

**CLASS 327, MISCELLANEOUS ACTIVE ELECTRICAL NONLINEAR DEVICES, CIRCUITS, AND SYSTEMS**

**SECTION I - CLASS DEFINITION**

This is the residual class for electrical devices, circuits or systems having an output not directly proportional to its input and comprising at least one component which can provide gain or can route electrical current and which device, circuit or system does not form a complete system such as is classified specifically elsewhere or a subcombination of utility only in such elsewhere classified system.

- (1) Note. The scope of patents classified herein can be determined only by determining the scope of other related classes which are listed below under SEARCH CLASS. Also, consult search notes and definitions of these classes.
- (2) Note. Typical active components are solid-state components, vacuum tubes, and gas filled tubes. However, also included would be components broadly claimed to have active properties, but which are not specifically limited to a particular embodiment such as a vacuum tube.

**MAIN SUBDIVISIONS OF THIS CLASS**

**A. Specific Signal Discriminating (e.g., Comparing Or Selecting) Without Subsequent Control**

Included here are circuits for the comparison, selection, or distinguishing of specific characteristics of either an input signal or signals without continuous regulation of such characteristic.

**B. Signal Converting, Shaping, Or Generating**

Included here are circuits wherein: (a) an inherent input signal parameter such as phase, frequency, amplitude or current is modified, maintained at some value, or changed to an entirely different parameter; (b) an input signal having a particular waveform modified into an output signal having a partially or a completely different waveform; or (c) an output signal of specified waveform is produced.

**C. Specific Input To Output Function**

Included here are circuits wherein an output signal is proportional to a mathematical

expression involving an input signal or signals.

- (1) Note. Characteristically, the input signals are continuous and slowly varying.
- (2) Note. Circuitry performing Boolean Algebra functions, per se, are excluded from this class. See References to Other Classes, below.
- (3) Note. The input signals of this subclass do not contain information (data). For data processing see References to Other Classes, below.

**D. Gating (i.e., Switching Input To Output)**  
Included here are electron tube or solid-state gating circuits which distribute unmodified input signals to selected outputs.

**E. External Effect**

Included here are circuits, not elsewhere classified responsive to or compensating for an ambient nonelectrical condition such as heat or magnetism.

**F. With Particular Control**

Included here are circuits where current or power to a broadly recited device is controlled in response to a control signal. The control signal may be derived from an external source or from a feedback structure responsive to the condition of the load.

- (1) Note. Where a specific load device is recited, classification will be in the particular class providing for the specific load device.

**G. Specific Identifiable Device, Circuit, Or System**

Included here are circuits having a particular structure, arrangement, or construction not classifiable elsewhere.

**H. Miscellaneous**

Included here are systems or circuits not provided for elsewhere.

**SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS**

**ACTIVE FILTERS**

The filters proper for this class include at least one

active device utilized in producing the transfer function defining the frequencies that will be passed.

A filter in combination with a specific load will be classified in the class providing for the load. See References to Other Classes, below for filtering of data within an electrical digital calculating computer or analog computer.

The filters within the Specific Identifiable Device, Circuit, Or System area (see above) are active filters that suppress an unwanted input signal. See Noise Filters below for additional noise filter areas within Class 327.

#### NOISE FILTERS

Limiting, clipping, or clamping circuits which achieve transient or signal noise reduction by filtering or otherwise are classified in this class.

Compensation for a noise signal which is a by-product of switching thereof is found in this class.

Miscellaneous unwanted signal suppression is classified in this class.

See Subclass References to the Current Class below for these art areas.

#### PHASE LOCK LOOP

A nonlinear phase lock loop circuit, per se, is classified in Class 327. A phase lock loop circuit in combination with a special art device, is classified with the special art device. For example, a phase lock loop claimed in combination with an oscillator is classified in Class 331, subclasses 172+, a phase lock loop in combination with a telecommunication system is classified in Class 455, and a phase lock loop in combination with a pulse or digital communication system is classified in Class 375, subclasses 111+.

See Subclass References to the Current Class below for a phase lock loop to synchronize one signal with another for the creation of a replica signal.

#### DIGITAL LOGIC

Digital logic, per se, is classified in Class 326 and this includes, for example, multiple connections of AND, OR, or NOT gates. However, combinations of multiple AND or OR gates, etc., which perform a particular function proper to some other class are classified in that other class. For example, an AND gate claimed to be

used as a comparator, for example, will be classified in Class 327, whereas a claimed AND gate, per se, would be classified in Class 326.

#### MULTIVIBRATOR

Patents reciting a free running astable multivibrator, per se, are classified elsewhere. For example, see References to Other Classes for a relaxation oscillator multivibrator.

Multivibrators having one or more stable states are classified in Class 327. See Subclass References to the current Class.

Generally, detailed flip-flops, per se, are in this class, subclasses 185+; however, multifunctional or programmable logic having a flip-flop is in Class 326, subclasses 37+ and redundant logic having a flip-flop is in Class 326, subclass 12.

#### INTEGRATED STRUCTURE

An integrated circuit chip, per se, is classified in Class 257.

Lead frames, per se, are classified in Class 257 since these are only used to connect an integrated circuit chip externally.

An integrated circuit chip in combination with a single lead, a battery or bias without any additional circuit configuration, is classified in Class 257.

An integrated circuit chip in combination with an external circuit proper for Class 327 will be classified in Class 327 since Class 327 is higher than Class 257 in the overall class hierarchy.

Circuit interconnections (e.g., point to point, lead interconnections, diode and transistor interconnections, etc.) within the confines of the integrated circuit chip itself are classified in Class 257, whereas circuit interconnections outside the environment of an integrated circuit chip are not.

If an integrated circuit is recited with other than a nominal recitation of a utility, the patent will be classified in the utility class.

#### CHARGE COUPLED DEVICES

CCD's recited as part of the circuitry within an integrated circuit chip are classified in Class 257.

CCD's recited with other than a nominal recitation of utility are classified in the utility class. See References to Other Classes, below.

#### POWER SUPPLIES

Power supplies in combination with another art device, classifiable elsewhere, will be found with the other art device. Tubes or solid-state device power supplies for a nonlinear device, circuit, or system, not elsewhere classified, will remain in this class (327).

A power supply in combination with a load, (i.e., a single power supply and a single load) without any claim to a substrate circuit is classified elsewhere. See References to Other Classes, below.

The power supply patents of this class, subclasses 530+ require a nonlinear device, circuit, or system as a load or control for the power supply. A claim to a power supply circuit in combination with a substrate containing a nonlinear device, circuit, or system is classified in Class 327.

#### SYSTEMS WITH SPECIFIC SOURCE OF INPUT ENERGY ONLY IDENTIFIED BY CHARACTERISTIC

This class does not provide for the subject matter included herein in combination with a specific type of electromagnetic wave energy since the broad recitation of the specific source would be classifiable with the art containing that particular source of energy. However, this class will take the systems and networks of the class in combination with a source of wave energy wherein the energy is expressed only as being composed of a band of frequencies or a source of pulses, etc., or wherein the source is recited by name only as a wave energy generator (such as an oscillator, pulse generator, etc.). Where the specific details of the source are recited such systems are classified with the art which provides for systems utilizing such specific source.

#### MECHANICAL STRUCTURE

Claims to a specific mechanical structure in combination with generic circuitry are classified with the mechanical structure. However, claims to broad mechanical structure in combination with specific circuitry is classified in this class unless provided for in a mechanical or electrical class and provided the circuitry is nonlinear.

#### MEMORY CIRCUIT

A generic nonlinear circuit claimed with a memory inside the circuit is classified in this class (327), whereas a claim to generic circuitry in combination with a memory external to the circuit would be classified with the memory class.

#### MONITORING, TEST OR CALIBRATING

The following areas reciting monitoring, testing or calibrating take precedence over Class 327:

Class 73, subclasses 1.01+ for instrument proving or calibrating; and subclass 865.9 for testing of apparatus.

Class 324, subclass 601 for calibration, and subclasses 74+ for testing and calibrating of electric meters.

Class 342, subclasses 165+ for testing or calibrating a radar system.

Class 348, subclasses 180+ for television monitoring or testing.

Class 358, subclass 406 for facsimile measuring or testing.

Class 374, subclasses 1+ for thermal measuring and testing.

Class 455, subclass 115 for measuring, testing or monitoring of a transmitter and subclass 226 for measuring, testing, or monitoring of a receiver. Only monitoring, testing, or calibrating, not elsewhere classified, and related to nonlinear devices, circuits and systems are classified in Class 327. The following are examples of those found in Class 327: subclasses 20, 262, 292, 378, 509, and 538.

Class 600, subclass 486 for testing means inserted in the human body.

Class 702, appropriate subclasses for testing and measuring which includes a computation.

#### FUNCTION

Only those nonlinear circuits or systems whose function is not specifically provided for elsewhere would be classified in this class (327) subclasses 334+.

#### SWITCHING

See References to Other Classes, below for examples of other areas for switching;

#### CIRCUITS WITH ELECTRON OR OTHER CHARGED PARTICLE BEAM TUBE

Only those nonlinear circuits utilizing electron or other charged particle beams that are not classifiable in other areas would be classified in Class 327.

Examples of electron or other charged particle beam tube circuits classified elsewhere are the cyclotron and CRT circuits of Class 313.

#### MODULATION OR COMMUNICATION

Nonlinear circuits used in combination with a modulated signal are classified in the classes containing the communication of information via a modulated signal.

#### ELECTRICAL CONTROL OF MACHINES

Electrical control with a broad machine is classified with the machine, if a class exists for the machine. Only those electrical control patents, not provided for in the machine classes, would be classified in Class 327, provided the circuit is nonlinear.

#### NEURON CIRCUITS OR NETWORKS

Patents reciting neuron simulator circuitry, per se, and neural networks are classified elsewhere. See References to Other Classes below.

#### FUSIBLE LINK AND INTENTIONAL DESTRUCTIVE CIRCUIT

Miscellaneous circuits of this type are classified in this class (327) subclass 525.

#### OSCILLATORS

Free running oscillators (including the asynchronous type) are classified elsewhere. See References to Other Classes below.

#### PERSONNEL OR DEVICE PROTECTIVE CIRCUITS

Circuits used to protect personnel from harm, or protect devices from failure (e.g., overload, power surge) are excluded from this class. See References to Other Classes below.

#### SYSTEMS WITH SPECIFIC LOADS IN THE OUTPUT CIRCUIT

This class does not provide for the subject matter in combination with a specific load device even though the load device is recited by name only (as a motor, loudspeaker, etc.). Such systems are classified in general with the particular art device constituting the load.

#### AMPLIFIERS

This class does not include electronic circuits, per se, wherein a variable electric current or voltage input signal is applied to an electrical amplifying device to control a source of electrical energy applied to the same device, and from which is derived an output signal of substantially the same waveform as the input signal and substantially linearly related thereto.

#### LINEAR DEVICE, CIRCUITS OR SYSTEMS

This class excludes linear resistors, reactive apparatus and insulators, per se. Although the claimed solid-state device may be active or passive and have some insulative or reactive properties, it cannot be classified in this class if the device is generally thought of as being only an insulator or reactive apparatus such as a capacitor, inductor, transformer, motor, etc.

#### COUNTERS

See References to Other Classes for electrical pulse counters, pulse dividers, or shift registers.

#### PASSIVE FILTERS

See References to Other Classes for filters utilizing lumped or distributed parameter passive elements.

#### SPECIAL ART DEVICES

Special art devices are to be classified with the specified device.

#### GAS TUBE

Circuitry utilizing gas tubes not elsewhere provided for are included here. See, Subclass References To The Current Class, below, for an example.

#### SECTION III - SUBCLASS REFERENCES TO THE CURRENT CLASS

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 147+, 156+ provide for a phase lock loop to synchronize one signal with another for the creation of a replica signal.
- 185+, for multivibrators having one or more stable states.
- 310+, for limiting, clipping, or clamping circuits which achieve transient or signal noise reduction by filtering or otherwise. (See "Noise Filters" above)
- 379+, for compensation for a noise signal which is a by-product of switching thereof. (See "Noise Filters" above)
- 551+, for miscellaneous unwanted signal suppression. (See "Noise Filters" above).
- 601+, for circuitry utilizing gas tubes (see "Gas Tube" above)

**SECTION IV - REFERENCES TO OTHER CLASSES****SEE OR SEARCH CLASS:**

- 73, Measuring and Testing, appropriate subclasses for systems and apparatus for making a measurement or test not provided for in other classes, particularly subclasses 1.01+ for instrument proving or calibrating, and subclass 865.9 for testing of apparatus.
- 84, Music, subclasses 600+ for electrical musical tone generation using transistors or space discharge devices.
- 136, Batteries: Thermoelectric and Photoelectric, appropriate subclasses.
- 148, Metal Treatment, subclasses 33+ for barrier layer stock material.
- 174, Electricity: Conductors and Insulators, appropriate subclasses for the physical structure of conductors.
- 178, Telegraphy, appropriate subclasses for telegraph apparatus and systems, particularly subclass 43 for space induction systems, and subclasses 66.1+ for alternating or pulsating current telegraph systems.
- 191, Electricity: Transmission to Vehicles, appropriate subclasses.
- 200, Electricity: Circuit Makers and Breakers, appropriate subclasses for electric switches and circuit breakers and for electrical and mechanical switches.

- 204, Chemistry: Electrical and Wave Energy, appropriate subclasses for apparatus for producing chemical changes through the agency of electrical wave energy.
- 219, Electric Heating, subclasses 600 through 780 for induction, electro-static or electro-magnetic heating systems and subclass 114 for welding circuits with space discharge tube control.
- 246, Railway Switches and Signals, appropriate subclass for electric circuits utilized in railway switches and signals.
- 250, Radiant Energy, appropriate subclasses for the detection of nuclear or electromagnetic radiant energy, the testing of material by nuclear or electromagnetic radiant energy, the irradiation of material by nuclear or electromagnetic radiant energy, electron energy analysis, the deflection or focussing of an ion or electron beam, and the generation of control of nuclear or electromagnetic radiant energy.
- 252, Compositions, subclasses 62.3+ for barrier layer compositions and subclasses 500+ for other semiconductor compositions.
- 257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for particular nonlinear solid-state devices, per se, also for an integrated circuit chip, per se, and for lead frames, per se, since these are only used to connect an integrated circuit chip externally. An integrated circuit chip in combination with a single lead, a battery or bias without any additional circuit configuration is classified in Class 257.
- 290, Prime-Mover Dynamo Plants, appropriate subclass for electric circuits utilized in prime mover dynamo plants.
- 307, Electrical Transmission or Interconnection Systems, appropriate subclasses for circuits providing electrical transmission or interconnection such as those having plural energy sources or plural loads and class appropriate switching systems, wave form determinative networks, and circuits responsive to external effects such as temperature or magnetism.
- 307, Electrical Transmission or Interconnection Systems, subclasses 326+ for circuits used to protect personnel from harm, or protect devices from failure (e.g., overload, power surge). (See "Personnel Or Device Protective Circuits" above)
- 310, Electrical Generator or Motor Structure, appropriate subclasses for the physical structure of electric generators and motors and electromagnetic clutches and for the circuits that

- relate to electromagnetic clutches, and particularly subclasses 314+ for piezoelectric devices in combination with tube structure where the significant structure claimed is that of the crystal, and the tube structure or circuitry is only incidentally claimed.
- 313, Electric Lamp and Discharge Devices, appropriate subclasses for the physical structure of electronic lamp and discharge devices, per se.
- 314, Electric Lamp and Discharge Devices: Consumable Electrodes, appropriate subclasses for electric lamp and discharge devices of the arc discharge type which may be combined with an electron space discharge tube.
- 315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses for circuits in combination with charged particle beam tubes, cathode-ray tubes or electric lamp and space discharge devices, particularly subclasses 8.51+ for pulse storage systems utilizing cathode-ray tubes, and subclasses 84.51+ for pulse storing systems comprised exclusively of gaseous discharge tubes.
- 318, Electricity: Motive Power Systems, subclasses 400.1 through 400.42 for synchronous motor commutation control systems.
- 320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclass for a battery or capacitor charging or discharging application that employs a space-discharge device.
- 322, Electricity: Single Generator Systems, subclasses 72+ for electron space discharge tube systems for controlling a single generator.
- 323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for circuits utilized in power voltage magnitude and phase control systems.
- 323, Electricity: Power Supply or Regulation Systems, for a power supply in combination with a load, (i.e., a single power supply and a single load) without any claim to a substrate circuit (See "Power Supplies" above).
- 324, Electricity: Measuring and Testing, appropriate subclasses for circuits utilized in electrical measuring, testing, and sensing systems.
- 326, Electronic Digital Logic Circuitry, appropriate subclasses for combinational or sequential logic, per se.
- 326, Electronic Digital Logic Circuitry, for circuitry for performing Boolean Algebra functions, per se. (See Class Definition, "Specific Input To Output Function" above)
- 326, Electronic Digital Logic Circuitry, for a logical function (see "Charge Coupled Devices" above)
- 327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, for delay (see "Charge Coupled Devices" above)
- 329, Demodulators, appropriate subclasses for circuits extracting information from a carrier.
- 330, Amplifiers, appropriate subclasses for electron space discharge tube apparatus combined with circuitry to form an amplifier system and subclasses 250+ for semiconductor amplifiers.
- 331, Oscillators, appropriate subclasses for electron space discharge tube or solid-state apparatus combined with tuned circuit apparatus forming an oscillatory system of the self-sustaining type, an asynchronous oscillator, per se, or in combination with other circuitry or an oscillator combined with a phase lock loop without any intelligence claimed; subclasses 8+ for transistorized automatic frequency control for oscillators; and subclasses 108+ for solid-state oscillators.
- 331, Oscillators, subclass 144 for a relaxation oscillator multivibrators.
- 331, Oscillators, for free running oscillators (including the asynchronous type). (See "Oscillators," above)
- 332, Modulators, appropriate subclasses for circuitry which superimposes information on a carrier.
- 333, Wave Transmission Lines and Networks, subclass 19 for passive element wave differentiating or integrating systems, subclasses 24+ for passive filters, and subclass 20 for wave shaping networks of the passive element type; subclasses 167+, 186+, and 202+ for filters utilizing lumped or distributed parameter passive elements.
- 334, Tuners, appropriate subclasses for tuning circuitry.
- 335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, appropriate subclasses for magnetically operated switches and circuit breakers.
- 336, Inductor Devices, appropriate subclasses for passive inductive devices.
- 337, Electricity: Electrothermally or Thermally Actuated Switches, appropriate subclasses for thermal switches, per se.
- 340, Communications: Electrical, subclass 146.2 for digital comparator systems, subclass 825.97 for electron beam type selective or remote control systems, subclass 825.57 for pulse respon-

- sive selective systems, subclass 825.67 for pulse responsive counting chains which may employ an electron space discharge device, and subclasses 870.01+ for telemetering systems. (also see "Charge Coupled Devices" above)
- 348, Television, (see "Charge Coupled Devices" above).
- 341, Coded Data Generation or Conversion, subclasses 50+ for code converters and subclasses 20+, 186, and 191 for a pulse transmitter or generator having a space discharge device.
- 342, Communications: Directive Radio Wave Systems and Devices (e.g., radar, Radio Navigation), appropriate subclasses for systems for object detection and utilizing pulse radio wave forms and subclass 165 for testing or calibrating a radar system.
- 343, Communications: Radio Wave Antennas, appropriate subclasses for antennas, per se.
- 348, Television, subclasses 180+ for television monitoring or testing.
- 352, Optics: Motion Pictures, subclasses 1+ for sound accompanied motion pictures including active electronic devices.
- 356, Optics: Measuring and Testing, subclasses 3+ for systems using light for distance finding and subclasses 26+ for light systems for the determination of velocity.
- 358, Facsimile and Static Presentation Processing, subclass 406 for facsimile measuring or testing.
- 359, Optics: Systems (Including Communication) and Elements, appropriate subclasses for optical components.
- 360, Dynamic Magnetic Information Storage or Retrieval, appropriate subclasses.
- 361, Electricity: Electrical Systems and Devices, subclasses 1+ for safety and protection of systems and devices, subclasses 100+ for current fault sensor with semiconductor circuit interrupter, subclasses 139+ for control circuits for electromagnetic devices, and subclasses 196+ for control circuits for electromagnetic devices with time delay including a semiconductor device.
- 361, Electricity: Electrical Systems and Devices, subclasses 1+ for circuits used to protect personnel from harm, or protect devices from failure (e.g., overload, power surge). (See "Personnel Or Device Protective Circuits" above)
- 363, Electric Power Conversion Systems, appropriate subclasses for circuits utilized in electric conversion systems where a single electrical source is connected to a single electrical load and particularly subclasses 94, 99, 111+, 151, and 166 for systems whereby a current or voltage of one characteristic is converted to a current or voltage of another characteristic and utilizing electron space discharge devices.
- 365, Static Information Storage and Retrieval, subclasses 73+ for recirculation of information in a storage read/write system, subclass 78 for plural shift register memory devices, subclasses 80+ for magnetic shift register, per se, subclasses 129+ for storage systems using a particular storage element, subclass 189.011 for read/write circuits peculiar to a storage and retrieval system, and subclasses 230.01+ for addressing circuits peculiar to a storage and retrieval system. (Also see "Charge Coupled Devices" above).
- 367, Communications, Electrical: Acoustic Wave Systems and Devices, appropriate subclasses.
- 369, Dynamic Information Storage or Retrieval, appropriate subclasses.
- 370, Multiplex Communications, appropriate subclasses for multiplexing systems.
- 373, Industrial Electric Heating Furnaces, subclasses 70, 102+, 135+, and 147 for electric furnaces having significant electrical circuits.
- 374, Thermal Measuring and Testing, subclasses 1+ for thermal calibration.
- 375, Pulse or Digital Communications, subclasses 106+ for digital communication synchronization.
- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for electrical pulse counters, dividers, and shift registers and particularly subclasses 57+ for charge coupled devices used as a counter, pulse divider, or shift register. (Also see "Charge Coupled Devices" above)
- 378, X-Ray or Gamma Ray Systems or Devices, subclasses 91+ for circuits combined with X-ray devices.
- 379, Telephonic Communications, appropriate subclasses, for telephone systems.
- 380, Cryptography, appropriate subclasses for cryptographic circuitry.
- 381, Electrical Audio Signal Processing Systems and Devices, subclasses 94.1+ for noise suppressing audio circuitry and subclass 111 for circuitry combined with a specific type of microphone or loudspeaker.
- 382, Image Analysis, appropriate subclasses.

- 388, Electricity: Motor Control Systems, art collection 913 for motor control systems including space discharge devices.
- 396, Photography, appropriate subclasses for apparatus producing pictures on light sensitive material which may utilize electronic devices. (Also see "Charge Coupled Devices" above).
- 427, Coating Processes, subclasses 58+ for coating processes wherein an electrical product is produced.
- 428, Stock Material or Miscellaneous Articles, subclass 620 for semiconductor stock material.
- 438, Semiconductor Device Manufacturing: Process, for methods of making semiconductor electrical devices; see the search notes thereunder.
- 445, Electric Lamp or Space Discharge Component or Device Manufacturing, appropriate subclasses for circuits utilized in the manufacture or repair of electric lamp or electric space discharge devices.
- 455, Telecommunications, appropriate subclasses for telecommunication systems and subsystems.
- 600, Surgery, subclasses 300+ for diagnostic apparatus utilizing transistors or tubes.
- 702, Data Processing: Measuring, Calibrating, or Testing, appropriate subclasses for testing and measuring which includes significant data processing.
- 706, Data Processing: Intelligent Processing Systems and Methods, subclasses 15+ for neural circuits and networks. (See "Neuron Circuits Or Networks" above).
- 708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 300+ for digital filters unique to digital computing, subclass 540 for the performance of arithmetic operations by a CRT, subclass 819 for analog filters which are unique to analog computing, and subclass 849 for analog function generation which utilizes a CRT. (See "Active Filters", above.)
- 714, Error Detection/Correction and Fault Detection/Recovery, appropriate subclasses.

## SUBCLASSES

**1 SPECIFIC SIGNAL DISCRIMINATING (E.G., COMPARING, SELECTING, ETC.) WITHOUT SUBSEQUENT CONTROL:**

This subclass is indented under the class definition. Subject matter wherein an output signal is derived from one or more input signals by comparing, selecting, or distinguishing a particular input signal parameter and which parameter is not continuously thereafter regulated.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

100+, for signal converting, shaping, or generating which may include control of the type of signal parameters found herein.

**SEE OR SEARCH CLASS:**

- 250, Radiant Energy, subclass 250 for wave meters, subclasses 281+ for systems adapted for ionic separation or analysis and comprising phase or frequency determining devices.
- 318, Electricity: Motive Power Systems, subclass 683 for electric motor position servomechanisms involving phase comparison devices.
- 322, Electricity: Single Generator Systems, subclass 32 for automatic frequency control for generator systems.
- 323, Electricity: Power Supply or Regulation Systems, subclasses 212+ for automatic phase control systems restricted to power circuits.
- 324, Electricity: Measuring and Testing, subclasses 76.39+ for frequency measuring or testing of electricity and subclasses 76.77+ for phase comparison systems for measuring or testing electricity and involving plural inputs.
- 329, Demodulators, appropriate subclasses for demodulators of signals which have been modulated by an intelligence signal.
- 340, Communications: Electrical, subclasses 3.1 through 3.9, 315, and 870.18-870.24 for electrical circuits whereby an indication or signal is transmitted to a distant point and which signal is indicative of an electrical condition which may comprise phase or frequency difference; and



- subclass 146.2 for digital comparator systems.
- 361, Electricity: Electrical Systems and Devices, subclasses 236+ for speed-controlled systems involving phase or frequency determining devices.
- 375, Pulse or Digital Communications, subclasses 106+ for synchronization in digital communications.
- 455, Telecommunications, subclasses 130+ for a telecommunication receiver.
- 714, Error Detection/Correction and Fault Detection/Recovery, appropriate subclasses for error detection or correction of information content of a digital signal.

## 2 By phase:

This subclass is indented under subclass 1. Subject matter wherein the discriminated input signal parameter is that fractional part of a periodic waveform which has elapsed relative to a fixed origin.

- (1) Note. If the time for one signal period is represented as 360 degrees along a time axis, the phase position is called the phase angle.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 39+, for frequency comparison circuits.  
231+, for phase correction or control.  
261+, for output waveform production delay.

SEE OR SEARCH CLASS:

- 303, Fluid-Pressure and Analogous Brake System, subclasses 91+ for speed-controlled vehicle systems.
- 329, Demodulators, subclasses 345+ for phase angle demodulation in which a intelligence signal is extracted.
- 331, Oscillators, subclasses 1+ for systems for stabilizing the frequency of an oscillator utilizing phase or frequency comparison devices, and subclasses 37+ for systems wherein two or more frequencies are combined to produce a beat frequency.
- 332, Modulators, subclasses 144+ for systems wherein the phase of a carrier wave is modulated by an arbitrarily varying quantity.

- 455, Telecommunications, subclasses 214+, for frequency or phase modulation with particular discrimination or detection.

## 3 Comparison between plural inputs (e.g., phase angle indication, lead-lag discriminator, etc.):

This subclass is indented under subclass 2. Subject matter wherein the output signal is indicative of the phase positioning or phase differences among two or more input signals.

- (1) Note. Detectors producing an output which is a result of demodulation of a carrier having previously been modulated by an intelligence waveform which varies arbitrarily will not be classified here. See SEARCH CLASS below.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 40+, for comparison between plural input frequencies.

SEE OR SEARCH CLASS:

- 329, Demodulators, subclasses 345+ for circuits producing an output which is a result of demodulation of a carrier having previously been phase modulated by an intelligence waveform.
- 363, Electric Power Conversion Systems, appropriate subclasses for phase conversion circuits with phase angle sensing.
- 455, Telecommunications, subclasses 130+ for mixers or converters utilized in a superheterodyne receiver (commonly referred to as a first detector).

## 4 With transducer:

This subclass is indented under subclass 3. Subject matter wherein a device is included that converts energy forms other than electrical into electrical energy.

- (1) Note. The other energy forms may be mechanical, thermal, hydraulic, or chemical, etc.

## 5 With input derived from feedback:

This subclass is indented under subclass 3. Subject matter wherein a portion of the output signal is returned to one of the plural inputs.

**6 With electron space discharge:**

This subclass is indented under subclass 3. Subject matter including a vacuum tube device or a gaseous medium within a gas tight envelope in which electron conduction takes place through the vacuum or gas.

**7 With reference signal:**

This subclass is indented under subclass 3. Subject matter wherein a signal of fixed phase acts as a constant for comparison to a variable input.

- (1) Note. The reference signal is usually an input signal or produced from an input signal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 42, for frequency comparison between a fixed reference frequency and a variable input.

**8 With varying frequency:**

This subclass is indented under subclass 7. Subject matter wherein the reference signal varies over a range of different frequencies or the reference signal is compared to different frequency signals.

**9 With sampling:**

This subclass is indented under subclass 7. Subject matter wherein a reference signal is derived by representation of an input signal at intermittently timed intervals.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 91+, for details of sampling or holding in general.

**10 Uniform pulse waveform:**

This subclass is indented under subclass 7. Subject matter wherein the reference signal is a series of pulses evenly spaced.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 42, for a frequency comparison between a fixed reference frequency and a variable input.

**11 With transformer:**

This subclass is indented under subclass 7. Subject matter wherein an electromagnetic induction device transfers electrical energy from one circuit to another adjacent circuit at a constant frequency.

- (1) Note. A transformer changes voltage in direct proportion to the ratio of the number of turns of its primary and secondary windings.

SEE OR SEARCH CLASS:

- 336, Inductor Devices, appropriate subclasses for transformer details.

**12 With logic or bistable circuit:**

Subject matter under 3 wherein the phase comparison (a) includes a device performing Boolean functions such as AND, OR, or exclusive-OR or (b) utilizes a device having two stable states.

- (1) Note. The combination of logic with specific phase comparison circuitry or function, not elsewhere classified is classified here.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 185+, for particular stable state circuits including bistable.

SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, subclasses 93+ for clocking or synchronizing of one or more logic stages and appropriate subclasses for general digital logic circuitry not classified elsewhere.  
331, Oscillators, subclass 1 for automatic frequency control synchronization with logic elements.

**13 By shape:**

This subclass is indented under subclass 1. Subject matter wherein input signal discriminating is based upon a predetermined geometric configuration.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 134, for sawtooth or triangular wave producing systems with slope or duration control.  
 172+, for pulse signal shaping with duration or width control.
- SEE OR SEARCH CLASS:  
 348, Television, subclasses 525+ for sync separating systems which may depend upon differences in the slope or shape of the input pulses.  
 455, Telecommunications, subclasses 296+ for static or noise elimination in radio receivers which may depend upon the slope or shape of the pulse present in the input signal applied to the receiver.
- 14 Slope:**  
 This subclass is indented under subclass 13. Subject matter wherein the predetermined geometric configuration is signal rate of change.
- (1) Note. The rate of change may be determined by digital means (such as counters) or analog means (such as slope detection using a charging capacitor).
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 134, for sawtooth or triangular waveform generation with slope control.  
 170, for slope control of a pulse or clock waveform.  
 261+, for output waveform production delay.  
 335, for the miscellaneous determination of the derivative of an input signal.
- 15 With direction (i.e., positive or negative):**  
 This subclass is indented under subclass 14. Subject matter wherein the output signal indicates an upward or downward inclination of the input.
- 16 Having feedback:**  
 This subclass is indented under subclass 13. Subject matter wherein a portion of the output signal is returned to an input.
- 17 With reference signal:**  
 This subclass is indented under subclass 13. Subject matter wherein a signal of predetermined shape acts as a constant for comparison to a variable input.
- 18 By presence or absence pulse detection:**  
 This subclass is indented under subclass 1. Subject matter wherein an output signal is indicative of an unexpected occurrence or lack of occurrence of a pulse in either a clocking signal or a predetermined sequence of pulses.
- 19 Arbitration:**  
 This subclass is indented under subclass 18. Subject matter wherein a particular pulse among plural pulses input during a particular time interval is selected based upon a predetermined priority arrangement.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 3+, for phase discrimination.
- 20 Monitoring (e.g., failure detection, etc.):**  
 This subclass is indented under subclass 18. Subject matter wherein the detection of an undesired absent or present pulse produces an output signal which indicates a failure.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 292, for clock fault compensation.
- 21 With variable frequency source:**  
 This subclass is indented under subclass 18. Subject matter wherein the absent or present pulse is detected from a varying frequency input signal.
- 22 By pulse noncoincidence:**  
 This subclass is indented under subclass 1. Subject matter wherein an output signal is produced when two or more input pulses are not received simultaneously.
- 23 By pulse coincidence:**  
 This subclass is indented under subclass 1. Subject matter wherein an output signal is produced when two or more input pulse signals occur simultaneously.

- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 104+ for circuits performing fundamental Boolean Algebra functions, especially the "AND" function.
- 24 Edge sensing:**  
This subclass is indented under subclass 23. Subject matter wherein a beginning or trailing end of a pulse is determined to occur simultaneously with a corresponding beginning or trailing end of another pulse.
- 25 With uniform spacing:**  
This subclass is indented under subclass 23. Subject matter wherein an output signal is produced when two or more input pulse signals having the same time interval between consecutive pulses occur simultaneously.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
31+, for detecting a pulse width or spacing in general.
- 26 With pulse width detecting:**  
This subclass is indented under subclass 23. Subject matter wherein pulse width discriminating is achieved via a pulse coincidence operation.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
31+, for detecting pulse width or spacing in general.
- SEE OR SEARCH CLASS:  
329, Demodulators, subclass 312 for a pulse width demodulator.
- 27 With reference:**  
This subclass is indented under subclass 23. Subject matter wherein an input pulse signal is compared with a predetermined standard signal.
- 28 By polarity:**  
This subclass is indented under subclass 1. Subject matter wherein the input signal parameter is its positive or negative orientation with respect to a fixed origin.
- 29 Selection of a particular polarity:**  
This subclass is indented under subclass 28. Subject matter wherein only a predetermined polarity of an input signal is chosen.
- 30 Opposite polarity:**  
This subclass is indented under subclass 28. Subject matter wherein an output signal results from comparing pulses which have or are expected to have differing polarities.
- 31 By pulse width or spacing:**  
This subclass is indented under subclass 1. Subject matter wherein the input signal parameter is (a) a time interval between a leading edge and a trailing edge of a single pulse or (b) a time interval between a trailing edge and a leading edge of two consecutive pulses.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
172+, for pulse signal shaping with duration or width control.
- SEE OR SEARCH CLASS:  
340, Communication: Electrical, subclass 825.63 for pulse width selective actuation and subclass 825.64 for pulse spacing selective actuation.
- 32 With shock-excited circuit:**  
This subclass is indented under subclass 31. Subject matter including a resonant circuit which oscillates at its natural frequency upon application of an electrical impulse.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
596, for miscellaneous circuitry containing shock excited resonant components.
- SEE OR SEARCH CLASS:  
331, Oscillators, appropriate subclasses for free running generators utilizing shock excited resonant circuits.  
334, Tuners, appropriate subclasses for tuned networks for use in wave energy apparatus and comprising inductance and capacitance elements in circuit arrangement to form a resonant circuit and in which structure is provided for adjusting one or both of

these elements for changing the mean resonant frequency of the circuit.

33

**With sampling:**

This subclass is indented under subclass 31. Subject matter including a circuit providing periodic representations of an input signal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9, for phase discriminating with sampling.

91+, for detailed sampling or holding circuits, per se.

34

**Narrow pulse elimination or suppression:**

This subclass is indented under subclass 31. Subject matter wherein the output signal does not include portions of the input signal having a pulse width shorter than a predetermined time interval.

(1) Note. Narrow or short pulse (spurious) duration in a system may be noise, which is unwanted disturbances superimposed upon a useful signal and which tends to obscure its information content.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

172+, for rectangular or pulse waveform continuous width control.

178+, for rectangular or pulse waveform amplitude control which may include some noise reduction.

310+, for transient or signal noise reduction by limiting, clipping, or clamping.

379+, for noise overriding in gating or switching.

551+, for miscellaneous unwanted signal elimination.

35

**Separating by duration or gap (e.g., duty cycle, etc.):**

This subclass is indented under subclass 31. Subject matter wherein (a) an input pulse signal is divided between long and short pulses contained therein or (b) a space is inserted between the trailing edge of a pulse and the leading edge of the next pulse or (c) a spacing between pulses is detected.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

134+, for duration control of a triangular or sawtooth wave.

172+, for rectangular wave or pulse width control.

SEE OR SEARCH CLASS:

329, Demodulators, subclass 312 for a pulse width demodulator.

36

**Selection of a particular pulse width:**

This subclass is indented under subclass 31. Subject matter wherein a predetermined pulse width is chosen from a series of input pulse signals.

SEE OR SEARCH CLASS:

329, Demodulators, subclass 312 for a pulse width demodulator.

37

**Comparison by threshold or reference:**

This subclass is indented under subclass 31. Subject matter wherein the output signal is indicative of the pulse width difference between an input pulse signal and a set value or predetermined standard.

38

**With plural paths:**

This subclass is indented under subclass 31. Subject matter wherein an input signal passes through more than one route or channel between an input terminal and an output terminal.

39

**By frequency:**

This subclass is indented under subclass 1. Subject matter wherein the discriminated signal parameter relates to the number of times a signal repeats its basic waveform within a unit of time.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

2+, for discriminating by phase.

47+, for circuits where the output is present only at a predetermined frequency of the input.

113+, for miscellaneous frequency or repetition rate control.

114+, for pulse generating which includes frequency or repetition rate control.

231+, for phase correction or control.

- 261+, for output waveform production delay.
- 552+, for unwanted signal suppression by an active filter.

**SEE OR SEARCH CLASS:**

- 303, Fluid-Pressure and Analogous Brake System, subclasses 91+ for speed-controlled fluid-pressure brake systems.
- 324, Electricity: Measuring and Testing, subclasses 76.19+ for a frequency spectrum analyzer and subclasses 76.39+ for measuring and testing of the frequency of cyclic current or voltage.
- 329, Demodulators, subclasses 315+ for frequency demodulation in which an intelligence signal is extracted.
- 331, Oscillators, subclasses 1+ for systems for stabilizing the frequency of an oscillator utilizing phase or frequency comparison devices and subclasses 37+ for systems wherein two or more frequencies are combined to produce a beat frequency.
- 332, Modulators, subclasses 117+ for systems wherein the frequency of a carrier wave is modulated by an arbitrarily varying quantity.
- 455, Telecommunications, subclass 214 for frequency or phase modulation with particular discrimination or detection.
- 702, Data Processing: Measuring, Calibrating, or Testing, subclasses 75+ for frequency measurement system.

**40 Comparison between plural inputs:**

This subclass is indented under subclass 39. Subject matter wherein the output signal is a function of the differences among two or more input signal frequencies.

- (1) Note. Systems wherein the claimed subject matter includes apparatus which responds only when a noninformation bearing input signal is in synchronism with a control signal locally generated (synchronous detectors) and which are not claimed as an integral part of a more comprehensive system will be classified herein. Detectors producing an output which is a result of demodulation of a carrier having previously been modu-

lated by an intelligence waveform which varies arbitrarily will not be classified here. See SEARCH CLASS, below.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 3, for phase comparison between plural input signals.

**SEE OR SEARCH CLASS:**

- 329, Demodulators, appropriate subclasses for a circuit having an output which is a result of demodulation of a carrier having previously been frequency modulated by an intelligence waveform.
- 455, Telecommunications, subclasses 130+, for mixers or converters utilized in a superheterodyne receiver (commonly referred to as a first detector), and subclasses 313+ for combining frequencies in a receiver to produce a beat frequency.

**41 With synchronous detection:**

This subclass is indented under subclass 40. Subject matter wherein the output signal provides an indication of the maintenance of precise matching between two or more input signal frequencies.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 141+, for synchronizing control.

**SEE OR SEARCH CLASS:**

- 331, Oscillators, subclasses 1+ for controlling frequency synchronization in oscillator circuits (e.g., phase lock loop circuits, etc.).
- 348, Television, subclasses 638+ and 726+ for television receivers that may include synchronous detectors.

**42 Fixed frequency reference signal:**

This subclass is indented under subclass 40. Subject matter wherein a signal of constant frequency acts as a standard for comparison to a variable input signal.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 7+, for a fixed phase signal compared to a variable input.

- 43 With logic or bistable circuit:**  
This subclass is indented under subclass 40. Subject matter wherein the frequency comparison of plural signals (a) includes a device performing Boolean functions such as AND, OR, or exclusive-OR or (b) utilizes a device having two stable states.
- (1) Note. The combination of logic with specific frequency comparison circuitry or function, not elsewhere classified is classified here.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
185+, for particular stable state circuits including bistable.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 93+ for clocking or synchronizing of one or more logic stages and appropriate subclasses for general digital logic circuitry not classified elsewhere.  
331, Oscillators, subclass 1 for automatic frequency control synchronization with logic elements.
- 44 With predetermined frequency selection:**  
This subclass is indented under subclass 39. Subject matter wherein the output signal consists of a chosen input signal having a specific frequency characteristic.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
552+, for unwanted signal suppression by an active filter.
- SEE OR SEARCH CLASS:  
329, Demodulators, appropriate subclasses for circuits which select signals from modulated wave signals.
- 45 Including sampling or reference frequency:**  
This subclass is indented under subclass 44. Subject matter wherein (a) the predetermined signal frequency selected is derived by representation of another known signal frequency at intermittent time intervals or (b) wherein a signal of fixed frequency is utilized in the frequency selection.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
7+, for phase angle sensing circuits using a reference signal.  
42, for a fixed frequency reference signal used in plural signal frequency comparison.
- 46 Including plural frequency detection:**  
This subclass is indented under subclass 44. Subject matter wherein more than one signal frequency is detected by a single circuit or system.
- 47 Frequency detection:**  
This subclass is indented under subclass 39. Subject matter wherein an output signal is present or changes only at a predetermined input frequency.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
102, for the conversion of input frequency to output current or voltage.  
113+, for frequency or repetition rate control.  
552+, for unwanted signal elimination by an active filter.
- SEE OR SEARCH CLASS:  
379, Telephonic Communications, subclass 346 for a repeater with voice frequency discriminator.  
708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 311+ for frequency detection/filtering using an electrical digital calculating computer.
- 48 With counting:**  
This subclass is indented under subclass 47. Subject matter wherein the output signal is incremented or decremented at a predetermined interval thereby forming a variable duty cycle according to the changes in the input frequency signal.
- (1) Note. A counter is a device capable of changing between a sequence of distinguishable states upon each receipt of an input signal.

**SEE OR SEARCH CLASS:**

377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, for counters, per se.

**49****With logic or bistable circuit:**

This subclass is indented under subclass 47. Subject matter wherein the frequency detection (a) includes a device performing Boolean functions such as AND, OR, or exclusive-OR or (b) utilizes a device having two stable states.

- (1) Note. The combination of logic with specific frequency detection circuitry or function, not elsewhere classified, is classified here.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

185+, for particular stable state circuits including bistable.

**SEE OR SEARCH CLASS:**

326, Electronic Digital Logic Circuitry, subclasses 93+ for clocking or synchronizing of one or more logic stages and appropriate subclasses for general digital logic circuitry not classified elsewhere.

**50****By amplitude:**

This subclass is indented under subclass 1. Subject matter wherein the discriminated input signal parameter is the magnitude of an electrical energy waveform measured with respect to a fixed origin.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

178+, for rectangular or pulse waveform amplitude control.

306+, for amplitude control in general.

**SEE OR SEARCH CLASS:**

324, Electricity: Measuring and Testing, subclasses 76+ for the measuring or testing of electricity, per se.

329, Demodulators, subclasses 347+ for amplitude demodulators.

**51****With sensing amplifier:**

This subclass is indented under subclass 50. Subject matter wherein low-level voltages (e.g., CCD charges, capacitive stored signal levels, etc.) are detected and increased in magnitude from one level to another.

- (1) Note. The voltage amplitude or storage charge levels detected in this subclass include the type of levels found in storage memory cells of an array; however, the static storage and retrieval of information coupled with the functions of "write", "read-out", "erase", etc., wherein voltage amplitude is sensed, is classified elsewhere. See the Search Note below.
- (2) Note. Differential comparator type sensing amplifiers including regenerative sensing arrangements (e.g., bistable flip-flops) are classified in this subclass.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

28, for discrimination by polarity.

**SEE OR SEARCH CLASS:**

365, Static Information Storage and Retrieval, subclasses 207 through 210.15 for the static storage and retrieval of information coupled with the functions of "write", "read-out", "erase", etc., wherein voltage amplitude is sensed.

**52****Differential amplifier:**

This subclass is indented under subclass 51. Subject matter including a device responsive to the offset between two input voltages or currents and nonresponsive to voltages or currents which are identical in the two inputs.

**53****Current mirror:**

This subclass is indented under subclass 52. Subject matter wherein the sensing amplifier circuit utilizes collector current matching of two transistors when connected base to base and emitter to emitter.



- 54 Having feedback:**  
This subclass is indented under subclass 52. Subject matter wherein a portion of the output signal is returned to an input.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
57, for a miscellaneous sense amplifier with a latching type element.
- 55 Cross-coupled:**  
This subclass is indented under subclass 54. Subject matter wherein there are two elements or stages which are mutually interconnected (i.e., the output of one is connected to the input of the other and vice versa).
- 56 With reference signal:**  
This subclass is indented under subclass 52. Subject matter wherein a signal of fixed voltage potential acts as a constant for comparison to a variable input.
- (1) Note. The reference signal is usually an input signal or produced from an input signal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
77+, for amplitude comparison between an input signal and a fixed reference, in general.
- 57 With latching type element (e.g., flip-flop, etc.):**  
This subclass is indented under subclass 51. Subject matter wherein the sense amplifier includes a device providing signal retention.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
185+, for stable state circuits including bistable.
- 58 Maximum or minimum amplitude:**  
This subclass is indented under subclass 50. Subject matter wherein an output signal is caused by either a greatest absolute magnitude or a least absolute magnitude of an input signal during a time period of interest.
- (1) Note. This subclass does not include comparison to a fixed reference or threshold.
- 59 Employing input compared to output:**  
This subclass is indented under subclass 58. Subject matter wherein a portion of an output signal is evaluated relative to an input signal.
- 60 Employing input compared to reference derived therefrom:**  
This subclass is indented under subclass 58. Subject matter wherein a signal from an external source is evaluated relative to a voltage or current obtained by processing signals from the same source.
- (1) Note. For this subclass either the processing or means therefor should be claimed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
72+, for generic amplitude comparing between an input and a reference derived therefrom.
- 61 By diode-capacitor network:**  
This subclass is indented under subclass 58. Subject matter wherein maximum or minimum amplitude discriminating is achieved by an electrical energy storage element combined with an element providing unidirectional current flow.
- 62 Maximum and minimum amplitude:**  
This subclass is indented under subclass 58. Subject matter wherein an output signal is caused by both the greatest absolute magnitude and least absolute magnitude of an input signal during a time period of interest.
- 63 Comparison between plural varying inputs:**  
This subclass is indented under subclass 50. Subject matter wherein fluctuating input signals from two or more sources external to a system are evaluated relative to one another.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
72+, for evaluation of an input signal relative to a reference derived therefrom.

- 74+, for a system wherein a signal from an external source is evaluated relative to plural fixed reference levels.
- 77+, for the evaluation of a signal relative to a single fixed reference level.
- 78+, for detection of a crossover point between an input signal and a reference level.
- 64 With logic or bistable circuit:**  
This subclass is indented under subclass 63. Subject matter wherein the comparison by amplitude (a) includes a device performing Boolean functions such as AND, OR, or exclusive-OR or (b) utilizes a device having two stable states.
- (1) Note. The combination of logic with specific amplitude comparison circuitry or function, not elsewhere classified is classified here.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
185+, for particular stable state circuits including bistable.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 93+ for clocking or synchronizing of one or more logic stages and appropriate subclasses for general digital logic circuitry not classified elsewhere.
- 65 Differential input:**  
This subclass is indented under subclass 63. Subject matter wherein the differences between the plural varying input signals are initially amplified prior to further processing.
- 66 Current mirror:**  
This subclass is indented under subclass 65. Subject matter wherein the comparison between plural varying inputs utilizes collector current matching of two transistors when connected base to base and emitter to emitter.
- 67 Having feedback:**  
This subclass is indented under subclass 65. Subject matter wherein a portion of the output signal is returned to an input.
- 68 Input provides varying reference signal:**  
This subclass is indented under subclass 63. Subject matter wherein at least one of the fluctuating inputs provides a changing signal to be used only as an evaluation standard.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
72, for amplitude discriminating where a reference signal is internally derived from one of the inputs.
- 69 With plural paths:**  
This subclass is indented under subclass 63. Subject matter wherein an input signal passes through more than one route or channel between an input terminal and an output terminal.
- 70 With single output:**  
This subclass is indented under subclass 69. Subject matter wherein the plural paths have a common output.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
407+, for plural channel input, single channel output gating systems.
- SEE OR SEARCH CLASS:  
370, Multiplex Communications, appropriate subclasses for similar subject matter used with multiplexing.
- 71 Three or more inputs:**  
This subclass is indented under subclass 63. Subject matter wherein the number of external signal sources is greater than two.
- 72 Input signal compared to reference derived therefrom:**  
This subclass is indented under subclass 50. Subject matter wherein a signal from an external source is evaluated relative to a voltage or current obtained by processing signals from the same source.
- (1) Note. For classification herein, either the processing or means therefor should be recited.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 68, for amplitude discriminating between plural varying inputs where at least one of the input signals is a varying reference.  
 74+, for an input signal compared to plural fixed references.  
 205+, for stable state circuits utilizing hysteresis.
- SEE OR SEARCH CLASS:  
 326, Electronic Digital Logic Circuits, subclasses 22+ for input noise margin enhancement.
- 73 Reference derived by feedback:**  
 This subclass is indented under subclass 72. Subject matter wherein the processing includes extracting a signal from an output terminal of the circuit and applying a portion of the extracted signal to an input terminal.
- 74 Input signal compared to plural fixed references:**  
 This subclass is indented under subclass 50. Subject matter wherein input signal amplitude is evaluated relative to two or more unvarying voltage or current levels.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 63+, for amplitude comparison between plural varying inputs.  
 72+, for an input signal compared to a reference derived therefrom.  
 77+, for an input signal compared to a single fixed reference.  
 205+, for a stable state circuit utilizing hysteresis.
- SEE OR SEARCH CLASS:  
 326, Electronic Digital Logic Circuits, subclass 22 for input noise margin enhancement.
- 75 Three or more:**  
 This subclass is indented under subclass 74. Subject matter wherein there are more than two unvarying reference levels.
- 76 With logic or bistable circuit:**  
 This subclass is indented under subclass 74. Subject matter wherein the comparison by amplitude between the input signal and plural fixed references (a) includes a device performing Boolean functions such as AND, OR, or exclusive-OR or (b) utilizes a device having two stable states.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 185+, for particular stable state circuits including bistable.
- SEE OR SEARCH CLASS:  
 326, Electronic Digital Logic Circuitry, for general digital logic circuitry not classified elsewhere and particularly subclasses 93+ for clocking or synchronizing of one or more logic stages.
- 77 Input signal compared to single fixed reference:**  
 This subclass is indented under subclass 50. Subject matter wherein the input signal is evaluated relative to a standard which is at a constant level of amplitude.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 74+, for an input signal compared to multiple fixed references.
- 78 Reference level crossover detecting:**  
 This subclass is indented under subclass 77. Subject matter wherein an output signal is produced when an input signal actually transits the reference amplitude of a comparison standard.
- (1) Note. The approach of the input signal to the reference level may be from either a positive or a negative direction.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 63+, for evaluation of plural sources of varying input signals relative to each other.  
 74+, for evaluation of an input signal relative to plural fixed thresholds.

- 79 Zero crossover:**  
This subclass is indented under subclass 78. Subject matter wherein the reference level which is transited is zero volts.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
451+, for AC supply zero point switching utilizing a four or more layer device such as a thyristor.
- 80 Reference determined by threshold of single circuit element:**  
This subclass is indented under subclass 77. Subject matter wherein the amplitude of the comparison standard is established by one electrical component.
- 81 With transistor:**  
This subclass is indented under subclass 80. Subject matter wherein the single electrical component is a three terminal semiconductor device composed of n or p type material.
- SEE OR SEARCH CLASS:  
257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for transistor structure details.
- 82 Plural sources of input signal:**  
This subclass is indented under subclass 77. Subject matter wherein multiple input signals are to be evaluated relative to a standard.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
63+, for an amplitude evaluation system having plural varying input signals which are to be evaluated against each other.  
72+, for a comparator system which evaluates an input signal against a reference derived from the same signal.
- 83 Temperature compensation:**  
This subclass is indented under subclass 77. Subject matter wherein an increase or decrease in thermal sensitivity of a system is cancelled or reduced by the effects of a counterbalancing element in the system.
- (1) Note. A counterbalancing element may be, for example, a resistor, capacitor, or inductor.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
513, for miscellaneous temperature compensation.
- 84 With bridge circuit:**  
This subclass is indented under subclass 77. Subject matter including four or more devices with their input and output terminals connected in a closed loop to form a four arm network.
- (1) Note. Another arm, called the diagonal arm, may be connected between an input terminal and an output terminal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
587, for a two electrode solid-state device bridge circuit.  
588, for miscellaneous bridge circuits.
- 85 Inverting input or output:**  
This subclass is indented under subclass 77. Subject matter wherein an input signal or an output signal is reversed in sign.
- 86 With transformer:**  
This subclass is indented under subclass 77. Subject matter wherein an electromagnetic induction device transfers electrical energy between adjacent circuit portions at a constant frequency.
- (1) Note. A transformer changes voltage in direct proportion to the ratio of the number of turns of its primary and secondary windings.
- SEE OR SEARCH CLASS:  
336, Inductor Devices, appropriate subclasses for transformer details.
- 87 Having feedback:**  
This subclass is indented under subclass 77. Subject matter wherein a portion of the output signal is returned to an input.

- 88 With source as reference:**  
This subclass is indented under subclass 77. Subject matter wherein a device which supplies signal power at a constant voltage or current level is used as a standard for comparison.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
100+, for signal generating.  
540+, for stabilized bias circuits with voltage regulating.
- 89 With differential amplifier:**  
This subclass is indented under subclass 77. Subject matter including a device responsive to the offset between two input voltages or currents and nonresponsive to voltages or currents which are identical in the two inputs.
- 90 Comparison between two characteristics of an input signal:**  
This subclass is indented under subclass 50. Subject matter wherein the output signal is representative of the amplitude difference between two consecutive or selected points of the input signal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
91+, for details of a sample or hold circuit.
- 91 Including details of sampling or holding:**  
This subclass is indented under subclass 50. Subject matter wherein a representation of an input signal magnitude at a particular point in time is produced or an established input signal magnitude value is maintained.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
124, for signal generation by periodic switching.  
365+, for gating of signals, in general.
- 92 With bridge circuit:**  
This subclass is indented under subclass 91. Subject matter including four or more devices with their input and output terminals connected in a closed loop to form a four arm network.
- (1) Note. Another arm, called the diagonal arm, may connect an input terminal and an output terminal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
587, for a two electrode solid-state device bridge circuit.  
588, for miscellaneous bridge circuits.
- 93 With reference source:**  
This subclass is indented under subclass 91. Subject matter including a device which supplies signal power to a sample or hold circuit at a constant voltage or current level.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
100+, for signal converting, shaping, or generating.  
530+, for miscellaneous bias voltage supply circuits and particularly subclasses 538+ for a stabilized bias voltage supply circuit.
- 94 Sample and hold:**  
This subclass is indented under subclass 91. Subject matter wherein a representation of an input signal magnitude at a particular point in time is produced and subsequently maintained for a time in a storage element.
- SEE OR SEARCH CLASS:  
341, Coded Data Generation or Conversion, subclasses 122+ for sample and hold circuits having code generation or conversion.
- 95 Having feedback:**  
This subclass is indented under subclass 94. Subject matter wherein a portion of the output signal is returned to an input.
- 96 With differential amplifier:**  
This subclass is indented under subclass 94. Subject matter including a device responsive to the offset between two input voltages or currents and nonresponsive to voltages or currents which are identical in the two inputs.
- 97 With logic or bistable circuit:**  
This subclass is indented under subclass 50. Subject matter wherein the comparison by amplitude (a) includes a device performing Boolean functions such as AND, OR, or exclusive-OR, or (b) utilizes a device having two stable states.

- (1) Note. The combination of logic with specific amplitude comparison circuitry or function, not elsewhere classified is classified here.

SEE OR SEARCH THIS CLASS, SUBCLASS:

185+, for particular stable state circuits including bistable.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclasses 93+ for clocking or synchronizing of one or more logic stages and appropriate subclasses for general digital logic circuitry not classified elsewhere.

**98 By separating composite signal:**

This subclass is indented under subclass 1. Subject matter wherein the output signal is a selected component of a multicomponent input signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

35, for pulse separating by width or spacing.

551+, for miscellaneous signal suppression which may include an active filter.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 105 for harmonic filters or neutralizing systems, in general.

324, Electricity: Measuring and Testing, subclasses 332+ for geophysical exploration systems utilizing radiant energy with separate detector means whereby signal components are selected or suppressed and subclasses 76.12+ for measuring systems which analyze complex electric waves.

330, Amplifiers, appropriate subclasses for frequency selective linear amplifiers.

331, Oscillators, subclasses 76 and 77 for oscillator systems combined with harmonic selecting means or wave filter, respectively, in the output circuit.

333, Wave Transmission Lines and Networks, appropriate subclasses for passive type wave selecting systems, particularly subclasses 167+ for wave filters, per se.

340, Communications: Electrical, subclasses 825.71+ for selective systems which are frequency responsive.

348, Television, subclass 506 for burst separation circuitry, subclasses 525+ for separating the synchronizing components from a composite signal wave, and subclasses 638+ for color signal deriving circuitry.

704, Data Processing: Speech Signal Processing, Linguistics, Language Translation, and Audio Compression/Decompression, subclass 200 for systems for analyzing complex speech waves (e.g., where the fundamental pitch frequency of the human voice is determined).

**99 Having selection between plural continuous waveforms:**

This subclass is indented under subclass 1. Systems wherein the output signal is one of a plurality of simultaneously applied input signal waveforms selected in accordance with a predetermined characteristic, the nonselected waveforms being attenuated or otherwise suppressed in such a manner that only the desired signal waveform appears at the output.

SEE OR SEARCH THIS CLASS, SUBCLASS:

98, for systems which select a signal component from a composite wave.

407+, for distribution systems wherein plural channels are input and the output consists of a signal from a selected channel.

SEE OR SEARCH CLASS:

324, Electricity: Measuring and Testing, subclasses 76.12+ for analysis systems of a complex wave.

331, Oscillators, subclass 76 for systems comprising an oscillator combined with a harmonic selection network and subclass 77 for oscillators with a wave selecting output filter.

- 333, Wave Transmission Lines and Networks, subclasses 167+ for wave filters comprised of passive elements.
- 340, Communications: Electrical, subclasses 825.71+ for remote control or selective signaling systems which are frequency responsive.
- 348, Television, subclasses 525+ for separating the synchronizing components from a composite signal wave.

## 100 SIGNAL CONVERTING, SHAPING, OR GENERATING:

This subclass is indented under the class definition. Subject matter wherein (a) an inherent input signal parameter such as phase, frequency, amplitude, or current is modified, maintained at some value, or changed to an entirely different parameter, (b) an input signal having a particular waveform is modified into an output signal having a partially or completely different waveform, or (c) an output signal of specified waveform is produced.

- (1) Note. An example of the second type above would be sine wave to triangular wave modification.
- (2) Note. This subclass and indented subclasses do not include single energy systems for conversion wherein a single electrical source circuit is coupled to a single electrical load circuit and which involves current, phase or frequency conversion, and wherein the energy in the load is supplied solely by the source. Such systems in general are classified in Class 363, Electric Power Conversion Systems, appropriate subclasses. See References to Other Classes in Class 363 for other classes providing for conversion systems.
- (3) Note. Excluded from this subclass and indented subclasses are free running signal generators which are classified, for example, in Class 331.
- (4) Note. Bias circuits of the pulsing type which establish device operating points are classified below with the bias circuits.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 334+, for circuits whose output is proportional to a mathematical function of the input.
- 544, for bias circuits of the pulsating type.
- 596, for miscellaneous circuits including a free running oscillatory type circuit.

SEE OR SEARCH CLASS:

- 128, Surgery, subclass 2.06 for electrocardiographs involving timing and subclasses 303.13+ for instruments for application of electricity to the human body involving timing.
- 236, Automatic Temperature and Humidity Regulation, subclass 46 for regulation systems involving timing.
- 237, Heating Systems, subclasses 2+ for systems for automatic control of a heating system.
- 307, Electrical Transmission or Interconnection Systems, subclasses 401+ for nonlinear reactor systems (e.g., saturable) and subclasses 106+ for a class appropriate wave shape determinative or pulse producing system. See also appropriate subclasses for plural source or load voltage magnitude and phase control.
- 315, Electric Lamp and Discharge Devices: Systems, subclasses 364+ for cathode ray deflecting circuits involving timing and subclasses 209+ for systems involving a periodic switch in the supply circuit of a gaseous discharge tube.
- 318, Electricity: Motive Power Systems, subclass 445 for systems of automatically starting and/or stopping a motor with timing, subclasses 606+ for electric motor position servomechanisms with phase or frequency control, and subclass 683 for particular phase detectors used in such a servomechanism.
- 320, Electricity: Battery or Capacitor Charging or Discharging, subclasses 166+ for charging or discharging a capacitor, per se.
- 322, Electricity: Single Generator Systems, subclasses 17+, especially indented subclass 18 for systems

- involving time delay means in the control of a generator or driving.
- 323, Electricity: Power Supply or Regulation Systems, subclasses 212+ for power supply phase control comprising an electron tube and wherein, in general, the tube does not act as an active element.
- 324, Electricity: Measuring and Testing, subclasses 83+ for phase indicators, subclasses 78+, particularly subclass 82 for measuring or testing the frequency of cyclic current or voltage by phase comparison, and subclasses 160+ for systems for measuring time or speed.
- 330, Amplifiers, subclass 107 for amplifiers with phase shifting means in a feedback path.
- 331, Oscillators, subclasses 37+ for systems including an oscillator or oscillators generating at least two different frequencies with a signal combining device (e.g., mixer, modulator, etc.) having a signal input circuit and a signal output circuit where the oscillator or oscillators are connected to the signal input circuit of the combining device and the device output comprises the sum or difference frequency of the outputs of the oscillator or oscillators.
- 332, Modulators, appropriate subclasses for systems including beating a source of carrier frequency with a signal wave which varies arbitrarily in a continuous manner in accordance with some intelligence.
- 333, Wave Transmission Lines and Networks, subclasses 18, 23, and 138+ for delay networks comprising passive elements and subclasses 138+. See (1) Note, above.
- 340, Communications: Electrical, subclass 870.24 for telemetering systems receiving information by pulse trains with length or spacing varied with respect to time.
- 341, Coded Data Generation or Conversion, subclasses 50+ for systems converting an input consisting of a coded arrangement representing a particular group of values to an output consisting of another coded arrangement.
- 348, Television, subclasses 469+ for systems generating or formatting a television signal.
- 361, Electricity: Electrical Systems and Devices, subclasses 195+ for time delay networks which control a relay load switching operation.
- 363, Electric Power Conversion Systems, appropriate subclasses for single energy conversion systems wherein a single electrical source circuit is coupled to a single electrical load circuit. See (2) Note, above.
- 455, Telecommunications, subclasses 313+ for mixer or converters in radio receiver circuits. See (3) Note, above.
- 101 Converting input current or voltage to output frequency:**  
This subclass is indented under subclass 100. Subject matter wherein a repetition rate of an output signal is directly related to the magnitude of an input signal current or voltage.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
113+, for miscellaneous frequency or repetition rate conversion or control.
- SEE OR SEARCH CLASS:  
332, Modulators, subclasses 117+ for a frequency modulator.
- 102 Converting input frequency to output current or voltage:**  
This subclass is indented under subclass 100. Subject matter wherein the magnitude of output signal current or voltage is directly related to the repetition rate of the input signal.
- (1) Note. Included here are devices wherein an input signal of varying frequency is changed into a direct current output voltage which is a function of the input frequency.
- (2) Note. Since period is inversely related to frequency, input period conversion to output current or voltage is also included here.



SEE OR SEARCH THIS CLASS, SUB-CLASS:

39+, for frequency discrimination and particularly subclasses 47+ for frequency detection.

SEE OR SEARCH CLASS:

329, Demodulators, subclasses 315+ for a frequency demodulator.

**103 Converting input voltage to output current or vice versa:**

This subclass is indented under subclass 100. Subject matter wherein electrical potential is changed to an equivalent electrical charge flow or vice versa.

SEE OR SEARCH CLASS:

363, Electric Power Conversion Systems, subclass 73 for power conversion systems between a constant current and a constant voltage or vice versa wherein a single source is connected to a single load.

**104 Converting, per se, of an AC input to corresponding DC at an unloaded output:**

This subclass is indented under subclass 100. Subject matter wherein an alternating current input signal wave is converted to an unloaded output wave consisting of a unidirectional representation of the half cycles of an input wave.

(1) Note. The conversion systems in this subclass do not include claimed subject matter such as would define demodulators, detectors, or rectifier systems classified elsewhere with specific art devices.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

28+, for polarity selection or discrimination.

39+, for selection or discrimination by repetition rate (i.e., frequency).

335+, for a differentiating network.

336+, for an integrating network.

348, for the determination of the RMS function of an input signal.

SEE OR SEARCH CLASS:

178, Telegraphy, appropriate subclasses for pulse producing (e.g., by rectification of AC signals, etc.) in combination with telegraph systems. In Class 178, the pulses are usually representative of a telegraph code. subclasses 118+ relate to telegraph receivers which may include signal rectifiers.

246, Railway Switches and Signals, appropriate subclasses for railway signaling systems which may include signal rectifying or other conversion systems as subcombinations thereof.

307, Electrical Transmission or Interconnection Systems, subclass 6 for systems having series connected converters of different voltages, subclass 45 for plural supply circuits with intervening converter, subclass 58 for load current dividing circuits utilizing plural converters, subclass 82 for plural converter systems, subclasses 401+ for nonlinear reactor systems, and subclass 107 for wave form or wave shape determining systems with wave rectification.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclass for charging or discharging a capacitor or battery where a rectifier is employed, particularly Digest 31.

324, Electricity: Measuring and Testing, subclass 89 for phase comparison meters and subclass 119 for meters in general with rectifying.

329, Demodulators, for demodulating systems using rectification designed to change a signal modulated wave so as to produce in the output circuit a pulsating direct current representative of the signal.

330, Amplifiers, appropriate subclasses for amplifiers, especially subclass 10 for modulator-demodulator type amplifiers.

343, Communications: Radio Wave Antennas, appropriate subclasses for signaling systems including radar and directive radio systems which may include demodulating type conversion systems as subcombinations thereof.

- 363, Electric Power Conversion Systems, subclasses 13+ for rectification and derectification involving a single source coupled to a single load in a power conversion system. See the class definition and search notes as to lines with other classes and further fields of search for rectifying systems.
- 375, Pulse or Digital Communications, appropriate subclasses and particularly subclasses 37+ for pulse communication systems using alternating or pulsating currents.
- 379, Telephonic Communications, appropriate subclasses for pulse producing systems with signal rectifying or other converting for use in telephone call transmitter systems.

### 105 **Synthesizer:**

This subclass is indented under subclass 100. Subject matter wherein an output waveform is derived which at any instant is proportional to the combined values of the corresponding instantaneous values of a plurality of input signal waveforms.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 3+, for circuits where the output is a function of the phase difference between plural input signal wave forms.
- 40+, for circuits where the output is a function of the frequency difference between plural input signal wave forms.
- 129, for miscellaneous sine wave generation.
- 355+, for circuits where the output signal is a function of a plurality of input signals.
- 361, for mathematical summing of two or more input signals.

SEE OR SEARCH CLASS:

- 84, Music, subclasses 600+ for generation of electrical musical tones utilizing synthesizing techniques.
- 324, Electricity: Measuring and Testing, subclass 77 for systems for analyzing complex electric waves and subclass 140 for measuring and testing circuits which combine plural inputs.

- 331, Oscillators, subclasses 37+ for oscillatory circuits whose output comprises a beat frequency and subclasses 46+ for plural oscillator systems.
- 332, Modulators, appropriate subclasses for plural wave modulating circuits.
- 333, Wave Transmission Lines and Networks, appropriate subclasses, especially subclass 20 for passive wave shaping networks.
- 455, Telecommunications, subclasses 313+ for plural wave combining heterodyning systems utilized in radio receivers wherein the output is a beat frequency.

### 106 **Having stored waveform data (e.g., in ROM, etc.):**

This subclass is indented under subclass 105. Subject matter wherein information about a desired output waveform is placed into a memory device.

SEE OR SEARCH CLASS:

- 365, Static Information Storage and Retrieval, appropriate subclasses for read-only memory (ROM) circuits in general.

### 107 **Having digital device (e.g., logic gate, flip-flop, etc.):**

This subclass is indented under subclass 105. Subject matter wherein a device which operates on binary signals is included.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 185+, for miscellaneous flip-flop circuits.

SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, appropriate subclasses for logic gates, per se.

### 108 **Current driver:**

This subclass is indented under subclass 100. Subject matter wherein an input signal is modified into a similar output signal having an enhanced current supplying ability.

- (1) Note. Current driving of the type associated with electronic digital logic circuitry is classified in Class 326.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

139, for sawtooth signal waveform production without output current drive enhancement and having an inductive load.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 401+ and particularly subclass 412 for similar subject matter where a nonlinear reactive element (e.g., magnetic core) is claimed as forming part of the operative combination of the invention.

326, Electronic Digital Logic Circuitry, subclasses 82+ for logic current driving.

365, Static Information Storage and Retrieval, appropriate subclasses for magnetic storage of signals on magnetic cores.

**109 Having semiconductive load:**

This subclass is indented under subclass 108. Subject matter wherein the output drive current is provided to a broadly recited semiconductive device.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for detailed semiconductor structure.

**110 Having inductive load (e.g., coil, etc.):**

This subclass is indented under subclass 108. Subject matter wherein the output drive current is provided to a broadly recited element which has the property of opposing current flow therethrough due to a resultant magnetic field.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

139, for a circuit providing a sawtooth or triangular waveform, as generated, to an inductive load.

190+, for a stable state circuit utilizing a transformer or saturable core device.

SEE OR SEARCH CLASS:

336, Inductor Devices, appropriate subclasses for generic inductive devices.

**111 Having capacitive load:**

This subclass is indented under subclass 108. Subject matter wherein the output drive current is provided to a broadly recited element which has the property of opposing voltage change due to stored charge.

SEE OR SEARCH CLASS:

361, Electricity: Electrical Systems and Devices, subclasses 500+ for electrolytic capacitors.

**112 Push-pull:**

This subclass is indented under subclass 111. Subject matter wherein an output circuit comprises two parallel identical portions each receiving signals which are the same except for a relative 180 degree phase offset.

SEE OR SEARCH CLASS:

330, Amplifiers, subclasses 250+ and particularly subclasses 262+ for semiconductor push-pull amplifiers, in general.

**113 Frequency or repetition rate conversion or control:**

This subclass is indented under subclass 100. Subject matter wherein a frequency characteristic of an input signal is modified to produce an output wave of different frequency characteristic which has a definite relationship to that of the input wave or where a frequency characteristic is held essentially constant.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

39+, for frequency discrimination without subsequent control.

141+, for miscellaneous synchronization circuits.

231+, for circuits providing a phase shift less than the period of an input signal.

SEE OR SEARCH CLASS:

84, Music, subclasses 600+ for apparatus for generating or modifying electric currents or potentials to produce varying electric currents or potentials in combination with or intended for use with structure for converting the varying electric currents or potentials into musical tones.

- 250, Radiant Energy, subclass 250 for wave meters which may employ frequency changing.
- 307, Electrical Transmission or Interconnection Systems, subclasses 424+ for parametric amplifier frequency converters, per se.
- 324, Electricity: Measuring and Testing, subclasses 79+ for electric wave frequency measuring systems of the heterodyne type.
- 329, Demodulators, subclasses 323+ or 346 for frequency or phase demodulators with oscillators.
- 331, Oscillators, subclasses 37+ for beat frequency oscillator systems and subclass 76 for systems including an oscillator combined with a harmonic producing or selecting network in the output. To be classified in Class 331 the oscillator must be the signal source and must be capable of self sustained oscillation.
- 332, Modulators, subclasses 117+ or 144+ for systems wherein a first source is modified in frequency or phase by mixing with an arbitrarily varying control source.
- 340, Communications: Electrical, particularly subclasses 870.01+ for telemetering systems and especially subclasses 870.18+ providing for frequency or phase modulation systems.
- 343, Communications: Radio Wave Antennas, appropriate subclasses for systems involving object detection by reflected pulses which may utilize phase or frequency modulation.
- 363, Electric Power Conversion Systems, subclasses 157+ for frequency conversion systems wherein a single electrical source is coupled to a single electrical load in a power conversion system.
- 375, Pulse or Digital Communications, appropriate subclasses for pulse communication systems which utilize phase or frequency modulation.
- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, for pulse counters or counting systems.
- 455, Telecommunications, subclasses 313+ for radio receivers including frequency changing means.
- 114 Of output rectangular waveform:**  
This subclass is indented under subclass 113. Subject matter including maintaining constant or varying the repetition rate of a continuous series of pulses having negligible transition times and available at a specific circuit location for subsequent utilization.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
39+, for frequency sensitive systems and see also the search notes thereunder.
- SEE OR SEARCH CLASS:  
84, Music, subclasses 600+ for apparatus for generating or modifying electric currents or potentials to produce varying electric currents or potentials in combination with or intended for use in converting the varying electric currents or potentials into musical tones.
- 250, Radiant Energy, subclass 250 for wave meters which may employ frequency changing.
- 307, Electrical Transmission or Interconnection Systems, subclass 424 for parametric amplifier frequency converters.
- 324, Electricity: Measuring and Testing, subclass 79 for electric wave frequency measuring systems of the heterodyne type.
- 329, Demodulators, subclasses 323+ for a frequency demodulator with a local oscillator and subclass 346 for a phase demodulator with a local oscillator.
- 331, Oscillators, subclasses 37+ for beat frequency oscillator systems and subclass 76 for systems including an oscillator combined with a harmonic producing or selecting network in the output. (To be classified in Class 331 the oscillator must be the signal source and must be capable of self sustained oscillation).
- 332, Modulators, appropriate subclasses for systems wherein a first source of one frequency is modified in frequency or phase by mixing with an

- arbitrarily varying control source of another frequency or frequencies.
- 340, Communications: Electrical, appropriate subclasses for systems whereby information is conveyed from one point to another by pulses arranged in a particular sequence or whose height or duration are varied to represent the particular information to be conveyed, particularly subclasses 870.01+ for telemetering systems, and subclasses 870.18+ for such systems providing frequency or phase modulation.
- 375, Pulse or Digital Communications, appropriate subclasses for pulse communication systems which utilize phase or frequency modulation.
- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, for pulse counters or counting systems.
- 115 Frequency division:**  
This subclass is indented under subclass 114. Subject matter wherein the repetition rate of the output pulses is less than the frequency of the input signal.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
117+, for frequency division, in general.
- SEE OR SEARCH CLASS:  
377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for analogous circuits which may utilize shift registers or other class appropriate devices.
- 116 Frequency multiplication:**  
This subclass is indented under subclass 114. wherein the repetition rate of the output pulses is greater than the frequency of the input signal.
- (1) Note. Miscellaneous frequency mixing which produces sum or difference frequencies of two input frequencies is classified in subclass 113. Rectangular or pulse waveform frequency mixing is classified in subclass 114.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
119+, for frequency multiplication in general.
- SEE OR SEARCH CLASS:  
377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for analogous circuits which may utilize shift registers or other class appropriate devices.
- 117 Frequency division:**  
This subclass is indented under subclass 113. Subject matter wherein an input signal having a first frequency is transformed into an output signal having a second lower frequency where the output frequency is a submultiple of the input frequency.
- (1) Note. Included as submultiples are fractions such as two-thirds.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
114, for frequency conversion of a pulse train.  
119+, for miscellaneous frequency multiplication.  
185+, for particular multivibrator type which may or may not be used as a frequency divider.
- SEE OR SEARCH CLASS:  
84, Music, subclasses 600+ for apparatus for generating or modifying electric currents or potentials to produce varying electric currents or potentials in combination with or intended for use with structure for converting the varying electric currents or potentials into musical tones.  
363, Electric Power Conversion Systems, subclasses 157+ for frequency conversion systems of a single electrical source coupled to a single electrical load where there is no intermediate conversion to DC.

**118 Having discrete active device (e.g., transistor, triode, etc.):**

This subclass is indented under subclass 117. Subject matter including an individual semiconductor or electron space discharge device.

**119 Frequency multiplication (e.g., harmonic generation, etc.):**

This subclass is indented under subclass 113. Subject matter wherein an input signal having a first frequency is transformed into an output signal having a second higher frequency, where the output frequency is a multiple of the input frequency.

- (1) Note. A harmonic output frequency is an integral multiple of an input frequency.
- (2) Note. Miscellaneous frequency mixing which produces sum or difference frequencies of two input frequencies is classified in subclass 113. Rectangular or pulse waveform frequency mixing is classified in subclass 114.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 113, for miscellaneous frequency mixing.
- 114, for pulse frequency mixing.
- 116, for frequency multiplication of an output rectangular or pulse waveform.
- 117, for miscellaneous frequency division.

SEE OR SEARCH CLASS:

- 84, Music, subclasses 600+ for apparatus for generating or modifying electric currents or potentials to produce varying electric currents or potentials in combination with or intended for use with structure for converting the varying electric currents or potentials into musical tones.
- 307, Electrical Transmission or Interconnection Systems, subclass 105 for a class appropriate harmonic filter or neutralizer.
- 331, Oscillators, subclass 76 for oscillators combined with electron space discharge tube harmonic generating or selecting.

- 363, Electric Power Conversion Systems, subclasses 157+ for frequency conversion systems of a single electrical source coupled to a single electrical load where there is no intermediate conversion to DC.

**120 With plural outputs:**

This subclass is indented under subclass 119. Subject matter wherein multiple harmonic output waves are simultaneously derived from a single input wave.

- (1) Note. The plurality of output waves are generally derived from separate output terminals by filter or other load.

**121 Selective:**

This subclass is indented under subclass 120. Subject matter wherein one or more of the multiple output harmonic waves may be chosen for utilization.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 407+, for a switching circuit having plural inputs and a single output.

**122 Doubling:**

This subclass is indented under subclass 119. Subject matter wherein the frequency of the output wave is exactly twice the frequency of the input wave independent of the input frequency.

- (1) Note. Included in this subclass are systems in which the claimed subject matter is restricted to frequency doublers even though the system singularly or in combination with similar systems may be used as a frequency multiplier other than a doubler.

**123 With particular tube or distributed parameter element:**

This subclass is indented under subclass 119. Subject matter wherein a harmonic producing device comprises a particular electron space discharge device or an element whose respective impedance cannot be considered to be concentrated at a point.

SEE OR SEARCH THIS CLASS, SUB-CLASS:  
593, for miscellaneous circuits with distributed parameter elements.

SEE OR SEARCH CLASS:  
331, Oscillators, subclass 76 for oscillators combined with electron space discharge tube harmonic generating or selecting.

**124 By periodic switching (e.g., chopper, etc.):**  
This subclass is indented under subclass 100. Subject matter wherein an input signal (typically low magnitude DC) is regularly interrupted to form a pulsating output waveform.

SEE OR SEARCH THIS CLASS, SUB-CLASS:  
291+, for miscellaneous clock or pulse generating.  
365+, for electronic input/output switching, in general.  
548, for miscellaneous circuits providing a specific source of supply or bias using an oscillator or interrupter.

SEE OR SEARCH CLASS:  
307, Electrical Transmission or Interconnection Systems, subclasses 132+ for relay repetitive make and break systems.  
330, Amplifiers, subclass 10 for interrupters used in modulator-demodulator type amplifiers.  
363, Electric Power Conversion Systems, subclasses 106+ and subclass 177 for circuit interrupter type converters for power systems.  
370, Multiplex Communications, appropriate subclasses for multiplex systems which utilize switching techniques.

**125 Generating parabolic or hyperbolic output:**  
This subclass is indented under subclass 100. Subject matter wherein a waveform is generated having the shape produced by (a) a locus of points each of which has an equal distance to a fixed line and a fixed point or (b) a locus of points wherein the difference in distances from each point to two fixed points is a constant.

SEE OR SEARCH CLASS:  
708, Electrical Computers: Arithmetic Processing and Calculating, subclass 853 for a hyperbolic function generator using an analog computer.

**126 Generating staircase output:**  
This subclass is indented under subclass 100. Subject matter including the generation of a signal whose amplitude increases or decreases between three or more discrete steps at regular intervals.

SEE OR SEARCH THIS CLASS, SUB-CLASS:  
105, for wave synthesizing systems.  
131+, for sawtooth or triangular wave output.  
291+, for an output discretely stepping between two levels.  
355+, for systems wherein the output is a resultant function of plural inputs.

SEE OR SEARCH CLASS:  
315, Electric Lamp and Discharge Devices: Systems, subclasses 364+ for step wave deflection systems used with cathode-ray tubes.  
370, Multiplex Communications, subclass 530 for a multiplexing system using a time-division step wave signal.

**127 With differential amplifier:**  
This subclass is indented under subclass 126. Subject matter including a gain producing device responsive to the offset between two input voltages or currents and nonresponsive to voltages or currents which are identical in the two inputs.

SEE OR SEARCH THIS CLASS, SUB-CLASS:  
563, for a nonlinear amplifier circuit utilizing a differential amplifier.

SEE OR SEARCH CLASS:  
330, Amplifiers, subclasses 252+ for a semiconductor differential amplifier in general.

**128 With rectifying element:**

This subclass is indented under subclass 126. Subject matter including an element converting an alternating current wave into a corresponding direct current wave.

SEE OR SEARCH THIS CLASS, SUBCLASS:

104, for a converter of an AC input to corresponding DC at an unloaded output.

SEE OR SEARCH CLASS:

363, Electric Power Conversion Systems, subclasses 13+ for current conversion (including rectification) in a power system which connects a single electrical source to a single electrical load.

**129 Generating sinusoidal output:**

This subclass is indented under subclass 100. Subject matter wherein an input signal wave is modified to or triggers an alternating current sinusoidal wave at the output.

(1) Note. Included here are signals having a cosinusoidal waveform.

SEE OR SEARCH THIS CLASS, SUBCLASS:

32, for a shock excited tuned circuit utilized in pulse width or spacing selection.

104, for miscellaneous converters of an AC signal input to DC voltage output.

105+, for synthesizing of an output waveform.

113+, for systems providing frequency conversion.

306+, for systems wherein the amplitude of an output wave is controlled within specific limits.

596, for miscellaneous circuits including an oscillatory or shock excited portion.

SEE OR SEARCH CLASS:

84, Music, subclasses 600+ for various systems for modifying electric currents or potentials in combination with converting the varying electric currents or potentials into sound waves for the production of musical tones.

128, Surgery, subclasses 419+ for systems wherein the usual 60 Hz commercial alternating current is converted to high frequency AC or pulsating current for application to the human body.

178, Telegraphy, subclasses 66.1+ for systems relating to frequency shift keying of an alternating current signal under the influence of a control pulse.

310, Electrical Generator or Motor Structure, subclass 160 for structural details of a rotary mechanical AC frequency converter and subclass 161 for phase shifter type rotary AC dynamoelectric machines.

315, Electric Lamp and Discharge Devices: Systems, subclasses 378+ and 391+ for systems which deflect a cathode ray by a rotating electric field having conversion of pulse wave energy to alternating wave energy, subclasses 200+ for systems comprising a discharge device or rectifier in the supply circuit of a gaseous tube or tubes where the output may be an alternating circuit wave, subclasses 209+ for systems comprising a periodic switch in the supply circuit of a gaseous tube or tubes where the switch may be pulse controlled with the output an AC wave and subclasses 246+ for systems comprising a pulsating supply for gaseous tubes.

318, Electricity: Motive Power Systems, subclasses 400.1 through 400.42 for synchronous motor commutation control systems.

331, Oscillators, particularly subclasses 37+ for systems comprising the combination of oscillator with production of a beat frequency, subclass 45 for an oscillator with polyphase output, and subclasses 172+ for an oscillator combined with pulse actuated control or synchronization.

332, Modulators, subclasses 117+ or 144+ for devices for modulating the phase or frequency of a carrier wave by an arbitrarily varying control wave.

333, Wave Transmission Lines and Networks, subclass 20 for systems comprising wave shape changing utilizing passive elements.



- 340, Communications: Electrical, appropriate subclasses for signaling or indicating devices responsive to pulse wave input and in which the output may or may not be an alternating current.
- 343, Communications: Radio Wave Antennas, appropriate subclasses for receivers for pulse wave transmitted carrier wave energy.
- 363, Electric Power Conversion Systems, subclasses 13+ for systems involving derectification, subclasses 148+ for systems including phase conversion, and subclass 157 for systems including frequency conversion wherein a single source is connected to a single load.
- 375, Pulse or Digital Communications, subclasses 1 through 58 for pulse responsive systems, subclasses 62+ for systems for transmitting information including frequency shift keying, and subclasses 75+ for pulse responsive receivers.
- 455, Telecommunications, subclasses 313+ for systems whereby an input modulated carrier wave is modified by a wave derived from a local oscillator or other source in such a manner as to obtain an output wave the frequency of which is the sum or difference of the input wave and the modifying wave (i.e., a beat frequency).
- 130 Generating trapezoidal output:**  
This subclass is indented under subclass 100. wherein the output waveform comprises an initial sloped rise from a normal voltage level followed by a steady level which is followed by a sloped return to the normal voltage level and where the sloped portions are mirror images.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
131+, for miscellaneous circuits producing a sawtooth or triangular output.
- 131 Generating sawtooth or triangular output:**  
This subclass is indented under subclass 100. Subject matter wherein a waveform is generated having a positive slope followed immediately by a negative slope.
- (1) Note. The positive slope is generally gradual (e.g., by slowly charging a capacitor, etc.), and the negative slope is generally much more rapid (e.g., by quickly discharging a capacitor).
- (2) Note. The slopes of a sawtooth waveform produced may only approximate a straight line.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
126+, for staircase output generation which may approximate a ramp or sawtooth signal.  
335+, for differentiating networks.  
336+, for integrating networks.
- SEE OR SEARCH CLASS:  
315, Electric Lamp and Discharge Device: Systems, subclasses 364+ for cathode-ray tube beam deflecting systems.  
331, Oscillators, subclasses 20+, 111+, 129+, and 143+ for free running sawtooth wave generators.  
348, Television, particularly subclasses 536+ for television systems which may include sawtooth generating circuits.
- 132 With current source or current mirror:**  
This subclass is indented under subclass 131. Subject matter including a circuit portion which supplies a particular level of electrical current therethrough or a circuit portion having collector current matching in a pair of transistors having their bases and emitters tied together.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
133, for linearization in a sawtooth or triangular wave generator.  
540+, for current source regulating in a stabilized bias circuit.
- SEE OR SEARCH CLASS:  
323, Electricity: Power Supply or Regulation Systems, for generic current regulation.

- 133 With distortion control (e.g., linearization, etc.):**  
This subclass is indented under subclass 131. Subject matter which compensates for or introduces output waveform irregularities.
- (1) Note. Distortion is sometimes introduced to the sawtooth or triangular signal to balance out some anticipated subsequent circuit distortion.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
132, for systems wherein the linearization includes a constant current device.  
165+, for regenerating or restoring a rectangular waveform.  
317, for an amplitude controlled distortion compensation circuit.  
379+, for signal transmission integrity in a circuit providing gating of an unmodified input signal to an output.  
551+, for miscellaneous unwanted signal suppression.
- 134 With slope or duration control:**  
This subclass is indented under subclass 131. Subject matter wherein the inclination or the period of the generated output is regulated.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
13+, for systems for selecting pulses as a function of slope or shape.  
130, for a circuit generating a trapezoidal output.  
170+, for slope control of a leading or trailing edge of a rectangular waveform.
- 135 Having digital element:**  
This subclass is indented under subclass 131. Subject matter including a device performing a logical function.
- (1) Note. An example of a digital element is an AND gate.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, appropriate subclasses for digital logic elements, per se.
- 136 Having particular delay or sync:**  
This subclass is indented under subclass 131. Subject matter including the control of a desired time relationship relative to the output signal.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
141+, for synchronizing, per se.
- 137 Having feedback:**  
This subclass is indented under subclass 131. Subject matter wherein a portion of the output signal is returned to the input.
- 138 Having temperature compensation:**  
This subclass is indented under subclass 131. Subject matter wherein undesired circuit variations due to a thermal condition are minimized.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
513, for miscellaneous temperature compensation circuits.
- 139 Having inductive load:**  
This subclass is indented under subclass 131. Subject matter wherein the output is supplied to a device producing a magnetic field which tends to inhibit any change in current passing therethrough.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
110, for a circuit which enhances current driving capability to an inductive device.
- SEE OR SEARCH CLASS:  
336, Inductor Devices, appropriate subclasses for generic inductive devices.
- 140 With amplitude control:**  
This subclass is indented under subclass 131. Subject matter including the maintenance or modification of output signal magnitude.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
306+, for miscellaneous amplitude control circuits.

## SEE OR SEARCH CLASS:

330, Amplifiers, for amplifier circuits in general.

**141 Synchronizing:**

This subclass is indented under subclass 100. Subject matter wherein a signal is produced which will (a) maintain a predetermined phase or frequency relationship between two sources of waves, one source being an excitation or standard source (sync source) and the other source being changed to achieve the predetermined relationship; (b) provide an initiate or stop operation to a device at a predetermined time; or (c) time (i.e., synchronize) the operation of some electrical circuit or system.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

185+, for circuits having one or more stable states.  
 231+, for a phase shift which is less than the period of an input signal.  
 261+, for a time delay in producing an output waveform.  
 392+, for a delay controlled switch.

## SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 108+ for resistance welding circuits which may contain timing means.  
 315, Electric Lamp and Discharge Devices: Systems, subclass 360 for timing circuits where the discharge device is the ultimate load.  
 318, Electricity: Motive Power Systems, subclasses 62, 141+, 364+, 445, 700+, 725+, and 727+ for motor control circuits containing time delay.  
 324, Electricity: Measuring and Testing, subclasses 160+ for time or speed measuring or determining.  
 326, Electronic Digital Logic Circuitry, subclasses 93+ for logic stage or gate synchronizing or timing.  
 331, Oscillators, subclasses 20+ for synchronized automatic frequency stabilized TV type oscillators, subclass 55 for synchronized plural oscillators, subclass 87 for synchronized magnetron oscillators, subclass 145 for synchronized free running multivibrators, subclass 149 for synchronized free

running blocking oscillators, and subclass 153 for synchronized free running relaxation oscillators in general.  
 348, Television, subclasses 500+ for television synchronizing.  
 358, Facsimile and Static Presentation Processing, subclasses 409 through 424 for facsimile synchronization.  
 375, Pulse or Digital Communications, subclasses 106+ for data communication synchronization.

**142 Reset (e.g., initializing, starting, stopping, etc.):**

This subclass is indented under subclass 141. Subject matter wherein a device provides either an initiate or stop operation at a predetermined interval from a predetermined starting time.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

198, for similar circuits which establish a particular stable state exclusive of synchronization.

## SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclass 94 for prevention of a metastable state in digital logic.

**143 Responsive to power supply:**

This subclass is indented under subclass 142. Subject matter wherein a circuit reacts to the supply of power thereto or the removal of power therefrom.

(1) Note. The change in supplied power may be of any duration.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

50+, for amplitude discriminating, comparing, or selecting without subsequent parameter control.  
 198, for initializing, resetting, or protecting a state of a stable state circuit.  
 545+, for miscellaneous signal protection or bias preservation.

**144 Using multiple clocks:**

This subclass is indented under subclass 141. Subject matter wherein plural square wave signals having precisely regulated amplitude and

frequency are utilized to achieve synchronization.

**145 Having different frequencies:**

This subclass is indented under subclass 144. Subject matter wherein the plural clocks have diverse repetition rates.

**146 With feedback:**

This subclass is indented under subclass 144. Subject matter wherein a portion of the circuit output is returned to an input.

(1) Note. Positive feedback occurs when a portion of an output signal is fed back in phase with the input to increase amplification and possibly cause oscillation.

(2) Note. Negative feedback occurs when a portion of an output signal is fed back 180 degrees out of phase relative to the input. This decreases amplification, stabilizes circuit performance, and minimizes noise and distortion.

SEE OR SEARCH THIS CLASS, SUBCLASS:

155, for feedback synchronization in general.

**147 Phase lock loop:**

This subclass is indented under subclass 146. Subject matter wherein a circuit compares the phase of the output signal with a reference signal and converts any difference into a correction voltage that changes the phase of the output so it matches that of the reference or input signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

155+, for phase lock loop type feedback synchronizing, in general.

**148 With charge pump:**

This subclass is indented under subclass 147. Subject matter wherein a device which pumps elemental positive or negative electrical energy is included.

**149 With variable delay means:**

This subclass is indented under subclass 147. Subject matter wherein means providing a changeable offset in time is included.

SEE OR SEARCH THIS CLASS, SUBCLASS:

231+, for phase shift or control.

261+, for specific delay in producing an output waveform.

**150 With digital element:**

This subclass is indented under subclass 147. Subject matter including a device performing Boolean algebra operations.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, appropriate subclasses for an electronic digital element, per se.

**151 With counter:**

This subclass is indented under subclass 144. Subject matter which includes a device which can total the number of pulses applied thereto.

SEE OR SEARCH CLASS:

377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for pulse counters, per se.

**152 With choice between multiple delayed clocks:**

This subclass is indented under subclass 144. Subject matter wherein a single delayed clock is obtained from plural candidates.

**153 With delay means:**

This subclass is indented under subclass 144. Subject matter including means providing a distinct signal time offset.

SEE OR SEARCH THIS CLASS, SUBCLASS:

231+, for phase shift or control.

261+, for specific delay in producing an output waveform.

**154 With feedforward:**

This subclass is indented under subclass 141. Subject matter wherein a portion of an input signal is advanced essentially unchanged to an output stage of the synchronizing circuit.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
144+, for feedforward type synchronization using multiple clocks.
- 155 With feedback:**  
This subclass is indented under subclass 141. Subject matter wherein a portion of the circuit output is returned to an input.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
146+, for feedback synchronization utilizing multiple clocks.
- 156 Phase lock loop:**  
This subclass is indented under subclass 155. Subject matter wherein a circuit compares the phase of the output signal with a reference signal and converts any difference into a correction voltage that changes the phase of the output so it matches that of the reference or input signal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
147+, for phase lock loop type feedback synchronizing using multiple clocks.
- 157 With charge pump:**  
This subclass is indented under subclass 156. Subject matter wherein a device which pumps elemental positive or negative electrical energy is included.
- 158 With variable delay means:**  
This subclass is indented under subclass 156. Subject matter wherein means providing a changeable offset in time is included.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
231+, for phase shift or control.  
261+, for specific delay in producing an output waveform.
- 159 With digital element:**  
This subclass is indented under subclass 156. Subject matter including a device performing Boolean algebra operations.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, appropriate subclasses for an electronic digital element, per se.
- 160 With counter:**  
This subclass is indented under subclass 141. Subject matter which includes a device which can total the number of pulses applied thereto.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
151, for a counter in a synchronizing circuit using multiple clocks.
- SEE OR SEARCH CLASS:  
377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for pulse counters, per se.
- 161 With delay means:**  
This subclass is indented under subclass 141. Subject matter including means providing a distinct signal time offset.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
231+, for phase shift or control.  
261+, for specific delay in producing an output waveform.
- 162 Having reference source:**  
This subclass is indented under subclass 141. Subject matter wherein a clock is used as a standard.
- 163 By phase:**  
This subclass is indented under subclass 162. Subject matter wherein the reference source controls the clock output of the synchronizing circuit by a fractional part of the period of an input signal periodic function or wave.
- (1) Note. The period of a periodic function or wave is defined as 360 electrical degrees.

- 164 Generating rectangular (e.g., clock, etc.) or pulse waveform having random characteristic (e.g., random width, etc.):**  
This subclass is indented under subclass 100. Subject matter including a probabilistic factor in the generation of a pulsating waveform which is repetitive or intermittent and where an individual pulse has negligible transition times.
- SEE OR SEARCH CLASS:  
331, Oscillators, subclass 78 for a free running random wave or noise generator.
- 165 Regenerating or restoring rectangular (e.g., clock, etc.) or pulse waveform:**  
This subclass is indented under subclass 100. Subject matter wherein a pulse waveform which has undergone attenuation or deformation is modified into an output pulse wave form whose characteristics correspond to an original pulse waveform prior to such attenuation or deformation.
- (1) Note. Usually a feedback or regenerative system is utilized to reshape the distorted pulse wave form.
- SEE OR SEARCH CLASS:  
178, Telegraphy, subclasses 70+ for regenerative repeaters used in telegraphy systems.  
326, Electronic Digital Logic Circuitry, subclass 29 for logic signal sensitivity or transmission integrity pulse shaping.  
330, Amplifiers, subclasses 75+, 290, and 291+ for feedback amplifiers.  
455, Telecommunications, subclasses 7+ for signal repeaters that may regenerate the repeated signal and which are used in radio systems.
- 166 Having digital device (e.g., logic gate, flip-flop, etc.):**  
This subclass is indented under subclass 165. Subject matter wherein a device which operates on binary signals is included.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
185+, for miscellaneous flip-flop circuits.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, appropriate subclasses for logic gates, per se.
- 167 Having network providing particular mathematical function (e.g., integrator, etc.):**  
This subclass is indented under subclass 165. Subject matter including circuitry which in response to a particular input value produces a corresponding output value per a standard mathematical relationship.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
334+, for a circuit providing a mathematical relationship between an input and an output.
- 168 Having inductive device (e.g., transformer, etc.):**  
This subclass is indented under subclass 165. Subject matter including an element which has the property of opposing current flow there-through due to a resultant magnetic field.
- SEE OR SEARCH CLASS:  
336, Inductor Devices, appropriate subclasses for generic inductive devices.
- 169 Having negative resistance device (e.g., tunnel diode, etc.):**  
This subclass is indented under subclass 165. Subject matter which includes a device having the property that, over a portion of its characteristic I-V plot, increasing applied device voltage results in a decrease in device current.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
568+, for miscellaneous negative resistance circuits.
- 170 Slope control of leading or trailing edge of rectangular (e.g., clock, etc.) or pulse waveform:**  
This subclass is indented under subclass 100. Subject matter wherein the rise time or fall time of a pulse is maintained constant or regulated in some manner.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
134, for slope or duration control of a saw-tooth or triangular waveform.
- 171 Output pulses having opposite polarities:**  
This subclass is indented under subclass 100. Subject matter wherein an input pulse wave form consisting of a series of pulses of a single polarity is converted to an output wave form consisting of a plurality of pulses of alternate polarities.
- (1) Note. Such pulses are often referred to as bipolar.
- 172 Rectangular (e.g., clock, etc.) or pulse waveform width control:**  
This subclass is indented under subclass 100. Subject matter including maintaining constant or varying the length of individual pulses in a pulsating waveform which is repetitive or intermittent and wherein an individual pulse has negligible transition times.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
31+, for pulse width discriminating without subsequent control.  
398, for delay controlled switching with predetermined activation time.
- SEE OR SEARCH CLASS:  
332, Modulators, subclasses 109+ for modulation of pulse width by an intelligence signal.  
375, Pulse or Digital Communications, subclass 22 for communication systems using pulse width modulation.
- 173 Pulse narrowing:**  
This subclass is indented under subclass 172. Subject matter wherein the output pulse width or duration is decreased relative to that at the input.
- (1) Note. This is also known as pulse shortening.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
31+, for pulse width discriminating.  
174, for pulse lengthening or stretching.
- 174 Pulse broadening:**  
This subclass is indented under subclass 172. Subject matter wherein the output pulse width or duration is increased relative to that of the input.
- (1) Note. This is also known as pulse stretching.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
31+, for pulse width discriminating.  
173, for pulse shortening or narrowing.
- 175 Duty cycle control:**  
This subclass is indented under subclass 172. Subject matter wherein the ratio of pulse width to pulse separation in a periodic wave is regulated.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
31+, for pulse width or spacing discriminating without subsequent control thereof.
- 176 Having digital device (e.g., logic gate, flip-flop, etc.):**  
This subclass is indented under subclass 172. Subject matter wherein a device which operates on binary signals is included.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
185+, for miscellaneous flip-flop circuits.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, appropriate subclasses for logic gates, per se.
- 177 Having inductive device (e.g., transformer, etc.):**  
This subclass is indented under subclass 172. Subject matter including an element which has the property of opposing current flow there-through due to a resultant magnetic field.
- (1) Note. The inductive element may be distributed or lumped.

- SEE OR SEARCH CLASS:  
336, Inductor Devices, appropriate subclasses for generic inductive devices.
- 178 Rectangular (e.g., clock, etc.) or pulse waveform amplitude control:**  
This subclass is indented under subclass 100. Subject matter wherein the magnitude of an output pulse wave is regulated.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
306+, for systems which regulate the height or amplitude of an input wave, in general.
- 179 Gain:**  
This subclass is indented under subclass 178. Subject matter wherein the ratio of output to input amplitude levels is regulated.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
306+, for miscellaneous amplitude control circuits.
- SEE OR SEARCH CLASS:  
330, Amplifiers, appropriate subclasses for generic amplifying circuits.
- 180 Limiting, clipping, or clamping:**  
This subclass is indented under subclass 178. Subject matter wherein the pulse has particular amplitude level constraints.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
309+, for limiting, clipping, or clamping circuits, in general.
- 181 Electromagnetic pulse forming:**  
This subclass is indented under subclass 100. Subject matter wherein a pulse of energy is produced which has simultaneously varying electric and magnetic fields which are at right angles to each other.
- (1) Note. This includes, for example, the production of pulsed RF or microwaves.
- 182 Delay line or capacitor storage element charged or discharged through or by a relaxation oscillator type circuit to form pulse:**  
This subclass is indented under subclass 100. Subject matter including a distributed parameter wave conveying network or analogous structure or capacitive retention device with a respective charge or discharge path through an oscillator which slowly charges and rapidly discharges an inductor or capacitor through a resistor to form a pulse.
- (1) Note. This subclass will not ordinarily contain subject matter wherein the capacitor constitutes an element of a free running relaxation oscillator circuit (such as provided for in Class 331, Oscillators).
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
183+, for other systems utilizing storage or delay elements.
- SEE OR SEARCH CLASS:  
331, Oscillators, subclasses 143+ for relaxation oscillators, per se.  
333, Wave Transmission Lines and Networks, appropriate subclasses for transmission lines, per se.
- 183 Delay line or capacitor storage element charges or discharges through a tube to form pulse:**  
This subclass is indented under subclass 100. Subject matter including a distributed parameter wave conveying network or analogous structure or capacitive retention device adapted to be charged or discharged through the electron path of an electron space discharge device to form a pulse.
- SEE OR SEARCH CLASS:  
333, Wave Transmission Lines and Networks, appropriate subclasses for transmission lines, per se.
- 184 Rectangular (e.g., clock, etc.) or pulse waveform generating by conversion from input AC (e.g., sine, etc.) wave:**  
This subclass is indented under subclass 100. Subject matter wherein an input signal from which the rectangular or pulse output is derived comprises a signal having both positive and negative portions.



- (1) Note. Typically, the AC signal is a sinusoidal wave.

**185 Particular stable state circuit (e.g., tristable, etc.):**

This subclass is indented under subclass 100. Subject matter comprising a circuit which will remain in a distinct current conductive steady-state condition unless toggled therefrom by a trigger input.

- (1) Note. The condition to which the circuit may be toggled may itself be stable or it may be unstable.
- (2) Note. Detailed flip-flops, per se, generally are contained herein; however, multifunctional or programmable logic having a flip-flop is classified in Class 326, subclasses 37+, and redundant logic having a flip-flop is classified in Class 326, subclass 12.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 365+, for gating of an unmodified input signal to an output.

SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, subclass 12 for redundant logic and flip-flop, subclasses 40 and 46 for programmable logic and flip-flop, and subclasses 59+ for logic circuits having three or more active states.
- 331, Oscillators, appropriate subclasses for free running oscillators (e.g., astable circuits).

**186 Superconductive (e.g., cryogenic, etc.):**

This subclass is indented under subclass 185. Subject matter wherein the circuit incorporates elements which exhibit a marked decrease in electrical resistance (to essentially zero ohms) at a temperature less than or equal to 30 K.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 366+, for superconductive gating or switching.
- 527+, for miscellaneous cryogenic device circuits.

SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, subclasses 1+ for superconductive electronic digital logic circuits.
- 505, Superconductor Technology: Apparatus, Material, Process, for high temperature (i.e., greater than 30 K) superconductive apparatus, materials, or processes.

**187 External effect device (e.g., light, heat, magnetic, or mechanical force sensitive devices, etc.):**

This subclass is indented under subclass 185. Subject matter wherein an ambient force or field provides a toggling stimulus to the stable state circuit.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 369+, for an external effect controlled superconductive gating circuit.
- 509+, for miscellaneous external effect device circuits.

**188 Minority carrier storage effect:**

This subclass is indented under subclass 185. Subject matter which utilizes or varies the concentration of electrons in p-type material or holes in n-type material which accumulate at a pn semiconductor junction.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 579, for miscellaneous circuits utilizing minority carrier storage in a three or more electrode solid-state device.
- 585, for miscellaneous circuits utilizing a minority carrier storage diode.

**189 Storage diode (e.g., step recovery, etc.):**

This subclass is indented under subclass 188. Subject matter including a two-terminal unidirectionally conductive semiconductor device having minority carriers which accumulate at the pn junction when the diode is forward biased and which are suddenly swept away as back biasing increases to a certain point.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 585, for miscellaneous circuits using minority carrier storage diodes.

- 190 With transformer or saturable core device:**  
This subclass is indented under subclass 185. Subject matter including a device whose ratio of input voltage to output voltage is directly proportional to the ratio of primary windings to secondary windings therein or a magnetic core reactor having reactance modified by varying the core saturation through a superimposed unidirectional flux.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
300, for clock or pulse waveform generators utilizing a saturable inductance.
- SEE OR SEARCH CLASS:  
307, Electrical Transmission or Interconnection Systems, subclasses 401+ for nonlinear reactor systems (e.g., saturable) in electrical transmission or interconnection systems.  
336, Inductor Devices, appropriate subclasses for generic inductive devices.
- 191 Blocking oscillator:**  
This subclass is indented under subclass 190. Subject matter wherein the circuit includes transformer coupled feedback in which output current flows for only one half cycle before the oscillation is halted due to blocking of the input and the oscillation is resumed after the input becomes unblocked.
- SEE OR SEARCH CLASS:  
331, Oscillators, subclass 112 for free running solid-state blocking oscillators.
- 192 Negative resistance transistor (e.g., unijunction, etc.):**  
This subclass is indented under subclass 185. Subject matter including a transistor whose characteristic on a current-voltage plot has a portion with a downward slope.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
568, for miscellaneous negative resistance circuits.
- 193 Four or more layer device (e.g., trigistor, etc.):**  
This subclass is indented under subclass 192. Subject matter wherein the transistor contains more than three adjacent regions having differing conductivities.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
582, for miscellaneous four or more layer device circuits.
- 194 Zener or capacitive diode:**  
This subclass is indented under subclass 185. Subject matter including a diode having a threshold voltage above which the applied voltage must rise before the diode junction breaks down allowing the current flow across the junction to suddenly rise or including a voltage responsive two terminal semiconductor device whose capacitance varies as a result of changes in the space charge at a pn junction.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
302, for clock or pulse waveform generating utilizing storage diodes.  
584, for miscellaneous zener diode circuits.  
586, for miscellaneous capacitive diode circuits.
- SEE OR SEARCH CLASS:  
257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 603+ for avalanche diodes, per se.
- 195 Negative resistance diode having "N"-shape characteristic on I-V plot (e.g., tunnel diode, backward diode, etc.):**  
This subclass is indented under subclass 185. Subject matter including a diode whose characteristic on a current versus voltage plot (i.e., with the current plotted on the Y axis and the voltage on the X axis) has an "N"-shape.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
570, for miscellaneous circuits using such diodes.

**196 Negative resistance diode having “S”-shape characteristic on I-V plot (e.g., four or more layer semiconductor device, etc.):**

This subclass is indented under subclass 185. Subject matter including a diode whose characteristic on a current versus voltage plot (i.e., with the current plotted on the Y axis and the voltage on the X axis) has an “S”-shape.

SEE OR SEARCH THIS CLASS, SUBCLASS:

571, for miscellaneous circuits using such diodes.

**197 Convertible circuit (e.g., bistable to monostable, D-type to T-type, etc.):**

This subclass is indented under subclass 185. Subject matter wherein (a) a stable state circuit with an initial number of stable states may be readily modified to one having a different number of stable states or (b) a stable state circuit with a fixed number of stable states can be readily modified between differing input configurations.

**198 Initializing, resetting, or protecting a steady state condition:**

This subclass is indented under subclass 185. Subject matter including the establishment of a starting condition in a stable state circuit, the restoration of a stable circuit to a previous stable-state condition, or the prevention of deterioration of an already established stable-state condition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

91+, for amplitude detection circuits including details of sampling or holding (e.g., capacitive storage element).

142+, for a synchronizing type reset circuit.

315+, for maintaining a predetermined input/output level ratio by limiting, clipping, or clamping.

545, for protection of nonlinear solid-state signal or circuit conditions against power or bias supply loss or perturbations, per se, and see search notes thereunder.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclass 94 for logic metastable state prevention.

**199 Circuit having only two stable states (i.e., bistable):**

This subclass is indented under subclass 185. Subject matter including a circuit with exactly two distinct current-conductive steady-state conditions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

227+, for monostable (single stable state) circuits, per se.

291+, for miscellaneous clock or pulse waveform generating.

365+, for switching of an unmodified input to an output.

**200 Dynamic bistable:**

This subclass is indented under subclass 199. Subject matter wherein a particular stable state is maintained by charge storing elements which must be regularly recharged.

**201 Complementary clock inputs:**

This subclass is indented under subclass 200. Subject matter which includes two inputs for clocks which are inverses of each other.

**202 Master-slave bistable latch:**

This subclass is indented under subclass 199. Subject matter wherein the bistable device includes a controlling circuit section, otherwise known as the “master” stage and a subsequent controlled section, known as the “slave” stage.

SEE OR SEARCH THIS CLASS, SUBCLASS:

216, for cross-coupled JK input bistable circuits in general,

217, for cross-coupled RS input bistable circuits in general.

SEE OR SEARCH CLASS:

377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, subclasses 115+ for counters and dividers including master-slave circuits as transfer means.

**203 Including field-effect transistor:**

This subclass is indented under subclass 202. Subject matter which includes a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type channel and electrons in an n-type channel).
- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

581, for field-effect device circuits, per se.

SEE OR SEARCH CLASS:

257, Active Solid State Devices (e.g., Transistors, Solid-State Diodes), subclasses 213+ for field-effect devices, per se.

**204 Including multi-emitter or multi-collector bipolar transistor:**

This subclass is indented under subclass 202. Subject matter which includes a semiconductor device which has current flowing through both n and p-type material and which has two

or more emitter regions or two or more collector regions.

**205 Using hysteresis (e.g., Schmitt trigger, etc.):**

This subclass is indented under subclass 199. Subject matter wherein the input voltage required to cause a change from a first stable state to a second stable state is distinctly different from that required to cause a subsequent change from the second stable state to the first stable state as a result of feedback.

- (1) Note. Electronic digital logic circuits which may utilize hysteresis for noise margin enhancement are classified with the logic circuits in Class 326.

SEE OR SEARCH THIS CLASS, SUBCLASS:

72+, for analogous circuitry recited as an amplitude comparator wherein an input is compared to a reference derived therefrom.

74+, for an input signal compared to plural fixed references.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuits, subclass 22 for input noise margin enhancement logic circuits which may utilize similar circuits.

**206 Including field-effect transistor:**

This subclass is indented under subclass 205. Subject matter which includes a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type channel and electrons in an n-type channel).
- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on

both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

581, for field-effect device circuits, per se.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 213+ for field-effect devices, per se.

**207 Including diverse solid-state devices (e.g., FET/ bipolar, etc.):**

This subclass is indented under subclass 199. Subject matter wherein plural distinct types of semiconducting elements are utilized.

(1) Note. Types of semiconducting elements include bipolar, FET, SCR, etc.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for diverse solid-state device structure.

**208 Including field-effect transistor:**

This subclass is indented under subclass 199. Subject matter which includes a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

(1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type

channel and electrons in an n-type channel).

(2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

51+, for a sensing amplifier which may utilize an FET bistable circuit.

581, for miscellaneous field-effect device circuits.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 213+ for field-effect devices, per se.

**209 Including enhancement and depletion devices:**

This subclass is indented under subclass 208. Subject matter including (a) an FET device which permits current conduction by attracting majority carriers to a channel by an appropriate applied voltage and (b) an FET device which inhibits current conduction by repelling majority carriers away from a channel by an appropriate applied voltage.

**210 CMOS:**

This subclass is indented under subclass 208. Subject matter wherein the FET is of the complementary metal-oxide-semiconductor type.

- 211 With clock input:**  
This subclass is indented under subclass 210. Subject matter which provides an input for a separate triggering source.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
291+, for miscellaneous circuits which generate a clock or pulse waveform.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 93+ for clocking of logic stages or gates.
- 212 With clock input:**  
This subclass is indented under subclass 208. Subject matter which provides an input for a separate triggering source.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
291+, for miscellaneous circuits which generate a clock or pulse waveform.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 93+ for clocking of logic stages or gates.
- 213 Plural independent clock inputs (i.e., non-complementary):**  
This subclass is indented under subclass 212. Subject matter wherein inputs accepting multiple distinct triggering sources are present.
- (1) Note. Clocks which are merely the inverse of each other are not considered independent.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
291+, for miscellaneous circuits which generate a clock or pulse waveform.
- 214 Complementary transistors:**  
This subclass is indented under subclass 199. Subject matter wherein the circuit includes a transistor of the pnp type and a transistor of the npn type.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
576, for miscellaneous circuits using complementary transistors.
- 215 Having at least two cross-coupling paths:**  
This subclass is indented under subclass 199. Subject matter including two active devices, each capable of assuming a distinct current-conductive stable state, the output of each device being coupled to the input of the other.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
228, for a monostable circuit having cross-coupled paths.
- 216 JK type input:**  
This subclass is indented under subclass 215. Subject matter wherein the multivibrator has a clock input and two additional inputs (the "J" and "K" inputs) which jointly determine the output state of the multivibrator at the application of a clock pulse using the following guidelines: (a) if both "J" and "K" are "HIGH", the multivibrator will change state; (b) if "J" and "K" are both "LOW", the multivibrator will maintain its current state; (c) if "J" = "HIGH" and "K" = "LOW", the multivibrator will go to the "HIGH" state; and (d) if "J" = "LOW" and "K" = "HIGH", the multivibrator will go to the "LOW" state.
- (1) Note. The "HIGH" state can be considered analogous to a logic "1" and the "LOW" state can be considered analogous to a logic "0."
- 217 RS or RST type input:**  
This subclass is indented under subclass 215. Subject matter wherein the multivibrator has two inputs (the "R" and "S") in the RS case and also a third (the "T" input) in the RST case and which inputs determine the output state of the multivibrator according to the following guidelines: (a) if the "S" is "HIGH" then the multivibrator will go to the "HIGH" state; (b) if the "R" is "HIGH", then the multivibrator will go to the "LOW" state; and (c) if there is a "T" input present and it is "HIGH", the multivibrator will change state from its previous value.

- (1) Note. A "HIGH" on both the "R" and the "S" inputs simultaneously is not permitted.
- (2) Note. The "HIGH" state can be considered analogous to a logic "1" and the "LOW" state can be considered analogous to a logic "0."
- 218 D type input:**  
This subclass is indented under subclass 215. Subject matter wherein the multivibrator has a clock input and an additional input (the "D" input) wherein the output state of the multivibrator represents the state of the "D" input just prior to the most recent clock pulse.
- 219 Particular device at input, output, or in cross-coupling path:**  
This subclass is indented under subclass 215. Subject matter including a specific active element at the multivibrator signal insertion point, the signal extraction point, or in the connection path between these two points.
- 220 With diode:**  
This subclass is indented under subclass 219. Subject matter including a conventional two-terminal unidirectionally conductive active element in the input circuit, the output circuit, or a cross coupling path of the multivibrator.
- SEE OR SEARCH CLASS:  
257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for diverse types of diodes, per se.
- 221 Parallel RC network in cross-coupling path:**  
This subclass is indented under subclass 219. Subject matter wherein a shunt-connected resistor and capacitor pair is inserted in one of the mutually interconnected paths.
- 222 Resistor in cross-coupling path:**  
This subclass is indented under subclass 219. Subject matter wherein a device which directly relates voltage to current is inserted in one of the mutually interconnecting paths.
- SEE OR SEARCH CLASS:  
338, Electrical Resistors, appropriate subclasses for details of electrical resistors.
- 223 Plural transistors of same conductivity type:**  
This subclass is indented under subclass 199. Subject matter including multiple solid-state devices which are all of the npn or all of the pnp variety.
- 224 With single semiconductor device:**  
This subclass is indented under subclass 199. Subject matter wherein only one solid-state device is utilized.
- 225 With logic element (e.g., NOR gate, etc.):**  
This subclass is indented under subclass 199. Subject matter wherein a device performing a Boolean algebraic function is included.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, appropriate subclasses for logic gates, per se.
- 226 With single electron tube:**  
This subclass is indented under subclass 199. Subject matter wherein a solitary active device is included which possesses two or more spaced electrodes and in which current flow therebetween comprises elemental negatively charged particles.
- SEE OR SEARCH CLASS:  
313, Electric Lamp and Discharge Devices, appropriate subclasses for electron tube structure, in general.
- 227 Monostable:**  
This subclass is indented under subclass 185. Subject matter wherein the circuit has a single stable state which can be momentarily changed to an unstable state by the application of a triggering signal, but which will revert to the stable state after a predetermined time.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
172+, for a monostable used in pulse waveform width control.  
199+, for two stable state circuits (i.e., bistable).

- 291+, for miscellaneous clock or pulse waveform generating.
- 228 Having cross-coupled paths:**  
This subclass is indented under subclass 227. Subject matter including two circuit stages in which the output of each stage is fed back to the input of the other.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
215+, for a bistable circuit having at least two cross-coupled paths.
- 229 Having differential circuitry:**  
This subclass is indented under subclass 227. Subject matter including circuitry responsive to the offset between two voltages or currents.
- 230 With external feedback (i.e., output to input):**  
This subclass is indented under subclass 227. Subject matter wherein a portion of the output signal is returned to an input terminal.
- 231 Phase shift by less than period of input:**  
This subclass is indented under subclass 100. Subject matter wherein a fraction of the period of an input periodic wave signal (with one period represented as 360 degrees along the time axis) is maintained or shifted.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
2+, for phase angle sensing without subsequent control.  
141+, for time or phase control of one signal to cause synchronization with another signal.  
261+, for specific delay in producing output waveforms.  
392+, for delay controlled switching.
- SEE OR SEARCH CLASS:  
323, Electricity: Power Supply or Regulation Systems, subclasses 212+ for electric power phase shift or control circuits.  
331, Oscillators, subclasses 1+ for automatic frequency stabilization using phase of frequency sensing means and for phase lock loop circuits in oscillator circuits and systems.
- 363, Electric Power Conversion Systems, appropriate subclasses for phase conversion circuits with control or error correction.
- 232 Dependent on frequency:**  
This subclass is indented under subclass 231. Subject matter wherein the phase shift is varied dependent upon the number or recurrences of a periodic input signal in a unit of time.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
39+, for frequency selecting, comparing, or discriminating without subsequent control.
- 233 Correction to specific phase shift:**  
This subclass is indented under subclass 231. Subject matter wherein correction is made to an input signal phase shift to ensure that the output signal has a predetermined phase shift.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
165+, for pulse or rectangular wave regeneration or restoration.  
237+, for variable or adjustable phase shifting, in general.
- 234 Dependent on variable controlled phase shifts:**  
This subclass is indented under subclass 233. Subject matter wherein the desired output phase shift is obtained by applying changeable phase shifts to the input signal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
235, for correction to specific phase shift by applying plural fixed phase shifts to the input signal.  
237+, for variable or adjustable phase shifting in general.
- 235 Dependent on multiple fixed phase shifts:**  
This subclass is indented under subclass 233. Subject matter wherein the desired output phase shift is obtained by applying a plurality of unchanging phase shifts to the input signal.



- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
234, for variable phase shifts applied to an input signal to produce correction to a specific phase shift.
- 236 By phase comparator or detector:**  
This subclass is indented under subclass 233. Subject matter wherein the phase shift change is effected by the output of a circuit that obtains both the magnitude and sign of the phase angle between two input voltages or currents.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
2+, for phase discriminating or detecting without subsequent control.  
244, for a phase comparator or detector in a variable or adjustable feedback circuit to control phase shift.
- 237 Variable or adjustable:**  
This subclass is indented under subclass 231. Subject matter wherein the phase control is (a) continuously changed or (b) modifiable (either automatically or in response to an operator) to various fixed delays.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
270, for output waveform production delay via variable or adjustable multiple outputs to effect a plurality of delay intervals.  
276, for output waveform production delay where a single output has variable or selectable delay.
- 238 Quadrature related (i.e., 90 degrees):**  
This subclass is indented under subclass 237. Subject matter wherein the variable or adjustable phase shift control involves the state or condition of two related periodic functions or two related points separated by a quarter of a cycle or 90 electrical degrees.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
254, for quadrature related phase shift control which is not variable or adjustable.
- SEE OR SEARCH CLASS:  
324, Electricity: Measuring and Testing, subclass 76.78 for quadrature sensing, per se.
- 239 Non-overlapping multiple outputs:**  
This subclass is indented under subclass 237. Subject matter wherein a variable or adjustable phase shift circuit produces plural output clock type waves wherein no two such waves are permitted to be "on" simultaneously.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
22, for pulse noncoincidence discriminating without subsequent control.  
23+, for pulse coincidence discriminating without subsequent control.  
259, for non-overlapping multiple outputs in phase shift circuitry in general.
- 240 Maintaining invariant amplitude:**  
This subclass is indented under subclass 237. Subject matter wherein a variable or adjustable phase control device produces an output signal having an unchanging amplitude relative to the input signal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
231, for unchanging phase shifts with invariant amplitude.
- 241 With counter or shift register:**  
This subclass is indented under subclass 237. Subject matter including (a) a circuit which totals input pulses to produce an output signal each time it receives a predetermined number of input pulses or (b) a circuit which transfers its digital contents along plural storage elements in a chain on the application of an input pulse.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
241+, for variable or adjustable phase shifting using a counter or shift register.  
265, for a counter in an active element or structure wherein output waveform production delay is effected by the rising or falling edge of an input.

- 273, for a counter in an active element or structure of a multiple output, plural delay interval environment.
- 279, for a counter in an active element or structure of a single output environment having a variable or selectable delay.
- 286, for a counter with an active circuit element or structure in output waveform production delay.

**SEE OR SEARCH CLASS:**

- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for counters or shift registers, per se.

**242 Having multiple outputs:**

This subclass is indented under subclass 241. Subject matter wherein more than one output is produced.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 245, for a variable or adjustable phase shift with feedback and multiple outputs.
- 247, for a variable or adjustable phase shift with a differential amplifier and multiple outputs.
- 249, for a variable or adjustable phase shift with an adder and multiple outputs.
- 251, for a variable or adjustable phase shift with an active time delay element and multiple outputs.
- 253, for a variable or adjustable phase shift with a passive time delay element and multiple outputs.
- 257, for multiple outputs wherein there is a 180 degree phase difference between the input and output.
- 258, for a phase control circuit having multiple outputs, in general.

**243 With feedback:**

This subclass is indented under subclass 237. Subject matter wherein a portion of the output signal is returned to an input.

- (1) Note. Positive feedback occurs when a portion of an output signal is fed back in phase with the input to increase amplification and possibly cause oscillation.

- (2) Note. Negative feedback occurs when a portion of an output signal is fed back 180 degrees out of phase relative to the input. This decreases amplification, stabilizes circuit performance, and minimizes noise and distortion.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 154, for feedforward synchronization.
- 155+, for feedback synchronization.

**244 With phase comparator or detector:**

This subclass is indented under subclass 243. Subject matter including a circuit whose output represents both the magnitude and sign of the phase angle between two input voltages or currents.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 2, for phase comparing without subsequent control.
- 236, for a phase comparator or detector used in correcting a specific phase shift.

**245 Having multiple outputs:**

This subclass is indented under subclass 243. Subject matter wherein more than one output is produced.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 242, for a variable or adjustable phase shift with a counter or shift register and multiple outputs.
- 247, for a variable or adjustable phase shift with a differential amplifier and multiple outputs.
- 249, for a variable or adjustable phase shift with an adder and multiple outputs.
- 251, for a variable or adjustable phase shift with an active time delay element and multiple outputs.
- 253, for a variable or adjustable phase shift with a passive time delay element and multiple outputs.
- 257, for multiple outputs where there is a 180 degree phase difference between the input and output.
- 258, for a phase control circuit having multiple outputs, in general.

**246 With differential amplifier:**

This subclass is indented under subclass 237. Subject matter wherein a circuit amplifies only the differences between two input signal voltages or currents and suppresses voltages or currents appearing simultaneously on both inputs.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 266, for a differential amplifier in an active circuit element or structure to effect output waveform production delay via the rising or falling edge of a pulse signal.
- 274, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of multiple outputs with a plurality of delay intervals.
- 280, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of a single output with variable or selectable delay.
- 287, for a differential amplifier in an active circuit element or structure to effect output waveform production delay.

**247 Having multiple outputs:**

This subclass is indented under subclass 246. Subject matter wherein more than one output is produced.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 242, for a variable or adjustable phase shift with a counter or shift register and multiple outputs.
- 245, for a variable or adjustable phase shift with feedback and multiple outputs.
- 249, for a variable or adjustable phase shift with an adder and multiple outputs.
- 251, for a variable or adjustable phase shift with an active time delay element and multiple outputs.
- 253, for a variable or adjustable phase shift with a passive time delay element and multiple outputs.
- 257, for multiple outputs where there is a 180 degree phase difference between the input and output.
- 258, for a phase control circuit having multiple outputs, in general.

**248 With adder:**

This subclass is indented under subclass 237. Subject matter wherein a variable or adjustable device includes a circuit which produces the sum of two or more quantities impressed on it.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 361, for algebraic summing circuits.

SEE OR SEARCH CLASS:

- 708, Electrical Computers: Arithmetic Processing and Calculating, subclass subclasses 670+ for a digital computer providing addition or subtraction.

**249 Having multiple outputs:**

This subclass is indented under subclass 248. Subject matter wherein more than one output is produced.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 242, for a variable or adjustable phase shift with a counter or shift register and multiple outputs.
- 245, for a variable or adjustable phase shift with feedback and multiple outputs.
- 247, for a variable or adjustable phase shift with a differential amplifier and multiple outputs.
- 251, for a variable or adjustable phase shift with an active time delay element and multiple outputs.
- 253, for a variable or adjustable phase shift with a passive time delay element and multiple outputs.
- 257, for multiple outputs where there is a 180 degree phase difference between the input and output.
- 258, for a phase control circuit having multiple outputs, in general.

**250 With active time delay element:**

This subclass is indented under subclass 237. Subject matter wherein the time required for a signal to travel between two points in a circuit is controlled by an element which requires an external power supply other than the main input signal for its operation.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

252, for a variable or adjustable phase shift with a passive time delay element.

**251 Having multiple outputs:**

This subclass is indented under subclass 250. Subject matter wherein more than one output is produced.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

242, for a variable or adjustable phase shift with a counter or shift register and multiple outputs.

245, for a variable or adjustable phase shift with feedback and multiple outputs.

247, for a variable or adjustable phase shift with a differential amplifier and multiple outputs.

249, for a variable or adjustable phase shift with an adder and multiple outputs.

253, for a variable or adjustable phase shift with a passive time delay element and multiple outputs.

257, for multiple outputs where there is a 180 degree phase difference between the input and output.

258, for a phase control circuit having multiple outputs, in general.

**252 With passive time delay element:**

This subclass is indented under subclass 237. Subject matter wherein the time required for a signal to travel between two points in a circuit is controlled by an element powered only by an input signal, without any bias voltage.

(1) Note. A passive element (such as a capacitor, resistor, or inductor), does not add any amplification or gain (i.e., it presents some loss to the system).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

250, for a variable or adjustable phase shift with an active time delay element.

**253 Having multiple outputs:**

This subclass is indented under subclass 252. Subject matter wherein more than one output is produced.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

242, for a variable or adjustable phase shift with a counter or shift register and multiple outputs.

245, for a variable or adjustable phase shift with feedback and multiple outputs.

247, for a variable or adjustable phase shift with a differential amplifier and multiple outputs.

249, for a variable or adjustable phase shift with an adder and multiple outputs.

251, for a variable or adjustable phase shift with an active time delay element and multiple outputs.

257, for multiple outputs where there is a 180 degree phase difference between the input and output.

258, for a phase control circuit having multiple outputs, in general.

**254 Quadrature related (i.e., 90 degrees):**

This subclass is indented under subclass 231. Subject matter wherein the phase shift control includes the state or condition of two related periodic functions or two related points separated by a quarter of a cycle or 90 electrical degrees.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

238, for quadrature related phase shift control which is variable or adjustable.

255, for a phase shift control circuit where the output is in quadrature with respect to the input.

SEE OR SEARCH CLASS:

324, Electricity: Measuring and Testing, subclass 76.78 for quadrature sensing, per se.

**255 90 degrees between input and output:**

This subclass is indented under subclass 254. Subject matter wherein the phase relationship between an output signal and an input signal is separated by a quarter of a cycle or 90 electrical degrees.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

238, for quadrature related variable or adjustable phase shift control.

## SEE OR SEARCH CLASS:

324, Electricity: Measuring and Testing, subclass 76.78 for quadrature sensing, per se.

**256 Phase inversion (i.e., 180 degrees between input and output):**

This subclass is indented under subclass 231. Subject matter wherein the phase relationship between the input and output signal is separated by a half of a cycle or 180 electrical degrees.

## SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclasses 104+ for logical inverters.

**257 Multiple outputs:**

This subclass is indented under subclass 256. Subject matter wherein more than one output is produced.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

242, for a variable or adjustable phase shift with a counter or shift register and multiple outputs.  
 245, for a variable or adjustable phase shift with feedback and multiple outputs.  
 247, for a variable or adjustable phase shift with a differential amplifier and multiple outputs.  
 249, for a variable or adjustable phase shift with an adder and multiple outputs.  
 251, for a variable or adjustable phase shift with an active time delay element and multiple outputs.  
 253, for a variable or adjustable phase shift with a passive time delay element and multiple outputs.  
 258, for a phase control circuit having multiple outputs, in general.

**258 Multiple outputs:**

This subclass is indented under subclass 231. Subject matter wherein more than one output is produced.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

242, for a variable or adjustable phase shift with a counter or shift register and multiple outputs.

245, for a variable or adjustable phase shift with feedback and multiple outputs.

247, for a variable or adjustable phase shift with a differential amplifier and multiple outputs.

249, for a variable or adjustable phase shift with an adder and multiple outputs.

251, for a variable or adjustable phase shift with an active time delay element and multiple outputs.

253, for a variable or adjustable phase shift with a passive time delay element and multiple outputs.

257, for multiple outputs where there is a 180 degree phase difference between the input and output.

**259 Non-overlapping:**

This subclass is indented under subclass 258. Subject matter wherein a phase shift circuit produces plural output clock type waves where no two such waves are permitted to be "on" simultaneously.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

22, for pulse noncoincidence discriminating without subsequent control.  
 23+, for pulse coincidence discriminating without subsequent control.  
 239, for non-overlapping multiple outputs in a variable or adjustable phase shift control circuit.

**260 Producing AC power control:**

This subclass is indented under subclass 231. Subject matter wherein an output alternating current signal is controlled either by a phase shift or by suppressing output dependent upon some phase.

(1) Note. A flow of electricity which reaches a maximum in one direction, decreases to zero, then reverses itself and reaches a maximum in the opposite direction and this cycle is continuously repeated is alternating current.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

306+, for amplitude control.  
 365+, for switching or gating of an AC signal.

530+, for miscellaneous circuits with specific source of supply or bias voltage.

**SEE OR SEARCH CLASS:**

323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for power supply regulation of a single source coupled to a single load.

**261 Having specific delay in producing output waveform:**

This subclass is indented under subclass 100. Subject matter wherein an output signal is obtained at a predetermined time interval subsequent to the application of an input or control or initiating signal to a system.

(1) Note. Delay controlled switching is classified below with gating circuits.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

141+, for time or phase control of one signal to cause synchronization with another signal.

231+, for a signal phase shift which is less than the input signal period.

336+, for the integration of an input signal.

392+, for a delay controlled switch.

**262 Including significant compensation (e.g., temperature compensated delay, etc.):**

This subclass is indented under subclass 261. Subject matter wherein undesired changes in circuit operation due to, for example, temperature changes, component structural differences, or power supply fluctuations are offset.

(1) Note. Regulating systems for controlling a load as well as compensating circuits for protecting systems and semiconductor structures against failure are found in Class 323.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

509+, for miscellaneous external effect circuits.

538, for miscellaneous supply or bias circuits with significant compensation or stabilization.

**SEE OR SEARCH CLASS:**

323, Electricity: Power Supply or Regulation Systems, subclasses 220+, 234+, 299+, 304+, and 318+ for load controlled or regulated systems.

326, Electronic Digital Logic Circuitry, subclass 14 for logic circuits which maintain a fail-safe condition against circuit breakdown and subclasses 21+ for signal sensitivity or transmission integrity in logic circuitry.

**263 Delay interval set by rising or falling edge:**

This subclass is indented under subclass 261. Subject matter wherein the delay time is determined by either (a) the interval between the occurrence of leading or trailing edges of a pulse signal or (b) the amount of time for the leading or trailing edge of a pulse waveform to rise or fall to a particular value.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

2+, for phase characteristic selecting and particularly subclasses 3+ for phase angle sensing (e.g., lead/lag discriminators).

172+, for controlling the duration of pulse signals (e.g., pulse stretching) in pulse generators.

**SEE OR SEARCH CLASS:**

318, Electricity: Motive Power Systems, subclass 62 for motor speed control with time delay; subclasses 141+ for generator-fed motor systems controlled by time delay; subclasses 283+ for time delay for motor-reversing; and subclasses 445+ for time delay control, per se, (e.g., automatic starting/stopping).

388, Electricity: Motor Control Systems, cross-reference art collection 921 for running-speed control systems including a time delay.

**264 Having specific active circuit element or structure (e.g., FET, complementary transistors, etc.):**

This subclass is indented under subclass 263. Subject matter including a particular circuit element or structure requiring an external power supply other than the main input signal

for its operation and which produces some dynamic function change (e.g., amplification) of the applied input electrical signal basic characteristic.

- (1) Note. Examples of active circuit elements are transistors, tunnel diodes, or SCR's.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 268, for a passive circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 272, for an active circuit element or structure in output waveform production delay with multiple outputs with a plurality of delay intervals.
- 278, for an active circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 283, for a passive circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 285, for an active circuit element or structure for output waveform production delay.
- 290, for a passive circuit element or structure in output waveform production delay.

**265 With counter:**

This subclass is indented under subclass 264. Subject matter wherein a circuit is included which totals input pulses to produce an output signal each time it receives a predetermined number of input pulses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 241, for a variable or adjustable phase shift using a counter or shift register.
- 273, for a counter in an active element or structure of a multiple output, plural delay environment.
- 279, for a counter in an active element or structure of a single output environment having a variable or selectable delay.

- 286, for a counter with an active circuit element or structure in output waveform production delay.

SEE OR SEARCH CLASS:

- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for counters, per se.

**266 Differential amplifier:**

This subclass is indented under subclass 264. Subject matter wherein a circuit amplifies only the differences between two input signal voltages or currents and suppresses voltages or currents appearing simultaneously on both inputs.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 246+, for variable or adjustable phase shift control using a differential amplifier.
- 274, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of multiple outputs with a plurality of delay intervals.
- 280, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of a single output with variable or selectable delay.
- 287, for a differential amplifier in an active circuit element or structure to effect output waveform production delay.

**267 Electron tube:**

This subclass is indented under subclass 264. Subject matter including a gas filled or partially or fully evacuated (vacuum) device which regulates current flow between spaced electrodes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 275, for circuits using an electron tube within an active circuit element or structure having multiple outputs with a plurality of delay intervals.
- 282, for time interval control using an electron tube within an active circuit element or structure having a single output with variable or selectable delay.

289, for circuits using an electron tube in a specific active circuit element or structure providing output waveform production delay.

**268 Having passive circuit element or structure (e.g., RLC circuit, etc.):**

This subclass is indented under subclass 263. Subject matter wherein a circuit element or structure is powered only by an input signal without any bias voltage and produces a desired modification of the input signal without adding any amplification or gain (i.e., it presents some loss to a system).

(1) Note. Examples of passive devices are capacitors, resistors, and inductors.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

264, for an active circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.

272, for an active circuit element or structure in output waveform production delay with multiple outputs with a plurality of delay intervals.

278, for an active circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.

283, for a passive circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.

285, for an active circuit element or structure for output waveform production delay.

290, for a passive circuit element or structure in output waveform production delay.

**269 Multiple outputs with plurality of delay intervals:**

This subclass is indented under subclass 261. Subject matter including plural outputs each having its own amount of delay.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

401, for time-delay circuits for controlling a switching or powering operation having plural switching elements.

403, for gating of plural parallel controlled signal paths.

**270 Variable or adjustable:**

This subclass is indented under subclass 269. Subject matter wherein the multiple delay intervals are either (a) continuously changing or (b) changeable, automatically or in response to an operator.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

237, for variable or adjustable phase shift control.

276, for output waveform production delay where a single output has variable or adjustable delay.

**271 Including delay line or charge transfer device:**

This subclass is indented under subclass 269. Subject matter wherein at least one time interval is derived from the time of propagation of a signal through a transmission line type means (e.g., shift register, cascade-connected nonlinear amplifier stages, charge transfer element, etc.).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

277, for a delay line type structure within a single output circuit having variable or selectable delay intervals.

284, for a delay line structure or charge transfer device which is utilized in output waveform production delay.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclass 61 for logic circuits using an insulated gate charge transfer device.

**272 Having specific active circuit element or structure (e.g., FET, complementary transistors, etc.):**

This subclass is indented under subclass 269. Subject matter including a particular circuit element or structure requiring an external



power supply other than the main input signal for its operation and which produces some dynamic function change (e.g., amplification) of the applied input electrical signal basic characteristic.

- (1) Note. Examples of active circuit elements are transistors, tunnel diodes, SCRs, or ICs.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 264, for an active circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 268, for a passive circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 278, for an active circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 283, for a passive circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 285, for an active circuit element or structure for output waveform production delay.
- 290, for a passive circuit element or structure in output waveform production delay.

### 273 **With counter:**

This subclass is indented under subclass 272. Subject matter wherein a circuit is included which totals input pulses to produce an output signal each time it receives a predetermined number of input pulses.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 241, for a variable or adjustable phase shift using a counter or shift register.
- 265, for a counter in an active element or structure wherein output waveform production delay is effected by the rising or falling edge of an input.
- 279, for a counter in an active element or structure of a single output environ-

ment having a variable or selectable delay.

- 286, for a counter with an active circuit element or structure in output waveform production delay.

SEE OR SEARCH CLASS:

- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for counters, per se.

### 274 **Differential amplifier:**

This subclass is indented under subclass 272. Subject matter including a circuit which amplifies only the differences between two input signal voltages or currents and suppresses voltages or currents appearing simultaneously on both inputs.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 246+, for variable or adjustable phase shift control using a differential amplifier.
- 266, for a differential amplifier in an active circuit element or structure to effect output waveform production delay via the rising or falling edge of a pulse signal.
- 280, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of a single output with variable or selectable delay.
- 287, for a differential amplifier in an active circuit element or structure to effect output waveform production delay.

### 275 **Electron tube:**

This subclass is indented under subclass 272. Subject matter including a gas filled or partially or fully evacuated (vacuum) device which regulates current flow between spaced electrodes.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 267, for the use of an electron tube within an active circuit element or structure to control the output waveform production delay via the rising or falling edge of an input pulse.
- 282, for output waveform production delay using an electron tube within an active

circuit element or structure having a single output with variable or selectable delay.

**276 Single output with variable or selectable delay:**

This subclass is indented under subclass 261. Subject matter including one output where the delay time is adjustable or may be chosen from multiple possibilities.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

237, for variable or adjustable phase shift control.

270, for multiple outputs which have a plurality of variable or adjustable delay intervals.

**277 Including delay line or charge transfer device:**

This subclass is indented under subclass 276. Subject matter wherein the delay interval is derived from the time of propagation of a signal through a transmission line type means (e.g., shift register, cascade-connected non-linear amplifier stages, charge transfer element, etc.).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

271, for a delay line type structure within an output waveform production delay circuit having multiple outputs and a plurality of delay intervals.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclass 61 for logic circuits using an insulated gate charge transfer device.

**278 Having specific active circuit element or structure (e.g., complementary transistors, etc.):**

This subclass is indented under subclass 276. Subject matter including a particular circuit element or structure requiring an external power supply other than the main input signal for its operation and which produces some dynamic function change (e.g., amplification) of the applied input electrical signal basic characteristic.

(1) Note. Examples of active circuit elements are transistors, tunnel diodes, SCRs, or ICs.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

264, for an active circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.

268, for a passive circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.

272, for an active circuit element or structure in output waveform production delay with multiple outputs with a plurality of delay intervals.

283, for a passive circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.

285, for an active circuit element or structure for output waveform production delay.

290, for a passive circuit element or structure in output waveform production delay.

**279 With counter:**

This subclass is indented under subclass 278. Subject matter wherein a circuit is included which totals input pulses to produce an output signal each time it receives a predetermined number of input pulses.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

241, for a variable or adjustable phase shift using a counter or shift register.

265, for a counter in an active element or structure wherein output waveform production delay is effected by the rising or falling edge of an input.

273, for a counter in an active element or structure of a multiple output, plural delay interval environment.

286, for a counter with an active circuit element or structure in output waveform production delay.

**SEE OR SEARCH CLASS:**

377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for counters, per se.

**280 Differential amplifier:**

This subclass is indented under subclass 278. Subject matter including a circuit which amplifies only the differences between two input signal voltages or currents and suppresses voltages or currents appearing simultaneously on both inputs.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

246+, for variable or adjustable phase shift control using differential amplifier.

266, for a differential amplifier in an active circuit element or structure to effect output waveform production delay via the rising or falling edge of a pulse signal.

274, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of multiple outputs with a plurality of delay intervals.

287, for a differential amplifier in an active circuit element or structure to effect output waveform production delay.

**SEE OR SEARCH CLASS:**

330, Amplifiers, for electrical amplifiers, in general.

**281 Field-effect transistor:**

This subclass is indented under subclass 278. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

(1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).

(2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**282 Electron tube:**

This subclass is indented under subclass 278. Subject matter including a gas filled, or partially or fully evacuated (vacuum) device which regulates current flow between spaced electrodes.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

267, for the use of an electron tube within an active circuit element or structure to control the output waveform production delay via the rising or falling edge of the input pulse.

275, for output waveform production delay using an electron tube within an active circuit element or structure having multiple outputs with a plurality of delay intervals.

**283 Having specific passive circuit element or structure (e.g., RLC circuit, etc.):**

This subclass is indented under subclass 276. Subject matter wherein a circuit element or structure is powered only by an input signal, without any bias voltage and produces a desired modification on the input signal without adding any amplification or gain (i.e., it presents some loss to a system).

(1) Note. Examples of passive devices are capacitors, resistors, and inductors.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 264, for an active circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 268, for a passive circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 272, for an active circuit element or structure in output waveform production delay with multiple outputs with a plurality of delay intervals.
- 278, for an active circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 285, for an active circuit element or structure for output waveform production delay.
- 290, for a passive circuit element or structure in output waveform production delay.

**284 Including delay line or charge transfer device:**

This subclass is indented under subclass 261. Subject matter wherein the time interval is derived from the time of propagation of a signal through a transmission line type means (e.g., shift register, cascade-connected non-linear amplifier stages, charge transfer element, etc.).

- (1) Note. Passive delay lines are included in this subclass.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 182, and 183, for pulse generators utilizing passive delay lines.

SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, subclass 61 for logic circuits using an insulated gate charge transfer device and subclasses 93+ for logic function circuits including one or more stages clocked synchronously for transmitting signals.

- 333, Wave Transmission Lines and Networks, subclasses 138+ for passive delay networks, per se.
- 365, Static Information Storage and Retrieval, subclass 76 for recirculating storage systems including delay lines.
- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, subclasses 64+ for shift registers, in general.

**285 Having specific active circuit element or structure (e.g., complementary transistors, etc.):**

This subclass is indented under subclass 261. Subject matter including a particular circuit element or structure requiring an external power supply other than the main input signal for its operation and which produces some dynamic function change (e.g., amplification) of the applied input electrical signal basic characteristic.

- (1) Note. Examples of active circuit elements are transistors, tunnel diodes, or SCR's.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 264, for an active circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 272, for an active circuit element or structure in output waveform production delay with multiple outputs with a plurality of delay intervals.
- 268, for a passive circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 278, for an active circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 283, for a passive circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.

290, for a passive circuit element or structure in output waveform production delay.

**286 With counter:**

This subclass is indented under subclass 285. Subject matter wherein a circuit is included which totals input pulses to produce an output signal each time it receives a predetermined number of input pulses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

241, for a variable or adjustable phase shift using a counter or shift register.

265, for a counter in an active element or structure wherein output waveform production delay is effected by the rising or falling edge of an input signal.

273, for a counter in an active element or structure of a multiple output, plural delay environment.

279, for a counter in an active element or structure of a single output environment having a variable or selectable delay.

SEE OR SEARCH CLASS:

377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, appropriate subclasses for counters, per se.

**287 Differential amplifier:**

This subclass is indented under subclass 285. Subject matter including a circuit which amplifies only the differences between two input voltages or currents and suppresses voltages or currents appearing simultaneously on both inputs.

SEE OR SEARCH THIS CLASS, SUBCLASS:

246+, for variable or adjustable phase shift control using a differential amplifier.

266, for a differential amplifier in an active circuit element or structure to effect output waveform production delay via the rising or falling edge of a pulse signal.

274, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of

multiple outputs with a plurality of delay intervals.

280, for a differential amplifier in an active circuit element or structure to effect output waveform production delay of a single output with variable or selectable delay.

**288 Field-effect transistor:**

This subclass is indented under subclass 285. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

(1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).

(2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**289 Electron tube:**

This subclass is indented under subclass 285. Subject matter including a gas filled or partially or fully evacuated (vacuum) device which regulates current flow between spaced electrodes.

## SEE OR SEARCH CLASS:

333, Wave Transmission Lines and Networks, subclasses 138+ for passive delay networks.

**290 Having specific passive circuit element or structure (e.g., RLC circuit, etc.):**

This subclass is indented under subclass 261. Subject matter wherein a circuit element or structure is powered only by an input signal, without any bias voltage, and produces a desired modification on the input signal without adding any amplification or gain (i.e., it presents some loss to a system).

- (1) Note. Examples of passive devices are capacitors, resistors, and inductors.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 264, for an active circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 268, for a passive circuit element or structure in output waveform production delay wherein the delay interval is set by the rising or falling of an input pulse.
- 272, for an active circuit element or structure in output waveform production delay with multiple outputs with a plurality of delay intervals.
- 278, for an active circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 283, for a passive circuit element or structure in output waveform production delay with a single output with a variable or selectable delay.
- 285, for an active circuit element or structure for output waveform production delay.

**291 Clock or pulse waveform generating:**

This subclass is indented under subclass 100. Subject matter wherein an output waveshape is produced which exhibits two distinct amplitude levels and where the transition therebetween is rapid.

- (1) Note. The systems contained in this subclass and the indented subclasses are very similar to those found in Class 331, Oscillators; the distinction being that the systems in Class 331 are self sustaining or free running while those in this class are not capable of self-sustained continuous operation.
- (2) Note. Bias circuits of the pulsing type which establish device operating points are classified with the bias circuits.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 104, for systems which convert AC to corresponding DC at an unloaded output.
- 185+, for stable state circuits (e.g., mono stable or bistable) which may provide a pulse.
- 309+, for systems wherein the output represents the input waveform with the peaks thereof clipped or limited between certain levels.
- 336+, for integrating networks.
- 544, for circuits with power conservation or pulse type source of supply or bias.
- 554, for a switched capacitor filter having an input which accepts a clock signal.

## SEE OR SEARCH CLASS:

- 128, Surgery, subclasses 419+ for systems wherein an alternating current is converted to pulses of energy for application to the human body.
- 178, Telegraphy, appropriate subclasses for pulse producing systems wherein the pulses are representative of a telegraph code, particularly subclasses 17+ for such systems where a perforated tape or other automatic device controls the production of the pulses, subclasses 2+ for systems where a keyboard is used to produce the pulses.
- 307, Electrical Transmission or Interconnection Systems, subclasses 106+ for class appropriate waveform or wave shape determinative or pulse producing systems and subclasses 401+ for nonlinear reactor systems.

- 315, Electric Lamp and Discharge Devices: Systems, subclasses 137+ for polyphase AC supply and subclasses 246+ for gaseous tube systems with pulsating or AC supply.
- 324, Electricity: Measuring and Testing, subclass 119 for measuring systems involving rectification.
- 331, Oscillators, appropriate subclasses, for self-sustained generators, particularly subclasses 20+ for TV oscillators with automatic frequency stabilization, subclass 61 for oscillators with plural outputs of diverse waveforms, subclass 75 for oscillators combined with wave shaping networks in the output circuit, subclass 87 for magnetron type oscillators with pulse forming means in the control circuit thereof, subclasses 143+ for pulse forming networks of the relaxation oscillators type, subclasses 165+ for shock excited resonant circuit with pulse type keying, and subclasses 172+ for synchronizing, triggering, or pulsing circuits for oscillators.
- 332, Modulators, subclasses 106+ for pulse modulators where the nature of the pulses is varied in an arbitrary manner.
- 333, Wave Transmission Lines and Networks, subclass 20 for wave shaping systems utilizing a passive element.
- 340, Communications: Electrical, appropriate subclasses, particularly subclasses 825.57+, for pulse responsive selective systems; subclasses 870.19+ for pulse modulation telemetering systems; and subclasses 287+ for electric signaling system with transmission of a train of pulse signals.
- 341, Code Data Generation or Conversion, subclasses 20+ and 173+ for a pulse code transmitter, and subclasses 50+ for digital to digital code converters.
- 342, Communications, Directive Radio Wave Systems and Devices (e.g., Radar, Radio Navigation), appropriate subclasses for pulse reflected wave systems, particularly subclasses 118+ and 147+ for radar type systems involving pulse generating for determining distance or direction.
- 361, Electricity: Electrical Systems and Devices, subclasses 182+ for single and plural relays which are frequency responsive, subclass 185 for phase responsive relays, and subclass 186 for pulse responsive relays.
- 363, Electric Power Conversion Systems, subclasses 13+ for current conversion (i.e., rectification or derectification) systems.
- 370, Multiplex Communications, subclasses 205, 212, and 213 for transmitting different messages involving pulse modulation.
- 375, Pulse or Digital Communications, subclass 37 for miscellaneous telegraph systems using pulsating currents and subclasses 59+ for transmitters with pulse production.
- 378, X-Ray or Gamma Ray Systems or Devices, subclass 104 for X-ray electrical systems utilizing rectifying means with AC or pulsating supply.
- 379, Telephonic Communication, appropriate subclasses for telephone pulse producing systems.
- 292 Clock fault compensation or redundant clocks:**  
This subclass is indented under subclass 291. Subject matter wherein clock accuracy is ensured by correcting for anticipated or actual clock errors.
- (1) Note. This may be achieved by providing multiple clocks which can, if necessary, be substituted for a defective clock.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
526, for miscellaneous redundant circuits.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 10+ for redundant logic circuitry.
- 293 With plural paths in network:**  
This subclass is indented under subclass 291. Subject matter including multiple channels between a signal input terminal and one or more output terminals.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
38, 69+, 293, 407+, and 415+, for other systems with plural paths or channels therein.
- 294 With common output:**  
This subclass is indented under subclass 293. Subject matter wherein the output of each of the plural paths or channels is fed to a common final output point.
- SEE OR SEARCH CLASS:  
370, Multiplex Communications, appropriate subclasses for similar subject matter used with multiplexing.
- 295 Plural outputs:**  
This subclass is indented under subclass 291. Subject matter wherein multiple separate output waveforms are produced and appear at respective output terminals.
- (1) Note. The separate outputs may be of similar or diverse wave shape or sign.
- 296 Plural clock outputs with multiple inputs:**  
This subclass is indented under subclass 295. Subject matter wherein multiple clock waveforms are derived at circuit outputs from plural clock inputs.
- 297 Clock bus:**  
This subclass is indented under subclass 295. Subject matter wherein the clock is applied to a distribution network which distributes a plural series of precisely timed, repetitive voltage pulses to plural devices.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
293+, for clock generators having plural paths.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclass 86 for bus current driving in a logic circuit.
- 298 Single clock output with multiple inputs:**  
This subclass is indented under subclass 291. Subject matter wherein plural inputs are utilized to produce the single clock output.
- 299 Single clock output with single clock or data input:**  
This subclass is indented under subclass 291. Subject matter wherein one series of precisely timed, repetitive voltage pulses of fixed frequency and amplitude or a signal containing information is the sole input for creating a single clock output.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
295+, for plural output clock generating.
- 300 With saturable inductance:**  
This subclass is indented under subclass 291. Subject matter including a magnetic core reactor having reactance modified by varying the core saturation through a superimposed unidirectional flux.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
181, for pulse generating systems comprising electromagnetic pulse forming.
- SEE OR SEARCH CLASS:  
307, Electrical Transmission or Interconnection Systems, subclasses 401+ for nonlinear reactor, (e.g., inductor) systems, in general.  
330, Amplifiers, subclass 8 for magnetic amplifiers involving saturable core devices.  
336, Inductor Devices, appropriate subclasses for structural details of induction devices and particularly subclasses 155+ for saturable type inductors.
- 301 With electron beam type tube:**  
This subclass is indented under subclass 291. Subject matter including at least one electron space discharge device whose performance depends upon the formation and control of one or more rays of elemental negatively charged particles.
- 302 With storage diode:**  
This subclass is indented under subclass 291. Subject matter which incorporates a two-terminal semiconductive device having minority carriers which accumulate at a pn junction when the diode is forward biased and which are



suddenly swept away after back biasing increases to a certain point.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

194, for stable state circuits utilizing capacitive diodes.

586, for capacitive diode circuits, in general.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 595+ for voltage variable capacitance diodes, per se.

### 303 With rectifier:

This subclass is indented under subclass 291. Subject matter including a device transforming an AC signal to a corresponding DC signal by a device permitting only unidirectional current flow.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

28+, for systems for determining or selecting desired pulses from a group of pulses by polarity and in which a rectifier may be utilized.

104, for systems for converting from an AC input to a corresponding DC voltage at an unloaded output and see the search notes thereunder.

336, for integrating networks in which a rectifier may be utilized.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 107 for pulse producing systems of the passive type and utilizing rectification or derectification.

315, Electric Lamp and Discharge Devices: Systems, subclasses 200+ for discharge devices or rectifiers in the supply circuit for gaseous tubes and subclass 272 for pulsating or AC supply systems for gaseous tubes and including a rectifier in the control circuit.

### 304 With inductive device (e.g., transformer, etc.):

This subclass is indented under subclass 291. Subject matter which includes an element which has the property of opposing current flow therethrough due to a resultant magnetic field.

SEE OR SEARCH CLASS:

336, Inductor Devices, appropriate subclasses for generic inductive devices.

### 305 With gas tube:

This subclass is indented under subclass 291. Subject matter which incorporates an electron discharge device where a small amount of gas is ionized to permit current flow.

### 306 Amplitude control:

This subclass is indented under subclass 100. Subject matter wherein the amplitude of an input signal waveform is modified, maintained, or regulated to produce the desired output signal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

50+, for voltage signal amplitude comparison (e.g., amplitude responsive pulse selecting systems).

90, for systems wherein the output is a function of the amplitude difference of two points on a wave.

178, for amplitude control systems of a pulse or rectangular wave output.

335, for differentiating networks.

336+, for integrating networks.

356+, for the recited algebraic product of two input signals which may be analogous to gain control circuits.

551+, for unwanted signal suppression and particularly subclasses 552+ for such signal suppression provided by an active filter.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 234+ for a power supply which is output level responsive.

330, Amplifiers, subclasses 96, 123, 127+, and 278+ for automatic signal level

- control or for amplitude limiting of amplifier power supplies.
- 331, Oscillators, subclasses 182+ for amplitude control of oscillator output.
- 332, Modulators, subclasses 149+ for amplitude modulation systems.
- 333, Wave Transmission Lines and Networks, subclass 14 for amplitude compression and expansion systems (i.e., companders) and subclasses 15, 16, 17.1+, and 81+ for passive element attenuator systems for controlling signal amplitude.
- 348, Television, subclasses 571+ for amplitude control used in television receivers.
- 455, Telecommunications, subclasses 234+ for automatic volume control systems used in radio receivers.
- 307 Baseline or DC offset correction:**  
This subclass is indented under subclass 306. Subject matter wherein the drift of a reference direct current component of a signal is compensated.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
165+, for rectangular or pulse waveform regeneration.  
178+, for rectangular or pulse waveform amplitude control.
- 308 Variable attenuator:**  
This subclass is indented under subclass 306. Subject matter wherein an input signal amplitude is diminished by an adjustable but typically unchanging factor.
- SEE OR SEARCH CLASS:  
330, Amplifiers, appropriate subclasses for amplifying circuits, in general.
- 309 By limiting, clipping, or clamping:**  
This subclass is indented under subclass 306. Subject matter wherein (a) the output signal amplitude is constrained by a maximum allowed level, a minimum allowed level or both or (b) the upper or lower amplitude extreme of the output signal is maintained at a particular level.
- SEE OR SEARCH CLASS:  
323, Electricity: Power Supply or Regulation Systems, subclasses 234+ for a power supply which is output level responsive.  
330, Amplifiers, subclasses 96, 123, 127+, and 278+ for automatic signal level and gain control or amplitude limiting of amplifier power supplies.  
331, Oscillators, subclasses 182+ for amplitude control of oscillator output.  
333, Wave Transmission Lines and Networks, subclass 14 for amplitude compression and expansion systems (i.e., companders); and subclasses 15, 16, 17.1+, and 81+ for passive element attenuator systems which control signal amplitude.  
348, Television, subclasses 571+ for amplitude control such as limiting or clamping in a television receiver.  
375, Pulse or Digital Communications, subclasses 34, 60, and 99+ for noise reduction in pulse code modulation, transmitters, and receivers and subclass 98 for automatic gain control in receivers.  
455, Telecommunications, subclasses 218+, 278+, 296+, and 501+ for noise or interference elimination in analog communication and subclasses 234+ for attenuators and automatic gain control circuits in receiver or analog modulated frequency converters.
- 310 Transient or signal noise reduction:**  
This subclass is indented under subclass 309. Subject matter wherein the limiting, clipping, or clamping lessens or eliminates an intermittent spuriously generated component from a signal.
- (1) Note. Recited noise override of the type associated with gating or switching is classified with the gating or switching area below.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
379+, for gating circuits having improvement of signal transmission integrity or spurious noise override.

551+, for miscellaneous unwanted signal suppression.

**SEE OR SEARCH CLASS:**

- 326, Electronic Digital Logic Circuitry, subclasses 21+ for signal sensitivity enhancement or signal transmission integrity in digital logic.
- 361, Electricity: Electrical Systems and Devices, subclasses 110 and 111 for transient protection in systems or devices.
- 375, Pulse or Digital Communications, subclasses 34, 51, 57, 58, 60, and 99+ for noise reduction in pulse code modulated systems, systems using pulsating current, pulse transmitters, AC or pulse systems or receivers.
- 381, Electrical Audio Signal Processing Systems and Devices, subclasses 13, 83, 93, and 94.1+ for noise or feedback suppression in audio systems.
- 455, Telecommunications, subclasses 63.1 through 65, 114.1-114.3, 218-225, 278.1-279.1, 283-288, 296-312, and subclasses 501-506 for noise or interference elimination in analog communication systems (e.g., transmitter and receiver at separate stations or transceivers, etc.).
- 704, Data Processing: Speech Signal Processing, Linguistics, Language Translation, and Audio Compression/Decompression, subclass 233 for detection of speech in noise.
- 714, Error Detection/Correction and Fault Detection/Recovery, subclasses 761 through 763 +, 781 and 788 for correcting digital data errors caused by random or burst noise signals.

**311 By filtering:**

This subclass is indented under subclass 310. Subject matter wherein the limiting, clipping or clamping of a signal transient is provided by a circuit which offers little opposition to some frequencies or DC while blocking or attenuating other frequencies.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 329, for tuned circuit limiters.
- 552+, for miscellaneous active filters which suppress an unwanted signal.

**SEE OR SEARCH CLASS:**

- 307, Electrical Transmission or Interconnection Systems, subclass 105 for harmonic filters and neutralizers other than nonlinear active device types.
- 333, Wave Transmission Lines and Networks, subclasses 17.1+ through 20 for filters (usually passive) for controlling amplitude, impedance matching, and wave shaping; subclasses 24+ for passive wave filters; and subclasses 213+ for active devices determining passive filter characteristics.
- 375, Pulse or Digital Communications, subclass 103 for filtering in receivers.
- 455, Telecommunications, subclasses 296+ and 339 for noise or interference elimination and for filter coupling or decoupling of stages in receiver or analog modulated signal frequency converter systems.
- 708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 300+ for digital filters and subclass 819 for filtering by an analog computer.

**312 By feedback limiting-clamping:**

This subclass is indented under subclass 310. Subject matter wherein transient or signal noise reduction is performed in a return path between an output terminal and an input terminal.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 316, for feedback circuits to maintain a constant input-output ratio relationship.
- 323, for feedback limiting-clamping circuits, in general.
- 332, for amplitude output level control with feedback.

**SEE OR SEARCH CLASS:**

- 330, Amplifiers, subclasses 75+, 156, 258, 260, 265, 270, 271, 282, 290, and 291+ for amplifiers with linear feedback.

- 313 Using 3 or more terminal type nonlinear devices only:**  
This subclass is indented under subclass 310. Subject matter wherein the circuit includes one or more elements having an output which is not in direct proportion to its input and having more than two electrodes as the only type of active element.
- 314 Using diode type nonlinear devices only:**  
This subclass is indented under subclass 310. Subject matter wherein the circuit includes one or more two-terminal unidirectionally conductive devices as the only type of active element.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
312, for feedback controlled limiting-clamping.  
318+, for diode limiting, clipping, or clamping in the input or output circuits.  
323, for Schottky barrier feedback limiting-clamping circuits.  
325, for limiting, clipping, or clamping in general which utilizes only diode devices.  
583, for miscellaneous solid-state diode circuits.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 130+ and 133+ for diode logic circuits.
- 315 Providing constant input/output amplitude level ratio:**  
This subclass is indented under subclass 309. Subject matter including maintenance of the ratio of the input to output signal magnitudes to a fixed value.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
331+, for amplitude control circuits which maintain a constant level output.
- SEE OR SEARCH CLASS:  
330, Amplifiers, subclasses 278+ for linear amplifier automatic signal level and gain control and subclasses 96 and 123 for amplitude limiting of amplifier power supplies in linear systems.
- 316 By feedback control:**  
This subclass is indented under subclass 315. Subject matter wherein a circuit is controlled by a signal returned along a path between an output terminal and an input terminal.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
312, for feedback limiting-clamping circuit for reducing unwanted noise signals.  
323, for feedback limiting-clamping circuits, per se.
- 317 Distortion compensation:**  
This subclass is indented under subclass 309. Subject matter wherein an undesired waveform modification is corrected or reduced by imposing amplitude constraints on the waveform.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
133, for distortion control in a sawtooth or triangular waveform.  
165+, for regenerating or restoring a rectangular waveform.  
551+, for miscellaneous unwanted signal suppression.
- 318 In input or output circuit:**  
This subclass is indented under subclass 309. Subject matter wherein the limiting, clipping, or clamping device is a component of either a signal insertion or extraction point of a circuit.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
309+, for limiting, clipping, or clamping to control output wave shape characteristics, generally.  
310+, for limiting, clipping, or clamping to remove unwanted noise signals.
- 319 For interstage coupling:**  
This subclass is indented under subclass 318. Subject matter wherein the limiting, clipping, or clamping permits the joining of two or more circuit sections together.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
333, for miscellaneous interstage coupling.

- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclass 62 for interface circuits for logic functions, per se.
- 320 Using diode:**  
This subclass is indented under subclass 319. Subject matter including one or more two-terminal unidirectionally conductive devices.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
314, for diodes used in shunt-type limiting, clipping, or clamping for reducing unwanted noise signals.  
325+, for limiting, clipping, or clamping circuits, per se, which utilize only diodes.
- SEE OR SEARCH CLASS:  
257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for diverse types of diodes.
- 321 Clamping of output to voltage level:**  
This subclass is indented under subclass 318. Subject matter wherein the maximum or minimum value of an output signal is held to a particular voltage level.
- 322 Of output current:**  
This subclass is indented under subclass 318. Subject matter including apparatus which regulates the value of the current in the output.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
540+, for current regulating in a miscellaneous circuit having a specific source of power supply or bias voltage.
- 323 Feedback:**  
This subclass is indented under subclass 309. Subject matter wherein a limiting, clipping, or clamping structure is in a return path between an output terminal and an input terminal.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
312, for feedback limiting, clipping, or clamping in reducing unwanted noise signals.
- 316, for feedback circuits to maintain a constant input-output ratio relationship.
- 332, for constant output amplitude control with feedback.
- SEE OR SEARCH CLASS:  
330, Amplifiers, subclasses 75+, 156, and 282+ for linear feedback amplifiers.
- 324 By using diverse-type nonlinear devices:**  
This subclass is indented under subclass 309. Subject matter wherein plural, unlike-in-kind, nonlinear devices are utilized.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
310+, for diverse-type limiting, clipping, or clamping to reduce unwanted noise signals.  
318+, for diverse-type limiting, clipping, or clamping in either the input or output circuit.
- SEE OR SEARCH CLASS:  
330, Amplifiers, subclass 299 for combined diverse-type linear gain semiconductor devices.
- 325 Using only diode active elements:**  
This subclass is indented under subclass 309. Subject matter wherein the limiting, clipping, or clamping utilizes a two-terminal unidirectionally conductive device as the sole active circuit device.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
314, for diode shunt-type limiting, clipping, or clamping to reduce unwanted noise signals.  
318+, for diode limiting, clipping, or clamping in the input or output circuits.
- SEE OR SEARCH CLASS:  
257, Active Solid-State Devices (e.g., Transistor, Solid-State Diodes), appropriate subclasses for diverse types of diodes.

**326 Avalanche or negative resistance device (e.g., zener diode, tunnel diode, etc.):**

This subclass is indented under subclass 325. Subject matter wherein at least one of the diode elements exhibits a sharp increase of current flow with increasing reverse bias applied thereto or has an IV characteristic with a portion where an increase in applied voltage results in a decrease of current therethrough.

SEE OR SEARCH THIS CLASS, SUBCLASS:

310+, for negative resistance device limiting, clipping, or clamping which reduce transient noise signals.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistor, Solid-State Diodes), appropriate subclasses for solid-state devices, per se, and particularly subclasses 603+ for avalanche diodes, per se.

**327 Using only transistor active elements:**

This subclass is indented under subclass 309. Subject matter wherein the limiting, clipping, or clamping utilizes a three or more terminal solid-state device as the sole active circuit device type.

SEE OR SEARCH THIS CLASS, SUBCLASS:

310+, for limiting, clipping, or clamping to reduce unwanted noise signals.

315+, for circuits providing constant input-output ratio level.

574+, for special three or more electrode solid-state devices and circuits, per se.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for solid-state devices, per se.

326, Electronic Digital Logic Circuitry, appropriate subclasses for transistor logic circuit arrangements.

**328 Field-effect type device:**

This subclass is indented under subclass 327. Subject matter which includes a unipolar transistor in which current carriers are injected at a

source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

(1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type channel and electrons in an n-type channel).

(2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

51+, for a sensing amplifier which may utilize an FET bistable circuit.

310+, for controlled shunt-type limiting, clipping, or clamping with one or more field-effect transistor devices to reduce unwanted noise signals.

581, for field-effect device circuits, per se.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 213+ for field-effect devices, per se.

**329 With tuned circuit:**

This subclass is indented under subclass 309. Subject matter including an inductive/capacitive network having a particular resonant frequency.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
532, for power or bias supply systems with a wave filter.
- SEE OR SEARCH CLASS:  
334, Tuners, appropriate subclasses for radio wave tuning circuitry and devices.
- 330 With rectifier or nonlinear impedance:**  
This subclass is indented under subclass 309. Subject matter including a device converting alternating current to direct current or an impedance where the voltage to current ratio is not directly related.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
104, and 531, for systems with detector or rectifier.
- SEE OR SEARCH CLASS:  
363, Electric Power Conversion Systems, subclasses 13+ for electrical power conversion rectifiers or inverters.
- 331 Maintaining constant level output:**  
This subclass is indented under subclass 306. Subject matter wherein the amplitude of an output waveform is kept at a fixed level independently of the amplitude of the input waveform.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
315+, for a circuit providing constant input/output amplitude level ratio.
- 332 With feedback:**  
This subclass is indented under subclass 331. Subject matter wherein a correction voltage is returned from an output circuit to a control electrode in the input.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
131, for systems utilizing cathode feedback.  
185, and 590+, for tube systems with feedback.
- SEE OR SEARCH CLASS:  
330, Amplifiers, appropriate subclasses, particularly subclasses 75+, 156, 258, 260, 265, 270, 271, 282, 290, and 291+ for amplifiers with linear feedback.
- 333 Interstage coupling (e.g., level shift, etc.):**  
This subclass is indented under subclass 306. Subject matter wherein interconnection of two diverse circuits having different ranges of acceptable signal values is made possible.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, subclasses 62+ for logic interface circuits.
- 334 SPECIFIC INPUT TO OUTPUT FUNCTION:**  
This subclass is indented under the class definition. Subject matter wherein an output is proportional to a nonlinear mathematical expression of an input signal.
- (1) Note. Characteristically the input signal is continuous and slowly varying with the output signal usually bearing a mathematical relationship to it.
  - (2) Note. Boolean algebra functions and linear amplifiers are excluded from this subclass.
  - (3) Note. The input signals in this subclass do not contain information (data) of any kind. For data processing, see Search Class below.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
1+, for discriminating systems.  
560, for nonlinear amplifying circuits.
- SEE OR SEARCH CLASS:  
326, Electronic Digital Logic Circuitry, appropriate subclasses for Boolean algebra functions.  
330, Amplifiers, subclasses 250+ for semiconductor linear amplifiers, per se.  
341, Coded Data Generation or Conversion, subclasses 138+ for nonlinear analog to digital conversion.

708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 200+ for digital computation and subclasses 801+ for analog computation.

**335 By differentiating:**

This subclass is indented under subclass 334. Subject matter wherein the output signal is proportional to the instantaneous rate of change of the input signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

1+, for signal discriminating (e.g., comparing or selecting) without subsequent control and particularly subclasses 14+ for signal slope comparing or selecting.  
336+, for signal integrating.

SEE OR SEARCH CLASS:

708, Electrical Computers: Arithmetic Processing and Calculating, subclass 443 for a digital computer adapted to perform a differentiation on an input and subclass 822 for an analog computer adapted to perform a differentiation on an input.

**336 By integrating:**

Subject matter under 334 wherein the output signal is proportional to a time integral function of the input signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

14+, for systems wherein the rate of change of an input signal is detected.  
100+, for wave conversion or shaping systems which may include differentiating or integrating means.  
131+, for systems producing a sawtooth output utilizing integration or differentiation.  
335, for input signal differentiation.

SEE OR SEARCH CLASS:

318, Electricity: Motive Power Systems, subclasses 141, 456+, 609+, 621+, and 702 for a motor control network involving differentiation or integration.

323, Electricity: Power Supply or Regulation Systems, subclasses 212 through 219 for miscellaneous phase control networks which involve differentiating or integrating networks.

331, Oscillators, subclass 17 for systems with means for the automatic frequency control of an oscillator and involving integrating networks.

333, Wave Transmission Lines and Networks, subclass 19 for a passive network performing differentiation or integration and being of general utility.

388, Electricity: Motor Control Systems, cross-reference art collections 900+ for motor control systems including integration circuits.

708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 823+ for an analog computer adapted to perform an integration function.

**337 Having switched capacitance:**

This subclass is indented under subclass 336. Subject matter wherein the time integral function is determined by a particular capacitor arrangement which is variable dependent upon a connect/disconnect path.

SEE OR SEARCH THIS CLASS, SUBCLASS:

365+, for gating of an input signal between input and output.  
554, for an adjustable filter utilizing a switched capacitive arrangement.

**338 With thermionic tube:**

This subclass is indented under subclass 336. Subject matter including an electron tube which ejects electrons by elevating the temperature of the tube cathode.

**339 With summing or counting:**

This subclass is indented under subclass 336. Subject matter wherein (a) a signal is produced that represents a weighted sum of the input signal or (b) a device is incremented or decremented at discrete intervals upon receipt of the input signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

361, for miscellaneous summing circuits.



- 340 Single vacuum tube:**  
This subclass is indented under subclass 336. Subject matter including only one device with sealed envelope which controls the flow of electrons between spaced electrodes through a fully or partially evacuated space.
- 341 With compensation:**  
This subclass is indented under subclass 336. Subject matter wherein an integration circuit is maintained in its normal operating state or offsets any undesirable changes in its circuitry.
- 342 With transducer:**  
This subclass is indented under subclass 336. Subject matter including a device that converts energy forms (other than electrical) into an electrical energy signal.
- (1) Note. The other energy forms may be mechanical, thermal, hydraulic, chemical, etc.
- 343 With rectifier circuit:**  
This subclass is indented under subclass 336. Subject matter including a device that converts alternating current to direct current.
- (1) Note. A rectifier circuit may be used prior to integrating the input signal.
- 344 Including RC circuit:**  
This subclass is indented under subclass 336. Subject matter including a particular arrangement of capacitance and resistance.
- 345 Having feedback:**  
This subclass is indented under subclass 336. Subject matter wherein a portion of the output signal is returned to an input.
- (1) Note. The feedback may be used to adjust the time constant of the time integral function.
- 346 Exponential:**  
This subclass is indented under subclass 334. Subject matter wherein the output signal is proportional to an input signal that is raised to a particular algebraic power.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
350+, for logarithmic functions.
- 347 Square root:**  
This subclass is indented under subclass 346. Subject matter wherein the output signal is proportional to the input signal raised to the power of one half.
- 348 RMS:**  
This subclass is indented under subclass 347. Subject matter wherein the output signal is proportional to the square root of the average of the squares of the input signal taken throughout one period.
- (1) Note. For example, in a sine wave, this value is 0.707 times the peak value of the input waveform.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
104, for conversion of an AC signal to a corresponding DC signal at an unloaded output.
- 349 Square function:**  
This subclass is indented under subclass 346. Subject matter wherein the output signal is proportional to the input signal raised to the power of two or a multiple of two.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
356+, for the determination of the product of two inputs, in general.
- SEE OR SEARCH CLASS:  
708, Electrical Computers: Arithmetic Processing and Calculating, subclass 606 and 808 for the evaluation of powers by a digital or analog electrical calculating computer, respectively.
- 350 Logarithmic:**  
This subclass is indented under subclass 334. Subject matter wherein the output signal is proportional to an inverse exponential function of the input signal.

- (1) Note. Function generators for producing internal logarithmic functions in analog computers are found elsewhere.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

346, for producing exponential functions.

SEE OR SEARCH CLASS:

- 340, Communications: Electrical, subclass 805 for selective visual display systems having specified waveform generators coupled to a display.
- 708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 512 and 517 for digital computer manipulation of operands having a logarithmic format and subclass 851 for analog computer generated logarithmic function signals.

**351 With cascade network:**

This subclass is indented under subclass 350. Subject matter including an arrangement of two or more similar circuits or stages in which an output of one circuit provides an input to the next circuit.

- (1) Note. Function generators for producing internal logarithmic functions in analog computers are found elsewhere.

**352 With summing:**

This subclass is indented under subclass 350. Subject matter wherein an output signal is produced that represents the algebraic sum of applied input signals.

**353 With vacuum tube:**

This subclass is indented under subclass 350. Subject matter including a device with sealed envelope which controls the flow of electrons between spaced electrodes through a fully or partially evacuated space.

**354 Absolute value:**

This subclass is indented under subclass 334. Subject matter wherein an output signal is proportional to the negative of an input signal, if the input signal is negative, and is proportional to an input signal, if the input signal is positive.

- (1) Note. Usually, the output to input magnitude ratio is unity.

**355 Combining of plural signals:**

This subclass is indented under subclass 334. Subject matter wherein the output is a resultant function of mathematically operating on two or more input signals.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 3+, for systems wherein the output is a function of phase difference of plural input waves.
- 40+, for systems wherein the output is a function of frequency difference of plural input waves.
- 105+, for conversion systems for synthesizing a complex wave from a plurality of waves.

SEE OR SEARCH CLASS:

- 324, Electricity: Measuring and Testing, subclasses 140+ for electricity measuring and testing systems which contain plural inputs (e.g., summation, ratio).
- 348, Television, subclasses 659+ for television matrixing systems.
- 708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 670+ for apparatus which performs a complete addition.

**356 Product:**

This subclass is indented under subclass 355. Subject matter wherein the output signal represents an analog multiplication of plural input signals.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 113+, for frequency control including frequency multiplication.
- 178+, for pulse waveform amplitude (e.g., gain) control.
- 306+, for miscellaneous waveform amplitude (e.g., gain) control.

## SEE OR SEARCH CLASS:

708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 620+ for digital computer multipliers and subclasses 835+ for analog computer multipliers.

**357 Quadrant:**

This subclass is indented under subclass 356. Subject matter wherein the output signal represents an analog multiplication performed on input signals having positive or negative polarities.

**358 Having feedback:**

This subclass is indented under subclass 356. Subject matter wherein a portion of the output signal is returned to an input.

**359 Differential amplifier:**

This subclass is indented under subclass 356. Subject matter wherein a circuit amplifies only the differences between the two input signals and suppresses the input signals when they have identical signals.

**360 Quotient:**

This subclass is indented under subclass 355. Subject matter wherein the output signal represents a ratio of plural input signals.

## SEE OR SEARCH CLASS:

708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 650+ for digital computer dividers and subclass 844 for analog computer dividers.

**361 Summing:**

This subclass is indented under subclass 355. Subject matter wherein an output signal is produced that represents an algebraic sum of input signals.

**362 With compensation:**

This subclass is indented under subclass 334. Subject matter wherein a functional circuit is maintained in its normal operating state or offsets any undesirable changes therein.

(1) Note. Undesired changes in the circuit signals may be due to temperature fluctuations, component structural differences, power supply fluctuations, etc.

tuations, component structural differences, power supply fluctuations, etc.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

513, for miscellaneous circuits providing temperature compensation.

## SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 220+, 234+, 299+, 304+, and 318+ for load controlled or regulated systems.

**363 Having feedback:**

This subclass is indented under subclass 334. Subject matter wherein a portion of the output signal is returned to an input.

**364 With vacuum tube:**

This subclass is indented under subclass 334. Subject matter including a device with a sealed envelope which controls the flow of electrons between spaced electrodes through a fully or partially evacuated space.

**365 GATING (I.E., SWITCHING INPUT TO OUTPUT):**

This subclass is indented under the class definition. Subject matter wherein one signal (a controlling signal) determines whether an input signal is transmitted without modification to an output or is blocked therefrom.

(1) Note. The input signal may be a DC, AC, or a complex wave in the switching operation.

(2) Note. Excluded herein are switching systems including those which are solely mechanical or electromechanical (either static or dynamic) and those handling high current or voltage.

(3) Note. Switching circuits or systems peculiar to an art device are classified with the art device. For example, a centralized telephone switching system is classified in Class 379, subclasses 242+.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

124, for signal waveform generating by periodic switching (e.g., chopping).

- 337, for an integrator which utilizes the switching of a capacitive arrangement.
- 554, for an adjustable filter which utilizes the switching of a capacitance into or out of the circuit.

## SEE OR SEARCH CLASS:

- 200, Electricity: Circuit Makers and Breakers, for closing or opening an electrical circuit.
- 307, Electrical Transmission or Interconnection Systems, subclass 29 for plural loads or sources selectively connected and subclasses 112+ for electrical transmission or interconnection type switching systems.
- 335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclasses 2+ for electromagnetically actuated switches.
- 337, Electricity: Electrothermally or Thermally Actuated Switches, for electric current switching devices which operate by heating effect.
- 340, Communications: Electrical, appropriate subclasses for an alarm or indicating device or system which includes a switching operation.
- 361, Electricity: Electrical Systems and Devices, subclasses 139+ for an interruptor or connector which is used for the purpose of safety and protection of a system or a device and subclasses 160+ for a solenoid or relay control circuit.
- 362, Illumination, subclass 802 for a position or condition responsive switch.
- 363, Electric Power Conversion Systems, for a single electric power signal being modified when transmitted from an input to a single output load.
- 370, Multiplex Communications, subclasses 351+ for multiplex switching.
- 379, Telephonic Communications, subclasses 156+, 177+, 219+, 242+, 422+, etc., for particular switching systems used in telephonic communication.

**366 Superconductive (e.g., cryogenic, etc.) device:**

This subclass is indented under subclass 365. Subject matter including a switching circuit which operates at a very low temperature (e.g., 30 K) where the electrical resistance becomes essentially zero.

- (1) Note. This subclass comprises superconductive devices which operate at a temperature less than or equal to 30 K; Class 505 comprises superconductive devices which operate at a temperature higher than 30 K.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 186, for superconductive stable state circuits,
- 527+, for miscellaneous superconductive circuits.

## SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, subclasses 1+ for superconductive electronic digital logic circuits.
- 505, Superconductor Technology: Apparatus, Material, Process, appropriate subclasses for superconductive devices operated at a temperature higher than 30 K.

**367 Josephson junction:**

This subclass is indented under subclass 366. Subject matter including an electronic fast-switching device consisting of two superconductors separated by a thin layer of insulator which allows a low current flow therethrough by quantum mechanical tunneling.

## SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, subclasses 3+ for electronic logic using a Josephson tunneling device.

**368 Critical current control:**

This subclass is indented under subclass 366. Subject matter wherein the switching operation depends on a value of current that, if exceeded, may destroy the superconductivity of the gate conductor.

**369 External control (e.g., piezoelectric, light, etc.):**

This subclass is indented under subclass 366. Subject matter wherein the switching operation is responsive to a physical condition, such as, mechanical stress from a piezoelectric element or light from an optical device, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

187, for external effect stable state circuits.  
509+, for miscellaneous external effect circuits.

**370 Magnetic field control:**

This subclass is indented under subclass 369. Subject matter wherein the switching operation depends on a variation of a controlled magnetic field.

SEE OR SEARCH THIS CLASS, SUBCLASS:

187, for an external effect stable state circuit.  
510+, for miscellaneous magnetic effect circuits.

**371 Temperature control:**

This subclass is indented under subclass 369. Subject matter wherein the switching operation is responsive to a variation of temperature.

SEE OR SEARCH THIS CLASS, SUBCLASS:

187, for an external effect stable state circuit.  
512+, for miscellaneous thermal effect circuits.

**372 Inductive effect:**

This subclass is indented under subclass 366. Subject matter wherein the switching operation depends on a property of a circuit that tends to oppose any change of current because of a magnetic field associated with the current itself.

SEE OR SEARCH CLASS:

336, Inductor Devices, appropriate subclasses for inductive elements, per se.

**373 Layout:**

This subclass is indented under subclass 366. Subject matter wherein the switching circuit is represented by its physical structure on a substrate with a detailed description of the topological arrangement and connection of conductors and components.

SEE OR SEARCH THIS CLASS, SUBCLASS:

564+, for miscellaneous circuits reciting integrated structure which may include layout or layout interconnections.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for integrated structure, per se.  
326, Electronic Digital Logic Circuitry, subclasses 101+ for logic circuits utilizing significant integrated structure, layout, or layout interconnections.  
338, Resistors, subclass 32 for superconducting resistors.  
505, Superconductor Technology: Apparatus, Material, Process, appropriate subclasses for superconducting devices or circuits operating at a temperature greater than 30 K.

**374 Accelerating switching:**

This subclass is indented under subclass 365. Subject matter including a circuit to minimize the time delay at the turn-on or turn-off period, therefore increasing the switching speed.

(1) Note. Excluded from this subclass is electronic digital logic switching acceleration (see search notes below).

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclasses 17+ for switching acceleration in electronic digital logic circuitry.

**375 Saturation prevention:**

This subclass is indented under subclass 374. Subject matter including a circuit intended to avoid the concentration of charges stored in a bipolar transistor base region, such concentra-

tion of charges prevents the bipolar transistor from turning on or off quickly.

**376 Turn-on:**

This subclass is indented under subclass 374. Subject matter including a circuit intended to reduce the time interval from the occurrence of a control input for turning on the gate to the occurrence of a current or a signal being gated to the output.

**377 Turn-off:**

This subclass is indented under subclass 374. Subject matter including a circuit intended to reduce the time interval from the occurrence of a control input for turning off the gate to the occurrence of a current or signal being blocked at the gate.

**378 Compensation for variations in external physical values (e.g., temperature, etc.):**

This subclass is indented under subclass 365. Subject matter including a circuit to offset an undesired change in the switched signal caused by the variation of a physical condition outside of the switching circuit, for example, variation in temperature, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:  
513, for miscellaneous temperature compensation.

**379 Signal transmission integrity or spurious noise override:**

This subclass is indented under subclass 365. Subject matter including a circuit to maintain signal transmission without impairment from unwanted or unintentionally generated electrical signals.

(1) Note. Excluded herein are circuits which relate to signal sensitivity or transmission integrity in an electronic digital logic circuit. These are classified in Class 326.

SEE OR SEARCH THIS CLASS, SUBCLASS:  
310+, for transient or signal noise reduction by limiting, clipping, or clamping.  
551+, for miscellaneous unwanted signal suppression.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclasses 21+ for signal sensitivity or transmission integrity in electronic digital logic circuitry.

**380 Preventing quick rise gating current (i.e., di/dt):**

This subclass is indented under subclass 379. Subject matter including a circuit for preventing, at the beginning of the turn-on period, an excessive current flow change at the control terminal which could cause damage to the switching device.

**381 Preventing quick rise gating voltage (i.e., dv/dt):**

This subclass is indented under subclass 379. Subject matter including a circuit for preventing, at the beginning of the turn-on period, an excessive potential change at the control terminal which could cause damage to the switching device.

**382 Parasitic prevention or compensation (e.g., parasitic capacitance, etc.):**

This subclass is indented under subclass 379. Subject matter including a circuit to alleviate detrimental changes in the switched signal caused by the presence of inherent non-ideal circuit elements.

(1) Note. Such undesired elements can be modeled by well known electrical elements, such as a capacitor or inductor and are responsible for parasitic capacitance or parasitic inductance, respectively.

(2) Note. Parasitic capacitance or parasitic inductance may be compensated by using impedance matching.

**383 Ensuring fully conducting state:**

This subclass is indented under subclass 379. Subject matter including a circuit for developing an essentially equal potential at all nodes along the transmission path of the switched signal.

(1) Note. Irregular potentials at different nodes along a transmission path are caused by non-ideal transistors which

tend to remain in a partially conducting state.

**384 Switch noise signal:**

This subclass is indented under subclass 379. Subject matter including a circuit which offsets an unwanted oscillation (ringing) or a spurious spike due to a switch being turned on or off.

**385 Contact bounce from mechanical switch:**

This subclass is indented under subclass 384. Subject matter wherein an electromechanically induced switching noise (i.e., chatter) is offset.

SEE OR SEARCH CLASS:

178, Telegraphy, subclasses 17, 81, and 101+ for systems including error prevention against contact bounce signals resulting from a key or keyboard operation.

341, Coded Data Generation or Conversion, subclasses 24+ for keyboard or keypad with contact debounce or anti-chatter feature.

361, Electricity: Electrical Systems and Devices, appropriate subclasses for protection from power or voltage surges.

**386 With clock input:**

This subclass is indented under subclass 385. Subject matter wherein the switching circuit accepts and is responsive to a predetermined time-related signal or a periodic signal in addition to the control signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

291+, for the generation of a clock signal.

**387 Control signal derived from or responsive to input signal:**

This subclass is indented under subclass 379. Subject matter wherein the control signal is dependent on or generated from a characteristic of the input signal.

- (1) Note. For example, in FET switching devices, a control signal which is responsive to the constancy or fluctuations of an input signal would be fed to the gate electrode to control the FET channel impedance.

**388 Additional external control signal:**

This subclass is indented under subclass 387. Subject matter including another control signal which controls the switching operation and which is independent of the characteristic of the input signal and the first control signal.

**389 Insulated gate FET (e.g., MOSFET, etc.):**

This subclass is indented under subclass 379. Subject matter wherein the circuit includes one or more unipolar transistors characterized by having a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) when an electrical field is applied; a layer of insulating material (e.g., SiO<sub>2</sub>) is grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier.

- (2) Note. A MOSFET or Metal-oxide field-effect transistor has a metallic gate insulated by an oxide layer from the semiconductor channel.

**390 With capacitive bootstrapping:**

This subclass is indented under subclass 389. Subject matter wherein the IGFET switching circuit includes discrete, capacitive elements, or uses its inherent capacitance to enhance its operating condition, to achieve full switching capabilities in response to control signals.

- (1) Note. Enhancement of the performance of the switching circuit includes boosting the DC level of the control signals for one or more semiconductor devices, as well as boosting the attained DC levels of individual circuit nodal locations, usually by, for example, either a feedforward/feedback connection or a separate time-related, pulse signal coupled via the boosting capacitor to a particular circuit location.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

589, for miscellaneous bootstrap circuits.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclass 88 and 92 for logic bootstrap circuits.

**391 Complementary metal-oxide semiconductor (CMOS):**

This subclass is indented under subclass 389. Subject matter including a unit of two enhancement mode metal-oxide field-effect transistors, each having a channel of conductivity type opposite that of the other (e.g., p-channel vs. n-channel) and they are connected in series across the power supply with gates linked together.

(1) Note. In the enhancement mode, a MOSFET is normally off with zero gate voltage applied.

(2) Note. Opposite channel conductivity type, as used above, characterizes the induced channel majority carrier conduction (i.e., holes for p-channel and electrons for n-channel).

**392 Delay controlled switch (e.g., fixed, single time of delay control, etc.):**

This subclass is indented under subclass 365. Subject matter wherein there is a recited significant time offset between the occurrence of a gating control signal and the actual initiation of the gating operation.

(1) Note. Time delay network systems which control the operation of a recited specific load circuit such as a motor, a relay, a display system, etc., are classified elsewhere.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

141+, for signal synchronization.

231+, for phase shift of an input signal which is less than the period thereof.

261+, for time delay in producing an output waveform.

SEE OR SEARCH CLASS:

318, Electricity: Motive Power Systems, subclasses 141+ for automatic generator control with time delay and subclasses 445+ for motive power systems with time delay, per se.

323, Electricity: Power Supply or Regulation Systems, subclasses 220+, 234+, 304+, and 318+ for load controlled or regulated systems.

361, Electricity: Electrical Systems and Devices, subclass 91.3 for overvoltage protection including time delay, and subclasses 195+ for time delay networks which control a relay load switching operation.

388, Electricity: Motor Control Systems, cross reference art collection 921 for running-speed control systems including a time delay.

**393 With variable or multiple adjustable time of delay control (e.g., variable charge-discharge, on-delay/off-delay control, etc.):**

This subclass is indented under subclass 392. Subject matter wherein the time offset is varied, for example, by (1) controlling a charge/discharge device to create different varying times, (2) changing a setting/resetting cycle, or (3) changing the on/off time of a control element.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

172+, for pulse width or duration control.

**394 With field-effect device:**

This subclass is indented under subclass 393. Subject matter including a circuit having one or more devices each having a high input impedance and low leakage, thus providing excellent isolation between the drive signal, which is used to switch the input signal from one part of the circuit to another.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

399, for a field-effect device used in a delay controlled switch.

581, for miscellaneous field-effect transistor circuits.



- 395 Propagation through plural delay devices or paths:**  
This subclass is indented under subclass 393. Subject matter wherein the variable or adjustable delay is achieved by connecting the input signal to multiple delaying elements or circuit branches.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
400, for a delay controlled switch having propagation through plural delay devices or paths, in general.
- 396 With plural switching elements (e.g., sequential, etc.):**  
This subclass is indented under subclass 393. Subject matter wherein multiple gating devices are utilized.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
269, for a plurality of time delay intervals in multiple outputs.  
401, for time delay switching using plural switching elements in a non-variable or non-multiple adjustable time of delay.  
403+, for switching parallel controlled paths without any delay of the input.  
415+, for applying a single input to plural outputs without any delay of the input.
- SEE OR SEARCH CLASS:  
361, Electricity: Electrical Systems and Devices, subclasses 166+ for timely operated plural relays.
- 397 Including negative resistance device in delay circuit (e.g., unijunction transistor, etc.):**  
This subclass is indented under subclass 393. Subject matter wherein the plot of the current-voltage operating characteristics of an incorporated device has a portion with a negative slope.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
498+, for two electrode solid-state negative resistance gating circuits.  
568+, for miscellaneous solid-state negative resistance device circuits.
- 398 For predetermined time period:**  
This subclass is indented under subclass 392. Subject matter wherein the activation duration of the switch is fixed prior to such activation.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
172+, for pulse waveform duration control.
- 399 With field-effect device:**  
This subclass is indented under subclass 392. Subject matter including a circuit having one or more devices each having a high input impedance and low leakage, thus providing excellent isolation between the drive signal which is used to switch the input signal from one part of the circuit to another.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
394, for a variable or multiple adjustable time of delay control.  
581, for miscellaneous field-effect transistor circuits.
- 400 Propagation through plural delay devices or paths:**  
This subclass is indented under subclass 392. Subject matter wherein the delay is controlled by connecting the input signal to multiple delaying elements or circuit branches.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
395, for a delay controlled switch having a variable or multiple adjustable delay including propagation through plural delay devices or paths.
- 401 With plural switching elements (e.g., sequential, etc.):**  
This subclass is indented under subclass 392. Subject matter wherein multiple gating devices are utilized.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
269, for a plurality of time delay intervals in multiple outputs.  
396, for variable or multiple adjustable time delay using plural switching elements.

- 403+, for switching parallel controlled paths without any delay of the input.
- 415+, for applying a single input to plural outputs without any delay of the input.

SEE OR SEARCH CLASS:

- 361, Electricity: Electrical Systems and Devices, subclasses 166+ for timely operated plural relays.

**402 Including negative resistance device in delay circuit (e.g., unijunction transistor, etc.):**

This subclass is indented under subclass 392. Subject matter wherein a plot of the current-voltage operating characteristics of an incorporated device has a portion with a negative slope.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 498+, for two electrode solid-state negative resistance gating circuits.
- 568+, for miscellaneous negative resistance device circuits.

**403 Parallel controlled paths:**

This subclass is indented under subclass 365. Subject matter comprising at least two signal paths having a common input and a common output, each signal path having at least one switch.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 407+, for converging plural inputs with single output.
- 415+, for diverging paths with a single input and plural outputs.

**404 Field-effect transistor:**

This subclass is indented under subclass 403. Subject matter wherein at least one path includes a unipolar transistor in which current carriers are injected at a source terminal and passed to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (i.e., gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type

material channel and electrons in an n-type material channel).

- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**405 Bipolar transistor:**

This subclass is indented under subclass 403. Subject matter wherein at least one path includes a three or more electrode semiconductor device of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).

- (1) Note. Npn and pnp type transistors are conventional bipolar transistors; each has three regions, three electrodes and two junctions. Each of the three regions is connected externally by a terminal labeled emitter, base, or collector.

**406 Electron tube:**

This subclass is indented under subclass 403. Subject matter wherein at least one path includes a vacuum tube or a gas filled tube, in which electrical currents flow between spaced electrodes, and in which the conduction of charged particles (e.g., electrons or ions), takes place between these electrodes.

**407 Converging with plural inputs and single output:**

This subclass is indented under subclass 365. Subject matter comprising at least two signal paths having separate inputs and a common

output, each signal path having at least one switch.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

403+, for controlled parallel paths.

415+, for diverging paths with a single input and plural outputs.

SEE OR SEARCH CLASS:

370, Multiplex Communications, appropriate subclasses for information multiplexing.

#### 408 **Field-effect transistor:**

This subclass is indented under subclass 407. Subject matter wherein at least one path includes a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

(1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).

(2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

#### 409 **Push-pull circuit:**

This subclass is indented under subclass 408. Subject matter wherein the switching circuit includes two similar field-effect transistors connected in series, having two input terminals and a common output terminal, and alternatively transmitting input signals to the output.

#### 410 **With complementary transistor devices:**

This subclass is indented under subclass 409. Subject matter wherein the push-pull circuit includes two field-effect transistors of n-type channel and p-type channel connected in series.

#### 411 **Bipolar transistor:**

This subclass is indented under subclass 407. Subject matter wherein at least one path includes a three or more electrode semiconductor device of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).

(1) Note. Npn and pnp type transistors are conventional bipolar transistors, each has three regions, three electrodes, and two junctions. Each of the three regions is connected externally by a terminal labeled emitter, base, or collector.

#### 412 **Push-pull circuit:**

This subclass is indented under subclass 411. Subject matter including a circuit containing two similar bipolar transistors connected in series, having two input terminals and a common output terminal, and alternatively transmitting input signals to the output.

#### 413 **With complementary transistor devices:**

This subclass is indented under subclass 412. Subject matter including two bipolar transistors of opposite conductivity type connected in series (e.g., npn and pnp transistors).

#### 414 **Electron tube:**

This subclass is indented under subclass 407. Subject matter wherein at least one path includes a vacuum tube or a gas filled device, in which electrical currents flow between spaced electrodes and in which the conduction of charged particles (e.g., electrons) takes place between electrodes.

**415 Diverging with single input and plural outputs:**

This subclass is indented under subclass 365. Subject matter comprising at least two signal paths having a single input and separate outputs, each signal path containing at least one switch.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403+, for controlled parallel paths.

407+, for converging paths with plural inputs and single output.

SEE OR SEARCH CLASS:

370, Multiplex Communications, appropriate subclasses for information multiplexing.

**416 Field-effect transistor:**

This subclass is indented under subclass 415. Subject matter wherein at least one path includes a unipolar transistor in which current carriers are injected at a source terminal and passed to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (i.e., gate).

(1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).

(2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating

material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**417 Bipolar transistor:**

This subclass is indented under subclass 415. Subject matter wherein at least one path includes a three or more electrode semiconductor device of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).

(1) Note. Npn and pnp type transistors are conventional bipolar transistors which have three regions, three electrodes and two junctions. Each of the three regions is connected externally by a terminal labeled emitter, base, or collector.

**418 Electron tube:**

This subclass is indented under subclass 415. Subject matter wherein at least one path includes a vacuum tube or gas filled device, in which electrical currents flow between spaced electrodes and in which the conduction of charged particles (e.g., electrons) takes place between electrodes.

**419 Utilizing three or more electrode solid-state device:**

This subclass is indented under subclass 365. Subject matter including a semiconductor device containing three or more elements that perform one or more of the following: (a) emit or collect electrons or holes, or (b) control the electron or hole movements by an applied electrical field.

**420 Breakdown characteristic (e.g., punch-through, tunneling, etc.):**

This subclass is indented under subclass 419. Subject matter wherein the operation of the solid-state device is characterized by a sudden change from high dynamic electrical resistance to a very low dynamic resistance in a reverse biased semiconductor devices (e.g., a reverse biased junction between p-type and n-type semiconductor materials), wherein reverse current increases rapidly for a small increase in reverse applied voltage, and the device behaves as if it had negative electrical resistance.

- (1) Note. Examples of breakdown characteristic are punch-through or tunneling. In punch-through, two adjacent diffused transistor regions become shorted together, causing a sharp rise in current. In tunneling, particles under certain conditions have the ability to pass through a barrier that normally it cannot pass over because of a required energy level.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

580, for miscellaneous circuits with breakdown transistor devices.

584, for miscellaneous circuits with breakdown diodes.

**421 Zener:**

This subclass is indented under subclass 420. Subject matter wherein a breakdown is caused in a semiconductor device by the field emission of charge carriers in a depletion layer.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

584, for miscellaneous circuits with breakdown diodes.

**422 Avalanche:**

This subclass is indented under subclass 420. Subject matter wherein a breakdown is caused by the action of a strong electric field which causes some free carriers to gain enough energy to liberate new hole-electron pairs by ionization.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

584, for miscellaneous circuits with breakdown diodes.

**423 Bridge circuit:**

This subclass is indented under subclass 419. Subject matter including four or more solid-state devices with their input and output terminals connected in a closed loop to form a four arm network, and at least one solid-state device is a transistor.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

588, for miscellaneous bridge circuits.

**424 Field-effect transistor:**

This subclass is indented under subclass 423. Subject matter wherein at least one arm of the bridge circuit includes a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (i.e., gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).

- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**425 Bilateral transistor:**

This subclass is indented under subclass 419. Subject matter wherein the solid-state device is a transistor which conducts equally in either direction.

**426 Plural:**

This subclass is indented under subclass 425. Subject matter wherein the switch comprises more than one bilateral transistor.

**427 Field-effect transistor:**

This subclass is indented under subclass 419. Subject matter including a unipolar transistor in which current carriers are injected at a

source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electrical field applied to the semiconductor from a control electrode (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).
- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**428 With silicon controlled rectifier (SCR):**  
This subclass is indented under subclass 427. Subject matter wherein the switching circuit includes a field-effect transistor and a four layer (pnpn), three junction, three electrode (anode, cathode, and gate) device which can be triggered into conduction in only one direction.

**429 Four or more electrode solid-state device:**  
This subclass is indented under subclass 427. Subject matter including a semiconductor device containing four or more elements that emit or collect electrons or holes, or that control their movements by an applied electrical field.

**430 JFET (i.e., junction field-effect transistor):**  
This subclass is indented under subclass 427. Subject matter including a field-effect transistor characterized by having heavily doped impurity regions of one type material (e.g., p-

type), known as gate regions on both sides of a second type material semiconductor bar (e.g., n+ type) to form a pn junction.

**431 MESFET (i.e., metal semiconductor field-effect transistor):**

This subclass is indented under subclass 430. Subject matter wherein the junction field-effect transistor operates on the principle of the injection of very highly concentrated majority carriers across a potential difference barrier which is formed by the junction of a lightly doped semiconductor substrate and a metal layer deposited thereon (i.e., Schottky gate junction).

- (1) Note. A MESFET can utilize a semiconductor device type silicon or gallium arsenide material; however, GaAs is most frequently used.

**432 With bipolar transistor:**

This subclass is indented under subclass 427. Subject matter including a field-effect transistor and a semiconductor device of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).

**433 Bi-CMOS:**

This subclass is indented under subclass 432. Subject matter including a bipolar transistor and a unit of two enhancement mode metal-oxide field-effect transistors connected in series with their gates linked together, each field-effect transistor has a channel of conductivity type opposite that of the other (e.g., p-channel vs. n-channel).

**434 Insulated gate FET (e.g., MOSFET, etc.):**

This subclass is indented under subclass 427. Subject matter including a unipolar transistor characterized by having a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) when an electrical field is applied and a layer of insulating material (e.g., SiO<sub>2</sub>) is grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier.
- (2) Note. A MOSFET or Metal-oxide field-effect transistor has a metallic gate insulated by an oxide layer from the semiconductor channel.
- 435 GaAs:**  
This subclass is indented under subclass 434. Subject matter wherein the semiconductor material is gallium arsenide.
- 436 Plural devices in series:**  
This subclass is indented under subclass 434. Subject matter having more than one insulated gate FET successively connected together.
- 437 Complementary metal-oxide semiconductor (CMOS):**  
This subclass is indented under subclass 434. Subject matter wherein the switching device includes a unit of two enhancement mode metal-oxide field-effect transistors, each having a channel of conductivity type opposite that of the other (e.g., p-channel vs. n-channel) and they are connected in series across the power supply with gates linked together.
- (1) Note. In the enhancement mode, a MOSFET is normally off with zero gate voltage applied.
- (2) Note. Opposite channel conductivity type, as used above, characterizes the induced channel majority carrier conduction (i.e., holes for p-channel and electrons for n-channel).
- 438 Four or more layer device (e.g., thyristor, etc.):**  
This subclass is indented under subclass 419. Subject matter including a semiconductor device with four or more alternating layers of p-type and n-type material, (e.g., pnpn, etc.)
- (1) Note. A typical four layer device is a thyristor which is a device comprising three or more junctions, at least one of the junctions can switch between reverse- and forward-voltage polarity
- within a single quadrant of the anode-to-cathode voltage-current characteristics.
- 439 Bipolar transistor circuit configuring SCR device:**  
This subclass is indented under subclass 438. Subject matter wherein a circuit built with bipolar transistors performs the same function as a silicon controlled rectifier.
- 440 GTO (i.e., gate turnoff):**  
This subclass is indented under subclass 438. Subject matter including a four layer pnpn device similar in construction to an SCR, but which is switched into a nonconduction state by a polarity reverse signal applied to the gate or control electrode.
- 441 Plural or combined with other four or more layer device:**  
This subclass is indented under subclass 440. Subject matter having more than one gate turn-off device or having at least one GTO and another four or more layer device.
- 442 Separate ON and OFF control circuit:**  
This subclass is indented under subclass 440. Subject matter wherein distinct circuits are used to control the turn-on and turn-off of the switching circuit.
- 443 Transformer or inductor in control circuit:**  
This subclass is indented under subclass 440. Subject matter wherein the control circuit includes a device which opposes any change of current therethrough because of a resultant magnetic field.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
190, for a stable state circuit utilizing a transformer.
- SEE OR SEARCH CLASS:  
336, Inductor Devices, appropriate devices for inductive elements, per se.
- 444 Complex wave supply:**  
This subclass is indented under subclass 438. Subject matter wherein the switching device's power supply has a waveform which is a periodic wave either made up of a combination of several frequencies or several sine waves superimposed on one another.

- 445 Silicon controlled rectifier (SCR):**  
This subclass is indented under subclass 444. Subject matter including a four layer, three junction device, which can be triggered into conduction in only one direction.
- (1) Note. The formal name of an SCR is a "reverse-blocking triode thyristor".
  - (2) Note. The three SCR terminals are called anode, cathode, and gate.
- 446 Triac:**  
This subclass is indented under subclass 445. Subject matter including a bidirectional rectifier (essentially two SCRs in parallel) that functions as an electronically controlled switch for AC loads and having an npnpn structure that can be triggered into either forward or reverse conduction (i.e., transmits AC power across its anode-cathode) by a pulse applied to its gate electrode.
- 447 AC supply:**  
This subclass is indented under subclass 438. Subject matter wherein the switching circuit is power supplied by a voltage source whose polarity changes, or alternates, with time.
- 448 Device in bridge:**  
This subclass is indented under subclass 447. Subject matter including four or more solid-state devices with their input and output terminals connected in a closed loop to form a four arm network, which may include another arm, called a diagonal arm, connected across two adjacent arms of the network between an input terminal and an output terminal and at least one solid-state device has four or more semiconducting layers.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
588, for miscellaneous bridge circuits.
- 449 PUT (i.e., programmable unijunction transistor):**  
This subclass is indented under subclass 447. Subject matter including a thyristor with an anode gate in which the anode-gate voltage differential determines the conduction or nonconduction state of the device.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
569, for miscellaneous unijunction transistor circuits.
- 450 Four electrodes:**  
This subclass is indented under subclass 447. Subject matter including a four or more layer device which has four terminals permitting connection to external circuits.
- 451 Zero point switching:**  
This subclass is indented under subclass 447. Subject matter wherein the switching device is switched or forward-biased to allow conduction of the AC power through the device's anode-cathode region at the point in time of the AC operating cycle when the AC waveform crosses the zero voltage level (i.e., moving from the negative part of the phase to the positive part of the operating phase or vice-versa).
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
78+, for amplitude reference crossover detecting and particularly subclasses 79 for amplitude detecting of zero crossover without subsequent control.
- 452 With triac:**  
This subclass is indented under subclass 451. Subject matter including a bidirectional rectifier (essentially two SCRs in parallel) that functions as an electronically controlled switch for AC loads and having an npnpn structure that can be triggered into either forward or reverse conduction (i.e., transmits AC power across its anode-cathode) by a pulse applied to its gate electrode.
- 453 Silicon controlled rectifier (SCR):**  
This subclass is indented under subclass 447. Subject matter including a four layer, three junction device, which can be triggered into conduction in only one direction.
- (1) Note. The formal name of an SCR is a "reverse-blocking triode thyristor".
  - (2) Note. The three SCR terminals are called anode, cathode, and gate.



- 454 With unijunction transistor:**  
This subclass is indented under subclass 453. Subject matter wherein the switching circuit includes a silicon controlled rectifier combined with a three-terminal semiconductor having only one pn junction and exhibiting a stable open-circuit negative resistance property.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
569, for miscellaneous unijunction transistor circuits.
- 455 Triac:**  
This subclass is indented under subclass 453. Subject matter including a bidirectional rectifier (essentially two SCRs in parallel) that functions as an electronically controlled switch for AC loads and having an npnp structure that can be triggered into either forward or reverse conduction (i.e., transmits AC power across its anode-cathode) by a pulse applied to its gate electrode.
- 456 Plural:**  
This subclass is indented under subclass 455. Subject matter including more than one triac.
- 457 Combined with diac:**  
This subclass is indented under subclass 455. Subject matter including a triac and a three layer (npn), two terminal switching semiconductor device.
- (1) Note. A diac is also called a three layer diode, a two-lead alternating current switching semiconductor, or a two-terminal voltage controlled device which exhibits a bilateral negative resistance characteristic.
- 458 Combined with diverse four or more layer device:**  
This subclass is indented under subclass 455. Subject matter including a triac and at least one different four or more layer device.
- 459 With bipolar transistor:**  
This subclass is indented under subclass 455. Subject matter including a triac and a transistor of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).
- 460 Plural SCRs:**  
This subclass is indented under subclass 453. Subject matter wherein more than one silicon controlled rectifier device is connected along the AC power supply path.
- 461 Inverse parallel connection:**  
This subclass is indented under subclass 460. Subject matter wherein two four or more layer devices are connected across each other, but in opposite directions (i.e., the cathode of one device is joined to the anode of the other device at one common node and vice versa at the other common node).
- 462 With bipolar transistor:**  
This subclass is indented under subclass 461. Subject matter wherein the switching circuit includes plural silicon controlled rectifiers and a transistor of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).
- 463 With bipolar transistor:**  
This subclass is indented under subclass 453. Subject matter wherein the switching circuit includes a silicon controlled rectifier and a transistor of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).
- 464 Having plural four or more layer devices:**  
This subclass is indented under subclass 447. Subject matter wherein more than one four or more layer device is connected along the AC power supply path.
- 465 DC supply:**  
This subclass is indented under subclass 438. Subject matter wherein the switching circuit is power supplied by a steady voltage source (i.e., its positive and negative terminals do not change their potentials over time).
- 466 PUT (i.e., programmable unijunction transistor):**  
This subclass is indented under subclass 465. Subject matter including a thyristor with an anode gate in which the anode-gate voltage dif-

- ferential determines the conduction or nonconduction state of the device.
- 467 Four electrodes:**  
This subclass is indented under subclass 465. Subject matter including a four or more layer device which has four terminals for connection to external circuits.
- 468 SCR and unijunction transistor:**  
This subclass is indented under subclass 465. Subject matter wherein the switching circuit includes a silicon controlled rectifier combined with a three-terminal semiconductor having only one pn junction and exhibiting a stable open circuit negative resistance property.
- 469 Triac:**  
This subclass is indented under subclass 465. Subject matter including a bidirectional rectifier (essentially two SCRs in parallel) that functions as an electronically controlled switch and having an npnp structure that can be triggered into either forward or reverse conduction by a pulse applied to its gate electrode.
- 470 Plural devices:**  
This subclass is indented under subclass 465. Subject matter wherein more than one four or more layer device is connected along the DC power supply path.
- 471 Series anode-cathode connection:**  
This subclass is indented under subclass 470. Subject matter wherein a plurality of four or more layer devices are successively connected, the positive terminal (anode) of one device is joined to the negative terminal (cathode) of the immediate adjacent device (i.e., cascade connected).
- 472 Plural paths:**  
This subclass is indented under subclass 471. Subject matter having more than one string of series connections.
- 473 Parallel connection:**  
This subclass is indented under subclass 470. Subject matter wherein a plurality of four or more layer devices are connected such that all positive terminals (anodes) are joined to a common node and all negative terminals (cathodes) are joined to another common node.
- 474 With bipolar transistor:**  
This subclass is indented under subclass 470. Subject matter having more than one four or more layer device combined with a transistor of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).
- 475 SCR and bipolar transistor:**  
This subclass is indented under subclass 465. Subject matter wherein the switching circuit includes a silicon controlled rectifier and a transistor of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).
- 476 Triac:**  
This subclass is indented under subclass 438. Subject matter including a bidirectional rectifier (essentially two SCRs in parallel) that functions as an electronically controlled switch and having an npnp structure that can be triggered into either forward or reverse conduction by a pulse applied to its gate electrode.
- 477 Unijunction transistor (UJT):**  
This subclass is indented under subclass 419. Subject matter including a three terminal semiconductor having only one pn junction and exhibiting a stable open-circuit negative resistance property.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
569, for miscellaneous unijunction transistor circuits.
- 478 Bipolar transistor:**  
This subclass is indented under subclass 419. Subject matter including a semiconductor device of the type having at least two potential barriers and having a controlled current flow of both majority and minority carriers (i.e., holes and electrons).
- (1) Note. Npn and pnp type transistors are conventional bipolar transistors which have three regions, three electrodes, and two junctions. Each of the three regions is connected externally by a terminal labeled emitter, base, or collector.

- 479 Special four or more electrode device (e.g., multiple bases, three electrode bipolar with FET gate, etc.):**  
This subclass is indented under subclass 478. Subject matter wherein the bipolar transistor has more than three electrodes or has particular features, such as an additional FET gate.
- 480 Multiple emitter transistor:**  
This subclass is indented under subclass 479. Subject matter wherein the bipolar transistor has at least two emitter regions in addition to the base and collector regions.
- 481 Multiple collector transistor:**  
This subclass is indented under subclass 479. Subject matter wherein the bipolar transistor has at least two collector regions in addition to the base and emitter regions.
- 482 Plural:**  
This subclass is indented under subclass 478. Subject matter having more than one bipolar transistor.
- 483 Darlington connection:**  
This subclass is indented under subclass 482. Subject matter which includes a circuit of two similar transistors where their collectors are tied together and the emitter of the first transistor is directly coupled to the base of the second transistor such that the emitter current of the first transistor equals the base current of the second transistor.
- (1) Note. A Darlington connection is also called a Darlington pair, double emitter follower, or beta-multiplier.
- 484 Opposite conductivity (i.e., complementary):**  
This subclass is indented under subclass 482. Subject matter wherein transistors of the npn and pnp type are present in the same circuit.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
576, for miscellaneous complementary transistor circuits.
- 485 Control circuit in cascade:**  
This subclass is indented under subclass 484. Subject matter wherein the switching control circuit includes two similar transistors arranged in tandem, with the output of one connected to the input of the next.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
483, for a bipolar Darlington connected gating circuit.
- 486 Control circuit in totem pole:**  
This subclass is indented under subclass 484. Subject matter wherein the switching control circuit includes two similar transistors arranged in a push-pull circuit which alternatively operate to provide a single ended control output signal.
- 487 Control circuit in cascade:**  
This subclass is indented under subclass 482. Subject matter wherein the switching control circuit includes two similar transistors arranged in tandem, with the output of one connected to the input of the next.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
483, for a bipolar Darlington connected gating circuit.
- 488 Control circuit in totem pole:**  
This subclass is indented under subclass 482. Subject matter wherein the switching control circuit includes two similar transistors arranged in a push-pull circuit which alternatively operate to provide a single ended control output signal.
- 489 Control circuit with common emitter:**  
This subclass is indented under subclass 482. Subject matter wherein the switching control circuit includes a bipolar transistor with the emitter terminal connected to a common ground of the circuit, and the outputs at the collector terminal provide control voltages to the switch.
- 490 With current mirror:**  
This subclass is indented under subclass 489. Subject matter wherein the control circuit relies on the collector current matching of two tran-

- sistors when connected together base to base and emitter to emitter with one transistor having its collector connected to its base.
- (1) Note. The collector currents are matched by having a predetermined ratio relationship to each other. When one of the collector current changes, the other also changes to keep the ratio relationship constant.
- SEE OR SEARCH CLASS:  
323, Electricity: Power Supply or Regulation Systems, subclass 315 for a current regulator using a current mirror.
- 491 With emitter follower:**  
This subclass is indented under subclass 489. Subject matter wherein the control circuit has a transistor amplifier circuit configuration which is characterized by relatively high input impedance, low output impedance, and a voltage gain of less than unity.
- 492 Control circuit with common collector:**  
This subclass is indented under subclass 482. Subject matter wherein the switching control circuit includes a bipolar transistor with the collector terminal connected to a common ground of the circuit, and the outputs at the emitter terminal provide control voltages to the switch.
- 493 Utilizing two electrode solid-state device:**  
This subclass is indented under subclass 365. Subject matter including a semiconductor device containing two elements that emit or collect electrons or holes, or that control their movements by an applied electrical field.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
583+, for miscellaneous two electrode solid-state device circuits.
- 494 Bridge circuit:**  
This subclass is indented under subclass 493. Subject matter including four two-electrode solid-state devices with their input and output terminals connected in a closed loop to form a four arm network.
- (1) Note. A bridge circuit may have another arm, called the diagonal arm, which is connected across two adjacent arms of the network between an input terminal and an output terminal.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
588, for miscellaneous bridge circuits.
- 495 Combined with diverse device in at least one arm:**  
This subclass is indented under subclass 494. Subject matter wherein a two-electrode solid-state device is combined with another device of a different type in at least one of the bridge arms.
- 496 Plural:**  
This subclass is indented under subclass 494. Subject matter including more than one bridge circuit.
- 497 Active element in diagonal arm:**  
This subclass is indented under subclass 494. Subject matter wherein the bridge circuit has in its diagonal arm a specific device that requires power for functioning.
- 498 Negative resistance:**  
This subclass is indented under subclass 493. Subject matter wherein the switch comprises a solid-state two electrode device whose characteristic on a current-voltage plot has a portion with a negative slope.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
568+, for miscellaneous negative resistance device circuits.
- 499 "N"-shape curve on I-V plot (e.g., tunnel diode type, etc.):**  
This subclass is indented under subclass 498. Subject matter including a solid-state device whose characteristic on a current versus voltage plot (i.e., with the current plotted on the Y axis and voltage on the X axis) has an "N"-shape.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
195, for a stable state circuit utilizing an "N"-shape negative resistance diode.

**500 “S”-shape curve on I-V plot (e.g., pnpn diode type, etc.):**

This subclass is indented under subclass 498. Subject matter including a solid-state device whose characteristic on a current versus voltage plot (i.e., with the current plotted on the Y axis and voltage on the X axis) has an “S”-shape.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

196, for a stable state circuit utilizing an “S”-shape negative resistance diode.

**501 Hyperconductive diode:**

This subclass is indented under subclass 500. Subject matter wherein the solid-state device is a four layer threshold diode, one of whose outer layers is metal and wherein at a predetermined reverse voltage point, junction breakdown occurs to provide high current at very low voltages.

**502 Breakdown characteristic (e.g., zener diode, etc.):**

This subclass is indented under subclass 493. Subject matter wherein the operation of the solid-state device is characterized by a sudden change from high dynamic electrical resistance to a very low dynamic resistance in a reverse biased semiconductor device (e.g., a reverse biased junction between p-type and n-type semiconductor materials, wherein reverse current increases rapidly for a small increase in reverse applied voltage, and the device behaves as if it had negative electrical resistance).

- (1) Note. An example of the breakdown characteristic is zener breakdown which is caused by the field emission of charge carriers in the depletion layer of the semiconductor device. When breakdown occurs, the electric field intensity in the material has become so great that electrons are effectively “ripped” from the valency bonding system.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

580, for miscellaneous circuits utilizing a breakdown transistor device.

584, for miscellaneous circuits utilizing a breakdown diode.

**503 PIN diode:**

This subclass is indented under subclass 493. Subject matter including a two layer region (p and n), two electrode, single junction semiconductor device which has an intrinsic semiconductor (i.e., one with no dopants) sandwiched between a p-type layer, and an n-type layer.

**504 PN junction diode**

This subclass is indented under subclass 493. Subject matter wherein the solid-state device has two regions, two terminals (anode and cathode), a single junction and conducts electricity much more easily in one direction than in the other.

**505 Inverse parallel connection:**

This subclass is indented under subclass 504. Subject matter wherein two diodes are connected across each other, but in opposite directions (i.e., the cathode of one device is joined to the anode of the other device at one common node and vice versa at the other common node).

**506 Three or more electrode electron tube:**

This subclass is indented under subclass 365. Subject matter including a vacuum or gas filled tube having three or more electrodes in which electrical currents flow between spaced electrodes and in which the conduction of charged particles (e.g., electrons), takes place between the electrodes.

**507 Two electrode electron tube:**

This subclass is indented under subclass 365. Subject matter including a vacuum or gas filled tube having two electrodes in which electrical currents flow between spaced electrodes, and in which the conduction of charged particles (e.g., electrons), takes place between electrodes.

**508 Bridge circuit:**

This subclass is indented under subclass 507. Subject matter including four two-electrode electron tubes with their input and output terminals connected in a closed loop to form a four arm network.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

588, for miscellaneous bridge circuits.

**509 EXTERNAL EFFECT:**

This subclass is indented under the class definition. Subject matter wherein the operation of the circuit or system depends upon some externally applied force or field such as radiation, light, heat, sound, mechanical pressure, etc., or where compensation for the effects of such externally applied force or field is provided.

SEE OR SEARCH THIS CLASS, SUBCLASS:

187, for two or more stable state circuits using external effect devices.

SEE OR SEARCH CLASS:

73, Measuring and Testing, appropriate subclasses for sensing various types of external influence such as, fluid pressure, vibration, etc.

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 414+ for active solid-state devices, per se, responsive to a non-electrical signal.

307, Electrical Transmission or Interconnection Systems, appropriate subclasses (e.g., subclasses 116+, 401+, 650+, etc.) for transmission or interconnection systems which are condition responsive.

438, Semiconductor Device Manufacturing: Process, subclasses 48+ for methods of making semiconductor devices which respond to nonelectrical stimuli.

**510 Magnetic:**

This subclass is indented under subclass 509. Subject matter wherein the external effect involves a magnetic field.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 421+ for a magnetic responsive semiconductor element, per se.

307, Electrical Transmission or Interconnection Systems, subclasses 401+ for nonlinear reactor systems including magnetic reactors.

324, Electricity: Measuring and Testing, subclasses 244+ and particularly subclasses 250 and 252 for magnetometers with indicators.

330, Amplifiers, subclass 4.8 for gyromagnetic parametric amplifiers, subclass 6 for amplifiers with Hall effect type means, subclass 8 for saturable reactor type amplifiers, subclasses 47+ for magnetically influenced discharge device amplifiers, subclass 60 for magnetostrictive type amplifiers and subclass 63 for amplifiers with magnetic means generally.

331, Oscillators, subclasses 5 and 86+ for magnetron oscillators, subclasses 6, 83, and 84 for Klystron oscillators and subclass 67 for oscillators with electromagnetic or electrostatic shielding.

338, Electrical Resistors, subclass 32 for resistance means whose value depends upon an applied magnetic field and see also the search notes thereunder.

341, Coded Data Generation or Conversion, subclass 15 for a magnetic digital pattern reading converter.

**511 Utilizing Hall effect:**

This subclass is indented under subclass 510. Subject matter wherein a magnetic field is applied to a current carrying conductor and use is made of the voltage which is produced between opposing edges of the conductor and which is perpendicular to both the current and the magnetic field.

SEE OR SEARCH THIS CLASS, SUBCLASS:

187, for a stable state circuit which is externally controlled.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 421+ for a magnetic responsive semiconductor element, per se.

324, Electricity: Measuring and Testing, subclass 251 for a Hall plate magnetometer with indicator.

**512 Temperature:**

This subclass is indented under subclass 509. Subject matter wherein the external effect involves heat or thermal energy.

## SEE OR SEARCH CLASS:

- 257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 467+ for a heat responsive semiconducting element, per se.
- 331, Oscillators, subclass 66 for a temperature controlled oscillator and subclass 70 for oscillators with temperature modifiers and see the search notes thereunder.
- 338, Electrical Resistors, subclasses 25+ for resistors whose value is responsive to ambient temperature and see the search notes thereunder.
- 340, Communications: Electrical, subclasses 584+ for thermal condition responsive indicating systems.
- 374, Thermal Measuring and Testing, subclass 163 for a thermal sensor with quantitative indicator and subclass 178 for an electrical thermometer having a barrier layer sensing element.

**513 With compensation for temperature fluctuations:**

This subclass is indented under subclass 512. Subject matter wherein circuit anomalies resulting from variations in ambient thermal conditions are counterbalanced.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 83, 138, 262, and 378, for diverse types of temperature compensation.

## SEE OR SEARCH CLASS:

- 323, Electricity: Power Supply or Regulation Systems, subclass 907 for a voltage control circuit having temperature compensation of a semiconductor.
- 326, Electronic Digital Logic Circuits, subclass 32 for temperature compensation in signal level or switching threshold stabilization.
- 330, Amplifiers, subclass 289 for a temperature compensated semiconductor amplifier.

**514 Light:**

This subclass is indented under subclass 509. Subject matter wherein the external effect involves energy of optical wavelengths.

- (1) Note. Secondary emissive circuits which may utilize a light sensitive cathode are classified below.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 573, for a secondary emissive circuit which utilizes a light sensitive cathode.

## SEE OR SEARCH CLASS:

- 250, Radiant Energy, subclasses 200+ for circuits using photocells and see also the search notes thereunder.
- 257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 431+ for a light responsive semiconducting element, per se.
- 359, Optics: Systems (Including Communication) and Elements, appropriate subclasses for miscellaneous optical systems and elements.

**515 Elements forming an array:**

This subclass is indented under subclass 514. Subject matter wherein plural light effect elements are arranged into a matrix having defined rows and columns.

## SEE OR SEARCH CLASS:

- 348, Television, subclasses 294+ for a solid-state television image sensor having elements in an array.

**516 Utilizing conversion of mechanical variations into electrical variations (e.g., vibration sensitive, etc.):**

This subclass is indented under subclass 509. Subject matter wherein an element of a circuit or system is responsive to the application of physical energy.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 517, for miscellaneous touch or proximity sensitive circuits.

**SEE OR SEARCH CLASS:**

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 415+ for a pressure responsive semiconducting element, per se.

**517 Responsive to proximity or touch:**

This subclass is indented under subclass 509. Subject matter wherein the operation of a circuit or system is modified by the approach of or slight contact with a physical object.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

516, for circuitry which utilizes the conversion of mechanical variations into electrical variations.

**SEE OR SEARCH CLASS:**

340, Communications: Electrical, subclass 407 for tactual communication circuits.

361, Electricity: Electrical Systems and Devices, subclasses 179+ for relays or solenoids responsive to proximity or contact.

**518 WITH PARTICULAR CONTROL:**

This subclass is indented under the class definition. Subject matter wherein a controlling means is a nonlinear device, circuit, or system which specifically controls the delivery of current or power to a load device connected to its output terminal in response to a control signal applied to its input terminal.

(1) Note. A load device as included in this subclass may include any load which is so broadly claimed as not to restrict the system to any specific class or subclass. Where a specific load device is claimed, classification will be in the particular class wherein the art device comprising the specific load device is to be found.

(2) Note. Systems not especially concerned with the delivery of current or power to the load device, but concerned instead with the control of a circuit parameter such as phase, frequency, or amplitude are excluded from this subclass.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

407, for a plurality of inputs appearing over a plurality of input channels selectively switched to a single output channel.

415, for means whereby a single input appearing over a single channel is selectively switched to a plurality of output channels.

**519 Plurality of load devices:**

This subclass is indented under subclass 518. Subject matter wherein the output of the nonlinear device, circuit, or system is connected to a multiple of controlled load devices.

(1) Note. Systems where current or voltage is applied to plural output loads selectively or successively as a result of a scanning operation are excluded from this subclass and will be found elsewhere in the class.

**SEE OR SEARCH CLASS:**

307, Electrical Transmission or Interconnection Systems, subclasses 11+ for electrical interconnections feeding plural loads.

315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses for circuits containing plural discharge device loads.

318, Electricity: Motive Power Systems, appropriate subclasses, especially subclasses 34+ for plural diverse or diversely controlled electric motors, with systems of electrical supply or control for one or more electric motors where the electric motor is claimed in combination with such systems or control and the electric motor as claimed constitutes the ultimate load.

330, Amplifiers, subclasses 73, 84, 124+, 148, and 295 for amplifier systems having plural loads.

331, Oscillators, subclasses 2 and 46+ for plural oscillator systems which may have plural loads and subclass 60 for a single oscillator system with plural output circuits.



361, Electricity: Electrical Systems and Devices, subclasses 191+ for miscellaneous electric circuits controlling a plurality of relay or electromagnetic load devices.

370, Multiplex Communications, appropriate subclasses for similar subject matter used with multiplexing.

**520 Plural active components included in a controlling circuit:**

This subclass is indented under subclass 518. Subject matter wherein the controlling means is constituted by a plurality of active components such as transistors, amplifiers, or space discharge devices.

(1) Note. Active components are components in a circuit which have gain or direct current flow, such as transistors, amplifiers, thyristors, electron tubes, or tunnels diodes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

185, for stable state circuits with series connected tubes.

**521 Connected in inverse parallel:**

This subclass is indented under subclass 520. Subject matter wherein a pair of active components in the controlling means circuit are connected side-by-side in differing directions between two circuit nodes.

(1) Note. For example, for a pair of electron tubes to be connected in inverse parallel, the anode of one device is connected to the cathode of another device and vice versa.

SEE OR SEARCH CLASS:

315, Electric Lamp and Discharge Devices: Systems, subclasses 196+ and 251 for inverse parallel connected space discharge load devices.

323, Electricity: Power Supply or Regulation Systems, subclasses 227 and 291 for voltage magnitude control systems with plural electric discharge devices reversely connected in parallel.

**522 Gaseous tube:**

This subclass is indented under subclass 520. Subject matter wherein the active components include an electronic tube into which a small amount of gas or vapor is introduced after the tube has been evacuated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

601+, for miscellaneous circuits having gas tubes of particular structure.

SEE OR SEARCH CLASS:

315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses for system wherein a gaseous space discharge tube is the ultimate load or controls a space discharge load.

**523 Gaseous tube:**

This subclass is indented under subclass 518. Subject matter wherein the controlling means includes an electronic tube into which a small amount of gas or vapor is introduced after the tube has been evacuated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

601+, for miscellaneous circuits having gas tubes of particular structure.

SEE OR SEARCH CLASS:

315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses for system wherein a gaseous space discharge tube is the ultimate load or controls a space discharge load.

**524 SPECIFIC IDENTIFIABLE DEVICE, CIRCUIT, OR SYSTEM:**

This subclass is indented under the class definition. Subject matter wherein a nonlinear device, circuit, or system has a particular structure, arrangement, or construction that is not classifiable elsewhere.

(1) Note. This subclass and the indented subclasses contain subject matter which is neither sufficiently comprehensive nor possessive of sufficiently significant

structure so as to be classified with a specific external area.

**SEE OR SEARCH CLASS:**

- 313, Electric Lamp and Discharge Devices, appropriate subclasses for the structure of space discharge devices.
- 315, Electric Lamp and Discharge Devices: Systems, subclasses 3+ and 32+ for combined tube and circuit element structure, subclasses 5.18+ and 5.24+ for reflex type beam tube circuits, and subclasses 88+ for automatic space discharge device substitution systems.
- 330, Amplifiers, subclass 3 for amplifiers with plural diverse amplifying devices, subclasses 4, 5, 43, 45, 47, and 49 wherein the internal tube structure forms part of the amplifier control circuit, subclasses 41, 42, 44+, and 64 for amplifier systems utilizing tubes of particular construction, subclasses 51, 52, 65+, and 127+ for systems that may include tube substitution; subclasses 87+, and the search notes thereto, for cathode follower amplifier systems; and subclasses 127+ for amplifier bias voltage control systems.
- 331, Oscillators, subclasses 5, 6+, 103, 126+, and 184 for oscillator systems utilizing tubes of particular construction; subclass 49 for oscillator substitution systems; subclass 84 for beam tube oscillators of the reflex type; subclasses 79+, 86+, 92+, and 103 wherein the internal tube structure may form part of the oscillator control circuit; and subclass 186 for oscillator bias voltage regulation.
- 376, Induced Nuclear Reactions: Processes, Systems, and Elements, subclasses 100+ for subject matter of this subclass (524) when utilized in connection with plasma in the generation of thermonuclear reactions.

**525 Fusible link or intentional destruct circuit:**  
This subclass is indented under subclass 524. Subject matter wherein an element burns out or is destroyed (i.e., is open circuited) in an interconnection or integrated circuit structure com-

ponent when applied current or voltage exceeds a predetermined limit.

**SEE OR SEARCH CLASS:**

- 102, Ammunition and Explosives, appropriate subclasses for fuses relating to munitions.
- 326, Electronic Digital Logic Circuitry, subclasses 37+ for programmable logic.
- 365, Static Information Storage and Retrieval, subclass 96 for fusible links relating to programmable read-only memory and subclass 200 for eliminating "bad bit" information associated with read/write circuits.
- 438, Semiconductor Device Manufacturing: Process, subclasses 467, 600, and 601 for methods of altering the conductivity of a fuse or antifuse element associated with a semiconductor integrated circuit.

**526 Redundant:**

This subclass is indented under subclass 524. Subject matter wherein there is a duplication of components, devices, circuits, elements, etc., such that a duplicate will assume operation upon failure of the original.

**SEE OR SEARCH CLASS:**

- 326, Electronic Digital Logic Circuitry, subclasses 10+ for redundant logic circuits.
- 714, Error Detection/Correction and Fault Detection/Recovery, subclasses 3+ for fault recovery by replacement with a spare device.

**527 Superconductive (e.g., cryogenic, etc.) device:**

This subclass is indented under subclass 524. Subject matter including a particular circuit which operates at temperatures which are approximately absolute zero (i.e., less than or equal to 30 K) where electrical resistance becomes essentially zero.

- (1) Note. Class 505 comprises superconductive devices which operate at a temperature higher than 30 K.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 186, for one or more stable state cryogenic circuits.  
366+, for cryogenic gating or switching.

SEE OR SEARCH CLASS:

- 326, Electronic Digital Logic Circuitry, subclasses 1+ for superconductor logic circuits.  
338, Electrical Resistors, subclass 32 for a resistive element whose resistance depends on the value of an applied magnetic field.  
340, Communications: Electrical, subclass 825.79 for matrix systems using superconductive elements.  
365, Static Information Storage and Retrieval, subclasses 160+ for information storage means using superconductive elements.  
505, Superconductor Technology: Apparatus, Material, Process, appropriate subclasses for superconductive devices operating above 30 K.

**528 Josephson junction:**

This subclass is indented under subclass 527. Subject matter wherein a current flows across a gap between two superconductors separated by a thin layer of insulator.

- (1) Note. Under certain conditions, a voltage appears across the gap, and high-frequency radiation emanates from it.

**529 Impact ionization:**

This subclass is indented under subclass 527. Subject matter wherein a breakdown can occur within a semiconductor device as a result of operation at temperatures approaching absolute zero (temperatures equal to or lower than 30 K).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 186, for one or more stable state circuits including an impact ionization device.

**530 With specific source of supply or bias voltage:**

This subclass is indented under subclass 524. Subject matter wherein either (a) a DC bias potential other than signal voltage is applied or maintained between two or more electrodes in order to determine the operating point on the characteristic curve of a device or (b) electrical power or bias voltage is applied to a region of a nonlinear solid-state device or circuit.

- (1) Note. The claimed subject matter does not comprise significant structure so as to limit the power supply to those provided for in a particular art area.  
(2) Note. The systems found in this class may include means to supply current to the anode or filament, a potential to the grid of an electron tube (which is usually negative with respect to the cathode), or establishing or maintaining a direct current voltage between two elements of an electron tube.  
(3) Note. Claimed subject matter having biasing on and off wherein a switched input is identical to the output will be classified in subclasses 365+.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 365+, for switching input supply or bias to the output wherein the input signal is the same as the output signal.  
531, for biasing systems in identifiable circuits, in general.  
535+, for biasing or power supply circuitry with significant stabilizing circuitry for regulating the bias or power supply level.  
597, for particular grid control systems.

SEE OR SEARCH CLASS:

- 307, Electrical Transmission or Interconnection Systems, subclasses 18+, 31+, and 43+ for plural power supplies, and subclass 150 for miscellaneous power packs, per se.  
315, Electric Lamp and Discharge Devices, Systems, subclasses 1+ for cathode-ray tube power supply circuits, subclasses 86+ for power supply systems

- for space discharge devices, in general, with automatic substitution in the power supply, subclasses 137+ for polyphase AC supply circuits, subclasses 160+ for plural power supplies, subclasses 200+ for circuits having a discharge device and/or rectifier in the supply circuit, subclass 209 for circuits having a periodic switch in the supply circuit, subclasses 227+ for circuits with a condenser in the supply circuit, and subclasses 248+ for a pulsating or AC supply circuit.
- 323, Electricity: Power Supply or Regulation Systems, subclasses 311+ for circuits that supply a regulated voltage, current or power to a nonspecific or general load device.
- 330, Amplifiers, subclass 113 for polyphase power supply systems, subclasses 114+ for unrectified AC power supply systems, subclasses 127+ for amplifier tube biasing systems subclasses 199+ for power or bias supplies, in general, and subclasses 296 and 297 having particular power supply or biasing for linear amplifier circuits or systems.
- 331, Oscillators, subclasses 185+ for particular sources of power or bias for oscillators.
- 363, Electric Power Conversion Systems, subclasses, particularly subclasses 13+ for rectifying or drectifying systems which may include electron tubes and their control.
- 378, X-Ray or Gamma Ray Systems or Devices, subclasses 91+ for X-ray device circuits.
- 531 Fluctuating or AC source with rectifier or filter:**  
This subclass is indented under subclass 530. Subject matter wherein the power supply is converted from an alternating or fluctuating input voltage or current to a direct current or voltage via a rectifier circuit or is smoothed or integrated by a filter circuit.
- (1) Note. The power supply may contain both AC and DC components, and the DC component is received from the out-
- put by coupling to a rectifier or a filter circuit.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
104, for AC waveform to DC waveform output conversion at an unloaded output.  
330, for amplitude limiting systems with a rectifier.  
552, for unwanted component eliminating systems with a filter.
- SEE OR SEARCH CLASS:  
363, Electric Power Conversion Systems, subclasses 44+ for rectifier systems with smoothing filters.
- 532 With particular filter circuit:**  
This subclass is indented under subclass 531. Subject matter including a filter circuit with specific structure.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
552+, for unwanted component eliminating utilizing a filter.
- SEE OR SEARCH CLASS:  
333, Wave Transmission Lines and Networks, subclasses 167+ for passive wave filters, especially subclasses 181+ for smoothing type filters.
- 533 With battery connected across rectifier:**  
This subclass is indented under subclass 531. Subject matter wherein the conversion is accomplished via a battery connected across or in shunt with a rectifier.
- SEE OR SEARCH CLASS:  
307, Electrical Transmission or Interconnection Systems, subclasses 44+ for systems wherein one source floats across another, see particularly subclasses 46 and 48+ for floating sources of the storage battery type.
- 534 Having particular substrate biasing:**  
This subclass is indented under subclass 530. Subject matter wherein a potential is applied to a substrate region of a nonlinear element or solid-state device.

## SEE OR SEARCH CLASS:

365, Static Information Storage and Retrieval, appropriate subclass for electromagnetic storage systems, subclasses 185.01+ for floating gate memory storage (e.g., flash memory).

**535 Having stabilized bias or power supply level:**

This subclass is indented under subclass 534. Subject matter wherein the bias or power supply level provided to the substrate of a nonlinear element or solid-state device is maintained constant.

- (1) Note. The stabilization may be for either voltage or current level to compensate for adverse conditions (e.g., nonuniformity of integrated chip structure, supply level perturbations, etc.).

## SEE OR SEARCH THIS CLASS, SUBCLASS:

540+, for stabilized electron tube circuits with voltage regulation.

## SEE OR SEARCH CLASS:

318, Electricity: Motive Power Systems, appropriate subclasses for motor power supply or speed control or regulation.

323, Electricity: Power Supply or Regulation Systems, subclasses 311+ for circuits that supply a regulated voltage, current, or power to a nonspecific or general load device.

**536 Charge pump details:**

This subclass is indented under subclass 535. Subject matter wherein the particular substrate biasing circuit is regulated by a significantly recited electrical circuit arrangement for pumping electric charges (electrons (negative charges) or protons (positive charges)) into or out of the substrate to polarize the substrate at a negative or positive potential which is the generated bias voltage.

**537 With field-effect transistor:**

This subclass is indented under subclass 535. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal

through a channel of semiconductor material whose conductivity depends largely on an electric field applied to the semiconductor from a control terminal (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).

- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**538 Stabilized (e.g., compensated, regulated, maintained, etc.):**

This subclass is indented under subclass 530. Subject matter wherein the bias circuit or a particular arrangement of the power supply offsets undesired changes in the circuit signals or maintains the circuit in its normal operating state.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

535, for particular substrate biasing with stabilized bias or power supply level.

**539 Using bandgap:**

This subclass is indented under subclass 538. Subject matter wherein a bandgap voltage of a semiconductor material is provided as a reference to compensate for variations of the voltage supply.

- (1) Note. Bandgap voltage is the difference in energy between the conduction band and the valence band in a semiconductor material (e.g., the bandgap voltage of silicon).

**540 With voltage source regulating:**

This subclass is indented under subclass 538. Subject matter wherein a voltage supplied to the electrodes of a space discharge device or to a solid-state device is maintained constant at a predetermined value.

SEE OR SEARCH THIS CLASS, SUBCLASS:

306, for amplitude control systems of a converted or shaped signal.

SEE OR SEARCH CLASS:

315, Electric Lamp and Discharge Devices: Systems, subclass 287 for periodic types of current or voltage regulator used with pulsating or AC supplies and subclasses 291+ for current or voltage regulation systems where the discharge device is the ultimate load claimed.

323, Electricity: Power Supply or Regulation Systems, subclasses 227 and 291 for voltage magnitude control systems with electron discharge devices where there is no interposed signal controlled transducer between the original and controlled energy.

330, Amplifiers, subclasses 127+ for control of amplifier power supplies or bias voltages.

331, Oscillators, subclass 186 for oscillators with regulated power supplies.

363, Electric Power Conversion Systems, subclasses 74+ for voltage or magnitude control for current conversion systems (e.g., rectification, derectification, etc.).

**541 With field-effect transistor:**

This subclass is indented under subclass 540. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an elec-

tric field applied to the semiconductor from a control terminal (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carriers (i.e., holes in a p-type material channel and electrons in an n-type material channel).

- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

537, for particular substrate biasing circuit with a field-effect transistor.

**542 With diverse type transistor devices:**

This subclass is indented under subclass 538. Subject matter including different types of transistors in the same circuit.

**543 Using field-effect transistor:**

This subclass is indented under subclass 538. Subject matter wherein the circuit includes only one type of transistor which is a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electric field applied to the semiconductor from a control terminal (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carriers (i.e., holes in a p-type

material channel and electrons in an n-type material channel).

- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 537, for a particular substrate biasing circuit with a field-effect transistor.  
541, for a stabilized circuit with current or voltage regulating using a field-effect transistor.

**544 Power conservation or pulse type:**

This subclass is indented under subclass 530. Subject matter wherein the power supply or bias level is reduced to conserve power or a power supply is provided for biasing having a periodic or nonperiodic pulsing type characteristic.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 100+, for signal converting, shaping, or generating and, particularly, subclasses 291+ for clock type signal generation.  
545+, for monitoring for supply or bias preservation.

SEE OR SEARCH CLASS:

- 365, Static Information Storage and Retrieval, subclass 227 for power conservation in memory systems.

- 368, Horology: Time Measuring Systems or Devices, subclass 66 for power source control for timekeeping devices.

**545 Including signal protection or bias preservation:**

This subclass is indented under subclass 530. Subject matter wherein a circuit is provided which guards against signal information loss or bias loss.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 379+, for gating circuitry with means to maintain signal transmission.  
392+, for time delay circuits to control switching operations.

SEE OR SEARCH CLASS:

- 324, Electricity: Measuring and Testing, subclasses 51+ for circuit fault detection and testing, per se.  
326, Electronic Digital Logic Circuitry, subclasses 21+ for digital logic circuits or systems for improving reception sensitivity and maintaining transmission integrity.  
340, Communications: Electrical, subclasses 636.1 through 636.21 for battery level condition responsive systems.  
365, Static Information Storage and Retrieval, subclass 228 for memory systems with provision for prevention of data loss (e.g., backup storage or power).  
368, Horology: Time Measuring Systems or Devices, subclass 66 for power source monitoring of chronological timepieces.  
714, Error Detection/Correction and Fault Detection/Recovery, appropriate subclasses for subject matter limited to particular loss of data by transmission apparatus or to the recovery of information from error or Fault operating conditions (e.g., pulse coded data).

**546 With field-effect transistor:**

This subclass is indented under subclass 545. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal

through a channel of semiconductor material whose conductivity depends largely on an electric field applied to the semiconductor from a control terminal (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).
- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 537, for particular substrate biasing circuit with field-effect transistor.
- 541, for a stabilized circuit with current or voltage regulating using a field-effect transistor.
- 543, for a stabilized circuit with a field-effect transistor.

**547 With selectively or alternately DC or AC input:**

This subclass is indented under subclass 530. Subject matter wherein a DC or AC power is selectively or alternately supplied to the input of the circuit device.

SEE OR SEARCH CLASS:

- 307, Electrical Transmission or Interconnection Systems, subclasses 18+ and 43+ for plural power supplies, particularly subclasses 23, 29, 64+, or 80+

for selective, substitute, or alternate sources.

**548 With oscillator or interrupter:**

This subclass is indented under subclass 530. Subject matter wherein the power supply employs an oscillatory circuit as a source of varying current.

- (1) Note. The oscillatory circuit may comprise an interrupting type network.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 100+, for non-free running signal generation, and particularly 124 for chopper type generation.
- 596, for miscellaneous oscillatory or shock excited circuits.

SEE OR SEARCH CLASS:

- 310, Electrical Generator or Motor Structure, subclasses 10+ for dynamoelectric generating apparatus, particularly subclass 25 for reed type, subclass 26 for magneto structure type, and subclasses 31+ for self actuated interrupter type current generating devices.
- 330, Amplifiers, subclass 9 for amplifier circuits in which the input signal is periodically interrupted or drectified, applied to the amplifier, and then rectified and subclass 137 where an oscillator supplies or controls bias voltage.
- 331, Oscillators, appropriate subclasses for self-sustaining wave generators, per se.
- 363, Electric Power Conversion Systems, subclasses 15+ for inverter-rectifiers (DC to AC to DC systems), subclasses 102+ for dynamoelectric machine current converters, and subclasses 106+ for circuit interrupter type current converters.

**549 With hum or interaction prevention:**

This subclass is indented under subclass 530. Subject matter wherein alternating or hum components in an output of a power supply are prevented from appearing in the output system circuit.



SEE OR SEARCH THIS CLASS, SUB-CLASS:

551+, for miscellaneous unwanted signal elimination.

SEE OR SEARCH CLASS:

330, Amplifiers, subclass 149 for bucking hum, noise or distortion introduced into the amplifier signal channel.

363, Electric Power Conversion Systems, subclasses 39+ for current conversion systems that introduce or eliminate frequency components.

381, Electrical Audio Signal Processing Systems and Devices, appropriate subclasses for audio signal noise suppression.

**550 With particular filament heating circuit:**

This subclass is indented under subclass 530. Subject matter wherein a filament heating circuit with specific structure provides a current to heat the filament of an electron space discharge tube.

SEE OR SEARCH CLASS:

315, Electric Lamp and Discharge Devices: Systems, subclasses 94+ for cathode or cathode heater supply circuits.

330, Amplifiers, subclasses 199+ especially subclass 206 for filamentary heating of the filaments of an amplifier.

**551 Unwanted signal suppression:**

This subclass is indented under subclass 524. Subject matter wherein an undesired signal or group of signals is diminished and wherein such subject matter is not elsewhere classifiable.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

98, for separating composite signals.

310+, for transient or signal noise reduction by limiting, clipping, or clamping.

SEE OR SEARCH CLASS:

326, Electronic Digital Logic Circuitry, subclasses 21+ for signal sensitivity or transmission integrity which

includes input noise margin enhancement.

**552 Active filter:**

This subclass is indented under subclass 551. Subject matter wherein a specified frequency or a range of frequencies of an input signal is passed or blocked by the use of an active device.

(1) Note. Filter circuits that do not include any active element, such as a transistor, an amplifier, etc., and are constituted by distributed parameters, lumped parameters, long line elements, or passive elements (resistors, capacitors, or inductors) are excluded from this subclass and are classified primarily in Class 333, Wave Transmission Lines and Networks.

(2) Note. Filter circuits involving a systematic operation on data which results in a significant change in data are classified elsewhere.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

311, for transient or signal noise reduction in a filtered limiting, clipping, or clamping circuit.

379, for a gating circuit with spurious noise override.

SEE OR SEARCH CLASS:

181, Acoustics, subclasses 175+ for sound filters.

307, Electrical Transmission or Interconnection Systems, subclass 105 for a class appropriate harmonic filter or neutralizer.

333, Wave Transmission Lines and Networks, subclass 28 for equalizers, subclasses 165, 166, and 167+ for frequency or time domain filters, subclass 202+ for wave filters including long line elements.

340, Communications: Electrical, subclasses 825.71+ for selective communication systems which are frequency responsive.

363, Electric Power Conversion Systems, subclasses 39+ for conversion systems in combination with a filter.

- 375, Pulse or Digital Communications, subclass 103 for noise filtering in a digital receiver.
- 708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 300+ for filtering of data by a digital calculating computer and subclass 819 for analog computer filtering.
- 553 Adjustable:**  
This subclass is indented under subclass 552. Subject matter wherein some component or parameter of a filter circuit (such as filter resistor, filter capacitor, filter time constant, filter amplifier gain, filter input signal, etc.) is changeable in value by a control circuit signal.
- 554 Switched capacitor filter:**  
This subclass is indented under subclass 553. Subject matter wherein a filter transfer function is determined by a particular capacitor arrangement which is variable dependent upon the switched connections controlled by an input clock signal.
- (1) Note. The frequency or timing of the input clock signal dictates the characteristics and features of the signal filtering function.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
291+, for clock signal generating.  
337, for an integrator having a switched capacitive arrangement.  
365+, for the gating of an electrical signal between an input and an output.
- 555 Selective type signal filtering (e.g., from low pass to high pass, etc.):**  
This subclass is indented under subclass 553. Subject matter wherein different types of signal filtering are selected by an applied control signal.
- (1) Note. The filter can be changed from one permitting low frequency signals to flow through to one that only permits high frequency signals to pass, (e.g., low pass to high pass filtering).
- 556 Notch or bandreject:**  
This subclass is indented under subclass 552. Subject matter wherein a circuit arrangement attenuates a very narrow band of frequencies of an input signal, but will pass frequencies on either side (i.e., higher and lower frequencies) of the narrow band.
- 557 Bandpass:**  
This subclass is indented under subclass 552. Subject matter wherein a circuit arrangement attenuates frequencies on either side of a predetermined range of frequencies of an input signal.
- 558 Lowpass:**  
This subclass is indented under subclass 552. Subject matter wherein a circuit arrangement allows passage of frequencies of an input signal below a predetermined threshold frequency and blocks passage of frequencies above that threshold.
- 559 Highpass:**  
This subclass is indented under subclass 552. Subject matter wherein a circuit arrangement allows passage of frequencies of an input signal above a predetermined threshold frequency and blocks passage of frequencies below that threshold.
- 560 Nonlinear amplifying circuit:**  
This subclass is indented under subclass 524. Subject matter wherein a non-linear circuit is combined with an amplifier in which the output is not a substantial replica of the input (e.g., the output is not linearly proportional to the input of the circuit).
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
334, for a circuit where the output signal is functionally related to the input signal by a series of straight line segments.
- 561 With operational amplifier:**  
This subclass is indented under subclass 560. Subject matter wherein a nonlinear circuit is combined with a stable, high-gain direct coupled amplifier that depends on an external feedback from the output to the input of the circuit to determine its functional characteristics (i.e., an operational amplifier).

- (1) Note. An operational amplifier classifiable in this subclass must be combined with a source of signal energy or with a load that constitutes a nonlinear circuit which is not sufficiently comprehensive to be classified with a specific art area.

**SEE OR SEARCH CLASS:**

- 330, Amplifiers, subclasses 75+ for an amplifier with feedback.  
381, Electrical Audio Signal Processing Systems and Devices, subclasses 111+ for systems which include combinations of amplifier and loud speaker or amplifier and microphone.

**562 With field-effect transistor:**

This subclass is indented under subclass 561. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electric field applied to the semiconductor from a control terminal (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).
- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**563 With differential amplifier:**

This subclass is indented under subclass 560. Subject matter wherein the non-linear circuit is combined with an amplifier having two similar input circuits so connected as to respond to the difference between two voltages (or currents) and effectively suppress voltages or currents which are alike in the two signals.

**SEE OR SEARCH CLASS:**

- 330, Amplifiers, subclasses 252+ for semiconductor differential amplifiers.

**564 Integrated structure:**

This subclass is indented under subclass 524. Subject matter wherein a plurality of circuit elements or components are formed on or in a single block of semiconductor material.

- (1) Note. The following criteria are established to distinguish patents proper for Class 327 from patents proper for Class 257 (Active Solid-State Devices (e.g., Transistors, Solid-State Diodes)): (a) a claimed integrated circuit (IC) chip, per se, is classified in Class 257; (b) a claim to lead frames, per se, is classified in Class 257 since these are only used to connect an IC chip to the external environment; (c) an IC chip claimed in combination with a single lead, a battery, or bias without any configuration is classified in Class 257 since no circuitry external to the chip is claimed; (d) an IC chip claimed in combination with an external circuit suitable for Class 327 will be classified in Class 327 since Class 327 is higher than Class 257 in the overall class hierarchy; (e) circuit interconnections (e.g., point to point, lead interconnections, diode and transistor interconnections, etc.) within the confines of the IC chip itself are classified in Class 257, whereas these same interconnections outside the environment of an IC chip are classified in Class 327; (f) if a specific or broad structure of the IC is claimed with a utility, the patent will be classified in the utility subclass, (e.g., Class 348 (Television), Class 365 (Static Information Storage and Retrieval), etc.); (g) Charge Coupled Devices

claimed as part of the circuitry within an IC chip are classified in Class 257.

**565 With specific layout or layout interconnections:**

This subclass is indented under subclass 564. Subject matter including specific design emphasis on the topological arrangement of the components in the circuit and the circuit connectors.

**SEE OR SEARCH CLASS:**

- 257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for specific nonlinear solid state devices with specific structure and especially subclasses 202+ for integrated chip devices having active devices arrayed in a grid.
- 324, Electricity: Measuring and Testing, subclasses 73+ for integrated circuit chip structural arrangements/layouts including monitoring or testing elements.
- 326, Electronic Digital Logic Circuitry, subclass 47 for multifunctional or programmable logic circuits with specific integrated structure layout or layout interconnections and subclasses 101+ for integrated structure layout or layout interconnections for digital logic circuits in general.
- 438, Semiconductor Device Manufacturing: Process, particularly subclasses 128+ and 598+ for methods of selectively interconnecting semiconductor barrier layer-type device arrays.
- 716, Data Processing: Design and Analysis of Circuit or Semiconductor Mask, subclasses 1 through 18 for the design of circuit systems and integrated circuit structure by data processing and computer programming techniques.

**566 Having field-effect transistor device:**

This subclass is indented under subclass 565. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an elec-

tric field applied to the semiconductor from a control terminal (gate).

- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carriers (i.e., holes in a p-type material channel and electrons in an n-type material channel).
- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 581, for nonlinear solid-state device circuits and systems with field-effect transistors, per se.

**567 Thin film:**

This subclass is indented under subclass 524. Subject matter wherein a conductive, resistive, or capacitive passive network is deposited under a form of thin patterned layer, which is less than 5 micrometers in thickness, on a substrate to form an electronic component that is included in a nonlinear circuit or acts as a nonlinear element of the circuit.

**SEE OR SEARCH CLASS:**

- 307, Electrical Transmission or Interconnection Systems, subclass 403 for thin film parametrons in nonlinear reactor systems.

**568 Negative resistance type:**

This subclass is indented under subclass 524. Subject matter wherein an electron space discharge device or a solid-state device included in the nonlinear circuit has a negatively sloped portion in its current-voltage characteristic plot in which an increase in voltage results in a decrease in current.

- (1) Note. Some examples of negative resistance tubes are the dynatron and the transitron.

**SEE OR SEARCH CLASS:**

- 331, Oscillators, subclass 115 for negative resistance semiconductor oscillators and subclasses 132+ for oscillatory circuits utilizing a negative resistance or negative transconductance tube means.
- 333, Wave Transmission Lines and Networks, subclasses 213+ for negative resistance or reactance networks of the active element type comprising a two terminal network.

**569 Unijunction transistor:**

This subclass is indented under subclass 568. Subject matter including a single junction three electrode solid-state device with two of the electrodes being connected to one region and the remaining electrode being connected to another region wherein a signal applied to the latter electrode causes a breakdown across the transistor junction allowing a current to flow between the other two electrodes.

**570 Having "N"-shape curve on I-V plot (e.g., tunnel diode type, etc.):**

This subclass is indented under subclass 568. Subject matter including an electron space discharge device or a solid-state device whose characteristic on a current versus voltage plot (i.e., with the current plotted on the Y axis and voltage on the X axis) has an "N"-shape.

- (1) Note. A solid-state diode having modified physical properties to reduce the amplitude of the negative slope portion of the curve thereby providing threshold operation is classified in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 571, for a miscellaneous circuit having a device with an "S"-shape negative resistance curve.

**571 Having "S"-shape curve on I-V plot (e.g., pnpn diode type):**

This subclass is indented under subclass 568. Subject matter including a solid-state device whose characteristic on a current versus voltage plot (i.e., with the current plotted on the Y axis and voltage on the X axis) has an "S"-shape.

- (1) Note. A solid-state four layer diode, one of whose outer layers is a metal, breaks down at a predetermined reverse voltage point junction to provide high current at low voltages.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 570, for a miscellaneous circuit having a device with an "N"-shape negative resistance curve.

**572 Secondary emissive type:**

This subclass is indented under subclass 568. Subject matter which includes an electron space discharge device which relies upon the phenomenon of the release of electrons from a structure which has been impacted by other high-velocity electrons.

SEE OR SEARCH CLASS:

- 330, Amplifiers, subclass 42 for amplifiers utilizing secondary emission tubes.
- 331, Oscillators, subclass 133 for oscillatory circuits utilizing a secondary emissive tube such as a dynatron.

**573 Electron multiplier type:**

This subclass is indented under subclass 572. Subject matter wherein the secondary emissive type tube includes multiple electrodes (i.e., dynodes) which attract electrons freed from a light sensitive cathode and thereby increase the number of flowing electrons.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
514+, for miscellaneous light responsive circuits which do not provide electron multiplication.
- 574 Utilizing a three or more electrode solid-state device:**  
This subclass is indented under subclass 524. Subject matter wherein the nonlinear circuit includes at least one solid-state device with more than two electrodes having a particularly described feature.
- SEE OR SEARCH CLASS:  
257, Active Solid-State Device (e.g., Transistors, Solid-State Diodes), appropriate subclass for transistors or solid-state devices, per se.
- 575 Darlington connection:**  
This subclass is indented under subclass 574. Subject matter wherein a nonlinear circuit includes a connection of two similar transistors where their collectors are tied together and the emitter of the first transistor is directly coupled to the base of the second transistor and the emitter current of the first transistor equals the base current of the second transistor.
- (1) Note. A Darlington connection is also called a Darlington pair, double emitter-follower or beta-multiplier.
- 576 Complementary transistors:**  
This subclass is indented under subclass 574. Subject matter wherein a nonlinear circuit includes two transistors that have opposite conductivity (i.e., pnp and npn) and have matching electrical characteristics.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
214, for bistable circuits including complementary transistors.
- 577 Multiple emitter transistor:**  
This subclass is indented under subclass 574. Subject matter wherein a circuit includes a three or more electrode solid-state device which is a junction type bipolar transistor having at least two emitter regions in addition to the base and collector regions.
- 578 Multiple collector transistor:**  
This subclass is indented under subclass 574. Subject matter wherein the circuit includes a three or more electrode solid-state device which is a junction type bipolar transistor having at least two collector regions in addition to base and emitter regions.
- 579 Minority carrier storage:**  
This subclass is indented under subclass 574. Subject matter wherein a concentration of minority carriers occurring at a pn junction of a semiconductor is utilized, increased, or avoided.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
585, for miscellaneous minority carrier storage diode circuits.
- 580 Transistor breakdown device (e.g., avalanche, zener, punch through, etc.):**  
This subclass is indented under subclass 574. Subject matter including a transistor having a threshold voltage above which the applied voltage must rise before a junction breakdown occurs allowing a current to flow across the transistor junction.
- 581 Field-effect transistor:**  
This subclass is indented under subclass 574. Subject matter including a unipolar transistor in which current carriers are injected at a source terminal and pass to a drain terminal through a channel of semiconductor material whose conductivity depends largely on an electric field applied to the semiconductor from a control terminal (gate).
- (1) Note. In a unipolar transistor, the source to drain current involves only one type of charge carrier (i.e., holes in a p-type material channel and electrons in an n-type material channel).
- (2) Note. Two types of FET structures are prevalent: (a) an all-junction device, known as a junction FET or JFET characterized by having heavily doped impurity regions of one type (e.g., p-type material), known as gate regions, on both sides of a second type semiconductor bar (e.g., n+ type material) to form a

pn junction, and (b) a device such as a MOSFET/IGFET, consisting of a lightly doped substrate (e.g., p-type material) into which two highly doped regions (e.g., n+ type material) are diffused for forming source/drain regions with the area therebetween becoming the channel for current carriers (i.e., holes or electrons) and with a layer of insulating material (e.g., SiO<sub>2</sub>) grown over the channel surface for separating the channel from a control (i.e., gate) electrode.

**582 Four or more layer device (e.g., silicon-controlled rectifier, etc.):**

This subclass is indented under subclass 574. Subject matter including a semiconductor device with four or more alternating layers having different conductivities, for example a pnpn device.

SEE OR SEARCH CLASS:

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for a semiconductor structure, per se.

**583 Utilizing two electrode solid-state device:**

This subclass is indented under subclass 524. Subject matter including a semiconductor device containing two structures that emit or collect electrons or holes, or that control their movements by an applied electrical field.

**584 Breakdown diode (e.g., zener diode, avalanche diode, etc.):**

This subclass is indented under subclass 583. Subject matter including a diode circuit having a threshold voltage above which the applied voltage must rise before the diode junction breaks down allowing current flow across the diode pn junction to rise suddenly.

**585 Minority carrier storage diode (e.g., enhancement diode, etc.):**

This subclass is indented under subclass 583. Subject matter including a diode wherein minority carriers which accumulate at the junction when the diode is forward biased are suddenly swept away after the back biasing increases to a certain point.

SEE OR SEARCH THIS CLASS, SUBCLASS:

579, for a miscellaneous minority carrier storage transistor circuit.

**586 Capacitive diode:**

This subclass is indented under subclass 583. Subject matter including a voltage responsive diode whose capacitance varies as a result of changes in the space charge at the pn junction.

SEE OR SEARCH THIS CLASS, SUBCLASS:

194, for stable state circuits utilizing a capacitive diode.

302, for clock or pulse waveform generating utilizing a storage diode.

**587 Bridge circuit:**

This subclass is indented under subclass 583. Subject matter including four two-electrode solid-state devices with their input and output terminals connected in a closed loop to form a four arm network.

(1) Note. Bridge circuits may have another arm, called a diagonal arm, which is connected across two adjacent arms of the network, between an input terminal and an output terminal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

588, for a miscellaneous bridge circuit.

**588 With bridge circuit:**

This subclass is indented under subclass 524. Subject matter including a circuit wherein four electrical elements have their input and output terminals connected in a closed loop to form a four arm network.

(1) Note. Bridge circuits may have another arm, called a diagonal arm, which is connected across two adjacent arms of the network, between an input terminal and an output terminal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

587, for two electrode solid-state device with bridge circuit.

**SEE OR SEARCH CLASS:**

- 323, Electricity: Power Supply or Regulation Systems, subclass 365 for Wheatstone bridges, in general.
- 324, Electricity: Measuring and Testing, subclasses 57+ for impedance measuring bridge systems and subclasses 98+ and 101 for bridge-type electric meter systems.
- 330, Amplifiers, subclasses 72, 76+, 146, and 175 for amplifier networks utilizing bridge networks.
- 331, Oscillators, subclasses 110 and 138+ for bridge-type oscillator systems.
- 332, Modulators, subclass 172 for bridge-type amplitude modulators.
- 333, Wave Transmission Lines and Networks, subclasses 117+, 169, 170+, and 197+ for passive type bridge systems.

**589 With bootstrap circuit:**

This subclass is indented under subclass 524. Subject matter which achieves enhanced circuit linearity generally by a particular signal boost feedback structure.

**SEE OR SEARCH CLASS:**

- 326, Electronic Digital Logic Circuitry, subclasses 88 and 92 for logic circuits with bootstrapping.
- 330, Amplifiers, subclass 156 for amplifiers which use a bootstrap coupling to the input circuit of the amplifier and in which there is a linear relationship between the output and the input.

**590 With particular feedback:**

This subclass is indented under subclass 524. Subject matter wherein energy is transferred from the output of the circuit device to an input thereof.

**SEE OR SEARCH CLASS:**

- 330, Amplifiers, subclasses 75, 290, and 291+ for feedback amplifiers.

**591 Tube performs plural functions:**

This subclass is indented under subclass 524. Subject matter wherein a nonlinear circuit device includes an electron tube which performs at least two independent operations either simultaneously or selectively.

- (1) Note. An example for this subclass is a circuit including a tube which may be used alternatively as a rectifier or a nonlinear amplifier, etc.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 334+, for a circuit which relates an output signal to an input signal by a mathematical operation or function.

**SEE OR SEARCH CLASS:**

- 331, Oscillators, subclass 58 for free running oscillators wherein the tube or tubes of the oscillator perform other functions simultaneously with the oscillatory function and subclass 59 for convertible oscillator systems (e.g., oscillator to amplifier, etc.).

**592 With oscillation prevention:**

This subclass is indented under subclass 524. Subject matter wherein a particular circuit prevents undesired oscillation or ringing.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 549, for a supply or bias source with hum prevention.

**SEE OR SEARCH CLASS:**

- 330, Amplifiers, subclass 149 for hum or noise bucking systems.
- 331, Oscillators, subclass 105 for oscillators with parasitic oscillation control or prevention means.

**593 With distributed parameter circuit:**

This subclass is indented under subclass 524. Subject matter wherein a particular circuit is of the distributed network type, the capacitance, inductance and resistance of which cannot be isolated into separate lumped capacitors, inductors, or resistors and wherein the time factor of propagation of wave energy in the network is appreciable.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 123, for harmonic frequency conversion systems with distributed parameter elements.



## SEE OR SEARCH CLASS:

- 330, Amplifiers, particularly subclasses 5, 43, 44+, 47, 49, and 53+ for amplifiers with distributed parameter elements.
- 331, Oscillators, subclasses 5, 6+, 79+, 86+, 93, and 96+ for oscillators with distributed parameter elements.
- 333, Wave Transmission Lines and Networks, appropriate subclasses for wave transmission networks of the long line type.

**594 With particular coupling or decoupling:**

This subclass is indented under subclass 524. Subject matter wherein a particular circuit includes an electrical interaction between a source and an input to the system, between the output of a first electrical device and the input of another such device, or between the input of the system and the output of the system.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 329, for amplitude limiting systems with tuned circuit.
- 531+, for particular source of power or bias voltage with filter or rectifier.

## SEE OR SEARCH CLASS:

- 330, Amplifiers, subclasses 157+ for plural stage amplifiers with interstage coupling means, subclasses 185+ for input and subclasses 192+ for output coupling networks.
- 331, Oscillators, subclasses 72+ for oscillator circuits utilizing electron coupled tube means and subclasses 74+ for oscillators with particular output coupling network.
- 333, Wave Transmission Lines and Networks, subclasses 3, 24, 109+, 117+, and 124+ for coupling networks comprised of passive elements.

**595 With particular connecting:**

This subclass is indented under subclass 524. Subject matter wherein a particular circuit includes a network in which there exists a path, composed of branches of the network, between every pair of terminals of the network.

- (1) Note. Some examples of systems to be found in this subclass are push-pull, push-push, direct, and parallel connected networks.

**596 Including oscillatory or shock-excited circuit:**

This subclass is indented under subclass 524. Subject matter wherein a particular circuit includes a circuit capable of maintaining sustained oscillations or a resonant circuit capable of oscillating freely upon having an impulse of energy applied thereto.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 32, for pulse width selecting systems with shock excited circuit.
- 100+, for non-free running signal generation.

## SEE OR SEARCH CLASS:

- 331, Oscillators, subclasses 128 and 165+ for shock excited resonant circuit oscillators.

**597 With particular grid control:**

This subclass is indented under subclass 524. Subject matter wherein a particular circuit includes an impedance network which is provided in the input circuit of a control grid of an electron space discharge tube whereby the conductive state of the tube depends upon the state of the impedance network.

## SEE OR SEARCH CLASS:

- 313, Electric Lamp and Discharge Devices, subclasses 293+ for a discharge device with apertured electrode (e.g., grid) between two other electrodes.
- 315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses for such discharge device systems as those which control a discharge device as the ultimate load therein.
- 330, Amplifiers, appropriate subclasses for grid controlled tube amplifiers.

**598 With particular tube structure:**

This subclass is indented under subclass 524. Subject matter wherein a particular circuit includes a space discharge device of special tube construction or electrode arrangement.

- (1) Note. This subclass and the intended subclasses will include structures of the tube wherein a plurality of groups of electrodes are contained in a single envelope, provided that there is one input circuit and one output circuit and the entire assembly acts as a single tube.
- (2) Note. For subject matter comprehending structural features of electrical lamp and discharge devices with no significant control circuit means, the search will extend to Class 313, Electric Lamp and Discharge Devices. For subject matter comprehending special types of electric lamp and space discharge devices combined with control circuits whereby the conductive condition of the device is determined and wherein no load is included, the search will extend to Class 315, Electric Lamp and Discharge Devices: Systems.

**SEE OR SEARCH CLASS:**

- 313, Electric Lamp and Discharge Devices, for the structure of space discharge device, see (2) Note.
- 315, Electric Lamp and Discharge Devices: Systems, subclasses 3+ and 32+ for combined tube and circuit element structure, see (2) Note.
- 330, Amplifiers, subclasses 3, 41, 42, 43, 44+, 47+, 49, and 64 for amplifier systems utilizing tubes of a particular construction.
- 331, Oscillators, subclasses 5, 6+, 79+, 86+, 103, 126+, and 184 for oscillator systems utilizing tubes of a particular construction.
- 332, Modulators, subclasses 165+ for modulator systems utilizing tubes of a particular construction.

**599 Vacuum tube type:**

This subclass is indented under subclass 598. Subject matter wherein a particular circuit includes a space discharge device which consists of electrodes in an evacuated tube.

**600 Beam tube structure:**

This subclass is indented under subclass 599. Subject matter including a space discharge device which contains and controls a narrow electron stream.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 301, for rectangular or pulse waveform generation with electron beam type tube.

**SEE OR SEARCH CLASS:**

- 250, Radiant Energy, subclass 281 for methods and apparatus for the ionic separation or analysis of material (e.g., mass spectrometer), subclass 306 for the inspection of solids or liquids by charged particles (e.g., electron microscopes), subclasses 440.1+ for irradiated object supports of the charged particle inspection type, and subclasses 492.1+ for the irradiation of objects or materials, generally.
- 313, Electric Lamp and Discharge Devices, subclass 62 for cyclotron structure, subclasses 299, 359, and 364 for beam tube structures, and subclasses 359.1+ for the structure of positive ion accelerators.
- 315, Electric Lamp and Discharge Devices: Systems, subclass 3 for beam tube and circuit element structure.

**601 Gas tube:**

This subclass is indented under subclass 598. Subject matter wherein a particular circuit includes a space discharge device which consists of electrodes in a gas filled envelope or tube.

**602 With particular electrode arrangement:**

This subclass is indented under subclass 601. Subject matter wherein a gaseous discharge tube device includes a particular electrode configuration.

**SEE OR SEARCH CLASS:**

313, Electric Lamp and Discharge Devices, subclasses 567+ for electron space discharge devices comprised of an envelope with gas or vapor and which may have a particular electrode arrangement.

**603 MISCELLANEOUS:**

This subclass is indented under the class definition. Subject matter not provided for in any of the preceding subclasses.

END