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Multichip CMOS Image Sensor Structure for Flash Image Acquisition

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Abstract:

A new 3D Pinned Photodiode (HAD) CMOS image sensor structure applied in the 3-Dimensional multichip high speed digital flash image data acquisition system is explained and the important features are discussed.

CONCLUSION

Hole Accumulation Diode[6] (HAD), with the P+ heavily doped surface hole accumulation layer, invented in 1975, is very important, because first of all it has the excellent short wave length blue light sensitivity feature producing the high picture quality of color reproduction in low level light illumination, which is realized by the photo electron and hole pair generation and separation in the built-in potential barrier[1] and the electric field at the surface heavily doped P+ hole accumulation HAD. No dark current is the second important feature. And no image lag is the third one since CCD was known to have the no image lag feature already. But CCD itself does NOT have the excellent blue light sensitivity and does NOT have the low dark current feature which the Pinned Photodiode[1,2,6,10] invented by Hagiwara has.

HAD is defined as the PNPN junction Photodiode with the VOD function. HAD is also by necessity the P+N-P junction Pinned Photodiode with no dark current feature. HAD is also by necessity the PN-P junction Depletion Photodiode defined as Buried Photodiode with no image lag feature. When Hagiwara invented HAD[1,2,6,10] in 1975, Hagiwara also invented (1) Pinned Photodiode[6], (2) Depletion Photodiode[1], (3) Buried Photodiode[10], (4) the in-pixel vertical overflow drain[6] (VOD) function and (5) the in-pixel Global Shutter function[1, 10]. The surface pinned potential[1, 6, 10] also serves as the hole collector terminal separating the holes from photo electrons which drift more than the distance estimated by Debye length until being collected into the Buried[10], Depletion[1] and Pinned[6] Photodiode (HAD), with the back light illumination scheme[1] which is the most important feature needed to build the super sensitive 3D CMOS image sensor with the high blue-light quantum efficiency and the excellent color reproduction at low light level for fast action pictures with no image lag.