

Marconi Applied Technologies

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

FEATURES

- 2048 x 2048 x 13.5 µm pixels
- Back Thinned for High Quantum Efficiency
- Advanced Inverted Mode Operation (AIMO)
- Low Noise Output Amplifiers
- Full-frame Architecture
- Gated Dump Drain on Output Register
- 42-pin PGA Package

GENERAL DATA

Format

Image area		27.6 x 27.6 mm	
	horizontal		
·	vertical		
	serial overscan pixels	50 at each end	
Pixel size:		13.5 x 13.5 µm	
Number of output amplifiers2			

The device has a 100% fill factor for maximum sensitivity

PERFORMANCE LIMITS

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 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 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 1 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 RN 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.

Parameter	Min	Typical	Max	Units	Notes	
Peak charge storage	80k	100k	-	e ⁻ /pixel	1	
Peak output voltage (normal mode unbinned)	-	450	-	mV		
Dark signal at 293 K	-	250	500	e ⁻ /pixel/s	2	
Charge transfer efficiency:						
parallel	99.999	99.9999	-	%	3	
serial	99.999	99.9993	-	%		
Output amplifier responsivity (normal mode)	3.0	4.5	6	μV/e⁻		
(high signal mode)	-	1.5	-	hvie		
Readout noise at 253 K	-	3.0	4.5	rms e	4	
Readout frequency	-	20	3000	kHz	5	
Line transfer period	TBA	100	-	μs		
Output node capacity	-	1,000,000	-	e	6	

Spectral Response (at 253 K)

Wavelength Basic process (nm) Midband AR co		Basic process ating 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	%

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

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NOTES

- 1. Signal level at which resolution begins to degrade.
- 2. The typical average (background) dark signal at any temperature T (kelvin) between 253 K and 300 K is given by: $Q_d/Q_{do} = 1.14 \times 10^6 T^3 e^{-9080/T}$ 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 1000 kHz can be achieved but performance to the parameters given cannot be guaranteed.
- 6. With output circuit configured in normal/low-noise mode (OG2 low).

TYPICAL OPERATING CONDITIONS

Ref SS, LS IN1 IN2 IN3 RN1(L) RN2(L) RN2(L) RN2(R) RN3 NR(L) NR(R) NSW (L) NSW (L) NSW (R) DG (Note 9) OG1(L) OG1(R) DD	Pin No. 1, 8, 13, 28, 35, 40 6, 39 7, 34 5, 38 20 19 23 22 24 18 27 20 25 26, 17 15 30 32, 11	Typ.Voltage 9.5 V 15 V 15 V 15 V 11 V 11 V 11 V 11 V 1
RN2(R)	22	11 V
	24	11 V
NR(L)	18	12 V
	27	12 V
NSW (L)	20	11 V
NSW(R)	25	11 V
DG (Note 9)	26, 17	0V
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)	33	17 V
RD(R)	12	17 V
NC	2, 3, 4, 21, 37, 41, 42	

Nomenclature

Substrate
Local substrate (connect to SS)
Image area clocks
Serial register clocks
Reset clock
Summing well
Register dump gate
Output gates
Dump drain
Output drain
Output source
Reset drain
Not connected

NOTES

- 7. 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 $5 10 \text{ k}\Omega$ load.
- 9. 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 \pm 0.5 V.
- 11. With the RN connections shown this device will operate through both outputs. In order to operate from the left-hand output only RN1(R) and RN2(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	250

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 253 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 125 times the specified maximum dark signal generation rate (measured between 253 and 293 K). The typical temperature dependence of white spot defects is the same as that of the average dark signal, i.e.: $Qd/Qd0 = 122T^3e^{-6400/T}$

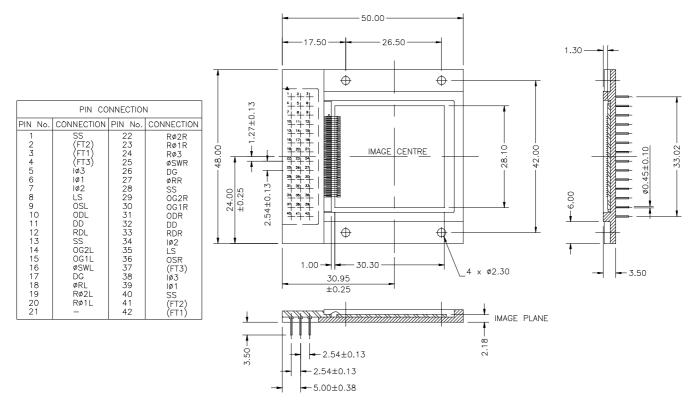
Column defects, a column that contains at least 50 white or 50 black defects.

Part Reference:

CCD42-40-*-343	*= grade,	AIMO, backside basic process midband AR, non-buttable PGA-metal package
CCD42-40-*-336	*= grade,	AIMO, backside basic process broadband AR, non-buttable PGA-metal package
CCD42-40-*-345	*= grade,	AIMO, backside basic process no AR, non-buttable PGA-metal package

Other variants of the CCD42-40 available are front illuminated format and non-inverted mode operation (NIMO). In common with all Marconi Applied 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 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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