PANDORA "HACKER" GUIDE

WARNING: Modifying your PCB is not covered by your warranty and any damage caused as a result will be the sole responsibility of the owner to fix or to have fixed at a fee set by the repair facility. The information provided here is for reference purposes only and the test points available were made accessible for the manufacturer's use but can be used by a customer willing to modify their unit for their own personal gain. Again it must be said that no warranty is expressed or implied solely because a document of this nature is made available to the public. Be aware that external ports have ESD protection but internal features do not. Use safe handling practices to prevent static discharge through electronic components at all times. Also be aware that these test pads on the PCB are small and cannot handle large gauge wires soldered to them because the torque of a bending wire will easily tear the pad away from the PCB. During testing of the boards, only flying probes or small rework wires of 28-30 AWG were used.

Version 1.00

(based on rev5a PCB)

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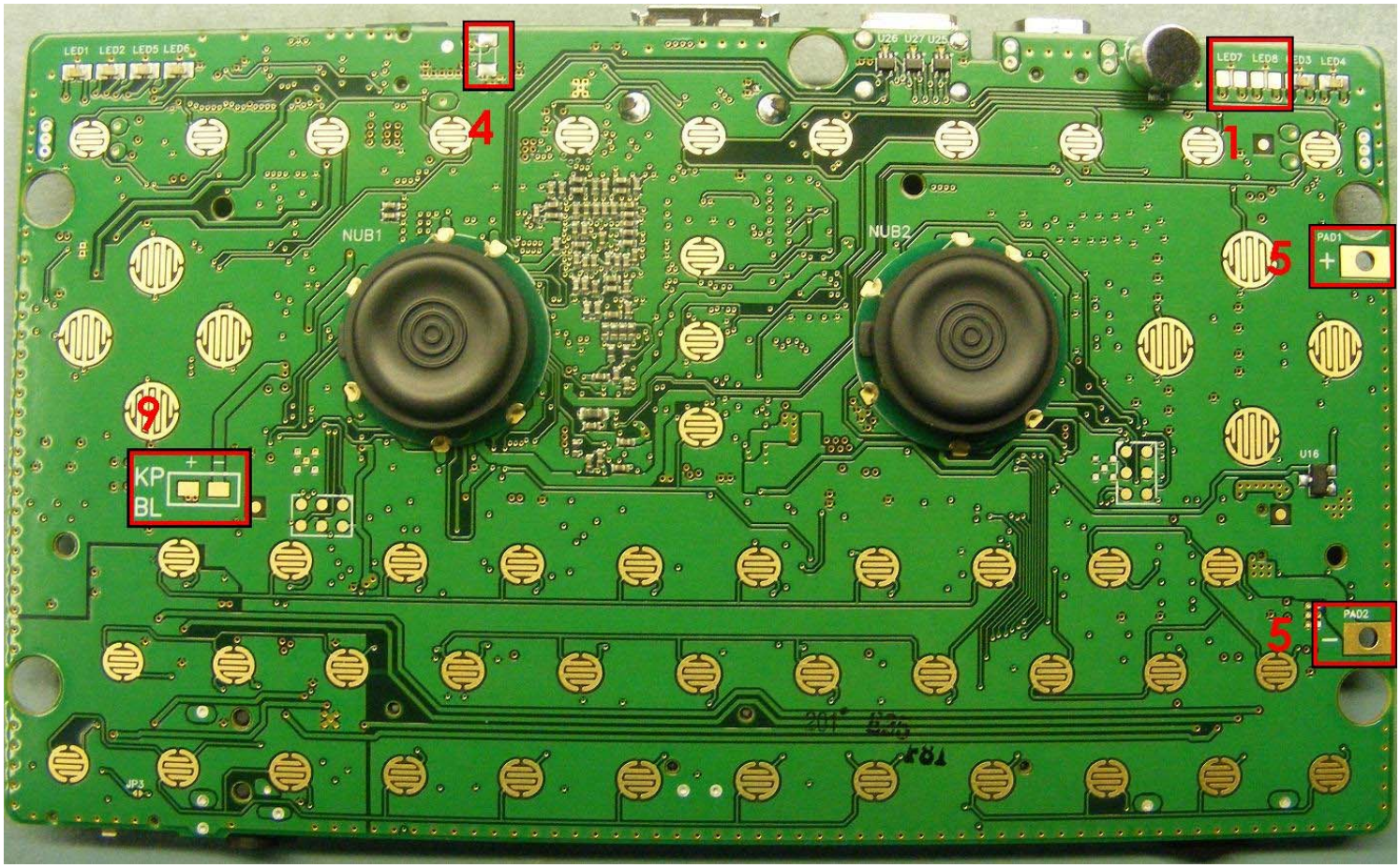
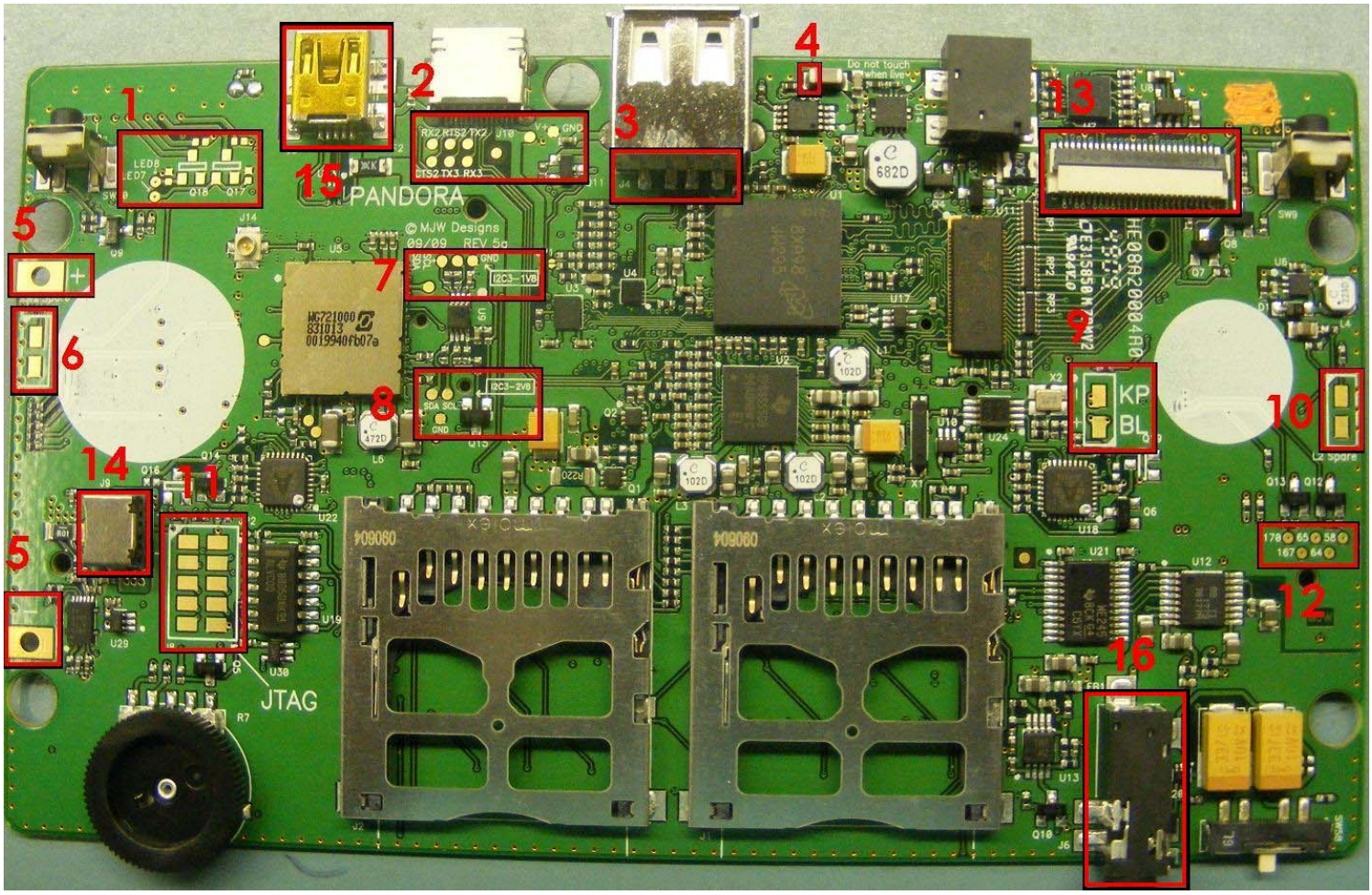
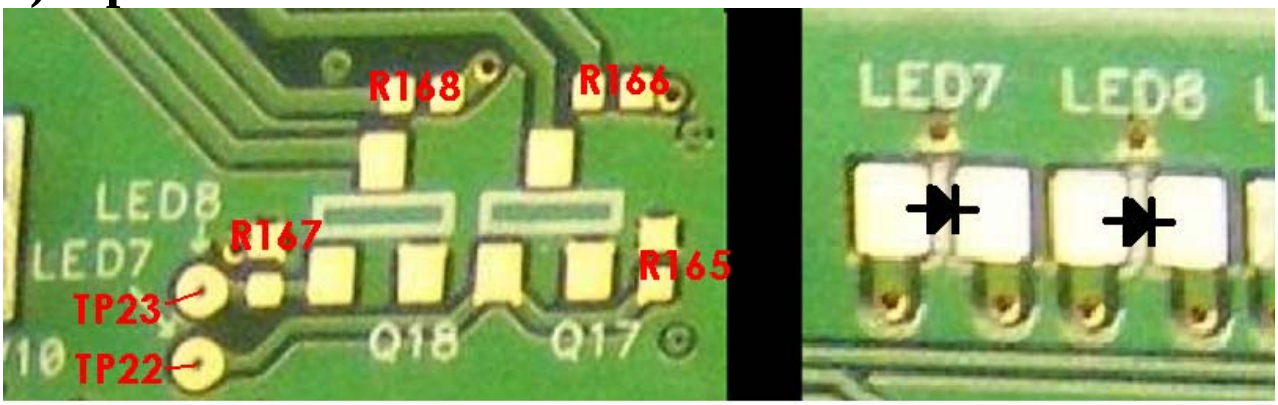
TOP SIDE


LED1 LED2 LED5 LED6
LED7 LED8 LED3 LED4
U26 U27 U25
4
1
NUB1
NUB2
PAD1
+
5
9
KP
BL
U16
PA02
5
JP3

BOTTOM SIDE



1) Spare LEDs



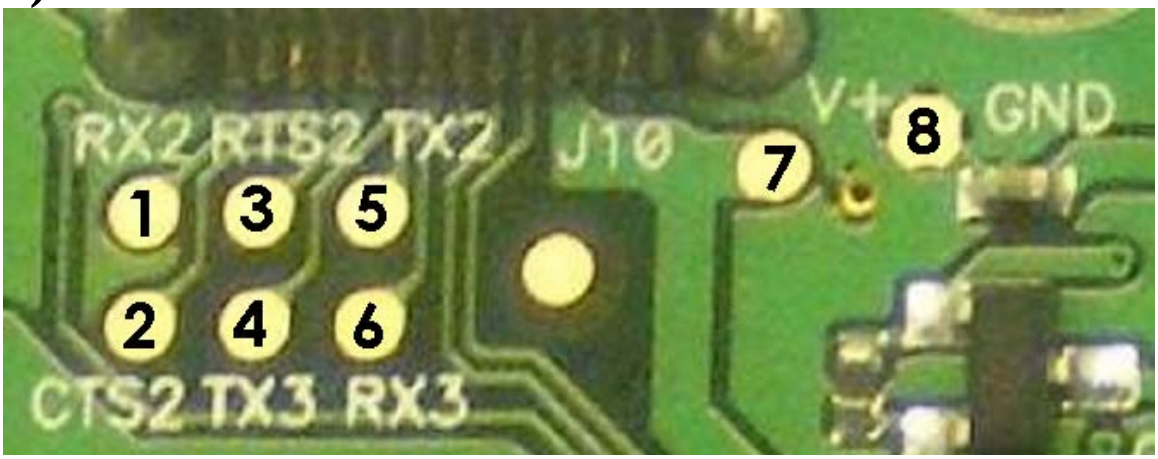
LED7

- **R167 = 100K ohm pull down to keep FET off**
- **R168 = current limiting resistor (set according to LED used, example: 360 ohm)**
- **Q18 = N-channel FET, example: FDV301N**
- **Connected to GPIO 58 on OMAP3530**
- **TP22 can be driven externally by 1.8V signal (do not exceed) if GPIO 58 is left an input on processor**
- **FET sinks LED current, LED voltage is derived directly from the battery (net: VBAT)**

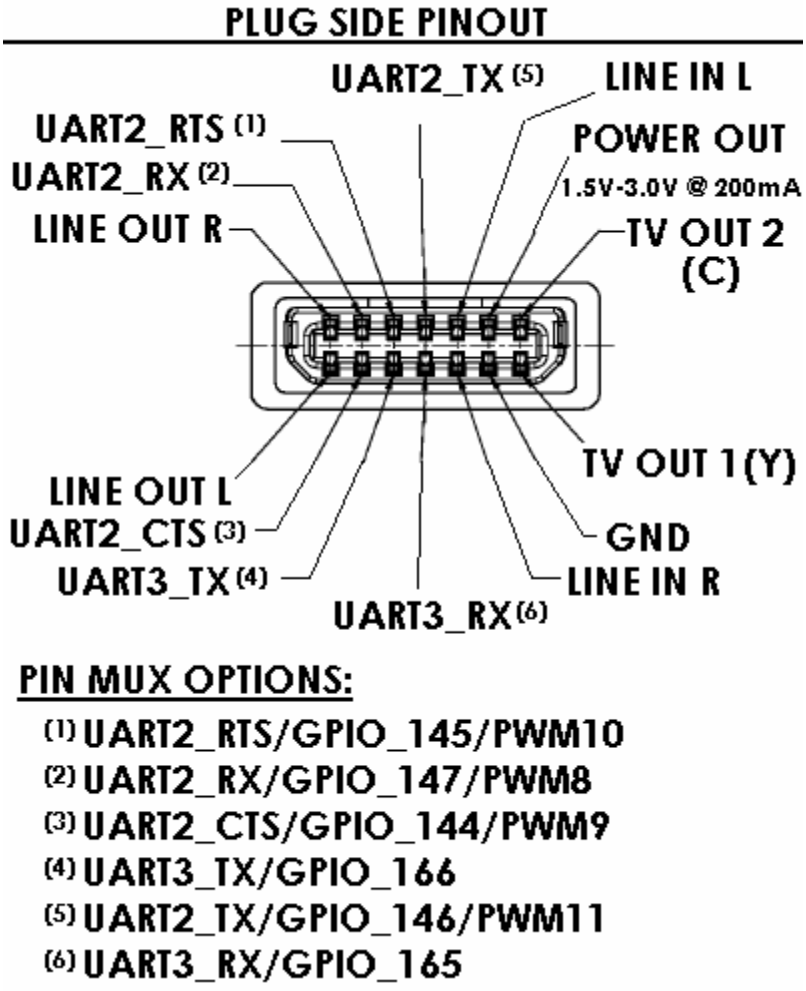
LED8

- **R165 = 100K ohm pull down to keep FET off**
- **R166 = current limiting resistor (set according to LED used, example: 360 ohm)**
- **Q17 = N-channel FET, example: FDV301N**
- **Connected to GPIO 64 on OMAP3530**
- **TP23 can be driven externally by 1.8V signal (do not exceed) if GPIO 64 is left an input on processor**
- **FET sinks LED current, LED voltage is derived directly from the battery (net: VBAT)**

2) EXPANSION PORT TEST PADS



These pads can be referenced to match those of the connector pinout:

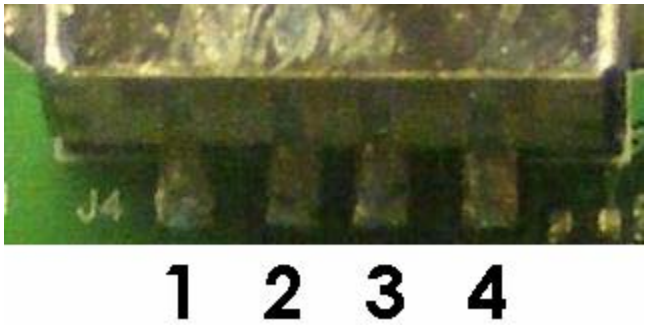


1 – UART2_RX/GPIO 147/PWM8
2 – UART2_CTS/GPIO 144/PWM9
3 – UART2_RTS/GPIO 145/PWM10
4 – UART3_TX/GPIO 166
5 – UART2_TX/GPIO 146/PWM11
6 – UART3_RX/GPIO 165
7 – POWER OUT (1.5V–3.0V, 200mA)
8 – Ground reference

- UART3 can also be configured for IrDA (Infrared Data Association) or CIR (Consumer Infrared Modes)

***** NOTE – All digital pins on this connector are 1.8V logic and must be level shifted if they need to be interfaced to a higher/lower voltage system. Failure to do so could result in permanent damage to these pins on the OMAP3530, rendering them inoperable or even creating a short circuit inside the chip.**

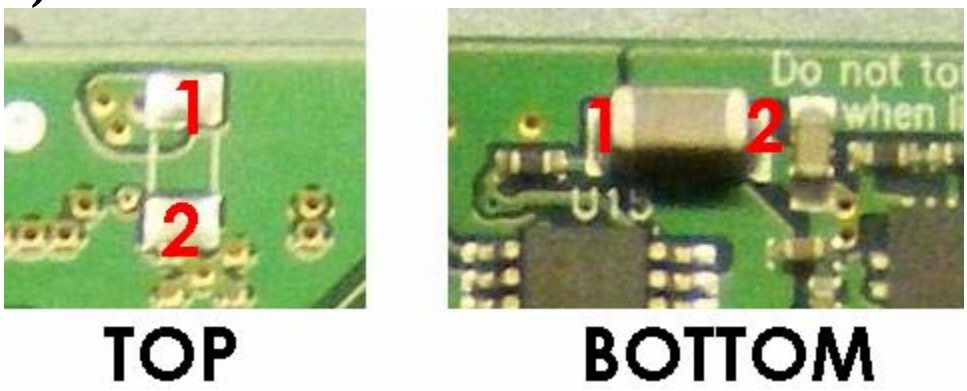
3) USB HOST PORT



PIN	VOLTAGE (V)	NAME	DESCRIPTION
1	0	GND	Ground Reference
2	3.3	D+	USB Data Signal
3	3.3	D-	USB Data Signal
4	5	POWER	5V, 500mA continuous, 750mA peak

- **There are no extra USB pads for soldering secondary wires to the USB signals. This was to avoid stubs which could degrade signal quality. Any internal modifications will have to be done directly on these pins.**

4) RAW 5V ACCESS POINT



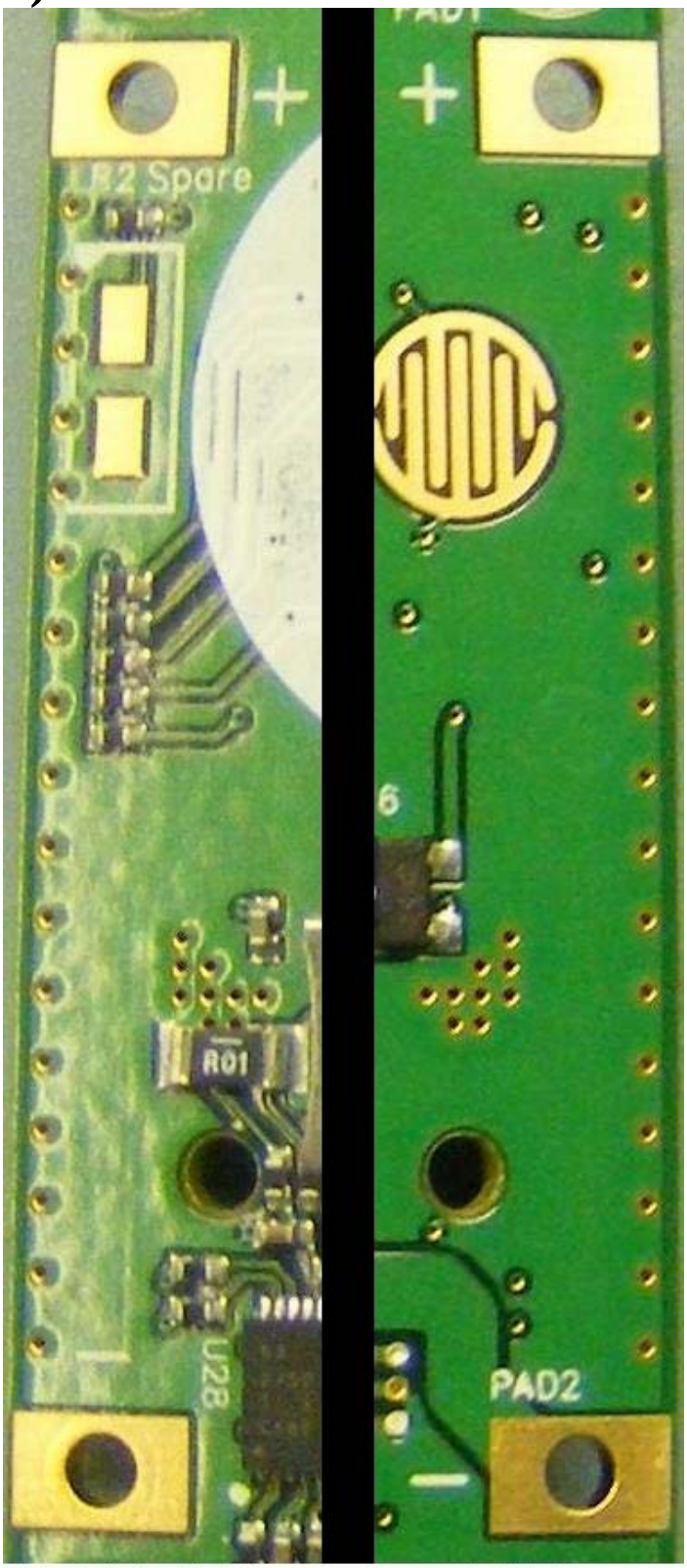
Pad 1 – 5V access point, could be as much as 1A available with a full battery or as low as 750mA with the battery near empty. There is no current limiting protection here as this is directly from the output of the supply. It is not recommended to load this supply down when the battery is low.

Pad 2 – 0V ground reference

***** If an experimental high current application is attempted as a modification of the normal use of this supply, the unpopulated capacitor pads on the top layer should be populated with a ceramic capacitor of at least 47uF. An example capacitor is described below:**

47uF ceramic, 1206 sized, X5R, 6.3V-10V, Kemet C1206C476M9PACTU

5) SECONDARY INPUT POWER SOURCE



- These two pads are designed to provide a way to power the board without a battery but will simulate the battery input. Use one or the other, never both.

- A bench supply or fixed voltage output source ranging from 3.3V – 4.2V can be applied.

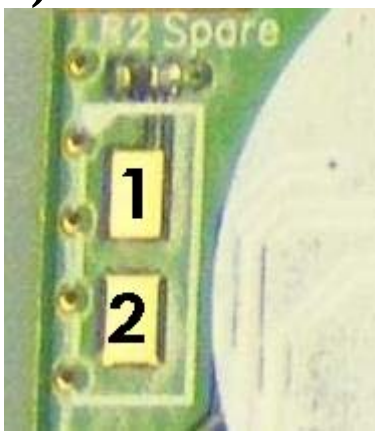
- Voltages on the + pad (PAD1) should NEVER exceed 4.2V.

- The voltage on the – pad (PAD2) should be 0V and a solid, low noise ground source. This pad is not at the exact same potential as the system ground found anywhere else on the PCB. This is because it must pass through a sense resistor for the battery fuel gauge first.

- This input must be able to provide the full range of current the system may need under all situations.

- An external battery can be connected to these pads but do not attempt to charge this battery in this way. There is no external thermistor connection and the system will be confused and could put an extreme amount of current here.

6) SECONDARY SPARE RIGHT SHOULDER BUTTON

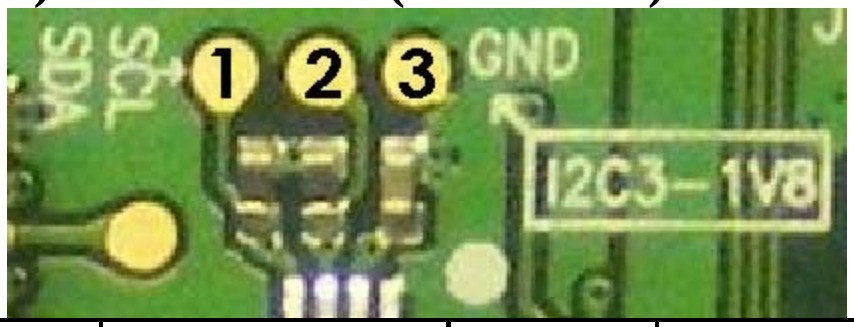


Pad 1 – Input signal connected to OMAP3530 on GPIO 107. The kernel already recognizes this as the R2 button and can be used immediately. This signal is 1.8V logic. Do not drive it with a higher voltage.

Pad 2 – Ground reference

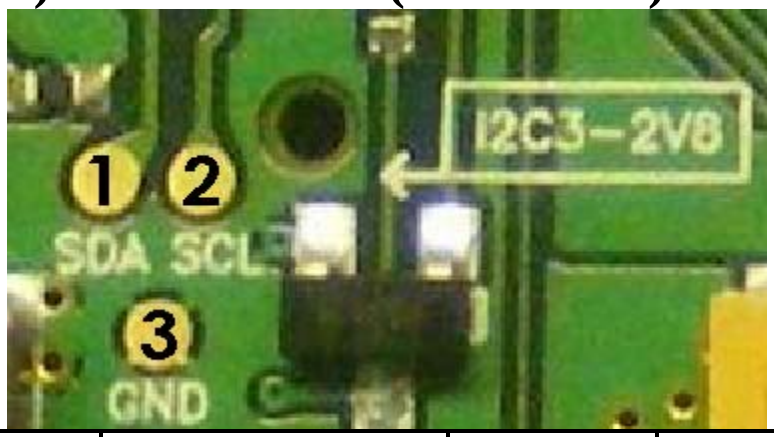
- Connect an SPST normally open momentary switch to these pads in order to use this functionality. Any basic switch will have no polarity so it does not matter which side of the switch goes to either pad.

7) I2C ACCESS (1.8V SIDE)



PIN	VOLTAGE (V)	NAME	DESCRIPTION
1	1.8	SDA	I2C Data line (1K ohm pullup on PCB)
2	1.8	SCL	I2C Clock line (1K ohm pullup on PCB)
3	0	GND	Ground reference

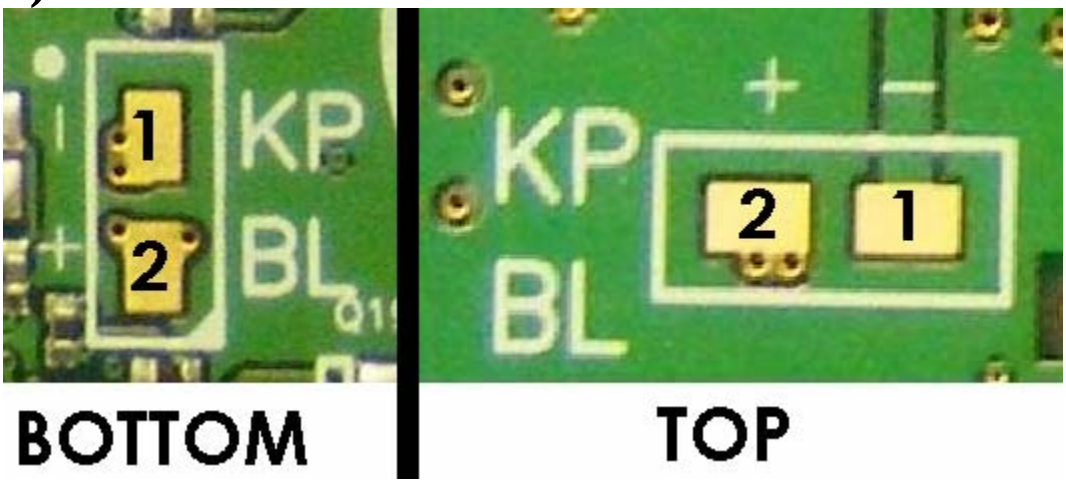
8) I2C ACCESS (2.8V SIDE)



PIN	VOLTAGE (V)	NAME	DESCRIPTION
1	2.8 (*)	SDA	I2C Data line (1K ohm pullup on PCB)
2	2.8 (*)	SCL	I2C Clock line (1K ohm pullup on PCB)
3	0	GND	Ground reference

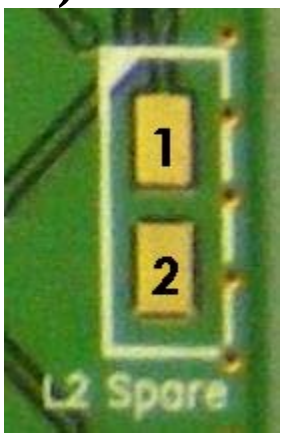
- **(*) Nub controllers run at 2.8V. This side of the I2C bus is only available when nub controllers are powered. The voltage cannot be lowered below 2.8V or nub operation cannot be guaranteed.**
- **Both sides of this bus (1.8V and 2.8V) are unbuffered and the load on either side is shared and identical. Regardless of which side is chosen to connect to, the capacitive loading of the new device and wiring added to these pins may affect the entire system.**
- **The bus is configured for a slow 100KHz clock rate in order to get stable data from the fuel gauge.**
- **There are three device addresses (7-bit) currently in use on this bus (I2C3 on OMAP3530):**
  0x55 – Battery fuel gauge
  0x67 – Analog nub 1
  0x66 – Analog nub 2

9) SPARE KEYPAD BACKLIGHT



- **This isn't specifically for keypad lighting but that is one possible application. It can be used for any type of lighting or many applications requiring a variable current source.**
- **This supply was not designed for inductive loads like motor control and it has never been tested for such an application.**
- **Pads are provided on both the top and bottom side of the PCB. They are connected to the same pin on the TPS65950 called LEDA.**
- **This feature can provide up to 160mA with a series or parallel set of LEDs (or any combination thereof).**
- **Current limiting resistors for each LED MUST be provided externally as there is no limiting in this circuit.**
- **The voltage source for this feature is the battery (net: VBAT).**
- **PWM control is available in the Linux kernel which can be used to set the LED current from zero to the maximum value set by the external resistors.**
- **Pad 1 is the current sink and can be considered the ground reference.**
- **Pad 2 is the positive voltage and connected directly to the battery (net: VBAT).**

10) SECONDARY SPARE LEFT SHOULDER BUTTON

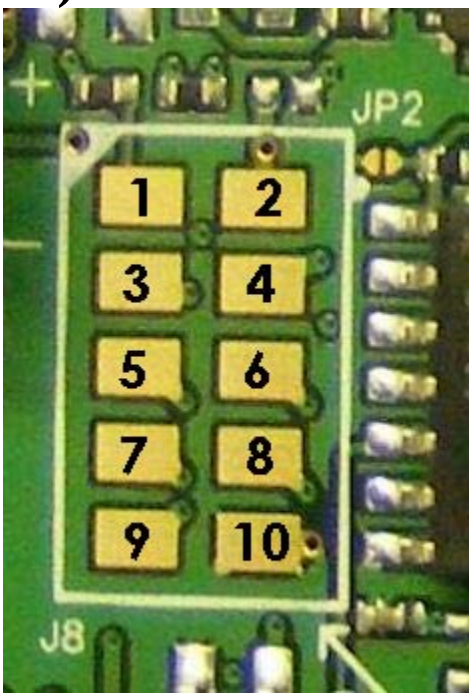


Pad 1 – Input signal connected to OMAP3530 on GPIO 97. The kernel already recognizes this as the L2 button and can be used immediately. This signal is 1.8V logic. Do not drive it with a higher voltage.

Pad 2 – Ground reference

- Connect an SPST normally open momentary switch to these pads in order to use this functionality. Any basic switch will have no polarity so it does not matter which side of the switch goes to either pad.

11) JTAG INTERFACE



1 – TDO
2 – 1.8V LOGIC SUPPLY
3 – EMU0
4 – EMU1
5 – TMS
6 – TCK
7 – TDI
8 – RTCK
9 – TRST
10 – GND

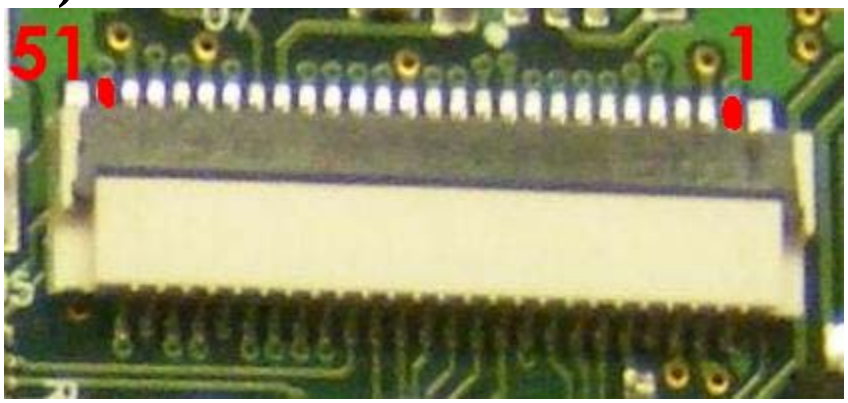
- **This interface supports 1.8V logic only. An intermediate buffer may be required if the JTAG control device does not support this voltage.**
- **The pinout of this interface is non-standard and requires translation to a standard 14 or 20 pin connector.**
- **Do not use the 1.8V LOGIC SUPPLY pad as a current source for any external circuits. It should only be used as a voltage reference for the interface.**
- **If extra capacitance is required for noise cancellation, an 0402 sized part can be installed in the empty pads above pad 2 on this interface.**

12) SPARE GPIOs

1 – GPIO 170/HDQSIO (1-Wire interface)
2 – GPIO 167
3 – GPIO 65
4 – GPIO 64 (also connected to LED8)
5 – GPIO 58 (also connected to LED7)

- **These pads are connected directly to the OMAP3530 and are 1.8V logic levels. Do not drive them with a higher voltage.**
- **They are not designed to source or sink a lot of current and should be buffered where necessary.**
- **These signals are not matched or dampened in any way and were not intended for high speed usage. The pins chosen do not have any extra features that run at high speeds so it should not be a problem.**
- **These signals are currently set up in the bootloader to be GPIOs in the input configuration. The Linux kernel does not use them at all.**

13) LCD CONNECTOR INTERFACE



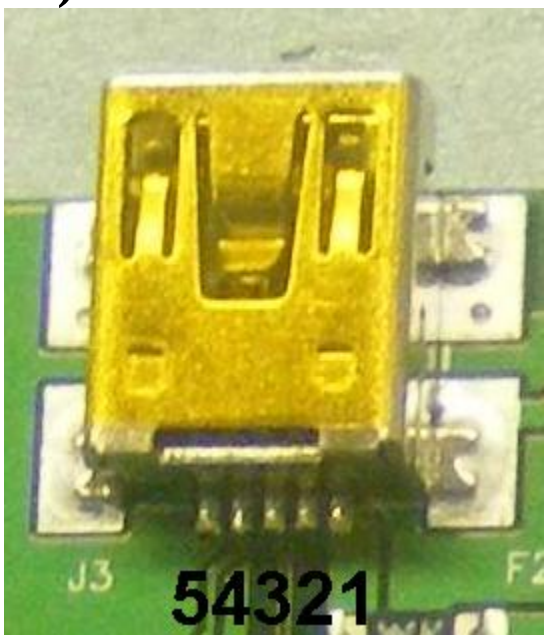
1 – GND (Digital)
2 – GND (Digital)
3 – Right speaker +
4 – Left speaker +
5 – GND (Speakers only)
6 – GND (Speakers only)
7 – Vertical Sync
8 – Horizontal Sync
9 – Data Enable
10 – Pixel Clock
11 – Data0 (Blue0)
12 – Data1 (Blue1)
13 – Data2 (Blue2)
14 – Data3 (Blue3)
15 – Data4 (Blue4)
16 – Data5 (Blue5)
17 – Data6 (Blue6)
18 – Data7 (Blue7)
19 – Data8 (Green0)
20 – Data9 (Green1)
21 – Data10 (Green2)
22 – Data11 (Green3)
23 – Data12 (Green4)
24 – Data13 (Green5)
25 – Data14 (Green6)
26 – Data15 (Green7)
27 – 3V Power
28 – Data16 (Red0)
29 – Data17 (Red1)
30 – Data18 (Red2)
31 – Data19 (Red3)
32 – Data20 (Red4)
33 – Data21 (Red5)
34 – Data22 (Red6)
35 – Data23 (Red7)
36 – 5V Power
37 – -5V Power
38 – LCD_nRESET
39 – GPIO 95 (Spare signal, **1.8V**)
40 – SPI_CS0
41 – SPI_CLK
42 – SPI_DATA_OUT (in to LCD)
43 – 3V Power
44 – Touch screen Y+
45 – Touch screen X+
46 – Touch screen Y-
47 – Touch screen X-
48 – LED Backlight –
49 – LED Backlight +
50 – GND (Digital)
51 – GND (Digital)

- All LCD and SPI signals are buffered to 3.0V logic levels and are only active when the LCD is powered on. Only pin 39 does not have its logic buffered to 3.0V.
- 3V Power can supply up to 200mA. 5V and -5V Power are designed for about 50mA each.

14) BATTERY CONNECTOR

- **Pin 1 is the positive battery voltage input (net: VBAT).**
- **Pin 2 is the thermistor input. Attach a 10K ohm resistor if it needs to be faked for testing purposes. Do not attempt to charge a battery without a useful resistance attached between pins 2 and 3.**
- **Pin 3 is the ground reference for the battery. It is not at the exact same potential as the system ground found anywhere else on the PCB. This is because it must pass through a sense resistor for the battery fuel gauge first.**

15) USB OTG Port

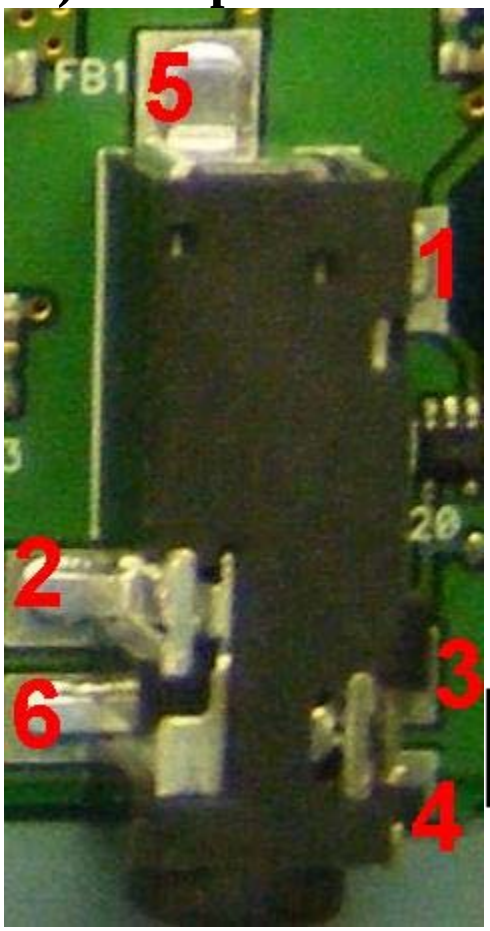


- **The pins are not very accessible but listed for completeness.**

PIN	VOLTAGE	NAME	DESCRIPTION
1	5V	POWER	100mA Power Output or 0-1100mA Power Input
2	3.1V	D-	USB Data Signal
3	3.1V	D+	USB Data Signal
4	3.1V	ID	Host/Peripheral ID
5	0V	GND	Ground Reference

- This port can provide up to 100mA of current in host mode. It is a charge pump based supply designed for a nominal 4.8V output and isn't as efficient as the supply on the big HOST port.
- USB charging in peripheral mode can support currents from zero to 1100mA. The self resetting fuse (F2) will open above this level.

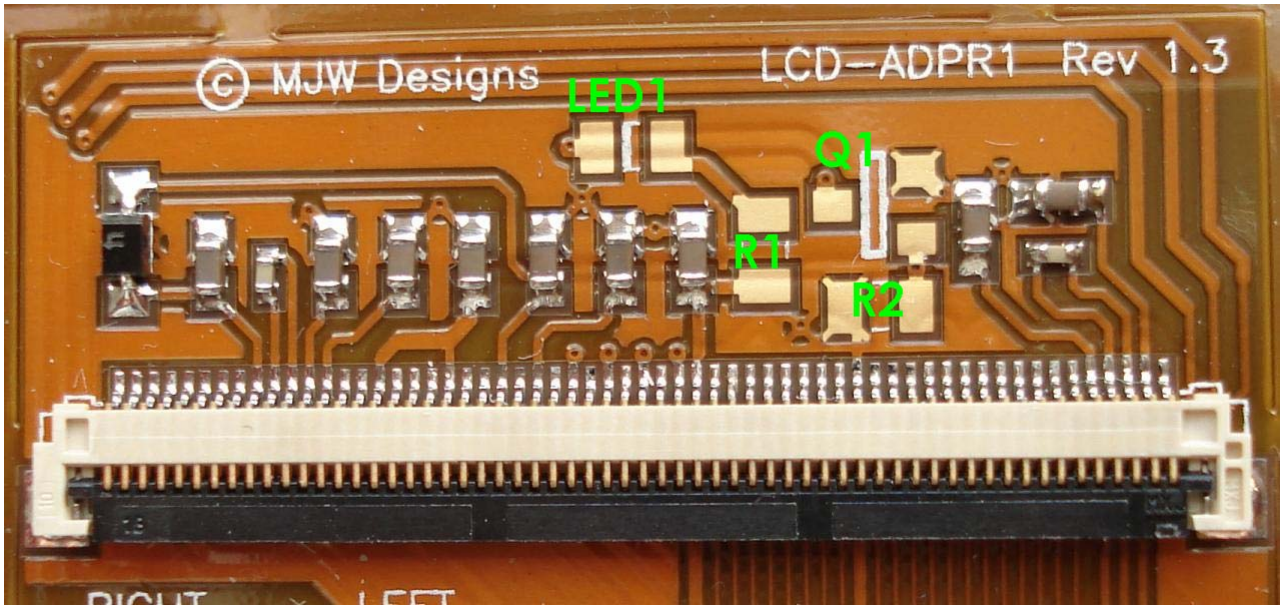
16) Headphone Connector



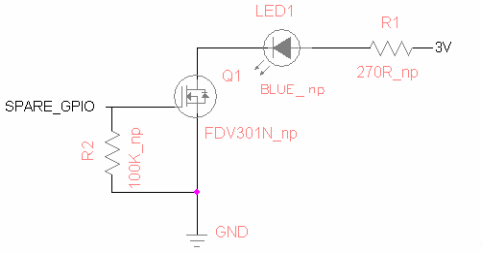
PIN	DESCRIPTION
1	Headphone Output LEFT Channel
2	Headphone Output RIGHT Channel
3	Microphone Input
4	Ground Reference
5	Internal Speaker LEFT Channel
6	Internal Speaker RIGHT Channel

- Internal speakers are only powered when no jack is plugged into the connector. Inserting the jack mechanically disconnects the speakers to provide headphone only output.

LCD CABLE SPARE GPIO

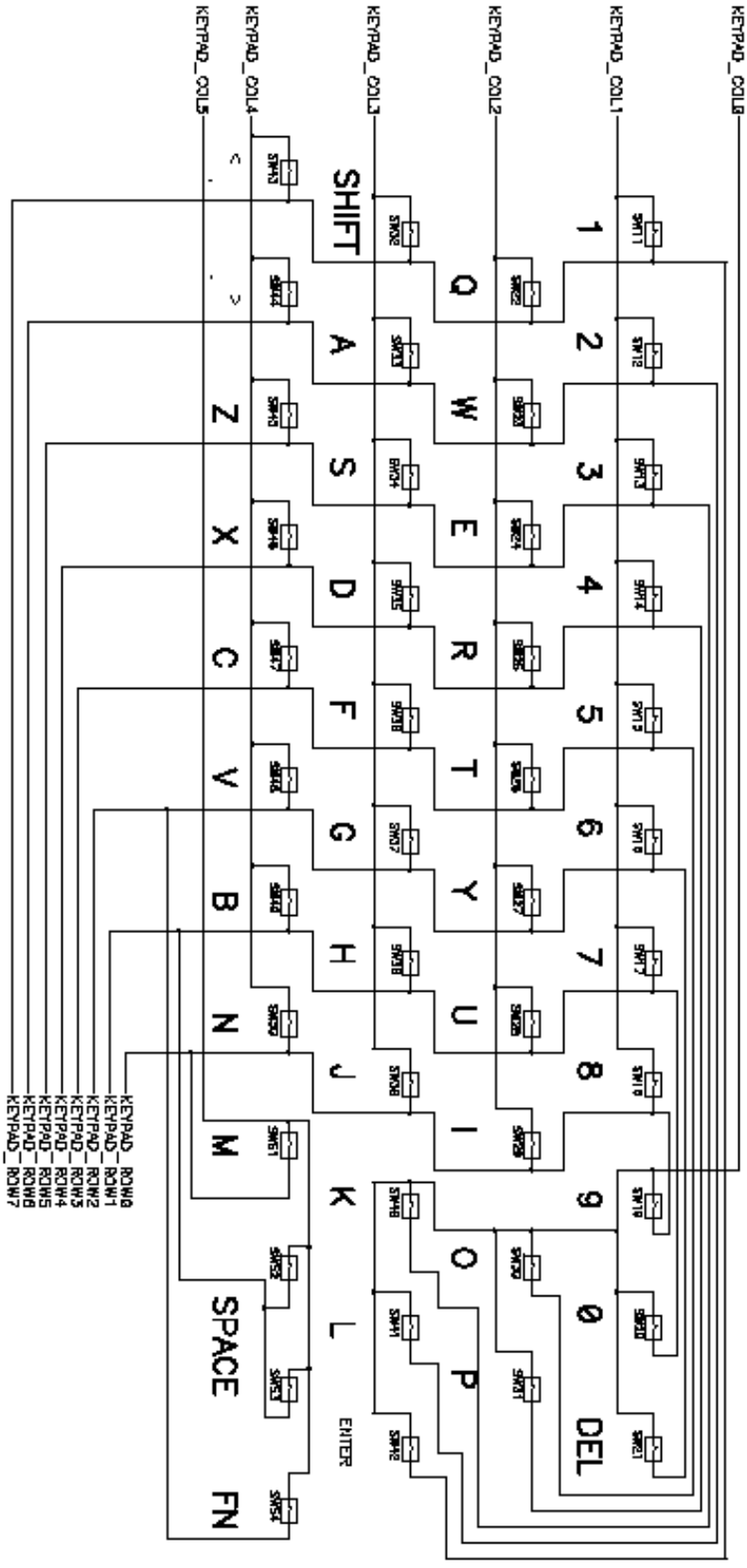


- **GPIO 95 from the OMAP3530 is routed to the lid and can be accessed on the right pad of the component marked R2 in the above picture. This signal is at 1.8V logic and should not be driven at a higher voltage. If this GPIO is to be used in a push button circuit, the best application would be to wire this pad to one side of the switch and the other side of the switch to ground (top right pad on Q1). Then enable the pull up for GPIO 95 in software. There is no 1.8V supply accessible in the lid so this is the only way.**
- **R2 is a pull down resistor and can be populated with a 100K ohm resistor. The pads are designed for an 0805 sized component but an 0603 should fit as well if you are careful. Do not populate this part if you want to use this GPIO for a push button.**
- **Q1 is an N-channel FET (ex: FDV301N) and is used to sink the current to LED1. LED1 is sourced by the 3V supply to the LCD electronics. It isn't recommended to drive a load of more than about 5-10mA which is common for a low power LED.**
- **R1 is the current limiting resistor for the LED. Its value is dependent on the application but a value of around 220 ohms is nominal. The pads are designed for an 0805 sized component but an 0603 should fit as well if you are careful.**



(Schematic representative of LED7, 8 configuration on main PCB as well)

Keypad Scanning Matrix Schematic



Internal Connection Overview Diagram