

DATA SHEET

SMV1247–SMV1255: Hyperabrupt Tuning Varactors

Features

- Designed for high volume commercial applications
- High capacitance ratio, $C_{0.3V}/C_{4.7V} = 12$ typ.
- Multiple packages SOT-23, SOD-323, SC-70 and SC-79
- Available lead (Pb)-free MSL-1 @ 250 °C per JEDEC J-STD-020
- SPICE models are available
- Available in tape and reel packaging



Description

The SMV1247–SMV1255 series of silicon hyperabrupt junction varactor diodes are designed for use in VCOs with low tuning voltage operation. This family of varactors is characterized for capacitance and resistance over temperature. SPICE models are provided.

NEW Skyworks offers lead (Pb)-free “environmentally friendly” packaging that is RoHS compliant (European Parliament for the Restriction of Hazardous Substances).



Absolute Maximum Ratings

Characteristic	Value
Reverse voltage (V_R)	15 V
Forward current (I_F)	20 mA
Power dissipation (P_D)	250 mW
Storage temperature (T_{ST})	-55 °C to +150 °C
Operating temperature (T_{OP})	-55 °C to +125 °C
ESD human body model	Class 0

Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void the warranty.

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 must be employed at all times.

Single	Single	Single	Common Anode	Common Cathode	Common Anode	Common Cathode
SC-79	SOD-323	SOT-23	SOT-23	SOT-23	SC-70	SC-70
SMV1247-079						SMV1247-074
Marking: Cathode						Marking: BF3
SMV1247-079LF						SMV1247-074LF
Marking: Cathode						Marking: GF3
SMV1248-079LF		SMV1248-001		SMV1248-004		SMV1248-074
Marking: Cathode		Marking: BG1				SMV1248-074LF
						Marking: GG3
SMV1249-079	SMV1249-011	SMV1249-001	SMV1249-003		SMV1249-073	SMV1249-074
Marking: Cathode	Marking: AF	Marking: P1	Marking: AF9		Marking: AF9	
SMV1249-079LF		SMV1249-001LF				
Marking: Cathode		Marking: EF1				
SMV1251-079	SMV1251-011	SMV1251-001		SMV1251-004		SMV1251-074
Marking: Cathode	Marking: AH	Marking: AH1		Marking: AH3		Marking: AH3
	SMV1251-011LF	SMV1251-001LF		SMV1251-004LF		
	Marking: EH	Marking: EH		Marking: EH3		
SMV1253-079				SMV1253-004		
Marking: Cathode				Marking: AJ3		
SMV1255-079	SMV1255-011	SMV1255-001		SMV1255-004	SMV1255-073	
Marking: Cathode	Marking: AK	Marking: AK1		Marking: AK3	Marking: AK9	
SMV1255-079LF	SMV1255-011LF					
Marking: Cathode	Marking: EK					
$L_S = 0.7 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$		$L_S = 1.5 \text{ nH}$	$L_S = 1.4 \text{ nH}$	$L_S = 1.4 \text{ nH}$

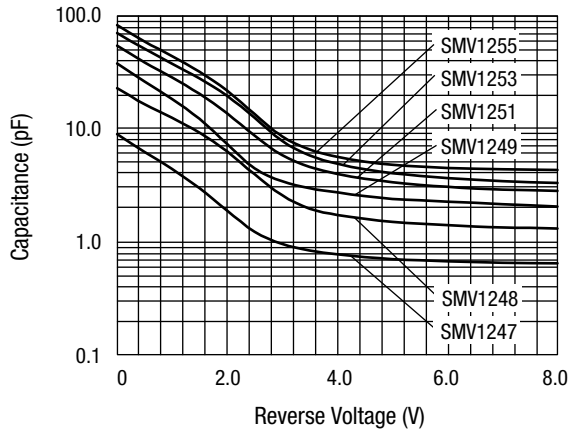
LF denotes lead (Pb)-free packaging option as an alternative to our standard tin/lead (Sn/Pb) packaging.

Electrical Specifications at 25 °C

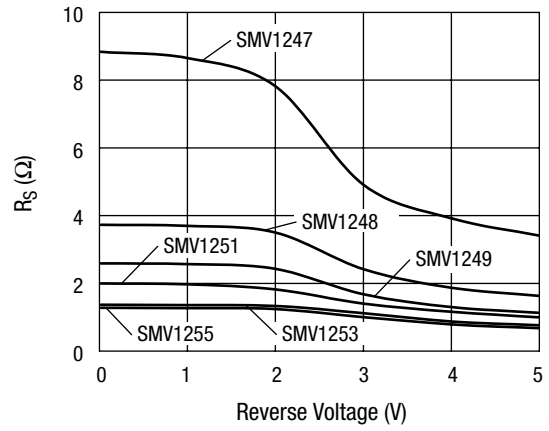
Part Number	C_T @ 0.3 V (pF)		C_T @ 4.7 V (pF)		C_T @ 1 V (pF)	C_T @ 3 V (pF)	$\frac{C_T @ 0.3 \text{ V}}{C_T @ 4.7 \text{ V}}$ (Ratio)		$\frac{C_T @ 1 \text{ V}}{C_T @ 3 \text{ V}}$ (Ratio)	$R_S @ 3 \text{ V}$ 500 MHz (Ω)	$Q @ 3 \text{ V}$ 50 MHz
	Min.	Typ.	Typ.	Max.	Typ.	Typ.	Min.	Typ.	Typ.	Max.	Typ.
SMV1247	6.5	7	0.7	0.78	4.4	0.95	9.5	10.0	4.6	6.0	1500
SMV1248	15.0	17	1.5	1.70	12.3	2.60	10.8	12.0	4.7	3.3	700
SMV1249	28.0	31	2.6	2.80	18.2	3.40	11.0	12.1	5.3	2.2	600
SMV1251	38.0	42	3.4	3.80	28.1	5.80	11.0	12.2	4.8	1.6	400
SMV1253	48.0	53	4.3	4.80	37.0	7.80	11.0	12.3	4.7	1.4	350
SMV1255	58.0	64	5.2	5.80	43.3	8.50	11.0	12.3	5.1	1.3	350

Reverse Voltage V_R ($I_R = 10 \mu\text{A}$): 15 V
 Reverse Current I_R ($V_R = 12 \text{ V}$): 20 nA

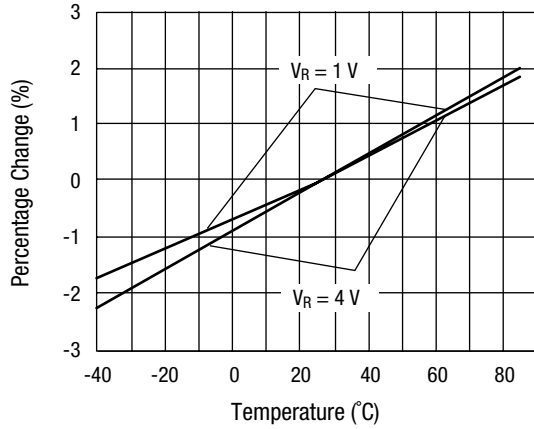
Typical Performance Data



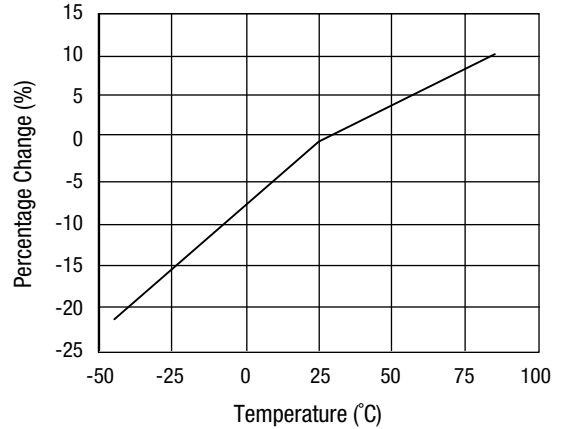
Capacitance vs. Reverse Voltage



Series Resistance vs. Reverse Voltage @ 500 MHz



Relative Capacitance Change vs. Temperature

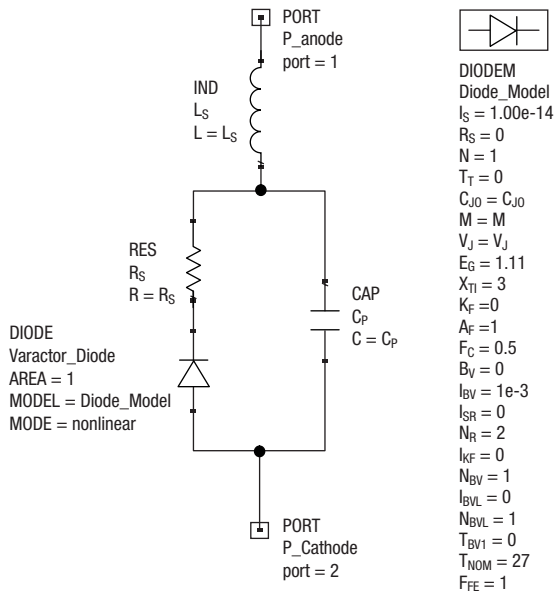


Relative Series Resistance Change vs. Temperature @ 500 MHz

Typical Capacitance Values

V _R (V)	SMV1247	SMV1248	SMV1249	SMV1251	SMV1253	SMV1255
	C _T (pF)	C _T (pF)	C _T (pF)	C _T (pF)	C _T (pF)	C _T (pF)
0.0	8.86	22.62	37.35	53.65	69.32	81.21
0.5	6.17	16.32	25.88	38.23	50.23	58.28
1.0	4.37	12.33	18.18	28.09	37.07	43.27
1.5	2.96	9.12	12.08	20.13	27.57	31.49
2.0	1.88	6.27	7.27	13.55	19.37	21.50
2.5	1.22	3.93	4.44	8.60	12.39	13.40
3.0	0.95	2.57	3.40	5.78	7.77	8.51
3.5	0.83	1.95	2.96	4.57	5.77	6.51
4.0	0.77	1.71	2.72	3.95	4.86	5.58
4.5	0.73	1.59	2.51	3.58	4.34	5.07
5.0	0.70	1.49	2.38	3.33	4.01	4.76
5.5	0.68	1.44	2.30	3.16	3.78	4.58
6.0	0.67	1.40	2.24	3.03	3.62	4.46
6.5	0.66	1.36	2.19	2.94	3.50	4.39
7.0	0.65	1.33	2.14	2.88	3.41	4.33
7.5	0.64	1.31	2.09	2.83	3.34	4.29
8.0	0.64	1.30	2.03	2.79	3.28	4.26

SPICE Model



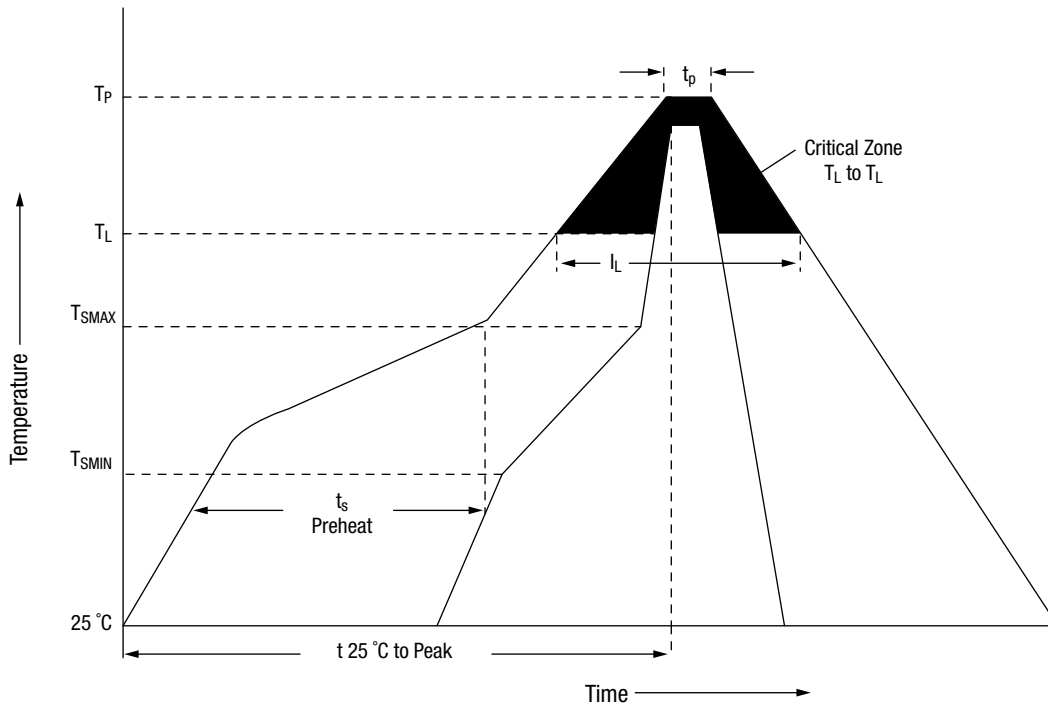
Part Number	C _{J0} (pF)	V _J (V)	M	C _P (pF)	R _S (Ω)
SMV1247	9.22	13	10.5	0	4.9
SMV1248	21.54	13	10.5	0	2.4
SMV1249	39.00	17	14.0	0	1.7
SMV1251	60.00	17	14.0	0	1.4
SMV1253	70.00	17	14.0	0	1.1
SMV1255	82.00	17	13.0	0	1.0

1. Model was designed to fit measured data in the range of up to 4 V.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

Recommended Solder Reflow Profiles

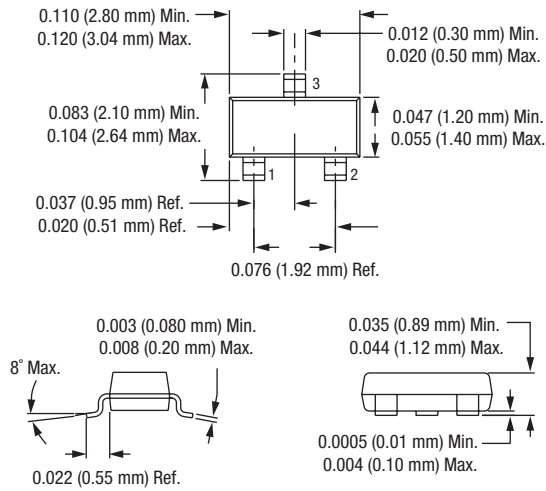
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average ramp-up rate (T_L to T_P)	3 °C/second max.	3 °C/second max.
Preheat		
Temperature min. (T_{SMIN})	100 °C	150 °C
Temperature max. (T_{SMAX})	150 °C	200 °C
Time (min. to max.) (t_s)	60–120 seconds	60–80 seconds
T_{SMAX} to T_L Ramp-up rate	—	3 °C/second max.
Time maintained above: Temperature (T_L)	183 °C	217 °C
Time (t_L)	60–150 seconds	60–150 seconds
Peak temperature (T_P)	240 +0/-5 °C	250 +0/-5 °C
Time within 5 °C of actual peak temperature (t_p)	10–30 seconds	20–40 seconds
Ramp-down rate	6 °C/second max.	6 °C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

All temperatures refer to the top side of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

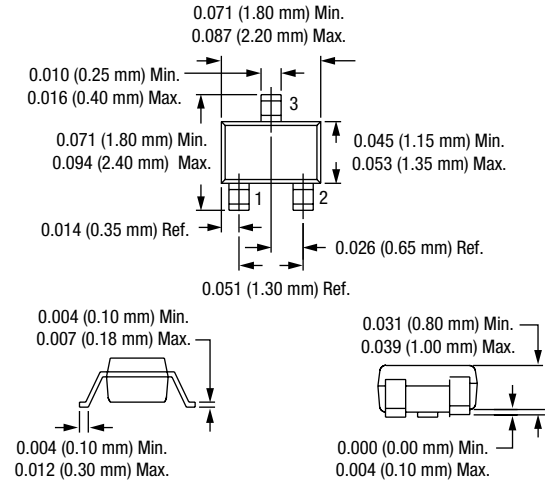


Reference JEDEC J-STD-020

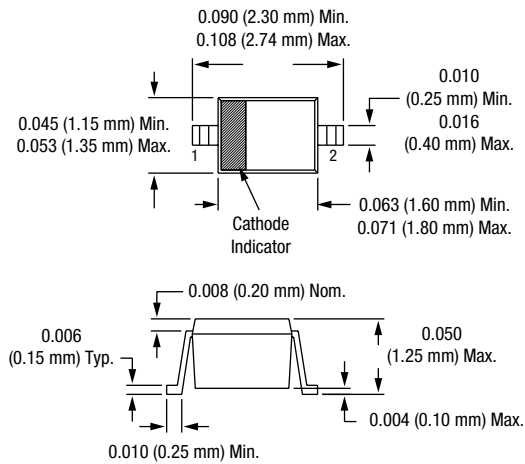
SOT-23



SC-70



SOD-323



SC-79

