

CCD/CMOS Image Sensors And Accessories



EURECA has specialised on supplying CCD/CMOS image sensors and accessories, as well as giving technical support for these products. We can offer a wide range of image sensors by various manufacturers. In some cases EURECA is the official representative and distributor of the respective manufacturers. If this is not the case, we act as a free reseller and work closely together with the official representatives. In the appendix of this document you can also find a short price list for single pieces of the most common sensors and some other products.

Besides CCD/CMOS sensors, we also offer a wide range of accessories and additional services, which we would like to introduce here briefly.

CCD/CMOS image sensors

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General notes

Image sensors transform light into electrical signals that are usually given as a voltage that is proportional to the amount of light. Main applications are electronic cameras, spectrometers and scanners as well as other measuring devices for detection of light and illumination intensity. For the detection of light in the visible range of the spectrum mainly sensors made of silicon are used, which are usually made in one of these technologies.

CCD (Charge Coupled Device):

CCD sensors basically are big spatially structured photodiodes, that are divided into single pixels by structuring. Incoming light generates charge carriers, which are accumulated under electrically conductive structures on the photodiode that are situated insulatedly on the silicon surface. By alteration of the potentials of the structures the charge carriers can be moved through the silicon towards an output amplifier, that converts the charge into a proportional voltage. Since all charge packages are converted by the same output amplifier maximum signal homogeneity can be achieved.

CMOS (Complementary Metal Oxide Semiconductor):

In contrast to CCD sensors CMOS sensors possess single photodiodes. In today's APS sensors every single pixel possesses an own output amplifier, which converts the charge of the photodiode into a voltage. The voltages are connected switched via a multiplexer to the output of the sensor. The main advantages of this kind of sensor is the possibility of the choice of single pixels without needing to read out the complete sensor, as well as the comparatively low current consumption. CMOS sensors also tend to have higher frame rates. These advantages are gained by a loss of homogeneity, which can, however, be improved by internal or external corrections to an acceptable degree.

Area sensors provide a two dimensional array of pixels and are suitable e.g. for recording pictures. Linear sensors provide only a one-dimensional line of pixels and are used e.g. for scanners and spectrometers. **TDI (Time Delayed Integration)** is a special technique for scanning fast moving objects. CIS sensors (**CIS = Contact Image Sensor**) finally are compact modules which consist of a CMOS pixel line, a linear lens and a LED lighting. Such modules are e.g. used for scanners, fax machines or inspecting endless goods in the industrial quality control.

Availability

When looking for a suitable image sensor for a new application, the availability within the next years is an important topic. Sensors by larger manufacturers as SONY, NEC or TOSHIBA, which are mainly used for consumer products, are normally available only for a time period of 5-7 years, before they become obsolete. Usually the end of the availability is announced early enough by the manufacturer, so the customers can order enough goods to build up a suitable own stock.

Obsolete sensors can sometimes be supplied for some more years via the international broker market. EURECA has established an own worldwide network of partner companies to find such obsolete parts. High end sensors as e.g. the products by FAIRCHILD IMAGING, which are also used for military applications, have a longer availability of up to 20 years.

Sensitivity

The sensitivity (in principle the conversion rate of the detected light into the electrical output signal) is dependent on various parameters. Unfortunately the manufacturers do not always use the same physical units to indicate the sensitivity. So it can be difficult to compare this specification of two different sensors. Beside production processes, the so called fill factor is very important. The internal chip structures for reading out the individual pixels need their own space, which reduces the light sensitive area. The percentage of the light sensitive area of a pixel is indicated by the fill factor. In some sensors micro lenses are used to increase the fill factor again. Sensitivity data are given in different units by different manufacturers. As a service Eureka offers to calculate them into comparable units.

For specifying the maximum read out frequency, the so called data rate or pixel frequency is used. This value indicates how many pixels can be read out per second and output. In order to increase the readout speed of the sensor, parallel outputs can be used.

Colour sensors

By using filters for the three basic colours monochrome sensors can be turned into colour versions. The filters are applied to the individual pixels with a suitable micro structuring technique. Formerly a sequential series of the three basic colours were used on a single pixel line in linear sensors. These sensor types were substituted by tri-linear versions. Here an own pixel line is used for each basic colour, where the lines are parallel to each other.



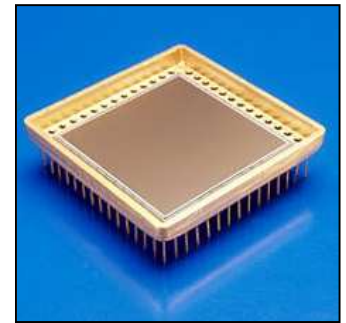
Detailed datasheets, as well as additional information, are available on our internet pages at <http://www.eureca.de>

FAIRCHILD IMAGING

CCD area sensors

FAIRCHILD IMAGING provides high-performance CCD area sensors, which are used in many applications in medicine, science and industry. Used with scintillators the sensors can also be used for X-ray applications.

CCD Sensors by FAIRCHILD IMAGING are often used in aerospace missions as e.g. Mars Observer, Cassini probe, Hubble Space Telescope, and many reconnaissance satellites. For such missions the sensors can be specially tested.



Some sensors are regularly available from stock as well as „frontside-“ or „backside-illuminated“ version. For many other sensors this feature is available on request. „Backside-illumination“ is a way to increase the sensitivity of CCD-sensors. Here the substrate of the sensor is etched down to a thickness of 7-20µm and the sensor gets mounted into the housing upside down. So the usually disturbing gate-structures are now on the under surface.

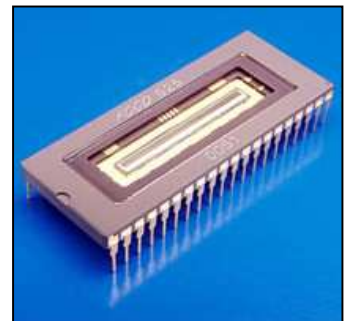
Designation	Pixel number	Pixel size [µm²]	Sensor area [mm]	Remarks
CCD3041	2048 x 2048	15 x 15	30.72 x 30.72	Full frame, 100% fill factor, available as „frontside“ or „backside“-illuminated
CCD6061	4096 x 4096	15 x 15	61.44 x 61.44	Full frame, 100% fill factor, available as „frontside“ or „backside“-illuminated
CCD595	9216 x 9216	8,75 x 8,75	80.64 x 80.64	extrem high resolution

Many of these sensors are also available with a attached fiber optic or a scintillation screen on request. FAIRCHILD IMAGING provides camera systems, which are based on the image sensors above. Closer information on this can be found in our overview about all FAIRCHILD IMAGING products, which we will send you on request.

TDI linear sensors

„TDI“ (Time Delayed Integration) means a technology, in which the charge packages in the sensor are moved internally across the image plane synchronously with the object to be scanned (comparable to the vertical shift register of an area sensor). Therefore, despite of the movement of the object, always the same part of object is scanned, so the integration time is multiplied by the number of TDI stages.

For this reason, TDI-sensors offer advantages compared to standard linear sensors. Beside a reduction of the noise, above all, the higher sensitivity is to be mentioned. This can be an advantage in applications with quickly moving objects, if exposition times are too short for common linear sensors.



Designation	Pixel size [µm²]	Pixel number	TDI stages	Number of outputs	Data rate [MHz]	Remarks
CCD525	13 x 13	2048	96, 64, 48, 32, 24	4	4 x 25	Antiblooming
CCD5045		4096	96, 64, 48, 32, 24	4	4 x 25	Antiblooming
CCD5061	8.75 x 8.75	6144	128, 64, 32, 16, 8,4	4	4 x 20	
CCD8091		9216	128, 64, 32, 16, 8,4	6	6 x 20	
CCD10121		12288	128, 64, 32, 16, 8,4	8	8 x 20	
CCD21241		24000	64, 32, 8, 1	16	16 x 18	

Originally TDI sensors were developed for high end applications in aeronautics or space. These products can be delivered in space proved housings with the needed special test protocols on request. Beside these the commercial versions of the types indicated above are available for standard applications. They are e.g. used for scanning documents at very high speed, as it is for example needed for sorting postage letters. FAIRCHILD IMAGING also supplies camera systems, that are based on these TDI sensors. You can find closer information about this in our overview about all FAIRCHILD IMAGING products, which we will send you on request.

PANAVISION

PANAVISION SVI provides CMOS sensors for the use in industrial quality control and optoelectronic measurement devices. Especially the linear sensors have an excellent cost/performance ratio and are suitable for high volume applications.

The sensors are manufactured using the patented ACS (active column sensor) technology. This results in sensors with high dynamic range and very low noise. Additionally the sensors provide a high fill factor with an increased sensitivity.

EURECA Messtechnik cooperates closely with PANAVISION and acts as a free reseller.



CMOS linear sensors

Type	Pixel number	Pixel size [μm^2]	Data rate [MHz]	Remarks
LIS-500	500	62.5 x 7.8	1	Low Cost, available as die only
LIS-1024D-LG	1024	125.0 x 7.8	20	
ELIS-1024A-LG	1024	125.0 x 7.8	30	Pixelbinning, Shutter, LCC housing
ELIS-1024A-D				Pixelbinning, Shutter, DIP housing Delivered without glass cover
RPLIS-2048-LG	2048	32.0 x 4.0	2.5	Low power consumption
DLIS-2K	4 x 2081	4.0 x 4.0 32.0 x 4.0	40	Four pixel rows, 12 Bit-ADC

At present the LIS-500 can only be delivered as die (sensor without housing). The minimum order volume is a complete wafer with approx. 3000 sensors. The wafers can also be sawed by the manufacturer. The single sensors will be delivered packed on trays then.

The ELIS-1024A-DIP is delivered in a DIP housing without glass cover. So this sensor is suitable for spectroscopy or for applications in which filters, quartz or other components are mounted directly onto the sensor. Also reflections are avoided by the missing glass cover. The DLIS-2K provides four parallel pixel rows. One row with rectangular pixels can be used for low-light applications. The other three rows with square pixels can be used for e.g. scanning documents.

Evaluation boards

For most of these linear sensors an evaluation board is available, which can be used to test the sensors fast and easily for a new application. This board provides an USB interface and a 12 bit ADC.

Please note that due to the USB interface not all sensors can be used with their maximum pixel frequency.

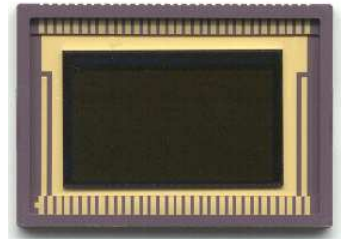


Designation	For sensor	Remarks
DBD003+ADC-LIS500	LIS-500	Basic board with adapter pcb
DBD003+ADC-LIS1024	LIS-1024D-LG	
DBD003+ADC-ELIS1024	ELIS-1024A-LG	
DBD003+ADC-RPLIS2048	RPLIS-2048-LG	

High resolution CMOS area sensors

The MDIC-2.0 was mainly developed to be used in mobile phones. Due to its remarkable small pixel size a high pixel number and so a high resolution is possible with a rather small optical active area.

With the Dynamax-35 PANAVISION offers a high resolution image sensor with the fourfold resolution of the new **High Definition TeleVision (HDTV)**. Because of its high pixel number this product is also suitable for applications in biometric, surveillance and science. The high resolution prevents aliasing effects caused by the used bayer pattern.



Designation	Pixel number	Pixel size [µm²]	Data rate [fps]	Remarks
MDIC-2.0	1600 x 1200	3.0 x 3.0	30	Digital Output

Please note that at present the MDIC-2.0 is only available for larger OEM projects with a certain minimum order volume per year.

NEC

NEC offers a wide range of CCD linear sensors, which are easily to operate due to on-chip drivers and clock generators. Besides monochrome linear sensors high-resolution colour sensors are available. They consist of three parallel linear CCD lines that are coated with filters for the three basic colours.

In contract to many other manufacturers of CCD sensors, NEC offers some sensors, which provide a remarkable long sensor length. With such sensors larger documents can be scanned without an additional optic to reduce the image.

At present EURECA Messtechnik is a free reseller for these products and is not bound to any contracts with the official distributors.



Monochrome sensors						
Designation	Pixel number	Pixel size [µm²]	Data rate [MHz]	Sensitivity [V / (lx · s)]	Remarks	Small volumes from stock
µPD3753CY-A	2088	14.0 x 14.0	2	90.0		•
µPD3734ACY-A	2660	11.0 x 11.0	5	70.0	Sample and Hold, two readout registers	•
µPD3737CY-A	5150	7.0 x 7.0	20	7.5	two readout registers	•
µPD3739D-A	5000	7.0 x 7.0	2 x 20	9.0	Ceramic housing, two outputs	•
µPD3747D-A	7400	4.7 x 4.7	2 x 22	19.0	Ceramic housing, two outputs	•
uPD8670ACY-A	7400	4.7 x 4.7	2 x 22	17.0	two outputs	•
Colour sensors (selection)						
µPD3768A-AZ	3 x 7500	9.3 x 9.3	2 x 22 each	red: 20.0 green: 18.0 blue: 8.0	Three parallel lines for each colour	•

NEC offers some more colour CCD sensors. Since these types are not sold very often, we have usually no stock of them. We can also supply these types at a certain minimum order volume (normally 100 pieces). Available are the following types:

µPD3728DZ, µPD8861, µPD8871, µPD8872, µPD8873, µPD8880, µPD8882, µPD8884A, µPD8891, µPD8894, µPD8821, µPD8827A and µPD8828A.

CCD matrix sensors

Sony has always been one of the leading manufacturers for CCD image sensors to be used in consumer products as e.g. digital still cameras, camcorder or other. Although the competition by CMOS sensors from other manufacturers has increased within the last years, these products by SONY offer still a very good price/performance ratio.

Most sensors are available as monochrome as well as colour version. As colour filters RGB and CMY are used. Some sensors are optimized for certain TV systems as PAL or NTSC, others offer a special pixel number and/or a special optical size. The suffix in the sensor designation indicates the grade (number of defective pixel). For details about this please refer to the data sheet to the respective sensor or the grade specification. You can find this information on our web pages.



Often we receive questions about the type designation by SONY. All sensor designations follow the same rules:

e.g. **ICX419AKB-E** → **ICX¹ 419² A³ K⁴ B⁵ – E⁶**

1	Product designation	ICX for area sensors ILX for linear sensors
2	Product number	Containing three digits
3	Product version	Starts normally with an „A“ for the initial basic version, upgraded sensor version are indicated by higher characters of the alphabet
4	Colour mask	L for monochrome sensors K or Q for colour sensors
5	Housing	This designation is optional for special housings
6	Region/grade code	Often area sensors show an additional designation suffix. This is used to determine between different grades (number of defect pixels). Further goods for different marketes are labeled in this way. E or F is normally used for the european market (RoHS certificate available) and A , B , 7 or 6 for the asian / US markets.

Monochrome (B/W) or colour sensors for various TV systems

Designation	Size [Inch]	TV system	Pixel number	Unit Cell [µm]	Socket	Remarks	Small volumes from stock
ICX207AK-E	1/4	PAL	500 x 582	7,30 x 4,70	IS232-414-274U-P27-L14		
ICX207AKB-6					-	round	
ICX226AL-E	1/4	EIA	510 x 492	7,15 x 5,55	IS232-414-274U-P27-L14		
ICX227AL-F	1/4	CCIR	500 x 582	7,30 x 4,70			
ICX227AK-E							
ICX227AK-F						lower grade	
ICX228AK-F	1/4	NTSC	768 x 494	4,75 x 5,55	-	round	
ICX228AKB-6							
ICX229AL-E	1/4	PAL	752 x 582	4,85 x 4,65	IS232-414-274U-P27-L14		
ICX229AK-E					-	colour	
ICX229AKB-6					-	round	

For all sensors indicated above the timing generator CXD1267AN can be used (refer to page 10)

Monochrome (B/W) and Colour sensors for various TV systems (continued from last page)

Designation	Size [Inch]	TV system	Pixel number	Unit Cell [µm]	Socket	Remarks	Small volumes from stock
ICX238AKC-6	1/6	NTSC	768 x 494	3,20 x 3,72	-	SON (LCC) housing	
ICX238AKE-6					-	SON (LCC) housing	
ICX238EKW-6					-	TCP housing	
ICX239AKC-6	1/6	PAL	752 x 582	3,27 x 3,15	-	SON (LCC) housing	
ICX239AKE-6 ICX239AKE-E					-	SON (LCC) housing	
ICX239EKW-6					-	TCP housing	
ICX254AL-E	1/3	NTSC	510 x 492	9,6 x 7,5	IS232-4516-274U-P27-L14		
ICX255AL-E	1/3	CCIR	500 x 582	9,8 x 6,3			
ICX255AK-E							
ICX256FKW-6	1/10	NTSC	510 x 492	2,95 x 1,90	-	TCL housing	
ICX257FKW-6		PAL	500 x 582				
ICX258AL-E	1/3	EIA	768 x 494	6,35 x 7,40	IS232-4516-274U-P27-L14		●
ICX258AK-E							
ICX259AL-E	1/3	CCIR	752 x 582	6,50 x 6,25			●
ICX259AK-E							
ICX278AL-7 ICX278AL-E	1/4	EIA	768 x 494	4,75 x 5,55	IS232-414-274U-P27-L14		
ICX278AK-E							
ICX279AL-E	1/4	CCIR	752 x 582	4,85 x 4,65			●
ICX279AK-E					-	●	
ICX404AL-F	1/3	EIA	510 x 494	9,60 x 7,50	IS232-4516-274U-P27-L14		
ICX404AK-F							
ICX405AL-E	1/3	CCIR	500 x 582	9,80 x 6,30		lower grade	
ICX405AL-F							
ICX405AK-E							
ICX408AL-E	1/3	EIA	768 x 494	6,35 x 7,40			
ICX408AK-E							
ICX408AK-A ICX408AK-F						lower grade	
ICX409AL-6 ICX409AL-E	1/3	CCIR	752 x 582	6,50 x 6,25			●
ICX409AL-F					lower grade		
ICX409AK-E							
ICX409AK-F					lower grade		
ICX418ALL-E	1/2	EIA	768 x 494	8,40 x 9,80	IS230-620-75S-P29-L14-A		
ICX418AKL-E							
ICX418AKB-E					-	round	
ICX419ALL-E	1/2	CCIR	752 x 582	8,60 x 8,30	IS230-620-75S-P29-L14-A	●	
ICX419AKL-E							
ICX419AKB-E					-	round	
ICX422AL-E	2/3	EIA	768 x 494	11,6 x 13,5	IS229-820-80S-P29-L14-A	Timing generator CXD1268M	
ICX423AL-E	2/3	CCIR	752 x 582	11,6 x 11,2			
ICX428ALL-E	1/2	EIA	768 x 494	8,40 x 9,80	IS230-620-75S-P29-L14-A	Timing generator CXD1267AN	
ICX428AKL-E							
ICX429ALL-E	1/2	CCIR	752 x 582	8,60 x 8,30			●
ICX429AKL-E							●

Monochrome (B/W) and colour sensors, progressive scan

Designation	Size [Inch]	Pixel number	Unit Cell [µm]	Timing generator	Socket	Remarks	Small volumes from stock	
ICX098BL-A	1/4	659 x 494	5,60 x 5,60	CXD1267AN	IS232-414-274U-P27-L14		●	
ICX098BL-E							●	
ICX098BQ-F							●	
ICX204AL-6 ICX204AL-E	1/3	1034 x 779	4,65 x 4,65		IS232-4516-274U-P27-L14	lower grade		
ICX204AL-F							●	
ICX204AK-A ICX204AK-F								
ICX205AL-A ICX205AL-E ICX205AL-F ICX205AK-F	1/2	1392 x 1040	4,65 x 4,65		IS230-620-75S-P29-L14-A	lower grade	●	
							●	
							●	
							●	
ICX274AL-A ICX274AL-F ICX274AQ-T	1/1.8	1628 x 1236	4,40 x 4,40		2 x CXD3400N	IS232-4820-274U-P27-L14		●
ICX285AL-A ICX285AL-F ICX285AQ-C ICX285AQ-F	2/3	1392 x 1040	6,45 x 6,45	CXD3400N	IS229-820-80S-P29-L14-A		●	
							●	
ICX414AL-6 ICX414AL-E ICX414AQ-E	1/2	692 x 504	9,90 x 9,90		IS232-622-274U-P27-L14			
ICX415AL-6 ICX415AL-E ICX415AQ-E	1/2	823 x 582	8,30 x 8,30				●	
ICX424AL-6 ICX424AL-E ICX424AQ-E	1/3	692 x 504	7,40 x 7,40		IS232-4516-274U-P27-L14		●	
							●	
ICX445AL/AQ ICX614 ICX618 ICX625ALA	1/3 1/4 1/4 2/3	1296 x 966 659 x 494 659 x 494 2456 x 2058	3,75 x 3,75 5,60 x 5,60 5,60 x 5,60 3,45 x 3,45	TBD	TBD	New! More information soon		

Monochrome (B/W) and colour sensors, frame readout

Designation	Size [Inch]	Pixel number	Unit Cell [µm]	Timing generator	Socket	Remarks
ICX252AK-T	8,933	2088 x 1550	3,45 x 3,45	CXD3400N	IS232-4820-274U-P27-L14	
ICX262AQF-C	8,933	2088 x 1550	3,45 x 3,45		-	SOP housing
ICX263AL-C	28,42	4024 x 2648	5,9 x 5,0	4 x CXD1268M	-	
ICX282AQ-C ICX282AQ-T	11,00	2588 x 1960	3,4 x 3,4		IS232-5724-274U-P27_L14	
ICX282AQF-T				2 x CXD3400N	-	SOP housing

Please note, that we have the possibility to remove the standard glass covers from these sensors and to replace them with a large range of available filters. The sensors can also be coated with an UV sensitive Lumigen coating then.

Peripheral ICs for Sony matrix sensors

In addition to the CCD matrix sensors SONY offers also a series on peripheral ICs, which generate the needed timing signals for the sensors. Please contact us, if you are not sure what device to use with a certain sensor. We will help you to select the most suitable component.

Designation	Function
CXD1217M CXD1217Q	Sync signal generator
CXD1254AQ/AR CXD1261AR CXD1265R	Timing pulse generator
CXD2400R CXD2401R CXD2463R	Timing controller (video)
CXD2408AR CXD2450R CXD2457R	Timing controller (progressive scan)
CXD2460R CXD3607R	
CXD2740R CXD2497R CXD2498R	Timing controller (frame readout)
CXD3406GA CXD3110GA CXD3412GA	
CXD3422GA CXD3423GA CXD3605R	
CXD3615R CXD3619R	

CCD linear sensors

Sony offers a range of low cost CCD linear sensors. Beside monochrome linear sensors, there are also high resolution colour sensors available.

The ILX554 provides rectangular pixels and is suitable for applications with barcode readers or in spectroscopy. The larger pixel area results in a higher dark noise and so in a reduced dynamic range. This can be improved again by the use of peltier elements (please refer to the last page of this document). The other sensors provide square pixel and are suitable for scanning documents and objects.

The EURECA Messtechnik is a free reseller for the CCD sensors by Sony, works closely together with an official distributor outside of Germany and also buys components on the free world market.



Designation	Pixel number	Pixel size [µm ²]	Data rate [MHz]	Sensitivity [V / (lx · s)]	Dynamic range	Remarks
ILX551B	2048	14.0 x 14.0	5	40	6000	as ILX751B, but with shutter
ILX553A	5150	7.0 x 7.0	16	15	6666	
ILX554B	2048	14.0 x 56.0	2	240	333	High sensitivity
ILX751B	2048	14.0 x 14.0	5	40	6000	as ILX551B, but without shutter
ILX555K	3 x 10680	3.5 x 3.5	3 x 5	red: 1.5 green: 1.5 blue: 1.3	900	Colour, 3 parallel CCD lines
ILX558K	3 x 5340	4.0 x 4.0	3 x 10	red: 2.6 green: 3.1 blue: 2.5	900	Colour, 3 parallel CCD lines

Please note, that we have the possibility to remove the standard glass covers from these sensors and to replace them with a large range of filters. Further the sensors can also be coated with an UV sensitive Lumigen coating.

USB camera boards

For some of the linear sensors mentioned above camera boards are available from our partner company SPECTRONIC DEVICES. These boards provide an USB interface and can e.g. be used to test sensors for a new application. The designations of these boards are USB-BOARD-ILX551, USB-BOARD-ILX554 and USB-BOARD-ILX751. You can find closer information about these boards on page 15.

TOSHIBA

Similar to SONY and NEC, TOSHIBA offers a range of CCD linear sensors for applications, which require a low or medium signal quality. Beside monochrome linear sensors, there are also high resolution colour sensors available, which consist of three or even more parallel pixel lines and respective RGB filters.

EURECA buys these components at the official German distributors. Due to the high volumes bought, we can offer these sensors at very good prices also in lower quantities.



Linear sensors with rectangular pixels

These sensors are very light sensitive and so are used in spectroscopy or in barcode readers. The large pixel areas increase the sensitivity of the sensor, but also the dark noise, which leads to a lower dynamic range.

Designation	Pixel number	Pixel size [µm ²]	Max. data rate [MHz]	Sensitivity [V / (lx · s)]	Dynamic range	Remarks
TCD1201DG	2048	14 x 200	2	80	400	As TCD1205DG, but without shutter
TCD1205DG	2048	14 x 200	1	80	400	As TCD1201DG, but with shutter
TCD1304DG	3648	8 x 200	1	160	300	

After SONY discontinued the very successful sensors ILX511 and ILX526A only TOSHIBA offers similar products. In the case of the ILX511 the TCD1205DG can be used as a kind of replacement, since it offers the same pixel size and number. The TCD1304DG can be used to replace the ILX526A in some applications, although it provides more pixels. In both cases the driving electronics used has to be changed, since the sensors by TOSHIBA need more clock signals and a different timing.

ILX511 and ILX526A by SONY were one-phase CCD sensors. In contrast to this the sensors by TOSHIBA are two phase sensors, which results in a higher full well capacity. Due to this, more electrical charge carriers can be collected in each pixel before the saturation level is reached. Due to a different internal pixel structure the sensors by TOSHIBA also show a higher sensitivity at higher wavelengths (700-850nm) compared to the obsolete products by SONY.

Sensors without glass cover

In some applications the standard glass covers of the sensors are disturbing, since they can cause unwanted absorption or reflections. Sensors without glass cover are also needed to attach fiber optics, special filters or to apply an UV sensitive coating.

EURECA has developed a technique to remove the glass cover without damaging the sensors. After this procedure every sensor is cleaned and tested optically and electrically. The types indicated above can be ordered without glass cover using the designation TCD1201DG-X, TCD1205DG-X and TCD1304DG-X. The sensors are shipped with a protective adhesive foil, which has to be removed before using the sensor. Although without glass cover the internal silica surface is lying blank, the sensors are relatively rugged. In order to protect the sensor in the respective application, humidity and dust have to be avoided. We have also the possibility to remove the standard glass covers from these sensors and to replace them with filters or apply an UV sensitive Lumigen coating.

USB camera boards

For the sensors mentioned above we can also offer a camera board from our partner company SPECTRONIC DEVICES. These boards provide an USB interface and can be used to test the sensors for new applications. The designation of these camera boards are USB-BOARD-TCD1201, USB-BOARD-TCD1205 and USB-BOARD-TCD1304. Further information about these boards can be found on page 15.

Linear sensors with square pixels (selection)

TOSHIBA produces a wide variety of different linear sensors with square pixels. Before planning to use a certain type please consider that not all sensors are available in low quantities also. Since the conditions for a sensor type can change quite fast, please contact us for further details.

Sensors with square pixels are mainly used to scan objects or documents. Please notice that there are sensors with long pixel lines also.

Monochrome Sensors (Selection)						
Designation	Pixel number	Pixel size [µm ²]	Max. data rate [MHz]	Sensitivity [V / (lx · s)]	Dynamic range	Remarks
TCD132DG	1024	14.0 x 14.0	2	12	2000	
TCD1209DG	2048	14.0 x 14.0	20	31	2000	
TCD1703C	7500	7.0 x 7.0	2 x 20	15	1667	2 read out registers
TCD1704DG	7500	7.0 x 7.0	4 x 20	17	2500	4 read out registers
TCD1706DG	7400	4.7 x 4.7	4 x 25	15		4 read out registers
TCD1707DG	7450	4.7 x 4.7	2 x 25	15	1800	2 read out registers
TCD1708D	7450	4.7 x 4.7	2 x 15	15	2600	2 read out registers
TCD1709D	7500	7.0 x 7.0	4 x 25	15	2500	4 read out registers
Colour sensors (selection)						
TCD2558DG-1	3 x 5340	7.0 x 7.0	3 x 10	red: 8.5 green: 12.7 blue: 9.5		3 parallel sensor lines
TCD2561DG-1	4 x 5348	7.0 x 7.0	4 x 10	red: 10.4 green: 14.4 blue: 8.7 b/w: 21.0		4 parallel sensor lines

The new leadless (Pb-free) sensors show the suffix "G" in the designation (TCDxxxxD → TCDxxxxDG). The main difference in contrast to the older versions is a different adhesive based on epoxy resin. The optical and electrical specifications as well as the housing dimensions are not affected.

There are more colour linear sensors with the designation TCD29xx. These are not supported by TOSHIBA on the European market. Should you have interest in these types please ask for further information.

Developments in the near future

TOSHIBA will continue to increase the performance of their sensors. The pixel pitch will be reduced down to 2µm, which will increase the resolution up to 4800dpi. A maximum pixel frequency of up to 40MHz is planned.

As housings CLCC types will be used more and more in the future (CLCC = Ceramic Leadless Chip Carrier). These SMD housings will show the suffix "CF" in the designation (TCDxxxxCF). They will be Pb-free and suitable for reflow soldering. Further the glass is protected by an adhesive foil, which has to be removed before operation. The sensors in CLCC housing will have the same reliability as the DIP versions available now. The optical tolerance will however be improved from now +/- 0.8mm with the DIP housings to +/- 0.15 with the new CLCC versions.

Some sensors (especially the versions for scanner applications) will provide improved pigment colour filters. In contrast to the filters now used the new variant will provide an increased sensitivity in the blue spectral range. Sensors with such new pigment filters will show the new Suffix "G-1" (e.g. TCD2558DG → TCD2558DG-1)

CMOS SENSOR INC.

EURECA Messtechnik distributes products by CMOS SENSOR INC. in Europe. This company produces a series of linear sensors based on CMOS technique, which are also used to build CIS modules. The sensors are provided in various forms. Beside cut dies (sensors without housing), also complete wafers are available. In a more processed form, some sensors are also available in a LCC housing or as CIS modules.

CIS modules

A CIS (**C**ontact **I**mage **S**ensor) module consists of CMOS linear sensors, a linear optic and a LED illumination. These modules are optimised for scanning documents that are in contact to the CIS module. The modules are available in standard resolution of 200 dpi and 600 dpi.

The few needed TTL compatible clock signals make the modules easy to control. A 5V supply voltage is sufficient for most modules. Beside this, some modules need an extra analogue auxiliary supply. Such CIS modules are used e.g. in fax machines, scanners, card reading devices and position sensors.



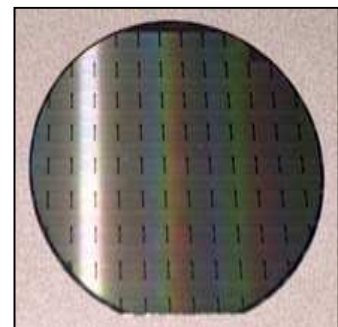
Designation	Pixel number	Scan width [mm]	Max. speed [ms/Zeile]	Resolution [dpi]	Lighting
M106-A9	256	32	0,25	200	Red LEDs
M106-A8B1	488	56	0,5	200	Blue LEDs
M106-A8R1	488	56	1,0	200	Red LEDs
M106H-A6-R1	832	104	0,6	200	Red LEDs
M106-A6-G1	832	104	2,5	200	Yellow-green LEDs
M106-A4-G1	1728	216	5,0	200	Yellow-green LEDs
M106-A4-R5	1728	216	0,36	200	Red LEDs
M106-A4-R5-X					Without linear lens optic and LEDs
M208-A8	1344	56	2,5	600	580nm LEDs
M208-A6	2496	106	2,0	600	Red LEDs
M208-A6-C1	2496	106	6,0	600	Red, green, blue LEDs
M208-A4	5184	219	3,0	600	Red, green, blue LEDs
M210-A6	2408	106	1,0	600	Red, green, blue LEDs
M210-A4	5160	216	1,5	600	Red, green, blue LEDs
M206-A6M	2048	102	0,1	300 / 600	UV, red and IR LEDs
M206-A4	5184	218	3,0	600	Red, green, blue LEDs
M206-A3C	7224	306	0,9	600	Red, green, blue LEDs

The module **M106-A4-R5-X** is supplied without the usual linear lens optic and LEDs, which are normally used in CIS modules. Due to this fact it can be used as a standard CMOS sensor. The main advantage is the unusual long sensor length of 216mm! The **M106-A4-R5-X** can be supplied in small volumes from stock. On request also the other CIS modules can be supplied without the linear lens optic and the LEDs. This is only possible for a certain minimum order volume.

CMOS linear sensors

The CIS modules described above are internally built up using several CMOS sensor dies, which are aligned next to each other. In this line each single sensor die triggers with the read out of the last pixel the readout of the next sensor die. By using this technique it is possible to manufacture CMOS sensors with customized lengths.

These sensor dies are available for the manufacturing of own CMOS devices. The minimum order volume is a complete wafer, which consists of 3000-5000 dies. On request the wafer can also be supplied cut with individual dies separately packed in trays.



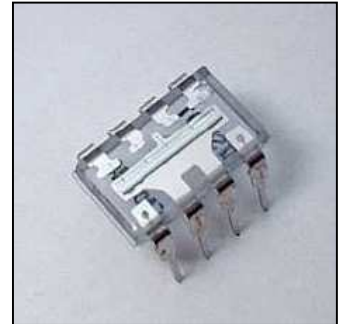
Designation	Pixel number	Pixel size [µm ²]	Line width [mm]	Max. data rate [MHz]	Resolution [dpi]	Remarks
C106	64	125 x 125	8	5	200	Also available in LCC housing
C208	192	42 x 42	8	10	600	Also available in LCC housing

TAOS

TAOS provides CMOS sensors which are very easy to operate. 5V is required as supply voltage and all control signals are TTL compatible. These products are suitable for low cost applications as e.g. position measurement.

All linear sensors by TAOS can be supplied ex stock in small numbers. Evaluation boards are available for many types. Versions with high temperature range are also available.

Regarding the products by TAOS EURECA Messtechnik cooperates with the official distributor in Germany.

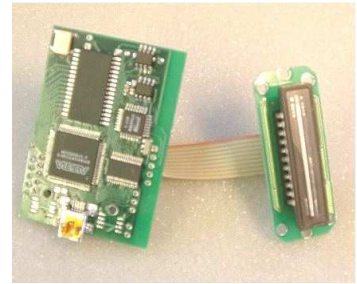


Designation	Pixel number	Pixel size [µm²]	Pitch [mm]	Data rate [MHz]	Sensitivity [V / (lx · s)]	Evaluation board	Remarks
TSL201R	64	120.0 x 70.0	125.0	5	2000	PC404A-201	
TSL202R	128	120.0 x 70.0	125.0	5	2000	PC404A-202	
TSL208R	512	120.0 x 70.0	125.0	5	2000	PC404A-208	
TSL210	640	120.0 x 70.0	125.0	5	2000	-	
TSL2014	896	120.0 x 70.0	125.0	5	2000	-	
TSL1301	102	85.0 x 77.0	85.0	2	2000	-	
TSL1401R	128	63.5 x 55.5	63.5	8	4000	PC404A-208	
TSL1402R	256	63.5 x 55.5	63.5	8	4000	-	
TSL1406R	768	63.5 x 55.5	63.5	8	4000	PC404A-1406	
TSL1410R	1280	63.5 x 55.5	63.5	8	4000	PC404A-1410	
TSL1412S	1536	63.5 x 55.5	63.5	8	4000	-	
TSL3301	102	88.0 x 77.0	85.0	1	2000	PC404A-1410	8 Bit digital output

USB camera boards

For many CCD/CMOS linear sensors EURECA supplies camera boards, which can be connected to the USB interface of a PC. With these boards pixel frequencies of up to 1MPixel per second are possible.

The boards consist of two pcbs (printed circuit boards), which are connected via a flat cable. The smaller sensor pcb, which contains also the ADC, has a dimension of 50mm x 20mm, so the sensor can be mounted separately from the interface pcb. This interface pcb (dimension 36mm x 60mm) contains the complete driving electronics, as well as all driving circuits for the USB interface. These camera boards are also available with a serial interface on request.



- programmable integration times
- internal memory for several scans (up to 512 scan with 1024 pixel sensor)
- small size
- large range of available sensors

The transmission of the recorded data to the attached PC is limited by the USB interface. If the USB port used is slower than the pixel frequency of the camera, the internal memory of the camera board can be used to store multiple scans. After the memory of the camera board is exceeded, the recording has to be stopped until the data are transferred to the PC.

Designation	Pixel	Pixel size [µm ²]	Remarks
USB-Board- ELIS-1024	1024	125,0 x 62,4	Rectangle pixel, variable pixel number
USB-Board- ILX511	2048	200,0 x 14,0	
USB-Board- ILX551	2048	14,0 x 14,0	
USB-Board- ILX553	5150	7,0 x 7,0	
USB-Board- ILX554	2048	56,0 x 14,0	Rectangle pixel
USB-Board- ILX751	2048	14,0 x 14,0	
USB-Board- M106A8R1	448	125,0 x 125,0	New! , CIS module
USB-Board- M106A6R1	832	125,0 x 125,0	New! , CIS module
USB-Board- M106A4R1	1728	125,0 x 125,0	New! , CIS module
USB-Board- M106A4R1-X	1728	125,0 x 125,0	New! , CIS module without linear optic and LEDs
USB-Board- S9840	2048	14,0 x 14,0	
USB-Board- TSL1401	128	63,5 x 55,5	Very large pixel
USB-Board- TSL1406	768	63,5 x 55,5	Very large pixel
USB-Board- TSL1410	1280	63,5 x 55,5	Very large pixel
USB-Board- TSL1412	1536	63,5 x 55,5	New! , Very large pixel
USB-Board- TCD1205	2048	200,0 x 14,0	Rectangle pixel
USB-Board- TCD1304	3648	200,0 x 8,0	Rectangle pixel
USB-Board- TCD1707	7450	4,7 x 4,7	Very high resolution

The USB boards are supplied with software drivers and a demonstration code. The documentation contains example codes for VisualC++, VisualBasic, Delphi and LabView. The software drivers are available as DLL, COM or ActiceX. The communication via the USB or RS232 interface is also possible with a simple ASCII terminal. The boards can also be delivered with customized PID or VIS on request. Such customized hardware allows an automatic identification of the camera in order to load a certain software. Furthermore we can supply the boards with UV sensitive coating (please refer to page 17 for details) and in aluminium housings.

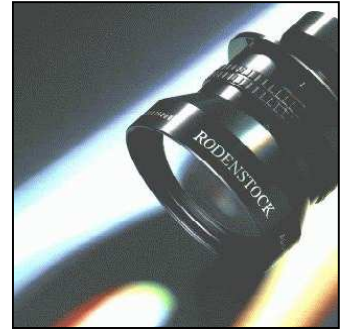
Also camera boards for many sensors by HAMAMATSU are available. The sensors by HAMAMATSU itself do not belong to our standard range of supply. Due to many requests, we have decided to offer the boards for these sensors also. Boards for HAMAMATSU sensors are normally supplied WITHOUT the sensor. Boards for the following types are available: S3901, S3902, S3903, S3904, S8377, S8378, S7010, S7011, S7030, S7031, S7033, S7034, G9201, G9202, G9203, G9204, G9205, G9206, G9207, G9208, G9211, G9212, G9213 and G9214.

An exception is the **USB-Board-S9840** for the S9840 by HAMAMATSU. This board is normally available from stock WITH sensor.

Lenses

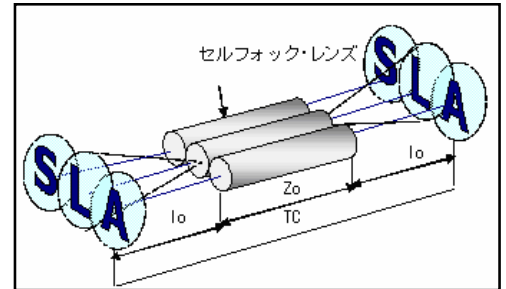
For the use with area sensors we offer a wide range of good value **CCTV lenses** as they are e.g. used in surveillance cameras. Measurement applications need more complex lenses with low distortion. Here we can also offer suitable types from different manufacturers. For the use with linear sensors lenses with a larger aperture are available. **Telecentric lenses** finally are mainly used in the industrial image processing when an object has to be measured without spatial distortions.

At present we can supply lenses by **FUJINON, CBC, PENTAX, LINOS, SCHNEIDER KREUTZNACH, SILL OPTICS** and **CARL ZEISS**. On request we can also supply lenses from other manufacturers



EURECA also supplies linear lens arrays by NSG (also known as SLA lenses; SLA = Selfoc Lens Arrays). These special lenses consist of a row of single gradient lenses. Main applications for these products are the use in scanners of fax machines.

These linear lenses are available in different standard lengths e.g. A3, A4 or A5. We can also provide them in customized lengths on request.



Filters

EURECA offers a wide variety of different filter types and sizes for many applications. We can also supply these filters in filter threats on request, or put them directly onto CCD/CMOS image sensors.

Please contact us, should be interested in these products. We will help you to select the most suitable components for your applications.

The filters are supplied by various manufacturers.



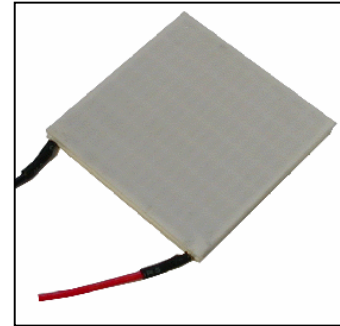
- **Quartz filters** for UV applications, transparent down to approx. 200nm; often used to replace the standard glass cover of image sensors
- **Interference filter** laminates of absorption filters with one or more dielectric layers. In this way narrowband steeply shouldered bandpasses are possible, that are available for many types for different wavelenghts
- **Double refraction filters** act as an optical low pass filter; can e.g. be used to avoid moire patterns which occur sometimes when using colour sensors
- **IR filters** very cheap infrared filter based on a plastic substrate. This filter material can be cutted by laser into nearly all shapes and dimensions.
- **Absorption filters** Low cost filters for general applications

Peltier cooling for noise reduction

By active cooling with peltier elements the dark noise of the sensors can be lowered significantly. So even high end applications can use rather inexpensive sensors.

Beside just peltier elements for cooling CCD/CMOS sensors, we also offer a wide supply of accessories e.g. thermal conductive adhesives, heat sinks and fans. Furtherly we offer the development of complete cooling applications.

The following table lists the most common peltier elements for the cooling of linear and area sensors:



Type	Size [mm]	Cooling power [W]	max. Temperature difference [K]	Remarks
TEC1M-5.0-5.0-1.1/76-B	5.0 x 5.0	1.1	76	for area sensors
TEC1M-8.0-8.0-10/77-B	8.0 x 8.0	10.0	76	
TEC1M-9.1-9.9-4.4/76-B	9.1 x 9.4	4.4	76	
TEC1S-15-15-12/78-B	15.0 x 15.0	12.0	78	for linear sensors
TEC1S-5.0-30.0-7.6/78-B	5.0 x 30.0	7.6	78	
TEC1S-6.0-40.0-17/78-B	6.0 x 40.0	17.0	78	

Removing the glass cover from CCD/CMOS sensors

From many CCD- and CMOS sensors the standard glass cover can be removed. This is necessary e.g. for the following modifications:

The cover glass is directly replaced by one single or a combination of several filters. This usually improves the signal quality substantially, since unwanted spectral regions can be faded out. By putting the filter directly onto the sensor, one receives a compact and above all durable unit without additional mounting plates for external filters in the path of rays. In order to improve the optical signal coupling to the CCD sensor a fiber glass optics can be attached. Apart from optics, which transfer an image true to scale, also reductions can be realized. Compared with conventional lens systems the light losses are substantially smaller with fiber glass optics. Last but not least the sensitivity for certain spectral regions can be expanded by coating special materials onto the sensor. Here e.g. fluorescent materials are used for the detection of UV or X-ray.

The following sensors can be delivered from stock without glass cover. The order designation show an additional "-X" as suffix to the standard sensor designation. The sensors are shipped with an adhesive foil to protect the sensor, which has to be removed before use.

Please also note the possibility of purchasing these sensors with UV coating (please refer to the next page).

Type	Manufacturer	Pixel number	Pixel size [μm^2]	Data rate fps of pixel frequency
ICX098BL-X	Sony	659 x 494	5,6 x 5,6	60 fps
ICX414AL-X	Sony	692 x 504	9,9 x 9,9	
ICX424AL-X	Sony	692 x 504	7,4 x 7,4	
ILX554B-X	Sony	2048	14,0 x 56,0	2 MHz
ELIS-1024-X	Panavision	1024	7,8 x 125,0	30 MHz
TCD1205D-X	Toshiba	2048	14,0 x 200,0	2 MHz
TCD1304AP-X	Toshiba	3648	8,0 x 200,0	1 MHz

UV coating of sensors

In order to extend the usable spectral region of the sensors, they can be provided with a specialized coating. In the case of applications with UV light this coating emits visible light, which is detected by the sensor. Such a coating lowers the lower end of the spectral sensitivity from 350nm down to 200nm.

Starting from 400nm the coating is almost transparent, so the sensitivity in the visible and in the near infrared is hardly affected. For such an UV coating above all sensors with large pixels are suitable. Some often requested sensors can be supplied with UV coating from stock (see table below). For other sensors this is possible on request.

Type	Manufacturer	Pixel number	Pixel size [µm²]	Data rate fps of pixel frequency
ICX098BL-UV	Sony	659 x 494	5,6 x 5,6	60 fps
ICX414AL-UV	Sony	692 x 504	9,9 x 9,9	
ICX424AL-UV	Sony	692 x 504	7,4 x 7,4	
ILX554B-UV	Sony	2048	14,0 x 56,0	2 MHz
ELIS-1024-UV	Panavision	1024	7,8 x 125,0	30 MHz
TCD1205D-UV	Toshiba	2048	14,0 x 200,0	2 MHz
TCD1304AP-UV	Toshiba	3648	8,0 x 200,0	1 MHz

Customized CCD image sensors

Not always a suitable sensor for a certain application can be found, which meets all specifications needed. If the budget of the project is high enough, a customized sensor can be developed and manufactured exclusively. EURECA offers this service for CCD sensors with the manufacturer FAIRCHILD IMAGING. A respective cooperation with a manufacturer of CMOS image sensors is planned for the near future.

In principle the customized production of a CCD image sensor is possible even for single pieces. There are, however, quite high research and development costs, which normally only makes sense for higher production volumes. If an existing design can be modified, the development costs can be reduced. However there are costs for producing the needed new lithographs. There is a minimum order volume of manufactured wafers in one production run. EURECA has all the knowledge and the tools to develop a new sensor design and to give an estimate of the technical specifications, which can be reached. After pre-configuration the design is optimized in cooperation with the manufacturer. The typical development time for a new sensor is about 24 months.

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