

The Industry's First Digital Copier CCD Linear Sensor with RGB Adjacent 3-Line Plus Monochrome 1-Line 7600-Pixel Sensors

ILX146K

At the same time as demand for digitizing documents is increasing, there is also rapid progress being made in switching from analog to digital in copiers. The increasing performance in this area is remarkable.

Due to this background, there is now strong demand for CCDs that can provide the performance to scan documents with high quality at even faster speeds.

To respond to these needs, Sony has now developed the ILX146K CCD linear sensor in which the RGB sensor lines are directly adjacent to each other.

- Color RGB adjacent 3-line CCD + monochrome (green) CCD
- High-speed transfer
Maximum data rates:
100 MHz (monochrome)
150 MHz (color)

■ Device Structure

Figure 1 shows the ILX146K block diagram and figure 2 shows the structure of the vertical transfer block of the color RGB adjacent 3-line CCD.

The color RGB adjacent 3-line sensor provides a vertical transfer gate adjacent to the blue sensor and reads out the charge collected at the green sensor. By carefully controlling the drive timing of the read gate and the vertical transfer gate, the read-out charge is transferred to individual horizontal registers without any mixing of the blue and green charge. This allowed Sony to create an adjacent RGB sensor and made the following two features possible.

Since the ILX146K also provides a monochrome (green) CCD, the ILX146K can support high-speed black-and-white scanning of documents and wide range of signal processing.

■ Suppression of Incorrect Color Registration During Scanning

Mechanical motion is required for document scanning using a CCD linear sensor. When spatial read errors (variations in the read position) in the scan direction occur during this mechanical motion, color registration errors occur. Since conventional CCD linear sensors have a wide spacing between the RGB sensors, the possibility for read errors to occur is high, especially during high-speed scanning. Since the ILX146K, in which the RGB sensors are adjacent, is resistant to the influence of spatial errors during scanning, color displacement is suppressed and it can support high-quality high-speed scanning.

■ High-Speed Transfer Maximum Data Rates: 100 MHz (Monochrome), 150 MHz (Color)

Figure 3 shows the structure of the monochrome CCD vertical transfer block. While the color RGB adjacent 3-line CCD has a 2-stage horizontal register structure for each color, the monochrome CCD adopts a 4-stage structure in the horizontal registers for even faster processing. Sony applied further refinements to the color CCD vertical transfer structure, to allow the signal charge to be divided among 4 horizontal registers. The signal charge transferred by the horizontal registers is transferred a maximum distance of 7 cm ($9.325 \mu\text{m} \times 7,500$ pixels) to the charge to voltage conversion block. Each of these horizontal registers has a maximum transfer rate of 25 MHz. This allows the ILX146K to achieve a maximum data rate of 100 MHz.

V O I C E

The ILX146K adopts a CCD transfer structure that differs from conventional sensors. We came up with a lot of new ideas, for example, in the drive timing, and as a result were able to create a CCD linear sensor that features the 3 RGB lines being adjacent, which was previously unknown. This device is optimal for copiers and other scanner-based end products that need to operate at high speed. I strongly recommend that you consider this device.

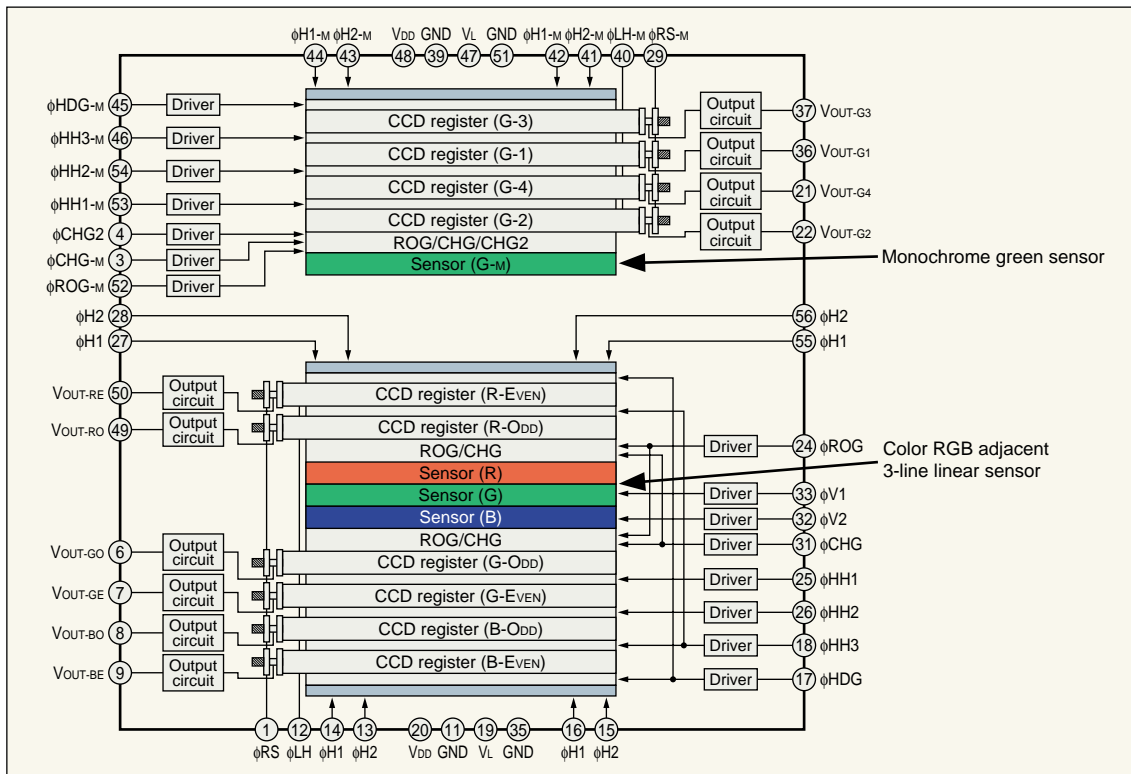


Figure 1 Block Diagram

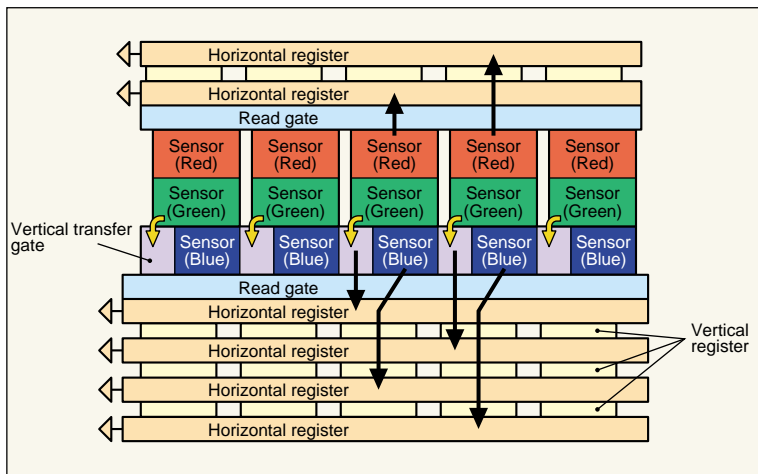


Figure 2 Vertical Transfer Block Structure (Color RGB adjacent 3-line CCD)

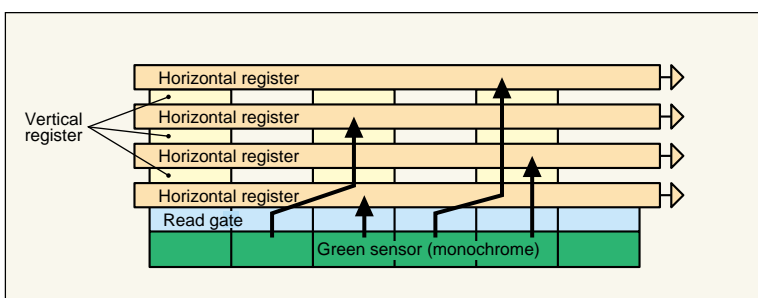


Figure 3 Vertical Transfer Block Structure (Monochrome CCD)

Table 1 Device Structure

Item	ILX146K
Number of effective pixels	30,400 pixels (7,600 pixels × 4)
Pixel size	9.325 μm (H) × 9.325 μm (V) (9.325 μm pitch)
Sensor structure	3 adjacent RGB lines + 1 G line
Number of outputs	10 outputs (2 outputs each for the color RGB lines) (4 green outputs for the monochrome line)
Supply voltage	Dual power supply: 10 V and -3 V
Resolution	600 DPI (A3)
Package	56-pin DIP (Cer-DIP)

Table 2 Electrooptical Characteristics

Ta = 25°C, VDD = 10 V, VL = -3 V, f0RS = 25 MHz, input clock = 5 Vp-p, light source = 3200K, using a CM-500S (t = 1.0 mm) IR cut filter.

Item	Typ.	Unit
Sensitivity	R	V/(lx · s)
	G	
	B	
	Monochrome	
Sensitivity nonuniformity	10	%
Adjacent pixel difference	10	%
Saturated output voltage	1.2 (Min.)	V
Dark voltage average	0.4	mV
Dark signal nonuniformity	1.0	mV
Image lag	0.1	%
Current consumption	125	mA
Maximum operating frequency	R, G, B	MHz/color
	Monochrome	