Segmented Photodiodes (SPOT Series)

Position Sensing Detector (PSD)

The SPOT Series are common substrate photodetectors segmented into either two (2) or four (4) separate active areas. They are available with either a 0.005" or 0.0004" well defined gap between the adjacent elements resulting in high response uniformity between the elements. The SPOT series are ideal for very accurate nulling or centering applications. Position information can be obtained when the light spot diameter is larger than the spacing between the cells.

Spectral response range is from 350-1100nm. Notch or bandpass filters can be added to achieve specific spectral responses.

These detectors exhibit excellent stability over time and temperature, fast response times necessary for high speed or pulse operation, and position resolutions of better than 0.1 µm.

Maximum recommended power density is 10 mW / cm2 and typical uniformity of response for a 1 mm diameter spot is ±2%.

The circuit on the opposite page represents a typical biasing and detection circuit set up for both bi-cells and quad-cells. For position calculations and further details, refer to “Photodiode Characteristics” section of the catalog.

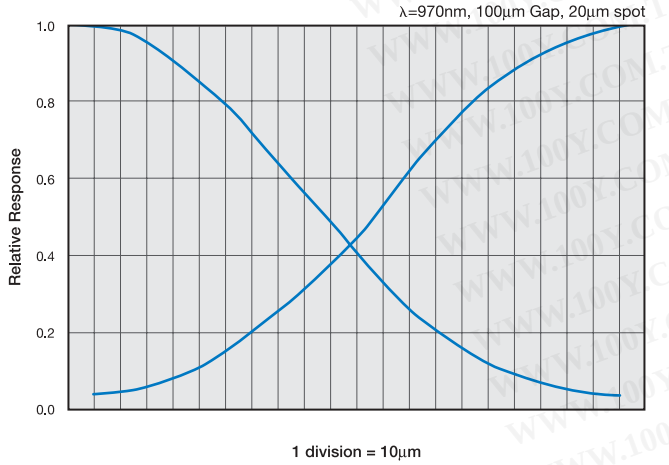
APPLICATIONS

- Machine Tool Alignment
- Position Measuring
- Beam Centering
- Surface Profiling
- Targeting
- Guidance Systems

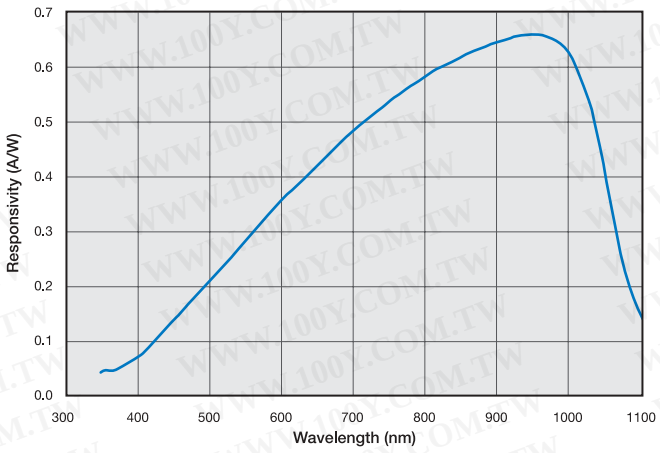
FEATURES

- High Accuracy
- Excellent Resolution
- High-Speed Response
- Ultra Low Dark Current
- Excellent Response Match
- High Stability over Time and Temperature

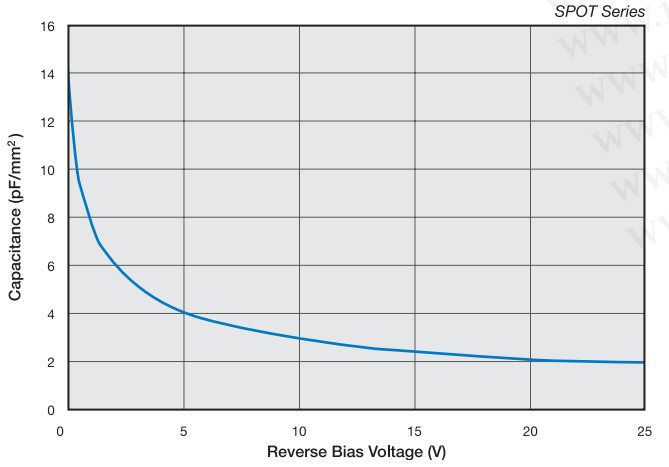
Typical Cross-Over Characteristics



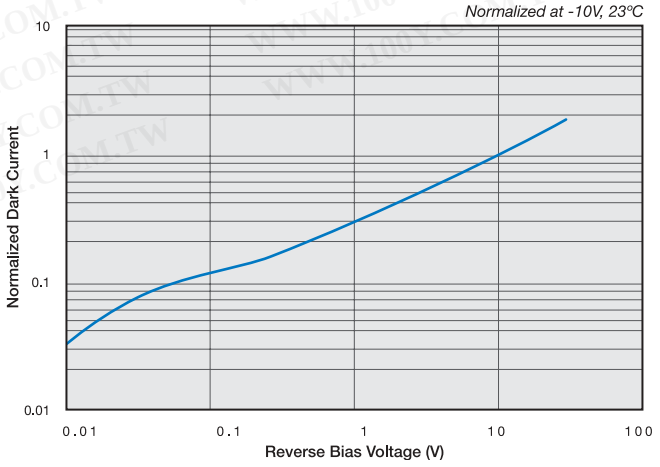
Typical Spectral Response



Typical Capacitance vs. Reverse Bias Voltage



Typical Dark Current vs. Reverse Bias



Segmented Photodiodes (SPOT Series)

Typical Electro-Optical Specifications at T_A=23ºC

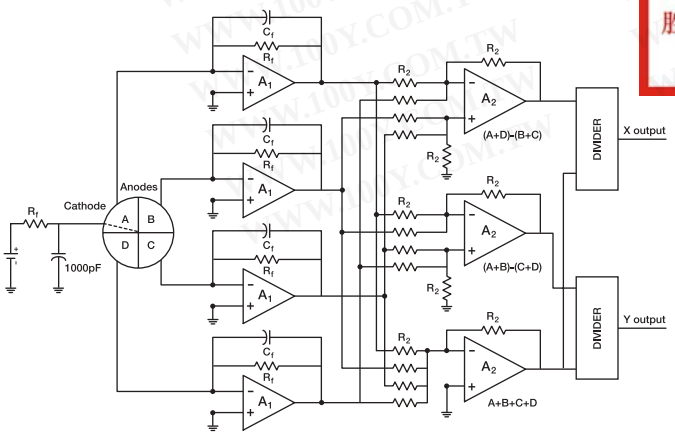
Model Number	Active Area Per Element		Element Gap (mm)	Responsivity (A/W)		Capacitance (pF)	Dark Current (nA)		NEP (W/√Hz)	Reverse Voltage (V)	Rise Time (ns)	Temp Range (°C)		Package Style ¶
	Area (mm^2)	Dimension (mm)		970 nm		-10 V	-10 V		-10 V 970 nm		-10V 780 nm 50 Ω	Operating	Storage	
				min.	typ.	typ.	typ.	max.	typ.	max.	typ.			
Two-Element Series, Metal Package														
SPOT-2D	3.3	1.3 X 2.5	0.127	0.60	0.65	11	0.15	2.0	1.1 e -14	30	5	-40 ~ +100	-55 ~ +125	41 / TO-5
SPOT-2DMI	0.7	0.6 x 1.2	0.013			3	0.05	1.0	6.2 e -15		7			40 / TO-18
SPOT-3D	2.8	0.6 X 4.6	0.025			7	0.13	2.0	9.9 e -15		4			41 / TO-5
Four-Element Series, Metal Package														
SPOT-4D	1.61	1.3 sq	0.127	0.60	0.65	5	0.10	1.0	8.7 e -15	30	3	-40 ~ +100	-55 ~ +125	41 / TO-5
SPOT-4DMI	0.25	0.5 sq	0.013			1	0.01	0.5	2.8 e -15					
SPOT-9D	19.6	10 ϕ ‡	0.102			60	0.50	10.0	1.9 e -14					43 / LoProf
SPOT-9DMI	19.6		0.010											
Plastic Package §														
FIL-S2DG	3.3	1.3 X 2.5	0.127	0.60	0.65	11	0.15	2.0	1.1 e -14	30	5	-10 ~ +60	-20 ~ +70	14 / Plastic
FIL-S4DG	1.6	1.3 sq	0.127			5	0.10	1.0	8.7 e -15		3			
FIL-S9DG	19.6	10 ϕ‡	0.102			60	0.50	10.0	1.9 e -14					15 / Plastic
UV-Enhanced Four Elements, Metal Package														
				Responsivity 257nm		Capacitance 0V	Shunt Resistance		NEP		Rise Time 0 V, 257nm			
				A/W		pF	MΩ		W/√Hz		µs			
				min.	typ.	typ.	min.	typ.	typ.		typ.			
SPOT-4DUV	1.61	1.3 sq	0.127	0.08	0.10	40	100	500	1.3 e-13	5	10	-10 ~ +60	-20 ~ +70	41 / TO-5

§ The photodiode chips in "FIL" series are isolated in a low profile plastic package. The have a large field of view as well as "in line" pins. FIL-S2DG has the same photodiode as SPOT-2D, FIL-S4DG has the same photodiode as SPOT-4D and FIL-S9DG has the same photodiode chip as SPOT-9D.

‡ Overall Diameter (All four Quads)

¶ For mechanical drawings please refer to pages 55 thru 66.

Chip centering within ±0.010".



Photodiode Care and Handling Instructions

AVOID DIRECT LIGHT

Since the spectral response of silicon photodiode includes the visible light region, care must be taken to avoid photodiode exposure to high ambient light levels, particularly from tungsten sources or sunlight. During shipment from UDT Sensors, your photodiodes are packaged in opaque, padded containers to avoid ambient light exposure and damage due to shock from dropping or jarring.

AVOID SHARP PHYSICAL SHOCK

Photodiodes can be rendered inoperable if dropped or sharply jarred. The wire bonds are delicate and can become separated from the photodiode's bonding pads when the detector is dropped or otherwise receives a sharp physical blow.

CLEAN WINDOWS WITH OPTICAL GRADE CLOTH / TISSUE

Most windows on UDT Sensors photodiodes are either silicon or quartz. They should be cleaned with isopropyl alcohol and a soft (optical grade) pad.

OBSERVE STORAGE TEMPERATURES AND HUMIDITY LEVELS

Photodiode exposure to extreme high or low storage temperatures can affect the subsequent performance of a silicon photodiode. Storage temperature guidelines are presented in the photodiode performance specifications of this catalog. Please maintain a non-condensing environment for optimum performance and lifetime.

OBSERVE ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

UDT Sensors photodiodes, especially with IC devices (e.g. Photops) are considered ESD sensitive. The photodiodes are shipped in ESD protective packaging. When unpacking and using these products, anti-ESD precautions should be observed.

DO NOT EXPOSE PHOTODIODES TO HARSH CHEMICALS

Photodiode packages and/or operation may be impaired if exposed to CHLOROTHENE, THINNER, ACETONE, or TRICHLOROETHYLENE.

INSTALL WITH CARE

Most photodiodes in this catalog are provided with wire or pin leads for installation in circuit boards or sockets. Observe the soldering temperatures and conditions specified below:

Soldering Iron:	Soldering 30 W or less Temperature at tip of iron 300°C or lower.	
Dip Soldering:	Bath Temperature: Immersion Time: Soldering Time:	260±5°C. within 5 Sec. within 3 Sec.
Vapor Phase Soldering:	DO NOT USE	
Reflow Soldering:	DO NOT USE	

Photodiodes in plastic packages should be given special care. Clear plastic packages are more sensitive to environmental stress than those of black plastic. Storing devices in high humidity can present problems when soldering. Since the rapid heating during soldering stresses the wire bonds and can cause wire to bonding pad separation, it is recommended that devices in plastic packages to be baked for 24 hours at 85°C.

The leads on the photodiode **SHOULD NOT BE FORMED**. If your application requires lead spacing modification, please contact UDT Sensors Applications group at (310)978-0516 before forming a product's leads. Product warranties could be voided.

Mechanical Drawings

Mechanical Specifications and Die Topography

1. Parameter Definitions:

A = Distance from top of chip to top of glass.
a = Photodiode Anode.
B = Distance from top of glass to bottom of case.
c = Photodiode Cathode
(Note: cathode is common to case in metal package products unless otherwise noted).
W = Window Diameter.
F.O.V. = Filed of View (see definition below).

2. Dimensions are in inches (1 inch = 25.4 mm).

3. Pin diameters are 0.018 ± 0.002" unless otherwise specified.

4. Tolerances (unless otherwise noted)

General: 0.XX ±0.01"
0.XXX ±0.005"
Chip Centering: ±0.010"
Dimension 'A': ±0.015"

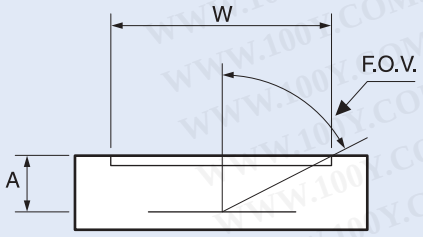
5. Windows

All **'UV'** Enhanced products are provided with QUARTZ glass windows, 0.027 ± 0.002" thick.

All **'XUV'** products are provided with removable windows.

All **'DLS'** PSD products are provided with A/R coated glass windows.

All **'FIL'** photoconductive and photovoltaic products are epoxy filled instead of glass windows.



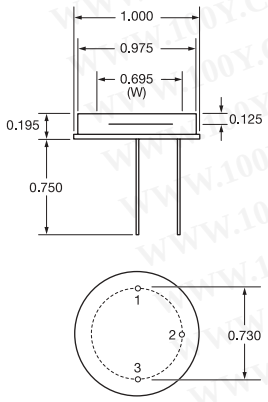
$$F.O.V. = \tan^{-1}\left(\frac{W}{2A}\right)$$

All units in inches. Pinouts are bottom view.

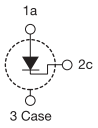
10 Low Profile

Products:

PIN-10DI
PIN-10DPI
PIN-10DPI/SB
UV-50L
UV-100L



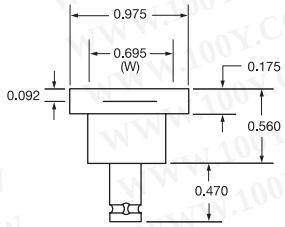
Pin Circle Dia.=0.100



11 BNC

Products:

PIN-10D
PIN-10DP
PIN-10DP/SB
UV-50
UV-100

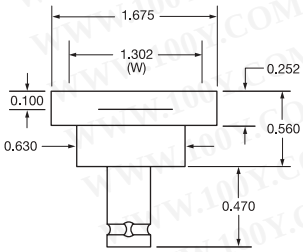


Outer Contact — Anode	PIN-10D, PIN-10DP, PIN-10DP/SB
Outer Contact — Cathode	UV-50, UV-100

12 BNC

Products:

PIN-25D
PIN-25DP

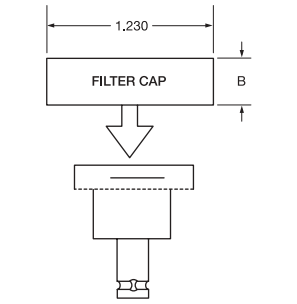


Outer Contact — Anode

13 Special BNC

Products:

PIN-10AP
PIN-10DF



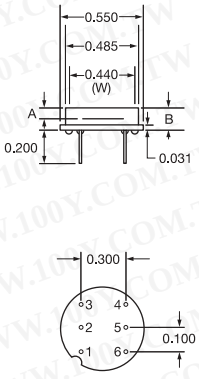
Dimensions

P/N	A	B	C
PIN-10DF	0.217	0.330	1.020
PIN-10AP	0.386	0.550	1.415

14 Special Plastic

Products:

FIL-3C
FIL-5C
FIL-20C
FIL-3V
FIL-5V
FIL-20V
FIL-UV20
FIL-UV005
FIL-S2DG
FIL-S4DG
FIL-C4DG



Dimensions

P/N	A	B
FIL-3V(C) FIL-5V(C) FIL-20V(C)	0.060	0.130
FIL-UV005 FIL-UV20 FIL-S4DG FIL-C4DG FIL-S2DG	0.087	0.152

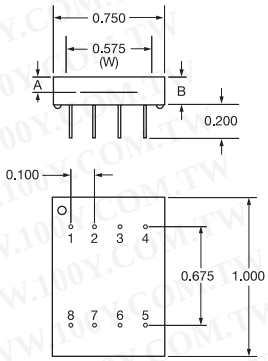
Pinouts

P/N	1	2	3	4	5	6
FIL-3V(C) FIL-5V(C) FIL-20V(C) FIL-UV005 FIL-S2DG	a	-	c	a	-	c
FIL-UV20	c	-	a	c	-	a
FIL-S4DG	a	a	c	a	a	c
FIL-C4DG	c	a	c	c	a	c

15 Special Plastic

Products:

FIL-44C
FIL-100C
FIL-44V
FIL-100V
FIL-UV50
FIL-UV100
FIL-S9DG
FIL-C10DG



Dimensions

P/N	A	B
FIL-44V(C) FIL-100V(C)	0.052	0.130
FIL-UV50 FIL-UV100	0.090	0.155
FIL-S9DG	0.072	0.155
FIL-C10DG	0.082	0.155

Pinouts

P/N	1	2	3	4	5	6	7	8
FIL-44V(C) FIL-100V(C)	a	-	-	c	a	-	-	c
FIL-UV50 FIL-UV100	c	-	-	a	c	-	-	a
FIL-S9DG	a	c	c	a	a	c	c	a
FIL-C10DG	c	a	a	c	c	a	a	c

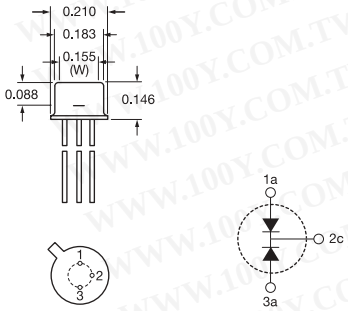
Mechanical Specifications

All units in inches. Pinouts are bottom view.

40 TO-18

Products:

SPOT-2DMI

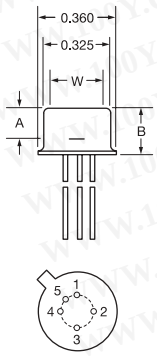


Pin Circle Dia.=0.100

41 TO-5

Products:

SC-4D
SL3-1
SPOT-2D
SPOT-3D
SPOT-4D
SPOT-4DMI
SPOT-4DUV



Pin Circle Dia.=0.200

Dimensions

P/N	A	B	W
SC-4D	0.071	0.142	0.240
SL3-1	0.106	0.195	0.217
SPOT-2D	0.063	0.114	0.240
SPOT-3D	0.104	0.138	0.240
SPOT-4D	0.063	0.142	0.240
SPOT-4DMI	0.063	0.142	0.240
SPOT-4DUV	0.063	0.142	0.240

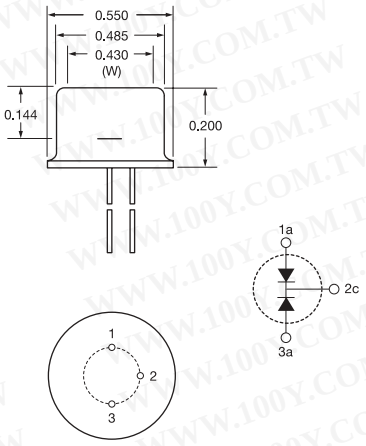
Pinouts

P/N	1	2	3	4	5
SC-4D	c	c	c	c	a
SL3-1	a	c	a	--	--
SPOT-2D	a	a	a	--	--
SPOT-3D	a	c	a	--	--
SPOT-4D	a	a	a	a	c
SPOT-4DMI	a	a	a	a	c
SPOT-4DUV	a	a	a	a	c

42 TO-8

Products:

SL5-1

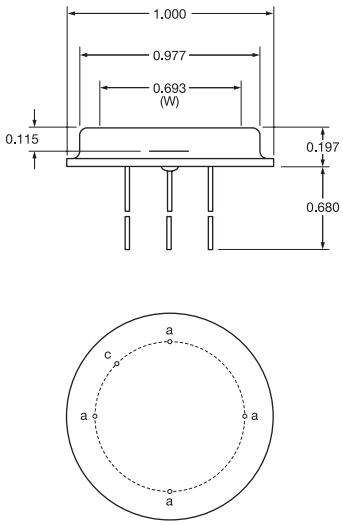


Pin Circle Dia.=0.300

43 Low Profile

Products:

SPOT-9D
SPOT-9DMI

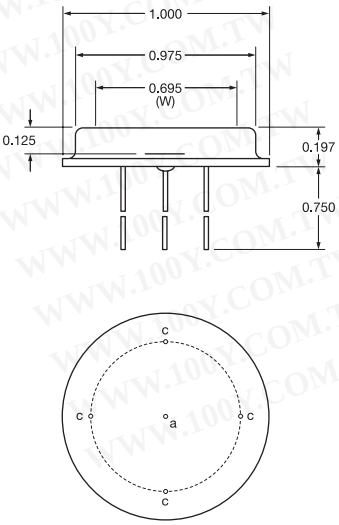


Pin Circle Dia.=0.730

44 Special

Products:

SC-10D

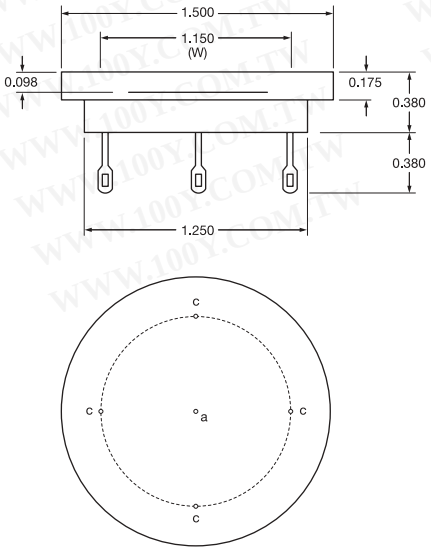


Pin Circle Dia.=0.730

45 Special

Products:

SC-25D



Pin Circle Dia.=0.950