Silicon PIN Diode Chips

RoHs Compliant
V 5.0

Features

- Switch & Attenuator Die
- Extensive Selection of I-Region Lengths
- Hermetic Glass Passivated CERMACHIP®
- Oxide Passivated Planar Chips
- Voltage Ratings to 3000V
- Faster Switching Speed
- Lower Loss, Higher Isolation
- RoHs Compliant

Description

M/A-COM offers a comprehensive line of low capacitance Silicon PIN diode chips using silicon oxide and silicon nitride passivated planar technology covering a wide range of performance characteristics for control circuit applications. These devices with a variety of I-region lengths, are designed to have lower capacitance, lower series resistance, and higher breakdown voltage for parametric tradeoffs. Because of their small size and lower parasitics, they are ideal choices for broad band, higher frequency, microstrip hybrid assemblies.

The attenuator PIN diode chips have a mesa construction and are silicon nitride passivated. Because of their thicker I-region and predictable
Rs vs. I characteristics, they are well suited for lower distortion attenuator and switch circuits.

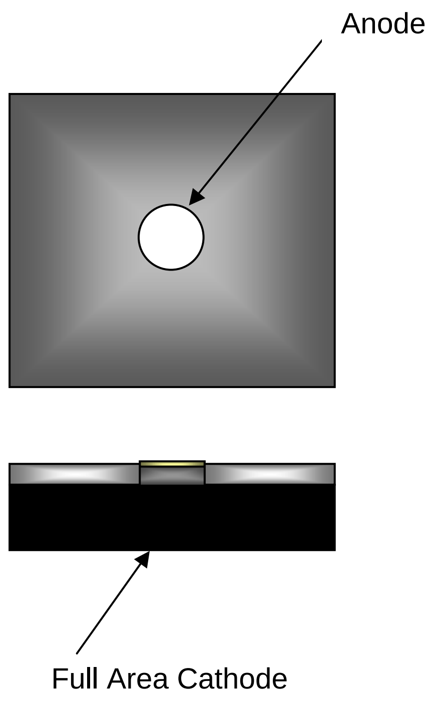
M/A-COM's CERMACHIP® PIN diodes employ
M/A-COM's, time proven, patented hard glass passivation process . This unique passivation covers the entire PIN junction resulting in a hermetically sealed chip that has been qualified for many military and space applications. The CERMACHIP® PIN diode chips are available with voltage ratings up to 3,000 volts and are capable of controlling kilowatts of power.

Most of the chips above are also available in hermetically sealed packages as described in the Packaged PIN Diode Datasheet.

Absolute Maximum Ratings[1]
@ Ta = +25°C (Unless otherwise specified)

Parameter	Absolute Maximum Value
Forward Current (I)	Per P/N Rs vs I Graph
Reverse Voltage (Vr)	Per Specification Table
Power Dissipation (W)	(175 °C –Tplate °C) / Theta
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +150 °C
Junction Temperature	+ 175 °C
Mounting Temperature	+320 °C for 10 seconds

1. Exceeding these limits may cause permanent damage.



Low Capacitance PIN Diode Chips
Specification @ T_A = +25°C

Part Number	Min. Rev. Volt.[3] V_R (V_{DC})	Max. Cap. 1MHz Cj@-10V (pF)	Max. Series Res. 500 MHz R_S @ 10mA (Ω)	Nominal Characteristics: Carrier Lifetime[1] TL (ηS)	Reverse Recovery Time[2] T_{RR} (ηS)	I Region Length (µm)	Theta (°C/W)	Anode Contact Dia. +/- 0.5 (mils)	Chip Size +/- 2 (mils)	Chip Thick. +/- 1 (mils)
MA4P102-134	50	0.05	2.50	50	5	7	200	1.3	13X13	6
MA4P160-134	100	0.05	2.40	200	20	19	150	1.8	13X13	6
MA4P161-134	100	0.10	1.50	150	15	13	65	3.5	13X13	6
MA4P165-134	150	0.05	2.50	200	20	19	150	1.8	13X13	6
MA4P166-134	150	0.10	2.00	200	20	19	150	1.8	13X13	6
MA4P202-134	100	0.05	2.50	200	20	19	150	1.8	13X13	6
MA4P203-134	100	0.15	1.50	150	25	13	75	3.1	13X13	6

Notes:

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

Attenuator PIN Diode Chips
Specification @ T_A = +25°C

Part Number	Min. Rev. Volt.[2] V_R (V_{DC})	Max. Cap. 1 MHz Cj@-10V (pF)	Max. Series Res. 100 MHz R_S@10mA (Ω)	Nominal Characteristics: Carrier Lifetime[1] T_L (µS)	Typ Series Res. 100 MHz R_S @ 1mA (Ω)	Typ Series Res. 100 MHz R_S @ 10µA (Ω)	I Region Length (mils)	Theta (°C/W)	Anode Contact Dia. +/- 0.5 (mils)	Chip Size +/- 2 (mils)	Chip Thk. +/- 1 (mils)
MA47416-132	200	0.15	6.00	2.0	30.00	2000	4	30	7.5X7.5 [3]	22X22	7
MA47418-134	200	0.15	3.00	1.0	15.00	500	2	25	7.5	13X13	7

Notes:

1.) Nominal carrier life time specified at I_F = + 10mA, I_{REV} = - 6mA.
2.) Vr (Reverse Voltage) is sourced and resultant reverse leakage current, Ir, is measured (< 10 uA).
3.) Anode top contact is square.

CERMACHIP® PIN Diode Chips
Specification @ T_A = +25°C

Part Number	Min. Rev. Volt.[5] V_R (V_{DC})	Max. Cap. 1 MHz Cj (pF)	(Unless otherwise specified) Max. Series Res. 100MHz R_S @ I_F (Ω)	Nominal Characteristics: Carrier Lifetime[4] T_L (µS)	I Region Length (µm)	Theta (°C/W)	Anode Contact Dia. +/- 0.5 (mils)	Chip Size +/- 2 (mils)	Chip Thick. +/- 1 (mils)
MA4P303-134	200	0.15 @ 10V	1.5 @ 50mA [2]	0.3	20	85	3.0	13X13	10.0
MA4P404-132	250	0.20 @ 50V	0.70 @ 50mA[2]	0.6	30	30	6.8	20X20	7.0
MA4P504-132	500	0.20 @ 100V	0.60 @ 100mA	1	50	35	6.8	20X20	12.0
MA4P505-131	500	0.35 @ 100V	0.45 @ 100mA	2	50	14	13.0	27X27	11.0
MA4P506-131	500	0.70 @ 100V	0.30 @ 100mA	3	50	11	15.8	27X27	12.0
MA4P604-131	1000	0.30 @ 100V	1.00 @ 100mA	3	90	10	17.0	27X27	13.5
MA4P606-131	1000	0.60 @ 100V	0.70 @ 100mA	4	90	8	21.0	32X32	14.0
MA4P607-212	1000	1.30 @ 100V	0.40 @ 100mA	5	127	4	37.0	62X62	18.5
MA4PK2000-223 [1]	2000	2.40 @ 100V	0.20 @ 500mA [3]	10	230	2	72.0	111X111	21.0
MA4PK3000-1252 [1]	3000	2.90 @ 100V	0.25 @ 500mA [3]	40	350	1.5	85.0	172X172	28.0

Notes:

1.) Upon completion of installation into a circuit, the chip must be covered with a dielectric conformal coating such as SYLGARD 539® to prevent voltage arcing.
2.) Test Frequency = 500MHz.
3.) Test frequency = 4MHz.
4.) Nominal carrier lifetime specified at I_F = + 10mA , I_{REV} = - 6mA.
5.) Vr (Reverse Voltage) is sourced and resultant reverse leakage current, Ir, is measured to be < 10 uA.

Typical Series Resistance vs. Forward Current Performance

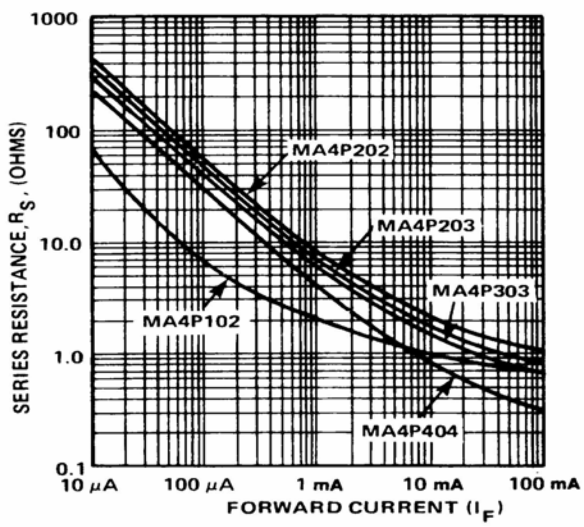


FIGURE 1. Forward Current vs. Series Resistance for MA4P202, MA4P203, MA4P303, MA4P404 and MA4P102

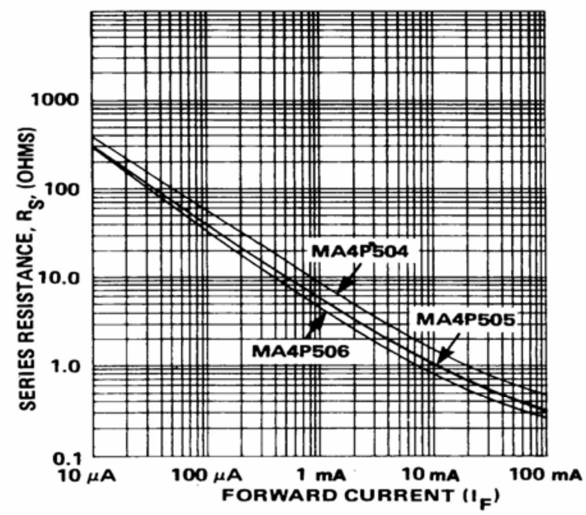


FIGURE 2. Forward Current vs. Series Resistance for MA4P504, MA4P505, MA4P506

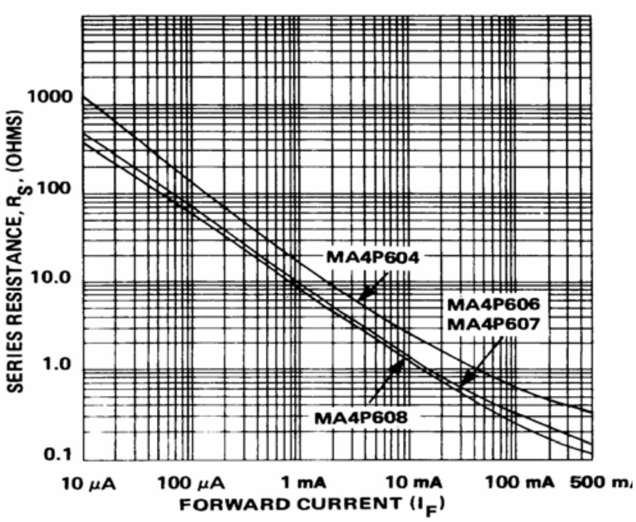
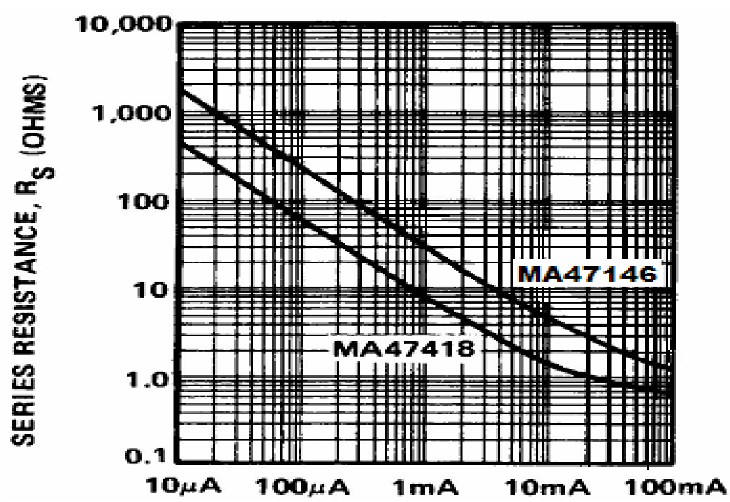


FIGURE 3. Forward Current vs. Series Resistance for MA4P604, MA4P606, MA4P607, MA4P608

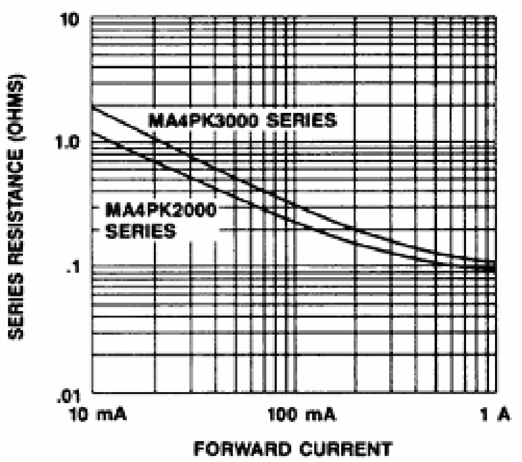


FORWARD CURRENT (I_F)

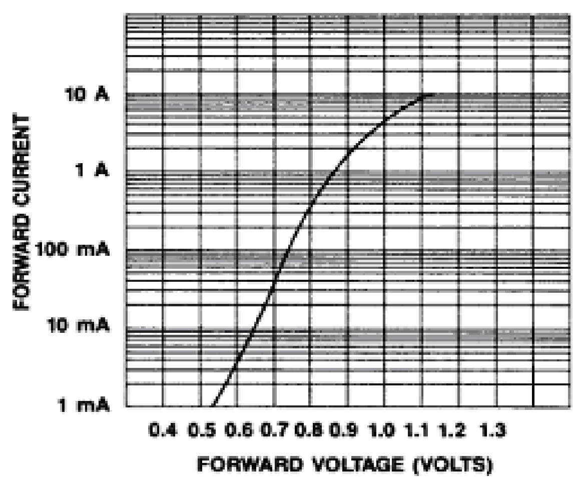
FIGURE 4. Forward Current vs. Series Resistance for MA47416 & MA47418

MA4PK2000 & MA4PK3000 Highest Voltage Chips

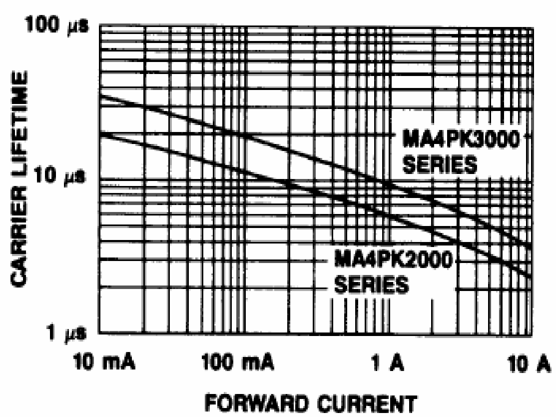
SERIES RESISTANCE vs CURRENT FREQUENCY AT 100 MHz



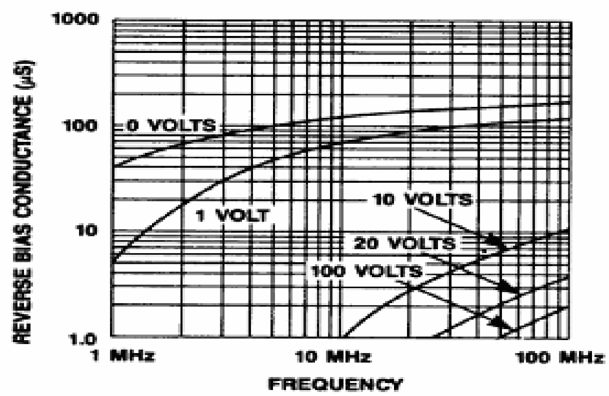
DC FORWARD VOLTAGE vs FORWARD CURRENT (MA4PK2000, MA4PK3000 SERIES)



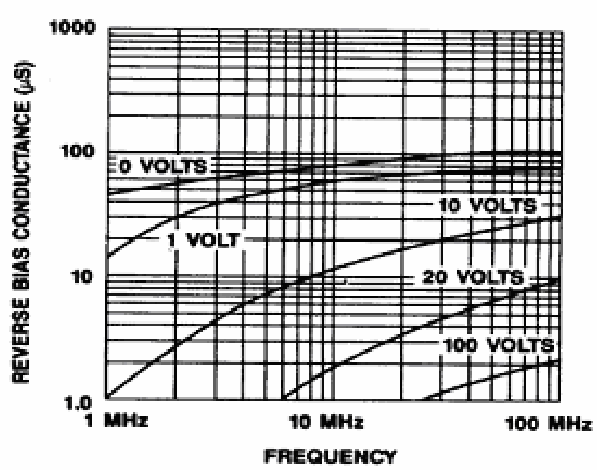
CARRIER LIFETIME vs FORWARD CURRENT



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



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



Die Handling and Mounting 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 pickups is strongly recommended for individual components. Bulk handling should ensure that abrasion and mechanical shock are minimized.

Die Attach Surface: Die can be mounted with a Au 80 / Sn 20 , or Sn 60 / Pb 40 type eutectic solder preform 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 < +/- 0.002".

Eutectic Die Attachment Using Hot Gas Die Bonder: An 80 Au / 20 Sn, eutectic, solder preform is recommended with a work surface temperature of 255°C. When the hot forming gas 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: See Application Note M541, "Bonding and Handling Procedures for Chip Diode Devices" at www.macom.com for recommended time-temperature profile.

Electrically Conductive Epoxy Die Attachment: Assembly should be preheated to 125-150 °C per manufacturers instructions. 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.

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 required amplitude to achieve a good bond. Excessive energy may cause the anode metallization to separate from the chip. Automatic ball or wedge bonding can also be used.

For more detailed handling and assembly instructions, see Application Note M541, "Bonding and Handling Procedures for Chip Diode Devices" at www.macom.com.