

MA4E2514 Series



SURMOUNT™ Low and Medium Barrier Silicon Schottky Diodes: Tee Pair

M/A-COM Products
Rev. V5

Features

- Extremely Low Parasitic Capacitance and Inductance
- Surface Mountable in Microwave 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

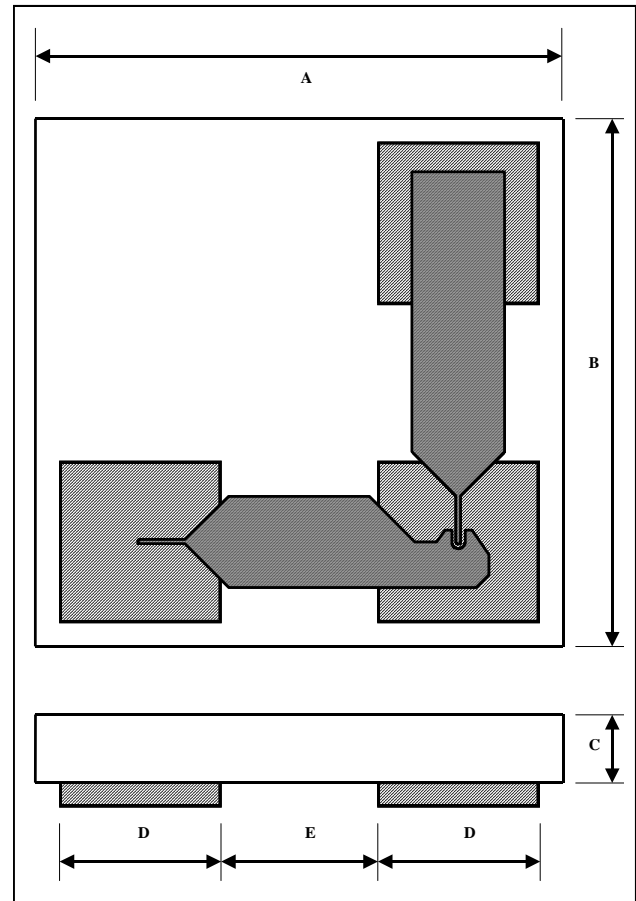
Description

The MA4E2514 SURMOUNT™ Diode Tee Series are Silicon Low, and Medium 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 glass dielectric, which acts as the low dispersion, low loss 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 multi-layer 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 "0505" outline allows for Surface Mount placement and multi-functional polarity orientations.



Case Style 1116

| DIM | INCHES | | MILLIMETERS | |
|-------|--------|--------|-------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.0445 | 0.0465 | 1.130 | 1.180 |
| B | 0.0445 | 0.0465 | 1.130 | 1.180 |
| 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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- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

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Electrical Specifications @ 25°C (Measured as Single Diodes) ^{1,2,3}

| Model Number | Type | Recommended Freq. Range | Vf @ 1 mA (mV) | Vb @ 10 uA (V) | Ct @ 0 V (pF) | Rt Slope Resistance (Vf1- Vf2)/ (10.5 mA - 9.5 mA) (Ω) |
|--------------|----------------|-------------------------|--------------------|----------------|----------------------|--|
| MA4E2514L | Low Barrier | DC - 18 GHz | 330 Max 300 Typ | 3 Min 5 Typ | 0.12 Max 0.10 Typ | 16 Typ 20 Max |
| MA4E2514M | Medium Barrier | DC - 18 GHz | 470 Max 400 Typ | 3 Min 5 Typ | 0.12 Max 0.10 Typ | 12 Typ 18 Max |

1. Rt is the dynamic slope resistance where $R_t = R_s + R_j$, where $R_j = 26 / I_{dc}$ (I_{dc} is in mA) and R_s is the ohmic resistance.
2. Max Forward Voltage Difference ΔV_f @ 1 mA: 10 mV
3. Max Total Capacitance Difference ΔC_t @ 0 V: 0.03 pF

Applications

The MA4E2514 Family 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.

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.

Absolute Maximum Ratings ⁴

| Parameter | Value |
|---|-----------------|
| Operating Temperature | -40°C to +150°C |
| Storage Temperature | -40°C to +150°C |
| Forward Current | 20 mA |
| Reverse Voltage | 5 V |
| RF C.W. Incident Power | + 20 dBm |
| RF & DC Dissipated Power | 50 mW |
| Electrostatic Discharge (ESD) Classification ⁵ | Class 0 |

4. Exceeding any of these values may result in permanent damage.
5. Human Body Model

Die Bonding

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 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 can be visually inspected through the die after the die attach is completed.

2

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MA4E2514L Low Barrier SPICE PARAMETERS (Per Diode)⁵

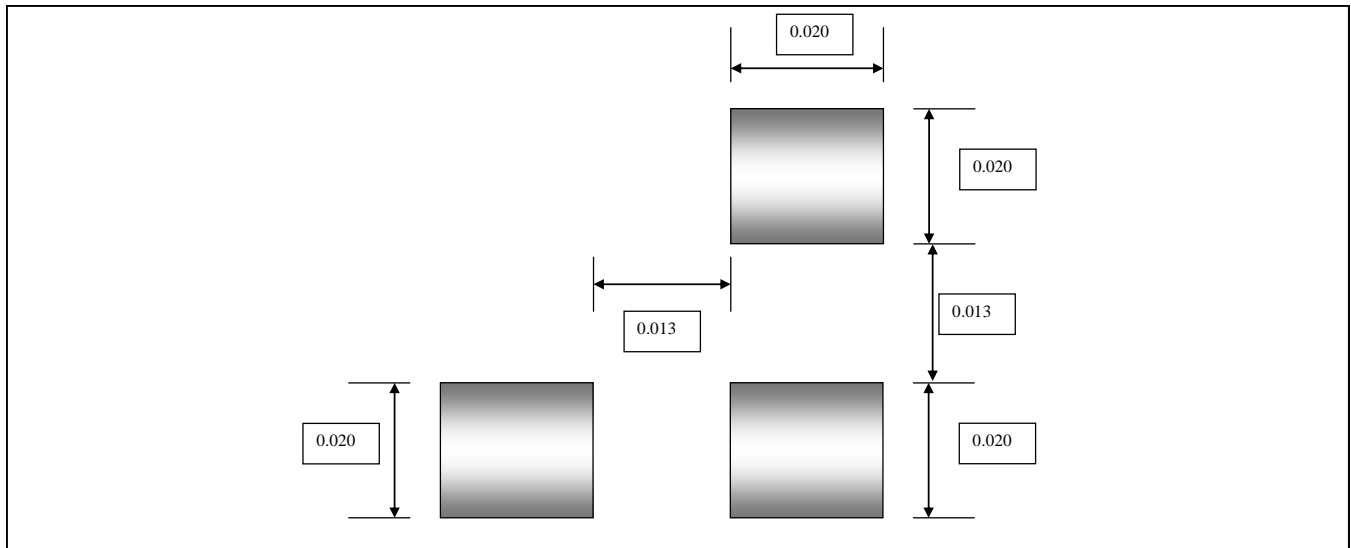
| Is (nA) | Rs (Ω) | N | Cj0 (pF) | M | Ik (mA) | Cjpar (pF) | Vj (V) | FC | BV (V) | IBV (mA) |
|---------|--------|------|----------|-----|---------|------------|---------|-----|--------|----------|
| 26 | 12.8 | 1.20 | 1.0 E-2 | 0.5 | 14 | 9.0 E-2 | 8.0 E-2 | 0.5 | 5.0 | 1.0 E-2 |

MA4E2514L Medium Barrier SPICE PARAMETERS (Per Diode)⁵

| 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-2 | 0.5 | 10 | 9.0 E-2 | 8.0 E-2 | 0.5 | 5.0 | 1.0 E-2 |

5. Spice parameters (Per Diode) are based on the MA4E2502 Series datasheet.

Circuit Mounting Dimensions (Inches)



Ordering Information

| Part Number | Packaging |
|--------------------|---------------------|
| MA4E2514L-1116W | Wafer on Frame |
| MA4E2514L-1116 | Die in Carrier |
| MA4E2514L-1116T | Surf Tape |
| MADS-002514-1116LP | Pocket Tape on Reel |
| MA4E2514M-1116W | Wafer on Frame |
| MA4E2514M-1116 | Die in Carrier |
| MA4E2514M-1116T | Surf Tape |
| MADS-002514-1116MP | Pocket Tape on Reel |

3

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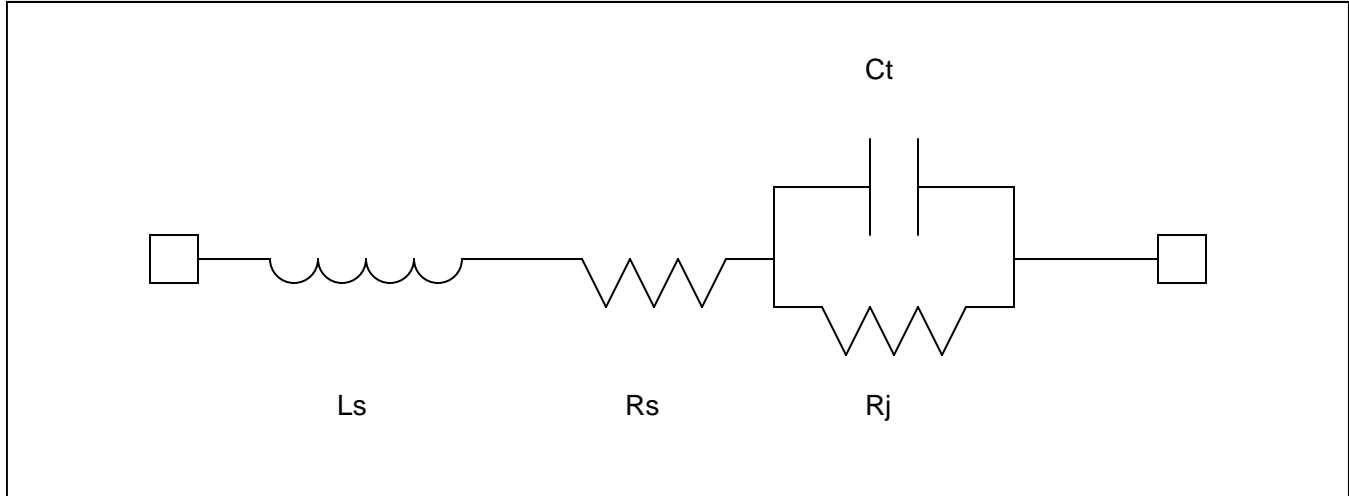
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MA4E2514 Schematic Per Diode



Schematic Values per Diode

| Model Number | Ls (nH) | Rs (Ω) | Rj (Ω) | Ct (pF) |
|--------------|---------|-----------------|----------------------|---------|
| MA4E2514L | 0.7 | 13.4 | 26 / I _{dc} | 0.10 |
| MA4E2514M | 0.7 | 9.4 | 26 / I _{dc} | 0.10 |

MA4E2514 Equivalent Circuit

