Fast MRI Protection Diode

MADP-010015
Rev. V4

Features

- Available in Surface Mount Package & Axial Lead
- Passivated Chip
- Ultra Low Magnetic Construction
- Non Cavity Design; Available as Anti-Parallel Pair
- Thermally Matched Configuration
- Low Capacitance @ 0 V bias
- Low Conductance @ 0 V bias
- Compatible with Automatic Insertion Equipment
- RoHS* Compliant

Applications

- MRI Receiver Protection
- Body Coil Isolation

Description

The MADP-010015 diode was designed to protect MRI receivers from high RF energy fields including long RF pulses and RF spike pulses present in most MRI machines. This diode acts as a passive protector (limiter) for the MRI receiver. No forward bias voltage is required to turn on the diode. It is self -biased by the RF transmitter pulse power. A switch driver is not needed for this receiver protection application.

Receiver protector diodes appear directly across the input port of the receiver. They are connected in anti -parallel pairs to limit the RF carrier excursion in both polarities. They must, therefore, exhibit extremely low insertion loss, both in the “on” state (high power present) and the “off” state (receiver power present) so as not to decrease the receiver’s sensitivity. This diode is available in three package configurations for flexibility in design. The anti-parallel packaging option eliminates the worry of incorrectly polarized diodes when devices are placed onto the PCB and decreases parasitic capacitance and inductance associated with single packaged diodes.

The MADP-010015 is ideally suited for MRI Receiver Protection and Body Coil Isolation.

MELF Package

Axial Leaded Package

Ordering Information

Part Number	MELF Package Description	Qty. per Reel
MADP-010015-14320T	Single	1000
MADP-010015-14420T	AP Pair	1000
MADP-010015-14340T	Axial	500

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

Electrical Specifications: T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Forward Voltage[1]	I_F = 10 uA, T_J = 25°C I_F = 1000 mA, T_J = 25°C	V	—	—	0.4 1.4
Reverse Breakdown Voltage[2]	I_R = 10 µA	V	75	—	—
Reverse Current[2]	V_R = 20 V, T_J = 25°C V_R = 50 V, T_J = 25°C	nA	—	—	50 500
Total Capacitance (Single Diode)	V_R = 0 V, 1 MHz V_R = 0 V, 64 MHz	pF	—	1.2 1.5	2.5 3.0
Conductance (Single Diode)	V_R = 0 V, 64 MHz	µs	—	—	20

1. Short term duration test pulse used to minimize self heating effect.
2. The reverse breakdown voltage is not measured on Anti-Parallel Pair.

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
Junction Temperature	175°C
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	75 V
RMS Reverse Voltage	50 V
Forward Current	1000 mA DC
Non-Repetitive Peak Forward Surge Current 8.3 ms Single half sine wave	2.5 A
Operating & Storage Temperature	-65°C to +175°C

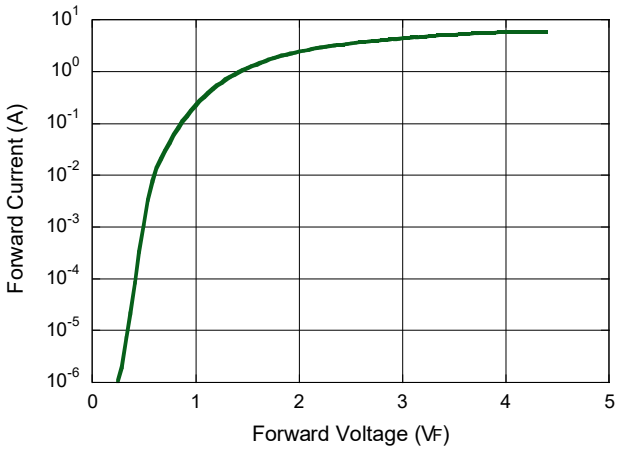
2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.

Thermal Characteristics

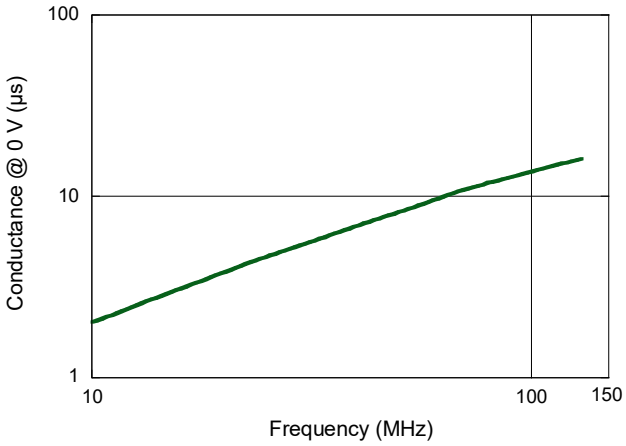
Parameter	Test Conditions	Units
Thermal Resistance	Axial Leaded $R\theta_{JL}$ @ lead length = 3/8 inches Surface Mount (US) $R\theta_{JEC}$	150°C/W 40°C/W

Typical Performance Curves

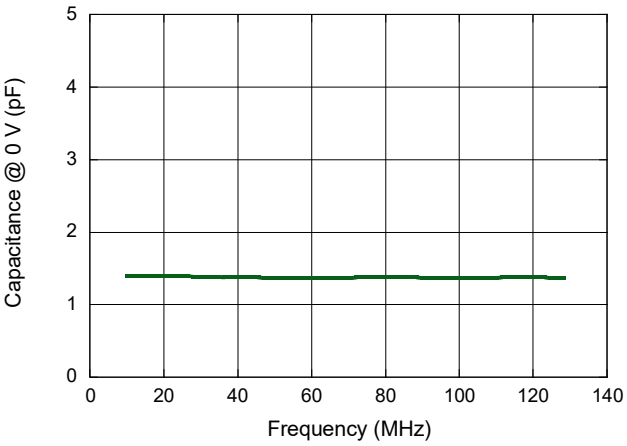
If vs. VF



Conductance vs. Frequency

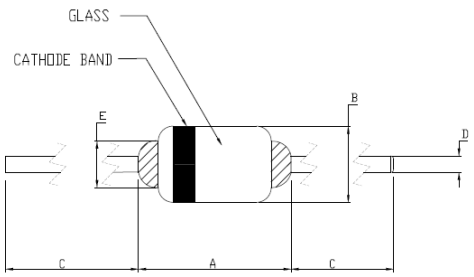


Capacitance vs. Frequency



Hermetically Sealed Outline Drawings:

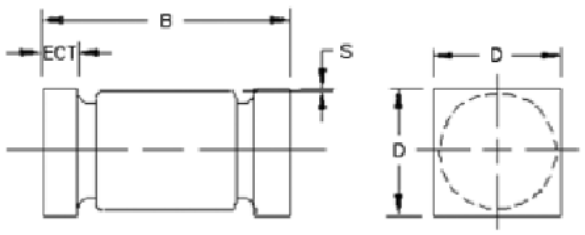
Axial Leaded Glass



Lead Finish: tin
Lead Material: copper
Polarity: cathode end is banded

Symbol	Dimensions			
	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	—-	0.200	—-	5.08
B	—-	0.070	—-	1.78
C	0.975	—-	24.77	—-
D	0.019	0.021	0.48	0.53
E		0.040		

Glass MELF

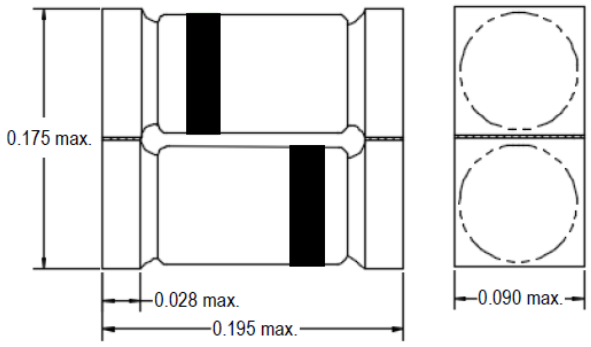


Lead Finish: tin
End Cap Material (U, US): copper
Polarity: cathode end is banded
Package Weight: 0.095 G
Mounting Surface Selection: The Axial Coefficient of Expansion (COE) of this device is approximately +4PPM/°C. The COE of the Mounting Surface System should be selected to provide a suitable match with this device.

Symbol	Dimensions			
	Inches		Millimeters	
	Min.	Max.	Min.	Max.
D	0.070	0.085	1.78	2.16
B	0.165	0.195	4.19	4.95
ECT	0.019	0.028	0.048	0.71
S	0.003	—	0.08	—

Notes:
1. Dimensions are in inches. Millimeters are given for general information only.
2. Dimension BD shall be measured at the largest diameter.
3. The specified lead diameter applies in the zone between .050 inch (1.27 mm) from the diode body to the end of the lead. Outside of this zone lead shall not exceed BD.
4. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

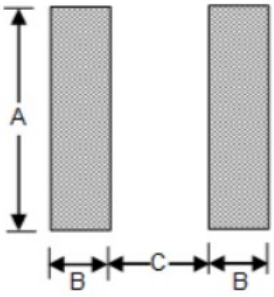
Outline (ODS-1442) Hermetically Sealed Glass Anti-Parallel MELF[4,5]



Lead Finish: Silver/Gold-Tin Eutectic Solder
End Cap Material (U, US): copper
Polarity: cathode end is banded, Anti-Parallel
Package Weight: 0.200 G
Mounting Surface Selection: The Axial Coefficient of Expansion (COE) of this device is approximately +4PPM/°C. The COE of the Mounting Surface System should be selected to provide a suitable match with this device.

4. Dimensions are in inches.
5. Refer to application note M538 for surface mounting recommendations.

Circuit Pad Layout



Dimension	Inches	mm
A	0.190	4.83
B	0.067	1.70
C	0.120	3.05