



1 ToF Camera from TriDiCam GmbH.

## TOF IMAGE SENSORS

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The new Fraunhofer IMS SQCIF image sensor generation for scannerless, real-time, pulse-modulated time-of-flight range imaging cameras is employing a novel high-speed low-noise photodetector. It ensures high precision range measurement at harsh environmental conditions.

The SQCIF PM ToF image sensor is offering a very high degree of flexibility to the user. The sensor enables for instance variable pulse accumulation count settings to improve the precision and increase the dynamic range. The key feature, here, is that these multiple accumulations are realized in the charge domain within the photodetector, hence reducing kTC noise significantly. The sensor can operate with a variety of active light sources and diverse timing. However, it is recommended using the patented MSI scheme since it provides better ambient light suppression.

Linearization within a certain measurement range allows to yield the range information from the output signals by means of the simple formula

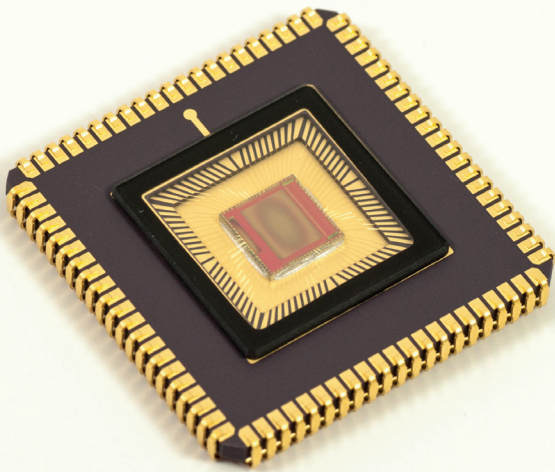
$$z = \frac{cT_{shutter}}{2} \frac{V_2 - V_3}{V_1 + V_2 - 2V_3}$$

which can be easily implemented. Usage of intelligent algorithms though allow to increase the measurement range significantly.

The dedicated ToF image sensors enable a multitude of applications in areas as:

- Industrial Imaging
- Machine Vision & Robotic
- Automotive
- Consumer Electronics
- Security and Surveillance



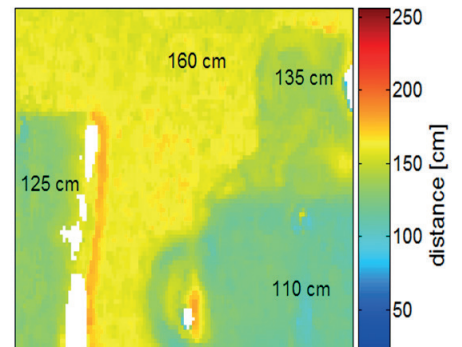


### Exemplary PM ToF Camera

Field-of-view	6° x 4,5°
Active light source	75W, 905 nm LASER module, 8 kHz repetition rate, 45 ns pulse width
Measurement range	≤ 2 m
Achieved precision	≤ σ = 4 cm; ≤ σ/Δz = 2 % @ R = 20 %; 10 % systematic error for z ≤ 150 cm @ accumulation count: 1000

### Specifications

Resolution	SQCIF (128 x 96)
Pixel pitch	40 x 40 μm <sup>2</sup>
Package	CQFJ84
Measurement range	adjustable
Frame rate	up to 50 fps
Accumulation count	adjustable
Short-time integration window	≥ 30 ns
Employable wavelengths	400 nm – 950 nm
Camera gain	0,14 DN/e <sup>-</sup>
Responsivity (@ 525 nm)	6 mDN/ph/pix
Linearity error according to EMVA1288	1,4 %
Read noise	700 μV
Full-well capacity	250 ke <sup>-</sup>
SNR <sub>max</sub>	54 dB
Optical dynamic range	70 dB
Linear output voltage swing	2 V
DSNU according to EMVA1288	2200 e <sup>-</sup>
PRNU according to EMVA1288	1,1 %
Dark current @ 28 °C	≤ 10000 e <sup>-</sup> /s



- 2 ToF Image Sensor.
- 3 Gray Scale Image.
- 4 Depth Image.