MA4SPS42X Series

SURMOUNT™ PIN Diodes
MA4SPS421, MA4SPS422

Rev. V7

Features

- Surface Mount
- No Wire Bonding Required
- Rugged Silicon-Glass Construction
- Silicon Nitride Passivation
- Polymer Scratch Protection
- Low Parasitic Capacitance and Inductance
- Higher Average and Peak Power Handling
- RoHS Compliant* and 260° Reflow Compatible

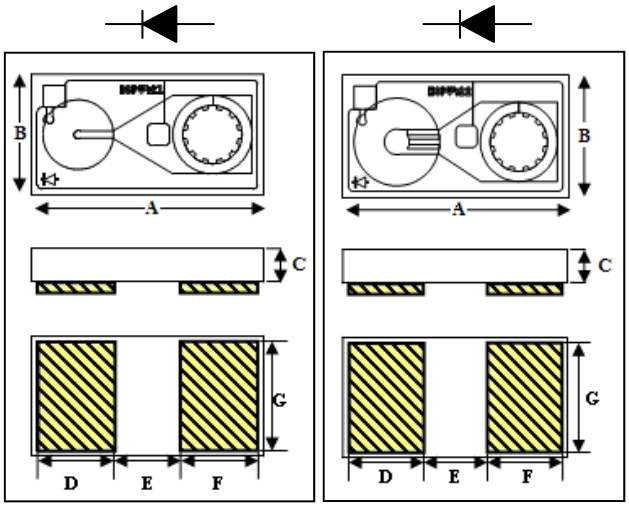
Description

This device is a Silicon-Glass PIN diode chip fabricated with M/A-COM Technology Solutions 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 surmount devices are suitable for usage in moderate incident power (10W C.W.) or higher incident peak power (500W) series, shunt, or series-shunt switches. Lower parasitic inductance, 0.1 to 0.2nH, and excellent RC constant (0.45pS), make the devices ideal for higher frequency switch elements compared to their plastic device counterparts.

MA4SPS421 **MA4SPS422**



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).

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

Absolute Maximum Ratings @ T_A = 25°C (unless otherwise specified)

Parameter	Absolute Maximum
Forward Current	250mA
Reverse Voltage	-200V
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +150°C
Junction Temperature	+175°C
Dissipated Power (RF & DC)	1.8W
Mounting Temperature	+280°C for 30 seconds

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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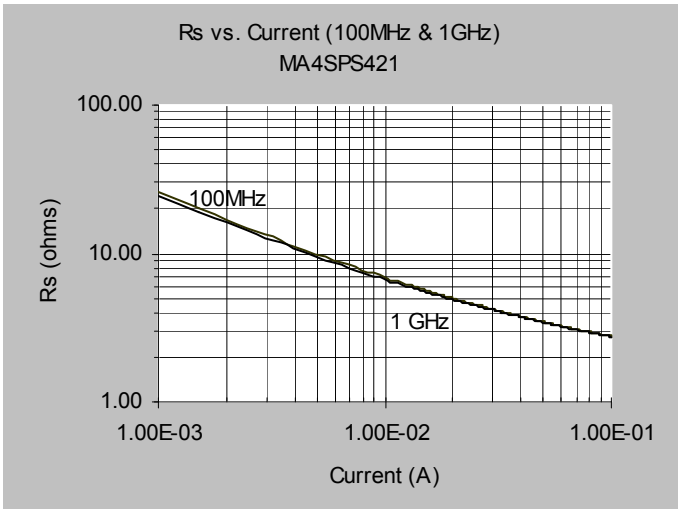
Visit www.macomtech.com for additional data sheets and product information.

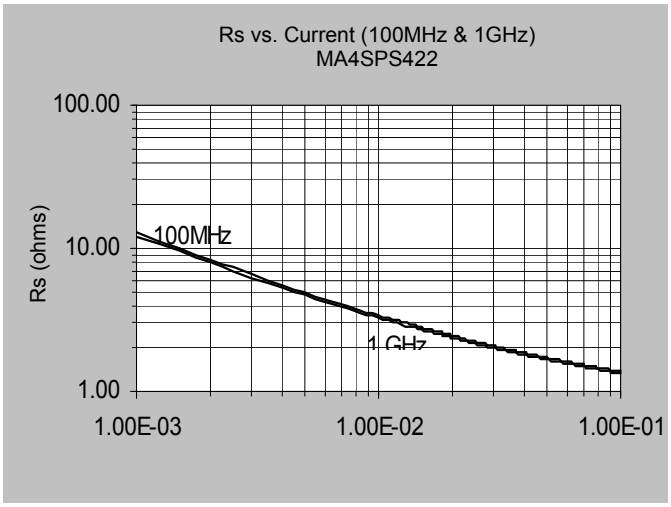
Electrical Specifications @ T_A = +25°C

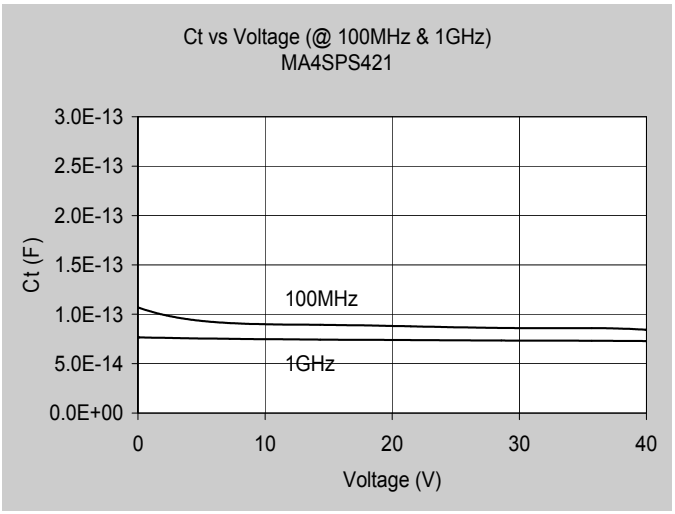
Parameter	Symbol	Conditions	Units	MA4SPS421		MA4SPS422	
				Typ.	Max.	Typ.	Max.
Capacitance	C_T	0V, 1MHz [1]	pF	0.130	0.175	0.340	0.500
Capacitance	C_T	0V, 1GHz [1,3]	pF	0.080		0.140	
Capacitance	C_T	- 40V, 1MHz [1]	pF	0.090	0.125	0.180	0.300
Capacitance	C_T	- 40V, 1GHz [1,3]	pF	0.070		0.130	
Resistance	R_S	+10mA, 1GHz [2,3]	Ω	6.200		3.100	
Forward Voltage	V_F	+10mA	V	0.900	0.950	0.840	0.900
Reverse Leakage Current	I_R	-200V	µA		|-10|		|-10|
Input Third Order Intercept Point	IIP^3	F_1 = 1000MHz	dBm	50		50	
		F_2 = 1010MHz					
		Input Power = +10dBm					
		I bias = +10mA					
Minority Carrier Lifetime	T_L	+10mA / -6mA	µS	5		10	
		(50% - 90% V)					
C.W. Thermal Resistance	$R_{ØJL}$	I_H = 0.5A, I_L = 10mA [4]	°C/W	80		70	

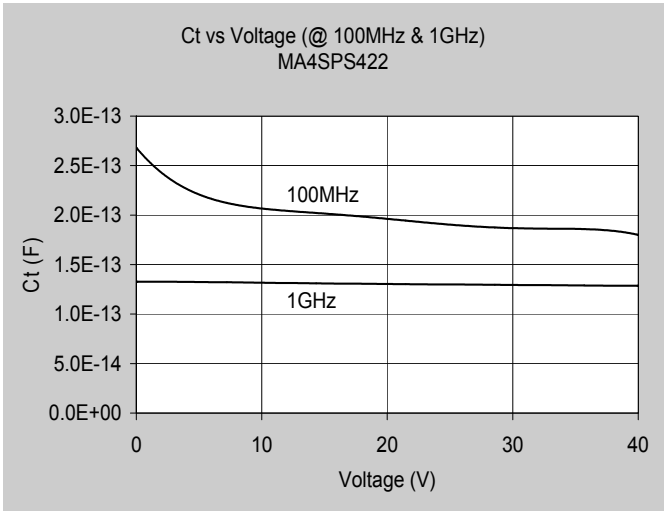
1. Total Capacitance, C_T, is equivalent to the sum of Junction Capacitance and Parasitic Capacitance. $C_T = C_J$ (Junction Capacitance) + C_{PAR} (Parasitic Capacitance)
2. Series resistance R_S is equivalent to the total diode resistance: $R_S = R_J$ (Junction Capacitance Junction Resistance) + R_O (Ohmic Resistance)
3. R_S and C_T are measured on an HP4291A Impedance Analyzer with die mounted in an ODS-186 package.
4. Steady-state $R_{ØJL}$ measured with die mounted in an ODS-186 package.

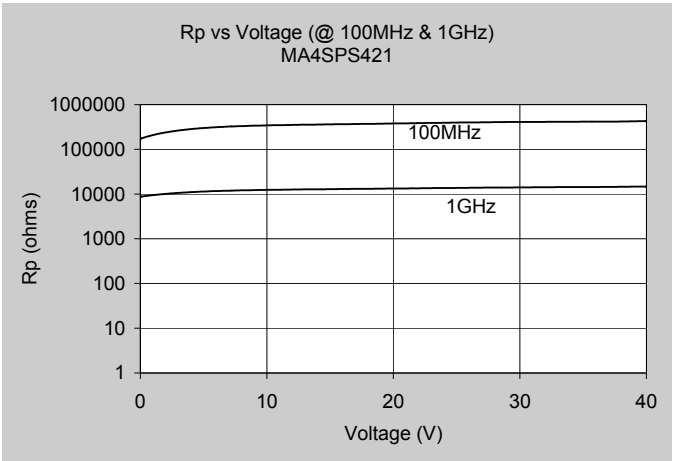
Typical Performance @ T_{AMB} = +25°C

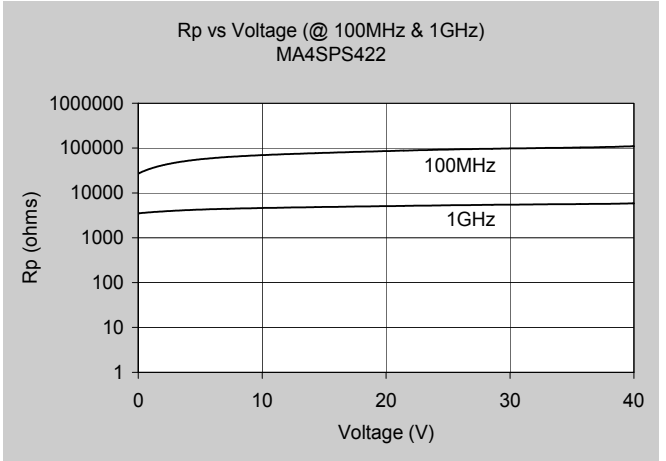






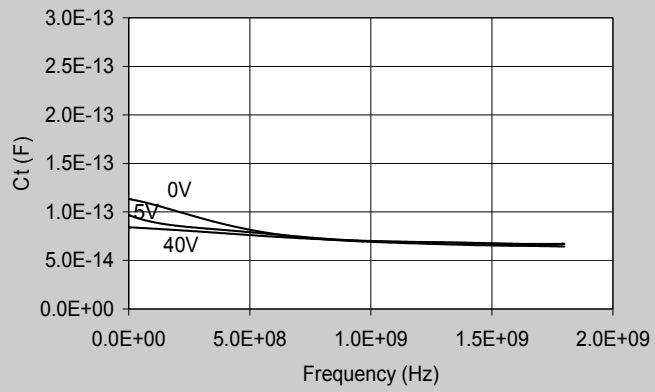




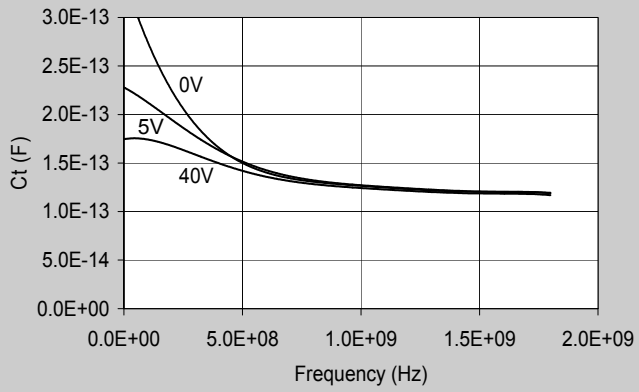


Typical Performance @ T_A = +25°C

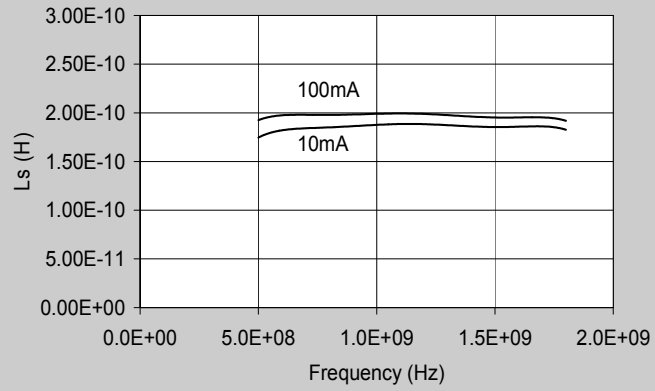
Ct vs Frequency (@ 0, 5 & 40V)
MA4SPS421



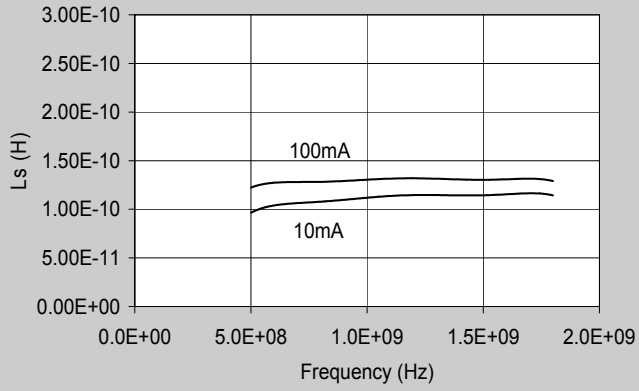
Ct vs Frequency (@ 0, 5 & 40V)
MA4SPS422



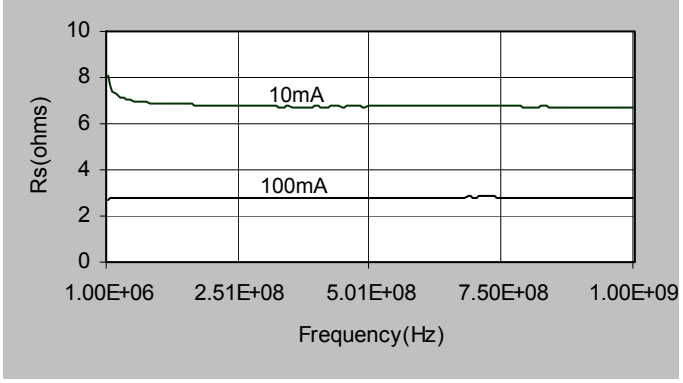
Ls vs Frequency (@ 10mA & 100mA)
MA4SPS421



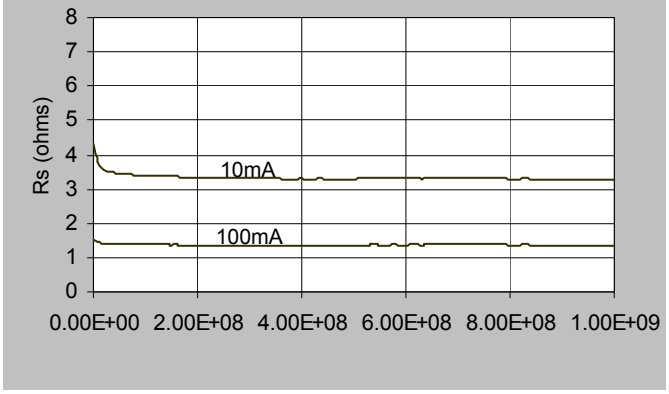
Ls vs Frequency (@ 10mA & 100mA)
MA4SPS422



Rs vs. Frequency (@10mA&100mA)
MA4SPS421



Rs vs. Frequency (@10mA & 100mA)
MA4SPS422

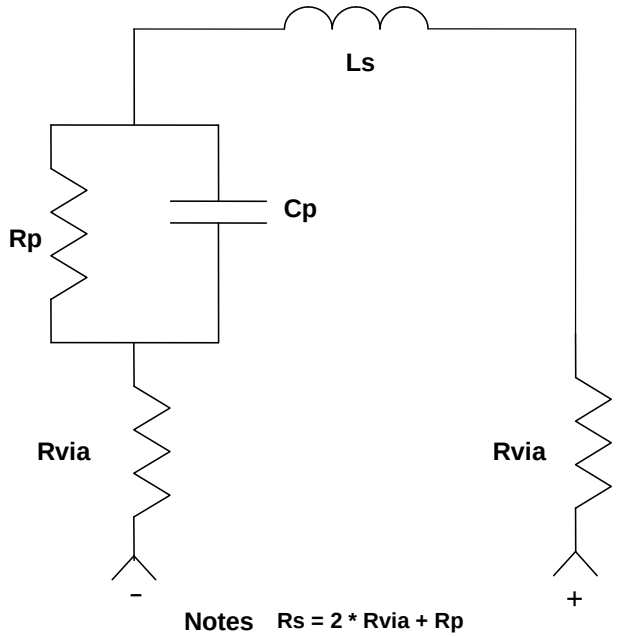


MA4SPS421 ADS SPICE Model

PinDiodeModel
NLPINM1
Is=3.5E-12A
Vi=0.0V
Un=900cm^2/V-sec
Wi=100µm
Rr=11KΩ
Cmin=0.06pF
Tau= 5µS
Rs=0.1Ω
Cj0=0.07pF
Vj=0.7V
M=0.5
Fc=0.5
Imax=3.1 E+8 A/m^2
Kf=0.0
Af=1.0

wBv=260V
wPmax=1.6W
Ffe=1.0

MA4SPS421 Schematic Diagram



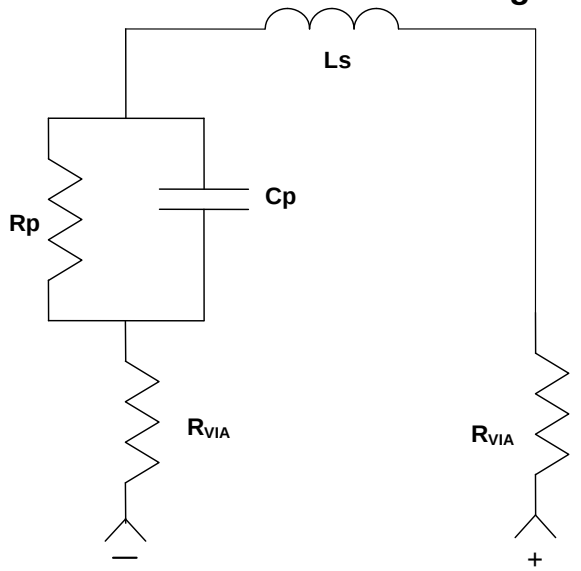
Notes **Rs = 2 * Rvia + Rp**

MA4SPS422 ADS SPICE

PinDiodeModel
NLPINM1
Is=3.5E-12A
Vi=0.0V
Un=900cm^2/V-sec
Wi=100µm
Rr=9 KΩ
Cmin=0.12pF
Tau= 10µS
Rs=0.1Ω
Cj0=0.13pF
Vj=0.7V
M=0.5
Fc=0.5
Imax=7.8E+7 A/m^2
Kf=0.0
Af=1.0

wBv=340V
wPmax=1.8W
Ffe=1.0

MA4SPS422 Schematic Diagram



Notes : Rs = 2 * Rvia + Rp

Handling

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

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 80/20, Au/Sn, 60/40, Sn/Pb or RoHS compliant solders is recommended. Conductive silver epoxy solder may also be used but could result in an increase in series and thermal resistance.

When soldering these devices to a hard substrate, hot gas die bonding is preferred. We recommend utilizing a vacuum tip and force of 60 to 100 grams applied normal to the top surface of the device. When soldering to soft substrates, it is recommended to use a lead-tin interface at the circuit board mounting pads. Position the die so that its mounting pads are aligned with the circuit board mounting pads and reflow the solder by heating the circuit trace near the mounting pad while applying 60 to 100 grams of force perpendicular to the top surface of the die. The solder joint must not be made one at a time, creating unequal heat flow and thermal stress. Solder reflow should not be performed by causing heat to flow through the top surface of the die. Since the HMIC glass is transparent, the edges of the mounting pads closest to each other can be visually inspected through the die after attach is completed.

Recommended temperature and re-flow profiles for 60/40, Sn/Pb and RoHS compliant solders are provided in Application Note M538 , “Surface Mounting Instructions“. Application Note M541 “Bonding and Handling Procedures for Chip Diode Devices” provides handling and assembly recommendations.

Ordering Information

The MA4SPS42X series of SURMOUNTS may be ordered in either gel packs or tape and reeled by adding the appropriate suffix per the table below. Tape and reel dimensions are provided in Application Note M513 located on the M/A-COM Tech website @ www.macomtech.com.

Part Number	
Gel Pack	**Tape and Reel Pocket Tape**
MA4SPS421	MADP-000421-12940P
MA4SPS422	MADP-000422-12950P