

DATA SHEET

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)

NEW


Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances) compliant packaging.


Description

The SMV1702-011LF silicon hyperabrupt junction varactor diode is specifically designed for battery operation. The high capacitance ratio and low reverse voltage 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
SMV1702-011LF Marking: HJ
Ls = 1.5 nH



LF denotes lead (Pb)-free, RoHS-compliant packaging option as an alternative to the standard Skyworks tin/lead (Sn/Pb) packaging.

Table 2. SMV1702-011LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Reverse voltage	V_R			15	V
Forward current	I_F			20	mA
Power dissipation	P_{DIS}			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 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)
($T_{OP} = 25\text{ °C}$, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Reverse current	I_R	$V_R = 8\text{ V}$		<0.01	20	nA
Reverse breakdown voltage	V_{BR}	$I_R = 10\text{ }\mu\text{A}$	10			V
Capacitance	C_T	$F = 1\text{ MHz}$				
		$V_R = 0.1\text{ V}$	90	100	50	pF
		$V_R = 2\text{ V}$	41	46	29	pF
		$V_R = 4\text{ V}$	22	25	—	pF
Capacitance ratio	C_{TR}	$C_T (0.1\text{ V}/4\text{ V})$	3.6	4.0		—
Series resistance	R_S	$V_R = 5\text{ V}, F = 470\text{ MHz}$		0.45	1.25	Ω

Note 1: Performance is guaranteed only under the conditions listed in this Table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

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.

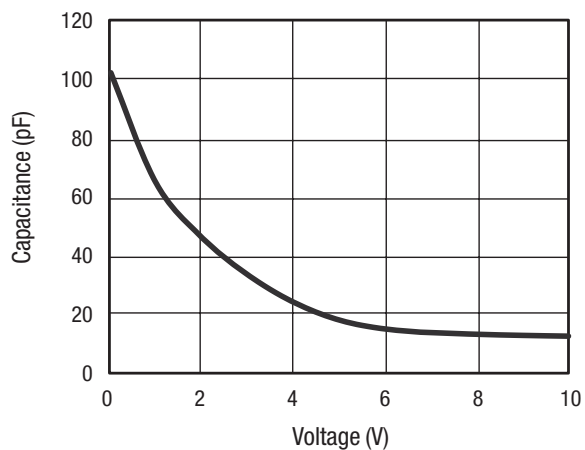
Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

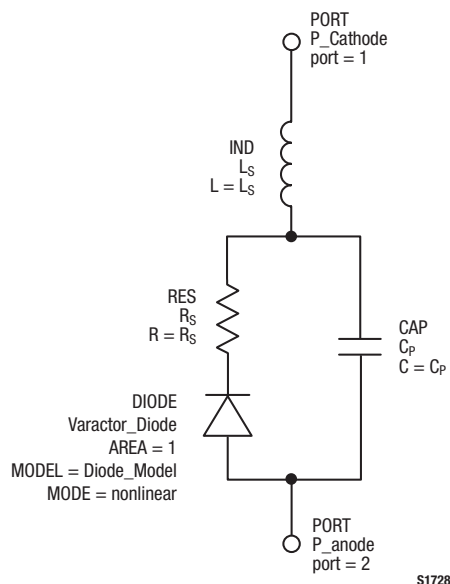
The SMV1702-011LF varactor is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. They can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164

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. For packaging details, refer to the Skyworks Application Note *Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation*, document number 200083.

Table 4. Capacitance vs Reverse Voltage

Voltage (V_R) (V)	Typical Capacitance (C_T) (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**

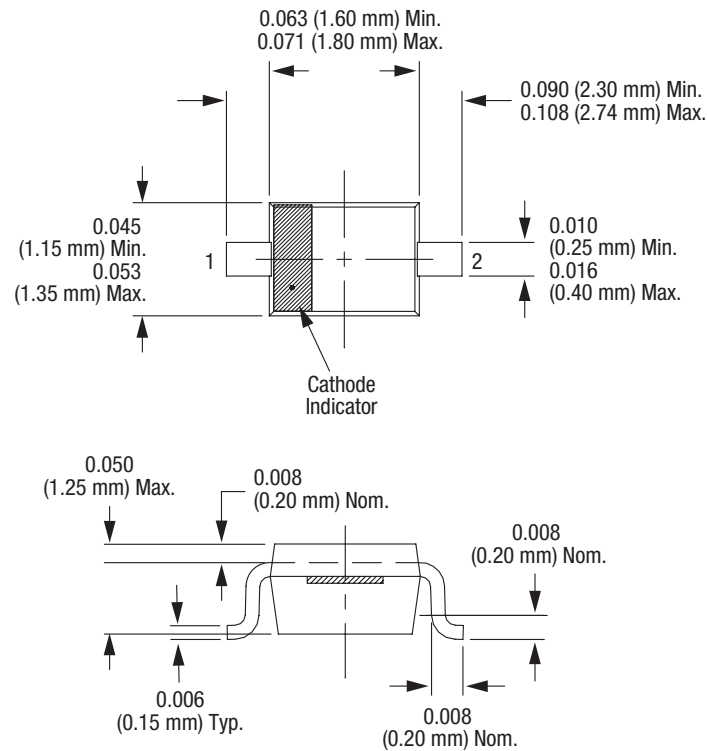
**Figure 2. SPICE Model****Table 5. SPICE Model Parameters (1 of 2)**

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	Transmit time	s	–	0
CJO	Zero-bias junction capacitance (with VJ and M, defines nonlinear junction capacitance of the diode)	F	120e-12	0
VJ	Junction potential (with CJO and M, defines nonlinear junction capacitance of the diode)	V	0.89	1
M	Grading coefficient (with CJO and VJ, defines nonlinear junction capacitance of the diode)	–	0.925	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	0.12	–
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 and millimeters (shown in parentheses).

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Figure 3. SOD-323 Package Dimensions

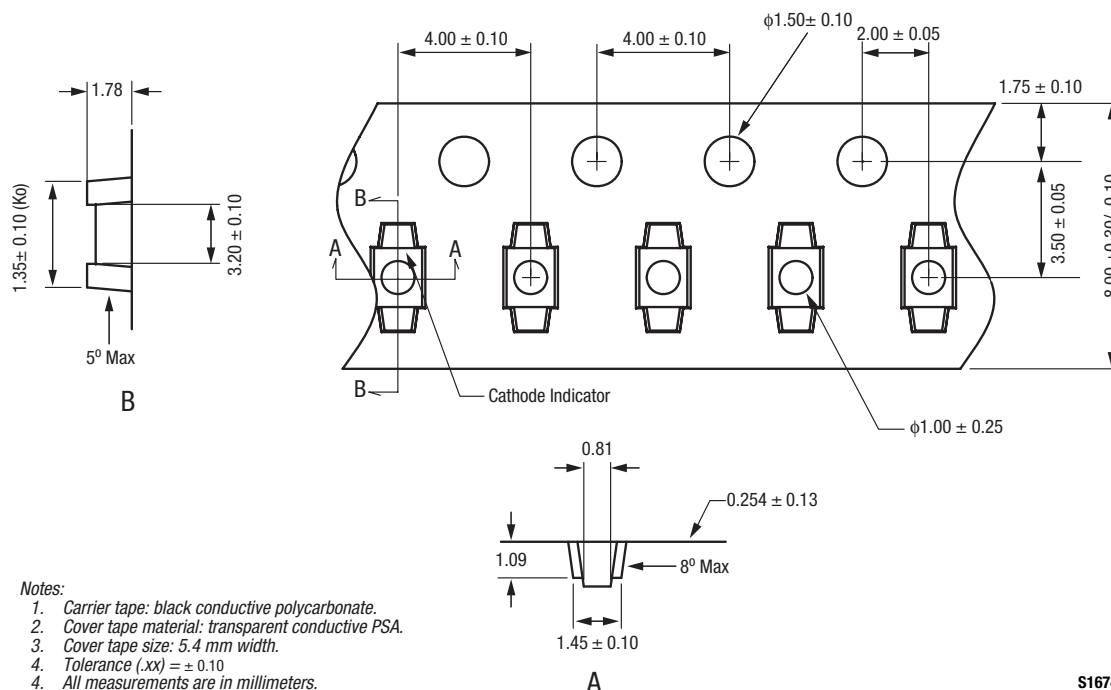


Figure 4. SOD-323 Tape and Reel Dimensions

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