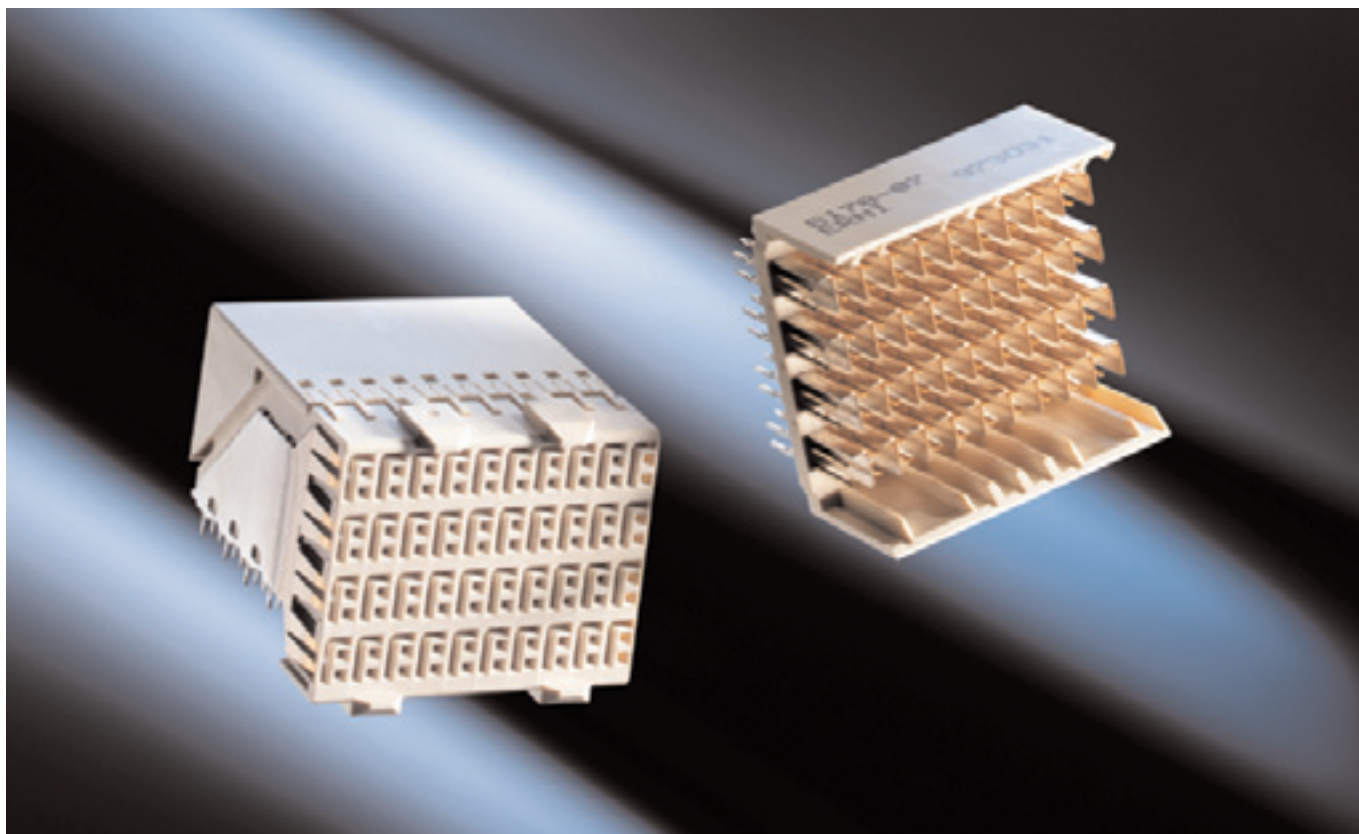


# ERmet ZD

## Application Note Version 1.1



### General

The ERmet ZD is specifically designed for high speed differential signaling in telecom applications at data rates of up to 5 Gbit/s. This robust, high performance, modular connector system is also designed to be used in conjunction with the 2mm hard metric (IEC 61076-4-101) family of connectors.

The connector meets the electrical performance requirements of high speed, low voltage differential signaling. The ERmet ZD connector family is available in pressfit versions. The backplane module is a male pin header that has three mating levels.

The robust mechanical design and excellent signal integrity are a result of the internal differential shielding scheme and the “L” shaped male shield blades. The inherently rigid male shields stand higher than the signal pins and surround each pair. An improved guidance feature completes the rugged mechanical design.

Optimized grid design to improve the RF characteristics.

Easy and economical trace routing achieved by in line-design of signal and ground pins.

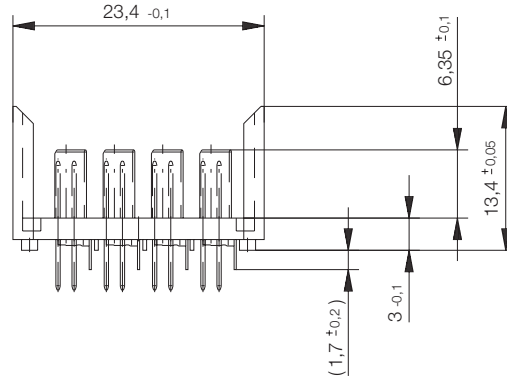
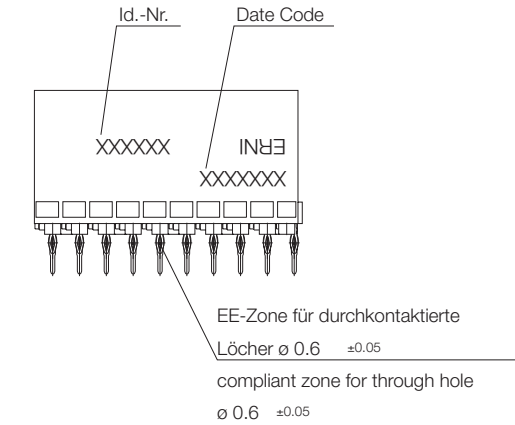
### Technical Features

- **Modules:** 2 pair, 3 pair and 4 pair versions available.
- **Design:** Wafers with individually fully shielded pairs of contacts.
- **Contacts:** Low noise, dual beam, leaf contacts with one ground blade for every pair of signals.
- **Wafer pitch:** 2.5mm from wafer to wafer.
- **Pitch between signal pins:** 1.5mm between pairs (within wafer).
- **Pitch between pairs:** 4.5mm (within wafer).
- **Ground arrangement:** In line with signals at termination and surrounding shield.
- **Multiline Crosstalk:** <3% at 100ps rise time, 250mV swing.
- **Insertion loss:** <1dB up to 3GHz.
- **Differential Impedance:** 100Ω
- **Propagation Delay:**

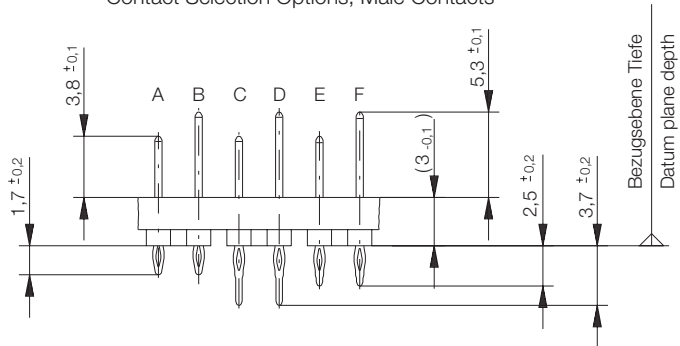
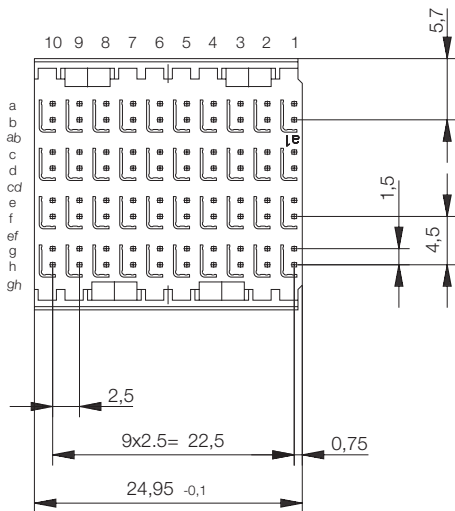
A Pin	97 ±10ps
B Pin	107 ±10ps
C Pin	125 ±10ps
D Pin	134 ±10ps
E Pin	157 ±10ps
F Pin	166 ±10ps
G Pin	187 ±10ps
H Pin	199 ±10ps
- **Power Modules:** Closed entry, vertical female backplane modules with stamped blades.
- **Alignment Features:** Improved pre-alignment guide and polarizing features, 4 rigid blades for all modules.

## Dimensional Drawings

Vertical Male Connectors 4 pair / 10 wafer



Kontaktversionen, Messerkontakte  
Contact Selection Options, Male Contacts

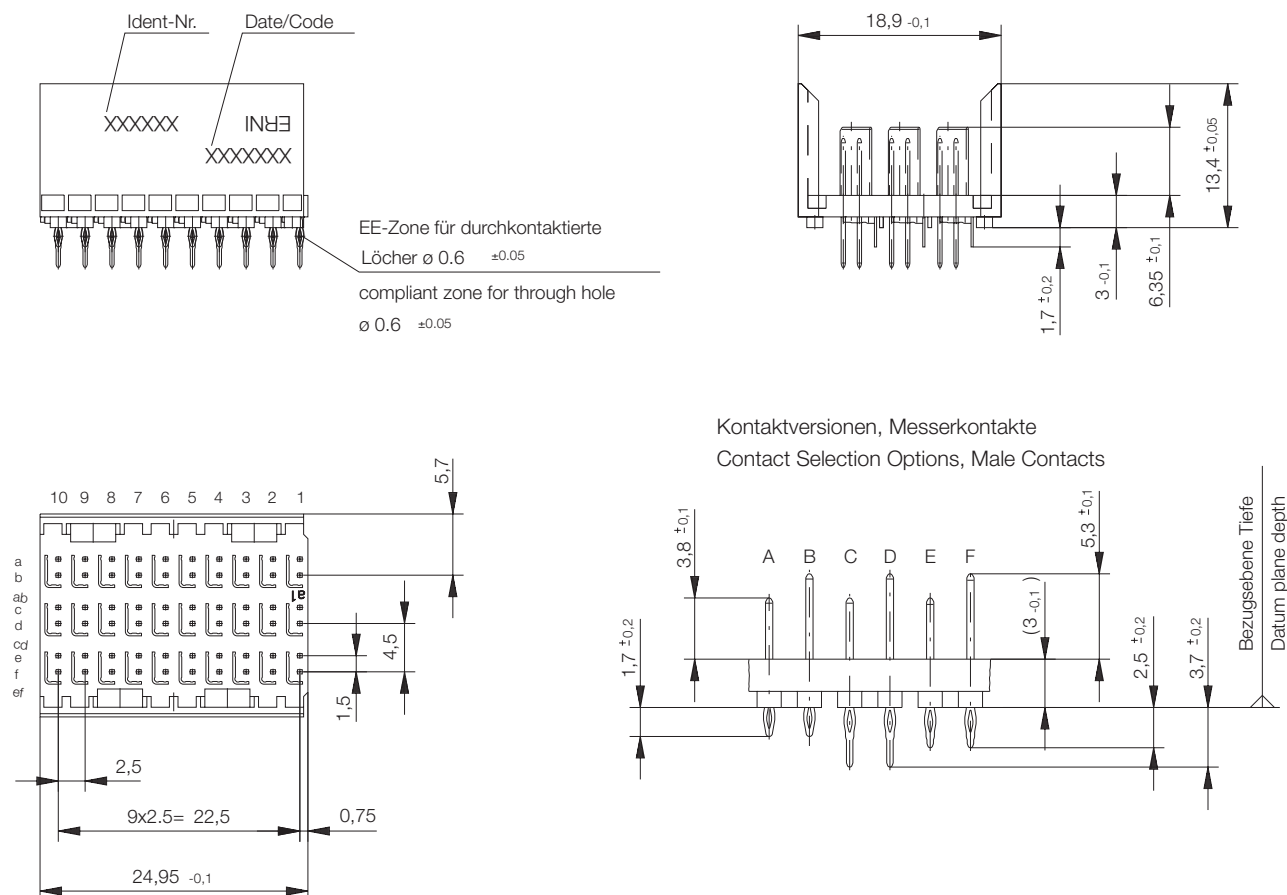


## Part Numbers

Configuration	Pin Version	Part Number
Type 4 (4 pairs) / 10 wafers	D	973031
Type 4 (4 pairs) / 10 wafers	B	973061

All dimensions in mm

## Vertical Male Connectors 3 pair / 10 wafer

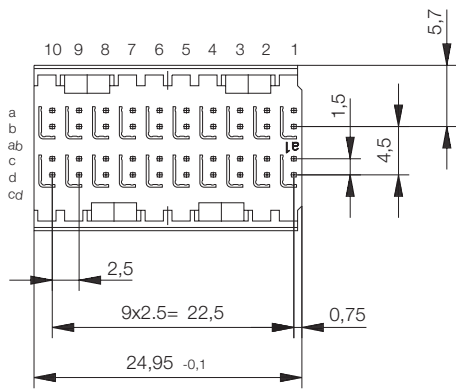
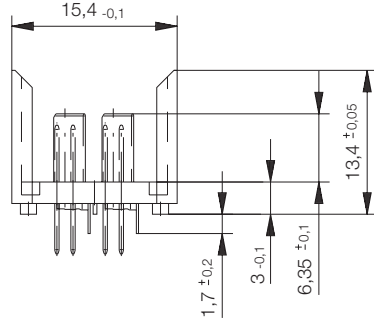
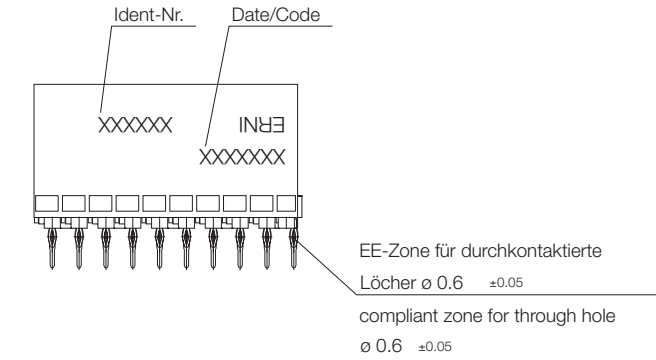


## Part Numbers

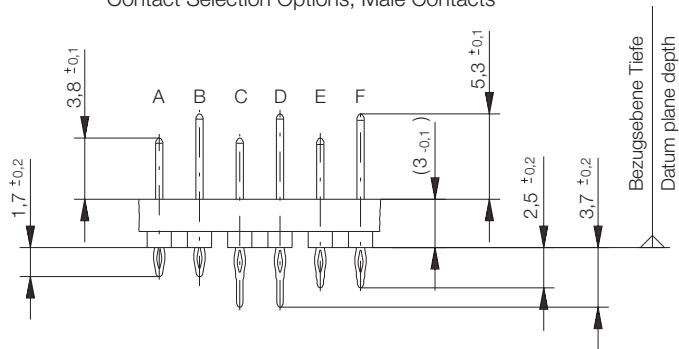
Configuration	Pin Version	Part Number
Type 3 (3 pairs) / 10 wafers	D	973027
Type 3 (3 pairs) / 10 wafers	B	973062

All dimensions in mm

Vertical Male Connectors 2 pair / 10 wafer



Kontaktversionen, Messerkontakte  
Contact Selection Options, Male Contacts

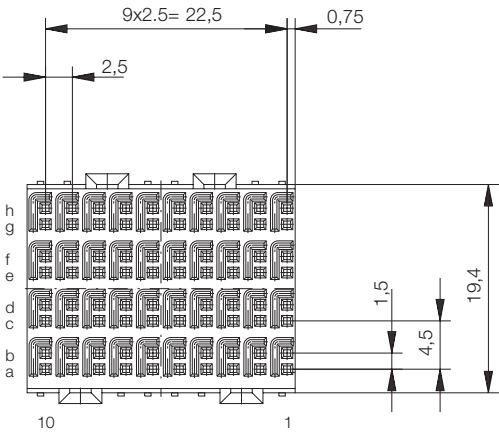


Part Numbers

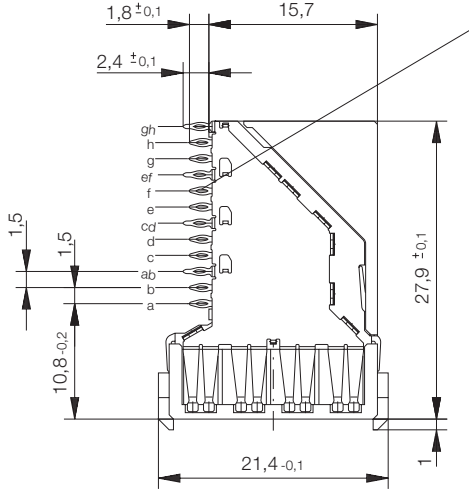
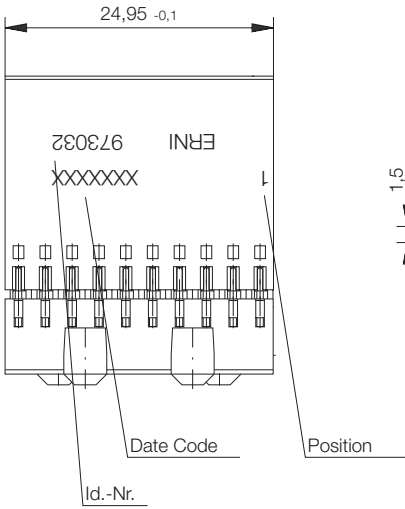
Configuration	Pin Version	Part Number
Type 2 (2 pairs) / 10 wafers	D	973056
Type 2 (2 pairs) / 10 wafers	B	973063

All dimensions in mm

Right Angle Female Connectors 4 pair / 10 wafer



EE-Zone für durchkontaktierte  
Löcher  $\varnothing 0.6 \pm 0.05$   
compliant zone for through hole  
 $\varnothing 0.6 \pm 0.05$

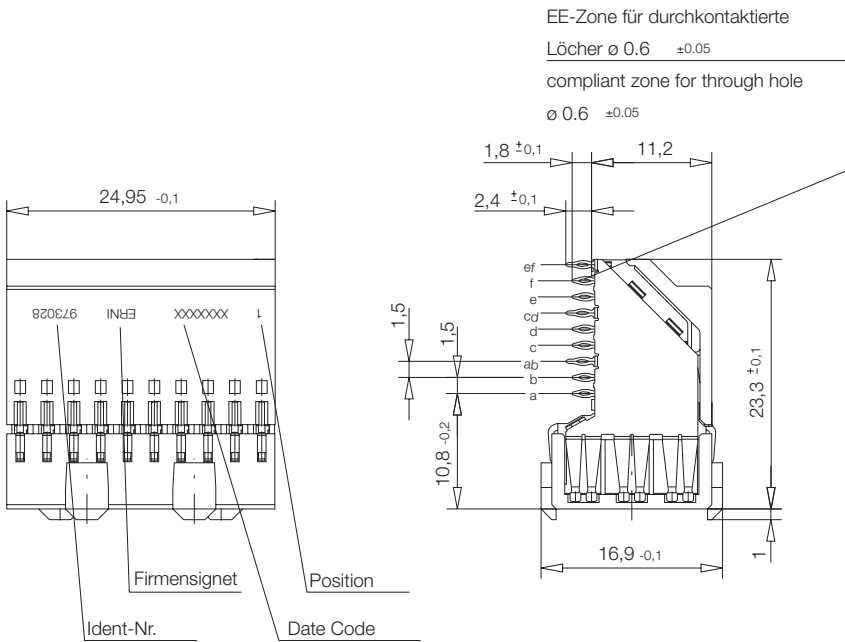
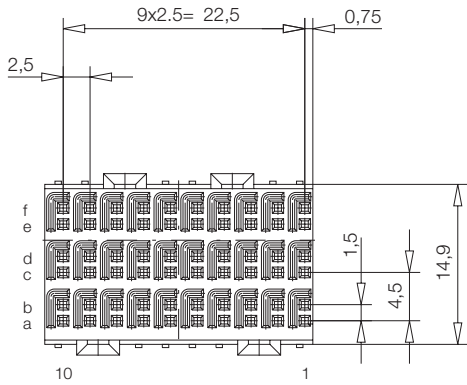


Part Numbers

Configuration	Part Number
Type 4 (4 pairs) / 10 wafers	973032

All dimensions in mm

Right Angle Female Connectors 3 pair / 10 wafer

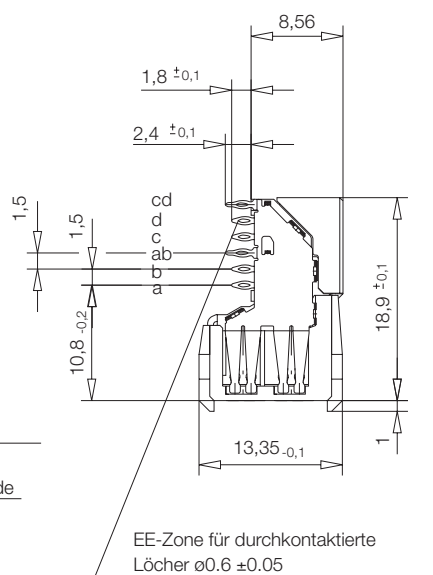
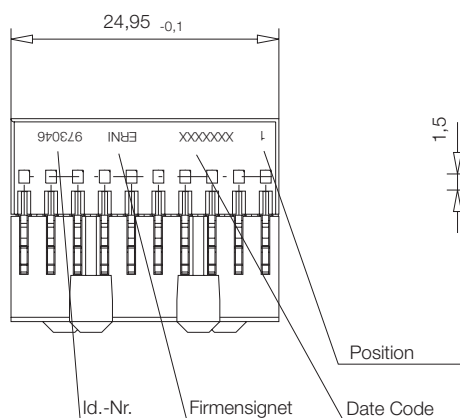
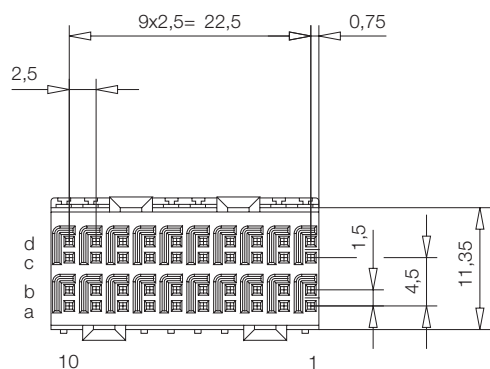


Part Numbers

Configuration	Part Number
Type 3 (3 pairs) / 10 wafers	973028

All dimensions in mm

## Right Angle Female Connectors 2 pair / 10 wafer



EE-Zone für durchkontaktierte  
Löcher  $\varnothing 0,6 \pm 0,05$

compliant zone for through hole  
 $\varnothing 0,6 \pm 0,05$

## Part Numbers

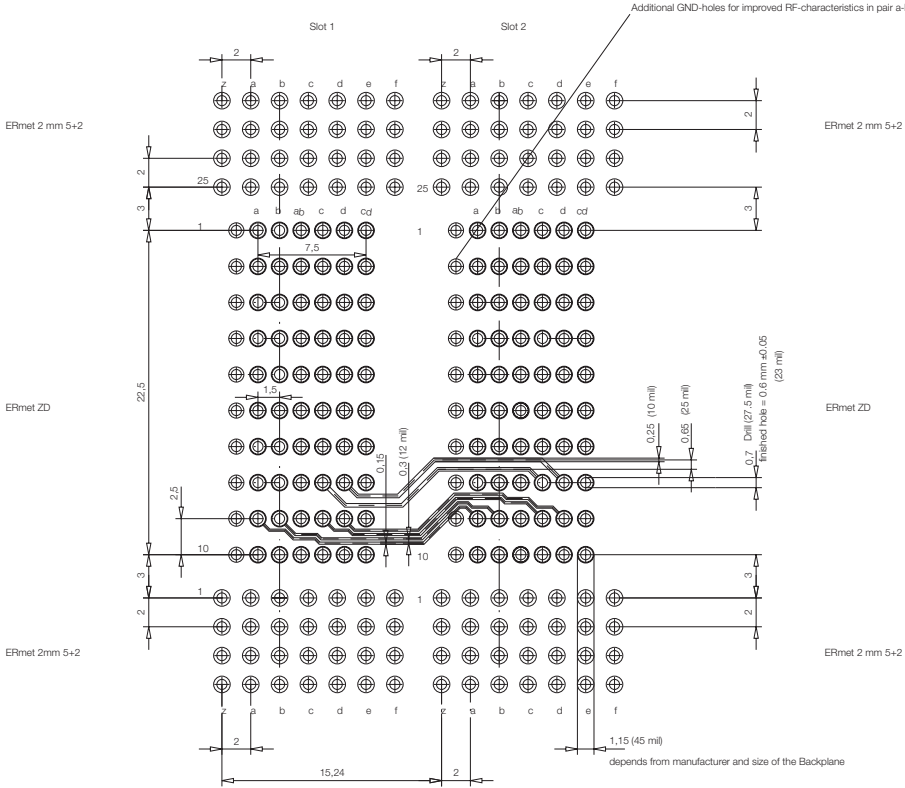
Configuration	Part Number
Type 2 (2 pairs) / 10 wafers	973046

All dimensions in mm

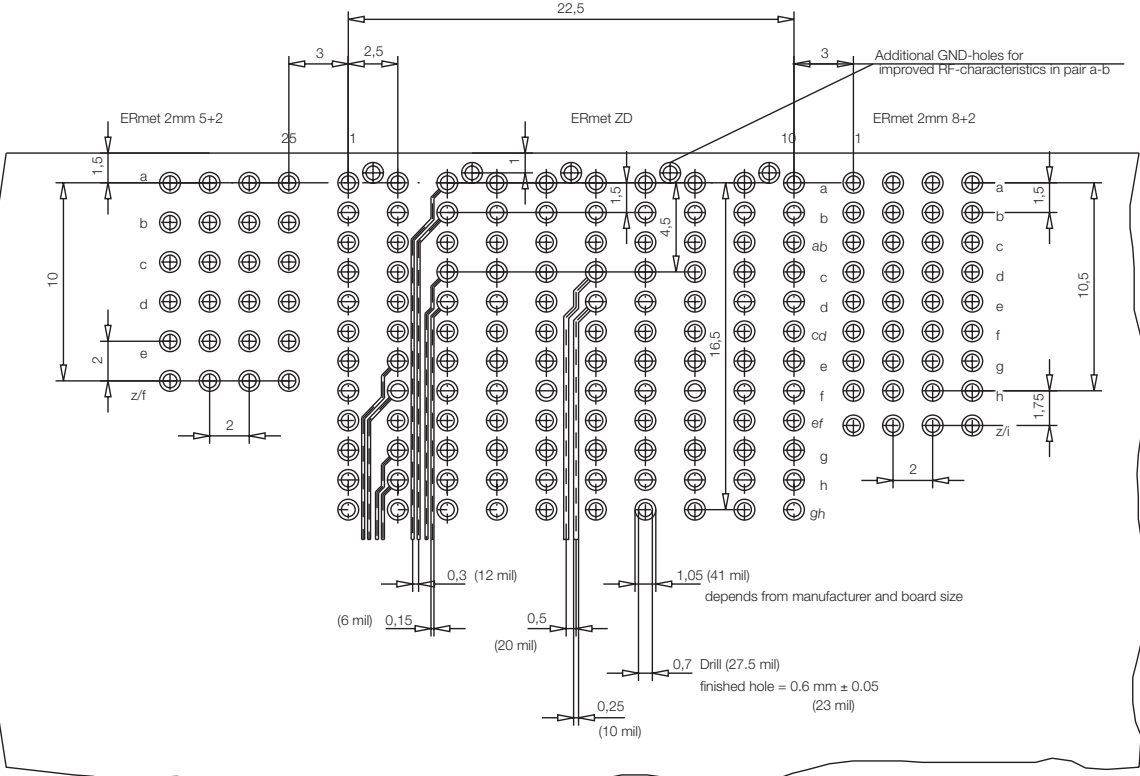




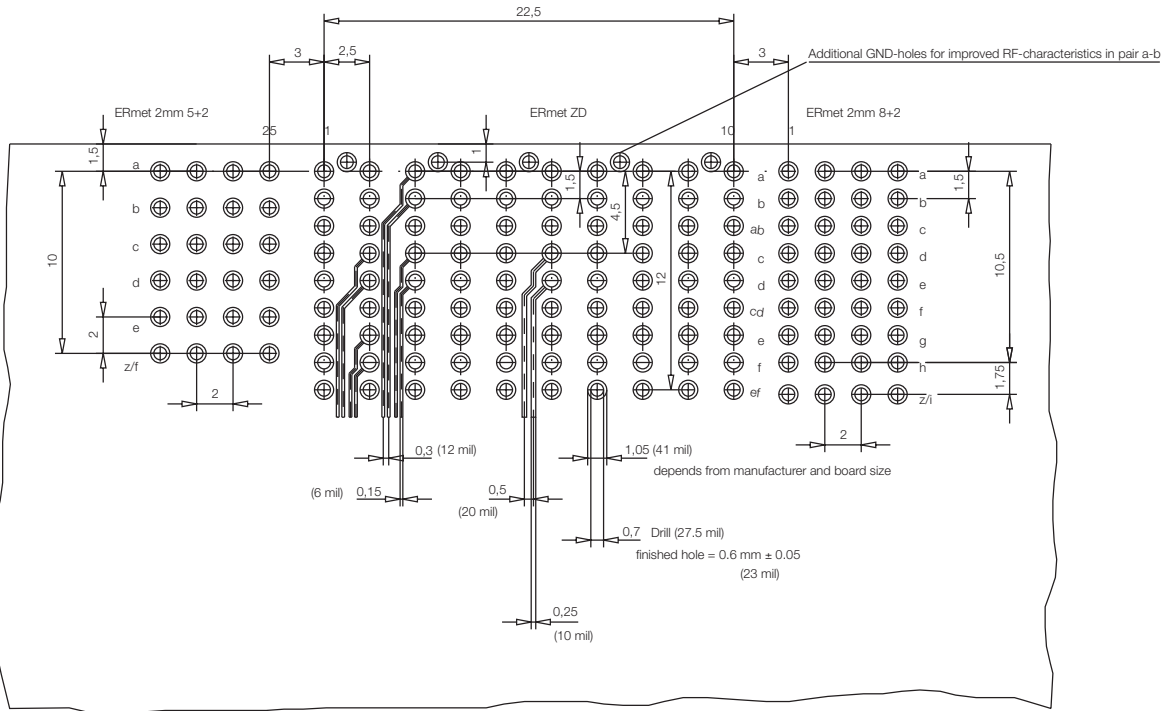
Backplane Layout 2 Pair



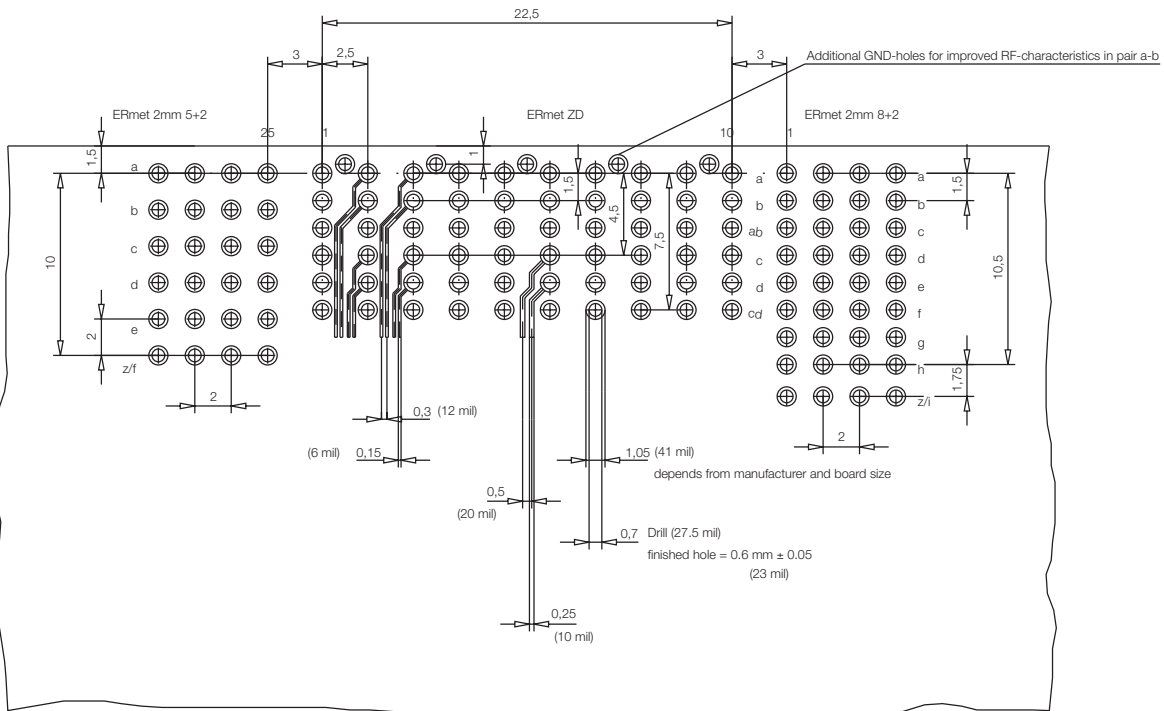
Daughtercard Layout 4 Pair



### Daughtercard Layout 3 Pair



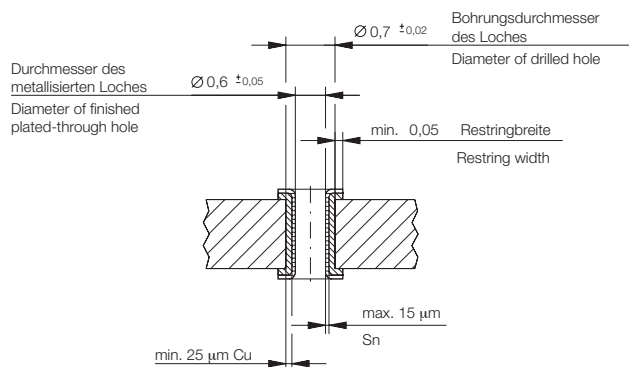
### Daughtercard Layout 2 Pair



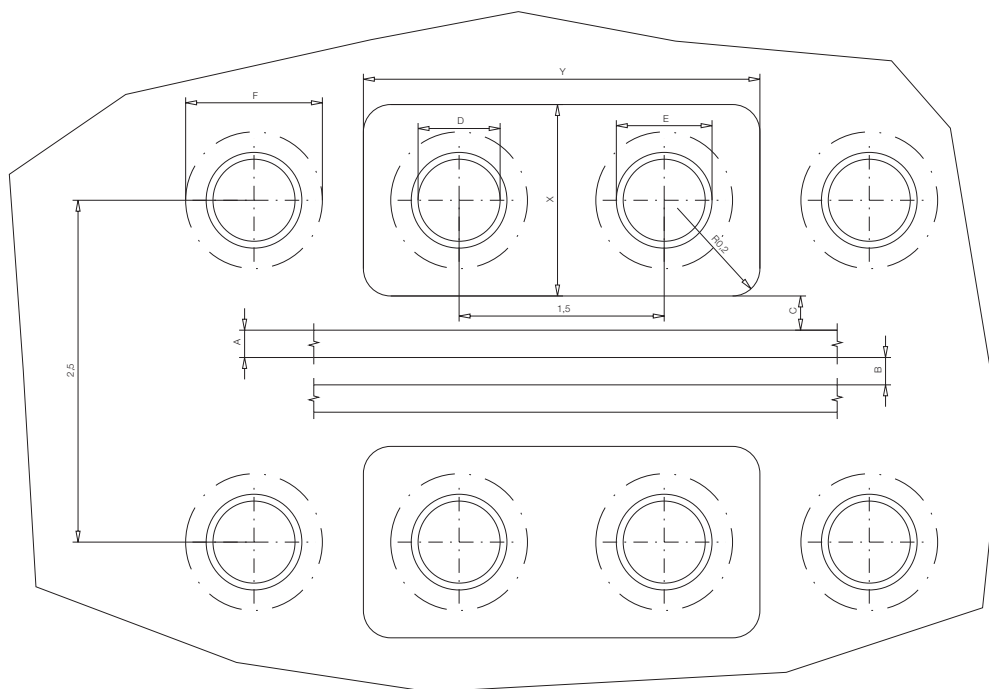
All dimensions in mm

### Plated Through-Holes for Pressfit Terminals

All ERmet ZD, ERmet 5+2, ERmet 8+2 and ERmet Power Module pressfit terminals share the same plated through-hole requirements. These pressfit terminals have been used successfully with reflowed tin-lead, plated tin-lead, immersion tin, organic coatings over bare copper and immersion gold hole plating regimes. The hole recommendations and press in force information shown in this catalog are for reflowed tin-lead and plated tin-lead. Additional test data for other hole plating regimes are available through customer service.



### Antipad Size



#### Drawing shows one differential track pair

- A = trackwidth
- B = space between tracks
- C = space
- D = plated hole
- E = drill hole
- F = pad diameter
- X x Y = antipad size

#### The table below shows two examples for the antipad size

No. of Track-Pairs	Pad-Diameter F	Antipad Size X x Y	Space C	Trackwidth A	Space between Tracks B
2	1.0mm	1.3 x 2.8mm	0.075mm*	0.15mm	0.15mm
1	1.0mm	1.4 x 2.9mm	0.1mm*	0.25mm	0.4mm

\* overlapping is necessary because of impedance control

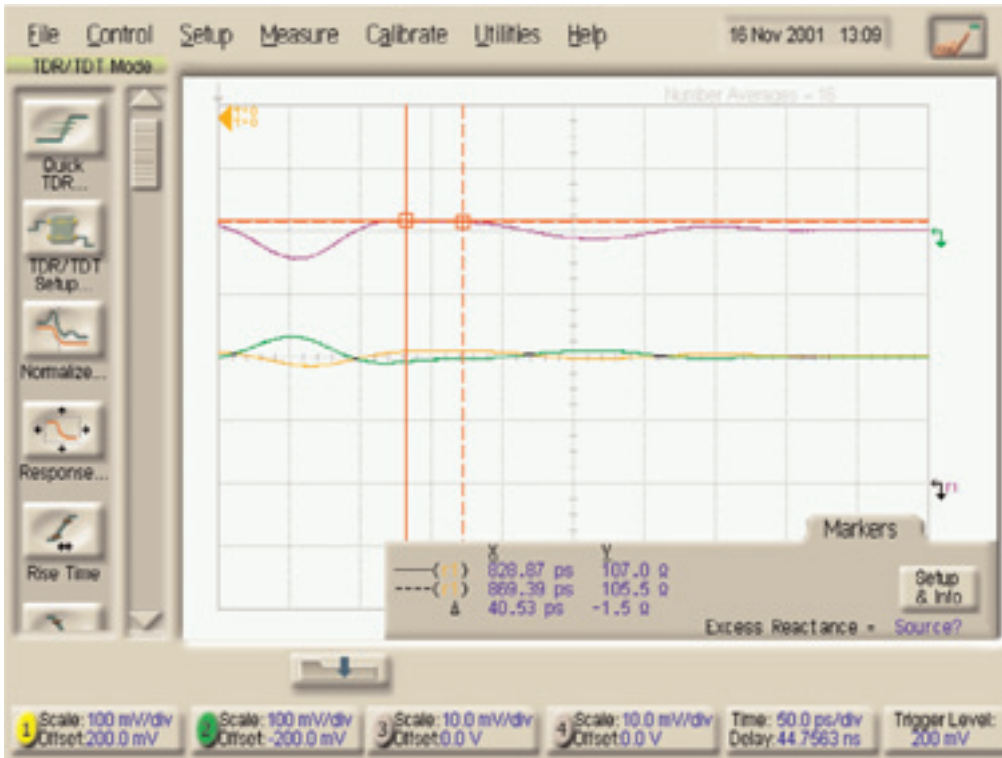
#### Note:

To improve the high speed characteristics, remove all pads on unconnected layers!  
 Smaller padsizes also improves the electrical characteristics!  
 Antipad size as large as possible also improves the electrical characteristics!

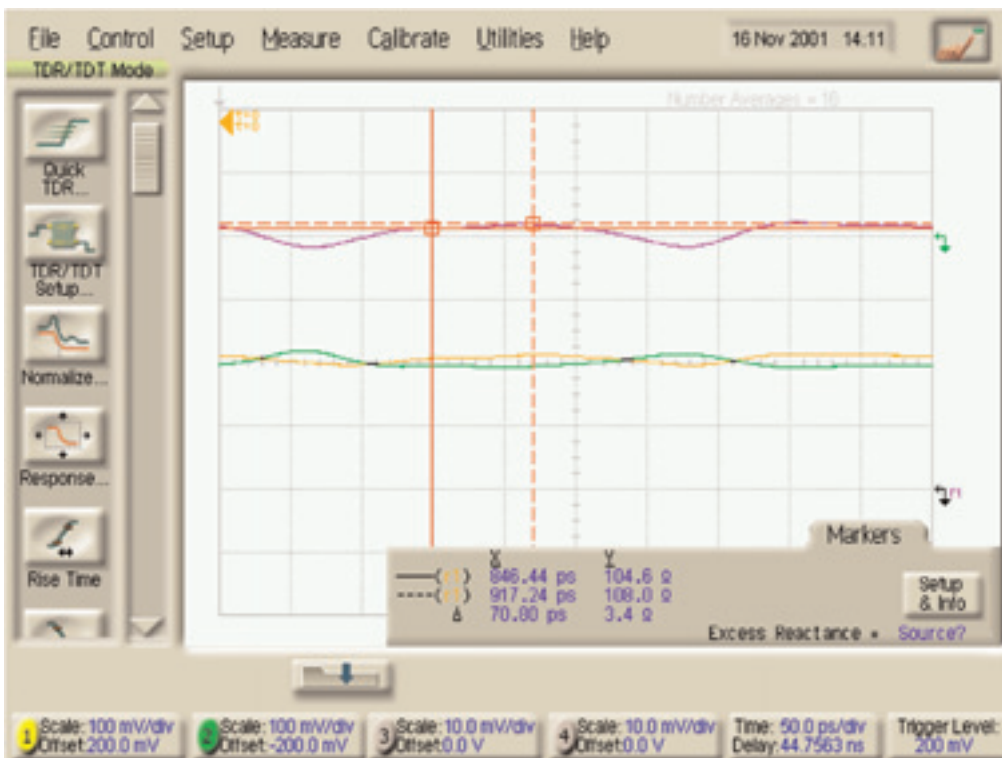
## Impedance Profiles

Measured from the daughtercard side, with Agilent 86100A TDR. Rise time is typically 35ps.

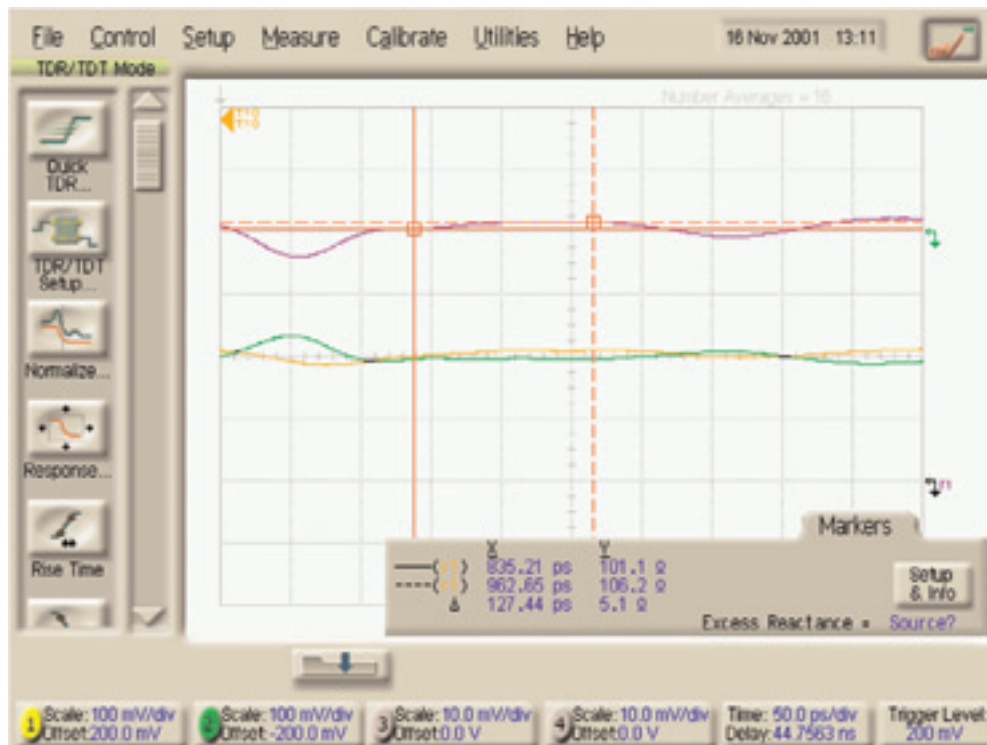
Row a-b



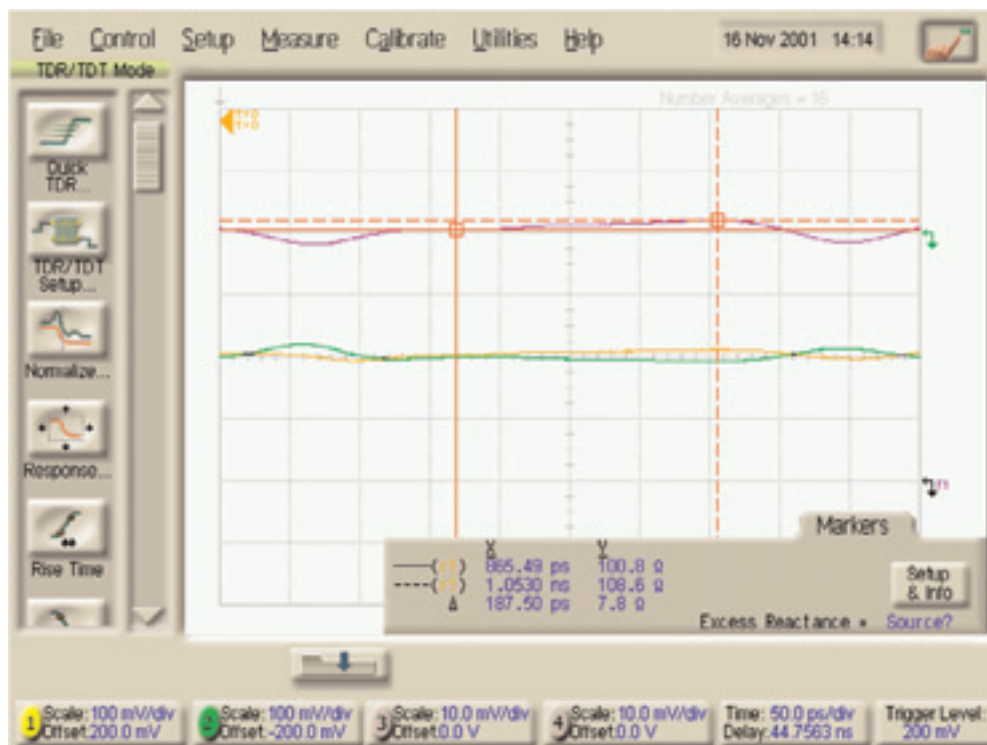
Row c-d



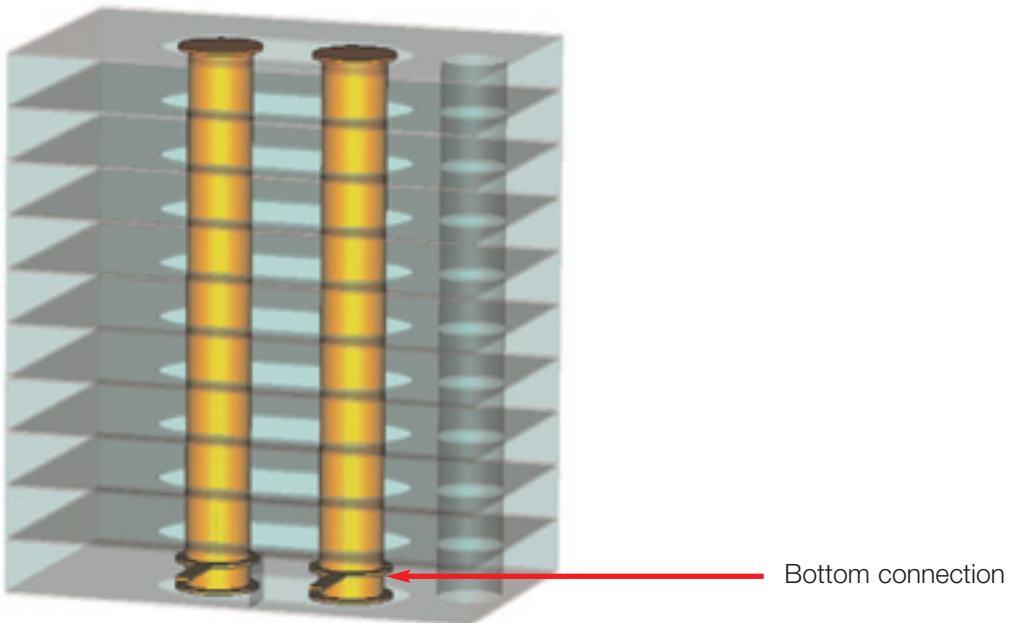
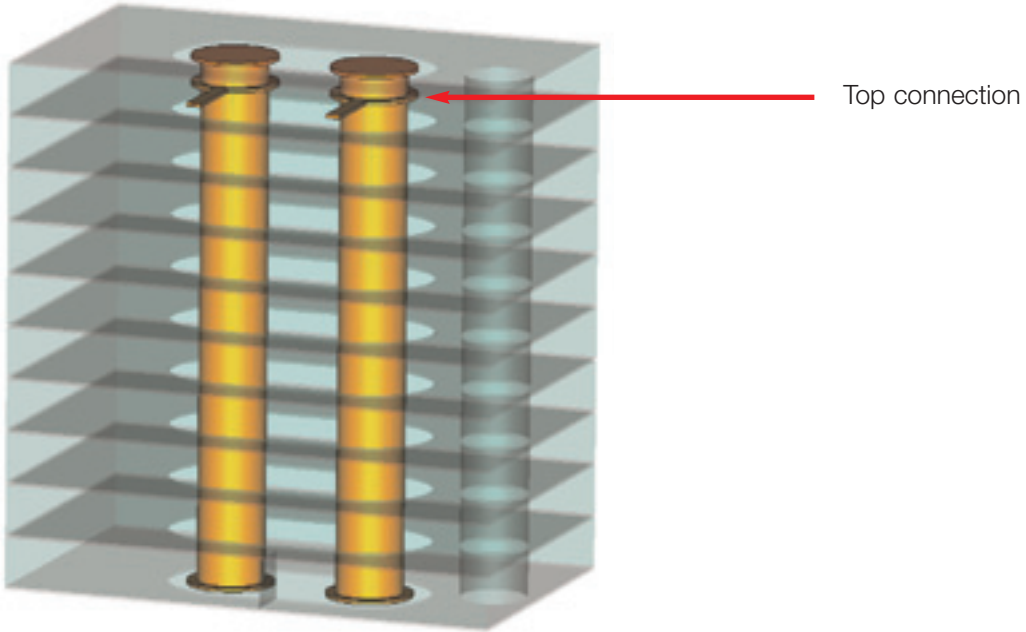
Row e-f



Row g-h

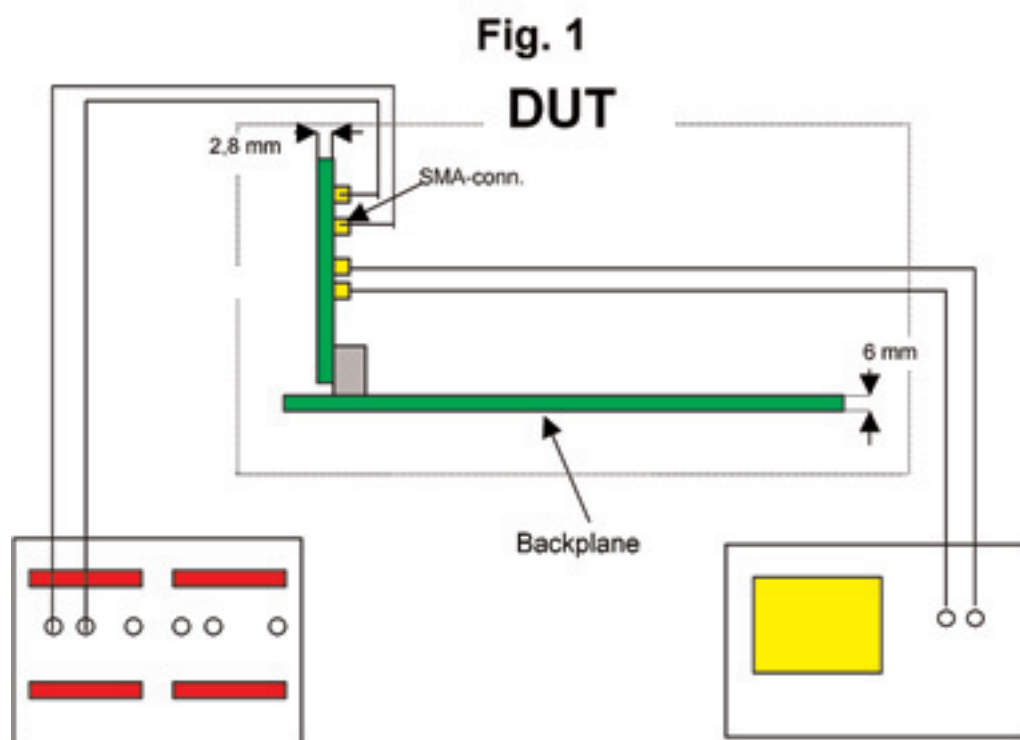


### Stubbing Effect



The bottom connection is to prefer, because it don't cause so much reflection.

## Measurement Setup for Eye Diagrams



The rise time of the bit pattern generator is 40ps. We use a PBRS 2 exp 7-1 signal.

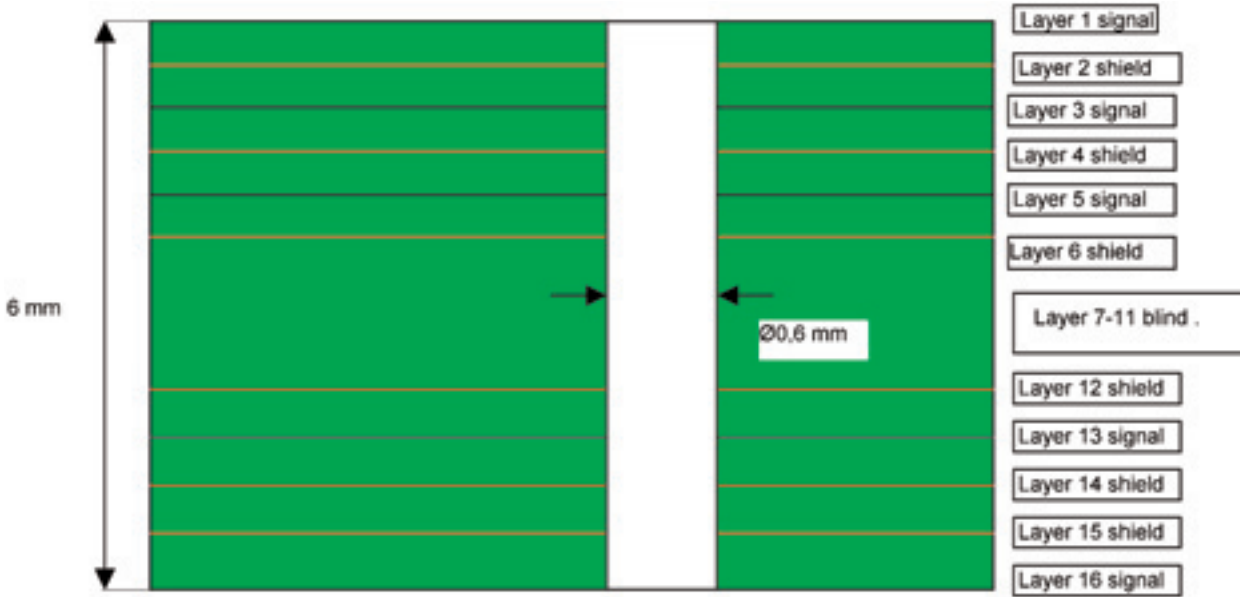
### Board Materials

For the testboards we used the materials Rogers 4350 and Standard FR4

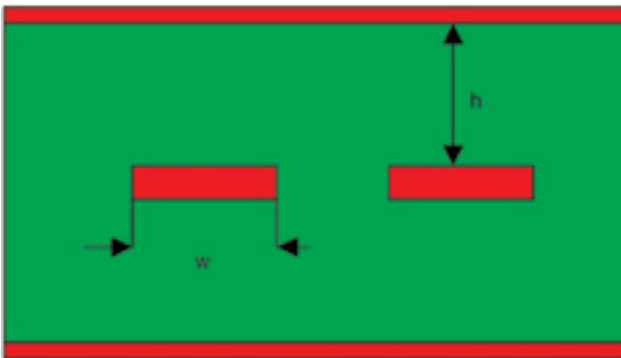
Material Parameters	Permittivity	Dielectric loss	Frequency
FR4	4 - 4.5	0.02	1MHz
Rogers 4350	3.5	0.004	up to 10GHz



## Board Constructions



## Edge coupled stripline



The traces are designed for 100Ω differential impedance. Copper layer thickness is 35µm for stripline and 18µm for microstrip.

The trace width and spacing is for:

Layer 1	0.25 / 0.20mm
Layer 3	0.25 / 0.27mm
Layer 5	0.15 / 0.15mm
Layer 13	0.20 / 0.17mm
Layer 16	0.25 / 0.20mm

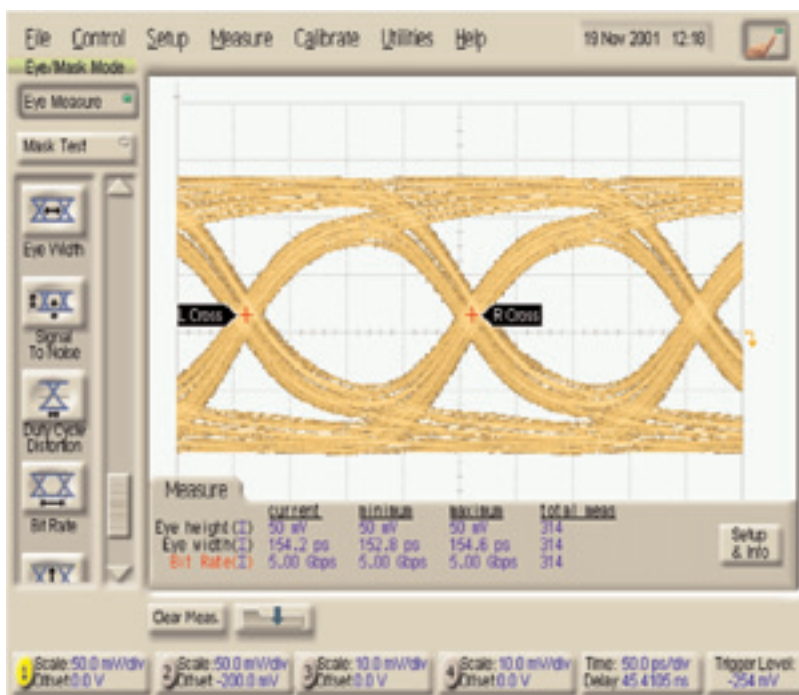
The SMA connectors were applied in SMD technology. The Daughtercards thickness is between 2.5 and 3mm. They had the same layer structure without the blind layers.



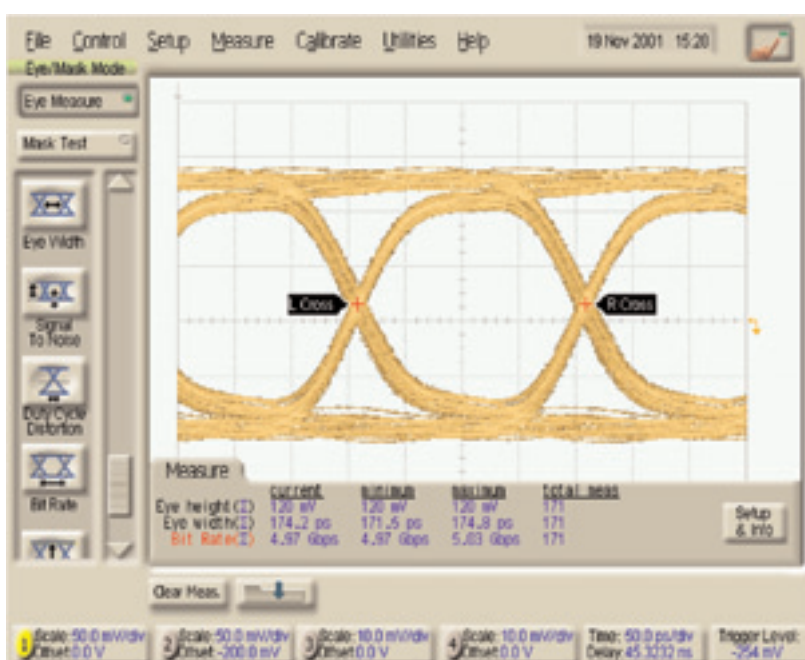
## Eye Diagrams

Without ERmet ZD Connectors for Different Materials

Data rate: 5Gbit/s  
Trace length: 380mm / 15inch  
Layer: 13



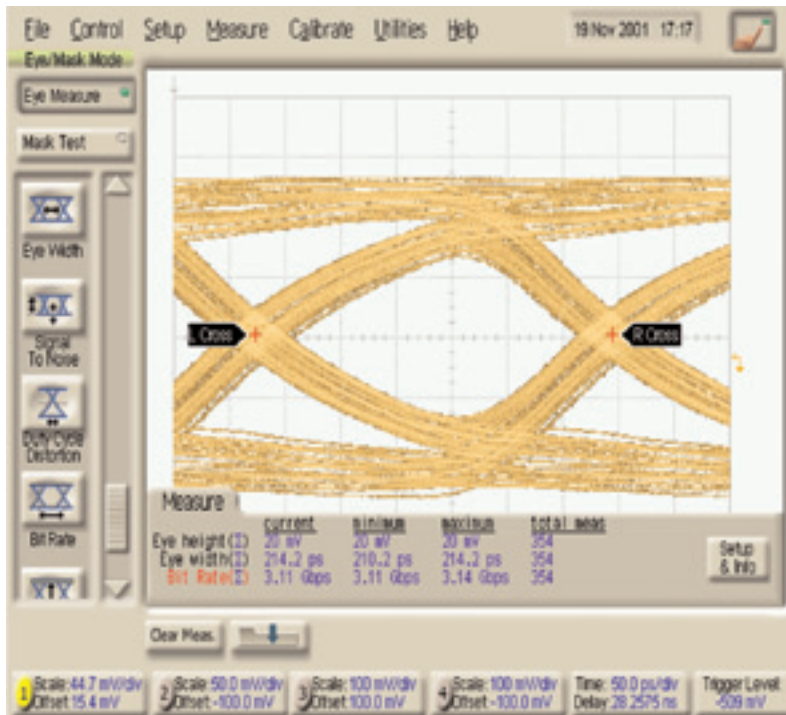
FR4  
Max. eye opening: 46%



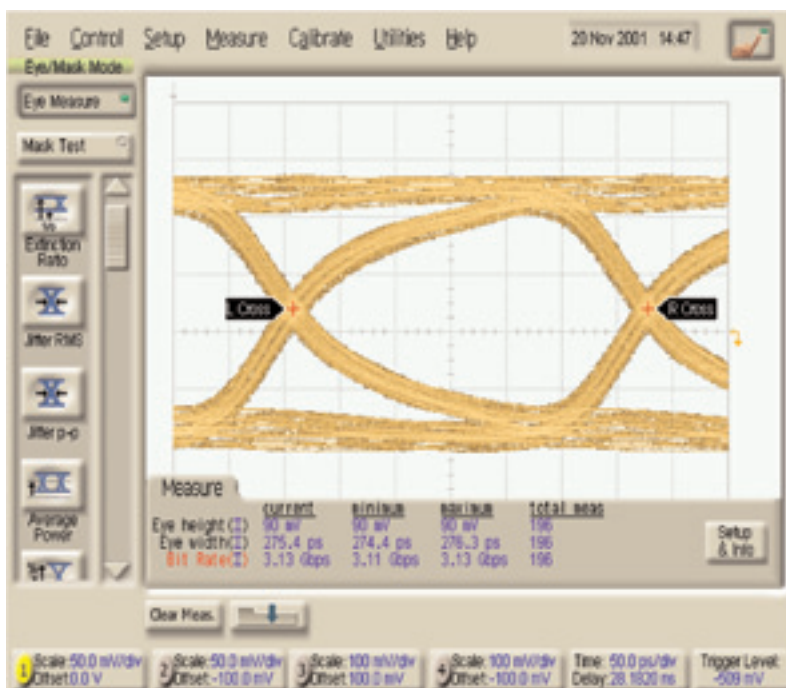
Rogers  
Max. eye opening: 66%

With ERmet ZD Connectors

Data rate: 3.125Gbit/s  
 Trace length: 600mm / 24inch  
 Layer: 13  
 Antipadsize: 3.5 x 1.7mm



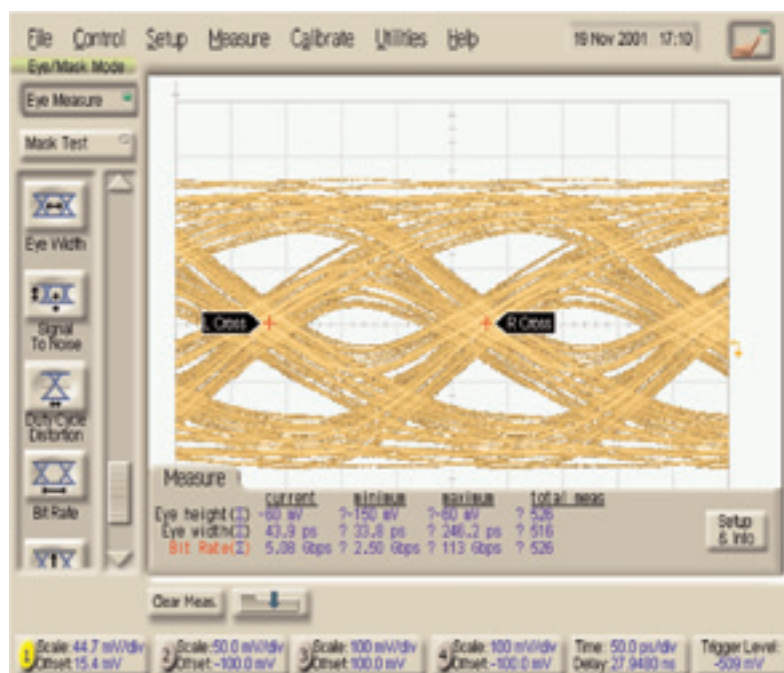
FR4  
 Max. eye opening: 46%



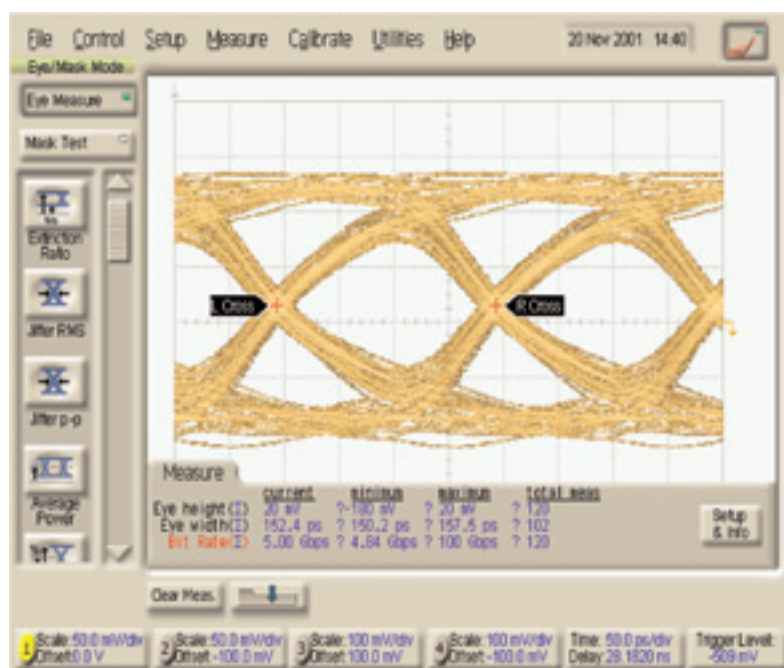
Rogers  
 Max. eye opening: 65%

With ERmet ZD Connectors

Data rate: 5Gbit/s  
 Trace length: 600mm / 24inch  
 Layer: 13  
 Antipadsize: 3.0 x 1.3mm



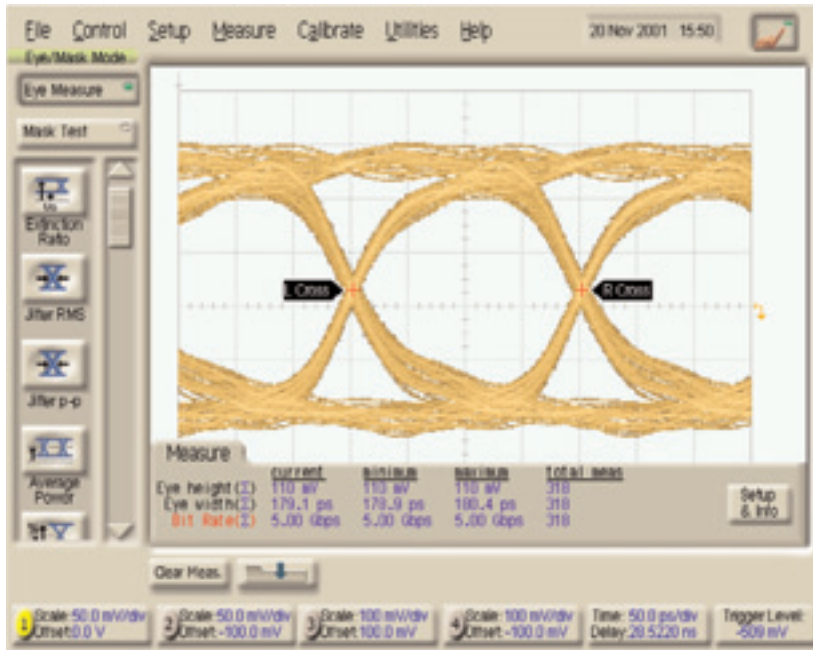
FR4  
 Max. eye opening: 13%



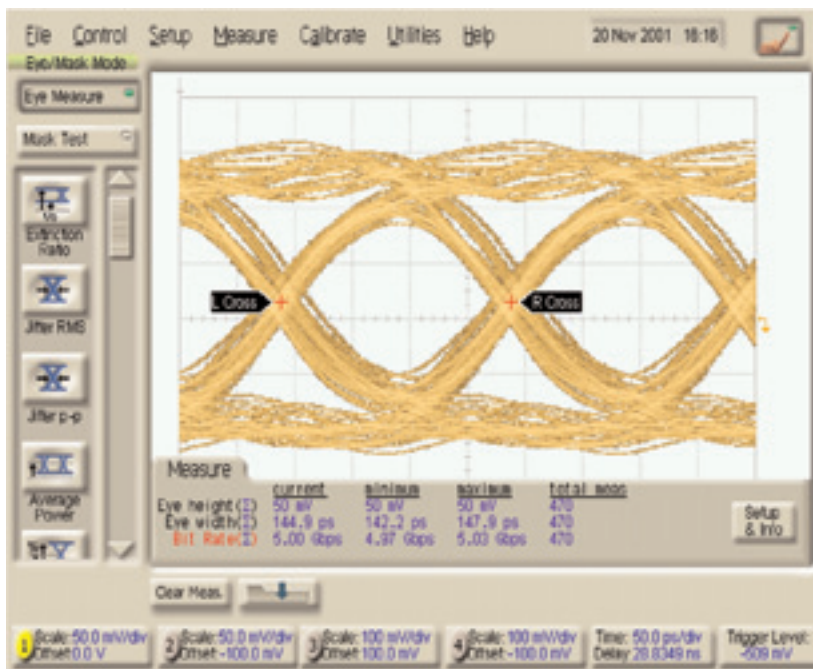
Rogers  
 Max. eye opening: 49%

With ERmet ZD Connectors “Stubbing Effect”

Data rate: 5Gbit/s  
 Trace length: 190mm / 7.5inch  
 Material: Rogers  
 Antipadsize: 3.5 x 1.7mm



Layer 13  
 Max. eye opening: 67%

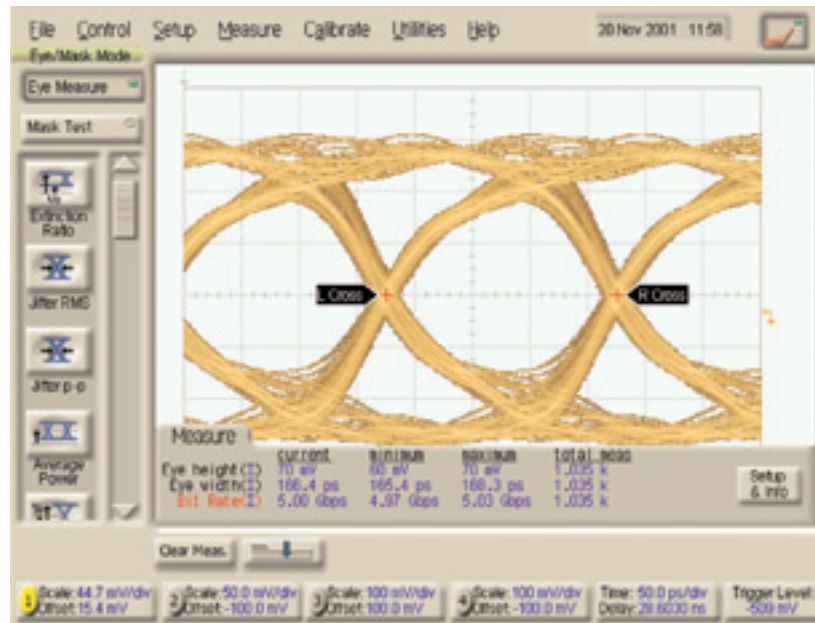


Layer 5  
 Max. eye opening: 52%

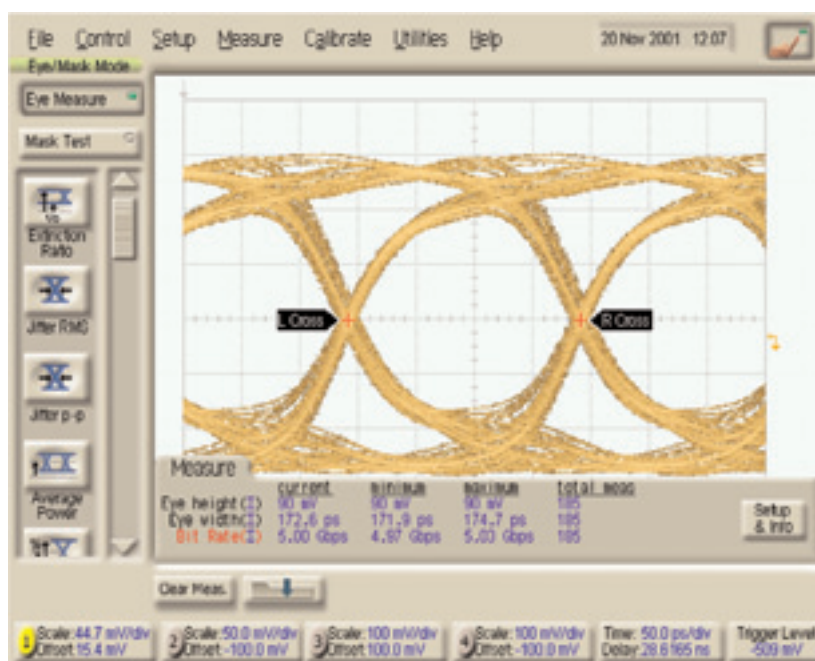


With Different Antipad sizes

Data rate: 5Gbit/s  
Trace length: 190mm / 7.5inch  
Layer: 13



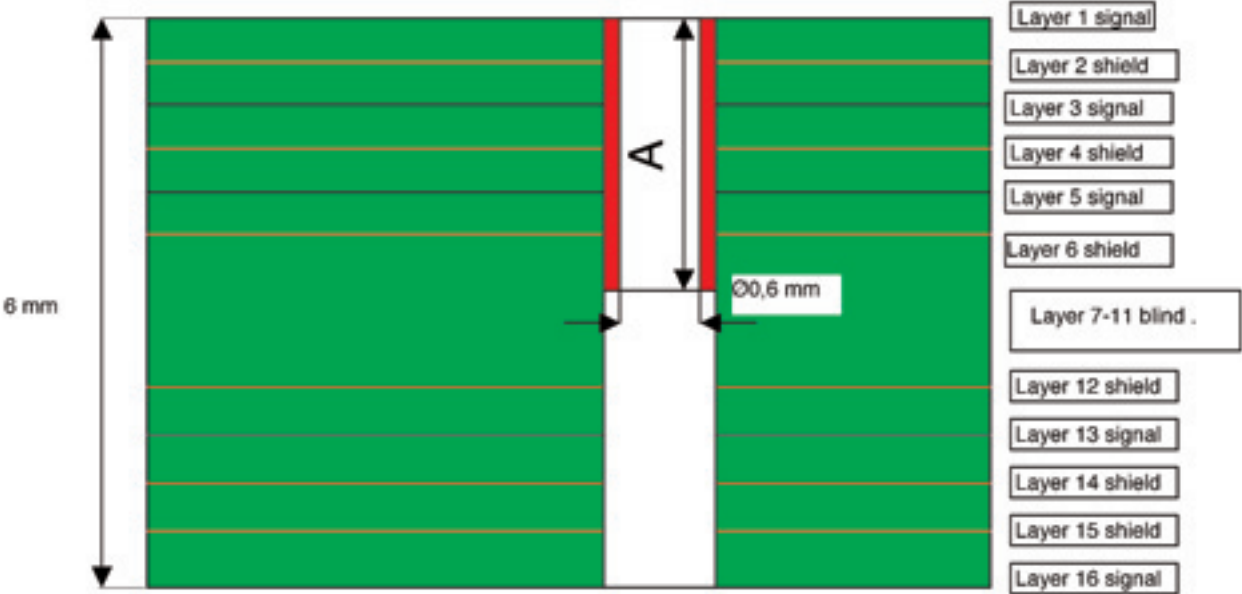
Antipadsize: 3.0 x 1.3mm  
Max. eye opening: 57%



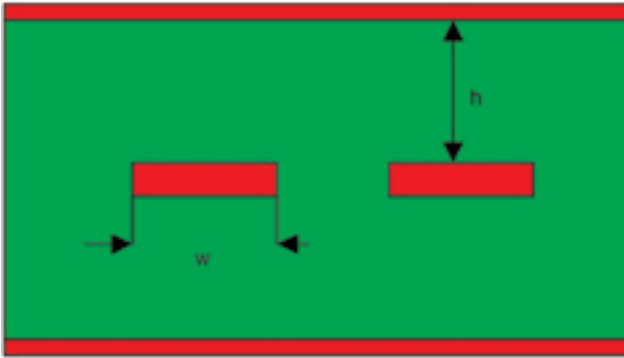
Antipadsize: 3.5 x 1.7mm  
Max. eye opening: 63%

**Measurements ERmet ZD Backdrilled**

Board Constructions



Edge coupled stripline



The traces are designed for 100Ω differential impedance. Copper layer thickness is 35µm for stripline and 18µm for microstrip.  
 The trace width and spacing is for:

Layer 1	0.25 / 0.20mm
Layer 3	0.25 / 0.27mm
Layer 5	0.15 / 0.15mm
Layer 13	0.20 / 0.17mm
Layer 16	0.25 / 0.20mm

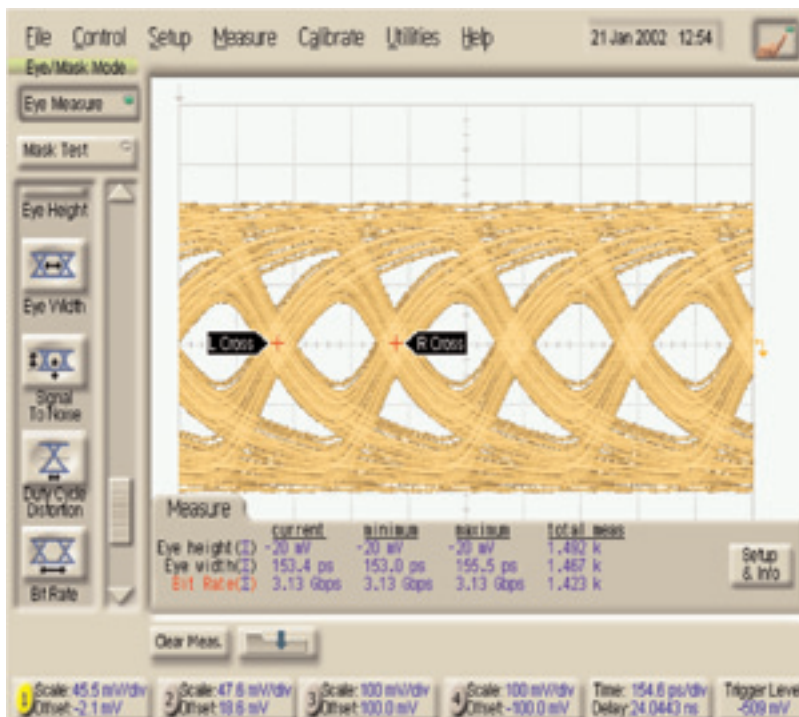
The SMA connectors were applied in SMD technology. The Daughtercards thickness is between 2.5 and 3mm. Backplane and daughtercard has the same layer structure without the blind layers.

**The via sleeves were backdrilled to a length A of 2.5mm at the backplane, and 2mm on the daughtercard.**

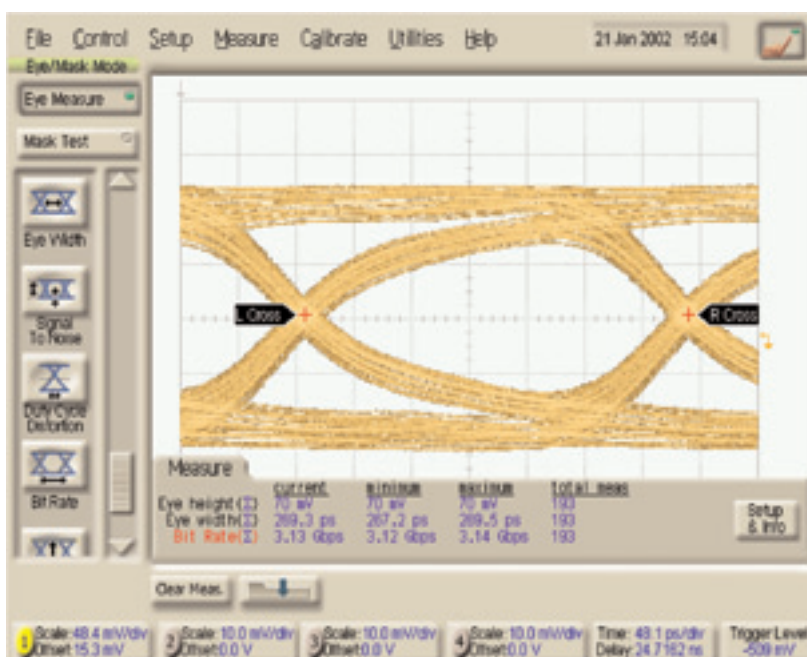
## Eye Diagrams

ERmet ZD Connector Backdrilled

Data rate: 3.125Gbit/s  
 Trace length: 1000mm / 40inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm



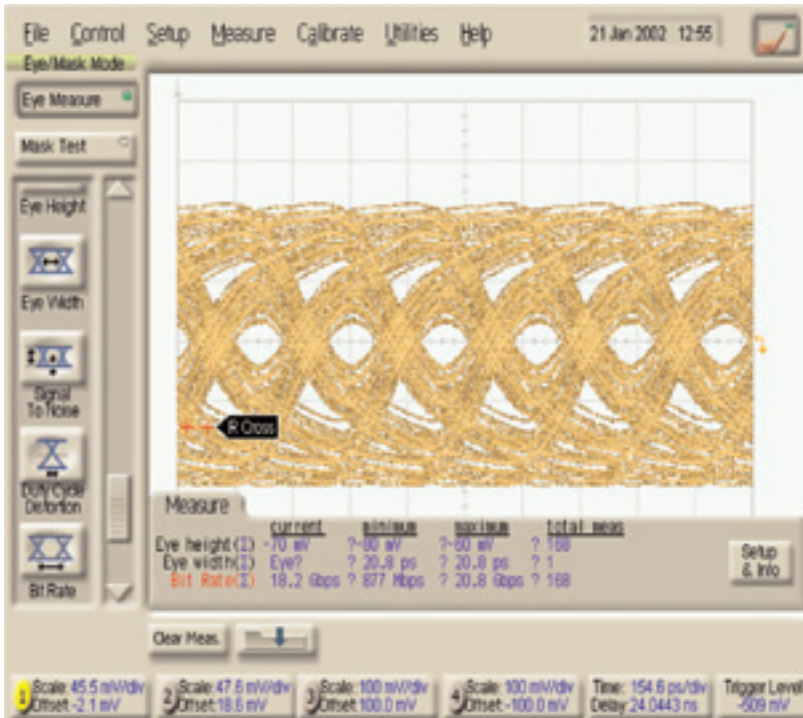
FR4  
 Max. eye opening: 25%



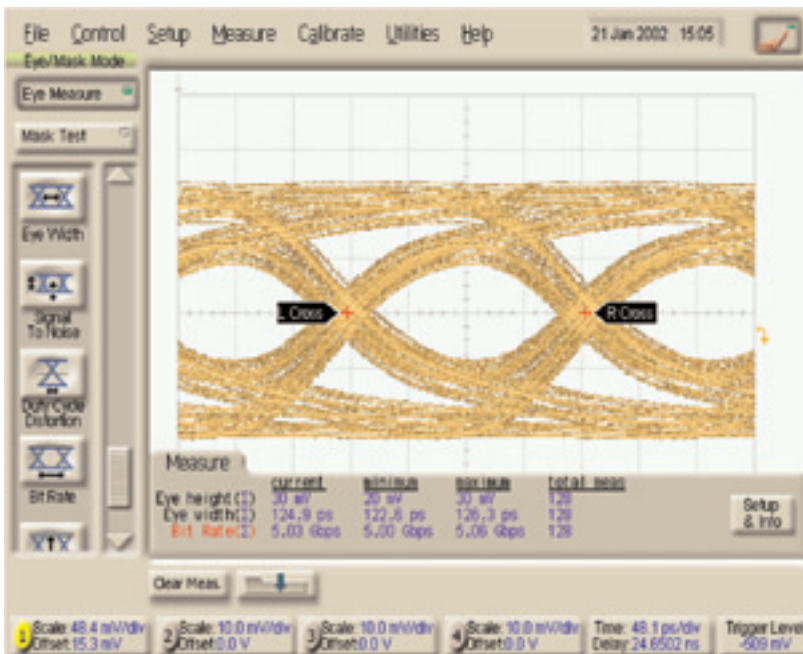
Rogers  
 Max. eye opening: 53%

ERmet ZD Connector Backdrilled

Data rate: 5Gbit/s  
 Trace length: 1000mm / 40inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm



FR4  
 Max. eye opening: 14%  
 At 5Gbit eye is closed.

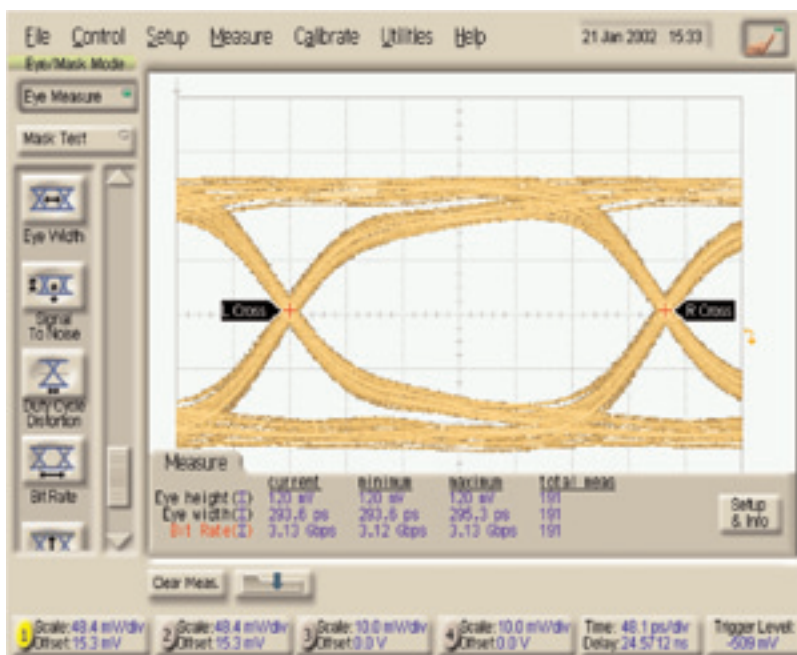
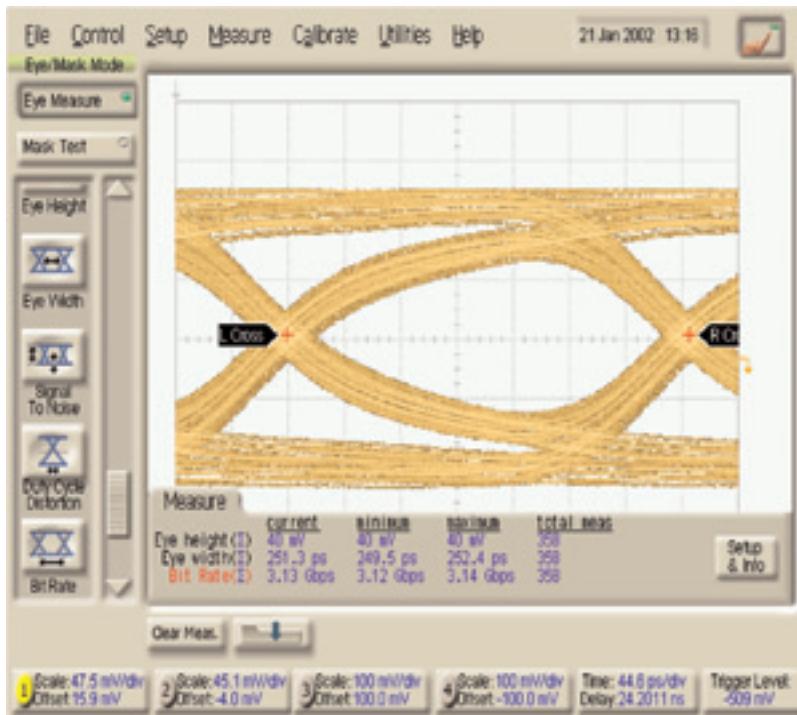


Rogers  
 Max. eye opening: 34%



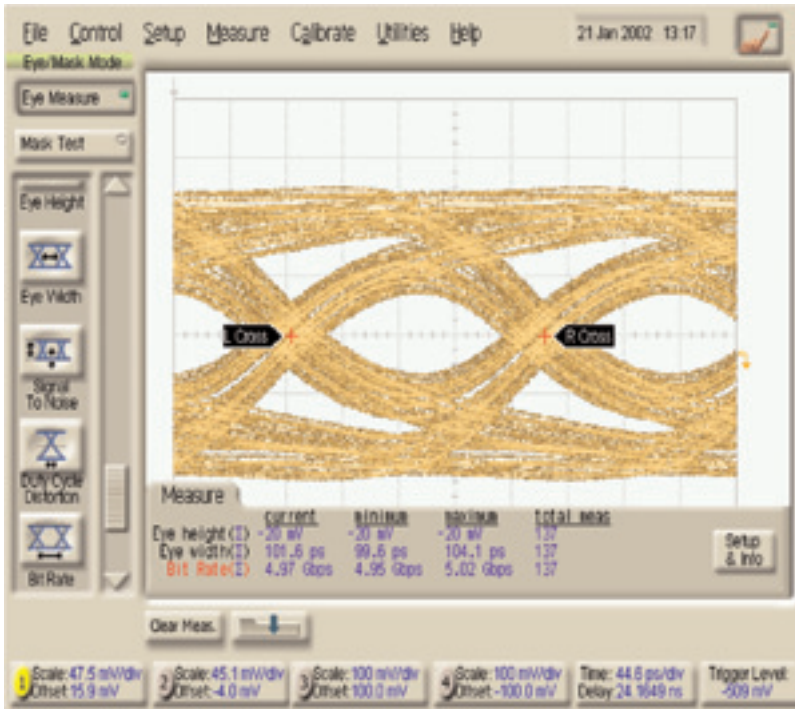
ERmet ZD Connector Backdrilled

Data rate: 3.125Gbit/s  
 Trace length: 600mm / 24inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm

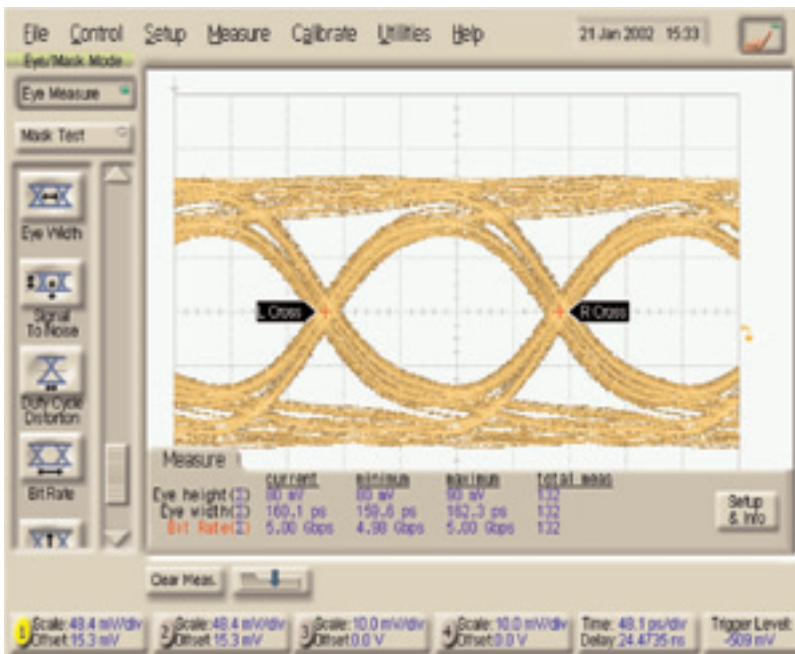


ERmet ZD Connector Backdrilled

Data rate: 5Gbit/s  
 Trace length: 600mm / 24inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm



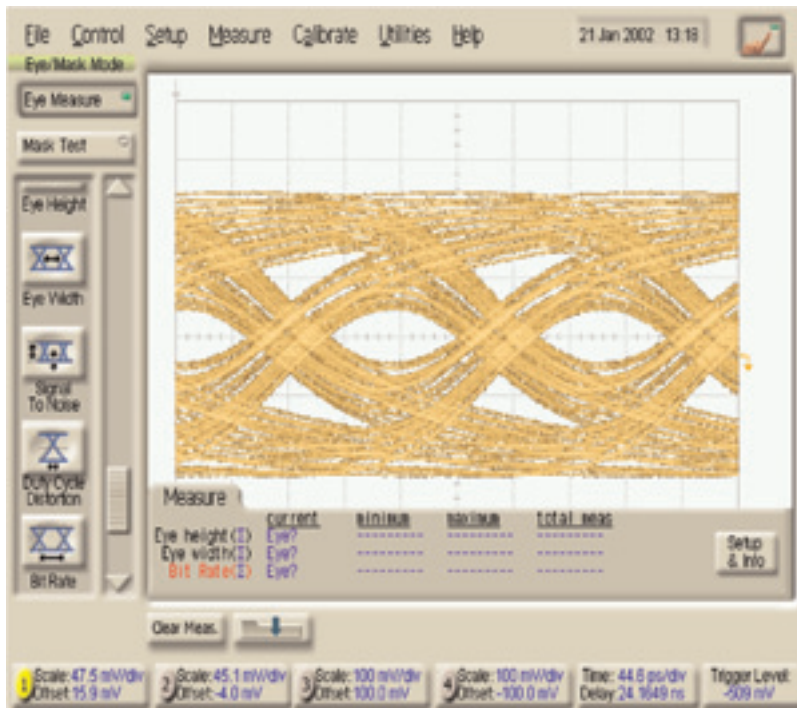
FR4  
 Max. eye opening: %



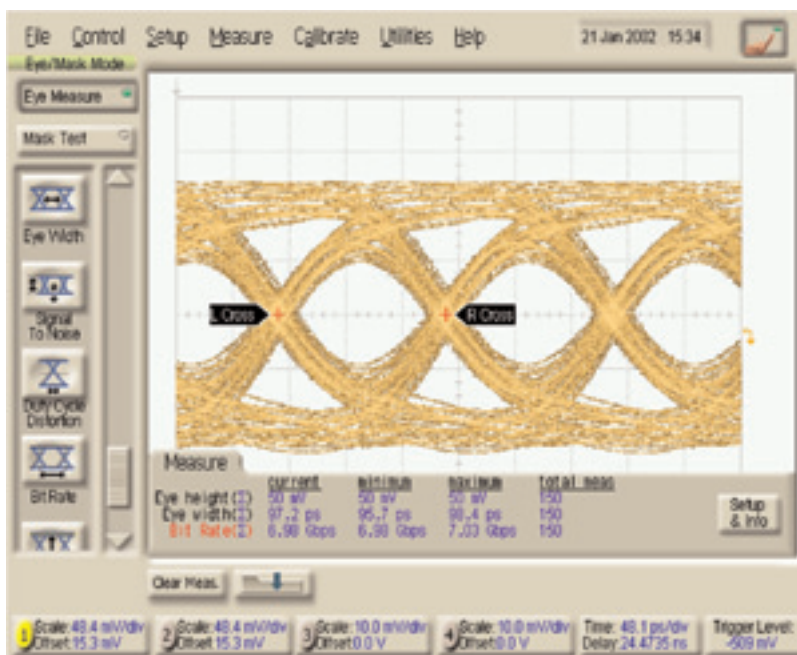
Rogers  
 Max. eye opening: %

ERmet ZD Connector Backdrilled

Data rate: 7Gbit/s  
 Trace length: 600mm / 24inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm



FR4  
 Max. eye opening: %



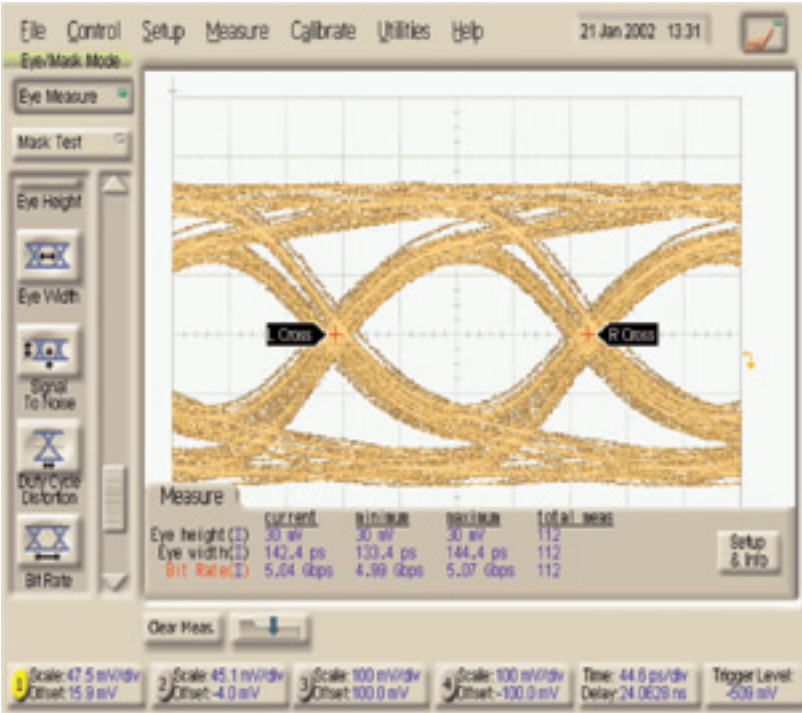
Rogers  
 Max. eye opening: %



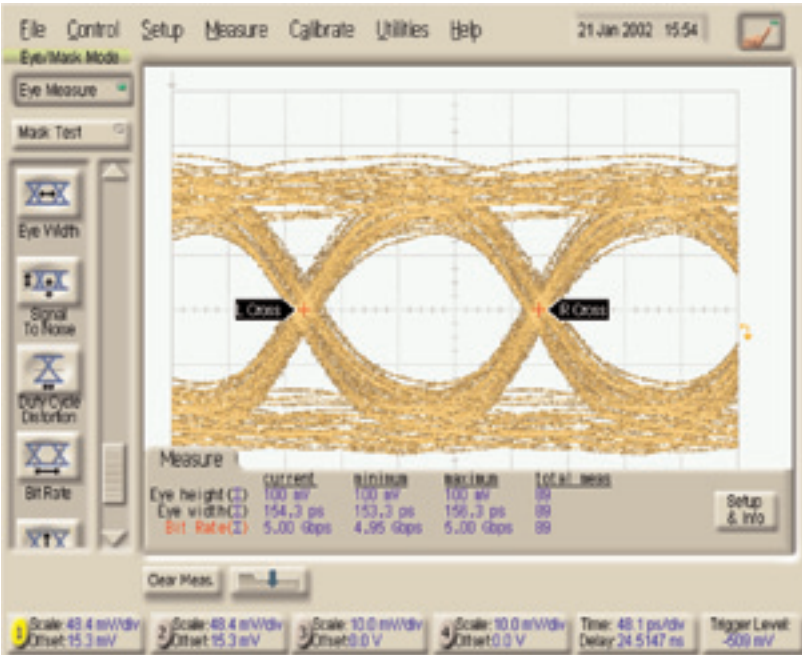
ERmet ZD Connector Backdrilled

Data rate: 5Gbit/s  
 Trace length: 380mm / 15inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm

FR4  
 Max. eye opening: %

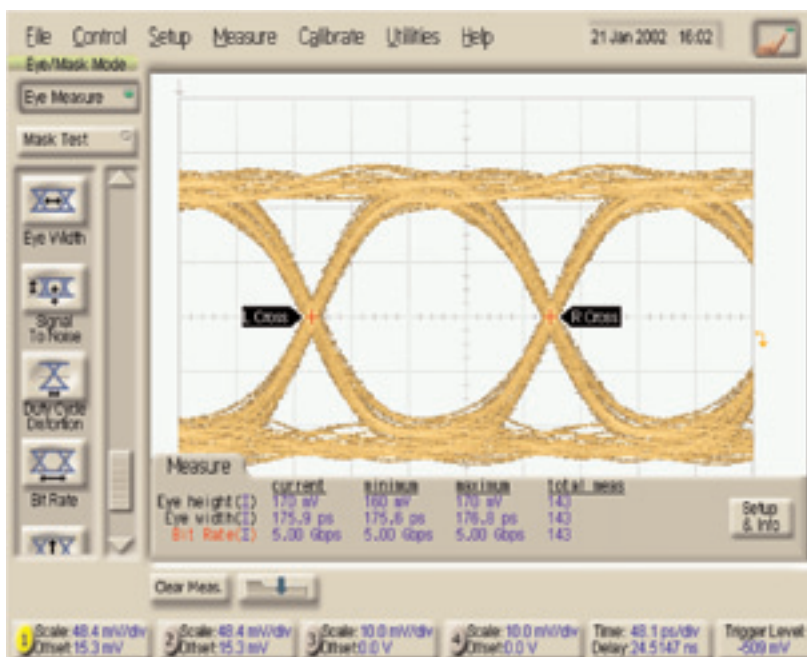
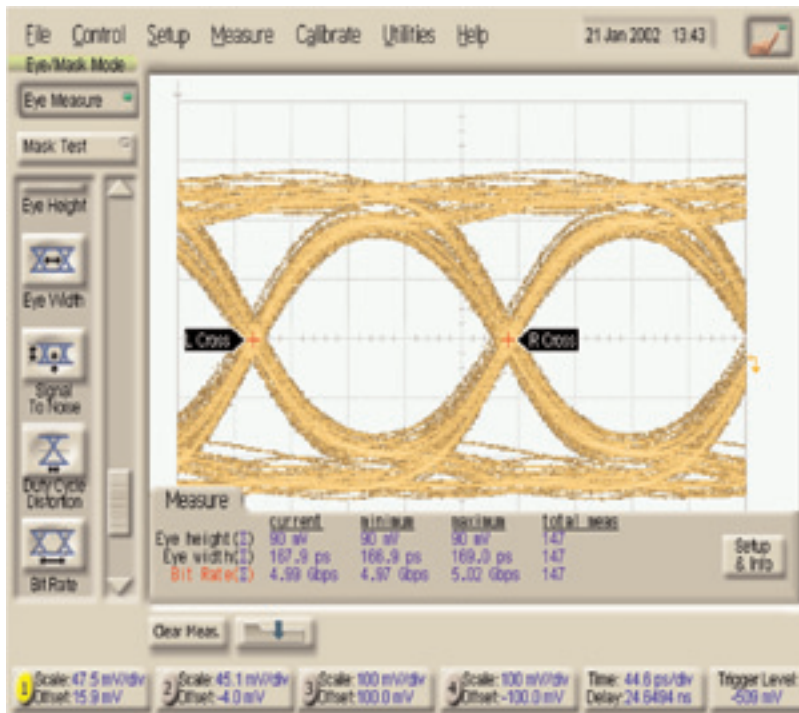


Rogers  
 Max. eye opening: %



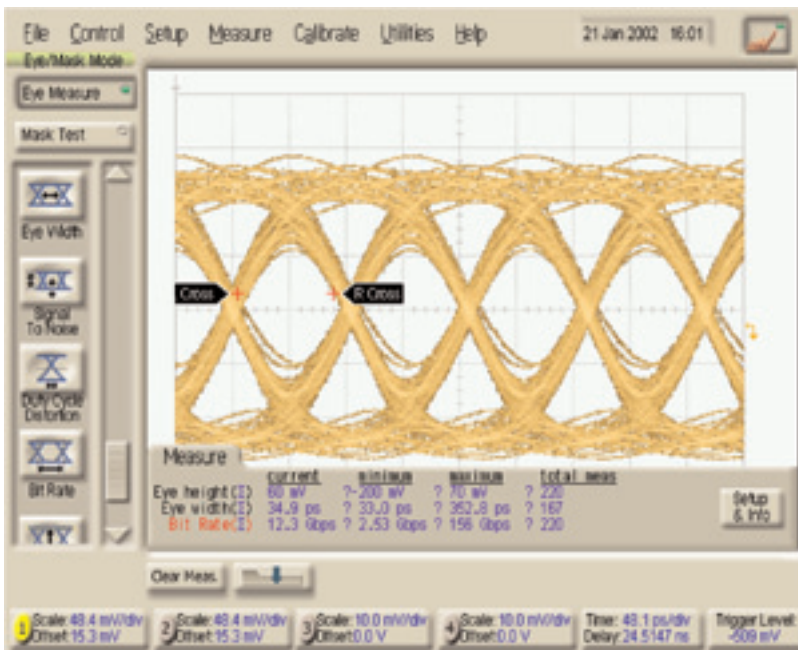
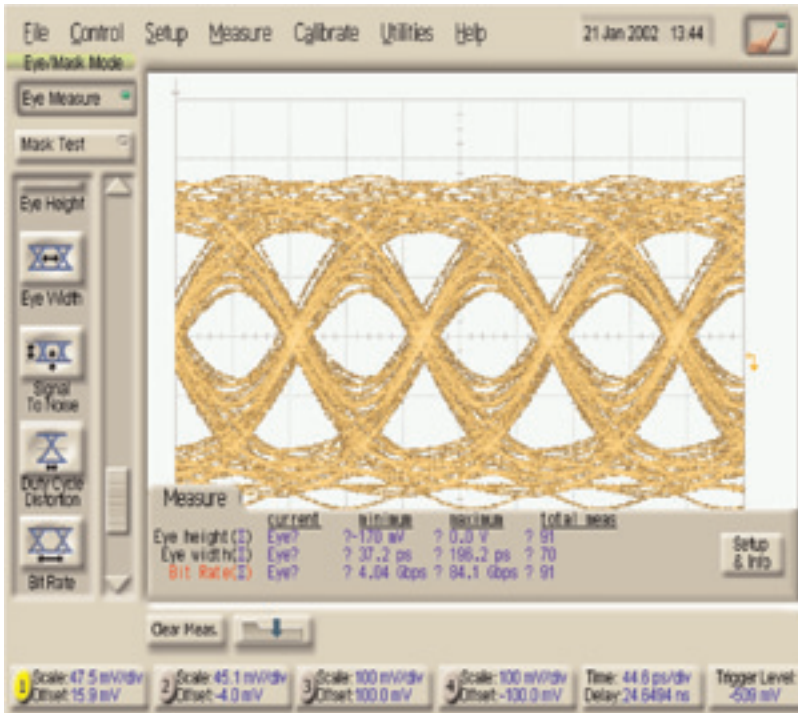
ERmet ZD Connector Backdrilled

Data rate: 5Gbit/s  
 Trace length: 190mm / 7.5inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm



ERmet ZD Connector Backdrilled

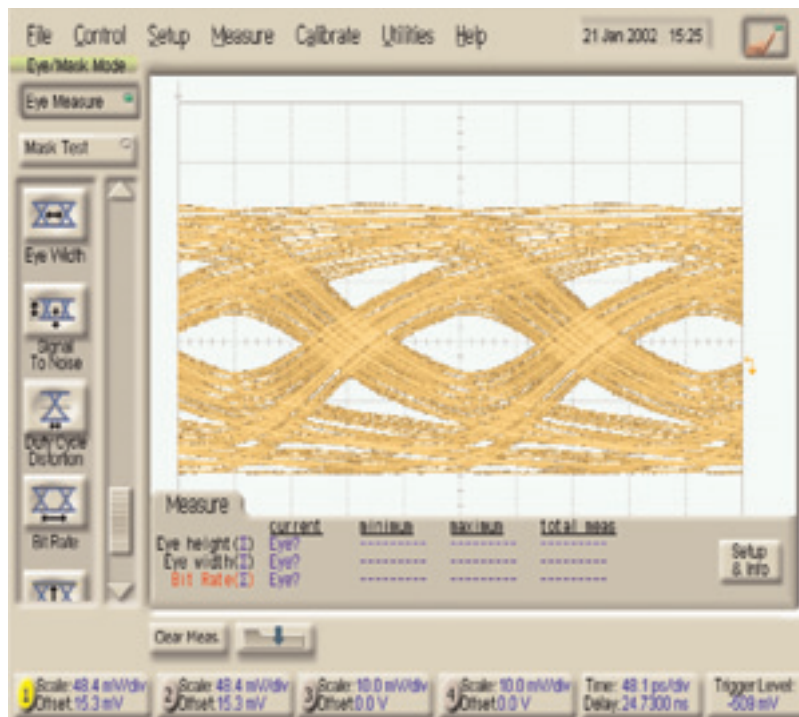
Data rate: 10Gbit/s  
 Trace length: 190mm / 7.5inch  
 Trace width: 0.25mm / 10mil  
 Layer: 3  
 Antipadsize: 3.5 x 1.7mm



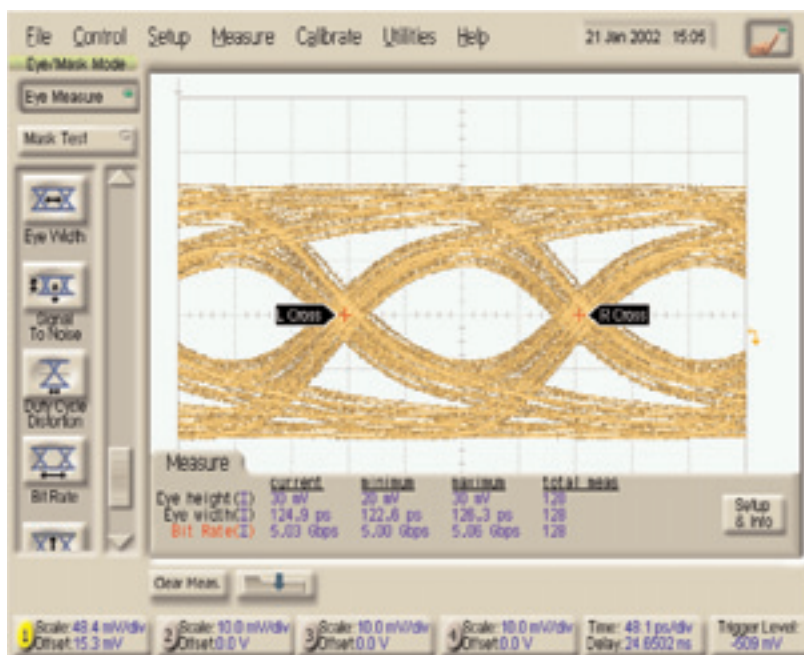


Influence of Skin Effect

Data rate: 5Gbit/s  
 Trace length: 1000mm / 40inch  
 Material: Rogers  
 Antipadsize: 3.5 x 1.7mm



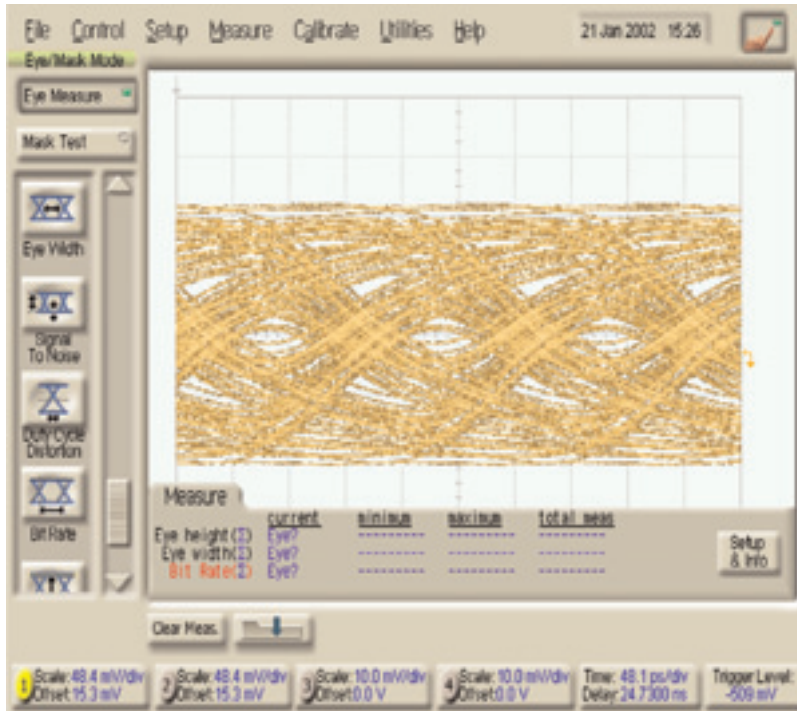
Trace width: 0.15mm / 6mil  
 Max. eye opening: 19%



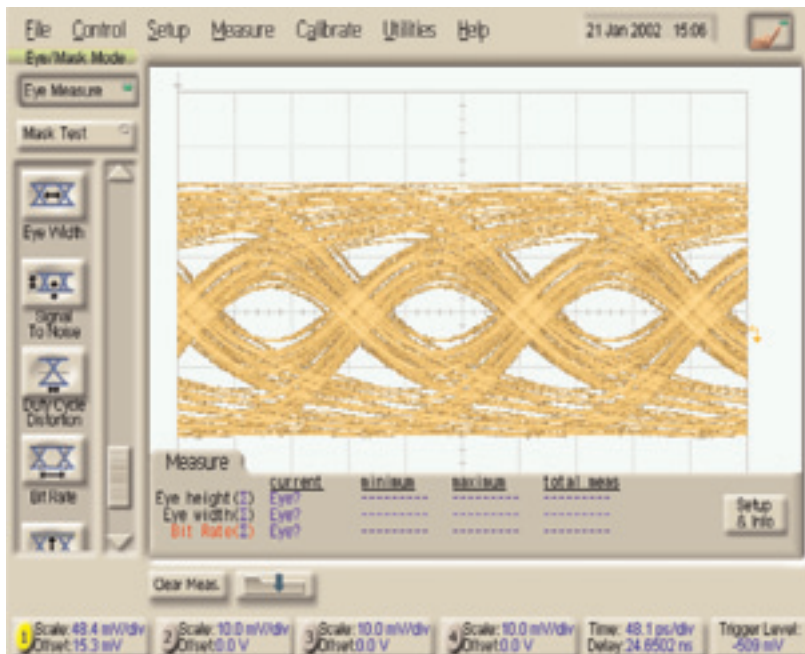
Trace width: 0.25mm / 10mil  
 Max. eye opening: 34%

Influence of Skin Effect

Data rate: 7Gbit/s  
 Trace length: 1000mm / 40inch  
 Material: Rogers  
 Antipads size: 3.5 x 1.7mm



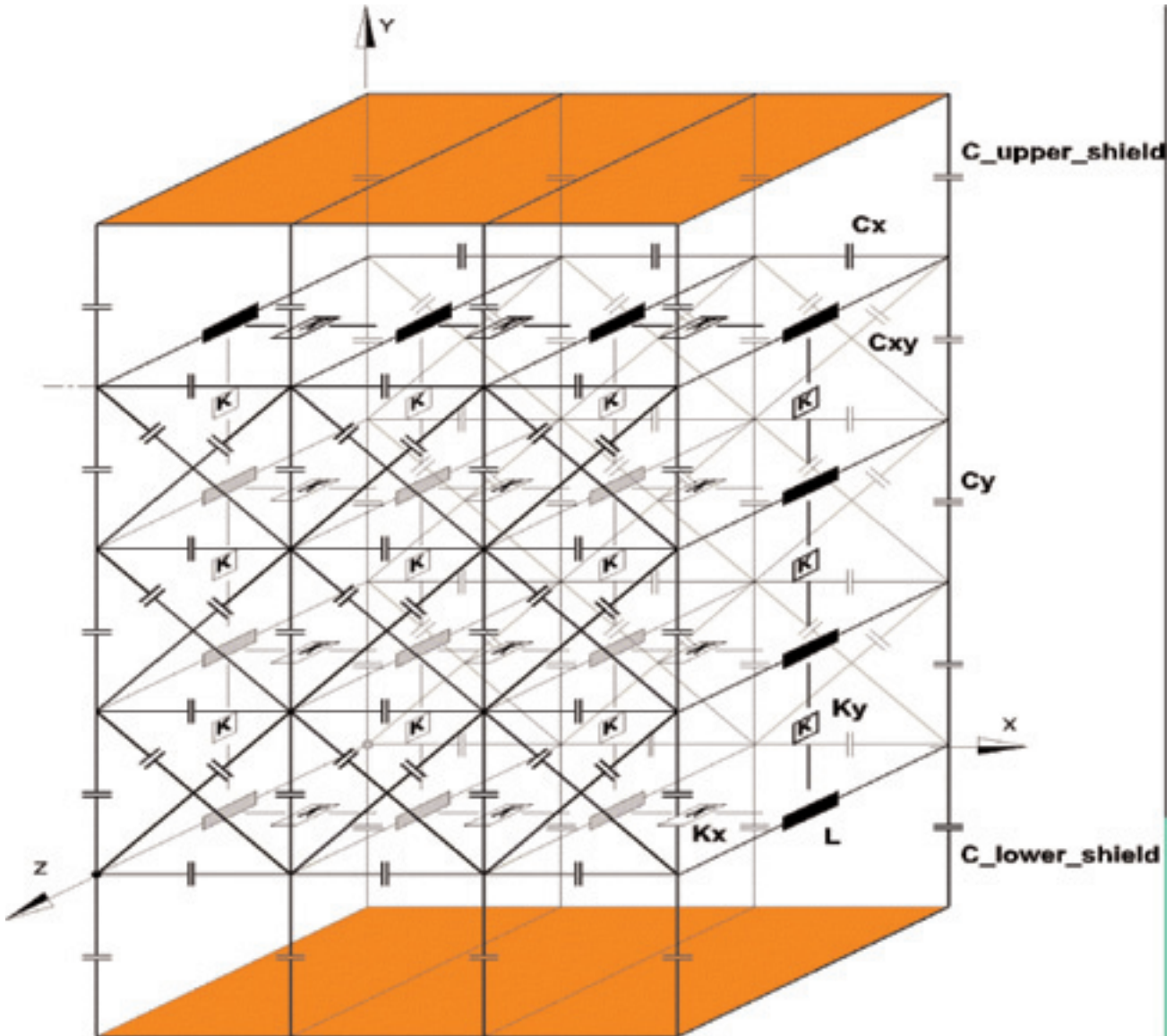
Trace width: 0.15mm / 6mil  
 Max. eye opening: 4%



Trace width: 0.25mm / 10mil  
 Max. eye opening: 19%



## Spice Model



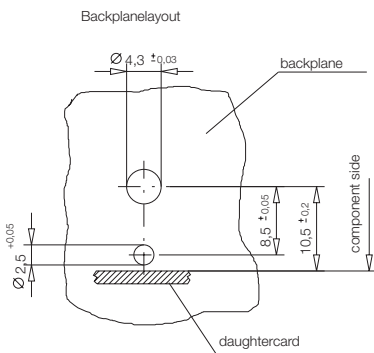
Single pair and multi pair spice models available. Also s-parameter and spectraquest models.

## Guiding System

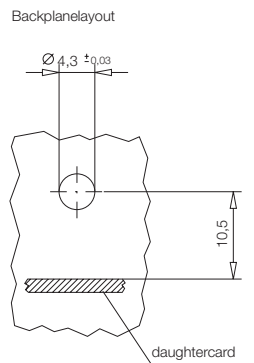


### Layouts

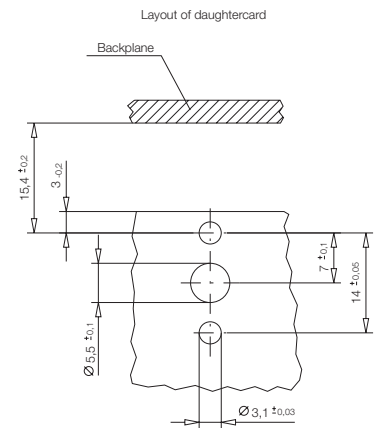
Alignment pin kit with base plate



Alignment pin kit without base plate



Alignment socket kit



### Ordering Information

#### Backplane versions

Description	PCB Thickness	Part Number
Alignment pin kit without base plate	3.2 – 5 mm	144370
Alignment pin kit without base plate	6 – 8 mm	144371
Alignment pin kit with base plate	3.2 – 5 mm	144131
Alignment pin kit with base plate	6 – 8 mm	144132

#### Daughtercard versions

Description	PCB Thickness	Part Number
Alignment socket kit	min. 1.5 mm	144127
Alignment socket kit	min. 3 mm	144128