

# SiS1-t253EM



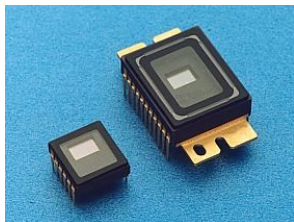
## SINGLE PHOTON SENSITIVE 14-BIT CCD-CAMERA SYSTEM WITH ELECTRON MULTIPLYING TECHNOLOGY



The Scientific Imaging System SIS1-t253EM (EMCCD) is a supersensitive 14-bit camera system designed for all kinds of industrial and scientific LLL (Low Light Level) applications. Up to now conventional image-intensified CCD-camera systems had to be used for such applications. By application of *On Chip Charge Gain* CCD image sensors, a readout noise of  $<0,5e^-$  is achieved so that the sensitivity of the system is increased up to the range of single-photon-detection. This is also achieved by the high quantum efficiency in the near UV-range up to the IR-range and the low dark current of the Texas Instruments image sensor TC253. The resulting high sensitivity and the square pixel with a size of  $7.4\mu\text{m} \times 7.4\mu\text{m}$  is optimal qualified for all applications in the optical microscopy, in particular on low fluorescence.

Features	
<b>0.5e<sup>-</sup> rms Noise</b> ▶	The <i>On Chip Charge Gain</i> technology intensifies the image electrons before the CCD-readout step/level by the factor $>100$ with the resulted readout noise of $<0.5e^-$ .
<b>14-bit Digitalization</b> ▶	Intensity resolution of 16,384 grayscales, 64 times better than 8-bit systems, important for photometric measurements and structures with low contrast.
<b>Low Dark Current</b> ▶	The low dark current of $< 3,5e^-/\text{pixel/s}$ offers the possibility of long time integration for $\mu\text{-Lux}$ imaging.
<b>&gt;60% Quantum Efficiency</b> ▶	The high quantum efficiency of $>60\%$ and the SNR of $<0.5e^-$ rms offer a high sensitivity for imaging at low light levels
<b>Anti-Blooming Funktion</b> ▶	Blooming from one overexposed pixel to adjacent pixels will be avoided by an efficiency of an overexposure factor of $>1000$ relative to the full well capacity.
<b>External Timing</b> ▶	Asynchronous electronic integration time control by external gate input for integration times from $100 \mu\text{s}$ up to hours.
<b>30Hz Frame Rate</b> ▶	The very high frame rate of 30Hz at full image resolution provides the possibility of image sequences with high time resolution and a live-mode for optimal setting possibilities.
<b>Binning + Partial Scan</b> ▶	The addition of the electronic charges of lines and columns (Binning) of the image sensor increases the sensitivity and the frame rate. The partial scan provides frame rates up to the kHz-range.
<b>WinSIS-Software</b> ▶	WinSIS6 for WinXP/2000/NT/9x controls all camera functions and integration timing. The concept of intuitive easy-to-use operation for all imaging and processing functions with integrated job creation and macro definition offers a fast realization of complex applications without long training periods. SDK for personal programming

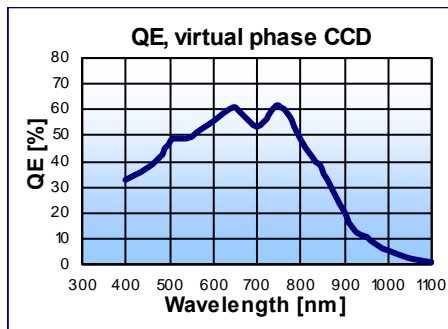
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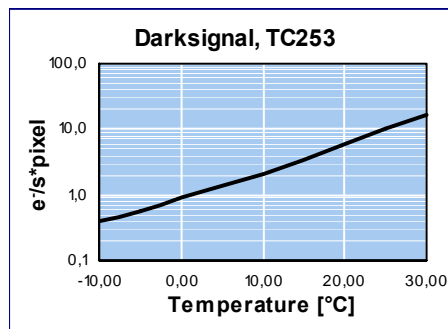
Monochrome, progressive-scan 1/3"-CCD image sensor Texas Instruments TC253, with and without integrated peltier cooling device.

## Specifications

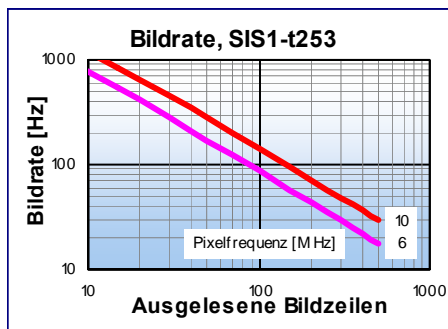
CCD Image Sensor	Texas Instruments TC253
Sensor Type	Progressive Scan, Frametransfer
Sensor Format	4 : 3; 1/3"-image sensor
Image Size	4.8mm x 3.67mm, 6.1mm diagonal
Pixel Size	7.4µm x 7.4µm
Pixel Number	656 (H) x 496 (V)
Electron Capacity	44,000e <sup>-</sup>
Noise, rms	<25e <sup>-</sup> , Gain=1. <0,5e <sup>-</sup> , Gain=60.
Dynamic	1,760 : 1, Gain=1
Dark Current @ 15°C	< 3.5e <sup>-</sup> / pixel / s
Quantum Efficiency	> 60% @ 650nm
Anti-Blooming	1000 x e <sup>-</sup> capacity
Binning	2 - 255 vertical, 2 horizontal
Partial Scan	vertical, user-defined
Digitalization	14-bit
Frame Rate	17.5Hz, 6MHz 29Hz, 10MHz
Integration Time	100µs to >1h
Trigger	External, asynchronous
Gain	1 - 100, em on chip
Optical Mount	c-mount
Mech. Dim. (BxHxL)	45mm x 45mm x 115mm
Weight	230g
Operational Temperature	+5 ... +45°C



The quantum efficiency QE is defined as the percentage of the incoming photons, which generate an electronic charge. The graph shows a typical characteristic of a virtual-phase-CCD-sensor.



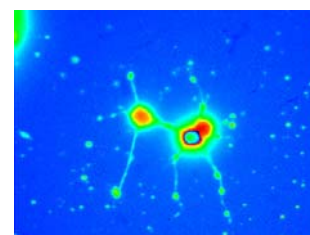
The temperature depending dark current of a CCD image sensor results from the thermal generation of electrons. The increase of the temperature of 6°C to 9°C doubles the dark current.



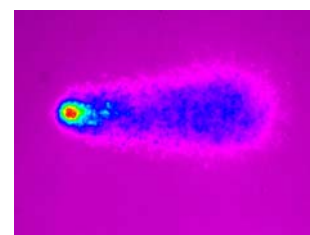
The readout of partial images (ROI's) and the binning of lines increase the frame rate up to the kHz-range, because only a small number of image sensor lines have to be transferred. There can be up to four user-defined line-ROI's.

## Applications

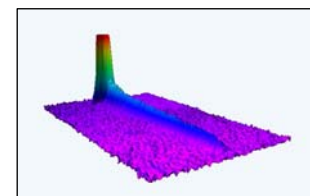
- ▶ LowLightLevel Imaging
- ▶ Fluorescence
- ▶ Luminescence
- ▶ Chemiluminescence
- ▶ Comet Assay
- ▶ FISH
- ▶ Spectroscopy
- ▶ Electrophoresis
- ▶ Gel-applications
- ▶ Astronomy
- ▶ Combustion processes
- ▶ Quality control
- ▶ Process control
- ▶ BEC



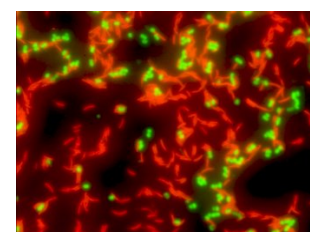
FURA, calciumfluorescence of a cancer cell



DAPI, Comet Assay



Absorption, atom laser beam



FISH Megapec

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