SKYWORKS®

DATA SHEET

SMV1405–SMV1413: Abrupt Junction Tuning Varactors

Features

- High Q
- Low series resistance for low phase noise
- Multiple packages: SOT-23, SC-70 and SC-79
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020
- Designed for high-volume commercial applications
- SPICE models are available



Description

The SMV1405–SMV1413 series of silicon abrupt junction varactor diodes is designed for use in VCOs requiring tight capacitance tolerances. The low resistance of these varactors makes them appropriate for high Q resonators in wireless system VCOs to frequencies beyond 2.5 GHz. The devices are characterized for capacitance over temperature. SPICE models are provided.

NEW Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant packaging.

Absolute Maximum Ratings

Characteristic	Value
Reverse voltage (V_R)	30 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, ESD (Electrostatic Discharge) 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	Common Cathode	Common Cathode
SC-79	SOT-23	SOT-23	SC-70
SMV1405-079 Marking: Cathode			**SMV1405-074** Marking: BE3
SMV1405-079LF Marking: Cathode			**SMV1405-074LF** Marking: GE3
	SMV1408-001 Marking: VV1		
	SMV1408-001LF Marking: DV1		
SMV1413-079 Marking: Cathode	**SMV1413-001** Marking: AR1	**SMV1413-004** Marking: AR3	
SMV1413-079LF Marking: Cathode	**SMV1413-001LF** Marking: ER1	**SMV1413-004LF** Marking: ER3	**SMV1413-074LF** Marking: ER3
L_S = 0.7 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.4 nH

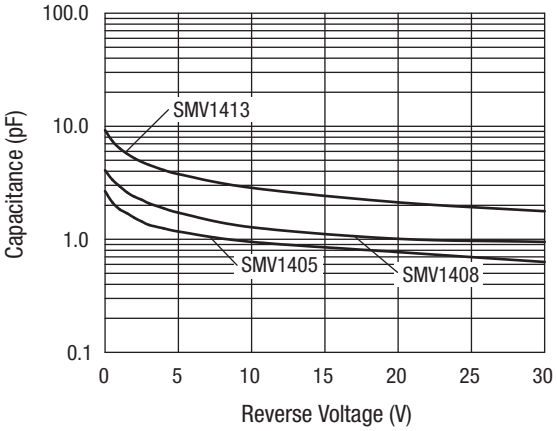
LF denotes lead (Pb)-free, RoHS-compliant packaging option as an alternative to our standard tin/lead (Sn/Pb) packaging.

Electrical Specifications at 25 °C

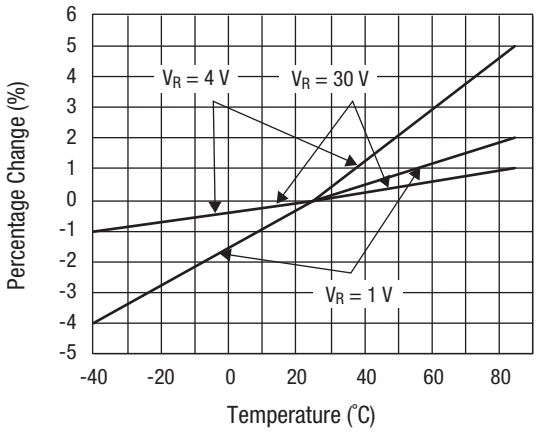
Part Number	C_T @ 0.5 V (pF)	C_T @ 1 V (pF)	C_T @ 4 V (pF)		$\frac{C_T \text{ @ 0 V}}{C_T \text{ @ 30 V}}$ (Ratio)	R_S @ 4 V 500 MHz (Ω)	Q @ 4 V 50 MHz
	Typ.	Typ.	Min.	Max.	Min.	Max.	Typ.
SMV1405	2.1	1.8	1.21	1.45	4.1	0.8	3200
SMV1408	3.4	2.9	1.75	2.11	4.1	0.6	2900
SMV1413	7.4	6.4	3.64	4.42	4.2	0.35	2400

Reverse Voltage V_R (I_R = 10 m A): 30 V minimum.
Reverse Current I_R (V_R = 24 V): 20 nA maximum.

Typical Performance Data

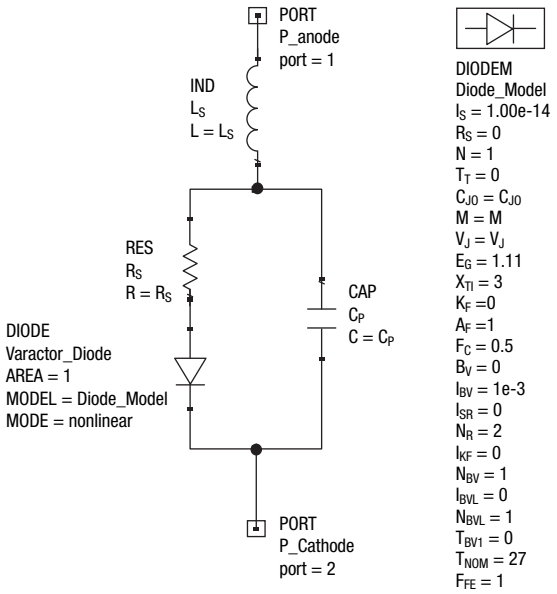


Capacitance vs. Reverse Voltage



Relative Capacitance Change vs. Temperature

SPICE Model



DIODEM
Diode_Model
I_S = 1.00e-14
R_S = 0
N = 1
T_T = 0
C_{J0} = C_{J0}
M = M
V_J = V_J
E_G = 1.11
X_{TI} = 3
K_F =0
A_F =1
F_C = 0.5
B_V = 0
I_{BV} = 1e-3
I_{SR} = 0
N_R = 2
I_{KF} = 0
N_{BV} = 1
I_{BVL} = 0
N_{BVL} = 1
T_{BV1} = 0
T_{NOM} = 27
F_{FE} = 1

Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1405	2.92	0.68	0.41	0.05	0.8
SMV1408	3.7	0.8	0.48	0.13	0.6
SMV1413	9.2	0.79	0.45	0.13	0.35

Values extracted from measured performance.
For package inductance (L_S) refer to package type.
For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

Typical Capacitance Values

V_R (V)	SMV1405 C_T (pF)	SMV1408 C_T (pF)	SMV1413 C_T (pF)
0	2.67	4.08	9.24
0.5	2.12	3.36	7.39
1	1.84	2.94	6.37
1.5	1.7	2.6	5.71
2	1.55	2.38	5.22
2.5	1.44	2.24	4.85
3	1.34	2.08	4.55
4	1.25	1.88	4.1
5	1.17	1.72	3.77
10	0.95	1.28	2.85
20	0.77	1.01	2.12
30	0.63	0.95	1.77

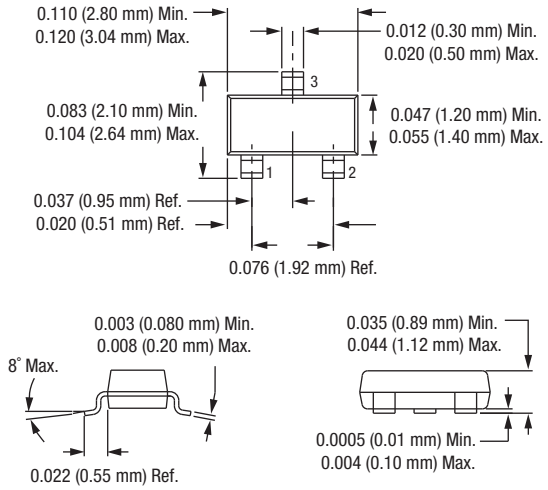
Recommended Solder Reflow Profiles

Refer to the *"Recommended Solder Reflow Profile"* Application Note.

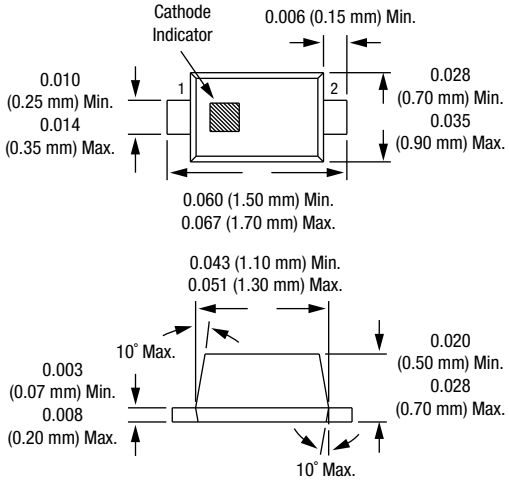
Tape and Reel Information

Refer to the *"Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation"* Application Note.

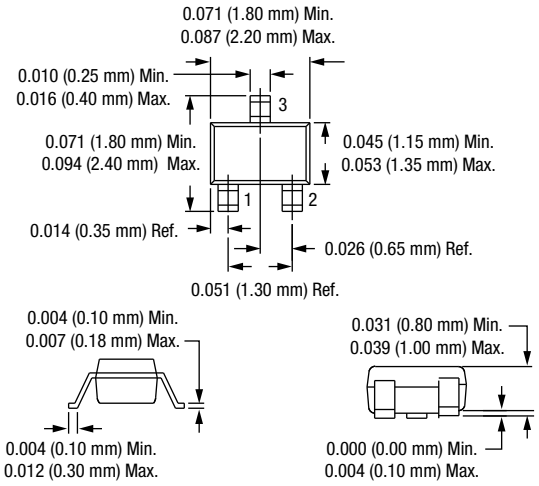
SOT-23



SC-79



SC-70



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