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DATA SHEET

## APD Series: Silicon PIN Diode Bondable Chips

### Applications

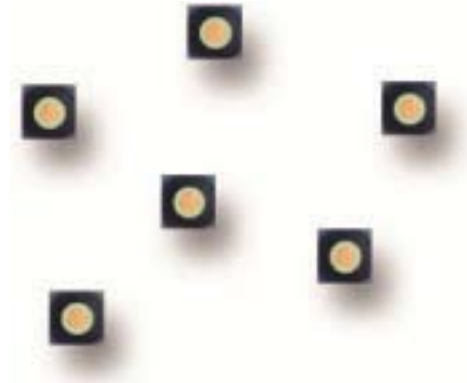
- Switches
- Attenuators

### Features

- Established Skyworks PIN diode process
- Low capacitance designs to 0.05 pF
- Voltage ratings to 200 V
- Chip size < 15 mils square
- Tight control of I layer base width
- Mesa and planar chip designs



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.



### Description

Skyworks APD series of silicon PIN diodes are designed for use as switch and attenuator devices in high-performance RF and microwave circuits. The PIN diode designs are useful over a wide range of frequencies from below 100 MHz to beyond 30 GHz. These devices use Skyworks well-established silicon technology resulting in PIN diodes with tightly controlled I-region characteristics.

The low capacitance and low resistance of the APD0505 through APD1520 diodes are ideal for switch applications that require insertion loss and fast switching speed. For switch or attenuator applications requiring high power and low distortion, the thick I-region and high reverse breakdown voltage of the APD2220 is ideal.

The absolute maximum ratings of the APD diode series are provided in Table 1. Electrical specifications are provided in Table 2. Table 3 identifies the die part numbers with their corresponding top contact diameters and die outline drawings. Typical performance characteristics are provided in Figures 1 through 4.

**Table 1. APD Series Absolute Maximum Ratings**

| Parameter             | Symbol    | Minimum | Typical | Maximum  | Units |
|-----------------------|-----------|---------|---------|--|-------|
| Power dissipation     | $P_{DIS}$ |         |         | $\frac{\text{Maximum } T_J - \text{Case Temp}}{\text{Thermal Resistance}_{\text{junction-to-case}}}$ | W     |
| Reverse voltage       | $V_R$     |         |         | See Voltage Rating column in Table 2   | V     |
| Forward current       | $I_F$     |         |         | 200  | mA    |
| Operating temperature | $T_{OP}$  | -65     |         | +175   | °C    |
| Storage temperature   | $T_{STG}$ | -65     |         | +200   | °C    |

**Note:** Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

**CAUTION:** Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

**Table 2. APD Series Electrical Specifications (Note 1)**

( $T_{OP} = +25\text{ °C}$ , Unless Otherwise Noted)

| Parameter                      | Junction Capacitance ( $C_J$ )<br>$V_R = 50\text{ V}$ ,<br>1 MHz (pF) | Junction Capacitance ( $C_J$ )<br>$V_R = 0\text{ V}$ ,<br>1 MHz (pF) | Series Resistance ( $R_S$ ),<br>$I = 10\text{ mA}$ ,<br>500 MHz ( $\Omega$ ) | Minority Carrier Lifetime ( $T_L$ )<br>$I = 10\text{ mA}$ (ns) | Voltage Rating (Note 2) (V) | I-Region Thickness ( $\mu\text{m}$ ) | Thermal Resistance ( $\theta_{JC}$ ) (°C/W) |
|--------------------------------|---|--|--|--|-----------------------------|--------------------------------------|---|
|                                | Maximum   | Typical  | Maximum  | Typical  |                             | Nominal                              | Maximum                                     |
| <b>Switching Applications</b>  |   |  |  |  |                             |                                      |   |
| APD0505-000                    | 0.05  | 0.10   | 2.5  | 70   | 50                          | 5                                    | 118   |
| APD0510-000                    | 0.10  | 0.20   | 1.5  | 90   | 50                          | 5                                    | 76  |
| APD0520-000                    | 0.20  | 0.25   | 1.0  | 120  | 50                          | 5                                    | 55  |
| APD0805-000                    | 0.05  | 0.10   | 2.0  | 100  | 100                         | 8                                    | 87  |
| APD0810-000                    | 0.10  | 0.15   | 1.5  | 160  | 100                         | 8                                    | 60  |
| APD1505-000                    | 0.06 @ 10 V   | 0.12   | 2.5  | 350  | 200                         | 15                                   | 60  |
| APD1510-000                    | 0.10  | 0.20   | 2.0  | 300  | 200                         | 15                                   | 56  |
| APD1520-000                    | 0.20  | 0.25   | 1.2  | 900  | 200                         | 15                                   | 44  |
| <b>Attenuator Applications</b> |   |  |  |  |                             |                                      |   |
| APD2220-000                    | 0.20  | 0.35   | 4.0  | 700  | 100                         | 50                                   | 18  |

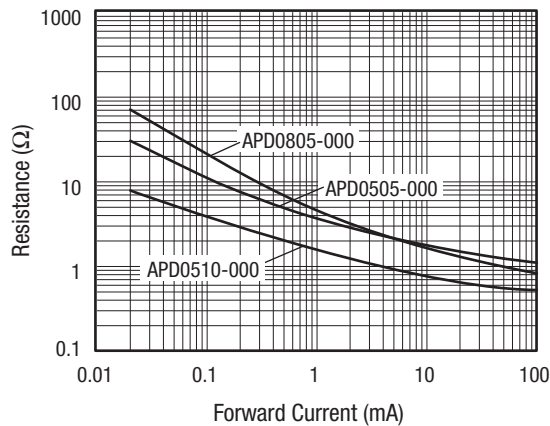
**Note 1:** Performance is guaranteed only under the conditions listed in this table.

**Note 2:** Reverse current is specified at 10  $\mu\text{A}$  maximum at the voltage rating noted. Do not exceed this voltage.

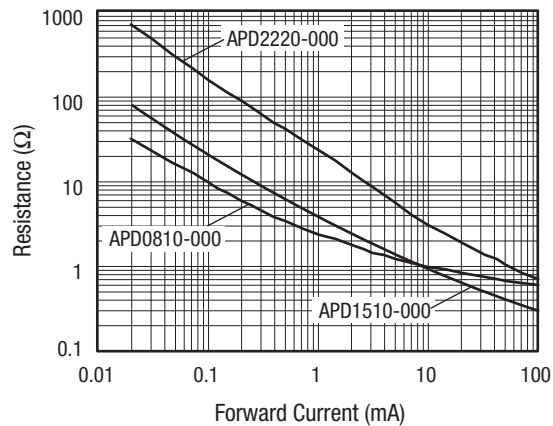
**Table 3. APD Series Parts**

| Part Number                           | Top Contact Diameter ( $\pm 0.5$ mils) | Die Drawing |
|---------------------------------------|--|-------------|
| <b><i>Switching Applications</i></b>  |  |             |
| APD0505-000                           | 1.50                                   | 150-806     |
| APD0510-000                           | 2.30                                   | 150-801     |
| APD0520-000                           | 3.05                                   | 150-801     |
| APD0805-000                           | 2.25                                   | 150-801     |
| APD0810-000                           | 3.05                                   | 150-801     |
| APD1505-000                           | 2.75                                   | 150-806     |
| APD1510-000                           | 3.50                                   | 150-813     |
| APD1520-000                           | 5.00                                   | 150-802     |
| <b><i>Attenuator Applications</i></b> |  |             |
| APD2220-000                           | 8.50                                   | 149-815     |

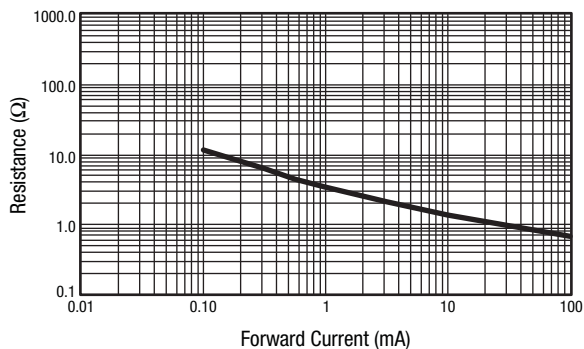
**Typical Performance Characteristics at 25 °C**



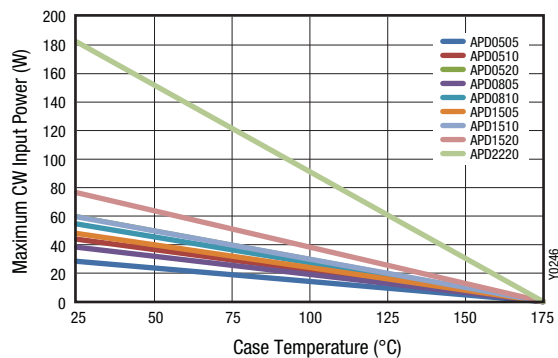
**Figure 1. Resistance vs Forward Current @ 1 GHz**



**Figure 2. Resistance vs Forward Current @ 1 GHz**



**Figure 3. Resistance vs Forward Current @ 500 MHz (APD1505-000 Package)**



**Figure 4. Maximum CW Input Power vs Case Temperature (-000 Package)**

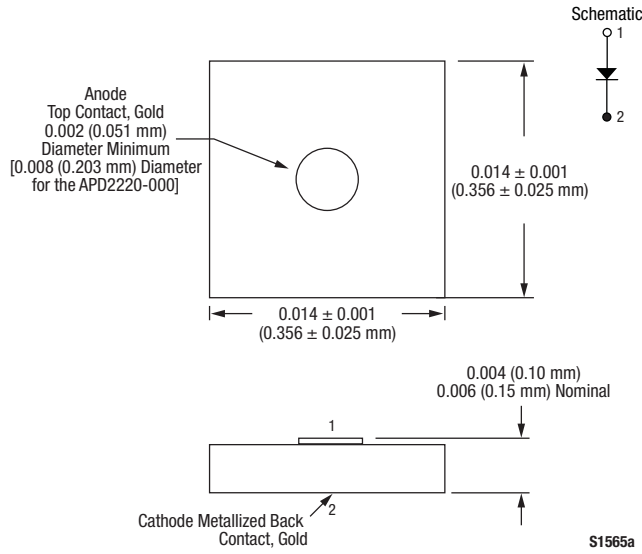


**Package Outline Drawings**

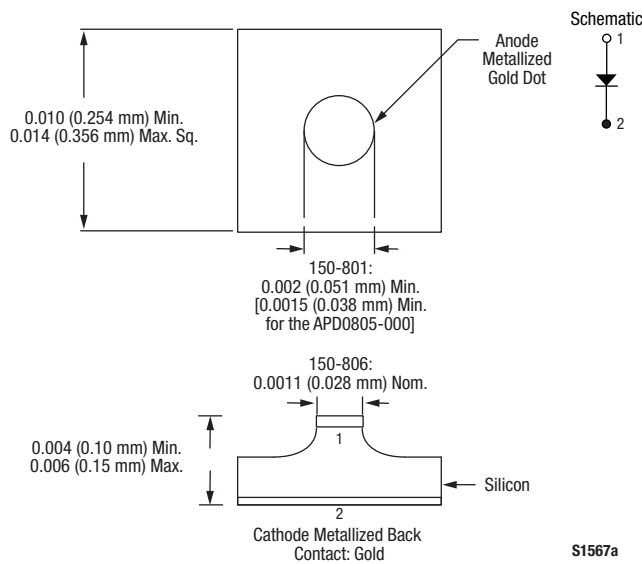
Package outline die drawings for the APD diode series are shown in Figures 5 and 6. Additional bonding and handling methods are contained in the Skyworks Application Notes, *Waffle Pack Chip Carrier Handling/Opening Procedure* (document #200146) and

*Diode Chips, Beam-Lead Diodes, Capacitors: Bonding Methods and Packaging* (document #200532).

**Die Packages**



**Figure 5. 149-815 Package**



**Figure 6. 150 Series Package**

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