AN2248
APPLICATION NOTE

Designing with the STMUX1000L Ethernet Gigabit LAN Switch

Introduction

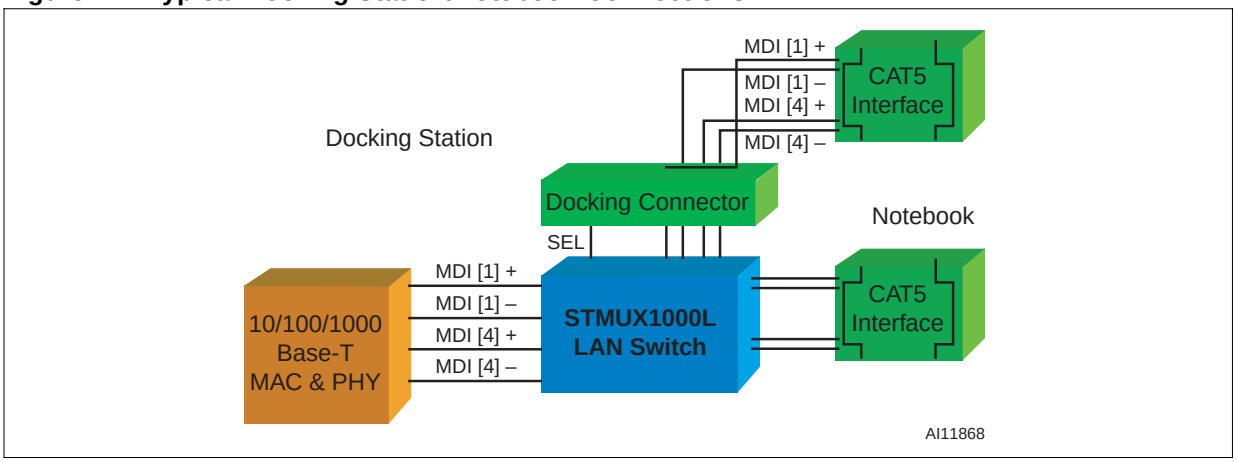
The STMUX1000L is an 8- to 16-bit bi-directional Multiplexer/Demultiplexer. It is designed for applications that require signal routing at 10/100/1000 Megabit Ethernet speeds. The device integrates three Single Pole Dual Throw (SPDT) Channels for LED support and is available in two different packages, the TSSOP56 and QFN56.

This application note highlights various applications into which the STMUX1000L Gigabit LAN Switch can be designed, such as PC Notebooks and docking stations (see *Figure 1*). These are applications where several electrical characteristics impact high performance data transfer, including

- low noise between signals,
- low R_{ON}, and
- low C_{on} and C_{off} capacitance.

Additionally, the superior performance of the STMUX1000L is illustrated when it is compared to a competitor's device.

Figure 1. Typical Docking Station/Notebook Connections



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1 Evolution of Gigabit Ethernet Technology

Gigabit Ethernet evolved from the original 10Mbps Ethernet and 100Mbps fast Ethernet standards. At one time, many organizations believed that a 10Mbps connection would always be adequate for the average business desktop user, and that 100Mbps would be needed only in the “backbone” (the central network that links all of the Internet together).

Gigabit Ethernet technology increases the performance of the data transfer between servers and desktops, thereby reducing the traffic flow in the congested areas.

It is also a good choice because it supports a high level of Quality of Service (QoS). QoS methods are increasingly important for avoiding latency problems as voice, video, and data share the same bandwidth for Next-Generation Networking (NGN) applications.

1.1 Typical Progression

Typical users of Gigabit Ethernet are the workgroups that usually need heavy bandwidth like the engineering and R&D Departments, which not only use CAD, 3D modelling and collaborative design, but also have more powerful workstations that can immediately take advantage of a high-performance connection. Other specialized business categories like medical imaging, graphic design or advertising production will also follow this new standard.

The transition to Gigabit Ethernet speeds and networks will happen in several phases which are summarized as follows:

- Phase 1

  High-performance Gigabit switches are used to aggregate backbone traffic.
- Phase 2

  Gigabit Ethernet is switched and routed at the network backbone with switch-to-switch connections.
- Phase 3

  Greater server-to-switch bandwidth is deployed using a gigabit switch to support Gigabit Ethernet network adapter cards, boosting server connections to 1000Mbps.
- Phase 4

  All servers have at least one Gigabit connection, and Gigabit becomes the standard for the highest-demand desktops and workgroups.
- Phase 5

  As PCs are replaced due to normal attrition, 10/100/1000Mbps network interfaces are specified to replace 10/100Mbps connections.
- Phase 6

  Servers are scaled to multi-Gigabit speeds. Older switches are replaced with Gigabit switches to take Gigabit down to the desktop. Gigabit Ethernet becomes standard for virtually all desktops.

2 STMUX1000L Testing and Measurement

Basic testing instruments (see *Table 1*) and benches (see *Figure 2 on page 5* and *Figure 4 on page 6*) were used to perform the –3dB bandwidth and Cross-talk measurements.

Figure 3. and *Figure 5.* illustrate the importance of a very high bandwidth and low noise device between the channels to enable a correct data transfer when the laptop is connected to the docking station.

Table 1. Testing Equipment

Brand	Model
Tektronics Dual Programmable Power Supply Generator	PS2521G
Agilent Technologies Network Analyzer 300KHz to 3GHz	E5070B

2.1 –3dB Measurement

The STMUX1000L –3dB bandwidth measurement is conducted as follows:

1. The STMUX1000L switch is connected to the testing circuit and turned ON.
2. A 10dBm sine signal is forced across the switch with a frequency sweep of 300KHz to 1GHz.
3. The output frequency values are checked to make sure they remain the same, while the signal is reduced by –3dB (in the case of *Figure 3*, signal reduction starts at 506.668MHz).

Figure 2. –3dB Bandwidth Test Bench

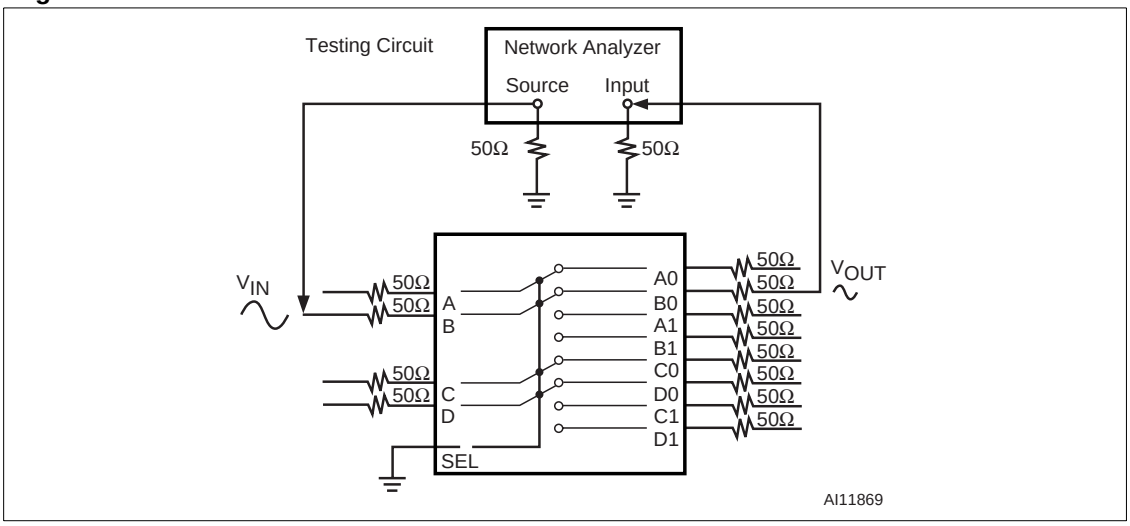
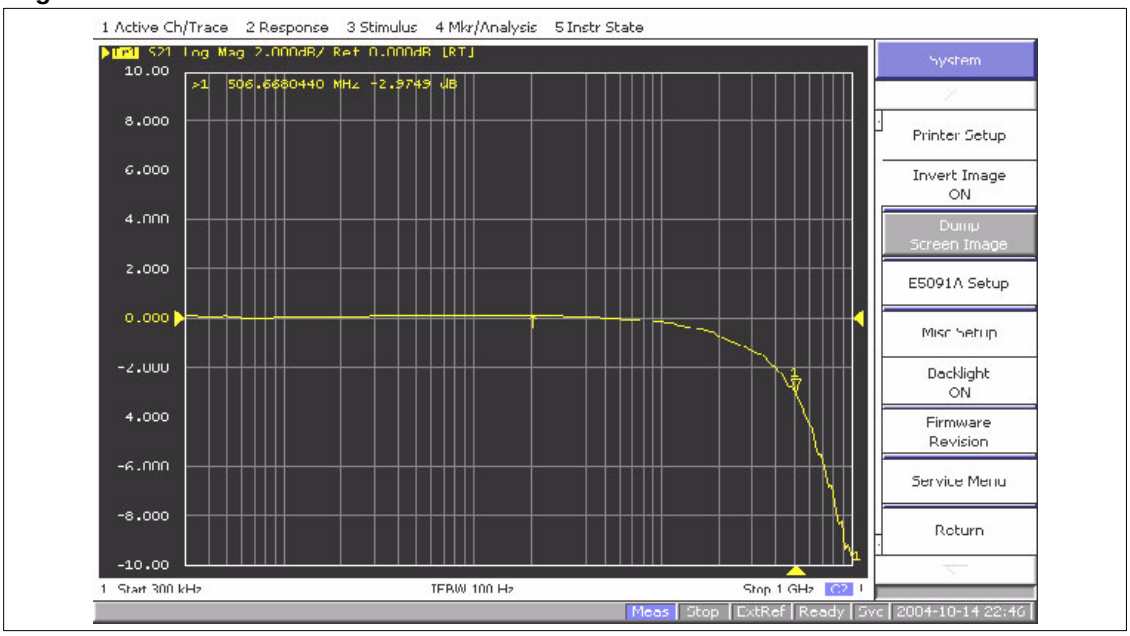


Figure 3. –3dB Bandwidth Characteristics



2.2 Cross-talk Measurement

The STMUX1000L cross-talk measurement is conducted as follows:

1. The STMUX1000L switch is connected to the testing circuit and turned ON.
2. A 10dBm sine signal is forced across the switch with a frequency sweep of 300KHz to 1GHz.
3. The switch is turned OFF and the residual signal level (attributed to the cross-talk phenomenon) is measured (in the case of *Figure 5*, the residual signal level is –47.148dB).

Figure 4. Cross-talk Measurement Test Bench

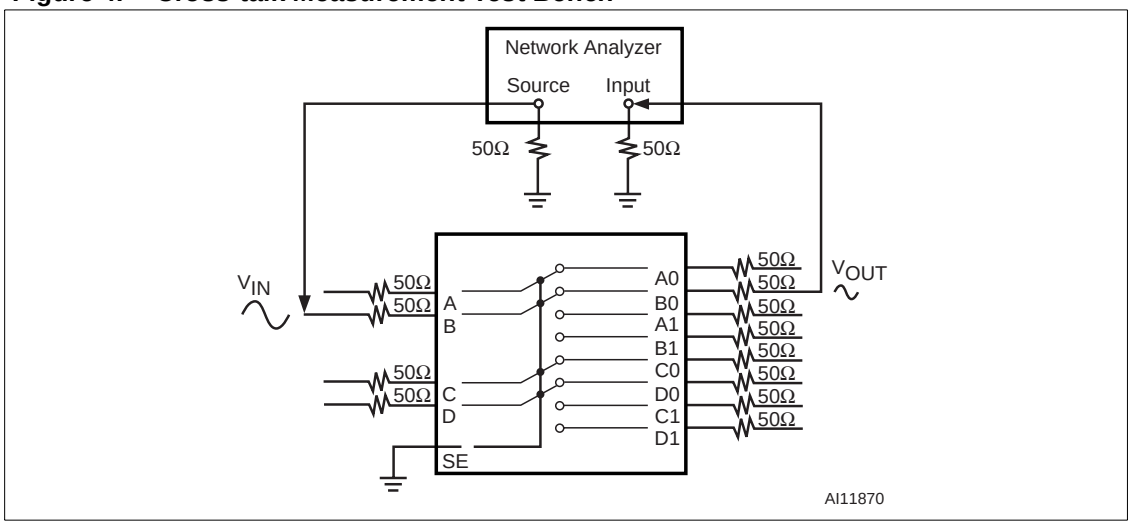


Figure 5. Typical Cross-talk Results

3 Features and Benefits

Table 2 shows the main STMUX1000L features and their corresponding benefits or applications.

For example, the lower quiescent current (I_Q) feature reduces battery consumption, making the STMUX1000L an excellent choice for portable applications.

Table 2. STMUX1000L Features and Benefits

Features	Benefits or Applications
Low $R_{DS\ (ON)}$ = 5Ω (typ)	Low Return Loss
Bandwidth = 350MHz –3dB (typ)	Can be used for Ethernet standards (e.g., 10/100/1000 Base-T)
Low Channel C_{on} = 6pF (typ)	Consistently high bandwidth performance
Low I_{CC} Consumption	Portable applications
Three spare SPDT switches	LED support
Available in QFN56 package	Space saving on the PCB

1. Measurement valid for V_{CC} = 3.3V.

4 Revision History

Date	Revision	Changes
06-October-2005	1.0	First edition