

High frame rate, low depth noise ToF sensor

- In-pixel analog memory array and sub-frame integration
- Frame rate : ~10kfps*1, Depth noise : <1.3%*2

*1 at HS mode
*2 at HP mode, 0.4-4.2m

Overview

- Recently, ToF sensors that can measure the distance from an object are attracting attention in various fields such as automobiles, robots, and sensor.
- However, conventional ToF sensors have **a issue that it is difficult to improve both characteristics** because there is a trade-off between **frame rate** and **depth noise**.
- Therefore, this work has successfully solved the above issue by **with in-pixel analog memory array for each image sensor and sub-frame integration**.
- This work achieved up to **10kfps at HS mode** and depth noise is **less than 1.3% at HP mode(0.4-4.2 m)**.
- This work shows higher characteristics than conventional ToF sensors, and therefore, it is expected to be applied to autonomous driving sensors, autonomous running robots, factory automation (FA), drones, VR/AR, etc.

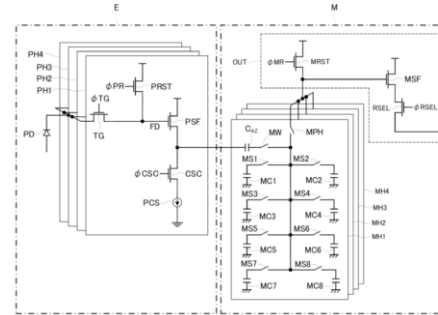
Product Application

- LiDAR for automotive、Sensor for FA、VR/AR
- Drone, Robots, Home appliance
- Auto focus function

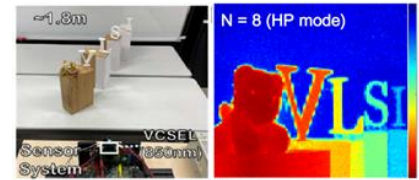
IP Data

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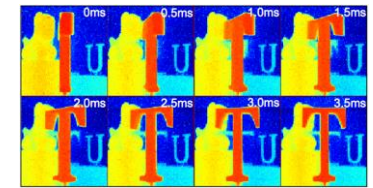
Features・Outstanding's



Schematic diagram



Sample images under HP mode



Sample images under HS mode (~600rpm rotating object)

	This work		Other work
Pixel Archt.	4-Tap		4-Tap
Process	0.18μm FSI		65nm BSI
Pixel Pitch(μm)	22.4 x 16		3.5 x 3.5 (Stack)
Pixel Array	134 x 132		1280 x 960
Lens F#	1.4		1.3
Modulation Contrast	85% @ 80MHz		80% @ 200MHz
Frame Rate(fps)	90 (HP)	1K~10K (HS)	60
Conv. Gain	85μV/e ⁻	85μV/e ⁻	50μV/e ⁻
Read Noise	4.8 e ⁻ rms	10.4 e ⁻ rms	3.4 e ⁻ rms
Depth Noise	< 1.3% @ 0.4~4.2m	< 1.67% @ 0.4~1.5m	< 1.52% @ 0.4~4m

This work shows better characteristics than conventional work

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