**Application circuit (Fig.1, only one channel output drawn)**

![Application Circuit Diagram]

**Reverse operating DC voltage (typ. 1 V ... 10 V)**

**Application notes**

- Keep all cathodes including guard rings on virtual or real ground potential [GND = 0 V].
- A single diode cathode (including guard ring) must never float or get disconnected from GND potential.
- The maximum voltage difference between any diode cathode and GND is +3 V / -0.3 V
- The photocurrent must be allowed to flow from or to any virtual or real ground at any time. So the DC input resistance of the amplifier must not be giga-ohmic (as MOS inputs usually are).
- If there is more than one photodiode enclosed with a guard diode a single channel input per pixel is the best way to process the output data. Alternately, an analog switch may be used. The switch matrix must make sure that all pixels including the guard diode except for the actual measured one are connected to GND.
- The use of a secure current limiter in the reverse operating DC voltage line is recommended. Any overload may produce heat in the device and / or irreversible breakdown in the input structures of the transimpedance amplifiers or analog switches.
- Fig. 1 shows a sample 25 element line array with guardring diodes. Quadrant devices get only 4 signal delivery diodes and one surrounding guardring diode instead of the two, drawn in Fig. 1. The operation mode however is exactly the same as in line arrays. The operation mode does not change even if no guardring diodes are present in a device.
- The guard ring diode must be connected to the circuit at least once per device.
- The outer light shield metal is at backside potential and may be bonded to backside potential. If this connection is used instead of a true low resistive backside contact, there may be enhanced parasitic resistances in the signal path, depending on the chip size.
- Please note the gap regions in all avalanche array type devices including quadrants are insensitive to light.
- If a guard ring diode is present it must be connected to the circuit at least once per device. Multiple connections to the same potential are possible.
- The outer light shield metal is at backside potential and may be bonded to backside potential. If this connection is used instead of a true low resistive backside contact, there may be enhanced parasitic resistances in the signal path, depending on the chip size.
- Current should be limited by a protecting resistor or current limiting - IC inside the power supply.
- For low light level applications blocking of ambient light should be used.
- Use low noise read-out - IC.
- Optimized PIN power supplies and evaluation kits are available. Visit our website.
- For further questions please refer to document "Instructions for handling and processing".

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**European, International Sales:**
First Sensor AG  
Peter-Behrens-Strasse 15  
12459 Berlin  
Germany  
T +49 30 6399 2399  
F +49 30 639923-752  
sales.opto@first-sensor.com

**USA:**
First Sensor Inc.  
5700 Corsa Avenue #105  
Westlake Village  
CA 91362 USA  
T +1 818 706 3400  
F +1 818 889 7053  
sales.us@first-sensor.com
First Sensor Application Note
PIN photodiode array with guard ring

Version 27-02-12

PIN Series overview

<table>
<thead>
<tr>
<th>PIN Series</th>
<th>Optimized for</th>
<th>Application</th>
<th>Special features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series -2*</td>
<td>200...500 nm</td>
<td>Analytical instruments, readout for scintillators</td>
<td>UV/ blue enhanced</td>
</tr>
<tr>
<td>Series -6b</td>
<td>400...650 nm</td>
<td>Photometric illuminometer</td>
<td>Blue / green enhanced</td>
</tr>
<tr>
<td>Series -5b</td>
<td>360...550 nm</td>
<td>Optical fiber communication,</td>
<td>High-Speed Epitaxy, blue / green enhanced</td>
</tr>
<tr>
<td>Series -5t</td>
<td>400...850 nm</td>
<td>high speed photometry</td>
<td>High-Speed Epitaxy, low voltage (3.5V)</td>
</tr>
<tr>
<td>Series -7</td>
<td>700...950 nm</td>
<td>Heat in the device and/or irreversible breakdown in the input structures of the transimpedance amplifiers or analog switches.</td>
<td></td>
</tr>
<tr>
<td>Series -7</td>
<td>700...1000 nm</td>
<td>High energy physics</td>
<td>Low capacity, fully depletable</td>
</tr>
<tr>
<td>Series -Q</td>
<td>900...1100 nm</td>
<td>YAG laser detection</td>
<td>Enhanced NIR sensitivity, low voltage, fully depletable, low</td>
</tr>
<tr>
<td>Series -i</td>
<td>600...1700 nm</td>
<td>Eye-safe laser detection</td>
<td>InGaAs photodiodes, high IR sensitivity, low dark current</td>
</tr>
<tr>
<td>Series -X</td>
<td>Ionizing radiation</td>
<td>Medical, security, material</td>
<td>With or without scintillator, ultra</td>
</tr>
</tbody>
</table>

* Please note that Series -2 has opposite polarity w.r.t. the other series'.

Responsivity (23 °C) | Quantum efficiency (23 °C)

PIN part description
From the part description it is possible to conclude the basic geometry of the detector:

<table>
<thead>
<tr>
<th>Number</th>
<th>Two letter designator : device type</th>
<th>Number</th>
<th>-</th>
<th>Number</th>
<th>Package designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>PC - PIN photodiode, circular area</td>
<td>Active area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>-</td>
<td>PS - PIN photodiode, square area</td>
<td>Active area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>-</td>
<td>PR - PIN photodiode, rectangular area</td>
<td>Active area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>-</td>
<td>DP - Dual PIN photodiode / bicell</td>
<td>Total active area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>-</td>
<td>QP - Quadrant photodiode</td>
<td>Total active area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>-</td>
<td>X - Ionizing radiation detector</td>
<td>Active area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>Pixel count</td>
<td>XA - PIN PD array for ionizing radiation</td>
<td>Single pixel area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>Pixel count</td>
<td>PA - PIN photodiode array</td>
<td>Single pixel area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>Pixel count</td>
<td>IA - irregular array</td>
<td>Single pixel area [mm²]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
</tbody>
</table>

*Package designator: TO Metal can type package | BNC BNC Connector (RF coaxial cable jack) | THD Through hole device package | CLP Chip level package | SMD Surface mount device package | CH Chip: bare die

Disclaimer: Due to our strive for continuous improvement, specifications are subject to change within our PCN policy according to JESD46C.

European, International Sales: First Sensor AG
Peter-Behrens-Strasse 15
12459 Berlin
Germany
T +49 30 6399 2399
F +49 30 639923-752
sales.opto@first-sensor.com

USA: First Sensor Inc.
5700 Corsa Avenue #105
Westlake Village
CA 91362 USA
T +1 818 706 3400
F +1 818 889 7053
sales.us@first-sensor.com