



SILICON VARACTOR MULTIPLIER AND STEP RECOVERY DIODES (SRD)

SELECTION CRITERIA

Varactor Multiplier Diodes (or Multi-Mode Diodes) generally exhibit a larger capacitance variation between zero volts and minus six (6) volts reverse bias. The use of these diodes results in:

- High Efficiency
- High Output Power
- Low Order Multiplication (N ≤ 4)

Step Recovery Diodes have relatively little capacitance change under reverse bias and are used for higher efficiency applications. These diodes do not require idler circuits to enhance efficiency. The use of these diodes results in:

- High Efficiency
- High and Low Order Multiplication
- Narrow Bandwidth
- Comb Generation

ABSOLUTE MAXIMUM RATINGS:

Storage Temperature:
-65°C to +200°C
Operating Temperature:
-65°C to +175°C

CAPACITANCE

To obtain maximum impedance (capacitive reactance) should be between 30 and 60 OHMS (if diode is in 50 OHM environment)

BREAKDOWN VOLTAGE (V_B)

As a minimum, breakdown voltage can be defined:

$$V_B = K \sqrt{\frac{2 P_{OUT}}{f_{IN} C_{T-6}}}$$

K = 0.8 for N ≤ 4

K = 1.5 for N > 4

P_{OUT} = Output power at output frequency (watts)

f_{IN} = Input Frequency (Hertz)

C_{T-6} = Total Capacitance at -6 volts (Farads)

SELECTION OF BIAS RESISTOR (R_b)

The value of the Bias Resistor for step recovery and varactor multiplier diodes can be calculated by the following:

SRD

Varactor Multiplier

$$R_b = \frac{5T_L}{N^2 C_{T-6}}$$

$$R_b = \frac{10T_L}{N^2 C_{T-6}}$$

T_L = Lifetime (seconds)

N = Order of multiplication

C_{T-6} = Total capacitance at -6 volts (Farads)

TRANSITION TIME (T_T)

The transition time is the time for the diode to switch from a conducting to a non-conducting state.

$$T_T < \frac{1}{f_{OUT}}$$

MINORITY CARRIER LIFETIME (T_L)

Lifetime is a measure of the charge stored in the junction and not lost through recombination. It should be long enough to allow the RF current to reach a maximum negative peak before it snaps back to high impedance state.

$$T_L > \frac{1}{f_{IN}}$$

THERMAL RESISTANCE (θR)

Thermal Resistance is expressed as a function of dice mounting techniques in the package and area of the junction, assuming the packaged diode is mounted in an effective "infinite" heat shrink.

$$\theta_R = \frac{T_{DIODE\ MAXIMUM} - T_A}{P_{IN} - P_{OUT}}$$

θR = Thermal Resistance (°C/Watt)

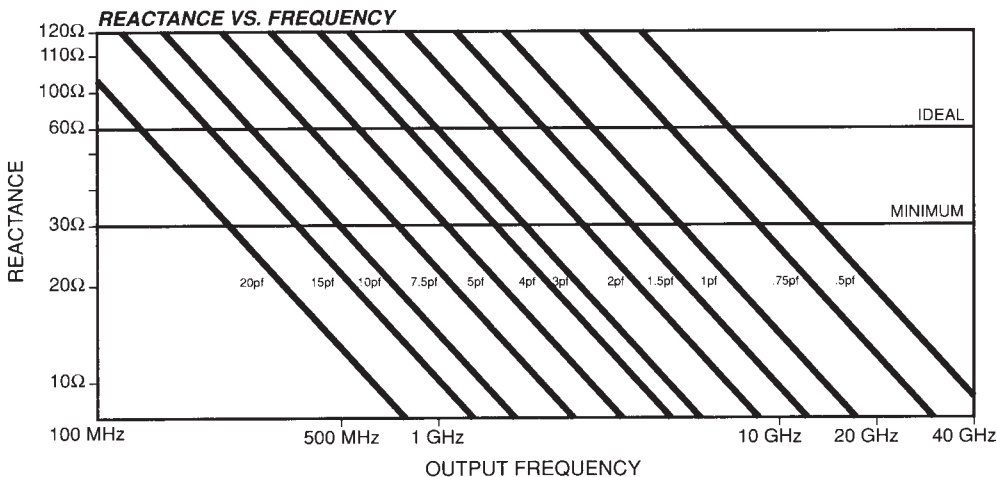
T_{DIODE MAXIMUM} = Maximum Diode

Operating Temperature (150°C)

T_A = Maximum Heat Sink

Temperature (°C)

P_{IN} - P_{OUT} = Power Dissipated in the Diode (Watts)



All of the varactor and SRD diodes meet or exceed the military environmental specifications of MIL-S-19500, MIL-STD-202 and methods from MIL-STD-750 that specify mechanical, electrical, thermal and environmental tests.

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SILICON MULTIPLIER DIODES

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TYPE NUMBER	POWER DISSIPATION P _D (WATTS) @ 25°C	THERMAL RESISTANCE °C/W MAX	INPUT FREQ. F _{IN} MHz	POWER INPUT P _{IN} WATTS	OUTPUT FREQ. F _{OUT} MHz	POWER OUTPUT P _{OUT} (MIN) WATTS	BREAKDOWN VOLTAGE V _B (MIN) @10μA	SERIES RESISTANCE R _S @-6V F=50 MHz OHMS	CAPACITANCE (TOTAL) V _R =6.0V F=1.0 MHz		PACKAGE OUTLINE
									MIN P _f	MAX P _f	
1N5149	10.0	9.0	500	20.0	1000	11.0	80	0.25	5.0	5.0	20
1N5150	14.0	9.0	500	37.0	1000	24.0	80	0.25	5.0	20.0	20
1N5150A	21.0	6.0	500	37.0	1000	25.1	80	0.25	10.8	13.2	20
1N5151	5.5	23.0	1000	12.0	2000	6.0	75	0.5	5.0	7.5	40
1N5152	5.5	23.0	1000	12.0	2000	6.0	75	0.5	5.0	7.5	51
1N5153	5.5	23.0	1000	12.0	2000	6.0	75	0.5	5.0	7.5	20
1N5152A	8.4	15.0	1000	12.0	2000	7.2	75	0.5	5.4	6.6	51
1N5153A	8.4	15.0	1000	12.0	2000	7.2	75	0.5	5.4	6.6	20
1N5154	3.5	35.0	2000	5.0	6000	2.0	35	0.9	1.0	3.0	40
1N5155	3.5	35.0	2000	5.0	6000	2.0	35	0.9	1.0	3.0	51
1N5155A	6.2	20.0	2000	5.0	6000	2.0	35	0.9	1.71	2.09	51
1N5156	3.3	38.0	5000	2.6	10000	1.0	20	1.0	0.5	1.0	40
1N5157	3.3	38.0	5000	2.6	10000	1.0	20	1.0	0.5	1.0	51

SUPER POWER MULTIPLIER DIODES

TYPE NUMBER	BREAKDOWN ¹ V _B (MIN) @ 10μA (VOLTS)	JUNCTION ² CAPACITANCE @-6V & 1 MHz (Pf)	MINIMUM ³ CUTOFF FREQUENCY OR MAXIMUM SERIES RESISTANCE (GHz OR OHMS)	TYPICAL MINORITY CARRIER LIFETIME 10mA/6mA (ns)	MAXIMUM TRANSITION TIME -10V/10mA (PS)	OUTPUT ⁴ FREQUENCY RANGE (GHz)	TYPICAL ⁵ EFFICIENCY AS A TRIPLER (%)	TYPICAL ⁶ AVAILABLE OUTPUT POWER (WATTS)	MAXIMUM THERMAL RESISTANCE (°C/W)	PACKAGE OUTLINE
AB810A	140	18-26	0.30π	450	5000	0.5-1.0	65	40	3	20
AB811A	80	8-10	60	160	2000	1.0-2.5	65	24	7	20
AB812A	80	4-5	90	130	2000	2.0-4.0	55	10	11	20
AB813A	60	2.5-3.5	140	60	700	3.0-5.0	50	6	13	20, 51
AB814A	60	1.5-2.5	140	60	500	5.0-8.0	50	4	15	20, 51
AB824A	45	1.0-1.5	160	30	300	7.0-10.0	50	2.5	25	51

STANDARD POWER MULTIPLIER DIODES

AB800	200	18-26	0.35π	450	10000	0.3-0.75	70	3-20	3	20
AB810	175	18-26	0.35π	400	8000	0.5-1.0	65	2-24	3	20
AB820	150	10-20	40	350	5000	0.6-1.2	60	2-16	5	20
AB801	120	8-10	60	210	3000	0.75-1.5	60	1-10	7	20
AB811	100	8-10	60	180	2000	1.0-2.5	65	1-10	7	20
AB802	120	4-5	90	200	3000	1.5-3.0	55	1-8	10	20
AB812	100	4-5	90	170	2000	2.0-4.0	55	1-6	11	20
AB822	80	4-6	110	180	925	2.0	-	2.0	-	20, 51
AB803	80	2.5-3.5	120	100	1000	3.0-5.0	50	0.5-4.0	13	20, 51
AB804	80	1.5-2.5	150	90	750	5.0-7.0	45	0.5-2.5	15	20, 51
AB814	60	1.5-2.5	150	60	400	5.0-8.0	45	0.3-1.5	15	20, 51
AB825	40	1.0-1.5	160	20	150	5.0-8.0	50	2.5	25	20, 51
AB805	40	0.5-0.7	175	18	150	8.0-12.0	40	0.1-0.6	50	51
AB806	30	0.3-0.5	200	10	100	12.0-15.0	30	0.05-0.30	75	51
AB807	6	0.15-0.2	350	3	-	15.0-25.0	15	0.05	300	43, 84

NOTES:

1. Breakdown voltage is measured at IR = 10μA

2. Junction capacitance is measured -6 volts and 1 MHz

3. Measured at -6 volts and 3.3 GHz

4. Defined as the operable range, not instantaneous bandwidth.

5. Typical values when used as a tripler. Useful from 2 to 4 times multiplication

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STEP RECOVERY DIODES (SRD'S)

TYPE (1) NUMBER	BREAKDOWN VOLTAGE V_B (MIN) (2) @ 10 μ A Volts	JUNCTION (3) CAPACITANCE C_{J-6} PF	MINORITY (4) CARRIER LIFETIME T_I (MIN) ns	TRANSITION (5) TIME T_t (MAX) ps
AS11A	10	0.26-0.42	5	100
AS11B	10	0.42-0.58	5	100
AS11C	10	0.58-1.60	5	100
AS11D	10	1.60-3.00	5	100
AS12A	10	0.26-0.42	5	200
AS12B	10	0.42-0.58	5	200
AS12C	10	0.58-1.60	5	200
AS12D	10	1.60-3.00	5	200
AS21A	20	0.26-0.42	7	100
AS21B	20	0.42-0.58	7	100
AS21C	20	0.58-1.60	7	100
AS21D	20	1.60-3.00	7	100
AS22A	20	0.26-0.42	7	200
AS22B	20	0.42-0.58	7	200
AS22C	20	0.58-1.60	7	200
AS22D	20	1.60-3.00	7	200
AS31A	30	0.26-0.42	8	100
AS31B	30	0.42-0.58	8	100
AS31C	30	0.58-1.60	8	100
AS31D	30	1.60-3.00	8	100
AS32A	30	0.26-0.42	8	200
AS32B	30	0.42-0.58	8	200
AS32C	30	0.58-1.60	8	200
AS32D	30	1.60-3.00	8	200
AS41A	40	0.26-0.42	12	120
AS41B	40	0.42-0.58	12	120
AS41C	40	0.58-1.60	12	120
AS41D	40	1.60-3.00	12	120
AS42A	40	0.26-0.42	12	200
AS42B	40	0.42-0.58	12	200
AS42C	40	0.58-1.60	12	200
AS42D	40	1.60-3.00	12	200
AS43A	40	0.26-0.42	12	300
AS43B	40	0.42-0.58	12	300
AS43C	40	0.58-1.60	12	300
AS43D	40	1.60-3.00	12	300
AS52A	50	0.26-0.42	15	200
AS52B	50	0.42-0.58	15	200
AS52C	50	0.58-1.60	15	200
AS52D	50	1.60-3.00	15	200
AS53A	50	0.26-0.42	15	300
AS53B	50	0.42-0.58	15	300
AS53C	50	0.58-1.60	15	300
AS53D	50	1.60-3.00	15	300
AS63A	60	0.26-0.42	20	300
AS63B	60	0.42-0.58	20	300
AS63C	60	0.58-1.60	20	300
AS63D	60	1.60-3.00	20	300

NOTES:

1. When ordering add package style suffix to denote desired package style. Package style 10, 42, 51 and 52 are available for this series

2. Breakdown Voltage measured at $I_R=10\mu A$.

3. Junction Capacitance measured at -6 volts and 1 MHz.

4. Minority Carrier Lifetime measured at $I_R=6mA$ and $I_F=1.7I_R$.

5. Transition Time is measured between the 20% and 80% points in the voltage recovery waveform. Test condition +10mA and -10 Volts.

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