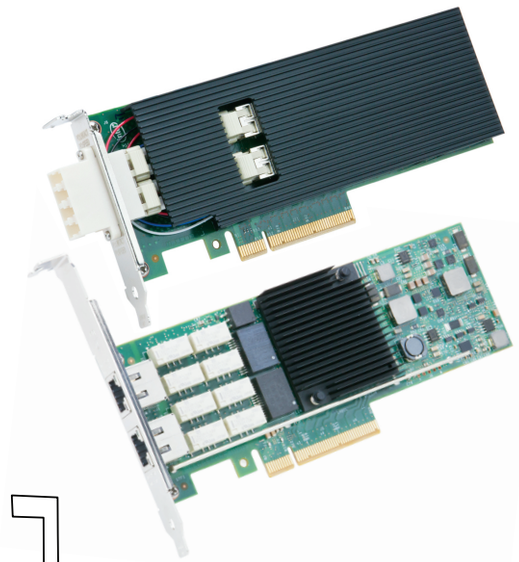
PRODUCT BRIEF
Intel® Ethernet Server Bypass Adapter X520/X540 Family
Network Connectivity

Intel® Ethernet Server Bypass Adapter X520/X540 Family

Dual-Port 10GbE Bypass Adapters enabling maximum network uptime and performance for mission-critical applications

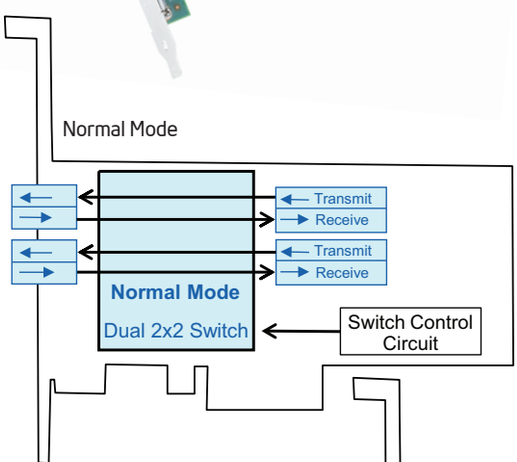


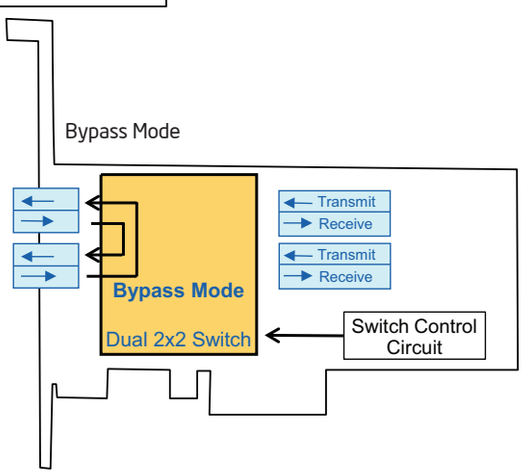
Overview

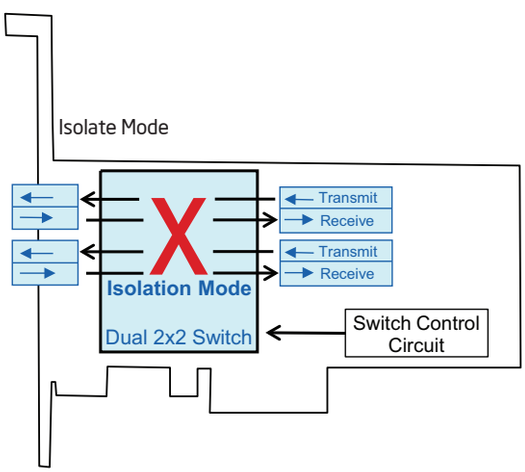
Intel's X520 adapters are known for their high performance, low latency, reliability, and flexibility. The addition of the Intel® Ethernet Server Bypass Adapter X520-SR2 and the Intel® Ethernet Server Bypass Adapter X540-T2 delivers all of the 10GbE performance in addition to business continuity in the event of a network failure. The bypass capability removes a single point of failure so that essential business communication can continue while a system failure is diagnosed and resolved. In the event of a power, hardware, or software failure, bypass will automatically activate, allowing network traffic to continue.

Bypass Features

Maintaining connectivity during software and power failures ensures maximum uptime for the network. The Intel® Ethernet Server Bypass Adapter Family supports three operational modes: Normal, Bypass, and Isolate. In Normal Mode, data travels into the adapter and is processed by the host server prior to being transmitted back to the network. In Bypass Mode, the LAN controller is disconnected from the ports and the two external ports are connected together into a single pipe whereby packets received from one port are then transmitted to the other port, bypassing the host server failure and maintaining network connectivity. When needed, isolate mode is available to ensure link is not established. Intel® Ethernet Server Bypass Adapters also include an onboard programmable watchdog timer, which gives administrators full control to manage the mode of the adapter. In addition, an event log provides the capability to document operation mode changes based on different detection conditions.







Reliable Performance

Data center networks are being pushed to their limits. The escalating deployments of servers with multi-core processors and demanding applications such as database clusters, cloud deployments, and video-on-demand are driving the need for 10Gbps connections. Customers require flexible, dependable, and scalable I/O solutions to meet the rigorous requirements of running mission-critical applications. The Intel® Ethernet Server Bypass Adapters address the demanding needs of the next-generation data center providing unmatched features and proven, reliable performance.

Best Choice for Virtualization

Intel leads the industry in virtualization by being the first to provide virtualization for all the major operating systems and working with the OEMs to implement virtualization not only on the adapter but also on the platform.

Intel® Virtualization Technology for connectivity (Intel® VT-c)

Intel® Ethernet Controllers include Intel® Virtualization Technology for connectivity (Intel VT-c) to deliver virtualized I/O performance optimizations and Quality of Service (QoS) features designed directly into the controller's silicon. Working in conjunction with virtualization-optimized drivers in Normal Mode, PCI-SIG* Single Root I/O Virtualization and Sharing (SR-IOV) can be used to help reduce I/O bottlenecks, and improve the overall server performance.

Hypervisor BYPASS using SR-IOV

In Normal Mode, bypassing the hypervisor and allowing direct hardware access by virtual machines, reduces CPU overhead, reduces latency, and increases network throughput. Most of the current hypervisor releases have been enabled to partition a single physical Ethernet controller in to multiple virtual Ethernet controllers that can be used directly by VMs by taking advantage the PCI-SIG* SR-IOV standard. The use of these virtual controllers, known as Virtual Functions (VF), enables additional QoS features in the controller's silicon to manage and direct traffic such as traffic isolation, port partitioning with bandwidth allocation and on-chip VF-VF switching.

iSCSI Acceleration

In Normal Mode, this adapter provides complete support for proven native OS iSCSI initiators as well as iSCSI boot. Intel Ethernet server adapters include hardware-based iSCSI acceleration features that do not require offloading to a proprietary TCP/IP stack. iSCSI acceleration uses large send offload, Receive Side Coalescing and transmit send offloads to help reduce latency and lower CPU utilization.

Intel® Ethernet Server Bypass Adapter X520-SR2

The Intel® Ethernet Server Bypass Adapter X520-SR2 is a dual-port 10GbE bypass adapter and ships with two two 10GBASE-SR Optics installed. This adapter is based on the industry-leading Intel® 82599 10 Gigabit Ethernet Controller, designed for next-generation 10 Gigabit performance and multi-core processors. PCIe v2.0 (5 GT/s) support enables customers to take full advantage of 10GbE by providing maximum of 20Gbps bi-directional throughput per port on an individual dual-port card.

Intel® Ethernet Server Bypass Adapter X540-T2

The Intel® Ethernet Server Bypass Adapter X540-T2 hosts Intel's latest 10GBASE-T silicon, the Intel® Ethernet Controller X540, which is used by many OEMs as a single chip solution for LAN on Motherboard (LOM) to deliver 10GbE on server platforms. The MAC+PHY integration drives down both cost and power, enabling broad deployment of 10GbE everywhere in the datacenter. BASE-T is the form factor that is well understood by the industry; making it a seamless and cost effective solution. 10GBASE-T is backward compatible with existing network infrastructure, providing a smooth transition and natural migration to 10GbE.

FEATURES	BENEFITS
BYPASS SPECIFIC	
Three connectivity modes	• Normal, Bypass, or Isolate—for maximum flexibility
Passive bypass	• Continued uptime during power loss or software failure
Programmable watchdog timer	• Flexibility in controlling adapter mode
Standard adapter emulation	• Force normal command available to emulate standard adapter mode
Circular event log	• Historical counter to record time stamp, detection condition and operation mode
GENERAL	
Intel® 82599 Ethernet Controller (X520)	• Industry-leading, energy-efficient design for 10 Gigabit performance and multi-core processors
Intel® Ethernet X540 Controller (X540)	• Industry's first integrated MAC + PHY, reducing cost and power
10GBASE-SR Connectivity (X520)	• Two 10GBASE-SR Optics installed
10GBASE-T Connectivity (X540)	• Two 10GBASE-T RJ-45 ports
RoHS-compliant, lead-free technology	• Complies with the European RoHS II per Directive 2011/65/EU of the European Parliament

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Time Sync (IEEE 1588*, 802.1as) (Normal Mode only)	• Enables networked Ethernet equipment to synchronize internal clocks according to a network master clock; endpoint can then acquire an accurate estimate of the master time by compensating for link latency
SCSI Boot (Normal Mode only)	• Enables system boot up via iSCSI • Provides additional network management capability

I/O FEATURES FOR MULTI-CORE PROCESSOR SERVERS (SUPPORTED IN NORMAL MODE)

Intel® Data Direct I/O (Intel® DDIO)	• Reduces memory accesses from I/O on local socket • Speeds up CPU data transfer • Accelerates inbound & outbound data flows
Intel® Ethernet Flow Director	• Intel Ethernet Flow Director and ATR can significantly lower latency and improve CPU utilization by preserving the affinity between the flow and the core where the application resides
RSS—Receive Side Scaling	• Uses multiple queues for receive traffic
Intel® Direct Cache Access (DCA)	• Enables the adapter to pre-fetch the data from memory, avoiding cache misses and improving application response time
MSI-X support	• Minimizes the overhead of interrupts • Load-balancing of interrupt handling between multiple cores/CPUs
Low Latency Interrupts (LLI)	• Based on the sensitivity of the incoming data, the adapter can bypass the automatic moderation of time intervals between the interrupts
Multiple Queues: 128 Tx & Rx queues per port	• Network packet handling without waiting or buffer overflow providing efficient packet prioritization
Tx/Rx IP, SCTP, TCP, & UDP checksum offloading (IPv4, IPv6) capabilities	• Lower processor usage • Checksum and segmentation capability extended to new standard packet type
TxTCP segmentation offload (IPv4, IPv6)	• Increased throughput and lower processor usage
Interrupt Throttle Rate (ITR)	• ITR parameter controls how many interrupts each interrupt vector can generate per second.
Jumbo frames	• Supports jumbo frames larger than default 1500
Large Receive Offload (LRO)	• Combines multiple Ethernet frames into a single receive in the stack, thereby potentially decreasing CPU utilization for receives
MAC and VLAN anti-spoofing	• If a malicious driver attempts to send a spoofed packet, it is dropped by the hardware and not transmitted. An interrupt is sent to the PF driver notifying it of the spoof attempt.
Flow Control	• Ethernet Flow Control (IEEE 802.3x) support for capable link partner
HW based receive side coalescing (RSC)	• Merges multiple frames from the same IPv4 TCP/IP flow into a single structure that can span one or more descriptors

VIRTUALIZATION FEATURES (SUPPORTED IN NORMAL MODE)

PC-SIG SR-IOV Implementation (up to 64 virtual functions per port)	• Provides an implementation of the PCI-SIG standard for I/O Virtualization. The physical configuration of each port is divided into multiple virtual ports. Each virtual port is assigned to an individual virtual machine directly by bypassing the virtual switch in the Hypervisor, resulting in near-native performance. • Integrated with Intel® VT for Directed I/O (Intel® VT-d) to provide data protection between virtual machines by assigning separate physical addresses in the memory to each virtual machine.
Advanced Packet Filtering	• 24 exact-matched packets (unicast or multicast) • 4096-bit hash filter for unicast and multicast frames • Lower processor usage • Promiscuous (unicast and multicast) transfer mode support • Optional filtering of invalid frames
VLAN support with VLAN tag insertion, stripping and packet filtering for up to 4096 VLAN tags	• Ability to create multiple VLAN segments

GENERAL SPECIFICATIONS

Connectors	Two LC 10GBASE-SR (X520) (Optics not removable) Two RJ-45 Copper (X540)	
Data rates supported per port: X520 X540	 Optical: 1GbE/10GbE Copper: 100Mbps/1GbE/10GbE	
Bus type	PCI Express 2.0 (5.0 GT/s) (X520) PCI Express 2.1 (5.0 GT/s) (X540)	
Bus widths	8-lane PCI Express (X520 & X540)	
Operating distances	X520 • Up to 150 meters in Bypass Mode • Up to 300 meters in Normal Mode	X540 (Cat-6A or better cabling) • Up to 50 meters in Bypass Mode • Up to 100 meters in Normal Mode

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LED Indicators	**X520—Two LED's per Port** Normal Mode ▪ LED 1—Link/Activity. No Link = Off; Link = Solid Green; Activity = Blinking Green ▪ LED 2—Speed. 10GbE = Solid Green; 1GbE = Solid Yellow Bypass Mode ▪ LED 1—Link/Activity. (Single Color LED); Blinking Green (300ms on, 300ms off, blinking in unison) ▪ LED 2—Speed. (Dual Color LED): Blinking Yellow (300ms on, 300ms off, blinking in unison) Isolation Mode ▪ LED 1—Link/Activity. (Single Color LED): OFF ▪ LED 2—Speed. (Dual Color LED): Blinking Yellow (300ms on, 300ms off, blinking in unison) **X540—Two LED's per port** Normal Mode ▪ LED 1—No Link = Off; Link = Solid Green; Activity = Blinking Green ▪ LED 2—Speed. 10GbE = Solid Green; 1GbE = Solid Yellow; 100Mbps = Off Bypass Mode ▪ LED 1—Link/Activity. (Single Color LED); Blinking Green (300ms on, 300ms off, blinking in unison) ▪ LED 2—Speed. (Dual Color LED): Blinking Yellow (300ms on, 300ms off, blinking in unison) Isolation Mode ▪ LED 1—Link/Activity. (Single Color LED): OFF ▪ LED 2—Speed. (Dual Color LED): Blinking Yellow (300ms on, 300ms off, blinking in unison) **NOTE:** If adapter is Powered OFF, LED's are OFF
Hardware certifications	FCC A, UL, CE, VCCI, BSMI, CTICK, KCC

POWER CONSUMPTION

X520 Dual Port 10GBASE-SR			X540 Dual Port 10GBASE-T		
Speed	Typical	Max	Speed	Typical	Max
10GbE	6.4W	6.9W	10GbE	4.4W	9.8W
1GbE	4.8W	5.4W	1GbE	8.5W	12.8W
			100Mb	5.9W	10.1W

Operating temperature	0 °C to 55 °C (32 °F to 131 °F)		
Air Flow	Minimum of 100 LFM required (X520) Minimum of 250 LFM required (X540)		
Storage temperature	-40 °C to 70 °C (-40 °F to 158 °F)		
Storage humidity	Maximum: 90% non-condensing relative humidity at 35 °C		
Product Codes	Full Height 10GBASE-SR	X520SR2BP (Single Pack)	X520SR2BPBLK (Bulk 5 Pack)
	Low Profile 10GBASE-SR	X520SR2BPL (Single Pack)	X520SR2BPLBLK (Bulk 5 Pack)
	Low Profile 10GBASE-T	X540T2BP (Single Pack)	X540T2BPBLK (Bulk 5 Pack)

NETWORK OPERATING SYSTEMS (NOS) SUPPORT

Operating System	IA-32	x86-64	IPF[1]
Linux* Stable Kernel version 2.6/3.x	X	X	N/A
Linux RHEL 5.9	X	X	X
Linux RHEL 6.3	X	X	N/A
Linux SLES 10 SP4	X	X	N/A
Linux SLES 11 SP2	X	X	X
FreeBSD* 9	X	X	N/A
UEFI* 2.1[2]	N/A	X	X
UEFI* 2.3[2]	N/A	X	X

[1] Itanium Product Family
[2] UEFI is tools support only

PLEASE NOTE: Intel® Ethernet Server Bypass Adapter driver support is not included in the kernel or distributions. Bypass products are targeted toward system integrator and appliance customers. Please contact Intel for bypass driver source code to install the product.

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For product information

To speak to a customer service representative, please call 1-800-538-3373 (U.S. and Canada) or visit support.intel.com/support/go/network/ contact.htm for the telephone number in your area. For additional product information on Intel Networking Connectivity products, visit www.intel.com/go/ethernet.

Customer Support

Intel® Customer Support Services offers a broad selection of programs including phone support and warranty service. For more information, contact us at support.intel.com/support/go/network/ adapter/home.htm.

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