MADP-042XX5-13060 Series

SURMOUNT™ PIN Diodes: RoHS

Rev. V8

Features

- Surface Mount
- No Wirebonds Required
- Rugged Silicon-Glass Construction
- Silicon Nitride Passivation
- Polymer Scratch Protection
- Low Parasitic Capacitance and Inductance
- High Average and Peak Power Handling
- RoHS Compliant

Description

This device is a silicon, glass PIN diode surmount chip fabricated with MACOM's 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 moisture, scratch and impact protection. These protective coatings prevent damage to the junction and the anode air-bridge during handling and assembly.

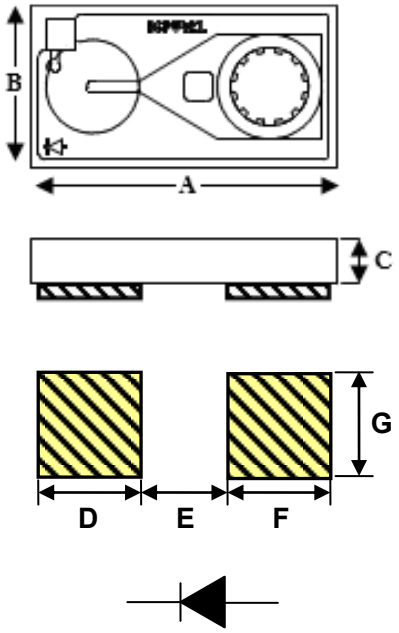
Applications

These packageless devices are suitable for moderate incident power applications, ≤10 W CW or where the peak power is ≤50 W, 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

Gel Pack	Tape and Reel, Pocket Tape
MADP-042305-130600	MADP-042305-13060P
MADP-042405-130600	MADP-042405-13060P
MADP-042505-130600	MADP-042505-13060P
MADP-042905-130600	MADP-042905-13060P

Package Dimensions ODS-1306 Style[1,2,3]



DIM	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.040	0.042	1.025	1.075
B	0.021	0.023	0.525	0.575
C	0.004	0.008	0.102	0.203
D	0.013	0.015	0.325	0.375
E	0.011	0.013	0.275	0.325
F	0.013	0.015	0.325	0.375
G	0.019	0.021	0.475	0.525

1. Backside metal: 0.1 µm thick.
2. Yellow hatched areas indicate backside ohmic gold contacts.
3. All devices have the same outline dimensions (A to G).

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Electrical Specifications @ T_{AMB} = +25°C [4,5,6,7]

Symbol	Parameter	Conditions	Units	MADP-042305-13060			MADP-042505-13060		
				Min.	Typ.	Max.	Min.	Typ.	Max.
C_T	Capacitance	-10 V, 1 MHz -10 V, 1 GHz -40 V, 1 MHz -40 V, 1 GHz	pF	—	0.14 0.15 0.13 0.14	0.22 — 0.22 —	—	0.28 0.28 0.27 0.27	0.40 — 0.40 —
R_S	Resistance	+20 mA, 1 GHz +50 mA, 1 GHz	Ω	—	1.32 1.18	—	—	0.83 0.76	—
V_F	Forward Voltage	+10 mA	V	—	0.87	1.00	—	0.84	1.00
I_R	Reverse Leakage Current	-80 V	µA	—	—	10	—	—	10
IIP3	Input Third Order Intercept Point	F1 = 1000 MHz F2 = 1010 MHz Input Power = +20 dBm I_{BIAS} = +20 mA	dBm	—	72	—	—	76	—
θ	CW Thermal Resistance	—	°C/W	—	145	—	—	115	—
T_L	Lifetime	+10 mA / -6 mA (50% - 90% V)	ns	—	180	—	—	210	—

Symbol	Parameter	Conditions	Units	MADP-042405-13060			MADP-042905-13060		
				Min.	Typ.	Max.	Min.	Typ.	Max.
C_T	Capacitance	-10 V, 1 MHz -10 V, 1 GHz -40 V, 1 MHz -40 V, 1 GHz	pF	—	0.61 0.61 0.57 0.58	0.75 — 0.75 —	—	0.06	0.18 — 0.18 —
R_S	Resistance	+20 mA, 1 GHz +50 mA, 1 GHz	Ω	—	0.62 0.58	—	—	3.14 2.60	—
V_F	Forward Voltage	+10 mA	V	—	0.82	1.00	—	0.93	1.00
I_R	Reverse Leakage Current	-80 V	µA	—	—	10	—	—	10
IIP3	Input Third Order Intercept Point	F1 = 1000 MHz F2 = 1010 MHz Input Power = +20 dBm I_{BIAS} = +20 mA	dBm	—	80	—	—	65	—
θ	CW Thermal Resistance	—	°C/W	—	100	—	—	185	—
T_L	Lifetime	+10 mA / -6 mA (50% - 90% V)	ns	—	255	—	—	140	—

4. Total capacitance (CT) is equivalent to the sum of junction capacitance (CJ) and parasitic capacitance (Cpar).
5. Series resistance (RS) is equivalent to the total diode resistance: RS = RJ (Junction Resistance) + RC (Ohmic Resistance)
6. RS and CT are measured on an HP4291A Impedance Analyzer with die mounted in an ODS-1134 package.
7. Theta (θ) is measured with the die mounted in an ODS-1134 package.

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Absolute Maximum Ratings[8,9]

Parameter	Absolute Maximum
CW Incident Power MADP-042305 MADP-042405 MADP-042505 MADP-042905	 40 dBm 44 dBm 43 dBm 35 dBm
Forward Current	250 mA
Reverse Voltage	-80 V
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +150°C
Junction Temperature	+175°C
Mounting Temperature	+280°C for 10 seconds

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

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 devices.

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 to100 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.

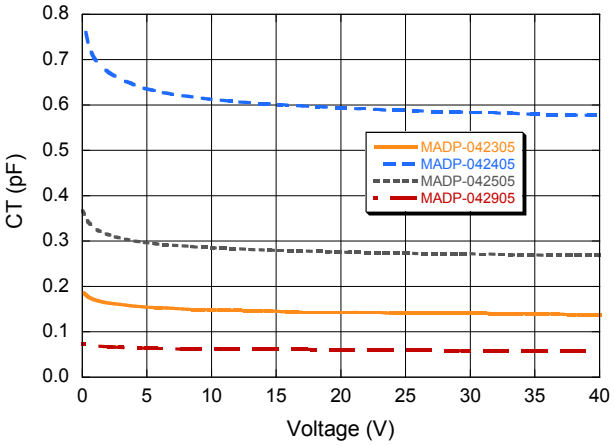
Typical re-flow profiles for Sn60/Pb40 and RoHS compliant solders is provided in Application Note M538 , “Surface Mounting Instructions“ and can viewed on the MACOM website @ www.macom.com

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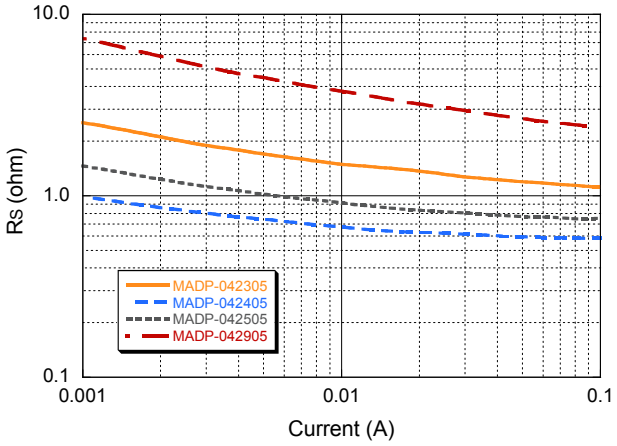
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Typical Performance @ T_{AMB} = +25 °C

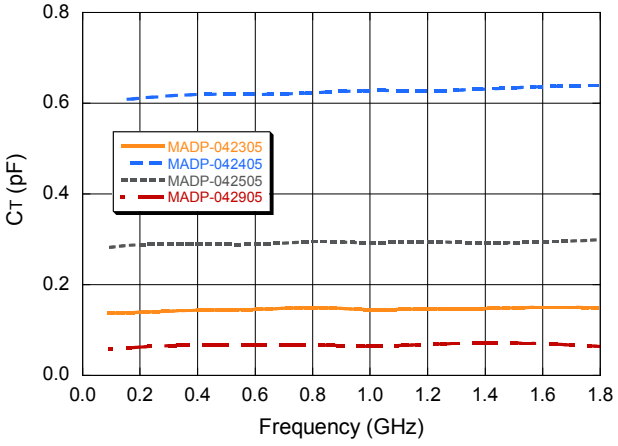
Capacitance @ 1 GHz



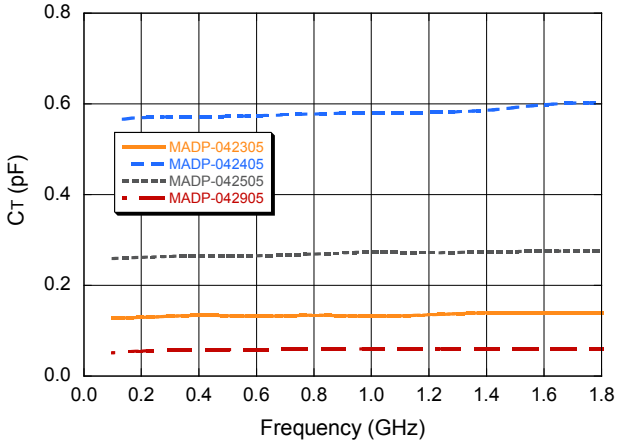
Resistance @ 1 GHz



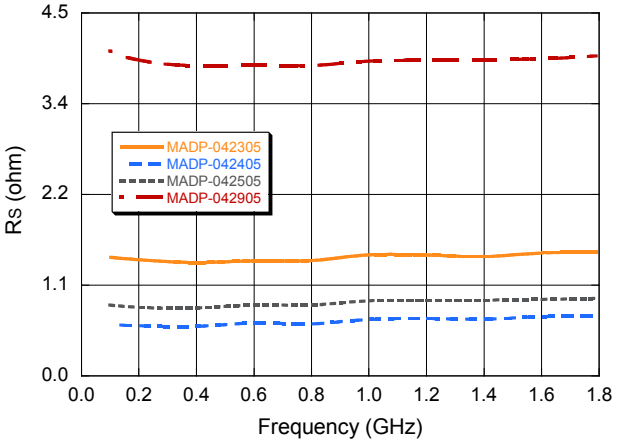
Capacitance @ 10 V



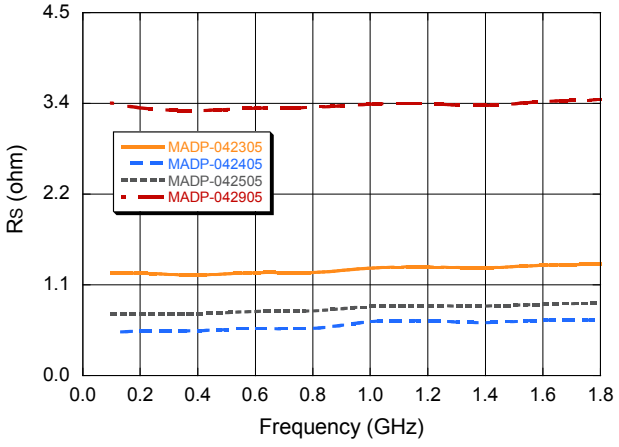
Capacitance @ 40 V



Resistance @ 10 mA



Resistance @ 20 mA



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