## 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 ($N \leq 4$)

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:

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

$K = 0.8$ for $N \leq 4$
$K = 1.5$ 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

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

Varactor Multiplier

$$R_b = \frac{1OT_L}{N^2C_{T\text{-}6}}$$

$T_L$ = 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 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.

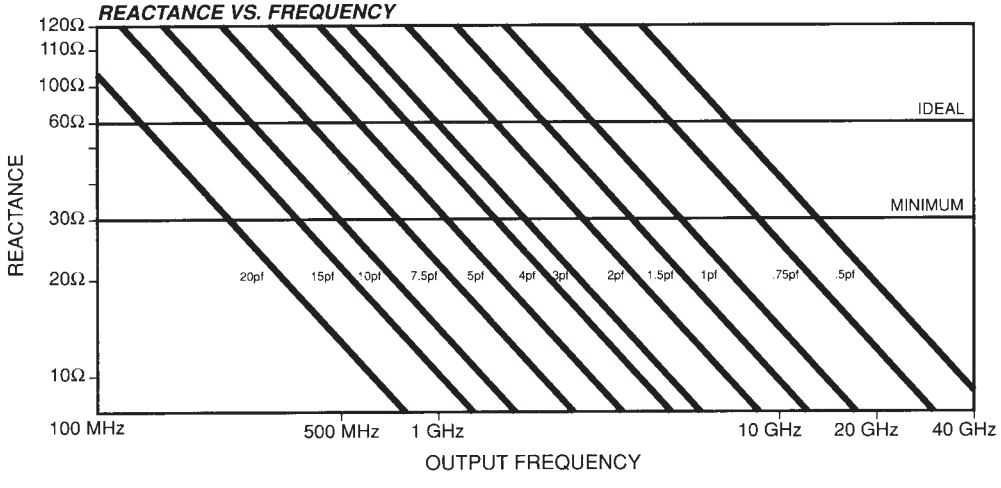
$$T_L > \frac{1}{f_{IN}}$$

### THERMAL RESISTANCE ($\theta R$)

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.

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

$\theta R$ = 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

| 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 MIN Pf | CAPACITANCE (TOTAL) $V_R$=6.0V F=1.0 MHz MAX Pf | PACKAGE OUTLINE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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] 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[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.

## *STEP RECOVERY DIODES (SRD'S)*

| TYPE (1) NUMBER | BREAKDOWN VOLTAGE $V_B$(MIN) (2) @ 10μA Volts | JUNCTION (3) CAPACITANCE $C_J$-6 PF | MINORITY (4) CARRIER LIFETIME TI (MIN) ns | TRANSITION (5) TIME Tt (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 $I_R$=10μA.

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

4. Minority Carrier Lifetime measured at $1_R$=6mA and $I_f$=1.7$I_R$.

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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