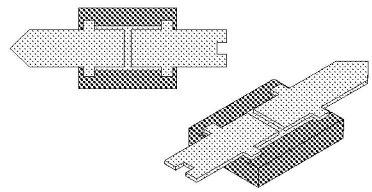
Planar and Mesa Beam Lead PIN Diodes

DSG6405–000, DSG6474–000, DSM6300 Series

Features

- Low Capacitance
- Low Resistance
- Fast Switching
- Oxide–Nitride Passivated
- Stronger, Full Frame Design
- High Voltage



Maximum Ratings

Operating Temperature:	–65 to + 150°C
Storage Temperature:	–65 to + 200°C
Power Dissipation (Derate Linearly to Zero @ 175°C):	250 mW
Typical Lead Strength:	8 Grams Pull

Description

Alpha's Silicon Planar and Mesa Beam Lead PIN diodes are surrounded by a glass frame for superior strength and electrical performance that surpasses the standard beam lead PINs. They are designed for low resistance, low capacitance and fast switching time. The oxide–nitride passivation layers provide reliable operation and stable junction parameters that provide complete sealing of the junction permitting use in assemblies with some degree of moisture sealing. A layer of glass provides increased mechanical strength.

Alpha's beam lead PIN diodes are ideal for microstrip or stripline circuits and for circuits requiring high isolation from a series mounted diode such as broad band multi–throw switches, phase shifters, limiters, attenuators and modulators.

Electrical Specifications at 25°C

Low Capacitance Planar Beam Lead Diodes

Part Number	Breakdown Voltage @ 10 µA (V)		Capacitance Total @ 50 Volts, 1 MHz (pF)		Series Resistance @ 20 mA 100 MHz (Ohms)		Minority Carrier Lifetime I_F = 10mA, I_R = 6mA (ns)	Reverse Recovery Time I_F = 20 mA, V_R = 10V, 90% Recovery (ns)		Outline Drawing Number
	Min.	Typ.	Typ.	Max.	Typ.	Max.	Typ.	Typ.	Max.	
DSG6405–000	100	125	0.017	0.02	4.5	6.0	200	20	35	389–004

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Performance Data for DSG6405–000

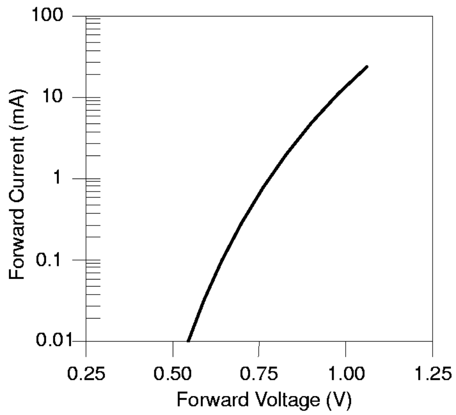

Figure 1. Typical Forward Characteristics

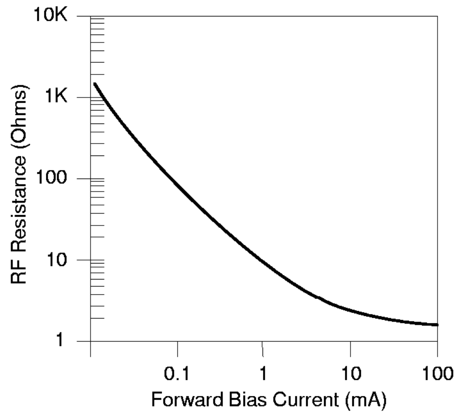

Figure 3. Typical RF Resistance vs. Forward Bias Current

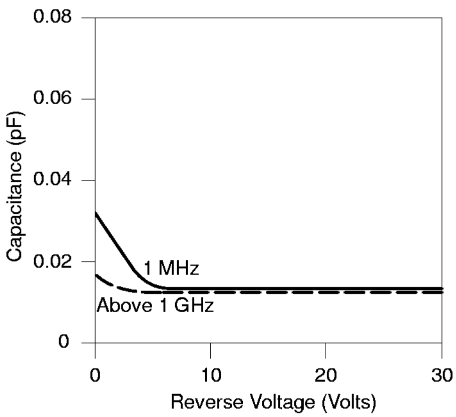

Figure 2. Typical Capacitance vs. Reverse Bias Voltage

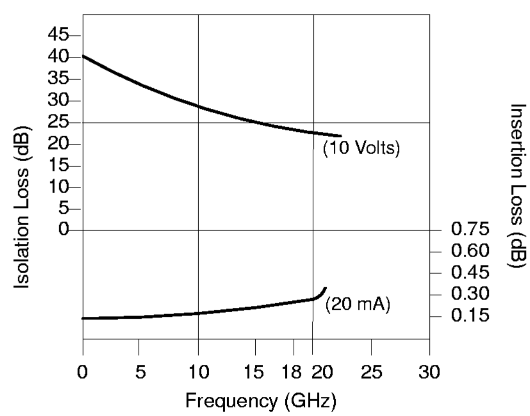

Figure 4. Typical Insertion Loss and Isolation Characteristics

Electrical Specifications at 25°C

Planar Beam Lead Diodes

Part Number	Voltage Breakdown @ 10 mA	Series Resistance (Ohms) (From Insertion Loss @ 3 GHz, 50 mA)[1]	Junction Capacitance C_J (pF)	RF Switching Time T_S (ns)[2]	Minority Carrier Lifetime (ns)	Outline Drawing Number
	Min.	Max.	Max.		Typ.	
▶DSG6474–000	200	4.0	0.02	25	250	169–001

▶ Available through distribution.

1. Total capacitance calculated from isolation at 9 GHz zero bias. Series resistance and capacitance are measured at microwave frequencies on a sample basis from each lot. All diodes are characterized for capacitance at –50 Volts, 1 MHz, and series resistance at 1 KHz, 50 mA, measurements which correlate well with microwave measurements.
2. T_S measured from RF transition, 90% to 10%, in series configuration.

Performance Data for DSG6474–000

Figures 5 and 6 show a single pole double–throw 1–18 GHz switch these diodes are mounted an Alumina, Duriod, or Teflon fiberglass 50 ohm microstrip circuits. Typical bonding methods include thermal compression bonding, parallel gap welding, and soldering.

SPDT isolation curves are shown in Figure 6 and insertion loss in Figures 7 and 8. With proper transitions and bias circuits, VSWR is better than 2.0 to 1 through 18 GHz.

Switching Considerations

The typical minority carrier lifetime of the DSG6474 diodes is 100 ns. With suitable drivers, the individual diodes can be switched from high impedance (off) to low R_S (on) in about 10 ns.

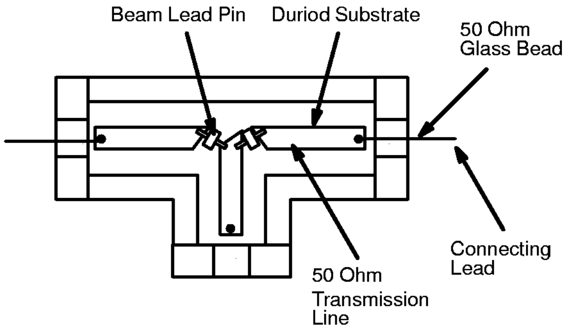

Figure 5. Typical SPDT Circuit Arrangement

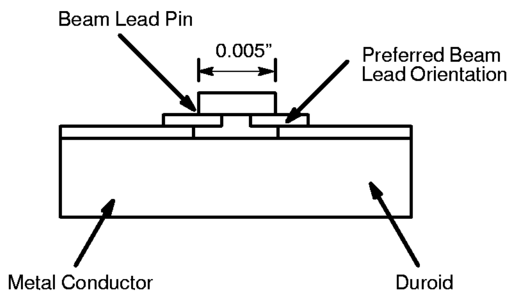

Figure 6. Typical Beam Lead Mounting

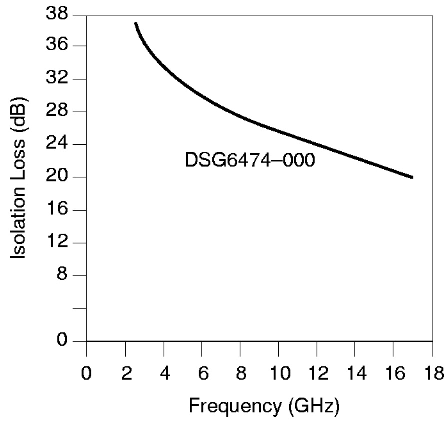

Figure 7. Isolation vs. Frequency, SPDT DSG6474–000

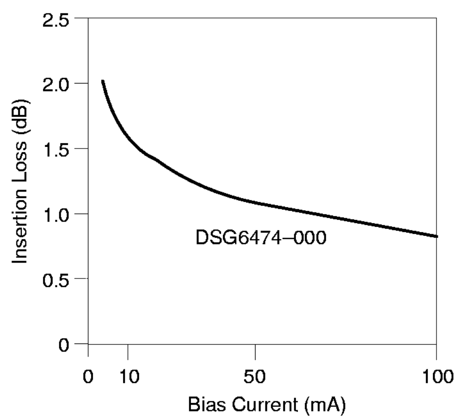

Figure 8. Diode Insertion Loss vs. Bias SPST, 18 GHz DSG6474–000

Power Handling for DSG6474–000

Beam lead diodes are not suitable for high power operation because of high internal thermal impedance of about 600°C/Watt.

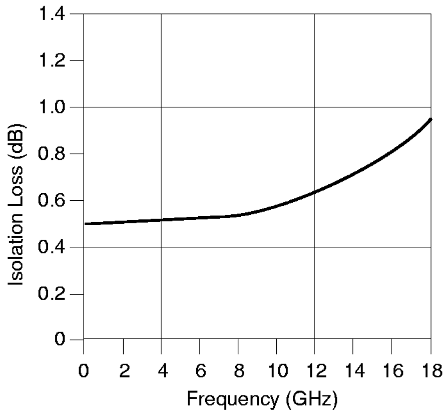

Figure 9. Diode Insertion Loss vs. Frequency SPST, 50 mA Bias DSG6474–000

With maximum CW power dissipation of 250 mW, the DSG6474–000 diodes are normally rated at 2 Watt CW with linear derating between 25°C and 150°C. Figure 10 presents data on CW power handling as a function of bias and frequency.

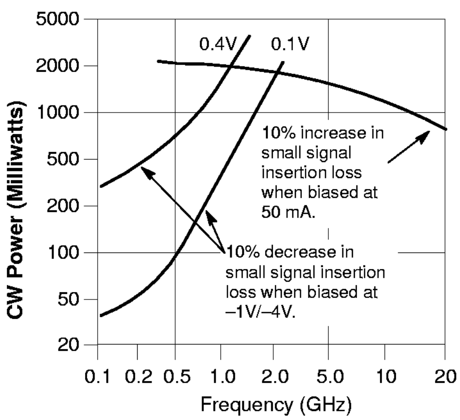

Figure 10. Typical Series Switch Behavior at Room Temperature and Biased at 50ma/1V/4V DSG6474–000

For pulsed operation, the total RF plus bias voltage must not exceed the rated breakdown. Alpha has made high power tests at 1 GHz with 1µs pulses, 0.001 duty, with 200V diodes. With 50 mA forward bias, there is no increase in insertion loss over the 0 dBm level with a peak power input of 50 watts. In the open state, reverse bias voltage is required to keep the diode from “rectifying,” with resultant decrease in isolation and possible failure. Figure 11 shows allowed peak power versus reverse bias at 1 GHz.

At this frequency, the required reverse voltage is almost equal to the peak RF voltage; at high frequency, the bias can be reduced somewhat. Experimentation is necessary.

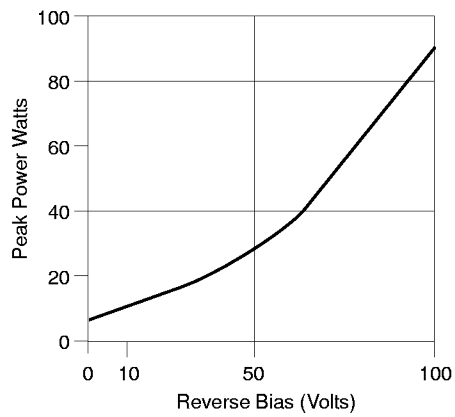

Figure 11. Peak Power Handling, SPST, 1 GHz DSG6474–000

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Mesa Beam Lead Diode Specifications

Part Number	Voltage Breakdown @ I_R < 10 mA (V)	Capacitance Total 50V, 1MHz (pF)	Series Resistance (Ohms)		C_{LT} I_F = 10 mA, I_R = 6 mA (ns)	Outline Drawing Number
			50 mA, 100 MHz	10 mA, 100 MHz		
	Max.	Max.	Max.	Typ.	Typ.	
Fast Beam Lead Pin Diodes						
▶ DSM6380–000	100	0.025	3.5	4.5	40	389–003
DSM6381–000	150	0.025	4.0	5.0	50	389–003
Low–Loss Ultra–Fast Beam Lead PIN Diodes						
DSM6361–000	60	0.025[1]	3.5[2]	—	25	389–003

▶ Available through distribution.

1. Capacitance Total @ 10 Volts, 1 MHz, pF, Max.
2. Series Resistance @ 10 mA, Ohms, Max., 100 MHz.

Part Number	Voltage Breakdown @ 10 µA, Reverse Current		Series Resistance @ 50 MHz, 50 mA		Capacitance Total @ –10V, 1 MHz		Lifetime (ns)	Switching Time (ns)	Video Recovery Time (ns)[2]	Outline Drawing Number
	Min.	Typ.	Typ.	Max.	Typ.	Max.	Typ.[1]	Typ.[2]		
Ultra Low Resistance High–Speed Beam Lead PIN Diodes										
DSM6356–000	30	50	1.2	1.5	0.12	0.15	30	5	2	389–003

1. I_F = 10mA, I = 6mA, recovery to 3 mA.
2. Video recovery time at 2 GHz from I_F = 10mA to V_R = 10V, from 100% to 10% in series configuration. Video reverse recovery time from I_F = 10mA to I_R = 2mA, with V_R = 10mV.

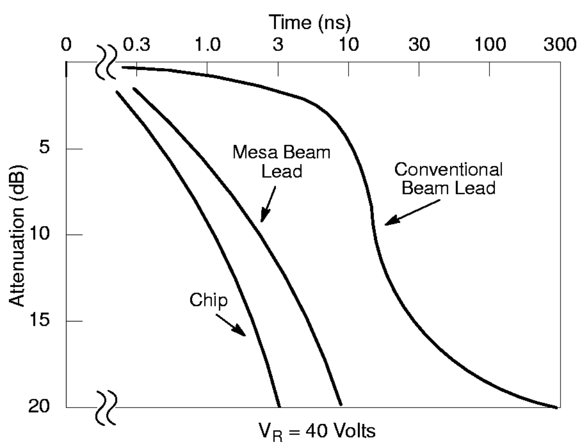

Figure 12. Switching Time Data

Typical Characteristics for DSM6380–000 and DSM6381–000

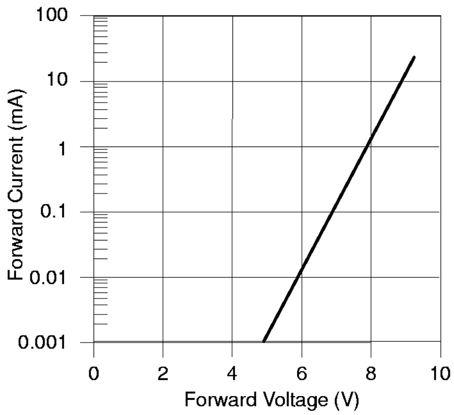

Figure 13. Typical Forward Characteristics of the DSM6380–000

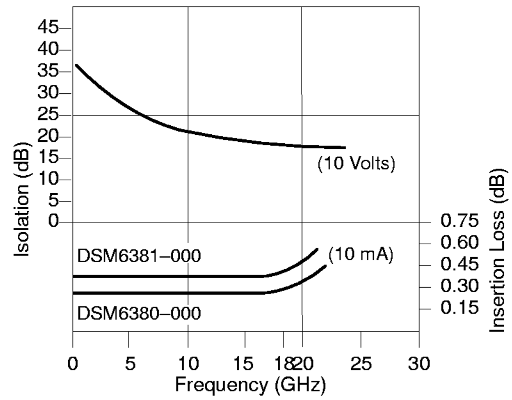

Figure 15. Typical Isolation and Insertion Loss Characteristics of the DSM6380–000/6381–000

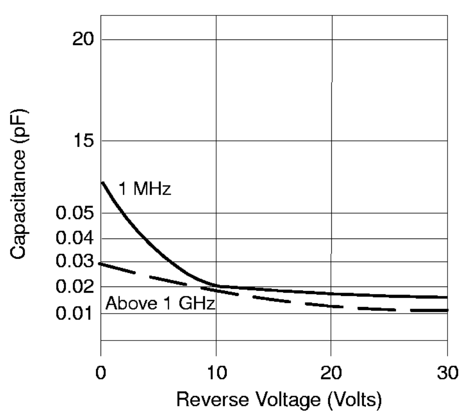

Figure 14. Typical Capacitance vs. Reverse Voltage for DSM6380–000

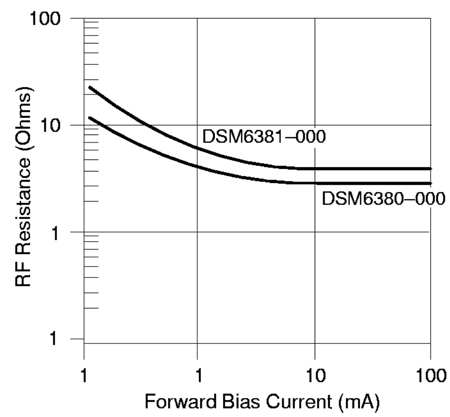

Figure 16. Typical RF Resistance vs. Forward Bias Current for DSM6380–000 and DSM6381–000

Typical Characteristics for DSM6361–000

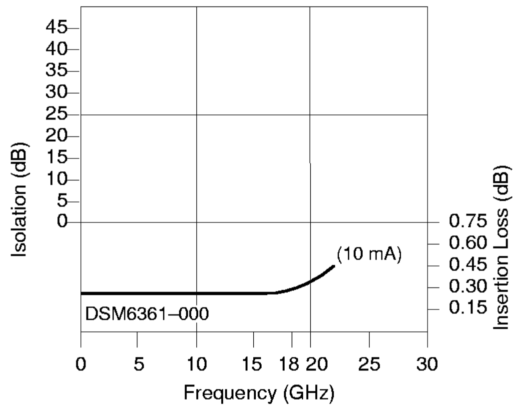

Figure 17. Typical Isolation and Insertion Loss Characteristics of the DSM6361–000

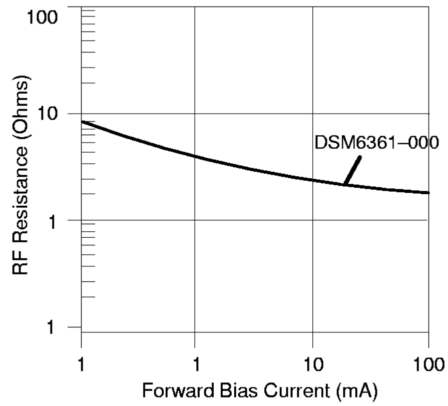

Figure 19. Typical RF Resistance vs. Forward Bias Current for DSM6361–000

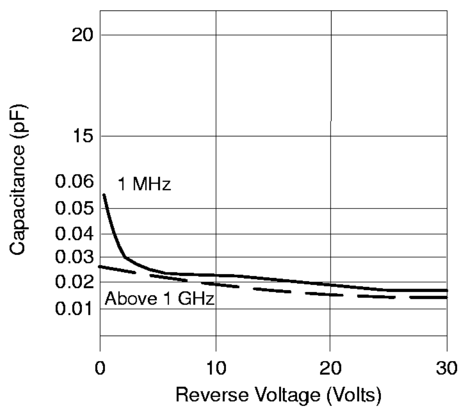

Figure 18. Typical Capacitance vs. Reverse Voltage for DSM6361–000

Typical Characteristics for DSM6356–000

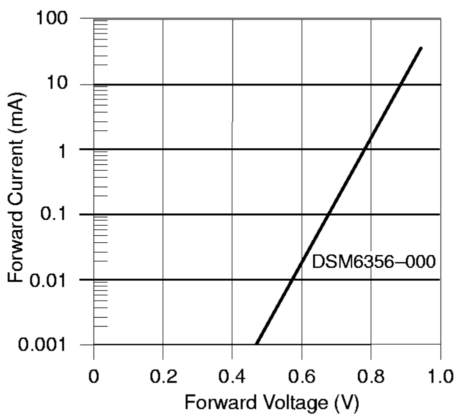

Figure 20. Typical Forward Characteristics

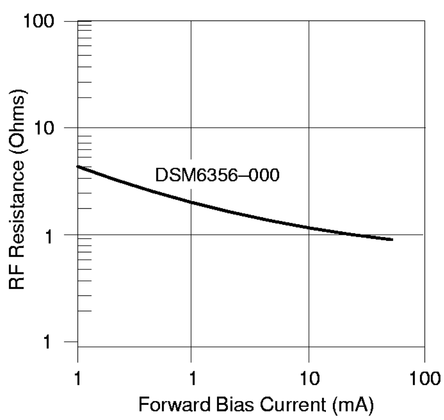

Figure 21. Typical RF Resistance vs. Forward Bias Current

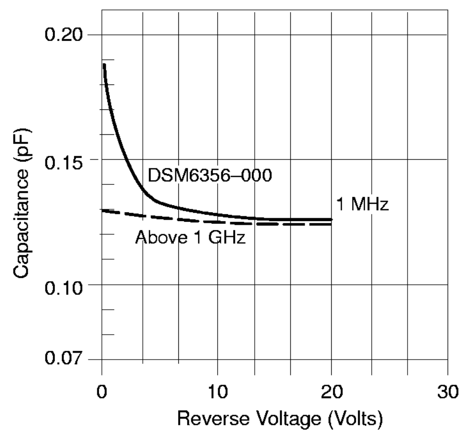

Figure 22. Typical Capacitance vs. Reverse Voltage

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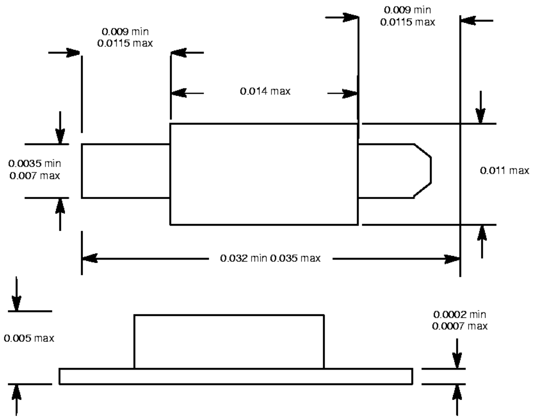
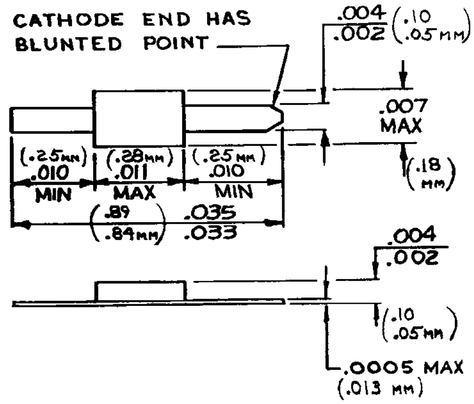
Outline Drawings

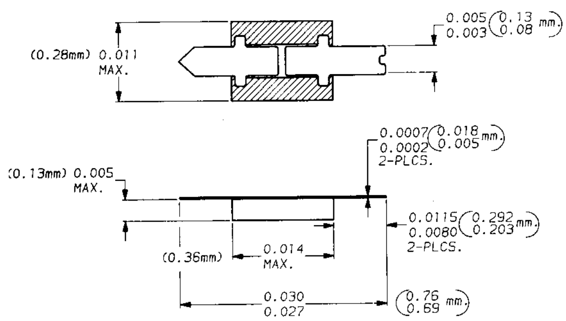
389–003



169–001

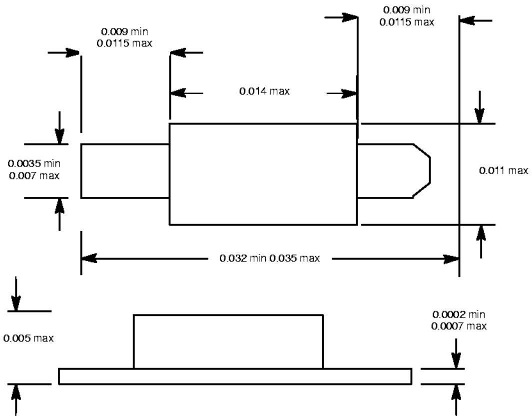


389–004

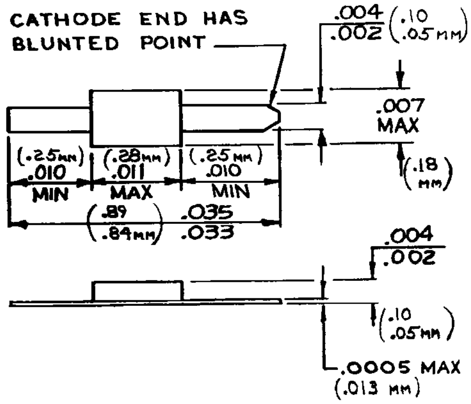


Outline Drawings

389–003



169–001



389–004