

## Surface Mount GaAs Tuning Varactors 0.75, 1.25, & 1.5 Gamma Hyperabrupt

Rev. V8

### Features

- Gamma Hyperabrupt Junctions: 0.75, 1.25 and 1.5
- Surface Mount Packages
- Very High Quality Factor
- Capacitance Ratio to 10:1
- Case Style 1056 is Hermetic and may be Screened to JANTX levels
- Tape and Reel Packaging Available

### Description

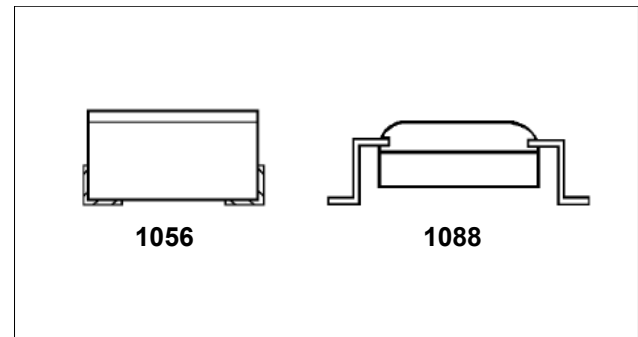
MACOM offers three families of low cost surface mount gallium arsenide tuning varactors. All families have silicon nitride protected junctions for low leakage current and high reliability.

The **MA46H070** through **MA46H073** family has hyperabrupt junctions with constant gamma of 0.75 from 0 to 20 volts and very high quality factor approaching that of abrupt junction varactors, but higher capacitance change versus tuning voltage. These diodes are very well suited for narrow bandwidth VCOs and VTFs where wide tuning range and very high quality factor are required.

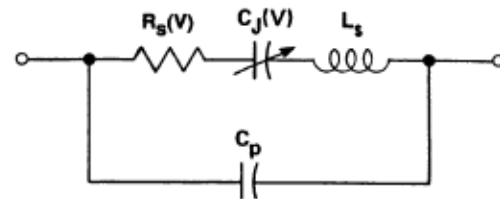
The **MA46H200** through **MA46H204** family has hyperabrupt junctions with constant gamma of 1.25 from 2 to 20 volts and has the largest capacitance ratio of the families of GaAs varactors and high quality factor. These diodes are very well suited for wide bandwidth VCOs and VTFs where the optimum combination of very wide tuning range and high quality factor is required.

The **MA46H500** through **MA46H504** family has hyperabrupt junctions with constant gamma of 1.5 from 2 to 12 volts and high quality factor. Designed for wide bandwidth VCOs and VTFs where limited bias voltage is available. These varactors have lower quality factor than the other families of GaAs varactors.

### Common Case styles



### Packaged Tuning Varactor Equivalent Circuit



### Absolute Maximum Ratings<sup>1,2</sup>

| Parameter             | Absolute Maximum   |                 |
|-----------------------|--|-----------------|
|                       | Case 1056  | Case 1088       |
| Operating Temperature | -65°C to +150°C  | -65°C to +125°C |
| Storage Temperature   | -65°C to +200°C  | -65°C to +125°C |
| Reverse Voltage       | Breakdown Voltage  |                 |
| Forward Current       | 50 mA @ 25°C   |                 |
| Power Dissipation     | 50 mW @ 25°C,<br>de-rate linearly to 0 mW @<br>maximum operating temperature |                 |

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.

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

#### 0.75 Gamma Hyperabrupt

Breakdown Voltage @ 10  $\mu\text{A}$  = 20 V minimum  
 Reverse Current @ 16 V = 100 nA maximum  
 Gamma<sup>3</sup> = 0.68 - 0.83, VR = 0 to 20 V @ 10  $\mu\text{A}$

| Part Number | Total Capacitance<br>+/-10% <sup>4,5,6</sup> | Total Capacitance<br>Ratio <sup>6</sup> | Q<br>Minimum |
|-------------|--|---|--------------|
|             | Vr=4 V                                       | Vr=0 V                                  | Vr=4 V       |
|             | (pF)   | -                                       | -            |
| MA46H070    | 0.5 - 0.7                                    | 5.5                                     | 4500         |
| MA46H071    | 0.9 - 1.1                                    | 6.4                                     | 4500         |
| MA46H072    | 2.7 - 3.3                                    | 7.5                                     | 3000         |
| MA46H073    | 4.5 - 5.5                                    | 7.5                                     | 2200         |

#### 1.25 Gamma Hyperabrupt

Breakdown Voltage @ 10  $\mu\text{A}$  = 22 V minimum  
 Reverse Current @ 16 V = 100 nA maximum  
 Gamma<sup>3</sup> = 1.13 - 1.38, VR = 2 to 20 V @ 10  $\mu\text{A}$

| Part Number           | Total Capacitance<br>+/-10% <sup>4,5,6</sup> | Total Capacitance<br>Ratio <sup>6</sup> | Q<br>Minimum |
|-----------------------|--|---|--------------|
|                       | Vr=4 V                                       | Vr=2 V                                  | Vr=4 V       |
|                       | (pF)   | -                                       | -            |
| MA46H200              | 0.5 - 0.7                                    | 3.0                                     | 1500         |
| MA46H201              | 0.9 - 1.1                                    | 4.1                                     | 3000         |
| MA46H202 <sup>7</sup> | 2.7 - 3.3                                    | 5.6                                     | 2000         |
| MA46H203              | 4.5 - 5.5                                    | 10.0                                    | 1500         |
| MA46H204              | 9.0 - 11.0                                   | 10.0                                    | 1500         |

#### 1.5 Gamma Hyperabrupt

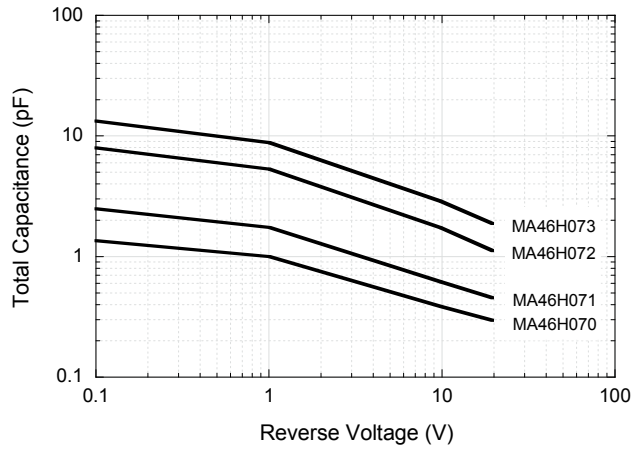
Breakdown Voltage @ 10  $\mu\text{A}$  = 18 V minimum  
 Reverse Current @ 14 V = 100 nA maximum  
 Gamma<sup>3</sup> = 1.4 - 1.6, VR = 2 to 12 V @ 10  $\mu\text{A}$

| Part Number | Total Capacitance<br>+/-10% <sup>4,5,6</sup> | Total Capacitance<br>Ratio <sup>6</sup> | Q<br>Minimum |
|-------------|--|---|--------------|
|             | Vr=4 V                                       | Vr=2 V                                  | Vr=4 V       |
|             | (pF)   | -                                       | -            |
| MA46H500    | 0.5 - 0.7                                    | 2.8                                     | 2500         |
| MA46H501    | 0.9 - 1.1                                    | 3.9                                     | 2500         |
| MA46H503    | 4.5 - 5.5                                    | 8.1                                     | 1200         |
| MA46H504    | 9.0 - 11.0                                   | 8.1                                     | 1200         |

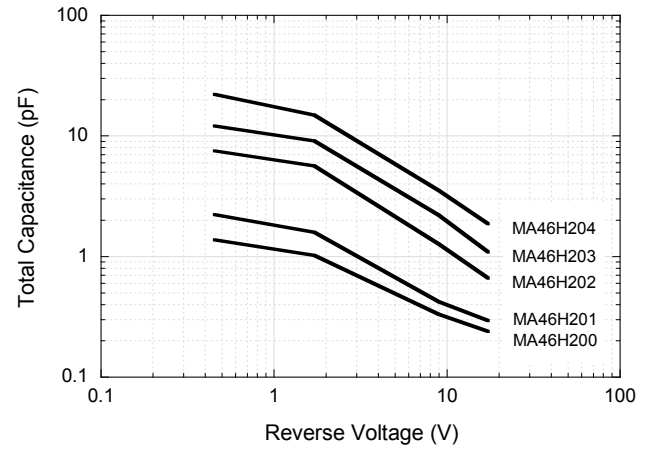
- The values guaranteed for gamma are measured on unpackaged chips. The total capacitance versus bias voltage curve will deviate slightly from the chip capacitance versus bias voltage curve due to the package parasitic capacitance (Cp).
- The Cp values listed typically have tolerances of  $\pm 0.02$  pF.
- Capacitance is measured at 1 MHz.
- The total capacitance and capacitance ratios shown are for diodes housed in case style 30. Other case styles will result in different values.
- When ordering MA46H202-134 as whole wafer P/N is MAVR-0046202-0134WR.

### Typical Performance Curves

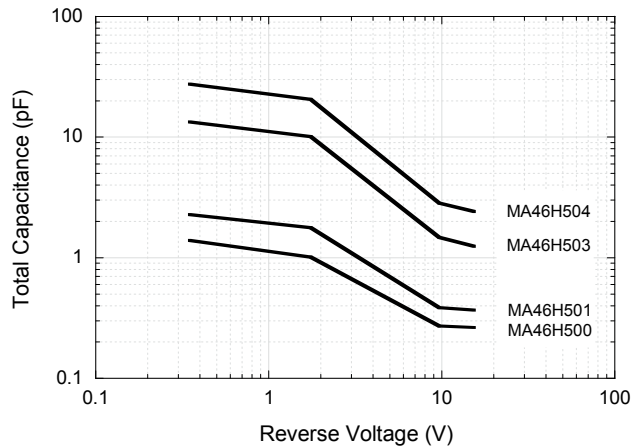
#### 0.75 Gamma Hyperabrupt



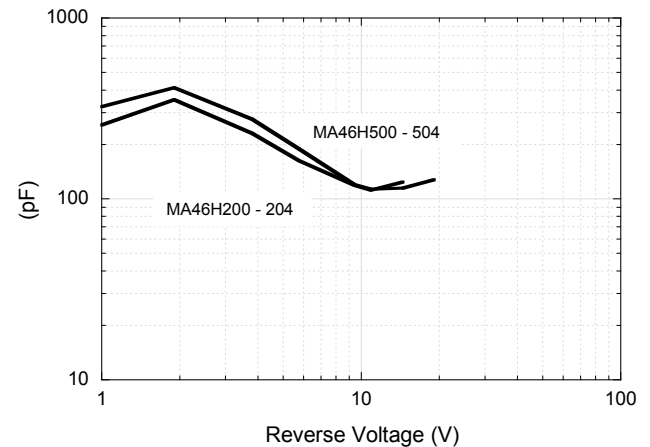
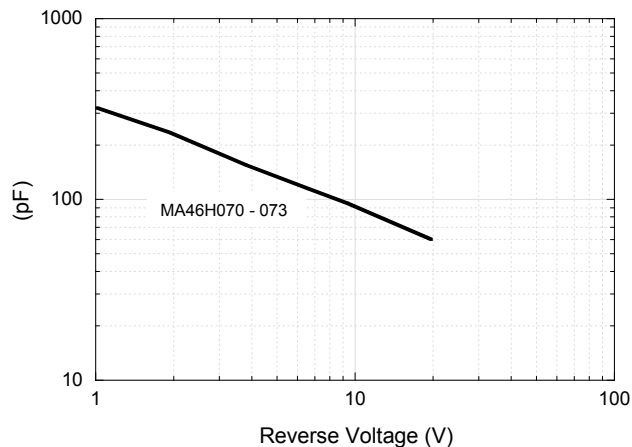
#### 1.25 Gamma Abrupt



#### 1.5 Gamma Hyperabrupt

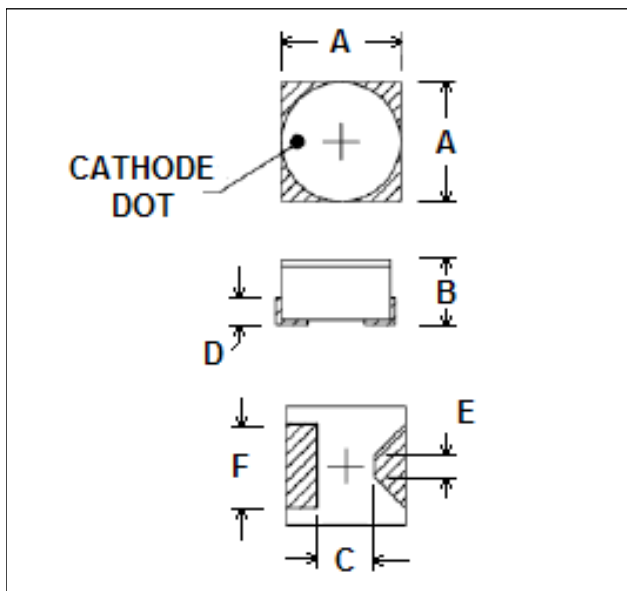


### Temperature Coefficient of Capacitance in PPM/°C vs. Reverse Voltage



### Case Styles

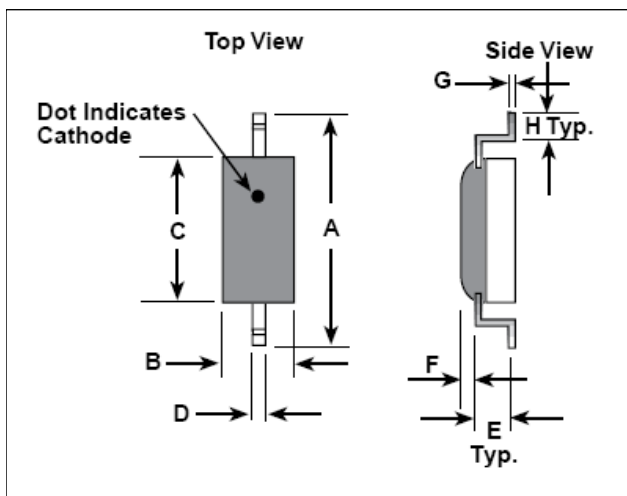
#### ODS-1056



| DIM. | INCHES |       | MILLIMETERS |      |
|------|--------|-------|-------------|------|
|      | MIN.   | MAX.  | MIN.        | MAX. |
| A    | 0.065  | 0.075 | 1.65        | 1.91 |
| B    | 0.034  | 0.041 | 0.86        | 1.04 |
| C    | 0.030  | 0.036 | 0.76        | 0.91 |
| D    | 0.009  | 0.021 | 0.23        | 0.53 |
| E    | 0.010  | 0.014 | 0.25        | 0.36 |
| F    | 0.043  | 0.053 | 1.09        | 1.35 |

Package Capacitance: 0.15 pF Typical  
Package Inductance: 0.45 nH Typical

#### ODS-1088



| DIM. | INCHES |       | MILLIMETERS |      |
|------|--------|-------|-------------|------|
|      | MIN.   | MAX.  | MIN.        | MAX. |
| A    | 0.175  | 0.195 | 4.44        | 4.95 |
| B    | 0.040  | 0.050 | 1.02        | 1.27 |
| C    | 0.085  | 0.095 | 2.16        | 2.41 |
| D    | 0.015  | 0.025 | 0.38        | 0.64 |
| E    | 0.010  | 0.015 | 0.25        | 0.38 |
| F    | 0.015  | 0.020 | 0.38        | 0.51 |
| G    | 0.004  | 0.006 | 0.10        | 0.15 |
| H    | 0.020  | 0.030 | 0.51        | 0.76 |
| J    | 0.013  | 0.033 | 0.33        | 0.84 |
| K    | 0.003  | 0.005 | 0.08        | 0.13 |

### Ordering Information

These GaAs tuning varactors are available in either case style as shown. When ordering, specify the desired case style by adding the case designation as a suffix to the model number. For example, a MA46H200-1088 specifies a 1.25 gamma hyperabrupt tuning diode in case style 1088.