

EUROPEAN PATENT OFFICE
U.S. PATENT AND TRADEMARK OFFICE

CPC NOTICE OF CHANGES 1597

DATE: JANUARY 1, 2024

PROJECT DP12191

The following classification changes will be effected by this Notice of Changes:

<u>Action</u>	<u>Subclass</u>	<u>Group(s)</u>
DEFINITIONS:		
Definitions New:	H04N	23/20, 23/30, 23/68, 23/69, 23/745, 23/80, 23/82, 23/83, 23/84, 23/85, 23/86, 23/87, 23/88
	H04N	25/21, 25/701, 25/707, 25/71, 25/773
Definitions Modified:	H04N	5/222, 5/30, 5/32, 5/33
	H04N	9/64, 9/67, 9/68
	H04N	23/00, 23/11, 23/17, 23/50, 23/60, 23/65, 23/695, 23/70, 23/743, 23/81, 23/95
	H04N	25/00, 25/10, 25/20, 25/30, 25/40, 25/42, 25/44, 25/441, 25/443, 25/47, 25/48, 25/50, 25/53, 25/533, 25/57, 25/571, 25/58, 25/581, 25/583, 25/585, 25/589, 25/59, 25/60, 25/61, 25/615, 25/616, 25/617, 25/621, 25/63, 25/633, 25/65, 25/671, 25/672, 25/683, 25/70, 25/702, 25/703, 25/704, 25/705, 25/709, 25/713, 25/75, 25/76, 25/766, 25/767, 25/77, 25/771, 25/772, 25/778, 25/779, 25/78, 25/79

No other subclasses/groups are impacted by this Notice of Changes.

This Notice of Changes includes the following:

1. CLASSIFICATION SCHEME CHANGES

- A. New, Modified or Deleted Group(s)
- B. New, Modified or Deleted Warning(s)
- C. New, Modified or Deleted Note(s)
- D. New, Modified or Deleted Guidance Heading(s)

2. DEFINITIONS

- A. New or Modified Definitions (Full definition template)
- B. Modified or Deleted Definitions (Definitions Quick Fix)

3. REVISION CONCORDANCE LIST (RCL)

4. CHANGES TO THE CPC-TO-IPC CONCORDANCE LIST (CICL)

5. CHANGES TO THE CROSS-REFERENCE LIST (CRL)

2. A. DEFINITIONS (new)

H04N 23/20

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Transforming infrared radiation	H04N 5/33
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H04N 23/30

Definition statement

This place covers:

Cameras or camera modules for generating image signals from X-rays.

Informative References

Attention is drawn to the following places, which may be of interest for search:

Measuring X-radiation, gamma radiation, corpuscular radiation or cosmic radiation	G01T 1/00
Transforming X-rays into electric information	H04N 5/32
Circuitry of SSIS for transforming X-rays into image signals	H04N 25/30

H04N 23/68

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Imaging systems using optical elements for stabilisation of the lateral and angular position of the image	G02B 27/64
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H04N 23/69

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Fluid-filled or evacuated lenses of variable focal length	G02B 3/14
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H04N 23/745

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Circuitry for suppressing or minimising disturbance in the image signal generation	H04N 23/81
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H04N 23/80

Definition statement

This place covers:

Circuitry for suppressing impulsive noise, for gamma control and for processing colour signals.

Relationships with other classification places

This group does not cover image signal processing as such or pipelines thereof which is covered by G06T 1/00.

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

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General purpose image data processing	G06T 1/00
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H04N 23/82

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Circuitry for gamma control of video signals	H04N 5/202
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H04N 23/83

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Circuits for modifying colour signals by gamma correction	H04N 9/69
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H04N 23/84

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Circuits for processing colour signals	H04N 9/64
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H04N 23/85

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

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Circuits for matrixing of colour signals	H04N 9/67
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H04N 23/86

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Circuits for controlling the amplitude of colour signals	H04N 9/68
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H04N 23/87

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Circuits for reinsertion of DC and slowly varying components of colour signals	H04N 9/72
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H04N 23/88

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Colour balance circuits	H04N 9/73
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H04N 25/21

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

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Details of photometry	G01J 1/02
Electric circuits of radiation detectors for photometry	G01J 1/44
Thermography	G01J 5/48
Formed in or on a common substrate controlled by radiation	H01L 27/144

H04N 25/701

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Details of scanning heads for picture-information pick-up with photodetectors arranged in a substantially linear array	H04N 1/03
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H04N 25/707

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Image sensors with pixel address output; Event-driven image sensors; Selection of pixels to be read out based on image data	H04N 25/47
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H04N 25/71

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Charge-coupled imagers	H01L 27/148
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H04N 25/773

References

Informative References

Attention is drawn to the following places, which may be of interest for search:

Semiconductor sensitive to radiation in which the potential barrier is working in avalanche mode, e.g. avalanche photodiode	H01L 31/107
Photometry using electric radiation detectors	G01J 1/42

2. A. DEFINITIONS (modified)

H04N 5/222

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuitry, devices and other equipment specially adapted to be used in television studio, e.g. for mixing images or generation of special effects.

References

Replace: The existing Limiting references table text with the following updated text.

Limiting references

This place does not cover:

Cameras or camera modules comprising electronic image sensors; Control thereof	H04N 23/00
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Insert: The following new Application-oriented references section.

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Studio equipment related to broadcast communication	H04H 60/04
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Insert: The following new Informative references section.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Buildings for studios for broadcasting, cinematography, television or similar purposes	E04H 3/22
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H04N 5/30

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuitry (electronic circuits) and driving.

References

Replace: The existing Limiting references table text with the following updated text.

Limiting references

This place does not cover:

Scanning details of television systems	H04N 3/00
Cameras or camera modules comprising electronic image sensors or control thereof	H04N 23/00
Circuitry of solid-state image sensors [SSIS]; Control thereof	H04N 25/00

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H04N 5/32

Delete: Each of the bullet statements so that the updated Definition statement text appears as follows.

Definition statement

This place covers:

X-ray imaging systems that directly or indirectly detect incident X-ray photons.

References

Replace: The text for H04N 25/30 with the following updated text.

Limiting references

This place does not cover:

Circuitry of solid-state image sensors [SSIS] for transforming X-rays into image signals	H04N 25/30
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Insert: The following new Application-oriented references section.

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Apparatus for radiation diagnosis, e.g. combined with radiation therapy equipment	A61B 6/00
Investigating or analysing materials by the use of wave or particle radiation, e.g. X-rays, by transmitting the radiation through the material and forming a picture	G01N 23/04
Measuring length, thickness or similar linear dimensions, angles, areas or irregularities of surfaces or contours, using X-rays	G01B 15/00

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Insert: The following new Informative references section.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measurement performed on radiation beams, e.g. position or section of the beam; Measurement of spatial distribution of radiation	G01T 1/29
Photographic processes for X-rays, infrared or ultraviolet light	G03C 5/16
Electrographic processes using X-rays, e.g. electroradiography	G03G 13/054
Apparatus for electrographic processes using X-rays, e.g. electroradiography	G03G 15/054

H04N 5/33

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Image sensors other than solid state image sensors and control thereof for near and far infrared [IR] cameras, for example pyroelectric imaging tubes or image intensifier tubes.

References

Replace: The text for H04N 25/20 with the following updated text.

Limiting references

This place does not cover:

Circuitry of solid-state image sensors [SSIS] for transforming only infrared radiation into image signals	H04N 25/20
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Insert: The following new Informative references section.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Radiation pyrometry, e.g. infrared or optical thermometry	G01J 5/00
Investigating or analysing materials using infrared light	G01N 21/35
Photographic processes for X-ray, infrared or ultraviolet ray	G03C 5/16
Thermoelectric devices comprising a junction of dissimilar materials	H10N 10/00
Thermoelectric devices without a junction of dissimilar materials	H10N 15/00
Organic devices sensitive to infrared radiation	H10K 30/00

H04N 9/64

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

- Color video sampling format conversion, e.g. 4:2:2 to 4:2:0
- Gamut mapping and colour space conversions
- Multiprimary colour signal conversion
- Colour sampling in digital video, e.g. 4:4:4, 4:2:0, 4:1:1
- Processing of the modulated or demodulated colour television signal
- Input colour signal detection relating to the type and standard of colour signals
- Synchronous modulation and demodulation of the colour signals
- Image enhancement or disturbance suppression specific to the modulated or demodulated colour television signal
- Colour space transformation of the demodulated colour signal
- Amplitude control and gamma control of the modulated or demodulated colour television signal
- DC control of the modulated colour television signal according to vertical blanking reference
- White balance control of the demodulated colour signal for display
- Mixing of foreground and background colour video signals using chroma keying

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Replace: The existing Relationships text with the following updated text.

Relationships with other classification places

With respect to colour or chrominance aspects, main group [H04N 1/00](#) contains subject-matter relating to the following aspects:

- Aspects of apparatus/methods for controlling or correcting colour video signals originating from a scanned picture signal, e.g. facsimile, document, photo.

Subclass [G06T](#) contains subject-matter relating to the following aspects:

- General purpose data processing of an image or enhancement of such image not particularly adapted to a motion video signal.

Subclass [H03D](#) contains subject-matter relating to the following aspects:

- Demodulation of amplitude modulated signals.

Demodulation circuits adapted to a particular standard are classified in:

- [H04N 11/146](#) for NTSC,
- [H04N 11/165](#) for PAL, and
- [H04N 11/186](#) for SECAM.

Delete: The entire Special rules section.

[H04N 9/67](#)

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Colour space transformation circuits relating to non-moving picture signals	H04N 1/6077
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H04N 9/68

References

Insert: The following two new references in the Limiting references table.

Limiting references

This place does not cover:

Circuits for processing colour signals for colour killing combined with colour gain control	H04N 9/71
Colour balance circuits	H04N 9/73

H04N 23/00

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Processes and apparatus related to the concept of electronic image capture using an electronic image sensor and the related control and processing of the generated electronic image signals.

Image pickup devices using electronic image sensors such as digital cameras, video cameras, TV cameras, CCTV cameras, surveillance cameras, camcorders, digital cameras embedded in mobile phones, aspects peculiar to the presence of electronic image sensors in electronic still cameras, digital still cameras, etc.

Electronic image capture by methods or arrangements involving at least the following step: the scanning of a picture, i.e. resolving the whole picture-containing area or scene into individual picture-elements and the derivation of picture-representative electrical signals related thereto, simultaneously or in sequence, e.g. by reading an electronic solid-state image sensor [SSIS] pickup device (e.g. CCD or CMOS image sensor) as an electronic image sensor converting optical image information into said electrical signals.

In colloquial speech said step is frequently formulated as, e.g. capturing a video sequence, digital photographing, etc.

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Concerning cameras:

- video cameras, TV cameras (e.g. in studios), CCTV cameras, surveillance cameras, camcorders; constructional and mechanical details related to such cameras even when not peculiar to the presence of the electronic image sensor e.g. housings;
- arrangements/methods for image capture using an electronic image sensor, i.e. (i) sensor read-out; (ii) processing or use of electrical image signals from the electronic image sensor for the generation of camera control signals;
- for controlling the electronic image sensor or its read-out for, e.g. exposure, scene selection for auto-focusing or electronic image enhancement, or processing of image signals captured by the electronic image sensor, e.g. white balance, electronic motion blur correction, noise suppression;
- for controlling other camera functions, e.g. exposure, anti-shake compensation by influencing optical parts of the camera, focusing;
- in-camera image processing, e.g. correction of lens distortion, defective pixel correction, noise suppression, removal of motion blur, improving the dynamic range of the final image;
- electronic viewfinders, control of image pickup devices based on information displayed by the electronic viewfinder;
- electrical and mechanical aspects of camera modules using electronic image sensors and related constructional details as in webcams or mobile phones;
- remote control of cameras peculiar to the electronic image sensor, e.g. affecting their operation, or being based on a generated image signal;
- adaptations peculiar to the presence or use of an electronic image sensor, the transmission, recording or other use of electrical image data and related circuitry, e.g. mounting of electronic image sensor, integrated cleaning system for the electronic image sensor, dust mapping, cooling of the electronic image sensor, controlling the operation of the electronic image sensor by external input signals;
- cameras wherein the inventive contribution lies in the interaction of features covered above with those covered by [G03B](#), e.g. switch-over between electronic motion-blur correction of electronic viewfinder during focusing and optical motion-blur correction of the lens during exposure, electronic-motion blur correction of the electronic image signal based on output signals of additional sensor or interaction between mechanical shutter and electronic control of the charge accumulation period of the electronic image sensor;

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- applications concerning studios and image capturing devices that cannot be classified in lower groups such as camera operation in general, e.g. for studio or TV events, processing for simulating film artefacts, virtual studio, virtual depth image, video assist systems, other studio equipment, e.g. autocues and teleprompters.

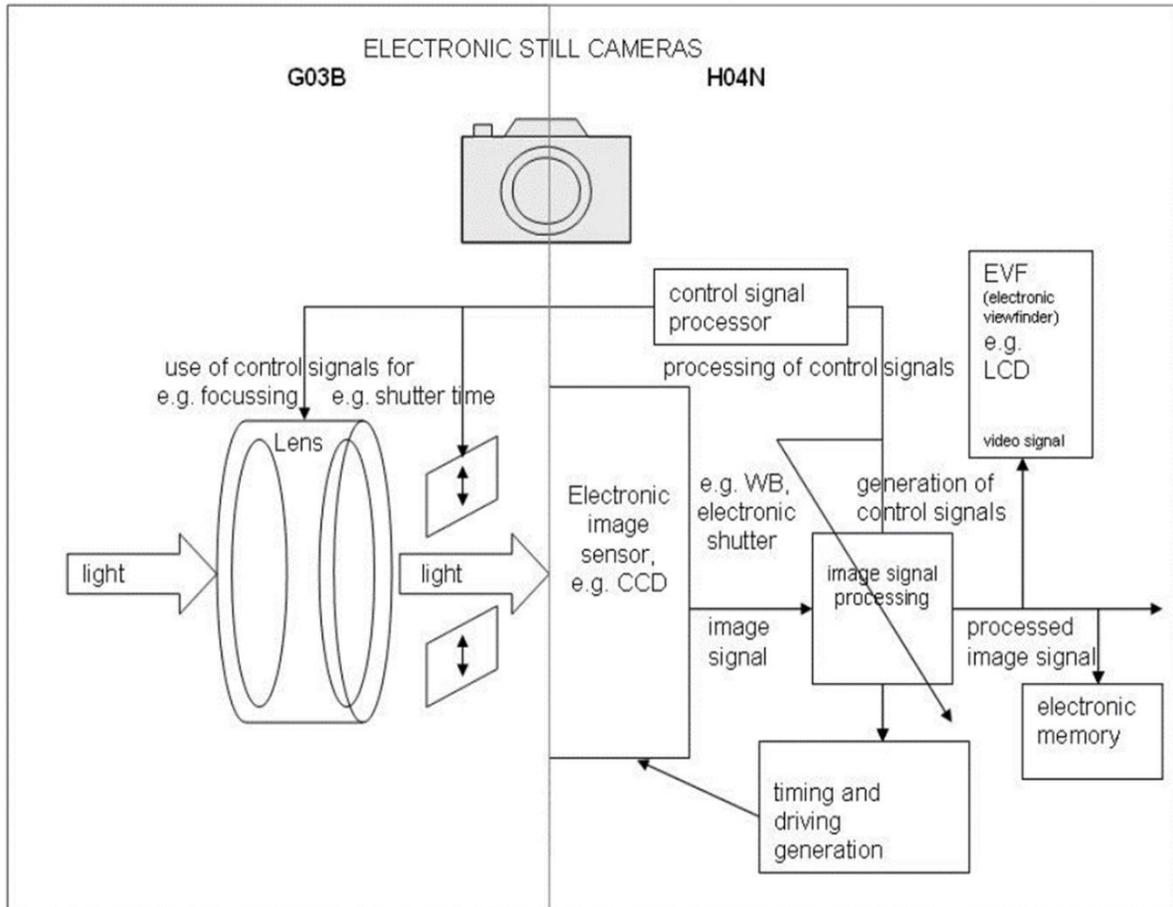
Replace: The existing Relationships text and image with the following updated text and image.

Relationships with other classification places

Groups in **G03B** are to be considered when the following aspects are concerned:

- apparatus/methods for taking photographs using light sensitive film for image capture, apparatus/methods for printing, projecting or viewing images using film stock, photographic film or slides by optical means, e.g. mounting of optical elements, flashes, and their related controls, e.g. exposure, focus, (opto-)mechanical motion blur (anti-shake), cooling, beam shaping;
- aspects of apparatus/methods for taking photographs using electronic image sensors for image capture, insofar as they correspond to those of said apparatus/methods for taking photographs using light-sensitive film, i.e. not peculiar to the presence or use of the electronic image sensor, e.g. mounting of optical elements or flashes, and their related controls insofar as they are not peculiar to the presence or use of the electronic image sensor, e.g. exposure, focus, (opto-)mechanical motion blur correction (anti-shake);
- optical viewfinders;
- remote control of cameras not peculiar to the electronic image sensor, e.g. not affecting their operation, or being based on a generated image signal;
- optical aspects of camera modules using electronic image sensors and related constructional details (e.g. lens actuators).

The following scheme is intended to illustrate the relationship between **H04N** and **G03B**:



The above image is intended to illustrate the relationship between H04N and G03B.

References

Replace: The existing Application-oriented references table text with the following updated text.

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Videophones	H04N 7/14
Closed circuit television systems	H04N 7/18
Cameras adapted for vehicles	B60R 1/00

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Image or video recognition or understanding	G06V
Surveillance systems with alarms	G08B 13/194 - G08B 13/196
Mobile phones	H04M 1/00

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Intermediate information storage using still video cameras	H04N 1/2112
Video recording	H04N 5/76
Testing of cameras	H04N 17/00
Circuitry of solid-state image sensors [SSIS] or control thereof	H04N 25/00
Radiation diagnosis, diagnostic aspect of medical imaging devices	A61B, A61C
Pyrometry, measuring temperature	G01J 5/00
Measuring X-rays, gamma radiation	G01T 1/00
Optical systems	G02B
Apparatus or arrangements for taking photographs	G03B
Image processing in general, i.e. not being exclusively adapted to be used in an image pickup device containing an electronic image sensor, or in studio devices or equipment	G06T
Editing of recorded image information	G11B 27/00
Associated working of recording or reproducing apparatus with TV camera or receiver in which the television signal is not significantly involved	G11B 31/006
Electric discharge tubes	H01J
Semiconductor technology of solid-state imaging devices, e.g. CMOS image sensors	H01L 27/146
CCD image sensors	H01L 27/148
Broadcasting	H04H

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Constructional features of telephone sets	H04M 1/02
Cameras used as input-only client peripherals for selective content distribution	H04N 21/4223

Replace: The existing Glossary of terms text with the following updated text.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

additional sensor	Sensor, other than the electronic image sensor, used for controlling a camera
camera	Device capturing image information represented by light patterns reflected from or emitted by objects, and exposing a light sensitive film or an electronic image sensor during a timed exposure, usually through an optical lens, and producing an image on a light sensitive film or an electrical image information signal respectively
electronic image sensor	Optoelectronic transducer, converting optical image information into an electrical signal susceptible of being processed, stored, transmitted or displayed
electronic spatial light modulator	Optoelectronic transducer converting electric signals representing image information into optical image information
projector	Device displaying image information by projection of light patterns, usually through an optical lens, wherein the light patterns are generated by illuminating an image, e.g. film or slide, or by converting an electric image signal into an optical signal using an electronic spatial light modulator
record	Registration (e.g. of sound or images) in permanent form by optical or electrical means for later reproduction

Replace: The existing Synonyms and Keywords text with the following updated text.

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

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ADAS	Advanced driver assistance system
ADC	Analog to digital converter
AE	Automatic exposure control
AF	Autofocus
AFE	Analog front end
AGC	Automatic gain control
AI	Artificial intelligence
ANN	Artificial neural network
APD	Avalanche photodiode
APS	Active pixel sensor
CCD	Charge-coupled device
CDS	Correlated double sampling
CFA	Colour filter array
CIS	Charge injection device
CIS	CMOS image sensor
CMOS	Complementary metal-oxide-semiconductor
CNN	Convolutional neural network
DSP	Digital Signal Processor
EMCCD	Electron multiplying charge-coupled device
ENG	Electronic news gathering
ESLM	Electronic spatial light modulator
EVF	Electronic viewfinder
EVS	Event-based vision sensor
FOV	Field of view
FPN	Fixed pattern noise
FLIR	Forward looking infrared
FPA	Focal plane array
FPD	Flat panel detector
FPGA	Field programmable gate array
GPU	Graphics processing unit
GUI	Graphical user interface
HDR	High dynamic range
LFM	Light flicker mitigation, LED flicker mitigation
LWIR	Long wavelength infrared
MWIR	Mid wavelength infrared
MTF	Modulation transfer function
NIR	Near infrared
NN	Neural network
NUC	Non-uniformity correction
OVF	Optical viewfinder
PD	Phase detection (pixel), phase difference (pixel)
PDAF	Phase-detection autofocus

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PMD	Photonic mixer device
PTZ	Pan tilt zoom
QIS	Quanta image sensor
QWIP	Quantum well infrared photodetector
ROIC	Readout integrated circuit
SBNUC	Scene-based non-uniformity correction (NUC)
SPAD	Single-photon avalanche diode
SPD	Single-photon detection
SSIS	Solid state image sensor
SWIR	Short wavelength infrared
TDI	Time delay and integration
TEC	Thermoelectric cooler
TFA	Thin film on ASIC
TOF	Time of flight
WDR	Wide dynamic range

In patent documents, the following words/expressions are often used as synonyms:

"digital camera", "camcorder", "video camera", "still video camera", "camera" and "digital still camera"

H04N 23/11

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Camera architectures:

- for generation of colour signals by using switchable colour filters or light sources, or by using different image sensors;
- for generation of RGB; RGBIR; RGBW; RW; R+(N)IR, G+IR, B+IR, W+R signals;
- comprising visible and IR sensors;
- comprising partial IR filters;
- comprising visible light sensors without IR filter, i.e. a pixel captures both visible and IR light (Y+IR);
- comprising switchable IR filters, i.e. the pixels are controlled to capture either only the visible light (Y) or both visible and IR light (Y+IR);

- comprising multiple image sensors, at least one of which is sensitive to IR light.

References

Replace: The existing H04N 25/131 text with the following updated text.

Informative references

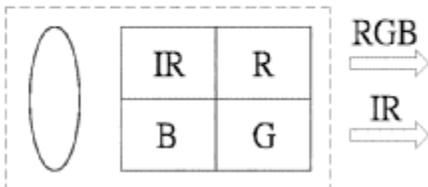
Attention is drawn to the following places, which may be of interest for search:

Arrangement of colour filter arrays [CFA] or filter mosaics characterised by the spectral characteristics of the filter elements including elements passing infrared wavelengths	H04N 25/131
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Replace: The existing Special rules text and image with the following updated text and image.

Special rules of classification

Image sensors comprising pixels sensitive to visible light and IR light and image sensors comprising pixels sensitive to both visible and IR light (Y+IR) and pixels sensitive to IR light (IR) are classified in group [H04N 25/131](#).



[H04N 23/17](#)

References

Delete: The entire Limiting references section.

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H04N 23/50

Replace: The existing Relationships text with the following updated text, removing the table so that the text appears as follows.

Relationships with other classification places

Constructional details not peculiar to the presence or use of the electronic image sensor in electronic still picture cameras, digital still picture cameras are classified in subclass G03B.

References

Replace: The existing text for H01J in the Informative references table.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electric discharge tubes	H01J
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H04N 23/60

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Internal or external camera control for:

- autofocusing operations;
- computer-aided image capturing;
- application programs for camera control;
- detecting malfunction;
- face recognition;
- generating a panoramic field of view;
- power saving or management;
- compensating for shutter delay;
- changing the image capture speed;

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- performing zoom operations;
- remote control;
- camera shake detection or correction.

Camera control using GUI (graphics user interface).

Camera control using remote control.

Camera control via network.

Camera control in different operation modes like viewfinder or playback mode, autofocus mode, video mode or still capture mode.

H04N 23/65

Replace: The existing Relationships text with the following updated text.

Relationships with other classification places

Details of circuitry for controlling the generation or management of the power supply for a solid-state image sensor [SSIS] is classified in [H04N 25/709](#).

Details of energy supply or management for control of exposure for digital still cameras not peculiar to the electronic image sensor are classified in group [G03B 7/26](#).

H04N 23/695

References

Insert: The following new reference in the Informative references table.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Means for changing the camera field of view without moving the camera body, e.g. nutating or panning of optics or image sensors	H04N 23/58
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H04N 23/70

References

Replace: The existing reference text with the following updated text.

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control of solid-state image sensor [SSIS] exposure	H04N 25/50
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H04N 23/743

Insert: The following new Definition statement.

Definition statement

This place covers:

Bracketing used for increasing the dynamic range.

Insert: The following new Relationships section.

Relationships with other classification places

Bracketing for image capture at varying focusing conditions is classified in group H04N 23/676.

Delete: The entire Informative references section.

H04N 23/81

References

Insert: The following new Informative references section.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Circuitry for suppressing or minimising impulsive noise of video signals	H04N 5/213
Detection of flicker frequency or suppression of flicker wherein the flicker is caused by illumination, e.g. due to fluorescent tube illumination or pulsed LED illumination	H04N 23/745

H04N 23/95

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Computational photography requiring combination of optical light modulation and computational reconstruction for acquiring dimensions of the plenoptic function.

Light field imaging systems for light field acquisition:

- using an array of cameras
- using single sensor with temporal, spatial or frequency-domain multiplexing
- temporal multiplexing with a programmable aperture
- spatial multiplexing using an array of lens or prisms
- frequency multiplexing by placing heterodyne mask

Camera systems comprising: Different types of image sensors, sensors of different resolutions, sensors with different field of view or focus.

Lensless imaging using:

- coded aperture masks
- zone plates
- angle-sensitive pixels using diffraction gratings

Coded-aperture imaging;

Extended Depth of Field Photography:

- using focal stacks
- focal sweep (moving the camera during the exposure)
- coded apertures

High speed imaging using:

- multiple devices
- high speed illumination
- stroboscopic illumination
- synthetic shutter speed imaging

H04N 25/00

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuitry and driving details of solid-state image sensors, in particular the circuitry and driving details of image sensors directed to the following purposes and functions:

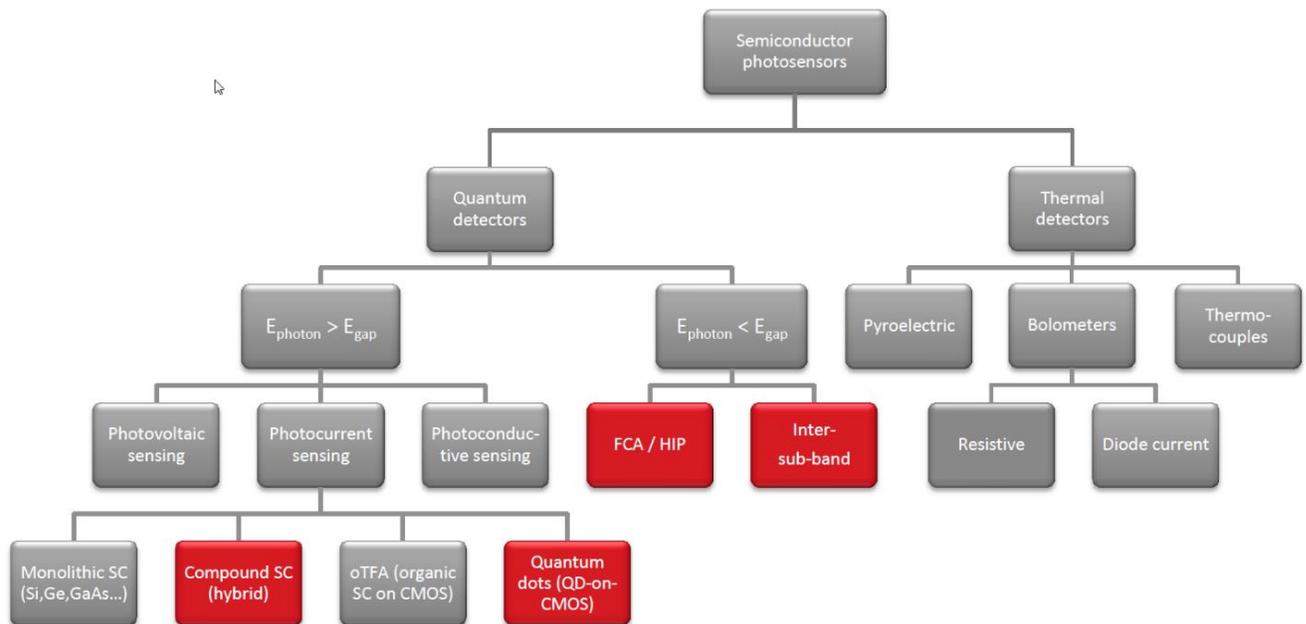
- Reading out image data from the image sensor;

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- Performing image processing within the image sensor;
- Control of exposure time by an electronic shutter;
- Noise removal;
- Improvement of resolution;
- Extension of dynamic ranges.

Solid-state image sensors encompass charge-coupled devices [CCDs], charge injection devices [CIDs], addressable photodiode arrays, complementary metal oxide semiconductor [CMOS] image sensors, etc.



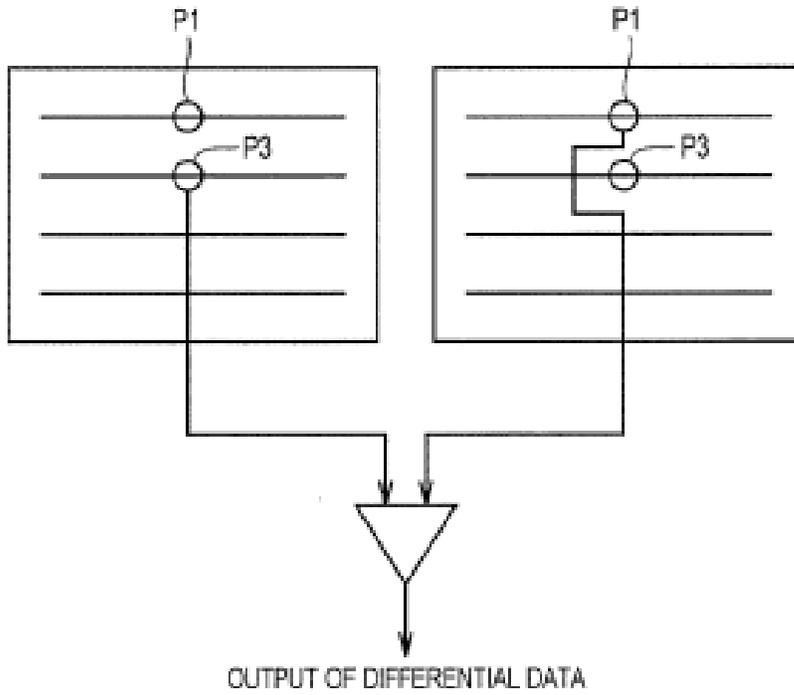
Solid-state image sensors normally capture and output image data as raw images. However, there are special image sensors that capture, process and output the image data. Details of such sensors are classified in the main group [H04N 25/00](#), for example:

- image sensors having on-chip compression means for data rate reduction purposes, e.g. DCT, wavelet transformation in the sensor;
- image sensors having on-chip compression means for data rate reduction purposes by outputting differential data, such as the difference between two exposures or events detecting a predetermined change of the image signal or differences between neighbouring pixels;

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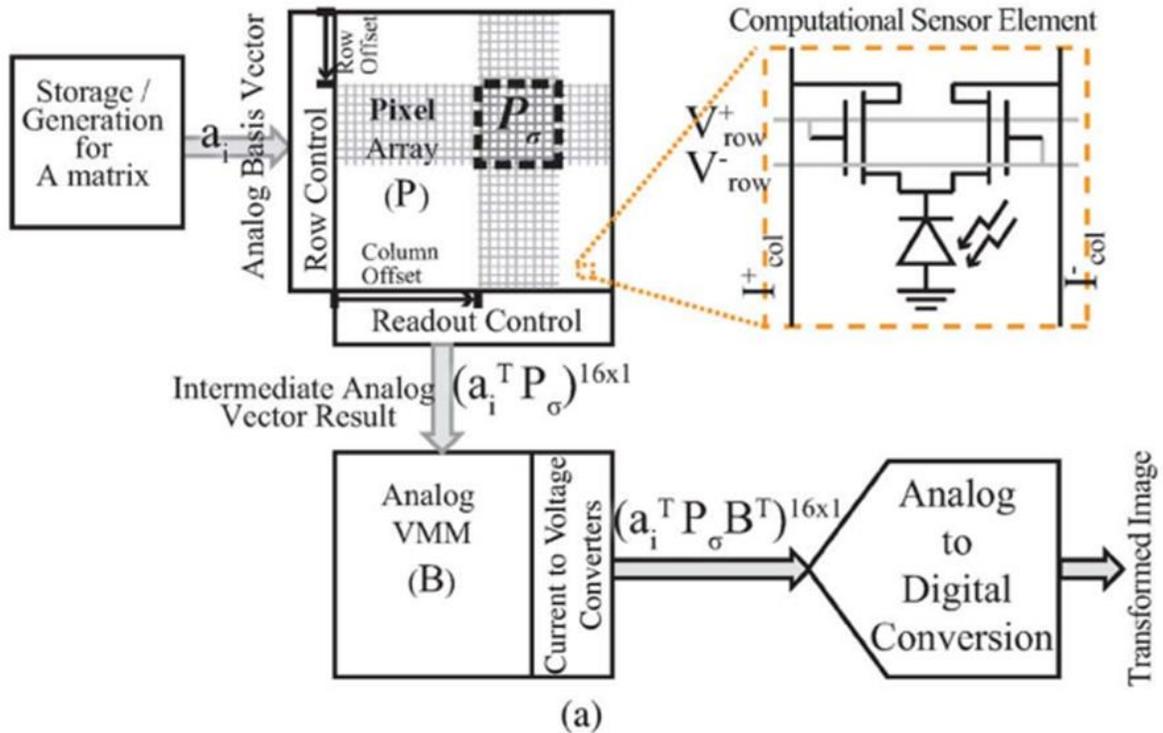
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- compressive sensing sensors

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- image sensors performing global operations such as generation of histograms, sorting, region segmentation/labelling, convolution functions, character recognition, or detecting maximum/minimum level;
- image sensors with edge detection in the sensor, for detecting differences between pixel signals in the spatial domain, for spatial filtering;
- image sensors with motion or event detection in the sensor, i.e. detecting change between pixel signals over time;
- image sensors comprising a dedicated temperature sensor or being controlled by the sensor temperature.
- SSIS with power optimization
- SSIS with processing time optimisation by using for example parallel processing circuitry

Replace: The existing Relationships text with the following updated text.

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Relationships with other classification places

While main group [H04N 25/00](#) is, inter alia, used for classifying electronic circuits of solid-state image sensors and their driving, control and readout, the groups in main group [H01L 27/00](#) cover details related to the implementation of the electronic circuits on a semiconductor chip.

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Receivers for pulse based Lidars	G01S 7/486
Receivers for non-pulse based Lidars	G01S 7/4912
Computer systems using neural network models	G06N 3/02
General purpose image data processing	G06T 1/00
Arrangements for image or video recognition	G06V 10/00
Imager structures consisting of a plurality of semiconductor or other solid-state components formed in or on a common substrate	H01L 27/146
Charged coupled imagers	H01L 27/148
Compressive sampling or sensing	H03M 7/30
Details of scanning heads	H04N 1/024
Scanning arrangements	H04N 1/04
Organic image sensors	H10K 39/32

Replace: The existing Special rules text with the following updated text.

Special rules of classification

Where the solid-state image sensor function is classified in groups [H04N 25/00](#) - [H04N 25/683](#) classification should also be made in the group corresponding to the sensor technology, i.e. [H04N 25/71](#), [H04N 25/76](#) or [H04N 25/79](#). For example, dark current correction for CCDs should be classified in both [H04N 25/63](#) and [H04N 25/71](#).

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Replace: The existing Glossary of terms text with the following updated text.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

image sensor	Sensor that detects and conveys the information that constitutes an image. An image sensor may do so by producing a signal that represents location-dependent attenuation of light (as the light passes through or reflects off a medium). The signal is an electric signal such as an electric voltage or current. The light an image sensor may detect is not limited to visible light, but can be electromagnetic radiation in other wavelengths (e.g., infrared, ultraviolet, X-rays, gamma rays).
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Insert: The following new Synonyms and Keywords section.

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

ADC	Analog to digital converter
AE	Automatic exposure control
AF	Autofocus
AFE	Analog front end
AGC	Automatic gain control
AI	Artificial intelligence
ANN	Artificial neural network
APD	Avalanche photodiode
APS	Active pixel sensor
BSI	Back-side illumination
CCD	Charge-coupled device
CDS	Correlated double sampling
CFA	Colour filter array
CID	Charge injection device
CIS	CMOS image sensor
CMOS	Complementary metal-oxide-semiconductor
CNN	Convolutional neural network
CTIA	Capacitive transimpedance amplifier
DPS	Digital pixel sensor
DSP	Digital signal processor

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EMCCD	Electron multiplying charge-coupled device
EVS	Event-based vision sensor
FD	Floating diffusion
FOV	Field of view
FPN	Fixed pattern noise
FLIR	Forward looking infrared
FPA	Focal plane array
FPD	Flat panel detector
FPGA	Field programmable gate array
GPU	Graphics processing unit
HDR	High dynamic range
LFM	Light flicker mitigation, LED flicker mitigation
LWIR	Long wavelength infrared
MWIR	Mid wavelength infrared
MTF	Modulation transfer function
NIR	Near infrared
NN	Neural network
NUC	Non-uniformity correction
OVF	Optical viewfinder
PD	Phase detection (pixel), phase difference (pixel)
PDAF	Phase-detection autofocus
PMD	Photonic mixer device
PTZ	Pan tilt zoom
QIS	Quanta image sensor
QWIP	Quantum well infrared photodetector
ROIC	Readout integrated circuit
SBNUC	Scene-based non-uniformity correction (NUC)
SPAD	Single-photon avalanche diode
SPD	Single-photon detection
SSIS	Solid state image sensor
SWIR	Short wavelength infrared
TDI	Time delay and integration
TEC	Thermoelectric cooler
TFA	Thin film on ASIC
TIA	Transimpedance amplifier
TOF	Time of flight
WDR	Wide dynamic range

H04N 25/10

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

- Architectures of colour filter arrays, e.g. arrangement of the colours in the colour filter array [CFA], number of the colours in the CFA, CFA comprising white or (N)IR pixels;
- Filter arrays characterised by the selection of primary colours, complementary colours, other colours, e.g. emerald, panchromatic filters, elements with different spectral sensitivity for the same colour, e.g. G1 and G2;
- Elements passing: IR, RGB+IR, W+IR;
- Random arrangement of the colour filter elements;
- CFA characterised by the size of the periodically replicated pattern;
- CFA using repeating patterns with more than one elements of the same colour adjacent to each other, e.g. Quad Bayer;
- Sensors for performing colour separation based on photon absorption depth;
- Circuitry of the sensor for performing colour imaging operations.

H04N 25/20

References

Insert: The following two new references.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Transforming infrared radiation	H04N 5/33
Integrated devices comprising at least one thermoelectric or thermomagnetic element	H10N 19/00

H04N 25/30

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Electronic circuitry of X-ray imaging detectors that directly or indirectly detect incident X-ray photons, including:

- current integrating detectors (CID) or energy integrating detectors (EID);
- photon counting detectors (PCD). Some X-ray PCDs rely on continuous time current monitoring and pulse counting implementation of photon counting. Each pixel typically contains a pulse shaping circuit along with a thresholding system connected to a counter;
- details of generating control signals based on data from the image sensor, like irradiation start/stop detection based on dummy readouts or form signals from specific pixels;
- operation and control of different sensor modes, like entering and control in sleep mode.

Insert: The following new Relationships section.

Relationships with other classification places

Issues with focus on measurement of X-radiation, on a measurement principle or its technological implementation or a dedicated measurement related circuit design should be classified in G01T 1/00.

When the imaging X-ray sensor is described with details related to systems for measuring of X-ray radiation with semiconductor detectors, classification should also be made in G01T 1/00. This is especially the case if details of circuitry for detecting, measuring or adapting the detected signal in order to obtain a correct signal are described, e.g. corrections for pile-up, for trapped charges, for dead-time, to determine energy or spatial corrections.

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References

Insert: The following six new references in the Informative references table.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Circuit arrangements not adapted to a particular type of detector for measuring radiation intensity	G01T 1/17
Transforming X-rays into electric information	H04N 5/32
Cameras or camera modules for generating image signals from X-rays	H04N 23/30
Electric solid-state thin-film or thick-film devices	H10N 97/00
Integrated devices comprising at least one organic element specially adapted for switching	H10K 19/00
Integrated devices comprising organic radiation-sensitive element specially adapted for detecting X-ray radiation	H10K 39/36

Replace: The existing Special rules text with the following updated text.

Special rules of classification

In many cases, it is necessary to add a symbol for an identified function or circuitry design covered in group [H04N 25/00](#).

H04N 25/40

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Details of extracting pixel data from an image sensor by controlling scanning circuits, for example:

scanning individual pixels or pixel regions;

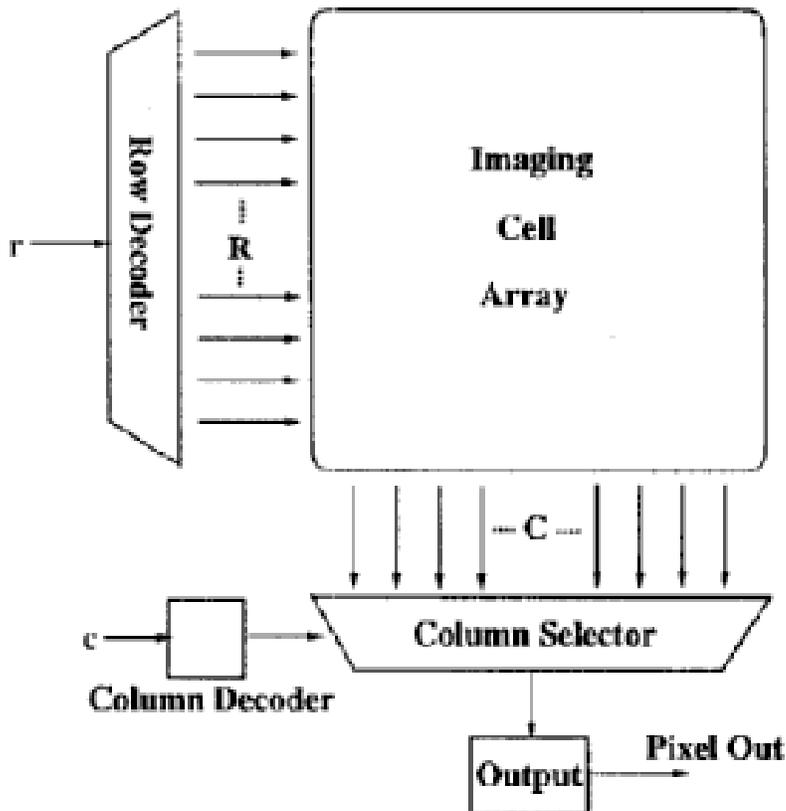
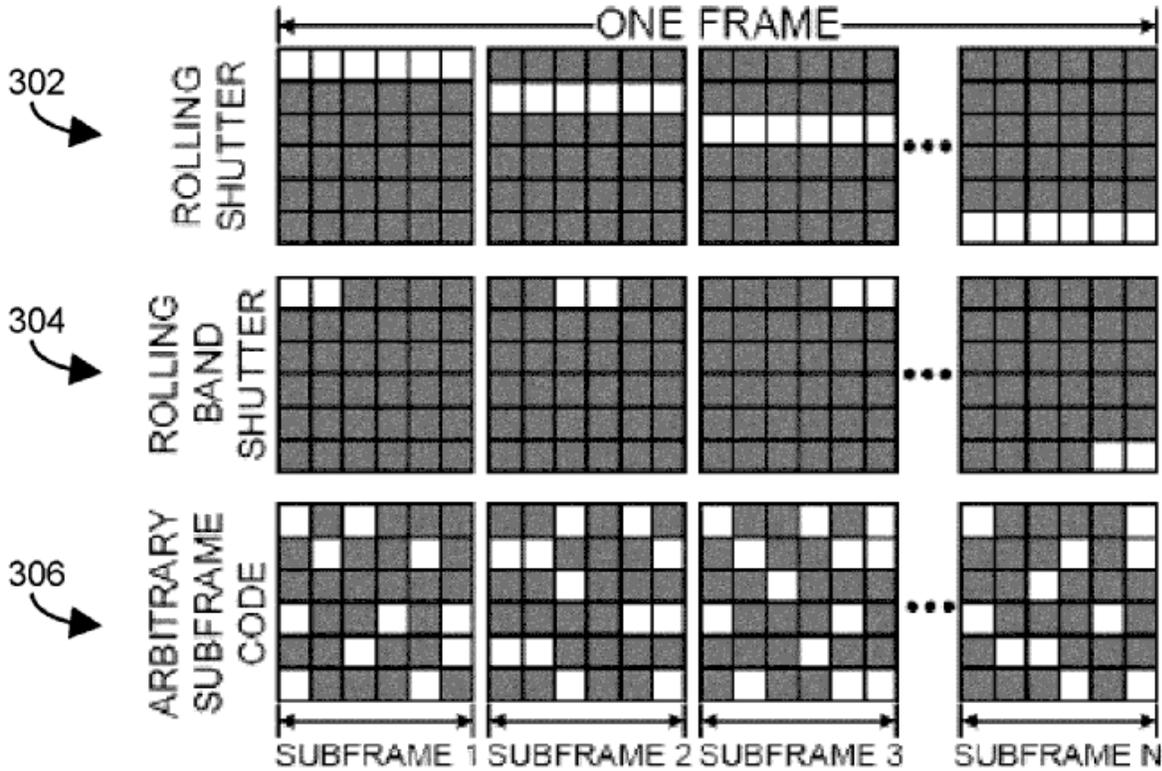


Figure 1: Random Access PD-array

using specific scanning sequences, like scanning in blocks, pyramidal, in different directions;



scanning and reading out data from a pixel while the pixel accumulates new charges or scanning or reading out data from a block, while the block processes the next data, normally additional storage elements like double buffers or parallel processing circuits are used, e.g. reading a pixel while the next exposure is running, reading out digital ADC data while the ADC is running the next conversion cycle, etc.

Scanning for high-speed operations where number of frames are successively captured and stored in the sensor and then readout from the memories;
reading out more than one sensor

- for increasing the field of view by combining the outputs of two or more sensors, e.g. panoramic imaging;
- having different imaging characteristics, e.g. exposure time, aperture size, gain, resolution or colour;

for performing data compression

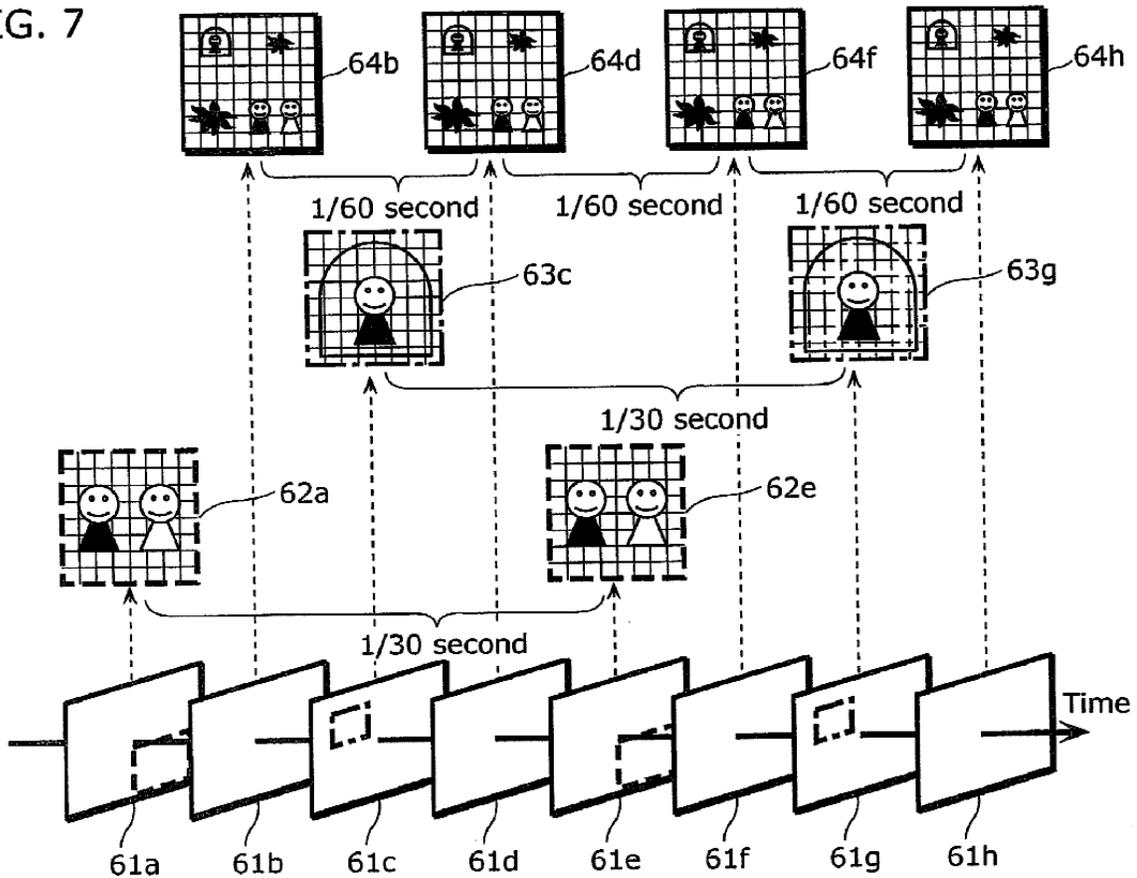
- by compressive sensing or sparse sampling;

- by DCT or wavelet transforms;
- by data differencing.

by controlling the frame rate

- of different regions of the image array;
- the regions being variable.

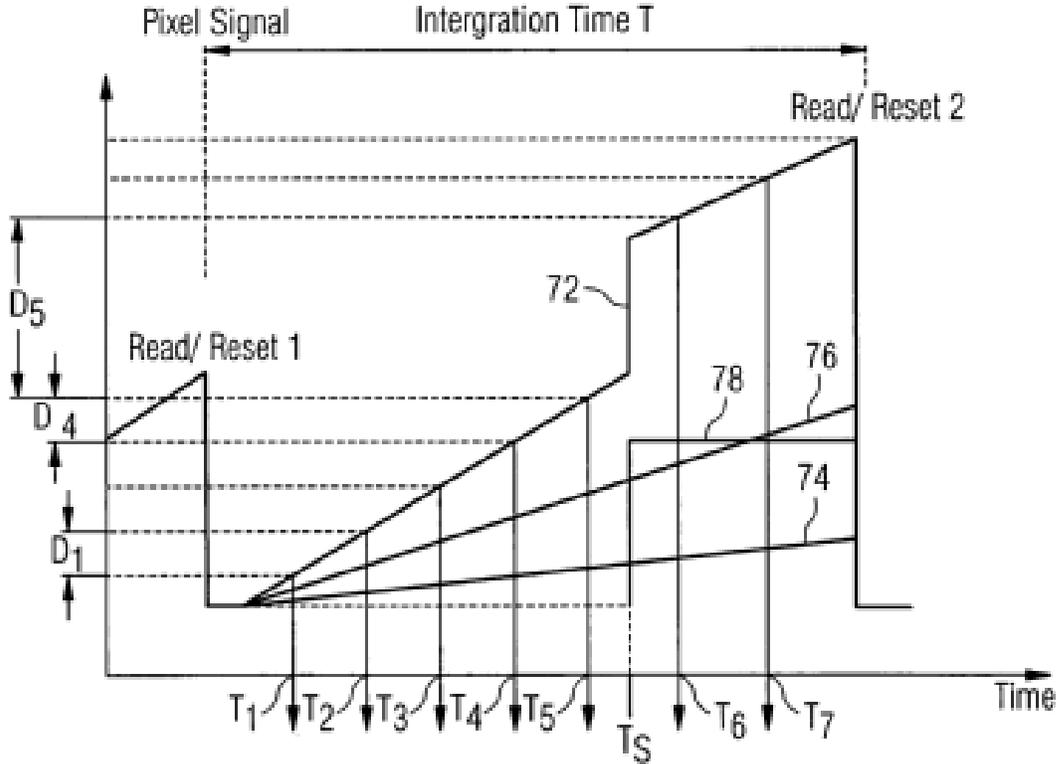
FIG. 7



for extracting focusing pixel data;

by non-destructive readout to read signals two or more times during the integration time of the pixel. The figure shows non-destructive readouts at time instants from T1 to T7, while the pixel signal (72, 74 or 76) increases as a result of the exposure during the integration time T;

FIG 7



for performing global operations, e.g. histogramming, sorting, region segmentation/labelling, convolution functions

- for detecting maximum or minimum level

adapted to implement artificial neural networks [ANNs];

for push broom scanning or together with relative movement.

References

Replace: The H04N 25/74 reference text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Circuitry for scanning or addressing the pixel array in CCD sensors	H04N 25/74
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Replace: The existing Special rules text with the following updated text.

Special rules of classification

In addition to classification in [H04N 25/40](#), classification should also be made in [H04N 25/74](#) or [H04N 25/779](#) when specific details of the scanning circuits are provided.

The readout operations in most of cases influence the exposure time of the pixels. Accordingly, classification should also be made in [H04N 25/53](#) when details related to the control of the exposure/integration time are disclosed.

H04N 25/42

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Image sensors comprising or being switchable between different readout modes, for example between interlaced or non-interlaced mode, or between high- and low-resolution modes, etc.

One of the modes can be related to readout of specific pixels only, for example there may be different modes for reading out focussing pixels and for reading out exposure pixels. The switching between different modes can be initiated, for example:

- upon change of the camera mode - auto exposure, auto focus, AWB, preview mode, video/still picture mode or
- upon scene parameters like motion or object detection.

Delete: The entire Special rules section.

H04N 25/44

Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

This place covers:

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Partial readout of an SSIS during one frame or sub-frame, including where the image sensor performs scanning of different image sensor regions at different resolutions.

Delete: The entire Special rules section.

H04N 25/441

Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

This place covers:

- Scanning only selected rows or columns of the array, for example interlaced scanning or reading only every N-th line of pixels in a frame.

Replace: The existing Special rules text with the following updated text.

Special rules of classification

Classification should also be made in H04N 25/46 if the interlaced scanning is combined with binning of the neighbouring pixels. However, if all pixel signals are readout (i.e. provided to the column output lines or to the charge transfer lines of the CCD), and then some of these are added or binned, then classification is only made in H04N 25/46.

H04N 25/443

Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

This place covers:

Scanning details for reading selected regions of the array, e.g. for performing electronic zooming.

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- control of threshold and bias settings of DVS pixels, e.g. a global or local signal setting or controlling either bias currents or threshold voltages of DVS pixels;
- reduction of noise events detected by DVS sensors;
- binning or spatial filtering of DVS pixels.

References

Insert: The following new Informative references section.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pixels for event detection	H04N 25/707
----------------------------	-------------

H04N 25/48

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuits and arrangements for increasing the resolution by shifting the sensor relative to the scene, including:

- implementing the micro-scanning or pixel shift by moving optical parts of the camera;
- implementing the micro-scanning or pixel shift by moving the sensor;
- increasing resolution by moving or exposing at subpixel positions;
- increasing resolution by using the relative motion of the images captured caused by the camera shake.

H04N 25/50

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Delete: The entire Special rules section.

H04N 25/53

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of camera brightness compensation by influencing the exposure time	H04N 23/73
Control of camera brightness compensation by influencing the scene brightness using illuminating means	H04N 23/74
Control of camera brightness compensation by influencing optical camera components	H04N 23/75

H04N 25/533

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Details of controlling the integration times of different regions of the image sensor wherein:

- the different regions can be predetermined;
- the different regions can be dynamically selected, for example based upon exposure conditions, ROI, speed or user selection;
- the integration time is controlled for each pixel.

Replace: The existing Relationships text with the following updated text.

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Relationships with other classification places

If the control of the integration times is related to extension of dynamic range, classification in [H04N 25/57](#) should also be considered.

H04N 25/57

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuitry and control thereof for extending the dynamic range of an SSIS. The dynamic range of an SSIS is defined as the ratio of the maximum possible, non-saturating input signal (full well capacity), versus the minimum detectable input signal limited by the total noise floor signal (in the dark). Circuitry and control thereof for converting the brightness of the scene into signal values by non-linear response function.

Circuitry and control thereof for reading image signals from which an HDR image can be generated.

H04N 25/571

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

- Controlling the sensor dynamic range using image sensors with pixel circuits having a non-linear response;
- Driving and control thereof.

The non-linear response can be achieved in different ways, for example, by using a specific photodetector, by controlling the reset or the transfer gate driving signals, by controlling the gain or by using non-linear amplifiers.

Replace: The existing Relationships text with the following updated text.

Relationships with other classification places

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Details of control of the charge storable in the pixel are classified in group [H04N 25/59](#).

While group [H04N 25/58](#) covers extending the dynamic range by using multiple exposures, group [H04N 25/571](#) covers the response characteristic (or the Opto Electronic Conversion Function) of the sensor during a single exposure.

H04N 25/58

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Combination of exposures for increasing the dynamic range	H04N 23/741
Bracketing, i.e. taking a series of images with varying exposure conditions	H04N 23/743

H04N 25/581

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Image sensors and driving circuits for controlling sensor dynamic range using two or more simultaneously acquired exposures, including:

- providing pixels for multiple exposures, like long- and short-time exposure pixels, high- and low-sensitivity pixels;
- reading out pixels non-destructively several times within a frame to provide multiple exposures;
- partial readout of pixels of the array (partial charge transfer or charge skimming) during the exposure time.

Delete: The entire Relationships section.

H04N 25/583

Replace: The existing Definition statement text with the following updated text. Images should remain as-is.

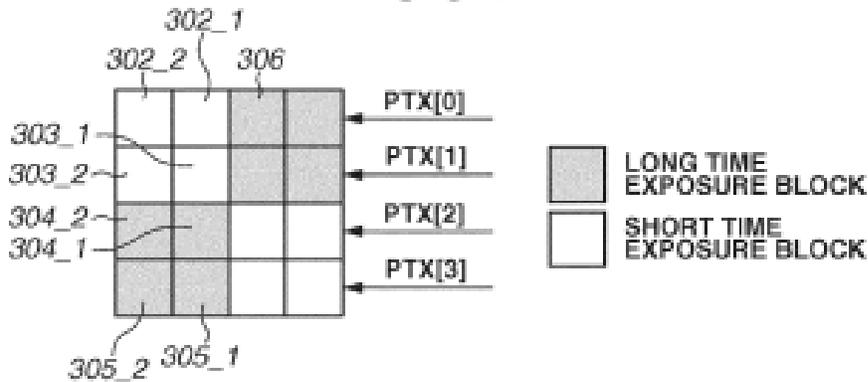
Definition statement

This place covers:

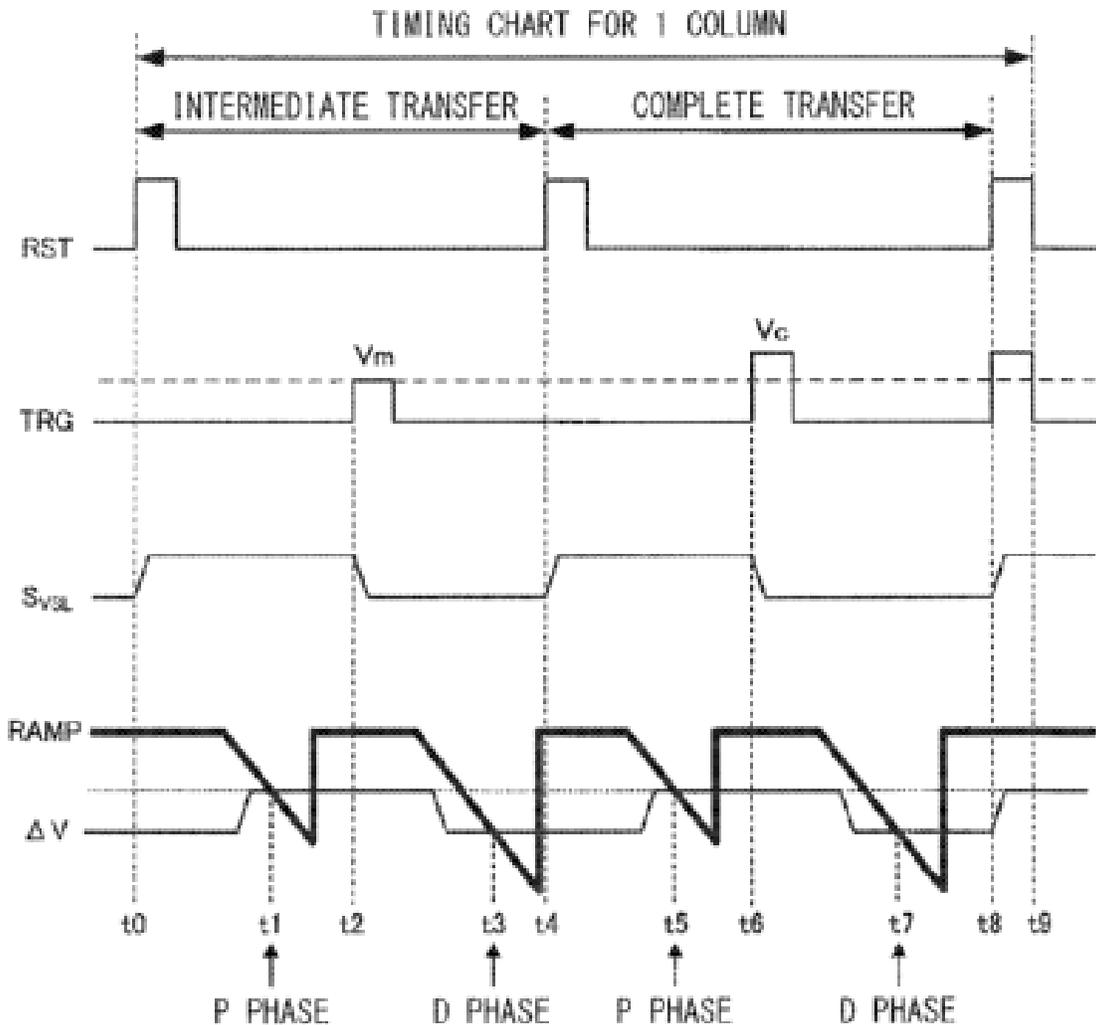
Controlling sensor dynamic range using two or more simultaneously acquired exposures with different integration times, including:

- providing with pixels for multiple exposures, such as long and short exposure time pixels;

FIG.3A



- providing pixels that are read out several times non-destructively during a single exposure period, wherein the readout signals are combined to generate a high dynamic range signal;
- providing pixels that have charge partially transferred to a storage node (charge skimming) during the exposure period, wherein the signals from the partial readout and from the end of exposure are combined to generate a high dynamic range signal.



Insert: The following new Relationships section.

Relationships with other classification places

While group H04N 25/533 covers control of exposure time in different regions of the image sensor, group H04N 25/583 provides for the simultaneous acquisition of two or more exposures using different integration times which are combined in such a way that a new high dynamic range image signal is generated. If a partial or non-destructive

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readout is used only for setting the exposure period of the pixel, classification should be made in H04N 25/533.

H04N 25/585

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Controlling sensor dynamic range using two or more simultaneously acquired exposures using different pixel sensitivities, including the use of sensors and driving circuits with:

- different sensitivities,
- different sizes,
- different conversion gains.

The combination of these signals is used to generate a HDR signal.

H04N 25/589

Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

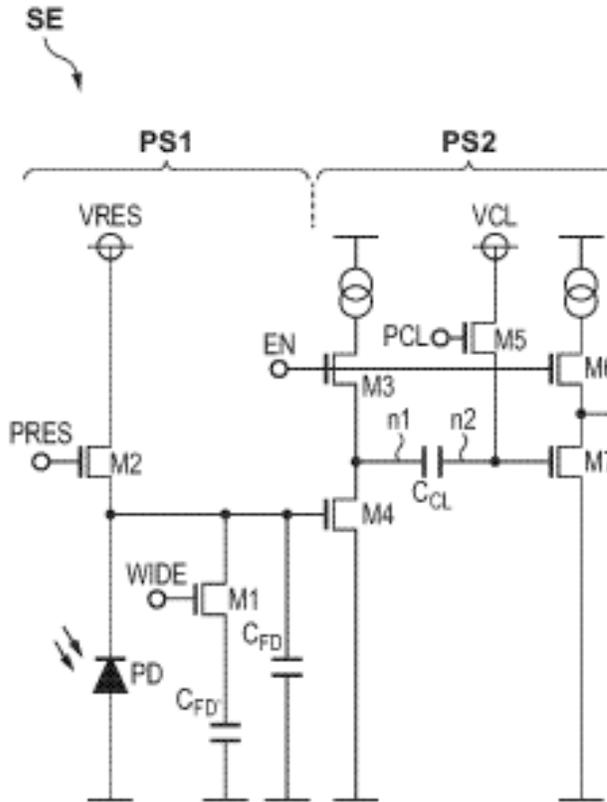
This place covers:

Controlling sensor dynamic range using two or more sequentially acquired exposures with different integration times, e.g. using long and short integration times.

H04N 25/59

Replace: The first image in the Definition statement text with the following updated image. The text and other image should remain as-is.

Definition statement



Delete: The entire Relationships section.

References

Insert: The following new Informative references section.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pixel circuitry comprising storage means other than floating diffusion	H04N 25/771
--	-------------

H04N 25/60

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

- Noise processing circuits for reduction of random noise, line noise, high frequency noise, temporal noise caused by voltage drop of power supply or of driving circuits when implemented as part of the image sensor;
- Circuits for control of bandwidth of amplifiers or comparators implemented in the image sensor as far as related to the overall noise level of the image sensor;
- Noise processing circuits for reduction of optical crosstalk, light leakage, colour mixing and other noise originating from the components of the associated optical system;
- Noise processing circuits for reduction of frame-to-frame variations caused by the image sensor and not by external illumination variation;
- Image sensor noise characterisation, e.g. methods to derive parametric models to quantify different sensor noise types (such as readout noise or photo-shot noise) in the sensed image according to e.g. Gaussian, Poisson or uniform probability distribution functions; methods to calibrate and obtain noise levels of sensor data for further use, for example in filtering applications.

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H04N 25/61

Insert: The following new Relationships section.

Relationships with other classification places

Although not always specific to SSIS, the noise/distortion produced by a lens is nevertheless classified in group H04N 25/61 and not in group H04N 23/81. This has been done to facilitate the search. Corrections of chromatic aberrations, which can also be related to lenses, are classified in group H04N 25/61. All other noise suppression or disturbance minimisation in picture signal generation, e.g. in a camera having an electronic image sensor, should be classified in group H04N 23/81.

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Geometric image transformation in the plane of the image	G06T 3/00
Image enhancement performing geometric correction	G06T 5/80
Camera processing pipelines or components thereof for suppressing or minimising disturbance in the image signal generation	H04N 23/81
Correction of chromatic aberration	H04N 25/611

Delete: The entire Special rules section.

H04N 25/615

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuits for detecting and correcting noise originating from the associated optical system involving a transfer function modelling the optical system.

H04N 25/616

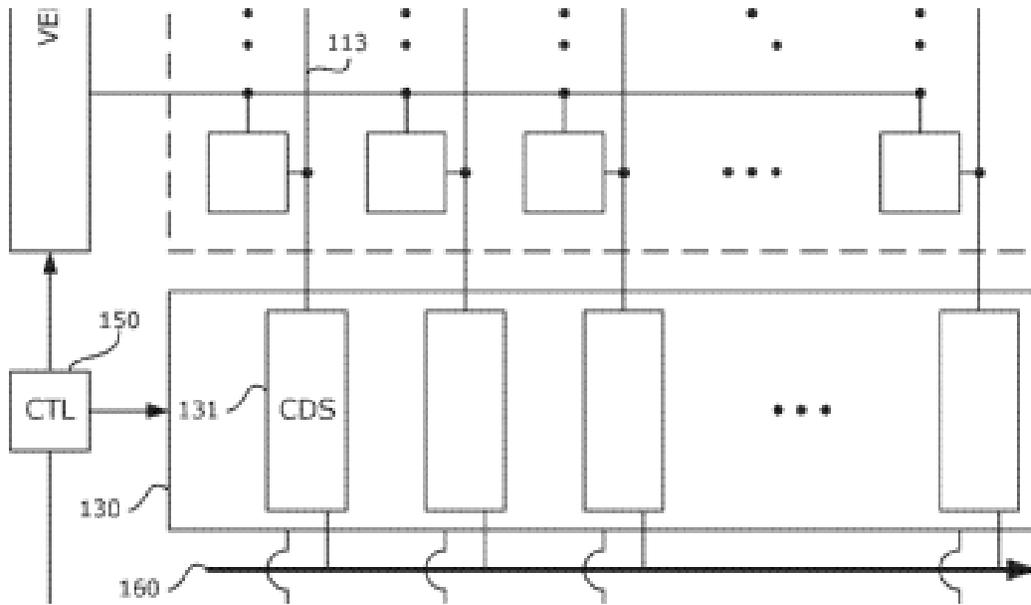
Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

This place covers:

Details of circuits for implementing:

- double sampling [DS] – these circuits compensate for offsets caused by the varying characteristics of pixel amplifiers (source followers);
- correlated double sampling [CDS] – these circuits further reduce the kTC (reset) noise;
- multiple sampling – multiple sampling of a reset signal and an image signal from a pixel is used to reduce or average the random noise;
- (correlated) double/multiple sampling function implemented in the analogue domain, i.e. by using clamping circuits, or by using separate sampling capacitors for the reset signal and the image signal;
- (correlated) double sampling function implemented at least partially in the ADC;
- (correlated) double sampling function implemented in the digital domain;
- CDS circuits per pixel;
- details of arrangement of the CDS circuit as part of the readout circuit;
- CDS arranged per column;



- CDS arranged at the output of the sensor.

Replace: The existing Relationships text with the following updated text.

Relationships with other classification places

If the specific position of the CDS in the image sensor is to be classified, classification should be made under H04N 25/70 according to the respective SSIS architecture. Correlated double sampling is a noise reduction technique in which the reference voltage of the pixel (i.e. the pixel's voltage after it is reset) is subtracted from the signal voltage of the pixel (i.e. the pixel's voltage at the end of integration) at the end of each integration period, to cancel kTC noise (the thermal noise associated with the sensor's capacitance). Therefore, classification should not be made in H04N 25/65 (reduction of kTC noise) if only CDS is used for kTC noise reduction.

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H04N 25/617

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuits for detecting and reducing electromagnetic interferences and clocking noises.

Such electromagnetic interference can be caused by sources internal or external to the sensor, such as from lens focusing motors.

H04N 25/621

Replace: The last bullet statement of the Definition statement text with the following updated bullet statement.

Definition statement

This place covers:

- Active CMOS pixels sensors comprising a dedicated reset or overflow transistor directly connected to the photoelectric converter, such a pixel is known as 5T pixel.

Insert: The following new Relationships section.

Relationships with other classification places

Details related to image sensors comprising pixels that can store and read out overflow charges are to be classified in group H04N 25/59.

References

Replace: The H04N 25/59 reference text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

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Controlling the dynamic range by controlling the amount of charge storable in the pixel	H04N 25/59
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Delete: The entire Special rules section.

H04N 25/63

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

- Circuits for detection and reduction of dark current.
- Circuits performing dark frame subtraction that remove an estimate of the mean fixed pattern, but there still remains a temporal noise, because the dark current itself has a shot noise.
- Circuits using optical black pixels for dark current compensation.
- Circuits using optical black pixels provided for each pixel or group of pixels.

Replace: The existing Relationships text with the following updated text.

Relationships with other classification places

The pattern of different dark currents can result in a fixed-pattern noise which is classified in H04N 25/67. Dark current is caused by charges generated in the detector when no radiation is entering the detector. Accordingly, only the fixed pattern noise caused by the dark current can be corrected or compensated. Dark current is temperature, exposure and pixel size dependent.

H04N 25/633

Replace: The existing Definition statement text with the following updated text.

Definition statement

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This place covers:

Pixels shielded from incident light for detecting only dark current.

H04N 25/65

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Noise processing involving a correlated sampling function, e.g. correlated double or triple sampling	H04N 25/616
--	-----------------------------

H04N 25/671

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuits and arrangements for correcting and detecting of non-uniformity caused by sensor characteristics such as:

- different pixel characteristics – sensitivity, gain, offset, response curve;
- different characteristics of sampling circuits, amplifiers, ADCs used for different groups of pixels;
- the resistive or capacitive properties of long readout or control lines.

Circuits and arrangements for correcting and detecting of non-uniformity by

- using dummy pixels and/or dummy structures, not OB pixels for detecting offset variations;
- using correction circuits for correcting gain variations between pixels or groups of pixels;
- performing measurement of the gain variations;
- using correction circuits for correcting offset variations between pixels or groups of pixels;
- performing measurement of the offset variations.

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Non-uniformity correction modes for

- measuring the gain responses of the pixels;
- measuring the offset responses of the pixels.

Replace: The existing Relationships text with the following updated text.

Relationships with other classification places

There is a certain similarity between the circuits and methods for correcting dark current (H04N 25/63) and for correcting offset non-uniformities of the pixels. Since both can be temperature dependent, both can be corrected by using a dark frame.

H04N 25/672

Delete: The image from the Definition statement, so that the entire Definition statement appears as follows.

Definition statement

This place covers:

Circuits and arrangements for correcting and detecting of non-uniformity between adjacent regions or output registers.

H04N 25/683

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Details of circuits that detect defects such as non-responsive pixels in real time by using the image signal.

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H04N 25/70

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Imager structures, as devices consisting of a plurality of semiconductor or other solid-state components formed in or on a common substrate, per se	H01L 27/146
---	-----------------------------

H04N 25/702

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

SSIS with

- non-planar (e.g. foveal) or curved pixel layouts;
- non-identical or non-equidistant pixels distributed over the pixel array.

References

Replace: The existing H04N 25/585 text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Controlling sensor dynamic range using two or more simultaneously acquired exposures using different pixel sensitivities	H04N 25/585
--	-----------------------------

H04N 25/703

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

SSIS comprising dedicated pixels or control thereof, e.g.

- pixels specially for white balance measurement;
- pixels for exposure or ambient light measurement;
- pixels for triggering an exposure period;
- pixels for edge detection;
- pixels for event detection, for motion or difference detection or for level detection;
- pixels for storing additional non-volatile information;
- pixels for measuring substrate temperature.

H04N 25/704

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

SSIS using pixels specially adapted for focusing, including:

- SSIS comprising phase difference pixels.
- SSIS comprising only phase difference pixels, i.e. all pixels comprise more than one photodiode per micro lens. The photodiodes can have shared amplifiers or can be connected to different (shared) amplifiers.

H04N 25/705

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

SSIS using pixels for depth measurement, e.g. using time of flight [TOF] or using photonic mixer devices [PMD].

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pixels specially adapted for focusing, e.g. phase difference pixel sets	H04N 25/704
Detector arrays as receiver circuits of Lidar systems	G01S 7/4863 , G01S 7/4914
Time delay measurement, e.g. time-of-flight measurement, at Lidar receivers	G01S 7/4865 , G01S 7/4915
Lidar systems, specially adapted for specific applications	G01S 17/88
Image signal generators for stereoscopic video systems constituting depth maps or disparity maps	H04N 13/271

H04N 25/709

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

SSIS with circuitry for controlling the power supply, including

- for controlling the control signal levels;
- for controlling different bias and reference voltages;

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- biasing circuits for adjusting or controlling the bias of the substrate or other circuitry.

H04N 25/713

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

- Details of transfer registers;
- Details of readout registers;
 - having for example changeable transfer direction
 - electron multiplying CCD [EMCCD]
- Split readout registers;
- Multiple readout registers;
 - for readout in H and V directions
 - for reading out of different colours.

H04N 25/75

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Readout circuits that are applicable to a CCD image sensor.

Readout circuits for CCD sensors arranged at the output of the sensor:

- CCD output stages like output buffers and source followers.
- CCD output stages which are column parallel, i.e. provided for each column.

CCD circuitry for modifying or processing image signals from the pixel array.

H04N 25/76

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Circuits of and for driving, controlling addressed sensors.

There is a wide variety of addressed image sensors using different ways of transforming light to electrical current or voltage. The following aspects are classified in this group.

Active pixels sensors [APS]:

- using photodiodes or two terminal semiconductor elements as photodetector;
- using Graphene Layer as photodetector;
- using Photo-conversion layer as photodetector;
- having pixels with small full-well capacity (200e-), high conversion gain (1 mV/e-), small pixel size (900 nm), e.g. QIS or binary pixels.

Passive pixel sensors:

- using photodiodes or two terminal semiconductor elements as photodetector;
- using bipolar transistors as photodetector;
- using charge injection devices [CID];
- charge modulation, static induction transistor [SIT] or base-stored image sensor BASIS;
- using CMOS-CCD structures;
- using diodes for (row) selection switches.

Bolometers used for far infrared imaging.

This group also covers addressed image sensors:

- comprising an additional frame memory;
- comprising testing structures;
- implemented within a display panel;
- providing specific details of the sensor input/output interfaces;
- providing details of partitioning of the signal processing circuits between the sensor and another chip;
- being a camera on chip.

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References

Replace: The existing References out of a residual place text with the following updated text.

References out of a residual place

Examples of places in relation to which this place is residual:

Detection or reduction of inverted contrast or eclipsing effects	H04N 25/627
Detection or reduction of noise due to excess charges produced by the exposure for reducing horizontal stripes caused by saturated regions of CMOS sensors	H04N 25/628

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Charge-coupled device [CCD] sensors; Charge-transfer registers specially adapted for CCD sensors	H04N 25/71
Semiconductor technology of imager structures other than CCD as, e.g. CMOS	H01L 27/146
Charged coupled imagers per se	H01L 27/148

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H04N 25/766

Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

This place covers:

Addressed sensors comprising control lines used for a plurality of control functions, for example:

- a control line used to control the transfer gate of one pixel and to control the reset gate of another pixel;
- a control line used as power line, pixel select line or column output line.

H04N 25/767

Replace: The existing Definition statement text with the following updated text. Images should remain as-is.

Definition statement

This place covers:

- Arrangement of scanning circuits for generating control signals for a multiplexer or an arrangement of switches that connects the column lines of the sensor array to the sensor output. In contrast to CCD sensors, addressed image sensors do not necessarily comprise transfer or readout registers that transfer the image signal to the output.
- Details of analogue (pixel signal) shift registers and scanning circuits thereof.
- Bucket-brigade type shift registers.
- Details of digital (signal) shift registers and scanning circuits thereof.
- Horizontal and vertical lines to read out the pixel array in x- and y- directions.
- Multiple horizontal readout lines for different sensor regions.
- Multiple horizontal readout lines for different colours.
- Details of multiplexer or switches for horizontal scanning used for performing horizontal binning between signals from different column lines.
- Details of multiplexer or switches for outputting signals from a column line to different readout line.

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Replace: The existing Relationships text with the following updated text. The image should remain as-is.

Relationships with other classification places

Circuits like AD converters, correlated double sampling or amplifiers provided for each column are not part of the readout registers, but all these circuits can be part of a readout circuit. Details of column parallel AD converters, CDS circuits or column amplifiers are classified in group H04N 25/78. Group H04N 25/767 covers details of how the data is transmitted to the output.

H04N 25/77

Replace: The existing Definition statement text with the following updated text. The images should remain as-is.

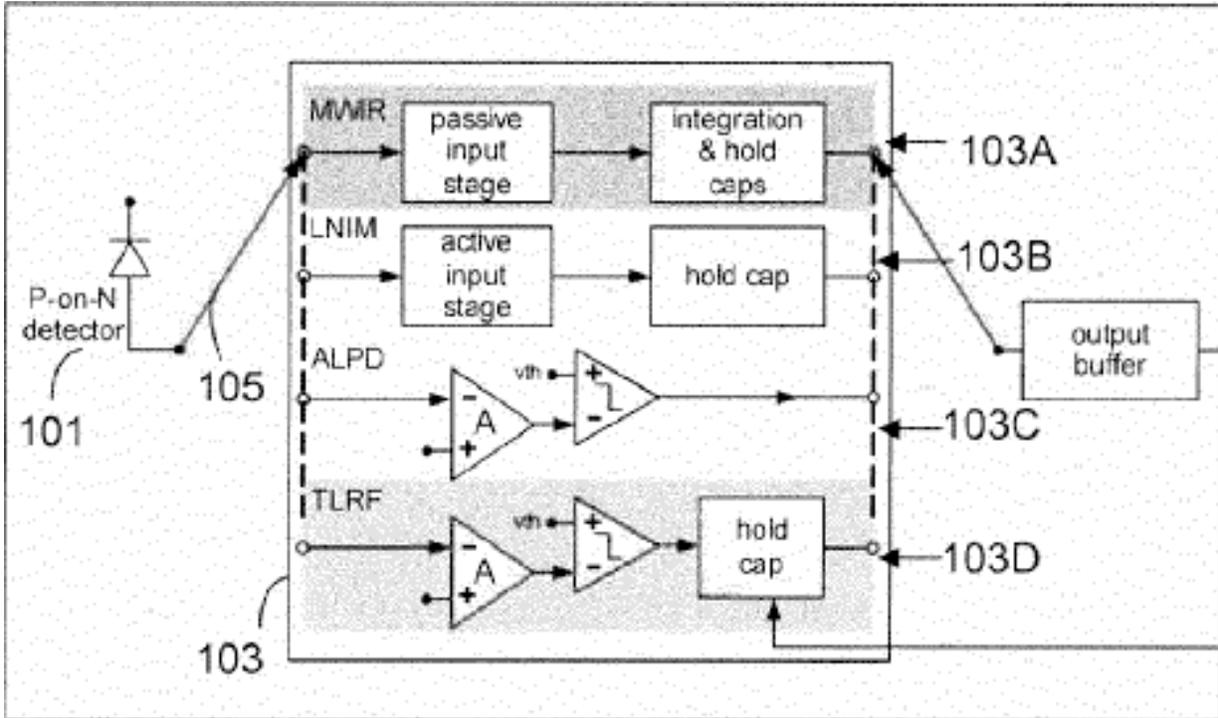
Definition statement

This place covers:

Details of pixel circuits and control thereof. However, since pixel circuits known as 3T, 4T, 5T or passive pixels are well known, these pixel structures as such are not classified in this group unless the invention relates to specific pixel properties.

Pixels characterised by their mode of operation:

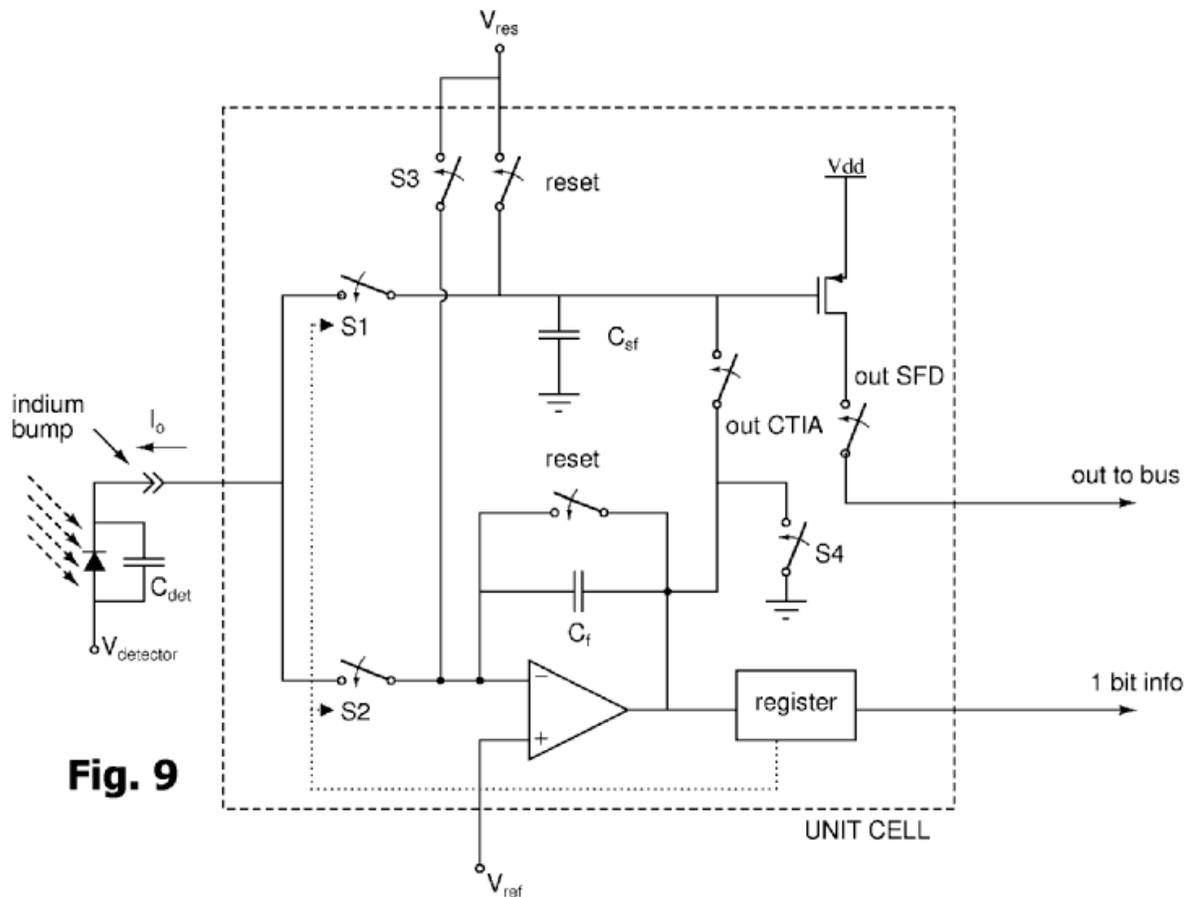
- pixels having different modes – e.g. a pixel configurable to work as TOF, as a photon counter, for event detection, as an integration pixel, etc.



- pixels having different read-out modes.

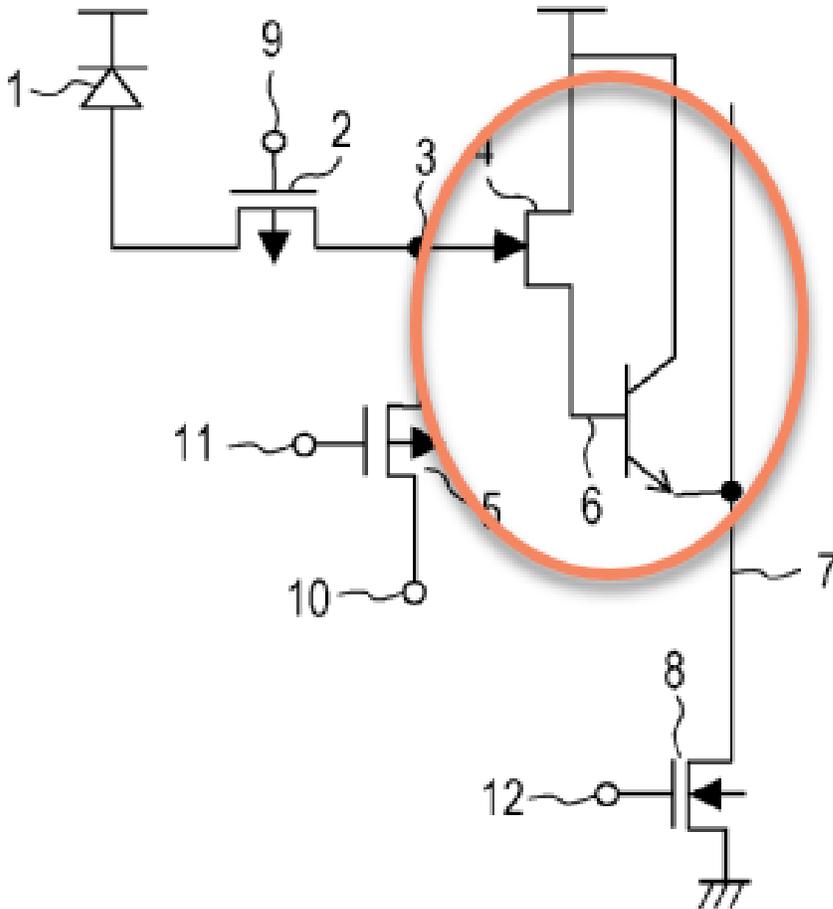
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**Fig. 9**

Pixel details related to the pixel output interface. For example, pixels:

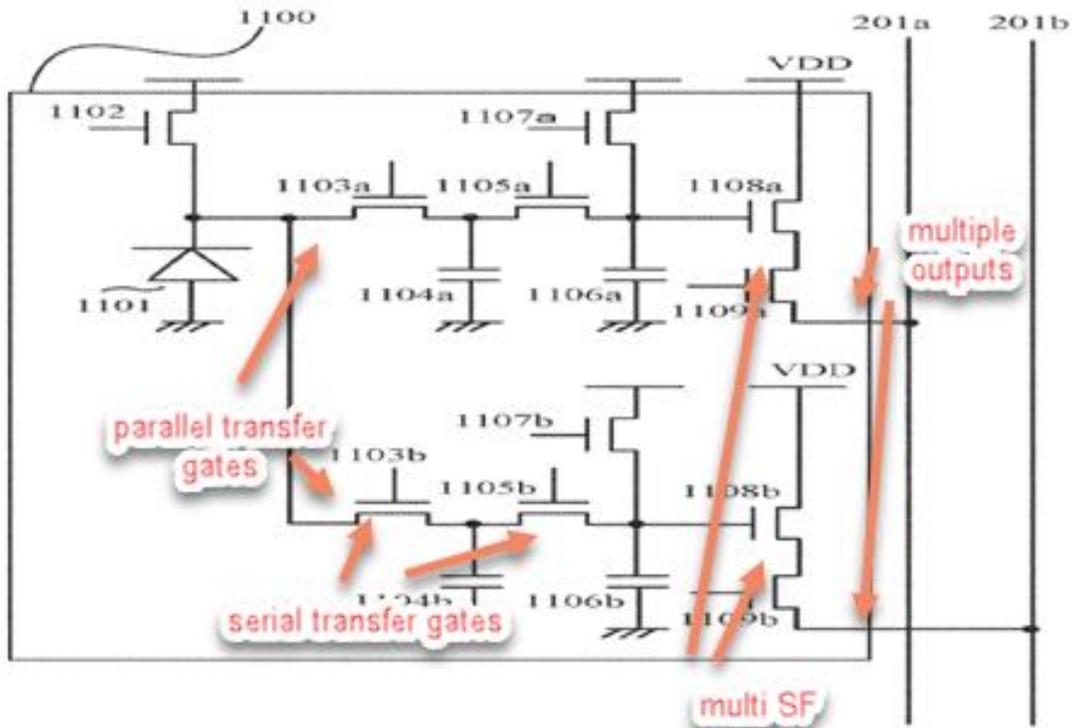
- having multiple outputs;
- having digital and analogue output;
- having passive and active output, i.e. pixels which can be read out as passive and active pixels.
- characterised by the type and the characteristics of the amplifier used. For example, pixels having specific details related to the source follower in the APS and of the source follower transistor, e.g. type of the SF transistor, load of the SF implemented in the pixel, control of the SF voltage;



- multistage amplifiers, e. g. two stage source followers;
- multiple source followers per pixels connected in parallel;
- distributed amplifiers, i.e. pixels comprising only part of the amplifier, the remaining part is shared for a group of pixels or for a column of pixels;
- CTIA or common drain amplifiers, not source followers.
- pixels characterised by the type and the characteristics of the charge transfer elements. For example, pixels:
- with details of control of the transfer gate;
- with details of transfer gate transistor: enhancement-, p- type;
- with plurality of transfer gates connected in parallel;

- with plurality of transfer gates connected in series.

Note: a plurality of transfer gates for connecting additional storage means within the pixel are classified in group [H04N 25/771](#).



- having direct injection gate.

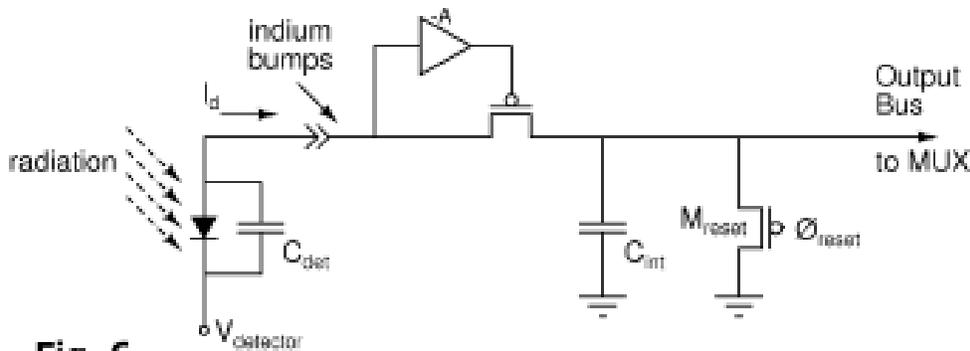


Fig. 6

- having charge multiplying portion.
- having time segregation structure for arrival time measuring.
- reading the photocurrent.

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Pixels characterised by the type and the characteristics of the reset switch. For example, pixels:

- with reset level control;
- with details of the reset transistor: enhancement-, p- type.

Pixels comprising control circuits using signals from the neighbouring pixels, e.g. for control of pixel conversion gain or exposure time in function of the average signal value of the neighbouring pixels.

Pixels comprising capacitors for applying control signals (RST, SEL) through it.

Replace: The existing Special rules text with the following updated text.

Special rules of classification

H04N 25/77 and subgroups do not cover associated circuits. For example, an A/D converter [ADC] in the readout circuit outside the matrix is classified in group H04N 25/78 and not in subgroup H04N 25/772.

H04N 25/771

Replace: The existing Definition statement text with the following updated text. The images should remain as-is.

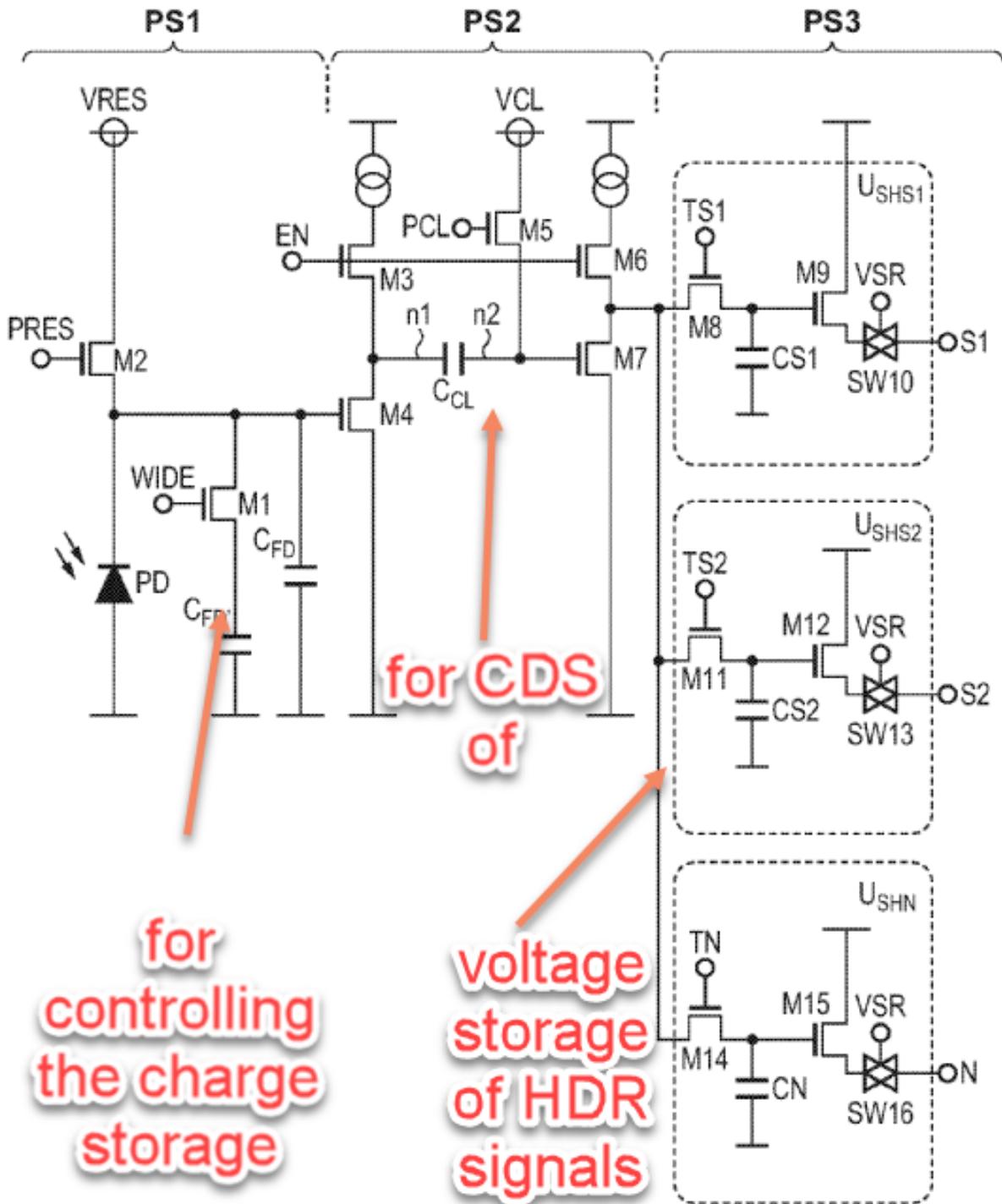
Definition statement

This place covers:

Addressed sensors with pixel circuits comprising additional storage means, i.e. storage means other than the floating diffusion.

The storage means can be analogue storage means:

- in the charge domain;



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References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Extending the dynamic range of solid-state image sensors [SSIS] by controlling the amount of charge storable in the pixel	H04N 25/59
Noise processing involving correlated double sampling [CDS] performed in the pixel	H04N 25/616
CDS performed in readout circuits for addressed sensors	H04N 25/78

[H04N 25/772](#)

Replace: The first paragraph of the Definition statement text with the following updated paragraph.

Definition statement

This place covers:

Addressed sensors with pixels or group of pixels comprising A/D, V/T, V/F, I/T or I/F converters. The converters should be at least partially implemented in the pixel array.

References

Replace: The G01T 1/247 reference text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Semiconductor detectors for measuring radiation intensity of X-, gamma, corpuscular or cosmic radiation	G01T 1/24
---	---------------------------

Insert: The following new Glossary of terms section.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

A/D converter	Circuit for analogue-to-digital conversion [ADC] of a signal
V/T converter	Circuit for converting a pixel output voltage to a time signal
V/F converter	Circuit for converting a pixel output voltage to a frequency signal
I/T converter	Circuit for converting a pixel output current to a time signal
I/F converter	Circuit for converting a pixel output current to a frequency signal

H04N 25/778

Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

This place covers:

Addressed sensors with pixel structures in which multiple photodiodes are provided. Respective transfer gates are used to transfer the charges accumulated in the photodiodes to a floating diffusion, and the floating diffusion is connected to a gate of an amplifier transistor. The amplifier is implemented within the pixel array.

Replace: The existing Relationships text with the following updated text.

Relationships with other classification places

Passive pixel sensors comprising a shared amplifier per column are classified in group [H04N 25/76](#).

Active pixels sensors comprising column parallel amplifiers are classified in group [H04N 25/78](#).

Replace: The existing Special rules text with the following updated text.

Special rules of classification

Where shared pixel structures are used for different applications, classification is also made in groups relating to the application. For example, when charges of the shared photodiodes are binned in the floating diffusion classification is also made in H04N 25/46. Where shared photodiodes have different sensitivities, classification is also made in H04N 25/585. Pixels specially adapted for focusing (e.g. phase difference pixel sets) are also classified in H04N 25/704.

H04N 25/779

Replace: The existing Definition statement text with the following updated text. The image should remain as-is.

Definition statement

This place covers:

- Addressed image sensors such as CMOS image sensors using row and column scanning or addressing circuits.
- Addressed sensor circuitry where the column scanning/addressing circuits are only used to provide row pixel data to the output of the sensor.
- Addressed sensor circuitry where the row scanning/addressing circuits, in addition to the row select signals, provide further control signals to the pixels such as transfer gate [TG] or reset [RST] signals.
- Details of scanning/addressing circuits for addressed image sensors;
- Details related to the electronic circuitry of the scanning circuits, multiple scanning circuits, details related to the generation of driving pulses for TG, RST, ROW SEL.

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Replace: The existing Relationships text with the following updated text. The image should remain as-is.

Relationships with other classification places

If the document does not provide any specific details related to the row scanning/addressing circuits but instead describes functional details of performing different sensor readout operations, then classification should only be made in H04N 25/40. Similarly, if the document only specifies functional details related to control of the exposure, then classification should be made in H04N 25/50 and/or H04N 25/57 as appropriate.

H04N 25/78

Replace: The existing Definition statement text with the following updated text. The images should remain as-is.

Definition statement

This place covers:

Readout circuits for addressed image sensors defining details related to the column readout lines and the circuits associated with them. Although the readout lines are placed in the sensor array, they are a functional part of the readout circuits.

These details are, for example, readout arrangements with:

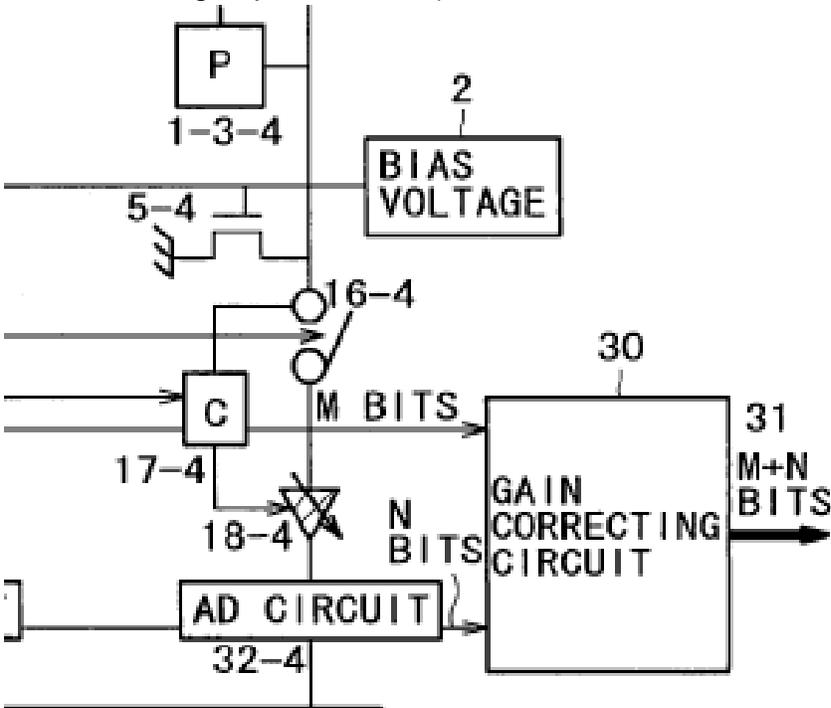
- several column readout lines per column of pixels;
- column lines connectable by switches to perform analogue signal averaging/binning;
- multiple column lines are multiplexed to be processed by common processing means, like CDS, ADC, buffers;
- column lines connectable to different processing means (CDS, ADC, buffers) to randomise the column pattern noise;
- column lines randomly connectable to different processing means (CDS, ADC, buffers) to randomise the column pattern noise;
- a column line being shared for pixels in a row;
- several storage capacitors per column used for CDS, binning, multi frame storage, etc;
- reset or clamping circuits connected to the column lines.

Details related to the load circuit, e. g. current source of the source follower and control thereof.

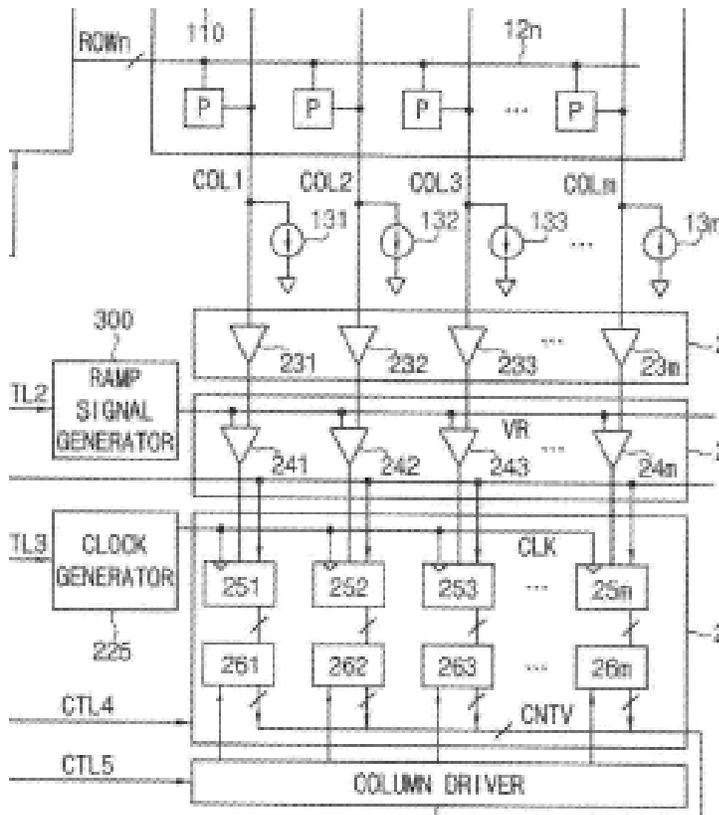
Details related to ADC circuits (ADC circuits as such – group [H03M 1/12](#)) used in sensor array readout circuits.

These details are for example, related to:

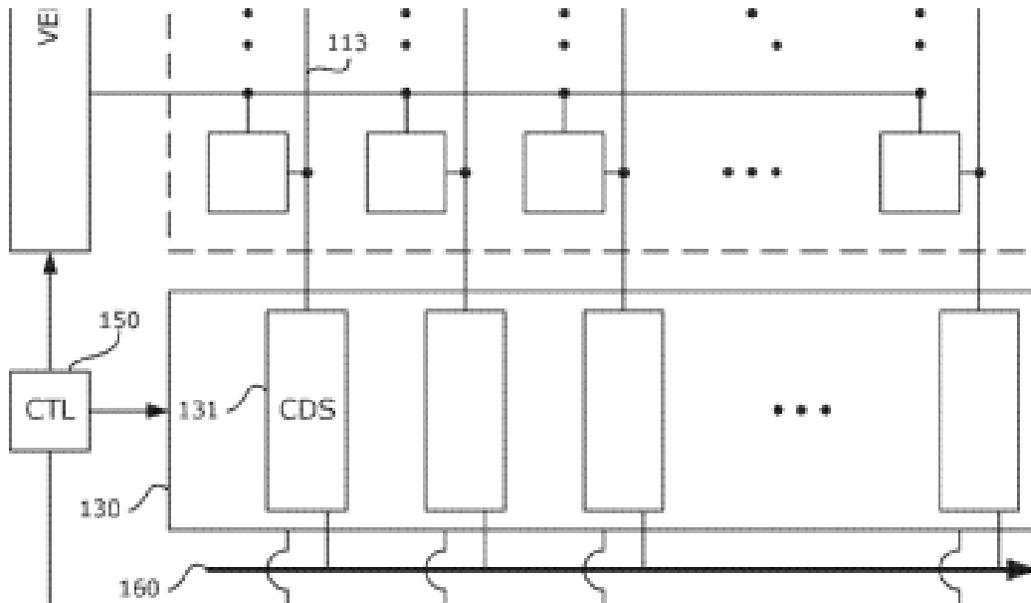
- ADC type, like single slope, flash, SAR, sigma-delta, ADC combined with the gain of a programmable gain amplifier (ADC of this type as such group [H03M 1/18](#));



- ADC arrangement in the readout circuit;
- ADC arranged per-column or for group of columns;



- ADC arranged at the output of the sensor;
- ADC ramp voltage generation - different slopes and directions, non-linear, ramp amplitude;
- Processing implemented in the ADC, like CDS, binning.
- Details related to output amplifiers:
- CTIA amplifiers (normally used in passive image sensors);
- Amplifiers with controllable gain GCA, PGA;
- Amplifiers arranged per-column or for group of columns;
- Amplifiers arranged at the output of the sensor.
- Details of arrangement of the CDS circuit as part of the readout circuit:
- CDS arranged per column;



- CDS arranged at the output of the sensor.
- CDS circuits as such are classified in group [H04N 25/616](#).

H04N 25/79

Replace: The existing Definition statement text with the following updated text.

Definition statement

This place covers:

Solid state image sensor [SSIS] circuitry divided between different or multiple substrates, including:

- Details of circuits and control thereof adapted for stacked image sensors and the like;
- Details of partitioning the image sensor functional blocks such as the pixel array, scanning circuits, readout circuits and memories between different stacked chips;
- Details of pixel circuitry distributed between different layers;
- Details of ADC circuitry distributed between different layers;

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- Details of specific control arrangements or control lines adapted for stacked sensors.

References

Replace: The existing Informative references table text with the following updated text.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Line sensors using abutted sensors arranged in a long line	H04N 25/7013
Flat panel detectors for transforming X-rays into image signals with butting of tiles	H04N 25/30