

IMX290LLR

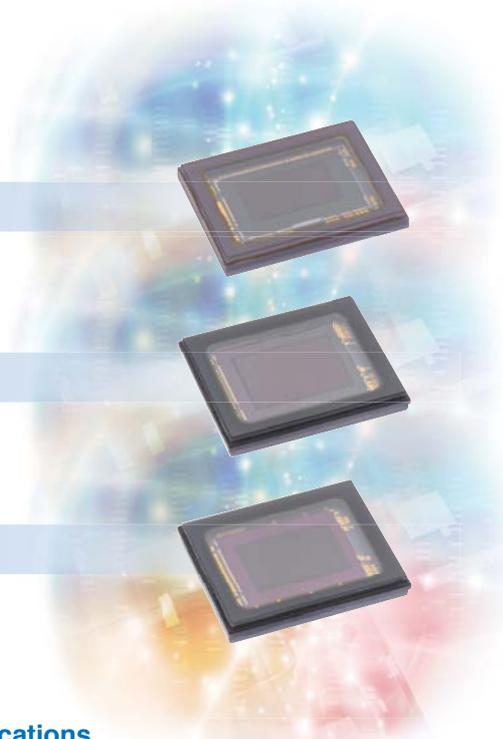
Diagonal 6.46 mm (Type 1/2.8) Approx. 2.13M-Effective Pixel
Monochrome CMOS Image Sensor

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-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)

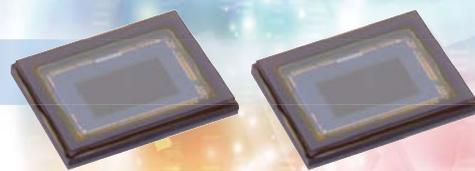
Drive mode	Recommended number of recording pixels	Frame rate (Max.) [frame/s]	ADC [bit]
all-pixel	3072 (H) × 2048 (V) approx. 6.29M pixels	29.97	14
		29.97	12
5M (4:3)	2592 (H) × 1944 (V) approx. 5.04M pixels	29.94	14
		59.97	12
5M (5:4)	2560 (H) × 2048 (V) approx. 5.24M pixels	29.94	14
		59.97	12
5M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

IMX290LQR, IMX291LQR

Diagonal 6.46 mm (Type 1/2.8) Square Pixel Array
Color CMOS Image Sensor



Back-Illuminated CMOS image Sensors with Improved Visible Light and Near Infrared Sensitivity that Support 1080p

Sony has developed the approx. 2.13M effective pixel back-illuminated CMOS image sensors IMX290LQR and IMX291LQR with improved sensitivity in the visible-light and near infrared light regions for industrial applications.

A new 2.9 μm -square unit pixel has been developed that combines a back-illuminated structure with technology for improving near infrared sensitivity to further enhance picture quality at low illumination while at the same time realizing Full HD cameras for industrial applications. This realizes two or

more times the sensitivity in the visible-light region and three or more times the sensitivity in the near infrared light region than that of the existing Sony product (IMX236LQJ)*¹. In addition, two types of WDR (Wide Dynamic Range) technology are also provided to further improve imaging performance.

The new lineup includes the two types of the IMX290LQR, which has the DOL (Digital Overlap) -WDR function and the IMX291LQR, which does not have the DOL-WDR function.

*¹ See the New Product Information released in September 2013.

- Back-illuminated structure with 2.9 μm -square unit pixel
- High sensitivity characteristics (two or more times that of the existing product)
- Improved sensitivity in the near infrared light region (three or more times that of the existing product)
- Supports WDR (multiple exposure WDR, DOL-WDR)
- Versatile interface (CMOS parallel, low-voltage LVDS serial, MIPI CSI-2)

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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.

Back-Illuminated Structure + Improved Sensitivity in the Near Infrared Light Region

Good sensitivity characteristics at low illumination and in the near infrared light region are a required performance of cameras for industrial applications. These new image sensors use a back-illuminated structure and also have an expanded photodiode area, which simultaneously improve sensitivity in both light regions compared to the existing front-illuminated structure.

In addition, the new image sensors realize improved sensitivity characteristics two or more times in the visible-light region and three or more times in the near infrared light region (850 nm) compared to the existing Sony product (IMX236LQJ) with the same pixel size and increased sensitivity in the near infrared light region (Photograph 2).

WDR Function

The IMX290LQR supports both multiple exposure and DOL-type WDR functions. (The IMX291LQR supports only the multiple exposure-type WDR function.)

The multiple exposure-type WDR function outputs one set of two or four frames with different exposure times. In this case, the gain can also be set separately for each frame in addition to the exposure time.

The DOL-type WDR function outputs the data for up to three frames with different storage times line by line. By performing special signal processing with an ISP (Image Signal Processor) or other device at the image sensor rear-end, this enables improvement of picture quality under low illumination compared to the multiple exposure-type WDR function.

Versatile interface

The IMX290LQR and IMX291LQR are equipped with three different types of output interface (low-voltage LVDS serial, MIPI CSI-2, CMOS parallel) to meet diverse needs. The low-voltage LVDS serial interface has a maximum output data rate of 445.5 Mbps/ch and the number of output channels

can be selected from 2ch, 4ch or 8ch. The MIPI CSI-2 interface has a maximum output data rate of 891 Mbps/lane and the number of output channels can be selected from 2 lanes or 4 lanes. The CMOS parallel interface has a maximum output data rate of 74.25 Mpixels/s.

< Photograph 1 > IMX290LQR Sample Image

Condition: 400 lx F1.4 (Full HD image, 60 frames/s)



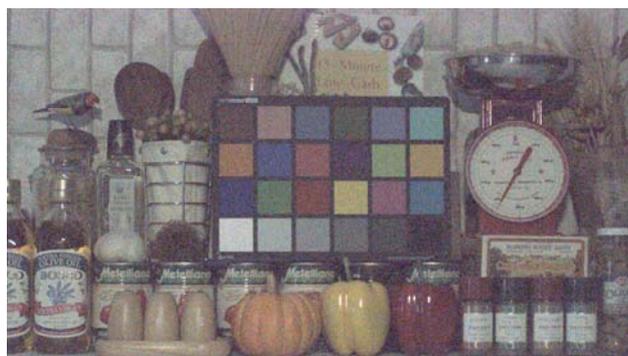
IMX290LQR (Internal gain 0 dB)

< Photograph 2 > Comparisons with the Existing Sony Product

Condition1: 0.08 lx F1.4 (Full HD image, 30 frames/s)



Existing IMX236LQJ
Internal gain 48 dB



IMX290LQR
Internal gain 63 dB

Condition 2: 0 lx (850 nm IR) F1.4 (Full HD image, 30 frames/s)



Existing IMX236LQJ
Internal gain 0 dB



IMX290LQR
Internal gain 0 dB

< Table 1 > Device Structure

Item	IMX290LQR / IMX291LQR	
Output Image size	Diagonal 6.46 mm (Type 1 / 2.8) (Full HD mode) Diagonal 4.31 mm (Type 1 / 4.2) (HD720p mode)	
Number of effective pixels	1945 (H) × 1097 (V) approx. 2.13M pixels 1305 (H) × 729 (V) approx. 0.95M pixels	
Unit cell size	2.9 μm (H) × 2.9 μm (V)	
Optical blacks	Horizontal	Front: 0 pixels, rear: 0 pixels
	Vertical	Front: 10 pixels, rear: 0 pixels
Input drive frequency	74.25 MHz / 37.125 MHz	
Package	110-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.	1300 mV 1/30s accumulation
Saturation signal	Min.	914 mV T _j = 60 °C

< Table 3 > Basic Drive Mode

Drive mode	Interface	ADC	Frame rate (Max.)	Bit rate (Max.)
Full HD 1080p	Low voltage LVDS serial 8 ch	10 bit	120 frame/s	445.5 Mbps/ch
	Low voltage LVDS serial 8 ch	12 bit	60 frame/s	222.75 Mbps/ch
	CSI-2 4 lane	10 bit	120 frame/s	891 Mbps/lane
	CSI-2 4 lane	12 bit	60 frame/s	445.5 Mbps/lane
HD720p	CMOS parallel	10 bits / 12 bits	30 frame/s	74.25 Mpixel/s
	Low voltage LVDS serial 4 ch	10 bit	120 frame/s	594 Mbps/ch
	Low voltage LVDS serial 4 ch	12 bit	60 frame/s	297 Mbps/ch
	CSI-2 4 lane	10 bit	120 frame/s	594 Mbps/lane
	CSI-2 4 lane	12 bit	60 frame/s	297 Mbps/lane
	CMOS parallel	10 bits / 12 bits	60 frame/s	74.25 Mpixel/s

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