MA4P MELF & HIPAX Series

High Power PIN Diodes

V16

Features

- High Power Handling
- Low Loss / Low Distortion
- Voltage Ratings up to 1000 Volts
- Passivated Chip for Low Leakage Current
- Low Theta (θ) Due to Full Face Chip Bonding
- Leadless Low Inductance MELF Packages
- Various Package Options
- Available as Chips
- Fully RoHS Compliant
- Non-Magnetic Packages Available for MRI

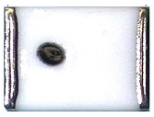
Description

The MELF and HIPAX PIN diode series are designed for usage in switch and attenuator applications requiring high power handling and low distortion. These diodes incorporate a fully passivated PIN diode chip resulting in an extremely low reverse bias leakage current. The semiconductor technology utilized in the MELF and HIPAX families draws on MACOM 's substantial experience in PIN diode design and wafer fabrication. The result is a device which has a thick I-region and long carrier lifetime while maintaining low series resistance and capacitance values. The chips of the MELF and HIPAX PIN diodes are enclosed in a rugged ceramic package and is full face bonded to metal pins on both the anode and cathode. The result is a low loss PIN diode with low thermal resistance due to symmetrical thermal paths. The parts are offered in either magnetic or non-magnetic, HIPAX (axial leaded) or MELF (Metal Electrode Leadless Faced) surface mount packages for MRI applications. The MELF is a rectangular SMQ, package which is designed for high volume tape and reel assembly. This easy to use package design makes automatic pick and place, indexing and assembly, extremely easy. The parallel flat surfaces are suitable for most key jaw or vacuum pick-up techniques. All of the solderable surfaces are tin plated and compatible with industry standard reflow and vapor phase soldering processes. See Application Note M538 for a typical solder reflow profile.

Many of MACOM's HIPAX PIN diodes are also available as chips. Please consult the "Silicon PIN Chip Datasheet" for availability and specifications.

Package Styles

401 & 402



1072 & 1091

Applications

HIPAX PIN diodes are designed for use in a wide variety of switch and attenuator applications from HF through UHF frequencies and at power levels above 1 kW, CW. The internal chip as well as each diode assembly has been comprehensively tested and characterized to ensure predictable and repeatable performance.

Design Recommendations

- Low Distortion Attenuators
  MA4P4301B
- Surface Mount Switches
  MA4P7101F
- Cellular Radio Antenna Switches
  MA4P1200, MA4P1250

Absolute Maximum Ratings
T_A = +25°C (Unless Otherwise Noted)[1]

Parameter	Absolute Maximum
DC Reverse Voltage (V_R)	(See Tables)
Operating Chip Junction Temperature	-55°C to +175°C
Storage Temperature	-55°C to +200°C
Installation Temperature	+280°C for 30 Seconds
ESD	Class 1A, HBM

Notes

1. Operation of this device above any one of these parameters may cause permanent damage.

MA4P1000 Series Electrical Specifications @ T_A = +25°C

Part # (NM Indicates Non-Magnetic)	C_T Total Capacitance pF		V_R Reverse Voltage VDC		R_S Series Resistance W		R_P Parallel Resistance kW
	V_R = 50 V, 1 MHz		I_R = 10 mA		I_F = 50 mA, 100 MHz		V_R = 0 V, 100 MHz
	Typ.	Max.	Min.	Max.	Typ.	Max.	Min.
MA4P1200 - 401T	1.2	1.5	50	100	0.5	0.75	5
MA4P1200NM - 401T	1.2	1.5					
MA4P1250 -1072T	0.8	1.2					
MA4P1250NM -1072T	0.8	1.2					
MA4P1450 -1091T	1.8	2.5					

Part # (NM Indicates Non-Magnetic)	V_F Forward Voltage (Max. $I_{Forward}$ @ 1V ≤		T_L Carrier Lifetime		Forward Bias Harmonic Distortion R(2a/a) * R(3a/a)		Reverse Bias Harmonic Distortion R(2a/a) – R(3a/a)	
	I_F = 50 mA		I_F = 10 mA, I_R = 6 mA		P_{IN} = 30 W, 100 MHz I_F = 50 mA		P_{IN} = 0 dBm, V_R = 0 V, 100 MHz	
	Typ.	Max.	Min.	Typ.	Min.	Typ.	Min.	Typ.
MA4P1200 - 401T	0.85	1.0	2	8	80	90	60	70
MA4P1200NM - 401T								
MA4P1250 -1072T								
MA4P1250NM-1072T								
MA4P1450 -1091T								

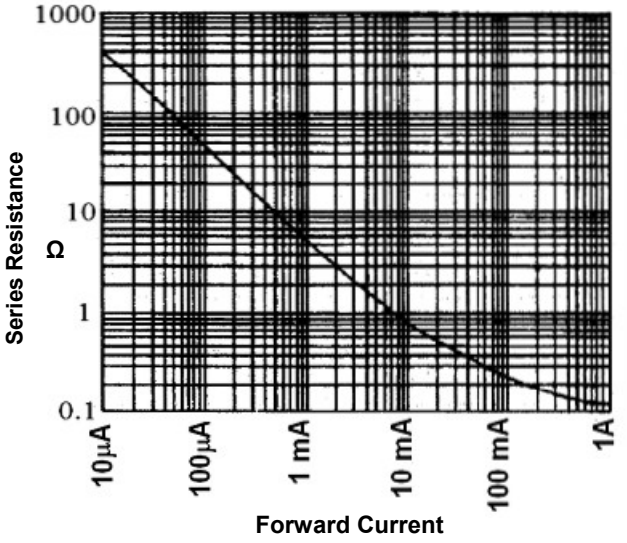
*Notes:
1.) “NM” in the base part number signifies non-magnetic package.
2.) “T” suffix denotes tape and reel

Power Dissipation and Thermal Resistance Ratings @ T_A = +25°C

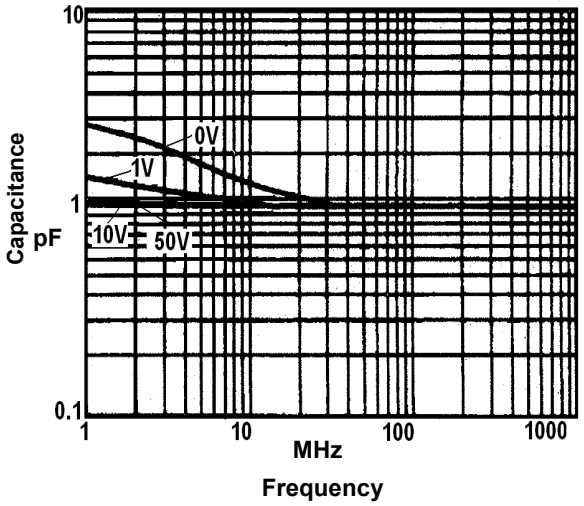
Package Style	Condition	MA4P1200(NM)-401T		MA4P1250(NM)-1072T		MA4P1450-1091T	
		P_{DISS}	θ_{JC}	P_{DISS}	θ_{JC}	P_{DISS}	θ_{JC}
B Axial Lead	No Heatsink	1.5 W	15°C/W	—	—	—	—
	Lead Length 1/4"	5.5 W		—	—	—	—
F MELF	No Heatsink	—		6 W	15°C/W	10 W	5°C/W
	Infinite Heatsink	—		18 W		30 W	

Typical Performance Curves @ T_A = +25°C
MA4P1200 Series

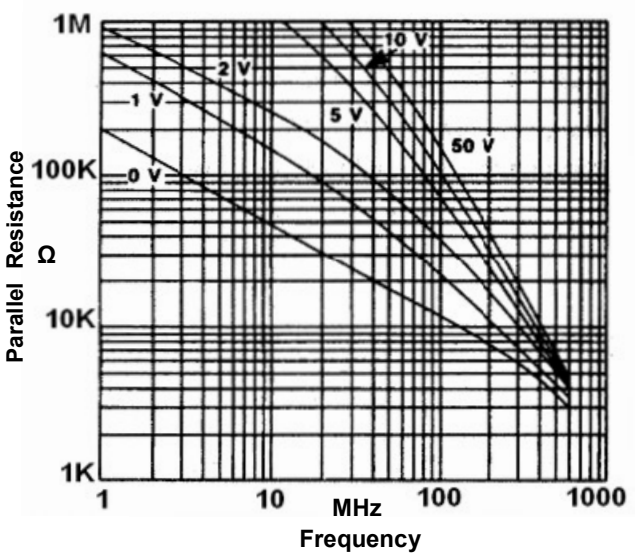
Series Resistance @ 100 MHz vs. Forward Current



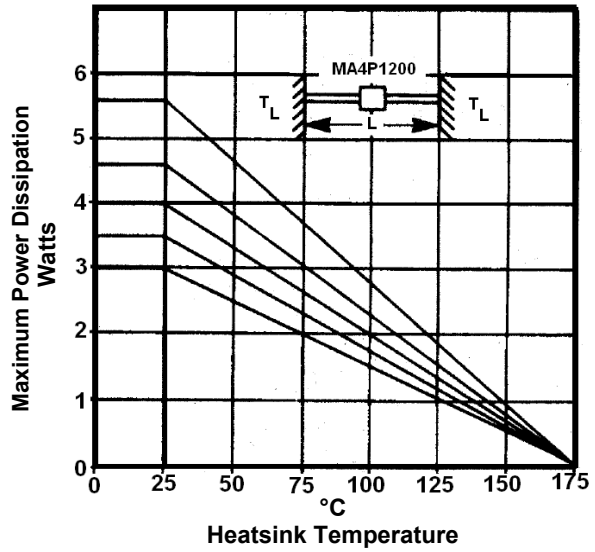
Capacitance vs. Frequency & Reverse Bias



Parallel Resistance vs. Frequency & Reverse Bias

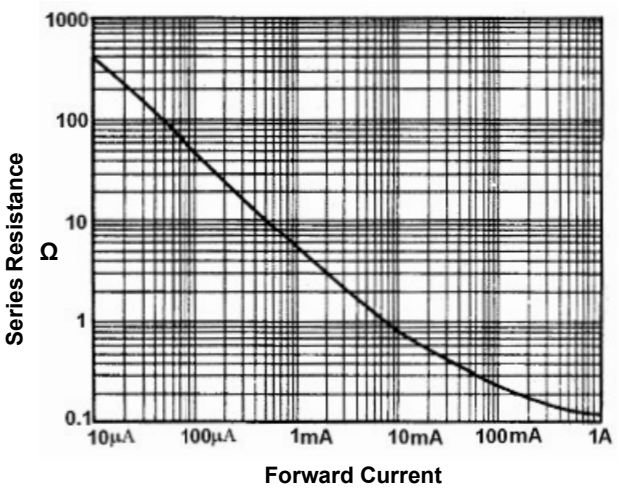


Heatsink Temperature vs. Max. Power Dissipation

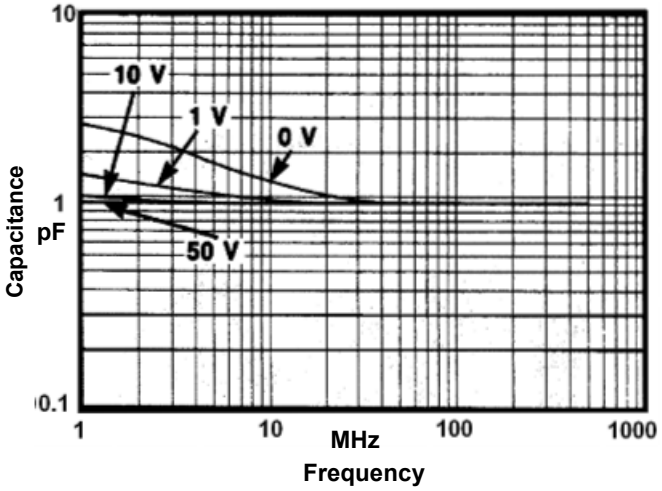


Typical Performance Curves @ T_A = +25°C
MA4P1250 Series

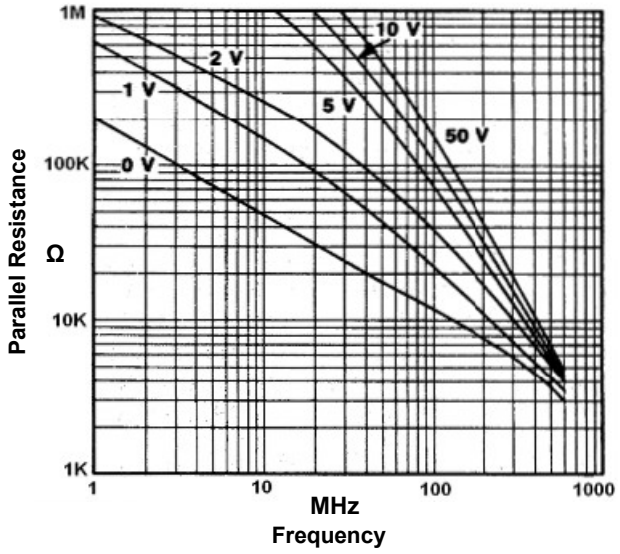
Series Resistance @ 100 MHz vs. Forward Current



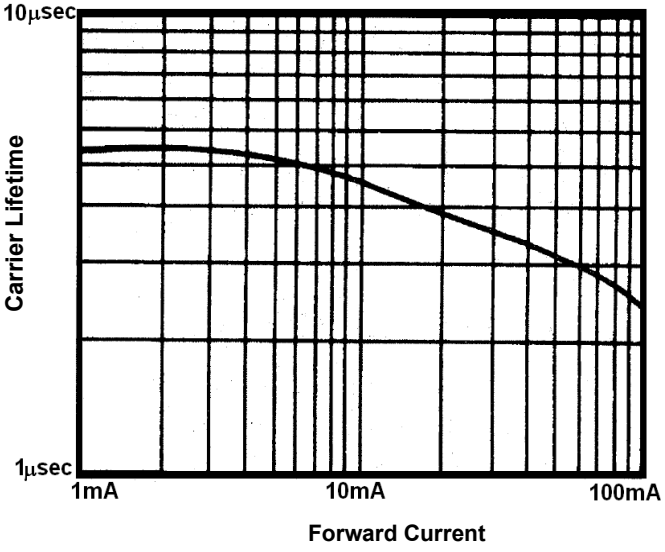
Capacitance vs. Frequency & Reverse Bias



Parallel Resistance vs. Frequency & Reverse Bias

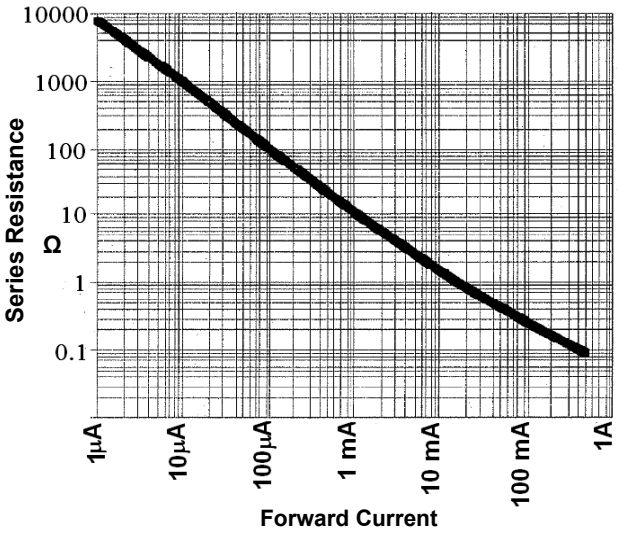


Carrier Lifetime vs. Forward Bias Current

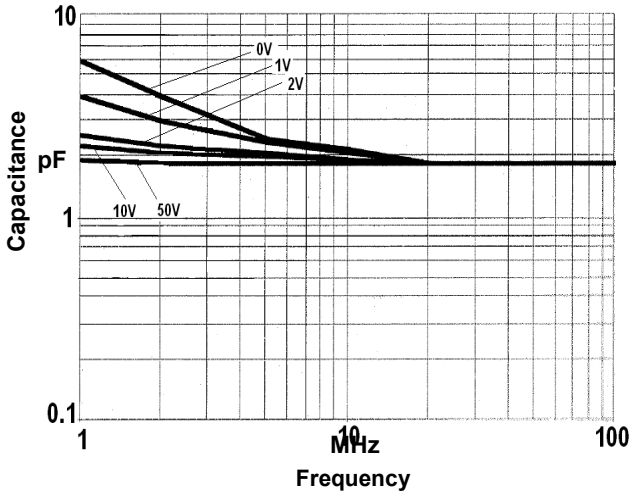


Typical Performance Curves @ T_A = +25°C
MA4P1450 Series

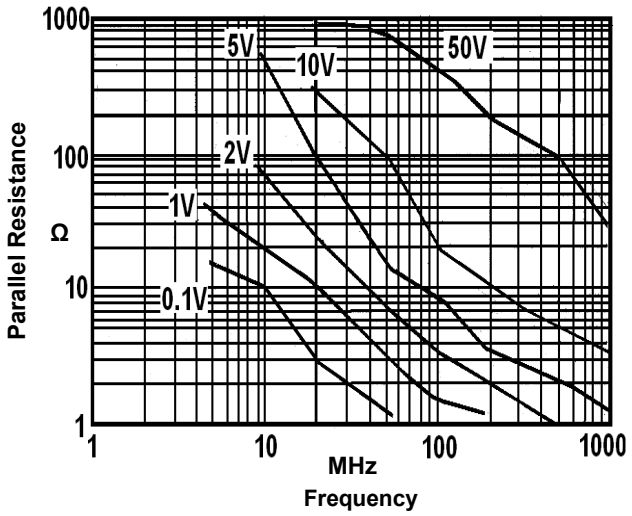
Series Resistance @ 100 MHz vs. Forward Current



Capacitance vs. Frequency and Reverse Bias



Parallel Resistance vs. Frequency and Reverse Bias



MA4P4000 - MA4P7100 Series Electrical Specifications @ T_A = +25°C

Parameter	Symbol	Condition	MA4P4000 Series	MA4P4300 Series	MA4P7000 Series	MA4P7100 Series
Maximum Series Resistance	R_S	I_F = 100 mA	0.5 Ω	1.0 Ω	0.9 Ω	0.5 Ω
Maximum Total Capacitance	C_T	V_R = 100 V	2.2 pF	2.0 pF	0.7 pF	1.0 pF
Minimum Parallel Resistance	R_P	V_R = 100 V	20 kΩ	50 kΩ	200 kΩ	100 kΩ
Minimum Carrier Lifetime	T_L	I_F = 10 mA	20 µs	15 µs	5 µs	2.5 µs
Maximum Forward Voltage	V_F	I_F = 100 mA	1.0 V	1.2 V	1.0 V	1.0 V
Maximum Reverse Current	I_R	At max. rated voltage	1 µA	1 µA	1 µA	1 µA
Nominal I-Region Width	µ	—	175 µm	300 µm	175 µm	100 µm

Maximum Reverse Voltage Rating (V_R)

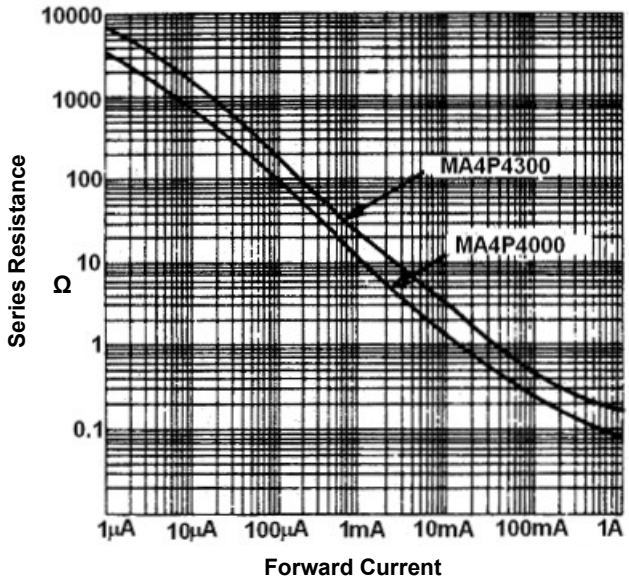
Maximum Reverse Voltage Rating	MA4P4000 Series	MA4P4300 Series	MA4P7000 Series	MA4P7100 Series
100 V	MA4P4001B-402 MA4P4001BNM-402 MA4P4001F-1091T	MA4P4301B-402 MA4P4301F-1091T	MA4P7001F-1072T	MA4P7101B-401T MA4P7101F-1072T
200 V	MA4P4002B-402 MA4P4002F-1091T	MA4P4302B-402	MA4P7002B-401T MA4P7002F-1072T	MA4P7102B-401T MA4P7102F-1072T
400 V	—	—	—	MA4P7104B-401T MA4P7104F-1072T
600 V	MA4P4006F-1091T MA4P4006B-402	—	MA4P7006B-401T MA4P7006F-1072T	—

*Notes:
1.) “NM” in the base part number signifies non-magnetic package.
2.) “T” suffix denotes tape and reel.

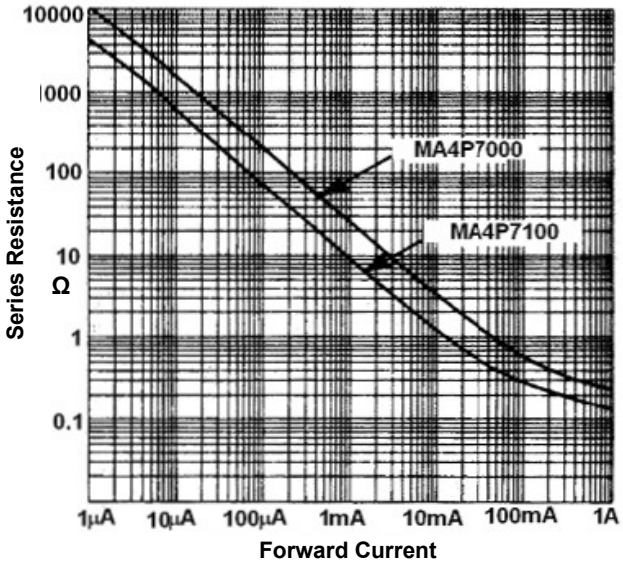
Package Style	Condition	MA4P4000 Series		MA4P4300 Series		MA4P7000 Series		MA4P7100 Series	
		P_{DISS}	θ_{JC}	P_{DISS}	θ_{JC}	P_{DISS}	θ_{JC}	P_{DISS}	θ_{JC}
B Axial Leaded	1/4” Lead Length	12 W	12.5°C/W	10 W	15°C/W	5 W	30°C/W	6 W	25°C/W
	No Heatsink	2.5 W	—	2.5 W	—	1.5 W	—	1.5 W	—
F MELF	Infinite Heatsink	7.5 W	20°C/W	5 W	30°C/W	10 W	15°C/W	11.5 W	13°C/W
Both B and F	Single 1 µs pulse	100 kW	—	100 kW	—	15 kW	—	15 kW	—
Both B and F	Single 100 µs	5 kW	0.03°C/W	5 kW	0.03°C/W	300 W	0.5°C/W	300 W	0.5°C/W

Typical Performance Curves @ T_{AMB} = +25°C
MA4P4000,MA4P4300, MA4P7000, MA4P7100 Series

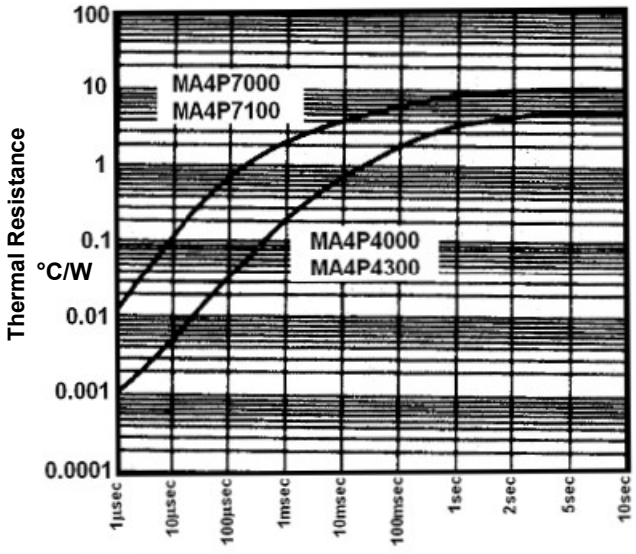
Series Resistance at 100 MHz vs. Forward Current
MA4P4000, MA4P4300 Series



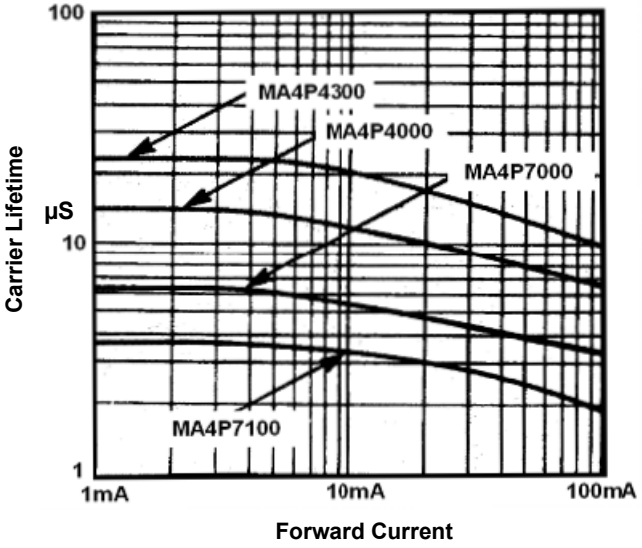
Series Resistance at 100 MHz vs. Forward Current
MA4P7000, MA4P7100 Series



Thermal Resistance vs. Pulse Width
MA4P4000, MA4P4300, MA4P7000 & MA4P7100 Series

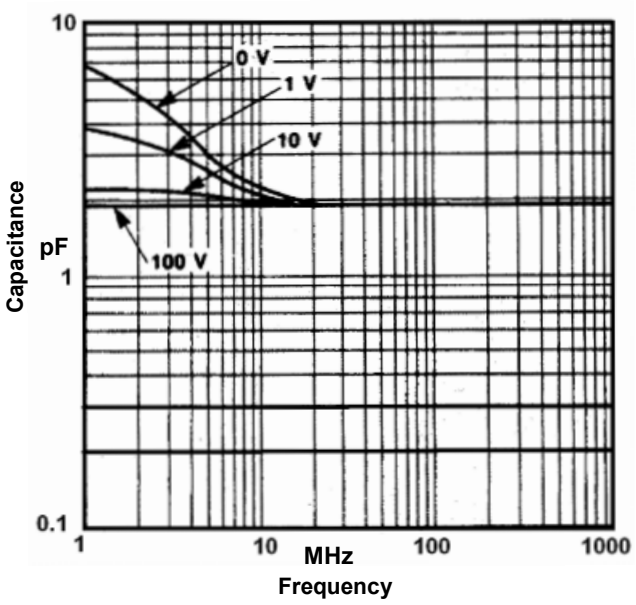


Carrier Lifetime vs. Forward Bias Current
MA4P4000, MA4P4300, MA4P7000 & MA4P7100 Series

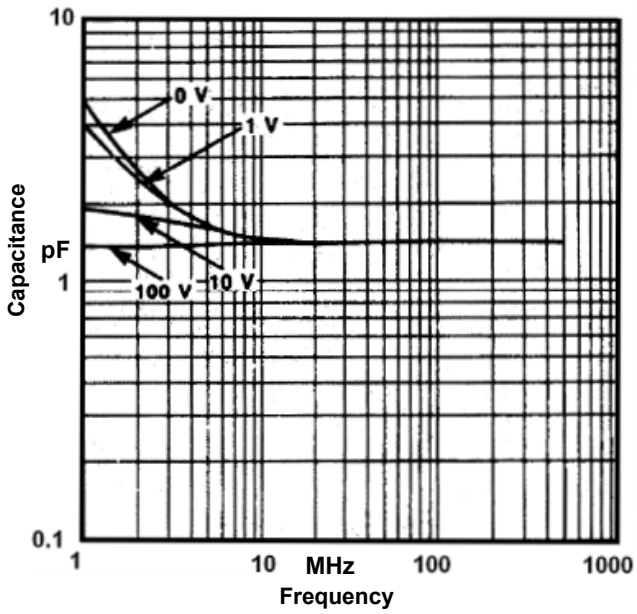


Typical Performance Curves @ T_{AMB} = +25°C
MA4P4000, MA4P4300, MA4P7000, MA4P7100 Series

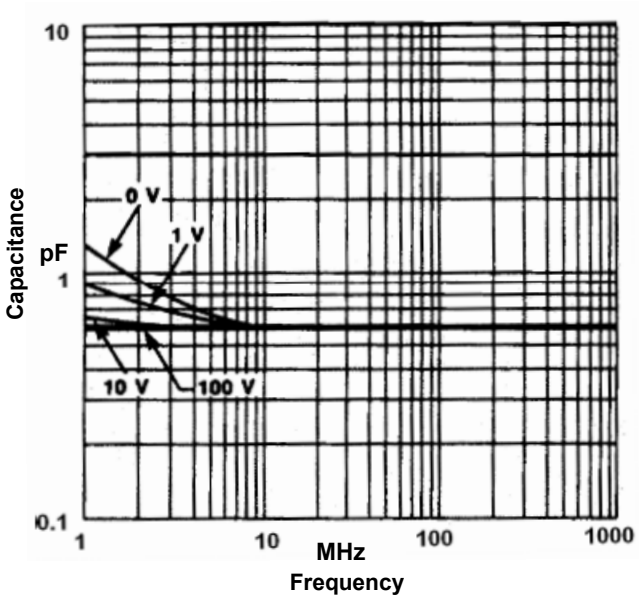
Capacitance vs. Frequency & Reverse Bias
MA4P4000 Series



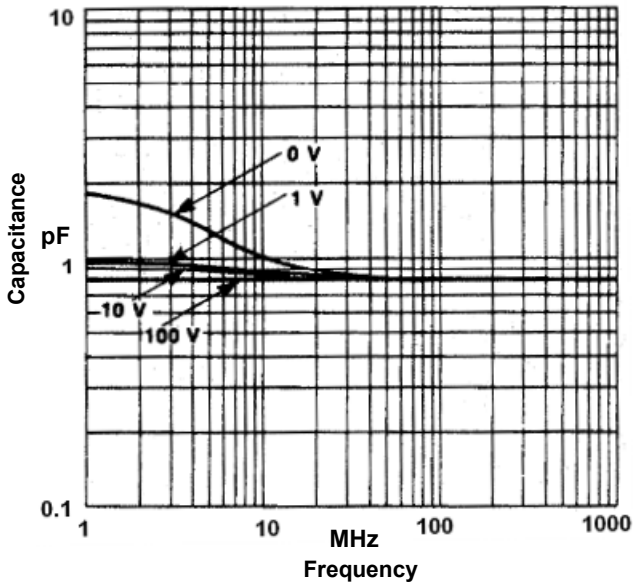
Capacitance vs. Frequency & Reverse Bias
MA4P4300 Series



Capacitance vs. Frequency & Reverse Bias
MA4P7000 Series

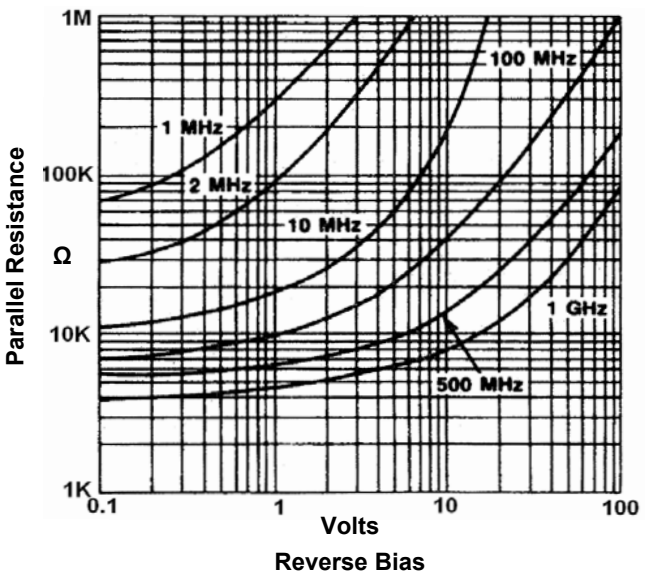


Capacitance vs. Frequency & Reverse Bias
MA4P7100 Series

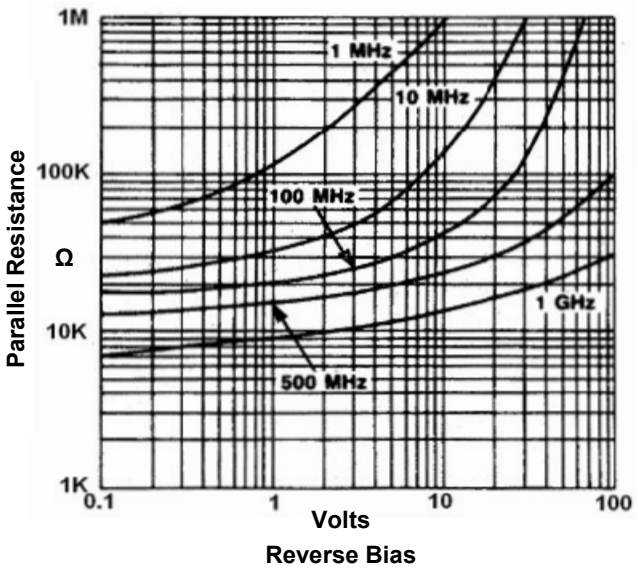


Typical Performance Curves @ T_{AMB} = +25°C
MA4P4000, MA4P4300, MA4P7000, MA4P7100 Series

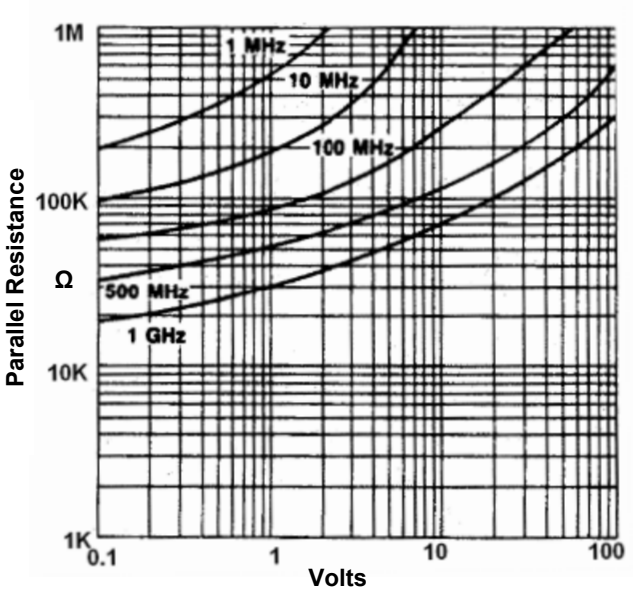
Parallel Resistance vs. Reverse Bias & Frequency
MA4P4000 Series



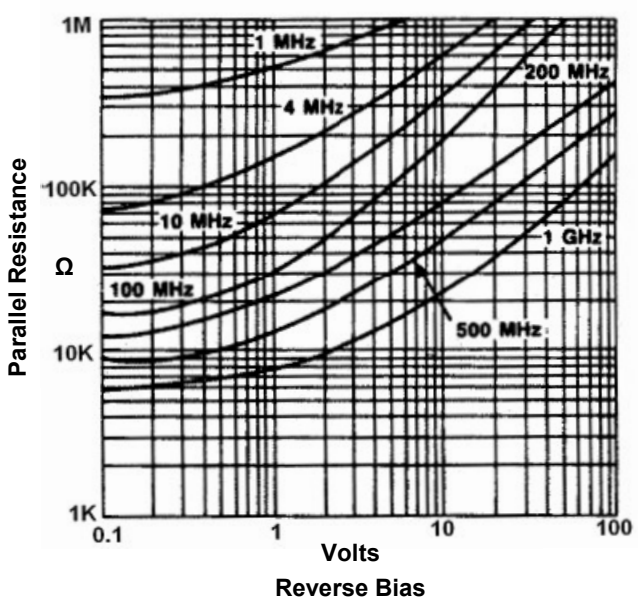
Parallel Resistance vs. Reverse Bias & Frequency
MA4P4300 Series



Parallel Resistance vs. Reverse Bias & Frequency
MA4P7000 Series

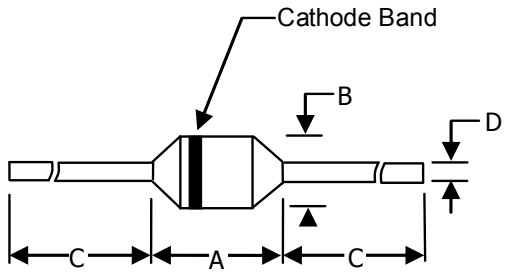


Parallel Resistance vs. Reverse Bias & Frequency
MA4P7100 Series



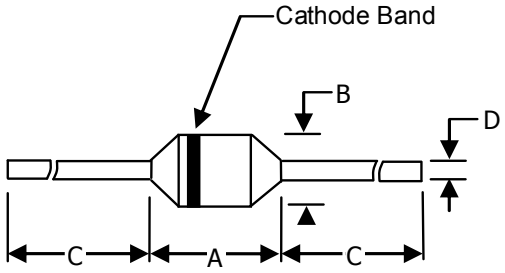
Case Styles

401 Axial Leaded Packages



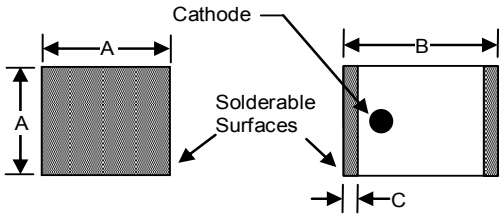
401 Package (tape and reel only) 500 or 1000 pcs/reel specify when ordering	Dimension	INCHES		MM	
		Min.	Max.	Min.	Max.
MA4P1200-401T MA4P1200NM-401T MA4P7002B-401T MA4P7006B-401T MA4P7101B-401T MA4P7102B-401T MA4P7104B-401T	A	—	0.130	—	3.30
	B	—	0.090	—	2.29
	C	0.975		24.77	—
	D	0.027	0.029	0.69	0.74

402 Axial Leaded Packages



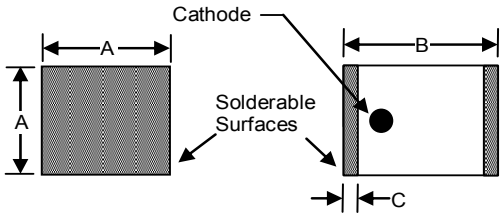
402 Package (bulk only) 100 pcs/bag	Dimension	INCHES		MM	
		Min.	MAX	Min.	Max.
MA4P4001B-402 MA4P4001BNM-402 MA4P4002B-402 MA4P4006B-402 MA4P4301B-402 MA4P4302B-402	A	—	0.230	—	5.84
	B	—	0.140	—	3.56
	C	0.975		24.77	—
	D	0.039	0.041	0.99	1.04

1091 MELF Surface Mount Packages



1091 Package (tape and reel only) 500 pcs/reel	Dimension	INCHES		MM	
		Min.	Max.	Min.	Max.
MA4P1450-1091T MA4P4001F-1091T MA4P4002F-1091T MA4P4006F-1091T MA4P4301F-1091T	A	0.138	0.155	3.51	3.94
	B	0.181	0.191	4.57	4.85
	C	0.011	0.026	0.279	0.660

1072 MELF Surface Mount Packages



1072 Package (tape and reel only) 1500 or 5000 pcs/reel specify when ordering	Dimension	INCHES		MM	
		Min.	Max.	Min.	Max.
MA4P1250-1072T MA4P1250NM-1072T MA4P7001F-1072T MA4P7002F-1072T MA4P7006F-1072T MA4P7101F-1072T MA4P7104F-1072T	A	0.080	0.095	2.032	2.413
	B	0.115	0.125	2.921	3.175
	C	0.008	0.023	0.203	0.584

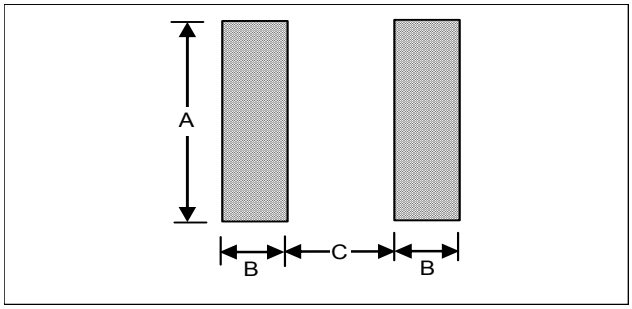
MELF Assembly Recommendations

Devices may be soldered using standard 60Sn/40Pb or RoHS compliant solders. Axial leads and solderable surfaces of MELF devices are tin plated 50 µm thick to ensure an optimum connection.

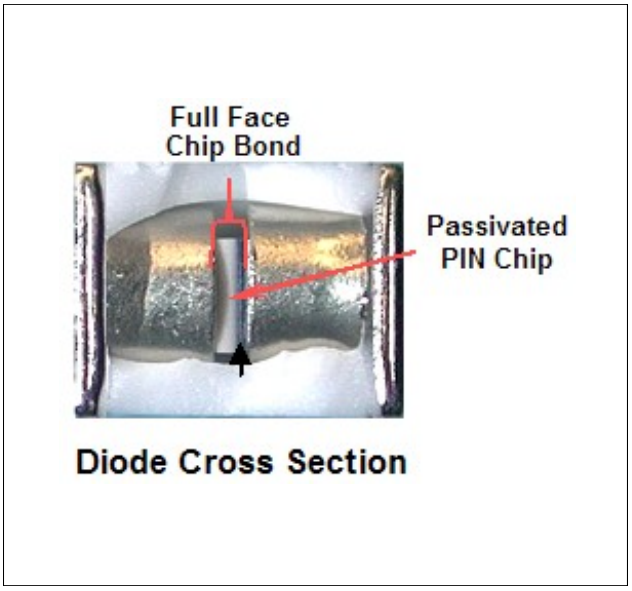
For recommended Sn/Pb and RoHS soldering profiles See Application Note M538 on the MACOM website.

Circuit Pad Layout for MELF Diodes

Dimension	Package Style			
	1072		1091	
	inches	mm	inches	mm
A	0.093	2.36	0.150	3.81
B	0.050	1.27	0.050	1.27
C	0.060	1.52	0.100	2.54



MELF Internal Construction



Ordering Information

MELF diodes are available in tape and reel in quantities as shown in table below

Package Style	Quantity (7" Reel)	Bulk Devices Per Bag
1072T	1500 or 5000	N/A
1091T	500	N/A

Tape and reel information can be found in application note M513 the MACOM website.

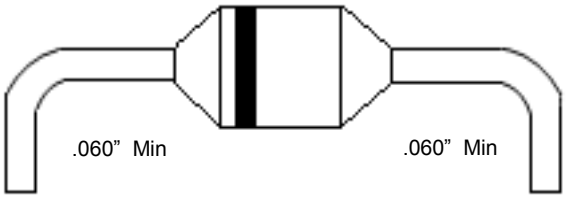
Axial Leaded HIPAX Assembly Recommendations

Bends on case styles 401 and 402, axially leaded devices, must be made while holding the lead firm and forming the bend no closer than .060 inches from the body of the part. Bending the lead <0.060 inches from the body of the part is not recommended and may cause internal damage to the chip. Appropriate fixturing should be used.

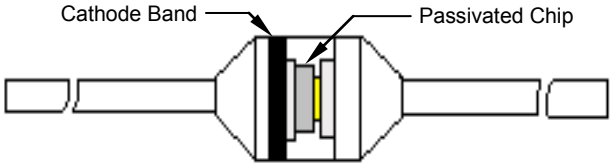
Devices may be soldered using standard 60Sn/40Pb or any RoHS compliant solders. Axial leads are tin plated 50 µm thick to ensure an optimum connection.

For recommended Sn/Pb and RoHS soldering profiles see Application Note M538 on the MACOM website.

Case Style 401 & 402
Minimum Bend Distance



Case Style 401 & 402
Internal Construction



Ordering Information

Axial leaded diodes are available in tape and reel or bulk in quantities shown in the table below

Package Style	Quantity Per Reel	Bulk Devices Per Bag
401T	500 or 1000 (specify qty. when ordering)	N/A
402	N/A	100

Environmental Ratings

HIPAX PIN diodes are designed to meet most environmental and electrical requirements and may be ordered screened to MIL-STD-750 specifications as described in the table below.

TEST	METHOD	DESCRIPTION/ CONDITIONS
Moisture Resistance	1021	85°C, 85% Relative Humidity, 168 hrs
High Temperature Storage	1031	+175°C , 250 Hours
HTRB	1038	80% of rated V_R, 50°C, 96 Hours
Temperature Shock	1051	-65°C to +175°C, 20 Cycles
Fine Leak	1071 Cond. H	1 x 10^{-7} CC/Sec
Constant Acceleration	2006	20,000 G's
Solderability	2026	IPC/JDEC J-STD-02
Tension[1]	2036.3 Cond. A	2 Lbs., 30 Seconds
Lead Fatigue[1]	2036.3 Cond. E	3 Cycles, 8 oz., 90°,

Note:

1) Test applicable to HIPAX axially leaded devices only.