

**DATA SHEET**

# SMV1705 Series: Hyperabrupt Junction Tuning Varactors

## Applications

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

## Features

- Low series resistance
- High capacitance ratio
- Packages rated MSL1, 260 °C per JEDEC J-STD-020

**NEW**

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






## Description

The SMV1705 group of silicon hyperabrupt junction varactor diodes is specifically designed for battery operation. The specified high capacitance ratio and low reverse voltage of these varactors make them appropriate for low-noise Voltage Controlled Oscillators (VCOs) used at frequencies in wireless systems up to and above 2.5 GHz.

Table 1 describes the various packages and markings of the SMV1705 group of varactors.



**Table 1. Packaging and Marking**

		
Common Cathode	Common Cathode	Single
SOT-23	SC-70	SC-79
<b>SMV1705-004</b> Marking: CY3	<b>SMV1705-074</b> Marking: CY3	
<b>SMV1705-004LF</b> Marking: HY3	<b>SMV1705-074LF</b> Marking: HY3	<b>SMV1705-079LF</b> Marking: Cathode
Ls = 1.4 nH		Ls = 0.7 nH



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

**Table 2. SMV1405-SMV1413 Series Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Reverse voltage	V <sub>R</sub>			15	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 SMV1705 group of varactors are Class 0 Human Body Model (HBM) ESD devices.

**Table 3. SMV1405-SMV1413 Series 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
Capacitance	C <sub>T</sub>	F = 1 MHz				
		V <sub>R</sub> = 1 V V <sub>R</sub> = 4 V	17.3 5.3	18.3 6.1	19.3 6.6	pF pF
Capacitance ratio	C <sub>TR</sub>	C <sub>T</sub> @ 1 V/ C <sub>T</sub> @ 4 V	2.8	3.0		–
Series resistance	R <sub>S</sub>	F = 470 MHz, V <sub>R</sub> = 1 V		0.32		Ω
Breakdown voltage	V <sub>BR</sub>	I <sub>R</sub> = 10 μA	12			V

**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 SMV1705 group of 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 SMV1705 varactors are illustrated in Figures 1 and 2.

The SPICE model for the SMV1705 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 (even numbers), and tape and reel dimensions are provided in Figures 5 to 9 (odd numbers).

### 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.

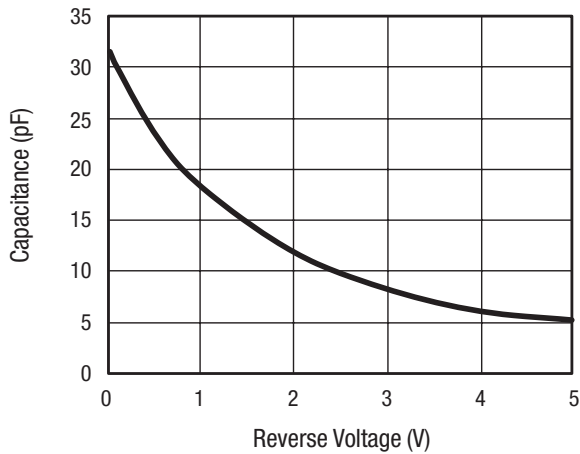
The SMV1705 series of varactors are rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. They can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164

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

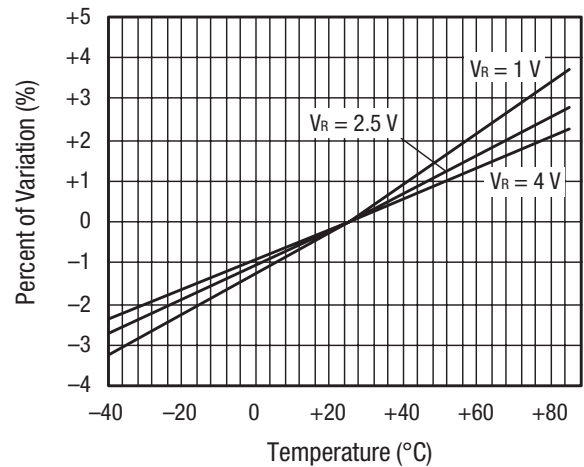
**Table 4. Capacitance vs Reverse Voltage**

$V_R$ (V)	$C_T$ (pF)
0	31.5
0.5	23.5
1.0	18.3
1.5	14.3
2.0	11.9
2.5	9.7
3.0	8.3
3.5	7.1
4.0	6.1
4.5	5.5
5.0	5.2

**Typical Performance Characteristics**



**Figure 1. Capacitance vs Reverse Voltage**



**Figure 2. Relative Capacitance Change vs Temperature**

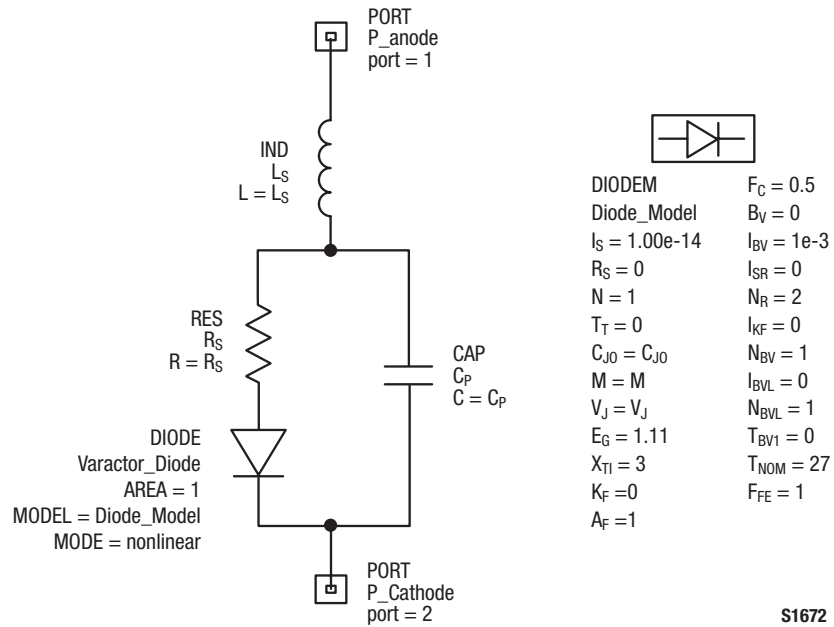


Figure 3. SPICE Model

Table 5. SPICE Model Parameters

Part Number	CJ0 (pF)	VJ (V)	M	Cp (pF)	Rs (Ω)	Ls (nH)
SMV1705	31	3	2	0.5	0.32	0.8

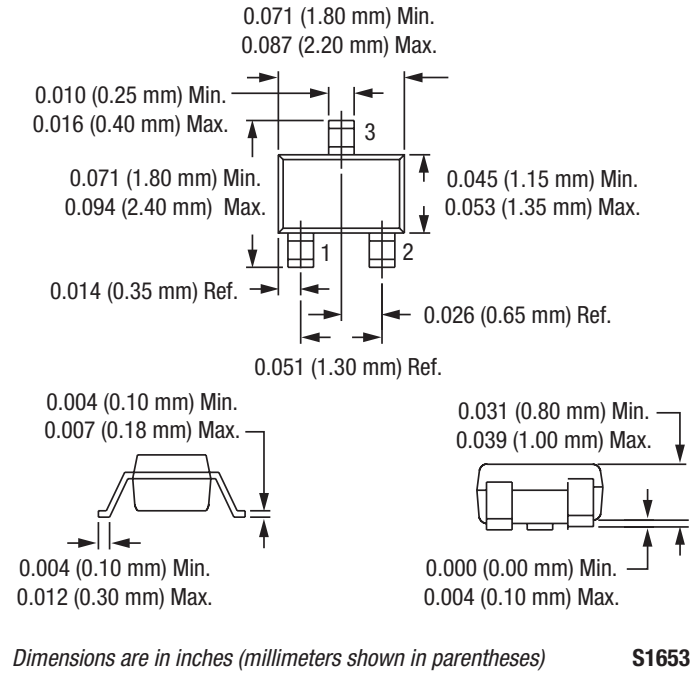


Figure 4. SC-70 Package Dimensions

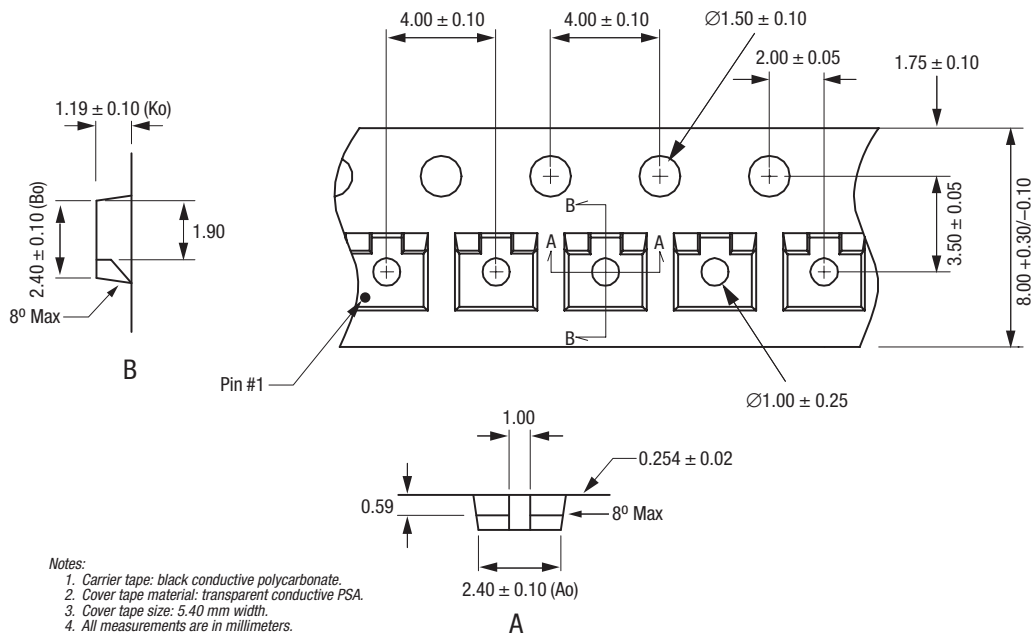
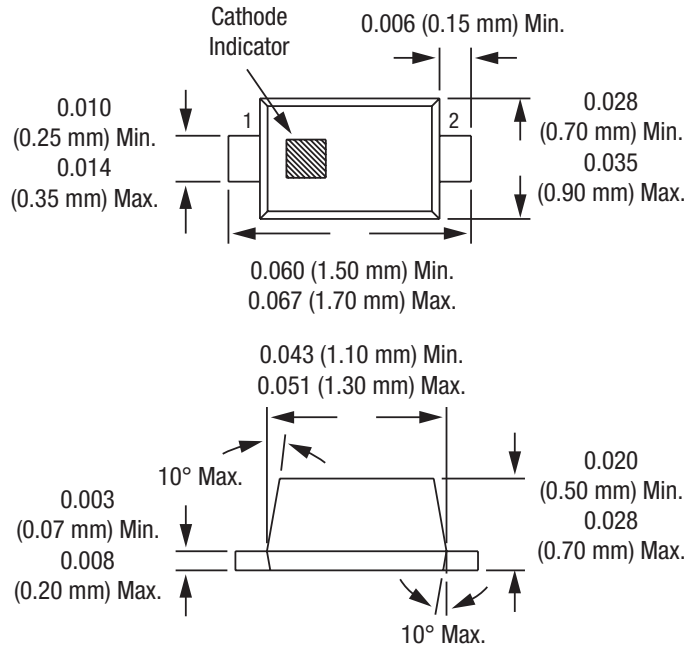
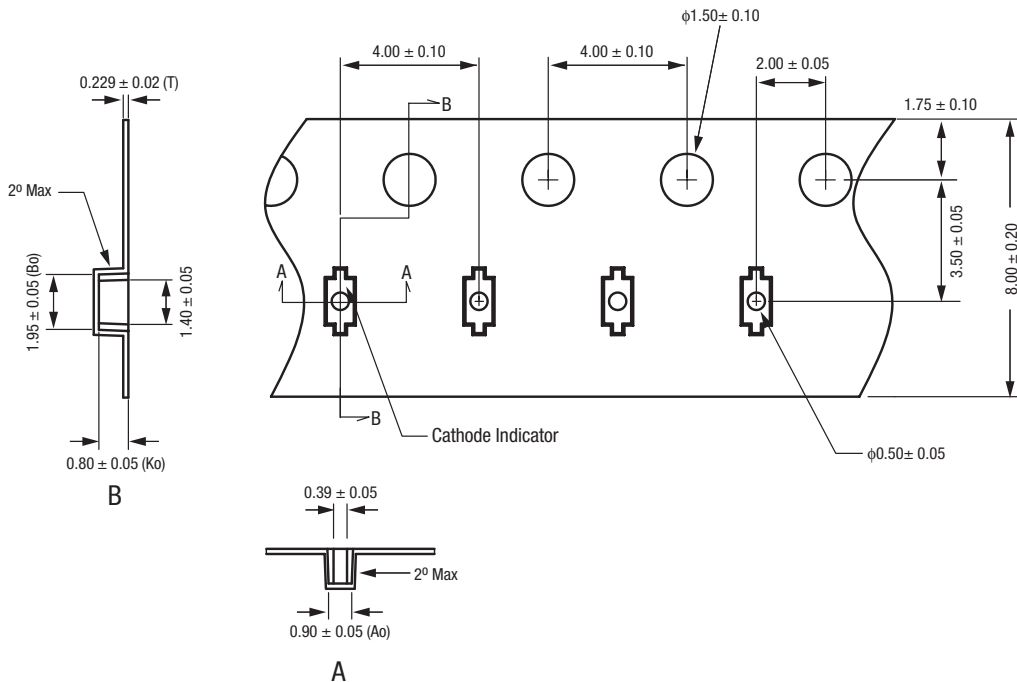


Figure 5. SC-70 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses) **S1652**

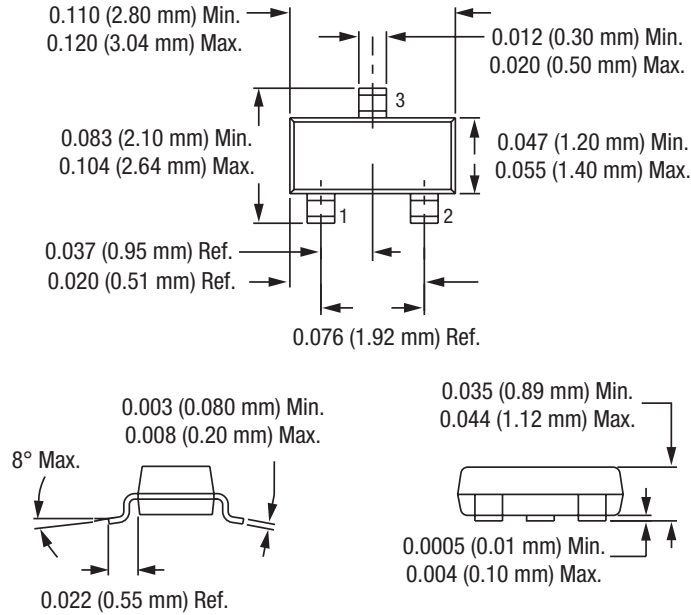
**Figure 6. SC-79 Package Dimensions**



- Notes:
1. Carrier tape: black conductive polycarbonate or polystyrene.
  2. Cover tape material: transparent conductive PSA.
  3. Cover tape size: 5.4 mm width.
  4. All measurements are in millimeters.

S1673

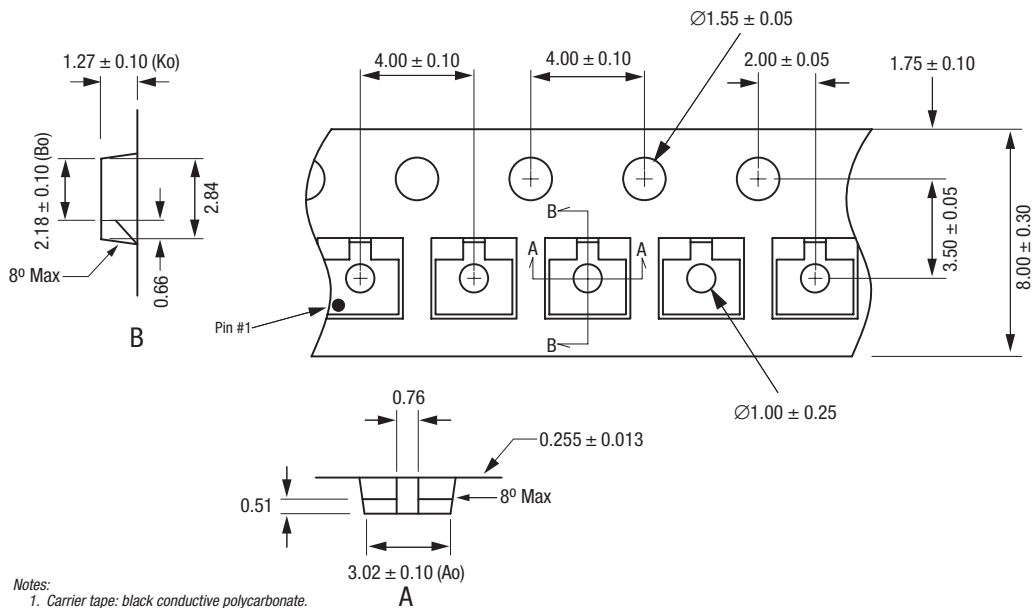
**Figure 7. SC-79 Tape and Reel Dimensions**



Dimensions are in inches (millimeters shown in parentheses)

S1389

Figure 8. SOT-23 Package Dimensions



Notes:

1. Carrier tape: black conductive polycarbonate.
2. Cover tape material: transparent conductive PSA.
3. Cover tape size: 5.40 mm width.
4. Tolerance  $\pm 0.10$  mm.
5. All measurements are in millimeters.

S1684

Figure 9. SOT-23 Tape and Reel Dimensions

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