The SPOT™ BOOST™ BT 2001 back illuminated EMCCD has single photon detection capability without an image intensifier, combined with greater than 90% QE of a back-illuminated sensor. Containing a 512 x 512 L3Vision™ Frame Transfer CCD sensor from E2V Technologies, it enables charge to be multiplied on the sensor before it is read out, while utilizing the full QE performance of the CCD sensor. The EMCCD gain of the camera can be varied from unity up to a thousand times directly through the software. The system offers a range of readouts from 10 MHz to 1 MHz at up to 16-bit digitization. This camera has both EMCCD and conventional amplifier outputs and benefits from minimized dark current with unequaled thermoelectric cooling down to –100°C.

### Camera Specs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMCCD Technology</td>
<td>Ultimate in sensitivity from EMCCD gain – even single photon signals are amplified above the noise floor</td>
</tr>
<tr>
<td>16-bit digitization</td>
<td>Allows for meaningful capture of real data at 1 MHz operation</td>
</tr>
<tr>
<td>True Linear gain</td>
<td>Control EMCCD gain with a linear, quantified scale – ask for a gain value and get it corrected to the CCD temperature</td>
</tr>
<tr>
<td>&gt; 90% QE back-illuminated sensor</td>
<td>Maximum possible photon collection efficiency</td>
</tr>
<tr>
<td>Variable readout rates up to 10 MHz</td>
<td>Quantitative accuracy at all speeds</td>
</tr>
<tr>
<td>Vacuum sealed cooling</td>
<td>Critical for sustained vacuum integrity to maintain unequalled cooling and QE performance</td>
</tr>
<tr>
<td>Thermoelectric cooling to –100°C possible</td>
<td>Critical for elimination of dark current detection limit – an EMCCD must!</td>
</tr>
<tr>
<td>512 x 512 Frame Transfer sensor</td>
<td>High resolution, large field of view and fast, shutterless imaging</td>
</tr>
<tr>
<td>High dynamic range</td>
<td>Extended sensor dynamic range (readout speed dependent) and matched digitization for quantization of dim and bright signals</td>
</tr>
<tr>
<td>Built-in C-mount compatible shutter</td>
<td>Easy means to record control dark images – excellent for optimization of experimental set-up</td>
</tr>
<tr>
<td>EM protect</td>
<td>EM gain register is protected from accidental damage using built-in algorithms. Also limits long-term gain aging.</td>
</tr>
</tbody>
</table>

### Camera Overview

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Pixels</td>
<td>512 x 512</td>
</tr>
<tr>
<td>Pixel Size (WxH; µm)</td>
<td>16 x 16</td>
</tr>
<tr>
<td>Image Area (mm)</td>
<td>8.2 x 8.2</td>
</tr>
<tr>
<td>Active Area pixel well depth (e–, typical)</td>
<td>200,000</td>
</tr>
<tr>
<td>Gain Register pixel well depth (e–, typical)</td>
<td>800,000</td>
</tr>
<tr>
<td>Max Readout Rate (MHz)</td>
<td>10</td>
</tr>
<tr>
<td>Frame Rate (frames per sec)</td>
<td>35 to &gt;500</td>
</tr>
<tr>
<td>Read Noise (e–)</td>
<td>&lt;1 EM gain &lt; 50 conventional @ 10 MHz</td>
</tr>
</tbody>
</table>

### System Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak QE</td>
<td>&gt;92%</td>
</tr>
<tr>
<td>Pixel Readout Rate (MHz)</td>
<td>10, 5, 3, 1</td>
</tr>
<tr>
<td>Electron Multiplying Amplifier</td>
<td>3 and 1</td>
</tr>
<tr>
<td>Conventional Amplifier</td>
<td>True 14-bit</td>
</tr>
<tr>
<td>Digitization @ 10, 5, 3 &amp; 1 MHz readout rate</td>
<td>16-bit @ 1 MHz</td>
</tr>
<tr>
<td>Vertical Clock Speed (µs)</td>
<td>0.3 to 3.3 (variable)</td>
</tr>
<tr>
<td>Linear Electron Multiplier Gain (software controlled)</td>
<td>1 – 1000 times</td>
</tr>
<tr>
<td>Non-Linearity</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Triggering</td>
<td>Internal, external, external start</td>
</tr>
<tr>
<td>Camera window type</td>
<td>Single window with double-sided AR coating–standard for BV model</td>
</tr>
</tbody>
</table>
**Dark Current & Dark Current Background Events**

@ -85° C (e-/pix/sec) 0.001

EMCCD-Amplified Background Events (events/pix)@ 1000 x gain and -85° C

EMCCD-Amplified Background Events 0.005

**Noise**

System Readout Noise (typical; e-) Typical with Electron Multiplication

10MHz through EMCCD amplifier 49 <1

5MHz through EMCCD amplifier 40 <1

**Operating & Storage Conditions**

Operating Temperature 0° C to 30° C ambient

Relative Humidity < 70% (non-condensing)

Storage Temperature -25° C to 55° C

**Computer Requirements**

To handle data transfer rates of 10MHz readout over extended sequential (kinetic) series, a powerful computer is recommended, e.g:

- 3 GHz Pentium (or better)
- 1GB RAM
- 10,000 rpm SATA hard drive, preferred for extended kinetic series

**Power Requirements**: 0.6A @ +12V | 0.3A @ -12V | 3.0A @ +5V

**Also**: PCI-compatible computer

- PCI slot must have bus master capability
- Available auxiliary internal power connector
- 32 Mbytes free hard disc space

**Operating System**: Windows 2000 or XP operating system

**Noise & EMCCD Gain**

Variations of Readout Noise with EMCCD Gain at 10MHz Readout Rate

**Cooling Temperature**

- Air-cooled (ambient air @ 20° C) -85
- Water cooled using Re-circulator (RC180) (ambient air @ 20° C) -90
- Water-cooled using Chiller (water @ 12° C, 0.75 l / min) -100

**Quantum Efficiency**

Quantum Efficiency at 575nm and –20° C°

**Full Frame Rate**

Max Frames per sec

<table>
<thead>
<tr>
<th>Array size</th>
<th>512 x 512</th>
<th>256 x 256</th>
<th>128 x 128</th>
<th>512 H x 100 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binning 1x1</td>
<td>35</td>
<td>68</td>
<td>132</td>
<td>168</td>
</tr>
<tr>
<td>2x1</td>
<td>68</td>
<td>132</td>
<td>248</td>
<td>313</td>
</tr>
<tr>
<td>2x2</td>
<td>68</td>
<td>132</td>
<td>248</td>
<td>313</td>
</tr>
<tr>
<td>4x1</td>
<td>131</td>
<td>246</td>
<td>439</td>
<td>549</td>
</tr>
<tr>
<td>4x4</td>
<td>131</td>
<td>246</td>
<td>439</td>
<td>549</td>
</tr>
</tbody>
</table>

Need more information?
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website: www.diaginc.com
For footnote review: www.diaginc.com/boostnotes
BOOST™ dimensions

5.42"

6.46"

5.36"