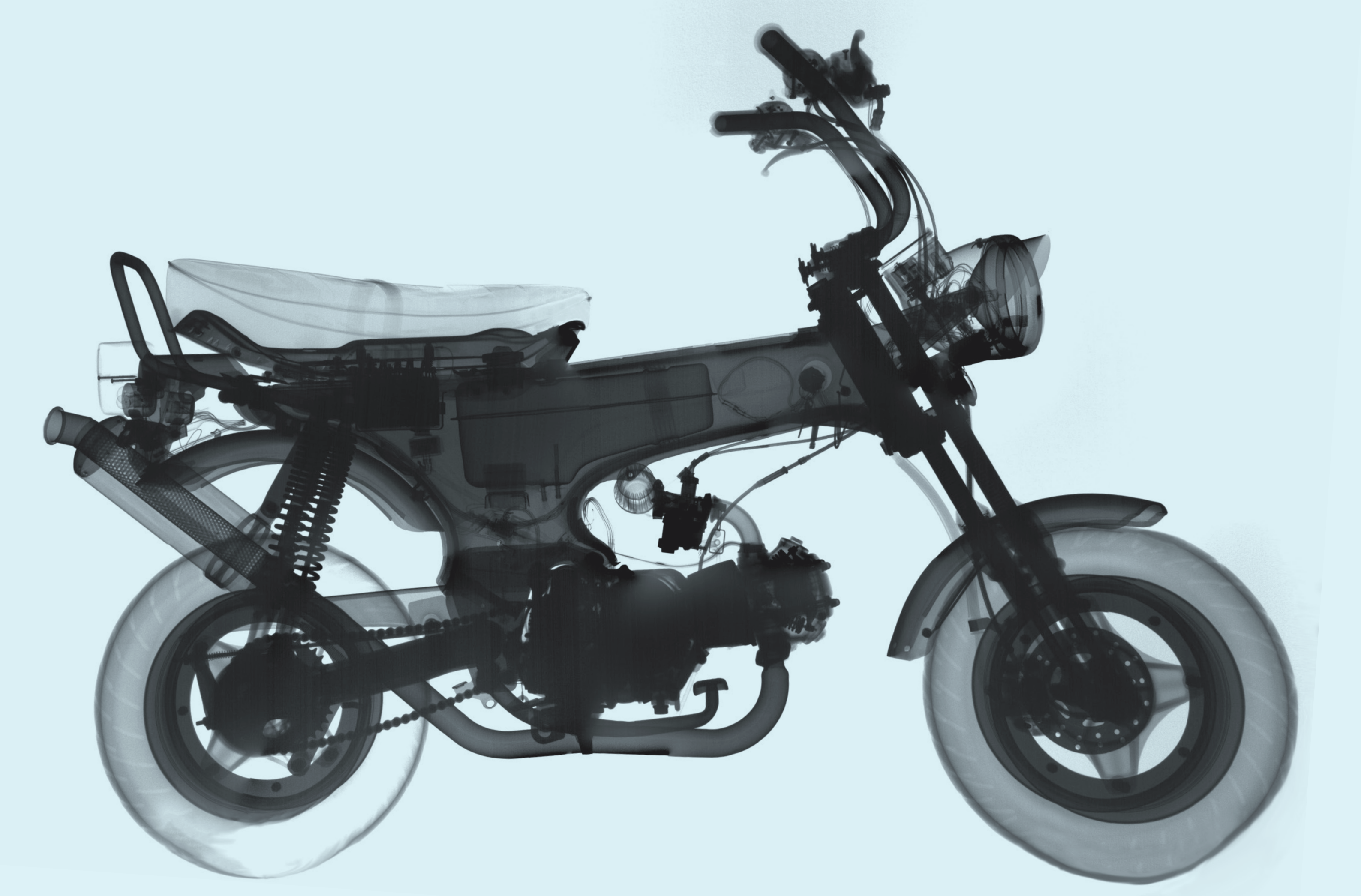
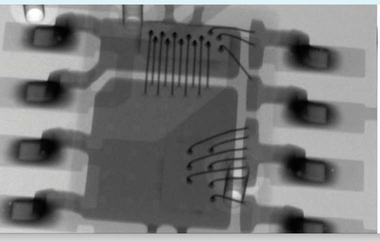
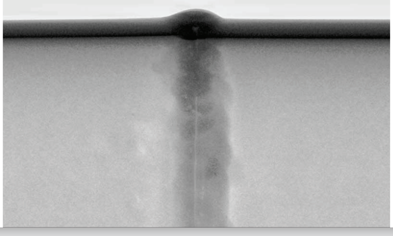
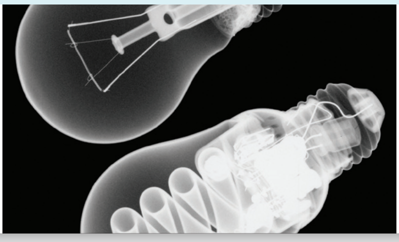
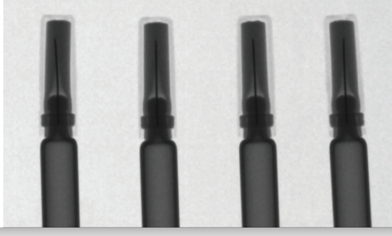
TELEDYNE | Teledyne DALSA











HIGH PERFORMANCE X-Ray Detectors

for Industrial Applications

Teledyne DALSA Industrial X-Ray Detectors

X-Ray Solutions for Non-Destructive Testing

Teledyne DALSA offers a complete portfolio of innovative X-Ray detectors tailored specifically to meet the demanding and diverse needs of non-destructive testing (NDT) applications. Our innovative and reliable products offer solutions for all types of industrial applications.

Dynamic Flat Detectors

Scanning Detectors

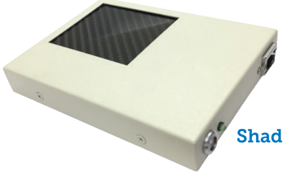
Static Flat Detectors

- Automotive
- Aerospace
- Electronics
- Food & Beverage
- Petrochemicals
- Medical Devices
- Packaging
- Metals
- Semiconductors
- Pharmaceuticals

Portfolio of Industrial X-Ray Detectors

Shad-o-Box 688/3K HS

Shad-o-Box 1548/6K HS



Shad-o-Box 1K HS

Shad-o-Box 2K HS

Rad-icon 1520

Rad-icon 2022

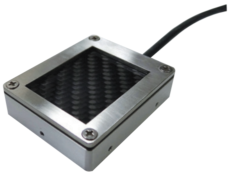
Rad-icon 3030

Rad-icon 1523

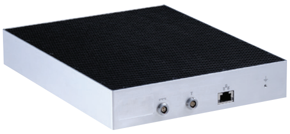
Rad-icon 2329

Shad-o-Scan 3001

Shad-o-Scan 4501

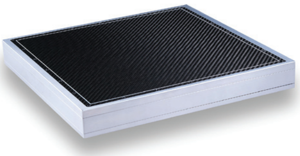


Remote RadEye HR



Rad-Xcam 1717

Rad-Xcam 1723



Rad-Xcam 3030

Premium CMOS

Active Pixel Sensor technology and expertise in low noise circuit design are the hallmarks of TELEDYNE DALSA's CMOS X-ray image sensors. Our CMOS image sensors exhibit unrivalled low readout noise levels and deliver superior image quality at the lowest dose levels, contributing to the high image quality required to support challenging industrial applications. Our CMOS detectors set the industry benchmark for low-dose image quality, rivalling the golden standard of legacy image intensifier and Amourphous Silicon (A-Si) devices.

On a system level, the low-noise raw images from TELEDYNE DALSA's CMOS detectors require less pre-processing before image enhancements, preserving image detail, and reducing system processing overhead and calibration complexity.

Unlike amorphous imaging technologies, the advanced crystalline CMOS design and manufacturing process supports the integration of sensor control, readout and signal digitization functionality from the peripheral electronics into the pixel array. This ability reduces electrical signal degradation and improves final image quality, while the reduction of components and interconnects improves product reliability at the same time.

CMOS Advantages

HIGH IMAGE QUALITY AND LOW DOSE

The very low noise of the CMOS material and the proprietary active pixel architecture of Teledyne DALSA's CMOS detectors ensure improved signal-to-noise ratio (SNR) with respect to the a-Si-based and even other CMOS-based competing products.

HIGH SPEED IMAGING

Enabled by high-speed electronics and the high electron mobility of the crystalline silicon material, CMOS detectors set an industry benchmark for speed at full resolution, while remaining lag- and artifact-free. Frame rates of >100 fps are achievable.

HIGH RESOLUTION

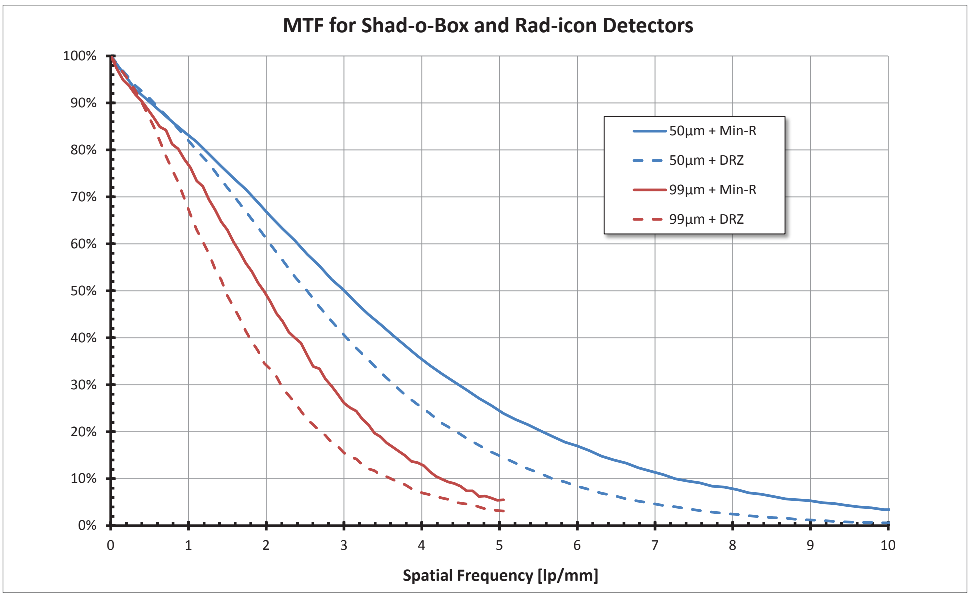
Our advanced pixel design is responsible for the very high fill factor (80-90%), even at small pixel sizes of 50-100 µm. The small pixel pitch combined with proprietary optical stack give rise to high spatial resolution (or MTF) performance.

INNOVATIVE DESIGN

Our sixth-generation proprietary technology enables radiation hard pixel design, with adjustable saturation dose levels that make our detectors suitable for all industrial applications.

LONG LIFETIME

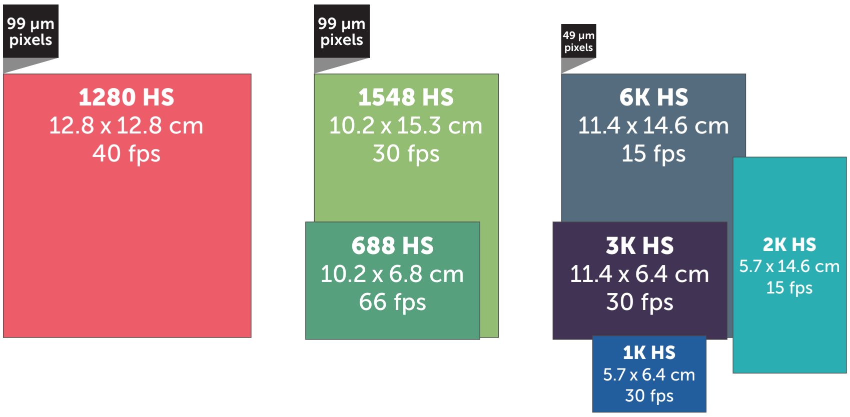
The high integration level of our CMOS design reduces the number of discrete components and interconnects, thus significantly improving the product reliability. The built-in radiation-hardness of our detectors enables long operating lifetime and less frequent calibration routines.



Shad-o-Box™ HS Product Family

The Shad-o-Box HS product family of digital X-ray detectors utilizes a fast and reliable Gigabit Ethernet interface and offers users a high-speed, high-performance X-ray imaging experience. The detectors in this product line are capable of frame rates up to 66 fps, and communicate via a standard Cat6e data cable over lengths up to 100 m. The products are available with different scintillator options to address a range of resolution and sensitivity requirements, making this detector an ideal choice for industrial inspection, biomedical, and scientific X-ray imaging applications.

STANDARD MODELS IN A RANGE OF PIXEL AND DETECTOR SIZES



Shad-o-Box HS FAMILY SPECIFICATIONS

PARAMETER	UNIT	SHAD-O-BOX 1280 HS	SHAD-O-BOX 688 HS	SHAD-O-BOX 1548 HS	SHAD-O-BOX 1K HS	SHAD-O-BOX 2K HS	SHAD-O-BOX 3K HS	SHAD-O-BOX 6K HS
GENERAL								
TECHNOLOGY		CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL
PIXEL PITCH	[µm]	99	99	99	49.5	49.5	49.5	49.5
PIXEL CAPACITY MODES	[#]	1	2	2	1	1	1	1
ACTIVE AREA	[mm]	128 x 128	102 x 68	102 x 153	57 x 64	57 x 146	114 x 64	114 x 146
RESOLUTION	[pxl]	1280 x 1280	1032 x 688	1032 x 1548	1152 x 1264	1152 x 2940	2304 x 1264	2304 x 2940
BANDWIDTH								
DATA INTERFACE	[-]	GigE	GigE	GigE	GigE	GigE	GigE	GigE
ADC CONVERSION	[bits]	14	14	14	14	14	14	14
FRAME RATE – 1X1 (GigE)	[fps]	40*	66	30	30	15*	30	15*
POWER CONSUMPTION								
POWER SUPPLY	[Vdc]	11..13	10..25	10..25	10..25	10..25	10..25	10..25
POWER CONSUMPTION	[W]	10	10	10	10	10	10	10
ACTIVE COOLING	[y/n]	NO	NO	NO	NO	NO	NO	NO
INTEGRATION								
FOOTPRINT (WxHxT)	[mm]	200 x 189 x 35	200 x 150 x 35	200 x 150 x 35	140 x 105 x 20	206 x 78 x 31	200 x 150 x 35	200 x 150 x 35
WEIGHT	[kg]	3.5	3.5	3.5	3.5	3.5	3.5	3.5
IMAGE PRE-PROCESSING**	[-]	yes	yes	yes	yes	yes	yes	yes
DOWNLOADABLE DEFECT MAPS	[-]	yes	yes	yes	yes	yes	yes	yes
ENVIRONMENTAL								
OPERATIONAL TEMPERATURE	[°C]	0..+40	0..+40	0..+40	0..+40	0..+40	0..+40	0..+40
STORAGE TEMPERATURE	[°C]	-10..+55	-10..+55	-10..+55	-10..+55	-10..+55	-10..+55	-10..+55
HUMIDITY	[% R.H.]	10..80	10..80	10..80	10..80	10..80	10..80	10..80
X-RAY RANGE	[kV]	10..225	10..225	10..225	10..225	10..225	10..225	10..225

* TurboDrive enabled

** DPC : Defect Pixel Correction (vector interpolation) | FFC: Flat Field Correction (offset & gain)

Rad-icon™ Large Area Product Family

Utilizing Teledyne DALSA's proprietary CMOS active pixel technology, the Rad-icon family of real-time CMOS X-ray detectors is the industry's first to exceed the low-dose performance of image intensified detectors, setting new industry benchmarks in DQE, low power dissipation and radiation lifetime.

Rad-icon 0720

Rad-icon 1520

Rad-icon 2022

Rad-icon 3030

Rad-icon 0723

Rad-icon 1523

Rad-icon 2329

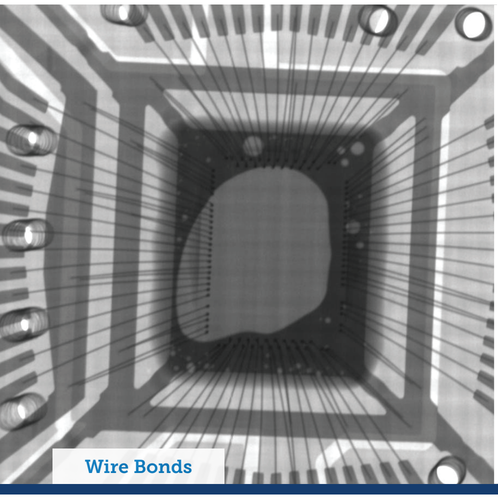
Rad-Icon FAMILY SPECIFICATIONS

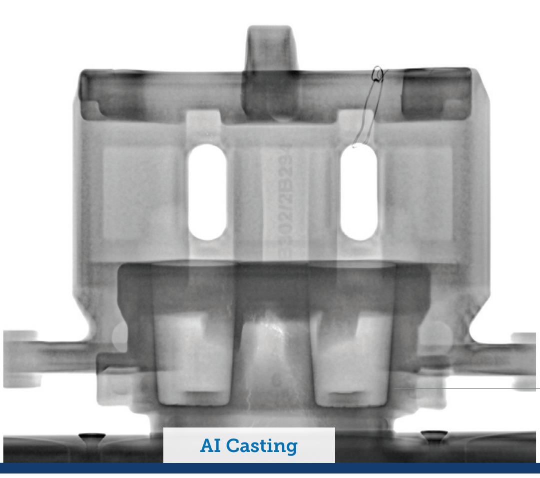
PARAMETER	UNIT	RAD-ICON 0720	RAD-ICON 1520	RAD-ICON 2022	RAD-ICON 3030	RAD-ICON 0723	RAD-ICON 1523	RAD-ICON 2329
GENERAL								
TECHNOLOGY		CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL
PIXEL PITCH	[µm]	99	99	99	99	49.5	49.5	49.5
PIXEL CAPACITY MODES	[#]	2	2	2	2	1	1	1
ACTIVE AREA	[mm]	68 x 204	153 x 204	204 x 221	307 x 307	64 X 228	146 X 228	228 x 292
RESOLUTION	[pxl]	688 x 2064	1548 x 2064	2064 x 2236	3096 x 3096	1300 X 4608	2940 X 4608	4608 x 5888
BANDWIDTH								
DATA INTERFACE	[-]	GigE	GigE	CameraLink	CameraLink	GigE	GigE	GigE
ADC CONVERSION	[bits]	14	14	14	14	14	14	14
FRAME RATE – 1X1 (GigE)	[fps]	66*	25*	30	30	40	20	2
POWER CONSUMPTION								
POWER SUPPLY	[Vdc]	10..25	10..25	10..25	10..25	11..25	11..25	11..13
POWER CONSUMPTION	[W]	12	12	15	18	20	20	20
ACTIVE COOLING	[y/n]	NO	NO	NO	NO	NO	NO	NO
INTEGRATION								
FOOTPRINT (WxHxT)	[mm]	229 x 204 x 36	229 x 204 x 36	292 x 237 x 59	377 x 329 x 59	253 X 182 X 38	253 X 182 X 38	322 x 315 x 23
WEIGHT	[kg]	3.5	3.5	5	8	3.5	3.5	3.5
IMAGE PRE-PROCESSING**	[-]	yes	yes	no	no	no	no	no
DOWNLOADABLE DEFECT MAPS	[-]	yes	yes	yes	yes	yes	yes	yes
ENVIRONMENTAL								
OPERATIONAL TEMPERATURE	[°C]	0..+40	0..+40	0..+40	0..+40	0..+40	0..+40	0..+40
STORAGE TEMPERATURE	[°C]	-10..+55	-10..+55	-10..+55	-10..+55	-10..+55	-10..+55	-10..+55
HUMIDITY	[% R.H.]	20 TO 80	20 TO 80	20 TO 80	20 TO 80	20 TO 80	20 TO 80	20 TO 80
X-RAY RANGE	[kV]	10..225	10..225	10..225	10..225	10..225	10..225	10..225

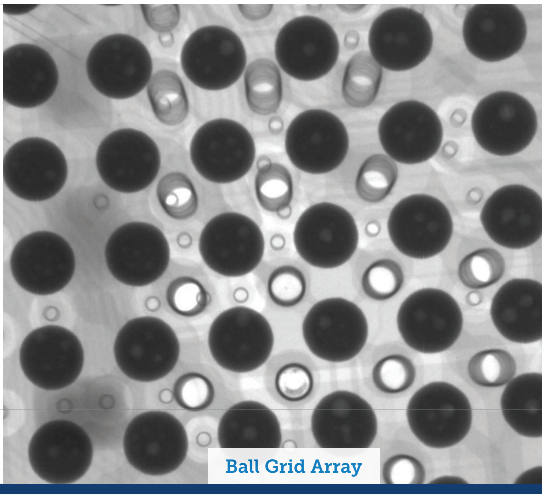
* TurboDrive enabled

** DPC : Defect Pixel Correction (vector interpolation) | FFC: Flat Field Correction (offset & gain)

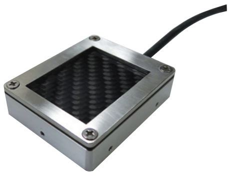
Remote RadEye™ HR X-Ray Detector


Wire Bonds


Al Casting


Ball Grid Array

The Remote RadEye HR X-ray detector is a slim, lightweight, rugged solution for high-resolution radiation imaging. The detector is suitable for industrial inspection applications where images are taken in tight or difficult-to-reach spaces. The Remote RadEye HR sensor module to a PC via USB cable.

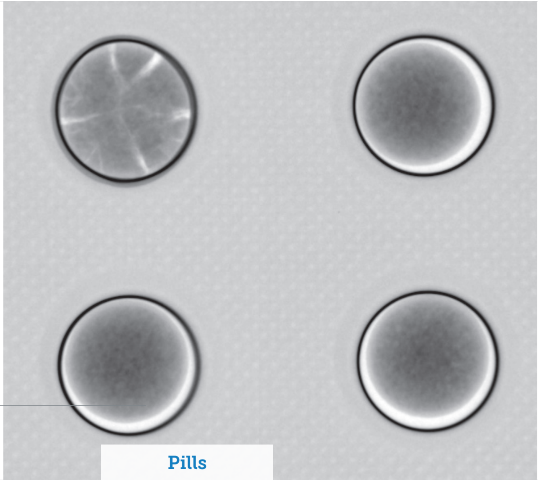

Remote RadEye HR

RadEye HR SPECIFICATIONS

PARAMETER	UNIT	RadEye HR
GENERAL		
TECHNOLOGY		CMOS ACTIVE PIXEL
PIXEL PITCH	[µm]	20
PIXEL CAPACITY MODES	[#]	1
ACTIVE AREA	[mm]	33.0 x 24.9
RESOLUTION	[pxl]	1650 x 1246
BANDWIDTH		
DATA INTERFACE	[-]	DIRECT USB
ADC CONVERSION	[bits]	14
FRAME RATE	[fps]	—
POWER CONSUMPTION		
POWER SUPPLY	[Vdc]	5V (USB)
POWER CONSUMPTION	[W]	<1W
ACTIVE COOLING	[y/n]	NO
INTEGRATION		
FOOTPRINT (WxHxT)	[mm]	50 x 40 x 12.7
WEIGHT (SENSOR HEAD)	[kg]	0.2
ENVIRONMENTAL		
OPERATIONAL TEMPERATURE	[°C]	0..+50
STORAGE TEMPERATURE	[°C]	-10..+65
HUMIDITY	[% R.H.]	10..80
X-RAY RANGE	[kV]	5..90

Shad-o-Scan™ Product Family

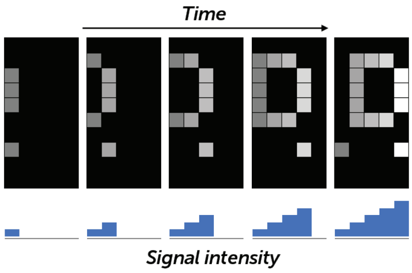
High Speed Inspection



Pills

Conveyor Belt Inspection

Teledyne DALSA's Shad-o-Scan is a family of scanning X-ray detectors specifically designed for the challenging requirements of high-performance industrial and scientific X-ray applications. Industry-leading CMOS performance enables the ultimate sensitivity and highest resolution in the industry, and ensures long detector lifetime in even the harshest radiation environments.



DIGITAL TIME DELAY INTEGRATION

Shad-o-Scan FAMILY SPECIFICATIONS

PARAMETER	UNIT	SHAD-O-SCAN 1501	SHAD-O-SCAN 3001	SHAD-O-SCAN 4501
GENERAL				
TECHNOLOGY		CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL	CMOS ACTIVE PIXEL
PIXEL PITCH	[µm]	99	99	99
ACTIVE AREA	[mm]	152 x 6	304 x 6	456 x 6
RESOLUTION	[pxl]	1536 x 64	3072 x 64	4608 x 64
BANDWIDTH				
DATA INTERFACE	[-]	5GigE	5GigE	5GigE
ADC CONVERSION	[bits]	14	14	14
FRAMERATE	[fps]	1400	1400	1000
POWER CONSUMPTION				
POWER SUPPLY	[Vdc]	12	12	12
POWER CONSUMPTION	[W]	17	18	21
ACTIVE COOLING	[y/n]	NO	NO	NO
INTEGRATION				
FOOTPRINT (WxHxT)	[mm]	190 X 175 X 26	337 x 148 x 49	489 x 148 x 49
WEIGHT	[kg]	3.5	3.5	5
IMAGE PRE-PROCESSING**	[-]	yes	yes	yes
DOWNLOADABLE DEFECT MAPS	[-]	yes	yes	yes
ENVIRONMENTAL				
OPERATIONAL TEMPERATURE	[°C]	+10..+40	+10..+40	+10..+40
STORAGE TEMPERATURE	[°C]	0..+60	0..+60	0..+60
HUMIDITY	[% R.H.]	10 TO 80	10 TO 80	10 TO 80
INGRESS PROTECTION CLASS		-	IP69K	IP69K
X-RAY RANGE	[kV]	10..225	10..225	10..225

** DPC : Defect Pixel Correction (vector interpolation) | FFC: Flat Field Correction (offset & gain)

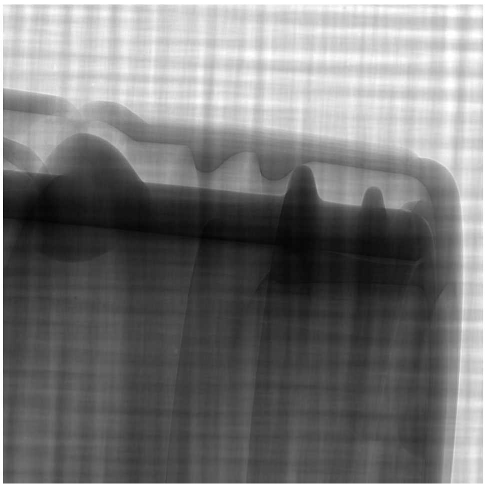
Shad-o-Scan 3001

Shad-o-Scan 4501

Performance IGZO

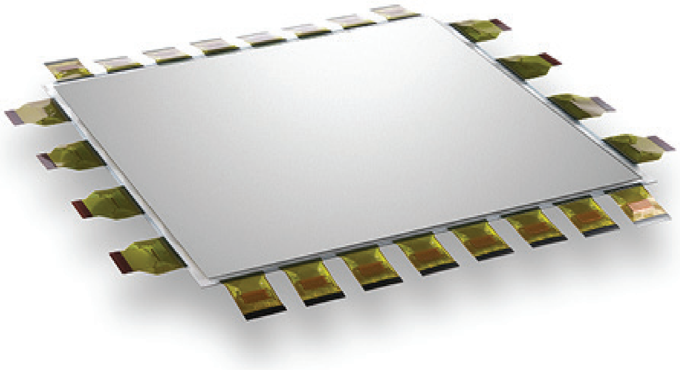
Passive pixel IGZO (indium gallium zinc oxide) technology uses thin films of IGZO coated onto glass substrates to create large format X-ray sensors. Although the process features are less refined compared to CMOS image processes, the technology can produce sensors with sufficient spatial resolution and frame rate to address the requirements of dynamic industrial applications like industrial X-ray or computed tomography.

Leveraging 40+ years of image sensor design experience and low-signal image processing know-how, Teledyne DALSA recognized early on the importance of keeping control of the full imaging chain, from X-ray photon conversion through readout up to electrical signal digitization. The proprietary technology powering these detectors provides artifact free images enabling easy integration and ensure reliable performance. The high thermal stability at operational conditions assures efficient workflow with high productivity and reduced system calibration requirements.



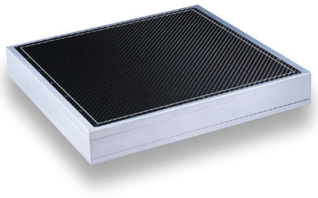
IGZO ADVANTAGES

- Glass substrate processing, more economical for larger formats
- Teledyne DALSA imaging chain, optimizing low dose image quality
- High readout bandwidth
- Detector design optimized for high image contrast and thermal stability



Rad-Xcam Large Area Product Family

Teledyne DALSA's Rad-Xcam 1717, 1723 & 3030 performance exceeds the existent industry benchmarks for legacy amorphous silicon and emerging IGZO technologies by providing higher frame rates and image quality at low dose, lower lag and increased signal-to-noise ratio.
The Rad-Xcam detectors are designed to address the demanding needs of Industrial inspection, biomedical and scientific applications, providing compelling integration cost advantages.



Rad-Xcam 3030

Rad-Xcam 1723

Rad-Xcam 1717

Parameter	**Unit**	**Rad-Xcam-3030**	**Rad-Xcam-1723**	**Rad-Xcam-1717**
PIXEL ARRAY				
TECHNOLOGY		IGZO	IGZO	IGZO
PIXEL PITCH	[um]	146	110	110
ACTIVE AREA	[mm]	299x299	170x226	170x170
RESOLUTION	[pixels]	2048x2048	1536x2048	1536x1536
BANDWIDTH				
DATA INTERFACE	[-]	NBASE-T (5Gbps)	NBASE-T (5Gbps)	NBASE-T (5Gbps)
ADC CONVERSION	[bits]	16	16	16
FRAMERATE	[fps]	55	44	44
POWER CONSUMPTION				
POWER SUPPLY	[Vdc]	11..28	11..28	11..28
POWER CONSUMPTION	[W]	24	21	21
ACTIVE COOLING	[y/n]	NO	NO	NO
INTEGRATION				
FOOTPRINT (WxHxT)	[mm]	330x338x40	253x200x40	196x200x40
WEIGHT	[kg]	8.9	3.2	2.6
IMAGE PRE-PROCESSING*	[-]	no	DPC	DPC
DOWNLOADABLE DEFECT MAPS	[-]	yes	yes	yes
INTEGRATION				
OPERATIONAL TEMPERATURE	[°C]	0..+40	0..+40	0..+40
STORAGE TEMPERATURE	[°C]	-10..+55	-10..+55	-10..+55
HUMIDITY	[% R.H.]	20 TO 80	20 TO 80	20 TO 80

** DPC : Defect Pixel Correction (vector interpolation) | FFC: Flat Field Correction (offset & gain)

TELEDYNE DALSA

OFFICE LOCATIONS

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