100 Gbps Differential Transmission Metal Cable for Data Centers

1. Outline

There has been growing demand for cloud servers due to the widespread use of IoT and smart devices. This has increased the demand for higher signal processing speed, namely, signal transmission speed.

We already mass-produce metal cables for 40 Gbps differential transmission. We have developed a metal cable for 100 Gbps differential transmission*1 designed for the next-generation communication protocol.

Table 1. Product specifications

	40 Gbps (mass-produced product)	100 Gbps (newly developed product)
Band/ch	10 Gbps (10 GHz) /1 ch	25 Gbps (25 GHz) / 1 ch
Number of channels	8 ch (4 each for upstream and downstream)	8 ch (4 each for upstream and downstream)
Intra-pair Skew	25 psec/m or less	10 psec/m or less

2. Features of the Product

2-1 Specifications

This metal cable is used for connection between servers or storage devices at data centers (Fig. 1).

The basic configuration is designed to transmit signals using four channels each for the upstream and downstream transmission (eight channels in total).

Table 1 shows the specifications of the product for 40 Gbps transmission that is already in mass-production and the newly developed product for 100 Gbps transmission.

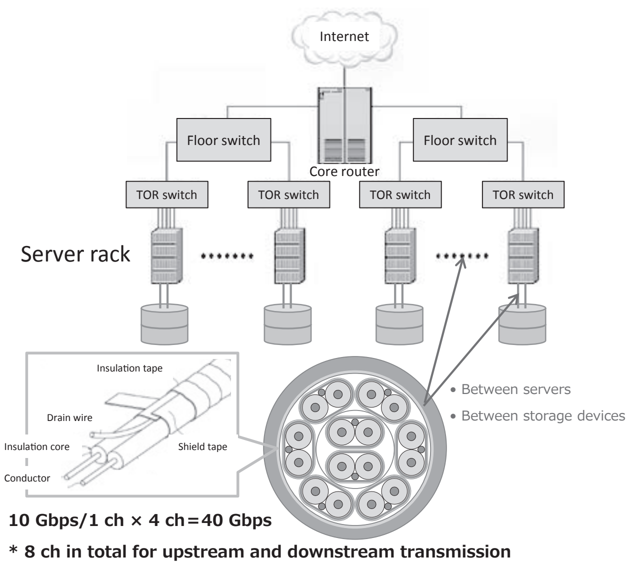

Fig. 1. Example of use at data centers

2-2 Features

In the mass-produced product, local deterioration of insertion loss occurs in the band beyond 10 GHz. For the newly developed product, the product design was required to prevent this phenomenon up to 25 GHz.

Local deterioration of insertion loss is known to be caused by the helical winding of a shield tape. To avoid suckout, the shield tape was applied longitudinally. The structure was changed to allow the current to flow linearly, as shown in Fig. 2.

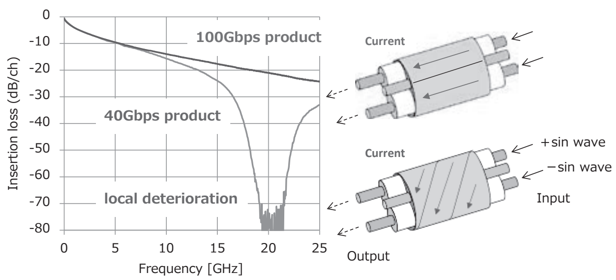

Fig. 2. Insertion loss waveform per channel

The comparison of the eye patterns of 40 Gbps and 100 Gbps (see Fig. 3) shows the need for more rigorous control of skew, which is the delay time difference between the + sine wave (Td1) and − sine wave (Td2).

In general, the delay time is determined by the synthetic permittivity between the insulation core and the shield tape (Fig. 4). That is, skew is affected by the variation in permittivity of the insulation materials used for the two transmission lines and small voids generated during extrusion molding, resulting in a delay time difference.

The difference in the physical length of the two transmission lines is another factor that contributes to a delay time difference. To eliminate these factors, the co-extruded insulated structure was used to process with two transmission lines at the same time to develop a metal cable for 100 Gbps differential transmission (Fig. 5).

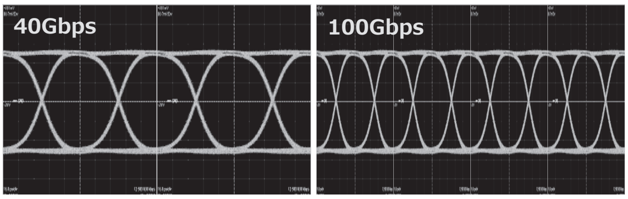

Fig. 3. Correlation between transmission speed and eye pattern

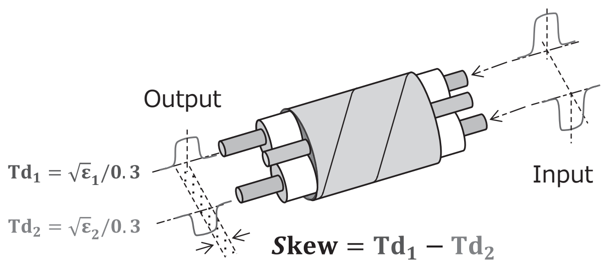

Fig. 4. Overview of skew

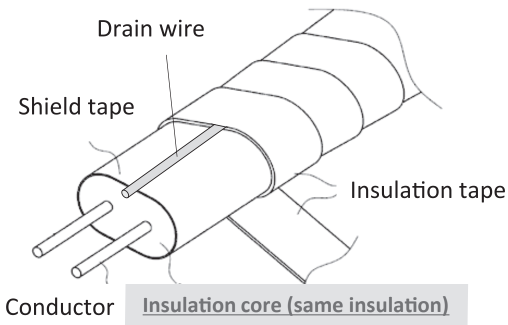

Fig. 5. Same insulation structure

＊1 Differential transmission: The + sine wave and − sine wave are input at the same time, and the difference of each wave is output on the output side. In general, this transmission method is characterized by low noise emission and low sensitivity to noise.