

CPC COOPERATIVE PATENT CLASSIFICATION

G PHYSICS (NOTES omitted)

INSTRUMENTS

G11 INFORMATION STORAGE

G11C **STATIC STORES** (information storage based on relative movement between record carrier and transducer [G11B](#); semiconductor devices for storage [H01L](#), e.g. [H01L 27/108](#) - [H01L 27/11597](#); pulse technique in general [H03K](#), e.g. electronic switches [H03K 17/00](#))

NOTES

1. This subclass covers devices or arrangements for storage of digital or analogue information in which no relative movement takes place between an information storage element and a transducer; which incorporate a selecting-device for writing-in or reading-out the information into or from the store
2. This subclass does not cover elements not adapted for storage and not provided with such means as referred to in Note (3) below, which elements are classified in the appropriate subclass, e.g. of [H01](#), [H03K](#).
3. In this subclass, the following terms are used with the meaning indicated:
 - "storage element" is an element which can hold at least one item of information and is provided with means for writing-in or reading-out this information;
 - "memory" is a device, including storage elements, which can hold information to be extracted when desired.

WARNINGS

1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

G11C 8/02	covered by	G11C 8/00 , H03K 17/00
G11C 11/4193	covered by	G11C 11/00
G11C 11/4195	covered by	G11C 11/00
G11C 11/4197	covered by	G11C 11/00
2. In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

5/00	Details of stores covered by G11C 11/00	5/08	• . for interconnecting magnetic elements, e.g. toroidal cores
5/005	• {Circuit means for protection against loss of information of semiconductor storage devices (manufacturing semi-conductor by using bombardement with radiation H01L 21/26 ; error detection, monitoring G06F 11/00)}	5/10	• . for interconnecting capacitors
5/02	• Disposition of storage elements, e.g. in the form of a matrix array	5/12	• Apparatus or processes for interconnecting storage elements, e.g. for threading magnetic cores
5/025	• . {Geometric lay-out considerations of storage- and peripheral-blocks in a semiconductor storage device (geometrical lay-out of the components in integrated circuits, H01L 27/0207)}	5/14	• Power supply arrangements (in general G05F , H02J , H02M), {e.g. Power down/chip (de)selection, layout of wiring/power grids, multiple supply levels}
5/04	• . Supports for storage elements {, e.g. memory modules}; Mounting or fixing of storage elements on such supports	5/141	• . {Battery and back-up supplies (back-up supplies per se H02J 9/061)}
5/05	• . . Supporting of cores in matrix	5/142	• . {Contactless power supplies, e.g. RF, induction, IR (in general H02J 5/00)}
5/06	• Arrangements for interconnecting storage elements electrically, e.g. by wiring	5/143	• . {Detection of memory cassette insertion/removal; Continuity checks of supply and ground lines (in general G01R 31/02); Detection of supply variations/interruptions/levels (G11C 5/148 takes precedence); Switching between alternative supplies (back-up supplies per se H02J 9/061), (G11C 5/141 takes precedence)}
5/063	• . {Voltage and signal distribution in integrated semi-conductor memory access lines, e.g. word-line, bit-line, cross-over resistance, propagation delay}	5/144	• . . {Detection of predetermined disconnection or reduction of power supply, e.g. power down or power standby}
5/066	• . {Means for reducing external access-lines for a semiconductor memory clip, e.g. by multiplexing at least address and data signals}	5/145	• . {Applications of charge pumps (charge pumps per se H02M 3/07); Boosted voltage circuits (for logic circuits or inverting circuits H03K 19/00); Clamp circuits therefor (G11C 5/141 takes precedence)}

- 5/146 . . . {Substrate bias generators ([G11C 5/141](#) takes precedence; in general [G05F 3/205](#))}
- 5/147 . . {Voltage reference generators, voltage and current regulators (in general [G05F 3/24](#)); Internally lowered supply level (in general [G05F 1/462](#)); Compensation for voltage drops ([G11C 5/141](#) takes precedence)}
- 5/148 . . {Details of power up or power down circuits, standby circuits or recovery circuits}
- 7/00 Arrangements for writing information into, or reading information out from, a digital store** ([G11C 5/00](#) takes precedence; auxiliary circuits for stores using semiconductor devices [G11C 11/4063](#), [G11C 11/413](#))
 - 7/005 . {with combined beam-and individual cell access}
 - 7/02 . with means for avoiding parasitic signals
 - 7/04 . with means for avoiding disturbances due to temperature effects
 - 7/06 . Sense amplifiers; Associated circuits, {e.g. timing or triggering circuits} ([amplifiers per se H03F, H03K](#))
 - 7/062 . . {Differential amplifiers of non-latching type, e.g. comparators, long-tailed pairs}
 - 7/065 . . {Differential amplifiers of latching type}
 - 7/067 . . {Single-ended amplifiers}
 - 7/08 . . Control thereof
 - 7/10 . Input/output [I/O] data interface arrangements, e.g. I/O data control circuits, I/O data buffers
 - 7/1003 . . {Interface circuits for daisy chain or ring bus memory arrangements}
 - 7/1006 . . {Data managing, e.g. manipulating data before writing or reading out, data bus switches or control circuits therefor}
 - 7/1009 . . . {Data masking during input/output}
 - 7/1012 . . . {Data reordering during input/output, e.g. crossbars, layers of multiplexers, shifting or rotating}
 - 7/1015 . . {Read-write modes for single port memories, i.e. having either a random port or a serial port}
 - 7/1018 . . . {Serial bit line access mode, e.g. using bit line address shift registers, bit line address counters, bit line burst counters}
 - 7/1021 {Page serial bit line access mode, i.e. using an enabled row address stroke pulse with its associated word line address and a sequence of enabled column address stroke pulses each with its associated bit line address}
 - 7/1024 {Extended data output [EDO] mode, i.e. keeping output buffer enabled during an extended period of time}
 - 7/1027 {Static column decode serial bit line access mode, i.e. using an enabled row address stroke pulse with its associated word line address and a sequence of enabled bit line addresses}
 - 7/103 . . . {using serially addressed read-write data registers ([G11C 7/1036](#) takes precedence)}
 - 7/1033 {using data registers of which only one stage is addressed for sequentially outputting data from a predetermined number of stages, e.g. nibble read-write mode}
 - 7/1036 . . . {using data shift registers}
- 7/1039 . . . {using pipelining techniques, i.e. using latches between functional memory parts, e.g. row/column decoders, I/O buffers, sense amplifiers}
- 7/1042 . . . {using interleaving techniques, i.e. read-write of one part of the memory while preparing another part}
- 7/1045 . . . {Read-write mode select circuits}
- 7/1048 . . {Data bus control circuits, e.g. precharging, presetting, equalising}
- 7/1051 . . {Data output circuits, e.g. read-out amplifiers, data output buffers, data output registers, data output level conversion circuits}
- 7/1054 . . . {Optical output buffers}
- 7/1057 . . . {Data output buffers, e.g. comprising level conversion circuits, circuits for adapting load}
- 7/106 . . . {Data output latches}
- 7/1063 . . . {Control signal output circuits, e.g. status or busy flags, feedback command signals}
- 7/1066 . . . {Output synchronization}
- 7/1069 . . . {I/O lines read out arrangements ([global or local sense amplifiers for bit lines G11C 7/06](#))}
- 7/1072 . . {for memories with random access ports synchronised on clock signal pulse trains, e.g. synchronous memories, self timed memories}
- 7/1075 . . {for multiport memories each having random access ports and serial ports, e.g. video RAM}
- 7/1078 . . {Data input circuits, e.g. write amplifiers, data input buffers, data input registers, data input level conversion circuits}
- 7/1081 . . . {Optical input buffers}
- 7/1084 . . . {Data input buffers, e.g. comprising level conversion circuits, circuits for adapting load}
- 7/1087 . . . {Data input latches}
- 7/109 . . . {Control signal input circuits}
- 7/1093 . . . {Input synchronization}
- 7/1096 . . . {Write circuits, e.g. I/O line write drivers}
- 7/12 . Bit line control circuits, e.g. drivers, boosters, pull-up circuits, pull-down circuits, precharging circuits, equalising circuits, for bit lines
- 7/14 . Dummy cell management; Sense reference voltage generators
- 7/16 . Storage of analogue signals in digital stores using an arrangement comprising analogue/digital [A/D] converters, digital memories and digital/analogue [D/A] converters
- 7/18 . Bit line organisation; Bit line lay-out
- 7/20 . Memory initialisation circuits, e.g. when powering up or down, memory clear, latent image memory
- 7/22 . Read-write [R-W] timing or clocking circuits; Read-write [R-W] control signal generators or management
- 7/222 . . {Clock generating, synchronizing or distributing circuits within memory device}
- 7/225 . . {Clock input buffers}
- 7/227 . . {Timing of memory operations based on dummy memory elements or replica circuits}
- 7/24 . Memory cell safety or protection circuits, e.g. arrangements for preventing inadvertent reading or writing; Status cells; Test cells
- 8/00 Arrangements for selecting an address in a digital store** (for stores using transistors [G11C 11/407](#), [G11C 11/413](#); {switching or gating circuits for general use [H03K 17/00](#)})

- 8/005 . {with travelling wave access}
- 8/04 . using a sequential addressing device, e.g. shift register, counter (using first in first out [FIFO] registers for changing speed of digital data flow [G06F 5/06](#); using last in first out [LIFO] registers for processing digital data by operating upon their order [G06F 7/00](#))
- 8/06 . Address interface arrangements, e.g. address buffers (level conversion circuits in general [H03K 19/0175](#))
- 8/08 . Word line control circuits, e.g. drivers, boosters, pull-up circuits, pull-down circuits, precharging circuits, for word lines
- 8/10 . Decoders
- 8/12 . Group selection circuits, e.g. for memory block selections, chip selection, array selection
- 8/14 . Word line organisation; Word line lay-out
- 8/16 . Multiple access memory array, e.g. addressing one storage element via at least independent addressing line groups {(multiport memories in general [G11C 7/1075](#))}
- 8/18 . Address timing or clocking circuits; Address control signal generation or management, e.g. for row address strobe [RAS] or column address strobe [CAS] signals
- 8/20 . Address safety or protection circuits, i.e. arrangements for preventing unauthorised or accidental access
- 11/00 Digital stores characterised by the use of particular electric or magnetic storage elements; Storage elements therefor**
([G11C 14/00](#) - [G11C 21/00](#) take precedence)
- 11/005 . {comprising combined but independently operative RAM-ROM, RAM-PROM, RAM-EPROM cells}
- NOTE**
Group [G11C 11/56](#) takes precedence over groups [G11C 11/02](#) - [G11C 11/54](#)
- 11/02 . using magnetic elements {(using multibit magnetic storage elements [G11C 11/5607](#); counters with magnetic elements [H03K 23/76](#); pulse generators, static switches, logic circuits with such elements [H03K 3/45](#), [H03K 17/80](#), [H03K 19/16](#); measurement of magnetic variables [G01R 33/00](#))}
- 11/04 . . using rod-type storage elements {(contains no documents; see [G11C 11/06085](#), [G11C 11/14](#), [G11C 11/155](#))}
- 11/06 . . using single-aperture storage elements, e.g. ring core; using multi-aperture plates in which each individual aperture forms a storage element
- 11/06007 . . . {using a single aperture or single magnetic closed circuit}
- NOTE**
Provisionally contains the following details; control write -, read -, address circuitry (pulse generators in general [H03K 5/00](#), [H03K 17/00](#)); arrangements for temperature compensation; checking of the correct functioning and repair arrangements (checking methods in general [G06F 11/00](#), [G06F 11/28](#); testing magnetic elements per se [G01R 33/00](#)); magnetic properties, choice of materials or the like (materials per se [H01F 1/00](#))
- 11/06014 {using one such element per bit}
- 11/06021 {with destructive read-out}
- 11/06028 {Matrixes}
- 11/06035 { "bit"- organised, e.g. 2 1/2D, 3D or a similar organisation, i.e. bit core selection for writing or reading, by at least two coincident partial currents}
- 11/06042 { "word"-organised, e.g. 2D organisation or linear selection, i.e. full current selection through all the bit-cores of a word during reading}
- 11/0605 {with non-destructive read-out}
- 11/06057 {Matrixes}
- 11/06064 { "bit"-organised (2 1/2D, 3D or similar organisation)}
- 11/06071 { "word"-organised (2D organisation or linear selection)}
- 11/06078 {using two or more such elements pro bit}
- 11/06085 . . . {Multi-aperture structures or multi-magnetic closed circuits, each aperture storing a "bit", realised by rods, plates, grids, waffle-irons,(i.e. grooved plates) or similar devices}
- 11/06092 . . . {Multi-aperture structures or multi-magnetic closed circuits using two or more apertures per bit}
- 11/061 . . . using elements with single aperture or magnetic loop for storage, one element per bit, and for destructive read-out {(contains no documents, see [G11C 11/06007](#), [G11C 11/06014](#), [G11C 11/06021](#), [G11C 11/06028](#))}
- 11/063 bit organised, such as 2 1/2D, 3D organisation, i.e. for selection of an element by means of at least two coincident partial currents both for reading and for writing {(contains no documents; see [G11C 11/06035](#))}
- 11/065 word organised, such as 2D organisation, or linear selection, i.e. for selection of all the elements of a word by means of a single full current for reading {(contains no documents; see [G11C 11/06042](#))}
- 11/067 . . . using elements with single aperture or magnetic loop for storage, one element per bit, and for non-destructive read-out {(contains no documents, see [G11C 11/0605](#) - [G11C 11/06071](#))}
- 11/08 . . using multi-aperture storage elements, e.g. using transfluxors; using plates incorporating several individual multi-aperture storage elements ([G11C 11/10](#) takes precedence; using multi-aperture plates in which each individual aperture forms a storage element [G11C 11/06](#))
- 11/10 . . using multi-axial storage elements
- 11/12 . . using tensors; using twistors, i.e. elements in which one axis of magnetisation is twisted
- 11/14 . . using thin-film elements
- 11/15 . . . using multiple magnetic layers ([G11C 11/155](#) takes precedence)
- 11/155 . . . with cylindrical configuration

- 11/16 . . . using elements in which the storage effect is based on magnetic spin effect { (sensors using magnetoresistive multilayer structures [G01R 33/093](#); thin layer magnetic read heads for magnetic discs [G11B 5/31](#); non-reciprocal magnetic elements in waveguides [H01P](#); composition of ferromagnetic material [H01F 1/00](#); gyrators [H03H 7/002](#)) }
 - 11/161 . . . { details concerning the memory cell structure, e.g. the layers of the ferromagnetic memory cell }
 - 11/165 . . . { Auxiliary circuits }
 - 11/1653 { Address circuits or decoders }
 - 11/1655 { Bit-line or column circuits }
 - 11/1657 { Word-line or row circuits }
 - 11/1659 { Cell access }
 - 11/1673 { Reading or sensing circuits or methods }
 - 11/1675 { Writing or programming circuits or methods }
 - 11/1677 { Verifying circuits or methods }
 - 11/1693 { Timing circuits or methods }
 - 11/1695 { Protection circuits or methods }
 - 11/1697 { Power supply circuits }
 - 11/18 . . . using Hall-effect devices
 - 11/19 . . . using non-linear reactive devices in resonant circuits { (contains no documents, see [G11C 11/20](#)) }
 - 11/20 . . . using parametrons { , i.e. ferroresonant triggers; with overcritical feedback magnetic amplifiers or similar (pulse generators using parametrons and ferroresonant devices [H03K 19/162](#), [H03K 19/164](#); counters using such elements [H03K 23/001](#)) }
 - 11/21 . . . using electric elements
 - 11/22 . . . using ferroelectric elements { (using multibit ferroelectric storage elements [G11C 11/5657](#); pulse generators using ferroelectric elements [H03K 3/45](#); counters using such elements [H03K 23/76](#)) }
 - 11/221 . . . { using ferroelectric capacitors }
 - 11/223 . . . { using MOS with ferroelectric gate insulating film }
 - 11/225 . . . { Auxiliary circuits }
 - 11/2253 { Address circuits or decoders }
 - 11/2255 { Bit-line or column circuits }
 - 11/2257 { Word-line or row circuits }
 - 11/2259 { Cell access }
 - 11/2273 { Reading or sensing circuits or methods }
 - 11/2275 { Writing or programming circuits or methods }
 - 11/2277 { Verifying circuits or methods }
 - 11/2293 { Timing circuits or methods }
 - 11/2295 { Protection circuits or methods }
 - 11/2297 { Power supply circuits }
 - 11/23 . . . using electrostatic storage on a common layer, e.g. Forrester-Haef tubes, { William tubes } ([G11C 11/22](#) takes precedence; { construction of Williams tubes [H01J 31/00](#) })
 - 11/24 . . . using capacitors ([G11C 11/22](#) takes precedence; using a combination of semiconductor devices and capacitors [G11C 11/34](#), e.g. [G11C 11/40](#))
 - 11/26 . . . using discharge tubes { (counters using such elements [H03K 25/00](#)) }
 - 11/265 . . . { counting tubes, e.g. decatrons, trochotrons (counters using such elements [H03K 29/00](#)) }
 - 11/28 using gas-filled tubes { (counting tubes [G11C 11/265](#); pulse generators, electronic switches, logic circuits using such elements [H03K 3/37](#), [H03K 17/52](#), [H03K 19/04](#)) }
 - 11/30 using vacuum tubes { (counting tubes [G11C 11/265](#); pulse generators, electronic switches, logic circuits using such elements [H03K 3/37](#), [H03K 17/52](#), [H03K 19/04](#)) }
 - 11/34 . . . using semiconductor devices { (processes or apparatus for the manufacture or treatment of semiconductor or solid state devices [H01L 21/00](#); integrated circuit devices [H01L 27/00](#); generating electric pulses, e.g. bistable devices using semiconductor devices [H03K 3/00](#)) }
 - 11/35 with charge storage in a depletion layer, e.g. charge coupled devices { (in shift registers [G11C 19/282](#)) }
 - 11/36 using diodes, e.g. as threshold elements { , i.e. diodes assuming a stable ON-stage when driven above their threshold (S- or N-characteristic) }
 - 11/38 using tunnel diodes
 - 11/39 using thyristors { or the avalanche or negative resistance type, e.g. PNP, SCR, SCS, UJT }
 - 11/40 using transistors
 - 11/401 forming cells needing refreshing or charge regeneration, i.e. dynamic cells
 - 11/402 with charge regeneration individual to each memory cell, i.e. internal refresh
 - 11/4023 { using field effect transistors }
 - 11/4026 { using bipolar transistors }
 - 11/403 with charge regeneration common to a multiplicity of memory cells, i.e. external refresh
 - 11/404 with one charge-transfer gate, e.g. MOS transistor, per cell
 - 11/4045 { using a plurality of serially connected access transistors, each having a storage capacitor }
- WARNING**
Not complete, see also [G11C 11/404](#)
- 11/405 with three charge-transfer gates, e.g. MOS transistors, per cell
 - 11/406 Management or control of the refreshing or charge-regeneration cycles
 - 11/40603 { Arbitration, priority and concurrent access to memory cells for read/write or refresh operations }
 - 11/40607 { Refresh operations in memory devices with an internal cache or data buffer }
 - 11/40611 { External triggering or timing of internal or partially internal refresh operations, e.g. auto-refresh or CAS-before-RAS triggered refresh }
 - 11/40615 { Internal triggering or timing of refresh, e.g. hidden refresh, self refresh, pseudo-SRAMs }
 - 11/40618 { Refresh operations over multiple banks or interleaving }
 - 11/40622 { Partial refresh of memory arrays }
 - 11/40626 { Temperature related aspects of refresh operations }

11/4063	. . . . .	Auxiliary circuits, e.g. for addressing, decoding, driving, writing, sensing or timing	11/413	. . . . .	Auxiliary circuits, e.g. for addressing, decoding, driving, writing, sensing, timing, power reduction (in general G11C 5/00 - G11C 8/00)
11/4067	. . . . .	for memory cells of the bipolar type	11/414	. . . . .	for memory cells of the bipolar type
11/407	. . . . .	for memory cells of the field-effect type	11/415	. . . . .	Address circuits
11/4072	. . . . .	Circuits for initialisation, powering up or down, clearing memory or presetting	11/416	. . . . .	Read-write [R-W] circuits
11/4074	. . . . .	Power supply or voltage generation circuits, e.g. bias voltage generators, substrate voltage generators, back-up power, power control circuits	11/417	. . . . .	for memory cells of the field-effect type
11/4076	. . . . .	Timing circuits (for regeneration management G11C 11/406)	11/418	. . . . .	Address circuits
11/4078	. . . . .	Safety or protection circuits, e.g. for preventing inadvertent or unauthorised reading or writing; Status cells; Test cells (protection of memory contents during checking or testing G11C 29/52)	11/419	. . . . .	Read-write [R-W] circuits
11/408	. . . . .	Address circuits	11/42	. .	using opto-electronic devices, i.e. light-emitting and photoelectric devices electrically - or optically - { feedback - } coupled
11/4082	. . . . .	{Address Buffers; level conversion circuits }	11/44	. .	using superconductive elements, e.g. cryotron
11/4085	. . . . .	{Word line control circuits, e.g. word line drivers, - boosters, - pull-up, - pull-down, - precharge }	11/46	. .	using thermoplastic elements
11/4087	. . . . .	{Address decoders, e.g. bit - or word line decoders; Multiple line decoders }	11/48	. .	using displaceable coupling elements, e.g. ferromagnetic cores, to produce change between different states of mutual or self-inductance { (contains no documents; see G11C 17/00 and subgroups) }
11/409	. . . . .	Read-write [R-W] circuits	11/50	. .	using actuation of electric contacts to store the information (mechanical stores G11C 23/00; switches providing a selected number of consecutive operations of the contacts by a single manual actuation of the operating part H01H 41/00)
11/4091	. . . . .	Sense or sense/refresh amplifiers, or associated sense circuitry, e.g. for coupled bit-line precharging, equalising or isolating	11/52	. .	using electromagnetic relays
11/4093	. . . . .	Input/output [I/O] data interface arrangements, e.g. data buffers	11/54	. .	using elements simulating biological cells, e.g. neuron
11/4094	. . . . .	Bit-line management or control circuits	11/56	. .	using storage elements with more than two stable states represented by steps, e.g. of voltage, current, phase, frequency (counting arrangements comprising multi-stable elements of this type H03K 25/00, H03K 29/00)
11/4096	. . . . .	Input/output [I/O] data management or control circuits, e.g. reading or writing circuits, I/O drivers or bit-line switches	11/5607	. .	{ using magnetic storage elements }
11/4097	. . . . .	Bit-line organisation, e.g. bit-line layout, folded bit lines	11/5614	. .	{ using conductive bridging RAM [CBRAM] or programming metallization cells [PMC] }
11/4099	. . . . .	Dummy cell treatment; Reference voltage generators	11/5621	. .	{ using charge storage in a floating gate }
11/41	. . . . .	forming { static } cells with positive feedback, i.e. cells not needing refreshing or charge regeneration, e.g. bistable multivibrator or Schmitt trigger	11/5628	. . .	{ Programming or writing circuits; Data input circuits }
11/411	. . . . .	using bipolar transistors only	11/5635	. . . .	{Erasing circuits }
11/4113	. . . . .	{with at least one cell access to base or collector of at least one of said transistors, e.g. via access diodes, access transistors }	11/5642	. . .	{ Sensing or reading circuits; Data output circuits }
11/4116	. . . . .	{with at least one cell access via separately connected emitters of said transistors or via multiple emitters, e.g. T2L, ECL }	11/565	. .	{ using capacitive charge storage elements }
11/412	. . . . .	using field-effect transistors only {(latent image memory G11C 7/20; multi-port cells G11C 8/16)}	11/5657	. .	{ using ferroelectric storage elements }
11/4125	. . . . .	{Cells incorporating circuit means for protection against loss of information (in general G11C 5/005) }	11/5664	. .	{ using organic memory material storage elements }
			11/5671	. .	{ using charge trapping in an insulator }
			11/5678	. .	{ using amorphous/crystalline phase transition storage elements }
			11/5685	. .	{ using storage elements comprising metal oxide memory material, e.g. perovskites }
			11/5692	. .	{ read-only digital stores using storage elements with more than two stable states }
			13/00		Digital stores characterised by the use of storage elements not covered by groups G11C 11/00, G11C 23/00 - G11C 25/00
			13/0002	. .	{ using resistive RAM [RRAM] elements }
			13/0004	. .	{ comprising amorphous/crystalline phase transition cells }
			13/0007	. .	{ comprising metal oxide memory material, e.g. perovskites }
			13/0009	. .	{ RRAM elements whose operation depends upon chemical change }

13/0011	. . . {comprising conductive bridging RAM [CBRAM] or programming metallization cells [PMCs]}	13/0097	. . . {Erasing, e.g. resetting, circuits or methods}
13/0014	. . . {comprising cells based on organic memory material}	13/02	. using elements whose operation depends upon chemical change (G11C 13/0009 takes precedence); using electrochemical charge G11C 11/00)
13/0016	. . . . {comprising polymers}	13/025	. . {using fullerenes, e.g. C60, or nanotubes, e.g. carbon or silicon nanotubes}
13/0019	. . . . {comprising bio-molecules}	13/04	. using optical elements {using other beam accessed elements, e.g. electron, ion beam (using electrostatic memory tubes G11C 11/23 ; recording of television signals H04N 5/76)}
13/0021	. . {Auxiliary circuits}	13/041	. . {using photochromic storage elements (G11C 13/042 takes precedence)}
13/0023	. . . {Address circuits or decoders}	13/042	. . {using information stored in the form of an interference pattern (hologram, lippman; holography G03H, G02B 5/32)}
13/0026	. . . . {Bit-line or column circuits}	13/043	. . . {using magnetic-optical storage elements}
13/0028	. . . . {Word-line or row circuits}	13/044	. . . {using electro-optical elements}
13/003	. . . {Cell access}	13/045	. . . {using photochromic storage elements}
13/0033	. . . {Disturbance prevention or evaluation; Refreshing of disturbed memory data}	13/046	. . . {using other storage elements storing information in the form of an interference pattern}
13/0035	. . . {Evaluating degradation, retention or wearout, e.g. by counting writing cycles}	13/047	. . {using electro-optical elements (G11C 13/042 takes precedence)}
13/0038	. . . {Power supply circuits}	13/048	. . {using other optical storage elements}
13/004	. . . {Reading or sensing circuits or methods}	13/06	. . using magneto-optical elements (G11C 13/042 takes precedence) magneto-optics in general G02F)
2013/0042	. . . . {Read using differential sensing, e.g. bit line [BL] and bit line bar [BLB]}	14/00	Digital stores characterised by arrangements of cells having volatile and non-volatile storage properties for back-up when the power is down {(bistable elements storing the actual state when the supply voltage fails H03K 3/02335, H03K 3/0375, H03K 3/2865, H03K 3/356008)}
2013/0045	. . . . {Read using current through the cell}	14/0009	. {in which the volatile element is a DRAM cell}
2013/0047	. . . . {Read destroying or disturbing the data}	14/0018	. . {whereby the nonvolatile element is an EEPROM element, e.g. a floating gate or metal-nitride-oxide-silicon [MNOS] transistor}
2013/005	. . . . {Read using potential difference applied between cell electrodes}	14/0027	. . {and the nonvolatile element is a ferroelectric element}
2013/0052	. . . . {Read process characterized by the shape, e.g. form, length, amplitude of the read pulse}	14/0036	. . {and the nonvolatile element is a magnetic RAM [MRAM] element or ferromagnetic cell}
2013/0054	. . . . {Read is performed on a reference element, e.g. cell, and the reference sensed value is used to compare the sensed value of the selected cell}	14/0045	. . {and the nonvolatile element is a resistive RAM element, i.e. programmable resistors, e.g. formed of phase change or chalcogenide material}
2013/0057	. . . . {Read done in two steps, e.g. wherein the cell is read twice and one of the two read values serving as a reference value}	14/0054	. {in which the volatile element is a SRAM cell}
13/0059	. . . {Security or protection circuits or methods}	14/0063	. . {and the nonvolatile element is an EEPROM element, e.g. a floating gate or MNOS transistor}
13/0061	. . . {Timing circuits or methods}	14/0072	. . {and the nonvolatile element is a ferroelectric element}
13/0064	. . . {Verifying circuits or methods}	14/0081	. . {and the nonvolatile element is a magnetic RAM [MRAM] element or ferromagnetic cell}
2013/0066	. . . . {Verify correct writing whilst writing is in progress, e.g. by detecting onset or cessation of current flow in cell and using the detector output to terminate writing}	14/009	. . {and the nonvolatile element is a resistive RAM element, i.e. programmable resistors, e.g. formed of phase change or chalcogenide material}
13/0069	. . . {Writing or programming circuits or methods}		
2013/0071	. . . . {Write using write potential applied to access device gate}		
2013/0073	. . . . {Write using bi-directional cell biasing}		
2013/0076	. . . . {Write operation performed depending on read result}		
2013/0078	. . . . {Write using current through the cell}		
2013/008	. . . . {Write by generating heat in the surroundings of the memory material, e.g. thermowrite}		
2013/0083	. . . . {Write to perform initialising, forming process, electro forming or conditioning}		
2013/0085	. . . . {Write a page or sector of information simultaneously, e.g. a complete row or word line}		
2013/0088	. . . . {Write with the simultaneous writing of a plurality of cells}		
2013/009	. . . . {Write using potential difference applied between cell electrodes}		
2013/0092	. . . . {Write characterized by the shape, e.g. form, length, amplitude of the write pulse}		
2013/0095	. . . . {Write using strain induced by, e.g. piezoelectric, thermal effects}		

15/00	Digital stores in which information comprising one or more characteristic parts is written into the store and in which information is read-out by searching for one or more of these characteristic parts, i.e. associative or content-addressed stores (in which information is addressed to a specific location G11C 11/00 ; selection information using addressing means, e.g. hashing, tree addressing, chaining G06F 11/22 ; information retrieval systems using a computer G06F 16/00)	16/105	. . . . . {Circuits or methods for updating contents of nonvolatile memory, especially with 'security' features to ensure reliable replacement, i.e. preventing that old data is lost before new data is reliably written}
15/02	. using magnetic elements	16/107	. . . . . {Programming all cells in an array, sector or block to the same state prior to flash erasing}
15/04	. using semiconductor elements	16/12	. . . . . Programming voltage switching circuits
15/043	. . {using capacitive charge storage elements}	16/14	. . . . . Circuits for erasing electrically, e.g. erase voltage switching circuits
15/046	. . {using non-volatile storage elements}	16/16	. . . . . for erasing blocks, e.g. arrays, words, groups
15/06	. using cryogenic elements	16/18	. . . . . Circuits for erasing optically
16/00	Erasable programmable read-only memories (G11C 14/00 takes precedence)	16/20	. . . . . Initialising; Data preset; Chip identification
16/02	. electrically programmable {(programmable multibit digital storage elements G11C 11/5621)}	16/22	. . . Safety or protection circuits preventing unauthorised or accidental access to memory cells
16/04	. . using variable threshold transistors, e.g. FAMOS	16/225	. . . . . {Preventing erasure, programming or reading when power supply voltages are outside the required ranges}
16/0408	. . . {comprising cells containing floating gate transistors (G11C 16/0483 , G11C 16/0491 take precedence)}	16/24	. . . Bit-line control circuits
16/0416	. . . . {comprising cells containing a single floating gate transistor and no select transistor, e.g. UV EPROM}	16/26	. . . Sensing or reading circuits; Data output circuits
16/0425	. . . . {comprising cells containing a merged floating gate and select transistor}	16/28	. . . . . using differential sensing or reference cells, e.g. dummy cells
16/0433	. . . . {comprising cells containing a single floating gate transistor and one or more separate select transistors}	16/30	. . . Power supply circuits
16/0441	. . . . {comprising cells containing multiple floating gate devices, e.g. separate read-and-write FAMOS transistors with connected floating gates}	16/32	. . . Timing circuits
16/045	. . . . . {Floating gate memory cells with both P and N channel memory transistors, usually sharing a common floating gate}	16/34	. . . Determination of programming status, e.g. threshold voltage, overprogramming or underprogramming, retention
16/0458	. . . . . {comprising plural independent floating gates which store independent data (for storage of more than two stable states at a single floating gate G11C 11/5621)}	16/3404	. . . . . {Convergence or correction of memory cell threshold voltages; Repair or recovery of overerased or overprogrammed cells}
16/0466	. . . {comprising cells with charge storage in an insulating layer, e.g. metal-nitride-oxide-silicon [MNOS], silicon-oxide-nitride-oxide-silicon [SONOS] (G11C 16/0483 , G11C 16/0491 take precedence)}	16/3409	. . . . . {Circuits or methods to recover overerased nonvolatile memory cells detected during erase verification, usually by means of a "soft" programming step}
16/0475	. . . . {comprising plural independent storage sites which store independent data (for storage of more than two stable states at a single storage site G11C 11/5621)}	16/3413	. . . . . {Circuits or methods to recover overprogrammed nonvolatile memory cells detected during program verification, usually by means of a "soft" erasing step}
16/0483	. . . {comprising cells having several storage transistors connected in series}	16/3418	. . . . . {Disturbance prevention or evaluation; Refreshing of disturbed memory data}
16/0491	. . . {Virtual ground arrays}	16/3422	. . . . . {Circuits or methods to evaluate read or write disturbance in nonvolatile memory, without steps to mitigate the problem}
16/06	. . Auxiliary circuits, e.g. for writing into memory (in general G11C 7/00)	16/3427	. . . . . {Circuits or methods to prevent or reduce disturbance of the state of a memory cell when neighbouring cells are read or written}
16/08	. . . Address circuits; Decoders; Word-line control circuits	16/3431	. . . . . {Circuits or methods to detect disturbed nonvolatile memory cells, e.g. which still read as programmed but with threshold less than the program verify threshold or read as erased but with threshold greater than the erase verify threshold, and to reverse the disturbance via a refreshing programming or erasing step}
16/10	. . . Programming or data input circuits	16/3436	. . . . . {Arrangements for verifying correct programming or erasure}
16/102	. . . . {External programming circuits, e.g. EPROM programmers; In-circuit programming or reprogramming; EPROM emulators}	16/344	. . . . . {Arrangements for verifying correct erasure or for detecting overerased cells}
		16/3445	. . . . . {Circuits or methods to verify correct erasure of nonvolatile memory cells}

- 16/345 {Circuits or methods to detect overerased nonvolatile memory cells, usually during erasure verification}
- 16/3454 {Arrangements for verifying correct programming or for detecting overprogrammed cells}
- 16/3459 {Circuits or methods to verify correct programming of nonvolatile memory cells}
- 16/3463 {Circuits or methods to detect overprogrammed nonvolatile memory cells, usually during program verification}
- 16/3468 {Prevention of overerasure or overprogramming, e.g. by verifying whilst erasing or writing}
- 16/3472 {Circuits or methods to verify correct erasure of nonvolatile memory cells whilst erasing is in progress, e.g. by detecting onset or cessation of current flow in cells and using the detector output to terminate erasure}
- 16/3477 {Circuits or methods to prevent overerasing of nonvolatile memory cells, e.g. by detecting onset or cessation of current flow in cells and using the detector output to terminate erasing}
- 16/3481 {Circuits or methods to verify correct programming of nonvolatile memory cells whilst programming is in progress, e.g. by detecting onset or cessation of current flow in cells and using the detector output to terminate programming}
- 16/3486 {Circuits or methods to prevent overprogramming of nonvolatile memory cells, e.g. by detecting onset or cessation of current flow in cells and using the detector output to terminate programming}
- 16/349 {Arrangements for evaluating degradation, retention or wearout, e.g. by counting erase cycles}
- 16/3495 {Circuits or methods to detect or delay wearout of nonvolatile EPROM or EEPROM memory devices, e.g. by counting numbers of erase or reprogram cycles, by using multiple memory areas serially or cyclically}
- 17/00 Read-only memories programmable only once; Semi-permanent stores, e.g. manually-replaceable information cards ({multibit read-only memories [G11C 11/5692](#); } erasable programmable read-only memories [G11C 16/00](#); coding, decoding or code conversion, in general [H03M](#) {; combination of ROM and RAM [G11C 11/005](#), [G11C 14/00](#); for electrical control of combustion engines [F02D 41/2406](#))}**
- 17/005 . {with a storage element common to a large number of data, e.g. perforated card ([G11C 17/02](#), [G11C 17/04](#) take precedence)}
- 17/02 . using magnetic or inductive elements ([G11C 17/14](#) takes precedence)
- 17/04 . using capacitive elements ([G11C 17/06](#), [G11C 17/14](#) take precedence)
- 17/06 . using diode elements ([G11C 17/14](#) takes precedence)
- 17/08 . using semiconductor devices, e.g. bipolar elements ([G11C 17/06](#), [G11C 17/14](#) take precedence)
- 17/10 . . in which contents are determined during manufacturing by a predetermined arrangement of coupling elements, e.g. mask-programmable ROM
- 17/12 . . . using field-effect devices
- 17/123 {comprising cells having several storage transistors connected in series}
- 17/126 {Virtual ground arrays}
- 17/14 . in which contents are determined by selectively establishing, breaking or modifying connecting links by permanently altering the state of coupling elements, e.g. PROM
- 17/143 . . {using laser-fusible links}
- 17/146 . . {Write once memory, i.e. allowing changing of memory content by writing additional bits}
- 17/16 . . using electrically-fusible links
- 17/165 . . . {Memory cells which are electrically programmed to cause a change in resistance, e.g. to permit multiple resistance steps to be programmed rather than conduct to or from non-conduct change of fuses and antifuses ([digital stores using resistance random access memory elements \[G11C 13/0002\]\(#\)](#))}
- 17/18 . . Auxiliary circuits, e.g. for writing into memory ([in general \[G11C 7/00\]\(#\)](#))
- 19/00 Digital stores in which the information is moved stepwise, e.g. shift register ([counting chains \[H03K 23/00\]\(#\)](#)) {stack stores, push-down stores ([linear pulse counters \[H03K 23/54\]\(#\)](#), [pulse distributors \[H03K 5/15\]\(#\)](#), [methods and arrangements for shifting data \[G06F 5/01\]\(#\)](#))}**
- 19/005 . {with ferro-electric elements (condensers)}
- 19/02 . using magnetic elements ([G11C 19/14](#) takes precedence)
- 19/04 . . using cores with one aperture or magnetic loop
- 19/06 . . using structures with a number of apertures or magnetic loops, e.g. transfluxors {laddic}
- 19/08 . . using thin films in plane structure ({[thin magnetic films and apparatus or processes specially adapted for manufacturing or assembling the same \[H01F 10/00\]\(#\), \[H01F 41/14\]\(#\)](#))}
- 19/0808 . . . {using magnetic domain propagation}
- 19/0816 {using a rotating or alternating coplanar magnetic field}
- 19/0825 {using a variable perpendicular magnetic field}
- 19/0833 {using magnetic domain interaction}
- 19/0841 {using electric current}
- 19/085 . . . {Generating magnetic fields therefor, e.g. uniform magnetic field for magnetic domain stabilisation ([coil construction \[H01F 5/00\]\(#\)](#); [electromagnets \[H01F 7/06\]\(#\)](#))}
- 19/0858 . . . {Generating, replicating or annihilating magnetic domains (also comprising different types of magnetic domains, e.g. "Hard Bubbles") ([G11C 19/0866](#) takes precedence)}
- 19/0866 . . . {Detecting magnetic domains ([measuring or detecting magnetic fields in general \[G01R 33/02\]\(#\)](#))}

- 19/0875 . . . {Organisation of a plurality of magnetic shift registers ([FIFO G06F 5/06](#); [LIFO G06F 7/78](#))}
- 19/0883 {Means for switching magnetic domains from one path into another path, i.e. transfer switches, swap gates, decoders (logic circuits using magnetic domains [H03K 19/168](#))}
- 19/0891 {using hybrid structure, e.g. ion doped layers}
- 19/10 . . using thin films on rods; with twistors
- 19/12 . using non-linear reactive devices in resonant circuits {, e.g. parametrons; magnetic amplifiers with overcritical feedback}
- 19/14 . using magnetic elements in combination with active elements, e.g. discharge tubes, semiconductor elements {(contains no documents, [see provisionally G11C 19/02 - G11C 19/10](#))}
- 19/18 . using capacitors as main elements of the stages {(if capacitors are used as auxiliary stage in between main stages with other elements, the latter take precedence; [G11C 19/005](#) takes precedence)}
- 19/182 . . {in combination with semiconductor elements, e.g. bipolar transistors, diodes}
- 19/184 . . . {with field-effect transistors, e.g. MOS-FET}
- 19/186 {using only one transistor per capacitor, e.g. bucket brigade shift register}
- 19/188 . . . {Organisation of a multiplicity of shift registers, e.g. regeneration, timing, input-output circuits ([FIFO G06F 5/06](#); [LIFO G06F 7/78](#))}
- 19/20 . using discharge tubes ([G11C 19/14](#) takes precedence)
- 19/202 . . {with vacuum tubes ([G11C 19/207](#) takes precedence)}
- 19/205 . . {with gas-filled tubes ([G11C 19/207](#) takes precedence)}
- 19/207 . . {with counting tubes}
- 19/28 . using semiconductor elements ([G11C 19/14](#) takes precedence)
- 19/282 . . {with charge storage in a depletion layer, i.e. charge coupled devices [CCD]}
- 19/285 . . . {Peripheral circuits, e.g. for writing into the first stage; for reading-out of the last stage}
- 19/287 . . {Organisation of a multiplicity of shift registers ([FIFO G06F 5/06](#); [LIFO G06F 7/78](#))}
- 19/30 . using opto-electronic devices, i.e. light emitting and photoelectric devices electrically or optically coupled
- 19/32 . using superconductive elements
- 19/34 . using storage elements with more than two stable states represented by steps, e.g. of voltage, current, phase, frequency {(in RAM multistable cells [G11C 11/56](#); in capacitive analog stores [G11C 27/04](#))}
- 19/36 . . using {multistable} semiconductor elements
- 19/38 . two-dimensional, e.g. horizontal and vertical shift registers
- 21/00 Digital stores in which the information circulates {continuously} (stepwise [G11C 19/00](#))**
- 21/005 . {using electrical delay line (construction of such lines [H03H 7/30](#), [H03H 11/26](#))}
- 21/02 . using electromechanical delay lines, e.g. using a mercury tank {(construction of such lines [H03H 9/00](#))}
- 21/023 . . {using piezo-electric transducers, e.g. mercury tank}
- 21/026 . . {using magnetostriction transducers, e.g. nickel delay line}
- 23/00 Digital stores characterised by movement of mechanical parts to effect storage, e.g. using balls; Storage elements thereof (storing by actuating contacts [G11C 11/50](#))**
- 25/00 Digital stores characterised by the use of flowing media; Storage elements thereof {(multiple fluid-circuit element arrangements for performing digital operations [F15C 1/12](#))}**
- 27/00 Electric analogue stores, e.g. for storing instantaneous values {(integrating circuits acting as stores [G06G 7/18](#); pulse counters with step by step integration and static storage [H03K 25/00](#))}**
- 27/005 . {with non-volatile charge storage, e.g. on floating gate or MNOS}
- 27/02 . Sample-and-hold arrangements ([G11C 27/04](#) takes precedence; sampling electrical signals, in general [H03K](#))
- 27/022 . . {using a magnetic memory element}
- 27/024 . . {using a capacitive memory element ([G11C 27/04](#) takes precedence)}
- 27/026 . . . {associated with an amplifier ([G11C 27/028](#) takes precedence)}
- 27/028 . . . {Current mode circuits, e.g. switched current memories}
- 27/04 . Shift registers (charge coupled devices [per se H01L 29/76](#))
- 29/00 Checking stores for correct operation {; Subsequent repair}; Testing stores during standby or offline operation {(testing of electronic circuits in general [G01R 31/28](#); error detection or error correction in computer memories during normal operation [G06F 11/1008](#), [G06F 11/1666](#); testing of computers during standby [G06F 11/22](#))}**
- 29/003 . {in serial memories}
- 29/006 . {at wafer scale level, i.e. WSI (for test and configuration during manufacture [H01L 22/00](#))}
- 29/02 . Detection or location of defective auxiliary circuits, e.g. defective refresh counters
- 29/021 . . {in voltage or current generators}
- 29/022 . . {in I/O circuitry}
- 29/023 . . {in clock generator or timing circuitry}
- 29/024 . . {in decoders}
- 29/025 . . {in signal lines}
- 29/026 . . {in sense amplifiers}
- 29/027 . . {in fuses}
- 29/028 . . {with adaption or trimming of parameters}
- 29/04 . Detection or location of defective memory elements {, e.g. cell construction details, timing of test signals}
- 29/0401 . . {in embedded memories}
- 29/0403 . . {during or with feedback to manufacture}
- 29/0405 . . {comprising complete test loop}
- 29/0407 . . {on power on}
- 29/0409 . . {Online test}
- 29/0411 . . {Online error correction}
- 29/06 . . Acceleration testing
- 29/08 . . Functional testing, e.g. testing during refresh, power-on self testing [POST] or distributed testing

29/10	. . .	Test algorithms, e.g. memory scan [MScan] algorithms; Test patterns, e.g. checkerboard patterns	29/5002	. . .	{Characteristic}
29/12	. . .	Built-in arrangements for testing, e.g. built-in self testing [BIST] {or interconnection details}	29/5004	. . .	{Voltage}
29/12005	. . . .	{comprising voltage or current generators}	29/5006	. . .	{Current}
29/1201	. . . .	{comprising I/O circuitry}	29/52	.	Protection of memory contents; Detection of errors in memory contents
29/12015	. . . .	{comprising clock generation or timing circuitry}	29/54	.	Arrangements for designing test circuits, e.g. design for test [DFT] tools
2029/1202	. . . .	{Word line control}	29/56	.	External testing equipment for static stores, e.g. automatic test equipment [ATE]; Interfaces therefor
2029/1204	. . . .	{Bit line control}	29/56004	. .	{Pattern generation}
2029/1206	. . . .	{Location of test circuitry on chip or wafer}	29/56008	. .	{Error analysis, representation of errors}
2029/1208	. . . .	{Error catch memory}	29/56012	. .	{Timing aspects, clock generation, synchronisation}
29/14	. . . .	Implementation of control logic, e.g. test mode decoders	29/56016	. .	{Apparatus features}
29/16	. . . .	using microprogrammed units, e.g. state machines	2029/5602	. .	{Interface to device under test}
29/18	. . . .	Address generation devices; Devices for accessing memories, e.g. details of addressing circuits	2029/5604	. .	{Display of error information}
2029/1802	. . . .	{Address decoder}	2029/5606	. .	{Error catch memory}
2029/1804	. . . .	{Manipulation of word size}	29/70	.	{Masking faults in memories by using spares or by reconfiguring}
2029/1806	. . . .	{Address conversion or mapping, i.e. logical to physical address}	29/702	. .	{by replacing auxiliary circuits, e.g. spare voltage generators, decoders or sense amplifiers, to be used instead of defective ones}
29/20	. . . .	using counters or linear-feedback shift registers [LFSR]	29/72	. .	{with optimized replacement algorithms}
29/22	. . . .	Accessing serial memories	29/74	. .	{using duplex memories, i.e. using dual copies}
29/24	. . . .	Accessing extra cells, e.g. dummy cells or redundant cells	29/76	. .	{using address translation or modifications}
29/26	. . . .	Accessing multiple arrays (G11C 29/24 takes precedence)	29/765	. . .	{in solid state disks}
2029/2602	. . . .	{Concurrent test}	29/78	. .	{using programmable devices}
29/28	. . . .	Dependent multiple arrays, e.g. multi-bit arrays	29/781	. . .	{combined in a redundant decoder}
29/30	. . . .	Accessing single arrays	29/783	. . .	{with refresh of replacement cells, e.g. in DRAMs}
29/32	. . . .	Serial access; Scan testing	29/785	. . .	{with redundancy programming schemes}
2029/3202	. . . .	{Scan chain}	29/787	. . .	{using a fuse hierarchy (for memories using fuses in general G11C 17/16)}
29/34	. . . .	Accessing multiple bits simultaneously	29/789	. . . .	{using non-volatile cells or latches (erasable programmable memory cells in general G11C 16/00)}
29/36	. . . .	Data generation devices, e.g. data inverters	29/80	. . .	{with improved layout}
2029/3602	. . . .	{Pattern generator}	29/802	. . . .	{by encoding redundancy signals}
29/38	. . . .	Response verification devices	29/804	. . . .	{to prevent clustered faults}
29/40	. . . .	using compression techniques	29/806	. . . .	{by reducing size of decoders}
2029/4002	. . . .	{Comparison of products, i.e. test results of chips or with golden chip}	29/808	. . . .	{using a flexible replacement scheme}
29/42	. . . .	using error correcting codes [ECC] or parity check	29/81	. . . .	{using a hierarchical redundancy scheme}
29/44	. . . .	Indication or identification of errors, e.g. for repair	29/812	. . . .	{using a reduced amount of fuses}
29/4401	. . . .	{for self repair}	29/814	. . . .	{for optimized yield}
2029/4402	. . . .	{Internal storage of test result, quality data, chip identification, repair information}	29/816	. . . .	{for an application-specific layout}
29/46	. . . .	Test trigger logic	29/818	. . . .	{for dual-port memories}
29/48	. . .	Arrangements in static stores specially adapted for testing by means external to the store, e.g. using direct memory access [DMA] or using auxiliary access paths (external testing equipment G11C 29/56)	29/82	. . . .	{for EEPROMs}
29/50	. .	Marginal testing, e.g. race, voltage or current testing	29/822	. . . .	{for read only memories}
29/50004	. . .	{of threshold voltage}	29/824	. . . .	{for synchronous memories}
29/50008	. . .	{of impedance}	29/83	. . .	{with reduced power consumption}
29/50012	. . .	{of timing}	29/832	. . . .	{with disconnection of faulty elements}
29/50016	. . .	{of retention}	29/835	. . .	{with roll call arrangements for redundant substitutions}
			29/838	. . .	{with substitution of defective spares}
			29/84	. . .	{with improved access time or stability}
			29/842	. . . .	{by introducing a delay in a signal path}
			29/844	. . . .	{by splitting the decoders in stages}
			29/846	. . . .	{by choosing redundant lines at an output stage}
			29/848	. . . .	{by adjacent switching}
			29/86	. .	{in serial access memories, e.g. shift registers, CCDs, bubble memories}

29/88	. . {with partially good memories}	2211/4016	. . Memory devices with silicon-on-insulator cells
29/883	. . . {using a single defective memory device with reduced capacity, e.g. half capacity}	2211/406	. . Refreshing of dynamic cells
29/886	. . . {combining plural defective memory devices to provide a contiguous address range, e.g. one device supplies working blocks to replace defective blocks in another device}	2211/4061	. . . Calibration or ate or cycle tuning
99/00	Subject matter not provided for in other groups of this subclass	2211/4062	. . . Parity or ECC in refresh operations
2207/00	Indexing scheme relating to arrangements for writing information into, or reading information out from, a digital store	2211/4063	. . . Interleaved refresh operations
2207/002	. Isolation gates, i.e. gates coupling bit lines to the sense amplifier	2211/4065	. . . Low level details of refresh operations
2207/005	. Transfer gates, i.e. gates coupling the sense amplifier output to data lines, I/O lines or global bit lines	2211/4066	. . . Pseudo-SRAMs
2207/007	. Register arrays	2211/4067	. . . Refresh in standby or low power modes
2207/06	. Sense amplifier related aspects	2211/4068	. . . Voltage or leakage in refresh operations
2207/061	. . Sense amplifier enabled by a address transition detection related control signal	2211/56	. Indexing scheme relating to G11C 11/56 and sub-groups for features not covered by these groups
2207/063	. . Current sense amplifiers	2211/561	. . Multilevel memory cell aspects
2207/065	. . Sense amplifier drivers	2211/5611	. . . Multilevel memory cell with more than one control gate
2207/066	. . Frequency reading type sense amplifier	2211/5612	. . . Multilevel memory cell with more than one floating gate
2207/068	. . Integrator type sense amplifier	2211/5613	. . . Multilevel memory cell with additional gates, not being floating or control gates
2207/10	. Aspects relating to interfaces of memory device to external buses	2211/5614	. . . Multilevel memory cell comprising negative resistance, quantum tunneling or resonance tunneling elements
2207/101	. . Analog or multilevel bus	2211/5615	. . . Multilevel magnetic memory cell using non-magnetic non-conducting interlayer, e.g. MTJ
2207/102	. . Compression or decompression of data before storage	2211/5616	. . . Multilevel magnetic memory cell using non-magnetic conducting interlayer, e.g. GMR, SV, PSV
2207/104	. . Embedded memory devices, e.g. memories with a processing device on the same die or ASIC memory designs	2211/5617	. . . Multilevel ROM cell programmed by source, drain or gate contacting
2207/105	. . Aspects related to pads, pins or terminals	2211/562	. . Multilevel memory programming aspects
2207/107	. . Serial-parallel conversion of data or prefetch	2211/5621	. . . Multilevel programming verification
2207/108	. . Wide data ports	2211/5622	. . . Concurrent multilevel programming of more than one cell
2207/12	. Equalization of bit lines	2211/5623	. . . Concurrent multilevel programming and reading
2207/16	. Solid state audio (deprecated, only for historical reasons, G06F 3/16, G11B)	2211/5624	. . . Concurrent multilevel programming and programming verification
2207/22	. Control and timing of internal memory operations	2211/5625	. . . Self-converging multilevel programming
2207/2209	. . Concurrent read and write (for multi-port memory G11C 7/1075)	2211/563	. . Multilevel memory reading aspects
2207/2218	. . Late write	2211/5631	. . . Concurrent multilevel reading of more than one cell
2207/2227	. . Standby or low power modes	2211/5632	. . . Multilevel reading using successive approximation
2207/2236	. . Copy	2211/5633	. . . Mixed concurrent serial multilevel reading
2207/2245	. . Memory devices with an internal cache buffer	2211/5634	. . . Reference cells
2207/2254	. . Calibration	2211/564	. . Miscellaneous aspects
2207/2263	. . Write conditionally, e.g. only if new data and old data differ	2211/5641	. . . Multilevel memory having cells with different number of storage levels
2207/2272	. . Latency related aspects	2211/5642	. . . Multilevel memory with buffers, latches, registers at input or output
2207/2281	. . Timing of a read operation (sense amplifier timing G11C 7/06, G11C 7/08)	2211/5643	. . . Multilevel memory comprising cache storage devices
2207/229	. . Timing of a write operation (sense amplifier timing G11C 7/06, G11C 7/08)	2211/5644	. . . Multilevel memory comprising counting devices
2211/00	Indexing scheme relating to digital stores characterized by the use of particular electric or magnetic storage elements; Storage elements therefor	2211/5645	. . . Multilevel memory with current-mirror arrangements
2211/401	. Indexing scheme relating to cells needing refreshing or charge regeneration, i.e. dynamic cells	2211/5646	. . . Multilevel memory with flag bits, e.g. for showing that a "first page" of a word line is programmed but not a "second page"
2211/4013	. . Memory devices with multiple cells per bit, e.g. twin-cells	2211/5647	. . . Multilevel memory with bit inversion arrangement
		2211/5648	. . . Multilevel memory programming, reading or erasing operations wherein the order or sequence of the operations is relevant

- 2211/5649 . . . Multilevel memory with plate line or layer, e.g. in order to lower programming voltages
- 2211/565 . . . Multilevel memory comprising elements in triple well structure
- 2213/00 Indexing scheme relating to [G11C 13/00](#) for features not covered by this group**
- 2213/10 . Resistive cells; Technology aspects
- 2213/11 . . Metal ion trapping, i.e. using memory material including cavities, pores or spaces in form of tunnels or channels wherein metal ions can be trapped but do not react and form an electro-deposit creating filaments or dendrites
- 2213/12 . . Non-metal ion trapping, i.e. using memory material trapping non-metal ions given by the electrode or another layer during a write operation, e.g. trapping, doping
- 2213/13 . . Dissociation, i.e. using memory material including molecules which, during a write operation, are dissociated in ions which migrate further in the memory material
- 2213/14 . . Use of different molecule structures as storage states, e.g. part of molecule being rotated
- 2213/15 . . Current-voltage curve
- 2213/16 . . Memory cell being a nanotube, e.g. suspended nanotube
- 2213/17 . . Memory cell being a nanowire transistor
- 2213/18 . . Memory cell being a nanowire having RADIAL composition
- 2213/19 . . Memory cell comprising at least a nanowire and only two terminals
- 2213/30 . Resistive cell, memory material aspects
- 2213/31 . . Material having complex metal oxide, e.g. perovskite structure
- 2213/32 . . Material having simple binary metal oxide structure
- 2213/33 . . Material including silicon
- 2213/34 . . Material includes an oxide or a nitride
- 2213/35 . . Material including carbon, e.g. graphite, grapheme
- 2213/50 . Resistive cell structure aspects
- 2213/51 . . Structure including a barrier layer preventing or limiting migration, diffusion of ions or charges or formation of electrolytes near an electrode
- 2213/52 . . Structure characterized by the electrode material, shape, etc.
- 2213/53 . . Structure wherein the resistive material being in a transistor, e.g. gate
- 2213/54 . . Structure including a tunneling barrier layer, the memory effect implying the modification of tunnel barrier conductivity
- 2213/55 . . Structure including two electrodes, a memory active layer and at least two other layers which can be a passive or source or reservoir layer or a less doped memory active layer
- 2213/56 . . Structure including two electrodes, a memory active layer and a so called passive or source or reservoir layer which is NOT an electrode, wherein the passive or source or reservoir layer is a source of ions which migrate afterwards in the memory active layer to be only trapped there, to form conductive filaments there or to react with the material of the memory active layer in redox way
- 2213/70 . Resistive array aspects
- 2213/71 . . Three dimensional array
- 2213/72 . . Array wherein the access device being a diode
- 2213/73 . . Array where access device function, e.g. diode function, being merged with memorizing function of memory element
- 2213/74 . . Array wherein each memory cell has more than one access device
- 2213/75 . . Array having a NAND structure comprising, for example, memory cells in series or memory elements in series, a memory element being a memory cell in parallel with an access transistor
- 2213/76 . . Array using an access device for each cell which being not a transistor and not a diode
- 2213/77 . . Array wherein the memory element being directly connected to the bit lines and word lines without any access device being used
- 2213/78 . . Array wherein the memory cells of a group share an access device, all the memory cells of the group having a common electrode and the access device being not part of a word line or a bit line driver
- 2213/79 . . Array wherein the access device being a transistor
- 2213/80 . . Array wherein the substrate, the cell, the conductors and the access device are all made up of organic materials
- 2213/81 . . Array wherein the array conductors, e.g. word lines, bit lines, are made of nanowires
- 2213/82 . . Array having, for accessing a cell, a word line, a bit line and a plate or source line receiving different potentials
- 2216/00 Indexing scheme relating to [G11C 16/00](#) and subgroups, for features not directly covered by these groups**
- 2216/02 . Structural aspects of erasable programmable read-only memories
- 2216/04 . . Nonvolatile memory cell provided with a separate control gate for erasing the cells, i.e. erase gate, independent of the normal read control gate
- 2216/06 . . Floating gate cells in which the floating gate consists of multiple isolated silicon islands, e.g. nanocrystals
- 2216/08 . . Nonvolatile memory wherein data storage is accomplished by storing relatively few electrons in the storage layer, i.e. single electron memory
- 2216/10 . . Floating gate memory cells with a single polysilicon layer
- 2216/12 . Reading and writing aspects of erasable programmable read-only memories
- 2216/14 . . Circuits or methods to write a page or sector of information simultaneously into a nonvolatile memory, typically a complete row or word line in flash memory
- 2216/16 . . Flash programming of all the cells in an array, sector or block simultaneously
- 2216/18 . . Flash erasure of all the cells in an array, sector or block simultaneously
- 2216/20 . . Suspension of programming or erasing cells in an array in order to read other cells in it
- 2216/22 . . Nonvolatile memory in which reading can be carried out from one memory bank or array whilst a word or sector in another bank or array is being erased or programmed simultaneously

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- 2216/24 . . Nonvolatile memory in which programming can be carried out in one memory bank or array whilst a word or sector in another bank or array is being erased simultaneously
- 2216/26 . . Floating gate memory which is adapted to be one-time programmable [OTP], e.g. containing multiple OTP blocks permitting limited update ability
- 2216/28 . . Floating gate memory programmed by reverse programming, e.g. programmed with negative gate voltage and erased with positive gate voltage or programmed with high source or drain voltage and erased with high gate voltage
- 2216/30 . . Reduction of number of input/output pins by using a serial interface to transmit or receive addresses or data, i.e. serial access memory
- 2229/00 Indexing scheme relating to checking stores for correct operation, subsequent repair or testing stores during standby or offline operation**
- 2229/70 . Indexing scheme relating to [G11C 29/70](#), for implementation aspects of redundancy repair
- 2229/72 . . Location of redundancy information
- 2229/723 . . . Redundancy information stored in a part of the memory core to be repaired
- 2229/726 . . . Redundancy information loaded from the outside into the memory
- 2229/74 . . Time at which the repair is done
- 2229/743 . . . After packaging
- 2229/746 . . . Before packaging
- 2229/76 . . Storage technology used for the repair
- 2229/763 . . . E-fuses, e.g. electric fuses or antifuses, floating gate transistors
- 2229/766 . . . Laser fuses