

DATA SHEET

# DME, DMF, DMJ Series: Silicon Beam-Lead Schottky Mixer Diode (Singles, Pairs, and Quads) Bondable Beam-Lead Devices

## Applications

- Microwave Integrated Circuits
- Mixers
- Detectors

## Features

- Low 1/f noise
- Low intermodulation distortion
- Statistical Process Control wafer fabrication



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.

## Description

Skyworks beam-lead silicon Schottky barrier mixer diodes are designed for applications through 40 GHz. The beam-lead design reduces the problem of bonding to the very small area characteristic of low capacitance junctions.

Beam-lead Schottky barrier mixer diodes are made by the deposition of a suitable barrier metal on an epitaxial silicon substrate to form the junction. The process and choice of materials result in low series resistance with a narrow spread of capacitance values for close impedance control.

A variety of forward voltages are available ranging from low values for low, or starved, local oscillator drive levels to high values for high drive, low distortion mixer applications. Capacitance ranges and series resistances are comparable with the beam-lead devices that are available up to, and including, the Ka-band. These diodes are well suited for use in Microwave Integrated Circuits (MICs).



Beam-lead Schottky barrier diodes are categorized by universal mixer applications in six frequency ranges: S, C, X, Ku, K, and Ka bands as noted in Table 1. They can also be used as modulators and high-speed switches.

Beam-lead diodes are suited for balanced mixers, due to their low parasitics and uniformity.

**Table 1. Frequency Table**

| Frequency Band | Frequency (GHz) |
|----------------|-----------------|
| S              | 2 to 4          |
| C              | 4 to 8          |
| X              | 8.2 to 12.4     |
| Ku             | 12.4 to 18.0    |
| K              | 18.0 to 26.5    |
| Ka             | 26.5 to 40.0    |

**Electrical and Mechanical Specifications**

The absolute maximum ratings of the DME, DMF, and DMJ series of Schottky mixer diodes are provided in Table 2. Electrical and physical specifications are provided in Tables 3 through 8.

Typical performance characteristics are shown in Figures 1 through 3. Typical mixer circuits are shown in Figure 4.

**Table 2. Absolute Maximum Ratings (Note 1)**

| Parameter                           | Symbol           | Minimum | Typical | Maximum | Units       |
|-------------------------------------|------------------|---------|---------|---------|-------------|
| Maximum current                     | I <sub>max</sub> |         |         | 100     | mA          |
| Power dissipation (continuous wave) | P <sub>d</sub>   |         |         | 75      | mW/junction |
| Storage temperature                 | T <sub>STG</sub> | -65     |         | +175    | °C          |
| Operating temperature               | T <sub>A</sub>   | -65     |         | +175    | °C          |

**Note 1:** Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

**CAUTION:** Although these devices are designed to be as robust as possible, electrostatic discharge (ESD) can damage them. These devices must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

**Table 3. Electrical Specifications: Beam-Lead Single N-Type Low, Medium, High Drive Schottky Diodes**



| Part Number | Frequency Band | C <sub>J</sub> @ 0 V, 1 MHz (pF) | Rs @ 5 mA (Ω) | V <sub>B</sub> @ 10 μA (V) | V <sub>F</sub> @ 1 mA (mV) | Drive Level | Outline Drawing |
|-------------|----------------|----------------------------------|---------------|----------------------------|----------------------------|-------------|-----------------|
|             |                |                                  | Max.          | Min.                       |                            |             |                 |
| DMF2820-000 | S, C           | 0.30 to 0.50                     | 5             | 2                          | 200 to 260                 | low         | 491-011         |
| DME2127-000 | S, C           | 0.30 to 0.50                     | 5             | 3                          | 300 to 400                 | medium      | 491-011         |
| DMJ2823-000 | S, C           | 0.30 to 0.50                     | 5             | 4                          | 500 to 600                 | high        | 491-011         |
| DMF2821-000 | X              | 0.15 to 0.30                     | 8             | 2                          | 220 to 300                 | low         | 491-011         |
| DME2957-000 | X              | 0.15 to 0.30                     | 8             | 3                          | 325 to 425                 | medium      | 491-011         |
| DMJ2777-000 | X              | 0.15 to 0.30                     | 8             | 4                          | 550 to 650                 | high        | 491-011         |
| DMF2344-000 | Ku             | 0.05 to 0.15                     | 13            | 2                          | 260 to 330                 | low         | 491-011         |
| DME2333-000 | Ku             | 0.05 to 0.15                     | 13            | 3                          | 350 to 450                 | medium      | 491-011         |
| DMJ2824-000 | Ku             | 0.05 to 0.15                     | 13            | 4                          | 500 to 680                 | high        | 491-011         |
| DMF2822-000 | K, Ka          | 0.1 max                          | 18            | 2                          | 270 to 350                 | low         | 491-011         |
| DME2458-000 | K, Ka          | 0.1 max                          | 18            | 3                          | 375 to 550                 | medium      | 491-011         |
| DMJ2825-000 | K, Ka          | 0.1 max                          | 18            | 4                          | 600 to 700                 | high        | 491-011         |

**Table 4. Electrical Specifications: Beam-Lead Series Pair, N-Type Low, Medium, High Drive Schottky Diodes**



| Part Number | Frequency Band | C <sub>J</sub> @ 0 V, 1 MHz (pF) | Rs @ 5 mA (Ω) | V <sub>B</sub> @ 10 μA (V) | V <sub>F</sub> @ 1 mA (mV) | Drive Level | Outline Drawing |
|-------------|----------------|----------------------------------|---------------|----------------------------|----------------------------|-------------|-----------------|
|             |                |                                  | Max.          | Min.                       |                            |             |                 |
| DMF2835-000 | S, C           | 0.30 to 0.50                     | 5             | 2                          | 200 to 260                 | low         | 504-012         |
| DME2050-000 | S, C           | 0.30 to 0.50                     | 5             | 3                          | 300 to 400                 | medium      | 504-012         |
| DMJ2092-000 | S, C           | 0.30 to 0.50                     | 5             | 4                          | 500 to 600                 | high        | 504-012         |
| DMF2826-000 | X              | 0.15 to 0.30                     | 8             | 2                          | 220 to 300                 | low         | 504-012         |
| DME2829-000 | X              | 0.15 to 0.30                     | 8             | 3                          | 325 to 425                 | medium      | 504-012         |
| DMJ2093-000 | X              | 0.15 to 0.30                     | 8             | 4                          | 550 to 650                 | high        | 504-012         |
| DMF2827-000 | Ku             | 0.05 to 0.15                     | 13            | 2                          | 260 to 330                 | low         | 504-012         |
| DME2830-000 | Ku             | 0.05 to 0.15                     | 13            | 3                          | 350 to 450                 | medium      | 504-012         |
| DMJ2832-000 | Ku             | 0.05 to 0.15                     | 13            | 4                          | 500 to 680                 | high        | 504-012         |
| DMF2828-000 | K, Ka          | 0.1 max                          | 18            | 2                          | 270 to 350                 | low         | 504-012         |
| DME2831-000 | K, Ka          | 0.1 max                          | 18            | 3                          | 375 to 550                 | medium      | 504-012         |
| DMJ2833-000 | K, Ka          | 0.1 max                          | 18            | 4                          | 600 to 700                 | high        | 504-012         |

**Table 5. Electrical Specifications: Beam-Lead Common Cathode, N-Type Low, Medium, High Drive Schottky Diodes**



| Part Number | Frequency Band | C <sub>J</sub> @ 0 V, 1 MHz (pF) | Rs @ 5 mA (Ω) | V <sub>B</sub> @ 10 μA (V) | V <sub>F</sub> @ 1 mA (mV) | Drive Level | Outline Drawing |
|-------------|----------------|----------------------------------|---------------|----------------------------|----------------------------|-------------|-----------------|
|             |                |                                  | Max.          | Min.                       |                            |             |                 |
| DMF2182-000 | S, C           | 0.30 to 0.50                     | 5             | 2                          | 200 to 260                 | low         | 504-013         |
| DME2205-000 | S, C           | 0.30 to 0.50                     | 5             | 3                          | 300 to 400                 | medium      | 504-013         |
| DMJ2208-000 | S, C           | 0.30 to 0.50                     | 5             | 4                          | 500 to 600                 | high        | 504-013         |
| DMF2183-000 | X              | 0.15 to 0.30                     | 8             | 2                          | 220 to 300                 | low         | 504-013         |
| DME2206-000 | X              | 0.15 to 0.30                     | 8             | 3                          | 325 to 425                 | medium      | 504-013         |
| DMJ2209-000 | X              | 0.15 to 0.30                     | 8             | 4                          | 550 to 650                 | high        | 504-013         |
| DMF2184-000 | Ku             | 0.05 to 0.15                     | 13            | 2                          | 260 to 330                 | low         | 504-013         |
| DME2207-000 | Ku             | 0.05 to 0.15                     | 13            | 3                          | 350 to 450                 | medium      | 504-013         |
| DMJ2210-000 | Ku             | 0.05 to 0.15                     | 13            | 4                          | 500 to 680                 | high        | 504-013         |
| DMF2834-000 | K, Ka          | 0.1 max                          | 18            | 2                          | 270 to 350                 | low         | 504-013         |
| DME2864-000 | K, Ka          | 0.1 max                          | 18            | 3                          | 375 to 550                 | medium      | 504-013         |
| DMJ2836-000 | K, Ka          | 0.1 max                          | 18            | 4                          | 600 to 700                 | high        | 504-013         |

**Table 6. Electrical Specifications: Beam-Lead Anti-Parallel, N-Type Low, Medium, High Drive Schottky Diodes**



| Part Number | Frequency Band | C <sub>J</sub> @ 0 V, 1 MHz (pF) | Rs @ 5 mA (Ω) | V <sub>B</sub> @ 10 μA (V) | V <sub>F</sub> @ 1 mA (mV) | Drive Level | Outline Drawing |
|-------------|----------------|----------------------------------|---------------|----------------------------|----------------------------|-------------|-----------------|
|             |                |                                  | Max.          | Min.                       |                            |             |                 |
| DMF2185-000 | S, C           | 0.30 to 0.50                     | 5             | 2                          | 200 to 260                 | low         | 522-025         |
| DME2282-000 | S, C           | 0.30 to 0.50                     | 5             | 3                          | 300 to 400                 | medium      | 522-025         |
| DMJ2303-000 | S, C           | 0.30 to 0.50                     | 5             | 4                          | 500 to 600                 | high        | 522-025         |
| DMF2186-000 | X              | 0.15 to 0.30                     | 8             | 2                          | 220 to 300                 | low         | 522-025         |
| DME2283-000 | X              | 0.15 to 0.30                     | 8             | 3                          | 325 to 425                 | medium      | 522-025         |
| DMJ2304-000 | X              | 0.15 to 0.30                     | 8             | 4                          | 550 to 650                 | high        | 522-025         |
| DMF2187-000 | Ku             | 0.05 to 0.15                     | 13            | 2                          | 260 to 330                 | low         | 522-025         |
| DME2284-000 | Ku             | 0.05 to 0.15                     | 13            | 3                          | 350 to 450                 | medium      | 522-025         |
| DMJ2246-000 | Ku             | 0.05 to 0.15                     | 13            | 4                          | 500 to 680                 | high        | 522-025         |
| DMF2837-000 | K, Ka          | 0.1 max                          | 18            | 2                          | 270 to 350                 | low         | 522-025         |
| DME2838-000 | K, Ka          | 0.1 max                          | 18            | 3                          | 375 to 550                 | medium      | 522-025         |
| DMJ2839-000 | K, Ka          | 0.1 max                          | 18            | 4                          | 600 to 700                 | high        | 522-025         |

**Table 7. Electrical Specifications: Beam-Lead Ring Quad, N-Type Low, Medium, High Drive Schottky Diodes**



| Part Number | Frequency Band | C <sub>J</sub> @ 0 V, 1 MHz (pF) | Rs @ 5 mA (Ω) | V <sub>B</sub> @ 10 μA (V) | V <sub>F</sub> @ 1 mA (mV) | Drive Level | Outline Drawing |
|-------------|----------------|----------------------------------|---------------|----------------------------|----------------------------|-------------|-----------------|
|             |                |                                  | Max.          | Min.                       |                            |             |                 |
| DMF2865-000 | S, C           | 0.30 to 0.50                     | 5             | 2                          | 200 to 260                 | low         | 488-002         |
| DME2857-000 | S, C           | 0.30 to 0.50                     | 5             | 3                          | 300 to 400                 | medium      | 488-002         |
| DMJ2502-000 | S, C           | 0.30 to 0.50                     | 5             | 4                          | 500 to 600                 | high        | 488-002         |
| DMF2011-000 | X              | 0.15 to 0.30                     | 8             | 2                          | 220 to 300                 | low         | 488-002         |
| DME2858-000 | X              | 0.15 to 0.30                     | 8             | 3                          | 325 to 425                 | medium      | 488-002         |
| DMJ2990-000 | X              | 0.15 to 0.30                     | 8             | 4                          | 550 to 650                 | high        | 488-002         |
| DMF2012-000 | Ku             | 0.05 to 0.15                     | 13            | 2                          | 260 to 330                 | low         | 488-002         |
| DME2859-000 | Ku             | 0.05 to 0.15                     | 13            | 3                          | 350 to 450                 | medium      | 488-002         |
| DMJ2667-000 | Ku             | 0.05 to 0.15                     | 13            | 4                          | 500 to 680                 | high        | 488-002         |
| DMF2454-000 | K, Ka          | 0.1 max                          | 18            | 2                          | 270 to 350                 | low         | 488-002         |
| DME2459-000 | K, Ka          | 0.1 max                          | 18            | 3                          | 375 to 550                 | medium      | 488-002         |
| DMJ2455-000 | K, Ka          | 0.1 max                          | 18            | 4                          | 600 to 700                 | high        | 488-002         |

**Table 8. Electrical Specifications: Beam-Lead Bridge Quad, N-Type Low, Medium, High Drive Schottky Diodes**



| Part Number | Frequency Band | C <sub>J</sub> @ 0 V, 1 MHz (pF) | Rs @ 5 mA (Ω) | V <sub>B</sub> @ 10 μA (V) | V <sub>F</sub> @ 1 mA (mV) | Drive Level | Outline Drawing |
|-------------|----------------|----------------------------------|---------------|----------------------------|----------------------------|-------------|-----------------|
|             |                |                                  | Max.          | Min.                       |                            |             |                 |
| DMF2076-000 | S, C           | 0.30 to 0.50                     | 5             | 2                          | 200 to 260                 | low         | 488-004         |
| DME2029-000 | S, C           | 0.30 to 0.50                     | 5             | 3                          | 300 to 400                 | medium      | 488-004         |
| DMJ2312-000 | S, C           | 0.30 to 0.50                     | 5             | 4                          | 500 to 600                 | high        | 488-004         |
| DMF2077-000 | X              | 0.15 to 0.30                     | 8             | 2                          | 220 to 300                 | low         | 488-004         |
| DME2850-000 | X              | 0.15 to 0.30                     | 8             | 3                          | 325 to 425                 | medium      | 488-004         |
| DMJ2088-000 | X              | 0.15 to 0.30                     | 8             | 4                          | 550 to 650                 | high        | 488-004         |
| DMF2078-000 | Ku             | 0.05 to 0.15                     | 13            | 2                          | 260 to 330                 | low         | 488-004         |
| DME2031-000 | Ku             | 0.05 to 0.15                     | 13            | 3                          | 350 to 450                 | medium      | 488-004         |
| DMJ2768-000 | Ku             | 0.05 to 0.15                     | 13            | 4                          | 500 to 680                 | high        | 488-004         |
| DMF2848-000 | K, Ka          | 0.1 max                          | 18            | 2                          | 270 to 350                 | low         | 488-004         |
| DME2851-000 | K, Ka          | 0.1 max                          | 18            | 3                          | 375 to 550                 | medium      | 488-004         |
| DMJ2852-000 | K, Ka          | 0.1 max                          | 18            | 4                          | 600 to 700                 | high        | 488-004         |

### Typical Performance Characteristics



**Figure 1. Typical Forward DC Characteristic Curves (Voltage vs Current)**



**Figure 2. Typical Forward DC Characteristic Curves (Voltage vs current)**



**Figure 3. Typical X-Band Low Drive Mixer Diode RF Parameters vs Local Oscillator Drive**

Single Ended Mixer



Balanced Mixer



Double Balanced Mixer



Figure 4. Typical Mixer Circuits

Dimensions and Package Information

Additional bonding and handling methods are contained in the Skyworks Application Note, *Diode Chips, Beam-Lead Diodes, Capacitors: Bonding Methods and Packaging* (document #200532).

Dimensions are provided in Figures 5 through 10.



Figure 5. 488-002 Package Dimensions



Figure 6. 488-004 Package Dimensions





**Figure 7. 491-011 Package Dimensions**



**Figure 8. 504-012 Package Dimensions**



Figure 9. 504-013 Package Dimensions



Figure 10. 522-025 Package Dimensions

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