Product Specification

Product: InnoCAM_DCM_AR1335PDAF

Part Number: INV-AR1335AF-13MP

Revision: Rev 1.2

Document No: INV307

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REVISION HISTORY

Revision	Description of change	Changed by	Date
1.0	Initial Draft	Jamie Lynn	02/01/2023
1.1	Updated with new connector and pinout	Jamie Lynn	07/13/2023
1.2	Updated with Schematic	Jamie Lynn	08/02/2023
1.3			

APPROVAL

Company	Name	Signature	Date
InnoWave Design LLC	Jamie Lynn		08/09/2023
InnoWave Design LLC	Tony Reed		08/11/2023

Contents

1. General

The camera module INV-AR1335AF-13MP has the On-Semi AR1335 color CMOS 13-megapixel sensor with 1.1-micron pixelarchitecture, auto focus lens, VCM, and FPC.

1.1. Specifications

Make and Model	On Semi AR1335
Optical format	1/3.2 -inch 13 MP (4:3)
Active pixels	4208H x 3120V
Pixel size	1.1mm Back Side Illuminated (BSI)
Chief ray angle (CRA)	32°
Die size	6.3 mm x 5.7 mm
Input clock frequency	6 - 48 MHz
Interface	4-lane MIPI (2- and 3-lane supported); Max data rate: 1.2Gbps/lane
Subsampling modes (column and row)	skip2 bin2 skip3 bin3 skip4 bin4 skip2bin2
ADC resolution	10 bits, on-die
Analog gain	1x – 7.75x
Digital gain	Up to 7.98x
Scaler	Adjustable scaling up to 8x
Temperature sensor	10-bit, controlled by two-wire serial I/F
Compression	DPCM: 10-8-10, 10-6-10
3D support	Frame rate and exposure synchronization
Supply voltage	
VAA, VAA_PIX	2.6 - 2.9 V (2.7 V nominal)
VDD_IO, VDDIO_ANA	1.7 - 1.9 V (1.8 V nominal)
VDD, VDD_ANA, VDD_PLL, VDD_PHY	1.14 - 1.3 V (1.2 V nominal)
Power consumption	270 mW at 60°C (TYP) at 13 Mp 30 fps
Responsivity	4700 e-/lux-sec
SNRMAX	37 dB
Dynamic Range	69 dB
Guaranteed Temperature Ranges	Operating -20C to+70C
	Storage -30 to +80C
	Performance -20C to +60C
Connector	OK-14-GM030-04
Lens Manufacturer	Largan
Lens Model	50065B
Construction	5P
Lens Type	Auto Focus
Maximum Image Circle	6.17 mm

Field of View (FOV) degrees	Vertical 51.6
	Horizontal 66.2
	Diagonal 78.4
Aperture (F#)	2 +/-5%
EFL	3.57
Relative illumination at sensor corner	34%
Distortion (TV)	<2%
Distortion (Optical)	<1.5%
Lens CRA	34.6 degrees
Lens Resolution (MTF)	
On Axis	32%(S、T)
	59%(S、T)
	77%(S、T)
80% Field	24%(S)、3%(T)
	49%(S)、42%(T)
	70%(S)、66%(T)
Focus Range	8cm to infinity
Calculated Hyperfocal distance	2.993cm
IR Filter Thickness	0.21mm
IR Filter Cutoff	650nm
Thread	M6.5 * P0.25
VCM	Suzhou LY13T6501-1
VCM Driver	Zinitix WV511A
Maximum Allowable Current	100mA (max)
Terminal Resistance	20 +/-2 Ω
Motor Size	8.5×8.5×3.65 mm
Dynamic Tilt	<= 10'
Sensitivity	5 +/-3μm/mA
Starting Current	20mA~40mA
Hysteresis	±10μm
Rated Stroke	≥200μm(@80mA (face up)
Sensitivity	3μm/mA~8μm/mA
Starting Current	20mA~40mA
Hysteresis	±10μm Max
Rated Stroke	≥200μm(@80mA (face up)

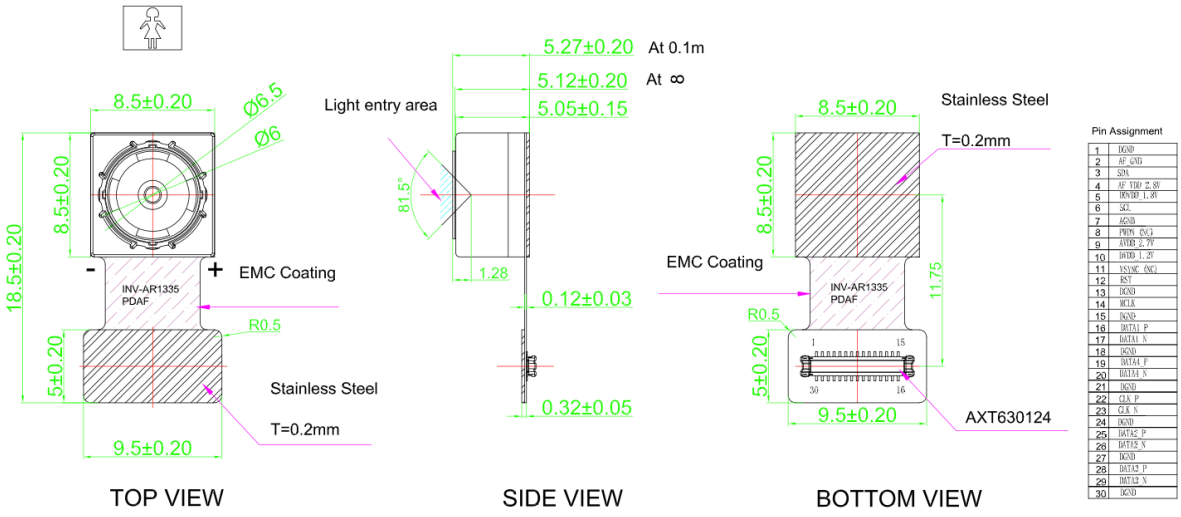
Table 1: Specifications

1.2. Sensor Features

- 13 MP CMOS sensor with advanced 1.1 m pixel BSI
- technology
- Data interfaces: two-, three-, and four-lane serial mobile industry processor interface (MIPI)
- Bit-depth compression available for MIPI Interface: 10-8 and 10-6 to enable lower bandwidth receivers for full frame rate applications
- 3D synchronization controls to enable stereo video capture
- 6.8 kbits one-time programmable memory (OTPM) for storing shading correction coefficients and module information
- Programmable controls: gain, horizontal and vertical blanking, auto black level offset correction, frame size/rate, exposure, left-right and top-bottom image reversal, window size, and panning
- Two on-die phase-locked loop (PLL) oscillators for super low noise performance
- On-chip temperature sensor
- Bayer pattern horizontal down-size scaler
- Simple two-wire fast-mode+ serial interface
- Low dark current
- Interlaced multi-exposure readout enabling High Dynamic Range (HDR) still and video applications
- On-chip lens shading correction
- Support for external mechanical shutter
- Support for external LED or Xenon Flash
- Extended Flash duration up to start of frame readout

1.3. Layout

Figure 1: Camera module assembly layout



1.4. Mode of Operation and Power

Mode	Resolution	Readout Configuration	HFOV	FPS	Power Consumption [mW]
4:3 Snapshot Mode					
13 M full resolution	4208x3120	13M full mode	100%	30	270
13 M full resolution	4208x3120	13M full mode	100%	24	250
VGA	640 x 480	Crop+Subsampling+Scaling	61%	120	190
QVGA	320 x 240	Crop+Subsampling+Scaling	30%	240	165
16:9 Video Mode 30 FPS					
4K UHD	3840 x 2160	Cropping	91%	30	230
4K Cinema	4096 x 2160	Cropping	97%	30	235
1080p	1920 x 1080	Crop+Subsampling+Scaling	91%	30	160
1080p LP	1920 x 1080	Crop+Subsampling+Scaling	91%	30	135
720p	1280 x 720	Crop+Subsampling+Scaling	91%	30	140
16:9 Video Mode 60 FPS					
1080p	1920 x 1080	Crop+Subsampling+Scaling	91%	60	210
1080p LP	1920 x 1080	Crop+Subsampling+Scaling	91%	60	180
720p	1280 x 720	Crop+Subsampling+Scaling	91%	60	175
3M 30 FPS					
3M	2000 x 1500	Crop+Subsampling+Scaling	95%	30	195
3M LP	2000 x 1500	Crop+Subsampling+Scaling	95%	30	170
16:9 Video Mode 120 FPS					
720p	1280 x 720	Crop+Subsampling+Scaling	91%	120	260

Table 3: Mode of Operation and Power

1.5. Recommended Operation Voltage

Symbol	Parameter	Condition	Min	Typ	Max	Unit
VDD_IO	I/O digital voltage	–	1.7	1.8	1.9	V
VDD	Digital voltage	–	1.14	1.2	1.3	V
VDD_PHY	PHY digital voltage	–	1.14	1.2	1.3	V
VAA	Analog voltage	–	2.6	2.7	2.9	V
VAA_PIX	Pixel supply voltage	–	2.6	2.7	2.9	V

Table 4: Recommended operation voltage

2. Environment Requirements

2.1. Operating Temperature

The camera module shall be fully functional when ambient temperature is between -20°C to 60°C with image qualityremaining stable. Test duration is 24 hours.

2.2. Storage Temperature

The camera module shall withstand storage temperatures between -30°C to 70°C. Test duration is 48 hours.

2.3. Humidity

The camera module shall withstand humidity at or below 90% RH under non-condensing conditions for 24 hours.

2.4. Thermal Shock

The camera module shall withstand the following temperatures (with humidity off)
-30°C to 70°C
20 min cycles (10 min dwell, 5 min ramp, 10 min dwell)

2.5. High Temperature Test

60C, humidity off, 24 hours

2.6. Low Temperature Test

-20C, humidly off, 24 hours

Stable image is -30°C to 70°C junction temperature. The sensor functions but image quality may be noticeablydifferent at temperatures outside of stable image range. Image quality remains stable between 0°C to 50°C.

3. Reliability Requirements

3.1. Drop Test

The camera module shall withstand a 1.2m Drop in packaging onto Concrete (12 drops) Random Positions

3.2. Random Vibration

The camera module shall withstand vibration of the following conditions
Frequency range: 50Hz
Amplitude：2mm Duration 10 minutes for each
positionTest all 3 axes (X, Y, Z)

3.3. Salt Fog Test

Condition: 5%nacl solvent Test duration: 24H

3.4. ESD (Electronic Discharge)

INV-AR1335AF-13MP
The camera module shall withstand Electrostatic
Discharge of8KV Contact Discharge
12KV Air
Discharge 10 Times
for a Second

4. Product Performance Verification

To verify the camera module performance, the following tests will be conducted at either the factory during production or as an initial qualification characterization at the InnoWave laboratory.

4.1. Electrical Parameters

Parameter	Test Frequency
Current consumption – Standby	Initial Qualification
Current consumption – Idle	Initial Qualification
Current consumption – Viewfinder	Initial Qualification
Current consumption – Capture	Initial Qualification

Table 5: Electrical parameter measurements

4.2. Mechanical Parameters

Parameter	Test Frequency
X Dimension (mm)	Initial Qualification
Y dimension (mm)	Initial Qualification
Z Dimension (mm)	Initial Qualification

Table 6: Mechanical parameter measurements

4.3. Environmental and Reliability Test Parameters

Parameter	Test Frequency
Thermal Shock	Initial Qualification
Humidly	Initial Qualification
High Temperature Test	Initial Qualification
Low Temperature Test	Initial Qualification
Drop Test	Initial Qualification

Random Vibration Test	Initial Qualification
Salt Fog Test	Initial Qualification
ESD Test	Initial Qualification

Table 7: Environmental and Reliability parameter measurements

5. Product Identification TBD

All modules will be marked with an identification number using laser marking or bar code label.

9 Packaging

The package will prevent damage to the components during transport and will be suitable for electrostatic-sensitive devices. The single camera modules shall be delivered in a reusable trayof anti-static plastic material. Several cameras shall be packed in one tray.
The tray has separate holders for each camera module.

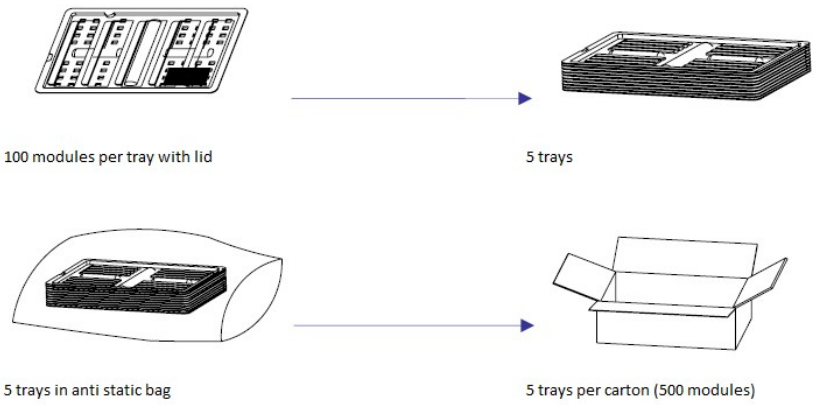


Figure 4: Packaging Example