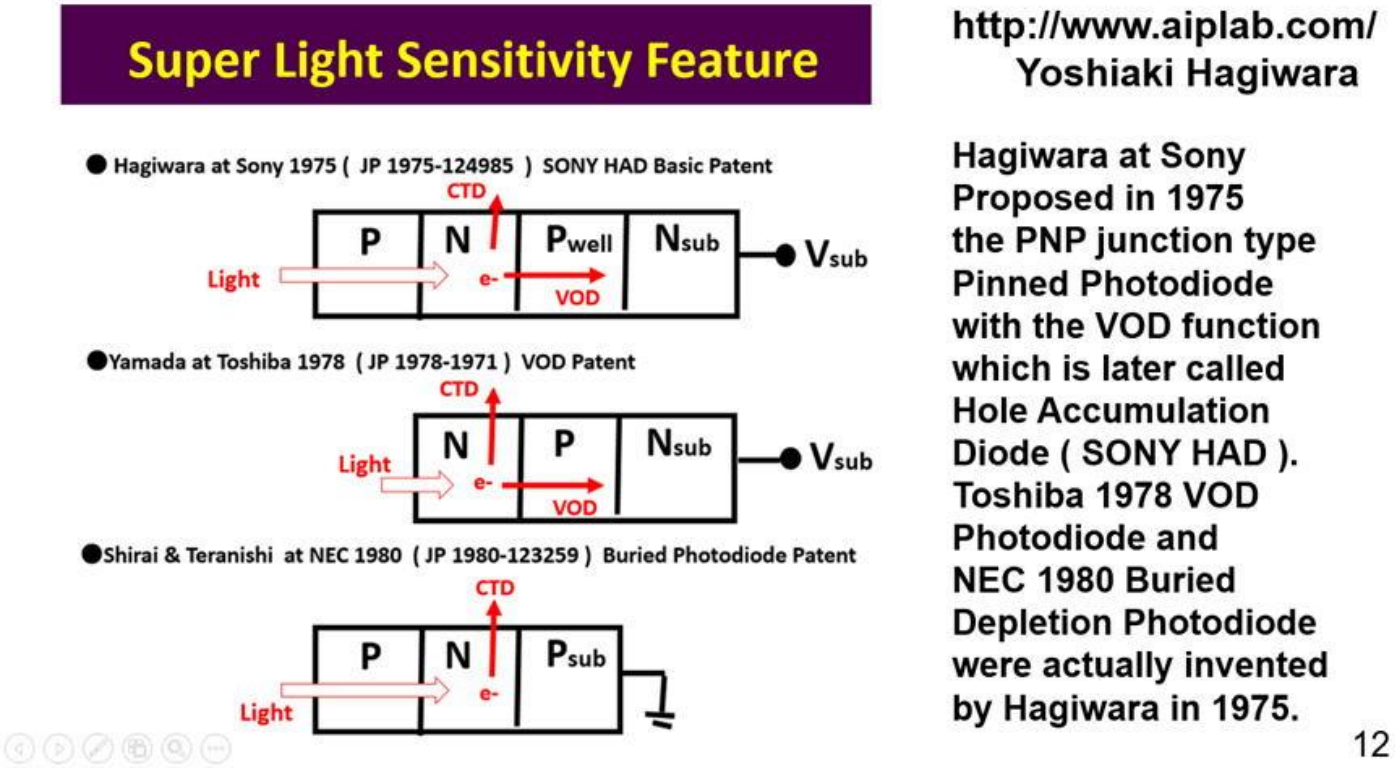

Slide 12

Hagiwara at Sony Proposed in 1975

the PNPN triple junction type Pinned Photodiode

with the vertical overflow drain (VOD) function

which is later called Hole Accumulation Diode (SONY HAD).

In Hagiwara in his 1975 three patent applications, Hagiwara described the four basic and important features of the triple junction type Pinned Photodiode.

They are (1) very excellent short wave blue light sensitivity (2) in-pixel vertical overflow drain function (3) the completely mechanical-part-free electrical shutter function because of the no image lag feature of the empty potential well of the complete charge transfer operation (4) the pinned P+ surface hole accumulation layer with no surface dark current noise and (5) the Global Shutter Function Capability with the Buffer MOS capacitor memory.

Toshiba proposed the 1978 VOD Photodiode and NEC proposed 1980 Buried Depletion Photodiode. But they were proposed after Hagiwara 1975 inventions.