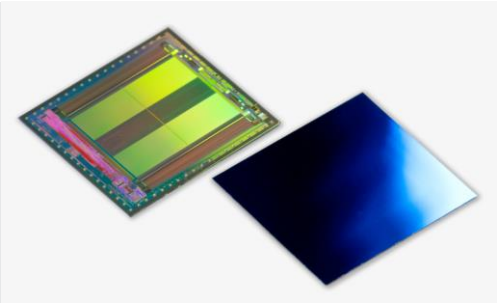
excelitas®

XTOF-102-A



High speed TOF imager chip

The XTOF-102-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 320 x 240 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.

By adding an MCU, an illumination systems and few external components, a powerful 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 Sensing
- Depth Sensing
- Robotics and Drone Navigation
- Smart Home Automation Sensors

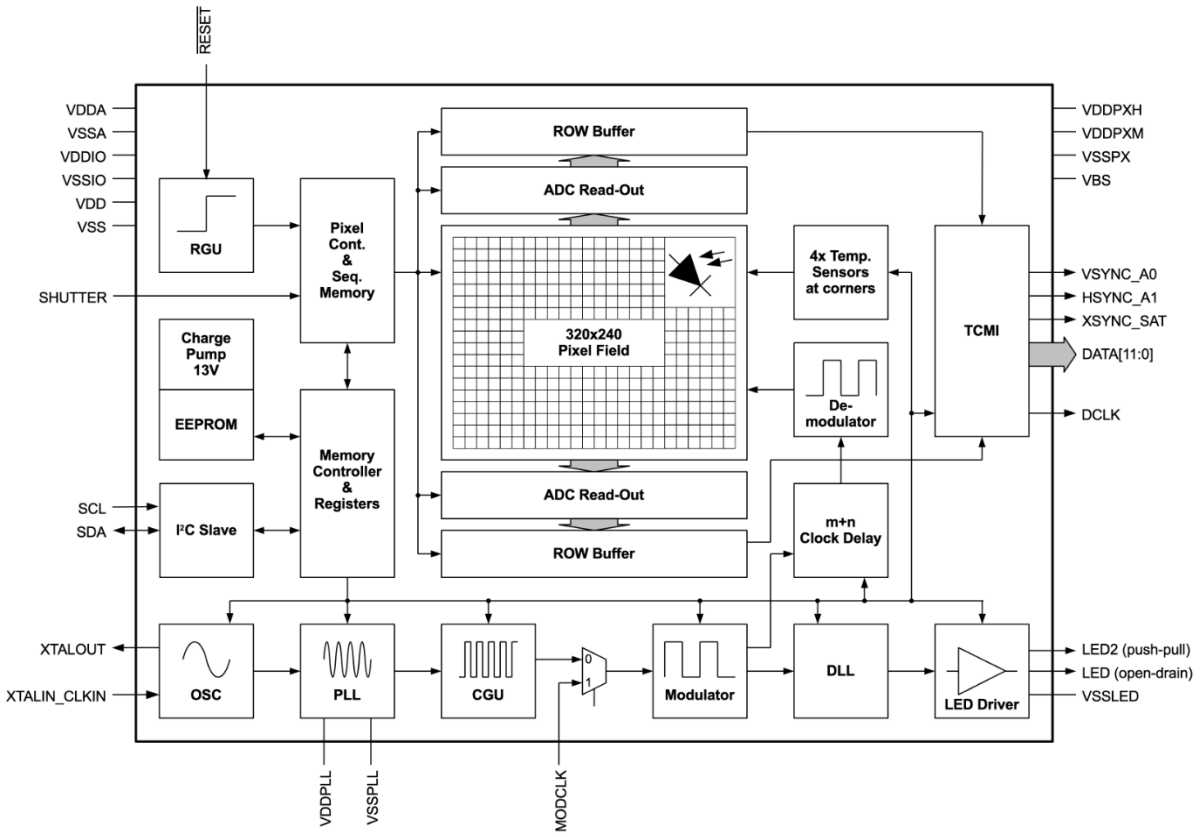
YOUR BENEFITS

- Operating range of up to 240 m
- Very small footprint of 9.7 x 8.7 mm
- Up to 158 TOF frames per second
- Full ambient light tolerant (0 .. 100 kLux) with active ambient light suppression

SPECIFICATIONS

- 320 x 240 pixel, pixel pitch 20 µm
- Quantum efficiency 85 % @ 850 nm
- Power consumption 750 mW
- Integrated illumination driver up to 200 mA
- Low distance noise of ≤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 VDDA VDDPIX VBS	1.71 4.9 9.5 -9.5	1.8 5.0 10.0 -10.0	1.98 5.1 10.5 -10.5	V
Power consumption	Average w/o illumination	P		750		mW
Illumination Driver		I_{LED}			200	mA
Pixel Pitch				20		µm
Optical fill factor				100		%
TOF Sensitivity	λ = 850 nm, T_{int} = 100 µs	S_{TOF}	0.5	0.6	0.7	nW/mm²/LSB
Grayscale Sensitivity	λ = 850 nm, T_{int} = 100 µs	S_{Gr}	0.19	0.25	0.31	nW/mm²/LSB
Optical Sensitivity	T_{int} = 100 µs	H_v		150k		LSB/Lux/s
Ambient light suppression	λ = 850 nm, T_{int} = 100 µs	E_e		0.2		mW/mm²
Quantum Efficiency	λ = 850 nm	QE		85		%
Wavelength range		λ	400		1030	nm
Modulation frequency	Internal / External	f_{Mod}	1.25 / 0.63		24 / 24	MHz
Parallel 12/8-bit TCMI		f_{SCKL}		24	48	MHz
Programmable Delay Line	In 2.1 ns steps	t_{del}	0		103	ns
3D TOF Pixel Rate		f_{Pix}		3	12	MPix/s
Temperature Range	Operating	T_{Op}	-40		105	°C

FIG 2. TYPICAL QUANTUM EFFICIENCY

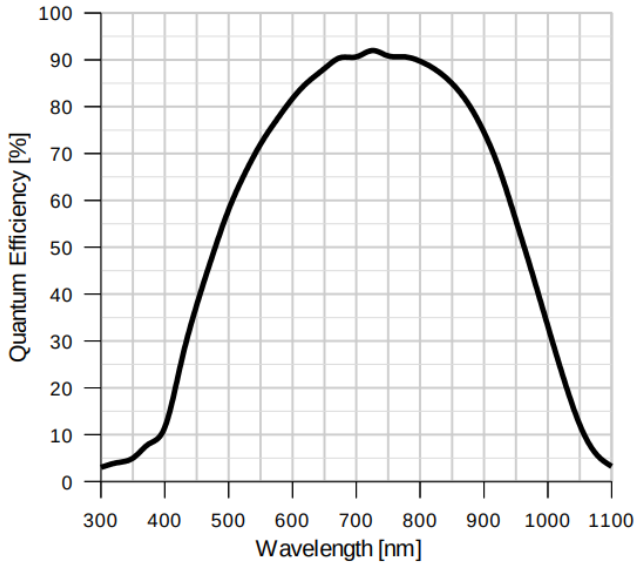


FIG 3. TYPICAL DISTANCE NOISE

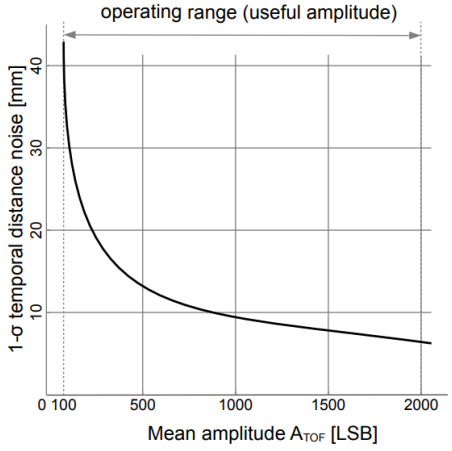


FIG 4. TYPICAL TOF SENSITIVTY TEMPERATURE COEFFICIENT

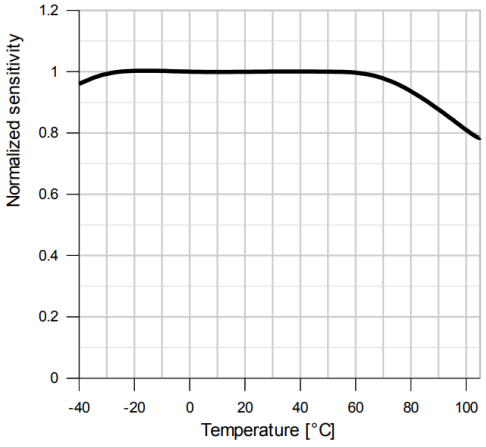
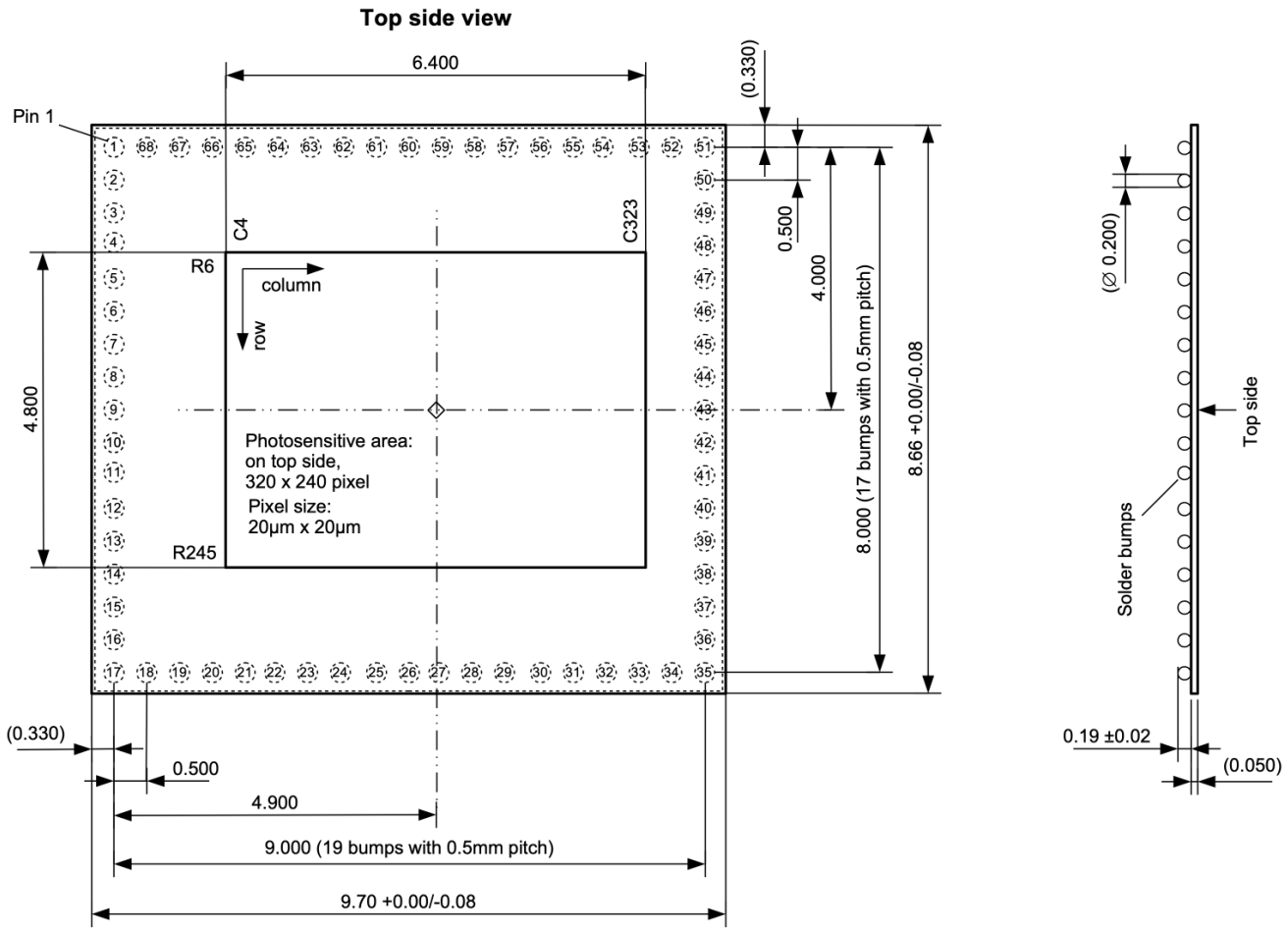


FIG 5. MECHANICAL DIMENSIONS



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 delivered on JEDEC tray for 26 x 8 pieces, maximum quantity 208 pieces per tray. Further tray specifications can be found in the JEDEC Association standard JEP95.

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 chips 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.

Excelitas Technologies
22001 Dumberry Road
Vaudreuil-Dorion, Quebec
Canada J7V 8P7
Telephone: (+1) 450.424.3300
Toll-free: (+1) 800.775.6786
Fax: (+1) 450.424.3345

Excelitas Technologies GmbH & Co. KG
Wenzel-Jaksch-Str. 31
D-65199 Wiesbaden
Germany
Telephone: (+49) 611 492 430
Fax: (+49) 611 492 165

Excelitas Technologies Singapore, Pte. Ltd.
8 Tractor Road
Singapore 627969
Telephone: (+65) 6775 2022 (Main number)
Telephone: (+65) 6770 4366 (Customer Service)
Fax: (+65) 6778-1752

For a complete listing of our global offices, visit **www.excelitas.com/locations**

XTOF-102-A_Rev.2026.03.25