Subelement G6 - Circuit Components

Group G6A - - Resistors; capacitors; inductors; rectifiers; solid-state diodes and transistors; vacuum tubes; batteries

G6A01 (C)

What is the minimum allowable discharge voltage for maximum life of a standard 12-volt lead-acid battery?

- A. 6 volts
- B. 8.5 volts
- C. 10.5 volts
- D. 12 volts

G6A02 (B)

What is an advantage of batteries with low internal resistance?

- A. Long life
- B. High discharge current
- C. High voltage
- D. Rapid recharge

G6A03 (B)

What is the approximate forward threshold voltage of a germanium diode?

- A. 0.1 volt
- B. 0.3 volts
- C. 0.7 volts
- D. 1.0 volts

G6A04 (C)

Which of the following is characteristic of an electrolytic capacitor?

- A. Tight tolerance
- B. Much less leakage than any other type
- C. High capacitance for a given volume
- D. Inexpensive RF capacitor

G6A05 (C)

What is the approximate forward threshold voltage of a silicon junction diode?

- A. 0.1 volt
- B. 0.3 volts
- C. 0.7 volts
- D. 1.0 volts

G6A06 (B)

Why should wire-wound resistors not be used in RF circuits?

- A. The resistor's tolerance value would not be adequate
- B. The resistor's inductance could make circuit performance unpredictable
- C. The resistor could overheat
- D. The resistor's internal capacitance would detune the circuit

G6A07 (A)

What are the operating points for a bipolar transistor used as a switch?

- A. Saturation and cutoff
- B. The active region (between cutoff and saturation)
- C. Peak and valley current points
- D. Enhancement and depletion modes

G6A08 (D)

Which of the following is characteristic of low voltage ceramic capacitors?

- A. Tight tolerance
- B. High stability
- C. High capacitance for given volume
- D. Comparatively low cost

G6A09 (B)

Which of the following describes MOSFET construction?

- A. The gate is formed by a back-biased junction
- B. The gate is separated from the channel by a thin insulating layer
- C. The source is separated from the drain by a thin insulating layer
- D. The source is formed by depositing metal on silicon

G6A10 (A)

Which element of a vacuum tube regulates the flow of electrons between cathode and plate?

- A. Control grid
- B. Suppressor grid
- C. Screen grid
- D. Trigger electrode

G6A11 (C)

What happens when an inductor is operated above its self-resonant frequency?

- A. Its reactance increases
- B. Harmonics are generated
- C. It becomes capacitive
- D. Catastrophic failure is likely

G6A12 (A)

What is the primary purpose of a screen grid in a vacuum tube?

- A. To reduce grid-to-plate capacitance
- B. To increase efficiency
- C. To increase the control grid resistance
- D. To decrease plate resistance

Group G6B - - Analog and digital integrated circuits (ICs); microwave ICs (MMICs); display devices; RF connectors; ferrite cores

G6B01 (C)

What determines the performance of a ferrite core at different frequencies?

- A. Its conductivity
- B. Its thickness
- C. The composition, or "mix," of materials used
- D. The ratio of outer diameter to inner diameter

G6B02 (B)

What is meant by the term MMIC?

- A. Multi-Mode Integrated Circuit
- B. Monolithic Microwave Integrated Circuit
- C. Metal Monolayer Integrated Circuit
- D. Mode Modulated Integrated Circuit

G6B03 (A)

Which of the following is an advantage of CMOS integrated circuits compared to TTL integrated circuits?

- A. Low power consumption
- B. High power handling capability
- C. Better suited for RF amplification
- D. Better suited for power supply regulation

G6B04 (C)

What is a typical upper frequency limit for low SWR operation of 50-ohm BNC connectors?

- A. 50 MHz
- B. 500 MHz
- C. 4 GHz
- D. 40 GHz

G6B05 (D)

What is an advantage of using a ferrite core toroidal inductor?

- A. Large values of inductance may be obtained
- B. The magnetic properties of the core may be optimized for a specific range of frequencies
- C. Most of the magnetic field is contained in the core
- D. All these choices are correct

G6B06 (D)

What kind of device is an integrated circuit operational amplifier?

- A. Digital
- B. MMIC
- C. Programmable Logic
- D. Analog

G6B07 (A)

Which of the following describes a type N connector?

- A. A moisture-resistant RF connector useful to 10 GHz
- B. A small bayonet connector used for data circuits
- C. A low noise figure VHF connector
- D. A nickel plated version of the PL-259

G6B08 (D)

How is an LED biased when emitting light?

- A. In the tunnel-effect region
- B. At the Zener voltage
- C. Reverse biased
- D. Forward biased

G6B10 (A)

How does a ferrite bead or core reduce common-mode RF current on the shield of a coaxial cable?

- A. By creating an impedance in the current's path
- B. It converts common-mode current to differential mode current
- C. By creating an out-of-phase current to cancel the common-mode current
- D. Ferrites expel magnetic fields

G6B11 (B)

What is an SMA connector?

- A. A type-S to type-M adaptor
- B. A small threaded connector suitable for signals up to several GHz
- C. A connector designed for serial multiple access signals
- D. A type of push-on connector intended for high-voltage applications

G6B12 (C)

Which of these connector types is commonly used for low frequency or dc signal connections to a transceiver?

- A. PL-259
- B. BNC
- C. RCA Phono
- D. Type N

Subelement G7 - Practical Circuits

Group G7A - - Power supplies; schematic symbols

G7A01 (B)

What is the function of a power supply bleeder resistor?

- A. It acts as a fuse for excess voltage
- B. It discharges the filter capacitors when power is removed
- C. It removes shock hazards from the induction coils
- D. It eliminates ground loop current

G7A02 (C)

Which of the following components are used in a power supply filter network?

- A. Diodes
- B. Transformers and transducers
- C. Capacitors and inductors
- D. All these choices are correct

G7A03 (A)

Which type of rectifier circuit uses two diodes and a center-tapped transformer?

- A. Full-wave
- B. Full-wave bridge
- C. Half-wave
- D. Synchronous

G7A04 (A)

What is characteristic of a half-wave rectifier in a power supply?

- A. Only one diode is required
- B. The ripple frequency is twice that of a full-wave rectifier
- C. More current can be drawn from the half-wave rectifier
- D. The output voltage is two times the peak input voltage

G7A05 (B)

What portion of the AC cycle is converted to DC by a half-wave rectifier?

- A. 90 degrees
- B. 180 degrees
- C. 270 degrees
- D. 360 degrees

G7A06 (D)

What portion of the AC cycle is converted to DC by a full-wave rectifier?

- A. 90 degrees
- B. 180 degrees
- C. 270 degrees
- D. 360 degrees

G7A07 (A)

What is the output waveform of an unfiltered full-wave rectifier connected to a resistive load?

- A. A series of DC pulses at twice the frequency of the AC input
- B. A series of DC pulses at the same frequency as the AC input
- C. A sine wave at half the frequency of the AC input
- D. A steady DC voltage

G7A08 (C)

Which of the following is characteristic of a switchmode power supply as compared to a linear power supply?

- A. Faster switching time makes higher output voltage possible
- B. Fewer circuit components are required
- C. High-frequency operation allows the use of smaller components
- D. Inherently more stable

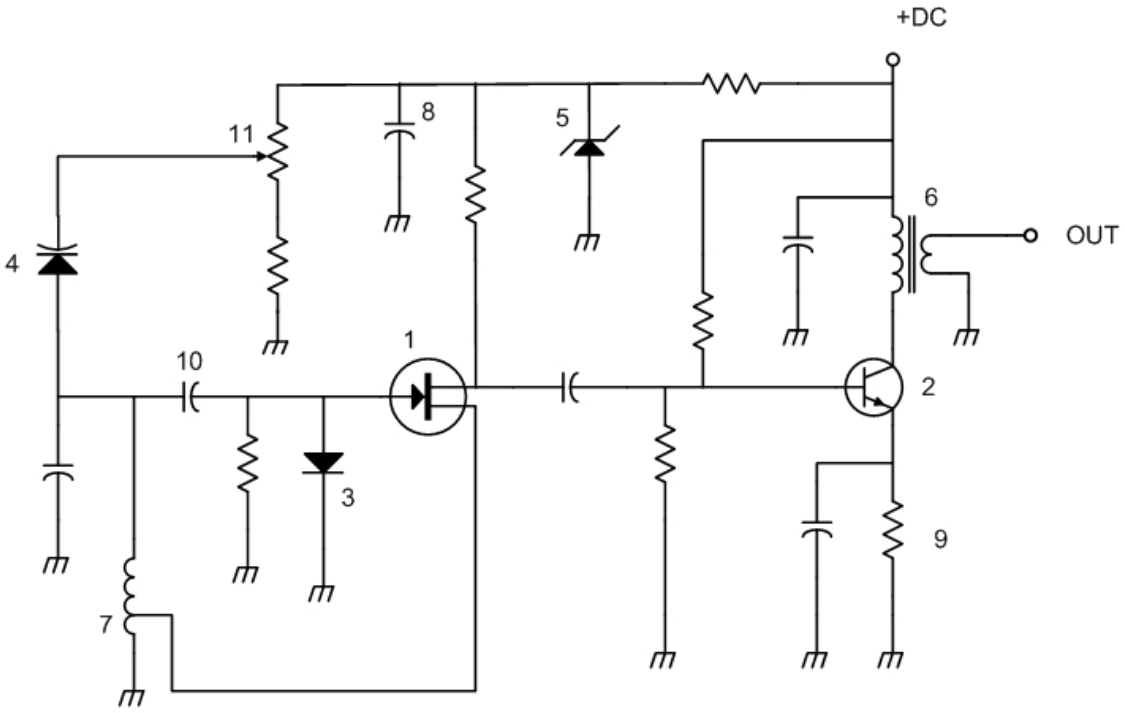

Figure G7-1

G7A09 (C)

Which symbol in figure G7-1 represents a field effect transistor?

- A. Symbol 2
- B. Symbol 5
- C. Symbol 1
- D. Symbol 4

G7A10 (D)

Which symbol in figure G7-1 represents a Zener diode?

- A. Symbol 4
- B. Symbol 1
- C. Symbol 11
- D. Symbol 5

G7A11 (B)

Which symbol in figure G7-1 represents an NPN junction transistor?

- A. Symbol 1
- B. Symbol 2
- C. Symbol 7
- D. Symbol 11

G7A12 (C)

Which symbol in Figure G7-1 represents a solid core transformer?

- A. Symbol 4
- B. Symbol 7
- C. Symbol 6
- D. Symbol 1

G7A13 (A)

Which symbol in Figure G7-1 represents a tapped inductor?

- A. Symbol 7
- B. Symbol 11
- C. Symbol 6
- D. Symbol 1

Group G7B - - Digital circuits; amplifiers and oscillators

G7B01 (B)

What is the purpose of neutralizing an amplifier?

- A. To limit the modulation index
- B. To eliminate self-oscillations
- C. To cut off the final amplifier during standby periods
- D. To keep the carrier on frequency

G7B02 (D)

Which of these classes of amplifiers has the highest efficiency?

- A. Class A
- B. Class B
- C. Class AB
- D. Class C

G7B03 (B)

Which of the following describes the function of a two-input AND gate?

- A. Output is high when either or both inputs are low
- B. Output is high only when both inputs are high
- C. Output is low when either or both inputs are high
- D. Output is low only when both inputs are high

G7B04 (A)

In a Class A amplifier, what percentage of the time does the amplifying device conduct?

- A. 100%
- B. More than 50% but less than 100%
- C. 50%
- D. Less than 50%

G7B05 (C)

How many states does a 3-bit binary counter have?

- A. 3
- B. 6
- C. 8
- D. 16

G7B06 (A)

What is a shift register?

- A. A clocked array of circuits that passes data in steps along the array
- B. An array of operational amplifiers used for tri-state arithmetic operations
- C. A digital mixer
- D. An analog mixer

G7B07 (D)

Which of the following are basic components of a sine wave oscillator?

- A. An amplifier and a divider
- B. A frequency multiplier and a mixer
- C. A circulator and a filter operating in a feed-forward loop
- D. A filter and an amplifier operating in a feedback loop

G7B08 (B)

How is the efficiency of an RF power amplifier determined?

- A. Divide the DC input power by the DC output power
- B. Divide the RF output power by the DC input power
- C. Multiply the RF input power by the reciprocal of the RF output power
- D. Add the RF input power to the DC output power

G7B09 (C)

What determines the frequency of an LC oscillator?

- A. The number of stages in the counter
- B. The number of stages in the divider
- C. The inductance and capacitance in the tank circuit
- D. The time delay of the lag circuit

G7B10 (B)

Which of the following describes a linear amplifier?

- A. Any RF power amplifier used in conjunction with an amateur transceiver
- B. An amplifier in which the output preserves the input waveform
- C. A Class C high efficiency amplifier
- D. An amplifier used as a frequency multiplier

G7B11 (B)

For which of the following modes is a Class C power stage appropriate for amplifying a modulated signal?

- A. SSB
- B. FM
- C. AM
- D. All these choices are correct

Group G7C - - Transceiver design; filters; oscillators; digital signal processing (DSP)

G7C01 (B)

What circuit is used to select one of the sidebands from a balanced modulator?

- A. Carrier oscillator
- B. Filter
- C. IF amplifier
- D. RF amplifier

G7C02 (D)

What output is produced by a balanced modulator?

- A. Frequency modulated RF
- B. Audio with equalized frequency response
- C. Audio extracted from the modulation signal
- D. Double-sideband modulated RF

G7C03 (B)

What is one reason to use an impedance matching transformer at a transmitter output?

- A. To minimize transmitter power output
- B. To present the desired impedance to the transmitter and feed line
- C. To reduce power supply ripple
- D. To minimize radiation resistance

G7C04 (D)

How is a product detector used?

- A. Used in test gear to detect spurious mixing products
- B. Used in transmitter to perform frequency multiplication
- C. Used in an FM receiver to filter out unwanted sidebands
- D. Used in a single sideband receiver to extract the modulated signal

G7C05 (D)

Which of the following is characteristic of a direct digital synthesizer (DDS)?

- A. Extremely narrow tuning range
- B. Relatively high-power output
- C. Pure sine wave output
- D. Variable output frequency with the stability of a crystal oscillator

G7C06 (A)

Which of the following is an advantage of a digital signal processing (DSP) filter compared to an analog filter?

- A. A wide range of filter bandwidths and shapes can be created
- B. Fewer digital components are required
- C. Mixing products are greatly reduced
- D. The DSP filter is much more effective at VHF frequencies

G7C07 (A)

What term specifies a filter's attenuation inside its passband?

- A. Insertion loss
- B. Return loss
- C. Q
- D. Ultimate rejection

G7C08 (D)

Which parameter affects receiver sensitivity?

- A. Input amplifier gain
- B. Demodulator stage bandwidth
- C. Input amplifier noise figure
- D. All these choices are correct

G7C09 (B)

What is the phase difference between the I and Q RF signals that software-defined radio (SDR) equipment uses for modulation and demodulation?

- A. Zero
- B. 90 degrees
- C. 180 degrees
- D. 45 degrees

G7C10 (B)

What is an advantage of using I-Q modulation with software-defined radios (SDRs)?

- A. The need for high resolution analog-to-digital converters is eliminated
- B. All types of modulation can be created with appropriate processing
- C. Minimum detectible signal level is reduced
- D. Automatic conversion of the signal from digital to analog

G7C11 (D)

Which of these functions is performed by software in a software-defined radio (SDR)?

- A. Filtering
- B. Detection
- C. Modulation
- D. All these choices are correct

G7C12 (C)

What is the frequency above which a low-pass filter's output power is less than half the input power?

- A. Notch frequency
- B. Neper frequency
- C. Cutoff frequency
- D. Rolloff frequency

G7C13 (D)

What term specifies a filter's maximum ability to reject signals outside its passband?

- A. Notch depth
- B. Rolloff
- C. Insertion loss
- D. Ultimate rejection

G7C14 (A)

The bandwidth of a band-pass filter is measured between what two frequencies?

- A. Upper and lower half-power
- B. Cutoff and rolloff
- C. Pole and zero
- D. Image and harmonic