Application notes

- Keep all cathodes including guard rings on virtual or real ground potential \([GND = 0 \text{ V}]\).
- 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 \(+3 \text{ V} / -0.3 \text{ V}\).
- 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 guarding diodes. Quadrant devices get only 4 signal delivery diodes and one surrounding guarding 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 guarding diodes are present in a device.
- Fig. 1 shows a passive current limiting scheme using a resistor \(R2\) which is in the range of several hundred \(\Omega\) to some \(M\\Omega\), depending on the application. If RF signals should be used the \(R2\) resistance must get a capacitive shortcut via \(C1\). The value of \(C1\) must not be too large because in case of failure or fast optical overload \(R2\) is bypassed and the resulting current may cause damage of the device or transimpedance amplifier.
- Breakdown voltage and hence the chosen operating point vary with temperature (see data sheet temperature coefficient).
- The operating reverse voltage should be controlled to compensate for any temperature shift of the device.
- Please note the gap regions in all avalanche array type devices including quadrants are insensitive to light.
- The guard ring diode 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.
- For high gain applications bias voltage should be temperature compensated.
- Please consider basic ESD protection while handling.
- Use low noise read-out - IC.
- Optimized APD 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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APD Series overview

<table>
<thead>
<tr>
<th>APD Series</th>
<th>Optimized for</th>
<th>Application</th>
<th>Special features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series -11*</td>
<td>360...560 nm</td>
<td>Analytical instruments, readout for scintillators</td>
<td>Blue enhanced, high speed</td>
</tr>
<tr>
<td>Series -12</td>
<td>550...750 nm</td>
<td>Precise distance measurement, communication</td>
<td>Ultra low temp. coefficient, flat frequency response up to 3 GHz</td>
</tr>
<tr>
<td>Series -8</td>
<td>750...820 nm</td>
<td>General purpose, distance measurement, laser scanner, high speed applications, optical fiber and communication</td>
<td>High speed, low temperature coefficient, high gain, high gain bandwidth product</td>
</tr>
<tr>
<td>Series -9</td>
<td>750...930 nm</td>
<td>Laser rangefinder, LIDAR, basic technology for arrays</td>
<td>Low rise time at higher NIR sensitivity, low temperature coefficient, high gain</td>
</tr>
<tr>
<td>Series -10</td>
<td>860...1100 nm</td>
<td>Range finder, laser tracker, LIDAR</td>
<td>Sensitivity at 1064 nm is close to physical limits</td>
</tr>
</tbody>
</table>

* Please note that Series 11 has opposite polarity w.r.t. the other series.

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

APD 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>AD - Avalanche photodiode</td>
<td>Diameter [µm]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>-</td>
<td>QA - Quadrant avalanche photodiode</td>
<td>Total diameter [µm]</td>
<td>-</td>
<td>Series</td>
<td>TO/THD/SMD/CLP/CH*</td>
</tr>
<tr>
<td>Pixel count</td>
<td>AA - Avalanche photodiode 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
THD Through hole device package
SMD Surface mount device package
CLP Chip level 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.