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A Look at PCI Board Design Guidelines

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Key Takeaways

- PCIe slots are commonly used in personal computers to connect motherboards to critical components.
- Peripheral Component Interconnect (PCI) is a bus available in two different bit variants: 32 bits and 64 bits.
- PCI generations specify the maximum trace length and impedance allowable for varying the data transfer speed.

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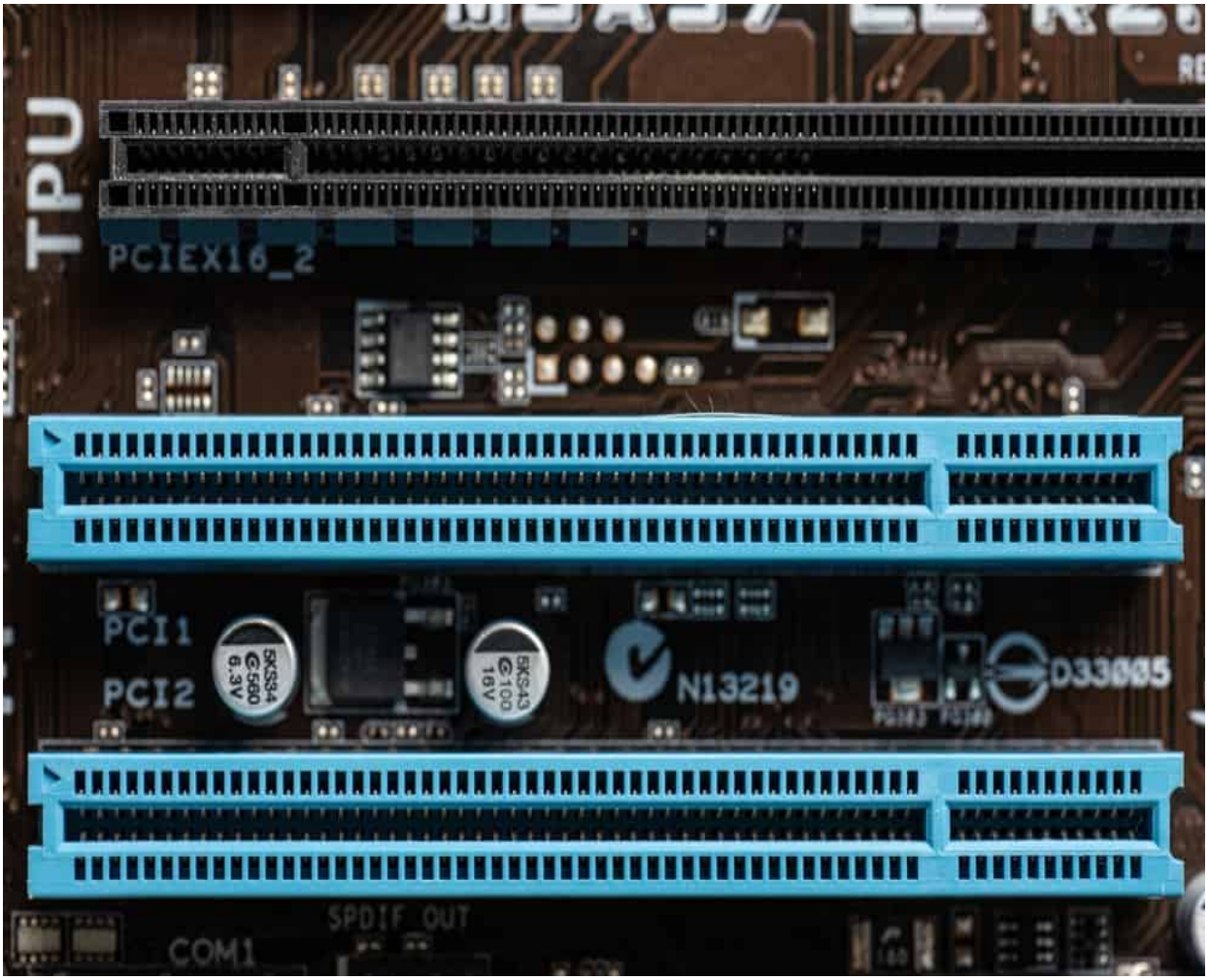

If you are into PC hardware customization and upgradation, you might have tried hands-on peripheral component interconnect (PCI) board design. PCI boards enable the interfacing of the memory, graphics, and storage to the PC. PCIe slots are commonly used in personal computers to connect motherboards to critical components. In this article, we will explore PCIe and PCI board design.

All About Peripheral Component Interconnects

The History of PCI

In computers, bus architecture is employed to transmit data from one part to another. The bus in computer hardware consists of a collection of wires, which act as an interface between various computer parts. Previously, the interfacing was done using an

accelerated graphics port (AGP). As graphics cards developed and became more powerful, a faster interfacing technology was needed, which led to the birth of PCI technology.

Defining PCI

PCI is a bus available in two different bit variants: 32 bits and 64 bits. PCI is a reliable interfacing technology for the expansion of computer hardware; much better than AGP slots. Intel was the pioneering company that designed the PCI interface to add new peripherals as well as to increase the RAM.

The Role of PCI Technology

PCI technology aids in the transmission of data at a faster rate. In PCI technology, expansion is in the form of card insertion. In the PCI bus, slots are provided to insert expansion cards, which makes the installation process faster and free of wires. The PCI is more like a plug-and-play system to connect the expansion cards. The peripherals that are put into service using PCI slots are USB, graphics cards, sound cards, modems, network cards, and controller cards.

The Shift to PCIe

The emergence of new standards and protocols paved the pathway for modernizing the PCI bus. Peripheral component interconnect express, commonly referred to as PCIe, is the standard interface connection in modern computers. Traditional PCI slots are now obsolete.

Here is how PCIe compares to traditional PCI technology.

PCI	PCIe
• PCI is based on the parallel bus concept.	• PCIe is a series bus technology.
• PCI sticks to individual buses.	• PCIe uses shared buses.
• PCI slots are of the same size irrespective of the device size.	• The form factor of PCIe changes with the size of the device.
• The PCI interfacing runs at clock rates which makes it a faster data transmission technology.	• The PCIe interfacing runs with higher clock rates compared to PCI. The bandwidth provided by PCIe is unparalleled compared to PCI.
• PCI connects the devices such that they share the bandwidth.	• Apart from the higher bandwidth, PCIe connects the devices to get their own bandwidth.

PCI Board Design Guidelines

PCI boards are designed to provide interfacing that guarantees speed. PCIe technology crosses four generations, and the data transfer speed has reached over 1950 MB/s. From the data transfer rate, it is clear that PCI board designs fall under the high-speed PCB design category.

Here are some guidelines for building a reliable PCI board design.

Routing, Trace Length, and Impedance

PCIe technology allows longer traces in the routing specification. PCI generations specify the maximum trace length and impedance allowable for varying the data transfer speed. By strictly following the specifications, designers can ensure the performance of the PCI board meets expectations.

There is a limit set to the differential impedance values as well for various PCIe generations. The routing pattern should be symmetrical to the pin, components, and pads in the PCI board. There should be tight coupling introduced throughout the length of the differential routing pairs. The variations due to vias, components, and pads in

one trace need to be compensated in the other trace to ensure minimized crosstalk.

Layer Stack-Ups

Most PCI boards have layer stack-ups with power planes and signal layers. It is a common trend to route signal traces on inner layers to improve EMI immunity. PCI board design guidelines are devised for each part of the board and are not limited to routing, layers, plug areas, thickness, etc.

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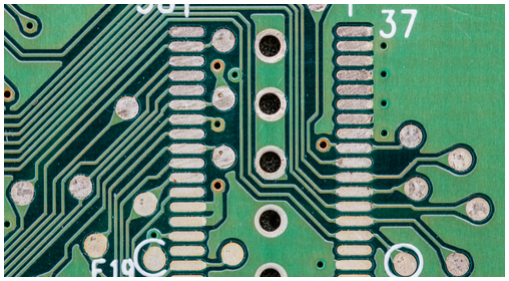

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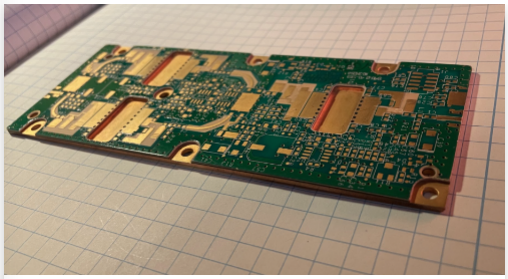

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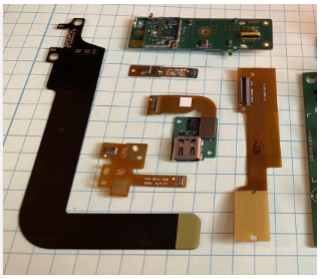

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