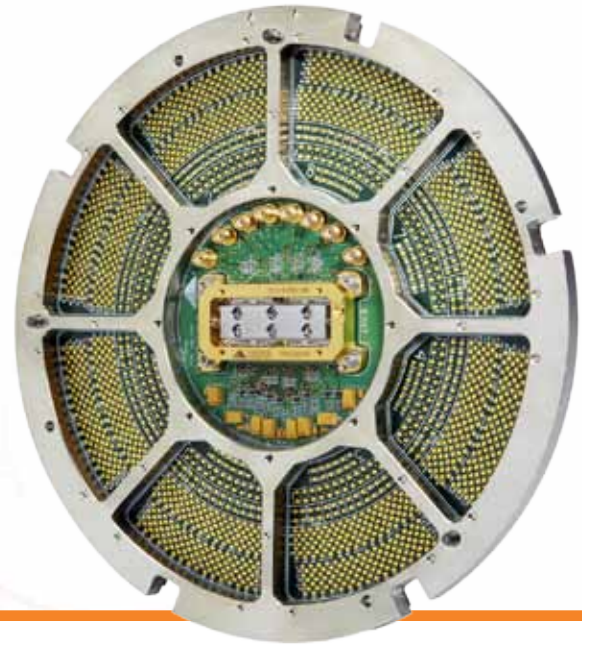


# RF Series

High-performance RF  
Pyramid Probe® cards



DATA SHEET

Cascade Microtech's high-performance RF Pyramid Probe cards provide state-of-the-art signal integrity for wireless RF and microwave production test. Microstrip transmission lines maintain impedance control all the way to the bond pad. Patented ground and power planes with bypass capacitors provide resonance-free power supplies directly to the IC. In addition, the RF Pyramid Probe card delivers minimal pad damage and extremely long life, dramatically reducing the cost of ownership versus other RF production probe card offerings. Cascade Microtech's innovative Pyramid Plus™ manufacturing process ensures a substantially lower cost of ownership, while delivering superior RF signal integrity in a single solution.

## FEATURES / BENEFITS

Superior signal performance	<p>High-bandwidth RF transmission lines and guarded DC traces to probe tips guarantee performance and ensure low signal loss.</p> <p>Patented ground and power planes, with bypass capacitors, provide resonance-free stable power supplies directly to the DUTs.</p> <p>Consistent low contact resistance and low-inductance probe tips ensure accurate and repeatable high-speed digital and analog measurements.</p>
Mechanical robustness	<p>MicroScrub® technology provides consistent low contact resistance and inductance on a variety of pad materials and flip-chip bumps.</p> <p>High-density photolithographically-placed contact probe tips are stable over lifetime of product.</p> <p>Low maintenance and permanent probe tip placement improve test cell uptime, reducing the cost of ownership compared to other probing technologies.</p>
Versatile and cost-effective	<p>Lower maintenance overhead with less cleaning and no need for probe tip alignment.</p>
Advanced membrane technology	<p>Cascade Microtech's industry-leading Pyramid Plus manufacturing process delivers higher performance, plus unique features that lower your cost of test.</p>

## MECHANICAL

P100-P800

P800-S

Minimum pitch, peripheral	50 $\mu\text{m}$	67 $\mu\text{m}$
Staggered pitch, peripheral	36 $\mu\text{m}$ /72 $\mu\text{m}$	44 $\mu\text{m}$ / 88 $\mu\text{m}$
Minimum pitch, array	180 $\mu\text{m}$	180 $\mu\text{m}$
Dimensional stability for lifetime	10 $\mu\text{m}$ for single temperature	10 $\mu\text{m}$ for single temperature
Probe tip size Al, Cu (nominal)	12 $\mu\text{m}$	N/A
Probe tip size Low K/PoAA (nominal)	18 $\mu\text{m}$	N/A
Probe tip size Au, solder balls (nominal)	25 $\mu\text{m}$	25 $\mu\text{m}$
Probe tip material	Non-oxidizing nickel alloy	Non-oxidizing nickel alloy
Temperature range	-50° C to 125° C	-50° C to 125° C
Pad and bump materials	Al, Cu, Au, all types of solder balls	All types of solder balls
Spring rate	1.67 g/mil	3.33 g/mil
Edge sense	Optional	Not available

## ELECTRICAL

Leakage	1.4 nA/V
Contact resistance	0.1 to 0.2 $\Omega$ (Al pads), 0.005 to 0.010 $\Omega$ (Au pads), 0.3 to 0.5 $\Omega$ (solder balls)
Maximum current / tip	1 A (Au pads), 200 mA (Al pads, Cu pads and solder balls)
Maximum power 50 $\Omega$ microstrip	+33 dBm CW, +36 dBm pulsed
Max. power 50 $\Omega$ Co-Planar Waveguide (CPW)	+33 dBm CW, +39 dBm pulsed

## POWER SUPPLY PERFORMANCE

Power trace impedance	10 $\Omega$
Power supply non-resonant	up to 10 GHz
Inductance to first capacitor	0.2 nH
Maximum current std power trace	1 A
Maximum current per power supply	10 A

## SIGNAL TRACE PERFORMANCE

### Standard

Signal line impedance	50 $\Omega$ nominal
Ground inductance (typical)	0.04 nH
Return loss ( $S_{11}$ ) to coax	>10 dB from 50 MHz to 20 GHz
Input reflection	$\pm 80$ mrho @ 50 $\Omega$

### Optional

Range of trace impedances	2 $\Omega$ to 120 $\Omega$ $\pm 20\%$
Differential impedance	50 $\Omega$ , 100 $\Omega$ and 200 $\Omega$

## SIGNAL TRACE LENGTH MATCHING

Typical pogo pad	No match
Custom line match	$\pm 1.5$ ps (3 ps window)

## SERIES PATH RESISTANCE (TYPICAL)

	P100	P300	P400	P500	P800/P800-S
DC resistance	1 $\Omega$	1 $\Omega$	1.6 $\Omega$	2.5 $\Omega$	2.5 $\Omega$
Microstrip	1.2 $\Omega$	1.2 $\Omega$	2 $\Omega$	3 $\Omega$	3 $\Omega$
CPW	0.8 $\Omega$	0.8 $\Omega$	1 $\Omega$	1.2 $\Omega$	1.2 $\Omega$

## TYPICAL ISOLATION MEASUREMENTS

Filter and switch	2 GHz	50 dB to 70 dB
High pin count	10 GHz	50 dB
Telecom	20 GHz	45 dB

## MATCHING NETWORKS EXAMPLES

	OUTPUT IMPEDANCE	COMPONENTS	CORRELATION TO PACKAGE
Power amplifiers	2 $\Omega$ to 8 $\Omega$	125 ps from DUT	$\pm 0.5$ dB
Wireless RF	100 $\Omega$ to 120 $\Omega$ differential	Balun on PCB	$\pm 1$ dB

## COMPONENTS ATTACHED TO MEMBRANE

Package type	SMT
Sizes	0201, 0402 (preferred), 0603, 0805

## COMPONENTS DEFINED WITHIN MEMBRANE

Inductors	0.3 nH to 1 nH ( $\pm 0.3$ nH)
Inductors	1 nH to 10 nH ( $\pm 30\%$ )
Trimmed inductors	0.3 nH to 10 nH ( $\pm 0.1$ nH)
Capacitors	20 fF to 2 pF ( $\pm 20\%$ )

## PYRAMID CORE OPTIONS

	P100	P300	P400	P500	P800	P800-S
I/O capacity	108	264	408	520	804	804
XY area (mm)	4.1 x 4.1	4.1 x 4.1	9.6 x 9.6	24 x 24	38 x 11	38.4 x 12.5
Components on core	32	32	40	100	120	120

## RF-CLASS BANDWIDTH AND RISE TIME PERFORMANCE

TRANSMISSION LINE			FRAME CORE BANDWIDTH AND RISE TIME					
Membrane	PCB	Connector	P100	P300	P400	P500	P800/P800-S	
Microstrip	Microstrip	Pogo pad	2 GHz 200 ps	2 GHz 200 ps	2 GHz 200 ps	2 GHz 200 ps	2 GHz 200 ps	
Microstrip	Microstrip	PCB coaxial	7 GHz 50 ps	7 GHz 50 ps	7 GHz 50 ps	7 GHz 50 ps	7 GHz 50 ps	
Microstrip	Coax	K or V	20 GHz 22 ps	20 GHz 22 ps	20 GHz 22 ps	15 GHz 25 ps	20 GHz 22 ps	
CPW	Coax	K or V	20 GHz 15 ps	20 GHz 15 ps	20 GHz 17 ps	20 GHz 22 ps	20 GHz 17 ps	

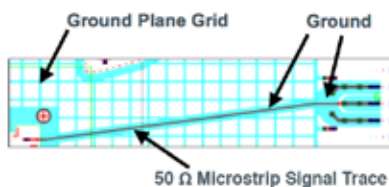
## PYRAMID CORE NAME CORRELATION

Frame core	P100	P300	P400	P500	P800	P800-S
Previous frame core	RFC	SRF	MSI	LSI	VLSR	N/A

## 50 $\Omega$ SIGNAL TRACE OPTIONS

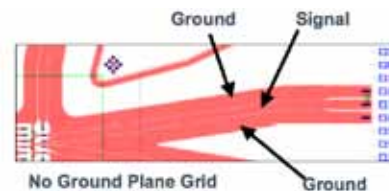
### Microstrip

Standard option
Higher routing density/Smaller trace width
Best choice for isolation



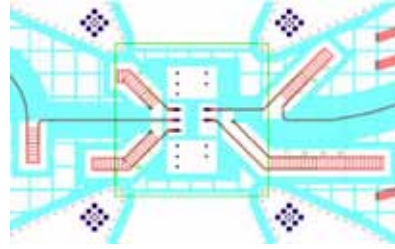
### Coplanar Waveguide (CPW)

Optional
Lower routing density/Wider trace width (GSG)
Higher power/Lower path resistance

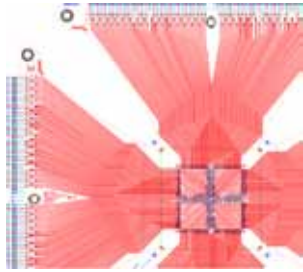


## EMULATING LEAD INDUCTANCE

- Some circuits require proper inductive loading
- Effects cannot be calibrated out easily
- Embed inductance on all interface pins into probe card
- Do not calibrate past lead inductance structures

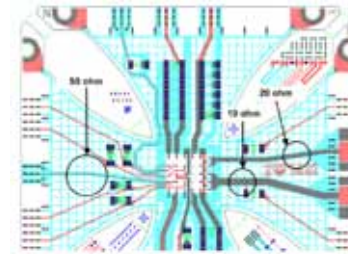


## MULTI-DUT TESTING (CELL PHONE PROCESSOR)



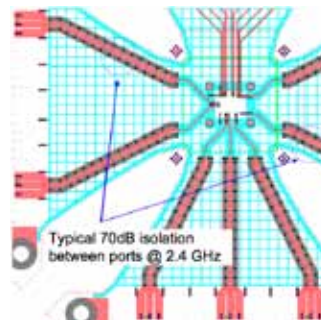
## IMPEDANCE MATCHING

- Not all devices operate at 50  $\Omega$
- Matching to real impedance is needed for many tests
- Incorporate into probe card
- Many techniques:
  - Lumped element
  - Quarter wave transmission line
  - Combination



## ISOLATION/CROSSTALK

- Port-to-port coupling must be less than the DUT
- Contain the fields within closed structures when possible
- Separate ports as best as possible
- Consider pad layout for isolation and test setup validation



Example: Multi-position RF switch

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PyramidRF-DS-0911

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