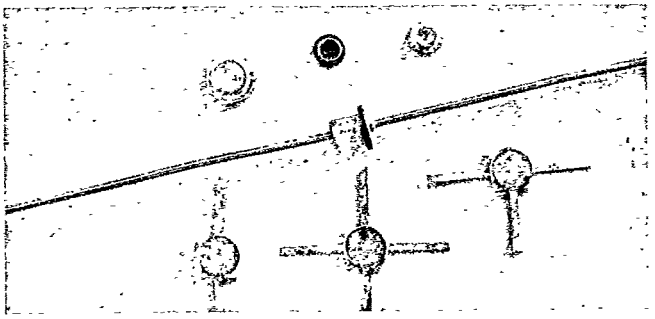
Planar Tunnel (Back) Diodes

Series A1S

Features

- Improved Reliability—Rugged Planar Design
- Optimum Performance Over Temperature
- Low Video Resistance—50 to 150 Ohms
- MIL-STD-883 Capability
- Excellent RF Match—Broadband Capability



Environmental Ratings (Maximum)

Operating Temperature ..... −65°C to +115°C
Storage Temperature ..... −65°C to +125°C
Soldering Temperature ..... 230°C for 5 sec

Detector Back Diode Selection Matrix

Recommended Frequency Range	High Sensitivity High VSWR $R_V \simeq 150$ Ohms	Intermediate Sensitivity Intermediate VSWR $R_V \simeq 100$ Ohms	Mid Sensitivity Mid VSWR $R_V \simeq 75$ Ohms	Lower Sensitivity Lower VSWR $R_V \simeq 50$ Ohms
X-Ku Band	A1S207	A1S307	A1S407	A1S507
S-C Band	A1S210	A1S310	A1S410	A1S510
L Band	A1S215	A1S315	A1S415	A1S515
Below 1 GHz	A1S220	A1S320	A1S420	A1S520

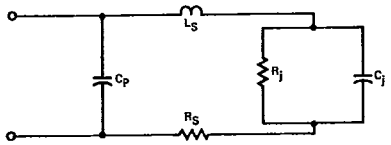
Electrical Specifications @ 25°C—Germanium Planar Detector Back Diodes

Model	I_P μA Range	I_V μA (Typ.)	V_R@500μA mV (Typ.)	V_F@3mA mV (Typ.)	R_S Ohms (Typ.)	C_T pF (Max.)
A1S207	50–200	30	450	120	15	0.7
A1S210	50–200	30	450	120	12	1.0
A1S215	50–200	30	450	120	10	1.5
A1S220	50–200	30	450	120	8	2.0
A1S307	200–300	40	440	110	15	0.7
A1S310	200–300	40	440	110	12	1.0
A1S315	200–300	40	440	110	10	1.5
A1S320	200–300	40	440	110	8	2.0
A1S407	300–400	50	430	100	15	0.7
A1S410	300–400	50	430	100	12	1.0
A1S415	300–400	50	430	100	10	1.5
A1S420	300–400	50	430	100	8	2.0
A1S507	400–550	70	420	90	15	0.7
A1S510	400–550	70	420	90	12	1.0
A1S515	400–550	70	420	90	10	1.5
A1S520	400–550	70	420	90	8	2.0

All A1S series in "A" package. Other hermetic packages available are D, G, U2, W2, X

TRW Microwave Tunnel (Back) Diode Technical Notes

1. Equivalent Circuit
Tunnel diodes used in microwave devices must be very carefully screened and tested to define all the parameters that affect their operation in the microwave circuits. These parameters are determined from the equivalent circuit shown below.



2. Package Capacitance (C_p)
The package capacity is a function of the package type. Specified values are average values for the specific type of package. In high frequency diodes, the junction capacity is often much less than the package capacity.

3. Series Inductance (L_s)
The effect of series inductance is somewhat dependent on the diode mounting in the microwave circuit. The values specified are average values for diodes mounted in series with the center conductor of a coaxial transmission line.

4. Junction Resistance (R_j)
The junction resistance is the dynamic (AC) resistance of the diode junction. Junction resistance varies from almost zero where the diode is heavily back-biased, to infinity at the peak current point, then to a minimum negative value and back to infinity at the valley current point. It is also approximately zero when the diode is biased heavily in the forward direction.

5. Series Resistance (R_S)
The series resistance is a combination of contact resistance and spreading resistance. It is measured by pulsing the diode far into the reverse region, where the junction resistance is very low, then measuring the incremental resistance with a small sampling pulse on top of the biasing pulse.

6. Junction Capacity (C_j)
The junction capacity is determined by measuring the total capacity with the diode biased at the valley voltage, then subtracting the package capacity. The **operating point junction capacity** is defined to be 75 percent of the valley point junction capacity.

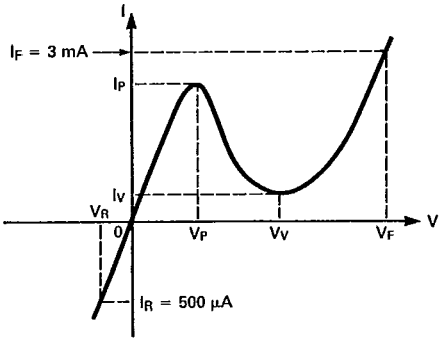
7. Characteristic Curves
The figures shown indicate the general behavior of the I-V and R-V relationships as seen from the **terminals** of the tunnel diode.

8. The Tunnel Diode
The Tunnel Diode is normally considered a high peak current device (in the milli-ampere or more range) useful for its high negative resistance region for oscillators, amplifiers and very fast pulse generators (in the picosecond range).

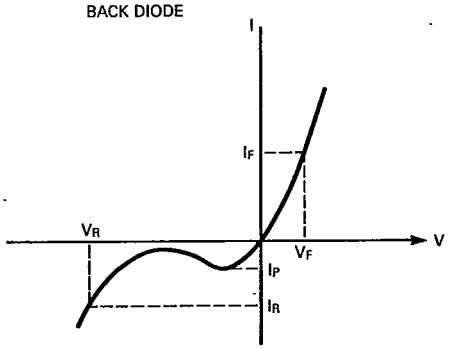
9. The Back Diode
The Back or "Backwards" diode is simply a very low peak current (hundreds of microamps) tunnel diode. Since it conducts more current near the zero-voltage, zero-current origin in the reverse direction of a Tunnel Diode it is a Backwards Diode and its I-V curve is defined upside down and backwards to that of the Tunnel Diode. Its main use is as a very temperature-stable zero-biased detector diode.

Characteristic Curves

TUNNEL DIODE



BACK DIODE



Handling Procedures
To achieve maximum microwave performance, one has to use a high quality material and must make the active area of the device as small as possible. Unfortunately, the reverse of this is true to make a highly pulse-resistant device. TRW Microwave products have been designed at an optimum condition to give superior microwave performance and to have as high a pulse resistance as possible. Due to design limitations, these devices are pulse-sensitive. We recommend the following handling procedures for all Tunnel Diodes.

1. The operator, as well as tweezers or any other pick-up tool, must be grounded to the test or inspection station. This prevents the build-up of static charge which can damage the diode if it is allowed to pass through it.

2. All test fixtures should be equipped with a short across the terminals which is disconnected only after the diode is inserted.

For measurements where a short across the terminals is not practical, a series resistor may be used. The series resistor (≃10 K) should be physically close to the test terminal.

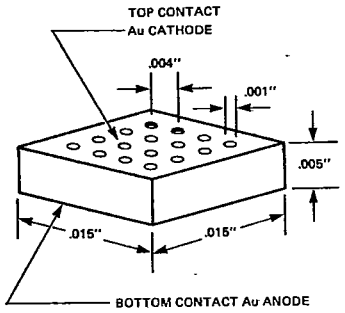
This will prevent discharge through the diode of any charge built up on the capacitance that is present in the fixture, leads, and test equipment. It is also advisable to minimize this capacitance.

3. Spurious pulses generated by test equipment, contact bounce during switching, induced voltage in the leads, etc., must be eliminated.

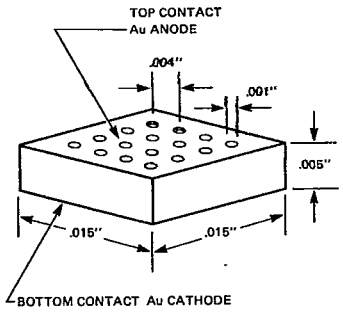
4. When passing a diode from one operator to another, the receiving operator should grasp the device so there is no possibility of passing the static charge through the diode.

Diode Outline Dimensions

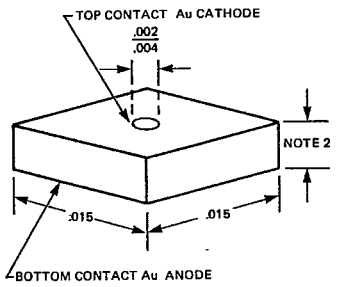
CASE STYLE "N1"*



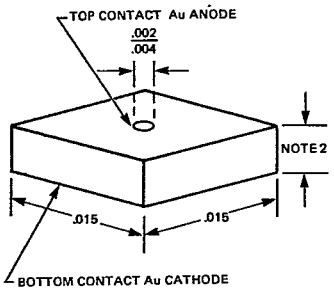
CASE STYLE "N2"*



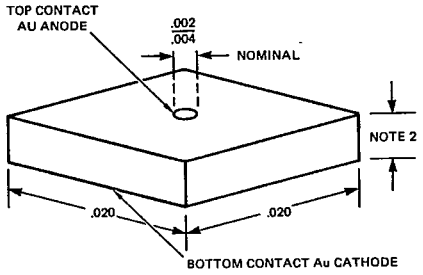
CASE STYLE "N3"



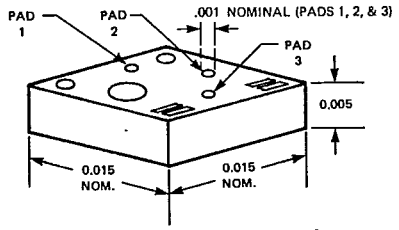
CASE STYLE "N4"



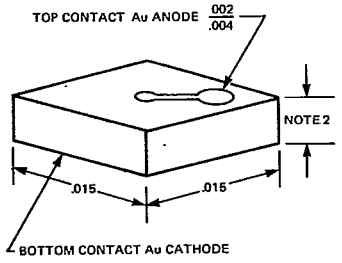
CASE STYLE "N5"



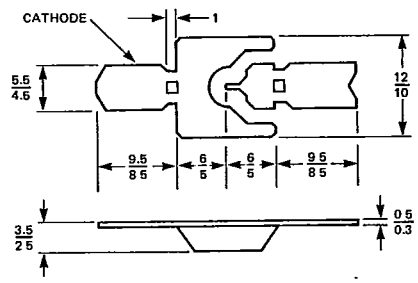
CASE STYLE "N6"*4



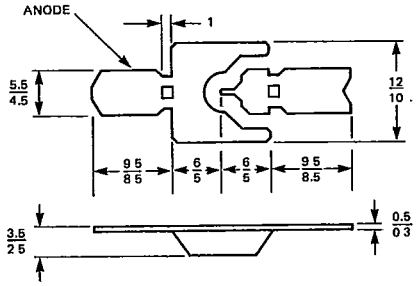
CASE STYLE "N7"



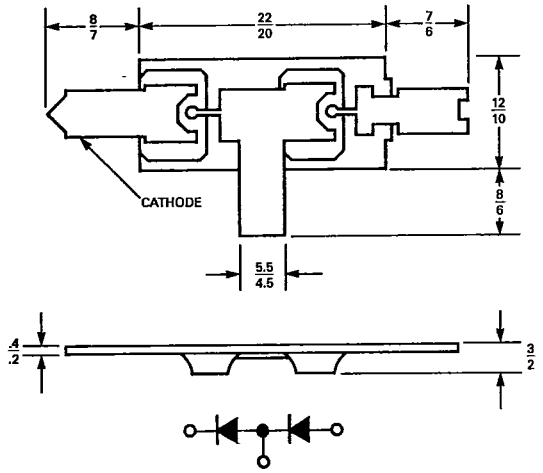
CASE STYLE "B1"6



CASE STYLE "B2"6



CASE STYLE "B3"6

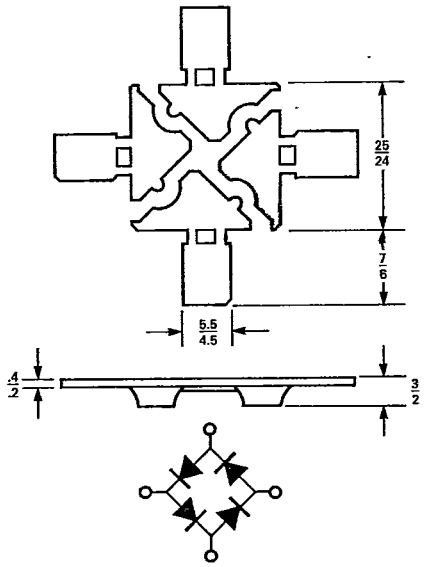


*Some die may have test pattern contacts in addition to the active junction. Always bond to the junction closest to the geometric center of the chip or the specified junction.

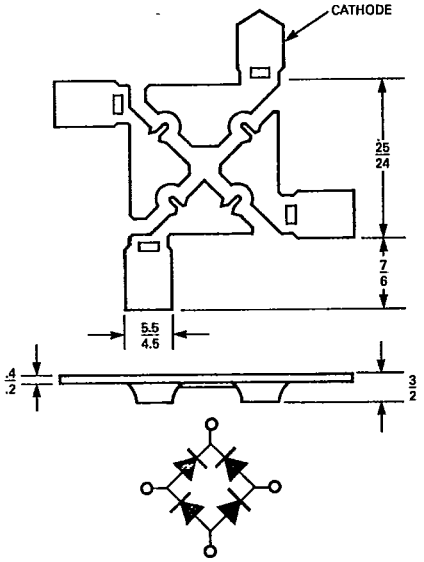
Notes:

1. All dimensions are nominal.
2. Chip thicknesses vary from .003" to .008" dependent upon specific product.
3. Chips N1 & N2 may have from 9 to 16 contacts. Always bond to the junction closest to the geometric center of the chip.
4. Contact to be used on chip N6 will be specified with each shipment.
5. Packages are not necessarily drawn to the same scale.
6. All "Bx" package dimensions are in thousandths of an inch.

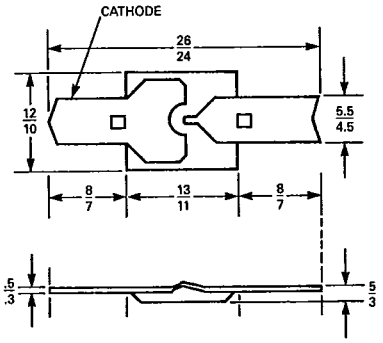
CASE STYLE "B4"[6]



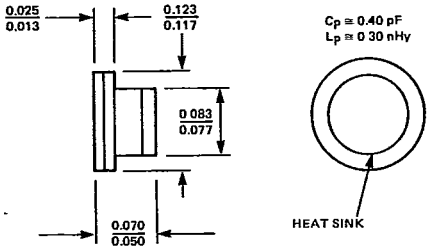
CASE STYLE "B5"[6]



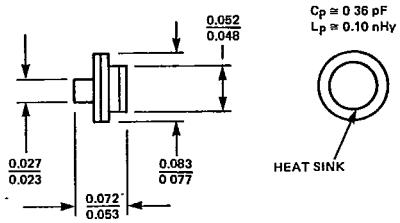
CASE STYLE "B7"[6]



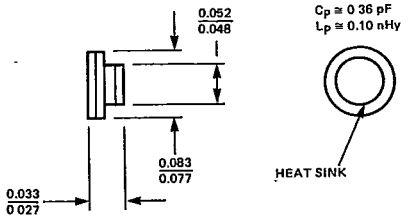
CASE STYLE "A"



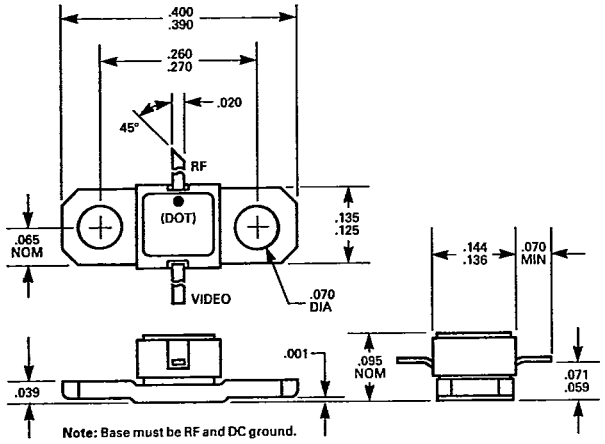
CASE STYLE "C"



CASE STYLE "D"

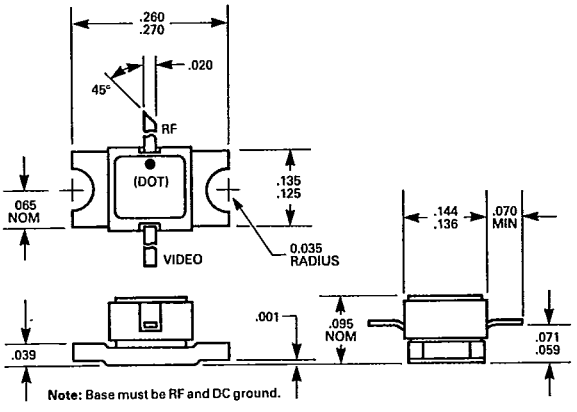


CASE STYLE "F"



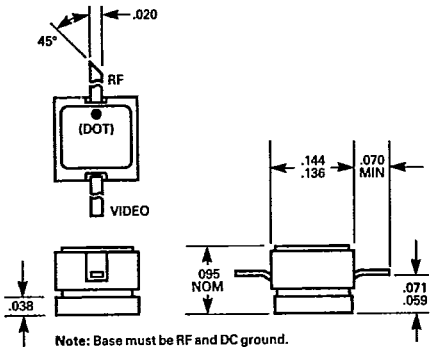
Note: Base must be RF and DC ground.

CASE STYLE "F1"



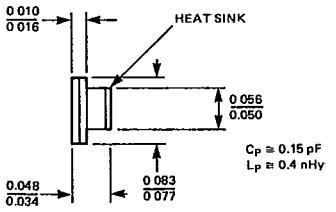
Note: Base must be RF and DC ground.

CASE STYLE "F2"

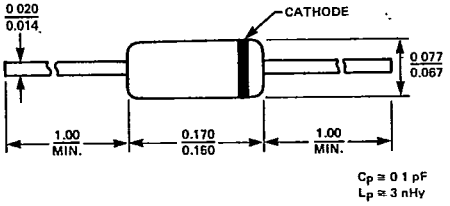


Note: Base must be RF and DC ground.

CASE STYLE "G"

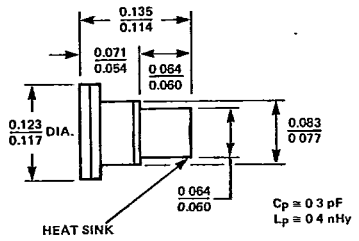


CASE STYLE "H"
(Glass axial lead—similar to D034)

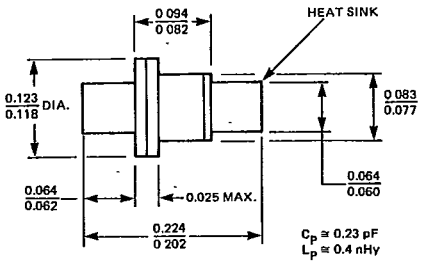


Diode Outline Dimensions

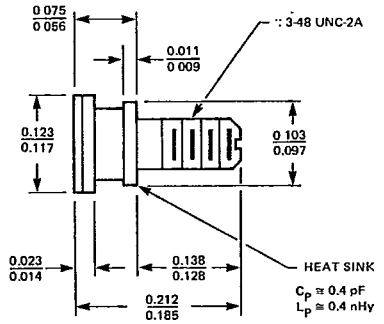
CASE STYLE "I"



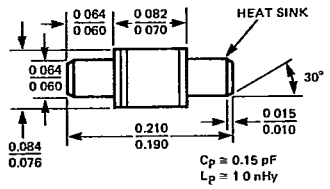
CASE STYLE "J"



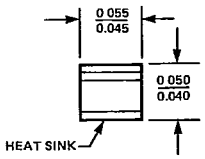
CASE STYLE "K"



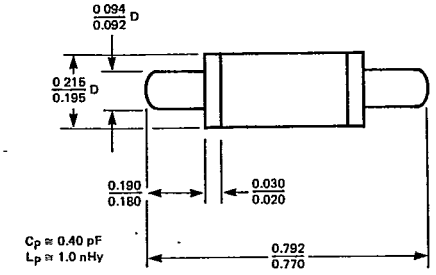
CASE STYLE "L"



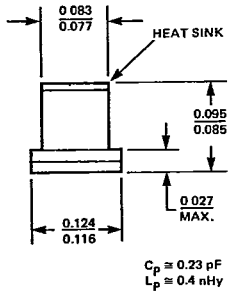
CASE STYLE "P"



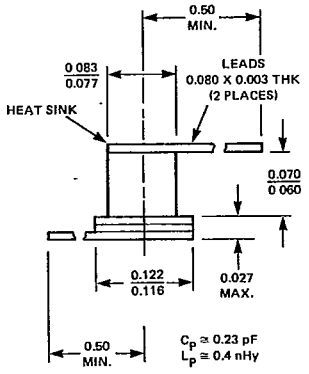
CASE STYLE "S2"



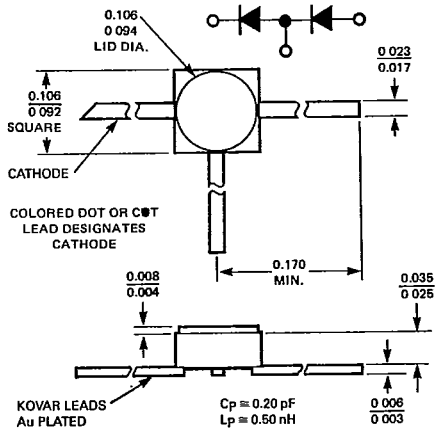
CASE STYLE "S3"



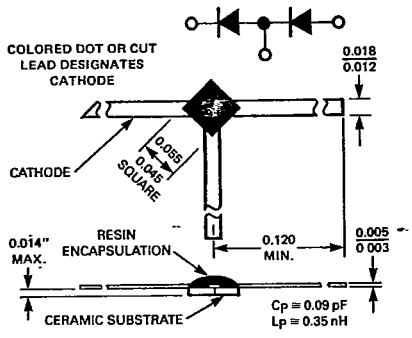
CASE STYLE "S4"



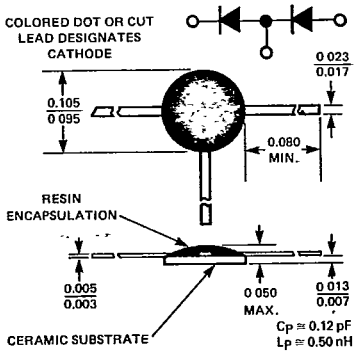
CASE STYLE "T2"



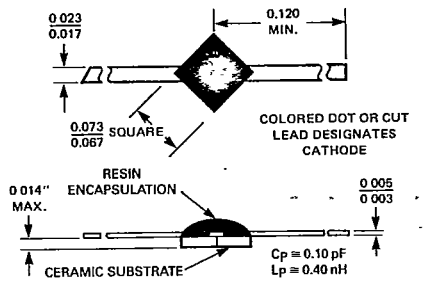
CASE STYLE "T3"



CASE STYLE "T4"

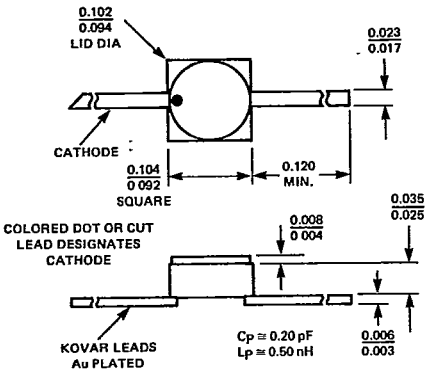


CASE STYLE "U1"



Note: Packages are not necessarily drawn to the same scale.

CASE STYLE "U2"



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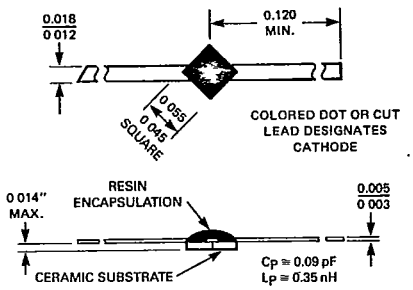
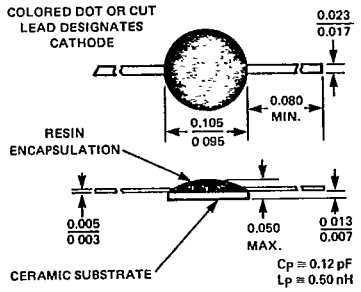
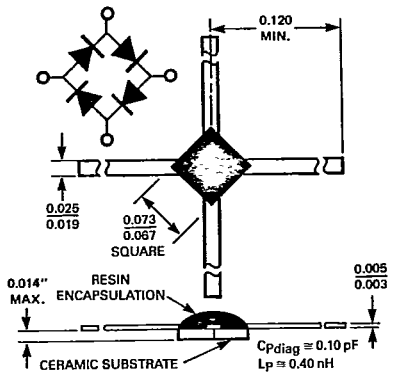


CASE STYLE "U4"



CASE STYLE "W1"



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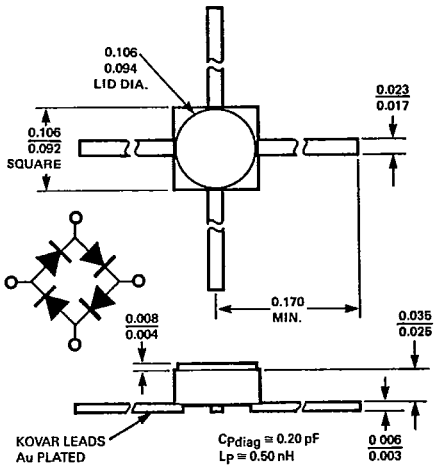

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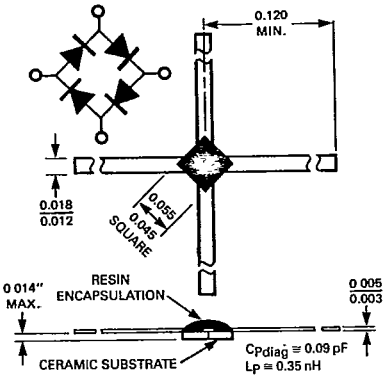
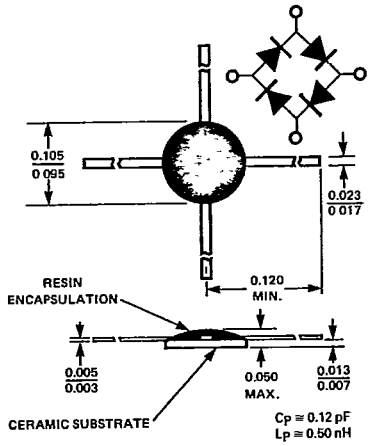
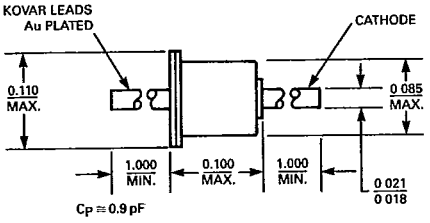


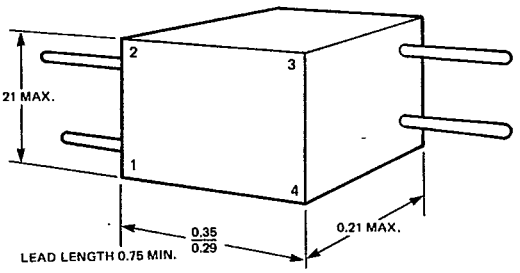
CASE STYLE "W4"



CASE STYLE "X"



CASE STYLE "Z"



CONNECTION DIAGRAMS FOR "Z"