

DATA SHEET

# SMV1705: Hyperabrupt Tuning Varactors Supplied on Film Frame and Waffle Packs

## Applications

- Wide bandwidth VCOs
- VHF and UHF TV tuners
- Analog phase shifters

## Features

- Designed for high volume, low-cost battery applications
- Low series resistance
- High capacitance ratio
- Available as:
  - Full wafer on film frame (SMV1705-099)
  - Dice in waffle packs (SMV1705-000)
- Small footprint chip size: 12 x 12 x 5.5 mils



## Description

Skyworks SMV1705 varactors are silicon hyperabrupt junction varactor diodes specifically designed for battery operation. These devices have a high capacitance ratio and low series resistance, which makes them appropriate for low phase noise voltage controlled oscillators (VCOs) operating at wireless frequencies of 2.5 GHz and higher.

The SMV1705-099 is supplied as 100 percent electrically tested, fully singulated wafers mounted on a film frame. The SMV1705-000 is supplied as a 100 percent electrically tested die in waffle packs.

The absolute maximum ratings of the SMV1705 varactors are provided in Table 1. Electrical specifications are specified in Table 2. Typical performance characteristics are provided in Figures 1 and 2. The SPICE model for the SMV1705 die is shown in Figure 3 and the associated model parameters are provided in Table 3. Die mechanical characteristics are listed in Table 4.



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.

**Table 1. SMV1705-000/-099 Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Power dissipation @ cathode temperature of 25 °C	P <sub>DIS</sub>			250	mW
Reverse voltage	V <sub>R</sub>			12	V
Forward current	I <sub>F</sub>			20	mA
Junction temperature	T <sub>J</sub>	-55		+150	°C
Storage temperature	T <sub>STG</sub>	-55		+150	°C

**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 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.

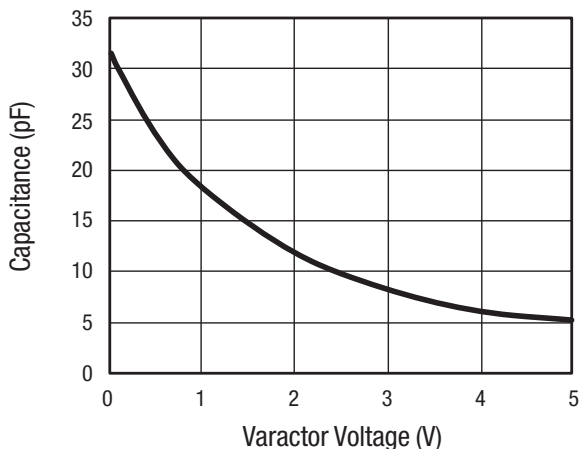
**Table 2. SMV1705-000/-099 Electrical Specifications (Note 1) (Note 2)**  
(Cathode Temperature = 25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Reverse breakdown voltage	V <sub>BR</sub>	I <sub>R</sub> = 10 μA	12			V
Reverse leakage current	I <sub>R</sub>	V <sub>R</sub> = 8 V			20	nA
Junction capacitance	C <sub>J1</sub>	V <sub>R</sub> = 1 V, f = 1 MHz	17.3	18.3	19.3	pF
	C <sub>J4</sub>	V <sub>R</sub> = 4 V, f = 1 MHz	5.3	6.1	6.6	pF
Capacitance ratio	C <sub>J1</sub> /C <sub>J4</sub>		2.8	3.0		-
Series resistance	R <sub>s</sub>	V <sub>R</sub> = 1 V, f = 470 MHz		0.32		Ω

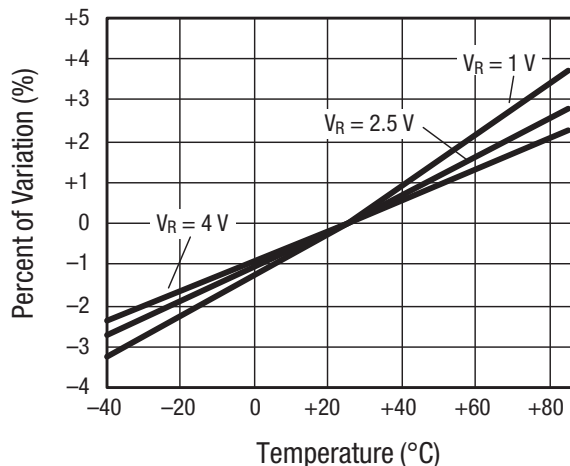
**Note 1:** Performance is guaranteed only under the conditions listed in this table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

**Note 2:** The SMV1705-000 and SMV1705-099 are 100% tested for junction capacitance, capacitance ratio, reverse leakage current, and breakdown voltage. Electrical rejects of the SMV1705-099 devices (singulated wafer on film frame) are identified with black ink.

**Typical Performance Characteristics**



**Figure 1. Capacitance vs Voltage**  
(T<sub>J</sub> = 25 °C)



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

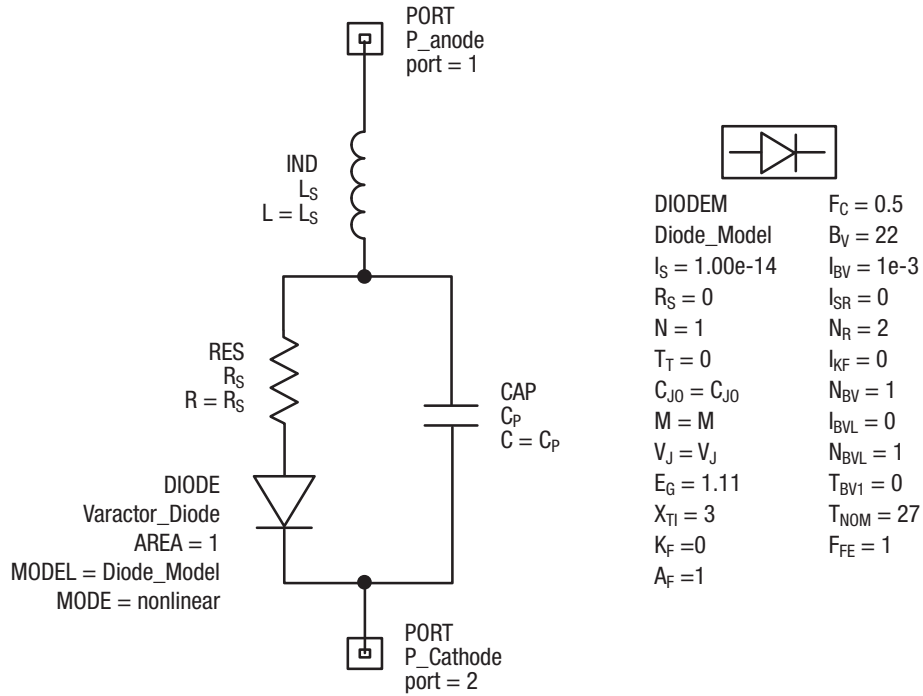


Figure 3. SPICE Model

Table 3. SPICE Model Parameters

Part Number	CJO (pF)	VJ (V)	M	CP (pF)	Rs (Ω)	Ls (nH)
SMV1705-000	31	3	2	0	0.32	0.15
SMV1705-099	31	3	2	0	0.32	0.15

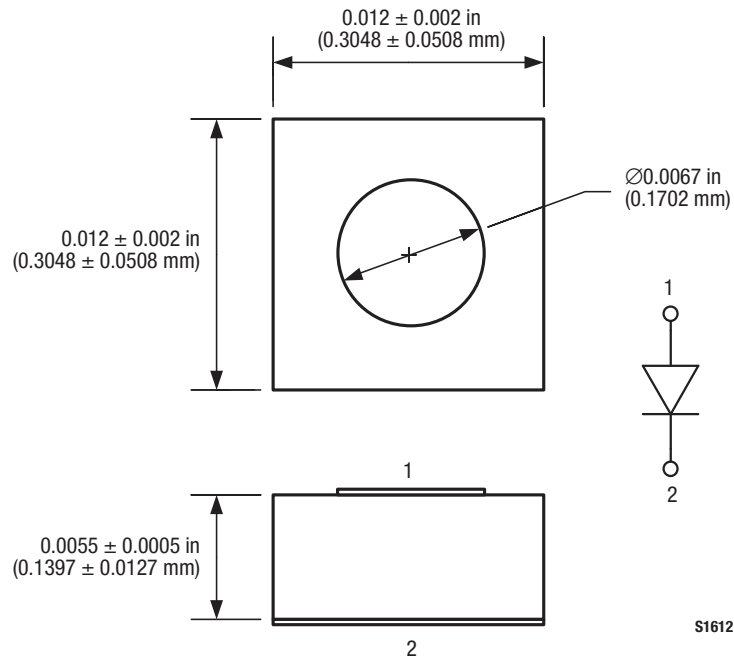
Table 4. SMV1705 Die Characteristics

Part Number	Quantity of Good Dice Per Wafer	Chip Size		Chip Thickness		Typical Anode Contact Diameter	
		(in)	(mm)	(in)	(mm)	(in)	(mm)
SMV1705-000	N/A	0.012 x 0.012	0.3048 x 0.3048	0.0055 ± 0.0005	0.1397 ± 0.0127	0.00675	0.17145
SMV1705-099	60,000 Minimum 65,000 Typical	0.012 x 0.012	0.3048 x 0.3048	0.0055 ± 0.0005	0.1397 ± 0.0127	0.00675	0.17145

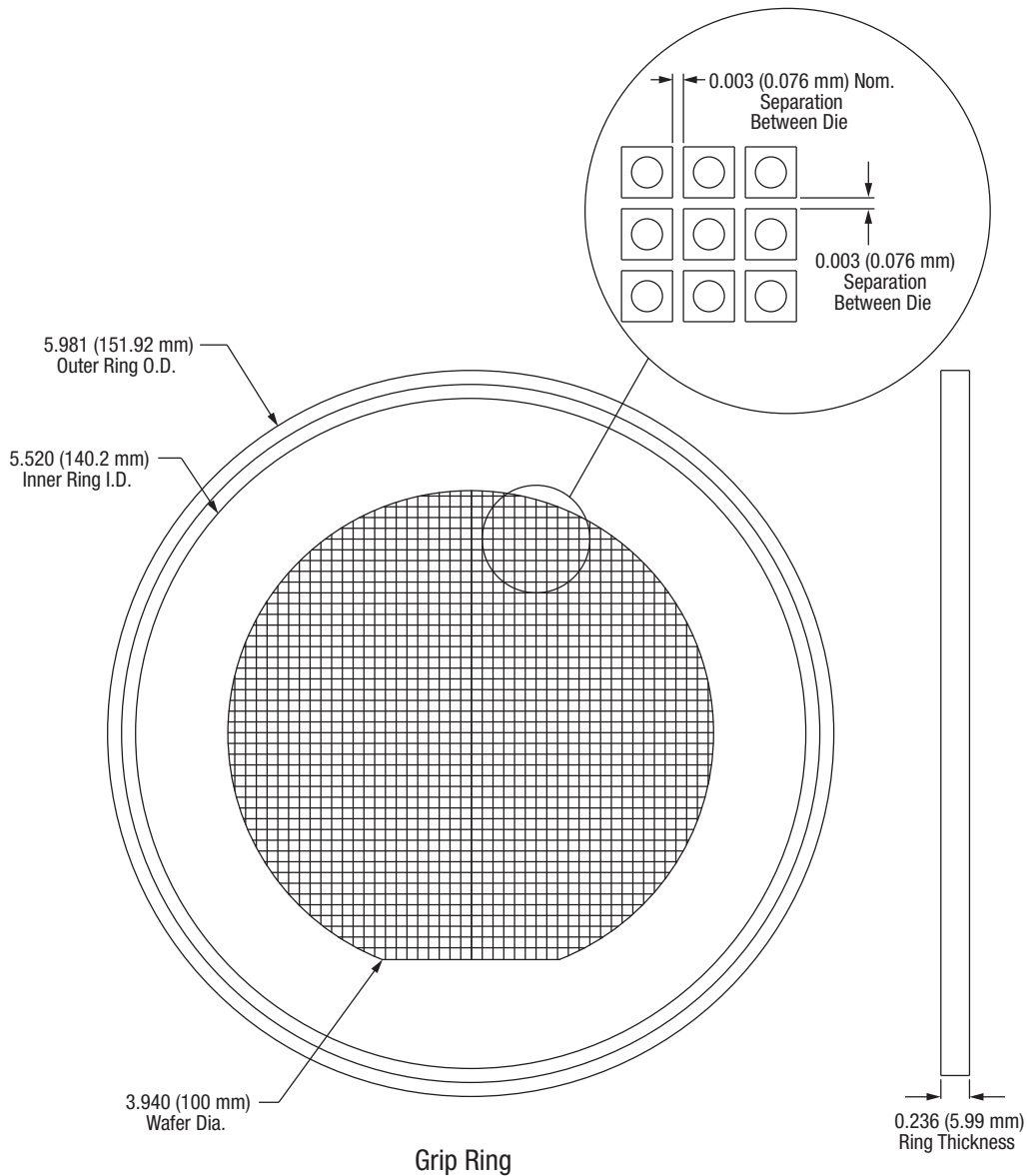
**Package Outline Drawings**

Table 4 identifies the die part numbers with their corresponding quantity per wafer and chip measurements. The package outline die drawing for the SMV1705-000 (dice in wafer packs) is shown

in Figure 4. The package outline die drawing for the SMV1705-099 (full wafer on film frame) is shown in Figure 5. The SMV1705-000 is supplied in quantities of 100 pieces per wafer pack.



**Figure 4. SMV1705-000 Die Outline Drawing  
(Dice in Waffle Packs)**



Wafer Film Frame Description  
 Wafer on nitto tape  
 Color: light blue  
 Thickness: 2.2–3 mils  
 Tensile strength: 6.6 (lbs. in width)  
 Ring material: plastic

S1611

**Figure 5. SMV1705-099 Die Outline Drawing  
 (Full Wafer on Film Frame)**

**Ordering Information**

Model Name	Manufacturing Part Number
SMV1705-000 (dice, 100 per wafer pack)	SMV1705-000
SMV1705-099 (singulated wafer on film frame)	SMV1705-099

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