To make the Industrial IoT and Industry 4.0 a reality, manufacturers must interconnect operations technology (OT), such as manufacturing and automation systems, to their information technology (IT), including inventory, logistics, and customer relationship management systems. Enabling the flow of information between these two domains will increase efficiency and reduce product delivery times.

Time-sensitive networking (TSN) enables the convergence of the IT and OT, using gigabit Ethernet to enable high bandwidth and legacy IT equipment, but adding features such as time-aware shaping, frame pre-emption, and frame replication and elimination to ensure the OT network requirements are met. The LS1028A can support daisy chain or ring deployments with its TSN capable switch, or endpoint applications with the TSN capable Ethernet controller.

**OVERVIEW**

Support for 125 °C junction temperature, NXP’s commitment to production for a minimum of 15 years, and industrial qualification makes this SoC family ideal for industrial applications that require reliability and long life in challenging environments.

**TARGET APPLICATIONS**

- Control and factory automation — robotics controllers, I/O controllers, motion controllers
- Transportation — Gateways, HMI, embedded controllers for mass transit and railways
- IoT gateways
- Networking gateways
- Programmable logic controllers (PLCs)
- Industrial PCs
- Avionics

**HIGHLY INTEGRATED DESIGN**

This family of SoCs integrates the high-performance Arm® Cortex®-A72 processor, Ethernet switching with TSN, Trust Architecture with Security Engine, and a 3D GPU with support for 4K display and integrated DisplayPort/embedded DisplayPort interface.

**TSN FOR CONVERGED NETWORKS IN THE INDUSTRIAL IoT**

To make the Industrial IoT and Industry 4.0 a reality, manufacturers must interconnect operations technology (OT), such as manufacturing and automation systems, to their information technology (IT), including inventory, logistics, and customer relationship management systems. Enabling the flow of information between these two domains will increase efficiency and reduce product delivery times.

Time-sensitive networking (TSN) enables the convergence of the IT and OT, using gigabit Ethernet to enable high bandwidth and legacy IT equipment, but adding features such as time-aware shaping, frame pre-emption, and frame replication and elimination to ensure the OT network requirements are met. The LS1028A can support daisy chain or ring deployments with its TSN capable switch, or endpoint applications with the TSN capable Ethernet controller.

**SECURITY**

The LS1028A family of SoCs can implement trusted platforms using features provided by Trust Architecture such as secure boot, secure key storage, and tamper detection. The Security Engine (SEC) provides cryptographic acceleration for encrypted Ethernet communication and disk storage. The SEC also offloads public/private key transactions, with support for elliptic-curve cryptography (ECC).
**FEATURE LIST**

**FEATURES**
- Dual 64-bit Arm®/v8 Cortex®-A72 Cores with NEON™ SIMD and floating point unit
- 4 Switched TSN-enabled Ethernet interfaces 10/100/1000/2500 Mbit/s
- 1 TSN-enabled Ethernet Interface 10/100/1000 Mbit/s
- 1 Ethernet Interface 10/100 Mbit/s
- Integrated 3D GPU, 4K LCD Controller, DP/eDP Phy
- Trust Architecture
- Security Engine with Cryptographic Offload
- 2 x PCIe® Gen 3.0 controllers, up to four SerDes lanes running at 8 Gbps root, and endpoint support
- 2 x USB 3.0 interfaces with integrated PHY host and device mode support
- 4 x 10 GHz SerDes lanes

**BENEFITS**
- High single-threaded floating point and integer performance for control applications
- Low latency, deterministic Ethernet communications for OT and IT systems, deployed in daisy-chain, ring, or star topologies
- TSN endpoint capabilities for control applications, with scalable bandwidth
- Low-power Ethernet for IT or console communications
- High-resolution graphics for human machine interfaces
- Secure key storage, use secure boot to create a trusted platform for industrial IoT applications
- High-bandwidth, low-latency communication to host processors, industrial communication ICs, and Wi-Fi® chipsets for gateways
- Flexible interconnect to support SATA 3.0, PCIe 3.0, 1 Gb and 2.5 Gb Ethernet

**LS1028A SOC FAMILY — SCALABLE PROCESSING WITH GRAPHICS**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LS1028A</th>
<th>LS1027A</th>
<th>LS1018A</th>
<th>LS1017A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm® core</td>
<td>2 x Cortex®-A72</td>
<td>2 x Cortex®-A72</td>
<td>1 x Cortex®-A72</td>
<td>1 x Cortex®-A72</td>
</tr>
<tr>
<td>DDR</td>
<td>32-bit/16-bit DDR3L/DDR4 + ECC</td>
<td>32-bit/16-bit DDR3L/DDR4 + ECC</td>
<td>32-bit/16-bit DDR3L/DDR4 + ECC</td>
<td>32-bit/16-bit DDR3L/DDR4 + ECC</td>
</tr>
<tr>
<td>GPU</td>
<td>1 x GC7000UltraLite</td>
<td>-</td>
<td>1 x GC7000UltraLite</td>
<td>-</td>
</tr>
<tr>
<td>Ethernet</td>
<td>4 x 2.5 G/1 G switched Eth (TSN enabled)</td>
<td>4 x 2.5 G/1 G switched Eth (TSN enabled)</td>
<td>4 x 2.5 G/1 G switched Eth (TSN enabled)</td>
<td>4 x 2.5 G/1 G switched Eth (TSN enabled)</td>
</tr>
<tr>
<td>PCIe</td>
<td>2 x Gen 3.0 Controllers (RC or EP)</td>
<td>2 x Gen 3.0 Controllers (RC or EP)</td>
<td>2 x Gen 3.0 Controllers (RC or EP)</td>
<td>2 x Gen 3.0 Controllers (RC or EP)</td>
</tr>
<tr>
<td>USB</td>
<td>2 x USB 3.0 with PHY (Host or Device)</td>
<td>2 x USB 3.0 with PHY (Host or Device)</td>
<td>2 x USB 3.0 with PHY (Host or Device)</td>
<td>2 x USB 3.0 with PHY (Host or Device)</td>
</tr>
</tbody>
</table>

**INDUSTRIAL OPERATION**

Fully qualified for industrial operation, the LS1028A family is designed and tested to run continuously in high-temperature environments for 10 years. Devices are available for extended temperature operation supporting a junction temperature between -40 and 105 °C, and are also available with support for junction temperatures up to 125 °C.

**ENABLEMENT FOR FACTORY AUTOMATION**

Open Industrial Linux® provides real-time processing performance on the LS1028A with support for bare-metal applications or Xenomai Linux with an RTOS co-kernel. Open Industrial Linux also provides protocol support for Time-Sensitive Networking and synchronization with IEEE® 1588.

**PRODUCT LONGEVITY**

The LS1028A is part of the NXP 15-year product longevity program, ensuring a stable supply of the LS1028A for long life industrial designs. Visit [www.nxp.com/productlongevity](http://www.nxp.com/productlongevity) for details.

**DEVELOPMENT PLATFORM**

The LS1028A reference design board (RDB) provides the ability to evaluate the capabilities of the LS1028A family of SoCs and get a jump-start on your embedded design. Contact your NXP sales representative for details.

**RELATED SOFTWARE**

- Linux SDK for Layerscape Processors
- Open Industrial Linux SDK with support for real-time applications
- CodeWarrior® Development Software for Arm® v8 64-bit based Layerscape series processors
- Uboot
- UEFI

To learn more, visit [nxp.com/LS1028A](http://nxp.com/LS1028A)