Latest developments in microbolometers detector technology

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1/ INTRODUCTION

The high level of accumulated expertise by ULIS and CEA/LETI on uncooled microbolometers made from an amorphous silicon layer enables ULIS to develop a full range of product from 160 x 120 to 384 x 288 (¼ VGA), 640 x 480 (VGA) and 1024 x 768 (XGA) with 25 µm and 17 µm pixel-pitch designed for high volume and high performance applications. These detectors have kept all the innovations developed on the full TV format ROIC (detector configuration by serial link, low power consumption or wide electrical dynamic range …).

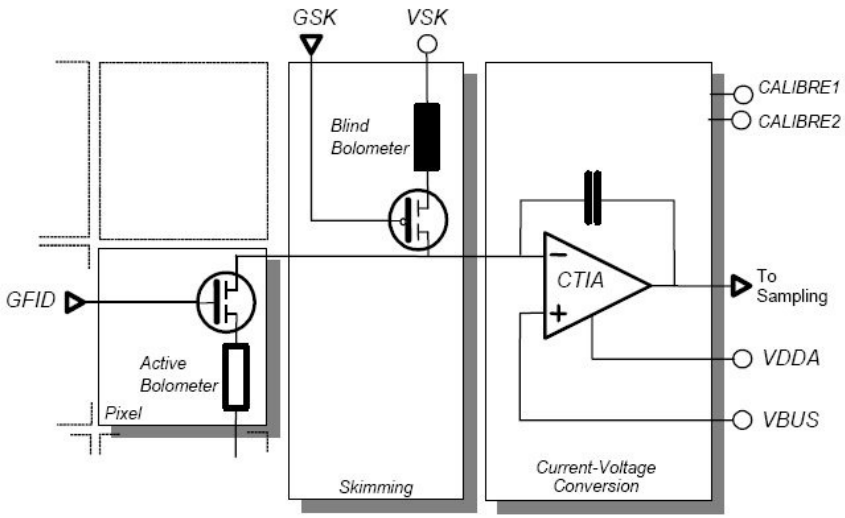

Figure 1: Schematic readout circuit architecture
of uncooled amorphous silicon IRFPA

Amorphous silicon material is well known for many applications and its use for uncooled infrared detector production benefits from a simple technology easier to master than other technologies making use of different sensitive material. By pushing the design rules closer to the limit, the amorphous silicon technology enables the manufacturing of detector arrays based on 25 µm as well as 17 µm pixel sizes and promises dramatic improvement in system size and cost while keeping the thermal time constant as low as < 10 ms.

2/ High volume product characteristics

The specific appeal of the high volume unit (160 x 120 and 384 x 288 / 25 µm), lies in the miniaturization of the TEC-less (Thermo-Electric Cooler) package and its extremely light weight. The reduction of the pixel-pitch and the innovative package turn this array into a low cost product well adapted for mass production.

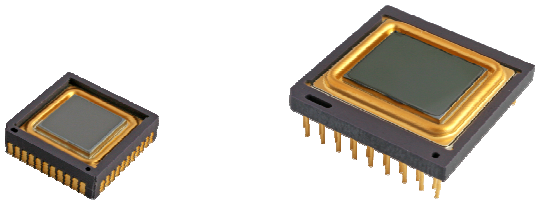

Figure 2: 160 x 120 (left) & 384 x 288 (right) High Volume Product

Mode	Power consumption (mW)	Responsivity (mV/K)	Dynamic range (°C)	NETD (mK)	τth (ms)	FPN/(temporal noise)
Analog	85	5.3	> 200	81	6	< 1
Digital	255	5.3	> 200	91	6	< 1

Table 1: Comparison of performance with analog or digital output

3/ High performance product characteristics

The sensor is optimized for high performance and uniformity. The figure 3 below shows a mean NETD lower than 30 mK (300 K, 60 Hz, f/1).

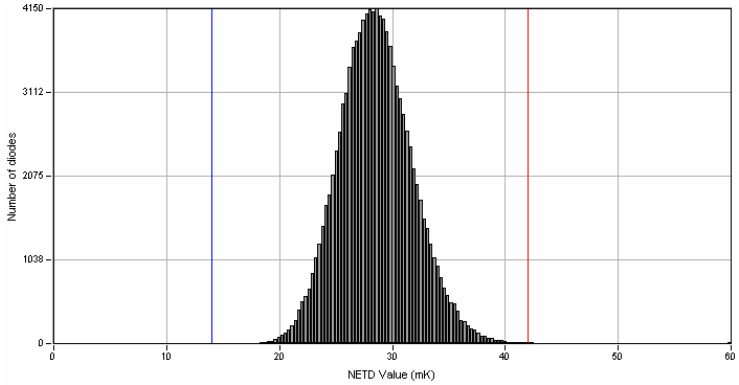

Figure 3: NETD distribution of a 384 x 288 / 25 µm array

Besides this 25 pixel pitch detector, a new family has been developed from 17 µm pixel pitch. A XGA format with NETD in the range of 40 mK has been demonstrated. Image quality is demonstrated by the following figure.

Figure 4: IR image obtained from 1024 x 768 / 17 µm sensor

4/ Conclusion

We have made a significant breakthrough in the uncooled amorphous silicon technology development to address high end and high volume applications. The development is focussed on pixel pitch reduction. Array of 1024 x 768 / 17 µm show high uniformity and performance and pave the way to smaller pixel devices.