*Feature rich, easy to use, and low power*

# PCI Express hard intellectual property solutions from Altera

Altera's 40-nm Stratix® IV GX and Arria® II GX FPGAs and HardCopy® IV GX ASICs are all equipped with PCI Express hard IP blocks that are PCI-SIG compliant in supported configurations. The hard IP blocks equip you to implement end-point and root-port applications with blocks that apply the PHY-MAC, data-link, and transaction layer functionalities. With virtually no costs associated with logic elements (LEs) or intellectual property (IP) cores, our PCI Express hard IP solutions enable you to create high-value, high-bandwidth transceiver-based applications.

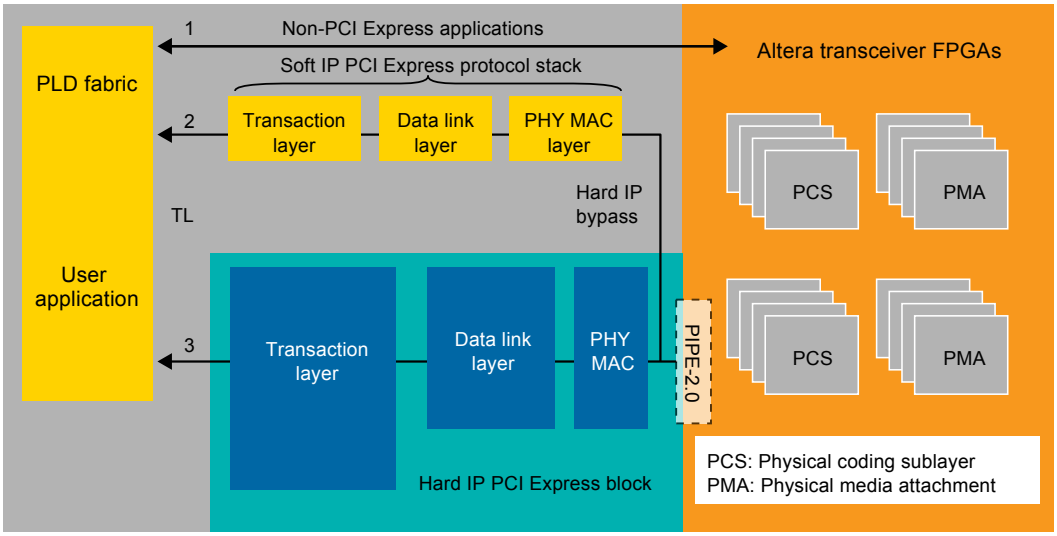
Stratix IV GX FPGAs are the market's highest density and highest performance FPGAs, with transceivers up to 8.5 Gbps. HardCopy IV GX ASICs, with up to 6.5-Gbps transceivers, are designed for volume production. Both devices support PCI Express Gen1 (2.5 Gbps) and Gen2 (5 Gbps), x1, x2, x4, and x8 lane configurations, and have up to four hard IP blocks in a single device. Through a seamless migration path to HardCopy IV GX ASICs, you can prototype your design in Stratix IV GX FPGAs and migrate to the ASICs for volume production.

Arria II GX FPGAs provide high-end capabilities at low cost and power with transceivers up to 3.75 Gbps. Each device has one hard IP block for PCI Express Gen1, supporting x1, x2, x4, and x8 lane configurations at a data rate of 2.5 Gbps.

**Key advantages of PCI Express hard IP**

- Close to zero logic elements (LEs) used
- $0 list price
- Easy migration from soft IP-based solution
- No licensing required
- Timing closed block
- Faster design and compile times
- Substantial power savings compared to soft IP core with equivalent functionality

## Hard IP architecture




1. Non-PCI Express cores e.g. XAUI, GbE, SRIO
2. Soft PCI Express IP protocol stack
3. Gen1 (all Altera transceiver FPGAs) and Gen2 (Stratix IV GX FPGAs, HardCopy IV GX ASICs) hard IP protocol stack

Soft logic | PCI Express hard IP | PCS/PMA

In the block diagram, which shows an example hard IP architecture using Altera transceiver FPGAs, the transceivers on the right can also be used for non-PCI Express applications.

## Hard IP benefits and features

| Advantages | Services |
|---|---|
| High-performance applications | - PCI Express Gen1/Gen2-compliant protocol stack[1]<br>- x1, x4, and x8 initial link width configurations<br>- Guaranteed timing closure across all targeted modes<br>- Up to four hard IP cores per device<br>- Low latency, cut through transmit path |
| No/low cost | - ~Zero LEs used<br>- No memory buffers used<br>- No list price |
| Flexible and option rich | - 125- or 250-MHz application layer clock rate supported<br>- Configurable maximum payload size (128, 256, 512, 1,024, and 2,048 bytes)[2]<br>- One or two virtual channels<br>- 64-bit interface to application logic in all modes<br>- Additional 128-bit interface in Gen1 x8 and Gen2 x4 and x8 modes |
| High-reliability applications | - End-to-end cyclical redundancy check (ECRC) protection through entire protocol stack<br>- Optional advanced error reporting<br>- Extensive interrupt support |

[1] Gen2 support for Stratix IV GX FPGAs and HardCopy IV GX ASICs

[2] Applies to FPGAs only

## Device family plan

| Device | LEs | Memory (Mbits) | Transceivers | Hard IP blocks | PCI Express blocks supported |
|---|---|---|---|---|---|
| Arria II GX FPGA | 16K-256K | 0.7-8.5 | 4-16 up to 3.75 Gbps | 1 | Gen1 x1, x4, x8 |
| Stratix IV GX FPGA | 70K-530K | 6.3-20.3 | 4-16 up to 6.5 Gbps<br>8-32 up to 8.5 Gbps | 1-4 | Gen1 and Gen2, x1, x4, and x8 |
| HardCopy IV GX ASIC | 2.8M-11.5M usable ASIC gates | 6.3-20.3 | 8-36 up to 6.5 Gbps | 1-4 | Gen1 and Gen2, x1, x4, and x8 |

## Want to dig deeper?

For more information about Altera's PCI Express hard IP solutions, please contact your local Altera sales representative or FAE, or visit **www.altera.com/pciexpress**. You can also download the user guide from our website.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