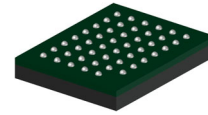


# 1/4.2-inch 5 MP CMOS Digital Image Sensor

## AR0544



ODCSP47  
 CASE 570DD

### General Description

The **onsemi** AR0544 is a stacked 1/4.2-inch back side illuminated (BSI) CMOS active-pixel digital image sensor with a pixel array of 2592 x 1944 (2608H x 1960V including border pixels). The AR0544 has enhanced NIR response.

It incorporates sophisticated on-chip camera functions such as Wake on Motion (WOM), context switching and multiple subsampling modes. It is programmable through a simple I<sup>2</sup>C interface and has very low power consumption.

The AR0544 digital image sensor features **onsemi**'s breakthrough low-noise CMOS imaging technology.

The AR0544 sensor can generate full resolution image at up to 60 frames per second (fps) in 10-bit linear mode and 30 fps in line interleaved high dynamic range (LI-HDR) mode. AR0544 also supports enhanced Dynamic Range (eDR) mode.

### Features

- 5 MP CMOS Sensor with Advanced 1.4  $\mu$ m Pixel Stacked BSI Technology
- Enhanced NIR Response at 850 nm and 940 nm Wavelength
- LI-HDR: Supports Line Interleaved T1/T2 Readout to Enable HDR Processing in ISP Chip
- enhanced Dynamic Range (eDR)
- Super Low Power Mode
- Wake on Motion (WOM)/Motion Detection
- Subsampling Modes: Skipping, Binning, Summing
- Data Interfaces:
  - ◆ 2-lane MIPI D-PHY
- Bit-depth Compression Available for MIPI Interface
- Various Trigger Modes for Multi-sensor Synchronization
- Electronic Rolling Shutter (ERS) and Global Reset Release (GRR) Modes Supported
- 2360 bytes One-Time Programmable Memory (OTPM) for Storing Shading Correction Coefficients and Module Information
- Programmable Controls: Gain, Horizontal and Vertical Blanking, Frame Size/Rate, Exposure, Window Size
- On-chip Temperature Sensor
- Simple Two-wire Fast-mode+ Serial Interface
- On-chip Lens Shading Correction

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 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](#)

### Applications

- Videoconferencing Endpoints
- Webcams
- Machine Vision Cameras
- Video Doorbells
- Retail In-store Cameras, Bodycams, etc.
- 3D and Stereo Cameras

Table 1. KEY PERFORMANCE PARAMETERS

| Parameter                                                            |                        | Value                                                                                       |
|----------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------|
| Optical Format                                                       |                        | 1/4.2-inch 5 MP (4:3)                                                                       |
| Active Pixels                                                        |                        | 2592 x 1944                                                                                 |
| Pixel Size                                                           |                        | 1.4 $\mu\text{m}$ Back Side Illuminated (BSI)                                               |
| Chief Ray Angle (CRA)                                                |                        | 11°, 33°                                                                                    |
| Color Filter Array                                                   |                        | RGB, Monochrome, RGBIR                                                                      |
| Input Clock Frequency                                                |                        | 6–48 MHz                                                                                    |
| Interface                                                            |                        | 2-lane MIPI using D-PHY @; Max data rate: 1.72 Gbps/lane                                    |
| ADC Resolution                                                       |                        | 10-bits, on die                                                                             |
| Gain Control: Gain Table                                             |                        | Linear Mode: 0–50.62 dB (Analog gain range: 0 ~ 27.37 dB, Digital gain range: 0 ~ 23.25 dB) |
| Subsampling                                                          |                        | Subsampling: Skipping (RGB, Mono), Binning (RGB), Summing (Mono)                            |
| Temperature Sensor                                                   |                        | 10-bit, controlled by two-wire serial I/F                                                   |
| Frame Rate                                                           | Full Size, Linear Mode | 60 fps                                                                                      |
| Compression                                                          |                        | DPCM: 10–8                                                                                  |
| 3D Support                                                           |                        | Frame rate and exposure synchronization                                                     |
| Supply voltage                                                       | Analog, Pixel          | 2.8 V (2.7 V < $V_{\text{supply}}$ < 2.9 V)                                                 |
|                                                                      | I/O                    | 1.8 V (1.7 V < $V_{\text{supply}}$ < 1.9 V)                                                 |
|                                                                      | PLL, MIPIphy           | 1.05 V (1 V < $V_{\text{supply}}$ < 1.1 V)                                                  |
| Power Consumption                                                    |                        | 158 mW at 5 MP 60 fps                                                                       |
| Responsivity                                                         |                        | 8.7 ke-/lux-sec (Green in RGB)<br>17.3 ke-/lux-sec (Clear in Mono)                          |
| SNR <sub>MAX</sub>                                                   |                        | 39.9 dB                                                                                     |
| Dynamic Range                                                        |                        | 73 dB (eDR 1-exp)<br>100 dB (LI-HDR Mode)                                                   |
| Operating Temperature Range (at junction) – T <sub>J</sub>           |                        | –30 °C to +85 °C                                                                            |
| Optimal Performance Temperature Range (at junction) – T <sub>J</sub> |                        | 0 °C to +60 °C                                                                              |
| Package Options:                                                     |                        | CSP-47 (4.67 x 3.68)<br>Bare Die                                                            |
| $\theta_{JA}$                                                        |                        | 46 °C/W (Note 1)                                                                            |
| $\theta_{JB}$                                                        |                        | 17 °C/W                                                                                     |

1.  $\theta_{JA}$  is dependent on the customer module design and should not be used for calculating junction temperature.



**Table 2. 10-bit MODES OF OPERATION**

| Mode Name              | Mode Description                             | Resolution  | Frame Rate |
|------------------------|----------------------------------------------|-------------|------------|
| Native                 | 5 MP Linear Mode Full Resolution             | 2592 x 1944 | 60         |
| LI Native              | 5 MP LI-HDR Mode                             | 2592 x 1944 | 30         |
| Crop                   | 1080P Linear                                 | 1920 x 1080 | 110        |
| SLP Native             | 5M Linear Mode Full Resolution, Lowest Power | 2592 x 1944 | 1          |
| Bin4                   | 0.3 MP Linear, Lowest Power                  | 648 x 486   | 1          |
| WoM Bin4               | Wake On Motion w/ Streaming                  | 648 x 486   | 1          |
| WoM Bin4Skip2 (Note 2) | Wake On Motion without Streaming             | 324 x 243   | 1          |

2. Sensor resolution is actually 648 x 486. GB columns are skipped which helps reduce power consumption. The stream output of the sensor cannot be used in this mode.

**Table 3. 12-bit MODES OF OPERATION**

| Mode Name  | Mode Description | Resolution  | Frame Rate |
|------------|------------------|-------------|------------|
| eDR Native | 5M eDR Mode      | 2592 x 1944 | 30         |

**Table 4. ORDERING INFORMATION**

| Part Number             | Product Description                       | Orderable Product Attribute Description |
|-------------------------|-------------------------------------------|-----------------------------------------|
| AR0544CSSC11SMKA1-CP    | 5 MP 1/4.2" CMOS Image sensor RGB 11° CRA | CSP with Protective Film                |
| AR0544CSSC11SMKA1-CP2   | 5 MP 1/4.2" CMOS Image sensor RGB 11° CRA | CSP with Protective Film Low MOQ        |
| AR0544CSSC11SMKA1-CR    | 5 MP 1/4.2" CMOS Image sensor RGB 11° CRA | CSP without Protective Film             |
| AR0544CSSC11SMKAH3-GEVB | 5 MP 1/4.2" CMOS Image sensor RGB 11° CRA | Demo3 Headboard                         |

|                         |                                            |                                  |
|-------------------------|--------------------------------------------|----------------------------------|
| AR0544CSSM11SMKA1-CP    | 5 MP 1/4.2" CMOS Image sensor Mono 11° CRA | CSP with Protective Film         |
| AR0544CSSM11SMKA1-CP2   | 5 MP 1/4.2" CMOS Image sensor Mono 11° CRA | CSP with Protective Film Low MOQ |
| AR0544CSSM11SMKA1-CR    | 5 MP 1/4.2" CMOS Image sensor Mono 11° CRA | CSP without Protective Film      |
| AR0544CSSM11SMKAH3-GEVB | 5 MP 1/4.2" CMOS Image sensor Mono 11° CRA | Demo3 Headboard                  |

|                         |                                             |                                  |
|-------------------------|---------------------------------------------|----------------------------------|
| AR0544CSSH11SMKA1-CP    | 5 MP 1/4.2" CMOS Image sensor RGBIR 11° CRA | CSP with Protective Film         |
| AR0544CSSH11SMKA1-CP2   | 5 MP 1/4.2" CMOS Image sensor RGBIR 11° CRA | CSP with Protective Film Low MOQ |
| AR0544CSSH11SMKA1-CR    | 5 MP 1/4.2" CMOS Image sensor RGBIR 11° CRA | CSP without Protective Film      |
| AR0544CSSH11SMKAH3-GEVB | 5 MP 1/4.2" CMOS Image sensor RGBIR 11° CRA | Demo Headboard                   |

|                         |                                           |                                  |
|-------------------------|-------------------------------------------|----------------------------------|
| AR0544CSSC33SMKA1-CP    | 5 MP 1/4.2" CMOS Image sensor RGB 33° CRA | CSP with Protective Film         |
| AR0544CSSC33SMKA1-CP2   | 5 MP 1/4.2" CMOS Image sensor RGB 33° CRA | CSP with Protective Film Low MOQ |
| AR0544CSSC33SMKA1-CR    | 5 MP 1/4.2" CMOS Image sensor RGB 33° CRA | CSP without Protective Film      |
| AR0544CSSC33SMKAH3-GEVB | 5 MP 1/4.2" CMOS Image sensor RGB 33° CRA | Demo3 Headboard                  |

|                         |                                             |                                  |
|-------------------------|---------------------------------------------|----------------------------------|
| AR0544CSSH33SMKA1-CP    | 5 MP 1/4.2" CMOS Image sensor RGBIR 33° CRA | CSP with Protective Film         |
| AR0544CSSH33SMKA1-CP2   | 5 MP 1/4.2" CMOS Image sensor RGBIR 33° CRA | CSP with Protective Film Low MOQ |
| AR0544CSSH33SMKA1-CR    | 5 MP 1/4.2" CMOS Image sensor RGBIR 33° CRA | CSP without Protective Film      |
| AR0544CSSH33SMKAH3-GEVB | 5 MP 1/4.2" CMOS Image sensor RGBIR 33° CRA | Demo Headboard                   |

3. Refer to AR0544 Die Data Sheet for Die Part Numbers & Ordering Information.

# AR0544

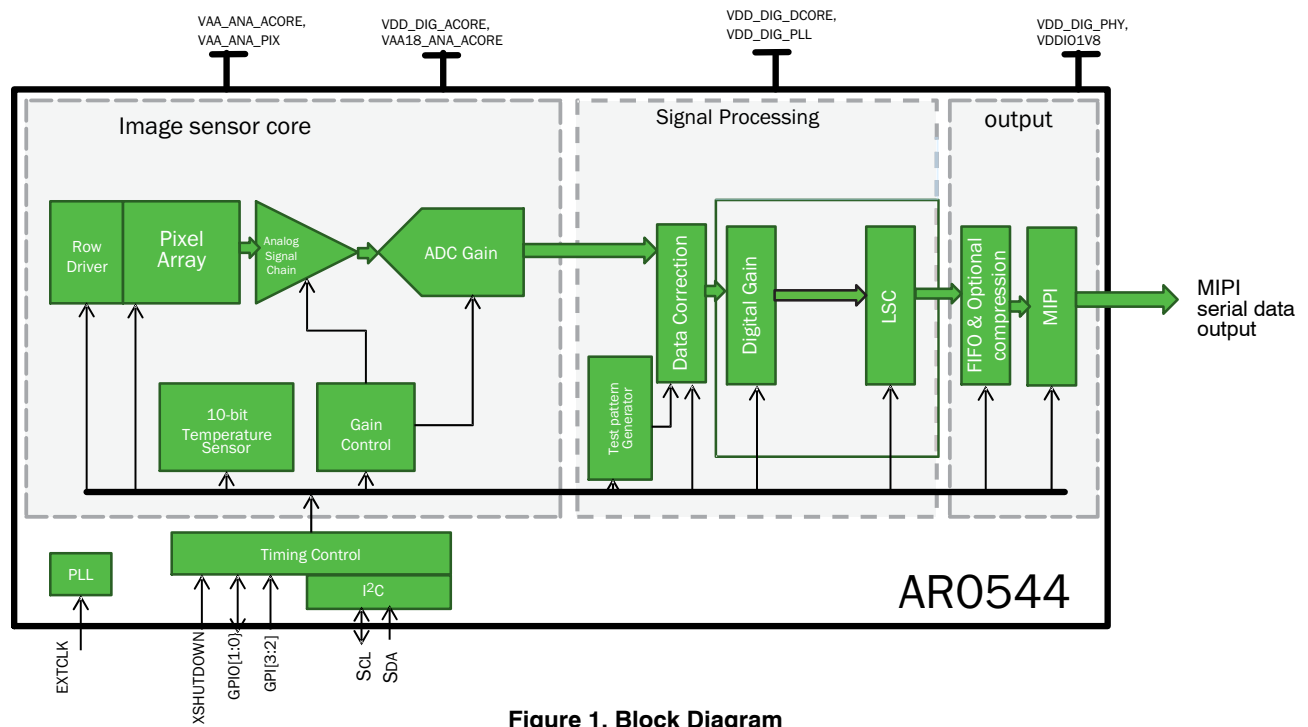
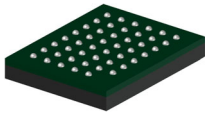


Figure 1. Block Diagram

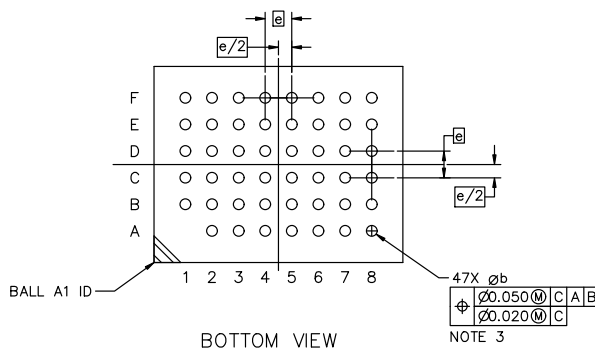
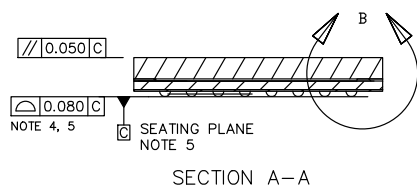
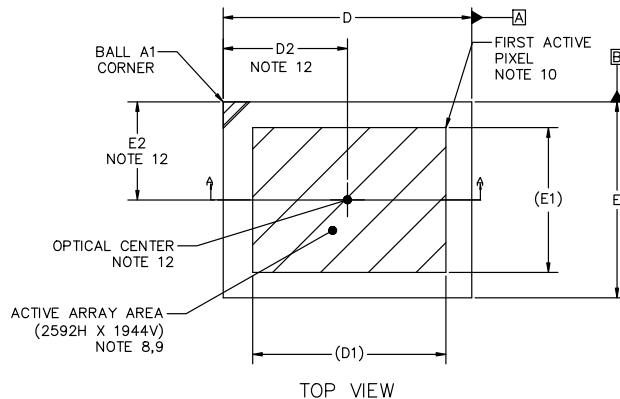


ODCSP47 4.67x3.68x0.63, 0.50P  
CASE 570DD  
ISSUE A

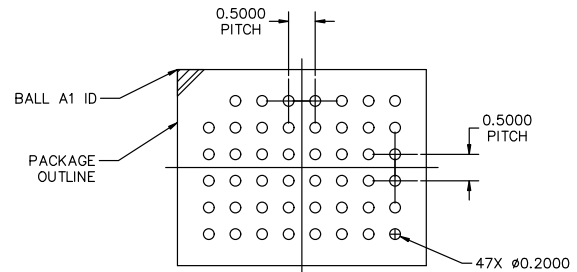
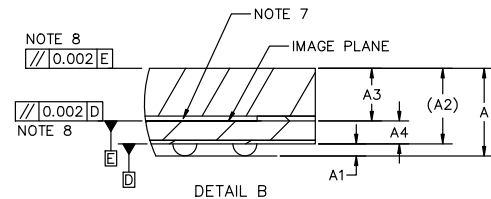
DATE 05 JUN 2025

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS [mm].
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  $\pm 0.1^\circ$ .
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) = (0.034, -0.005).
13. PLAIN COVER GLASS WITHOUT AR COATING.



| MILLIMETERS |           |       |       |
|-------------|-----------|-------|-------|
| DIM         | MIN       | NOM   | MAX   |
| A           | ---       | ---   | 0.762 |
| A1          | 0.081     | 0.101 | 0.121 |
| A2          | 0.631 REF |       |       |
| A3          | 0.426     | 0.440 | 0.454 |
| A4          | 0.180     | 0.191 | 0.202 |
| b           | 0.184     | 0.204 | 0.224 |
| D           | 4.645     | 4.670 | 4.695 |
| D1          | 3.629 REF |       |       |
| D2          | 2.344     | 2.369 | 2.394 |
| E           | 3.657     | 3.682 | 3.707 |
| E1          | 2.722 REF |       |       |
| E2          | 1.821     | 1.846 | 1.871 |
| e           | 0.500 BSC |       |       |



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.

|                  |                               |                                                                                                                                                                                  |
|------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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