Common Interface
ELF67

Narrow Profile
ELF67-001

Standard Profile
ELF67-002

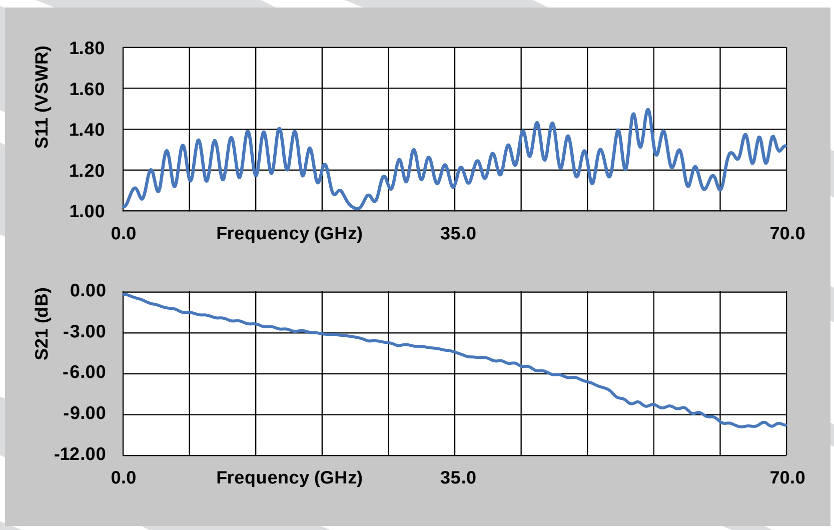
Signal Microwave ELF67

1.85 mm Edge Launch Connectors for the Digital Industry

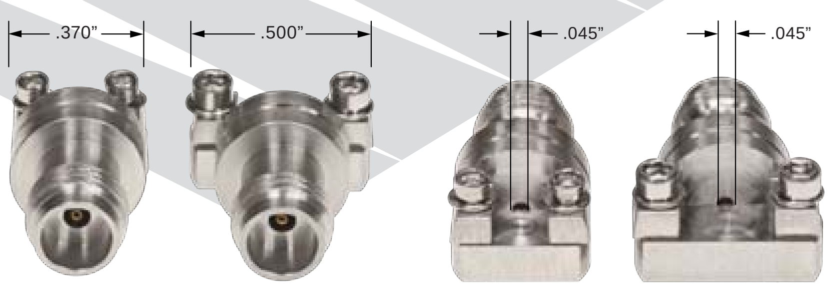
ELF67-001 (Narrow Profile) to more tightly couple differential lines on curved edges

ELF67-002 (Standard Profile) to use instead of current high priced offerings. Both Models have the same launch geometry and internal construction.

- **1.85 mm Interface**
- **Top Ground Only**
- **70 GHz Bandwidth**
- **Board Design Support Available**
- **Edge Launch**
- **Test Boards Available**
- **No Soldering Required**



2” microstrip test board with typical data through 70 GHz

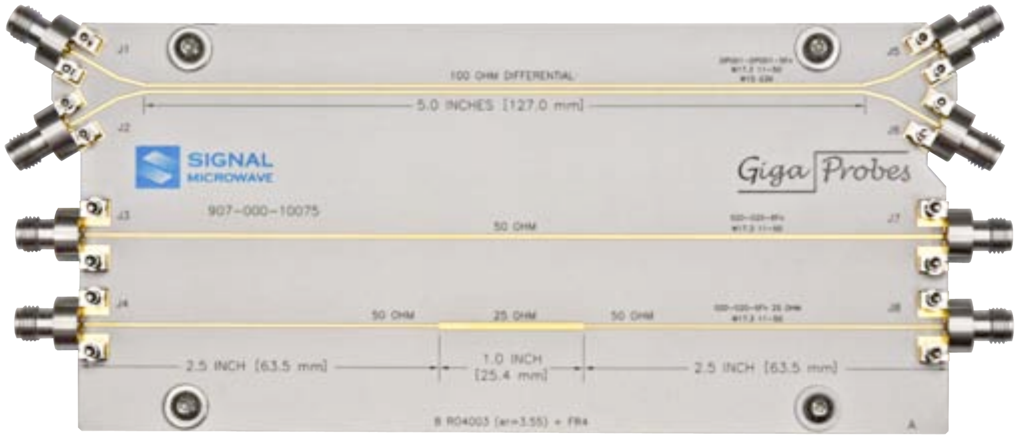


Signal Microwave, LLC
info@signalmicrowave.com
(480) 322-4992

40GHz VNA Calibration Verification Board

Reference Waveforms for DB40-003

From Signal Microwave and Giga-Probes®



This document contains reference waveforms measured from the 100 ohm differential, 50 ohm single ended and 50-25-50 ohm Beatty line traces on the DB40-003 40GHz VNA Calibration Verification Board for use with VNAs. These measurements provide a known performance response over frequency which can be used to verify VNA calibrations, check for measurement drift, and are teaching tools for VNA users. This high bandwidth board design can also be used as model for developing 70GHZ PCB designs as describe later in this document.

Verify VNA Calibrations

Once the VNA is calibrated, measure the 100ohm differential trace (4 ports VNA) or the 50 ohm single ended trace (2 ports VNA) and compare the measurement against the waveforms that are contained in this document. If they do not correlate, VNA functions affecting the measurement have been left on and the source must be determined before accurate measurement can be performed.

Measurement drift

A common measurement error that can be caused by changing room temperature, moving the cable or the VNA is out of calibration. To avoid inaccurate frequency measurements, measure a 50 or 100 ohm trace and store the results in a ref memory. Prior to making measurements that day, recall the previous stored measurement and make a new measurement from the board and the two should correlate. If not, recalibrate the VNA or successive measurements will not correlate with the previous day measurements.

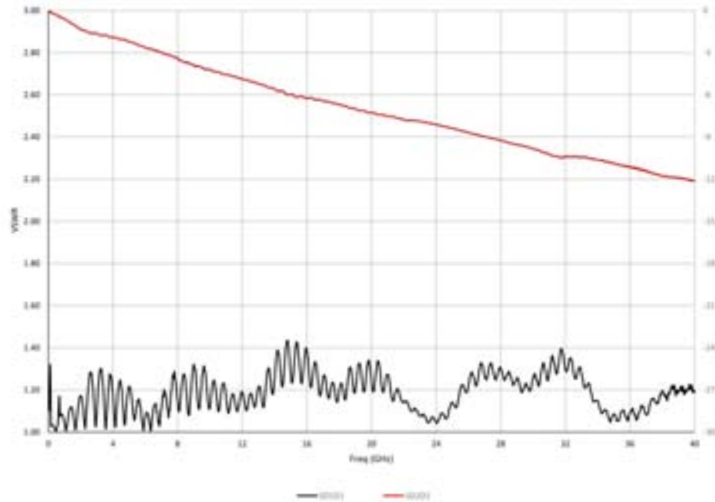
Calibrate VNA to measure both time (impedance) and frequency domain S-parameters

Attach two ports to the Beatty line. The Er value is stamped on the board that can be used to calibrate the cursers to accurately measure distance and impedance. If you have calibrated the VNA correctly, your cursers will be calibrated to physically locate the impedance change of this trace when it goes from 25 to 50 ohms.

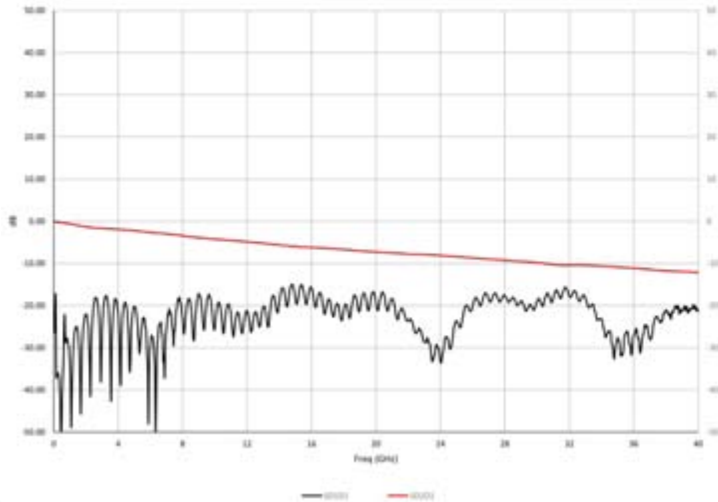
Teaching tools for VNA users

Haven't used the VNA in months or ever? Practice setting up the VNA to measure the 50, 100 and Beatty lines and compare the measurements with those that come with the board prior to making measurement on your prototypes

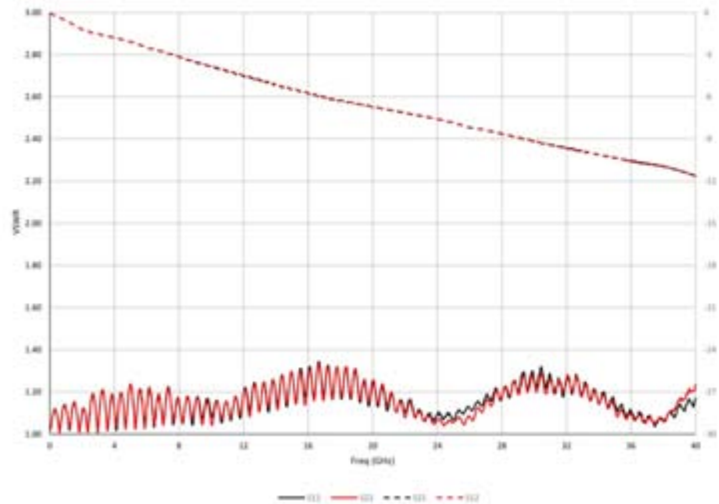
100 Ohm Differential Pair
VSWR



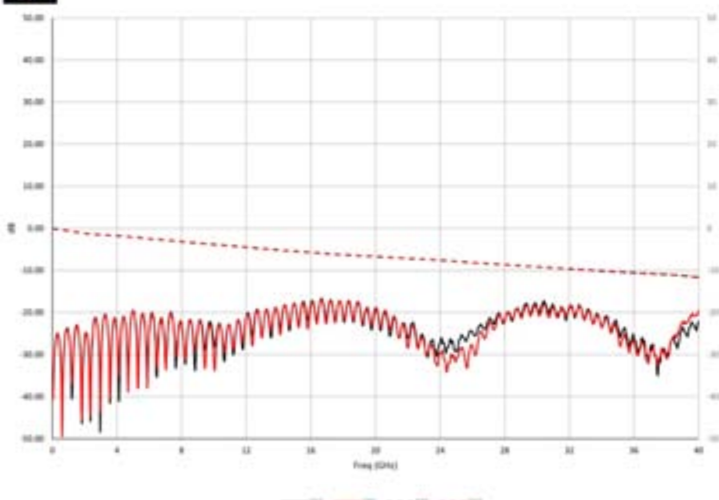
100 Ohm Differential Pair
Return and Insertion Loss



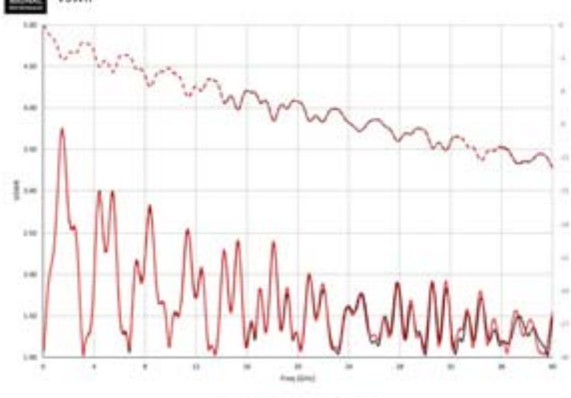
50 Ohm Thru Line
VSWR



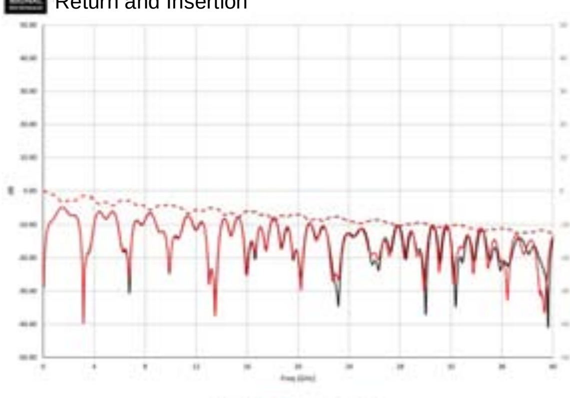
50 Ohm Thru Line
Return and Insertion Loss



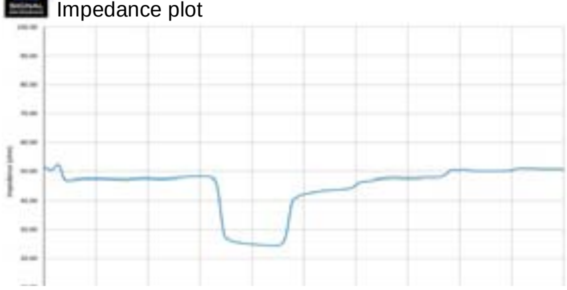
25 Ohm Beatty Standard
VSWR



25 Ohm Beatty Standard
Return and Insertion



25 Ohm Beatty Standard
Impedance plot



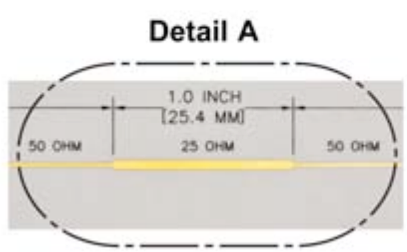
VNA Calibration Verification:

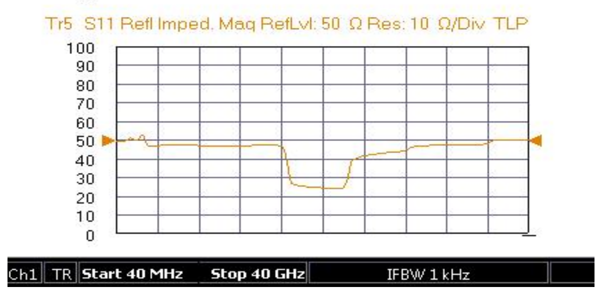
When a VNA does a calibration, it sweeps through multiple frequency points and at every point it locks the frequency to a reference, levels the power, then makes a measurement. During calibration two major parameters are accounted for by using a calibration kit as a reference, the instrument's system noise is taken out of the measurement, and the characteristic impedance of 50 ohms is established. For VNA calibration verification many operators use only a low loss through adapter. This method only verifies that the system noise was removed by the calibration. A "golden unit" like the VNA Calibration Verification board, with known response over the frequency range of the calibration, should be used to verify that the calibration was successful in "teaching" the VNA how to make an accurate measurement over the frequency range of the calibration.

Board Versatility:
The nature of the VNA calibration verification board design lends it to easily create many versions.

One version of the board is an expanded version of the basic board which includes test lines for the GigaProbes® 40 GHz DVT40 differential probe. The board allows a user to verify 4 port VNA calibration using a 100 ohm connector to connector test line. Then the user can move to a similar 100 ohm differential line that is connector to probe so each probe can be evaluated.

This version of the board also includes a 25 ohm "Beatty" line for verification of a TDR measurement using a VNA. This line is useful in verifying that the VNA calibration is done correctly to perform accurate TDR transformation for an impedance measurement along a transmission line.





Reasons for the high performance
It starts with the high performance connectors manufactured by Signal Microwave (www.signalmicrowave.com). These edge launch connectors are designed using 3D modeling and RF transmission line analysis instead of just a mechanical solution. The next component leading to the high performance is the board launch design. The board launch is the transition from the board to the connector. The launch structure on the board starts with a Grounded Coplanar Waveguide (GCPWG) section which incorporates a top ground launch that transitions the ground to an inner layer as it transitions to a microstrip line. The launch design is also done by Signal Microwave using 3D modeling to match the board to high

performance connectors and this service is available for customers that are using the connectors in their own products.

Another factor in the high performance of the board is the material and the way it is manufactured. The material is Rogers RO4003 with a thickness of 8 mils and ½ ounce copper. The finish on the board is electroless nickel with a top layer of immersion gold (ENIG). The Rogers material performs excellently through 70 GHz and the plating provides a corrosion free surface. The next step in the manufacturing process is the 8 mil RO4003 is processed completely by itself including drilling to vias required and the plating. Then the panel is laminated to an FR4 backer for mechanical stiffness without having to backdrill any vias which can cause problems at frequencies as high as the 70 GHz bandwidth of the board.

Magnetic feet

The board also incorporates custom design stand-off with magnets installed at the end. When placed on a magnetic plate it holds the board securely to the plate. The plates are available from DVT Solutions and are very useful in securing the board for measurements with probes.

For more information contact

40GHz - 67GHz
VNA Calibration Verification Board

The NEW VNA Calibration Verificaion Board is a 70 GHz PCB containing traces and probe pads and replaceable solderless 2.92mm or 1.85mm connectors configured in multiple connection modes (connector to connector, probe to connector and probe to probe). Accompanying the board is printouts with S-parameter (S2p/S4p) files of each connector to connector trace.

- Avoid Measurement Errors due to Improper Calibration Settings
- Detect Measurement Drift in order to Make Repeatable Measurements
- Reduce VNA Setup Time when Renting or Purchasing a New System
- Determine Actual Measurement

"Avoid costly swept frequency calibration errors"

Use either the 50 ohm or 100 ohm high bandwidth traces as a measurement frequency standard to verify that the VNA is making accurate measurements after calibration and *prior* to making critical measurements on prototypes, or as a quick calibration check when the accuracy of frequency domain measurements are in question. This simple verification process can prevent hours of retaking erroneous measurements do to improper calibration, setup or instrument drift.

"Save money by reducing measurement errors and setup time"

The VNA Calibration Verificaion Board is a valuable training resource to assist engineers to quickly learn how to setup and make accurate measurements with a TDR or VNA, including probes. Simply connect the VNA to the 50 ohm or 100 ohm differential traces and compare your results with the measurements included with the board. This process builds confidence in instrument proficiency, reducing setup time prior to measuring similar traces on prototypes or the verification of simulator models used to create today's high speed digital systems.

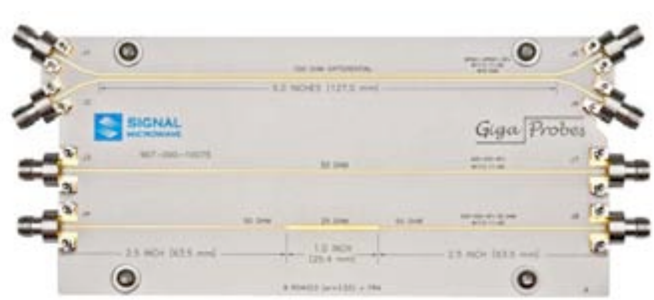
"Determine actual system measurement bandwidth when using probes or cables"

Determining the system's bandwidth is a challenge when you include Instrument measurement uncertainty error, cables, probes, connectors and options for de-embedding it all from the measurement. To dial it in, the 40GHz Model DB40-002 contains seven traces with a mix of 50 ohm & 100 ohm configuration modes (con.-con., probe-probe, pad-con. and con.-con) to help determine the bandwidth of your measurement system.

\

Model # DB40-002 (40GHz) DB67-002 (67GHz)

- **Three connector to connector traces:**
  - 50 ohm (J3-J8)
  - 100 ohm (J5/J6-J10/J11)
  - Beatty Standard (50ohm-25ohm-50ohm, J4-J9)
- **Two connector to test probe traces:**
  - 100 ohm differential connectors (J1/J2) to differential test pads (P1)
  - 50 ohm connector (J7) to test pads (P2)
- **Two test probe to test probe traces:**
  - 50 ohm (P3) to (P4) trace
  - 100 ohm Differential test pads (P5) to (P6)



Model # DB40-003 (40GHz) DB67-003 (67GHz)

- **Three connector to connector traces:**
  - 50 ohm (J3-J7)
  - 100 ohm (J1/J2-J15/J6)
  - Beatty Standard (50ohm-25ohm-50ohm, J4-J8)

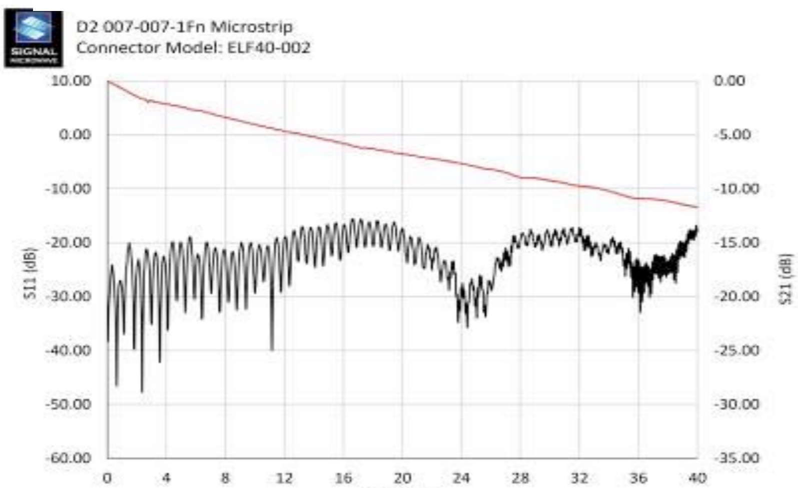
Common PCB Specifications

70GHz GHz Design

- Signal Microwave Connectors: 2.92mm 40GHz or 1.85mm 67GHz. replaceable solder-less edge mount
- E_r (DK) is 3.55 PCB material
- Measurements are included for each trace.

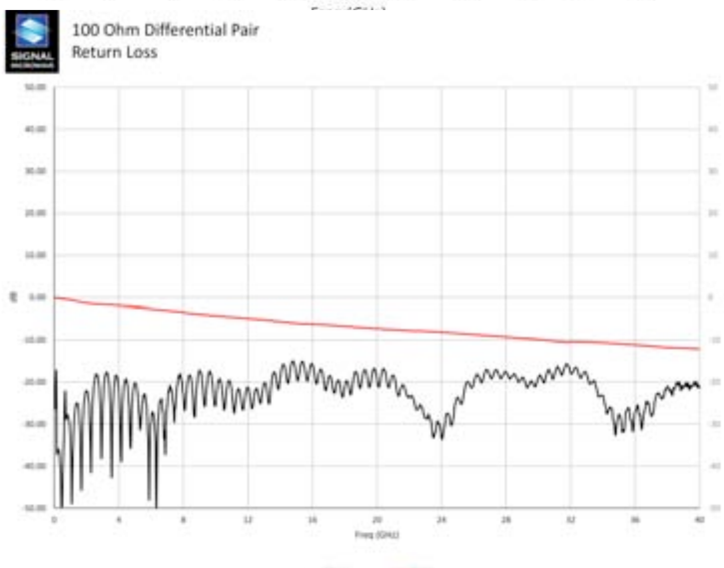
Applications

- **Verify VNA calibration is accurate prior to making critical measurements on prototypes**
- **Verify VNA measurement repeatability and detect system drift**
- **Teaching tool for measuring distance and impedance using cursers**
- **Learn to perform differential and single ended probing techniques**
- **Manufacturer's instrument Demonstrations and Training**
- **Correlate accuracy between VNA swept sinewave vs. Time domain extracted S-parameters**
- **Post sales or rental instrument training tool**
- **Make differential and single ended probing measurements typical to Signal Integrity analysis on high speed passive linear differential interconnects (i.e. PCI Express, SATA, 10 GB/s Ethernet, etc.)**



S-parameter return loss and insertion loss plots for the 50 ohm through trace

- S21 shows 40 GHz of bandwidth
- S11 shows a return loss of 15 dB



S-parameter return loss and insertion loss plots for the 100 ohm differential trace

- SDD21 shows 40 GHz of bandwidth
- SDD11 shows a return loss of 15 dB

Ordering Information

Model # DB40-002 (40GHz) DB67-002 (67GHz)

- Three connector to connector traces (50,100, Beatty Standard)
- Two connector to test probe traces (50ohm, 100ohm)
- Two test probe to test probe traces (50ohm, 100ohm)

Model # DB40-003 (40GHz) DB67-003 (67GHz)

Three connector to connector traces:

- 50 ohm
- 100 ohm
- Beatty Standard (50ohm-25ohm-50ohm)

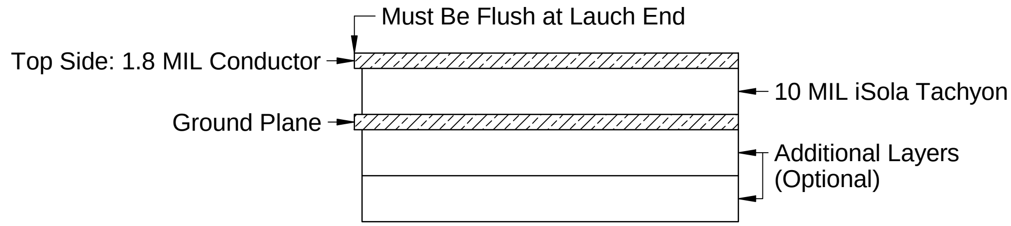
Sales Contact
Brian Shumaker
DVT Solutions, LLC
650 593-7083
email:sales@gigaprobes.com
www.gigaprobes.com
www.SignalMicrowave.com

SIGNAL MICROWAVE

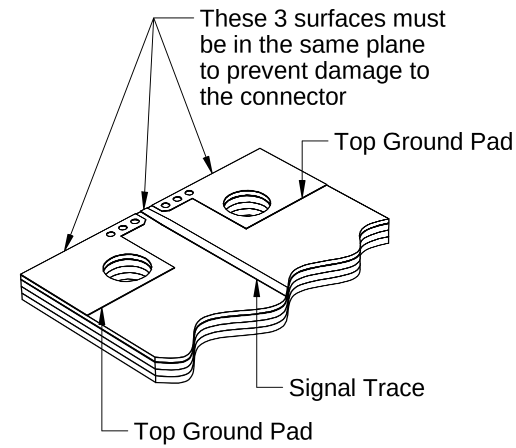
Giga Probes

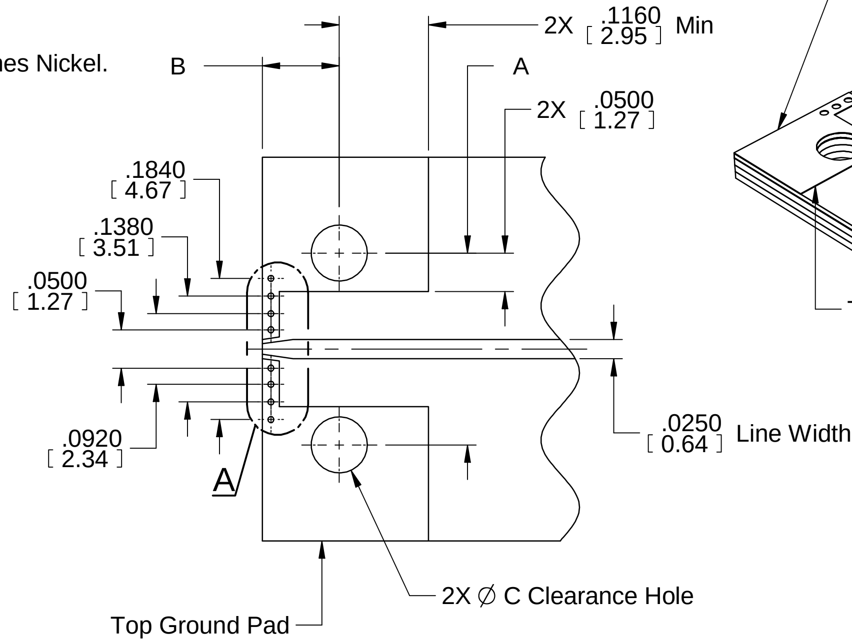
Notes (Unless Otherwise Specified):

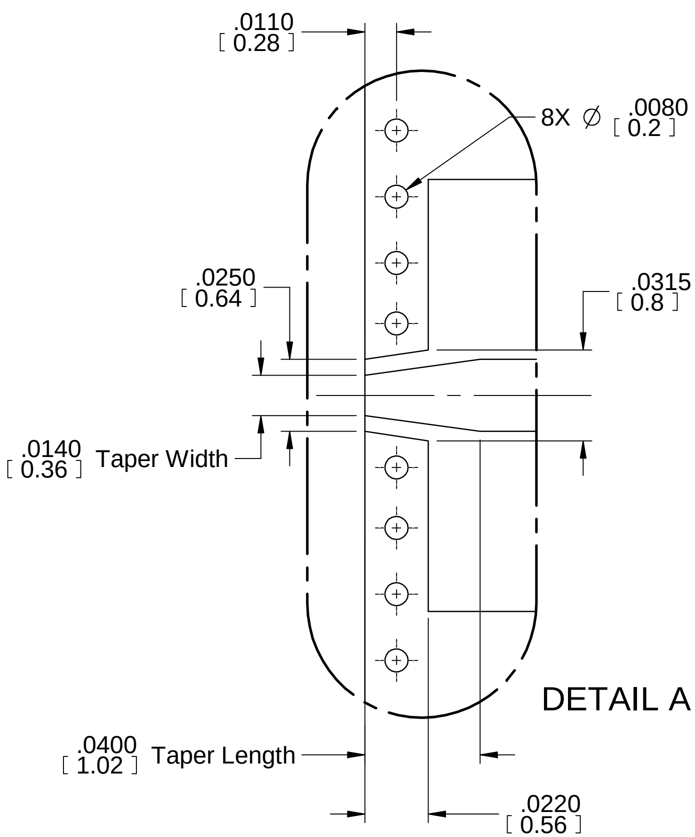
1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 10 MIL iSola Tachyon Dk = 3.02
4. Line Width = 25.0 MIL.
5. Launch Taper = 14 MIL. X 40 MIL.
6. Max Frequency = 70GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask required.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification: 1/2 oz. CU ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup







DETAIL A

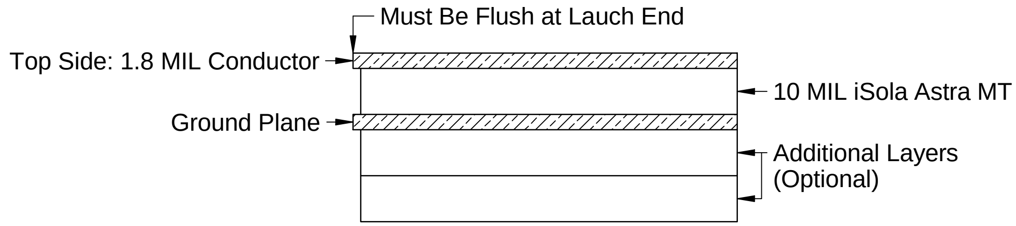
Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

SIGNAL MICROWAVE

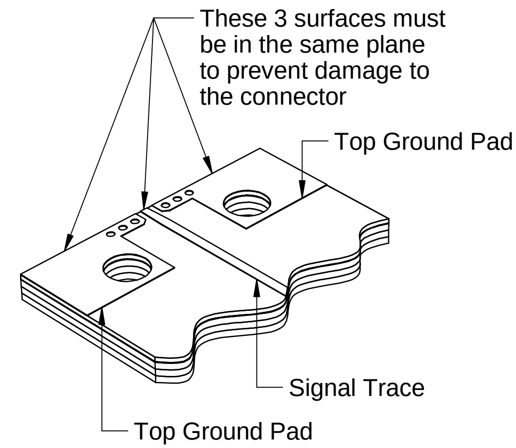
MATERIAL	037 Launch, Microstrip, 10MIL iSola Tachyon, 70GHz
iSola Tachyon Dk = 3.02	
APPROVAL: BR	DATE: 02/02/16
DWG NO: EL-MS-M-10-TACHYON-037	REV: B
FILE NAME: EL-MS-M-10-TACHYON-037, 10mil iSola Tachyon Edge Launch 70GHz.dft	SHEET 1 OF 1

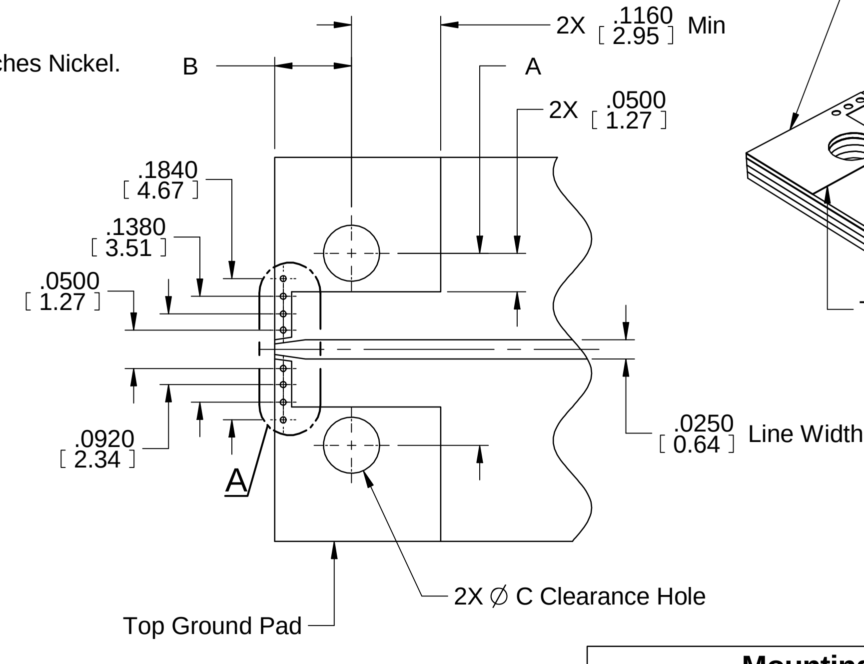
Notes (Unless Otherwise Specified):

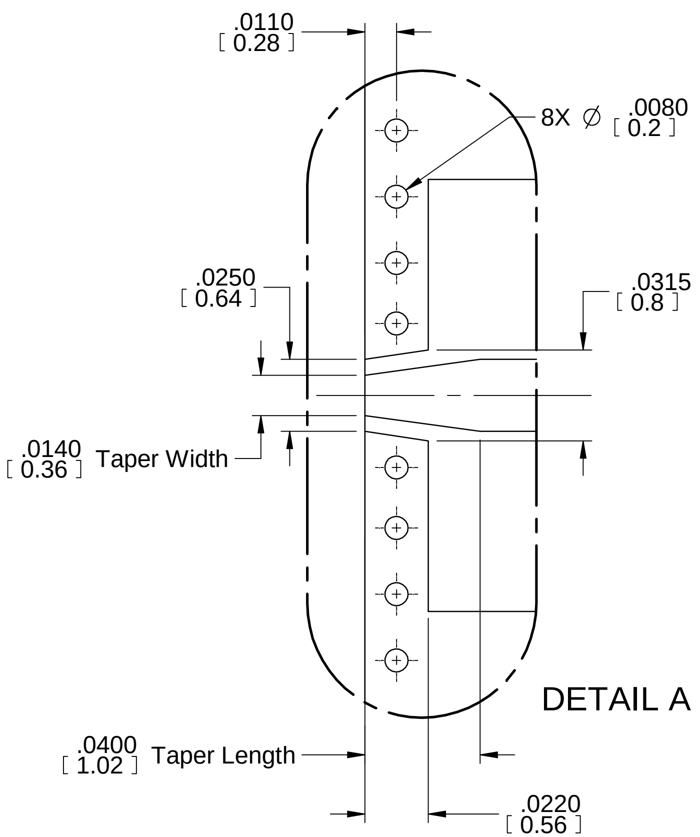
1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 10 MIL iSola Astra MT Dk = 3.02
4. Line Width = 25.0 MIL.
5. Launch Taper = 14 MIL. X 40 MIL.
6. Max Frequency = 70GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask required.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification: 1/2 oz. CU ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup







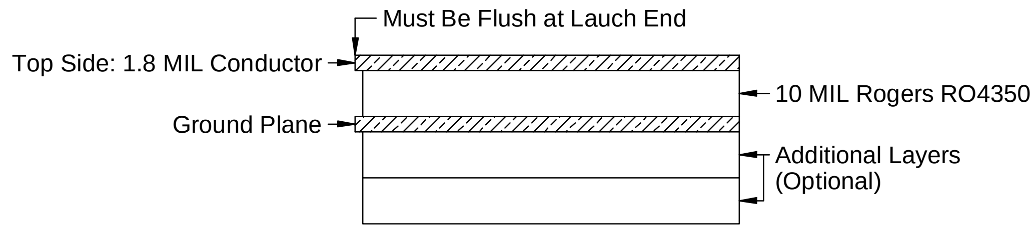
DETAIL A

Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

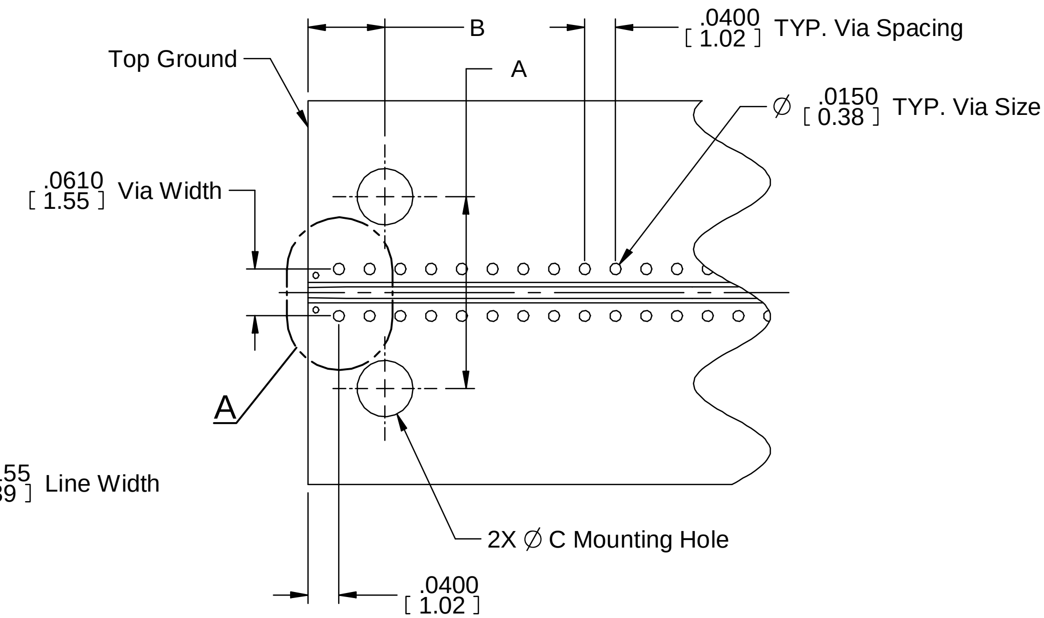
SIGNAL MICROWAVE	MATERIAL	036 Launch, Microstrip, 10MIL iSola Astra MT, 70GHz
	iSola Astra MT Dk = 3.02	DWG NO EL-MS-M-10-ASTRA-036 REV C
	APPROVAL: BR; DATE: 02/02/16	FILE NAME: EL-MS-M-10-ASTRA-036, 10mil iSola Astra Edge Launch 70GHz.dft; SHEET 1 OF 1

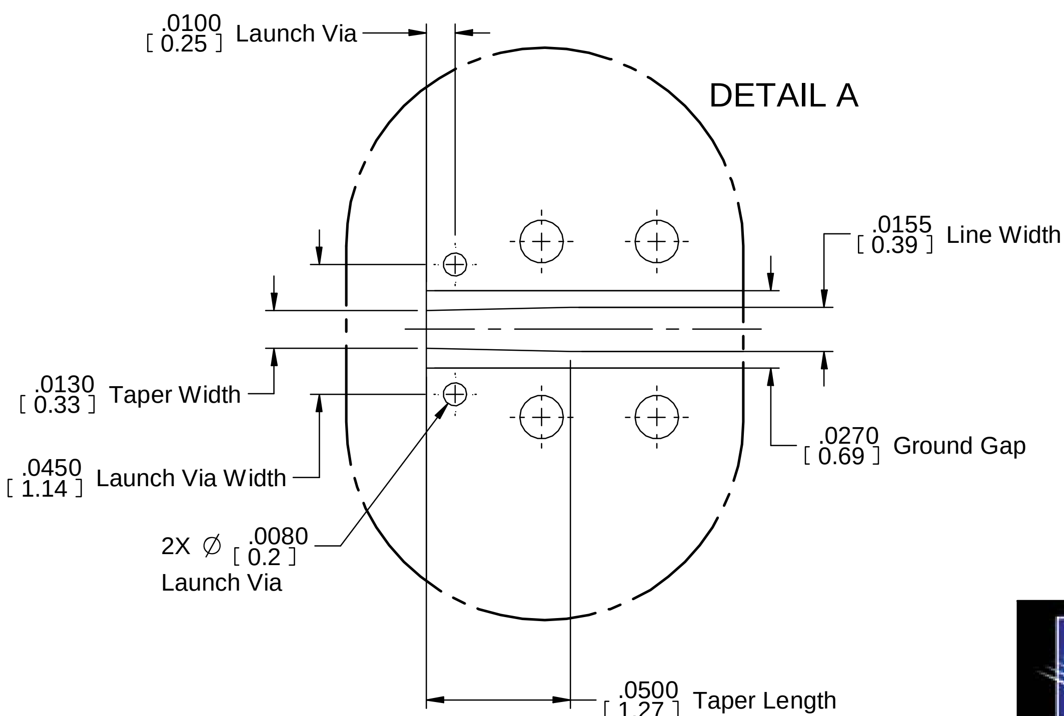
Notes (Unless Otherwise Specified):

1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 10 MIL Rogers RO4350 Dk = 3.66
4. Mounting holes are not plated.
5. Line Width = 15.5 MIL.
6. Launch Taper = 13 MIL. X 50 MIL.
7. Max Frequency = 70GHz
8. Hole Diameters are stated as finished hole size.
9. Plated through holes are to have a minimum of .001" copper.
10. No soldermask required.
11. Fabrication Tolerance: End product line widths and lands +/-.0005".
12. Copper Specification: 1/2 oz. CU ± .0002, 1.8 MILS Finished
13. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup





Mounting Holes

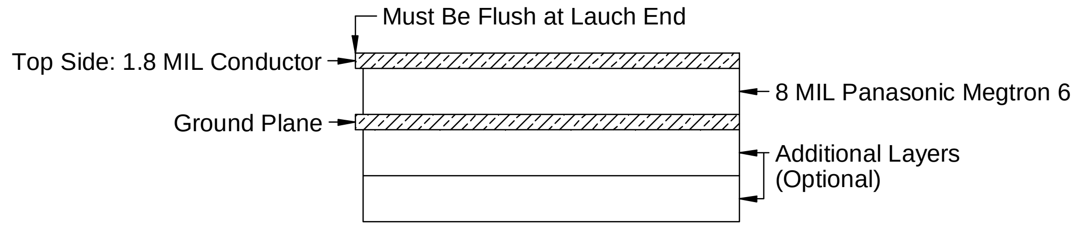
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

SIGNAL MICROWAVE

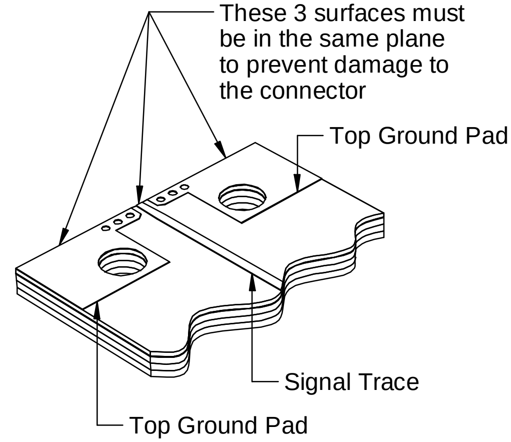
MATERIAL		035 Launch, Grounded Coplaner Wave Guide, 10mil Rogers RO4350, 70GHz	
ROGERS RO4350 Dk = 3.66			
APPROVAL	DATE	DWG NO EL-GC-M-10-RO4350-035	REV A
BR	05/28/15	FILE NAME: EL-GC-M-10-RO4350-035 Edge Launch.dft	SHEET 1 OF 1

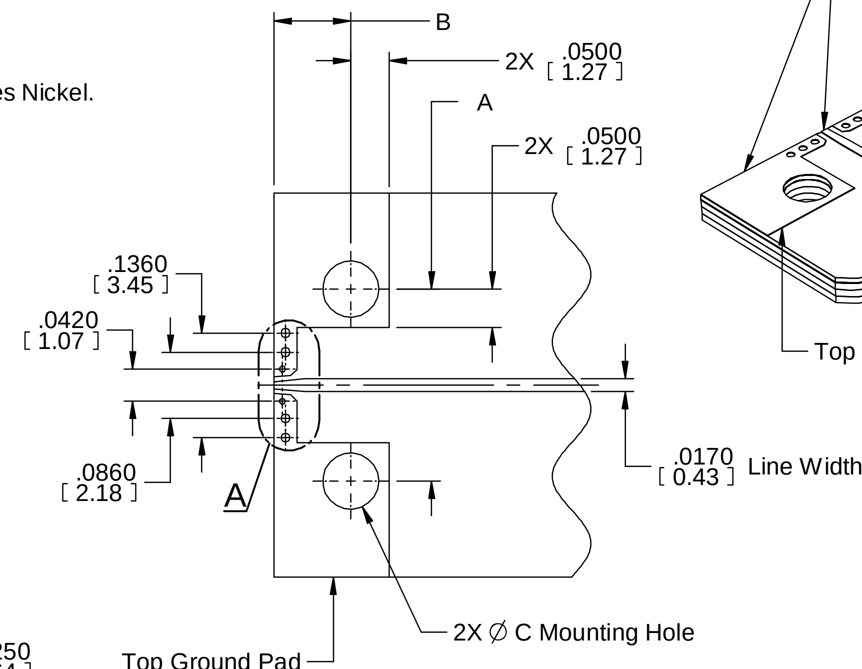
Notes (Unless Otherwise Specified):

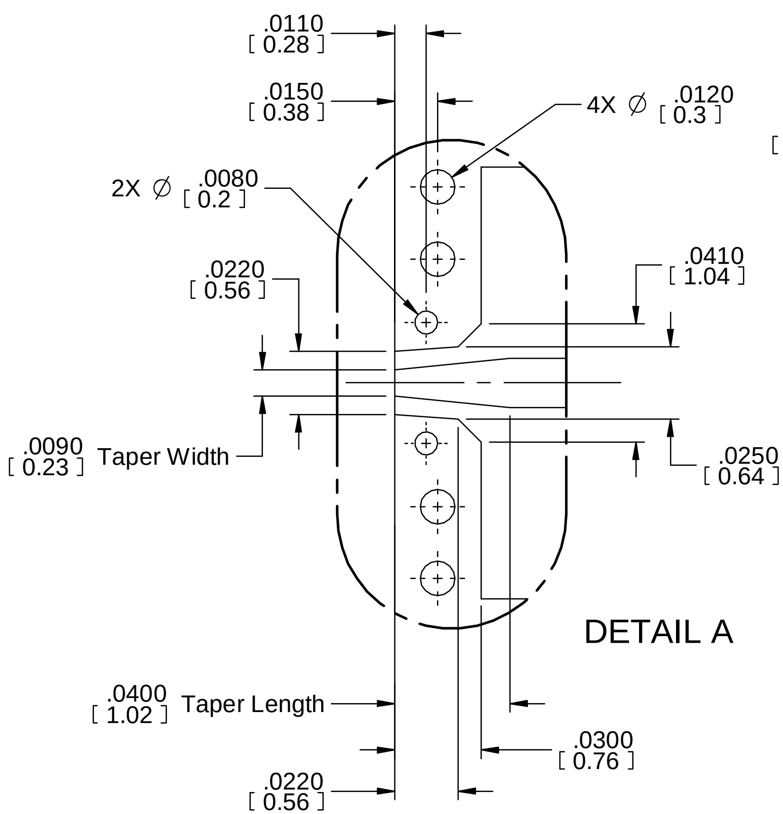
1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 8 MIL Panasonic Megtron 6 Dk = 3.6
4. Line Width = 17.0 MIL.
5. Launch Taper = 9 MIL. X 40 MIL.
6. Max Frequency = 70GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification: 1/2 oz. Cu ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup







DETAIL A

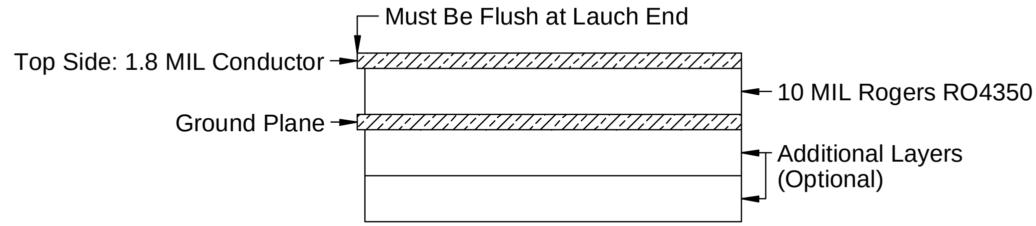
Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

SIGNAL MICROWAVE

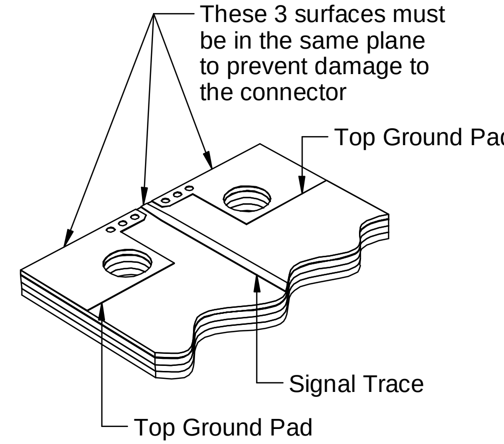
MATERIAL		
Panasonic Megtron 6 DK = 3.6		034 Launch, Microstrip, 8MIL Megtron 6, 70GHz
APPROVAL	DATE	DWG NO EL-MS-M-08-MEGTRON6-034 REV B
BR	10/05/15	FILE NAME: EL-MS-M-08-MEGTRON6-034, 8milMegtron 6 Edge Launch 70GHz.dft SHEET 1 OF 1

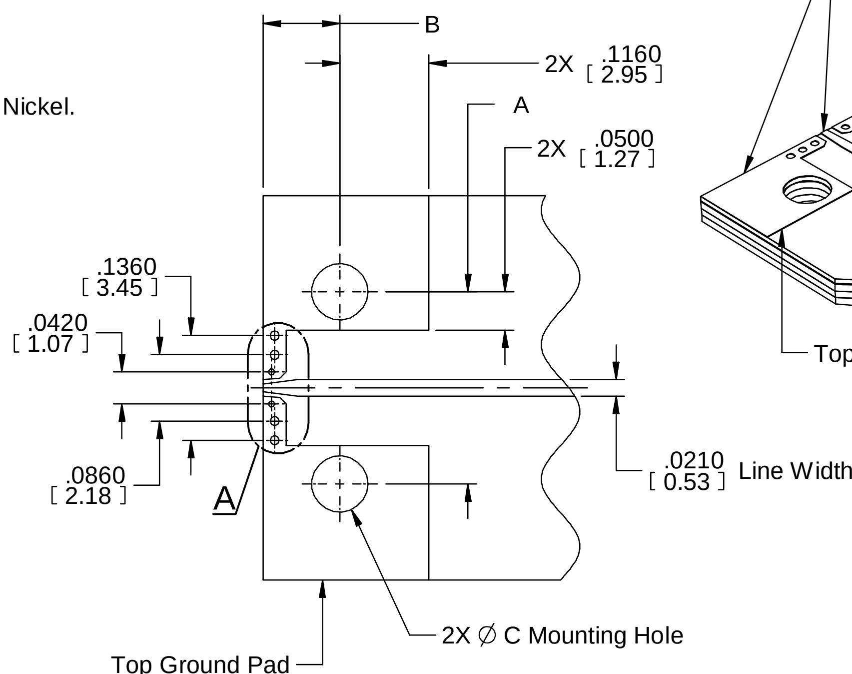
Notes (Unless Otherwise Specified):

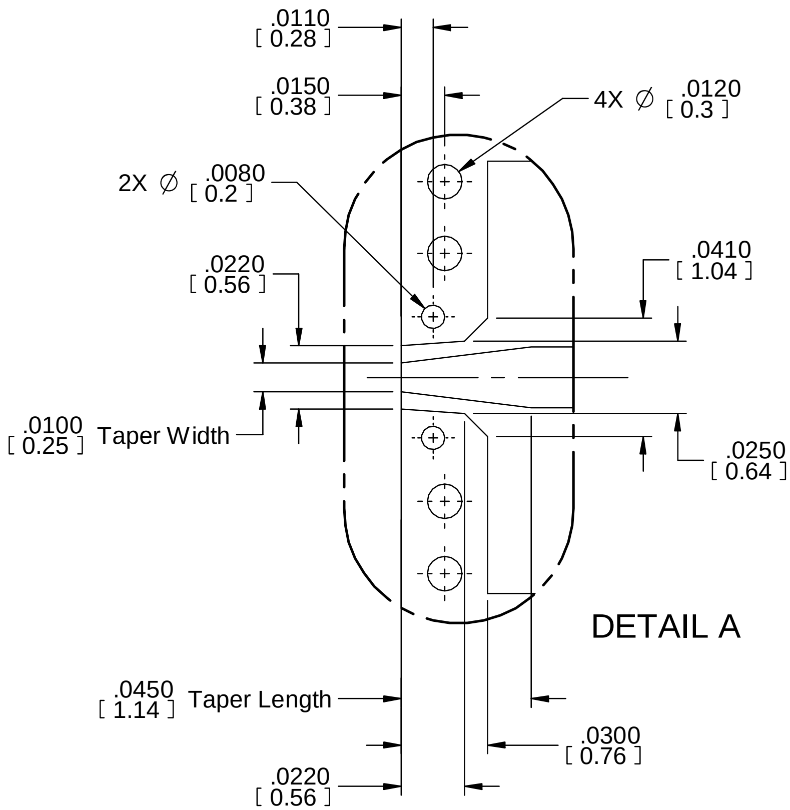
1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 10 MIL Rogers RO4350 Dk = 3.66
4. Line Width = 21.0 MIL.
5. Launch Taper = 10 MIL. X 45 MIL.
6. Max Frequency = 70GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification: 1/2 oz. Cu ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup







DETAIL A

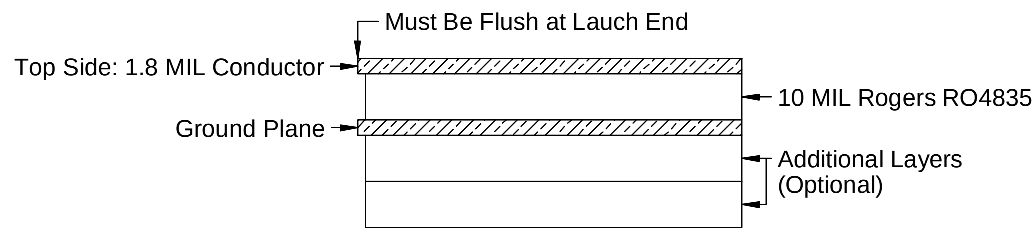
Mounting Holes

Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

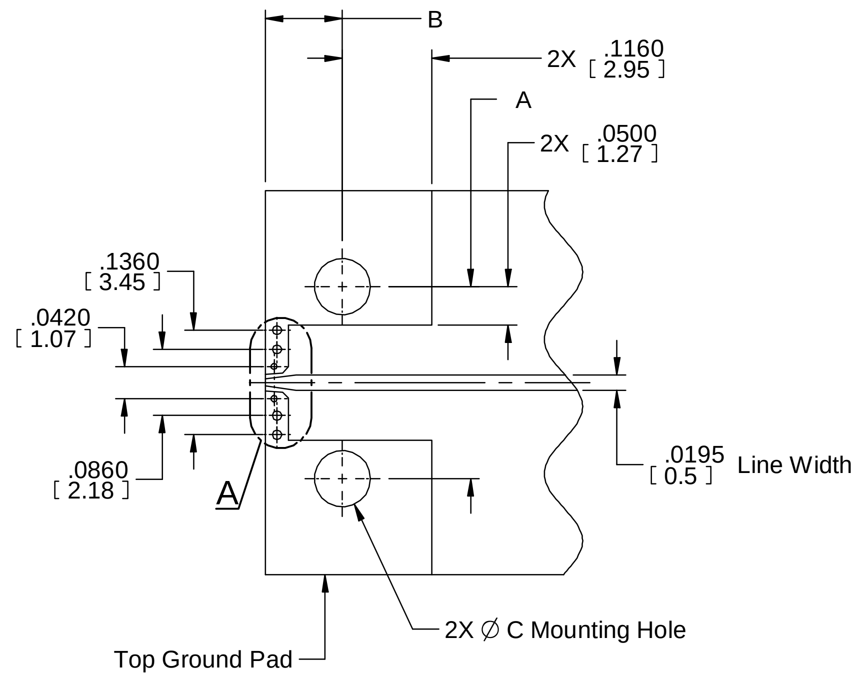
SIGNAL MICROWAVE	MATERIAL		033 Launch, Microstrip, 10MIL Rogers RO4350, 70GHz	
	ROGERS RO4350 Dk = 3.66			
	APPROVAL	DATE	DWG NO EL-MS-M-05-RO4350-033	REV B
	BR	10/07/15	FILE NAME: EL-MS-M-10-RO4350-033, 10mil RO4350 Edge Launch 70GHz.dft	SHEET 1 OF 1

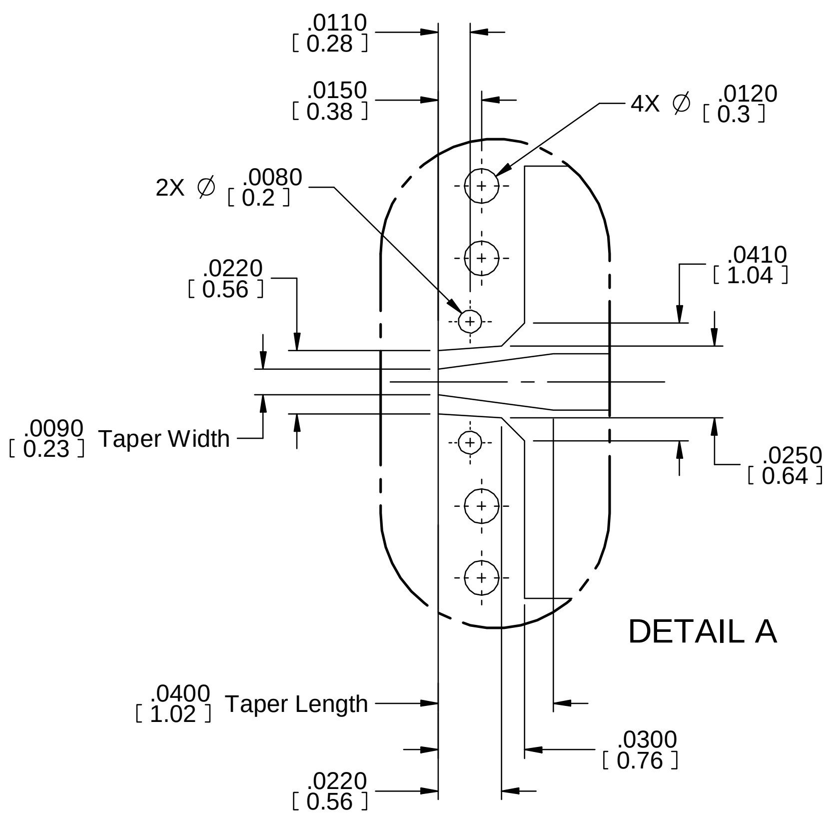
Notes (Unless Otherwise Specified):

1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 10 MIL Rogers RO4835 Dk = 3.66
4. Mounting holes are not plated.
5. Line Width = 19.5 MIL.
6. Launch Taper = 9 MIL. X 40 MIL.
7. Max Frequency = 70GHz
8. Hole Diameters are stated as finished hole size.
9. Plated through holes are to have a minimum of .001" copper.
10. No soldermask required.
11. Fabrication Tolerance: End product line widths and lands +/-.0005".
12. Copper Specification: 1/2 oz. CU ± .0002, 1.8 MILS Finished
13. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup





DETAIL A

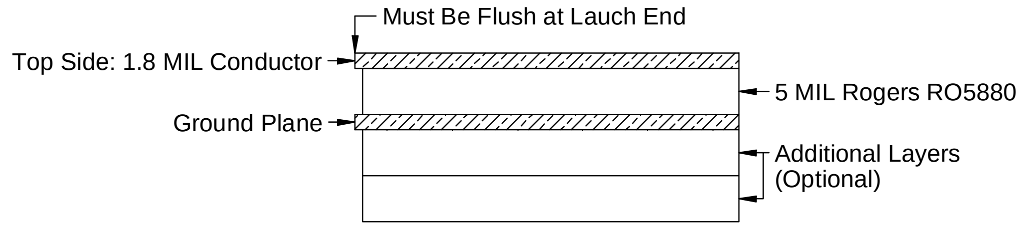
Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

SIGNAL MICROWAVE

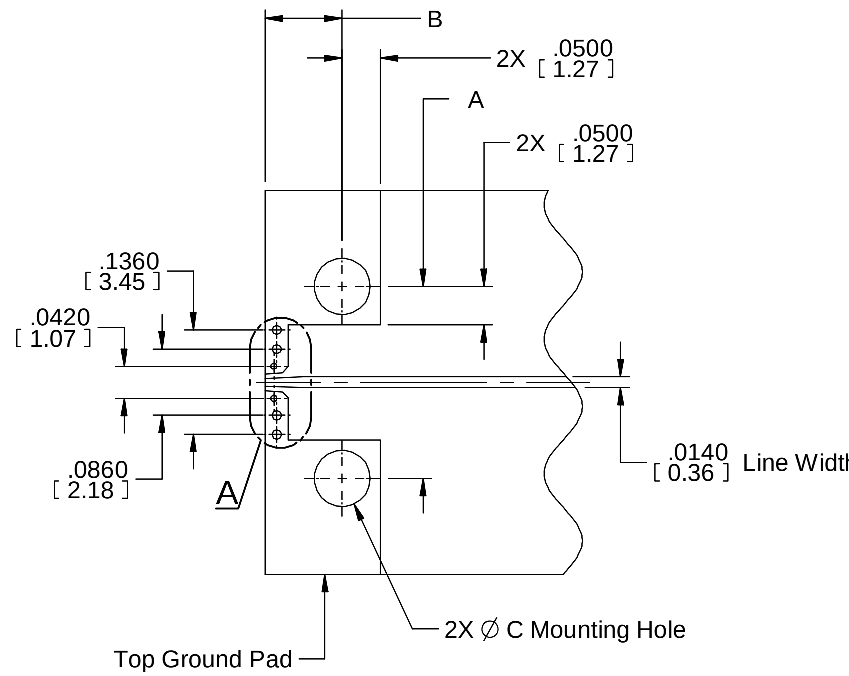
MATERIAL		032 Launch, Microstrip, 10MIL Rogers RO4835, 70GHz	
ROGERS RO4835 Dk = 3.66			
APPROVAL	DATE	DWG NO EL-MS-M-05-RO4835-032	REV A
BR	05/26/15	FILE NAME: EL-MS-M-10-RO4835-032, 10mil RO4835 Edge Launch 70GHz.dft	SHEET 1 OF 1

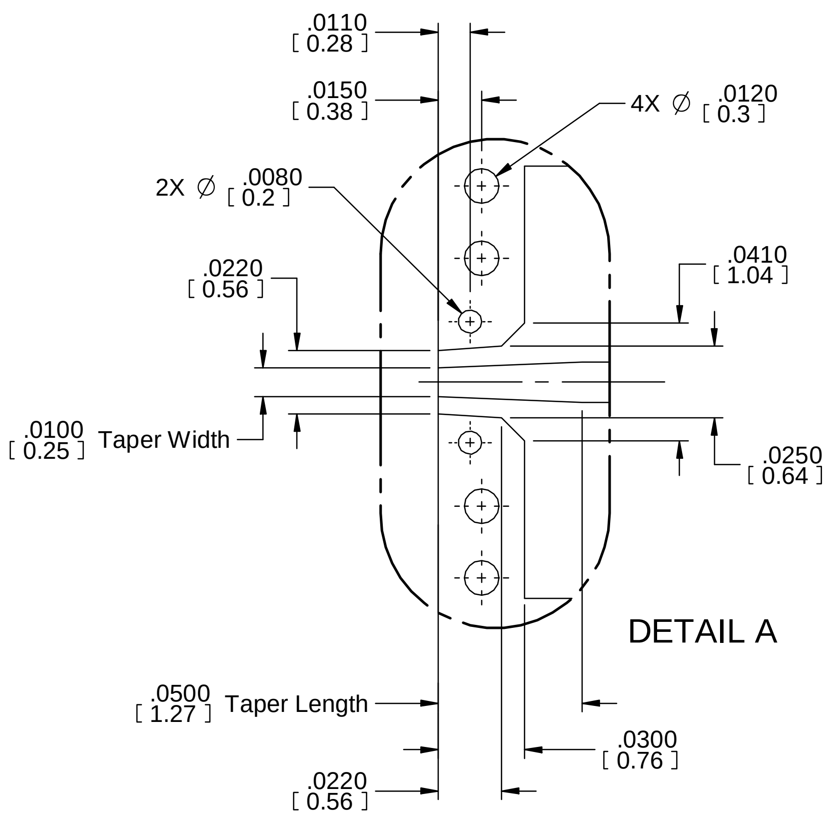
Notes (Unless Otherwise Specified):

1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 5 MIL Rogers RO5880 Dk = 2.20
4. Mounting holes are not plated.
5. Line Width = 14.0 MIL.
6. Launch Taper = 10 MIL. X 50 MIL.
7. Max Frequency = 70GHz
8. Hole Diameters are stated as finished hole size.
9. Plated through holes are to have a minimum of .001" copper.
10. No soldermask required.
11. Fabrication Tolerance: End product line widths and lands +/-.0005".
12. Copper Specification Signal Size: 1/2 oz. CU ± .0002, 1.8 MILS Finished
13. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup





DETAIL A

Mounting Holes

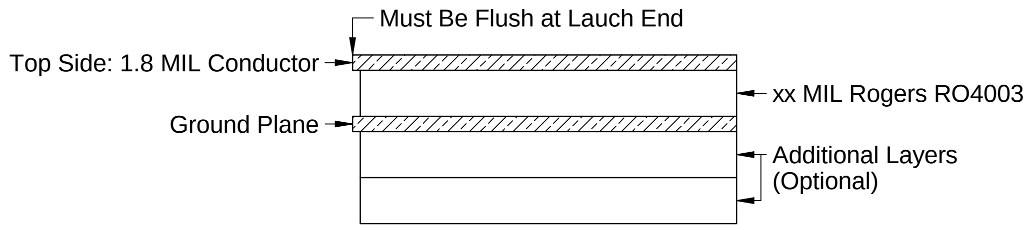
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

SIGNAL MICROWAVE

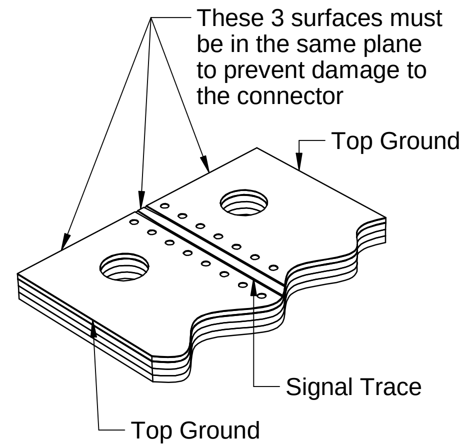
MATERIAL		031 Launch, Microstrip, 5MIL Rogers RO5880, 70GHz	
ROGERS RO5880 Dk = 2.20			
APPROVAL	DATE	DWG NO EL-MS-M-05-RO5880-031	REV A
BR	05/26/15	FILE NAME: EL-MS-M-05-RO5880-031, 5mil RO5880 Edge Launch 70GHz.dft	SHEET 1 OF 1

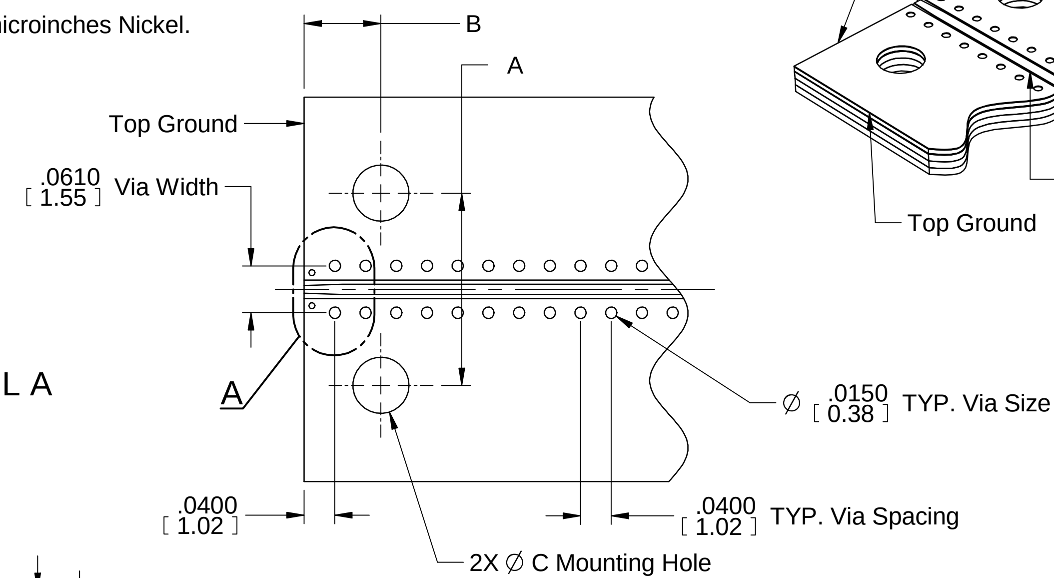
Notes (Unless Otherwise Specified):

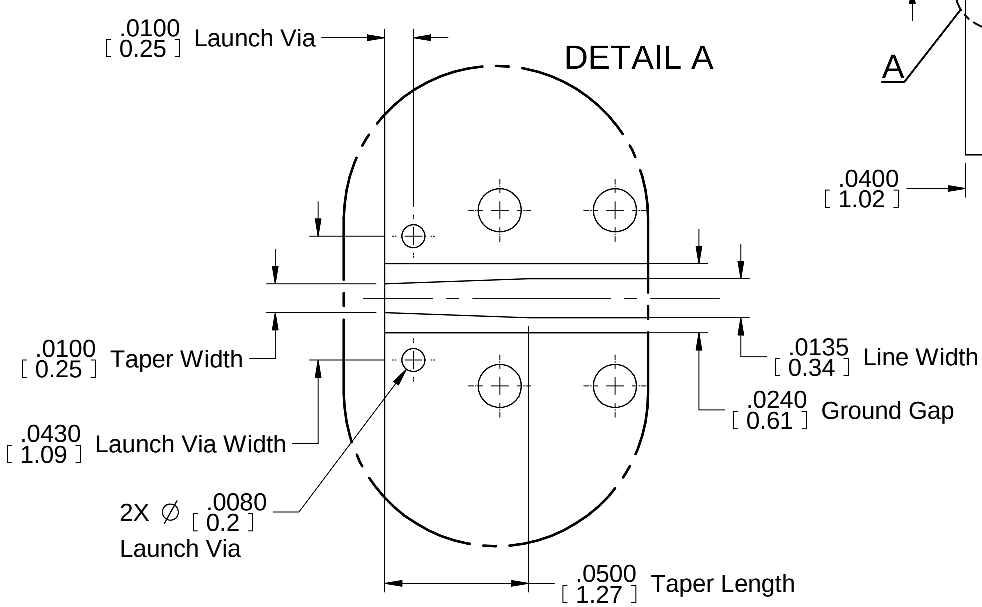
1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 8 MIL Rogers RO4003 Dk = 3.55
4. Line Width = 13.5 MIL.
5. Launch Taper = 10 MIL. X 50 MIL.
6. Max Frequency = 70GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask required.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification: 1/2 oz. CU ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup







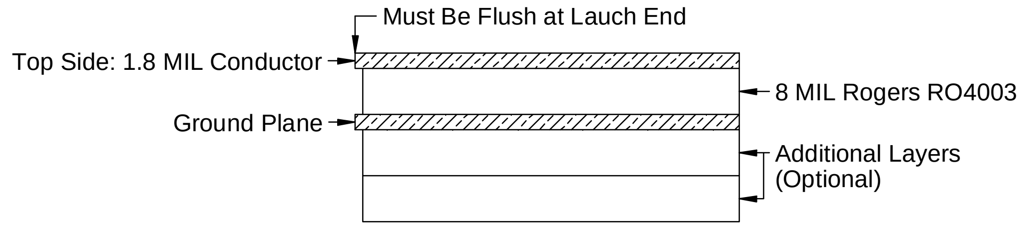
Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

SIGNAL MICROWAVE

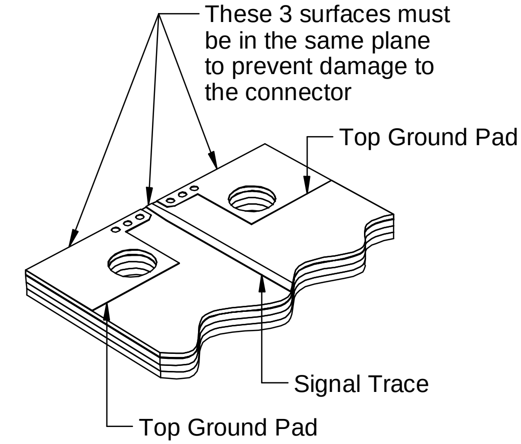
MATERIAL		
Rogers RO4003 Dk = 3.55		021 Launch, Grounded Coplaner Wave Guide, 8mil RO4003, 70GHz
APPROVAL	DATE	DWG NO EL-GC-M-08-RO4003-021 — REV B
BR	02/02/16	FILE NAME: EL-GC-M-08-RO40003-021, 8mil RO4003 Edge Launch 70GHz.dft — SHEET 1 OF 1

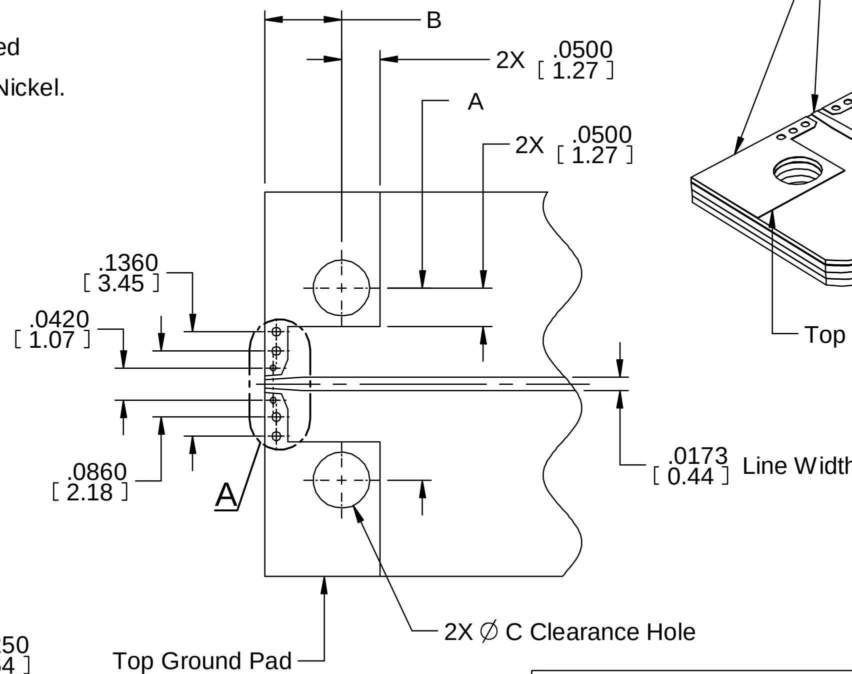
Notes (Unless Otherwise Specified):

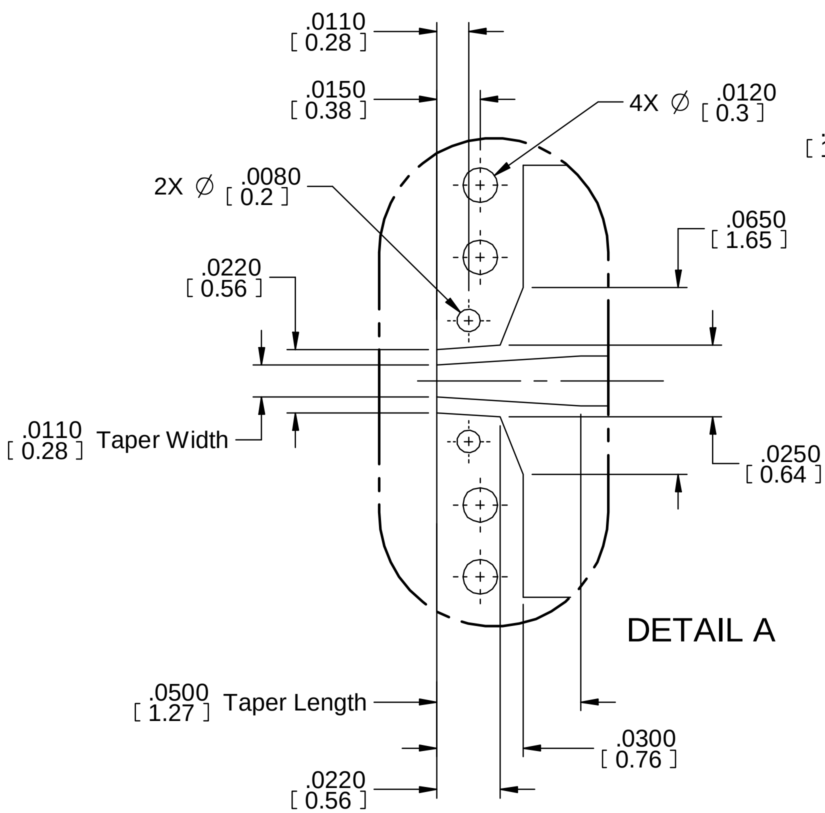
1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 8 MIL Rogers RO4003 Dk = 3.55
4. Line Width = 17.3 MIL.
5. Launch Taper = 11 MIL. X 50 MIL.
6. Max Frequency = 70GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask required.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification Signal Size: 1/2 oz. CU ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup







DETAIL A

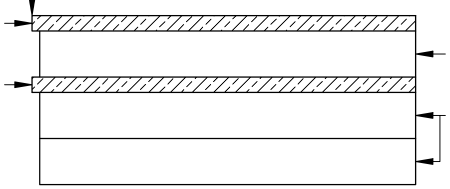
Mounting Holes

Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

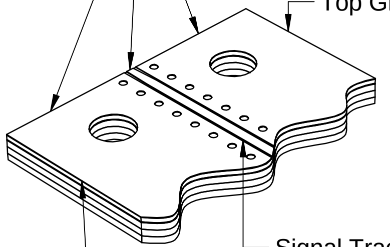
SIGNAL MICROWAVE	MATERIAL		020 Launch, Microstrip, 8MIL RO4003, 70GHz	
	Rogers RO4003 Dk = 3.55			
	APPROVAL	DATE	DWG NO EL-MS-M-08-RO4003-020	REV A
	BR	06/12/15	FILE NAME: EL-MS-M-08-RO40003-020, 8mil RO4003 Edge Launch 70GHz.dft	SHEET 1 OF 1

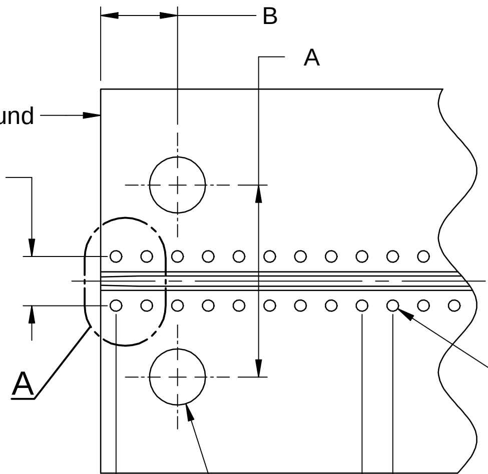
Notes (Unless Otherwise Specified):

1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 8 MIL Rogers RO4003 Dk =3.55
4. Line Width =13.5 MIL.
5. Launch Taper = 11 MIL. X 50 MIL.
6. Max Frequency = 40GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask required.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification: 1/2 oz. CU ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.

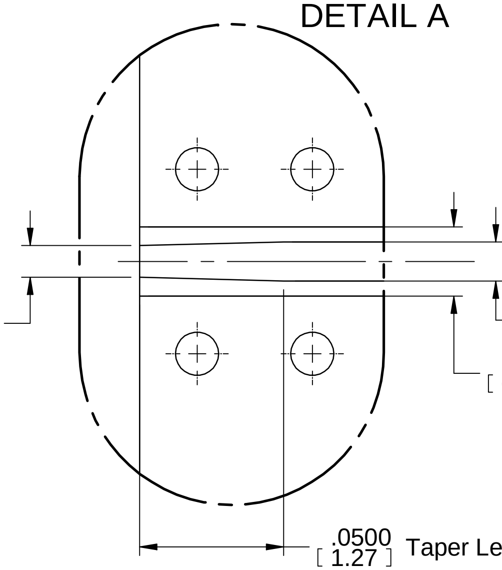


PCB Stackup





DETAIL A



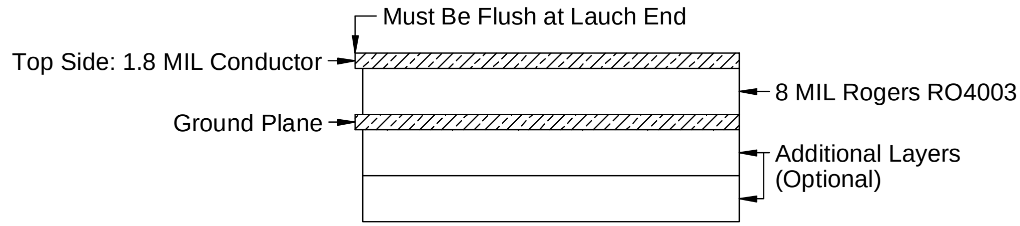
Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

SIGNAL MICROWAVE

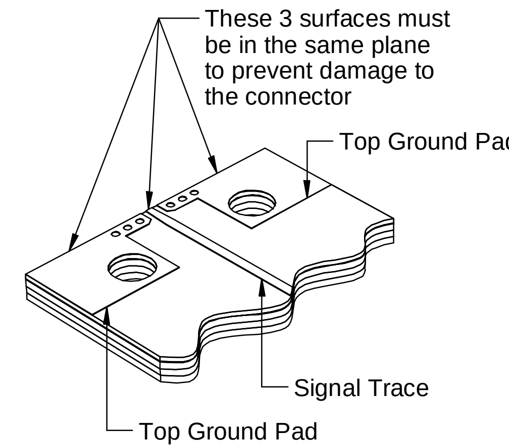
MATERIAL		008 Launch, Grounded Coplaner Wave Guide, 8mil Rogers RO4003, 40GHz	
Rogers RO4003 Dk = 3.55			
APPROVAL	DATE	DWG NO EL-GC-M-08-RO4003-008	REV C
BR	02/02/16	FILE NAME: EL-GC-M-08-RO40003-008, 8mil RO4003 Edge Launch 40GHz.dft	SHEET 1 OF 1

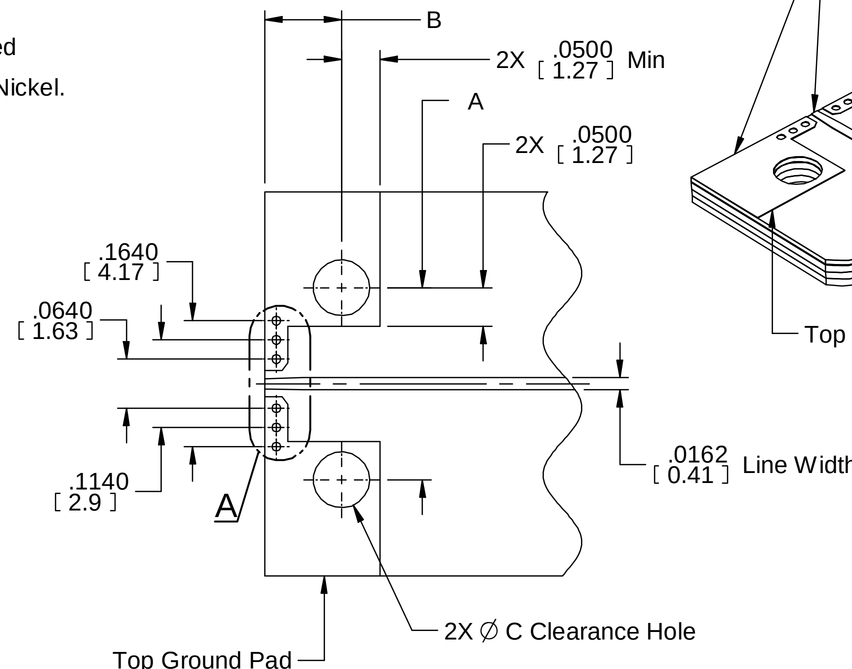
Notes (Unless Otherwise Specified):

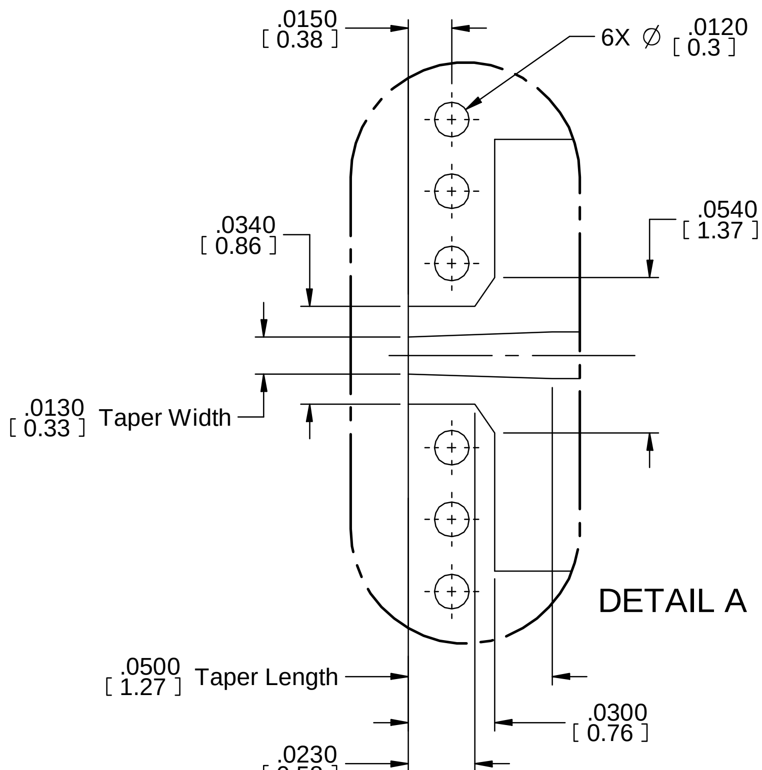
1. All dimensions are in inches.
2. Dimensions in [xxx] are in millimeters.
3. Material: 8 MIL Rogers RO4003 Dk = 3.55
4. Line Width = 16.2 MIL.
5. Launch Taper = 13 MIL. X 50 MIL.
6. Max Frequency = 40GHz
7. Hole Diameters are stated as finished hole size.
8. Plated through holes are to have a minimum of .001" copper.
9. No soldermask.
10. Fabrication Tolerance: End product line widths and lands +/-.0005".
11. Copper Specification Signal Size: 1/2 oz. Cu ± .0002, 1.8 MILS Finished
12. Plating Specification: 3 to 10 microinches Gold over 100 microinches Nickel.



PCB Stackup







DETAIL A

Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.078

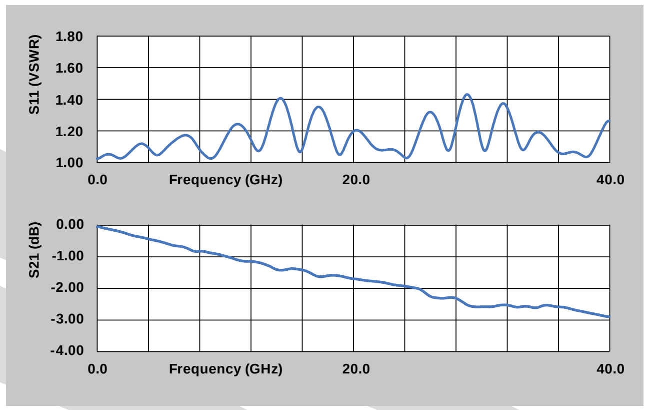
SIGNAL MICROWAVE

MATERIAL		007 Launch, Microstrip, 8MIL Rogers RO4003, 40GHz
Rogers RO4003 Dk = 3.55		DWG NO EL-MS-M-08-RO4003-007 REV B
APPROVAL	DATE	FILE NAME: EL-MS-M-08-RO40003-007, 8mil RO4003 Edge Launch 40GHz.dft
BR	10/07/15	SHEET 1 OF 1

Signal Microwave

40 GHz Test Boards for Edge Launch Connectors

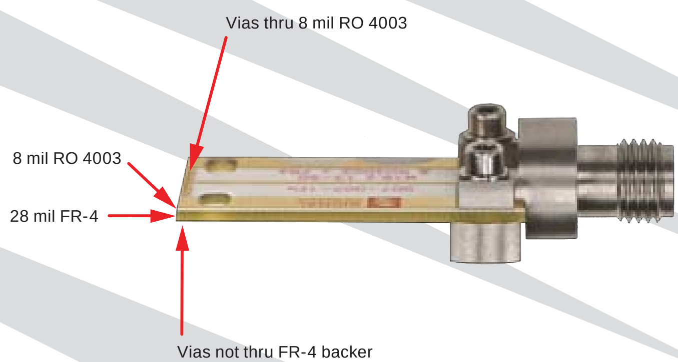
1” microstrip test board with typical data through 40 GHz:

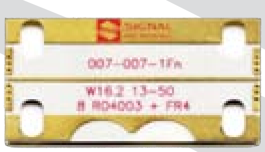


Test board options and test board construction showing no bottom ground.

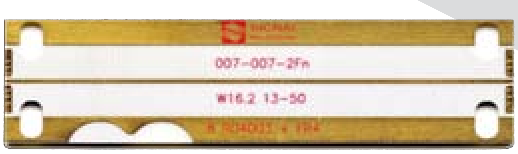
1” Grounded Coplanar Waveguide (GCPWG) on 8 mil RO4003 with FR-4 Backer

2” Grounded Coplanar Waveguide (GCPWG) on 8 mil RO4003 with FR-4 Backer





1” Microstrip on 8 mil RO4003 with FR-4



2” Microstrip on 8 mil RO4003 with FR-4

40 GHz Test Board Part Numbers:

007-007-1Fn	1” Microstrip
007-007-2Fn	2” Microstrip
008-008-1Fn	1” Grounded Coplanar Waveguide (GCPWG)
008-008-2Fn	2” Grounded Coplanar Waveguide (GCPWG)

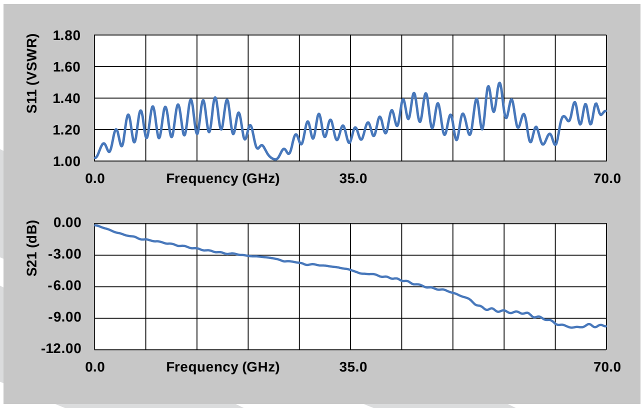
All test board designs are available at no charge.
in .pdf and .dxf formats.

Demo boards are available with sample connectors and test data.

Signal Microwave

70 GHz Test Boards for Edge Launch Connectors

2" microstrip test board with typical data through 70 GHz:

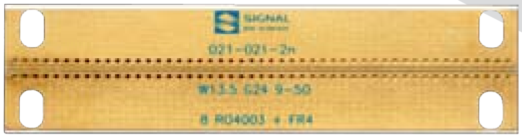


Test board options and test board construction showing no bottom ground.

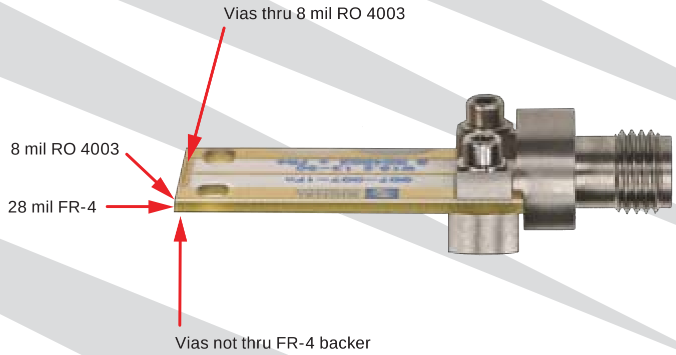
1" Microstrip on 8 mil RO4003 with FR-4

2" Microstrip on 8 mil RO4003 with FR-4

1" Grounded Coplanar Waveguide (GCPWG)
on 8 mil RO4003 with FR-4 Backer



2" Grounded Coplanar Waveguide (GCPWG) on 8 mil RO4003 with FR-4 Backer



Current Board Part Numbers:

020-020-1Fn 1" Microstrip

020-020-2Fn 2" Microstrip

021-021-1Fn 1" Grounded Coplanar Waveguide (GCPWG)

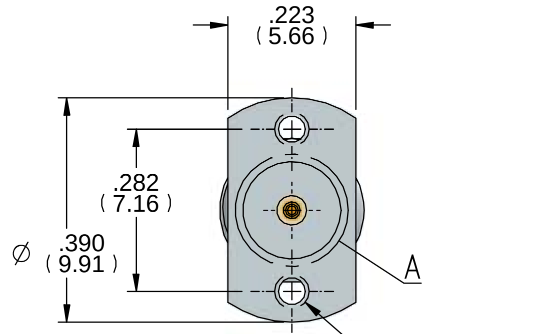
021-021-2Fn 2" Grounded Coplanar Waveguide (GCPWG)

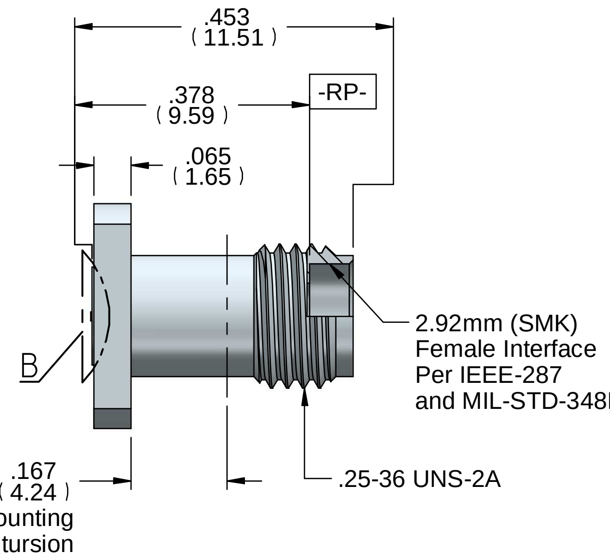
All test board designs are available at no charge in .pdf and .dxf formats.

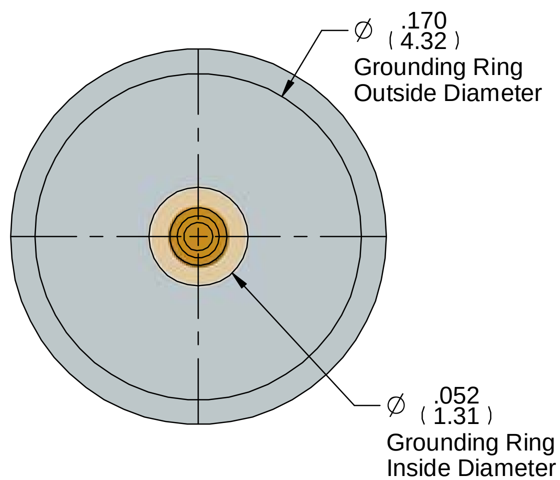
Demo boards are available with sample connectors and test data.

SIGNAL MICROWAVE

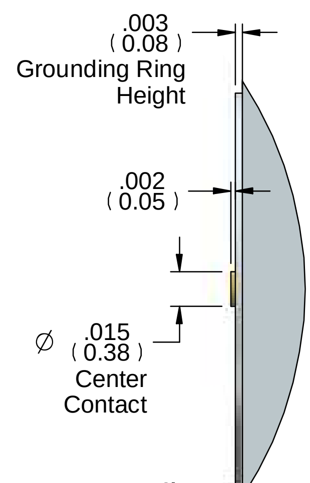
VLF40-002
2.92mm Vertical Launch, 40GHz







Detail A



Detail B

MATERIAL TABLE

ITEM	MATERIAL
Housing	303 Stainless Steel
Dielectric	Neoflon
Center Conductor	Gold Plated BeCu

Notes (Unless Otherwise Specified):

1. All Dimensions are in Inches.
2. All Angles are in Degrees.
3. All Dimensions in (XXX) are in Millimeters.

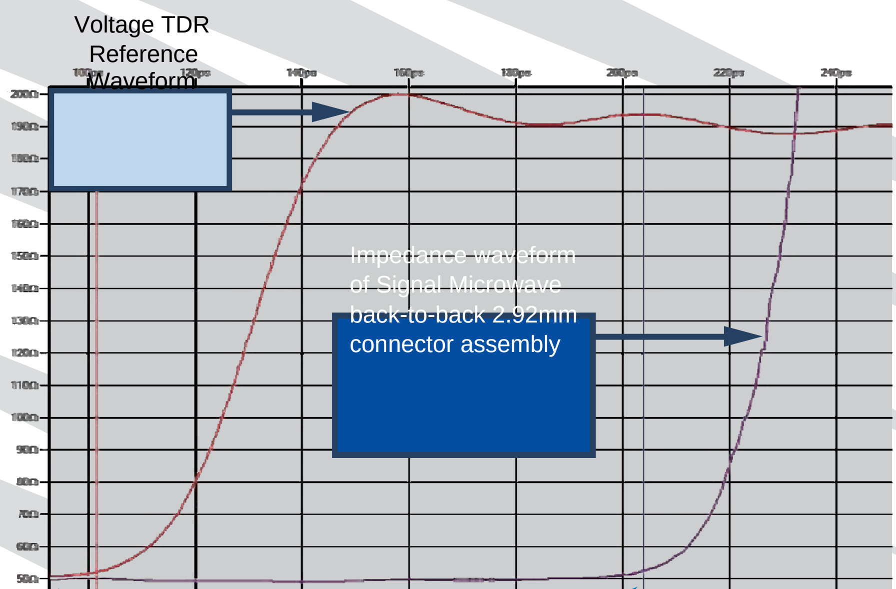
APPROVAL	DATE	DWG NO VLF40-002	REV B
BR	03/25/15	FILE NAME: VLF40-002 Outline.dft	SHEET 1 OF 1

Signal Microwave VLF40

The Transparent Connector

2.92 mm Connector for the High Speed Digital Industry with Superior Electrical Performance

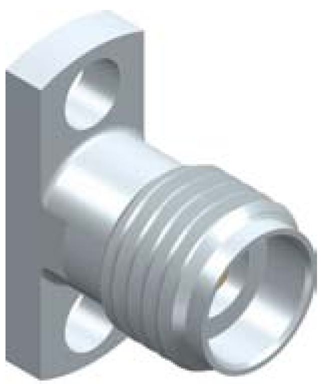
- **2.92 mm Interface**
- **Board Mounted**
- **40 GHz Bandwidth**
- **Vertical Launch**
- **Screw-on Mounting**
- **Compression Fit**
- **No Soldering Required**

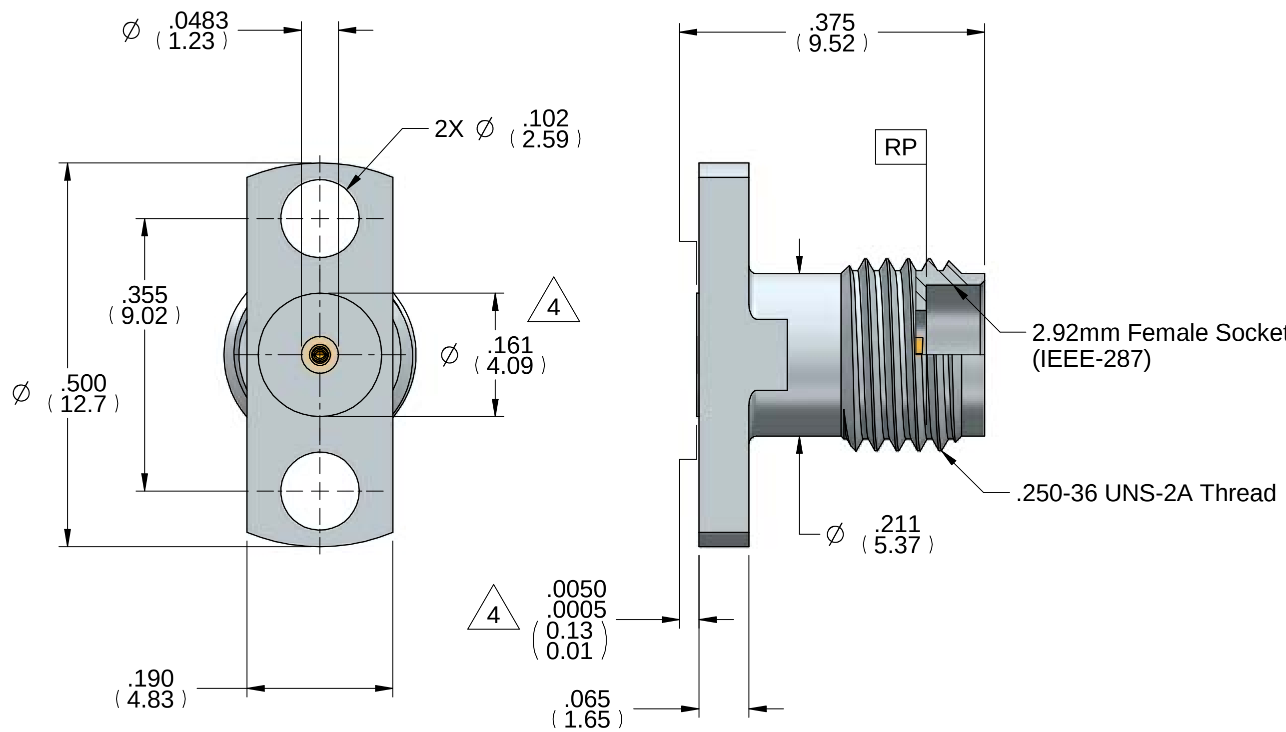


Typical Test Data
TDR impedance test data of a back-to-back pair showing 50 ohms impedance through the connectors.

Signal Microwave, LLC

FRF40-003
2.92mm, .500 2 Hole Flange, 12mil





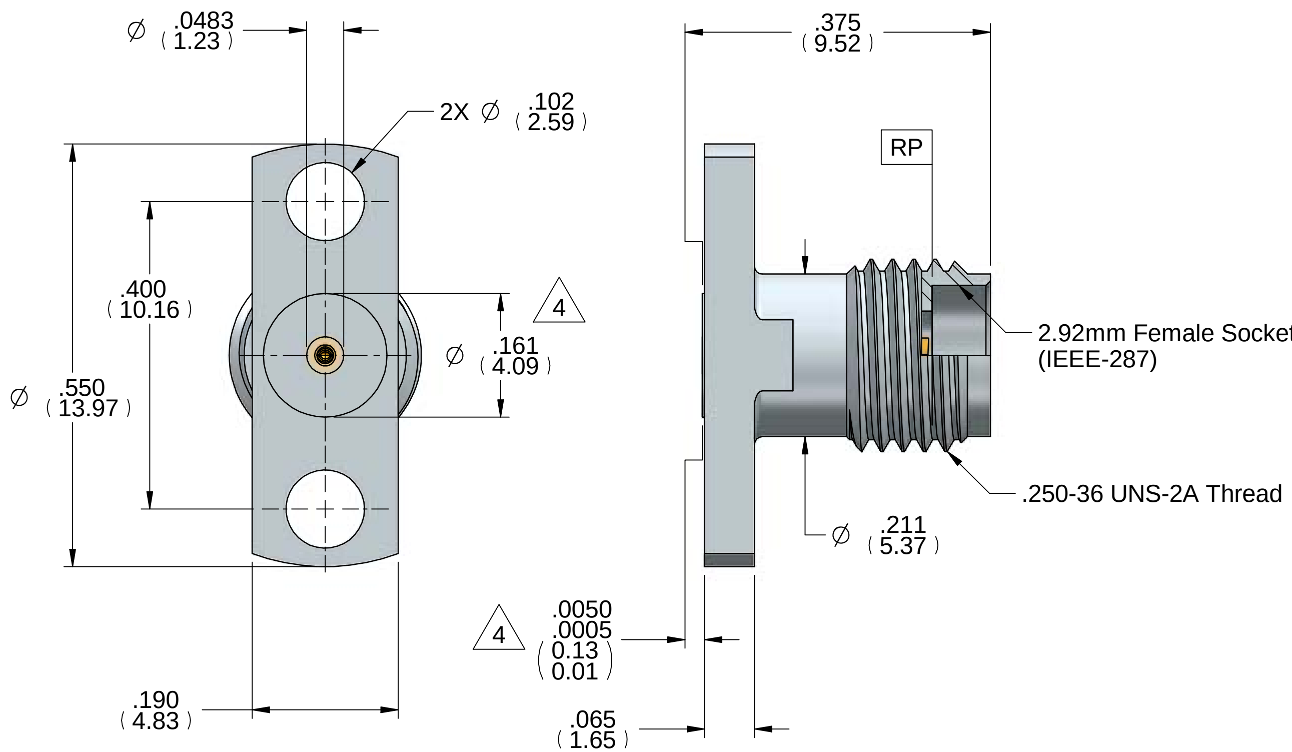
MATERIAL TABLE	
ITEM	**MATERIAL**
Housing	303 Stainless Steel, Steel Cres Alloy UNS S30300 per ASTM A582
Dielectric	Neoflon per ASTM D1430
Center Conductor	BeCu Alloy UNS C17300 Cond. TH04 per ASTM B196, Gold Plated per MIL-DTL-45204

Notes (Unless Otherwise Specified):

1. All dimensions are in inches.
2. All angles are in degrees.
3. Dimensions in [xxx] are in millimeters.
4. 360˚ Metal Grounding Ring

APPROVAL	DATE	DWG NO FRF40-003	REV C
BR	04/20/16	FILE NAME: FRF40-003 Outline.dft	SHEET 1 OF 1

FRF40-002
2.92mm, .550 2 Hole Flange, 12mil



MATERIAL TABLE

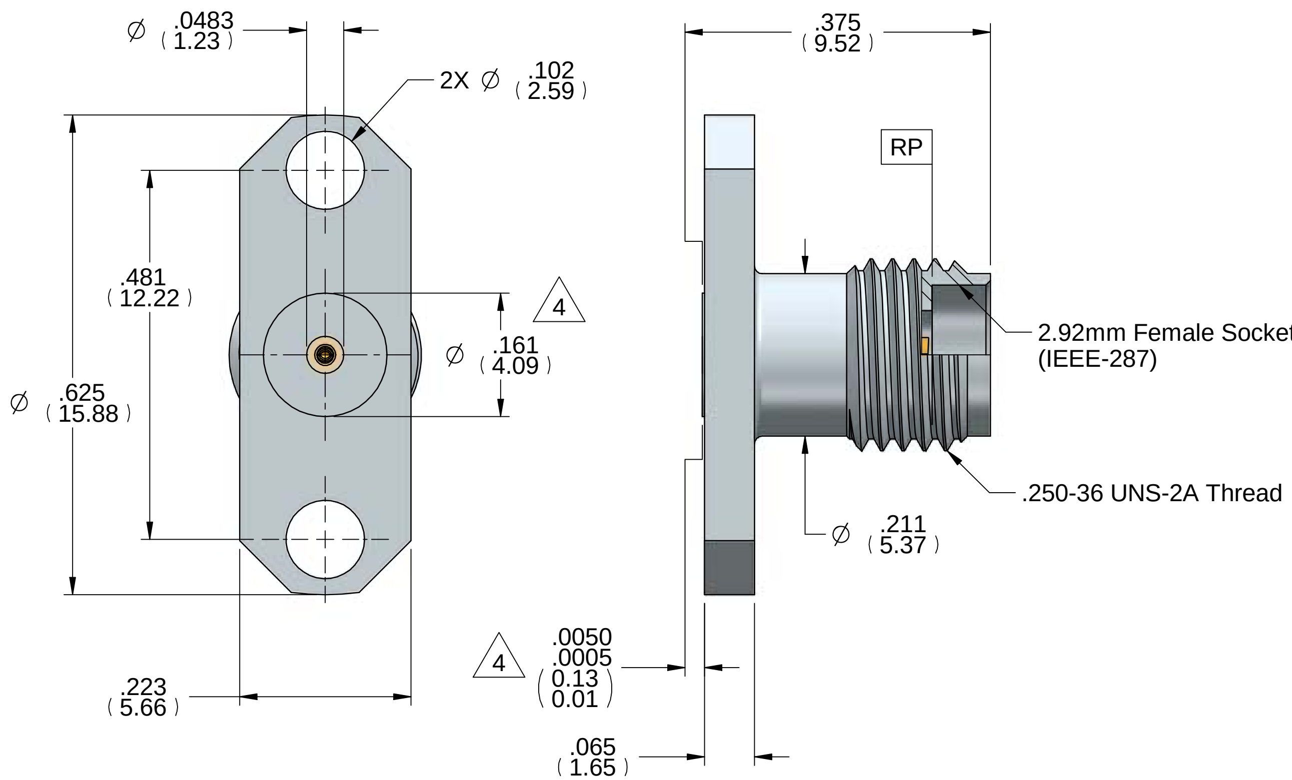
ITEM	MATERIAL
Housing	303 Stainless Steel, Steel Cres Alloy UNS S30300 per ASTM A582
Dielectric	Neoflon per ASTM D1430
Center Conductor	BeCu Alloy UNS C17300 Cond. TH04 per ASTM B196, Gold Plated per MIL-DTL-45204

Notes (Unless Otherwise Specified):

1. All dimensions are in inches.
2. All angles are in degrees.
3. Dimensions in [xxx] are in millimeters.
4. 360˚ Metal Grounding Ring

APPROVAL	DATE	DWG NO	REV
BR	04/20/16	FRF40-002	C
		FILE NAME: FRF40-002 Outline.dft	SHEET 1 OF 1

FRF40-001
2.92mm, .625 2 Hole Flange, 12mil



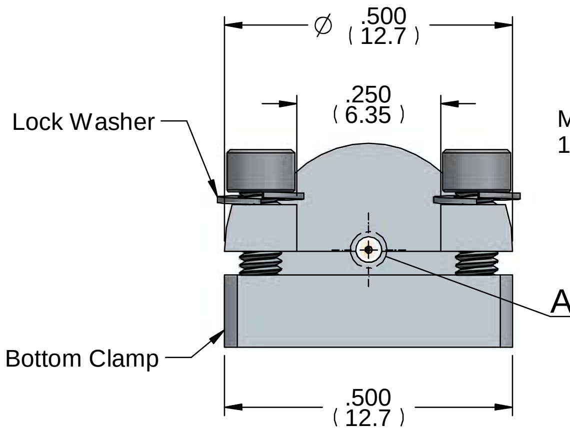
MATERIAL TABLE	
ITEM	**MATERIAL**
Housing	303 Stainless Steel, Steel Cres Alloy UNS S30300 per ASTM A582
Dielectric	Neoflon per ASTM D1430
Center Conductor	BeCu Alloy UNS C17300 Cond. TH04 per ASTM B196, Gold Plated per MIL-DTL-45204

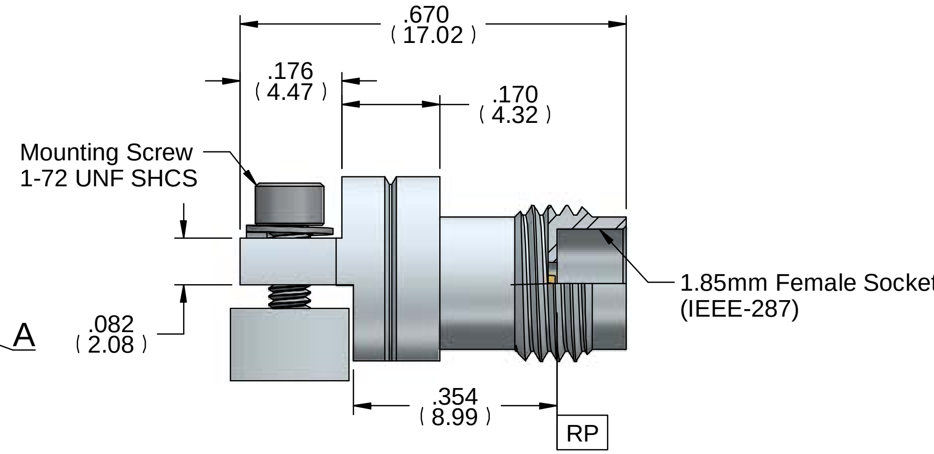
Notes (Unless Otherwise Specified):

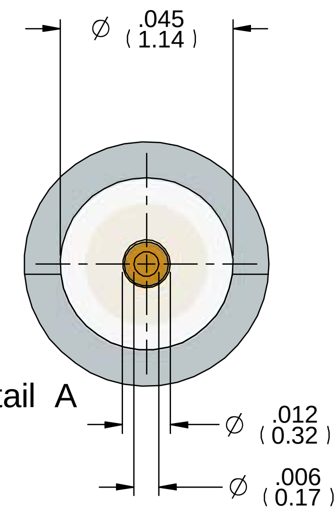
1. All dimensions are in inches.
2. All angles are in degrees.
3. Dimensions in [xxx] are in millimeters.
4. 360° Metal Grounding Ring

APPROVAL	DATE	DWG NO FRF40-001	REV A
BR	04/08/16	FILE NAME: FRF40-001 Outline.dft	SHEET 1 OF 1

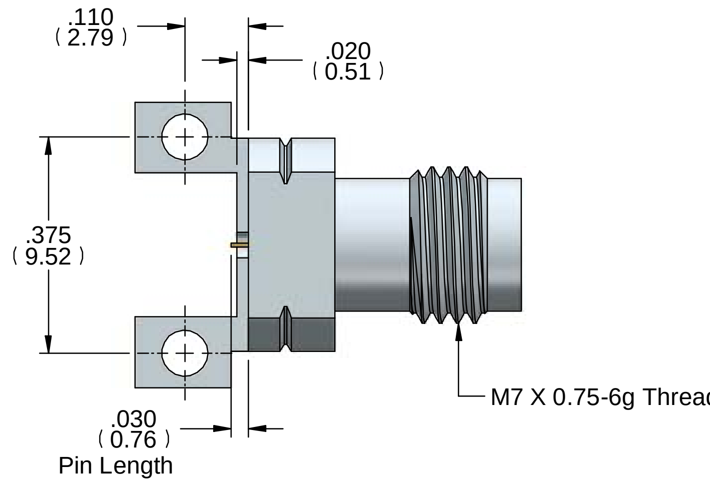
ELF67-002
1.85mm Edge Launch, .500 Profile



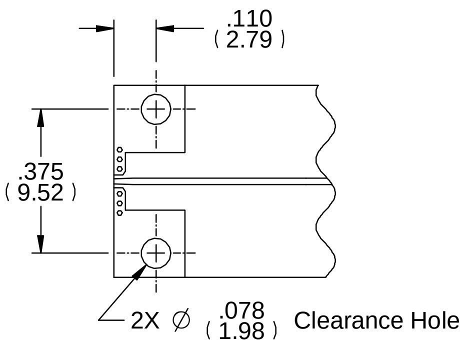




Detail A



Mounting Screws and Bottom Clamp
Not Shown for Clearity



Board Mounting Detail

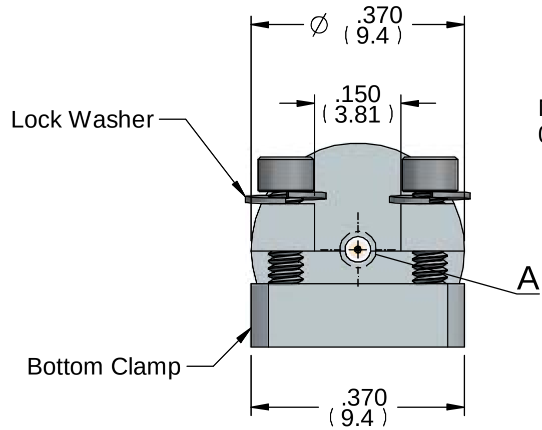
MATERIAL TABLE	
ITEM	**MATERIAL**
Housing	303 Stainless Steel, Steel Cres Alloy UNS S30300 per ASTM A582
Dielectric	Neoflon per ASTM D1430
Center Conductor	BeCu Alloy UNS C17300 Cond. TH04 per ASTM B196, Gold Plated per MIL-DTL-45204

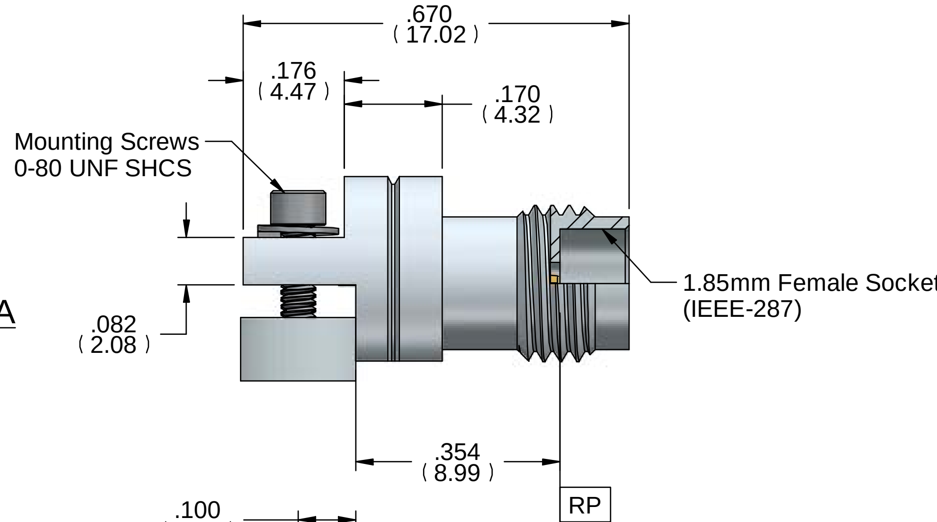
Notes (Unless Otherwise Specified):

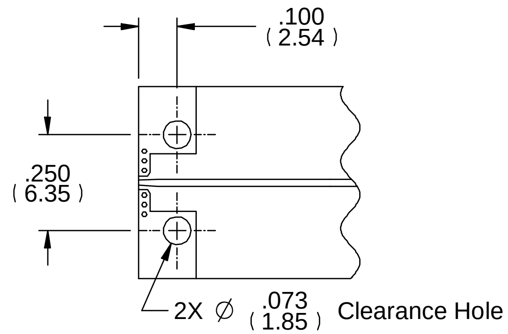
1. All dimensions are in inches.
2. All angles are in degrees.
3. Dimensions in [xxx] are in millimeters.

APPROVAL	DATE	DWG NO	REV
BR	07/17/15	ELF67-002	C
		FILE NAME: ELF67-002 Outline.dft	SHEET 1 OF 1

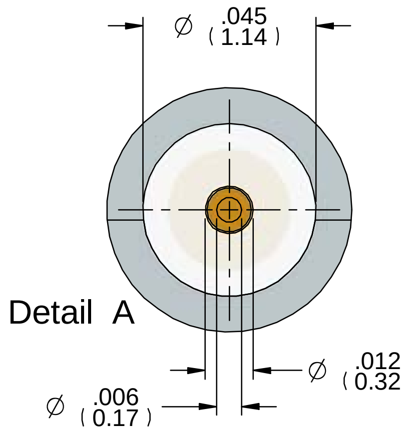
ELF67-001
1.85mm Edge Launch, .375 Profile



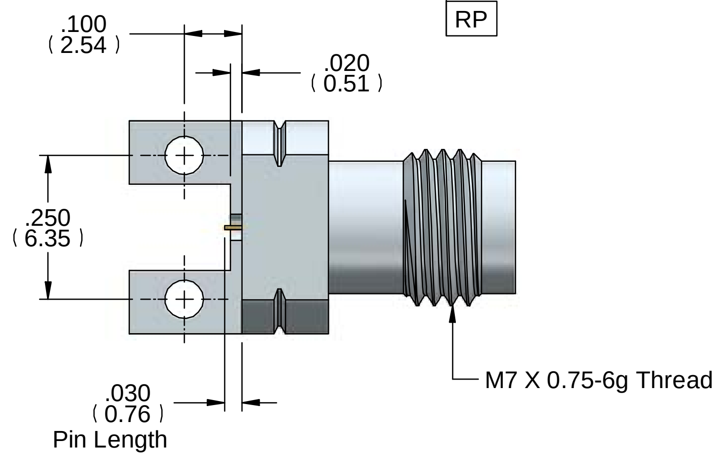




Board Mounting Detail



Detail A



Mounting Screws and Bottom Clamp
Not Shown for Clearity

MATERIAL TABLE	
ITEM	**MATERIAL**
Housing	303 Stainless Steel, Steel Cres Alloy UNS S30300 per ASTM A582
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Notes (Unless Otherwise Specified):

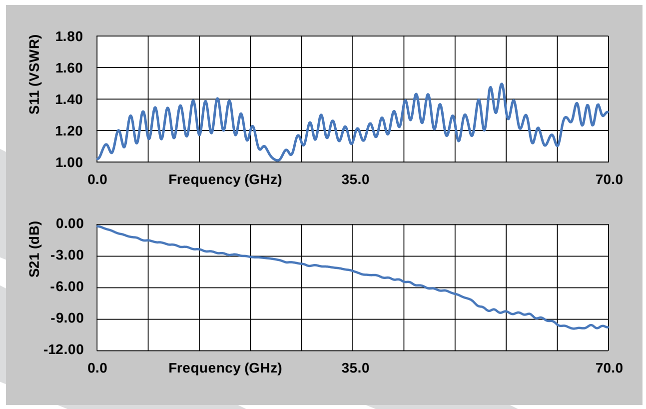
1. All dimensions are in inches.
2. All angles are in degrees.
3. Dimensions in [xxx] are in millimeters.

APPROVAL	DATE	DWG NO	REV
BR	07/17/15	ELF67-001	C
		FILE NAME: ELF67-001 Outline.dft	SHEET 1 OF 1

Signal Microwave

70 GHz Test Boards for Edge Launch Connectors

2" microstrip test board with typical data through 70 GHz:



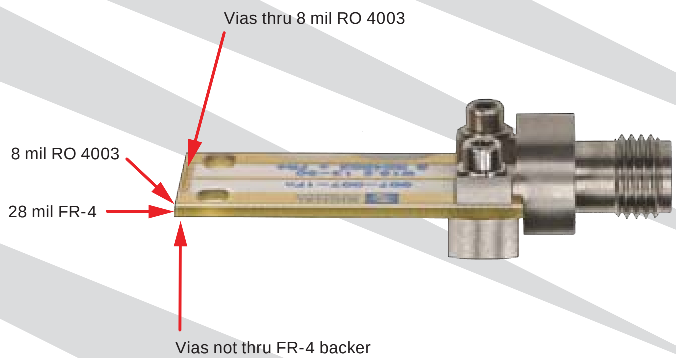
Test board options and test board construction showing no bottom ground.

1" Microstrip on 8 mil RO4003 with FR-4

2" Microstrip on 8 mil RO4003 with FR-4

1" Grounded Coplanar Waveguide (GCPWG)
on 8 mil RO4003 with FR-4 Backer

2" Grounded Coplanar Waveguide (GCPWG) on 8 mil RO4003 with FR-4 Backer



Current Board Part Numbers:

020-020-1Fn	1" Microstrip
020-020-2Fn	2" Microstrip
021-021-1Fn	1" Grounded Coplanar Waveguide (GCPWG)
021-021-2Fn	2" Grounded Coplanar Waveguide (GCPWG)

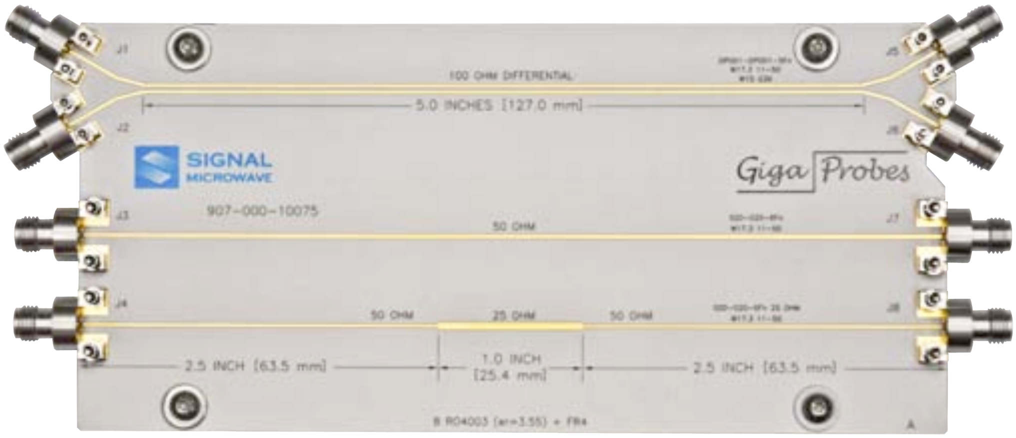
All test board designs are available at no charge in .pdf and .dxf formats.

Demo boards are available with sample connectors and test data.

40GHz VNA Calibration Verification Board

Reference Waveforms for DB40-003

From Signal Microwave and Giga-Probes®



This document contains reference waveforms measured from the 100 ohm differential, 50 ohm single ended and 50-25-50 ohm Beatty line traces on the DB40-003 40GHz VNA Calibration Verification Board for use with VNAs. These measurements provide a known performance response over frequency which can be used to verify VNA calibrations, check for measurement drift, and are teaching tools for VNA users. This high bandwidth board design can also be used as model for developing 70GHZ PCB designs as describe later in this document.

Verify VNA Calibrations

Once the VNA is calibrated, measure the 100ohm differential trace (4 ports VNA) or the 50 ohm single ended trace (2 ports VNA) and compare the measurement against the waveforms that are contained in this document. If they do not correlate, VNA functions affecting the measurement have been left on and the source must be determined before accurate measurement can be performed.

Measurement drift

A common measurement error that can be caused by changing room temperature, moving the cable or the VNA is out of calibration. To avoid inaccurate frequency measurements, measure a 50 or 100 ohm trace and store the results in a ref memory. Prior to making measurements that day, recall the previous stored measurement and make a new measurement from the board and the two should correlate. If not, recalibrate the VNA or successive measurements will not correlate with the previous day measurements.

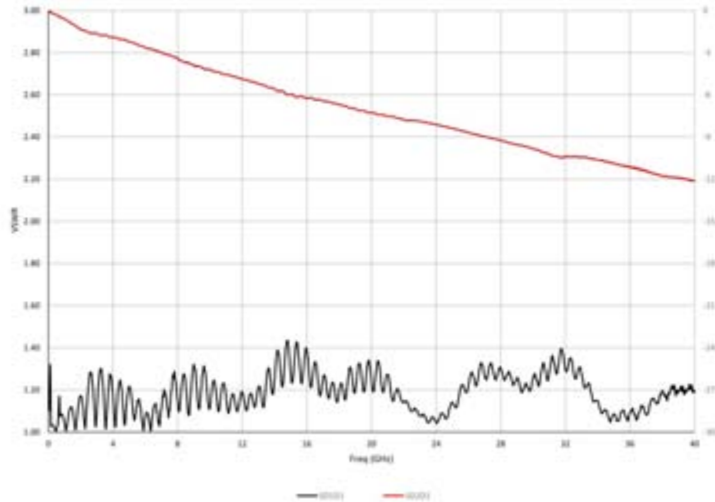
Calibrate VNA to measure both time (impedance) and frequency domain S-parameters

Attach two ports to the Beatty line. The Er value is stamped on the board that can be used to calibrate the cursers to accurately measure distance and impedance. If you have calibrated the VNA correctly, your cursers will be calibrated to physically locate the impedance change of this trace when it goes from 25 to 50 ohms.

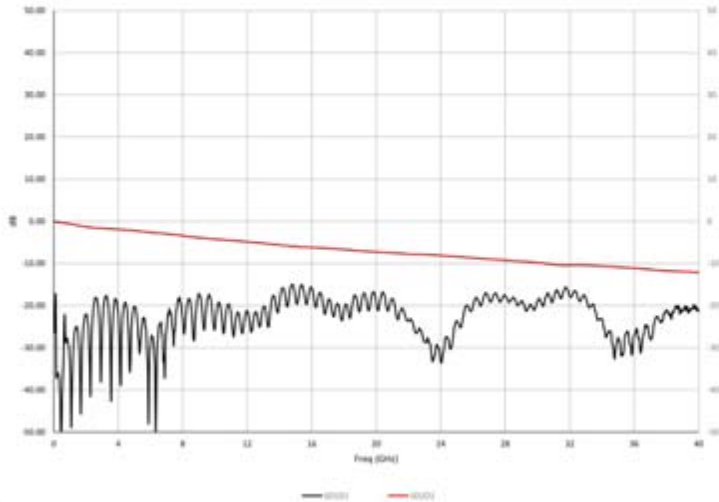
Teaching tools for VNA users

Haven't used the VNA in months or ever? Practice setting up the VNA to measure the 50, 100 and Beatty lines and compare the measurements with those that come with the board prior to making measurement on your prototypes

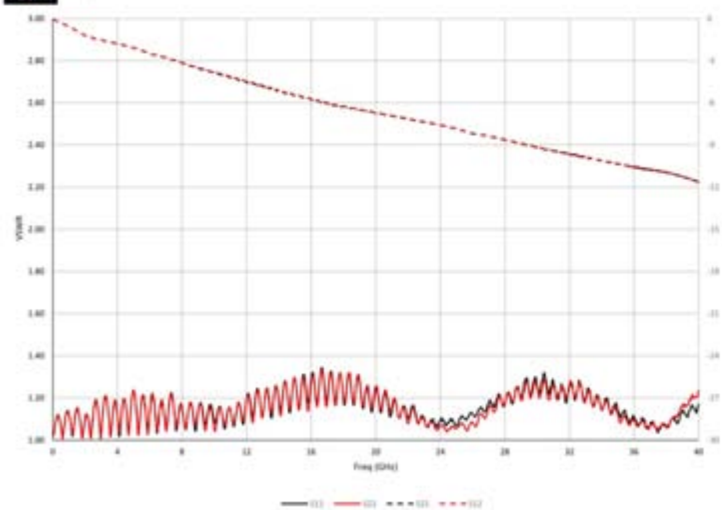
100 Ohm Differential Pair
VSWR



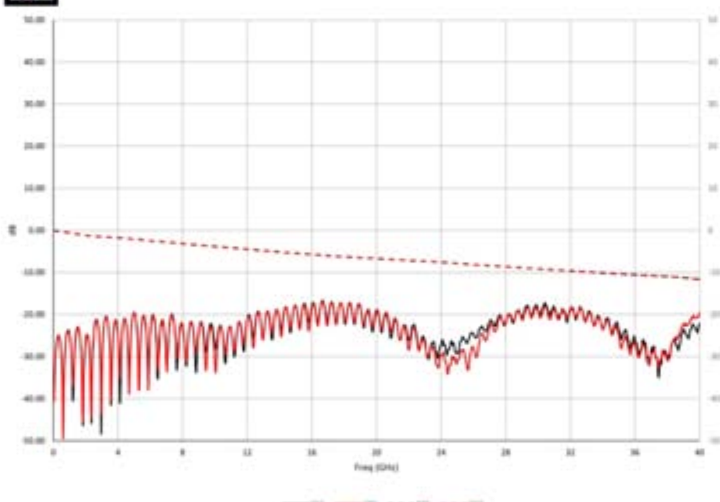
100 Ohm Differential Pair
Return and Insertion Loss



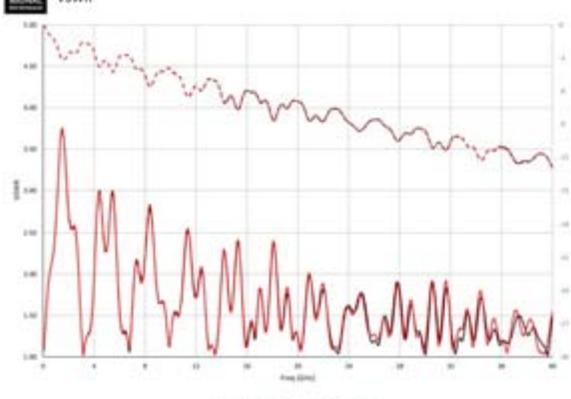
50 Ohm Thru Line
VSWR



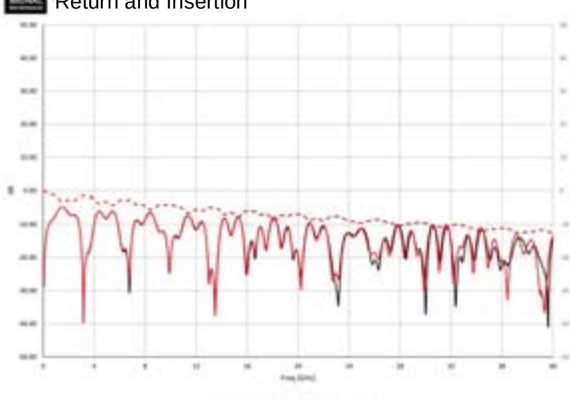
50 Ohm Thru Line
Return and Insertion Loss



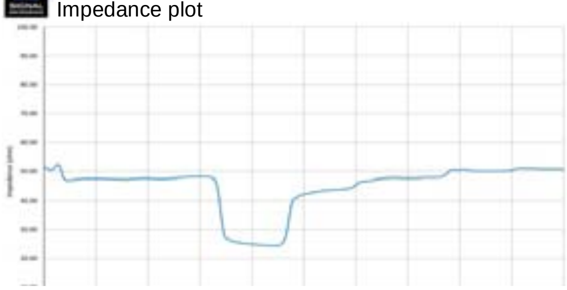
25 Ohm Beatty Standard
VSWR



25 Ohm Beatty Standard
Return and Insertion



25 Ohm Beatty Standard
Impedance plot



VNA Calibration Verification:

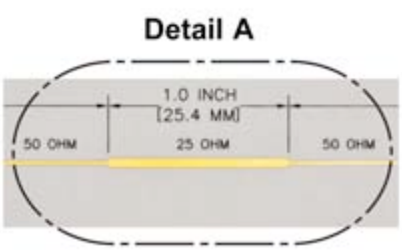
When a VNA does a calibration, it sweeps through multiple frequency points and at every point it locks the frequency to a reference, levels the power, then makes a measurement. During calibration two major parameters are accounted for by using a calibration kit as a reference, the instrument's system noise is taken out of the measurement, and the characteristic impedance of 50 ohms is established. For VNA calibration verification many operators use only a low loss through adapter. This method only verifies that the system noise was removed by the calibration. A "golden unit" like the VNA Calibration Verification board, with known response over the frequency range of the calibration, should be used to verify that the calibration was successful in "teaching" the VNA how to make an accurate measurement over the frequency range of the calibration.

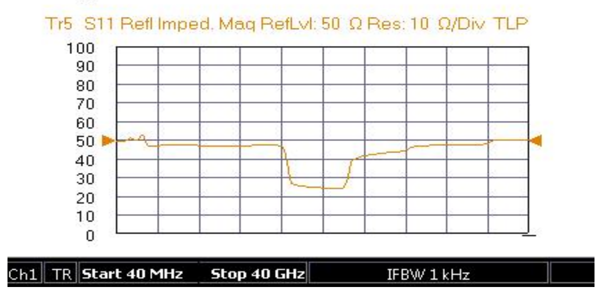
Board Versatility:

The nature of the VNA calibration verification board design lends it to easily create many versions.

One version of the board is an expanded version of the basic board which includes test lines for the GigaProbes® 40 GHz DVT40 differential probe. The board allows a user to verify 4 port VNA calibration using a 100 ohm connector to connector test line. Then the user can move to a similar 100 ohm differential line that is connector to probe so each probe can be evaluated.

This version of the board also includes a 25 ohm "Beatty" line for verification of a TDR measurement using a VNA. This line is useful in verifying that the VNA calibration is done correctly to perform accurate TDR transformation for an impedance measurement along a transmission line.





Reasons for the high performance

It starts with the high performance connectors manufactured by Signal Microwave (www.signalmicrowave.com). These edge launch connectors are designed using 3D modeling and RF transmission line analysis instead of just a mechanical solution. The next component leading to the high performance is the board launch design. The board launch is the transition from the board to the connector. The launch structure on the board starts with a Grounded Coplanar Waveguide (GCPWG) section which incorporates a top ground launch that transitions the ground to an inner layer as it transitions to a microstrip line. The launch design is also done by Signal Microwave using 3D modeling to match the board to high performance connectors and this service is available for customers that are using the connectors in their own products.

Another factor in the high performance of the board is the material and the way it is manufactured. The material is Rogers RO4003 with a thickness of 8 mils and ½ ounce copper. The finish on the board is electroless nickel with a top layer of immersion gold (ENIG). The Rogers material performs excellently through 70 GHz and the plating provides a corrosion free surface. The next step in the manufacturing process is the 8 mil RO4003 is processed completely by itself including drilling to vias required and the plating. Then the panel is laminated to an FR4 backer for mechanical stiffness without having to backdrill any vias which can cause problems at frequencies as high as the 70 GHz bandwidth of the board.

Magnetic feet

The board also incorporates custom design stand-off with magnets installed at the end. When placed on a magnetic plate it holds the board securely to the plate. The plates are available from DVT Solutions and are very useful in securing the board for measurements with probes.

Giga Probes

SIGNAL MICROWAVE

40GHz - 67GHz
VNA Calibration Verification Board

The NEW VNA Calibration Verificaion Board is a 70 GHz PCB containing traces and probe pads and replaceable solderless 2.92mm or 1.85mm connectors configured in multiple connection modes (connector to connector, probe to connector and probe to probe). Accompanying the board is printouts with S-parameter (S2p/S4p) files of each connector to connector trace.

- Avoid Measurement Errors due to Improper Calibration Settings
- Detect Measurement Drift in order to Make Repeatable Measurements
- Reduce VNA Setup Time when Renting or Purchasing a New System
- Determine Actual Measurement

"Avoid costly swept frequency calibration errors"

Use either the 50 ohm or 100 ohm high bandwidth traces as a measurement frequency standard to verify that the VNA is making accurate measurements after calibration and *prior* to making critical measurements on prototypes, or as a quick calibration check when the accuracy of frequency domain measurements are in question. This simple verification process can prevent hours of retaking erroneous measurements do to improper calibration, setup or instrument drift.

"Save money by reducing measurement errors and setup time"

The VNA Calibration Verificaion Board is a valuable training resource to assist engineers to quickly learn how to setup and make accurate measurements with a TDR or VNA, including probes. Simply connect the VNA to the 50 ohm or 100 ohm differential traces and compare your results with the measurements included with the board. This process builds confidence in instrument proficiency, reducing setup time prior to measuring similar traces on prototypes or the verification of simulator models used to create today's high speed digital systems.

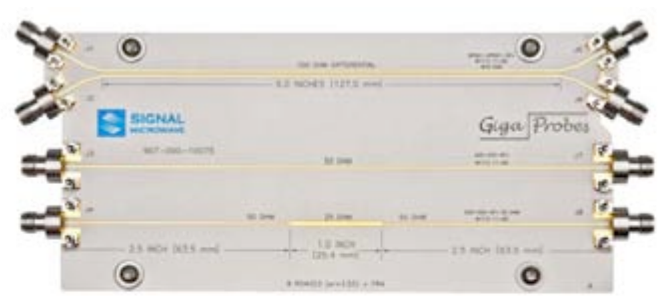
"Determine actual system measurement bandwidth when using probes or cables"

Determining the system's bandwidth is a challenge when you include Instrument measurement uncertainty error, cables, probes, connectors and options for de-embedding it all from the measurement. To dial it in, the 40GHz Model DB40-002 contains seven traces with a mix of 50 ohm & 100 ohm configuration modes (con.-con., probe-probe, pad-con. and con.-con) to help determine the bandwidth of your measurement system.

\

Model # DB40-002 (40GHz) DB67-002 (67GHz)

- **Three connector to connector traces:**
  - 50 ohm (J3-J8)
  - 100 ohm (J5/J6-J10/J11)
  - Beatty Standard (50ohm-25ohm-50ohm, J4-J9)
- **Two connector to test probe traces:**
  - 100 ohm differential connectors (J1/J2) to differential test pads (P1)
  - 50 ohm connector (J7) to test pads (P2)
- **Two test probe to test probe traces:**
  - 50 ohm (P3) to (P4) trace
  - 100 ohm Differential test pads (P5) to (P6)



Model # DB40-003 (40GHz) DB67-003 (67GHz)

- **Three connector to connector traces:**
  - 50 ohm (J3-J7)
  - 100 ohm (J1/J2-J15/J6)
  - Beatty Standard (50ohm-25ohm-50ohm, J4-J8)

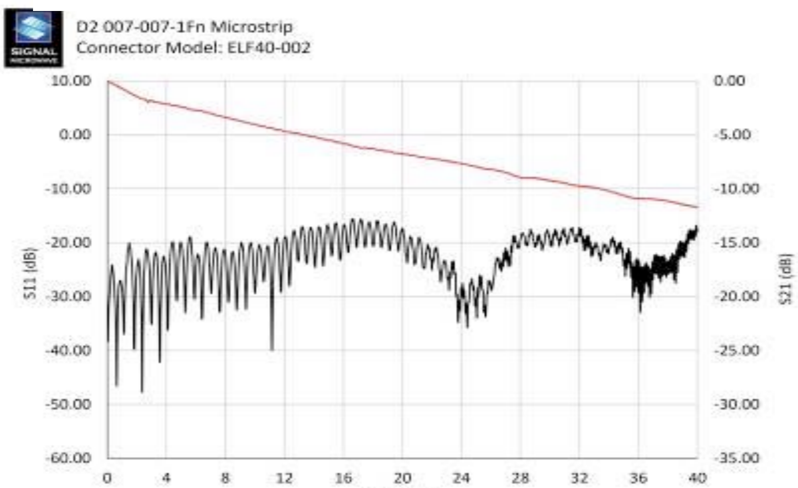
Common PCB Specifications

70GHz GHz Design

- Signal Microwave Connectors: 2.92mm 40GHz or 1.85mm 67GHz. replaceable solder-less edge mount
- E_r (DK) is 3.55 PCB material
- Measurements are included for each trace.

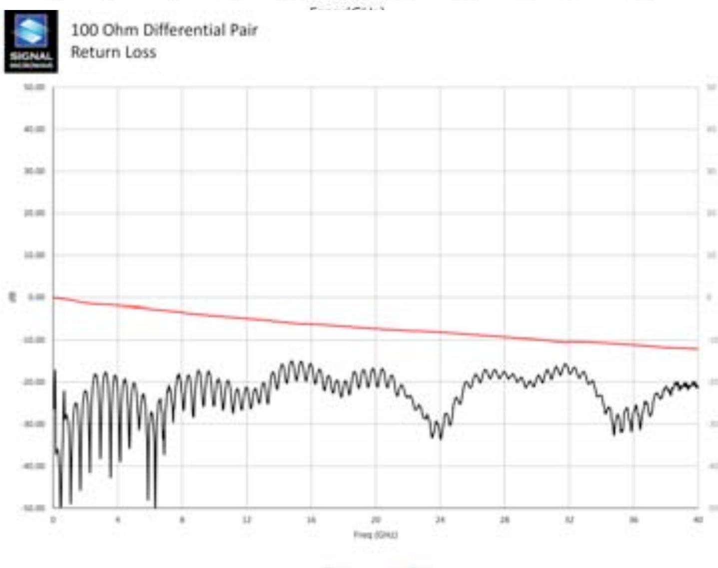
Applications

- **Verify VNA calibration is accurate prior to making critical measurements on prototypes**
- **Verify VNA measurement repeatability and detect system drift**
- **Teaching tool for measuring distance and impedance using cursers**
- **Learn to perform differential and single ended probing techniques**
- **Manufacturer's instrument Demonstrations and Training**
- **Correlate accuracy between VNA swept sinewave vs. Time domain extracted S-parameters**
- **Post sales or rental instrument training tool**
- **Make differential and single ended probing measurements typical to Signal Integrity analysis on high speed passive linear differential interconnects (i.e. PCI Express, SATA, 10 GB/s Ethernet, etc.)**



S-parameter return loss and insertion loss plots for the 50 ohm through trace

- S21 shows 40 GHz of bandwidth
- S11 shows a return loss of 15 dB



S-parameter return loss and insertion loss plots for the 100 ohm differential trace

- SDD21 shows 40 GHz of bandwidth
- SDD11 shows a return loss of 15 dB

Ordering Information

Model # DB40-002 (40GHz) DB67-002 (67GHz)

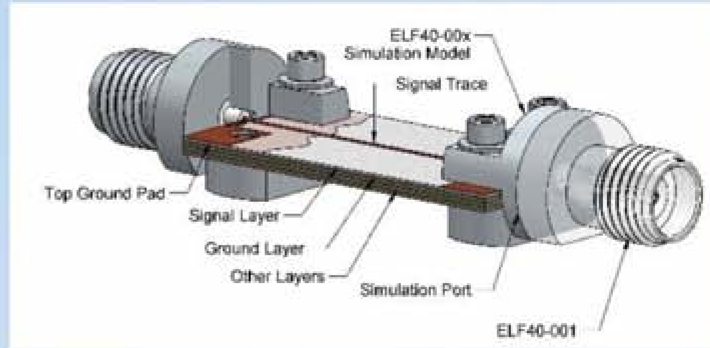
- Three connector to connector traces (50,100, Beatty Standard)
- Two connector to test probe traces (50ohm, 100ohm)
- Two test probe to test probe traces (50ohm, 100ohm)

Model # DB40-003 (40GHz) DB67-003 (67GHz)

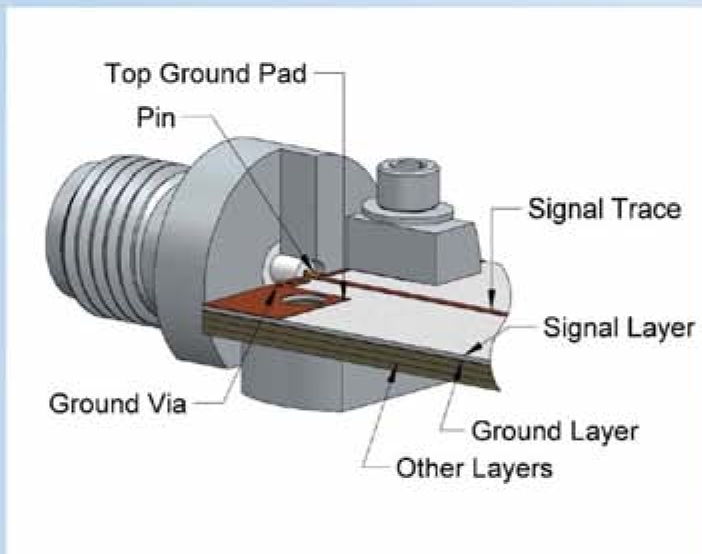
Three connector to connector traces:

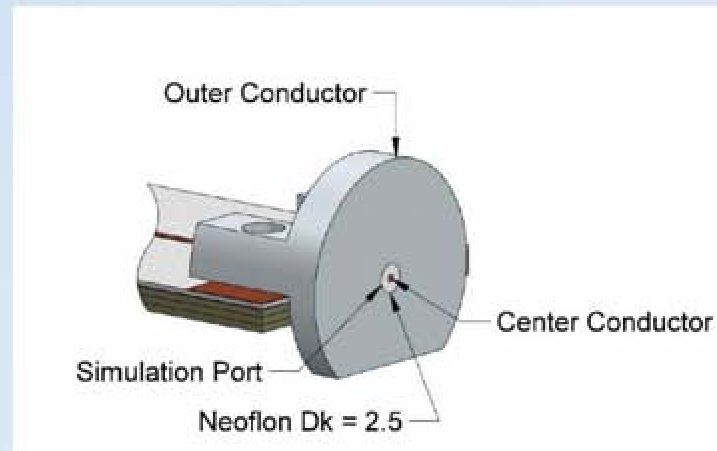
- 50 ohm
- 100 ohm
- Beatty Standard (50ohm-25ohm-50ohm)

ELF40 Simulation Model



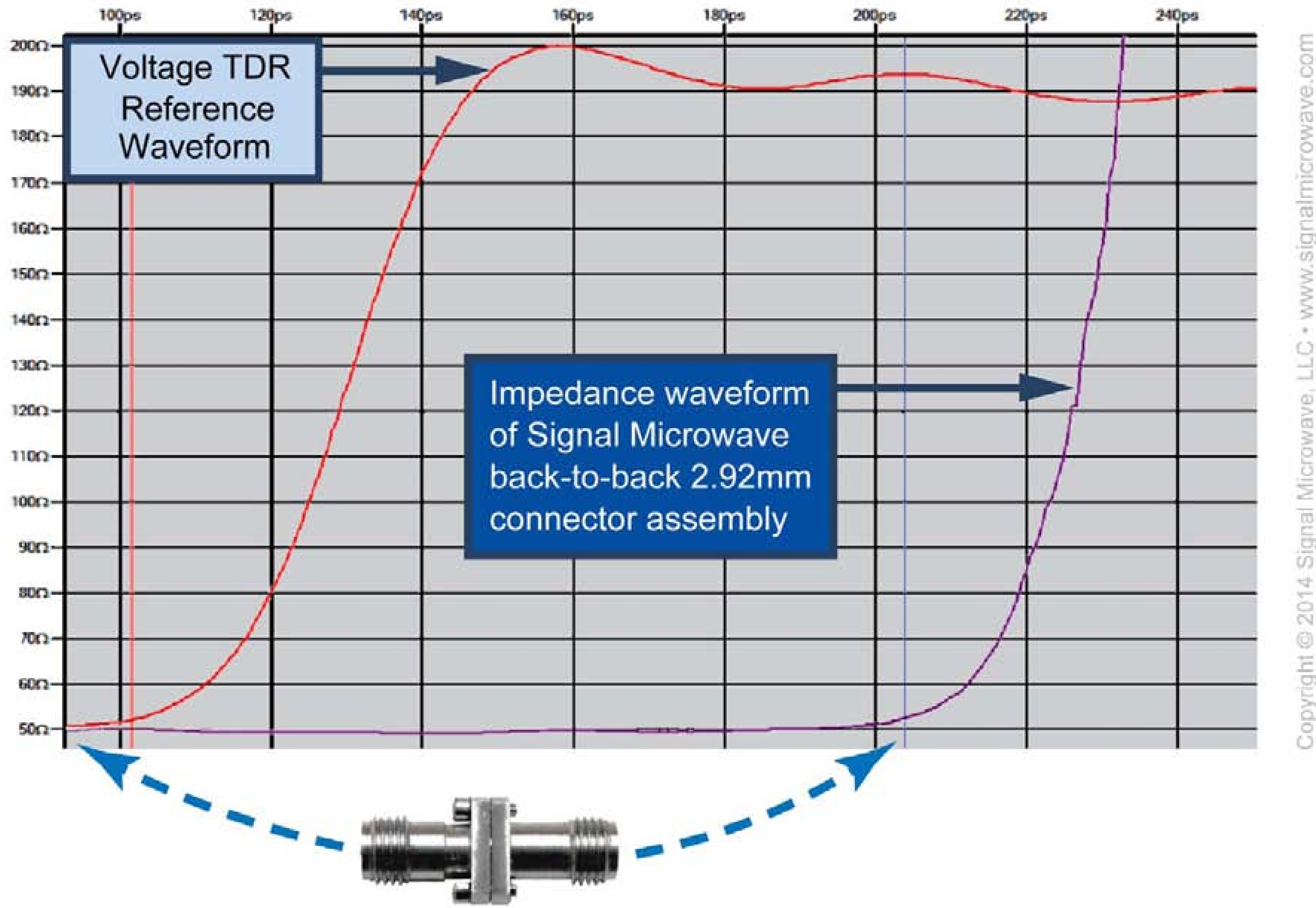
- The simulation model includes the launch portion of the connector along with the mounting legs of the .370" body part which is worst case for performance.
- Models available in common 3D graphic formats
- .igs, .stp, .X_T, .SAT, and other formats are available





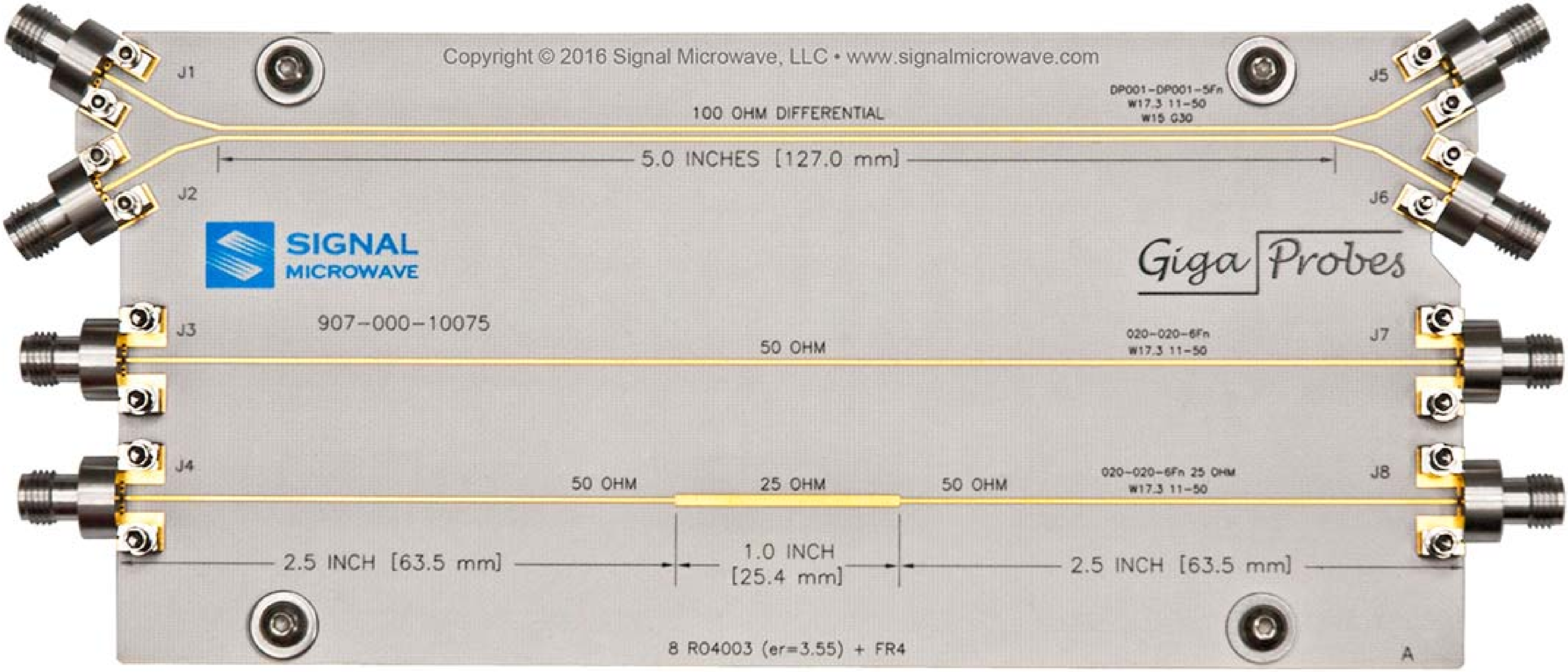
ELFxx-00x 3D Simulation Model

SIGNAL MICROWAVE



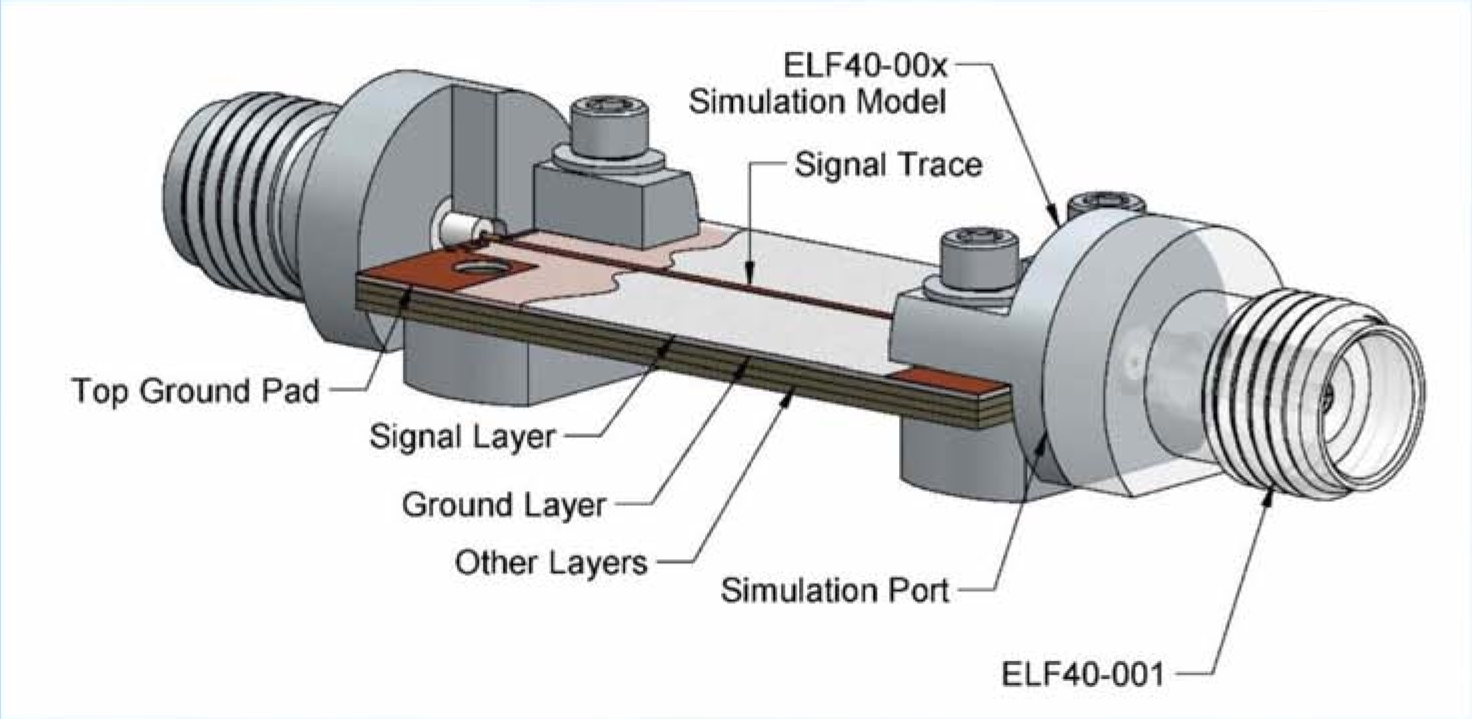
Typical Test Data

TDR impedance test data of a back-to-back pair showing 50 ohms impedance through the connectors.

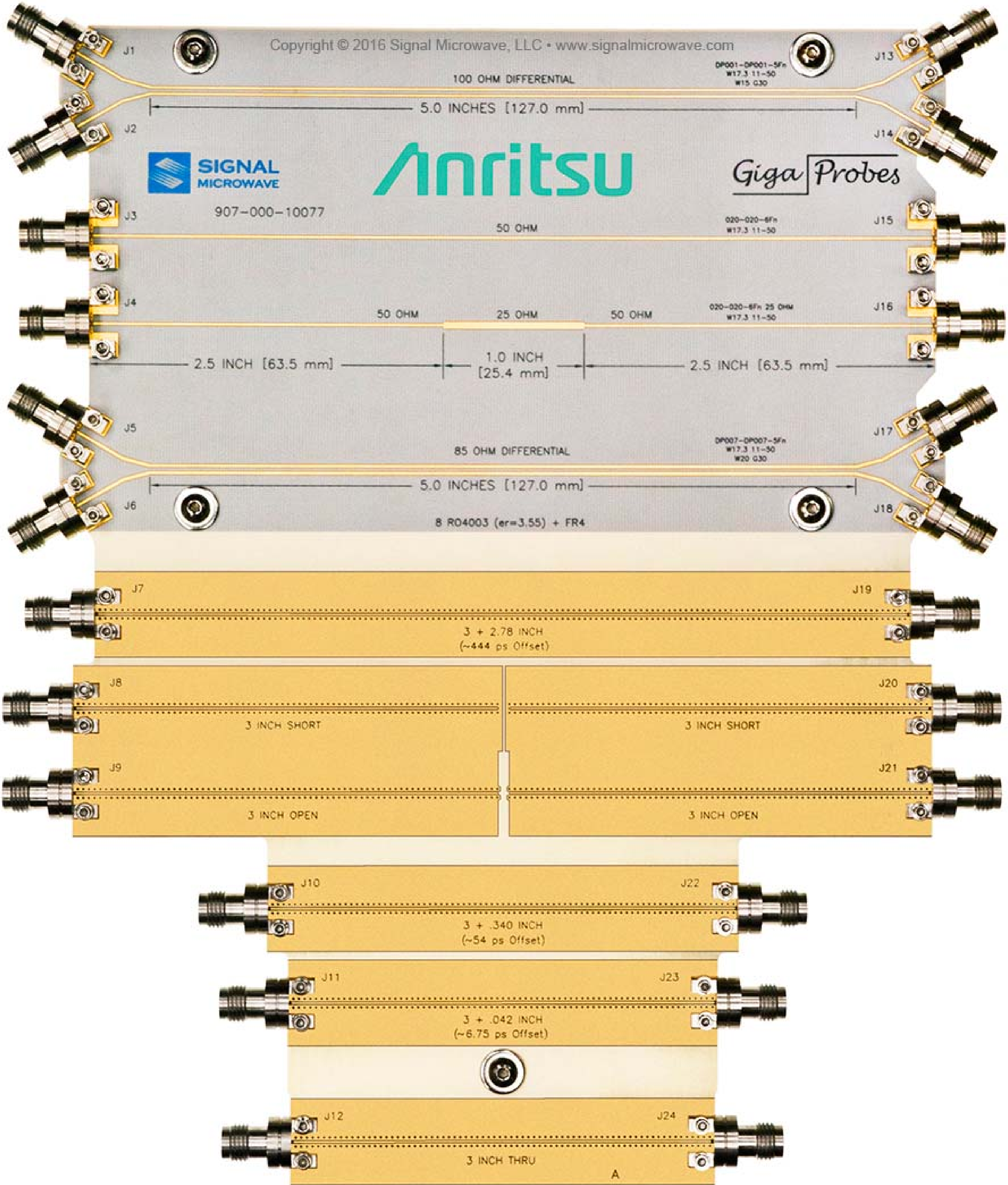

Copyright © 2016 Signal Microwave, LLC • www.signalmicrowave.com
J1
J2
J3
J4
J5
J6
J7
J8
100 OHM DIFFERENTIAL
DP001-DP001-5Fn
W17.3 11-50
W15 G30
5.0 INCHES [127.0 mm]
SIGNAL
MICROWAVE
Giga Probes
907-000-10075
50 OHM
020-020-6Fn
W17.3 11-50
50 OHM
25 OHM
50 OHM
020-020-6Fn 25 OHM
W17.3 11-50
2.5 INCH [63.5 mm]
1.0 INCH
[25.4 mm]
2.5 INCH [63.5 mm]
8 RO4003 (er=3.55) + FR4
A

Typical board stack-up example for Edge Launch

- The top layer is the microwave signal layer
- There is a ground layer directly under the signal layer.
- The launch from the connector only uses the top ground transition to the internal ground layer.



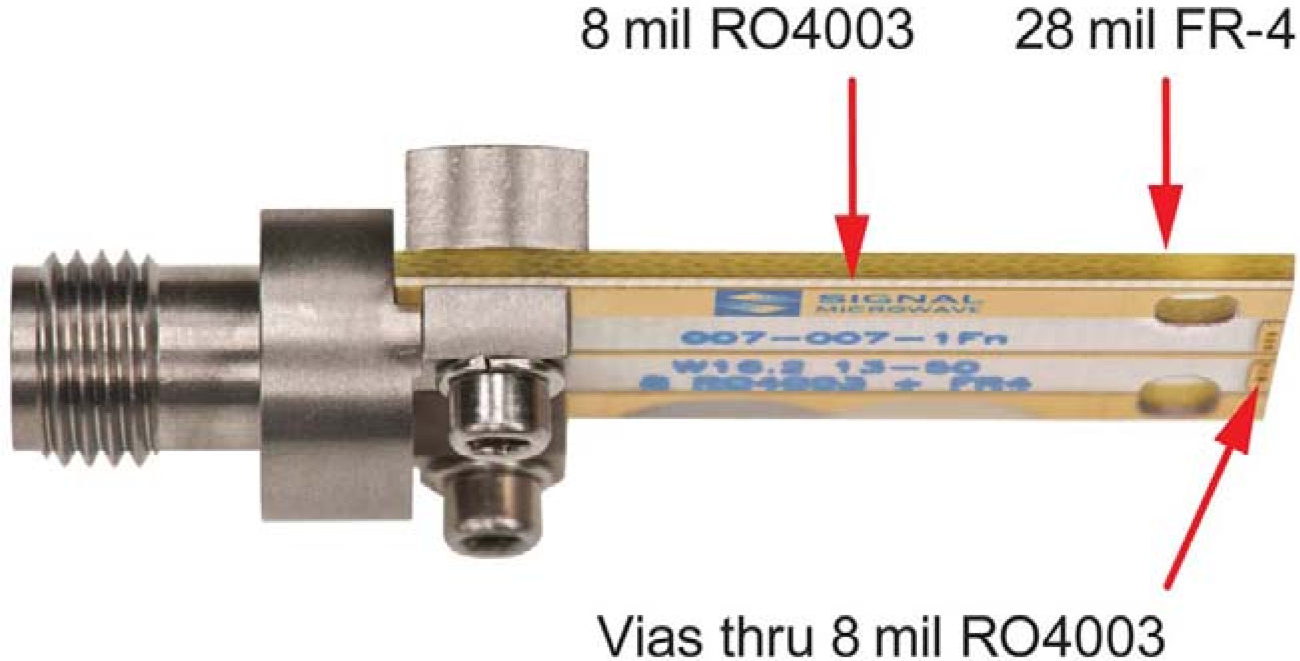
SIGNAL MICROWAVE

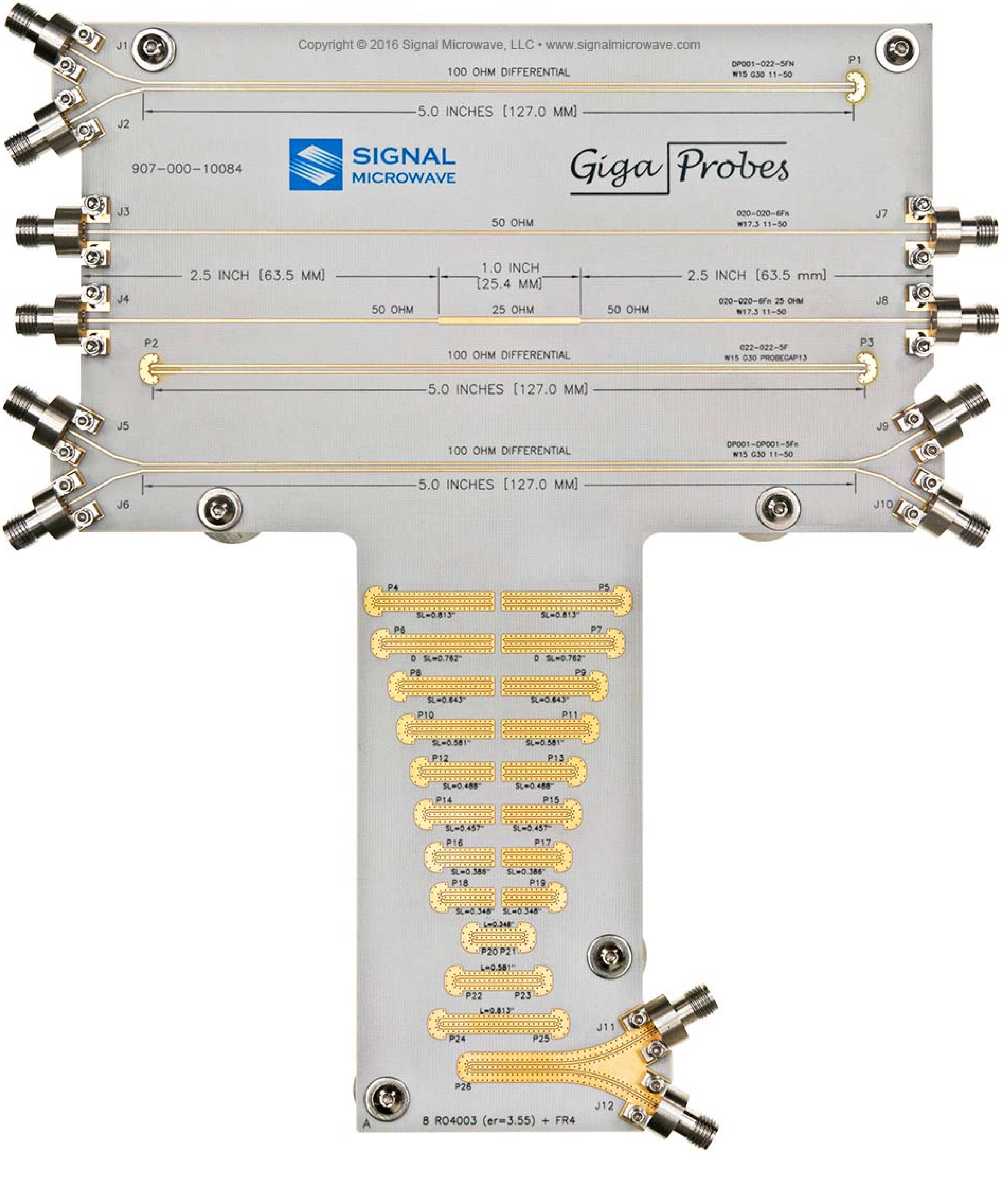

Copyright © 2016 Signal Microwave, LLC • www.signalmicrowave.com
J1
J2
J13
J14
100 OHM DIFFERENTIAL
5.0 INCHES [127.0 mm]
SIGNAL MICROWAVE
Anritsu
Giga Probes
907-000-10077
J3
J15
50 OHM
J4
J16
50 OHM
25 OHM
50 OHM
2.5 INCH [63.5 mm]
1.0 INCH [25.4 mm]
2.5 INCH [63.5 mm]
J5
J17
85 OHM DIFFERENTIAL
5.0 INCHES [127.0 mm]
J6
J18
8 RO4003 (er=3.55) + FR4
J7
J19
3 + 2.78 INCH
(~444 ps Offset)
J8
J20
3 INCH SHORT
3 INCH SHORT
J9
J21
3 INCH OPEN
3 INCH OPEN
J10
J22
3 + .340 INCH
(~54 ps Offset)
J11
J23
3 + .042 INCH
(~6.75 ps Offset)
J12
J24
3 INCH THRU
A

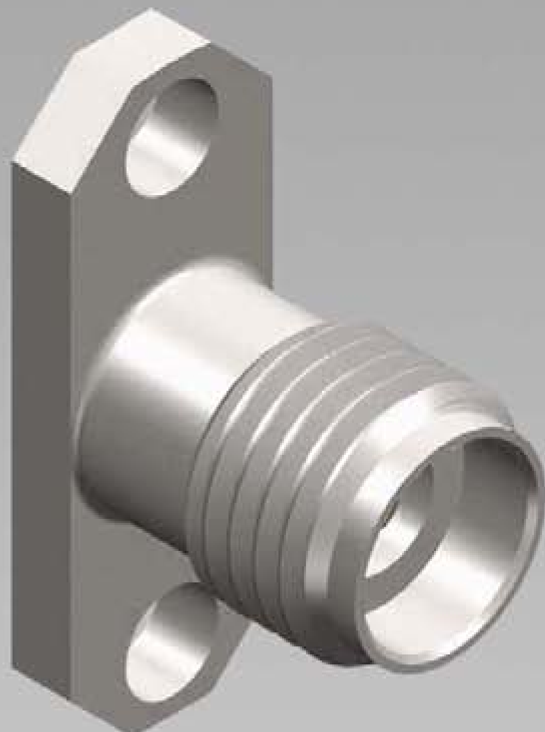
Narrow Profile
ELF67-001

Standard Profile
ELF67-002

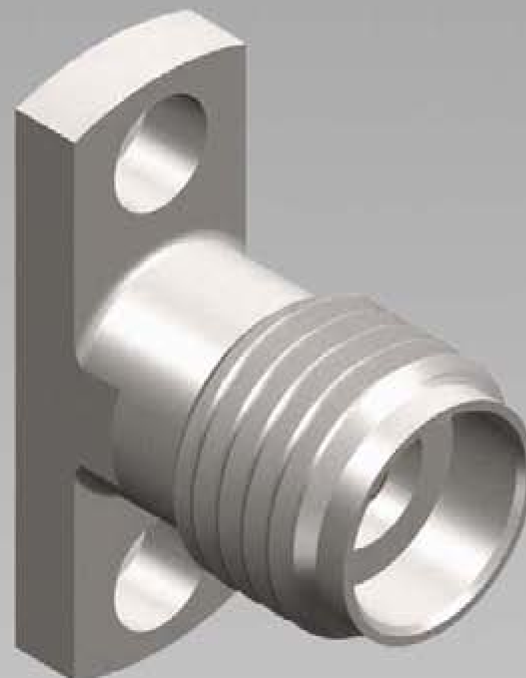

Vias not thru FR-4 backer


8 mil RO4003
28 mil FR-4
Vias thru 8 mil RO4003

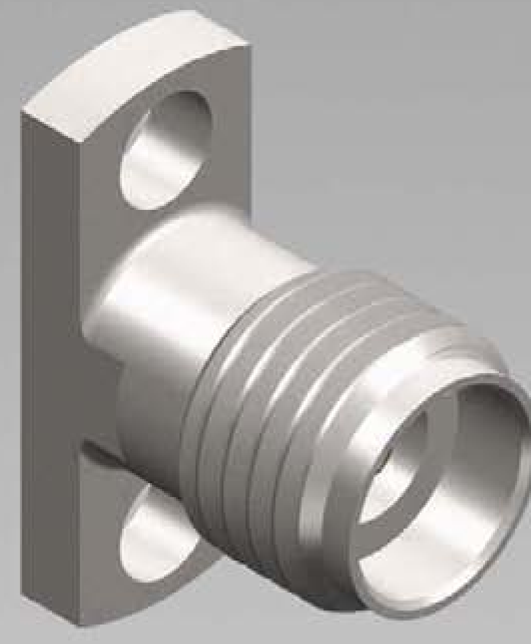

Copyright © 2016 Signal Microwave, LLC • www.signalmicrowave.com
100 OHM DIFFERENTIAL
5.0 INCHES [127.0 MM]
907-000-10084
SIGNAL
MICROWAVE
Giga Probes
50 OHM
2.5 INCH [63.5 MM]
1.0 INCH
[25.4 MM]
2.5 INCH [63.5 mm]
25 OHM
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J11
J12
P1
P2
P3
8 RO4003 (er=3.55) + FR4



FRF40-001
(.625 in)

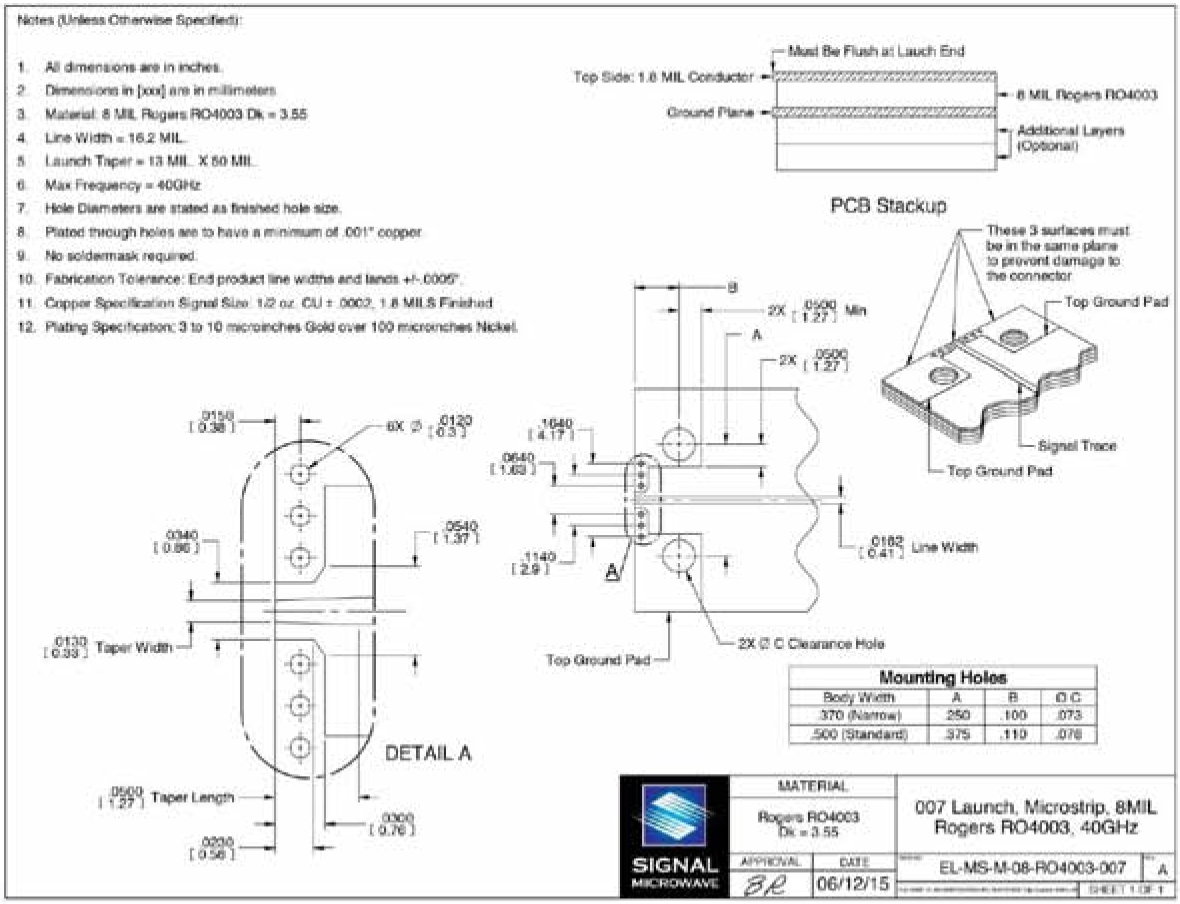


FRF40-002
(.550 in)



FRF40-003
(.500 in)

Microstrip Design Example for 8 mil RO4003

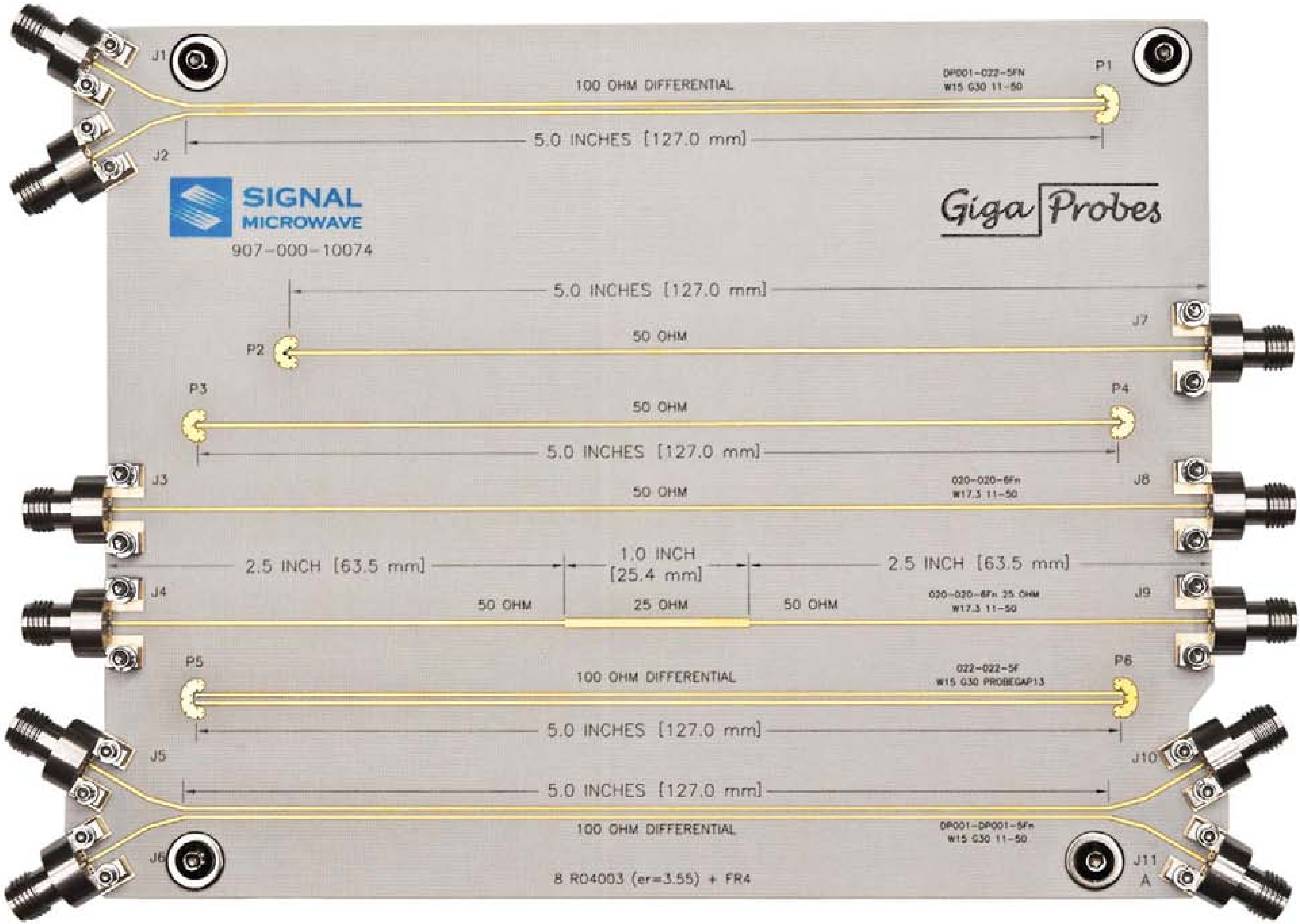


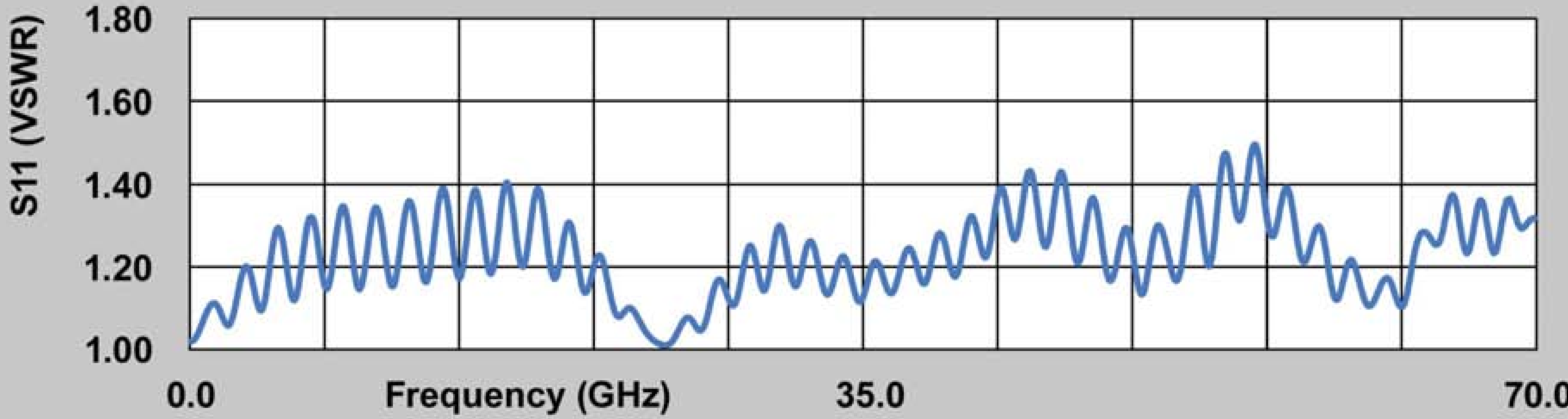
Mounting Holes			
Body Width	A	B	Ø C
.370 (Narrow)	.250	.100	.073
.500 (Standard)	.375	.110	.076

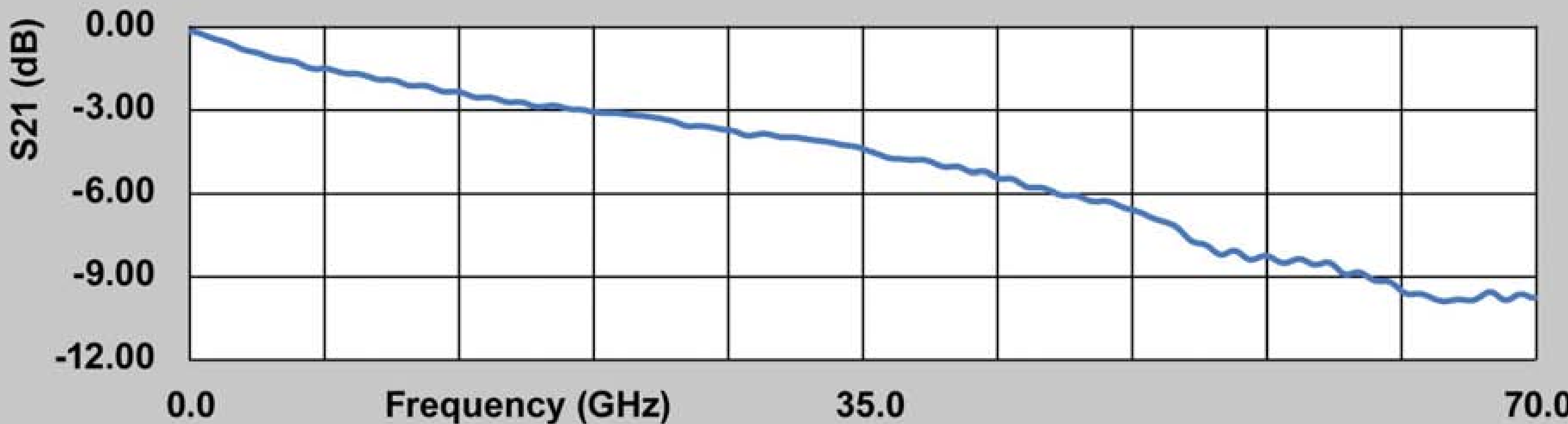
SIGNAL MICROWAVE

Board Mounted Flush to Connector
(zero gap for smooth signal transition)

Gap causes poor connection
at higher frequency


J1
J2
P1
100 OHM DIFFERENTIAL
DP001-022-5FN
W15 G30 11-50
5.0 INCHES [127.0 mm]
SIGNAL
MICROWAVE
907-000-10074
Giga Probes
5.0 INCHES [127.0 mm]
J7
P2
50 OHM
P3
P4
50 OHM
5.0 INCHES [127.0 mm]
J3
J8
50 OHM
020-020-6Fn
W17.3 11-50
2.5 INCH [63.5 mm]
1.0 INCH
[25.4 mm]
2.5 INCH [63.5 mm]
J4
J9
50 OHM
25 OHM
50 OHM
020-020-6Fn 25 OHM
W17.3 11-50
P5
P6
100 OHM DIFFERENTIAL
022-022-5F
W15 G30 PROBEGAP13
5.0 INCHES [127.0 mm]
J5
J10
5.0 INCHES [127.0 mm]
100 OHM DIFFERENTIAL
DP001-DP001-5Fn
W15 G30 11-50
J6
J11
A
8 RO4003 (er=3.55) + FR4


S11 (VSWR)
1.80
1.60
1.40
1.20
1.00
0.0
Frequency (GHz)
35.0
70.0


S21 (dB)
0.00
-3.00
-6.00
-9.00
-12.00
0.0
Frequency (GHz)
35.0
70.0


SIGNAL
MICROWAVE
020-020-2Fn
W17.3 10-50
8 RO4003 + FR4