



## SILICON PHOTODIODES

FIL\*

## PHOTOCONDUCTIVE DEVICES (PC)

| Parameter & Unit<br>Model Number | Active Surface  |               | Reference Diagram Letters | Typical Responsivity-R <sub>λ</sub> |           | Typ. Junction Capacitance-C <sub>j</sub> |     | Typ. R <sub>i</sub> 10%-90%, F |
|----------------------------------|-----------------|---------------|---------------------------|-------------------------------------|-----------|------------------------------------------|-----|--------------------------------|
|                                  | Area            | Dimensions    |                           | λ <sub>0</sub> =930nm               | λ=632.8nm | 10V                                      | 25V | 10V                            |
|                                  | mm <sup>2</sup> | inches        |                           | A/W                                 | A/W       | pf                                       | pf  | ns                             |
| FIL-3C *                         | 3.23            | 0.100 x 0.050 | A-F, J                    | 0.57                                | 0.35      | 10                                       | 6   | 6                              |
| FIL-5C *                         | 5.07            | 0.100 DIA     | A-F, J                    | 0.57                                | 0.35      | 16                                       | 10  | 10                             |
| FIL-20C                          | 20.3            | 0.200 DIA     | A-F, J                    | 0.57                                | 0.35      | 60                                       | 38  | 35                             |
| FIL-100C                         | 100             | 0.444 DIA     | A-F, K                    | 0.57                                | 0.35      | 300                                      | 192 | 50                             |
| FIL-C4D <sup>(2)</sup>           | 6.45            | 0.100 x 0.100 | A-E, H, J                 | 0.57                                | 0.35      | 27                                       | 17  | 70                             |
| FIL-C10D <sup>(2)</sup>          | 103             | 0.400 x 0.400 | A-E, H, K                 | 0.57                                | 0.35      | 260                                      | 166 | 100                            |
| FIL-S2D <sup>(1)</sup>           | 6.45            | 0.100 x 0.105 | A-E, I, J                 | 0.57                                | 0.35      | 11                                       | 7   | 15                             |
| FIL-S4D <sup>(1)</sup>           | 6.45            | 0.105 x 0.105 | A-E, I, J                 | 0.57                                | 0.35      | 8                                        | 5   | 12                             |
| FIL-S9D <sup>(1)</sup>           | 60.6            | 0.394 DIA     | A-E, I, K                 | 0.57                                | 0.35      | 62                                       | 40  | 30                             |

## PHOTOVOLTAIC DEVICES (PV)

| Parameter & Unit<br>Model Number | Active Surface  |               | Reference Diagram Letters | Typical Responsivity-R <sub>λ</sub> |           | Typ. Junction Capacitance-C <sub>j</sub> | Typ. R <sub>i</sub> 10%-90%, F |
|----------------------------------|-----------------|---------------|---------------------------|-------------------------------------|-----------|------------------------------------------|--------------------------------|
|                                  | Area            | Dimensions    |                           | λ <sub>0</sub> =870nm               | λ=632.8nm | OV                                       | OV                             |
|                                  | mm <sup>2</sup> | inches        |                           | A/W                                 | A/W       | pf                                       | ns                             |
| FIL-3V *                         | 3.23            | 0.100 x 0.050 | A-E, G, J                 | 0.55                                | 0.40      | 290                                      |                                |
| FIL-5V *                         | 5.07            | 0.100 DIA     | A-E, G, J                 | 0.55                                | 0.40      | 450                                      |                                |
| FIL-20V                          | 20.3            | 0.200 DIA     | A-E, G, J                 | 0.55                                | 0.40      | 1800                                     | 30                             |
| FIL-100V                         | 100             | 0.444 DIA     | A-E, G, K                 | 0.55                                | 0.40      | 9000                                     | 150                            |
| FIL-C4D <sup>(2)</sup>           | 6.45            | 0.100 X 0.100 | A-E, H, J                 | 0.55                                | 0.40      | 100                                      | 30                             |
| FIL-C10D <sup>(2)</sup>          | 103             | 0.400 x 0.400 | A-E, H, K                 | 0.55                                | 0.40      | 1200                                     | 50                             |
| FIL-S2D <sup>(1)</sup>           | 6.45            | 0.100 x 0.105 | A-E, I, J                 | 0.55                                | 0.40      | 50                                       |                                |
| FIL-S4D <sup>(1)</sup>           | 6.45            | 0.105 x 0.105 | A-E, I, J                 | 0.55                                | 0.40      | 30                                       |                                |
| FIL-S9D <sup>(1)</sup>           | 60.6            | 0.394 DIA     | A-E, I, K                 | 0.55                                | 0.40      | 300                                      | 15                             |

## Designers' Footnotes:

1. These devices are segmented position sensing photodiodes; all specifications except dimensions are per element; refer to Data Sheet 20DS80 for additional information.
  2. These devices are dual axis position sensing photodiodes.
  3. Rise time is a function of capacitance and varies 20% due to process variability.
  4. Maximum values equal twice typical shown here.
  5. Unit rated at 20V for rise time.
  6. Divide values by R<sub>λ</sub> for corresponding saturation current at any given λ; see Diagram E.
- T<sub>A</sub> = 22°C for all specifications.
  - See UDT's "Selecting a Silicon Photodiode" for a discussion of these and other UDT devices.

Information in this brochure is believed to be accurate and reliable, however, no responsibility is assumed by UDT for use.

\*Devices are now furnished in modified package. Consult factory for details and pricing.

# Series

\* Field of view exceeding 145° In-line compatible package Low cost for high volume OEM use

| Response Time<br>$\tau_L = 50\Omega$ (3) | Noise Equivalent<br>Power-NEP<br>$\lambda_0$ , 1KHz, 1Hz | Saturation<br>Current<br>$I_L - 1\%$ (6) | Typical Dark<br>Current - $I_D$ (4) |      | Min. Reverse<br>Breakdown<br>Voltage- $V_B$ |            | Series<br>Resistance - $R_S$ |
|------------------------------------------|----------------------------------------------------------|------------------------------------------|-------------------------------------|------|---------------------------------------------|------------|------------------------------|
| 25V                                      | 10v                                                      | Typ.                                     | 10V                                 | 25V  | 10 $\mu$ A                                  | 25 $\mu$ A | Typ.                         |
| ns                                       | WHZ $^{-1/2}$                                            | mA                                       | nA                                  | nA   | V                                           | V          | $\Omega$                     |
| 4                                        | $1.0 \times 10^{-13}$                                    | 1.0                                      | 10                                  | 30   | 50                                          | —          | 10                           |
| 6                                        | $1.2 \times 10^{-13}$                                    | 2.0                                      | 50                                  | 100  | 50                                          | —          | 10                           |
| 23                                       | $1.5 \times 10^{-13}$                                    | 2.0                                      | 75                                  | 150  | 50                                          | —          | 10                           |
| 30                                       | $2.0 \times 10^{-13}$                                    | 4.0                                      | 100                                 | 250  | —                                           | 50         | 10                           |
| 50 <sup>(5)</sup>                        | $1.8 \times 10^{-13}$                                    | 1.0                                      | 50                                  | 500  | 25                                          | —          | 10                           |
| 70 <sup>(5)</sup>                        | $2.2 \times 10^{-13}$                                    | 1.0                                      | 150                                 | 1500 | 25                                          | —          | 10                           |
| 11                                       | $6.5 \times 10^{-14}$                                    | 1.0                                      | 5.0                                 | 9.0  | 50                                          | —          | 10                           |
| 10                                       | $5.0 \times 10^{-14}$                                    | 1.0                                      | 3.0                                 | 6.0  | 50                                          | —          | 10                           |
| 15                                       | $9.5 \times 10^{-14}$                                    | 1.0                                      | 10                                  | 30   | —                                           | 50         | 10                           |

| Response Time<br>$\tau_L = 50\Omega$ (3) | Noise Equivalent<br>Power-NEP<br>$\lambda_0$ , 1KHz, 1Hz | Saturation<br>Current<br>$I_L - 1\%$ (6) | Series Resistance - $R_S$ |          | Source Resistance - $R_{SO}$ |            |
|------------------------------------------|----------------------------------------------------------|------------------------------------------|---------------------------|----------|------------------------------|------------|
| V                                        | OV                                                       | Typ.                                     | Typ.                      | Max.     | Min.                         | Typ.       |
| s                                        | WHZ $^{-1/2}$                                            | mA                                       | $\Omega$                  | $\Omega$ | M $\Omega$                   | M $\Omega$ |
| 15                                       | $1.0 \times 10^{-14}$                                    | 2.0                                      | 10                        | 100      | 100                          | 300        |
| 30                                       | $1.6 \times 10^{-14}$                                    | 2.0                                      | 10                        | 100      | 40                           | 150        |
| 30                                       | $3.3 \times 10^{-14}$                                    | 5.0                                      | 10                        | 100      | 20                           | 50         |
| 30                                       | $5.9 \times 10^{-14}$                                    | 10.0                                     | 10                        | 100      | 2                            | 12         |
| 50                                       | $2.3 \times 10^{-14}$                                    | 1.0                                      | 25                        | 250      | —                            | 100        |
| 30                                       | $7.3 \times 10^{-14}$                                    | 1.0                                      | 25                        | 250      | —                            | 10         |
| 75                                       | $2.3 \times 10^{-14}$                                    | 1.0                                      | 20                        | 200      | —                            | 100        |
| 30                                       | $2.3 \times 10^{-14}$                                    | 1.0                                      | 20                        | 200      | —                            | 100        |
| 50                                       | $1.6 \times 10^{-15}$                                    | 1.0                                      | 20                        | 200      | —                            | 50         |

## Chips, Wafers and Detector/Filter Combinations

All of the devices listed above can be provided with:

- a. CIE photometric filter  
b. red optimized CIE filter  
c. flat radiometric filter
- by adding suffix { AP  
RP  
DF } to the existing model number.

As a result of top contact technology, UDT offers all of the FIL Series devices in chip and wafer form. These photodiodes are especially suited for high volume and OEM applications. To order, substitute prefix CHP (chip) or WFR (wafer) in place of FIL.

All standard FIL devices are filled with optical epoxy. To obtain glass window versions, add suffix G to the appropriate model number.

## Additional Characteristics of FIL Devices:

- Chip centering within .003" (.076mm)
- Linear output throughout ten decades within 5%
- Temperature range (°C): storage -55 to +100 operation -25 to +80

Diagram A  
TEMPERATURE VARIATION  
VS. SPECTRAL RESPONSE

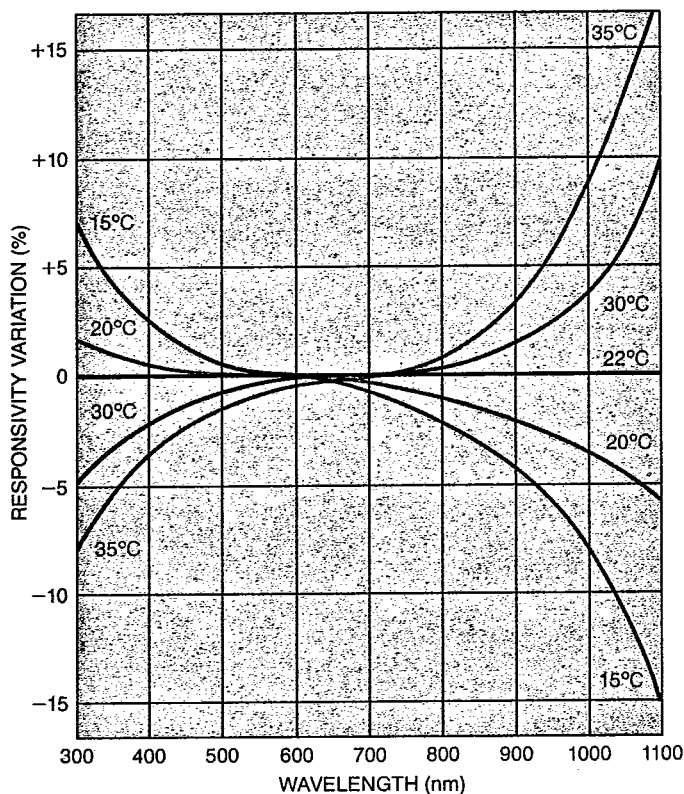


Diagram B  
RELATIVE CAPACITANCE VS.  
REVERSE BIAS VOLTAGE

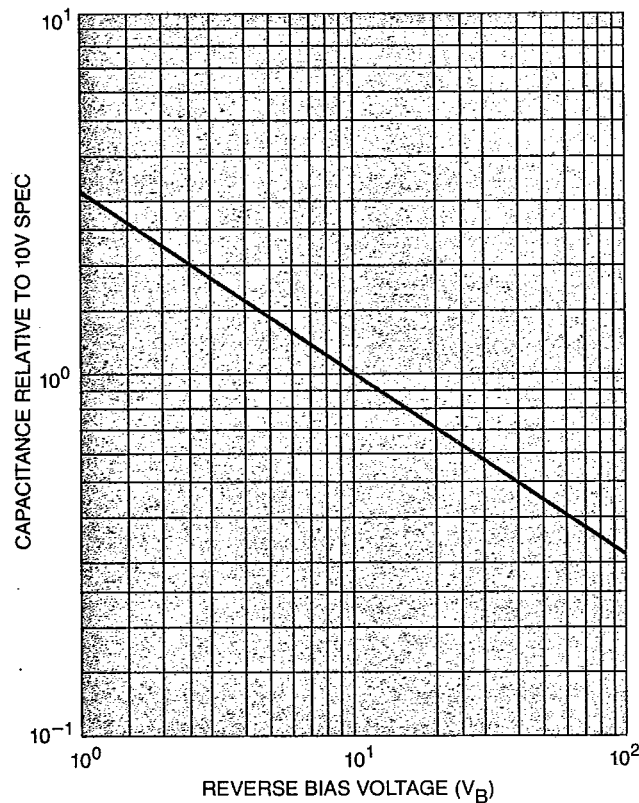


Diagram C  
RELATIVE SOURCE RESISTANCE  
VS. TEMPERATURE

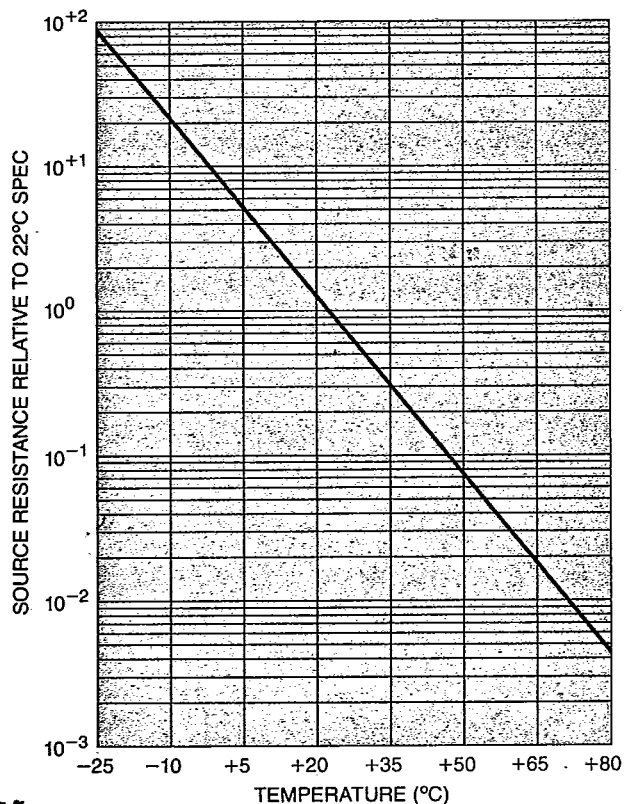
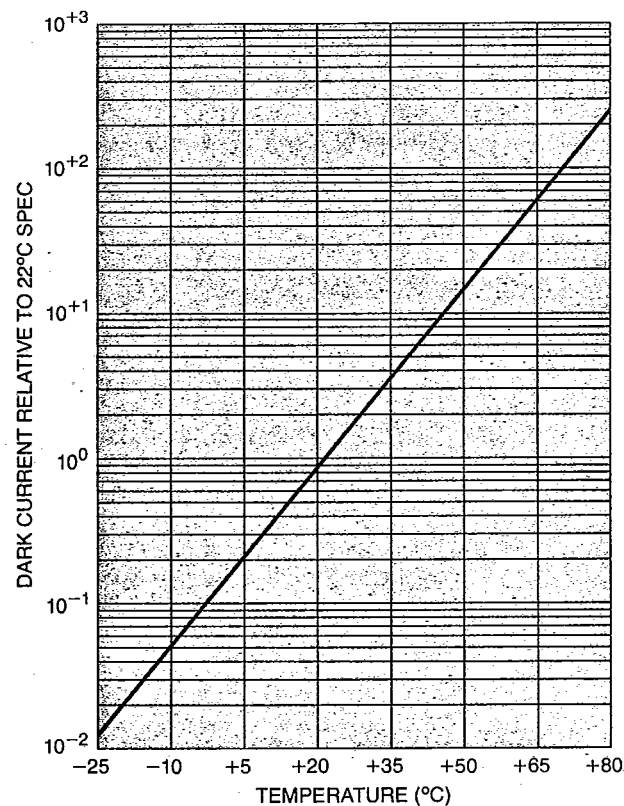


Diagram D  
RELATIVE DARK CURRENT  
VS. TEMPERATURE



**Diagram E TYPICAL RESPONSIVITY CURVES FOR UDT FIL SERIES**

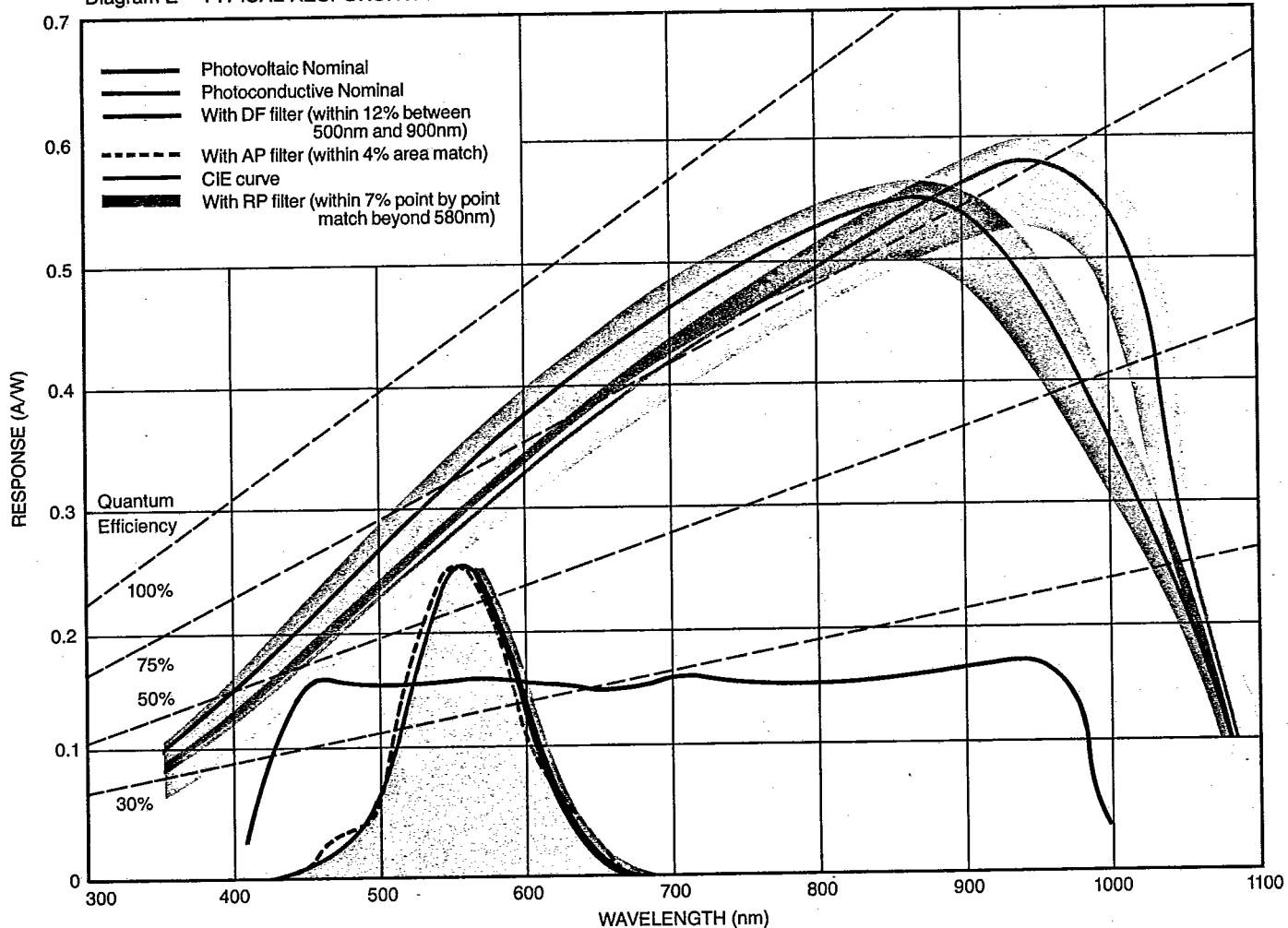
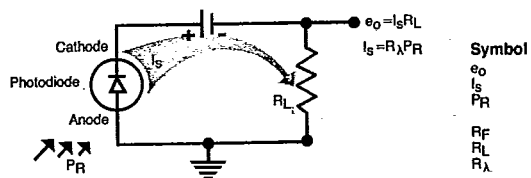


Diagram F  
TYPICAL HOOKUP PHOTOCONDUCTIVE SERIES



|                       | Package J |   | Package K |   |
|-----------------------|-----------|---|-----------|---|
| Pin numbers for Anode | ①         | ④ | ①         | ⑤ |
| Cathode               | 3         | 6 | 4         | 8 |

**Definition**  
 resultant voltage potential  
 current signal  
 incident radiant power  
 on active area  
 feedback resistance  
 load resistance  
 responsivity at wavelength

Diagram G  
TYPICAL HOOKUP PHOTOVOLTAIC SERIES

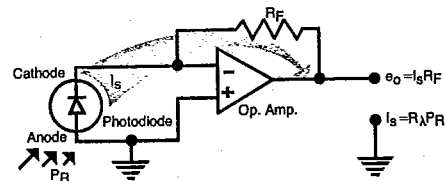
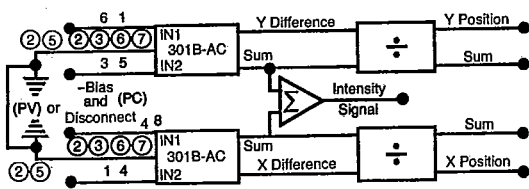
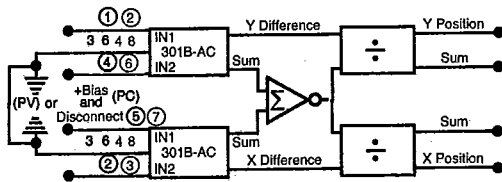


Diagram H  
TYPICAL HOOKUP for FIL—C4D and C10D



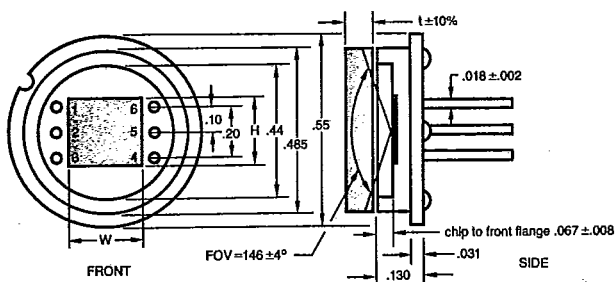
**Note:** Circled pin numbers correspond to anode.

**Diagram I**  
**TYPICAL HOOKUP for FIL-S2D, S4D and S9D**



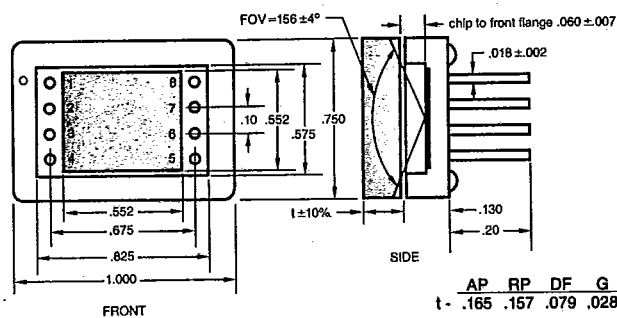
Notes: Only use one channel with FIL-S2D.  
Circled pin numbers correspond to anode.

**Diagram J**



|            |          |          |               |          |          |     |           |           |           |          |
|------------|----------|----------|---------------|----------|----------|-----|-----------|-----------|-----------|----------|
| <u>FIL</u> | <u>W</u> | <u>H</u> | <u>FIL</u>    | <u>W</u> | <u>H</u> |     | <u>AP</u> | <u>RP</u> | <u>DF</u> | <u>G</u> |
| 3C, 3V     | .079     | .129     | 20C, 20V      | .233     | .233     |     |           |           |           |          |
| 5C, 5V     | .153     | .153     | C4D, S2D, S4D | .153     | .153     | t - | .165      | .157      | .079      | .028     |

**Diagram K**



|     |      |      |      |      |
|-----|------|------|------|------|
|     | AP   | RP   | DF   | G    |
| t - | .165 | .157 | .079 | .028 |