

IMX290LLR

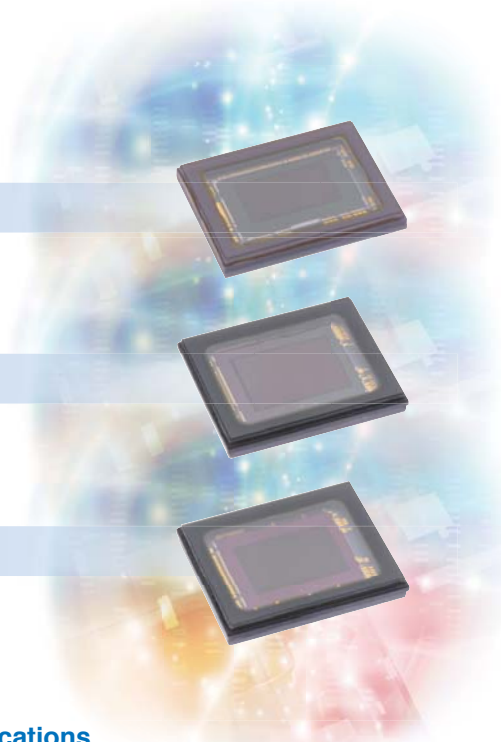
Diagonal 6.46 mm (Type 1/2.8) Approx. 2.13M-Effective Pixel
Monochrome CMOS Image Sensor

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 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 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-Effective 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.

Multiangl

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)

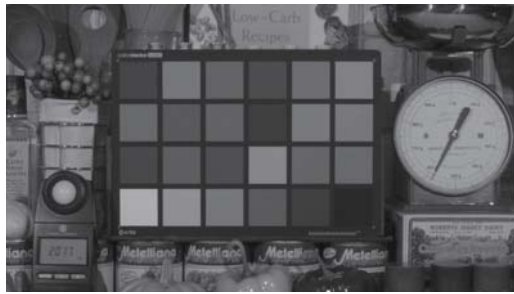
Various functions

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)



IMX290LLR

< Photograph 2 >

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



IMX178LLJ

< Photograph 3 >

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



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: 96 pixels, rear: 0 pixels
	Vertical	Front: 10 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/m ² 1/30s accumulation
Saturation signal	Min.	914 mV	945 mV	810 mV	T _j = 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)

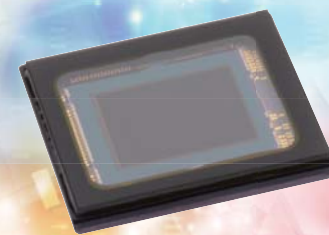
Drive mode	Recommended number of recording pixels	Frame rate (Max.) [frame/s]	ADC [bit]
all-pixel	3072 (H) × 2048 (V) approx. 6.29M pixels	29.97	14
		29.97	12
5M (4:3)	2592 (H) × 1944 (V) approx. 5.04M pixels	29.94	14
		59.97	12
5M (5:4)	2560 (H) × 2048 (V) approx. 5.24M pixels	29.94	14
		59.97	12
5M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

IMX226CQJ

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



Back-illuminated CMOS Image Sensor for Security Cameras and Industrial Applications Supports 4K High Resolution and High Sensitivity

Sony developed approximately 12.40M pixels back-illuminated CMOS image sensor, "IMX226CQJ", supporting Type 1/2 and 4K (approximately 17:9 ratio).

This image sensor has advantages in both high resolution and high sensitivity with back-illuminated structure 1.85 μm unit pixel, and suits for next generation of 4K security camera.

- Back-illuminated structure 1.85 μm unit pixel
- Higher resolution 4K video imaging mode (4096 H \times 2160 V, 60 frame/s)
- Higher sensitivity and lower noise
- Favorable incident light angle characteristics and F-number dependency

Exmor R

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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 μm^2 (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.

Higher Resolution

The IMX226CQJ employs approximately 12.40M effective pixels and supports 12M (4:3 ratio) and 4K (approximately 17:9 ratio). High quality picture and fast video imaging is possible at 4K 60 frame/s with Type 1/1.9 approximately 9.03M pixels (approximately 17:9 ratio), and the specifications serve best for next generation of 4K high resolution security camera.

This image sensor provides higher quality picture and clearer imaging than full HD output image of the existing front-illuminated structure 3.75 μm unit pixel, the IMX185LQJ*¹. (See photograph 1 and photograph 2.)

*¹: See the New Products section released in 2013 August.

Higher Sensitivity and Lower Noise

For the image sensor with higher pixel counts supporting 4K video or other formats, the reduced pixel size might cause sensitivity deterioration, which is crucial for security camera purpose.

The IMX226CQJ has back-illuminated structure 1.85 μm unit

pixel and achieves a big difference in its high sensitivity and low noise compared with the existing front-illuminated CMOS image sensor while it keeps 4K and the image size of Type 1/2.

Favorable Incident Light Angle Characteristics and F-number Dependency

The light collecting characteristics were optimized to maximize the light collecting efficiency of the back-illuminated structure. As a result, it obtained better conditions in incident light angle characteristics (See figure 1.) and F-number dependency (See figure 2.) than the existing IMX136LQJ*² with front-illuminated structure 2.8 μm unit pixel.

These characteristics are extremely important for security

camera which often opens lens diaphragm during night-time shooting. And at the lower F-number better low light performance is possible than front-illuminated structure 2.8 μm unit pixel, the IMX136LQJ. (See photograph 3.)

Also, optical characteristics of this magnitude mean that the sensor can handle high power zoom lenses.

*² See the New Products section in CX-NEWS, Volume 68

< Photograph 1 > Resolution Comparison (2000 lx, 0 dB)



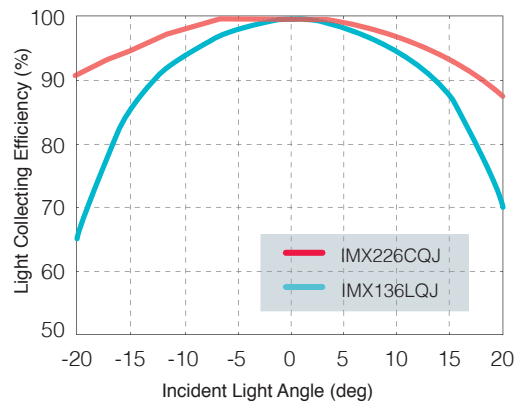
< Photograph 2 > Resolution Comparison (F11, 0 dB)



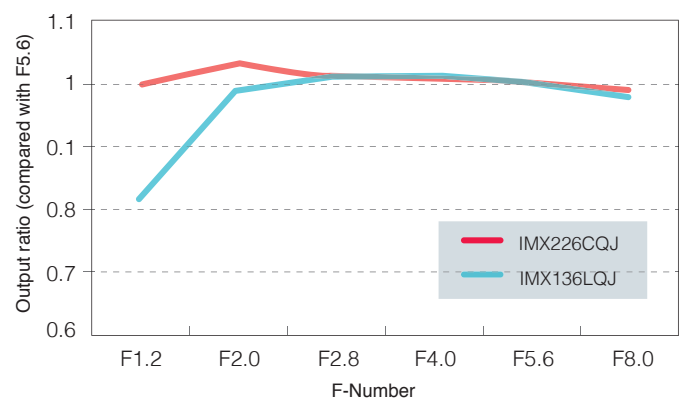
< Photograph 3 > Low Light Sensitivity Comparison (0.68 lx, F0.95, 12 bit, 60 fps, 45 dB)



< Figure 1 > Incident Light Angle Characteristics



< Figure 2 > F-number Dependency



< Table 1 > Device Structure

Item	IMX226CQJ
Output image size	Diagonal 9.33 mm (Type 1/1.7) 12M 4:3 ratio Diagonal 8.61 mm (Type 1/1.9) 4K Approx. 17:9 ratio
Number of effective pixels	4072 (H) × 3046 (V) Approx. 12.40M pixels 4152 (H) × 2174 (V) Approx. 9.03M pixels
Unit cell size	1.85 μm (H) × 1.85 μm (V)
Optical blacks	Horizontal Front: 96 pixels, rear: 0 pixels
	Vertical Front: 16 pixels, rear: 0 pixels
Input drive frequency	72 MHz
Package	128-pin LGA
Supply voltage V _{DD} (Typ.)	2.9 V / 1.8 V / 1.2 V

< Table 2 > Image Sensor Characteristics

Item	Value	Remarks
sensitivity (F5.6)	Typ. 280 mV	1/30s accumulation
Saturation signal	Min. 810 mV	T _j = 60 °C

< Table 3 > Basic Drive Mode

Drive mode	Number of recommended recording pixels	ADC	Frame rate
12M 4:3 ratio	4000 (H) × 3000 (V) 12.00M pixels	10 bit	40 frame/s
		12 bit	35 frame/s
4K Approx. 17:9 ratio	4096 (H) × 2160 (V) Approx. 8.85M pixels	10 bit	60 frame/s
		12 bit	30 frame/s
Full HD	2048 (H) × 1080 (V) Approx. 2.21M pixels	10 bit	60 frame/s