

# 5M-Pixel CMOS Sensor for Cellular Phones Achieves High Picture Quality, High Speed, and the Industry's Smallest Pixel Size

## IMX020

Along with the recent trend towards higher pixel counts in cellular phone cameras, these cameras are approaching digital cameras in their level of functionality.

Sony has now developed the IMX020 5M-pixel CMOS sensor to respond to these trends.

Sony developed a new 2.0  $\mu\text{m}$  unit pixel, which is now the industry's smallest\*<sup>1</sup>, and achieved the same high signal-to-noise ratio as the IMX018\*<sup>2</sup>, which has been well received by the market.

The IMX020 adopts the column-parallel A/D converter technique\*<sup>3</sup> and achieves a high frame rate.

\*1: As of spring 2007

\*2: See CX-News Volume 46 (November 2006), New Products

\*3: See CX-News Volume 47 (February 2007), Featuring

- Diagonal 6.52 mm (Type 1/2.8) 5.15M effective pixels
- High picture quality sensor for cellular phones
- The industry's smallest 2.0  $\mu\text{m}$  unit pixel
- 10-bit column A/D converter readout
- High-speed serial interface
- Extensive set of solutions

### ■ Smaller Pixels and Improved Picture Quality

Due to the strong desires for module miniaturization in the cameras included in cellular phones, it is necessary to reduce the pixel size when increasing the pixel count. Last year, Sony developed the 2.5  $\mu\text{m}$  unit pixel 3M-pixel IMX018. The IMX018 was included in a GSM terminal and was praised for its picture quality.

Sony developed a 2.0  $\mu\text{m}$  unit pixel to achieve 5M pixels in the IMX020 with the same optical system as the IMX018. Despite a pixel area reduce by 64% from that of the IMX018, Sony introduced a new condenser structure that increases the condensing efficiency even further as well as a new wafer process that can suppress noise generated in the pixels to an absolute minimum. The IMX020 thus achieves a high signal-to-noise ratio equivalent to that of the IMX018 even in low light. (See photograph 1.)

By providing the IMX020 with an addition function (2  $\times$  2) in low-resolution output mode, Sony made the IMX020 capable of providing even brighter images. (See figure 1.)

### ■ Faster Operation

The IMX020 adopts Sony's unique column-parallel A/D conversion technique that is optimal for increasing operating speeds. Sony also introduced their unique two-channel data strobe type sub-LVDS serial interface, which allows applications to read out the 10 bits per pixel output at 864 Mbps (a pixel rate of 86.4 MHz). Despite the large number of pixels, 5M pixels, this allows the IMX020 top operate at 15 frame/s in progressive scan mode and to achieve the high speed of 120 frame/s in 1/8 decimation mode, which is equivalent to QVGA output mode. (See table 3.)

### ■ Extensive Set of Solutions

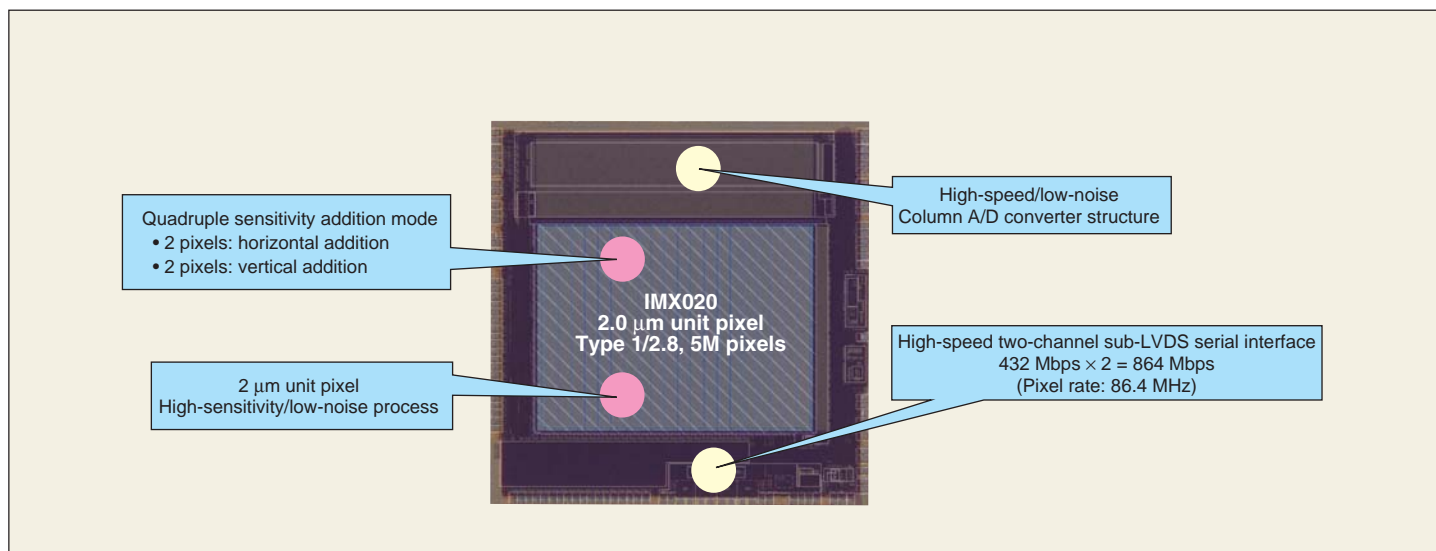
To respond to our customer's diverse needs, Sony provides solutions in a variety of forms as IMX020-related products.

- Independent sensor
- IU020 series (lens modules): sensor + optical system
- MCB990 series (camera modules): sensor + camera DSP + optical system

These lens and camera modules use a lens optimized for the IMX020 and achieve miniaturization, high resolution, and low shading.

## V O I C E

The IMX020 adopts several technologies that are making their appearance for the first time in a Sony cellular phone sensor, including a 2.0  $\mu\text{m}$  unit pixel, column A/D readout, and a high-speed serial interface. The IMX020 achieves a high signal-to-noise ratio comparable to that of 2.5  $\mu\text{m}$  unit cell sensors and the high-speed operation of 15 frame/s in 5M-pixel progressive scan mode. The attractiveness of portable equipment lies, I think, in the fact that it is always at hand. I hope you will enjoy being able to take high picture quality images conveniently at any place and at any time.



■ Figure 1 IMX020 Features



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

■ Table 1 Device Structure

Item	IMX020	
Image size	Diagonal 6.52 mm (Type 1/2.8)	
Format	4:3	
Fabrication process	1-poly, 3-metal, 0.14 $\mu\text{m}$ CMOS	
Output format	Progressive scan, 10-bit digital data	
Interface	3-wire serial	
Total number of pixels	Approx. 5.31M (2664H $\times$ 1992V)	
Number of effective pixels	Approx. 5.15M (2616H $\times$ 1968V)	
Number of active pixels	Approx. 5.11M (2608H $\times$ 1960V)	
Unit cell size	2.0 $\mu\text{m}$ (H) $\times$ 2.0 $\mu\text{m}$ (V)	
Optical black	Horizontal	Front: 48 pixels, rear: 0 pixels
	Vertical	Front: 24 pixels, rear: 0 pixel
Input clock	18 / 24 MHz	
Power supply specifications	2.7 V (analog), 1.8 V (digital)	
PGA	30.0 dB (Max.)	

■ Table 2 Image Sensor Characteristics

Item	IMX020	Remarks
Sensitivity (F5.6)	57 mV	3200K, 706 $\text{cd}/\text{m}^2$ , 1/30 s accumulation, G signal
Saturation signal	175 mV	$T_a = 60^\circ\text{C}$
Smear (F5.6)	None	

■ Table 3 Readout Modes

Mode	Recommended number of recording pixels	Frame rate	Bit rate	Remarks
Progressive scan	Approx. 5.04M (2592H $\times$ 1944V)	15 frame/s	864 Mbps	
Vertical 1/2 elimination	Approx. 1.26M (1296H $\times$ 972V)	30 frame/s	432 Mbps	The addition operation may be used.
Vertical 1/4 elimination	Approx. 0.63M (1296H $\times$ 486V)	60 frame/s	432 Mbps	The addition operation may be used.
Vertical 1/8 elimination	Approx. 0.31M (1296H $\times$ 243V)	120 frame/s	432 Mbps	The addition operation may be used.