and show how it is used to maintain a constant DC output.
13. Define freewheeling or catch diode.
14. Define Schottky diode
15. State the main features and benefits of a Schottky diode.
16. Explain the characteristics and operation of a boost regulator.
17. Explain the characteristics and operation of a buck-boost regulator.

Questions

1. Which of the following best describes a SMPS?
 - a. A power supply that uses linear amplification for conversion and control
 - b. A power supply that uses all digital circuits
 - c. A power supply that is easily switched off and on
 - d. A power supply that uses switching transistors for conversion and control
2. Another name for SMPS is:
 - a. Switcher
 - b. On-off supply
 - c. Digital supply
 - d. Pulse supply.
3. Which of the following is NOT a type of switching supply?
 - a. Inverter
 - b. Switching regulator
 - c. AC to Pulse translator
 - d. DC-DC converter



4. The purpose of a voltage regulator is to:
 - a. Control output current
 - b. Protect the load from damage from excessive input.
 - c. Maintain a constant output load voltage
 - d. Provide a way to set the output to any value desired
5. How does a linear regulator control the circuit output voltage?
 - a. A transistor switch turns off and on rapidly to provide an average output.
 - b. A series transistor acting as a power amplifier adjusts its conduction to vary the output.
 - c. A parallel transistor varies the load current to ensure a constant output.
 - d. Pulse width modulation is used to ensure a constant output.
6. A linear regulator has a DC input of 24 volts and an output of 15 volts. The load current is 0.5 ampere. What is the efficiency of this regulator?
 - a. 12.5 %
 - b. 44.8 %
 - c. 52.8 %
 - d. 62.5 %
7. How does the power wasted in a linear regulator manifest itself?
 - a. Poor regulation
 - b. Heat dissipation
 - c. Non-continuous operation
 - d. Short circuit and component life
8. Why are switching regulators more efficient than linear regulators?
 - a. They operate from lower power.
 - b. The control transistor is either off or on for a short time so does not conduct continuously.
 - c. They use MOSFETs instead of bipolar transistors.
 - d. They are in integrated circuit form.
9. In pulse width modulation what aspect of the pulse train is controlled?
 - a. Pulse amplitude
 - b. Pulse frequency
 - c. Pulse off time
 - d. Duty cycle
10. If the average voltage produced by a PWM decreases, how should the duty cycle be changed to correct for the decrease?
 - a. Increase
 - b. Decrease
 - c. Remain the same
 - d. Drop to zero



11. The switching frequency range of switching regulators is approximately
 - a. 50 to 120 Hz
 - b. 2 kHz to 6 kHz
 - c. 24 kHz to 150 kHz
 - d. 50 kHz to 1 MHz
12. What components in a buck regulator assist in converting a stream of pulse width modulated pulses into a constant DC?
 - a. Series MOSFET switch
 - b. Filter inductor and capacitor at the output
 - c. Catch diode
 - d. PWM chip
13. Which of the descriptions best describes a buck regulator?
 - a. Output is greater than the input
 - b. Output is the same as the input
 - c. Output is less than the input
 - d. Output can be higher or lower than the input
14. A Schottky diode is
 - a. A faster PN junction diode
 - b. A metal-semiconductor junction diode
 - c. A diode made from GaAs or InP
15. Which of the following is NOT a feature of a Schottky diode?
 - a. Smaller than a PN junction diode
 - b. Forward voltage drop of 0.2 -0.4 volts
 - c. Higher switching speed
 - d. Lower power consumption
16. How does the filter circuit in a buck regulator maintain continuity when the switching transistor turns off?
 - a. Series MOSFET switch turns off
 - b. Filter inductor and capacitor store the voltage
 - c. Catch diode
 - d. PWM chip
17. Which of the descriptions best describes a boost regulator?
 - a. Output is greater than the input
 - b. Output is the same as the input
 - c. Output is less than the input
 - d. Output can be higher or lower than the input



18. What component in a boost regulator gives it the ability to achieve its primary feature?
 - a. Series inductor
 - b. Filter capacitor
 - c. Step-up transformer
 - d. Catch diode

19. A buck-boost regulator can have an output voltage whose polarity is opposite of the input polarity.
 - a. True
 - b. False

20. A switching regulator is a type of DC-DC converter.
 - a. True
 - b. False

21. The PWM method of regulation works with any type of switching regulator.
 - a. True
 - b. False

22. In a switching regulator, the error voltage for adjusting the duty cycle is derived from the
 - a. Output
 - b. Input
 - c. Output compared to a reference
 - d. Triangle wave