

High-Resolution Diagonal 7.183 mm (Type 1/2.5) 8.15M-Effective Pixel and Diagonal 9.299 mm (Type 1/1.7) 12.19M-Effective Pixel Color CCDs for Consumer Digital Still Cameras Support VGA Resolution Moving Picture Imaging

# ICX636/646 Series ICX612CQZ

In the compact consumer digital still camera market, in addition to the earlier desire for higher pixel counts, there are increasing needs for improved high ISO sensitivity and lower power.

By taking advantage of Sony's unique fine pixel fabrication technologies, by optimizing circuit designs, and by other efforts, Sony has now developed the ICX636/646 Series of 1.75  $\mu\text{m}$  unit pixel CCDs which achieve the industry's smallest pixel size while maintaining high picture quality. Sony has also developed at the same time the ICX612CQZ, which achieves a recorded pixel count of 12M pixels in compact consumer digital still cameras.

Additionally, both the ICX636 Series and the ICX612CQZ achieve lower power consumption through the adoption of new drive methods.

## ICX636/646 Series

- Diagonal 7.183 mm (Type 1/2.5) 8.15M effective pixels
- Pixel size: 1.75  $\mu\text{m}$  unit pixel
- Five-field readout
- Horizontal divided into thirds output
- Horizontal 3-phase drive (The ICX646 Series devices use horizontal 2-phase drive)

## ICX612CQZ

- Diagonal 9.299 mm (Type 1/1.7) 12.19M effective pixels
- Pixel size: 1.85  $\mu\text{m}$  unit pixel
- Six-field readout
- Horizontal divided into thirds output
- Horizontal 3-phase drive

### ■ CCD with a 1.75 $\mu\text{m}$ Unit Pixels, the Industry's Smallest

Sony has now released the ICX636/646 Series, which feature a 1.75  $\mu\text{m}$  unit pixels, the industry's smallest. To achieve at the same time superb performance in the sensitivity characteristics, the saturation signal level, and the smear characteristics, Sony switched to a finer feature size in the vertical transfer registers and optimized the aperture area. Sony increased the aperture ratio per unit pixel by 9% from the existing ICX629 (see CX-NEWS Vol. 45).

These technologies allowed Sony to achieve equivalent levels of sensitivity, saturation signal level, and smear characteristics as the existing ICX629 despite the reduced pixel size.

### ■ Low Power Consumption

Sony achieved a 57% reduction in the horizontal transfer register power consumption compared to the existing Sony ICX629 by developing and adopting two new drive methods.

### ■ Load Reduction of 50% Due to Horizontal Divided into Thirds Output Method

In earlier methods, a single signal line was transferred to the horizontal transfer register at the same time. In the divided into thirds output method newly developed for this product, a single unit consists of three pixels and a single signal line is divided into lines consisting of every three pixels for transfer to the horizontal transfer register. (See figure 1.) By adopting this structure, Sony was able to radically reduce the number of electrodes and reduce the capacitance between clocks by 50%. Also, by increasing the area per single electrode, Sony achieved a charge amount

handled by the horizontal transfer register about three times larger than that of earlier technologies. Additionally, in moving picture imaging mode, as opposed to the earlier technique in which two pixels were added horizontally, in this new technique, three pixels are added horizontally. This makes it possible to increase the frame rate.

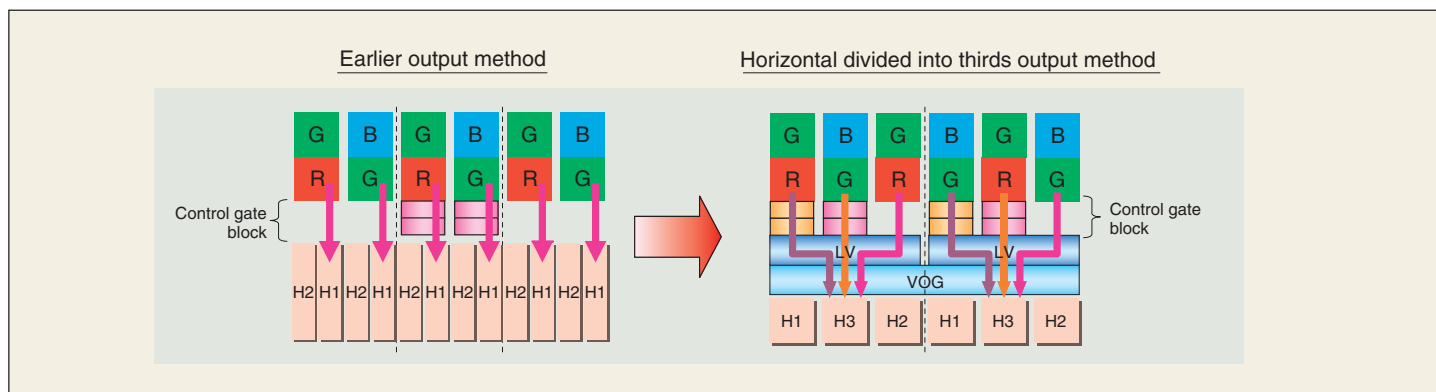
### ■ 2.3 V Low-Amplitude Drive Horizontal Three-Phase Driver

In the earlier horizontal two-phase drive method, it was necessary to transfer charge while overcoming a potential barrier for preventing color mixing, and a large amplitude was required. In horizontal three-phase drive, since charge is transferred sequentially as shown in figure 2, no potential barrier is required and transfer at low amplitudes becomes possible. By switching from horizontal two-phase drive to horizontal three-phase drive, Sony reduced the required amplitude by about 1 V.

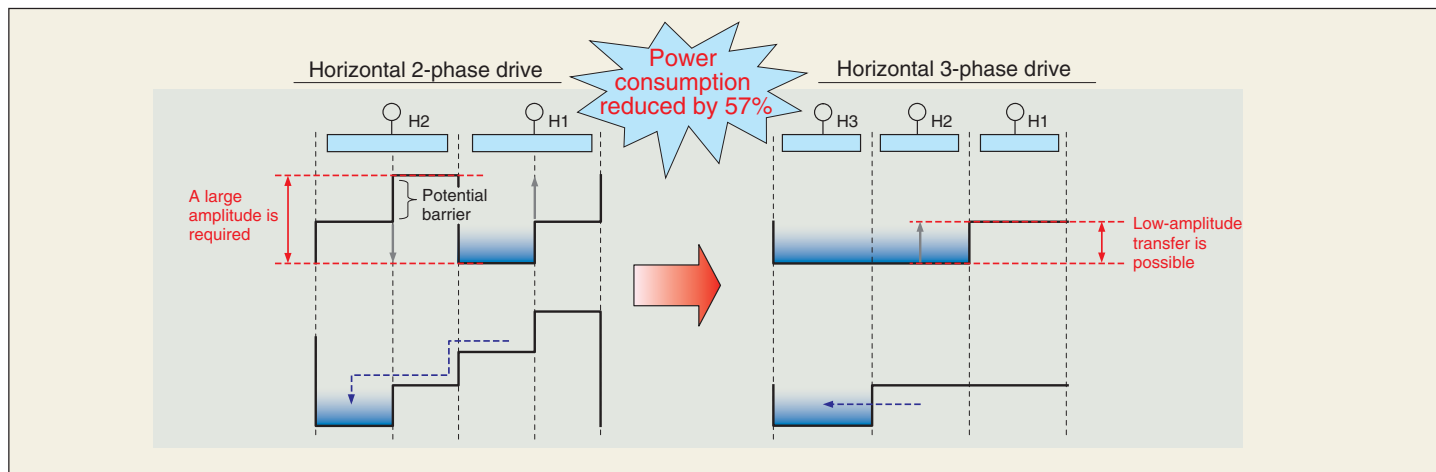
\*: The ICX646 Series products use the same horizontal two-phase drive as Sony's existing ICX629, and are therefore used with the same drive specifications as that existing product.

## V O I C E

The members of our group are unanimous in our conviction that we have achieved the industry's highest picture quality. We also worked both to improve the frame rate and to lower power consumption, which are two critical issues for CCD products, and we also established a new CCD drive technique. I strongly hope that you will take advantage of the industry-leading ICX636/646 Series and ICX612CQZ CCD products.



■ Figure 1 Vertical Register to Horizontal Register Output Methods



■ Figure 2 Horizontal Register Transfer Methods

■ Table 1 Device Structure

Item	ICX636 Series	ICX646 Series	ICX612CQZ
Image size	Diagonal 7.183 mm (Type 1/2.5)	←	Diagonal 9.299 mm (Type 1/1.7)
Transfer method	Frame readout interline transfer method	←	←
Readout method	Horizontal	3-phase drive, divided into thirds	2-phase drive, divided into thirds
	Vertical	5-field readout	←
Total number of pixels	Approx. 8.29M (3336H × 2484V)	←	Approx. 12.39M (4078H × 3038V)
Number of effective pixels	Approx. 8.15M (3298H × 2472V)	←	Approx. 12.19M (4032H × 3024V)
Number of active pixels	Approx. 8.08M (3286H × 2460V)	←	Approx. 12.12M (4024H × 3012V)
Number of recommended recording pixels (Aspect ratio: 4:3)	Approx. 7.99M (3264H × 2448V)	←	Approx. 12.00M (4000H × 3000V)
Unit cell size	1.75 μm (H) × 1.75 μm (V)	←	1.85 μm (H) × 1.85 μm (V)
Horizontal drive frequency	36 MHz	←	38 MHz
Package	EQZ: 34-pin QFN (Ceramic) EQP: 32-pin QFN (Ceramic)	CQZ: 34-pin QFN (Ceramic) CQP: 32-pin QFN (Ceramic)	40-pin QFN (Ceramic)

■ Table 2 Image Sensor Characteristics

Item	ICX636 Series	ICX646 Series	ICX612CQZ	Remarks
Sensitivity (G signal)	165 mV (Typ.)	160 mV (Typ.)	180 mV (Typ.)	3200K, 706 cd/m <sup>2</sup> , 1/30 s accumulation, F5.6
Saturation signal	Frame readout mode	420 mV (Min.)	420 mV (Min.)	Ta = 60°C, per pixel
	4/10-line readout mode*1	165 mV (Min.)	165 mV (Min.)	
	4/20-line readout mode*1	165 mV (Min.)	165 mV (Min.)	
	4/24-line readout mode*1	—	—	
Smear	Frame readout mode	-85.1 dB (Typ.)	-86.0 dB (Typ.)	None when a mechanical shutter is used, V/10 method, F5.6
	4/10-line readout mode*1	-79.1 dB (Typ.)	-80.0 dB (Typ.)	
	4/20-line readout mode*1	-70.9 dB (Typ.)	-71.8 dB (Typ.)	
	4/24-line readout mode*1	—	—	
Frame rate	Frame readout mode	2.5 frame/s	2.5 frame/s	Number of output lines: 494 lines
	4/10-line readout mode*1	30 frame/s	30 frame/s	
	4/20-line readout mode*1	60 frame/s	60 frame/s	
	4/24-line readout mode*1	—	—	
			48.53 frame/s	Number of output lines: 252 lines

\*1 With horizontal addition

Note: This device was designed for use in consumer digital still cameras and may not be appropriate for other applications. Contact your Sony representative for consultation when considering this product for use in other applications.