

# Marvell® AQRATE GEN2 Ethernet PHYs

10GBASE-T/5GBASE-T/2.5GBASE-T/1000BASE-T/100BASE-TX Ethernet PHYs

## Overview

The Marvell® AQRate GEN2 PHYs are low-power, high-performance, multi-gigabit 10GBASE-T/5GBASE-T/2.5GBASE-T/1000BASE-T/100BASE-TX transceivers. AQRate technology enables broad-based market adoption of multi-gigabit network connectivity through a wide range of cable types including Cat 5e, Cat 6, and Cat 6a or above. AQRate bridges the bandwidth gap between legacy cabling infrastructure designed for 1 Gbps data rates and new applications that demand bandwidth in excess of 1 Gbps with zero changes to legacy cabling or infrastructure, enabling the unabated roll-out of higher-speed connectivity solutions for Enterprise, Data Center, SMB/SOHO, Carrier, Automotive, and ISM (Industrial, Scientific, Medical) markets.

AQRate PHYs are compliant with both the IEEE® 802.3an/bz standard and the NBASE-TTM Alliance PHY Specification to perform all the physical layer functions required to implement 10GBASE-T/5GBASE-T/2.5GBASE-T/1000BASE-T/100BASE-TX transmission over 100 meters of twisted pair cabling. The

AQRate PHY family integrates such features as Energy Efficient Ethernet (EEE), Precision Time Protocol (PTP)/1588v2, IEEE MAC Security (MACsec), supports all PoE standards up to 100W, and supports jumbo packets up to 16KB in all operating modes.

### Quad

The AQR407/AQR408/AQR409 are pin-compatible, multi-gigabit, quad-port PHYs housed in 19 mm flip-chip BGA packages enabling efficient, high-density design for high port-count and compact switches across a range of speed requirements.

### Single

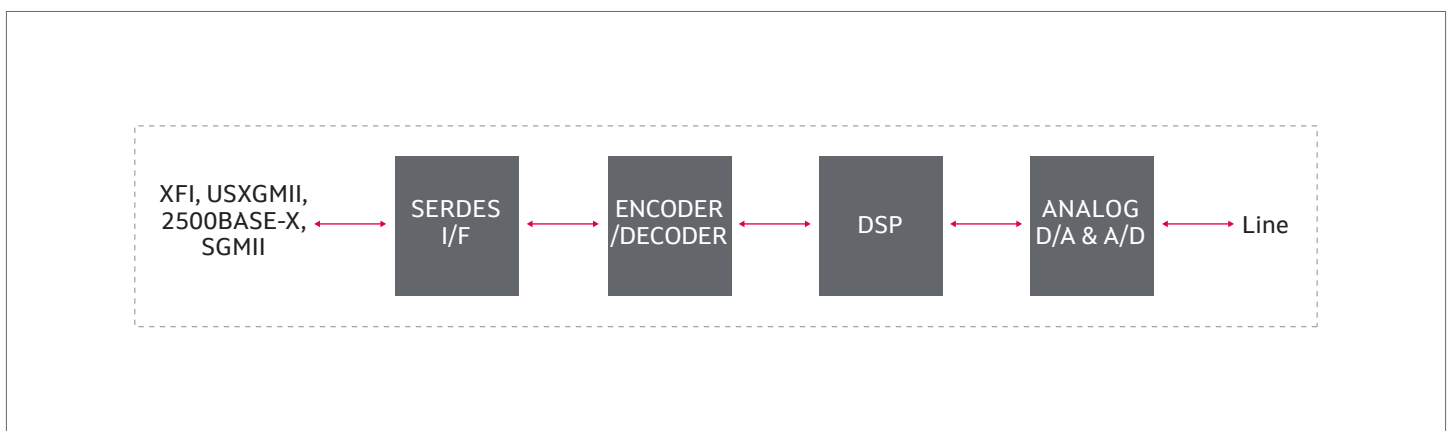
The AQR107/AQR108/AQR109 are pin-compatible, multi-gigabit, single-port PHYs that address multiple network connectivity applications and speed requirements. These devices are available in compact 7 mm x 11 mm flip-chip BGA packages featuring the Industrial (-40°C to +108°C) temperature operating range.

## Target Applications

Marvell's GEN2 AQRate multi-gigabit PHYs are a game changing technology enabling Enterprise, Data Center, SMB/ SOHO, Carrier, Automotive, and ISM (Industrial, Scientific, Medical) markets to evolve beyond 1 Gbps to 5 Gbps and 2.5 Gbps data rates. The single-port product family is ideally suited for

wireless access point backhaul, residential gateways/ routers, client computing, and a myriad of networked device applications while the quad-port family permits efficient high-port density and compact switch design.

## Block Diagram



<sup>1</sup> Minimum specification is ambient temperature, and the maximum is junction temperature.

## Key Features

Features	Benefits
<ul style="list-style-type: none"> <li>IEEE 802.3an/bz and NBASE-T featuring AQrate technology</li> <li>10GBASE-T: 100 meters over Augmented Cat 6 (Cat 6A) and Cat 7, 55 meters over Cat 6, and best effort over Cat 5e</li> <li>5GBASE-T, 2.5GBASE-T: over 100 meters of Cat 5e or better cabling</li> </ul>	<ul style="list-style-type: none"> <li>Ability to support highest data rate possible with a given cable environment while reducing power and latency</li> <li>5G and 2.5G operation over legacy infrastructure, while delivering backward compatibility with existing equipment</li> </ul>
<ul style="list-style-type: none"> <li>Energy-Efficient Ethernet (EEE)</li> <li>MACsec (IEEE 802.1ae, MAC security standard)</li> <li>Full support for Advanced Encryption Standard (AES-256) and stand-alone operation</li> <li>PTP/1588v2</li> <li>Synchronous Ethernet (Sync-E), ITU-T standard in cooperation with IEEE</li> </ul>	<ul style="list-style-type: none"> <li>EEE lowers overall power consumption and lowers equipment operating costs</li> <li>MACsec provides for secure, encrypted data communications across networks</li> <li>PTP/1588v2 provides for timing accuracy across the network</li> <li>Sync-E synchronizes clock signals on the PCB</li> </ul>
<ul style="list-style-type: none"> <li>Integrated Wake-on-LAN (WoL) Support</li> <li>Compliant to Microsoft Network Device Class specification</li> </ul>	<ul style="list-style-type: none"> <li>Integrated packet filtering enables sub-1W support in 100BASE-TX mode</li> </ul>
<ul style="list-style-type: none"> <li>Built-in Thermal Management</li> <li>On-chip thermal sensor with alarm and warning thresholds</li> </ul>	<ul style="list-style-type: none"> <li>Enables deployment in thermally constrained environments</li> </ul>
<ul style="list-style-type: none"> <li>Advanced Cable Diagnostics</li> <li>On-chip high-resolution cable analyzer</li> </ul>	<ul style="list-style-type: none"> <li>Enables the deployment of meaningful cable analysis tools for debugging installation problems</li> </ul>
<ul style="list-style-type: none"> <li>High-Performance full KR (with autonegotiation)/XFI/USXGMII/2500BASE-X/SGMII I/F w/AC-JTAC</li> <li>Capable of rate adapting all rates into KR/XFI via PAUSE and 100M/1G into 2500BASE-X</li> </ul>	<ul style="list-style-type: none"> <li>Ensures trouble-free operation over a range of interconnect scenarios</li> <li>Comprehensive interface support                             <ul style="list-style-type: none"> <li>Supports legacy and next generation MACs/switches/processors</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Advance Loopback and Diagnostic Capability</li> <li>Flexible on-chip BERT</li> <li>Full 1-second packet counters and CRC-32 checkers</li> </ul>	<ul style="list-style-type: none"> <li>Enables extensive system test and debug with remote loopback control</li> </ul>
<ul style="list-style-type: none"> <li>Integrated MDI Filter and Advanced RFI Cancellation</li> <li>Eliminates external filter components</li> </ul>	<ul style="list-style-type: none"> <li>Robust Radio Frequency Interference (RFI) performance</li> <li>Resilient operation when exposed to RFI</li> </ul>

## Ordering Codes

Part Number	Speed	Package
AQR407/AQR107	5-Speed	10 Gbps/5 Gbps/2.5 Gbps/1 Gbps/ 100 Mbps
AQR408/AQR108	4-Speed	5 Gbps/2.5 Gbps/1 Gbps/ 100 Mbps
AQR409/AQR109	3-Speed	2.5 Gbps/1 Gbps/ 100 Mbps



Marvell first revolutionized the digital storage industry by moving information at speeds never thought possible. Today, that same breakthrough innovation remains at the heart of the company's storage, networking and connectivity solutions. With leading intellectual property and deep system-level knowledge, Marvell semiconductor solutions continue to transform the enterprise, cloud, automotive, industrial, and consumer markets. For more information, visit [www.marvell.com](http://www.marvell.com).

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