

Product Bulletin

CCDs and Video Cameras

Texas Instruments has been involved in the development and manufacture of image sensors since the invention of the charge-coupled device (CCD) concept in 1970. Early work began in the design of CCDs for astronomy and led to the development of advanced virtual-phase technology (AVP). Advanced virtual-phase technology offers large improvements in quantum efficiency, blue response and reduced dark current compared with conventional multiphase CCDs. Furthermore, advanced virtual-phase technology simplifies the design of support circuitry by reducing the number of required clock drivers. Subsequent TI breakthroughs in sensor technology include the clocked antiblooming gate, the advanced plastic package and the latest technological innovation, its IMPACTRON™ family of electron multiplying charge-coupled

devices (EMCCD), which can detect down to a single photon.

TI's patented advanced virtual-phase CCDs are high speed and have very high sensitivity in the spectral range from deep ultraviolet (DUV) to near infrared (NIR). TI's high-quality CCDs and cameras are well-suited for scientific, industrial, security/surveillance, military, spectroscopy, traffic, astronomy and medical applications.

A New Family of charged-coupled devices (CCDs) from TI revolutionizes the image sensor market with IMPACTRON, a breakthrough technology that enables CCDs to see in extremely low light scenes. TI's IMPACTRON CCDs can be used to build high-sensitivity cameras that can detect as little light as a single photon. With the IMPACTRON CCD's integrated image intensifier, TI enables manufacturers to build smaller cameras with easier system integration at a lower system cost. The devices are processed using TI's patented advanced virtual-phase technology, which gives them superior sensitivity over a wide spectral range.

These high-speed, high-sensitivity CCDs are ideal for biomedical and scientific applications requiring high sensitivity and precision. Additional imaging applications well-suited for these devices include security/surveillance, automotive, industrial machine vision, astronomy, traffic and spectroscopy.

Key Benefits

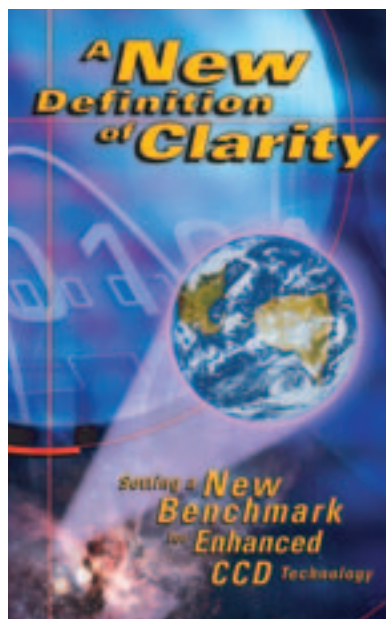
- High speed
- High sensitivity from deep UV to near IR
- High resolution
- High dynamic range
- High blue response
- Low dark current
- Fast clear capability
- Multi-mode readout capability
- Progressive scan
- Interlaced scan
- Partial scan/skip capability
- Multi-line readout
- Image-area line summing
- Smear subtraction
- Solid-state reliability with no image burn-in, residual imaging, image distortion, image lag or microphonics

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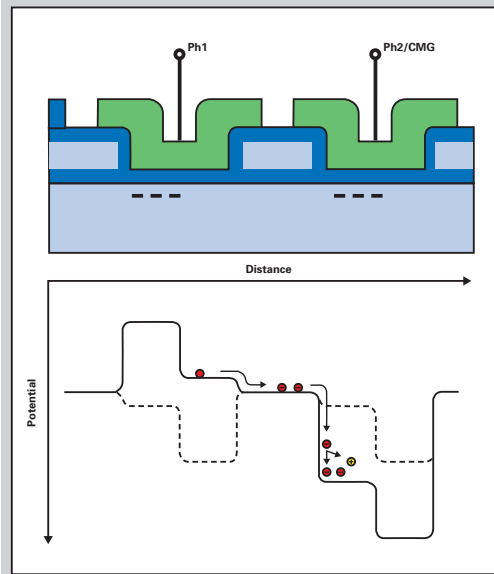
<http://www.tij.co.jp/jsc/docs/dis/p/eng/index-e.htm>
or get more information at
ccd-camera-info@list.ti.com

This remarkable technology works by multiplying the photon-generated charge using a low-noise impact ionization process. The electron charge is multiplied in the serial register before readout. This prevents the readout noise from being amplified as well.

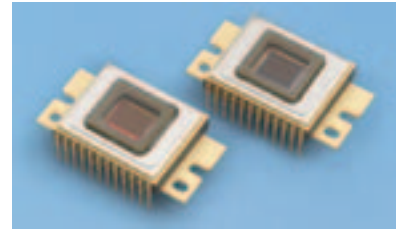
TI's IMPACTRON technology can be applied to any known CCD architecture. And because solid-state sensors have excellent sensitivity over a wide spectral range, TI has taken the next logical step in the development of this remarkable technology – COLOR! Please see the IMPACTRON Devices Table in this brochure for more details about our available IMPACTRON sensor formats.



Charge Carrier Multiplication concept in a CCD device.



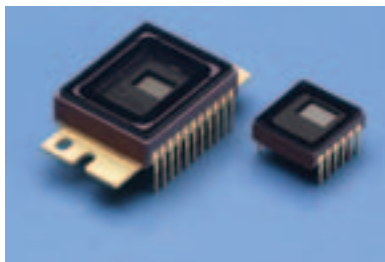
- A high field region is created between suitable gate electrodes within each pixel of a CCD register section.
- Carriers are injected into the high field region where impact ionization occurs.
- Even if the probability of impact ionization is small, carriers are transported through many CCD stages with high field to achieve the desired level of multiplication.
- The design of the pixel is such that the amount of transported charge does not affect the multiplication field strength to prevent the loss of linearity.



TC246RGB/TC246CYM

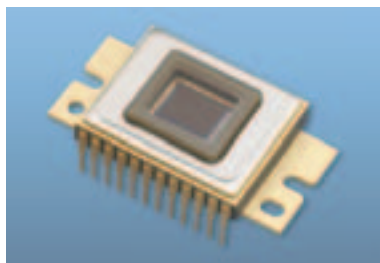
The TC246RGB/TC246CYM is a frame interline transfer CCD image sensor designed for use in color, NTSC TV, computer and special-purpose applications requiring low noise. The TC246RGB/TC246CYM is a new device of the IMPACTRON family of very-low noise, high sensitivity, high speed and low smear sensors that multiply charge directly in charge domain before conversion to voltage. The image-sensing area of the TC246RGB/TC246CYM is configured into 500 lines with 680 pixels in each line. Because of its low smear, it is perfect for low-light-level surveillance.

IMPACTRON CCDs



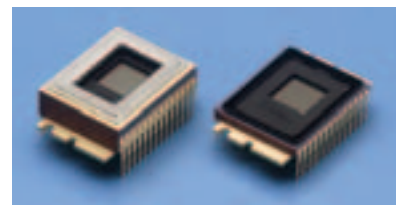
TC253 IMPACTRON

The TC253 IMPACTRON is a frame-transfer CCD image sensor designed for use in black and white NTSC TV, computer and special-purpose applications requiring high sensitivity, ultra-low noise and small size. The image-sensing area of the TC253 IMPACTRON is configured into 500 lines with 680 pixels in each line. The TC253 IMPACTRON is the first device of the IMPACTRON family of ultra-low noise, high sensitivity image sensors that multiplies charge directly in charge domain before conversion to voltage.



TC247 IMPACTRON

The TC247 IMPACTRON is a frame interline transfer CCD image sensor designed for use in black and white or color, NTSC TV, computer and special-purpose applications requiring low noise. The TC247 IMPACTRON is a new device of the IMPACTRON family of very-low noise, high sensitivity, high speed and low smear sensors that multiply charge directly in charge domain before conversion to voltage. As a result of the frame interline architecture, smear is significantly reduced. The image-sensing area of the TC247 IMPACTRON is configured into 500 lines with 680 pixels in each line. To increase sensitivity even further, micro lenses have been attached directly to the image-area pixels.



TC285 IMPACTRON

The TC285 IMPACTRON is the first 1Megapixel, 30 fps EMCCD in the world. It is a 1004x1002, frame-transfer IMPACTRON image sensor designed for use in black and white, biomedical and special-purpose applications requiring high sensitivity, high speed, high resolution and low noise. The TC285 IMPACTRON achieves nearly 70 percent peak QE, and has a wide spectral response from NIR to UV. Available in Peltier-cooled and non-cooled versions, the TC285 IMPACTRON is ideal for real-time, low-light-level applications such as biotech and medical.

Current IMPACTRON CCD Lineup

Model	TC246RGB/TC246CYM	TC253 IMPACTRON	TC247 IMPACTRON	TC285 IMPACTRON
Imager Size	1/2-inch	1/3-inch	1/2-inch	2/3-inch
Pixel Count (HxV)	658 X 496	656X496	658X496	1000X1000
Pixel Size (HxV) μm	10.0 X 10.0	7.4 X 7.4	10.0 X 10.0	8.0 X 8.0
Color Filter	RGB Bayer or CYMG Complementary	-	-	-
Scan Method		Progressive/Interlace		Progressive
Data Rate	12.5~25MHz	12.5MHz	12.5MHz	35MHz
Sensitivity (typ)	3.100_V/lux/sec	1.200_V/lux/sec	3.100_V/lux/sec	3.500_V/lux/sec
Full Well Capacity (typ)	28K e	44K e	28K e	60K e
Charge Conversion Factor	14 $\mu\text{V}/\text{e}$	9 $\mu\text{V}/\text{e}$	14 $\mu\text{V}/\text{e}$	14 $\mu\text{V}/\text{e}$
Dynamic Range (typ) TA=25	75dB	64dB	75dB	62dB
Package	Cooled 22-pin DIP	Cooled 22-pin DIP Non-cooled 12-pin DIP	Cooled 22-pin DIP	Cooled 28-pin DIP Non-cooled 28-pin DIP

IMPACTRON Cameras



MC681 IMPACTRON-R0B0

The super-high sensitivity low-light-level MC681 IMPACTRON-R0B0 camera that uses the TC253 IMPACTRON CCD employs charge multiplication, a new technique in imaging introduced by TI. In the CCD, charge is multiplied in several stages within the readout serial register before it ever reaches the output amplifier. In this way noise is reduced since there is no need to amplify the voltage of the readout charge conversion amplifier. The device is divided into a head section and a camera control unit (CCU) with built-in processing. From the CCU, integration time,

cooling and charge multiplication can be adjusted for optimum performance. In addition to an EIA analog composite output, there is also a 12-bit digital output. The real-time speed of this high-sensitivity camera makes it the right choice for low-light applications in which motion is involved.



MC285SPD-L0B0

TI Japan introduces the MC285SPD-L0B0, a 1 Megapixel, charge multiplication CCD video camera with 30 fps video output. This latest IMPACTRON camera combines high resolution and real-time imaging with extraordinarily low noise and high quantum

efficiency (peak QE >60%). TI's IMPACTRON charge multiplication technology is completely immune to common problems of conventional image intensifier technologies such as image burn-in or residual imaging. Furthermore, the charge multiplication gain is variable, allowing for adjustments to suit a wide range of light conditions. The MC285SPD-L0B0 is an astounding camera that was created for use in applications for which real-time, high-resolution and high sensitivity are required. The CCD in the camera is cooled to approximately -20 degrees Celsius. Additionally, this camera features RS-232 controllability. Functions such as charge multiplication gain, exposure, 2 x 2 or 4 x 4 column/row binning and image averaging can all be modified through a standard serial port interface common to almost all PCs and laptops.

IMPACTRON Camera Lineup

	MC681 IMPACTRON	MC285 IMPACTRON
Imager	TC253 IMPACTRON CCD	TC285 IMPACTRON CCD
Imager size	1/3-inch	2/3-inch
Pixel Count	656X480	1000X1000
Pixel Size (HXV) μm	7.4X7.4	8.0X8.0
Aspect Ratio (H:V)	4 : 3	1 : 1
Lens Mount	CS-Mount (12.526mm) C-Mount (17.526mm)	C-Mount (Flange Back 17.526mm)
Video Format	EIA RS-170 Analog Composite	-
Digital Output Format	LVDS Parallel 12-bit	
Readout Method	2 : 1 interlace (analog)	Progressive
Frame Rate	60 Fields (for Digital: 30 Hz, Progressive Scan)	30Hz
Data Rate	12.5MHz	35MHz
Active Pixels	500 X 380	1000 X 1000
Synchronization Method	Internal	Internal/External Synch (automatic)
AGC	NO	
Gamma	1	
Gain	Range (5~1000 times, manual)	Range (4~2000 times, manual)
Electronic Shutter	4~1/4000sec (16 steps)	1/2~1/3800 sec (16 steps)
Other	Random Shutter Averaging 2,4,8,16 frames On-chip Peltier Cooler	Averaging 2,4,8 frames Pixel Binning 2X2, B4X4 On-chip Peltier Cooler
Power Supply	100~240VAC 50/60Hz	
Power Consumption	38W	55W
Dimensions (WxHxD)mm	Head Unit 60x50x83.5 CCU Unit: 200 x 65 x 170AC	Camera Unit: 110.0X110.0X202.0 2.2kg) Adapter:136.0 X54.0X214.2 (1.0kg)

When ordering, please use the complete part numbers:

(1) MC681SPD-R0B0 (2) MC285SPD-L0B0

Standard CCD Product Lineup

Imager	Total Photosites (H x V)	Active Photosites (H x V)	Image Diagonal (mm)	Pixel Dimensions (μm) (H x V)	Comments
TC237B	680x500	658x496	6	7.4x7.4	VGA/Standard Resolution CCTV Sensor
TC323	526x514	512x512	17.6	24.0x24.0	For Bio Applications
TC341	780x244	754x488	11	11.5x27	Standard Resolution CCTV Sensor
TC255P	336x244	324x486	4	10x10	Low Resolution CCTV Sensor

UV through IR Standard Video Camera Product Lineup

(All cameras have sensitivity in the Near IR range)

Application	Outline	Product Name	Suffix	Imager Information
Scientific Measurement	250K-pixel Progressive Scan Digital Camera	MC-512PF	---	24 Micron Square pixels
Standard TV-output products	380K-pixel Video Camera	MC-781P	-0030	Standard Type
			-0077	248nm UV Laser apps
			-0078	193nm UV Laser apps
	Remote-head-type 380K-pixel Video Camera	MC-781PAR	-0030	Standard Type
			-0077	248nm UV Laser apps
			-0078	193nm UV Laser apps
Progressive Scan, Digital Output Video Cameras	330K-pixel Digital Camera Board	TCK237D	-0030	Standard Type
	330-pixel Frame Shutter Digital Camera	MC-680PF	-0030	Standard Type
			-U	248nm/365nm UV
			-1034	248nm/365nm UV Laser Type
380K-pixel Frame Shutter Digital Camera	MC-781PF	-0030	Standard Type	
High Resolution Progressive Scan Video Camera	2M-Pixel Progressive Scan Video Camera	MC-2000PF	-0030	Standard Type
			-U2	248nm/365nm UV
				248nm/365nm UV
			-U5	(1Kx1K Partial Scan)
High-Resolution Progressive Scan Digital Output Video Cameras	High Speed 1Mpixel Progressive Scan Video Camera	MC-1002PF	-0030	Standard Type
			-0077	248nm UV Laser apps
			-0078	193nm UV Laser apps
	High Speed 3.7Mpixel Progressive Scan Video Camera	MC3700CL	---	30 full 3.7Mpixel Frames Per Second!

This information is subject to change without notice.

For individual specification details please send email to ccd-camera-info@list.ti.com.

New Wide-Dynamic-Range Sensor Coming Soon

Early in 2005 TI will unveil another new and cutting-edge imaging technology.
Stay tuned for announcements...

The New Wide-Dynamic-Range Imaging Technology from Texas Instruments:

“i-DREAM” © Imaging - Dynamic-Range-Enhanced Array Module

i-DREAM© with clarity...

i-DREAM© in COLOR...

i-DREAM© - The FUTURE!!

The table below shows some of the important target parameters for the new i-DREAM Wide-Dynamic-Range color CMOS image sensor planned by TI.

Preview of the first planned WDR i-DREAM sensor	
Sensor Name	TC920
Optical format	1/3 inch
Pixel Size	7.5 um x 7.5 um
Active Pixels	640 x 480 VGA
Supply voltage	5 V
Frame Rate	30 fps
DYNAMIC RANGE	Greater than 100 dB !!!!

IMPACTRON ordering and technical information:

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Or visit us on the web at

<http://www.tij.co.jp/jsc/docs/disp/eng/index-e.htm>

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