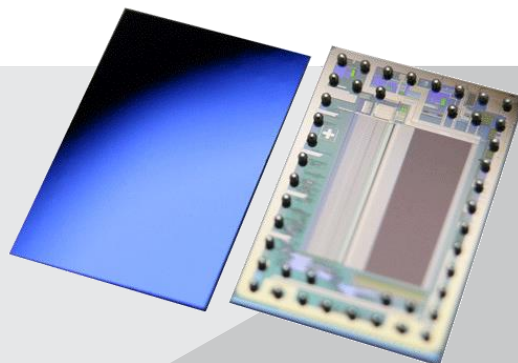




# XTOF-101-A Series



## TOF imager chip for optimized systems

The XTOF-101-A chip is a general-purpose, monolithic, fully integrated photoelectric CMOS device for optical distance measurements and object detection. Its working principle is based on 3D TOF measurement. It is a system-on-chip (SOC) device and contains:

- A full data acquisition path including the modulation driver for LEDs or Laser Diodes, the photo-receiver with an 160 x 60 pixel TOF/CCD array, signal conditioning, A/D converter and signal processing.
- An on-chip controller managing data acquisition and data communication.
- An I2C interface for command and a parallel TCMI for data communication.
- A supply-voltage power management unit.

Various modes allow the chip to operate as a very fast line range-finder chip or as an 160 x 60 TOF imager chip. By adding a small MCU and few external components, a TOF range-finder or a TOF camera with distance ranges of more than 200 m can be built.

The working principle is based on the time-of-flight (TOF) of photons emitted by the illumination and reflected back by the object to the photosensitive pixels. It measures the phase-shift between the emitted and received signal which is proportional to the distance. A very high photo-sensitivity and high resolution ADC allows measurement accuracy down to a centimeter depending on the lens, the illumination power and the modulation frequency.

Due to the unique CCD/CMOS technology, the TOF chip performance is just shot noise limited.

## APPLICATIONS

- Volumetric Measurement
- Door Sensors
- Collision Avoidance
- Gesture Sensing

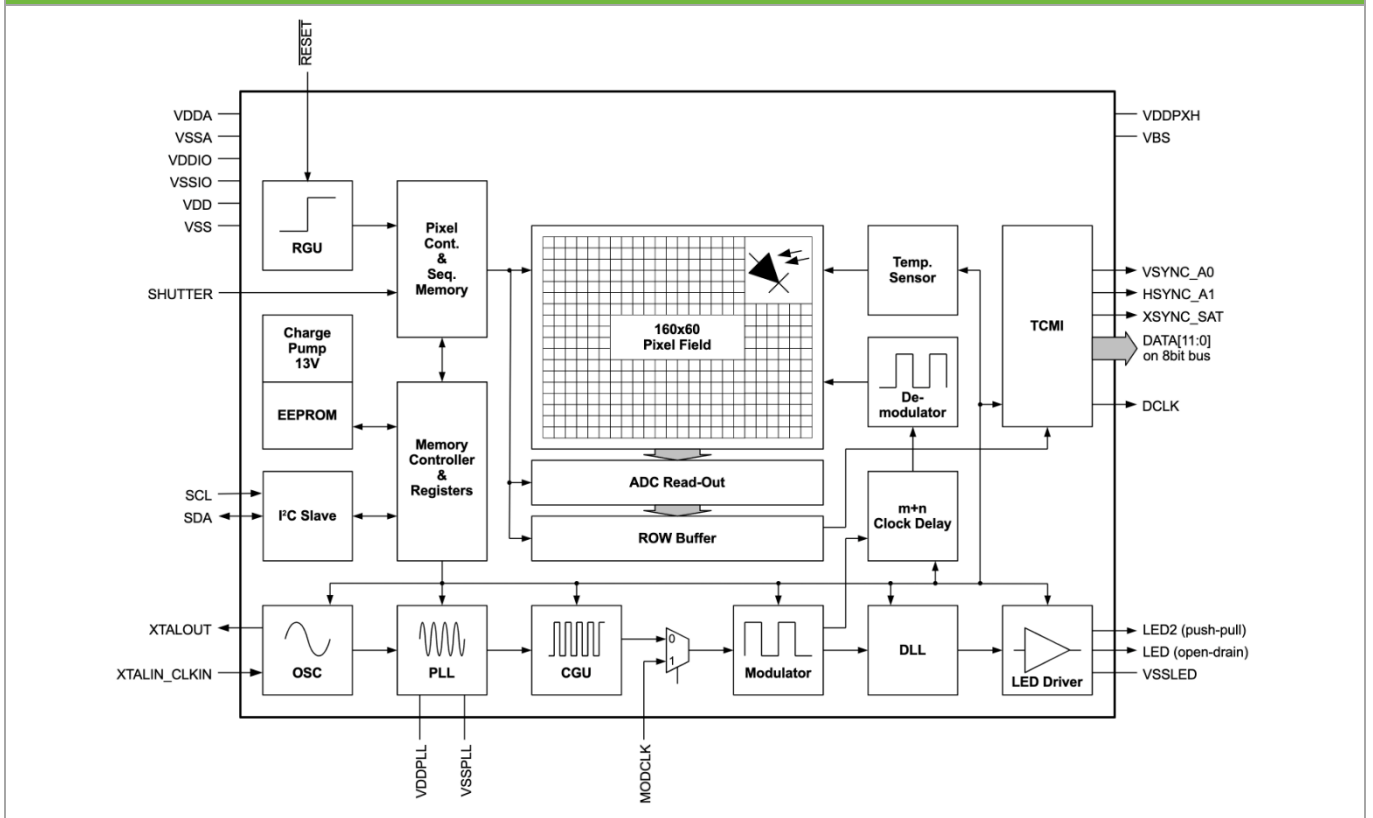
## YOUR BENEFITS

- Operating range of up to 240 m
- Very small footprint of 6.3 x 4.2 mm
- Up to 512 TOF frames per second
- Full ambient light tolerant (0 .. 100 kLux) with active ambient light suppression

## SPECIFICATIONS

- 160 x 60 pixel, pixel pitch 20  $\mu\text{m}$
- Quantum efficiency 90 % @ 850 nm
- Low power consumption of 300 mW
- Integrated illumination driver up to 200 mA
- Low distance noise of  $\leq 10$  mm @25% signal
- Output data with 12 bit resolution
- Pixel binning supported

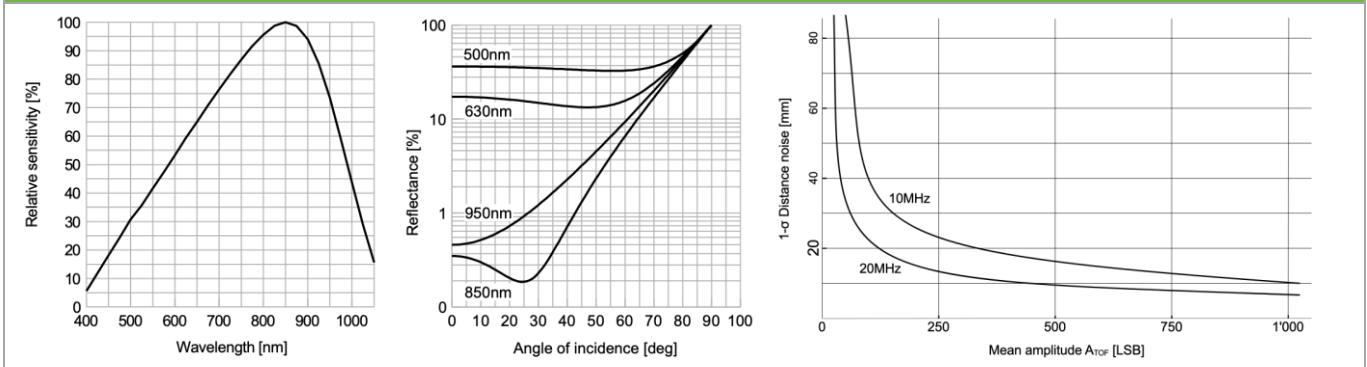
**FIG 1. BLOCK DIAGRAM**



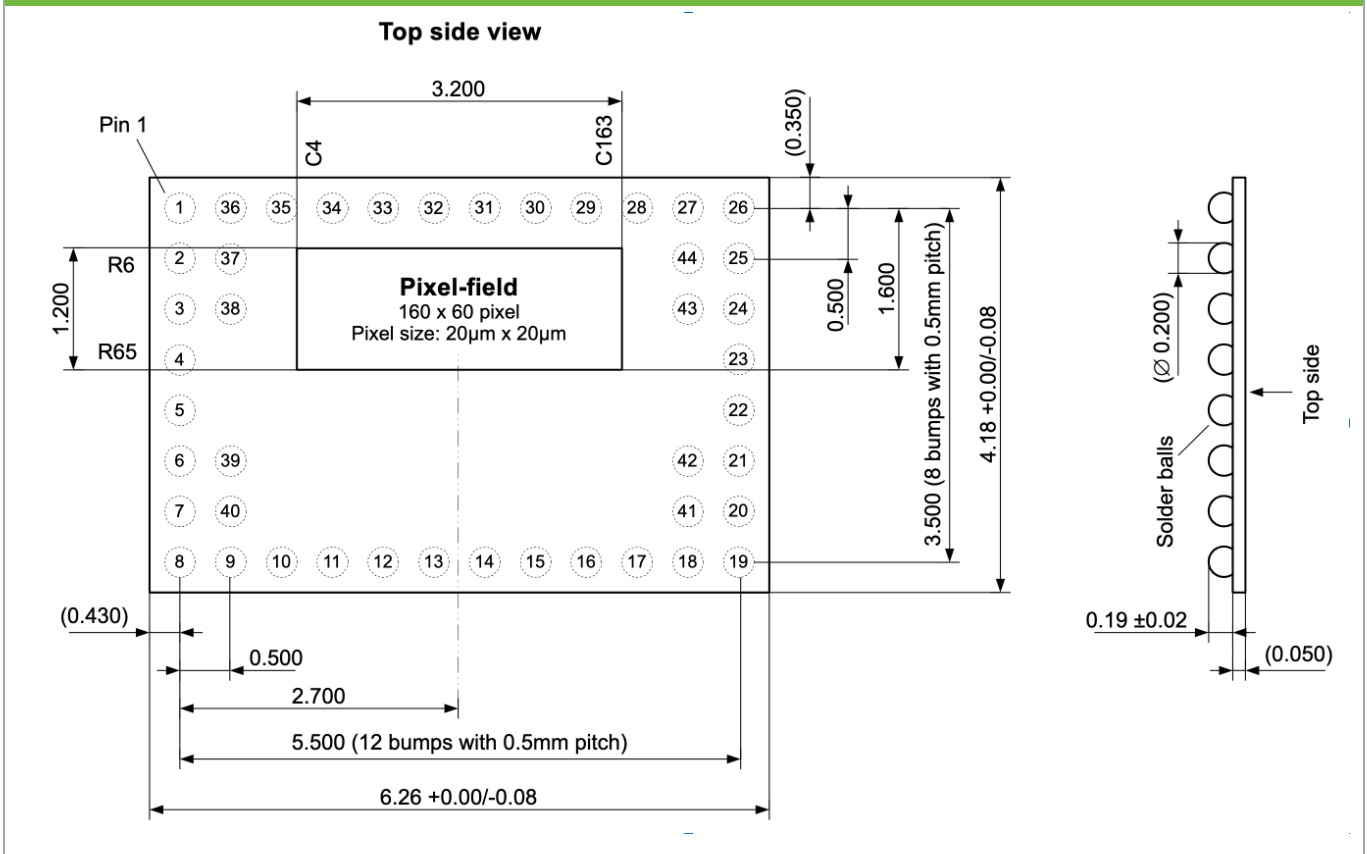
**Key characteristics**

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Supply Voltage		VDD	1.71	1.8	1.98	V
		VDDA	4.9	5.0	5.1	
		VDDPIX	9.5	10.0	10.5	
		VBS	-9.5	-10.0	-10.5	
Power consumption	Average w/o illumination	P		300		mW
Illumination Driver		I <sub>LED</sub>			200	mA
Pixel Pitch				20		µm
Optical fill factor				100		%
TOF Sensitivity	λ = 850 nm T <sub>int</sub> = 100 µs	S <sub>TOF</sub>	0.5	0.6	0.7	nW/mm <sup>2</sup> /LSB
Grayscale Sensitivity	λ = 850 nm T <sub>int</sub> = 100 µs	S <sub>Gr</sub>	0.19	0.25	0.31	nW/mm <sup>2</sup> /LSB
Optical Sensitivity	T <sub>int</sub> = 100 µs	H <sub>v</sub>		150k		LSB/Lux/s
Ambient light suppression	λ = 850 nm T <sub>int</sub> = 100 µs	E <sub>e</sub>		0.2		mW/mm <sup>2</sup>
Quantum Efficiency	λ = 850 nm	QE		85		%
Wavelength range		λ	400		1030	nm
Modulation frequency	Internal / External	f <sub>Mod</sub>	1.25 / 0.63		24 / 24	MHz
Parallel 8-bit TCMi		f <sub>SCKL</sub>		40	80	MHz
Programmable Delay Line	In 2.1 ns steps	t <sub>del</sub>	0		103	ns
3D TOF Pixel Rate		f <sub>pix</sub>		1.23	4.9	MPix/s
Temperature Range	Operating	T <sub>Op</sub>	-40		105	°C

**FIG 2. OPTICAL KEY PARAMETERS**



**FIG 3. MECHANICAL DIMENSIONS**



## Testing and operation methods

Excelitas verifies the electro optical specifications on every device. Electrical and imaging performance tests as well as visual inspection (AOI) during fabrication is performed as per our quality standard. Failed dies are removed.

Excelitas Technologies is certified to meet ISO-9001.

## Packaging and shipping

The devices are mounted on embossed tape for automatic placement systems. Tape width is 12 mm, pitch from part to part is 8 mm. The tape is wound on 178 mm (7 inch) or 330 mm (13 inch) reels and individually packaged for shipment. General tape-and-reel specification data are available in a separate datasheets and indicate the tape sizes for various package types. Further tape-and-reel specifications can be found in the Electronic Industries Association (EIA) standard 481-1, 481-2, 481-3.

## Storage and handling

Excelitas highly recommends following the notes below:

- Keep devices in an ESD controlled environment until final assembly.
- Open the sealed packing just before SMT assembly. Once the sealed packing is open, keep the devices under N2 atmosphere to avoid corrosion and oxidation of the solder ball surface.
- PCB design and SMD manufacturing process shall be according to our Chip-Scale Package Assembly Process Guidelines.

## RoHS compliance

This series of TOF imagers is designed and built to be fully compliant with the European Union Directive on restrictions on the use of certain hazardous substances in electrical and electronic equipment.



## Warranty

A standard 12-month warranty following shipment applies.





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XTOF-101-A\_Rev.2026.03.25