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

Interfacing Grove Digital Light I2C Sensor Application Note

September 2016

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

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LM80-P0436-23 Rev C
## Revision history

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<th>Revision</th>
<th>Date</th>
<th>Description</th>
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<tr>
<td>C</td>
<td>August 2016</td>
<td>Update for ‘E’ part</td>
</tr>
<tr>
<td>B</td>
<td>October 14, 2015</td>
<td>Instructions for making changes to Makefile and Kconfig, page 7.</td>
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<tr>
<td>A</td>
<td>August 4, 2015</td>
<td>Initial release.</td>
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1 Introduction

1.1 Purpose

This application note describes how to integrate and test the Grove Digital Light I2C sensor on 3.10 kernel on DragonBoard™ 410c based on Qualcomm® Snapdragon™ 410E processor.

1.2 Acronyms, abbreviations, and terms

Table 1-1 provides definitions for the acronyms, abbreviations, and terms used in this document.

<table>
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<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>I2C</td>
<td>Inter-Integrated Circuit</td>
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<tr>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>TTL</td>
<td>Transistor Transistor Logic</td>
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<tr>
<td>UART</td>
<td>Universal Asynchronous Receiver Transmitter</td>
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<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
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1.3 Components used

- DragonBoard 410c and power supply
- Grove Digital Light Sensor
- PCA9306 level shifter
  https://www.sparkfun.com/products/11955
- Bread Board and connector cables
- TTL-232 RG 1.8V USB to UART cable
2 Configuring Kernel

2.1 Rebuilding kernel

The Android build dated 6/18/2015 on https://www.96boards.org/products/ce/dragonboard410c/
   Android 5.1 (Lollipop)
   Linux Kernel 3.10
   Release: 15.06

does not have the kernel configured to detect the Grove Digital Light I2C sensor by default.

Download the Linux Android Board Support Package from:
   https://developer.qualcomm.com/hardware/dragonboard-410c/tools

Clone the build and set up the environment as described in the “Linux Android Software Build
   and Installation Guide”.

2.2 Commands to modify and rebuild kernel

Change the directory to the source root:
   - cd $BUILDROOT
   - source build/envsetup.sh
   - lunch msm8916_64-userdebug

To launch the kernel config, run the command:
   - make -j8 kernelconfig

   Where -j8 depends on the Linux machine cores; change accordingly.
You should see the configuration window as shown below:

- Select Device Drivers → Industrial I/O support → Light sensors → TSL2563.

- Choose the kernel built option for:
  `<*> TAOS TSL2560, TSL2561, TSL2562, and TSL2563 ambient light sensors.`

- Save and exit from the kernel config menu.

- If you are adding a new driver on your own you need to make changes to Makefile and Kconfig in kernel/drivers and add the right path in kernel/drivers/Kconfig which sources the new device driver Kconfig file. This adds the new entries in the kernel config screen that you can select, driver files need to be added in the same directory as your new Kconfig and Makefile as well.
Open kernel/arch/arm64/boot/dts/qcom/apq8016-sbc.dtsi and add the code shown below (highlighted in yellow):

```c
&soc {
    i2c@78b6000 {
        tsl2561@29 { /* Grove digital light sensor */
            compatible = "taos,tsl2561";
            reg = <0x29>;
        };
    }
```

Save the file and then run the command:

```
make -j8 bootimage
```

boot.img will be generated at out/target/product/msm8916_64/boot.img.

**NOTE:** 78b6000 is the BLSP address configured for I2C communication; we are connecting the light sensor to i2c-0.

### 2.3 Flashing the kernel to DragonBoard 410c

Bring the DragonBoard 410c into fastboot by holding VOL during power up. Once in fastboot, you can flash the boot.img using the command:

- fastboot flash boot boot.img

Connection Diagram for Grove Light Sensor and PCA9306 from J8 on DragonBoard 410c (DragonBoard 410c (J8) \(\rightarrow\) PCA9306 \(\rightarrow\) Grove light sensor:

- PIN #37 \(\rightarrow\) VREF2 of PCA9306 \(\rightarrow\) VCC of grove light sensor
- PIN #39 \(\rightarrow\) "-" on Bread Board

- PIN #35 \(\rightarrow\) VREF1 of PCA9306
- PIN #15 (I2C0_SCL) \(\rightarrow\) SCL1 of PCA9306
- PIN #17 (I2C0_SDA) \(\rightarrow\) SDA1 of PCA9306
- PCA9306 GND to "-" on Bread Board
- VREF2 of PCA9306 \(\rightarrow\) VCC of Digital Light Sensor
- SCL2 of PCA9306 \(\rightarrow\) SCL of Digital Light Sensor
- SDA2 of PCA9306 \(\rightarrow\) SDA of Digital Light Sensor
- "-" from Bread Board \(\rightarrow\) GND of Digital Light Sensor
USB to UART cable (TTL-232 RG 1.8V) connection to see kernel boot traces. On J8 connector on DragonBoard 410c:

- PIN #11 UART1_TX
- PIN #13 UART1_RX
- PIN #1 GND

Refer to DragonBoard™ 410c based on Qualcomm® Snapdragon™ 410E processor Connecting the UART to USB Adapter Application Note for details. DragonBoard 410c schematics are available at: https://www.96boards.org/products/ce/dragonboard410c/

- With the above connection setup, power ON the device.
- Check for kernel traces for the below message:
  
  ```
  tsl2563 0-0029: model 5, rev. 0
  ```

  If you do not have a USB to UART cable you can check this via `dmesg` on adb shell as root:

  ```
  adb shell
  su
  dmesg
  ```
- At the shell prompt, change the directory to:
  `cd /sys/bus/i2c/devices/i2c-0/`
  You should see 0-0029. 0x29 is the I2C address of the new sensor that we just added:

  `cd /sys/bus/i2c/devices/i2c-0/0-0029/iio:device0`

  `cat in_illuminance0_input`

- You will see an integer value as output. Keep trying the same command by using a cell phone flash light or other light source. The integer value increases or decreases depending on the light intensity.

**NOTE:** This application note provides basic instructions on validating the I2C sensor with kernel changes only. For full Android user space integration please refer to the “Sensors Porting Guide for DragonBoard 410c” on https://developer.qualcomm.com/hardware/dragonboard-410c/tools.
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