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## Product Specification

**Product:** InnoCAM\_DCM\_OV2640FF-2MP

**Part Number:** INV-OV2640FF-2MP

**Revision:** Rev 1.2

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INV-OV2640FF-2MP

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#### REVISION HISTORY

| Revision | Description of change | Changed by | Date       |
|----------|-----------------------|------------|------------|
| 1.0      | Initial Draft         | Jamie Lynn | 12/12/2023 |
| 1.1      |                       |            |            |
| 1.2      |                       |            |            |
| 1.3      |                       |            |            |
|          |                       |            |            |
|          |                       |            |            |
|          |                       |            |            |
|          |                       |            |            |

#### APPROVAL

| Company             | Name      | Signature                                                                            | Date       |
|---------------------|-----------|--------------------------------------------------------------------------------------|------------|
| InnoWave Design LLC | Tony Reed |  | 02/10/2024 |
| InnoWave Design LLC | Jamie Lyn |  | 03/10/2023 |
|                     |           |                                                                                      |            |

## Contents

|                                                          |           |
|----------------------------------------------------------|-----------|
| <b>Product Specification .....</b>                       | <b>1</b>  |
| <b>1. General .....</b>                                  | <b>4</b>  |
| 1.1. Specifications .....                                | 4         |
| 1.2. Sensor Features .....                               | 5         |
| 1.3. Applications .....                                  | 5         |
| 1.4. Layout .....                                        | 6         |
| <b>2. Electrical .....</b>                               | <b>7</b>  |
| 2.1. DC characteristics .....                            | 7         |
| 2.2. AC Characteristics .....                            | 8         |
| <b>3. Environment Requirements .....</b>                 | <b>8</b>  |
| 3.1. Operating Temperature .....                         | 8         |
| 3.2. Storage Temperature .....                           | 8         |
| 3.3. Humidity .....                                      | 9         |
| 3.4. Thermal Shock .....                                 | 9         |
| 3.5. High Temperature Test .....                         | 9         |
| 3.6. Low Temperature Test .....                          | 9         |
| <b>4. Reliability Requirements .....</b>                 | <b>9</b>  |
| 4.1. Drop Test .....                                     | 9         |
| 4.2. Random Vibration .....                              | 9         |
| 4.3. Salt Fog Test .....                                 | 9         |
| 4.4. ESD (Electronic Discharge) .....                    | 9         |
| <b>5. Product Performance Verification .....</b>         | <b>9</b>  |
| 5.1. Electrical Parameters .....                         | 9         |
| 5.2. Mechanical Parameters .....                         | 10        |
| 5.3. Environmental and Reliability Test Parameters ..... | 10        |
| <b>6. Product Identification TBD .....</b>               | <b>10</b> |
| <b>7 Packaging .....</b>                                 | <b>10</b> |



## INV-OV2640FF-2MP

### 1. General

The INV-OV2640FF-2MP is a color fixed focus 2-megapixel 1600x1200 camera module with a 4-element glass lens plus IRCF within a lens holder. The OV2640 low voltage sensor provides the full functionality of a single-chip camera and image processor in a small footprint package.

#### 1.1. Specifications

|                                                           |                                                                                        |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------|
| Sensor Make and Model                                     | Omni Vision OV2640                                                                     |
| Sensor Type                                               | 38 pin CSP                                                                             |
| Resolution                                                | 2MP (1600x1200)                                                                        |
| Active array size                                         | 1600x1200                                                                              |
| Pixel Size                                                | 2.2um x 2.2um                                                                          |
| Module Size                                               | 38x38x21.0mm                                                                           |
| Optical size                                              | 1/4"                                                                                   |
| Output Interfaces                                         | SCCB Interface                                                                         |
| Output Formats                                            | YUV(422/420)/YCbCr422<br>RGB565/555<br>8-bit compressed data<br>8-/10-bit Raw RGB data |
| Chroma                                                    | Color                                                                                  |
| Image Area                                                | 3590 $\mu\text{m}$ x 2684 $\mu\text{m}$                                                |
| Package dimensions                                        | 5725 $\mu\text{m}$ x 6285 $\mu\text{m}$                                                |
| Frame Rate                                                | 15 fps @ 1600 x 1200                                                                   |
| Sensor CRA                                                | 25° non-linear                                                                         |
| Power Requirements                                        | Core: 1.3VDC + 5%                                                                      |
|                                                           | Analog: 2.5 ~ 3.0VDC                                                                   |
|                                                           | I/O: 1.7V to 3.3V                                                                      |
| Maximum image transfer rate<br>UXGA/SXGA<br>SVGA<br>CIF   | 15 fps<br>30 fps<br>60 fps                                                             |
| Shutter                                                   | Rolling                                                                                |
| Scan mode                                                 | Progressive                                                                            |
| Maximum Exposure Interval                                 | 1247 x tROW                                                                            |
| Temperature Range                                         | 0° C to 50° C (Stable image)                                                           |
| Stable Image Temperature Range                            | 0° C to 65° C junction temperature                                                     |
| Lens Type                                                 | Fixed Focus                                                                            |
| Field of View (FOV)<br>Vertical<br>Horizontal<br>Diagonal | 43°<br>56°<br>75°                                                                      |
| Aperture (F#)                                             | F#2.4                                                                                  |
| EFL                                                       | 3.6mm                                                                                  |

## INV-OV2640FF-2MP

|                       |                 |
|-----------------------|-----------------|
| BFL                   | 4.5mm           |
| FFL                   | 4.25mm          |
| TV Distortion         | 6%              |
| Relative illumination | >88%            |
| Focus Range           | 61cm - infinity |
| Thread                | M12*P0.5        |
| IR Filter             | 940 IR          |
| TTL                   | 21.7mm          |

**Table 1: Specifications**

## 1.2. Sensor Features

- High sensitivity for low-light operation
- Low operating voltage for embedded portable apps
- Standard SCCB interface
- Output support for Raw RGB, RGB (RGB565/555), GRB422, YUV (422/420) and YCbCr (4:2:2) formats
- Supports image sizes: UXGA, SXGA, SVGA, and any size scaling down from SXGA to 40x30
- VarioPixel<sup>®</sup> method for sub-sampling
- Automatic image control functions including Automatic Exposure Control (AEC), Automatic Gain Control (AGC), Automatic White Balance (AWB), Automatic Band Filter (ABF), and Automatic Black-Level Calibration (ABLC)
- Image quality controls including color saturation, gamma, sharpness (edge enhancement), lens correction, white pixel canceling, noise canceling, and 50/60 Hz luminance detection
- Internal/external frame synchronization
- Variable frame rate control
- Line optical black level output capability
- Video or snapshot operation
- Zooming, panning, and windowing functions
- Supports LED and flash strobe mode
- Supports scaling
- Supports compression
- Embedded microcontroller

**Table 2: Sensor Features**

## 1.3. Applications

- Camera Phones
- PC Multimedia

## 1.4. Layout

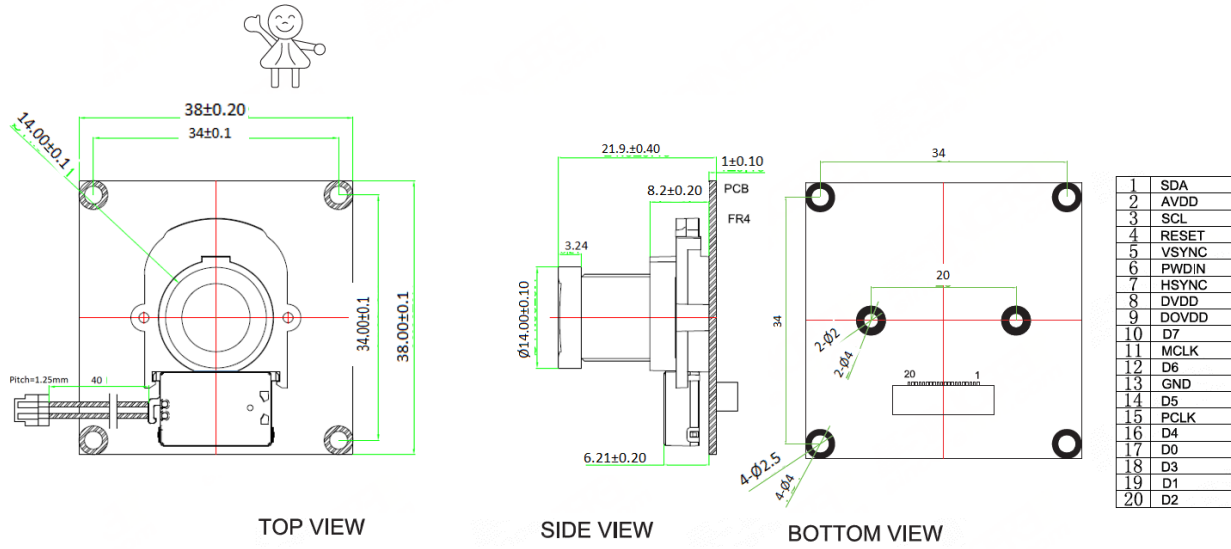


Figure 1: Camera module assembly layout

## 2. Electrical

### 2.1. Absolute Maximum Ratings

|                                                    |        |                    |
|----------------------------------------------------|--------|--------------------|
| Ambient Storage Temperature                        |        | -40°C to +95°C     |
| Supply Voltages (with respect to Ground)           | VDD-A  | 4.5V               |
|                                                    | VDD-C  | 3V                 |
|                                                    | VDD-IO | 4.5V               |
| All Input/Output Voltages (with respect to Ground) |        | -0.3V to VDD-IO+1V |
| Lead-free Temperature, Surface-mount process       |        | 245°C              |

Table 3 Absolute Maximum Ratings

### 2.2. DC characteristics (-30°C < T<sub>J</sub> < 85°C)

| Supply                                                                             | Parameter                     | Min  | Typ  | Max  | Unit |
|------------------------------------------------------------------------------------|-------------------------------|------|------|------|------|
| VDD-A                                                                              | supply voltage (analog)       | 3.00 | 3.30 | 3.60 | V    |
| VDD-D                                                                              | supply voltage (digital core) | 1.43 | 1.50 | 1.58 | V    |
| VDD-IO                                                                             | supply voltage (digital I/O)  | 1.70 | 1.80 | 3.60 | V    |
| IDD-A                                                                              | active (operating) current    |      | 80   | 90   | mA   |
| IDD-IO b, c                                                                        |                               |      | 50   | 60   | mA   |
| IDDS-SCCB                                                                          |                               |      | 0.7  | 1    | mA   |
| IDDS-PWDN                                                                          | Standby Current               |      | 50   | 120  | mA   |
| <b>Digital inputs (typical conditions: AVDD = 3.3V, DVDD = 1.5V, DOVDD = 1.8V)</b> |                               |      |      |      |      |
| VIL                                                                                |                               |      |      | 0.54 | V    |
| VIH                                                                                | input voltage HIGH            | 1.26 |      |      | V    |
| CIN                                                                                | input capacitor               |      |      | 10   | pF   |
| <b>Digital outputs (standard loading 25 pF)</b>                                    |                               |      |      |      |      |
| VOH                                                                                | Output Voltage HIGH           | 1.62 |      |      | V    |
| VOL                                                                                | Output Voltage Low            |      |      | 0.18 | V    |
| <b>Serial interface inputs</b>                                                     |                               |      |      |      |      |
| VIL                                                                                | SIOC and SIOD                 | -0.5 | 0    | 0.54 | V    |
| VIH                                                                                | SIOC and SIOD                 | 1.26 | 1.8  | 2.3  | V    |

## INV-OV2640FF-2MP

- using the internal DVDD regulator is strongly recommended for minimum power down current
- active current is based on sensor resolution at full size and at full speed, 25°C
- with MIPI function, the active current needs an additional 20mA
- standby current is measured at room temperature
- based on DOVDD = 1.8V

Table 4 DC characteristics

## 2.3. AC Characteristics

AC characteristics ( $T_A = 25^\circ\text{C}$ ,  $V_{DD-A} = 2.8\text{V}$ )

| ADC Parameters |                                         |  |     |      |     |
|----------------|-----------------------------------------|--|-----|------|-----|
| B              | Analog bandwidth                        |  | 20  |      | MHz |
| DLE            | DC differential linearity error         |  | 0.5 |      | LSB |
| IIE            | DC integral linearity error             |  | 1   |      | LSB |
|                | Settling time for hardware reset        |  |     | <1   | ms  |
|                | Settling time for software reset        |  |     | <1   | ms  |
|                | Settling time for UXGA/SVGA mode change |  |     | <1   | ms  |
|                | Settling time for register setting      |  |     | <300 | ms  |

Table 5: AC Characteristics

## 3. Environment Requirements

### 3.1. Operating Temperature

The camera module shall be fully functional when ambient temperature is between  $-20^\circ\text{C}$  to  $50^\circ\text{C}$  with image quality remaining stable. Test duration is 24 hours.

### 3.2. Storage Temperature

The camera module shall withstand storage temperatures between  $-40^\circ\text{C}$  to  $95^\circ\text{C}$ . Test duration is 48 hours.



INV-OV2640FF-2MP

### **3.3. Humidity**

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

### **3.4. 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)

### **3.5. High Temperature Test**

60C, humidity off, 24 hours

### **3.6. Low Temperature Test**

-20C, humidity off, 24 hours

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

## **4. Reliability Requirements**

### **4.1. Drop Test**

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

### **4.2. Random Vibration**

The camera module shall withstand vibration of the following conditions

Frequency range: 50Hz

Amplitude: 2mm Duration 10 minutes for each position

Test all 3 axes (X, Y, Z)

### **4.3. Salt Fog Test**

Condition: 5%nacl solvent Test duration: 24H

### **4.4. ESD (Electronic Discharge)**

The camera module shall withstand Electrostatic Discharge of

8KV Contact Discharge

12KV Air Discharge

10 Times for a Second

## **5. 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 in either the factory laboratory or at the InnoWave laboratory.

### **5.1. Electrical Parameters**

INV-OV2640FF-2MP

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

**Table 6: Electrical parameter measurements**

## 5.2. Mechanical Parameters

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

**Table 7: Mechanical parameter measurements**

## 5.3. 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 8: Environmental and Reliability parameter measurements**

## 6. Product Identification TBD

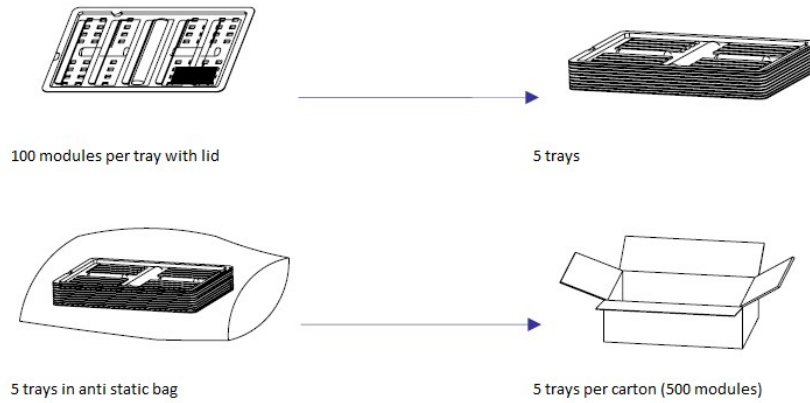
All modules will be marked with an identification number using laser marking or bar code label.

## 7 Packaging

### INV-OV2640FF-2MP

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 tray of anti-static plastic material. Several cameras shall be packed in one tray.

The tray has separate holders for each camera module.



**Figure 3: Packaging Example**