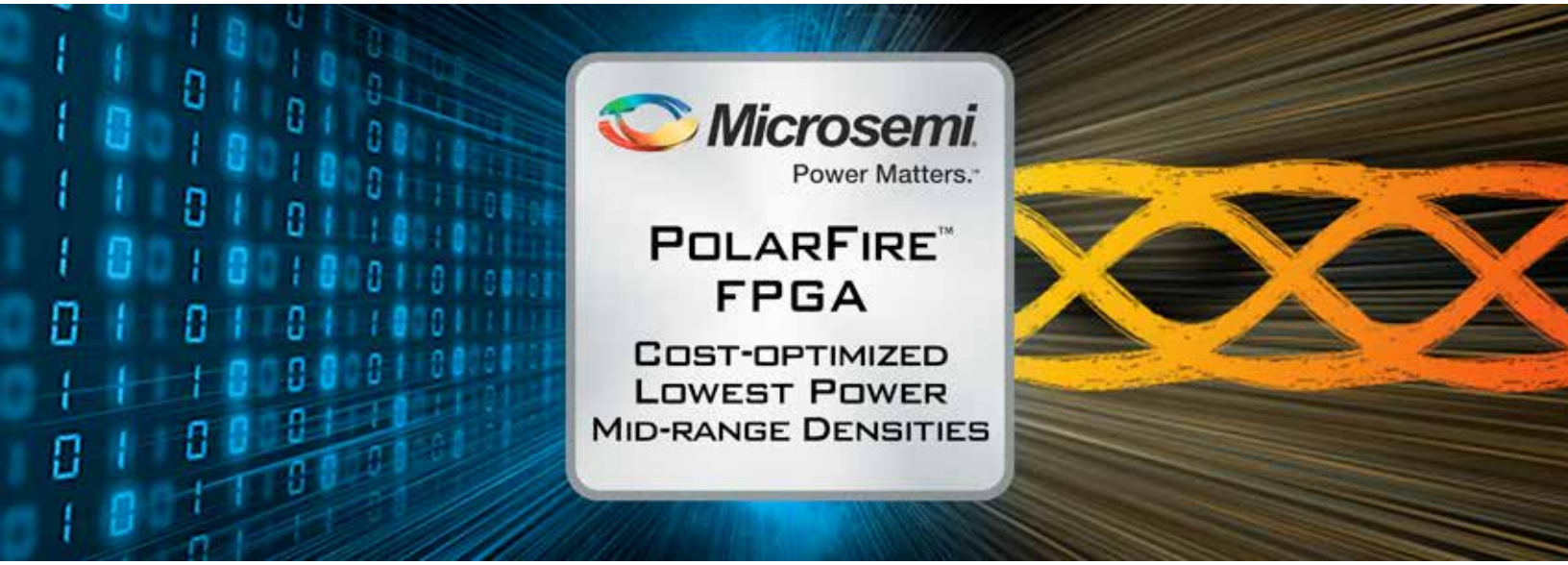
Up to 50% Lower Power 100K to 500K LEs 12.7G Transceivers



Microsemi
Power Matters.™

PolarFire FPGAs

PolarFire Cost-optimized FPGAs Deliver the Lowest Power at Mid-range Densities

Microsemi extends its non-volatile FPGA leadership with the PolarFire family of cost-optimized FPGAs. PolarFire FPGAs deliver up to 50% lower power than equivalent SRAM FPGAs. The devices are ideal for a wide range of applications within wireline access networks and cellular infrastructure, defense and commercial aviation markets, as well as industrial automation and IoT markets.

As a true broad-range FPGA supplier, Microsemi offers FPGA product families spanning 1K to 500K logic elements (LEs).

Wireline access and cellular infrastructure markets can leverage Microsemi's expertise in delivering mission-critical security and high-reliability designs to defense and industrial markets when designing with PolarFire FPGAs. The devices offer unprecedented capabilities while maintaining all the advantages traditionally associated with non-volatile FPGAs such as the lowest static power, security, and single event upset (SEU) immunity. The PolarFire FPGA family delivers up to 50% lower power in a cost optimized architecture for mid-range densities.

With the introduction of PolarFire, the market now has a cost-optimized mid-range FPGA solution that not only delivers outstanding power efficiency, but significantly higher security and reliability than alternative solutions.

Cost-optimized Architecture

- Transceiver performance optimized for 12.7 Gbps, which yields smaller size
- Architecture and process optimizations for specific bandwidths (10 Gbps–40 Gbps) at specific densities
- 1.6 Gbps I/Os—best-in-class hardened I/O gearing logic with CDR (supports SGMII/GbE links on these GPIOs)
- High-performance, best-in-class hardened security IP in mid-range devices

Power Optimization

- The lowest static power—28nm non-volatile process yields very low static power
- Optimized for 12.7 Gbps, which yields the lowest power
- Low power modes—Flash*Freeze yields best-in-class standby power
- Integrated hard IP—DDR PHY, PCIe endpoint/root port, crypto processor
- Total power (static and dynamic)—up to 50% lower power

Solving Key Market Issues

Communications

- Significantly improved network capacity and coverage with limited spectrum and CAPEX
- Delivers 4K video
- Lower OPEX
- IoT growth with minimal energy consumption
- Lower physical and carbon footprint

Defense

- Anti-tamper for Foreign Military Sales (FMS)
- Increasing automation in vehicles and weaponry
- Enhancing operator situational awareness
- Battlefield portability and increased mission life
- Increased cybersecurity
- Supply chain security

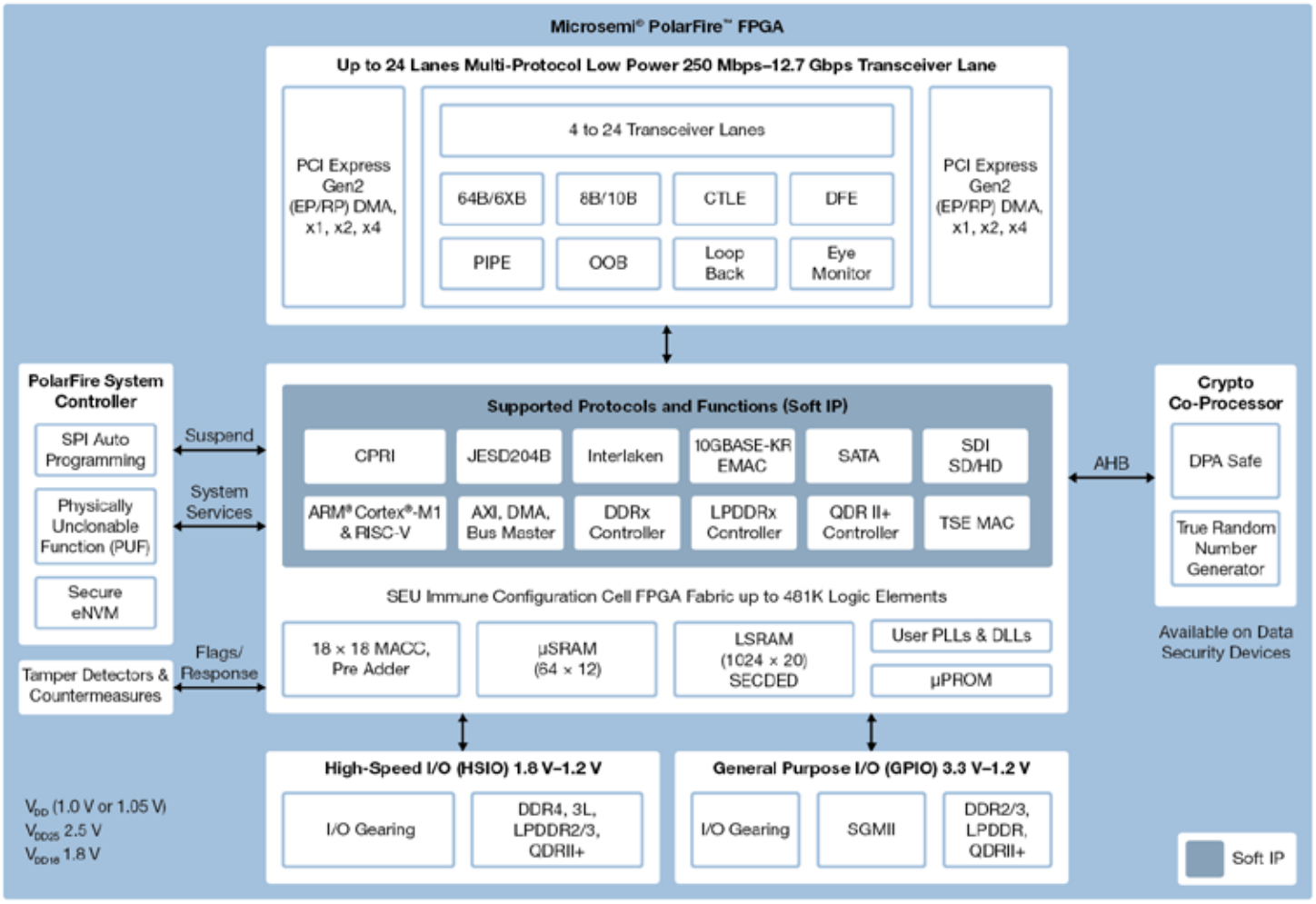
Industrial

- Increased networking of factory automation
- M2M—growth of additional sensors and nodes
- Rise of cloud services requiring decentralized, secure computing
- Portability becoming more prevalent
- Cyber security threats
- Functional safety

PolarFire Architecture

PolarFire FPGAs Deliver Up to 500K Logic Elements, 12.7G Transceivers at 50% Lower Power

- High-speed serial connectivity with built-in multi-gigabit/multi-protocol transceivers from 250 Mbps to 12.7 Gbps
- Up to 481K logic elements consisting of a 4-input look-up table (LUT) with a fractureable D-type flip-flop
- Up to 33 Mbits of RAM
- Up to 1480 18x18 multiply accumulate blocks with hardened pre-adders
- Integrated dual PCIe for up to x4 Gen 2 endpoint (EP) and root port (RP) designs
- High-speed I/O (HSIO) supporting up to 1600 Mbps DDR4, 1333 Mbps DDR3L, and 1333 Mbps LPDDR3/DDR3 memories with integrated I/O gearing
- General purpose I/O (GPIO) supporting 3.3 V built-in CDR to support SGMII for serial gigabit Ethernet, 1067 Mbps DDR3, and 1600 Mbps LVDS I/O speed with integrated I/O gearing logic



Reliability Features

- SEU immune FPGA configuration cells
- Built-in SECDED and memory interleaving on LSRAMs
- System controller suspend mode for safety-critical designs

Security Features

- Cryptography Research Incorporated (CRI)-patented differential power analysis (DPA) bitstream protection
- Integrated physically unclonable function (PUF)
- 56 Kbytes of secure eNVM (sNVM)
- Built-in tamper detectors and countermeasures
- Integrated Athena TeraFire EXP5200B Crypto Co-processor, Suite B-capable
- Digest integrity check for FPGA, µPROM, and sNVM
- True random number generator
- CRI DPA countermeasure pass through license

Communications—Wireline Access and Cellular Infrastructure

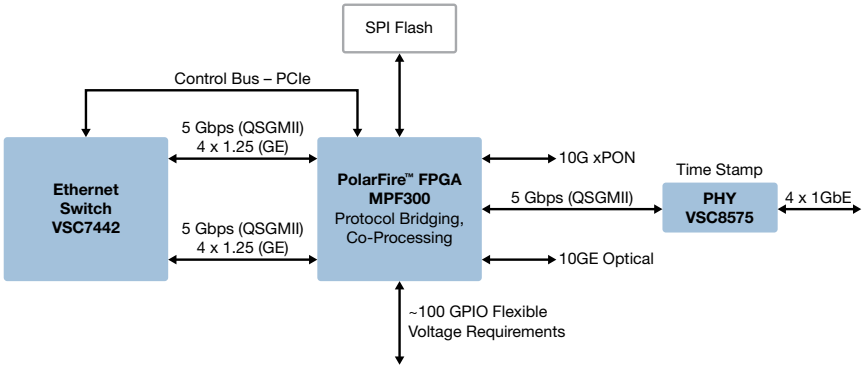
Solving the Access Infrastructure Dilemma: Delivering Additional Bandwidth at Lower Cost

Today's cellular infrastructure and wireline access networks are facing a rapid transformation, having to deliver terabytes of high value content to consumers while reducing operational and capital expenditure spend, as well as reducing their thermal and carbon footprint. Microsemi's PolarFire FPGAs provide cost-effective bandwidth processing capabilities for the increasing number of converged 10 Gpbs ports with the lowest power footprint. The FPGAs also address the market's growing concerns over cybersecurity threats as well as the reliability concerns that face deep submicron SRAM-based FPGAs as they relate to SEUs in their configuration memory.

Applications

- Wireline access, edge, metro (1G–40G)
- Wireless heterogeneous networks
- Wireless backhaul
- Smart optical modules
- Video broadcasting

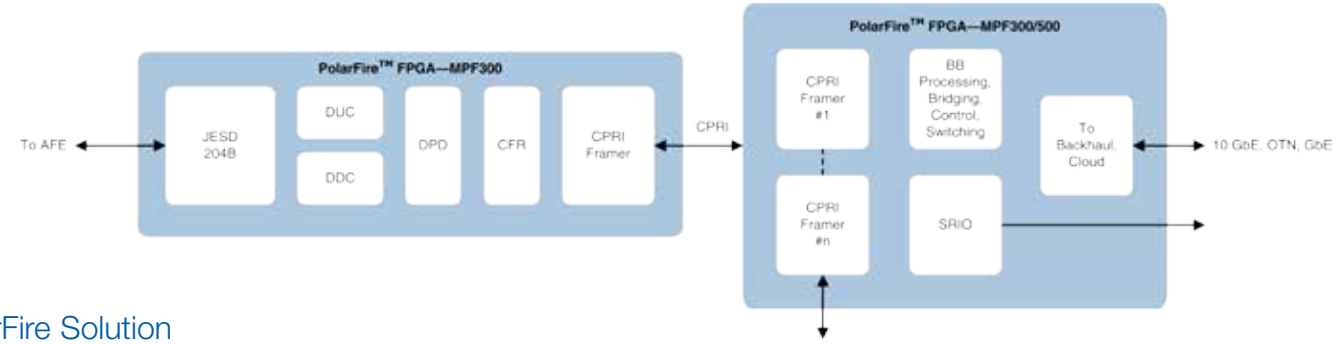
Wireline Access



PolarFire Solution

- Low-cost 10G SERDES with built-in burst mode receiver for PON applications
- Built-in CDR on GPIO enables use of smaller devices when using GbE
- Up to 50% lower total power
- Non-volatile, instant-on
- Best-in-class security and immune to configuration SEU

HetNet—Remote Radio Head Digital Front End and BBU



PolarFire Solution

- Lowers power up to 50% for power-constrained wireless products
- Especially important for power-constrained small cells and thermally-constrained outdoor units
- Signal processing capabilities with hardened pre-adders ideal for low/mid-bandwidth DFE 4 x 4 x 60 MHz and baseband processing
- Includes ultra-low power transceiver for 10G CPRI, bridging, and fronthaul/backhaul transport
- Provides best-in-class security against tampering and hacking

Defense and Aviation

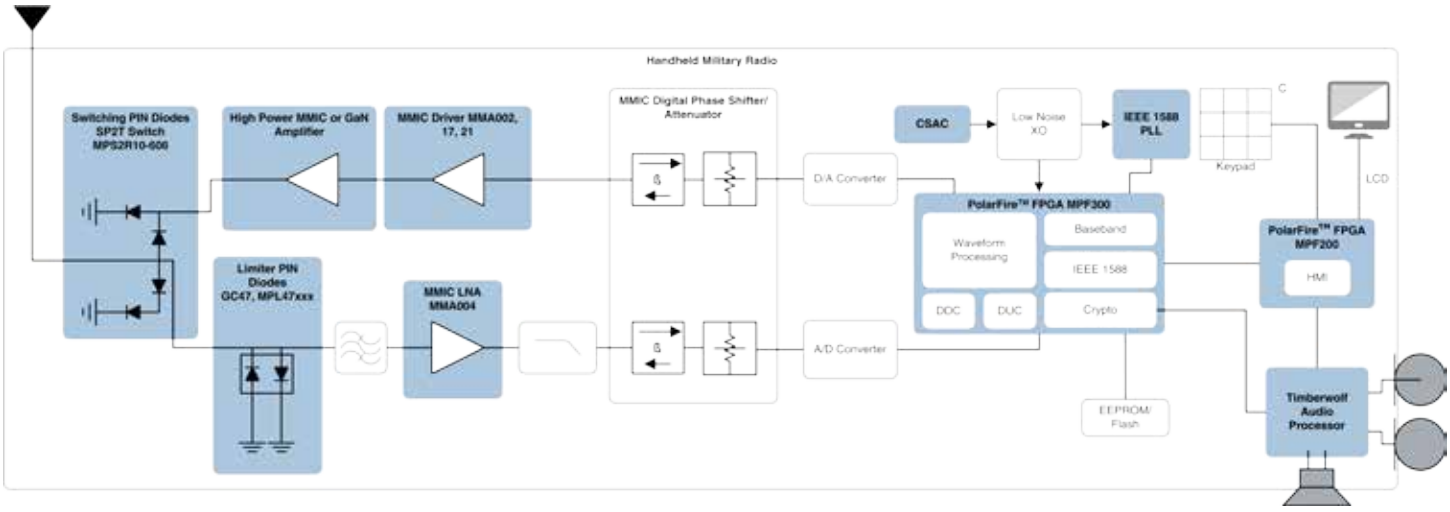
Enabling Security While Lowering Size, Weight, and Power

For the modern solider to be successful in the battlefield, it is imperative that they be equipped with gear that delivers high-tech capabilities at the lowest size and weight possible. Mission life is as key as portability, and power consumption is a decisive factor. PolarFire FPGAs provide high bandwidth radio and image signal processing capabilities at a fraction of the power of competing FPGAs. Microsemi also delvers best-in-class anti-tamper and data security capabilities in cost-efficient FPGAs for FMS, smart munitions, radar, and secure radios.

Defense and Aviation Applications

- Encryption and root of trust
- Secure wireless communications
- Smart munitions
- Radar and electronic warfare
- Aircraft networking
- Actuation and control

Handheld Military Radio



PolarFire Solution

- DSP blocks with hardened pre-address running at 450 MHz for high speed radio and image signal processing
- GPIOs supporting ADC/DACs at up to 1.6 Gbps
- Up to 50% lower total power
- Non-volatile, instant-on
- Best-in-class security and secure manufacturing
- Exceptional reliability—immune to configuration SEU

Industry 4.0

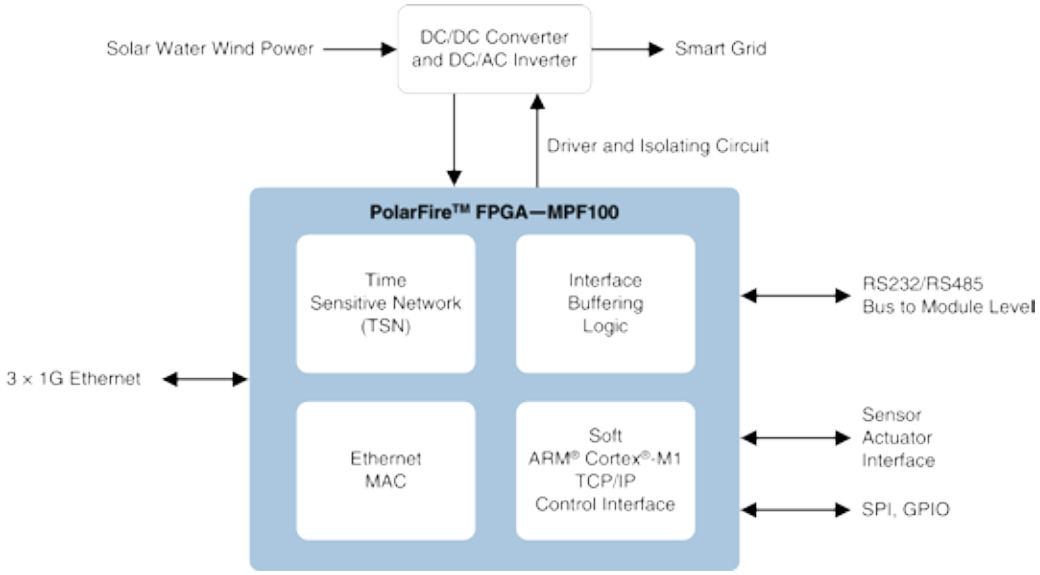
Enabling the Connected Smart Factory

Industry 4.0 combines the smart factory with connectivity using the Internet of Things (IoT). This will require the intelligence to move to the edge of the industrial network and for systems to make decentralized decisions while communicating and cooperating. These systems will require FPGAs with high bandwidth and processing capabilities while using packet-based interfaces. The edge of these networks will need to be miniaturized for low physical footprints and have immunity against tampering and hacking. Machine vision, robotics, thermal imaging, and other technologies will require increased image processing capabilities throughout the network in the most power-efficient manner.

Industry 4.0 Applications

- Process control and automation
- Factory automation
- Industrial networking
- Industrial IoT
- Programmable logic controllers

Networked Power Generation Control



PolarFire Solution

- GPIOs supporting ADC/DACs at up to 1.6 Gbps
- Industry-leading 1588 algorithms for TSN
- Up to 50% lower total power
- Non-volatile, instant-on
- Best-in-class security
- SEU immunity for functional safety requirements

Industrial

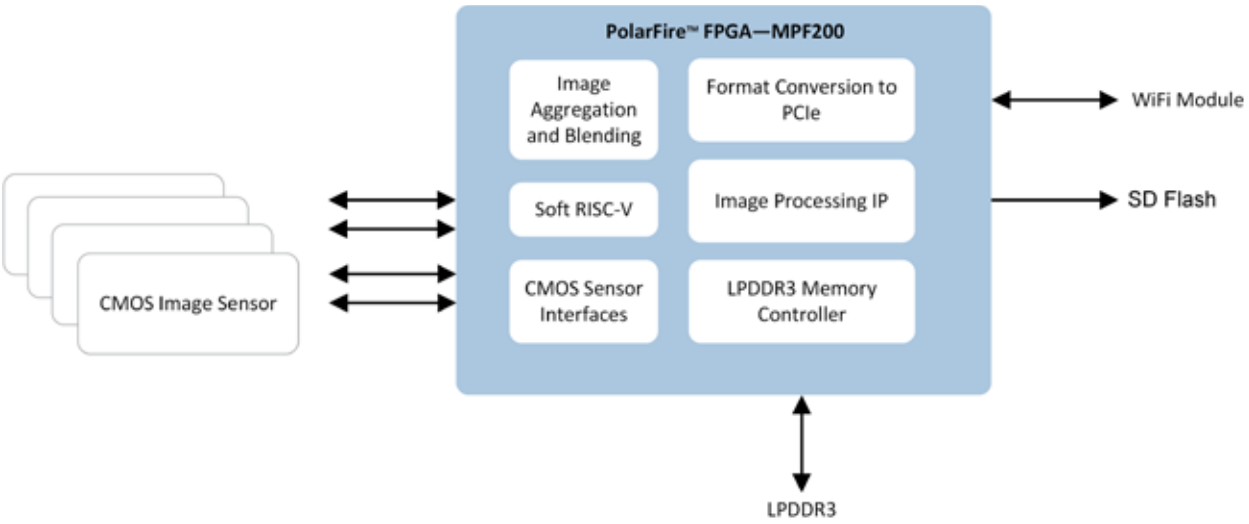
Enhance Tomorrow's Industrial Solutions

Today, Microsemi FPGAs and technology solutions are deployed at the highest safety levels within industrial markets around the world. Our heritage in safety-critical industrial applications range from hazardous area laser curtain sensors, liquid flow meters, nuclear power plant control, navigation systems, and secure communications.

Industrial Applications

- Machine vision, processing, and analytics
- Smart Grid
- Robotics
- Motion control
- Thermal and image processing

Sphere Camera—Aggregates Multiple Image Sensors and Performs Image Processing



PolarFire Solution

- GPIOs supporting sensor interfaces at up to 1.6 Gbps
- Support for low-power 12.5G SDI
- DSP blocks with hardened preadders running at 450 MHz for 4K2K image signal processing
- Flash*Freeze mode to extend battery life on portable applications
- Up to 50% lower total power
- Non-volatile, instant-on
- Best-in-class security
- Soft RISC-V processor for protocol stacks

Industry's Best FPGA Security

Cyber Security is the #1 Concern for Connected Devices on the Network Edge

It is not enough for today's demanding applications to meet the functional requirements of their design—they must do so in a secured way. Security starts during silicon manufacturing and continues through system deployment and operations. Microsemi's PolarFire FPGAs represent the industry's most advanced secure programmable FPGAs.

Microsemi Security Leadership

Security Advantage	Low Density		Mid-Range	
	Microsemi	Competition	Microsemi	Competition
Prevent overbuilding and cloning	Best Low-density Security	N/A	Best Security in the Industry	N/A
Full design IP protection		N/A		Weak
Root of trust		N/A		N/A
Secure data communications		N/A		Weak
Anti-tamper		N/A		N/A

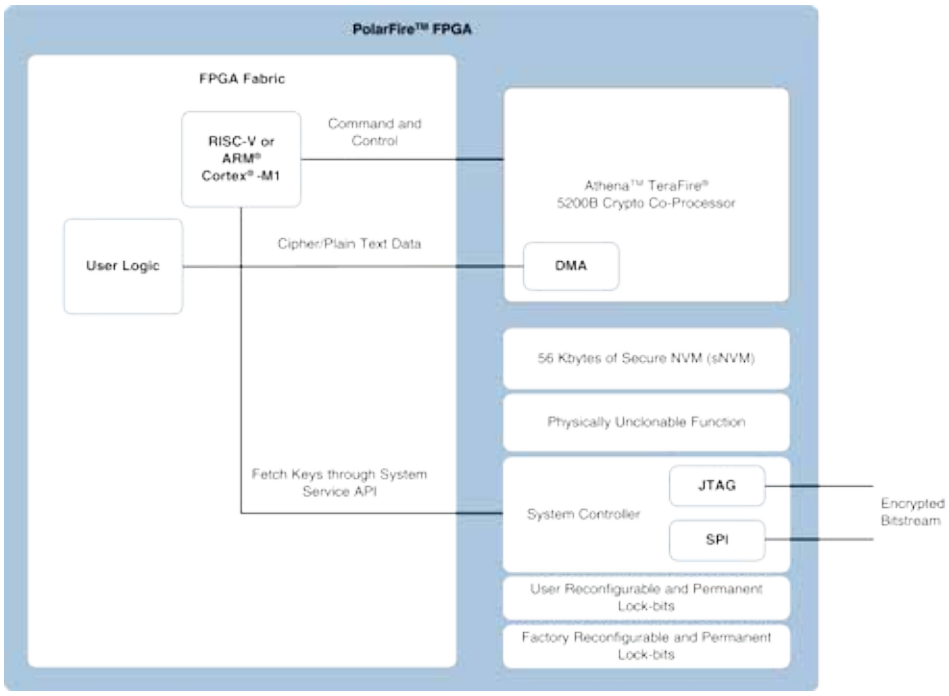
"The number of IoT sensors is expected to approach 30 billion in 5 years – and each unit is a potential entry point for cyber-criminals" – *The Economist Intelligence Unit, 4/11/2016*

"Some call cybercrime the greatest transfer of wealth in human history" – *The Center of Strategic and International Studies, July 2013, The Economic Impact of Cybercrime*

Athena TeraFire® Cryptographic Processor

Select Microsemi PolarFire FPGAs build on the design security capabilities in all PolarFire FPGAs by enabling high-speed DPA resistant cryptographic protocols at wireline speeds. PolarFire data security FPGAs include the following additional features.

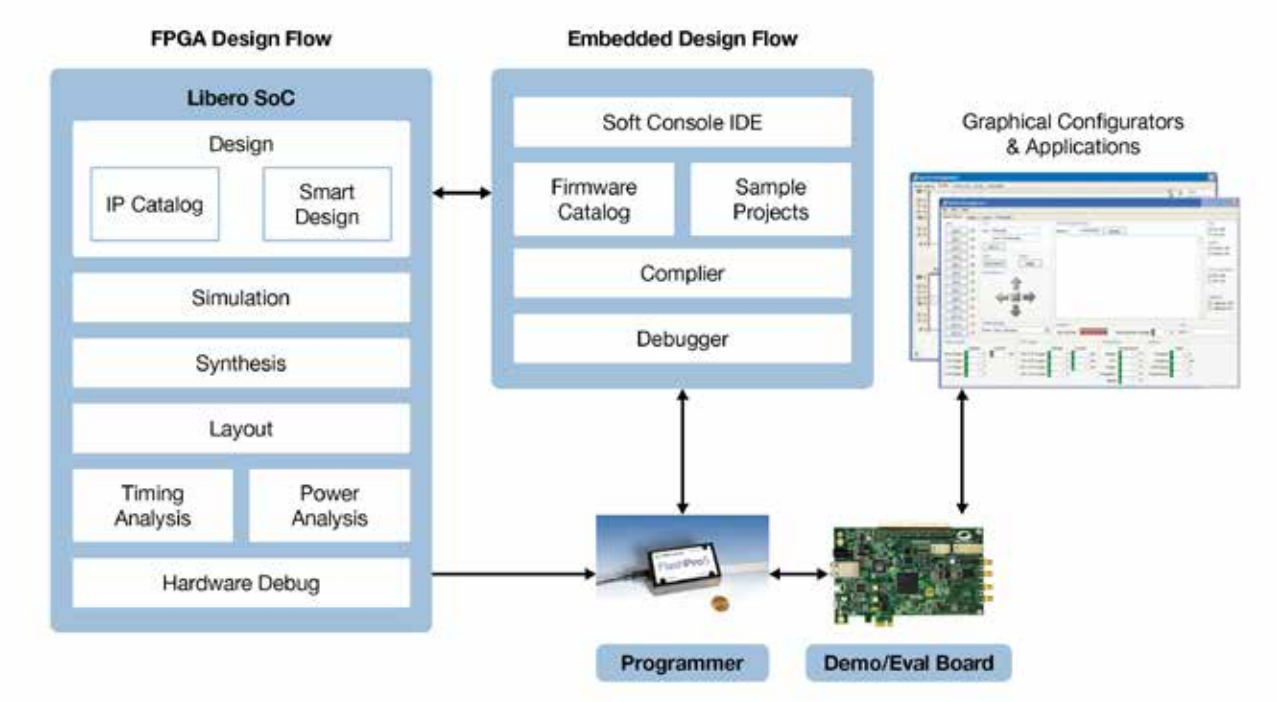
- Integrated true random number generator for enabling modern cryptographic protocols capable of generating random numbers at greater than 100 Mbps
- ~200 MHz Athena TeraFire F5200B DPA resistant cryptographic processor capable of implementing all Suite-B+ algorithms, plus more.
- Rambus/CRI DPA pass-through licensing enabling DPA resistant high-speed cryptographic designs in the FPGA fabric. A CRI license is included in the purchase price of the TS devices. There is no need to negotiate a separate license.
- NIST-certified algorithms



PolarFire Design Environment

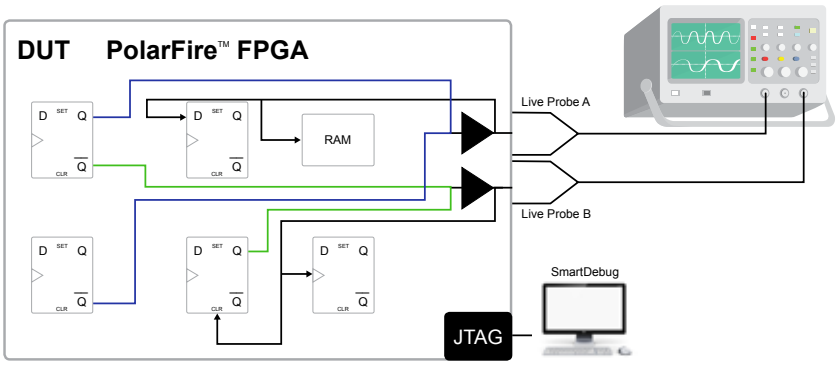
Libero SoC Design Suite

Microsemi's Libero SoC design suite offers high productivity with its comprehensive, easy-to-learn, easy-to-adopt development tools for designing with Microsemi's power-efficient PolarFire FPGA devices. The suite integrates industry-standard Synopsys Synplify Pro synthesis and Mentor Graphics ModelSim simulation with best-in-class constraints management, debug capabilities, timing analysis, power analysis, secure production programming, and push button design flow.



SmartDebug

SmartDebug offers the equivalent of an oscilloscope inside Microsemi FPGAs. SmartDebug features a tool called LiveProbes that enables an engineer to see any two nodes inside the FPGA on external pins, without requiring recompilation of a design. Nodes can be quickly selected and modified and the real-time signals can be seen externally immediately. This SmartDebug capability can cut engineers' debug time by weeks, if not months. In addition, the Smartbert module allows customers to configure and monitor the built-in PMA tester in PolarFire devices.

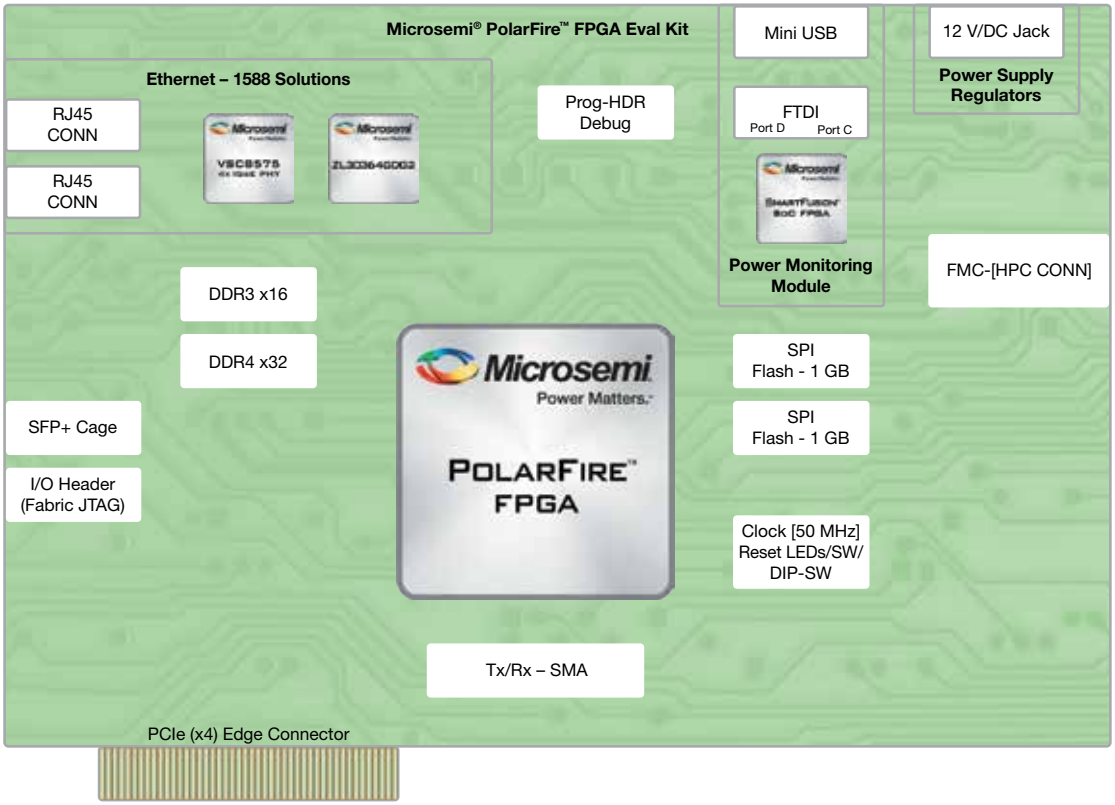


PolarFire Design Hardware

PolarFire Evaluation Kit

The PolarFire Evaluation Kit is a high-performance kit for full development and testing. The kit features:

- 300K LE device (MPF300TS-1FCG1152)
- HPC FMC connector
- 1x SFP+ cage
- IEEE 1588 PLL
- SMA connectors for testing of full-duplex 12.7 Gbps SerDes channel
- 4 GB DDR4 x16 and 2 GB DDR3 x16
- PCI Express (x4) edge connector
- 2 x RJ45 Ethernet using SGMII on GPIO

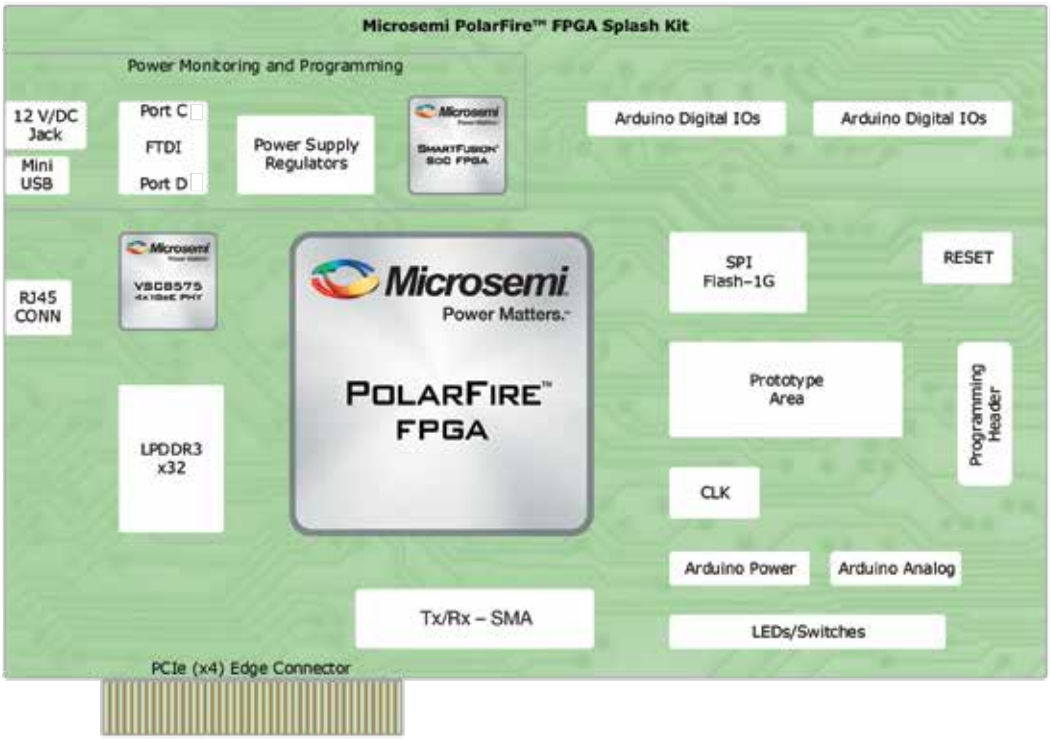


PolarFire Design Hardware and Solutions

PolarFire Splash Kit

The PolarFire Splash Kit is a lower-cost kit with popular interfaces. The kit features:

- 300K LE device (MPF300TS-1FCG484)
- PCI Express (x4) edge connector
- X32 LPDDR3
- RJ45 Ethernet using SGMII on GPIO
- SMA pairs for transceiver
- Arduino Shield connector
- JTAG and SPI programming interface



Protocols and Solutions

An important part of the customer PolarFire FPGA experience will be the availability of numerous protocols to support the connectivity needs of various targeted applications. Complete solutions will be provided for these protocols including complete design and hardware evaluation platforms. Some of the protocols are supported directly through hardened ASIC gates (meaning no fabric utilization), while others use a mixture of hardened silicon features and FPGA fabric IP (either from Microsemi or from third parties).

Popular protocols and solutions for PolarFire Designs

- PCI Express Gen2
- JESD204B (ADC and DAC high-speed interfaces)
- 10G and 1G Ethernet
- DDR memory (DDR3, DDR4, LPDDR3)
- CPRI
- Interlaken
- MIPI D-PHY
- Serial video interfaces
- DSP
- AXI4 interfaces

PolarFire Product Family

Feature and Packaging Overview of the PolarFire FGPA Family

Features		PolarFire FPGAs			
		MPF100T	MPF200T	MPF300T	MPF500T
FPGA fabric	Logic elements (4 LUT + DFF)	109	192	300	481
	Math blocks (18 x 18 MACC)	336	588	924	1480
	LSRAM blocks (20 kbits)	352	616	952	1520
	µSRAM blocks (64 x 12)	1008	1764	2772	4440
	Total RAM (Mbits)	7.6	13.3	20.6	33
	µPROM (Kbits, 9-bit bus)	297	297	459	513
	User DLLs/PLLs	8	8	8	8
High-speed I/O	250 Mbps to 12.7 Gbps transceiver lanes	8	16	16	24
	PCIe Gen2 endpoints/root ports	2	2	2	2
Total I/Os	Total user I/Os	284	368	512	584
Packaging	Type/size/pitch	Total user I/Os (HSIO/GPIO)/transceivers			
	FCSG325 (11 mm x 11 mm, 11 mm x 14.5 mm*, 0.5 mm)	170(84/86)/4	170(84/86)/4*		
	FCSG536 (16 mm x 16 mm, 0.5 mm)		300(120/180)/4	300(120/180)/4	
	FCVG484 (19 mm x 19 mm, 0.8 mm)	284(120/164)/4	284(120/164)/4	284(120/164)/4	
	FCG484 (23 mm x 23 mm, 1.0 mm)	244(96/148)/8	244(96/148)/8	244(96/148)/8	
	FCG784 (29 mm x 29 mm, 1.0 mm)		368(132/236)/16	388(156/232)/16	388(156/232)/16
	FCG1152 (35 mm x 35 mm, 1.0 mm)			512(276/236)/16	584(324/260)/24

Devices in the same package and family type are pin-compatible.
*Wider package dimension applies to the MPF200 device only.

Microsemi is continually adding new products to its industry-leading portfolio.

For the most recent updates to our product line and for detailed information and specifications, please call, email, or visit our website.

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