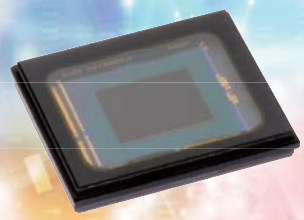
SONY

IMX123LQT



Diagonal 6.46 mm (Type 1/2.8) Approx. 3.21M-Effective Pixel Color CMOS Image Sensor

Back-Illuminated CMOS Image Sensor with Improved Near Infrared Sensitivity for Industrial Applications

Sony has developed the approx. 3.21M-pixel back-illuminated CMOS image sensor IMX123LQT with improved sensitivity in the near infrared range for industrial applications.
Sensitivity in the near infrared range has been increased to 1.5 or more times that of existing models by applying technical know-how for improving sensitivity in the near infrared range developed for front-illuminated structures to the pixels of an industry-leading*1 back-illuminated structure. In addition, this new image sensor is equipped with a variety of functions enabling selection of WDR (wide dynamic range), gain settings and interface according to the application.

※1: As of April 2014 (based on Sony's research)

- Back-illuminated structure with 2.5 μm unit pixel
- Introduction of technology that improves sensitivity in the near infrared range achieves near infrared sensitivity 1.5 or more times that of existing products. (Approx. 3.8 times that of the IMX136LQJ, and approx. 1.5 times that of the IMX124LQT)
- Supports various WDR functions
- A variety of gain modes
- Low-voltage LVDS/MIPI (CSI-2 compliant)

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 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.

Back-Illuminated Structure + Improved Sensitivity in the Near infrared Range

Good sensitivity characteristics in the near infrared range are a key requirement of industrial application cameras. This new image sensor realizes even higher sensitivity by combining technology for improving sensitivity in the near infrared range used in front-illuminated structures typified by the existing Sony product, IMX222LQJ,*3 with the pixels of the 2.5 μm unit pixel back-illuminated structure used by the existing Sony product, IMX124LQT.*2
The IMX123LQT has approximately 1.5 times the sensitivity in the 850 nm wavelength range of the existing product, IMX124LQT. Despite having a different pixel size, the low-light picture quality and the sensitivity in the near infrared range are also vastly improved compared to the existing product, IMX136LQJ*4 (2.8 μm unit pixel front-illuminated structure). (See photograph 2.)
In addition, optimization of the pixel separation structure and suppression of color mixing between pixels enables simultaneously reduction of disruption of the color balance and aggravation of color mixing, which easily occur when increasing sensitivity in the near infrared range, and achieves high picture quality in the visible light range. (See photograph 1.)

*2: See the New Product Information released in November 2013.
*3: See the New Product Information released in September 2013.
*4: See the New Products section in CX-NEWS, Volume 68.

A Variety of WDR Modes

WDR functions are typically demanded of industrial application cameras. The IMX123LQT is equipped with the four different functions as follows in accordance with the ISP (image signal processor) to be used and the driving to be realized.

1) 14-bit AD drive
This enables expansion of the dynamic range by increasing the quantization resolution with a single exposure.

2) Multiple frame set output function
The exposure time and the gain can be set separately for each frame. This function helps to realize WDR functions, and can also be applied to applications such as bracket shooting.

3) Function that combines two images with different exposure times inside the image sensor and outputs the synthesized image
This function is suited to applications that aim to easily realize WDR when there is no function for combining multiple frames on the ISP side.

4) DOL (digital overlap) drive
This function outputs up to three frames of images alternately on each line. It requires a dedicated ISP, but provides advantages such as improved characteristics in low-light environments compared to conventional WDR that uses multiple frame set output. (See photograph 3.) Multiple DOL drive settings are provided to enable control and data reception in accordance with the ISP used.

* MIPI (CSI-2 compliant) does not support DOL drive.

A Variety of Gain Functions

Normal analog gain is a maximum of 27 dB. When using the gain expansion function, the frame rate is reduced by half, but the analog gain can be expanded by +12 dB. Together with the digital gain, a gain of up to 63 dB (max.) can be set by just the image sensor.
In addition, high picture quality can be realized by setting the gain separately for each color. In multiple frame set output mode, the gain can also be varied in each frame as described in the WDR item above. Furthermore, a mode is provided that outputs one pixel on two systems and applies gain separately to each output. Noise can be reduced or sensitivity increased through addition of pixel signals by setting a different gain for each of the two systems, or by applying the same gain to both systems and processing the output at the rear end. In this manner, a variety of gain functions are available and can be selected in accordance with the function characteristics to be realized.

Interfaces

The IMX123LQT is equipped with a low-voltage LVDS that can select 8-channel or 4-channel operation and an MIPI (CSI-2 compliant) interface, and these interfaces can be selected in accordance with the camera specifications. The MIPI (CIS-2 compliant) interface supports up to four lanes, so it doe support all IMX123LQT functions, but it enables easy connection with a general-purpose ISP. In addition, the package is shared with the previously commercialized IMX124LQT, which facilitates common design.

＜Photograph 1＞
IMX123LQT Sample Image

Condition: 500 lx F1.4 (QXGA image, 60 frame/s)

IMX123LQT Internal gain 0 dB

＜Photograph 2＞
Comparisons with the Existing Sony Product

Condition 1: 0.06 lx F1.4 (QXGA image, 30 frame/s)

IMX136LQJ (FI 2.8 μm, 2.4 M pixels)
Internal gain 48 dB (Maximum gain)

IMX123LQT (the new product)
Internal gain 63 dB (Maximum gain)

Condition 2: 0 lx (with IR) F2.8 (QXGA image, 30 frame/s)

IMX136LQJ (FI 2.8 μm, 2.4 M pixels)
Internal gain 0 dB

MX123LQT (the new product)
Internal gain 0 dB

＜Photograph 3＞
Sample Images with WDR

Sample images with single exposure

Sample images with DOL-WDR

＜Table 1＞ Device Structure

Item		IMX123LQT
Image size		Diagonal 6.46 mm (Type 1/2.8) (QXGA mode) Diagonal 5.56 mm (Type 1/3.2) (Full HD mode)
Number of effective pixels		2065 (H) × 1553 (V) approx. 3.21M pixels
Unit cell size		2.50 µm (H) × 2.50 µm (V)
Optical blacks	Horizontal	Front: 0 pixels, rear: 0 pixels
	Vertical	Front: 12 pixels, rear: 0 pixels
Input drive frequency		54 MHz / 27 MHz / 37.125 MHz / 74.25 MHz
Package		98-pin LGA
Supply voltage V_{DD} (Typ.)		2.8 V / 1.8 V / 1.2 V

＜Table 2＞ Image Sensor Characteristics

Item		Value	Remarks
G sensitivity (F5.6)	Typ.	600 mV	1/30s accumulation
Saturation signal	Min.	812 mV	Tj = 60 °C

＜Table 3＞ Basic Drive Mode

Drive mode	Interface	ADC	Frame rate (Max.)	Bit rate (Max.)
QXGA	Low voltage LVDS serial 8 ch	12 bit	120 frame/s	648 Mbps/ch
	Low voltage LVDS serial 4 ch	12 bit	60 frame/s	648 Mbps/ch
	Low voltage LVDS serial 4 ch	14 bit	30 frame/s	594 Mbps/ch
	CSI-2 4 lane	12 bit	60 frame/s	702 Mbps/ch
	CSI-2 4 lane	14 bit	30 frame/s	594 Mbps/ch
Full HD	Low voltage LVDS serial 8 ch	12 bit	120 frame/s	594 Mbps/ch
	Low voltage LVDS serial 4 ch	12 bit	60 frame/s	594 Mbps/ch
	Low voltage LVDS serial 4 ch	14 bit	60 frame/s	594 Mbps/ch
	CSI-2 4 lane	12 bit	60 frame/s	445.5 Mbps/ch
	CSI-2 4 lane	14 bit	60 frame/s	594 Mbps/ch