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RK3288_ Android9.0_MID_SDK 软件开发指南

RK3288_Android9.0_MID_SDK_Software_Developer_Guide

（技术部，第二系统产品部）

(Technical Department, R & D Dept. II）

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目 录 Contents

前 言 Preface

概述 Overview

本文档主要介绍 Rockchip RK3288(W-Version) Android 9.0 软件开发指南，旨在帮助软件开发工程师更快上手 RK3288(W-Version)的开发及调试。

This document mainly introduces Rockchip RK3288(W-Version) Android9.0 software developer guide, which is aiming to help software engineers familiar with RK3288(W-Version) development and debugging more quickly.

注：本 SDK 软件包仅支持 RK3288(W 版本)芯片，不支持旧 RK3288 芯片。

This SDK software package only supports RK3288(W-Version) chipset and doesn't support the older version of RK3288 chipset.

产品版本 Product version

芯片名称 Chipset name	内核版本 Kernel version	Android 版本 Android version
RK3288(W-Version)	Linux4.4	Android 9.0.0

读者对象 Applicable object

本文档（本指南）主要适用于以下工程师：

This document (guide) is mainly suitable for below engineers:

技术支持工程师

Field application engineers

软件开发工程师

Software development engineers

1 支持列表 Support list

RK3288(W-Version) 为旧版 RK3288 芯片的升级版本，下方所列相关支持列表同旧版 RK3288 芯片。

RK3288(W-Version) chipset is an upgrade version of old RK3288, so the support list below is the same as old RK3288 chipset.

1.1 DDR 支持列表 DDR support list

RK3288 DDR 目前选型列表支持双通道 DDR3、DDR3L、LPDDR2、LPDDR3。

Current RK3288 DDR AVL supports dual channel DDR3, DDR3L, LPDDR2 and LPDDR3.

Table 1- 1 RK3288 DRAM Support Type

Chip	DRAM Support Type
RK3288	DDR3/DDR3L/LPDDR2/LPDDR3

RK3288 DDR 颗粒支持程度列表，详见 RKDocs\common\Platform support lists 目录下《RK DDR Support List Ver2.34》，下表中所标示的 DDR 支持程度表，只建议选用√、T/A 标示的颗粒。

For more details about RK3288 DDR component support list, please refer to the document 《RK DDR Support List Ver2.34》 in the directory of RKDocs\common\Platform support lists. Only recommend to use the DDR components marked with the symbol √ and T/A as shown in below table.

Table 1- 2 RK3288 DDR Support Symbol

Symbol	Description
√	Fully Tested and Mass production
T/A	Fully Tested and Applicable
N/A	Not Applicable

1.2 EMMC 支持列表 EMMC support list

详见 RKDocs\Common\Platform support lists 目录下《RKeMMCSupportList Ver1.41_2018_10_30》，下表中所标示的 EMMC 支持程度表，只建议选用√、T/A 标示的颗粒。

Refer to the document 《RKeMMCSupportList Ver1.41_2018_10_30》 in the directory of RKDocs\Common\Platform support lists for the details. Only recommend to use the EMMC components marked with the symbol √ and T/A as shown in below table.

Table 1- 3 RK3288 EMMC Support Symbol

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Symbol	Description
√	Fully Tested , Applicable and Mass Production
T/A	Fully Tested , Applicable and Ready for Mass Production
D/A	Datasheet Applicable, Need Sample to Test
N/A	Not Applicable

1.2.1 高性能 EMMC 颗粒的选取 High performance eMMC component selection

为了提高系统性能，选取高性能的 EMMC 颗粒也是需要的。请在挑选 EMMC 颗粒前，参照我们的支持列表的型号，对应的研究下厂商提供的 Datasheet，重点关注下厂商标注的 performance 章节。

It is necessary to select the EMMC component with high performance to improve the system performance. Before selecting EMMC component, please refer to the AVL provided by Rockchip, study the Datasheet provided by the vendor, and pay attention to the performance chapter.

参照厂商大小、读写的速率进行筛选。建议选取顺序读速率>200Mb/s、顺序写速率>40Mb/s。

Refer to the vendor and read/write rate to do the sorting. Recommend to choose the component with the sequential reading rate >200Mb/s and sequential writing rate >40Mb/s.

如有选型上的疑问，也可直接联系我们的 Fae 窗口。

Please contact Rockchip FAE if you have any questions about the component selection.

6.1.5 Performance

[Table 23] Performance

Density	Partition Type	Performance	
		Read(MB/s)	Write (MB/s)
16GB	General	285	40
32GB		310	70
64GB		310	140
128GB		310	140
16GB	Enhanced	295	80
32GB		320	150
64GB		320	245
128GB		320	245

图 1- 1 EMMC Performance 示例

Picture 1-1 EMMC Performance example

1.3 SDK 软件包适用硬件列表 SDK software package applicable hardware list

本 SDK 是基于谷歌 Android9.0 最新系统，只适配瑞芯微 RK3288(W-Version)，只适用于

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RK3288(W-Version)平台及基于其上开发的产品。

This SDK is compatible with Rockchip RK3288(W-Version) based on Google Android9.0 system, and only suitable for RK3288(W-Version) platform and the products developed based on it.

1.4 WiFi/BT 支持列表 Wi-Fi/BT support list

RK3288 内核运行 Linux4.4，WiFi/BT 支持列表详见 RKDocs\common\Platform support lists 目录下《Rockchip_WiFi_Situation_20180611.pdf》。文档中所列的的 Wifi/Bt 芯片列表经过大量测试，建议按照列表上的型号进行选型。如果有其他 WiFi/BT 芯片调试，可先与 WiFi/BT 芯片原厂沟通，是否有可以稳定在 Linux4.4 运行的驱动程序，并能提供调试帮助。

RK3288 kernel is Linux4.4. For the Wi-Fi/BT support list, please refer to 《Rockchip_WiFi_Situation_20180611.pdf》 in the directory of RKDocs\common\Platform support lists. The Wi-Fi/BT chipsets involved in the support list are already verified. Recommend to choose the components in the table. If want to debug other Wi-Fi/BT chipset, first need to communicate with Wi-Fi/BT vendor whether they can provide the driver program which can work stably on Linux4.4 and technical support during debugging.

如有疑问和建议请联系瑞芯微 Fae 窗口。

You can contact with Rockchip FAE if there is any question or suggestion.

RK3368H Wi-Fi Situation

WiFi Chip	IFACE	IEEE 802.11 Standard	2.4GHz Band	5.0GHz Band	BT	GPS	NFC	11AC	SDIO3.0	MIMO	BT4.0	BT4.2	Android7.1	Android8.1	VTS
AP6255	SDIO	IEEE 802.11A/B/G/N/AC	✓	✓	✓	×	×	✓	✓	×	✓	✓	✓	✓	✓
RTL8723CS	SDIO	IEEE 802.11B/G/N	✓	×	✓	×	×	×	×	×	✓	×	✓	✓	✓

1. √：支持 ×：不支持 注：空的表示没调过
2. 该列表仅适用kernel4.4

图 1-2 RK3288 Wi-Fi/Bt 支持列表

Picture 1-2 RK3288 Wi-Fi/BT support list

1.5 多媒体编解码支持列表 Multimedia encoding/decoding support list

具体的编解码支持列表，详见 RKDocs\rk3288 目录下《Rockchip_RK3288_Introduction_Multimedia_Codec_Benchmark_EN.pdf》。

For the detailed encoding/decoding support list, refer to the document 《 Rockchip_RK3288_Introduction_Multimedia_Codec_Benchmark_EN.pdf 》 in the directory of RKDocs\rk3288.

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2 文档/工具索引 Document/tool index

2.1 文档索引 Document index

RK3288 SDK 发布文档旨在帮助开发者快速上手开发及调试，文档中涉及的并不能涵盖所有的知识和问题。文档列表也正在不断更新，如有文档上的疑问及需求，请联系我们的 Fae 窗口。

The documents released along with RK3288 SDK are aiming to help developers familiar with development and debugging quickly. The documents may not cover all the knowledge and issues and the document list will also be updated continuously. Please contact Rockchip FAE if you have any question or requirement about the documents.

RK3288 SDK 中在 RKDocs 目录下附带了三大块的文档，分别为：android（android 相关开发文档），rk3288(rk3288 相关发布文档)，common（公共开发文档）；common 目录细分为内核驱动开发文档、uboot 开发文档、模块开发文档、Platform support lists（支持列表）、RKTools manuals（工具使用文档）等。

RK3288 SDK includes three kinds of documents in RKDocs directory, android (android related development documents), rk3288 (3288 related release documents), and common (common development documents). Common directory consists of kernel driver development documents, uboot development document, module development documents, Platform support lists (support list), RKTools manuals (tool usage document) etc.

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│   ├── project.config
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        │   │   ├──── Rockchip_User_Guide_RKDevInfoWriteTool_EN.pdf
        │   │   ├──── Rockchip_User_Guide_RK_Platform_MP_Upgrading_CN.pdf
        │   │   ├──── Rockchip_User_Manual_Android_Development_Tool_CN.pdf
        │   │   ├──── Rockchip_User_Manual_RKIQTool_CN.pdf
        │   │   ├──── Rockchip_User_Manual_RKIQTool_EN.pdf
        │   │   └──── Rockchip_User_Manual_RKUpgrade_Dll_CN.pdf
        │   ├──── security
        │   │   ├──── Efuse process explain .pdf
        │   │   ├──── RK3399_Efuse_Operation_Instructions_V1.00_20190214_EN.pdf
        │   │   ├──── Rockchip_Developer_Guide_Secure_Boot_V1.1_20190603_CN.pdf
        │   │   ├──── Rockchip_Developer_Guide_TEE_Secure_SDK_CN.pdf
        │   │   ├──── Rockchip_RK3399_Introduction_Efuse_Operation_EN.pdf
        │   │   ├──── Rockchip-Secure-Boot2.0.pdf
        │   │   ├──── Rockchip-Secure-Boot-Application-Note-V1.9.pdf
        │   │   └──── Rockchip Vendor Storage Application Note.pdf
        │   ├──── Sensors
        │   │   └──── Rockchip_Developer_Guide_Sensors_CN.pdf
        │   ├──── SPI
```

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```
        │   │   └── Rockchip-Developer-Guide-linux4.4-SPI.pdf
        │   ├── Thermal
        │   │   ├── Rockchip-Developer-Guide-Linux4.4-Thermal-CN.pdf
        │   │   └── Rockchip-Developer-Guide-Linux4.4-Thermal-EN.pdf
        │   ├── TRUST
        │   │   ├── Rockchip_Developer_Guide_Trust_CN.pdf
        │   │   └── Rockchip_Developer_Guide_Trust_EN.pdf
        │   ├── UART
        │   │   ├── Rockchip-Developer-Guide-linux4.4-UART.pdf
        │   │   └── Rockchip-Developer-Guide-RT-Thread-UART.pdf
        │   ├── u-boot
        │   │   ├── Rockchip-Developer-Guide-Linux-AB-System.pdf
        │   │   ├── Rockchip-Developer-Guide-Uboot-mmc-device-driver-analysis.pdf
        │   │   └── Rockchip-Developer-Guide-UBoot-nextdev-CN.pdf
        │   └── usb
        │       ├── putty20190213_162833_1.log
        │       ├── Rockchip-Developer-Guide-Linux4.4-RK3399-USB-DTS-CN.pdf
        │       ├── Rockchip-Developer-Guide-Linux4.4-USB-CN.pdf
        │       ├── Rockchip-Developer-Guide-Linux4.4-USB-FFS-Test-Demo-CN.pdf
        │       ├── Rockchip-Developer-Guide-Linux4.4-USB-Gadget-UAC-CN.pdf
        │       ├── Rockchip-Developer-Guide-USB-Initialization-Log-Analysis-CN.pdf
        │       ├── Rockchip-Developer-Guide-USB-Performance-Analysis-CN.pdf
        │       ├── Rockchip-Developer-Guide-USB-PHY-CN.pdf
        │       └── Rockchip-Developer-Guide-USB-SQ-Test-CN.pdf
        └── rk3288
            ├── project.config
            ├── Rockchip_Introduction_Android9.0_System_New_Feature_CN&EN.pdf
            ├── Rockchip_Introduction_Android9.0_System_New_Feature_CN.pdf
            ├── Rockchip_RK3288_Introduction_Multimedia_Codec_Benchmark_EN.pdf
            ├── Rockchip_RK3288_User_Guide_EVB2.0_CN.pdf
            ├──
Rockchip_RK3288(W-Version)_Android9.0_MID_SDK_Release_V1.0.0_20190410_CN.pdf
            └──
Rockchip_RK3288(W-Version)_Developer_Guide_Android9.0_MID_SDK_Software_CN.pdf
```

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2.2 工具索引 Tool index

RK3288 SDK 发布的工具，用于开发调试阶段及量产阶段使用。工具可能随 SDK 更新不断更新，如有工具上的疑问及需求，请联系我们的 Fae 窗口。

The tool released along with RK3288 SDK is used in development debugging stage and MP stage. The tool version may upgrade along with SDK. Please contact with Rockship FAE if there is any question or requirement about the tool.

RK3288 SDK 中在 RKTools 目录下附带了 linux（Linux 操作系统环境下使用工具）、windows（Windows 操作系统环境下使用工具）。

RK3288 SDK includes linux (the tool used in Linux operation system environment), and windows (the tool used in Windows operation system environment) in RKTools directory.

```
├── linux
│   ├── Linux_AttestationKeyboxPack_Tool.rar
│   ├── Linux_Pack_Firmware
│   │   ├── Linux_rockdev.zip
│   │   └── rockdev
│   │       ├── afptool
│   │       ├── mkupdate.sh
│   │       ├── package-file
│   │       ├── readme.txt
│   │       ├── rkImageMaker
│   │       └── unpack.sh
│   ├── Linux_SecureBoot
│   │   └── SecureBootConsole_v1.90.rar
│   ├── Linux_TA_Sign_Tool.rar
│   └── Linux_Upgrade_Tool
│       └── Linux_Upgrade_Tool_v1.43.zip
└── windows
    ├── AndroidTool
    │   ├── AndroidTool_Release_v2.63
    │   │   ├── AndroidTool.exe
    │   │   ├── Android 开发工具手册_v1.2.pdf
    │   │   ├── bin
    │   │   │   ├── adb.exe
    │   │   │   ├── AdbWinApi.dll
    │   │   │   ├── AdbWinUsbApi.dll
    │   │   │   ├── AFPTool.exe
    │   │   │   └── RKImageMaker.exe
    │   │   ├── config.cfg
```

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```
│   │   ├── config.ini
│   │   ├── Language
│   │   │   ├── Chinese.ini
│   │   │   └── English.ini
│   │   ├── Log
│   │   └── tool_error.dmp
│   ├── AndroidTool_Release_v2.63.rar
│   └── rockdev
│       ├── AFPTool.exe
│       ├── backupimage
│       │   ├── backup.img
│       │   └── package-file
│       ├── baseparamer.img
│       ├── mkupdate.bat
│       ├── package-file
│       ├── recover-script
│       ├── RKImageMaker.exe
│       └── update-script
├── Demo 镜像烧写工具包.zip
├── DriverAssitant_v4.5.zip
├── efuse_v1.37.rar
├── FactoryTool_v1.65.zip
├── FWFactoryTool-5.4.rar
├── KeyBoxWrite_v1.53.rar
├── OemTool_v1.3.rar
├── parameter_adjustment_tool.xlsx
├── rk312x-pcba-tools.rar
├── RKDevInfoWriteTool_Setup_V1.0.3.rar
├── RKImageMaker_v1.62.zip
├── Rockchip Box 厂测工具 V2.0-M-20170327.zip
├── Rockchip 平台 DDR 测试工具_V1.35 发布通知.7z
├── SDDiskTool_v1.57.zip
├── SecureBootTool_v1.85_foruser.zip
├── SpiImageTools_v1.41.zip
├── SpiImageTool_v1.33.zip
├── UpgradeDllTool_v1.35.zip
├── Windows_TA_Sign_Tool.rar
└── 电池曲线检测工具
    ├── ADC 电池测试工具_V2.3.pdf
    └── BatteryArray_V2.4.apk
```

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3 SDK 编译/烧写 SDK compiling/flashing

3.1 SDK 获取 How to get SDK

SDK 通过瑞芯微代码服务器对外发布，客户向瑞芯微技术窗口申请 SDK，需同步提供 SSH 公钥进行服务器认证授权，获得授权后即可同步代码。关于瑞芯微代码服务器 SSH 公钥授权，请参考《Rockchip_RK3288(W-Version)_Android9.0_MID_SDK_Release_V1.0.0_20190410_CN&EN.pdf》。

SDK is released through Rockchip code server. Customers apply SDK from Rockchip FAE contact, and will be able to sync code after obtaining the server certificate authorization with SSH public key. For the SSH public key authorization of Rockchip code server, please refer to the document 《Rockchip_RK3288(W-Version)_Android9.0_MID_SDK_Release_V1.0.0_20190410_CN&EN.pdf》.

3.1.1 SDK 下载链接 SDK download link

RK3288(W-Version)_ANDROID9.0_SDK 下载地址如下：

RK3288(W-Version)_ANDROID9.0_SDK download address is as below:

```
$ repo init --repo-url=ssh://git@www.rockchip.com.cn:2222/repo-release/tools/repo.git -u ssh://git@www.rockchip.com.cn:2222/Android_pie_stable/platform/rk3288/manifests.git -m RK3288_Android_Pie_release.xml
```

如果需要包含 GMS 包的 SDK(需要开通权限)，使用如下地址：

If need SDK with GMS which requires additional authority, use the address as below:

```
$ repo init --repo-url=ssh://git@www.rockchip.com.cn:2222/repo-release/tools/repo.git -u ssh://git@www.rockchip.com.cn:2222/Android_pie_stable/platform/rk3288/manifests.git -m RK3288_Android_Pie_Express_release.xml
```

3.1.2 repo

Repo 是 Google 用 Python 脚本写的调用 Git 的一个脚本，主要是用来下载、管理 Android 项目的软件仓库，其下载地址如下：

Note: repo is a script invoking git developed by Google using Python script, and mainly used to download, manage Android project software lib. The download address is as below:

```
$ git clone ssh:// git@www.rockchip.com.cn:2222/repo-release/tools/repo
```

3.1.3 SDK 代码压缩包 SDK code compressed package

为方便客户快速获取 SDK 源码，瑞芯微技术窗口通常会提供对应版本的 SDK 初始压缩包，开发者可以通过这种方式，获得 SDK 代码的初始压缩包，该压缩包解压得到的源码，与通过 Repo 下载的源码是一致的。以 RK3288_ANDROID9.0_MID_SDK_V1.0.0_20190410.tar.gz 为例，拷贝到该初始化包后，通过如下命令可检出源码：

Generally, Rockchip FAE contact will provide the initial compressed package of the corresponding

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version SDK in order to help customers acquire SDK source code quickly. Developer can acquire the initial compressed package of SDK code in this way and unzip it to get the source code. It is the same as the source code downloaded through repo. Take RK3288_ANDROID9.0_MID_SDK_V1.0.0_20190410.tar.gz as an example, you can sync the source code through below command after getting the initial package:

```
$ mkdir rk3288
$ tar zxvf RK3288_ANDROID9.0_MID_SDK_V1.0.0_20190410.tar.gz -C rk3288
$ cd rk3288
$ .repo/repo/repo sync -l
$ .repo/repo/repo sync
```

后续开发者可根据 Fae 窗口定期发布的更新说明，通过 ".repo/repo/repo sync" 命令同步更新。

Developers can execute the command ".repo/repo/repo sync" to sync the new code according to the update notice periodically released by FAE contact in future.

3.2 SDK 编译 SDK compiling

3.2.1 JDK 安装 JDK installation

Android9.0 系统编译依赖于 JAVA 8。编译之前需安装 OpenJDK。

Android9.0 system compiling is dependent on JAVA 8. Need to install OpenJDK before compiling.

安装命令如下：

Install command is as below:

```
$ sudo apt-get install openjdk-8-jdk
```

配置 JAVA 环境变量，例如，安装路径为/usr/lib/jvm/java-8-openjdk-amd64，可在终端执行如下命令配置环境变量：

Configure JAVA environment variable, for example, if the install path is /usr/lib/jvm/java-8-openjdk-amd64, it is able to execute the following command to configure the environment variable at the terminal.

```
$ export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
$ export PATH=$JAVA_HOME/bin:$PATH
$ export CLASSPATH=.:$JAVA_HOME/lib:$JAVA_HOME/lib/tools.jar
```

SDK 带有 Open JDK8 的配置脚本，在工程根目录下，命名为 javaenv.sh。

SDK contains Open JDK8 configuration script named javaenv.sh in project root directory.

可直接执行以下命令，配置 JDK：

Directly execute the following command to configure JDK:

```
$ source javaenv.sh
```

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3.2.2 编译模式 Compilation mode

SDK 默认以 userdebug 模式编译。

SDK default compiling mode is userdebug.

使用 adb 时，需要先执行 adb root ，adb disable-verity 关闭 system 分区的 verity 特性，重启后再执行 adb root, adb remount，进而进行 push 操作来 debug。

When using adb, first need to execute adb root, adb disable-verity to close the verity feature of the system partition, then execute adb root, adb remount after reboot, and then execute push operation to debug.

3.2.3 SDK 代码编译 SDK code compiling

uboot 编译:

uboot compiling:

```
$ cd u-boot
$ make clean
$ make mrproper
$ ./make.sh rk3288
```

kernel 编译:

```
$ cd kernel
$ make ARCH=arm rockchip_defconfig
$ make ARCH=arm rk3288-evb-android-rk808-edp-avb.img -j12
```

Android 编译:

Android compiling:

```
$ source build/envsetup.sh
$ lunch rk3288-userdebug
$ make -j12
$ ./mkimage.sh
```

3.2.4 固件生成步骤 Image build step

执行./mkimage.sh 后，在 rockdev/Image-xxx/目录生成完整的固件包(xxx 是具体 lunch 的产品名)。

The complete images package will be generated in rockdev/Image-xxx/ (xxx is the specific name of lunched product) directory after executing ./mkimage.sh.

```
rockdev/Image-xxx/
├── boot.img
├── kernel.img
├── MiniLoaderAll.bin
├── vbmeta.img
├── dtbo.img
├── misc.img
```

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```
├── oem.img
├── parameter.txt
├── pcba_small_misc.img
├── pcba_whole_misc.img
├── recovery.img
├── resource.img
├── system.img
├── trust.img
├── uboot.img
└── vendor.img
```

得到所有镜像文件后，为了方便烧写及量产，通常可手动将这些单独的镜像通过脚本打包成为 update.img。

After acquiring all the mirror files, usually you can manually use the script to package them as update.img which is convenient for flashing and MP.

3.2.5 全自动编译脚本 Fully automatic compiling script

如前几节所述，编译可大致分为 u-boot、kernel、android 三大部分进行编译，为了提高编译的效率，降低人工编译可能出现的误操作，该 SDK 中集成了全自动化编译脚本，方便固件编译、备份。

As described above, the compilation mainly contains three parts compiling u-boot, kernel and android. In order to improve the compiling efficiency and lower down the possible mistake operation of manual compiling, this SDK integrates the fully automatic compiling script which is convenient for image compiling and backup.

1）该全自动化编译脚本原始文件存放于：

The original file of the fully automatic compiling script is put in:

```
device/rockchip/RK3288/build.sh
```

2）在 repo sync 的时候，通过 manifest 中的 copy 选项拷贝至工程根目录下：

When repo sync, copy it to the project root directory through manifest:

```
<project path="device/rockchip/rk3288" ... >
<copyfile src="buildspec.mk" dest="buildspec.mk"/>
        <copyfile src="build.sh" dest="build.sh"/>
</project>
```

3）修改 build.sh 脚本中的特定变量以编出对应产品固件。

Modify the specific variable in build.sh script to build out the corresponding product images.

```
KERNEL_DTS= rk3288-evb-android-rk808-edp-avb
```

变量请按实际项目情况，对应修改：

Modify the variable according to the actual project situation:

KERNEL_DTS 变量指定编译 kernel 的产品板极配置；

KERNEL_DTS variable specifies the product board level configuration for kernel compiling.

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Android 编译需要指定对应的 lunch 选项，请在执行 build.sh 之前执行 lunch 操作，确保使用了正确的 lunch 选项，例如：

Android compiling needs to specify the corresponding lunch option. Please execute lunch operation before executing build.sh to make sure the correct lunch option is used. For example:

```
$ lunch rk3288-userdebug
```

4）执行自动编译脚本：

Execute automatic compiling script:

```
$ ./build.sh -U -K -A -u -p -v userdebug
```

该脚本会自动配置 JDK 环境变量，编译 u-boot，编译 kernel，编译 Android，继而生成固件和版本信息，并打包成 update.img。

The script will automatically configure JDK environment variable, compile u-boot, compile kernel, compile Android, then generate images and version information, and package them to be update.img.

5）脚本生成内容：

The script generated contents:

脚本会将编译生成的固件拷贝至：

The script will copy the compiled images to:

IMAGE/RK3288 *****_RELEASE_TEST/IMAGES 目录下，具体路径以实际生成为准。每次编译都会新建目录保存，自动备份调试开发过程的固件版本，并存放固件版本的各类信息。建议在每次大版本编译的时候 ，使用这个编译脚本生成固件，里面包含了很多的版本信息，便于追查问题的时候定位代码的状态。

the directory of IMAGE/RK3288 *****_RELEASE_TEST/IMAGES which path is subject to the actual generation. Each compiling will create new directory and save, automatically backup images version during debugging, and keep all the information of images version. Recommend to use this compiling script to generate images for every big version compilation. It includes much version information which is convenient to locate code status for debugging issues.

该目录下的 update.img 可直接用于 Android 开发工具及工厂烧写工具下载更新。

update.img in the directory can be directly used to download and update Android development tool and factory flashing tool.

3.3 固件烧写 Image flashing

刷机说明详见 RKDocs\common\RKTools manuals 目录下《Android 开发工具手册.pdf》。

Flashing instruction refers to 《Android 开发工具手册.pdf》 in the directory of RKDocs\common\RKTools manuals.

SDK 提供烧写工具，如下图所示。编译生成相应的固件后，进入烧写模式，即可进行刷机；对于已烧过其它固件的机器，可以选择重新烧录固件，或是选择低格设备，擦除 idb，然后进行刷机。

SDK provides flashing tools as shown in below picture. After compiling to generate corresponding images, enter flashing mode, it is able to flash images. For the devices with existing images, you can

select to re-flash images, or select to format the device, erase idb, and then flash the images.

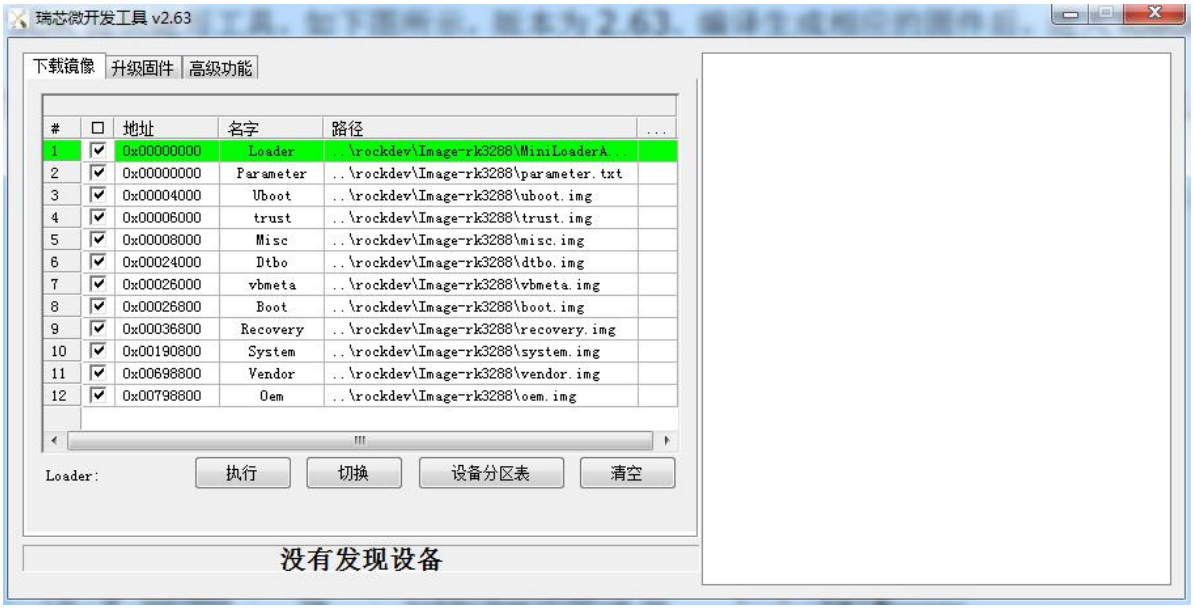

图 3-1 Android 开发工具烧写界面

Picture 3-1 Android development tool flashing interface

注：Note:

1）烧写前，需安装最新的 USB 驱动，驱动详见：

Need to install the latest USB driver before flashing. The driver refers to:

```
RKTools/windows/
|── DriverAssitant_v4.5.zip
```

2）Android9.0 相比 Android8.1 多了 Dtbo.img 和 vbmeta.img，固件烧写的时候必须烧写这两个 img，否则系统无法开机。

Comparing with Android8.1, android9.0 has two additional images Dtbo.img and vbmeta.img which must be flashed, otherwise the system will fail to boot up.

3.4 量产烧写 MP flashing

量产上考虑到生产效率及工厂工位安排，量产烧写说明详见 RKDocs\common\RKTools manuals 目录下《Rockchip 量产烧录 指南 V1.1-20170214.pdf》。

Considering the production efficiency and factory work station arrangement during MP, the flashing instruction refers to 《Rockchip 量产烧录 指南 V1.1-20170214.pdf》 in the directory of RKDocs\common\RKTools manuals.

在量产过程中如涉及到工具上的问题，可以联系我们的 FAE 窗口。

Please contact with our FAE if you have any tool related issues during production.

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4 U-Boot 开发 U-Boot development

U-Boot 基本概念、编译的注意事项和 RK 平台 U-Boot 框架等具体的开发细节可参考 RKDocs\common\u-boot 目录下《Rockchip-Developer-Guide-UBoot-nextdev.pdf》。

For U-Boot basic concept, compiling notice, RK platform U-Boot framework and other specific development details, you can refer to 《Rockchip-Developer-Guide-UBoot-nextdev.pdf》 in the directory of RKDocs\common\u-boot.

5 内核开发 Kernel development

本节简单介绍内核一些常见配置的修改，主要是 dts 的配置，帮助客户更快更方便的进行一些简单的修改。RK3288 kernel 版本是 4.4，config 配置文件统一为 arch/arm/configs/ rockchip_defconfig，RK3288 的串口波特率为 115200，调试时请保证设置准确。

This chapter simply introduces some kernel common configuration changes, mainly for dts configuration, to help customers to do some simple changes easier and more conveniently. RK3288 kernel version is 4.4 and config files are unified as arch/arm/configs/ rockchip_defconfig. RK3288 serial port baud rate is 115200. Please make sure the setting is correct for debugging.

5.1 DTS 介绍 DTS introduction

5.1.1 DTS 说明 DTS introduction

RK3288 的 dts 文件在 kernel/arch/arm/boot/dts/下，其中 rk3288.dtsi 是核心配置文件定义了平台相关的内容；RK3288-android.dtsi 是产品级配置文件定义了一些外围设备；具体的产品 dts 需要 include 这两个文件。产品的 dts 里需根据具体的产品需求配置 CPU、GPU、DDR 的频率和电压表，配置 io、屏、wifi、bt、sensor、温控、背光、电池、系统供电配置等等。

RK3288 dts file is in kernel/arch/arm/boot/dts/. rk3288.dtsi is the core configuration file which defines the platform related contents. Rk3288-android.dtsi is the product level configuration file which defines some peripheral devices. The product dts needs to include these two files. Configure CPU, GPU, DDR frequency and voltage table in product dts according to the specific product requirement. Configure io, panel, wifi, bt, sensor, thermal control, backlight, system power supply configuration and so on.

SDK 板采用 rk3288-evb-android-rk808-edp-avb.dts 这个文件。

SDK board uses the file rk3288-evb-android-rk808-edp-avb.dts.

5.1.2 新增一个产品 DTS Create a new product DTS

RK3288 的产品 dts 文件需放在 kernel/arch/arm/boot/dts/下。

RK3288 product dts file should be put in kernel/arch/arm/boot/dts/.

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1、以 rk3288-evb-android-rk808-edp-avb.dts 为参照，拷贝一份 dts 文件命名为 rk3288-product-avb.dts。

Take rk3288-evb-android-rk808-edp-avb.dts as reference, copy a dts file and name it as rk3288-product-avb.dts.

2、修改 arch/arm/boot/dts/Makefile 文件，添加对应 dtb 声明：

Modify arch/arm/boot/dts/Makefile file, and add the corresponding dtb statement:

```
+rk3288-product-avb.dtb
```

3、修改编译脚本或编译命令。

Modify the compiling script or command.

4、重新编译内核。

Re-compile kernel.

5.2 Wi-Fi & BT 配置 Wi-Fi & BT configuration

RK3288 Android 9.0 平台上 WiFi、BT 可做到自动兼容，按照 RK 提供的编译 Android9.0 编译步骤，生成固件后，默认就可以支持相应的 WiFi 模块，并且一套固件可以支持多个 WiFi 模块。 在硬件完全按照 RK SDK 规范设计的前提下，RK3288 android 9.0 平台 wifi、bt 模块 android 和 kernel 无需做任何配置。

RK3288 Android9.0 platform supports auto compatibility for WiFi and BT. After generating the image according to the Android9.0 compiling steps provided by RK, it can support the corresponding WiFi module by default, and one set of image can support multiple WiFi modules. Under the pre-condition of hardware strictly following RK SDK standard design, there is no need to do any configuration in android and kernel for wifi, bt module on RK3288 android 9.0 platform.

目前对外发布 RK3288 Android9.0 SDK，Wi-Fi 自动兼容框架已经搭建完毕，如果客户需要自行调试其他模块，只需按照 RKDocs\android\wifi\目录下《RealTek wifi 驱动移植说明_V1.1.pdf》及《ROCKCHIP_ANDROID_9.0_WIFI 配置说明_V1.4.pdf》提到的注意事项进行修改即可。

Currently released RK3288 Android9.0 SDK already implemented the auto compatibility framework for Wi-Fi. If customers need to debug other modules, only need to modify according to the notices mentioned in the 《RealTek wifi 驱动移植说明_V1.1.pdf》 and 《ROCKCHIP_ANDROID_9.0_WIFI 配置说明_V1.4.pdf》 in the directory of RKDocs\android\wifi\.

5.3 GPIO

关于原理图上的 gpio 跟 dts 里面的 gpio 的对应关系，例如 GPIO4c0，那么对应的 dts 里面应该是“gpio4 16”。因为 GPIO4A 有 8 个 pin，GPIO4B 也有 8 个 pin，以此计算可得 c0 口就是 16，c1 口就是 17，以此类推；

As to the gpio corresponding relationship between schematic and dts, such as GPIO4c0, the corresponding gpio in dts should be “gpio4 16”. As GPIOA has 8 pins, GPIOB also has 8 pins, inferring in this way, we can know c0 port is 16, c1 port is 17, and so on.

GPIO 的使用请参考 RKDocs\common\PIN-Ctrl\ 目录下《Rockchip Pin-Ctrl 开发指南

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V1.0-20160725.pdf》。

GPIO usage refers to 《Rockchip Pin-Ctrl 开发指南 V1.0-20160725.pdf》 in the directory of RKDocs\common\PIN-Ctrl\.

5.4 ARM、GPU 频率修改 ARM, GPU frequency change

DVFS（Dynamic Voltage and Frequency Scaling）动态电压频率调节，是一种实时的电压和频率调节技术。目前 4.4 内核中支持 DVFS 的模块有 CPU、GPU、DDR。

DVFS (Dynamic Voltage and Frequency Scaling) is a real-time voltage and frequency scaling technology. Currently in kernel 4.4 CPU, GPU and DDR modules support DVFS.

CPUFreq 是内核开发者定义的一套支持动态调整 CPU 频率和电压的框架模型。它能有效的降低 CPU 的功耗，同时兼顾 CPU 的性能。

CPUFreq is a set of framework model supporting dynamically adjusting CPU frequency and voltage defined by kernel developers. It can effectively reduce CPU power consumption and balance CPU performance at the same time.

CPUFreq 通过不同的变频策略，选择一个合适的频率供 CPU 使用，目前的内核版本提供了以下几种策略：

CPUFreq selects a suitable frequency for CPU through different frequency scaling strategies. Current kernel version provides several strategies as below:

- interactive：根据 CPU 负载动态调频调压；
  interactive: dynamically adjust frequency and voltage according to CPU load.
- conservative：保守策略，逐级调整频率和电压；
  conservative: conservative strategy, adjust frequency and voltage step by step.
- ondemand：根据 CPU 负载动态调频调压，比 interactive 策略反应慢；
  ondemand: dynamically adjust frequency and voltage according to CPU load, slower than interactive.
- userspace：用户自己设置电压和频率，系统不会自动调整；
  userspace: users set voltage and frequency by self, and system doesn’t automatically adjust.
- powersave：功耗优先，始终将频率设置在最低值；
  powersave: power consumption first, always set the frequency to the lowest value.
- performance：性能优先，始终将频率设置为最高值。
  performance: performance first, always set the frequency to the max value.

详细的模块功能及配置，请参考 RKDocs/common/DVFS/目录下《Rockchip-Developer-Guide-Linux4.4-CPUFreq-CN.pdf》和《Rockchip-Developer-Guide-Linux4.4-Devfreq.pdf》文档。

The detailed module function and configuration refer to《Rockchip-Developer-Guide-Linux4.4-CPUFreq-CN.pdf》 and 《Rockchip-Developer-Guide-Linux4.4-Devfreq.pdf》 in the directory of RKDocs/common/DVFS/.

ARM/GPU/DDR 分别有对应的调试接口，可以通过 ADB 命令进行操作，对应的接口目录如下：

ARM/GPU/DDR all have corresponding debugging interface which can be operated with ADB

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command. The corresponding interface contents are as below:

- ARM：/sys/devices/system/cpu/cpu0/cpufreq/ and /sys/devices/system/cpu/cpu4/cpufreq/
- GPU: /sys/class/devfreq/ffa30000.rogue-g6110/
- DDR: /sys/class/devfreq/dmc/

这些目录下有如下类似节点：

These contents have the similar nodes as below:

- available_frequencies：显示支持的频率 show the supported frequency
- available_governors：显示支持的变频策略 show the supported frequency scaling strategy
- cur_freq：显示当前频率 show current frequency
- Governor：显示当前的变频策略 show current frequency scaling strategy
- max_freq：显示当前最高能跑的频率 show currently supported max frequency
- min_freq：显示当前最低能跑的频率 show currently supported min frequency

以 GPU 为例进行定频操作，流程如下：

Take GPU as example to do the fixed frequency operation. The process is as below:

- 查看支持哪些频率

  Check the supported frequencies

  cat /sys/class/devfreq/ffa30000.rogue-g6110/available_frequencies
- 切换变频策略

  Switch the frequency scaling strategy

  echo userspace > /sys/class/devfreq/ffa30000.rogue-g6110/governor
- 定频

  Fix the frequency

  echo 400000000 > /sys/class/devfreq/ffa30000.rogue-g6110/userspace/set_freq
- 设置完后，查看当前频率

  Check current frequency after setting

  cat /sys/class/devfreq/ffa30000.rogue-g6110/cur_freq

5.5 温控配置 Thermal control configuration

在 Linux 内核中，定义一套温控框架 linux Generic Thermal Sysfs Drivers，在 4.4 内核 arm 版本，我们使用 thermal 框架的 sysfs 接口读取当前的温度；温控策略是自定义的方式：

In Linux kernel, define a set of thermal control framework linux Generic Thermal Sysfs Drivers. In kernel 4.4 arm version, we use sysfs interface of thermal framework to read current temperature. The thermal control strategy is defined by self:

- performance 策略：温度超过一定的温度，CPU 会设定在固定的频率，具体的数值配置在芯片级 dtsi 文件。

Performance strategy: when the temperature is over certain value, CPU will be set at the fixed frequency, the specific value is configured in dtsi file at chipset level.

- normal 策略：当前温度超过设定值不同的温度时，CPU 会降低相应的频率，具体的数值配置

在芯片级 dtsi 文件。

Normal strategy: when current temperature is over the set value with different values, CPU will reduce to the corresponding frequencies, the specific value configuration is in the dtsi file at chipset level.

详细的模块功能及配置，请参考 RKDocs\common\Thermal\目录下的开发说明文档。

For the detailed module function and configuration, please refer to the development document in the directory of RKDocs\common\Thermal\.

6 Android 常见配置 Android common configuration

6.1 Android9.0 系统新特性说明 Android9.0 new feature instruction

该部分内容请参阅 SDK 中 RKDocs/rk3288 目录下《Android_9.0 系统新特性说明_V1.1_20181205.pdf》。

Please refer to 《Android_9.0 系统新特性说明_V1.1_20181205.pdf》 in the directory of RKDocs/rk3288 in sdk.

6.2 Android 产品配置 Android product configuration

6.2.1 lunch 选项说明 lunch option description

rk3288-userdebug: //rk3288 平台平板产品 userdebug rk3288 platform tablet product userdebug

rk3288-user: //rk3288 平台平板产品 user rk3288 platform tablet product user

6.2.2 添加一个新的产品 Create a new product

各开发厂商可能有同款芯片不同产品开发的需求，一套 SDK 需同时编译生成多款产品固件。

Customers may have the requirement to develop different products based on the same chipset. One set of SDK should be able to compile images for multiple products.

rk3288 平台支持各种平板类型产品形态，当需要添加一个新的产品时，如下以建立一个新的平板产品为例进行说明，具体步骤为：

RK3288 platform supports various tablet products. Below take a new tablet product as example to describe the detailed steps:

- 在 device/rockchip/rk3288/目录下，基于 rk3288.mk 创建 rk3288_xxx.mk。

  Create rk3288_xxx.mk based on rk3288.mk in the directory of device/rockchip/rk3288/.

  cd device/rockchip/rk3288

  cp rk3288.mk ./rk3288_xxx.mk
- 在 device/rockchip/rk3288/AndroidProducts.mk 中添加：

  Add in device/rockchip/rk3288/AndroidProducts.mk:

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```
PRODUCT_MAKEFILES := \
    $(LOCAL_DIR)/rk3288.mk \
    $(LOCAL_DIR)/rk3288_xxx.mk
```

- 在 vendorsetup.sh 中添加产品对应的 lunch 选项：

  Add the corresponding lunch option of the product in vendorsetup.sh:

```
add_lunch_combo rk3288-userdebug
add_lunch_combo rk3288-user
add_lunch_combo rk3288_xxx-userdebug
add_lunch_combo rk3288_xxx-user
```

- 修改 rk3288_ xxx.mk 中新产品所需要修改的配置。

  Modify the configurations for the new product in rk3288_ xxx.mk.

- 修改编译脚本或编译命令，重新 lunch 产品名称进行新产品编译。

  Modify the compiling script or compiling command, re-lunch the product name to compile the new product.

6.3 常用功能配置说明 Common function configuration instruction

6.3.1 常用配置宏说明 Common configuration macro instruction

宏配置 Macro configuration	功能说明 Function instruction
BUILD_WITH_GOOGLE_MARKET	若为 true 则集成 GMS 包，false 不集成 If true, integrate GMS package, false not to integrate
BUILD_WITH_GOOGLE_MARKET_ALL	若为 true 集成 full 的 GMS 包，false 集成 mini 的 GMS 包 If true, integrate full GMS package, false to integrate mini GMS package
BUILD_WITH_GOOGLE_FRP	使能恢复出厂设置保护 FRP 功能 Enable FRP factory reset protection function
BUILD_WITH_FORCEENCRYPT	使能默认全盘加密 Enable default full disk encryption
PRODUCT_SYSTEM_VERITY	使能 Verified boot Enable Verified boot
BUILD_WITH_GMS_CER	GMS 认证配置选项 GMS certificate configuration option
BUILD_WITH_WIDEVINE	集成 Widevine level3 插件库 Integrate Widevine level3 plug-in library
BOARD_NFC_SUPPORT	使能 NFC 功能

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	Enable NFC function
BOARD_SENSOR_ST	选用 ST 的 sensor 框架 Select ST sensor framework
BOARD_SENSOR_MPU	选用 MPU 的 sensor 框架 Select MPU sensor framework
BOARD_SENSOR_MPU_VR	选用 MPU_VR 的 sensor 框架 Select MPU_VR sensor framework
BOARD_GRAVITY_SENSOR_SUPPORT	使能 G-Sensor Enable G-Sensor
BOARD_COMPASS_SENSOR_SUPPORT	使能 Compass Enable Compass
BOARD_GYROSCOPE_SENSOR_SUPPORT	使能陀螺仪 Gyroscope Enable Gyroscope
BOARD_PROXIMITY_SENSOR_SUPPORT	使能距离感应器 Enable P-sensor
BOARD_LIGHT_SENSOR_SUPPORT	使能光感应器 Enable the light sensor
BOARD_PRESSURE_SENSOR_SUPPORT	使能压力感应器 Enable the pressure sensor
BOARD_TEMPERATURE_SENSOR_SUPPORT	使能温度传感器 Enable the temperature sensor
BOARD_ENABLE_3G_DONGLE	使能 3G Dongle 功能 Enable 3G Dongle function
TARGET_ROCKCHIP_PCBATEST	使能 PCBA 测试 Enable PCBA test
BOOT_SHUTDOWN_ANIMATION_RINGING	使能开关机动画+铃声 Enable power on/off animation and tones
BOARD_SYSTEMIMAGE_PARTITION_SIZE	System 分区最大容量 System partition maximum capacity

6.3.2 预装 APK Pre-install APK

Android 上的应用预安装功能，主要是指配置产品时，根据厂商要求，将事先准备好的第三方应用预制进 Android 系统。预安装分为不可卸载安装、可永久卸载安装以及卸载后恢复出厂设置后自动恢复安装，详细配置和使用请参阅工程目录 RKDocs/android/下相关说明文档：

Android apk pre-install function means to install the third party application prepared in advance into the Android system when configuring the product according to customer requirements. Pre-install can be divided into non-uninstall installation, permanent uninstall installation and automatic installation after factory reset. Please refer to below document in the project directory of RKDocs/android/ for the detailed configuration and usage:

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《Android_预安装应用功能说明文档_V1.0_20171109.pdf》.

6.3.3 开/关机动画及铃声 Power on/off animation and tones

定制 Android9.0 的开机铃声，关机铃声，开机动画，关机动画的详细方法请参阅工程目录 RKDocs/android/下的说明文档：《Android_定制开关机动画（铃音）说明_V1.0_20181112.pdf》。

Android9.0 power on tones, power off tones, power on animation, and power off animation customizations refer to the document 《Android_定制开关机动画（铃音）说明_V1.0_20181112.pdf》 in the project directory of RKDocs/android/.

6.4 Parameter 说明 Parameter instruction

关于 parameter 中各个参数、分区情况细节，请参考\RKDocs\common\RKTools manuals\ Rockchip Parameter File Format Ver1.3.pdf。

For the parameter and partition details, please refer to \RKDocs\common\RKTools manuals\ Rockchip Parameter File Format Ver1.3.pdf.

6.5 新增分区配置 New partition configuration

请参考\RKDocs\android\《Android 增加一个分区配置指南 V1.00.pdf》。

Please refer to \RKDocs\android\《Android 增加一个分区配置指南 V1.00.pdf》.

6.6 OTA 升级 OTA upgrade

OTA （over the air）升级是 Android 系统提供的标准软件升级方式。它功能强大，提供了完全升级（完整包）、增量升级模式（差异包），可以通过本地升级，也可以通过网络升级。详细的 OTA 升级及 Recovery 模块功能及配置，请参考 RKDocs\android 目录下《Rockchip Recovery 用户操作指南 V1.03》。

OTA (over the air) upgrade is the standard software upgrade method provided by Android system. It provides complete upgrading (full package) and incremental upgrading mode (difference package). You can upgrade locally or over the network. For the detailed OTA upgrade and Recovery mode function and configuration, please refer to 《Rockchip Recovery 用户操作指南 V1.03》 in the directory of RKDocs\android.

7 系统调试 System debug

本节重点介绍 SDK 开发过程中的一些调试工具和调试方法，并会不断补充完善，帮助开发者快速上手基础系统调试，并做出正确的分析。

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This chapter mainly introduces the debugging tools and methods used in SDK development and will update and improve continually to help developers familiar with the basic system debugging quickly and analyze the issues correctly.

7.1 ADB 工具 ADB tool

7.1.1 概述 Overview

ADB（Android Debug Bridge）是 Android SDK 里的一个工具，用这个工具可以操作管理 Android 模拟器或真实的 Android 设备。主要功能有：

ADB (Android Debug Bridge) is a tool in Android SDK which can be used to operate and manage Android simulator or the real Android device. The functions mainly include:

- 运行设备的 shell（命令行）
  Run the device shell (command line)
- 管理模拟器或设备的端口映射
  Manage the port mapping of the simulator or the device
- 计算机和设备之间上传/下载文件
  Upload/download files between the computer and the device
- 将本地 apk 软件安装至模拟器或 Android 设备
  Install the local apk to simulator or Android device

ADB 是一个“客户端－服务器端”程序，其中客户端主要是指 PC，服务器端是 Android 设备的实体机器或者虚拟机；根据 PC 连接 Box 机器的方式不同，ADB 可以分为两类：

ADB is a “client – server” program. Usually the client is PC and the server is the actual Android device or simulator. The ADB can be divided into two categories according to the way PC connects to the Box device:

- 网络 ADB：主机通过有线/无线网络（同一局域网）连接到 STB 设备；
  Network ADB: PC connects to STB device through cable/wireless network.
- USB ADB：主机通过 USB 线连接到 STB 设备；
  USB ADB: PC connects to STB device through USB cable.

7.1.2 USB adb 使用说明 USB adb usage

USB adb 使用有以下限制：

USB adb usage has the following limitations:

- 只支持 USB OTG 口
  Only support USB OTG port
- 不支持多个客户端同时使用（如 cmd 窗口，eclipse 等）
  Not support multiple clients at the same time (such as cmd window, eclipse etc.)
- 只支持主机连接一个设备，不支持连接多个设备
  Support host connects to only one device but not multiple devices

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连接步骤如下：

The connection steps are as below:

1、机器已经运行 Android 系统， 设置->开发者选项->已连接到计算机 打开，usb 调试开关打开。

The device is already running Android system, setting -> developer option -> connect to the computer, enable usb debugging switch.

2、PC 主机只通过 USB 线连接到机器 USB otg 口，然后电脑通过如下命令与机器相连。

PC connects to the device USB otg port only through USB cable, and then the computer connects with the device through below command:

```
$ adb shell
```

3、测试是否连接成功，运”adb devices”命令，如果显示机器的序列号，表示连接成功。

Execute the command ”adb devices” to see if the connection is successful or not. If the device serial number shows up, the connection is successful.

7.1.3 网络 ADB 使用要求 Network ADB usage requirement

adb 早期版本只能通过 USB 来对设备调试，从 adb v1.0.25 开始，增加了通过 tcp/ip 调试 Android 设备的功能。

ADB early versions only support device debugging through USB, and the function of debugging Android devices through tcp/ip is added from adb v1.0.25.

如果你需要使用网络 ADB 来调试设备，必须要满足如下条件：

If you need to use network ADB to debug the device, must meet below conditions:

1、设备上面首先要有网口，或者通过 Wi-Fi 连接网络。

The device must have network port, or connect the network through Wi-Fi.

2、设备和研发机（PC 机）已经接入局域网，并且设备设有局域网的 IP 地址。

The device and PC are already in the local network and the device has IP address.

3、要确保研发机和设备能够相互 ping 得通。

Need to confirm the device and PC can ping each other.

4、研发机已经安装了 ADB。

PC already installs ADB.

5、确保 Android 设备中 adbd 进程（adb 的后台进程）已经运行。adbd 进程将会监听端口 5555 来进行 ADB 连接调试。

Confirm Android device adbd process (adb background process) is already run. adbd process will monitor port 5555 to do ADB connection debugging.

7.1.4 SDK 网络 ADB 端口配置 SDK network ADB port configuration

SDK 默认未对网络 ADB 端口进行配置，需要手动修改打开配置。

SDK doesn’t configure network ADB port by default. Need to manually enable the configuration.

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7.1.5 网络 ADB 使用 Network ADB usage

本节假设设备的 ip 为 192.168.1.5，下文将会用这个 IP 建立 ADB 连接，并调试设备。

This chapter assumes the device IP is 192.168.1.5. This IP will be used for adb connection and device debugging in the following context.

1、首先 Android 设备需要先启动，如果可以话，可以确保一下 adbd 启动(ps 命令查看)。

Firstly the Android device should boot up, if possible, confirm adbd is started (use ps command to check).

2、在 PC 机的 cmd 中，输入：

In PC cmd, input:

```
$ adb connect 192.168.1.5:5555
```

如果连接成功会进行相关的提示，如果失败的话，可以先 kill-server 命令，然后重试连接。

If successful, it will prompt relative hints, if fail, you can execute kill-server command and then retry connection.

```
adb kill-server
```

3、如果连接已经建立，在研发机中，可以输入 ADB 相关的命令进行调试了。比如 adb shell，将会通过 TCP/IP 连接设备上面。和 USB 调试是一样的。

After connected, you can input ADB related commands to debug in PC, such as adb shell, it will connect the device through TCP/IP which is the same as USB debugging.

4、调试完成之后，在研发机上面输入如下的命令断开连接：

After debugging, input the following command to disconnect the connection in PC:

```
$ adb disconnect 192.168.1.5:5555
```

7.1.6 手动修改网络 ADB 端口号 Manually change the network ADB port number

若 SDK 未加入 ADB 端口号配置，或是想修改 ADB 端口号，可通过如下方式修改：

If SDK doesn’t add adb port number configuration, or want to change ADB port number, you can change through below method:

1、首先还是正常地通过 USB 连接目标机，在 windows cmd 下执行 adb shell 进入。

Firstly also connect the device normally through USB, execute adb shell in windows cmd to enter.

2、设置 ADB 监听端口：

Set ADB monitor port:

```
#setprop service.adb.tcp.port 5555
```

3、通过 ps 命令查找 adbd 的 pid

Look up adbd pid using ps command.

4、重启 adbd

Reset adbd.

```
#kill -9<pid>，这个 pid 就是上一步找到那个 pid This pid is just the one found in last step.
```

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杀死 adbd 之后，android 的 init 进程后自动重启 adbd。adbd 重启后，发现设置了 service.adb.tcp.port，就会自动改为监听网络请求。

After killing adbd, adbd will automatically restart after Android init process. After adbd restart, if service.adb.tcp.port is set, it will automatically change to monitor network request.

7.1.7 ADB 常用命令详解 ADB commonly used command elaboration

（1） 查看设备情况

Check the device situation

查看连接到计算机的 Android 设备或者模拟器：

Check the Android device or simulator connected to computer:

```
$ adb devices
```

返回的结果为连接至计算机的 Android 设备的序列号或是 IP 和端口号（Port）、状态。

The return result is the serial number or IP and port number, status of the Android device connected to PC.

（2）安装 apk

Install APK

将指定的 apk 文件安装到设备上：

Install the specific apk file to the device:

```
$ adb install <apk 文件路径 apk file path >
```

示例如下：

For example:

```
$ adb install “F:\WishTV\WishTV.apk”
```

重新安装应用：

Re-install application:

```
$ adb install –r <apk 文件路径 apk file path >
```

示例如下：

For example:

```
$ adb install –r “F:\WishTV\WishTV.apk”
```

（3）卸载 apk

Uninstall APK

完全卸载：

Complete uninstall:

```
$ adb uninstall <package>
```

示例如下：

For example:

```
$ adb uninstall com.wishtv
```

（4）使用 rm 移除 APK 文件：

Use rm to remove apk file:

```
$ adb shell rm <filepath>
```

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示例如下：

For example:

```
$ adb shell
$ rm “system/app/WishTV.apk”
```

示例说明：移除“system/app”目录下的“WishTV.apk”文件。

Note: remove WishTV.apk file in the directory of system/app.

（5）进入设备和模拟器的 shell

Enter shell of the device and simulator

进入设备或模拟器的 shell 环境：

Enter the shell environment of the device or simulator:

```
$ adb shell
```

（6）从电脑上传文件到设备

Upload the file to the device from PC

用 push 命令可以把本机电脑上的任意文件或者文件夹上传到设备。本地路径一般指本机电脑；远程路径一般指 ADB 连接的单板设备。

Use push command can upload any file or folder from PC to the device. Generally local path means the computer and remote path means the single board device connected with ADB.

```
$ adb push <本地路径 local path> <远程路径 remote path>
```

示例如下：

For example:

```
$ adb push “F:\WishTV\WishTV.apk” “system/app”
```

示例说明：将本地“WishTV.apk”文件上传到 Android 系统的“system/app”目录下。

Note: upload local WishTV.apk file to the system/app directory of the Android system.

（7）从设备下载文件到电脑

Download the file from the device to PC

pull 命令可以把设备上的文件或者文件夹下载到本机电脑中。

Use pull command can download the file or folder from the device to local computer.

```
$ adb pull <远程路径 remote path> <本地路径 local path>
```

示例如下：

For example:

```
$ adb pull system/app/Contacts.apk F:\
```

示例说明：将 Android 系统“system/app”目录下的文件或文件夹下载到本地“F:\”目录下。

Note: download the file or folder from the system/app directory of Android system to local F:\ directory.

（8）查看 bug 报告

Check bug report

需要查看系统生成的所有错误消息报告，可以运行 adb bugreport 指令来实现，该指令会将 Android 系统的 dumpsys、dumpstate 与 logcat 信息都显示出来。

Run adb bugreport command can check all the error message report generated by system. The command will show all dumpsys, dumpstate and logcat information of the Android system.

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（9）查看设备的系统信息

Check the system information of the device

在 adb shell 下查看设备系统信息的具体命令。

The specific commands to check the device system information in adb shell.

```
$ adb shell getprop
```

7.2 Logcat 工具 Logcat tool

Android 日志系统提供了记录和查看系统调试信息的功能，日志都是从各种软件和一些系统的缓冲区中记录下来的，缓冲区可以通过 Logcat 来查看和使用；Logcat 是调试程序用的最多的功能，该功能主要是通过打印日志来显示程序的运行情况，由于要打印的日志量非常大，需要对其进行过滤等操作。

Android logcat system provides the function to record and check the system debugging information. The logcats are all recorded from various softwares and some system buffer. The buffer can be checked and used through Logcat. Logcat is the most commonly used function for debugging program. The function shows the program running status mainly by printing logcat. Because the amount of logcat is very large, need to do filtering and other operations.

7.2.1 Logcat 命令使用 Logcat command usage

用 logcat 命令来查看系统日志缓冲区的内容：

Use logcat command to check the contents of the system logcat buffer:

基本格式：

The basic format:

```
[adb] logcat [<option>] [<filter-spec>]
```

示例如下：

For example:

```
$ adb shell
$ logcat
```

7.2.2 常用的日志过滤方式 The commonly used logcat filter method

控制日志输出的几种方式：

Several ways to control the logcat output:

- 控制日志输出优先级。

  Control the logcat output priority.

示例如下：

For example:

```
$ adb shell
$ logcat *:W
```

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示例说明：显示优先级为 warning 或更高的日志信息。

Note: show the logcat information with priority of warning or higher.

- 控制日志标签和输出优先级。

  Control the logcat label and output priority.

示例如下：

For example:

```
$ adb shell
$ logcat ActivityManager:I MyApp:D *:S
```

示例说明：支持所有的日志信息，除了那些标签为“ActivityManager”和优先级为“Info”以上的、标签为“MyApp”和优先级为“Debug”以上的。

Note: support all the logcat information except those with label of ActivityManager and priority of Info above, label of MyApp and priority of Debug above.

- 只输出特定标签的日志

  Only output the logcat with the specific label

示例如下：

For example:

```
$ adb shell
$ logcat WishTV:* *:S
```

或者 Or

```
$ adb shell
$ logcat –s WishTV
```

示例说明：只输出标签为 WishTV 的日志。

Note: only output the logcat with label of WishTV.

- 只输出指定优先级和标签的日志

  Only output the logcat with the specific priority and label

示例如下：

For example:

```
$ adb shell
$ logcat WishTV:I *:S
```

示例说明：只输出优先级为 I，标签为 WishTV 的日志。

Note: only output the logcat with priority of I and label of WishTV.

7.2.3 查看上次 log View last log

可以加-L 参数来打印出上次系统复位前的 logcat 信息。若出现拷机异常或者异常掉电的情况，可通过该命令打印出上一次 Android 运行状态的日志。命令如下：

Add –L parameter can print out the logcat information before last system reset. If the stress test abnormal or power down abnormal occurs, the command can be used to print out the logcat of last Android running status. The command is as below:

```
$ adb shell
```

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```
$ logcat -L
```

7.3 Procrank 工具 Procrank tool

Procrank 是 Android 自带的一款调试工具，运行在设备侧的 shell 环境下，用来输出进程的内存快照，便于有效的观察进程的内存占用情况。

Procrank is a debugging tool with Android, running in the shell environment of the device, used to output the memory snapshot of the process in order to effectively observe the memory usage status of the process.

包括如下内存信息：

Include the following memory information:

- VSS：Virtual Set Size 虚拟耗用内存大小（包含共享库占用的内存）The memory size used by virtual (including the memory used by the shared lib)
- RSS：Resident Set Size 实际使用物理内存大小（包含共享库占用的内存）The actually used physical memory size (including the memory used by the shared lib)
- PSS：Proportional Set Size 实际使用的物理内存大小（比例分配共享库占用的内存）The actually used physical memory size (allocate the memory used by the shared lib in proportion)
- USS：Unique Set Size 进程独自占用的物理内存大小（不包含共享库占用的内存）The physical memory used exclusively by the process (not including the memory used by the shared lib)

注意：Note:

- USS 大小代表只属于本进程正在使用的内存大小，进程被杀死后会被完整回收；
  USS size represents the memory size only used by the process, and it will be completely recovered after the process is killed.
- VSS/RSS 包含了共享库使用的内存，对查看单一进程内存状态没有参考价值；
  VSS/RSS includes the memory used by the shared lib, so it is not helpful to check the memory status of the single process.
- PSS 是按照比例将共享内存分割后，某单一进程对共享内存区的占用情况。
  PSS is the shared memory status used by the specific single process after the shared memory is allocated in proportion.

7.3.1 使用 procrank Use procrank

执行 procrank 前需要先让终端获取到 root 权限

Make sure the terminal has the root authority before executing procrank

```
$ su
```

命令格式：

The command format:

```
procrank [ -W ] [ -v | -r | -p | -u | -h ]
```

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常用指令说明 :

The commonly used command instructions:

- -v：按照 VSS 排序 order by VSS
- -r：按照 RSS 排序 order by RSS
- -p：按照 PSS 排序 order by PSS
- -u：按照 USS 排序 order by USS
- -R：转换为递增[递减]方式排序 convert to order by increasing[decreasing] method
- -w：只显示 working set 的统计计数 only display the statistical count of working set
- -W：重置 working set 的统计计数 reset the statistical count of working set
- -h：帮助 help

示例：

For example:

- 输出内存快照：Output the memory snapshot:

```
procrank
```

- 按照 VSS 降序排列输出内存快照：Output the memory snapshot in VSS decreasing order:

```
procrank –v
```

默认 procrank 输出是通过 PSS 排序。

Procrank is output in PSS order by default.

7.3.2 检索指定内容信息 Search the specific content information

查看指定进程的内存占用状态，命令格式如下：

Use below command format to view the memory status of the specific process:

```
procrank | grep [cmdline | PID]
```

其中 cmdline 表示需要查找的应用程序名，PID 表示需要查找的应用进程。

cmdline means the target application name, PID means the target application process.

输出 systemUI 进程的内存占用状态:

Output the memory status used by systemUI process:

```
procrank | grep “com.android.systemui”
```

或者：Or:

```
procrank  | grep 3396
```

7.3.3 跟踪进程内存状态 Trace the process memory status

通过跟踪内存的占用状态，进而分析进程中是否存在内存泄露场景；使用编写脚本的方式，连续输出进程的内存快照，通过对比 USS 段，可以了解到此进程是否内存泄露。

Analyze if there is memory leakage in the process by tracing the memory usage status. Use the script to continuously output the process memory snapshot, and compare with USS segment to see if there is memory leakage in this process.

示例：输出进程名为 com.android.systemui 的应用内存占用状态，查看是否有泄露：

For example: output the application memory usage of the process named com.android.systemui to

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see if there is leakage:

1、编写脚本 test.sh

Write the script test.sh

```
#!/bin/bash
while true;do
adb shell procrank | grep “com.android.systemui”
sleep 1
done
```

2、通过 ADB 工具连接到设备后，运行此脚本：./test.sh。如图所示。

After connect to the device by adb tool, run the script ./test.sh as shown in below picture:

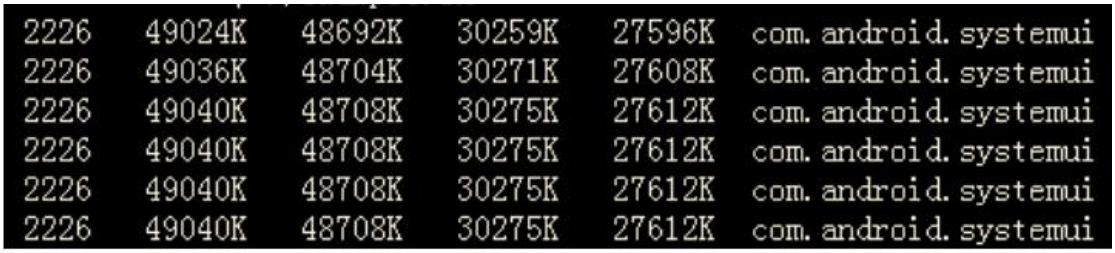

图 7- 1 跟踪进程内存状态

Picture 7-1 Trace the process memory status

7.4 Dumpsys 工具 Dumpsys tool

Dumpsys 工具是 Android 系统中自带的一款调试工具，运行在设备侧的 shell 环境下，提供系统中正在运行的服务状态信息功能。正在运行的服务是指 Android binder 机制中的服务端进程。

Dumpsys tool is a debugging tool in Android system, running in the shell environment of the device, and provides the service status information running in the system. The running service means the service process in the Android binder mechanism.

dumpsys 输出打印的条件：

The conditions for dumpsys to output the print:

1、只能打印已经加载到 ServiceManager 中的服务；

Only print the services already loaded to ServiceManager.

2、如果服务端代码中的 dump 函数没有被实现，则没有信息输出。

If the dump function in the service code is not implemented, there will be no information output.

7.4.1 使用 Dumpsys Use Dumpsys

- 查看 Dumpsys 帮助

  View Dumpsys help

作用：输出 dumpsys 帮助信息。

Function: output dympsys help information.

```
$ dumpsys   -help
```

- 查看 Dumpsys 包含服务列表

  View the service list of Dumpsys

作用：输出 dumpsys 所有可打印服务信息，开发者可以关注需要调试服务的名称。

Function: output all the printable service information of dumpsys, developer can pay attention to the service names required for debugging.

```
$ dumpsys   -l
```

- 输出指定服务的信息

  Output the specific service information

作用：输出指定的服务的 dump 信息。

Function: output the specific service dump information.

格式：dumpsys [servicename]

Format: dumpsys [servicename]

示例：输出服务 SurfaceFlinger 的信息，可执行命令：

For example: execute below command can output the service information of SurfaceFlinger

```
$ dumpsys SurfaceFlinger
```

- 输出指定服务和应用进程的信息

  Output the specific service and application process information

作用：输出指定服务指定应用进程信息。

Function: output the specific service and application process information

格式：dumpsys [servicename] [应用名]

Format: dumpsys [servicename] [application name]

示例：输出服务名为 meminfo，进程名为 com.android.systemui 的内存信息，执行命令：

For example: execute below command to output the memory information for the service named meminfo and process named com.android.systemui.

```
$ dumpsys meminfo com.android.systemui
```

注意：服务名称是大小写敏感的，并且必须输入完整服务名称。

Note: the service name is case sensitive and must input the full service name.

7.5 串口调试 Serial port debugging

7.5.1 串口配置 Serial port configuration

调试过程中最方便的就是串口的输入输出，这里需要注意的是 RK3288 波特率设置为 115200。RTS/CTS 不要勾选，否则串口无法输入。

The serial input and output is the most convenient during debugging. Need to note that RK3288 baud rate is set as 115200. No need to choose RTS/CTS, otherwise the serial port cannot be input.

7.5.2 FIQ 模式 FIQ mode

快速中断请求（Fast Interrupt Request，FIQ）在 ARM 中，FIQ 模式是特权模式中的一种，同

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时也属于异常模式一类。

FIQ (Fast interrupt request) in ARM is a kind of privilege modes and also one of the abnormal modes.

RK 平台上，在串口输入“fiq”，可以进入该模式。此时会有使用帮助跳出，可根据情况进行一些调试。经常在死机，或系统卡死的时候起作用。

In RK platforms, input fiq through serial port can enter this mode. At this moment the usage help will pop out and you can do some debugging according to the situation. Usually it is helpful when crash or system die happens.

7.6 音频 codec 问题调试工具及文档 Audio codec issue debugging tool and document

请参考 RKDocs\common\driver\ Rockchip Audio 开发指南 V1.1-20170215-linux4.4.pdf。

Please refer to RKDocs\common\driver\ Rockchip Audio 开发指南 V1.1-20170215-linux4.4.pdf.

7.7 Last log 开启 Enable Last log

在 dts 文件里面添加下面两个节点，rk3288-android.dtsi 里面已经默认开启了：

Add the following two nodes in dts file, which are already enabled in rk3288-android.dtsi by default:

```
ramoops_mem: ramoops_mem {
        reg = <0x0 0x110000 0x0 0xf0000>;
        reg-names = "ramoops_mem";
};

ramoops {
        compatible = "ramoops";
        record-size = <0x0 0x20000>;
        console-size = <0x0 0x80000>;
        ftrace-size = <0x0 0x00000>;
        pmsg-size = <0x0 0x50000>;
        memory-region = <&ramoops_mem>;
};
```

- root@rk3288:/sys/fs/pstore # ls

  dmesg-ramoops-0 上次内核 panic 后保存的 log。

  dmesg-ramoops-0 Log saved after last kernel panic

  pmsg-ramoops-0 上次用户空间的 log，android 的 log。

  pmsg-ramoops-0 Log of last user space, android log

  ftrace-ramoops-0 打印某个时间段内的 function trace。

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ftrace-ramoops-0 Print function trace during some period.

console-ramoops-0 last_log 上次启动的 kernel log，但只保存了优先级比默认 log level 高的 log。

console-ramoops-0 kernel log when last_log was enabled last time, but only save the log with higher priority than default log level.

- 使用方法：Usage:

  cat dmesg-ramoops-0

  cat console-ramoops-0

  logcat -L （pmsg-ramoops-0） 通过 logcat 取出来并解析 pull out by logcat and parse

  cat ftrace-ramoops-0

8 常用工具说明 Commonly used tool instruction

本节简单介绍 SDK 附带的一些开发及量产工具的使用说明，方便开发者了解熟悉 RK 平台工具的使用。详细的工具使用说明请见 RKTools 目录下各工具附带文档，及 RKDocs\ common\RKTools manuals 目录下工具文档。

This chapter simply describes some developing and MP tools usage along with SDK to help the developers familiar with RK platform tool usage. The detailed tool usage refers to the tool related documents in the directory of RKTools and RKDocs\ common\ RKTools manuals.

8.1 StressTest

设备上使用 Stresstest 工具，对待测设备的各项功能进行压力测试，确保整个系统各项运行的稳定性。SDK 通过打开计算器应用，输入“83991906=”暗码，可启动 StressTest 应用，进行各功能压力测试。

Use the Stresstest tool to do the stress test for the various functions on the target devices to make sure the whole system running stably. SDK can start StressTest application and perform stress test of various functions by entering “83991906=” code in the calculator.

Stresstest 测试工具测试的内容主要包括：

The test items of Stresstest tool mainly include:

模块相关

Module related

- Camera 压力测试：包括 Camera 打开关闭，Camera 拍照以及 Camera 切换

  Camera stress test: including Camera on/off, Camera taking photo and Camera switch.

- Bluetooth 压力测试： 包括 Bluetooth 打开关闭

  Bluetooth stress test: including Bluetooth on/off.

- Wifi 压力测试： 包括 Wifi 打开关闭，（ ping 测试以及 iperf 测试待加入）

  WiFi stress test: including WiFi on/off, (plan to add ping test and iperf test).

非模块相关

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Non module related

- 飞行模式开关测试 fly mode on/off test
- 休眠唤醒拷机测试 sleep and resume stress test
- 视频拷机测试 video playing stress test
- 重启拷机测试 restart stress test
- 恢复出厂设置拷机测试 recovery stress test
- ARM 变频测试 ARM frequency scaling test
- GPU 变频测试 GPU frequency scaling test
- DDR 变频测试 DDR frequency scaling test

8.2 PCBA 测试工具 PCBA test tool

PCBA 测试工具用于帮助在量产的过程中快速地甄别产品功能的好坏，提高生产效率。目前包括屏幕（LCD）、无线（wifi）、蓝牙（bluetooth）、DDR/EMMC 存储、SD 卡（sdcard）、USB HOST、按键（KEY），喇叭耳机（Codec）测试项目。

PCBA test tool is used to help quickly identify good and bad product features during production to improve the production efficiency. Current test items include panel (LCD), wireless (Wi-Fi), Bluetooth, DDR/eMMC memory, SD card, USB HOST, key, speaker earphone (Codec).

这些测试项目包括自动测试项和手动测试项，无线网络、DDR/EMMC、以太网为自动测试项，按键、SD 卡、USB HOST、Codec、为手动测试项目。

These test items include automatic test item and manual test item. Wireless network, DDR/eMMC, Ethernet are automatic test items, while key, SD card, USB Host, Codec are manual test items.

具体 PCBA 功能配置及使用说明，请参考：

For the detailed PCBA function configuration and usage, please refer to:

\RKDocs\common\RKTools manuals\Rockchip PCBA 模块开发指南--20170210.pdf

8.3 DDR 测试工具 DDR test tool

设备上使用 DDR 测试工具，对待测设备的 DDR 进行稳定性测试，确保 DDR 功能正常及稳定。

Use DDR test tool to do the stability test on the target devices to make sure DDR function normal and stable.

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8.4 Android 开发工具 Android development tool

8.4.1 下载镜像 Download the mirror image

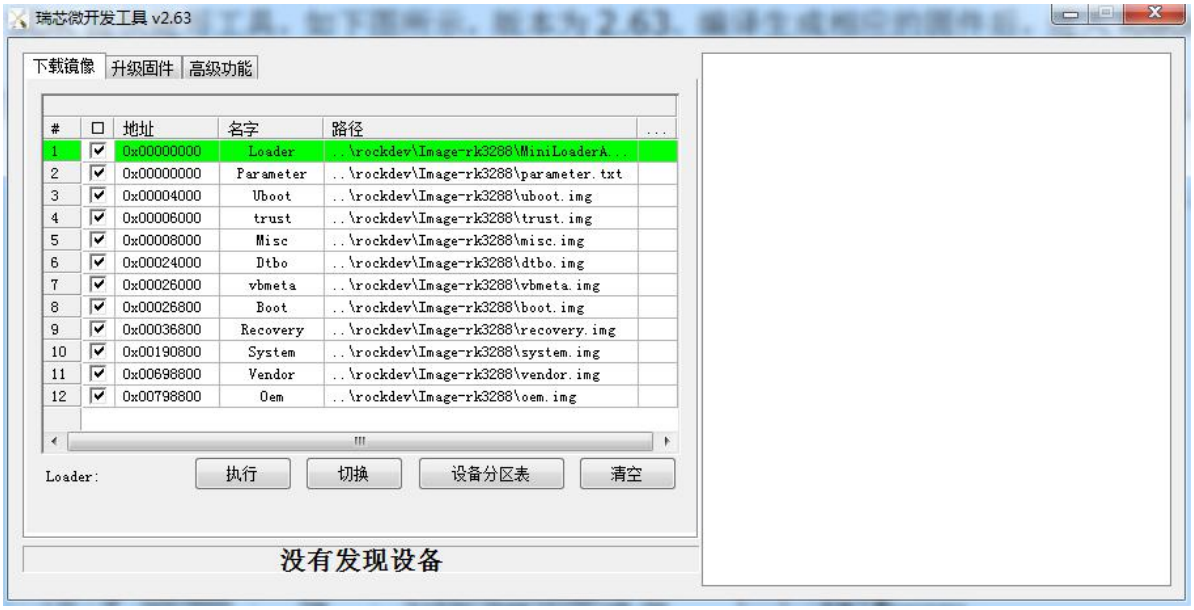

图 8-1 Android 开发工具下载镜像

Picture 8-1 Use Android development tool to download the mirror image

1）连接开发板进入下载模式。

Connect the development board to enter the download mode.

下载模式：先按住开发板 reset 按键，再长按 recovery 按键约 3-4s 时间进入。

Download mode: Firstly press and hold the reset key of the development board, and then long press recovery key around 3-4s to enter.

2）打开工具，点击“下载镜像”菜单。单击每一行末尾红色箭头所指处，会弹出文件选择框。选择对应分区的 img 文件路径。

Open the tool, and click “download mirror image” menu. Single click every line end as marked with red arrow, it will pop out file selection box and then choose the img file path of the corresponding partition.

3）依次设置所有 img 文件的路径。

Set all the img file paths successively.

4）配置完成后，点击“执行”。右侧信息框将显示相关信息。

After configuration, click “execute”. The right information box will display the relative information.

5）按钮说明

Button description

“低格”按钮：用于擦除设备

“低格” button: Used to erase the device

“清空”按钮：清空信息框

“清空” button: Used to clean up the information box

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8.4.2 升级固件 Upgrade image

图 8-2 Android 开发工具升级固件

Picture 8-2 Use Android development tool to upgrade image

1）准备目标固件。（可参考 update.img 打包）

Prepare the target image (refer to update.img package).

2）确认设备已经进入下载模式。

Confirm the device is already in the download mode.

下载模式进入方法：先按住开发板 reset 按键，再长按 recovery 按键约 3-4s 时间进入。

The way to enter the download mode: Firstly press and hold the reset key of the development board, and then long press recovery key around 3-4s to enter.

3）点击“固件”按钮，选择目标固件 update.img 文件。

Click “image” button, and choose the target image file update.img.

4）点击“升级”按钮进行下载。右侧信息框将显示相关信息。

Click “upgrage” button to download. The right information box will display the relative information.

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8.4.3 高级功能 Senior functions

图 8-3 Android 开发工具高级功能

Picture 8-3 Android development tool senior functions

高级功能说明：

Senior functions description:

1）Boot 只能选择打包好的 update.img 文件或是 loader 文件。

Boot can only select the packed update.img file or loader file.

2）固件必须使用打包后的 update.img。

Image must use the packed update.img.

3）解包功能可将 update.img 拆解为各部分镜像文件。

The unpack function can unpack update.img into partial mirror files.

8.5 update.img 打包 update.img package

本平台支持将各零散镜像文件，打包成一个完整的 update.img 形式，方便量产烧写及升级。具体打包步骤如下：

This platform supports to pack the scattered mirror files into one complete update.img to benefit production flashing and upgrading. The detailed package steps are as below:

1）打开 AndroidTool 工具目录底下的 rockdev 目录。编辑 package-file。

Open the rockdev directory under AndroidTool directory. Compile package-file.

2）按照 package-file 进行配置，package-file 里面有一些 img 镜像放在 Image 目录底下的，如果没有该目录存在，则自己手工新建该 Image 目录，并将需要放到 Image 目录的镜像放进去即可，且注意配置时，镜像名字的准确。其中注意 bootloader 选项，应该根据自己生成的 loader 名称进行修改。

Configure according to package-file, there are some img mirror put under the directory of Image in

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package-file. If the directory doesn’t exist, you need to manually create the Image directory and put the required mirror files in the directory. Note that the mirror file name must be correct during configuration and bootloader option should change the loader name according to the generated name yourself.

3）编辑 mkupdate.bat

Compile mkupdate.bat.

4）修改 loader 名称为实际存放的 loader 名称；

Change loader name to be the one actually saved.

5）点击 mkupdate.bat 运行，结束后会在该目录生成一个 update.img。

Click mkupdate.bat to run, and it will generate one update.img in the directory finally.

8.6 固件签名工具 Image sign tool

参考 RKTools\windows\SecureBootTool_v1.83_foruser.rar 中的《Rockchip Secure Boot Application Note》。

Refer to 《Rockchip Secure Boot Application Note》 in RKTools\windows\SecureBootTool_v1.83_foruser.rar.

8.7 序列号/Mac/厂商信息烧写-RKDevInfoWriteTool 工具 SN/Mac/Vendor information flashing-RKDevInfoWriteTool

本平台使用 RKDevInfoWriteTool 工具进行序列号/Mac/厂商信息的烧写。以下说明该工具的基本用法。

This platform uses RKDevInfoWriteTool to flash SN/Mac/vendor information. The basic usage of the tool is described as below.

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8.7.1 使用 RKDevInfoWriteTool 写入 Use RKDevInfoWriteTool to write

图 8- 4WNpctool 工具

Picture 8-4 WNpctool tool

1）进入 loader 模式。

Enter loader mode.

2）点击“设置”菜单，用来设置 SN/WIFI/LAN/BT 等相关参数。

Click “setting” menu to set SN/WIFI/LAN/BT and other related parameters.

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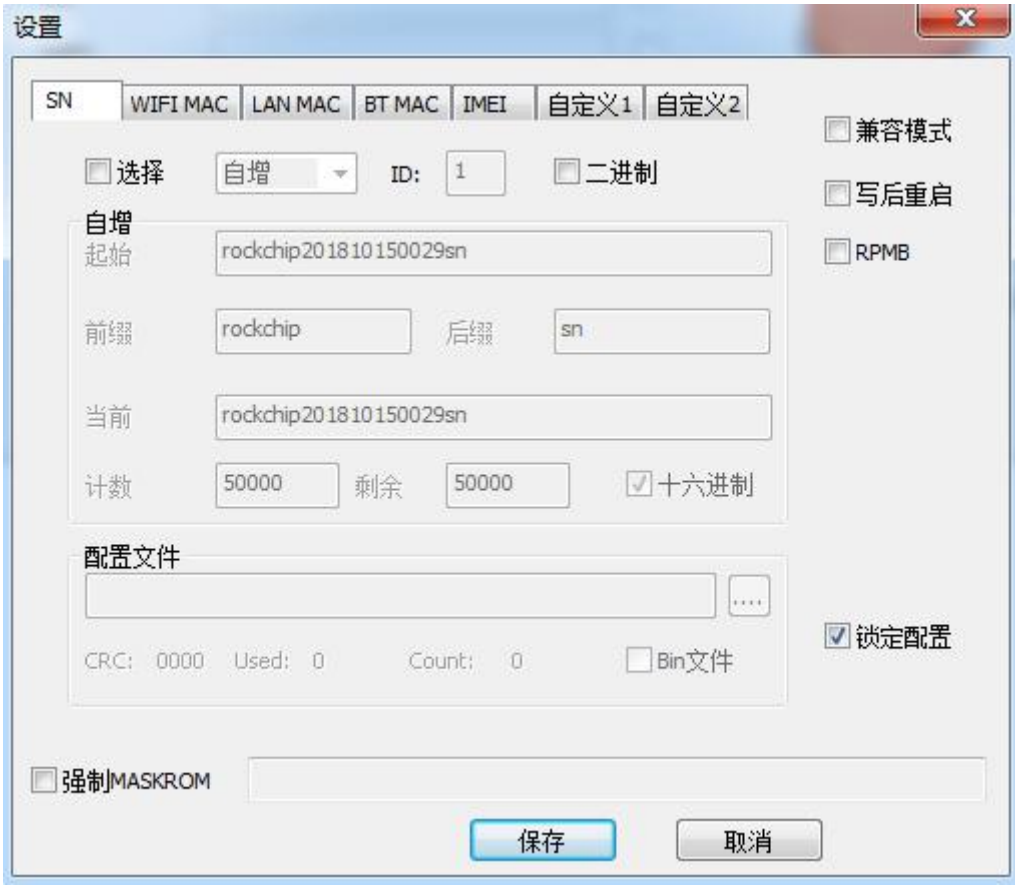

图 8- 5 RKDevInfoWriteTool 工具模式设置

Picture 8-5 RKDevInfoWriteTool tool mode setting

3）设置完成后，点击“保存”按钮，返回主窗口。

After setting, click “Save” button, back to the main window.

4）点击“写入”按钮即可。

Just click “Write” button.

8.7.2 使用 RKDevInfoWriteTool 读取 Use RKDevInfoWriteTool to read

1）进入 loader 模式。

Enter loader mode.

2）点击“读取”按钮即可。

Just click “Read” button.

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8.8 量产工具使用 MP tool usage

8.8.1 工具下载步骤 Tool download steps

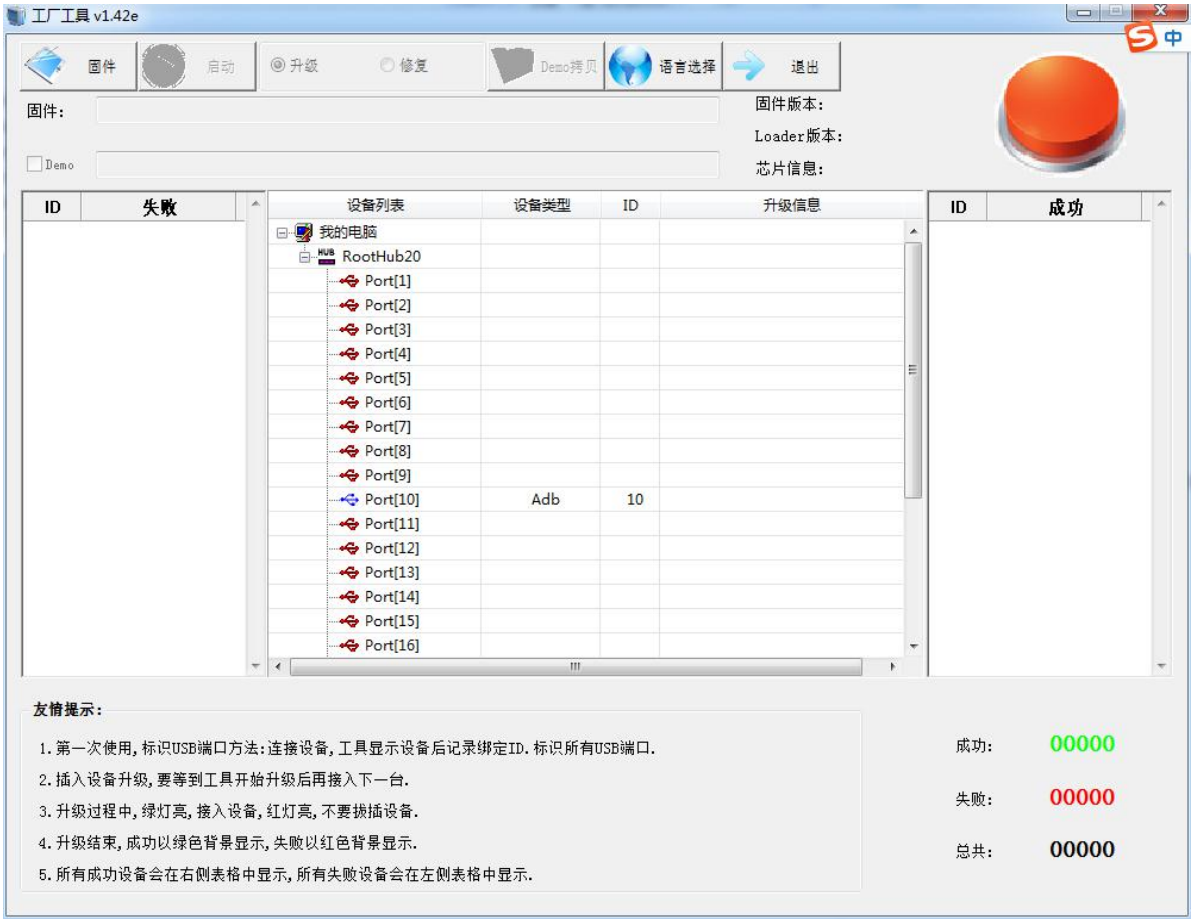

图 8-6 量产工具

Picture 8-6 MP tool

1）点击固件按钮，选择打包工具打包后的 update.img，等待解包成功；

Click image button, select the update.img packed by the package tool, and then wait for unpackage done.

2）连接设备，并让设备进入 loader 或者 maskrom 模式，工具会自动进行下载；

Connect the device, make it enter loader or maskrom mode, and the tool will start to download automatically.

3）可同时连接多台设备，进行一拖多烧写，提高工厂烧写效率。

It is able to connect multiple devices to do the flashing at the same time in order to improve the flashing efficiency in factory.

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