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: $C_P < 0.05$ pF, $L_S < 0.2$ nH
- Low profile, ultra-miniature 0201 SMT package rated MSL1, 260 °C per JEDEC J-STD-020

Skyworks Pb-free products are compliant with all applicable legislation. For additional information, refer to *Skyworks Definition of Lead (Pb)-Free*, document number SQ04-0073.

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.

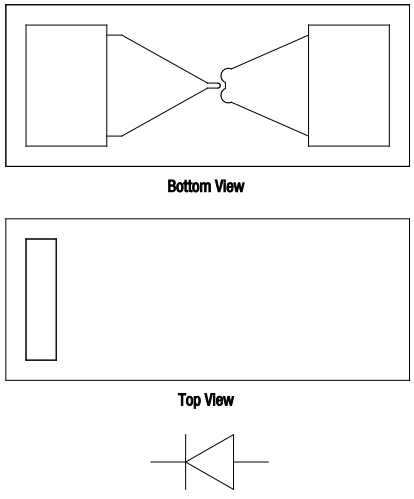

Figure 1. SMS7630-061 Pinout Diagram

Table 1. SMS7630-061 Series Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Reverse voltage	V_R		Minimum reverse breakdown voltage	V
Forward current	I_F		50	mA
Power dissipation	P_D		75	mW
Storage temperature	T_{STG}	–65	+200	°C
Operating temperature	T_A	–65	+150	°C

Note: 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.

Attention: Observe Precautions for Handling Electrostatic Sensitive Devices

ESD Human Body Model (HBM) = 250 V (Class 1A)
ESD Machine Model (MM) = <30 V (Class A)
ESD Charged Device Model (CDM) = 1000 V (Class 4)

Electrostatic Discharge (ESD) can damage this device, which must be protected from ESD at all times. 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)
(T_A = +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.

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 Ω microstrip line from the left and is shorted to GND by a 90 degree 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 kΩ 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 RO-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.

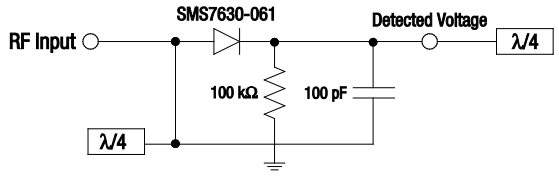

Figure 2. Schematic of a 24 GHz Detector Design

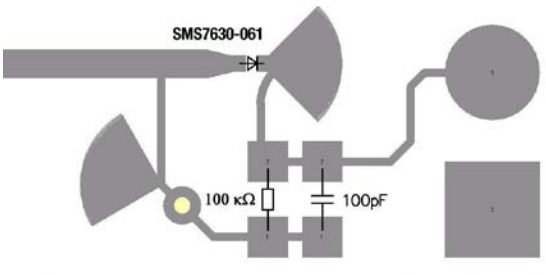

Figure 3. Layout for a 24 GHz Detector Design

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 Ω 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.

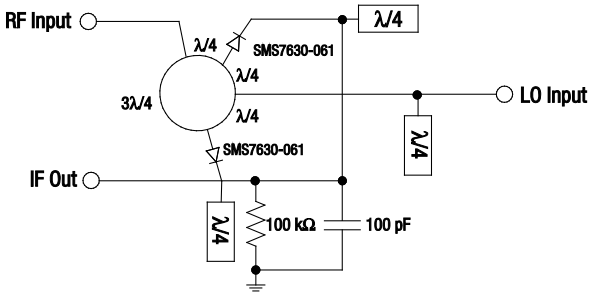

Figure 4. Schematic of a 24 GHz Rat-Race Mixer

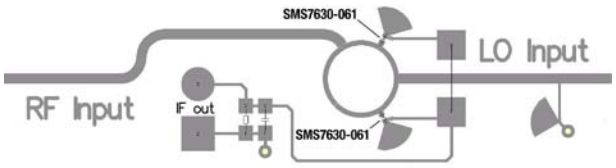

Figure 5. Layout for a 24 GHz Rat-Race Mixer

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. 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 3. SPICE Model Parameters

Parameter	Units	SMS7630-061
I_S	A	5E-06
R_S	Ω	20
N	–	1.05
TT	sec	1E-11
C_{J0}	pF	0.14
M	–	0.4
E_G	eV	0.69
XTI	–	2
F_C	–	0.5
B_V	V	2
I_{BV}	A	1E-04
V_J	V	0.34

Typical Performance Characteristics @ 25 °C

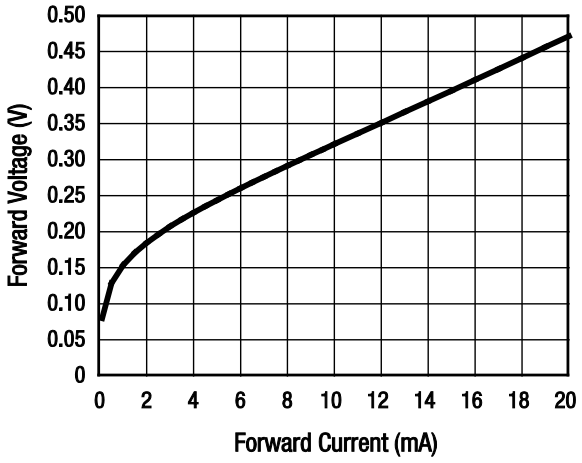

Figure 6. Forward Voltage vs Forward Current

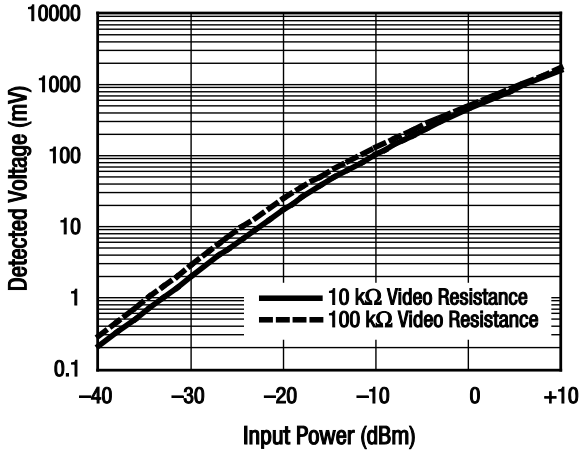

Figure 7. Detector Voltage vs Input Power

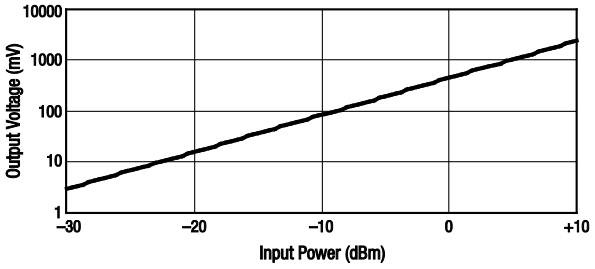

Figure 8. Output Voltage vs Input Power

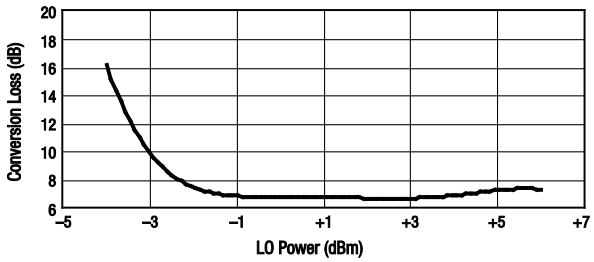

Figure 9. Conversion Loss vs LO Power

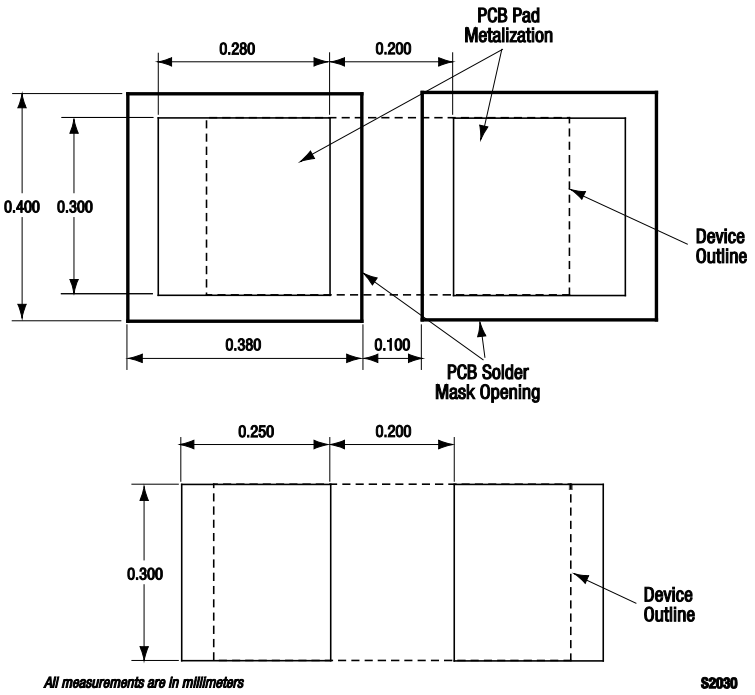

Figure 10. SMS7630-061 PCB Layout Footprint

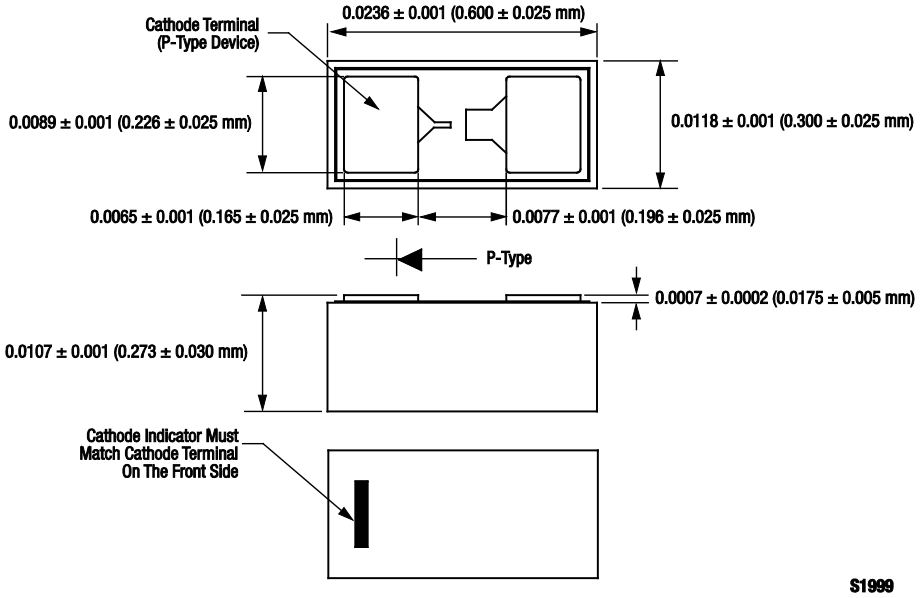

Figure 11. SMS7630-061 Package Dimension Drawing

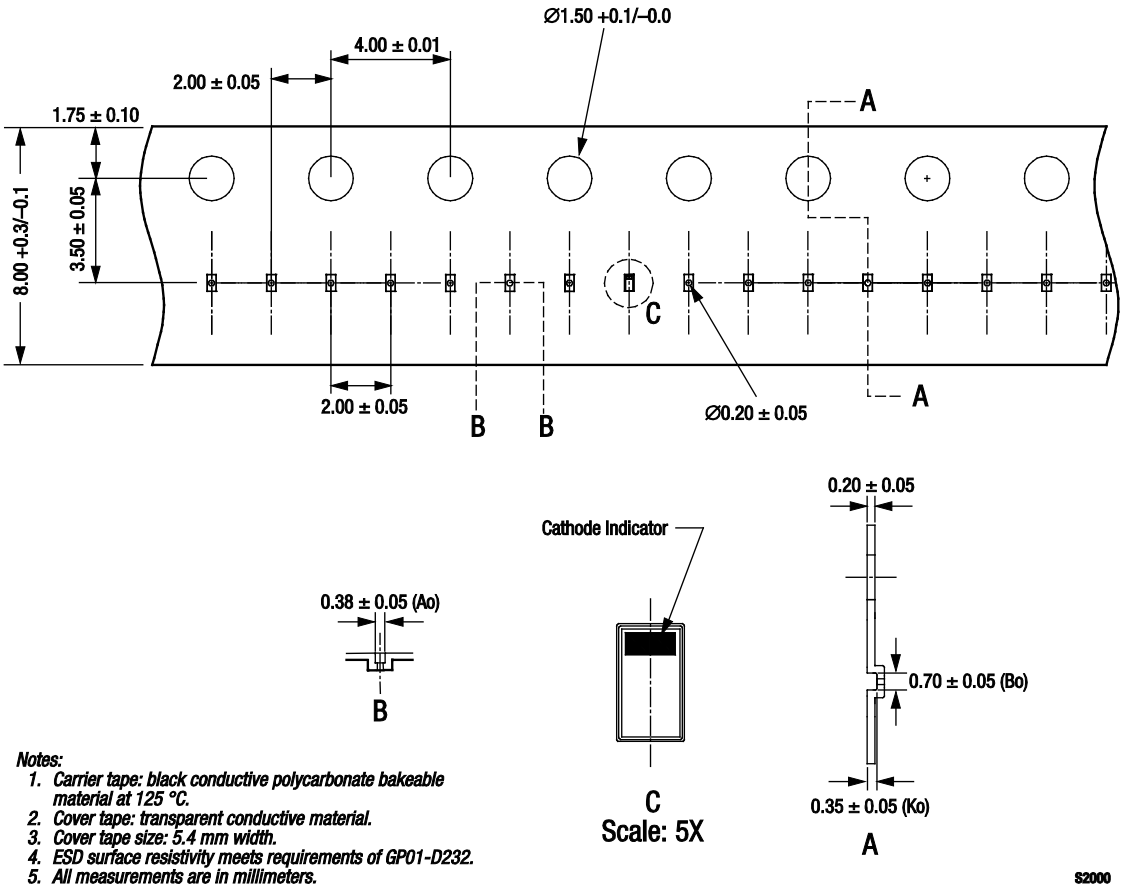

Figure 12. SMS7630-061 Tape and Reel Dimensions