DATA SHEET

SMV1405-SMV1413 Series: Silicon Abrupt Junction Varactors, Packaged and Bondable Chips

Applications

- VCO applications up to 18 GHz
- Voltage tuned filters
- Voltage variable phase shifters



Features

- High Q
- Low series resistance for low phase noise
- Multiple chip and hermetic packages
- 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.

Datasheet Live

Description

The SMV1405-SMV1413 group of silicon abrupt junction varactor diodes is 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 to frequencies up to 18 GHz. This family of varactors is characterized for capacitance over temperature.

Table 1 lists the various packages and part numbers of the SMV1405-SMV1413 group of varactors.

Table 1. Hermetic Packaged Abrupt Junction Tuning Varactor Chips

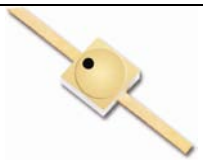
			
Hermetic Stripline 240	**Hermetic Pill 203**	**Stripline 219**	**Coaxial 210**
SMV1405-240	SMV1405-203	SMV1405-219	SMV1405-210
SMV1408-240	SMV1408-203	SMV1408-219	SMV1408-210
SMV1413-240	SMV1413-203	SMV1413-219	SMV1413-210
L_S = 0.55 nH	L_S = 0.40 nH	L_S = 0.50 nH	L_S = 0.45 nH

Table 2. SMV1405-SMV1413 Series Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Reverse voltage	V_R			30	V
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 SMV1405-SMV1413 group of varactors are Class 0 Human Body Model (HBM) ESD devices.*

Table 3. SMV1405-SMV1413 Series Electrical Specifications (Note 1)
(T_{OP} = 25 °C, Unless Otherwise Noted)

Part Number	Min. V_B, I_R @ 10 μA (V)	C_T @ 4 V (pF)	Min. $\frac{C_T \text{ @ 0 V}}{C_T \text{ @ 30 V}}$ (Ratio)	Max. R_S @ 4 V, 500 MHz (Ω)	Typ. Q @ 4 V, 50 MHz	Die Drawing
SMV1405	30	1.08 to 1.32	4.1	0.80	3200	150-813
SMV1408	30	1.62 to 1.98	4.1	0.60	2900	150-813
SMV1413	30	3.59 to 4.29	4.2	0.35	2400	150-813

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

Electrical and Mechanical Specifications

The absolute maximum ratings of the SMV1405-SMV1413 varactors are provided in Table 2. Electrical specifications are provided in Table 3. Typical capacitance values are listed in Table 4. Typical performance characteristics of the SMV1405-SMV1413 varactors are illustrated in Figures 1 and 2.

The SPICE model for the SMV1405- SMV1413 varactors is shown in Figure 3 and the associated model parameters are provided in Table 5.

Package dimensions are shown in Figures 4 to 8. The SMV1405-SMV1413 series of 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 SMV1405- SMV1413 series of 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. Production quantities of this product are shipped in a standard tape and reel format.

Table 4. Capacitance vs Reverse Voltage

V_R (V)	C_T (pF)		
	SMV1405	SMV1408	SMV1413
0	2.67	4.08	9.24
0.5	2.12	3.36	7.39
1.0	1.84	2.94	6.37
1.5	1.70	2.60	5.71
2.0	1.55	2.38	5.22
2.5	1.44	2.24	4.85
3.0	1.34	2.08	4.55
4.0	1.25	1.88	4.10
5.0	1.17	1.72	3.77
10.0	0.95	1.28	2.85
20.0	0.77	1.01	2.12
30.0	0.63	0.95	1.77

Typical Performance Characteristics

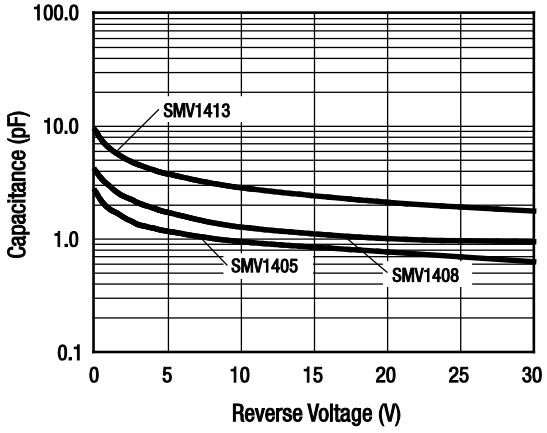


Figure 1. Capacitance vs Reverse Voltage

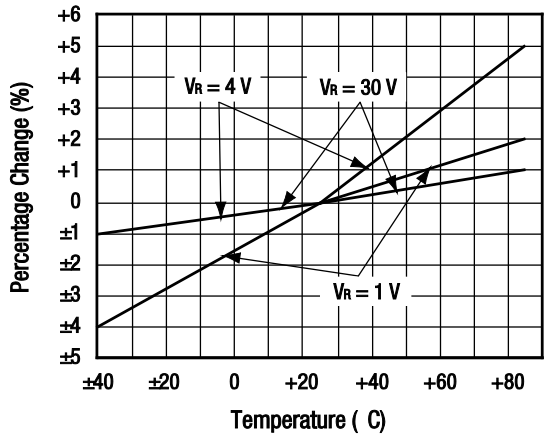


Figure 2. Relative Capacitance Change vs Temperature

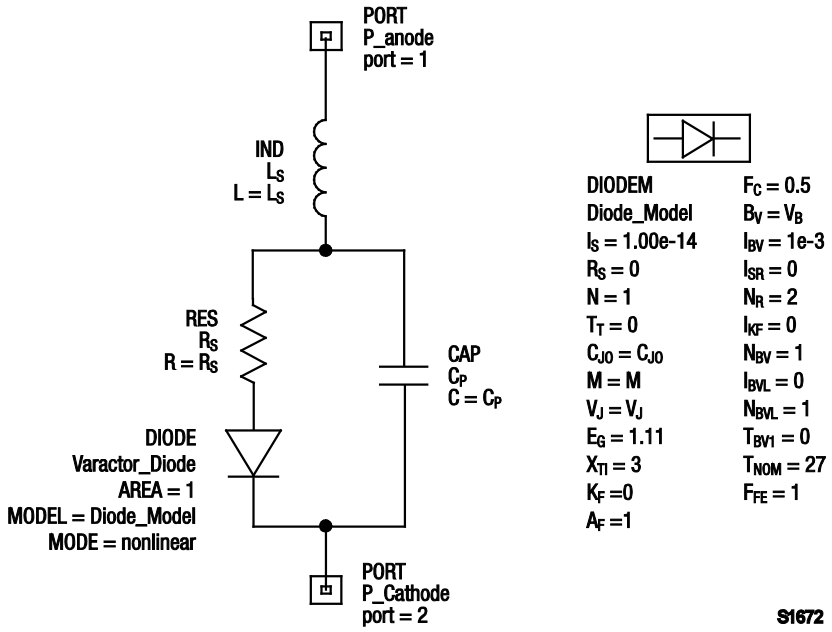


Figure 3. SPICE Model

Table 5. SPICE Model Parameters

Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1405	2.37	0.77	0.5	0.29	0.80
SMV1408	3.89	0.92	0.5	0.21	0.60
SMV1413	8.92	0.87	0.5	0.30	0.35

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.

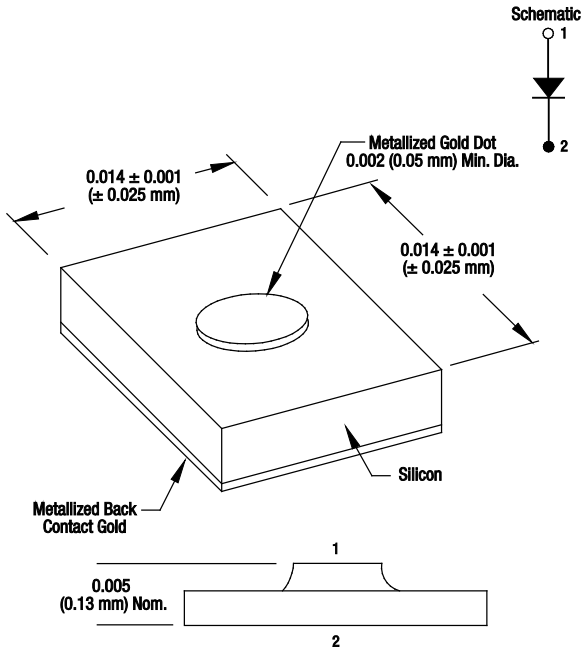


Figure 4. 150-813 Die Dimensions

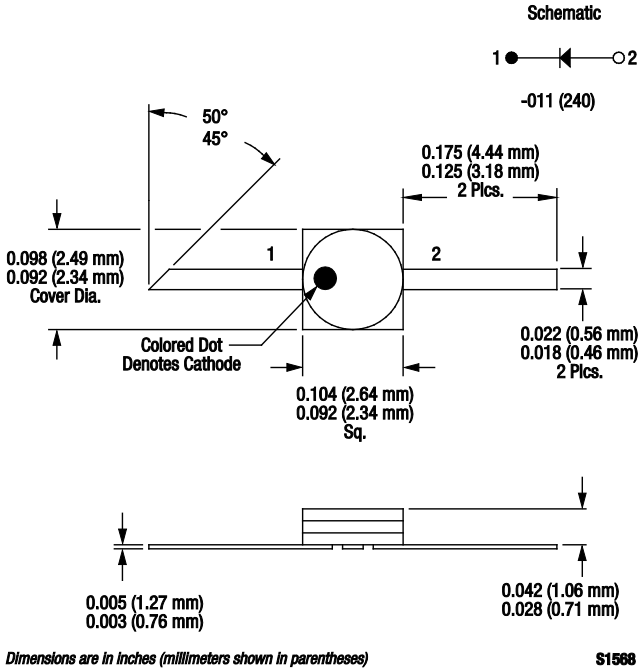
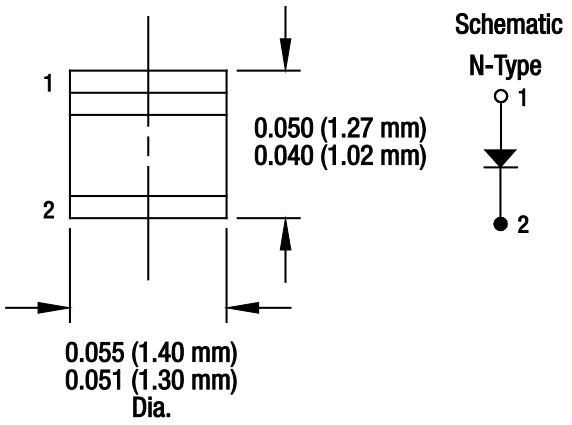


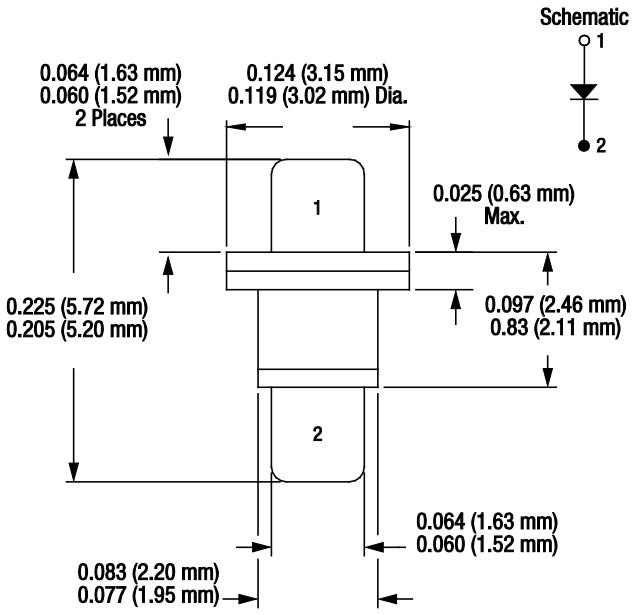
Figure 5. -240 Package Dimensions



Dimensions are in inches (millimeters shown in parentheses)

S1569

Figure 6. -203 Package Dimensions



Dimensions are in inches (millimeters shown in parentheses)

S1570

Figure 7. -210 Package Dimensions

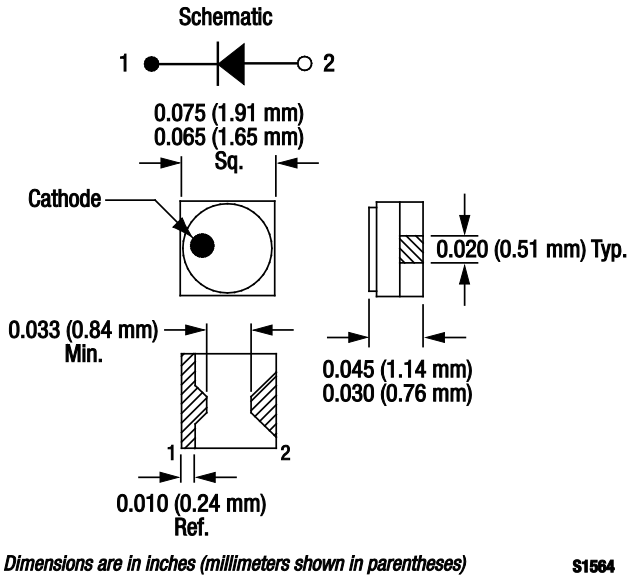


Figure 8. -219 Package Dimensions

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