E2V Technologies

CCD42-40 PGA Back Illuminated NIMO Large Area Sensor for Scientific Applications

FEATURES

- 2048 x 2048 x 13.5 µm pixels
- Back Thinned for High Quantum Efficiency
- Low Noise Output Amplifiers
- Full-frame Architecture
- Dual Responsivity Output
- Gated Dump Drain on Output Register
- 42-pin PGA Package

GENERAL DATA

Format

| Image area | | 27.6 x 27.6 mm |
|----------------|------------------------|----------------|
| Active pixels: | horizontal | 2048 |
| • | vertical | |
| | serial overscan pixels | 50 at each end |
| Pixel size: | | 13.5 x 13.5 µm |
| | | · |
| Number of out | out amplifiers | 2 |
| | | |

The device has a 100% fill factor for maximum sensitivity.

INTRODUCTION

This version of the CCD42 family of CCD Sensors has full frame architecture, which in combination with back thinning and extremely low noise amplifiers make the device well suited for use in general scientific imaging.

The output amplifiers are 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 $R \varnothing$ 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 amplifiers have a feature (switchable OG2) to enable the responsivity to be reduced, allowing the reading of such large charge packets.

The device is supplied in a 42-pin PGA metal package designed for ease of use. The design of the package permits easy interfacing to cold shoes or supports.

PERFORMANCE LIMITS

| Parameter | Min | Typical | Max | Units | Notes |
|--|------------------|--------------------|--------|-------------------------|-------|
| Peak charge storage | 100k | 150k | - | e ⁻ /pixel | 1 |
| Peak output voltage (unbinned) | - | 675 | - | mV | |
| Dark signal at 293 K | - | 20,000 | 45,000 | e ⁻ /pixel/s | 2 |
| Dark signal at 243 K | - | 127 | - | e ⁻ /pixel/s | 2 |
| Charge transfer efficiency: parallel serial | 99.999 99.999 | 99.9999 99.9993 | - | % | 3 |
| Output amplifier responsivity (normal mode) (high signal mode) | 3.0 | 4.5 1.5 | 6 - | μV/e ⁻ | |
| Readout noise at 243 K | - | 3.0 | 4.0 | rms e | 4 |
| Readout frequency | - | 20 | 3000 | kHz | 5 |
| Line transfer period | 10 | 20 | - | μs | |
| Output node capacity | - | 1,000,000 | - | e ⁻ | 6 |

Spectral Response (at 243 K)

| Wavelength (nm) | Basic process Midband AR coating | | Basic process Broadband AR coating | | Photo response non-uniformity | |
|-----------------|----------------------------------|---------------|------------------------------------|---------------|-------------------------------|-------|
| | Minimum QE | Typical QE | Minimum QE | Typical QE | Maximum (1s) | Units |
| 300 | Not specified | Not specified | Not specified | Not specified | - | % |
| 350 | 15 | 20 | 25 | 40 | 5 | % |
| 400 | 40 | 52 | 55 | 75 | 3 | % |
| 500 | 85 | 90 | 75 | 84 | 3 | % |
| 650 | 85 | 90 | 75 | 77 | 3 | % |
| 900 | 30 | 42 | 30 | 38 | 5 | % |

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Spectral Response (at 243 K)

| Wavelength (nm) | Enhanced process UV AR coating | | Enhanced process Broadband AR coating | | Photo response non-uniformity | |
|-----------------|--------------------------------|------------|---------------------------------------|---------------|-------------------------------|-------|
| | Minimum QE | Typical QE | Minimum QE | Typical QE | Maximum (1s) | Units |
| 300 | 45 | 63 | Not specified | Not specified | - | % |
| 350 | 45 | 55 | 50 | 67 | 5 | % |
| 400 | 55 | 57 | 80 | 89 | 3 | % |
| 500 | 60 | 65 | 80 | 87 | 3 | % |
| 650 | 60 | 66 | 75 | 79 | 3 | % |
| 900 | 30 | 36 | 30 | 33 | 5 | % |

A CCD with no coating is also available for soft X-ray and EUV applications.

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: $Q_d/Q_{do} = 122T^3e^{-6400/T}$ where Q_{do} is the dark current at 293 K. Note that this is typical performance and some variation may be seen between devices.
- 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. | Typ.Voltage |
|-------------------|-------------------------|-------------|
| SS, LS | 1, 8, 13, 28, 35, 40 | 9 V |
| IØ1 | 6, 39 | 10 V |
| IØ2 | 7, 34 | 10 V |
| IØ3 | 5, 38 | 10 V |
| RØ1(L) | 20 | 11 V |
| RØ2(L) | 19 | 11 V |
| RØ1(R) | 23 | 11 V |
| RØ2(R) | 22 | 11 V |
| RØ3 | 24 | 11 V |
| \emptyset R(L) | 18 | 12 V |
| \emptyset R(R) | 27 | 12 V |
| ØSW(L) | 16 | 11 V |
| \emptyset SW(R) | 25 | 11 V |
| DG (see note 9) | 26, 17 | 0 V |
| OG1(L) | 15 | 3 V |
| OG1(R) | 30 | 3 V |
| DD | 32, 11 | 24 V |
| OG2(L) | 14 | see note 7 |
| OG2(R) | 29 | see note 7 |
| OD(L) | 10 | 29 V |
| OD(R) | 31 | 29 V |
| OS(L) | 9 | see note 8 |
| OS(R) | 36 | see note 8 |
| RD(L) | 12 | 17 V |
| RD(R) | 33 | 17 V |
| NC | 2, 3, 4, 21, 37, 41, 42 | |

Nomenclature

| SS | - | Substrate |
|----------|---|---------------------------------|
| LS | - | Local substrate (connect to SS) |
| IØ1/2/3 | - | lmage 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 |
| NC | - | Not connected |
| | | |

NOTES

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

BLEMISH SPECIFICATION

| Grade | 0 | 1 | 2 |
|---------------------------|-----|-----|-----|
| Column defects | 0 | 3 | 6 |
| Black spots | 100 | 150 | 250 |
| Traps > 200e ⁻ | 10 | 20 | 30 |
| White Spots | 100 | 150 | 200 |

Grade 5 are functional devices for set-up purposes only.

Traps Pixels where charge is temporarily held. Traps are counted if they have a capacity greater than 200 e at 243 K.

Black spots are counted when they have a signal level of less than 80% of the local mean at a signal level of approximately half full-well.

White spots are counted when they have a generation rate 25 times the specified maximum dark signal generation rate (measured between 243 and 293 K). The typical temperature dependence of white spot defects is the same as that of the average dark signal, i.e.: $Q_d/Q_{d0} = 122 T^3 e^{-6400/T}$

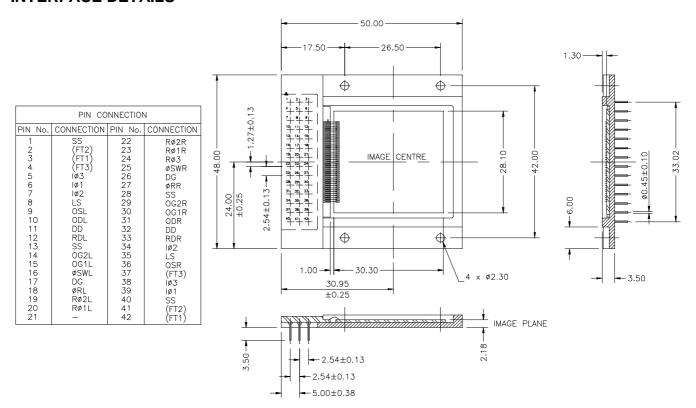
Column defects, a column that contains at least 50 white or 50 black defects.

Part Reference:

| CCD42-40-* CCD42-40-* CCD42-40-* | *= grade, *= grade, *= grade, | NIMO, backside basic midband AR, non-buttable PGA-metal package. Ask for details. NIMO, backside basic broadband UV AR, non-buttable PGA-metal package. Ask for details. NIMO, backside basic no AR, non-buttable PGA-metal package. Ask for details. |
|--|-------------------------------------|---|
| CCD42-40-*-310 CCD42-40-* CCD42-40-* | *= grade, *= grade, *= grade, | NIMO, backside enhanced process broadband AR, non-buttable PGA-metal package. NIMO, backside enhanced UV AR, non-buttable PGA-metal package. Ask for details. NIMO, backside enhanced UV no AR, non-buttable PGA-metal package. Ask for details. |

Other variants of the CCD42-40 available are front illuminated format and advanced inverted mode operation (AIMO). In common with all E2V Technologies CCD Sensors, the back 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 compact ceramic pack or on a metal 3-side buttable package.

INTERFACE DETAILS



Note The Frame Transfer connections (FT) are not used in this version of the CCD42-40 (i.e. not connected).

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