Dell OptiPlex 3020

Technical Guidebook

Inside the OptiPlex 3020
SPECIFIC FEATURES/ MODELS/CONFIGURATIONS/OPTIONS DISCUSSED IN THIS DOCUMENT MAY NOT BE AVAILABLE IN ALL REGIONS

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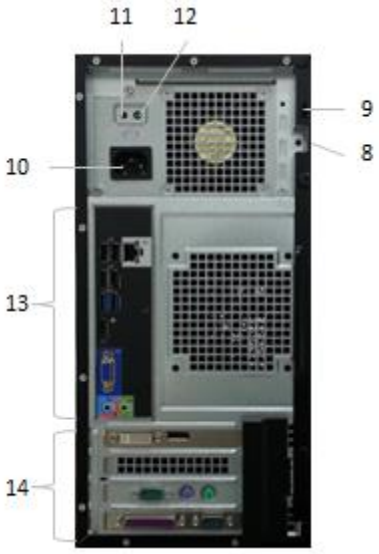
Overview

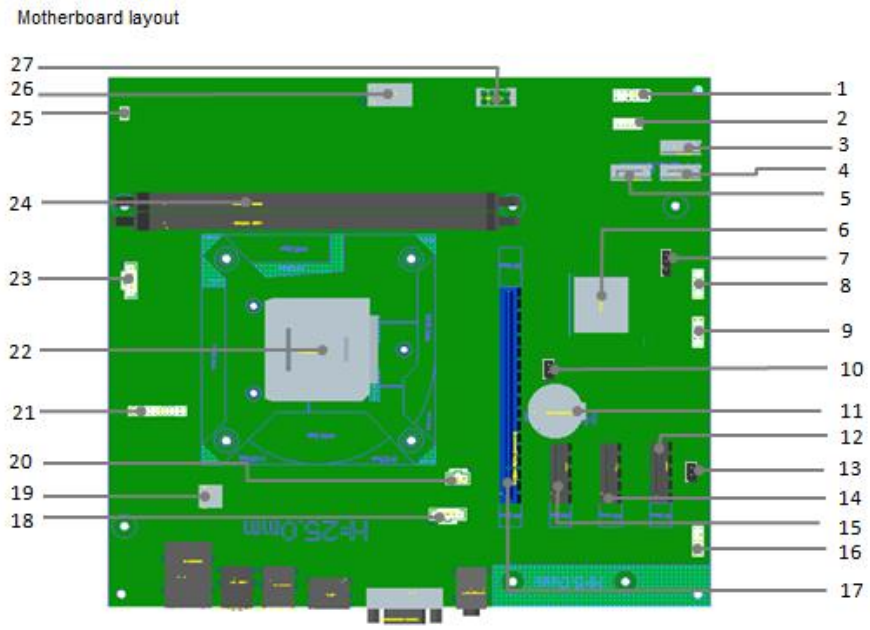
Mini Tower Computer (MT) View



Front View				Rear View			
1	Optical Drive	5	Headphone Connector	8	Padlock Ring	12	Power Supply Diagnostic Light
2	Optical Drive Eject Button	6	Microphone Connector	9	Kensington / Noble Security Cable Slot	13	Back Panel Connectors
3	Power Button, Power Light	7	Drive Activity Light	10	Power Connectors	14	Expansion Card Slots (4)
4	USB2.0 connectors (2)			11	Power Supply Diagnostic Button		

Back Panel Connectors			
1	DisplayPort Connector	6	Network Connector
2	VGA Connector	7	Network Activity Light
3	USB2.0 Connectors (4)	8	Line-Out Connector
4	Line-in / Microphone Connector	9	USB3.0 Connectors (2)
5	Link Integrity Light		

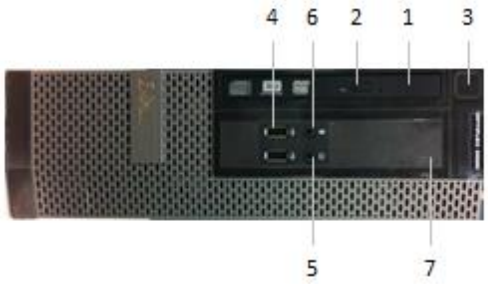
MT Motherboard Layout

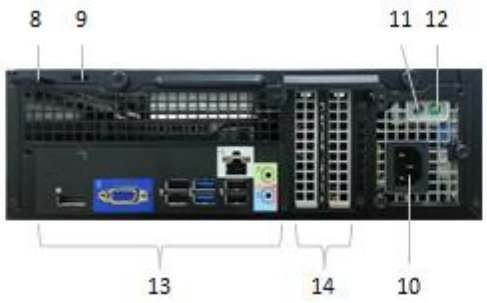


Number	Name	Number	Name
1	HDD LED and Chassis Detect Connector (FRONT_HDD_LED)	15	PCIe x1 Connector (SLOT2)
2	Internal Speaker Connector (INT_SPKR)	16	Front Audio Connector (FRONT_AUDIO)
3	SATA 2 Connector (SATA2) (Black color)	17	PCIe x16 Connector (SLOT1)
4	SATA 0 Connector (SATA0) (Blue color)	18	System Fan Connector (FAN_SYS)
5	SATA 1 Connector (SATA1) (White color)	19	CPU Power Connector (CPU_PWRCONN)
6	PCH chip	20	Intrusion Switch Connector (INTRUDER)
7	PSWD Jumper (PSWD)	21	PS2 Serial Port Connector (KB_MS_SERIAL)
8	Front USB2.0 Connector (FRONTPANEL)	22	Processor Socket
9	Internal USB Connector (INT_USB)	23	CPU Fan Connector (FAN_CPU)
10	RTCRST Jumper (RTCRST)	24	Memory Connectors (DIMM1, DIMM2)
11	Battery Connector (BATTERY)	25	Power Switch Connector (PWR_SW)
12	PCIe x1 Connector (SLOT4)	26	ATX Power Connector (ATX_POWERCON)
13	SERVICE MODE Jumper (SERVICE_MODE)	27	HDD_ODD Power Cable Connector (HDD_ODD_PWR)

14	PCIe x1 Connector (SLOT3)		

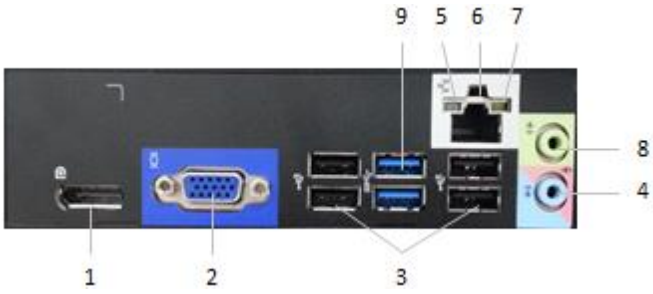
Small Form Factor Computer (SFF) View





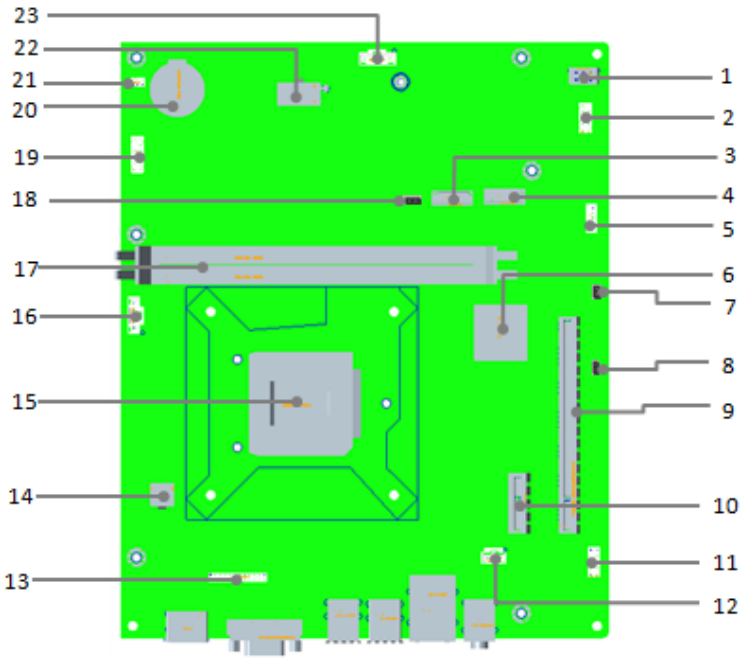
Front View				Rear View			
1	Optical Drive	5	Headphone Connector	8	Padlock Ring	12	Power Supply Diagnostic Light
2	Optical Drive Eject Button	6	Microphone Connector	9	Kensington / Noble Security Cable Slot	13	Back Panel Connectors
3	Power Button, Power Light	7	Drive Activity Light	10	Power Connectors	14	Expansion Card Slots (2)
4	USB2.0 Connectors (2)			11	Power Supply Diagnostic Button		

Rear Panel Connectors			
1	DisplayPort Connector	6	Network Connector
2	VGA Connector	7	Network Activity Light
3	USB2.0 Connectors (4)	8	Line-Out Connector
4	Line-in Microphone Connector	9	USB3.0 Connectors (2)
5	Link Integrity Light		



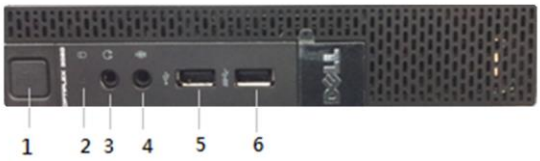
SFF Motherboard Layout

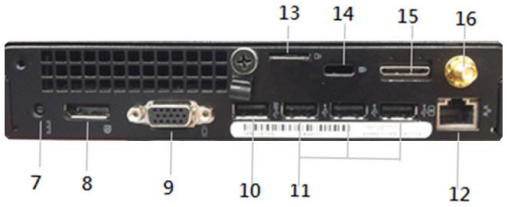
Motherboard layout



Number	Name	Number	Name
1	HDD_ODD Power Cable Connector (HDD_ODD_PWR)	13	PS2 Serial Port Connector (KB_MS_SERIAL)
2	Front USB2.0 Connector (FRONTPANEL)	14	CPU Power Connector (CPU_PWRCONN)
3	SATA 1 Connector (SATA1) (White color)	15	Processor Socket
4	SATA 0 Connector (SATA0) (Blue color)	16	CPU Fan Connector (FAN_CPU)
5	Internal Speaker Connector (INT_SPKR)	17	Memory Connectors (DIMM1, DIMM2)
6	PCH chip	18	RTCRST Jumper (RTCRST)
7	PSWD Jumper (PSWD)	19	HDD LED and Chassis Detect Connector (FRONT_HDD_LED)
8	SERVICE MODE Jumper (SERVICE_MODE)	20	Battery Connector (BATTERY)
9	PCIe x16 Connector (SLOT1)	21	Power Switch Connector (PWR_SW)
10	PCIe x1 Connector (SLOT2)	22	ATX Power Connector (ATX_POWERCON)
11	Front Audio Connector (FRONT_AUDIO)	23	System Fan Connector (FAN_SYS)
12	Intrusion Switch Connector (INTRUDER)		

Micro Computer View

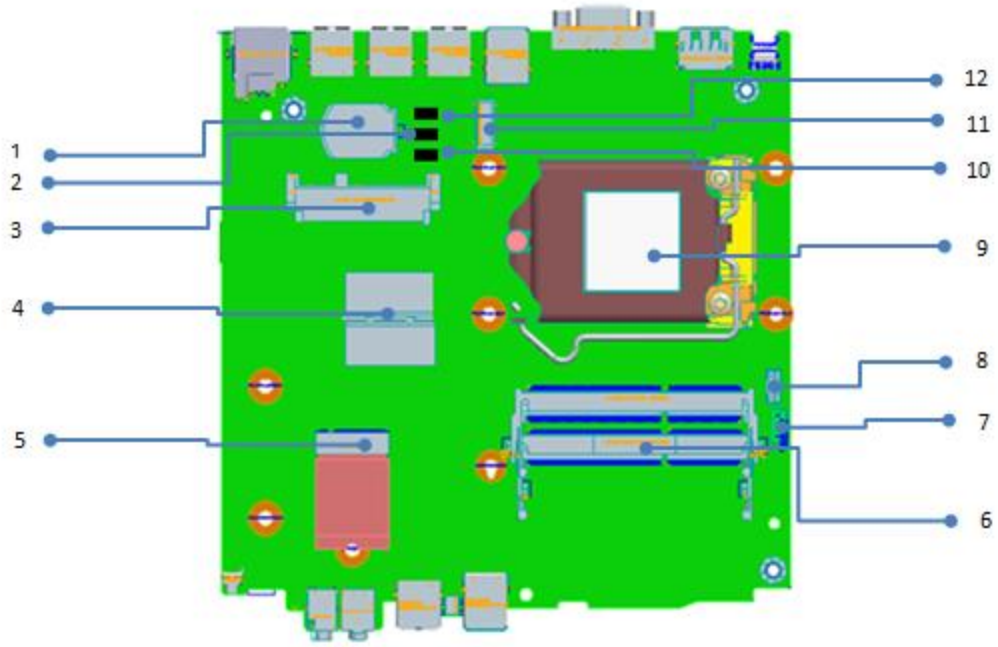




Front View				Rear View			
1	Power Switch	5	USB2.0	7	DC_IN	12	RJ45
2	HDD Light	6	USB3.0	8	DP	13	Pad Lock
3	Audio Jack			9	VGA	14	Kensington Lock
4	Mic Jack			10	USB3.0	15	Option I/O (PS2/COM)
				11	USB2.0	16	External Antenna (Main)

Micro Motherboard Layout

Motherboard layout



Number	Name	Number	Name
1	Battery connector (BATTERY)	7	Internal speaker connector(INT_SPKR)

2	PSWD Jumper (PSWD)	8	System Fan Connector (FAN_SYS)
3	SATA Connector (HDD)	9	Processor Socket
4	PCH chip	10	SERVICE MODE Jumper (SERVICE_MODE)
5	M.2 socket (SLOT1_M.2)	11	PS2 / Serial Port Connector (KB_MS_SERIAL)
6	Memory Connectors (DIMM1, DIMM2)	12	RTCRST Jumper (RTCRST)

Optional PS2 / Serial Port

Marketing System Configurations

NOTE: Offerings may vary by country; not all configurations available in all regions. 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

	MT	SFF	Micro
Windows Operating System	Microsoft® Windows 8 Pro (64 bit), Microsoft® Windows 8 (64bit) Microsoft® Windows 8 Single Language (64bit) Microsoft® Windows 7® Home Premium SP1 (32 and 64 bit), Microsoft® Windows 7® Home Premium w/MUI SP1 (32 and 64 bit), Microsoft® Windows 7® Professional w/MUI SP1 (32 and 64 bit), Microsoft® Windows 7® Professional SP1 (32 and 64 bit),		Microsoft® Windows 8.1 Pro (64 bit), Microsoft® Windows 8 .1(64bit) Microsoft® Windows 8.1 Single Language (64bit) Microsoft® Windows 7® Professional w/MUI SP1 (32 and 64 bit), Microsoft® Windows 7® Professional SP1 (32 and 64 bit),
Other	Ubuntu 12.04		
OS Media Support (optional)	Optional		

Chipset

	MT	SFF	Micro
Chipset	Intel H81 Chipset		
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]	4KB located at TPM1.2 on chipset		
Non-TPM	Available in select countries		
NIC EFuse	LOM configuration contained in LOM EFuse		

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

	MT	SFF	Micro
Intel Quad Core Processors			
Core™ I5-4570 Processor (Quad Core, 3.20GHz Turbo, 6MB, w/ HD Graphics 4600), 84W	X	X	
Intel® Core™ i5-4590 Processor (Quad Core, 3.30GHz Turbo, 6MB, w/ HD Graphics 4600), 84W	X	X	
Intel® Core™ i5-4590T QC/6MB/4T/2.0GHz, 35W			X
Intel Dual Core Processors			
Core™ i3-4130 Processor (Dual Core, 3.4GHz, 3MB w/ HD Graphics 4400), 54W	X	X	
Core™ i3-4150 Processor (Dual Core, 3.5GHz, 3MB w/ HD Graphics 4400), 54W	X	X	
Core™ i3-4160 Processor (Dual Core, 3.6GHz, 3MB w/ HD Graphics 4400), 54W	X	X	
Pentium® G3220 Processor (Dual Core, 3.0GHz, 3MB w/ HD Graphics), 54W	X	X	
Pentium® G3240 Processor (Dual Core, 3.1GHz, 3MB w/ HD Graphics), 54W	X	X	
Pentium® G3250 Processor (Dual Core, 3.2GHz, 3MB w/ HD Graphics), 54W	X	X	
Celeron® G1820 Processor (Dual Core, 2.7GHz, 2MB w/HD Graphics), 54W	X	X	
Celeron® G1840 Processor (Dual Core, 2.8GHz, 2MB w/HD Graphics), 54W	X	X	
Intel® Core™ i3-4150T DC/3MB/4T/3.0GHz, 35W			X

Intel® Core™ i3-4160T DC/3MB/4T/3.0GHz, 35W			X
Intel® Pentium™ G3240T DC/3MB/2T/2.7GHz, 35W			X
Intel® Pentium™ G3250T DC/3MB/2T/2.7GHz, 35W			X
Intel® Celeron™ G1840T DC/2MB/2T/2.5GHz, 35W			X

Memory

NOTE: Memory modules should be installed in pairs of matched memory size, speed, and technology. If the memory modules are not installed in matched pairs, the computer will continue to operate, but with a slight reduction in performance. The entire memory range is available to 64-bit operating systems.

	MT	SFF	Micro
Type: DDR3 Synch DRAM Non-ECC Memory	1600 MHz		
DIMM Slots	2 Long DIMM		2 SO-DIMM
DIMM Capacities	Up to 8GB		
Minimum Memory	2GB		
Maximum System Memory	16GB		
Memory Configurations			
8GB[1] DDR3, 1600MHz, (2 x 4GB)	X	X	X
4GB[1] DDR3, 1600MHz, (1 x 4GB)	X	X	X
2GB DDR3, 1600MHz, (1 x 2GB)	X	X	X

[1] The 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	SFF	Micro
Bays			

Optical Drive Bay Supported	1 HH or 1 Slim Line	1 Slim Line	N/A
Hard Drive Bay Supported	2	1	1
Maximum Hard Drives Supported (3.5" / 2.5")	2x3.5" OR 2x2.5" OR 1x3.5" + 1x2.5"	1x3.5" or 1x2.5"	1x 2.5"
Interface			
SATA2.0	1	1	N/A
SATA3.0	2	1	1
3.5" Hard Drives			
1TB[1] SATA3 7200 RPM HDD	X	X	N/A
500GB[1] SATA3 7200 RPM HDD	X	X	N/A
2.5" Hard Drives			
1TB[1] SATA3 5400 RPM HDD	N/A	N/A	X
500GB[1] SATA3 7200 RPM HDD	N/A	N/A	X
500GB[1] SATA3 Solid State Hybrid Drive w/8GB Flash	X	X	X
500GB[1] SATA3 Secure Encrypted Hybrid Drive	X	X	X
128GB[1] SATA3 Solid State Drive	X	X	X
250GB[1] 7200RPM Hard Drive	X	X	X
Optical Drive			
DVD+/-RW[2]	X	X	N/A
DVD-ROM[3]	X	X	N/A
Media Card Reader			
Dell 19 in 1 Media Card Reader	X	N/A	N/A

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.

4 Dell 19 in 1 Media Card Reader (MCR) is supported via a F5 to F3 bay converter on the MT and requires a slim line optical drive.

System Board Connectors

NOTE: See Detailed Engineering Specifications for maximum card dimensions.

	MT	SFF	Micro
PCIex16 Gen 2	1FH	1HH	N/A
PCIex1	3FH	1HH	N/A
M.2 2230	NA		1 slot
Total expansion	4 slots	2 slots	1 slot

Graphics / Video Controller

NOTE: MT supports full height (FH) cards and SFF supports low profile (LP) cards.

	MT	SFF	Micro
Intel HD Graphics	X	X	X
Discrete Graphics Card Options			
1GB AMD Radeon HD8490	Optional		
1GB AMD Radeon HD8570	Optional		
2 GB AMD Radeon™ R7 250 *after June 2014	Optional		N/A
1 GB AMD Radeon™ R5 240 *after June 2014	Optional		N/A

External Ports / Connectors

NOTE: MT supports full height (FH) cards and SFF supports low profile (LP) cards. See chassis diagrams section for port/connector locations

	MT	SFF	Micro
USB 2.0 (Front / Rear / Internal)	2 / 4 / 1	2 / 4 / 0	1/3/1
USB 3.0 (Front / Rear / Internal)	0 / 2 / 0	0 / 2 / 0	1/1/0
Network Connector (RJ-45)	1	1	1
Serial	Via optional add-on bracket or PCIe card		Via optional daughter card
PS/2	Via optional add-on bracket		Via optional daughter card
Parallel	Via optional PCIe card		N/A
Video			
VGA	1	1	1
DisplayPort 1.2	1	1	1
HDMI	N/A	N/A	N/A
Audio			

Front panel Mic-in, Headphones out	X	X	N/A
Rear panel Mic-in/Line-in, Line-out	X	X	N/A
Front panel Mic-in, GHS	N/A	N/A	X

Communications – Integrated Realtek RTL8151GD

NOTE: MT supports full height (FH) cards and SFF supports low profile (LP) cards.

	MT	SFF	Micro
Realtek RTL8151GD[1] Ethernet LAN 10/100/1000 (Remote Wake Up, PXE support)	Integrated on system board		
Broadcom NetXtreme 10/100/1000 PCIe Gigabit Networking Card	Optional card		N/A

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 – Wireless

NOTE: MT supports full height (FH) cards and SFF supports low profile (LP) cards.

	MT	SFF	Micro
Dell Wireless 1540 PCIe WLAN card (802.11a/b/g/n)	Optional card		N/A
Intel Wireless 7260AC M.2 WLAN card	N/A		Optional card

Audio and Speakers

	MT	SFF	Micro
Internal Business Speakers	Optional		X
Dell AX210CR USB Stereo speakers	Optional		N/A
Dell AX510/AX510PA Flat Panel Soundbar Speakers	Optional		N/A
Dell AC411 External Speakers			X
Dell AC511 Sound Bar			X

Keyboards and Mouse

	MT	SFF	Micro
Dell Entry Keyboard[1]	Optional		
Dell Multimedia Pro Keyboard[1]	Optional		
Dell SmartCard Keyboard[1]	Optional		
Dell USB Optical Mouse[1]	Optional		
Dell Laser Mouse[1]	Optional		

[1] These offerings are not Halogen Free

Security

	MT	SFF	Micro
Trusted Platform Module (TPM) 1.2[1]	Integrated on system board		
Chassis Intrusion Switch	Integrated on system board		
Dell Smartcard Keyboard	Optional		
Chassis lock slot and loop support	Standard		

1TPM is not available in all countries. Depending on your country regulations, no-TPM system boards may be available.

Software

	MT	SFF	Micro
Dell Client Manager	Available on Dell.com		N/A
Dell Data Protection | Security Tools (DDP|ST)	Standard		Optional
Dell Data Protection | Encryption (DDPE)	Optional		Optional

Environmental

NOTE: For more details on Dell Environmental features, please to go to Environmental Attributes section. See your specific region for availability.

	MT	SFF	Micro
Multi-pack support	Optional, US only		
80 PLUS Energy Efficient Power Supply	Optional		N/A

Service and Support

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

	MT	SFF	Micro
1 Year Warranty[1] Next Business Day On-site[2] (1-1-1)	Standard in some regions		
3 Year Warranty[1] Next Business Day On-site[2] (3-3-3)	Standard in some regions		
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.

Recommended Accessories

To complete your Dell Experience, we recommend the following accessories for your OptiPlex 3020 system.

For MT/SFF

Category	**Product**
Audio & Multimedia	Dell 2.0 USB Soundbar AC511
Audio & Multimedia	Dell 2.1 Multimedia Speaker AC411
Audio & Multimedia	Jabra UC Voice 250 MS Headset
Audio & Multimedia	Logitech C615 Webcam
Cables & Dongles	Dell DP to DVI-SL Adapter
Displays	Dell Dual Monitor Stand MDS14
Displays	Dell E1913S
Displays	Dell E1914H
Displays	Dell E2014H
Displays	Dell E2014T Touch Monitor
Displays	Dell E2214H
Displays	Dell P1913
Displays	Dell P1914S
Displays	Dell P2014H
Displays	Dell P2214H
Displays	Dell P2414H
Displays	Dell Single-Arm Stand MSA14
Imaging	Dell B1165nfw Mono Multifunction Printer
Imaging	Dell B5460dnf Mono Laser Printer
Imaging	Dell C1765nfw Color Multifunction Printer
Imaging	Dell B2375dnf Mono Multifunction Printer
Imaging	Dell B5465dnf Mono Laser Printer
Imaging	Dell C5765dnf Color Multifunction Printer

Input Devices	Dell Business Multimedia Keyboard KB522
Input Devices	Dell Laser Mouse
Input Devices	Dell Smartcard Keyboard KB813
Input Devices	Dell Wired Keyboard
Input Devices	Dell Wired Mouse
Power	APC BE750G Back UPS
Power	Belkin 8-outlet Surge Protector with 6ft Power Cord & Telephone Protection
Security	Dell Premium Lock LP500
Storage	Dell 1TB Portable Hard Drive

For Micro

Category	**Product**
Audio & Multimedia	Dell Rihanna (Dell Lync Headset) -Dell version of Jabra 550
Audio & Multimedia	AC411 External Speakers
Audio & Multimedia	AC511 Sound Bar
Audio & Multimedia	C525 Logitech Camera (good)
Cables & Dongles	Dell DP to DVI-SL
Cables & Dongles	Dell DP to HDMI
Cables & Dongles	3 foot power A/C cord (WW)
Stands and Mounting Solutions	Dual Monitor Stand
Stands and Mounting Solutions	Single Monitor Stand
Stands and Mounting Solutions	Dell OptiPlex Micro Vertical Stand
Stands and Mounting Solutions	Dell OptiPlex Micro VESA Mount
Stands and Mounting Solutions	Dell OptiPlex Micro Dual VESA Mount
Stands and Mounting Solutions	Dell OptiPlex Micro All in One Mount
Stands and Mounting Solutions	Dell OptiPlex Micro Console with DVD-RW
Displays	E1914H
Displays	E2014H
Displays	E2214H
Displays	E2314H
Displays	E2414H
Displays	P2014H
Displays	P2214H
Displays	P2314H
Displays	P2414H

Displays	U2412M
Displays	E1715S
Displays	E1913
Displays	P1914S
Displays	P2213
Displays	P1913
Displays	E2014T
Displays	P2314T
Displays	UZ2214H
I/O	Entry - Ruby Keyboard
I/O	Entry - Indigo Mouse
I/O	Scarlet Multimedia KB
I/O	Cardinal Smart Card KB
I/O	Naruto Laser Mouse (6-button mouse)
I/O	Burgundy Wireless KB
Imaging	Dell B1165nfw Mono Multifunction Printer
Imaging	Dell B5460dnf Mono Laser Printer
Imaging	Dell C1765nfw Color Multifunction Printer
Imaging	Dell B2375dfw Mono Multifunction Printer
Imaging	Dell B5465dnf Mono Laser Printer
Imaging	Dell C5765dnf Color Multifunction Printer
Security	Kensington Twin Head Lock
Security	Dell Premium Lock LP500
Storage	Dell External Tray Load ODD (Emerald)
Storage	Dell 1TB Portable Hard Drive (Lepton Lite)

Micro Mounting Options

Product
Dell OptiPlex Micro Vertical Stand
Dell OptiPlex Micro VESA Mount
Dell OptiPlex Micro Dual VESA Mount
Dell OptiPlex Micro All in One Mount
Dell OptiPlex Micro Console with DVD-RW

Dell OptiPlex Micro Vertical Stand

Dell OptiPlex Micro VESA Mount

Dell OptiPlex Micro Dual VESA Mount

Dell OptiPlex Micro All in One Mount

Dell OptiPlex Micro Console with DVD-RW

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.

	MT	SFF	Micro
Chassis Volume (liters)	26.27	8.38	1.2
Chassis Weight (pounds / kilograms)	16.98 / 7.7	11.03 / 5	2.82 / 1.28
Chassis Dimensions (H x W x D)			
Height (inches / centimeters)	14.17 / 36	11.42 / 29	6.93 / 17.6
Width (inches / centimeters)	6.89 / 17.5	3.65 / 9.26	1.42 / 3.6
Depth (inches / centimeters)	16.42 / 41.7	12.28/31.2	7.17 / 18.2
Shipping Weight (pounds / kilograms – includes packaging materials)	38.1 / 17.3	20.1 / 9.1	7.3 / 3.3
Packaging Parameters (H x W x D)			
Height (inches / centimeters)	14.1 / 35.8	10.2 / 25.9	5.2 / 13.3
Width (inches / centimeters)	18.7 / 47.6	15.8 / 40.2	9.4 / 23.8
Depth (inches / centimeters)	21.3 / 54.1	19.3 / 48.9	19.6 / 49.8

Micro Mounting Dimensions (Physical)

	Dell OptiPlex Micro Vertical Stand	Dell OptiPlex Micro VESA Mount	Dell OptiPlex Micro Dual VESA Mount	Dell OptiPlex Micro All in One Mount	Dell OptiPlex Micro Console with DVD-RW
Volume (liters)	0.23L	1.6L	1.9L	4.88L	4.3L
Weight (pounds / kilograms)	0.104 / 0.047	1.358 / 0.616	2.624/1.19	3.57/1.62	3.95 / 1.79
Dimensions (H x W x D)					
Height (inches / centimeters)	6.61/16.8	7.47 / 18.99	7.52 / 19.12	12.3/31.26	2.52 / 6.41
Width (inches / centimeters)	0.69/ 1.75	1.93 / 4.92	2.35 / 5.97	2.20/5.59	9.64 / 24.5
Depth (inches /	3.07/ 7.8	6.75 / 17.17	6.77 / 17.22	11.00/27.95	11.02 / 28.0

centimeters)					
Shipping Weight (pounds / kilograms – includes packaging materials)	0.69	0.69	1.29	2.01	2.07
Packaging Parameters (H x W x D)					
Height (inches / centimeters)	8.54/21.7	8.54/21.7	10.86/27.6	15/38.1	13.38/34
Width (inches / centimeters)	7.87/20	7.87/20	8.03/20.4	6.30/16	5.11/13
Depth (inches / centimeters)	2.52/6.4	2.52/6.4	2.72/6.9	15.27/38.8	14.13/35.9

System Board Connector Maximum Add-in Card Allowable Dimensions

	MT	SFF	Micro
PCIex16 Slot (Black) (Voltage supported 3.3V/12V)	1	1	N/A
Height (inches / centimeters)	4.376 / 11.115	2.731 / 6.89	N/A
Length (inches / centimeters)	6.6 / 16.765	6.6 / 16.765	N/A
Maximum Wattage	75W	50W	N/A
PCIex1 Slot (Black) (Voltage supported 3.3V/12V)	3	1	N/A
Height (inches / centimeters)	4.376 / 11.115	2.731 / 6.89	N/A
Length (inches / centimeters)	4.5 / 11.44	4.5 / 11.44	N/A
Maximum Wattage	10W	10W	N/A
M.2 2230 type (Black) (Voltage supported 3.3V)			1
Length (inches / centimeters)			11.81 / 30
Width(inches / centimeters)			8.66 / 22
Maximum Wattage			2 W

System Level Environmental and Operating Conditions

	MT	SFF	Micro
Temperature			

Operating	0 degree to 40 degree	0 degree to 40 degree	0 degree to 40 degree
Non-Operating (Storage)	-40 degree to 65 degree	-40 degree to 65 degree	-40 degree to 65 degree
Relative Humidity	10 ~ 90 %	10 ~ 90 %	10 ~ 90 %
Maximum Vibration			
Operating	0.26 Grms	0.26 Grms	0.26 Grms
Non-Operating	1.46 Grms	1.46 Grms	1.37 Grms
Maximum Shock			
Operating	40G/2ms	40G/2ms	40G/2ms
Non-Operating	55G/19ms	55G/19ms	105G/2ms

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 manufacture to confirm the output type.

	MT			SFF			Micro
Power Supply	APFC	EPA Gold	EPA Bronze	APFC	EPA Gold	EPA Bronze	Adapter
Wattage	290W	290W	290W	255W	255W	255W	65W
AC input Voltage Range	90 – 264Vac	90 – 264Vac	90 – 264Vac	90 – 264Vac	90 – 264Vac	90 – 264Vac	90V~264 V
AC input current (low ac range/high AC range)	5.4A / 2.7A	5.4A / 2.7A	5.4A / 2.7A	4.6A / 2.3A	4.6A / 2.3A	4.6A / 2.3A	MAX 1.7 A@ 90 Vac MAX 1A @ 180Vac
AC input Frequency	47HZ/63 HZ	47HZ/63 HZ	47HZ/63 HZ	47HZ/63HZ	47HZ/63HZ	47HZ/63 HZ	Min 47 Hz , Max 63Hz
AC holdup time (80% load)	16 mini sec	16 mini sec	16 mini sec	16 mini sec	16 mini sec	16 mini sec	10mS

Average Efficiency (Energy Star 5.2 Compliant)		87 – 90 – 87% @ 20 – 50 – 100% load	82 – 85 – 82% @ 20 – 50 – 100% load		87 – 90 – 87% @ 20 – 50 – 100% load	82 – 85 – 82% @ 20 – 50 – 100% load	>87%
Typical Efficiency (Active PFC)	65%			65%			Minimum Efficiency >87% @ 100V,Full load
DC parameters							
	MT			**SFF**			**Micro**
Power Supply	APFC	EPA Gold	EPA Bronze	APFC	EPA Gold	EPA Bronze	Adapter
+12.0v output	12VA/14A; 12VB/16A	12VA/14A ; 12VB/16A	12VA/14A ; 12VB/16A	12VA/14A ; 12VB/13A	12VA/14A; 12VB/13A	12VA/14A; 12VB/13A	19.5V /3.34A
-12.0v output	N/A	N/A	N/A	N/A	N/A	N/A	NA
+12.0v auxiliary output	1.67A	1.67A	1.67A	1.67A	1.67A	1.67A	NA
Max total power	290W	290W	290W	255W	255W	255W	65W(19.5V)
Max combined 12.0v power (note: only if more than one 12v rail)	290W	290W	290W	255W	255W	255W	65W(19.5V)
BTUs/h (based on PSU max wattage)	989 BTU	989 BTU	989 BTU	870 BTU	870 BTU	870 BTU	NA
Power Supply Fan	80*25mm	80*25mm	80*25mm	60*25mm	60*25mm	60*25mm	NA
Compliance							

	MT			SFF			Micro
Power Supply	APFC	EPA Gold	EPA Bronze	APFC	EPA Gold	EPA Bronze	Adapter
Erp Lot6 Tier 2 0.5watt requirement	Yes	Yes	Yes	Yes	Yes	Yes	Y
Climate Savers / 80Plus Compliant	No	Yes	Yes	No	Yes	Yes	N
FEMP Standby Power Compliant	Yes	Yes	Yes	Yes	Yes	Yes	N

3.0v CMOS battery (Type and estimated battery life)				
Brand	Type	Voltage	Composition	Life
JHIH HONG	CR2032	3V	Lithium	Continuous Discharge Under 15 kΩ Load to 2.5V End-Voltage. 20°C±2°C: 940Hrs or longer; 910Hrs or longer after 12 months
PANASONIC	CR2032	3V	Lithium	Continuous Discharge Under 15 kΩ Load to 2.5V End-Voltage. 20℃±2℃.1183Hrs. or Longer.1133Hrs.or Longer after 12 months.
MITSUBISHI	CR2032	3V	Lithium	Continuous Discharge Under 15 kΩ Load to 2.0V End-Voltage. 20℃±2℃ 940Hrs. or Longer.910Hrs.or Longer after 12 months.
KTS	CR2032	3V	Lithium	Continuous Discharge Under 15 kΩ Load to 2.0V End-Voltage. 23℃±3℃ 940Hrs. or Longer.910Hrs.or Longer after 12 months.

Audio

Integrated Realtek High Definition Audio	MT	SFF	Micro
Codec chip	ALC3220	ALC3220	ALC3234
High Definition Stereo Support	X	X	X

Number of channels	2	2	2
Number of Bits / Audio resolution	16, 24-bit resolution	16, 24-bit resolution	16, 24-bit resolution
Sampling rate (recording / playback)	Support 44.1K/48K/96K/192 kHz sample rates Support 44.1K/48K/96K/192 kHz sample rates	Support 44.1K/48K/96K/192 kHz sample rates Support 44.1K/48K/96K/192 kHz sample rates	Support 44.1K/48K/96K/192 kHz sample rates Support 44.1K/48K/96K/192 kHz sample rates
Signal to Noise Ratio	98 dB DAC outputs, 92 dB for ADC inputs	98 dB DAC outputs, 92 dB for ADC inputs	95 dB DAC outputs, 88 dB for ADC inputs
Analog Audio	X	X	X
Dolby Digital	N/A	N/A	N/A
THX	N/A	N/A	N/A
Digital out (S/PDIF)	N/A	N/A	N/A
Audio Jack Impedance			
Microphone	40K ohm~60K ohm	40K ohm~60K ohm	40K ohm~60K ohm
Line-in	40K ohm~60K ohm	40K ohm~60K ohm	40K ohm~60K ohm
Line-out	100~150 ohm	100~150 ohm	100~150 ohm
Headphone	1~4 ohm	1~4 ohm	1~4 ohm
Internal Speaker Power Rating	2Watt (peak) 8 Ohm / 1Watt (average) 8 Ohm	2Watt (peak) 8 Ohm / 1Watt (average) 8 Ohm	2.6Watt (peak) 4 Ohm / 2 Watt (average) 4 Ohm

Communications

Integrated Realtek RTL8151GD

INTEGRATED Realtek RTL8151GD GIGABIT[1] ETHERNET LAN 10/100/1000	MT	SFF	Micro
External Connector Type	RJ45	RJ45	RJ45
Data Rates Supported	10/100/1000 Mbps[1]	10/100/1000 Mbps[1]	10/100/1000 Mbps[1]
Controller Details			
Controller Bus Architecture	PCI Express Base Specification Revision 1.1	PCI Express Base Specification Revision 1.1	PCI Express Base Specification Revision 1.1
Integrated Memory	Yes	Yes	Yes
Data Transfer Mode (example: Bus-Master DMA)	Yes	Yes	Yes
Power Consumption (full operation per data rate connection speed)	828.76mW (Max.)	828.76mW (Max.)	828.76mW (Max.)

Power Consumption (standby operation)	49.37mW (Max.)	49.37mW (Max.)	49.37mW (Max.)
IEEE Standards Compliance	802.3	802.3	802.3
Hardware Certifications	N/A	N/A	N/A
Boot ROM Support	N/A	N/A	N/A
Network Transfer Mode			
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)	10 Mb (full/half-duplex) 100 Mb (full/half-duplex) 1000 Mb (full-duplex)	10 Mb (full/half-duplex) 100 Mb (full/half-duplex) 1000 Mb (full-duplex)
Environmental			
Operating Temperature	0° C to 70° C	0° C to 70° C	0° C to 70° C
Operating Humidity	IC level 40~60% RH PCB level 0~90% RH	IC level 40~60% RH PCB level 0~90% RH	IC level 40~60% RH PCB level 0~90% RH
Operating System Driver Support	Windows 7 32/64, Windows 8 32/64	Windows 7 32/64, Windows 8 32/64	Windows 7 32/64, Windows 8.1 64
Manageability	WOL, PXE 2.1	WOL, PXE 2.1	WOL, PXE 2.1
Management Capabilities Alerting	N/A	N/A	N/A

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.

Network Adapter

Broadcom NetXtreme 10/100/1000 PCIe Gigabit1 Networking Card	MT	SFF	Micro
External Connector Type	RJ45		N/A
Data Rates Supported	10/100/1000 Mbps Half/Full duplex		N/A
Controller Details			
Controller Bus Architecture	PCIe c1.0a x1		N/A
Integrated Memory	64KBytes RX, 8KBytes TX		N/A
Data Transfer Mode (example: Bus-Master DMA)	Bus-Master DMA		N/A
Power Consumption (full operation per data rate connection speed)	2.84W (860mA @ +3.3V)	2.84W (860mA @ +3.3V)	N/A
Power Consumption (standby operation)	Less than 300mW		N/A

IEEE Standards Compliance	802.3, 802.2, 802.3x, 802.1p	N/A
Hardware Certifications	FCC B, VCCI B, CE	N/A
Boot ROM Support	No	N/A
Network Transfer Mode		
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.	N/A
Environmental		
Operating Temperature	0° C to 55° C (32° F - 131° F)	N/A
Operating Humidity	5% ~ 95% (non-condensing)	N/A
Operating System Driver Support	Windows 7 32/64, Windows 8 32/64, Linux	N/
Manageability	WOL, PXE2.1, ACPI	N/A
Management Capabilities Alerting	N/A	N/A

[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.

Wireless

	MT	SFF	Micro
WLAN card	DW1540		Intel 7260AC
Connector Type	Custom WLAN Antenna Connector		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.		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		802.11a, 802.11b, 802.11g, 802.11n
802.11a Data Rates Supported	11, 5.5, 2, 1 Mbps		11, 5.5, 2, 1 Mbps
802.11b Data Rates Supported	54, 48, 36, 24, 18, 12, 9, 6 Mbps		54, 48, 36, 24, 18, 12, 9, 6 Mbps
802.11g Data Rates Supported	54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1 Mbps		54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1 Mbps
802.11n Data Rates Supported	270, 240, 180, 135, 130, 121.5, 120, 117, 108, 104, 90, 81, 78, 65, 60, 58.5, 54, 52, 40.5, 39, 30, 27,		270, 240, 180, 135, 130, 121.5, 120, 117,

	26, 19.5, 13.5, 13, 6.5 Mbps	108, 104, 90, 81, 78, 65, 60, 58.5, 54, 52, 40.5, 39, 30, 27, 26, 19.5, 13.5, 13, 6.5 Mbps
Encryption	WEP 64-bit and 128-bit, TKIP, AES-CCMP 128-bit	WEP 64-bit and 128-bit, TKIP, AES-CCMP 128-bit
Operating Temperature	-10–85°C	0–85°C
Operating Humidity	Max Operating Humidity 95 %	
Operating System Driver Support	Windows 8 32/64, Windows 7 32/64, Windows XP 32/64, Vista 32/64	Windows 8 /8.1 32/64, Windows 7 32/64

Serial / PS/2 Add-in Bracket

Serial / PS/2 Add-in Bracket	MT	SFF	Micro
Connector Type	RS232 and PS2		RS232 and PS2
Controller Details			
Interface type	24 pins header connect to MB directly		Through 24 pins connector dongle
IO Ports	1 Serial, 2 PS2		1 Serial, 2 PS2
Full height PS2/Serial add in dongle	Optional		N/A
Half height PS2/Serial add in dongle		Optional	N/A
Special PS2/Serial add in dongle for Mico			Optional
Environmental			
Operating Temperature	0° C to 70° C (32° F to 158° F)		0° C to 70° C (32° F to 158° F)
Operating Humidity	20% to 80% (non-condensing)		20% to 80% (non-condensing)
Storage Temperature	-20 to 85° C (-4 to 185° F)		-20 to 85° C (-4 to 185° F)

Serial / Parallel Port PCIe Add-in Card

Serial / Parallel Port PCIe Add-in Card	MT	Micro
Connector Type	RS-232 and IEEE1284	N/A
Data Rates Supported	50bps ~115.2Kbps(Serial)&Maximum 1.8MBp(Parallel)	N/A
Controller Details		
Controller	SUNIX SUN2212	N/A
Controller Bus Architecture	PCI Express Spec 2.0, Single-Lane (x1)	N/A
Driver Support	Microsoft Client XP/Vista/7/8 (X86/X64) Microsoft Server 2000/2003/2008/2008 R2	N/A

	(X86/X64) Microsoft Embedded XP Embedded/POS Ready 2009/ Embedded System 2009 Linux 2.4.x/2.6.x/3.x DOS	
Full height Serial/Parallel add in dongle	Optional	N/A
Environmental		
Operating Temperature	0 to 60°C (32 to 140°F)	N/A
Operating Humidity	5 to 95% RH	N/A
Storage Temperature	-20 to 85°C (-4 to 185°F)	N/A

Serial Port PCIe Add-in Card

Serial Port PCIe Add-in Card	MT	SFF
Connector Type	Expands four RS-232 serial ports	
Data Rates Supported	50bps ~115.2Kbps	
Controller Details		
Controller	SUN2410	
Controller Bus Architecture	PCI Express Spec 2.0, Single-Lane (x1)	
Driver Support	Microsoft Client XP/Vista/7/8 (X86/X64) Microsoft Server 2000/2003/2008/2008 R2 (X86/X64) Microsoft Embedded XP Embedded/POS Ready 2009/ Embedded System 2009 Linux 2.4.x/2.6.x/3.x DOS	
Full height Serial add in dongle	Optional	
Half height Serial add in dongle		Optional
Environmental		
Operating Temperature	0 to 60° C (32 to 140° F)	
Operating Humidity	5 to 95% RH	
Storage Temperature	-20 to 85° C (-4 to 185° F)	

Serial Port PCIe Add-in Card

Serial Port PCIe Add-in Card	SFF
Connector Type	RS-232
Data Rates Supported	50bps ~115.2Kbps
Controller Details	
Controller	SUNIX SUN2212
Controller Bus Architecture	PCI Express Spec 2.0, Single-Lane (x1)
Driver Support	Microsoft Client XP/Vista/7/8 (X86/X64) Microsoft Server 2000/2003/2008/2008 R2 (X86/X64) Microsoft Embedded XP Embedded/POS Ready 2009/ Embedded System 2009 Linux 2.4.x/2.6.x/3.x DOS
Half height Serial port in dongle	Optional
Environmental	

Operating Temperature	0 to 60° C (32 to 140° F)
Operating Humidity	5 to 95% RH
Storage Temperature	-20 to 85° C (-4 to 185° F)

Parallel Port PCIe Add-in Card

Parallel Port PCIe Add-in Card	SFF	Micro
Connector Type	IEEE1284	N/A
Data Rates Supported	Maximum 1.8MBps	N/A
Controller Details		
Controller	SUNIX SUN2212	N/A
Controller Bus Architecture	PCI Express Spec 2.0, Single-Lane (x1)	N/A
Driver Support	Microsoft Client XP/Vista/7/8 (X86/X64) Microsoft Server 2000/2003/2008/2008 R2 (X86/X64) Microsoft Embedded XP Embedded/POS Ready 2009/ Embedded System 2009 Linux 2.4.x/2.6.x/3.x DOS	N/A
Half height Serial port in dongle	Optional	N/A
Environmental		
Operating Temperature	0 to 60° C (32 to 140° F)	N/A
Operating Humidity	5 to 95% RH	N/A
Storage Temperature	-20 to 85° C (-4 to 185° F)	N/A

Graphics / Video Controller

NOTE: MT supports full height (FH) cards and SFF supports low profile (LP) cards.

Onboard Graphics

Onboard Graphics	MT	SFF	Micro
Bus Type	Integrated		
GPU core clock	Depends on CPU type (Intel® HD Graphics@1100Mhz /HD Graphics 4600 @ 1150MHz)		
Frame Buffer Memory (onboard and shared) Size and Speed	Depends on available system memory (Up to 1.7GB with 4GB system Memory)		
Overlay Planes	Yes		
Maximum Color Depth	32bit		
Maximum Vertical Refresh Rate	75Hz		
Multiple Display Support	Yes		

Operating System Graphics / API Support	OpenGL 4.0/DirectX 11.1/OpenCL 1.2
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Up to 3840x2160 @ 60Hz (DP) Up to 2560x1600 @ 60Hz (HDMI) Up to 4096x2304 @ 24Hz (HDMI) Up to 1920x1200 @ 60Hz (DVI&VGA)
External Connectors	VGA, DisplayPort
DisplayPort	
Bus Type	DDPB
Maximum Supported Resolution	Up to 3840x2160 @ 60Hz
Maximum Power Consumption	N/A
External Connectors	DisplayPort

1GB AMD RADEON HD8490

1GB AMD RADEON HD8490	MT	SFF
Bus Type	PCIEx16	
GPU core clock	875Mhz	
Frame Buffer Memory (onboard and shared) Size and Speed	1GB/900Mhz	
Maximum Power Consumption	35W	
Overlay Planes	Yes	
Maximum Color Depth	32-bits	
Maximum Vertical Refresh Rate	60Hz (2560x1600)	
Multiple Display Support	Yes	
Operating System Graphics / API Support	D3D / OpenGL4.1 / OpenCLv1.1 / DirectX11	
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Dual-Link DVI: 2560 x 1600, 60Hz DisplayPort: 2560 x 1600, 60Hz VGA: 1920 x 1440, 60Hz	
External Connectors	DisplayPort, DVI-I	
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.	

1GB AMD RADEON HD8570

1GB AMD RADEON HD8570	MT	SFF
Bus Type	PCIE x16	
GPU core clock	780Mhz	
Frame Buffer Memory (onboard	1GB/900Mhz	

and shared) Size and Speed		
Maximum Power Consumption	50W	
Overlay Planes	Yes	
Maximum Color Depth	24-bits	
Maximum Vertical Refresh Rate	60Hz (4096x2160)	
Multiple Display Support	Yes	
Operating System Graphics / API Support	D3D / OpenGL4.1 / OpenCLv1.1 / DirectX11	
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Single-Link DVI: 1920 x 1200, 60Hz DisplayPort1.2: 4096 x 2160, 60Hz(Single Stream) VGA: 1920 x 1440, 60Hz	
External Connectors	DisplayPort, DVI-I	
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.	

2GB AMD Radeon R7 250

Bus Type	PCIEx16
GPU core clock	1050MHz
Frame Buffer Memory (onboard and shared) Size and Speed	2GB / 1000MHz
Maximum Power Consumption	< 50W
Overlay Planes	Yes
Maximum Color Depth	32-bit
Maximum Vertical Refresh Rate	60Hz (4096x2160)
Multiple Display Support	Yes
Operating System Graphics / API Support	D3D / OpenGL4.3 / OpenCLv1.2 / DirectX11
Supported Resolutions & Max Refresh Rates (Hz) (Analog and/or digital)	Single-Link DVI: 1920 x 1200, 60Hz DisplayPort: 4096 x 2160, 60Hz VGA: 1920 x 1440, 90Hz
External Connectors	DisplayPort, SL-DVI-I
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.

1GB AMD Radeon R5 240

Bus Type	PCIEx16
GPU core clock	825MHz
Frame Buffer Memory (onboard and shared) Size and Speed	1GB / 1000MHz
Maximum Power Consumption	< 35W
Overlay Planes	Yes
Maximum Color Depth	32-bit
Maximum Vertical Refresh Rate	60Hz (4096x2160)
Multiple Display Support	Yes
Operating System Graphics / API Support	D3D / OpenGL4.3 / OpenCLv1.2 / DirectX11
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Single-Link DVI: 1920 x 1200, 60Hz DisplayPort: 4096 x 2160, 60Hz VGA: 1920 x 1440, 90Hz
External Connectors	DisplayPort, SL-DVI-I
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.

Hard Drives

3.5" 1TB SATA3 7200 RPM HDD

3.5" 1TB SATA3 7200 RPM HDD	MT	SFF	Micro

Capacity (bytes)	1,000,204,886,016	N/A
Dimensions inches (W x D x H)	5.87 x 4 x 1	N/A
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)	N/A
Internal buffer size	64 MB	N/A
Average Seek Time	13ms	N/A
Rotational Speed	7200 rpm	N/A
Logical Blocks	1,953,525,168	N/A
Power Source		
Power Consumption (reference only)	Idle 5.0W, Active 10.0W(running IOmeter utility)	N/A
Spin Up Current (reference only)	5V (1A) ,12V (2A)	N/A
Environmental Operating Conditions (Non-Condensing)		
Temperature Range	5°C to 60°C	N/A
Relative Humidity Range	10% to 90% non-condensing	N/A
Maximum Dew Point Temperature	Operating: 26°C Non-Operating: 33° C	N/A
Altitude Range	-1000 ft to 10000 ft	N/A
Environmental Non-Operating Conditions (Non-Condensing):		
Temperature Range	-40°C to 65°C	N/A
Relative Humidity Range	5% to 95% non-condensing	N/A
Maximum Wet Bulb Temperature	33°C	N/A
Altitude Range	-1000 ft to 40000 ft	N/A

3.5" 500GB SATA3 7200 RPM HDD

3.5" 500GB SATA3 7200 RPM HDD	MT	SFF	Micro
Capacity (bytes)	500,107,862,016		N/A
Dimensions inches (W x D x H)	5.87 x 4 x 1		N/A
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)		N/A
Internal buffer size	64 MB		N/A
Average Seek Time	13ms		N/A
Rotational Speed	7200 rpm		N/A
Logical Blocks	976,773,168		N/A
Power Source			
Power Consumption (reference only)	Idle 5.0W, Active 10.0W(running IOmeter utility)		N/A
Spin Up Current (reference only)	5V (1A) ,12V (2A)		N/A
Environmental Operating Conditions (Non-Condensing)			
Temperature Range	5°C to 60°C		N/A
Relative Humidity Range	10% to 90% non-condensing		N/A
Maximum Dew Point Temperature	Operating: 26°C Non-Operating: 33° C		N/A

Altitude Range	-1000 ft to 10000 ft	N/A
Environmental Non-Operating Conditions (Non-Condensing):		
Temperature Range	-40°C to 65°C	N/A
Relative Humidity Range	5% to 95% non-condensing	N/A
Maximum Wet Bulb Temperature	33°C	N/A
Altitude Range	-1000 ft to 40000 ft	N/A

2.5" 500GB SATA3 5400 RPM HYBRID HDD W/8GB FLASH

2.5" 500GB SATA3 5400 RPM HYBRID HDD W/8GB FLASH	MT	SFF	Micro
Capacity (bytes)	500,107,862,016		
Cache	Dynamic		
Dimensions inches (W x D x H)	Approximately (2.75 x 3.951 x 0.268 inches)		
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)		
Internal buffer size	64MB		
Average Seek Time	12 ms		
Rotational Speed	5400 rpm		
Logical Blocks	976,773,168		
Power Source			
Power Consumption (reference only)	Idle 0.7W, Active 3.25W		
Spin Up Current (reference only)	5V (1A)		
Environmental Operating Conditions (Non-Condensing)			
Temperature Range	5°C to 60°C		
Relative Humidity Range	10% to 90% non-condensing		
Maximum Dew Point Temperature	Operating: 26°C Non-Operating: 33° C		
Altitude Range	-1000 ft to 10000 ft		
Environmental Non-Operating Conditions (Non-Condensing):			
Temperature Range	-40°C to 65°C		
Relative Humidity Range	5% to 95% non-condensing		
Maximum Wet Bulb Temperature	33°C		
Altitude Range	-1000 ft to 40000 ft		

2.5" 500GB SATA 5400 RPM SECURE ENCRYPTED DRIVE

2.5" 500GB SATA 5400 RPM SECURE ENCRYPTED DRIVE	MT	SFF	Micro
Capacity (bytes)	500,107,862,016		
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	15 ms (Read)
Rotational Speed	5400 rpm
Logical Blocks	976,773,168
Power Source	
Power Consumption (reference only)	Idle 0.7W, Active 3.25W
Spin Up Current (reference only)	5V (1A)
Environmental Operating Conditions (Non-Condensing)	
Temperature Range	5°C to 60°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Dew Point Temperature	Operating: 26°C Non-Operating: 33° C
Altitude Range	-1000 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	5% to 95% non-condensing
Maximum Wet Bulb Temperature	33°C
Altitude Range	-1000 ft to 40000 ft

2.5" 500GB SATA3 7200 RPM HDD

2.5" 500GB SATA3 7200 RPM HDD	MT	SFF	Micro
Capacity (bytes)	500,107,862,016		
Dimensions inches (W x D x H)	Approximately (3.93 x 2.75 x 0.374 inches)		
Interface type and Maximum speed	Up to 6Gb/s(SATA 3.0)		
Internal buffer size	32 MB		
Average Seek Time	12 ms (Read)		
Rotational Speed	7200 rpm		
Logical Blocks	976,773,168		
Power Source			
Power Consumption (reference only)	Idle 0.7W, Active 3.25W		
Spin Up Current (reference only)	5V (1A)		
Environmental Operating Conditions (Non-Condensing)			
Temperature Range	5°C to 60°C		
Relative Humidity Range	10% to 90% non-condensing		
Maximum Dew Point Temperature	Operating: 26°C Non-Operating: 33° C		
Altitude Range	-1000 ft to 10000 ft		
Environmental Non-Operating Conditions (Non-Condensing):			

Temperature Range	-40°C to 65°C
Relative Humidity Range	5% to 95% non-condensing
Maximum Wet Bulb Temperature	33°C
Altitude Range	-1000 ft to 40000 ft

2.5" 1TB SATA3 5400 RPM HDD

2.5" 1TB SATA3 5400 RPM HDD	MT	SFF	Micro
Capacity (bytes)	1,000,204,886,016		
Dimensions inches (W x D x H)	Approximately (2.75 x 3.951 x 0.268 inches)		
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)		
Internal buffer size	16 MB		
Average Seek Time	12ms(Read)		
Rotational Speed	5400 rpm		
Logical Blocks	1,953,525,168		
Power Source			
Power Consumption (reference only)	Idle 0.7W, Active 3.25W		
Spin Up Current (reference only)	5V (1A)		
Environmental Operating Conditions (Non-Condensing)			
Temperature Range	5°C to 60°C		
Relative Humidity Range	10% to 90% non-condensing		
Maximum Dew Point Temperature	Operating: 26°C Non-Operating: 33° C		
Altitude Range	-1000 ft to 10000 ft		
Environmental Non-Operating Conditions (Non-Condensing):			
Temperature Range	-40°C to 65°C		
Relative Humidity Range	5% to 95% non-condensing		
Maximum Wet Bulb Temperature	33°C		
Altitude Range	-1000 ft to 40000 ft		

2.5" 128GB SOLID STATE DRIVE

2.5" 128GB SOLID STATE DRIVE	MT	SFF	Micro
Capacity (bytes)	128,035,676,160		
Dimensions inches (W x D x H)	3.94 x 2.75 x 0.374		
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)		
MTBF	>1.5M hours		

Logical Blocks	250,069,680
Power Source	
Power Consumption (reference only)	Idle 0.5W, Active 2.5W
Spin Up Current (reference only)	5V (1000mA)
Environmental Operating Conditions (Non-Condensing)	
Temperature Range	5°C to 60°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Dew Point Temperature	Operating: 26°C Non-Operating: 33° C
Altitude Range	-1000 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	5% to 95% non-condensing
Maximum Wet Bulb Temperature	33°C
Altitude Range	-1000 ft to 40000 ft

2.5" 250GB HDD 7200 RPM

250 GB HDD 7200 RPM	
Capacity (GB)	250GB
Dimensions inches (W x D x H)	Approximately (2.760 x 3.959 x 0.276 inches)
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)
MTBF	550,000 hours
Logical Blocks	488,397,168
Power Source	
Power Consumption (reference only)	Idle 0.7W, Active 3.10 W

Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5°C to 60°C
Relative Humidity Range	5 to 90%
Op Shock (@2ms)	350G
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	5 to 95%

2.5” 500GB Hybrid w/8GB Flash

500GB HYBRID 8GB	
Capacity (GB)	500GB
Dimensions inches (W x D x H)	Approximately (2.760 x 3.959 x 0.276 inches)
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)
MTBF	550,000 hours
Logical Blocks	976,773,168
Power Source	
Power Consumption (reference only)	Idle 0.7W, Active 3.10 W
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5°C to 60°C
Relative Humidity Range	5 to 90%
Op Shock (@2ms)	350G
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	5 to 95%

Optical Drives

DVD-ROM

DVD-ROM	MT	SFF	Micro
External Dimensions inches/centimeters (Without Bezel – W x H x D)	148.4mm(6in)/42mm (2in)/171mm (6.73in) (max)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)	N/A
Weight (max) pounds/kilograms	700g	165g	N/A
Interface type and speed	SATA 1.5Gbit/s	SATA 1.5Gbit/s	N/A
Disc Capacity	Standard	Standard	N/A
Internal buffer size	supplier dependent	supplier dependent	N/A
Access Times (typical)	supplier dependent	supplier dependent	N/A
Maximum Data Transfer Rates			
Writes	N/A	N/A	N/A

Reads	16x DVD/48x CD	8x DVD/ 24x CD	N/A
Power Source			
DC Power Requirements	12V, 5V	5V	N/A
DC Current	800mA (12V)/ 1000mA (5V)	1000mA[1]	N/A
Environmental Operating Conditions (Non-Condensing):			
Operating Temperature Range	5C to 50C	5C to 50C	N/A
Relative Humidity Range	20% to 80% RH	20% to 80% RH	N/A
Maximum Wet Bulb Temperature	29C	29C	N/A
Altitude Range	-200 to 3048m	-200 to 3048m	N/A
Environmental Non-Operating Conditions (Non-Condensing):			
Operating Temperature Range	-40C to 65C	-40C to 65C	N/A
Relative Humidity Range	5% to 95% RH	5% to 95% RH	N/A
Maximum Wet Bulb Temperature	38C	38C	N/A
Altitude Range	-200 to 10600m	-200 to 10600m	N/A

DVD-RW

DVD +/- RW[1]	MT	SFF	Micro
External Dimensions inches/centimeters (Without Bezel – W x H x D)	148.4mm(6in)/42mm (2in)/171mm (6.73in) (max)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)	N/A
Weight (max) pounds/kilograms	700g	170g	N/A
Interface type and speed	SATA 1.5Gbit/s	SATA 1.5Gbit/s	N/A
Disc Capacity	Standard	Standard	N/A
Internal buffer size	supplier dependent	supplier dependent	N/A
Access Times (typical)	supplier dependent	supplier dependent	N/A
Maximum Data Transfer Rates			
Writes	16x DVD/48x CD	8x DVD/ 24x CD	N/A
Reads	16x DVD/48x CD	8x DVD/ 24x CD	N/A
Power Source			
DC Power Requirements	12V, 5V	5V	N/A

DC Current	800mA (12V)/ 1000mA (5V)	1000mA[2]	N/A
Environmental Operating Conditions (Non-Condensing):			
Operating Temperature Range	5C to 50C	5C to 50C	N/A
Relative Humidity Range	20% to 80% RH	20% to 80% RH	N/A
Maximum Wet Bulb Temperature	29C	29C	N/A
Altitude Range	-200 to 3048m	-200 to 3048m	N/A
Environmental Non-Operating Conditions (Non-Condensing):			
Operating Temperature Range	-40C to 65C	-40C to 65C	N/A
Relative Humidity Range	5% to 95% RH	5% to 95% RH	N/A
Maximum Wet Bulb Temperature	38C	38C	N/A
Altitude Range	-200 to 10600m	-200 to 10600m	N/A

Media Card Reader (MCR)

NOTE: Dell 19 in 1 Media Card Reader (MCR) is supported via a F5 to F3 bay converter on the MT and may require a slim line optical drive depending on selectable configuration. MCR is not available on the SFF chassis.

19 in 1 Media Card Reader	MT
External Dimensions inches/(centimeters) (With Bezel – W x H)	3.99/(10.13cm)/1.0/(2.54cm)
Weight (max) pounds/kilograms	~151g
Interface type and speed	USB 2.0, 480Mb/s
Media Supported (maximum capacity supported will vary by Flash Media Types)	
Media Supported	CF I CF II Micro Drive (MD) Secure Digital (SD) SDHC / SDXC Mini Secure Digital (mini-SD) Micro Secure Digital (Micro-SD) (with adapter) Multi Media Card (MMC) RS Multi Media Card (RS-MMC) Multi Media Card plus (MMC plus)

	RS Multi Media Card plus (RS-MMC plus) Multi Media Card Micro (MMC Micro) (with adapter) Memory Stick (MS) Memory Stick Pro (MS Pro) Memory Stick Pro Duo (MS Pro Duo) Memory Stick Duo (MS-Duo) Memory Stick Micro (MS Micro)(M2) (with adapter) Smart Media (SM) xD
Support Specification Versions:	Compact Flash type I/II Version 4.0 Smart Media (SM) Specification 2003 Multi Media Card (MMC) Specification 4.2 Secure Digital (SD) 2.0 Memory Stick Pro (MS-PRO) Specification 1.02 Memory Stick (MS) Specification 1.43 xD Specification 1.2
Power Source	
Max Power Requirements	2.5W
Supply Voltage Range	4.75V ~ 5.25V
Power Consumption:	Standby less than 0.5mA @ 5.0VDC
Environmental Operating Conditions (Non-Condensing):	
Operating Temperature Range	5C to 50C
Relative Humidity Range	10% to 90% RH
Environmental Non-Operating Conditions (Non-Condensing):	
Operating Temperature Range	-40C to 65C
Relative Humidity Range	5% to 95% RH

BIOS Defaults

		MT/SFF	Micro
System Configuration	Integrated NIC:	Enable w/PXE	Enable w/PXE
	Serial Port:	Disable	Disable
	SATA Operation:	AHCI	AHCI
	Drives:	Enable (SATA-0, SATA-1, SATA-2,)	Enable (SATA-0)
	SMART Reporting:	Disable	Disable
	USB Configuration:	Enable (Boot Support, Front USB Ports, Rear Dual USB Ports, Rear Quad USB Ports)	Enable (Boot Support, Front USB Ports, Rear Quad USB Ports)

	Miscellaneous Devices:		
Video	Multi-display:	Disable	N/A
	Primary Display	Auto	N/A
Performance	Multiple Core Support:	All	All
	Intel® SpeedStep™:	Enable	Enable
	C States Control:	Enable	Enable
	Limit CPUID Value:	Disable	Disable
	Intel TurboBoost	Enable	Enable
	HyperThread control:	Enable	Enable
Virtualization Support	Virtualization:	Enable	Enable
Security	Strong Password:	Disable	Disable
	Password Configuration:	4~32	4~32
	Password Bypass	Disable	Disable
	Password Changes:	Enable	Enable
	TPM Security:	Disable	Disable
	Computrace®:	Deactivate	Deactivate
	CPU XD Support:	Enable	Enable
	Admin Setup Lockout	Disable	Disable
Power Management	AC Recovery:	Power Off	Power Off
	Auto On Time:	Disable	Disable
	Deep Sleep Control:	Enable in S4 & S5	Enable in S4 & S5
	Fan Control Override:	Disable	Disable
	Wake on LAN/WLAN:	Disable	Disable
	Block sleep	Disable	Disable
	USB Wake Support**	Enable	S3 Enable / S4 Disable

Maintenance	Service Tag:	Set by the factory	Set by the factory
	Asset Tag:	Optional User Entry	Optional User Entry
	SERR Message:	Enable	Enable
POST Behavior	Numlock LED:	Enable	Enable
	Keyboard Errors:	Enable	Enable
	Adapter warning	N/A	Enable
Wireless	Wireless Device Enable		Enable(WLAN/WiGig Bluetooth)

**• With USB Wake Support from Standby (S3) – Enables both the Keyboard and Mouse to wake the system, no matter which USB ports are used.

- With USB Wake Support from Hibernate (S4) – A wired Keyboard or Mouse is able to wake the system if connected to the designated USB port (marked with smart power on icon). For wireless keyboard and mice, if both devices share the same USB dongle and the dongle is inserted into the designated USB port, both Keyboard and mouse can wake the system. For wireless Keyboard only or mouse only, either could wake the system as long as the dongle is inserted into the designated USB port.

- Note that the user can go into the BIOS setup menu Power Management Section and USB Wake Support item to enable and disable USB wake support in Standby (S3) and Hibernation (S4).

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 AND ENVIRONMENTAL COMPLIANCE

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

OptiPlex 3020 MT

Component	Test Configuration
CPU	Intel i5-4570 3.2GHz
Memory	8G DD3,1600 x 2pcs
HDD (#, capacity)	WD 1T 3.5inch x2
RMSD	19 in 1 card reader
Graphics Adapter	HD 8570

Declared Sound Power (LWAd)

The Declared Noise Emission in accordance with ISO 9296 for the OptiPlex 3020 MT is as follows: (all values LWAd expressed in bels; 1 bel=10 decibels, re 10-12 Watts)

Operating Mode	Declared Sound Power(LWAd)
Idle	3.8
HDD Operating	4.0
CPU Stressed	3.8
ODD Operating	4.2

A-Weighted Sound Pressure Level (dB)

The Declared A-weighted Sound Pressure Level in decibels (re 2x10-5 Pa), at Operator and Bystander 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 follows[1]:

Declared Sound Pressure (LpA)				
	Tabletop System		Floor Standing System	
Operating Mode	Operator Position	Bystander Position	Operator Position	Bystander Position
Idle	27.5	n/a	n/a	n/a
HDD Operating	n/a	n/a	n/a	n/a
CPU Stressed	29.2	n/a	n/a	n/a
ODD Operating	n/a	n/a	n/a	n/a

1 All tests are conducted according to ISO 7779 and declared according to ISO 9296 except CPU Stressed. 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 3020 SFF

Component	Test Configuration
CPU	Intel i5-4570 3.2GHz
Memory	8G DD3,1600 x 2pcs
HDD (#, capacity)	Seagate 1T 3.5 inch x1
RMSD	19 in 1 card reader
Graphics Adapter	HD 8570

Declared Sound Power (LWAd)

The Declared Noise Emission in accordance with ISO 9296 for the OptiPlex 3020 SFF is as follows: (all values LWAd expressed in bels; 1 bel=10 decibels, re 10-12 Watts)

Operating Mode	Declared Sound Power(LWAd)
Idle	3.6
HDD Operating	3.7
CPU Stressed	4.8
ODD Operating	3.6

A-Weighted Sound Pressure Level (dB)

The Declared A-weighted Sound Pressure Level in decibels (re 2x10-5 Pa), at Operator and Bystander 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 follows[1]:

Declared Sound Pressure (LpA)				
	Tabletop System		Floor Standing System	
Operating Mode	Operator Position	Bystander Position	Operator Position	Bystander Position
Idle	25.2	n/a	n/a	n/a
HDD Operating	n/a	n/a	n/a	n/a
CPU Stressed	31.9	n/a	n/a	n/a
ODD Operating	n/a	n/a	n/a	n/a

1 All tests are conducted according to ISO 7779 and declared according to ISO 9296 except CPU Stressed. 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 3020 Micro

Component	Test Configuration
CPU	PRC,HSL,I5-4460T,1.9G,35W,L
Memory	8G DDR3,1600 x 2pcs
HDD (#, capacity)	HDD 1TB WD WD10JPVX-75JC3T0 5.4K 6G
RMSD	N/A
Graphics Adapter	Intel Integrated

Declared Sound Power (LWAd)

The Declared Noise Emission in accordance with ISO 9296 for the OptiPlex 3020 Micro is as follows: (all values LWAd expressed in bels; 1 bel=10 decibels, re 10-12 Watts)

Operating Mode	Declared Sound Power(LWAd
Idle	3.2
HDD Operating	3.2
CPU Stressed	4.2
ODD Operating	n/a

A-Weighted Sound Pressure Level (dB)

The Declared A-weighted Sound Pressure Level in decibels (re 2x10-5 Pa), at Operator and Bystander 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 follows[1]:

Declared Sound Pressure (LpA)				
	Tabletop System		Floor Standing System	
Operating Mode	Operator Position	Bystander Position	Operator Position	Bystander Position
Idle	20.6	19.0	n/a	n/a
HDD Operating	20.8	19.1	n/a	n/a
CPU Stressed	33.8	29.1	n/a	n/a
ODD Operating	n/a	n/a	n/a	n/a

1 All tests are conducted according to ISO 7779 and declared according to ISO 9296 except CPU Stressed. 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