SURMOUNT™ 15 µm PIN Diode

MAPD-017015 & MAPD-030015

Rev. V9

Features

- 0603 Outline
- Surface Mount
- 15 µm I-Region Length Devices
- No Wirebonds Required
- Silicon Nitride Passivation
- Polymer Scratch Protection
- Low Parasitic Capacitance and Inductance
- High Average and Peak Power Handling

Description

This device is a silicon, glass PIN diode surmount chip fabricated with a MACOM patented HMIC™ process. This device features two silicon pedestals embedded in a low loss, low dispersion glass. The diode is formed on the top of one pedestal and connections to the backside of the device are facilitated by making the pedestal sidewalls electrically conductive. Selective backside metallization is applied producing a surface mount device. This vertical topology provides for exceptional heat transfer. The topside is fully encapsulated with silicon nitride and has an additional polymer layer for scratch and impact protection. These protective coatings prevent damage to the junction and the anode air-bridge during handling and assembly.

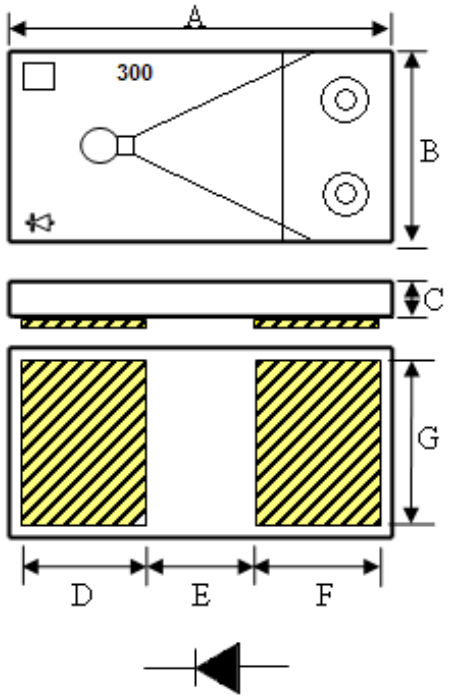
Applications

These packageless devices are suitable for usage in moderate incident power, ≤50 dBm/C.W. or where the peak power is ≤75 dBm, pulse width is ≤1 µs, and duty cycle is ≤0.01%. Their low parasitic inductance, 0.4 nH, and excellent RC constant, make these devices a superior choice for higher frequency switch elements when compared to their plastic package counterparts.

Ordering Information

Part Number	Package
MADP-017015-13140G	100 piece gel pack
MADP-017015-13140P	3000 piece reel
MADP-030015-13140G	100 piece gel pack
MADP-030015-13140P	3000 piece reel

Case Style ODS 1314



Chip Dimensions[1,2,3]

DIM.	INCHES		MM	
	Min.	Max.	Min.	Max.
A	0.060	0.061	1.535	1.55
B	0.031	0.032	0.785	0.800
C	0.004	0.005	0.115	0.135
D	0.019	0.021	0.475	0.525
E	0.019	0.021	0.475	0.525
F	0.019	0.021	0.475	0.525
G	0.029	0.031	0.725	0.775

1. Backside metal: 0.1 microns thick.
2. Yellow area with hatch lines indicate backside ohmic gold contacts.
3. Both devices have same outline dimensions (A to G).

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

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Electrical Specifications @ T_A = 25°C (unless otherwise noted)

Parameter	Conditions	Units	MADP-017015			MADP-030015		
			Min.	Typ.	Max.	Min.	Typ.	Max.
Capacitance (C_T)	-40 V, 1 MHz [4,6] -40 V, 1 GHz [4,6]	pF	— —	0.32 0.31	0.38 —	— —	0.79 0.78	0.85 —
Capacitance (C_T) @ 85°C	-40 V, 1 GHz [4,6]	pF	—	0.29	—	—	0.76	—
Resistance (R_S)	+10 mA, 1 GHz [5,6] +70 mA, 1 GHz [5,6]	Ω	— —	0.72 0.51	— —	— —	0.49 0.38	— —
Resistance (R_S) @ 85°C	+10 mA, 1 GHz [5,6] +70 mA, 1 GHz [5,6]	Ω	— —	1.08 0.84	— —	— —	0.82 0.69	— —
Forward Voltage (V_F)	+10 mA	V	—	0.74	0.90	—	0.72	0.90
Reverse Leakage Current (I_R)	-115 V	A	—	—	10	—	—	10
Third Order Intermodulation Product (IM3)	F1= 1800 MHz F2 = 1810 MHz Input Power = 0 dBm I bias = +70 mA	dBc	—	-36.8	—	—	-37.0	—
Thermal Resistance [7] (θ)	—	°C/W	—	30	—	—	13	—
Lifetime (T_L)	+10 mA / -6 mA (50% - 90% V)	µs	—	1.3	—	—	1.6	—

4. Total capacitance, C_T, is equivalent to the sum of Junction Capacitance ,Cj, and Parasitic Capacitance, Cpar.
5. Series resistance R_S is equivalent to the total diode resistance : Rs = Rj (Junction Resistance) + Rc (Ohmic Resistance).
6. Rs and C_T are measured on an HP4291A Impedance Analyzer with the die mounted in an ODS-186 package.
7. Theta (θ) is measured with the die mounted in an ODS-186 package.

Typical Spice Parameters @ T_A = +25°C

Spice Parameter	N	RS	IS	IK	BV	IBV	Ct	CJO	VJ	M	FC	Cpar_Cj
Units	-	W	A	(mA)	(Volts)	(mA)	(pF)	(pF)	(Volts)	-	-	(F)
MADP-017015-1314	1.1	1.2	9.8E-15	14.7	145	10	0.46	0.10	0.29	0.50	0.34	3.5E-13
MADP-030015-1314	1.1	1.1	8.5E-15	13.9	145	10	1.12	0.29	0.18	0.50	0.19	8.2E-13

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Absolute Maximum Ratings[8] @ T_A = +25°C (unless otherwise specified)

Parameter	Absolute Maximum
Forward Current	500 mA
Reverse Voltage	115 V
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +150 °C
Junction Temperature	+175 °C
CW Incident Power	50 dBm
Mounting Temperature	+280 °C for 30 seconds

8. Exceeding these limits may cause in permanent damage.

Handling Procedures

All semiconductor chips should be handled with care to avoid damage or contamination from perspiration and skin oils. The use of plastic tipped tweezers or vacuum pickups is strongly recommended for individual components. Bulk handling should insure that abrasion and mechanical shock are minimized.

Bonding Techniques

Attachment to a circuit board is made simple through the use of surface mount technology. Mounting pads are conveniently located on the bottom surface of these devices and are removed from the active junction locations. These devices are well suited for solder attachment onto hard and soft substrates. The use of 80Au/20Sn, or RoHS compliant solders is recommended. For applications where the average power is ~1 W, conductive silver epoxy may also be used. Cure per manufacturers recommended time and temperature, typically 1 hour at 150 °C.

When soldering these devices to a hard substrate, hot gas die bonding is preferred. A vacuum tip pick-up tool and a force of 60 to 100 grams applied to the top surface of the device is recommended. When soldering to soft substrates, such as Duroid, it is recommended to use a soft solder at the circuit board to mounting pad interface. Position the die so that its mounting pads are aligned with the circuit board mounting pads. While applying a downward force perpendicular to the top surface of the die, apply heat near the circuit trace and diode mounting pad. The solder connection to the two pads should not be made one at a time as this will create unequal heat flow and thermal stress to the part. Solder reflow should not be performed by causing heat to flow through the top surface of the die to the back. Since the HMIC glass is transparent, the edges of the mounting pads can be visually inspected through the die after attachment is completed.

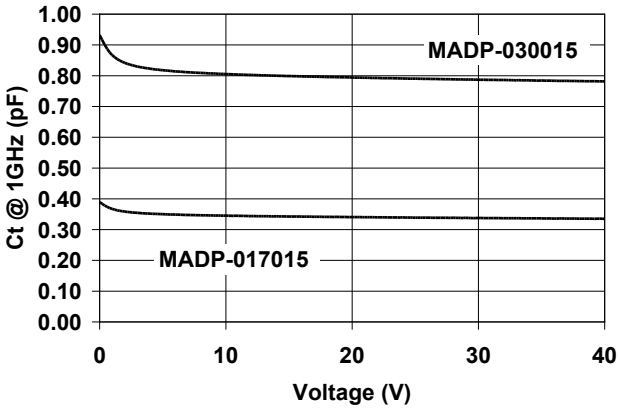
Typical re-flow profiles for Sn60/Pb40 and RoHS compliant solders are provided in Application Note M538, “Surface Mounting Instructions“ and can viewed on the MACOM website @ www.macom.com

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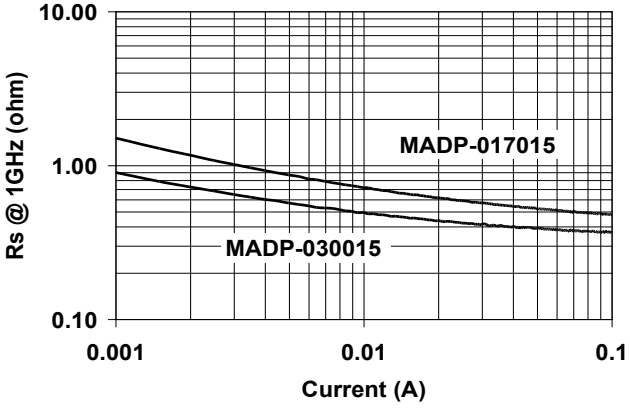
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Typical Performance @ T_A = +25°C

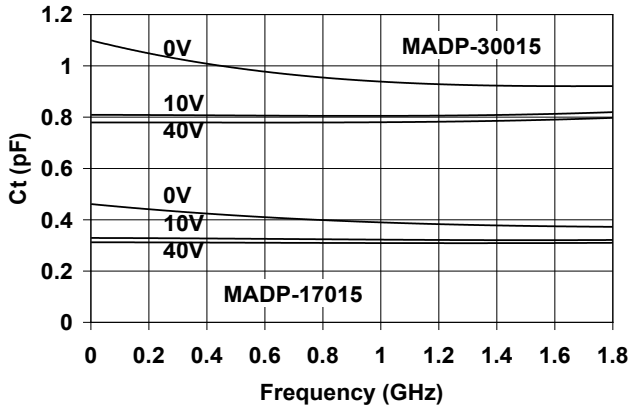
Total Capacitance (Ct) vs. Reverse Voltage



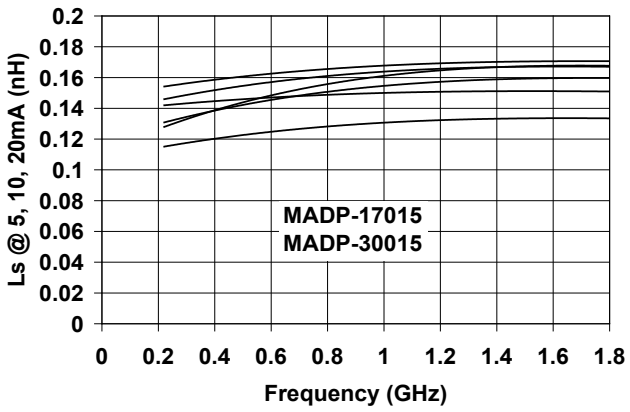
Series Resistance (Rs) vs. Forward Current



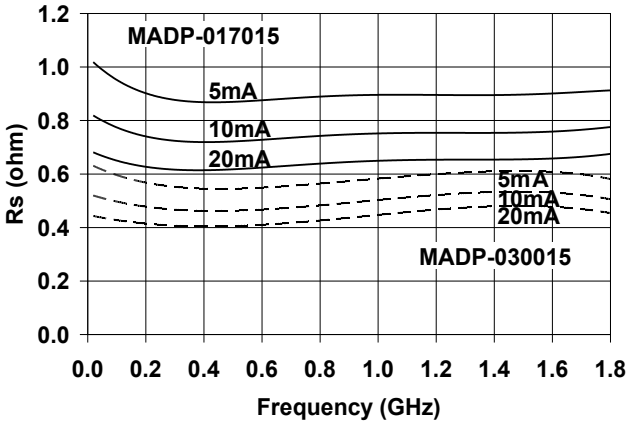
Total Capacitance (Ct) vs. Frequency



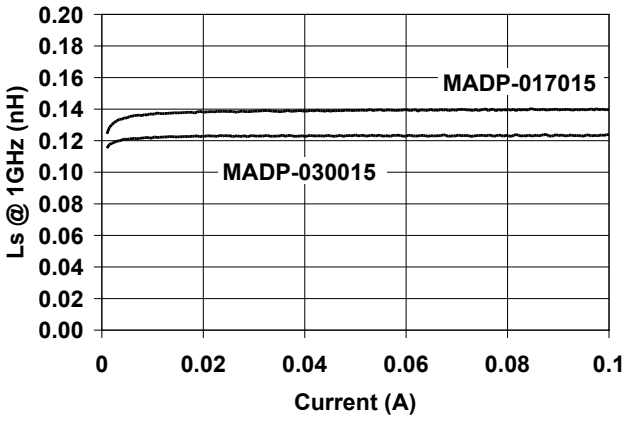
Series Inductance (Ls) vs. Frequency



Series Resistance (Rs) vs. Frequency



Series Inductance (Ls) vs. Forward Current



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