LVDS: The ribbon cable connection

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Introduction

As LVDS gains popularity, multi-channel applications are becoming common. In systems where cables are used to connect drivers to receivers, CAT5-type cable, usually containing unshielded twisted pairs (UTPs), has worked well. Now that 8-channel and 16-channel LVDS drivers and LVDS receivers are available in single packages, ribbon cable is being used successfully in these “wide-bus” applications. It has become much easier to implement 16-, 32-, or 64-channel-wide LVDS systems. But what happens to the performance? The most common cable used in LVDS applications is 4-pair CAT5 cable. When 16 or 32 twisted pairs are needed, can ribbon cable be used?

Test set-up

A customer requested our assistance to determine the feasibility of using ribbon cable for a 16-channel-wide point-to-point LVDS system. The customer, using a single LVDS387 driver connected to a single LVDS386 receiver, requested jitter and crosstalk data at 50 Mbps and 100 Mbps using 0.5-m and 3-m lengths of twisted ribbon cable.

For these tests, a generic evaluation module (EVM) was developed (one PWB that can be used for the LVDS387 or LVDS386). BergSticks™ were used for the signal I/O and ribbon cable connections. Amphenol Cable Type 843-132-2801-064 twisted ribbon cable was used. Figure 1 shows the bench test set-up with the EVMs connected using a 3-m length of ribbon cable. The inputs to the LVDS387 driver were provided by a Tektronix HFS-9009 Pattern Generator Mainframe configured with four HFS 9DG1 plug-ins cards.

For these measurements, all 16 channels were supplied with NRZ data. The pattern generator was set up with 16 channels supplying pseudo-random binary data to the ’387 driver.

The programmable delays between source channels in the pattern generator were set to zero, so all channels would be switching at the same time.

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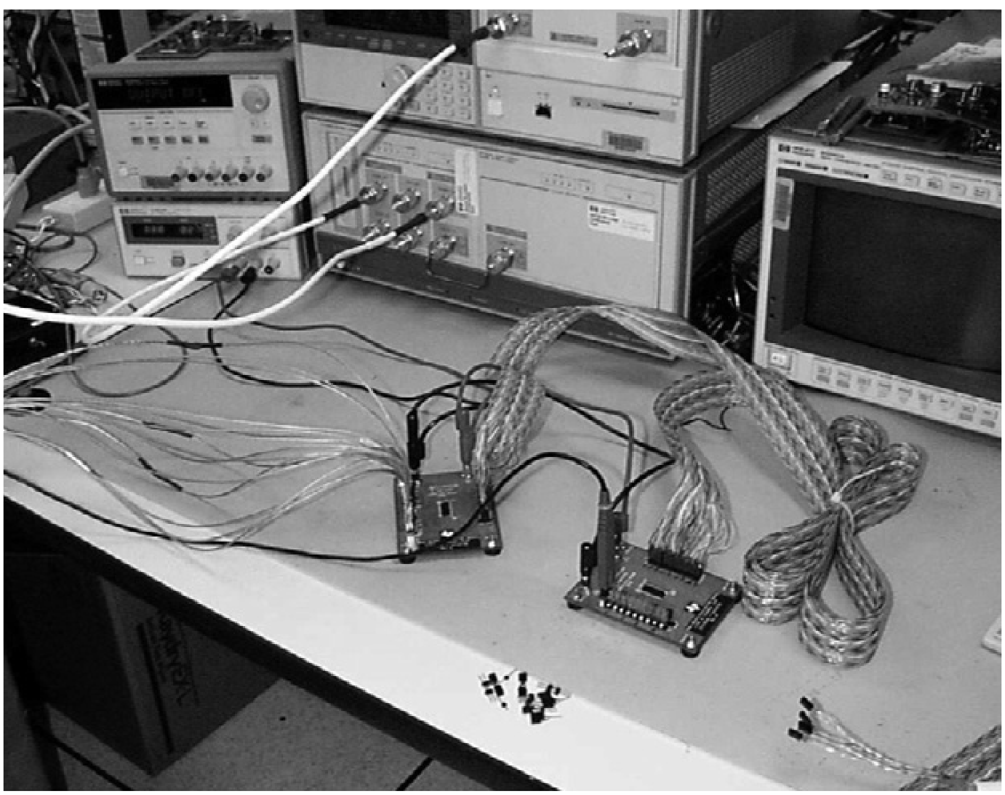
Figure 1. Bench test set-up



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Test results

Jitter was measured on the eye pattern at four points along the transmission path:

Point 1. Output of the receiver
Point 2. Input to the receiver
Point 3. Output of the driver
Point 4. Input to the driver

By collecting the jitter values at these four points, jitter added by each component could quickly be determined. For example, the jitter added by the receiver is simply the jitter measured at Point 2 minus the jitter measured at Point 1. Jitter added by the ribbon cable is Point 3 minus Point 2, and so on. Data was collected and loaded into a spreadsheet, and the jitter contribution was plotted for each of the four tests that were run (see Figures 2, 3, 4, and 5).

During the first test, the output jitter from Channel C2 was much higher than from any other channel. Similar problems were also observed on Channel C4. The problem was determined to be a short circuit between input pins on the driver EVM. This was caused by the author's soldering ability.

Data for Channels C2 and C4 were not collected for the remaining tests.

Figure 2. Jitter contributions using 0.5-m ribbon cable at 50 Mbps

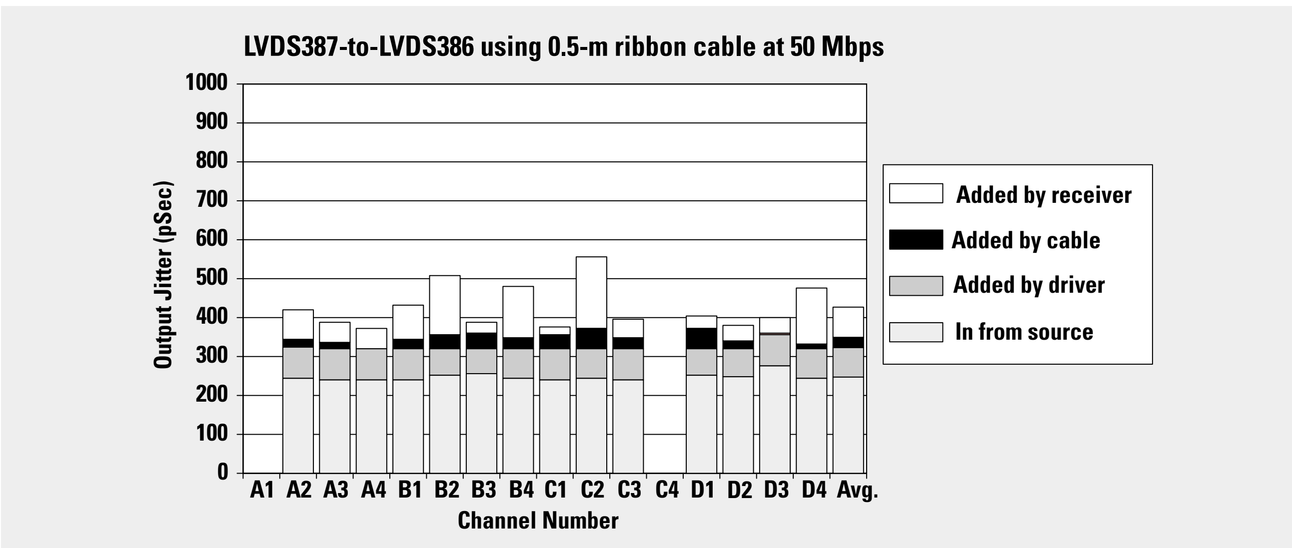
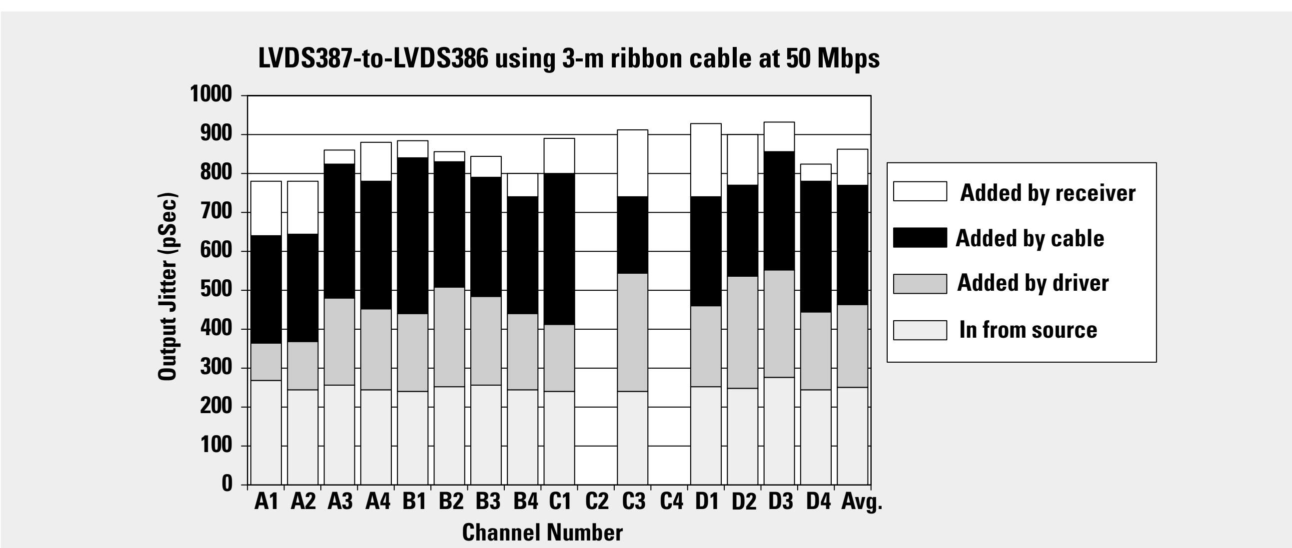


Figure 3. Jitter contributions using 3-m ribbon cable at 50 Mbps



Conclusion

The results show that short lengths of ribbon cable can be used successfully for interconnecting LVDS drivers and receivers. They suggest, however, that the length be kept short, as the increase in cable-generated crosstalk increased significantly between 0.5-m and 3-m lengths tested at 100 Mbps. It should also be noted that there is no significant increase associated with channels running in the middle of the ribbon cable compared to the channels along the edge of the cable.

Related Web sites

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www.ti.com/sc/docs/tools/analog/interfacedevelopmentboards.html

Get product data sheets at:

www.ti.com/sc/docs/products/analog/*device*.html
Replace *device* with sn65lvds386 or sn65lvds387

Figure 4. Jitter contributions using 0.5-m ribbon cable at 100 Mbps

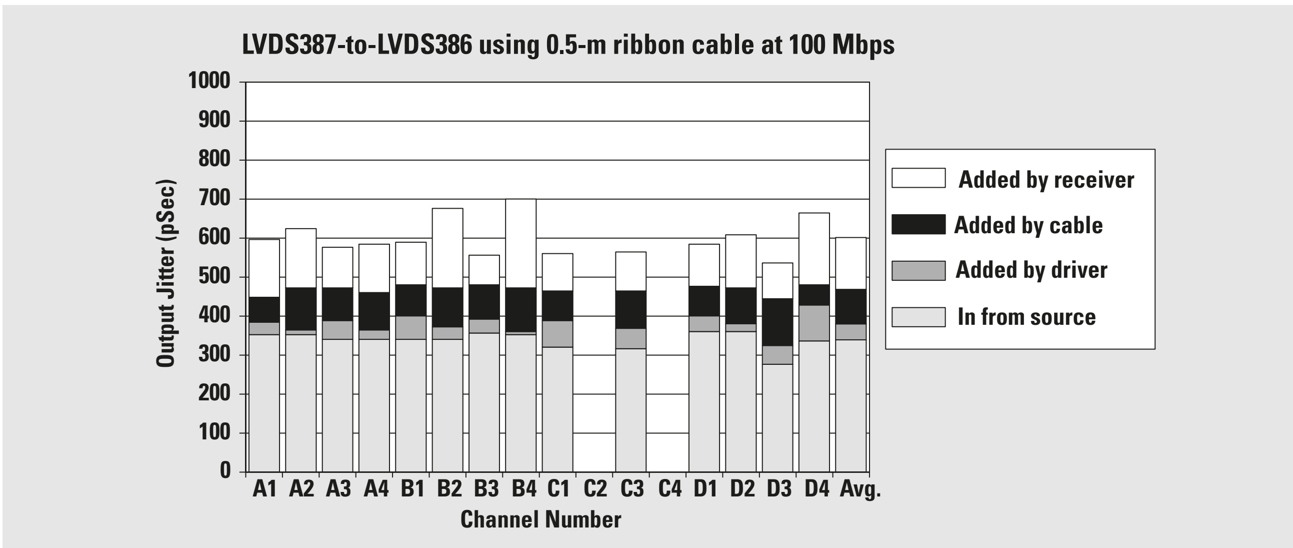
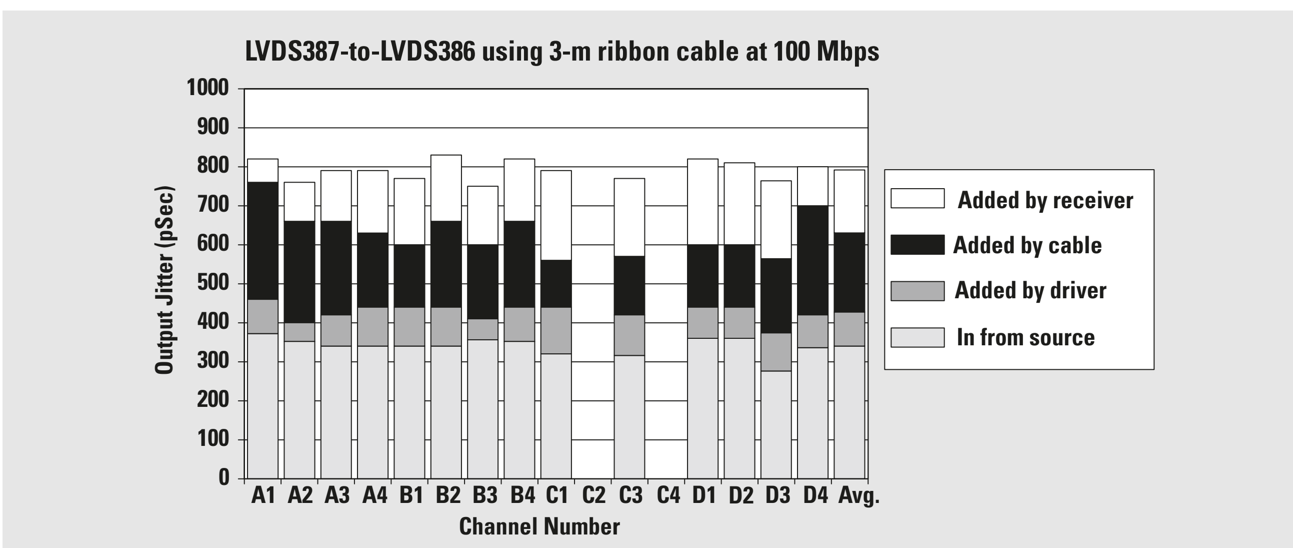


Figure 5. Jitter contributions using 3-m ribbon cable at 100 Mbps



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