DB1

Single Board Computer

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Blue Chip Technology Limited
Chowley Oak,
Tattenhall,
Chester.
Cheshire,
England
CH3 9EX
Tel: 44 (0)1829 772000
Web:
https://www.bluechiptechnology.com/

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This product meets the essential protection requirements of the European EMC Directive (2014/30/EU) and the Low Voltage Directive (2014/35/EU) and is eligible to bear the UKCA mark.

Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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This product meets the essential protection requirements of the European EMC Directive (2014/30/EU) and the Low Voltage Directive (2014/35/EU) and is eligible to bear the CE mark.

Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4.3 FCC

NOTE: This equipment has been designed to meet the requirements of a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

WARNING: Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

4.4 General/National Safety Warnings

4.4.1 General

This unit is of Class I construction and requires a protective earth connection to be made to its power inlet ensure that the unit remains safe in the event of a breakdown of an insulation barrier.

4.4.2 North America

If the power lead (cord) is not supplied with the computer, select a power lead according to your local electrical regulations. In the USA use a 'UL listed' lead. In Canada use a CSA approved or 'cUL listed' lead.

Si le cordon secteur n'est pas livré avec l'ordinateur, utiliser un cordon secteur en accord avec votre code electrique nationale. En l'Etat Unis utiliser un cordon secteur 'UL listed'. En Canada utiliser un cordon secteur certifié CSA, ou 'cUL listed'.

5 General Precautions

5.1 Static Electricity

The electronic components in this assembly are susceptible to damage by electrostatic discharges. To avoid damage normal anti-static precautions should be observed during handling of this product. Wear an anti-static wrist strap connected to a suitable earth point before opening any anti-static packaging.

Where a wrist strap is not available, discharge any static charge you may have built-up by touching an earth point and the chassis metalwork. Avoid any further movement that could build up another static charge. Touch an earth point from time to time to avoid further build-up and remove the items from their anti-static bags only when required.

6 Features

The Blue Chip Technology DB1 (BCT-DB1) is a multi-core ARM based single board computer which is targeted at more demanding applications.

The BCT DB1 is supplied with a Qualcomm APQ8016E Quad-core Arm Cortex A53 processor running at 1.2GHz. An 8GB EMMC is provided along with 2GB DDR3 RAM. A µSD card socket provides additional storage if needed or the capability to boot a different OS to that stored on the EMMC.

The BCT DB1 is operated from a 12v DC power supply. Power requirements will vary depending on any LCD panel and other peripherals attached to the DB1. See section 15 for typical DB1 current consumption values.

The DB1 has the capability to support a Lithium Battery via connector P18 to retain time and date when the unit is powered off.

6.1 Specification

- Qualcomm APQ8016E Quad-core Arm Cortex A53, 1.2GHz per core
- 8GB EMMC.
- 2GB DDR3 RAM.
- RTC.
- Ethernet 100Mbps.
- WIFI IEEE802.11b/g/n (2.4GHz only).
- Bluetooth.
- GPS.
- UART. RS232, RS422.

- USB 2 host, 1 device.
- On-board temperature sensor.
- 4KB Non-volatile storage.
- LVDS display driver. 7” 9.7” & 12” LCD supported.
- Capacitive or resistive touch.
- µSD card interface.
- 12 GPIO.
- Audio input/output.

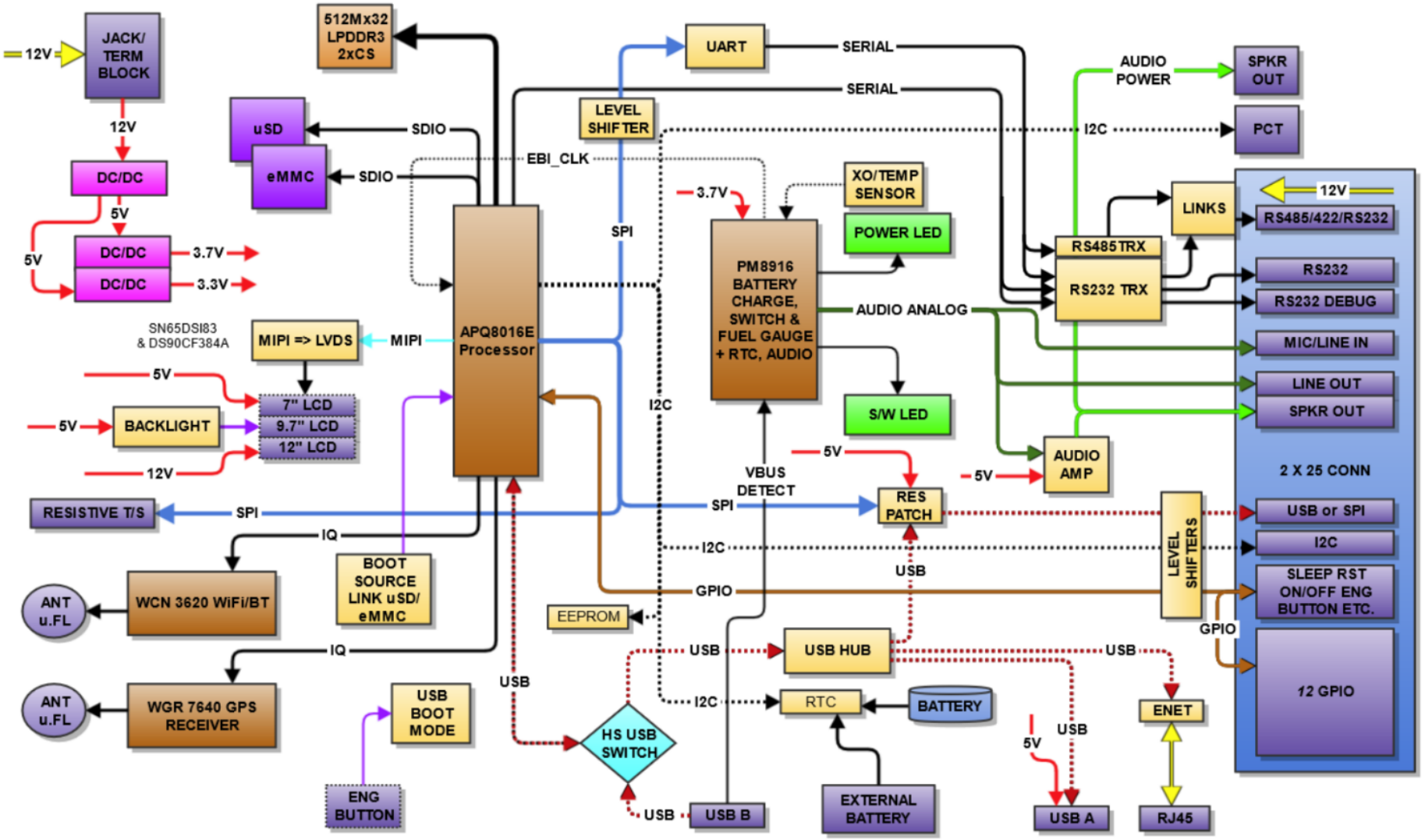


Figure 6-1 DB1 Overview

7 PCB Layout

7.1 DB1 for 7” and 12” LCD

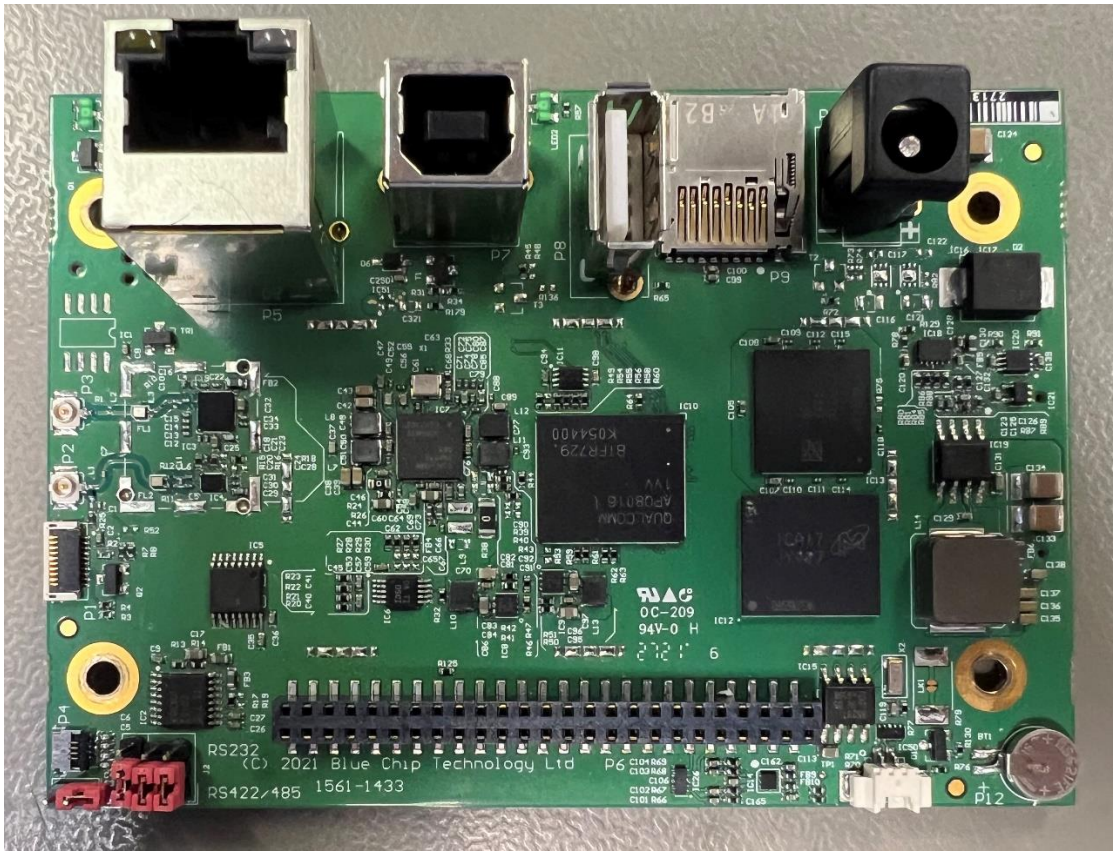


Figure 7-1 DB1 for 7” and 12” LCD top view

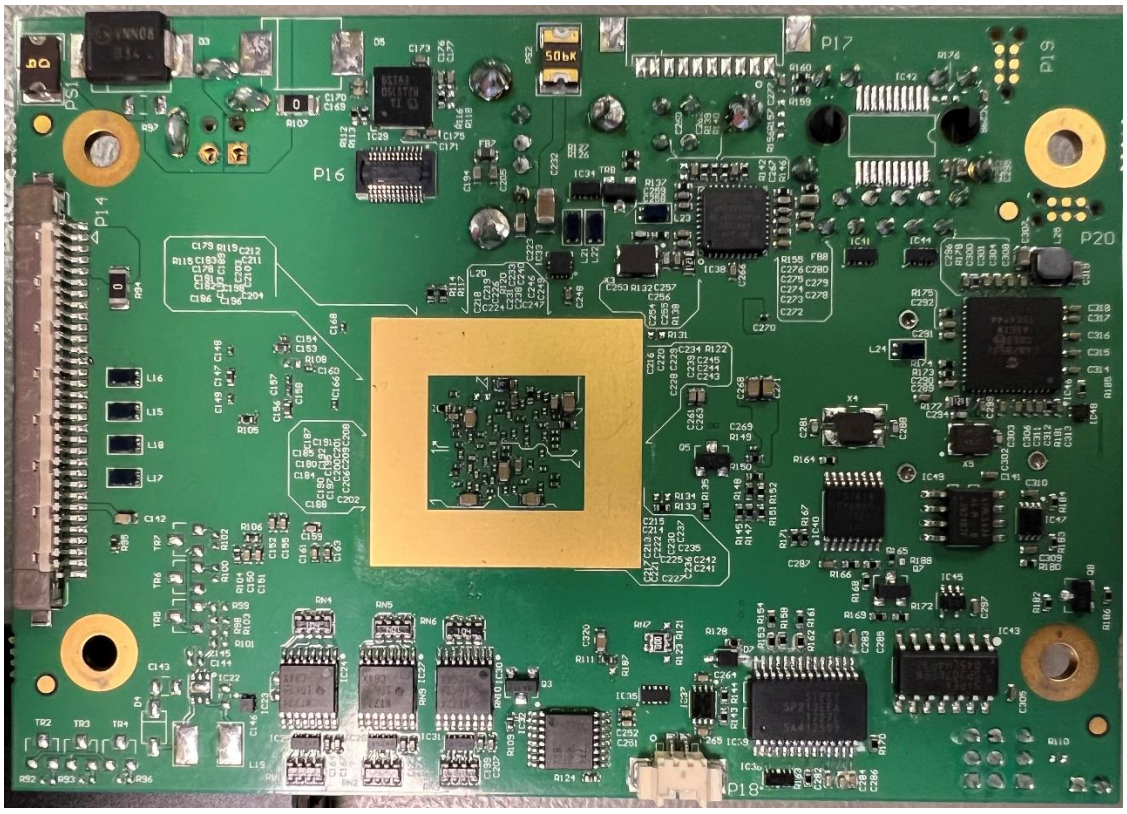


Figure 7-2 DB1 for 7” and 12” LCD bottom view

7.2 DB1 for 9.7” LCD

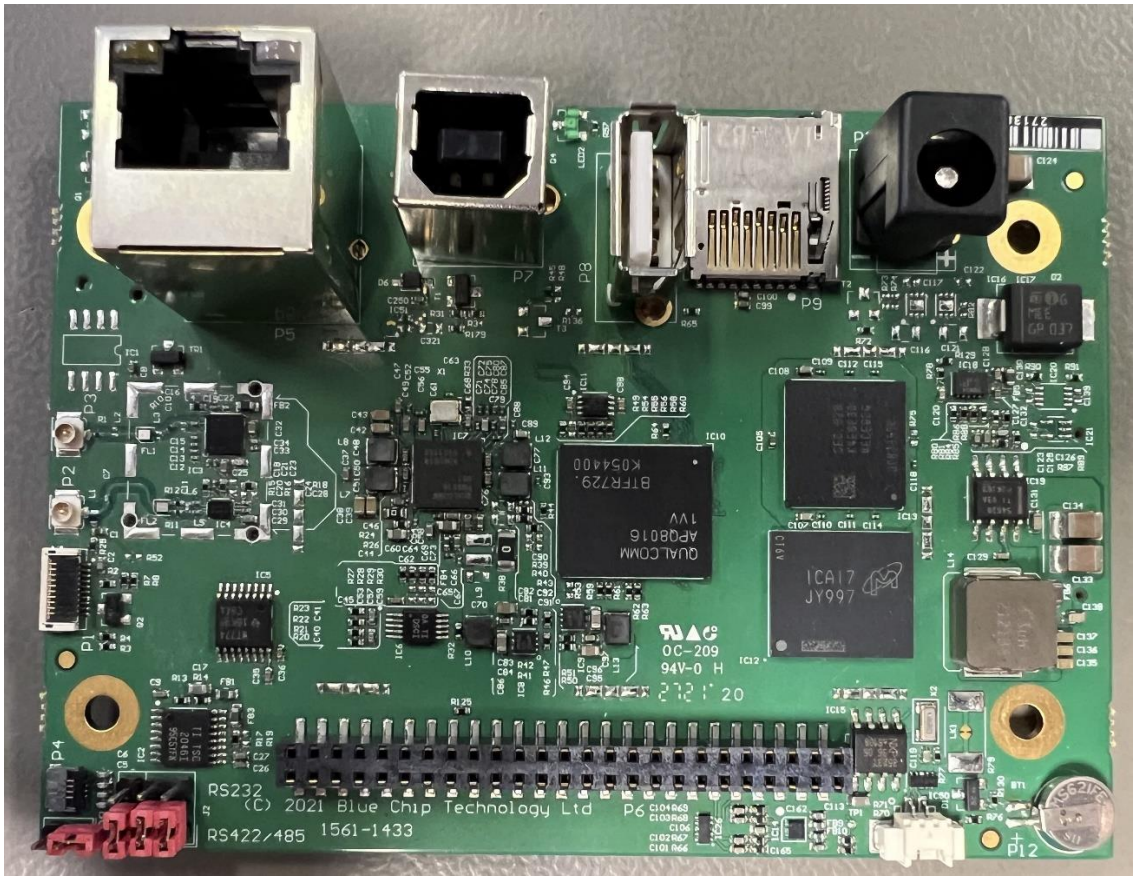


Figure 7-3 DB1 for 9.7” LCD top view

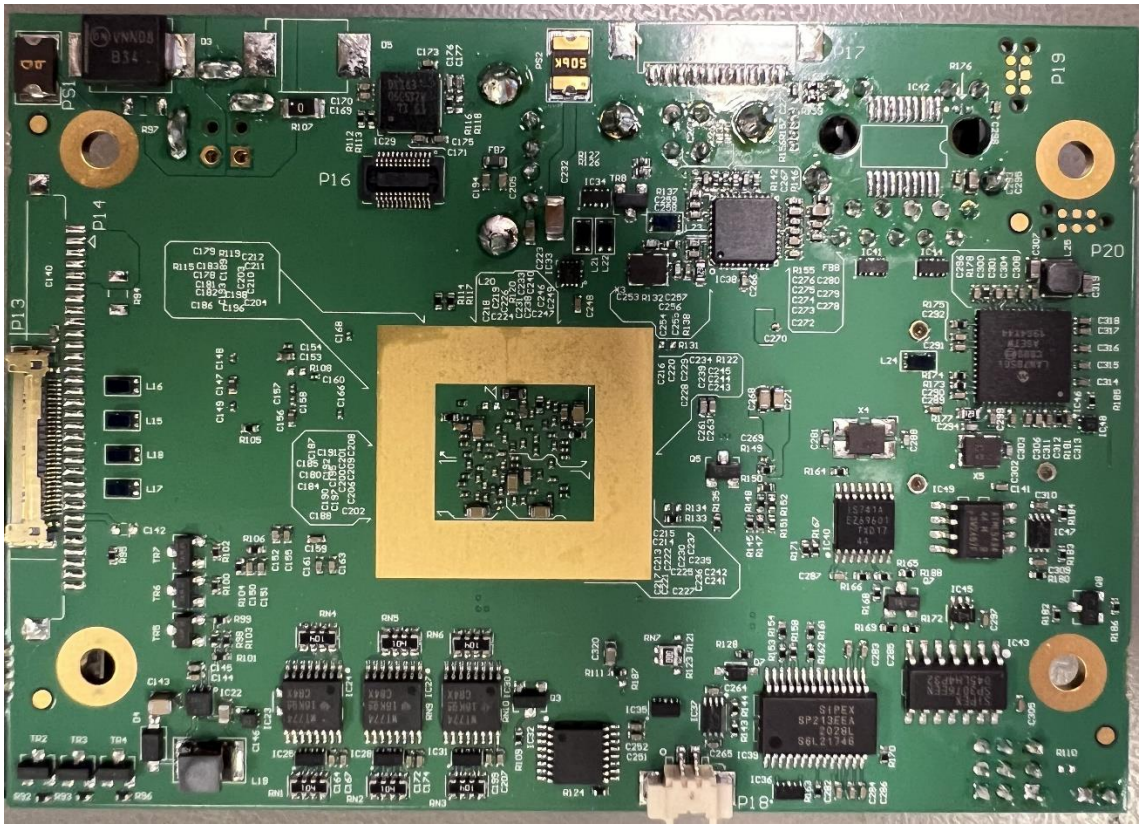


Figure 7-4 DB1 for 9.7” LCD bottom view

8 Connectors

Connector / Description
P1 – Capacitive Touch
P2 – GPS
P3 – WiFi / Bluetooth
P4 – Resistive Touch
P5 – Ethernet
P6 – Expansion Connector
P7 – USB-B Connector
P8 – USB-A Connector
P10 – Power (DC jack)[1]
P11 – Power (Screw Terminal)[1]
P12 – Speaker
P13 – 9.7” LCD Connector[2]
P14 – 7” / 12” LCD Connector[2]
P16 – Camera Input
P18- RTC Battery

Table 8-1 Connector summary

8.1 P1 – Capacitive Touch

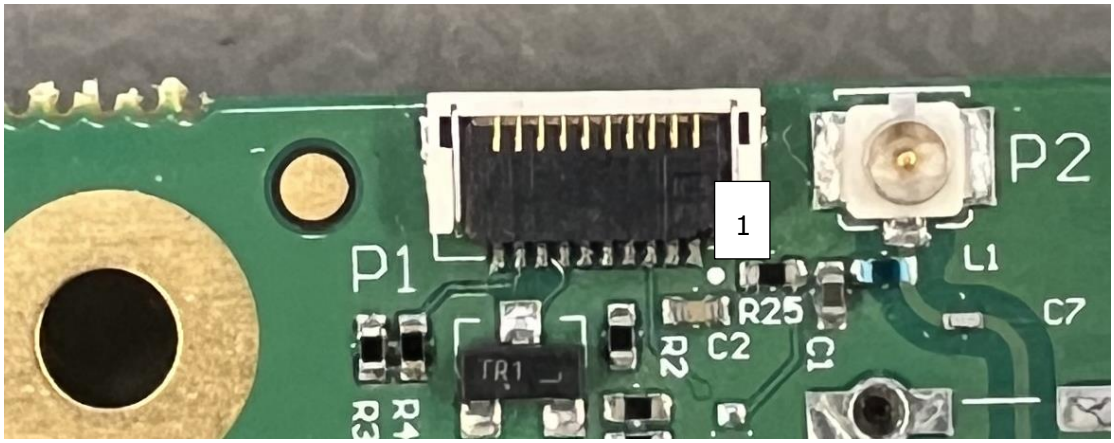


Figure 8-1 P1 – Capacitive Touch

Pin	Signal	Comments
1	GND	
2	VCC	3.3v power out
3	I2C_SDA	3.3v I2C Data
4	NC	
5	I2C_SCK	3.3v I2C Clock
6	NC	
7	RESET#	Active low reset
8	NC	
9	IRQ#	Active low interrupt request
10	GND	

Table 8-2 P1 – Capacitive Touch pinout

[1] P10 and P11 are mutually exclusive. Either DC jack or screw terminal.

[2] P13 and P14 are mutually exclusive. P13 is for 9.7” LCD displays. P14 for 7” and 12” LCD displays.

8.2 P2 – GPS

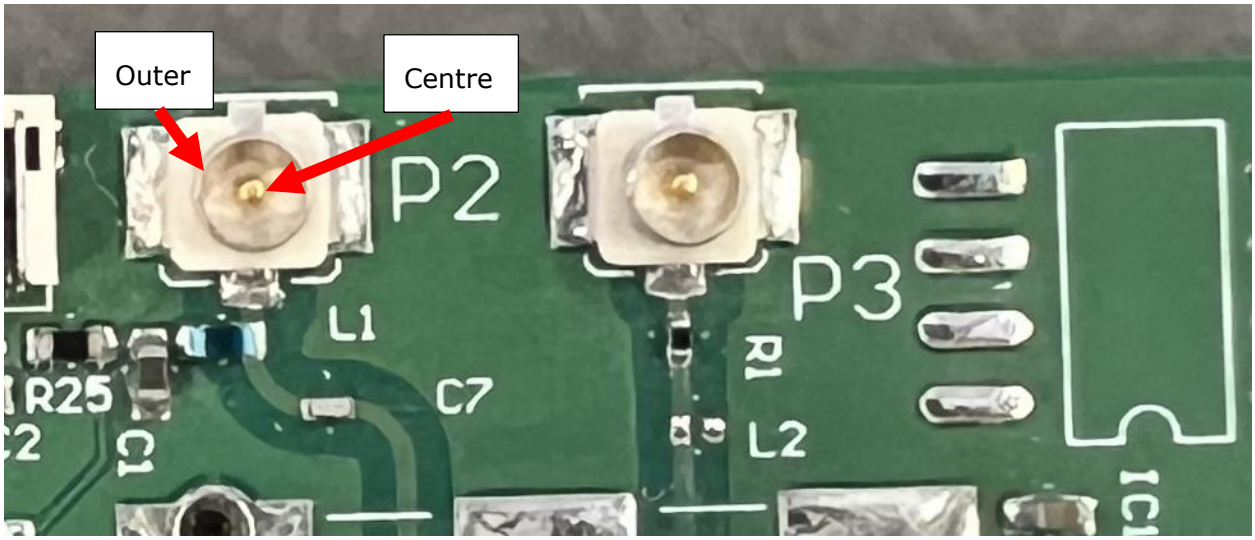


Figure 8-2 P2 – GPS

Pin	Signal	Comments
Outer	GND	
Centre	12V	

Table 8-3 P2 – GPS pinout

8.3 P3 – WiFi / Bluetooth

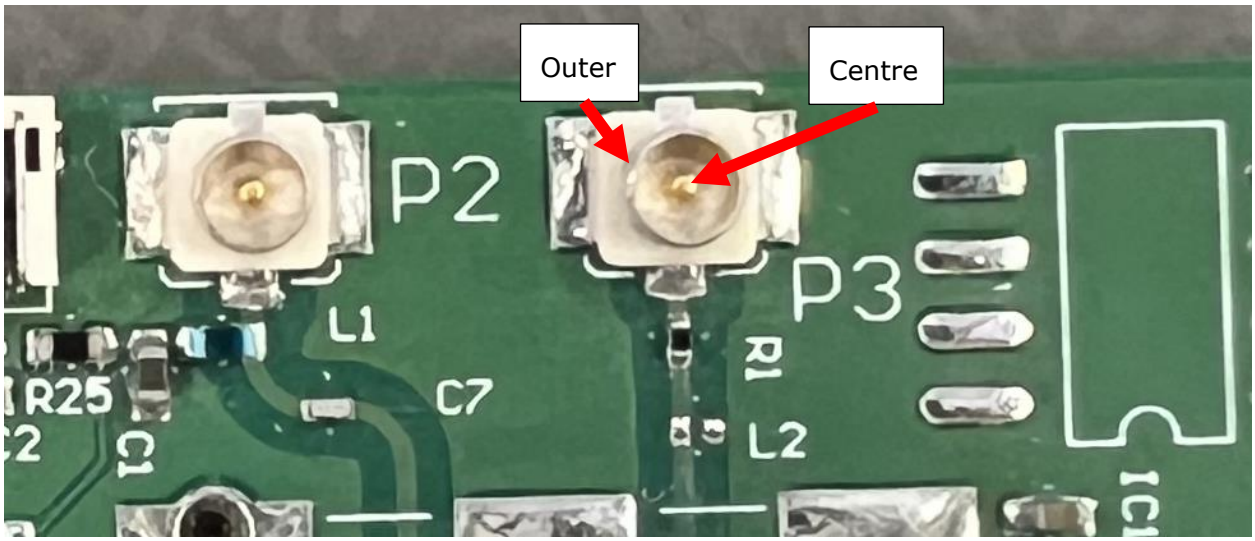


Figure 8-3 P3 – WiFi / Bluetooth

Pin	Signal	Comments
Outer	GND	
Centre	12V	

Table 8-4 P3 – WiFi / Bluetooth pinout

8.4 P4 – Resistive Touch

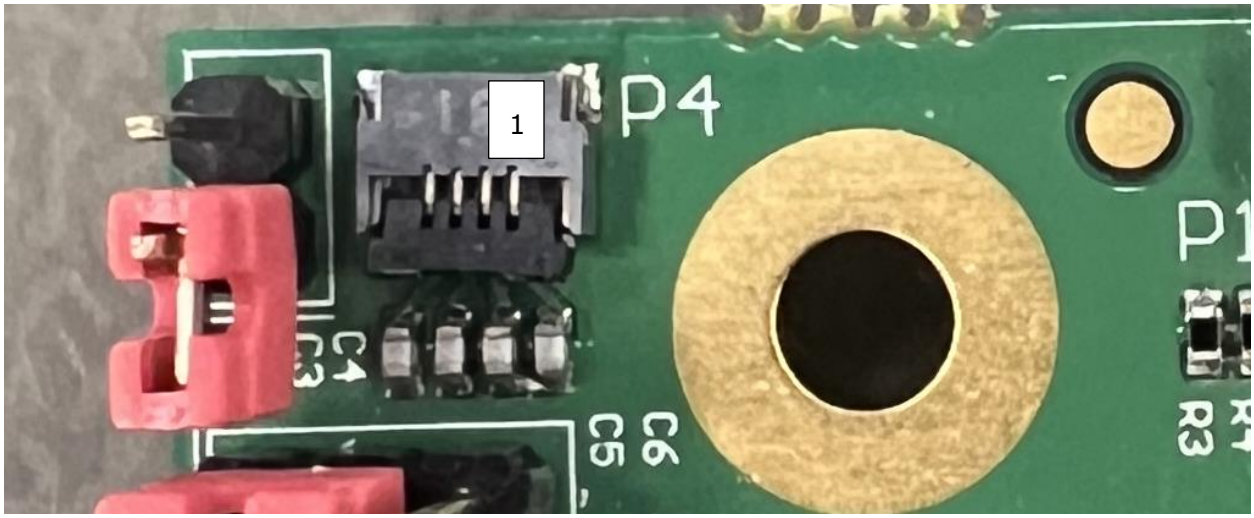


Figure 8-4 P4 – Resistive Touch

Pin	Signal	Comments
1	YU	Y+ position input
2	XL	X- position input
3	YD	Y- position input
4	XR	X+ position input

Table 8-5 P2 -USB-A pinout

8.5 P5 – Ethernet

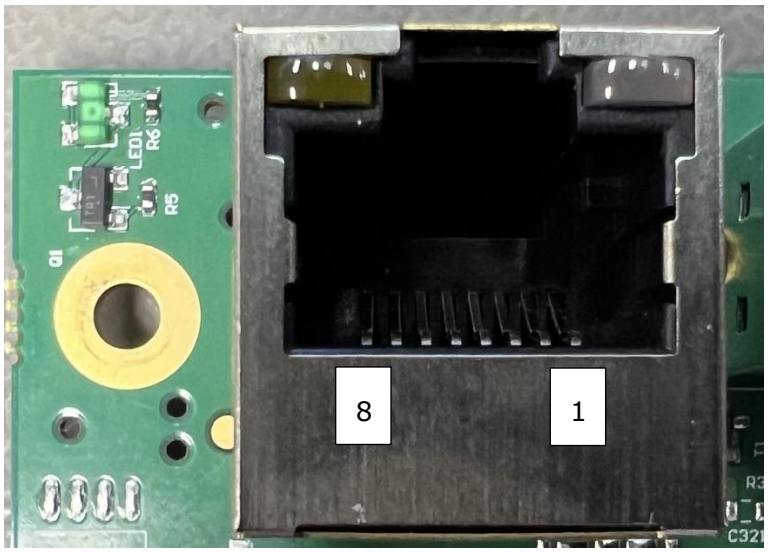


Figure 8-5 P5 – Ethernet

Pin	Signal	External Connections (RJ45)	Comments
1	TX1P	1	Bi-directional pair 1 +
2	TX1N	2	Bi-directional pair 1 -
3	TX2P	3	Bi-directional pair 2 +
4	TX2N	4	Bi-directional pair 2 -
5	TX3P	5	Bi-directional pair 3 +
6	TX3N	6	Bi-directional pair 3 -
7	TX4P	7	Bi-directional pair 4+
8	TX4N	8	Bi-directional pair 4 -

Table 8-6 P5 – Ethernet pinout

8.6 P6 – Expansion Connector

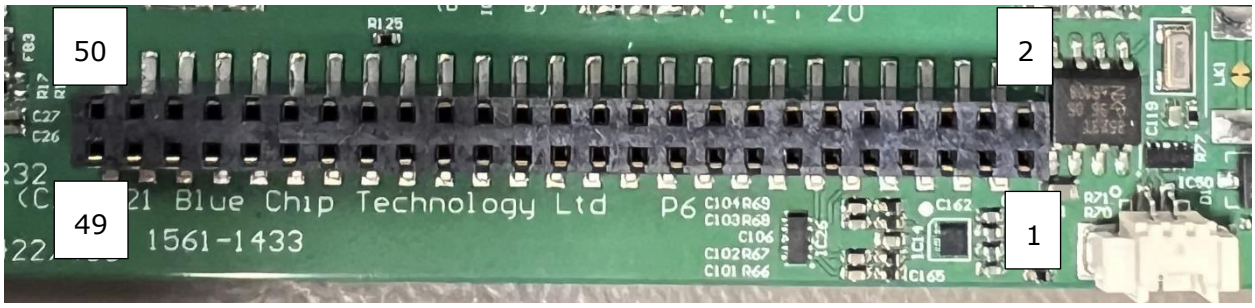


Figure 8-6 P6 – Expansion Connector

Pin	Signal	Comments
1	GND	
2	GND	
3	Headphone R	
4	GPIO 12	
5	Headphone L	
6	GPIO 11	
7	GND	
8	GPIO 10	
9	Microphone1 P	
10	GPIO 9	
11	Microphone2 P	
12	GPIO 8	
13	GND	
14	GPIO 7	
15	SPKR P	
16	GPIO 6	
17	SPKR N	
18	GPIO 5	
19	GND	
20	GPIO 4	
21	COM1 TX	Debug Port RS232
22	GPIO 3	
23	COM1 RX	Debug Port RS232
24	GPIO 2	
25	GND	
26	GPIO 1	
27	COM2 TX	RS232
28	GND	
29	COM2 RX	RS232
30	MISO USB5V	
31	GND	
32	HUB2 DC P	
33	CTX3 P / COM3 TX	RS422 / RS232 with Link J1 & J2 (refer to section 14).
34	HUB2 DC N	
35	CTX3 N / COM3 RX	RS422 / RS232 with Link J1 & J2 (refer to section 14).
36	GND	
37	CRX3 P	RS422

38	Power Off	
39	CRX3 N	RS422
40	Reset	
41	GND	
42	Sleep Request	
43	I2C SCL	
44	Boot Mode	
45	I2C SDA	
46	GND	
47	GND	
48	3.3v output	
49	VIN	Power INPUT.
50	External RTC battery	Voltage range 3.0-3.6v

Table 8-7 P6 – Expansion pinout

8.7 P7 – USB-B Connector

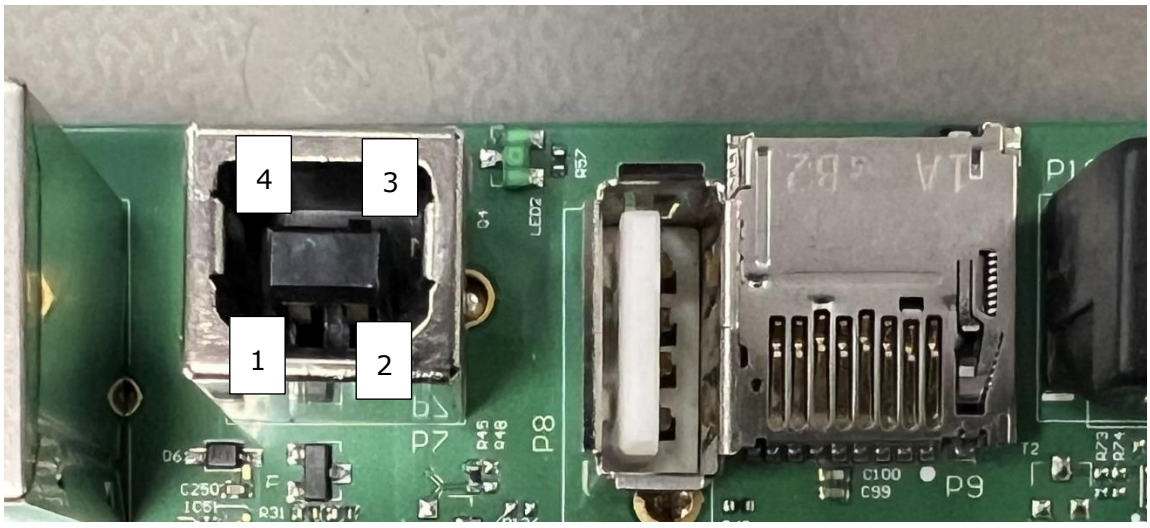


Figure 8-7 P7 – USB-B Connector

Pin	Signal	Comments
1	VBUS	+5 volts – Filtered & current limited
2	DN	USB Data Negative
3	DP	USB Data Positive
4	GND	Filtered Electrical ground

Table 8-8 P7 – USB-B Connector pinout

8.8 P8 – USB-A Connector

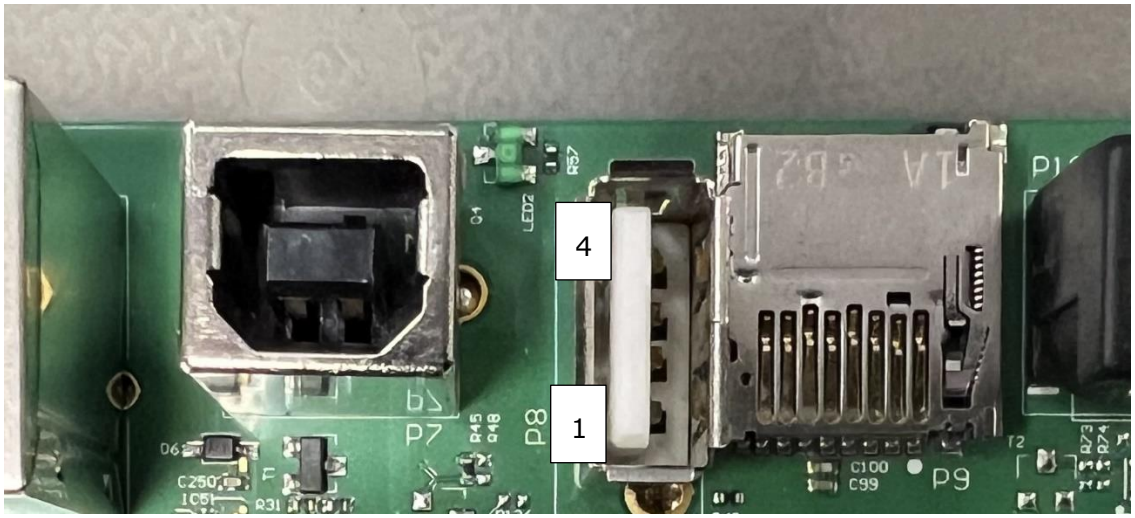
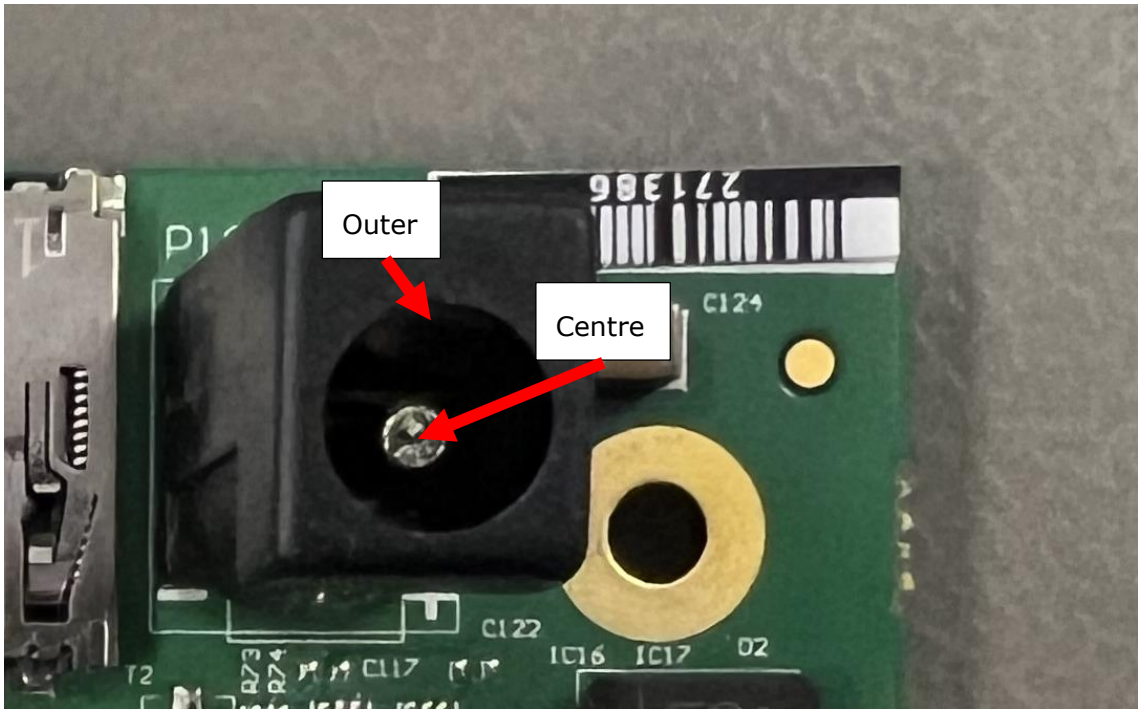


Figure 8-8 P8 – USB-A Connector

Pin	Signal	Comments
1	VBUS	+5 volts – Filtered & current limited
2	DN	USB Data Negative
3	DP	USB Data Positive
4	GND	Filtered Electrical ground

Table 8-9 P8 – USB-A Connector pinout

8.9 P10 – Power (DC jack)



The DC power jack is a 2.5/5.5mm Power Jack

Pin	Signal	Comments
1	12v	Centre pin
2	GND	Outer

Table 8-10 P10 – Power (DC jack) pinout

8.10P11 – Power (Screw Terminal)

Pin	Signal	Comments
1	GND	Square pad (bottom side of PCA)
2	12v	Round pad (bottom side of PCA)

Table 8-11 P11 – Power (Screw Terminal) pinout

8.11P12 – Speaker

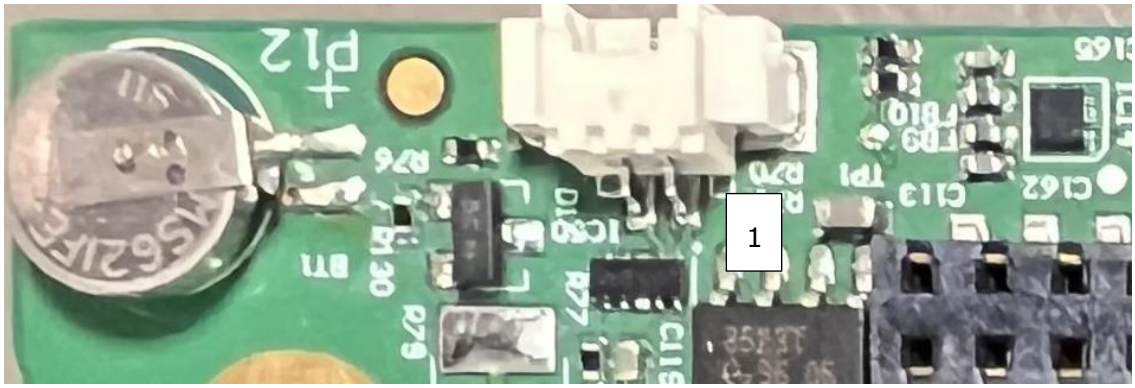


Figure 8-9 P12 – Speaker

Pin	Signal	Comments
1	SPEAKER_N	
2	SPEAKER_P	

Table 8-12 P12 – Speaker pinout

8.12P13 – 9.7” LCD Connector

Note that the connectors P13 and P14, which are for the 9.7” and 7”/12” displays respectively, are mutually exclusive.

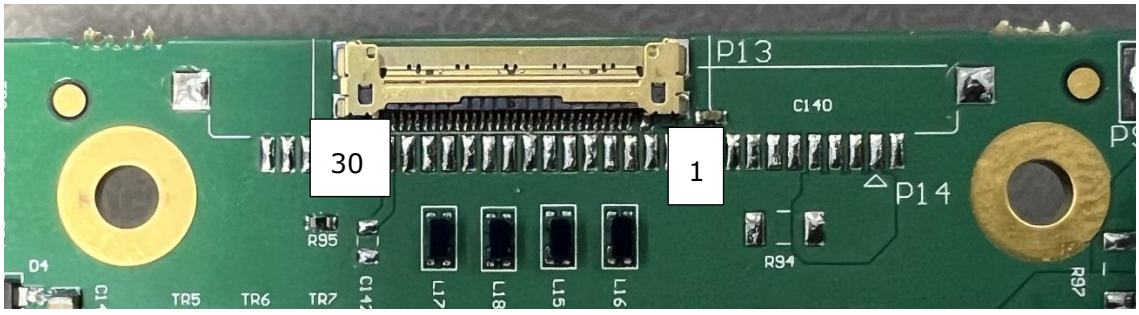


Figure 8-10 P13 – 9.7” LCD Connector

Pin	Signal	Comments
1	GND	
2	VPNL	
3	VPNL	
4	NC	
5	GND	
6	NC	
7	NC	
8	LVDS 0 N	
9	LVDS 0 P	
10	GND	
11	LVDS 1 N	
12	LVDS 1 P	
13	GND	
14	LVDS 2 N	
15	LVDS 2 P	
16	GND	
17	LVDS C N	
18	LVDS C P	
19	GND	
20	NC	
21	LEDA	
22	LEDA	
23	NC	
24	LEDK1	
25	LEDK1	
26	LEDK1	
27	LEDK1	
28	LEDK1	
29	LEDK1	
30	NC	

Table 8-13 RS232 / RS485 pinout

8.13P14 – 7” / 12” LCD Connector

Note that the connectors P13 and P14, which are for the 9.7” and 7”/12” displays respectively, are mutually exclusive.

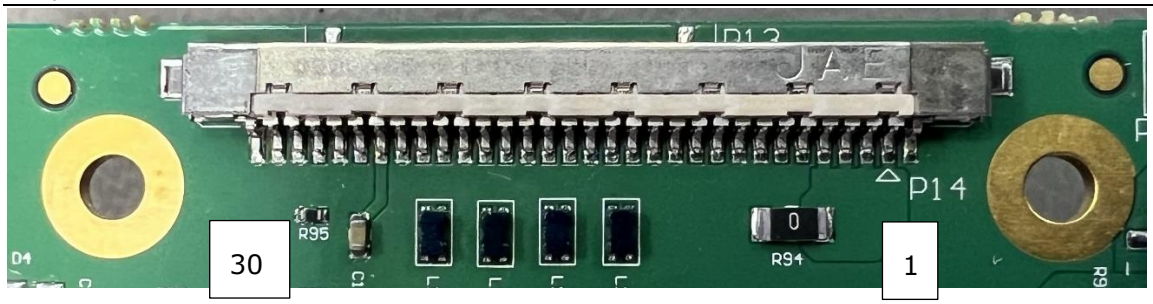


Figure 8-11 P14 – 7" / 12" LCD Connector

Pin	Signal	Comments
1	12v	
2	12v	
3	12v	
4	12v	
5	ENLED	Enable Display
6	LCD BL	LCD PWM
7	GND	
8	GND	
9	3.3v	
10	3.3v	
11	GND	
12	GND	
13	LVDS0 N	
14	LVDS0 P	
15	GND	
16	LVDS1 N	
17	LVDS1 P	
18	GND	
19	LVDS2 N	
20	LVDS2 P	
21	GND	
22	LVDC N	
23	LVDC P	
24	GND	
25	EN_BL0	Enable Backlight
26	NC	
27	GND	
28	GND	
29	GND	
30	GND	

Table 8-14 P14 – 7" / 12" LCD Connector pinout

8.14P16 – Camera Input

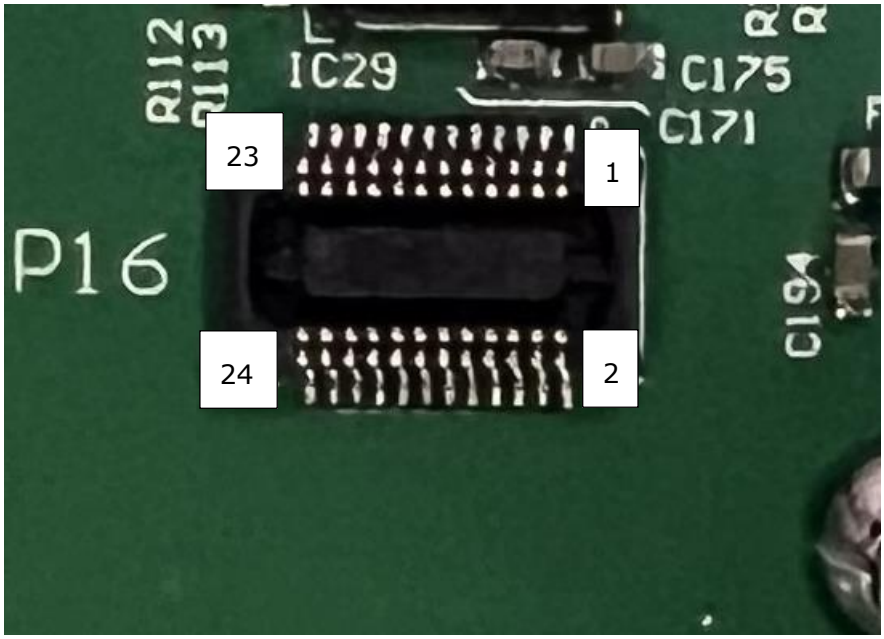


Figure 8-12 P16 – Camera Input

Pin	Signal	Comments
1	VREG_L10_2P8	
2	GND	
3	I2C_SDA	
4	AVCC_2P8	
5	I2C_SCK	
6	RESET#	
7	NC	
8	DISABLE	
9	NC	
10	VCC_1P5	
11	VREG_L6_1P8	
12	CSI0_1_P	
13	CSI0_MCLK	
14	CSIO_1_N	
15	GND	
16	CSIO_C_P	
17	GND	
18	CSIO_C_N	
19	NC	
20	CSIO_0_P	
21	NC	
22	CSIO_0_N	
23	NC	
24	GND	

Table 8-15 P16 – Camera Input pinout

8.15P18- RTC Battery

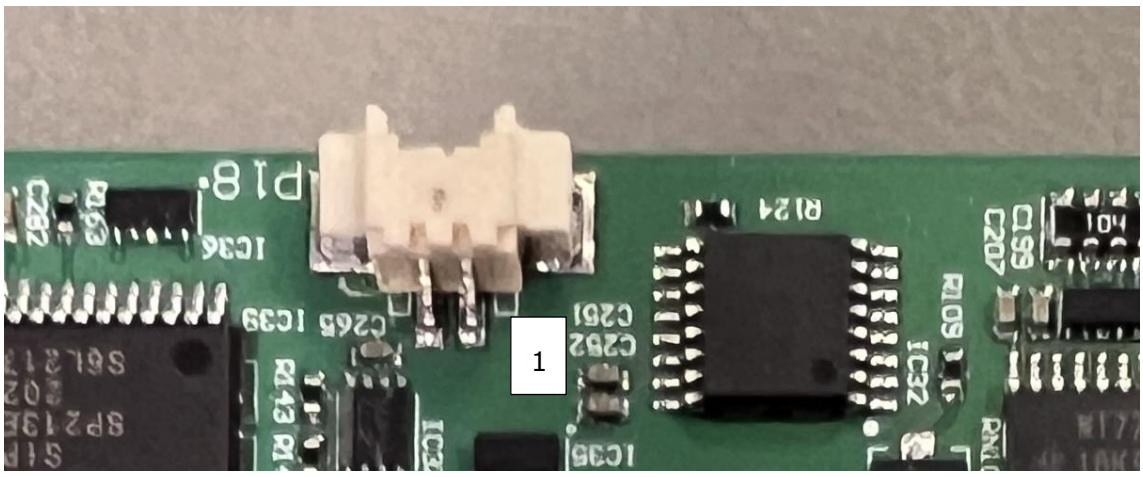


Figure 8-13 P18- RTC Battery

Pin	Signal	Comments
1	VBAT	
2	GND	

Table 8-16 P18- RTC Battery pinout

9 Jumpers

9.1 J1, J2 - COM Port #3 Function

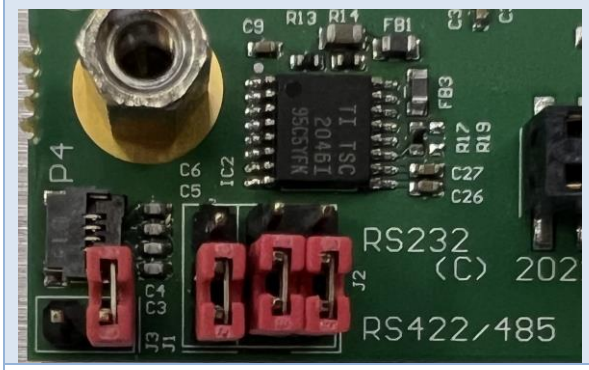
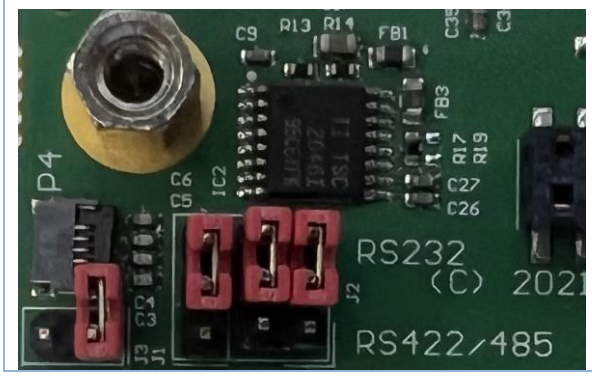
Jumper	Comment
	COM Port #3 is RS422/RS485.
	COM Port #3 is RS232.

Table 9-1 J1, J2 - COM Port #3 Function Jumpers

9.2 J3 - Boot Order Selection

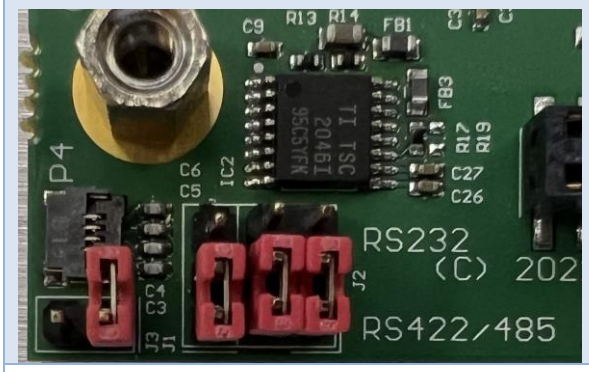
Jumper	Comment
	Boot order is EMMC, µSD card.
	Boot order is µSD card, EMMC.

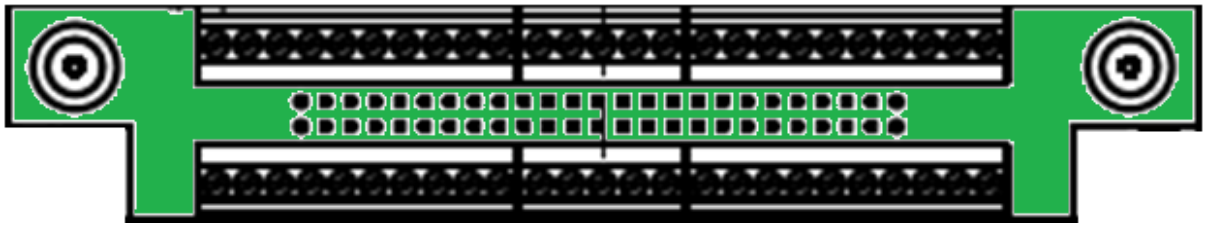
Table 9-2 J3 - Boot Order Selection Jumper

10 Expansion Connector PCAs

10.1 Screw Terminal PCA

For users who prefer screw terminal connections a dual 25-way row PCA with 3.5mm pitch connectors is available. The connections are indicated using the upper- and lower-case alphabet rather than numbers.

A B C D E F G H I J K L M N O P Q R S T U V W X Y



a b c d e f g h i j k l m n o p q r s t u v w x y

Figure 10-1 Screw Terminal PCA

Pin	Signal	Comment
A	RTC_BAT	Nominal 3 volts DC for Real Time Clock
B	VCC_3V	3 volts DC
C	0 volts	
D	BOOT_MODE#	Apply logic low during power up to put the unit into USB engineering mode.
E	SLEEP_RQ#	Apply logic low while the system in operational to signal that the OS should go into suspend. Apply logic low while the system in suspend wake up the system.
F	RESET#	Apply logic low to reset the unit
G	PWROFF#	Apply logic low to power down the unit
H	0 volts	
I	USB DATA-	USB data negative
J	USB DATA+	USB data positive
K	USB 5v	+5v supply for USB port
L	0 volts	
M	GPIO 1	GPIO signal – 3 volts level
N	GPIO 2	GPIO signal – 3 volts level
O	GPIO 3	GPIO signal – 3 volts level
P	GPIO 4	GPIO signal – 3 volts level
Q	GPIO 5	GPIO signal – 3 volts level
R	GPIO 6	GPIO signal – 3 volts level
S	GPIO 7	GPIO signal – 3 volts level
T	GPIO 8	GPIO signal – 3 volts level
U	GPIO 9	GPIO signal – 3 volts level
V	GPIO 10	GPIO signal – 3 volts level
W	GPIO 11	GPIO signal – 3 volts level
X	GPIO 12	GPIO signal – 3 volts level
Y	0 volts	
a	VIN	Alternative power INPUT – in parallel with the main power in connector on DB1.
b	0 volts	
c	I2C SDA	I2C Data at a 3 volts level
d	I2C SCL	I2C Clock at a 3 volts level
e	0 volts	
f	CRX3_N	COM Port 3 Receive – Negative – 3volts level for RS422/485.
g	CRX3_P	COM Port 3 Receive – Positive – 3volts level for RS422/485.

h	CTX3_N	COM Port 3 Transmit – Negative / COM 3 RS232 Receive – 3volts level for RS422/485, RS232 levels for RS232. See section 14 for further information.
i	CTX3_P	COM Port 3 Transmit – Positive / COM 3 RS232 Transmit – 3volts level for RS422/485, RS232 levels for RS232. See section 14 for further information.
j	0 volts	
k	COM2_RX	RS232 Port 2 Receive – RS232 levels
l	COM2_TX	RS232 Port 2 Transmit – RS232 levels
m	0 volts	
n	COM1_RX	RS232 Port 1 Receive – RS232 levels
o	COM1_TX	RS232 Port 1 Transmit – RS232 levels
p	0 volts	
q	SPEAKER_L	Audio speaker output – Negative
r	SPEAKER_H	Audio speaker output – Positive
s	0 volts	
t	LINEIN_L	Audio line in – left channel
u	LINEIN_R	Audio line in – right channel
v	0 volts	
w	LINEOUT_L	Audio line out – left channel
x	LINEOUT_R	Audio line out – right channel
y	0 volts	

Table 10-1 Screw Terminal PCA Pinout

10.2 PicoBlade™ Connector PCA

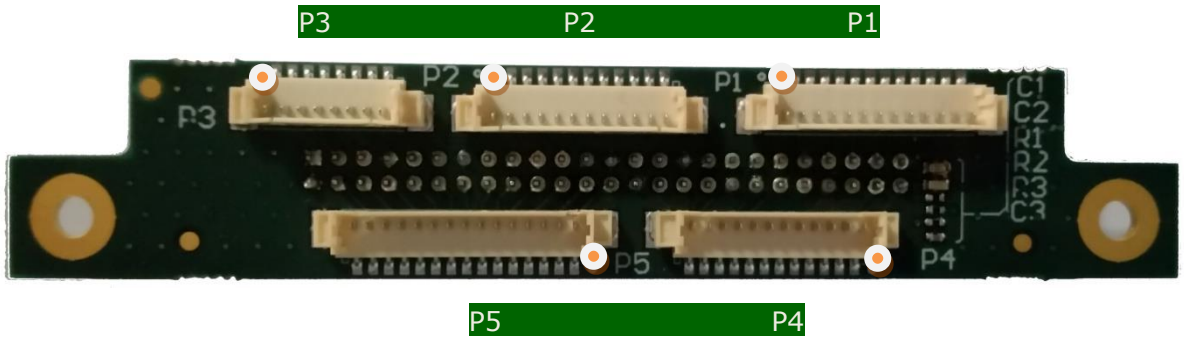


Figure 10-2 PicoBlade™ Connector PCA

- *Denotes pin 1 on each connector.*

Note: The USB port which is available on the screw terminal IO PCA is not available on the PicBlade™ PCA.

10.2.1 Connector P1 – Utilities

Pin	Signal	Comments
1	PWROFF#	Apply logic low to power down the unit
2	0 volts	
3	RESET#	Apply logic low to reset the unit
4	0 volts	
5	I2C SCL	I2C Clock at a 3 volts level
6	I2C SDA	I2C Data at a 3 volts level
7	0 volts	
8	SLEEP RQ#	Apply logic low while the system in operational to signal that the OS should go into suspend. Apply logic low while the system in suspend wake up the system.
9	0 volts	
10	Reserved	
11	0 volts	
12	BOOT MODE#	Apply logic low during power up to put the unit into USB engineering mode.
13	0 volts	

Table 10-2 Connector P1 – Utilities pinout

10.2.2 Connector P2 - RS232

Pin	Signal	Comments
1	0 volts	Ground for COM 1 RS232 channel
2	COM 1 RX	RS232 receive channel – console for Linux & Android
3	COM 1 TX	RS232 transmit channel – console for Linux & Android
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	

Table 10-3 Connector P2 - RS232 pinout

10.2.3 Connector P3 – Audio

Pin	Signal	Comments
1	Line out right channel	Audio line level signal
2	Line out left channel	Audio line level signal
3	0 volts	Audio ground
4	Line in left channel	Audio line level signal
5	Line in right channel	Audio line level signal
6	0 volts	Audio ground
7	Speaker negative	Combined left and right audio channels amplified – Negative (not 0 volts)
8	Speaker positive	Combined left and right audio channels amplified - Positive

Table 10-4 Connector P3 – Audio pinout

10.2.4 Connector – P4 – RS232 & RS232/422/485

Pin	Signal	Comments
1	0 volts	Ground for COM 2 RS232 channel
2	COM 2 RX	RS232 receive channel
3	COM 2 TX	RS232 transmit channel
4	VCC	3 Volts
5	Termination – low	10K ohm to 0 volts
6	Termination – high	10K ohm to 3 volts
7	Termination – signal	120 ohm and 100nF in series and then pin 10 (COM 3 RX +ve)
8	COM 3 Receive –ve	Differential signal – negative. Connected to pin 9 to allow termination to be connected in circuit
9	COM 3 Receive –ve	Differential signal – negative. Connected to pin 8 to allow termination to be connected in circuit
10	COM 3 Receive +ve	Differential signal – positive. Connected to 100nF and 120Ω then pin 7
11	COM 3 Transmit –ve	RS422/485 Differential signal – negative. COM 3 RS232 Receive. See section 14 for further information.
12	COM 3 Transmit +ve	RS422/485 Differential signal – positive. COM 3 RS232 Transmit. See section 14 for further information.

Table 10-5 Connector – P4 – RS232 & RS232/422/485 pinout

10.2.5 Connector – P5 – GPIO

Pin	Signal	Comments
1	3 volts	3 volts DC source for GPIO signal pull ups etc
2	GPIO 1	GPIO signal – 3 volts level
3	GPIO 2	GPIO signal – 3 volts level
4	GPIO 3	GPIO signal – 3 volts level
5	GPIO 4	GPIO signal – 3 volts level
6	GPIO 5	GPIO signal – 3 volts level
7	GPIO 6	GPIO signal – 3 volts level
8	GPIO 7	GPIO signal – 3 volts level
9	GPIO 8	GPIO signal – 3 volts level
10	GPIO 9	GPIO signal – 3 volts level
11	GPIO 10	GPIO signal – 3 volts level
12	GPIO 11	GPIO signal – 3 volts level
13	GPIO 12	GPIO signal – 3 volts level
14	Reserved	
15	0 volts	0-volt reference for GPIO signals

Table 10-6 Connector – P5 – GPIO

11 RTC Battery

The DB1 provides a real-time clock (RTC) that can preserve the time when main power is off. This can be powered by an onboard rechargeable battery or by an external battery.

This section describes the options for using this feature.

11.1 External Battery specification

The external battery is attached to P18 or dedicated pin on P6. The battery voltage needs to be in the range 3.0V to 3.6V and therefore a Lithium-manganese dioxide "Li-Mn" battery like a CR2032 can be used.

The DB1 does not offer the ability to charge the external battery or super-capacitor, so rechargeable lithium batteries are not suitable.

12 Thermal Specifications

Configuration	Min(°C)	Max(°C)
Headless	-20	60
7”	-20	60
9.7”	-15	60
12”	-10	60

Table 12-1 Thermal Specifications

Please note that the temperature is local to the PCB and is not the room or enclosure ambient which may be a lot lower.

A temperature sensor to monitor the core temperature of the Qualcomm APQ8016E processor provided. This is done in Linux using the following command.

```
“sudo cat /sys/class/thermal/thermal_zone0/temp"
```

Since this is the core temperature, it is expected that this will be higher than the PCB temperature. This is particularly the case when the CPU is operating at full load. Under such conditions, if the core temperature rises above approximately 74°C, the CPU clock frequency is reduced to maintain the core temperature at this temperature. The frequency is drops in steps down from 1.2GHz to a minimum of 200MHz.

To aid in determining whether a heatsink and forced airflow is required, under Linux, the following command can be used to read the IMX6 temperature in degrees Celsius.

```
"sudo cat /sys/devices/system/cpu/cpu0/cpufreq/cpuinfo_cur_freq”
```

13 GPIO

Note that each of the 12 GPIOs is fitted with a 100K pull-down resistor.

The basic electrical characteristics are as follows: -

Feature:	Min:	Max:	Units:
V_{OH} Input Low Voltage	0	0.8	V
V_{IH} Input High Voltage	2	3.6	V
V_{OH} Output High Voltage	2.3	3.3	V
V_{OL} Output Low Voltage	0	0.7	V
I_{IH} Output High Current	-	12	mA
I_{IL} Output Low Current	-	-12	mA

Table 13-1 GPIO voltage ranges

For Linux, the recommended way to access the GPIO is using the SYSFS interface. This can be done using the command line (or scripts) or can be done from inside an application. The GPIO documentation can be found here:

https://www.kernel.org/doc/Documentation/gpio/sysfs.txt

The link below has some useful examples:

https://falsinsoft.blogspot.com/2012/11/access-gpio-from-linux-user-space.html

13.1 General Purpose I/O Operation

The operation of the General-Purpose Input/Outputs (GPIOs) on the DB1 is slightly different to that used on most other BCT products. The Qualcomm APQ8016E GP pins operate at 1.8v logic levels. To maintain compatibility with previous BCT products, all GPIOs are level shifted to 3.3v before they reach the 50-way expansion connector. This means that an additional GPIO is needed to control the direction of the level shifter.

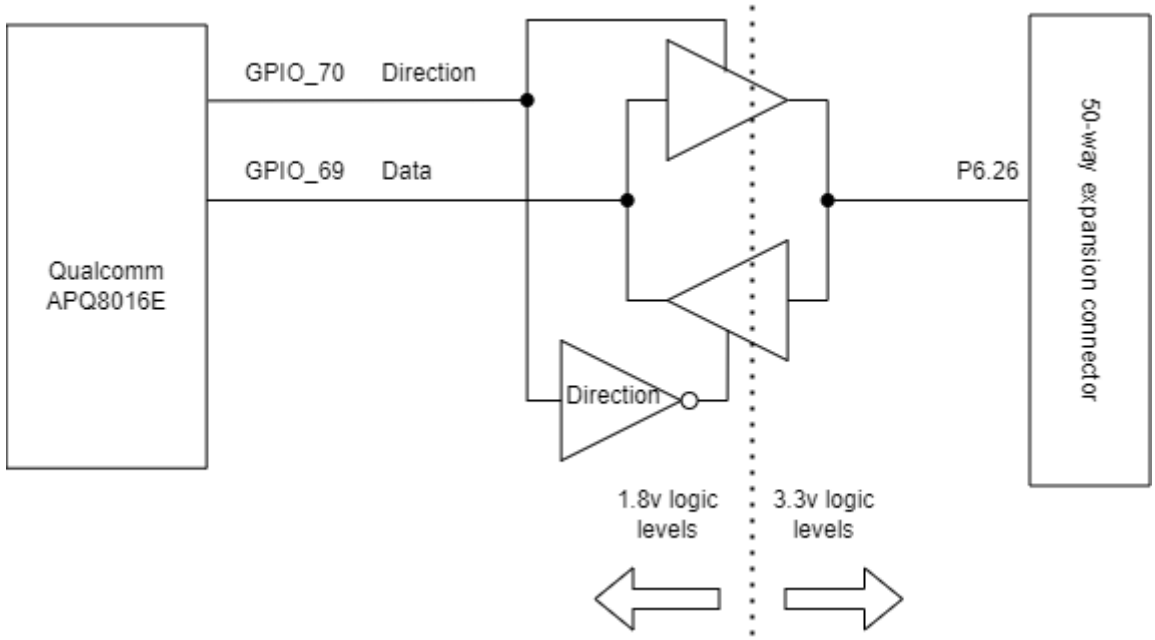


Figure 13-1 GPIO Schematic

As a result of this, when programming the GPIOs, the direction of the level-shifter must also be managed. Care must be taken to avoid a conflict between the Qualcomm SOC and the level-shifter which will occur if the SOC GPIO is set to output while the level-shifter is set to input.

The DB1 has 12 GPIO lines available.

P6	GPIO	CPU GPIO	DIRECTION
4	GPIO_12	118	59
6	GPIO_11	117	58
8	GPIO_10	115	57
10	GPIO_9	114	56
12	GPIO_8	113	55
14	GPIO_7	112	54
16	GPIO_6	111	53
18	GPIO_5	110	52
20	GPIO_4	109	51
22	GPIO_3	108	50
24	GPIO_2	107	49
26	GPIO_1	69	70

Table 13-2 GPIO mapping

The GPIOs labelled GPIO_1 to GPIO_12 are available on the specified pins of P6. These use 3.3v logic. Since the CPU is requires 1.8v logic, each GPIO passes through a bidirectional level shifter. The level shifter has a direction pin with low for input, high for output.

The example below configures GPIO_1 in Table 13-2 to be an output. The direction of the level shifter is controlled with GPIO_70.

```
#--                                    Set the GPIO_1 to be an output
cd /sys/class/gpio
#--                                    Set the level shifter direction to be
an
#--                                    output.
echo 70 > export
echo out > gpio70/direction
echo 1 > gpio70/value
#--                                    Set the direction of GPIO_1 to be an
output
echo 69 > export
echo out > gpio69/direction
echo 1 > gpio69/value
```

14 RS232 / RS485

14.1 Port Configuration

The DB1 is equipped with 3 serial ports which are available via the 50-way expansion connector and both the screw terminal and PicoBlade™ PCAs detailed in section 10. Two of the ports are RS232 and the third port may be configured using jumpers for RS232 or RS422/RS485 operation. The default factory setting is for RS422/RS485.

For RS232 jumper J1 must be set to link pins 2 & 3. All three jumpers in J2 must also be set to link pins 2 & 3. For RS485/RS422 operation, place J1 and all three jumpers in J2 to position 1 & 2. See section 9.1 for further information.

The DB1 must only be operated when the J1 and J2 links are either linking pins 1 & 2 or 2 & 3 and never with a mixture.

14.2 RS232

All RS232 ports have only transmit and receive functionality. There are no modem control lines available and therefore hardware flow control is not possible. RS232 is intended to form a connection between two systems as shown in Figure 14-1. This forms a full duplex system between the devices A and B. The RS232 standard does not support multidrop systems as most RS232 devices provide no means of disabling the transmitter. If a third device was added to Figure 14-1, it would need to be connected to a transmitter on either device A or device B.

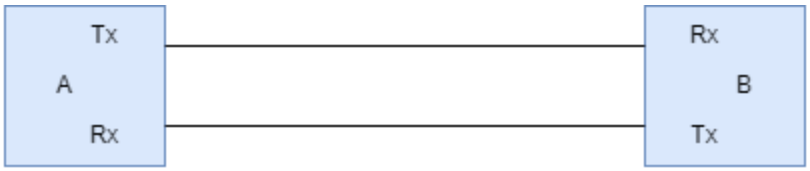


Figure 14-1 RS232 communications

14.3 RS422

RS422 uses two differential pairs for transmit and receive giving a total of 4 wires between the devices. Since the transmit and receive pairs are separate, full-duplex communication is possible.

Figure 14-2 shows a typical RS422 wiring arrangement.

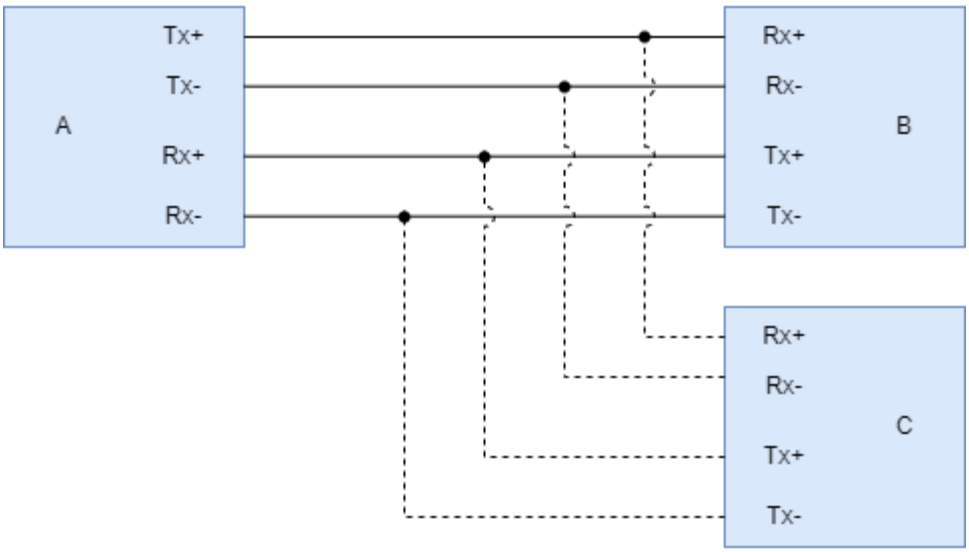


Figure 14-2 RS422 communications

RS422 also can support a multidrop connection as it is possible to disable the transmitters. A third device is added in Figure 14-2. Note that the transmit pairs of devices B and C are connected. As a result, care must be taken to prevent both B and C attempting to transmit simultaneously. Application software is responsible for ensuring that this happens.

14.4 RS485

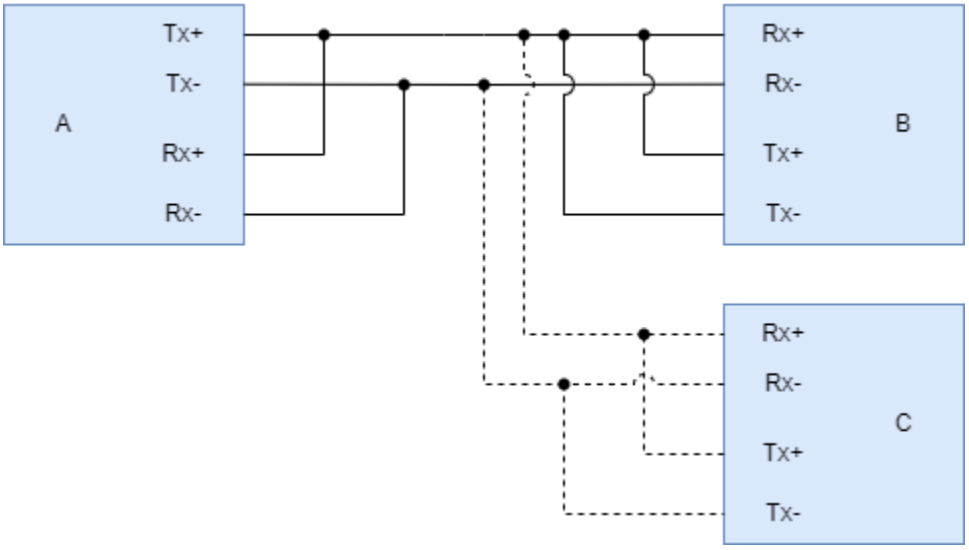


Figure 14-3 RS485 communications

RS485 is a 2-wire system. The transmit and receive pairs are connected on each device and 2 wires connect each device in the system. Since the transmit and receive pairs are connected, simultaneous bidirectional communications are not possible, and this therefore forms a half-

duplex system. Physically, the devices A and B would be placed at either end of the cable with device C on a short stub. Like RS422, it is possible to connect multiple devices. The enabling of the transmitters is essential in this configuration. It may also be desirable to disable the receiver during transmissions. Without this, a device will receive its own transmissions since the transmit and receive pairs are connected.

14.5 RS422/RS485 Termination Resistors

For RS422/RS485 applications which require long cable runs or high data rates it is generally necessary to include terminating resistors. The are placed between the differential pairs at the receiver end. The DB1 does not provide termination resistors, these must be added by the user as required.

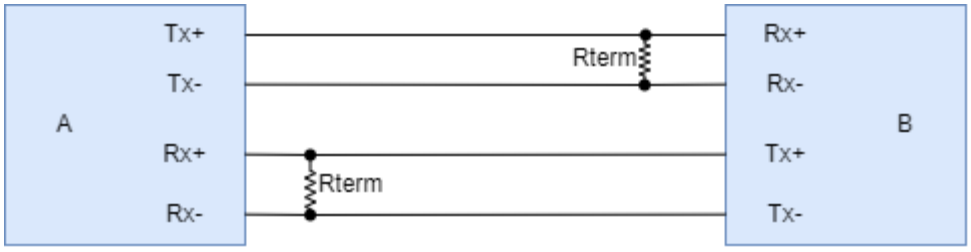


Figure 14-4 RS422 line termination

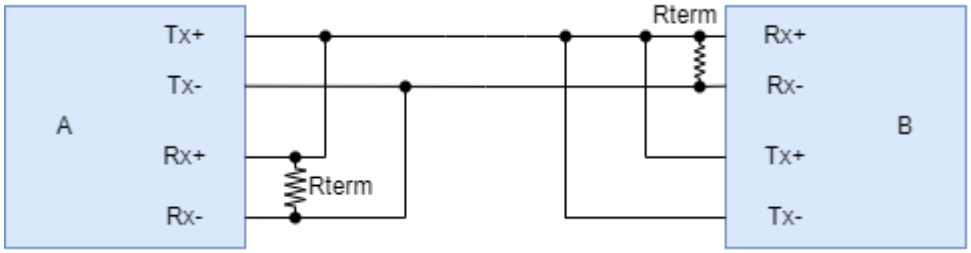


Figure 14-5 RS485 line termination

The value of the terminating resistors is typically 120Ω. If additional devices are added, these are placed on short stub connections and are not terminated.

14.6 RS422/RS485 Transmit and Receive Control

When the third serial port is configured for RS422/RS485 operation, the line driver automatically enables the receiver when the transmitter is disabled. When the transmitter is enabled, the user may choose either to enable or disable the receiver.

15 DB1 Current Consumption

The current consumption measurements were made with 12v input voltage. The peak current was the highest value measured whilst the DB1 booted Linux. The idle measurements indicate the current draw after the system has fully booted.

DB1 Configuration	Peak (mA)	Idle(mA)
Headless	329	160
7”	585	346
9.7”	743	525
12”	1090	824

Table 15-1 DB1 Current Consumption

16 OS Installation

The DB1 can boot an OS installed on the on-board EMMC or from a µSD card. This section describes only the method for installation to the EMMC.

16.1 Requirements

- An Intel/AMD PC with at least Windows 7, 64 bit or at least Ubuntu Linux 18.04, 64 bit operating system installed.
- Administrator rights for both OS are required. For Windows it means to be able to install a new driver as Administrator, for Linux it means be able to run commands as super-user (via sudo).
- USB 2.0 Host cable – one side male connector Type-A, other side male connector Type-B (sometimes also known as USB printer cable)
- Internet connection or pre-downloaded installation .zip archives of the OS intended to be installed on DB1.
- Approx. 20GB of free space on the local drive of the PC
- A switch or a tool to trigger USB Boot mode on DB1.
- A DB1 board which may or may not have an operating system already installed on the EMMC.

16.2 Downloading and unpacking OS zip archives

Blue Chip Technology provides both Android 6.0.1 and Lubuntu 18.04 installation archives. Each archive contains all necessary installation files for both Windows and Linux.

Unzip the downloaded archive. Windows users can right click on the archive file in the File Explorer and select the 'Extract all...' menu item.

Linux users can issue the following commands in terminal.

```
mkdir install && cd install
unzip ../db1_android_601_r9.zip
```

Make note of the installation directory path on your PC

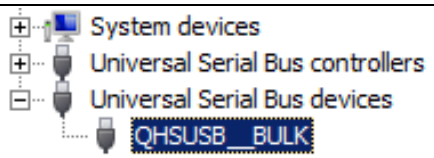
16.3 Windows Driver Installation

This step is required only on a Windows PC and needs to be performed only once.

- Open a File Explorer and navigate to the installation directory path.
- Right click on qdl_usb_driver_win.zip file and select the 'Extract all...' menu item.
- Enter the newly extracted driver directory and execute driver installer as administrator by right-clicking on the 'installer_x64.exe' file and selecting 'Run as administrator'. A console window will open briefly and then close.

16.4 Connecting DB1 and PC

- Ensure that the DB1 is turned off.
- Connect the USB cable between the PC (USB connector Type-A) and DB1 connector P7 (USB connector Type-B).
- Short the between the BOOT_MODE# to GND on the DB1 50-way expansion connector. The exact means of accessing the BOOT_MODE# pin depends on the options purchased. Refer to sections 8.6, 10.1 or 10.2 for the location of BOOT_MODE# on the 50-way expansion connector, screw terminal PCA or PicoBlade™ PCA.
- While the BOOT_MODE# pin is shorted to GND, power on DB1.
- Wait 3 seconds then remove the short between BOOT_MODE# and GND.
- It is possible to verify that DB1 has started in USB boot mode by checking that the QHSUSB_BULK device is present in Universal Serial Bus devices group in Device Manager.



- On Linux, run `lsusb` command and check that the Qualcomm device is present.

```
05c6:9008 Qualcomm, Inc. Gobi Wireless Modem (QDL mode)
```

16.5 OS Installation

- Ensure that there is no µSD card plugged-in the DB1.
- Open a command line interface and navigate to the installation directory.
- On Windows, run `'cmd.exe'` and then use `'cd'` command to enter the installation directory.
- On Linux, start Terminal Emulator and then use `'cd'` command to enter the installation directory.
- Check the screen size (7", 9.7" or 12") and touch screen type (capacitive, resistive) of the DB1 being programmed. The installation scripts are named according to screen size and touch panel type. The structure of the script name is:

  ```
  install_DDT.bat
  ```

  or

  ```
  install_DDT.sh
  ```

  'DD' is the display size which can be '07', '09' or '12'.
  'T' is the touch panel type which is either 'c' for capacitive or 'r' for resistive.
- On Windows, to program a 9.7" capacitive DB1, the installation script would be:

  ```
  install_09c.bat
  ```
- On Linux, to program a 7" resistive DB1, the installation script would be:

  ```
  sudo ./install_07r.sh
  ```

The DB1 device and the file transfer should take place. On Linux you may need to turn the DB1 off, start the tool and then power the DB1 on in the USB mode. The file transfer takes about 20 minutes, and the progress information is printed on the console. After the installation is complete the DB1 is reset, and the OS is started.

17 Delete Me Later!

- ~~Update the thermal specifications of DB1 (Section 12) once validation is complete. Include performance with and without cooling solution if applicable.~~
- ~~Add section describing the 422/485 port. linking TX to RX for half duplex operation~~. How to implement termination. How RS485 Tx control is handled
- Include input voltage requirements. Min and Max
- Document the USB implementation including how the device and host are mutually exclusive.
- USB/SPI mutually exclusive, and default configuration
- Boot mode pin description
- What the LEDs indicate
- WiFi / BT / GPS capabilities
- Ethernet MAC address
- Ask Roy for 2D drawings for the manual.
- ~~Section describing how to update and install the OS.~~
- GPS antenna requirements
- Audio implementation. Line-out, Line-in, and MIC (including mic bias)
- Document any protection circuits included if applicable. Over voltage, current, polarity

- Class-D amp specification and speaker requirements

18 Appendix

18.1 Change Log

Issue	Date	Author	Details of Change
1.0	05/09/2023	CC	First version

Table 18-1 Change Log