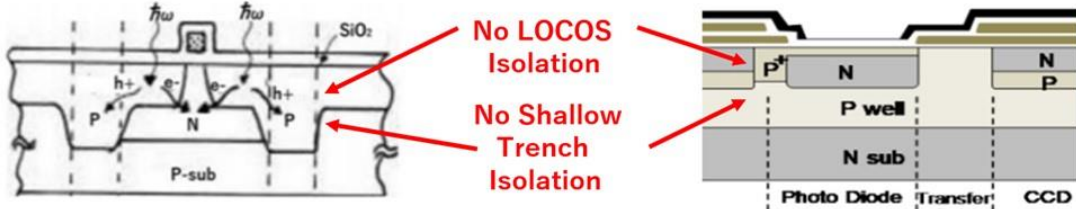


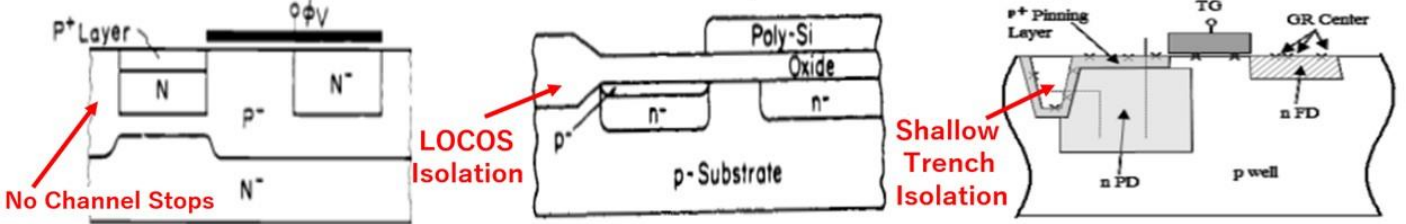
**Sony Pinned Photodiode has the adjacent P+ heavily doped channel stops always directly grounded to the metal wire at the surface since 1978. Sony never used LOCOS isolation nor Shallow Trench Isolation !!!**

**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. (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



**Since Hagiwara SSDM1978 Paper, Sony never used LOCOS isolation.**

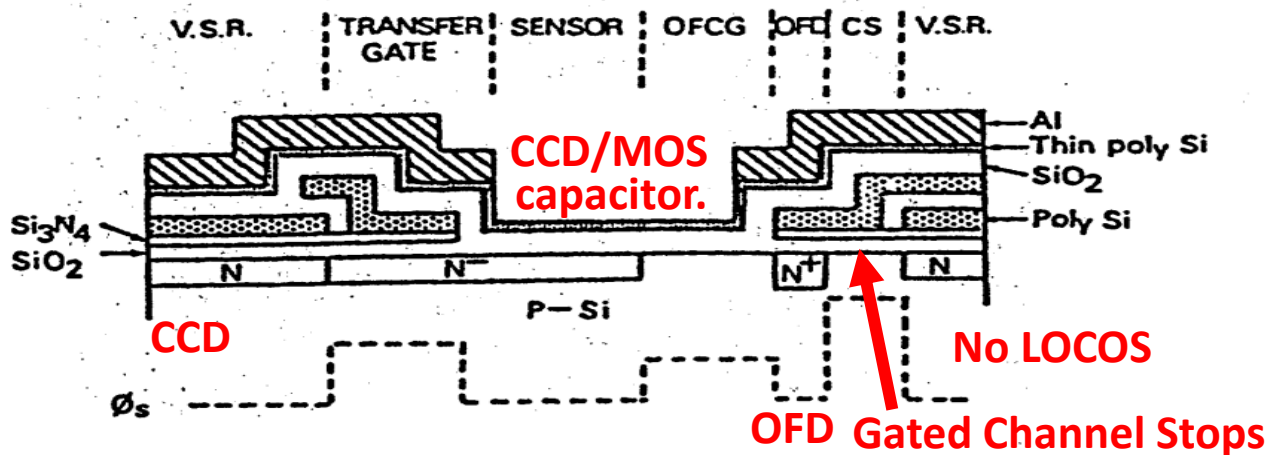
昭和55年1月24日(木)発表

テレビジョン学会技術報告

## インターライン転送方式 CCD 撮像素子

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Using the thin Poly Si gate CCD/MOS capacitor type Photo Sensor, Sony's Interline Transfer CCD Image Sensors in 1980 had no-image-lag. And also with in-pixel anti-blooming feature, the OFD Punch-thru Clocking Scheme was invented by Hagiwara that realized Electric Shutter. See JP1977-126885. This is the first CCD/MOS Photo Capacitor type Electric Function Image Sensor.