



High-Bandwidth I/O Interface Support Solutions

APEX Devices Provide I/O Interface Support for Today's High-Performance Designs

High-Bandwidth I/O Interface Standards Support

- Support for numerous I/O standards
- High-performance, low-voltage operation
- Low power consumption and low noise operation
- Saves board space
- No external transceiver required
- Eliminates chip-to-chip delays

Changing system requirements are driving the need for high-bandwidth I/O interface standards support. Higher performance systems, driven by faster processors and memory, are increasing the need for higher bandwidth data transfers. In addition, process technology advancements drive decreasing supply voltage and power consumption.

In response to these system changes, emerging I/O standards offer support for high-bandwidth, low-voltage operation. These new standards have differential inputs to provide lower power consumption and lower noise operation.

Altera's APEX™ device family supports these emerging I/O standards. APEX devices can help save board space and eliminate chip-to-chip delays by removing the requirement for an external transceiver.

High-Bandwidth I/O Interface Standards

APEX devices support a number of I/O standards, including low-voltage differential signaling (LVDS), Gunning transceiver logic plus (GTL+), stub-series terminated logic

(SSTL-2/3), 64-bit, 66-MHz PCI, high-speed transceiver logic (HSTL), and accelerated graphics port (AGP).

I/O Standards Supported by APEX Devices

- Low-Voltage Differential Signaling (LVDS)
- Gunning Transceiver Logic Plus (GTL+)
- Stub-Series Terminated Logic, 2.5 V (SSTL-2) Class I, II
- Stub-Series Terminated Logic, 3.3 V (SSTL-3) Class I, II
- 64-bit, 66-MHz PCI
- High-Speed Transceiver Logic (HSTL) Class I, II, III, IV
- Accelerated Graphics Port (AGP)
- Low-Voltage CMOS (LVCMOS)
- Low-Voltage Transistor-to-Transistor Logic (LVTTTL)
- Center Tap Terminated (CTT)

APEX Devices Support LVDS

Altera is the first programmable logic device (PLD) vendor to offer support for LVDS on a programmable device. LVDS is unique in its capacity to handle very high-speed data transfers. Used in applications such as point-to-point data links and backplane drivers, LVDS can provide data rates of up to 622 Mbps.



I/O Standard	Performance	Application
LVDS	622 Mbits/s	Backplane Driver, Fast Ethernet, High-Speed Data Links
GTL+	150 MHz	Processor Interface, Backplane Driver
SSTL-2/3	200 MHz	Memory Interface, Fast SDRAM
PCI (64-bit/66-MHz)	200 MHz	Bus Interface
HSTL	200 MHz	Memory Interface
AGP	133 MHz	Graphics Interface

APEX devices are designed to meet the ANSI/TIA/EIA-644 (American National Standards Institute/Telecommunication Industry Association/Electronic Industries Association) standard. Two of the four phase-locked loops (PLLs) on an APEX device can be used to provide frequency multiplication for LVDS. If these PLLs are not used for LVDS, they can be used as general purpose PLLs.

Altera MultiVolt Interface

The Altera® MultiVolt™ interface allows seamless incorporation of APEX devices on boards with varying voltage levels. Today's printed circuit boards often contain a mix of 3.3-, 2.5-, and 1.8-V devices. The central interface device—often a high-density PLD—must be able to connect with these different

devices. The MultiVolt feature makes APEX devices an excellent fit for this environment.

APEX Devices Are Designed for I/O Standards Compliance

APEX I/O buffers are designed to meet the voltage, drive strength, and AC characteristics necessary for compliance with the I/O standards shown in this document. APEX devices have eight programmable I/O blocks, two of which can be used to support LVDS.

The programmable I/O blocks have individual power planes with separate V_{CCIO} pins for each I/O block. The V_{CCIO} plane supports 3.3-, 2.5-, or 1.8-V voltage levels.

The APEX Solution

Altera meets the need for high-bandwidth I/O interface support with high-performance, low-voltage operation, low-power consumption and low-noise operation. Altera's APEX family provides the I/O standard support for today's high-performance designs.

To determine which APEX device will work best for you, contact your local Altera Sales Representative or visit the Altera web site at <http://www.altera.com>.

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