

## Low-Voltage / High Q Si Hyperabrupt Varactors

MA4ST200 Series  
V2

### Features

- Surface Mount Packages (SOT-23, SOT-323, SOD-323)
- High Q at Low Voltages
- High Capacitance Ratio at Low Voltages
- SPC Process for Superior C-V Repeatability
- Available as Single and Common Cathode Pairs Tape and Reel Packaging
- Designed for Commercial Wireless Applications
- Lead-Free (RoHS Compliant) equivalents available with 260°C reflow compatibility

### Description

M/A-COM's MA4ST200 series is a ion-implanted, hyperabrupt junction, silicon tuning varactors in SOT-23, SOT-323, and SOD-323 surface mount packages. This series of varactors is designed for high Q and low voltage operation. Each varactor type has a Q greater than 400 at -2 V. These diodes are offered with standard Sn/Pb plating, as well as 100% matte Sn plating on our RoHS compliant equivalent devices.

### Applications

The MA4ST200 series tuning varactors are useful for wide band tuning and low phase noise applications where the supply voltage is limited to 5 volts or less. These varactors have been specifically designed for use in the wireless communications up to the 2.4 GHz band. Applications include VCOs and voltage tuned filters.

### RoHS Compliant parts

| Part Number | RoHS Compliant Base Part Number |
|-------------|---------------------------------|
| MA4ST230    | MAVR-000230                     |
| MA4ST240    | MAVR-000240                     |
| MA4ST250    | MAVR-000250                     |

### Absolute Maximum Ratings @ $T_A = +25^\circ\text{C}$ (Unless Otherwise Noted)<sup>1</sup>

| Parameter               | Absolute Maximum  |
|-------------------------|-------------------|
| Reverse Voltage         | 12 V              |
| Forward Current         | 50 mA             |
| Total Power Dissipation | 250 mW            |
| 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

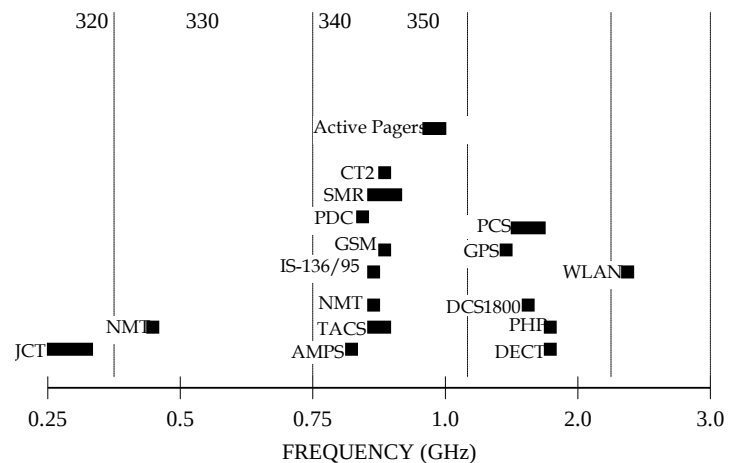
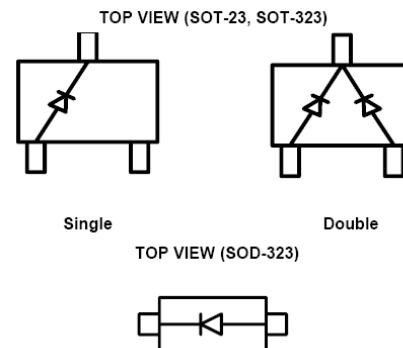


Fig. 1 Typical Device Selection by Frequency

### Configurations



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

Breakdown Voltage @  $I_R = 10\mu\text{A}$ ,  $V_b = 12\text{ V}$  Minimum

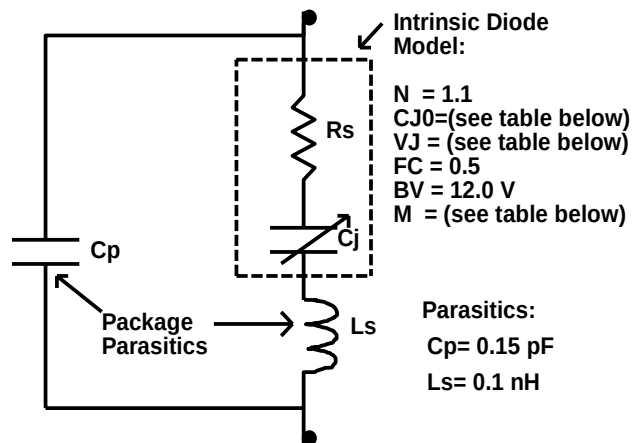
Reverse Leakage Current @  $V_R = 10\text{V}$ ,  $I_R = 100\text{ nA}$  Maximum

| Part Number<br>Base | RoHS Compliant<br>Part Number Base <sup>1</sup> | $C_T^2$            |      |      |                              | Capaci-<br>tance<br>Ratio | Q Factor                       |
|---------------------|-------------------------------------------------|--------------------|------|------|------------------------------|---------------------------|--------------------------------|
|                     |                                                 | (pF)               |      |      | (pF)                         |                           |                                |
|                     |                                                 | f=1 MHz, $V_R=2.0$ |      |      | f=1MHz,<br>$V_R=4.0\text{V}$ | $C_{T0.5}/C_{T4.0}$       | f=50 MHz,<br>$V_R=2.0\text{V}$ |
|                     |                                                 | Min.               | Nom. | Max. | Max.                         | Typ.                      | Min.                           |
| MA4ST230            | MAVR-000230-XXXXXX                              | 4.5                | 5.0  | 6.0  | 3.1                          | 3.5                       | 400                            |
| MA4ST240            | MAVR-000240-XXXXXX                              | 3.0                | 3.5  | 4.2  | 2.3                          | 3.5                       | 450                            |
| MA4ST250            | MAVR-000250-XXXXXX                              | 2.3                | 2.7  | 3.5  | 1.8                          | 3.5                       | 450                            |

<sup>1</sup> The suffix defines package style, configuration and packaging information. Contact representative for complete part identification. Example : The MA4ST250-1141T RoHS compliant version is MAVR-000250-11410T .

<sup>2</sup> Capacitance @ 1 MHz

### Spice Model



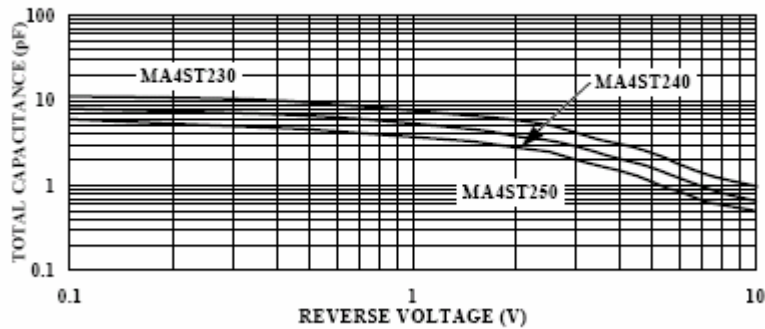
| Part No. | RoHS Compliant Base<br>Part No. | CJ0 (pF) | VJ (V) | M     |
|----------|---------------------------------|----------|--------|-------|
| MA4ST230 | MAVR-000230                     | 12.0     | 4.085  | 2.228 |
| MA4ST240 | MAVR-000240                     | 8.16     | 4.930  | 2.520 |
| MA4ST250 | MAVR-000250                     | 6.19     | 4.774  | 2.458 |

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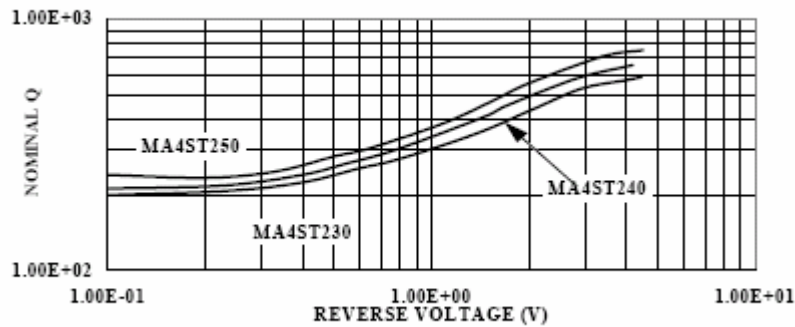
MA4ST200 Series  
V2

### Typical Performance Curves

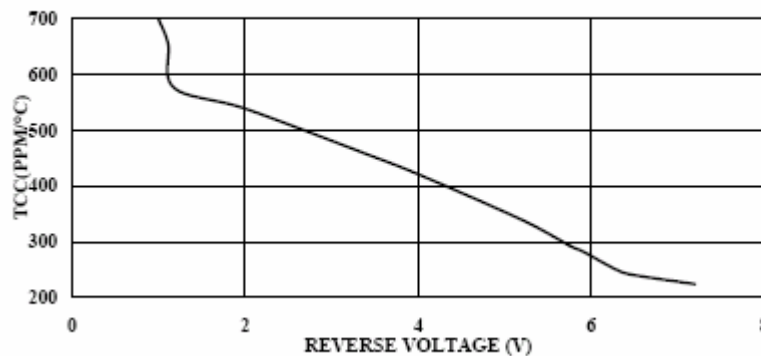
**TOTAL CAPACITANCE vs REVERSE VOLTAGE at 1 MHz**



**NOMINAL Q at 50 MHz vs REVERSE VOLTAGE**



**NOMINAL CHANGE in CAPACITANCE with TEMPERATURE**



# Low-Voltage / High Q Si Hyperabrupt Varactors

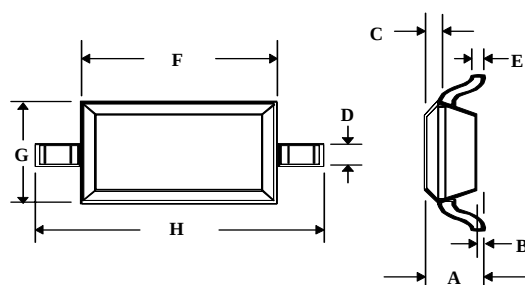
MA4ST200 Series

V2

## Case Styles

### SOD-323

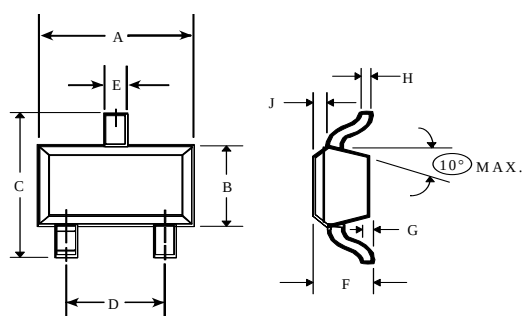
#### Case Style 1141



| 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 | 1.15        | 1.45 |
| H    | 0.091  | 0.106 | 2.3         | 2.7  |

### SC-70, 3 Lead

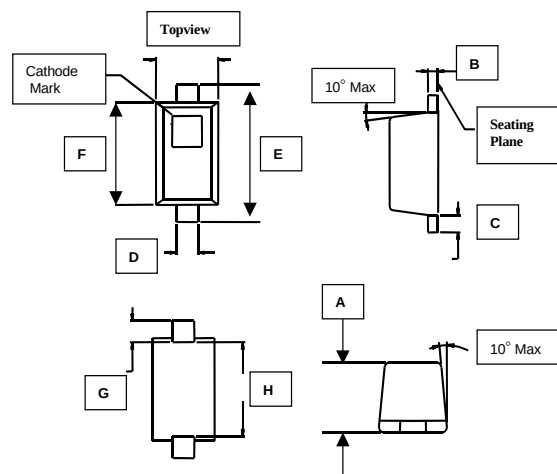
#### Case Style 1146



| 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    | 0.000  | 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<br>typical | 0.043 | 0.94        | 1.09 |

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### Mounting Information

The illustration indicates the recommended mounting pad configuration for the SC-79, SOT-323 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.

These varactors are available in the three case styles shown. When ordering, specify the desired case style by adding the case designation (287 for SOT-23, 1146 for SOT-323, 1141 for SOD-323) as a suffix to the model number. For example, MA4ST230-1141 specifies the MA4ST230 varactor in the SOD-323 package. The model number indicated is for a single varactor. Common cathode pairs are available in SOT-23 package, and are specified by adding "CK" to the end of the model number. For example MA4ST230CK-287 specifies the MA4ST230 varactor in common cathode pairs.

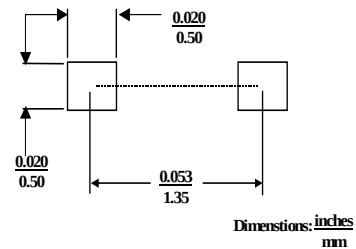
For RoHS Compliant Parts, use the Following  
Suffixes for the Given Package Style  
( After the Base P/N ) :

SC-79 : 12790T  
SOD-323 : 11410T  
SOT-323 : 1146FT

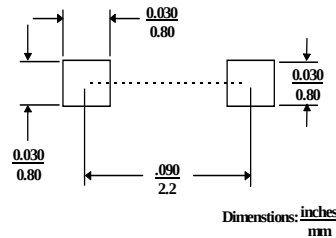
As example, the RoHS P/N for the Base P/N  
MA4VR-000230 in SOD-323 is :  
MAVR-000230-1146FT.

**Please refer to Application Note M538 for surface  
mounting instructions.**

### SC-79



### SOD-323



### SOT-323

