

DATA SHEET

SMV1211–SMV1215: Hyperabrupt Junction Tuning Varactors

Features

- High capacitance ratio, $C_1 \sqrt{V}/C_4 V = 5$ typ.
- Multiple packages SOT-23, SOD-323, SC-70 and SC-79
- Designed for high volume commercial applications
- SPICE models are available

Description

The SMV1211–SMV1215 series of silicon hyperabrupt junction varactor diodes is 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)	12 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 Cathode	Common Cathode
SC-79	SOD-323	SOT-23	SOT-23	SC-70
		SMV1211-001		
		Marking: AA1		
SMV1212-079		SMV1212-001	SMV1212-004	SMV1212-074
Marking: Cathode		Marking: AB1	Marking: AB3	Marking: AB3
		SMV1212-001LF		
		Marking: EB1		
SMV1213-079		SMV1213-001	SMV1213-004	SMV1213-074
Marking: Cathode		Marking: 86	Marking: BD3	Marking: BD3
SMV1213-079LF		SMV1213-001LF	SMV1213-004LF	
Marking: Cathode		Marking: D86	Marking: GD3	
		SMV1214-001		
		Marking: VL1		
	SMV1215-011	SMV1215-001	SMV1215-004	
	Marking: VM	Marking: VM1		
$L_S = 0.7 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.4 \text{ nH}$	$L_S = 1.4 \text{ nH}$

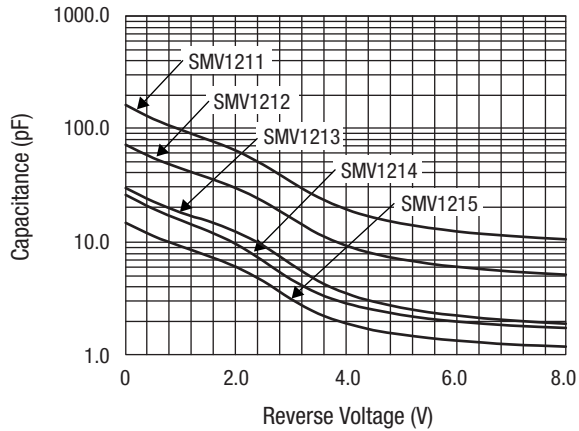
LF denotes lead (Pb)-free packaging option as an alternative to our standard tin/lead (Sn/Pb) packaging.

Electrical Specifications at 25 °C

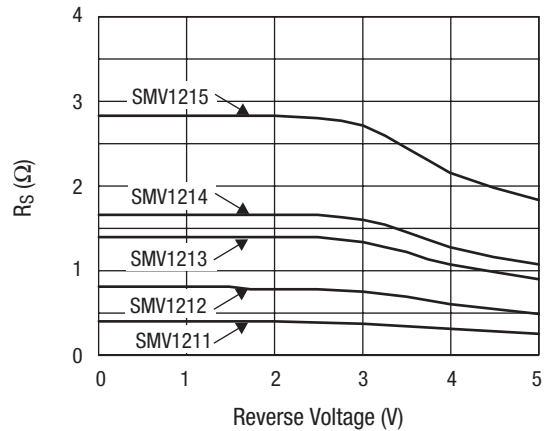
Part Number	$C_T @ 1 \text{ V}$ (pF)		$C_T @ 2.5 \text{ V}$ (pF)		$C_T @ 4 \text{ V}$ (pF)		$\frac{C_T @ 1 \text{ V}}{C_T @ 2.5 \text{ V}}$ (Ratio)	$\frac{C_T @ 1 \text{ V}}{C_T @ 4 \text{ V}}$ (Ratio)	$R_S @ 4 \text{ V}$ 500 MHz (Ω)	$Q @ 4 \text{ V}$ 50 MHz
	Min.	Typ.	Min.	Max.	Typ.	Max.	Typ.	Typ.	Typ.	Min.
SMV1211	95.0	100.0	40.0	65.0	20	25.0	2	5	0.4	80
SMV1212	42.0	50.0	18.0	27.0	9	12.0	2	5	0.8	150
SMV1213	17.0	22.0	8.5	10.5	4	5.5	2	5	1.4	200
SMV1214	14.5	16.0	6.5	7.8	3	4.8	2	5	1.7	300
SMV1215	8.7	9.5	4.3	5.5	2	2.9	2	5	2.8	350

Reverse Voltage V_R ($I_R = 10 \mu\text{A}$): 12 V minimum.
 Reverse Current I_R ($V_R = 8 \text{ V}$): 20 nA maximum.

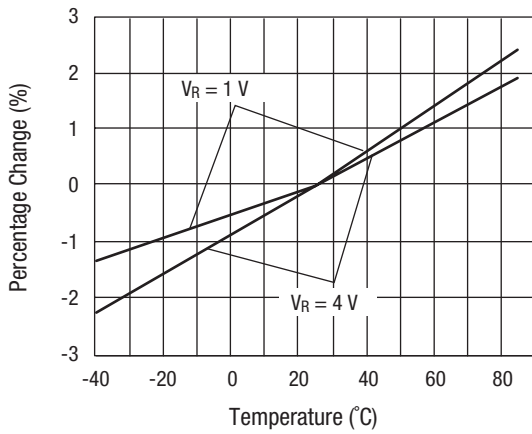
Typical Performance Data



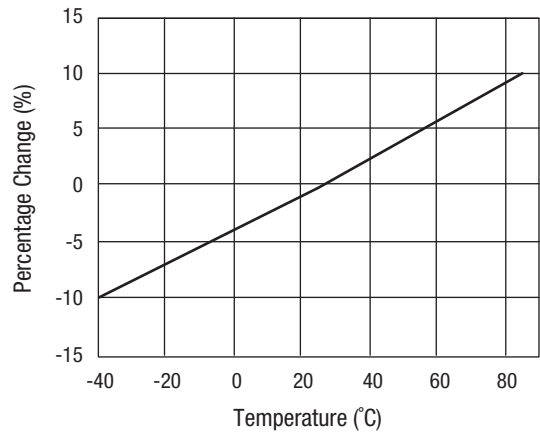
Capacitance vs. Reverse Voltage



Series Resistance vs. Reverse Voltage @ 500 MHz



Relative Capacitance Change vs. Temperature

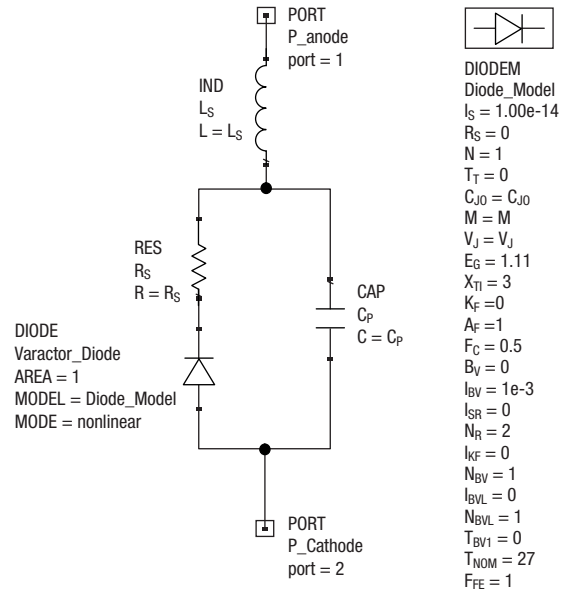


Relative Series Resistance Change vs. Temperature @ 500 MHz

Typical Capacitance Values

V_R (V)	SMV1211	SMV1212	SMV1213	SMV1214	SMV1215
	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)
0.0	162.6	72.4	30.0	26.0	14.8
0.5	122.3	55.3	22.8	19.6	11.3
1.0	98.6	44.9	18.1	15.6	9.1
1.5	80.4	36.9	15.3	12.4	7.5
2.0	64.2	29.9	12.3	9.6	6.0
2.5	48.2	22.9	9.2	6.8	4.5
3.0	34.1	16.3	6.4	4.7	3.1
3.5	24.7	11.8	4.5	3.5	2.3
4.0	19.4	9.3	3.5	2.9	1.9
4.5	16.4	7.9	3.0	2.5	1.7
5.0	14.6	7.0	2.6	2.3	1.5
5.5	13.3	6.4	2.4	2.1	1.4
6.0	12.4	6.0	2.2	2.0	1.3
6.5	11.7	5.7	2.1	1.9	1.3
7.0	11.2	5.5	2.0	1.8	1.2
7.5	10.8	5.3	1.9	1.8	1.2
8.0	10.5	5.1	1.9	1.7	1.2

SPICE Model



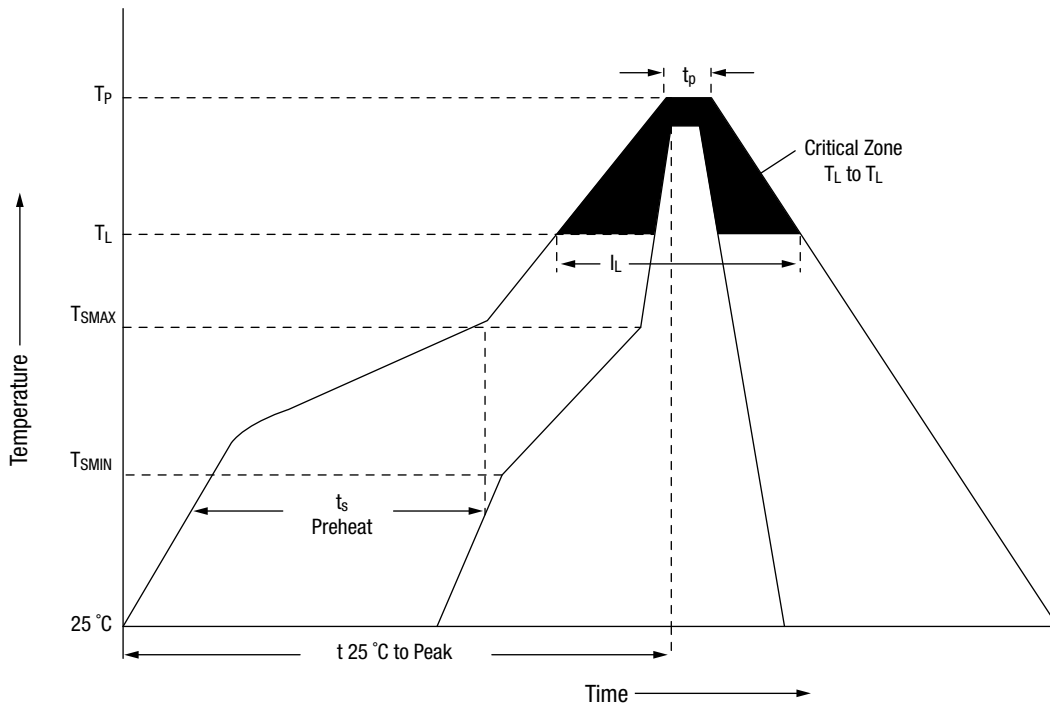
Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1211	163.00	200	130	9.5	0.4
SMV1212	72.47	110	67	4.5	0.8
SMV1213	28.90	190	105	2.2	1.4
SMV1214	22.74	190	106	1.5	1.7
SMV1215	14.36	190	115	1.1	2.8

1. Values extracted from measured performance.
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

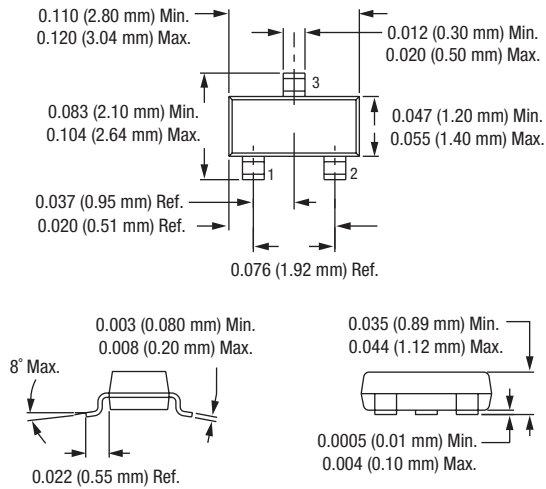
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average ramp-up rate (T_L to T_P)	3 °C/second max.	3 °C/second max.
Preheat		
Temperature min. (T_{SMIN})	100 °C	150 °C
Temperature max. (T_{SMAX})	150 °C	200 °C
Time (min. to max.) (ts)	60–120 seconds	60–80 seconds
T_{SMAX} to T_L 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 (tp)	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.

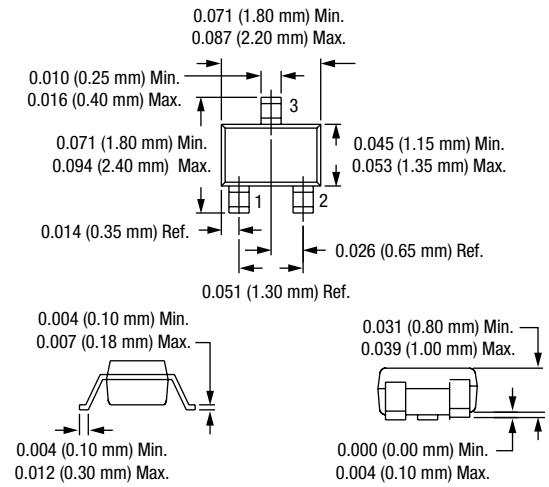


Reference JEDEC J-STD-020

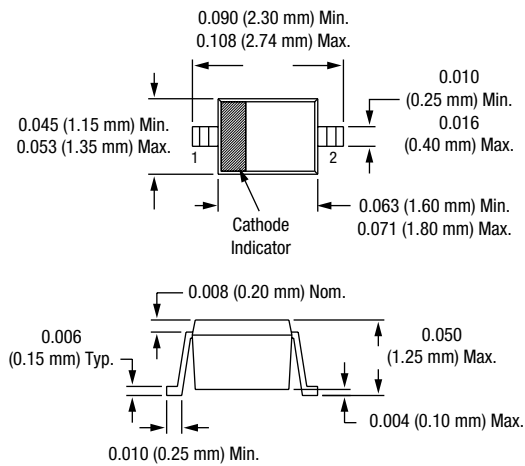
SOT-23



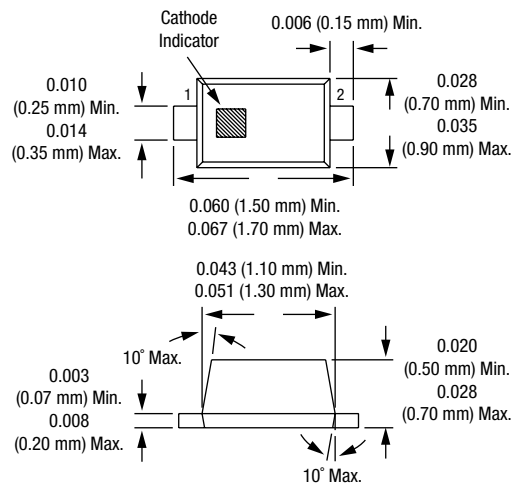
SC-70



SOD-323



SC-79



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