Lenovo Phab2Pro 3D ToF Camera: Technology and Cost Analysis

Description: Recently, camera modules in smartphones have evolved rapidly. All major players have adopted dual cameras. Now, with the Phab2Pro, Lenovo is the first to choose a different approach. As augmented reality plays a bigger part in consumer life, Lenovo is integrating a 3D Time-of-Flight (ToF) camera. The module features three cameras: one with high resolution, a global shutter motion detector and a Near Infra-Red (NIR) sensor.

The Lenovo Phab2Pro brings totally new functionality based on the Google Tango Project. This project, a collaboration including Infineon, pmd and Sunny Optical, has developed 3D ToF sensors for consumer applications.

The Phab2Pro implements this technology using a tri-camera sensor. The subsystem features a 16 megapixel resolution CMOS image sensor (CIS) from Samsung, a VGA resolution CIS with global shutter technology from Omnivision, and a 38 kilopixel resolution 3D Image Sensor from the collaboration between Infineon and pmd integrated into a subsystem with a NIR vertical-cavity surface-emitting laser (VCSEL).

To provide the 3D scene, the tri-camera's high-resolution camera supplies the texture and the global shutter camera supplies the motion-tracking. Finally, the ToF sensor supplies the depth perception at a high rate thanks to the VCSEL emitter, which gives the phone the ability to understand space and motion quickly, like a human.

The report includes technology and cost analysis of the 3D ToF sensor and technology analyses of the two other modules. These analyses provide the technical intelligence necessary to understand this technology.

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IR VCSEL
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Cross-section of the IR VCSEL
- Overview
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Motion detector and High Resolution Cameras Disassembly

- CISs view and dimensions
- CISs pixels

Cross-section of the camera modules: housing, flex PCB, IR filter, pads, CIS

ToF Manufacturing Process Flow

3D ToF front-end process

- IR VCSEL front-end process
- CIS wafer fabrication unit

Cost Analysis

The main steps used in the economic analysis

- Yield hypotheses
- 3D image sensor cost
- Front-end cost
- Filter and Microlens front-end cost
- Total front-end cost
- Back-end: tests and dicing
- Wafer and die cost

IR VCSEL cost

- Epitaxy step
- VCSEL epitaxy cost
- VCSEL front-end cost
- VCSEL wafer cost
- VCSEL cost per process steps

3D ToF Module Assembly Cost

- Lens module cost
- Final assembly cost
- 3D ToF module cost

Estimated Price Analysis

Motion detector and high resolution cameras prices

- Tri-camera 3D ToF module price

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