

DATA SHEET

CDC7630/7631 and DDC2353/2354 Series: Zero Bias Silicon Schottky Barrier Detector Diodes

Applications

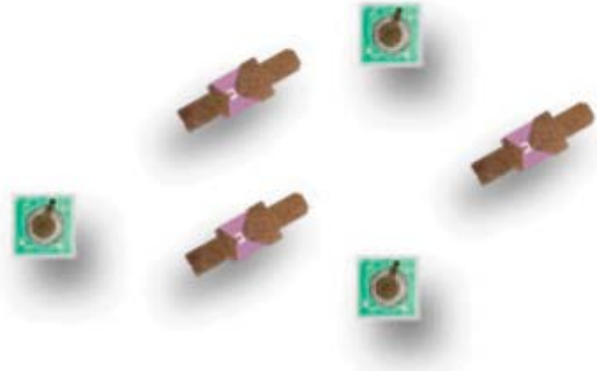
- Microwave integrated circuits
- Detectors

Features

- High sensitivity
- Low video impedance



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 bare die and beam-lead zero-bias Schottky barrier detector diodes are designed for applications through the K band. The choice of barrier metal and process techniques results in a group of diodes with a wide selection of video impedance ranges.

The CDC and DDC series of Schottky diodes are especially well suited for use in Microwave Integrated Circuit (MIC) applications where the chip and wire approach is desirable. Mounted beam-lead diodes can be easily used in MIC, stripline, or other such circuitry.

Applications

The CDC and DDC series of zero-bias Schottky diodes are designed for detector applications through 26 GHz and are useful up to 40 GHz. They require no bias and operate efficiently even at tangential signal power levels. Since they require no bias, noise is at a minimum. A low video impedance means a short R-C time constant and, therefore, wide video bandwidth and excellent pulse fidelity.

As power monitors, these diodes may also be used to directly drive metering circuits even at low power input levels. These diodes are categorized by Tangential Signal Sensitivity (TSS), voltage output, and video impedance for detector applications.

TSS is a parameter that best describes the use of a diode as a video detector. 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 noise fluctuations by an amount equal to the average noise level. TSS is approximately 4 dB above the minimum detectable signal.

Voltage output is another useful parameter since it can be used in the design of threshold detectors and power monitor circuits. Since voltage output is a function of the diode's video impedance, a different minimum value is specified for each video impedance range.

Electrical and Mechanical Specifications

The absolute maximum ratings for the CDC and DDC series of Schottky diodes are provided in Table 1. Electrical and physical specifications are provided in Table 2. SPICE model parameters for the CDC7630/7631 series are defined in Table 3.

Typical performance characteristics are shown in Figures 1 through 8. Typical video detector circuits are shown in Figure 9. The multi-octave, high-sensitivity circuit would be used in Electronic Countermeasures (ECM) and similar applications. An RF matching structure that presents maximum power at the diode junction must be incorporated to ensure maximum sensitivity.

The broadband low-sensitivity circuit would be used where a low input VSWR is required. In this circuit, low VSWR is accomplished by the use of the 50 Ω terminating resistor. Sensitivity, however, is degraded by typically 10 dB from the multi-octave, high-sensitivity circuit. The most common use for this circuit is in a broadband, flat detector used primarily in the laboratory.

Package dimensions are provided in Figures 10 and 11. 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).

Table 1. CDC7630/7631 and DDC2353/2354 Diode Series Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Minimum | Maximum | Units |
|---|------------------|---------|---------|-------|
| Reverse voltage | V _R | | 2 | V |
| Forward current | I _F | | 100 | mA |
| RF input power @ T _A = 25 °C | P _D | | 75 | mW |
| Storage temperature | T _{STG} | -60 | +200 | °C |
| Operating temperature | T _A | -55 | +150 | °C |
| Electrostatic discharge: Human Body Model (HBM), Class 0 | ESD | | <250 | V |

Note 1: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

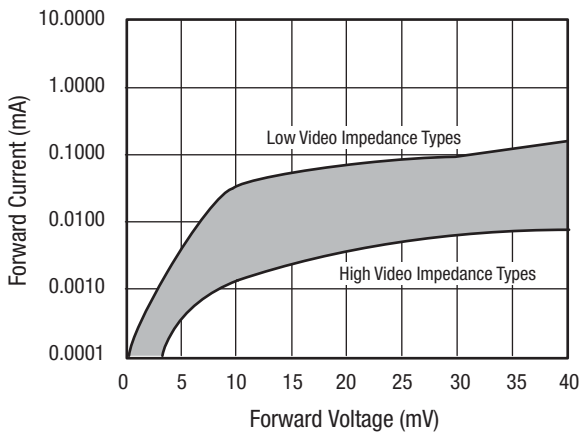
CAUTION: Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

Table 2. CDC7630/7631 and DDC2353/2354 Diode Series Electrical Specifications (Note 1)
(T_A = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

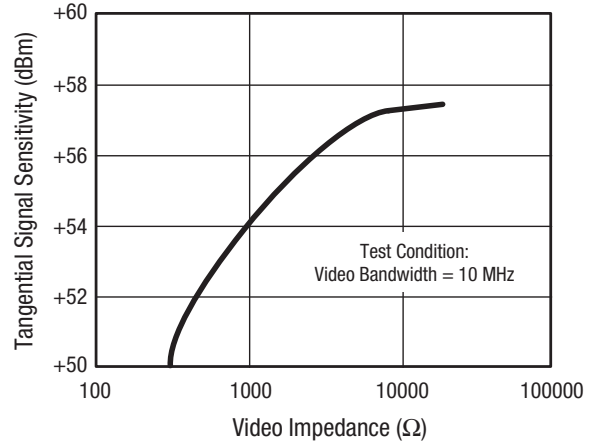
| Part Number | Min. Detected Output Voltage, E _O (mV) | Video Impedance, Z _v (Ω) | Max. TSS (dBm) | Outline Drawing |
|-------------|---|-------------------------------------|----------------|-----------------|
| DDC2353-000 | 8 | 2000 to 6500 | -52 | 491-006 |
| DDC2354-000 | 15 | 5000 to 15000 | -56 | 491-006 |
| CDC7630-000 | 8 | 2000 to 6500 | -52 | 571-006 |
| CDC7631-000 | 15 | 5000 to 15000 | -56 | 571-006 |

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

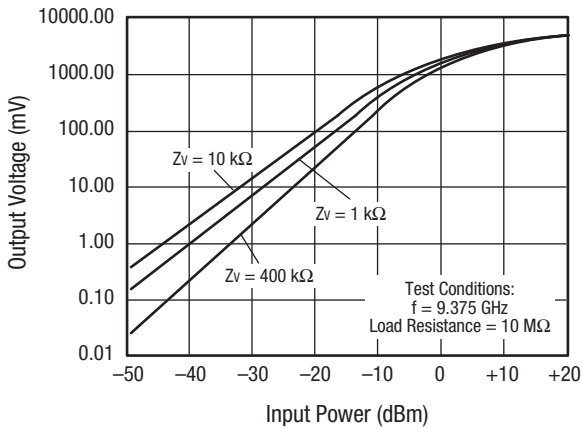
Typical Performance Characteristics



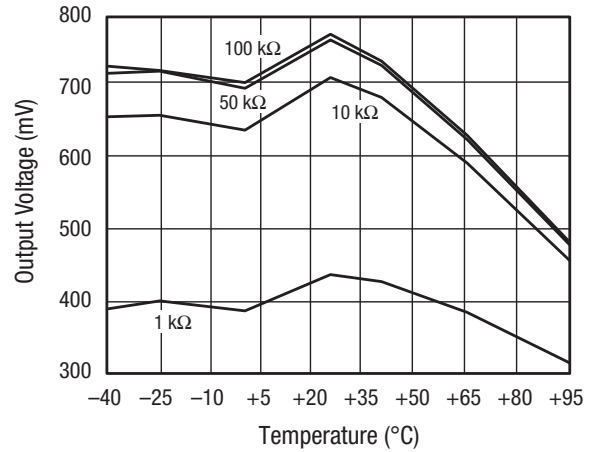
**Figure 1. Zero Bias Schottky Detector Diodes
Typical Forward DC Characteristics**



**Figure 2. Typical Zero Bias X-Band Detector Diodes
TSS vs Video Impedance**



**Figure 3. Typical Zero Bias X-Band Detector Diodes
Output Voltage vs Input Power as a Function of Video Impedance**



**Figure 4. Output Voltage vs Temperature
Over Load Resistance @ 0 dBm**

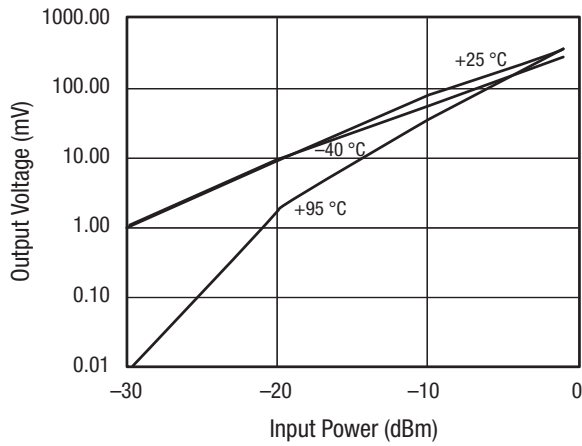


Figure 5. Output Voltage vs Input Power Over Temperature (Load Resistance = 1 kΩ)

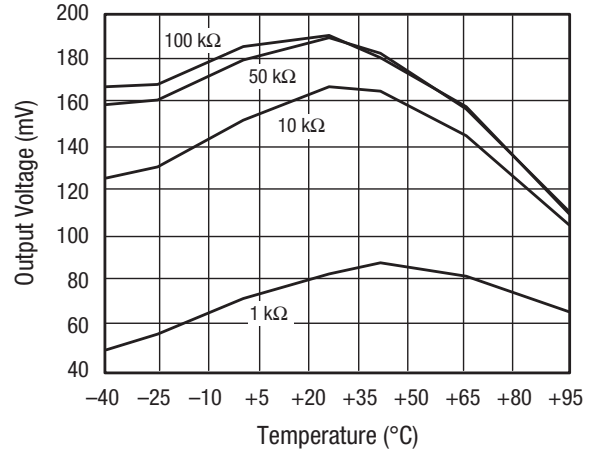


Figure 6. Output Voltage vs Temperature Over Load Resistance @ -10 dBm

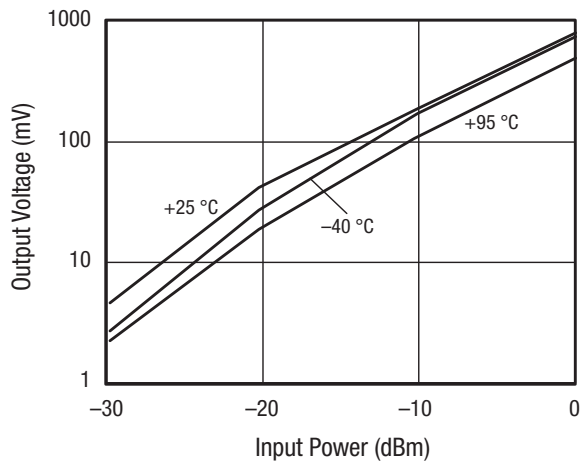


Figure 7. Output Voltage vs Input Power Over Temperature (Load Resistance = 100 kΩ)

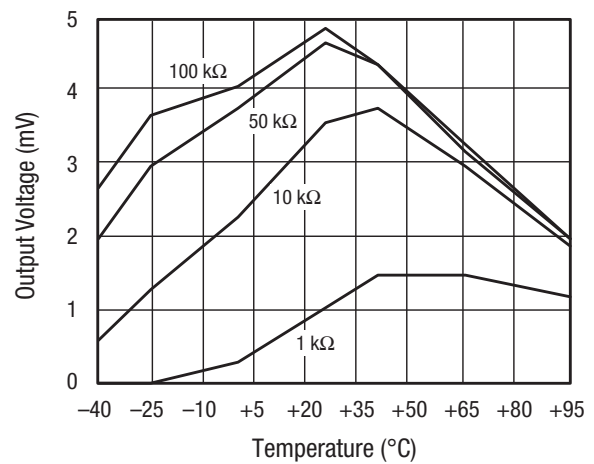
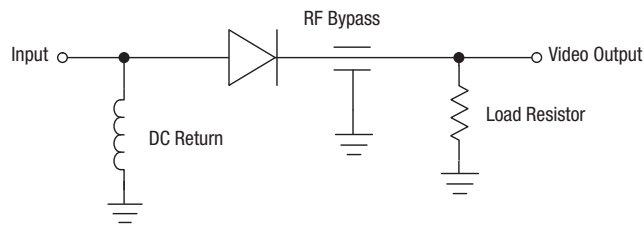


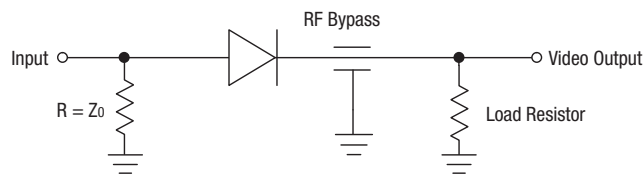
Figure 8. Output Voltage vs Temperature Over Load Resistance @ -30 dBm

Table 4. SPICE Model Parameters

| Parameter | Units | Part Number | |
|-----------|----------|-------------|-------------|
| | | CDC7630-000 | CDC7631-000 |
| Is | A | 5E-06 | 3.8E-06 |
| Rs | Ω | 20 | 51 |
| N | – | 1.05 | 1.05 |
| TT | sec | 1E-11 | 1E-11 |
| CJO | pF | 0.14 | 0.08 |
| M | – | 0.4 | 0.4 |
| Eg | eV | 0.69 | 0.69 |
| XTI | – | 2 | 2 |
| Fc | – | 0.5 | 0.5 |
| Bv | V | 2 | 2 |
| Ibv | A | 1E-04 | 1E-04 |
| VJ | V | 0.34 | 0.34 |

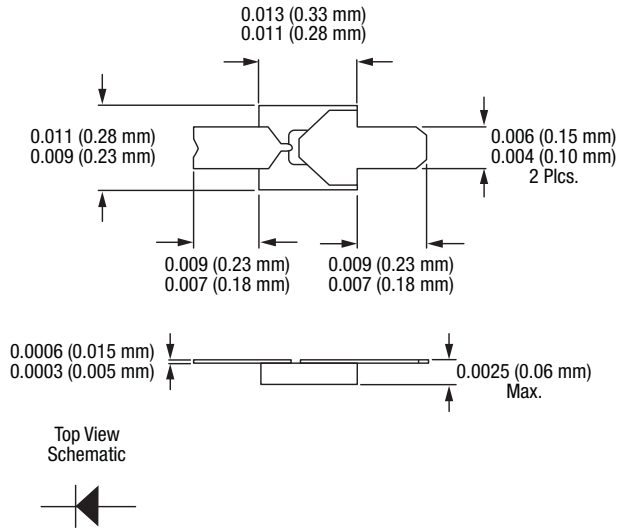


Multi-Octave: High-Sensitivity



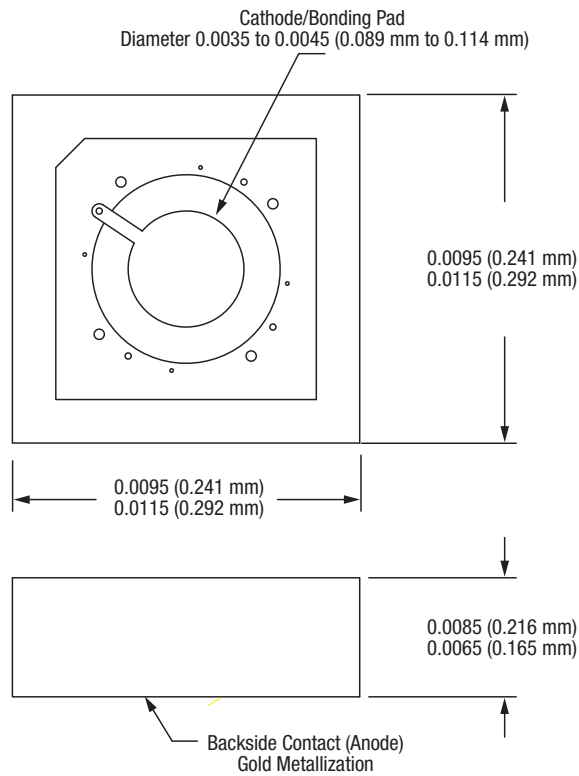
Broadband: Low-Sensitivity

Figure 9. Typical Video Detector Circuits



Dimensions are in inches (millimeters shown in parentheses)

Figure 10. 491-006 Package Dimensions



Dimensions are in inches (millimeters shown in parentheses)

S3181

Figure 11. 571-006 Package Dimensions

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