



# LDA1024P12.5X-1.7-C

Near Infrared Linear Image Sensor (0.9 - 1.7  $\mu\text{m}$ ) with 1024 x 1 pixels

| FEATURES  | APPLICATIONS   |
|---|--|
| <ul style="list-style-type: none"> <li>● 1024 x 1 pixels<br/>(pixel size: S 12.5 x 12.5, M 12.5 x 250 <math>\mu\text{m}</math>)</li> <li>● 28-pin Ceramic DIP (CDIP)</li> <li>● Built-in Temperature Sensor</li> <li>● 0.9 <math>\mu\text{m}</math> - 1.7 <math>\mu\text{m}</math> Spectral Range</li> <li>● Minimum Pixel Operability &gt; 99%</li> <li>● Quantum Efficiency &gt; 70%</li> <li>● Snapshot ITR / IWR</li> <li>● 2 Outputs with up to 22 MHz Pixel Rate</li> </ul> | <ul style="list-style-type: none"> <li>● Shortwave-Infrared Imaging</li> <li>● Semiconductor Inspection / Process Monitoring</li> <li>● Sorting, Recycling</li> <li>● Near-Infrared Spectrophotometry</li> </ul> |



The LDA1024 is an uncooled near-infrared linear image sensor consisting of a linear InGaAs-detector array bonded to two p-on-n readout-ICs. The series includes two products with different sensor pixel sizes, LDA1024P12.5S-1.7-C and LDA1024P12.5M-1.7-C.

## GENERAL DESCRIPTIONS

| PARAMETER              | UNIT          | VALUE                     |             |
|------------------------|---------------|---------------------------|-------------|
| Sensor Technology      | ---           | Planar InGaAs PIN         |             |
| Spectral Range         | $\mu\text{m}$ | 0.9 - 1.7                 |             |
| Actual Pixel Array     | --            | 1024 x 1                  |             |
| Pixel Pitch            | $\mu\text{m}$ | 12.5                      |             |
| Pixel Size             | $\mu\text{m}$ | Pixel Size                | Dimension   |
|                        |               | S                         | 12.5 x 12.5 |
|                        |               | M                         | 12.5 x 250  |
| Chip Size              | mm            | 15.3 x 9.0                |             |
| Package Type           | ---           | 28-pin Ceramic DIP (CDIP) |             |
| Package Size L x W x T | mm            | 35.56 x 15.61 x 7.15      |             |
| Weight                 | g             | 5.18                      |             |



## SPECIFICATIONS (ITS<sup>1</sup> = 20 ± 1°C)

| PARAMETER  | UNIT              | TYPICAL VALUE | CONDITIONS   |
|--|-------------------|---------------|--|
| Dark Current <sup>2,3</sup>                          | fA                | S ≤ 600       | Photo pixel biased @ -0.5 V  |
|  |                   | M ≤ 1000      |  |
| Quantum Efficiency <sup>2</sup> * Fill Factor (QEFF) | %                 | ≥ 70          | λ = 1550 nm  |
| Response Nonuniformity <sup>2</sup>                  | %                 | ≤ 5           | At 50% Full Well   |
| Response Nonlinearity <sup>2</sup>                   | %                 | ≤ 2           | 15% - 85% Well Occupation Range                                    |
| Charge Capacity                                      | μV/e <sup>-</sup> | Cint = 6.4 fF | 16 settings from 6.4fF to 2.1pF                                    |
|  |                   | Cint = 16 fF  |  |
|  |                   | Cint = 30 fF  |  |
|  |                   | Cint = 120 fF |  |
|  |                   | Cint = 2.1 pF |  |
| Readout Noise  | mV                | Cint = 6.4 fF | ROIC Specifications  |
|  |                   | Cint = 16 fF  |  |
|  |                   | Cint = 30 fF  |  |
|  |                   | Cint = 120 fF |  |
|  |                   | Cint = 2.1 pF |  |
| Output Swing   | V                 | ≥ 2.0         | Gain @16fF (High Gain Mode)  |
| Minimum Integration Period                           | μs                | 5             | ROIC Specifications  |
| Maximum Pixel Rate                                   | MHz               | 22            | ROIC Specifications  |
| Pixel Operability <sup>2</sup>                       | %                 | ≥ 99          | Percentage of Pixels with QEFF Deviation within ± 20%* (QEFF Mean) |

1. Readings from Integrated Temperature Sensor (ITS).
2. These items are defined for central effective pixel array (1024x1). Their values correspond to default operation conditions.
3. High gain, charge capacity @16fF, integration time 5ms.

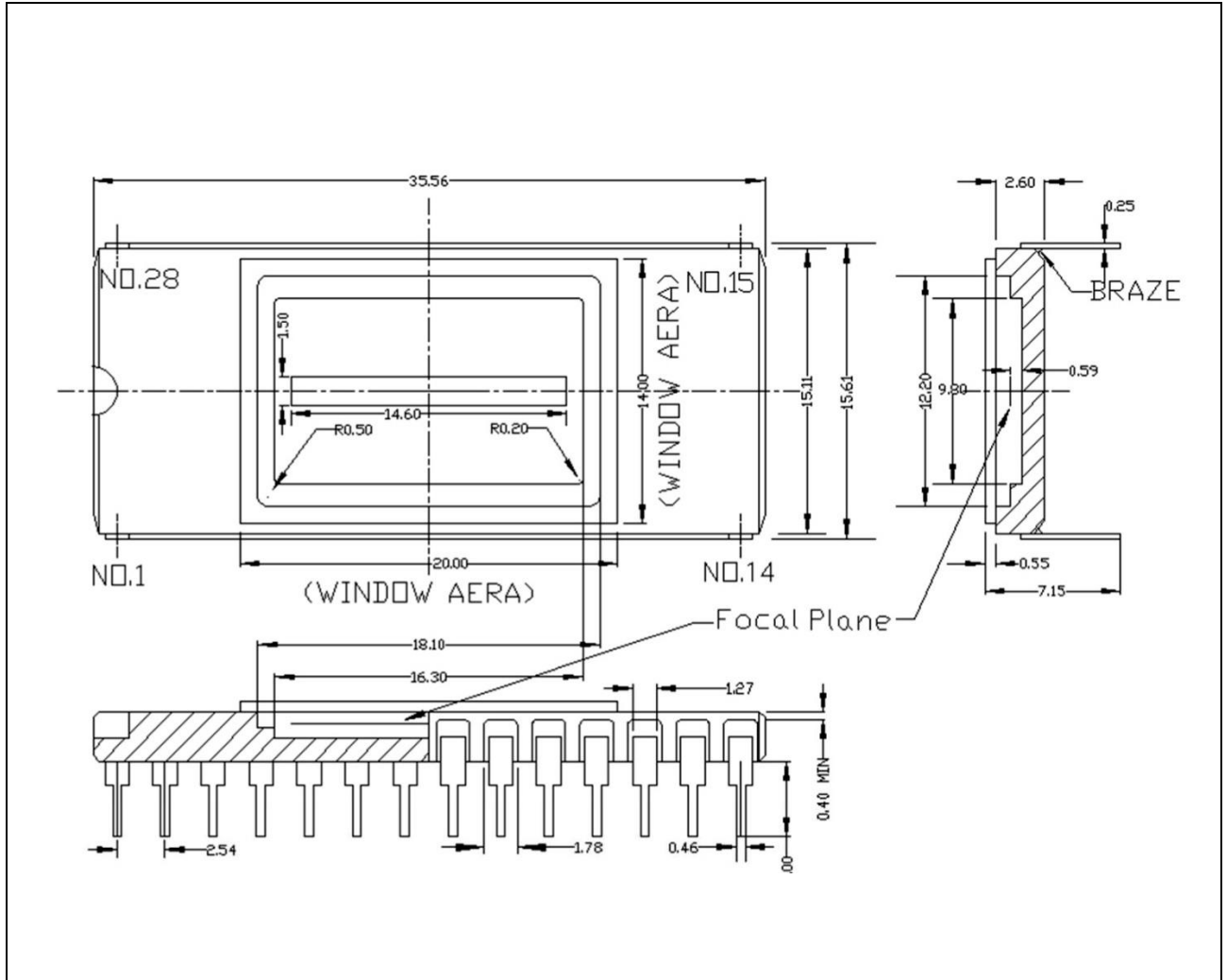
## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                          | UNIT | MIN. | MAX. |
|------------------------------------|------|------|------|
| Operating Temperature <sup>4</sup> | °C   | -40  | +70  |
| Storage Temperature <sup>4</sup>   | °C   | -40  | +70  |
| Power Consumption <sup>5</sup>     | mW   | ---  | 190  |

4. In non-condensing environment.
5. Without powering on the thermoelectric cooler.



## PACKAGE OUTLINE (Unit: mm)



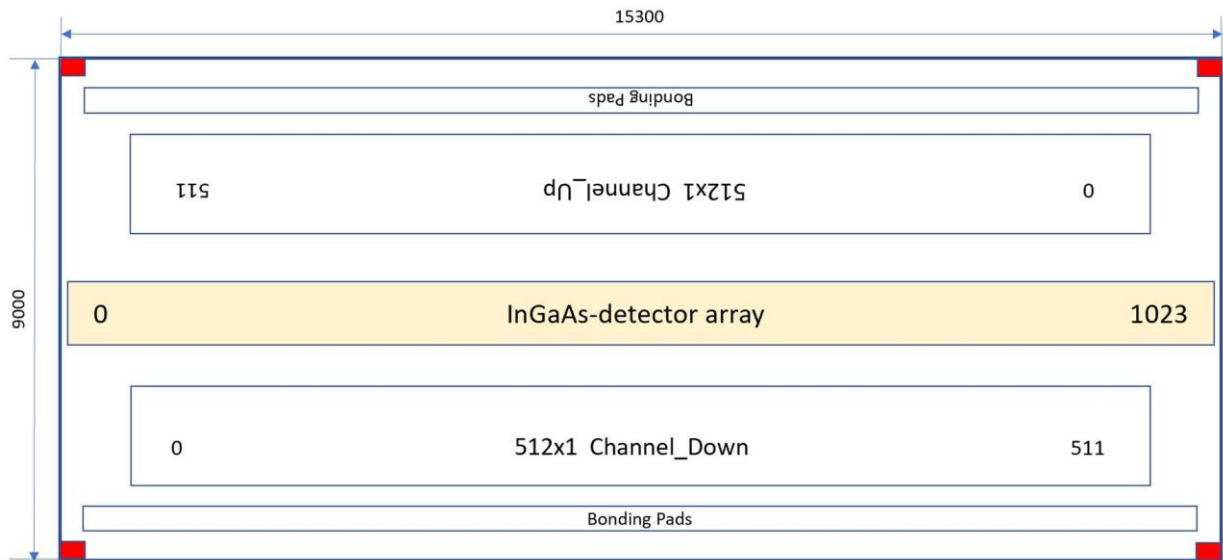
## PIN DEFINITION

|    |         |    |            |    |         |    |         |
|----|---------|----|------------|----|---------|----|---------|
| 01 | VDD_D   | 08 | SDOUT_D    | 15 | GND     | 22 | SDIN_U  |
| 02 | RESET_D | 09 | DATVALID_D | 16 | VR1_U   | 23 | CEB_U   |
| 03 | NC      | 10 | VOUT_D     | 17 | VR2_U   | 24 | MC_U    |
| 04 | INT_D   | 11 | VDDA_D     | 18 | VTEMP_U | 25 | INT_U   |
| 05 | MC_D    | 12 | VR2_D      | 19 | VDDA_U  | 26 | NC      |
| 06 | CEB_D   | 13 | VR1_D      | 20 | VOUT_U  | 27 | RESET_U |
| 07 | SDIN_D  | 14 | VDETCOM    | 21 | SDOUT_U | 28 | VDD_U   |



## CHIP PROFILE

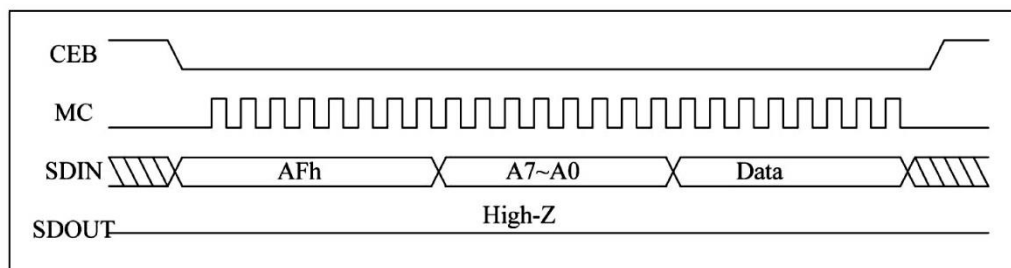
### Layout



Chip size:15.3mm x 9.0mm

## SPI Interface

LDA1024 supports SPI protocol to set the command registers. There are functions of the gain mode, power consumption control and the sequence of pixel output. The 1024x1 photodiode array is connected to two 512x1 readout ICs.



SPI Protocol Schematic



## OPERATING CONDITIONS

### Bias Input

| Pin #  | Bias             | Voltage   | Current | Remark  |
|--------|------------------|-----------|---------|---|
| 01, 28 | VDD_D, VDD_U     | 1.8 V     | > 30 mA | Positive logic supply   |
| 11, 19 | VDDA_D, VDDA_U   | 3.6 V     | > 60 mA | Positive analog supply  |
| 12, 17 | VR2_D, VR2_U     | 0.3 V     | > 30 mA | External Input Bias   |
| 13, 16 | VR1_D, VR1_U     | 2.3 V     | > 5 mA  | External Input Bias   |
| 14     | VDETCOM          | > VR1_D&U | --      | Detector common voltage<br>Detector bias <sup>6</sup> = VDETCOM-VR1_D&U |
| 15     | GND              | 0 V       | --      | Ground  |
| 02, 27 | RESET_D, RESET_U | 1.8 V     | --      | Chip reset  |

6. VDETCOM lower than 2.3V will forward bias the sensor, the exact zero bias voltage is device and temperature dependent.

### Digital Pattern Input

| Pin #  | Clocks         | Levels      | Rise/Fall | Remark                            |
|--------|----------------|-------------|-----------|-----------------------------------|
| 04, 25 | INT_D, INT_U   | 1.8 V / 0 V | < 50 ns   | Integration time                  |
| 05, 24 | MC_D, MC_U     | 1.8 V / 0 V | < 5 ns    | Master clock, Max. Freq. = 22 MHz |
| 06, 23 | CEB_D, CEB_U   | 1.8 V / 0 V | < 10 ns   | Chip enable <sup>7</sup>          |
| 07, 22 | SDIN_D, SDIN_U | 1.8 V / 0 V | < 5 ns    | Data code input                   |

7. The input and output of all commands start after the falling edge of CEB.

### Digital Pattern Output

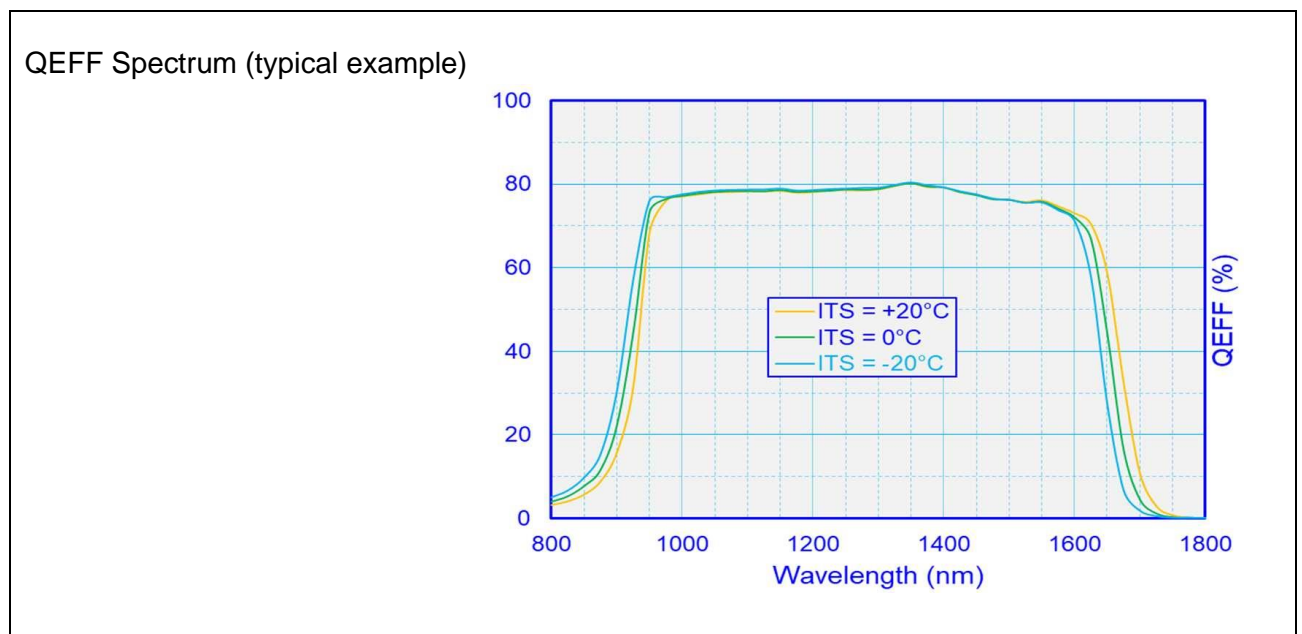
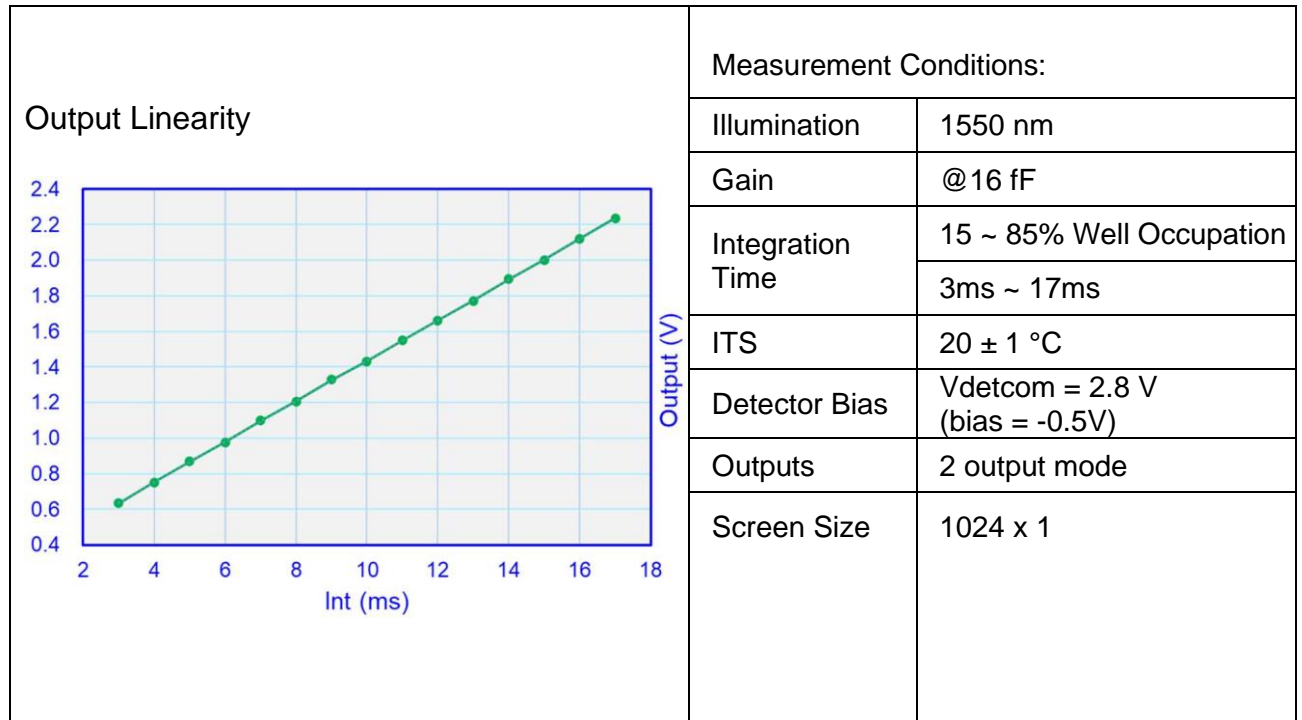
| Pin #  | Clocks           | Levels      | Rise/Fall | Remark                        |
|--------|------------------|-------------|-----------|-------------------------------|
| 08, 21 | SDOUT_D, SDOUT_U | 1.8 V / 0 V | --        | Data code output              |
| 09     | DATVALID_D       | 1.8 V / 0 V | --        | Valid data output flag signal |

### Analog Output

| Pin #  | Outputs        | Levels      | Value | Remark  |
|--------|----------------|-------------|-------|---|
| 10, 20 | VOUT_D, VOUT_U | 0.2 ~ 2.4 V | --    | Video output                                  |
| 18     | VTEMP_U        | 2.138 V     | 27 °C | Integrated Temperature Sensor<br>(-0.6 mV/°C) |



## EXAMPLE CURVES



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