



## Surface Mount GaAs Varactors

# Surface Mount GaAs Tuning Varactors

## MA46504, MA46H070, MA46H200 and MA46H500 Series

### Features

- Low Cost
- Surface Mount Packages  
Leadless – Case 1056  
Leaded – Case 1088
- Very High Quality Factor
- Constant Gamma  
Abrupt Junction: 0.5  
Hyperabrupt Junction: 0.75, 1.25 and 1.5
- Capacitance Ratio to 10:1
- SPC Controlled Epitaxial Diodes for Excellent C-V Repeatability
- Case Style 1056 is Hermetic and may be Screened to JANTX levels
- Tape and Reel Packaging Available

### Description

M/A-COM offers four 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 **MA46H500 - MA46H506** family has hyperabrupt junctions with constant gamma of 1.5 from 2 to 12 volts and high quality factor.

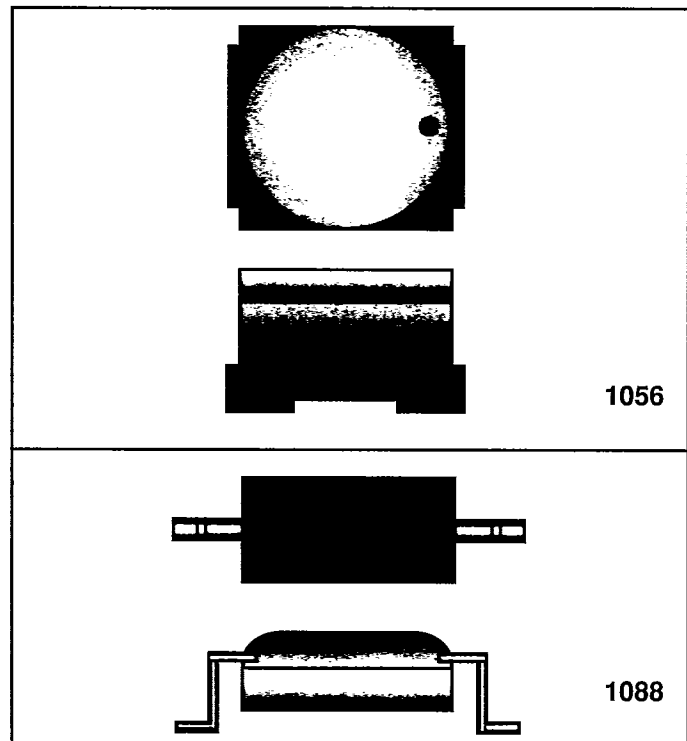
The **MA46H200 - MA46H206** family has hyperabrupt junctions with constant gamma of 1.25 from 2 to 20 volts and higher quality factor.

The **MA46H070 - MA46H076** family has hyperabrupt junctions with constant gamma of 0.75 from 0 to 20 volts and very high quality factor.

The **MA46504 - MA46510** family has abrupt junctions with constant gamma of 0.5 from 0 to 30 volts and the highest quality factor.

### Applications

The **MA46H500 - MA46H506 (gamma 1.5)** family of constant gamma hyperabrupt GaAs tuning varactors is designed for wide bandwidth



VCOs and voltage tuned filters where limited bias voltage is available. These varactors have greatest capacitance change versus voltage at the cost of slightly lower quality factor than the other families of GaAs varactors.

The **MA46H200 - MA46H206 (gamma 1.25)** family of constant gamma hyperabrupt GaAs tuning varactors 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. These varactors have large capacitance change versus voltage with excellent quality factor.

The **MA46H070 - MA46H076 (gamma 0.75)** family of constant gamma hyperabrupt GaAs tuning varactors has quality factor approaching that of abrupt junction varactors, but higher capacitance change versus tuning voltage. These diodes are very well suited for narrower bandwidth VCOs and VTFs where wide tuning range and very high quality factor are required.

The **MA46504 - MA46510 (gamma 0.5)** family of constant gamma abrupt GaAs tuning varactors has the highest quality factor. These diodes are very well suited for narrower bandwidth VCOs and VTFs where highest quality factor is of paramount concern.

Bulletin No. 4614

Surface Mount GaAs Tuning Varactors

**Absolute Maximum Ratings**

	Case 1056	Case 1088
Operating Temperature	-65°C to +125°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, derate linearly to 0 mW at maximum operating temperature	

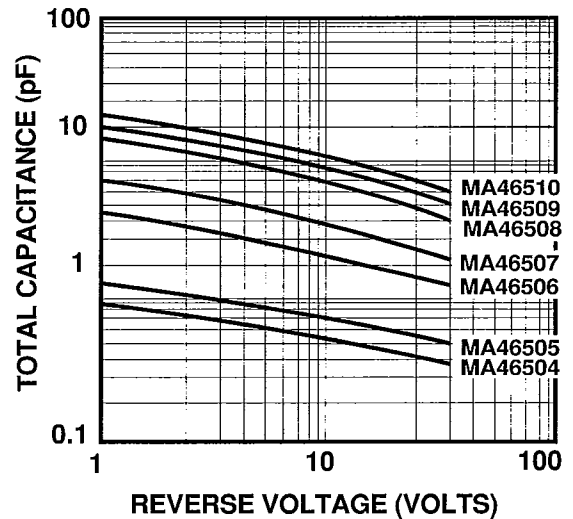
**Electrical Specifications @ 25°C**

**Gamma 0.5 Abrupt Tuning Varactors**  
 Breakdown Voltage @ 10 μA = 30 volts minimum  
 Reverse Current @ 24V = 100 nA maximum  
 Gamma = 0.48 - 0.50, V<sub>R</sub> = 0 to 30 volts

Model Number	Total Capacitance (pF)	Nominal Total Capacitance Ratio (C <sub>T0</sub> /C <sub>T30</sub> )	Minimum Q
	f=1 MHz V <sub>R</sub> =4 Volts	f=1 MHz V <sub>R</sub> =0/V <sub>R</sub> =30	f=50 MHz V <sub>R</sub> =4 Volts
MA46504	0.5 - 0.7	2.1	6000
MA46505	0.9 - 1.1	2.8	5700
MA46506	2.7 - 3.3	3.4	4500
MA46507	4.5 - 5.5	3.5	3500
MA46508	9.0 - 11.0	3.6	3300
MA46509	10.8 - 13.2	3.6	3100
MA46510	13.5 - 16.5	3.6	3000

**Capacitance vs. Reverse Voltage**

MA46504 - MA46510

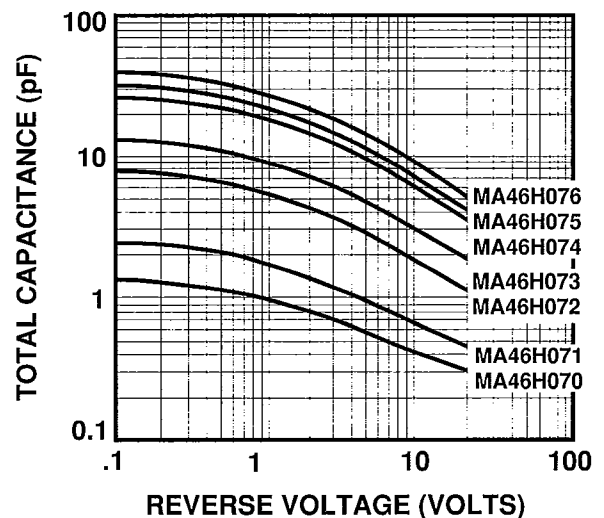


**Gamma 0.75 Hyperabrupt Tuning Varactors**

Breakdown Voltage @ 10 μA = 20 volts minimum  
 Reverse Current @ 16V = 100 nA maximum  
 Gamma = .68 - .83, V<sub>R</sub> = 0 to 20 volts

Model Number	Total Capacitance (pF)	Nominal Total Capacitance Ratio (C <sub>T0</sub> /C <sub>T20</sub> )	Minimum Q
	f=1 MHz V <sub>R</sub> =4 Volts	f=1 MHz V <sub>R</sub> =0/V <sub>R</sub> =20	f=50 MHz V <sub>R</sub> =4 Volts
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
MA46H074	9.0 - 11.0	7.5	2200
MA46H075	10.8 - 13.2	7.5	2200
MA46H076	13.5 - 16.5	7.5	2200

MA46H070 - MA46H076



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Gamma 1.25 Hyperabrupt Tuning Varactors

Breakdown Voltage @ 10  $\mu$ A = 22 volts minimum

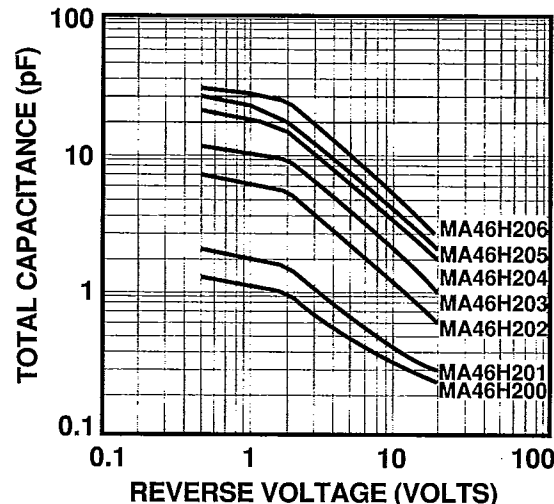
Reverse Current @ 16V = 100 nA maximum

Gamma = 1.13 - 1.38,  $V_R$  = 2 to 20 volts

Capacitance vs. Reverse Voltage

MA46H200 - MA46H206

Model Number	Total Capacitance (pF)	Nominal Total Capacitance Ratio ( $C_{T2}/C_{T20}$ )	Minimum Q
	f=1 MHz $V_R=4$ Volts	f=1 MHz $V_R=2/V_R=20$	
MA46H200	0.5 - 0.7	3.0	3000
MA46H201	0.9 - 1.1	4.1	3000
MA46H202	2.7 - 3.3	5.6	2000
MA46H203	4.5 - 5.5	10.0	1500
MA46H204	9.0 - 11.0	10.0	1500
MA46H205	10.8 - 13.2	10.0	1500
MA46H206	13.5 - 16.5	10.0	1500



Gamma 1.5 Hyperabrupt Tuning Varactors

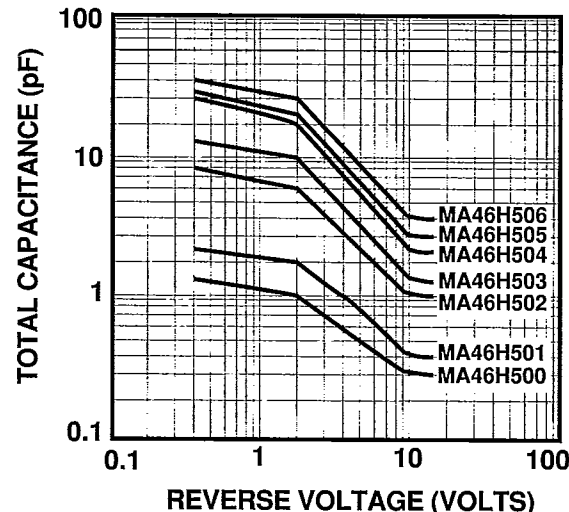
Breakdown Voltage @ 10  $\mu$ A = 18 volts minimum

Reverse Current @ 14V = 100 nA maximum

Gamma = 1.4 - 1.6,  $V_R$  = 2 to 12 volts

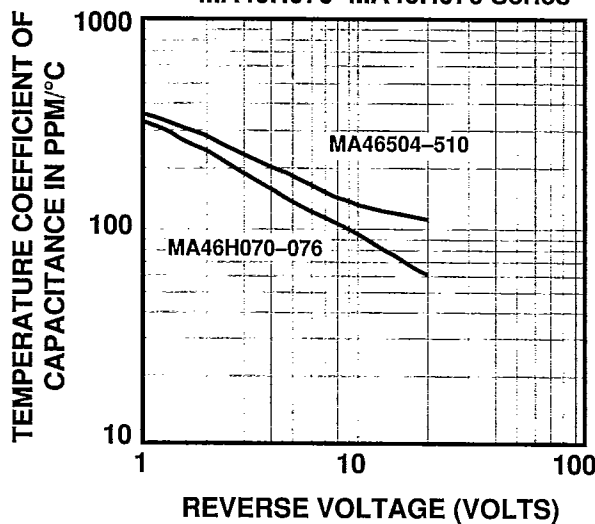
MA46H500 - MA46H506

Model Number	Total Capacitance (pF)	Nominal Total Capacitance Ratio ( $C_{T2}/C_{T12}$ )	Minimum Q
	f=1 MHz $V_R=4$ Volts	f=1 MHz $V_R=2/V_R=12$	
MA46H500	0.5 - 0.7	2.8	2500
MA46H501	0.9 - 1.1	3.9	2500
MA46H502	2.7 - 3.3	5.0	1800
MA46H503	4.5 - 5.5	8.1	1200
MA46H504	9.0 - 11.0	8.1	1200
MA46H505	10.8 - 13.2	8.1	1200
MA46H506	13.5 - 16.5	8.1	1200

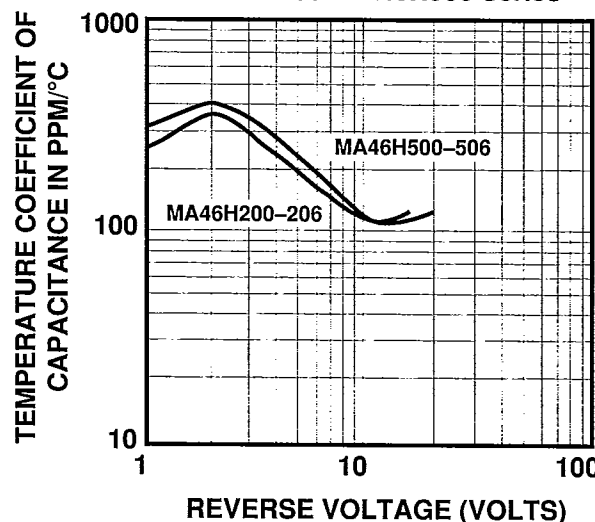


Temperature Coefficient of Capacitance vs. Reverse Voltage

MA46504-MA46510 Series  
MA46H070-MA46H076 Series



MA46H200-MA46H206 Series  
MA46H500-MA46H506 Series



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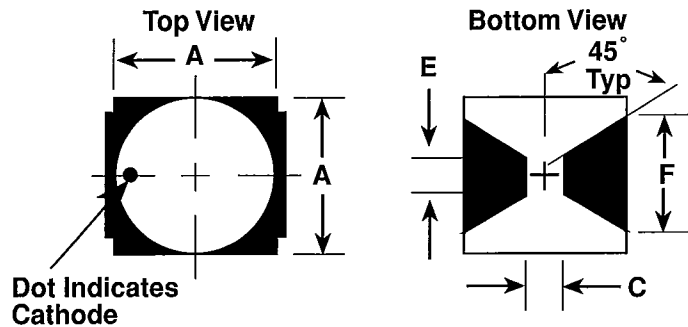
Ordering Information

All GaAs tuning varactors in this bulletin are available in both case styles 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 with a total capacitance value at  $V_R = 4V$  of 0.5 - 0.7 pF and Q at -4 volts and 50 MHz of 3000 minimum.

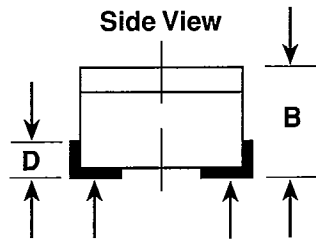
Case Styles

1056



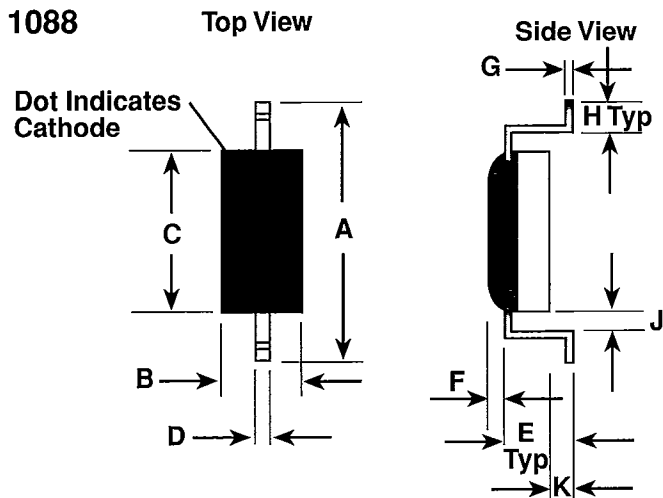
DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.065	0.075	1.72	1.90
B	0.034	0.041	0.86	1.04
C	0.030	0.036	0.76	0.91
D	0.013	0.017	0.33	0.44
E	0.010	0.014	0.25	0.36
F	0.043	0.053	1.09	1.35

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



Not to Scale

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

Package Capacitance: 0.13 pF Typical  
 Package Inductance: 0.50 nH Typical