

# KILOVOLT™ Series

## 2000 Volt & 3000 Volt PIN Diodes MA4PK200X & MA4PK300X

V10

### Features

- Reverse Voltage up to 3000 Volts
- 25 Ampere Current Rating
- Designed for HF, Multi-Throw Kilowatt Switches
- Low Loss, Low Distortion
- Rugged, Hermetically Sealed Packaging
- Convenient Solder Lug Attachment
- Non Magnetic to 3 Tesla for MRI Applications
- RoHS Compliant

### Description

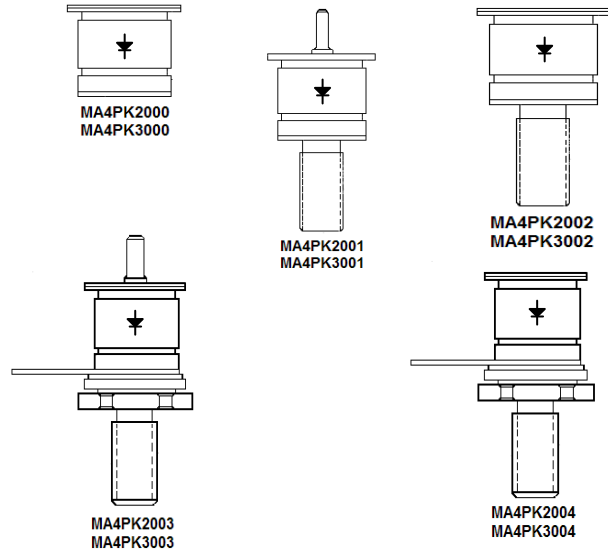
M/A-COM Technology Solutions KILOVOLT™ PIN diode series utilize modern semiconductor and packaging technology that assures low loss, low distortion, and reliable performance in multi-kilowatt switch applications at frequencies as low as 1 MHz. The PIN chips employed have low resistance, high power dissipation and very high stand-off voltage capability. KILOVOLT™ PIN diodes employ ultra high resistivity, long carrier lifetime, float zone material onto which P+ and N+ regions are deposited using an epitaxial process designed by M/A-COM Technology Solutions for high voltage PIN diodes. This process results in better preservation of the carrier lifetime and superior layer to layer interface when compared to a conventional double diffused process. The processing of the I-region width is tightly controlled using modern lapping techniques. KILOVOLT™ PIN diode chips utilize M/A-COM Technology Solutions proprietary Cermachip™ glass passivation. The hard glass covers all exposed junction and intrinsic surfaces. This results in a hermetically sealed, passivated chip that has been used in many high reliability military and commercial programs.

### Applications

The KILOVOLT™ PIN diode series is designed for use as high power switching elements in multi-kilowatt HF and VHF applications. These PIN diodes have been extensively characterized for their electrical and thermal properties to assure predictable, low loss, high power handling and low distortion performance. Some typical applications are as follows:

- Filter Switches
- Antenna Couplers
- Power Amplifier By-pass Switches
- MRI Switches

### Package Outlines



### Packaging

The metal-ceramic packages were developed specifically for the KILOVOLT™ PIN diode series. The packages are designed to withstand extremely high voltages and currents. The packages meet the environmental requirements of MIL-STD-202 and MIL-STD750. The PIN diode chip is bonded to the package and the anode strap is bonded to the chip at temperatures exceeding 300°C. The anode strap has a unique, large cross-sectional area allowing for high current carrying capability. The packages are sealed using a projection welding technique in an inert environment. KILOVOLT™ PIN diodes are available with a solder lug on the anode electrode to allow for a convenient and reliable wrap-around

### Diode Part Numbers & Package Style

| 2000 Volts | 3000 Volts | Package Style                        |
|------------|------------|--------------------------------------|
| MA4PK2000  | MA4PK3000  | Pill                                 |
| MA4PK2001  | MA4PK3001  | Threaded Stud & Solder Lug           |
| MA4PK2002  | MA4PK3002  | Threaded Stud Only                   |
| MA4PK2003  | MA4PK3003  | Insulated Threaded Stud & Solder Lug |
| MA4PK2004  | MA4PK3004  | Insulated Threaded Stud Only         |

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| ABSOLUTE MAXIMUM RATINGS      |                  | MAXIMUM POWER DISSIPATION @ T <sub>CASE</sub> = 25°C |            |
|-------------------------------|------------------|------------------------------------------------------|------------|
| Operating and Storage Temp.   | -65°C to +175°C  | MA4PK2001<br>MA4PK2002                               | 50 Watts   |
| Installation Temperature      | 250°C/30 Seconds | MA4PK2003<br>MA4PK2004                               | 37.5 Watts |
| Instantaneous Reverse Voltage | Voltage Rating   | MA4PK3001<br>MA4PK3002                               | 75 Watts   |
| Forward Current (RF and DC)   | 25 Amperes       | MA4PK3003<br>MA4PK3004                               | 50 Watts   |
| ESD                           | Class 1C, HBM    |                                                      |            |

### Electrical Specifications<sup>1</sup> @ T<sub>A</sub> = 25°C

| PARAMETER                                    | CONDITION                   | MA4PK2000 Series                 | MA4PK3000 Series                 |
|----------------------------------------------|-----------------------------|----------------------------------|----------------------------------|
| Reverse Voltage (Max)<br>V <sub>R</sub>      | 10 μA                       | 2000 Volts                       | 3000 Volts                       |
| Series Resistance (Max)<br>R <sub>S</sub>    | F = 4 MHz, I = 0.5 A        | 0.20 Ω                           | 0.25 Ω                           |
| Series Resistance (Typ.)<br>R <sub>S</sub>   | F = 1.0 -100 MHz, I = 0.5 A | 0.10 Ω                           | 0.15 Ω                           |
| Total Capacitance (Max)<br>C <sub>T</sub>    | F = 1 MHz, V = 100 V        | 3.2 pF                           | 4.0 pF                           |
| Parallel Resistance (Typ.)<br>R <sub>P</sub> | F =100 MHz, V = 0 V         | 5K Ω                             | 10K Ω                            |
| Carrier Lifetime (Min)<br>T <sub>L</sub>     | IF = 10 mA                  | 30 μs                            | 65 μs                            |
| Forward Voltage (Max)<br>V <sub>F</sub>      | IF = 1 A                    | 1.2 V                            | 1.2 V                            |
| Thermal Resistance (Max)<br>Ø                |                             | 3°C/W (Stud)<br>4°C/W (Ins Stud) | 2°C/W (Stud)<br>3°C/W (Ins Stud) |
| I-Region Width (Nom)                         |                             | 200 μm                           | 325 μm                           |

1. Specifications Subject to Change Without Notice.

# KILOVOLT™ Series

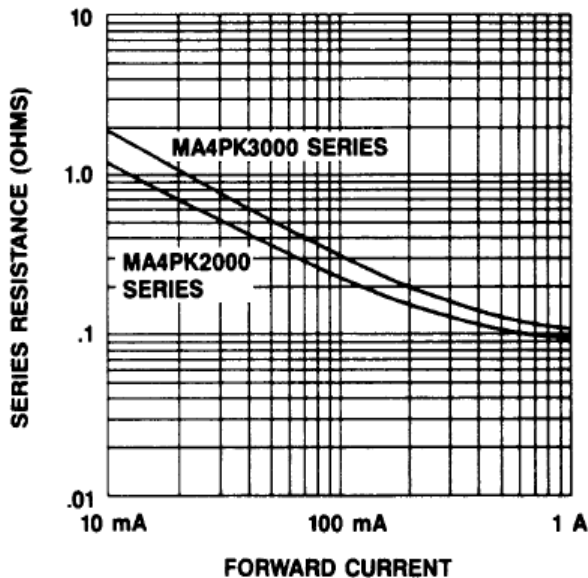


2000 Volt & 3000 Volt PIN Diodes  
MA4PK200X & MA4PK300X

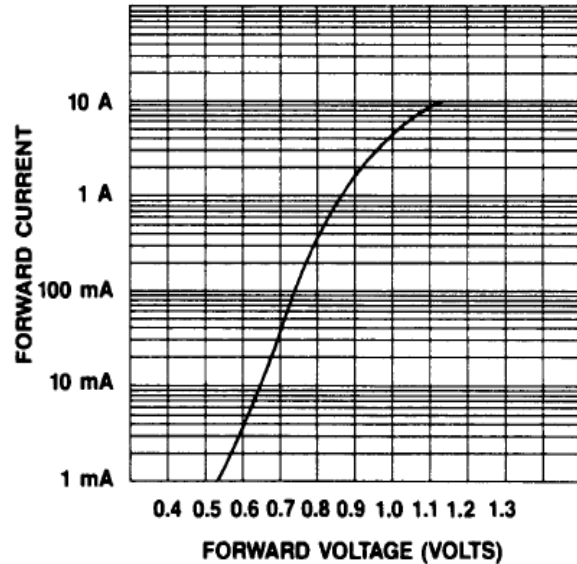
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## Typical Performance Curves @ +25°C

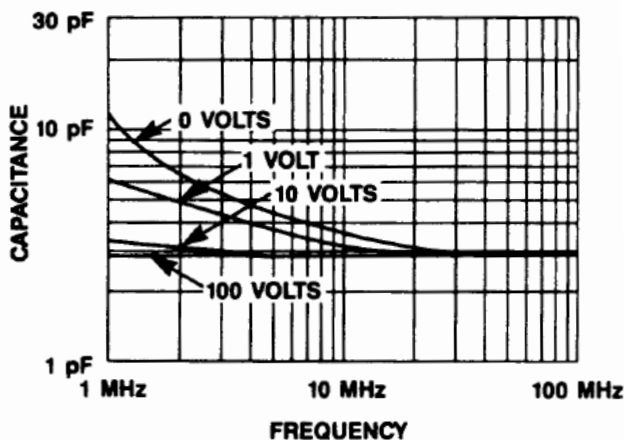
Series Resistance vs. Current @ 100MHz  
(MA4PK2000 & MA4PK3000 Series)



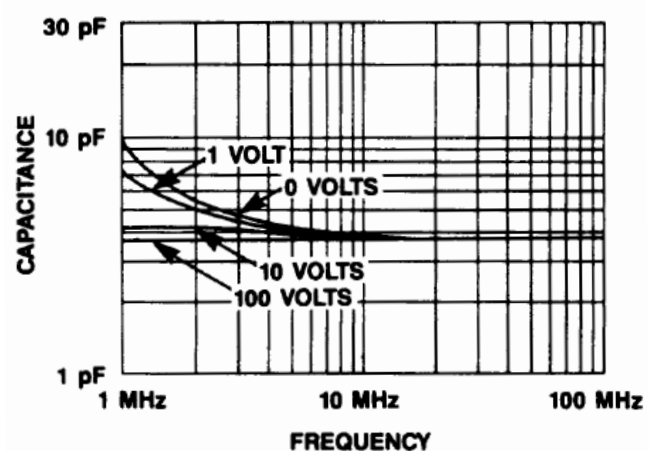
Forward Voltage vs. Forward Current  
(MA4PK2000 & MA4PK3000 Series)



Capacitance vs. Frequency & Reverse Voltage  
(MA4PK2000 Series)



Capacitance vs. Frequency & Reverse Voltage  
(MA4PK3000 Series)



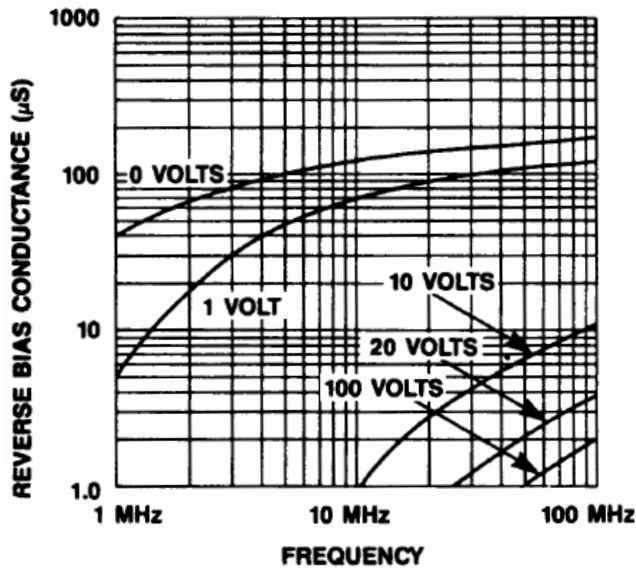
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MA4PK200X & MA4PK300X

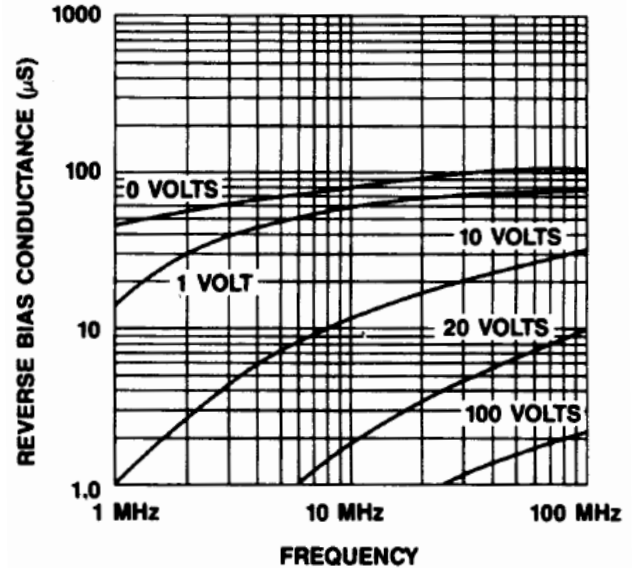
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## Typical Performance Curves @ 25°C

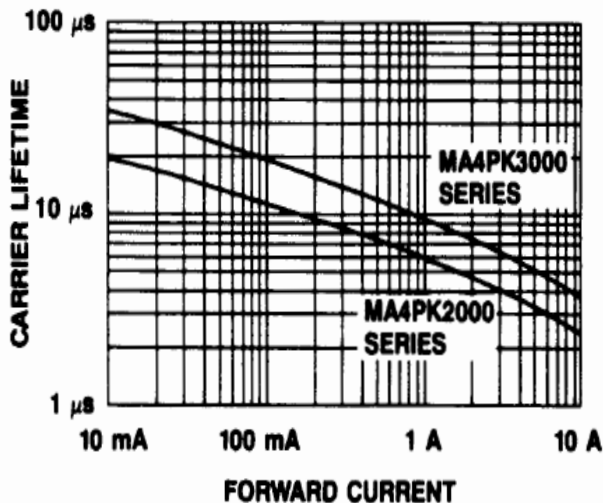
Conductance vs. Frequency & Reverse Voltage  
(MA4PK2000 SERIES)



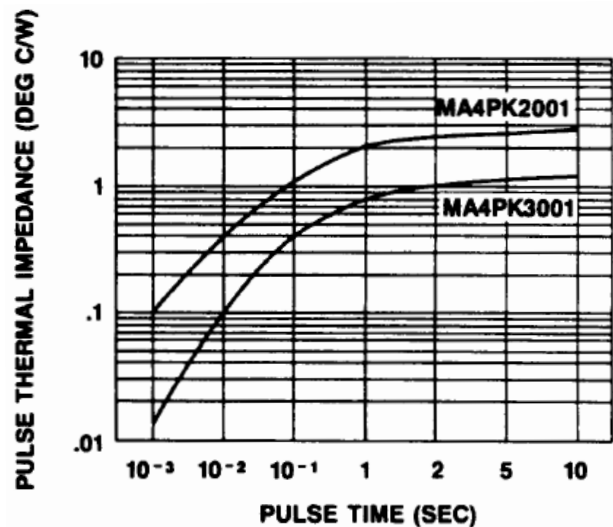
Conductance vs. Frequency & Reverse Voltage  
(MA4PK3000 SERIES)



Carrier Lifetime vs. Forward Current



Pulsed Thermal Resistance



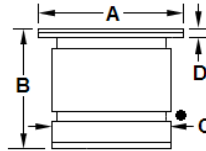
# KILOVOLT™ Series



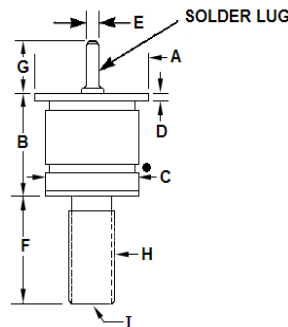
## 2000 Volt & 3000 Volt PIN Diodes MA4PK200X & MA4PK300X

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### Case Styles • Black Dot Denotes Cathode



| DIM | MA4PK2000<br>CASE STYLE 1027 |       |                      |      | MA4PK3000<br>CASE STYLE 1073 |       |                      |       |
|-----|------------------------------|-------|----------------------|------|------------------------------|-------|----------------------|-------|
|     | INCHES                       |       | MILLIMETERS          |      | INCHES                       |       | MILLIMETERS          |       |
|     | MIN                          | MAX   | MIN                  | MAX  | MIN                          | MAX   | MIN                  | MAX   |
| A   | 0.304                        | 0.316 | 7.72                 | 8.02 | 0.468                        | 0.485 | 11.90                | 12.30 |
| B   | 0.286                        | 0.292 | 7.26                 | 7.42 | 0.387                        | 0.411 | 9.83                 | 10.40 |
| C   | 0.245                        | 0.255 | 6.22                 | 6.48 | 0.390                        | 0.400 | 9.90                 | 10.10 |
| D   | 0.023                        | 0.031 | 0.58                 | 0.79 | 0.028                        | 0.042 | 0.71                 | 1.06  |
|     | $C_P = .45 \text{ pF}$       |       | $L_S = 2 \text{ nH}$ |      | $C_P = .75 \text{ pF}$       |       | $L_S = 3 \text{ nH}$ |       |



| DIM | MA4PK2001<br>CASE STYLE 1082 |       |                      |      | MA4PK3001<br>CASE STYLE 1084 |       |                      |       |
|-----|------------------------------|-------|----------------------|------|------------------------------|-------|----------------------|-------|
|     | INCHES                       |       | MILLIMETERS          |      | INCHES                       |       | MILLIMETERS          |       |
|     | MIN                          | MAX   | MIN                  | MAX  | MIN                          | MAX   | MIN                  | MAX   |
| A   | 0.304                        | 0.316 | 7.72                 | 8.02 | 0.468                        | 0.485 | 11.90                | 12.30 |
| B   | 0.286                        | 0.292 | 7.26                 | 7.42 | 0.387                        | 0.411 | 9.83                 | 10.40 |
| C   | 0.245                        | 0.255 | 6.22                 | 6.48 | 0.390                        | 0.400 | 9.90                 | 10.10 |
| D   | 0.023                        | 0.031 | 0.58                 | 0.79 | 0.028                        | 0.042 | 0.71                 | 1.06  |
| E   | 0.060                        | 0.065 | 1.52                 | 1.65 | 0.060                        | 0.065 | 1.52                 | 1.65  |
| F   | 0.281                        | 0.305 | 7.14                 | 7.75 | 0.425                        | 0.445 | 10.80                | 11.30 |
| G   | 0.190                        | 0.205 | 4.83                 | 5.21 | 0.190                        | 0.205 | 4.83                 | 5.21  |
| H   | 6-40 UNF-3A                  |       |                      |      | 10-32 UNF-2A                 |       |                      |       |
| I   | .072 SPLINE X .070 DP        |       |                      |      | 0.50 SLOT X .060 DP          |       |                      |       |
|     | $C_P = .45 \text{ pF}$       |       | $L_S = 2 \text{ nH}$ |      | $C_P = .75 \text{ pF}$       |       | $L_S = 3 \text{ nH}$ |       |

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**ADVANCED:** Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

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 Visit [www.macomtech.com](http://www.macomtech.com) for additional data sheets and product information.

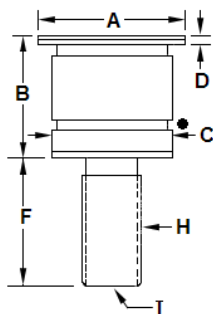
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### Case Styles • Black Dot Denotes Cathode



| DIM | MA4PK2002<br>CASE STYLE 1048 |       |                      |      | MA4PK3002<br>CASE STYLE 1074 |       |                      |       |
|-----|------------------------------|-------|----------------------|------|------------------------------|-------|----------------------|-------|
|     | INCHES                       |       | MILLIMETERS          |      | INCHES                       |       | MILLIMETERS          |       |
|     | MIN                          | MAX   | MIN                  | MAX  | MIN                          | MAX   | MIN                  | MAX   |
| A   | 0.304                        | 0.316 | 7.72                 | 8.02 | 0.468                        | 0.485 | 11.90                | 12.30 |
| B   | 0.286                        | 0.292 | 7.26                 | 7.42 | 0.387                        | 0.411 | 9.83                 | 10.40 |
| C   | 0.245                        | 0.255 | 6.22                 | 6.48 | 0.390                        | 0.400 | 9.90                 | 10.10 |
| D   | 0.023                        | 0.031 | 0.58                 | 0.79 | 0.028                        | 0.042 | 0.71                 | 1.06  |
| F   | 0.281                        | 0.305 | 7.14                 | 7.75 | 0.425                        | 0.445 | 10.80                | 11.30 |
| H   | 6-40 UNF-3A                  |       |                      |      | 10-32 UNF-2A                 |       |                      |       |
| I   | .072 SPLINE X .070 DP        |       |                      |      | 0.50 SLOT X .060 DP          |       |                      |       |
|     | $C_P = .45 \text{ pF}$       |       | $L_S = 2 \text{ nH}$ |      | $C_P = .75 \text{ pF}$       |       | $L_S = 3 \text{ nH}$ |       |

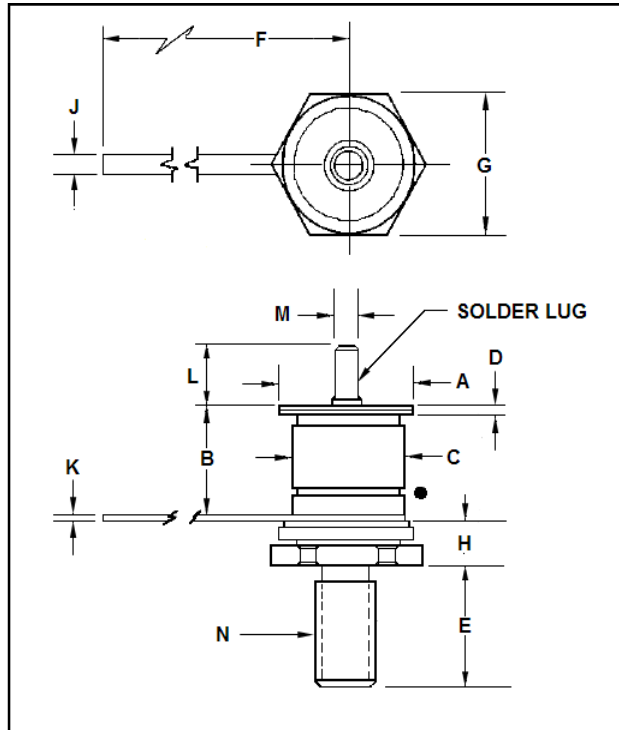
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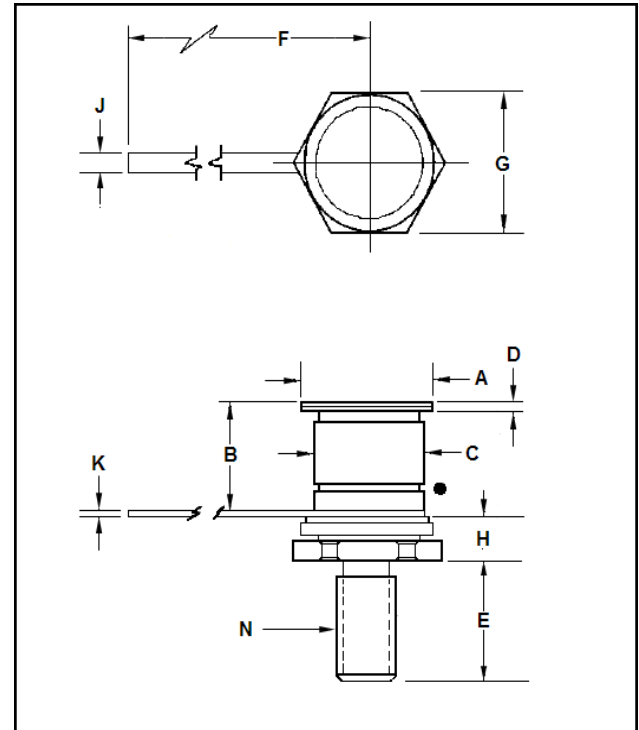
## 2000 Volt & 3000 Volt PIN Diodes MA4PK200X & MA4PK300X

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### Case Styles • Black Dot Denotes Cathode



| MA4PK2003                                                                        |             |      |             |      |
|----------------------------------------------------------------------------------|-------------|------|-------------|------|
| CASE STYLE 1080                                                                  |             |      |             |      |
| DIM                                                                              | INCHES      |      | MILLIMETERS |      |
|                                                                                  | MIN         | MAX  | MIN         | MAX  |
| A                                                                                | .304        | .316 | 7.72        | 8.02 |
| B                                                                                | .254        | .270 | 6.45        | 6.86 |
| C                                                                                | .245        | .255 | 6.22        | 6.48 |
| D                                                                                | .023        | .031 | 0.58        | 0.79 |
| E                                                                                | .221        | .252 | 5.61        | 6.40 |
| F                                                                                | .780        | .790 | 19.8        | 20.1 |
| G                                                                                | .245        | .255 | 6.22        | 6.48 |
| H                                                                                | .128        | .137 | 3.25        | 3.48 |
| J                                                                                | .120        | .130 | 3.05        | 3.30 |
| K                                                                                | .007        | .009 | 0.18        | 0.23 |
| L                                                                                | .190        | .205 | 4.83        | 5.21 |
| M                                                                                | .060        | .065 | 1.52        | 1.65 |
| N                                                                                | 6-32 UNF-3A |      |             |      |
| C <sub>GND</sub> = 1.1Pf      C <sub>P</sub> = .45 Pf      L <sub>S</sub> = 2 nH |             |      |             |      |



| MA4PK2004                                                                        |             |      |             |      |
|----------------------------------------------------------------------------------|-------------|------|-------------|------|
| CASE STYLE 1038                                                                  |             |      |             |      |
| DIM                                                                              | INCHES      |      | MILLIMETERS |      |
|                                                                                  | MIN         | MAX  | MIN         | MAX  |
| A                                                                                | .304        | .316 | 7.72        | 8.02 |
| B                                                                                | .254        | .270 | 6.45        | 6.86 |
| C                                                                                | .245        | .255 | 6.22        | 6.48 |
| D                                                                                | .023        | .031 | 0.58        | 0.79 |
| E                                                                                | .221        | .252 | 5.61        | 6.40 |
| F                                                                                | .780        | .790 | 19.8        | 20.1 |
| G                                                                                | .245        | .255 | 6.22        | 6.48 |
| H                                                                                | .128        | .137 | 3.25        | 3.48 |
| J                                                                                | .120        | .130 | 3.05        | 3.30 |
| K                                                                                | .007        | .009 | 0.18        | 0.23 |
| N                                                                                | 6-32 UNF-3A |      |             |      |
| C <sub>GND</sub> = 1.1Pf      C <sub>P</sub> = .45 Pf      L <sub>S</sub> = 2 nH |             |      |             |      |

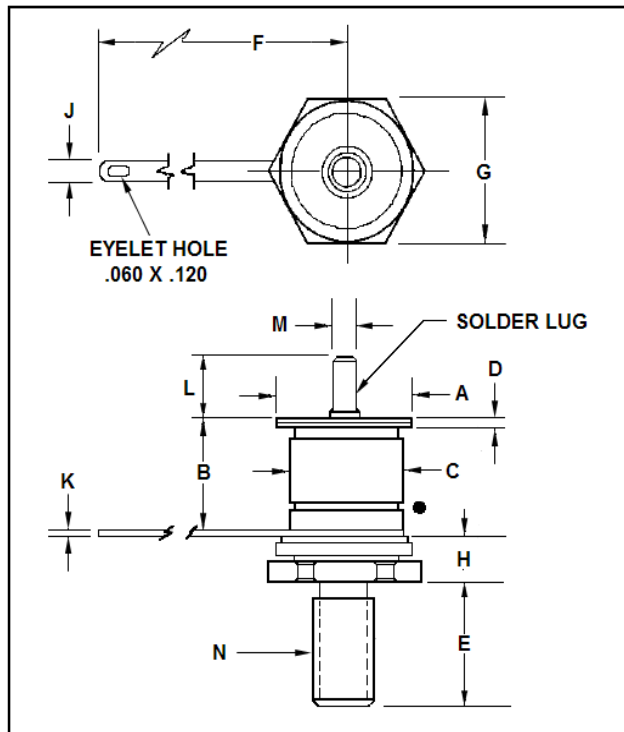
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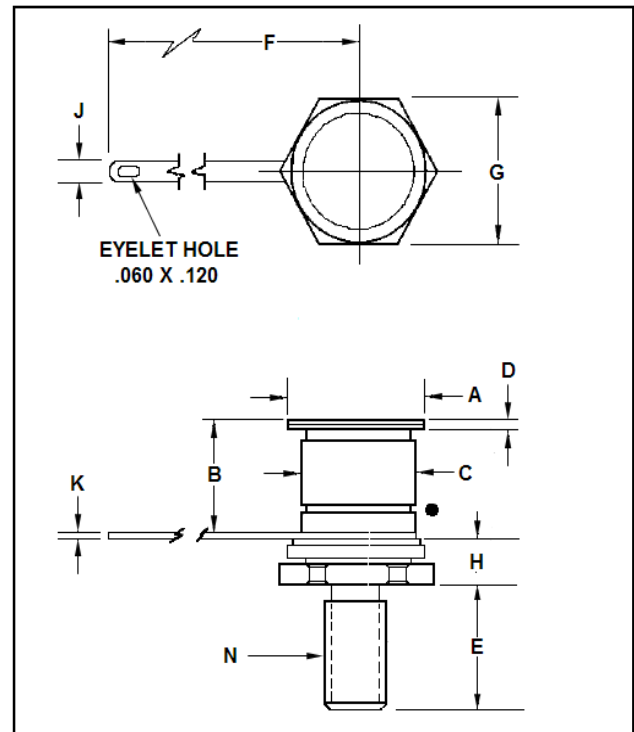
### Case Styles ● Black Dot Denotes Cathode



**MA4PK3003**

**CASE STYLE 1085**

| DIM                                                                              | INCHES       |      | MILLIMETERS |       |
|----------------------------------------------------------------------------------|--------------|------|-------------|-------|
|                                                                                  | MIN          | MAX  | MIN         | MAX   |
| A                                                                                | .468         | .485 | 11.9        | 12.3  |
| B                                                                                | .385         | .410 | 9.8         | 10.4  |
| C                                                                                | .390         | .400 | 9.90        | 10.1  |
| D                                                                                | .030         | .045 | 0.76        | 1.14  |
| E                                                                                | .422         | .452 | 10.72       | 11.48 |
| F                                                                                | .805         | .820 | 20.45       | 20.83 |
| G                                                                                | .490         | .500 | 12.45       | 12.70 |
| H                                                                                | .155         | .175 | 3.94        | 4.45  |
| J                                                                                | .120         | .130 | 3.05        | 3.30  |
| K                                                                                | .022         | .026 | .559        | .660  |
| L                                                                                | .190         | .205 | 4.83        | 5.21  |
| M                                                                                | .060         | .065 | 1.52        | 1.65  |
| N                                                                                | 10-32 UNF-2A |      |             |       |
| C <sub>GND</sub> = 1.1Pf      C <sub>P</sub> = .75 Pf      L <sub>S</sub> = 3 nH |              |      |             |       |



**MA4PK3004**

**CASE STYLE 1075**

| DIM                                                                              | INCHES       |      | MILLIMETERS |       |
|----------------------------------------------------------------------------------|--------------|------|-------------|-------|
|                                                                                  | MIN          | MAX  | MIN         | MAX   |
| A                                                                                | .468         | .485 | 11.9        | 12.3  |
| B                                                                                | .385         | .410 | 9.8         | 10.4  |
| C                                                                                | .390         | .400 | 9.90        | 10.1  |
| D                                                                                | .030         | .045 | 0.76        | 1.14  |
| E                                                                                | .422         | .452 | 10.72       | 11.48 |
| F                                                                                | .805         | .820 | 20.45       | 20.83 |
| G                                                                                | .490         | .500 | 12.45       | 12.70 |
| H                                                                                | .155         | .175 | 3.94        | 4.45  |
| J                                                                                | .120         | .130 | 3.05        | 3.30  |
| K                                                                                | .022         | .026 | .559        | .660  |
| N                                                                                | 10-32 UNF-2A |      |             |       |
| C <sub>GND</sub> = 1.1Pf      C <sub>P</sub> = .75 Pf      L <sub>S</sub> = 3 nH |              |      |             |       |