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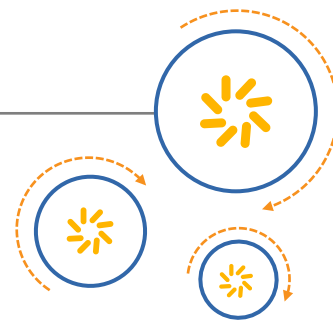
Qualcomm Technologies, Inc.

DragonBoard™ 410c based on Qualcomm® Snapdragon™ 410E processor

GPIO/MPP Usage on Low Speed Connector Application Note

September 2016

Questions or comments: https://www.96boards.org/DragonBoard410c/forum

Revision history

Revision	Date	Description
C	September 2016	Update for 'E' part
B	July 2, 2015	Miscellaneous updates.
A	June 8, 2015	Initial release.

Contents

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1 Introduction

1.1 Purpose

This application note explains how to access GPIO pins on a low speed connector on the DragonBoard™ 410c board to blink LED from the SYS file system.

1.2 Acronyms and abbreviations

Table 1 Acronyms and abbrevations

Acronym	Definition
APQ	Application Processor Qualcomm
GND	Ground
LED	Light-emitting Diode
GPIO	General Purpose Input/Output
MPP	Multi-Purpose Pin
PMIC	Power Management Integrated Circuit

2 Blinking LED

2.1 Blinking LED on J8 using APQ GPIOs

The J8 connector has application processor GPIOs (APQ_GPIO_x). They are signals LS_EXP_GPIO_A to LS_EXP_GPIO_L except LS_EXP_GPIO_F and one power management IC multipurpose pin LS_EXP_GPIO_F (PM MPP_4).

Follow the instructions below to control the APQ_GPIO_x. (Instructions to control PM MPP_4 are provided in Section 3, Controlling PMIC MPP.)

1. Boot the DragonBoard 410c and verify that adb is enumerated on "Device Manager".

2. Run the following commands:

   ```
   adb devices
   adb root
   adb remount
   adb shell
   ```

3. If the file system is not already mounted by default in the release you are using, then use the following commands to mount the file system:

   ```
   mount  -t debugfs none  /sys/kernel/debug

   cd   /sys/class/gpio/
   ```

You can identify the default free GPIO pins from the DragonBoard 410c schematic.

The DragonBoard 410c schematics are available on:
http://www.96boards.org/product/dragonboard410c/

Figure 1 is a snapshot of low speed connector J8. LS_EXP_GPIO_x are free GPIOs on J8.
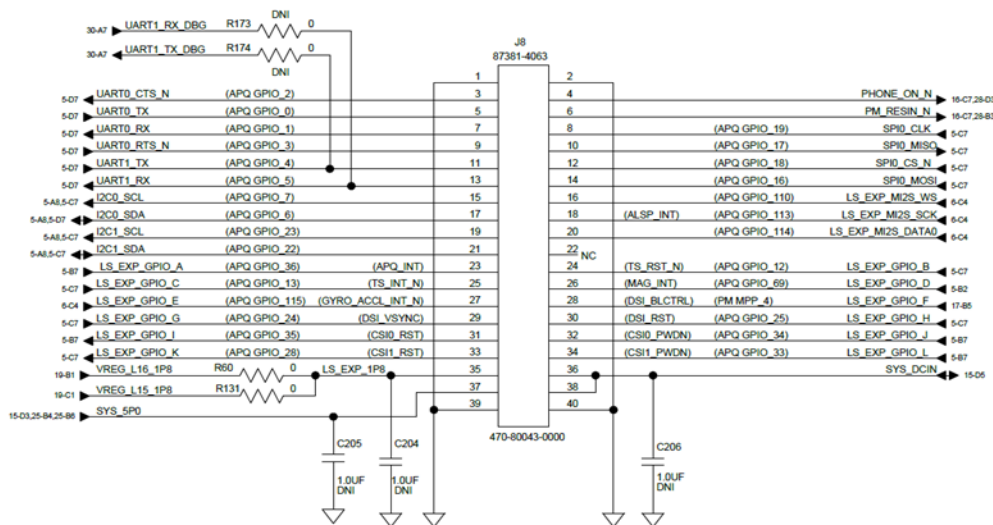

Figure 1 GPIO pin schematic

4. Export the GPIO number that you want to use. For example, to export GPIO#36, add the offset value of 902 to GPIO#36. This offset of 902 is a dynamic number added by the GPIO library for DragonBoard 410c.

   Example: **`echo 938 > export`** creates a "gpio36" node for GPIO #36 (APQ GPIO_36, pin #23 on J8).

   "**unexport**" reverses the effect of exporting to user space.

   Example: **`echo 938 > unexport`** removes the "gpio36" node exported using the "export" file.

5. Once exported, the **sysfs** entry is created as **/sys/class/gpio/gpio36/** (for GPIO #36) and will have the following read/write attributes when you type "**ls**" at **/sys/class/gpio/gpio36/** :

   ```
   Direction
   Value
   Edge
   Active low
   ```

6. To blink the LED on the DragonBoard 410c on the GPIO Expansion connector, connect the positive end to pin #23 and GND to pin#1 on J8. Then run the following commands in an adb shell. Use "su" on the shell if needed:

   ```
   echo "out" > /sys/class/gpio/gpio938/direction
   echo "1" > /sys/class/gpio/gpio938/value
   ```
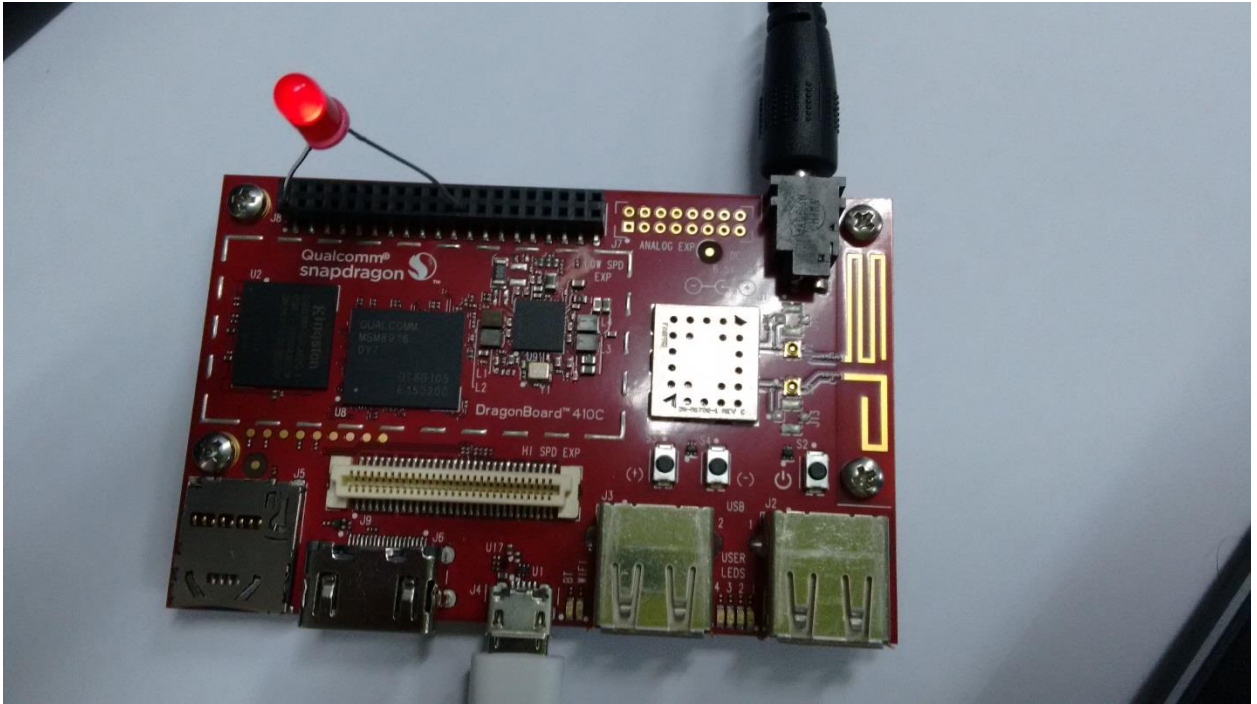
Figure 2 LED in ON state

```
echo "0" > /sys/class/gpio/gpio938/value
```


Figure 3 LED in OFF state

3 Controlling PMIC MPP

3.1 Using PM MPP_4

Out of the 4 PMIC MPP (power management integrated circuit multipurpose pin) signals, only MPP_4 is available on J8.
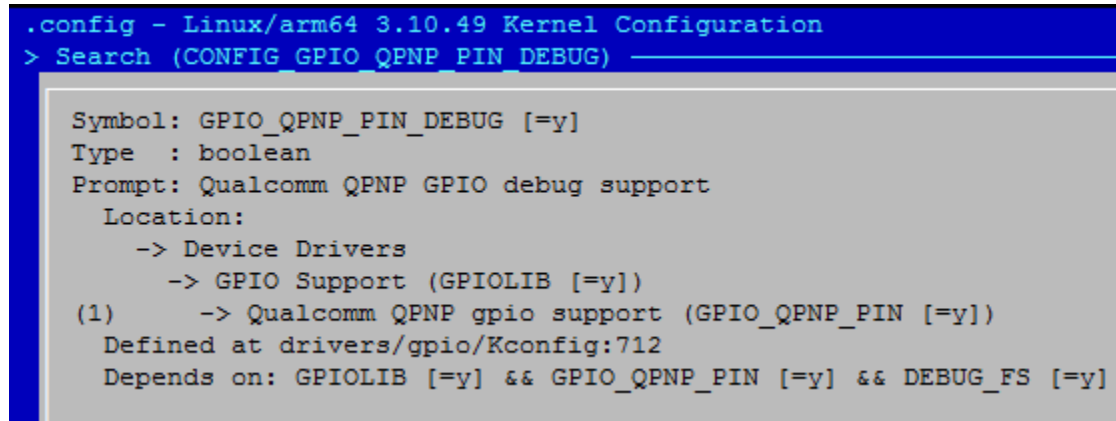
To use this, you must rebuild the kernel with config CONFIG_GPIO_QPNP_PIN_DEBUG set.

Detailed instructions on this are provided in the *Software Build and Installation Guide, Linux Android* guide on: https://developer.qualcomm.com/hardware/dragonboard-410c/tools

1. At the Android source root directory under a bash shell, run the following commands:

   ```
   source build/envsetup.sh

   lunch msm8916_64-userdebug

   make -j8 kernelconfig
   ```

2. Choose CONFIG_GPIO_QPNP_PIN_DEBUG=y

3. Save and exit.

4. Use one of the following commands: "**make -j8 bootimage**" or "**make -j8**".

   A new boot.img will be generated in `$BUILDROOT/out/target/product/msm8916_64/`

5. Get the device into fastboot and flash the newly generated boot.img by running the following command from the correct directory where the image exists:

   ```
   fastboot flash boot boot.img
   ```

6. Reboot the device and get into adb shell or console shell. You should see qpnp_pin in /sys/kernel/debug/

7. Change directory: `cd  /sys/kernel/debug/qpnp_pin/pm8916-mpp`

   You will see 2 and 4 listed (1,3 MPPs are reserved for LEDs)

8. Change directory:

```
cd 4
ls
```

The list command should list the following attributes:

```
ain_route
cs_out
invert
master_en
mode
src_sel
vin_sel
```

You can control the o/p by :

```
echo 1 > master_en
```
to enable and

```
echo 0 > master_en
```
to disable

You can also "echo 0 or 1" to attribute "invert".

NOTE: The recommended changes assume default software on DragonBoard 410c board. Many of these signals could be reconfigured and, if that is the case, you must manage any needed changes accordingly.

EXHIBIT 1

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