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 μA).

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.

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

Frequency Band	Part Number	TSS (dBm) (Note 2)	R_V (Ω)		Total Capacitance (CT) @ 0 V (pF)	V_F @ 1.0 mA (mV)		V_B @ 10 uA (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	Rv (Ω)	TSS (dBm) (Note 2)	Total Capacitance (C_T) @ 0 V (pF)	V_F @ 1 mA (mV)		Total Resistance (R_T) @ 10 mA (Ω) (Note 3)	V_B @ 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
RV = 2800 Ω

Note 3: R_t is the slope resistance @ 10 mA. The maximum series resistance (R_S) is calculated as : $R_S = R_t - 2.8$

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 mA (mV)		R_V (Ω)	Total Capacitance (CT) @ 0 V (pF)	Total Resistance (RT) @ 10 mA (Ω) (Note 2)	V_B @ 10 uA (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: Rt is the slope resistance @ 10 mA. The maximum series resistance (Rs) is calculated as : Rs = Rt – 2.8

Table 4. SPICE Model Parameters

Parameter	Units	Part Number			
		CDB7620	CDF7621	CDC7623	CDB7619
Is	A	4E-08	9E-08	1.1E-07	3E-08
Rs	Ω	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
Eg	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
Ibv	A	1E-05	1E-05	1E-05	1E-05
Vj	V	0.495	0.510	0.510	0.540

Typical I-V Characteristics

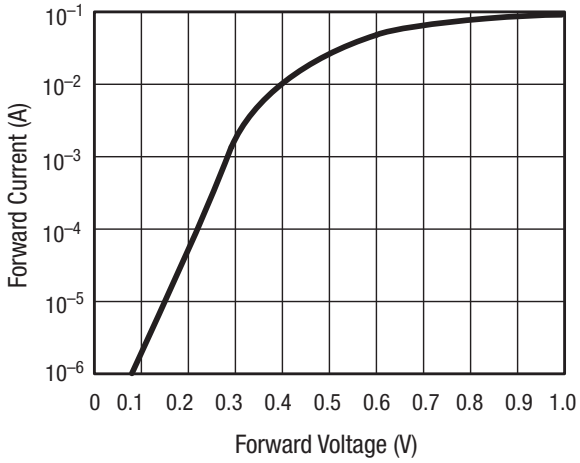

Figure 1. CDF7621

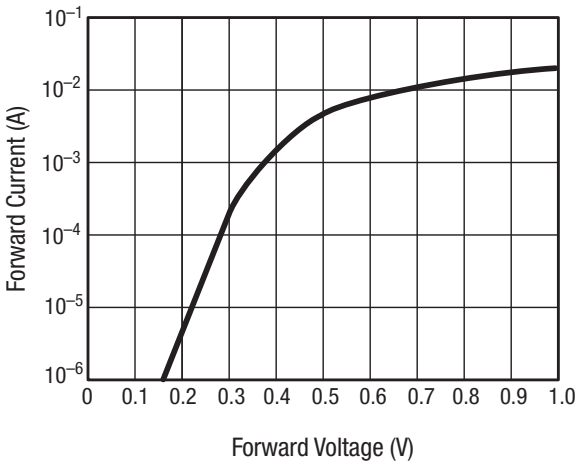

Figure 2. CDB7619

Typical Performance Characteristics

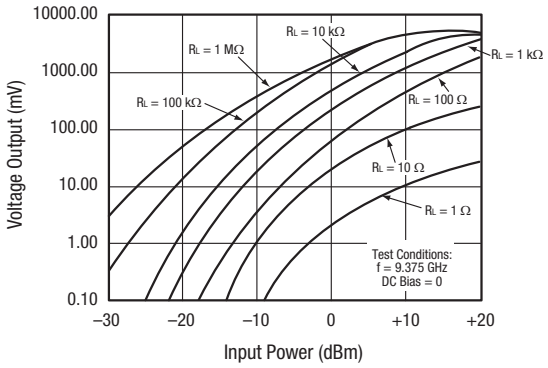

Figure 3. Voltage Output vs Input Power as a Function of Load Resistance

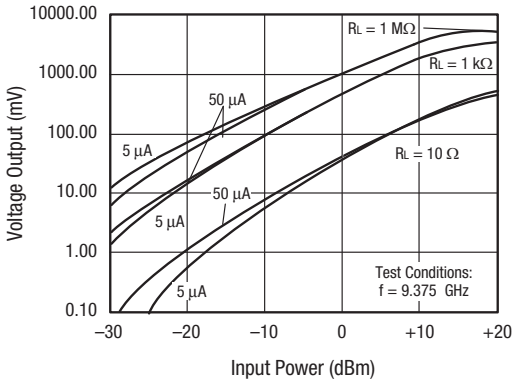

Figure 4. Voltage Output vs Input Power as a Function of Load Resistance and Bias

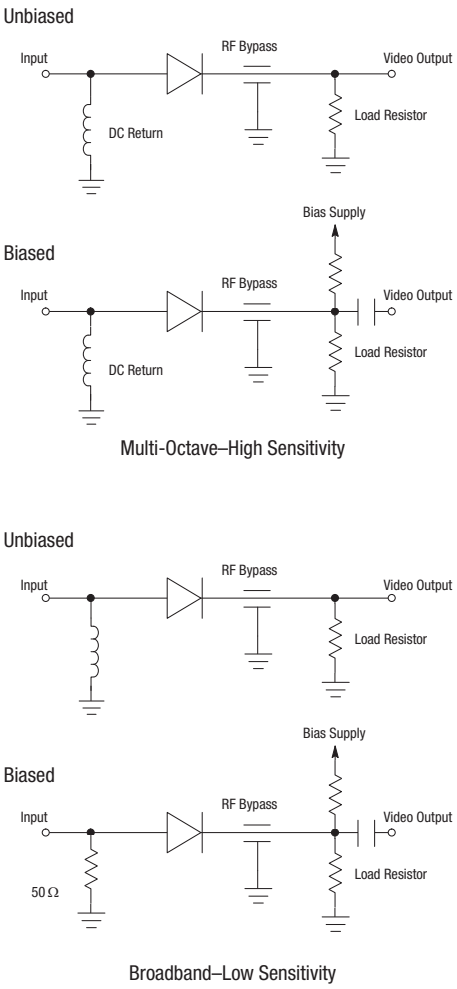

Figure 5. Typical Video Detector Circuits

Package Dimensions

Package dimensions are provided in Figures 6 through 10.

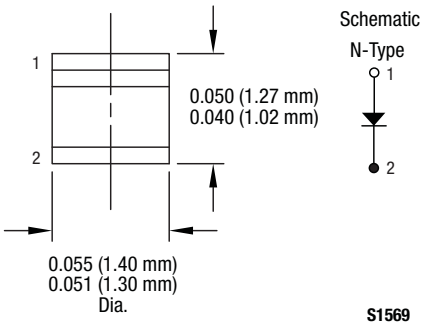

Figure 6. -203 Package Dimensions

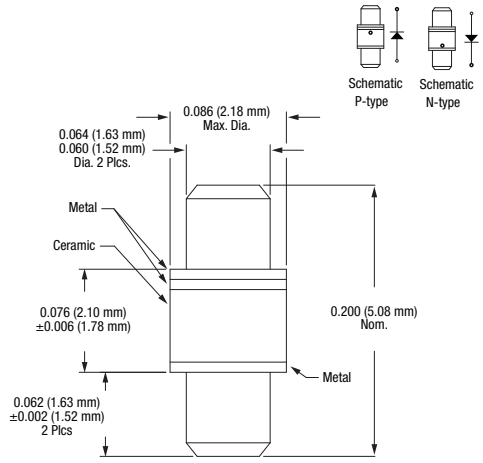

Figure 7. -207 Package Dimensions

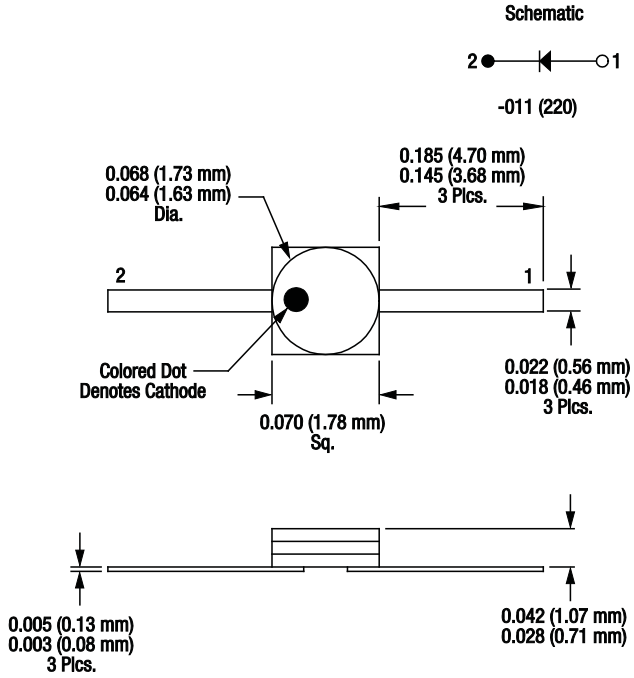

Figure 8. -220 Package Dimensions

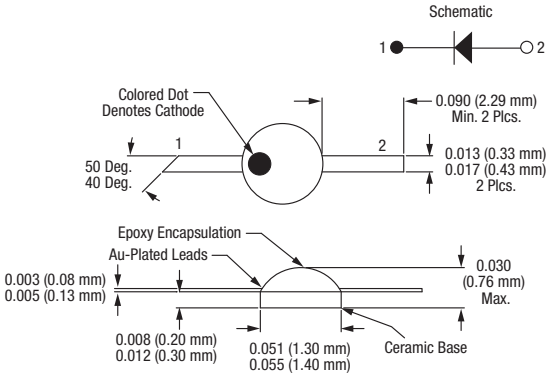

Figure 9. -230 Package Dimensions

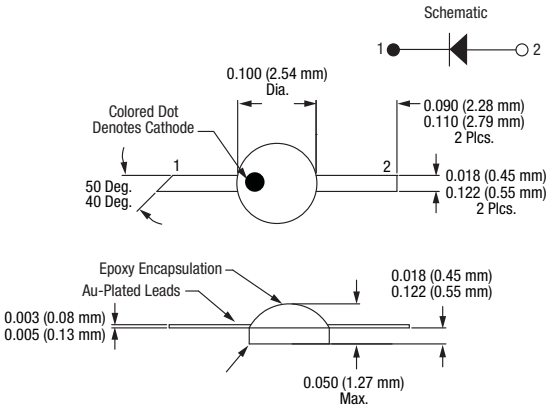

Figure 10. -250 Package Dimensions