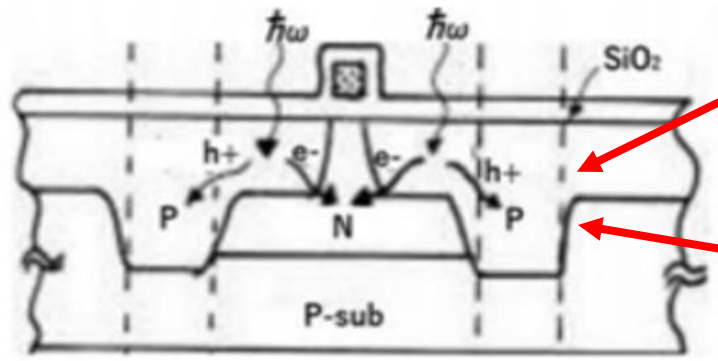


First Pinned Photodiode was invented by Hagiwara in 1975 and reported at SSDM1978 by Sony.

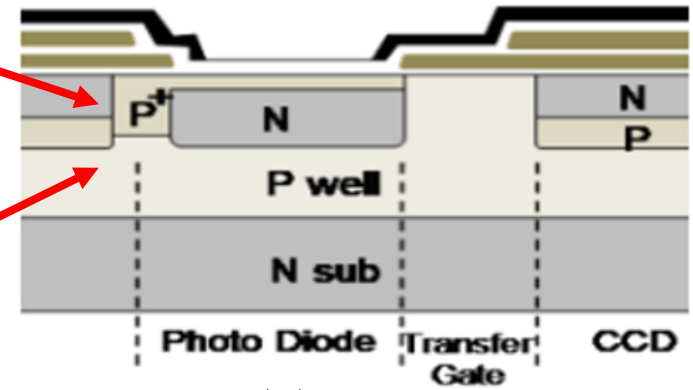
Sony never used LOCOS isolation nor Shallow Trench Isolation. Both suffer the yield problem of dark Current and White Defects. Instead Sony used high energy ion implantation to form the adjacent heavily doped P+ channel stops region with the Lamp Anneal Technology invented by Kazuo Nishiyama at Sony.

(1) The first Pinned Photodiode with the adjacent P+ channel stops and no LOCOS isolation invented and reported at SSDM1978 by Hagiwara.

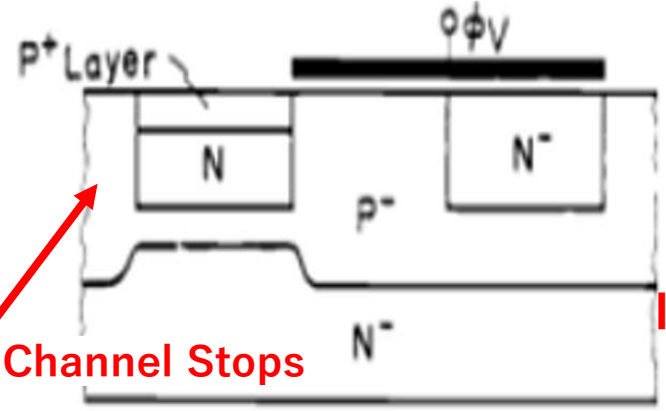


No LOCOS Isolation
No Shallow Trench Isolation

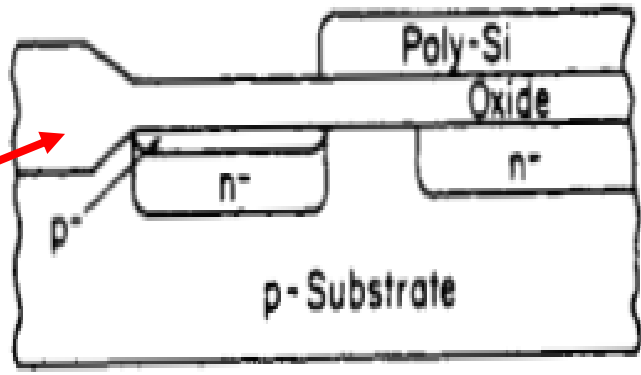
(2) Pinned Photodiode with the adjacent P+ channel stops and no LOCOS isolation as explained by ssis.or.jp in the official Semiconductor History Museum WEB site.



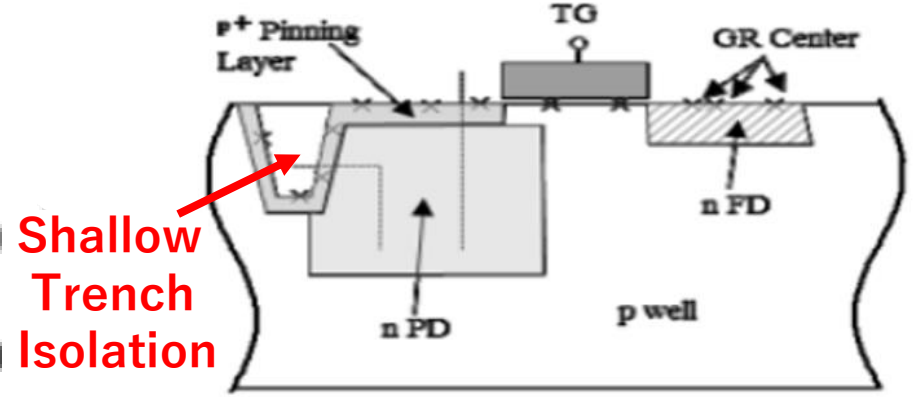
(3) Buried Photodiode reported at IEDM1982 by NEC



(4) Pinned Photodiode reported at IEDM1984 by KODAK



(5) Pinned Photodiode reported by Teranishi in 2014



No Channel Stops

LOCOS Isolation

Shallow Trench Isolation