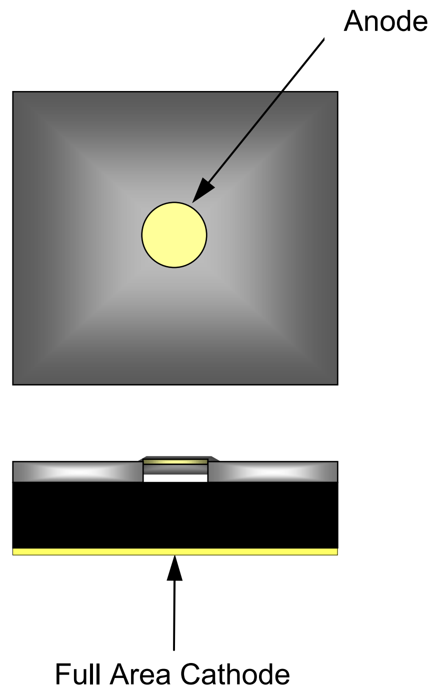
Silicon PIN Chips

V18

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 variety of voltage ratings, up to 3,000 volts and are capable of controlling kilowatts of power.

Many of M/A-COM Tech's silicon PIN diode chips are also available in several different package styles. Please consult the "Packaged PIN Diode Datasheet" for case style availability and specifications. The datasheet is located on the M/A-COM website at :
www.macomtech.com/DataSheets/packagedpindiodes.pdf

Absolute Maximum Ratings[1]
T_{AMB} = +25°C (Unless otherwise specified)

Parameter	Absolute Maximum Value
Forward Current (I_F)	Per P/N R_S vs. I Graph
Reverse Voltage (V_R)	Per Specification Table
Power Dissipation (W)	$\frac{175°C - T_{ambient}°C}{Theta}$
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**

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Low Capacitance PIN Specification @ T_{AMB} = +25°C

Part Number	Max. Rev. Volt.[3]	Max. Cap. 1 MHz	Max. Series Res. 500 MHz	Nominal Characteristics: Carrier Lifetime[1]	Reverse Recovery Time[2]	I Region Length	Theta	Anode Dia.	Chip Size	Chip Thk.
	$V_{R\,<10\,\mu A}$ V_{DC}	$C_{j\,@\,-10\,V}$ pF	$R_{S\,@\,10\,mA}$ Ω	T_L ηS	T_{RR} ηS	μm	°C/W	± 0.5 mils	± 0.5 mils	± 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
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. V_R (Reverse Voltage) is sourced and the resultant reverse leakage current, Ir, is measured to be <10μA.

Attenuator PIN Specification @ T_{AMB} = +25°C

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

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

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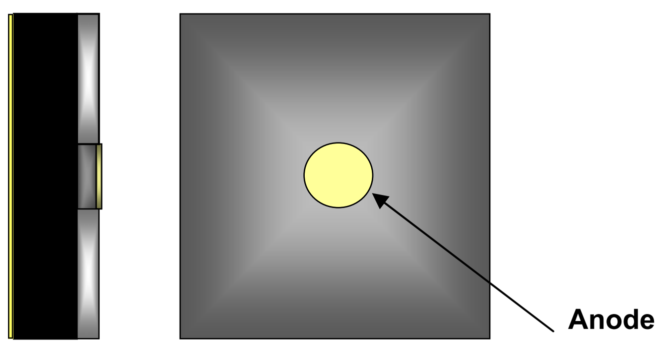
CERMACHIP® PIN Chips Specification @ T_{AMB} = +25°C

Part Number	Max. Rev. Volt.[5]	*Unless otherwise noted* Max. Cap. 1 MHz	*Unless otherwise noted* Max. Series Res. 100 MHz	*Nominal Characteristics* Carrier Lifetime[4]	I Region Length	*Theta*	*Anode Dia.*	*Chip size*	*Chip Thk.*
	$V_{R < 10 \mu A}$ V_{DC}	$C_{J @ -100 V}$ pF	$R_{S @ 100 mA}$ Ω	µS	µm	°C/W	± 0.5 mil	± 2 mils	± 1 mil
MA4P303-134	200	0.15 @ 10 V	1.5 @ 50 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:

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 = 500 MHz.
3. Test Frequency = 4 MHz.
4. Nominal carrier lifetime, T_L, specified at I_F = +10 mA , I_{REV} = - 6 mA.
5. Minimum specified V_R (Reverse Voltage) is sourced and the resultant reverse leakage current, I_{REV}, is measured to be < 10 µA.



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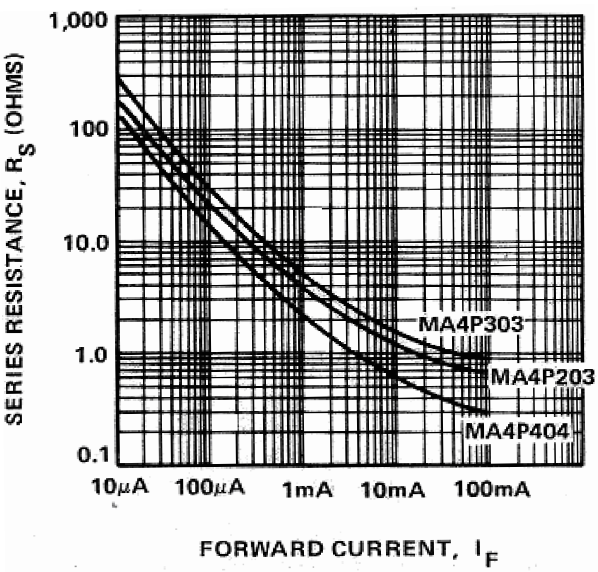
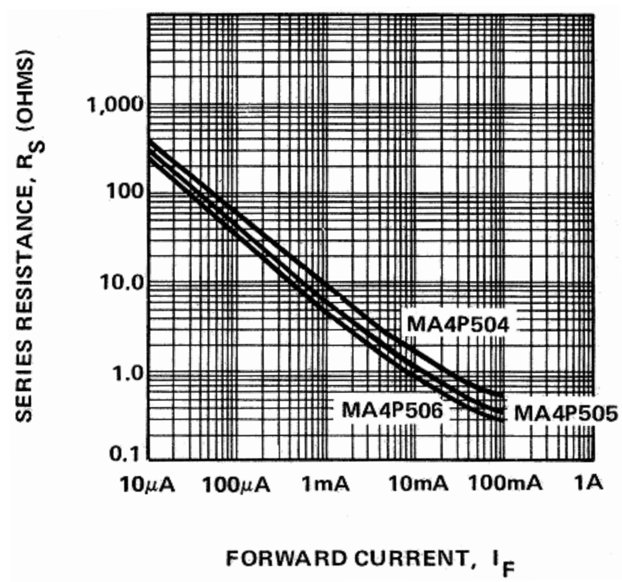
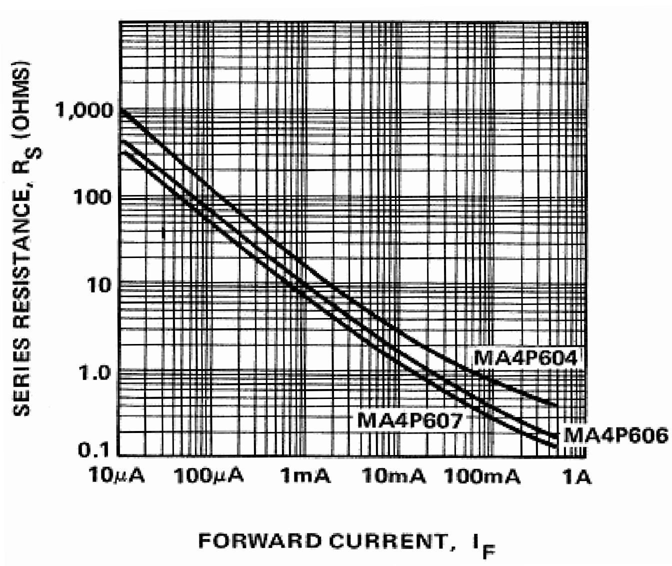
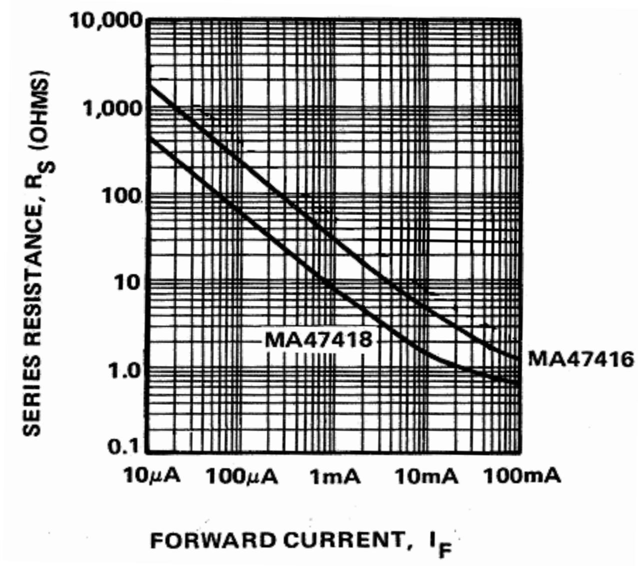
Typical Series Resistance vs. Forward Current Performance









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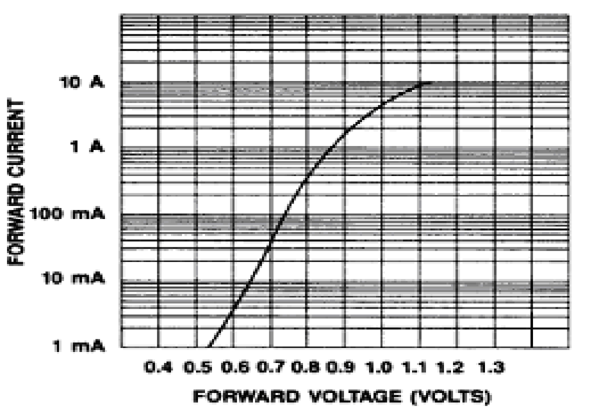
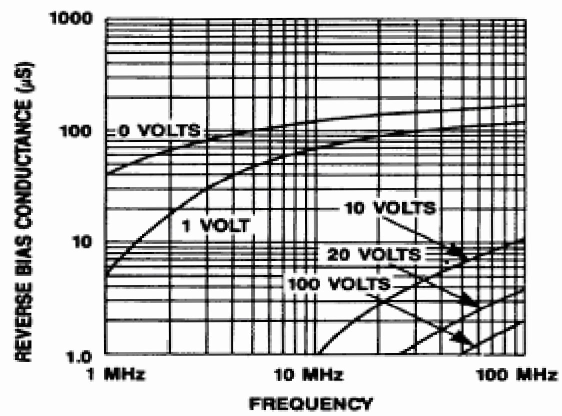
MA4PK2000 & MA4PK3000 (2kV & 3kV) Chips

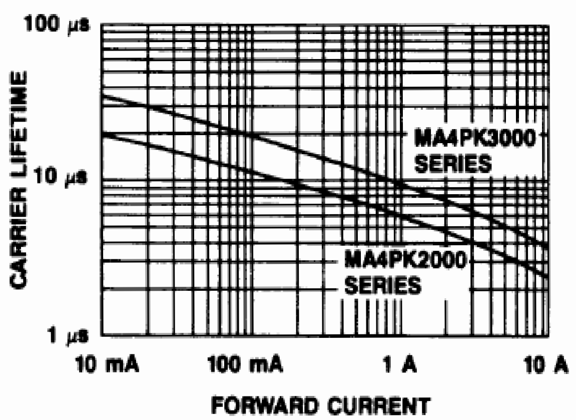
DC FORWARD VOLTAGE vs FORWARD CURRENT (MA4PK2000, MA4PK3000 SERIES)



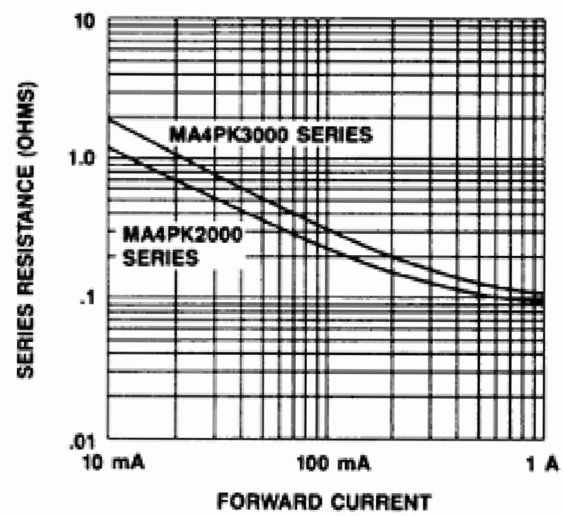
REVERSE BIAS CONDUCTANCE vs FREQUENCY AND REVERSE VOLTAGE (MA4PK2000 SERIES)



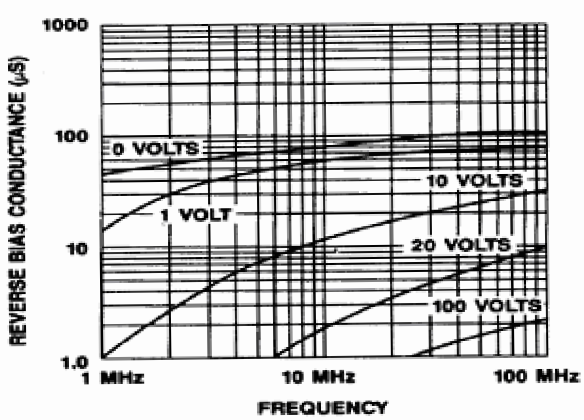
CARRIER LIFETIME vs FORWARD CURRENT



SERIES RESISTANCE vs CURRENT FREQUENCY AT 100 MHz



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



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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 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 < ±0.002”.

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

Eutectic Die Attachment Using Reflow Oven: Refer to pages 5-7 of Application Note M538, “Surface Mounting Instructions” at www.macomtech.com for recommended time-temperature profile.

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^{o}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” at** www.macomtech.com.

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