DATA SHEET

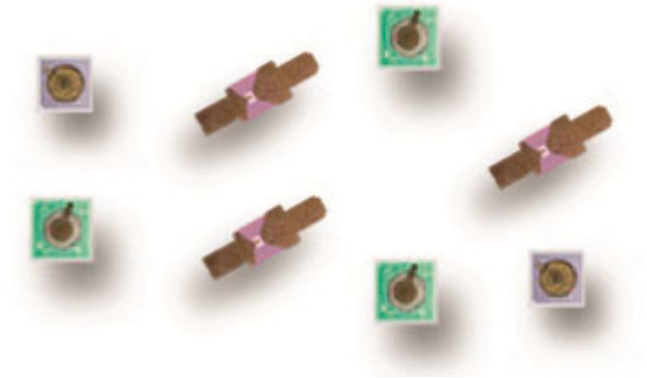
Silicon Schottky Barrier Diode Bondable Chips and Beam Leads

Applications

- Detectors
- Mixers

Features

- Available in both P-type and N-type low barrier designs
- Low 1/f noise
- Large bond pad chip design
- Planar passivated beam-lead and chip construction



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 beam-lead and chip Schottky barrier detector diodes are designed for applications through 40 GHz in the Ka band. They are made by the deposition of a suitable barrier metal on an epitaxial silicon substrate to form the junction. The process and choice of materials result in low series resistance along with a narrow spread of capacitance values for close impedance control. P-type silicon is used to obtain superior 1/f noise characteristics. N-type silicon is also available.

Beam-lead and chip diodes can be mounted on special customer substrates.

Unmounted beam-lead diodes are especially well suited for use in microwave integrated circuit (MIC) applications. Mounted beam-lead diodes can be easily used in MIC, stripline, or other such circuitry.

These “universal chips” are designed for a high degree of device reliability in both commercial and industrial uses. The offset bond pad assures that no mechanical damage occurs at the junction during the wire bonding. Additionally, the 4 mil bond pad eliminates performance variation due to bonding, improves efficiency during manual operations, and is ideal for automated assembly.

The choice of N- and P-type silicon allows the designer to optimize the silicon material for the intended application:

- Doppler mixers and high-sensitivity detectors benefit from using the low noise characteristics of the P-type silicon.
- Low conversion loss mixers and biased detectors can be designed using standard N-type material.

Applications

These diodes are categorized by tangential signal sensitivity (TSS) for detector applications in four frequency ranges: S, X, Ku, and Ka bands. However, they can also be used as modulators, high-speed switches, and low-power limiters.

TSS is a parameter that describes a diode’s detector sensitivity. It is defined as the amount of signal power, below a one-milliwatt reference level, required to produce an output pulse with an amplitude sufficient to raise the noise fluctuations by an amount equal to the average noise level. TSS is approximately 4 dB above the minimum detectable signal.

The P-type Schottky diodes in this Data Sheet are optimized for low noise in the 1/f region. They require a small forward bias (to reduce video resistance) if efficient operation is required. The bias not only increases sensitivity but also reduces parameter variation

due to temperature change. Video impedance is a direct function of bias and follows the 26/I (mA) relationship. This is important to pulse fidelity, since the video impedance together with the detector output capacitance affects the effective amplifier bandwidth.

Bias does, however, increase typical noise, particularly in the 1/f region. Therefore, it should be kept as low as possible (typically 5 to 50 μA).

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).

Electrical and Mechanical Specifications

Electrical and physical specifications for the silicon Schottky barrier diodes are provided in Tables 1 through 3. SPICE model parameters are defined in Table 4. Typical performance characteristics are shown in Figures 1 through 4. Typical video detector circuits are shown in Figure 5.

Table 1. Electrical Specifications: Beam-Lead P-Type Detector Schottky Diodes[1]

Frequency Band	Part Number	Electrical Characteristics						Test Frequency (GHz)	Outline Drawing
		TSS (dBm) [2]	R_V (Ω)		C_J @ 0 V (pF)	V_F @ 1 mA (mV)	V_B @ 10 μA (V)		
		Typ	Min	Max	Max				
X	DDB2503-000	-50	500	700	0.15	200-350	2	10.00	491-006
Ku	DDB2504-000	-48	500	700	0.10	200-350	2	16.00	491-006
K	DDB2265-000	-50[3]	800[3]	1200[3]	0.10	300-450	3	24.15	491-006

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

2 Bias = 50 μA
Video bandwidth = 10 MHz.

3 Bias = 30 μA

Table 2. Electrical Specifications: P-Type Detector Schottky Diode Universal Chips

Frequency Band	Part Number	Barrier	Electrical Characteristics						Outline Drawing
			R_V (Ω)	TSS (dBm) [1]	C_J @ 0 V (pF)	V_F @ 1 mA (mV)	R_T @ 10 mA (Ω) [2]	V_B @ 10 μA (V)	
			Typ	Min	Max		Max	Min	
Ku	CDB7620-000	Low	537	-40	0.15	250-350	30	2	571-006
K	CDB7619-000	Low	735	-50[3]	0.10	275-375	40	3	571-006

1 Bias = 50 μA
Video bandwidth = 10 MHz
R_V = 2800 Ω

2 Rt is the slope resistance @ 10 mA. The maximum series resistance (Rs) is calculated as: Rs = Rt – 2.8.

3 Bias = 30 μA

Table 3. Electrical Specifications: N-Type Detector Schottky Diode Chips

Frequency Band	Part Number	Electrical Characteristics					R_V (Ω)	Outline Drawing
		Barrier	V_F @ 1 mA (mV)	C_J @ 0 V (pF)	R_T @ 10 mA (Ω)	V_B @ 10 µA (V)		
				Max	Max	Min	Typ	
X	CDF7623-000	Low	240-300	0.30	10	2	245	571-011
K	CDF7621-000	Low	270-350	0.10	20	2	680	571-011
Ku	CME7660-000	Medium	350-450	0.15	10	3	–	571-011
K	CDE7618-000	Medium	375-500	0.10	20	3	–	571-011
Ku	CDP7624-000	Medium/High	450-575	0.15	15	3	–	571-011

Table 4. SPICE Model Parameters

Parameter	Units	Part Number			
		CDB7620-000	CDF7621-000	CDF7623-000	CDB7619-000
I_S	A	4E-08	9E-08	1.1E-07	3E-08
R_S	Ω	4	6	5	30
N	–	1.20	1.10	1.10	1.04
TT	sec	1E-11	1E-11	1E-11	1E-11
C_{JO}	pF	0.15	0.11	0.20	0.11
M	–	0.35	0.30	0.30	0.32
E_G	eV	0.69	0.69	0.69	0.69
XTI	–	2	2	2	2
F_C	–	0.5	0.5	0.5	0.5
B_V	V	2.0	2.5	2.5	3.0
I_{BV}	A	1E-05	1E-05	1E-05	1E-05
V_J	V	0.495	0.510	0.510	0.540

Typical I-V Characteristics

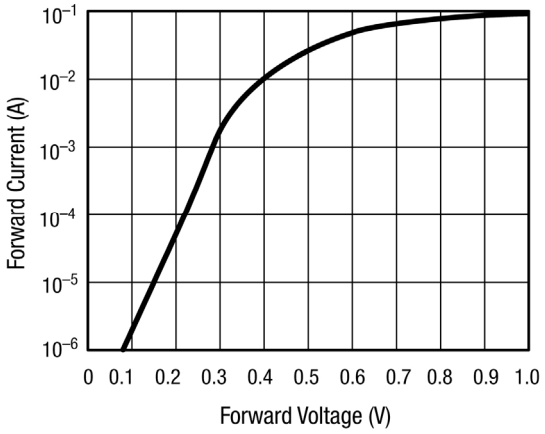


Figure 1. CDF7621-000

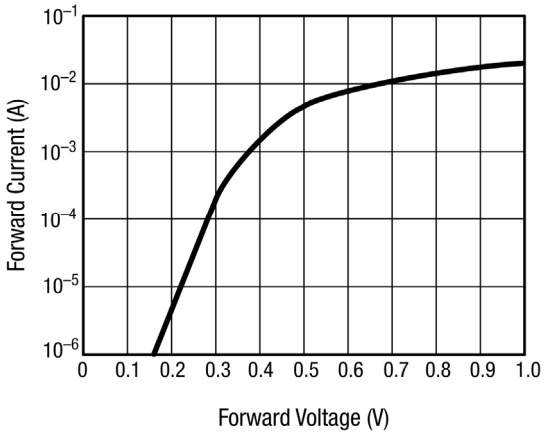


Figure 2. CDB7619-000

Typical Performance Data

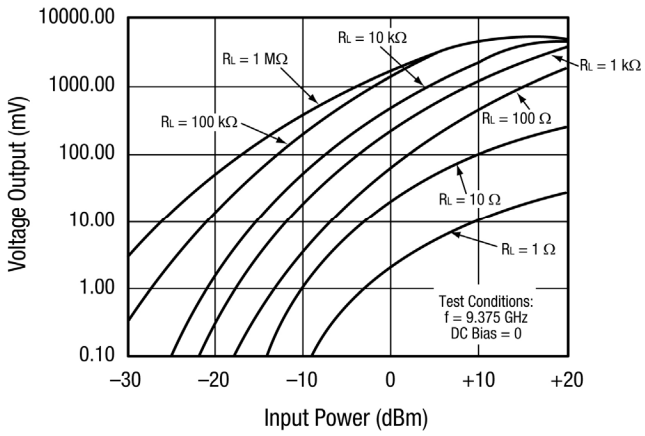


Figure 3. Voltage Output vs Input Power as a Function of Load Resistance

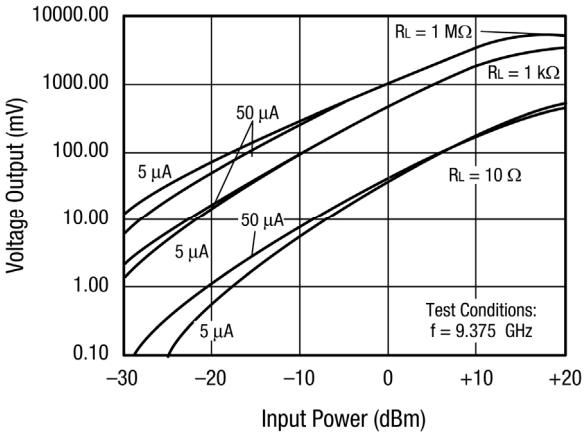
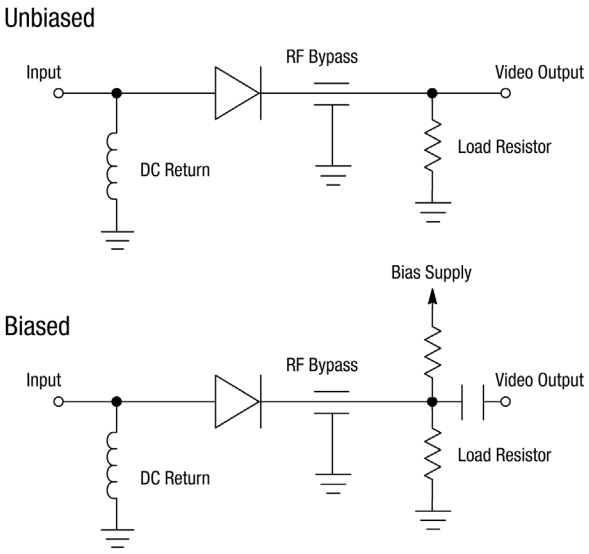
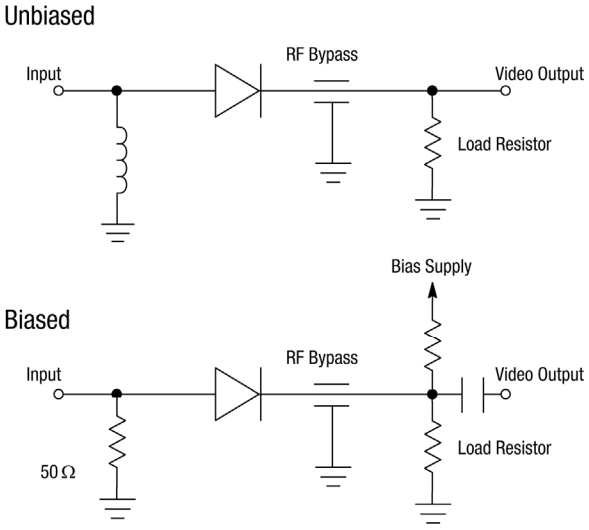


Figure 4. Voltage Output vs Input Power as a Function of Load Resistance and Bias



Multi-Octave–High Sensitivity



Broadband–Low Sensitivity

Figure 5. Typical Video Detector Circuits

Shipping Information

Individual Chips

Skyworks silicon Schottky barrier diodes are provided in waffle packs for bare die and in gel-pack carriers for beamlead devices.

Dimensions are provided in Figures 6, 7, and 8.

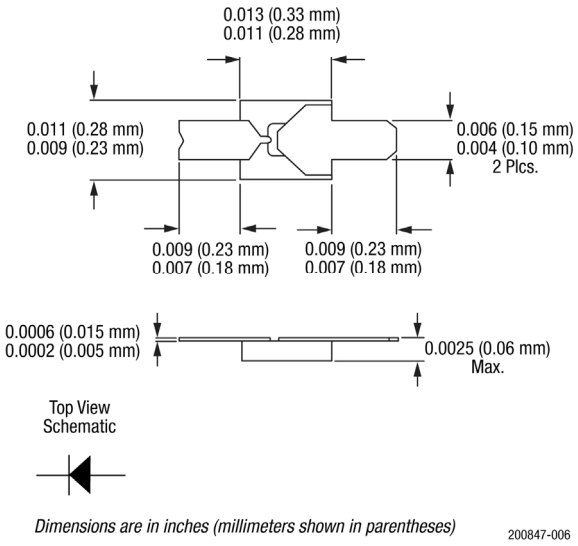
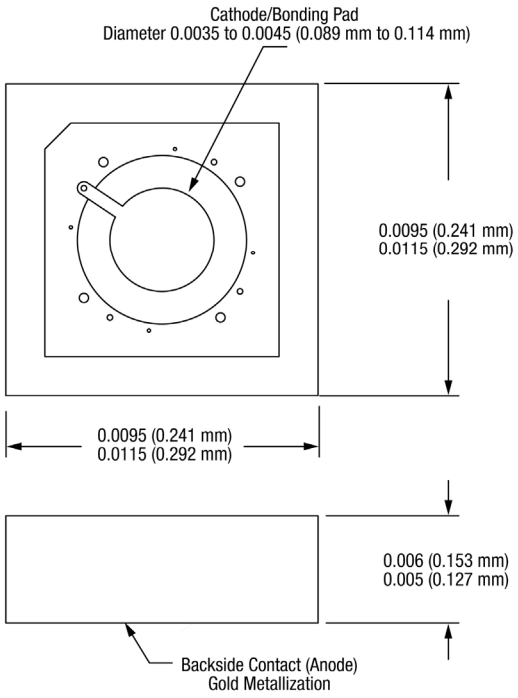


Figure 6. 491-006 Package Dimensions



Dimensions are in inches (millimeters shown in parentheses)

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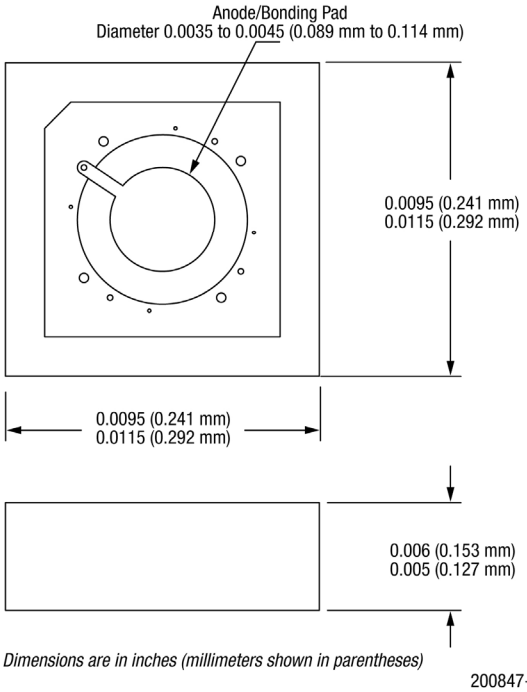
Figure 7. 571-006 Package Dimensions



Dimensions are in inches (millimeters shown in parentheses)

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Figure 8. 571-011 Package Dimensions