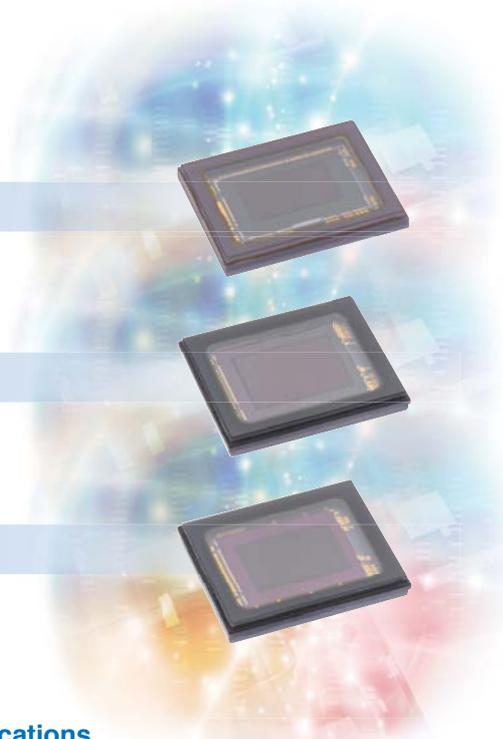# SONY

IMX290LLR

Diagonal 6.46 mm (Type 1/2.8) Approx. 2.13M-Effective Pixel Monochrome CMOS Image Sensor

IMX178LLJ

Diagonal 8.92 mm (Type 1/1.8) Approx. 6.44M-Effective Pixel Monochrome CMOS Image Sensor

IMX226CLJ

Diagonal 9.33 mm (Type 1/1.7) Approx. 12.40M-Effective Pixel Monochrome CMOS Image Sensor

2M, 6M, and 12M Monochrome CMOS Image Sensors for Industrial Applications

Sony Semiconductor Solutions Corporation has commercialized the "IMX290LLR", "IMX178LLJ", and "IMX226CLJ" monochrome back-illuminated CMOS image sensors for industrial camera applications. These image sensors use the STARVIS™ technology, which was originally developed for security cameras. 2M-, 6M-, and 12M-pixel image sensors can be selected according to the application. In addition to the basic angle of view, the drive mode can be changed to HD, 5M, and 4K according to the imaging subject. These products also support functions that enable imaging in accordance with the surrounding environment, such as the global reset function and multiple exposure function.

- ■ High sensitivity monochrome image sensors
- ■ 2M-, 6M-, and 12M-pixel lineup
- ■ Global reset function

Exmor R

*Exmor R is a trademark of Sony Corporation. 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 trademark of Sony Corporation. The STARVIS is back-illuminated pixel technology for CMOS image sensors for surveillance 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.

High sensitivity monochrome image sensors

Products that support monochrome imaging were prepared by making use of the low illumination characteristics of the IMX290LQR[1], IMX178LQJ[2], and IMX226CQJ[3] color image sensors, which are equipped with the STARVIS technology that is highly regarded by customers as image sensors for security cameras.

- Diagonal 6.46 mm (Type 1/2.8) Approx. 2.13M-Effectiv Pixel: IMX290LLR
- Diagonal 8.92 mm (Type 1/1.8) Approx. 6.44M-Effective Pixel: IMX178LLJ
- Diagonal 9.33 mm (Type 1/1.7) Approx. 12.40M-Effective Pixel: IMX226CLJ

The angle of view can be selected according to the application. (Photograph 1, Photograph 2, Photograph 3)

[1]: See the New Product Information released in February 2015.
[2]: See the New Product Information released in September 2013.
[3]: See the New Product Information released in February 2014.

Multiangle

Various angles of view are available for each sensor in addition to all-pixel output. The IMX290LLR can select all-pixel (Full HD) output or HD output. The IMX178LLJ can select all-pixel 6M output or 5M output with an aspect ratio of 4:3, 5:4, or 16:9 in accordance with the application. The IMX226CLJ can select all-pixel 12M output or 4K output, and is capable of imaging at 60 frame/s in ADC 10-bit mode when 4K output is selected. (Table 3-1, Table 3-2, Table 3-3)

Various functions

The IMX290LLR and IMX178LLJ support multiple exposure drive, and the exposure time can be changed for each frame. The IMX290LLR also supports the DOL (Digital Overlap)-type HDR (High Dynamic Range) function, and can realize multiple exposures with little exposure time difference. These products are also equipped with the global reset function required by cameras for industrial applications, and use together with a flash makes it possible to obtain images with low distortion.

The IMX178LLJ and IMX226CLJ use a low-voltage LVDS, and the number of channels used can be reduced according to the frame rate. The IMX290LLR can select from low-voltage LVDS, MIPI CSI-2, or CMOS parallel output interfaces in accordance with the interface to be connected.

<Photograph 1>

Condition: 2000 lx F5.6
(Exposure time 17.5 ms, Internal gain 0 dB)

<Photograph 2>

Condition: 2000 lx F5.6
(Exposure time 25 ms, Internal gain 0 dB)

<Photograph 3>

Condition: 2000 lx F5.6
(Exposure time 32 ms, Internal gain 0 dB)

IMX290LLR

IMX178LLJ

IMX226CLJ

<Table 1> Device Structure

Item		IMX290LLR	IMX178LLJ	IMX226CLJ
Output image size		Diagonal 6.46 mm (Type 1/2.8) Full HD Diagonal 4.31 mm (Type 1/4.2) HD	Diagonal 8.92 mm (Type 1/1.8) all-pixel Diagonal 7.83 mm (Type 1/2.0) 4:3 Diagonal 7.92 mm (Type 1/2.0) 5:4 Diagonal 8.51 mm (Type 1/1.9) 16:9	Diagonal 9.33 mm (Type 1/1.7) 12M Diagonal 8.61 mm (Type 1/1.9) 4K
Number of effective pixels		1945 (H) × 1097 (V) approx. 2.13M pixels	3096 (H) × 2080 (V) approx. 6.44M pixels	4072 (H) × 3046 (V) approx. 12.40M pixel 4152 (H) × 2174 (V) approx. 9.03M pixels
Unit cell size		2.9 µm (H) × 2.9 µm (V)	2.4 µm (H) × 2.4 µm (V)	1.85 µm (H) × 1.85 µm (V)
Optical blacks	Horizontal	Front: 0 pixels, rear: 0 pixels	Front: 0 pixels, rear: 0 pixels	Front: 96 pixels, rear: 0 pixels
	Vertical	Front: 10 pixels, rear: 0 pixels	Front: 14 pixels, rear: 0 pixels	Front: 16 pixels, rear: 0 pixels
Input drive frequency		37.125 MHz / 74.25 MHz	37.125 MHz / 54.0 MHz / 74.25 MHz	72.0 MHz
Output Interface		Low Voltage LVDS 8 ch MIPI (CSI-2) 4lane CMOS parallel	Low Voltage LVDS 10 ch	Low Voltage LVDS 10 ch
Package		110-pin LGA	128-pin LGA	128-pin LGA
Supply voltage V$_{DD}$ (Typ.)		2.9 V / 1.8 V / 1.2 V	2.9 V / 1.8 V / 1.2 V	2.9 V / 1.8 V / 1.2 V

<Table 2> Image Sensor Characteristics

Item		IMX290LLR	IMX178LLJ	IMX226CLJ	Remarks
Sensitivity (monochrome)	Typ. [F8]	1200 mV	380 mV	250 mV (TBD)	3200 K, 706 cd/m² 1/30s accumulation
Saturation signal	Min.	914 mV	945 mV	810 mV	Tj = 60 °C

<Table 3-1> Basic Drive Mode (IMX290LLR)

Drive mode	Recommended number of recording pixels	Frame rate (Max.) [frame/s]	ADC [bit]
Full HD (1080p)	1920 (H) × 1080 (V) approx. 2.07M pixels	60	12 (Low Voltage LVDS/CSI-2)
		120	10 (Low Voltage LVDS/CSI-2)
		30	12/10 (CMOS)
HD (720p)	1280 (H) × 720 (V) approx. 0.92M pixels	60	12 (Low Voltage LVDS/CSI-2)
		120	10 (Low Voltage LVDS/CSI-2)
		60	12/10 (CMOS)

<Table 3-2> Basic Drive Mode (IMX178LLJ)

Drive mode	Recommended number of recording pixels	Frame rate (Max.) [frame/s]	ADC [bit]
all-pixel	3072 (H) × 2048 (V) approx. 6.29M pixels	29.97	14
		29.97	12
5M (4:3)	2592 (H) × 1944 (V) approx. 5.04M pixels	29.94	14
		59.97	12
5M (5:4)	2560 (H) × 2048 (V) approx. 5.24M pixels	29.94	14
		59.97	12
5M (16:9)	3072 (H) × 1728 (V) approx. 5.31M pixels	30	14
		60	12

<Table 3-3> Basic Drive Mode (IMX226CLJ)

Drive mode	Recommended number of recording pixels	Frame rate (Max.) [frame/s]	ADC [bit]
12M (4:3)	4000 (H) × 3000 (V) approx. 12.00M pixels	35	12
		40	10
4K (17:9)	4096 (H) × 2160 (V) approx. 8.85M pixels	30	12
		60	10

*Sony reserves the right to change products and specifications without prior notice.

SONY

IMX178LQJ

Diagonal 8.92 mm (Type 1/1.8) 6.44M-Effective Pixel
Color CMOS Image Sensor

Back-illuminated Structure CMOS Image Sensor for Security Cameras and Industrial Applications Achieves High Sensitivity and High Dynamic Range

Sony developed back-illuminated structure CMOS image sensor, "IMX178LQJ", supporting three formats of 4:3, 5:4, and 16:9 ratio with type 1/2 in 5M-Effective pixel. Adopting back-illuminated structure with 2.4 µm unit pixel and 14 bit ADC, it provides all three advantages of high resolution, high sensitivity, and high dynamic range, which are necessary for security cameras.

- Back-illuminated structure 2.4 μm unit pixel
- 10 bit/12 bit/14 bit A/D converters
- Supporting type 1/2 5M effective pixels in 3 formats
- HLP (High Light Performance) mode
- LLP (Low Light Performance) mode
- Pin compatible with the existing product "IMX185LQJ"*1

*1: For details on the IMX185LQJ, see the New Products section of this volume.

Exmor R

* Exmor R is a trademark of Sony Corporation. 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 ExmorTM pixel adopted column parallel A/D converter to back-illuminated type.

STARVIS

*STARVIS is a trademark of Sony Corporation. The STARVIS is back-illuminated pixel technology used in CMOS image sensors for surveillance 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.

High Sensitivity

To achieve high sensitivity, which is one of the most important characteristics for security cameras, this time Sony developed back-illuminated structure 2.4 µm unit pixel and accomplished the equivalent sensitivity as the existing back-illuminated structure 2.8 µm unit pixel, "IMX136LQJ"*2. Also near infrared sensitivity was improved from the IMX136LQJ, which is equivalent to the IMX236LQJ*3, and it is suitable for Day/Night cameras and near infrared light LED used as auxiliary light.

*2: See the New Products section in CX-NEWS, Volume 68.
*3: For details on the IMX236LQJ, see the New Products section of this volume.

High Dynamic Range

Dynamic range is determined by the ratio of saturation signal and dark random noise. The IMX178LQJ featuring 14 bit ADC reduced quantization noise and also suppressed dark random noise. At the result, high dynamic range was achieved, which is equivalent to the existing 3.75 µm unit pixel, the IMX104LQJ*4. It enables clear image quality in light and dark areas even for the objects with high contrast.

*4: See the New Products section in CX-NEWS, Volume 68.

Image Format

The format for image size of security camera is typically 4:3, 5:4 for fisheye lens, or 16:9 for full HD. The IMX178LQJ supports all these three formats in 5M pixels high resolution. Also it secures high resolution as well as high sensitivity and high dynamic range at the same time, therefore the specification works best for high performance security cameras with type 1/2 lenses.

Compatibility with Existing Sony Products

The IMX178LQJ is pin compatible with the 3.75 µm unit pixel full HD image sensor, the ICX185LQJ, supporting type 1/2 lenses. If you are using the IMX185LQJ, please do not miss the chance to try the performance of the IMX178LQJ.

＜Photograph 1＞ All-pixel Scan, and 5M Pixels in Three Formats: 4:3, 5:4, and 16:9

Number of recommended recording pixels: All-pixel scan approx. 6.29M pixels (3:2), approx.
5.04M pixels (4:3), approx. 5.24M pixels (5:4), and approx. 5.31M pixels (16:9).

All-pixel scan
recommended recording
3072H × 2048V

5M 4:3
recommended recording
2592H × 1944V

5M 5:4
recommended recording
2560H × 2048V

5M 16:9
recommended recording
3072H × 1728V

＜Photograph 2＞ Sample Images

(recommended recording approx.
5.04M pixels, 4:3, ADC 12 bit mode,
59.94 frame/s)

1000 lx HLP mode internal gain 12 dB, F5.6

1 lx LLP mode internal gain 51 dB, F1.4

＜Photograph 3＞ High Dynamic Range Imaging

(recommended recording approx.
5.04M pixels, 4:3, 29.97 frame/s HLP
mode, internal gain 0 dB, F5.6)

A/D conversion 12 bit mode

A/D conversion 14 bit mode

＜Table 1＞ Device Structure

Item	IMX178LQJ
image size	Diagonal 8.92 mm (Type 1/1.8) Approx. 6.38M pixels all-pixel scan Diagonal 7.83 mm (Type 1/2.0) Approx. 5.11M pixels 4:3 Diagonal 7.92 mm (Type 1/2.0) Approx. 5.32M pixels 5:4 Diagonal 8.51 mm (Type 1/1.9) Approx. 5.39M pixels 16:9
Transfer method	All-pixel scan
Number of effective pixels	3096 (H) × 2080 (V) Approx. 6.44M pixels
Unit cell size	2.4 μm (H) × 2.4 μm (V)
Optical blacks — Horizontal	Front:0 pixels, rear: 0 pixels
Optical blacks — Vertical	Front:14 pixels, rear: 0 pixels
Input drive frequency	54 MHz/27 MHz/74.25 MHz/37.125 MHz
Package	128-pin LGA
Supply voltage VDD (Typ.)	2.9 V/1.8 V/1.2 V

＜Table 2＞ Image Sensor Characteristics

Item		IMX178LQJ	Remarks
sensitivity (F5.6)	Typ.	425 mV	1/30s accumulation
Saturation signal	Min.	945 mV	Tj = 60 °C

＜Table 3＞ Basic Drive Mode

Drive mode	Number of recommended recording pixels	ADC	
All-pixel scan	3072 (H) × 2048 (V) approx. 6.29M pixels	12 bit	29.97 frame/s
		14 bit	29.97 frame/s
5M 4:3	2592 (H) × 1944 (V) approx. 5.04M pixels	12 bit	59.94 frame/s
		14 bit	29.97 frame/s
5M 5:4	2560 (H) × 2048 (V) approx. 5.24M pixels	12 bit	59.94 frame/s
		14 bit	29.97 frame/s
5M 16:9	3072 (H) ×1728 (V) approx. 5.31M pixels	12 bit	60 frame/s
		14 bit	30 frame/s