Diagonal 6.0 mm (Type 1/3.0) 2.07M-Effective Pixel Primary Color Progressive Scan CMOS Sensor for Cellular Phones

IMX011CQ

As megapixel class camera cellular phones become more widely used, the shift to higher pixel counts in the cameras included in these cellular phones has progressed.
Sony has now developed the IMX011CQ diagonal 6.0 mm (Type 1/3.0) 2.07M-effective pixel primary color progressive scan CMOS sensor.
In developing the IMX011CQ, at the same time as fully incorporating Sony's high picture quality know-how gained through Sony's extensive CCD development experience into a newly-developed 0.18 μm CMOS sensor process, Sony also improved the device structure of the IMX006FQ (see CX-NEWS Vol. 38) even further. As a result, this new sensor achieves picture quality equivalent to that of CCD and reaches the high speed of 15 frames/s at 2.07M pixels.

- **Diagonal 6.0 mm (Type 1/3.0) 2.07M effective pixels**
- **High picture quality sensor for mobile applications**
- **Built-in 10-bit A/D converter**
- **Extensive set of solutions**

The IMX011CQ is a diagonal 6.0 mm (Type 1/3.0) 2.07M-effective pixel CMOS sensor that was developed for use in cellular phone camera modules. It features the industry's smallest class unit pixel size of 2.925 μm, and achieves both quality equivalent to that of CCD and the high speed of a 15 frames/s progressive scan speed for 2.07M-pixel images.
The 1.28M-pixel IMX012CQ is under development as another CMOS sensor of the 2.925 μm unit pixel size generation. Table 1 lists the device structure, and table 2 lists the imaging characteristics of both the IMX011CQ and the IMX012CQ.

V O I C E

In this CMOS sensor development project, we aimed at creating a sensor whose image quality would exceed that of CCD. I am pleased that we succeeded in developing an image sensor that is optimal, in both performance and functionality, for mobile equipment. I strongly recommend that anyone who has felt the limits of cellular phone picture quality try the IMX011CQ. Keep your eye on Sony for an ever expanding line of CMOS sensors.

Improved Picture Quality

In developing this sensor, Sony created a 0.18 μm CMOS sensor process that fully incorporates the know-how gained through Sony's CCD experience. In addition, Sony also optimized the on-chip microlenses and the pixel structure to achieve the same high picture quality as CCD with the same pixel size class. Furthermore, since CMOS sensors do not have a smear problem, it is possible to use brighter lenses than can be used with CCD. (See photograph 1.)

Application Circuit Example

The IMX011CQ integrates 10-bit A/D converter, sensor control, and other circuits on the same chip. At the same time as significantly reducing the number of external components, this allows the IMX011CQ to be directly connected to a DSP or other circuit with only digital signals. (See figure 1.)

Extensive Set of Solutions

Sony provides an extensive set of solutions for customer needs as IMX011CQ related products, including the following.

- Independent sensors
- IU011 series (lens modules)
  : sensor + optical system
- MCB770 series (camera modules)
  : sensor + camera DSP + optical system

Since lenses optimized for the IMX011CQ are used in these lens and camera modules, these products achieve miniature sizes, high resolution, and low shading.

[F2.8, 1/3.75 s accumulation, 2.925 μm square pixels]

IMX011CQ (2M-pixel CMOS sensor)

[F3.5, 1/3.75 s accumulation, 3.275 μm square pixels]

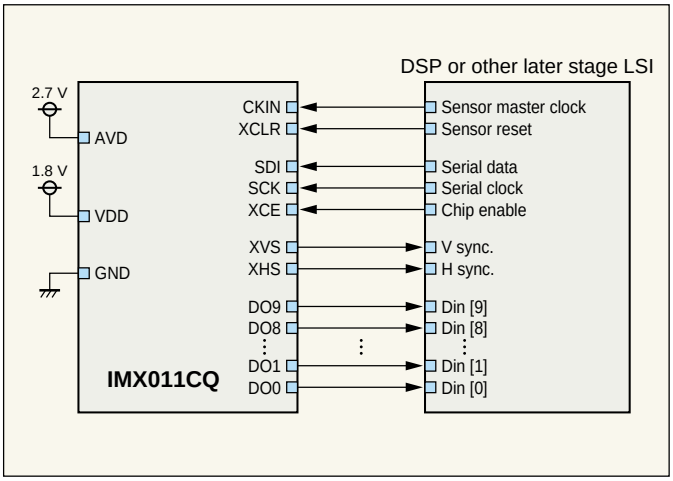
2M-pixel CCD

■ Photograph 1 Low-Light Imaging Examples (5 lx)

■ Table 1 Device Structure

Item		IMX011CQ	IMX012CQ (Under development)
Image size		Diagonal 6.03 mm (Type 1/3.0)	Diagonal 4.74 mm (Type 1/3.8)
Format		4 : 3	←
Fabrication process		1-poly 3-metal 0.18 μm CMOS	←
Output format		Progressive scan, digital, 10 bits	←
Interface		3-wire serial	←
Total number of pixels		Approx. 2.13M (1664H × 1281V)	Approx. 1.13M (1304H × 1017V)
Number of effective pixels		Approx. 2.07M (1656H × 1249V)	Approx. 1.28M (1296H × 985V)
Number of active pixels		Approx. 2.05M (1648H × 1241V)	Approx. 1.23M (1292H × 960V)
Unit cell size		2.925 μm (H) × 2.925 μm (V)	←
Optical black	Horizontal	Front: 8 pixels, rear: 0 pixels	←
	Vertical	Front: 16 pixels, rear: 16 pixels	←
Horizontal drive frequency		39.0 MHz	24.0 MHz
Power supply specifications		2.7 V (analog) 1.8 V (digital)	←
PGA		23. 7 dB (Max.)	23.7 dB (Max.)

*: The IMX012 is under development and its specifications are subject to change.



■ Figure 1 Application Circuit Example

■ Table 2 Imaging Characteristics

Item		IMX011CQ	IMX012CQ (Under development)	Remarks
Sensitivity (F5.6)		230 mV	230 mV	3200K, 706 cd/m^2, 1/30 s accumulation, G signal
Saturation signal		550 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	