

## for RF testing up to 110GHz

# 2021





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# Product Overview

PENPROBE, equipped with coaxial connectors for coaxial cable solutions, has 4 types of coaxial connectors from 2.92mm to 1mm providing various frequency range solutions from DC to 110GHz. Each connector types are equipped with various probe-contactor configurations (GSG, GS, SG), 4 types of probe-contactor pitch 75um, 100um, 150um, 200um for fast delivery, and 3 types of equipped connector angles (30, 45 or 90 degrees).

Impedance Standard Substrate (ISS) and Absorbing ISS base are also available.







PENPROBE is designed for RF probe-test with coaxial cable system. Its probe-contactor is made of photolithographic pattern plated Ni to the copper foil on the laminated liquid crystal polymer (LCP) film, thus realizing good contactor coplanarity, durability and RF performance such as insertion loss/ return loss. PENPROBE has various frequency range models and probe-contactor configurations aiming for versatile RF probe-testing.

- 2.92mm/K connector : DC-40GHz
- 2.4mm connector : DC-50GHz
- 1.85mm connector : DC-67GHz
- 1mm connector : DC-110GHz
- Probe-contactor : GSG, GS, SG
- Pitches: 75, 100, 150, 200um (These are available for fast delivery)
- Equipped Connector angles: 30, 45 or 90 degrees

### Impedance Standard Substrate (ISS)



Impedance Standard Substrate (ISS) is supported for your high-frequency probing applications. Each has various ISS types based on probe contactor configurations, pitch matrix and frequency ranges.

- Frequency classification : DC-40GHz, DC-110GHz
- Probe-contactor configuration : GSG and GS/SG
- Pitch : 50-75um, 75-150um and 150-250um

#### **MODEL PC40 Series**

The Model PC40 series of PENPROBE serves high performance microwave probe testing from DC to 40GHz. PC40 series is composed of a low loss coaxial cable and the photolithographic pattern plated Ni contactors on the laminated LCP film. This series has 3 different probe-contactor configurations of GSG (Ground Signal Ground), GS, and SG denoted as PC40S, PC40L, and PC40R each. The Model PC40S45 achieves an insertion loss less than 0.6dB(typ.) and a return loss greater than 17dB(typ.) through 40GHz. PC40 series realizes good contact capability and coplanarity thanks to the plated Ni hardness, laminated LCP film resilience and photographic plating process. PC40 series can be mounted in various adapters for use in standard microwave probe station.



PC40S Performance Data



Typical insertion loss of Model PC40S45N100A PENPROBE when touching thru pattern on ISS.

#### **PC40S** Features

- Durable
- Insertion loss less than 0.6dB(typ.)
- •Return loss more than 17dB(typ.)
- Equipped Connector angles 30, 45 or 90 degrees
- Photolithographic pattern
  plated Ni contactor
- Pitch 75, 100, 150, 200 microns (These are available for fast delivery)
- Available with 2.92mm/K connector which is compatible with SMA and 3.5mm connector



Typical return loss of a Model PC40S45N100A PENPROBE when touching 50 ohm load on ISS.



Model numbering convention of PC40 series is as follows:



When ordering Model PC40 series, please use the above model numbering convention.

Contactor Configuration and Pitch

**Configuration**: Specify GSG, GS, and SG for contactor configurations where S is the signal contactor and G is the ground contactor. However, GS and SG contactor types are used up to 10GHz.

**Pitch**: Specify ground (G) center to signal (S) center spacing as 75, 100, 150 or 200 microns for standard products. Please inquire if any specific spacing is required.



Photolithographic pattern plated Ni contactor of Model PC40 series.

Probe Form and Dimensions

#### **MODEL PC50 Series**

The Model PC50 series of PENPROBE serves high performance microwave probe testing from DC to 50GHz. PC50 series is composed of a low loss coaxial cable and the photolithographic pattern plated Ni contactors on the laminated LCP film. This series has a probe contactor configurations of GSG (Ground Signal Ground), denoted as PC50S. The Model PC50S achieves an insertion loss less than 0.7dB(typ.) and a return loss greater than 15dB(typ.) through 50GHz. PC50 series realizes good contact capability and planarity thanks to the plated Ni hardness, laminated LCP film resilience and photographic plating process. PC50 series can be mounted in various adapters for use in standard microwave probe station.







Typical insertion loss of Model PC50S45N100A PENPROBE when touching thru pattern on ISS.

#### PC50S Features

- Durable
- •Insertion loss less than 0.7dB(typ.)
- Return loss more than 15dB(typ.)
- Equipped Connector angles 30, 45 or 90 degrees
- Photolithographic pattern
  plated Ni contactor
- Pitch 75, 100, 150, 200 microns
- (These are available for fast delivery)
- Available with 2.4mm connector



Typical return loss of a Model PC50S45N100A PENPROBE when touching 50 ohm load on ISS.

Model Numbering Convention

Model numbering convention of PC50 series is as follows:

|                                    | <u>PC50</u>  | <u>S</u> | <u>30</u> | <u>N</u> | <u>075</u> | A |
|------------------------------------|--------------|----------|-----------|----------|------------|---|
| Model number                       |              |          |           |          |            |   |
|                                    |              |          |           |          |            |   |
| Contactor configuration            |              |          |           |          |            |   |
| (5.050)                            | 5 an 00 daam |          |           |          |            |   |
| Equipped connector angle (30, 43   | or 90 degre  | ees)     |           |          |            |   |
| Delimiter                          |              |          |           |          |            |   |
| Pitch (75, 100, 150, 200, etc., mi | crons) —     |          |           |          |            |   |
| Revision letter                    |              |          |           |          |            |   |

When ordering Model PC50 series, please use the above model numbering convention.

Contactor Configuration and Pitch

**Configuration**: Specify GSG for contactor configurations where S is the signal contactor and G is the ground contactor.

**Pitch**: Specify ground (G) center to signal (S) center spacing as 75, 100, 150 or 200 microns for standard products. Please inquire if any specific spacing is required.









Photolithographic pattern plated Ni contactor of Model PC50 series.



#### MODEL PC67 Series

The Model PC67 series of PENPROBE serves high performance microwave probe testing from DC to 67GHz. PC67 series is composed of a low loss coaxial cable and the photolithographic pattern plated Ni contactors on the laminated LCP film. This series has a probe contactor configurations of GSG (Ground Signal Ground), denoted as PC67S. The Model PC67S achieves an insertion loss less than 0.9dB(typ.) and a return loss greater than 15dB(typ.) through 67GHz. PC67 series realizes good contact capability and coplanarity thanks to the plated Ni hardness, laminated LCP film resilience and photographic plating process. PC67 series can be mounted in various adapters for use in standard microwave probe station.



PC67S Performance Data



Typical insertion loss of Model PC67S45N100A PENPROBE when touching thru pattern on ISS.

#### PC67S Features

• Durable

- •Insertion loss less than 0.9dB(typ.)
- Return loss more than 15dB(typ.)
- Equipped Connector angles 30, 45 or 90 degrees
- Photolithographic pattern
  plated Ni contactor
- Pitch 75, 100, 150, 200 microns
- (These are available for fast delivery) • Available with 1.85mm connector



Typical return loss of a Model PC67S45N100A PENPROBE when touching 50 ohm load on ISS.

Model Numbering Convention

Model numbering convention of PC67 series is as follows:



When ordering Model PC67 series, please use the above model numbering convention.

**Contactor Configuration and Pitch** 

Configuration: Specify GSG for contactor configurations where S is the signal contactor and G is the ground contactor.

Pitch: Specify ground (G) center to signal (S) center spacing as 75, 100, 150 or 200 microns for standard products. Please inquire if any specific spacing is required.









Photolithographic pattern plated Ni contactor of Model PC67 series.



#### MODEL PC110 Series

The Model PC110 series of PENPROBE serves high performance microwave probe testing from DC to 110GHz. PC110 series is composed of a low loss coaxial cable and the photolithographic pattern plated Ni contactors on the laminated LCP film. This series has a probe contactor configurations of GSG (Ground-Signal-Ground), denoted as PC110S. The Model PC110S achieves an insertion loss less than 1.5dB(typ.) and a return loss greater than 15dB(typ.) through 110GHz. PC110 series realizes good contact capability and coplanarity thanks to the plated Ni hardness, laminated LCP film resilience and photographic plating process. PC110 series can be mounted in various adapters for use in standard microwave probe station.



PC110S Performance Data



Typical insertion loss of Model PC110S45N100A PENPROBE when touching thru pattern on ISS.

#### **PC110S** Features

• Durable

- •Insertion loss less than 1.5dB(typ.)
- Return loss more than 15dB(typ.)
- Equipped Connector angles 30, 45 or 90 degrees
- Photolithographic pattern
  plated Ni contactor
- Pitch 75, 100, 150, 200 microns
- (These are available for fast delivery)
- ·Available with 1mm connector



Typical return loss of a Model PC110S45N100A PENPROBE when touching 50 ohm load on ISS.

Model Numbering Convention

Model numbering convention of PC110 series is as follows:

|                                     | <u>PC110</u> | <u>S</u> | <u>30</u> | <u>N</u> | <u>075</u> | A |
|-------------------------------------|--------------|----------|-----------|----------|------------|---|
| Model number                        |              |          |           |          |            |   |
| Contactor configuration             |              |          |           |          |            |   |
| (S: GSG)                            |              |          |           |          |            |   |
| Equipped connector angle (30, 45    | or 90 degree | es) –    |           |          |            |   |
| Delimiter                           |              |          |           | _1       |            |   |
| Pitch (75, 100, 150, 200, etc., mic | rons) —      |          |           |          | ]          |   |
| Revision letter                     |              |          |           |          |            |   |

When ordering Model PC110 series, please use the above model numbering convention.

Contactor Configuration and Pitch

**Configuration**: Specify GSG for contactor configurations where S is the signal contactor and G is the ground contactor.

**Pitch**: Specify ground (G) center to signal (S) center spacing as 75, 100, 150 or 200 microns for standard products. Please inquire if any specific spacing is required.







GSG Photolithographic pattern plated Ni contactor of Model PC110 series.



# Impedance Standard Substrate

### **ISS** Series



The Impedance Standard Substrate (ISS) series is designed for the calibration of PENPROBE. ISS is classified into 2 frequency ranges; i.e. ISS40 for DC-40GHz, ISS110 for DC-110GHz. Each has detailed ISS model numbering convention based on probe contactor configurations and pitch matrix.

#### ISS40 Features

- DC-40GHz
- For GSG, GS/SG probe contactor calibration
- Ceramic substrate
- Pitch 75-150, 150-250 microns

#### **ISS110** Features

- · DC-110GHz
- For GSG probe contactor calibration
- Ceramic substrate
- Pitch 75-150, 150-250 microns

Model numbering convention

Model numbering convention of ISS series is as follows:





When ordering Model ISS series calibration accessories, please use the above model numbering convention.

#### yokowo

# Technical Information

### **PENPROBE**

#### Structure

- Probe has a coaxial connector input.
- · Coaxial cable is connected to the taper shaped, coplanar waveguide (PEN probe-head).
- Coplanar waveguide is fabricated by laminated LCP film substrate and has quite precise pattern dimensions.
- LCP film substrate has resilience and endurable against bend stress.
- The probe contactor is formed by plating with Ni to copper foil on a LCP film substrate and has sufficient endurance for production line use.



#### Electrical Characteristics

- The PENPROBE is 100% tested and warranted in  $S_{11}$ ,  $S_{22}$ ,  $S_{21}$ , and  $S_{12}$ . The test data is attached to individual PENPROBE.
- Typical contact resistance:  $50[m\Omega]$  on Al,  $30[m\Omega]$  on Au

#### Interface Compatibility

- Interface connector is : SMA F, APC3.5 F, 2.92mm/K-F, 2.4mm F, 1.85mm F, 1.0mm F
- Mount interface is compatible with general RF probes stations.

#### Mechanical Endurance

• PENPROBE has durability against over 500,000 times contact. The endurance test result is shown below.

#### yokowo



Note : The endurance test is done using GSG contactor where contact resistance is measured between S and G contactor on plated gold pattern.

#### Calibration

- YOKOWO provides ISS (Impedance Standard Substrate) for calibration.
- Standard SOLT (SHORT, OPEN, LOAD, THRU) calibration is recommended.
- LOAD standards are laser trimmed to have 50  $\pm$  1.5  $\Omega$  accuracy.
- ISS contains patterns for the self-calibration (TRL, LRM ).

Handling Precautions

- Amount of recommended overdrive: 30µm
- Amount of skating for maximum overdrive: 30µm
- Bias current : 500mA (max.) per one signal line
- Ambient temperature : -55 degree C to +125 degree C

## APPENDIX-1: Products Table

PENPROBE

| No  | . MODEL          | Frequency<br>Range (GHz) | Insertion Loss<br>(dB) | Return Loss<br>(dB) | Electrical<br>repeatability<br>(dB) | Probe pitch<br>(μm) | Contactor<br>Configuration | Min. Probe pad<br>size (μm) | Equipped<br>Connector<br>angle (degree) | Recommended<br>overtravel (μm) | Max safe<br>overtravel<br>(μm) | Contact life | MAX. DC<br>current (mA) | MAX. RF<br>Power @2GHz<br>(W) | Typical Contact<br>Resistance<br>on Al, Au (mΩ) | Thermal range<br>(degree-C) | Connector<br>(Max. frequency) | Contactor<br>material |
|-----|------------------|--------------------------|------------------------|---------------------|-------------------------------------|---------------------|----------------------------|-----------------------------|---|--------------------------------|--------------------------------|--------------|-------------------------|-------------------------------|---|-----------------------------|-------------------------------|-----------------------|
|     | (a) PC40S30N075A | DC-40                    | 0.6                    | 17                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (b) PC40S30N100A | DC-40                    | 0.6                    | 17                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (c) PC40S30N150A | DC-40                    | 0.6                    | 17                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (d) PC40S30N200A | DC-40                    | 0.6                    | 17                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (e) PC40S45N075A | DC-40                    | 0.6                    | 17                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
| 1   | (f) PC40S45N100A | DC-40                    | 0.6                    | 17                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
| ' L | (g) PC40S45N150A | DC-40                    | 0.6                    | 17                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (h) PC40S45N200A | DC-40                    | 0.6                    | 17                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (i) PC40S90N075A | DC-40                    | 1.1                    | 17                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (j) PC40S90N100A | DC-40                    | 1.1                    | 17                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (k) PC40S90N150A | DC-40                    | 1.1                    | 17                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (I) PC40S90N200A | DC-40                    | 1.1                    | 17                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (a) PC40L30N075A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 75                  | GS                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (b) PC40R30N075A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 75                  | SG                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (c) PC40L30N100A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 100                 | GS                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (d) PC40R30N100A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 100                 | SG                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (e) PC40L30N150A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 150                 | GS                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (f) PC40R30N150A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 150                 | SG                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (g) PC40L30N200A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 200                 | GS                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (h) PC40R30N200A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 200                 | SG                         | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (i) PC40L45N075A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 75                  | GS                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (j) PC40R45N075A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 75                  | SG                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (k) PC40L45N100A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 100                 | GS                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (I) PC40R45N100A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 100                 | SG                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
| 2   | (m) PC40L45N150A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 150                 | GS                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (n) PC40R45N150A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 150                 | SG                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (o) PC40L45N200A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 200                 | GS                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (p) PC40R45N200A | DC-10                    | 2.0@10GHz              | 10@10GHz            | -50                                 | 200                 | SG                         | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (q) PC40L90N075A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 75                  | GS                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (r) PC40R90N075A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 75                  | SG                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (s) PC40L90N100A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 100                 | GS                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (t) PC40R90N100A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 100                 | SG                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (u) PC40L90N150A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 150                 | GS                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (v) PC40R90N150A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 150                 | SG                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (w) PC40L90N200A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 200                 | GS                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |
|     | (x) PC40R90N200A | DC-10                    | 4.0@10GHz              | 10@10GHz            | -50                                 | 200                 | SG                         | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                  | -55 to 125                  | 2.92mm/K (40GHz, Note-1)      | Ni                    |

### Note-1; also compatible with SMA (18GHz) and 3.5mm (26.5GHz) connector

| Ν | 0.  | MODEL         | Frequency<br>Range (GHz) | Insertion Loss<br>(dB) | Return Loss<br>(dB) | Electrical<br>repeatability<br>(dB) | Probe pitch<br>(μm) | Contactor<br>Configuration | Min. Probe pad<br>size (μm) | Equipped<br>Connector<br>angle (degree) | Recommended<br>overtravel (μm) | Max safe<br>overtravel<br>(mm) | Contact life | MAX. DC<br>current (mA) | MAX. RF<br>Power @2GHz<br>(W) | Typical Contact Resistance on Al, Au $(m\Omega)$ | Thermal range<br>(degree-C) | Connector<br>(Max. frequency) | Contactor<br>material |
|---|-----|---------------|--------------------------|------------------------|---------------------|-------------------------------------|---------------------|----------------------------|-----------------------------|---|--------------------------------|--------------------------------|--------------|-------------------------|-------------------------------|--|-----------------------------|-------------------------------|-----------------------|
|   | (a) | PC50S30N075A  | DC-50                    | 0.7                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (b) | PC50S30N100A  | DC-50                    | 0.7                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (c) | PC50S30N150A  | DC-50                    | 0.7                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (d) | PC50S30N200A  | DC-50                    | 0.7                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (e) | PC50S45N075A  | DC-50                    | 0.7                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
| 3 | (f) | PC50S45N100A  | DC-50                    | 0.7                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
| 5 | (g) | PC50S45N150A  | DC-50                    | 0.7                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (h) | PC50S45N200A  | DC-50                    | 0.7                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (i) | PC50S90N075A  | DC-50                    | 1.2                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (j) | PC50S90N100A  | DC-50                    | 1.2                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (k) | PC50S90N150A  | DC-50                    | 1.2                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (I) | PC50S90N200A  | DC-50                    | 1.2                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 2.4mm (50GHz)                 | Ni                    |
|   | (a) | PC67S30N075A  | DC-67                    | 0.9                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (b) | PC67S30N100A  | DC-67                    | 0.9                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (c) | PC67S30N150A  | DC-67                    | 0.9                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (d) | PC67S30N200A  | DC-67                    | 0.9                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (e) | PC67S45N075A  | DC-67                    | 0.9                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
| 1 | (f) | PC67S45N100A  | DC-67                    | 0.9                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
| 4 | (g) | PC67S45N150A  | DC-67                    | 0.9                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (h) | PC67S45N200A  | DC-67                    | 0.9                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (i) | PC67S90N075A  | DC-67                    | 1.7                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (j) | PC67S90N100A  | DC-67                    | 1.7                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (k) | PC67S90N150A  | DC-67                    | 1.7                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (I) | PC67S90N200A  | DC-67                    | 1.7                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1.85mm (67GHz)                | Ni                    |
|   | (a) | PC110S30N075A | DC-110                   | 1.5                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (b) | PC110S30N100A | DC-110                   | 1.5                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (c) | PC110S30N150A | DC-110                   | 1.5                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (d) | PC110S30N200A | DC-110                   | 1.5                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 30                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(AI), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (e) | PC110S45N075A | DC-110                   | 1.5                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
| Б | (f) | PC110S45N100A | DC-110                   | 1.5                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
| 5 | (g) | PC110S45N150A | DC-110                   | 1.5                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (h) | PC110S45N200A | DC-110                   | 1.5                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 45                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (i) | PC110S90N075A | DC-110                   | 2.2                    | 15                  | -50                                 | 75                  | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (j) | PC110S90N100A | DC-110                   | 2.2                    | 15                  | -50                                 | 100                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (k) | PC110S90N150A | DC-110                   | 2.2                    | 15                  | -50                                 | 150                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |
|   | (I) | PC110S90N200A | DC-110                   | 2.2                    | 15                  | -50                                 | 200                 | GSG                        | 30 × 30                     | 90                                      | 50                             | 100                            | > 500,000    | 500                     | 5                             | 50(Al), 30(Au)                                   | -55 to 125                  | 1mm (110GHz)                  | Ni                    |

## ISS

| No. | MODEL      | Frequency Range<br>(GHz) | Pad<br>Configuaration | Pitch<br>(μm) |
|-----|------------|--------------------------|-----------------------|---------------|
| 1   | ISS40LR075 | DC-40                    | GSG, GS/SG            | 75–150        |
| 2   | ISS40S075  | DC-40                    | GSG                   | 75–250        |
| 3   | ISS110S075 | DC-110                   | GSG                   | 75-150        |
| 4   | ISS110S150 | DC-110                   | GSG                   | 150-250       |

# **APPENDIX-2**: Style and Dimensions

### PENPROBE

PENPROBE is equipped with the following three styles. Style A, B and C has a single signal contactor (GSG, GS, SG) at 30, 45, or 90 degrees equipped connector angle each.



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