

10.1 Dell Optiplex 790

10.2 Glossary

10.1 Dell Optiplex 790

DELL™

OPTIPLX™ 780

TECHNICAL GUIDEBOOK

INSIDE THE OPTIPLX 780



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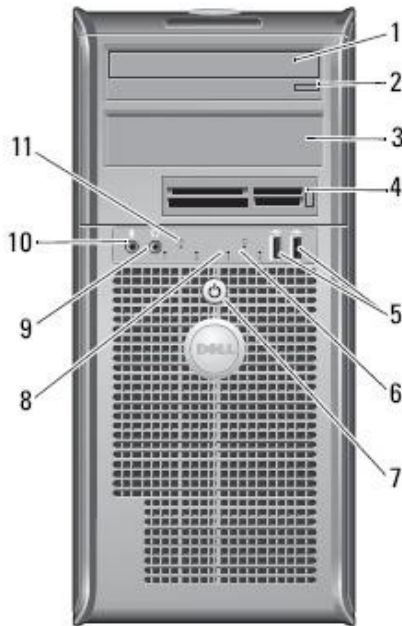
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MINI TOWER COMPUTER (MT) VIEW



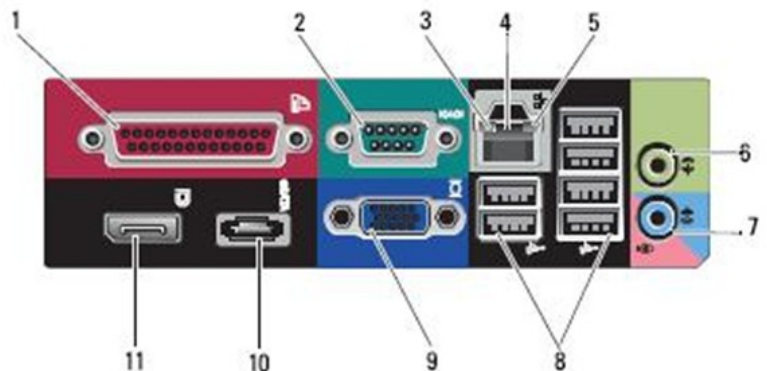
FRONT VIEW **BACK VIEW**

1	Optical Drive (optional)	7	Power Button, Power Light
2	Optical Drive Eject Button	8	Diagnostic Lights (4)
3	Optical Drive Bay	9	Headphone Connector
4	Media Card Reader (optional)	10	Microphone Connector
5	USB 2.0 Connectors (2)	11	Network Connectivity Light
6	Hard Drive Activity Light		

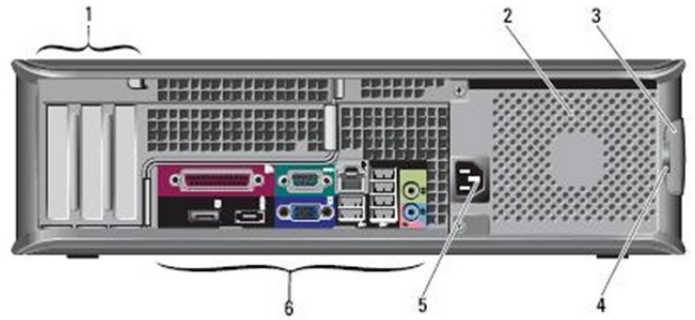
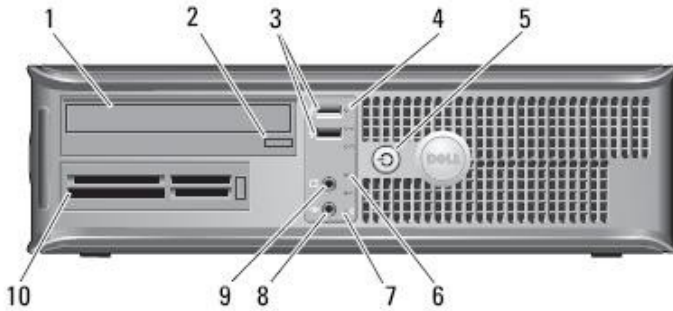
1	Power Connector	4	Power-Supply Vent
2	Back-Panel Connectors	5	Chassis Lock Loop
3	Expansion Card Slots (4)	6	Cover Release Latch

BACK PANEL CONNECTORS

1	Parallel Connector	7	Line-in Connector
2	Serial Connector	8	USB 2.0 Connectors (6)
3	Link Integrity Light	9	VGA Video Connector
4	Network Connector	10	eSATA Connector
5	Network Activity Light	11	DisplayPort Connector
6	Line-out Connector		



DESKTOP COMPUTER (DT) VIEW



FRONT VIEW

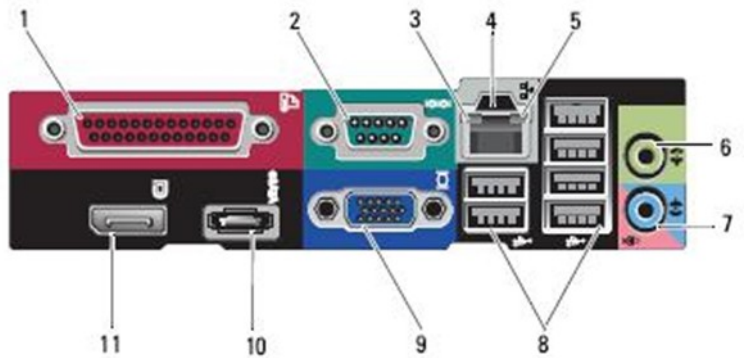
1	Optical Drive (optional)	7	Network Connectivity Light
2	Optical Drive Eject Button	8	Microphone Connector
3	USB 2.0 Connectors (2)	9	Headphone Connector
4	Hard Drive Activity Light	10	Media Card Reader (optional)
5	Power Button, Power Light		
6	Diagnostic Lights (4)		

BACK VIEW

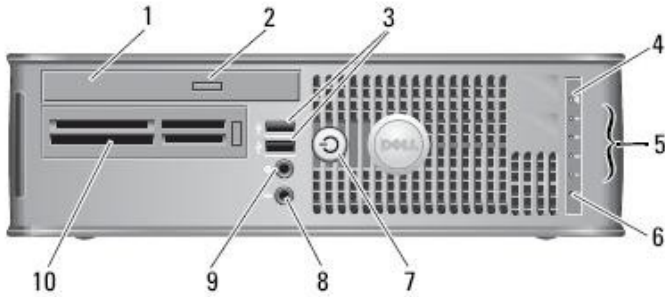
1	Expansion Card Slots (3)	4	Chassis Lock Loop
2	Air Vent	5	Power Connector
3	Cover Release Latch	6	Back-Panel Connectors

BACK PANEL CONNECTORS

1	Parallel Connector	7	Line-in Connector
2	Serial Connector	8	USB 2.0 Connectors (6)
3	Link Integrity Light	9	VGA Video Connector
4	Network Connector	10	eSATA Connector
5	Network Activity Light	11	DisplayPort Connector
6	Line-out Connector		



SMALL FORM FACTOR COMPUTER (SFF) VIEW



FRONT VIEW

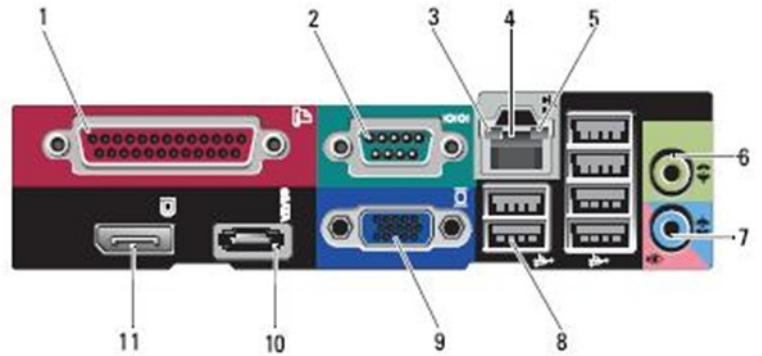
1	Optical Drive (optional)	7	Power Button, Power Light
2	Optical Drive Eject Button	8	Microphone Connector
3	USB 2.0 Connectors (2)	9	Headphone Connector
4	Network Connectivity Light	10	Media Card Reader (optional)
5	Diagnostic Lights (4)		
6	Hard Drive Activity Light		

BACK VIEW

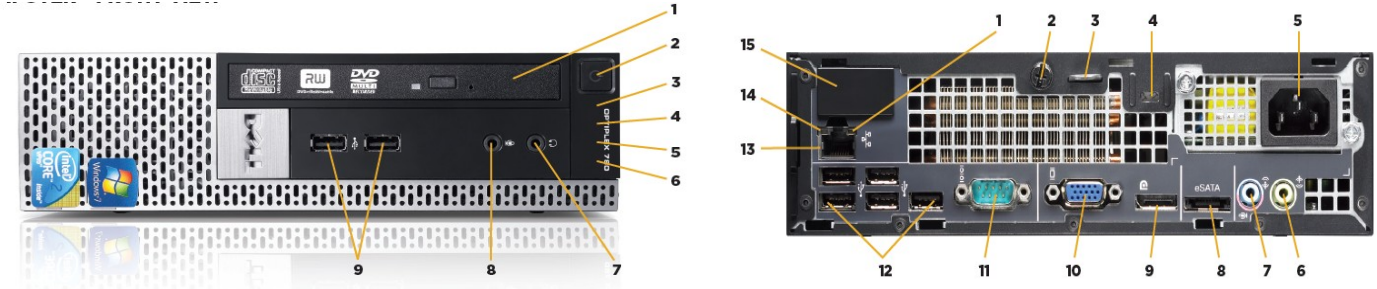
1	Chassis Lock Loop	4	Back-Panel Connectors
2	Cover Release Latch	5	Expansion Card Slots (2)
3	Power Connector		

BACK PANEL CONNECTORS

1	Parallel Connector	7	Line-in Connector
2	Serial Connector	8	USB 2.0 Connectors (6)
3	Link Integrity Light	9	VGA Video Connector
4	Network Connector	10	eSATA Connector
5	Network Activity Light	11	DisplayPort Connector
6	Line-out Connector		



ULTRA SMALL FORM FACTOR COMPUTER (USFF) VIEW



FRONT VIEW			
1	Optical Drive	7	Headphone Connector
2	Power Button, Power Light	8	Microphone Connector
3	Drive Activity Light	9	USB Connector 2.0 (2)
4	Diagnostic Lights (4)		
5	Network Connectivity Light		
6	WiFi Activity Light (optional)		

BACK VIEW			
1	Network Activity Light	9	Display Port Connector
2	Captive Thumbscrew	10	VGA Video Connector
3	Padlock Ring	11	Serial Connector
4	Security Cable Slot	12	USB Connector 2.0 (5)
5	Power Connector	13	Network Connector
6	Line-Out Connector	14	Link Integrity Light
7	Line-in/ Microphone Connector	15	WiFi Antenna (optional)
8	eSATA Connector		

MARKETING SYSTEM CONFIGURATIONS

NOTE: Offerings may vary by region. For more information regarding the configuration of your computer, click Start>Help and Support and select the option to view information about your computer.

OPERATING SYSTEM

NOTE: One of the following Operating Systems will be preinstalled.

	MT	DT	SFF	USFF
Windows 7® operating system (available in Q4 2009)	Microsoft® Windows 7® Basic; Microsoft® Windows 7® Professional (64 and 32 bit); Microsoft® Windows 7® Ultimate			
Windows Vista® operating system	Windows Vista® Business SP1 (32 bit), Windows Vista® Home Basic SP1 (32 bit), Windows Vista® Business SP1 (32 bit) via Windows 7 Professional Downgrade Rights, Windows Vista® Ultimate SP1 (32 bit) via Windows 7 Ultimate Downgrade Rights,			
Windows XP® operating system	Windows® XP Professional SP3 via Windows Vista® Business or Ultimate Downgrade Rights (32 bit), Windows® XP Professional SP3 via Microsoft® Windows 7® Professional or Microsoft® Windows 7® Ultimate Downgrade Rights (32 bit)			
Other	FreeDOS for (N-series), Ubuntu® Linux (China only)			
OS Media Support	X	X	X	X

CHIPSET

	MT	DT	SFF	USFF
Chipset	Intel Q45 Express Chipset w/ICH10DO			
Non-volatile memory on chipset				
BIOS Configuration SPI (Serial Peripheral Interface)	64Mbit (8MB) located at SPI_FLASH on chipset			
TPM 1.2 Security Device (Trusted Platform Module) ¹	16KB located at TPM1.2 on chipset			
TCM (Trusted Computing Module)	Available in China only			
Non-TPM	Available in select countries			
NIC EEPROM	LOM configuration contained within SPI_FLASH – no dedicated LOM EEPROM			

PROCESSOR

NOTE: Global Standard Products (GSP) are a subset of Dell's relationship products that are managed for availability and synchronized transitions on a worldwide basis. They ensure the same platform is available for purchase globally. This allows customers to reduce the number of configurations managed on a worldwide basis, thereby reducing their costs. They also enable companies to implement global IT standards by locking in specific product configurations worldwide. The following GSP processors identified below will be made available to Dell customers.

NOTE: Processor numbers are not a measure of performance.

NOTE: Processor availability subject to change and may vary by region/country.

	MT	DT	SFF	USFF
Intel® Core™ 2 Quad Processors				
Intel® Core™ 2 Quad Q9650/3.00GHz, 12M, 1333FSB	X-GSP	X-GSP	X-GSP	
Intel® Core™ 2 Quad Q9550/2.83GHz, 12M, 1333FSB	X-GSP	X-GSP	X-GSP	
Intel® Core™ 2 Quad Q9400/2.66GHz, 6M, 1333FSB	X-GSP	X-GSP	X-GSP	
Intel® Core™ 2 Quad Q8400/2.66GHz, 4M, 1333FSB	X	X	X	
Intel® Core™ 2 Quad Q8300/2.50GHz, 4M, 1333FSB	X	X	X	
Intel® Core™ 2 Duo and Pentium® Dual Core Processors				
Intel® Core™ 2 Duo E8600/3.33GHz, 6M, 1333FSB	X-GSP	X-GSP	X-GSP	X-GSP
Intel® Core™ 2 Duo E8500/3.16GHz, 6M, 1333FSB	X-GSP	X-GSP	X-GSP	X-GSP
Intel® Core™ 2 Duo E8400/3.0GHz, 6M, 1333FSB	X-GSP	X-GSP	X-GSP	X-GSP
Intel® Core™ 2 Duo E7600/3.06GHz, 3M, 1066FSB	X	X	X	X
Intel® Core™ 2 Duo E7500/2.93GHz, 3M, 1066FSB	X	X	X	X
Intel® Pentium® Dual-Core E6300/2.8GHz, 2M, 1066FSB	X	X	X	X
Intel® Pentium® Dual-Core E5400/2.7GHz, 2M, 800FSB	X	X	X	X
Intel® Pentium® Dual-Core E5300/2.60GHz, 2M, 800FSB	X	X	X	X
Intel® Celeron® Processors				
Intel® Celeron® Dual-Core 3300/2.50GHz, 1M, 800FSB	X	X	X	X
Intel® Celeron® Dual-Core 3200/2.40GHz, 1M, 800FSB	X	X	X	X
Intel® Celeron® Dual-Core 1600/2.40GHz, 512K, 800FSB	X	X	X	X
Intel® Celeron® Dual-Core 1500/2.20GHz, 512K, 800FSB	X	X	X	X
Intel® Celeron® 450/2.20GHz, 512K, 800FSB	X	X	X	X

ADVANCED SYSTEM MANAGEABILITY MODES

NOTE: Hardware management mode options allow you to select the right systems management feature support for your enterprise. Dell's innovative approach to scalable remote client management offers you a choice of built-in hardware management capabilities across platform offerings.

The latest generation of Intel® vPro™ technology provides the capability to manage your install base of systems regardless of the power state or hardware functionality of the system.

This functionality allows IT to address many issues remotely rather than having to physically visit systems.

The OptiPlex 780 supports Intel® vPro™ technology and Intel® Standard Manageability which supports the following features:

Asset reporting and inventory capabilities, Remote troubleshooting and repair, Client System Isolation, Remote patching/ updating

Intel® vPro™ technology adds these additional features:

Client initialed "Fast Call for Help"/ beyond firewall systems management capability, Microsoft NAP support, Hardened security monitoring, Support for the latest generation of Intel® Core™ 2 Processors

-Intel vPro Technology Enabled: This option enables full vPro out of band functionality. Requires a vPro processor.

-Intel vPro Technology Disabled: This option disables vPro technology but allows for the later enablement of vPro as desired. Requires a vPro processor

-Intel Standard Manageability: This option delivers a portion of basic out of band capabilities (see above)

-No Out of Band Systems Management: This option does not support out of band management. Cannot be enabled after point of sale.

	MT	DT	SFF	USFF
Intel® vPro Technology Enabled* (iAMT 5.x)	X	X	X	X
Intel® vPro Technology Disabled * (iAMT 5.x)	X	X	X	X
Intel® Standard Manageability *	X	X	X	X
No Out-of-Band Systems Management	X	X	X	X

*The functionality described above requires an appropriate software management console

MEMORY

Memory modules should be installed in pairs of matched memory size, speed, and technology. If the memory modules are not installed in matched pairs, a slight reduction in performance may occur.

	MT	DT	SFF	USFF
Type: DDR3 Synch DRAM Non-ECC Memory	1066MHz			
DIMM Slots	4	4	4	2
DIMM Capacities	Up to 2GB	Up to 2GB	Up to 2GB	Up to 2GB
Minimum Memory	1GB	1GB	1GB	1GB
Maximum System Memory (uses 2GB DIMMS)	8GB ¹	8GB ¹	8GB ¹	4GB
1066MHz Memory configurations				
8GB ¹ DDR2 Non-ECC SDRAM, 1066MHz, (4 DIMM)	X	X	X	
4GB ¹ DDR2 Non-ECC SDRAM, 1066MHz, (4 DIMM)	X	X	X	
4GB ¹ DDR2 Non-ECC SDRAM, 1066MHz, (2 DIMM)	X	X	X	X
3GB DDR2 Non-ECC SDRAM, 1066MHz, (3 DIMM)	X	X	X	
3GB DDR2 Non-ECC SDRAM, 1066MHz, (2 DIMM)	X	X	X	X
2GB DDR2 Non-ECC SDRAM, 1066MHz, (2 DIMM)	X	X	X	X
2GB DDR2 Non-ECC SDRAM, 1066MHz, (1 DIMM)	X	X	X	X
1GB DDR2 Non-ECC SDRAM, 1066MHz, (1 DIMM)	X	X	X	X

¹The total amount of available memory will be less than 4GB. The amount less depends on the actual system configuration. To fully utilize 4GB or more of memory requires a 64-bit enabled processor and 64-bit operating system.

DRIVES AND REMOVABLE STORAGE

	MT	DT	SFF	USFF
Bays:				
3.5-inch bay (External 19-1 Media Card Reader)	1	1	1 (slim-line)	
5.25-inch bay (External Optical)	2	1	1 (slim-line)	
Hard Drives Supported (Internal and External)	2	2	2	1
Optical Drives Supported	2	1	1	1
Interface:				
SATA	4	3	3	2
3.5" Hard Drives:				
160GB ¹ SATA 10K RPM HDD	X	X	X	
80GB ¹ SATA 10K RPM HDD	X	X	X	
500GB ¹ SATA 7200 RPM HDD	X	X	X	
320GB ¹ SATA 7200 RPM HDD	X	X	X	
250GB ¹ SATA 7200 RPM HDD	X	X	X	
160GB ¹ SATA 7200 RPM HDD	X	X	X	
2.5" Hard Drives:				
320GB ¹ SATA 7200 RPM HDD				X
250GB ¹ SATA 7200 RPM HDD (available in Q4 2009)	X	X	X	X
160GB ¹ SATA 7200 RPM HDD	X	X	X	X
160GB ¹ SATA Full Disk Encryption HDD	X	X	X	X
64GB ¹ SATA Solid State Drive	X	X	X	X
128GB ¹ SATA Solid State Drive				X
RAID 1 Data Protection: (includes two matching capacity/speed hard drives)				
160GB ¹ SATA 10K RPM HDD (3.5")	X			
80GB ¹ SATA 10K RPM HDD (3.5")	X			
500GB ¹ SATA 7200 RPM HDD (3.5")	X			
320GB ¹ SATA 7200 RPM HDD (3.5")	X			
250GB ¹ SATA 7200 RPM HDD (3.5")	X			
160GB ¹ SATA 7200 RPM HDD (3.5")	X			
250GB ¹ SATA 7200 RPM HDD (2.5")	X	X	X	
160GB ¹ SATA 7200 RPM HDD (2.5")	X	X	X	

DRIVES AND REMOVABLE STORAGE

	MT	DT	SFF	USFF
RAID 0 Performance: (includes two matching capacity/speed hard drives)				
320GB ¹ SATA 10K RPM HDD (3.5")	X			
160GB ¹ SATA 10K RPM HDD (3.5")	X			
1TB ¹ SATA 7200 RPM HDD (3.5")	X			
640GB ¹ SATA 7200 RPM HDD (3.5")	X			
500GB ¹ SATA 7200 RPM HDD (3.5")	X			
320GB ¹ SATA 7200 RPM HDD (3.5")	X			
500GB ¹ SATA 7200 RPM HDD (2.5")	X	X	X	
320GB ¹ SATA 7200 RPM HDD (2.5")	X	X	X	
Optical Drive: (SFF/USFF require slim-line optical drive)				
DVD+/-RW ²	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s
DVD-ROM ³	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s
Media Card Reader:				
Dell 19 in 1 Media Card Reader	480Mb/s			

¹ For hard drives, GB means 1 billion bytes; actual capacity varies with preloaded material and operating environment and will be less.

² Discs burned with this drive may not be compatible with some existing drives and players; using DVD+R media provides maximum compatibility.

³ DVD-ROM drives may have write-capable hardware that has been disabled via firmware modifications.

SYSTEM BOARD CONNECTORS

NOTE: See Detailed Engineering Specifications for maximum card dimensions.

	MT	DT	SFF	USFF
PCI Slot(s): number of	2	2	1	
PCIe x16 Slot: number of	1	1	1	
PCIe x1 Slot: number of	1	0	0	
Flexbay	1	1	1	
Serial ATA (SATA)	4	3	3	2

GRAPHICS/VIDEO CONTROLLER

NOTE: MT supports full height card, DT supports low profile card or full height card with optional riser. SFF supports low profile card.

	MT	DT	SFF	USFF
Integrated Intel GMA 4500	Integrated on system board			
Enhanced Graphic/Video Options				
DVI (Digital) Adapter Card	Optional card			
256MB ATI RADEON HD 3450 Graphics with dual DVI or VGA and S-Video Out (adapters convert to dual DVI or dual VGA)	Optional card			
256MB ATI RADEON HD 3470 Graphics with Dual DP (adapters convert to dual DVI or dual VGA)	Optional card			
256MB nVidia GeForce 9300 GE with dual DVI or VGA and S-Video Out (adapters convert to dual DVI or dual VGA)	Optional card			
NVIDIA Quadro NVS 420 (available in Q4 2009)	Optional card			

EXTERNAL PORTS/CONNECTORS

NOTE: MT supports full height card, DT supports low profile card or full height card with optional riser. SFF supports low profile card.

See chassis diagrams section for port/connector locations

	MT	DT	SFF	USFF
USB 2.0	2 Front, 6 Rear, 1 Internal			2 Front, 5 Rear
Serial	1 rear, second port optional via card			1 Rear
eSATA	1 Rear			1 Rear
Parallel	1 Rear			
Network Connector (RJ-45)	1 Rear			
PS/2	Optional via add-in card			
1394 Controller	Optional via add-in card			
Video:				
VGA	1 Rear			
DVI-I	Optional via add-in card			
DisplayPort	1 Rear			
Audio:				
Line in for microphone	1 Front			
Line in for microphone or stereo	1 Rear			
Line out for headphones or speakers	1 Front, 1 Rear			
Risers: (replaces 1 PCI slot and 1 PCIe slot on DT system board)				
Combo full height riser with 1 PCI and 1 PCIe connector		X		
Dual full height riser with 2 PCI connectors		X		

COMMUNICATIONS - NETWORK ADAPTER (NIC)

NOTE: MT supports full height card, DT supports low profile card or full height card with optional riser. SFF supports low profile card.

	MT	DT	SFF	USFF
Intel® 82567LM Gigabit ¹ Ethernet LAN 10/100/1000 (Remote Wake Up, PXE support and Intel Active Management Technology support)	Integrated on system board			
Broadcom NetXtreme 10/100/1000 PCIe Gigabit Networking Card	Optional via add-in card			

¹ This term does not connote an actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

COMMUNICATIONS – MODEM

NOTE: MT supports full height card, DT supports low profile card or full height card with optional riser.

	MT	DT	SFF	USFF
V.92 Data/Fax Controllerless Modem	Optional via add-in card			

COMMUNICATIONS – WIRELESS

	MT	DT	SFF	USFF
Dell Wireless 1505 PCIe WLAN card (802.11 Draft N)	Optional via add-in card			
Broadcom 1510 miniPCIe WLAN card (802.11 Draft N)				Optional

AUDIO AND SPEAKERS

	MT	DT	SFF	USFF
ADI 1984A High Definition Audio Codec	Integrated on system board			
Internal Dell Business Audio Speaker	Optional			
Dell AX210 2.0 Desktop Speakers	Optional			
Dell AX510/AX510PA Flat Panel Soundbar Speakers	Optional			
Dell AY410 2.1 Desktop Speakers	Optional			

KEYBOARD AND MOUSE

	MT	DT	SFF	USFF
Dell USB Entry Keyboard with optional palmrest	Standard			
Dell QuietKey Keyboard with optional palmrest	Optional			
Dell Multimedia Pro Keyboard	Optional			
Dell Smartcard Keyboard	Optional			
Dell USB Optical Mouse	Optional			
Dell Laser Mouse	Optional			
Dell Logo Mouse Pad	Optional			

SECURITY

	MT	DT	SFF	USFF
Trusted Platform Module (TPM) 1.2 ¹	Integrated on system board			
Trusted Computing Module (TCM)	Integrated on system board (China only)			
Chassis Intrusion Switch	Optional			
Dell Smartcard Keyboard	Optional			
Chassis lock slot and loop support	Standard			

¹TPM is not available in all countries. Depending on your country regulations, TCM or No-TPM system boards will be made available.

SERVICE AND SUPPORT

NOTE: For more details on Dell Service Plans please to go to: www.dell.com/service/service_plans

	MT	DT	SFF	USFF
3 Year Warranty ¹ Next Business Day On-site ² (3-3-3)	Standard			
ProSupport	Optional			

¹ For a copy of our guarantees or limited warranties, please write Dell USA L.P., Attn: Warranties, One Dell Way, Round Rock, TX 78682. For more information, visit www.dell.com/warranty.

² Service may be provided by third-party. Technician will be dispatched if necessary following phone-based troubleshooting. Subject to parts availability, geographical restrictions and terms of service contract. Service timing dependent upon time of day call placed to Dell. U.S. only.

SOFTWARE

	MT	DT	SFF	USFF
Dell Client Manager	Available via Dell.com			
Dell ControlPoint	Standard			
Norton 2009 Internet Security	30 Day Trial or Optional Subscription			
McAfee 10 SecurityCenter	30 Day Trial or Optional Subscription			

DETAILED ENGINEERING SPECIFICATIONS

SYSTEM DIMENSIONS (PHYSICAL)

NOTE: System Weight and Shipping Weight is based on a typical configuration and may vary based on PC configuration. A typical configuration includes: integrated graphics, one hard drive, one optical drive, and one diskette drive.

	MT	DT	SFF	USFF
Chassis Volume (liters)	33.0	16.0	10.7	3.7
Chassis Weight (pounds/kilograms)	25.8 / 11.7	18.2 / 8.26	15 / 6.80	7.0 / 3.2
Chassis Dimensions: (HxWxD)				
Height (inches/centimeters)	16.1 / 40.8	4.5 / 11.4	3.65 / 9.26	9.40 / 23.9
Width (inches/centimeters)	7.4 / 18.7	15.7 / 39.9	12.4 / 31.4	2.60 / 6.50
Depth (inches/centimeters)	17.0 / 43.3	13.9 / 35.3	13.4 / 34	9.30 / 23.6
Shipping Weight (pounds/kilograms - includes packaging materials)	43.5 / 19.73	28 / 12.7	21.3 / 9.66	13.5 / 6.12
Packaging Parameters (HxWxD)				
Height (inches/centimeters)	22.38 / 56.85	20.63 / 52.4	20.88 / 50.04	TBD
Width (inches/centimeters)	22.25 / 56.52	20.31 / 51.59	19.38 / 49.23	TBD
Depth (inches/centimeters)	14.25 / 36.2	11.75 / 29.85	10.63 / 27	TBD

SYSTEM BOARD CONNECTOR MAXIMUM ALLOWABLE DIMENSIONS

	MT	DT	SFF	USFF
PCI Slots	2	2	1	
Height (inches/centimeters)	4.376 / 11.115	2.731 / 6.89		
Length (inches/centimeters)	7.4 / 18.796*	6.6 / 16.764		
PCIe x16 Slots	1	1	1	
Height (inches/centimeters)	4.376 / 11.115	2.731 / 6.89		
Length (inches/centimeters)	7.4 / 18.796*	6.6 / 16.764		
PCIe x1 Slots	1			
Height (inches/centimeters)	4.376 / 11.115			
Length (inches/centimeters)	7.4 / 18.796*			
Risers: (replaces 1 PCI slot and 1 PCIe slot on DT system board)				
Combo Full Height Riser with 1 PCI and 1 PCIe connector (HxL)		1		
Height (inches/centimeters)		4.376 / 11.115		
Length (inches/centimeters)**		6.6 / 16.764		
Dual Full Height Riser with 2 PCI connectors (HxL)		1		
Height (inches/centimeters)		4.376 / 11.115		
Length (inches/centimeters)**		6.6 / 16.764		

* Card length can be longer than standard Half-Length Card but cannot be a Full-Length Card.

** 6.9/17.53 in/cm is longer than the standard Half-Length Card

SYSTEM LEVEL ENVIRONMENTAL AND OPERATING CONDITIONS

	MT	DT	SFF	USFF
Temperature				
Operating	10° to 35° C (50° to 95° F)			
Non-Operating (Storage)	-40° to 65° C (-40° to -149° F)			
Relative Humidity	20% to 80% (non-condensing)			
Maximum vibration				
Operating	0.25 G at 3 to 200 Hz at 0.5 octave/min			
Non-Operating	0.5 G at 3 to 200 Hz at 1 octave/min			
Maximum Shock				
Operating	Bottom half-sine pulse with a change in velocity of 50.8 cm/sec (20 inches/sec)			
Non-Operating	27-G faired square wave with a velocity change of 508 cm/sec (200 inches/sec)			
Maximum Altitude				
Operating	-15.2 to 3048 m (-50 to 10,000 ft)			
Non-Operating	-15.2 to 10,668 m (-50 to 35,000 ft)			

POWER

NOTE: These form factors utilize a more efficient Active Power Factor Correction (APFC) power supply. Dell recommends only Universal Power Supplies (UPS) based on Sine Wave output for APFC PSUs, not an approximation of a Sine Wave, Square Wave, or quasi-Square Wave. If you have questions, please contact the manufacturer to confirm the output type.

	MT		DT		SFF		USFF
	APFC	EPA	APFC	EPA	APFC	EPA	EPA
Power Supply Wattage	305W	255W High Efficiency	255W	255 W High Efficiency	235W	235W High Efficiency	180W High Efficiency
AC input Voltage Range	90 – 264Vac	90 – 264Vac	90 – 264Vac	90 – 264Vac	90 – 264Vac	90 – 264Vac	90 – 264Vac
AC input current (low ac range/high AC range)	5.6A / 2.8A	3.6A / 1.8A	5.0A / 2.5A	4.0A / 2.0A	4.5A / 2.25A	3.5A / 1.75A	2.6A / 1.3A
AC input Frequency	47HZ / 63HZ	47HZ / 63HZ	47HZ / 63HZ	47HZ / 63HZ	47HZ / 63HZ	47HZ / 63HZ	47 – 63 Hz
AC holdup time (80% load)	16MSEC	16MSEC	16MSEC	16MSEC	16MSEC	16MSEC	16 ms
Average Efficiency (Energy Star 5.0 Compliant)		87 – 90 – 87% @ 20 – 50 – 100% load		87 – 90 – 87% @ 20 – 50 – 100% load		87 – 90 – 87% @ 20 – 50 – 100% load	87 – 90 – 87% @ 20 – 50 – 100% load
Typical Efficiency (Active PFC)	65%		65%		65%		N/A
DC parameters							
+3.3v output	8.0A	8.0A	7.0 A	7.0 A	5A	5A	N/A
+5.0v output	16A	16A	15A	15A	16A	16A	N/A
+12.0v output	12vA/15A; 12VB/10A	12VA/13A; 12VB/7A	18A	18A	17A	17A	+12VA - 9.0 A & +12VB - 7.0 A Note: +12VB Rated at 0.4A when in Standby Mode.
+5.0v auxiliary output	4.0A	4.0A	4.0	4.0	4.0A	4.0A	N/A
-12.0v output	0.5A	0.5A	0.5A	0.5A	0.5A	0.5A	0.1 A
Max total power	305W	255W	255W	255W	235W	235W	180W
Max combined +3.3v / +5.0v power	80W	80W	91.5W	91.5W	88W	88W	N/A
Max combined 12.0v power (note: only if more than one 12v rail)	240W	240W	N/A	N/A	N/A	N/A	180W
BTUs/h (based on PSU max wattage)	1603 BTU	1000 BTU	1341 BTU	1000 BTU	1235 BTU	921 BTU	723 BTU
3.3v CMOS battery (type and estimated battery life)							
Power Supply Fan	80*25mm	80*25mm	92*25mm	92*25mm	80*15mm	80*15mm	N/A
Compliance:							
1watt requirement	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Blue Angel Compliant	Pending	Pending	Pending	Pending	Pending	Pending	Yes
Climate Savers / 80Plus Compliant	No	Yes	No	Yes	No	Yes	Yes
FEMP (CECP) Standby Power Compliant	No	Yes	No	Yes	No	Yes	Yes

AUDIO

INTEGRATED ADI 1984A HIGH DEFINITION AUDIO	MT	DT	SFF	USFF
High Definition Stereo support	X	X	X	X
Number of channels	2			
Number of Bits / Audio resolution	16, 20, and 24-bit resolution			
Sampling rate (recording/playback)	Independent 8, 11.025, 16, 22.05, 32, 44.1, 48, 88.2, 96, 176.4, and 192 kHz sample rates			
Signal to Noise Ratio	96+ dB audio outputs, 90+ dB audio inputs			
Analog Audio	X	X	X	X
Dolby Digital				
THX				
Digital out (S/PDIF)				
Audio Jack Impedance				
Microphone	150 kΩ			
Line-In	150 kΩ			
Line-Out	190 Ω			
Headphone	.5 Ω			
Internal Speaker Power Rating	2W			

COMMUNICATIONS - NETWORK ADAPTER (NIC)

NOTE: MT supports full height card, DT supports low profile card or full height card with optional riser. SFF supports low profile card.

INTEGRATED INTEL® 82567 GIGABIT 1 ETHERNET LAN 10/100/1000	MT	DT	SFF	USFF
External Connector Type	RJ45			
Data Rates supported	10/100/1000 Mbps			
Controller Details				
Controller bus architecture (example PCIe 1.0a x1)	Intel Gigabit LAN Connect Interface (GLCI) and LAN Connect Interface (LCI)			
Integrated memory	N/A			
Data transfer mode (example Bus-Master DMA)	N/A			
Power consumption (full operation per data rate connection speed)	680mW (Max.)			
Power consumption (standby operation)	141mW (Max.)			
IEEE standards compliance (example 802.1P)	802.3			
Hardware Certifications (example FCC, B, GS mark...)	N/A			
Boot ROM Support	EEPROM (located in SPI)			
Network Transfer Mode (example Full Duplex, Half Duplex)				
Network Transfer Rate (example 10BASE-T (half-duplex) 10 Mbps 10BASE-T (full-duplex) 20 Mbps 100BASE-TX (half-duplex) 100 Mbps 100BASE-TX (full-duplex) 200 Mbps 1000BASE-T (full-duplex) 2000 Mbps	10 Mb (full/half-duplex) 100 Mb (full/half-duplex) 1000 Mb (full-duplex)			

COMMUNICATIONS - NETWORK ADAPTER (NIC) (CONT.)**INTEGRATED INTEL® 82567 GIGABIT1
ETHERNET LAN 10/100/1000 (CONT.)**

	MT	DT	SFF	USFF
Environmental				
Operating temperature	0° C to 70° C (32° F to 158° F)			
Operating humidity	20% to 80% (non-condensing)			
Operating System Driver Support	Windows® XP, Windows Vista® Ultimate, Windows Vista® Business 32 bit/64 bit, Windows Vista Home Basic			
Manageability (examples WOL, PXE)	WOL, PXE 2.1			
Management Capabilities Alerting	Intel® Standard Manageability, Intel Core 2 Duo/Quad Processor with vPro Technology			

¹ This term does not connote an actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

COMMUNICATIONS – INTEGRATED LAN

NOTE: MT supports full height card, DT supports low profile card or full height card with optional riser. SFF supports low profile card.

Broadcom NetXtreme 10/100/1000 PCIe Gigabit¹ Networking Card

	MT	DT	SFF	USFF
Connector Type	RJ45			
Data Rates supported	10/100/1000 Mbps Half/Full duplex			
Controller Details				
Controller bus architecture (example PCIe 1.0a x1)	PCIe c1.0a x1			
Integrated memory	64KBytes RX, 8KBytes TX			
Data transfer mode (example Bus-Master DMA)	Bus-Master DMA			
Power consumption (full operation per data rate connection speed)	2.84W (860mA @ +3.3V)			
Power consumption (standby operation)	Less than 300mW			
IEEE standards compliance (example 802.1P)	802.3, 802.2, 802.3x, 802.1p			
Hardware Certifications (example FCC, B, GS mark...)	FCC B, VCCI B, CE			
Boot ROM Support	No			
Network Transfer Mode (example Full Duplex, Half Duplex)	Full Duplex/Half Duplex			
Network Transfer Rate (example 10BASE-T (half-duplex) 10 Mbps 10BASE-T (full-duplex) 20 Mbps 100BASE-TX (half-duplex) 100 Mbps 100BASE-TX (full-duplex) 200 Mbps 1000BASE-T (full-duplex) 2000 Mbps)	10BASE-T (full-duplex) 20 Mbps Max* 100BASE-TX (half-duplex) 100 Mbps Max* 100BASE-TX (full-duplex) 200 MbpsMax* 1000BASE-T (full-duplex) 2000 Mbps Max* * Depends on the system environment.			

¹ This term does not connote an actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

COMMUNICATIONS – INTEGRATED LAN (CONT.)**BROADCOM NETXTREME 10/100/1000
PCI-E GIGABIT¹ NETWORKING CARD (CONT.)**

	MT	DT	SFF	USFF
Environmental				
Operating temperature	0° C to 55° C (32° F - 131° F)			
Operating humidity	5% ~ 85% (non-condensing)			
Operating System Driver Support	Windows® 7, Windows® XP, Windows Vista® Ultimate, Windows Vista® Business 32 bit/64 bit, Windows Vista Home Basic, Linux			
Manageability (examples WOL, PXE)	WOL, PXE2.1, ACPI			
Management Capabilities Alerting (example ASF 2.0)	None			

¹ This term does not connote an actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

COMMUNICATIONS – MODEM**V.92 DATA/FAX CONTROLLERLESS MODEM**

	MT	DT	SFF	USFF
Bus	PCI			
External Connector	RJ-11			
Data Transmission	PCM - Pulse Coded Modulation (V.92/V.90) TCM - Trellis Coded Modulation (V.90/V.34/V.32 bis/V.32)			
Data Speeds	56kbps receive, 48kbps transmit			
Data Standards	ITU V.92/V.90, V.34/V.32 bis/V.32			
Fax Speeds	14.4kbps			
Fax Mode Capabilities	2-wire, half-duplex, synchronous			
Error Correction and Data Compression	V.44, V.42, V.42bis, MNP 2-4, MNP 5			
Power Management	WOR (wake on ring) capable			
Upgradeability	Driver upgradeable			
Video	V.80 Synchronous Access Mode (SAM) can be supported by software applications (not driver)			
Operating Temperature	0~50 degree C			
Operating Humidity	45 degree C 90% max			
Operating System Support	Windows 7, Vista 32/64, Windows XP 32/64			
Operating System Driver Support	Windows 7, Vista 32/64, Windows XP 32/64			
Power Requirements	+3.0V~+3.6V, 116.6mW max			
Chipset	Conexant SmartHSFs/LF (CX11256 & CX20493)			
Dimensions of full height card inches/centimeters (L X H)	L: 5.25/13.325 H: 4.73/12.002			
Dimensions of low profile card inches/centimeters (L X H)	L: 5.26/13.366 H: 3.12/7.923			

COMMUNICATIONS – WIRELESS

NOTE: Native DisplayPort on system is not supported with optional wireless card on the DT and SFF chassis.

DELL WIRELESS 1505 PCIE WLAN CARD (802.11 DRAFT N WITH REMOTE WAKE UP SUPPORT)	MT	DT	SFF
External Connector Type	Custom WLAN Antenna Connector		
Controller Details			
Controller bus architecture	Electrically compatible with the PCI Express Base Specification v1.1 (x1 lane) and PCIe v1.0a.		
WLAN standards supported	802.11a, 802.11b, 802.11g, 802.11n		
802.11b Data Rates supported	11, 5.5, 2, 1 Mbps		
802.11a Data Rates supported	54, 48, 36, 24, 18, 12, 9, 6 Mbps		
802.11g Data Rates supported	54, 48, 36, 24, 18, 12, 9, 6 Mbps		
802.11n Data Rates supported	300, 270, 243, 240, 180, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps		
Encryption	WEP 64-bit and 128-bit, TKIP, AES-CCMP 128-bit		
Operating temperature	0 to +70 °C		
Operating humidity	Max Operating Humidity 85 %		
Operating System Driver Support	Windows 7, Windows XP 32/64, Vista 32/64		

DELL WIRELESS 1510 PCIE MINI PCIE WLAN CARD (802.11 DRAFT N)	USFF
External Connector Type	Custom WLAN Antenna Connector
Controller Details	
Controller bus architecture	Electrically compatible with the PCI Express Base Specification v1.1 (x1 lane) and PCIe v1.0a.
WLAN standards supported	802.11a, 802.11b, 802.11g, 802.11n
802.11b Data Rates supported	11, 5.5, 2, 1 Mbps
802.11a Data Rates supported	54, 48, 36, 24, 18, 12, 9, 6 Mbps
802.11g Data Rates supported	54, 48, 36, 24, 18, 12, 9, 6 Mbps
802.11n Data Rates supported	300, 270, 243, 240, 180, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps
Encryption	WEP 64-bit and 128-bit, TKIP, AES-CCMP 128-bit
Operating temperature	0 to +70 °C
Operating humidity	Max Operating Humidity 85 %
Operating System Driver Support	Windows 7, Windows XP 32/64, Vista 32/64

GRAPHICS/VIDEO CONTROLLER

NOTE: MT supports full height card, DT supports low profile card or full height card with optional riser. SFF supports low profile card.

INTEGRATED INTEL GMA 4500	MT	DT	SFF	USFF
Bus Type	Integrated			
GPU core clock	Gen5 core @ 667 350 MHz Integrated and with 350MHz 24 bit RAMDAC			
Frame Buffer Memory (onboard and shared) Size and Speed	XP: Up to 1GB shared system memory with 2GB system memory Vista: Up to 2GB shared system memory with 4GB system memory			
Maximum power consumption	4 W			
Overlay Planes	Yes			
Maximum Color Depth	32 bit			
Maximum Vertical Refresh Rate	85 Hz			
Multiple Display Support	Yes			
Operating Systems Graphics/ Video API Support	OpenGL 2.0/DirectX 10.0			
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/ or digital)	Up to 2560x11600 @ 60Hz (DP) Up to 1920x1200 @ 60Hz (DVI & VGA) Up to 1600x1200 @ 85Hz (VGA only)			
External Connectors	VGA, DisplayPort			
Environmental Operating Conditions (Non-Condensing):				
Operating Temperature Range	0° to 106° C (32° to 223° F)			
Relative Humidity Range	20% to 80% (non-condensing)			
Altitude Range	-15.2 to 3048 m (-50 to 10,000 ft)			
DisplayPort				
Bus Type	AUX 1, 2, 4 lanes			
Maximum supported resolution	Up to 2560x1600 @ 60Hz			
Maximum power consumption	N/A			
External connectors	DisplayPort			
DVI (Digital) Adder Card (MT,DT and SFF Only)				
Bus Type	sDVO			
Maximum supported resolution	Up to 1920x1566 @ 60 Hz			
Dimensions of full height card inches/centimeters (L x H)	5.75 x 2.75 / 14.61 x 6.99			
Dimensions of low profile card inches/centimeters (L x H)		5.75 x 2.75 / 14.61 x 6.99		
Maximum power consumption	N/A			
External connectors	DVI			

¹ Up to 1.7 GB of system memory may be allocated to support integrated graphics, depending on operating system, system memory size and other factors.

² DVI and VGA can be used concurrently for multi-monitor display in DOS. The DisplayPort controller does not support multi-monitor display in DOS

³ Populating a discrete graphics card in the x16 slot disables onboard video.

GRAPHICS/VIDEO CONTROLLER (CONT.)**256MB AMD RADEON™ HD 3450
GRAPHICS DUAL DVI OR VGA AND TV OUT**

	MT	DT	SFF
Bus Type (example integrated or PCIe x16)	PCIEx16		
GPU core clock	600Mhz		
Frame Buffer Memory (onboard and shared) Size and Speed	500Mhz		
Maximum power consumption	22W		
Overlay Planes	Yes		
Maximum Color Depth	32-bit		
Maximum Vertical Refresh Rate	85Hz		
Multiple Display Support	Yes		
Operating Systems Graphics/ Video API Support	D3D and OpenGL		
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Max : 1920x1440/32bpp @ 75Hz Min : 640x480/8bpp @ 60Hz		
External connectors	DMS-59 ¹ and S-video		
Dimensions of full height card inches/centimeters (L x H)	6.6 x 4.7 / 16.764 x 12.0		
Dimensions of low profile card inches/centimeters (L x H)		6.6 x 3.35 / 16.764 x 8.5	
Environmental Operating Conditions (Non-Condensing):			
Operating Temperature Range	10°-50° C		
Relative Humidity Range	5-90% RH		
Altitude Range	0-20,000 ft.		

¹DMS-59 to VGA or DMS-59 to DVI adaptors required.

256MB NVIDIA GEFORCE 9300 GE

	MT	DT	SFF
Bus Type (example integrated or PCIe x16)	PCIEx16		
GPU core clock	540Mhz		
Frame Buffer Memory (onboard and shared) Size and Speed	500Mhz		
Maximum power consumption	25W		
Overlay Planes	Yes		
Maximum Color Depth	32-bit		
Maximum Vertical Refresh Rate	85Hz		
Multiple Display Support	Yes		
Operating Systems Graphics/ Video API Support	D3D and OpenGL		
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Max : 1920x1440/32bpp @ 75Hz Min : 640x480/8bpp @ 60Hz		
External connectors	DMS-59 ¹ and S-video		
Dimensions of full height card inches/centimeters (L x H)	6.6 x 4.7 / 16.764 x 12.0		
Dimensions of low profile card inches/centimeters (L x H)		6.6 x 3.35 / 16.764 x 8.5	
Environmental Operating Conditions (Non-Condensing):			
Operating Temperature Range	10°-50° C		
Relative Humidity Range	5-90% RH		
Altitude Range	0-20,000 ft.		

¹DMS-59 to VGA or DMS-59 to DVI adaptors required.

GRAPHICS/VIDEO CONTROLLER (CONT.)

256MB AMD RADEON™ HD 3470 GRAPHICS W/ DUAL DP	MT	DT	SFF
Bus Type (example integrated or PCIe x16)	PCIEx16		
GPU core clock	750Mhz		
Frame Buffer Memory (onboard and shared) Size and Speed	500Mhz		
Maximum power consumption	18W		
Overlay Planes	Yes		
Maximum Color Depth	32-bit		
Maximum Vertical Refresh Rate	85Hz		
Multiple Display Support	Yes		
Operating Systems Graphics/ Video API Support	D3D and OpenGL		
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Max : 1920x1440/32bpp @ 75Hz Min : 640x480/8bpp @ 60Hz		
External connectors	2 Display Port		
Dimensions of full height card inches/centimeters (L x H)	6.6 x 4.7 / 16.764 x 12.0		
Dimensions of low profile card inches/centimeters (L x H)		6.6 x 4.7 / 16.764 x 12.0	
Environmental Operating Conditions (Non-Condensing):			
Operating Temperature Range	10°-50° C		
Relative Humidity Range	5-90% RH		
Altitude Range	0-20,000 ft.		

512MB NVIDIA QUADRO NVS 420	MT	DT	SFF
Bus Type (example integrated or PCIe x16)	PCIEx16		
GPU core clock	550Mhz		
Frame Buffer Memory (onboard and shared) Size and Speed	512MB, 700Mhz		
Maximum power consumption	40W		
Overlay Planes	Yes		
Maximum Color Depth	32-bit		
Maximum Vertical Refresh Rate	75Hz		
Multiple Display Support	Yes		
Operating Systems Graphics/ Video API Support			
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Max : 2560x1600 @ 60Hz (Digital) Max : 1920x1200 @ 60Hz (Analog)		
External connectors	VHDCI to Quad DisplayPort VHDCI to Quad single-link DVI-D		
Dimensions of full height card inches/centimeters (L x H)	6.6 x 2.731 / 16.764 x 6.936		
Dimensions of low profile card inches/centimeters (L x H)		6.6 x 2.731 / 16.764 x 6.936	
Environmental Operating Conditions (Non-Condensing):			
Operating Temperature Range	10°-50° C		
Relative Humidity Range	5-90% RH		
Altitude Range	0-20,000 ft.		

HARD DRIVES¹**3.5" 160GB SATA 7200 RPM HDD**

Capacity (bytes)	160,041,885,696
Dimensions inches (W x D x H)	5.87 x 4 x 1
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	8 MB
Average Seek Time	8.5 ms
Rotational Speed	7200 rpm
Logical Blocks	312,581,808
Power Source	
DC Power (Max)	Idle 7.0W, Active 10.0W
DC Current	5V (.8A) and 12V (1.8A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5 ⁰ C to 60 ⁰ C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29 ⁰ C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40 ⁰ C to 65 ⁰ C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38 ⁰ C
Altitude Range	-50 ft to 35000 ft

3.5" 250GB SATA 7200 RPM HDD

Capacity (bytes)	250,059,350,016
Dimensions inches (W x D x H)	5.87 x 4 x 1
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	8 MB
Average Seek Time	8.5 ms
Rotational Speed	7200 rpm
Logical Blocks	488,397,168
Power Source	
DC Power (Max)	Idle 7.0W, Active 10.0W
DC Current	5V (.8A) and 12V (1.8A)

HARD DRIVES (CONT.)**2.5" 160GB FULL DISK ENCRYPTION SATA HDD**

Capacity (bytes)	160,041,885,696
Dimensions inches (W x D x H)	5.87 x 4 x 1 (includes sled)
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	8 MB
Average Seek Time	8.5 ms
Rotational Speed	7200 rpm
Logical Blocks	312,581,808
Power Source	
DC Power (Max)	Idle 7W, Active 10W
DC Current	5V (.8A) and 12V (1.8A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	50°C to 60°C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29°C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38°C
Altitude Range	-50 ft to 35000 ft

¹ For hard drives, GB means 1 billion bytes ; actual capacity varies with preloaded material and operating environment and will be less.

2.5" 64GB³ SATA SOLID STATE DRIVE

Capacity (bytes)	64,023,257,088
Dimensions inches (W x D x H)	3.94 x 2.75 x 0.374
Interface type and Maximum speed	Up to 3Gb/s
MTBF	1M hours
Average Seek Time	n/a
Performance: Sequential Read/ Write	220/200 (MB/s)
Performance: SYSmark '07 Overall Score	156
Logical Blocks	125,045,424
Power Source	
DC Power Consumption (Max)	Idle 0.205W, Active 0.435W
DC Current	5V (0.8A)

HARD DRIVES (CONT.)**3.5" 250GB SATA 7200 RPM HDD (CONT.)**

Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5 ⁰ C to 60 ⁰ C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29 ⁰ C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40 ⁰ C to 65 ⁰ C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38 ⁰ C
Altitude Range	-50 ft to 35000 ft

3.5" 320GB SATA 7200 RPM HDD

Capacity (bytes)	320,072,933,376
Dimensions inches (W x D x H)	5.87 x 4 x 1
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	16 MB
Average Seek Time	8.5 ms
Rotational Speed	7200 rpm
Logical Blocks	625,142,448
Power Source	
DC Power (Max)	Idle 7.0W, Active 10.0W
DC Current	5V (.8A) and 12V (1.8A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5 ⁰ C to 60 ⁰ C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29 ⁰ C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40 ⁰ C to 65 ⁰ C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38 ⁰ C
Altitude Range	-50 ft to 35000 ft

HARD DRIVES (CONT.)**3.5" 500GB SATA 7200 RPM HDD**

3.5" 500GB SATA 7200 RPM HDD	
Capacity (bytes)	500,107,862,016
Dimensions inches (W x D x H)	5.87 x 4 x 1
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	16 MB
Average Seek Time	8.5 ms
Rotational Speed	7200 rpm
Logical Blocks	976,773,168
Power Source	
DC Power (Max)	Idle 7.0W, Active 10.0W
DC Current	5V (.8A) and 12V (1.8A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5 ^o C to 60 ^o C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29 ^o C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40 ^o C to 65 ^o C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38 ^o C
Altitude Range	-50 ft to 35000 ft

3.5" 80GB SATA 10000 RPM HDD

3.5" 80GB SATA 10000 RPM HDD	
Capacity (bytes)	80,026,361,856
Dimensions inches (W x D x H)	5.87 x 4 x 1 (includes sled)
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	16 MB
Average Seek Time	4.6 ms (average read)
Rotational Speed	10000 rpm
Logical Blocks	156,301,488
Power Source	
DC Power (Max)	Idle 7W, Active 10W
DC Current	5V (.8A) and 12V (1.8A)

HARD DRIVES (CONT.)**3.5" 80GB SATA 10000 RPM HDD (CONT.)**

Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5°C to 60°C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29°C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38°C
Altitude Range	-50 ft to 35000 ft

3.5" 160GB SATA 10000 RPM HDD

Capacity (bytes)	160,041,885,696
Dimensions inches (W x D x H)	5.87 x 4 x 1 (includes sled)
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	16 MB
Average Seek Time	4.6 ms (average read)
Rotational Speed	10000 rpm
Logical Blocks	312,581,808
Power Source	
DC Power (Max)	Idle 7W, Active 10W
DC Current	5V (.8A) and 12V (1.8A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5°C to 60°C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29°C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38°C
Altitude Range	-50 ft to 35000 ft

HARD DRIVES (CONT.)

2.5" 64GB³ SATA SOLID STATE DRIVE (CONT.)	
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	0°C to 70°C
Relative Humidity Range	10 to 90%
Maximum Wet Bulb Temperature	29°C
Altitude Range	-200 to 5,000 m
Op Shock (@0.5ms)	1,500G
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-55°C to 95°C
Relative Humidity Range	5 to 95%
Maximum Wet Bulb Temperature	38°C
Altitude Range	-200 to 10,600 m

2.5" 160GB SATA 7200 RPM HDD

Capacity (bytes)	160,144,285,696
Dimensions inches (W x D x H)	Approximately (3.93 x 2.75 x 0.374 inches)
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	16 MB
Average Seek Time	12 ms (Read)
Rotational Speed	7200 rpm
Logical Blocks	312,581,808
Power Source	
DC Power (Max)	Idle 1.0W, Active 3.25W
DC Current	5V (.8A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5°C to 60°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	29°C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38°C
Altitude Range	-50 ft to 35000 ft

¹ For hard drives, GB means 1 billion bytes ; actual capacity varies with preloaded material and operating environment and will be less.

HARD DRIVES (CONT.)**2.5" 250GB SATA 7200 RPM HDD**

Capacity (bytes)	
Dimensions inches (W x D x H)	Approximately (3.93 x 2.75 x 0.374 inches)
Interface type and Maximum speed	Up to 3Gb/s
Internal buffer size	16 MB
Average Seek Time	12 ms (Read)
Rotational Speed	7200 rpm
Logical Blocks	488,397,168
Power Source	
DC Power (Max)	Idle 1.0W, Active 3.25W
DC Current	5V (.8A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5 ⁰ C to 60 ⁰ C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	29 ⁰ C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40 ⁰ C to 65 ⁰ C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38 ⁰ C
Altitude Range	-50 ft to 35000 ft

¹ For hard drives, GB means 1 billion bytes ; actual capacity varies with preloaded material and operating environment and will be less.

OPTICAL DRIVES

DVD +/- RW¹	MT	DT	SFF	USFF
External Dimensions inches/centimeters (Without Bezel – W x H x D)	148.2mm(6in)/42mm (2in)/ 190.5 (max)	148.2mm(6in)/42mm (2in)/ 190.5 (max)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)
Weight (max) pounds/ kilograms	800g	800g	170g	170g
Interface type and speed	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s
Disc Capacity	Standard	Standard	Standard	Standard
Internal buffer size	supplier dependent	supplier dependent	supplier dependent	supplier dependent
Access Times (typical)	supplier dependent	supplier dependent	supplier dependent	supplier dependent
Maximum Data Transfer Rates				
Writes	16x DVD/48x CD	16x DVD/48x CD	8x DVD/ 24x CD	8x DVD / 24x CD
Reads	16x DVD/48x CD	16x DVD/48x CD	8x DVD/ 24x CD	8x DVD/ 24x CD
Power Source				
DC Power Requirements	12V, 5V	12V, 5V	5V	5V
DC Current	1200mA (12V)/ 900mA (5V)	1200mA (12V)/ 900mA (5V)	1000mA	1000mA
Environmental Operating Conditions (Non-Condensing):				
Operating Temperature Range	5C to 50C	5C to 50C	5C to 50C	5C to 50C
Relative Humidity Range	20% to 80% RH	20% to 80% RH	20% to 80% RH	20% to 80% RH
Maximum Wet Bulb Temperature	29C	29C	29C	29C
Altitude Range	-200 to 3048	-200 to 3048	-200 to 3048	-200 to 3048
Environmental Non-Operating Conditions (Non-Condensing):				
Operating Temperature Range	-40C to 65C	-40C to 65C	-40C to 65C	-40C to 65C
Relative Humidity Range	5% to 95% RH	5% to 95% RH	5% to 95% RH	5% to 95% RH
Maximum Wet Bulb Temperature	38C	38C	38C	38C
Altitude Range	-200 to 10600m	-200 to 10600m	-200 to 10600m	-200 to 10600m

¹ Discs burned with this drive may not be compatible with some existing drives and players; using DVD+R media provides maximum compatibility.

DVD-ROM	MT	DT	SFF	USFF
External Dimensions inches/centimeters (Without Bezel – W x H x D)	148.2mm(6in)/42mm (2in)/ 190.5 (max)	148.2mm(6in)/42mm (2in)/ 190.5 (max)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)
Weight (max) pounds/ kilograms	750g	750g	165g	165g
Interface type and speed	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s
Disc Capacity	Standard	Standard	Standard	Standard
Internal buffer size	supplier dependent	supplier dependent	supplier dependent	supplier dependent
Access Times (typical)	supplier dependent	supplier dependent	supplier dependent	supplier dependent
Maximum Data Transfer Rates				
Writes	N/A	N/A	N/A	N/A
Reads	16x DVD/48x CD	16x DVD/48x CD	8x DVD/ 24x CD	8x DVD/ 24x CD

OPTICAL DRIVES (CONT.)

DVD-ROM (CONT.)	MT	DT	SFF	USFF
Power Source				
DC Power Requirements	12V, 5V	12V, 5V	5V	5V
DC Current	1200mA (12V)/ 900mA (5V)	1200mA (12V)/ 900mA (5V)	800mA	800mA
Environmental Operating Conditions (Non-Condensing):				
Operating Temperature Range	5C to 50C	5C to 50C	5C to 50C	5C to 50C
Relative Humidity Range	20% to 80% RH	20% to 80% RH	20% to 80% RH	20% to 80% RH
Maximum Wet Bulb Temperature	29C	29C	29C	29C
Altitude Range	-200 to 3048m	-200 to 3048m	-200 to 3048m	-200 to 3048m
Environmental Non-Operating Conditions (Non-Condensing):				
Operating Temperature Range	-40C to 65C	-40C to 65C	-40C to 65C	-40C to 65C
Relative Humidity Range	5% to 95% RH	5% to 95% RH	5% to 95% RH	5% to 95% RH
Maximum Wet Bulb Temperature	38C	38C	38C	38C
Altitude Range	-200 to 10600m	-200 to 10600m	-200 to 10600m	-200 to 10600m

COMBO DVD/CDRW	MT	DT	SFF	USFF
External Dimensions inches/centimeters (Without Bezel – W x H x D)	148.2mm(6in)/42mm (2in)/ 190.5 (max)	148.2mm(6in)/42mm (2in)/ 190.5 (max)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)
Weight (max) pounds/ kilograms	750g	750g	165g	165g
Interface type and speed	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s
Disc Capacity	Standard	Standard	Standard	Standard
Internal buffer size	supplier dependent	supplier dependent	supplier dependent	supplier dependent
Access Times (typical)	supplier dependent	supplier dependent	c	supplier dependent
Maximum Data Transfer Rates				
Writes	48x CD	48x CD	24x CD	24x CD
Reads	16x DVD/48x CD	16x DVD/48x CD	8x DVD/ 24x CD	8x DVD/ 24x CD
Power Source				
DC Power Requirements	12V, 5V	12V, 5V	5V	5V
DC Current	1200mA (12V)/ 900mA (5V)	1200mA (12V)/ 900mA (5V)	900mA	900mA
Environmental Operating Conditions (Non-Condensing):				
Operating Temperature Range	5C to 50C	5C to 50C	5C to 50C	5C to 50C
Relative Humidity Range	20% to 80% RH	20% to 80% RH	20% to 80% RH	20% to 80% RH
Maximum Wet Bulb Temperature	29C	29C	29C	29C
Altitude Range	-200 to 3048m	-200 to 3048m	-200 to 3048m	-200 to 3048m
Environmental Non-Operating Conditions (Non-Condensing):				
Operating Temperature Range	-40C to 65C	-40C to 65C	-40C to 65C	-40C to 65C
Relative Humidity Range	5% to 95% RH	5% to 95% RH	5% to 95% RH	5% to 95% RH
Maximum Wet Bulb Temperature	38C	38C	38C	38C
Altitude Range	-200 to 10600m	-200 to 10600m	-200 to 10600m	-200 to 10600m

BIOS DEFAULTS

Drives	Diskette drive:	USB
	SATA Operation:	RAID On
	SMART Reporting:	Disable
	SATA-0:	Enable
	SATA-1:	Enable
	External SATA:	Enable
System Configuration	Integrated NIC:	Enable
	USB Controller:	Enable
	Parallel Port:	PS/2
	Parallel Port Address:	378h
	Serial Port #1:	Auto
	Serial Port #2:	Auto
	Front USB:	Enable
	Rear Quad USB:	Enable
	Rear Dual USB:	Enable
	PCI Slots:	Enable
	Audio:	Enable
Video	Primary Video:	Auto
Performance	Multiple CPU Core:	Enable
	Intel® SpeedStep™:	Disable, unless the customer purchased a SpeedStep™ capable processor.
	C States Control:	Disable
	Limit CPUID Value:	Disable
	HDD Acoustic Mode:	Bypass
Virtualization Support	Virtualization:	Disable
	VT for Direct I/O:	Disable
Security	Administrator Password:	Not set
	System Password:	Not set
	Password Changes:	Enable
	TPM Security:	Disable
	CPU XD Support:	Enable
	Computrace®:	Deactivate
	SATA-0 Password:	Not set

BIOS DEFAULTS (CONT.)

Power Management	AC Recovery:	Power Off
	Auto On Time:	Disable
	Low Power Mode:	Disable
	Remote Wake Up:	Disable
	Suspend Mode:	S3
	Fan Control Override:	Disable
Maintenance	Service Tag:	Set by the factory
	Asset Tag:	Optional User Entry
	SERR Message:	Enable
Post Behavior	Fast Boot:	Enable
	Numlock LED:	Enable
	POST HotKeys:	Enable
	Keyboard Errors:	Enable
	MEBx HotKey	Enable

CHASSIS ENCLOSURE & VENTILATION REQUIREMENTS

ENCLOSURE VENTILATION

If your enclosure has doors, they need to be of a type that allows at least 30% airflow through the enclosure (front and back).

ENCLOSURE MINIMUM CLEARANCE

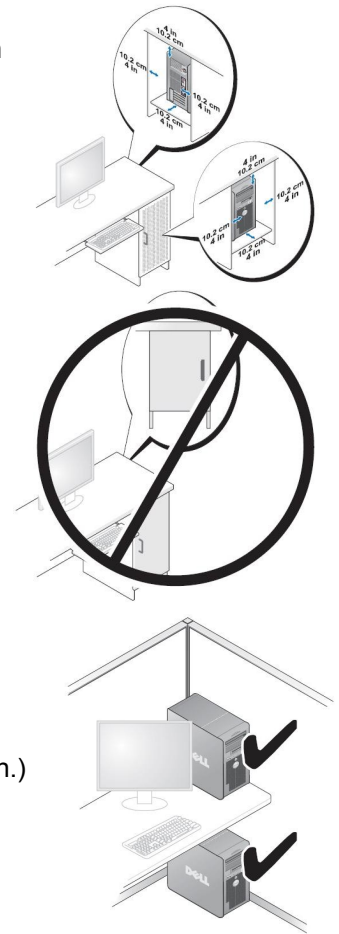
Leave a 10.2 cm (4 in.) minimum clearance on all vented sides of the computer to permit the airflow required for proper ventilation.

RECOMMENDED ENCLOSURE

Do not install your computer in an enclosure that does not allow airflow. This restricts the airflow and impacts your computer's performance, possibly causing it to overheat.

OPEN DESK MINIMUM CLEARANCE

If your computer is installed in a corner, on a desk, or under a desk, leave at least 5.1 cm (2 in.) clearance from the back of the computer to the wall to permit the airflow required for proper ventilation.



REGULATORY COMPLIANCE AND ENVIRONMENTAL

Product related conformity assessment and regulatory authorizations including Product Safety, Electromagnetic Compatibility (EMC), Ergonomics, and Communication Devices relevant to this product may be viewed at www.dell.com/regulatory_compliance. The Regulatory Datasheet for this product is located at http://www.dell.com/regulatory_compliance.

Details of Dell's environmental stewardship program to conserve product energy consumption, reduce or eliminate materials for disposal, prolong product life span and provide effective and convenient equipment recovery solutions may be viewed at www.dell.com/environment. Product related conformity assessment, regulatory authorizations, and information encompassing Environmental, Energy Consumption, Noise Emissions, Product Materials Information, Packaging, Batteries, and Recycling relevant to this product may be viewed by clicking the Design for Environment link on the webpage.

ACOUSTIC NOISE EMISSION INFORMATION (TBD)

OPTIPLEX 780 MT

Component	Typical Configuration	High-end Configuration
CPU	E8500	Q9650
Memory	1GB DDR3 1066 MHz (x1)	2GB DDR3 1066 MHz (x2)
HDD (#, capacity)	160 GB 7200 RPM SATA2	250 GB 7200 RPM SATA2 (x2)
RMSD	DVDRW/DVD dual config	DVDRW/DVD dual config
Graphics Adapter	Radeon HD3450	Radeon HD3470

The Declared Noise Emission in accordance with ISO 9296 for the Dell Optiplex 780 MT is as follows:
(all values L_{WAd} expressed in bels; 1 bel=10 decibels, re 10^{-12} Watts)

Operating Mode	Typical Configuration Declared Sound Power (L_{WAd})	High-end Configuration Declared Sound Power (L_{WAd})
Idle		
HDD Operating		
90% CPU		
ODD Operating		

The Declared A-weighted Sound Pressure Level in decibels (re 2×10^{-5} Pa), at Operator, Bystander, and Desk Side Positions are measured in accordance with ISO 7779 7.6.1, 7.6.2, and C.15.2 and declared in accordance with ISO 9296 for this product is as follows¹:

Operating Mode	Typical Configuration Declared Sound Pressure (LpA)				High-end Configuration Declared Sound Pressure (LpA)			
	Table-Top		Floor-Standing		Table-Top		Floor- Standing	
	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	By-stander Position (LpA)
Idle								
HDD Operating								
90% CPU								
ODD Operating								

¹ All tests are conducted according to ISO 7779 and declared according to ISO 9296 except 90% CPU. For this mode, the system CPU was stressed at 90% utilization with no other peripheral device actively seeking. This test mode is not specified in ISO 7779, but was measured using the same microphone distances and measurement techniques defined for the other reported operating modes.

² Declared Sound Power rounded to nearest tenth of a bel per ISO 9296 section 4.4.2

ACOUSTIC NOISE EMISSION INFORMATION (TBD)

OPTIPLEX 780 DT

Component	Typical Configuration	High-end Configuration
CPU	E8500	Q9650
Memory	1GB DDR3 1066 MHz (x1)	2GB DDR3 1066 MHz (x2)
HDD (#, capacity)	160 GB 7200 RPM SATA2	250 GB 7200 RPM SATA2 (x2)
RMSD	DVDRW/DVD dual config	DVDRW/DVD dual config
Graphics Adapter	Radeon HD3450	Radeon HD3470

The Declared Noise Emission in accordance with ISO 9296 for the Dell Optiplex 780 DT is as follows:
(all values L_{WAd} expressed in bels; 1 bel=10 decibels, re 10^{-12} Watts)

Operating Mode	Typical Configuration Declared Sound Power (L_{WAd})	High-end Configuration Declared Sound Power (L_{WAd})
Idle		
HDD Operating		
90% CPU		
ODD Operating		

The Declared A-weighted Sound Pressure Level in decibels (re 2×10^{-5} Pa), at Operator, Bystander, and Desk Side Positions are measured in accordance with ISO 7779 7.6.1, 7.6.2, and C.15.2 and declared in accordance with ISO 9296 for this product is as follows¹:

Operating Mode	Typical Configuration Declared Sound Pressure (LpA)				High-end Configuration Declared Sound Pressure (LpA)			
	Table-Top		Floor-Standing		Table-Top		Floor- Standing	
	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	By-stander Position (LpA)
Idle								
HDD Operating								
90% CPU								
ODD Operating								

¹ All tests are conducted according to ISO 7779 and declared according to ISO 9296 except 90% CPU. For this mode, the system CPU was stressed at 90% utilization with no other peripheral device actively seeking. This test mode is not specified in ISO 7779, but was measured using the same microphone distances and measurement techniques defined for the other reported operating modes.

² Declared Sound Power rounded to nearest tenth of a bel per ISO 9296 section 4.4.2

ACOUSTIC NOISE EMISSION INFORMATION (TBD)**OPTIPLEX 780 SFF**

Component	Typical Configuration	High-end Configuration
CPU	E8500	Q9650
Memory	1GB DDR3 1066 MHz (x1)	2GB DDR3 1066 MHz (x2)
HDD (#, capacity)	160 GB 7200 RPM SATA2	250 GB 7200 RPM SATA2 (x2)
RMSD	DVDRW/DVD dual config	DVDRW/DVD dual config
Graphics Adapter	Radeon HD3450	Radeon HD3470

The Declared Noise Emission in accordance with ISO 9296 for the Dell Optiplex 780 SFF is as follows:
(all values L_{WAd} expressed in bels; 1 bel=10 decibels, re 10^{-12} Watts)

Operating Mode	Typical Configuration Declared Sound Power (L_{WAd})	High-end Configuration Declared Sound Power (L_{WAd})
Idle		
HDD Operating		
90% CPU		
ODD Operating		

The Declared A-weighted Sound Pressure Level in decibels (re 2×10^{-5} Pa), at Operator, Bystander, and Desk Side Positions are measured in accordance with ISO 7779 7.6.1, 7.6.2, and C.15.2 and declared in accordance with ISO 9296 for this product is as follows¹:

Operating Mode	Typical Configuration Declared Sound Pressure (LpA)				High-end Configuration Declared Sound Pressure (LpA)			
	Table-Top		Floor-Standing		Table-Top		Floor- Standing	
	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	Bystander Position (LpA)	Operator Position (LpA)	Bystander Position (LpA)
Idle								
HDD Operating								
90% CPU								
ODD Operating								

¹ All tests are conducted according to ISO 7779 and declared according to ISO 9296 except 90% CPU. For this mode, the system CPU was stressed at 90% utilization with no other peripheral device actively seeking. This test mode is not specified in ISO 7779, but was measured using the same microphone distances and measurement techniques defined for the other reported operating modes.

² Declared Sound Power rounded to nearest tenth of a bel per ISO 9296 section 4.4.2

ACOUSTIC NOISE EMISSION INFORMATION**OPTIPLEX 780 USFF**

Component	Typical Configuration
CPU	E8500
Memory	2GB DDR3 1066 MHz (x1)
HDD (#, capacity)	160 GB 7200 RPM SATA2
RMSD	DVDRW
Graphics Adapter	Integrated

The Declared Noise Emission in accordance with ISO 9296 for the Dell Optiplex 780 USFF is as follows:
(all values L_{WAd} expressed in bels; 1 bel=10 decibels, re 10^{-12} Watts)

Operating Mode	Typical Configuration Declared Sound Power (L_{WAd})
Idle	3.9
HDD Operating	3.9
90% CPU	4.4
ODD Operating	4.8

The Declared A-weighted Sound Pressure Level in decibels (re 2×10^{-5} Pa), at Operator, Bystander, and Desk Side Positions are measured in accordance with ISO 7779 7.6.1, 7.6.2, and C.15.2 and declared in accordance with ISO 9296 for this product is as follows¹:

¹ All tests are conducted according to ISO 7779 and declared according to ISO 9296 except 90% CPU. For this mode, the system CPU was stressed at 90% utilization with no other peripheral device actively seeking. This test mode is not specified in ISO 7779, but was measured using the same microphone distances and measurement techniques defined for the other reported operating modes.

² Declared Sound Power rounded to nearest tenth of a bel per ISO 9296 section 4.4.2

