

# Schottky Barrier Diodes for Stripline, Microstrip Mixers and Detectors

## Technical Data

5082-2207/09  
5082-2765/85  
5082-2774/94

### Features

- **Small Size**
- **Low Noise Figure**  
6 dB Typical at 9 GHz
- **Rugged Design**
- **High Uniformity**
- **High Burnout Rating**  
1 W RF Pulse Power Incident
- **Both Medium and Low Barrier Available**

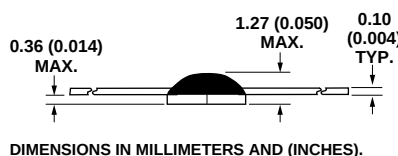
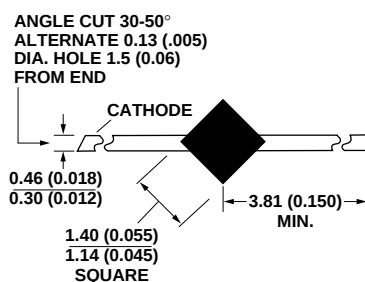
### Description/Applications

This family consists of medium barrier and low barrier beam lead diodes mounted in easily handled carrier packages. Low barrier diodes provide optimum noise figure at low local oscillator drive levels. Medium barrier diodes provide a wider dynamic range for lower distortion mixer designs. Application Note 976 presents design techniques for an X-Band mixer.

**Note:** For new designs, the HSMS-286X and HSMS-820X series of surface mount microwave diodes are recommended.

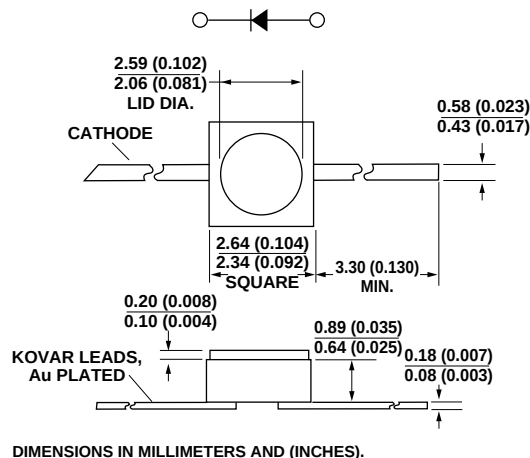
### Outline C2

$C_P = 0.055 \text{ pF}$



### Outline H2

$C_P = 0.175 \text{ pF}$



### Package Characteristics

These diodes are designed for microstrip and stripline use. The kovar leads provide good continuity of transmission line impedance to the diode. Outline C2 is a plastic on ceramic package. Outline H2 has a metal ceramic hermetic seal. The ceramic is alumina. Metal parts are gold plated kovar.

The hermetic package, outline H2, is capable of passing many of the environmental tests of MIL-STD-750. The applicable solderability test is reference 2031.1: 260°C, 10 seconds.

## Maximum Ratings

Operating and Storage Temperature Range

C2 Packaged Diodes ..... -65°C to +150 °C

H2 Packaged Diodes ..... -65°C to +175 °C

Pulse Power Incident at  $T_{CASE} = 25^{\circ}\text{C}$  ..... 1 W  
(1  $\mu\text{s}$  pulse,  $D_u = 0.001$ )

CW Power Dissipation at  $T_{CASE} = 25^{\circ}\text{C}$

(Measured in an infinite heat sink) ..... 125 mW

*Derate linearly to zero at maximum operating temperature.*

Diode Mounting Temperature in Packages

C2 ..... 235°C for 10 sec max.

H2 ..... 260°C for 10 sec max.

Peak Inverse Voltage ..... 4 V

These diodes are ESD sensitive. Handle with care to avoid static discharge through the diode.

## RF Electrical Specifications at $T_A = 25^{\circ}\text{C}$

| Part Number<br>5082- | Test Freq.<br>(GHz) | Barrier          | Maximum Noise Figure<br>NF (dB)                                         | IF Impedance<br>Z <sub>IF</sub> (Ω) |      | Maximum SWR    | Package      | Typical Junction Capacitance<br>C <sub>j</sub> (pF) |
|----------------------|---------------------|------------------|-------------------------------------------------------------------------|-------------------------------------|------|----------------|--------------|-----------------------------------------------------|
|                      |                     |                  |                                                                         | Min.                                | Max. |                |              |                                                     |
| 2765<br>2785         | 9.375               | Low<br>Low       | 6.0<br>6.5                                                              | 150                                 | 350  | 1.5:1<br>2.0:1 | Hermetic H2  | 0.18                                                |
| 2207<br>2209         |                     | Medium<br>Medium | 6.0<br>6.5                                                              | 200                                 | 400  | 1.5:1<br>2.0:1 | Broadband C2 |                                                     |
| 2774<br>2794         |                     | Low<br>Low       | 6.0<br>6.5                                                              | 150                                 | 350  | 1.5:1<br>2.0:1 |              |                                                     |
| Test Conditions      |                     |                  | DC Load Resistance = 0 Ω<br>L.O. Power = 1 mW<br>IF = 30 MHz, 1.5 dB NF |                                     |      |                |              | V = 0                                               |

\*Minimum batch size 20 units.

## Typical Detector Characteristics at $T_A = 25^{\circ}\text{C}$

### Medium Barrier and Low Barrier (DC Bias)

| Parameter              | Symbol   | Typical Value | Units             | Test Conditions                                                                                                                  |
|------------------------|----------|---------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Tangential Sensitivity | $T_{SS}$ | -54           | dBm               | 20 $\mu\text{A}$ Bias, $R_L = 100\text{ K}\Omega$<br>$P_{in} = -40\text{ dBm}$<br>Video Bandwidth = 2 MHz<br>$f = 10\text{ GHz}$ |
| Voltage Sensitivity    | $\gamma$ | 6.6           | mV/ $\mu\text{W}$ |                                                                                                                                  |
| Video Resistance       | $R_V$    | 1400          | $\Omega$          |                                                                                                                                  |

### Low Barrier (Zero Bias)

| Parameter              | Symbol   | Typical Value | Units             | Test Conditions                                                                                                     |
|------------------------|----------|---------------|-------------------|---------------------------------------------------------------------------------------------------------------------|
| Tangential Sensitivity | $T_{SS}$ | -44           | dBm               | Zero Bias, $R_L = 10\text{ M}\Omega$<br>$P_{in} = -30\text{ dBm}$<br>Video Bandwidth = 2 MHz<br>$f = 10\text{ GHz}$ |
| Voltage Sensitivity    | $\gamma$ | 10            | mV/ $\mu\text{W}$ |                                                                                                                     |
| Video Resistance       | $R_V$    | 1.8           | $\text{M}\Omega$  |                                                                                                                     |

SPICE Parameters

| Parameter       | Units | 5082-2207<br>5082-2209 | 5082-2765<br>5082-2774<br>5082-2785<br>5082-2794 |
|-----------------|-------|------------------------|--------------------------------------------------|
| B <sub>V</sub>  | V     | 5                      | 5                                                |
| C <sub>J0</sub> | pF    | 0.20                   | 0.20                                             |
| E <sub>G</sub>  | eV    | 0.69                   | 0.69                                             |
| I <sub>BV</sub> | A     | 10E-5                  | 10E-5                                            |
| I <sub>S</sub>  | A     | 3 x 10E-10             | 4 x 10E-8                                        |
| N               |       | 1.08                   | 1.08                                             |
| R <sub>S</sub>  | Ω     | 5                      | 6                                                |
| P <sub>B</sub>  | V     | 0.65                   | 0.5                                              |
| P <sub>T</sub>  |       | 2                      | 2                                                |
| M               |       | 0.5                    | 0.5                                              |

Typical Parameters

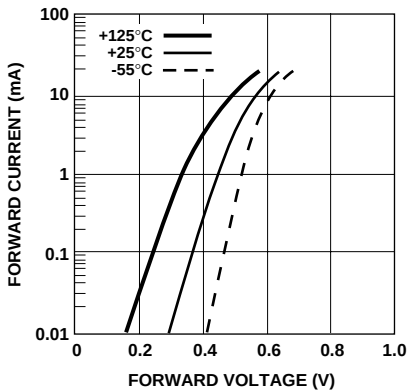


Figure 1. Typical Forward Characteristics for Medium Barrier Diodes.

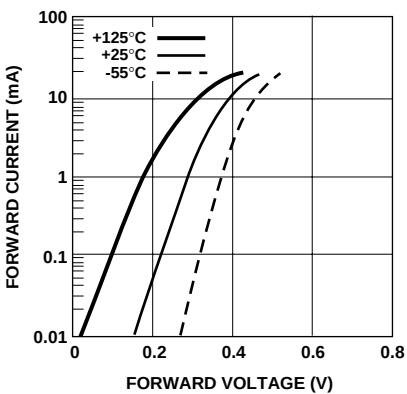


Figure 2. Typical Forward Characteristics for Low Barrier Diodes.

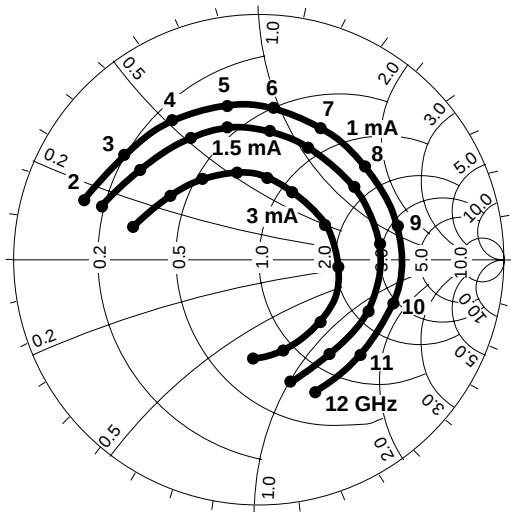


Figure 3. Typical Admittance Characteristics, 5082-2765 with Self Bias.

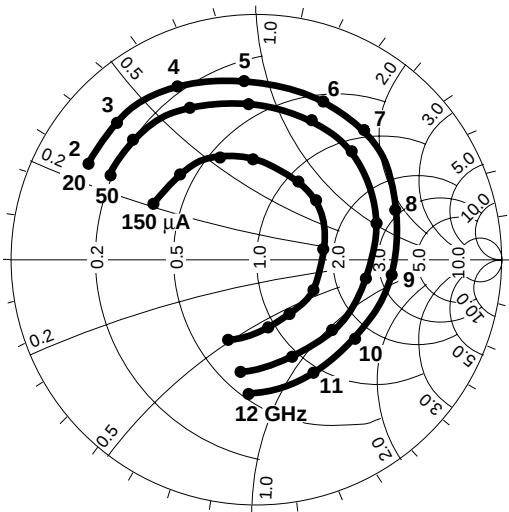


Figure 4. Typical Admittance Characteristics, 5082-2765 with External Bias.

## Typical Parameters, continued

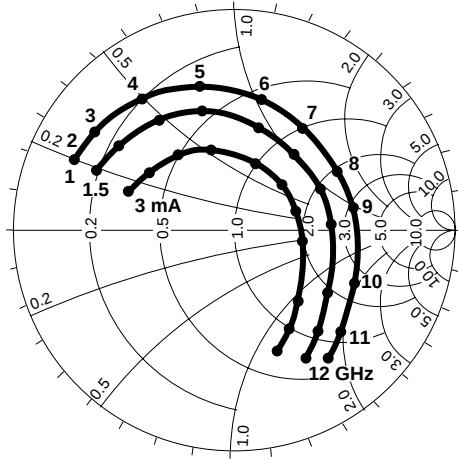


Figure 5. Typical Admittance Characteristics 5082-2785 with Self Bias.

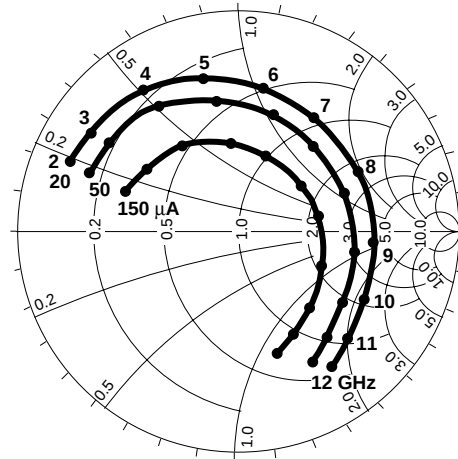


Figure 6. Typical Admittance Characteristics 5082-2785 with External Bias.

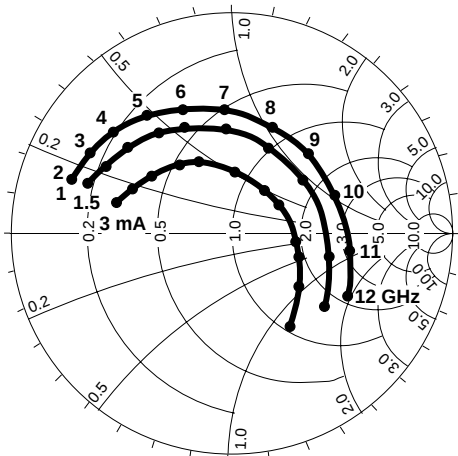


Figure 7. Typical Admittance Characteristics, 5082-2207 and 5082-2774 with Self Bias.

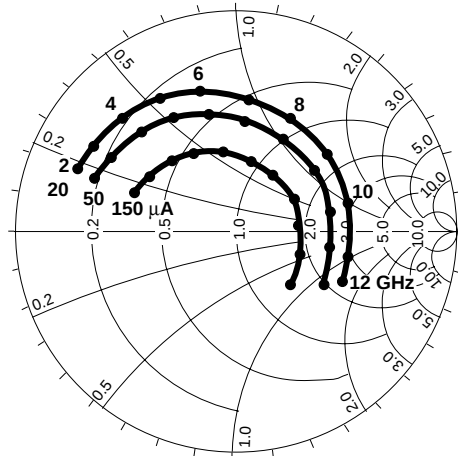


Figure 8. Typical Admittance Characteristics, 5082-2207 and 5082-2774 with External Bias.

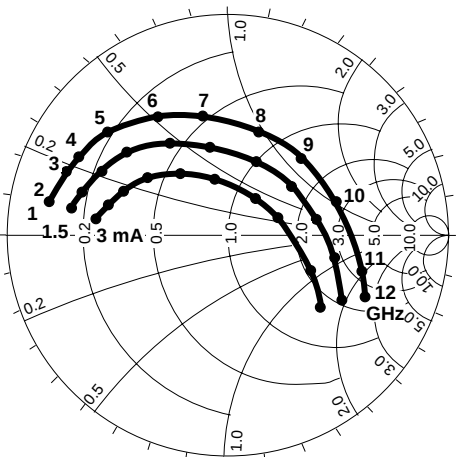


Figure 9. Typical Admittance Characteristics, 5082-2209 and 5082-2794 with Self Bias.

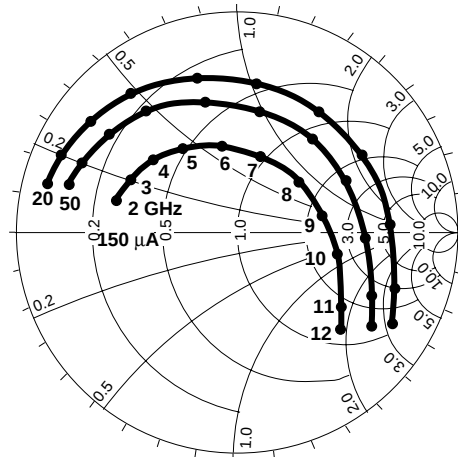


Figure 10. Typical Admittance Characteristics, 5082-2209 and 5082-2794 with External Bias.

## Typical Parameters, continued

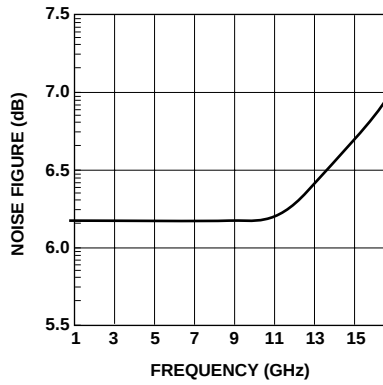


Figure 11. Typical Noise Figure vs. Frequency for 5082-2209, -2794.

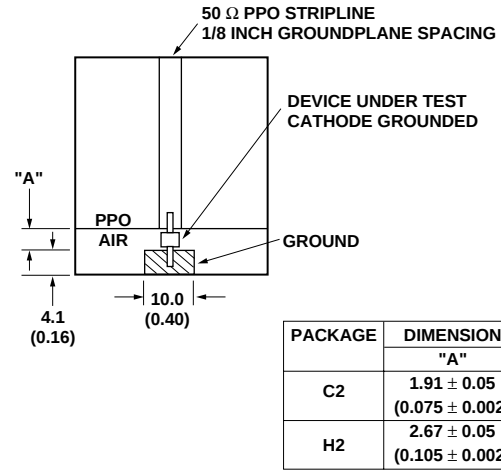
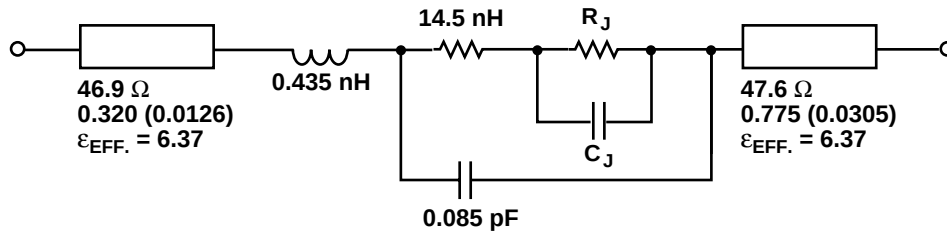


Figure 12. Admittance Test Circuit.

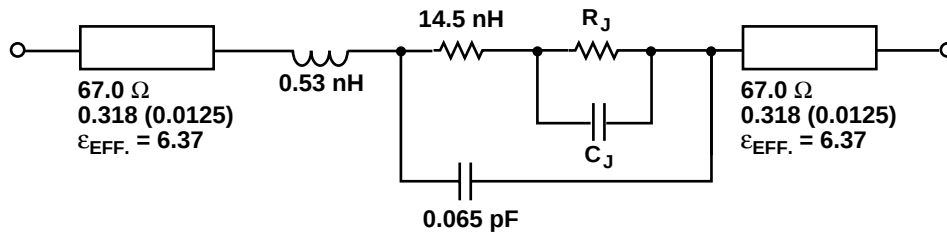
### MODEL FOR H2 DIODES



DIMENSIONS IN MILLIMETERS (INCHES)

| Parameter            | Symbol | 1 mA Rect. Current | 20 μA Ext. Bias | Units |
|----------------------|--------|--------------------|-----------------|-------|
|                      |        | 5082-2765          | 5082-2765       |       |
| Junction Resistance  | $R_J$  | 258                | 545             | Ω     |
| Junction Capacitance | $C_J$  | 0.255              | 0.302           | pF    |

### MODEL FOR C2 DIODES



DIMENSIONS IN MILLIMETERS (INCHES)

| Parameter            | Symbol | 1 mA Rect. Current   | 20 μA Ext. Bias      | Units |
|----------------------|--------|----------------------|----------------------|-------|
|                      |        | 5082-2207, 5082-2774 | 5082-2207, 5082-2774 |       |
| Junction Resistance  | $R_J$  | 338                  | 421                  | Ω     |
| Junction Capacitance | $C_J$  | 0.189                | 0.195                | pF    |