



CCD42-40 Front Illuminated AIMO Ceramic Compact Pack Large Area Sensor for Scientific Applications

e2v technologies

FEATURES

- 2048 x 2048 x 13.5 µm pixels
- Advanced Inverted Mode Operation (AIMO)
- Low Noise Output Amplifier
- Dual Responsivity Output
- Full-frame Architecture
- Gated Dump Drain on Output Register
- Compact Footprint Ceramic Package

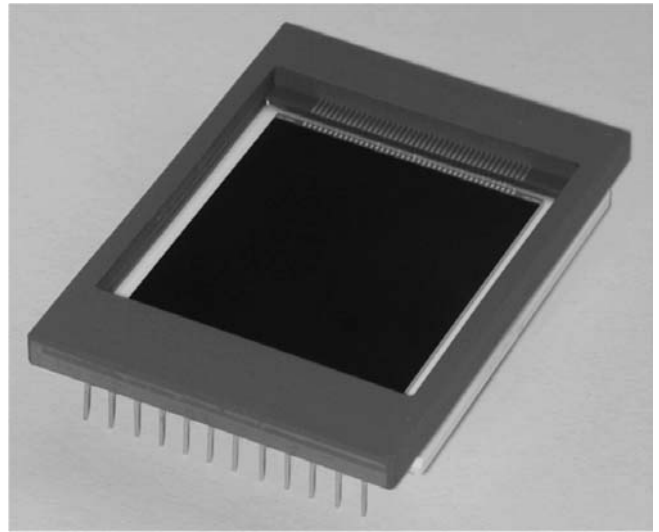
INTRODUCTION

This version of the CCD42 family of CCD Sensors has full-frame architecture, which in combination with an extremely low noise amplifier, makes the device well suited for use in general scientific imaging. The advanced inverted mode operation (AIMO) gives a 100 times reduction in dark current with minimal full well reduction and is suitable for use at Peltier temperatures.

The output amplifier is designed to give excellent noise levels at low pixel rates and can match the noise performance of most conventional science CCDs at pixel rates as high as 3 MHz.

There are two low noise amplifiers in the readout register, one at each end. Charge can be made to transfer through either or both amplifiers by making the appropriate RØ connections. The readout register has a gate controlled dump drain to allow fast dumping of unwanted data.

The register is designed to accommodate four image pixels of charge and a summing well is provided, capable of holding six image pixels of charge. The output amplifier has a feature (switchable OG2) to enable the responsivity to be reduced, allowing the reading of such large charge packets.



GENERAL DATA

Format

| | |
|--|----------------|
| Image area | 27.6 x 27.6 mm |
| Active pixels: | |
| horizontal | 2048 |
| vertical | 2048 + 4 |
| serial overscan pixels | 50 at each end |
| Pixel size | 13.5 x 13.5 µm |
| Number of output amplifiers | 2 |
| The device has a 100% fill factor for maximum sensitivity. | |
| Spectral range | 420 - 1060 nm |

PERFORMANCE LIMITS

| | Min | Typical | Max | |
|--|--------|-----------|------|-------------------------|
| Peak charge storage (see note 1) | 80k | 100k | - | e ⁻ /pixel |
| Peak output voltage (unbinned) | - | 450 | - | mV |
| Dark signal at 293 K (see note 2) | - | 100 | 200 | e ⁻ /pixel/s |
| Charge transfer efficiency (see note 3): | | | | |
| parallel | 99.999 | 99.9999 | - | % |
| serial | 99.999 | 99.9993 | - | % |
| Output amplifier responsivity: | | | | |
| normal mode | 3.0 | 4.5 | 6.0 | μV/e ⁻ |
| high signal mode | - | 1.5 | - | μV/e ⁻ |
| Readout noise at 253 K (see note 4) | - | 3.0 | 4.0 | rms e ⁻ |
| Readout frequency (see note 5) | - | 20 | 3000 | kHz |
| Line transfer period | 20 | 40 | - | μs |
| Output node capacity (see note 6) | - | 1,000,000 | - | e ⁻ |

NOTES

1. Signal level at which resolution begins to degrade.
2. The typical average (background) dark signal at any temperature T (kelvin) between 230 K and 300 K is given by:

$$Q_d/Q_{do} = 1.4 \times 10^6 T^3 e^{-9080/T}$$
 where Q_{do} is the dark current at 293 K. Below 230 K additional dark current components with a weaker temperature dependence may become significant.
3. CTE is measured for a complete 3-phase clock triplet.
4. Measured using correlated double sampling. Noise specification applies at 20 kHz.
5. Readout above 3000 kHz can be achieved but performance to the parameters given cannot be guaranteed.
6. With output circuit configured in low responsivity/high capacity mode (OG2 high).

TYPICAL OPERATING CONDITIONS

| Ref | Pin No. | Typical Voltage |
|-----------------|---------------|-----------------|
| SS | 1, 12, 13, 24 | 9.5 V |
| IØ1 | 17 | 12 V |
| IØ2 | 18 | 12 V |
| IØ3 | 16 | 12 V |
| RØ1(L) | 20 | 11 V |
| RØ2(L) | 19 | 11 V |
| RØ1(R) | 22 | 11 V |
| RØ2(R) | 23 | 11 V |
| RØ3 | 21 | 11 V |
| ØR | 14 | 12 V |
| ØSW | 15 | 11 V |
| DG (see note 9) | 7 | 0 V |
| OG1 | 2 | 3 V |
| DD | 6 | 24 V |
| OG2 | 11 | see note 7 |
| OD(L) | 4 | 29 V |
| OD(R) | 9 | 29 V |
| OS(L) | 3 | see note 8 |
| OS(R) | 10 | see note 8 |
| RD(L) | 5 | 17 V |
| RD(R) | 8 | 17 V |

Nomenclature

| | |
|----------|---------------------------------|
| SS | Substrate |
| LS | Local substrate (connect to SS) |
| IØ1/2/3 | Image area clocks |
| RØ1/2/3 | Serial register clocks |
| ØR | Reset clock |
| ØSW | Summing well |
| DG | Register dump gate |
| OG1, OG2 | Output gates |
| DD | Dump drain |
| OD | Output drain |
| OS | Output source |
| RD | Reset drain |

Part Reference

CCD42-40-* -388 * = grade, AIMO, frontside, ceramic compact package.

Other variants of the CCD42-40 available are back illuminated format and non-inverted mode operation (NIMO). In common with all e2v technologies CCD Sensors, the front illuminated CCD42-40 is available with a fibre-optic window or taper, or with a phosphor coating. Sensors are normally supplied with a temporary glass window. The CCD42-40 is also available in a PGA metal pack or on a metal 3-side buttable package.

NOTES

- OG2 = OG1 + 1 V - normal low noise mode or OG2 = 20 V - low responsivity/increased charge handling mode.
- OS = 3 to 5 V below OD typically. Use 3 - 5 mA current source or 5 - 10 kW load.
- Non-charge dumping level is shown. For charge dumping, DG should be pulsed to 12 ± 2 V.
- Readout register clock pulse low levels +1 V; other clock low levels 0 ± 0.5 V.
- With the RØ connections shown, this device will operate through both outputs. In order to operate from the left-hand output only, RØ1(R) and RØ2(R) should be reversed.

BLEMISH SPECIFICATION

Traps Pixels where charge is temporarily held. Traps are counted if they have a capacity greater than $200 e^-$ at 253 K.

Black spots Are counted when they have a signal level of less than 90% of the local mean at a signal level of approximately half full-well.

White spots Are counted when they have a generation rate 125 times the specified maximum dark signal generation rate (measured between 253 and 293 K). The typical temperature dependence of white spot defects is:

$$Q_d/Q_{d0} = 122T^3 e^{-6400/T}$$

Column defects A column that contains at least 21 white or 21 black defects.

| GRADE | 0 | 1 | 2 |
|----------------------------|----|----|-----|
| Column defects | 0 | 1 | 4 |
| Black spots | 50 | 75 | 100 |
| Traps > 200 e ⁻ | 10 | 20 | 30 |
| White spots | 50 | 75 | 100 |

Grade 5 Functional devices for set-up purposes only.

