

Automotive PCIe 3.0 Packet Switch Family

PI7C9X3G606GPQ/ PI7C9X3G808GPQ/ PI7C9X3G816GPQ/ PI7C9X3G1632GPQ

Automotive PCIe 3.0 6-16 Ports/ 6-32 Lanes Packet Switch

Features

- Configurable Upstream port number up to 2 and lane number up to 16
- Configurable Downstream port number up to 15 and lane number up to 30
- PHY and MAC Layers
 - PHY initial settings optionally programmable through JTAG, EEPROM, and SMBus/I2C
 - Adaptive Continuous Time Linear Equalizer and 5-tap Decision Feedback Equalizer for RX
 - Adaptive and programmable 3-tap TX equalization
 - RX Polarity Inversion and Lane Reversal
- Data Link Layer
 - Programmable ACK latency timer to response ACK based upon traffic condition
 - Configurable Flow Control Credit Update to balance bandwidth utilization and buffer usage
- Transaction Layer
 - Packet forwarding options including Cut-Through and Store & Forward
 - Support up to 512-Byte Max Payload Size
 - Low packet forwarding latency < 150ns (typical case)
 - Access Control Service (ACS) for peer-to-peer traffic
 - Address Translation (AT) packet for SR-IOV application
 - Support Atomic operation
 - Support Multicast
 - Provide Performance Visibility for ingress/egress packet types and packet counts
- Side-band Access Register Interface
 - I2C/ SMBus bus
 - SPI EEPROM
 - JTAG

Advanced Features

- Reference Clock
 - Integrated PCIe Gen3 clock buffer for all downstream ports
 - Support three reference clock structures (Common, SRNS and SRIS)
 - Handle SSC Isolation up to three ports
 - Provide two clock application modes (Base and CDSR)
- Power Management
 - Support 7 power states (P0/P0s/P1/P1.1/P1.2/P2/P1.2PG)
 - Start-up power management scheme
 - “Empty” Hot-Plug ports put in P2 state
 - Continuous power management scheme
 - Support ASPM L1 Sub-state (P1.1/P1.2)
 - Support Message packet for System Power Management

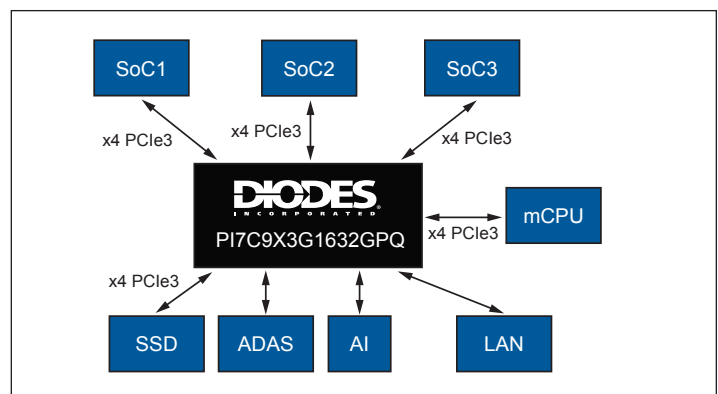
Description

The Automotive PCIe[®] 3.0 Packet Switch family is a series of 6-32 lanes PCI Express third generation switches with 6 to 16 PCI Express ports specifically designed to meet high performance, RAS (Reliability, Availability and Serviceability) and the latest power management system requirements of Zonal Central Controller, ADAS and telematics etc. The Automotive PCIe3 Packet Switch family provides elastic bifurcation for upstream and downstream ports. The superior signal integrity performance enables support for long PCIe trace length with loss more than 30 dB. The Automotive PCIe 3.0 Packet Switch family are able to connect up to 15 endpoints, such as PCIe- SSD drives, and support multi-host applications and up to 8 DMA physical channels and 3 configurable Cross Domain End-Point (CDEP) ports for high performance fabric and failover applications.

Application(s)

- ADAS
- Central Controller
- Zonal ECU
- Telematics
- Infotainment
- Cockpit Control
- In-vehicle Communication

Application Diagram



Note: CDEP = Cross Domain End Point

Advanced Features Cont.

- Latency Tolerance Reporting (LTR)
- Optimized Buffer Flush Fill (OBFF)
- Multi-Host Application
 - Support up to 3 Cross-Domain End-Point (CDEP) ports for Host-to-Host Communications
 - Support Fail-over using CDEP port
 - Provide up to 8 physical or 16 virtual DMA channels enabling communications among Hosts and EPs
 - Switch bifurcated up to 2 individual packet switches to allow 2 hosts operating independently
- Reliability, Availability and Serviceability
 - Enhanced Advanced Error Reporting
 - End-to-End Data Protection with ECC
 - Error Handling Mechanism
 - Support Surprise Hot Removal
 - Support Downstream Port Containment (DPC)
 - Support Hot Plug for Upstream and Downstream port
 - Provide Serial Host Plug Type
 - Support LED Management
 - Thermal Sensor reporting operational temperature instantly
 - IEEE1149.1 and 1149.6 JTAG interface support
- Advanced Diagnostic Tools: PCIBUDDY™
 - PHY Eye™
 - MAC Viewer™ (including embedded LA)
 - On-the-fly PRBS loopback test
 - On-the-fly Compliance pattern test
- Power & Package
 - Two Power Rails (0.95V and 1.8V)
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. “Green” Device (Note 3)
- The Automotive PCIe3 Packet Switch Family: The DIODES™ PI7C9X3G606GPQ, the DIODES™ PI7C9X3G808GPQ, the DIODES™ PI7C9X3G816GPQ and the DIODES™ PI7C9X3G1632GPQ are suitable for automotive applications requiring specific change control; these parts are AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.

<https://www.diodes.com/quality/product-definitions/>

Industry Specifications Compliance

- AEC-Q100 Grande 3 Compliant
- Compliant with PCI Express Base Specification Revision 3.1
- Compliant with PCI Express CEM Specification Revision 3.0
- Compliant with Advanced Configuration Power Interface (ACPI) Specification
- Compliant with System Management (SM) Bus, Version 2.0
- Compliant with SFF-8639 (U.2)

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, “Green” and Lead-free.
3. Halogen- and Antimony-free “Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

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Product Highlights and Advantages

- **Enhanced High-Speed Channel Performance**
 - Maintain good signal integrity overcome channel loss > 30dB
 - Reach to a lower BER better than standard (i.e. 1E-12)
 - Adaptive Analog Front End (AFE) compensate high frequency loss
 - 5-Tap Decision Feedback Equalizer (DFE) compensates ISI tail effect
 - Up to 1300mV TX Swing boost and 3-tap TX feed forward equalizer to compensate long channel trace loss
- **Advanced Power Management Mechanism**
 - Advanced power saving scheme to reduce power even better
 - Supports 7 power states (P0/P0s/P1/P1.1/P1.2/P2/ P1.2PG) manage power efficiently
 - Support ASPM L1 Sub-state (P1.1, P1.2) to lower much more power while link is idle
- **Optimize PCIe Transmission Performance**
 - Adjustable elastic buffer depth to reduce latency of common clock structure
 - Adjustable advanced arbitration mechanism to ensure each port be served fairly
 - Have Performance Statistics Counters for each port and Timer for statistics calculation
- **Enabling Host to Host Communication**
 - A new switch fabric architecture to efficiently exchange data among multi-host environment
 - Provide abundant DMA channels to facilitate multi-thread data-moving processes
- **Reliability, Availability and Serviceability (RAS)**
 - Advanced Error Reporting, Errors can be classified as correctable, non-fatal uncorrectable and fatal uncorrectable categories
 - Error Handling Mechanism, can handle Bad-header TLP, Received a good-header TLP with uncorrectable error and Uncorrectable error generated internally
 - End-to-End Data Protection, Ensure data integrity from ingress-end to egress-end, Low Soft Error Rate
 - Hot-Plug and Surprise Removal, support to serial hot-plug; a surprise hot removal sequence is in place to process ASYNC removal event
- **Software Tools**
 - PHY Eye™
 - MAC Viewer™ (w/ embedded LA and LTSSM monitor)
 - On-the-fly PRBS loopback test
 - On-the-fly Compliance pattern test

Automotive PCIe 3.0 Packet Switch Portfolio

Part Number	AEC-Q100	PCIe Specification	Ports	Lanes	Power* (W)	Latency (ns)	Operating Temperature (°C)	Package
PI7C9X3G606GPQ	Grade3	3.0	6	6	2.5	150	-40 ~ +85	FC LFBGA (FCA144)
PI7C9X3G808GPQ	Grade3	3.0	8	8	2.9	150	-40 ~ +85	HFCBGA (HFC196)
PI7C9X3G816GPQ	Grade3	3.0	8	16	4.1	150	-40 ~ +85	HFCBGA (HFC324)
PI7C9X3G1632GPQ	Grade3	3.0	16	32	5.6	150	-40 ~ +85	HFCBGA (HFC676)

Ordering Information

Orderable Part Number	Compliance	Package Code	Package	Moisture Sensitivity	Carrier	Quantity
PI7C9X3G606GPQ3FCAEX	Automotive	FCA	144-pin FCCSP 10mm x 10mm	MSL-3	TnR	3000
PI7C9X3G808GPQ3HFCEX	Automotive	HFC	196-pin HFCBGA 15mm x 15mm	MSL-3	TnR	800
PI7C9X3G816GPQ3HFCE	Automotive	HFC	324-pin HFCBGA 19mm x 19mm	MSL-3	Tray	84
PI7C9X3G1632GPQ3HFCE	Automotive	HFC	676-pin HFCBGA 27mm x 27mm	MSL-3	Tray	40

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3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. Q = Automotive Compliant
5. 3 = AEC-Q100 Grade Level
6. E = Pb-free and Green
7. X suffix = Tape/Reel

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