

**DATA SHEET**

# SMVA1211-001LF: Hyperabrupt Junction Tuning Varactor

## Automotive Applications

- Low tuning voltage VCOs
- Infotainment
- Navigation
- Telematics
- Garage door openers
- Wireless control systems



## Features

- AEC-Q101 qualified
- ISO/TS16949 certified facility
- High capacitance ratio:  $C_{1V}/C_{4V} = 5$  typical
- Package is rated MSL1, 260 °C per JEDEC J-STD-020




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## Description

The SMVA1211-001LF silicon hyperabrupt junction varactor diode is designed for use in voltage controlled oscillators (VCOs) with a low tuning voltage operation and is ideal for in-vehicle infotainment applications. This varactor is characterized for capacitance and resistance over temperature.

Table 1 describes the SMVA1211-001LF package and marking.

**Table 1. Package and Marking**

|   |
|---|
|  |
| Single  |
| SOT-23  |
| <b>SMVA1211-001LF</b><br>Green™<br>Marking: EA1                                       |
| Ls = 1.5 nH   |



The Pb-free symbol or "LF" in the part number denotes a lead-free, RoHS-compliant package unless otherwise noted as Green™.

**Electrical and Mechanical Specifications**

The absolute maximum ratings of the SMVA1211-001LF varactor 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 SMVA1211-001LF varactor are illustrated in Figures 1 and 2.

The SPICE model for the SMVA1211-001LF varactor is shown in Figure 3 and the associated model parameters are provided in Table 4.

**Table 2. SMVA1211-001LF Varactor Absolute Maximum Ratings (Note 1)**

| Parameter                           | Symbol           | Minimum | Maximum | Units |
|-------------------------------------|------------------|---------|---------|-------|
| Reverse voltage                     | V <sub>R</sub>   |         | 12      | 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    |
| Electrostatic discharge:            | ESD              |         |         |       |
| Charged Device Model (CDM), Class 3 |                  |         | 1000    | V     |
| Human Body Model (HBM), Class 1A    |                  |         | 500     | V     |
| Machine Model (MM), Class A         |                  |         | 100     | V     |

**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 3. SMVA1211-001LF Varactor Electrical Specifications (Note 1)**

(T<sub>OP</sub> = 25 °C, Unless Otherwise Noted)

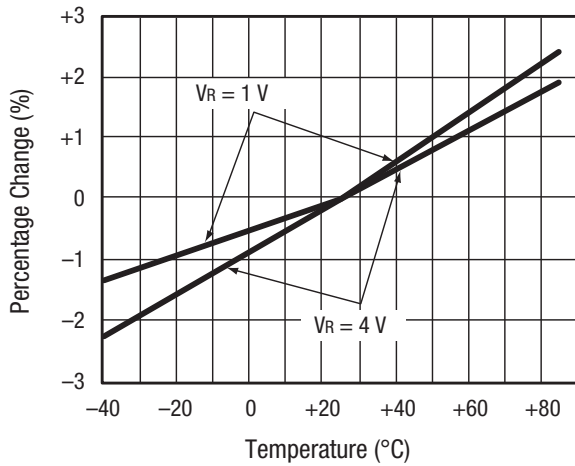
| C <sub>T</sub> @ 1 V<br>(pF) |       | C <sub>T</sub> @ 2.5 V<br>(pF) |      | C <sub>T</sub> @ 4 V<br>(pF) |      | C <sub>T</sub> @ 1 V<br>C <sub>T</sub> @ 2.5 V<br>(Ratio) | C <sub>T</sub> @ 1 V<br>C <sub>T</sub> @ 4 V<br>(Ratio) | R <sub>S</sub> @ 4 V,<br>500 MHz<br>(Ω) |
|------------------------------|-------|--------------------------------|------|------------------------------|------|---|---|---|
| Min.                         | Typ.  | Min.                           | Max. | Typ.                         | Max. | Typ.  | Typ.  | Typ.                                    |
| 95.0                         | 100.0 | 40.0                           | 65.0 | 20                           | 25.0 | 2   | 5   | 0.4                                     |

**Note 1:** Performance is guaranteed only under the conditions listed in this table.  
 Reverse voltage V<sub>R</sub> (I<sub>F</sub> = 10 μA) = 12 V minimum  
 Reverse current I<sub>R</sub> (V<sub>R</sub> = 8 V) = 20 nA maximum

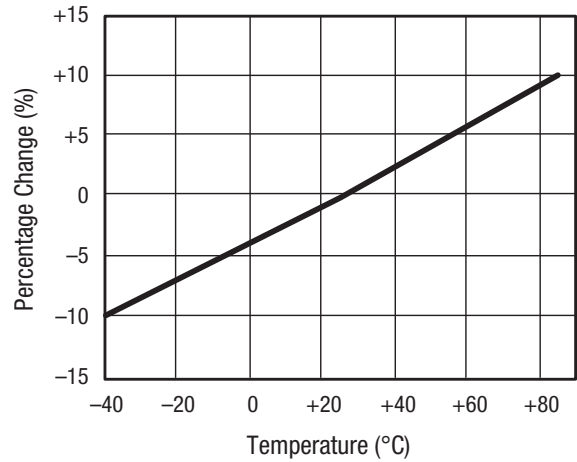
**Table 4. Typical Capacitance Values**

| $V_R$<br>(V) | $C_T$ (pF) |
|--------------|------------|
| 0            | 162.6      |
| 0.5          | 122.3      |
| 1.0          | 98.6       |
| 1.5          | 80.4       |
| 2.0          | 64.2       |
| 2.5          | 48.2       |
| 3.0          | 34.1       |
| 3.5          | 24.7       |
| 4.0          | 19.4       |
| 4.5          | 16.4       |
| 5.0          | 14.6       |
| 5.5          | 13.3       |
| 6.0          | 12.4       |
| 6.5          | 11.7       |
| 7.0          | 11.2       |
| 7.5          | 10.8       |
| 8.0          | 10.5       |

**Typical Performance Characteristics**



**Figure 1. Relative Capacitance Change vs Temperature**



**Figure 2. Relative Series Resistance Change vs Temperature @ 500 MHz**

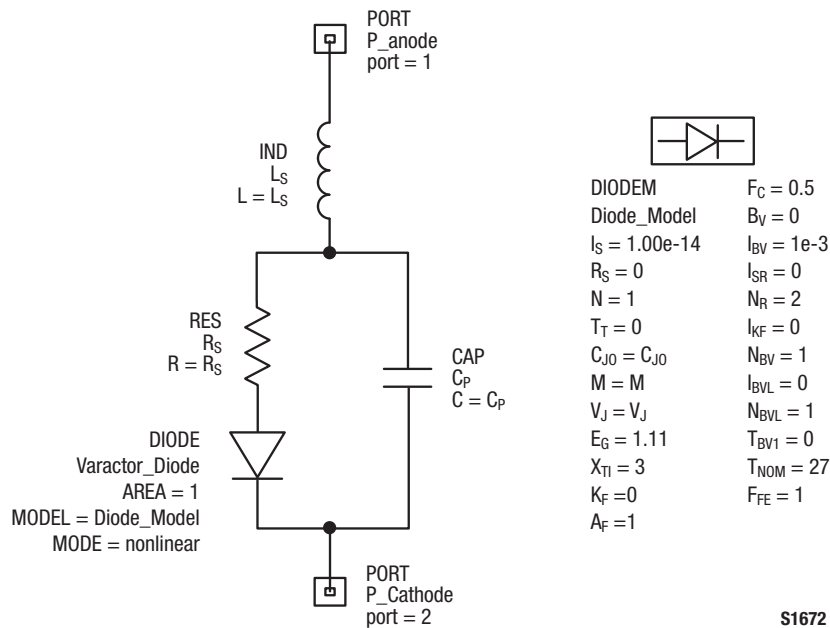


Figure 3. SPICE Model

Table 5. SPICE Model Parameters

| Cj0 (pF) | Vj (V) | M   | Cp (pF) | Rs (Ω) |
|----------|--------|-----|---------|--------|
| 163.00   | 200    | 130 | 9.5     | 0.4    |

Values extracted from measured performance.

For package inductance (Ls), refer to Table 1.

For more details, refer to the Skyworks Application Note, *Varactor SPICE Model for Approved RF VCO Applications*, document number 200315.

### Package Dimensions

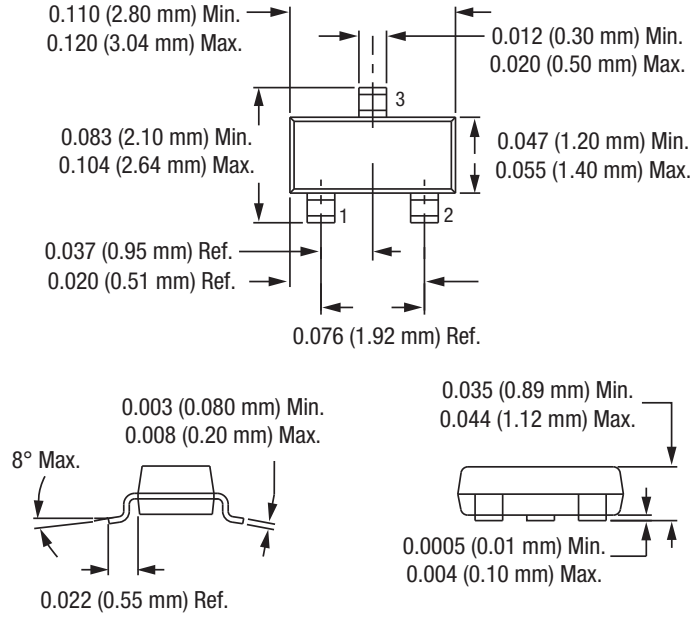
Package dimensions are shown in Figure 4, and tape and reel dimensions are provided in Figure 5.

### 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 SMVA1211-001LF varactor is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

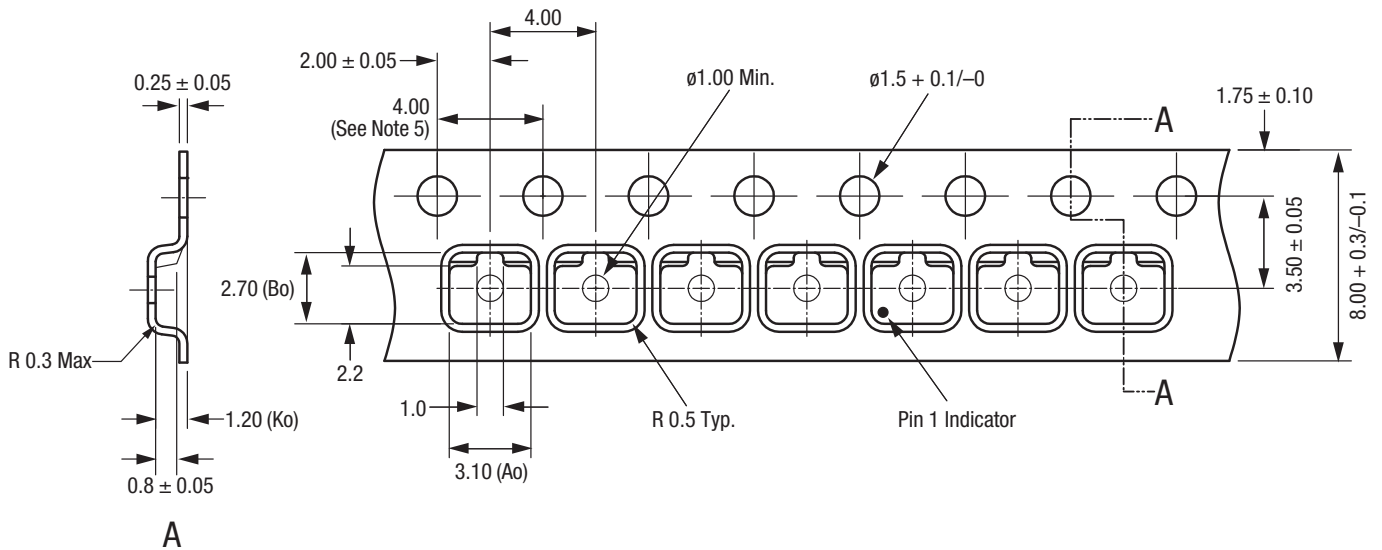
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



Dimensions are in inches (millimeters shown in parentheses)

S1389

Figure 4. SOT-23 Package Dimensions



Notes:

- Carrier tape: black conductive polycarbonate.
- Cover tape material: transparent conductive PSA.
- Cover tape size: 5.40 mm width.
- Tolerance: ±0.10 mm.
- Ten sprocket hole pitch cumulative tolerance: ±0.2 mm.
- All measurements are in millimeters.
- Alternative carrier tape dimensions are:  
 $A_o = 3.3$   
 $B_o = 2.9$   
 $K_o = 1.22$

S1684b

Figure 5. SOT-23 Tape and Reel Dimensions

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