

# Ultra High Ratio Si Hyperabrupt Varactor Diode

V 4.00

## MA4ST2000 Series

### 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

### Description

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.

### Ordering Information

| Part Number     | Configuration  | Package         |
|-----------------|----------------|-----------------|
| MA4ST2XXX-1279T | Single         | SC-79           |
| MA4ST2XXX-1141T | Single         | SOD-323         |
| MA4ST2XXX-1146T | Common Cathode | SC-70<br>3 Lead |

### Absolute Maximum Ratings

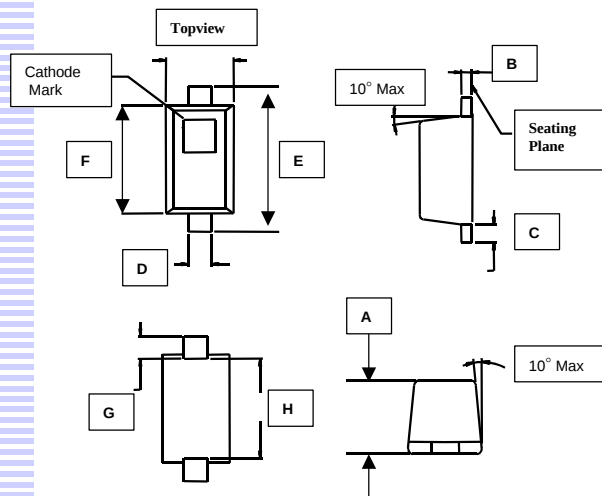
@T<sub>A</sub> = +25 °C

| 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 |

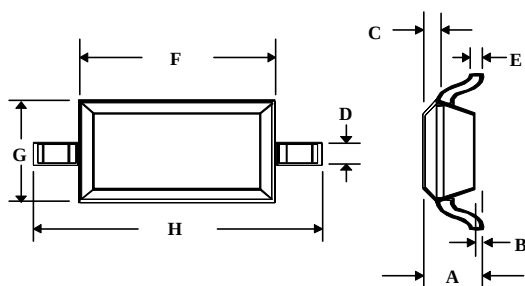
### Technical Parasitic Information

| Package Type     | Package Cp | Package Ls |
|------------------|------------|------------|
| SC-79            | 0.10       | 0.6        |
| SOD-323          | 0.11       | 1.2        |
| SC-70,<br>3 Lead | 0.12       | 1.3        |

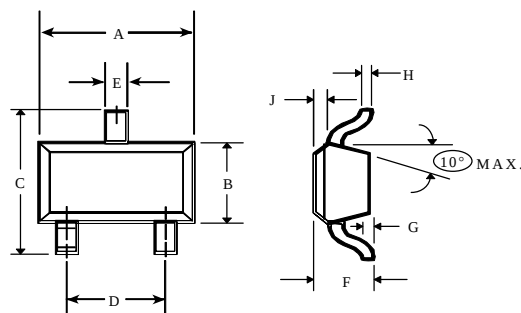
## Case Styles

SC-79 (SOD-523)  
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  | 0.043 | 0.94        | 1.09 |

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 | 1.15        | 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        | 2.20 |
| B    | 0.045  | 0.053 | 1.15        | 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    | —      | 0.004 | —           | 0.10 |
| H    | 0.004  | 0.007 | 0.10        | 0.18 |
| J    | 0.004  | 0.010 | 0.10        | 0.25 |

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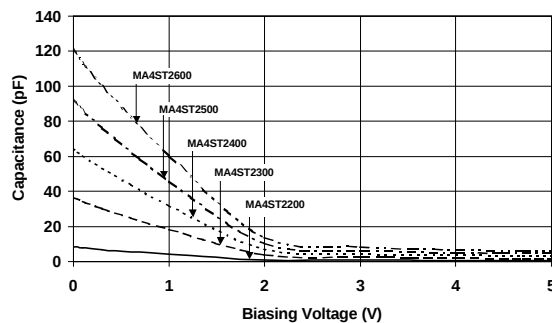
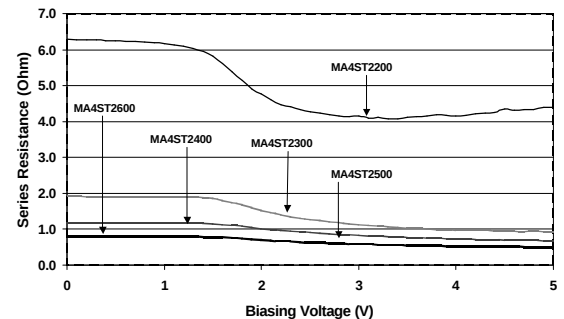
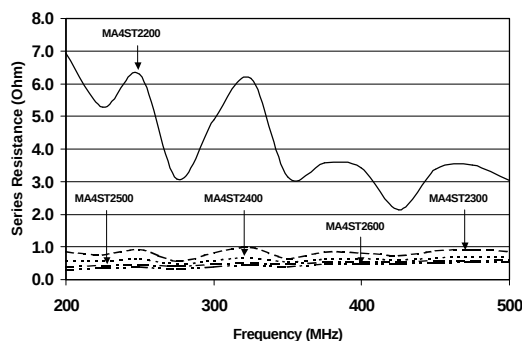
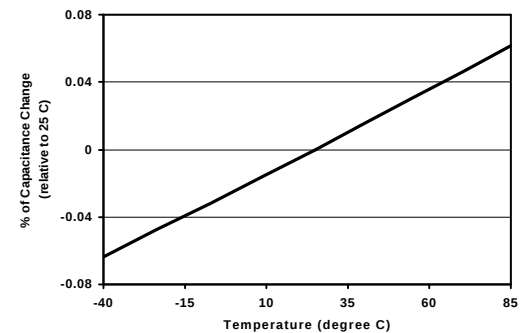
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**Electrical Characteristics @  $T_A = +25^\circ\text{C}$** **Breakdown Voltage @  $I_R = 10\text{mA}$ ,  $V_b = 12\text{V}$  Minimum****Reverse Leakage Current @  $V_R = 10\text{V}$ ,  $I_R = 10\text{nA}$  Maximum**

| Part Number | Ct* (pF)            |                     |      |      |      |                     | Capacitance Ratio   |                     | Rs** (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   | 7.68                | 3.66                | 4.07 | 4.48 | 0.70 | 0.47                | 16.3                | 11.0                | 3.84                | 4.6                 |
| MA4ST2300   | 34.2                | 16.2                | 18.0 | 19.8 | 2.67 | 1.85                | 18.5                | 12.8                | 0.95                | 1.2                 |
| MA4ST2400   | 60.3                | 28.6                | 31.8 | 34.9 | 4.98 | 3.27                | 18.4                | 12.1                | 0.67                | 0.9                 |
| MA4ST2500   | 86.4                | 41.4                | 46.0 | 50.6 | 6.68 | 4.64                | 18.6                | 12.9                | 0.61                | 0.8                 |
| MA4ST2600   | 113.3               | 54.3                | 60.3 | 66.4 | 9.14 | 6.27                | 18.1                | 12.4                | 0.54                | 0.7                 |

\* Capacitance @ 1 MHz

\*\* Series Resistance @ 470 MHz

**Typical Capacitance vs. Biasing Voltage****Typical Series Resistance vs. Biasing Voltage****Typical Series Resistance vs. Frequency****Typical Capacitance Change vs. Temperature**

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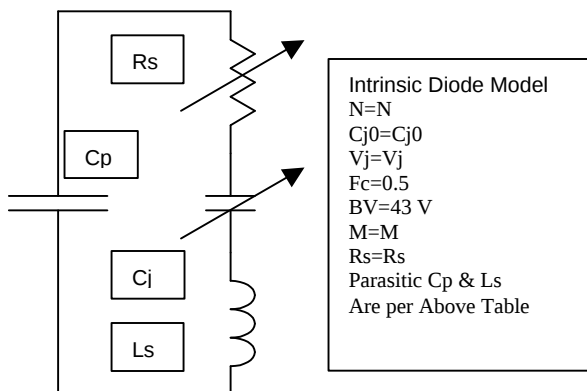
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## Typical Capacitance Values

| $V_R$ (V) | MA4ST2200 | MA4ST2300 | MA4ST2400 | MA4ST2500 | MA4ST2600 |
|-----------|-----------|-----------|-----------|-----------|-----------|
|           | 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     |

## Spice Model



| Part Number | N     | CJO (pF) | Vj (V) | M     | Rs (W) |
|-------------|-------|----------|--------|-------|--------|
| MA4ST2200   | 1.261 | 10.2     | 12.62  | 18.60 | 1.114  |
| MA4ST2300   | 1.210 | 46.8     | 2.450  | 4.268 | 1.085  |
| MA4ST2400   | 1.158 | 84.6     | 1.322  | 2.632 | 0.903  |
| MA4ST2500   | 1.204 | 100      | 1.616  | 2.700 | 0.842  |
| MA4ST2600   | 1.196 | 159      | 1.169  | 2.270 | 0.910  |

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