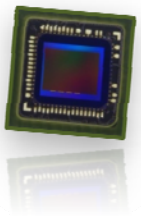


# datasheet

## PRODUCT SPECIFICATION

1/3.2" color CMOS 8 megapixel(3264×2448) image sensor
with OmniBSI™ technology

OV8820

# SD08820

color CMOS 8 megapixel(3264×2448) image sensor with OmniBSI™ technology

## applications

- digital still cameras
- digital video camcorders (DVC)
- cellular phones

## ordering information

- OV08820 (color, Lead-free) 36-Pin PLCC

## features

- automatic black level calibration (ABLC)
- programmable controls for frame ratel, mirror and flip, cropping, windowing, and scaling
- image quality controls: lens correction and defective pixel canceling
- support for output formats: 10-bit RAW RGB (MIPI)
- support for horizon and vertical subampling
- support for images sizes:8 Mpixel ,EIS1080p, 1080P,EIS720p,EISQ 1080p, EIS VGA , VGA QVGA etc.
- support 2×2 binning
- standard serial SCCB interface
- MIPI serial output interface
- 256 bytes of embedded one-time programmable (OTP) memory for part identification ,etc.
- on-chip phase lock loop (PLL)
- built-in 1.5V regulator for core power
- programmable I/O drive capability, I/O tri-state configurability

## key specifications (typical)

- **active array size:** 3296 x 2460
- **power supply:**
  core: 1.5V ± 5%
  analog: 2.6 ~ 3.0V
  I/O: 1.7V~ 3.0V
- **power requirements:**
  active: 170 mA
  standby: 30 µA
- **temperature range:**
  operating: -30°C to 70°C junction temperature
  stable image: 0°C to 50°C junction temperature
- **output formats:** 10-bit RGB RAW output
- **lens size:** 1/3.2"
- **lens chief ray angle:** 27° non-linear
- **input clock frequency:** 6~27 MHz
- **max S/N ratio:** 35 dB
- **dynamic range:** 68 dB @ 8x gain
- **maximum image transfer rate:**
  8Mpixel : 24 fps
  EIS1080p: 30 fps
  EIS720p: 60 fps
- **sensitivity:** 600mV/Lux-sec
- **scan mode:** prigressive
- **maximum exposure interval:** 2480 x $t_{ROW}$
- **pixel size:** 1.4 µm x 1.4 µm
- **dark current:** <8 mV/s @ 60°C junction temperature
- **image area:** 4614 µm x 3444 µm
- **package dimensions:** 10.0 mm x 10.0 mm

# table of contents

# 1. signal descriptions

**table 1-1** lists the signal descriptions and their corresponding pin numbers for the SD08820 image sensor. The package information is shown in **section 4**.

**table 1-1 signal descriptions (sheet 1 of 2)**

| Pad number | signal name | pad type | description | default SCCB status |
|---|---|---|---|---|
| 01 | FREX | I/O | frame exposure input / mechanical shutter output | |
| 02 | VSYNC | I/O | video output vertical signal or video data input | |
| 03 | SIO_D | input | SCCB interface data pin | |
| 04 | SIO_C | input | SCCB interface input clock | |
| 05 | DOVDD | power | power for I/O circuit | |
| 06 | DGND | ground | digital logic ground | |
| 07 | VN | reference | internal analog reference | |
| 08 | VNH | reference | internal analog reference | |
| 09 | VNL | reference | internal analog reference | |
| 10 | DGND | ground | digital logic ground | |
| 11 | DOVDD | power | power for I/O circuit | |
| 12 | VSNK | analog I/O | VCM driver current sink input | |
| 13 | VGNG | ground | ground for VCM driver | |
| 14 | MDN3 | I/O | MIPI TX fourth data Lane negative output | |
| 15 | MDP3 | I/O | MIPI TX fourth data Lane positive output | |
| 16 | MDN1 | I/O | MIPI TX second data Lane negative output | |
| 17 | MDP1 | I/O | MIPI TX second data Lane positive output | |
| 18 | MCN | I/O | MIPI TX clock Lane negative output | |
| 19 | MCP | I/O | MIPI TX clock Lane positive output | |
| 20 | MDN0 | I/O | MIPI TX first data Lane negative output | |
| 21 | MDP0 | I/O | MIPI TX first data Lane positive output | |
| 22 | MDN2 | I/O | MIPI TX third data Lane negative output | |
| 23 | MDP2 | I/O | MIPI TX third data Lane positive output | |
| 24 | AGND | ground | analog ground | |
| 25 | DVDD | power | power for digital circuit | |

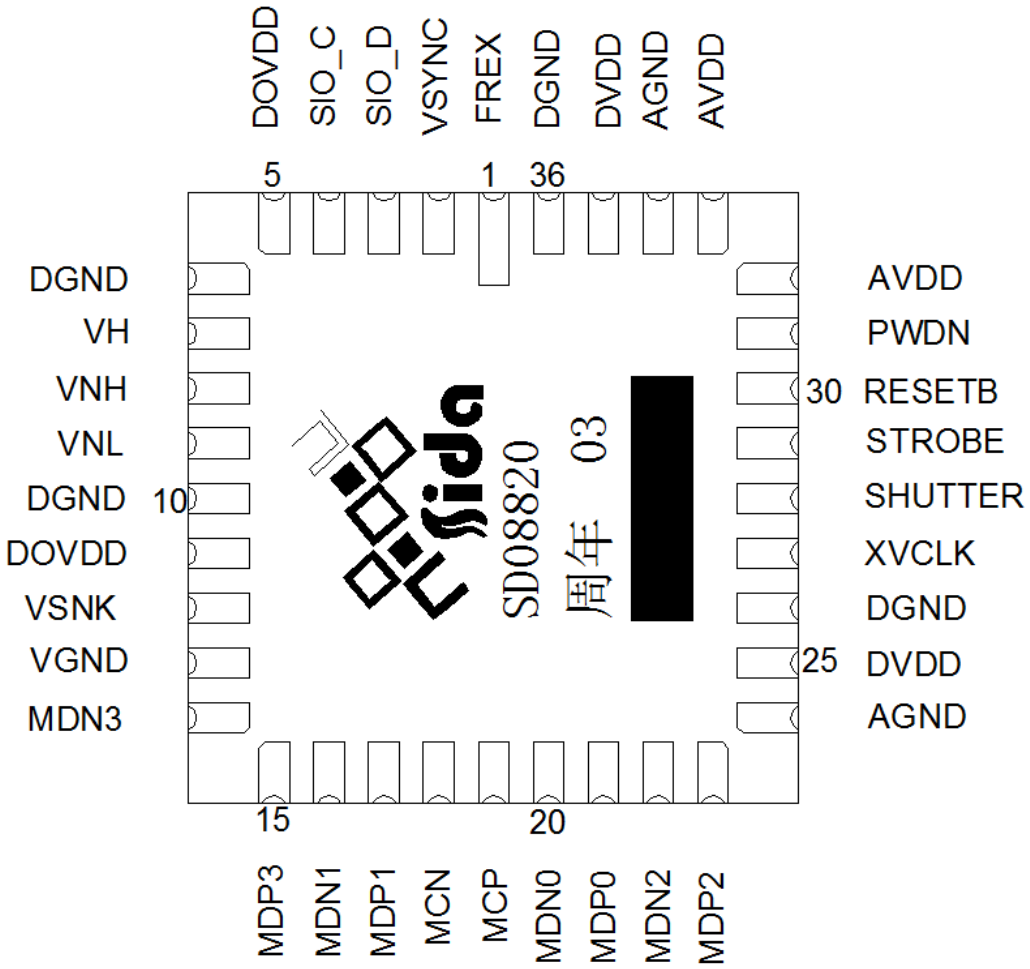
**table 1-1 signal descriptions (sheet 2 of 2)**

| Pad number | signal name | pad type | description | default SCCB status |
|---|---|---|---|---|
| 26 | DGND | ground | digital logic ground | |
| 27 | XVCLK | input | system input clock | |
| 28 | SHUTTER | I/O | illumination control output | |
| 29 | STROBE | I/O | strobe output | |
| 30 | RESETB | input | reset (active low with internal pull up transistors ) Depending on process condition and DOVDD voltage ,thepull up resistance ranges from 1MΩ~7 MΩ when it is low and ranges from 200KΩ to 1MΩ when it is high | |
| 31 | POWDN | input | power down (active low with internal pull up resistor ) Depending on process condition ,the pull up resistance is 700KΩ~1.3 MΩ | |
| 32 | AVDD | power | power for analog circuit | |
| 33 | AVDD | power | power for analog circuit | |
| 34 | AGND | ground | analog ground | |
| 35 | DVDD | power | power for digital circuit | |
| 36 | DGND | ground | digital logic ground | |

**table 1-2 configuration under various conditions**

| signal name | RESET | after RESET release | software standby | hardware standby (PWDNB=0) |
|---|---|---|---|---|
| VSYNC | high-z | high-z | high-z by default (configurable) | high-z by default (configurable) |
| FREX | high-z | high-z | high-z by default (configurable) | high-z by default (configurable) |
| SHUTTER | high-z | high-z | high-z by default (configurable) | high-z by default (configurable) |
| RESETB | input | input | input | input |
| PWDNB | input | input | input | input |
| STROBE | high-z | high-z | high-z by default (configurable) | high-z by default (configurable) |
| XVCLK | input | input | input | hihg-z |
| VSNK | high-z | open drain | open drain | hihg-z |
| SIOD | open drain | I/O | I/O | open drain |
| SIOC | input | input | input | high-z |
| MCP | 0 | 0 | 0 by default (configurable) | 0 by default (configurable) |
| MCN | 0 | 0 | 0 by default (configurable) | 0 by default (configurable) |
| MDP | high-z | high-z | high-z by default (configurable) | high-z by default (configurable) |
| MDN | high-z | high-z | high-z by default (configurable) | high-z by default (configurable) |

figure 1-1 pin diagram



# 2. system level description

## 2.1 overview

The OV8820color image sensor is a low voltage, high performance 1/3.2-inch , 8 megapixel CMOS image sensor that provides 3264x2448 video output using OmniBSI™ technology. It provides full-frame,sub-sampled,windowed 10-bit MIPI images in various via the control of the Serial Camera Cont Bus (SCCB) interface .

The OV8820 has an image array capable of operating at up to 24 fps in 10-bit 8megapixel resolution with complete user control over image quality, data transfer, camera functions through the SCCB interface. All required image processing functions,including exposure control ,white balance ,defective pixel canceling ,etc., are programmable through the SCCB interface .

In addition ,omnivision image sensors use proprietary sensor technolagy to improve improve image quality by reducing or eliminating common lighting /elect sources of image contamination,such as fixed pattem noise, smearing,etc., to priduce a clean,fully stable,color image.

For customized information purposes,the OV8820 includes a one-time programmble(OTP)memory. The ov8820 has up to four lanes of MIPI interface.

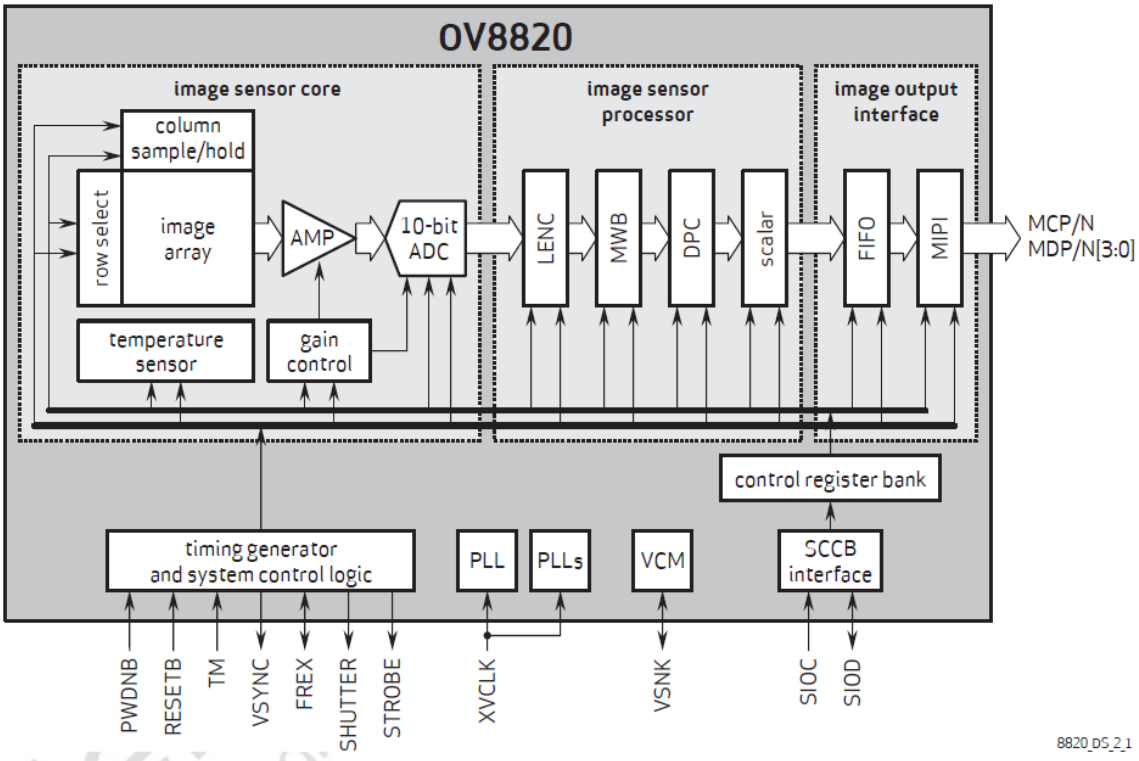
## 2.2 architecture

The OV8820 sensor core generates streaming pixel data at a constant frame rate,

The timing generator outputs clocks to access the rows of the imaging array , precharging and samping the rows of the array sequentially. In the time between precharging and sampling row ,the charge ing the pixls decrease with exposure to incident light .this is the exposure time in rolling shutter architecture .

The exposure time is controlled by adjusting the time interval between precharging and sampling. After the data of the pixels is the row has been sampled, it is processed through analog circuitry to correct the offset and multiply the data with corresponding gain. Following analog processing identification the ADC Chichester outputs 10-bit data for echinacea pixel in the array.

figure 2-1 OV8820 block diagram



# 3. format and frame

The OV8820 supports RAW RGB output with a one ,two ,or four Lane MIPI interface .

**table 3-1 MIPI supported frame and frame rate(using 4lanes,700Mbps max data rate)**

| format | resolution | maximum frame rate with MIPI | methodology |
|---|---|---|---|
| full resolution | 3264×2448 | 24 fps | full |
| EIS 1080p | 2112×1188 | 30 fps | crop+scale1.5(3168×1782) |
| 1080p | 1920×1080 | 30 fps | crop+scale1.7(3264×1836) |
| quartersize | 1632×1224 | 30 fps | binning +scale (3264×2448) |
| EIS 720p | 1408×792 | 30 fps / 60fps | crop+binning×2 +scale2.3(3138×1822) HB2 /VB2 |
| 720p | 1280×720 | 30 fps / 60fps | crop+binning×2 +scale2.5(3200×1800) HB2 /VB2 |
| EIS Q1080p | 1056×594 | 30 fps / 60fps | crop+binning×2 +scale3.0(3168×1782) HB2 /VB2 |
| Q1080p | 960×540 | 30 fps / 60fps | crop+binning×2 +scale3.4(3264×1836) HB2 /VB2 |
| EIS VGA | 704×528 | 90 fps / 120fps | crop+binning+skip+scale |
| VGA | 640×480 | 90 fps / 120fps | crop+binning+skip+scale |

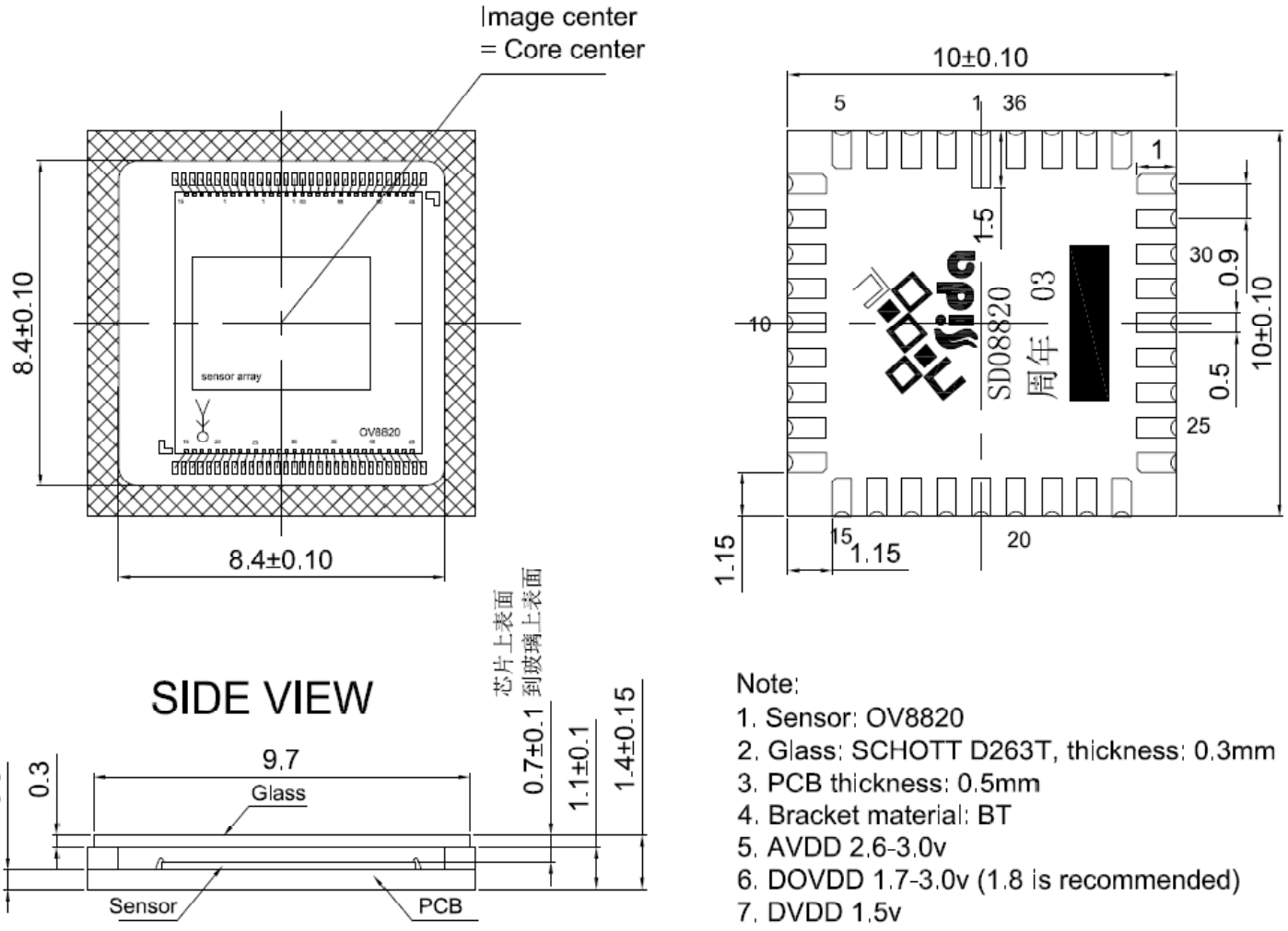
**table 3-1 MIPI supported frame and frame rate(using 2lanes,800Mbps max data rate)**

| resolution | frame rate | description |
|---|---|---|
| 4:3 full resolution(8megapixel ) | 15 fps | full |
| 16:9 full resolution (cropped ) | 30 fps | crop (3264×1838) |
| 16:9 1080p using scalar | 30 fps | crop +scale (3264×1863) |
| 16:9 720p using scalar | 30 fps | crop +scale (3200×1800) |

# 4 mechanical specifications

## 4.1 physical specifications

**4.1figure package specifications**




Note:
1. Sensor: OV8820
2. Glass: SCHOTT D263T, thickness: 0.3mm
3. PCB thickness: 0.5mm
4. Bracket material: BT
5. AVDD 2.6-3.0v
6. DOVDD 1.7-3.0v (1.8 is recommended)
7. DVDD 1.5v

**Note1** all exposed metallized areas shall be gold-plate 0.05um min. thickness over nickel plate unless otherwise specified in purchase order

**Note2** seal area and die attach area shall be without metallization

table 4-1 package dimensions (sheet 1 of 2)

| dimensions | millimeters | inches |
|---|---|---|
| Package size | 10.0±0.10 sq | 0.394±0.004 sq |
| Package height | 1.4±0.15 | 0.055±0.006 |
| Substrate base height | 0.5±0.05 | 0.0197±0.002 |
| Cavity size | 8.40±0.20 sq | 0.331±0.008 sq |
| Castellation height | 0.65±0.05 | 0.026±0.002 |
| Pin 1# pad size | 0.50 x 1.50 | 0.0197 x 0.059 |
| Pad size | 0.50 x 1.00 | 0.0197 x 0.0394 |
| Pad pitch | 0.90±0.05 | 0.0354±0.002 |
| Package edge to first lead side | 0.75±0.10 | 0.213±0.004 |
| Glass size | 9.70±0.10 sq | 0.382±0.004 sq |
| Glass height | 0.30±0.05 | 0.012±0.002 |
| Die thickness | 0.20±0.015 | 0.008±0.0006 |
| Top of glass to image plane | 0.70±0.10 | 0.028±0.004 |
| Substrate height | 1.00±0.10 | 0.039±0.004 |

## 4.2 IR reflow specifications

figure 4-2 IR reflow ramp rate requirements

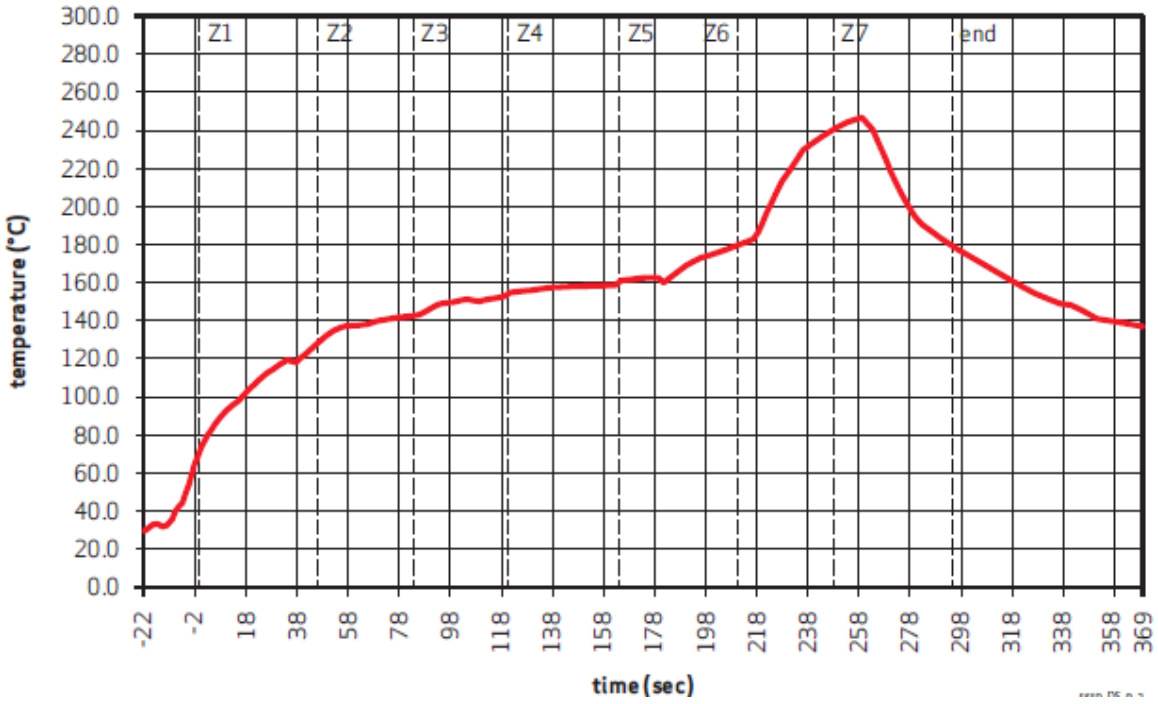


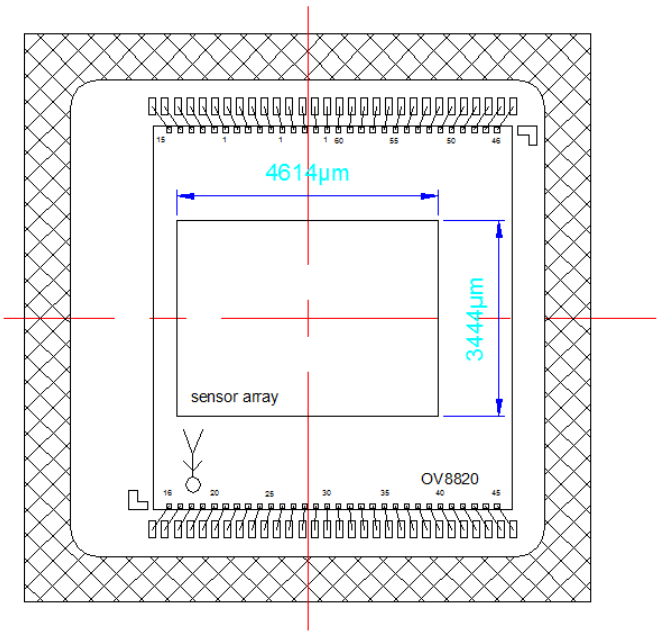
**table 4-2 reflow conditions**

| condition | exposure |
|---|---|
| Average ramp-up rate (30℃ to 217℃) | Less than 3℃per second |
| > 100℃ | Between 330 – 600 seconds |
| > 150℃ | At least 210 seconds |
| > 217℃ | At least 30 seconds (30 ~ 120 seconds) |
| Peak temperature | 245℃ |
| Cool-down rate (peak to 50℃) | Lesss than 6℃ per second |
| Time from 30℃ to 245℃ | No greater than 390 seconds |

# 5 optical specifications

## 5.1 sensor array center

**figure 5-1 sensor array center**




Array center = package center
(0um, 0um)

## 5.2 lens chief ray angle (CRA)

figure 5-2 chief ray angle (CRA)

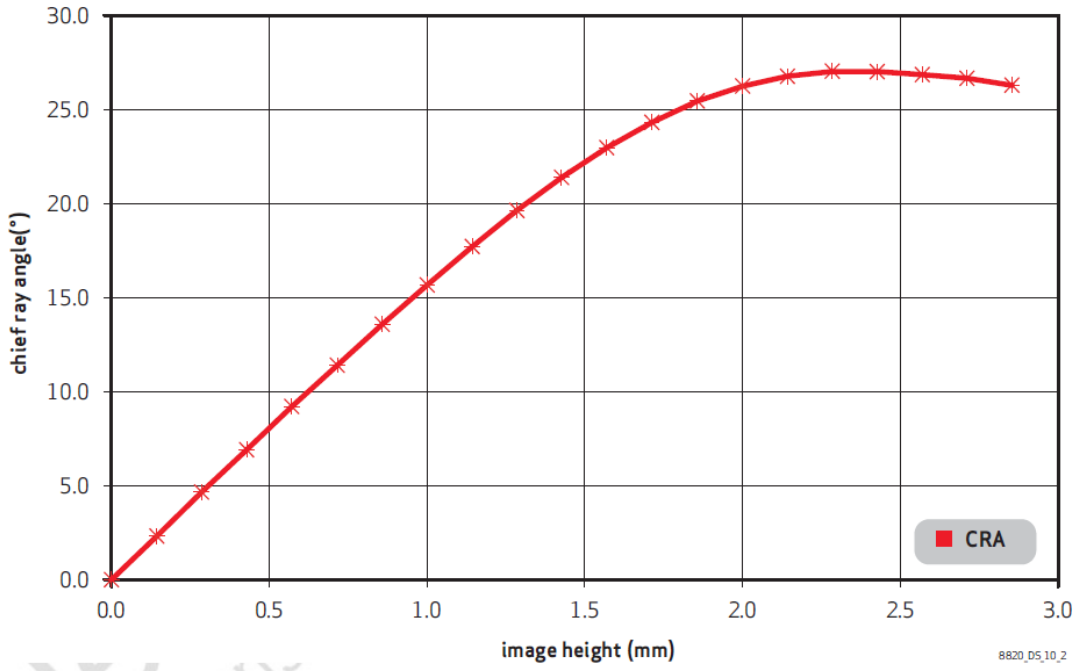



table 5-1 CRA versus image height plot (sheet 1 of 2)

| Field (%) | Image height (mm) | CRA (degrees) |
|---|---|---|
| 0 | 0 | 0 |
| 0.05 | 0.143 | 2.3 |
| 0.10 | 0.286 | 4.6 |
| 0.15 | 0.428 | 6.9 |
| 0.20 | 0.571 | 9.2 |
| 0.25 | 0.714 | 11.4 |
| 0.30 | 0.857 | 13.6 |
| 0.35 | 1.000 | 15.7 |
| 0.40 | 1.142 | 17.7 |
| 0.45 | 1.285 | 19.6 |
| 0.50 | 1.428 | 21.4 |
| 0.55 | 1.571 | 23.0 |
| 0.60 | 1.714 | 24.4 |
| 0.65 | 1.856 | 25.5 |
| 0.70 | 1.999 | 26.3 |

table 5-1 CRA versus image height plot (sheet 2 of 2)

| Field (%) | Image height (mm) | CRA (degrees) |
|---|---|---|
| 0.75 | 2.142 | 26.8 |
| 0.80 | 2.285 | 27.0 |
| 0.85 | 2.428 | 27.0 |
| 0.90 | 2.570 | 26.9 |
| 0.95 | 2.713 | 26.7 |
| 1.00 | 2.856 | 26.3 |