Clara AGX Developer Kit User Guide

Purpose: Provides the instructions to flash, setup, and start using a Clara AGX Developer Kit.

Disclaimer: The Clara AGX Developer Kit is not an approved medical device and is not intended for clinical use.

Version: 1.6

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Checklist for Setting up the Developer Kit

After receiving the Clara AGX Developer Kit, ensure the following actions are taken before developing on the kit. Each action is described in its corresponding section of this user guide.

- Read through the **Hardware Setup** requirements and precautions.
- Familiarize yourself with the **System Overview**: the main components and system I/O.
- Power up the system.
- If you had previously flashed the devkit, check firmware version and manually update if needed. If this is your first time flashing, come back to the step at the end of the checklist.
- Flash and update the Clara AGX Developer Kit with Jetpack using SDK Manager.
- Switch from iGPU to dGPU mode.
- Set up the 250GB SSD storage.
- Set up Docker and Docker storage.
- Install the Clara Holoscan SDK from Github.

**Hardware Setup**

**Requirements**

- A Clara AGX Developer Kit
- A compatible power cable
  - Your NVIDIA Clara AGX Developer Kit may not include a power cable compatible with your local electrical requirements.
  - A compatible cable should meet the following requirements:
    - Provides a certified local 3-prong AC power plug
    - Provides a C13 connector
    - Supports ratings of 100-120VAC/6A, 200-240VAC/3A, or higher with a minimum wire thickness of 18AWG and insulation rating of 300V or higher.
- An Ubuntu 18.04 / 20.04 host system (for use during flashing)
- A standard USB-A to USB-C or USB-C to USB-C cable with data enabled (for use during flashing)
- Connection to the Internet for the host system before and during flashing, and for the Clara AGX Developer Kit during flashing
- A keyboard, mouse, and monitor with HDMI for the Clara AGX Developer Kit

**Precautions**

- Only connect and disconnect a PCIe card (e.g. miniSAS or dGPU) when the system is powered down.
Apply extra care when plugging and removing PCIe cards to avoid stress on the PCIe connectors (wearing, bending, breaking).
- The rightmost USB connector is USB 2.0 (even if the color is blue). The other two USB connectors are USB 3.0.

**System Overview**

**Main Components**
The Clara AGX Developer Kit contains the following major components:

- [AGX Xavier 32 GB Module](#)
- [RTX 6000 discrete GPU](#)
- ConnectX-6 IC
- 250GB Removeable SSD

**Tech Specs**

<table>
<thead>
<tr>
<th>CPU</th>
<th>8-core Carmel ARM v8.2 64-bit CPU, 8MB L2 + 4MB L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>32GB 256-Bit LPDDR4x</td>
</tr>
<tr>
<td>GPU</td>
<td>RTX6000</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>250GB SSD</td>
</tr>
<tr>
<td>------------</td>
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</tr>
<tr>
<td><strong>I/O</strong></td>
<td>USB2.0</td>
</tr>
<tr>
<td><strong>Expansion</strong></td>
<td>PCIe x8 (single slot width) to Xavier</td>
</tr>
<tr>
<td><strong>Power Supply</strong></td>
<td>750W</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>227mm W x 149mm H x 332mm L</td>
</tr>
</tbody>
</table>
I/O and external interfaces

1) Power cable connection
2) Power switch
3) PCIe slots for customer cards
4) dGPU outputs from RTX 6000, including four Display Ports and one mini HDMI port
   a. Reference the GPU section below to determine which display output to use.
5) 100 GbE QSFP28 Ethernet connector to NVIDIA ConnectX-6
6) 10 GbE RJ45 Ethernet connector to NVIDIA ConnectX-6
   a. The 10GbE connector only supports 10 GbE speeds.
7) 1 GbE RJ45 Ethernet connector to Xavier module
8) USB 3.0 ports (2x)
9) USB 2.0 port (1x)
10) HDMI out
    a. Reference the GPU section below to determine which display output to use.
11) HDMI in: Connect to instruments that output HDMI to the platform.
12) Debug USB-C port: Connect to the Linux host system for flashing and serial port connections.

13) x8 PCIe slot (x16 physical) for customer card, to Xavier Module
14) x8 PCIe slot (x16 physical) for customer card, to RTX6000
   a. Used for cards supporting GPU Direct RDMA data transfer to RTX6000 GPU
15) SD card slot
16) Recovery button
17) Reset button
18) Main secondary compartment fan connector (there is an additional system fan inside the chassis)
19) Auxiliary fan connector for card fans
20) Power button
To access ports 13-19, remove the left-hand side cover. The process is illustrated below. Unscrew the two Phillips screws (21 and 22) that secure the cover at the back of the machine. Next, push and slide the cover in the direction towards the back of the machine without lifting (step 1). It should slide about 0.5 inch, or less than 1.5 cm. Finally, you should be able to lift the cover off once it has more than one degree of freedom and can be easily lifted upwards (step 2).

Powering up the System

1) Connect all peripherals to the system before powering up the system.
2) Connect the power cable to the system in the slot labeled (1) in the graphic above.
3) Once the power is connected, press the power button (20) for less than 1 second. It should light up.
4) If you have a display connected, you might already see the system booting on it. During flashing or re-flashing, use the HDMI output port (10) to connect to the display. Reference the GPU section below to determine how to choose between display outputs in different modes.

Note: The machine can be powered off by depressing the power button for approximately 10 seconds.
Check Firmware Version and Manually Update if Needed

If you are a current user of the Clara AGX Developer Kit and have flashed your devkit before, check and if needed, update the firmware on the devkit before moving on to the next step of flashing Jetpack 5.0 (compatible with Clara Holoscan SDK v0.2). Without the firmware update, you might experience Known Issue #1 once Jetpack 5.0 is installed.

If you are a new user of the Clara AGX Developer Kit and have not flashed your devkit before, follow the rest of this document to set up your devkit, then come back to this section to check and update your firmware after switching to dGPU mode.

1. Install the tools for checking and updating firmware version

   $ sudo apt install mstflint

2. Check for device address and look for the address for “Ethernet controller: Mellanox Technologies MT28908 Family [ConnectX-6]”. The old firmware uses 0000:09:00.0 address, the up-to-date firmware should use 0000:03:00.0.

   $ lspci | grep Mellanox

3. Run the command with the device address obtained in step 2 to check for the firmware version. If you see a version lower than 20.33.1048 then firmware update is needed. Otherwise, there’s no need to update your firmware if the current version is 20.33.1048, you can skip the rest of steps 4 - 7.

   $ sudo mstflint -d 0000:09:00.0 q full
   ...
   FW Version:            20.27.4006  <- Update is needed
   ...

   $ sudo mstflint -d 0000:03:00.0 q full
   ...
   FW Version:            20.33.1048  <- Firmware is already updated
   ...

4. Download the new firmware from [here](#) and unzip.

5. Install new firmware.

   $ sudo mstflint -d 0000:09:00.0 -i fw-ConnectX6-rel=20_33_1048-
   Nvidia_McCoy_LOM_PCIE_switch_Ax.bin burn

6. Reboot the devkit.

7. Check the newly installed firmware has correct version.

   $ sudo mstflint -d 0000:03:00.0 q full
   ...
   FW Version:            20.33.1048
   ...


Flashing and Updating Clara AGX Developer Kit using SDK Manager

1. Register and activate an NVIDIA Developer Account [here](#) to access the latest version of Jetpack in SDK Manager.
2. If you are running a VPN on your host system, log off before flashing the Clara AGX Developer Kit.
3. Using a VM as your host machine isn’t officially supported, but it is possible with certain VMs such as VMWare Workstation 16 running Ubuntu 18.04. If using a VM, ensure the USB port that connects to the USB-C port on the Clara AGX Developer Kit is always routed to the VM.
4. From the host system, download and install the latest version of [NVIDIA SDK Manager](#). Instructions for downloading and setting up NVIDIA SDK Manager can be found [here](#).
5. Connect the Clara AGX Developer Kit to the host system via USB-C (12).
6. From the NVIDIA SDK Manager, download and flash the Clara AGX Developer Kit. See the [step-by-step instructions](#) for more details.

   **Note:** It is recommended to put the unit to reset mode for the flashing process, and select “Manual Setup” mode in the prompt at Step 03 in SDK Manager, as it has been observed that flashing can be stuck in “Automatic Setup” mode.

   a. If you joined the Clara Holoscan SDK program after your initial SDK Manager login, you will need to log out and log in again on SDK Manager for the permissions to take effect.
   b. Follow these steps to reset the Clara AGX Developer Kit:
      i. Remove the left-hand side cover to expose ports 13-19
      ii. While the unit is powered on, press the Recovery button (16) + Reset button (17), then release both buttons.
   c. If resetting the unit doesn’t work, try putting the unit into recovery mode:
      i. Power off the unit.
      ii. Remove the left-hand side cover to expose ports 13-19
      iii. Hold down the Recovery button (16) while pressing the Power button (20) to turn on the unit.
      iv. Release the Power Button, then the Recovery button.
7. NVIDIA recommends putting the devkit into reset mode during flashing, but if for any reason you need to know the default credentials when SDK Manager is preparing to flash the Clara AGX Developer Kit, it is shown below
   a. Username: ubuntu
   b. Password: ubuntu
Switching between iGPU and dGPU

The Clara AGX Developer Kit can use either the Xavier AGX module GPU (iGPU, integrated GPU) or the RTX6000 add-in card GPU (dGPU, discrete GPU). You can only use one type of GPU at a time.

By default, the Clara AGX Developer Kit uses the iGPU. Switching between the iGPU and dGPU is performed using the nvgpuswitch.py script, located at the /opt/nvidia/l4t-gputools/bin/ directory. To make the nvgpuswitch.py script accessible globally, copy it to a directory included in $PATH if it hasn’t been already:

```bash
$ sudo cp /opt/nvidia/l4t-gputools/bin/nvgpuswitch.py /usr/local/bin/
```

To switch from the iGPU to the dGPU, follow these steps:

1. Connect the Clara AGX Developer Kit to the Internet using one of the following methods:
   a. An Ethernet cable connected to a router or Wi-Fi extender
      i. Use the 1GbE connector to the Xavier module at port 7
   b. A USB Wi-Fi receiver
      i. Not all USB Wi-Fi receivers will work out of the box on the Clara AGX
         Developer Kit.
      ii. The USB Wi-Fi receiver should have support for Ubuntu 20.04
      iii. The TP-Link Archer T2U Nano USB Wi-Fi Adapter which has previously
            been working with the Ubuntu 18.04 based Holoscan SDK versions will
            no longer work with the Ubuntu 20.04 based Holoscan SDK v0.2.

2. To view the currently installed drivers and their version, use the query command:

```bash
$ nvgpuswitch.py query
iGPU (nvidia-l4t-cuda, 34.1.2-20220613164700)
```

3. To install the dGPU drivers, use the install command with the dGPU parameter (note that sudo must be used to install drivers):

```bash
$ sudo nvgpuswitch.py install dGPU
```

The install command prints out the list of commands that will be executed as part of the driver install, and then continues to execute those commands. This aids with debugging if any of the commands fail to execute.

The following arguments may also be provided with the install command:

```bash
$ nvgpuswitch.py install -h
```

positional arguments:
The dGPU driver install may be verified using the `query` command:

```
$ nvgpuswitch.py query
dGPU (cuda-drivers, 510.73.08-1)
Quadro RTX 6000, 24576 MiB
```

5. After the dGPU drivers have been installed, rebooting the system will complete the switch to the dGPU. At this point the Ubuntu desktop will be output via DisplayPort on the dGPU, and so the display cable must be switched from the onboard HDMI (port 10) to DisplayPort (port 4) on the dGPU.

Note: If the output connection isn’t switched before the devkit finishes rebooting, the terminal screen will hang during booting.

6. Modify PATH and LD_LIBRARY_PATH. CUDA installs its runtime binaries such as nvcc into its own versioned path that is not included by the default $PATH environment variable. Because of this, attempts to run commands like nvcc will fail on dGPU unless the CUDA 11.6 path is added to the $PATH variable. To add the CUDA 11.6 path for the current user, add the following lines to $HOME/.bashrc after the switch to dGPU:

```
export PATH=/usr/local/cuda-11.6/bin:$PATH
export LD_LIBRARY_PATH=/usr/local/cuda-11.6/lib64:$LD_LIBRARY_PATH
```

If at any time you want to switch back to iGPU, use the `install` command with the `iGPU` parameter:

```
$ sudo nvgpuswitch.py install iGPU
```

After the iGPU drivers have been installed, rebooting the system will complete the switch back to iGPU. At this point the Ubuntu desktop will be output via the onboard HDMI, so the display cable must be switched from the DisplayPort on the dGPU (4) to the onboard HDMI (10).

Note: The GPU settings will persist through reboots until it is changed again with `nvgpuswitch.py`. 
Reinstalling Optional SDK Packages
This section only applies if you have selected “Additional SDKs” in Step 01 of the SDK Manager installation process.

When switching between GPUs, CUDA is first uninstalled and then reinstalled by the script in order to provide the correct versions used by iGPU or dGPU (CUDA 11.4 and 11.6, respectively). Since some optionally installed packages via SDK Manager such as DeepStream depend on CUDA, this means that these packages are also uninstalled when the active GPU is switched.

To reinstall the packages after switching GPUs, the corresponding *.deb packages that were downloaded by SDK Manager during the initial installation can be copied to the Clara AGX Developer Kit and installed using apt. By default, SDK Manager downloads the *.deb packages to the following location on the host machine:

```bash
~/Downloads/nvidia/sdkmanager
```

Note that the version numbers may differ - if this is the case, use the latest version of the arm64 package that exists in the download directory.

```
$ sudo apt install -y ./deepstream-6.1_6.1.0-1_arm64.deb
```

Setting up SSD Storage

Without setting up SSDK storage and moving docker storage to SSD, you might fill up the root directory with Docker image pull operations, since a complete installation of the Jetpack leaves only about 10GB of storage remaining in the root 32GB.

Note:

If the Clara AGX Developer Kit is reflashed with a new JetPack image, the partition table of the m2 drive will not be modified and the contents of the partition will be retained. In this case the Create Partition steps can be skipped, however the Mount Partition steps should be followed again in order to remount the partition.

Any state, binaries, or docker images that persist on the m2 drive after flashing the system may be made incompatible with new libraries or components that are flashed onto the system. It may be required to recompile or rebuild these persistent objects to restore runtime compatibility with the system.

The Clara AGX Developer Kit includes a pre-installed 250GB m2 solid-state drive (SSD), but this drive is not partitioned or mounted by default. This section outlines the steps that you should follow after the initial SDK installation in order to partition and format the drive for use.

Note:
The following steps assume that the m2 drive is identified by the Clara AGX Developer Kit as /dev/sda. This is the case if no additional drives have been attached, but if other drives have been attached (such as USB drives) then the disk identifier may change. This can be verified by looking at the symlink to the drive that is created for the m2 hardware address on the system. If the symlink below shows something other than ../../sda, replace all instances of sda in the instruction below with the identifier that is being used by your system:

```
$ ls -l /dev/disk/by-path/platform-14100000.pcie-pci-0001:01:00.0-ata-1
lrwxrwxrwx 1 root root 9 Jan 28 12:24 /dev/disk/by-path/platform-14100000.pcie-pci-0001:01:00.0-ata-1 -> ../../sda
```

### Create Partition

1. **Launch fdisk utility:**

   ```bash
   $ sudo fdisk /dev/sda
   ```

2. **Create a new primary partition.** Use the command ‘n’, then accept the defaults (press enter) for the next 4 questions to create a single partition that uses the entire drive:

   ```
   Command (m for help): n
   Partition type
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
   Select (default p):
   
   Using default response p.
   Partition number (1-4, default 1):
   First sector (2048-488397167, default 2048):
   Last sector, +sectors or +size(K,M,G,T,P) (2048-488397167, default 488397167):
   
   Created a new partition 1 of type 'Linux' and of size 232.9 GiB.
   ```

3. **Write the new partition table and exit.** Use the ‘w’ command:

   ```
   Command (m for help): w
   The partition table has been altered.
   Calling ioctl() to re-read partition table.
   Syncing disks.
   ```

4. **Initialize ext4 filesystem on the new partition:**

   ```
   $ sudo mkfs -t ext4 /dev/sdal
   mke2fs 1.44.1 (24-Mar-2018)
   Creating filesystem with 486400 4k blocks and 121680 inodes
   Filesystem UUID: c3817b9c-eaa9-4423-ad5b-d6bae8aa44ea
   Superblock backups stored on blocks:
   32768, 98304, 163840, 229376, 294912
   Allocating group tables: done
   Writing inode tables: done
   Creating journal (8192 blocks): done
   Writing superblocks and filesystem accounting information: done
   ```
Mount Partition

1. **Create a directory for the mount point.** These instructions will use the path /media/m2, but any path may be used if preferred.

   ```bash
   $ sudo mkdir /media/m2
   ```

2. **Determine the UUID of the new partition.** The UUID will be displayed as a symlink to the /dev/sda1 partition within the /dev/disk/by-uuid directory. For example, the following output shows that the UUID of the /dev/sda1 partition is 4b2bb292-a4d8-4b7e-a8cc-bb799dfeb925:

   ```bash
   $ ls -l /dev/disk/by-uuid/ | grep sda1
   lrwxrwxrwx 1 root root 10 Jan 28 10:05 4b2bb292-a4d8-4b7e-a8cc-bb799dfeb925 -> ../../sda1
   ```

3. **Add the fstab entry.** Using the mount path and the UUID from the previous steps, add the following line to the end of /etc/fstab:

   ```bash
   UUID=4b2bb292-a4d8-4b7e-a8cc-bb799dfeb925 /media/m2 ext4 defaults 0 2
   ```

4. **Mount the partition.** The /etc/fstab entry above will mount the partition automatically at boot time. To mount the partition immediately without rebooting instead, use the mount command (and df to verify the mount):

   ```bash
   $ sudo mount -a
   $ df -h /dev/sda1
   Filesystem Size  Used Avail Use% Mounted on
   /dev/sda1 229G 5.6M 229G 0% /media/m2
   ```

---

Setting up Docker and Docker Storage on SSD

Install and Set up Docker and NVIDIA runtime

If Docker has not been installed in your system, follow the steps below.

1. **Install Docker:**

   ```bash
   $ sudo apt-get update
   $ sudo apt-get install -y docker.io
   ```

2. **Configure docker by writing the following to /etc/docker/daemon.json:**

   ```json
   {
   "runtimes": {
   "nvidia": {
   "path": "/usr/bin/nvidia-container-runtime",
   "runtimeArgs": []
   }
   },
   "default-runtime": "nvidia"
   }
   ```
3. **Restart the docker daemon:**

```bash
$ sudo systemctl daemon-reload
$ sudo systemctl restart docker
```

4. **Add current USER to docker group** so docker command can run without sudo

```bash
# Create the docker group.
$ sudo groupadd docker
# Add your user to the docker group.
$ sudo usermod -aG docker $USER
# Activate the changes to groups. Alternatively, reboot or re-login.
$ newgrp docker
```

5. **Verify** that you can run a hello world container

```bash
$ docker run hello-world
```

**Move Docker Storage to m2 Partition**

A complete installation of the Clara SDK leaves only about 10GB of storage remaining in the root 32GB filesystem (/dev/mmcblk0p1). The remaining disk space is usually insufficient to store Docker images, because the individual images can be several GB each. NVIDIA recommends that the Docker daemon data directory be moved to a location on the new m2 partition. This can be done with the following steps:

1. **Create a new Docker data directory.** This is where Docker will store all of its data including build cache and container images. These instructions use the path /media/m2/docker-data, but another directory name can be used if preferred:

```bash
$ sudo mkdir /media/m2/docker-data
```

2. **Configure the Docker Daemon.** Add the following data-root configuration option to the /etc/docker/daemon.json file, pointing to the new data directory created above. Create the /etc/docker/daemon.json file if it does not already exist.

```json
{
  "data-root": "/media/m2/docker-data"
}
```

When a configuration already exists in the daemon.json file, make sure to add a comma to the preceding line before the data-root configuration, e.g.

```json
{
  ...
  "default-runtime": "nvidia",
  "data-root": "/media/m2/docker-data"
}
```

3. **Restart the Docker Daemon.**

```bash
$ sudo systemctl daemon-reload
$ sudo systemctl restart docker
```
Install the Clara Holoscan SDK

The Clara Holoscan SDK is hosted on Github starting from v0.2. See https://github.com/nvidia/clara-holoscan. See https://github.com/nvidia/clara-holoscan-embedded-sdk for information on installing the Clara Holoscan Embedded SDK.

Known Issues

1. PCIE bridge doesn’t show and dGPU cannot be detected

   Note that upon flashing, the devkit will be in iGPU mode. This known issue refers to a scenario where dGPU cannot be detected even after switching from iGPU to dGPU mode.

   Environment: The intermittent issue can appear if Jetpack 5.0 (Clara Holoscan v0.2) was installed on the devkit, and should not come up in Jetpack 4.x (Clara Holoscan v0.1).

   Observed errors: PCIE bridge doesn’t come up, hence dGPU cannot be detected, lspci does not show VGA device or Mellanox PCIE bridge, and nvidia-smi fails.

   Frequency: This issue happens intermittently after each reboot of the devkit.

   Action: If after a reboot of the devkit, the issue occurs, reboot the devkit multiple times until the PCIE bridge comes up in lspci. Then, update the firmware. See update instructions in Section “Check Firmware Version and Manually Update if Needed”.

2. Automatic Setup during the flashing process gets stuck

   When flashing the devkit using SDK Manager, at the dialog prompt where it says “SDK Manager is about to flash your Clara AGX Developer Kit module” in Step 03, it has been observed that if you choose Automatic Setup, even if your devkit had been flashed before, the SDK Manager UI can hang at this step.

   Action: Put your devkit into recovery mode following the steps in section “Flashing and Updating Clara AGX Developer Kit using SDK Manager” and choose “Manual Setup” in Step 03 of SDK Manager’s flashing process.
3. Attempting to switch to dGPU mode failed and the system is not in iGPU or dGPU mode

When running the nvgpuswitch.py script to install dGPU, if for any reason it fails, the system will not default back to the previous iGPU mode, therefore the system doesn’t have either of the GPU modes enabled.

Action: When you are ready to try again, first check that the nvgpuswitch.py script is still in your $PATH, otherwise find the location of the script and copy it to a place in $PATH.

```
$ sudo find / -name nvgpuswitch.py
/opt/nvidia/l4t-gputools/bin/nvgpuswitch.py
$ sudo cp /opt/nvidia/l4t-gputools/bin/nvgpuswitch.py /usr/local/bin/
```

Then, use the -f option when running nvgpuswitch.py to force the reinstall of the dGPU stack.

```
$ sudo nvgpuswitch.py install dGPU -f
```

**Additional Resources**

For other documentation and release notes, see the [Clara Holoscan SDK page](#).

For further Jetson documentation, see the [L4T documentation](#).

For feedback, discussion, and questions, please post to the Clara Holoscan SDK [Developer Forum](#).

**Compliance Information**

**United States**

**Federal Communications Commission (FCC)**

![FCC Marking (Class B)](#)

FCC Marking (Class B)
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including any interference that may cause undesired operation of the device.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

TUV Rheinland/cTUVus

Canada

Innovation, Science and Economic Development Canada (ISED)

CAN ICES-003(B)/NMB-003(B)

This device complies with Industry Canada’s license-exempt RSSs. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d’Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes : (1) l’appareil ne doit pas produire de brouillage, et (2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

European Union

European Conformity; Conformité Européenne (CE)
This device complies with the following Directives:

- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- RoHS Directive 2011/65/EU

The full text of EU declaration of conformity is available at the following internet address: www.nvidia.com/support

A copy of the Declaration of Conformity to the essential requirements may be obtained directly from NVIDIA GmbH (Bavaria Towers - Blue Tower, Einsteinstrasse 172, D-81677 Munich, Germany).

Great Britain (England, Wales and Scotland)

UK Conformity Assessed

This device complies with the following Regulations:

SI 2016/1091: Electromagnetic Compatibility (EMC)
SI 2016/1101: The Low Voltage Electrical Equipment (Safety)
SI 2012/3032: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (As Amended)

A copy of the Declaration of Conformity to the essential requirements may be obtained directly from NVIDIA Ltd. (100 Brook Drive, 3rd Floor Green Park, Reading RG2 6UJ, United Kingdom).

Japan

Voluntary Control Council for Interference (VCCI)
日本工業規格JIS C 0950:2008により、2006年7月1日以降に販売される特定分野の電気および電子機器について、製造者による含有物質の表示が義務付けられます。

機器名称：NVIDIA Clara AGX Developer Kit

<table>
<thead>
<tr>
<th>主な分類</th>
<th>特定化学物質記号</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pb</td>
</tr>
<tr>
<td>PCBボード</td>
<td>0</td>
</tr>
<tr>
<td>パッシブ電子部品</td>
<td>除外項目</td>
</tr>
<tr>
<td>アクティブ電子部品</td>
<td>除外項目</td>
</tr>
<tr>
<td>プロセッサー</td>
<td>0</td>
</tr>
<tr>
<td>メモリ</td>
<td>0</td>
</tr>
<tr>
<td>機械部品</td>
<td>0</td>
</tr>
<tr>
<td>ケーブル/コネクター</td>
<td>除外項目</td>
</tr>
<tr>
<td>はんだ付け材料</td>
<td>0</td>
</tr>
<tr>
<td>フラックス、クリームはんだ、ラベル、その他消耗品</td>
<td>0</td>
</tr>
</tbody>
</table>

注：
1. 「0」は、特定化学物質の含有率が日本工業規格JIS C 0950:2008に記載されている含有率基準値より低いことを示します。
2. 「除外項目」は、特定化学物質が含有マークの除外項目に該当するため、特定化学物質について、日本工業規格JIS C 0950:2008に基づく含有マークの表示が不要であることを示します。
3. 「0.1wt%超」または「0.01wt%超」は、特定化学物質の含有率が日本工業規格JIS C 0950:2008より高いことを示します。

**Product Model Number:** NVIDIA Clara AGX Developer Kit

<table>
<thead>
<tr>
<th>Major Classification</th>
<th>Symbols of Specified Chemical Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pb</td>
</tr>
<tr>
<td>PCB</td>
<td>0</td>
</tr>
<tr>
<td>Passive components</td>
<td>Exempt</td>
</tr>
<tr>
<td>Active components</td>
<td>Exempt</td>
</tr>
<tr>
<td>Processor</td>
<td>0</td>
</tr>
<tr>
<td>Memory</td>
<td>0</td>
</tr>
<tr>
<td>Mechanicals</td>
<td>0</td>
</tr>
<tr>
<td>Cables/Connectors</td>
<td>Exempt</td>
</tr>
<tr>
<td>Soldering material</td>
<td>0</td>
</tr>
<tr>
<td>Flux, Solder Paste, label and other consumable materials</td>
<td>0</td>
</tr>
</tbody>
</table>

**Notes:**

1. “0” indicates that the level of the specified chemical substance is less than the threshold level specified in the standard, JIS C 0950: 2008.

2. “Exempt” indicates that the specified chemical substance is exempt from marking and it is not required to display the marking for that specified chemical substance per the standard, JIS C 0950: 2008.

3. “Exceeding 0.1wt%” or “Exceeding 0.01wt%” is entered in the table if the level of the specified chemical substance exceeds the threshold level specified in the standard, JIS C 0950: 2008.

**Australia and New Zealand**

**Australian Communications and Media Authority**
This product meets the applicable EMC requirements for Class B, I.T.E equipment and applicable radio equipment requirements.

China

China Compulsory Certificate

China RoHS Material Content Declaration

<table>
<thead>
<tr>
<th>部件名称</th>
<th>铅 (Pb)</th>
<th>汞 (Hg)</th>
<th>锑 (Cd)</th>
<th>六价铬 (Cr(VI))</th>
<th>多溴联苯 (PBB)</th>
<th>多溴二苯醚 (PBDE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB板 PCB</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>被动电子零件 Passive components</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>主动电子零件 Active components</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>处理器 Processor</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>内存</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
### Memory

<table>
<thead>
<tr>
<th>Parts Description</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical parts and Fan</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cable/Connectors</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soldering material</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flux, Solder Paste, label and other consumable materials</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

本表格依据SJ/T 11364-2014的规定编制

<table>
<thead>
<tr>
<th>The table according to SJ/T 11364-2014</th>
</tr>
</thead>
</table>

O：表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572-2011标准规定的限量要求以下。

O: Indicates that this hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572-2011.

X：表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572-2011标准规定的限量要求。

X: Indicates that this hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572-2011.

此表中所有名称中含“X”的部件均符合欧盟RoHS立法。

All parts named in this table with an “X” are in compliance with the European Union’s RoHS Legislation.

注：环保使用期限的参考标识取决于产品正常工作的温度和湿度等条件

Note: The referenced Environmental Protection Use Period Marking was determined according to normal operating use conditions of the product such as temperature and humidity.

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**South Korea**

**Radio Research Agency (RRA)**

**Korean Agency for Technology and Standards (KATS)**

R-R-NVA-E3904

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B급 기기</td>
<td>이 기기는 가정용(B급) 전자파적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모</td>
</tr>
<tr>
<td>(가정용방송통신기자재)</td>
<td></td>
</tr>
</tbody>
</table>
Korea RoHS Material Content Declaration

| 문 | 상호 : 엔비디아홍콩홀딩즈리미티드(영업소) | 대표자성명: 카렌테레사번즈 | 주소: 서울특별시 강남구 영동대로 511, 2101호 (삼성동, 코엑스무역타워) |
| 준비 | 법인등록번호: 110181-0036373 | 사업자등록번호: 120-84-06711 |

<table>
<thead>
<tr>
<th>제품 내용</th>
</tr>
</thead>
<tbody>
<tr>
<td>제품의 종류</td>
</tr>
<tr>
<td>세부모델명(번호)</td>
</tr>
<tr>
<td>제품의 중량</td>
</tr>
</tbody>
</table>

엔비디아의 그래픽 카드 제품은 전기 전자 제품 및 자동차의 자원순환에 관한 법률 시행령 제11조 제1항에 의거한 법 시행령규칙 제3조에 따른 유해물질함유 기준을 확인 및 평가한 결과, 이를 준수하였습니다.

구비서류 : 없음
작성방법

① 제품의 종류는 "전기 전자제품 및 자동차의 자원순환에 관한 법률 시행령" 제8조 제1항 및 제2항에 따른 품목별로 구분하여 기재합니다.

② 전기 전자 제품의 경우 모델명(번호), 자동차의 경우, 제조관리번호를 기재합니다.

③ 해당제품의 제조업자 또는 수입업자를 기재합니다.
## Confirmation and Evaluation Form Concerning the Adherence to Acceptable Standards of Hazardous Materials Contained in Products

<table>
<thead>
<tr>
<th>Statement Prepared by</th>
<th>Company Name: Nvidia Hong Kong Holding Ltd. Korea branch</th>
<th>Corporate Identification Number: 110181-0036373</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Company Representative: Karen Theresa Burns</td>
<td>Business Registration Number: 120-84-06711</td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td>2788 San Tomas Expressway, Santa Clara, CA 95051</td>
<td></td>
</tr>
</tbody>
</table>

### Product Information

<table>
<thead>
<tr>
<th>Product Category: N/A</th>
<th>Name of Product: N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed Product Model Name (Number): N/A</td>
<td>Date of first market release: N/A</td>
</tr>
</tbody>
</table>

Weight of Product: N/A

Manufacturer and/or Importer: NVIDIA Corporation

This for is publicly certify That NVIDIA Company has undergone the confirmation and evaluation procedures for the acceptable amounts of hazardous materials contained in graphic card according to the regulations stipulated in Article 3 of the ‘Status on the Recycling of Electrical and Electronic Products, and Automobiles’ and that company has graphic card adhered to the Enforcement Regulations of Article 11, Item 1 of the statute.

Attachment: None

*Preparing the Form

1. Please indicate the product category according to the categories listed in Article 8, Items 1 and 2 of the ‘Enforcement Ordinance of the Statute on the Recycling of Electrical, Electronic and Automobile Materials’

2. For electrical and electronic products, please indicate the Model Name (and number). For automobiles, please indicate the Vehicle Identification Number.

3. Please indicate the name of manufacturer and/or importer of the product.

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**Taiwan**

**Bureau of Standards, Metrology & Inspection (BSMI)**
This device complies with CNS 13438 (2006) Class B.

**Taiwan RoHS Material Content Declaration**

<table>
<thead>
<tr>
<th>Parts</th>
<th>鉛 (Pb)</th>
<th>汞 (Hg)</th>
<th>鎘 (Cd)</th>
<th>六價鉻 (Cr (VI))</th>
<th>多溴聯苯 (PBB)</th>
<th>多溴二苯醚 (PBDE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB板/PCB</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>被動電子零件/Passive components</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>主動電子零件/Active components</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>處理器/Processor</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>內存/Memory</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>結構件及風扇/Mechanical parts and Fan</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>線材/連接器/Cables/Connectors</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>焊接金屬/Soldering material</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>助焊劑、錫膏、標籤及耗材 Flux, Solder Paste, label and other consumable materials</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

備考1：0：系指該限用物質未超出百分比含量基準值。

Note 1：0 indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.

備考2：-：系指該項限用物質為排外項目。

Note 2：- indicates that the restricted substance is excluded.
### Note 2

- :: indicates that the restricted substance corresponds to the exemption.

<table>
<thead>
<tr>
<th>All parts named in this table with an “-” are in compliance with the European Union’s RoHS Legislation.</th>
</tr>
</thead>
</table>

| 註：環保使用期限的參考標識取決與產品正常工作的溫度和濕度等條件。 |
| Note: The referenced Environmental Protection Use Period Marking was determined according to normal operating use conditions of the product such as temperature and humidity. |