SONY
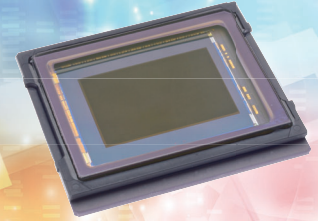
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IMX294CJK

Diagonal 21.63 mm (Type 4/3) Approx. 10.71M-Effective Pixel
Color CMOS Image Sensor

High-Sensitivity Type 4/3 CMOS Image Sensor that Supports 4K for Security Camera and Industrial Applications

Sony Semiconductor Solutions Corporation has commercial-ized the "IMX294CJK" Type 4/3 back-illuminated CMOS image sensor with approximately 10.71M-effective pixels for the expanding security camera market.

The "IMX294CJK" is the first in-house image sensor for security cameras to adopt the Type 4/3 format, and realizes output of the number of pixels needed for 4K at 120 frame/s (in ADC 10-bit output mode). In addition, use of a large-size pixel achieves SNR1s of 0.14 lx[*1], and use of a Quad Bayer pixel structure (see Figure 1) realizes an HDR (High Dynamic Range) function with no time difference, enabling video imag-ing with a wide dynamic range.

*1: Low illuminance performance index advocated by Sony for image sensors for industrial applications

- Large-size optical format (Type 4/3)
- Supports 4K output at 120 frame/s
- High sensitivity (SNR1s = 0.14 lx)
- High-speed interfaces (CSI-2/SLVS-EC[*2])
- Supports Quad Bayer Coding HDR

*2: Scalable Low Voltage Signaling Embedded Clock

Exmor R

* Exmor R is a registered trademark or trademark of Sony Group Corporation or its affiliates. The Exmor R is a Sony's CMOS image sensor with significantly enhanced imaging characteristics including sensitivity and low noise by changing fundamental structure of Exmor™ pixel adopted column parallel A/D converter to back-illuminated type.

STARVIS

* STARVIS is a registered trademark or trademark of Sony Group Corporation or its affiliates. The STARVIS is back-illuminated pixel technology used in CMOS image sensors for security camera applications. It features a sensitivity of 2000 mV or more per 1 μm² (color product, when imaging with a 706 cd/m² light source, F5.6 in 1 s accumulation equivalent), and realizes high picture quality in the visible-light and near infrared light regions.

Supports Type 4/3 4K output

The IMX294CJK adopts Type 4/3 as the optical size, and supports various output formats (angle of view) including 10M (3704 × 2778) for aspect ratio 4:3, UHD (3840 × 2160) for 16:9, and 4096 × 2160 for 17:9. In addition, the A/D converter can be selected from 10 bits, 12 bits, and 14 bits according to the application (Table 3).

Exceptional low-illumination performance

Exceptional low-illumination performance of SNR1s: 0.14 lx is realized by use of a large-size optical system and by expand-ing the area per pixel to 4.63 μm. This makes the IMX294CJK ideal for security camera market applications that require low-illumination performance (Photograph 2).

High-speed movie imaging

This product realizes high-speed movie imaging with a 4K angle of view at the high frame rate of 120 frame/s, and also enables high-speed imaging at 60 frame/s in HDR drive mode.

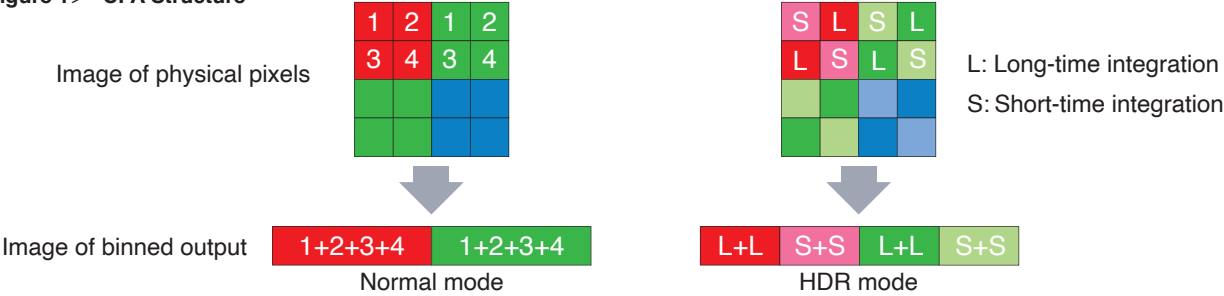In addition, use of our proprietary high-speed serial interface SLVS-EC together with high-speed imaging enables image transfer with few signal lines. This product is also equipped with a general-purpose MIPI (CSI-2) interface, and supports connection with a general-purpose ISP (Image Signal Processor).

Quad Bayer Coding HDR

The IMX294CJK uses a Quad Bayer structure, and outputs data binned in 2 × 2 pixel units in normal mode. In HDR mode, integration can be divided into long-time integration and short-time integration for each 2 pixels in the Quad array (Figure 1). In this case there is no time difference between long-time integration and short-time integration, which realizes HDR with little blending offset when imaging moving subjects (Photograph 3).

＜Figure 1＞ CFA Structure

Image of physical pixels

1	2	1	2
3	4	3	4

S	L	S	L
L	S	L	S

L: Long-time integration
S: Short-time integration

Image of binned output

1+2+3+4	1+2+3+4

Normal mode

L+L	S+S	L+L	S+S

HDR mode

＜Photograph 1＞ Normal image
Condition: 500 lx F2.0 (Exposure time 33.3 ms, Internal gain 0 dB)

＜Photograph 2＞ Low illumination image
Condition: 0.2 lx F2.0 (Exposure time 33.3 ms, Internal gain 45 dB (HCG))

＜Photograph 3＞ Example of HDR image
Condition: Exposure time (3.2 ms/0.2 ms) blended image

Multiple exposure HDR

Quad Bayer Coding HDR

＜Table 1＞ Device Structure

Item		IMX294CJK
Output image size		Diagonal 21.63 mm (Type 4/3) aspect ratio 17:9 & 4:3
Number of effective pixels		4168 (H) × 2176 (V) approx. 8.93M pixels (aspect ratio 17:9) / 3792 (H) × 2824 (V) approx. 10.71M pixels (aspect ratio 4:3)
Unit cell size		4.63 µm (H) × 4.63 µm (V)
Optical blacks	Horizontal	Front: 0 pixels, rear: 0 pixels
	Vertical	Front: 16 pixels, rear: 0 pixels
Input drive frequency		72 MHz (SLVS-EC) / 6 to 27 MHz (MIPI CSI-2)
Output Interface		SLVS-EC (2.304 Gbps / Lane) Max. 8lane / MIPI CSI-2 (1.728 Gbps / Lane) Max. 4lane
Package		248-pin LGA
Supply voltage V_{DD} (Typ.)		2.8 V / 1.8 V / 1.2 V

＜Table 2＞ Image Sensor Characteristics

Item		Value	Remarks
Sensitivity (F5.6)	Typ.	1900 mV	1/30s accumulation (HCG)
Saturation signal	Min.	970 mV	Tj = 60 ℃ (LCG)

＜Table 3＞ Basic Drive Mode

Drive mode	Recommended number of recording pixels	Frame rate [frame/s]	ADC [bit]
All-pixel scan (aspect ratio 4:3)	3704 (H) × 2778 (V)	24	14
All-pixel scan (aspect ratio 17:9)	4096 (H) × 2160 (V)	60 (SLVS-EC) / 30 (CSI-2)	12
All-pixel scan (aspect ratio 16:9)	3840 (H) × 2160 (V)	60 (CSI-2)	12
All-pixel scan (aspect ratio 4:3)	3704 (H) × 2778 (V)	60 (SLVS-EC) / 30 (CSI-2)	12
All-pixel scan (aspect ratio 17:9) Horizontal/vertical 2/2-line binning	2048 (H) × 1080 (V)	120 (SLVS-EC) / 60 (CSI-2)	12
All-pixel scan (aspect ratio 17:9)	4096 (H) × 2160 (V)	120 (SLVS-EC) / 60 (CSI-2)	10
HDR-1 (aspect ratio 17:9)	4096 (H) × 2160 (V)	60 (SLVS-EC) / 30 (CSI-2)	10
HDR-2 (aspect ratio 4:3)	3704 (H) × 2778 (V)	30 (SLVS-EC) / 15 (CSI-2)	10
HDR-3 (aspect ratio 17:9) Horizontal/vertical 2/2-line binning	2048 (H) × 1080 (V)	60	10

Image Sensors for Security Cameras:
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