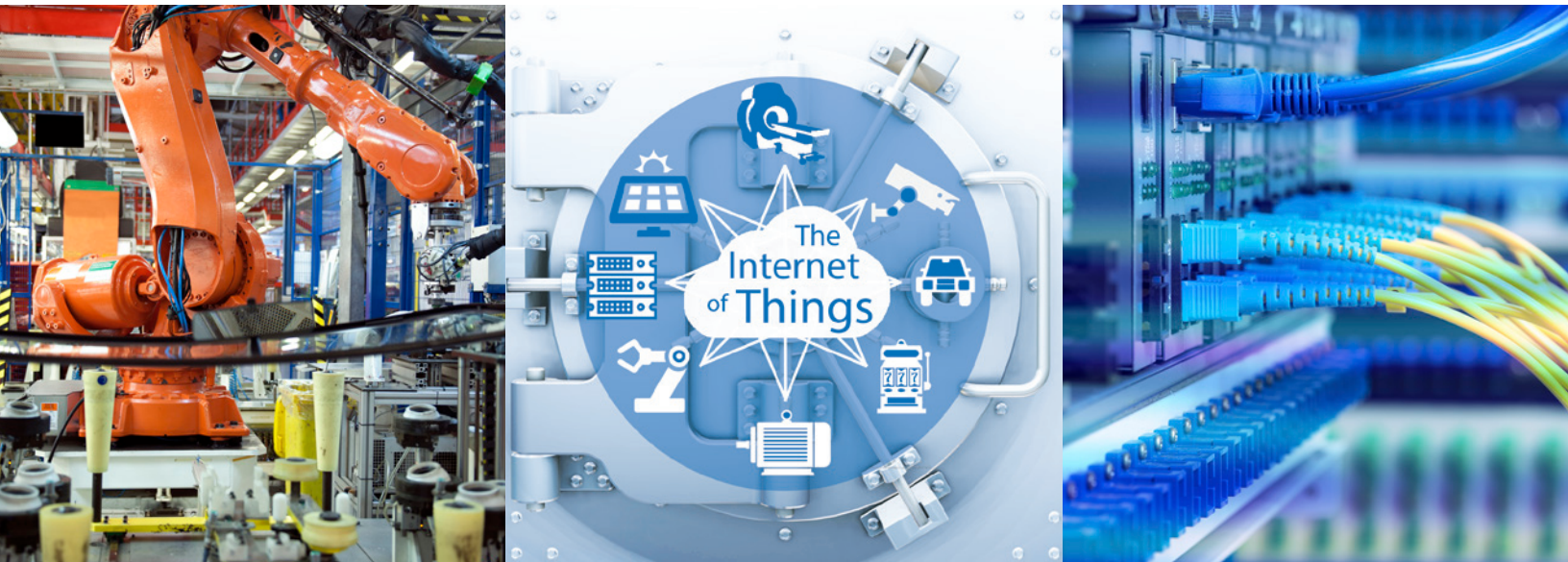# Flexible and Secure Low-Power Ethernet Solutions

Ethernet Switches and PHYs

Software

Power over Ethernet (PoE)

Miniature Atomic Clocks

Timing ICs

FPGAs

Signal Conditioners and Crosspoint Switches

**Microsemi**

Power Matters.™

# Microsemi and Industrial IoT

## The Challenge

Machines and various types of equipment are increasingly both connected and intelligent, imposing vastly increased networking and bandwidth requirements on network infrastructures in order to deliver real-time visibility and control. However, today's industrial network architectures are largely heterogeneous with vast installations of legacy equipment and specialized networked protocols still in use. Modernizing these networks requires a strategy to address the system reliability, determinism and security imperatives of industrial settings. With Ethernet increasingly the common denominator in these environments, Industrial Internet of Things (IIoT) networking has new requirements for deeply embedded, secure, and performance-optimized networking connectivity with accurate timing synchronization, ring protection, and line rate encryption, while demanding deterministic and reliable performance at low power.

## The Solution

Microsemi's broad portfolio—including ICs, systems, software, IP and ecosystem solutions–is inherently optimized for IIoT Ethernet networking applications and needs.

**ICs and Systems:** Microsemi's flexible Industrial Ethernet solutions portfolio includes ICs such as Ethernet switches and PHYs, PLLs and oscillators, FPGAs/SoCs, Power over Ethernet (PoE) devices, and rubidium oscillators, complemented by system solutions such as industrial PoE injectors/midspans and grandmaster clocks. Unlike traditional Ethernet switch IC suppliers, Microsemi focuses on low-bandwidth and high-feature IC architectures that deliver sizeable low-power

advantages and fit IIoT market needs such as port flexibility, long life cycle, deterministic behavior, and stringent reliability.

**Software:** To reduce development costs and time to market, Microsemi also offers comprehensive software choices that enrich our device portfolio, including IEEE 1588 timing and optimized managed switch software stacks.

**IP:** Microsemi SoC IP provides all the necessary building blocks for Industrial Ethernet communications to simplify communications from fieldbus interfaces to an Ethernet backbone.

**Ecosystem Solutions:** Through Microsemi's ecosystem, customers may also leverage multi-protocol Industrial Ethernet solutions as well as security and ODM turnkey solutions specifically for industrial applications.

## The Value of Choosing Microsemi

Selecting a solutions provider that can meet your IIoT networking requirements is an important choice. Microsemi is a long-term supplier of Ethernet switching and PHY technology, with over 300 million Gigabit Ethernet ports shipped. Microsemi is also the only IC, systems, and software provider with a power-optimized, flexible, and reliable industrial Ethernet networking portfolio that supports Ethernet interfaces and fieldbus protocols for a broad range of Industrial Ethernet applications, enabling highly reliable and secure IIoT networks.

**Contact us today to learn how you can get to market faster with Microsemi IIoT solutions.**


Industrial Automation


Process Control


Intelligent Transportation


Smart Energy


Physical Security


Automotive

# Ethernet Solutions

## Ethernet Switches, PHYs, Software, and PoE: Optimized for IIoT Networking

Microsemi has been at the forefront of the worldwide transition of industrial networks and other market segments to Ethernet, with a growing portfolio of products providing advanced features and efficient architectures that result in scalable, low-power and high-reliability performance in the transmission of voice, video, and data.

With over 300 million Gigabit Ethernet ports shipped, Microsemi is a global leader in Ethernet switch and physical layer IC technology and IP. Microsemi is also a leading provider of end-to-end PoE ICs and midspans/injectors since 1999, with a well-established track record in Enterprise applications.

## Key Features

- Faster time-to-production with complete hardware and software solutions
- Industrial temperature range operation
- Ethernet switch solutions up to 100 Gbps of bandwidth, with low power and integrated PHYs
- Ethernet PHYs offer simplified designs with flexible clocking and management features, wide voltage interface ranges, and adjustable drive strength to reduce EMI
- Complete IEEE 1588-compliant 1 Gbps and 10 Gbps solutions with nanosecond-level timestamping accuracy and AES-256 MACsec security features that preserve accuracy

- Line monitoring features that gauge and react to the health of an active Ethernet link
- Solutions with low-alpha mold compound, improving overall SEU immunity
- Broadest PoE product portfolio for indoor and outdoor deployments with PoE ICs delivering power (PSE) and receiving power (PD), and a wide range of PoE injectors/midspans injecting up to 95 W over a single Category 5/5E/6/6A/7 cable

## Ethernet Switches

| Product Number | Ports* | | | Managed | Embedded PHYs | | Interfaces | | | | | L2/L2+/L3-Aware | 1588 | Ring Protection | Temp. Min.°C | Temp. Max. °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1G | 2.5G | 10G | | 10G | 1G | SGMII | QSGMII | XAUI | SFI/XFI | PCIe | | | | | |
| VSC7420 SparX-III-10um™ | 10 | 2 | | | | 8 | • | | | | | L2 | | | −40 | 125 |
| VSC7421 SparX-III-17um™ | 17 | 2 | | | | 12 | • | | | | | L2 | | | −40 | 125 |
| VSC7422 SparX-III-25um™ | 25 | 1 | | | | 12 | • | • | | | | L2 | | | −40 | 125 |
| VSC7423 Caracal Lite™ | 7 | 2 | | • | | 5 | • | | | | | L2+ | • | • | −40 | 125 |
| VSC7428 Caracal-1™ | 11 | 2 | | • | | 8 | • | | | | | L2+ | • | • | −40 | 125 |
| VSC7429 Caracal-2™ | 26 | 2 | | • | | 12 | • | • | | | | L2+ | • | • | −40 | 125 |
| VSC7414 SparX-III-11™ | 11 | 2 | | • | | | • | | | | • | L2+ | • | | −40 | 125 |
| VSC7460 Jaguar-1™ | 31 | 10 | 4 | • | | | • | | • | | | L2+/L3-Aware | • | • | −40 | 125 |
| VSC7462 LynX-1™ | 20 | 10 | 4 | • | | | • | | • | | | L2+/L3-Aware | • | • | −40 | 125 |
| VSC7438 Serval-2™ | 14 | 12 | 2 | • | 2 | | • | • | • | • | • | L2+/L3-Aware | • | • | −40 | 125 |
| VSC7464 LynX-2™ | 26 | 16 | 4 | • | 4 | | • | • | • | • | • | L2+/L3-Aware | • | • | −40 | 125 |
| VSC7468 Jaguar-2™ | 52 | 24 | 4 | • | 4 | | • | • | • | • | • | L2+/L3-Aware | • | • | −40 | 125 |
| VSC7440 SparX-IV-34™ | 4 | 4 | 2 | • | 2 | 2 | • | | | • | • | L2+/L3-Aware | • | • | −40 | 125 |
| VSC7442 SparX-IV-52™ | 52 | | | • | | | • | • | | | • | L2+/L3-Aware | • | • | −40 | 110 |
| VSC7444 SparX-IV-44™ | 26 | 16 | 2 | • | 2 | | • | • | R | • | • | L2+/L3-Aware | • | • | −40 | 110 |
| VSC7448 SparX-IV-80™ | 52 | 24 | 4 | • | 4 | | • | • | R | • | • | L2+/L3-Aware | • | • | −40 | 110 |
| VSC7511 Ocelot-4um™ | 4 | | | | | 4 | • | | | | • | L2 | | • | −40 | 125 |
| VSC7512 Ocelot-10um™ | 10 | 2 | | | | 4 | • | • | | | • | L2 | | • | −40 | 125 |
| VSC7513 Ocelot-8™ | 8 | | | • | | 4 | • | • | | | • | L2 | • | • | −40 | 125 |
| VSC7514 Ocelot-10™ | 10 | 2 | | • | | 4 | • | • | | | • | L2 | • | • | −40 | 125 |

*Maximum port counts exclude the NPI port. Shall not surpass the device's max available I/O bandwidth.
"R" denotes both RXAUI and XAUI support
1G integrated ports support dual media Copper or Fibre applications

3

# Ethernet Solutions

## Ethernet PHYs

| Product Number | Speed FE | Speed GE | Ports | MAC Interfaces | Cu-Only or Dual Media | 256/128-bit MACsec | SyncE | 1588v2 Accuracy | Temp. Min.°C | Temp. Max. °C |
|---|---|---|---|---|---|---|---|---|---|---|
| VSC8501-03 | | • | 1 | RGMII/GMII/MII (2.5 V/3.3 V) | Cu | | • | | –40 | 125 |
| VSC8502-03 | | • | 2 | RGMII/GMII/MII (2.5 V/3.3 V) | Cu | | • | | –40 | 125 |
| VSC8504-04 | | • | 4 | QSGMII/SGMII | Dual Media | | • | | –40 | 125 |
| VSC8512 | | • | 12 | Q/SGMII | Dual Media | | • | | –40 | 125 |
| VSC8514-03 | | • | 4 | QSGMII | Cu | | • | | –40 | 125 |
| VSC8514-14 | | • | 4 | QSGMII | Cu | | | | –40 | 125 |
| VSC8530-03 | • | | 1 | RGMII/RMII (1.5 V/1.8 V/2.5 V/3.3 V) | Cu | | | | –40 | 125 |
| VSC8531-03 | | • | 1 | RGMII/RMII (1.5 V/1.8 V/2.5 V/3.3 V) | Cu | | | | –40 | 125 |
| VSC8540-03 | • | | 1 | RGMII/RMII/MII (1.5 V/1.8 V/2.5 V/3.3 V) | Cu | | • | | –40 | 125 |
| VSC8541-03 | | • | 1 | RGMII/RMII/GMII/MII (1.5 V/1.8 V/2.5 V/3.3 V) | Cu | | • | SOF | –40 | 125 |
| VSC8552-04 | | • | 2 | QSGMII/SGMII/RGMII (2.5 V/3.3 V) | Dual Media | | • | | –40 | 125 |
| VSC8562-14 | | • | 2 | QSGMII/SGMII | Dual Media | • | • | | –40 | 125 |
| VSC8564-14 | | • | 4 | QSGMII/SGMII | Dual Media | • | • | | –40 | 125 |
| VSC8572-04 | | • | 2 | QSGMII/SGMII/RGMII (2.5 V/3.3 V) | Dual Media | | • | ±10 nS | –40 | 125 |
| VSC8574-04 | | • | 4 | QSGMII/SGMII | Dual Media | | • | ±10 nS | –40 | 125 |
| VSC8575-14 | | • | 4 | QSGMII/SGMII | Dual Media | | • | ±4 nS | –40 | 125 |
| VSC8582-14 | | • | 2 | QSGMII/SGMII | Dual Media | • | • | ±4 nS | –40 | 125 |
| VSC8584-14 | | • | 4 | QSGMII/SGMII | Dual Media | • | • | ±4 nS | –40 | 125 |

All Gigabit Ethernet PHYs are also available with a 0° C to 125° C temperature range.

## Ethernet Software

| Product Number eCOS | Product Number LINUX | Description | Market | Application | Basic L2 | Advanced L2 | Protection | IEEE 1588/ SyncE | Carrier Ethernet | iCLI, JSON/ RPC, SNMP |
|---|---|---|---|---|---|---|---|---|---|---|
| VSC6810SDK | VSC6818SDK | CE Services | Service Provider | Turnkey | • | • | • | • | • | • |
| VSC6815SDK | VSC6817SDK | IStaX | Industrial IoT | Turnkey | • | • | • | • | | • |
| VSC6813SDK | VSC6816SDK | SMBStaX | Enterprise | Turnkey | • | • | | | | • |
| VSC6812SDK | VSC6819SDK | WebStaX | Enterprise | Turnkey | • | | | | | |
| VSC6802API | | Unified API | | Development | | | | | | |
| VSC6803API | | Open API | | Development | | | | | | |
| VSC6811SDK | | WebConfig | | Turnkey | • | | | | | |
| VSC6825SDK | | Unmanaged | | Turnkey | • | | | | | |
| VSC6830SDK | | Linux BSP | | Development | | | | | | |

# Power over Ethernet (PoE)

## Industrial PoE Solutions

| Watts per Port | Product | Number of Ports | Power Input | Warranty |
|---|---|---|---|---|
| 30 W | PD-9001GI/DC | 1 | DC | 1 Year |
| 60 W | PD-9501GI/DC | 1 | DC | 1 Year |

All Microsemi PoE products support Gigabit data rates

## PoE PD Front End ICs

| Product | IC Type | PoE Type | IEEE Compliant | Max Power [W] | Max Current [A] | Max Channel Impedance [Ω] |
|---|---|---|---|---|---|---|
| PD70100ILD | Front end | Type 1 – AF – 15 W | IEEE 802.3af | 15.4 | 0.45 | 0.6 |
| PD70101ILQ | Combo: Front + PWM controller | Type 1 – AF – 15 W | IEEE 802.3af | 15.4 | 0.45 | 0.6 |
| PD70200ILD | Front end | Type 2 – AT – 30 W | IEEE 802.3at | 51 | 1.2 | 0.6 |
| PD70201ILQ | Combo: Front + PWM controller | Type 2 – AT – 30 W | IEEE 802.3at | 51 | 1.2 | 0.6 |
| PD70210ILD/PD70210AILD | Front end | PoH – 95 W | PoH | 95 | 2 | 0.3 |
| PD70211ILQ | Combo: Front + PWM controller | PoH – 95 W | PoH | 95 | 2 | 0.3 |
| PD70224ILQ-TR | Ideal diode bridge | PoH – 95 W | PoH | 95 | 2 | NA |

## PoE PSE Manager

| Product | Ports | FETs | Sense Resistor | MCU Options | Host I/F Options | LED Driving Options | Standards Supported | Max PM System | Evaluation Boards |
|---|---|---|---|---|---|---|---|---|---|
| PD69208ILQ | 8 | Internal 0.2 Ω | Internal 0.1 Ω | PD69200-VVVVSS Marvell ISSR | I²C UART SPI | CPLD Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W PoH 95W | 96 Ports | PD-IM-7648 PD-IM-7648H |
| PD69204ILQ | 4 | Internal 0.2 Ω | Internal 0.1 Ω | PD69200-VVVVSS Marvell ISSR | I²C UART SPI | CPLD Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W PoH 95W | 96 Ports | PD-IM-7648 PD-IM-7648H |
| PD69108ILQ/ PD69108FILQ | 8 | Internal 0.3 Ω | External 0.36 Ω | PD39100X-0YYY PD69100Y-GGGG Marvell ISSR | I²C UART SPI | CPLD Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W PoH 95W | 96 Ports | PD-IM-7548 PD-IM-7548H |
| PD69104ILQ | 4 | Internal 0.3 Ω | External 0.36 Ω | PD39100X-0YYY PD69100Y-GGGG Marvell ISSR | I²C UART SPI | CPLD Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W PoH 95W | 92 Ports | Use PD69108 EVB |
| PD69104B1ILQ/ PD69104B1FILQ | 4 | Internal 0.3 Ω | External 0.36 Ω | Auto Mode | I²C UART | Direct Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W PoH 95W | 4 Ports | PD-IM-7504B |
| PD69101ILQ | 1 | Internal 0.3 Ω | External 0.5 Ω | Auto Mode | SPI | Direct Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W | 2 Ports | PD-IM-7401 |
| PD69012 | 12 | External 0.1 Ω | External 0.5 Ω | PD69000XX-GGGG Marvell ISSR Auto Mode | I²C UART SPI | CPLD Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W | 96 Ports | PD-IM-7448E PD-IM-7448A |
| PD69008 | 8 | External 0.1 Ω | External 0.5 Ω | PD69000XX-GGGG Marvell ISSR Auto Mode | I²C UART SPI | CPLD Host | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W | 88 Ports | PD-IM-7416A |
| PD64001 | 1 | External 0.1 Ω | External 2 Ω | Auto Mode | none | Direct | IEEE 802.3af 15.4W IEEE 802.3at 30W IEEE 802.3at 60W | 1 Port | PD-IM-7301 |

# Miniature Atomic Clocks

## Miniature Atomic Clocks: SWaP Optimized for Robust Industrial Holdover

Highly compact, lightweight, and low power, Microsemi's Miniature Atomic Clock (MAC) portfolio delivers significant advantages over traditional lamp-based rubidium clocks used in industrial holdover applications. With the industry's broadest operating temperature range (–10 °C to 70 °C), the SA.3Xm devices are the ideal choice for industrial applications requiring rubidium oscillator precision with no external physical connection.

| | SA.35m | SA.33m | SA.31m |
|---|---|---|---|
| Size (volume) | 46 cm$^3$/2.8 in$^3$ | | |
| Power (W) @ 25 °C | 5 | | |
| Phase Noise (dBc/Hz)<br>1 Hz<br>10 Hz<br>100 Hz<br>1 KHz<br>10 KHz | ≤ –70<br>≤ –87<br>≤ –114<br>≤ –130<br>≤ –140 | ≤ –70<br>≤ –87<br>≤ –114<br>≤ –130<br>≤ –140 | ≤ –65<br>≤ –85<br>≤ –112<br>≤ –130<br>≤ –140 |
| Aging (monthly) | <±1E–10 | <±1E–10 | <±3E–10 |
| TempCo (–10 °C to 75 °C) | <1E–10 | <1.5E–10 | <1E–9 |
| Allan Deviation<br>1 s<br>10 s<br>100 s | ≤3E–11<br>≤1.6E–11<br>≤8E–12 | ≤3E–11<br>≤1.6E–11<br>≤8E–12 | ≤5E–11<br>≤2.5E–11<br>≤1E–11 |

## Timing ICs: From the Market Leader in SyncE

Microsemi provides both SyncE alone (with an easy migration path to IEEE 1588) or combined SyncE and IEEE 1588 for frequency and time alignment. The market leader in Synchronous Ethernet timing devices, Microsemi was the first to introduce Synchronous Ethernet PLLs in 2006. Microsemi now offers the industry's most comprehensive portfolio of SyncE timing devices, providing G.8262 compliance and ultra-low jitter for PHYs up to 100G.

## SyncE for Timing Card

| Product | Description | DPLLs / NCOs | BW (Hz) | Split XO Feature | Inputs | Input Frequency | Embedded PPS & EPP2S | Diff. Outputs | CMOS Outputs | Output Frequency | Low-Jitter APLLs | GP Clock Gen | Jitter ps RMS | Pkg Size mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZL30142 | 10 GbE Single SyncE and Telecom DPLL | 1 | 01. m–890 | | 3 SE | 2k, N x 8K, SDH, SyncE | | 1 | 2 | 2k, N x 8K, SDH, SyncE | 1 | 1 | 1.0 | 9 x 9 |
| ZL30143 | 10 GbE Dual SyncE and Telecom DPLL | 2 | 01. m–890 | | 8 SE | 2k, N x 8K, SDH, SyncE | | 2 | 6 | 2k, N x 8K, SDH, SyncE | 1 | 2 | 1.0 | 9 x 9 |
| ZL30161 | 10 GbE Any-Frequency SyncE PLL/NCO | 1 | 0.1 m–1 k | | 11 | 1 Hz–750 MHz | | 6 | 6 | 1 Hz–750 MHz | 3 | 0 | 0.6 | 13 x 13 |
| ZL30162 | 10 GbE Any-Frequency Quad SyncE PLL/NCO | 4 | 0.1 m–1 k | | 11 | 1 Hz–750 MHz | | 8 | 8 | 1 Hz–750 MHz | 4 | 0 | 0.6 | 13 x 13 |
| ZL30163 | 10 GbE Any-Frequency Dual SyncE PLL/NCO | 2 | 0.1 m–1 k | | 11 | 1 Hz–750 MHz | | 8 | 8 | 1 Hz–750 MHz | 4 | 0 | 0.6 | 13 x 13 |
| ZL30164 | 10 GbE Any-Frequency Triple SyncE PLL/NCO | 3 | 0.1 m–1 k | | 11 | 1 Hz–750 MHz | | 8 | 8 | 1 Hz–750 MHz | 4 | 0 | 0.64 | 13 x 13 |
| ZL30621 | 10 GbE and above Single SyncE PLL/NCO | 1 | 0.1 m–10 | | 2 D/SE + 1 SE | 8 kHz–1250 MHz | | 3 | 6 | <1 Hz–1035 MHz | 1 | 0 | 0.25 | 5 x 10 |
| ZL30622 | 10 GbE and above Single SyncE PLL/NCO | 1 | 0.1 m–500 | | 2 D/SE + 1 SE | 8 kHz–1250 MHz | | 3 | 6 | <1 Hz–1035 MHz | 1 | 0 | 0.25 | 5 x 5 |
| ZL30623 | 10 GbE and above Dual SyncE PLL/NCO | 2 | 0.1 m–500 | | 4 D/SE + 1 SE | 8 kHz–1250 MHz | | 6 | 12 | <1 Hz–1035 MHz | 2 | 0 | 0.25 | 5 x 10 |
| ZL30601 | Single Channel Network Synchronizer | 1 | 0.1 m–448 | • | 5 D/10 SE | 0.5 Hz–900 MHz | • | 6 | 14 | 0.5 Hz–900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |
| ZL30602 | Dual Channel Network Synchronizer | 2 | 0.1 m–448 | • | 5 D/10 SE | 0.5 Hz–900 MHz | • | 6 | 14 | 0.5 Hz–900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |
| ZL30603 | Triple Channel Network Synchronizer | 3 | 0.1 m–448 | • | 5 D/10 SE | 0.5 Hz–900 MHz | • | 6 | 14 | 0.5 Hz–900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |
| ZL30604 | Quad Channel Network Synchronizer | 4 | 0.1 m–448 | • | 5 D/10 SE | 0.5 Hz–900 MHz | • | 6 | 14 | 0.5 Hz–900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |

## SyncE for Line Card

| Product | Description | DPLLs | BW (Hz) | Inputs | Input Frequency | Embedded PPS | Outputs (Diff/ CMOS) | Output Frequency | Low-Jitter APLLs/GP Clock Gen | Jitter ps RMS | Pkg Size mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ZL30151 | 10 GbE and above Single SyncE PLL | 1 | 1–500 | 2 D/SE + 1 SE | 1 kHz–650 MHz | | 0–3/0–6 | <1 Hz–650 MHz | 1/0 | 0.25 | 5 x 5 |
| ZL30165 | 10 GbE Any-Frequency Quad SyncE PLL/NCO | 4 or (4 NCO) | 5–896 | 8 D/SE | 1 kHz–750 MHz | | 8/8 | 1 kHz–750 MHz | 4/0 | 0.63 | 13 x 13 |
| ZL30166 | 10 GbE Any-Frequency Triple SyncE PLL/NCO | 3 or (3 NCO) | 5–896 | 9 D/SE + 2 SE | 1 kHz–750 MHz | | 8/8 | 1 kHz–750 MHz | 4/0 | 0.63 | 13 x 13 |
| ZL30167 | 10 GbE Any-Frequency Dual SyncE PLL/NCO | 2 or (2 NCO) | 5–896 | 9 D/SE + 2 SE | 1 kHz–750 MHz | | 8/8 | 1 kHz–750 MHz | 4/0 | 0.63 | 13 x 13 |
| ZL30611 | SyncE Line Card | 1 or (1 NCO) | 14–448 | 5 D/10 SE | 1 kHz–900 MHz | • | 6/14 | 0.5 Hz–650 MHz | 3/1 | 0.25 | 10 x 10 |
| ZL30612 | Dual SyncE Line Card | 2 or (2 NCO) | 14–448 | 5 D/10 SE | 1 kHz–900 MHz | • | 6/14 | 0.5 Hz–650 MHz | 3/1 | 0.25 | 10 x 10 |
| ZL30614 | Quad SyncE Line Card | 4 or (4 NCO) | 14–448 | 5 D/10 SE | 1 kHz–900 MHz | • | 6/14 | 0.5 Hz–650 MHz | 3/1 | 0.25 | 10 x 10 |

# Timing ICs

## IEEE 1588 PLL

IEEE 1588 is a protocol-based synchronization mechanism useful for existing unaware networks where frequency syntonization is required. When coupled with physical layer technologies such as Synchronous Ethernet, IEEE 1588 can also provide robust time alignment. Microsemi offers the industry's most comprehensive and cost effective IEEE 1588 solution with a range of products offering ultra-low jitter for PHYs up to 100G and IEEE 1588 profiles.

## IEEE 1588 for Timing Cards

| Product | Description | DPLLs | BW (Hz) | Split XO Feature | Inputs | Input Frequency | Embedded PPS & EPP2S | Diff. Outputs | CMOS Outputs | Output Frequency | Low-Jitter APLLs | GP Clock Gen | Jitter ps RMS | Pkg Size mm |
|---------|-------------|-------|---------|------------------|--------|-----------------|----------------------|---------------|--------------|------------------|------------------|--------------|---------------|-------------|
| ZL30342 | SyncE/SONET/SDH G.8262/ Stratum 3 and IEEE 1588 Packet G.8261 Synchronizer | 1 NCO | 0.1–890 | | 3 SE | N x 8K, SyncE | | 1 | 2 | N x 8K, SDH, SyncE | 1-Int-N | 1 | 1.0 | 9 x 9 |
| ZL30343 | SyncE/SONET/SDH G.8262/ Stratum 3 and IEEE 1588 Packet G.8261 Synchronizer | 2 NCO | 0.1–890 | | 8 SE | N x 8K, SyncE | | 2 | 6 | N x 8K, SDH, SyncE | 1-Int-N | 2 | 1.0 | 9 x 9 |
| ZL30361 | Single Channel Combined IEEE 1588 ToP and SyncE Device | 1 NCO | 0.1–896 | | 11 | 1 Hz– 750 MHz | | 6 | 6 | 1 Hz– 750 MHz | 3 | 0 | 0.6 | 13 x 13 |
| ZL30362 | Quad Channel Combined IEEE 1588 ToP and SyncE Device | 4 NCO | 0.1–896 | | 11 | 1 Hz– 750 MHz | | 8 | 8 | 1 Hz– 750 MHz | 4 | 0 | 0.6 | 13 x 13 |
| ZL30363 | Dual Channel Combined IEEE 1588 ToP and SyncE Device | 2 NCO | 0.1–896 | | 11 | 1 Hz– 750 MHz | | 8 | 8 | 1 Hz– 750 MHz | 4 | 0 | 0.6 | 13 x 13 |
| ZL30364 | Triple Channel Combined IEEE 1588 ToP and SyncE Device | 3 NCO | 0.1–896 | | 11 | 1 Hz– 750 MHz | | 8 | 8 | 1 Hz– 750 MHz | 4 | 0 | 0.64 | 13 x 13 |
| ZL30721 | Single Channel Combined IEEE 1588 ToP and SyncE Device | 1 NCO | 0.1–10 | | 2 D/SE + 1 SE | 8 kHz– 1250 MHz | | 3 | 6 | <1 Hz– 1035 MHz | 1 | 0 | 0.25 | 5 x 10 |
| ZL30722 | Single Channel Combined IEEE 1588 ToP and SyncE Device | 1 NCO | 0.1–500 | | 2 D/SE + 1 SE | 8 kHz– 1250 MHz | | 3 | 6 | <1 Hz– 1035 MHz | 1 | 0 | 0.25 | 5 x 5 |
| ZL30723 | Dual Channel Combined IEEE 1588 ToP and SyncE Device | 2 NCO | 0.1–500 | | 4 D/SE + 1 SE | 8 kHz– 1250 MHz | | 6 | 12 | <1 Hz– 1035 MHz | 2 | 0 | 0.25 | 5 x 10 |
| ZL30701 | Single Channel IEEE 1588 Synchronizer | 1 or (1 NCO) | 0.1 m–448 | • | 5 D/ 10 SE | 0.5 Hz– 900 MHz | • | 6 | 14 | 0.5 Hz– 900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |
| ZL30702 | Dual Channel IEEE 1588 Synchronizer | 2 or (2 NCO) | 0.1 m–448 | • | 5 D/ 10 SE | 0.5 Hz– 900 MHz | • | 6 | 14 | 0.5 Hz– 900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |
| ZL30703 | Triple Channel IEEE 1588 Synchronizer | 3 or (3 NCO) | 0.1 m–448 | • | 5 D/ 10 SE | 0.5 Hz– 900 MHz | • | 6 | 14 | 0.5 Hz– 900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |
| ZL30704 | Quad Channel IEEE 1588 Synchronizer | 4 or (4 NCO) | 0.1 m–448 | • | 5 D/ 10 SE | 0.5 Hz– 900 MHz | • | 6 | 14 | 0.5 Hz– 900 MHz | 2 or 3 | 1 | 0.25 | 10 x 10 |

## IEEE 1588 for Line Cards

| Product | Description | DPLLs | BW (Hz) | Inputs | Input Frequency | Diff. Outputs | CMOS Outputs | Output Frequency | Low-Jitter APLLs | GP Clock Gen | Jitter ps RMS | Pkg Size mm |
|---------|-------------|-------|---------|--------|-----------------|---------------|--------------|------------------|------------------|--------------|---------------|-------------|
| ZL30347 | 10 GbE Any Frequency Stratum 2/3E/3 DPLL | 1 | 0.5 m–400 | 2 D/SE | Nx8k, SyncE | 2 | 6 | N x 8K, SDH, SyncE | 1-Int-N | 2 | 1.0 | 9 x 9 |
| ZL30365 | Quad Channel Combined IEEE 1588 ToP and SyncE Device | 4 NCO | 5–890 | 8 D/SE | 1 Hz– 750 MHz | 8 | 8 | <1 Hz– 750 MHz | 4 | 0 | 0.65 | 13 x 13 |
| ZL30367 | Dual Channel Combined IEEE 1588 ToP and SyncE Device | 2 NCO | 5–890 | 9 D/ SE+2 SE | 1 Hz– 750 MHz | 6 | 6 | <1 Hz– 750 MHz | 3 | 0 | 0.65 | 13 x 13 |

## Clock Management

Microsemi's clock management portfolio provides devices for clock synthesis, frequency conversion, jitter attenuation, and fan out buffers to reduce bill of material costs and board space requirements, improve performance reliability, and simplify design complexity. Key features include industry-leading ultra-low jitter, high integration, wide frequency range, and highly programmable outputs.

## Clock Synthesis Devices

| Product | Independent Output Freq. Families | Inputs | Crystal Input Freq. Range | Xtal Osc. or CMOS Input Freq. Range | Diff Input Freq. Range | Typical Jitter fs RMS | NCO ppb | Outputs Diff/CMOS | Output Freq. Range | NV Memory | Host Bus | Pkg Size, mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX24405 | 2 | 1 XTAL/SE, 3 D/SE | 25 M–52 M | 9.72 M–160 M | 9.72 M–750 M | 180[1] | – | 0-5/0-10 | <1 Hz–750 M | Ext EE | SPI | 10 x 10 |
| MAX24505 | 2 | 1 XTAL/SE, 3 D/SE | 25 M–52 M | 9.72 M–160 M | 9.72 M–750 M | 180[1] | – | 0-5/0-10 | <1 Hz–750 M | Int EE | SPI | 10 x 10 |
| MAX24410 | 2 | 1 XTAL/SE, 3 D/SE | 25 M–52 M | 9.72 M–160 M | 9.72 M–750 M | 180[1] | – | 0-10/0-20 | <1 Hz–750 M | Ext EE | SPI | 10 x 10 |
| MAX24510 | 2 | 1 XTAL/SE, 3 D/SE | 25 M–52 M | 9.72 M–160 M | 9.72 M–750 M | 180[1] | – | 0-10/0-20 | <1 Hz–750 M | Int EE | SPI | 10 x 10 |
| ZL30250 | 1 | 1 XTAL/SE, 3 D/SE | 25 M–60 M | 9.72 M–300 M | 9.72 M–1250 M | 160[1] | 0.01 | 0-3/0-6 | <1 Hz–1035 M[2] | Ext EE[3] | SPI/I2C | 5 x 5 |
| ZL30251 | 1 | 1 XTAL/SE, 3 D/SE | 25 M–60 M | 9.72 M–300 M | 9.72 M–1250 M | 160[1] | 0.01 | 0-3/0-6 | <1 Hz–1035 M[2] | Int EE[3] | SPI/I2C | 5 x 5 |
| ZL30244 | 2 | 2 XTAL/SE, 6 D/SE | 25 M–60 M | 9.72 M–300 M | 9.72 M–1250 M | 160[1] | 0.01 | 0-6/0-12 | <1 Hz–1035 M[2] | Ext EE[3] | SPI/I2C | 5 x 10 |
| ZL30245 | 2 | 2 XTAL/SE, 6 D/SE | 25 M–60 M | 9.72 M–300 M | 9.72 M–1250 M | 160[1] | 0.01 | 0-6/0-12 | <1 Hz–1035 M[2] | Int EE[3] | SPI/I2C | 5 x 10 |

Abbreviation Key:
D = Differential    SE = Single-ended (CMOS)    NCO = Numerically controlled oscillator
Ext EE = External EEPROM    Int EE = Internal EEPROM    Supply Voltage = 3.3+1.8
1 = Integer-mode APLL-only operation    2 = Spread spectrum capable    3 = Up to four configurations pin-selectable

## Rate Conversion/Jitter Attenuation Devices

| Product | Independent Output Freq. Families | Inputs | Crystal Input Freq. Range | XTAL Osc. or CMOS Input Freq. Range | Diff Input Freq. Range | Typical Jitter fs RMS | DPLL Features: Ref. Switching/ Holdover/ Bandwidth | NCO ppb | Outputs Diff/CMOS | Output Freq. Range | NV Memory | Host Bus | Pkg Size, mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX24605 | 2 | 1 XTAL/SE, 3 D/SE | 25 M–52 M | 2 KHz–160 M | 2 KHz–750 M | 180[1] | Glitchless/ Digital Hold/ 4 Hz–400 Hz | <0.001 | 0-5/0-10 | <1 Hz–750 M | Ext EE | SPI | 10 x 10 |
| MAX24610 | 2 | 1 XTAL/SE, 3 D/SE | 25 M–52 M | 2 KHz–160 M | 2 KHz–750 M | 180[1] | Glitchless/ Digital Hold/ 4 Hz–400 Hz | <0.001 | 0-10/0-20 | <1 Hz–750 M | Ext EE | SPI | 10 x 10 |
| ZL30252 | 1 | 1 XTAL/SE, 3 D/SE | 25 M–60 M | 1 kHz–300 M | 1 kHz–1250 M | 160[1] | Glitchless/ Digital Hold/ 14 Hz–500 Hz | 0.01 | 0-3/0-6 | <1 Hz–1035 M[2] | Ext EE[3] | SPI/ I2C | 5 x 5 |
| ZL30253 | 1 | 1 XTAL/SE, 3 D/SE | 25 M–60 M | 1 kHz–300 M | 1 kHz–1250 M | 160[1] | Glitchless/ Digital Hold/ 14 Hz–500 Hz | 0.01 | 0-3/0-6 | <1 Hz–1035 M[2] | Int EE[3] | SPI/ I2C | 5 x 5 |
| ZL30254 | 1 | 1 XTAL, 2 SE | 49.152 MHz | 8 kHz or 25 MHz | – | <1ps | Glitchless/ Digital Hold/ 25 Hz | – | 2/0 | 125 MHz or 156.25 MHz | – | None | 5 x 5 |
| ZL30255 | 2 | 2 XTAL/SE, 6 D/SE | 25 M–60 M | 1 kHz–300 M | 1 kHz–1250 M | 160[1] | Glitchless/ Digital-Hold/ 14 Hz–500 Hz | 0.01 | 0-6/0-12 | <1 Hz–1035 M[2] | Int EE[3] | SPI/ I2C | 5 x 10 |

Abbreviation Key:
D = Differential    SE = Single-ended (CMOS)    NCO = Numerically controlled oscillator
Ext EE = External EEPROM    Int EE = Internal EEPROM    Supply Voltage = 3.3+1.8
1 = Integer-mode APLL-only operation    2 = Spread spectrum capable    3 = Up to four configurations pin-selectable

9

Microsemi high-performance buffers deliver industry leading power supply noise rejection performance and low additive jitter.

This preserves signal integrity resulting in high performance while simplifying engineering board design efforts.

## Precision Differential Fanout Buffers

| Product | Output Type | Inputs | Outputs | Input Termination | Switching | 750 MHz Additive Jitter fs RMS typ | Input Type | Input Coupling | Operating Frequency | Power Supply, V | Operating Temp., °C | Pkg | Pkg Size, mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZL40200 | LVPECL | 1 | 2 | External | N/A | 30–40 | LVPECL LVDS HCSL CML | DC or AC | Up to 750 MHz | 2.5 or 3.3 | –40 to 85 | QFN-16 | 3 x 3 |
| ZL40201 | | | 2 | Internal | N/A | | | | | | | QFN-16 | 3 x 3 |
| ZL40202 | | | 4 | External | N/A | | | | | | | QFN-16 | 3 x 3 |
| ZL40203 | | | 4 | Internal | N/A | | | | | | | QFN-16 | 3 x 3 |
| ZL40204 | | | 6 | External | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40205 | | | 6 | Internal | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40206 | | | 8 | External | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40207 | | | 8 | Internal | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40224 | | 2 | 8 | External | Simple | | | | | | | QFN-32 | 5 x 5 |
| ZL40225 | | | 8 | Internal | Simple | | | | | | | QFN-32 | 5 x 5 |
| ZL40208 | | 2 | 6 | External | Glitch Free | 106–121 | | | | | | QFN-32 | 5 x 5 |
| ZL40209 | | | 6 | Internal | Glitch Free | | | | | | | QFN-32 | 5 x 5 |
| ZL40210 | | | 8 | External | Glitch Free | | | | | | | QFN-32 | 5 x 5 |
| ZL40211 | | | 8 | Internal | Glitch Free | | | | | | | QFN-32 | 5 x 5 |
| ZL40212 | LVDS | 1 | 2 | External | N/A | 78–138 | | | | | | QFN-16 | 3 x 3 |
| ZL40213 | | | 2 | Internal | N/A | | | | | | | QFN-16 | 3 x 3 |
| ZL40214 | | | 4 | External | N/A | | | | | | | QFN-16 | 3 x 3 |
| ZL40215 | | | 4 | Internal | N/A | | | | | | | QFN-16 | 3 x 3 |
| ZL40216 | | | 6 | External | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40217 | | | 6 | Internal | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40218 | | | 8 | External | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40219 | | | 8 | Internal | N/A | | | | | | | QFN-32 | 5 x 5 |
| ZL40226 | | 2 | 8 | External | Simple | | | | | | | QFN-32 | 5 x 5 |
| ZL40227 | | | 8 | Internal | Simple | | | | | | | QFN-32 | 5 x 5 |
| ZL40220 | | 2 | 6 | External | Glitch Free | 165–194 | | | | | | QFN-32 | 5 x 5 |
| ZL40221 | | | 6 | Internal | Glitch Free | | | | | | | QFN-32 | 5 x 5 |
| ZL40222 | | | 8 | External | Glitch Free | | | | | | | QFN-32 | 5 x 5 |
| ZL40223 | | | 8 | Internal | Glitch Free | | | | | | | QFN-32 | 5 x 5 |

# FPGAs

## FPGAs: Best-in-Class for Industrial IoT Infrastructure

Microsemi SmartFusion2 SoC FPGAs offer more resources in low density devices with the lowest power, proven security features, and exceptional reliability. These Flash FPGA devices are ideal for general purpose functions such as Gigabit Ethernet or dual PCI Express control planes, bridging functions, input/output (I/O) expansion and conversion, video/image processing, system management, and secure connectivity. Microsemi's SoC FPGAs enable a wide variety of these complex systems, deployed at the lowest power and smallest form factor. These FPGAs also deploy best-in-class security solutions that prevent tampering, counterfeiting, and installation of malicious code.

## Key Features

- 166 MHz ARM Cortex-M3 with hard 10/100/100 Ethernet MAC
- Industrial Ethernet protocol support on a single FPGA platform, lowering TCO
- Ethernet protocols supported: MII, RGMII, GMII, SGMII

- Continued use of heterogenous installed base of Ethernet/fieldbus equipment
- Broad array of SoC IP with all the different building blocks needed for Industrial Ethernet communications (including system I/O expansion, glue logic, and other communications interfaces)

| | Features[2,3] | M2S005 | M2S010 | M2S025 | M2S050 | M2S060 | M2S090 | M2S150 |
|---|---|---|---|---|---|---|---|---|
| **Logic/DSP** | Maximum Logic Elements (4LUT + DFF)[1] | 6,060 | 12,084 | 27,696 | 56,340 | 56,520 | 86,184 | 146,124 |
| | Math Blocks (18x18) | 11 | 22 | 34 | 72 | 72 | 84 | 240 |
| | Fabric Interface Controllers (FICs) | 1 | | 2 | | 1 | | 2 |
| | PLLs and CCCs | 2 | | | 6 | | 8 | |
| | Data Security | AES256, SHA256, RNG | | | | AES256, SHA256, RNG, ECC, PUF | | |
| **MSS** | Cortex-M3 + Instruction cache | Yes | | | | | | |
| | eNVM (K Bytes) | 128 | | 256 | | 512 | | |
| | eSRAM (K Bytes) | 64 | | | | | | |
| | eSRAM (K Bytes) Non SECDED | 80 | | | | | | |
| | CAN, 10/100/1000 Ethernet, HS USB | 1 each | | | | | | |
| | Multi-Mode UART, SPI, I2C, Timer | 2 each | | | | | | |
| **Fabric Memory** | LSRAM 18K Blocks | 10 | 21 | 31 | 69 | 69 | 109 | 236 |
| | uSRAM1K Blocks | 11 | 22 | 34 | 72 | 72 | 112 | 240 |
| | Total RAM (K bits) | 191 | 400 | 592 | 1314 | 1314 | 2074 | 4488 |
| **High Speed** | DDR Controllers (Count x Width) | 1x18 | | 2x36 | 271 | | 1x18 | 2x36 |
| | SERDES Lanes (T) | 0 | 4 | | 8 | 4 | 4 | 16 |
| | PCIe End Points | 0 | | 1 | | 2 | | 4 |
| **User I/Os** | MSIO (3.3 V) | 115 | 123 | 157 | 139 | 271 | 309 | 292 |
| | MSIOD (2.5 V) | 28 | 40 | 40 | 62 | 40 | 40 | 106 |
| | DDRIO (2.5 V) | 66 | 70 | 70 | 176 | 76 | 76 | 176 |
| | Total User I/O | 209 | 233 | 267 | 377 | 387 | 425 | 574 |
| **Grades** | Commercial (C), Industrial (I), Military (M) | C, I | | | | C, I, M | | |

1 Total logic may vary based on utilization of DSP and memories in your design. Please see the IGLOO2 Fabric UG for details
2 Feature availability is package dependent
3 Data security features are only available in 'S' and 'TS' devices

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# Signal Conditioners and Crosspoint Switches

## Signal Conditioners and Crosspoint Switches: For the Ultimate in Flexibility & Performance

Microsemi offers a wide range of signal conditioner and crosspoint switch ICs across port speeds, channel counts, and practical feature sets for industrial applications. Microsemi products deliver many industry-leading features such as very low jitter as well as autonomous equalization for demanding backplane, module host, and high port count Layer-1 switching applications. Microsemi's low power, multi-protocol family of signal conditioners includes both redrivers and retimers and delivers the ultimate in flexibility and performance.

## Key Features

- Data rates up to 16 Gbps
- Per channel adaptive input equalization and gain adjustment
- Per channel output multi-tap de-emphasis and drive level adjustment
- Power-saving green mode options including ability to power down unused ports

| Product Number | Ports | Device Type | Min Temp (Ambient) | Max Temp (Junction) | Max Data Rate |
|---|---|---|---|---|---|
| VSC7111 | Dual 2x2 | Redriver | –40 °C | 110 °C | 11.5 Gbps |
| VSC7113 | Dual 2x2 | Redriver | –40 °C | 110 °C | 10.3 Gbps |
| VSC7223 | 4 | Retimer | –40 °C | 90 °C | 16 Gbps |
| VSC7224 | 4 | Retimer | –40 °C | 110 °C | 12.5 Gbps |
| VSC7227 | 12 | Retimer | –40 °C | 100 °C | 14.5 Gbps |
| VSC8247 | 4 | Retimer | 0 °C | 95 °C | 11.3 Gbps |
| VSC8248 | 4 (bi-dir) | Retimer | 0 °C | 95 °C | 11.3 Gbps |
| VSC3308 | 8x8 | Redriver | –40 °C | 100 °C | 11.5 Gbps |
| VSC3316 | 16x16 | Redriver | –40 °C | 100 °C | 11.5 Gbps |

## Why Microsemi for IIoT Networking?

Microsemi is the only IC, systems, and software provider with a power-optimized, flexible, and reliable industrial Ethernet networking portfolio that supports Ethernet interfaces and fieldbus protocols for a broad range of Industrial Ethernet applications, enabling highly reliable, and secure IIoT networks.

**Contact us today to learn how you can get to market faster with Microsemi IIoT solutions.**

## Microsemi

Power Matters.™

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, California and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

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