

DATA SHEET

# SMV1211–SMV1215: Hyperabrupt Junction Tuning Varactors

## Features

- High capacitance ratio,  $C_1 \sqrt{V}/C_4 \sqrt{V} = 5$  typ.
- Multiple packages SOT-23, SOD-323, SC-70 and SC-79
- Designed for high-volume commercial applications
- SPICE models are available
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020



## Description

The SMV1211–SMV1215 series of silicon hyperabrupt junction varactor diodes is designed for use in VCOs with low tuning voltage operation. This family of varactors is characterized for capacitance and resistance over temperature. SPICE models are provided.

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



## Absolute Maximum Ratings

| Characteristic                     | Value             |
|------------------------------------|-------------------|
| Reverse voltage ( $V_R$ )          | 12 V              |
| Forward current ( $I_F$ )          | 20 mA             |
| Power dissipation ( $P_D$ )        | 250 mW            |
| Storage temperature ( $T_{ST}$ )   | -55 °C to +150 °C |
| Operating temperature ( $T_{OP}$ ) | -55 °C to +125 °C |
| ESD human body model               | Class 0           |

Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void the warranty.

**CAUTION:** Although this device is designed to be as robust as possible, ESD (Electrostatic Discharge) 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 must be employed at all times.

|  |                                     |  |                                      |                                      |
|--|-------------------------------------|--|--------------------------------------|--------------------------------------|
|  |                                     |  |                                      |                                      |
| Single                                   | Single                              | Single                                 | Common Cathode                       | Common Cathode                       |
| SC-79                                    | SOD-323                             | SOT-23                                 | SOT-23                               | SC-70                                |
|  |                                     | <b>SMV1211-001</b><br>Marking: AA1     |                                      |                                      |
|  |                                     | <b>SMV1211-001LF</b><br>Marking: EA1   |                                      |                                      |
| <b>SMV1212-079</b><br>Marking: Cathode   |                                     | <b>SMV1212-001</b><br>Marking: AB1     | <b>SMV1212-004</b><br>Marking: AB3   | <b>SMV1212-074</b><br>Marking: AB3   |
| <b>SMV1212-079LF</b><br>Marking: Cathode |                                     | <b>SMV1212-001LF</b><br>Marking: EB1   | <b>SMV1212-004LF</b><br>Marking: EB3 | <b>SMV1212-074LF</b><br>Marking: EB3 |
| <b>SMV1213-079</b><br>Marking: Cathode   | <b>SMV1213-011</b><br>Marking: BD   | ◆ <b>SMV1213-001</b><br>Marking: 86    | <b>SMV1213-004</b><br>Marking: BD3   | <b>SMV1213-074</b><br>Marking: BD3   |
| <b>SMV1213-079LF</b><br>Marking: Cathode | <b>SMV1213-011LF</b><br>Marking: GD | ◆ <b>SMV1213-001LF</b><br>Marking: D86 | <b>SMV1213-004LF</b><br>Marking: GD3 | <b>SMV1213-074LF</b><br>Marking: GD3 |
|  |                                     | <b>SMV1214-001</b><br>Marking: VL1     |                                      |                                      |
|  |                                     | <b>SMV1214-001LF</b><br>Marking: DL1   |                                      |                                      |
|  | <b>SMV1215-011</b><br>Marking: VM   | <b>SMV1215-001</b><br>Marking: VM1     |                                      |                                      |
|  | <b>SMV1215-011LF</b><br>Marking: DM | <b>SMV1215-001LF</b><br>Marking: DM1   |                                      |                                      |
| $L_S = 0.7 \text{ nH}$                   | $L_S = 1.5 \text{ nH}$              | $L_S = 1.5 \text{ nH}$                 | $L_S = 1.4 \text{ nH}$               | $L_S = 1.4 \text{ nH}$               |

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

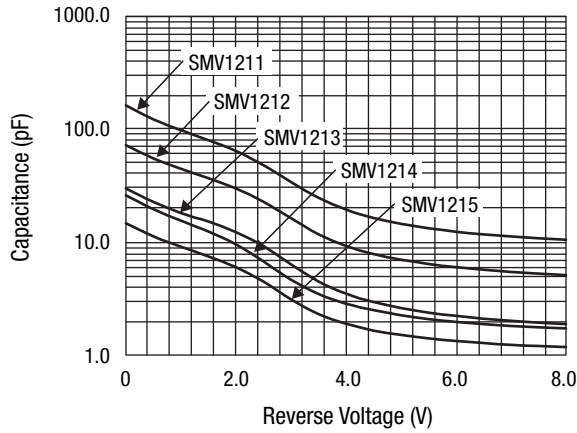
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### Electrical Specifications at 25 °C

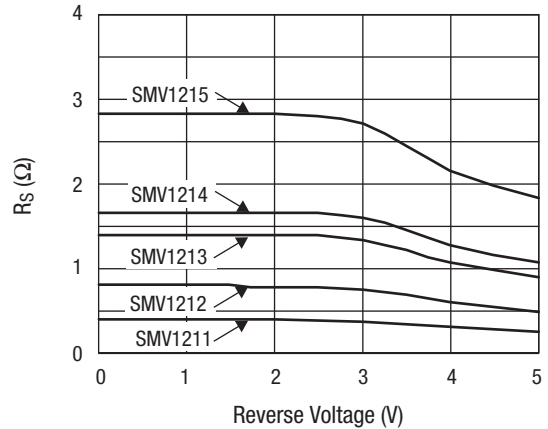
| Part Number | $C_T @ 1 \text{ V}$ (pF) |      | $C_T @ 2.5 \text{ V}$ (pF) |      | $C_T @ 4 \text{ V}$ (pF) |      | $\frac{C_T @ 1 \text{ V}}{C_T @ 2.5 \text{ V}}$ (Ratio) | $\frac{C_T @ 1 \text{ V}}{C_T @ 4 \text{ V}}$ (Ratio) | $R_S @ 4 \text{ V}$ 500 MHz ( $\Omega$ ) | $Q @ 4 \text{ V}$ 50 MHz |
|-------------|--------------------------|------|----------------------------|------|--------------------------|------|---|---|--|--------------------------|
|             | Min.                     | Typ. | Min.                       | Max. | Typ.                     | Max. | Typ.  | Typ.  | Typ.                                     | Min.                     |
| SMV1211     | 95                       | 100  | 40                         | 65   | 20                       | 25   | 2   | 5   | 0.4                                      | 80                       |
| SMV1212     | 42                       | 50   | 18                         | 27   | 9                        | 12   | 2   | 5   | 0.8                                      | 150                      |
| SMV1213     | 17                       | 22   | 8.5                        | 10.5 | 4                        | 5.5  | 2   | 5   | 1.4                                      | 200                      |
| SMV1214     | 14.5                     | 16   | 6.5                        | 7.8  | 3                        | 4.8  | 2   | 5   | 1.7                                      | 300                      |
| SMV1215     | 8.7                      | 9.5  | 4.3                        | 5.5  | 2                        | 2.9  | 2   | 5   | 2.8                                      | 350                      |

Reverse Voltage  $V_R$  ( $I_R = 10 \mu\text{A}$ ): 12 V minimum.  
Reverse Current  $I_R$  ( $V_R = 8 \text{ V}$ ): 20 nA maximum.

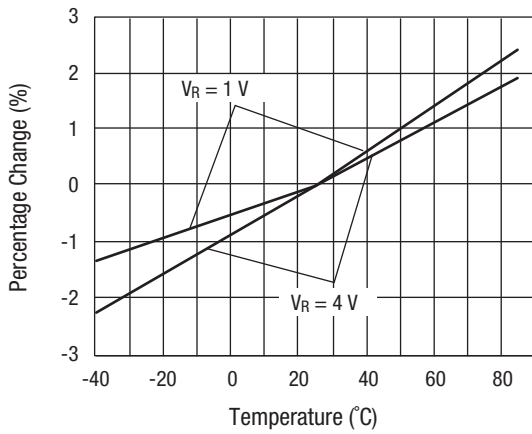
**Typical Performance Data**



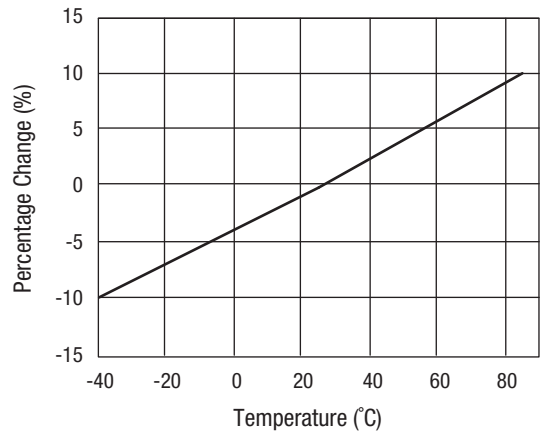
**Capacitance vs. Reverse Voltage**



**Series Resistance vs. Reverse Voltage @ 500 MHz**



**Relative Capacitance Change vs. Temperature**



**Relative Series Resistance Change vs. Temperature @ 500 MHz**

### Typical Capacitance Values

| $V_R$ (V) | SMV1211    | SMV1212    | SMV1213    | SMV1214    | SMV1215    |
|-----------|------------|------------|------------|------------|------------|
|           | $C_T$ (pF) | $C_T$ (pF) | $C_T$ (pF) | $C_T$ (pF) | $C_T$ (pF) |
| 0         | 162.6      | 72.4       | 30         | 26         | 14.8       |
| 0.5       | 122.3      | 55.3       | 22.8       | 19.6       | 11.3       |
| 1         | 98.6       | 44.9       | 18.1       | 15.6       | 9.1        |
| 1.5       | 80.4       | 36.9       | 15.3       | 12.4       | 7.5        |
| 2         | 64.2       | 29.9       | 12.3       | 9.6        | 6          |
| 2.5       | 48.2       | 22.9       | 9.2        | 6.8        | 4.5        |
| 3         | 34.1       | 16.3       | 6.4        | 4.7        | 3.1        |
| 3.5       | 24.7       | 11.8       | 4.5        | 3.5        | 2.3        |
| 4         | 19.4       | 9.3        | 3.5        | 2.9        | 1.9        |
| 4.5       | 16.4       | 7.9        | 3          | 2.5        | 1.7        |
| 5         | 14.6       | 7          | 2.6        | 2.3        | 1.5        |
| 5.5       | 13.3       | 6.4        | 2.4        | 2.1        | 1.4        |
| 6         | 12.4       | 6          | 2.2        | 2          | 1.3        |
| 6.5       | 11.7       | 5.7        | 2.1        | 1.9        | 1.3        |
| 7         | 11.2       | 5.5        | 2          | 1.8        | 1.2        |
| 7.5       | 10.8       | 5.3        | 1.9        | 1.8        | 1.2        |
| 8         | 10.5       | 5.1        | 1.9        | 1.7        | 1.2        |

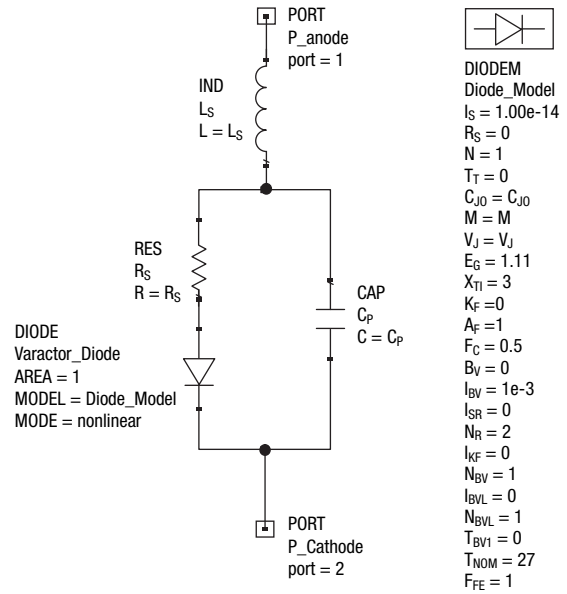
### Recommended Solder Reflow Profiles

Refer to the [“Recommended Solder Reflow Profile”](#) Application Note.

### Tape and Reel Information

Refer to the [“Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation”](#) Application Note.

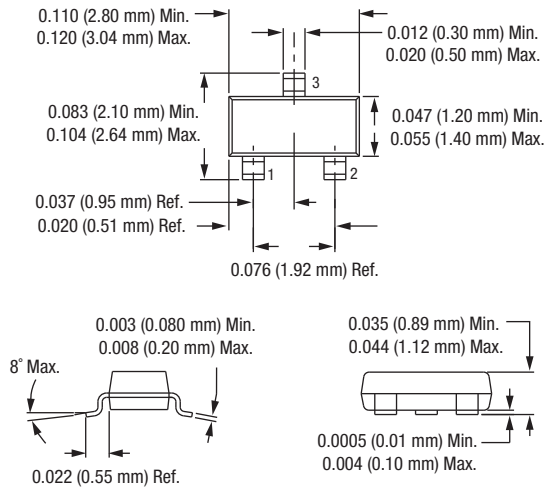
### SPICE Model



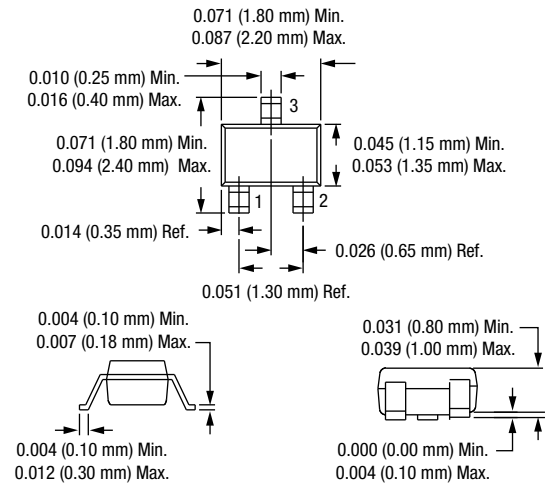
| Part Number | $C_{J0}$ (pF) | $V_J$ (V) | M   | $C_P$ (pF) | $R_S$ ( $\Omega$ ) |
|-------------|---------------|-----------|-----|------------|--------------------|
| SMV1211     | 163           | 200       | 130 | 9.5        | 0.4                |
| SMV1212     | 72.47         | 110       | 67  | 4.5        | 0.8                |
| SMV1213     | 28.9          | 190       | 105 | 2.2        | 1.4                |
| SMV1214     | 22.74         | 190       | 106 | 1.5        | 1.7                |
| SMV1215     | 14.36         | 190       | 115 | 1.1        | 2.8                |

Values extracted from measured performance.  
 For package inductance ( $L_S$ ) refer to package type.  
 For more details refer to the “Varactor SPICE Models for RF VCO Applications” Application Note.

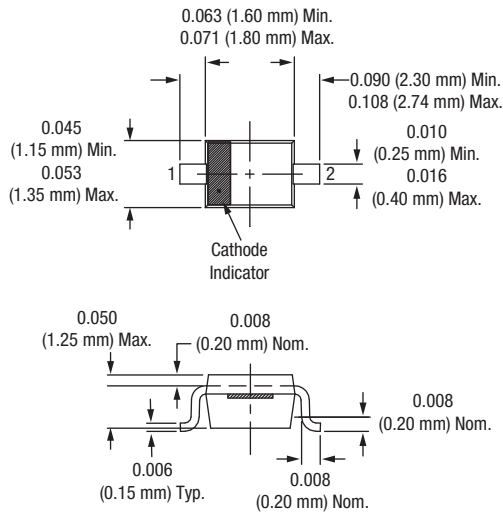
**SOT-23**



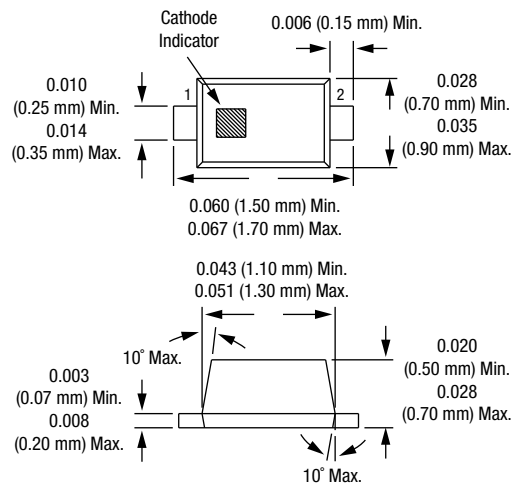
**SC-70**



**SOD-323**



**SC-79**



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