

SURMOUNT™ Schottky Diodes: Cross-Over Quad Series, Ultra-Small 600 μm Surface-Mount Chip

Rev. V1

Features

- Ultra Low Parasitic Capacitance and Inductance
- Surface Mountable in Microwave Circuits , No Wire bonds Required
- Rugged HMIC Construction with Polyimide Scratch Protection
- Reliable, Multilayer Metallization with a Diffusion Barrier, 100% Stabilization Bake (300°C, 16 hours)
- Lower Susceptibility to ESD Damage

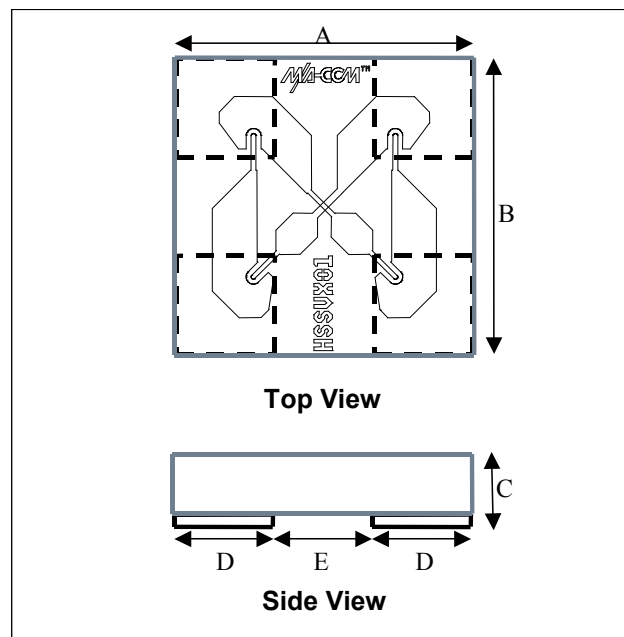
Description and Applications

The MADS-002545-1307 Series Surmount silicon Schottky cross-over quad diodes are 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, 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.

These 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 “0202” outline allows for surface mount placement and multi- functional polarity orientations. The MADS-002545-1307 Series is 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.



| Dim. | Inches | | Millimeters | |
|-------|--------|-------|-------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.023 | 0.025 | 0.575 | 0.625 |
| B | 0.023 | 0.025 | 0.575 | 0.625 |
| C | 0.004 | 0.008 | 0.102 | 0.203 |
| D Sq. | 0.007 | 0.009 | 0.175 | 0.225 |
| E Sq. | 0.007 | 0.009 | 0.175 | 0.225 |

Ordering Information

| Part Number | Package |
|--------------------|-------------------------------|
| MADS-002545-1307LG | Low Barrier Die in Carrier |
| MADS-002545-1307MG | Medium Barrier Die in Carrier |
| MADS-002545-1307HG | High Barrier Die in Carrier |

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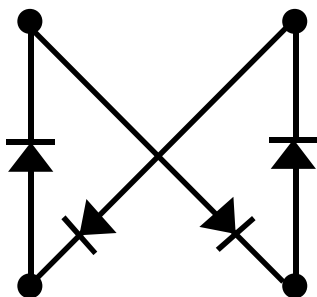
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Electrical Specifications: Freq. = DC - 18 GHz, $T_A = +25^\circ\text{C}^{1,2}$

| Model Number | Barrier | $V_F @ 1 \text{ mA}$ (mV) | $CT @ 0 \text{ V}$ (pF) | R_T Slope Resistance ($V_{F1} - V_{F2}$) / (10.5 mA - 9.5 mA) (Ω) |
|-------------------|---------|------------------------------|----------------------------|---|
| MADS-002545-1307L | Low | 330 max. 305 typ. | 0.22 max. 0.11 typ. | 11 typ. 20 max. |
| MADS-002545-1307M | Medium | 470 max. 390 typ. | 0.22 max. 0.11 typ. | 11 typ. 18 max. |
| MADS-002545-1307H | High | 700 max. 650 typ. | 0.22 max. 0.11 typ. | 9 typ. 15 max. |

1. R_T 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. Maximum forward voltage difference $DV_f @ 1 \text{ mA}$: 10 mV

Schematic (equivalent circuit)



Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

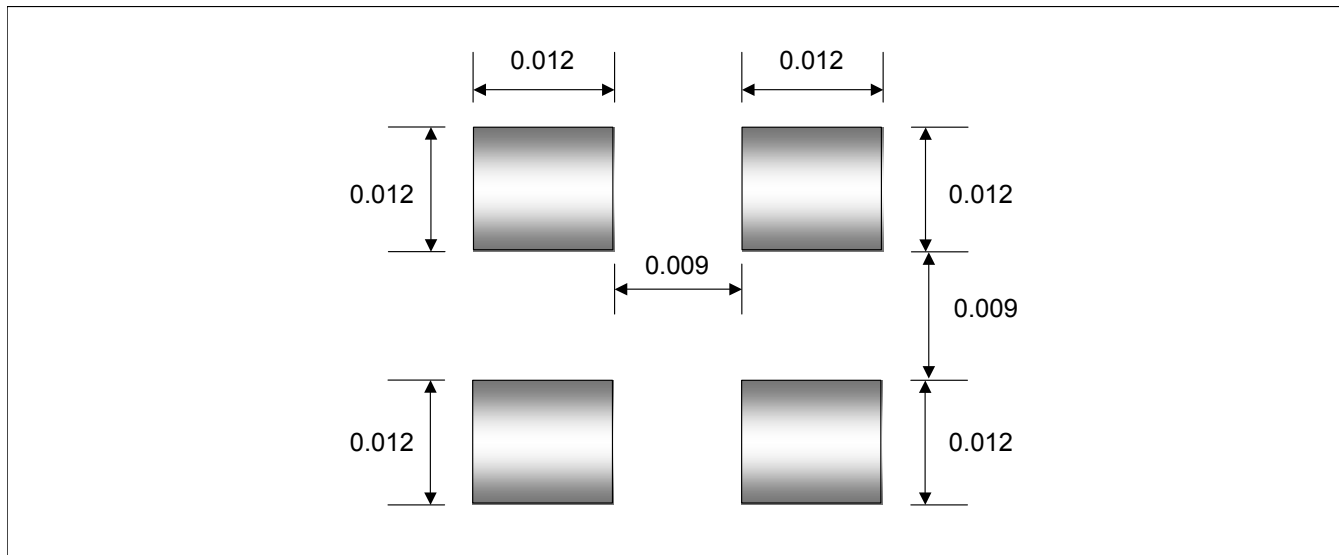
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 0 devices.

Absolute Maximum Ratings^{3,4}

| Parameter | Absolute Maximum |
|--------------------------|------------------|
| Forward Current | 20 mA |
| Reverse Voltage | 5 V |
| RF CW Incident Power | 20 dBm |
| RF & DC Dissipated Power | 50 mW |
| Junction Temperature | +175°C |
| Operating Temperature | -40°C to +125°C |
| Storage Temperature | -40°C to +150°C |

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

Circuit Mounting Dimensions (Inches)



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. 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/Pb36 solders are acceptable for usage.

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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