

# SMV1702-011LF Hyperabrupt Junction Tuning Varactor

## Applications

- Low-noise and wideband UHF and VHF VCOs
- High-volume, low-voltage VCOs

## Features

- Low series resistance
- High capacitance ratio
- Small footprint SOD-323 package (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 SMV1702-011LF silicon hyperabrupt junction varactor diode is specifically designed for battery operation. The high capacitance ratio and low series resistance make this varactor appropriate for low-noise Voltage Controlled Oscillators (VCOs) used at frequencies in wireless systems.

Table 1 describes the SOD-323 package and marking of the SMV1702-011LF varactor.

**Table 1. Packaging and Marking**


Single
SOD-323 Green™
<b>SMV1702-011LF</b> Marking: HJ
$L_s = 1.5 \text{ nH}$



The Pb-free symbol or "LF" in the part number denotes a lead-free, RoHS-compliant package unless otherwise noted as Green™. Tin/lead (Sn/Pb) packaging is not recommended for new designs.

**Table 2. SMV1702-011LF Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Reverse voltage	V <sub>R</sub>			10	V
Forward current	I <sub>F</sub>			20	mA
Power dissipation	P <sub>DIS</sub>			250	mW
Operating temperature	T <sub>OP</sub>	-55		+125	°C
Storage temperature	T <sub>STG</sub>	-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 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. The SMV1702-011LF varactor is a Class 0 Human Body Model (HBM) ESD device.

**Table 3. SMV1702-011LF Electrical Specifications (Note 1)**  
(T<sub>OP</sub> = 25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Reverse current	I <sub>R</sub>	V <sub>R</sub> = 8 V		<0.01	20	nA
Reverse breakdown voltage	V <sub>BR</sub>	I <sub>R</sub> = 10 μA	10			V
Capacitance	C <sub>T</sub>	F = 1 MHz				
		V <sub>R</sub> = 0.1 V	90	100	110	pF
		V <sub>R</sub> = 2 V	41	46	50	pF
		V <sub>R</sub> = 4 V	22	25	29	pF
Capacitance ratio	C <sub>TR</sub>	C <sub>T</sub> (0.1 V/4 V)	3.6	4.0		-
Series resistance	R <sub>S</sub>	V <sub>R</sub> = 5 V, F = 470 MHz		0.45	1.25	Ω

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

### Electrical and Mechanical Specifications

The absolute maximum ratings of the SMV1702-011LF varactor is provided in Table 2. Electrical specifications are provided in Table 3. Typical capacitance values are listed in Table 4. Typical capacitance vs voltage performance for the SMV1702-011LF varactor is illustrated in Figure 1.

The SPICE model for the SMV1702-011LF varactor is shown in Figure 2 and the associated model parameters are provided in Table 5.

Package dimensions are shown in Figure 3, and tape and reel dimensions are provided in Figure 4.

### 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.

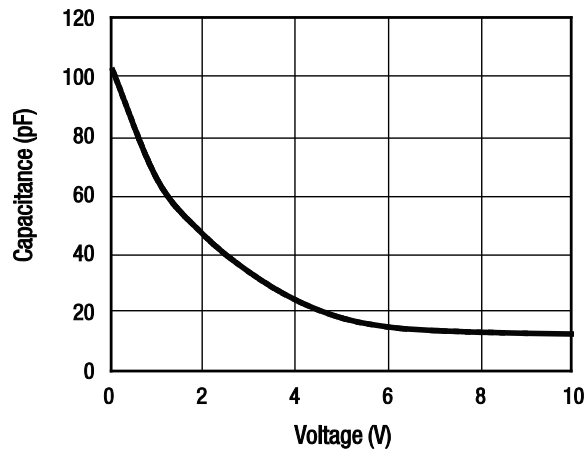
The SMV1702-011LF varactor is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. They can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

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**

Voltage (V <sub>R</sub> ) (V)	Typical Capacitance (C <sub>T</sub> ) (pF)
0	103.3
1	65.1
2	46.38
3	33.57
4	24.20
5	18.08
6	15.01
7	13.80
8	13.21
9	12.84
10	12.58

**Typical Performance Characteristics**



**Figure 1. Capacitance vs Voltage**

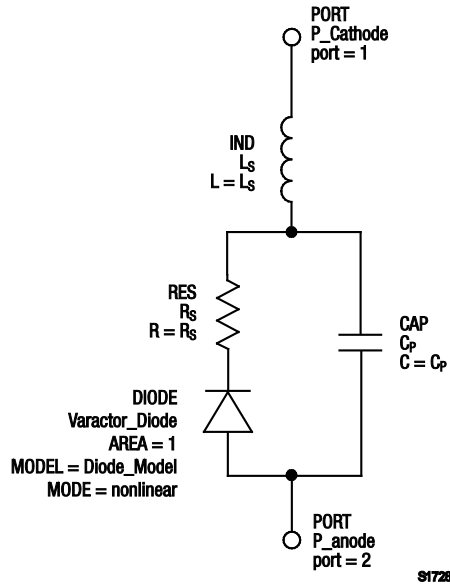


Figure 2. SPICE Model

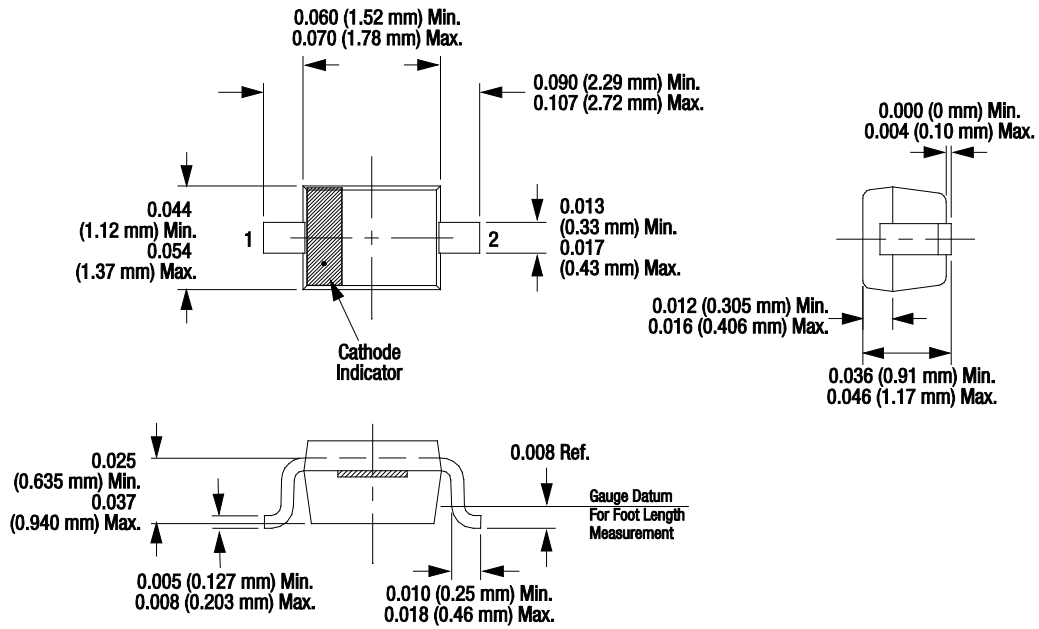
Table 5. SPICE Model Parameters (1 of 2)

Parameter	Description	Unit	Value	Default
IS	Saturation current (with N, determines the DC characteristics of the diode)	A	–	1e-14
Rs	Series resistance	–	0.5	0
N	Emission coefficient (with IS, determines the DC characteristics of the diode)	–	–	1
TT	Transit time	s	–	0
Cj0	Zero-bias junction capacitance (with Vj and M, defines nonlinear junction capacitance of the diode)	F	92.65e-12	0
Vj	Junction potential (with Cj0 and M, defines nonlinear junction capacitance of the diode)	V	25	1
M	Grading coefficient (with Cj0 and Vj, defines nonlinear junction capacitance of the diode)	–	12.76	0.5
Eg	Energy gap (with XTI, helps define the dependence of IS on temperature)	eV	–	1.11
XTI	Saturation current temperature exponent (with Eg, helps define the dependence of IS on temperature)	–	–	3
KF	Flicker noise coefficient	–	–	0
AF	Flicker noise exponent	–	–	1
FC	Forward-bias depletion capacitance coefficient	–	–	0.5
Bv	Reverse breakdown voltage	V	18	–
Ibv	Current at reverse breakdown voltage	A	1e-5	1e-3
ISR	Recombination current parameter	A	–	0
NR	Emission coefficient for ISR	–	–	2
IKF	High-injection knee current	A	–	–
NBV	Reverse breakdown ideality factor	–	–	1

**Table 5. SPICE Model Parameters (2 of 2)**

Parameter	Description	Unit	Value	Default
IBVL	Low-level reverse breakdown knee current	A	–	0
NBVL	Low-level reverse breakdown ideality factor	–	–	1
TNOM	Nominal ambient temperature at which these model parameters were derived	°C	–	27
FFE	Flicker noise frequency exponent	–	–	1
Cpkg		pF	10.36	–
LS		nH	1.5	–

**Note:** This Table contains typical SPICE parameters for the SMV1702-011LF. The default value should be used for any parameter for which the Value column is blank.

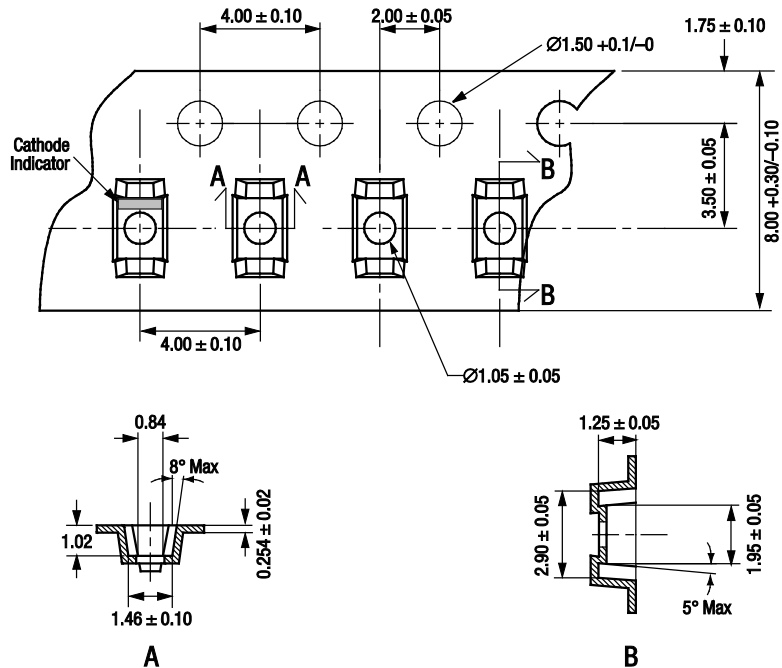


Dimensions are in inches (millimeters shown in parentheses)

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**Figure 3. SOD-323 Package Dimensions**

**DATA SHEET • SMV1702-011LF HYPERABRUPT JUNCTION TUNING VARACTOR**



**Notes:**

1. Carrier tape: black conductive polycarbonate or polystyrene.
2. Cover tape: transparent conductive material.
3. Cover tape size: 5.5 mm width.
4. ESD surface resistivity is  $\geq 1 \times 10^6 \sim \leq 1 \times 10^{11}$  Ohms/square.
5. 10 sprocket hole pitch cumulative tolerance:  $\pm 0.20$  mm.
6.  $A_0$  and  $B_0$  measured on plane 0.30 mm above bottom of the pocket.
7. All measurements are in millimeters.
8. Standard reel size is 7 inches. Standard reel quantity is 3000 pcs.

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**Figure 4. SOD-323 Tape and Reel Dimensions**

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