1.2 MP Smart iToF 1/3.2-inch Stacked BSI Global Shutter Depth Sensor AF0130, AF0131

onsemi AF0130 and AF0131 Smart Indirect Time of Flight (iToF) sensors are a 1/3.2-inch optical format, back side illuminated CMOS global shutter depth and imaging solution. The sensors have on-chip dual laser driver controls and modulation frequencies (up to 200 MHz) as well as on-chip laser eye-safety thresholds.

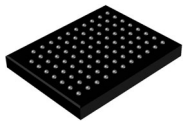
The AF0130 sensor version comes with a depth processing ASIC stacked below its pixel area which calculates depth, confidence and intensity maps at high speeds from its laser modulated exposures.

The AF0131 sensor version does not come with on-chip depth processing but does come with the same performance. This sensor is for solutions which prefer their own depth calculations off-chip.

Table 1. KEY PERFORMANCE PARAMETERS

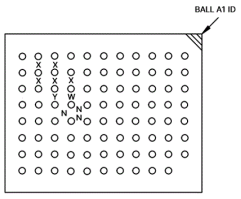
Parameter	Typical Value
Optical Format	1/3.2 inch (5.60 mm, 4:3 Aspect Ratio)
Active Pixels	1280 (H) x 960 (V)
Pixel Size	3.5 x 3.5 μm Back Side Illuminated (BSI)
Chief Ray Angle	30°
Shutter Type	Global Shutter
One-Time Programmable Memory (OTPM)	Three instances of 1024 x 24 bits
Input Clock Range	10–30 MHz
Interface	– *Data:* MIPI (2 Lanes, 2 Gbps/lane) – *Host:* Two-Wire / Four-Wire – *Laser Driver:* Three-Wire – *Laser Modulation:* LVDS
ADC Resolution	10–11 bit
Analog Gain Range	1–7.75x gain
Frame Rate	Mode 2.2: Max 60 fps (1.2 MP), 110 fps (VGA) Mode 3.2: Max 54 fps (VGA)
Read Noise	<6 e^- with on-chip memory ($C_{1:4}$) <3 e^- from storage gates ($SG_{1:2}$)
Binning	2x2, 4x4
SNR_{MAX} (60 °C)	Mode 2.2: 46 dB (RAW), 52 dB (Intensity) Mode 3.2: 52 dB (RAW), 58 dB (Intensity)
Dynamic Range (60 °C)	Mode 2.2: 64 dB (RAW), 69 dB (Intensity) Mode 3.2: 67 dB (RAW), 72 dB (Intensity)
Supply Voltage I/O Digital Analog	1.2 V, 1.8 V, 2.8 V
Power Consumption (Note 1)	For 30 fps and 1 ms exposure: ~ 600 mW in Mode 2.2 (100 MHz) ~ 900 mW in Mode 3.2 (100+120 MHz)
Operating Temperature	–30 °C < T_J < +85 °C
Optimal Performance Temperature	0 °C < T_J < +60 °C
Package Options	– CSP (6.06 x 4.84 mm) 11x8 pin, 0.5 mm pitch – Bare Die
θJA: °C/W (Note 2)	32.0
θJB: °C/W	10.0

1. Power consumption will increase with exposure time, frame rate and modulation frequency due to AVDD_MG supply.
2. θJA is dependent on the customer module design and should not be used for calculating junction temperature.



ODCSP87 6.05x4.83x0.63, 0.50P
CASE 570AZ

MARKING DIAGRAM



XXXX = Specific Device Code
Y = Year
W = Work Week
NNN = Serial Number

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

Non–NDA Data Sheet

Interested in what you see? If you would like more detailed information, please request the full version of our data sheet.

Request Full Data Sheet

Features

- 1.2 MP CMOS Smart iToF Sensor with Advanced 3.5 μm Pixel Stacked BSI Technology
- Superior Low-Light and Ambient-Light Performance
- Enhanced NIR Response at 850 nm and 940 nm Wavelength (QE > 40%)
- Dual Laser (Frequency) Operation for Increased Depth Range (Disambiguation) in VGA Resolution
- Low Voltage Differential Signal (LVDS) Driver for Modulation Control of Two Lasers up to 200 MHz
- Two or Four-Wire Serial Interface for Register Access
- 2 Gbps/Lane, 2-lane MIPI CSI-2 D-PHY Data Interface
- Laser Eye Safety Monitoring
- Three Output Mode: RAW, Data Reduction (DR), Integrated Depth Processing (DP)
- Phase and Pulsed (Hybrid) Modulation Support
- Simultaneous Depth, Confidence and Grayscale Output
- Horizontal and Vertical Mirroring, Windowing and Pixel Binning
- Context State Machine with 64 Programmable Contexts
- Automatic Exposure Control (AEC)
- Pixel Identification & Correction (PDI & PDC)
- Multi Camera and Interference Mitigation
- Reduced Motion Artefacts due to Decoupling between Integration and Readout
- Hardware Trigger Control
- On-Chip Mean and Histogram Statistics for Smart Control
- On-Chip Temperature Sensor
- These Devices are Pb-Free and RoHS Compliant

Applications

- Computing
- Drones, Robotics & Automation
- Metrology
- Machine Vision
- Future Retail & Intelligent Logistics
- Security & Access Control
- Virtual or Augmented Reality
- 3D Modeling

Table 2. ORDERING INFORMATION – PART

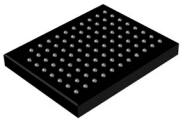
Part Number	Container Qty	Product Description	On-chip Depth Processing	Protective Film
AF0130CSSM30SMKA1−CP	3000	AF0130 REV2 Production Samples (AF0131 + Depth, Confidence & Visual)	yes	yes
AF0130CSSM30SMKA1−CP2	50			
AF0131CSSM30SMKA1−CP	3000	AF0131 REV2 Production Samples (RAW, DR, 1.2 MP, 30° CRA)	no	yes
AF0131CSSM30SMKA1−CP2	50			
AF0130CSSM30SMKA1−CR	3000	AF0130 REV2 Production Samples (AF0131 + Depth, Confidence & Visual)	yes	no
AF0130CSSM30SMKA1−CR2	50			
AF0131CSSM30SMKA1−CR	3000	AF0131 REV2 Production Samples (RAW, DR, 1.2 MP, 30° CRA)	no	no
AF0131CSSM30SMKA1−CR2	50			

Table 3. ORDERING INFORMATION – EVALUATION BOARD

Part Number	Product Description
AF0130CSSM30SMKAH3-GEVK	AF0130 Sensor Headboard + Lens (940 nm filter, 65° HFOV)
AGBENECS-GEVK	Laser Headboard (4 VCSEL's, 60° HFOI)
AGB1N0CS-GEVK	Demo 3 Board (FPGA Base Board including USB Cable and Tripod)

NOTE: While Hybrid mode enhances ambient light rejection, similar benefits can also be achieved in standard CW operation by using higher optical peak power in combination with shorter integration times. This approach is generally recommended for ambient suppression without the added complexity of Hybrid mode.

This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.



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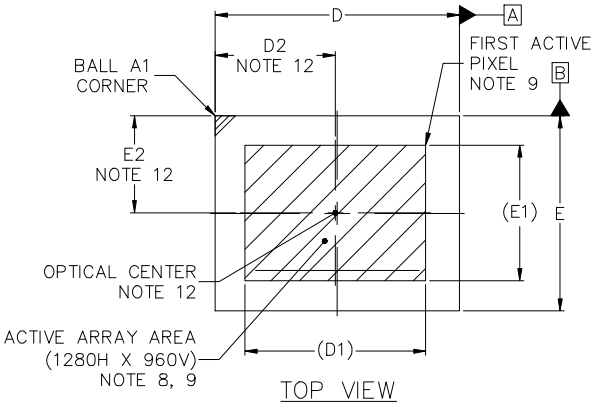
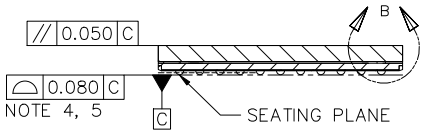
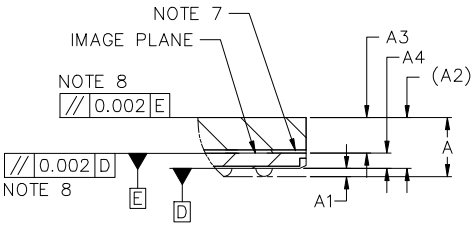
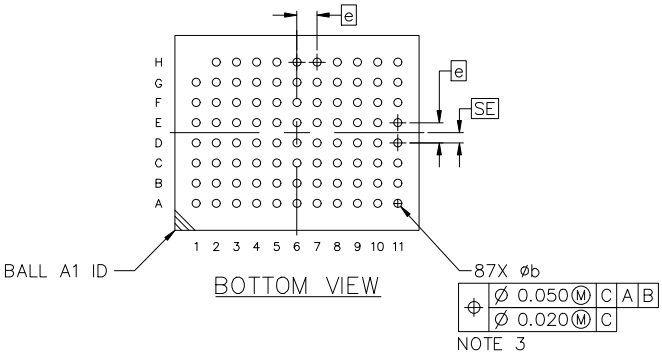
DATE 17 JUN 2024





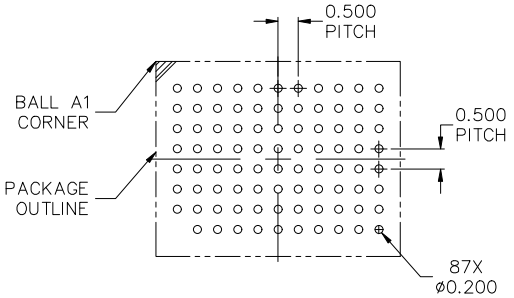




DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	0.762
A1	0.081	0.101	0.121
A2	0.631 REF.		
A3	0.425	0.440	0.455
A4	0.171	0.191	0.211
b	0.184	0.204	0.224
D	6.030	6.055	6.080
D1	4.480 REF.		
D2	2.956	2.981	3.006
E	4.810	4.835	4.860
E1	3.360 REF.		
E2	2.380	2.405	2.430
e	0.500 BSC		

NOTES:

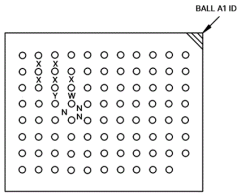
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5–2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. SOLDER BALL DIAMETER IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER PARALLEL TO DATUM C.
4. COPLANARITY APPLIES TO THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. DATUM C, THE SEATING PLANE IS DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
6. GLASS: 0.400 THICKNESS; REFRACTIVE INDEX = 1.52.
7. AIR GAP BETWEEN GLASS AND PIXEL ARRAY: 0.040 THICKNESS.
8. PARALLELISM APPLIES ONLY TO THE ACTIVE ARRAY.
9. MAXIMUM ROTATION OF ACTIVE ARRAY RELATIVE TO DATUMS A AND B IS ±0.1°.
10. REFER TO THE DEVICE DATA SHEET FOR TOTAL PIXEL ARRAY DEFINITIONS.
11. PACKAGE CENTER (X, Y) = (0.000, 0.000).
12. OPTICAL CENTER RELATIVE TO PACKAGE CENTER (X, Y) = (−0.046, 0.012).



RECOMMENDED MOUNTING FOOTPRINT*

*FOR ADDITIONAL INFORMATION ON OUR Pb–FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



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*This information is generic. Please refer to device data sheet for actual part marking. Pb–Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

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