

Silicon Step Recovery Diodes

MA43000, MA44600 Series

V4

Features

- Low Transition Times
- Tight Capacitance Ranges
- High Voltage and Low Thermal Resistance for Higher Input Power
- Lead-Free (RoHs Compliant)

Description and Applications

The MA44600 series of Step Recovery diodes is designed for use in low and moderate power multipliers with output frequencies of up to 20 GHz. These Step Recovery diodes generate harmonics by storing a charge as the diode is driven to forward conduction by the positive voltage of the input signal. When the signal reverses polarity, this charge is extracted. The Step Recovery diode will appear as a low impedance current source until all the charge is extracted, then it will “snap” to a higher impedance. This causes a voltage pulse to form in the impulse circuit of the multiplier. Step Recovery diodes make excellent high order multipliers such as comb generators. They are also useful as efficient moderate power X2- X4 multipliers.

- High Order Narrow Band Moderate Power Multipliers (MA44600 series)
- Comb Generators (MA43592, MA43543)
- High Power Circuit Tested Multiplier (MA43000 Series)

Environmental Performance

The MA44600 and MA43000 series of diodes in ceramic packages are capable of meeting the tests dictated by the methods and procedures of the latest revisions of MIL-S-9500, MIL-STD-202 and MIL-STD-750 which specify mechanical, electrical, thermal and other environmental tests common to military semiconductor products.

Environmental Ratings PER MIL-STD-750

| | Method | Level |
|-----------------------|--------|----------------------------|
| Storage Temperature | 1031 | See maximum ratings |
| Temperature Cycle | 1051 | 10 cycles, -65°C to +175°C |
| Shock | 2016 | 500 g's |
| Vibration | 2056 | 15 g's |
| Constant Acceleration | 2006 | 20,000 g's |
| Humidity | 1021 | 10 days |

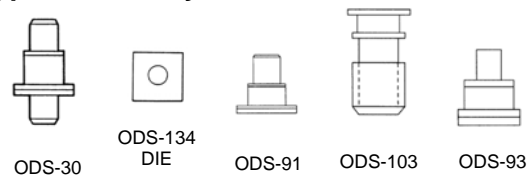
Specifications Subject to Change Without Notice.

Absolute Maximum Ratings @ T_A=+25 °C
(Unless Otherwise Noted)¹

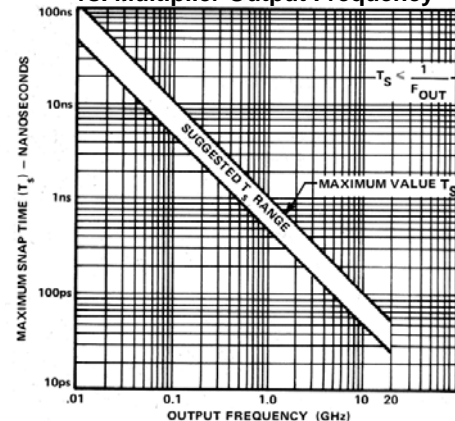
| Parameter | Absolute Maximum |
|-----------------|------------------|
| Operating Range | -65°C to +175°C |
| Storage Range | -65°C to +200°C |

1. Operation of this device above any one of these parameters may cause permanent damage.

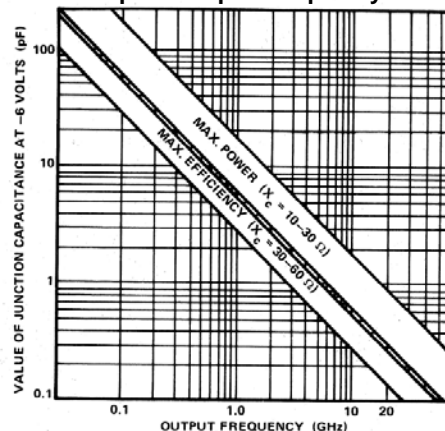
Typical Case Styles



Maximum and Suggested Values of Snaptime (T_s) vs. Multiplier Output Frequency



Suggested Junction Capacitance vs. Multiplier Output Frequency



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Electrical Specifications @ $T_A = +25\text{ }^\circ\text{C}$

Snap Varactors

| Part Number ¹ | Minimum Reverse Voltage ² (V _R) | Junction Capacitance(C _j) ³ Min./Max. | Minimum Lifetime (T _L) | Transition Time (T _s) ⁴ | |
|--------------------------|--|--|--|--|------|
| | | V _r =6V | I _f =10mA/ I _r =6mA | (pS) | (pS) |
| | (V) | (pF) | (nS) | Nominal | Max |
| MA44621A | 20 | 0.200-0.300 | 7 | 50 | 100 |
| MA44631A | 30 | 0.300-0.500 | 8 | 70 | 100 |
| MA44631C | 30 | 0.700-0.900 | 8 | 70 | 100 |
| MA44641A | 40 | 0.400-0.600 | 12 | 90 | 150 |

High Power Circuit Tested Step Recovery Diodes

| Part Number ¹ | Minimum Reverse Voltage ² (V _R) Min./Max | Junction Capacitance (C _j) ³ Min./Max. | Lifetime (T _L) Min./Max. | Maximum Snap Time (T _s) ⁴ | Maximum Thermal Resistance (θ _{jc}) |
|--------------------------|---|---|--|--|---|
| | | V _r =6V | I _f =10mA/ I _r =6mA | | |
| | (V) | (pF) | (nS) | (pS) | (°C/W) |
| MA43000 | 85-105 | 3.00-4.50 | 250-500 | 100 | 12 |
| MA43002 | 45-70 | 1.60-2.40 | 75-225 | 100 | 25 |
| MA43004 | 30-45 | 0.45-0.85 | 20-50 | 100 | 45 |
| Part Number ¹ | Case Style | Minimum Output Power | Input Frequency | Output Frequency | Maximum Input Power |
| | | (Watts) | (GHz) | (GHz) | (Watts) |
| | | | | | |
| MA43000 | 103 | 4.0 | 0.333 | 2.000 | 15 |
| MA43002 | 91 | 1.5 | 2.000 | 6.000 | 5 |
| MA43004 | 91 | 0.3 | 3.300 | 13.000 | 2 |

Notes:

- When ordering, specify the desired case style by adding the case designation as a suffix to the model number. Case styles for the MA44600 series are -30,-91 and -93. To order chip form, add the suffix "-134" to the model number. The nominal chip size for the MA44600 series is 15 mils.
- Reverse voltage (V_R) is measured at a reverse bias current of 10μA.
- Junction capacitance is measured at a reverse voltage of 6V and a frequency of 1MHz.
- Transition time is measured between 20% and 80% points on the voltage recovery trace. Test conditions are +10mA and -10 volts.

Specifications Subject to Change Without Notice.

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Electrical Specifications @ $T_A = +25^\circ\text{C}$

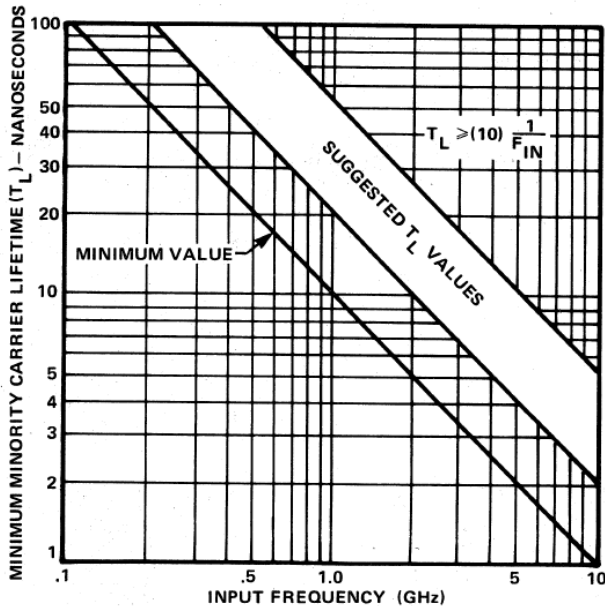
High Order Step Recovery Diode Varactors for Use in Comb Generation

| Part Number ¹ | Minimum Reverse Voltage ³ (V_R) Min./Max | Junction Capacitance (C_j) ⁴ Min./Max. | Lifetime (T_L) Min./Max. | Maximum Snap Time (T_s) ⁵ | Maximum Thermal Resistance (θ_{jc}) | Output Frequency ² | Maximum Input Power ² | Case Style ¹ |
|--------------------------|---|---|------------------------------------|---|---|-------------------------------|----------------------------------|-------------------------|
| | | $V_r=6V$ | $I_f=10mA/I_r=6mA$ | | | | | |
| | (V) | (pF) | (pS) | (pS) | ($^\circ\text{C/W}$) | (GHz) | (Watts) | |
| MA43592 | 25-40 | 0.20-0.30 | 9-27 | 90 | 70 | 1.00-12.00 | 1.0 | 30 |
| MA43543 | 20-50 | 0.20-0.55 | 10-25 | 60 | 125 | 2.00-20.00 | 1.5 | 93 |

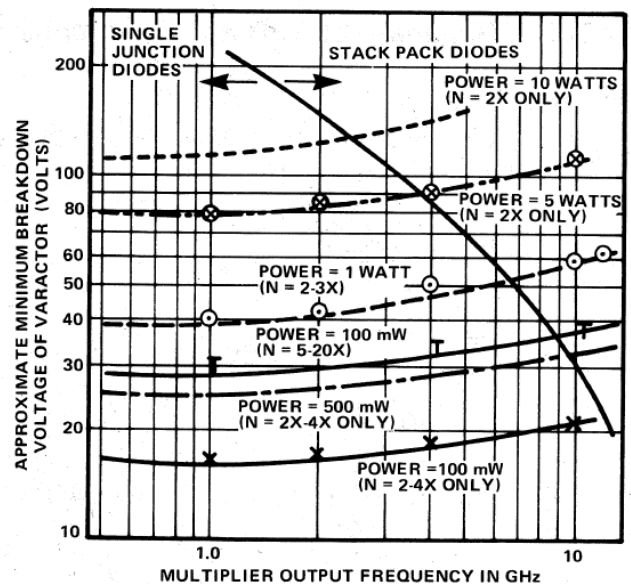
Notes:

- The standard case styles are indicated for each model number. For other available case styles, consult factory.
- This is an operable output frequency range and does not imply instantaneous bandwidth.
- Reverse voltage (V_R) is measured at a reverse bias current of $10\mu\text{A}$.
- Junction capacitance is measured at a reverse voltage of 6V and a frequency of 1MHz.
- Transition time is measured between 20% and 80% points on the voltage recovery trace. Test conditions are $+10\text{mA}$ and -10 volts.

Suggested Design Considerations



Minimum and Suggested Values of Minority Lifetime (TL) for SRD vs. Multiplier Input Frequency



Approximate Minimum Breakdown Voltage Required for SRD at Various Output Power Levels vs. Output Frequency

Specifications Subject to Change Without Notice.

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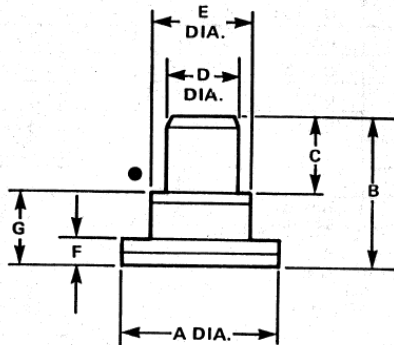
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Case Styles

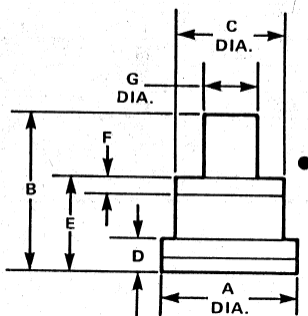
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| DIM. | INCHES | | MILLIMETERS | |
|------|--------|-------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.119 | 0.127 | 3,02 | 3,23 |
| B | 0.115 | 0.129 | 2,92 | 3,28 |
| C | 0.060 | 0.064 | 1,52 | 1,63 |
| D | 0.060 | 0.062 | 1,52 | 1,57 |
| E | 0.077 | 0.083 | 1,96 | 2,11 |
| F | 0.016 | 0.024 | 0,41 | 0,61 |
| G | 0.055 | 0.065 | 1,40 | 1,65 |

C_P = 0.30 pF Typical
L_S = 0.40 nH Typical

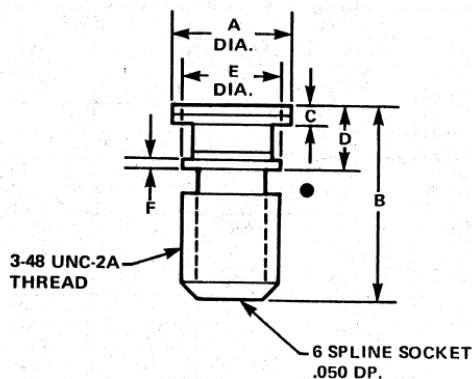
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| DIM. | INCHES | | MILLIMETERS | |
|------|--------|-------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.059 | 0.069 | 1,50 | 1,75 |
| B | 0.070 | 0.080 | 1,78 | 2,03 |
| C | 0.047 | 0.053 | 1,19 | 1,35 |
| D | — | 0.015 | — | 0,38 |
| E | 0.040 | 0.050 | 1,02 | 1,27 |
| F | 0.004 | 0.010 | 0,10 | 0,25 |
| G | 0.024 | 0.026 | 0,61 | 0,66 |

C_P = 0.15 pF Typical
L_S = 0.17 nH Typical

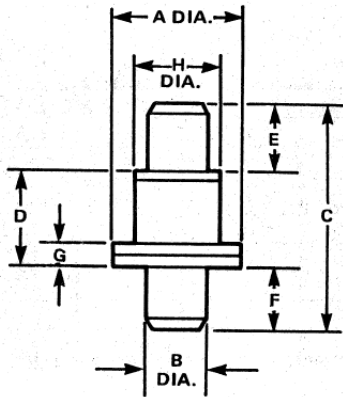
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| DIM. | INCHES | | MILLIMETERS | |
|------|--------|-------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.119 | 0.127 | 3,02 | 3,23 |
| B | 0.188 | 0.208 | 4,78 | 5,28 |
| C | 0.016 | 0.024 | 0,41 | 0,61 |
| D | 0.058 | 0.071 | 1,47 | 1,80 |
| E | 0.098 | 0.102 | 2,49 | 2,59 |
| F | 0.009 | 0.011 | 0,23 | 0,28 |

Case Styles

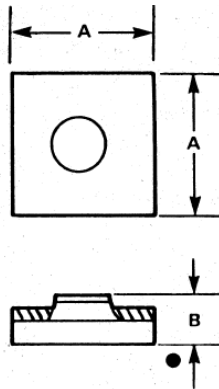
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| DIM. | INCHES | | MILLIMETERS | |
|------|--------|-------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.119 | 0.127 | 3,02 | 3,22 |
| B | 0.060 | 0.064 | 1,52 | 1,63 |
| C | 0.205 | 0.225 | 5,21 | 5,72 |
| D | 0.085 | 0.097 | 2,16 | 2,46 |
| E | 0.060 | 0.064 | 1,52 | 1,63 |
| F | 0.060 | 0.064 | 1,52 | 1,63 |
| G | 0.016 | 0.024 | 0,41 | 0,61 |
| H | 0.079 | 0.083 | 2,01 | 2,11 |

$C_P = 0.18$ pF Typical
 $L_S = 0.40$ nH Typical

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| DIM. | INCHES | | MILLIMETERS | |
|------|--------|--------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.0135 | 0.0165 | 0,34 | 0,42 |
| B | 0.0035 | 0.0065 | 0,09 | 0,17 |