

### Features

- Reverse Voltage up to 6000 Volts
- 25 A 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

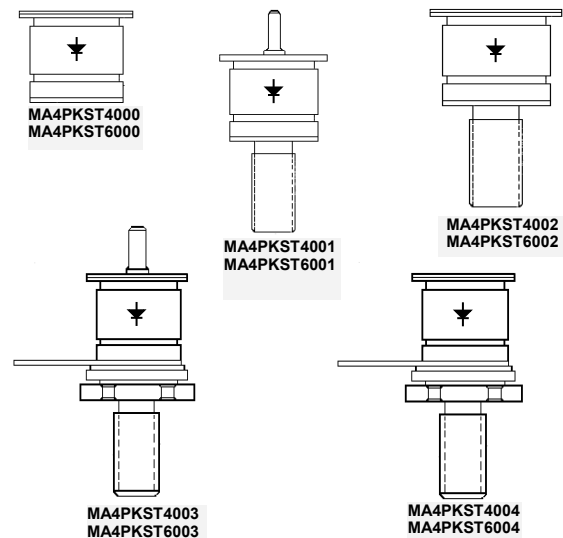
### Applications

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

### Description

The 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 stacked 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 MACOM 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. These kilovolt PIN diode chips utilize MACOMs' 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.

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



### Diode Part Numbers & Package Style

4000 V	6000 V	Package Style
MA4PKST4000	MA4PKST6000	Pill
MA4PKST4001	MA4PKST6001	Threaded Stud & Solder Lug
MA4PKST4002	MA4PKST6002	Threaded Stud Only
MA4PKST4003	MA4PKST6003	Insulated Threaded Stud & Solder Lug
MA4PKST4004	MA4PKST6004	Insulated Threaded Stud Only

### 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 stacked die are connected using high temperature eutectic solder. 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 wire connection.

1 \* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications:  $T_A = +25^\circ\text{C}$

**MA4PK4000 Series**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Reverse Voltage ( $V_R$ )	200 $\mu\text{A}^1$	V	—	—	4000
Series Resistance ( $R_S$ )	4 MHz, 0.5 A 1 -100 MHz, 0.5 A	$\Omega$	—	— 0.20	0.30 —
Total Capacitance ( $C_T$ )	1 MHz, 100 V	pF	—	—	2.5
Parallel Resistance ( $R_P$ )	100 MHz, 0 V	K $\Omega$	—	10	—
Carrier Lifetime ( $T_L$ )	10 mA	$\mu\text{s}$	25	—	—
Forward Voltage ( $V_F$ )	1 A	V	—	—	2.4
Thermal Resistance ( $\emptyset$ )	C/W (Stud) C/W (Ins Stud)	$^\circ$	—	—	7 8
Nominal I-Region Width	Single DIE	$\mu\text{m}$	—	200	—

**MA4PK6000 Series**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Reverse Voltage ( $V_R$ )	200 $\mu\text{A}^1$	V	—	—	6000
Series Resistance ( $R_S$ )	4 MHz, 0.5 A 1 -100 MHz, 0.5 A	$\Omega$	—	— 0.25	0.35 —
Total Capacitance ( $C_T$ )	1 MHz, 100 V	pF	—	—	3.5
Parallel Resistance ( $R_P$ )	100 MHz, 0 V	K $\Omega$	—	20	—
Carrier Lifetime ( $T_L$ )	10 mA	$\mu\text{s}$	40	—	—
Forward Voltage ( $V_F$ )	1 A	V	—	—	2.4
Thermal Resistance ( $\emptyset$ )	C/W (Stud) C/W (Ins Stud)	$^\circ$	—	—	5 6
Nominal I-Region Width	Single DIE	$\mu\text{m}$	—	325	—

1. Use of dielectric coating required to ensure low leakage current at voltages greater than 3000 V.

### Absolute Maximum Ratings

Parameter	Absolute Maximum
Operating & Storage Temperature	-65°C to +175°C
Installation Temperature	250°C/30 Seconds
Instantaneous Reverse Voltage	Voltage Rating
Forward Current (RF & DC)	25 A

### Maximum Power Dissipation @ T<sub>c</sub> = 25°C

Part #	Absolute Maximum
MA4PKST4001 MA4PKST4002	25 W
MA4PKST4003 MA4PKST4004	20 W
MA4PKST6001 MA4PKST6002	30 W
MA4PKST6003 MA4PKST6004	25 W

### Handling Procedures

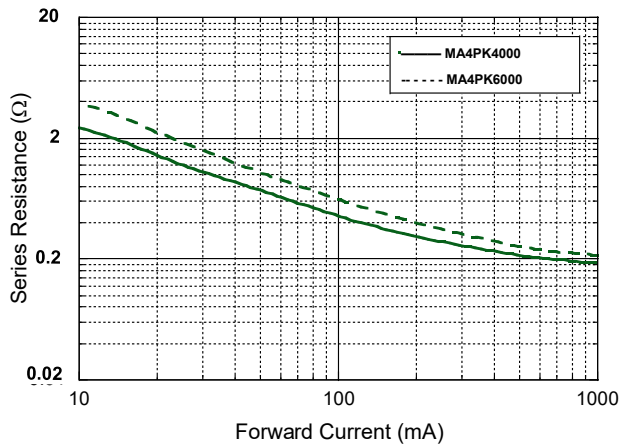
Please observe the following precautions to avoid damage:

### Static Sensitivity

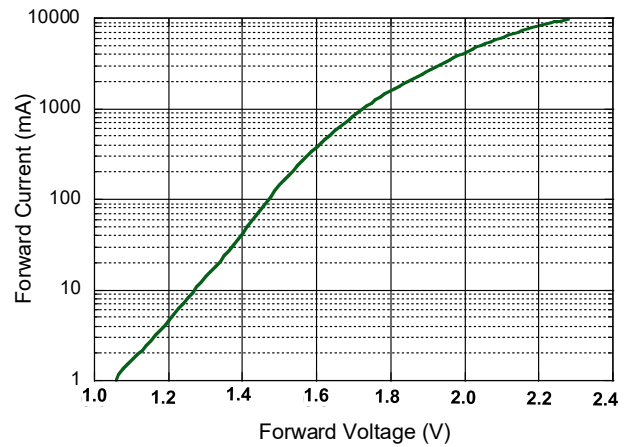
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 1C, HBM devices.

Typical Performance Curves @ +25°C

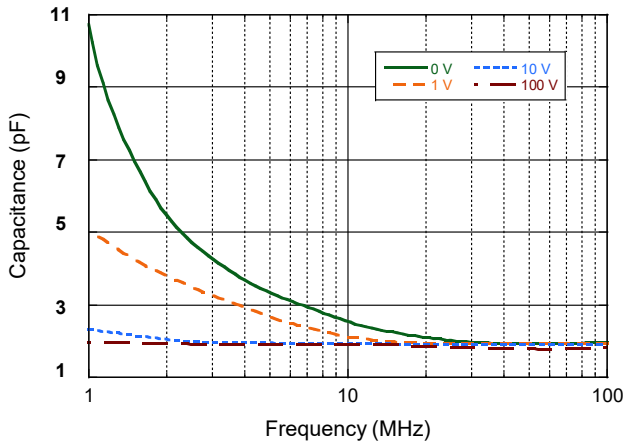
Series Resistance vs. Current @ 100 MHz  
(MA4PKST4000 & MA4PKST6000 Series)



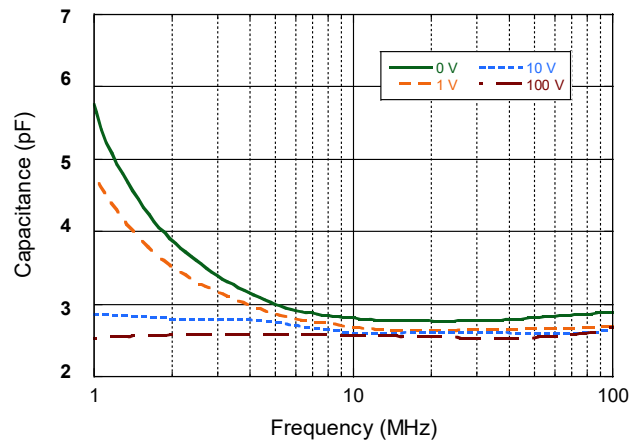
Forward Voltage vs. Forward Current  
(MA4PKST4000 & MA4PKST6000 Series)



Capacitance vs. Frequency & Reverse Voltage  
(MA4PKST4000 Series)



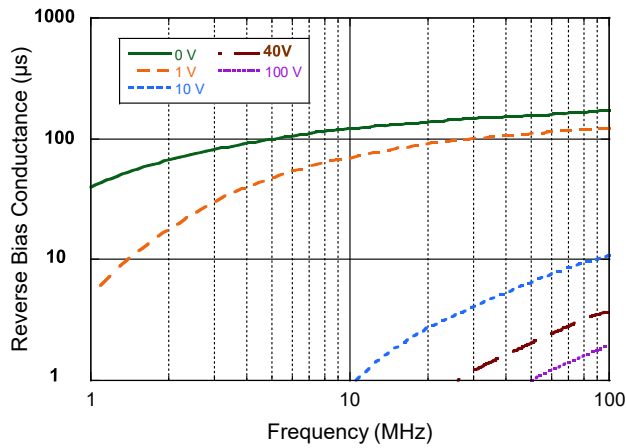
Capacitance vs. Frequency & Reverse Voltage  
(MA4PKST6000 Series)



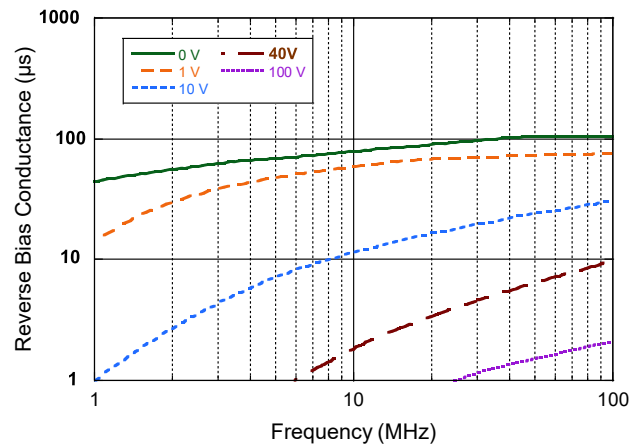
**MA4PKST400X & MA4PKST600x Series**  
Rev. V4

**Typical Performance Curves @ +25°C**

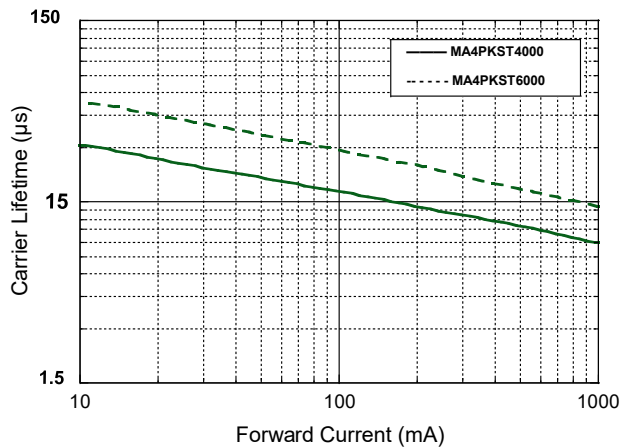
**Conductance vs. Frequency & Reverse Voltage (MA4PKST4000 Series)**



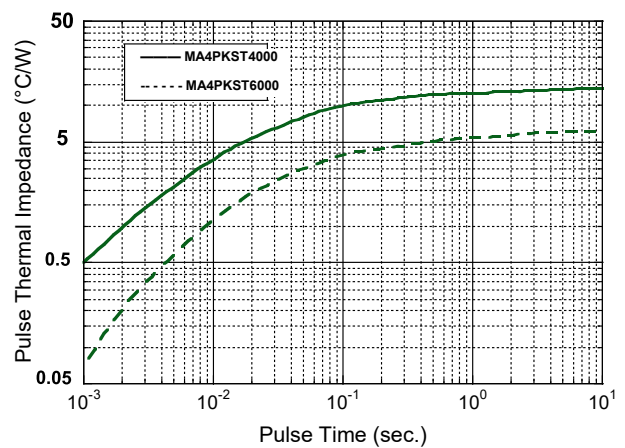
**Conductance vs. Frequency & Reverse Voltage (MA4PKST6000 Series)**



**Carrier Lifetime vs. Forward Current**



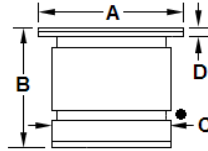
**Pulsed Thermal Resistance °C/W**



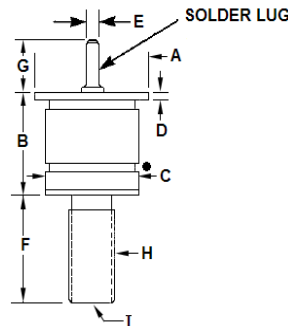
MA4PKST400X & MA4PKST600x Series

Rev. V4

Case Styles (Black Dot Denotes Cathode)



DIM.	MA4PK4000 Case Style 1027				MA4PK6000 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	0.254	0.270	6.45	6.86	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	
		$C_P = 0.45 \text{ pF}$		$L_S = 2 \text{ nH}$		$C_P = 0.75 \text{ pF}$		$L_S = 3 \text{ nH}$	

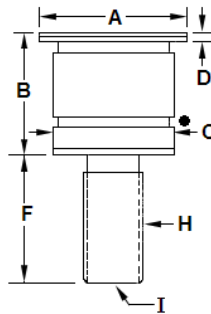


DIM.	MA4PK4001 Case Style 1082				MA4PK6001 Case Style 1084				
	Inches		Millimeters		Inches		Millimeters		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
A	0.304	0.316	7.72	8.02	0.468	0.485	11.90	12.30	
B	0.254	0.270	6.45	6.86	0.387	0.411	9.83	10.40	
C	0.245	0.255	6.22	6.48	0.390	0.400	9.90	10.10	
D	0.023	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	0.072 SPLINE X 0.070 DP				0.50 SLOT X 0.060 DP				
		$C_P = 0.45 \text{ pF}$		$L_S = 2 \text{ nH}$		$C_P = 0.75 \text{ pF}$		$L_S = 3 \text{ nH}$	

MA4PKST400X & MA4PKST600x Series

Rev. V4

Case Styles (Black Dot Denotes Cathode)

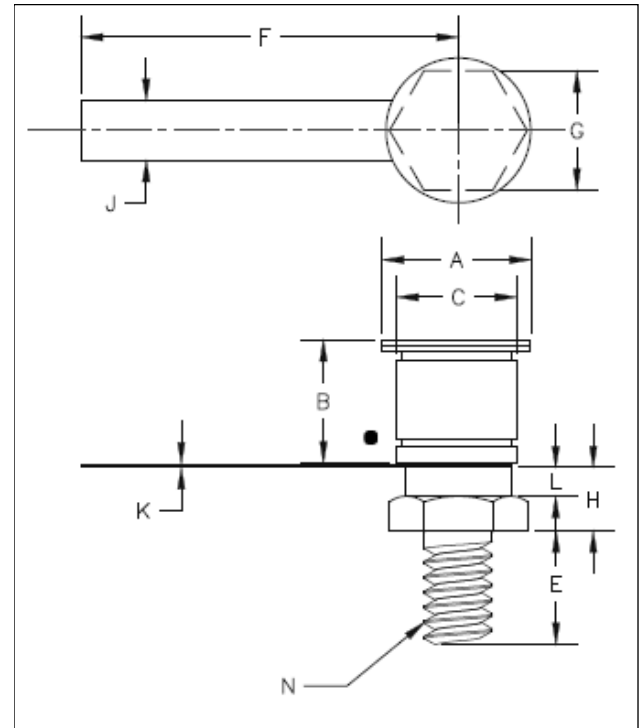
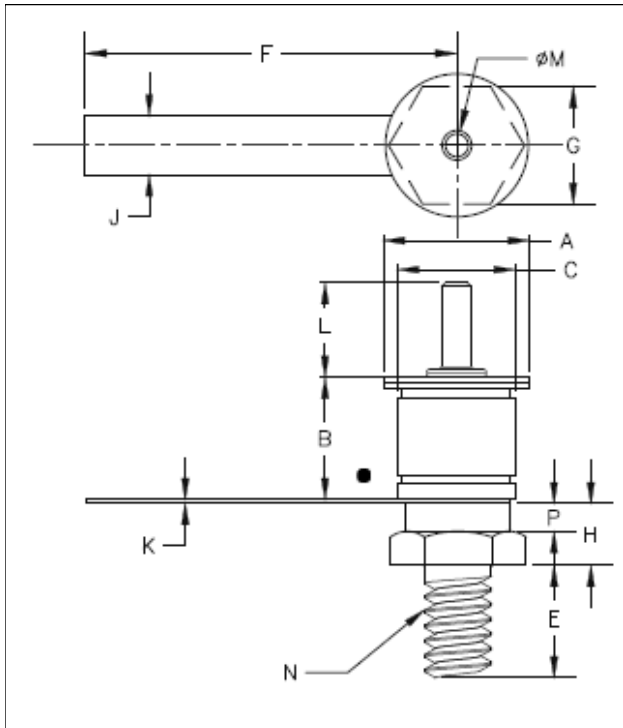


DIM.	MA4PK4002 Case Style 1048				MA4PK6002 Case Style 1074			
	Inches		Millimeters		Inches		Millimeters	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
A	0.304	0.316	7.72	8.02	0.468	0.485	11.90	12.30
B	0.254	0.270	6.45	6.86	0.387	0.411	9.83	10.40
C	0.245	0.255	6.22	6.48	0.390	0.400	9.90	10.10
D	0.023	0.031	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	0.072 SPLINE X 0.070 DP				0.50 SLOT X 0.060 DP			
	C <sub>p</sub> = 0.45 pF		L <sub>s</sub> = 2 nH		C <sub>p</sub> = 0.75 pF		L <sub>s</sub> = 3 nH	

MA4PKST400X & MA4PKST600x Series

Rev. V4

Case Styles (Black Dot Denotes Cathode)



MA4PK4003 Case Style 1080				
Dim.	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.304	0.316	7.72	8.02
B	0.254	0.270	6.45	6.86
C	0.245	0.255	6.22	6.48
D	0.023	0.031	0.58	0.79
E	0.221	0.252	5.61	6.40
F	0.780	0.790	19.8	20.1
G	0.245	0.255	6.22	6.48
H	0.128	0.137	3.25	3.48
J	0.120	0.130	3.05	3.30
K	0.007	0.009	0.18	0.23
L	0.190	0.205	4.83	5.21
M	0.060	0.065	1.52	1.65
P	0.058	0.062	1.47	1.58
N	6-32 UNF-3A			
C <sub>GND</sub> = 1.1 pF		C <sub>P</sub> = 0.45 pF		L <sub>S</sub> = 2 nH

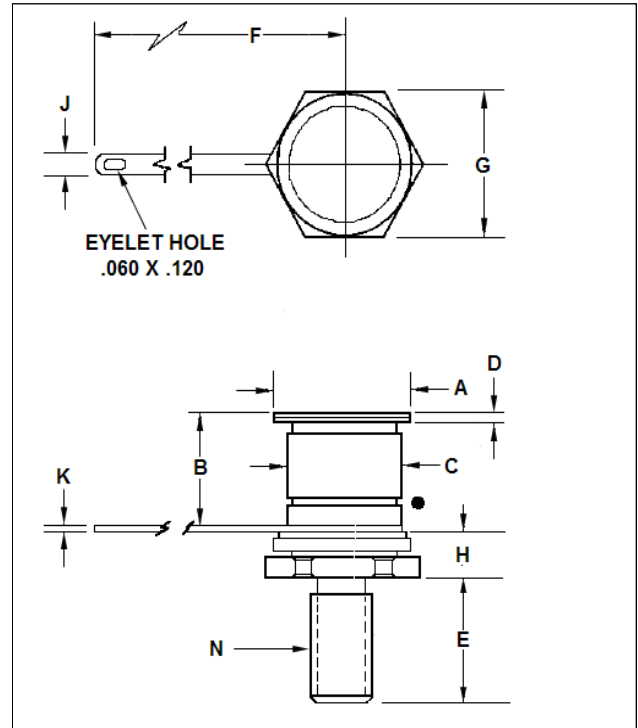
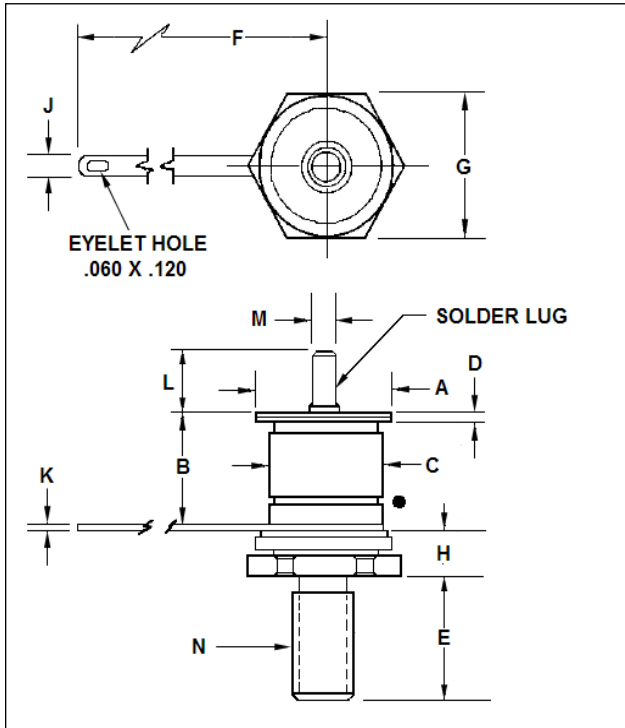
MA4PK4004 Case Style 1038				
Dim.	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.304	0.316	7.72	8.02
B	0.254	0.270	6.45	6.86
C	0.245	0.255	6.22	6.48
D	0.023	0.031	0.58	0.79
E	0.221	0.252	5.61	6.40
F	0.780	0.790	19.8	20.1
G	0.245	0.255	6.22	6.48
H	0.128	0.137	3.25	3.48
J	0.120	0.130	3.05	3.30
K	0.007	0.009	0.18	0.23
L	0.058	0.062	1.47	1.58
N	6-32 UNF-3A			
C <sub>GND</sub> = 1.1 pF		C <sub>P</sub> = 0.45 pF		L <sub>S</sub> = 2 nH



MA4PKST400X & MA4PKST600x Series

Rev. V4

Case Styles (Black Dot Denotes Cathode)



MA4PK6003 Case Style 1085				
Dim.	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.468	0.485	11.9	12.3
B	0.385	0.410	9.8	10.4
C	0.390	0.400	9.90	10.1
D	0.030	0.045	0.76	1.14
E	0.422	0.452	10.72	11.48
F	0.805	0.820	20.45	20.83
G	0.490	0.500	12.45	12.70
H	0.155	0.175	3.94	4.45
J	0.120	0.130	3.05	3.30
K	0.022	0.026	0.559	0.660
L	0.190	0.205	4.83	5.21
M	0.060	0.065	1.52	1.65
N	10-32 UNF-2A			
C <sub>GND</sub> = 1.1 pF		C <sub>P</sub> = 0.475 pF		L <sub>S</sub> = 3 nH

MA4PK6004 Case Style 1075				
Dim.	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.468	0.485	11.9	12.3
B	0.385	0.410	9.8	10.4
C	0.390	0.400	9.90	10.1
D	0.030	0.045	0.76	1.14
E	0.422	0.452	10.72	11.48
F	0.805	0.820	20.45	20.83
G	0.490	0.500	12.45	12.70
H	0.155	0.175	3.94	4.45
J	0.120	0.130	3.05	3.30
K	0.022	0.026	0.559	0.660
N	10-32 UNF-2A			
C <sub>GND</sub> = 1.1 pF		C <sub>P</sub> = 0.75 pF		L <sub>S</sub> = 3 nH

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.