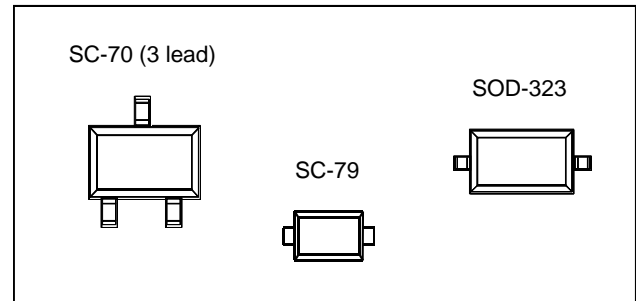


Features

- Ultra High Capacitance Ratio,
 $C(0.1V)/C(4.7V) = 18:1$
 $C(0.1V)/C(2.7V) = 12:1$
- Surface Mount Plastic Packages: SC-79, SOD-323, SC-70, 3 Lead
- SPC Process for Superior C vs. V and Q vs. V Repeatability
- RoHS Compliant equivalents available with 260°C reflow compatibility



Description and Applications

M/A-COM's MA4ST2000 series is a highly repeatable, UHCVD/ion-implanted, hyperabrupt silicon tuning varactor in a cost effective surface mount package. This series of varactors is designed for high capacitance ratio for low battery voltage operation. It is efficient for wide band tuning and low phase noise application where the supply voltage is limited to 5 volts or less. Varactors in this series have a typical 18:1 capacitance ratio between 0.1 V and 4.7 V and a 12:1 ratio between 0.1 V and 2.7 V. The Varactors are offered as Singles in both SC-79 and SOD-323 configurations with Common Cathode version offered in a SC-70, 3 Lead. These diodes are offered with standard Sn/Pb plating, as well as 100% matte Sn plating on our RoHs compliant equivalent devices.

Absolute Maximum Ratings ^{1,2}

@ T_A=+25 °C (Unless Otherwise Noted)

| Parameter | Absolute Maximum |
|-----------------------|-------------------|
| Reverse Voltage | 12 V |
| Forward Current | 50 mA |
| Operating Temperature | -55 °C to +125 °C |
| Storage Temperature | -55 °C to +125 °C |

1. Operation of this device above any one of these parameters may cause permanent damage.
2. Please refer to application note M538 for surface mounting instructions

| Part Number (Contains lead) | RoHS Compliant Part Number | Configuration | Package | Package Cp (pF) | Package Ls (nH) |
|-----------------------------|----------------------------|----------------|------------|-----------------|-----------------|
| | MAVR-002200-12790T | Single | SC-79 | 0.10 | 0.6 |
| | MAVR-002300-12790T | Single | SC-79 | 0.10 | 0.6 |
| | MAVR-002400-12790T | Single | SC-79 | 0.10 | 0.6 |
| | MAVR-002500-12790T | Single | SC-79 | 0.10 | 0.6 |
| | MAVR-002600-12790T | Single | SC-79 | 0.10 | 0.6 |
| | MAVR-002200-11410T | Single | SOD-323 | 0.11 | 1.2 |
| | MAVR-002300-11410T | Single | SOD-323 | 0.11 | 1.2 |
| | MAVR-002400-11410T | Single | SOD-323 | 0.11 | 1.2 |
| | MAVR-002500-11410T | Single | SOD-323 | 0.11 | 1.2 |
| | MAVR-002600-11410T | Single | SOD-323 | 0.11 | 1.2 |
| MA4ST2200CK-1146T | MAVR-002200-1146FT | Common Cathode | SC-70 (3L) | 0.12 | 1.3 |
| MA4ST2300CK-1146T | MAVR-002300-1146FT | Common Cathode | SC-70 (3L) | 0.12 | 1.3 |
| MA4ST2400CK-1146T | MAVR-002400-1146FT | Common Cathode | SC-70 (3L) | 0.12 | 1.3 |
| MA4ST2500CK-1146T | MAVR-002500-1146FT | Common Cathode | SC-70 (3L) | 0.12 | 1.3 |
| MA4ST2600CK-1146T | MAVR-002600-1146FT | Common Cathode | SC-70 (3L) | 0.12 | 1.3 |

1

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MA4ST2000 Series



Ultra High Ratio Si Hyperabrupt Varactor Diode

Rev. V10

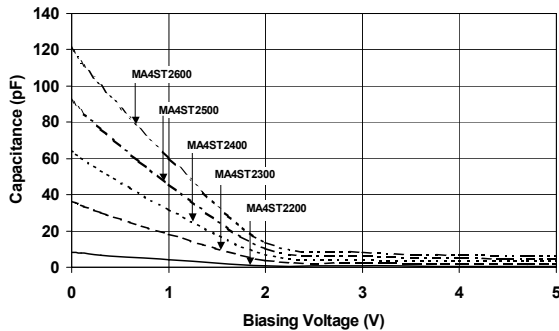
Electrical Specifications @ $T_A = +25^\circ\text{C}$

Breakdown Voltage @ $I_R = 10\mu\text{A}$, $V_b = 30\text{ V}$ Minimum;
Reverse Leakage Current @ $V_R = 10\text{V}$, $I_R = 100\text{ nA}$ Maximum

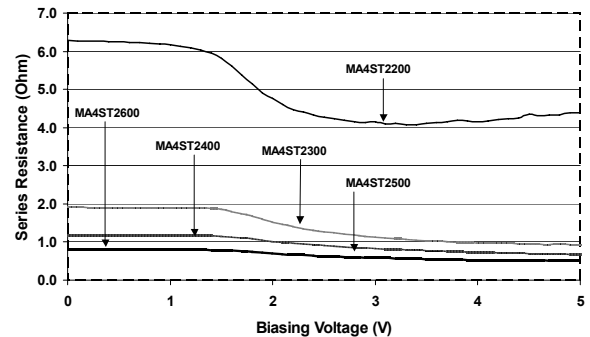
| Part Number ¹ | RoHS Compliant Part Number ¹ | C_t^2 (pF) | | | | | | Capacitance Ratio | | R_s^3 (Ohm) | |
|--------------------------|---|----------------------|------|----------------------|------|----------------------|----------------------|---------------------|---------------------|----------------------|------|
| | | $V_R = 0.1\text{ V}$ | | $V_R = 1.0\text{ V}$ | | $V_R = 2.7\text{ V}$ | $V_R = 4.7\text{ V}$ | $C_{t0.1}/C_{t4.7}$ | $C_{t0.1}/C_{t2.7}$ | $V_R = 4.0\text{ V}$ | |
| | | Typ. | Min. | Nom. | Max. | Typ. | Typ. | Typ. | Typ. | Typ. | Max. |
| MA4ST2200 | MAVR-002200-XXXXXX ³ | 7.68 | 3.7 | 4.1 | 4.5 | 0.70 | 0.47 | 16.3 | 11.0 | 3.84 | 4.6 |
| MA4ST2300 | MAVR-002300-XXXXXX ³ | 34.2 | 16.2 | 18.0 | 19.8 | 2.67 | 1.85 | 18.5 | 12.8 | 0.95 | 1.2 |
| MA4ST2400 | MAVR-002400-XXXXXX ³ | 60.3 | 29 | 32 | 35.2 | 4.98 | 3.27 | 18.4 | 12.1 | 0.67 | 0.9 |
| MA4ST2500 | MAVR-002500-XXXXXX ³ | 86.4 | 41.4 | 46.0 | 50.6 | 6.68 | 4.64 | 18.6 | 12.9 | 0.61 | 0.8 |
| MA4ST2600 | MAVR-002600-XXXXXX ³ | 113.3 | 54.3 | 60.3 | 66.4 | 9.14 | 6.27 | 18.1 | 12.4 | 0.54 | 0.7 |

- The suffix defines package style, configuration, and packaging information. Contact representative for complete part identification.
- Capacitance @ 1 MHz
- Series Resistance @ 100 MHz

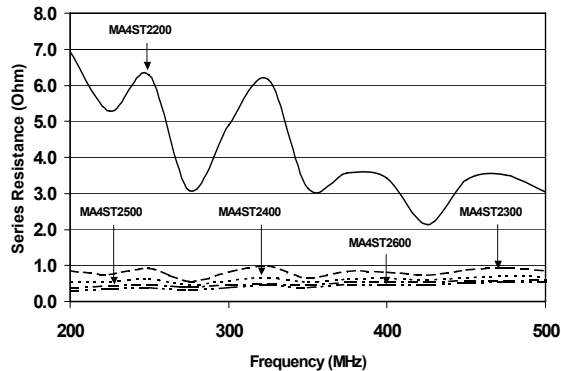
Typical Capacitance vs. Biasing Voltage



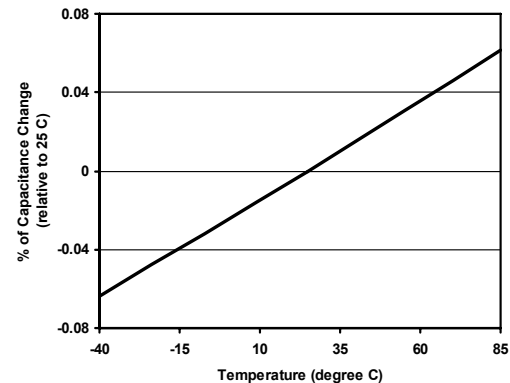
Typical Series Resistance vs. Biasing Voltage



Typical Series Resistance vs. Frequency



Typical Capacitance Change vs. Temperature



2

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MA4ST2000 Series



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Rev. V10

Typical Capacitance Values

| V_R (V) | MA4ST2200 MAVR-002200- XXXXXX | MA4ST2300 MAVR-002300- XXXXX MAVR-002301- 11410T | MA4ST2400 MAVR-002400- XXXXXX | MA4ST2500 MAVR-002500- XXXXXX | MA4ST2600 MAVR-002600- XXXXXX |
|-----------|-------------------------------------|--|-------------------------------------|-------------------------------------|-------------------------------------|
| | Ct (pF) | Ct (pF) | Ct (pF) | Ct (pF) | Ct (pF) |
| 0.1 | 7.643 | 34.06 | 60.26 | 86.48 | 113.09 |
| 0.3 | 6.746 | 30.07 | 53.12 | 76.34 | 99.80 |
| 0.5 | 5.948 | 26.56 | 46.81 | 67.36 | 88.07 |
| 1.0 | 4.006 | 18.00 | 31.75 | 46.09 | 60.31 |
| 1.5 | 1.895 | 8.313 | 15.52 | 22.83 | 30.21 |
| 2.0 | 0.985 | 3.941 | 7.470 | 10.05 | 13.94 |
| 2.5 | 0.744 | 2.889 | 5.407 | 7.112 | 9.952 |
| 3.0 | 0.638 | 2.429 | 4.512 | 5.918 | 8.274 |
| 3.5 | 0.579 | 2.166 | 4.000 | 5.275 | 7.332 |
| 4.0 | 0.543 | 1.993 | 3.663 | 4.895 | 6.749 |
| 4.5 | 0.517 | 1.845 | 3.370 | 4.691 | 6.317 |
| 5.0 | 0.469 | 1.771 | 3.200 | 4.557 | 6.086 |

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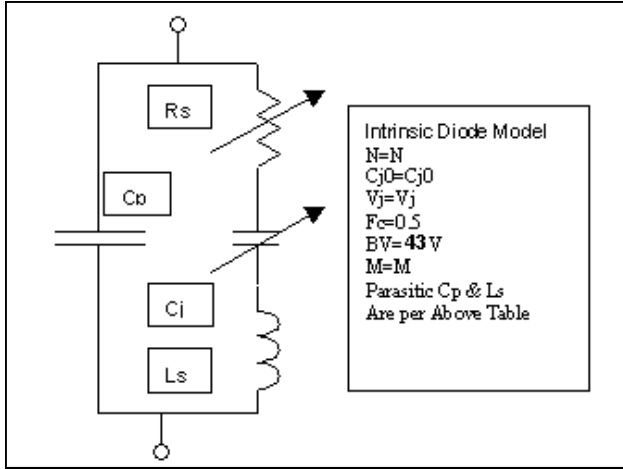
MA4ST2000 Series



Ultra High Ratio Si Hyperabrupt Varactor Diode

Rev. V10

Spice Model



| Part Number | N | CJO (pF) | Vj (V) | M | Rs (Ω) |
|---|-------|----------|--------|-------|-----------------|
| MA4ST2200 MAVR-002200-XXXXXX | 1.261 | 10.2 | 12.62 | 18.60 | 1.114 |
| MA4ST2300 MAVR-002300-XXXXXX MAVR-002301-11410T | 1.210 | 46.8 | 2.450 | 4.268 | 1.085 |
| MA4ST2400 MAVR-002400-XXXXXX | 1.158 | 84.6 | 1.322 | 2.632 | 0.903 |
| MA4ST2500 MAVR-002500-XXXXXX | 1.204 | 100 | 1.616 | 2.700 | 0.842 |
| MA4ST2600 MAVR-002600-XXXXXX | 1.196 | 159 | 1.169 | 2.270 | 0.910 |

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MA4ST2000 Series

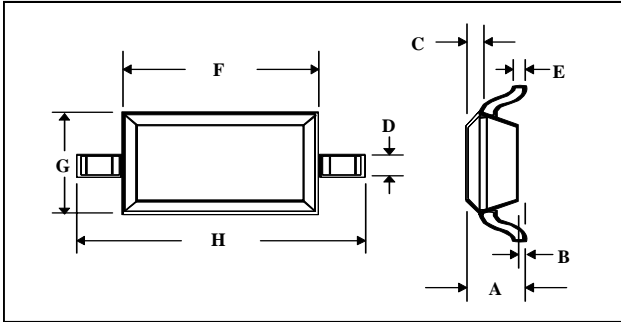


Ultra High Ratio Si Hyperabrupt Varactor Diode

Rev. V10

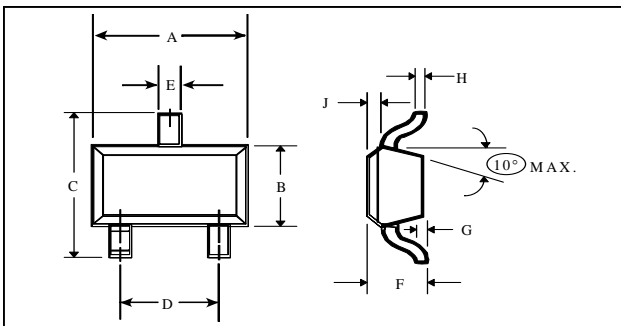
Case Styles

SOD-323 (Case Style 1141)



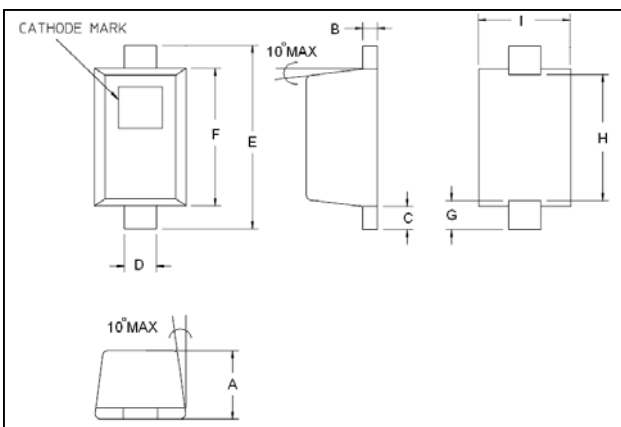
| DIM. | INCHES | | MILLIMETERS | |
|------|--------|-------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | — | 0.043 | — | 1.1 |
| B | — | 0.004 | — | 0.1 |
| C | — | 0.008 | — | 0.2 |
| D | 0.010 | 0.016 | 0.25 | 0.4 |
| E | 0.003 | 0.006 | 0.08 | 0.15 |
| F | 0.063 | 0.075 | 1.6 | 1.9 |
| G | 0.045 | 0.057 | 1.14 | 1.45 |
| H | 0.091 | 0.106 | 2.3 | 2.7 |

SC-70, 3 Lead (Case Style 1146)



| DIM. | INCHES | | MILLIMETERS | |
|------|--------|-------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.071 | 0.087 | 1.80 | 2.21 |
| B | 0.045 | 0.053 | 1.14 | 1.35 |
| C | 0.071 | 0.094 | 1.80 | 2.40 |
| D | 0.047 | 0.057 | 1.19 | 1.45 |
| E | 0.010 | 0.016 | 0.25 | 0.41 |
| F | 0.031 | 0.039 | 0.80 | 1.00 |
| G | 0.000 | 0.004 | 0.00 | 0.10 |
| H | 0.004 | 0.007 | 0.10 | 0.18 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |

SC-79 (Case Style 1279)



| DIM. | INCHES | | MILLIMETERS | |
|------|------------------|-------|-------------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.020 | 0.028 | 0.50 | 0.71 |
| B | 0.003 | 0.008 | 0.08 | 0.20 |
| C | 0.006 | 0.010 | 0.15 | 0.25 |
| D | 0.010 | 0.014 | 0.25 | 0.36 |
| E | 0.059 | 0.067 | 0.08 | 0.15 |
| F | 0.043 | 0.051 | 1.50 | 1.30 |
| G | 0.011 | 0.012 | 0.28 | 0.30 |
| H | 0.037 typical | 0.043 | 0.94 | 1.09 |
| I | .028 | .035 | 0.71 | 0.89 |

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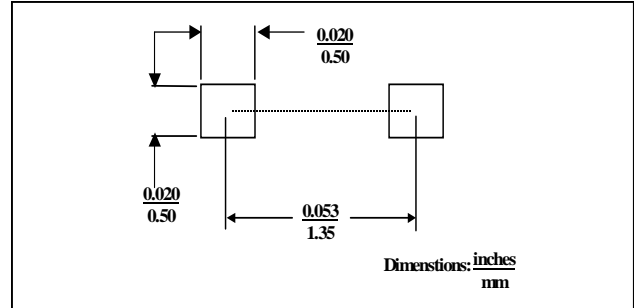
Mounting Information

The illustration indicates the recommended mounting pad configuration for the SC-79, SC70 3LD and SOD-323 packages. Solder paste containing flux should be screened onto the pads to a thickness of 0.005- 0.007 inches. The plastic package is placed in position, firmly adhering to the solder paste.

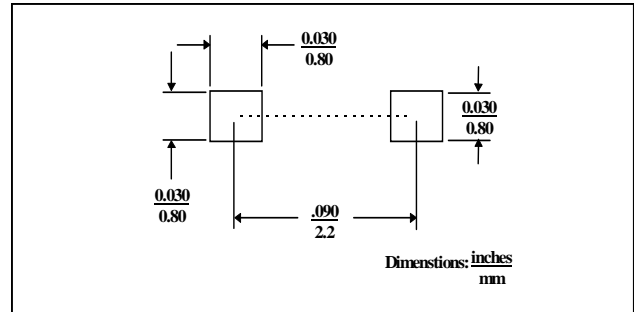
Permanent attachment is performed by a reflow soldering procedure during which the tab temperature does not exceed +275 °C and the body temperature does not exceed +250 °C, for standard models and +260 °C for the RoHS compliant devices.

Please refer to Application Note M538 for surface mounting instructions.

SC-79 (Case Style 1279)



SOD-323 (Case Style 1141)



SC-70, 3 Lead (Case Style 1146)

