VHDM® H-Series

High Speed

Comparative Single-Ended Electrical Characterization

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SCOPE

1. The scope of this document is to define the electrical performance of the VHDM H Series connector products, as compared to the VHDM connector product, measured on test fixtures of the same construction.

2. Parameters measured include reflections, multi-line crosstalk, signal delay and rise time degradation for the 8 row VHDM H connector. Although 5 & 6 row are not included in this report, the 8 row serves as a good estimation for overall connector performance.

3. Test equipment used in collecting data includes the Agilent 8364B PNA and 4421B Four-Port Test Set. Standard measurement and SOLT calibration was used.
TEST BOARDS & BOARD TEST PATTERNS:

The high-speed layers used Rogers 4003, in a standard stripline construction. Standard high-speed layout/routing practices were employed during board design and fabrication. In order to minimize fixture loss, traces to and from the connector were kept to a 2.5-inch distance. In addition, cal traces for the 1x and 2x distances were created, to measure the fixture burden.

The board was split into two S/G test patterns, shown in the figure below. The pattern gives the ability to drive all lines in a wafer (column 2), while columns 3 and 4 show typical performance using a 1:1 S/G configuration.

**VHDM Backplane Signal Pattern**

PCI Cal traces include:

1) A TRL reference trace set,

2) Open/Short/Load/Through (good for SOLT calibration, limited by the return loss to ~1.5GHz maximum)

3) 1x and 2x through traces, equal in length and construction to the traces attaching the connector attach vias to the SMAs.
VHDM SINGLE ENDED CONNECTOR IMPEDANCE:
The figure below shows a typical single-ended impedance profile for VHDM, indicating the relative positions of different physical features in the channel.
VHDM SINGLE 1/1 S/G CONNECTOR IMPEDANCE:
The below figures show the VHDM and VHDM-H series impedance profiles, as driven at an equivalent source rise time of 50 psec (70 psec delivered to the connector footprint) into the backplane header connector. The figures are grouped, first showing the impedance profiles for the column with all pins attached to traces, and secondly showing the columns where a 1:1 S/G ratio is present. Within each group of plots, the two attached pins are consistently top- or bottom-routed, with the bottom-routed pins showing a lesser via discontinuity.
Generally, the daughtercard leadframe is moderately inductive, showing a profile on the order of 60 ohms characteristic impedance for those rows of discernable length. In addition, the mating interface is observed to be consistently on the order of 46-47 ohms, within this test environment.
VHDM CONNECTOR SINGLE ENDED CROSSTALK:
Table 6 shows the first column Next crosstalk data, at various rise times, for the single ended 1:0 gnd pattern. This column does not have a shield on one side.

VHDM CONNECTOR PROPAGATION DELAY

Typical VHDM 8 row propagation delays are as follows:

VHDM® Propagation Delay
Test Signal Rise Time: 500 ps (10-90%)
A -> A' 152 ps
B -> B' 171 ps
C -> C' 188 ps
D -> D' 211 ps
E -> E' 222 ps
F -> F' 245 ps
G -> G' 262 ps
H -> H' 290 ps

Fig 6: Typical propagation delays
Frequency Domain
Single Ended
The below figure shows the insertion loss of the 1x (2.5-inch) and 2x(5-inch) PCB reference traces. This is shown to provide a frame of reference for the following plots, which indicate the insertion loss and frequency-domain isolation for different adjacent combinations of pins.

Test Fixture Insertion Loss
In each case for the insertion loss trace plots which follow, the VHDM and VHDM-H connector pins for the same location are shown, with the loss of the VHDM-H being the higher trace (less loss) in each case. As before, the trace plots for the fully-populated column are shown first, with the 1:1 S:G ratio pins in subsequent plots. On each plot, the five-inch trace insertion loss is shown, to be used as a subtractive reference for the connector contribution.
E2 Insertion Loss

F2 Insertion Loss
C4 Insertion Loss

D3 Insertion Loss
G4 Insertion Loss

H3 Insertion Loss
Conclusions

In each case observed through measurement, the VHDM-H series outperformed the standard VHDM 8-row product. In addition, for the data rates proposed in this application, 6 Gbps single-ended, the greatest amount of signal margin would be present for the 1:1 signal-to-ground ratio, provided that sufficient area is available to accommodate this.