

Mini Coax modules (press-fit)

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The Mini Coax connector system is a multi line RF interconnection for board-to-backplane applications. The Mini Coax allows transmission of radio frequency signals up to 2.5 GHz per line. Moreover this connector system is compact, ruggedised and provides total mating reliability due to its closed entry. The compact size (a 10 coaxial line connector is as small as a PC's enter key) and excellent crosstalk features propel this connector system for high end equipment within cellular telecom infrastructure.

The modules are available in metric sizes 1.00, 1.25 and 1.50 SU (SU = System Unit = 25 mm) for both cable harnesses and pcb's with 2 to 10 coaxial lines. The angled daughtercard modules and the straight backplane modules are press-fitted with simple tooling. The straight modules are delivered with an

inserted plastic cap that protects the coaxial contacts against dust and dirt as well as being used as an upper press-in tool. So an easy and safe flat rock process is guaranteed.

In addition to the coax modules an angled power connector with press-in termination is available. It is assembled in the same board drillings as the coaxial configuration and can be loaded up to 15 A working current at 70 °C.

Customer specific cable assemblies utilising different modules are manufactured on request. An extensive accessory and tooling range compliments the wide product range.

Both connector types (Mini Coax and *har-bus*[®] HM) are made for simultaneous use on the same board (see Fig. 2).

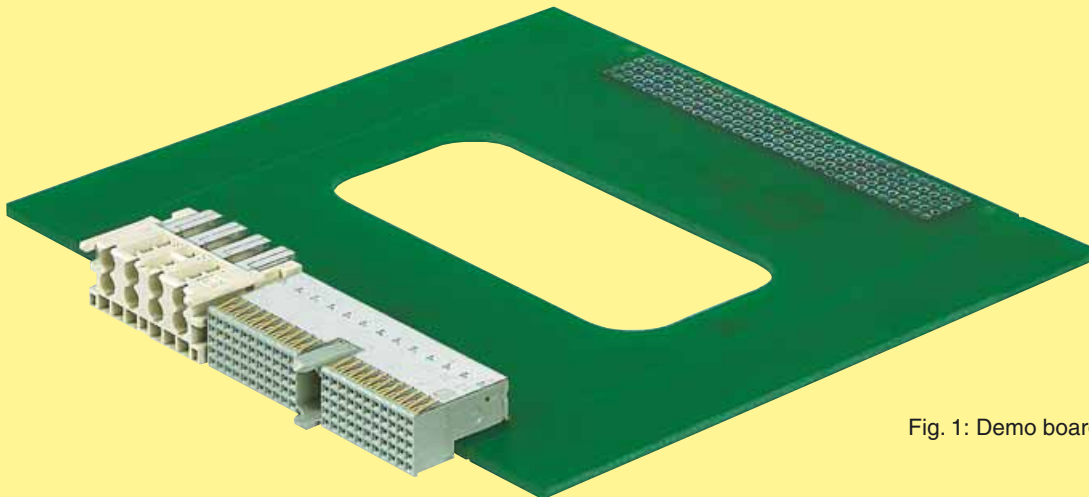


Fig. 1: Demo board

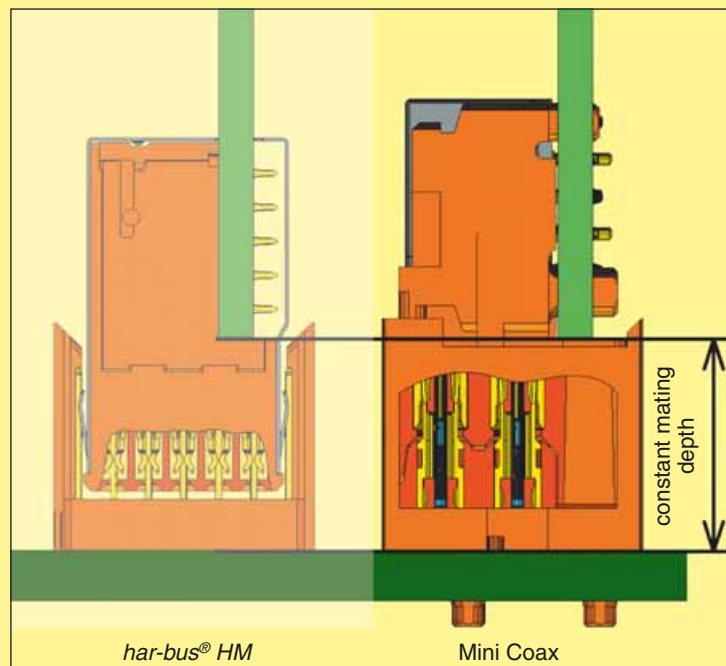


Fig. 2: Cross section of both connector types

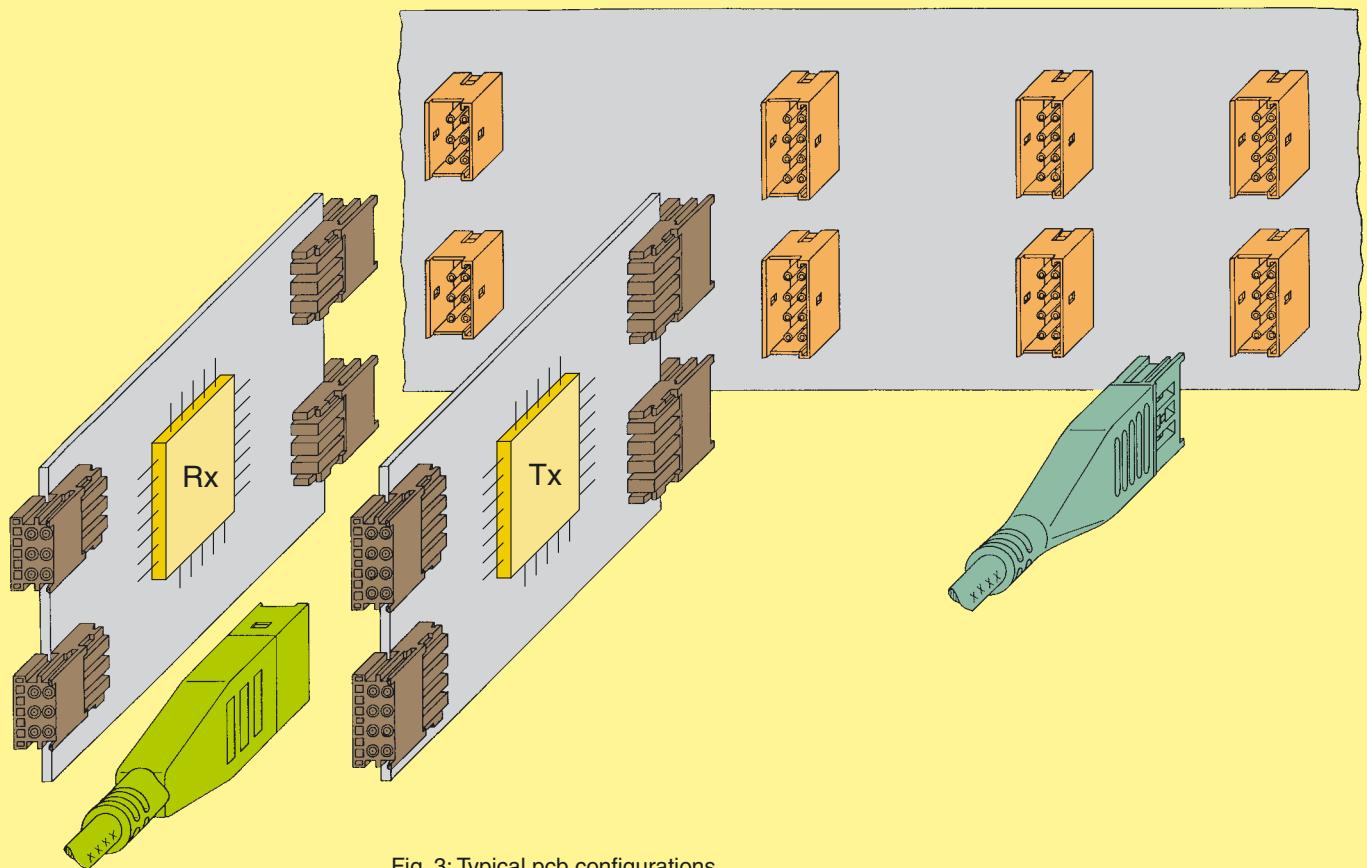


Fig. 3: Typical pcb configurations

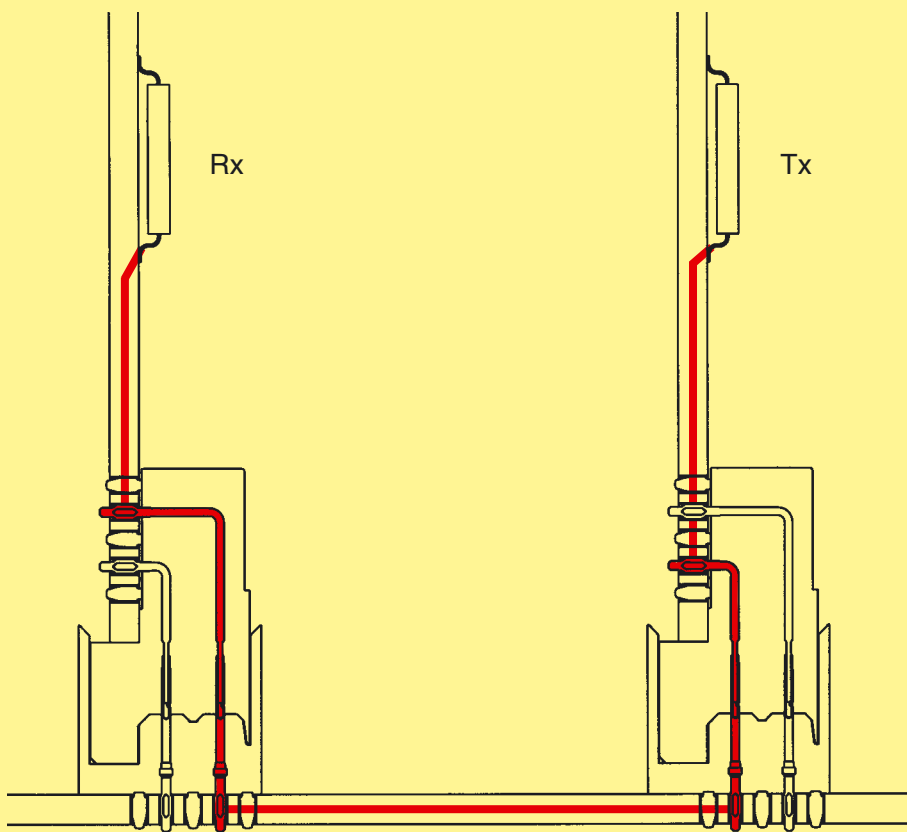


Fig. 4: Signal path of an analog RF signal from Rx to Tx

Rx: Receiver
Tx: Transceiver

Number of contacts	:	2, 4, 6, 8 or 10 coaxial contacts																																													
Dielectric withstanding Voltage $U_{r.m.s.}$:	≤ 1000 V (for 60s)																																													
Power	:	≤ 40 W (at 2.5 GHz)																																													
DC-contact resistance	:																																														
Centre contact	:	≤ 12 m Ω																																													
Ground contact	:	≤ 6 m Ω																																													
Insulation resistance	:	≥ 5000 M Ω																																													
Nominal impedance	:	50 Ω																																													
Frequency range	:	0 – 2.5 GHz																																													
Return loss* (see Fig. 11)	:	≥ 22 dB ¹⁾ (0 ... 2.5 GHz) equal to VSWR ≤ 1.17																																													
Insertion loss (see Fig. 10)	:	≤ 0.25 dB ¹⁾ (0 ... 2.5 GHz) ≤ 0.8 dB ²⁾ (0 ... 2.5 GHz)																																													
Crosstalk attenuation (see Fig. 12)	:	35 dB / 50 dB / 70 dB ²⁾ (0 ... 2.5 GHz) depending on distances between adjacent contacts																																													
Mating cycles	:	max. 500																																													
Recommended configuration of plated through holes	:	<table border="1"> <tr> <td rowspan="4"><i>Tin-lead plated PCB (HAL) acc. DIN EN 60352-5</i></td><td>Hole</td><td>1.15\pm0.025 mm</td></tr> <tr> <td>Cu</td><td>min. 25 μm</td></tr> <tr> <td>Sn</td><td>max. 15 μm</td></tr> <tr> <td>Plated hole</td><td>0.94-1.09 mm</td></tr> <tr> <td rowspan="4"><i>Chemical tin-plated PCB</i></td><td>Hole</td><td>1.15\pm0.025 mm</td></tr> <tr> <td>Cu</td><td>min. 25 μm</td></tr> <tr> <td>Sn</td><td>min. 0.8 μm</td></tr> <tr> <td>Plated hole</td><td>1.00-1.10 mm</td></tr> <tr> <td rowspan="5"><i>Au / Ni plated PCB</i></td><td>Hole</td><td>1.15\pm0.025 mm</td></tr> <tr> <td>Cu</td><td>min. 25 μm</td></tr> <tr> <td>Ni</td><td>3-7 μm</td></tr> <tr> <td>Au</td><td>0.05-0.12 μm</td></tr> <tr> <td>Plated hole</td><td>1.00-1.10 mm</td></tr> <tr> <td rowspan="4"><i>Silver plated PCB</i></td><td>Hole</td><td>1.15\pm0.025 mm</td></tr> <tr> <td>Cu</td><td>min. 25 μm</td></tr> <tr> <td>Ag</td><td>0.1-0.3 μm</td></tr> <tr> <td>Plated hole</td><td>1.00-1.10 mm</td></tr> <tr> <td rowspan="3"><i>OSP copper plated PCB</i></td><td>Hole</td><td>1.15\pm0.025 mm</td></tr> <tr> <td>Cu</td><td>min. 25 μm</td></tr> <tr> <td>Plated hole</td><td>1.00-1.10 mm</td></tr> </table>	<i>Tin-lead plated PCB (HAL) acc. DIN EN 60352-5</i>	Hole	1.15 \pm 0.025 mm	Cu	min. 25 μ m	Sn	max. 15 μ m	Plated hole	0.94-1.09 mm	<i>Chemical tin-plated PCB</i>	Hole	1.15 \pm 0.025 mm	Cu	min. 25 μ m	Sn	min. 0.8 μ m	Plated hole	1.00-1.10 mm	<i>Au / Ni plated PCB</i>	Hole	1.15 \pm 0.025 mm	Cu	min. 25 μ m	Ni	3-7 μ m	Au	0.05-0.12 μ m	Plated hole	1.00-1.10 mm	<i>Silver plated PCB</i>	Hole	1.15 \pm 0.025 mm	Cu	min. 25 μ m	Ag	0.1-0.3 μ m	Plated hole	1.00-1.10 mm	<i>OSP copper plated PCB</i>	Hole	1.15 \pm 0.025 mm	Cu	min. 25 μ m	Plated hole	1.00-1.10 mm
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PCB board thickness: $\geq 1,6$ mm																																															
Mating force	:	≤ 5 N/line																																													
Withdrawal force	:	> 1 N/line																																													
Grid pattern	:	4.40 x 6.25 mm (within a twin x between twins)																																													
Stack height	:	9.5 mm																																													
Mating distance	:	12.5 ... 15 mm																																													
Wiping length	:	2.5 mm																																													
Acceptable radial mating offset	:	max. ± 1.5 mm																																													
Temperature range	:	- 55 °C ... + 125 °C																																													
Moulding material	:	Liquid Cristal Polymer (LCP), UL 94-V0																																													
Contact surface	:																																														
Contact zone	:	Au																																													
Termination area	:																																														
Centre pin	:	Au																																													
Ground pin	:	Ni																																													

* Reference: short contact

¹⁾ Data of a separate Mini Coax mated connector pair including the press-in terminations to pcb

²⁾ Data of Mini Coax connector pair including the whole test board environment (see Fig. 6)

Mini Coax connector integrated in test boards

Transmission characteristics of a connector can only be measured within its typical environment. The environment for a board-to-board connector is generally a pcb (printed circuit board). The approach to determine the transmission characteristics of the connector itself is to measure the complete arrangement with special calibration techniques and to remove the parameters of the connector. The performance of the test board is responsible for the accuracy of the parameters on the connector itself.

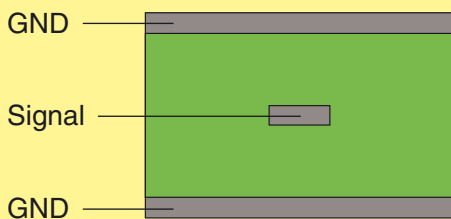


Fig. 5: Cross-section of a trace of the test board

The signal integrity of a test board is mainly influenced by the characteristic impedance, losses of pcb traces and the design of micro vias. It's obvious that the pin in hole of the connector and the vias have to be considered as one. This means that the thickness, material and the amount of layers of the pcb have to be taken into consideration for the characterisation of a board-to-board connector.

Fig. 6 shows the test boards with the integrated Mini Coax connector. The test boards are executed in stripline technology with a characteristic impedance of $50\ \Omega$. To connect the test boards with the cables of the measurement instrument, SMA connectors are used.

For high speed digital applications the main parameters are defined in the time-domain, like reflection loss, rise-time degradation, eye-opening etc. For RF-applications like in radio base stations or broadcasting services the frequency-domain is the preferred point-of view in order to characterise the systems and the components in regards to return loss, insertion loss, crosstalk, linearity etc.

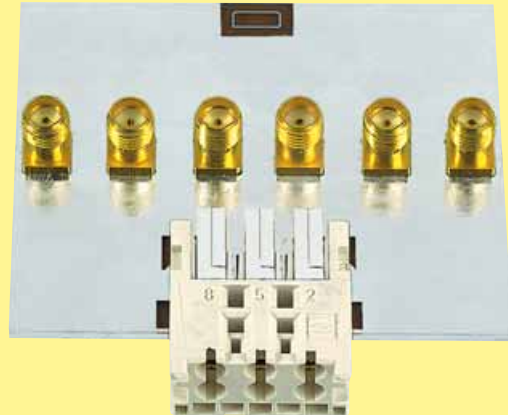


Fig. 6: Test boards with implemented Mini Coax connector

Figure 7 shows the signal path given by the Mini Coax connector and the components on the evaluation board. Significant areas in the signal path are indicated with the characters A...G and T for traces on the board.

The signal path was measured with a Time Domain Reflectometer (TDR) to determine the discontinuities of the arrangement (Fig. 8).

Figure 9 shows the equivalent circuit of the signal path with grouped elements for the Mini Coax connector. The parameters had been extracted from the measured TDR profile.

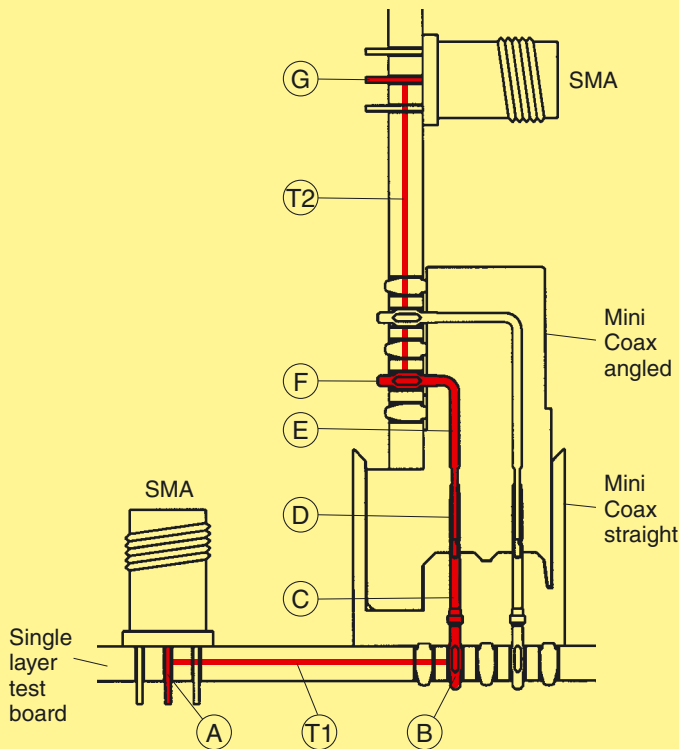


Fig. 7: Signal path of a board to board Mini Coax connector (SMA connectors used for measurement device connection)

Legend for Fig. 7 and Fig. 8

- (A) : SMA connector
- (T1) : 50 Ω trace of the backplane
- (B) : Pin in hole of the straight Mini Coax module
- (C) : Section of straight contact behaves capacitive
- (D) : Transition of the straight module to the angled module behaves inductive
- (E) : Section of angled contact behaves capacitive
- (F) : Pin in hole of the angled Mini Coax module
- (T2) : 50 Ω trace of the daughtercard
- (G) : SMA connector

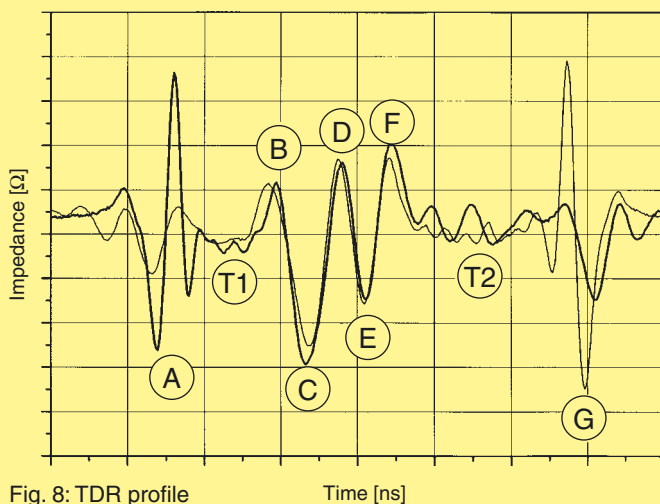


Fig. 8: TDR profile

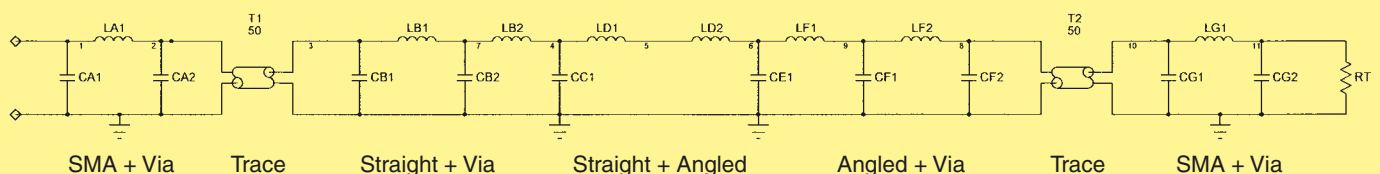


Fig. 9: Equivalent circuit with grouped elements

Insertion and return loss

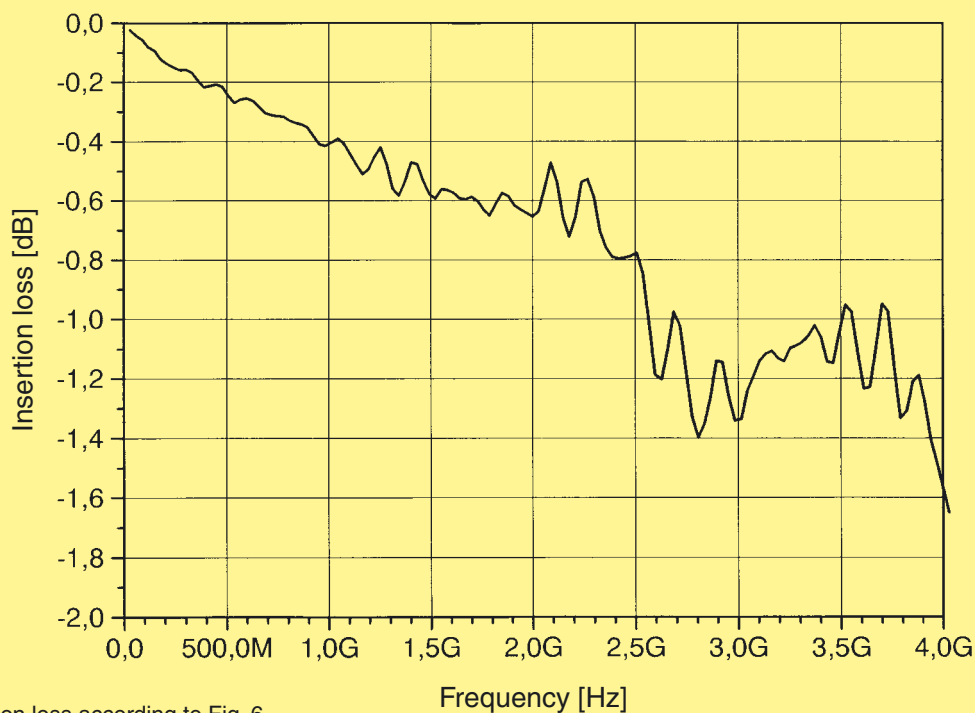


Fig. 10: Insertion loss according to Fig. 6

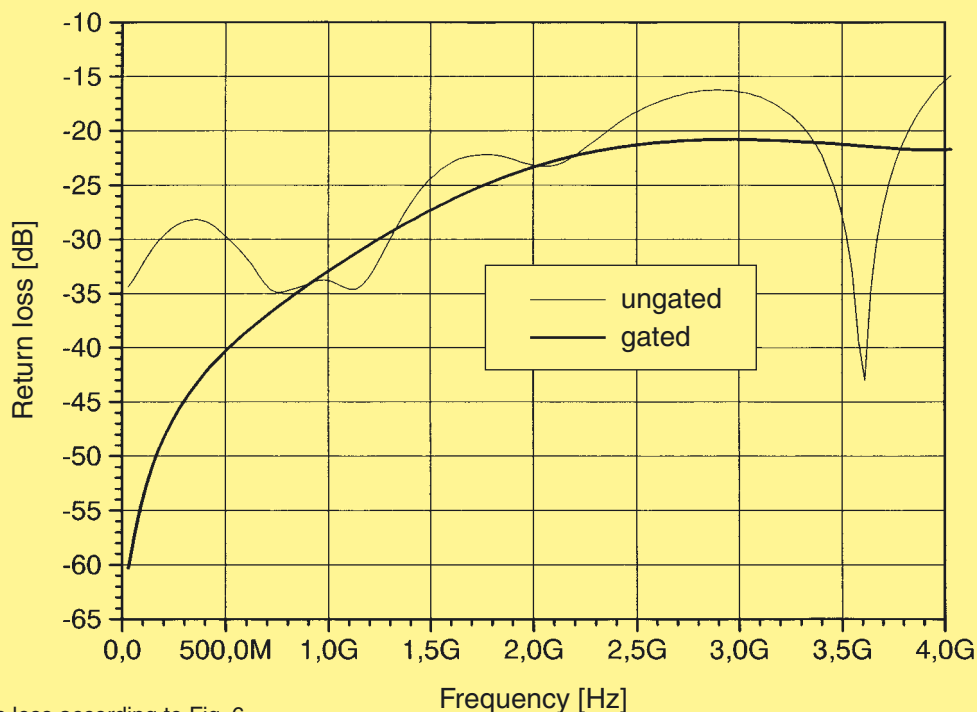


Fig. 11: Return loss according to Fig. 6

To extract the parameters of the connector itself the method of gating was selected. This eliminates the effects of SMA launchers. The test launchers reduce the performance of transmission characteristics due to their discontinuities.

Near-end crosstalk of the Mini Coax modules

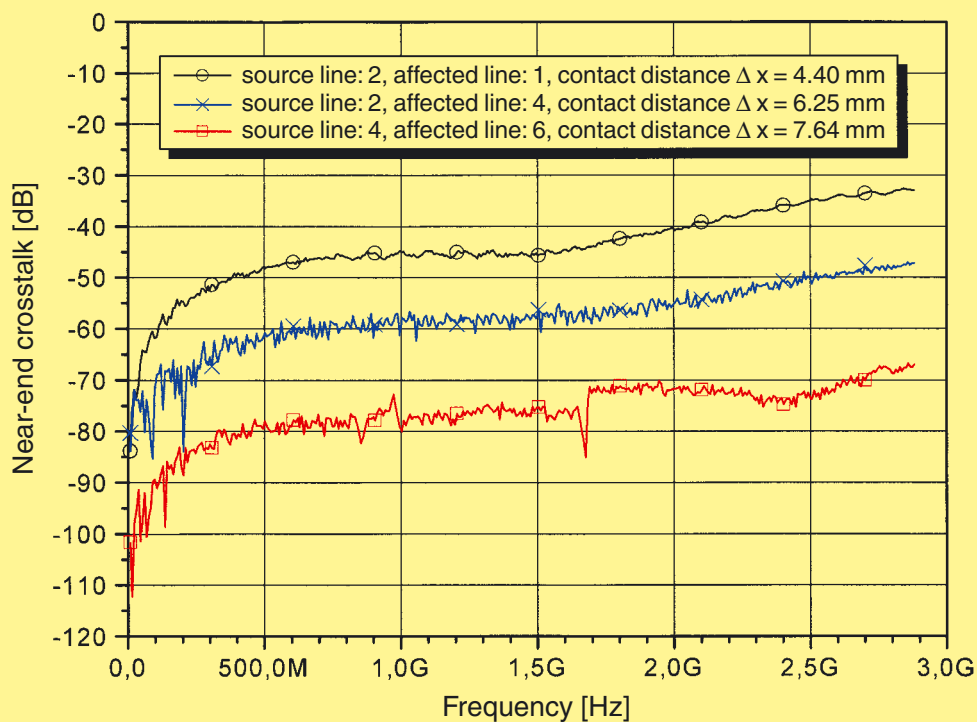


Fig. 12: Near-end crosstalk of several contact configurations

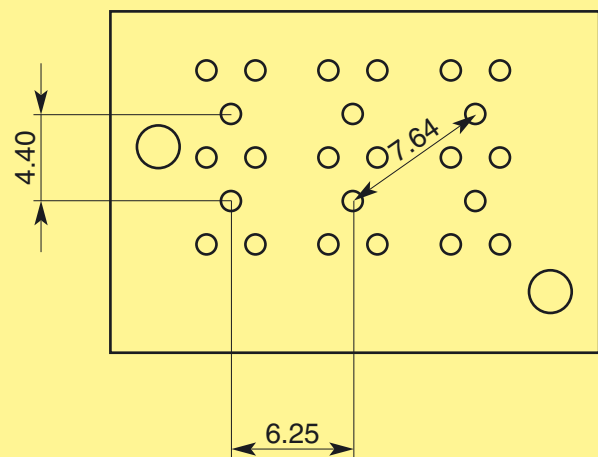
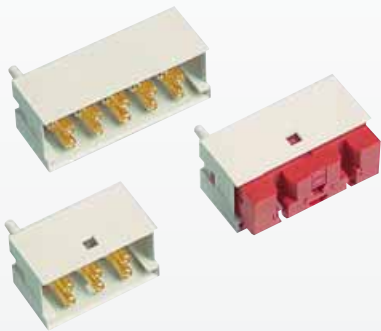


Fig. 13: Measured configurations [mm]

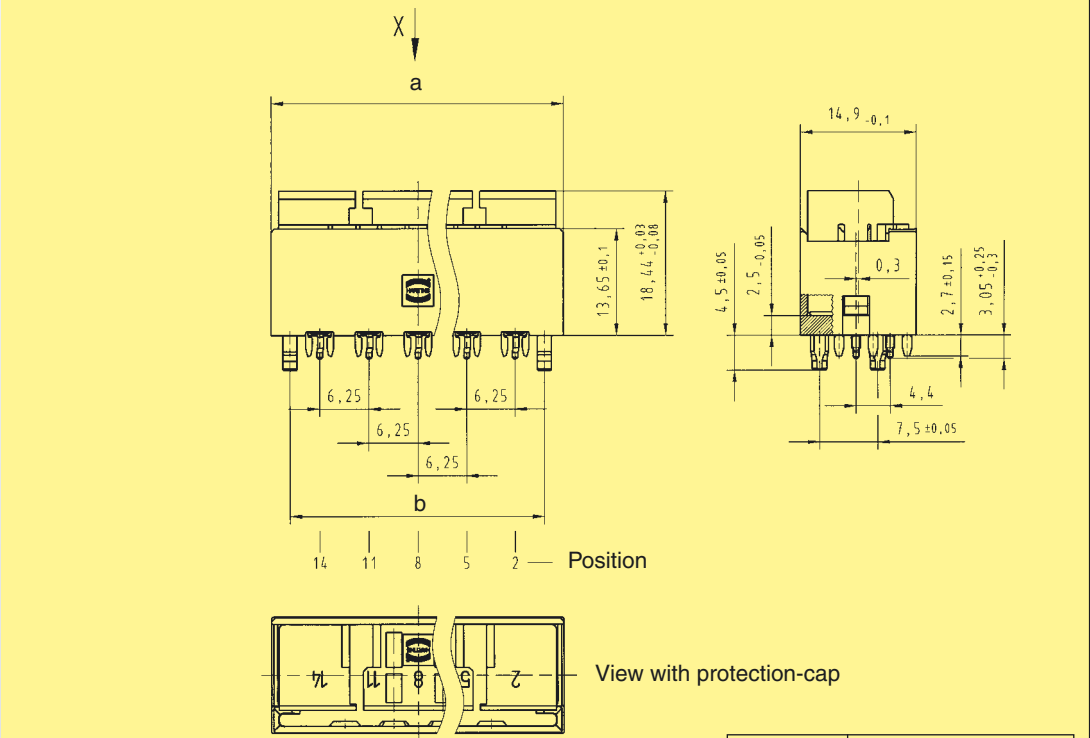
Even for the shortest distance of 4.40 mm crosstalk-values better than 30 dB can be achieved for frequencies of 2.5 GHz and above.



Straight modules

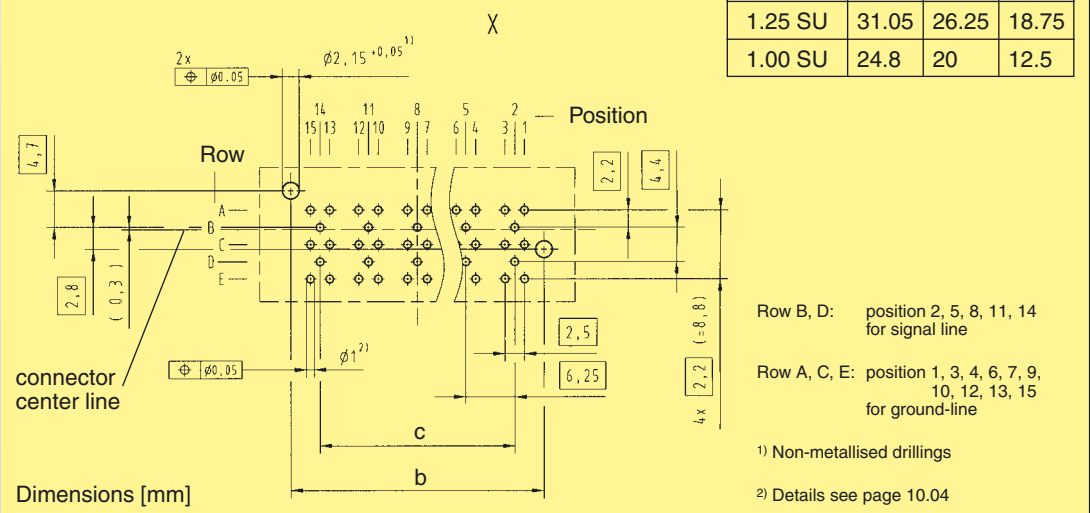
Identification	Number of contacts	SU	loaded positions	Part number
Mini Coax modules, press-in termination	10	1.50	2, 5, 8, 11, 14	07 11 100 0026
	8	1.25	2, 5, 8, 11	07 11 100 0024
	6	1	2, 5, 8	07 11 100 0023
	4	1	2, 8	07 11 900 0024
	2	1	2	07 11 900 0023

Dimensions



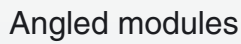
Straight module	Dimension [mm]		
	a	b	c
1.50 SU	37.3	32.5	25
1.25 SU	31.05	26.25	18.75
1.00 SU	24.8	20	12.5

Board drillings

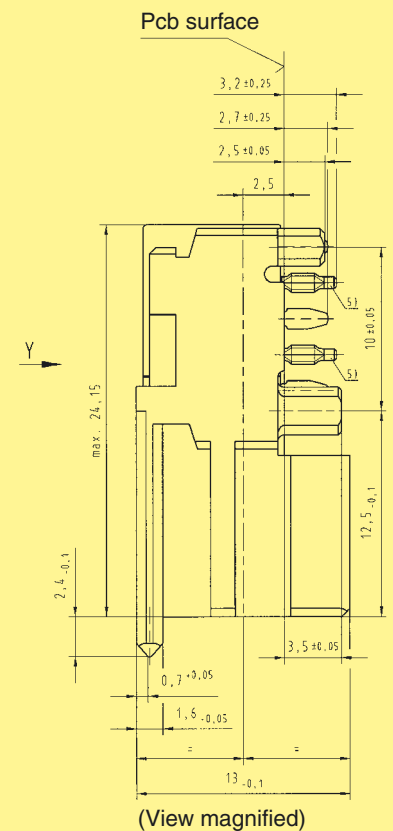


Row B, D: position 2, 5, 8, 11, 14 for signal line
Row A, C, E: position 1, 3, 4, 6, 7, 9, 10, 12, 13, 15 for ground-line

1) Non-metallised drillings
2) Details see page 10.04

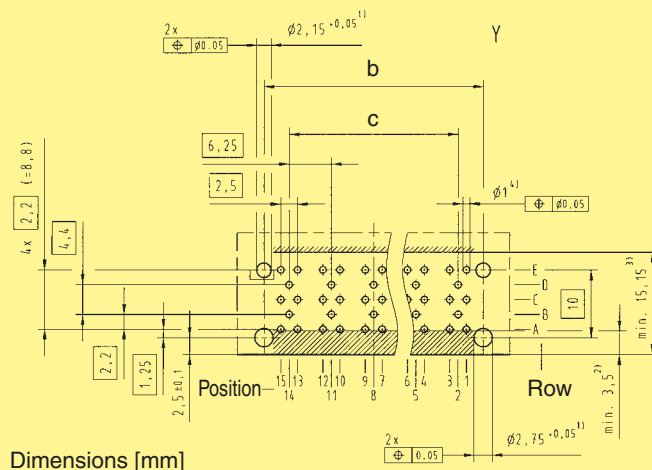


Dimensions



(View magnified)

Board drillings

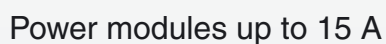


5) Press-in zone in any angular position related to it's longitudinal axis possible

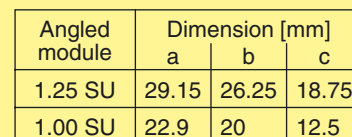
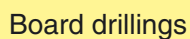
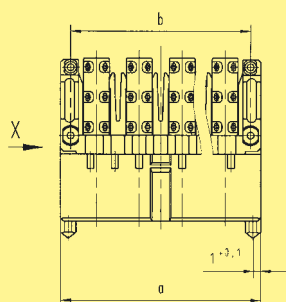


Cable assemblies

Identification	Number of contacts	Part No.	Drawing	Dimensions [mm]
Cable assembly for mating with the straight module*	1-10	on request		
Cable assembly for mating with the angled module*	1-10	on request		
* Plug and jack crimp contacts				



Dimensions



- 1) Non-metallised drillings
- 2) No tracks, except solder eyes
- 3) Limit area of components (valid for both pcb-sides)