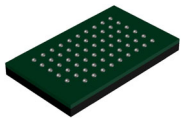
# 1/2.9-inch 8 MP CMOS Digital Image Sensor

# AR0830



ODCSP59
CASE 570AY

**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

### General Description

The **onsemi** AR0830 is a stacked 1/2.9-inch back side illuminated (BSI) CMOS active-pixel digital image sensor with a pixel array of 3840Hx2160V (3856H x 2176V including border pixels). The AR0830 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 $I^2C$ interface and has very low power consumption.

The AR0830 digital image sensor features **onsemi**'s breakthrough low-noise CMOS imaging technology.

The AR0830 sensor can generate full resolution image at up to 60 frames per second (fps) in 10-bit linear mode. AR0830 can achieve 30 fps in line interleaved high dynamic range (LI-HDR) and enhanced Dynamic Range (eDR) modes.

### Features

- 8 MP CMOS Sensor with Advanced 1.4 μm 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 (SLP)
- Wake On Motion (WOM)/Motion Detection
- Subsampling Modes: Skipping, Binning, Summing
- Data Interfaces:
  - MIPI D-PHY – 4 Lanes
- Bit-depth Compression Available for MIPI Interface
- $I^2C$ Fast Mode+ Serial Interface ($I^2C$)
- Various Trigger Modes for Multi-sensor Synchronization
- Electronic Rolling Shutter (ERS) and Global Reset Release (GRR) Modes Supported
- Context Switching
- 800 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, Cropping and Mirror and Flip
- On-chip Temperature Sensor
- Simple Two-wire Fast-mode+ Serial Interface
- On-chip Lens Shading Correction

### Applications

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

**Table 1. KEY PERFORMANCE PARAMETERS**

| Parameter | | Value |
|---|---|---|
| Optical Format | | 1/2.9-inch 8 MP (16:9) |
| Active Pixels | | 3840 x 2160 |
| Pixel Size | | 1.4 μm Back Side Illuminated (BSI), |
| Chief Ray Angle (CRA) | | 11°, 35° |
| Color Filter Array | | RGB Bayer, RGB-IR, Monochrome |
| Input Clock Frequency | | 6-48 MHz |
| Interface | | 4-lane MIPI (1- and 2-lane supported) using D-PHY; Max data rate: 1.5 Gbps/lane |
| ADC Resolution | | 10-bits, on die |
| Gain Control: Gain Table | | Linear Mode: 0−53.6 dB total (Analog 0−27.3 dB, Digital 0−26.3 dB) |
| Subsampling | | Subsampling: Skipping (RGB, Mono), Binning (RGB), Summing (Mono) (Note 2) |
| Temperature Sensor | | 10-bit, controlled by two-wire serial I/F |
| Frame Rate | Full Size, Linear Mode | 60 fps (MIPIx4), 30 fps (MIPIx2) |
| Compression | | DPCM: 10−8 |
| 3D Support | | Frame rate and exposure synchronization |
| Supply Voltage | Analog, Pixel | 2.8 V (2.7 V < $V_{supply}$ < 2.9 V) |
| | I/O | 1.8 V (1.7 V < $V_{supply}$ < 1.9 V) |
| | PLL, MIPIphy | 1.05 V (1 V < $V_{supply}$ < 1.1 V) |
| Power Consumption | | 190 mW (Typical condition) at 8M and 60 fps |
| Responsivity | | 17.3 ke−/lux−sec (Clear in Mono)<br>8.0 ke−/lux−sec (Green in RGB−IR)<br>8.7 ke−/lux-sec (Green in RGB) |
| $SNR_{MAX}$ | | 39.9 dB |
| Dynamic Range | | 100 dB (LI-HDR Mode)<br>73 dB (eDR 1-exp) |
| Operating Temperature Range (at junction) − $T_J$ | | −30°C to +85°C |
| Optimal Performance Temperature Range (at junction) − $T_J$ | | 0°C to +60°C |
| Package Options: | | CSP-59 (6.42 mm x 3.92 mm) |
| $\theta_{JA}$ | | 30°C/W (Note 1) |
| $\theta_{JB}$ | | 6°C/W |

1. $\theta_{JA}$ is dependent on the customer module design and should not be used for calculating junction temperature.
2. Subsampling modes are not available for AR0830 RGBIR sensors.

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

| Mode Name | Mode Description | Resolution | Frame Rate |
|---|---|---|---|
| Native | 4K Linear Full Res | 3840 x 2160 | 60 |
| Native | 4K Linear Full Res, Lower Frame Rate | 3840 x 2160 | 30 |
| SLP Native | 4K Linear Full Res, Lowest Power | 3840 x 2160 | 1 |
| LI Native | 4K 2-exp LI-HDR | 3840 x 2160 | 30 |
| eDR Native | 4K eDR | 3840 x 2160 | 30 |
| Max Frame Rate | Crop Linear for Max Fps | 1650 x 1650 | 90 |
| Bin2 | 2 MP Linear | 1920 x 1080 | 120 |
| Bin4 | 0.5 MP Linear | 960 x 540 | 1 |
| WOM Bin4 | Wake On Motion w/ Streaming | 960 x 540 | 1 |

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

| Mode Name | Mode Description | Resolution | Frame Rate |
|---|---|---|---|
| eDR Native | 4K eDR | 3840 x 2160 | 30 |

**Table 4. ORDERING INFORMATION**

| Part Number | Product Description | Orderable Product Attribute Description |
|---|---|---|
| AR0830CSSC11SMKA1-CP | 8 MP 1/2.9” CMOS Image sensor RGB 11° CRA | CSP with Protective Film |
| AR0830CSSC11SMKA1-CP2 | 8 MP 1/2.9” CMOS Image sensor RGB 11° CRA | CSP with Protective Film Low MOQ |
| AR0830CSSC11SMKAH3-GEVB | 8 MP 1/2.9” CMOS Image sensor RGB 11° CRA | Demo3 Headboard |
| AR0830CSSM11SMKA1-CP | 8 MP 1/2.9” CMOS Image sensor Mono 11° CRA | CSP with Protective Film |
| AR0830CSSM11SMKA1-CP2 | 8 MP 1/2.9” CMOS Image sensor Mono 11° CRA | CSP with Protective Film Low MOQ |
| AR0830CSSM11SMKAH3-GEVB | 8 MP 1/2.9” CMOS Image sensor Mono 11° CRA | Demo3 Headboard |
| AR0830CSSH11SMKA1-CP | 8 MP 1/2.9” CMOS Image sensor RGBIR 11° CRA | CSP with Protective Film |
| AR0830CSSH11SMKA1-CP2 | 8 MP 1/2.9” CMOS Image sensor RGBIR 11° CRA | CSP with Protective Film Low MOQ |
| AR0830CSSH11SMKAH3-GEVB | 8 MP 1/2.9” CMOS Image sensor RGBIR 11° CRA | Demo3 Headboard |
| AR0830CSSC35SMKA1-CP | 8 MP 1/2.9” CMOS Image sensor RGB 35° CRA | CSP with Protective Film |
| AR0830CSSC35SMKA1-CP2 | 8 MP 1/2.9” CMOS Image sensor RGB 35° CRA | CSP with Protective Film Low MOQ |
| AR0830CSSC35SMKAH3-GEVB | 8 MP 1/2.9” CMOS Image sensor RGB 35° CRA | Demo3 Headboard |
| AR0830CSSH35SMKA1-CP | 8 MP 1/2.9” CMOS Image sensor RGBIR 35° CRA | CSP with Protective Film |
| AR0830CSSH35SMKA1-CP2 | 8 MP 1/2.9” CMOS Image sensor RGBIR 35° CRA | CSP with Protective Film Low MOQ |
| AR0830CSSH35SMKAH3-GEVB | 8 MP 1/2.9” CMOS Image sensor RGBIR 35° CRA | Demo Headboard |

3. Refer to AR0830 Die Data Sheet for Die Part Numbers & Ordering Information.

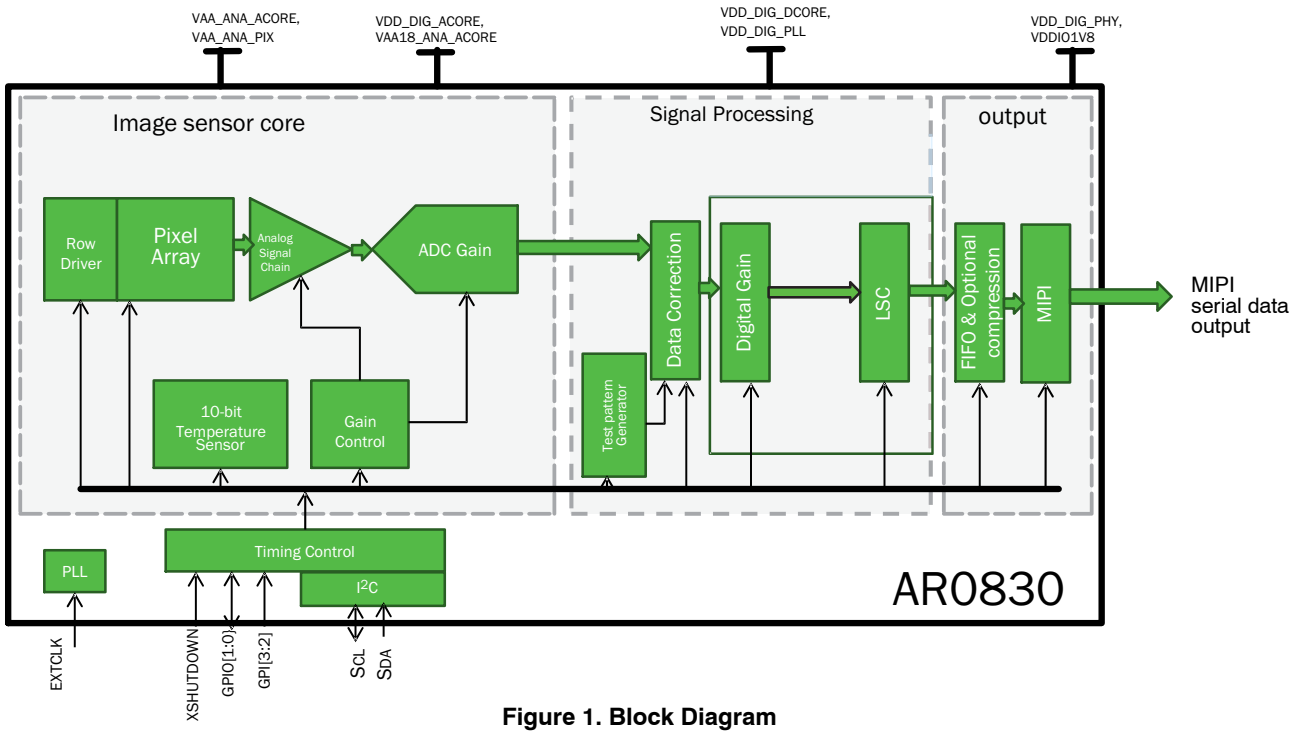
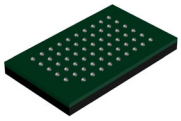



**Figure 1. Block Diagram**



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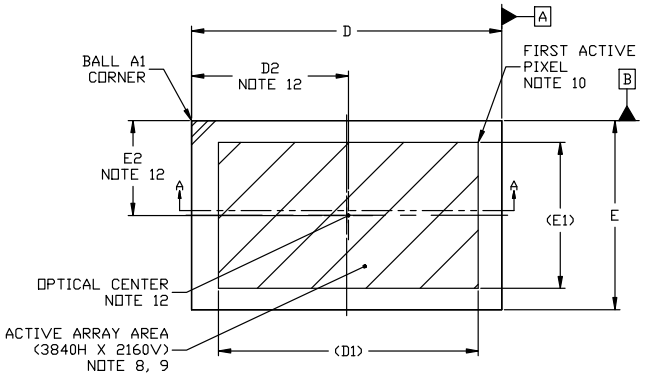
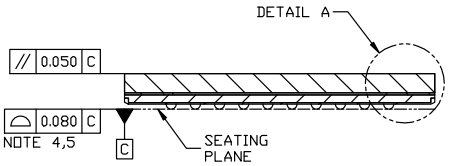
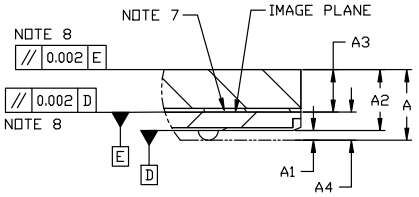


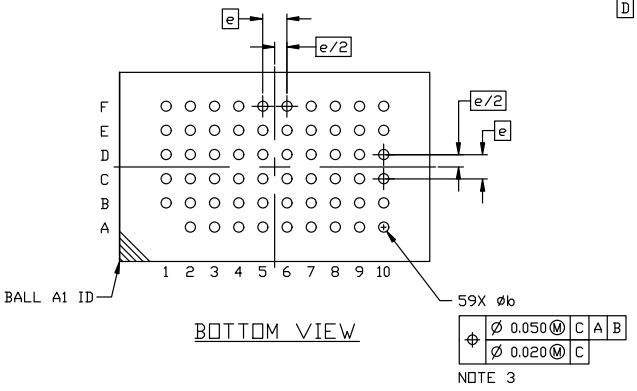

TOP VIEW




SECTION A-A




DETAIL "A"
SCALE 2:1

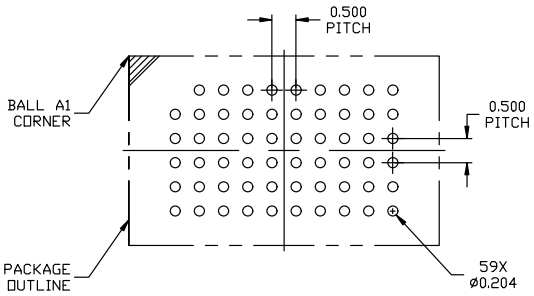



BOTTOM VIEW

| 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 | 0.252 | 0.292 | 0.332 |
| b | 0.184 | 0.204 | 0.224 |
| D | 6.392 | 6.417 | 6.442 |
| D1 | 5.376 REF. | | |
| D2 | 3.218 | 3.243 | 3.268 |
| E | 3.889 | 3.914 | 3.939 |
| E1 | 3.024 REF. | | |
| E2 | 1.937 | 1.962 | 1.987 |
| e | 0.500 BSC | | |

NOTES:

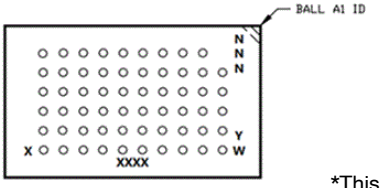
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. SOLDER BALL DIAMETER IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER PARALLEL TO DATUM C.
4. COPLANARITY APPLIES TO THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. DATUM C, THE SEATING PLANE IS DEFINED BY 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) = (0.035, -0.005).




RECOMMENDED MOUNTING FOOTPRINT*

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

### GENERIC MARKING DIAGRAM*




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

*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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## ADDITIONAL INFORMATION

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