SILICON VARACTOR MULTIPLIER AND STEP RECOVERY DIODES (SRD)

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°Cto +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:

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

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)
$C_{T\text{-}6}$= 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 $\qquad$ Varactor Multiplier

$$R_b = \frac{5T_L}{N^2 C_{T\text{-}6}} \qquad R_b = \frac{10T_L}{N^2 C_{T\text{-}6}}$$

T_L= Lifetime (seconds)
N =Order of multiplication
$C_{T\text{-}6}$=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.

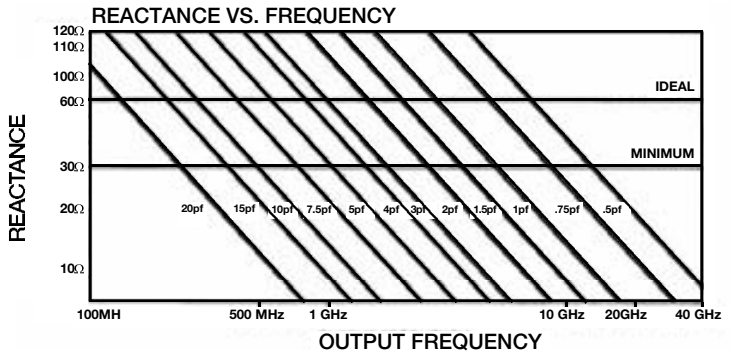
$$T_T < \frac{1}{f_{OUT}}$$

MINORITY CARRIER LIFETIME (T_L)
Lifetime is a measure of the change stored in 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 sink.

$$\theta R = \frac{T_{DIODEMAXIMUM} - T_A}{P_{IN} - P_{OUT}}$$

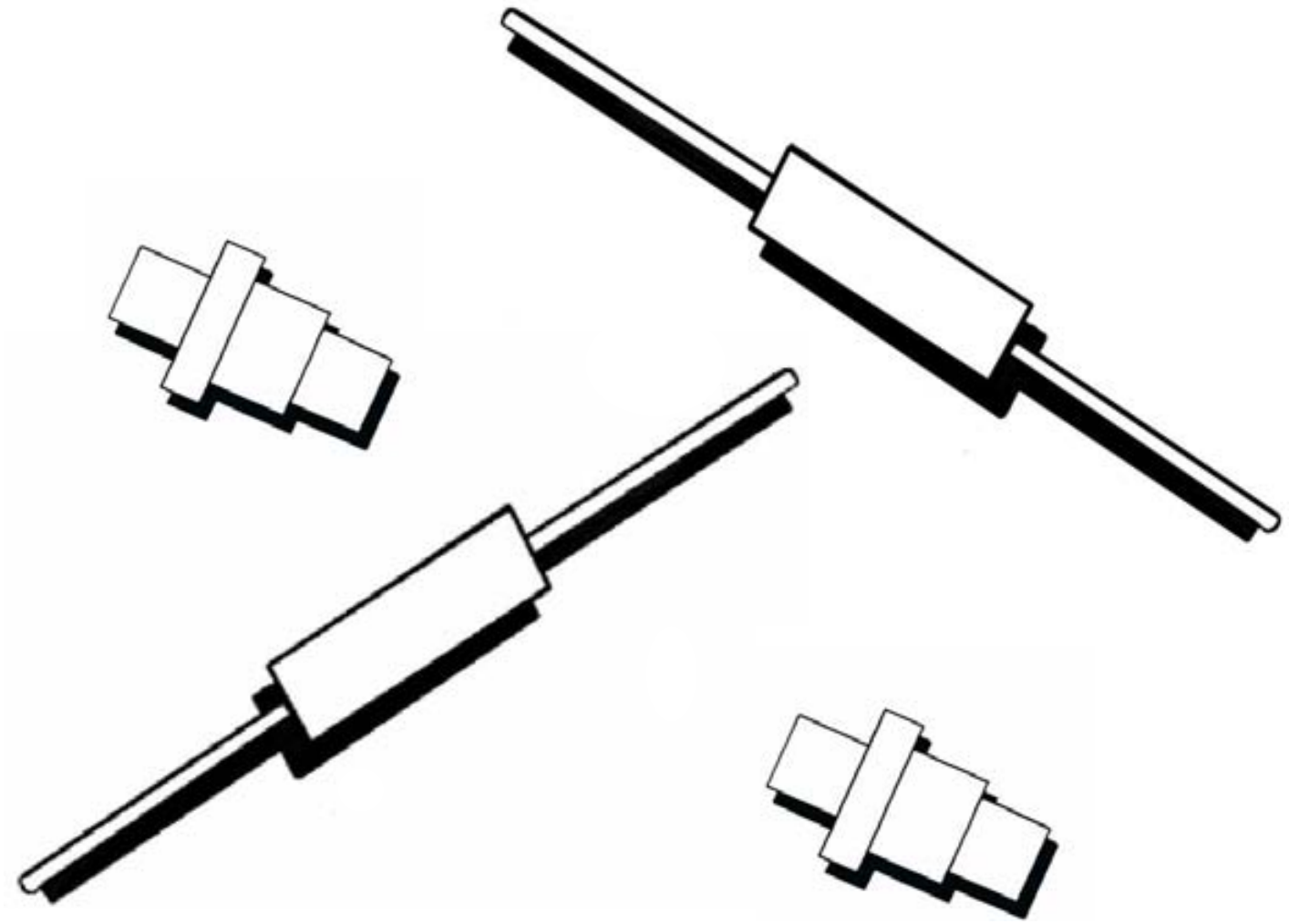
θR = Thermal Resistance (°C/Watt)
$T_{DIODEMAXIMUM}$ = Maximum Diode Operating Temperature (150°C)
T_A= Maximum Heat Sink Temperature (°C)
$P_{IN} - P_{OUT}$ = Power Dissipated in the Diode (Watts)



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.

Silicon Multiplier Diodes

TYPE NUMBER	POWER DISSIPATION PD(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) VR=6.0V F=1.0 MHz	
									MIN Pf	MAX Pf
1N5149	10.0	9.0	500	20.0	1000	11.0	80	0.25	5.0	5.0
1N5150	14.0	9.0	500	37.0	1000	24.0	80	0.25	5.0	20.0
1N5150A	21.0	6.0	500	37.0	1000	25.1	80	0.25	10.8	13.2
1N5151	5.5	23.0	1000	37.0	2000	6.0	75	0.5	5.0	7.5
1N5152	5.5	23.0	1000	12.0	2000	6.0	75	0.5	5.0	7.5
1N5153	5.5	23.0	1000	12.0	2000	6.0	75	0.5	5.0	7.5
1N5152A	8.4	15.0	1000	12.0	2000	7.2	75	0.5	5.4	6.6
1N5153A	8.4	15.0	1000	12.0	2000	7.2	75	0.5	5.4	6.6
1N5154	3.5	35.0	2000	5.0	6000	2.0	35	0.9	1.0	3.0
1N5155	3.5	35.0	2000	5.0	6000	2.0	35	0.9	1.0	3.0
1N5155A	6.2	20.0	2000	5.0	6000	2.0	35	0.9	1.71	2.09
1N5156	3.3	38.0	5000	2.6	10000	1.0	20	1.0	0.5	1.0
1N5157	3.3	38.0	5000	2.6	10000	1.0	20	1.0	0.5	1.0



SUPER POWER MULTIPLIER DIODES

TYPE NUMBER	BREAKDOWN[1] VOLTAGE V_R (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 AVAILABLE OUTPUT POWER (WATTS)	MAXIMUM THERMAL RESISTANCE (°C/W)
MPD711A	140	18-26	0.30π	450	5000	0.5-1.0	65	40	3
MPD712A	80	8-10	60	160	2000	1.0-2.5	65	24	7
MPD714A	80	4-5	90	130	2000	2.0-4.0	55	10	11
MPD716A	60	2.5-3.5	140	60	700	3.0-5.0	50	6	13
MPD718A	60	1.5-2.5	140	60	500	5.0-7.0	50	4	15
MPD720A	45	1.0-1.5	160	30	300	7.0-10.0	50	2.5	25

STANDARD POWER MULTIPLIER DIODES

TYPE NUMBER	BREAKDOWN[1] VOLTAGE V_R (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 AVAILABLE OUTPUT POWER (WATTS)	MAXIMUM THERMAL RESISTANCE (°C/W)
MPD801	200	18-26	0.35π	450	10000	0.3-0.75	70	3-20	3
MPD802	175	18-26	0.35π	400	8000	0.5-1.0	65	2-24	3
MPD803	150	10-20	40	350	5000	0.6-1.2	60	2-16	5
MPD804	120	8-10	60	210	3000	0.75-1.5	60	1-10	7
MPD805	100	8-10	60	180	2000	1.0-2.5	65	1-10	7
MPD806	120	4-5	90	200	3000	1.5-3.0	55	1-8	10
MPD807	100	4-5	90	170	2000	2.0-4.0	55	1-6	11
MPD808	80	4-6	110	180	925	2.0	-	2.0	-
MPD809	80	2.5-3.5	120	100	1000	3.0-5.0	50	0.5-4.0	13
MPD810	80	1.5-2.5	150	90	750	5.0-7.0	45	0.5-2.5	15
MPD811	60	1.5-2.5	150	60	400	5.0-8.0	45	0.3-1.5	15
MPD812	40	1.0-1.5	160	20	150	5.0-8.0	50	2.5	25
MPD813	40	0.5-0.7	175	180	150	8.0-12.0	40	0.1-0.6	50
MPD814	30	0.3-0.5	200	10	100	12.0-15.0	30	0.05-0.30	70
MPD815	6	0.15-0.2	350	3	-	15.0-25.0	15	0.05	300

NOTES:

1. Breakdown Voltage measured at I_R= 10μA.
2. Junction Capacitance measured at -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.
6. Available in various package styles.

STEP RECOVERY DIODES (SRD'S)

TYPE NUMBER	BREAKDOWN VOLTAGE V_B(MIN) (1) @ 10μA Volts	JUNCTION (2) CAPACITANCE C_{J-6} PF	MINORITY (3) CARRIER LIFETIME T_L (MIN) ns	TRANSITION (4) TIME T_t (MAX) ps
MSR10A	10	0.26-0.42	5	100
MSR10B	10	0.42-0.58	5	100
MSR10C	10	0.58-1.60	5	100
MSR10D	10	1.60-3.00	5	100
MSR13A	10	0.26-0.42	5	200
MSR13B	10	0.42-0.58	5	200
MSR13C	10	0.58-1.60	5	200
MSR13D	10	1.60-3.00	5	200
MSR15A	20	0.26-0.42	7	100
MSR15B	20	0.42-0.58	7	100
MSR15C	20	0.58-1.60	7	100
MSR15D	20	1.60-3.00	7	100
MSR17A	20	0.26-0.42	7	200
MSR17B	20	0.42-0.58	7	200
MSR17C	20	0.58-1.60	7	200
MSR17D	20	1.60-3.00	7	200
MSR19A	30	0.26-0.42	8	100
MSR19B	30	0.42-0.58	8	100
MSR19C	30	0.58-1.60	8	100
MSR19D	30	1.60-3.00	8	100
MSR23A	30	0.26-0.42	8	200
MSR23B	30	0.42-0.58	8	200
MSR23C	30	0.58-1.60	8	200
MSR23D	30	1.60-3.00	8	200
MSR25A	40	0.26-0.42	12	120
MSR25B	40	0.42-0.58	12	120
MSR25C	40	0.58-1.60	12	120
MSR25D	40	1.60-3.00	12	120
MSR27A	40	0.26-0.42	12	200
MSR27B	40	0.42-0.58	12	200
MSR27C	40	0.58-1.60	12	200
MSD27D	40	1.60-3.00	12	200
MSR29A	40	0.26-0.42	12	300
MSR29B	40	0.42-0.58	12	300
MSR29C	40	0.58-1.60	12	300
MSR29D	40	1.60-3.00	12	300
MSR33A	50	0.26-0.42	15	200
MSR33B	50	0.42-0.58	15	200
MSR33C	50	0.58-1.60	15	200
MSR33D	50	1.60-3.00	15	200
MSR35A	50	0.26-0.42	15	300
MSR35B	50	0.42-0.58	15	300
MSR35C	50	0.58-1.60	15	300
MSR35D	50	1.60-3.00	15	300
MSR37A	60	0.26-0.42	20	300
MSR37B	60	0.42-0.58	20	300
MSR37C	60	0.58-1.60	20	300
MSR37D	60	1.60-3.00	20	300

NOTES:

1. Breakdown Voltage measured at I_R= 10μA.
2. Junction Capacitance measured at -6 volts and 1 MHz.
3. Minority Carrier Lifetime measured at I_R=6mA and I_F=1.7 I_R.
4. Transition Time is measured between the 20% and 80% points in the voltage recovery waveform. Test condition +10mA and -10 Volts.
5. Available in various package styles.