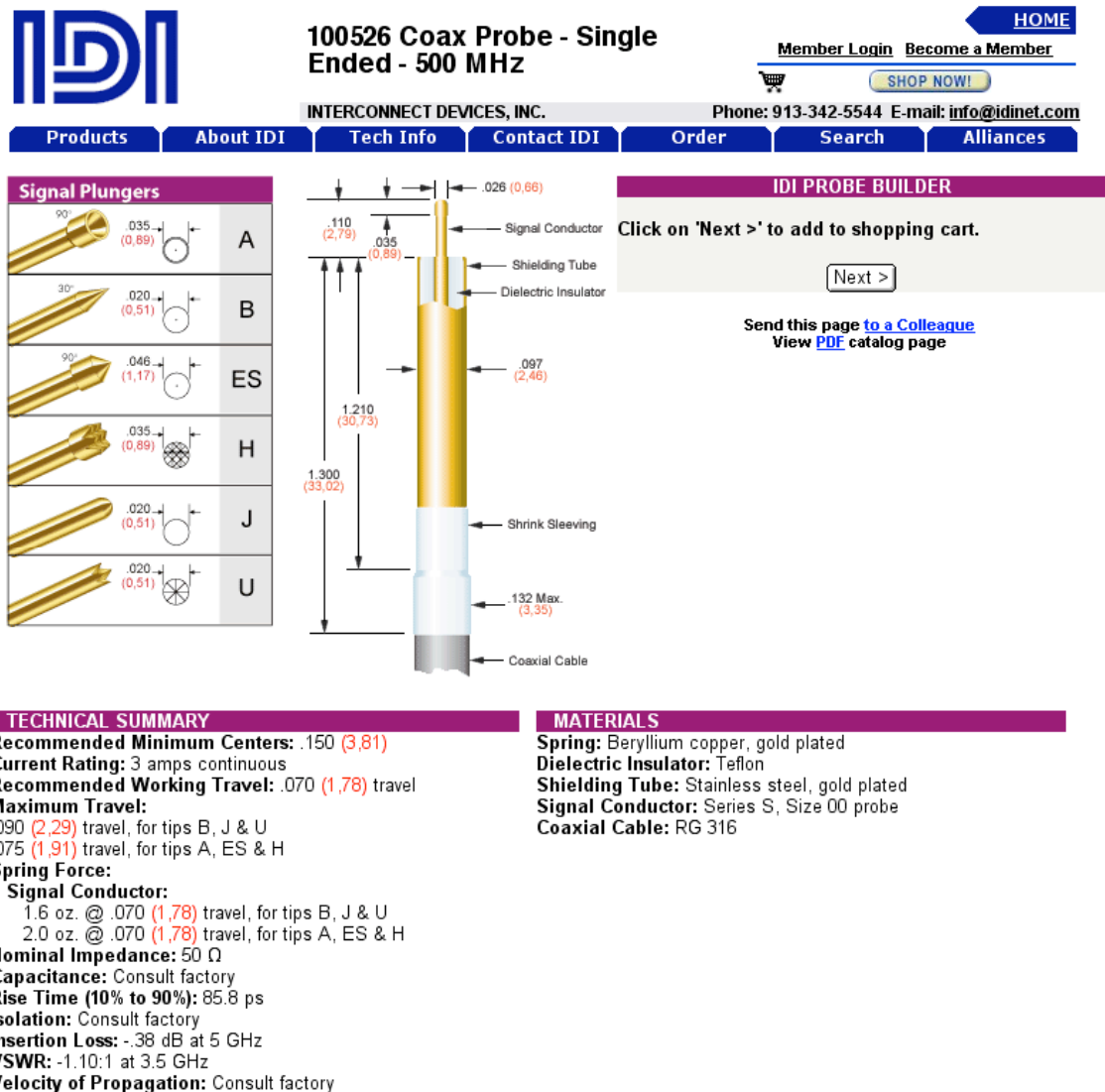


TO: DISTRIBUTION
FROM: C NEUMEYER
SUBJECT: TF JOINT VOLTAGE PROBES


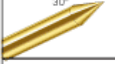
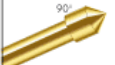



Options considered for the TF voltage probe implementation are described herein.

A catalog cut of the selected probe type is given in figure 1. Note that there are several probe tip options. Option H is preferred for NSTX application. The probes normally come with a 12" cable length and terminated with an SMB connector.



100526 Coax Probe - Single Ended - 500 MHz

INTERCONNECT DEVICES, INC. Phone: 913-342-5544 E-mail: info@idinet.com

Signal Plungers	Dimensions	Option
	90° 0.035 (0.89)	A
	30° 0.020 (0.51)	B
	90° 0.046 (1.17)	ES
	0.035 (0.89)	H
	0.020 (0.51)	J
	0.020 (0.51)	U

Technical Drawing Dimensions:

- Signal Conductor: 0.026 (0.66)
- Shielding Tube: 0.110 (2.79)
- Dielectric Insulator: 0.035 (0.89)
- Shrink Sleeve: 1.210 (30.73)
- Coaxial Cable: 1.300 (33.02)
- Other dimensions: 0.097 (2.46), 0.132 Max. (3.35)

TECHNICAL SUMMARY

Recommended Minimum Centers: .150 (3.81)
Current Rating: 3 amps continuous
Recommended Working Travel: .070 (1.78) travel
Maximum Travel:
 .090 (2.29) travel, for tips B, J & U
 .075 (1.91) travel, for tips A, ES & H
Spring Force:
Signal Conductor:
 1.5 oz. @ .070 (1.78) travel, for tips B, J & U
 2.0 oz. @ .070 (1.78) travel, for tips A, ES & H
Nominal Impedance: 50 Ω
Capacitance: Consult factory
Rise Time (10% to 90%): 85.8 ps
Isolation: Consult factory
Insertion Loss: -.38 dB at 5 GHz
VSWR: -1.10:1 at 3.5 GHz
Velocity of Propagation: Consult factory

MATERIALS

Spring: Beryllium copper, gold plated
Dielectric Insulator: Teflon
Shielding Tube: Stainless steel, gold plated
Signal Conductor: Series S, Size 00 probe
Coaxial Cable: RG 316

Figure 1 : Voltage Probe Catalog Cut

Two mounting schemes have been considered are shown in figures 2-4.

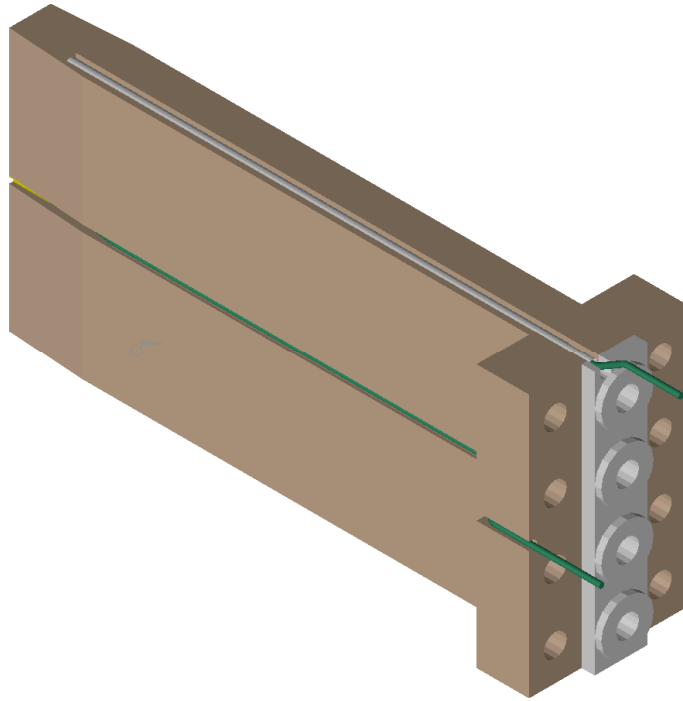


Figure 2 : Mounting Schemes – Right Rear Iso View

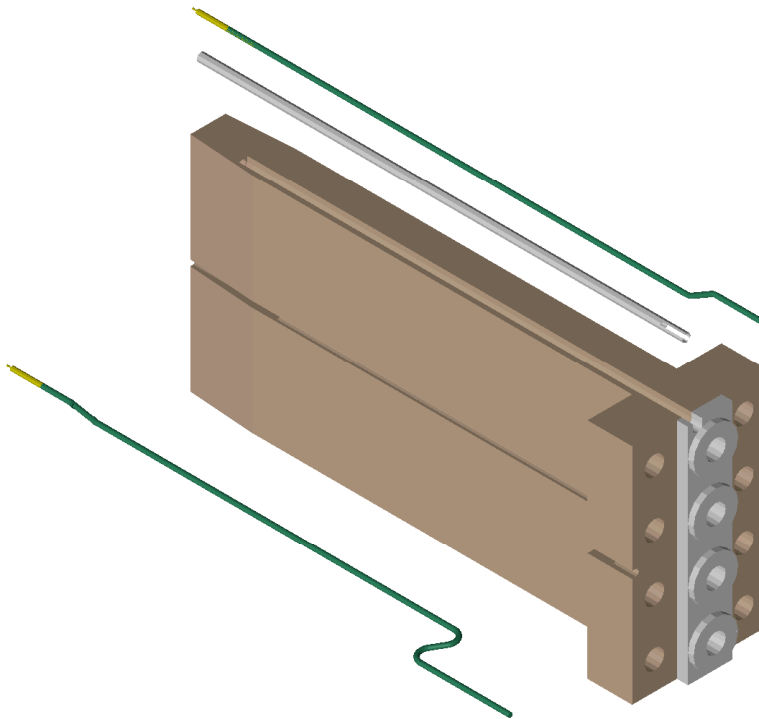


Figure 3 : Mounting Schemes – Right Rear Iso Exploded View

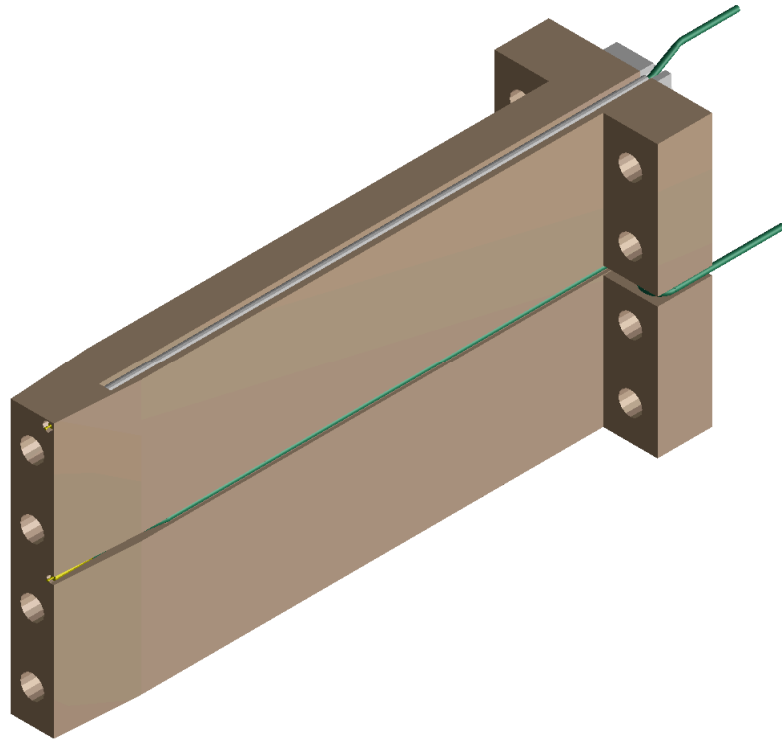


Figure 4 : Mounting Schemes – Right Iso View

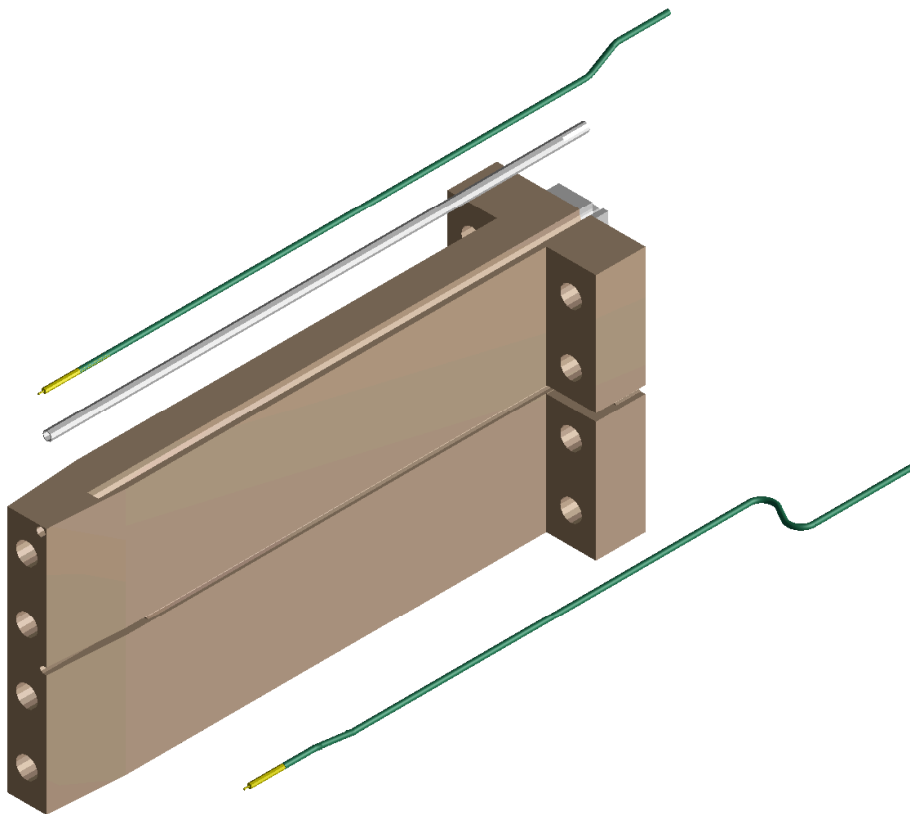


Figure 5 : Mounting Schemes – Right Iso Exploded View

Scheme 1-Permanent Probe

In the first scheme, the probe is mounted in a U-shaped groove based on 0.130" diameter milled in the side of the flag and on the back and side of the flag tee. The outer barrel is affixed to the flag copper via electrically conductive epoxy. The probe tip protrudes half of its travel, $0.110/2=0.055$ ".

On the side of the flag the groove is just deep enough to accommodate the cable, including shrink tubing (see figure 1) which is 0.132" max. On the outer layer flags the flag ends are necked down to 0.79" from the 1" along the main part. There are three options to accommodate this taper. The first would be to machine a groove of one depth which is parallel to the tapered flag surface. The second would be to machine a groove parallel to the centerline of the flag, which would vary in depth from 0.130" at the taper to $0.130+(1-0.79)/2=0.235$ " along the non-tapered length. The third would employ grooves parallel to the flag centerline with a jog after passing through the tapered region. The third option is selected, because it maintains the probe tip perpendicular at the face of the flag and it minimizes the loss of copper cross section. On the inner leg flags there is no taper, so a groove parallel to the flag centerline is most appropriate.

On the back side of the flag tee the probe cable makes two 90 degree turns at bend radius of 0.25". A slot of 0.130" width x 0.5" depth is required to accommodate this bend. Along the side of the tee another 0.130" slot is used to route the wire. Prior to installation of the connector which joins to the tee end, the wire is held back and protected against the maneuvering of the heavy bus bar. Once installed, the wire is placed in the groove and kapton tape is applied around the periphery of the tee.

For redundancy, two probes can be installed per flag, one on each side.

To protect the probe tips while handling the flag, and to facilitate the positioning of the tips during the epoxy attachment procedure, a screwed on clip is used as shown in figures 6 and 7. The clip is attached via a 1/8" screw which threads into the face of the flag. The clip is 0.79" wide x 0.25" tall x 0.125" deep. There are two circular protrusions on each end of the clip, 0.125" diameter and 0.055" deep. These establish the initial position of the probe tips in their fully retracted position.

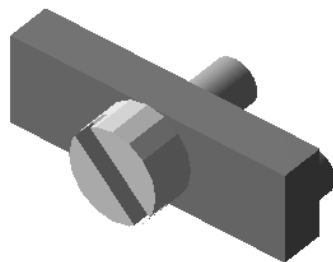


Figure 6 : Probe Protector Clip – Front View

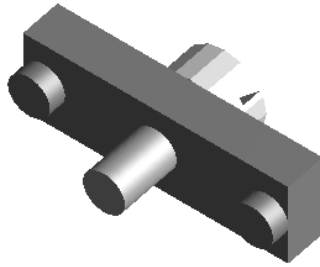


Figure 7 : Probe Protector Clip – Rear View

Scheme 2-Removable Probe

In the second scheme, the probe is mounted in a 3/16” diameter stainless steel tube. The outer barrel is affixed to the tube via electrically conductive epoxy. The tube is threaded on one end, and a slot is machine into the other to allow for a tightening tool. A layer of kapton insulation is applied along the non-threaded length of the tube to prevent contact with the copper flag body. At the face of the flag, a 3/16” diameter threaded hole is provided. Then a groove is milled all the way to the end of the flag tee, based on 7/32” diameter, to allow clearance including the kapton layer. The groove is continued in the washer plate. A plug (not shown in the figures) is screwed into the flag face via an allen wrench. The allen wrench hole in the plug allows for the tip of the probe to protrude by 0.055”. The plug also serves as a positive stop when tightening the probe tube.

The probe is mounted slightly off center such that it is at the edge of the flag at the tapered nose. With the dimensions chosen, it just clears the extent of a 1” diameter Belleville washer. In addition, although not shown, the groove does not interfere with the planned 0.25” diameter alignment pin on the top of the flag.

Epoxy Adhesive

Recommended epoxy adhesive is described in the figure 8 catalog cut.

Conductive Epoxy

SILVER-FILLED EPOXY SYSTEMS

GENERAL DESCRIPTION

72-00008 - EPOXY ADHESIVE, CONDUCTIVE TWO-COMPONENT - This commercial grade, conductive epoxy is designed for use in bonding applications where good conductivity is required. When mixed in a ratio of 1:1.4 by volume or weight, the two components produce a light colored creamy paste which can be easily applied.

U.S. Customary
(SI Metric)

72-08116 - EPOXY SOLDER, CONDUCTIVE, HIGH SILVER CONTENT, TWO-COMPONENT - This is a silver filled epoxy system designed for maximum performance and lowest volume resistivity.

It is easily mixed 1:1 by volume or weight, from the two one-ounce jars. Its consistency is that of a thick paste, making it easy to dispense and apply.

PREPARATION AND CLEANING

To insure the best electrical and mechanical reliability, it is highly recommended that the surfaces to be bonded are thoroughly cleaned of grease, oils, dirt and oxide coatings. Preparation should be in accordance with standard practice for preparing surfaces for adhesive bonding.

APPLICATION OF EPOXY SYSTEMS

72-00008 - Epoxy Adhesive, Conductive, Two-Component.

Stir parts 1 and 2 thoroughly, then mix together one unit of part 1 and 1.4 units of part 2. They may be mixed either by volume or weight. Apply with dispensing equipment, syringe or spatula. May be cured at room temperature or elevated temperature. See Table for cure time and temperature.

72-08116 - Epoxy Solder, Conductive, High Silver Content, Two Component.

Stir Part 1 and Part 2 thoroughly, then mix together one unit of Part 1 and one unit of Part 2. They may be mixed either by volume or weight. Since each jar is half filled, there is sufficient room to mix Part 1 and Part 2 together in either jar. May be cured at room temperature or elevated temperature. For solvent cleaning of surface or material cleaning use Xylene



CAUTIONS

The conductive systems are safe, non-volatile and non-toxic; however, the following precautions must be observed:

Avoid direct skin contact, as the systems may cause irritation to some individuals. If this should occur, wash with mild soap and rinse with clean water. Contact physician should irritation occur ... Avoid inhalation of vapors by working in ventilated area ... Prevent contact with the eyes ... Do not use near open flame ... This material is for industrial use only.

ORDERING INFORMATION

When ordering CONDUCTIVE EPOXY, specify number of jars or cans and TECKNIT Part Number. For assistance, contact your nearest TECKNIT area representative or factory location.

SPECIFICATIONS

MATERIAL DESCRIPTION

● Number of Components:	Two	Two
● Resin:	Epoxy	Epoxy
● Filler:	Ag/Glass	Ag

AS SUPPLIED

● Color:	Silver gray	Bright silver
● Consistency:	Thick paste	Thick paste
● Final Condition:	Rigid	Rigid
● Solids:	100%	100%
● Mix Ratio:	1:1.4	1:1
● Volume:	14.7 in. ³	1.5 in. ³
● Weight:	16 oz.	2 oz.
● Density, g/cc (ASTM D-792):	1.88 ± 13%	2.30 ± 13%
● Pot Life @ 25°C:	45 minutes	45 minutes
● Shelf Life, unopened container:	15 months	15 months
● Tack Free:	4 - 24 hours	4 - 24 hours
● Recommended Cure:	30 minutes @ 212°F [100°C]	30 minutes @ 212°F [100°C]

CURED*

● Volume Resistivity, QAP-1017 max.:	0.02 ohm-cm	.001 ohm-cm
● Shear Strength, min. (ASTM D-1002):	1000 psi	1400 psi
● Peel Strength, min. (ASTM D-1876), silicone-aluminum:	N/A	N/A
● Shrinkage, max.:	1%	1%
● Temperature Range:	-80°F to 300°F [-62°C to 149°C]	-80° to 300°F [-62°C to 149°C]

PART NUMBER	72-00008	72-08116
● Transportation Class:	Part I - Nonflammable Part II - Nonflammable	Combustable Combustable

* 30 min. @ 212°F [100°C] followed by 24 hrs. @ RT

U.S.A.:
908 272-5500
EUROPE:
44-1476-590600

Figure 8 : Conductive Epoxy Catalog Cut

Recommendation

The scheme 1 approach is the easiest to implement. If two probes are installed per flag, the redundancy should offset the risk of probe failure and the need to remove and rework the effected flag. Therefore it is the preferred approach. For this case, the probe lead length needs to be 16” to provide a suitable pigtail.

cc:

M Bell	J Chrzanowski	L Dudek	P Heitzenroeder	M Kalish
R Marsala	T Meighan	M Ono	B Paul	H Schneider
M Williams	A Von Halle			