

DATA SHEET

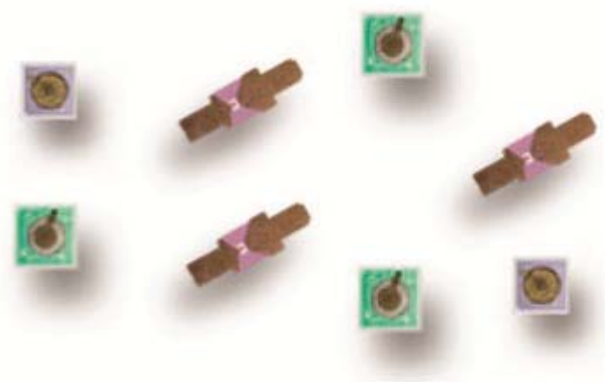
# Silicon Schottky Barrier Diode Bondable Chips and Beam Leads

## 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.

Download Meet.Live

## 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

## SILICON SCHOTTKY BARRIER DIODES

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  $\mu$ A).

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 (Note 1)**

Frequency Band	Part Number	Electrical Characteristics						Test Frequency (GHz)	Outline Drawing
		TSS (dBm) (Note 2)	R <sub>v</sub> ( $\Omega$ )		C <sub>J</sub> @ 0 V (pF)	V <sub>F</sub> @ 1 mA (mV)	V <sub>b</sub> @ 10 $\mu$ A (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 (Note 3)	800 (Note 3)	1200 (Note 3)	0.10	300-450	3	24.15	491-006

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

**Note 2:** Bias = 50  $\mu$ A  
Video bandwidth = 10 MHz.

**Note 3:** Bias = 30  $\mu$ A

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

Frequency Band	Part Number	Barrier	Electrical Characteristics						Outline Drawing
			R <sub>v</sub> ( $\Omega$ )	TSS (dBm) (Note 1)	C <sub>J</sub> @ 0 V (pF)	V <sub>F</sub> @ 1 mA (mV)	R <sub>t</sub> @ 10 mA ( $\Omega$ ) (Note 2)	V <sub>b</sub> @ 10 $\mu$ A (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 (Note 3)	0.10	275-375	40	3	571-006

**Note 1:** Bias = 50  $\mu$ A  
Video bandwidth = 10 MHz  
R<sub>v</sub> = 2800  $\Omega$

**Note 2:** R<sub>t</sub> is the slope resistance @ 10 mA. The maximum series resistance (R<sub>s</sub>) is calculated as: R<sub>s</sub> = R<sub>t</sub> - 2.8.

**Note 3:** Bias = 30  $\mu$ A

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

Frequency Band	Part Number	Electrical Characteristics					R <sub>v</sub> (Ω)	Outline Drawing
		Barrier	V <sub>F</sub> @ 1 mA (mV)	C <sub>J</sub> @ 0 V (pF)	R <sub>T</sub> @ 10 mA (Ω)	V <sub>B</sub> @ 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	CDC7623-000	CDB7619-000
I <sub>s</sub>	A	4E-08	9E-08	1.1E-07	3E-08
R <sub>s</sub>	Ω	4	6	5	30
N	–	1.20	1.10	1.10	1.04
T <sub>T</sub>	sec	1E-11	1E-11	1E-11	1E-11
C <sub>JO</sub>	pF	0.15	0.11	0.20	0.11
M	–	0.35	0.30	0.30	0.32
E <sub>G</sub>	eV	0.69	0.69	0.69	0.69
X <sub>TI</sub>	–	2	2	2	2
F <sub>c</sub>	–	0.5	0.5	0.5	0.5
B <sub>v</sub>	V	10	2.5	2.5	3.0
I <sub>bv</sub>	A	1E-05	1E-05	1E-05	1E-05
V <sub>J</sub>	V	0.495	0.510	0.510	0.540

### Typical I-V Characteristics

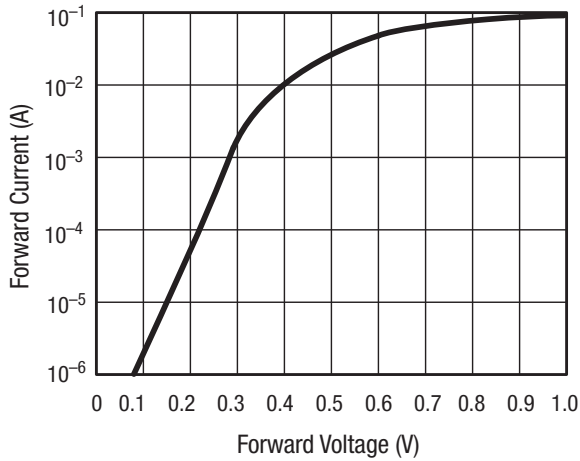


Figure 1. CDF7621-000

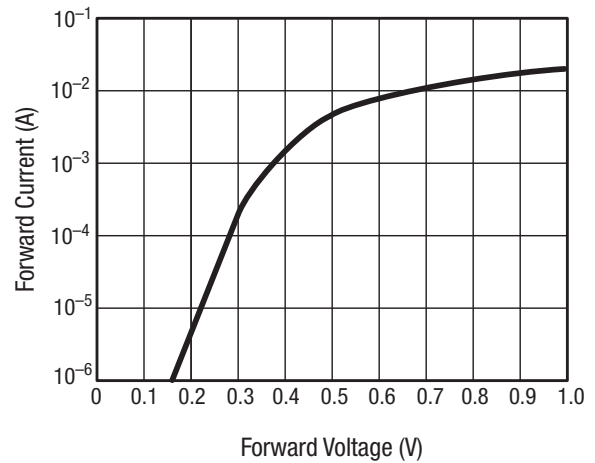


Figure 2. CDB7619-000

### Typical Performance Data

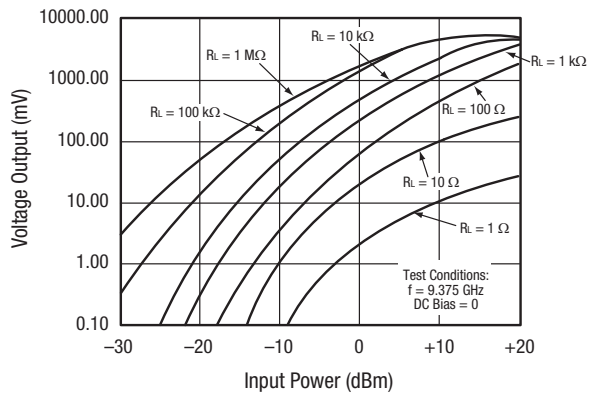


Figure 3. Voltage Output vs Input Power as a Function of Load Resistance

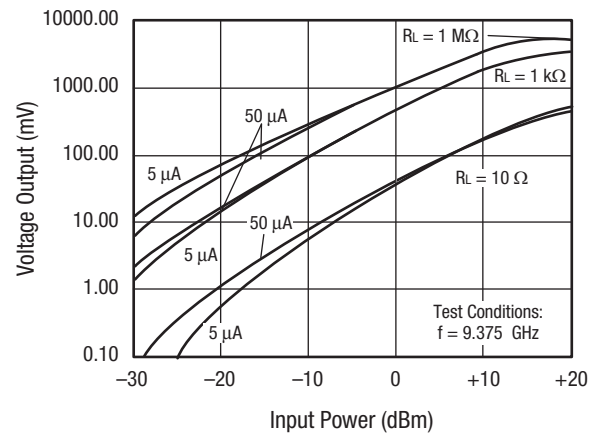
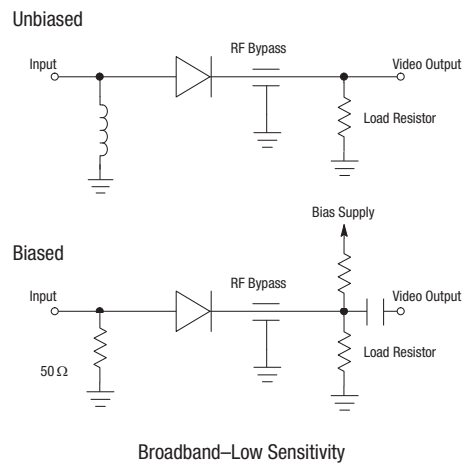
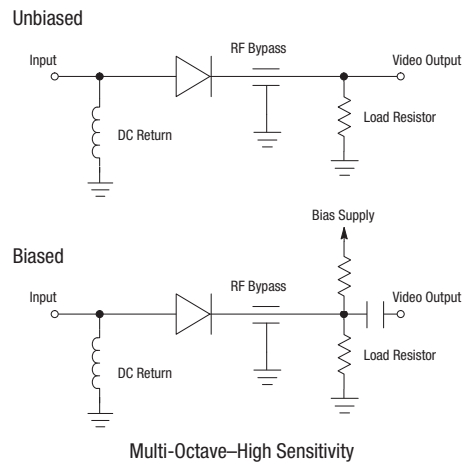


Figure 4. Voltage Output vs Input Power as a Function of Load Resistance and Bias



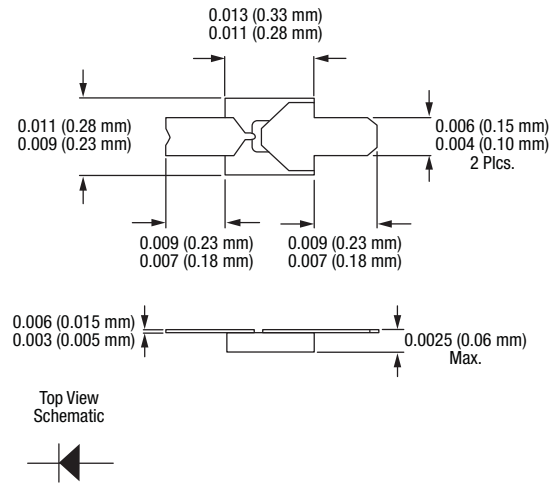
**Figure 5. Typical Video Detector Circuits**

## Shipping Information

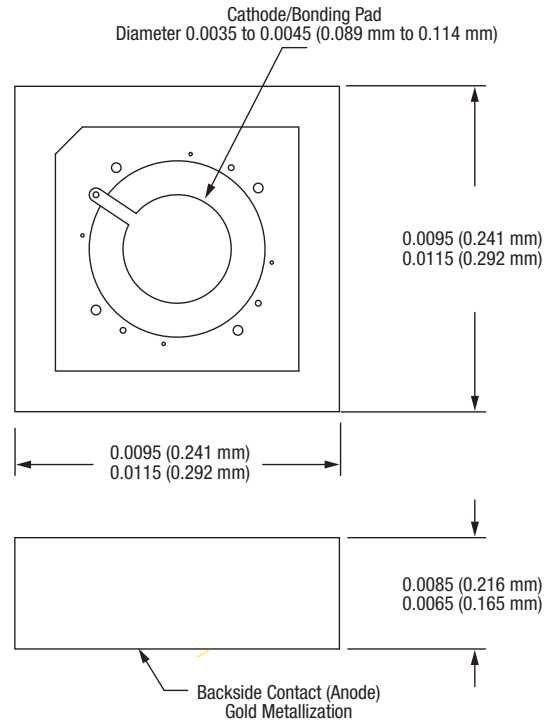
### Individual Chips

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.



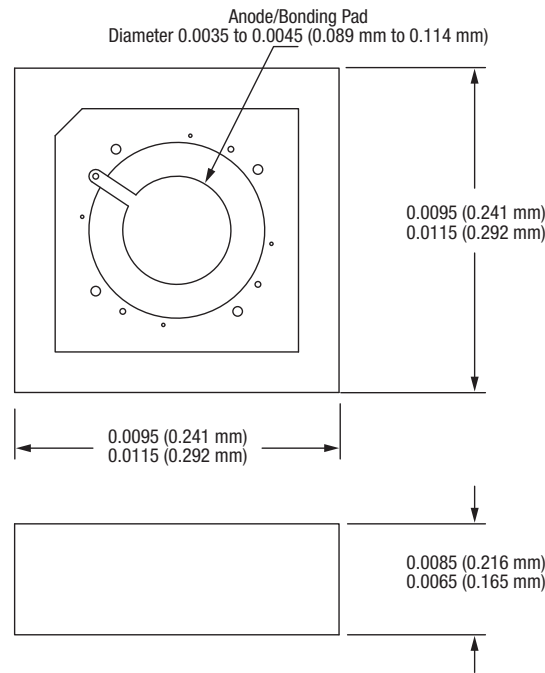
**Figure 6. 491-006 Package Dimensions**



Dimensions are in inches (millimeters shown in parentheses)

S3181

**Figure 7. 571-006 Package Dimensions**



Dimensions are in inches (millimeters shown in parentheses)

S3182

**Figure 8. 571-011 Package Dimensions**

Copyright © 2002-2009, 2011-2014 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks and the Skyworks symbol are trademarks or registered trademarks of Skyworks Solutions, Inc., in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at [www.skyworksinc.com](http://www.skyworksinc.com), are incorporated by reference.