Megapixel Class 1.28M-Pixel Diagonal 5.6 mm (Type 1/3.2)
Primary Color Progressive Scan CMOS Sensor for Cellular Phones

IMX006FQ

As the use of camera cellular phones becomes more widespread, the shift to megapixel class camera cellular phones is accelerating. Sony has now developed the IMX006FQ diagonal 5.6 mm (Type 1/3.2) 1.28M-effective pixel primary color progressive scan CMOS sensor. At the same time as including a 10-bit A/D converter and achieving a 15 frames/s frame rate when reading out 1.28M-pixel images, that is, providing the functionality and speed typical of CMOS sensors, the IMX006FQ also incorporates Sony's high picture quality technologies developed for CCD, and thus achieves picture quality equal or better than that of CCD.

- **Primary color filters**
- **Diagonal 5.6 mm (Type 1/3.2), 1.28M effective pixels**
- **Progressive scan method**
- **Built-in 10-bit A/D converter**

The IMX006FQ is a diagonal 5.6 mm (Type 1/3.2) 1.28M-effective pixel CMOS sensor that was developed for use in cellular phone camera modules. By adopting the Sony's unique device structure to provide pixel miniaturization and higher picture quality, two issues that are problematic in CMOS sensors, Sony achieved miniaturization and improved picture quality equivalent to those of progressive scan CCD. Furthermore, since CMOS sensors have no smear, the IMX006FQ acquires bright and clear images. Table 1 lists the IMX006FQ device structure and table 2 lists its imaging characteristics.

V O I C E

We developed this sensor with the hope that it would allow people to capture memorable moments with their cellular phones and other portable electronic equipment that adopts this sensor. Since it would be unfortunate to harm these important memories, we put a lot of effort into picture quality, and created a sensor that is in no way inferior to CCD. I hope that this device will represent the start of the CMOS sensor age.

Improved Picture Quality

In the IMX006FQ, Sony achieved sensitivity that is no way inferior to that of CCD by optimizing the on-chip microlenses and photodiodes. (See photograph 1.)

Built-in A/D Converter

The IMX006FQ integrates a 10-bit A/D converter, sensor control circuits, and other circuits on the same chip. At the same time as significantly reducing the number of external components, integrating the A/D converter on the same chip obviates the need for analog signal processing that requires fine adjustments and thus achieves excellent picture quality.

Low Power Consumption

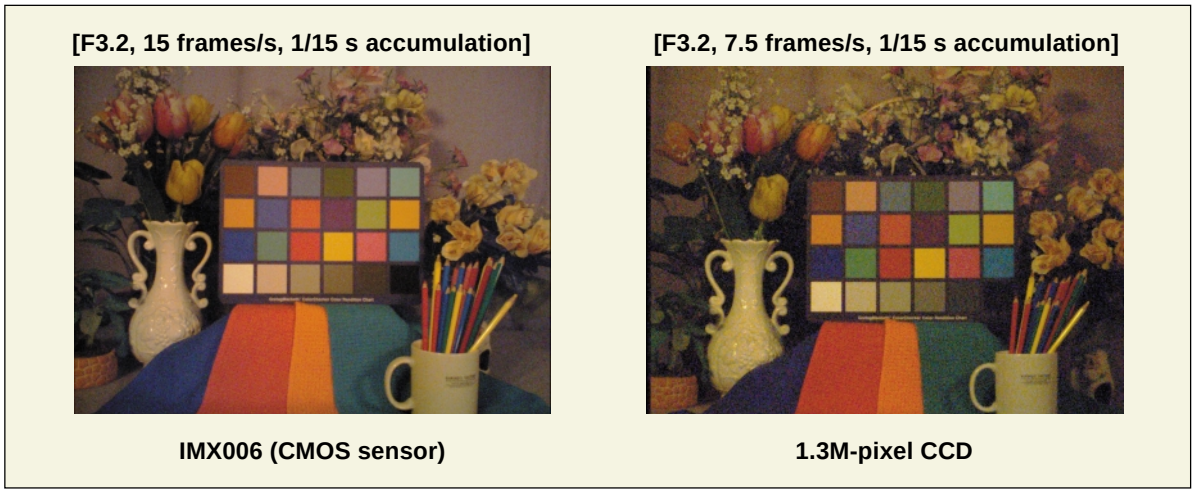
Despite providing 1.28M pixels at a 15 frames/s frame rate, the IMX006FQ achieves the low power of under 80 mW.

Module

Sony provides the IU006 lens module, which combines a lens with the IMX006FQ. By combining a lens optimal for the IMX006FQ, the IU006 achieves a miniature form factor, high resolution, and low shading.

Increased Pixel Counts

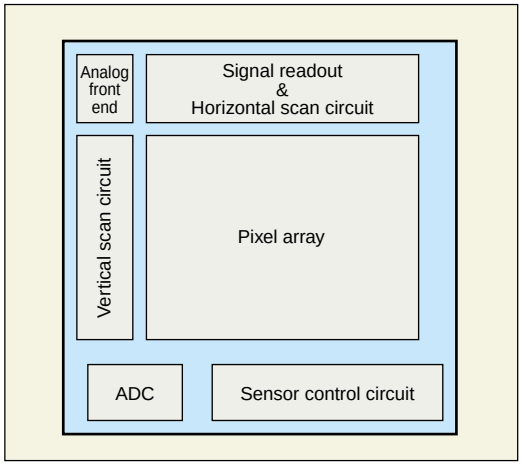
To achieve even higher pixel counts, Sony is now developing the IMX011CQ CMOS sensor with 2.07M effective pixels and the IU011 lens module.



■ **Photograph 1 Low-Light Imaging Examples (10 lx)**

■ **Table 1 Device Structure**

Item		IMX006	IMX011
Image size		Diagonal 5.6 mm (Type 1/3.2)	Diagonal 6.03 mm (Type 1/3)
Format		4 : 3	4 : 3
Fabrication process		2-poly 3-metal 0.25 µm CMOS	1-poly 3-metal 0.18 µm CMOS
Output format		Progressive scan, digital, 10 bits	Progressive scan, digital, 10 bits
Interface		3-wire serial	3-wire serial
Total number of pixels		Approx. 1.33M (1304H × 1017V)	Approx. 2.13M (1664H × 1281V)
Number of effective pixels		Approx. 1.28M (1296H × 985V)	Approx. 2.07M (1656H × 1249V)
Number of active pixels		Approx. 1.26M (1292H × 977V)	Approx. 2.05M (1648H × 1241V)
Unit cell size		3.45 µm (H) × 3.45 µm (V)	2.925 µm (H) × 2.925 µm (V)
Optical black	Horizontal	Front: 8 pixels, rear: 0 pixels	Front: 8 pixels, rear: 0 pixels
	Vertical	Front: 16 pixels, rear: 16 pixels	Front: 16 pixels, rear: 16 pixels
Horizontal drive frequency		24.0 MHz	39.0 MHz
Power supply specifications		2.7 V (analog) 1.8 V (digital)	2.7 V (analog) 1.8 V (digital)
PGA		35.7 dB (Max.)	23.7 dB (Max.)



■ **Figure 1 Block Diagram**

■ **Table 2 Imaging Characteristics**

Item		IMX006	IMX011	Remarks
Sensitivity (F5.6)		370 mV	230 mV	3200K, 706 cd/m^2, 1/30 s accumulation, G signal
Saturation signal		630 mV	550 mV	Ta = 60°C
Smear		None	None	
Frame rate	Progressive scan mode	15 frames/s	15 frames/s	
	High frame rate readout mode	30 frames/s	30 frames/s	