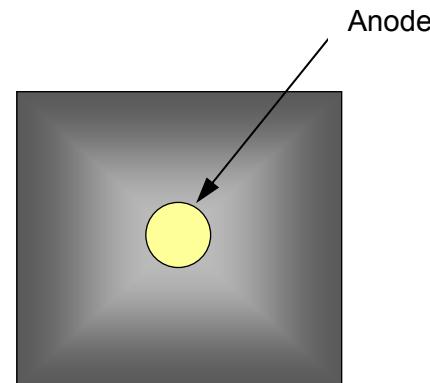


Features

- ◆ Switch & Attenuator Die
- ◆ Extensive Selection of I-Region Lengths
- ◆ Hermetic
- ◆ Glass Passivated CERMACHIP®
- ◆ Oxide Passivated Planar Chips
- ◆ Voltage Ratings to 3000V
- ◆ Fast Switching Speed
- ◆ Low Loss
- ◆ High Isolation
- ◆ RoHS Compliant



Description

M/A-COM Technology Solutions offers a comprehensive line of low capacitance, planar and mesa, silicon PIN diode chips which use ceramic glass and silicon nitride passivation technology. The Silicon PIN Chip series of devices cover a broad spectrum of performance requirements for control circuit applications. They are available in several choices of I-region lengths and have been optimally designed to minimize parametric trade offs when considering low capacitance, low series resistance, and high breakdown voltages. Their small size and low parasitics, make them an ideal choice for broadband, high frequency, micro-strip hybrid assemblies.

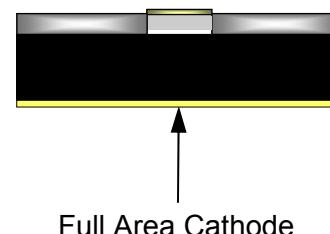
The attenuator line of PIN diode chips are a planar or mesa construction and because of their thicker I-regions and predictable R_s vs. I characteristics, they are well suited for low distortion attenuator and switch circuits. Incorporated in the chip's construction is M/A-COM Tech's, time proven, hard glass, CERMACHIP®. The hard glass passivation completely encapsulates the entire PIN junction area resulting in a hermetically sealed chip which has been qualified in many military applications. These CERMACHIP® diodes are available in a wide range of voltages, up to 3,000 volts, which are capable of controlling kilowatts of RF power.

Many of M/A-COM Tech's silicon PIN diode chips are also available in several different package styles. Please refer to the "Packaged PIN Diode Datasheet" for case style availability and electrical specifications located on the M/A-COM Tech website at :

macomtech.com/datasheets/packagedpindiodes

and for high voltage, high power devices at :

macomtech.com/datasheets/MA4PK2000_3000_Series



Absolute Maximum Ratings¹

$T_{AMB} = +25^{\circ}\text{C}$ (Unless otherwise specified)

| Parameter | Absolute Maximum |
|-----------------------------------|--|
| Forward Current (I _F) | Per P/N R_s vs. I Graph |
| Reverse Voltage (V _R) | Per Specification Table |
| Power Dissipation (W) | $\frac{175^{\circ}\text{C} - T_{ambient}^{\circ}\text{C}}{\Theta}$ |
| Operating Temperature | -55°C to +175°C |
| Storage Temperature | -55°C to +200°C |
| Junction Temperature | +175°C |
| Mounting Temperature | +320°C for 10 seconds |

1. Exceeding these limits may cause permanent damage to the chip

1

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Low Capacitance PIN Specification @ $T_{AMB} = +25^{\circ}C$

| Part Number | Max. Rev. Voltage ³ $V_R < 10 \mu A$ V_{DC} | Max. Cap. 1 MHz $C_j @ -10 V$ pF | Max. Series Res. 500 MHz $R_S @ 10 mA$ Ω | Nominal Characteristics | | | | | | |
|--------------------|--|--|---|--|--|----------------------------|---------------|------------------------------|-------------------------|-------------------------|
| | | | | Carrier Lifetime ¹ T_L ηS | Reverse Recovery Time ² T_{RR} ηS | I Region Length μm | Theta °C/W | Anode Diameter ± 0.5 mils | Chip Size ± 0.5 mils | Chip Thk. ± 0.5 mils |
| MA4P161-134 | 100 | 0.10 | 1.50 | 150 | 15 | 13 | 65 | 3.5 | 13X13 | 6 |
| MA4P203-134 | 100 | 0.15 | 1.50 | 150 | 25 | 13 | 75 | 3.1 | 13X13 | 6 |
| MA4P7493-134 | 150 | 0.05 | 1.80 | 80 | 8 | 19 | 60 | 3.8 | 13X13 | 6.5 |
| MADP-000165-01340W | 200 | 0.06 | 2.50 | 200 | 20 | 19 | 30 | 1.8 | 13X13 | 7 |
| MADP-000135-01340W | 200 | 0.15 | 1.20 | 440 | 44 | 19 | 30 | 3.1 | 13x13 | 10 |

Notes:

1. Nominal carrier life time (T_L) specified at $I_F = + 10mA$, $I_{REV} = - 6mA$.
2. Nominal reverse recovery time specified at $I_F = + 20mA$, $I_{REV} = - 200mA$.
3. Reverse Voltage (V_R) is sourced and the resultant reverse leakage current (I_R) is measured to be $<10\mu A$.

Attenuator PIN Specification @ $T_{AMB} = +25^{\circ}C$

| Part Number | Max. Rev. Voltage ² $V_R < 10 \mu A$ V_{DC} | Max. Cap. 1MHz $C_j @ -100 V$ pF | Max. Series Res. 100MHz $R_S @ 10 mA$ Ω | Nominal Characteristics | | | | | | | |
|-------------|--|--|--|---|--|--|-------------------------|---------------|------------------------------|-----------------------|-----------------------|
| | | | | Carrier Lifetime ¹ T_L μS | Series Res. 100MHz $R_S @ 10 \mu A$ Ω | Series Res. 100MHz $R_S @ 1 mA$ Ω | I Region Length mils | Theta °C/W | Anode Diameter ± 0.5 mils | Chip Size ± 2 mils | Chip Thk. ± 1 mils |
| MA47416-132 | 200 | 0.15 | 6 | 2 | 2000 | 30 | 4 | 30 | 7.5 X7.5 ³ | 19X19 | 7 |
| MA47418-134 | 200 | 0.15 | 3 | 1 | 500 | 15 | 2 | 25 | 7.5 | 13X13 | 7 |

Notes:

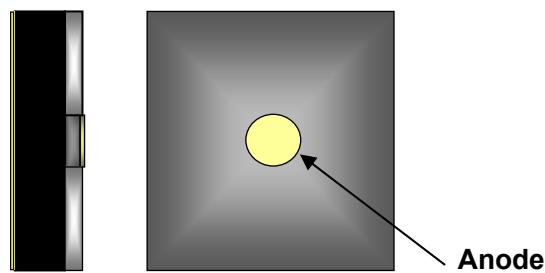
1. Nominal carrier life time (T_L) specified at $I_F = + 10mA$, $I_{REV} = - 6mA$.
2. Reverse Voltage (V_R) is sourced and the resultant reverse leakage current (I_R) is measured to be $<10\mu A$.
3. Anode top contact is square.

CERMACHIP® PIN Chips Specification @ $T_{AMB} = +25^{\circ}\text{C}$

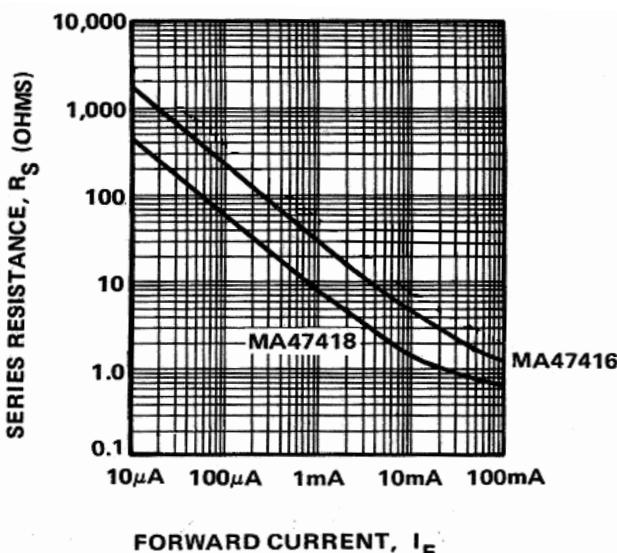
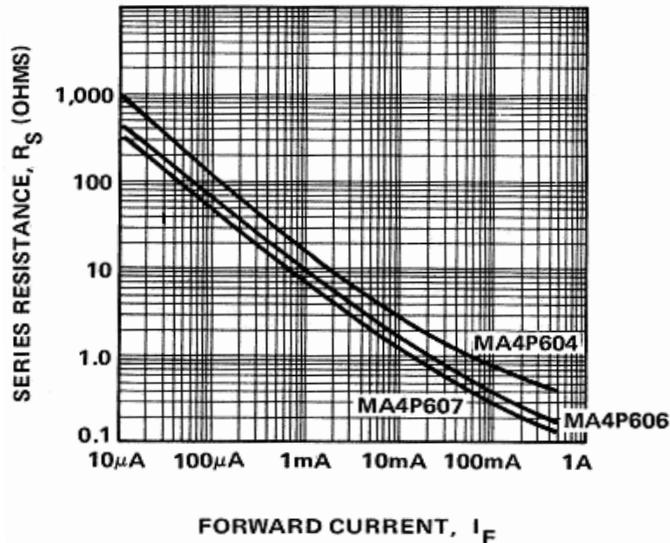
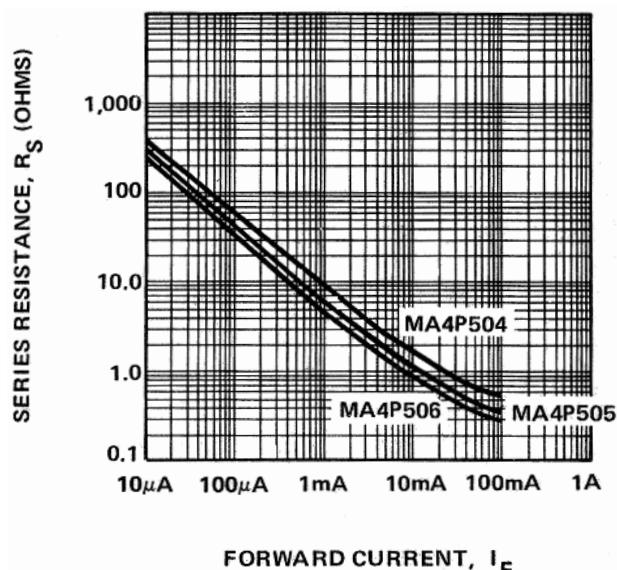
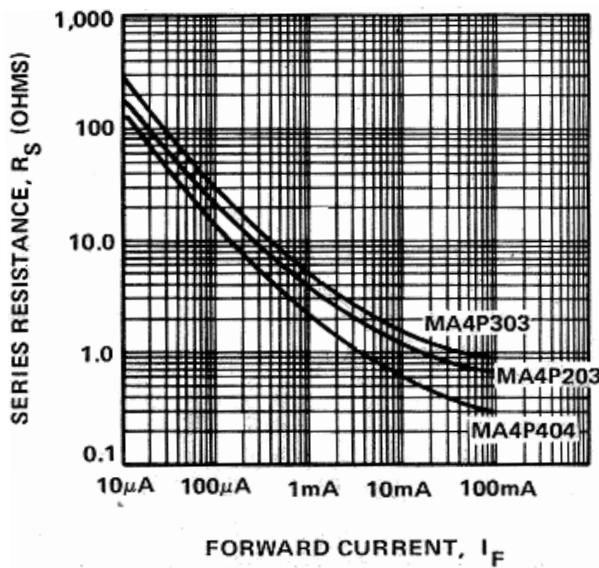
| Part Number | Max. Rev. Volt. ⁵ $V_R < 10 \mu\text{A}$ V_{DC} | Max. Cap. 1 MHz $C_J @ -100 \text{ V}$ pF | Max. Series Res. 100 MHz $R_S @ 100 \text{ mA}$ Ω | Nominal Characteristics | | | | | |
|-----------------------------|--|---|---|--|----------------------------------|-------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| | | | | Carrier Lifetime ⁴ μs | I Region Length μm | Theta $^{\circ}\text{C/W}$ | Anode Dia. $\pm 0.5 \text{ mils}$ | Chip size $\pm 2.0 \text{ mils}$ | Chip Thk. $\pm 1.0 \text{ mils}$ |
| MA4P303-134 | 200 | 0.15 @ 10 V | 1.5 @ 10 mA ² | 0.3 | 20 | 30 | 3.0 | 13X13 | 10.0 |
| MA4P404-132 | 250 | 0.20 @ 50 V | 0.70 @ 50 mA ² | 0.6 | 30 | 20 | 6.8 | 20X20 | 10.0 |
| MA4P504-132 | 500 | 0.20 | 0.60 | 1 | 50 | 20 | 6.8 | 20X20 | 10.0 |
| MA4P505-131 | 500 | 0.35 | 0.45 | 2 | 50 | 14 | 13.0 | 27X27 | 11.0 |
| MA4P506-131 | 500 | 0.70 | 0.30 | 3 | 50 | 11 | 15.8 | 27X27 | 12.0 |
| MADP-000488-13740W | 900 | 0.16 @ 50V | 1.6 @ 50 mA | 4 | 140 | 45 | 12.2 | 23X23 | 13.5 |
| MA4P604-131 | 1000 | 0.30 | 1.00 | 3 | 90 | 10 | 17.0 | 27X27 | 13.5 |
| MA4P606-131 | 1000 | 0.60 | 0.70 | 4 | 90 | 8 | 21.0 | 32X32 | 14.0 |
| MA4P607-212 | 1000 | 1.30 | 0.40 | 12 | 127 | 4 | 37.0 | 62X62 | 18.5 |
| MA4PK2000-223 ¹ | 2000 | 2.40 | 0.20 @ 500 mA ³ | 30 | 230 | 2 | 72.0 | 111X111 | 21.0 |
| MA4PK3000-1252 ¹ | 3000 | 2.90 | 0.25 @ 500 mA ³ | 60 | 350 | 1.5 | 85.0 | 172X172 | 28.0 |

Notes:

- Upon completion of circuit installation, the chip must be covered with a dielectric conformal coating such as SYLGARD 539® to prevent voltage arcing.
- Test Frequency = 500 MHz
- Test Frequency = 4 MHz
- Nominal carrier lifetime (T_L) specified at $I_F = +10 \text{ mA}$, $I_{REV} = -6 \text{ mA}$.
- Minimum specified V_R (Reverse Voltage) is sourced and the resultant reverse leakage current (I_{REV}) is measured to be $<10 \mu\text{A}$.

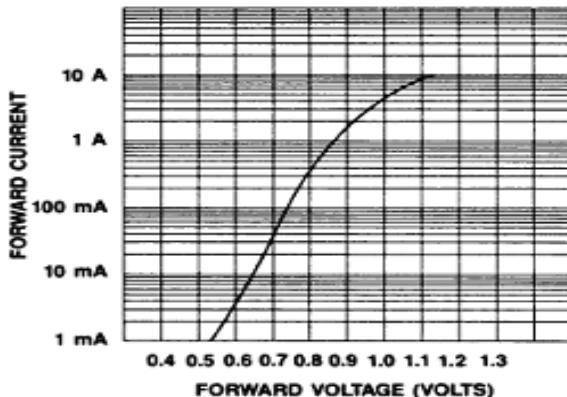


Typical Series Resistance vs. Forward Current Performance

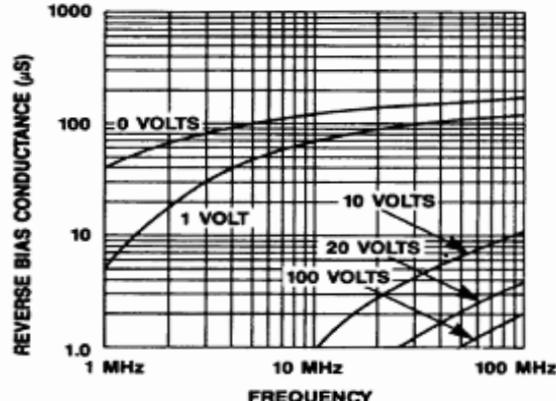


MA4PK2000 & MA4PK3000 (2kV & 3kV) Chips

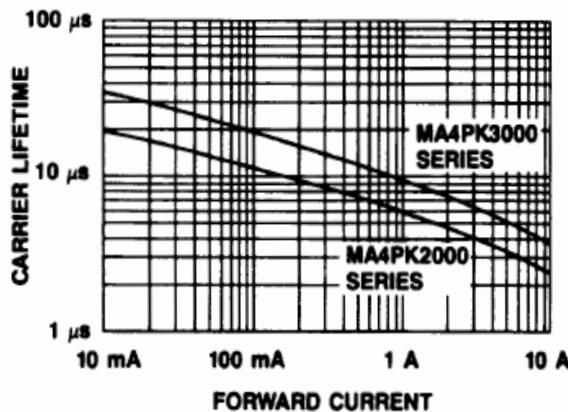
DC FORWARD VOLTAGE vs FORWARD CURRENT
(MA4PK2000, MA4PK3000 SERIES)



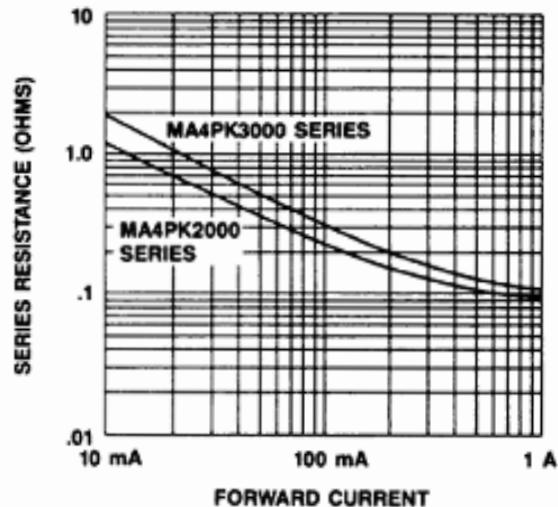
REVERSE BIAS CONDUCTANCE vs FREQUENCY AND
REVERSE VOLTAGE (MA4PK2000 SERIES)



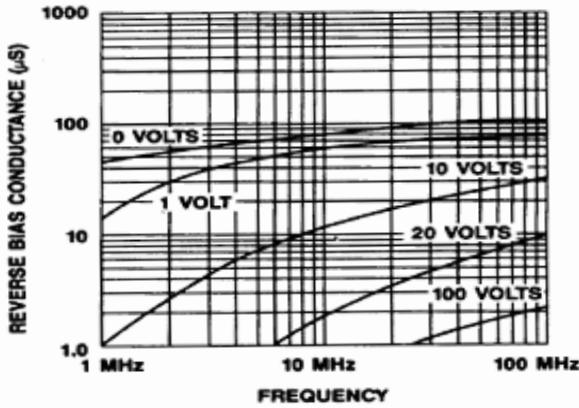
CARRIER LIFETIME vs FORWARD CURRENT



SERIES RESISTANCE vs CURRENT FREQUENCY AT 100 MHZ



REVERSE BIAS CONDUCTANCE vs FREQUENCY AND
REVERSE VOLTAGE (MA4PK3000 SERIES)



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Package Availability Table

| Base Part Number | Available ODS Package Styles |
|------------------|----------------------------------|
| MA4P161 | None. Use MA4P203 as alternative |
| MADP-000165 | None |
| MADP-000135 | None |
| MA47416 | None |
| MA47418 | None |
| MA4P203 | 30, 32, 94, 111, 1056 |
| MA4P303 | 32, 36, 94, 120, 186, 255, 1088 |
| MA4P404 | 30, 31, 36, 111, 258, 1072T* |
| MA4P504 | 30, 120, 144, 186, 255, 1072T* |
| MA4P505 | 36, 255, 1072T* |
| MA4P506 | 30, 31, 36, 255, 258, 1072T* |
| MA4P604 | 30, 43, 255, 258 |
| MA4P606 | 30, 36, 258 |
| MA4P607 | 43, 296 |
| MA4P709 | 150 |
| MA4P7493 | None |
| MA4PK2000 | 1027, 1048, 1082, |
| MA4PK3000 | 1073, 1074, 1084, |

*Note: "T" after the package style number indicates tape and reel.

1072T = 1500pcs/reel

Datasheets for electrical specifications of packaged devices can be found at :

macomtech.com/datasheets/packagedpindiodes

and for high voltage, high power devices

macomtech.com/datasheets/MA4PK2000_3000_Series

For package outlines refer to web page:

macomtech.com/Content/outlinedrawings

Package Parasitic Capacitance

| Package Style | Cap. (pF) |
|---------------|-----------|
| 30 | 0.18 |
| 31 | 0.18 |
| 32 | 0.30 |
| 36 | 0.18 |
| 43 | 0.75 |
| 94 | 0.15 |
| 111 | 0.27 |
| 120 | 0.13 |
| 144 | 0.42 |
| 186 | 0.15 |
| 255 | 0.30 |
| 258 | 0.18 |
| 276 | 0.13 |
| 296 | 0.35 |
| 1027 | 0.80 |
| 1048 | 0.80 |
| 1056 | 0.20 |
| 1072 | 0.16 |
| 1073 | 0.90 |
| 1074 | 0.90 |
| 1082 | 0.80 |
| 1084 | 0.90 |
| 1088 | 0.12 |

Die Handling and Bonding Information

Handling: All semiconductor chips should be handled with care to avoid damage or contamination from perspiration, salts, and skin oils. The use of plastic tipped tweezers or vacuum pickup is strongly recommended for the handling and placing of individual components. Bulk handling should ensure that abrasion and mechanical shock are minimized.

Die Attach Surface: Die can be mounted with an 80Au/Sn20, eutectic solder preform, RoHS compliant solders or electrically conductive silver epoxy. The metal RF and D.C. ground plane mounting surface must be free of contamination and should have a surface flatness of $< \pm 0.002"$.

Eutectic Die Attachment Using Hot Gas Die Bonder: A work surface temperature of 255°C is recommended. When hot forming gas (95%N/5%H) is applied, the work area temperature should be approximately 290°C. The chip should not be exposed to temperatures greater than 320°C for more than 10 seconds.

Eutectic Die Attachment Using Reflow Oven: For recommended reflow profile refer to pages 5-7 of [Application Note 538](#) "Surface Mounting Instructions",

Electrically Conductive Epoxy Die Attachment: A controlled amount of electrically conductive, silver epoxy, approximately 1-2 mils in thickness, should be used to minimize ohmic and thermal resistance. A thin epoxy fillet should be visible around the perimeter of the chip after placement to ensure full area coverage. Cure conductive epoxy per manufacturer's schedule. Typically 150°C for 1 hour.

Wire and Ribbon Bonding: The die anode bond pads have a Ti-Pt-Au metallization scheme, with a final gold thickness of 1.0 micron. Thermo-compression or thermo-sonic wedge bonding of either gold wire or ribbon is recommended. A bonder heat stage temperature setting of 200°C, tool tip temperature of 150°C and a force of 18 to 50 grams is suggested. Ultrasonic energy may also be used but should be adjusted to the minimum amplitude required to achieve an acceptable bond. Excessive energy may cause the anode metallization to separate from the chip. Automatic ball or wedge bonding may also be used.

For more detailed handling and assembly instructions, see [Application Note M541](#), "Bonding and Handling Procedures for Chip Diode Devices".