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DATA SHEET

SMS7630-061: Surface Mount, 0201 Zero Bias Silicon Schottky Detector Diode

Applications

- Sensitive RF and microwave detector circuits
- Sampling and mixer circuits
- High volume wireless systems
- WiFi and mobile devices
- Low-noise receivers for high sensitivity ID tags
- Radio designs



Features

- Extremely low barrier height
- Suitable for use above 26 GHz
- Low parasitic impedance: $C_P < 0.05 \text{ pF}$, $L_S < 0.2 \text{ nH}$
- Low profile, ultra-miniature 0201 SMT package (MSL1, 260 °C per JEDEC J-STD-020)



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

The SMS7630-061 is a silicon, zero bias Schottky detector diode with an ultra-miniature 0201 footprint and very low barrier height. This P-type diode can be used for sensitive video detector circuits and sampling circuits.

The low barrier height results in good detector sensitivity without the need for external bias current. The low junction capacitance of this diode makes it an excellent detector at frequencies up to 26 GHz and higher.

A pinout diagram for the SMS7630-061 is shown in Figure 1.

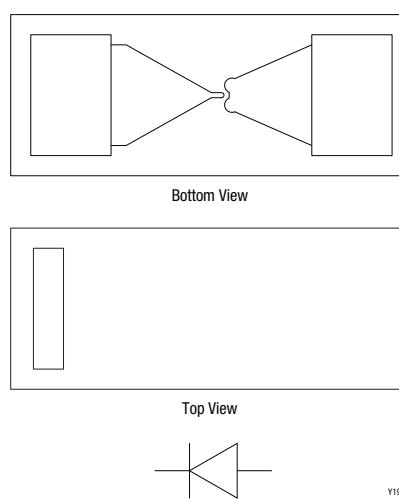


Figure 1. SMS7630-061 Pinout Diagram

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Mixer and Detector Applications

24 GHz Detector Design

A detector circuit that incorporates an SMS7630-061 Schottky diode and covers the 24 GHz band is shown in Figure 2. The RF arrives on a $50\ \Omega$ microstrip line from the left and is shorted to GND by a 90° line with a stud (GND arrives by a via). The cathode of the diode is directly connected to a 24 GHz stub. This output is loaded by a $100\ k\Omega$ resistor and a $100\ pF$ capacitor. The output voltage is fed to a 2-pin, 2.54 mm header. The circuit was built on a 0.254 mm Rogers R0-4350B substrate and measured with a power-variable 24 GHz source. A layout design is illustrated in Figure 3.

The cathode of the diode is directly connected to a 24 GHz stub. This output is loaded by a $100\ k\Omega$ resistor and a $100\ pF$ capacitor. The output voltage is fed to a 2-pin, 2.54 mm header. The circuit was built on a 0.254 mm Rogers R0-4350B substrate and measured with a power-variable 24 GHz source. A layout design is illustrated in Figure 3.

Input power versus detected voltage for this detector is shown in Figure 8.

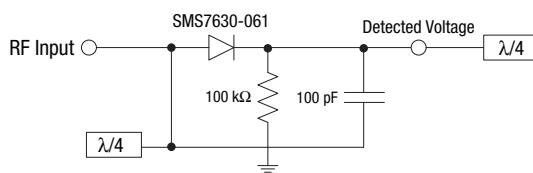


Figure 2. Schematic of a 24 GHz Detector Design

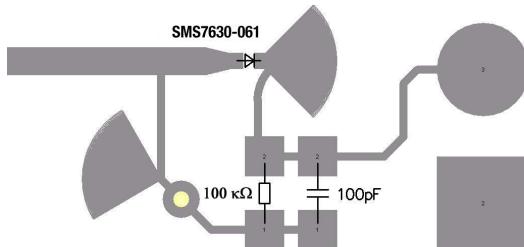


Figure 3. Layout for a 24 GHz Detector Design

24 GHz Rat-Race Mixer

A rat-race mixer that uses two SMS7630-061 Schottky diodes is shown in Figure 4. The LO signal (24 GHz) is fed from the right side and reaches a rat-race ring. The diodes are positioned 90° degrees apart from the LO input and are terminated in a stub.

Both diodes are connected (using a 1206 resistor) and are loaded by a $470\ \Omega$ resistor and a $10\ pF$ capacitor. This forms the IF output (10 MHz). The RF input (24.010 GHz) is directly connected to the rat-race ring. A layout design is illustrated in Figure 5.

The mixer has been tested with the following conditions:

LO frequency: 24 GHz
 LO power: -4 to $+6$ dBm
 RF frequency: 24.010 GHz
 RF power: -30 dBm

Typical conversion loss data for this mixer is shown in Figure 9.

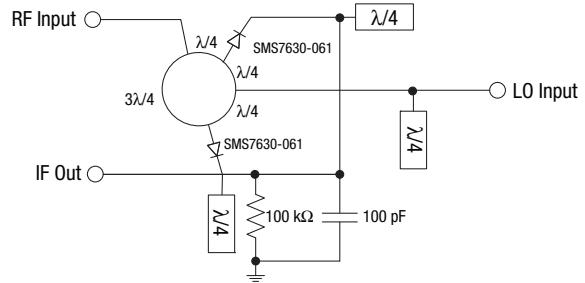


Figure 4. Schematic of a 24 GHz Rat-Race Mixer

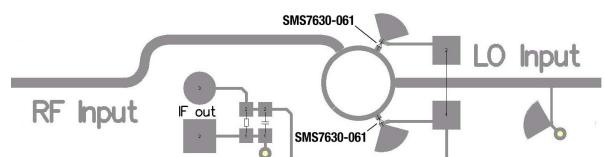


Figure 5. Layout for a 24 GHz Rat-Race Mixer

Electrical and Mechanical Specifications

The absolute maximum ratings of the SMS7630-061 are provided in Table 1. Electrical specifications are provided in Table 2. The associated SPICE model parameters are provided in Table 3.

Typical performance characteristics are shown in Figures 6 through 9.

Package Dimensions

The PCB layout footprint for the SMS7630-061 is provided in Figure 10. Package dimensions are shown in Figure 11, and tape and reel dimensions are provided in Figure 12.

Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SMS7630-061 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

Table 1. SMS7630-061 Series Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Minimum | Maximum | Units |
|-------------------------------------|--------|---------|-----------------------------------|-------|
| Reverse voltage | VR | | Minimum reverse breakdown voltage | V |
| Forward current | IF | | 50 | mA |
| Power dissipation | PD | | 75 | mW |
| Storage temperature | TSTG | -65 | +200 | °C |
| Operating temperature | TA | -65 | +150 | °C |
| Electrostatic discharge: | ESD | | | |
| Charged Device Model (CDM), Class 4 | | | 1000 | V |
| Human Body Model (HBM), Class 1A | | | 250 | V |
| Machine Model (MM), Class A | | | <30 | 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. SMS7630-061 Electrical Specifications (Note 1)
 (TA = +25 °C, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|-------------------|----------------|--|-----------|---------|------------|----------|
| Breakdown voltage | V _B | I _R = 100 μA | 1 | | | V |
| Total capacitance | C _T | V _R = 0.15 V, f = 1 MHz | | 0.2 | | pF |
| Video resistance | R _V | | | 5000 | | Ω |
| Series inductance | L _S | | | 0.2 | | nH |
| Forward voltage | V _F | I _F = 0.1 mA I _F = 1 mA | 60 135 | 180 | 120 240 | mV mV |

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

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Table 3. SPICE Model Parameters

| Parameter | Units | SMS7630-061 |
|-----------------|-------|-------------|
| I _s | A | 5E-06 |
| R _s | Ω | 20 |
| N | – | 1.05 |
| T _T | sec | 1E-11 |
| C _{JO} | pF | 0.14 |
| M | – | 0.4 |
| E _G | eV | 0.69 |
| X _{TI} | – | 2 |
| F _c | – | 0.5 |
| B _V | V | 2 |
| I _{BV} | A | 1E-04 |
| V _J | V | 0.34 |

Typical Performance Characteristics @ 25 °C

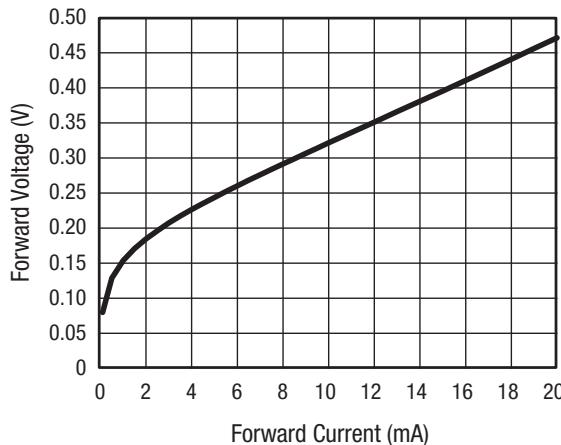


Figure 6. Forward Voltage vs Forward Current

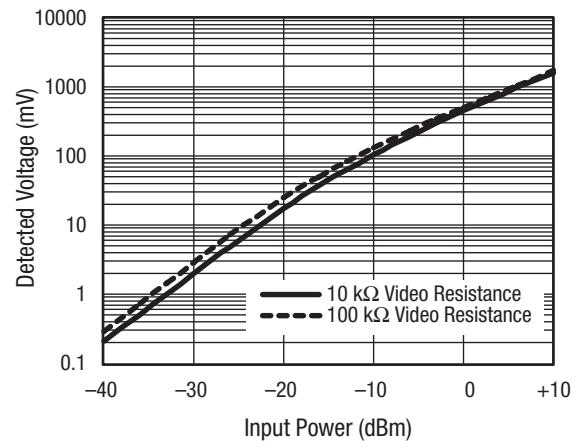


Figure 7. Detector Voltage vs Input Power

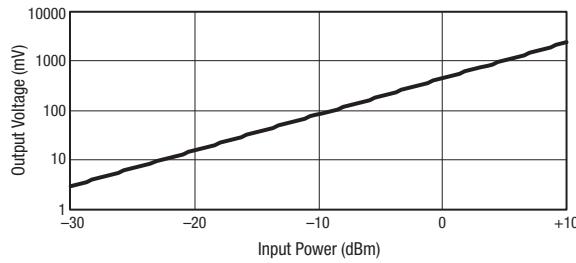


Figure 8. Output Voltage vs Input Power

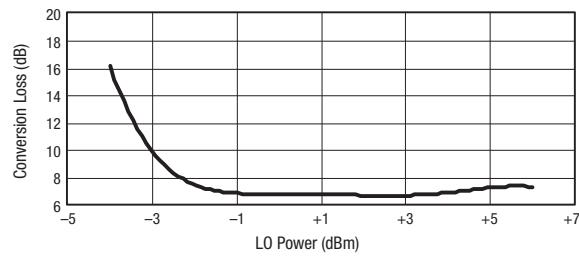
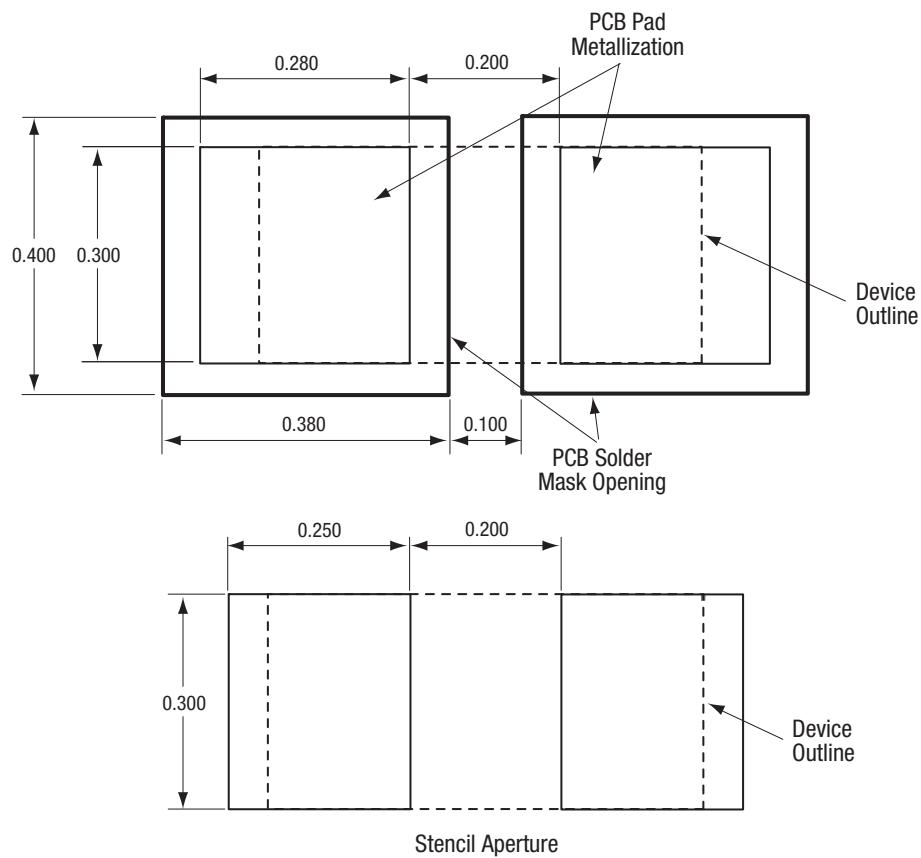


Figure 9. Conversion Loss vs LO Power

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All measurements are in millimeters

S2030

Figure 10. SMS7630-061 PCB Layout Footprint

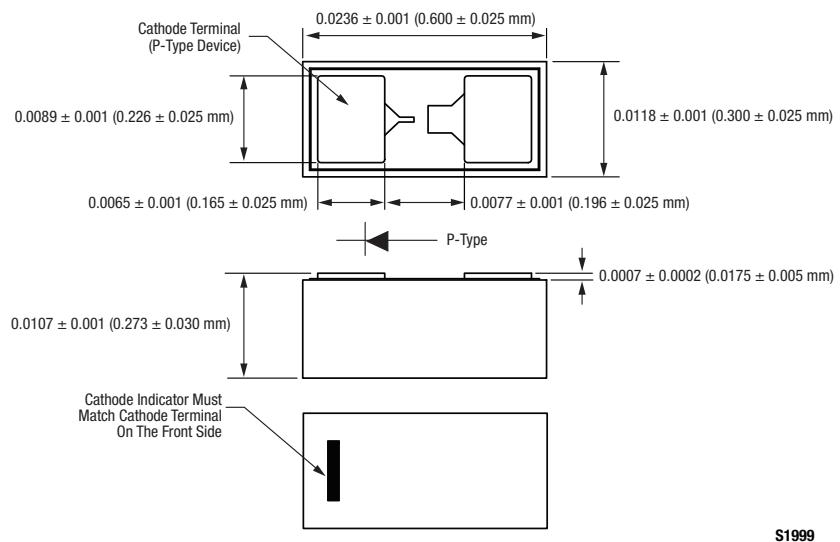


Figure 11. SMS7630-061 Package Dimension Drawing

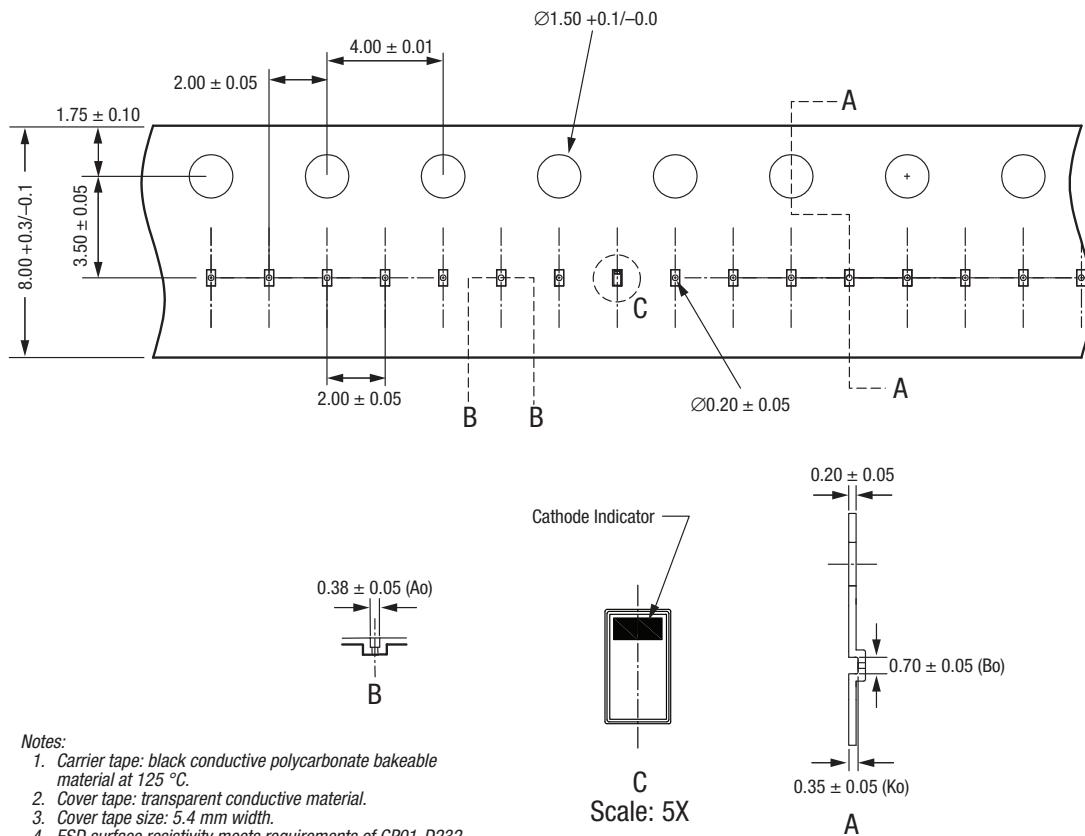


Figure 12. SMS7630-061 Tape and Reel Dimensions

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