DATA SHEET

SMV1405 to SMV1413 Series: Silicon Abrupt Junction Varactor Bondable Chips

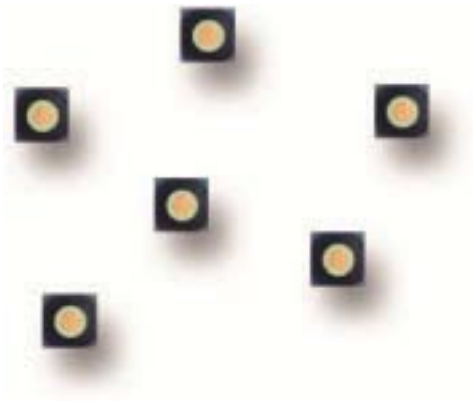
Applications

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

Features

- High Q
- Low series resistance for low phase noise

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 SMV1405 to 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.

Electrical and Mechanical Specifications

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

The SPICE model for the SMV1405 to SMV1413 varactors is shown in Figure 3 and the associated model parameters are provided in Table 4.

Table 1. SMV1405 to SMV1413 Series Absolute Maximum Ratings (Note 1)

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
Electrostatic discharge:	ESD				
Human Body Model (HBM), Class 0				<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 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.*

Table 2. SMV1405 to 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
SMV1405-000	30	1.08 to 1.32	4.1	0.80	3200	150-813
SMV1408-000	30	1.62 to 1.98	4.1	0.60	2900	150-813
SMV1413-000	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.

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.

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).

Package dimensions are shown in Figure 4. The SMV1405 to SMV1413 series of varactors are not delivered on carrier tapes.

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

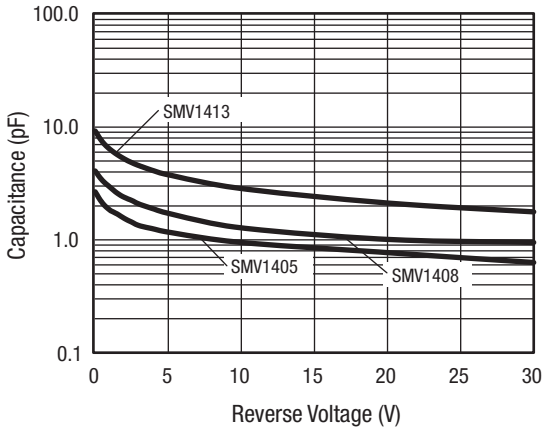


Figure 1. Capacitance vs Reverse Voltage

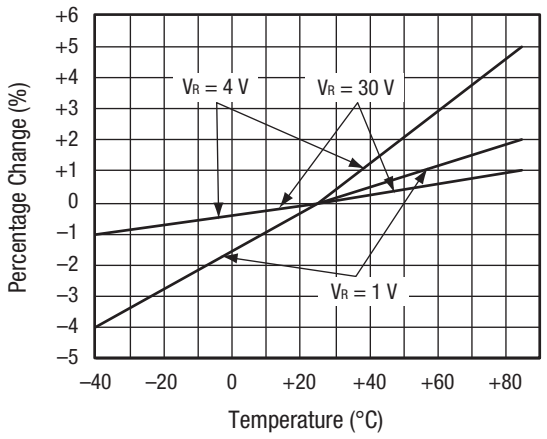


Figure 2. Relative Capacitance Change vs Temperature

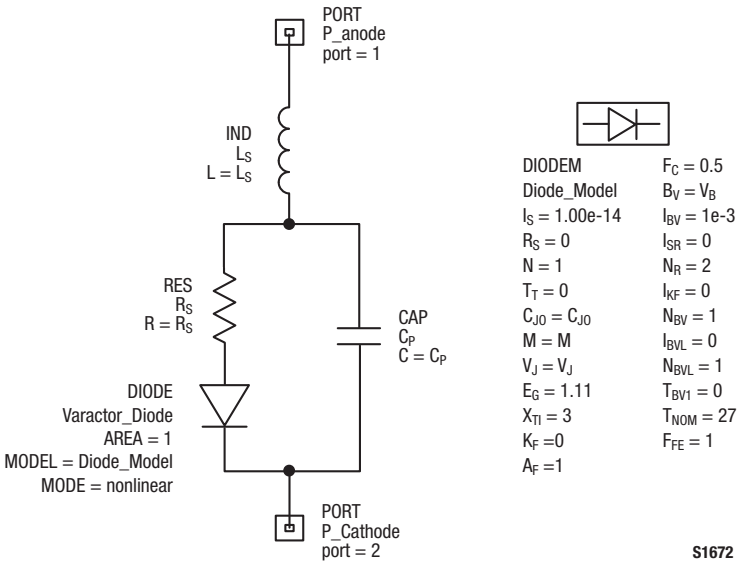


Figure 3. SPICE Model

Table 5. SPICE Model Parameters (Note 1)

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

Note 1: Values extracted from measured performance.
For more details, refer to the Skyworks Application Note, *Varactor SPICE Models for RF VCO Applications*, document #200315.

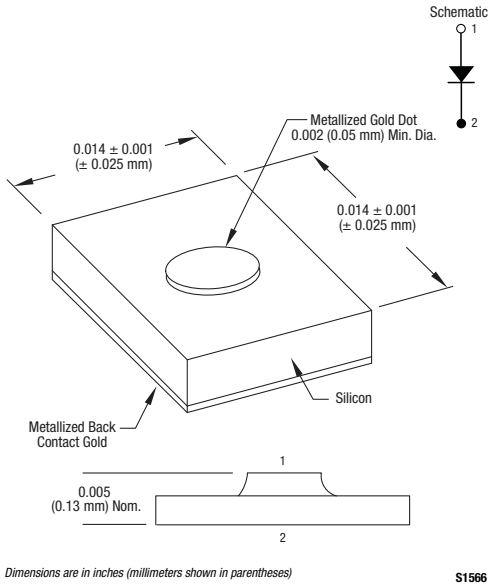


Figure 4. 150-813 Die Dimensions