

DATA SHEET

SMV2025 Series: Surface Mount, Silicon Hyperabrupt Tuning Varactor Diodes

Applications

- Wide bandwidth and low phase noise VCOs
- Wide range, voltage-tuned phase shifters and filters
- Miniature RF and microwave tuners

Features

- Low series resistance and leakage current for low phase noise VCOs
- High capacitance ratio: $C_T(2\text{ V})/C_T(10\text{ V}) = 2.2$ minimum
- Broad 18 V tuning range
- Competitive cross to Toshiba 1SV280 varactor diode
- SC-79 and ultra-small SOD-882 packages (MSL1, 260 °C per JEDEC J-STD-020)



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.

Description

The SMV2025 series are silicon surface mount, hyperabrupt tuning varactor diodes, excellent for use as high-Q tuning elements in an RF Voltage Controlled Oscillator (VCO), voltage-controlled phase shifter, or tunable bandpass filter.

The minimum capacitance ratio from 2 V to 10 V is 2.2 makes the SMV2025 series suitable for wide bandwidth VCOs and wide phase range phase shifters.

The SMV2025 is manufactured in a surface mount, industry-standard SC-79 package and an ultra-small SOD-882 package that offer very low parasitic inductance and capacitance.

Table 1 describes the packages and markings of the SMV2025 series diodes.

Table 1. Packaging and Marking

| | |
|--|---|
|  |  |
| Single | Single |
| SC-79 Green™ | SOD-882 Green™ |
| SMV2025-079LF Marking: Cathode | SMV2025-040LF Marking: DK1 |
| $L_s = 0.70\text{ nH}$ | $L_s = 0.45\text{ nH}$ |



The Pb-free symbol or "LF" in the part number denotes a lead-free, RoHS-compliant package unless otherwise noted as Green™. Tin/lead (Sn/Pb) packaging is not recommended for new designs.

Electrical and Mechanical Specifications

The absolute maximum ratings for the SMV2025 series are provided in Table 2. Electrical specifications are provided in Table 3. Table 4 summarizes the typical capacitance for reverse voltages between 0 and 20 V.

Typical performance characteristics are illustrated in Figures 1 and 2.

The SPICE model for the SMV2025 series of varactor diodes is shown in Figure 3 and the associated model parameters are provided in Table 5.

Package Dimensions

Package dimensions for the SMV2025 series are provided in Figure 4 (SC-79) and Figure 6 (SOD-882). Tape and reel dimensions are provided in Figure 5 (SC-79) and Figure 7 (SOD-882). For the PCB layout footprint, refer to the Skyworks Application Note, *Suggested PCB Land Pattern Designs for Leaded and Leadless Packages, and Detailed Surface Mount Guidelines for Leadless Packages*, document number 200123.

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 SMV2025 series 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.

Table 2. SMV2025 Series Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Minimum | Maximum | Units |
|---|------------------|---------|---------|-------|
| Forward current | I _F | | 100 | mA |
| Reverse voltage | V _R | | 20 | V |
| Dissipated power @ 25 °C | P _D | | 250 | mW |
| Storage temperature | T _{STG} | -55 | +200 | °C |
| Junction temperature | T _J | -55 | +175 | °C |
| Solder interface temperature | T _S | -40 | +85 | °C |
| Electrostatic discharge: Human Body Model (HBM), Class 2 | ESD | | 4000 | 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. SMV2025 Series Electrical Specifications (Note 1)
(Ts = +25 °C, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|-------------------|----------|--|------|---------|------|-------|
| Reverse current | I_R | $V_R = 19\text{ V}$ | | | 20 | nA |
| Capacitance | C_T | $f = 1\text{ MHz}$: | | | | |
| | | $V_R = 2\text{ V}$ | 4.20 | | 5.10 | pF |
| | | $V_R = 10\text{ V}$ | 1.60 | | 2.00 | pF |
| | | $V_R = 18\text{ V}$ | 1.00 | | 1.25 | pF |
| Capacitance ratio | C_{TR} | $C_T @ 2\text{ V}/C_T @ 10\text{ V}$ | 2.2 | | | – |
| Series resistance | R_S | $f = 470\text{ MHz}, V_R = 1\text{ V}$ | | 0.8 | | Ω |
| Breakdown voltage | V_{BR} | $I_R = 10\ \mu\text{A}$ | 20 | | | V |

Note 1: Performance is guaranteed only under the conditions listed in this table.

Table 4. Reverse Voltage vs Typical Capacitance

| V_R (V) | C_T (pF) |
|-----------|------------|
| 0 | 8.81 |
| 0.5 | 6.93 |
| 1.0 | 5.88 |
| 1.5 | 5.18 |
| 2.0 | 4.67 |
| 2.5 | 4.27 |
| 3.0 | 3.94 |
| 3.5 | 3.67 |
| 4.0 | 3.44 |
| 4.5 | 3.23 |
| 5.0 | 3.05 |
| 6.0 | 2.74 |
| 7.0 | 2.47 |
| 8.0 | 2.24 |
| 9.0 | 2.03 |
| 10.0 | 1.83 |
| 11.0 | 1.65 |
| 12.0 | 1.50 |
| 13.0 | 1.38 |
| 14.0 | 1.30 |
| 15.0 | 1.24 |
| 16.0 | 1.21 |
| 17.0 | 1.19 |
| 18.0 | 1.17 |
| 19.0 | 1.16 |
| 20.0 | 1.15 |

Typical Performance Characteristics

(TA = 25 °C, Unless Otherwise Noted)

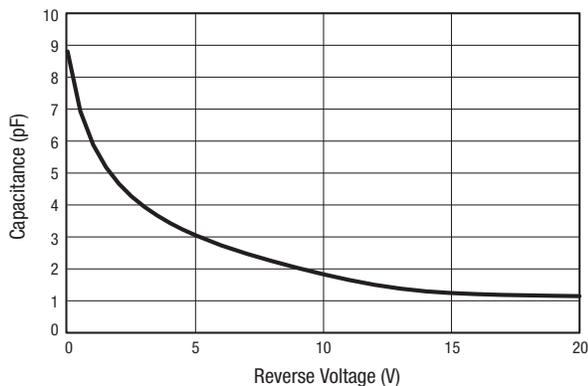


Figure 1. Capacitance vs Reverse Voltage

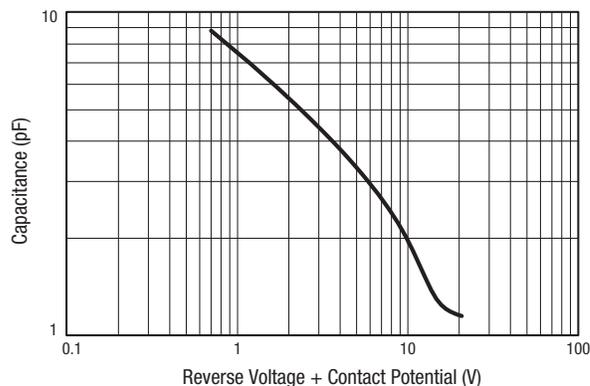


Figure 2. Capacitance vs Reverse Voltage (Logarithmic Plot)

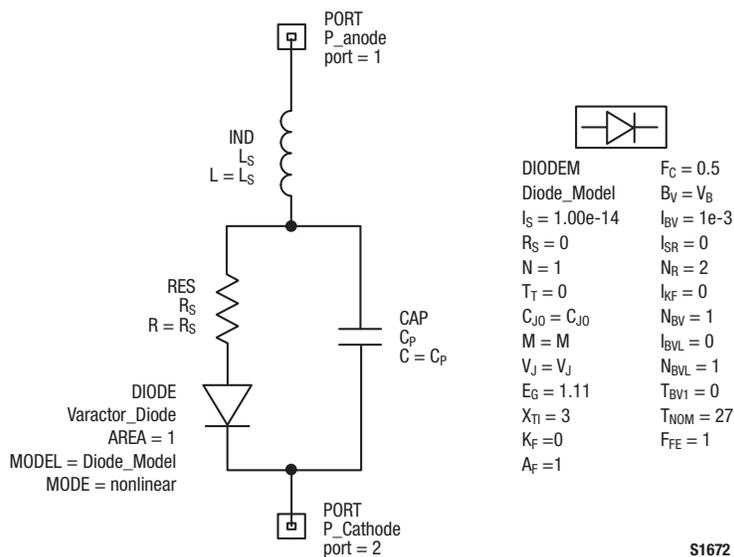
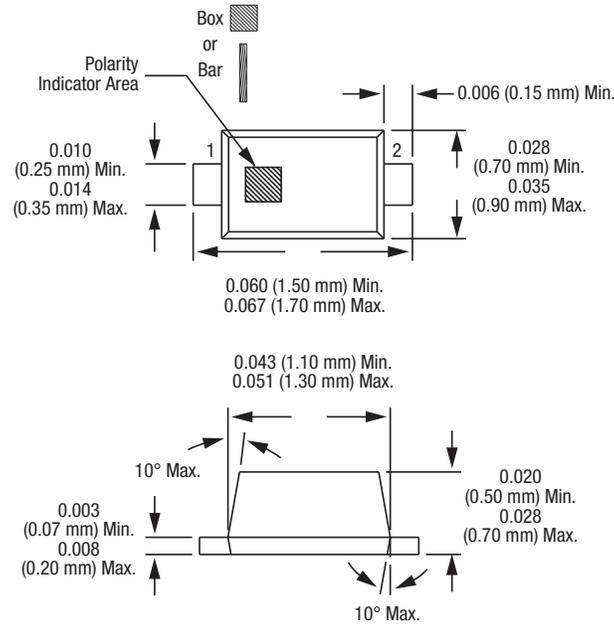


Figure 3. SPICE Model

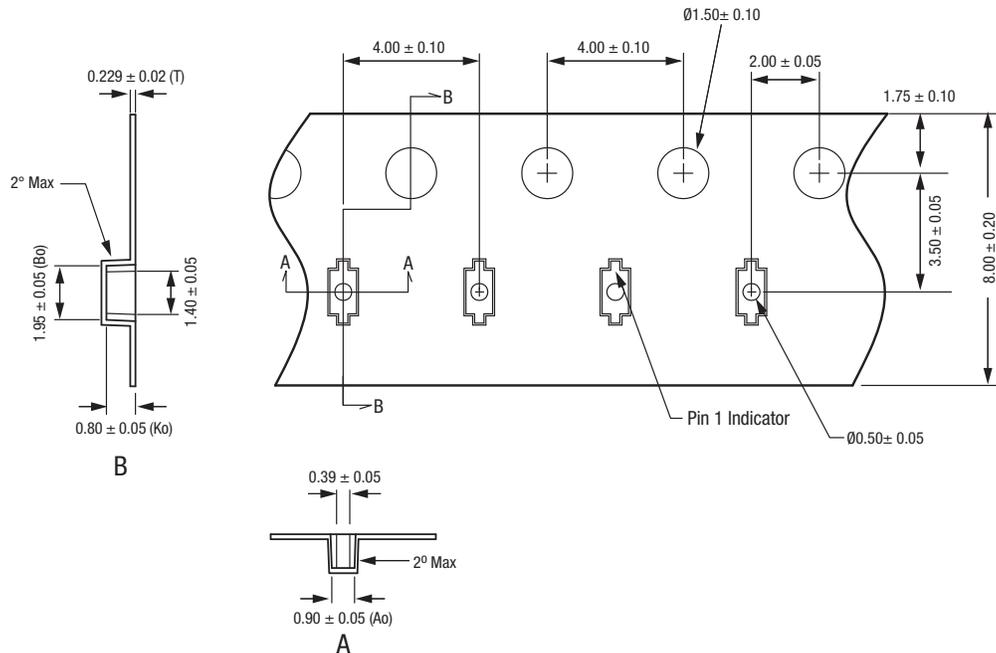
Table 5. SPICE Model Parameters

| Part Number | C _{JO} (pF) | V _J (V) | M | C _P (pF) | R _S (Ω) | L _S (nH) |
|---------------|----------------------|--------------------|-----|---------------------|--------------------|---------------------|
| SMV2025-079LF | 8.8 | 1.05 | 0.7 | 0.07 | 0.8 | 0.70 |
| SMV2025-040LF | 8.8 | 1.05 | 0.7 | 0.07 | 0.8 | 0.45 |



Dimensions are in inches (millimeters shown in parentheses) S1652

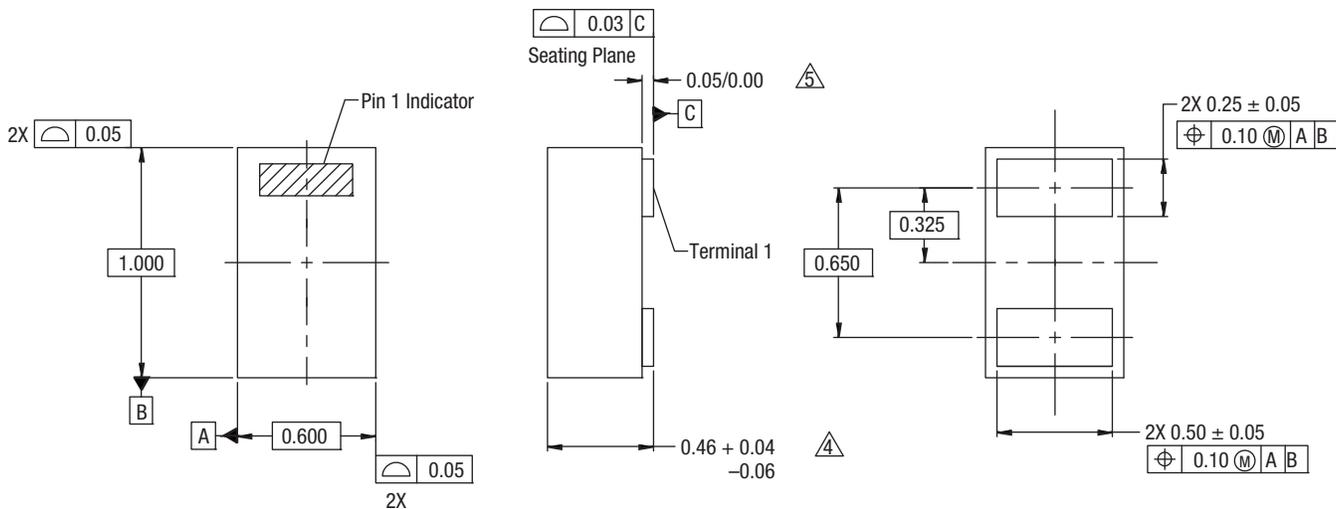
Figure 4. SMV2025-079LF Package Dimensions (SC-79)



- 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. ESD-surface resistivity is $\leq 1 \times 10^8$ Ohms/square per EIA, JEDEC TNR Specification.
 4. All measurements are in millimeters.

S2929

Figure 5. SMV2025-079LF Tape and Reel Dimensions (SC-79)

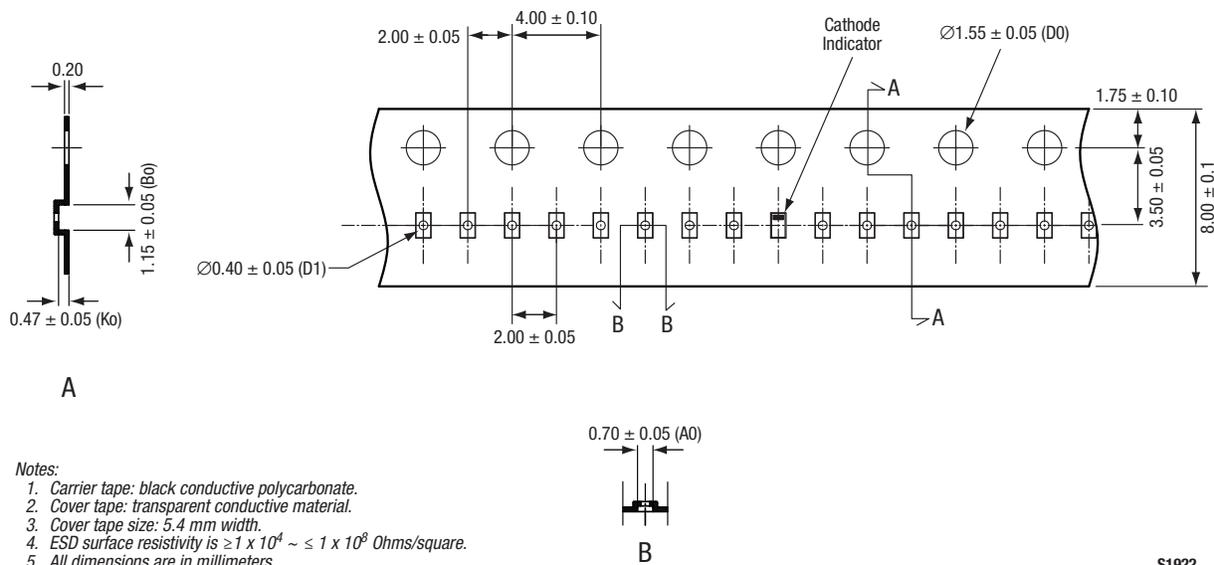


NOTES:

1. All measurements are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.
3. These packages are used principally for discrete devices.
4. This dimension includes stand-off height and package body thickness, but does not include attached features, e.g., external heatsink or chip capacitors. An integral heatslug is not considered an attached feature.
5. This dimension is primarily terminal plating, but does not include small metal protrusion.

Y1410

Figure 6. SMV2025-040LF Package Dimensions (SOD-882)



Notes:

1. Carrier tape: black conductive polycarbonate.
2. Cover tape: transparent conductive material.
3. Cover tape size: 5.4 mm width.
4. ESD surface resistivity is $\geq 1 \times 10^4 \sim \leq 1 \times 10^8$ Ohms/square.
5. All dimensions are in millimeters.

S1922

Figure 7. SMV2025-040LF Tape and Reel Dimensions (SC-79)

Ordering Information

| Model Name | Manufacturing Part Number |
|--|--------------------------------|
| SMV2025 Series Surface Mount Hyperabrupt Tuning Varactor Diode | SMV2025-079LF SMV2025-040LF |

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