ODROID-H3 and ODROID-H3+

Modern 4-Core 4-Thread x86 64-bit single board computer with large memory capacity and advanced IO ports.

- Intel® Quad-Core Processor Jasper Lake N5105(H3+: N6005) has a base clock of 2GHz and a boost clock of 2.9GHz (H3+: 3.3GHz) with 1.5 MB L2 and 4 MB L3 cache by a 10 nm process.

- Up to 64GB Dual-channel Memory DDR4 PC4-23400 (2933MT/s)

- Two SO-DIMM slots, up to 32GB per slot

- PCIe 3.0 x 4 lanes for one M.2 NVMe storage

- 2 x 2.5Gbit Ethernet ports

- 2 x SATA 3.0 ports

- SSE4.2 accelerator (SMM, FPU, NX, MMX, SSE, SSE2, SSE3, SSSE3, SSE4.1, SSE4.2, AES)

- Intel UHD Graphics 24 EUs(H3+:32 EUs) Turbo 800MHz(H3+:900MHz)

- HDMI 2.0 and DP 1.2 multiple video outputs

Processor	H2	H2+	H3	H3+
CPU	Celeron J4105	Celeron J4115	Celeron N5105	Pentium Silver N6005
Code name	Gemini Lake	Gemini Lake	Jasper Lake	Jasper Lake
Lithography	14 nm	14 nm	10 nm (Intel 7)	10 nm (Intel 7)
Microarchitecture	Goldmont Plus	Goldmont Plus	Tremont	Tremont
Cores / Threads	4C4T	4C4T	4C4T	4C4T
TDP	10W	10W	10W	10W
Base Frequency (GHz)	1.5	1.8	2.0 (11% more)	2.0 (11% more)

Burst Frequency (Single Thread) (GHz)	2.5	2.5	2.9 (16% more)	3.3 (32% more)
Burst Frequency (Multi Thread) (GHz)	2.3	2.3	2.6 (13% more)	2.8 (22% more)
Memory				
Max. Memory address space (GB)	32	32	64 (100% more)	64 (100% more)
Max. Memory Speed (MT/s)	2400	2400	2933 (22% more)	2933 (22% more)
IGP (INTEL UHD Graphics)				
Base Frequency (MHz)	250	250	450 (80% more)	450 (80% more)
Burst Frequency (MHz)	750	750	800 (7% more)	900 (20% more)
Execution Units	12	12	24 (100% more)	32 (167% more)
PCIe (via NVMe adapter)				
Generation	Gen 2	Gen 2	Gen 3	Gen 3
Lanes	4	4	4	4
Max Transfer Rate (GT/s)	5.00	5.00	8 (60% more)	8 (60% more)
Max Throughput x4 (GB/s)	2	2	3.94 (97% more)	3.94 (97% more)
USB				
2.0	2 ports	2 ports	2 ports	2 ports

3.0	2 ports	2 ports	2 ports	2 ports
Ethernet				
2.5GbE		2 ports	2 ports	2 ports
Using a low or mid-range graphics card	Yes (via NVMe slot + optional PCIe cable adapter)	Yes (via NVMe slot + optional PCIe cable adapter)	Yes (via NVMe slot + optional PCIe cable adapter) With the Odroid H3/H3+, all the graphics cards we tested worked out of the box. Graphics performance, e.g. OpenGL, is excellent for this range of hardware. All the benchmarks we tried ran OK. No bugs, no hassles, no misery like one experiences when trying to use the PCIe bus with a graphics card on an ARM-based SBC. Graphics operations are up to more than 15 times faster compared to the INTEL UHD when using a low or mid-range dGPU (external graphics card).	
SATA III	2 ports	2 ports	2 ports	2 ports
NVMe	PCIe Gen 2 x4 (Limited speed)	PCIe Gen 2 x4 (Limited speed)	PCIe Gen 3 x4 Full speed	PCIe Gen 3 x4 Full speed
IO Expansion ports	I2C x 2	I2C x 2	I2C x 2	I2C x 2
	No USB	USB 2.0 x 1	USB 2.0 x 3	USB 2.0 x 3
	UART x 2	UART x 2	UART x 1	UART x 1
	No HDMI-CEC	HDMI-CEC x 1	HDMI-CEC x 1	HDMI-CEC x 1
	Ext. Power Button x 1	Ext. Power Button x 1	Ext. Power Button x 1	Ext. Power Button x 1

Optional Cooling Fan	92 mm, custom small footprint 4pin connector with 5Volt power	92 mm, custom small footprint 4pin connector with 5Volt power	92 mm, standard PC 4-pin with 12V fan	92 mm, standard PC 4-pin for 12V fan
Dimensions	110x110mm (4.3×4.3 in)	110x110mm (4.3×4.3 in)	110x110mm (4.3×4.3 in)	110x110mm (4.3×4.3 in)
Power Supply	15V x 4A = 60W	15V x 4A = 60W	15V x 4A = 60W or 19V x 7A = 133W	15V x 4A = 60W or 19V x 7A =133W
Security (TPM 2.0)	fTPM disabled	fTPM disabled	fTPM enabled Windows 11 compatible Attestation ready and Storage ready	
Hardkernel H-series cases	DIY assembly Translucid Blue Acrylic	DIY assembly Translucid Blue Acrylic	DIY assembly Satin black PCB with gold lettering One new case is glossy royal blue.	
Certifications	FCC/CE/KC/RoHS	FCC/CE/KC/RoHS	FCC/CE/KC/RoHS	FCC/CE/KC/RoHS

Hardware Installation

- Connect the backup battery to the board. The backup battery is packaged with the ODROID-H3, and it will maintain BIOS settings as well as the Real Time Clock on the board.

- Install DDR4 memory cards as desired up to 32GB (2 x 16GB). Although ODROID-H3 supports dual channel memory, a single memory card can be used. For best performance, install two identical memory cards of the same capacity. (i.e 2 x 4GB for Max.8GB instead of 1 x 8GB)

- Connect any additional peripherals such as a display monitor, keyboard, and mouse. ODROID-H3 doesn't support a PS-2 type keyboard or mouse. Only USB or Bluetooth keyboard and mouse are supported.

- For desktop like use, a display device can be connected with HDMI and/or DisplayPort. Operating system support is required for dual display use.

- Single or dual ethernet (10/100/1000Mbps/2500Mbps) cables can be connected for network support.

- Finally, connect the DC power adapter to the DC jack at the rear side of the ODROID-H3. For high performance computing and/or multiple storage devices, at least a DC 15V/4A power adapter is strongly recommend.

- For more detailed installation requirements, please refer to the hardware specification. Also, it is strongly recommended to install and keep the ODROID-H3 in a secure hardware case to protect it from environmental hazards.

Entering BIOS Menu

- At the very first boot after the ODROID-H3 hardware is assembled, the BIOS will be entered immediately. You can set hardware configuration options and save them. The BIOS settings will be maintained until the backup battery is disconnected or discharged.

- You can use the **DEL** key while booting to enter the BIOS manually.

- **The very first booting process might take up to 3 minutes**.

The first boot needs a long post process to start the BIOS due to a long period of checking the RAM timing parameters.
Once the configuration is stored into the backup memory in the SoC, it boots quickly.
If you disconnect the backup coin battery for a while, you will meet the very slow booting process again.

Operating System Installation

- No operating system license or installation media are included in the ODROID-H3 package. This implies that you must purchase the license of the operating system you wish to install or download a free operating system such as Debian or Ubuntu.

- In order to install an operating system, you will need an installation media such as a USB stick or CD/DVD. These can be purchased at a store or downloaded from the website of the provider and written to a USB stick or CD/DVD media.

- To install from CD/DVD media, you have to connect a USB CD/DVD drive to a USB host port on ODROID-H3. Installation media will need to be created using another computer and the appropriate software.

Burning OS to USB Stick

- This section assumes that you will install an operating system from a USB stick and are going to burn an operating system image to the USB stick on another computer. There are various software depending on operating system, but this section uses a popular burning software called "Etcher" that supports multiple operating systems and is easy to use.

- You can download the "Etcher" software from its official site and install it in your computer. Then, open "Etcher" once the installation is completed.

- Before burning an installation image, you must have the image as a file on your computer. If not, you must purchase or download the image from the provider. For example, you can download the Ubuntu image from Official Canonical Ubuntu images. We tested Ubuntu 22.04 LTS images. Ubuntu 22.04(ubuntu-22.04-desktop-amd64.iso) had newer Linux Kernel with improved video drivers and it gave us better GPU performance.

Download Ubuntu Desktop

The open-source desktop operating system that powers millions of PCs and laptops around the world. Find out more about Ubuntu's features and how we support developers and organisations below.

Ubuntu Desktop homepage   Visit the Ubuntu Desktop blog ›

Ubuntu 22.04.1 LTS

Download the latest LTS version of Ubuntu, for desktop PCs and laptops. LTS stands for long-term support — which means five years, until April 2027, of free security and maintenance updates, guaranteed.

Ubuntu 22.04 LTS release notes

Recommended system requirements:

- ✔ 2 GHz dual-core processor or better
- ✔ 4 GB system memory
- ✔ 25 GB of free hard drive space
- ✔ Internet access is helpful
- ✔ Either a DVD drive or a USB port for the installer media

Download

For other versions of Ubuntu Desktop including torrents, the network installer, a list of local mirrors, and past releases see our alternative downloads.

Flash Ubuntu to Your USB Flash

- Open Etcher.
- Click "Select Image" button and select the downloaded OS image.
- Etcher selects a USB stick to flash automatically. If not, or if you want to use a different drive, click "Change" and select one.
- Click the "Flash" button to start the flashing and verification process.

## Installing an operating system from an installation media

- The instruction in this section can be used to install an operating system from a USB stick or CD/DVD media or when you want to switch an operating system installed on storage attached to the ODROID-H3 while changing the boot priority.

- The procedure to install an operating system varies depending on the operating system, but it's no different between a regular personal computer and the ODROID-H3. Therefore, you may also need to contact the operating system provider if you encounter any installation failures.

- After installing an operating system is completed, the operating system will eventually ask you to remove the installation media from the ODROID-H3 and reboot. On the next boot, if everything is fine, the operating system you have installed will appear.

Installable boot media on the ODROID-H3

- The ODROID-H3 can have multiple storage devices that an operating system can be installed on. These storage devices can be connected to the ODROID-H3 at the same time and an operating system can be installed and select to use during booting.

1. eMMC (Embedded Multimedia Card)

2. SATA HDD/SSD drive #1

3. SATA HDD/SSD drive #2

4. M.2 NVMe

- The major difference between these storage devices is the I/O bandwidth. One is slower or faster than others because of the different hardware bus or interface specifications.

Selecting Installation Media on Boot

- The BIOS on the ODROID-H3 always tries to load bootable images from the storage as configured in the BIOS. For example, you can set SATA port 2 to load the operating system rather than SATA port 1 by setting this order in the BIOS.

- In order to boot a USB stick or CD/DVD removable drive, you can enter the BIOS and change the boot priority.
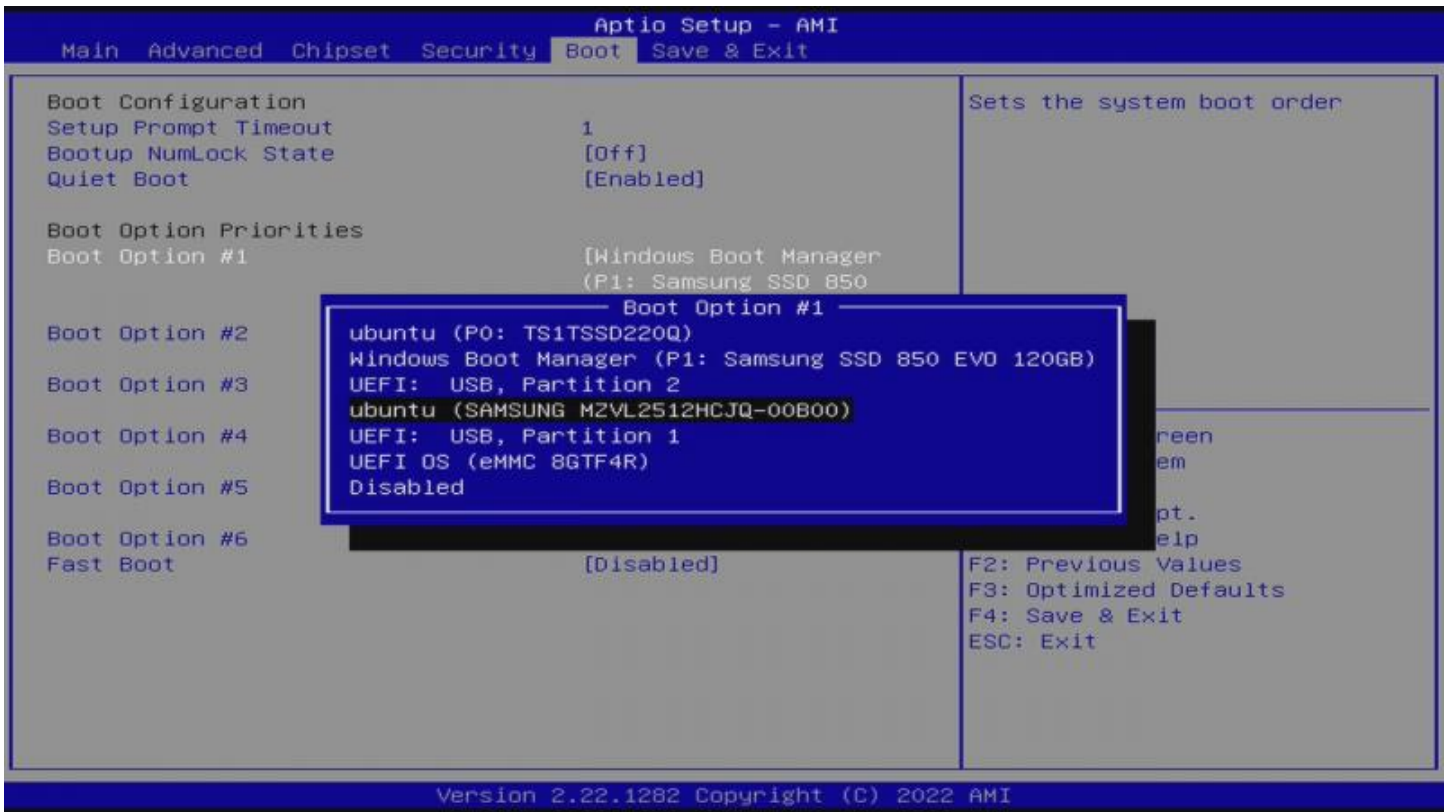
- Instead of entering the BIOS menu to select a boot device, the "F7" key can be used at power on or reboot. This will present a menu with the list of connected storage devices and you can select one of them to boot from.

Hardware (Block Diagram)
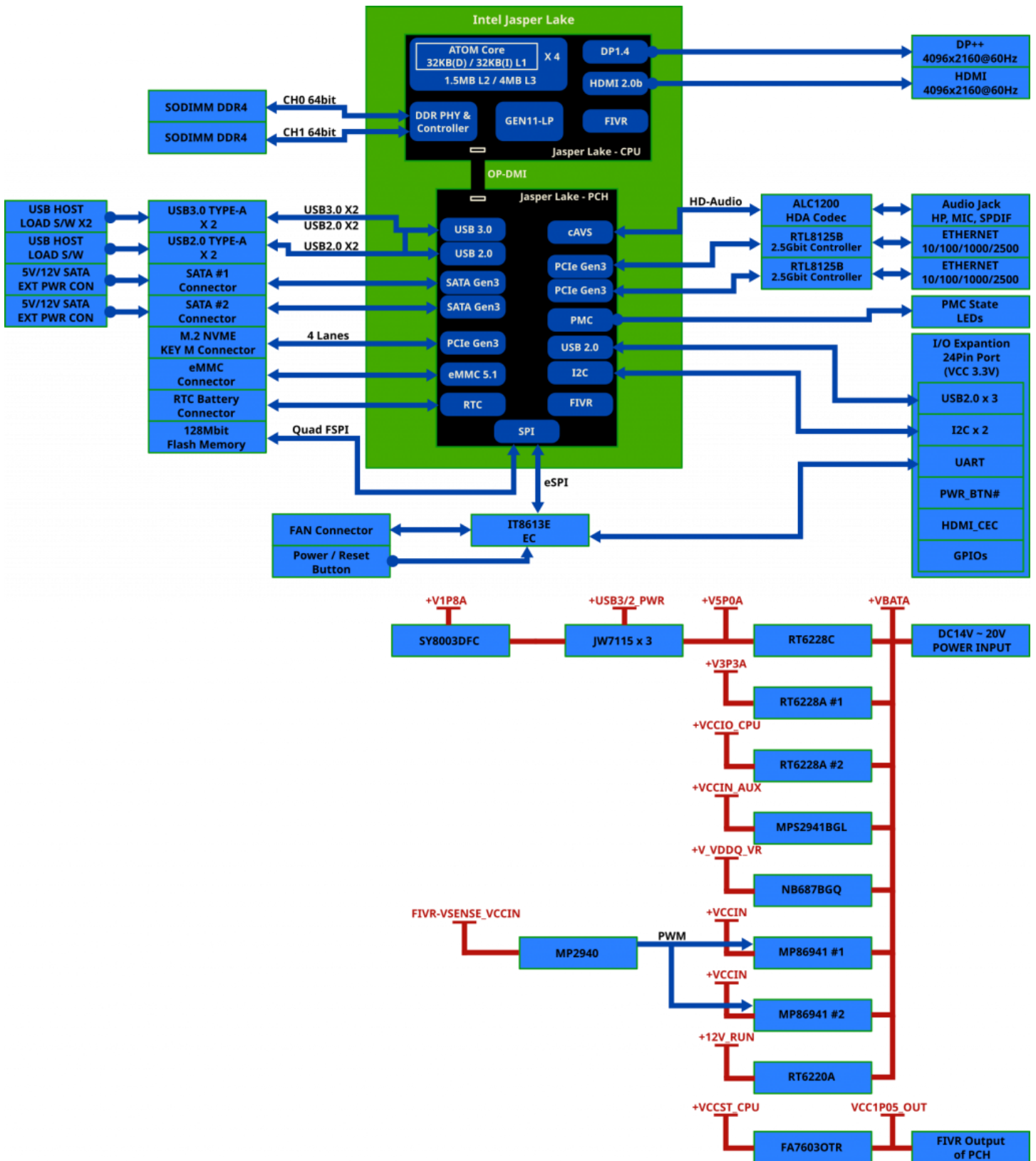
- board_layout
- board_dimensions

Schematics and N5105 Datasheet

- ODROID-H3 Schematics (PDF format)

- Intel@ N5105 datasheet Vol 1
- Intel@ N5105 datasheet Vol 2

BIOS

- ODROID-H3 BIOS Release
- How to update ODROID-H3's BIOS
- eMMC Connection Check in BIOS
- Serial Port Console Redirection on ODROID-H3

Application Notes

- 2x12 24pin IO Ports
  - I2C
  - UART
- Usage 20x4 I2C LCD | System Monitor with 20x4 I2C LCD
- Usage RTS and CTS pin as GPIO
- Install Power LED Button for ODROID-H3 Cases
- How to install Wifi Moudle 5/5A(Realtek rtl8812au) WiFi Driver in Linux
- Auto Start Of System When Power Applied
- How To Enable Wake On LAN
- Memory compatible with the ODROID-H3 / H3+
- How the Blue LED Works by System Conditions
- How to control the PWM fan on ODROID-H3
- How to install H2/H3 Net Card