

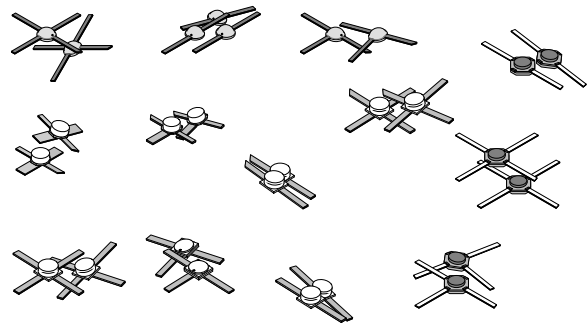
# Silicon Beam-Lead Schottky Barrier Mixer Diodes



DME, DMF and DMJ Series

## Features

- Ideal for MIC
- Low  $1/f$  Noise
- Low Intermodulation Distortion
- Low Turn On
- Hermetically Sealed Packages
- SPC Controlled Wafer Fabrication



## Description

Alpha beam-lead and chip Schottky barrier mixer diodes are designed for applications through 40 GHz in Ka-band. The beam-lead design eliminates the problem of bonding to the very small junction area that is characteristic of the low capacitance involved in microwave devices.

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 along with a narrow spread of capacitance values for close impedance control.

A variety of forward knees are available, ranging from a low value for low, or starved, local oscillator drive levels to a higher value for high drive, low intermode mixer applications. The beam-lead diodes are available in a wide range of packages as shown. Capacitance ranges and series resistances are comparable with the packaged devices that are available through K-band. The unmounted diodes are especially well suited for use in microwave integrated circuits. The mounted devices can be easily inserted as hybrid elements in stripline, microstrip or other such circuitry.

Beam-lead and chip Schottky barrier diodes are categorized by noise figure for mixer applications in four frequency ranges: S, X, Ku and Ka-bands. However, they can also be used as modulators, high speed switches and low power limiters.

Several types of semiconductor-barrier metal systems are available, thus allowing proper selection for optimum mixer design. For most applications the N-type silicon, low drive types are preferable, especially for starved LO mixers.

Beam-lead diodes are ideally suited for balanced mixers, since they exhibit low parasitics and are extremely uniform. A typical  $V_F$  vs.  $I_F$  curve is shown in Figure 1. Typical noise figures vs LO drive is shown in Figure 2 for single N-type, low drive diode types.

## Maximum Ratings

|                        |                |
|------------------------|----------------|
| Storage Temperature:   | -65°C/+175°C   |
| Operating Temperature: | -65°C/+175°C   |
| Dissipated Power:      | 75 mW/Junction |
| Max Current:           | 100 mA         |

| Band | Frequencies  |
|------|--------------|
| S    | 2 to 4       |
| C    | 4 to 8       |
| X    | 8.2 to 12.4  |
| Ku   | 12.4 to 18.0 |

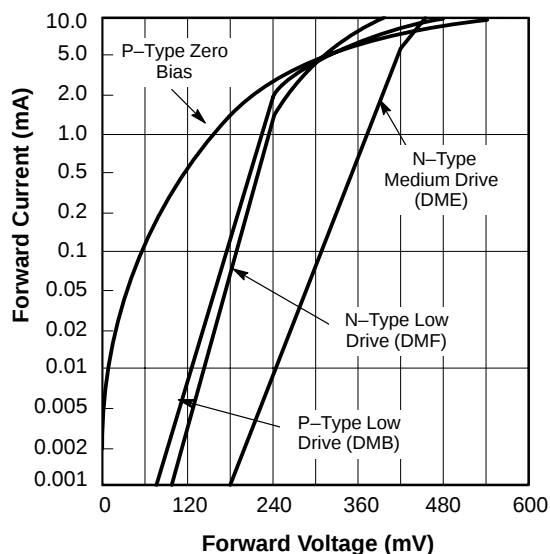


Figure 1. Typical Forward DC Characteristics Curves – Voltage vs. Current

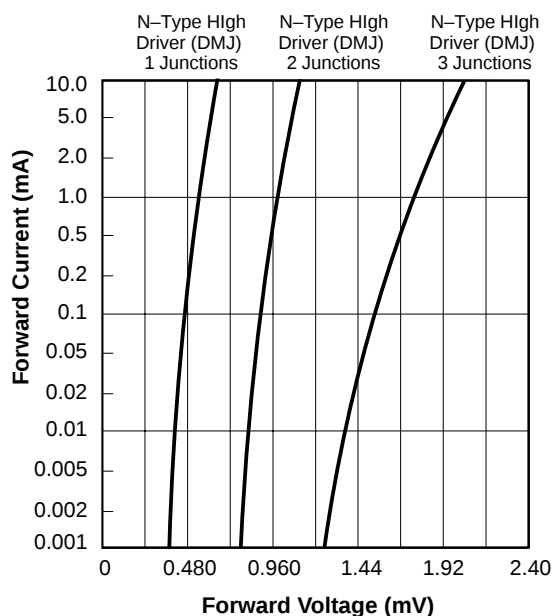


Figure 2. Typical Forward DC Characteristic Curves – Voltage vs. Current

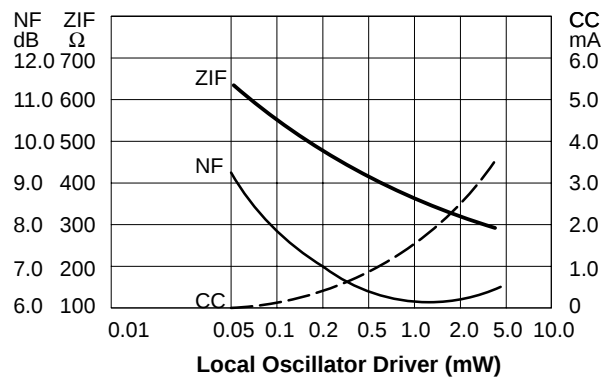
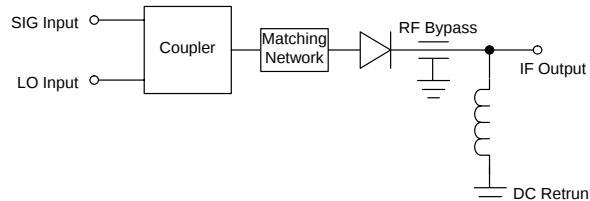
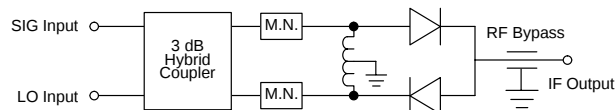


Figure 3. Typical X-Band Low Drive Mixer Diode – RF Parameters vs. Local Oscillator Drive

#### Single Ended Mixer



#### Balanced Mixer



#### Double Balanced Mixer

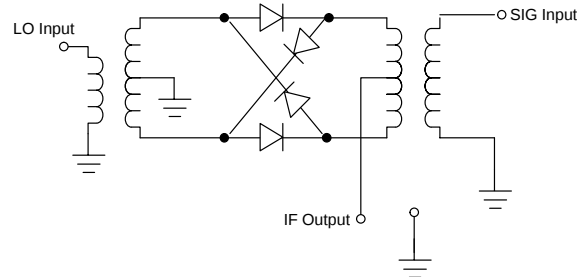


Figure 4. Typical Mixer Circuits

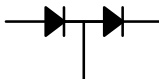
## Ordering Information

To order a packaged diode, simply append the part number to the package outline number. For example, a Medium Drive Ring Quad, Ku band (part number DME2859-000) in a 234 package would be ordered as DME2859-234.

## DME, DMF and DMJ Series

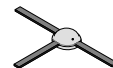
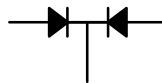
Beam-Lead (Singles), N-Type,  
Low, Medium, High Drive

| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>5 mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead | Epoxy<br>Packages |             |
|---------------|----------------------------------|------|-----------------------------|------------------------------|------------------------------|------|----------------|--------------|-------------------|-------------|
|               | Min.                             | Max. |                             |                              | Min.                         | Max. |                | 491-011      | 250               | 230         |
| S             | 0.30                             | 0.50 | 5                           | 2                            | 200                          | 260  | Low            | DMF2820-000  | DMF2820-250       |             |
|               |                                  |      |                             | 3                            | 300                          | 400  | Med            | DME2127-000  | DME2127-250       |             |
|               |                                  |      |                             | 4                            | 500                          | 600  | High           | DMJ2823-000  | DMJ2823-250       |             |
| X             | 0.15                             | 0.30 | 8                           | 2                            | 250                          | 310  | Low            | DMF2821-000  | DMF2821-250       |             |
|               |                                  |      |                             | 3                            | 325                          | 425  | Med            | DME2957-000  | DME2957-250       |             |
|               |                                  |      |                             | 4                            | 550                          | 650  | High           | DMJ2777-000  | DMJ2777-250       |             |
| KU            | 0.05                             | 0.15 | 13                          | 2                            | 260                          | 330  | Low            | DMF2344-000  | DMF2344-250       | DMF2344-230 |
|               |                                  |      |                             | 3                            | 350                          | 450  | Med            | DME2333-000  | DME2333-250       | DME2333-230 |
|               |                                  |      |                             | 4                            | 500                          | 680  | High           | DMJ2824-000  | DMJ2824-250       | DMJ2824-230 |
| K             | —                                | 0.1  | 18                          | 2                            | 270                          | 350  | Low            | DMF2822-000  |                   | DMF2822-230 |
|               |                                  |      |                             | 3                            | 375                          | 550  | Med            | DME2458-000  |                   | DME2458-230 |
|               |                                  |      |                             | 4                            | 600                          | 700  | High           | DMJ2825-000  |                   | DMJ2825-230 |

Beam-Lead (Series Pair), N-Type,  
Low, Medium, High Drive

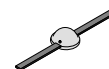
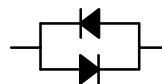
| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>10 mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead | Epoxy<br>Packages |             |
|---------------|----------------------------------|------|------------------------------|------------------------------|------------------------------|------|----------------|--------------|-------------------|-------------|
|               | Min.                             | Max. |                              |                              | Min.                         | Max. |                | 504-012      | 252               | 232         |
| S             | 0.30                             | 0.50 | 5                            | 2                            | 200                          | 260  | Low            | DMF2835-000  | DMF2835-252       |             |
|               |                                  |      |                              | 3                            | 300                          | 400  | Med            | DME2050-000  | DME2050-252       |             |
|               |                                  |      |                              | 4                            | 500                          | 600  | High           | DMJ2092-000  | DMJ2092-252       |             |
| X             | 0.15                             | 0.30 | 8                            | 2                            | 250                          | 310  | Low            | DMF2826-000  | DMF2826-252       |             |
|               |                                  |      |                              | 3                            | 325                          | 425  | Med            | DME2829-000  | DME2829-252       |             |
|               |                                  |      |                              | 4                            | 550                          | 650  | High           | DMJ2093-000  | DMJ2093-252       |             |
| KU            | 0.05                             | 0.15 | 13                           | 2                            | 260                          | 330  | Low            | DMF2827-000  | DMF2827-252       | DMF2827-232 |
|               |                                  |      |                              | 3                            | 350                          | 450  | Med            | DME2830-000  | DME2830-252       | DME2830-232 |
|               |                                  |      |                              | 4                            | 500                          | 680  | High           | DMJ2832-000  | DMJ2832-252       | DMJ2832-232 |
| K             | —                                | 0.1  | 18                           | 2                            | 270                          | 350  | Low            | DMF2828-000  |                   | DMF2828-232 |
|               |                                  |      |                              | 3                            | 375                          | 550  | Med            | DME2831-000  |                   | DME2831-232 |
|               |                                  |      |                              | 4                            | 600                          | 700  | High           | DMJ2833-000  |                   | DMJ2833-232 |

### Beam-Lead (Common Cathode), N-Type, Low, Medium, High Drive



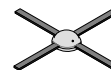
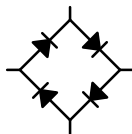
| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>10 mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead | Epoxy<br>Package |
|---------------|----------------------------------|------|------------------------------|------------------------------|------------------------------|------|----------------|--------------|------------------|
|               | Min.                             | Max. |                              |                              | Min.                         | Max. |                | 504-013      | 253              |
| S             | 0.30                             | 0.50 | 5                            | 2                            | 200                          | 260  | Low            | DMF2182-000  | DMF2182-253      |
|               |                                  |      |                              | 3                            | 300                          | 400  | Med            | DME2205-000  |                  |
|               |                                  |      |                              | 4                            | 500                          | 600  | High           | DMJ2208-000  | DMJ2208-253      |
| X             | 0.15                             | 0.30 | 8                            | 2                            | 250                          | 310  | Low            | DMF2183-000  | DMF2183-253      |
|               |                                  |      |                              | 3                            | 325                          | 425  | Med            | DME2206-000  |                  |
|               |                                  |      |                              | 4                            | 550                          | 650  | High           | DMJ2209-000  |                  |
| KU            | 0.05                             | 0.15 | 13                           | 2                            | 260                          | 330  | Low            | DMF2184-000  | DMF2184-253      |
|               |                                  |      |                              | 3                            | 350                          | 450  | Med            | DME2207-000  |                  |
|               |                                  |      |                              | 4                            | 500                          | 680  | High           | DMJ2210-000  |                  |
| K             | —                                | 0.1  | 18                           | 2                            | 270                          | 350  | Low            | DMF2834-000  |                  |
|               |                                  |      |                              | 3                            | 375                          | 550  | Med            | DME2835-000  |                  |
|               |                                  |      |                              | 4                            | 600                          | 700  | High           | DMJ2836-000  |                  |

### Beam-Lead (Anti-Parallel Pairs), N-Type, Low, Medium, High Drive

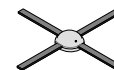
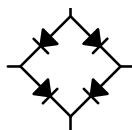


| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>10 mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead | Epoxy<br>Package |
|---------------|----------------------------------|------|------------------------------|------------------------------|------------------------------|------|----------------|--------------|------------------|
|               | Min.                             | Max. |                              |                              | Min.                         | Max. |                | 522-025      | 251              |
| S             | 0.30                             | 0.50 | 5                            | 2                            | 200                          | 260  | Low            | DMF2185-000  | DMF2185-251      |
|               |                                  |      |                              | 3                            | 300                          | 400  | Med            | DME2282-000  | DME2282-251      |
|               |                                  |      |                              | 4                            | 500                          | 600  | High           | DMJ2303-000  | DMJ2303-251      |
| X             | 0.15                             | 0.30 | 8                            | 2                            | 250                          | 310  | Low            | DMF2186-000  | DMF2186-251      |
|               |                                  |      |                              | 3                            | 325                          | 425  | Med            | DME2283-000  | DME2283-251      |
|               |                                  |      |                              | 4                            | 550                          | 650  | High           | DMJ2304-000  | DMJ2304-251      |
| KU            | 0.05                             | 0.15 | 13                           | 2                            | 260                          | 330  | Low            | DMF2187-000  | DMF2187-251      |
|               |                                  |      |                              | 3                            | 350                          | 450  | Med            | DME2284-000  | DME2284-251      |
|               |                                  |      |                              | 4                            | 500                          | 680  | High           | DMJ2246-000  | DMJ2246-251      |
| K             | —                                | 0.1  | 18                           | 2                            | 270                          | 350  | Low            | DMF2837-000  |                  |
|               |                                  |      |                              | 3                            | 375                          | 550  | Med            | DME2838-000  |                  |
|               |                                  |      |                              | 4                            | 600                          | 700  | High           | DMJ2839-000  |                  |

## DME, DMF and DMJ Series

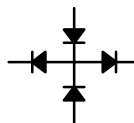
Beam-Lead (Ring Quad), N-Type,  
Low, Medium, High Drive

| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>10 mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead | Epoxy<br>Packages |             |
|---------------|----------------------------------|------|------------------------------|------------------------------|------------------------------|------|----------------|--------------|-------------------|-------------|
|               | Min.                             | Max. | Max.                         | Min.                         | Min.                         | Max. |                | 488-002      | 254               | 234         |
| S             | 0.30                             | 0.50 | 5                            | 2                            | 200                          | 260  | Low            | DMF2865-000  | DMF2865-254       | DMF2865-234 |
|               |                                  |      |                              | 3                            | 300                          | 400  | Med            | DME2857-000  | DME2857-254       | DME2857-234 |
|               |                                  |      |                              | 4                            | 500                          | 600  | High           | DMJ2502-000  | DMJ2502-254       |             |
| X             | 0.15                             | 0.30 | 8                            | 2                            | 250                          | 310  | Low            | DMF2011-000  | DMF2011-254       | DMF2011-234 |
|               |                                  |      |                              | 3                            | 325                          | 425  | Med            | DME2858-000  | DME2858-254       |             |
|               |                                  |      |                              | 4                            | 550                          | 650  | High           | DMJ2990-000  | DMJ2990-254       |             |
| KU            | 0.05                             | 0.15 | 13                           | 2                            | 260                          | 330  | Low            | DMF2012-000  | DMF2012-254       | DMF2012-234 |
|               |                                  |      |                              | 3                            | 350                          | 450  | Med            | DME2859-000  | DME2859-254       | DME2859-234 |
|               |                                  |      |                              | 4                            | 500                          | 680  | High           | DMJ2667-000  | DMJ2667-254       | DMJ2667-234 |
| K             | —                                | 0.1  | 18                           | 2                            | 270                          | 350  | Low            | DMF2454-000  |                   | DMF2454-234 |
|               |                                  |      |                              | 3                            | 375                          | 550  | Med            | DME2459-000  |                   | DME2459-234 |
|               |                                  |      |                              | 4                            | 600                          | 700  | High           | DMJ2455-000  |                   | DMJ2455-234 |

Beam-Lead (Bridge Quad), N-Type,  
Low, Medium, High Drive

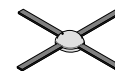
| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>10 mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead | Epoxy<br>Package |             |
|---------------|----------------------------------|------|------------------------------|------------------------------|------------------------------|------|----------------|--------------|------------------|-------------|
|               | Min.                             | Max. | Max.                         | Min.                         | Min.                         | Max. |                | 488-004      | 255              | 235         |
| S             | 0.30                             | 0.50 | 5                            | 2                            | 200                          | 260  | Low            | DMF2076-000  | DMF2076-255      | DMF2076-235 |
|               |                                  |      |                              | 3                            | 300                          | 400  | Med            | DME2029-000  | DME2029-255      |             |
|               |                                  |      |                              | 4                            | 500                          | 600  | High           | DMJ2312-000  | DMJ2312-255      |             |
| X             | 0.15                             | 0.30 | 8                            | 2                            | 250                          | 310  | Low            | DMF2077-000  | DMF2077-255      |             |
|               |                                  |      |                              | 3                            | 325                          | 425  | Med            | DME2850-000  | DME2850-255      |             |
|               |                                  |      |                              | 4                            | 550                          | 650  | High           | DMJ2088-000  | DMJ2088-255      |             |
| KU            | 0.05                             | 0.15 | 13                           | 2                            | 260                          | 330  | Low            | DMF2078-000  | DMF2078-255      |             |
|               |                                  |      |                              | 3                            | 350                          | 450  | Med            | DME2031-000  | DME2031-255      |             |
|               |                                  |      |                              | 4                            | 500                          | 680  | High           | DMJ2768-000  | DMJ2768-255      |             |
| K             | -                                | 0.1  | 18                           | 2                            | 270                          | 350  | Low            | DMF2848-000  |                  |             |
|               |                                  |      |                              | 3                            | 375                          | 550  | Med            | DME2851-000  |                  |             |
|               |                                  |      |                              | 4                            | 600                          | 700  | High           | DMJ2852-000  |                  |             |

### Beam-Lead (Star Quad), N-Type, Low, Medium, High Drive



| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>10 mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead |
|---------------|----------------------------------|------|------------------------------|------------------------------|------------------------------|------|----------------|--------------|
|               | Min.                             | Max. | Max.                         | Min.                         | Min.                         | Max. |                | 520-034      |
| S             | 0.30                             | 0.50 | 5                            | 2                            | 200                          | 260  | Low            | DMF2137-000  |
|               |                                  |      |                              | 3                            | 300                          | 400  | Med            | DME2191-000  |
|               |                                  |      |                              | 4                            | 500                          | 600  | High           | DMJ2193-000  |
| X             | 0.15                             | 0.30 | 8                            | 2                            | 250                          | 310  | Low            | DMF2138-000  |
|               |                                  |      |                              | 3                            | 325                          | 425  | Med            | DME2192-000  |
|               |                                  |      |                              | 4                            | 550                          | 650  | High           | DMJ2194-000  |
| KU            | 0.05                             | 0.15 | 13                           | 2                            | 260                          | 330  | Low            | DMF2189-000  |
|               |                                  |      |                              | 3                            | 350                          | 450  | Med            | DME2178-000  |
|               |                                  |      |                              | 4                            | 500                          | 680  | High           | DMJ2195-000  |
| K             | —                                | 0.1  | 18                           | 2                            | 270                          | 350  | Low            | DMF2190-000  |
|               |                                  |      |                              | 3                            | 375                          | 550  | Med            | DME2174-000  |
|               |                                  |      |                              | 4                            | 600                          | 700  | High           | DMJ2180-000  |

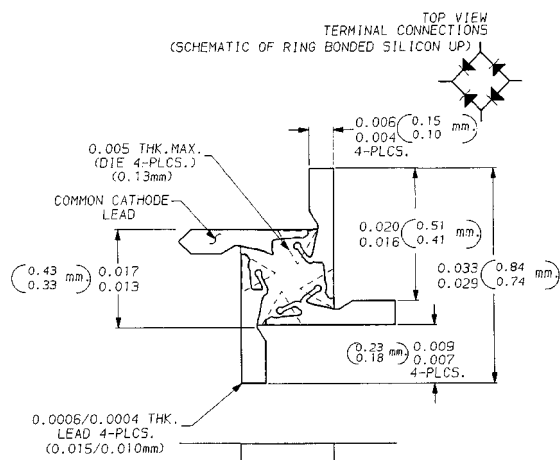
### Beam-Lead (Octo Quad Ring), N-Type, Medium, High Drive



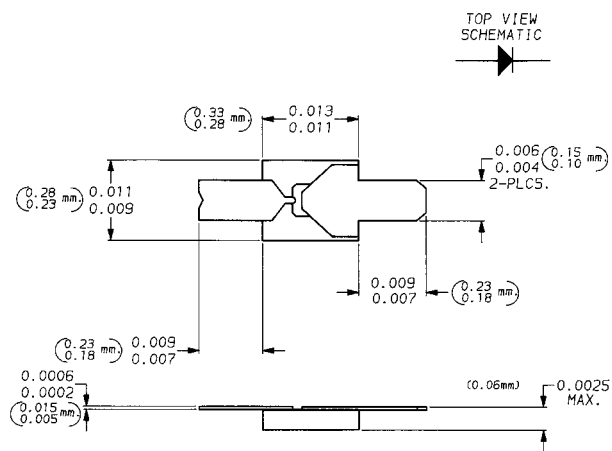
| Freq.<br>Band | C <sub>J</sub><br>0V 1 MHz<br>pF |      | R <sub>S</sub><br>5mA<br>Ω | V <sub>B</sub><br>10 μA<br>Ω | V <sub>F</sub><br>1 mA<br>mV |      | Drive<br>Level | Beam<br>Lead | Epoxy       |
|---------------|----------------------------------|------|----------------------------|------------------------------|------------------------------|------|----------------|--------------|-------------|
|               | Min.                             | Max. | Max.                       | Min.                         | Min.                         | Max. |                | 294-020      | 257         |
| S-X           | 0.15                             | 0.30 | 10                         | 6                            | 600                          | 800  | Med            | DME3273-000  | DME3273-257 |
|               |                                  |      |                            | 8                            | 1000                         | 1200 | High           | DMJ4759-000  | DMJ4759-257 |
| KU            | 0.05                             | 0.15 | 16                         | 6                            | 650                          | 850  | Med            | DME3274-000  | DME3274-257 |
|               |                                  |      |                            | 8                            | 1100                         | 1300 | High           | DMJ4771-000  | DMJ4771-257 |

## Outline Drawings

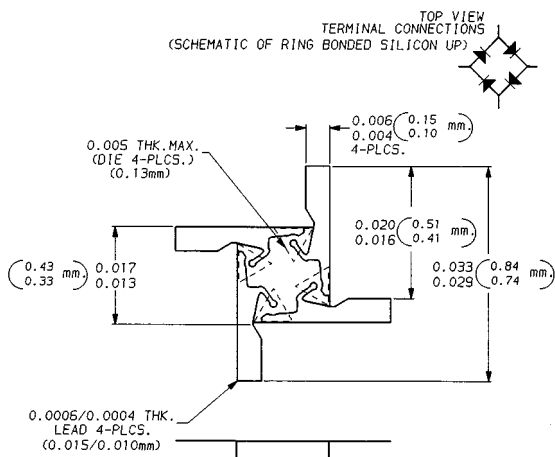
## 484-004



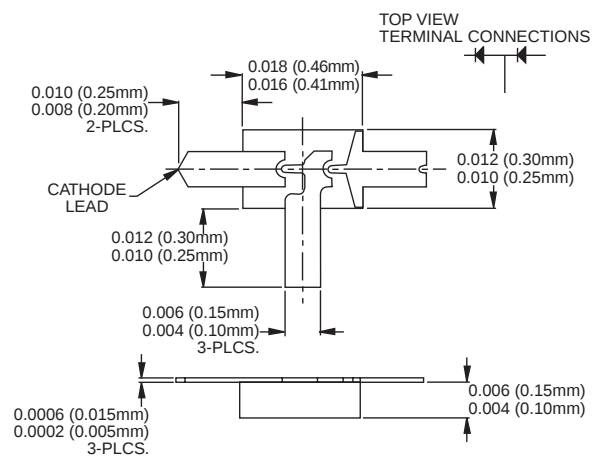
## 491-011



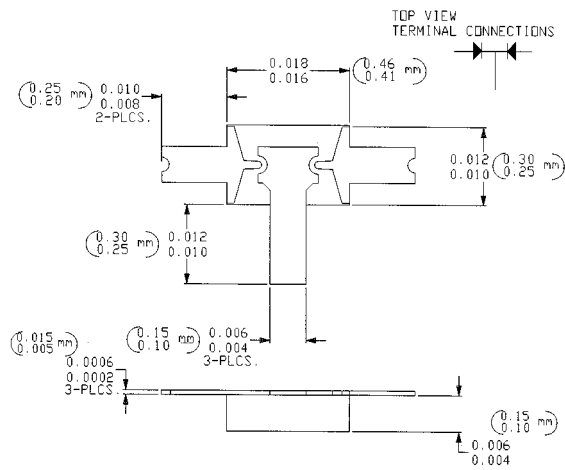
## 488-002



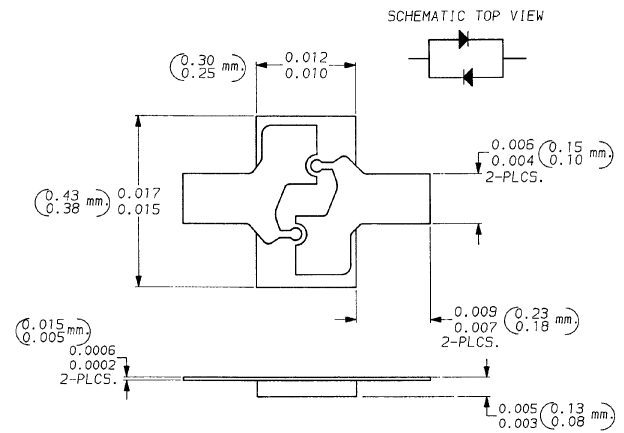
## 504-012



## 504-013



## 522-025



## 520-034

