

# High Power PIN Diodes

## MA4P HIPAX™ Series

V3.00

### Features

- High Power Handling
- Low Loss, Low Distortion
- Voltage Ratings to 1000 Volts
- Passivated PIN Chip – Full Face Bonded
- Hermetically Sealed
- Low Inductance Axial Lead, and SMQ Surface Mount Package Options
- Available as Chips

### Description

M/A-COM's HIPAX PIN diodes are designed for service in switch and attenuator applications requiring high power handling and low distortion. HIPAX PIN diodes incorporate a fully passivated PIN diode chip resulting in extremely low reverse leakage current. All high voltage HIPAX PIN diodes are specified at 1  $\mu$ A reverse current at the voltage rating. The chip is full face bonded to refractory metal pins on both anode and cathode. The result is a low loss PIN diode with low thermal resistance due to symmetrical thermal paths.

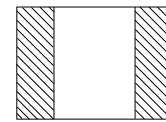
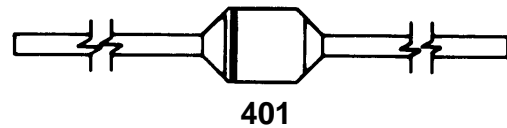
HIPAX PIN diodes are packaged in hermetically sealed ceramic enclosures at temperatures exceeding 300°C. Package options include: axial leaded and surface mount packages that have a square, nonrollable outline.

The semiconductor technology utilized in the HIPAX family draws on M/A-COM's substantial experience in PIN diode design. This results in thick intrinsic region PIN diodes specified with low resistance, low capacitance and long carrier lifetime parameters.

### SMQ Square Outline Surface Mount

The surface mount HIPAX PIN diode is available in M/A-COM's unique, square outline, non-rollable SMQ package design. The SMQ package eases automatic pick and place indexing and assembly.

### Case Styles



### Applications

HIPAX PIN diodes are designed for use in a wide variety of switch and attenuator applications from HF through UHF at power levels beyond 1 kW CW. These diodes have been comprehensively characterized to ensure predictable performance.

### Design Recommendations

1. Low Distortion Attenuators: MA4P4301B
2. Surface Mount Switches: MA4P7101F
3. Cellular Radio Antenna Switches:  
MA4P1200, MA4P1250

### Environmental Capability

HIPAX PIN diodes are appropriate for use in military, industrial and commercial applications. They are capable of meeting the environmental requirements of MIL-STD-750 and MIL-STD-202. HIPAX PIN diodes are capable of HTRB screening at 80% of voltage rating at 150°C.

Specifications Subject to Change Without Notice.

### M/A-COM, Inc.

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**Voltage Ratings and Model Numbers**

Voltage Rating	MA4P4000 Series	MA4P4300 Series	MA4P7000 Series	MA4P7100 Series
100 Volts	MA4P4001	MA4P4301	MA4P7001	MA4P7101
200 Volts	MA4P4002	MA4P4302	MA4P7002	MA4P7102
400 Volts	—	—	—	MA4P7104
600 Volts	MA4P4006	—	MA4P7006	—

**Absolute Maximum Ratings @ 25°C**

Parameter	Absolute Maximum
DC Reverse Voltage	Voltage Rating
Operating and Storage Temperature	-65°C to +175°C
Installation Temperature	+250°C, 30 Seconds

**Electrical Specifications @ 25°C**

Parameter	Symbol	Condition	MA4P4000 Series	MA4P4300 Series	MA4P7000 Series	MA4P7100 Series
Series Resistance (Max)	R <sub>S</sub>	100 mA, 100 MHz	0.5 Ω	1.0 Ω	0.8 Ω	0.5 Ω
Total Capacitance (Max)	C <sub>T</sub>	100 V, 1 MHz	2.2 pF	2.0 pF	0.7 pF	1.0 pF
Parallel Resistance (Min)	R <sub>p</sub>	100 V, 100 MHz	20 kΩ	50 kΩ	200 kΩ	100 kΩ
Carrier Lifetime (Min)	T <sub>L</sub>	10 mA	6 μs	8 μs	3 μs	2.5 μs
Forward Voltage (Max)	V <sub>F</sub>	100 mA	1.0 V	1.2 V	1.0 V	1.0 V
Reverse Current (Max)	I <sub>R</sub>	Voltage Rating	1 μA	1 μA	1 μA	1 μA
I-Region Width (Nominal)	W	—	175 μm	300 μm	175 μm	100 μm

**Power Dissipation and Thermal Resistance Ratings**

Package Style	Condition	MA4P4000		MA4P4300		MA4P7000		MA4P7100	
		P <sub>D</sub>	∅JC	P <sub>D</sub>	∅JC	P <sub>D</sub>	∅JC	P <sub>D</sub>	∅JC
B (Axial Leaded)	1/4 Inch Total Length to 25°C Free Air Rating	12 W	12.5°C/W	10 W	15°C/W	5 W	30°C/W	6 W	25°C/W
		2.5 W	—	2.5 W	—	1.5 W	—	1.5 W	—
F (SMQ Surface Mount)	25°C Contacts	7.5 W	20°C/W	5 W	30°C/W	3 W	50°C/W	3 W	50°C/W
Both B and F	Single 1 μs pulse	100 kW	—	100 kW	—	15 kW	—	15 kW	—
Both B and F	Single 100 μs pulse	5 kW	.03°C/W	5 kW	03°C/W	300 W	0.5°C/W	300 W	0.5°C/W

**Environmental Ratings**

HIPAX PIN diodes may be supplied with JAN TX level screening. The table lists some of the MIL-STD-750 environmental tests HIPAX PIN diodes are designed to meet.

Test	MIL-STD-750 Method	Description
High Temperature Storage	1031	+175°C, 250 Hours
Temperature Shock	1051	-65°C to +175°C, 20 Cycles
HTRB	1038	809b VR, +150°C, 96 Hours
Moisture Resistance	1021	
Fine Leak	1071 Cond. H	1 x 10 <sup>-7</sup> CC/Sec
Constant Acceleration	2006	20,000 G's
Vibration Fatigue	2046	20,000 G's
Solderability	2026	
Lead Fatigue	2036.3 Cond. E	3 cycles, 8 oz., 90°, Bent at Body
Tension	2036.3 Cond. A	2 lbs., 30 seconds

**Ordering Information**

HIPAX PIN diodes are designated by MA4P followed by four digits which indicate the voltage rating and series. A package style letter suffix follows:

To purchase:  
MA4P4000 Series, 600V, SMQ package (F)

Order Model No.: MA4P4006F  
The same unit in an axial lead package (B) is: MA4P4006B.

Specifications Subject to Change Without Notice.

Electrical Specifications @ 25°C (MA4P1200)

Parameter	Minimum	Typical	Maximum	Unit	Condition
Voltage Rating	50	—	—	V	I = 10 μA
Series Resistance	—	0.5	075	Ω	F = 100 MHz I = 50 mA
Capacitance: MA4P1200	—	1.2	1.5	pF	F = 1 MHz V = 50 V
Parallel Resistance	5 K	10 K	—	Ω	F = 100 MHz V = 0 V
Carrier Lifetime	2.0	4.0	—	μs	I = 10 mA
Forward Bias Harmonic Distortion ( $R_a^{2a} - R_a^{3a}$ )	80	90	—	dBc	F = 100 MHz P = 30 WA I = 50 mA
Reverse Bias Harmonic Distortion ( $R_a^{2a} - R_a^{3a}$ )	60	70	—	dBc	F = 100 MHz P = 0 dBm V = 0 V
Forward Voltage	—	—	1.0	V	I = 50 mA

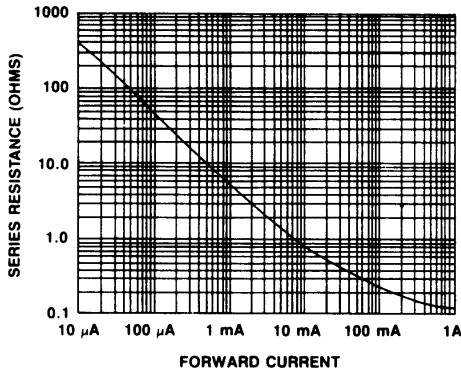
Note: MA4P1200 available in axial leaded case style.

Absolute Maximum Ratings @ 25°C

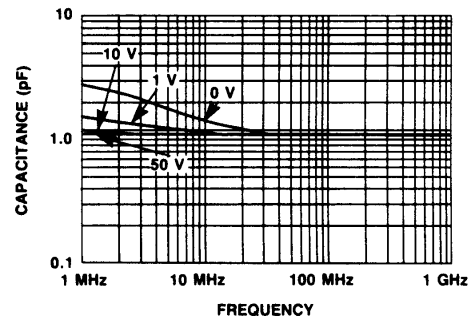
Parameter	Absolute Maximum
Operating and Storage Temp.	-65°C to +175°C
DC Reverse Voltage	50 Volts
Power Dissipation:	
Free Air	1.5 Watts
1/4 inch spaced to +25°C Contacts	5.5 Watts

Typical Performance Curves

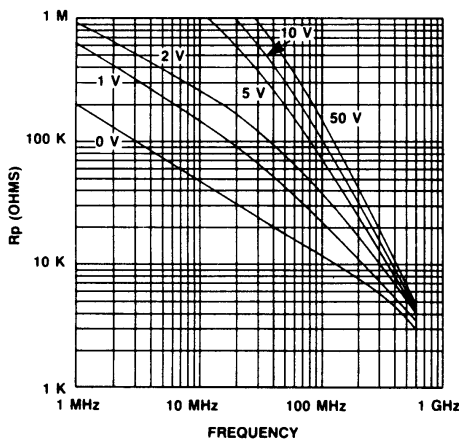
SERIES RESISTANCE AT 100 MHz vs FORWARD CURRENT (MA4P1200)



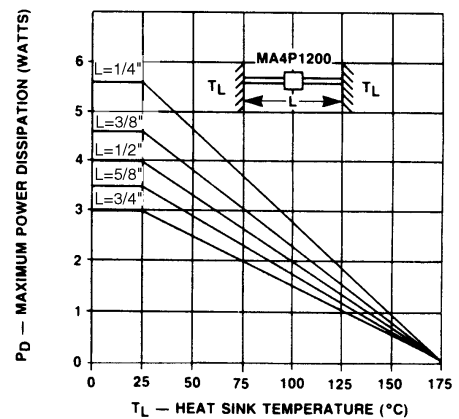
CAPACITANCE vs FREQUENCY (MA4P1200)



PARALLEL RESISTANCE vs FREQUENCY AND REVERSE BIAS (MA4P1200)



HEAT SINK TEMPERATURE vs MAXIMUM POWER DISSIPATION (MA4P1200)



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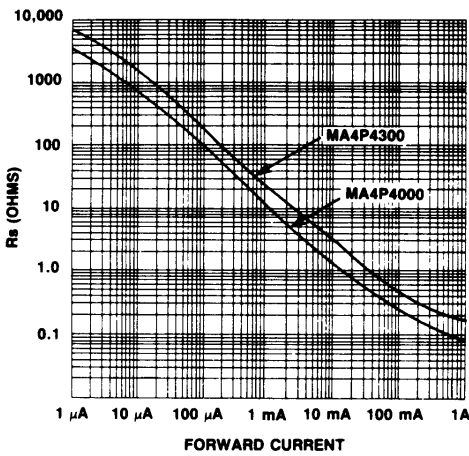
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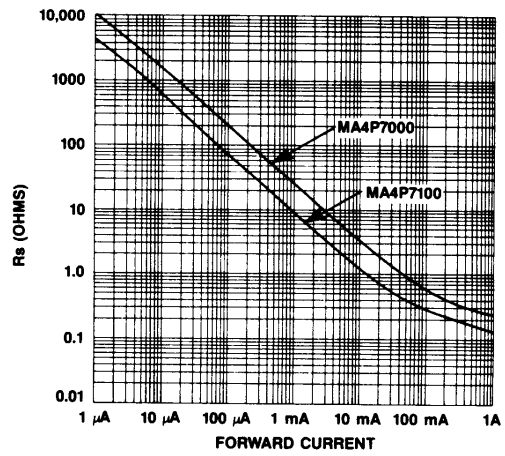
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Typical Performance Curves

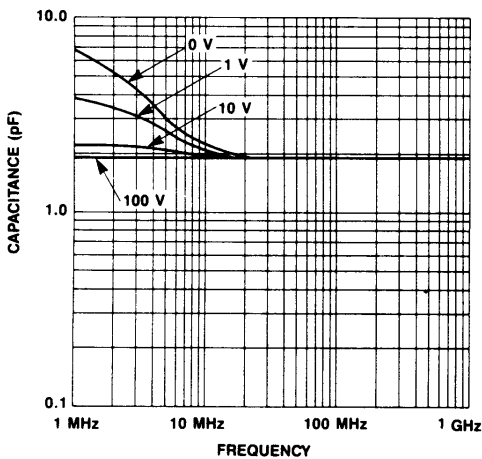
SERIES RESISTANCE AT 100 MHz vs FORWARD CURRENT (MA4P4000, MA4P4300 SERIES)



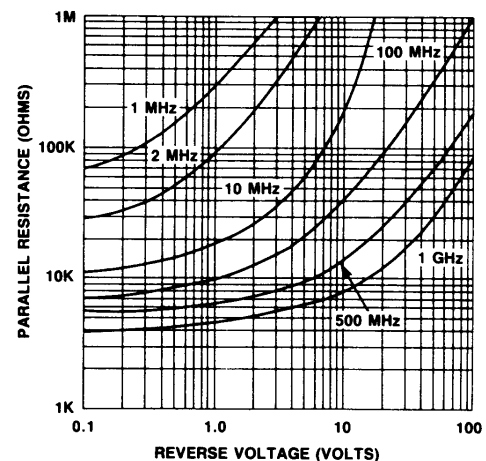
SERIES RESISTANCE AT 100 MHz vs FORWARD CURRENT (MA4P7000, MA4P7100 SERIES)



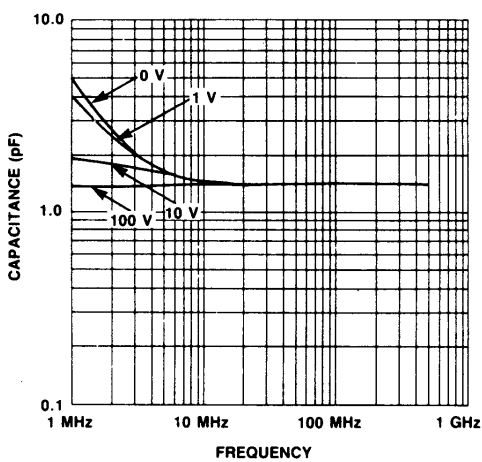
CAPACITANCE vs FREQUENCY AND REVERSE BIAS (MA4P4000 SERIES)



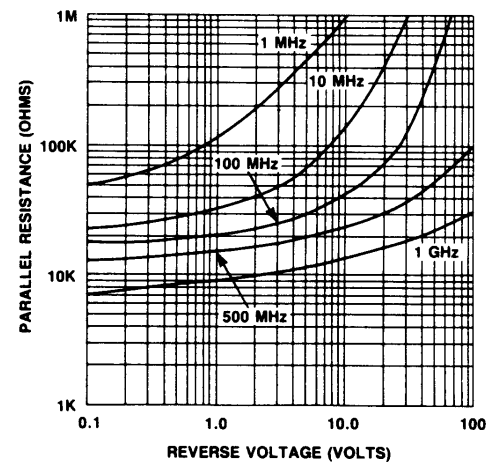
PARALLEL RESISTANCE vs FREQUENCY AND REVERSE VOLTAGE (MA4P4000 SERIES)



CAPACITANCE vs FREQUENCY AND REVERSE BIAS (MA4P4300 SERIES)



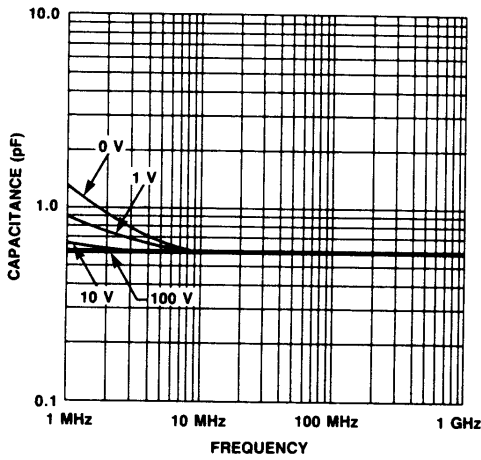
PARALLEL RESISTANCE vs FREQUENCY AND REVERSE VOLTAGE (MA4P4300 SERIES)



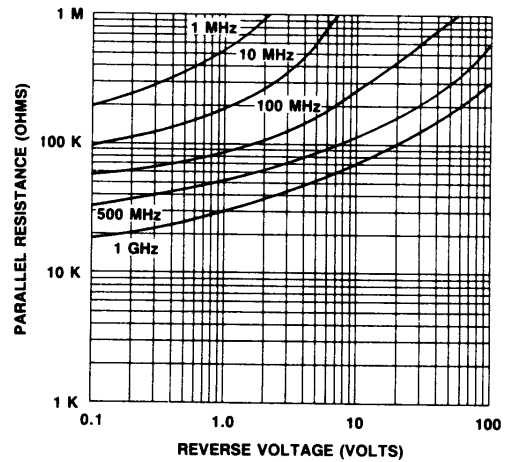
Specifications Subject to Change Without Notice.

Typical Performance Curves (Cont'd)

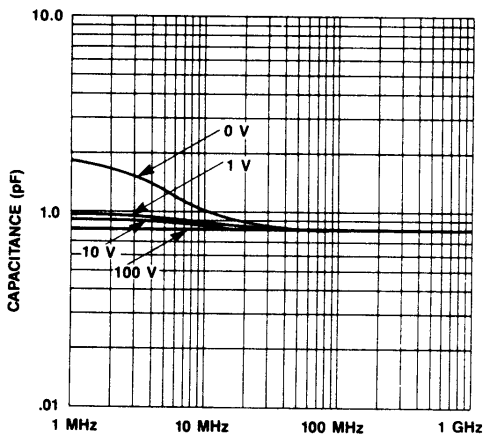
CAPACITANCE vs FREQUENCY AND REVERSE BIAS (MA4P7000 SERIES)



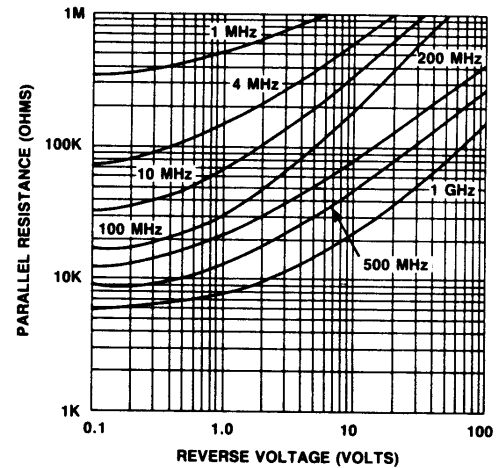
PARALLEL RESISTANCE vs REVERSE VOLTAGE (MA4P7000 SERIES)



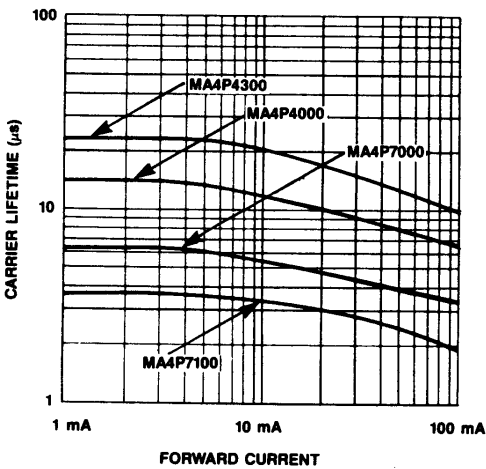
CAPACITANCE vs FREQUENCY AND REVERSE BIAS (MA4P7100 SERIES)



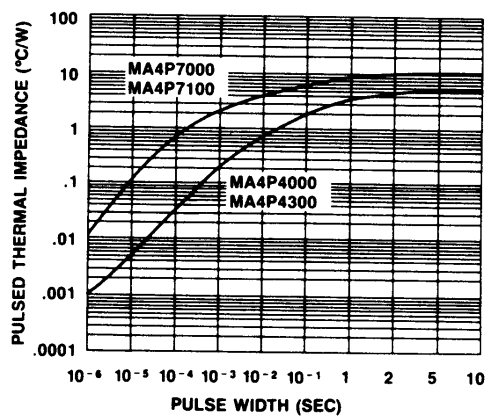
PARALLEL RESISTANCE vs FREQUENCY AND REVERSE VOLTAGE (MA4P7100 SERIES)



CARRIER LIFETIME vs FORWARD CURRENT



PULSED THERMAL IMPEDANCE vs PULSE WIDTH

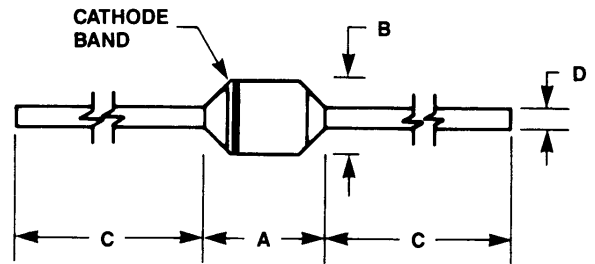


Case Styles

Style B - Axial Leaded

Case Style 401 — MA4P7000B, MA4P7100B, MA4P1200

DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	—	0.190	—	4,83
B	—	0.090	—	2,29
C	0.975	—	24,8	—
D	0.027	0.029	0,69	0,74



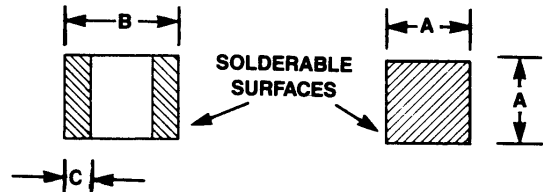
Case Style 402 — MA4P4000B, MA4P4300B

DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	—	0.230	—	5,842
B	—	0.140	—	3,556
C	0.975	—	24,765	—
D	0.039	0.041	0,991	1,041

Style F- SMQ Surface Mount

Case Style 1072 — MA4P7000F, MA4P7100F

DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.080	0.095	2,032	2,413
B	0.115	0.135	2,921	3,429
C	0.008	0.030	0,203	0,762

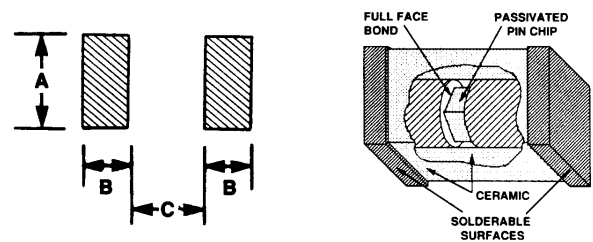


Case Style 1091 — MA4P4000F, MA4P4300F

DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.138	0.155	3,51	3,94
B	0.180	0.200	4,57	5,08
C	0.008	0.030	0,203	0,762

Bonding Pad for SMQ Diodes

DIM.	Case Styles 1072		Case Styles 1091	
	IN.	MM	IN.	MM
A	0.093	2,36	0.150	3,81
B	0.050	1,27	0.050	1,27
C	0.060	1,52	0.100	2,54



Specifications Subject to Change Without Notice.