# MA46410 thru MA46485 Series

## GaAs Hyperabrupt Varactor Diode
## Gamma = 1.0, 1.25, & 1.50

Rev. V6

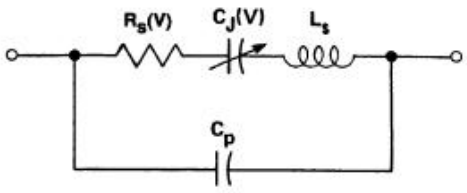
### Features

- Constant Gamma = 1.0, 1.25 or 1.5
- High Q (up to 4000 at -4 Volts)
- More Linear Frequency Tuning
- High and Nearly Constant Modulation Sensitivity
- Lead-Free (RoHs Compliant) equivalents available with 260°C reflow compatibility.

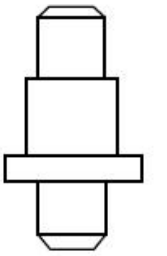
### Description and Applications

The MA46450, MA46470 and MA46410 series of tuning varactors are hyperabrupt junction Gallium Arsenide diodes featuring constant gamma 1.0 (MA46450 series),1.25 (MA46470 series) or 1.5 (MA46410 series). These diodes offer high Q (up to 4000) permitting excellent tuning performance from VHF through Ka band. Each part in this series exhibits the large change in capacitance versus bias voltage characteristic of hyperabrupt junctions. The standard capacitance tolerance is ±10%, with tighter tolerances available. Capacitance matching at one or more bias voltages is also available. All diode types are available in a wide selection of ceramic packages and in chip form. The constant gamma value of 1.0, 1.25 or 1.5 available with these diodes enables the circuit designer to produce significant improvements in circuit performance. Constant gamma tuning varactors permit more linear VCO frequency tuning than do conventional hyperabrupt tuning varactors.These varactors are particularly well suited for use in voltage tuned filters, analog phase shifters, and modulator circuits.

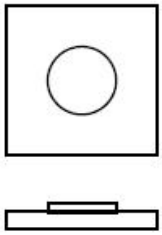
PACKAGED TUNING VARACTOR EQUIVALENT CIRCUIT




### Common Case styles



ODS-30



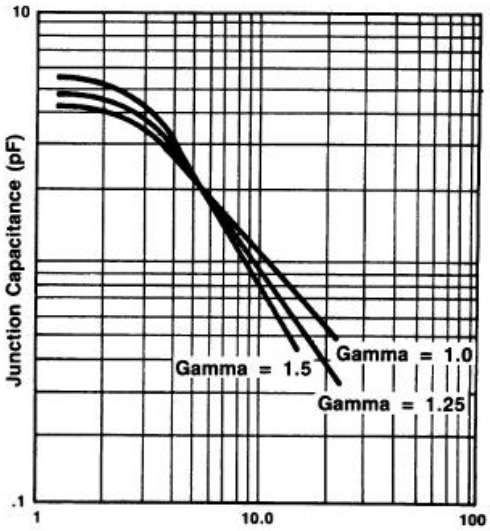
ODS-134 Die

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

| Parameter | Absolute Maximum |
|---|---|
| Reverse Voltage | Breakdown Voltage |
| Operating Temperature | -65°C to +175°C |
| Storage Temperature | 65°C to +200°C |

1. Operation of this device above any one of these parameters may cause permanent damage.The maximum storage and operating temperature of the plastic ODS-1088 case style is 125°C.

TYPICAL JUNCTION CAPACITANCE vs TUNING VOLTAGE



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## GaAs Hyperabrupt Varactor Diode
## Gamma = 1.0, 1.25, & 1.50

Rev. V6

### Electrical Specifications @ $T_A$ = +25 °C

**MA46450 Series Gamma = 1.0 [4]**

***Gamma[4] = 0.9 - 1.1, VR = 2 - 20 Volts***
***Junction Capacitance Ratio (CJ2/CJ20) = 5.0 - 8.0***
***Breakdown Voltage @ $I_R$ = 10µA, $V_b$ = 22 V Min***
***Reverse Leakage Current @ $V_R$ =18V, $I_R$ = 100 nA Max***

| Part Number | Case Style[2] | Total Capacitance[2,3,4,5] +/-10% | Total Capacitance Ratio[7] | Q Minimum |
|---|---|---|---|---|
| | | Vr=4 V | Vr=2 V / Vr=20 V | Vr=4 V f=50 MHz |
| | | (pF) | - | - |
| MA46450 | 30 | 0.5 | 2.0-3.8 | 4000 |
| MA46451 | 30 | 0.7 | 2.9-4.4 | 4000 |
| MA46452 | 30 | 1.0 | 3.6-5.2 | 3000 |
| MA46457 | 30 | 2.2 | 4.1-6.1 | 3000 |
| MA46461 | 30 | 4.7 | 4.8-7.2 | 1500 |

### Electrical Specifications @ $T_A$ = +25°C

**MA46410 thru MA46425 Series Gamma = 1.5[4]**

***Gamma[4] = 1.4-1.6 VR = 2 - 12 Volts***
***Junction Capacitance Ratio (CJ2/CJ12) = 6.2-10.8***
***Breakdown Voltage @ $I_R$ = 10µA, $V_b$ = 18 V Min***
***Reverse Leakage Current @ $V_R$ =10V, $I_R$ = 100 nA Max***

| Part Number | Case Style[2] | Total Capacitance[3,7,8] | Total Capacitance Ratio[7] | Q Minimum |
|---|---|---|---|---|
| | | Vr=4 V | Vr=2 V / Vr=12 V | Vr=4 V f=50 MHz |
| | | (pF) | - | - |
| MA46410 | 30 | 0.45-0.60 | 2.7-4.3 | 3000 |
| MA46413 | 30 | 0.90-1.10 | 4.2-5.7 | 2500 |
| MA46416 | 30 | 1.62-1.98 | 5.2-4.9 | 2500 |
| MA46418 | 30 | 2.42-2.97 | 5.7-7.6 | 1800 |
| MA46420 | 30 | 3.33-4.22 | 6.0-8.1 | 1800 |
| MA46425 | 30 | 9.00-11.00 | 6.6-8.8 | 1200 |

### Electrical Specifications @ $T_A$ = +25 °C

**MA46470 thru MA46485 Series Gamma = 1.25 [4]**

***Gamma[4] = 1.13-1.38, VR = 2 - 20 Volts***
***Junction Capacitance Ratio (CJ2/CJ20) = 8.15-12.99***
***Breakdown Voltage @ $I_R$ = 10µA, $V_b$ = 22 V Min***
***Reverse Leakage Current @ $V_R$ =18V, $I_R$ = 100 nA Max***

| Part Number | Case Style[2] | Total Capacitance[2,3,4,5] +/-10% | Total Capacitance Ratio[7] | Q Minimum |
|---|---|---|---|---|
| | | Vr=4 V | Vr=2 V / Vr=20 V | Vr=4 V f=50 MHz |
| | | (pF) | - | - |
| MA46470 | 30 | 0.5 | 2.2/4.1 | 4000 |
| MA46471 | 30 | 0.7 | 3.6/5.6 | 4000 |
| MA46472 | 30 | 1.0 | 4.8/7.4 | 3000 |
| MA46473 | 30 | 1.2 | 4.8/7.4 | 3000 |
| MA46474 | 30 | 1.5 | 5.0/7.4 | 3000 |
| MA46475 | 30 | 1.8 | 6.6/8.7 | 3000 |
| MA46476 | 30 | 2.0 | 6.6/8.7 | 3000 |
| MA46477 | 30 | 2.2 | 6.6/8.7 | 3000 |
| MA46479 | 30 | 3.3 | 6.4/10.0 | 2000 |
| MA46480 | 30 | 3.7 | 6.8/11.0 | 2000 |
| MA46481 | 30 | 5.1 | 6.9/11.1 | 1500 |
| MA46483 | 30 | 6.8 | 7.2/11.5 | 1500 |
| MA46485 | 30 | 10.0 | 7.5/12.0 | 1500 |

1. All GaAs tuning varactors are available in chip form as well as the case styles shown on the following page. When ordering, specify the desired case by adding the case designation as a suffix to the type number.
2. Case parasitics (Cp and Ls) are given for most case styles along with case outlines in the appendix. The Cp values listed typically have tolerances of ±0.02 pF.
3. The nominal tolerance at -4 Volts is ± 10%. Closer tolerances are available upon request. By adding the suffix A to the part number, a tolerance of ± 5% at -4 Volts is guaranteed.
4. 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).
5. Capacitance is measured at 1 MHz.
6. Reverse voltage (VB) is measured at 10 microamps.
7. The total capacitance and capacitance ratios shown are for diodes housed in case style 30. Other case styles will result in different values.



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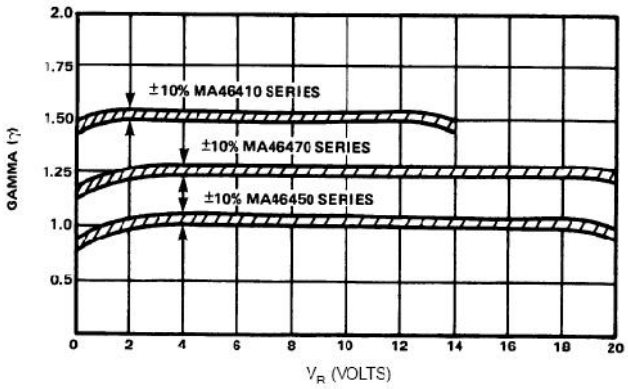
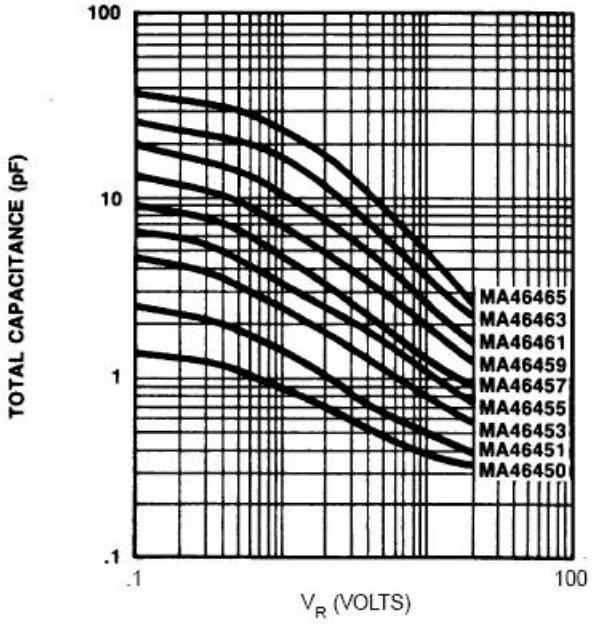
Rev. V6

### Typical Performance Curves

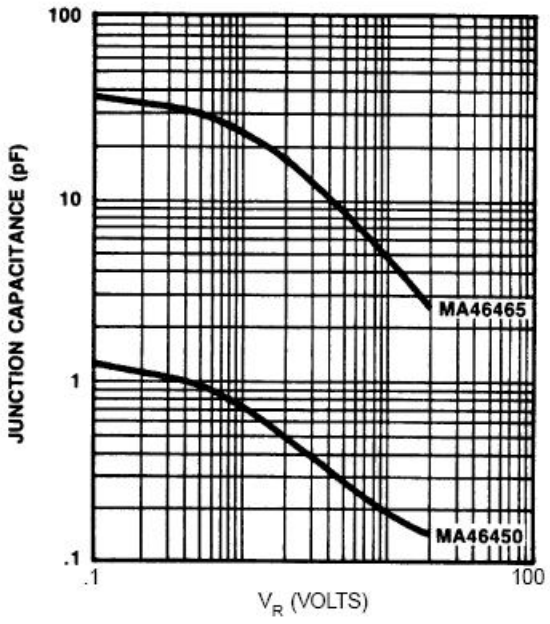
GAMMA vs VOLTAGE




TOTAL CAPACITANCE vs REVERSE BIAS VOLTAGE (γ = 1.0)
(PARTS IN CASE STYLE 30)




JUNCTION CAPACITANCE vs REVERSE BIAS VOLTAGE (γ = 1.0)
(CHIPS)







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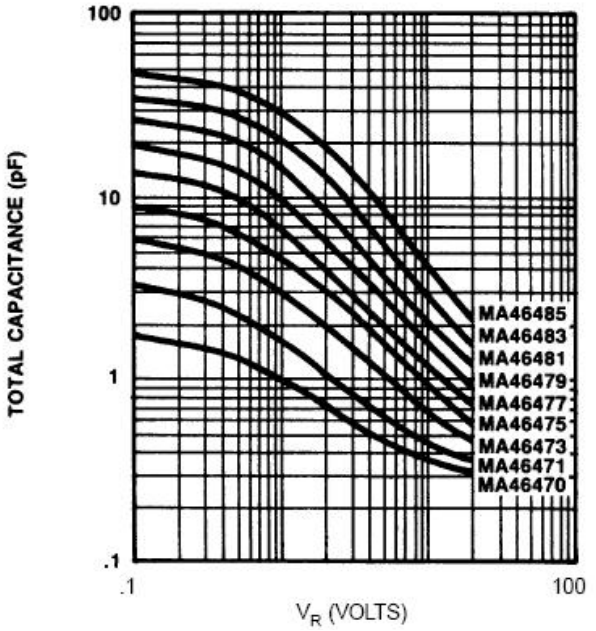
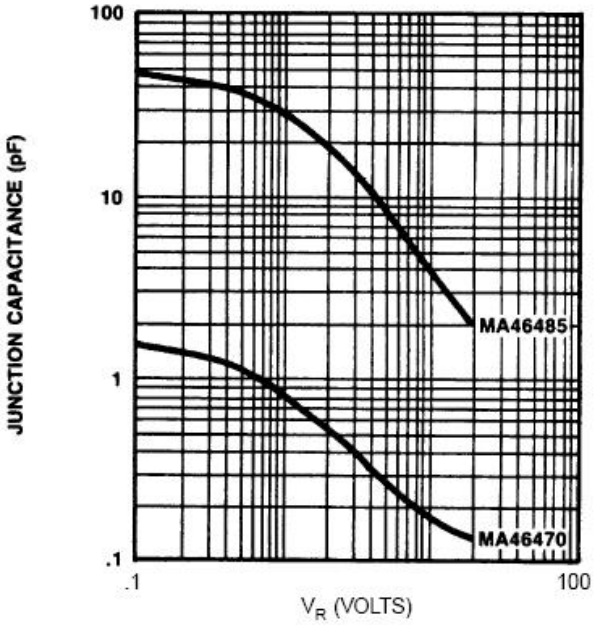
### Typical Performance Curves

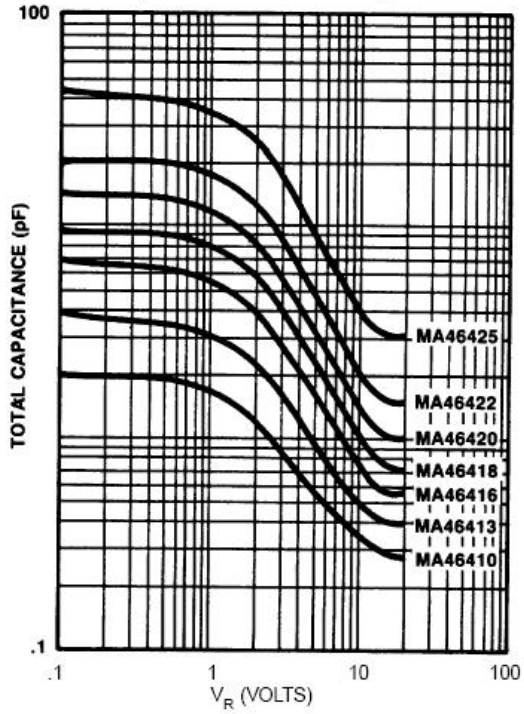
TOTAL CAPACITANCE vs REVERSE BIAS VOLTAGE ($\gamma$ = 1.25)
(PARTS IN CASE STYLE 30)



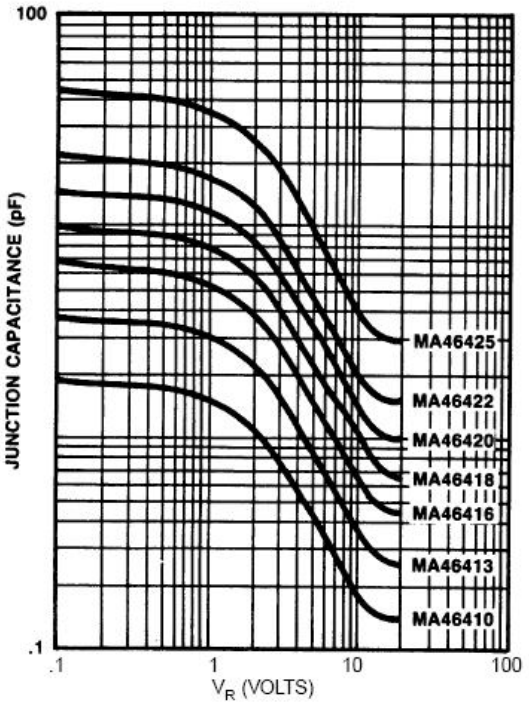

JUNCTION CAPACITANCE vs REVERSE BIAS VOLTAGE ($\gamma$ = 1.25)
(CHIPS)




TOTAL CAPACITANCE vs REVERSE BIAS VOLTAGE ($\gamma$ = 1.5)
(PARTS IN CASE STYLE 30)




JUNCTION CAPACITANCE vs REVERSE BIAS VOLTAGE ($\gamma$ = 1.5)
(CHIPS)







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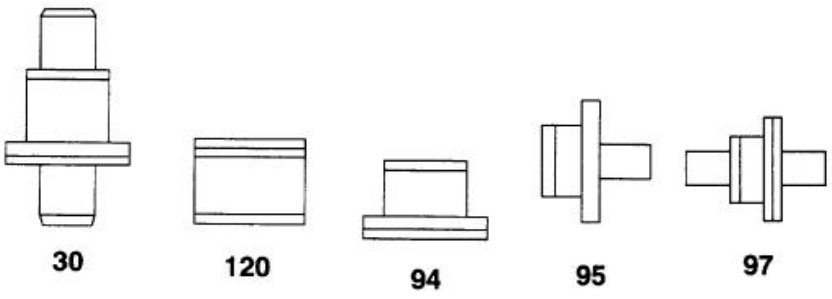
### Environmental Ratings PER MIL-STD-750

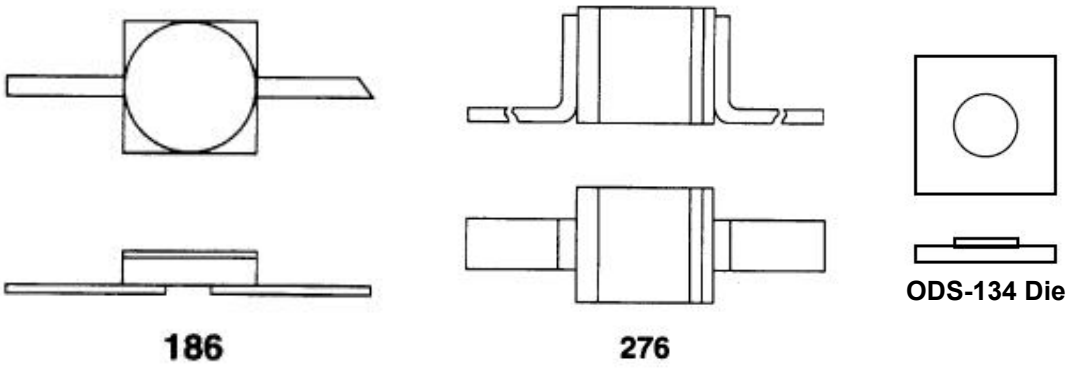
| | Method | Level |
|---|---|---|
| Storage Temperature | 1031 | See Max. Ratings |
| Temperature Cycle | 1051 | 10 cycles, -65°C to +175°C |
| Shock | 2016 | 500 g's |
| Vibration | 2056 | 15 g's |

### Case Styles (Dimensions are available upon request)

### Typical Coaxial Packages




### Typical Coplanar Packages



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