

DATA SHEET

# SMVA1470-004LF: Hyperabrupt Junction Tuning Varactor

## Automotive Applications

- Low-noise VCOs and VCXOs in wireless systems
- Infotainment
- Navigation
- Telematics
- Garage door openers
- Wireless control systems

## Features

- AEC-Q101 qualified
- High capacitance ratio
- SOT-23 package (MSL1, 260 °C per JEDEC J-STD-020)



## Description

The SMVA1470-004LF is a dual silicon, hyperabrupt junction varactor diode in a common cathode configuration. The specified high capacitance ratio and low series resistance make this varactor appropriate for low-noise voltage controlled oscillators (VCOs) and voltage-controlled crystal oscillators (VCXOs) in wireless systems for in-vehicle infotainment applications.

Table 1 describes the SMVA1470-004LF package and marking.



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. Package and Marking**

|   |
|---|
|  |
| Common Cathode  |
| SOT-23  |
| <b>SMVA1470-004LF</b><br>Green™<br>Marking: ET3                                       |
| $L_S = 1.4 \text{ nH}$  |



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 SMVA1470-004LF 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 SMVA1470-004LF varactor are illustrated in Figures 1 and 2.

The SPICE model for the SMVA1470-004LF varactor is shown in Figure 3 and the associated model parameters are provided in Table 5.

**Table 2. SMVA1470-004LF Absolute Maximum Ratings<sup>1</sup>**

| Parameter                           | Symbol           | Minimum | Maximum | Units |
|-------------------------------------|------------------|---------|---------|-------|
| Forward current                     | I <sub>F</sub>   |         | 20      | mA    |
| Power dissipation                   | P <sub>D</sub>   |         | 250     | mW    |
| Storage temperature                 | T <sub>STG</sub> | -55     | +150    | °C    |
| Operating temperature               | T <sub>A</sub>   | -55     | +125    | °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         |                  |         | 50      | V     |

<sup>1</sup> 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.

---

**ESD HANDLING:** *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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

---

**Table 3. SMVA1470-004LF Electrical Specifications<sup>1</sup>**  
**(T<sub>A</sub> = +25 °C Unless Otherwise Noted)**

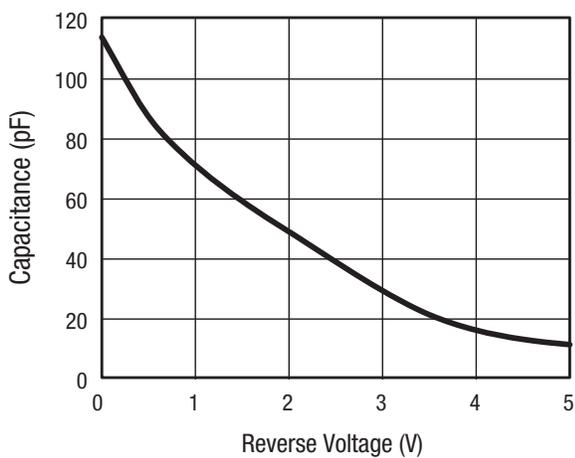
| Parameter         | Symbol          | Test Condition                            | Min  | Typ  | Max  | Units |
|-------------------|-----------------|---|------|------|------|-------|
| Reverse current   | I <sub>R</sub>  | V <sub>R</sub> = 10 V                     |      |      | 20   | nA    |
| Capacitance       | C <sub>T</sub>  | V <sub>R</sub> = 1 V, F = 1 MHz           | 65.8 | 70.0 | 74.2 | pF    |
|                   |                 | V <sub>R</sub> = 4.5 V, F = 1 MHz         | 12.0 | 13.4 | 14.8 | pF    |
| Capacitance ratio | C <sub>TR</sub> | C <sub>T</sub> (1 V)/C <sub>T</sub> (5 V) | 5    | 6    |      | –     |
| Series resistance | R <sub>S</sub>  | V <sub>R</sub> = 1.5 V, F = 900 MHz       |      | 0.5  | 0.8  | Ω     |
| Breakdown voltage | V <sub>B</sub>  | I <sub>R</sub> = 10 μA                    | 10   |      |      | V     |

<sup>1</sup> Performance is guaranteed only under the conditions listed in this table.

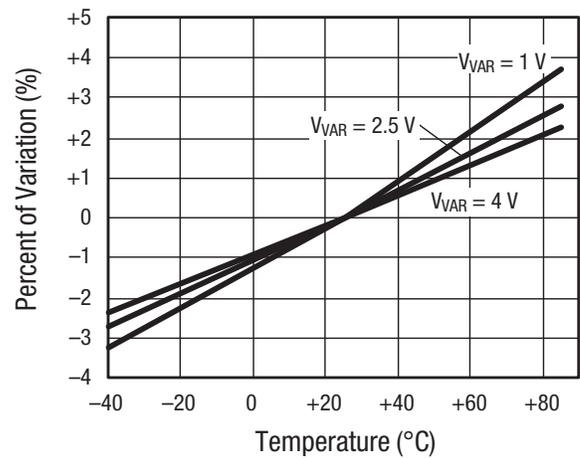
**Table 4. Capacitance vs Reverse Voltage**

| $V_R$<br>(V) | $C_T$ (pF) |
|--------------|------------|
| 0            | 113.9      |
| 0.5          | 87.4       |
| 1.0          | 71.3       |
| 1.5          | 59.3       |
| 2.0          | 49.0       |
| 2.5          | 39.1       |
| 3.0          | 29.4       |
| 3.5          | 21.4       |
| 4.0          | 16.3       |
| 4.5          | 13.3       |
| 5.0          | 11.5       |
| 5.5          | 10.3       |
| 6.0          | 9.5        |
| 6.5          | 8.9        |
| 7.0          | 8.5        |
| 7.5          | 8.1        |
| 8.0          | 7.9        |
| 8.5          | 7.7        |
| 9.0          | 7.6        |
| 9.5          | 7.5        |
| 10.0         | 7.5        |

**Typical Performance Characteristics**



**Figure 1. Capacitance vs Voltage**



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

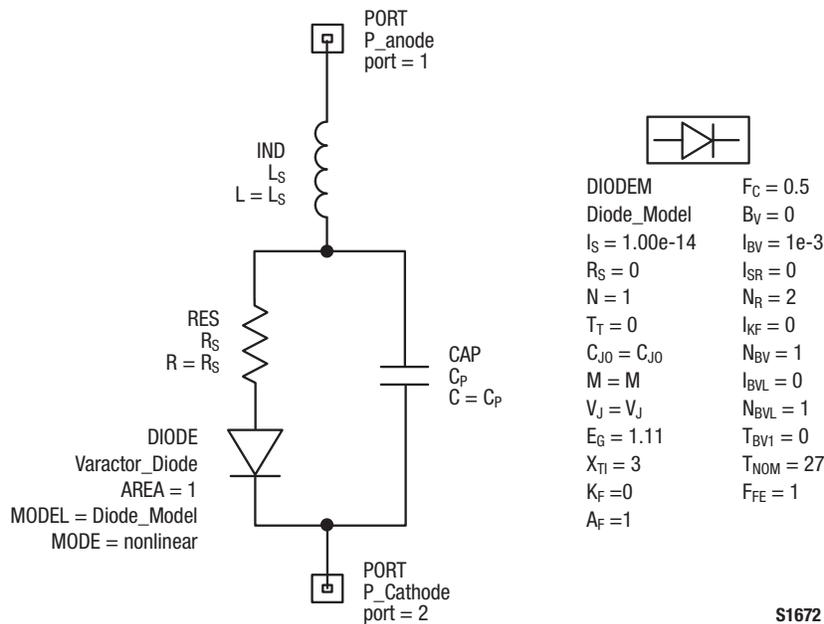


Figure 3. SPICE Model

Table 5. SPICE Model Parameters

| CJO<br>(pF) | VJ<br>(V) | M    | CP<br>(pF) | RS<br>(Ω) | LS<br>(nH) |
|-------------|-----------|------|------------|-----------|------------|
| 110         | 80        | 39.7 | 3.94       | 0.5       | 1.4        |

### 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 SMVA1470-004LF 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.

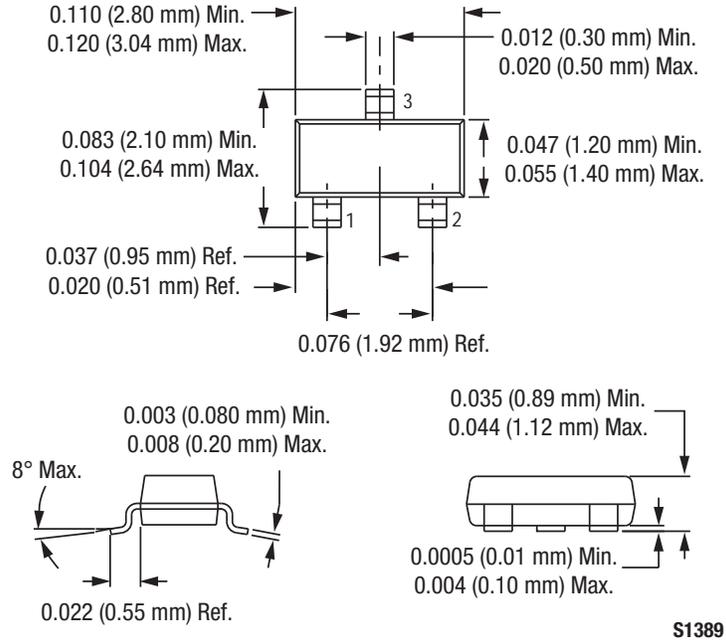
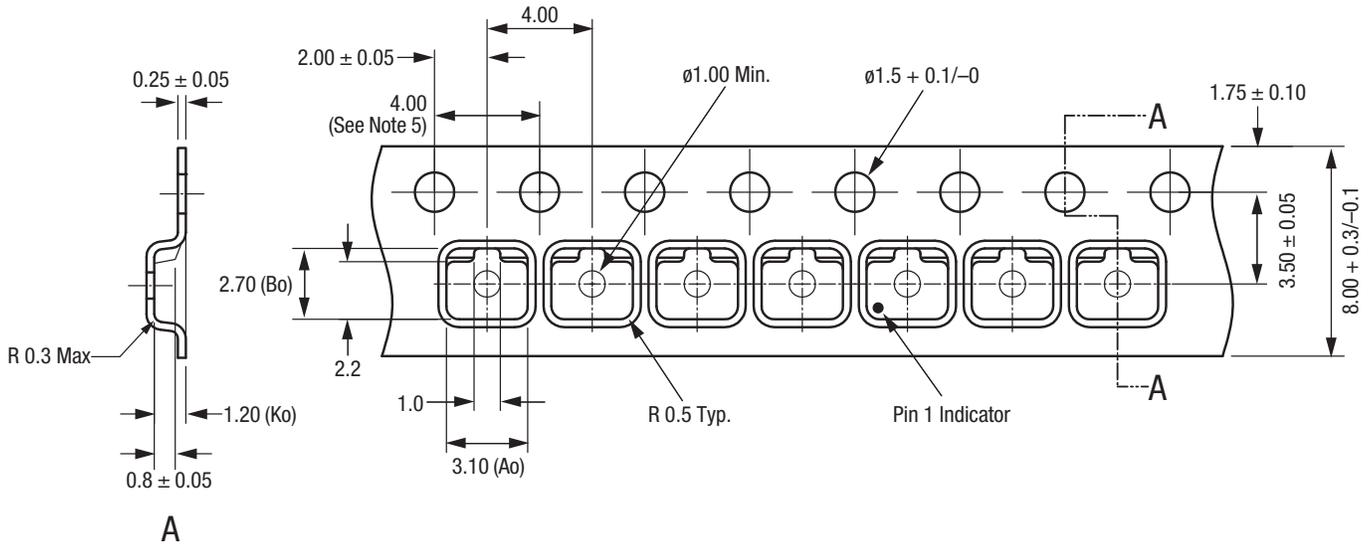


Figure 4. SOT-23 Package Dimension Drawing



Notes:

1. Carrier tape: black conductive polycarbonate.
2. Cover tape material: transparent conductive PSA.
3. Cover tape size: 5.40 mm width.
4. Tolerance: ±0.10 mm.
5. Ten sprocket hole pitch cumulative tolerance: ±0.2 mm.
6. All measurements are in millimeters.
7. Alternative carrier tape dimensions are:  
 Ao = 3.3  
 Bo = 2.9  
 Ko = 1.22

S1684b

Figure 5. SOT-23 Tape and Reel Dimensions

**DATA SHEET • SMVA1470-004LF: HYPERABRUPT JUNCTION TUNING VARACTOR**

Copyright © 2002-2011, 2013-2015, 2018 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks and the Skyworks symbol are trademarks or registered trademarks of Skyworks Solutions, Inc. or its subsidiaries in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at [www.skyworksinc.com](http://www.skyworksinc.com), are incorporated by reference.