



IEEE1394 -- New Interface for the Digital Network Age

The IEEE 1394 standard defines a serial interface ideal for the digital age. This inexpensive, easy-to-use and high-speed bus easily handles multimedia bandwidth requirements and provides a universal interface for a variety of devices. By allowing seamless data exchange between devices such as workstations, personal computers and digital televisions, VCRs, camcorders and set-top boxes, it enables a new generation of computers and consumer electronic devices to operate in a common environment (Figures 1 and 2). Industry analysts predict a surge in IEEE 1394 product shipments and expect the market to grow from less than 2 million devices in 1997 to more than 460 million by 2011.

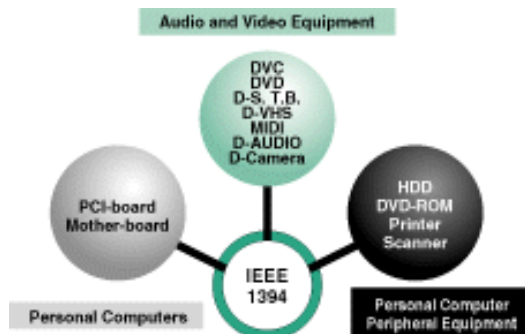


Figure 1. IEEE 1394 Applications

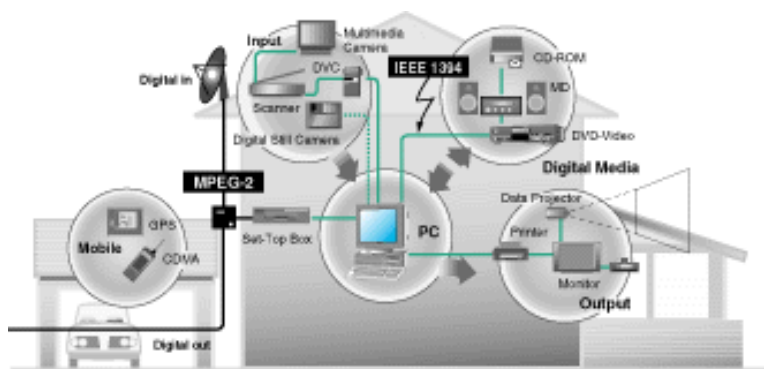


Figure 2. Digital Home Network Concept

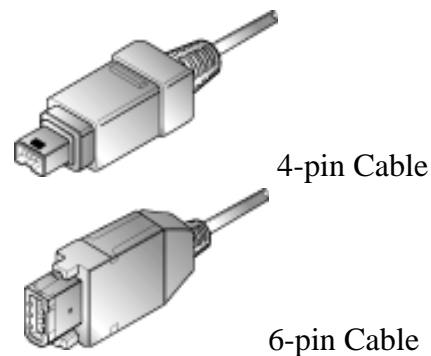
Originally developed as an interface to replace SCSI, IEEE 1394 offers

bi-directionality, high data transfer rates and isochronous data transfers. It provides "hot plug" capability -- the ability to connect or disconnect equipment with the power on. It also enables devices that require audio, video and control signals to be connected with a single cable.

Sony was among the first to practically apply the advantages of the IEEE 1394 standard including its scalability, real-time data processing, simple connections and low cost. In 1995, Sony released the DCR-VX1000 digital video camcorder, the first commercial product to feature an IEEE 1394 interface. The company was also among the first to develop LSI products to support this standard. Sony offers or is developing IEEE 1394 LSIs for a variety of products including personal computers, set-top boxes, digital video camcorders, hard disk drives, CD-ROM drives and DVD-ROM drives. These LSIs greatly expand the ability to connect traditional consumer electronics equipment such as digital video cassette recorders and set-top boxes to personal computers.

IEEE 1394 Cable

To make high-speed serial interfaces easy to use, the IEEE 1394 standard adopts an extremely simple cable with a flexible structure. Using this cable, the wide connectors and multi-conductor cables that are now standard in personal computer interfaces are no longer required (Figures 3.1 and 3.2).



Figures 3.1 & 3.2 IEEE 1394 Connector Styles

Data transfer is handled by a shielded double twisted pair cable that is driven by low-amplitude differential signals (Figure 4). During data transfer, a clock signal is generated automatically by converting the data into two signals: the data itself and a strobe signal that supplements the data (Figure 5). This eliminates the need for the high-speed phase lock loop (PLL) circuits required by other interfaces at both the transmit and receive sides of the communications channel. As a result, systems can be constructed inexpensively. In addition, since the interface includes a power line in the cable, power can be supplied directly to low-power devices.

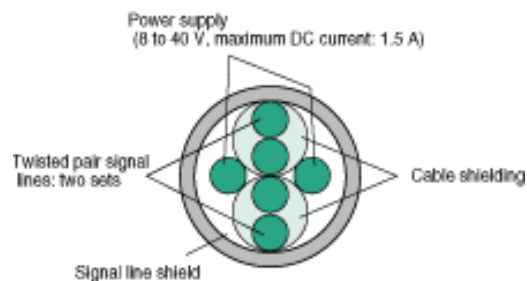
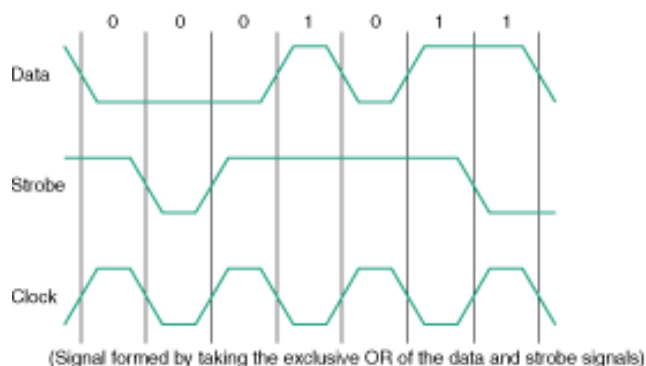


Figure 4. 6-pin Cable Configuration**Figure 5. DS-Link Coding Scheme**

Designed to connect various peripherals in IEEE 1394 environments, Sony's family of LSIs are shown in Table 1.

	LINK Layer LSI			PHY Layer LSI	
Product name	CXD1947Q	CXD1948R	CXD3220R (Under development)	CXD1944R	CXD1943R (Under development)
Application	PC	D-STB, D-VHS	HDD, CD/ DVD-ROM	1394 Cable Transceiver/ Receiver	
Applicable standards	Conforming to the IEEE 1394-1995 standard				
Features	<ul style="list-style-type: none"> • PCI interface (5-V ports) • 6-channel DMA • Asynchronous TX and RX • Iso TX (×2) • Iso RX (×2) • Large-capacity FIFOs 	<ul style="list-style-type: none"> • DVB/DSS support (MPEG-TS) • Automatic addition and detection of CIP headers • Support for packet split-terminating • Support for packet insertion • Large-capacity FIFOs 	<ul style="list-style-type: none"> • Conforms to the 8BP-2 standard. • High data transfer rates provided by the adoption of an ADP circuit. • Transaction layer support • Large-capacity FIFOs 	<ul style="list-style-type: none"> • Three ports • Unused ports automatically switched to low-power mode • Short bus reset support 	<ul style="list-style-type: none"> • One port • Unused ports automatically switched to low-power mode • Short bus reset support
Transfer rate (Mbps)	100/200				
Supply voltage (V)	3.3 ± 0.3				

Table 1. Sony LSI Product Family

PCI Bus Link Layer LSI

Sony's [CXD1947Q](#) is a PCI bus link layer LSI that conforms to the IEEE 1394-1995 serial bus standard. Since it includes a built-in PCI bus bridge, it can be connected directly to the PCI bus. It also includes a six-channel DMA circuit for high-performance data transfer. Systems that support the IEEE standard can easily be implemented by using the [CXD1947Q](#) and the [CXD1944R](#) LSIs.

MPEG-2 DVB and DSS Link Layer LSI

The [CXD1948R](#) link layer LSI conforms to the IEEE 1394-1995 standard. It supports MPEG-2 streams for set-top boxes, digital television, digital video broadcast (DVB) and digital satellite system (DSS) applications. This LSI adds a time stamp and common isochronous protocol (CIP) headers to each packet during transmission, and can automatically recover time stamps during reception. It supports data transfer rates of 100 and 200Mbps and supports the DVB (188-byte) and DSS (130-/140-byte) transport streams. Providing an asynchronous host interface and an isochronous TPS interface, it also includes an insert FIFO to allow isochronous transfers from the host interface (Figure 6).

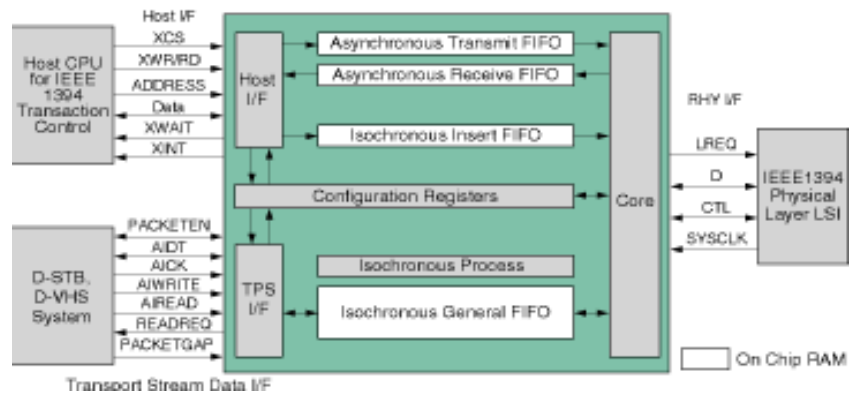


Figure 6. CXD1948R Block Diagram

SBP-2 Link/Transaction Layer LSI

The [CXD3220R](#) link/transaction layer LSI conforms to the SBP-2 (Serial Bus Protocol 2) standard (Figure 7). This LSI can connect any type of storage device -- including hard disk, DVD-ROM, CD-ROM and streaming tape drives -- to an IEEE 1394 digital interface.

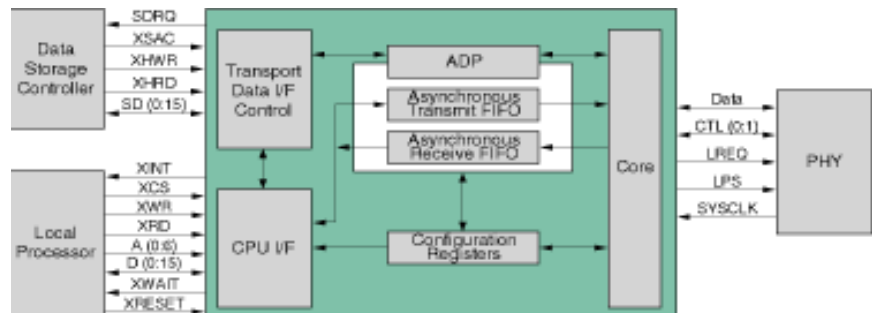


Figure 7. CXD3220R Block Diagram

This LSI includes an asynchronous data page circuit to automatically generate SBP-2 packets. Unlike previous generation products which implement the transaction layer in software, the highly-integrated [CXD3220R](#) implements it in hardware. The device supports data transfer rates of 100 and 200Mbps. It includes three large capacity FIFOs: a 2KB FIFO for data transfers, a 96-byte FIFO for asynchronous transfers and a 156-byte FIFO for reception.

The [CXD3220R](#) provides 8- and 16-bit interfaces for both CPU and transport data, making it ideal for native IEEE 1394 drives which many computer manufacturers support as serial SCSI.

Future Developments

IEEE 1394 is destined to become the network standard of the future for supporting digital content. Sony is committed to the practical application of this standard through larger capacity, higher speed, lower power and even more compact products. The company is dedicated to developing IEEE 1394-compliant LSIs that support an even wider range of applications, integrating this technology with a broad variety of system chipsets and developing products that support data transfer rates for emerging applications requiring 400Mbps and higher (Figure 8).

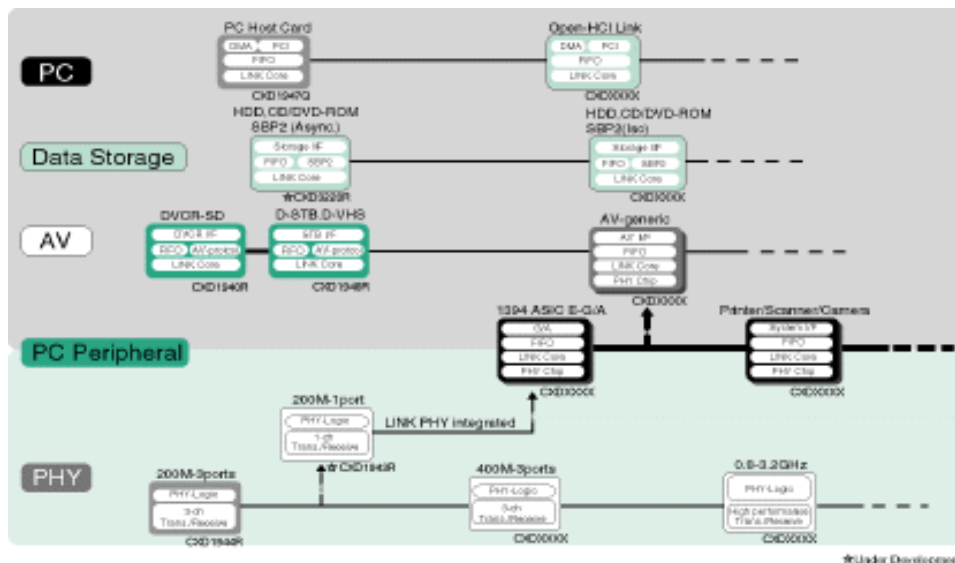


Figure 8. IEEE 1394 LSI Roadmap

In the future, IEEE 1394 may become the basis of home networking and a replacement for PCI and IDE buses in personal computers. Currently there are several groups actively discussing extensions to IEEE 1394, including the IEEE 1394a and 1394b working groups. Sony is taking an active role in these standards activities and is committed to creating a broad spectrum of IEEE 1394-based products.