

Schottky Barrier Chips for Hybrid Integrated Circuits

Technical Data

HSMS-0005/06
HSMS-8002/12

Features

- **Thermocompression/Thermosonically Bondable**
- **Gold Metallization**
- **Silicon Nitride Passivation**
- **Uniform Electrical Characteristics**
- **Batch Matched Versions Available**
- **Planar Construction**
- **Available in Many Electrical Selections**
- **Ideal for Hybrid Integrated Circuits**

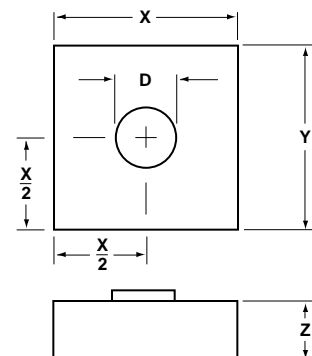
Description/Applications

These Schottky chips are designed for hybrid applications at DC through K-band frequencies. The passivated planar construction of these Schottky chips provides a wide temperature range capability combined with broad bandwidth performance.

A variety of chips are provided which are optimized for various analog and digital applications. Typical applications of Schottky chips are mixing, detecting, switching, gating, sampling, and wave shaping.

This series of Schottky diode chips are specifically designed for analog and digital hybrid applications requiring thermosonic or thermocompression bonding techniques. The large bonding pad allows easy bonding. The top metallization is a layer of gold deposited on adhesive metal layers for a tarnish-free surface that allows either thermosonic or thermocompression bonding techniques. The bottom metallization is also gold, suitable for epoxy or eutectic die attach methods.

Chip Dimensions



| DIMENSIONS | PART NO. HSMS- | |
|-------------|----------------|-------------|
| | -0006/-8002 | -0005 |
| D | 75 (3) | 55 (2) |
| X | 250 (10) | 250 (10) |
| Y | 275 (11) | 250 (10) |
| Z | 150 (8) | 150 (6) |
| Top Contact | Anode | Cathode |

NOTES:

1. Dimensions in microns (1/1000 inch).
2. Dimension tolerance is $\pm 30\mu$.
3. All contact metallization is gold.

Absolute Maximum Ratings, $T_A = 25^\circ\text{C}$

| Symbol | Parameter | Units | HSMS-8002 | HSMS-0005 |
|-----------|--|------------------|------------|------------|
| P_T | Total device dissipation, measured in an infinite heatsink. Derate linearly to zero at maximum rated temperature | mW | 75 | 75 |
| P_{IV} | Peak Inverse Voltage | V | 4.0 | 2.0 |
| T_J | Junction Temperature (maximum) | $^\circ\text{C}$ | 150 | 200 |
| T_{STG} | Storage Temp. Range | $^\circ\text{C}$ | -65 to 150 | -65 to 200 |
| T_{OP} | Operating Temperature | $^\circ\text{C}$ | -65 to 150 | -65 to 200 |

Note: Operation in excess of any one of these conditions may result in permanent damage to the device.

DC Electrical Specifications at $T_A = 25^\circ\text{C}$

Schottky Barrier Chips for Microwave and RF Mixers

| Part Number HSMS- | Batch Matched ^[1] HSMS- | Nearest Equivalent Packaged Part: HSMS- | Minimum Breakdown Voltage V_{BR} (V) | Maximum Forward Voltage V_F (mV) | Maximum Forward Voltage V_F (mV) | Maximum Capacitance C_T (pF) | Maximum Dynamic Resistance R_D (Ω) ^[2] |
|----------------------|--|---|---|---------------------------------------|---------------------------------------|--|---|
| 8002 | 8012 | 8101 | 4 | 250 | 350 | 0.16 | 14 |
| Test Conditions | $\Delta V_F = 15\text{ mV}$ $I_F = 1\text{ mA}$ | | $I_R = 10\text{ }\mu\text{A}$ | $I_F = 1\text{ mA}$ | | $V_R = 0\text{ V}$ $f = 1.0\text{ MHz}$ | $I_F = 5\text{ mA}$ |

Notes:

- Standard batch match size, 100 units.
- To obtain R_S , subtract $26/5 = 5.2\text{ }\Omega$.

RF Electrical Parameters at $T_A = 25^\circ\text{C}$

| Part Number HSMS- | Typical Conversion Loss L_C (dB) | Typical IF Impedance Z_{IF} (Ω) | Typical SWR | Typical Tangential Sensitivity T_{SS} (dBm) |
|----------------------|--|---|-------------|--|
| 8002 | 5.5 | 150 | 1.2:1 | -46 |
| Test Conditions | $f = 16\text{ GHz}$ DC load resistance = $0\text{ }\Omega$, LO power = 1 mW | | | $f = 10\text{ GHz}$ $BW = 2\text{ MHz}$ $I_{BIAS} = 20\text{ }\mu\text{A}$ |

DC Electrical Specifications at $T_A = 25^\circ\text{C}$

Schottky Barrier Chips for Microwave and RF Detectors

| Part Number HSMS- | Nearest Equivalent Packaged Part No. HSMS- | Maximum Forward Voltage V_F (mV) | Minimum Breakdown Voltage V_{BR} (V) | Typical Capacitance C_T (pF) |
|----------------------|--|--|--|--|
| 0005 | 2850 | 250 | — | 0.20 |
| 0006 | 2860 | 350 | 4.0 | 0.17 |
| Test Conditions | | $I_F = 1\text{ mA}$ | $I_R = 10\text{ }\mu\text{A}$ | $V_R = 0.5\text{ V}$, $f = 1\text{ MHz}$ |

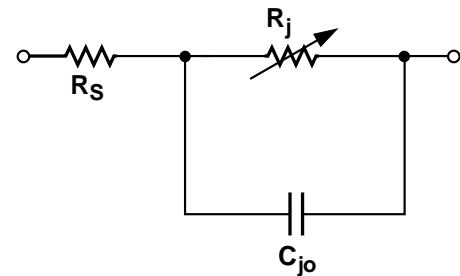
Typical RF Electrical Parameters at $T_A = 25^\circ\text{C}$

| Part Number HSMS- | DC Bias | Voltage Sensitivity γ (mV/ μW) | | | Video Resistance R_V (K Ω) |
|----------------------|-----------------|--|----------|---------|---|
| | | 915 MHz | 2.45 GHz | 5.8 GHz | |
| 0005 | zero | 40 | 30 | 22 | 8.0 |
| 0006 | 5 μA | 40 | 32 | 25 | 5.5 |
| Test Conditions | | $P_{in} = -40\text{ dBm}$ $R_L = 100\text{ K}\Omega$ | | | |

SPICE Parameters

| Parameter | Units | HSMS-8002 | HSMS-0005 | HSMS-0006 |
|-----------|----------|-------------|-----------|-----------|
| B_V | V | 7.0 | 3.8 | 6.0 |
| C_{J0} | pF | 0.16 | 0.16 | 0.17 |
| E_G | eV | 0.69 | 0.69 | 0.69 |
| I_{BV} | A | 10E-5 | 10E-5 | 10E-5 |
| I_S | A | 4.6 x 10E-8 | 3 x 10E-6 | 3 x 10E-8 |
| N | | 1.08 | 1.15 | 1.10 |
| R_S | Ω | 5.0 | 20 | 7.0 |
| P_B | V | 0.65 | 0.65 | 0.65 |
| P_T | | 2 | 2 | 2 |
| M | | 0.5 | 0.5 | 0.5 |

Equivalent Circuit Model



$$R_j \approx \frac{.026}{I_s + I_b}$$

I_b = bias current in A

Assembly and Handling Procedures for Schottky Chips

1. Storage

Devices should be stored in a dry nitrogen purged desiccator or equivalent.

2. Cleaning

If required, surface contamination may be removed with electronic grade solvents such as freon (T.F. or T.M.C.), acetone, deionized water, and methanol used singularly or in combinations. Typical cleaning times per solvent are one to three minutes. DI water and methanol should be used (in that order) in the final cleansing. Final

drying can be accomplished by placing the cleaned dice on clean filter paper and drying with an infrared lamp for 5–10 minutes. Acids such as hydrofluoric (HF), nitric (HNO_3) and hydrochloric (HCl) must not be used.

The effects of cleaning methods/solutions should be verified on small samples prior to submitting the entire lot.

Following cleaning, dice should either be used in assembly (typically within a few hours) or stored in clean containers in an inert atmosphere or a vacuum chamber.

3. Die Attach

a. Eutectic

Eutectic die attach can be accomplished by “scrubbing” the die with a preform on the header. (Note—times and temperature utilized vary depending on the type of preform.) For example, 310°C is suitable for a Au/Sn preform.

b. Epoxy

For epoxy die-attach, conductive silver-filler epoxies are recommended. This method can be used for all Hewlett-Packard Schottky chips.

4. Wire Bonding

Thermocompression wire bonding is recommended. Suggested wire is pure gold, 0.7 to 1.5 mil diameter.