

CPC**COOPERATIVE PATENT CLASSIFICATION****H03K**

PULSE TECHNIQUE (measuring pulse characteristics [G01R](#); mechanical counters having an electrical input [G06M](#); information storage devices in general [G11](#); sample-and-hold arrangements in electric analogue stores [G11C 27/02](#); construction of switches involving contact making and breaking for generation of pulses, e.g. by using a moving magnet, [H01H](#); static conversion of electric power [H02M](#); generation of oscillations by circuits employing active elements which operate in a non-switching manner [H03B](#); modulating sinusoidal oscillations with pulses [H03C](#), [H04L](#); discriminator circuits involving pulse counting [H03D](#); automatic control of generators [H03L](#); starting, synchronisation or stabilisation of generators where the type of generator is irrelevant or unspecified [H03L](#); coding, decoding or code conversion in general [H03M](#))

NOTE

1. This subclass covers:
 - methods, circuits, devices, or apparatus using active elements operating in a discontinuous or switching manner for generating, counting, amplifying, shaping, modulating, demodulating, or otherwise manipulating signals;
 - electronic switching not involving contact-making and braking;
 - logic circuits handling electric pulses.
2. In this subclass, the following expression is used with the meaning indicated:
 - "active element" exercises control over the conversion of input energy into an oscillation or a discontinuous flow of energy.
3. In this subclass, where the claims of a patent document are not limited to a specific circuit element, the document is classified at least according to the elements used in the described embodiment.

WARNING

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups :

[H03K 17/695](#) covered by [H03K 17/687](#)

H03K 3/00

Circuits for generating electric pulses; Monostable, bistable or multistable circuits ([H03K 4/00](#) takes precedence; for digital computers [G06F 1/025](#), {[G06F 1/04](#)})

H03K 3/01

. Details

H03K 3/011

. . Modifications of generator to compensate for variations in physical values, e.g. voltage, temperature {(to maintain energy constant [H03K 3/015](#))}

H03K 3/012

. . Modifications of generator to improve response time or to decrease power consumption

H03K 3/013

. . Modifications of generator to prevent operation by noise or interference

H03K 3/014

. . Modifications of generator to ensure starting of oscillations

H03K 3/015

. . Modifications of generator to maintain energy constant

| | | |
|--------------|-------|--|
| H03K 3/017 | .. | Adjustment of width or dutycycle of pulses (pulse width modulation H03K 7/08 ; {to maintain energy constant H03K 3/015 }) |
| H03K 3/02 | . | Generators characterised by the type of circuit or by the means used for producing pulses (H03K 3/64 to H03K 3/84 take precedence) |
| H03K 3/021 | .. | by the use, as active elements, of more than one type of element or means, e.g. BIMOS, composite devices such as IGBT |
| H03K 3/023 | .. | by the use of differential amplifiers or comparators, with internal or external positive feedback |
| H03K 3/0231 | ... | Astable circuits {(H03K 3/0315 takes precedence)} |
| H03K 3/02315 | .... | {Stabilisation of output, e.g. using crystal} |
| H03K 3/0232 | ... | Monostable circuits |
| H03K 3/0233 | ... | Bistable circuits |
| H03K 3/02332 | .... | {of the master-slave type} |
| H03K 3/02335 | .... | {provided with means for increasing reliability; for protection; for ensuring a predetermined initial state when the supply voltage has been applied; for storing the actual state when the supply voltage fails (digital storage cells each combining volatile and non-volatile storage properties G11C 14/00)} |
| H03K 3/02337 | .... | {Bistables with hysteresis, e.g. Schmitt trigger (non-regenerative amplitude discriminators G01R 19/165)} |
| H03K 3/0234 | ... | Multistable circuits |
| H03K 3/027 | .. | by the use of logic circuits, with internal or external positive feedback |
| H03K 3/03 | ... | Astable circuits |
| H03K 3/0307 | .... | {Stabilisation of output, e.g. using crystal} |
| H03K 3/0315 | .... | {Ring oscillators} |
| H03K 3/0322 | ..... | {with differential cells} |
| H03K 3/033 | ... | Monostable circuits |
| H03K 3/037 | ... | Bistable circuits |
| H03K 3/0372 | .... | {of the master-slave type} |
| H03K 3/0375 | .... | {provided with means for increasing reliability; for protection; for ensuring a predetermined initial state when the supply voltage has been applied; for storing the actual state when the supply voltage fails (digital storage cells each combining volatile and non-volatile storage properties G11C 14/00)} |
| H03K 3/0377 | .... | {Bistables with hysteresis, e.g. Schmitt trigger (non-regenerative amplitude discriminators G01R 19/165)} |
| H03K 3/038 | ... | Multistable circuits |
| H03K 3/04 | .. | by the use, as active elements, of vacuum tubes only, with positive feedback (H03K 3/023 , H03K 3/027 take precedence) |
| H03K 3/05 | ... | using means other than a transformer for feedback |
| H03K 3/06 | .... | using at least two tubes so coupled that the input of one is derived from the output of another, e.g. multivibrator |
| H03K 3/08 | ..... | astable |
| H03K 3/09 | ..... | Stabilisation of output |
| H03K 3/10 | ..... | monostable |
| H03K 3/12 | ..... | bistable |

| | | |
|-----------------------------|-------|---|
| H03K 3/13 | ..... | Bistables with hysteresis, e.g. Schmitt trigger |
| H03K 3/14 | ..... | multistable |
| H03K 3/16 | ... | using a transformer for feedback, e.g. blocking oscillator with saturable core |
| H03K 3/22 | .... | specially adapted for amplitude comparison, i.e. Multiar |
| H03K 3/26 | .. | by the use, as active elements, of bipolar transistors with internal or external positive feedback (H03K 3/023 , H03K 3/027 take precedence) |
| H03K 3/28 | ... | using means other than a transformer for feedback |
| H03K 3/281 | .... | using at least two transistors so coupled that the input of one is derived from the output of another, e.g. multivibrator |
| H03K 3/282 | ..... | astable |
| H03K 3/2821 | ..... | {Emitters connected to one another by using a capacitor} |
| H03K 3/2823 | ..... | {using two active transistor of the same conductivity type (H03K 3/2821 takes precedence)} |
| H03K 3/2825 | ..... | {in an asymmetrical circuit configuration} |
| H03K 3/2826 | ..... | {using two active transistors of the complementary type (H03K 3/2821 take precedence)} |
| H03K 3/2828 | ..... | {in an asymmetrical circuit configuration} |
| H03K 3/283 | ..... | Stabilisation of output {e.g. using crystal} |
| H03K 3/284 | ..... | monostable |
| H03K 3/286 | ..... | bistable |
| H03K 3/2865 | ..... | {ensuring a predetermined initial state when the supply voltage has been applied; storing the actual state when the supply voltage fails (digital storage cells each combining volatile and non-volatile storage properties G11C 14/00)} |
| H03K 3/287 | ..... | using additional transistors in the feedback circuit (H03K 3/289 takes precedence) |
| H03K 3/288 | ..... | using additional transistors in the input circuit (H03K 3/289 takes precedence) |
| H03K 3/2885 | ..... | the input circuit having a differential configuration |
| H03K 3/289 | ..... | of the master-slave type |
| H03K 3/2893 | ..... | Bistables with hysteresis, e.g. Schmitt trigger |
| H03K 3/2897 | ..... | with an input circuit of differential configuration |
| H03K 3/29 | ..... | multistable |
| H03K 3/30 | ... | using a transformer for feedback, e.g. blocking oscillator |
| H03K 3/313 | .. | by the use, as active elements, of semiconductor devices with two electrodes, one or two potential-jump barriers, and exhibiting a negative resistance characteristic |
| H03K 3/315 | ... | the devices being tunnel diodes |
| H03K 3/33 | .. | by the use, as active elements, of semiconductor devices exhibiting hole storage or enhancement effect |
| H03K 3/335 | .. | by the use, as active elements, of semiconductor devices with more than two electrodes and exhibiting avalanche effect |

- H03K 3/35 .. by the use, as active elements, of bipolar semiconductor devices with more than two PN junctions, or more than three electrodes, or more than one electrode connected to the same conductivity region ([H03K 3/023](#), [H03K 3/027](#) take precedence)

WARNING

Not complete; for four layer diodes see also [H03K 3/313](#)

- H03K 3/351 ... the devices being unijunction transistors ([H03K 3/352](#) takes precedence)
- H03K 3/352 ... the devices being thyristors
- H03K 3/3525 Anode gate thyristors or programmable unijunction transistors
- H03K 3/353 .. by the use, as active elements, of field-effect transistors with internal or external positive feedback ([H03K 3/023](#), [H03K 3/027](#) take precedence)
- H03K 3/354 ... Astable circuits
- H03K 3/3545 {Stabilisation of output, e.g. using crystal}
- H03K 3/355 ... Monostable circuits
- H03K 3/356 ... Bistable circuits
- H03K 3/356008 {ensuring a predetermined initial state when the supply voltage has been applied; storing the actual state when the supply voltage fails (digital storage cells each combining volatile and non-volatile storage properties [G11C 14/00](#))}
- H03K 3/356017 {using additional transistors in the input circuit ([H03K 3/356104](#), [H03K 3/3562](#) take precedence)}
- H03K 3/356026 {with synchronous operation ([H03K 3/356034](#), [H03K 3/356052](#) take precedence)}
- H03K 3/356034 {the input circuit having a differential configuration}
- H03K 3/356043 {with synchronous operation}
- H03K 3/356052 {using pass gates}
- H03K 3/35606 {with synchronous operation}
- H03K 3/356069 {using additional transistors in the feedback circuit ([H03K 3/356104](#), [H03K 3/3562](#) take precedence)}
- H03K 3/356078 {with synchronous operation}
- H03K 3/356086 {with additional means for controlling the main nodes ([H03K 3/356104](#), [H03K 3/3562](#) take precedence)}
- H03K 3/356095 {with synchronous operation}
- H03K 3/356104 {using complementary field-effect transistors ([H03K 3/35625](#) takes precedence)}

WARNING

Subgroups of [H03K 3/356104](#) are not complete.

- H03K 3/356113 {using additional transistors in the input circuit}
- H03K 3/356121 {with synchronous operation ([H03K 3/35613](#), [H03K 3/356147](#) take precedence)}
- H03K 3/35613 {the input circuit having a differential configuration}

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|---------------|-------|--|
| H03K 3/356139 | | {with synchronous operation} |
| H03K 3/356147 | | {using pass gates} |
| H03K 3/356156 | | {with synchronous operation} |
| H03K 3/356165 | ..... | {using additional transistors in the feedback circuit} |
| H03K 3/356173 | ..... | {with synchronous operation} |
| H03K 3/356182 | ..... | {with additional means for controlling the main nodes} |
| H03K 3/356191 | ..... | {with synchronous operation} |
| H03K 3/3562 | .... | of the master-slave type |
| H03K 3/35625 | ..... | {using complementary field-effect transistors} |
| H03K 3/3565 | .... | Bistables with hysteresis, e.g. Schmitt trigger |
| H03K 3/3568 | ... | Multistable circuits |
| H03K 3/357 | .. | by the use, as active elements, of bulk negative resistance devices, e.g. Gunn-effect devices |
| H03K 3/36 | .. | by the use, as active elements, of semiconductors, not otherwise provided for |
| H03K 3/37 | .. | by the use, as active elements, of gas-filled tubes, e.g. astable trigger circuits (H03K 3/55 takes precedence) |
| H03K 3/38 | .. | by the use, as active elements, of superconductive devices |
| H03K 3/40 | .. | by the use, as active elements, of electrochemical cells |
| H03K 3/42 | .. | by the use, as active elements, of opto-electronic devices, i.e. light-emitting and photoelectric devices electrically- or optically-coupled |
| H03K 3/43 | .. | by the use, as active elements, of beam deflection tubes |
| H03K 3/45 | .. | by the use, as active elements, of non-linear magnetic or dielectric devices |
| H03K 3/455 | ... | {using thin films} |
| H03K 3/47 | ... | the devices being parametrons |
| H03K 3/49 | ... | the devices being ferro-resonant |
| H03K 3/51 | ... | the devices being multi-aperture magnetic cores, e.g. transfluxors |
| H03K 3/53 | .. | by the use of an energy-accumulating element discharged through the load by a switching device controlled by an external signal and not incorporating positive feedback (H03K 3/335 takes precedence; {working of metal by electro-erosion with spark discharge B23H ; for internal combustion engine ignition systems F02P 3/08 ; electronic lighters F23Q 2/285 , F23Q 3/00 ; flash lamps H05B 41/30 }) |
| H03K 3/537 | ... | the switching device being a spark gap |
| H03K 3/543 | ... | the switching device being a vacuum tube |
| H03K 3/55 | ... | the switching device being a gas-filled tube having a control electrode |
| H03K 3/57 | ... | the switching device being a semiconductor device |
| H03K 3/59 | .. | by the use of galvano-magnetic devices, e.g. Hall effect devices |
| H03K 3/64 | . | Generators producing trains of pulses, i.e. finite sequences of pulses |
| H03K 3/66 | .. | by interrupting the output of a generator |
| H03K 3/70 | ... | time intervals between all adjacent pulses of one train being equal |
| H03K 3/72 | .. | with means for varying repetition rate of trains |
| H03K 3/78 | . | Generating a single train of pulses having a predetermined pattern, e.g. a predetermined number |

- H03K 3/80 . Generating train of sinusoidal oscillations (by interrupting [H03C](#), [H04L](#))
- H03K 3/84 . Generating pulses having a predetermined statistical distribution of a parameter, e.g. random pulse generators
- H03K 3/86 . Generating pulses by means of delay lines and not covered by the preceding sub-groups

- H03K 4/00** **Generating pulses having essentially a finite slope or stepped portions**
(generation of supply voltages from deflection waveforms [H04N 3/18](#))
- H03K 4/02 . having stepped portions, e.g. staircase waveform
- H03K 4/023 .. {by repetitive charge or discharge of a capacitor, analogue generators}
- H03K 4/026 .. {using digital techniques}
- H03K 4/04 . having parabolic shape
- H03K 4/06 . having triangular shape
- H03K 4/063 .. {high voltage - or current generators}
- H03K 4/066 .. {using a Miller-integrator ([H03K 4/08](#) takes precedence)}
- H03K 4/08 .. having sawtooth shape
- H03K 4/085 ... {Protection of sawtooth generators}
- H03K 4/10 ... using as active elements vacuum tubes only
- H03K 4/12 in which a sawtooth voltage is produced across a capacitor
- H03K 4/14 using two tubes so coupled that the input of each one is derived from the output of the other, e.g. multivibrator {(multivibrator generating other pulses [H03K 3/00](#))}
- H03K 4/16 using a single tube with positive feedback through transformer, e.g. blocking oscillator {(blocking oscillators generating other pulses [H03K 3/00](#))}
- H03K 4/18 using a single tube exhibiting negative resistance between two of its electrodes, e.g. transitron, dynatron
- H03K 4/20 using a tube with negative feedback by capacitor, e.g. Miller integrator
- H03K 4/22 combined with transitron, e.g. phantastron, sanatron
- H03K 4/24 Boot-strap generators
- H03K 4/26 in which a sawtooth current is produced through an inductor
- H03K 4/28 using a tube operating as a switching device
- H03K 4/32 combined with means for generating the driving pulses
- H03K 4/34 using a single tube with positive feedback through a transformer
- H03K 4/36 using a single tube exhibiting negative resistance between two of its electrodes, e.g. transitron, dynatron
- H03K 4/38 combined with Miller integrator
- H03K 4/39 using a tube operating as an amplifier
- H03K 4/41 with negative feedback through a capacitor, e.g. Miller-integrator
- H03K 4/43 combined with means for generating the driving pulses
- H03K 4/48 ... using as active elements semiconductor devices ([H03K 4/787](#) to [H03K 4/84](#) take precedence)
- H03K 4/50 in which a sawtooth voltage is produced across a capacitor

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| H03K 4/501 | | the starting point of the flyback period being determined by the amplitude of the voltage across the capacitor, e.g. by a comparator |
| H03K 4/502 | ..... | the capacitor being charged from a constant-current source |
| H03K 4/52 | ..... | using two semiconductor devices so coupled that the input of each one is derived from the output of the other, e.g. multivibrator {(multivibrators generating other pulses H03K 3/00)} |
| H03K 4/54 | ..... | using a single semiconductor device with positive feedback through a transformer, e.g. blocking oscillator {(blocking oscillators generating other pulses H03K 3/00)} |
| H03K 4/56 | ..... | using a semiconductor device with negative feedback through a capacitor, e.g. Miller integrator |
| H03K 4/58 | ..... | Boot-strap generators |
| H03K 4/60 | .... | in which a sawtooth current is produced through an inductor |
| H03K 4/62 | ..... | using a semiconductor device operating as a switching device |
| H03K 4/625 | ..... | {using pulse-modulation techniques for the generation of the sawtooth wave, e.g. class D, switched mode} |
| H03K 4/64 | ..... | combined with means for generating the driving pulses {(H03K 4/625 takes precedence)} |
| H03K 4/66 | ..... | using a single device with positive feedback, e.g. blocking oscillator |
| H03K 4/68 | ..... | Generators in which the switching device is conducting during the fly-back part of the cycle |
| H03K 4/69 | ..... | using a semiconductor device operating as an amplifier |
| H03K 4/693 | ..... | {operating in push-pull, e.g. class B (H03K 4/696 takes precedence)} |
| H03K 4/696 | ..... | {using means for reducing power dissipation or for shortening the flyback time, e.g. applying a higher voltage during flyback time} |
| H03K 4/71 | ..... | with negative feedback through a capacitor, e.g. Miller-integrator |
| H03K 4/72 | ..... | combined with means for generating the driving pulses |
| H03K 4/725 | ..... | {Push-pull amplifier circuits} |
| H03K 4/787 | ... | using as active elements semiconductor devices with two electrodes and exhibiting a negative resistance characteristic |
| H03K 4/793 | .... | using tunnel diodes |
| H03K 4/80 | ... | using as active elements multi-layer diodes |
| H03K 4/83 | ... | using as active elements semiconductor devices with more than two PN junctions or with more than three electrodes or more than one electrode connected to the same conductivity region |
| H03K 4/835 | .... | {using pulse-modulation techniques for the generation of the sawtooth wave, e.g. class D, switched mode} |
| H03K 4/84 | .... | Generators in which the semiconductor device is conducting during the fly-back part of the cycle {(H03K 4/835 takes precedence)} |
| H03K 4/86 | ... | using as active elements gas-filled tubes {or spark-gaps} |
| H03K 4/88 | ... | using as active elements electrochemical cells {or galvano-magnetic or photo-electric elements} |

- H03K 4/90 . . . Linearisation of ramp (modifying slopes of pulses [H03K 6/04](#); scanning correction for television receivers [H04N 3/16](#); Synchronisation of pulses (in pictorial communication systems [H04N 1/36](#), [H04N 5/04](#); colour synchronisation [H04N 9/44](#))
- H03K 4/92 . having a waveform comprising a portion of a sinusoid (generating sinusoidal oscillations [H03B](#))
- H03K 4/94 . having trapezoidal shape

H03K 5/00 **Manipulating pulses not covered by one of the other main groups in this subclass** (circuits with regenerative action [H03K 3/00](#), [H03K 4/00](#); by the use of non-linear magnetic or dielectric devices [H03K 3/45](#))

NOTE

In this group, the input signals are of the pulse type.

- H03K 5/00006 . {Changing the frequency (modulating pulses [H03K 7/00](#); frequency dividers [H03K 21/00](#) to [H03K 29/00](#); additive or subtractive mixing of two pulse rates into one [G06F 7/605](#); pulse rate dividers [G06F 7/68](#))}
- H03K 2005/00013 . {Delay, i.e. output pulse is delayed after input pulse and pulse length of output pulse is dependent on pulse length of input pulse}
- H03K 2005/00019 .. {Variable delay}
- H03K 2005/00026 . . . {controlled by an analog electrical signal, e.g. obtained after conversion by a D/A converter}
- H03K 2005/00032 {Dc control of switching transistors}
- H03K 2005/00039 {having four transistors serially}
- H03K 2005/00045 {Dc voltage control of a capacitor or of the coupling of a capacitor as a load}
- H03K 2005/00052 {by mixing the outputs of fixed delayed signals with each other or with the input signal}
- H03K 2005/00058 . . . {controlled by a digital setting}
- H03K 2005/00065 {by current control, e.g. by parallel current control transistors}
- H03K 2005/00071 {by adding capacitance as a load}
- H03K 2005/00078 .. {Fixed delay}
- H03K 2005/00084 . . . {by trimming or adjusting the delay}
- H03K 2005/00091 {using fuse links}
- H03K 2005/00097 . . . {Avoiding variations of delay using feedback, e.g. controlled by a PLL}
- H03K 2005/00104 {using a reference signal, e.g. a reference clock}
- H03K 2005/0011 {using a separate time interval to calibrate the delay}
- H03K 2005/00117 . . . {Avoiding variations of delay due to line termination}
- H03K 2005/00123 . . . {Avoiding variations of delay due to integration tolerances}
- H03K 2005/0013 . . . {Avoiding variations of delay due to power supply}
- H03K 2005/00136 . . . {Avoiding asymmetry of delay for leading or trailing edge; Avoiding variations of delay due to threshold}
- H03K 2005/00143 . . . {Avoiding variations of delay due to temperature}
- H03K 2005/0015 .. {Layout of the delay element}

| | | |
|-----------------|------|---|
| H03K 2005/00156 | ... | {using opamps, comparators, voltage multipliers or other analog building blocks} |
| H03K 2005/00163 | ... | {using bipolar transistors} |
| H03K 2005/00169 | .... | {using current mirrors} |
| H03K 2005/00176 | .... | {using differential stages} |
| H03K 2005/00182 | .... | {using constant current sources} |
| H03K 2005/00189 | ... | {in BiCMOS technology} |
| H03K 2005/00195 | ... | {using FET`s} |
| H03K 2005/00202 | .... | {using current mirrors} |
| H03K 2005/00208 | .... | {using differential stages} |
| H03K 2005/00215 | .... | {where the conduction path of multiple FET`s is in parallel or in series, all having the same gate control} |
| H03K 2005/00221 | .... | {where the conduction path of the different output FET`s is connected in parallel with different gate control, e.g. having different sizes or thresholds, or coupled through different resistors} |
| H03K 2005/00228 | ... | {having complementary input and output signals} |
| H03K 2005/00234 | ... | {using circuits having two logic levels} |
| H03K 2005/00241 | .... | {using shift registers} |
| H03K 2005/00247 | .... | {using counters} |
| H03K 2005/00254 | .... | {using microprocessors} |
| H03K 2005/0026 | .... | {using memories or FIFO`s} |
| H03K 2005/00267 | .... | {using D/A or A/D converters} |
| H03K 2005/00273 | .... | {using digital comparators} |
| H03K 2005/0028 | ... | {using varicaps, e.g. gate capacity of a FET with specially defined threshold, as delaying capacitors} |
| H03K 2005/00286 | . | {Phase shifter, i.e. the delay between the output and input pulse is dependent on the frequency, and such that a phase difference is obtained independent of the frequency} |
| H03K 2005/00293 | . | {Output pulse is a delayed pulse issued after a rising or a falling edge, the length of the output pulse not being in relation with the length of the input triggering pulse} |
| H03K 5/003 | . | Changing the DC level (television signals H04N 3/00) |
| H03K 5/007 | .. | Base line stabilisation (thresholding H03K 5/08) |
| H03K 5/01 | . | Shaping pulses (discrimination against noise or interference H03K 5/125) |
| H03K 5/02 | .. | by amplifying (H03K 5/04 takes precedence ; wide-band amplifiers in general H03F) |
| H03K 5/023 | ... | {using field effect transistors} |
| H03K 5/026 | ... | {with a bidirectional operation} |
| H03K 5/04 | .. | by increasing duration; by decreasing duration |
| H03K 5/05 | ... | by the use of clock signals or other time reference signals |
| H03K 5/06 | ... | by the use of delay lines or other analogue delay elements |
| H03K 5/065 | .... | {using dispersive delay lines} |
| H03K 5/07 | ... | by the use of resonant circuits |
| H03K 5/08 | .. | by limiting; by thresholding; by slicing, i.e. combined limiting and thresholding (H03K 5/07 takes precedence ; comparing one pulse with another H03K 5/22 ; providing a determined threshold for switching H03K 17/30) |

- H03K 5/082 . . . {with an adaptive threshold}
- H03K 5/084 {modified by switching, e.g. by a periodic signal or by a signal in synchronism with the transitions of the output signal}
- H03K 5/086 {generated by feedback}
- H03K 5/088 {modified by switching, e.g. by a periodic signal or by a signal in synchronism with the transitions of the output signal}
- H03K 5/12 . . by steepening leading or trailing edges
- H03K 5/125 . Discriminating pulses (measuring or indicating [G01R 19/00](#), [G01R 23/00](#), [G01R 25/00](#), [G01R 29/00](#); separation of synchronising signals in television systems [H04N 5/08](#))
- H03K 5/1252 . . Suppression or limitation of noise or interference (specially adapted for transmission systems [H04B 15/00](#), [H04L 25/08](#))
- H03K 5/1254 . . . specially adapted for pulses generated by closure of switches, i.e. anti-bouncing devices (debouncing circuits for electronic time-pieces [G04G 5/00](#))
- H03K 5/13 . Arrangements having a single output and transforming input signals into pulses delivered at desired time intervals {(measuring time intervals using electronic timing, e.g. counting means [G04F 1/005](#))}
- H03K 5/131 . . Digitally controlled
- H03K 5/133 . . using a chain of active delay devices
- H03K 5/134 . . . with field-effect transistors
- H03K 5/135 . . by the use of time reference signals, e.g. clock signals
- H03K 5/14 . . by the use of delay lines ([H03K 5/133](#) takes precedence)
- H03K 5/145 . . by the use of resonant circuits
- H03K 5/15 . Arrangements in which pulses are delivered at different times at several outputs, i.e. pulse distributors (distributing, switching or gating arrangements [H03K 17/00](#))
- H03K 5/15006 . . {with two programmable outputs}
- H03K 5/15013 . . {with more than two outputs}
- H03K 5/1502 . . . {programmable}
- H03K 5/15026 . . . {with asynchronously driven series connected output stages}
- H03K 5/15033 {using a chain of bistable devices}
- H03K 5/1504 {using a chain of active delay devices ([H03K 5/15053](#) takes precedence)}
- H03K 5/15046 {using a tapped delay line}
- H03K 5/15053 {using a chain of monostable devices}
- H03K 5/1506 . . {with parallel driven output stages; with synchronously driven series connected output stages}
- H03K 5/15066 {using bistable devices ([H03K 5/15093](#) takes precedence)}
- H03K 5/15073 {using a plurality of comparators}
- H03K 5/1508 {using a plurality of delay lines}
- H03K 5/15086 {using a plurality of monostables devices}
- H03K 5/15093 {using devices arranged in a shift register}
- H03K 5/151 . . with two complementary outputs
- H03K 5/1515 . . . {non-overlapping}

- H03K 5/153
 - . Arrangements in which a pulse is delivered at the instant when a predetermined characteristic of an input signal is present or at a fixed time interval after this instant ([switching at zero crossing H03K 17/13](#); {measuring characteristics of individual pulses [G01R 29/02](#)})
- H03K 5/1532
 - .. Peak detectors
- H03K 5/1534
 - .. Transition or edge detectors
- H03K 5/1536
 - .. Zero-crossing detectors ([in measuring circuits G01R 19/175](#))
- H03K 5/156
 - . Arrangements in which a continuous pulse train is transformed into a train having a desired pattern
- H03K 5/1565
 - .. {the output pulses having a constant duty cycle}
- H03K 5/159
 - . Applications of delay lines not covered by the preceding subgroups
- H03K 5/19
 - . Monitoring patterns of pulse trains ([indicating amplitude G01R 19/00](#); [indicating frequency G01R 23/00](#); [measuring characteristics of individual pulses G01R 29/02](#))
- H03K 5/22
 - . Circuits having more than one input and one output for comparing pulses or pulse trains with each other according to input signal characteristics, e.g. slope, integral ([indicating phase difference of two cyclic pulse trains G01R 25/00](#))
- H03K 5/24
 - .. the characteristic being amplitude
- H03K 5/2409
 - ... {using bipolar transistors ([H03K 5/2436](#) takes precedence)}
- H03K 5/2418
 - {with at least one differential stage}
- H03K 5/2427
 - {using clock signals}
- H03K 5/2436
 - ... {using a combination of bipolar and field-effect transistors}
- H03K 5/2445
 - {with at least one differential stage}
- H03K 5/2454
 - {using clock signals}
- H03K 5/2463
 - ... {using diodes}
- H03K 5/2472
 - ... {using field effect transistors ([H03K 5/2436](#) takes precedence)}
- H03K 5/2481
 - {with at least one differential stage}
- H03K 5/249
 - {using clock signals}
- H03K 5/26
 - .. the characteristic being duration, interval, position, frequency, or sequence
- H03K 6/00**
Manipulating pulses having a finite slope and not covered by one of the other main groups of this subclass ([circuits with regenerative action H03K 4/00](#))
- H03K 6/02
 - . Amplifying pulses {(generation of a sawtooth current through an inductor by amplification [H03K 4/28](#), [H03K 4/39](#), [H03K 4/43](#), [H03K 4/62](#), [H03K 4/69](#))}
- H03K 6/04
 - . Modifying slopes of pulses, {e.g. S-correction}
- H03K 7/00**
Modulating pulses with a continuously-variable modulating signal
- H03K 7/02
 - . Amplitude modulation, i.e. PAM
- H03K 7/04
 - . Position modulation, i.e. PPM
- H03K 7/06
 - . Frequency or rate modulation, i.e. PFM or PRM
- H03K 7/08
 - . Duration or width modulation {Duty cycle modulation}
- H03K 7/10
 - . Combined modulation, e.g. rate modulation and amplitude modulation
- H03K 9/00**
Demodulating pulses which have been modulated with a continuously-variable signal

- H03K 9/02 . of amplitude-modulated pulses
- H03K 9/04 . of position-modulated pulses
- H03K 9/06 . of frequency- or rate-modulated pulses
- H03K 9/08 . of duration- or width-modulated pulses {or of duty-cycle modulated pulses}
- H03K 9/10 . of pulses having combined modulation

H03K 11/00 Transforming types of modulations, e.g. position-modulated pulses into duration-modulated pulses

H03K 12/00 Producing pulses by distorting or combining sinusoidal waveforms
(combining sinewaves using elements operating in a non-switching manner [H03B](#); {limiting or clipping, e.g. [H03G 11/00](#)})

WARNING

Not complete, see also [H03K 5/08](#), [H03K 5/12](#)

H03K 17/00 Electronic switching or gating, i.e. not by contact-making or -braking
(selection of the stylus or auxiliary electrode in electric printing [B41J 2/405](#); sample-and-hold arrangements [G11C 27/02](#); switching or interrupting devices in waveguides [H01P](#); gated amplifiers [H03F 3/72](#); switching arrangements for exchange systems using static devices [H04Q 3/52](#))

- H03K 17/002 . {Switching arrangements with several input- or output terminals (code converters [H03M 5/00](#), [H03M 7/00](#))}
- H03K 17/005 .. {with several inputs only}
- H03K 17/007 .. {with several outputs only}
- H03K 17/04 . Modifications for accelerating switching
- H03K 17/0403 .. {in thyristor switches}
- H03K 17/0406 .. {in composite switches}
- H03K 17/041 .. without feedback from the output circuit to the control circuit {(H03K 17/0403, [H03K 17/0406](#) take precedence)}
- H03K 17/04106 ... {in field-effect transistor switches ([H03K 17/0412](#), [H03K 17/0416](#) take precedence)}
- H03K 17/04113 ... {in bipolar transistor switches ([H03K 17/0412](#), [H03K 17/0416](#) take precedence)}
- H03K 17/0412 ... by measures taken in the control circuit
- H03K 17/04123 {in field-effect transistor switches}
- H03K 17/04126 {in bipolar transistor switches}
- H03K 17/0414 Anti-saturation measures
- H03K 17/0416 ... by measures taken in the output circuit
- H03K 17/04163 {in field-effect transistor switches}
- H03K 17/04166 {in bipolar transistor switches}
- H03K 17/042 .. by feedback from the output circuit to the control circuit {(H03K 17/0403, [H03K 17/0406](#) take precedence)}
- H03K 17/04206 ... {in field-effect transistor switches}
- H03K 17/04213 ... {in bipolar transistor switches}

- H03K 17/0422 . . . Anti-saturation measures
- H03K 17/0424 . . . by the use of a transformer
- H03K 17/06 . Modifications for ensuring a fully conducting state
- H03K 17/063 . . {in field-effect transistor switches}
- H03K 2017/066 . . {Maximizing the OFF-resistance instead of minimizing the ON-resistance}
- H03K 17/08 . Modifications for protecting switching circuit against overcurrent or overvoltage
- H03K 2017/0803 . . {against radiation hardening}
- H03K 2017/0806 . . {against excessive temperature}
- H03K 17/081 . . without feedback from the output circuit to the control circuit
- H03K 17/08104 . . . {in field-effect transistor switches ([H03K 17/0812](#), [H03K 17/0814](#) take precedence)}
- H03K 17/08108 . . . {in thyristor switches ([H03K 17/0812](#), [H03K 17/0814](#) take precedence)}
- H03K 17/08112 . . . {in bipolar transistor switches ([H03K 17/0812](#), [H03K 17/0814](#) take precedence)}
- H03K 17/08116 . . . {in composite switches ([H03K 17/0812](#), [H03K 17/0814](#) take precedence)}
- H03K 17/0812 . . . by measures taken in the control circuit
- H03K 17/08122 {in field-effect transistor switches}
- H03K 17/08124 {in thyristor switches}
- H03K 17/08126 {in bipolar transistor switches}
- H03K 17/08128 {in composite switches}
- H03K 17/0814 . . . by measures taken in the output circuit
- H03K 17/08142 {in field-effect transistor switches}
- H03K 17/08144 {in thyristor switches}
- H03K 17/08146 {in bipolar transistor switches}
- H03K 17/08148 {in composite switches}
- H03K 17/082 . . by feedback from the output circuit to the control circuit
- H03K 17/0822 . . . {in field-effect transistor switches}
- H03K 17/0824 . . . {in thyristor switches}
- H03K 17/0826 . . . {in bipolar transistor switches}
- H03K 17/0828 . . . {in composite switches}
- H03K 17/10 . Modifications for increasing the maximum permissible switched voltage
- H03K 17/102 . . {in field-effect transistor switches}
- H03K 17/105 . . {in thyristor switches}
- H03K 17/107 . . {in composite switches}
- H03K 17/12 . Modifications for increasing the maximum permissible switched current
- H03K 17/122 . . {in field-effect transistor switches}
- H03K 17/125 . . {in thyristor switches}
- H03K 17/127 . . {in composite switches}
- H03K 17/13 . Modifications for switching at zero crossing ([generating an impulse at zero crossing H03K 5/153](#))
- H03K 17/133 . . {in field-effect transistor switches}

- H03K 17/136 .. {in thyristor switches}
- H03K 17/14 . Modifications for compensating variations of physical values, e.g. of temperature
- H03K 17/145 .. {in field-effect transistor switches}
- H03K 17/16 . Modifications for eliminating interference voltages or currents
- H03K 17/161 .. {in field-effect transistor switches}
- H03K 17/162 ... {without feedback from the output circuit to the control circuit}
- H03K 17/163 {Soft switching}
- H03K 17/164 {using parallel switching arrangements}
- H03K 17/165 ... {by feedback from the output circuit to the control circuit}
- H03K 17/166 {Soft switching}
- H03K 17/167 {using parallel switching arrangements}
- H03K 17/168 .. {in composite switches}
- H03K 17/18 . Modifications for indicating state of switch
- H03K 17/20 . Modifications for resetting core switching units to a predetermined state
- H03K 17/22 . Modifications for ensuring a predetermined initial state when the supply voltage has been applied ([bi-stable generators H03K 3/12](#))
- H03K 17/223 .. {in field-effect transistor switches}
- H03K 2017/226 .. {in bipolar transistor switches}
- H03K 17/24 . Storing the actual state when the supply voltage fails
- H03K 17/26 . Modifications for temporary blocking after receipt of control pulses
- H03K 17/28 . Modifications for introducing a time delay before switching ([time-programme switches providing a choice of time-intervals for executing more than one switching action H03K 17/296; {measuring time intervals using electronic timing, e.g. counting means G04F 1/005}](#))
- H03K 17/284 .. in field effect transistor switches
- H03K 17/288 .. in tube switches
- H03K 17/292 .. in thyristor, unijunction transistor or programmable unijunction transistor switches
- H03K 17/296 . Time-programme switches providing a choice of time-intervals for executing more than one switching action and automatically terminating their operation after the programme is completed ([electronic clocks comprising means to be operated at preselected times or after preselected time-intervals G04G 15/00](#))
- H03K 17/30 . Modifications for providing a predetermined threshold before switching ([shaping pulses by thresholding H03K 5/08; {for logic circuits H03K 19/0021}](#))
- H03K 17/302 .. {in field-effect transistor switches}
- H03K 17/305 .. {in thyristor switches}
- H03K 2017/307 .. {circuits simulating a diode, e.g. threshold zero}
- H03K 17/51 . characterised by the components used ([H03K 17/04 to H03K 17/30, H03K 17/94 take precedence](#))
- H03K 2017/515 .. {Mechanical switches; Electronic switches controlling mechanical switches, e.g. relais}
- H03K 17/52 .. using gas-filled tubes
- H03K 17/54 .. using vacuum tubes ([using diodes H03K 17/74](#))
- H03K 17/545 ... {using micro-engineered devices, e.g. field emission devices}

| | | |
|--------------|-------|---|
| H03K 17/56 | .. | using semiconductor devices (using diodes H03K 17/74) |
| H03K 17/567 | ... | Circuits characterised by the use of more than one type of semiconductor device, e.g. BIMOS, composite devices such as IGBT |
| H03K 17/58 | ... | using tunnel diodes |
| H03K 17/60 | ... | using bipolar transistors |
| H03K 17/601 | .... | {using transformer coupling (H03K 17/61 takes precedence) } |
| H03K 17/602 | .... | {in integrated circuits } |
| H03K 17/603 | .... | {with coupled emitters } |
| H03K 17/605 | .... | with galvanic isolation between the control circuit and the output circuit (H03K 17/78 takes precedence) |
| H03K 17/61 | ..... | using transformer coupling |
| H03K 17/615 | .... | in a Darlington configuration |
| H03K 17/62 | .... | Switching arrangements with several input- or output-terminals (code converters H03M 5/00, H03M 7/00) |
| H03K 17/6207 | ..... | {without selecting means (H03K 17/6242 to H03K 17/6285 take precedence) } |
| H03K 17/6214 | ..... | {using current steering means } |
| H03K 17/6221 | ..... | {combined with selecting means (H03K 17/6242 to H03K 17/6285 take precedence) } |
| H03K 17/6228 | ..... | {using current steering means } |
| H03K 17/6235 | ..... | {with storage of control signal } |
| H03K 17/6242 | ..... | {with several inputs only and without selecting means } |
| H03K 17/625 | ..... | {using current steering means } |
| H03K 17/6257 | ..... | {with several inputs only combined with selecting means } |
| H03K 17/6264 | ..... | {using current steering means } |
| H03K 17/6271 | ..... | {with several outputs only and without selecting means } |
| H03K 17/6278 | ..... | {using current steering means } |
| H03K 17/6285 | ..... | {with several outputs only combined with selecting means } |
| H03K 17/6292 | ..... | {using current steering means } |
| H03K 17/64 | .... | having inductive loads {(driving circuits for electromagnets making use of a switching regulator provisionally in H01H 47/325)} |
| H03K 17/66 | .... | Switching arrangements for passing the current in either direction at will; Switching arrangements for reversing the current at will |
| H03K 17/661 | ..... | {connected to both load terminals } |
| H03K 17/662 | ..... | {each output circuit comprising more than one controlled bipolar transistor } |
| H03K 17/663 | ..... | {using complementary bipolar transistors } |
| H03K 17/664 | ..... | {in a symmetrical configuration } |
| H03K 17/665 | ..... | {connected to one load terminal only } |
| H03K 17/666 | | { the output circuit comprising more than one controlled bipolar transistor } |
| H03K 17/667 | | { using complementary bipolar transistors } |

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|----------------|-------|--|
| H03K 17/668 | | {in a symmetrical configuration} |
| H03K 17/68 | | specially adapted for switching ac currents or voltages |
| H03K 17/687 | ... | using field-effect transistors |
| H03K 17/6871 | .... | {the output circuit comprising more than one controlled field-effect transistor} |
| H03K 17/6872 | ..... | {using complementary field-effect transistors} |
| H03K 17/6874 | ..... | {in a symmetrical configuration} |
| H03K 2017/6875 | .... | {using self-conductive, depletion FETs} |
| H03K 17/6877 | .... | {the control circuit comprising active elements different from those used in the output circuit} |
| H03K 2017/6878 | .... | {using multi-gate field-effect transistors} |
| H03K 17/689 | .... | with galvanic isolation between the control circuit and the output circuit (H03K 17/78 takes precedence) |
| H03K 17/6895 | ..... | {using acoustic means} |
| H03K 17/691 | ..... | using transformer coupling |
| H03K 17/693 | .... | Switching arrangements with several input- or output-terminals (code converters H03M 5/00, H03M 7/00) |
| H03K 17/70 | ... | having two electrodes and exhibiting negative resistance (using tunnel diodes H03K 17/58) |
| H03K 17/72 | ... | having more than two PN junctions; having more than three electrodes; having more than one electrode connected to the same conductivity region |
| H03K 17/722 | .... | with galvanic isolation between the control circuit and the output circuit (H03K 17/78 takes precedence) |
| H03K 17/7225 | ..... | {using acoustic means} |
| H03K 17/723 | ..... | using transformer coupling |
| H03K 17/725 | .... | for ac voltages or currents (H03K 17/722, H03K 17/735 take precedence) |
| H03K 17/73 | | for dc voltages or currents (H03K 17/722, H03K 17/735 take precedence) |
| H03K 17/731 | | {with inductive load} |

WARNING

Not complete, see also [H03K 17/73](#)

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|-------------|-------|---|
| H03K 17/732 | | Measures for enabling turn-off |
| H03K 17/735 | | Switching arrangements with several input- or output-terminals (H03K 17/722 takes precedence) |
| H03K 17/74 | .. | using diodes {(using a combination of diodes and other devices H03K 17/567; using tunnel diodes H03K 17/58)} |
| H03K 17/76 | ... | Switching arrangements with several input- or output-terminals (code converters H03M 5/00, H03M 7/00) |
| H03K 17/78 | .. | using opto-electronic devices, i.e. light-emitting and photoelectric devices electrically- or optically-coupled |
| H03K 17/785 | ... | controlling field-effect transistor switches |
| H03K 17/79 | ... | controlling {bipolar} semiconductor switches with more than two PN-junctions, or more than three electrodes, or more than one electrode connected to the same conductivity region |

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| H03K 17/795 | ... | controlling bipolar transistors |
| H03K 17/7955 | | {using phototransistors} |
| H03K 17/80 | .. | using non-linear magnetic devices; using non-linear dielectric devices {(H03K 17/95, H03K 17/97 take precedence)} |
| H03K 17/81 | ... | Switching arrangements with several input- or output-terminals (code converters H03M 5/00, H03M 7/00) |
| H03K 17/82 | ... | using transfluxors |
| H03K 17/84 | ... | using thin-film devices |
| H03K 17/86 | ... | using twistors |
| H03K 17/88 | .. | using beam-deflection tubes |
| H03K 17/90 | .. | using galvano-magnetic devices, e.g. Hall effect devices (H03K 17/95, H03K 17/97 take precedence) |
| H03K 17/92 | .. | using superconductive devices |
| H03K 17/94 | . | characterised by the way in which the control signal is generated (mechanical structural details of control members of switches or keyboards, such as keys, push- buttons, levers or other mechanisms for transferring force to the activated elements, not directly producing electronic effects H01H; keyboards for special applications, see the relevant places, e.g. B41J, G06F 3/023, H04L 15/00, H04L 17/00, H04M 1/00) |
| H03K 17/941 | .. | {using an optical detector (H03K 17/968 takes precedence)} |
| H03K 17/943 | ... | {using a plurality of optical emitters or detectors, e.g. keyboard} |
| H03K 17/945 | .. | Proximity switches (H03K 17/96 takes precedence; {proximity fuzes F42C 13/00; detecting masses or objects, e.g. by using a magnetic or optical detector G01V, e.g. G01V 3/00, G01V 8/10}) |
| H03K 2017/9455 | ... | {constructional details (of proximity switches using a magnetic detector H03K 17/9505)} |
| H03K 17/95 | ... | using a magnetic detector |
| H03K 17/9502 | .... | {Measures for increasing reliability} |
| H03K 17/9505 | .... | {Constructional details} |
| H03K 2017/9507 | ..... | {with illumination} |
| H03K 17/951 | .... | {Measures for supplying operating voltage to the detector circuit} |
| H03K 17/9512 | .... | {using digital techniques} |
| H03K 17/9515 | .... | {using non-linear magnetic devices} |
| H03K 17/9517 | .... | {using galvanomagnetic devices} |
| H03K 17/952 | .... | {using inductive coils} |
| H03K 17/9522 | ..... | {with a galvanically isolated probe} |
| H03K 17/9525 | ..... | {controlled by an oscillatory signal (H03K 17/9537 takes precedence)} |
| H03K 2017/9527 | ..... | {Details of coils in the emitter or receiver; Magnetic detector comprising emitting and receiving coils} |
| H03K 17/953 | ..... | {forming part of an oscillator (H03K 17/9537 takes precedence)} |
| H03K 17/9532 | ..... | {with variable frequency} |
| H03K 17/9535 | ..... | {with variable amplitude} |
| H03K 17/9537 | | {in a resonant circuit} |
| H03K 17/954 | | {controlled by an oscillatory signal} |

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| H03K 17/9542 | | {forming part of an oscillator} |
| H03K 17/9545 | | {with variable frequency} |
| H03K 17/9547 | ..... | {with variable amplitude} |
| H03K 17/955 | ... | using a capacitive detector |
| H03K 17/96 | .. | Touch switches |
| H03K 2017/9602 | ... | {characterised by the type or shape of the sensing electrodes} |
| H03K 2017/9604 | .... | {characterised by the number of electrodes} |
| H03K 2017/9606 | ..... | {using one electrode only per touch switch} |
| H03K 2017/9609 | ..... | {where the electrode is the object to be switched} |
| H03K 2017/9611 | ..... | {where the electrode is a plant} |
| H03K 2017/9613 | ..... | {using two electrodes per touch switch} |
| H03K 2017/9615 | ..... | {using three electrodes per touch switch} |
| H03K 17/9618 | ... | {using a plurality of detectors, e.g. keyboard} |
| H03K 17/962 | ... | {Capacitive touch switches} |
| H03K 17/9622 | .... | {using a plurality of detectors, e.g. keyboard} |
| H03K 17/9625 | ... | {using a force resistance transducer} |
| H03K 17/9627 | ... | {Optical touch switches} |
| H03K 17/9629 | .... | {using a plurality of detectors, e.g. keyboard} |
| H03K 17/9631 | .... | {using a light source as part of the switch} |
| H03K 2017/9634 | ..... | {using organic light emitting devices, e.g. light emitting polymer [OEP] or OLED} |
| H03K 17/9636 | ..... | {using a pulsed light source} |
| H03K 17/9638 | .... | {using a light guide} |
| H03K 17/964 | ... | {Piezo-electric touch switches} |
| H03K 17/9643 | .... | {using a plurality of detectors, e.g. keyboard} |
| H03K 17/9645 | ... | {Resistive touch switches} |
| H03K 17/9647 | .... | {using a plurality of detectors, e.g. keyboard} |
| H03K 17/965 | .. | Switches controlled by moving an element forming part of the switch |
| H03K 17/967 | ... | having a plurality of control members, e.g. keyboard (H03K 17/969 , H03K 17/972 , H03K 17/98 take precedence) |
| H03K 17/968 | ... | using opto-electronic devices |
| H03K 17/969 | .... | having a plurality of control members, e.g. keyboard |
| H03K 17/97 | ... | using a magnetic movable element |
| H03K 2017/9706 | .... | {Inductive element} |
| H03K 2017/9713 | .... | {Multiposition, e.g. involving comparison with different thresholds} |
| H03K 17/972 | .... | having a plurality of control members, e.g. keyboard |
| H03K 17/975 | ... | using a capacitive movable element |
| H03K 2017/9755 | .... | {Ohmic switch;} |
| H03K 17/98 | .... | having a plurality of control members, e.g. keyboard |

H03K 19/00

Logic circuits, i.e. having at least two inputs acting on one output; Inverting circuits {(inverting circuits used as delay elements [H03K 5/13](#))}

H03K 19/0002

- . {Multistate logic ([H03K 19/02](#) takes precedence)}

H03K 19/0005

- . {Modifications of input or output impedance}

WARNING

Not complete, see also [H03K 19/017545](#)

H03K 19/0008

- . {Arrangements for reducing power consumption}

H03K 19/001

- .. {in bipolar transistor circuits}

H03K 19/0013

- .. {in field effect transistor circuits}

H03K 19/0016

- .. {by using a control or a clock signal, e.g. in order to apply power supply}

H03K 19/0019

- .. {by energy recovery or adiabatic operation}

H03K 19/0021

- . {Modifications of threshold (for electronic switching or gating [H03K 17/30](#))}

H03K 19/0024

- .. {in bipolar transistor circuits}

H03K 19/0027

- .. {in field effect transistor circuits}

H03K 19/003

- . Modifications for increasing the reliability {for protection}

H03K 19/00307

- .. {in bipolar transistor circuits}

H03K 19/00315

- .. {in field-effect transistor circuits}

H03K 19/00323

- .. {Delay compensation}

H03K 19/0033

- .. {Radiation hardening}

H03K 19/00338

- ... {In field effect transistor circuits}

H03K 19/00346

- .. {Modifications for eliminating interference or parasitic voltages or currents}

H03K 19/00353

- ... {in bipolar transistor circuits}

H03K 19/00361

- ... {in field effect transistor circuits}

H03K 19/00369

- .. {Modifications for compensating variations of temperature, supply voltage or other physical parameters}

WARNING

Not complete, see also [H03K 19/00](#)

H03K 19/00376

- ... {in bipolar transistor circuits}

H03K 19/00384

- ... {in field effect transistor circuits}

H03K 19/00392

- .. {by circuit redundancy ([H03K 19/0075](#) takes precedence)}

H03K 19/007

- . Fail-safe circuits

H03K 19/0075

- .. {by using two redundant chains}

H03K 19/01

- . Modifications for accelerating switching

H03K 19/013

- .. in bipolar transistor circuits

H03K 19/0133

- ... {by bootstrapping, i.e. by positive feed-back}

H03K 19/0136

- ... {by means of a pull-up or down element}

H03K 19/017

- .. in field-effect transistor circuits

- H03K 19/01707 . . . {in asynchronous circuits}
- H03K 19/01714 . . . {by bootstrapping, i.e. by positive feed-back}
- H03K 19/01721 . . . {by means of a pull-up or down element}
- H03K 19/01728 . . . {in synchronous circuits, i.e. by using clock signals}
- H03K 19/01735 . . . {by bootstrapping, i.e. by positive feed-back}
- H03K 19/01742 . . . {by means of a pull-up or down element}
- H03K 19/0175 . . Coupling arrangements; Interface arrangements (interface arrangements for digital computers [G06F 3/00](#), [G06F 13/00](#))
- H03K 19/017509 . . {Interface arrangements}
- H03K 19/017518 . . . {using a combination of bipolar and field effect transistors [BIFET]}

WARNING

Not complete, see also [H03K 19/018](#), [H03K 19/0185](#)

- H03K 19/017527 . . . {with at least one differential stage}
- H03K 19/017536 . . . {using opto-electronic devices}
- H03K 19/017545 . . {Coupling arrangements; Impedance matching circuits}
- H03K 19/017554 . . . {using a combination of bipolar and field effect transistors [BIFET]}

WARNING

Not complete, see also [H03K 19/01806](#), [H03K 19/018507](#)

- H03K 19/017563 . . . {with at least one differential stage}
- H03K 19/017572 . . . {using opto-electronic devices}
- H03K 19/017581 . . {programmable}
- H03K 19/01759 . . {with a bidirectional operation}
- H03K 19/018 . . using bipolar transistors only
- H03K 19/01806 . . . {Interface arrangements}
- H03K 19/01812 . . . {with at least one differential stage}

WARNING

Not complete, see also [H03K 19/01806](#)

- H03K 19/01818 . . . {for integrated injection logic (I²L)}
- H03K 19/01825 . . . {Coupling arrangements, impedance matching circuits}
- H03K 19/01831 . . . {with at least one differential stage}
- H03K 19/01837 . . . {programmable}
- H03K 19/01843 . . . {with a bidirectional operation}
- H03K 19/0185 . . using field effect transistors only
- H03K 19/018507 . . . {Interface arrangements}
- H03K 19/018514 . . . {with at least one differential stage ([H03K 19/018528](#) and [H03K 19/018542](#) take precedence)}

H03K 19/018521 {of complementary type, e.g. CMOS}

WARNING

Not complete, see also [H03K 19/018507](#)

H03K 19/018528 {with at least one differential stage}

H03K 19/018535 {of Schottky barrier type [MESFET]}

WARNING

Not complete, see also [H03K 19/018507](#)

H03K 19/018542 {with at least one differential stage}

H03K 19/01855 {synchronous, i.e. using clock signals}

H03K 19/018557 . . . {Coupling arrangements; Impedance matching circuits}

H03K 19/018564 {with at least one differential stage ([H03K 19/018578](#) takes precedence)}

H03K 19/018571 {of complementary type, e.g. CMOS}

H03K 19/018578 {with at least one differential stage}

H03K 19/018585 . . . {programmable}

H03K 19/018592 . . . {with a bidirectional operation}

H03K 19/02 . . using specified components ({[H03K 19/0005](#) to [H03K 19/0021](#)}, [H03K 19/003](#) to [H03K 19/0175](#) take precedence)

H03K 19/04 . . using gas-filled tubes

H03K 19/06 . . using vacuum tubes ([using diode rectifiers H03K 19/12](#))

H03K 19/08 . . using semiconductor devices ([H03K 19/173](#) takes precedence; wherein the semiconductor devices are only diode rectifiers [H03K 19/12](#))

H03K 19/0806 . . . {using charge transfer devices (DTC, CCD)}

H03K 19/0813 . . . {Threshold logic}

H03K 19/082 . . . using bipolar transistors {(in combination with field-effect transistor [H03K 19/094](#))}

H03K 19/0823 {Multistate logic}

H03K 19/0826 {one of the states being the high impedance or floating state}

H03K 19/084 Diode-transistor logic

H03K 19/0843 {Complementary transistor logic [CTL]}

H03K 19/0846 {Schottky transistor logic [STL]}

H03K 19/086 Emitter coupled logic

H03K 19/0863 {Emitter function logic [EFL]; Base coupled logic [BCL]}

H03K 19/0866 {Stacked emitter coupled logic ([H03K 19/1738](#) takes precedence)}

H03K 19/088 Transistor-transistor logic

H03K 19/09 Resistor-transistor logic

H03K 19/091 Integrated injection logic or merged transistor logic

H03K 19/0912 {Static induction logic [STIL] (when the logic function is fulfilled by a fet [H03K 19/09414](#))}

| | | |
|---------------|-------|--|
| H03K 19/0915 | ..... | {Integrated schottky logic [ISL]} |
| H03K 19/0917 | ..... | {Multistate logic} |
| H03K 19/094 | ... | using field-effect transistors |
| H03K 19/09403 | .... | {using junction field-effect transistors (H03K 19/096 takes precedence)} |
| H03K 19/09407 | ..... | {of the same canal type} |
| H03K 19/0941 | ..... | {of complementary type} |
| H03K 19/09414 | ..... | {with gate injection or static induction [STIL] (H03K 19/0912 takes precedence)} |
| H03K 19/09418 | ..... | {in combination with bipolar transistors [BIFET]} |
| H03K 19/09421 | .... | {Diode field-effect transistor logic (H03K 19/0956 , H03K 19/096 take precedence)} |
| H03K 19/09425 | .... | {Multistate logic (H03K 19/096 takes precedence)} |
| H03K 19/09429 | ..... | {one of the states being the high impedance or floating state} |
| H03K 19/09432 | .... | {with coupled sources or source coupled logic (H03K 19/096 takes precedence)} |
| H03K 19/09436 | ..... | {Source coupled field-effect logic [SCFL]} |
| H03K 19/0944 | .... | using MOSFET {or insulated gate field-effect transistors, i.e. IGFET} (H03K 19/096 takes precedence) |
| H03K 19/09441 | ..... | {of the same canal type} |
| H03K 19/09443 | ..... | {using a combination of enhancement and depletion transistors} |
| H03K 19/09445 | ..... | {with active depletion transistors} |
| H03K 19/09446 | ..... | {using only depletion transistors} |
| H03K 19/09448 | ..... | {in combination with bipolar transistors [BIMOS]} |
| H03K 19/0948 | ..... | using CMOS {or complementary insulated gate field-effect transistors} |
| H03K 19/09482 | ..... | {using a combination of enhancement and depletion transistors} |
| H03K 19/09485 | ..... | {with active depletion transistors} |
| H03K 19/09487 | ..... | {using only depletion transistors} |
| H03K 19/0952 | .... | using Schottky type FET {MESFET} ({ H03K 19/09421 , H03K 19/09432 }, H03K 19/096 take precedence) |
| H03K 19/0956 | .... | Schottky diode FET logic (H03K 19/096 takes precedence) |
| H03K 19/096 | .... | Synchronous circuits, i.e. using clock signals ({ H03K 19/01728 , H03K 19/01855 take precedence}) |
| H03K 19/0963 | ..... | {using transistors of complementary type (H03K 19/0966 takes precedence)} |
| H03K 19/0966 | ..... | {Self-timed logic} |
| H03K 19/098 | ... | using thyristors |
| H03K 19/10 | ... | using tunnel diodes |
| H03K 19/12 | .. | using diode rectifiers {(diode-transistor logic H03K 19/084)} |
| H03K 19/14 | .. | using opto-electronic devices, i.e. light-emitting and photoelectric devices electrically- or optically-coupled (optical logic elements per se G02F 3/00) |
| H03K 19/16 | .. | using saturable magnetic devices |
| H03K 19/162 | ... | using parametrons |

| | | |
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| H03K 19/164 | ... | using ferro-resonant devices |
| H03K 19/166 | ... | using transfluxors |
| H03K 19/168 | ... | using thin-film devices |
| H03K 19/17 | .. | using twistors |
| H03K 19/173 | .. | using elementary logic circuits as components |
| H03K 19/1731 | ... | {Optimisation thereof} |
| H03K 19/1732 | .... | {by limitation or reduction of the pin/gate ratio (for data-processing equipment G06F 1/22)} |
| H03K 19/1733 | ... | {Controllable logic circuits (H03K 19/177 takes precedence)} |
| H03K 19/1735 | .... | {by wiring, e.g. uncommitted logic arrays} |
| H03K 19/1736 | ..... | {in which the wiring can be modified} |
| H03K 19/1737 | .... | {using multiplexers (H03K 19/1738 takes precedence)} |
| H03K 19/1738 | .... | {using cascode switch logic [CSL] or cascode emitter coupled logic [CECL]} |
| H03K 19/177 | ... | arranged in matrix form |
| H03K 19/17704 | .... | {the logic functions being realised by the interconnection of rows and columns} |
| H03K 19/17708 | ..... | {using an AND matrix followed by an OR matrix, i.e. programmable logic arrays} |
| H03K 19/17712 | ..... | {one of the matrices at least being reprogrammable} |
| H03K 19/17716 | ..... | {with synchronous operation, i.e. using clock signals, e.g. of I/O or coupling register (H03K 19/17712 takes precedence)} |
| H03K 19/1772 | ..... | {with synchronous operation of at least one of the logical matrixes} |
| H03K 19/17724 | .... | {Structural details of logic blocks} |
| H03K 19/17728 | ..... | {Reconfigurable logic blocks, e.g. lookup tables} |
| H03K 19/17732 | ..... | {Macro blocks} |
| H03K 19/17736 | .... | {Structural details of routing resources} |
| H03K 19/1774 | ..... | {for global signals, e.g. clock, reset} |
| H03K 19/17744 | ..... | {for input/output signals} |
| H03K 19/17748 | .... | {Structural details of configuration resources} |
| H03K 19/17752 | ..... | {for hot reconfiguration} |
| H03K 19/17756 | ..... | {for partial configuration or reconfiguration} |
| H03K 19/1776 | ..... | {for memories} |
| H03K 19/17764 | ..... | {for reliability} |
| H03K 19/17768 | ..... | {for security} |
| H03K 19/17772 | ..... | {for powering on or off} |
| H03K 19/17776 | ..... | {for speeding up configuration or reconfiguration} |
| H03K 19/1778 | .... | {Structural details for adapting physical parameters} |
| H03K 19/17784 | ..... | {for supply voltage} |
| H03K 19/17788 | ..... | {for I/O voltages} |
| H03K 19/17792 | ..... | {for operating speed} |
| H03K 19/17796 | ..... | {for physical disposition of blocks} |

- H03K 19/18 . . . using galvano-magnetic devices, e.g. Hall-effect devices
- H03K 19/185 . . . using dielectric elements with variable dielectric constant, e.g. ferro-electric capacitors
- H03K 19/19 using ferro-resonant devices
- H03K 19/195 . . . using superconductive devices
- H03K 19/1952 . . . {with electro-magnetic coupling of the control current}
- H03K 19/1954 . . . {with injection of the control current}
- H03K 19/1956 {using an inductorless circuit}
- H03K 19/1958 . . . {Hybrid configuration, i.e. using electromagnetic coupling and injection of the control current}
- H03K 19/20 . characterised by logic function, e.g. AND, OR, NOR, NOT circuits ([H03K 19/003](#) to [H03K 19/01](#) take precedence)
- H03K 19/21 . . EXCLUSIVE-OR circuits, i.e. giving output if input signal exists at only one input; COINCIDENCE circuits, i.e. giving output only if all input signals are identical
- H03K 19/212 . . . {using bipolar transistors}
- H03K 19/215 . . . {using field-effect transistors}
- H03K 19/217 {using Schottky type FET [MESFET]}
- H03K 19/23 . . Majority or minority circuits, i.e. giving output having the state of the majority or the minority of the inputs

- H03K 21/00** **Details of pulse counters or frequency dividers {(number-of-one counters [G06F 7/607](#))}**
- H03K 21/02 . Input circuits
- H03K 21/023 . . {comprising pulse shaping or differentiating circuits}
- H03K 21/026 . . {comprising logic circuits}
- H03K 21/08 . Output circuits
- H03K 21/10 . . comprising logic circuits
- H03K 21/12 . . with parallel read-out
- H03K 21/14 . . with series read-out of number stored
- H03K 21/16 . Circuits for carrying over pulses between successive decades
- H03K 21/17 . . with field effect transistors
- H03K 21/18 . Circuits for visual indication of the result
- H03K 21/20 . . using glow discharge lamps
- H03K 21/38 . Starting, stopping or resetting the counter ([counters with a base other than a power of two \[H03K 23/48\]\(#\), \[H03K 23/66\]\(#\)](#))
- H03K 21/40 . Monitoring; Error detection; Preventing or correcting improper counter operation
- H03K 21/403 . . {Arrangements for storing the counting state in case of power supply interruption}
- H03K 21/406 . . {Synchronisation of counters}

- H03K 23/00** **Pulse counters comprising counting chains; Frequency dividers comprising counting chains ([H03K 29/00](#) takes precedence)**
- H03K 23/001 . {using elements not covered by groups [H03K 23/002](#) and [H03K 23/74](#) to [H03K 23/84](#)}

- H03K 23/002 . {using semiconductor devices ([H03K 23/78](#), [H03K 23/80](#), [H03K 23/84](#) take precedence)}
- H03K 23/004 . {Counters counting in a non-natural counting order, e.g. random counters}
- H03K 23/005 .. {using minimum change code, e.g. Gray Code}
- H03K 23/007 .. {using excess three code}
- H03K 23/008 .. {using biquinary code}
- H03K 23/40 . Gating or clocking signals applied to all stages, i.e. synchronous counters ([H03K 23/74](#) to [H03K 23/84](#) take precedence)}
- H03K 23/42 .. Out-of-phase gating or clocking signals applied to counter stages
- H03K 23/425 ... {using bistables}
- H03K 23/44 ... using field-effect transistors ([H03K 23/46](#) and [H03K 23/425](#) take precedence)}
- H03K 23/46 ... using charge transfer devices, i.e. bucket brigade or charge coupled devices
- H03K 23/48 .. with a base or radix other than a power of two ([H03K 23/42](#) takes precedence)
- H03K 23/483 ... {with a base which is an odd number}
- H03K 23/486 ... {with a base which is a non-integer}
- H03K 23/50 .. using bi-stable regenerative trigger circuits ([H03K 23/42](#) to [H03K 23/48](#) take precedence)
- H03K 23/502 ... {with a base or a radix other than a power of two ([H03K 23/54](#) takes precedence)}
- H03K 23/505 {with a base which is an odd number}
- H03K 23/507 {with a base which is a non-integer}
- H03K 23/52 ... using field-effect transistors
- H03K 23/54 ... Ring counters, i.e. feedback shift register counters ([H03K 23/52](#) takes precedence)
- H03K 23/542 {with crossed-couplings, i.e. Johnson counters}
- H03K 23/544 {with a base which is an odd number}
- H03K 23/546 {with a base which is a non-integer}
- H03K 23/548 {Reversible counters}
- H03K 23/56 ... Reversible counters ([H03K 23/52](#) {and [H03K 23/548](#)} take precedence)
- H03K 23/58 . Gating or clocking signals not applied to all stages, i.e. asynchronous counters ([H03K 23/74](#) to [H03K 23/84](#) take precedence)
- H03K 23/582 .. {with a base or a radix different of a power of two}
- H03K 23/584 ... {with a base which is an odd number}
- H03K 23/586 ... {with a base which is a non-integer}
- H03K 23/588 .. {Combination of a synchronous and an asynchronous counter}
- H03K 23/60 .. with field-effect transistors
- H03K 23/62 .. reversible
- H03K 23/64 . with a base or radix other than a power of two ([H03K 23/40](#) to [H03K 23/62](#) take precedence)
- H03K 23/66 .. with a variable counting base, e.g. by presetting or by adding or suppressing pulses
- H03K 23/662 ... {by adding or suppressing pulses}

- H03K 23/665 . . . {by presetting}
- H03K 23/667 . . . {by switching the base during a counting cycle}
- H03K 23/68 . . with a base which is a non-integer
- H03K 23/70 . . with a base which is an odd number ([H03K 23/66](#) takes precedence)
- H03K 23/72 . . Decade counters ([H03K 23/66](#) takes precedence)
- H03K 23/74 . using relays
- H03K 23/76 . using magnetic cores or ferro-electric capacitors
- H03K 23/763 . . {using superconductive devices}
- H03K 23/766 . . {using thin-film devices}
- H03K 23/78 . using opto-electronic devices
- H03K 23/80 . using semiconductor devices having only two electrodes, e.g. tunnel diode, multi-layer diode, {e.g. with a negative resistance characteristic (unijunction transistors [H03K 23/84](#))}
- H03K 23/82 . using gas-filled tubes
- H03K 23/825 . . {using vacuum tubes}
- H03K 23/84 . using thyristors or unijunction transistors
- H03K 23/86 . reversible ([H03K 23/40](#) to [H03K 23/84](#) take precedence)

H03K 25/00 Pulse counters with step-by-step integration and static storage; Analogous frequency dividers

- H03K 25/02 . comprising charge storage, e.g. capacitor without polarisation hysteresis
- H03K 25/04 . . using auxiliary pulse generator triggered by the incoming pulses

WARNING

Not complete, see also [H03K 25/02](#)

- H03K 25/12 . comprising hysteresis storage

H03K 27/00 Pulse counters in which pulses are continuously circulated in a closed loop; Analogous frequency dividers (feedback shift register counters [H03K 23/54](#))

H03K 29/00 Pulse counters comprising multi-stable elements, e.g. for ternary scale, for decimal scale; Analogous frequency dividers

- H03K 29/04 . using multi-cathode gas discharge tubes
- H03K 29/06 . using beam-type tubes, e.g. magnetrons, cathode-ray tubes

H03K 99/00 Subject matter not provided for in other groups of this subclass

H03K 2217/00 Indexing scheme related to electronic switching or gating, i.e. not by contact-making or -breaking covered by [H03K 17/00](#)

- H03K 2217/0009 . AC switches, i.e. delivering AC power to a load
- H03K 2217/0018 . Special modifications or use of the back gate voltage of a FET
- H03K 2217/0027 . Measuring means of e.g. currents through or voltages across the switch
- H03K 2217/0036 . Means reducing energy consumption

- H03K 2217/0045 . Full bridges, determining the direction of the current through the load
- H03K 2217/0054 . Gating switches, e.g. pass gates
- H03K 2217/0063 . High side switches, i.e. the higher potential [DC] or live wire [AC] being directly connected to the switch and not via the load
- H03K 2217/0072 . Low side switches, i.e. the lower potential [DC] or neutral wire [AC] being directly connected to the switch and not via the load
- H03K 2217/0081 . Power supply means, e.g. to the switch driver
- H03K 2217/009 . Resonant driver circuits
- H03K 2217/94 . characterised by the way in which the control signal is generated
- H03K 2217/94005 .. activated by voice or sound
- H03K 2217/9401 .. Calibration techniques
- H03K 2217/94015 ... Mechanical, e.g. by displacement of a body, a shielding element, or a magnet, in or out of the sensing area
- H03K 2217/94021 ... with human activation, e.g. processes requiring or being triggered by human intervention, user-input of digital word or analog voltage
- H03K 2217/94026 ... Automatic threshold calibration; e.g. threshold automatically adapts to ambient conditions or follows variation of input
- H03K 2217/94031 ... Calibration involving digital processing
- H03K 2217/94036 .. Multiple detection, i.e. where different switching signals are generated after operation of the user is detected at different time instants at different locations during the actuation movement by two or more sensors of the same or different kinds
- H03K 2217/94042 .. Means for reducing energy consumption
- H03K 2217/94047 .. Cascode connected switches
- H03K 2217/94052 .. with evaluation of actuation pattern or sequence, e.g. tapping
- H03K 2217/94057 .. Rotary switches
- H03K 2217/94063 ... with optical detection
- H03K 2217/94068 ... with magnetic detection
- H03K 2217/94073 ... with capacitive detection
- H03K 2217/94078 ... with acoustic detection
- H03K 2217/94084 .. Transmission of parameters among sensors or between sensor and remote station
- H03K 2217/94089 ... Wireless transmission
- H03K 2217/94094 ... Wired transmission, e.g. via bus connection or similar.
- H03K 2217/941 .. using an optical detector
- H03K 2217/94102 ... characterised by the type of activation
- H03K 2217/94104 using a light barrier
- H03K 2217/94106 Passive activation of light sensor, e.g. by ambient light
- H03K 2217/94108 making use of reflection
- H03K 2217/94111 ... having more than one emitter
- H03K 2217/94112 ... having more than one receiver
- H03K 2217/94114 ... Optical multi axis
- H03K 2217/94116 ... increasing reliability, fail-safe.

| | | |
|------------------|-------|---|
| H03K 2217/945 | .. | Proximity switches |
| H03K 2217/95 | ... | using a magnetic detector |
| H03K 2217/952 | .... | Detection of ferromagnetic and non-magnetic conductive targets |
| H03K 2217/954 | .... | Ferromagnetic case |
| H03K 2217/956 | .... | Negative resistance, e.g. LC inductive proximity switches |
| H03K 2217/958 | .... | involving transponders |
| H03K 2217/96 | .. | Touch switches |
| H03K 2217/96003 | ... | using acoustic waves, e.g. ultrasound |
| H03K 2217/96007 | .... | by reflection |
| H03K 2217/96011 | .... | with propagation, SAW or BAW |
| H03K 2217/96015 | ... | Constructional details for touch switches (for capacitive touch switches see H03K 2217/9607) |
| H03K 2217/96019 | .... | using conductive paint |
| H03K 2217/96023 | .... | Details of electro-mechanic connections between different elements, e.g.: sensing plate and integrated circuit containing electronics |
| H03K 2217/96027 | .... | Piezoelectric snap spring |
| H03K 2217/96031 | ... | Combination of touch switch and LC display |
| H03K 2217/96035 | ... | by temperature detection, i.e. body heat |
| H03K 2217/96038 | ... | Inductive touch switches |
| H03K 2217/96042 | ... | with illumination |
| H03K 2217/96046 | .... | Key-pad combined with display, back-lit |
| H03K 2217/9605 | ... | Detection of leakage or discharge current across the touching body to ground |
| H03K 2217/96054 | ... | Double function: touch detection combined with detection of a movable element |
| H03K 2217/96058 | ... | Fail-safe touch switches, where switching takes place only after repeated touch |
| H03K 2217/96062 | ... | with tactile or haptic feedback |
| H03K 2217/96066 | ... | Thumbwheel, potentiometer, scrollbar or slider simulation by touch switch |
| H03K 2217/9607 | ... | Capacitive touch switches |
| H03K 2217/960705 | .... | Safety of capacitive touch and proximity switches, e.g. increasing reliability, fail-safe |
| H03K 2217/96071 | .... | characterised by the detection principle |
| H03K 2217/960715 | ..... | Rc-timing; e.g. measurement of variation of charge time or discharge time of the sensor |
| H03K 2217/96072 | ..... | Phase comparison, i.e. where a phase comparator receives at one input the signal directly from the oscillator, at a second input the same signal but delayed, with a delay depending on a sensing capacitance |
| H03K 2217/960725 | ..... | Charge-transfer |
| H03K 2217/96073 | ..... | Amplitude comparison |
| H03K 2217/960735 | .... | characterised by circuit details |
| H03K 2217/96074 | ..... | Switched capacitor |
| H03K 2217/960745 | ..... | Capacitive differential; e.g. comparison with reference capacitance |
| H03K 2217/96075 | ..... | involving bridge circuit |
| H03K 2217/960755 | | Constructional details of capacitive touch and proximity switches |

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| H03K 2217/96076 | | with spring electrode |
| H03K 2217/960765 | | Details of shielding arrangements |
| H03K 2217/96077 | ..... | comprising an electrode which is floating |
| H03K 2217/960775 | ..... | Emitter-receiver or "fringe" type detection, i.e. one or more field emitting electrodes and corresponding one or more receiving electrodes |
| H03K 2217/96078 | ..... | Sensor being a wire or a strip, e.g. used in automobile door handles or bumpers |
| H03K 2217/960785 | .... | with illumination |
| H03K 2217/96079 | ..... | using a single or more light guides |
| H03K 2217/960795 | ..... | using organic light emitting devices, e.g. light emitting polymer [OEP] or OLED |
| H03K 2217/965 | .. | Switches controlled by moving an element forming part of the switch |
| H03K 2217/9651 | ... | the moving element acting on a force, e.g. pressure sensitive element |
| H03K 2217/9653 | ... | with illumination |
| H03K 2217/9655 | .... | using a single or more light guides |
| H03K 2217/9656 | .... | using organic light emitting devices, e.g. light emitting polymer [OEP] or OLED |
| H03K 2217/9658 | ... | Safety, e.g. fail-safe switching requiring a sequence of movements |