

# Sum and Difference Amplifier Modules

## Position Sensing Modules

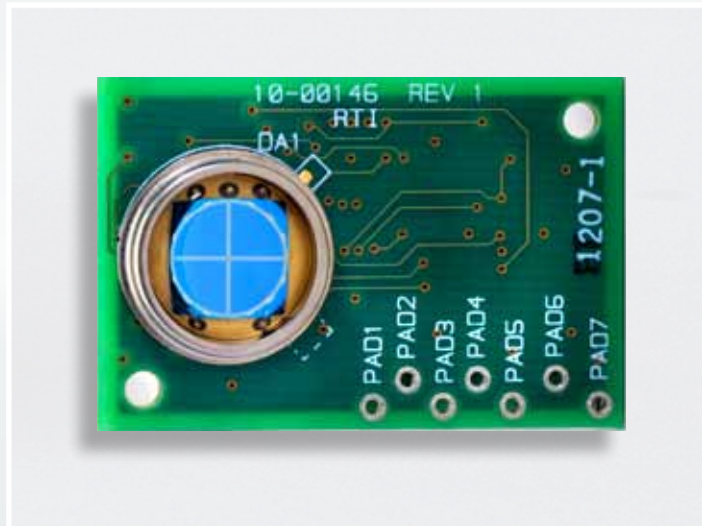
**QD7-0-SD** or **QD50-0-SD** are quadrant photodiode arrays with associated circuitry to provide two difference signals and a sum signal. The two difference signals are voltage analogs of the relative intensity difference of the light sensed by opposing pairs of the photodiode quadrant elements. In addition the amplified sum of all 4 quadrant elements is provided as the sum signal. This makes the QD7-0-SD or QD50-0-SD ideal for both light beam nulling and position applications. Very precise light beam alignments are possible, and the circuit can also be used for target acquisition and alignment.

### APPLICATIONS

- Position Measuring
- Beam Centering
- Targeting
- Guidance Systems

### FEATURES

- Other QD7-XX or QD50-XX are available upon request



Values given as per element unless otherwise stated

| Model Number | Active Area Total |                 | 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 (mm²)        | Dimensions (mm) |                  | 900 nm             |      | 0 V              |                   |      | 900 nm      |                     | -30 V<br>900 nm<br>50 Ω | Operating       | Storage       |                 |
|              |                   |                 |                  | min.               | typ. | typ.             | typ.              | max. | typ.        | max.                | typ.                    |                 |               |                 |
| 'O' Series   |                   |                 |                  |                    |      |                  |                   |      |             |                     |                         |                 |               |                 |
| QD7-0        | 7                 | 3.0 ϕ           | 0.2              | 0.47               | 0.54 | 20               | 4.0               | 15.0 | 9.0 e-14    | 30                  | 10                      | -40 ~<br>+100   | -55 ~<br>+125 | 41 / TO-5       |
| QD50-0       | 50                | 8.0 ϕ           |                  |                    |      | 125              | 15.0              | 30.0 | 1.3 e-13    |                     |                         |                 |               | 70 / TO-8       |

### INPUT

Power supply voltage  $V_{CC} = \pm 4.5V$  min;  $\pm 15V$  typical;  $\pm 18V$  max

Photodiode bias voltage =  $(.91) \times (V_{PDBIAS})$

$V_{PDBIAS} = 0$  TO  $+V_{CC}$ ; Absolute maximum  $V_{PDBIAS}$  is  $+V_{CC}$

NOTE: Negative voltages applied to PDBIAS will render the QD7-0-SD or QD50-0-SD inoperative.

### ENVIRONMENTAL

|                       |                                                                               |
|-----------------------|-------------------------------------------------------------------------------|
| Operating temperature | 0 to 70° C                                                                    |
| Theoretical noise     | 15 nV/Hz <sup>1/2</sup>                                                       |
| Frequency response    | (-3dB): 120kHz @ $V_{PDBIAS}=0V$ ; 880nm<br>250kHz @ $V_{PDBIAS}=15V$ ; 880nm |
| Max slew rate         | 10V/μs                                                                        |
| Output current limit  | 25 mA                                                                         |

### OUTPUT

Where  $i_x$  is the current from quadrant x

$$V_{T-B} = -\{(i_1 + i_2) - (i_3 + i_4)\} \times (10^4)$$

$$V_{L-R} = -\{(i_2 + i_3) - (i_1 + i_4)\} \times (10^4)$$

$$V_{SUM} = -\{(i_1 + i_2 + i_3 + i_4)\} \times (10^4)$$

### MAXIMUM OUTPUT VOLTAGE

Positive:  $(+V_{CC} - 3V)$

Negative:  $(-V_{CC} + 3V)$

## 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 OSI Optoelectronics, 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 OSI Optoelectronics 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

OSI Optoelectronics 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<br>Temperature at tip of iron 300°C or lower. |               |
| Dip Soldering:         | Bath Temperature:                                                    | 260±5°C.      |
|                        | Immersion Time:                                                      | within 5 Sec. |
|                        | Soldering Time:                                                      | 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 OSI Optoelectronics Applications group at (310)978-0516 before forming a product's leads. Product warranties could be voided.



\*Most of our standard catalog products are RoHS Compliant. Please contact us for details

# 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. = Field of View (see definition below).

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

## 3. Pin diameters are $0.018 \pm 0.002$ " unless otherwise specified.

## 4. Tolerances (unless otherwise noted)

General:  $0.XX \pm 0.01$ "

$0.XXX \pm 0.005$ "

Chip Centering:  $\pm 0.010$ "

Dimension 'A':  $\pm 0.015$ "

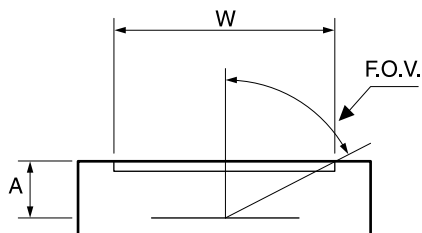
## 5. Windows

All '**UV**' Enhanced products are provided with QUARTZ glass windows,  $0.027 \pm 0.002$ " 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.



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

**OSI Optoelectronics**  
An OSI Systems Company

For Further Assistance  
Please Call One of Our Experienced  
Sales and Applications Engineers

**310-978-0516**

- Or -

visit our website at

**[www.osioptoelectronics.com](http://www.osioptoelectronics.com)**

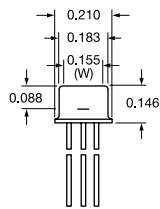
# Mechanical Specifications

All units in inches. Pinouts are bottom view.

## 40 TO-18

Products:

SPOT-2DMI

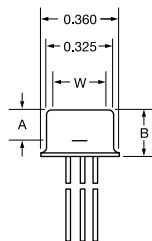


Pin Circle Dia.=0.100

## 41 TO-5

Products:

SC-4D  
SL3-1  
SPOT-2D  
SPOT-3D  
SPOT-4D  
SPOT-4DMI  
QD7-0



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 |
| QD7-0     | 0.050 | 0.130 | 0.230 |

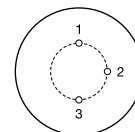
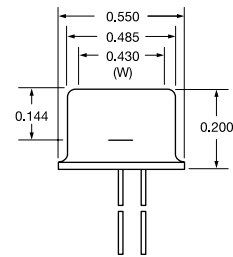
Pinouts

| P/N       | 1 | 2 | 3 | 4  | 5  |
|-----------|---|---|---|----|----|
| SC-4D     | c | c | c | c  | a  |
| SL3-1     | a | c | a | -- | -- |
| SPOT-2D   | a | c | 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  |
| QD7-0     | a | a | a | a  | c  |

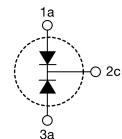
## 42 TO-8

Products:

SL5-1



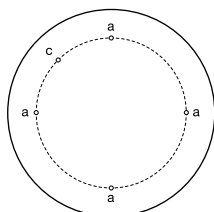
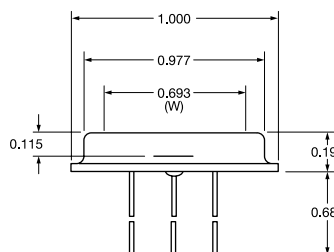
Pin Circle Dia.=0.300



## 43 Low Profile

Products:

SPOT-9D  
SPOT-9DMI

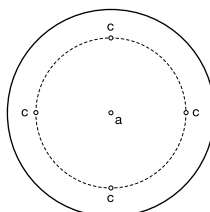
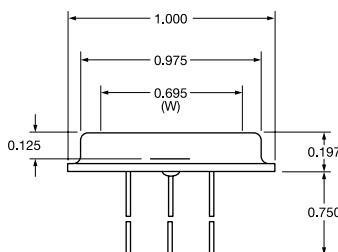


Pin Circle Dia.=0.730

## 44 Special

Products:

SC-10D

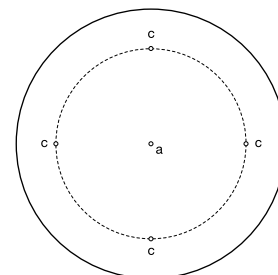
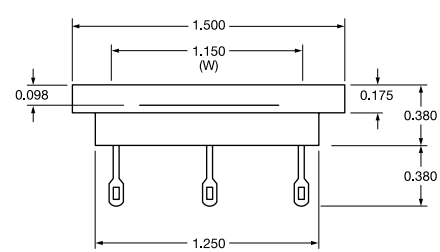


Pin Circle Dia.=0.730

## 45 Special

Products:

SC-25D



Pin Circle Dia.=0.950

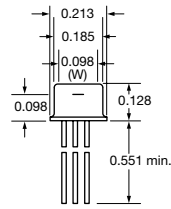
# Mechanical Specifications

All units in inches. Pinouts are bottom view.

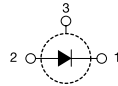
## 65 TO-52

### Products:

APD02-8-150-T52  
APD05-8-150-T52  
APD10-8-150-T52



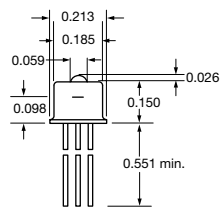
Pin Circle Dia.=0.100



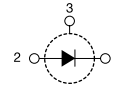
## 66 TO-52L

### Products:

APD02-8-150-T52L  
APD05-8-150-T52L  
APD10-8-150-T52L



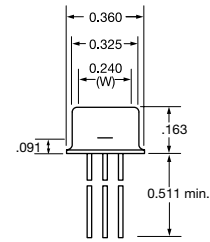
Pin Circle Dia.=0.100



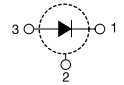
## 67 TO-5

### Products:

APD15-8-150-TO5  
APD30-8-150-TO5



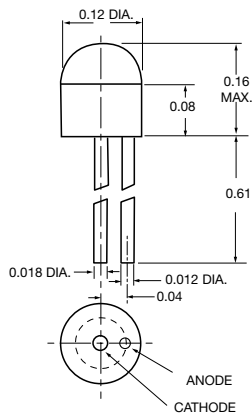
Pin Circle Dia.=0.200



## 68 Plastic

### Products:

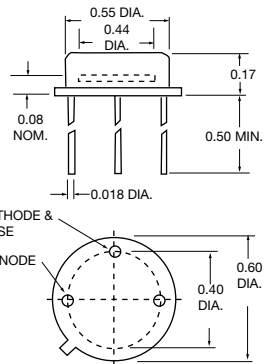
CD-1705



## 69 TO-8

### Products:

OSD60-0  
OSD60-5T  
OSD60-E



## 70 TO-8

### Products:

QD50-0

