Axial Lead PIN Diodes

V 2.00

Features

- Glass Hermetic Sealed Packages
- Screenable to JAN-TXV and Military Specifications
- General Purpose Switch Diodes
- Low Distortion Attenuator Diodes
- Tape and Reel Packaging Available

Description

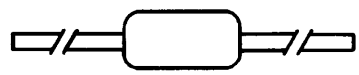
M/A-COM's series of glass, hermetically sealed axial lead PIN diodes are designed for switch and attenuator applications from HF through S-Band. The manufacturing methods employed to construct these devices are suitable to meet high volume production requirements.

These PIN diodes are applicable for use in industrial and military applications. Their inherent ruggedness and reliability allows them to be screened to JAN-TX level and to meet other military standards.

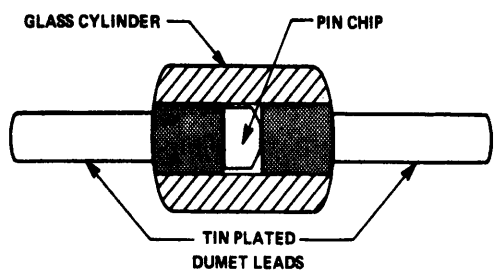
Applications for M/A-COM's axial lead PIN diode products include electrically tuned digital filter circuits, AGC attenuators, antenna switches as well as general purpose PIN diode applications. These PIN diodes are particularly useful in distortion sensitive circuit environments.

This series of PIN diodes are available in three glass packages. The case style 54 is the most suitable to meet low total capacitance requirements for high isolation in series connected switches at VHF frequencies. The case style 139 and case style 146 are most suitable for moderate power applications requiring lower package inductance.

Case Style 54



Case Styles 139, 146*



* Enlarged to show detail.

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

Model Number	Case[1] Style	Minimum Reverse Voltage V_R (Volts)	Maximum Series Resistance R_S @ I_F (mA) (Ohms)	Maximum Total Capacitance C_T @ V_R (Volts) (pF)	Nominal Characteristics	
					Carrier Lifetime (µs)	I-Region Thickness (mils)
MA47120	54	35	0.5 @ 10	1.00 @ 20	0.3	0.4
MA4P270	139	35	0.5 @ 10	1.20 @ 20	0.3	0.4
MA4PH401	54	50	1.5 @ 10	0.30 @ 20	0.2	0.4
MA4PH151	139	100	0.6 @ 10	1.20 @ 50	1.0	0.8
1N5719	54	100	1.5 @ 50	0.25 @ 50	1.0	2.0
MA47047	54	200	3.0 @ 10	0.30 @ 50	1.0	2.0
MA47123	139	200	3.0 @ 10	0.50 @ 50	1.0	2.0
MA47266	146	200	0.6 @ 50	1.50 @ 50	3.0	3.0

Note: 1. See Appendix for full dimensions.

Low Distortion Attenuator PIN Diodes

Model Number	Case[1] Style	Minimum Reverse Voltage V_R (Volts)	Maximum Series Resistance R_S @ I_F - 10 mA (Ohms)	Maximum Total Capacitance C_T @ 50V (pF)	Nominal Characteristics			
					R_S		Carrier Lifetime (µs)	I-Region Thickness (mils)
					I_F = 1 mA (Ohms)	I_F = 10 µA (Ohms)		
MA47600	54	200	6	0.30	30	2,000	2	4
MA47110	139	200	6	0.50	30	2,000	2	4
MA47100	54	200	8	0.30	50	3,000	2.5	7
MA4P208	139	100	20	0.35	100	6,500	1.5	9
MA47111	146	200	25	0.80	75*	4,000	4.0	14

*75 Ohms @ I_F = 1.5 to 2.5 mA.

Note: 1. See Appendix for full dimensions.

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Maximum Ratings

Parameter	Absolute Maximum
Operating Temp.	- 65°C to +175°C
Storage Temp.	- 65°C to +175°C
Voltage	Voltage Rating
Power Dissipation	(derate linearly to zero at +175°C)
Case Style 54	250 mW (Free Air)
Case Style 139	500 mW (Free Air)
Case Style 146	1.0 W (Free Air) 1.5 W (0.5 inch total length to +25°C contact)

Environmental Capability (Per MIL-STD-750 and MIL-S-202)

	Method	Level
Storage Temperature	1031	See Maximum Ratings
Operating Temperature	—	See Maximum Ratings
Temperature Cycling	1051	5 cycles, - 65°C to 150°C
Shock	2016	500 g's
Vibration	2056	15 g's
Constant Acceleration	2006	20,000 g's
Humidity	1021	10 days

Screened Diodes

Typical 100% Preconditioning and Screening Program for TX Level Screening Per MIL-S-202

Inspections	Method	Conditioning
Internal Visual and/or X-ray	2072/2076	See note 1
High Temperature Life	1032	48 hours minimum at maximum storage temperature
Thermal Shock	1051	10 cycles
Constant Acceleration	2006	20,000 g's, Y1
Fine Leak	1071	H
Gross Leak	1071	C or E
Electrical	— —	See note 2
Burn-In	1038	See note 2

Notes:
1. Internal visual on TXV screening programs only. X-ray is optional for any screening plan.
2. Conditions and details of test depend on specific part number. Information available on request.

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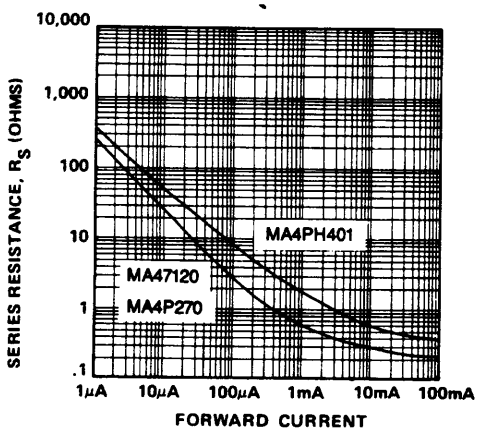
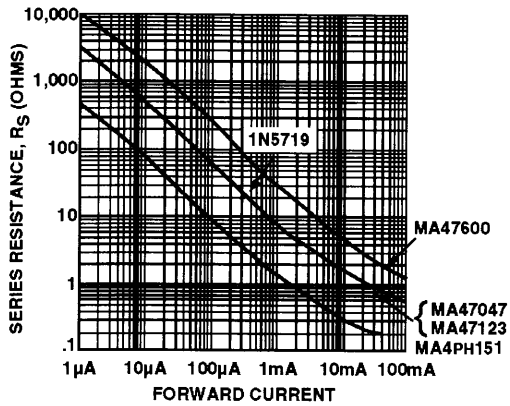
Typical Resistance Curves at 100 MHz

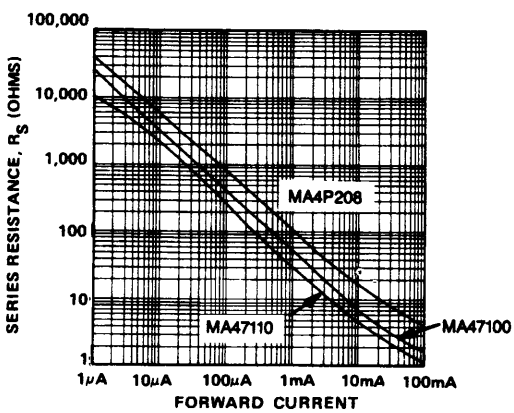
SERIES RESISTANCE vs FORWARD CURRENT FOR GENERAL PURPOSE PIN DIODES



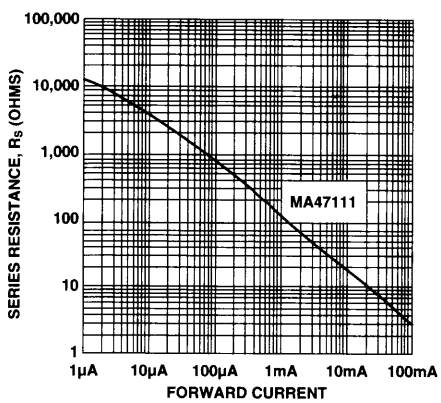
SERIES RESISTANCE vs FORWARD CURRENT FOR GENERAL PURPOSE PIN DIODES



SERIES RESISTANCE vs FORWARD CURRENT FOR LOW DISTORTION ATTENUATOR PIN DIODES



SERIES RESISTANCE vs FORWARD CURRENT FOR LOW DISTORTION ATTENUATOR PIN DIODES



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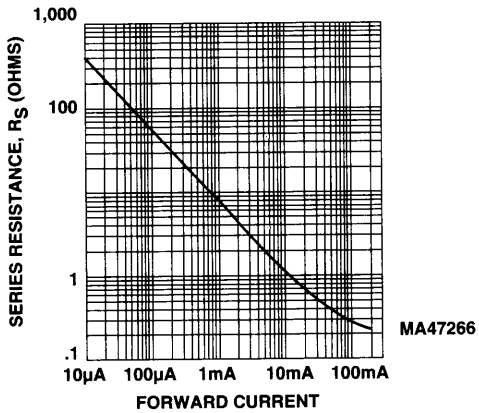
Typical Resistance Curves at 100 MHz

SERIES RESISTANCE vs FORWARD CURRENT FOR LARGE SIGNAL SWITCH PIN DIODES



Cross Reference

Many of M/A-COM's axial lead, hermetic surface mount (SMQ) and SOT-23 PIN diodes use similar chips and, therefore, have the same electrical characteristics except for package parasitics.

The following table lists the axial lead PIN diode by model number and the equivalent square surface mount (SMQ) PIN and SOT-23 PIN diodes.

Axial Lead PIN Diodes	SMQ PIN Diodes	SOT-23 Diodes
MA47100	—	MA4P278
MA47110	MA4PH238	MA4P277
MA47111	MA4PH239	—
MA47123	MA4PH236	MA4P274
MA47266	MA4PH237	—
MA4P270	MA4PH235	MA4P275
MA4PH151	—	MA4P282
MA4PH401	—	MA4P789

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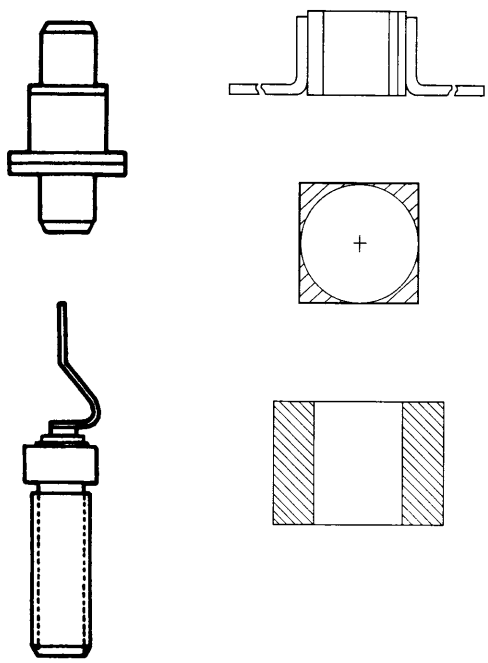
Packaged PIN Diodes

MA4P100 thru 600 Series

V 2.00

Features

- High Power PIN Diodes
- Fast Speed PIN Diodes
- Voltage Ratings to 1500 Volts
- Long Carrier Lifetime Designs
- Wide Variety of Hermetic Packages
- High Reliability for Space/Military Applications



Description

M/A-COM's product line of packaged PIN diodes represents a comprehensive combination of PIN diode electrical characteristics and package outlines. This union of semiconductor and packaging technology gives considerable design flexibility to the PIN diode circuit designer.

The fast switching speed PIN diodes utilize thin I-region silicon dioxide passivated chips that incorporate careful control of semiconductor processing. These diodes achieve consistent performance in control circuit applications. The packaged CERMACHIP PIN diodes employ M/A-COM's unique hard glass passivated, hermetically sealed PIN diode chip. The packaged CERMACHIP PIN diodes are designed for use in high power and high RF voltage applications. The PIN diode chips are bonded into hermetically sealed ceramic or glass packages that are designed for high volume, close tolerance utilization. Packages are available which are suitable for mounting in a variety of microwave and RF circuit media.

The packaged silicon PIN diode series has high inherent reliability and is capable of meeting stringent environmental tests. These diodes may be ordered with testing to selected reliability levels.

Ordering Information

Packaged PIN diode specifications are listed in the appropriate tables. The standard package style is indicated as part of the model number; i.e., MA4P506-30. Alternative package styles for the diodes are also indicated. To order, indicate the desired model number by indicating the chip model number and desired package style; i.e., MA4P506-258. Note that the specification tables lists total diode capacitance in the standard case style only. The total capacitance for the diode in an alternative package are computed from the difference in package capacitance. Parts are available only in the case styles as indicated in each product table.

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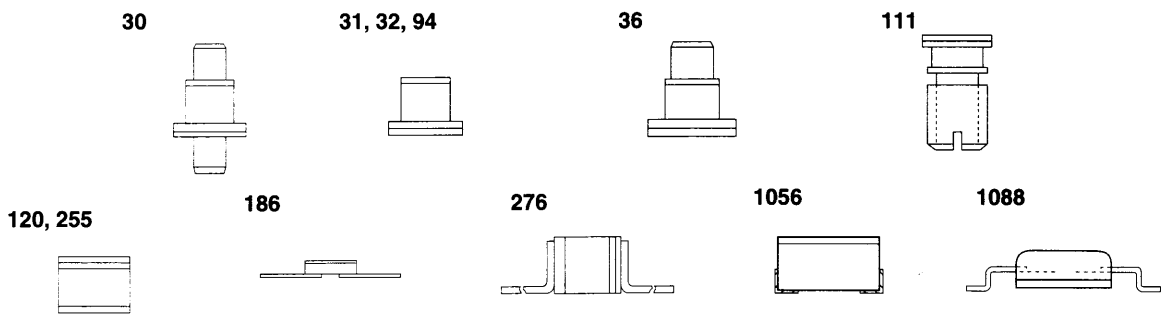
50 to 250 Volt, Fast Switching PIN Diodes
Specifications T_A = +25°C

Model[1] Number	Mimimum[2] Reverse Voltage V_R (Volts)	Maximum[3] Capacitance C_T @ 10V (pF)	Maximum[4] R_S @ 10 mA 500 MHz (ohms)	Maximum Thermal Resistance (°C/W)	Nominal Characteristics		
					Carrier[5] Lifetime (ns)	T_{rr}[6] (ns)	I-Region Width (microns)
MA4P102-30	50	0.30	2.0	60	20	3	7
MA4P202-30	100	0.25	2.5	60	60	5	12
MA4P203-30	100	0.35	1.5	30	100	20	12
MA4P303-30	200	0.35	1.5	30	200	60	20
MA4P404-30	250	0.40*	0.6**	20	1000	100	30

* At 50 Volts
** At 50mA, 100 MHz

The standard case style is 30. Also available in the following packages:
31, 32, 36, 94, 111, 120, 186, 255, 276, 1056 and 1088. See Appendix for full dimensions and nominal parasitic values.



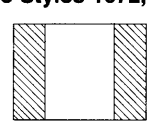
SMQ General Purpose Switching Diodes
Specifications T_A = +25°C

Model Number	Case* Style	Minimum[2] Reverse Voltage V_R (Volts)	Maximum Capacitance C_T @ 50V (pF)	Maximum[3] Resistance I_F @ 10 mA (Ohms)	Typical Current for R_S = 75Ω (mA)	Typical[5] Carrier Lifetime (μs)	Typical I-Region Thickness (mils)	Power Dissipation Rating (watts)
MA4PH235	1072	35	1.2	0.5	—	0.3	0.4	1.0
MA4PH236	1072	200	0.5	3.0	—	1.5	2.0	1.0
MA4PH237	1079	200	1.5	0.6	—	3.0	3.0	2.0
MA4PH238	1072	200	0.5	6.0	0.3 - 0.6	2.0	4.0	1.0
MA4PH239	1079	200	0.8	25.0	1.2 - 2.4	6.0	14.0	2.0

*Available only in case styles indicated. See Appendix for full dimensions.

Notes:
1. The diodes are available in chip form for integrated circuits.
2. The maximum reverse current is 10 μA at voltage rating.
3. Capacitance is specified at 1 MHz.
4. Resistance is specified at 100 MHz unless otherwise indicated.
5. Nominal carrier lifetime is specified at 10 mA.

Case Styles 1072, 1079



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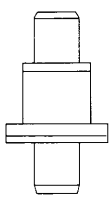
500 Volt CERMACHIP PIN Diodes
Specifications T_A = +25°C

Model[1] Number	Minimum[2] Reverse Voltage V_R (Volts)	Maximum[3] Capacitance C_T @ 100V (pF)	Maximum[4] R_S @ 100 mA (Ohms)	Maximum Thermal Resistance (°C/W)	Nominal Characteristics	
					Carrier[5] Lifetime (us)	I-Region Width (mils)
MA4P504-30	500	0.40	0.60	20	1.0	2
MA4P505-30	500	0.55	0.45	15	2.0	2
MA4P506-30	500	0.90	0.30	10	3.0	2

The standard case style is 30. Also available in the following packages:
31, 32, 36, 111, 255, 258 (isolated Heatsink), 1056, 1088. See Appendix for full dimensions and nominal parasitic values.

30



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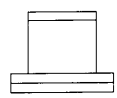

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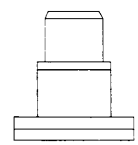
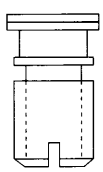


111



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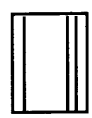

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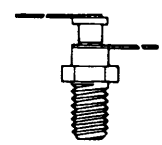


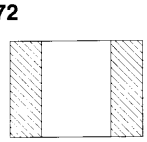
SMQ CERMACHIP High Voltage PIN Diodes
Specifications T_A = +25°C

Model Number	Case* Style	Minimum[2] Reverse Voltage V_R (Volts)	Maximum[3] Capacitance C_T @ V_R = 100 V (pF)	Maximum[4] R_S @ 100 mA (Ohms)	Typical[5] Carrier Lifetime (µs)	Typical I-Region Thickness (mils)	Power Dissipation Rating (Watts)
MA4P504-1072	1072	500	0.5	0.6	1.0	2.0	1.5
MA4P505-1072	1072	500	0.65	0.45	2.0	2.0	1.5
MA4P506-1072	1072	500	1.0	0.3	3.0	2.0	1.5

*See Appendix for full dimensions.

Notes:
1. The diodes are available in chip form for integrated circuits.
2. The maximum reverse current is 10 µA at voltage rating.
3. Capacitance is specified at 1 MHz.
4. Resistance is specified at 100 MHz unless otherwise indicated.
5. Nominal carrier lifetime is specified at 10 mA.

1072



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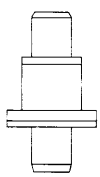
1000 Volt CERMACHIP PIN Diodes
Specifications T_A = +25°C

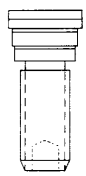
Model[1] Number	Minimum[2] Reverse Voltage V_R (Volts)	Maximum[3] Capacitance C_T @ 100V (pF)	Maximum[4] R_S @ Forward Current (Ohms)	Maximum Thermal Resistance (°C/W)	Nominal Characteristics	
					Carrier[5] Lifetime (µs)	I-Region Width (mils)
MA4P604-30	1000	0.50	1.00 @ 100	20	3.0	4
MA4P606-30	1000	0.80	0.70 @ 100	10	4.0	4
MA4P607	1000	2.00	0.40 @ 100	7	5.0	4
MA4P608-43	1000	3.20	0.35 @ 150	5	5.0	4

The standard case styles are indicated as a suffix to the model number. See Appendix for full dimensions.
The MA4P604 and MA4P606 are available only in case style 30.
The MA4P607 is available only in case styles 43 and 296. Add case style suffix to model number.
The MA4P608 is available only in case style 43.

30, 296



43



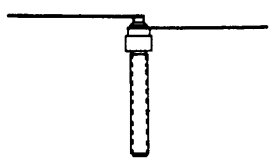
1500 Volt CERMACHIP PIN Diode
Specifications T_A = +25°C

Model Number	Minimum[2] Reverse Voltage V_R (Volts)	Maximum[3] Capacitance C_T @ 100V (pF)	Maximum[4] R_S @ Forward Current (Ohms)	Maximum Thermal Resistance (°C/W)	Nominal Characteristics	
					Carrier[5] Lifetime (µS)	I-Region Width (mils)
MA4P709-150	1500	3.3	0.25 @ 200	2	10	7

The standard case style is 150. Also available in 985 (Isolated heatsink). See Appendix for full dimensions.

150

985



Notes:
1. The diodes are available in chip form for integrated circuits.
2. The maximum reverse current is 10 µA at voltage rating.
3. Capacitance is specified at 1 MHz.
4. Resistance is specified at 100 MHz unless otherwise indicated.
5. Nominal carrier lifetime is specified at 10 mA.

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Maximum Ratings

Parameter	Absolution Max.
Voltage	Voltage Rating
Operating Temperature	- 65°C to +175°C
Storage Temperature	- 65°C to +200°C
Operating & Storage Temp. Case Sty. 1088 (Plastic)	- 65°C to +125°C

Power Dissipation

Cathode Heat Sinked Packages (Case Styles 30, 31, 32, 36, 94, 111, 120, 150, 258, 985, 1072, 1079)	$P_{diss} = \frac{T_{(max.\ operating)} - 25°C}{\text{Thermal Resistance}}$
Leaded Packages @ +25°C (Case Styles 186, 276, 1088)	P_{diss} = 250mW
Surface Mount Package (Case Style 1056)	P_{diss} = 300mW

Environmental Ratings

Per MIL-STD 750

The following table is recommended for Group B and C testing for TX, TXV level screening.

	Method	Level
Storage Temperature	1031	See maximum ratings
Operating Temperature	—	See maximum ratings
Temperature Cycling	1051	5 cycles -65° to + 150°C
Shock	2016	500 g's
Vibration	2056	15 g's
Constant Acceleration	2006	20,000 g's
Humidity	1021	10 days

Maximum Soldering Temperature

Case Style 150, 186, 258, 985, 188: 200°C maximum for 5 seconds.

Case Style 120, 255, 276: 200°C maximum for 5 seconds — cathode only.

Case Style 30, 31, 32, 36, 43, 94, 111, 296: 225°C maximum for 5 seconds.

Case Style 1088: 150°C maximum for 5 seconds, 1mm from the case.

Screened Diodes (MIL-STD 750)

Suggested 100% preconditioning and screening program for TX level and TXV level screening.

Inspection	Method	Condition
Internal Visual and/or Xray	2072/2076	See note
High Temp. Storage	1032	48 hours minimum @ max. storage temp.
Thermal Shock	1051	10 Cycles
Constant Acceleration	2006	20,000 g's, Y1
Fine Leak	1071	H
Gross Leak	1071	C or E
Electrical	—	See note
Burn-In	1038	See note

Note:
Conditions and details of test depend on specific model number. Information available upon request. The case styles 1056 and 1088 are not military (MIL-STD-750 rated packages).

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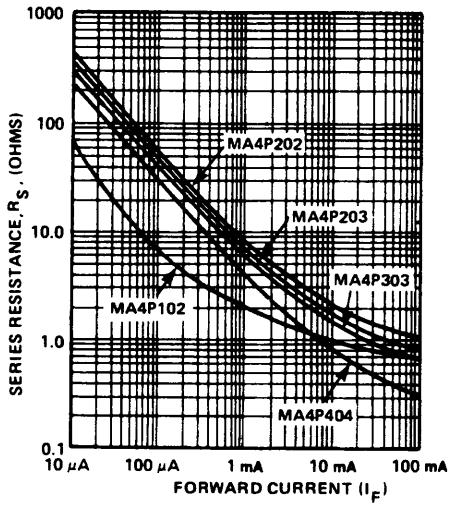
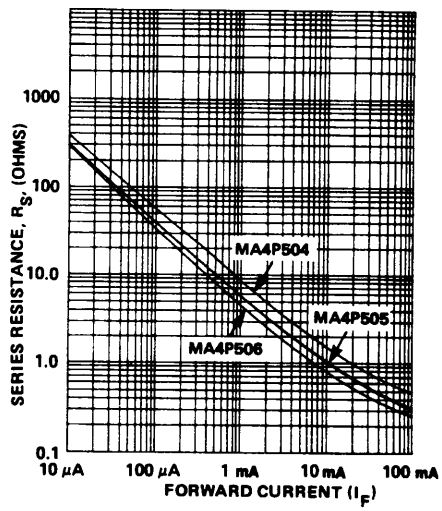
Typical Resistance Curves

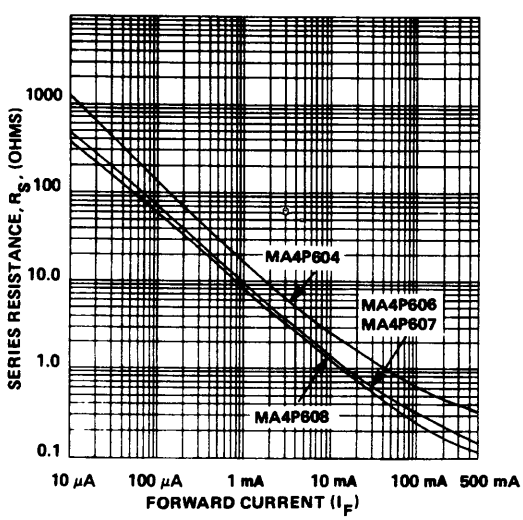
FORWARD CURRENT vs SERIES RESISTANCE
(MA4P202, MA4P203, MA4P303, MA4P404 AND MA4P102)



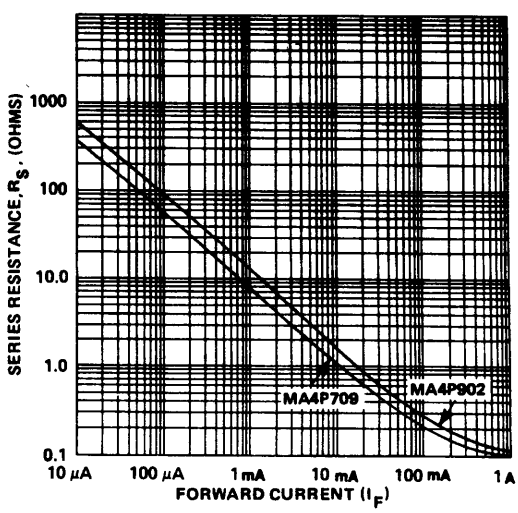
FORWARD CURRENT vs SERIES RESISTANCE
(MA4P504, MA4P505, MA4P506)



FORWARD CURRENT vs SERIES RESISTANCE
(MA4P604, MA4P606, MA4P607, MA4P608)



FORWARD CURRENT vs SERIES RESISTANCE
(MA4P709, MA4P902)



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