Intel Desktop Computer Builds: January 2012 175KB

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1. Introduction

A motherboard chipset (chipset, for short) is a defined set of capabilities upon which a motherboard is built. Specifically, a chipset defines: 1.) the processor, memory, expansion cards, data storage devices, and peripheral devices that are compatible with a motherboard; and 2.) the additional devices (e.g., audio and ethernet) and technologies (e.g., RAID and power management) that are integrated into a motherboard. In other words, a chipset defines a motherboard's capabilities, which, in turn, defines a computer's capabilities. Therefore, when building a computer, the chipset is the most important computer component to choose wisely.

There are two types of desktop chipsets: 1.) AMD desktop chipsets, which support AMD desktop processors; and 2.) Intel desktop chipsets, which support Intel desktop processors. The current Intel desktop chipset manufacturer is Intel, which has a virtual monopoly on the Intel desktop chipset market. Past Intel desktop chipset manufacturers included ATI, NVIDIA, SiS, and VIA.

A motherboard is an implementation of a chipset. Motherboard manufacturers currently incorporating Intel desktop chipsets into their motherboards include ASRock, ASUS, BIOSTAR, ECS, EVGA, Foxconn, GIGABYTE, Intel, and MSI.

Based on chipset/processor, desktop computers are divided into two types (a.k.a., platforms): 1.) AMD desktop computers, which have an AMD desktop chipset/processor; and 2.) Intel desktop computers, which have an Intel desktop chipset/processor. Therefore, when building a desktop computer you must decide to build either an AMD desktop computer or an Intel desktop computer. This page describes Intel desktop computer builds based on user need.

1.1. Component Overlay

Component considerations that serve as an overlay for each build and this page as a whole.

> **Note:** For information on desktop computer components, see Builder's Guide To Desktop Computer Components (stevestechresource.com).

- Motherboard:
  - Latest Intel desktop chipset required:
    - Intel 6 Series Chipset:
      - Intel B65 Express Chipset (socket LGA1155).
      - Intel Q65 Express Chipset (socket LGA1155).
      - Intel Q67 Express Chipset (socket LGA1155).
      - Intel H61 Express Chipset (socket LGA1155).
      - Intel H67 Express Chipset (socket LGA1155).

- Intel P67 Express Chipset (socket LGA1155).
- Intel Z68 Express Chipset (socket LGA1155).

Important Note: On January 31, 2011 Intel announced that an issue had been identified with the Intel Series 6 Chipset, that shipment of the affected chipset had been stopped, and that newly manufactured, corrected versions of the chipset will start shipping in late February. For additional information, see Chipset Circuit Design Issue Identified: Update February 7, 2011 (intel.com).

The newly manufactured, corrected versions of the Intel Series 6 Chipset also include B3 stepping. To distinguish motherboards with the corrected chipset from those with the affected chipset, motherboard manufacturers are adding "B3" or "REV 3.0" to the naming and packaging of motherboards with the corrected chipset. For additional information, see ASRock Brand New P67/H67 B3 Stepping Chipset Motherboard Is Ready To Go (asrock.com), Quickly And Easily Identify ASUS New B3 Revision Motherboards (event.asus.com), GIGABYTE Ships All New B3 6 Series Motherboards (gigabyte.com), and Chipset Stepping (B2/B3) Identification Of MSI's 6 Series Mainboards (event.msi.com).

The Intel B65, Q67, H61, H67, and P67 Express Chipsets were affected. Therefore, B65, Q67, H61, H67, and P67 chipset motherboards should be labelled "B3" or "REV 3.0." The Intel Q65 Express Chipset (released April 2011) and Intel Z68 Express Chipset (released May 2011) were not affected. Therefore, Q65 and Z68 chipset motherboards do not need to be labelled "B3" or "REV 3.0." However, for the sake of consistency, some motherboard manufacturers are labelling Q65 and Z68 chipset motherboards "B3" or "REV 3.0."

- Intel X79 Express Chipset (socket LGA2011).

- microATX form factor required for Intel Desktop Computer 1: eMachine and Intel Desktop Computer 2: Mainstream. microATX or ATX form factor required for Intel Desktop Computer 3: Performance/Gaming One Add-In GPU. ATX form factor required for Intel Desktop 4: Gaming Two Add-In GPUs and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
- CrossFireX/SLI certified not required for Intel Desktop Computer 1: eMachine, Intel Desktop Computer 2: Mainstream, and Intel Desktop Computer 3: Performance/Gaming One Add-In GPU. CrossFireX/SLI certified required for Intel Desktop Computer 4: Gaming Two Add-In GPUs and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
- Integrated audio required and is sufficient.
- SATA 6.0Gb/s not required for Intel Desktop Computer 1: eMachine. SATA 6.0Gb/s required for Intel Desktop Computer 2: Mainstream, Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
- USB 3.0 not required for Intel Desktop Computer 1: eMachine. USB 3.0 required for Intel Desktop Computer 2: Mainstream, Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
- Computer front USB and audio required. Therefore, motherboard (internal) USB header and motherboard (internal) audio header required. Computer front USB does not need to be USB 3.0. Therefore, motherboard (internal) USB header does not need to be USB 3.0.
- Integrated gigabit (10/100/1000Mb/s) ethernet required.
- Manufacturers considered: ASRock, ASUS, GIGABYTE, Intel, and MSI.

- Processor:
  - Latest Intel desktop processor required:
    - Intel Celeron G400/G500 Series Processor (socket LGA1155) (code name Sandy Bridge).
    - Intel Pentium G600/G800 Series Processor (socket LGA1155) (code name Sandy Bridge).
    - 2nd Generation Intel Core i3 Processor (socket LGA1155) (code name Sandy Bridge).
    - 2nd Generation Intel Core i5 Processor (socket LGA1155) (code name Sandy Bridge).
    - 2nd Generation Intel Core i7 Processor (socket LGA1155 or LGA2011) (code name Sandy Bridge or Sandy Bridge-E).
    - 2nd Generation Intel Core i7 Extreme Processor (socket LGA2011) (code name Sandy Bridge-E).
  - No overclocking. Therefore, no fancy processor cooling system required. Get boxed processor and use factory heat sink/fan.
- Memory:
  - Four DIMM slots not required for Intel Desktop Computer 1: eMachine. Four DIMM slots required for Intel Desktop Computer 2: Mainstream, Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
  - No overclocking. Therefore, no fancy memory cooling system required. Get value memory that passed motherboard testing.
  - Manufacturers considered: Kingston.

- Graphics:
    - Intel HD Graphics, Intel HD Graphics 2000, and Intel HD Graphics 3000 (collectively known as Intel HD Graphics) are the latest Intel integrated GPU solutions. Intel HD Graphics is built into the latest Intel processors, not the Intel motherboard chipsets. However, not all of the latest Intel processors include Intel HD Graphics. Intel desktop processors code named Sandy Bridge except for the Core i5-2550K, Core i5-2450P, and Core i5-2380P include Intel HD Graphics. Intel desktop processors code named Sandy Bridge-E do not include Intel HD Graphics. Motherboard support for Intel HD Graphics is simply providing video out connectors and an interface to the processor's integrated GPU. The Intel B65, Q65, Q67, H61, H67, and Z68 Express Chipsets support Intel HD Graphics. The Intel P67 and X79 Express Chipsets do not support Intel HD Graphics.
    - Intel HD Graphics required for Intel Desktop Computer 1: eMachine and Intel Desktop Computer 2: Mainstream. One PCIe add-in GPU required for Intel Desktop Computer 3: Performance/Gaming One Add-In GPU. Two PCIe add-in GPUs required for Intel Desktop Computer 4: Gaming Two Add-In GPUs. Three PCIe add-in GPUs required for Intel Desktop Computer 5: Gaming Three Add-In GPUs.
    - PCIe Gen3 add-in GPU performance requires; 1.) motherboard PCIe Gen3 slot, 2.) processor PCIe Gen3 port, and 3.) PCIe Gen3 add-in GPU. Although the current Intel desktop chipsets do not specify PCIe Gen3 slots, motherboard manufacturers are adding PCIe Gen3 slots to some of their desktop motherboards, including Z68 (socket LGA1155), X79 (socket LGA2011), and even P67 (socket LGA1155) chipset motherboards. Sandy Bridge socket LGA1155 processors do not have PCIe Gen3 ports. The forthcoming Ivy Bridge socket LGA1155 processors will have PCIe Gen3 ports. Sandy Bridge-E socket LGA2011 processors have PCIe Gen3 ports. Currently, PCIe Gen3 add-in GPUs do not exist. When the Ivy Bridge socket LGA1155 processors and PCIe Gen3 add-in GPUs are released, many builders with an Intel 6 Series Chipset motherboard and PCIe Gen3 slots who want to upgrade to PCIe Gen3 add-in GPU performance will also want the latest motherboard features, including possibly a new chipset, and, therefore, will also buy a new motherboard instead of installing the new processor and add-in GPU on their existing motherboard. Therefore, PCIe Gen3 not required for Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
    - AMD add-in GPU manufacturers considered: Sapphire. NVIDIA add-in GPU manufacturers considered: EVGA.
- Audio:
    - Integrated audio required and is sufficient.
    - Computer front audio required. Therefore, motherboard (internal) audio header and case I/O panel audio ports required.
- Hard Drive:
    - 500GB or greater required for Intel Desktop Computer 1: eMachine. 1.0TB or greater required for Intel Desktop Computer 2: Mainstream, Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
    - SATA 6.0Gb/s not required for Intel Desktop Computer 1: eMachine. SATA 6.0Gb/s required for Intel Desktop Computer 2: Mainstream, Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
    - Manufacturers considered: Seagate and Western Digital.
- Optical Drive:
    - CD/DVD burner required. Blu-ray support not required.
- USB:
    - USB 3.0 not required for Intel Desktop Computer 1: eMachine. USB 3.0 required for Intel Desktop Computer 2: Mainstream, Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
    - Computer front USB required. Therefore, motherboard (internal) USB header and case I/O panel USB ports required. Computer front USB does not need to be USB 3.0. Therefore, motherboard (internal) USB header and case I/O panel USB ports do not need to be USB 3.0.
- Ethernet:
    - Integrated gigabit (10/100/1000Mb/s) ethernet required.
- Firewire (a.k.a., IEEE 1394) and eSATA:
    - Not required.
- Case:
    - No neon colors, lights, see through side panels, and crazy designs for Intel Desktop Computer 1: eMachine and Intel Desktop Computer 2: Mainstream. Minimal neon colors, lights, see through side panels, and crazy designs for Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs,

and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
- One case mounted fan required. No overclocking. Therefore, no fancy case cooling system required and one case mounted fan is sufficient.
- Mini tower required for Intel Desktop Computer 1: eMachine and Intel Desktop Computer 2: Mainstream. Mid tower or larger required for Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
- Computer front USB and audio required. Therefore case I/O panel USB ports and case I/O panel audio ports required. Computer front USB does not need to be USB 3.0. Therefore, case I/O panel USB ports do not need to be USB 3.0.
- Manufacturers considered: Antec, Cooler Master, Corsair, Lian Li, and Thermaltake.

- Power Supply:

  - ATX12V v2.2 compliant or above required.
  - 80 PLUS Bronze or better not required for Intel Desktop Computer 1: eMachine and Intel Desktop Computer 2: Mainstream. 80 PLUS Bronze or better required for Intel Desktop Computer 3: Performance/Gaming One Add-In GPU, Intel Desktop Computer 4: Gaming Two Add-In GPUs, and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
  - Must provide all required connectors. No mismatched connectors. No adapters.
  - CrossFireX/SLI certified not required for Intel Desktop Computer 1: eMachine, Intel Desktop Computer 2: Mainstream, and Intel Desktop Computer 3: Performance/Gaming One Add-In GPU. CrossFireX/SLI certified required for Intel Desktop Computer 4: Gaming Two Add-In GPUs and Intel Desktop Computer 5: Gaming Three Add-In GPUs.
  - Manufacturers considered: Antec, Cooler Master, Corsair, and Thermaltake.

- Legacy Devices:

  - VGA, IDE, FDD, PCI, serial (COM) port/internal header, parallel port/internal header, PS/2 keyboard, and PS/2 mouse support not required.

1.2. Build Changes From Intel Desktop Builds: July 2011 (stevestechresource.com)

- Intel Desktop Computer 1: eMachine (Model: IDC1-EMA):

  - Motherboard: ASUS P8H61-M LE/CSM (usa.asus.com) $85 to MSI H61M-E23 (B3) (msi.com) $70.
  - Processor: Intel Pentium Processor G840 (BX80623G840) (ark.intel.com) $90 to Intel Celeron Processor G530 (BX80623G530) (ark.intel.com) $55.
  - Memory: Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (kit of 2) 2GB total (KVR1333D3N9K2/2G) (shop.kingston.com) $25 to $20.
  - Hard Drive: Western Digital Caviar Blue 500GB SATA 3.0Gb/s (WD5000AAKS) (wdc.com) $50 to Western Digital Caviar Blue 500GB SATA 6.0Gb/s (WD5000AAKX) (wdc.com) $90.
  - Optical Drive: ASUS DRW-24B1ST $30 to $25.
  - Case/Power Supply: Cooler Master Elite 342 case with Cooler Master Elite Power 400W power supply (RC-342-KKRJ-GP) (coolermaster-usa.com) $70 to $65.
  - Build Total Cost (Recommended): $350 to $325.

- Intel Desktop Computer 2: Mainstream (Model: IDC2-MAI):

  - Motherboard: Intel H67 Express Chipset Intel DH67BLB3 (intel.com) $110 to Intel Z68 Express Chipset ASRock Z68 Pro3-M (asrock.com) $110.
  - Processor: 2nd Generation Intel Core i3-2100 Processor (BX80623I32100) (ark.intel.com) $140 to Intel Pentium Processor G840 (BX80623G840) (ark.intel.com) $90.
  - Memory: Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (kit of 2) 4GB total (KVR1333D3N9K2/4G) (shop.kingston.com) $40 to $35.
  - Hard Disk: Western Digital Caviar Blue 1.0TB SATA 6.0Gb/s (WD10EALX) (wdc.com) $70 to $120.
  - Optical Drive: ASUS DRW-24B1ST $30 to $25.
  - Case/Power Supply: Cooler Master Elite 342 case with Cooler Master Elite Power 400W power supply (RC-342-KKRJ-GP) (coolermaster-usa.com) $70 to $65.
  - Build Total Cost (Recommended): $460 to $445.

- Intel Desktop Computer 3: Performance/Gaming One PCIe Add-In GPU (Model: IDC3-GA1):

  - Motherboard: ASRock Z68 Pro3 (asrock.com) $140 to ASRock Z68 Pro3 Gen3 (asrock.com) $125.
  - Memory: Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (kit of 2) 8GB total (KVR1333D3N9K2/8G) (shop.kingston.com) $70 to $50.
  - Graphics: 1 x Sapphire Radeon HD 6850 1GB GDDR5 (100315L) (sapphiretech.com) $185 to 1 x EVGA GeForce GTX 560 Ti FPB 1GB GDDR5 (01G-P3-1561-AR) (evga.com) $240.
  - Hard Disk: Western Digital Caviar Black 1.0TB SATA 6.0Gb/s (WD1002FAEX) (wdc.com) $95 to $175.
  - Optical Drive: ASUS DRW-24B1ST $30 to $25.
  - Case: Antec Two Hundred (antec.com) $70 to Corsair Carbide Series 400R (CC-9011011-WW) (corsair.com) $100.

    - Power Supply: Antec High Current Gamer HCG-520 (antec.com) $90 to Cooler Master Silent Pro M 600W (RS600-AMBAD3-US/RS-600-AMBA-D3) (coolermaster-usa.com) $105.
    - Build Total Cost (Recommended): $880 to $1020.

- Intel Desktop Computer 4: Gaming Two PCIe Add-In GPUs (Model: IDC4-GA2):

    - Motherboard: GIGABYTE GA-Z68XP-UD3 (rev. 1.0) (gigabyte.com) $170 to MSI Z68A-GD65 (G3) (msi.com) $200.
    - Memory: Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (kit of 2) 8GB total (KVR1333D3N9K2/8G) (shop.kingston.com) $70 to $50.
    - Graphics: 2 x Sapphire Radeon HD 6850 1GB GDDR5 (100315L) (sapphiretech.com) 2 x $185 to 2 x EVGA GeForce GTX 560 Ti 2GB GDDR5 (02G-P3-1568-KR) (evga.com) 2 x $290.
    - Hard Disk: Western Digital Caviar Black 1.0TB SATA 6.0Gb/s (WD1002FAEX) (wdc.com) $95 to $175.
    - Optical Drive: ASUS DRW-24B1ST $30 to $25.
    - Case: Lian Li PC-9F (lian-li.com) $140 to Corsair Carbide Series 400R (CC-9011011-WW) (corsair.com) $100.
    - Power Supply: Thermaltake Toughpower XT 675W (TPX-675M) (thermaltakeusa.com) $130 to Cooler Master Silent Pro Gold 800W (RS800-80GAD3-US/RS-800-80GA-D3) (coolermaster-usa.com) $150.
    - Build Total Cost (Recommended): $1205 to $1480.

- Intel Desktop Computer 5: Gaming Three/Four Add-In GPUs renamed Intel Desktop Computer 5: Gaming Three PCIe Add-In GPUs (Model: IDC5-GA3):

    - Motherboard: Intel P67 Express Chipset ASUS P8P67 WS Revolution REV 3.0 (asus.com) $280 to Intel Z68 Express Chipset ASUS Maximus IV Extreme-Z (asus.com) $345.
    - Processor: 2nd Generation Intel Core i7-2600 Processor (BX80623I72600) (ark.intel.com) $300 to 2nd Generation Intel Core i5-2400 Processor (BX80623I52400) (ark.intel.com) $200.
    - Memory: Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (kit of 2) 8GB total (KVR1333D3N9K2/8G) (shop.kingston.com) $70 to $50.
    - Graphics: 3 x Sapphire Radeon HD 6950 2GB GDDR5 (100312-2SR) (sapphiretech.com) 3 x $290 to 3 x Sapphire Radeon HD 6970 2GB GDDR5 Dual Fan (100311-3SR) (sapphiretech.com) 3 x $355.
    - Hard Disk: Western Digital Caviar Black 1.0TB SATA 6.0Gb/s (WD1002FAEX) (wdc.com) $95 to $175.
    - Optical Drive: ASUS DRW-24B1ST $30 to $25.
    - Case: Corsair Graphite Series 600T (CC600T) (corsair.com) $150 to Corsair Graphite Series 600T Mesh (CC600TM) (corsair.com) $150.
    - Power Supply: Thermaltake Toughpower Grand 1050W (TPG-1050M) (thermaltakeusa.com) $270 to Thermaltake Toughpower Grand 1200W (TPG-1200M) (thermaltakeusa.com) $265.
    - Build Total Cost (Recommended): $2065 to $2275.

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2. Intel Desktop Computer 1: eMachine (Model: IDC1-EMA)

Intended For:

- Casual/budget user wanting a modern, no frills computer for Internet, Microsoft Office, and multimedia viewing.

Build Overview:

- Low end to upper low end combination of chipset, processor, memory, and graphics:

    - Chipset: Intel B65 Express Chipset (socket LGA1155), Intel Q65 Express Chipset (socket LGA1155), or Intel H61 Express Chipset (socket LGA1155).
    - Processor: Intel Celeron G400/G500 Series Processor (socket LGA1155) or Intel Pentium G600/G800 Series Processor (socket LGA1155).
    - Memory: 2GB.
    - Graphics: Intel HD Graphics.

- Motherboard/case form factor: microATX/mini tower.

Intel Desktop Computer 1: eMachine (Model: IDC1-EMA)		
Comp	**Recommended**	**Notes/Alternates**
Mother-board	MSI H61M-E23 (B3) (msi.com) $70: • Intel H61 Express Chipset / LGA1155 / microATX (245mm x 215). • 1 x 24 pin motherboard main / 1 x 4 pin ATX 12V CPU.	• SATA 3.0Gb/s. USB 2.0. • Alternate: For microATX (244mm x 205) and two less USB 2.0 via internal headers, GIGABYTE GA-H61M-S2H (rev. 1.3) (gigabyte.com) $75.

	• Dual channel memory / 2 DIMMs / 16GB max / DDR3-1333/1066 SDRAM / 1.5V / Non-ECC / Unbuffered. • Supports Intel HD Graphics. 1 x HDMI / 1 x DVI-D / 1 x VGA. • 1 x PCIe Gen2 x16 (x16 mode) / 2 x PCIe Gen2 x1 / 1 x PCI. Supports single PCIe Gen2 add-in GPU at x16 mode. No CrossFireX/SLI support. • 4 x internal SATA 3.0Gb/s. • 10 x USB 2.0 (4 x back + 6 x via internal headers). Internal audio header. • 1 x gigabit (10/100/1000Mb/s) ethernet.	
Processor	Intel Celeron Processor G530 (BX80623G530) (ark.intel.com) $55: • 2MB cache / 2.40GHz / 5.0GT/s / LGA1155 / 32nm / Max TDP 65W / Sandy Bridge. • Dual core no Intel Hyper-Threading Technology (2C/2T). • Dual channel memory / 32GB max / DDR3-1066 SDRAM / 21.3GB/s max memory bandwidth. • Intel 64 / Intel VT-x / No Intel Turbo Boost / Intel HD Graphics / No Intel Quick Sync Video. • Heat sink/fan included.	• 1066MT/s x 8B/T x 2 channels = 17.1GB/s, not 21.3GB/s. Therefore, Intel's spec for Celeron Processor G530 (either DDR3-1066 or 21.3GB/s max memory bandwidth) is incorrect.
Memory	Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (Kit of 2) 2GB total (KVR1333D3N9K2/2G) (shop.kingston.com) $20: • 2GB DDR3-1333 SDRAM / CL9 / 1.5V / Non-ECC / Unbuffered / Kit 2 x 1GB.	• 1066MT/s x 8B/T x 2 channels = 17.1GB/s, not 21.3GB/s. Therefore, Intel's spec for Celeron Processor G530 (either DDR3-1066 or 21.3GB/s max memory bandwidth) is incorrect. • 1333MT/s x 8B/T x 2 channels = 21.3GB/s, which equals/exceeds the Celeron Processor G530 max memory bandwidth, and is better than getting 1066MHz DDR3, which would bottleneck the Celeron Processor G530 if 21.3GB/s max memory bandwidth is correct.
Graphics	Intel HD Graphics (intel.com) $0: • 1 x HDMI / 1 x DVI-D / 1 x VGA.	
Hard Drive	Western Digital Caviar Blue 500GB SATA 6.0Gb/s (WD5000AAKX) (wdc.com) $90: • Caviar Blue / 500GB / SATA 6.0Gb/s / 16MB cache / 7200rpm.	• Currently less expensive than Western Digital and Seagate 500GB SATA 3.0Gb/s hard drives.
Optical Drive	ASUS DRW-24B1ST $25: • SATA. 2MB cache. • 24X DVD+R/8X DVD+RW/12X DVD+R DL/24X DVD-R/6X DVD-RW/12X DVD-RAM/16X DVD-ROM/48X CD-R/32X CD-RW/48X CD-ROM.	• 4x Newegg Customer Choice Award Winner - CD/DVD Burners.
Case/ Power Supply	Cooler Master Elite 342 case with Cooler Master Elite Power 400W power supply (RC-342-KKRJ-GP) (coolermaster-usa.com) $65: • Cooler Master Elite 342 case. • 352mm x 180 x 440 (H x W x L). 4kg. • Supports microATX, not ATX motherboards. • 2 x external 5.25" / 1 x external 3.5" / 5 x internal 3.5". No hard drive caddies. Removable hard drive cage. • 4 x expansion. • I/O panel: Front mid / 2 x USB 2.0 / Audio. • Fans included: 1 x front 120mm 1200rpm. • Power supply top. • Cooler Master Elite Power 400W power supply. • 400W / ATX 12V v2.31 / 150mm x 86 x 140 (W x H x	• Mini tower.

	L). • MTBF 100,000hr / 1 year warranty. • 2 x +12V rails (+12V1 16A / +12V2 16A). • 1 x 20+4 pin motherboard main / 1 x 4+4 pin ATX/EPS 12V CPU / 1 x 6 pin PCIe / 4 x SATA / 3 x 4 pin peripheral / 1 x floppy.	
Total	$325	$325-330
Intel Desktop Computer 1: eMachine (Model: IDC1-EMA)		

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3. Intel Desktop Computer 2: Mainstream (Model: IDC2-MAI)

Intended For:

- Home/office user.
- User who occasionally executes multiple system resource intensive applications simultaneously.

Build Overview:

- Upper low end to mid level combination of chipset, processor, memory, and graphics:
  - Chipset: Intel H67 Express Chipset (socket LGA1155) or Intel Z68 Express Chipset (socket LGA1155).
  - Processor: Intel Pentium G600/G800 Series Processor (socket LGA1155) or 2nd Generation Intel Core i3 Processor (socket LGA1155).
  - Memory: 4GB.
  - Graphics: Intel HD Graphics.
- Motherboard/case form factor: microATX/mini tower.
- Storage: SATA 6.0Gb/s and USB 3.0.

Intel Desktop Computer 2: Mainstream (Model: IDC2-MAI)		
Comp	**Recommended**	**Notes/Alternates**
Mother-board	ASRock Z68 Pro3-M (asrock.com) $110: • Intel Z68 Express Chipset / LGA1155 / microATX (244mm x 244). • 1 x 24 pin motherboard main / 1 x 8 pin EPS 12V CPU. • Dual channel memory / 4 DIMMs / 32GB max / DDR3-1600/1333/1066 SDRAM / 1.5V / Non-ECC / Unbuffered. • Supports Intel HD Graphics. 1 x DisplayPort / 1 x HDMI / 1 x DVI-D / 1 x VGA. Supports LucidLogix Virtu. • 1 x PCIe Gen2 x16 (x16 mode) / 2 x PCIe Gen2 x1 / 1 x PCI. Supports single PCIe Gen2 add-in GPU at x16 mode. No CrossFireX/SLI support. • 2 x internal SATA 6.0Gb/s / 3 x internal SATA 3.0Gb/s / 1 x back eSATA 3.0Gb/s. RAID. • 2 x USB 3.0 (2 x back) / 10 x USB 2.0 (4 x back + 6 x via internal headers). Internal audio header. • 1 x gigabit (10/100/1000Mb/s) ethernet.	• Intel Z68 Express Chipset motherboard with outstanding Newegg customer rating at Intel H67 Express Chipset motherboard price.
Processor	Intel Pentium Processor G840 (BX80623G840) (ark.intel.com) $90: • 3MB cache / 2.8GHz / 5.0GT/s / LGA1155 / 32nm / Max TDP 65W / Sandy Bridge. • Dual core no Intel Hyper-Threading Technology (2C/2T). • Dual channel memory / 32GB max / DDR3-1333/1066 SDRAM / 21.3GB/s max memory bandwidth. • Intel 64 / Intel VT-x / No Intel Turbo Boost / Intel HD	• Alternate: For 3.10GHz, 2C/4T, Intel HD Graphics 2000, and Intel Quick Sync Video, 2nd Generation Intel Core i3-2100 Processor (BX80623I32100) (ark.intel.com) $125.

	Graphics / No Intel Quick Sync Video. • Heat sink/fan included.	
Memory	Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (Kit of 2) 4GB total (KVR1333D3N9K2/4G) (shop.kingston.com) $35: • 4GB DDR3-1333 SDRAM / CL9 / 1.5V / Non-ECC / Unbuffered / Kit 2 x 2GB.	• 1333MT/s x 8B/T x 2 channels = 21.3GB/s, which equals the Pentium Processor G840 max memory bandwidth.
Graphics	Intel HD Graphics (intel.com) $0: • 1 x DisplayPort / 1 x HDMI / 1 x DVI-D / 1 x VGA.	
Hard Drive	Western Digital Caviar Blue 1.0TB SATA 6.0Gb/s (WD10EALX) (wdc.com) $120: • Caviar Blue / 1.0TB / SATA 6.0Gb/s / 32MB cache / 7200rpm.	
Optical Drive	ASUS DRW-24B1ST $25: • SATA. 2MB cache. • 24X DVD+R/8X DVD+RW/12X DVD+R DL/24X DVD-R/6X DVD-RW/12X DVD-RAM/16X DVD-ROM/48X CD-R/32X CD-RW/48X CD-ROM.	• 4x Newegg Customer Choice Award Winner - CD/DVD Burners.
Case/ Power Supply	Cooler Master Elite 342 case with Cooler Master Elite Power 400W power supply (RC-342-KKRJ-GP) (coolermaster-usa.com) $65: • Cooler Master Elite 342 case. • 352mm x 180 x 440 (H x W x L). 4kg. • Supports microATX, not ATX motherboards. • 2 x external 5.25" / 1 x external 3.5" / 5 x internal 3.5". No hard drive caddies. Removable hard drive cage. • 4 x expansion. • I/O panel: Front mid / 2 x USB 2.0 / Audio. • Fans included: 1 x front 120mm 1200rpm. • Power supply top. • Cooler Master Elite Power 400W power supply. • 400W / ATX 12V v2.31 / 150mm x 86 x 140 (W x H x L). • MTBF 100,000hr / 1 year warranty. • 2 x +12V rails (+12V1 16A / +12V2 16A). • 1 x 20+4 pin motherboard main / 1 x 4+4 pin ATX/EPS 12V CPU / 1 x 6 pin PCIe / 4 x SATA / 3 x 4 pin peripheral / 1 x floppy.	• Mini tower.
Total	$445	$445-480
Intel Desktop Computer 2: Mainstream (Model: IDC2-MAI)		

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4. Intel Desktop Computer 3: Performance/Gaming One PCIe Add-In GPU (Model: IDC3-GA1)

Intended For:

- Power user.
- User who frequently executes multiple system resource intensive applications simultaneously.
- Gaming with one PCIe add-in GPU.

Build Overview:

- Mid level to lower high end combination of chipset, processor, memory, and graphics:
  - Chipset: Intel Q67 Express Chipset (socket LGA1155), Intel P67 Express Chipset (socket LGA1155), or Intel Z68 Express Chipset (socket LGA1155).
  - Processor: 2nd Generation Intel Core i3 Processor (socket LGA1155) 2nd Generation Intel Core i5 Processor (socket LGA1155), or 2nd Generation Intel Core i7 Processor (socket LGA1155, not LGA2011).
  - Memory: 8GB.
  - Graphics: For gaming, best PCIe Gen2 add-in GPU with 1GB GDDR5 ~$250. If not for gaming, best PCIe Gen2 add-in GPU with 1GB GDDR5 ~$150.

Note: The Radeon HD 6950 is available with 1GB or 2GB GDDR5 and not only sits at the boundary of, but bridges the gap between Radeon HD PCIe Gen2 add-in GPUs with 1GB and 2GB GDDR5. The Radeon HD 6950 1GB GDDR5 is ~$250, and the otherwise similarly spec'd Radeon HD 6950 2GB GDDR5 is ~$300. In other words, the Radeon HD 6950 1GB GDDR5 is the best Radeon HD PCIe Gen2 add-in GPU with 1GB GDDR5, and increasing the Radeon HD 6950 memory from 1GB to 2GB GDDR5 is ~$50.

For gaming with one PCIe add-in GPU, increasing the Radeon HD 6950 memory from 1GB to 2GB GDDR5 does not improve gaming performance. Therefore, for gaming with one PCIe add-in GPU, to upgrade gaming performance over the Radeon HD 6950 1GB GDDR5, it is necessary to move up to the Radeon HD 6970. The Radeon HD 6970 has 2GB GDDR5 and is ~$350. Since increasing the Radeon HD 6950 memory from 1GB to 2GB GDDR5 does not improve gaming performance, and since the Radeon HD 6970 is only available with 2GB GDDR5, it begs asking whether the additional ~$100 for the Radeon HD 6970 2GB GDDR5 is worth the money, or, perhaps, if half of it is waisted on needlessly increasing the memory from 1GB to 2GB GDDR5. Benchmarks with one Radeon HD add-in GPU show that the Radeon HD 6950 1GB GDDR5 and the Radeon HD 6950 2GB GDDR5 perform virtually identically, and that the Radeon HD 6970 2GB GDDR5 performs, on average, no more than ~10% better than the Radeon HD 6950 2GB GDDR5. Since the Radeon HD 6950 1GB GDDR5 specs and the Radeon HD 6950 2GB GDDR5 specs (excluding the amount of memory) are identical, and since the Radeon HD 6970 2GB GDDR5 specs are ~10% better than the Radeon HD 6950 1GB/2GB GDDR5 specs, for gaming with one PCIe add-in GPU, upgrading from the Radeon HD 6950 1GB GDDR5 to the Radeon HD 6970 2GB GDDR5 is a poor investment because approximately half the additional ~$100 for the Radeon HD 6970 2GB GDDR5 is waisted on needlessly increasing the memory from 1GB to 2GB GDDR5.

For additional information on gaming performance with one Radeon HD 6950 and 1GB or 2GB GDDR5, see The Radeon HD 6950 Sweet Spot: Five 1 GB Cards Rounded-Up (tomshardware.com) For additional information on gaming performance with one Radeon HD 6950 2GB GDDR5 and one Radeon HD 6970 2GB GDDR5, see Radeon HD 6970 And 6950 Review: Is Cayman A Gator Or A Crock? (tomshardware.com).

The GeForce equivalent to the Radeon HD 6950 1GB GDDR5 is the GeForce GTX 560 Ti 1GB GDDR5. The GeForce GTX 560 Ti 1GB GDDR5 is smaller, slightly less expensive (~$240), and more widely available than the Radeon HD 6950 1GB GDDR5. Some NVIDIA add-in GPU manufacturers are producing 2GB GDDR5 versions of the GeForce GTX 560 Ti. The GeForce GTX 560 Ti 2GB GDDR5 is ~$300. I have not seen any reviews comparing the gaming performance of the GeForce GTX 560 Ti 1GB GDDR5 to the GeForce GTX 560 Ti 2GB GDDR5. Nonetheless, to upgrade gaming performance over the GeForce GTX 560 Ti 1GB GDDR5, and to possibly avoid that seen with the Radeon HD 6950, where increasing memory from 1GB to 2GB GDDR5 does not improve gaming performance with one PCIe add-in GPU, it is recommended that you get the GeForce GTX 560 Ti 448 Cores Limited Edition (1.28GB 320-bit GDDR5), not the GeForce GTX 560 Ti 2GB GDDR5. The GeForce GTX 560 Ti 448 Cores Limited Edition is ~$300.

Regardless of deciding on a Radeon HD or a GeForce GTX, for gaming with one PCIe add-in GPU, the recommendation is best PCIe Gen2 add-in GPU with 1GB GDDR5 ~$250. Why? Because anything better gets into the high end PCIe add-in GPUs where costs, price to performance ratios, GPU lengths, case max add-in GPU lengths, power supply requirements, and/or heat dissipation considerations start to get crazy, which is best reserved for the Intel Desktop Computer 4: Gaming Two PCIe Add-In GPUs (below) and Intel Desktop Computer 5: Gaming Three PCIe Add-In GPUs (below).

- Motherboard/case form factor: microATX or ATX/mid tower or larger.
- Storage: SATA 6.0Gb/s and USB 3.0.

Intel Desktop Computer 3: Performance/Gaming One PCIe Add-In GPU (Model: IDC3-GA1)		
Comp	**Recommended**	**Notes/Alternates**
Mother-board	ASRock Z68 Pro3 Gen3 (asrock.com) $125: • Intel Z68 Express Chipset / LGA1155 / ATX (305mm x 191). • 1 x 24 pin motherboard main / 1 x 8 pin EPS 12V CPU. • Dual channel memory / 4 DIMMs / 32GB max / DDR3-1600/1333/1066 SDRAM / 1.5V / Non-ECC / Unbuffered. • Supports Intel HD Graphics. 1 x HDMI / 1 x DVI-D / 1 x VGA. Supports LucidLogix Virtu. • 1 x PCIe Gen3 x16 (x16 mode) / 3 x PCIe Gen2 x1 / 2 x PCI. Supports single PCIe Gen2 or Gen3 add-in GPU at x16 mode. No CrossFireX/SLI support. • 2 x internal SATA 6.0Gb/s / 4 x internal SATA 3.0Gb/s. RAID. • 2 x USB 3.0 (2 x back) / 10 x USB 2.0 (4 x back + 6 x via internal headers). Internal audio header.	• PCIe x16 graphics slot located at 4th expansion slot, not typical 1st or 2nd expansion slot. • Alternate: For ATX (305mm x 220), 1 x 4 pin ATX 12V CPU instead of 1 x 8 pin EPS 12V CPU, DDR3-1333/1066 SDRAM, no HDMI, 1 x PCIe Gen2 x16 (x4 mode) / 2 x PCIe Gen2 x1 instead of 3 x PCIe Gen2 x1, one more PCI, and two more USB 2.0 via internal headers, MSI Z68A-G43 (G3) (msi.com) $125. To reduce cost and for microATX (244mm x 244), added DisplayPort, 1 x PCIe Gen2 x16 (x16 mode) instead of 1 x PCIe Gen3 x16 (x16 mode), one less PCIe Gen2 x1, one less PCI, and 3 x internal SATA 3.0Gb/s / 1 x back eSATA 3.0Gb/s

	• 1 x gigabit (10/100/1000Mb/s) ethernet.	instead of 4 x internal SATA 3.0Gb/s, ASRock Z68 Pro3-M (asrock.com) $110.
Processor	2nd Generation Intel Core i5-2400 Processor (BX80623I52400) (ark.intel.com) $200: • 6MB cache / 3.10GHz / 5.0GT/s / LGA1155 / 32nm / Max TDP 95W / Sandy Bridge. • Quad core no Intel Hyper-Threading Technology (4C/4T). • Dual channel memory / 32GB max / DDR3-1333/1066 SDRAM / 21.3GB/s max memory bandwidth. • Intel 64 / Intel VT-x / Intel Turbo Boost 2.0 / Intel HD Graphics 2000 / Intel Quick Sync Video. • Heat sink/fan included.	• Alternate: To reduce cost and for 3MB cache, 65W, 2C/4T, and no Intel Turbo Boost, 2nd Generation Intel Core i3-2100 Processor (BX80623I32100) (ark.intel.com) $125. For 8MB cache, 3.40GHz, 4C/8T, 0-10% frame rate improvement depending upon game, and 50% more cost, 2nd Generation Intel Core i7-2600 Processor (BX80623I72600) (ark.intel.com) $300.
Memory	Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (Kit of 2) 8GB total (KVR1333D3N9K2/8G) (shop.kingston.com) $50: • 8GB DDR3-1333 SDRAM / CL9 / 1.5V / Non-ECC / Unbuffered / Kit 2 x 4GB.	• 1333MT/s x 8B/T x 2 channels = 21.3GB/s, which equals the Core i5-2400 Processor max memory bandwidth.
Graphics	1 x EVGA GeForce GTX 560 Ti FPB 1GB GDDR5 (01G-P3-1561-AR) (evga.com) 1 x $240: • PCIe Gen2 x16 / 1GB GDDR5 / 256-bit / 850MHz GPU / 4104MHz effective memory. • 1 x mini HDMI 1.4a / 2 x dual link DVI-I. • DX11 / OpenGL 4.1 / NVIDIA 3D Vision. • Supports 2-way SLI, not 3-way SLI. Accessories do not include SLI bridge. • 229mm x 111 (L x H). Double slot. • Max 200W. 2 x 6 pin PCIe power connectors required. 500W power supply required.	• Best Graphics Cards For The Money: December 2011 (tomshardware.com). • Alternate: To reduce cost for gaming, 250mm length, and 151W, 1 x Sapphire Radeon HD 6870 1GB GDDR5 (100314-3L) (sapphiretech.com) 1 x $185. To further reduce cost for gaming, or if not for gaming, 217mm length, and 127W, 1 x Sapphire Radeon HD 6850 1GB GDDR5 (100315L) (sapphiretech.com) 1 x $155. To further reduce cost if not for gaming, ~200mm length, and 108W, 1 x Sapphire Radeon HD 6770 1GB GDDR5 (100328L) (sapphiretech.com) 1 x $125.
Hard Drive	Western Digital Caviar Black 1.0TB SATA 6.0Gb/s (WD1002FAEX) (wdc.com) $175: • Caviar Black / 1.0TB / SATA 6.0Gb/s / 64MB cache / 7200rpm.	• Difficult to justify ~$0.50/GB for Western Digital VelociRaptor 10,000rpm SATA 6.0Gb/s or ~$1.50/GB for SSD SATA 3.0Gb/s or 6.0Gb/s. • Alternate: To reduce cost and for 32MB cache, Western Digital Caviar Blue 1.0TB SATA 6.0Gb/s (WD10EALX) (wdc.com) $120.
Optical Drive	ASUS DRW-24B1ST $25: • SATA. 2MB cache. • 24X DVD+R/8X DVD+RW/12X DVD+R DL/24X DVD-R/6X DVD-RW/12X DVD-RAM/16X DVD-ROM/48X CD-R/32X CD-RW/48X CD-ROM.	• 4x Newegg Customer Choice Award Winner - CD/DVD Burners.
Case	Corsair Carbide Series 400R (CC-9011011-WW) (corsair.com) $100: • 503mm x 206 x 521 (H x W x L). • Supports microATX and ATX motherboards. • 4 x external 5.25" / 6 x internal 3.5" including 3.5"/2.5" hard drive caddies. No removable hard drive cage. • 8 x expansion. • I/O panel: Front top / 2 x USB 3.0 / Audio. • Fans included: 2 x front 120mm with switchable on/off white LEDs / 1 x back 120mm. • Power supply bottom. 316mm max add-in GPU length.	• Large size mid tower. • Mesh side panel includes mount points for 2 x 120mm fans, not included. • Internal 3.5" bays oriented perpendicular to length of case. Therefore, long add-in GPUs do not obstruct internal 3.5" bays. • Alternate: To reduce cost and for 458mm x 205 x 465 (H x W x L), one less external 5.25", no hard drive caddies, one less expansion, USB 2.0, 279mm max add-in GPU length, internal 3.5" bays oriented parallel to length of case, long add-in GPUs obstructing adjacent internal 3.5" bays, etc., Antec Three Hundred (antec.com) $60. For fans with blue LEDs, Antec Three Hundred Illusion $70.

		For 475mm x 210 x 498 (H x W x L), one less external 5.25", one external 5.25" including 5.25" to 3.5" adapter, removable hard drive cage, 285mm max add-in GPU length, etc., Lian Li PC-9F (lian-li.com) $130.
Power Supply	Cooler Master Silent Pro M 600W (RS600-AMBAD3-US/RS-600-AMBA-D3) (coolermaster-usa.com) $105: • 600W / ATX 12V v2.3 / EPS 12V v2.91 / 150mm x 86 x 150 (W x H x L). • 80 PLUS Bronze Certified / Active PFC / MTBF 100,000hr / 5 year warranty. • 1 x +12V rail 40A. • 1 x 20+4 pin motherboard main / 1 x 4+4 pin ATX/EPS 12V CPU / 2 x 6+2 pin PCIe / 9 x SATA / 5 x 4 pin peripheral / 1 x floppy. Partially modular cable management.	• Alternate: To reduce cost if get 151W or less alternate add-in GPU, Antec High Current Gamer HCG-520 (antec.com) $80.
Total	$1020	$695-1150
Intel Desktop Computer 3: Performance/Gaming One PCIe Add-In GPU (Model: IDC3-GA1)		

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5. Intel Desktop Computer 4: Gaming Two PCIe Add-In GPUs (Model: IDC4-GA2)

Intended For:

- Gaming with two PCIe add-in GPUs.

> **Note:** The Intel Desktop Computer 4: Gaming Two PCIe Add-In GPUs is designed to support two PCIe add-in GPUs in 2-way CrossFireX/SLI, and, therefore, some of its components (i.e., motherboard, case, and power supply) are exorbitant if two PCIe add-in GPUs are not installed. In other words, if you are interested in building a performance/gaming Intel desktop computer with one PCIe add-in GPU, the Intel Desktop Computer 3: Performance/Gaming One PCIe Add-In GPU (above), which has the same specs for chipset, processor, and memory, is more appropriate.

Build Overview:

- Chipset supporting two PCIe Gen2 add-in GPUs in 2-way CrossFireX or 2-way SLI at x8/x8 mode or higher and two high end PCIe Gen2 add-in GPUs supporting 2-way CrossFireX or 2-way SLI:
  - Chipset: Intel P67 Express Chipset (socket LGA1155), Intel Z68 Express Chipset (socket LGA1155), or Intel X79 Express Chipset (socket LGA2011).

    > **Note:** Not all P67 and Z68 chipset motherboards support 2-way CrossFireX/SLI at x8/x8 mode.

  - Graphics: 2 x best PCIe Gen2 add-in GPUs ~$300 each.

    > **Note:** 2-way CrossFireX, not 2-way SLI, can exhibit levels of micro-stuttering that some people are sensitive to and find annoying. Therefore, build 2-way SLI, not 2-way CrossFireX. For additional information on micro-stuttering, see Micro-Stuttering And GPU Scaling In CrossFire And SLI (tomshardware.com).

- Processor: 2nd Generation Intel Core i5 Processor (socket LGA1155), 2nd Generation Intel Core i7 Processor (socket LGA1155 or LGA2011), or 2nd Generation Intel Core i7 Extreme Processor (socket LGA2011).
- Memory: 8GB.
- Motherboard/case form factor: ATX/mid tower or larger.
- Storage: SATA 6.0Gb/s and USB 3.0.

Intel Desktop Computer 4: Gaming Two PCIe Add-In GPUs (Model: IDC4-GA2)		
Comp	**Recommended**	**Notes/Alternates**

Mother-board	MSI Z68A-GD65 (G3) (msi.com) $200: • Intel Z68 Express Chipset / LGA1155 / ATX (305mm x 245). • 1 x 24 pin motherboard main / 1 x 8 pin EPS 12V CPU. • Dual channel memory / 4 DIMMs / 32GB max / DDR3-1333/1066 SDRAM / 1.5V / Non-ECC / Unbuffered. • Supports Intel HD Graphics. 1 x HDMI / 1 x DVI-D / 1 x VGA. Supports LucidLogix Virtu. • 1 x PCIe Gen3 x16 (x16 mode) / 1 x PCIe Gen3 x16 (x8 mode) / 3 x PCIe Gen2 x1 / 2 x PCI. Supports single PCIe Gen2 or Gen3 add-in GPU at x16 mode. Supports dual PCIe Gen2 or Gen3 add-in GPUs (single or double slot) in 2-way CrossFireX or 2-way SLI at x8/x8 mode. Accessories include SLI bridge. • 4 x internal SATA 6.0Gb/s / 4 x internal SATA 3.0Gb/s. RAID. • 4 x USB 3.0 (2 x back + 2 x via internal header) / 10 x USB 2.0 (4 x back + 6 x via internal headers). Internal audio header. • 1 x gigabit (10/100/1000Mb/s) ethernet.	• Graphics slots for 2-way CrossFireX or 2-way SLI are three expansion slots apart. • Installing double slot graphics cards for 2-way CrossFireX or 2-way SLI does not require 8 expansion slot case. • Difficult to justify cost of X79 chipset/socket LGA2011 platform for 0-10% frame rate improvement depending upon game. • Alternate: For DDR3-1600/1333/1066 SDRAM, 1 x PCIe Gen2 x16 (x4 mode) / 2 x PCIe Gen2 x1 instead of 3 x PCIe Gen2 x1, two less internal SATA 6.0Gb/s, added back eSATA 3.0Gb/s, and two more USB 2.0 back, ASUS P8Z68-V/GEN3 (asus.com) $195. To reduce cost and for P67 chipset, DDR3-1600/1333/1066 SDRAM, no Intel HD Graphics support, no video connectors, no LucidLogix Virtu support, 1 x PCIe Gen2 x16 (x4 mode) / 2 x PCIe Gen2 x1 instead of 3 x PCIe Gen2 x1, 3 x internal SATA 6.0Gb/s / 1 x shared back/internal SATA 6.0Gb/s instead of 4 x internal SATA 6.0Gb/s, and two more USB 2.0 back, ASRock P67 Extreme4 Gen3 (asrock.com) $170.
Processor	2nd Generation Intel Core i5-2400 Processor (BX80623I52400) (ark.intel.com) $200: • 6MB cache / 3.10GHz / 5.0GT/s / LGA1155 / 32nm / Max TDP 95W / Sandy Bridge. • Quad core no Intel Hyper-Threading Technology (4C/4T). • Dual channel memory / 32GB max / DDR3-1333/1066 SDRAM / 21.3GB/s max memory bandwidth. • Intel 64 / Intel VT-x / Intel Turbo Boost 2.0 / Intel HD Graphics 2000 / Intel Quick Sync Video. • Heat sink/fan included.	• Difficult to justify cost of X79 chipset/socket LGA2011 platform for 0-10% frame rate improvement depending upon game. • Alternate: For 8MB cache, 3.40GHz, 4C/8T, 0-10% frame rate improvement depending upon game, and 50% more cost, 2nd Generation Intel Core i7-2600 Processor (BX80623I72600) (ark.intel.com) $300.
Memory	Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (Kit of 2) 8GB total (KVR1333D3N9K2/8G) (shop.kingston.com) $50: • 8GB DDR3-1333 SDRAM / CL9 / 1.5V / Non-ECC / Unbuffered / Kit 2 x 4GB.	• 1333MT/s x 8B/T x 2 channels = 21.3GB/s, which equals the Core i5-2400 Processor max memory bandwidth.
Graphics	2 x EVGA GeForce GTX 560 Ti 2GB GDDR5 (02G-P3-1568-KR) (evga.com) 2 x $290: • PCIe Gen2 x16 / 2GB GDDR5 / 256-bit / 822MHz GPU / 4000MHz effective memory. • 1 x mini HDMI 1.4a / 2 x dual link DVI-I. • DX11 / OpenGL 4.1 / NVIDIA 3D Vision. • Supports 2-way SLI, not 3-way SLI. Accessories do not include SLI bridge. • 229mm x 111 (L x H). Double slot. • Max 200W each. 2 x 6 pin PCIe power connectors required each.	• Alternate: To reduce cost and for 1GB GDDR5 each, 2 x EVGA GeForce GTX 560 Ti FPB 1GB GDDR5 (01G-P3-1561-AR) (evga.com) 2 x $240. To further reduce cost and for GTX 560, 2 x EVGA GeForce GTX 560 1GB GDDR5 (01G-P3-1460-KR) (evga.com) 2 x $195
Hard Drive	Western Digital Caviar Black 1.0TB SATA 6.0Gb/s (WD1002FAEX) (wdc.com) $175: • Caviar Black / 1.0TB / SATA 6.0Gb/s / 64MB cache / 7200rpm.	• Difficult to justify ~$0.50/GB for Western Digital VelociRaptor 10,000rpm SATA 6.0Gb/s or ~$1.50/GB for SSD SATA 3.0Gb/s or 6.0Gb/s. • Alternate: To reduce cost and for 32MB cache, Western Digital Caviar Blue 1.0TB SATA 6.0Gb/s (WD10EALX) (wdc.com)

		$120.
Optical Drive	ASUS DRW-24B1ST $25: • SATA. 2MB cache. • 24X DVD+R/8X DVD+RW/12X DVD+R DL/24X DVD-R/6X DVD-RW/12X DVD-RAM/16X DVD-ROM/48X CD-R/32X CD-RW/48X CD-ROM.	• 4x Newegg Customer Choice Award Winner - CD/DVD Burners.
Case	Corsair Carbide Series 400R (CC-9011011-WW) (corsair.com) $100: • 503mm x 206 x 521 (H x W x L). • Supports microATX and ATX motherboards. • 4 x external 5.25" / 6 x internal 3.5" including 3.5"/2.5" hard drive caddies. No removable hard drive cage. • 8 x expansion. • I/O panel: Front top / 2 x USB 3.0 / Audio. • Fans included: 2 x front 120mm with switchable on/off white LEDs / 1 x back 120mm. • Power supply bottom. 316mm max add-in GPU length.	• Large size mid tower. • Mesh side panel includes mount points for 2 x 120mm fans, not included. • Internal 3.5" bays oriented perpendicular to length of case. Therefore, long add-in GPUs do not obstruct internal 3.5" bays. • Alternate: For 508mm x 206 x 521 (H x W x L), two removable and repositionable hard drive cages, fan controller, and mesh side panel with 200mm fan and switchable on/off white LEDs, Corsair Carbide Series 500R (CC-9011012-WW for black/black) (corsair.com) or Corsair Carbide Series 500R White (CC-9011013-WW for black/white) (corsair.com) $130. For 475mm x 210 x 498 (H x W x L), one less external 5.25", one external 5.25" including 5.25" to 3.5" adapter, removable hard drive cage, 285mm max add-in GPU length, etc., Lian Li PC-9F (lian-li.com) $130.
Power Supply	Cooler Master Silent Pro Gold 800W (RS800-80GAD3-US/RS-800-80GA-D3) (coolermaster-usa.com) $150: • 800W / ATX 12V v2.3 / EPS 12V v2.92 / 150mm x 86 x 160 (W x H x L). • 80 PLUS Gold Certified / Active PFC / MTBF 100,000hr / 5 year warranty. • 1 x +12V rail 65A. • 1 x 20+4 pin motherboard main / 1 x 4+4 pin ATX/EPS 12V CPU / 3 x 6+2 pin PCIe / 3 x 6 pin PCIe / 9 x SATA / 4 x 4 pin peripheral / 1 x floppy. Partially modular cable management. • CrossFireX Certified / SLI Certified.	• Alternate: To reduce cost and for 775W, 80 PLUS Bronze, etc., Thermaltake Toughpower XT 775W (TPX-775M) $140.
Total	$1480	$1195-1610
Intel Desktop Computer 4: Gaming Two PCIe Add-In GPUs (Model: IDC4-GA2)		

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6. Intel Desktop Computer 5: Gaming Three PCIe Add-In GPUs (Model: IDC5-GA3)

Intended For:

- Gaming with three PCIe add-in GPUs.

> **Note:** The Intel Desktop Computer 5: Gaming Three PCIe Add-In GPUs is designed to support three PCIe add-in GPUs in 3-way CrossFireX/SLI, and, therefore, some of its components (i.e., motherboard, case, and power supply) are exorbitant if three PCIe add-in GPUs are not installed. In other words, if you are interested in building a performance/gaming Intel desktop computer with one PCIe add-in GPU, the Intel Desktop Computer 3: Performance/Gaming One PCIe Add-In GPU (above), which has the same specs for chipset, processor, and memory, is more appropriate. And if you are interested in building a gaming Intel desktop computer with two PCIe add-in GPUs, the Intel Desktop Computer 4: Gaming Two PCIe Add-In GPU (above), which has the same specs for chipset, processor, and memory, is more appropriate.

Build Overview:

- Chipset supporting three PCIe Gen2 add-in GPUs in 3-way CrossFireX or 3-way SLI at x16/x8/x8 mode or higher and three upper high end PCIe Gen2 add-in GPUs supporting 3-way CrossFireX or 3-way SLI:

- Chipset: Intel P67 Express Chipset (socket LGA1155) plus NVIDIA NF200 or LucidLogix LT22102 chip, Intel Z68 Express Chipset (socket LGA1155) plus NVIDIA NF200 or LucidLogix LT22102 chip, or Intel X79 Express Chipset (socket LGA2011).
- Graphics: 3 x best PCIe Gen2 add-in GPUs 2GB ~$350 each.

> **Note:** 3-way CrossFireX does not exhibit the level of micro-stuttering seen in 2-way CrossFireX that some people are sensitive to and find annoying. Therefore, can build 3-way CrossFireX or 3-way SLI. For additional information on micro-stuttering, see Micro-Stuttering And GPU Scaling In CrossFire And SLI (tomshardware.com).

- Processor: 2nd Generation Intel Core i5 Processor (socket LGA1155), 2nd Generation Intel Core i7 Processor (socket LGA1155 or LGA2011), or 2nd Generation Intel Core i7 Extreme Processor (socket LGA2011).
- Memory: 8GB.
- Motherboard/case form factor: ATX/mid tower or larger.
- Storage: SATA 6.0Gb/s and USB 3.0.

Intel Desktop Computer 5: Gaming Three PCIe Add-In GPUs (Model: IDC5-GA3)		
Comp	**Recommended**	**Notes/Alternates**
Mother-board	ASUS Maximus IV Extreme-Z (asus.com) $345: • Intel Z68 Express Chipset plus NVIDIA NF200 / LGA1155 / Extended ATX (305mm x 269). • 1 x 24 pin motherboard main / 1 x 8 pin EPS 12V CPU. • Dual channel memory / 4 DIMMs / 32GB max / DDR3-1600/1333/1066 SDRAM / < 1.65V / Non-ECC / Unbuffered. • Supports Intel HD Graphics but provides no video connectors. Add-in GPU required. Supports LucidLogix Virtu. • 3 x PCIe Gen2 x16 (x16 mode) / 1 x PCIe Gen2 x16 (x8 mode) / 1 x PCIe Gen2 x4 / 1 x PCIe Gen2 x1. Supports single PCIe Gen2 add-in GPU at x16 mode. Supports dual PCIe Gen2 add-in GPUs (single or double slot) in 2-way CrossFireX or 2-way SLI at x8/x8 mode. Supports triple PCIe Gen2 add-in GPUs (single or double slot) in 3-way CrossFireX or 3-way SLI at x8/x16/x16 mode. • 4 x internal SATA 6.0Gb/s / 4 x internal SATA 3.0Gb/s / 2 x back eSATA 3.0Gb/s. RAID. • 10 x USB 3.0 (8 x back + 2 x via internal headers) / 9 x USB 2.0 (1 x back + 8 x via internal headers). Internal audio header. • 2 x gigabit (10/100/1000Mb/s) ethernet.	• Graphics slots for 3-way CrossFireX or 3-way SLI are two expansion slots apart. • Installing double slot graphics cards for 3-way CrossFireX or 3-way SLI does not require 8 expansion slot case. • Difficult to justify cost of X79 chipset/socket LGA2011 platform for 0-10% frame rate improvement depending upon game. • Alternate: To reduce cost and for P67 chipset, no Intel HD Graphics support, and no LucidLogix Virtu support, ASUS Maximus IV Extreme REV 3.0 (asus.com) $310. To further reduce cost and for P67 chipset, ATX (305mm x 245), no Intel HD Graphics support, no LucidLogix Virtu support, 2 x PCIe Gen2 x16 (x16 mode) / 2 x PCIe Gen2 x16 (x8 mode) / 3 x PCIe Gen2 x1, triple PCIe Gen2 add-in GPUs (single or double slot) in 3-way CrossFireX or 3-way SLI at x16/x8/x8 mode, no back eSATA, 2 x USB 3.0 (2 x back) / 14 x USB 2.0 (8 x back + 6 x via internal), and installing double slot graphics card in 4th graphics slot requires 8 expansion slot case, ASUS P8P67 WS Revolution REV 3.0 (asus.com) $265.
Processor	2nd Generation Intel Core i5-2400 Processor (BX80623I52400) (ark.intel.com) $200: • 6MB cache / 3.10GHz / 5.0GT/s / LGA1155 / 32nm / Max TDP 95W / Sandy Bridge. • Quad core no Intel Hyper-Threading Technology (4C/4T). • Dual channel memory / 32GB max / DDR3-1333/1066 SDRAM / 21.3GB/s max memory bandwidth. • Intel 64 / Intel VT-x / Intel Turbo Boost 2.0 / Intel HD Graphics 2000 / Intel Quick Sync Video. • Heat sink/fan included.	• Difficult to justify cost of X79 chipset/socket LGA2011 platform for 0-10% frame rate improvement depending upon game. • Alternate: For 8MB cache, 3.40GHz, 4C/8T, 0-10% frame rate improvement depending upon game, and 50% more cost, 2nd Generation Intel Core i7-2600 Processor (BX80623I72600) (ark.intel.com) $300.
Memory	Kingston 1333MHz DDR3 Non-ECC CL9 DIMM (Kit of 2) 8GB total (KVR1333D3N9K2/8G) (shop.kingston.com) $50: • 8GB DDR3-1333 SDRAM / CL9 / 1.5V / Non-ECC / Unbuffered / Kit 2 x 4GB.	• 1333MT/s x 8B/T x 2 channels = 21.3GB/s, which equals the Core i5-2400 Processor max memory bandwidth.

Graphics	3 x Sapphire Radeon HD 6970 2GB GDDR5 Dual Fan (100311-3SR) (sapphiretech.com) 3 x $355: • PCIe Gen2 x16 / 2GB GDDR5 / 256-bit / 880MHz GPU / 5500MHz effective memory. • 2 x mini DisplayPort 1.2 / 1 x HDMI 1.4a / 1 x dual link DVI / 1 x single link DVI-D. • DX11 / OpenGL 4.1 / AMD Eyefinity. • Supports 2-way and 3-way CrossFireX. Accessories include CrossFireX bridge, mini DisplayPort to DisplayPort adapter, and HDMI cable. • 270mm x 111 x 45 (L x H x W). Double slot. • Max 250W each. 1 x 8 pin + 1 x 6 pin PCIe power connectors required each.	• Best Graphics Cards For The Money: December 2011 (tomshardware.com). • Alternate: To reduce cost and for Radeon HD 6950, 3 x Sapphire Radeon HD 6950 2GB GDDR5 (100312-2SR) (sapphiretech.com) 3 x $290.
Hard Drive	Western Digital Caviar Black 1.0TB SATA 6.0Gb/s (WD1002FAEX) (wdc.com) $175: • Caviar Black / 1.0TB / SATA 6.0Gb/s / 64MB cache / 7200rpm.	• Difficult to justify ~$0.50/GB for Western Digital VelociRaptor 10,000rpm SATA 6.0Gb/s or ~$1.50/GB for SSD SATA 3.0Gb/s or 6.0Gb/s. • Alternate: To reduce cost and for 32MB cache, Western Digital Caviar Blue 1.0TB SATA 6.0Gb/s (WD10EALX) (wdc.com) $120.
Optical Drive	ASUS DRW-24B1ST $25: • SATA. 2MB cache. • 24X DVD+R/8X DVD+RW/12X DVD+R DL/24X DVD-R/6X DVD-RW/12X DVD-RAM/16X DVD-ROM/48X CD-R/32X CD-RW/48X CD-ROM.	• 4x Newegg Customer Choice Award Winner - CD/DVD Burners.
Case	Corsair Graphite Series 600T Mesh (CC600TM) (corsair.com) $150: • 507mm x 265 x 592 (H x W x L). • Supports microATX and ATX motherboards. • 4 x external 5.25" / 6 x internal 3.5" including 3.5"/2.5" hard drive caddies. Two removable and repositionable hard drive cages. • 8 x expansion. • I/O panel: Top front / 1 x USB 3.0 / 4 x USB 2.0 / Audio / Fan controller.. • Fans included: 1 x top 200mm with white LEDs / 1 x front 200mm with white LEDs / 1 x back 120mm. • Power supply bottom. Plenty of room for 3 x Sapphire Radeon HD 6970 2GB GDDR5 Dual Fan (100311-3SR).	• Extended size mid tower. • Internal 3.5" bays oriented perpendicular to length of case. Therefore, long add-in GPUs do not obstruct internal 3.5" bays. • Alternate: For no mesh side panel, Corsair Graphite Series 600T (CC600T) (corsair.com) $150. For 508mm x 206 x 521 (H x W x L), 2 x front 120mm fans with switchable on/off white LEDs instead of 1 x top and 1 x front 200mm fans with white LEDs, and mesh side panel with 200mm fan and switchable on/off white LEDs, Corsair Carbide Series 500R (CC-9011012-WW for black/black) (corsair.com) or Corsair Carbide Series 500R White (CC-9011013-WW for black/white) (corsair.com) $130.
Power Supply	Thermaltake Toughpower Grand 1200W (TPG-1200M) (thermaltakeusa.com) $265: • 1200W / ATX 12V v2.3 / EPS 12V v2.92 / 150mm x 86 x 180 (W x H x L). • 80 PLUS Gold Certified / Active PFC / MTBF 120,00hr / 7 year warranty. • 2 x +12V rails (+12V1 40A / +12V2 85A). • 1 x 24 pin motherboard main / 1 x 4+4 pin ATX/EPS 12V CPU / 1 x 8 pin EPS 12V CPU / 8 x 6+2 pin PCIe / 12 x SATA / 8 x 4 pin peripheral. Partially modular cable management. • CrossFireX Certified / SLI Certified.	• Alternate: To reduce cost and for 1 x +12V rail 98A, some shorter connector cable lengths, etc., Cooler Master Silent Pro Gold 1200W (RSC00-80GAD3-US/RS-C00-80GA-D3) (coolermaster-usa.com) $240.
Total	$2275	$1900-2375
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7. Additional Reading

- Intel Technologies Demonstrated (intel.com)
- Realistic Graphics With Intel Visual Technology (intel.com)
- Intel HD Graphics Provides Next Generation Integrated Graphics (intel.com)
- HD Graphics Quick Reference Guide (software.intel.com)
- Quick Reference Guide To 2nd Generation Intel Core Processor Graphics (HD Graphics) (software.intel.com)
- Intel Core i3 Desktop Processors That Contain Intel HD Graphics (intel.com)
- Intel Core i5 Desktop Processors That Contain Intel HD Graphics (intel.com)
- Intel Core i7 Desktop Processors That Contain Intel HD Graphics (intel.com)
- Intel Desktop Products (ark.intel.com)
- Intel 6 Series Chipset/Intel C200 Series Chipset: Datasheet (intel.com)
- Intel B65 Express Chipset (intel.com)
- Intel Q65 Express Chipset (intel.com)
- Intel Q67 Express Chipset (intel.com)
- Intel H61 Express Chipset (intel.com)
- Intel H67 Express Chipset (intel.com)
- Intel P67 Express Chipset (intel.com)
- Intel Z68 Express Chipset (intel.com)
- Intel X79 Express Chipset Datasheet (intel.com)
- Intel X79 Express Chipset (intel.com)
- Intel Celeron Desktop Processor (Desktop) (ark.intel.com)
- Intel Pentium Desktop Processor (Desktop) (ark.intel.com)
- 2nd Generation Intel Core i3 Processors (Desktop) (ark.intel.com)
- 2nd Generation Intel Core i5 Processors (Desktop) (ark.intel.com)
- 2nd Generation Intel Core i7 Processors (Desktop) (ark.intel.com)
- 2nd Generation Intel Core i7 Extreme Processor (Desktop) (ark.intel.com)
- ASRock Motherboard Series (asrock.com)
- ASUS Motherboards (asus.com)
- Gigabyte Motherboards (gigabyte.com)
- Intel Motherboards (intel.com)
- MSI Motherboards (msi.com)
- Kingston (kingston.com)
- AMD Radeon Graphics For Desktop PCs (amd.com)
- Sapphire (sapphiretech.com)
- Sapphire: Radeon Specifications Matrix (sapphiretech.com) (.xls)
- NVIDIA GeForce Graphics Cards (nvidia.com)
- EVGA (evga.com)
- Virtu GPU Virtualization Software (lucidlogix.com)
- Tom's Hardware (tomshardware.com)
- The Radeon HD 6950 Sweet Spot: Five 1 GB Cards Rounded-Up (tomshardware.com)
- Radeon HD 6970 And 6950 Review: Is Cayman A Gator Or A Crock? (tomshardware.com)
- Micro-Stuttering And GPU Scaling In CrossFire And SLI (tomshardware.com)
- Seagate Desktop Storage (seagate.com)
- Western Digital Internal Desktop Hard Drives (wdc.com)
- Antec (antec.com)
- Cooler Master (coolermaster.com)
- Corsair (corsair.com)
- Lian Li (lian-li.com)
- Thermaltake (thermaltakeusa.com)
- Newegg (newegg.com)

Steve's Tech Resource
The Web Development, Internet, Software, Hardware, and Multimedia Resource