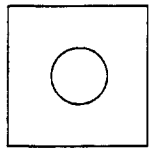
PIN Diode Chips

V 2.00

Features

- CERMACHIP™ (glass) or Silicon Dioxide Passivation
- Hermetically Sealed CERMACHIP Design
- Fast Speed, Low Loss Microwave Chips
- Attenuator Chips
- Voltage Ratings to 1500 Volts
- Wide Range of PIN Characteristics



Description

M/A-COM offers a comprehensive product line of silicon PIN diode chips covering a wide range of performance characteristics for use in hybrid integrated circuits. PIN diode chips designed for fast switching speed, low loss microwave applications and for high power, high voltage RF applications are available.

The small size and low parasitics of PIN diode chips allow for the design of miniature, broadband microwave circuits particularly useful in microstrip assemblies. These devices combine M/A-COM's latest design technology and long experience as a manufacturer of PIN diodes.

M/A-COM's PIN diode chips have gold contact surfaces, with the cathode surface as the bottom contact.

The low capacitance PIN diode chips have a mesa construction and are passivated with silicon dioxide. Capacitance values range from 0.05 pF. These devices are designed with thin I region widths and short carrier lifetime for fast switching speed microwave circuits.

The attenuator PIN diode chips have a mesa construction and are passivated with CERMACHIP glass. Because of their thick intrinsic region and well controlled resistance current characteristics, these devices are well suited for low distortion attenuator circuits.

The general purpose PIN diode chips are silicon dioxide passivated mesa structures. They are also available in hermetically sealed packages as described in the packaged PIN diode section. These diodes encompass a wide range of characteristics with voltage ratings from 50 to 250 volts.

M/A-COM's CERMACHIP PIN diode chips employ M/A-COM's unique hard glass passivation, covering the entire active surface of the PIN diode junction. This results in an hermetically sealed chip that has been qualified for many high reliability military and space programs. The CERMACHIP PIN chips are available with voltage ratings up to 1,500 volts and are capable of controlling kilowatts of power.

M/A-COM, Inc.

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

Model[1] Number	Voltage[2] Rating (Volts)	Maximum[3] Cj @ 10V (pF)	Maximum[4] R_S @ 10 mA (Ohms)	Nominal Characteristics		
				Carrier[5] Lifetime (ns)	Reverse[6] Recovery Time (ns)	Contact Diameter (mils)
MA4P150	20	0.10	1.5	10	2	1.5
MA4P151	30	0.05	2.0	10	2	1.5
MA4P152	30	0.10	1.5	10	2	2.0
MA4P153	30	0.15	1.2	10	2	2.0
MA4P154	30	0.20	1.0	10	2	2.0
MA4P155	40	0.05	2.0	15	4	1.5
MA4P156	40	0.10	1.5	15	4	1.5
MA4P157	60	0.10	1.5	50	6	2.0
MA4P159	60	0.20	1.0	65	7	2.5
MA4P160	100	0.05	1.9	80	8	2.0
MA4P161	100	0.10	1.5	90	9	2.5
MA4P162	100	0.15	1.2	100	10	3.0
MA4P165	200	0.05	2.5	170	20	2.0
MA4P166	200	0.10	2.0	190	20	3.0

Notes:
1. Nominal chip size is 15 X 15 mil, case style 134. See Appendix for full dimensions.
2. Maximum reverse current is 10 µA at the specified voltage rating.
3. Maximum capacitance is specified at 1 MHz at the indicated voltage.
4. Maximum series resistance is at the specified current and a frequency of 500 MHz.
5. Nominal carrier lifetime is specified at I_F = 10 mA.
6. Nominal reverse recovery time is specified at I_F - 20 mA, I_R = 200 mA.

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

Model[1] Number	Voltage[2] Rating (Volts)	Maximum[4] R_S @ 10 mA (Ohms)	Maximum[3] Cj @ 100V @ 100 V (pF)	Nominal Characteristics				
				Rs for I_F = 1 mA (Ohms)	Rs for I_F = 10 µA (Ohms)	Carrier Lifetime (µS)	I-Region Width (mils)	Equivalent[4] M/A-COM Axial Lead PIN Diode
MA47418	200	3	0.15	8	500	1.0	2	MA47047
MA47416	200	6	0.15	30	2000	2.0	4	MA47600
MA47406	200	8	0.15	50	3000	2.5	7	MA47100

Notes:
1. Nominal chip size for the MA47418 and MA47416 is 30 x 30 mil (case style 131), MA47406 is 20 x 20 mil (case style 132). See Appendix for full dimensions
2. Maximum reverse current is 10 µA at specified voltage rating.
3. Capacitance is specified at 1 MHz.
4. Resistance is specified at 100 MHz.
5. Carrier Lifetime is specified at 10 mA.

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General Purpose PIN Chips
Specifications @ T_A = +25° C

Model[1] Number	Voltage[2] Rating (Volts)	Maximum R_S @ 10 mA (Ohms)	Maximum[3] Cj @ V_R (pF)	Nominal Characteristics				
				Carrier[4] Lifetime (ns)	I-Region Width (µm)	Contact Diameter (mils)	Thermal Resistance (°C/W)	Chip Size[5] (mils X mils)
MA4P420-132	35	0.5	0.85 @ 20	300	10	6.0	60	20 X 20
MA4P102-134	50	2.0	0.05 @ 10	20	7	1.5	60	15 X 15
MA4P202-134	100	2.5	0.05 @ 10	60	12	1.5	60	15 X 15
MA4P203-134	100	1.5	0.15 @ 10	100	12	2.5	30	15 X 15
MA4P303-134	200	1.5	0.15 @ 10	200	20	4.0	30	15 X 15
MA4P404-132	250	0.6*	0.20 @ 50	1000	30	4.0	20	20 X 20

*At 50 mA, 100 MHz

Notes:
1. Maximum reverse current is 10 µA at specified voltage rating.
2. Resistance is specified at 500 MHz unless indicated.
3. Capacitance is specified at 1 MHz at the indicated voltage.
4. Nominal carrier lifetime is specified at 10 mA.
5. Case style is indicated by model number suffix. See Appendix for full dimensions.

PIN CERMACHIPS
Specifications @ T_A = +25°C

Model[1] Number	Voltage[2] Rating (Volts)	Maximum R_S @ 100 mA (Ohms)	Maximum[3] Cj @ 100V (pF)	Nominal Characteristics				
				Carrier[4] Lifetime (µs)	I-Region Width (mils)	Chip Size[5] (mils X mils)	Contact Diameter (mils)	Thermal Resistance (°C/W)
MA4P504-132	500	0.60	0.20	1	2	20 X 20	5	20
MA4P505-131	500	0.45	0.35	2	2	30 X 30	8	15
MA4P506-131	500	0.30	0.70	3	2	30 X 30	12	10
MA4P604-131	1000	1.00	0.30	3	4	30 X 30	12	15
MA4P606-131	1000	0.70	0.60	4	4	30 X 30	18	10
MA4P607-210	1000	0.40	1.30	5	4	65 X 65	28	7
MA4P608-130	1000	0.35*	2.50	5	4	80 X 80	38	5
MA4P709-223	1500	0.25**	3.30	10	7	110 X 110	50	2

* At 150 mA
** At 300 mA

Notes:
1. Maximum reverse current is 10 µA at specified voltage ratings.
2. Capacitance is specified at 1 MHz.
3. Resistance is specified at 100 MHz.
4. Nominal Carrier Lifetime is specified at 10 mA.
5. Case style is indicated by model number suffix. See Appendix for full dimensions.

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Maximum Ratings

Parameters	Absolute Maximum
Storage Temperature	-65°C to +200°C
Operating Temperature	-65°C to +175°
Voltage	Voltage Rating

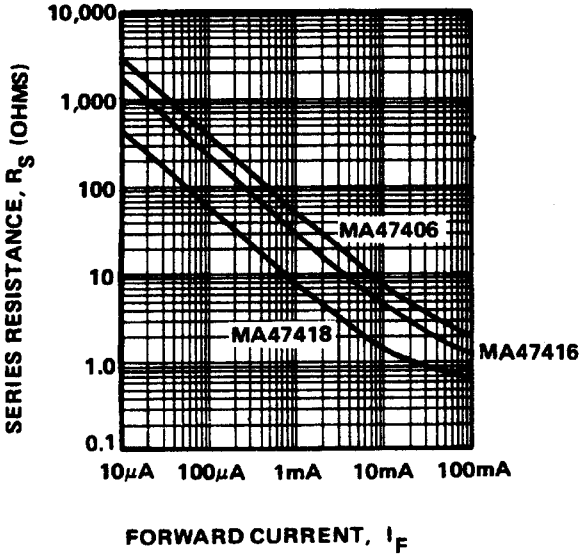
Power Dissipation

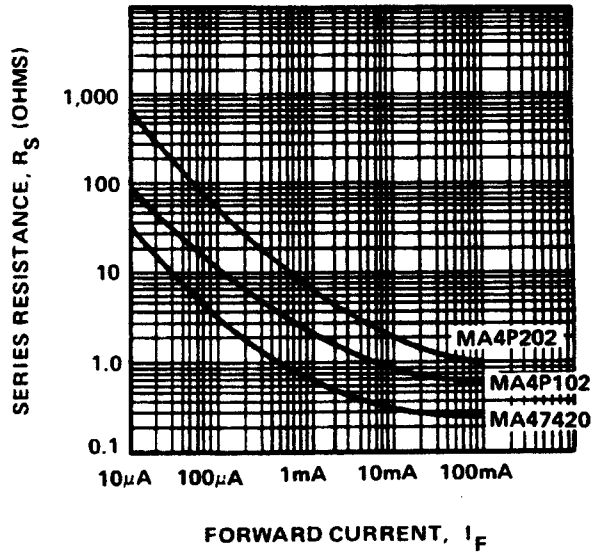
Low Capacitance and Attenuator Chips 0.5 Watts @ 25°C (derate to zero watts at 175°C)

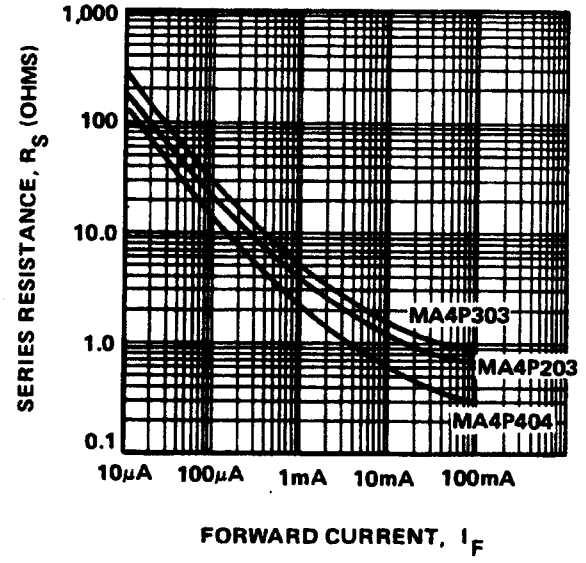
General Purpose Chips and CERMACHIPS

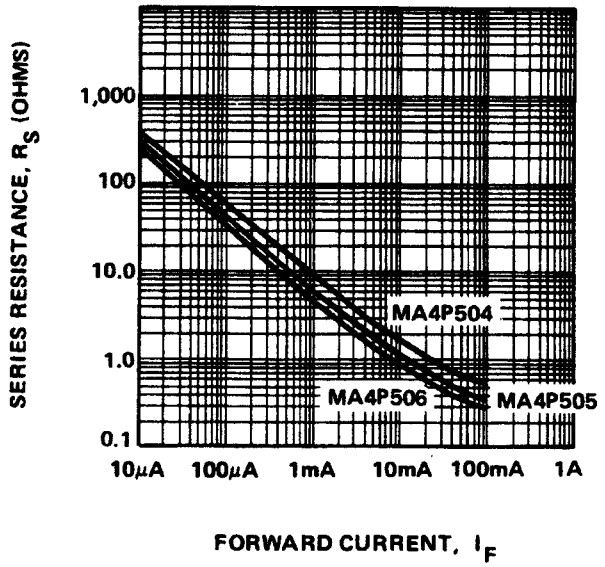
$$P_{diss} = \frac{175°C - T_{ambient}}{\text{Thermal Resistance}}$$

Typical Series Resistance vs Current Performance Curves









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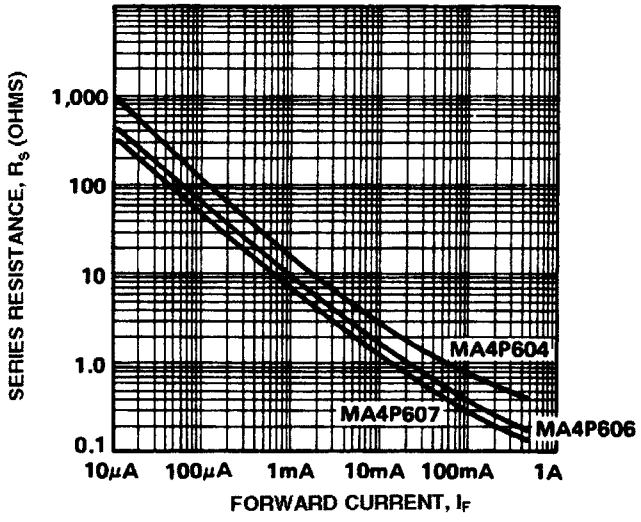
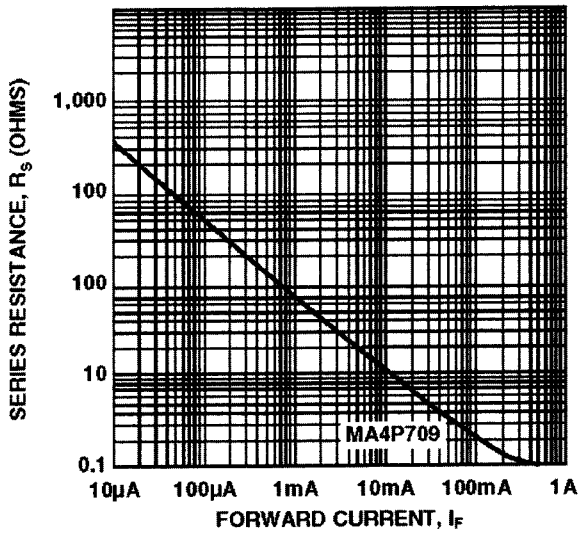
Typical Series Resistance vs Current Performance Curves





Bonding and Handling Considerations for Silicon PIN Diode Chips

The normal handling precautions used on semiconductors in hybrid microelectronic circuits are appropriate to silicon PIN diode chips. PIN diode chips are packaged in waffle packs that should be stored in a dry, clean environment. It is recommended that the chips be removed and subsequently handled using a vacuum pencil.

Die Bonding

Hot gas bonding is recommended for the passivated chips and the smaller CERMACHIP (less than 60 X 60 mils) PIN diodes. The preferred mating substrate surface is plated with gold or tin over a nickel flash. A gold tin preform (80%/20%, 280°C melting temperature) should be used. The substrate is heated to 250°C and the hot gas (forming gas) is injected at 350°C. The collet pressure should be about 70 grams during bonding.

For the larger CERMACHIP PIN diodes, it is recommended that softer solder preform such as lead-tin-silver (90%/5%/5%, 308°C melting temperature) be used. Bonding should take place in a belt furnace using a hydrogen cover gas.

It is also possible to solder these chips directly on a heat transfer platform using a solder preform or solder cream. If flux is required, it should be used sparingly and its residue removed immediately after bonding. Flux should not be used with CERMACHIP diodes since it will damage the passivation surface. The platform temperature should be raised to 30°C above the solder liquid state temperature.

Bonding with conductive epoxy is also acceptable. The manufacturers recommendations for mixing, applying and curing must be followed. The curing should take place in a circulating air chamber dedicated to inorganic epoxies.

Lead Bonding

Thermocompression and thermocompression ultrasonic lead bonding techniques may be employed for PIN diode chips. Wire bonds using 0.7 mil and 1 mil gold wire may be ball or wedge bonded; ribbons from 0.25 mil X 3.0 mil to 1 mil X 10 mil maybe wedge bonded. The choice depends on the application and the contact size. During lead bonding, it is preferable that the substrate be raised to approximately 150°C. The bonding tip temperature and pressure depends on the wire or ribbon size and contact area. The resulting bond strength should exceed the specification in MIL-STD883, Method 2011.3 for gold wire or ribbon leads.