

# Packaged PIN Diodes

V11

## Features

- ◆ High Power
- ◆ Fast Speed
- ◆ Voltage Ratings to 1500 Volts
- ◆ Wide Selection of Carrier Lifetimes
- ◆ Wide Selection of Capacitances
- ◆ Assortment of Packages Styles
- ◆ Available Screened for Military Applications
- ◆ RoHS Compliant

## Description and Applications

M/A-COM Tech's broad line of packaged PIN diodes encompass a comprehensive range of electrical characteristics and package outlines. This diverse union of semiconductor technology and chip packaging gives considerable flexibility to the circuit designer. The fast switching series of Packaged PIN Diodes utilize a thin I-region, silicon oxide or glass passivated chip which provides for low leakage current and low insertion loss. With the use of in process control monitors to regulate wafer fabrication parameters, these devices will achieve consistent performance in control circuit applications. The high voltage product line of Packaged PIN Diodes employs M/A-COM Tech's CERMACHIP® passivation process which provides for a hard glass encapsulation that hermetically seals and protects the active area of the chip. These packaged CERMACHIP® PIN diodes are ideally suited for use in high power applications where high level RF voltages are present. The diode chips are bonded into sealed ceramic packages that are designed for the most stringent electrical and environmental conditions. An extensive choice of package styles are available which may be used in a wide variety of RF microwave circuits. The Packaged PIN Diodes series are designed to have a high inherent reliability and may be ordered screened to meet many MIL-STD requirements.

## Absolute Maximum Ratings<sup>1</sup>

| Parameter                               | Absolution Max.       |
|-----------------------------------------|-----------------------|
| Voltage                                 | As Specified in Table |
| Operating Temperature                   | - 65°C to +175°C      |
| Storage Temperature                     | - 65°C to +200°C      |
| Operating and Storage (Case Style 1088) | - 65°C to +125°C      |

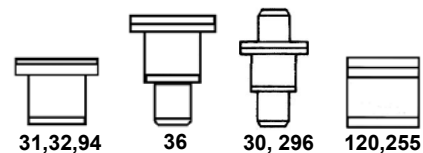
1. Operation beyond any one of the above conditions may cause permanent damage to the device.

Specifications subject to change without prior notification.

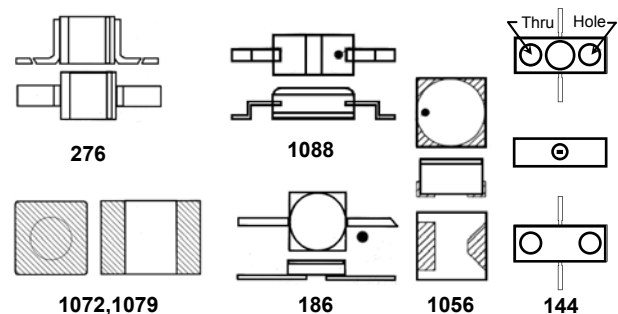
## Maximum Power Dissipation

|                                                                                                    |                                                                                    |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b><u>Cathode Heatsink Packages</u></b><br>30,31,32,36,43,94,111,120,<br>150,255 258,296,1072,1079 | $P_{diss} = \frac{T (max \text{ oper.}) - 25^{\circ}C}{\text{Thermal Resistance}}$ |
| <b><u>Leaded Packages +25°C</u></b><br>144, 186, 276,1088                                          | $P_{diss} = 250mW$                                                                 |
| <b><u>Surface Mount Package +25°C</u></b><br>1056                                                  | $P_{diss} = 300mW$                                                                 |

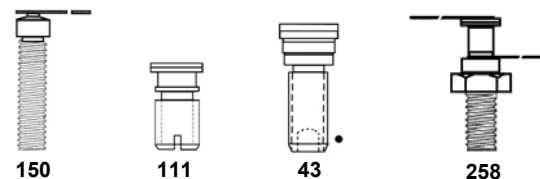
## Co-Axial Packages



## Leaded/Surface Mount Packages



## Threaded Packages



## Unpackaged Die



131,132.134 , 212

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## Packaged PIN Diodes

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### 100V to 250V Fast Switching PIN Diodes Specifications ( $T_{AMB} = +25^{\circ}\text{C}$ )

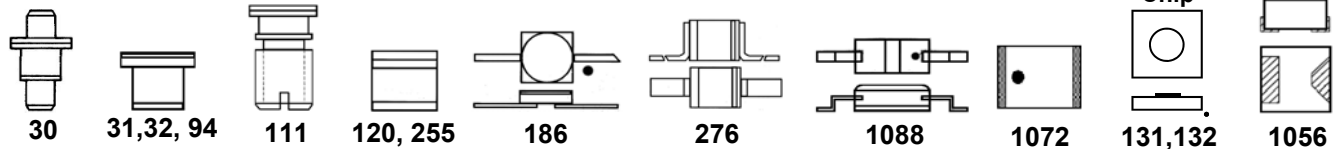
| Part Number | Minimum Reverse Voltage <sup>1</sup> | (Unless otherwise specified)<br>Maximum Capacitance | (Unless otherwise specified)<br>Maximum Series Res.    | Maximum Thermal Resistance | Nominal Characteristics             |                             |                           |
|-------------|--------------------------------------|-----------------------------------------------------|--------------------------------------------------------|----------------------------|-------------------------------------|-----------------------------|---------------------------|
|             | @ $I_R < 10\mu\text{A}$<br>Volts     | $C_T @ -10\text{V}$<br>$f = 1\text{MHz}$<br>pF      | $R_S @ 10\text{mA}$<br>$f = 500\text{MHz}$<br>$\Omega$ | $^{\circ}\text{C/W}$       | Carrier Lifetime <sup>4</sup><br>nS | $T_{RR}$ <sup>5</sup><br>nS | I-Region Width<br>Microns |
| MA4P202-120 | 100                                  | 0.25                                                | 2.50                                                   | 60                         | 60                                  | 5                           | 12                        |
| MA4P203-30  | 100                                  | 0.35                                                | 1.50                                                   | 30                         | 100                                 | 20                          | 12                        |
| MA4P303-32  | 200                                  | 0.35                                                | 1.50                                                   | 30                         | 200                                 | 60                          | 20                        |
| MA4P404-30  | 250                                  | 0.40 <sup>2</sup>                                   | 0.70 <sup>3</sup>                                      | 20                         | 1000                                | 100                         | 30                        |

#### Notes:

1. The minimum specified  $V_R$  (Reverse Voltage) is sourced and the resultant reverse leakage current,  $I_R$ , is measured to be  $<10\mu\text{A}$
2. At  $V_R = -50\text{V}$
3.  $R_S$  measured at  $I_F = +50\text{mA}$ ,  $f = 100\text{MHz}$ .
4. Nominal carrier life time specified with diode biased at  $I_F = +10\text{mA}$ ,  $I_{REV} = -6\text{mA}$

#### Package Options

Consult the "Package Availability Table" on page 7 for package style choices.



[Package Dimensions](#) can be found on the [M/A-COM Technology Solutions website](#).

### 35V to 500V MELF General Purpose Switching Diodes Specifications ( $T_{AMB} = +25^{\circ}\text{C}$ )

| Part Number <sup>1</sup> | Minimum Reverse Voltage <sup>2</sup> | Maximum Capacitance                           | (Unless otherwise specified)<br>Maximum Series Res.    | CW Power Dissipation Rating | Nominal Characteristics                      |                                                |                        |
|--------------------------|--------------------------------------|-----------------------------------------------|--------------------------------------------------------|-----------------------------|----------------------------------------------|------------------------------------------------|------------------------|
|                          | $I_R < 10\mu\text{A}$<br>Volts       | $C_T @ 10\text{V}$<br>$f = 1\text{MHz}$<br>pF | $R_S @ 10\text{mA}$<br>$f = 100\text{MHz}$<br>$\Omega$ | Watts                       | Typical $I_F$ When<br>$R_S = 75\Omega$<br>mA | Carrier Lifetime <sup>3</sup><br>$\mu\text{S}$ | I-Region Width<br>mils |
| MA4PH235-1072T           | 35                                   | 1.2                                           | 0.50                                                   | 1.0                         | —                                            | 0.3                                            | 0.4                    |
| MADP-000593-10720T       | 150                                  | 1.5                                           | 0.55                                                   | 10                          | —                                            | 1.0                                            | 21                     |
| MA4PH236-1072T           | 600                                  | 0.5                                           | 3.0                                                    | 1.0                         | —                                            | 1.5                                            | 2.0                    |
| MA4PH237-1079T           | 200                                  | 1.5                                           | 0.6@50mA                                               | 2.0                         | —                                            | 3.0                                            | 3.0                    |
| MA4PH238-1072T           | 200                                  | 0.5                                           | 6.0                                                    | 1.0                         | 0.30-0.60                                    | 2.0                                            | 4.0                    |
| MA4PH239-1079T           | 200                                  | 0.8                                           | 25.0                                                   | 2.0                         | 1.20-2.40                                    | 6.0                                            | 14.0                   |
| MADP-000234-10720T       | 500                                  | 1.5 <sup>4</sup>                              | 0.25@100mA                                             | 5.0                         | —                                            | 3.0                                            | 2.0                    |

#### Notes:

1. Only available in case styles indicated.
2. The minimum specified  $V_R$  (Reverse Voltage) is sourced and the resultant reverse leakage current,  $I_R$ , is measured to be  $<10\mu\text{A}$ .
3. Nominal carrier life time specified with diode biased at  $I_F = +10\text{mA}$ ,  $I_{REV} = -6\text{mA}$
4.  $C_t$  tested at 100V



Case Styles 1072, 1079

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# Packaged PIN Diodes

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## 500V PIN Diodes Specifications ( $T_{AMB} = +25^{\circ}\text{C}$ )

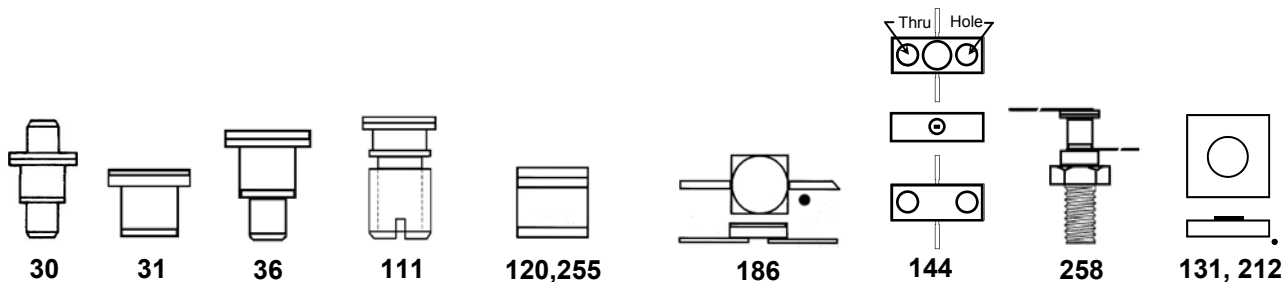
| Part Number                    | Minimum Reverse Voltage <sup>1</sup> | Maximum Capacitance                             | Maximum Series Resistance                                | CW Power Dissipation Rating | Nominal Characteristics                        |                        |
|--------------------------------|--------------------------------------|-------------------------------------------------|----------------------------------------------------------|-----------------------------|------------------------------------------------|------------------------|
|                                | $I_R < 10\mu\text{A}$<br>Volts       | $C_T @ 100\text{V}$<br>$f = 1\text{ MHz}$<br>pF | $R_S @ 100\text{mA}$<br>$f = 100\text{ MHz}$<br>$\Omega$ | Watts                       | Carrier Lifetime <sup>2</sup><br>$\mu\text{S}$ | I-Region Width<br>mils |
| MA4P504-30                     | 500                                  | 0.40                                            | 0.60                                                     | 10                          | 1.0                                            | 2                      |
| MADP000015-000030 <sup>3</sup> | 500                                  | 0.55                                            | 0.45                                                     | 15                          | 2.0                                            | 2                      |
| MA4P506-30                     | 500                                  | 0.90                                            | 0.30                                                     | 15                          | 3.0                                            | 2                      |

### Notes:

1. The minimum specified  $V_R$  (Reverse Voltage) is sourced and the resultant reverse leakage current,  $I_R$ , is measured to be  $<10\mu\text{A}$ .
2. Nominal carrier life time specified with diode biased at  $I_F = +10\text{mA}$ ,  $I_{REV} = -6\text{mA}$
3. To order this part in a package style other than 30, use the prefix MA4P505 followed by a dash and the desired package style.

### Package Options

Consult the "Package Availability Table" on page 7 for package style choices.



[Package dimensions](#) can be found on the M/A-COM Technology Solutions website.

## 500V MELF PIN Diode Specifications ( $T_{AMB} = +25^{\circ}\text{C}$ )

| Part Number   | Minimum Reverse Voltage <sup>1</sup> | Maximum Capacitance                             | Maximum Series Resistance                                | CW Power Dissipation Rating | Nominal Characteristics                        |                        |
|---------------|--------------------------------------|-------------------------------------------------|----------------------------------------------------------|-----------------------------|------------------------------------------------|------------------------|
|               | $I_R < 10\mu\text{A}$<br>Volts       | $C_T @ 100\text{V}$<br>$f = 1\text{ MHz}$<br>pF | $R_S @ 100\text{mA}$<br>$f = 100\text{ MHz}$<br>$\Omega$ | Watts                       | Carrier Lifetime <sup>2</sup><br>$\mu\text{S}$ | I-Region Width<br>mils |
| MA4P504-1072T | 500                                  | 0.5                                             | 0.60                                                     | 10                          | 1.0                                            | 2                      |
| MA4P505-1072T | 500                                  | 0.65                                            | 0.45                                                     | 15                          | 2.0                                            | 2                      |
| MA4P506-1072T | 500                                  | 1.0                                             | 0.30                                                     | 15                          | 3.0                                            | 2                      |

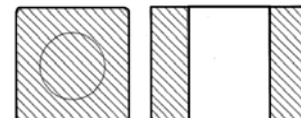
### Notes:

1. The minimum specified  $V_R$  (Reverse Voltage) is sourced and the resultant reverse leakage current,  $I_R$ , is measured to be  $<10\mu\text{A}$ .
2. Nominal carrier life time specified with diode biased at  $I_F = +10\text{mA}$ ,  $I_{REV} = -6\text{mA}$

3

Specifications subject to change without prior notification.

### 1072 Package



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## Packaged PIN Diodes

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### 1000V CERMACHIP PIN Diodes Specification ( $T_{AMB} = +25^{\circ}\text{C}$ )

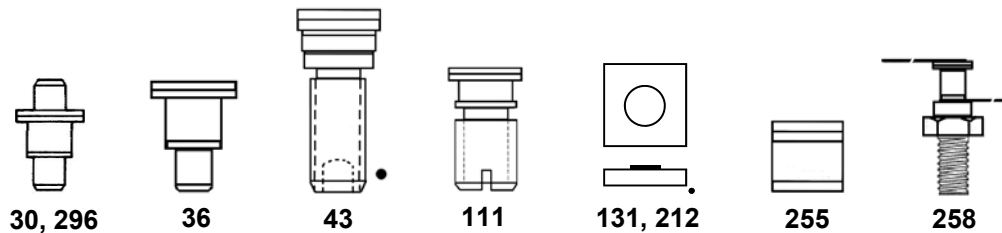
| Part Number | Minimum Reverse Voltage <sup>1</sup> | Maximum Capacitance                            | Maximum Series Resistance                               | CW Power Dissipation Rating | Nominal Characteristics                        |                        |
|-------------|--------------------------------------|------------------------------------------------|---------------------------------------------------------|-----------------------------|------------------------------------------------|------------------------|
|             | $I_R < 10\mu\text{A}$<br>Volts       | $C_T @ 100\text{V}$<br>$f = 1\text{MHz}$<br>pF | $R_s @ 100\text{mA}$<br>$f = 100\text{MHz}$<br>$\Omega$ | Watts                       | Carrier Lifetime <sup>2</sup><br>$\mu\text{S}$ | I-Region Width<br>Mils |
| MA4P604-30  | 1000                                 | 0.50                                           | 1.00                                                    | 15                          | 3.0                                            | 4                      |
| MA4P606-30  | 1000                                 | 0.80                                           | 0.70                                                    | 20                          | 4.0                                            | 4                      |
| MA4P607-43  | 1000                                 | 2.00                                           | 0.40                                                    | 25                          | 5.0                                            | 4                      |

#### Notes:

- The maximum specified  $V_R$  (reverse voltage) is sourced and the resultant reverse leakage current,  $I_r$ , is measured to be  $< 10\mu\text{A}$
- Nominal carrier life time specified with diode biased at  $I_F = +10\text{mA}$ ,  $I_{REV} = -6\text{mA}$

#### Package Options

Consult the "Package Availability Table" on page 7 for package style choices.



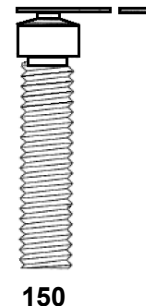
[Package dimensions](#) can be found on the [M/A-COM Technology Solutions website](#).

### 1500V CERMACHIP PIN Diode Specifications ( $T_{AMB} = +25^{\circ}\text{C}$ )

| Part Number | Minimum Reverse Voltage <sup>1</sup> | Maximum Capacitance                            | Maximum Series Resistance                               | Maximum Thermal Resistance | Nominal Characteristics                        |                        |
|-------------|--------------------------------------|------------------------------------------------|---------------------------------------------------------|----------------------------|------------------------------------------------|------------------------|
|             | $I_R < 10\mu\text{A}$<br>Volts       | $C_t @ 100\text{V}$<br>$f = 1\text{MHz}$<br>pF | $R_s @ 200\text{mA}$<br>$f = 100\text{MHz}$<br>$\Omega$ | $^{\circ}\text{C/W}$       | Carrier Lifetime <sup>2</sup><br>$\mu\text{S}$ | I-Region Width<br>mils |
| MA4P709-150 | 1500                                 | 3.30                                           | 0.25                                                    | 2                          | 10.0                                           | 7                      |

#### Notes:

- The minimum specified  $V_R$  (reverse voltage) is sourced and the resultant reverse leakage current,  $I_r$ , is measured to be  $< 10\mu\text{A}$
- Nominal carrier life time specified with diode biased at  $I_F = +10\text{mA}$ ,  $I_{REV} = -6\text{mA}$

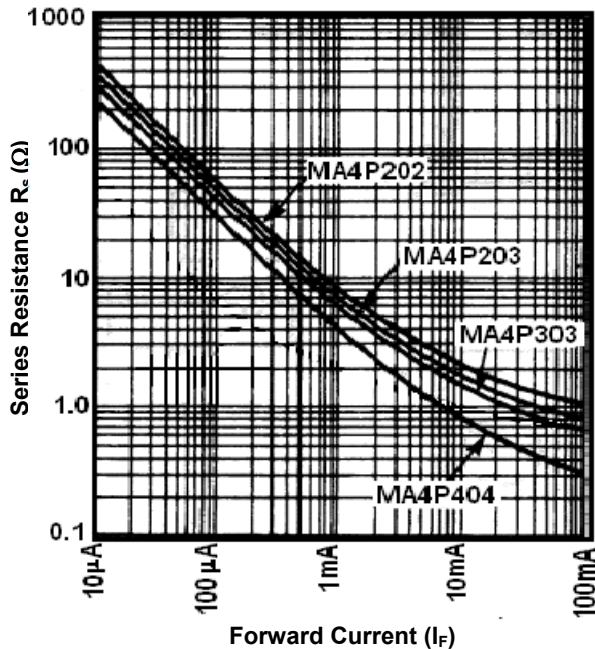


150

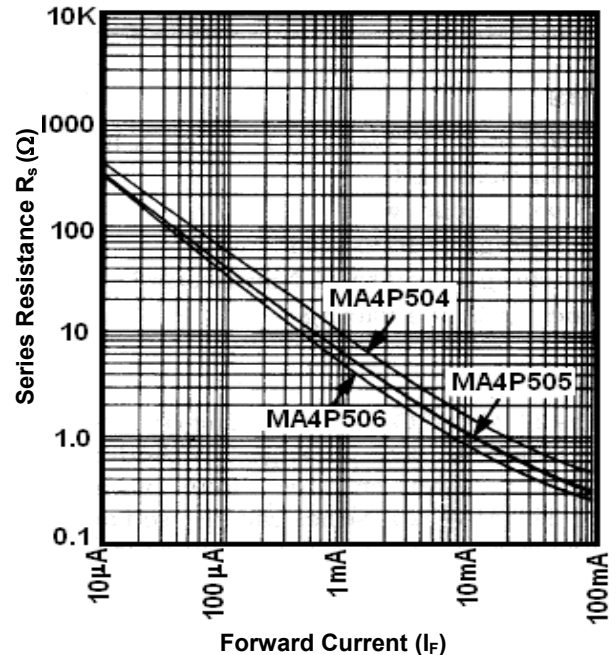
# Packaged PIN Diodes

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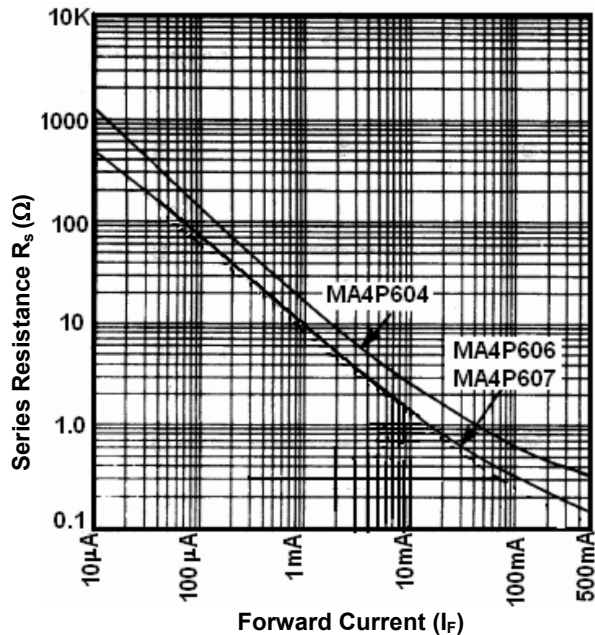
**Forward Current vs. Series Resistance**  
MA4P202, MA4P203, MA4P303 and MA4P404  
100MHz



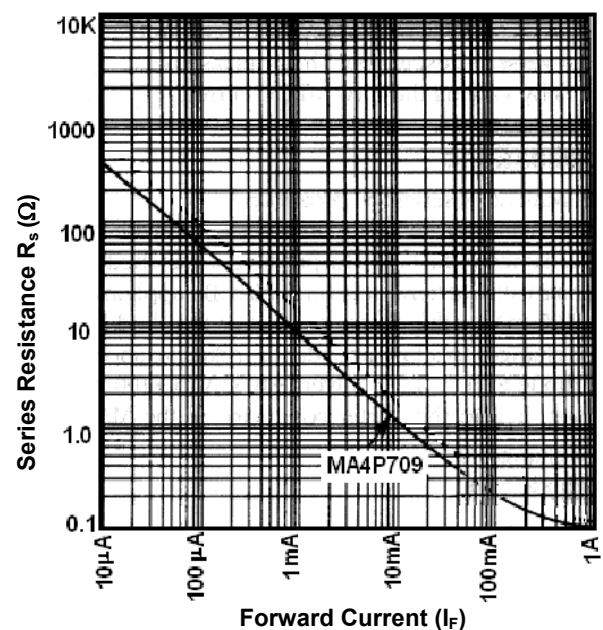
**Forward Current vs. Series Resistance**  
MA4P504, MA4P505 and MA4P506  
100MHz



**Forward Current vs. Series Resistance**  
MA4P604, MA4P606 and MA4P607  
100MHz



**Forward Current vs. Series Resistance**  
MA4P709  
100MHz



## Packaged PIN Diodes

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### Recommended Groups B & C Testing Per MIL-STD 750

Recommended methods and conditions for Groups B, C and equivalent TX and TXV level screening.

| Inspection            | Method | Condition                    |
|-----------------------|--------|------------------------------|
| Storage Temperature   | 1031   | See Maximum Ratings          |
| Operating Temperature | —      | See Maximum Ratings          |
| Temperature Cycling   | 1051   | 5 cycles<br>- 65°C to +150°C |
| Shock                 | 2016   | 500g's                       |
| Vibration             | 2056   | 15g's                        |
| Constant Acceleration | 2006   | 20,000g's                    |
| Humidity              | 1021   | 10 Days                      |

### Recommended Screening Per MIL-STD 750

Recommended methods and conditions for equivalent TX and TXV level screening.

| Inspection                     | Method     | Condition                          |
|--------------------------------|------------|------------------------------------|
| Internal Visual and / or X-Ray | 2072, 2076 | See Note                           |
| High Temp. Storage             | 1032       | 48 hours min. @ 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                           |

#### Notes:

- Conditions and details of test depend on specific model number. Information available upon request.
- Case styles 1056 and 1088 are not military, MIL-STD-750, rated packages.

# Packaged PIN Diodes

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## Maximum Soldering Temperature

### For hand soldering operation:

Case Style: 120, 144, 150\*, 186, 255, 258\*, 276, 1088, 1072, 1079 ♦ 265°C maximum for 5 seconds

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

### \*Note:

Package styles that are threaded or have pronged ends rely on a pressure connection and do not require solder attachment but can be soldered if desired.

### For solder reflow profiles:

Refer to application note M-538 on the M/A-COM website using the following link:

<http://www.macomtech.com/Application%20Notes/pdf/M538.pdf>

## Ordering Information

The Packaged PIN Diode specifications shown in the tables on pages 2, 3, & 4 are for the standard style package. The standard package style is indicated by the number following the dash after the base part number. Note that the specification tables lists the total diode capacitance for the standard case style. The total capacitance for the base part in an alternative package will differ and is computed by adding the junction capacitance of the chip and the parasitic capacitance of the alternative package as defined in the **Package Parasitic Capacitance** table below. To compute the chip junction capacitance, subtract the total capacitance shown in the specifications tables on pages 2, 3, & 4 from the appropriate standard style package capacitance below. The various base part numbers are only available in the case styles shown in the **Package Availability Table** below. To order, indicate the base part number followed by a dash and the desired package style.

For example: The MA4P506-258 is the MA4P506 chip in the 258 style package.

**Package Availability Table**

| Base Part Number  | Available ODS Package Styles        |
|-------------------|-------------------------------------|
| MA4P202           | 120, 134, 276, 1056                 |
| MA4P203           | 30, 32, 94, 111, 134, 1056          |
| MA4P303           | 32, 36, 94, 120, 186, 255, 1088     |
| MA4P404           | 30, 31, 36, 111, 132, 258, 1072T*   |
| MA4P504           | 30, 120, 132, 144, 186, 255, 1072T* |
| MA4P505           | 36, 131, 255, 1072T*                |
| MA4P506           | 30, 31, 36, 131, 255, 258, 1072T*   |
| MA4P604           | 30, 43, 131, 255, 258               |
| MA4P606           | 30, 36, 131, 258                    |
| MA4P607           | 43, 212, 296                        |
| MA4P709           | 150                                 |
| MADP000015-000030 | 30                                  |
| MA4PH235          | 1072T*                              |
| MA4PH236          | 1072T*                              |
| MA4PH237          | 1079T*                              |
| MA4PH238          | 1072T*                              |
| MA4PH239          | 1079T*                              |
| MADP-000234       | 10720T* (1072 package style)        |

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

**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       |
| 131           | N/A (chip) |
| 132           | N/A (chip) |
| 134           | N/A (chip) |
| 144           | 0.42       |
| 186           | 0.15       |
| 212           | N/A (chip) |
| 255           | 0.30       |
| 258           | 0.18       |
| 276           | 0.13       |
| 296           | 0.35       |
| 1056          | 0.20       |
| 1072          | 0.16       |
| 1079          | 0.13       |
| 1088          | 0.12       |

Tape and reel information can be found on the M/A-COM website at <http://www.macomtech.com/Application%20Notes/pdf/M513.pdf>

Package dimensions can be found on the M/A-COM website at <http://www.macomtech.com/static/content.aspx?page=outlinedrawings>

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