SureLINK
Ultra160 Domain Validation

SURELINK TECHNOLOGY OFFERS SERVERS, STORAGE SUBSYSTEMS AND WORKSTATIONS THE INDUSTRY'S NEWEST AND MOST ADVANCED METHOD OF ENSURING ULTRA160 SCSI INTEGRITY

OVERVIEW

LSI Logic's SureLINK™ domain validation technology offers the most comprehensive and reliable method available today for enhancing Ultra160 SCSI performance. A significant advancement in system manageability, SureLINK technology ensures robust and low-risk Ultra160 implementations by optimizing the interoperability of SCSI devices. SureLINK domain validation is integrated in the Storage Device Management System (SDMS™) software solution. SDMS software provides the software control for the manageability enhancements in LSI Logic's highly integrated LSI53C1010 PCI-Dual Channel Ultra160 SCSI controller, as well as the LSI53C180, the industry's first Ultra160 SCSI bus expander. The groundbreaking SureLINK domain validation technology, backed by LSI Logic's long history of providing innovative SCSI I/O solutions, can enable OEMs, designers and system integrators to deliver a highly competitive Ultra160 SCSI offering for servers, storage subsystems and workstations.

SureLINK domain validation, performed at boot time as well as throughout system operation, verifies that the system is capable of transferring data at Ultra160 speeds, allowing it to renegotiate to lower speed and bus width if necessary. SureLINK technology. Extends the domain validation guidelines documented in the SPI-3 Annex. SureLINK technology performs basic, enhanced and margined domain validation. SureLINK domain validation significantly improves system manageability by assuring that the system has margin at its given operating speed. This cable plant margining capability, exclusive to LSI Logic's Ultra160 solution, includes end-to-end margining from the LSI53C1010 controller through the LSI53C180 bus expander to the target device. Also, key to the LSI53C180 bus expander is its ability to couple bus segments together without any impact to SCSI protocol or software, for entirely transparent communication.

The domain validation capability of SDMS software is available as an independent application, as well as integrated in the DMI-based (Desktop Management Interface) system management solution for enterprise class implementations, providing the network administrator remote management capability. SureLINK technology's SDMS software also enables and manages Asynchronous Information Protection (AIP), which safeguards all non-data

BENEFITS

SureLINK domain validation technology ensures robust Ultra160 SCSI performance through a variety of capabilities:

- Verifies Ultra160 link integrity
- Ensures system operation at Ultra160 speeds
- Reduces system downtime
- Identifies marginal cabling environments
- Enables seamless integration with SDMS software
- Improves boot reliability

FEATURES

- Implementation of the SPI-3 Domain Validation Annex guidelines
  - Basic Integrity Check (Level 1)
  - Enhanced Integrity Check (Level 2)
  - Extension of domain validation to Margined Integrity Check (Level 3)
- Detects marginal cable and backplane configurations that may limit performance

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FEATURES (Continued)

- Includes drive strength margining and programmable REQ/ACK skew test
- Supported by industry's only Ultra160 SCSI bus expander
- Separate SCSI target validation
- Target-specific SCSI settings
  - Bus width
  - Data transfer mode/rate
- Graphical User Interface (GUI) for control and configuration
- Event-initiated alerts
- On-screen notification of SCSI bus status

phases and augments the CRC feature of LSI Logic's Ultra160 SCSI solutions. Additionally, the SCSI BIOS component of SureLINK technology enables improved boot reliability by assuring optimum data transfer rates and bus widths through successive INQUIRY results.

Applications

- *Servers* - Internet/Intranet network, video, e-mail, printing, database management, etc.
- *Workstations* - CAD/CAM, industrial simulation, etc.
- *Host-attach for RAID and JBOD mass storage subsystems* - Anywhere data access is the bottleneck

Integrity-Checking Methods

The advanced SureLINK technology provides software control that enables LSI Logic's Ultra160 SCSI controllers to perform domain validation to verify successful Ultra160 transfers. Verifying Ultra160 processes is done through integrity checking-that is, a means for assuring that the physical layer is able to transfer data between the initiator and the target at the negotiated speed and width. SureLINK technology provides all three levels of integrity checking (as defined in the ANSI T10 SPI-3 Annex), unprecedented in the Ultra160 SCSI arena:

- *Basic Domain Validation (Level 1)* - Detects transfer errors and thus determines if the initiator/target connection can operate at the maximum speed and width;
- *Enhanced Domain Validation (Level 2)* - Assesses the stress placed on the physical layer when known data patterns are sent and received;
- *Margined Domain Validation (Level 3)* - Provides information on the amount of margin in a given system.

LEVEL 1: BASIC DOMAIN VALIDATION

Basic domain validation is performed by first issuing two INQUIRY commands with the timing parameters set to asynchronous and narrow. The data that is returned by the INQUIRY is stored so it can be compared later. Next, a second INQUIRY command is issued with the period and width set to the desired transfer rate. This second INQUIRY data is then compared to that of the first. If the data does not match, the initiator falls back to a lower speed/width and tries the INQUIRY again. If the data does match, the

initiator and target can successfully communicate at the negotiated speed and these settings are kept. Basic domain validation is used to find problems with cabling (for example, narrow cable on wide device or bad cables), expanders that are not capable of transferring at the negotiated period or width, damaged transceivers and improper termination.

LEVEL 2: ENHANCED DOMAIN VALIDATION

Enhanced domain validation expands on basic domain validation by providing the ability to send and receive a particular pattern. Enhanced domain validation is performed by issuing several WRITE/READ BUFFER commands and comparing the data sent and received. First, a WRITE BUFFER is issued with a desired data pattern. Next, a READ BUFFER is issued to the same buffer. The data of the READ BUFFER is compared to the data sent during the WRITE BUFFER. If the data does not match, the initiator renegotiates for a lower speed. If the data does match, the process can be repeated with another data pattern. Several data patterns can be used to check for different types of failures. The use of specific data patterns in enhanced domain validation makes it possible to find problems such as crosstalk, system noise, weak or strong transceivers, improper termination, incorrect device spacing and cables with the wrong impedance.

LEVEL 3: MARGINED DOMAIN VALIDATION

Margined domain validation provides information on whether a given system has margin. Margined domain validation uses the same WRITE/READ BUFFER with data patterns as enhanced domain validation while altering the electrical characteristics of the SCSI signals in the LSI53C1010 Ultra160 SCSI controller. The electrical characteristics of the signal are changed to verify the degree of margin in a system, which ensures proper communication. One of the electrical characteristics that can be altered is low voltage differential (LVD) drive strength. The drive current for the SCSI signals can be set to nominal (Figure A), 120% of nominal (Figure B), or 80% of nominal (Figure C). Setting the drive strength to 80% or 120% of nominal is done to verify that the bus is not too heavily loaded and that it does not have an impedance mismatch that may cause failures when large amounts of data are sent. The LSI53C1010 controller can also modify data to match the REQ/ACK time (Figure D and Figure E) of the SCSI data signals. This is another way to verify that the domain has some degree of margin to account for skew that may be introduced due to impedance and wire length differences between data signals and REQ/ACK that may not be found with the drive strength modification.

OS DRIVERS WITH SURELINK TECHNOLOGY

SureLINK technology is supported by an SDMS driver suite, which includes:

- Microsoft® Windows® NT® and Windows 2000
- Novell® NetWare® 4.11 and 5.0
- Sun® Solaris™ 7.0
- SCO UnixWare™ 7.x
- Linux™

Figure A: Shows a peak-to-peak value of 503 mV for the ACK# signal with drive strength set to nominal

Figure B: Shows a peak-to-peak value of 594 mV for the ACK# signal with drive strength set to 120% of nominal

Figure C: Shows a peak-to-peak value of 400 mV for the ACK# signal with drive strength set to 80% of nominal.

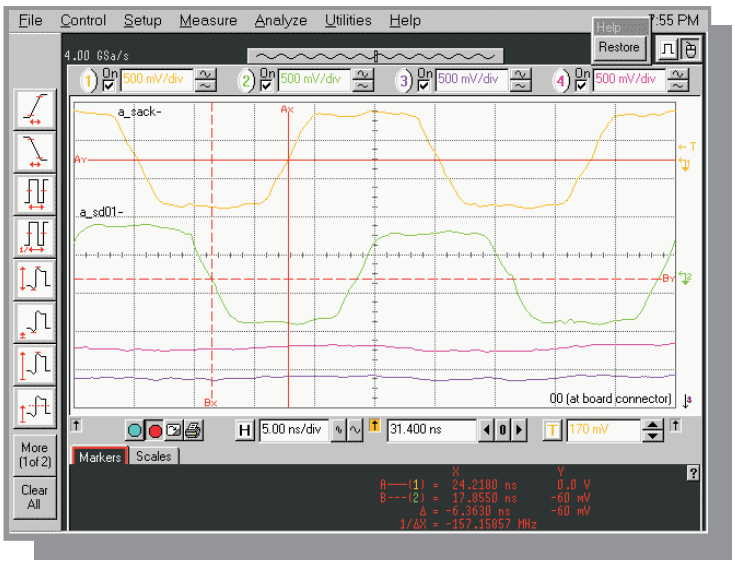

Figure D: Shows a setup time of 6.363 ns with the REC#/ACK# to data skew set to nominal

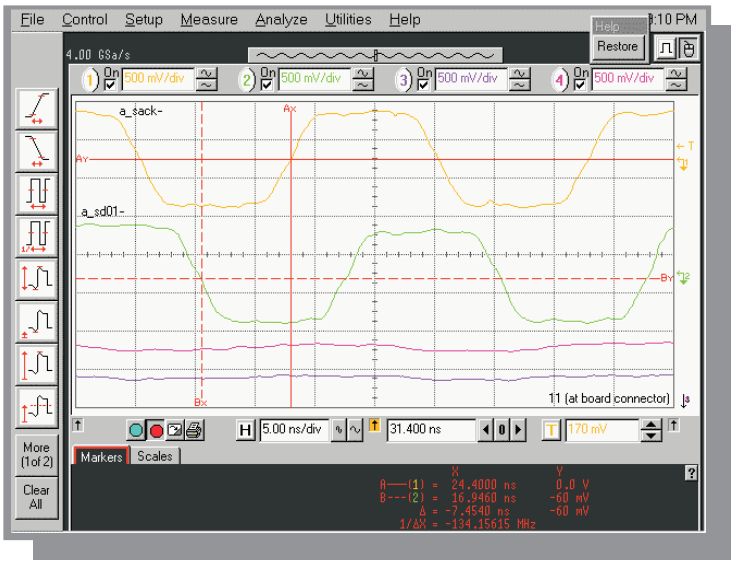

Figure E: Shows a setup time of 7.454 ns with the REC#/ACK# to data skew set to the maximum value.

SYSTEM MANAGEMENT SUPPORT WITH SURELINK TECHNOLOGY

SureLINK domain validation supports system manageability applications with the following tests:

- READ/WRITE testing of legacy target devices
- SCSI bus testing
  - REQ/ACK skew testing
  - SCSI data bus drive current margining
  - Transfer rate downshifting

For DMI component instrumentation:

- Standardized event reporting
- Standardized Management Information Format (MIF) implementation
- Remote analysis of SCSI cable plant
- Console manager snap-in browser

CONCLUSION

LSI Logic's SureLINK technology exceeds the industry's standard domain validation, making it the most effective way to ensure the integrity of bus performance by not only testing the validity of the data transfer, but also by varying the LVD drive strength and testing for marginal Ultra160 SCSI systems. Through incorporating all three levels of domain validation into the SureLINK technology, LSI Logic is able to exclusively offer this Ultra160 SCSI advancement, ensuring customers highly competitive and robust Ultra160 system operation.

ABOUT LSI LOGIC

LSI Logic Corporation (NYSE: LSI) is a leading designer and manufacturer of communications and storage semiconductors for applications that access, interconnect and store data, voice and video. In addition, the company supplies storage network solutions for the enterprise. LSI Logic is headquartered at 1551 McCarthy Boulevard, Milpitas, CA 95035, 408-433-8000, ***http://www.lsilogic.com***.

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