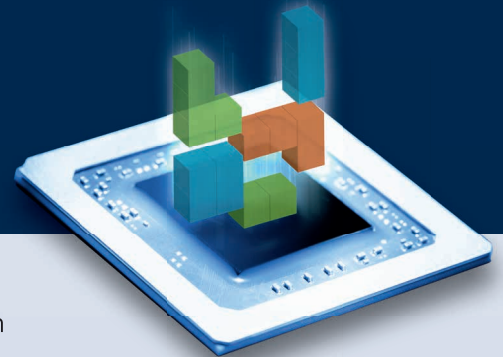


# Flex IP Solution

Flexible Deterministic Ethernet IP Core  
with TSN (Time Sensitive Networking)



- ✓ Configurable and scalable features for optimal silicon design-in
- ✓ Delivered according to ASIC development requirements
- ✓ Provides guaranteed low-latency communication for critical traffic
- ✓ Includes Linux software reference for switch and switched-endpoint operation

Flex IP Solution is a flexible design IP for customized chip or ASIC products. Flex IP Solution offers a wide range of configurable features and a verification environment that enables developers to check the coverage and quality of IP. Flex IP Solution source code is developed and delivered according to ASIC requirements e.g. memories instantiated on top-level.

## TSN Switch Features

### IEEE 802.1AS Time Synchronization

Profile of IEEE 1588v2 for synchronization of clocks in the network. Supports timing requirements for scheduled TSN networks.

### IEEE 802.1Qcc SRP Enhancements

Defines the interfaces for central configuration of TSN networks. Supports configuration models for dynamic scheduling of TSN.

### IEEE 802.1CB Seamless Redundancy

Enables seamless redundancy for increased network availability. Allows for redundancy on a per stream basis for individual critical streams.

### IEEE 802.1Qbv Time Aware Shaping

Provides guaranteed communication latency for time-critical traffic over standard Ethernet even in a converged infrastructure.

### IEEE 802.1Qbu Frame Preemption

Allows for optimal bandwidth utilization of non-scheduled background traffic sent in parallel with scheduled traffic.

### IEEE 802.1Qci Filtering and Policing

Protects against faulty and/or malicious endpoints and switches. Isolates faults to specific regions in the network. (Available 2021)

|                                      |   |
|--------------------------------------|---|
| <b>Ports</b>                         | 3 to 12 ports; 10/100/1000 Mbit/s   |
| <b>Physical Interfaces</b>           | MII, GMII, DMA for host<br>PPS (Pulse-Per-Second) output<br>AXI, Avalon or AHB slave interface for management register access<br>AXI or Avalon master interface for DMA to host CPU   |
| <b>Supported Ethernet Interfaces</b> | MII, GMII, RMII, RGMII, SGMII,<br>100BASE-FX, 1000BASE-X  |
| <b>TSN</b>                           | IEEE 802.1AS-2020 Time Synchronization<br>IEEE 802.1Qbv Time Aware Shaping<br>IEEE 802.1Qcc SRP Enhancements<br>IEEE 802.1Qbu Frame Preemption<br>IEEE 802.1CB Frame Replication and Elimination<br>IEEE 802.1Qci Filtering and Policing (Available 2021)   |
| <b>AVB</b>                           | IEEE 802.1AS-2020 Time Synchronization for Time-Sensitive Applications (gPTP)<br>IEEE 802.1Qav Forwarding and Queuing for Time-Sensitive Streams (FQTSS)  |
| <b>HSR</b>                           | HSR RedBox, HSR End Node, HSR-PRP RedBox and QuadBox support  |
| <b>PRP</b>                           | PRP RedBox and DANP support   |
| <b>IEEE 802.1Q</b>                   | Port-based VLANs and VLAN tagging<br>Prioritization of packets on egress ports<br>Untagging of VLAN frames on egress ports  |
| <b>Clock Synchronization</b>         | IEEE 802.1AS-2020 (including multi-time domain support)<br>IEEE 1588-2019 one-step end-to-end transparent clock support   |
| <b>Switching Engine</b>              | Store and forward architecture providing full cross-sectional bandwidth<br>128-512 kbit frame buffer per port<br>4096 VLANs, up to 64 MSTIs<br>16 MAC address filters per port<br>Up to 4096 entry MAC address hash-based learning table<br>Up to 4096 policer per port<br>8 traffic shapers per port (optional)<br>Static configuration of MAC addresses<br>Flow identification-based MAC addresses<br>Ingress rate-limiting on a per-port basis for unicast, multicast, and broadcast traffic |
| <b>Embedded Software</b>             | Linux kernel module<br>Native Linux interfaces / user space configuration library<br>Edge PTP in binary format for ARM - for IEEE 1588 / IEEE 802.1AS clock synchronization<br>MSTP including additions for engineered traffic (IEEE 802.1Qcc)<br>Open source support for SNMP and NETCONF  |
| <b>Delivery</b>                      | IP core design files in source code<br>Software and device drivers for Linux<br>YOCTO based build system<br>Integration manual<br>Verification environment<br>Test report<br>Technical documentation  |

| Material name               | Material number | Material name               | Material number |
|-----------------------------|-----------------|-----------------------------|-----------------|
| DE-IP Solution Flex License | 12642           | DE-IP Solution Flex Royalty | 12644           |