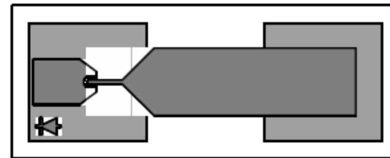
MA4E2502 Series

SURMOUNT™ Low, Medium, and High Barrier Silicon Schottky Diodes

Rev. V3

Features

- Extremely Low Parasitic Capacitance & Inductance
- Surface Mountable in Microwavable Circuits, No Wirebonds Required
- Rugged HMIC Construction with Polyimide Scratch Protection
- Reliable, Multilayer Metalization with a Diffusion Barrier, 100% Stabilization Bake (300°C, 16 hours)
- Lower Susceptibility to ESD Damage



Description and Applications

The MA4E2502 Surmount™ Series diodes are silicon low, medium, and high barrier Schottky devices fabricated with the patented Heterolithic Microwave Integrated Circuit (HMIC) process. HMIC circuits consist of silicon pedestals which form diodes or via conductors embedded in a glass dielectric, which acts as the low dispersion, microstrip transmission medium. The combination of silicon and glass allows HMIC devices to have excellent loss and power dissipation characteristics in a low profile, reliable device.

The Surmount™ Schottky devices are excellent choices for circuits requiring the small parasitics of a beam lead device coupled with the superior mechanical performance of a chip. The Surmount™ structure employs very low resistance silicon vias to connect the Schottky contacts to the metalized mounting pads on the bottom surface of the chip. These devices are reliable, repeatable, and a lower cost performance solution to conventional devices. They have lower susceptibility to electrostatic discharge than conventional beam lead Schottky diodes.

The multilayer metallization employed in the fabrication of the Surmount™ Schottky junctions includes a platinum diffusion barrier, which permits all devices to be subjected to a 16-hour non-operating stabilization bake at 300°C.

The “0502” outline allows for surface mount placement and multi-functional polarity orientations.

The MA4E2502 series of Surmount™ Schottky diodes are recommended for use in microwave circuits through Ku band frequencies for lower power applications such as mixers, sub-harmonic mixers, detectors, and limiters. The HMIC construction facilitates the direct replacement of more fragile beam lead diodes with the corresponding Surmount™ diode, which can be connected to a hard or soft substrate circuit with solder.

Ordering Information

Part Number[1]	Package
MA4E2502x-1246W	wafer on frame[2]
MA4E2502x-1246	100 piece Die in carrier
MADS-002502-1246xP	3000 piece reel

1. Replace x with L for low barrier, M for medium barrier or H for high barrier.
2. Call factory for standard quantities for full wafers on frames.

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Electrical Specifications: Recommended Freq. = DC - 18 GHz, @ +25°C

Model Number	Type	V_F @ 1 mA (mV)	V_B @ 10 µA (V)	C_T @ 0 V (pF)	R_T Slope Resistance[3] $(V_F1 - V_F2)/(10.5 - 9.5\ mA)$ (Ω)
MA4E2502L	Low Barrier	330 max. 300 typ.	3 min. 5 typ.	0.12 max. 0.10 typ.	16 typ. 20 max.
MA4E2502M	Medium Barrier	470 max. 420 typ.	3 min. 5 typ.	0.12 max. 0.10 typ.	12 typ. 18 max.
MA4E2502H	High Barrier	700 max. 650 typ.	3 min. 5 typ.	0.12 max. 0.10 typ.	11 typ. 15 max.

3. R_T is the dynamic slope resistance where $R_T = R_S + R_J$, where $R_J = 26 / Idc$ (Idc is in mA)

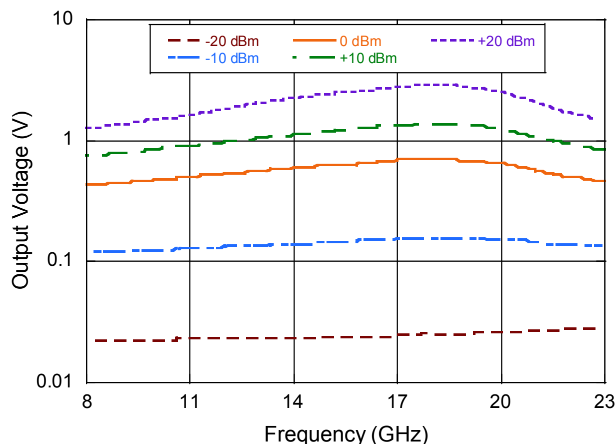
Absolute Maximum Ratings @ +25°C

Parameter	Absolute Maximum
Forward Current	20 mA
Reverse Voltage	5 V
RF C.W. Incident Power	20 dBm
RF & DC Dissipated Power	50 mW
Junction Temperature	+175°C
Operating Temperature	-40°C to +125°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge (ESD) Classification	Class 0 HBM (Human Body Model)

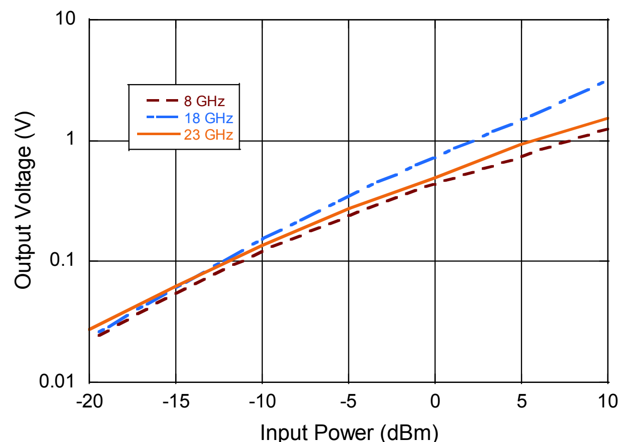
Typical Performance Curves

The MA4E2502L-1246 chip was evaluated in a detector circuit in which the Schottky diode terminates a 50 Ω transmission line on a duroid substrate. The chip was attached to the terminal of a 3.5 mm connector and the output voltage was measured through a bias tee on a voltmeter. Matching was not attempted.

Output Voltage vs. Frequency



Output Voltage vs. Input Power



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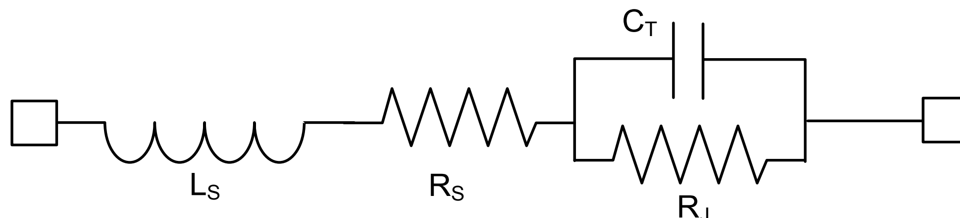
MA4E2502 Diode Schematic



Schematic Values

Model Number	Ls (nH)	Rs (Ω)	Rj (Ω)	Ct (pF)
MA4E2502L	0.45	12.8	26 / Idc (mA)	0.10
MA4E2502M	0.45	9.6	26 / Idc (mA)	0.10
MA4E2502H	0.45	6.5	26 / Idc (mA)	0.10

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. The top surface of the die has a protective polyimide coating to minimize damage.

The rugged construction of these Surmount™ devices allows the use of standard handling and die attach techniques. It is important to note that industry standard electrostatic discharge (ESD) control is required at all times, due to the sensitive nature of Schottky junctions.

Bulk handling should insure that abrasion and mechanical shock are minimized.

Die Bonding

Die attach for these devices is made simple through the use of surface mount die attach technology. Mounting pads are conveniently located on the bottom surface of these devices, and are opposite the active junction. The devices are well suited for high temperature solder attachment onto hard substrates. 80Au/20Sn and Sn63/Pb37 solders are acceptable for usage. Die attach with electrically conductive silver epoxy is not recommended.

For hard substrates, we recommend utilizing a vacuum tip and force of 60 to 100 grams applied uniformly to the top surface of the device, using a hot gas bonder with equal heat applied across the bottom mounting pads 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. Reflow the solder paste by applying equal heat to the circuit at both die-mounting pads. The solder joint must not be made one at a time, creating un-equal 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 can be visually inspected through the die after die attach is completed.

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MA4E2502L Low Barrier SPICE PARAMETERS

Is (nA)	Rs (Ω)	N	Cj0 (pF)	M	Ik (mA)	Cjpar (pF)	Vj (V)	FC	BV (V)	IBV (mA)
26	12.8	1.20	1.0 E-2	0.5	14	9.0 E-2	8.0 E-2	0.5	5.0	1.0 E-2

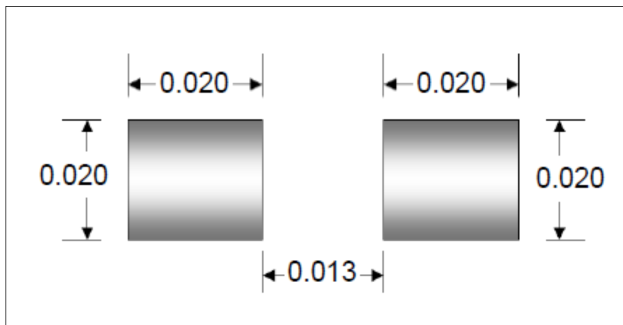
MA4E2502M Medium Barrier SPICE PARAMETERS

Is (nA)	Rs (Ω)	N	Cj0 (pF)	M	Ik (mA)	Cjpar (pF)	Vj (V)	FC	BV (V)	IBV (mA)
5 E-1	9.6	1.20	1.0 E-02	0.5	10	9.0 E-2	8.0 E-2	0.5	5.0	1.0 E-2

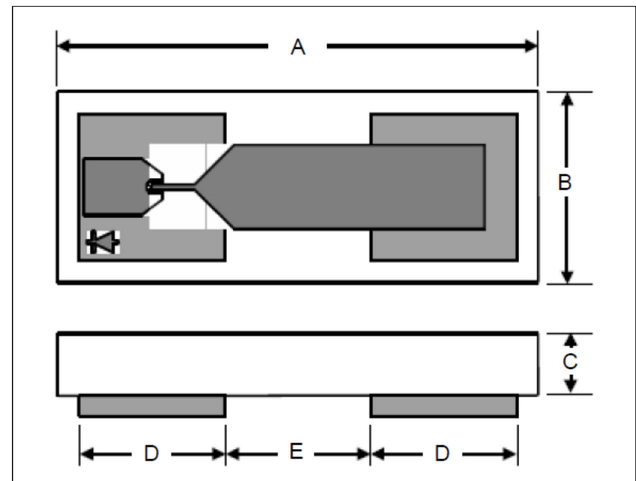
MA4E2502H High Barrier SPICE PARAMETERS

Is (nA)	Rs (Ω)	N	Cj0 (pF)	M	Ik (mA)	Cjpar (pF)	Vj (V)	FC	BV (V)	IBV (mA)
5.7 E-2	6.5	1.20	1.0 E-02	0.5	4	9.0 E-2	8.0 E-2	0.5	5.0	1.0 E-2

Circuit Mounting Dimensions (Inches)



Case Style 1246



Dim.	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.0445	0.0465	1.130	1.180
B	0.0169	0.0189	0.430	0.480
C	0.0040	0.0080	0.102	0.203
D Sq.	0.0128	0.0148	0.325	0.375
E	0.0128	0.0148	0.325	0.375

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