

DATA SHEET

# Silicon Schottky Barrier Diodes in Hermetic and Epoxy Ceramic Packages

## Applications

- Detectors
- Mixers

## Features

- Available in both P-type and N-type low barrier designs
- Low 1/f noise
- Packages rated MSL1, 260 °C per JEDEC J-STD-020

## Description

Our packaged Schottky barrier detector diodes are designed for applications through 20 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.

Packaged diodes are suitable for use in waveguide, coaxial, and stripline applications.

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  $\mu$ A).

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 I-V characteristics are shown in Figures 1 and 2. Typical performance characteristics are shown in Figures 3 and 4. Typical video detector circuits are shown in Figure 5.

## SILICON SCHOTTKY BARRIER DIODES

**Table 1. Electrical Specifications: Beam-Lead P-Type Detector Schottky Diodes (Note 1)**

Frequency Band	Part Number	TSS (dBm) (Note 2)	R <sub>v</sub> (Ω)		Total Capacitance (CT) @ 0 V (pF)	V <sub>F</sub> @ 1.0 mA (mV)		V <sub>B</sub> @ 10 μA (V)
		Typical	Minimum	Maximum	Maximum	Minimum	Maximum	Minimum
X	DDB2503-220	50	500	700	0.3	200	350	2
X	DDB2503-230	50	500	700	0.3	200	350	2
X	DDB2503-250	50	500	700	0.3	200	350	2
Ku	DDB2504-220	48	500	700	0.2	200	350	2
Ku	DDB2504-230	48	500	700	0.2	200	350	2
Ku	DDB2504-250	48	500	700	0.2	200	350	2
K	DDB2265-220	50 (Note3)	800 (Note 3)	1200 (Note 3)	0.2	300	450	3
K	DDB2265-230	50 (Note3)	800 (Note 3)	1200 (Note 3)	0.2	300	450	3
K	DDB2265-250	50 (Note3)	800 (Note 3)	1200 (Note 3)	0.2	300	450	3

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

**Note 2:** Bias = 50 μA  
Video bandwidth = 10 MHz.

**Note 3:** Bias = 30 μA

**Table 2. Electrical Specifications: P-Type Detector Schottky Diodes (Note 1)**

Frequency Band	Part Number	Barrier	R <sub>v</sub> (Ω)	TSS (dBm) (Note 2)	Total Capacitance (CT) @ 0 V (pF)	V <sub>F</sub> @ 1 mA (mV)		Total Resistance (R <sub>T</sub> ) @ 10 mA (Ω) (Note 3)	V <sub>B</sub> @ 10 μA (V)
			Typical	Typical	Maximum	Minimum	Maximum	Maximum	Minimum
Ku	CDB7620-203	Low	537	+40	0.4	250	350	30	2
Ku	CDB7620-207	Low	537	+40	0.4	250	350	30	2
K	CDB7619-203	Low	735	+50 (Note 4)	0.35	275	375	40	3
K	CDB7619-207	Low	735	+50 (Note 4)	0.35	275	375	40	3

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

**Note 2:** Bias = 50 μA  
Video bandwidth = 10 MHz  
R<sub>V</sub> = 2800 Ω

**Note 3:** 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 4:** Bias = 30 μA

**Table 3. Electrical Specifications: N-Type Detector Schottky Diodes (Note 1)**

Frequency Band	Part Number	Barrier	$V_F @ 1.0 \text{ mA}$ (mV)		$R_V$ ( $\Omega$ )	Total Capacitance (CT) @ 0 V (pF)	Total Resistance (RT) @ 10 mA ( $\Omega$ ) (Note 2)	$V_B @ 10 \mu\text{A}$ (V)
			Minimum	Maximum	Typical	Maximum	Maximum	Minimum
X	CDF7623-203	Low	240	300	245	0.50	10	2
X	CDF7623-207	Low	240	300	245	0.50	10	2
K	CDF7621-203	Low	270	350	680	0.30	20	2
K	CDF7621-207	Low	270	350	680	0.30	20	2
Ku	CME7660-203	Medium	350	450	-	0.40	10	3
Ku	CME7660-207	Medium	350	450	-	0.40	10	3
K	CDE7618-203	Medium	375	500	-	0.30	20	3
K	CDE7618-207	Medium	375	500	-	0.30	20	3
Ku	CDP7624-203	Medium/High	450	575	-	0.40	15	3
Ku	CDP7624-207	Medium/High	450	575	-	0.40	15	3

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

**Note 2:**  $R_t$  is the slope resistance @ 10 mA. The maximum series resistance ( $R_S$ ) is calculated as :  $R_S = R_t - 2.8$

**Table 4. SPICE Model Parameters**

Parameter	Units	Part Number			
		CDB7620	CDF7621	CDC7623	CDB7619
$I_S$	A	4E-08	9E-08	1.1E-07	3E-08
$R_S$	$\Omega$	4	6	5	30
N	-	1.20	1.10	1.10	1.04
TT	sec	1E-11	1E-11	1E-11	1E-11
CJO	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
Fc	-	0.5	0.5	0.5	0.5
Bv	V	10	2.5	2.5	3.0
$I_{BV}$	A	1E-05	1E-05	1E-05	1E-05
VJ	V	0.495	0.510	0.510	0.540

### Typical I-V Characteristics

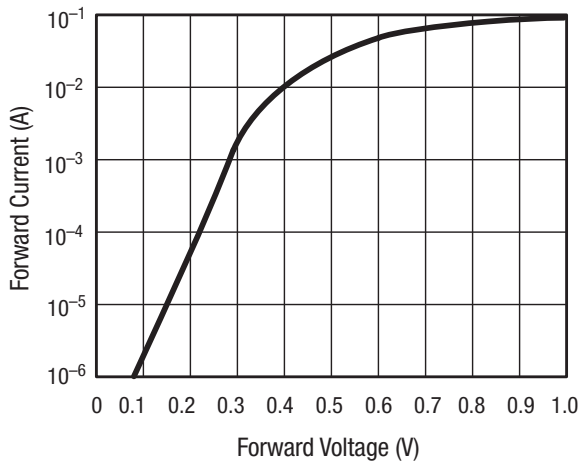


Figure 1. CDF7621

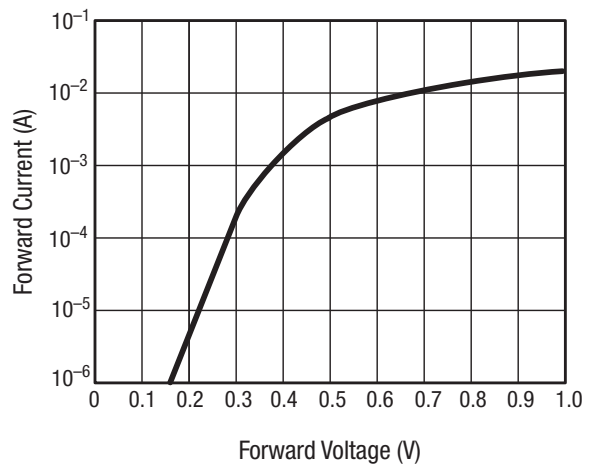


Figure 2. CDB7619

### Typical Performance Characteristics

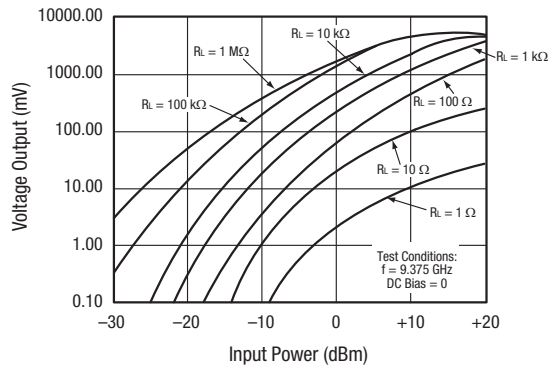


Figure 3. Voltage Output vs Input Power as a Function of Load Resistance

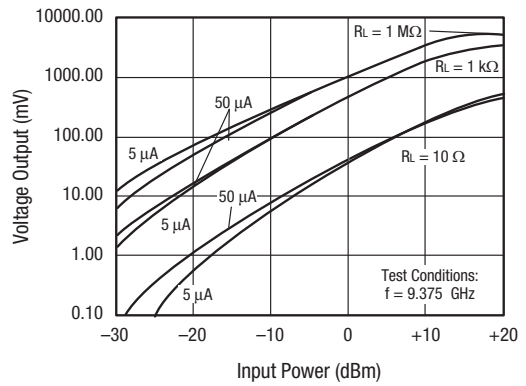
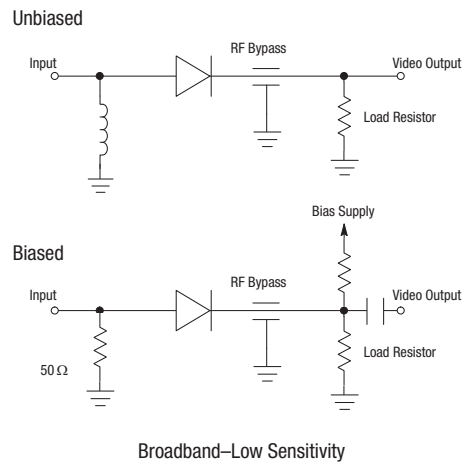
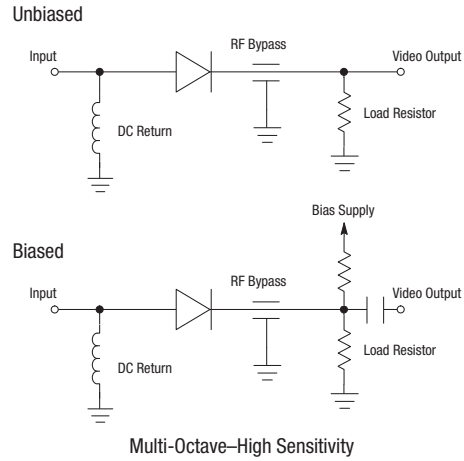


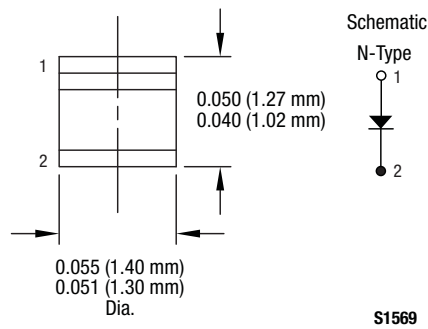
Figure 4. Voltage Output vs Input Power as a Function of Load Resistance and Bias



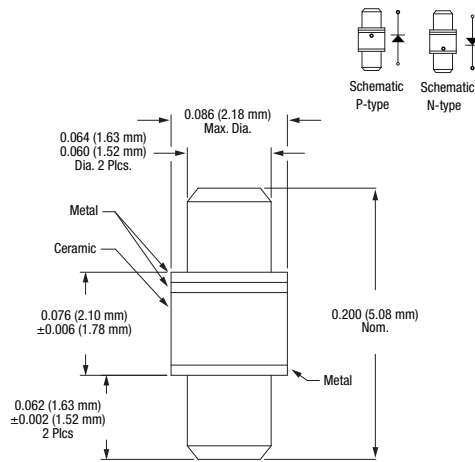
**Figure 5. Typical Video Detector Circuits**

## Package Dimensions

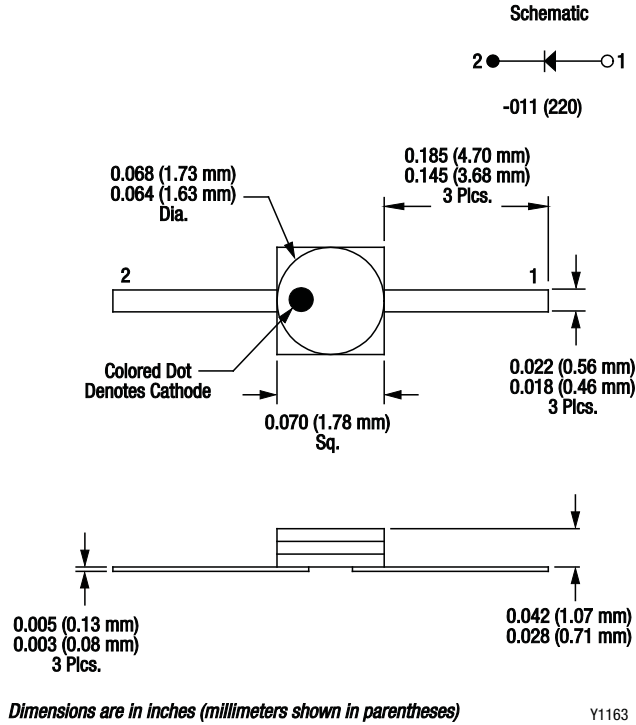
Package dimensions are provided in Figures 6 through 10.



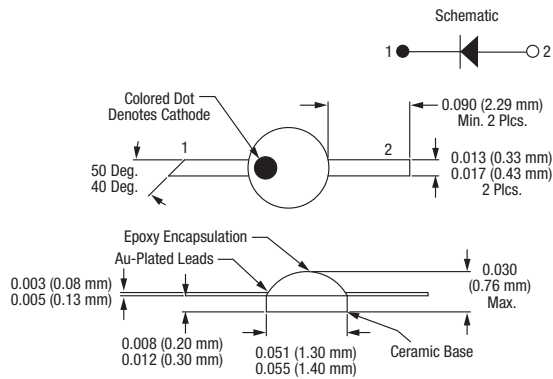
**Figure 6. -203 Package Dimensions**



**Figure 7. -207 Package Dimensions**

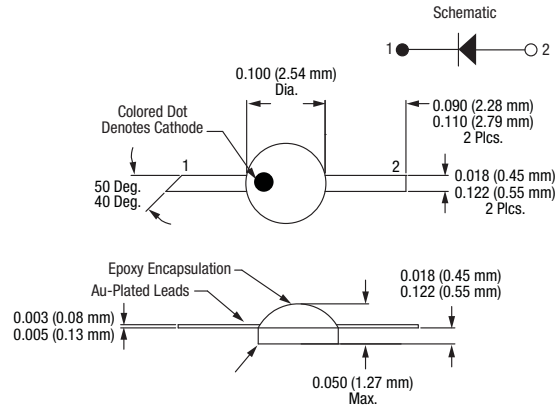


**Figure 8. -220 Package Dimensions**



**Figure 9. -230 Package Dimensions**

**DATA SHEET • SILICON SCHOTTKY BARRIER DIODES**



**Figure 10. -250 Package Dimensions**



Copyright © 2014-2015, 2017 Isolink, Inc. All Rights Reserved.

Information in this document is provided in connection with Isolink, Inc. ("Isolink"), a wholly-owned subsidiary of Skyworks Solutions, Inc. These materials, including the information contained herein, are provided by Isolink as a service to its customers and may be used for informational purposes only by the customer. Isolink assumes no responsibility for errors or omissions in these materials or the information contained herein. Isolink may change its documentation, products, services, specifications or product descriptions at any time, without notice. Isolink 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. Isolink assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Isolink products, information or materials, except as may be provided in Isolink 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. ISOLINK DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. ISOLINK 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.

Customers are responsible for their products and applications using Isolink 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. Isolink assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Isolink products outside of stated published specifications or parameters.

Isolink is a trademark of Isolink Inc. in the United States and other countries. 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.