
高通8976功耗温升优化技术期刊- 20160427



Qualcomm Technologies, Inc.

Confidential and Proprietary – Qualcomm Technologies, Inc.

机密和专有信息——高通技术股份有限公司



Confidential and Proprietary – Qualcomm Technologies, Inc.

Confidential and Proprietary – Qualcomm Technologies, Inc.

NO PUBLIC DISCLOSURE PERMITTED: Please report postings of this document on public servers or web sites to: DocCtrlAgent@qualcomm.com. **禁止公开：**如在公共服务器或网站上发现本文档，请报告至：DocCtrlAgent@qualcomm.com.

Restricted Distribution: Not to be distributed to anyone who is not an employee of either Qualcomm or its affiliated without the express approval of Qualcomm's Configuration Management. **限制分发：**未经高通配置管理部门的明示批准，不得发布给任何非高通或高通附属及关联公司员工的人。 Not to be used, copied, reproduced, or modified in whole or in part, nor its contents revealed in any manner to others without the express written permission of Qualcomm Technologies, Inc. 未经高通技术股份有限公司明示的书面允许，不得使用、复印、复制、或修改全部或部分文档，不得以任何形式向他人透露其内容。

The user of this documentation acknowledges and agrees that any Chinese text and/or translation herein shall be for reference purposes only and that in the event of any conflict between the English text and/or version and the Chinese text and/or version, the English text and/or version shall be controlling. 本文档的用户知悉并同意中文文本和/或翻译仅供参考之目的，如英文文本和/或版本和中文文本和/或版本之间存在冲突，以英文文本和/或版本为准。

This document contains confidential and proprietary information and must be shredded when discarded. 未经高通明示的书面允许，不得使用、复印、复制全部或部分文档，不得以任何形式向他人透露其内容。本文档含有高通机密和专有信息，丢弃时必须粉碎销毁。

Qualcomm reserves the right to make changes to the product(s) or information contained herein without notice. No liability is assumed for any damages arising directly or indirectly by their use or application. The information provided in this document is provided on an "as is" basis. 高通保留未经通知即修改本文档中提及的产品或信息的权利。本公司对使用或应用本文档所产生的直接或间接损失概不负责。本文档中的信息为基于现状所提供，使用风险由用户自行承担。

Qualcomm is a trademark of QUALCOMM Incorporated, registered in the United States and other countries. All QUALCOMM Incorporated trademarks are used with permission. Other product and brand names may be trademarks or registered trademarks of their respective owners. Qualcomm是高通公司在美国及其它国家注册的商标。所有高通公司的商标皆获得使用许可。其它产品和品牌名称可能为其各自所有者的商标或注册商标。

This technical data may be subject to U.S. and international export, re-export, or transfer ("export") laws. Diversion contrary to U.S. and international law is strictly prohibited. 本文档及所含技术资料可能受美国和国际出口、再出口或转移出口法律的 限制。严禁违反或偏离美国和国际的相关法律。

Qualcomm Technologies, Inc. 5775 Morehouse Drive San Diego, CA 92121 U.S.A.

高通技术股份有限公司，美国加利福尼亚州圣地亚哥市莫豪斯路 5775 号，邮编 92121

Revision History

Revision	Date	Description
A	Jan 7, 2016	Initial version
B	Feb 5, 2016	Add more CRs
C	March 15, 2016	Add more CRs
D	April 27, 2016	Add more CRs

Checklist

- Generic Power Debug Document
- Generic Power Measurement Checklist
- Generic Power Debug Tips
- MSM8976 Power Document
- MSM8976 CR/Patches Checklist
- MSM8976 Tips

Generic Power Debug Document

Document # (文档编号)	Document Description (文档描述)
80-P0955-1SC (中文版) 80-P0955-1 (英文版)	Power Debug Guide with Simplified Chinese 很详细的功耗debug中文手册，里面有各种case debug的步骤，以及如何来抓取各种log。功耗优化的必读宝典
80-NA157-246	LA Power Optimization 很详细的调试功耗如何抓log，用工具的文档。有各种场景如何抓log的介绍
80-NT616-1	Multimedia Power Debugging Case 有各种多媒体case的功耗调试手段介绍
80-NP961-1	Camera Power Debug Guide Camera功耗调试手册
80-NT384-1	PerfLock API Overview PerfLock接口的介绍
80-P1818-1EC	QUALCOMM ONDEVICE POWER DASHBOARD TEST GUIDE 客户机功耗测试指导手册
80-NT614-1	Android_Power_Basics_Power_Feature_Overview
80-P0956-1	Android_Power_Overview
80-P0958-1	Master_Reference_Document_Power

Generic Power Measurement Checklist

- 在测试功耗之前，请检查下面的这些基本项
- Use perf_defconfig instead defconfig
 - Remove “Debug” features
 - Double check if “CORESIGHT” config is removed
 - Double check if “CONFIG_MSM_DEBUG_LAR_UNLOCK” config is removed
- Disable UART console
 - Especially for smart panel
- Remove unnecessary debug log with high frequency
- Remove on-device logging tools

Generic Power Debug Tips --- How To Check RBSC Power

- Use IR camera to scan board's hot spot if RBSC current is high ;
当RBSC高的时候可以使用IR Camera看看热点在哪里，这样可以确定是哪个硬件模块没有进入休眠。这个对某个大模块没有进入休眠很有帮助。比如Audio Codec
- Check if some clocks prevent system from going to VDD_MIN from AP side
运行下面的命令，然后从kernel的dmesg中能看到AP休眠的时候，还有那些clock是enabled的。例如最常见NFC配置错误的时候，bb_clk2_pin在suspend之前没有被disable，导致系统进入不了VDD_MIN
`adb shell "echo 1 > /sys/kernel/debug/clk/debug_suspend"`
- Hardware break down
硬件break down对于调试RBSC非常有用。通过焊掉不同器件能够知道到底是哪个器件有漏电。比如拔屏，焊掉NFC模块，Audio Codec模块，各种sensors等等。
- Compare HW difference between OEM device and Qualcomm reference board
比如LCD, Touch Screen, Finger Print, NFC, Audio Codec, Sensors。最经常有问题的比如NFC, Finger Print.
- 对于有Finger Print的设备，如果Finger Print驱动request了CXO,那么系统就不能进入VDD_MIN. 这样RBSC就会高些
- Dump only clock via JTAG
如果不希望通过JTAG传递太多数据，可以只dump clock，这样可以看出哪个clock阻止系统进入休眠。
- For more details, pls refer to doc 80-P0955-1SC, chapter 3.1.
更多细节，请参考文档80-P0955-1SC的“3.1 底电流”

Generic Power Debug Tips --- How To Check MP3 Power

- Identify the MP3 playback mode

Compress offload /Tunnel mode: Decoding on ADSP , 下面是命令

```
adb shell setprop audio.offload.disable 0
```

Non-Offload/Nontunnel mode: Decoding on CPU , 下面是命令

```
adb shell setprop audio.offload.disable 1
```

- Check if there is 3rd party sound effect lib such as Dolby

如果有第三方的音效处理算法，系统功耗肯定会比高通参考数据高。为了方便比较，可以先disable第三方算法，然后和参考平台进行比较

- Check is there any Hi-Fi function enabled

可以重点关注Hi-Fi PA的功耗情况。同时看看有没有Hi-Fi bypass mode用来方便做对比测试

- For more details, pls refer to doc 80-P0955-1SC, chapter 3.4.

更多细节，请参考文档80-P0955-1SC的“3.4 MP3播放”

Generic Power Debug Tips --- How To Check Static Display Power

- Check Static Display with Android Native UI

这样可以排除由于产品本身的UI引起的功耗增加。Native UI case功耗正常以后再切换到产品定制UI上来。很多时候我们可以根据波形来进行对比。比如看看定制化UI的功耗波形是否有周期性的peak之类。

- Check if Touch Screen consumes more power

当Touch Screen产生了更多中断的时候，Static Display这种case会有更好的功耗。Touch Screen本身firmware是否有优化空间也是考虑之一。需要和Touch Screen厂家沟通以确认。

- Check if auto backlight adjustment feature is enabled

为了能更好对比功耗数据，做测试的时候需要disable自动背光调整功能

- For more details, pls refer to doc 80-P0955-1SC, chapter 3.3.

更多细节，请参考文档80-P0955-1SC的“3.3 静态显示”

Generic Power Debug Tips --- How To Check Camera Power

- Disable all unnecessary logs
Camera应用场景的时候因为log过多会导致系统功耗上升很多。要减少不必要log输出，或者直接disable LogD。
- Balance Performance and Power
比如对于fps,可以低于30fps以取得更低功耗。需要找Camera Vendor提供更低帧率的设置
对于sensor output，可以采用最低的sensor output resolution来满足实际场景需要，比如1080P video record的时候sensor就不用输出Full Size，而是最接近1080P的sensor output.
- Balance Performance and Power
比如对于fps,可以低于30fps以取得更低功耗。需要找Camera Vendor提供更低帧率的设置
对于sensor output，可以采用最低的sensor output resolution来满足实际场景需要，比如1080P video record的时候sensor就不用输出Full Size
- Get basic power data with all features disabled, such as OIS, ASD
第一步先disable各种feature来得到一个最低功耗。因为各种feature功耗多少是可以采用叠加方式的。把最简单的case调好了后面就好调了。调试简单case的时候最好避免其他因素的干扰。
- For more details, pls refer to doc 80-P0955-1SC, chapter 4.17, 4.18 and 4.19.
更多细节，请参考文档80-P0955-1SC的4.17 摄像头预览调试, 4.18 摄像头功率优化技术 4.19 视频录制功率 优化技术 ”

Generic Power Debug Tips --- How To Check Trex Power

- Disable thermal engine before power data collection
- Optimize Display Porch Values
这样可以优化功耗
- Get ftrace log for analysis
可以重点focus在DDR和CPU的频率和利用率上

Generic Power Debug Tips --- DoU (Days of Usage)

- Brightness should be adjust to a reasonable value when do apple to apple comparing with the target HW;
不同硬件的同一亮度实际的背光功耗也可能有区别，这部分在做DoU比较的时候要弄清楚
- Thermal facts should be taken into account
不同的thermal config会对DoU结果有影响

MSM8976 Power Document

Document # (文档编号)	Document Description (文档描述)
80-NT667-7	MSM8976_LA_Current_Consumption_Data 包括各种应用场景下的功耗breakdown数据
80-P1718-8	Power Data for MSM8976.LA.1.0-00350-STD.PROD
80-P2778-4	Power Data for MSM8976.LA.1.0.1_00060_STD

MSM8976 Checklist --- CR/Patches

N means No Impact

- means Side Effect

+ means Good Impact

CR	Fix	Patches	Perf	Power	Stability	Comment
924779	Can not sleep for LTE standby		N	+	N	
949222	Add 550Mhz power level, this helps in both performance and power.		+	+	N	

MSM8976 Checklist --- CR/Patches (improve Performance/Power)

N means No Impact

- means Side Effect

+ means Good Impact

CR	Fix	Patch	Perf	Power	Stability	Comment
881194	Scheduler : Load balancing improvement.		+	-	N	
914674 943813	8976 QOS patches – GPU and Wireless		+	-	N	
928243 931349	Riptide Whitelist patches		+	-	N	
942601 944709	GPU DCVS changes		+	-	N	
943361	Ramp Governor and Scheduler aggressively Increase Launch boost 1.5GHz - > 1.8GHz Set min DDR Floor (BIMC Clk) to 192MHz		+	-	N	

MSM8976 Checklist --- CR/Patches

N means No Impact

- means Side Effect

+ means Good Impact

CR	Fix	Patch	Perf	Power	Stability	Comment
933762	GPU DCVS tuning on MSM8976		+	+	N	
960111	Fix perf core bootup failure issue , which can lead some of stability issues and standby power issues.		N	+	+	
969112	Fix Tsen interrupts issue in low temperature to avoid high standby power issue		N	+	N	
957221	avoid uart reconfig enable clk that block device not sleep when using virtual sim		N	+	N	
916022	wakelock is not acquired when polling state is set and allow system to go to suspend.		N	+	N	
959992	Fix the error "Thermal-Client-Lib: Pipe error" when enter camera.		N	N	N	Thermal engine

Checklist --- CR/Patches

N means No Impact **- means Side Effect** **+ means Good Impact**

CR	Fix	Patch	Perf	Power	Stability	Comment
971588	Fix core_ctl initialization failure issue when the battery SOC is less then 10%		+	+	N	
961055	CX running @ NOM instead of SVS+ in LTE CA CAT6		+	+	N	Cat6 Power optimization CR
967605	8976_CAT6 : Reduce Q6 frequency from 614MHz to 576MHz and Boost API change for Q6		N	+	N	
967621	8976_CAT6 : LTE FW optimization for reduced Q6 clocks		N	+	N	
977178	LFW: Free up some space in static TCM		N	+	N	

Checklist --- CR/Patches

N means No Impact **- means Side Effect** **+ means Good Impact**

CR	Fix	Patch	Perf	Power	Stability	Comment
972118	Do not resume the eMMC device as part of the system resume. Only resume it when there's a request to be processed.		+	+	N	Fix Vdd min sleep issue when enable EMMC deferred resume function
961377	IPA_WS wakelock will be hold for a long time and lead standby power issue		N	+	N	Need to merge after CR 916022 integration
984992	clk: qcom: clock-gcc: Update the frequency precision for clocks		N	+	N	Fix high power issue during usb charging
987462	msm_otg suspend failed with DCP Charger Connect/Disconnect use case.		N	+	N	After the removal of USB cable, the issue here is USB acquired wakelock is still held.

Checklist --- CR/Patches (NEW)

N means No Impact

- means Side Effect

+ means Good Impact

CR	Fix	Patch	Perf	Power	Stability	Comment
992618	Standby current is more higher after using QUAT_MI2S		N	+	N	Fix Vdd min sleep issue that is caused by audio/LPASS clock voting XO

MSM8976 Tips

问题：

低温环境中（低于15C）待机，电池消耗较快。

分析：

在运行该命令后，重现问题，收集问题机器中的dmesg。分析log发现，“tsens_interrupt”多次唤醒系统。

```
echo 1 > /sys/module/msm_show_resume_irq/parameters/debug_mask
```

原因：

MSM8976上增加了VDD Mx voltage restriction的功能，设置低温15C触发，17C移除。因为监控所有的on-die sensors，导致中断触发频繁唤醒系统，影响待机耗电。

解决：

CR 969112