

## 1990

### Development of first CCD sensor for HDTV having two million pixels per inch (Sony, Toshiba, and Matsushita)

~ Discrete Semiconductor/Others ~

HDTV experimental broadcasting began in NHK BS in June 1989, and the development of imaging devices for HDTV became active. From 1988 to 1990, Japan's image sensor manufacturers (Sony, Toshiba, Matsushita) succeeded ahead of the world in the development of FIT (Frame Interline Transfer) type CCD image sensors of 200 million pixels (1920H × 1036V), meeting the HDTV specification (9:16 aspect ratio, 1125 scanning lines, 2:1 interlace) of ITU (International Telecommunication Union) -R recommendation.

As shown in the Figure, Toshiba used a photo-conductive amorphous Si (a-Si: H) film of an overlay structure as the photo detector element. 2 million  $7.3\mu\text{m}$  (H) ×  $7.6\mu\text{m}$  (V) pixels were integrated in 1-inch optical format (14.0 (H) mm × 7.8 (V) mm).

Sony used p-n photodiodes for the photo sensor elements as shown in the Figure. Sony's unique structure called HAD (Hole-Accumulation Diode) was used in which a hole accumulation layer was added to the surface of the n-layer to suppress a dark current originated at the surface.

In 1992 Sony released a three-plate HD color camera that used three of these CCD image sensors. The increase in the number of pixels and miniaturization of the CCD image sensor has progressed for the next 20 years, and in 2009, Sharp developed and released 1/2.3 type 12-megapixel CCD image sensors. The area of one pixel was reduced to  $1.55\mu\text{m} \times 1.55\mu\text{m}$ .

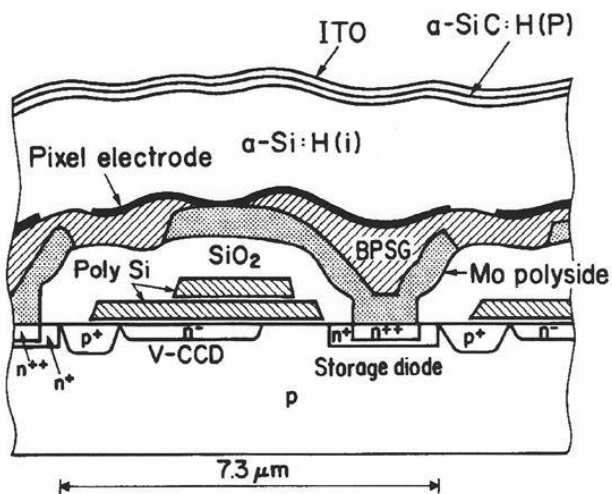


Fig.1: Cross-sectional view of the pixel portion of 1-inch 2 mega pixel CCD image sensor for HDTV by Toshiba (Amorphous Si is used for optical sensor) <sup>(1)</sup>

