1394 (FireWire®)

Overview

IEEE 1394 high-speed interconnection enables simple, low-cost, high-bandwidth real-time data connectivity between many types of electronic equipment. As a multimedia network standard, 1394 is ideally suited for consumer electronics, computers and peripherals. It is also ideal for situations that benefit from true peer-to-peer operation and maximum flexibility. 1394 is self-configuring, has strong power management/distribution capabilities and robust error-detection that make it a leading choice in control applications, especially those that also need to accommodate streaming multimedia.

The new 1394b technology enables higher performance (up to 3.2 Gbps), longer distances (up to 100 meters) and a variety of cable media to fit any application (STP, UTP, POF and GOF), making it excellent for home networking and high-speed data transfer applications. For example, in long-haul applications such as home networking, 1394b is capable of 100 Mbps over 100 meters of unshielded twisted pair Category 5 cable (called CAT5 or UTP5). For high-speed applications, TI offers a 1394b chip set that enable speeds up to 800 Mbps for applications such as video-on-demand or backing up a RAID array. TI 1394b is backward-compatible to 1394a.

Design Considerations

Physical-Layer Selection Issues

- The 1394 PHY layer should support the minimum number of nodes or ports required by the end-product. Having two ports permits spanning to other devices on the bus through daisy-chaining. Three or more nodes enables branching or hub capabilities.

- Will the end-product need DC isolation at the 1394 interface? The cable does not provide a DC-isolated path from node-to-node. In cases where there's a possibility for the various equipment connected across 1394 to be at different ground potentials or different power domains, the grounds may need to be isolated from each other to prevent excessive currents and noise. However, the ground signal on the 1394 cable must not be DC-isolated from the PHY power-distribution ground plane. Thus when DC isolation between units is required at the 1394 interface, it is frequently performed at the PHY- and link-layer interfaces—often through the use of special I/O cells that allow for capacitive-coupling of the PHY-link signals.

- While the EIA-775 specification requires a minimum speed of 200 Mbps at the 1394 interface, using a 400-Mbps PHY is recommended. Slower nodes present on the bus can be a source of speed traps. Almost all 1394 silicon available today is already 400-Mbps capable.

- The suspend/resume feature of the PHY layer lets two currently inactive ports achieve low-power states while maintaining their connection status. It also permits them to quickly resume operation as soon as they detect an applied port-bias voltage.

Link-Layer Selection Issues

- What kind of data needs to be transferred? Some link controllers are designed to implement specific data protocols over 1394, such as the serial-bus protocol 2 (SBP-2) for mass storage or IEC 61883-4 for MPEG-2 transport, and some are designed as general purpose.

- What is being interfaced to 1394? If the system has PCI, consider one of the PCI/OHCI links. Applications involving streaming compressed audio/video usually require a link from the iceLynx family. Other TI links have interfaces for external processors/memory or are dedicated for a peripheral function (camera/storage).

- For audio/visual (A/V) applications, different types of A/V data require different formatting and transmission methods on 1394. Specifically identifying which types of A/V is to be supported is fundamental to choosing the right 1394 chip-set for the digital set-top box (DSTB) or digital TV (DTV) design. Standards define how to carry MPEG-2 transport streams in both digital video broadcasting (DVB) format and in DirecTV format, which have different packetization schemes.

- Another aspect of the link-layer that should be considered is the amount of data-buffer memory supported. Typically, the more bandwidth an application requires, or the more simultaneous isochronous/asynchronous traffic that needs to be supported, the larger the buffer memories required.

- As the number of simultaneous isochronous channels present goes up, or the bit rate of an individual stream increases, the receive buffer needs to be larger.

Technical Information

- 1394-1995 is an IEEE designation for a high-performance serial bus. A revision to this standard has been published as IEEE 1394a-2000, and clarifies as well as adds to portions of the IEEE 1394-1995 standard. The 1394b standard increases the speed of 1394 to 800, 1600 and 3200 Mbps, as well as providing new connection options such as plastic optical fiber (POF), glass optical fiber (GOF) and UTP-5. This serial bus defines both a back-plane (for example, VME, FB+) physical layer and a point-to-point, cable-connected virtual bus. The back-plane version operates at 12.5, 25 or 50 Mbps, whereas the cable version supports data rates of 100, 200, 400, 800 and 1,600 Mbps across the cable medium supported in the current standard. Both versions are totally compatible at the link-layer and above. The interface standard defines transmission method, media and protocol.

- Applications of the cable version are the integration of I/O connectivity of personal computers, peripherals, and consumer electronics using a low-cost, scalable, high-speed serial interface. The 1394 standard provides services such as real-time I/O and live connect/disconnect capability for devices including storage (HDD, CD-ROM, CDRW, MO, ZIP, RAID, SAN, etc.), printers, scanners, cameras, set-top boxes, HDTVs and camcorders.

Technical Information (Continued)

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Key Features

- Real-time streaming of audio and video
- High-speed: up to 400 Mbps with IEEE 1394-1995 and 1394a-2000, up to 1, 2 and 4 Gbps with 1394b
- Plug-and-play hot pluggable
- Peer-to-peer communication
- Small, durable and flexible cable and connectors
- Memory-mapped architecture
- Seamless I/O interconnect

1394b Advantages

- Faster: speeds from 800 Mbps to 3200 Mbps
- Longer distances: 100 meters with GOF and CAT5; 50 meters with POF
- TI1394b is bi-lingual: communicates in 1394a and 1394b modes
- More cabling options: STP, CAT5, POF, GOF
- More efficient: BOSS arbitration
- More user-friendly: loop-free build allows any topology and redundancy

Selection Guide

Device	Ports	Voltage (V)	Data Rate (Mbps)	Package(s)	Description	Price*
1394 Physical Layer Controllers						
TSB14AA1A	1	3.3	up to 100	48 TQFP	IEEE 1394-1995, 3.3-V, 1-port, 50/100-Mbps, backplane PHY controller	5.90
TSB41AB1	1	3.3	up to 400	48/64 HTQFP,	IEEE 1394a 1-port cable transceiver/arbiter	1.50
TSB41AB2	2	3.3	up to 400	64 HTQFP	IEEE 1394a 2-port cable transceiver/arbiter	1.85
TSB41AB3	3	3.3	up to 400	80 HTQFP	IEEE 1394a 3-port cable transceiver/arbiter	3.00
TSB41BA3B	3	3.3	up to 400	80 TQFP	1394b-2002 3-port physical layer device	6.50
TSB41LV04A	4	3.3	up to 400	80 HTQFP	IEEE 1394a 4-port cable transceiver/arbiter	6.50
TSB41LV06A	6	3.3	up to 400	100 HTQFP	IEEE 1394a 6-port cable transceiver/arbiter	6.40
TSB81BA3D	3	1.8, 3.3	up to 800	80 HTQFP	High-performance 1394b s800 3-port cable transceiver/arbiter	5.55

**Suggested resale price in U.S. dollars in quantities of 1,000.*

IEEE 1394b 3-Port Cable Transceiver/Arbiter
TSB81BA3D

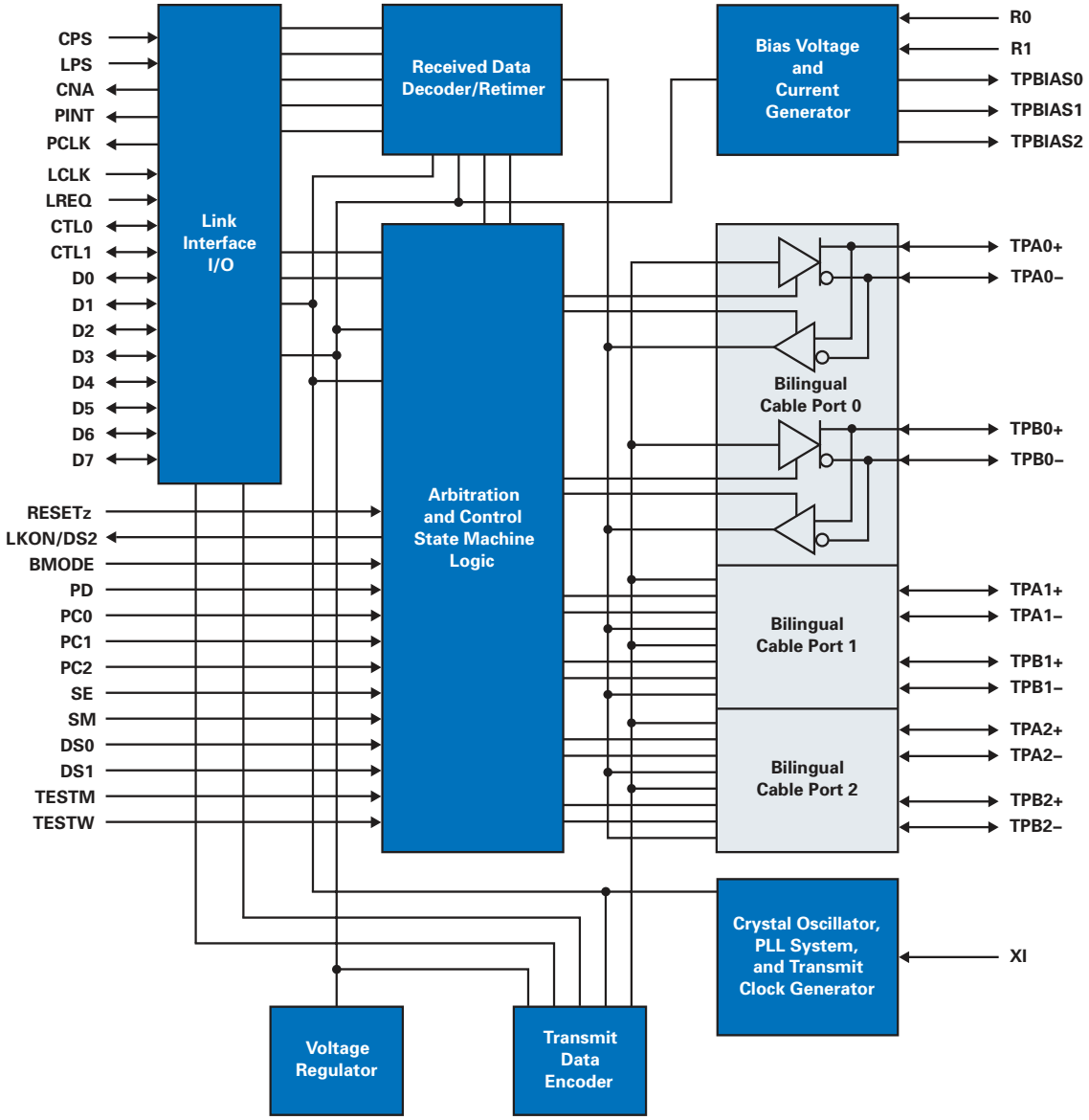
Get samples, datasheets and app reports at: **www.ti.com/sc/device/TSB81BA3D**

Key Features

- Compliant with IEEE 1394b-2002, IEEE 1394a-2000 and 1394-1995 standards
- 3 Bilingual 1394 Ports
  - 1394b (Beta) Mode at s400 and s800
  - 1394a (Data Strobe -DS) Mode at s100, s200 and s400
- Interoperable with link layer controllers using 3.3-V supplies and other 1394 PHYs using 1.8-V, 3.3-V and 5-V supplies

Applications

- Storage devices
- Consumer electronics
- 1394B PC ports



TSB81BA3D block diagram.

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