DATA SHEET

SMV1493, SMV1494: Silicon Abrupt Junction Tuning Varactors, Packaged and Bondable Mesa Chips

Applications

- RF and UHF VCOs
- Voltage tuned filters
- Voltage variable phase shifters

Features

- Supports high frequencies to beyond 56 GHz
- Low series resistance for low phase noise
- Packages 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 SMV1493 and SMV1494 bare die and hermetic packaged silicon abrupt junction varactor diodes are designed for use in Voltage Controlled Oscillators (VCOs) requiring tight capacitance tolerances. The low resistance of these varactors makes them appropriate for high-Q resonators in wireless system VCOs from RF to to frequencies beyond 56 GHz.

Table 1 lists the various packages and part numbers for the SMV1493 and SMV1494 varactors.

Table 1. Hermetic Packaged Abrupt Junction Tuning Varactor Chips

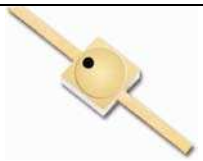			
Hermetic Stripline 240	**Hermetic Pill 203**	**Stripline 219**	**Coaxial 210**
SMV1493-240	SMV1493-203	SMV1493-219	SMV1493-210
SMV1494-240	SMV1494-203	SMV1494-219	SMV1494-210
Ls = 0.55 nH	Ls = 0.40 nH	Ls = 0.50 nH	Ls = 0.45 nH

Table 2. SMV1493 and SMV1494 Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Forward current	I_F		20	mA
Power dissipation	P_D		250	mW
Operating temperature	T_{OP}	–55	+125	°C
Storage temperature	T_{STG}	–55	+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.

***CAUTION**: Although these devices are designed to be as robust as possible, Electrostatic Discharge (ESD) can damage them. These devices 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. The SMV1493 and SMV1494 varactors are Class 0 Human Body Model (HBM) ESD devices.*

Table 3. SMV1493 and SMV1494 Electrical Specifications (Note 1)
(T_{OP} = 25 °C, Unless Otherwise Noted)

Part Number	Min. V_B, I_R @ 10 μA (V)	C_J @ 1 V (pF)	C_J @ 4 V (pF)	Max. R_S @ 1 V, 500 MHz (Ω)	Outline Drawing
SMV1493	12	17.4 to 20.0	9.87 to 11.97	0.50	150-802
SMV1494	12	36.3 to 41.7	20.57 to 25.07	0.45	150-802

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

Electrical and Mechanical Specifications

The absolute maximum ratings of the SMV1493 and SMV1494 varactors are provided in Table 2. Electrical specifications are provided in Table 3. Typical capacitance values are listed in Table 4. The typical capacitance versus reverse voltage performance of the SMV1493 and SMV1494 varactors is illustrated in Figure 1.

The SPICE model for the SMV1493 and SMV1494 varactors is shown in Figure 2 and the associated model parameters are provided in Table 5.

Package dimensions are shown in Figures 3 to 7. The SMV1493 and SMV1494 varactors are not delivered on carrier tapes.

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 SMV1493 and SMV1494 varactors are rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. They 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.

Table 4. Capacitance vs Reverse Voltage

V_R (V)	C_T (pF)	
	SMV1493	SMV1494
0	28.7	57.8
0.2	25.6	51.5
0.4	23.3	46.9
0.6	21.5	43.4
0.8	20.1	40.5
1.0	19.0	38.4
1.2	17.9	36.3
1.4	17.0	34.6
1.6	16.2	33.0
1.8	15.5	31.6
2.0	15.0	30.6
2.2	14.4	29.5
2.4	13.9	28.5
2.6	13.5	27.6
2.8	13.1	26.7
3.0	12.7	26.1
3.2	12.4	25.3
3.4	12.0	24.7
3.6	11.7	24.1
3.8	11.4	23.5
4.0	11.2	23.1
4.2	10.9	22.6
4.4	10.7	22.1
4.6	10.5	21.7
4.8	10.3	21.3
5.0	10.1	20.9
6.0	9.2	19.2
7.0	8.5	17.9
8.0	8.0	16.7
9.0	7.6	15.7
10.0	7.1	14.7

Typical Performance Characteristics

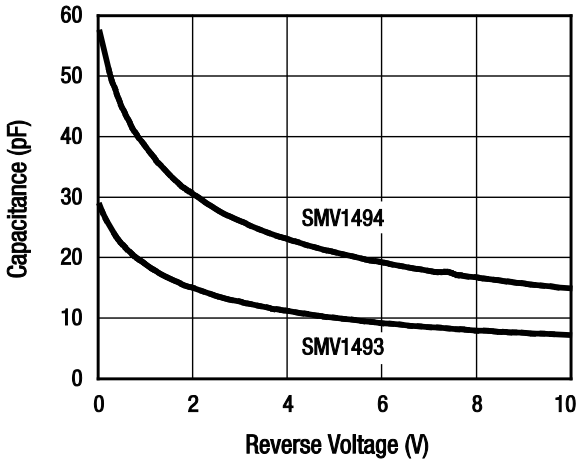

Figure 1. Capacitance vs Reverse Voltage

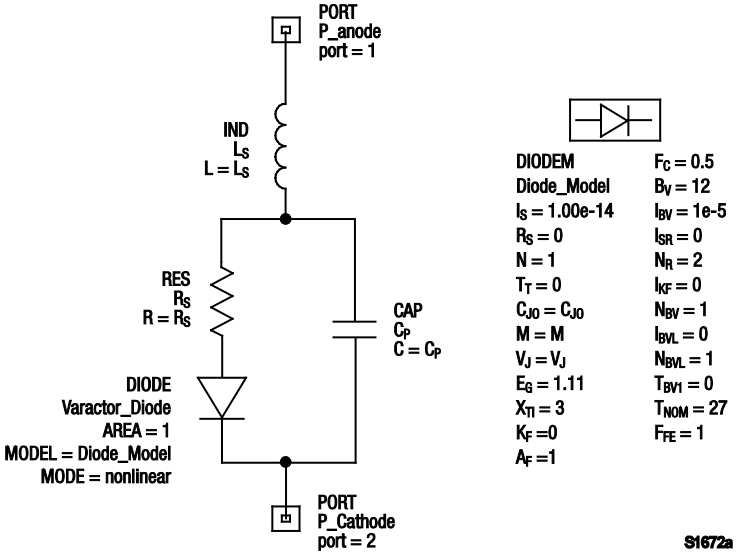

Figure 2. SPICE Model

Table 5. SPICE Model Parameters

Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1493	28.66	0.88	0.55	0	0.50
SMV1494	57.70	0.83	0.52	0	0.45

Values extracted from measured performance.

For package inductance ,Ls, refer to Table 1.

For more details, refer to the Skyworks Application Note, *Varactor SPICE Model for Approved RF VCO Applications*, document number 200315.

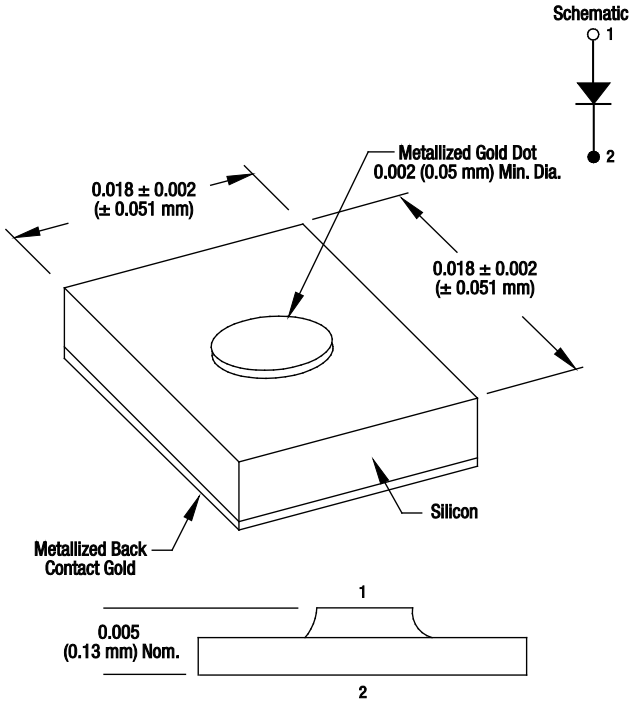

Figure 3. 150-802 Die Dimensions

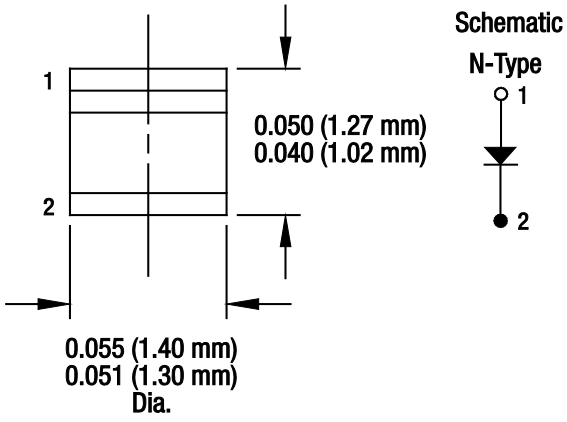

Figure 4. -203 Package Dimensions

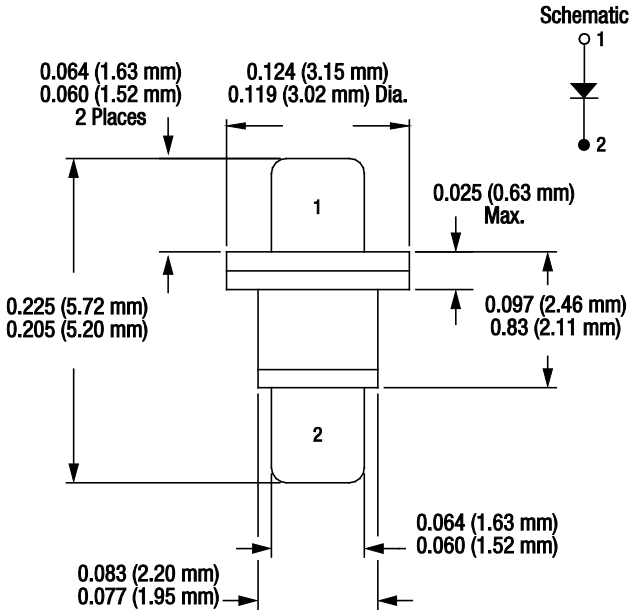

Figure 5. -210 Package Dimensions

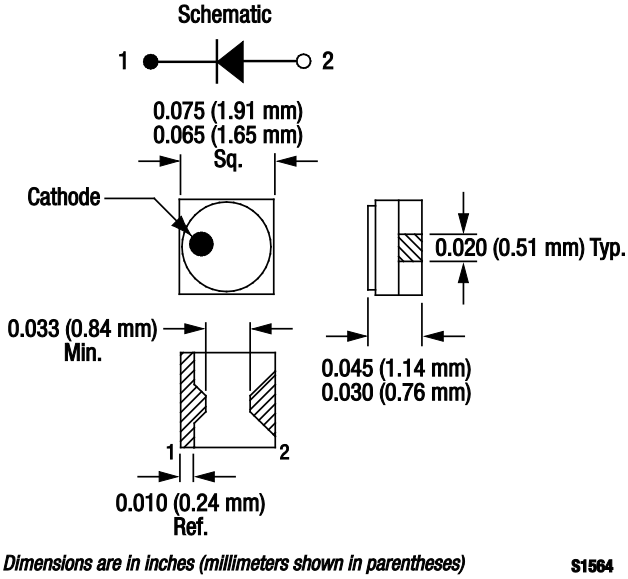

Figure 6. -219 Package Dimensions

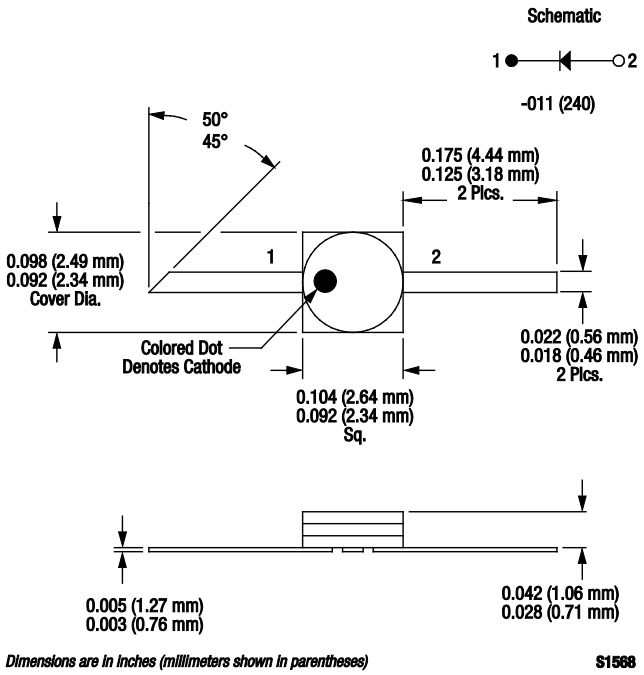

Figure 7. -240 Package Dimensions