

**DATA SHEET**

# **SMV1405-040LF: Surface Mount, 0402 Silicon Abrupt Tuning Varactor Diode**

**Applications**

- Wide bandwidth VCOs
- Wide range voltage-tuned phase shifters and filters

**Features**

- Low series resistance: 0.8  $\Omega$  typical
- High Q: 3200 typical
- Industry-standard 0402 footprint
- Packages rated 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 SMV1405-040LF is a silicon abrupt junction varactor diode designed for use in Voltage Controlled Oscillators (VCOs) that require tight capacitance tolerances. The low resistance of this varactor makes it appropriate for high-Q resonators in wireless system VCOs operating at frequencies above 2.5 GHz.

The SMV1405-040LF is compatible with the industry-standard 0402 PCB footprint.

**Table 1. SMV1405-040LF Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Maximum	Units
Forward current	$I_F$		20	mA
Reverse voltage	$V_R$		30	V
Dissipated power @ 25 °C	$P_D$		750	mW
Storage temperature	$T_{STG}$	-55	+200	°C
Junction temperature	$T_J$	-55	+175	°C
Solder interface temperature	$T_S$	-40	+85	°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 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. SMV1405-040LF Electrical Specifications (Note 1)**  
**( $T_S = +25\text{ °C}$ , Characteristic Impedance  $[Z_0] = 50\ \Omega$ , Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Reverse current	$I_R$	$V_R = 24\text{ V}$			20	nA
Capacitance	$C_T$	$f = 1\text{ MHz}, V_R = 4\text{ V}$	1.16		1.45	pF
Capacitance ratio	$C_{TR}$	$C_T @ 0\text{ V}/C_T @ 30\text{ V}$	3.8			—
Series resistance	$R_S$	$f = 500\text{ MHz}, V_R = 4\text{ V}$			0.8	$\Omega$
Series inductance	$L_S$			0.45		nH
Breakdown voltage	$V_{BR}$	$I_R = 10\ \mu\text{A}$	30			V

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

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SMV1405-040LF are provided in Table 1. Electrical specifications are provided in Table 2. Table 3 summarizes the capacitance for reverse voltages between 0 and 20 V.

Typical performance characteristics of the SMV1405-040LF are illustrated in Figures 1 and 2.

The SPICE model for the SMV1405-040LF varactor is shown in Figure 3 and the associated model parameters are provided in Table 4.

## Package Dimensions

The PCB layout footprint for the SMV1405-040LF is provided in Figure 4. Typical case markings are shown in Figure 5. Package dimensions for the SMV1405-040LF are provided in Figure 6. Tape and reel dimensions are provided in Figure 7.

## Package and Handling Information

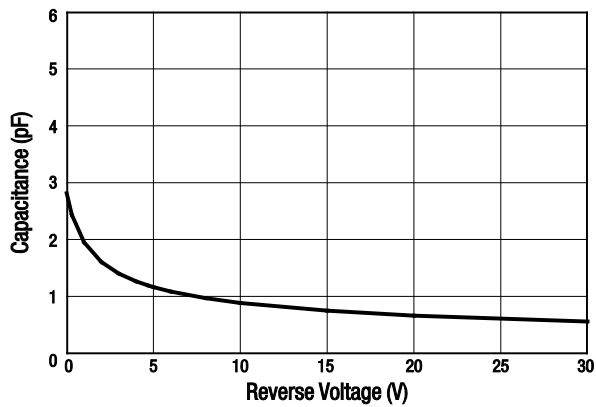
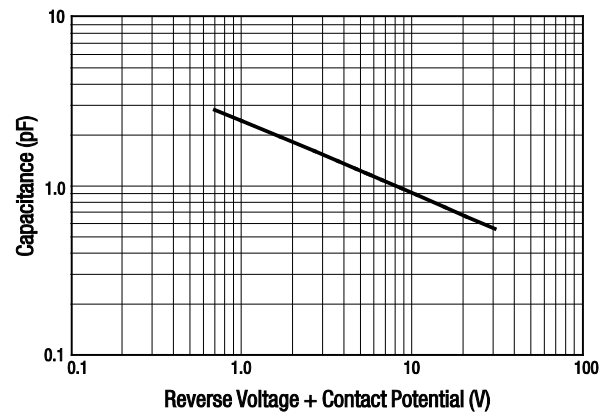
Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SMV1405-040LF 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. Capacitance vs Reverse Voltage**

$V_R$ (V)	$C_T$ (pF)
0	2.81
0.3	2.43
1.0	1.95
2.0	1.60
3.0	1.40
4.0	1.26
4.7	1.19
5.0	1.16
6.0	1.08
8.0	0.97
10	0.89
15	0.75
20	0.66
30	0.56

**Typical Performance Characteristics**(T<sub>A</sub> = 25 °C, Unless Otherwise Noted)**Figure 1. Capacitance vs Reverse Voltage****Figure 2. Capacitance vs Reverse Voltage + Contact Potential**

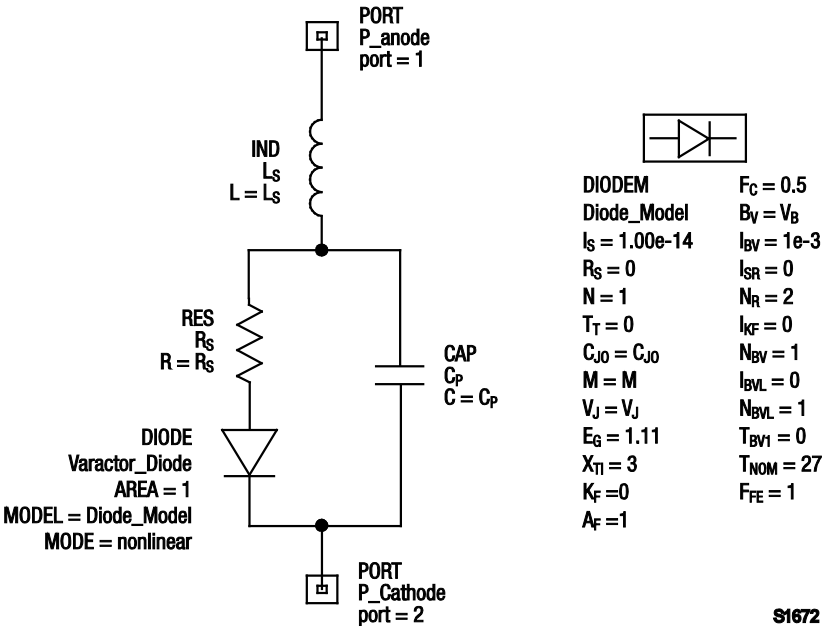
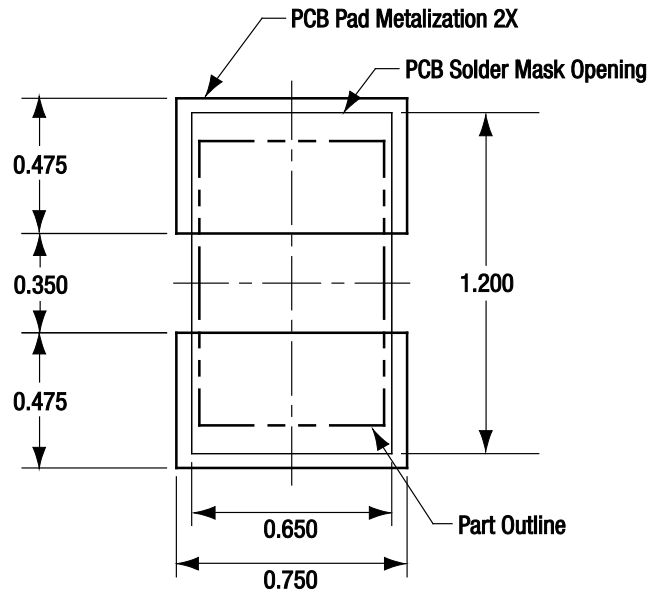


Figure 3. SPICE Model

Table 4. SPICE Model Parameters

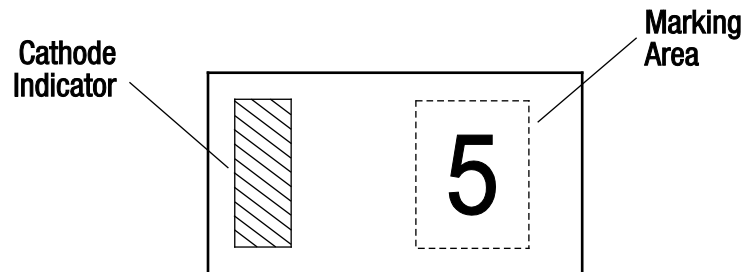
Part Number	Cj0 (pF)	Vj (V)	M	Cp (pF)	Rs (Ω)	Ls (nH)
SMV1405-040LF	2.78	0.7	0.5	0.15	0.75	0.45



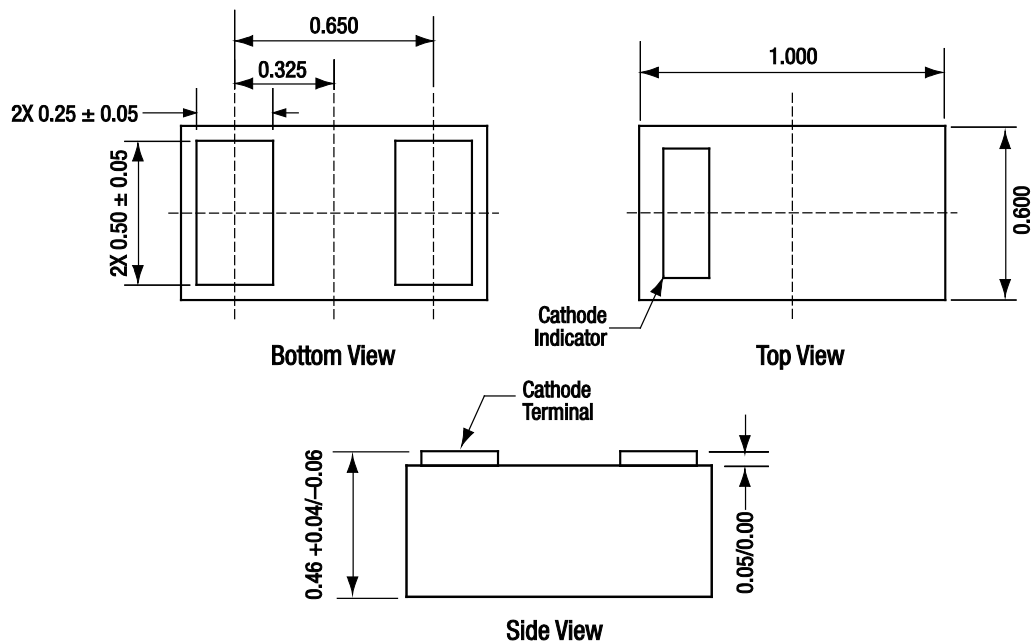
All measurements in millimeters

S1997

**Figure 4. SMV1405-040LF PCB Layout Footprint**



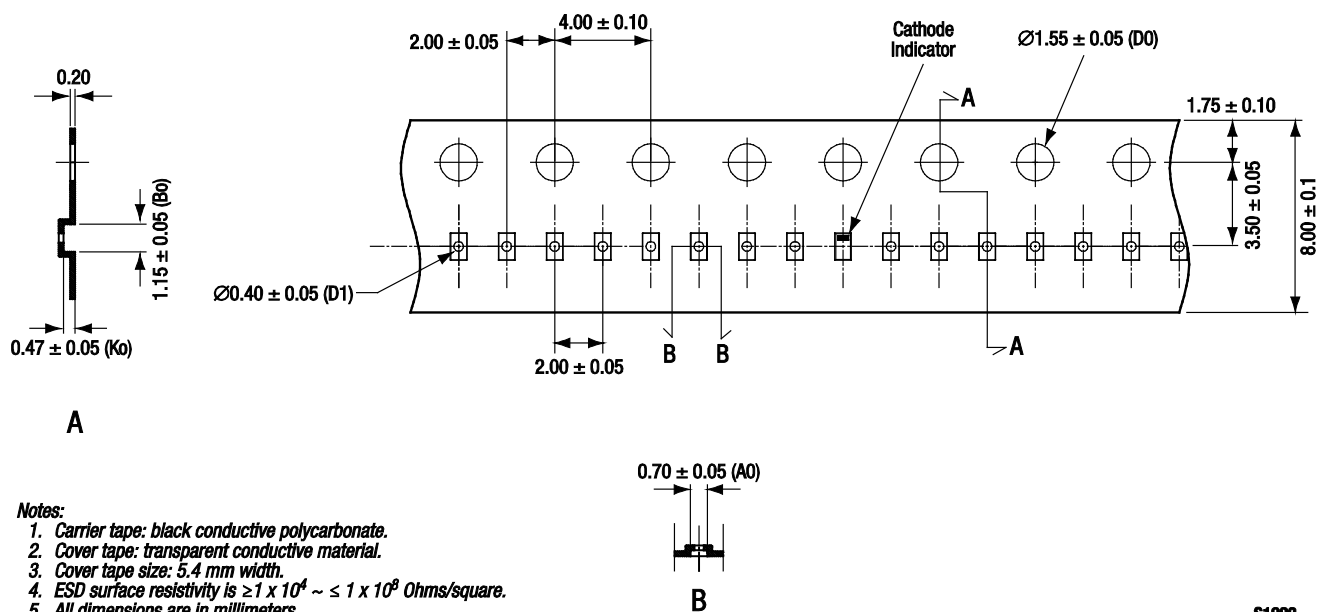
**Figure 5. Typical Case Markings  
(Top View)**



**All dimensions in millimeters**

**\$1892**

**Figure 6. SMV1405-040LF Package Dimensions**

**S1922**

### Figure 7. SMV1405-040LF Tape and Reel Dimensions

## Ordering Information

Model Name	Manufacturing Part Number
SMV1405-040LF Surface Mount Abrupt Tuning Varactor Diode	SMV1405-040LF

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