

Diagonal 6.25 mm (Type 1/2.9) SPAD ToF Depth Sensor with Signal-amplifying Pixels

Description

The IMX560-AAMV is a diagonal 6.25 mm (Type 1/2.9) Single Photon Avalanche Diode (SPAD) ToF Depth Sensor with signal-amplifying pixels. By arraying the 597 × 168 number of SPADs and summing their outputs, the 3D distance images can be generated from the distance information, and it can be achieved a measurement distance of up to 300 m. The number of SPADs (size of a macro pixel) at the time of ranging operation can be adjusted according to the application. The ranging operation is operated by 1 GHz sampling, and the function of generating a histogram with ToF width of 2024 bins (2024 ns) and grayscale width of 12 bits and it can be detecting echo and peak of the emitted light from the result. Its ambient light elimination function ensures that it works more stably under sunlight and can achieve distance measurements with a high dynamic range. Its light emission timing control function is able to compensate for the delay in timing between laser emission and reception. Equipped with echo and peak detection functions, ranging data output modes, digital signal processing, and more, it is optimized to meet the performance and functionality required by LiDAR.

(Applications: FA LiDAR cameras, Industrial LiDAR cameras)

Features

- ◆ SPAD signal-amplifying pixels
- ◆ Number of effective SPAD pixels
597 (H) × 168 (V) approx. 100 k SPAD pixels
- ◆ CRA: 0 degrees
- ◆ Input frequencies: 16 MHz, 20 MHz, 24 MHz, 30 MHz
- ◆ External communication interfaces
 - I2C communication
 - SPI communication
- ◆ Output interface
 - MIPI CSI-2 serial output (4 lanes / 2 lanes)
- ◆ Readout modes
 - Line mode
 - Array mode
- ◆ Output formats
 - Ranging data output mode (RAW12, ToF width: 2024 bins, gray scale width: 12 bits)
 - Echo output mode (RAW12, ToF width: 2024 bins, gray scale width: 12 bits)
 - Histogram output mode (RAW12, ToF width: 2024 bins, gray scale width: 12 bits)
- ◆ Variable pixel size, region of interest (ROI) function
- ◆ Ambient light monitor function
 - Ambient light count width: 22 bits
- ◆ Emission timing control function
- ◆ Histogram generation function
- ◆ Echo and peak detection functions

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Device Structure

◆ SPAD ToF Depth Sensor		
◆ Image size	Diagonal 6.25 mm (Type 1/2.9)	
◆ SPAD unit cell size	10.08 μm (H) × 10.08 μm (V)	
◆ Element size	3 (H) × 3 (V) SPAD pixels	
◆ Number of physical active SPAD pixels *1	600 (H) × 189 (V) approx. 110 k SPAD pixels	
◆ Number of effective SPAD pixels	597 (H) × 168 (V) approx. 100 k SPAD pixels	
◆ Substrate material	Silicon	
◆ Package	152 pin BGA	15.35 mm (H) × 15.65 mm (V)

*1 Including non-effective pixels and monitor pixels.

Sensor Characteristics

Item	Characteristics			Unit	Remarks
	Min.	Typ.	Max.		
Breakdown voltage	-24.5	(-22.5)	-17	V	—
Dark count rate	—	(3.5 k)	6 M	cps	Average per SPAD
Photon detection efficiency	10	(24)	—	%	Average per SPAD
Dead time (Pulse width, accumulation 99 %)	—	(15)	(20)	ns	Average per SPAD
Dead time (Pulse width, most frequent)	—	(9)	11.5	ns	Average per SPAD

Note: Values in parentheses are for reference only.

Operating Modes (Ranging Mode)

Number of pixels	One Pixel configuration (H × V SPAD)	SPAD on period	TDC	Up Sample	Ranging possible distance	Ranging resolution	Minimum slot rate	Remarks
192 pixels	3 × N	1.000 μs	1 GHz	× 1, × 2 coarse	150 m	15 cm	50 μs	Output data needs to be reduced
96 pixels	6 × N	2.024 μs			303 m		50 μs	—
48 pixels	12 × N	2.024 μs			303 m		50 μs	—
192 pixels	3 × N	2.000 μs	0.5 GHz	× 1, × 2 coarse	300 m	30 cm	50 μs	Output data needs to be reduced
96 pixels	6 × N	2.024 μs			303 m		50 μs	—
48 pixels	12 × N	2.024 μs			303 m		50 μs	—

Prerequisites: Ranging mode, MIPI 2 Gbps/lane, 4 lanes

N = 1 to 21

