

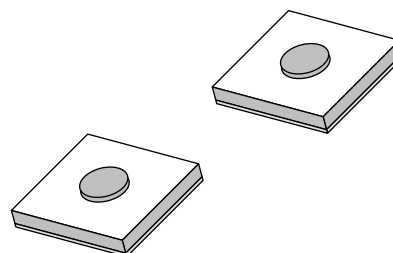
Silicon Hyperabrupt Varactor Diode Chips



SMV2019 to SMV2023

Features

- High Q for Low Loss Resonators
- Low Leakage Current
- High Tuning Ratio for Wideband VCOs
- SPICE Model Parameters
- Small Footprint Chip Design



Description

Alpha Industries' product line of silicon hyperabrupt junction varactor diode chips are processed using established ion-implantation technology resulting in low R_S wide tuning ratio devices with high Q values. These planar chips have a small outline size (12 x 12 mils

nominal) and are fully passivated resulting in low leakage current and high reliability. These varactor chips are intended for assembly in hybrid integrated circuit resonators used in VCOs and analog tuned filters.

Electrical Specifications at 25°C

Part Number	C_J @ 0 V (pF) ¹	C_J @ 4 V (pF)		C_J @ 20 V (pF)		Q @ 4 V 50 MHz ²	1 GHz R_S @ 4 V (Ω)	I_R @ 17.6 V (nA) ³	Contact Diam. (mils) ⁴
	Typ.	Min.	Max.	Min.	Max.	Min.	Typ.	Max.	Nom.
SMV2019-000	2.3	0.68	0.88	0.13	0.23	500	4.8	50	2.00
SMV2020-000	3.1	1.13	1.43	0.23	0.33	500	4.1	50	2.50
SMV2021-000	4.5	1.58	1.98	0.32	0.44	500	2.8	50	3.00
SMV2022-000	7.1	2.48	3.08	0.48	0.68	400	2.2	50	3.75
SMV2023-000	10.8	4.28	5.28	0.78	1.08	400	1.4	50	5.00

1. All capacitance values specified at 1 MHz.

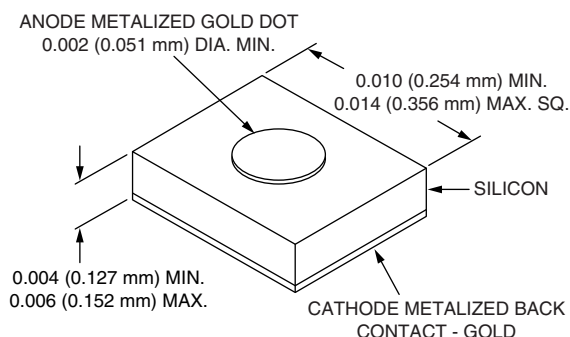
2. 50 MHz Q calculated from 1 GHz R_S and 1 MHz C_J .

3. V_B at 10 μ A specified at 22 V Min.

4. Outline drawing 149-801.

Outline Drawing

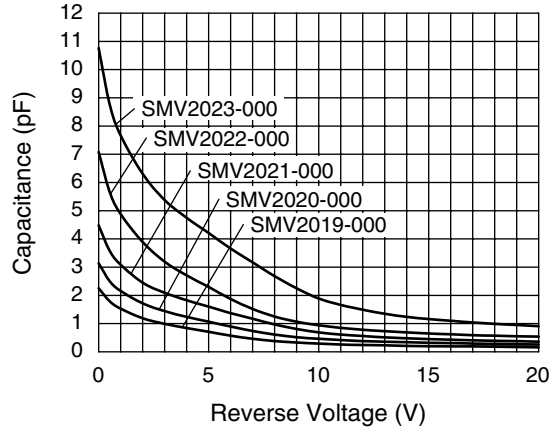
149-801



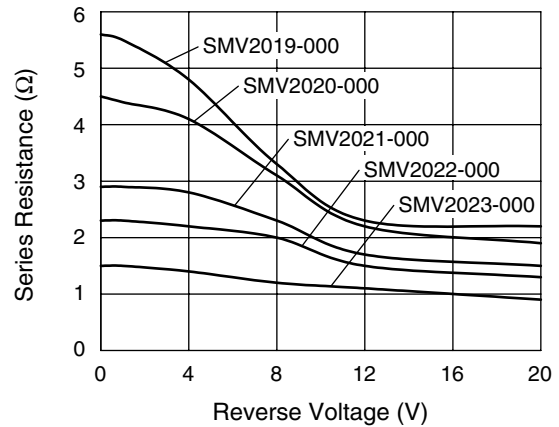
Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	22 V
Forward Current (I_F)	100 mA
Power Dissipation at 25°C (P_D)	250 mW
Operating Temperature (T_{OP})	-55°C to +150°C
Storage Temperature (T_{ST})	-65°C to +200°C

Typical Performance Data



Capacitance vs. Reverse Voltage

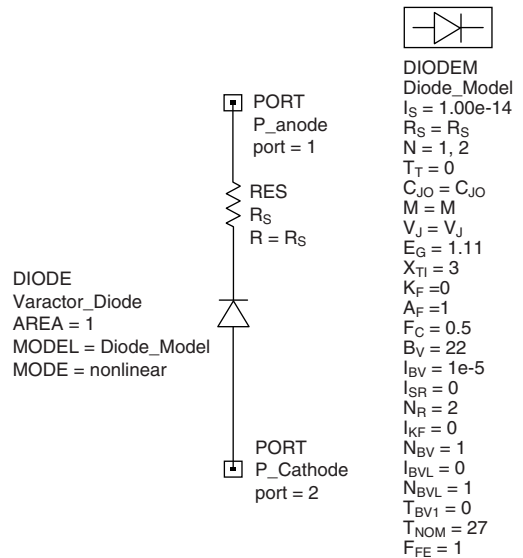


Series Resistance vs. Voltage @ 1 GHz

Typical Capacitance Values

V _R (V)	SMV2019 C _J (pF)	SMV2020 C _J (pF)	SMV2021 C _J (pF)	SMV2022 C _J (pF)	SMV2023 C _J (pF)
0.0	2.25	3.14	4.48	7.08	10.76
0.5	1.79	2.5	3.57	5.66	8.76
1.0	1.53	2.16	3.09	4.88	7.67
2.0	1.19	1.72	2.45	3.89	6.31
3.0	0.99	1.44	2.09	3.19	5.38
4.0	0.84	1.24	1.83	2.71	4.75
5.0	0.71	1.07	1.60	2.30	4.21
6.0	0.57	0.90	1.37	1.87	3.66
7.0	0.46	0.74	1.17	1.52	3.17
8.0	0.38	0.61	0.97	1.25	2.68
9.0	0.33	0.52	0.81	1.07	2.25
10.0	0.29	0.46	0.69	0.94	1.89
11.0	0.26	0.42	0.61	0.85	1.66
12.0	0.24	0.38	0.56	0.78	1.49
13.0	0.23	0.36	0.51	0.73	1.35
14.0	0.21	0.34	0.48	0.69	1.24
15.0	0.20	0.32	0.45	0.65	1.16
16.0	0.19	0.31	0.43	0.62	1.10
17.0	0.19	0.29	0.41	0.59	1.04
18.0	0.18	0.28	0.39	0.57	0.99
19.0	0.17	0.27	0.38	0.55	0.95
20.0	0.16	0.26	0.36	0.54	0.91

SPICE Model



$$C_V = \frac{C_{JO}}{\left(1 + \frac{V_R}{V_J}\right)^M} + C_P$$

Part Number	C _{JO} (pF)	V _J (V)	M	R _S (Ω)
SMV2019	2.3	3.5	1.40	4.8
SMV2020	3.3	3.6	1.30	4.1
SMV2021	4.5	3.9	1.34	2.8
SMV2022	7.1	4.0	1.40	2.2
SMV2023	10.8	4.6	1.45	1.4

SPICE model parameters extracted from measured characteristics may not reflect exact physical or electronic properties. See application note APN1004.