# Full spectrum

Simple bridging. Bandwidth-hungry, media-rich applications. Or something in between. No matter the scope, create your designs with the broadest portfolio of FPGAs and ASICs with transceivers. From low cost to the widest range of speeds and densities, you'll have a full spectrum of transceiver solutions—as broad as your imagination.

A breadth of 40-nm high-speed transceiver solutions
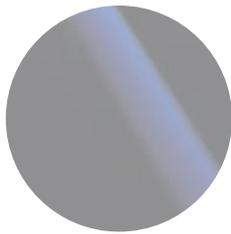
With the addition of two new product families, we now provide the industry's broadest portfolio of FPGAs and ASICs with integrated transceivers. From this portfolio—encompassing the market's first 40-nm FPGAs and ASICs—you'll find a diverse mix of power and performance, densities and speeds, price points, as well as memory, LVDS channels, and other resources for your unique design requirements.

Each of our 40-nm FPGAs and ASICs with transceivers is architected with the same proven transceiver architecture that's ideal for high-bandwidth serial interface applications. In each device, the integrated transceiver block is optimized for its targeted applications.

- Arria® II GX FPGAs are a low-power, cost-effective FPGA family that makes designing 3.75-Gbps transceiver solutions easy
- Stratix® IV GX FPGAs are high-performance devices with up to 530K logic elements (LEs) and high levels of transceiver and memory bandwidth
- Stratix IV GT FPGAs are the only FPGAs with integrated 11.3-Gbps transceivers, ideal for 40G and 100G applications
- HardCopy® IV GX ASICs are a package- and pin-compatible ASIC counterpart to Stratix IV GX FPGAs, ready to help you lower your risks, power, and total cost in ASIC designs with embedded transceivers

All of our custom logic devices offer the productivity advantage of a single, comprehensive design environment, a common set of intellectual property (IP) cores, and a variety of supporting reference designs and design examples. Learn once, then extend your skills across multiple designs.

Altera transceivers: optimized cost, performance, and signal integrity

We're continuing to enhance our transceiver technology, building on more than 10 years of design and applications development. Choose from an array of capabilities and performance and cost options to fit your design's needs without compromising on signal integrity. For example:

- Dynamically reconfigurable transmit pre-emphasis and receive equalization enables support of multiple protocols, data rates, and physical medium attachment (PMA) settings. You can drive a 50-inch backplane on FR-4 at 6.375 Gbps (Stratix IV GX and GT FPGAs, HardCopy IV GX ASICs) and a 40-inch backplane at 3.75 Gbps (Arria II GX FPGAs).

- Plug & Play Signal Integrity, consisting of our adaptive dispersion engine and hot socketing, lets you change the position of backplane cards on the fly, without having to manually configure your backplane equalization settings (Stratix IV GX and GT FPGAs and HardCopy IV GX ASICs).

Ideal for implementing chip-to-chip, chip-to-module, and backplane applications, our devices with transceivers support emerging and standard serial protocols, as well as proprietary protocols. Configurable hard IP transceiver blocks, including PCI Express Gen1 and Gen 2 x8 hard IP, simplify your implementation of these protocols.

Our portfolio of devices with transceivers currently includes:

- Transceiver speeds from 155 Mbps to 11.3 Gbps.

- Density ranges from 16K LEs to 530K LEs.

- Up to 11.5 million ASIC gates on HardCopy devices.

- Popular industry-standard packages, optimized for cost and signal integrity.

- Dedicated memory interface circuitry supporting the latest power-optimized or high-performance memory interfaces.

- 1,067-Mbps (533 MHz) DDR3 interfaces, low simultaneous switching noise (SSN), and superior eye quality.

At a glance: custom logic devices with transceivers

Device	LEs	Transceivers	Memory (Mbits)	Multipliers (18x18)	I/O pins
Arria II GX FPGAs	16K-256K	4-16 up to 3.75 Gbps	0.7-8.5	56-736	170-610
Stratix IV GX FPGAs	70K-530K	0-16 up to 6.5 Gbps 8-32 up to 8.5 Gbps	6.3-20.3	384-1,288	288-904
Stratix IV GT FPGAs	230K-530K	12-24 up to 11.3 Gbps 12-24 up to 6.5 Gbps	13.9-20.3	1,024-1,288	636-754
HardCopy IV GX ASICs	2.8M-11.5M usable ASIC gates	8-36 up to 6.5 Gbps	6.3-20.3	384-1,288	368-736

Arria II GX FPGAs

Our new Arria II GX FPGAs are an easy-to-use device family optimized for low-power and low-cost applications in wireless, wireline, broadcast, military, and industrial markets requiring transceivers operating up to 3.75 Gbps.

Extending the benefits of the preceding Arria GX FPGAs to new protocols, Arria II GX FPGAs deliver the same robust signal integrity at half the power. As a result, you can achieve 20 Gbps of bandwidth at less than 3 Watts.

Stratix IV GX FPGAs

Stratix IV GX FPGAs are the lowest power high-density, high-performance FPGAs—ideal for applications that require up to 48 transceivers at up to 8.5 Gbps. These devices are well suited for access, enterprise, service provider, and transmission wireline applications, wireless infrastructure systems, as well as the medical, test, and military industries.

The first 40-nm FPGAs in the industry, Stratix IV GX devices started shipping in late 2008. A key advantage in Stratix IV GX FPGAs is Programmable Power Technology, a capability that automatically optimizes logic, digital signal processing (DSP), and memory blocks for the lowest power at your required performance.

Stratix IV GT FPGAs

Today's media-rich electronic services are pushing up the demand for high-bandwidth devices and solutions. Stratix IV GT FPGAs—the newest variant to the Stratix IV family—bring the lowest power high-density, high-performance FPGAs to 40G and 100G applications.

Stratix IV GT FPGAs come with the same architectural advantages as Stratix IV GX FPGAs, and extend the transceiver speed to 11.3 Gbps. In addition, Stratix IV GT FPGAs can, in a single chip with a direct connection to optical modules, meet the emerging IEEE 802.3ba standard for 100G media access controllers (MACs).

HardCopy IV GX ASICs

With an equivalent transceiver block and package- and pin-compatibility to Stratix IV GX FPGAs, HardCopy IV GX ASICs help you achieve the lowest risk and lowest total cost in ASIC designs with embedded transceivers. Prototype and debug with Stratix IV GX FPGAs, then migrate your design to HardCopy IV GX ASICs for volume production. Our proven turnkey process creates a functionally equivalent HardCopy IV GX ASIC with embedded transceivers in just 9 to 14 weeks.

Compared to their FPGA prototypes, HardCopy IV GX ASICs deliver more than 50 percent power consumption reduction. You'll also save much of the total development cost of standard-cell ASICs through reductions in expenses associated with design verification, EDA tooling, and NRE masks. What's more, our FPGA-based design and verification methodology, which features a seamless migration from our Stratix series FPGAs to HardCopy ASICs, will save 9 to 12 months in system time to market.

Protocols, devices, and data rates

Protocol	Arria II GX data rates (Gbps per lane)	Stratix IV GT data rates (Gbps per lane)	Stratix IV GX data rates (Gbps per lane)	HardCopy IV GX data rates (Gbps per lane)
3G-SDI	2.97	2.97	2.97	2.97
SDI SD/HD	0.27/1.485	-	0.27/1.485	0.27/1.485
ASI	0.27	-	0.27	0.27
Basic (proprietary)	0.6 - 3.75	2.488 - 11.3[1]	0.6 - 8.5	0.6 - 6.5
CEI-6G/SR/LR	-	4.976-6.375	4.976-6.375	4.976-6.375
CPRI	0.6144, 1.2288, 2.4576, 3.072	3.072	0.6144, 1.2288, 2.4576, 3.072	0.6144, 1.2288, 2.4576, 3.072
10G Ethernet (XAUI)	3.125	3.125	3.125	3.125
10G Ethernet (XFI, SFI)	-	10.3125	-	-
40G, 100G Ethernet	-	10.3125	-	-
Gigabit Ethernet	1.25	1.25 (LVDS based)	1.25	1.25
Fibre Channel	1.0625, 2.125	4.25, 8.5, 10.51875[2]	1.0625, 2.125, 4.25, 8.5	1.0625, 2.125, 4.25
GPON	1.244 uplink, 2.488 downlink	2.488 downlink	1.244 uplink, 2.488 downlink	1.244 uplink, 2.488 downlink
G.709 OTU-2	-	10.7	-	-
OTN 10 Gigabit Ethernet with FEC	-	11.1, 11.3	-	-
HiGig+	3.75	3.75	3.75	3.75
HyperTransport™ 3.0	-	2.8, 3.2	0.4, 2.4, 2.8, 3.2	0.4, 2.4, 2.8, 3.2
Interlaken	-	3.125-6.375	3.125-6.375	3.125-6.375
OBSAI	0.768, 1.536, 3.072	3.072	0.768, 1.536, 3.072	0.768, 1.536, 3.072
PCI Express Gen1, Gen2	2.5, NA	2.5, 5	2.5, 5	2.5, 5
PCI Express Cable	2.5	2.5	2.5	2.5
RXAUI	-	6.25	6.25	6.25
SAS	1.5, 3	3, 6	1.5, 3, 6	1.5, 3, 6
SATA	1.5, 3	3, 6	1.5, 3, 6	1.5, 3, 6
SerialLite II	0.6-3.75	2.488-6.375	0.6-6.375	0.6-6.375
Serial RapidIO®	1.25, 2.5, 3.125	2.5, 3.125	1.25, 2.5, 3.125	1.25, 2.5, 3.125
SFI-5.1	-	2.488-3.125[3]	2.488-3.125	2.488 - 3.125
SFI-5.2	-	9.9-11.3	-	-
SONET OC-3/ OC-12/OC-48/ OC-192	0.155, 0.622, 2.488, NA	NA, NA, 2.488, 9.95[4]	0.155, 0.622, 2.488, NA	0.155, 0.622, 2.488, NA
SPAUI	3.125	3.125, 6.25	3.125, 6.25	3.125, 6.25

[1]10G Basic (proprietary)   [2]10G Fibre Channel   [3]Includes SFI-4.2 and SFI-5.1
[4]10G SONET/SDH OC-192/STM-64

TSMC and Altera: low risk and on-time delivery

With our track record of successful on-time product releases, you can experience the fastest ramp to revenue for your products. Our first-to-market 40-nm custom logic devices are developed on Taiwan Semiconductor Manufacturing Company's (TSMC's) 40-nm process technology. This process utilizes 193-nm immersion lithography, extreme low-k dielectrics, variable channel lengths and oxide thicknesses, and strained silicon to enhance device performance and power efficiency.

Altera custom logic with transceivers is everywhere

Wireless infastructure

Address next-generation requirements in radio frequency cards, remote radio heads, and baseband processing applications, taking advantage of support for serial protocols such as CPRI, OBSAI, and Serial RapidIO. Get the optimal power and DSP functionality.

Video/broadcast

Use a single platform for multiple product lines and image resolutions. Meet the latest standards, including triple-rate serial digital interface (SDI) protocols, for 1080p digital video broadcast and video compression encoding and decoding. Accelerate your design process with our Video and Image Processing Suite, which includes commonly used functions such as color space conversion, scaling, de-interlacing, and 2D finite impulse response (FIR) filters.

Wireline access

FPGAs have moved beyond bridging into the core of networking and telecommunications systems. Networks are evolving rapidly to support voice, video, and data delivery over the access network, with a converged multi-service network to aggregate and transport traffic. Tap into solutions for 10G/40G/100G, MAC/framer, traffic management, and packet processing, and meet existing and emerging market requirements.

Military

Meet the low-power, high DSP content, design security, and anti-tamper requirements in application areas such as encrypted communications, guidance and control, and avionics. With the right mix of protocol IP such as PCI Express, Serial RapidIO, and Gigabit Ethernet, as well as memory interfaces and system integration tools, you can jump-start your system design.

Computer and storage

Protocols such as PCI Express, Fibre Channel, Serial Attached SCSI (SAS), and Serial ATA (SATA) are dominating the storage protocol landscape, while HyperTransport is widely used in computing. Altera's portfolio of devices with transceivers enables you to develop your server and storage applications quickly, efficiently, and affordably, while meeting key standards.

Quartus II software—industry's fastest compile times

Quartus® II software provides a common, productive design environment for our entire device portfolio. This, along with a common underlying transceiver architecture and IP cores that work across product families, means that you can apply your knowledge and design resources across many different applications. With Quartus II software, you'll:

- Compile complex designs faster.

- Achieve efficient resource utilization from advanced place-and-route algorithms.

- Further reduce compilation times by up to 70 percent through incremental compilation, which compiles only the changed partitions in your design.

- Minimize power consumption through its PowerPlay power optimization tool.

Tools to ease transceiver integration and board design

- Pre-Emphasis and Link Estimation (PELE) tool
- Power distribution network (PDN) tool
- Early Simultaneous Switching Noise (SSN) Estimator
- SPICE and IBIS simulation models

Get a head start with development kits

Out of the box, our development kits provide a standard board test system with a PC-based GUI, documentation, and reference designs and demonstrations.

Development kits for 40-nm design

Kit	Device	Features
Transceiver Signal Integrity Kit, Stratix IV GX Edition	Stratix IV GX EP4SGX230F40	• Hardware platform for evaluating signal integrity capabilities and transceiver performance • 8 full duplex transceiver channels with SMA connectors, including full transceiver block with stripline traces and backplane channel with long trace • Embedded USB-Blaster™, fast passive parallel (FPP) with MAX® series configuration controller with flash • 156.25-, 155.52-, 125-, 100-, and 50-MHz clock oscillators
Stratix IV GX FPGA Development Kit	Stratix IV GX EP4SGX230F40	• Full-featured hardware development platform for prototyping and testing of high-speed serial interfaces to a Stratix IV GX FPGA • PCI Express x8 form factor • On-board memory includes: 1x64 DDR3, 2x32 DDR3, 2x18 QDR+, flash, and SRAM • 5 SMA connectors for differential transmit/receive, along with 156.25-, 155.52-, 125-, 100-, and 50-MHz clock oscillators
Arria II GX FPGA Development Kit	Arria II GX EP2AGX125F35	• Full-featured hardware development platform for prototyping and testing of high-speed serial interfaces to an Arria II GX FPGA • PCI Express x8 form factor • Includes two HSMC connectors, DDR2 SDRAM SO-DIMM, DDR3 device, SRAM, and parallel flash
Stratix IV GT Development Kit	Stratix IV GT EP4S40G2F40 (40G) Stratix IV GT EP4S100GF45 (100G)	• Full-featured hardware development platform for implementing 40G/100G MAC and framer applications • 100G Interlaken support—20 lanes at 6G on AirMax connector • Scalable solution for implementing packet processing and traffic management applications

Innovation you can count on

A wide range of transceiver speeds. New levels of system bandwidth. Decreasing power consumption. With our custom logic portfolio of devices with transceivers, you'll have a full spectrum of design resources to quickly bring your unique, high-performing applications to market. For more information, including white papers, webcasts, videos, and product documentation, please visit **www.altera. com/transceiver**.

Altera Corporation

101 Innovation Drive
San Jose, CA 95134
USA
www.altera.com

Altera European Headquarters

Holmers Farm Way
High Wycombe
Buckinghamshire
HP12 4XF
United Kingdom
Telephone: (44) 1494 602000

Altera Japan Ltd.

Shinjuku i-Land Tower 32F
6-5-1, Nishi-Shinjuku
Shinjuku-ku, Tokyo 163-1332
Japan
Telephone: (81) 3 3340 9480
www.altera.co.jp

Altera International Ltd.

Unit 11- 18, 9/F
Millennium City 1, Tower 1
388 Kwun Tong Road
Kwun Tong
Kowloon, Hong Kong
Telephone: (852) 2 945 7000
www.altera.com.cn