

**IMX045PQ/  
IMX046PQ/  
IMX060PQ**

# 1.4 $\mu\text{m}$ Unit Pixel High Picture Quality CMOS Sensors for Cellular Phones Feature the Industry's Smallest\*<sup>1</sup> Pixel Size



The camera function in cellular phones is being used increasingly in daily life due to its convenience. As a result, even higher picture quality is now required to allow use as a recording medium that is always close at hand. In addition, cellular phones themselves are becoming smaller and slimmer to improve their designer image, and even further miniaturization is desired in the cameras used in these products.

Sony has now developed fabrication technology that can create the industry's smallest\*<sup>1</sup> unit pixel with a width of only 1.4  $\mu\text{m}$ , and has now developed three CMOS sensors, with 5, 8, and 12M-pixel resolutions, using this technology. In addition to the miniaturization and increased resolution provided by this 1.4  $\mu\text{m}$  unit pixel, Sony has also achieved high sensitivity and a high signal-to-noise ratio in these devices by developing a new condensing structure and new process technologies to support the finer pixel pitch.

\*<sup>1</sup> As of Spring 2009.

## IMX045PQ

- Diagonal 4.5 mm (Type 1/4)  
5.15M effective pixels
- Frame rate: 22.5 frame/s

## IMX046PQ

- Diagonal 5.76 mm (Type 1/3.2)  
8.11M effective pixels
- Frame rate: 15 frame/s

## IMX060PQ

- Diagonal 7.1 mm (Type 1/2.5)  
12.25M effective pixels
- Frame rate: 10 frame/s

**Exmor**™

\*: "Exmor" is a trademark of Sony Corporation. "Exmor" is a version of Sony's high performance CMOS sensor with high-speed processing, low noise and low power dissipation by using column-parallel A/D conversion.

### The Industry's Smallest Pixel and Highest Pixel Count Achieved

In general, when making pixels even smaller, the area of the pixel aperture becomes smaller and it becomes more difficult for the pixel to collect light. As a result, picture quality is reduced by the corresponding reduction in

sensitivity and signal-to-noise ratio.

In the development of those devices, Sony reexamined the optimal condensing structure for this 1.4  $\mu\text{m}$  fine unit pixel and succeeded in improving the condensing ratio. Also, by developing new fine pixel fabrication process technologies, Sony achieved an aperture ratio in the light accepting area equivalent to that of Sony's existing 1.75  $\mu\text{m}$  unit pixel. As a result of these new technologies, these new devices achieve the same high sensitivity and high signal-to-noise ratio of the 1.75  $\mu\text{m}$  unit pixel despite the 1.4  $\mu\text{m}$  pixel size. (See tables 1 and 2.)

Furthermore, as a result of developing this 1.4  $\mu\text{m}$  pixel, the IMX060PQ achieves the industry's highest pixel count for a Type 1/2.5 sensor of 12.25M pixels, which corresponds to a factor of about 1.5 increase in pixel count over existing products. Despite its small size, the IMX060PQ can acquire finely detailed images. (See photograph 1.)

### Pixel Peripheral Circuits Miniaturized

In this device, Sony succeeded in reducing the size of the circuits in the pixel periphery by introducing a new fine fabrication process technology.

In addition to Sony's unique column-parallel A/D conversion circuits having a structure that is easy for the fine fabrication technologies designed for digital circuits to handle, Sony was able to reduce the number

of circuits by a factor of 2 due to the greater efficiency of these A/D converters. This contributed to a significant size reduction. (See figure 1.)

### Wide Range of Solutions

These products support the MIPI interface, which is the next generation high-speed serial interface standard for cellular phones equipment, as the output format for captured image data. This makes it possible to connect these sensors to next generation multimedia processors that include an MIPI interface.

These devices also provide a wide range of readout modes that support high-speed video. In addition to pixel elimination mode, pixel addition readout mode, and window cropping mode, they also provide 720p and 1080p modes as HDTV modes. (See table 3.) These devices respond to a wide range of user needs in addition to the small size and high pixel counts they provide.

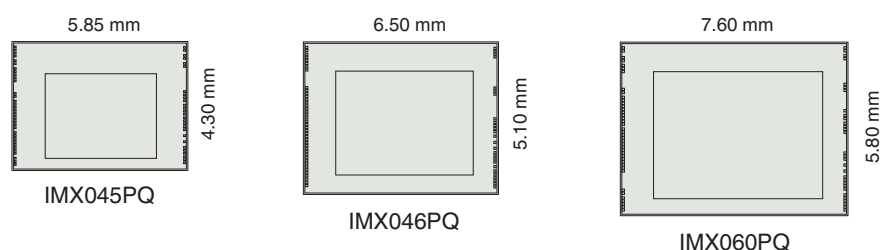
### V O I C E

We succeeded in creating a CMOS sensor product with a unit pixel size of 1.4  $\mu\text{m}$ , which goes beyond the trend in CCD image sensor miniaturization. This is the result of the design and manufacturing groups working together as a single team towards the goal of improving, even slightly, the image quality from the cameras that are always at hand. We strongly recommend that you look into this product.

**Photograph 1** Sample Image from the IMX060PQ Type 1/2.5 12.25M-Effective Pixel CMOS Sensor



**Figure 1** Chip Sizes



**Table 1** Device Structure

Item		IMX045PQ	IMX046PQ	IMX060PQ
Image size		Diagonal 4.5 mm (Type 1/4)	Diagonal 5.76 mm (Type 1/3.2)	Diagonal 7.1 mm (Type 1/2.5)
Format		4:3	←	←
Fabrication process		1 poly 5-metal 90 nm CMOS	←	←
Output format		Digital 10-bit 2ch Sub-LVDS / MIPI	←	←
Control signal interface		3-wire serial, I <sup>2</sup> C	←	←
Total number of pixels		Approx. 5.33M (2664H × 2000V)	Approx. 8.30M (3320H × 2500V)	Approx. 12.53M (4088H × 3064V)
Number of effective pixels		Approx. 5.15M (2616H × 1968V)	Approx. 8.11M (3288H × 2468V)	Approx. 12.25M (4040H × 3032V)
Unit cell size		1.4 μm (H) × 1.4 μm (V)	←	←
Optical black	Horizontal	Front: 48 pixels, rear: 0 pixels	Front: 32 pixels, rear: 0 pixels	Front: 48 pixels, rear: 0 pixels
	Vertical	Front: 32 pixels, rear: 0 pixels	←	←
Power supply specifications	Analog	2.7 +0.2/-0.1 V	←	←
	Digital	1.2 ± 0.1 V	←	←
	Digital interface	1.8 ± 0.1 V	←	←
PGA		Analog: 18 dB (Max.) Digital: 24 dB (Max.)	←	←

**Table 2** Image Sensor Characteristics

Item		IMX045PQ	IMX046PQ	IMX060PQ	Remarks
Sensitivity (F5.6)	Min.	90 mV	←	←	3200K, 706 cd/m <sup>2</sup>
Saturation signal	Min.	280 mV	←	370 mV	T <sub>a</sub> = 60°C

**Table 3** Readout Modes

Item		IMX045PQ	IMX046PQ	IMX060PQ	Remarks
Frame rate	All-pixel scan	22.5 frame/s	15 frame/s	10 frame/s	
	Vertical 1/2 elimination	45 frame/s	30 frame/s	20 frame/s	Pixel addition can also be used.
	Vertical 1/4 elimination	90 frame/s	60 frame/s	40 frame/s	Pixel addition can also be used.
	Vertical 1/8 elimination	180 frame/s	120 frame/s	80 frame/s	Pixel addition can also be used.
	HD720p	60 frame/s	30 frame/s	30 frame/s	Used in conjunction with window cropping
	HD1080p	30 frame/s	30 frame/s	27 frame/s	Used in conjunction with window cropping