

MA4P4001B-402 Datasheet



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| | |
|------------------------------|--|
| DiGi Electronics Part Number | MA4P4001B-402-DG |
| Manufacturer | MACOM Technology Solutions |
| Manufacturer Product Number | MA4P4001B-402 |
| Description | RF DIODE PIN 100V 2.5W AXIAL |
| Detailed Description | RF Diode PIN - Single 100V 2.5 W Axial |

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Manufacturer Product Number:

MA4P4001B-402

Series:

-

Diode Type:

PIN - Single

Capacitance @ Vr, F:

-

Power Dissipation (Max):

2.5 W

Package / Case:

Axial

Base Product Number:

MA4P4001

Manufacturer:

MACOM Technology Solutions

Product Status:

Active

Voltage - Peak Reverse (Max):

100V

Resistance @ If, F:

500mOhm @ 100mA, 100MHz

Operating Temperature:

-55°C ~ 175°C (TJ)

Supplier Device Package:

Axial

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

ECCN:

EAR99

Moisture Sensitivity Level (MSL):

1 (Unlimited)

HTSUS:

8541.10.0060

MA4P MELF & HIPAX Series



High Power PIN Diodes

V16

Features

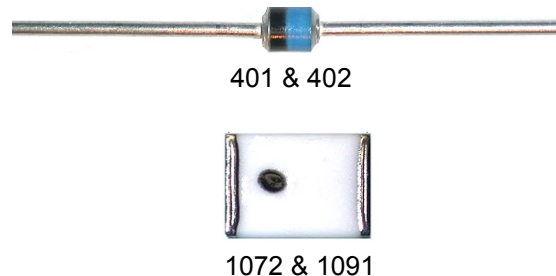
- High Power Handling
- Low Loss / Low Distortion
- Voltage Ratings up to 1000 Volts
- Passivated Chip for Low Leakage Current
- Low Theta (θ) Due to Full Face Chip Bonding
- Leadless Low Inductance MELF Packages
- Various Package Options
- Available as Chips
- Fully RoHS Compliant
- Non-Magnetic Packages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



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

$T_A = +25^\circ\text{C}$ (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.

MA4P MELF & HIPAX Series



High Power PIN Diodes

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MA4P1000 Series Electrical Specifications @ $T_A = +25^\circ\text{C}$

| 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 |
|---|-----------------------------------|------|---------------------------------|------|--------------------------------------|------|------------------------------------|
| | $V_R = 50\text{ V}, 1\text{ MHz}$ | | $I_R = 10\text{ mA}$ | | $I_F = 50\text{ mA}, 100\text{ MHz}$ | | $V_R = 0\text{ V}, 100\text{ MHz}$ |
| | 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. $I_{\text{Forward}} @ 1\text{V} \leq$ | | T_L Carrier Lifetime | | Forward Bias Harmonic Distortion $R(2a/a) * R(3a/a)$ | | Reverse Bias Harmonic Distortion $R(2a/a) - R(3a/a)$ | |
|---|---|------|---|------|---|------|---|------|
| | $I_F = 50\text{ mA}$ | | $I_F = 10\text{ mA}, I_R = 6\text{ mA}$ | | $P_{\text{IN}} = 30\text{ W}, 100\text{ MHz}$ $I_F = 50\text{ mA}$ | | $P_{\text{IN}} = 0\text{ dBm}, V_R = 0\text{ V},$ 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 @ $T_A = +25^\circ\text{C}$

| 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 | |

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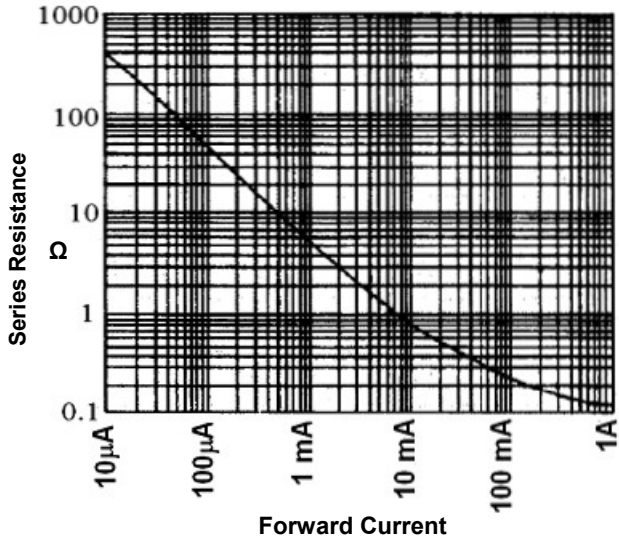


High Power PIN Diodes

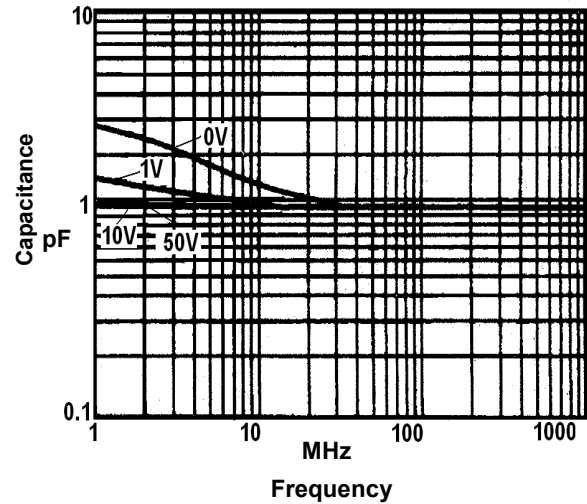
V16

Typical Performance Curves @ $T_A = +25^\circ\text{C}$ MA4P1200 Series

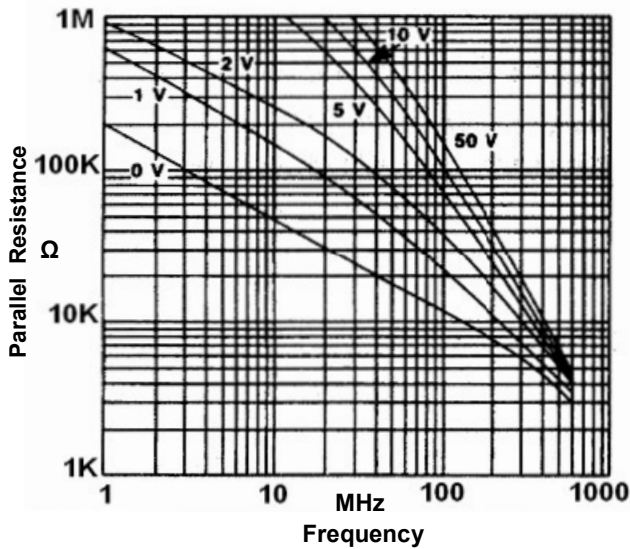
Series Resistance @ 100 MHz vs. Forward Current



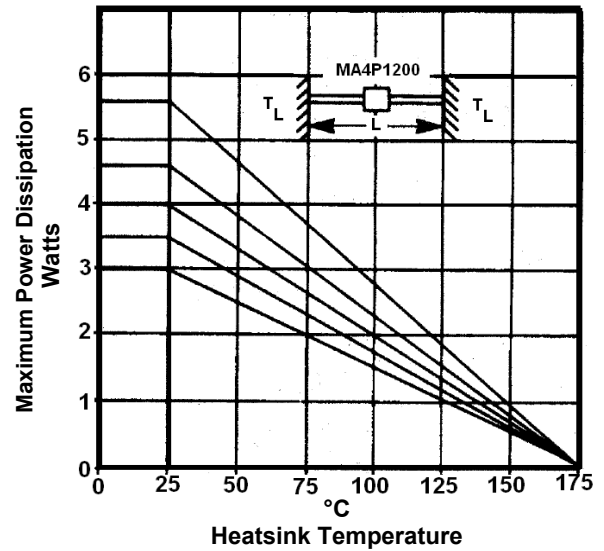
Capacitance vs. Frequency & Reverse Bias



Parallel Resistance vs. Frequency & Reverse Bias



Heatsink Temperature vs. Max. Power Dissipation



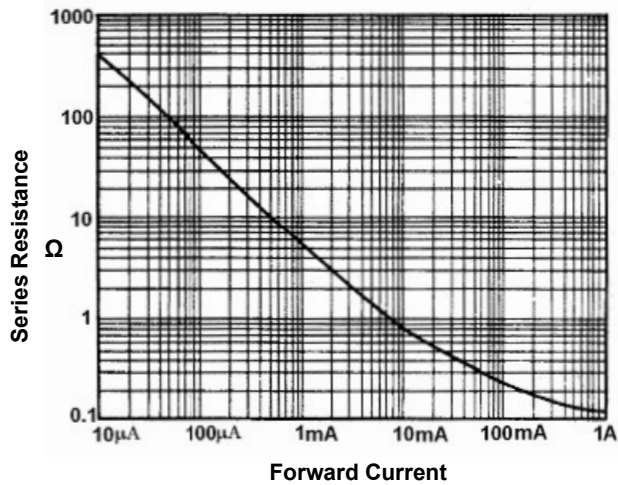
MA4P MELF & HIPAX Series



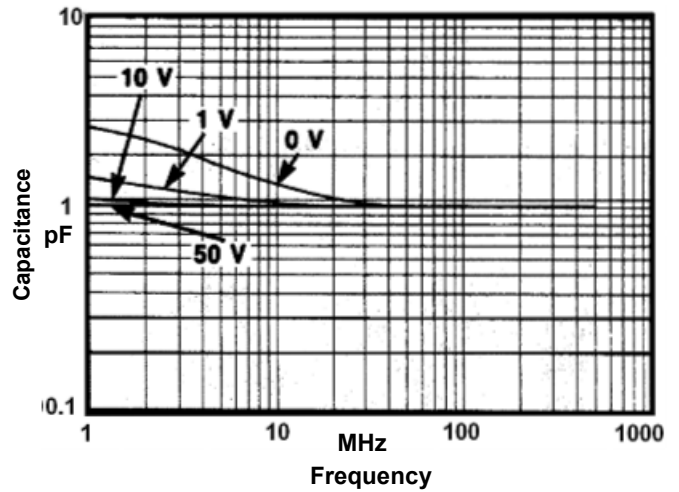
High Power PIN Diodes V16

Typical Performance Curves @ $T_A = +25^\circ\text{C}$ MA4P1250 Series

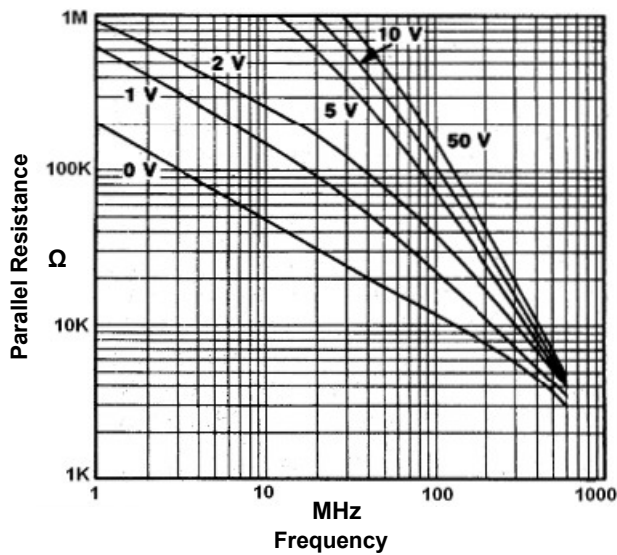
Series Resistance @ 100 MHz vs. Forward Current



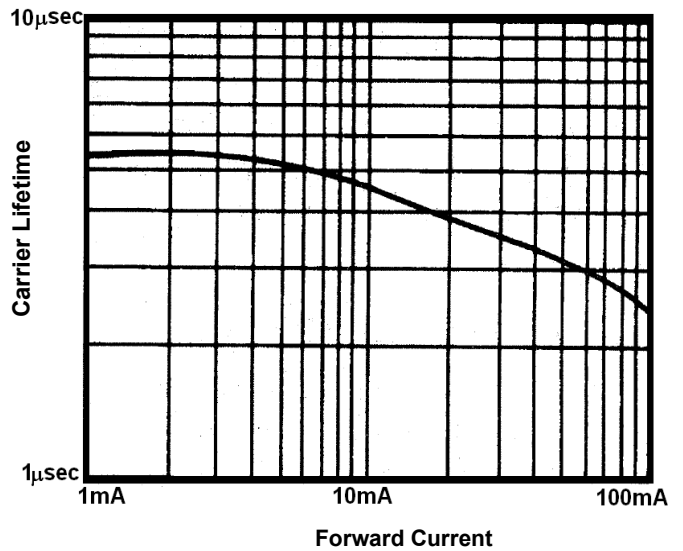
Capacitance vs. Frequency & Reverse Bias



Parallel Resistance vs. Frequency & Reverse Bias



Carrier Lifetime vs. Forward Bias Current



MA4P MELF & HIPAX Series

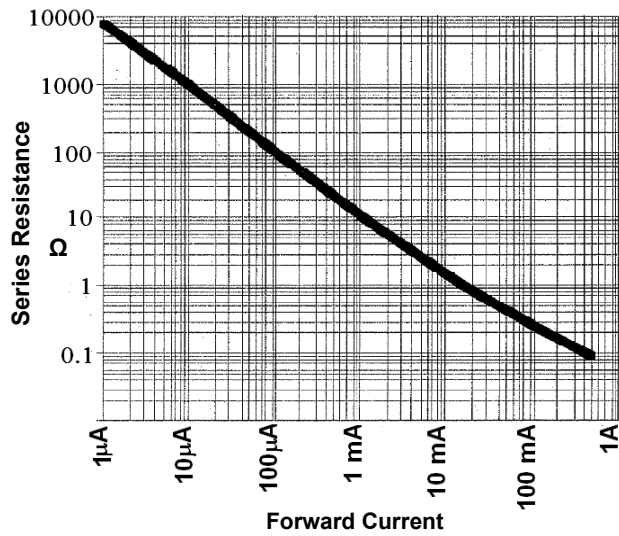


High Power PIN Diodes

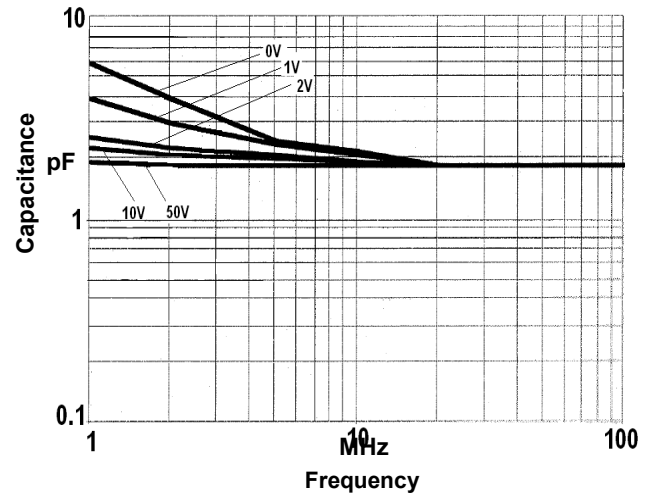
V16

Typical Performance Curves @ $T_A = +25^\circ\text{C}$ MA4P1450 Series

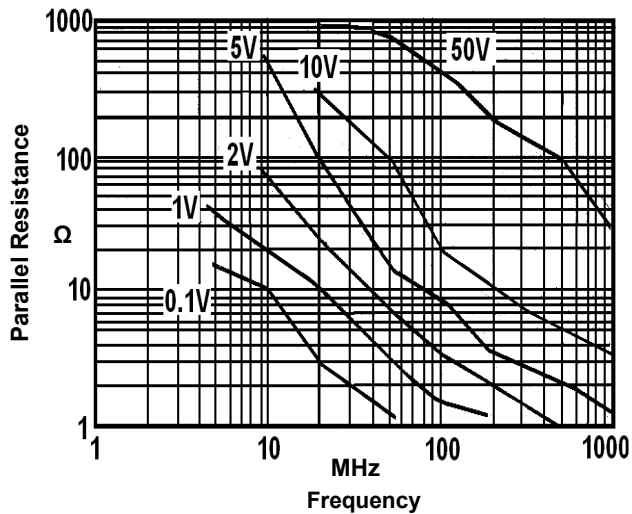
Series Resistance @ 100 MHz vs. Forward Current



Capacitance vs. Frequency and Reverse Bias



Parallel Resistance vs. Frequency and Reverse Bias



MA4P MELF & HIPAX Series



High Power PIN Diodes

V16

MA4P4000 - MA4P7100 Series Electrical Specifications @ $T_A = +25^\circ\text{C}$

| Parameter | Symbol | Condition | MA4P4000 Series | MA4P4300 Series | MA4P7000 Series | MA4P7100 Series |
|-----------------------------|--------|------------------------|-------------------|-------------------|-------------------|-------------------|
| Maximum Series Resistance | R_S | $I_F = 100 \text{ mA}$ | 0.5 Ω | 1.0 Ω | 0.9 Ω | 0.5 Ω |
| Maximum Total Capacitance | C_T | $V_R = 100 \text{ V}$ | 2.2 pF | 2.0 pF | 0.7 pF | 1.0 pF |
| Minimum Parallel Resistance | R_P | $V_R = 100 \text{ V}$ | 20 k Ω | 50 k Ω | 200 k Ω | 100 k Ω |
| Minimum Carrier Lifetime | T_L | $I_F = 10 \text{ mA}$ | 20 μs | 15 μs | 5 μs | 2.5 μs |
| Maximum Forward Voltage | V_F | $I_F = 100 \text{ mA}$ | 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 |

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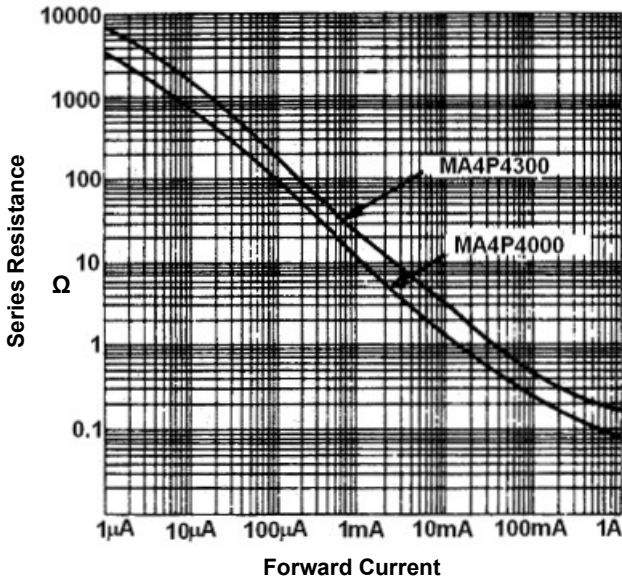
MA4P MELF & HIPAX Series



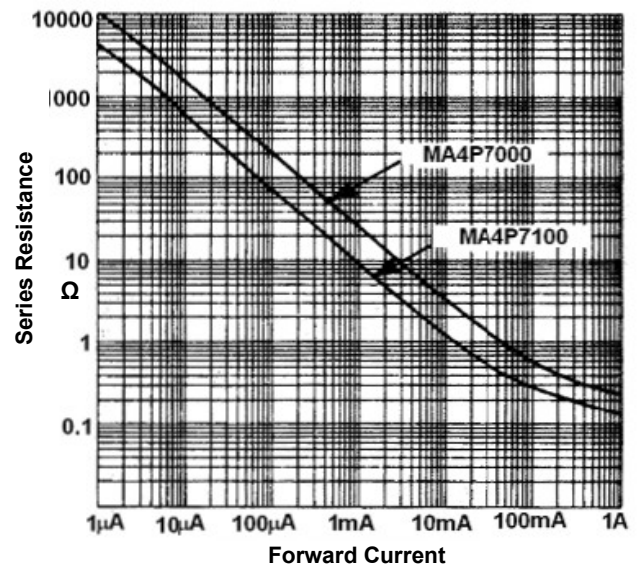
High Power PIN Diodes V16

Typical Performance Curves @ $T_{AMB} = +25^{\circ}C$ MA4P4000, MA4P4300, MA4P7000, MA4P7100 Series

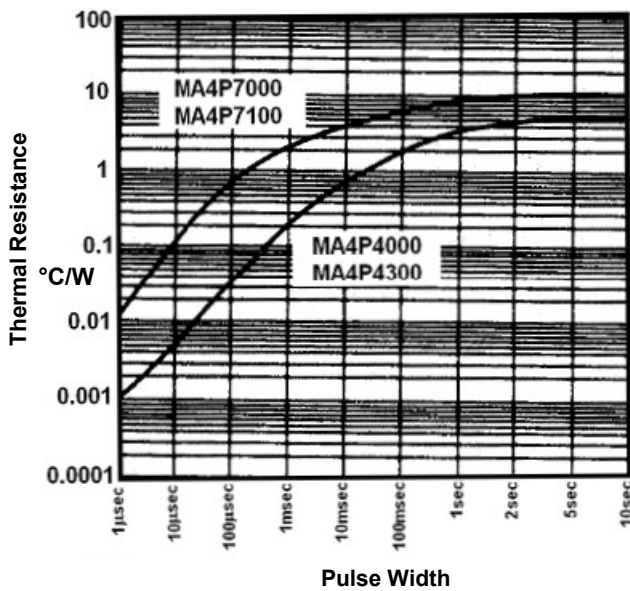
Series Resistance at 100 MHz vs. Forward Current
MA4P4000, MA4P4300 Series



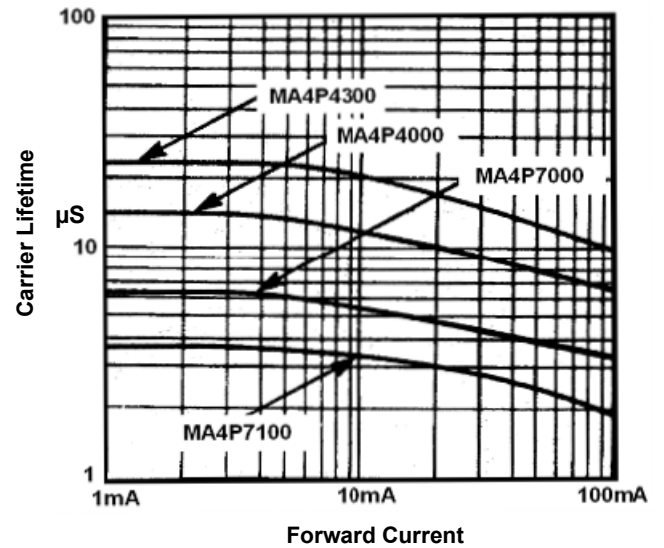
Series Resistance at 100 MHz vs. Forward Current
MA4P7000, MA4P7100 Series



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



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



MA4P MELF & HIPAX Series

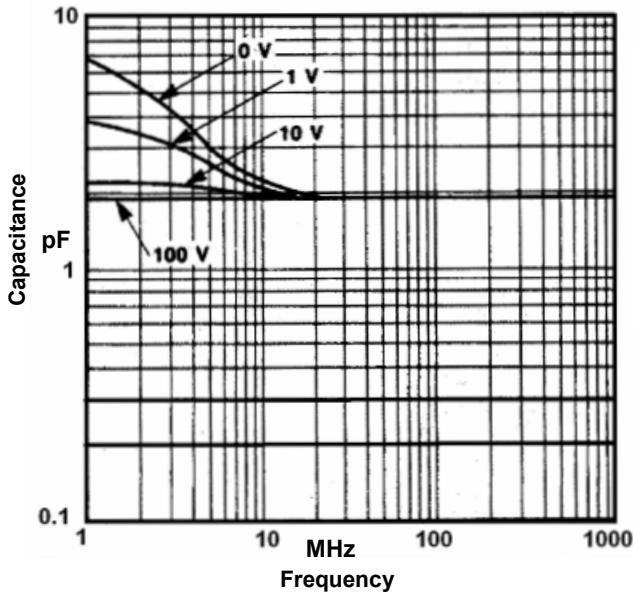


High Power PIN Diodes

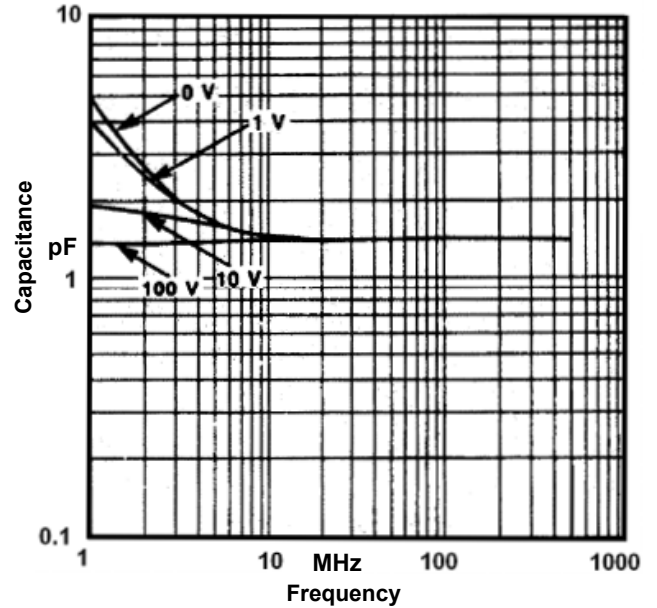
V16

Typical Performance Curves @ $T_{AMB} = +25^{\circ}C$ MA4P4000, MA4P4300, MA4P7000, MA4P7100 Series

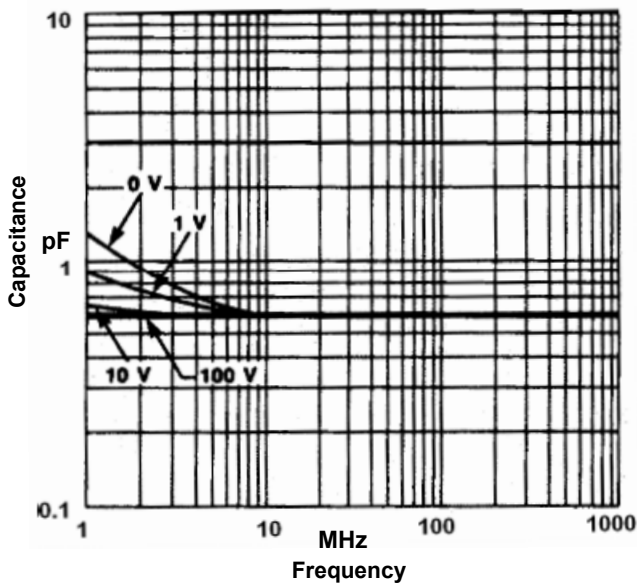
Capacitance vs. Frequency & Reverse Bias
MA4P4000 Series



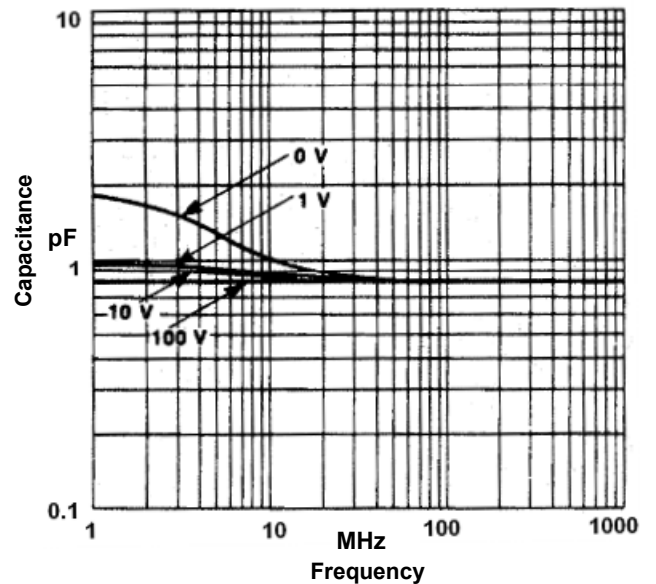
Capacitance vs. Frequency & Reverse Bias
MA4P4300 Series



Capacitance vs. Frequency & Reverse Bias
MA4P7000 Series



Capacitance vs. Frequency & Reverse Bias
MA4P7100 Series



MA4P MELF & HIPAX Series

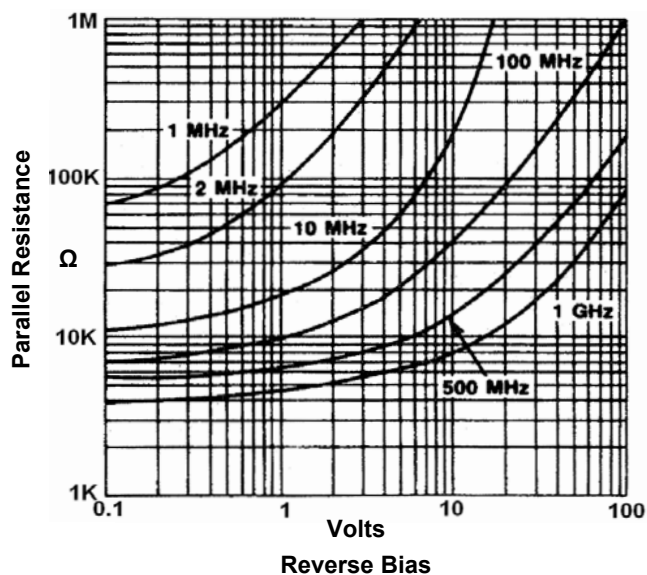


High Power PIN Diodes

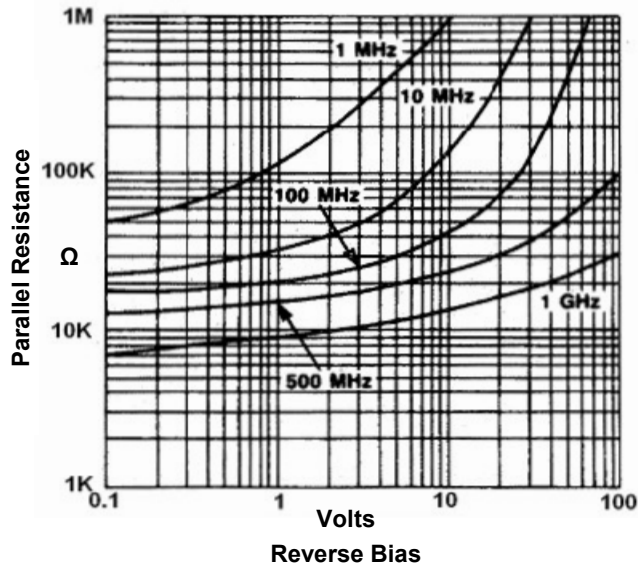
V16

Typical Performance Curves @ $T_{AMB} = +25^{\circ}C$ MA4P4000, MA4P4300, MA4P7000, MA4P7100 Series

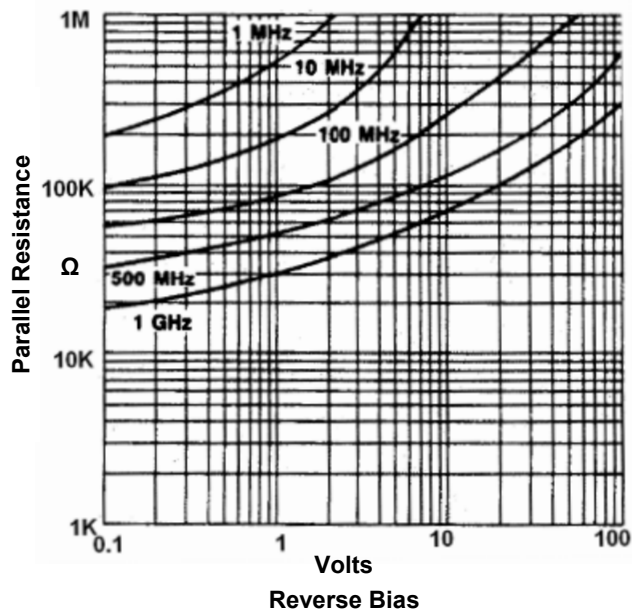
Parallel Resistance vs. Reverse Bias & Frequency
MA4P4000 Series



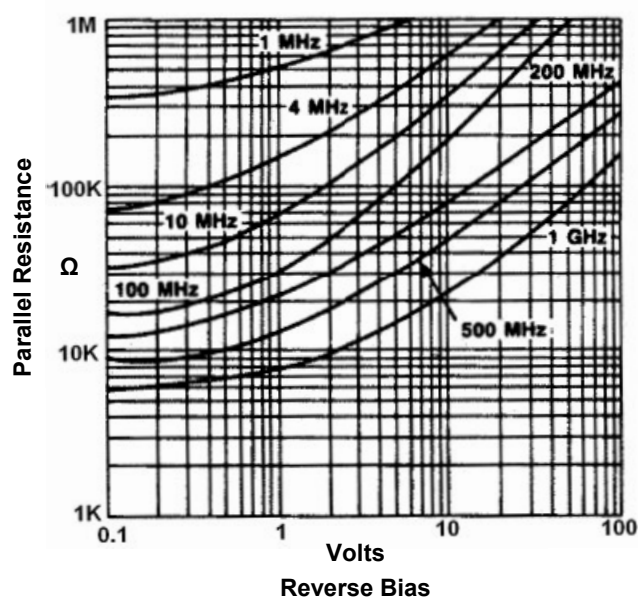
Parallel Resistance vs. Reverse Bias & Frequency
MA4P4300 Series



Parallel Resistance vs. Reverse Bias & Frequency
MA4P7000 Series



Parallel Resistance vs. Reverse Bias & Frequency
MA4P7100 Series



MA4P MELF & HIPAX Series

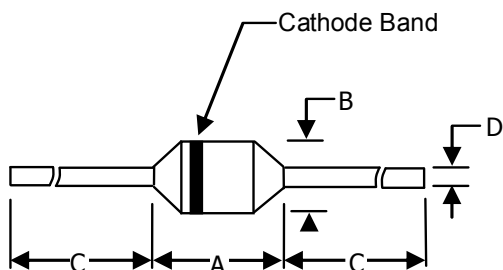


High Power PIN Diodes

V16

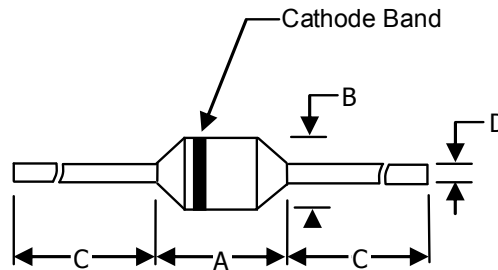
Case Styles

401 Axial Leaded Packages



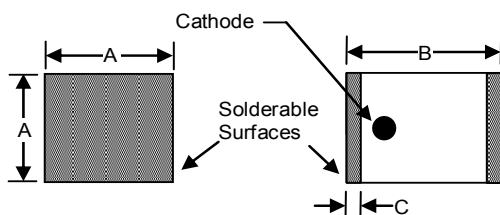
| 401 Package (tape and reel only) 500 or 1000 pcs/reel specify when ordering | Dimension | INCHES | | MM | |
|--|-----------|--------|-------|-------|------|
| | | Min. | Max. | Min. | Max. |
| MA4P1200-401T MA4P1200NM-401T MA4P7002B-401T MA4P7006B-401T MA4P7101B-401T MA4P7102B-401T MA4P7104B-401T | 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



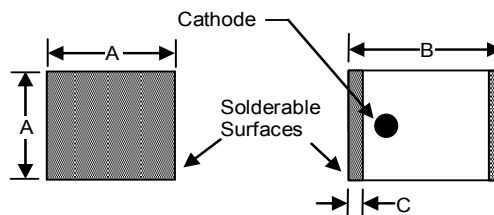
| 402 Package (bulk only) 100 pcs/bag | Dimension | INCHES | | MM | |
|--|-----------|--------|-------|-------|------|
| | | Min. | MAX | Min. | Max. |
| MA4P4001B-402 MA4P4001BNM-402 MA4P4002B-402 MA4P4006B-402 MA4P4301B-402 MA4P4302B-402 | A | — | 0.230 | — | 5.84 |
| | B | — | 0.140 | — | 3.56 |
| | 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 |

MA4P MELF & HIPAX Series



High Power PIN Diodes

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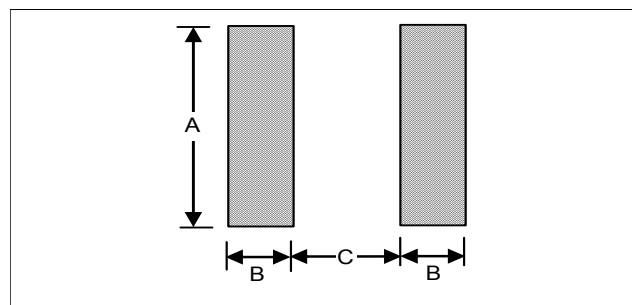
MELF Assembly Recommendations

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.

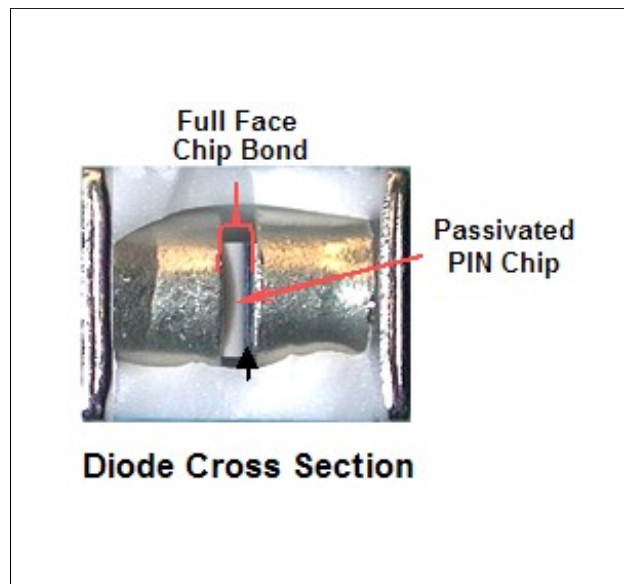
For recommended Sn/Pb and RoHS soldering profiles See Application Note M538 on the MACOM website.

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.

MA4P MELF & HIPAX Series



High Power PIN Diodes

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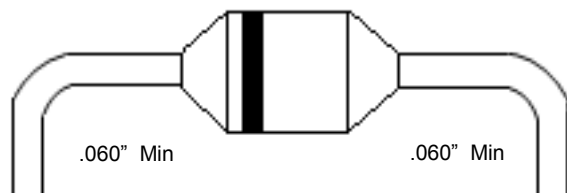
Axial Leaded HIPAX Assembly Recommendations

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.

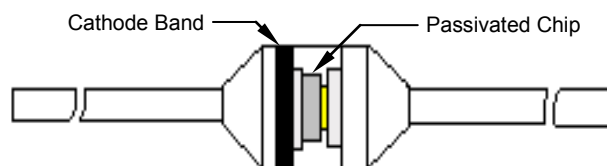
Devices may be soldered using standard 60Sn/40Pb or any RoHS compliant solders. Axial leads are tin plated 50 μm thick to ensure an optimum connection.

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 | 1×10^{-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.

MA4P MELF & HIPAX Series



High Power PIN Diodes

V16

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