RZ/G2L Ubuntu Environment Setup Script Instructions

Application Note

Introduction

This document provides a guide for setting up and configuring an Ubuntu environment on the RZ/G2L Evaluation Board Kit.

This guide provides the following information:

- **Environment Configuration**: Guidance on how to create and configure the Ubuntu root file system.
- **Software Porting**: Steps on how to port software such as Weston, GStreamer, and Qt to the target system.
- **SD Card Preparation**: Detailed instructions on how to prepare the SD card for system boot and operation.
- **System Testing**: Testing steps to verify the functionality of the system and applications.

Target Reference Board

- RZ/G2L Evaluation Board Kit (RTK9744L23S01000BE)

Contents

1. Specifications

1.1 Introduction

- **Board**: RZ/G2L Evaluation Board Kit
- **VLP Version**: VLP3.0.6
- **Rootfs**: ubuntu-base-20.04.4-base-arm64.tar.gz

1.2 File Descriptions

The following files are included in the Ubuntu-V1.0 folder:

- **makeRootfs.sh**: Executable script.
- **sources.list**: Configuration file for specified package sources for Ubuntu aarch64, can be replaced with other files.

  Note: This file uses mirrors located in China, which is due to local restrictions; users in other regions do not need to use these.
- **network-manager-all.yaml**: Configuration file for netplan (network management), can be modified according to the specific network environment.
- **installGstreamer.sh**: Script for porting GStreamer.
- **installweston.sh**: Script for porting Weston.
- **installQt.sh**: Script for porting Qt 5.6.3.
- **gst-test.sh:** Used for testing gst.S
- **README.MD:** ubuntu_rootfs_tool description and copyright notice.
- **ubuntu_rootfs_tool.sh:** A GUI tool for building Ubuntu.
- **recoverCodecLibs.sh:** Script to recover Codec libraries.
- **recoverGpuLibs.sh:** Script to recover GPU libraries.

2. Make Ubuntu Rootfs

You can create an Ubuntu system using the following two methods. Please choose one and follow the steps:

2.1 Creating an Ubuntu Environment (Using a Graphical Interface)

Execute the ./ubuntu_rootfs_tool.sh command to start the tool.

```
$ ./ubuntu_rootfs_tool.sh
```

After opening the tool, you can choose to click <EXIT> to exit the tool, or use the [ESC] key to cancel or exit (without saving). Use the [Tab] key to select buttons. Make changes by pressing the <Change> button (or Enter). If you have made any changes, you can click the<SAVE-EXIT>button to save and exit, or press [ESC] to exit without saving.

2.1.1 Select the WIC File

After launching the tool, you will be prompted to select a WIC file.

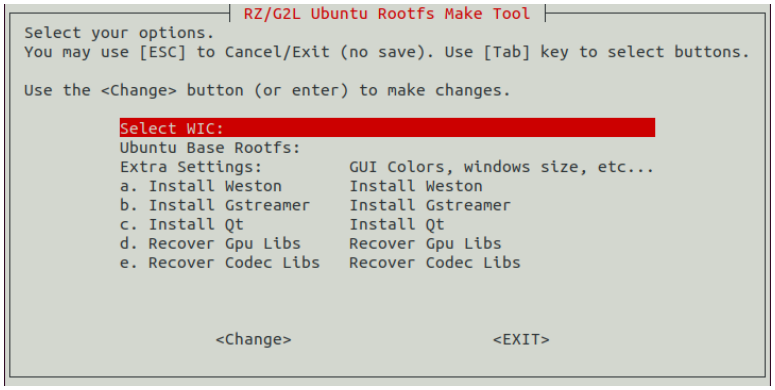

Figure 1

There are three methods available:

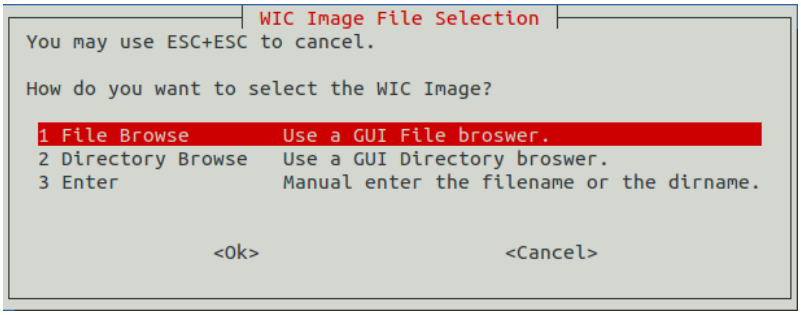

Figure 2

- **File Browse**: Use the graphical interface file browser to select the extracted .wic image file (core-image-qt-smarc-rzg2l.wic). The file will be loaded as a loop device and automatically mounted to the /mnt/wic directory. The directory will be automatically unmounted when exiting the tool.
- **Directory Browse**: If you have already manually mounted the WIC file, you can choose this option and use the graphical interface directory browser to select the mounted directory.
- **Enter**: Manually enter the path of the mounted WIC file or directory. After selection, the tool will display the path of the WIC file you have chosen.

WIC download link:RZG2L_VLP3.0.6_Pre-built_Images_EN.zip

2.1.2 Select Ubuntu Base Rootfs

Next, you need to select the Ubuntu base root file system:

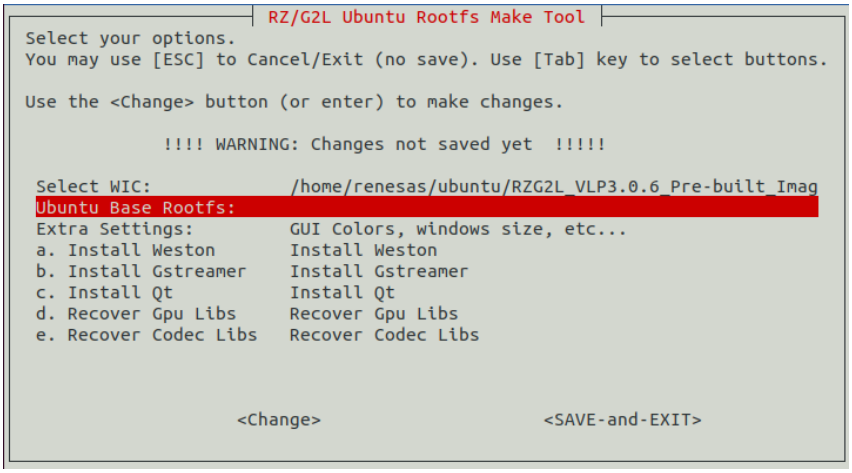

Figure 3

After pressing Enter to proceed, we provide you with three options to choose from:

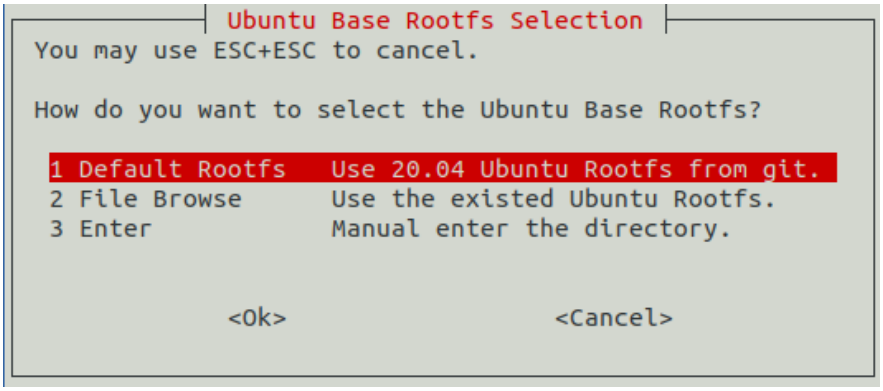

Figure 4

- **Default Rootfs**: This option will pull the default Ubuntu 20.04 root file system from git. The estimated execution time is about 7-10 minutes, depending on your system performance. Upon completion, a ubuntu-rootfs root file system will be generated in the current path.

  Note: This operation will install two software packages: qemu-user-static and wget, and perform a series of configurations in the root file system. All operations are within the control of the script and will not adversely affect the host.

  System Configuration: For detailed instructions on the default Ubuntu environment, please refer to section2.2.1.2.

- **File Browse**: Select your own root file system. Please ensure you have backed up before selecting to avoid data loss.

- **Enter**: Select your root file system by entering the path of the root file system. Remember to back up.

Note: if you choose to port an existing file system, you must perform a backup in advance to avoid any unforeseen issues.

2.1.3 Choose GUI Interface Color (Optional)

This step allows you to choose a color for the GUI interface. This is an optional step and does not affect system functionality.

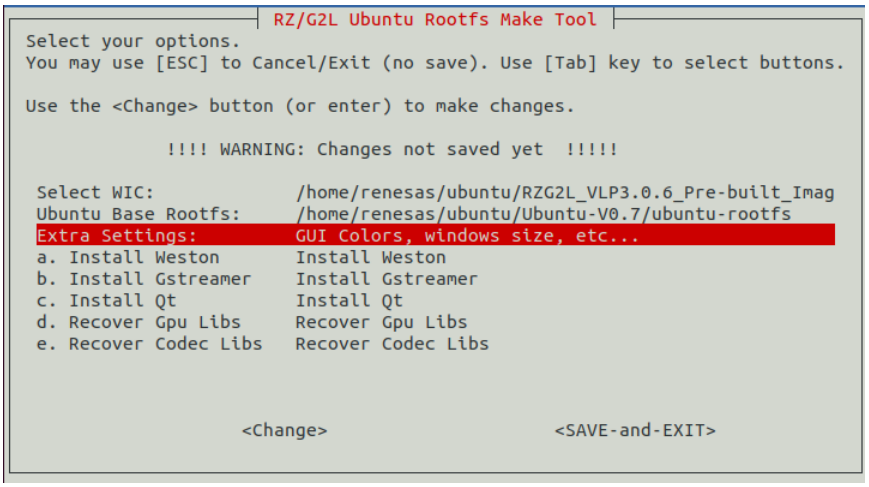

Figure 5

2.1.4 Porting

You can select the following options by pressing the Enter key:

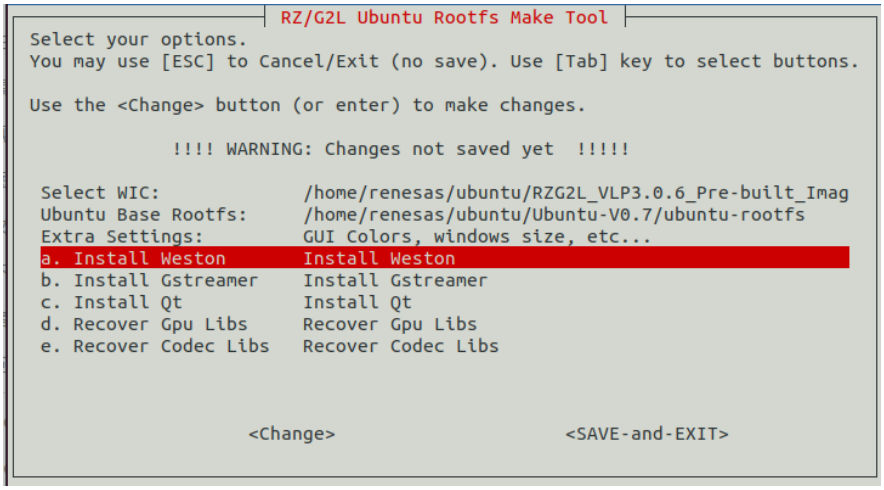

Figure 6

- **a. Install Weston**: Transfer Weston from WIC to the ubuntu-rootfs root file system.
- **b. Install Gstreamer**: If you need to play videos, you must transfer GStreamer after installing Weston or Wayland window.

  Note: If Wayland or Weston is not installed, directly installing GStreamer may result in GStreamer not functioning properly. The script does not check for this dependency, so please make sure Weston is correctly installed before proceeding with the GStreamer installation.
- **c. Install Qt**: Transfer Qt 5.6.3 from WIC to the ubuntu-rootfs root file system.
- **d. Recover Gpu Libs**: Recover GPU libraries.
- **e. Recover Codec Libs**: Recover Codec libraries. The main function of the recoverCodecLibs and recoverGpuLibs scripts is to restore GPU libraries and Codec libraries that may have been overwritten or damaged after the customer installs other software with apt, ensuring the normal function of GPU and Codec.

Precautions

Before performing any operations, ensure that you have backed up all important data.

2.2 Creating an Ubuntu Environment (Without Using a Graphical Interface)

Creating an Ubuntu Environment by Manually Entering Commands. If you have already created the Ubuntu root file system in step 2.1, please skip this step.

2.2.1 Basic Ubuntu Environment Setup Script

2.2.1.1 Creating the Root File System

First, copy the Ubuntu-V1.0 folder to the Ubuntu development PC as the working directory.

In the Ubuntu-V1.0 directory, execute the `makeRootfs.sh` script:

```
$ chmod +x makeRootfs.sh
```

```
$ ./makeRootfs.sh | tee makeRootfs-log.log
```

After executing the above commands, the script will display output information in the shell during execution and save this information in `makeRootfs-log.log`. The estimated execution time for this script is approximately 7-10 minutes, depending on your system's performance. If the execution fails, you can resolve the issue based on the output prompts. If you need to contact engineering personnel for assistance, please provide this log file. Upon successful execution, the root file system `ubuntu-rootfs` will be generated in the current path.

Note :The direct impact of executing this script on the client's host machine is primarily the installation of two packages: `qemu-user-static` and `wget`. It downloads and extracts an ARM64 root filesystem of Ubuntu, and performs a series of configurations within that root filesystem. The host machine itself is not adversely affected by these operations; all actions are controlled within the script's scope, and the host's status will be restored to normal after the script has completed.

2.2.1.2 System Configuration Instructions

To set up a basic development environment based on aarch64 Ubuntu:

- **Root User**:

  Username: root

  Password: root

- **User**

  Username: rz

  Password: rz

The default time zone is set to Asia/Shanghai. To change the time zone, you can use the timedatectl command.

Install the network configuration tool netplan, and modify the etc/netplan/01-network-manager-all.yaml configuration file as necessary.

Note: For system security, Ubuntu generally disables SSH remote login for the root user by default, so a user named `rz` is created for SSH login access. The system configuration merely describes the Default Rootfs.

2.2.1.3 Common Issues

1.If the script execution fails, you can choose to delete the generated root file system ubuntu-rootfs and re-execute the script.

2. When re-executing the script, it is necessary to remove the previously generated root file system.

2.2.2 Porting

2.2.2.1 Preparation for Porting

(1) Extracting wic.gz File

Download the RZ/G2L Pre-built Images (RZG2L_VLP3.0.6_Pre-built_Images_EN.zip) wic Image and extract the wic.gz file. Copy the core-image-qt-smarc-rzg2l.wic file to the Ubuntu-V1.0 folder.

(2) Loading wic File as Loop Device

Use the `losetup` command to mount the decompressed .wic image file (core-image-qt-smarc-rzg2l.wic) as a loop device. This command will return a device path, stored in the `loop_device` variable, and then check the partition information of the loop device to confirm that the mounting was successful.

```
$ loop_device=$(sudo losetup -Pf --show core-image-qt-smarc-rzg2l.wic)
```

```
$ sudo fdisk -l $loop_device
```

As shown below:

```
renesas@renesas-VirtualBox:~/Ubuntu-V1.0$ loop_device=$(sudo losetup -Pf --show core-image-qt-smarc-rzg2l.wic)
renesas@renesas-VirtualBox:~/Ubuntu-V1.0$ sudo fdisk -l $loop_device
Disk /dev/loop13: 3.69 GiB, 3944804352 bytes, 7704696 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x1492ffae

Device         Boot Start     End Sectors  Size Id Type
/dev/loop13p1        2048   47283   45236 22.1M  c W95 FAT32 (LBA)
/dev/loop13p2       47288 7704695 7657408  3.7G 83 Linux
```

(3) Mounting Device Partition2 at /mnt/wic

Create a mount point directory /mnt/wic, then use the mount command to mount the second partition of the loop device ("$loop_device"p2) to this directory.

```
$ sudo mkdir -p /mnt/wic
```

```
$ sudo mount "$loop_device"p2 /mnt/wic
```

2.2.2.2 Executing Scripts

The scripts will port Weston, GStreamer, and Qt from the wic to the root file system ubuntu-rootfs generated in section 2.

(1) Porting Weston

Place the script installweston.sh in the same directory as makeRootfs.sh and execute the script. This script will port Weston from the wic to the root file system ubuntu-rootfs.

```
$ chmod +x installweston.sh
```

```
$ ./installweston.sh
```

(2) Porting GStreamer

If you need to play videos, GStreamer must be ported after installing Weston or Wayland window. For porting Weston, refer to section 3.2.1. Other preparation for porting can be found in section 3.1.
Place the script installGstreamer.sh in the same directory as makeRootfs.sh and execute the script. This script will port GStreamer from the wic to the root file system ubuntu-rootfs.

```
$ chmod +x installGstreamer.sh
```

```
$ ./installGstreamer.sh
```

(3) Porting Qt

The Qt 5.6.3 being ported does not support eglfs; you can use the Wayland window. If you need linuxfb, you must modify QT_QPA_PLATFORM at runtime. If using the Wayland window, refer to section 3.2.1 for porting Weston. Other preparation for porting can be found in section 3.1.
Place the script installQt.sh in the same directory as makeRootfs.sh and execute the script. This script will port Qt 5.6.3 from the wic to the root file system ubuntu-rootfs.

```
$ chmod +x installQt.sh
```

```
$ ./installQt.sh
```

(4) updateCodecLibs and updateGpuLibs(Optional)

The primary function of the updateCodecLibs and updateGpuLibs scripts is to restore the GPU libraries and Codec libraries that may have been overwritten or corrupted after the customer installs other software using apt, ensuring the proper functioning of the GPU and Codec.

```
$ chmod +x updateCodecLibs.sh
```

```
$ ./ updateCodecLibs.sh
```

```
$ chmod +x updateGpuLibs.sh
```

```
$ ./ updateGpuLibs.sh
```

3. Preparing SD Card

3.1 SD Card Partitioning

Please refer to the document r01us0616ej0103-rz-g(Linux Start-up Guide RZG2L, LC, UL).pdf, section 3.2 (1)-(6) for SD card partitioning.

3.2 Porting Kernel and Device Tree

Copy the Image and r9a07g044l2-smarc.dtb from /mnt/wic/boot/ to SD card partition 1. The kernel and device tree used are from the WIC /boot directory.
Replace <username> with the actual username of the user on their host PC.

Note: If you are using 2.1 Creating an Ubuntu Environment (Using a Graphical Interface), you should first run 2.2.2.1 Preparation for Porting's (2) Loading the wic File as a Loop Device, and (3) Mounting Device Partition 2 at /mnt/wic.

```
$ sudo cp /mnt/wic/boot/* /media/<username>/A299-E6A6
```

3.3 Porting Root File System

Copy the root file system from the prepared ubuntu-rootfs to SD card partition 2.

Replace <username> with the actual username on your host PC, and replace <path_to_ubuntu_rootfs> with the path to the Ubuntu root file system directory that you created or used in step 2.1.2.

```
$ sudo rsync -av --progress /<path_to_ubuntu_rootfs>/ubuntu-rootfs/
/media/<username>/rootfs
```

3.4 Add Gstreamer Test Files

Add GStreamer test files. This step is to prepare for testing the GStreamer functionality later. (Optional)

Replace <path_to_Ubuntu-V1.0> with the location of your Ubuntu-V1.0 folder and <username> with your actual username according to your situation.

```
$ sudo cp /<path_to_Ubuntu-V1.0>/Ubuntu-V1.0/1.mp4 /media/<username>/rootfs/root
```

```
$ sudo cp /<path_to_Ubuntu-V1.0>/Ubuntu-V1.0/gst-test.sh /media/<username>/rootfs/root
```

3.5 Unmounting Device

After porting is complete, unmount the device.

```
$ sudo umount /mnt/wic
```

```
$ sudo losetup -d $loop_device
```

4. Running Ubuntu

This chapter mainly introduces information about the boot modes for running Ubuntu.

Prior to Running Ubuntu, please ensure you follow Chapters 4.2 to 4.4 of the document "r01us0616ej0103-rz-g(Linux Start-up Guide RZG2L, LC, UL).pdf " to write the bootloader to the FlashROM before starting the evaluation.

Before booting the board, please ensure that the bootloader built with your VLP is written to your board.

4.1 Set SPI Boot Mode

To set the board to SPI Boot mode, set the SW11 as below:

Figure 1. SW11

4.2 Power On and Boot Process

Turn on the power of the board by pressing the reset button SW10.

```
U-Boot 2021.10 (Mar 31 2022 - 03:57:20 +0000)
CPU: Renesas Electronics K rev 16.10
Model: smarc-rzg2l
DRAM: 1.9 GiB
MMC: sd@11c00000: 0, sd@11c10000: 1
Loading Environment from MMC... OK
In: serial@1004b800
Out: serial@1004b800
Err: serial@1004b800 Net: Error: ethernet@11c20000 address not set.
No ethernet found.
Hit any key to stop autoboot: 2 1 0
=>
```

Please use the following commands to set environment variables for booting the RZ/G2L board from the microSD card.

```
=> setenv bootargs 'root=/dev/mmcblk1p2 rootwait rw'
=> setenv bootcmd 'mmc dev 1;fatload mmc 1:1 0x48080000 Image; fatload mmc 1:1
0x48000000 r9a07g044l2-smarc.dtb; booti 0x48080000 - 0x48000000'
=> saveenv
Saving Environment to MMC... Writing to MMC(0)….OK
```

bootargs: 'root=/dev/mmcblk1p2 rootwait'

root filesystem is partition 2 of block 1 on microSD card.

bootcmd: 'mmc dev 1;fatload mmc 1:1 0x48080000 Image;
fatload mmc 1:1 0x48000000 r9a07g044l2-smarc.dtb;
booti 0x48080000 - 0x48000000'

Note: The above settings are based on the preparation of the SD card in section 4. The microSD card has two partitions and stores data as follows:

First partition: formatted as FAT, including Image and r9a07g044l2-smarc.dtb.

Second partition: formatted as ext4, with the root file system as ubuntu_rootfs.

5. Testing

5.1 Testing Weston

After the system starts, execute weston-simple-egl to verify successful execution.

```
$ weston-simple-egl
```

5.2 Testing GStreamer

- You can upload the test files in section 4.4 or use methods such as SSH.gst-test.sh.
- big_buck_bunny_1080p_30fps_30s.mp4
  Please note that this sample movie file is not included in the package. You need to download it from the following URL:
  — https://github.com/renesas-rz/media/tree/main/Big_Buck_Bunny

Execute gst-test.sh to play the video.

```
$ chmod +x gst-test.sh
```

```
$ ./gst-test.sh
```

5.3 Testing Qt 5.6.3

Enter the Qt 5.6.3 OpenGL example directory and run the HelloWindow example to verify whether the OpenGL application is functioning properly.

```
$ cd /usr/share/qt5/examples/opengl/hellowindow
```

```
$ ./hellowindow
```

In the Qt 5.6.3 Widgets examples directory, run the calculator example to check if the Widgets application functionality is operating as expected.

```
$ cd /usr/share/qt5/examples/widgets/widgets/calculator
```

```
$ ./calculator
```

Note: The currently supported platform plugins include: linuxfb, minimal, offscreen, wayland-egl, wayland. You can change the runtime platform based on your actual application needs by setting the environment variable QT_QPA_PLATFORM. For example, to switch to the Linuxfb platform to run an application, export QT_QPA_PLATFORM=linuxfb.

Revision History

Rev.	Date	Description	
		Page	Summary
1.0	Dec 27, 2024	-	First edition issued

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

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   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
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5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
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   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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