High Breakdown Voltage, Fully Depleted Series

LARGE ACTIVE AREA SILICON PHOTODIODES

APPLICATIONS | **FEATURES**

Large Active Area High Speed Detectors

Large Active Area Radiation Detectors

The **Large Active Area High Speed Detectors** can be fully depleted to achieve the lowest possible junction capacitance for fast response times. They may be operated at a higher reverse voltage, up to the maximum allowable value, for achieving even faster response times in nano seconds. The high reverse bias at this point, increases the effective electric field across the junction, hence increasing the charge collection time in the depleted region. Note that this is achieved without the sacrifice for the high responsivity as well as active area.

The **Large Active Area Radiation Detectors** can also be fully depleted for applications measuring high energy X-rays, -rays as well as high energy particles such as electrons, alpha rays and heavy ions. These types of radiation can be measured with two different methods. Indirect and direct.

<u>Indirect High Energy Radiation Measurement</u>:

In this method, the detectors are coupled to a scintillator crystal for converting high energy radiation into a detectable visible wavelength. The devices are mounted on a ceramic and covered with a clear layer of an epoxy resin for an excellent optical coupling to the scintillator. This method is widely used in detection of high energy gamma rays and electrons. This is where the X-UV devices fail to measure energies higher than 17.6 keV. The type and size of the scintillator can be selected based on radiation type and magnitude.

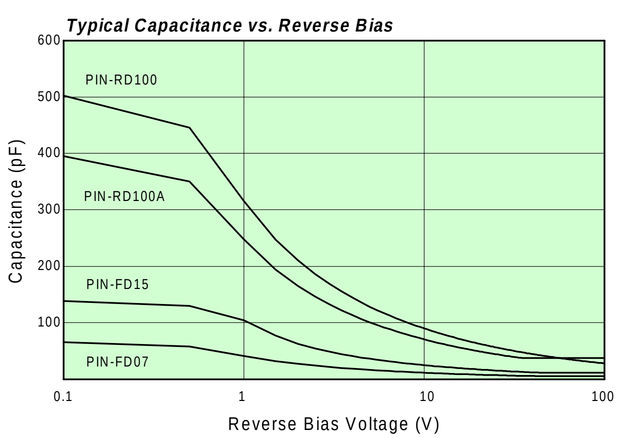
<u>Direct High Energy Radiation Measurement</u>:

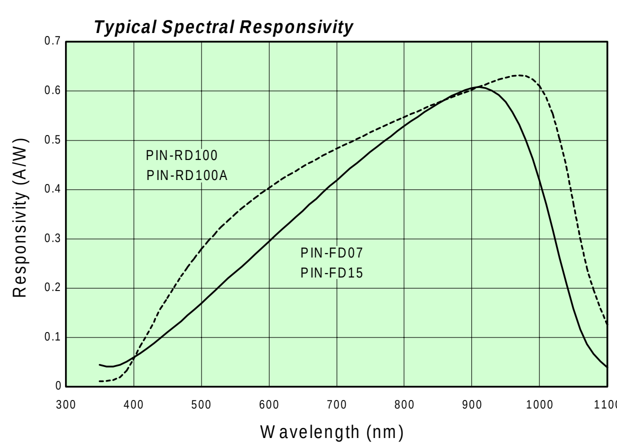
Both PIN-RD100 and PIN-RD100A, can also be used without any epoxy resin or glass window for direct measurement of high energy radiation such as alpha rays and heavy ions. The radiation exhibits loss of energy along a linear line deep into the silicon after incident on the active area.

The amount of loss and the penetration depth is determined by the type and magnitude of the radiation. In order to measure completely the amount of radiation, the depletion layer should be deep enough to cover the whole track from the incident point to the stop point. This requires a high bias application to fully deplete the detector. In spite of the large active area as well as high bias voltage applications, the devices exhibit super low dark currents, low capacitances and low series resistances.

In addition to their use in high energy particle detection, the PIN-RD100 and PIN-RD100A are also excellent choices for detection in the range between 350 to 1100 nm in applications where a large active area and high speed is desired.

These detectors can be coupled to a charge sensitive preamplifier or low-noise op-amp as shown in the next page. The configuration for indirect measurement is also shown with a scintillator crystal.





Model No.	Active Area		Peak Wavelength (nm)	Responsivity (A/W)	Depletion Voltage (V)	Dark Current (nA)		Capacitance (pF)		Rise Time (ns)	NEP (W/√Hz)	Reverse Voltage (V)	Temp Range (°C)		Package Style ¶
	Area (mm^2)	Dimension (mm)		900 nm		-100 V		-100 V		900 nm -100 V 50 ohm	900 nm -100V	10µA	Operating	Storage	
			typ	typ	typ	typ	max	typ	max	typ	typ	max			
LARGE ACTIVE AREA, HIGH SPEED															
PIN-FD07	7.1	3.00	900	0.55	48	0.2	5.0	8.0	9.0	1.5	1.2 e-14	135	-40 ~ +100	-55 ~ +125	25 / TO-8
PIN-FD15	14.9	4.35		0.58	55	1.0	30	14	16	3.0	2.5 e-14	140			

Model No.	Active Area		Peak Wavelength (nm)	Responsivity (A/W)		Depletion Voltage (V)	Dark Current (nA)		Capacitance (pF)		NEP (W/√Hz)	Reverse Voltage (V)	Temp Range (°C)		Package Style ¶
	Area (mm^2)	Dimension (mm)		450 nm	950 nm		Depletion Voltage		Depletion Voltage		Depletion Voltage 950 nm	10µA	Operating	Storage	
			typ	typ		typ	typ	max	typ	max	typ	max			
LARGE ACTIVE AREA, RADIATION DETECTORS															
PIN-RD100	100	10 Sq	950	0.3	0.65	120	2*	10*	50*	60*	3.2 e-14*	75	-20 ~ +60	-20 ~ +80	24 / Ceramic
PIN-RD100A	100	10 Sq		0.3	0.60	35	2	10	40	45	3.4 e-14	70			

* Measured at V_{bias} = -50V

For MECHANICAL DRAWINGS Click Here

DIRECT DETECTION

For direct detection of high-energy particles, the pre-amplifier is a FET input op-amp, followed by one or more amplification stages, if necessary, or a commercial charge sensitive preamplifier. The counting efficiency is directly proportional to the incident radiation power. The reverse bias voltage must be selected as such to achieve the best signal-to-noise ratio. For low noise applications, all components should be enclosed in a metal box. Also, the bias supply should be either simple batteries or a very low ripple DC supply. The detector should also be operated in the photovoltaic mode.

INDIRECT DETECTION (WITH SCINTILLATOR CRYSTAL)

The circuit is very similar to the direct detection circuit except that the photodiode is coupled to a scintillator. The scintillator converts the high-energy -rays and/or X-rays into visible light. Suitable scintillator include CsI(TL), $CdWO_4$, BGO and NaI(TL). The amplifier should be a FET input op-amp, followed by one or more amplification stages, or a commercial charge sensitive preamplifier. The output voltage depends primarily on the scintillator efficiency and should be calibrated by using radioactive sources.

Amplifier: OPA-637, OP-27 or similar
R_F : 10M Ωto 10G Ω
R_S : 1MΩ;Smaller for High Counting Rates
C_F : 1pF
C_D : 1pF to 10µF

OUTPUT $V_{OUT} = Q / C_F$
Where Q is the Charge Created by One Photon or One Particle