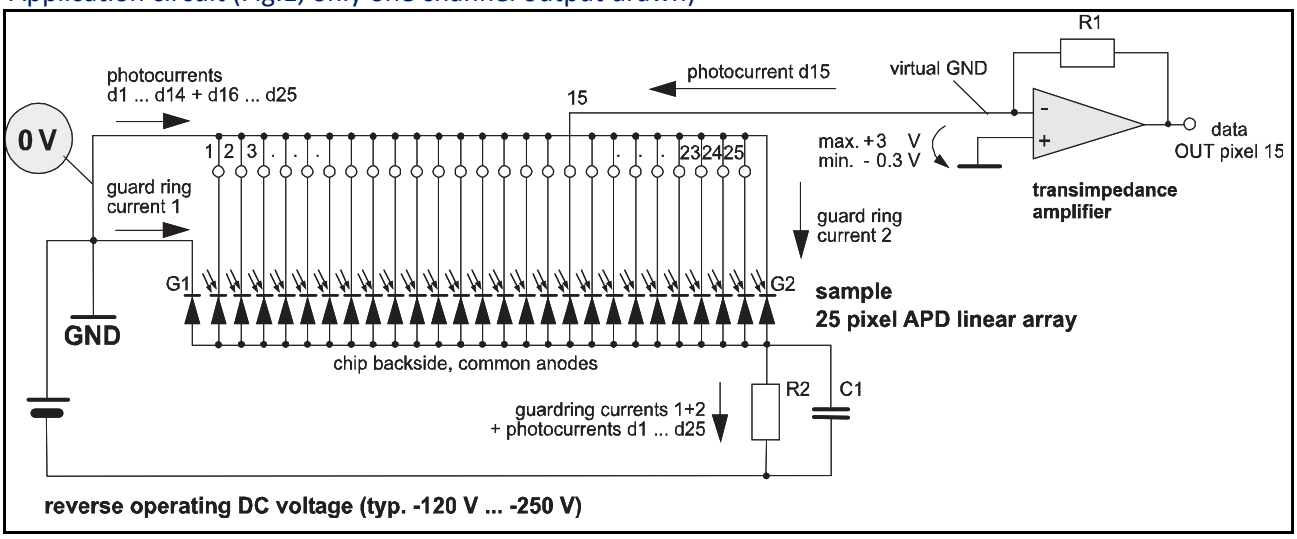
Application circuit (Fig.1, only one channel output drawn)



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.
- Fig. 1 shows an passive current limiting scheme using a resistor R2 which is in the range of several hundred KΩ to some MΩ, 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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First Sensor

First Sensor Application Note
APD array with guard ring

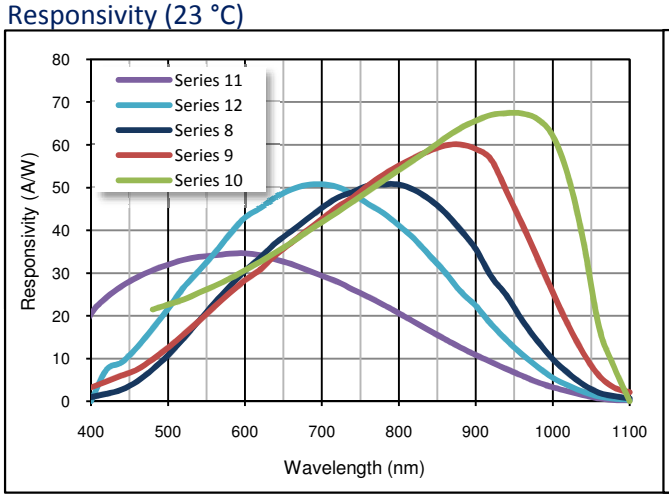
Version 08-07-11

APD Series overview

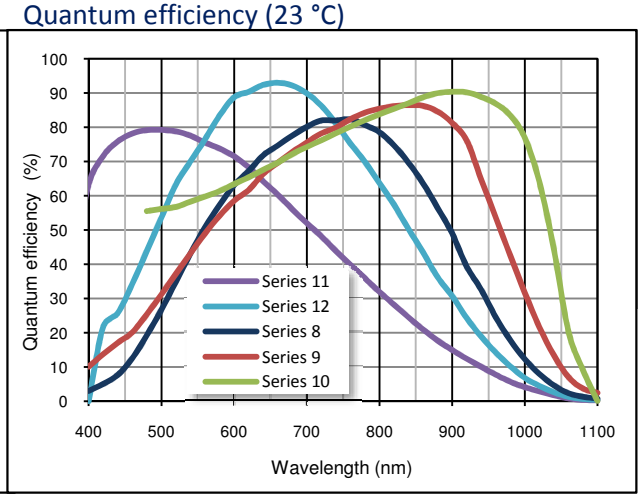
APD Series	Optimized for	Application	Special features
Series -11*	360…560 nm	Analytical instruments, readout for scintillators	Blue enhanced, high speed
Series -12	550…750 nm	Precise distance measurement, communication	Ultra low temp. coefficient, flat frequency response up to 3 GHz
Series -8	750…820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

* Please note that Series 11 has opposite polarity w.r.t. the the other series'.

Responsivity (23 °C)



Quantum efficiency (23 °C)



APD part description

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

Number	Two letter designator : device type	Number	-	Number	Package desgnator
-	AD - Avalanche photodiode	Diameter [µm]	-	Series	TO/THD/SMD/CLP/CH*
-	QA - Quadrant avalanche photdiode	Total diameter [µm]	-	Series	TO/THD/SMD/CLP/CH*
Pixel count	AA - Avalanche photodiode array	Single pixel area [mm²]	-	Series	TO/THD/SMD/CLP/CH*

*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

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