RESTAR FRAMOS
T E C H N O L O G I E S

SONY LOW LIGHT IMAGERS
High Sensitivity for Surveillance Applications Even Under Moonlight

It features unprecedented sensitivity in a compact format and high resolution. These characteristics were created based on a new pixel architecture. **Even under moonlight, image sensors using STARVIS provide images with low noise.**

With its broadcast quality images, control room staff and their software can easily analyze the video stream accurately.

BACKSIDE-ILLUMINATED PIXEL DESIGN BY Sony

Traditional CMOS pixel architectures comprise a photon-sensitive silicon layer (photodiode) with a significant amount of circuits and wiring for readout electronics on top of it. These electronics, however, absorb incoming photons which reduces the quantum efficiency of each pixel. Especially under low light levels, this decrease in the signal level harms the overall sensitivity of the sensor.

A backside-illuminated pixel design flips the traditional architecture upside down. Now, the readout electronics are located under the photodiode which maximizes the number of photons reaching the sensitive silicon layer. It may sound simple, but it is a major challenge of semiconductor engineering and manufacturing. Yet, Sony's renowned image process experts came together to create a masterpiece of image sensing with STARVIS.

ALL-IN-ONE: SENSITIVITY, COMPACTNESS, RESOLUTION, SPEED

Backside-illuminated sensors with rolling shutters using STARVIS technology reach a **SNR of 1 at 0.13 lx** under SNR1s conditions, Sony's proprietary sensitivity index. For reference, a full moon on a clear night creates a luminance on surfaces of 0.05 to 0.3 lx. This means that the sensor is able to see under moonlight. Nearinfrared enhanced models are also available.

NIR light (850nmLED)

HD1080p 30fps 24dB   HD1080p 30fps 24dB

Source: Sony https://www.Sony-semicon.co.jp/e/products/IS/security/technology.html
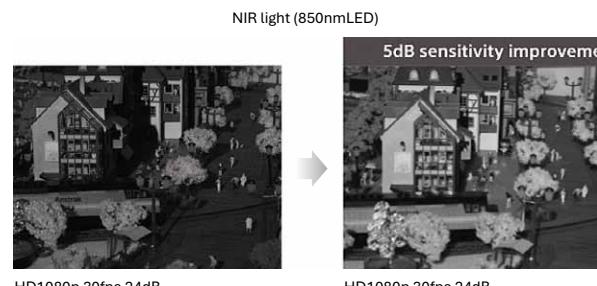
Image sensors with STARVIS provide resolutions from 2 MP up to 61 MP. With pixel pitches starting from just 1.45 µm, a 4K resolution sensor gets as compact as 1/2.8 in optical format. Frame rates of up to 120 fps also ensure a high resolution in the time domain for smooth display or detailed analysis. Sensor interfaces like MIPI CSI-2, sub LVDS, and SLVS-EC facilitate camera integration.

With the given combination of sensitivity, compactness, resolution, and speed, image sensors using STARVIS technology are **the first choice for low light surveillance.**

PIXEL ARCHITECTURES

Front Side Illuminated (FSI) Sensors

In FSI CMOS sensors, there is a wiring layer on the silicon substrate that forms the photodiode. The benefit of this structure facilitates the formation of a light shield for protecting the signal charge temporarily stored in the memory area from leaked light. For this reason, conventional CMOS image sensors with global shutter function have adopted an FSI pixel structure. However, the wiring on top of the photodiode hinders the incident light, which creates an issue when attempting to miniaturize the pixels.

Back Side Illuminated (BSI) Sensors

Conventional CMOS image sensors mount the pixel section and analog logic circuit on top of the same chip, which require numerous constraints when mounting these large-scale circuits. These constraints include measures to counter the circuit scale and chip size; suppression of the noise caused by the layout of the pixel and circuit sections; and, optimizing the characteristics of pixels and circuit transistors.

*Source: Sony Semiconductor Solutions*
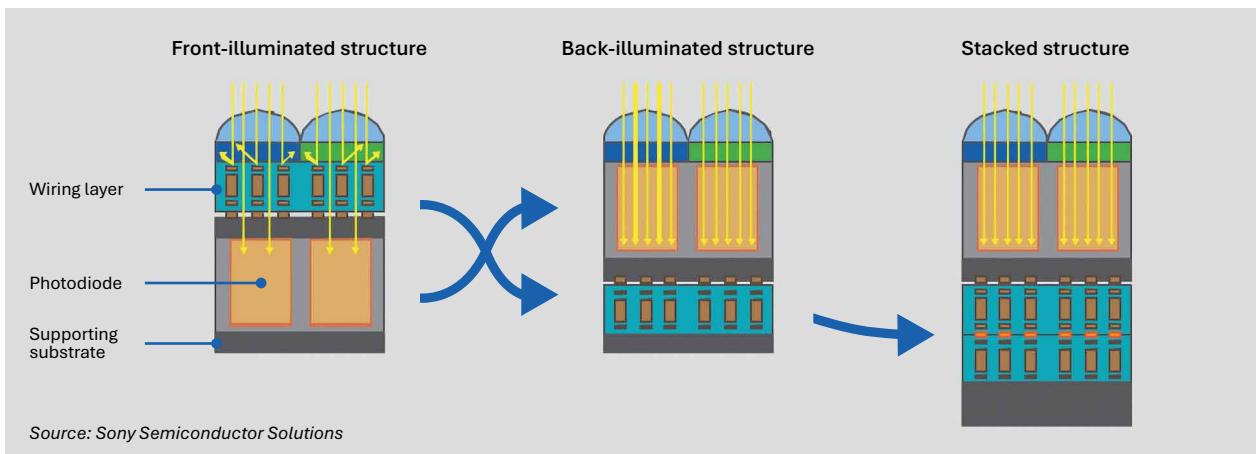
Image sensor designers have created the BSI sensor architecture to help overcome these drawbacks. In this configuration, the pixel's circuit section is moved below the photosensitive area (pixel section), to allow more incoming light. This arrangement also benefits in the creation of smaller pixel configurations. Consequently, this feature leads to smaller, more compact sensors which enable both smaller sensors and larger resolutions to work with smaller optical formats.

Other benefits of this structure are less cross talk between pixels, with better response times and more accurate color. Photons that enter the sensor quickly hit the pixel section to ensure that they are captured and correctly detected. This structural scenario improves the sensor's quantum efficiency. Additionally, the pixel's fill factor and the ratio of the photosensitive area to the total pixel area is much larger. These features reduce the requirements of the pixel's micro-lens design (i.e., no increased refraction of the light to send it to the pixel); improves its CRA (Chief Ray Angle), while bringing the Bayer filter mask closer to the pixel. All these factors further improve the sensor's image performance.

STARVIS 2

STARVIS 2 uses a 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). It also has a wide dynamic range (AD12bit) of **more than 8dB compared to STARVIS** for the same pixel size in a single exposure, and achieves high picture quality in the visible-light and near infrared light regions.

More information: Sony to Release 1/1.2-type 4K-Resolution CMOS Image Sensor for Security Cameras with Approximately 8 times the Dynamic Range of Conventional Model in a Single Exposure suppression of the noise caused by the layout of the pixel and circuit sections; and, optimizing the characteristics of pixels and circuit transistors.

STARVIS

STARVIS™ based sensors use a 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.

PRODUCT LINE UP WITH STARVIS TECHNOLOGY

Sensor	Resolution (Megapixels)	Image Size (Type)	Pixel Size V=H (µm)	Max. Frame Rate (frame/s)	Chroma	Output Interface	Application
IMX455AQK-K/ALK-K	61.2M [3:2]	2.7	3.76	21	RGB / Monochrome	SLVS-EC	Security
IMX571BQR-J/BLR-C	26.1M [3:2]	1.8	3.76	48	RGB / Monochrome	SLVS-EC	Security
IMX226CQJ/CLJ	12.4M [4:3]	1/1.7	1.85	40	RGB / Monochrome	sub LVDS Serial	Security
IMX412AACK	12.3M [4:3]	1/2.3	1.55	60	RGB	MIPI CSI-2	Security
IMX294CJK	10.2M [4:3]	4/3	4.63	60	RGB	SLVS-EC; MIPI CSI-2	Security
IMX533CQK-D/CLK-D	9.0M [1:1]	1	3.76	64	RGB / Monochrome	SLVS-EC	Security
IMX779-AQR	8.2M [16:9]	1/2.8	1.45	90	RGB	MIPI CSI-2	Security
IMX779-AQN**	8.2M [16:9]	1/2.8	1.45	90	RGB	MIPI CSI-2	Security
IMX778-AQR1*	8.2M [16:9]	1/2.8	1.45	90	RGB	MIPI CSI-2	Security
IMX415AAQR/AAMR	8.2M [16:9]	1/2.8	1.45	90	RGB / Monochrome	MIPI CSI-2	Security
IMX485LQJ/LQJ1	8.2M [16:9]	1/1.2	2.9	90	RGB	MIPI CSI-2	Security
IMX515AAQN	8.2M [16:9]	1/2.8	1.45	61	RGB	MIPI CSI-2	Security
IMX715AAQR1	8.2M [16:9]	1/2.8	1.45	90	RGB	MIPI CSI-2	Security
IMX178LQJ/LLJ	6.2M [3:2]	1/1.8	2.4	60	RGB / Monochrome	sub LVDS Serial	Security; Industry
IMX335LQN/LLN	5.0M [4:3]	1/2.8	2.0	60	RGB / Monochrome	MIPI CSI-2	Security
IMX347LQR	4.1M [16:9]	1/1.8	2.9	90	RGB	MIPI CSI-2	Security
IMX464LQR/LQR1	4.1M [16:9]	1/1.8	2.9	90	RGB	MIPI CSI-2	Security
IMX307LQD/LQR	2M; 1080p-HD, [16:9]	1/2.8	2.9	60	RGB	sub LVDS Serial, MIPI CSI-2	Security
IMX327LQR/LQR1	2M; 1080p-HD, [16:9]	1/2.8	2.9	60	RGB	sub LVDS Serial, MIPI CSI-2	Security
IMX462LQR/LQR1	2M; 1080p-HD, [16:9]	1/2.8	2.9	120	RGB	CMOS Parallel, sub LVDS Serial, MIPI CSI-2	Security
IMX482LQJ/LQJ1	2M; 1080p-HD, [16:9]	1/1.2	5.8	90	RGB	MIPI CSI-2	Security

*AR coating
**BGA, CSP package
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PRODUCT LINE UP WITH STARVIS 2 TECHNOLOGY

Sensor	Resolution (Megapixels)	Image Size (Type)	Pixel Size V=H (µm)	Max. Frame Rate (frame/s)	Chroma	Output Interface	Application
IMX676-AACR1/AAMR1*	12M	1/1.6	2.0	60	RGB / Monochrome	MIPI CSI-2	Security
IMX835-AQJ1* (New)	8.2M [16:9]	1/1.2	2.9	90	RGB	MIPI CSI-2	Security
IMX838-AQR1* (New)	8.2M [16:9]	1/1.8	2.0	72	RGB	MIPI CSI-2	Security
IMX585-AAQJ1/AAMJ1*	8.2M [16:9]	1/1.2	2.9	90	RGB / Monochrome	MIPI CSI-2	Security
IMX678-AAQR1/AAMR1-C*	8.2M [16:9]	1/1.8	2.0	72	RGB / Monochrome	MIPI CSI-2	Security
IMX678-AAMR1*	8.2M [16:9]	1/1.8	2.0	72	Monochrome	MIPI CSI-2	Security
IMX785 (New)	6M	1/1.7	2.9	90	RGB / Monochrome	MIPI CSI-2	Security
IMX675-AAQR/AAMR	5M	1/2.8	2.0	80	RGB / Monochrome	MIPI CSI-2	Security
IMX675-AAQR1*	5M	1/2.8	2.0	80	RGB	MIPI CSI-2	Security
IMX675-AATN**	5M	1/2.8	2.0	80	RGB	MIPI CSI-2	Security
IMX664-AAQR1/AAMR1*	4M	1/1.8	2.9	120	RGB / Monochrome	MIPI CSI-2	Security
IMX832-AQR1* (New)	2M	1/2.8	2.9	90	RGB	MIPI CSI-2	Security
IMX832-AQR (New)	2M	1/2.8	2.9	90	RGB	MIPI CSI-2	Security
IMX662-AAQR / AAMR	2M	1/2.8	2.9	90	RGB / Monochrome	MIPI CSI-2	Security
IMX662-AAQR1*	2M	1/2.8	2.9	90	RGB	MIPI CSI-2	Security

*AR coating
**BGA package
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PRODUCT LINE UP OF HIGH RESOLUTION INDUSTRIAL CMOS IMAGE SENSORS

Sensor	Resolution (Megapixels)	Image Size (Type)	Pixel Size V=H (µm)	Max. Frame Rate (frame/s)	Chroma	Output Interface
IMX811-AAQR/AAMR	247M	4.1	2.81	12	RGB / Monochrome	SLVS-EC
IMX411AQR/ALR	151M	4.2	3.76	6	RGB / Monochrome	SLVS-EC
IMX461AQR/ALR	102M	3.4	3.76	8	RGB / Monochrome	SLVS-EC
IMX06A-AMR/AJ1R (New)	50M	1/0.98	1.6	30	RGB / Monochrome	MIPI CSI-2
IMX492LQJ/LLJ	47M	1.4	2,315	24	RGB / Monochrome	SLVS-EC, MIPI CSI-2
IMX183CQJ/CLK	20M	1	2.4	24	RGB / Monochrome	sub LVDS Serial

PRODUCT LINE UP OF CMOS IMAGE SENSORS FOR CONSUMER CAMERA

Sensor	Resolution (Megapixels)	Image Size (Type)	Pixel Size V=H (µm)	Max. Frame Rate (frame/s)	Chroma	Output Interface	Technology
IMX461	100M	3.4	3.76	6	RGB / Monochrome	SLVS-EC 8Lane	BI
IMX455	61M	35mm	3.76	9	RGB / Monochrome	SLVS-EC 8Lane	BI
IMX366 (New)	44M	35mm	4.4	26	RGB	SLVS-EC 16Lane	BI
IMX677L (New)	27M	1/1.9	1.12	60	RGB	SLVS-EC 4, 8Lane	Stacked BI
IMX571	26M	APS	3.76	16	RGB / Monochrome	SLVS-EC 8Lane	BI
IMX410	24M	35mm	5.94	19	RGB	SLVS-EC 8Lane	BI
IMX677	23M	1/2.3	1.12	60	RGB	SLVS-EC 4, 8Lane	Stacked BI
IMX472	20M	4/3rds	3.3	120	RGB	SLVS-EC 14Lane	Stacked BI
IMX272	20M	4/3rds	3.3	60	RGB	SLVS-EC 12Lane	FI
IMX383	20M	1	2.4	50	RGB	SLVS-EC 8Lane	Stacked BI
IMX283	20M	1	2.4	22	RGB	MIPI 4Lane	BI
IMX577	12M	1/2.3	1.55	40	RGB	MIPI 4Lane	Stacked BI
IMX477	12M	1/2.3	1.55	40	RGB	MIPI 4Lane	Stacked BI
IMX277	12M	1/2.3	1.55	44	RGB	SLVS-EC 8Lane	BI
IMX299	11M	4/3rds	4.63	60	RGB	MIPI 4Lane; SLVS-EC 8Lane	BI

Stacked: Stacked CMOS Image Sensor
BI: Back-illuminated CMOS Image Sensor
FI: Front-illuminated CMOS Image Sensor