

Intel® 6000 Series Thunderbolt™ 3 Controllers



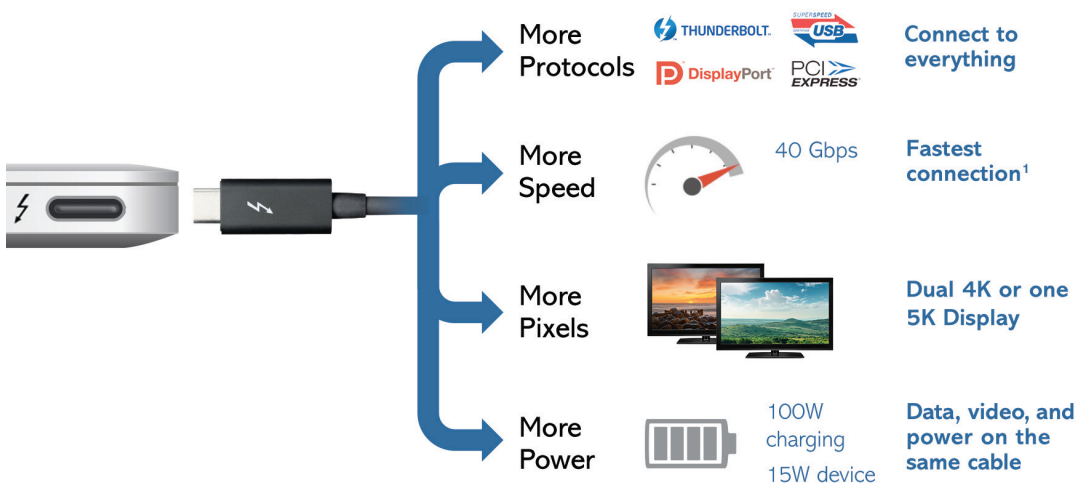
Thunderbolt™ 3: The USB-C That Does It All

Thunderbolt™ 3 delivers a single cable, multi-purpose I/O solution at speeds up to 40 Gbps, creating one compact port that does it all – delivering today's fastest,¹ most versatile connection to any dock, display, or data device. With Thunderbolt 3, one computer port connects to Thunderbolt devices, every display, and billions of USB devices. A single cable now provides four times the data and twice the video bandwidth of any other solution, while also supplying power. It's unrivaled for new uses, such as single-cable docks with charging, docking displays, super-fast storage, external graphics, and 10 GbE networking. Simply put, Thunderbolt 3 delivers the best USB-C.



Thunderbolt Overview

Fundamentally, Thunderbolt is a tunneling architecture designed to combine underlying protocols onto a single interface so that the total speed and performance of the link can be shared between the usages of these protocols allowing Thunderbolt 3 to deliver data, display, and power all over a single cable. Thunderbolt 3 provides more protocols, more speed, more pixels, and more power.



The Thunderbolt controller provides several important features. It includes a physical interface (PHY) layer that can dynamically switch operating modes to drive either:

- Native USB 2.0, 3.0, and 3.1
- Native DisplayPort* 1.1 and 1.2a²
- Thunderbolt at 20 and 40 Gbps

In the Thunderbolt mode, a Thunderbolt 3 port has the ability to support one or two (4 lane) DisplayPort interface(s), and up to 4 lanes of PCI Express* Gen 3. If the Thunderbolt device has two Thunderbolt ports, the dynamic mode configuration described above will be configured on the downstream or second port of the device when another cable and device are plugged into it. Each mode will still be supported on this downstream connector, and data and display traffic will be provided as needed to that downstream port. If each consecutive device is a Thunderbolt device, up to six devices in a chain can be supported.

Key Features and Benefits

More Speed

Provides a 40 Gbps connection

- Double the speed of Thunderbolt™ 2 and 8x the bandwidth of USB 3.0
- Provides a Bi-directional connection with 40 Gbps of bandwidth in each direction

More Protocols

Thunderbolt 3, USB, DisplayPort, and power over one cable

- 4 lanes of PCI Express Gen 3
 - Provides the Lowest latency for PCI Express audio
- 8 lanes of DisplayPort 1.2 (HBR2)
 - Supports two 4K displays (4096 x 2160 30bpp @ 60 Hz)
 - Compatible with existing DisplayPort displays, devices, and cables²
 - Allows connection of DVI, HDMI, and VGA displays via adapters
- Includes a USB 3.1 Gen2 (10 Gbps) connection
 - Compatible with existing USB devices and cables
- Includes Thunderbolt™ Networking
 - Provides greater than 10 Gb Ethernet bandwidth connection between computers

More Power

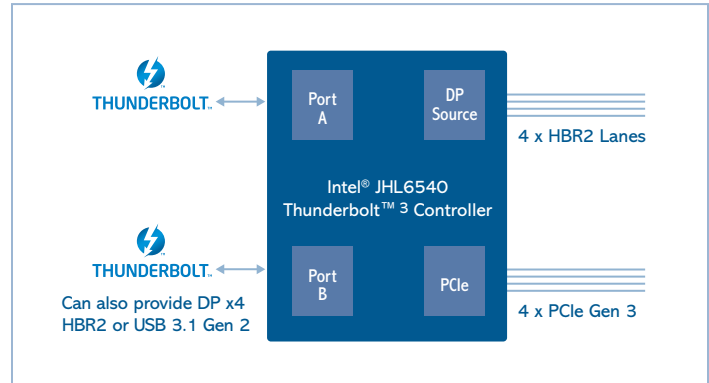
Delivers Power to Computer or Peripheral (based on USB power delivery)

- Up to 100W system charging
- 15W to bus-powered devices

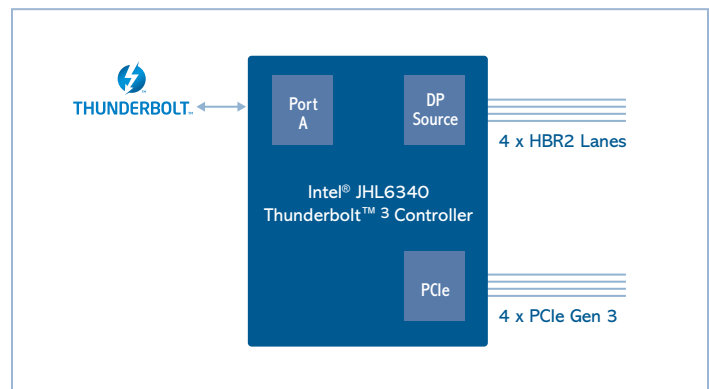
Utilizes the USB-C connector for a small, reversible, easy to use solution

There are three components in the Intel® 6000 Series Thunderbolt™ 3 controller family. These block diagrams showcase their use in Thunderbolt 3 peripherals.

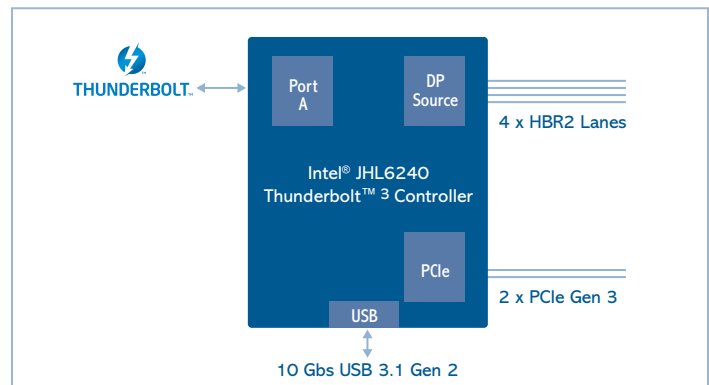
Intel® JHL6540 Thunderbolt™ 3 Controller



Intel® JHL6340 Thunderbolt™ 3 Controller



Intel® JHL6240 Thunderbolt™ 3 Controller



Intel® 6000 Series Thunderbolt™ 3 Controller Technical Specifications

SKU Details

| | | | |
|-----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Product Name | Intel® 6540 Thunderbolt™ Controller | Intel® 6340 Thunderbolt™ Controller | Intel® 6240 Thunderbolt™ Controller |
| Product Number | JHL6540 | JHL6340 | JHL6240 |
| Order Number: Tape and Reel | 950427 – SLLSM | 950430 – SLLSP | 948590 – SLLNF |
| Order Number: Tray | 950428 – SLLSN | 950431 – SLLSQ | 948591 – SLLNG |
| Expected Usage | Computer or peripheral | Computer or peripheral | Computer or peripheral |

Thunderbolt Features

| | | | |
|-------------------------|---|--|--|
| Speed | 40 Gbps | 40 Gbps | 40 Gbps |
| PCIe* Lanes | 4 | 4 | 2 |
| DisplayPort* Streams | Host Configuration: 2 Peripheral Configuration: 2 | Host Configuration: 2 Peripheral Configuration: 1 | Host Configuration: 1 Peripheral Configuration: 1 |
| DisplayPort Total Lanes | 8 | Up to 8 in host configuration | 4 |
| USB Compatibility | Host port and downstream port in peripheral devices are compatible with USB devices | Host port is compatible with USB devices | USB 3.1 Gen 2 downstream port is provided |

Physical Characteristics

| | | | |
|-----------------------------|---|---|---|
| Dimensions (HxWxD) | 10.7mm x 10.7mm | 10.7mm x 10.7mm | 10.7mm x 10.7mm |
| Weight | .23g | .23g | .23g |
| Operating Temperature | 0 – 65 deg C | 0 – 65 deg C | 0 – 65 deg C |
| Humidity Non-Operating | MSL3 | MSL3 | MSL3 |
| Operating Systems Supported | Microsoft Windows* 10, MacOS*, Linux* (certain distributions) | Microsoft Windows* 10, MacOS*, Linux* (certain distributions) | Microsoft Windows* 10, MacOS*, Linux* (certain distributions) |



To learn more visit <https://thunderbolttechnology.net/>

¹Fastest connection as compared to other PC I/O connection technologies including eSATA, USB, and IEEE 1394 Firewire*. Performance will vary depending on the specific hardware and software used. Must use a Thunderbolt-enabled device.

²Thunderbolt™ 3 provides DisplayPort, which can natively connect to all displays with DisplayPort and mini-DisplayPort, and via adapters can connect to all other modern display interfaces, including HDMI, DVI, and VGA.

Intel technologies may require enabled hardware, specific software, or services activation. Check with your system manufacturer or retailer.

Information included in this product brief is intended for informational purposes only and is not intended as a basis for product design. Detailed Thunderbolt 3 design collateral is available, please contact Intel for additional information.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

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