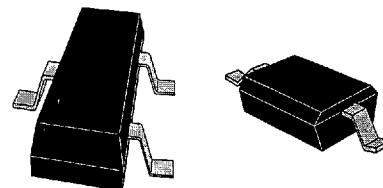


# Plastic Packaged Surface Mount Varactor Diodes

SMV1100, SMV1200, SMV1400 Series

## Features

- Industry Standard Outlines: SOD-323 and SOT SOT 23 Packages
- High "Q" Abrupt and Hyperabrupt Junction Designs
- Single and Common Cathode Configurations
- Available for 3 Volt Battery Operated Circuits
- Priced for High Volume Commercial Applications
- Available in Tape and Reel



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## Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

|                        |               |
|------------------------|---------------|
| Forward Current:       | 100 mA        |
| Power Dissipation:     | 250 mW        |
| Junction Temperature:  | 125 °C        |
| Storage Temperature:   | -55 to 150 °C |
| Operating Temperature: | -55 to 125 °C |

## Description

The surface mount plastic varactor diodes are designed for RF and Microwave applications in VCOs, electronically tunable filters and matching networks. Package offerings include the SOT-23 and the small footprint SOD-323 package. Alpha offers a comprehensive capability in capacitance values, package options and voltage ratings all aggressively priced for high volume commercial applications.

The SMV1200-49 to SMV1200-55 varactors were specifically designed for battery operated applications where 3 to 5 volts is available. These varactors have capacitance ratios of greater than 12 from 0.3 to 4.7 volts.

Alpha's hyperabrupt varactors are available in a wide variety of tightly specified capacitance values and

high capacitance ratios. They are available as single junctions and common cathode configurations where they may be employed in a back-to-back orientation to reduce distortion.

Alpha's abrupt junction varactors are noted for extremely high Q factor and are the preferred choice in applications that require low phase noise and high temperature stability.

The inductance of the SOT-23 package is typically 1.5 nH for each junction. Employing a common cathode SOT-23 with the varactor junctions connected in parallel reduces the inductance to approximately 0.9 nH. The inductance of a varactor in the SOD-323 package is approximately 1.2 nH.

## SMV1100, SMV1200, SMV1400 Series

## Electrical Characteristics (TA = 25°C)

## High Ratio Hyperabrupt Junction Varactors for Battery Operated Applications

Breakdown Voltage, V<sub>B</sub> (10 μA), 15V MinReverse Leakage Current, I<sub>R</sub> (12V), 50 nA MaxCapacitance Ratio C<sub>T</sub> 0.3V/C<sub>T</sub> 3.0V, 7.8 Typical

|                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |
| Single                                                                            | Single                                                                            | Series                                                                            | Common Anode                                                                       | Common Cathode                                                                      |
| SOD 323                                                                           | SOT 23                                                                            |                                                                                   |                                                                                    |                                                                                     |

| Part Number               | C <sub>T</sub> @ 0.3V (pF) |     | C <sub>T</sub> @ 3.0V (pF) | C <sub>T</sub> @ 4.7V (pF) |     | C <sub>T</sub> 0.3V/C <sub>T</sub> 4.7V |      | R <sub>S</sub> @ 3V 50 MHz | Package Style (SOT 23)   |
|---------------------------|----------------------------|-----|----------------------------|----------------------------|-----|-----------------------------------------|------|----------------------------|--------------------------|
|                           | typ                        | min | typ                        | typ                        | max | typ                                     | min  | max (Ω)                    |                          |
| SMV1200-49<br>SMV1200-149 | 31                         | 28  | 4.0                        | 2.6                        | 2.8 | 12.1                                    | 11.0 | 1                          | Single<br>Common Cathode |
| SMV1200-50<br>SMV1200-150 | 36                         | 33  | 4.5                        | 3.0                        | 3.3 | 12.2                                    | 11.0 | 0.9                        | Single<br>Common Cathode |
| SMV1200-51<br>SMV1200-151 | 42                         | 38  | 5.5                        | 3.4                        | 3.8 | 12.2                                    | 11.0 | 0.75                       | Single<br>Common Cathode |
| SMV1200-53<br>SMV1200-153 | 53                         | 48  | 6.7                        | 4.3                        | 4.8 | 12.3                                    | 11.0 | 0.6                        | Single<br>Common Cathode |
| SMV1200-55<br>SMV1200-155 | 64                         | 58  | 8.0                        | 5.2                        | 5.8 | 12.3                                    | 11.0 | 0.5                        | Single<br>Common Cathode |

## 12 Volt Hyperabrupt Junction Varactors for General Purpose

Reverse Breakdown Voltage, V<sub>BR</sub> (10 μA):

12V Minimum

Reverse Leakage Current, I<sub>R</sub> (8V):

50 nA Maximum

| Part Number | C <sub>T</sub> @ 1V (pF) |     | C <sub>T</sub> @ 2.5V (pF) |      | C <sub>T</sub> @ 4V (pF) |      | Q @ 4V, 50 MHz | Package Style (SOT 23) |
|-------------|--------------------------|-----|----------------------------|------|--------------------------|------|----------------|------------------------|
|             | min                      | typ | min                        | max  | typ                      | max  | min            |                        |
| SMV1204-11  | 95                       | 100 | 40                         | 65   | 20                       | 25   | 80             | Single                 |
| SMV1204-12  | 42                       | 50  | 18                         | 27   | 9.0                      | 12   | 150            | Single                 |
| SMV1204-13  | 17                       | 22  | 8.5                        | 10.5 | 4.0                      | 5.5  | 200            | Single                 |
| SMV1204-14  | 14.5                     | 16  | 6.5                        | 7.8  | 3.0                      | 4.8  | 300            | Single                 |
| SMV1204-15  | 8.7                      | 9.5 | 4.3                        | 5.5  | 2.0                      | 2.9  | 350            | Single                 |
| SMV1201-97  | 85                       | —   | —                          | —    | 15.0                     | 30.0 | 500*           | Single                 |

\*Q @ 2V, F=1 MHz

| Part Number               | V <sub>B</sub> @ 10V | I <sub>R</sub> @ 8V (nA) | C <sub>T</sub> @ 0.2V (pF) |     | C <sub>T</sub> @ 2V (pF) |     | C <sub>T</sub> @ 6V, 50 MHz |     | Q @ 2V, 50 MHz | Package Style (SOT 23)   |
|---------------------------|----------------------|--------------------------|----------------------------|-----|--------------------------|-----|-----------------------------|-----|----------------|--------------------------|
|                           | min                  | max                      | min                        | max | min                      | max | min                         | max | min            |                          |
| SMV1204-99<br>SMV1204-199 | 12                   | 50                       | 11                         | 14  | 4                        | 6.5 | 1.2                         | 1.9 | 250            | Single<br>Common Cathode |

| Part Number | C <sub>T</sub> @ 2.5V (pF) |     | C <sub>T</sub> @ 1V/C <sub>T</sub> @ 2.5V |     | C <sub>T</sub> @ 2.5V/C <sub>T</sub> @ 4V (pF) |     | Q @ 4V, 50 MHz | Package Style (SOT 23) |
|-------------|----------------------------|-----|-------------------------------------------|-----|------------------------------------------------|-----|----------------|------------------------|
|             | min                        | max | min                                       | max | min                                            | max | min            |                        |
| SMV1204-22  | 18                         | 27  | 1.5                                       | 2.0 | 1.5                                            | 2.0 | 150            | Single                 |
| SMV1204-23  | 9                          | 13  | 1.5                                       | 2.0 | 1.5                                            | 2.0 | 200            | Single                 |
| SMV1204-24  | 6                          | 8   | 1.5                                       | 2.0 | 1.5                                            | 2.0 | 300            | Single                 |
| SMV1204-25  | 4.2                        | 5.6 | 1.5                                       | 2.0 | 1.5                                            | 2.0 | 350            | Single                 |

## 15 Volt Hyperabrupt Junction Varactors

Reverse Breakdown Voltage,  $V_{BR}$  (10  $\mu$ A):

15V Minimum

Reverse Leakage Current,  $I_R$  (12V):

50 nA Maximum

|                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |
| Single                                                                            | Single                                                                            | Series                                                                            | Common Anode                                                                       | Common Cathode                                                                      |
| SOD 323                                                                           | SOT 23                                                                            |                                                                                   |                                                                                    |                                                                                     |

| Part Number                             | $C_T$ @ 1V (pF) |       | $C_T$ (1V)/ $C_T$ (3V) |     | $C_T$ (1V)/ $C_T$ (6V) |     | $R_S$ @ 3V 50 MHz | $Q$ @ 3V, 50 MHz | Package Style (SOT 23)                     |
|-----------------------------------------|-----------------|-------|------------------------|-----|------------------------|-----|-------------------|------------------|--------------------------------------------|
|                                         | min             | max   | min                    | max | min                    | max | max               | min              |                                            |
| SMV1104-33<br>SMV1204-33<br>SMV1204-133 | 3.0             | 3.6   | 1.5                    | 1.9 | 2.6                    | 3.3 | 1.2               | 1200             | Single SOD 323<br>Single<br>Common Cathode |
| SMV1104-34<br>SMV1204-34<br>SMV1204-134 | 5.85            | 7.15  | 1.6                    | 2.0 | 2.8                    | 3.4 | 0.8               | 1000             | Single SOD 323<br>Single<br>Common Cathode |
| SMV1104-35<br>SMV1204-35<br>SMV1204-135 | 10.35           | 12.65 | 1.6                    | 2.0 | 2.9                    | 3.4 | 0.6               | 750              | Single SOD 323<br>Single<br>Common Cathode |
| SMV1104-36<br>SMV1204-36<br>SMV1204-136 | 15.50           | 18.50 | 1.6                    | 2.0 | 3.0                    | 3.5 | 0.5               | 700              | Single SOD 323<br>Single<br>Common Cathode |
| SMV1204-37                              | 45.00           | 54.00 | 1.6                    | 2.0 | 3.0                    | 3.5 | 0.25              | 500              | Single                                     |

## 20 Volt Hyperabrupt Junction Varactors for General Wide Band Applications

Reverse Breakdown Voltage,  $V_{BR}$  (10  $\mu$ A):

20V Minimum

Reverse Leakage Current,  $I_R$  (16V):

50 nA Maximum

| Part Number               | $C_T$ @ $V_{R1}$ (pF) |      | $V_{R1}$ (V) | $C_{T2}$ @ $V_{R2}$ (pF) |      | $V_{R2}$ (V) | $C_{T1}/C_{T2}$ | $Q$ @ $V_{R1}$ , 50 MHz | Package Style (SOT 23)   |
|---------------------------|-----------------------|------|--------------|--------------------------|------|--------------|-----------------|-------------------------|--------------------------|
|                           | min                   | max  |              | min                      | max  |              | min             | min                     |                          |
| SMV1200-04<br>SMV1200-104 | 10.5                  | 12.5 | 3            | 2.1                      | 2.5  | 20           | 4.6             | 400                     | Single<br>Common Cathode |
| SMV1200-07<br>SMV1200-107 | 25                    | 31   | 3            | 4.5                      | 5.3  | 20           | 4.8             | 300                     | Single<br>Common Cathode |
| SMV1204-04<br>SMV1204-104 | 2.5                   | 3.3  | 4            | 0.6                      | 0.85 | 20           | 3.0             | 500                     | Single<br>Common Cathode |
| SMV1204-05<br>SMV1204-105 | 4.5                   | 5.5  | 4            | 0.9                      | 1.2  | 20           | 4.2             | 500                     | Single<br>Common Cathode |
| SMV1202-03                | 18                    | 22   | 4            | 3.1                      | 3.9  | 20           | 4.6             | 300                     | Single                   |
| SMV1202-08                | 45                    | 55   | 4            | 7.3                      | 9.2  | 20           | 5.0             | 200                     | Single                   |
| SMV1202-12                | 100                   | 120  | 4            | 16                       | 20   | 20           | 5.2             | 125                     | Single                   |

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**SMV1100, SMV1200, SMV1400 Series****Low Series Resistance Abrupt Junction Varactors**

Reverse Breakdown Voltage,  $V_{BR}$  (10  $\mu$ A): 12V Minimum  
 Reverse Leakage Current,  $I_R$  (10V): 50 nA Maximum

|                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |
| Single                                                                            | Single                                                                            | Series                                                                            | Common Anode                                                                       | Common Cathode                                                                      |
| SOD 323                                                                           | SOT 23                                                                            |                                                                                   |                                                                                    |                                                                                     |

| Part Number | $C_T$ @ 1.0V (pF) |      | $C_T$ @ 4.0V (pF) |      | $R_S$ Max @ 1V, 50 MHz | Package Style (SOD 323) |
|-------------|-------------------|------|-------------------|------|------------------------|-------------------------|
|             | min               | max  | min               | max  | max                    |                         |
| SMV1401-99  | 17.4              | 20.0 | 10.0              | 12.1 | 0.25                   | Single SOD 323          |
| SMV1401-98  | 36.3              | 41.7 | 20.7              | 25.3 | 0.20                   | Single SOD 323          |

**30 Volt Abrupt Junction Varactors For General Purpose**

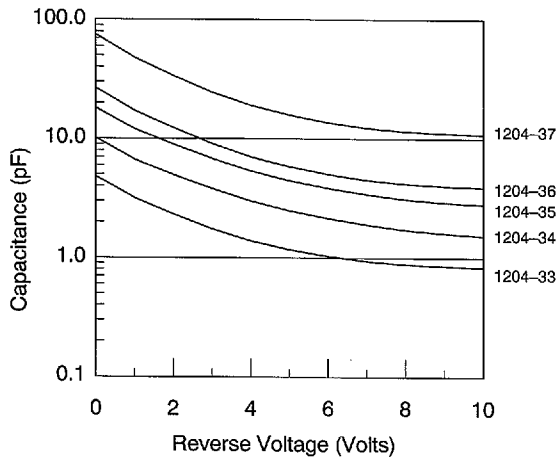
Reverse Breakdown Voltage,  $V_{BR}$  (10  $\mu$ A): 30V Minimum  
 Reverse Leakage Current,  $I_R$  (24V): 50 nA Maximum

| Part Number               | $C_T$ @ 4V (pF) |       | $C_T$ 0/ $C_T$ 30 | $R_S$ @ 4V 50 MHz (Ohms) | Q @ 4V, 50 MHz | Package Style (SOT 23)   |
|---------------------------|-----------------|-------|-------------------|--------------------------|----------------|--------------------------|
|                           | min             | max   |                   |                          |                |                          |
| SMV1400-08<br>SMV1400-108 | 1.62            | 1.98  | 4.1               | 0.60                     | 2900           | Single<br>Common Cathode |
| SMV1400-09<br>SMV1400-109 | 1.98            | 2.42  | 4.1               | 0.50                     | 2800           | Single<br>Common Cathode |
| SMV1400-10<br>SMV1400-110 | 2.43            | 2.97  | 4.2               | 0.45                     | 2600           | Single<br>Common Cathode |
| SMV1400-11<br>SMV1400-111 | 2.97            | 3.63  | 4.2               | 0.40                     | 2500           | Single<br>Common Cathode |
| SMV1400-13<br>SMV1400-113 | 3.51            | 4.29  | 4.2               | 0.35                     | 2400           | Single<br>Common Cathode |
| SMV1400-14<br>SMV1400-114 | 4.23            | 5.17  | 4.2               | 0.30                     | 2200           | Single<br>Common Cathode |
| SMV1400-15<br>SMV1400-115 | 5.04            | 6.16  | 4.3               | 0.27                     | 2100           | Single<br>Common Cathode |
| SMV1400-16<br>SMV1400-116 | 6.12            | 7.48  | 4.3               | 0.24                     | 2000           | Single<br>Common Cathode |
| SMV1400-17<br>SMV1400-117 | 7.38            | 9.02  | 4.3               | 0.22                     | 1800           | Single<br>Common Cathode |
| SMV1400-19                | 9.00            | 11.00 | 4.4               | 0.20                     | 1600           | Single                   |
| SMV1400-20                | 10.80           | 13.20 | 4.4               | 0.18                     | 1500           | Single                   |
| SMV1400-21                | 13.50           | 16.50 | 4.4               | 0.18                     | 1200           | Single                   |
| SMV1400-22                | 16.20           | 19.80 | 4.4               | 0.18                     | 1000           | Single                   |

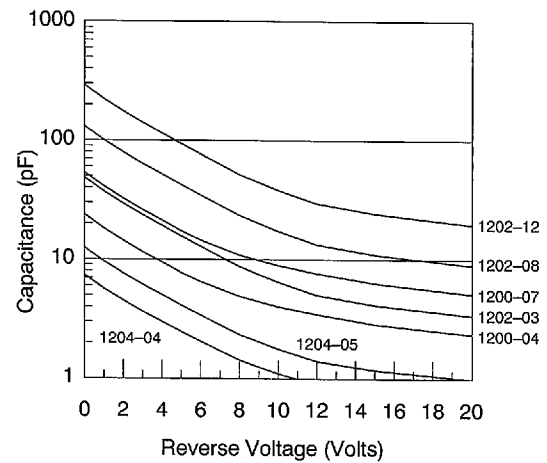
- The outline 546-011 contains a single varactor junction in a two leaded SOD-323 package. The outline 434-043 contains a single varactor junction in a three leaded SOT-23 package. The outline 434-013 contains two varactor junctions in a common cathode configuration in a three leaded SOT-23 package.
- For part numbers designating two varactor junctions in a common cathode configuration, the listed electrical characteristics apply to a single junction.

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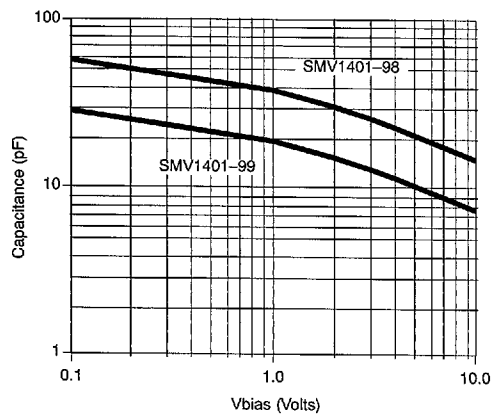
## Typical Performance Data



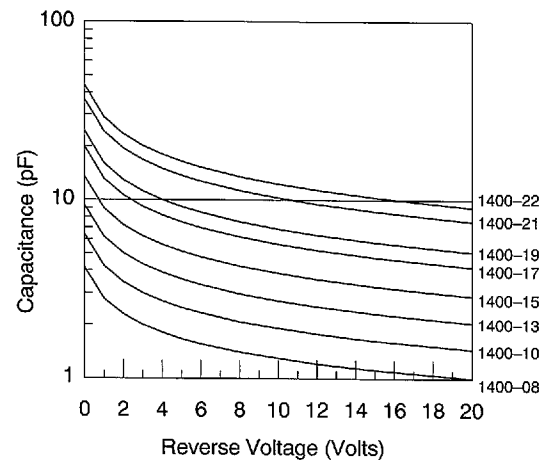
Capacitance vs. Reverse Voltage



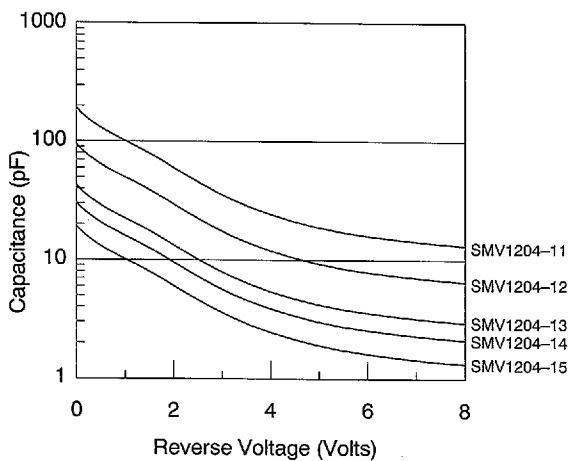
Capacitance vs. Reverse Voltage



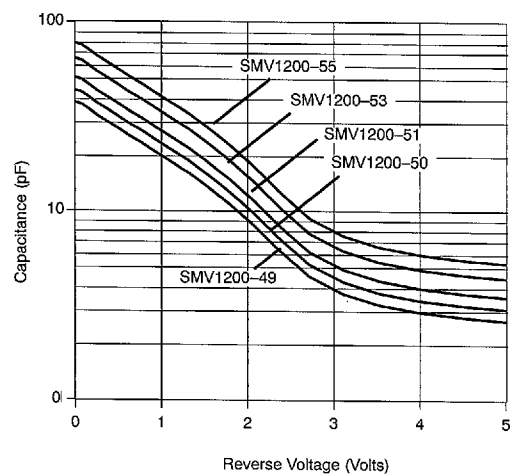
Capacitance vs. Voltage



Capacitance vs. Reverse Voltage

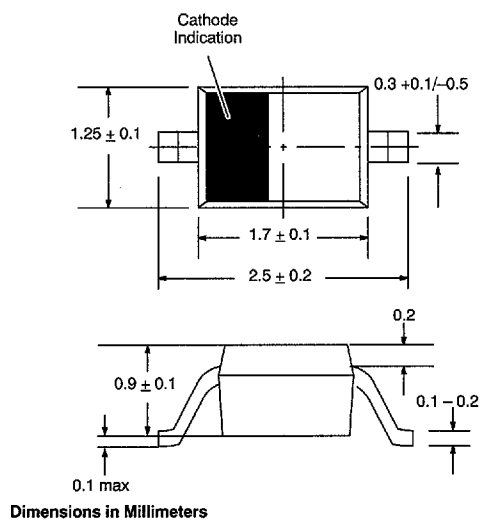


Capacitance vs. Reverse Voltage



Capacitance vs. Voltage

**SOT 23**



# RF GaAs MMIC Products in Metal Packages

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