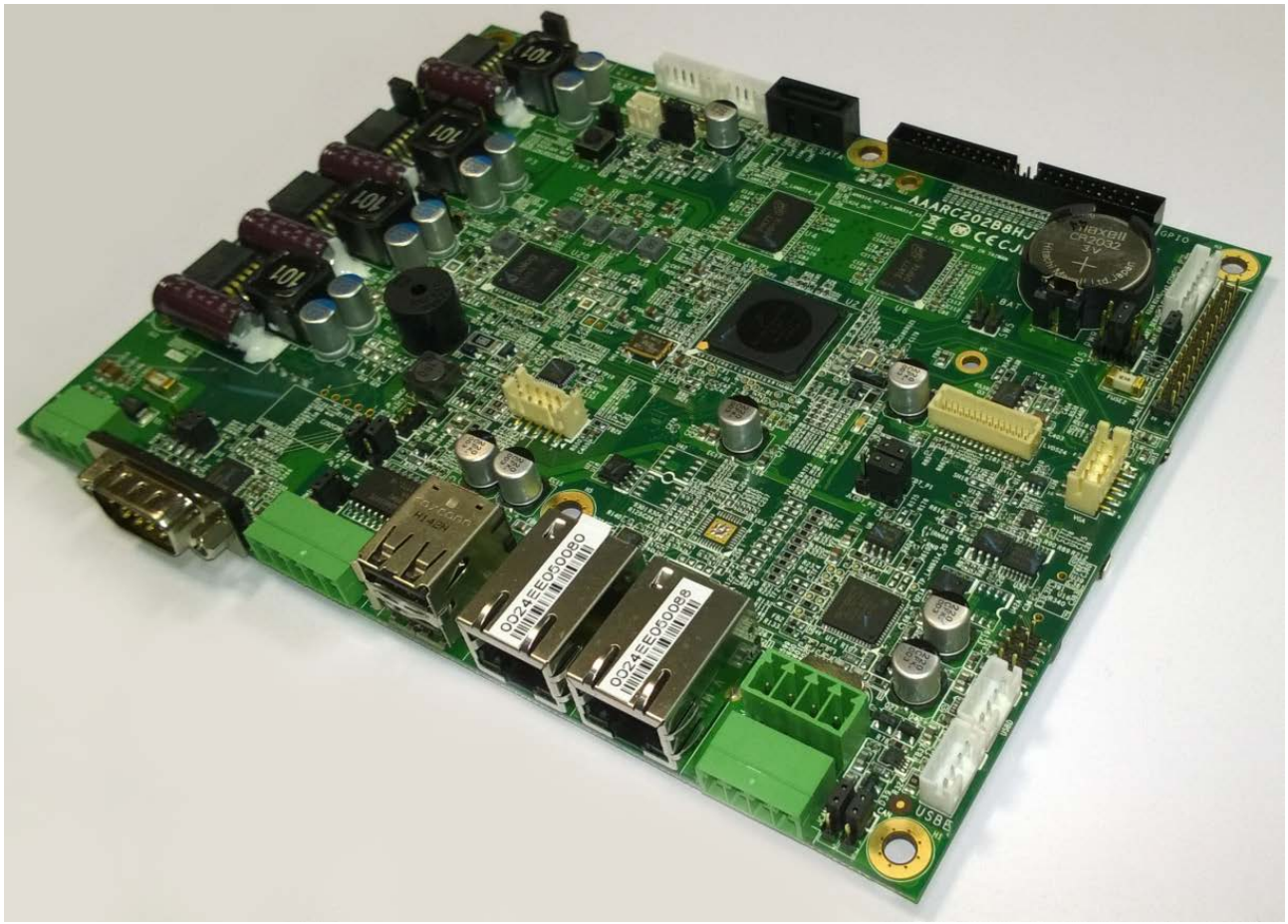
ARMFSC2

ARM CORTEX A8 CPU BOARD
w/Freescale i.MX53x



USER'S MANUAL

REV 2.0

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2 THE C2 CPU BOARD

2.1 Introduction

The C2 is a powerful and versatile ARM Freescale iMX536 CPU board. It has been designed and manufactured by CJB to provide a flexible computing core to be used for small to medium controllers.

A “Controller” is a system where CJB supplies the C2 together with an HMI unit (LCD + touch) and all the necessary software for the appliance’s process management:

http://www.cjb.it/en/products/powerplc/powerplcbridge

CJB also provides an extensive support for QT-Library (Embedded Linux) or .NET Compact Framework (CE7).

Usually the C2 drives a number of peripherals thanks to its versatile I/O features: Ethernet or serial COM port (RS485) for Modbus, and CAN for CANopen modules.
The board has also 25 onboard GPIOs (TTL level) which can be easily conditioned (externally) for local I/O management.

The wide power supply range (DC 12~36V [*]) and operating temperature (-20ºC ~ +70ºC) and the capability to drive LCD panels of any size up to Full-HD resolution make the C2 the most reliable and versatile choice for applications like:

- Professional food appliances (Ovens, Steam boilers, refrigerators, ice-cream, etc.)
- Vending machines (especially outdoor)
- Parking, ticketing machines (especially outdoor)
- Controllers for building & home automation
- Small & medium sized controllers

[*] some limitation of usage with some LCD panels may occur if the DC_IN is lower than 16Vdc

2.2 Features

The **C2** Freescale iMX53 CPU board has these features *(evidenced features in Italic style are not stuffed in the depopulated version)*:

- Freescale iMX536 (optional: i.MX535)
- 1GB RAM onboard
- 128kB SPI-RAM (static) for permanent storage of data with unlimited write cycles, with battery backup (uses the same battery which keeps the Real Time Clock running)
- UARTS:
  - 1 x RS485/RS-422 optically insulated
  - 1 x RS232 general purpose COM port, not insulated, selectable also as RS422/485
- 2 x USB ports with Type_A dual-stack connector 90º
- 2 x USB 4-pin headers for auxiliary functions (placed inside the pcba)
- 1 x USB OTG for debug purposes
- 2 x Ethernet 10/100 with RJ45 90º connector (*1 Ethernet port in the Depopulated version*)
- 1 x Micro-SD socket (µSD)
- 1 x SD socket
- 2 x LCD Interfaces:
  - 1 x TTL to support 40pin FPC connector for standard 7" 800x480 with LED backlight (with bonded touch 4W), for two standard versions of LCD panels
  - 1 x LVDS 2ch 24bit to support any kind of LCD panel, up to Full-HD
- *1 x VGA video port*
- 1 x 4W touch interface for the touch screen (resistive, 4W)
- 1 x optional 5W/8W resistive touch interface
- 1 x LED Backlight driver for the 7" LCD (which don't have onboard DCDC), with PWM dimming
- *1 x expansion connector for 3G module piggy-back micro board: this will support one 3G (4G) Mini-PCIe card socket and its USIM card socket*
- GPIO: 25 x TTL I/O software selectable as Inputs or Outputs
- 1 x 1-Wire interface (optional, for Dallas-type sensors)
- 1 x CANbus interface
- AUDIO interface:
  - 1 x stereo Line-Out connection
  - 1 x MIC in
  - 1 x stereo Line-In
- Power-Supply: 12~36Vdc wide range power supply with power for 7" LCD panels. *The Full-featured board can also provide 3.3Vdc or 5Vdc or 12Vdc for most common LCD panels, and also 5Vdc or 12Vdc for LED driver or CCFL inverter.*
- Dimensions: 170mm x 130mm
- Operating System: Embedded Linux, Windows CE7.0
- Certifications: CE. Verified for FCC-B.

The board is available in different versions: **ARM-C2-FULL** Full-Optional and **ARM-C2-DEP** depopulated with only one Ethernet port (instead of two) and limited LCD-Power interface onboard. This depopulated version is mainly designed to suit small 7" HMI controllers.

Following page shows the block schematic of the CPU board.

2.3 BLOCK SCHEMATIC

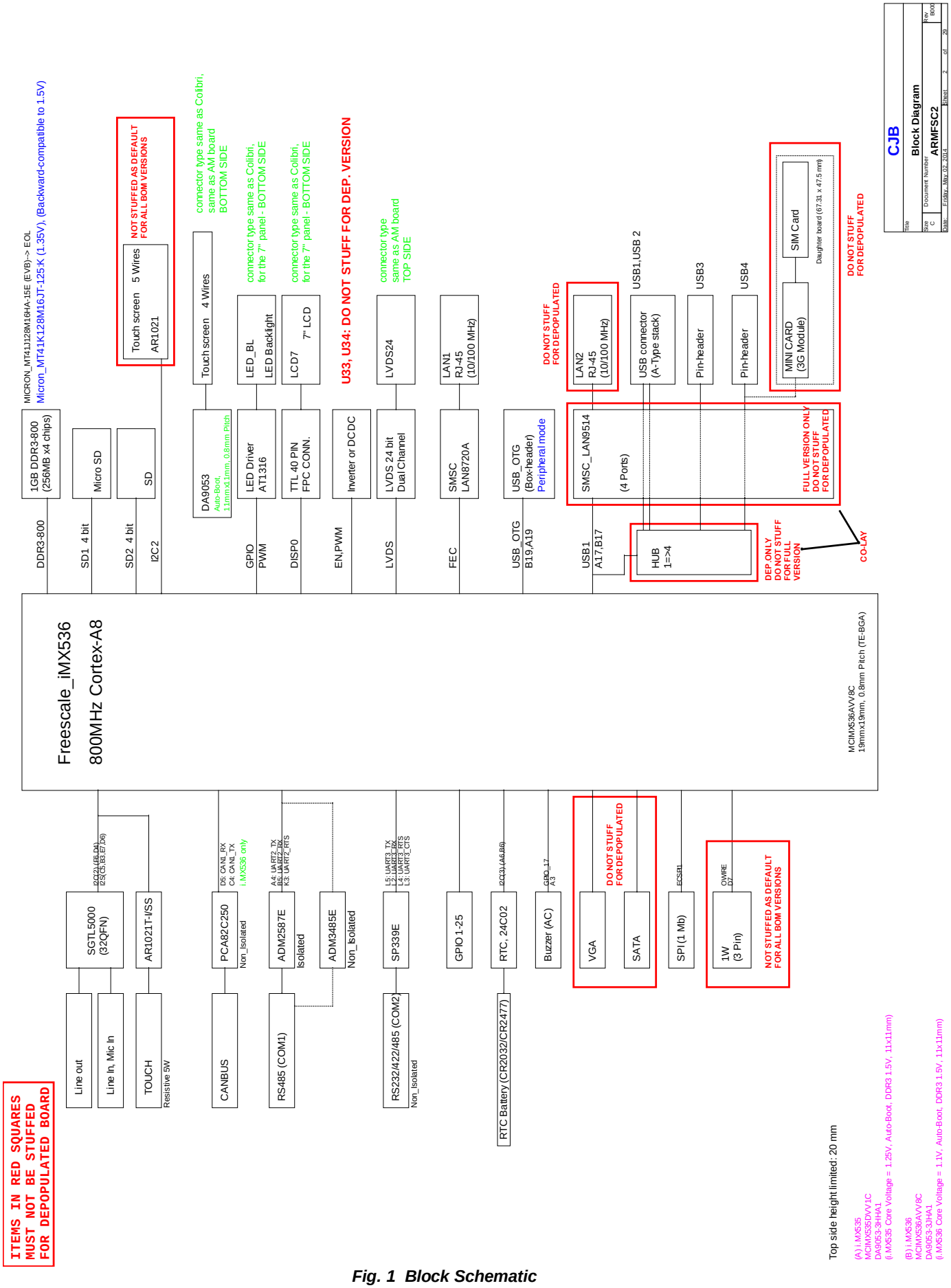


Fig. 1 Block Schematic

2.4 TOP SIDE VIEW

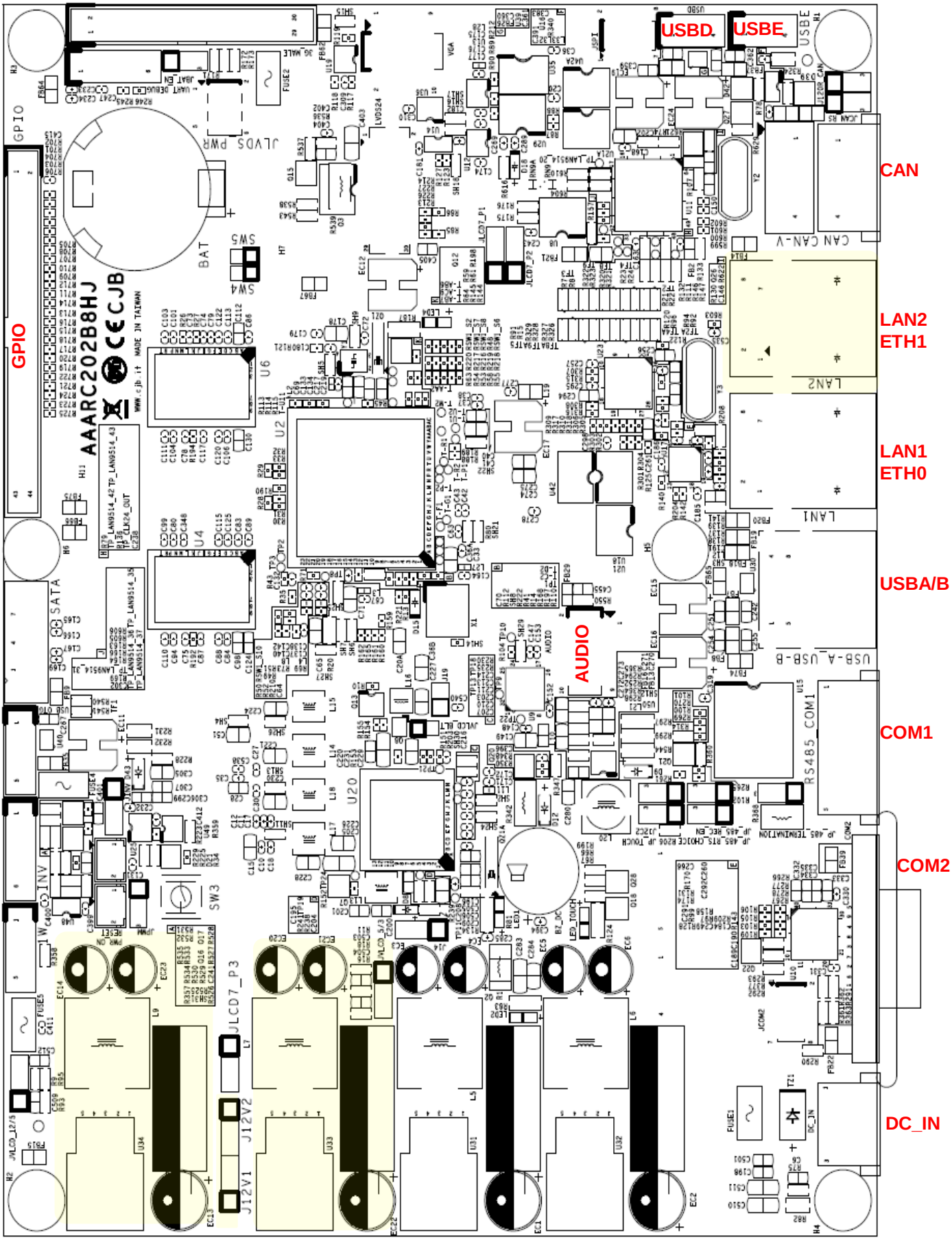


Fig. 2 Top Side view: shaded areas show features not stuffed in the depopulated version

2.5 BOTTOM SIDE VIEW

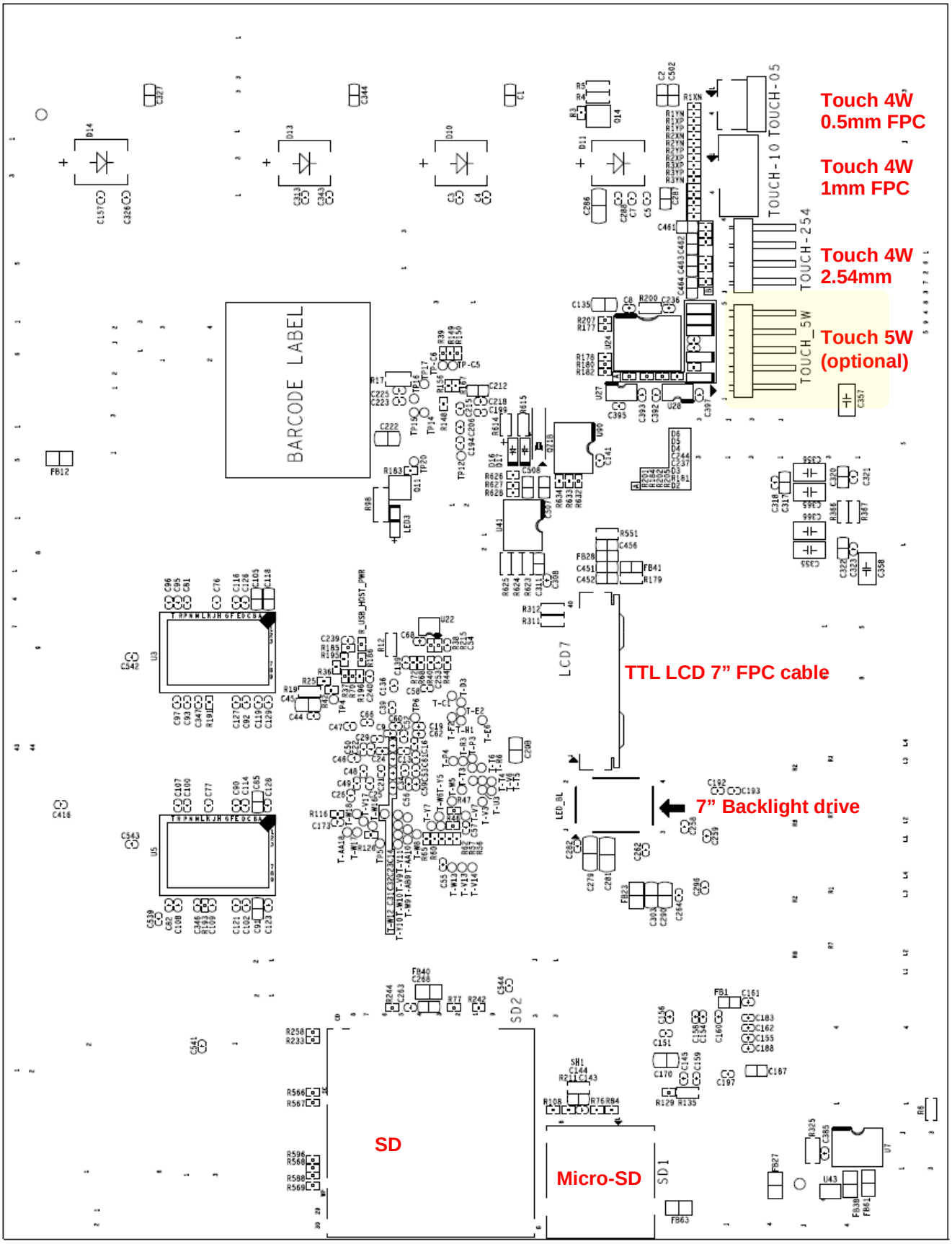


Fig. 3 Bottom Side view: shaded area shows items not stuffed because optional upon request.

2.6 OVERVIEW OF ONBOARD FEATURES

2.6.1 RS-485~422 ISOLATED COM1 PORT

The 1st UART (COM1) is RS485/RS422 selectable, and is the main peripheral interface port which will communicate (e.g.: by Modbus-RTU) with external peripherals. This is optically insulated to avoid communication troubles.

2.6.2 RS232/422/485 NON ISOLATED COM2 PORT

The 2nd UART (COM2) is RS232/485/RS422 selectable, and is the general purpose COM port interface. The choice (232/422/485) is made by simple jumper setting (JCOM2 pin header).

2.6.3 CANBUS INTERFACE

The board has a CANbus port, made from the native CANbus interface of the iMX536.

2.6.4 GPIOs

25 TTL (3.3V) GPIOs are wired to a 44-pin header connector, and can be used for an external I/O conditioning board (user's designed). All GPIOs come from direct GPIO ports of the iMX53x. Furthermore, another GPIO is used for Backlight control, and another one is used for the Buzzer.

2.6.5 LVDS General Purpose Port

The 24Bit 2-Chan LVDS port is provided to interface almost all kinds of commonly available LVDS panels.
It can handle up to 2-Channel 24Bits Full-HD.

2.6.6 TTL LCD Port

This 18Bit TTL LCD port is designed to make a snap connection through a 40pin FPC cable for standard 7" 800x480 LCD panels with LED backlight. A suitable LED driver for such panels is provided onboard or can be powered by 5Vdc (most new panels have embedded LED driver).

2.6.7 1-Wire INTERFACE (OPTIONAL)

This is a native interface of the iMX535, available to connect sensors like Dallas or like devices.

2.6.8 Ethernet Ports

There are two 10/100Mb Ethernet Ports (1 only for the depopulated version) available from RJ45 connectors.

2.6.9 Extensive Feature Selectable by Pin-Headers

A number of pin-headers allow easy selection of onboard features, to fit the needs of each application (panel power selection, backlight selection, COM port settings and so on).

2.6.10 Wide Range Power Supply

The board can be powered by 12~36Vdc wide range power supply.

3 JUMPER SETTINGS of the C2

This Chapter details all the onboard Jumpers of the C2 and their settings.

3.1 JUMPER TOPOLOGY of the C2 CPU Board (TOP)

Please always refer to the board TOP topology as from below drawing.

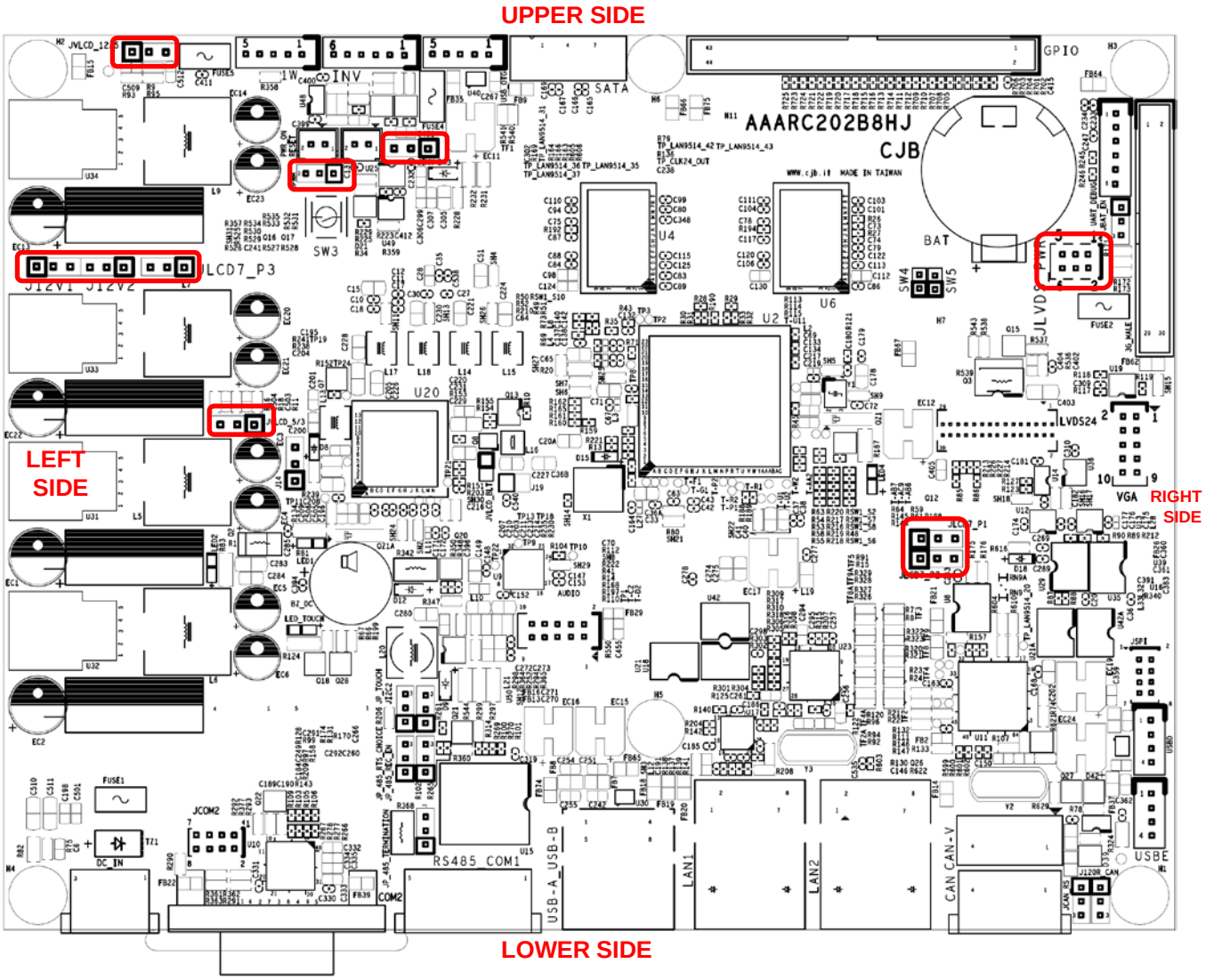


Fig. 4 Topology of the Board (TOP). Lower Side is the Connector Area.

3.2 JUMPER TOPOLOGY of the C2 CPU Board (BOTTOM)

There are no Jumpers on bottom side.

3.2.1 HOW TO RECOGNIZE PIN 1 (JUMPERS & CONNECTORS)

To recognize Pin 1 of Connectors & Jumpers, the rules are the following:

1) Pin 1 of Jumpers is evidenced by a **bold square** around
2) Pin 1 of Connectors is evidenced by a **bold marking** at side of Pin 1
3) Underneath (BOTTOM Side) Pin 1 has always a **square pad** (others have round pads)
4) In most cases, where there is room, pins are numbered.

Fig. 5 Examples of Silk-Screen figures to recognize Pin 1

3.3 POWER SELECTION JUMPERS

Before going to describe the jumper settings, it's very important to understand the POWER SCHEME of the C2, since there are many jumpers which can affect the behavior of the board, and their settings must be correct, otherwise the board can be damaged.

3.3.1 OVERVIEW OF POWER ROUTING JUMPERS

The image below shows the whole power distribution scheme for the C2 FULL version. Main DC power input is from DC_IN connector, which is protected by fuse and by a Varistor.
The board is NOT protected against polarity inversion.

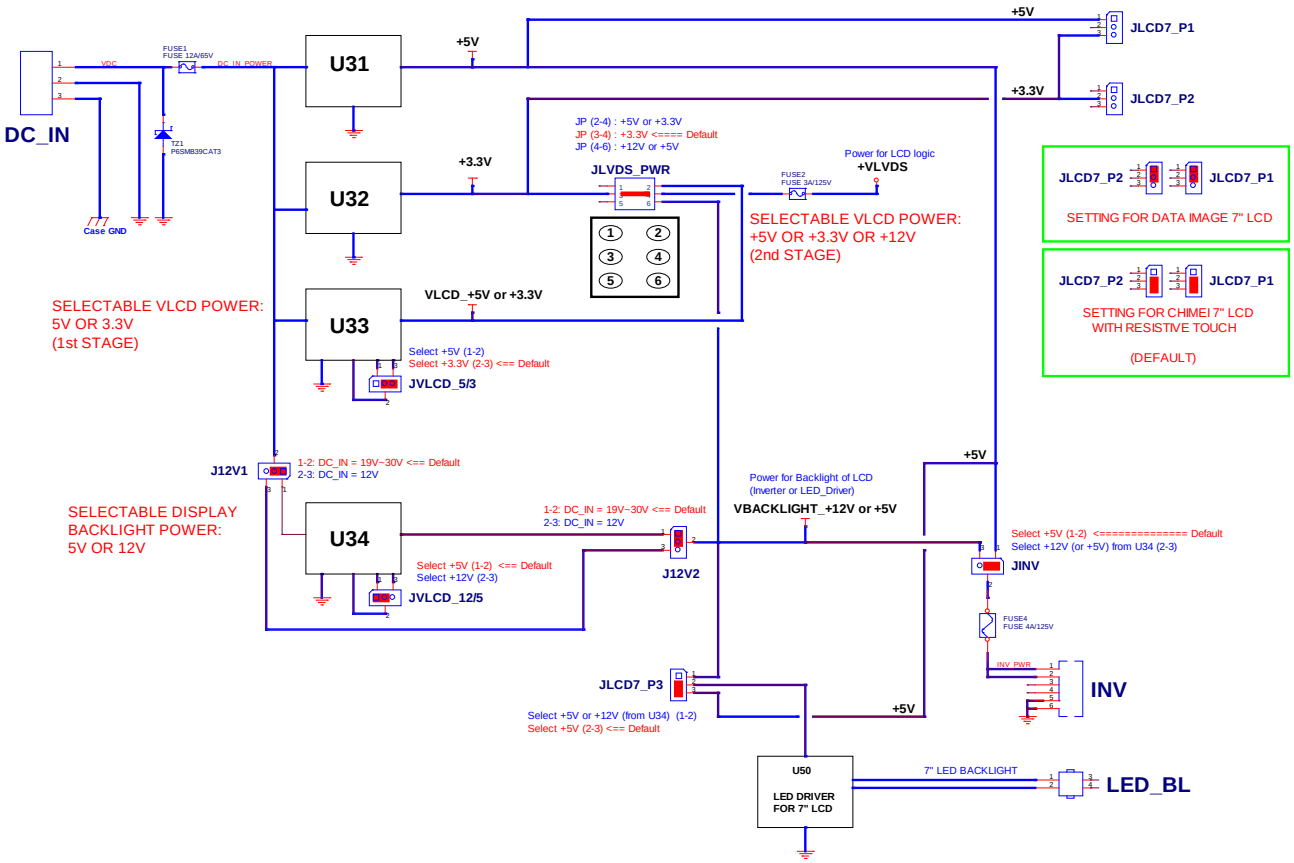


Fig. 6 Power Supply Routing Schematic and default jumper settings (whole board)

The DC_IN supply must be within 12 ~ 36Vdc range.
The first important fact is to know if the board is powered by 12Vdc or by a higher voltage:

- If DC_IN is 12Vdc (or anyway under 16Vdc), then it is **not possible** to use **U34** unless it's set to produce 5Vdc by JLVCD_12/5 (1-2)
- If DC_IN is over 16Vdc then it's possible to use **U34** for any setting of JVLCD_12/5.

U34 is the onboard DCDC to be used for the LCD backlight power of big panels (usually 8.4" and larger), which is typically 12Vdc. So you have also to know which LCD panel you are going to use. Every LCD panel usually needs two voltages:

1. The voltage for its electronics, which is typically 3.3Vdc (up to 15" panels), or 5Vdc (17" to 21"), and even 12Vdc (32"and over)
2. The voltage for the backlight: 5V typically for small panels, 12Vdc for all other panels up to 21", and 24Vdc for big panels (but in this case you will provide the backlight power directly, not through the C2 circuits, since the currents involved will be too high for the C2).

You will use the C2 FULL version for driving small and big panels, while the C2 Depopulated can be used only for small panels (typically: 7").

3.3.2 POWER SUPPLY ROUTING FOR THE FULL-FEATURED C2

The FULL version of the C2 CPU board has all the 4 onboard DCDC subsystems (U31, U32, U33 and U34). This version of the C2 has been designed to support small *and* big LCD panels, since U33 and U34 can supply the necessary power for both panel's electronics and panel's backlight.

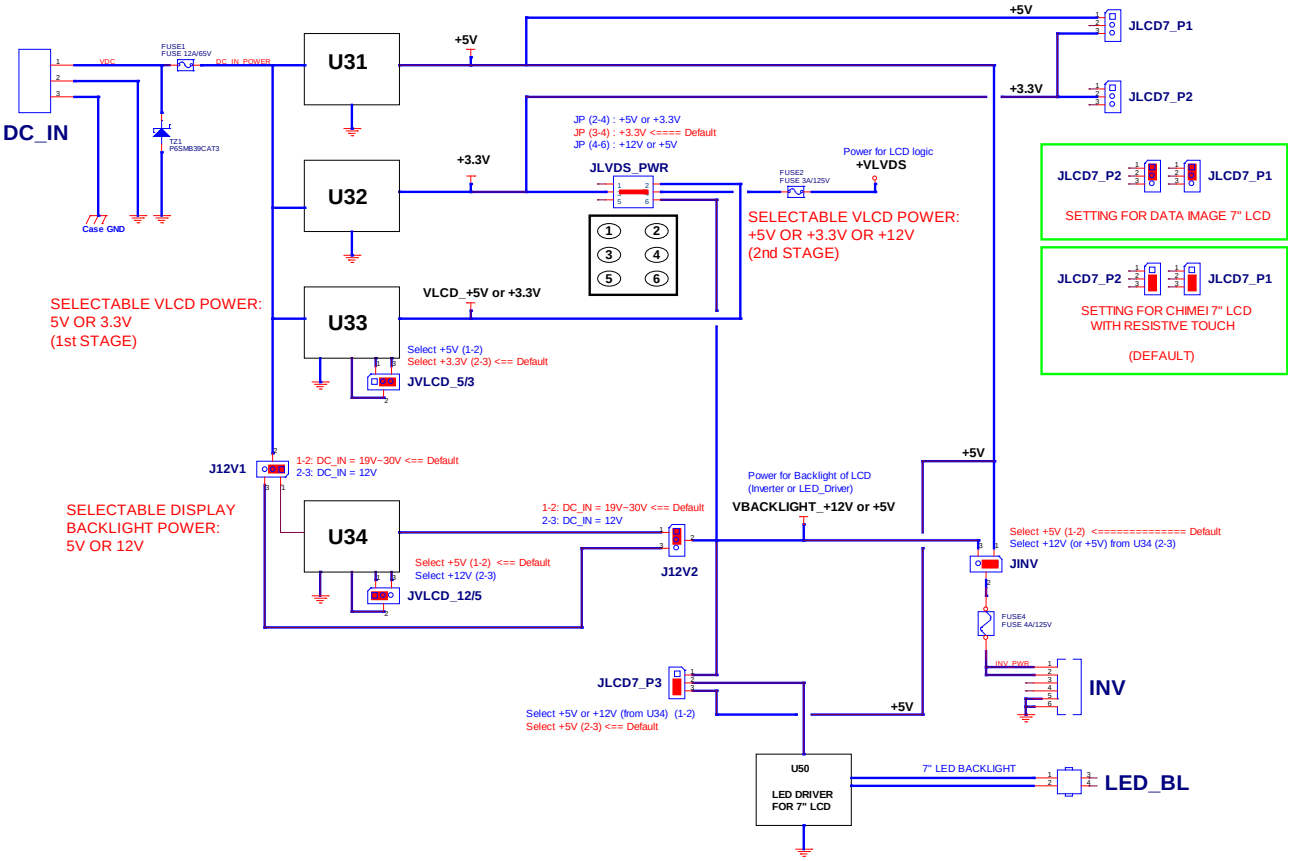


Fig. 7 Power Supply Routing Schematic of the C2 Full and default jumper settings

3.3.2.1 JVLCD_5/3 (C2 Full only)

Jumper **JVLCD_5/3** allows choosing the voltage for pin 2 of the 6-pin header called **JLVDS_PWR** where you can select the supply voltage for the LVDS LCD connected to the C2.

- Set **JVLCD_5/3** for **2-3** (default) if the LCD needs +3.3Vdc (e.g.: 8.4" or 10.4" or 12" or 15")
- Set **JVLCD_5/3** for **1-2** only if the LCD needs +5Vdc (e.g.: 17" or 19" or 21.5")

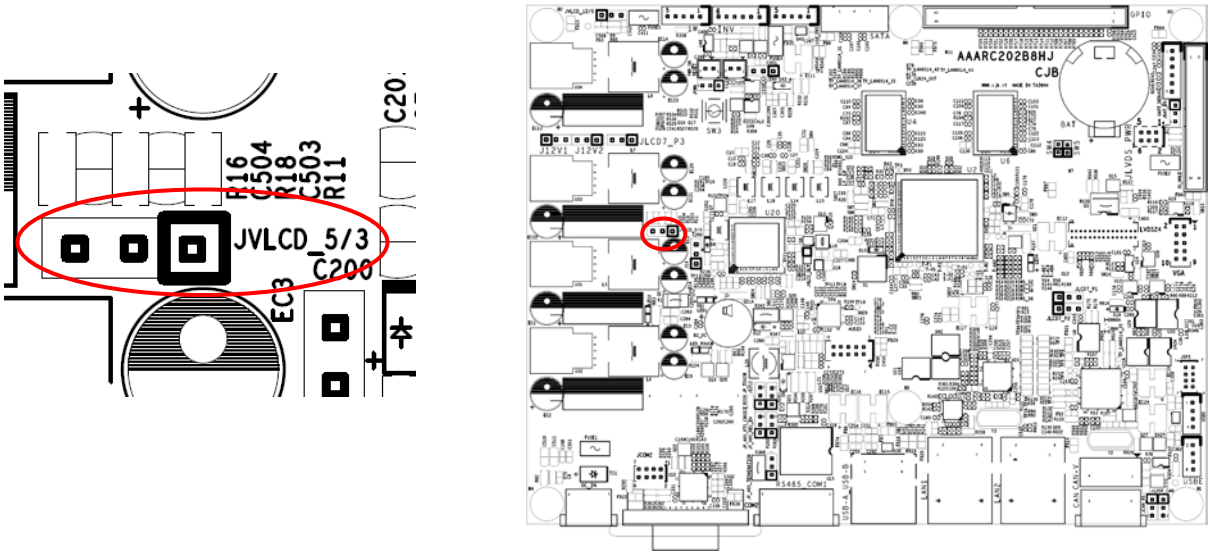


Fig. 8 JVLCD_5/3 (C2 Full only)

3.3.2.2 J12V1 and J12V2 (C2 Full only)

Jumpers **J12V1** and **J12V2** are used to bypass U34 when the C2 is powered by 12Vdc *and* the voltage for the LCD backlight needs 12Vdc.
If the LCD backlight needs 5Vdc then you can use U34, provided the **JVLCD_12/5** jumper is correctly set **1-2** (default).

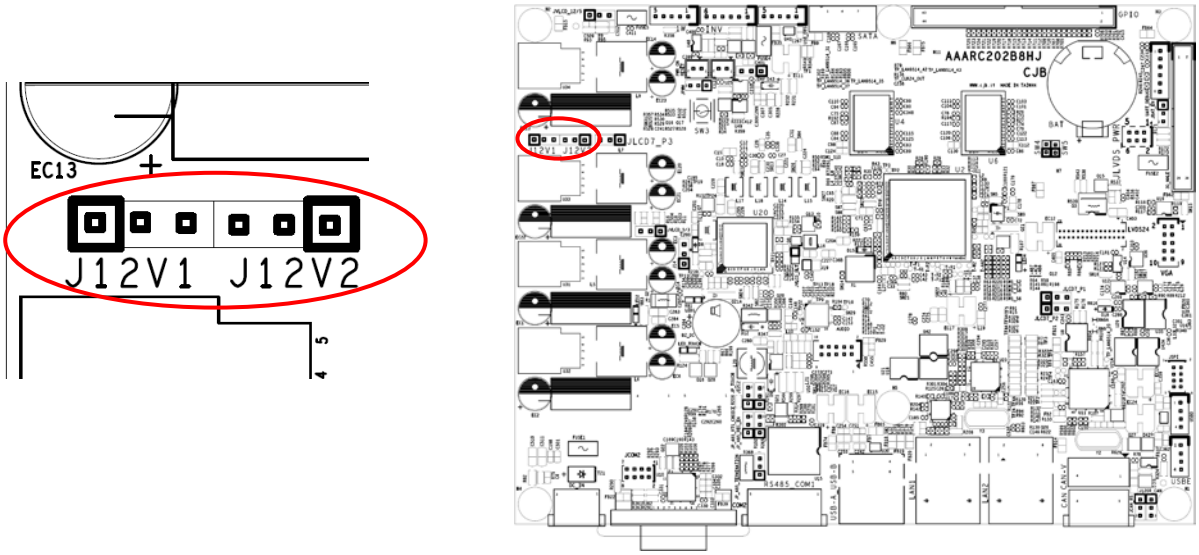


Fig. 9 J12V1 and J12V2 (C2 Full only)

- Set **J12V1** and **J12V2** both **2-3** if the C2 Full DC_IN is 12Vdc ***and*** backlight needs 12Vdc
- Set **J12V1** and **J12V2** both **1-2** if the C2 Full DC_IN is 12Vdc ***and*** the backlight needs 5Vdc ➔ then set **JVLCD_12/5** to **1-2**
- Set **J12V1** and **J12V2** both **1-2** if the C2 Full is powered by 16Vdc or more, ***and*** the backlight needs 12Vdc ➔ then set **JVLCD_12/5** to **2-3**
- Set **J12V1** and **J12V2** both **1-2** if the C2 Full is powered by 16Vdc or more, ***and*** the backlight needs 5Vdc ➔ then set **JVLCD_12/5** to **1-2**

The table here below shows the possible combinations.

J12V1	J12V2	JVLCD_12/5	DC_IN Power Supply	Effect
2-3	**2-3**	**Does not care, U34 bypassed**	+12Vdc	V-Backlight 12Vdc
1-2	**1-2**	**1-2**	+12Vdc	V-Backlight 5Vdc
1-2	**1-2**	**1-2**	> 16Vdc	V-Backlight 5Vdc
1-2	**1-2**	**2-3**	> 16Vdc	V-Backlight 12Vdc

Fig. 10 Allowed combinations for J12V1 and J12V2 (C2 Full only)

3.3.2.3 JLVDS_PWR (C2 Full only)

This is a 6-pin header which allows selecting the correct voltage for the LVDS LCD electronic. You can select the voltage to be +3.3Vdc, +5Vdc and +12Vdc. Refer to the LCD's datasheet.

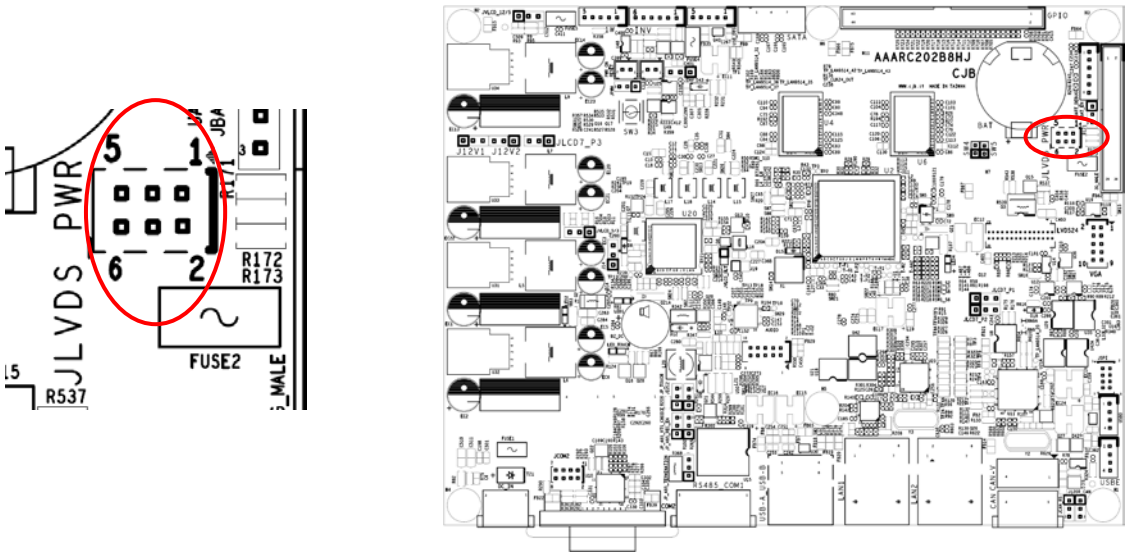


Fig. 11 JLVDS_PWR (C2 Full only)

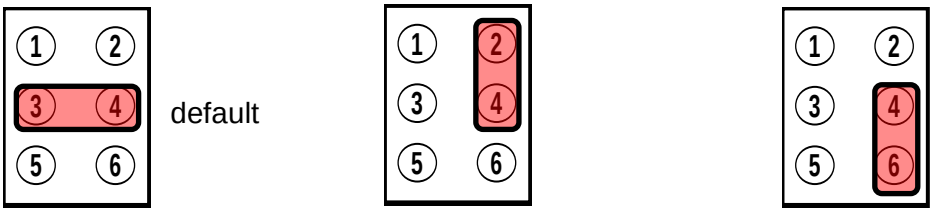


Fig. 12 JLVDS_PWR jumper pin assignment and the 3 possible settings

The connection of **JLVDS_PWR for the C2 Full version** is sensitive to the settings of jumpers **JVLCD_5/3**, **J12V1**, **J12V2** and **JVLCD_12/5**. The table here below shows the possible settings.

JLVDS_PWR	DC_IN Power Supply	J12V1	J12V2	JVLCD_12/5	JVLCD_5/3	Resulting LVDS LCD Power available from LVDS24 conn.
3-4 (default)	+12Vdc or higher	Does not care	Does not care	Does not care	Does not care	**3.3Vdc from U32** (use with small 3.3V LCD only)
2-4	+12Vdc or higher	Does not care	Does not care	Does not care	2-3 (default)	**3.3Vdc from U33** (use with bigger 3.3V LCD)
2-4	+12Vdc or higher	Does not care	Does not care	Does not care	1-2	**5Vdc from U33** (use with bigger 5V LCD)
4-6	+12Vdc	2-3	2-3	Does not care since U34 is bypassed	Does not care	**12Vdc same as DC_IN** (use with big LCD like 32") Make Sure 12Vdc DC_IN has enough current available
4-6	+12Vdc	1-2	1-2	1-2 (default)	Does not care	**5Vdc from U34** (use with bigger 5V LCD)
4-6	> 16Vdc	1-2	1-2	1-2 (default)	Does not care	**5Vdc from U34** (use with bigger 5V LCD)
4-6	> 16Vdc	1-2	1-2	2-3	Does not care	**12Vdc from U34** (use with big LCD like 32") Make Sure DC_IN has enough current

Fig. 13 Combinations allowed for Jumpers for LCD power (C2 Full only)

3.3.2.4 BACKLIGHT SELECTION (C2 Full only)

The last step is the choice of the supply for the LCD's backlight. The involved jumpers are **JINV** and **JLCD7_P3**.

The first simply selects between +5Vdc and the voltage which exits from **J12V2**: this voltage is then forwarded to the **INV** connector, where you will connect the LED driver or the CCFL inverter.

The second jumper does the same selection for the onboard LED driver which can be used for the LED backlight of small panels (like 7"). **Wrong setting of this jumper can create board's damage since its setting strictly depends on the setting of J12V1, J12V2 and JVLCD_12/5.**

3.3.2.5 JINV (C2 Full only)

This jumper will bring the backlight power to pins 1 and 2 of the **INV** connector. The LCD's LED Driver or CCFL Inverter will be connected to this **INV** connector. Table here below shows the allowed settings, since **JINV** strictly depends on the settings of **J12V1**, **J12V2** and **JVLCD_12/5**.

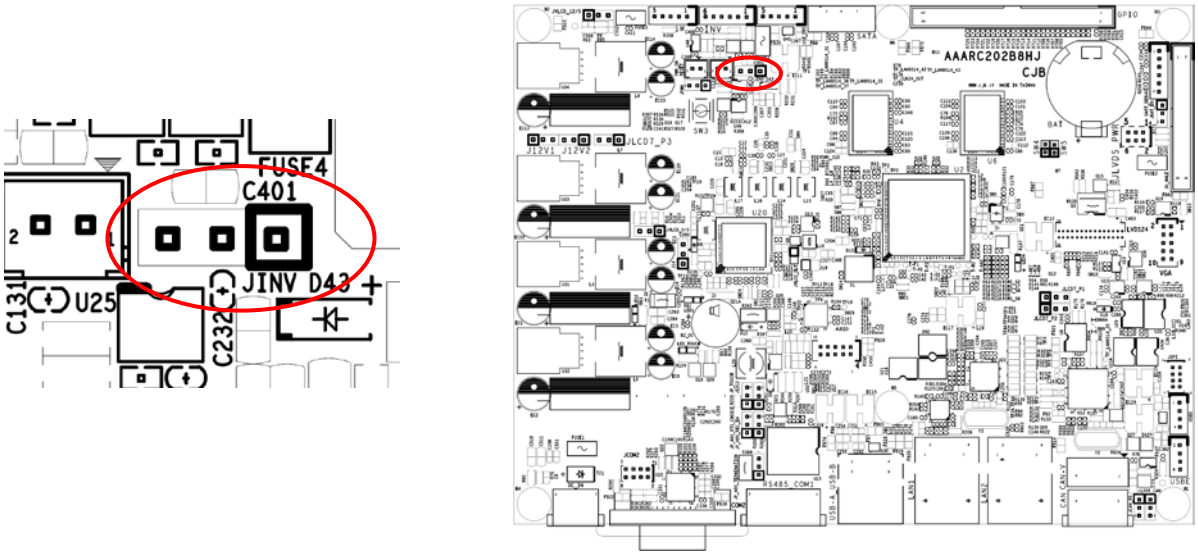


Fig. 14 JINV (C2 Full only)

JINV	DC_IN Power Supply	J12V1	J12V2	JVLCD_12/5	Available Backlight Power
1-2 (default)	Does not care	Does not care	Does not care	Does not care	**5Vdc from U31** (use with small LCD choice #1)
2-3	+12Vdc	2-3	2-3	Does not care since U34 is bypassed	**12Vdc from DC_IN** (use with bigger LCD) Make Sure 12Vdc DC_IN has enough current
2-3	+12Vdc	1-2	1-2	1-2 (default)	**5Vdc from U34** (use with small LCD choice #2)
2-3	> 16Vdc	1-2	1-2	1-2 (default)	**5Vdc from U34** (use with small LCD choice #2)
2-3	> 16Vdc	1-2	1-2	2-3	**12Vdc from U34** (use with bigger LCD) Make Sure DC_IN has enough current

Fig. 15 Combinations allowed for JINV jumper (C2 Full only)

3.3.2.6 JLCD7_P3 (C2 Full only)

This jumper's name reminds its usage is for 7" LCD panels only. Its setting selects the voltage for the onboard LED driver (U50) which is used to power the LED backlight of the 7" panels which don't have onboard LED driver.
The onboard LED driver of the C2 can only run from +5Vdc, otherwise U50 will burn. So it's mandatory that the **JLCD7_P3** setting never feeds 12Vdc (or higher voltage) to U50.

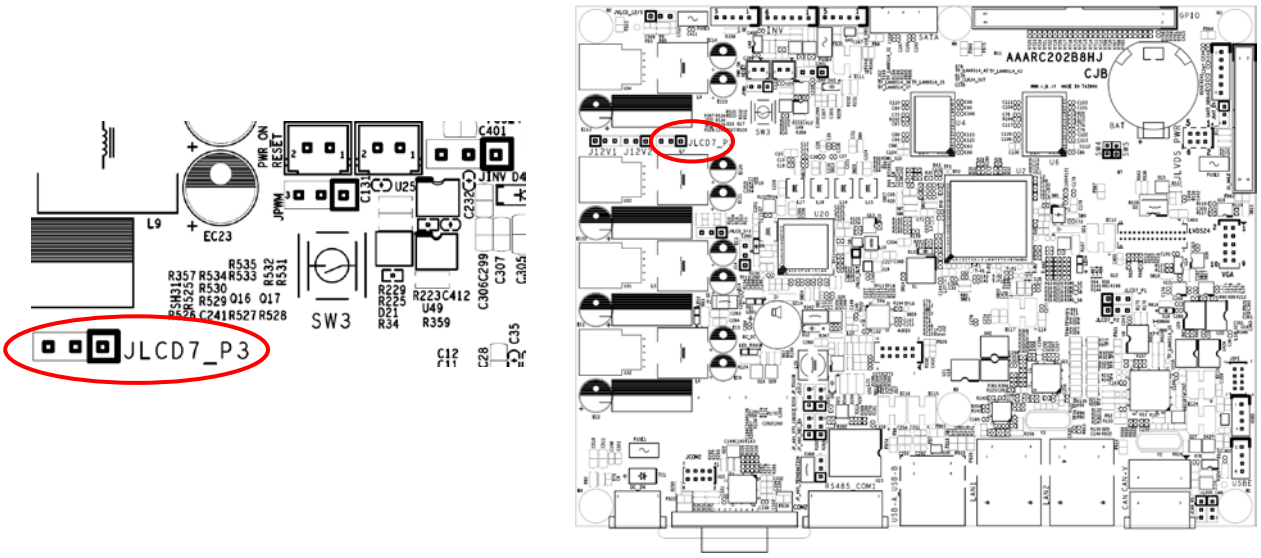


Fig. 16 JLCD7_P3 (C2 Full only)

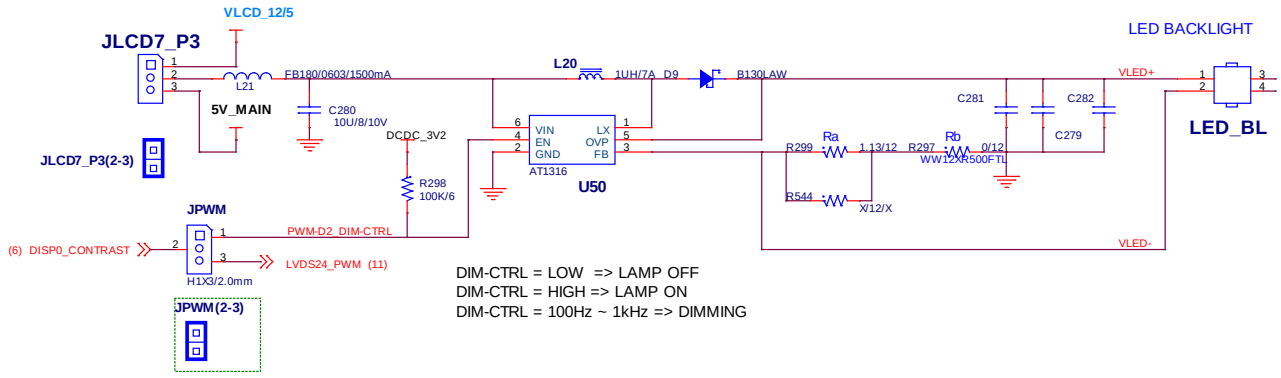


Fig. 17 Onboard LED Driver (for 7" small LCD panels)

JLCD7_P3	DC_IN Power Supply	J12V1	J12V2	JVLCD_12/5	Available Backlight Power
2-3 (default)	Does not care	Does not care	Does not care	Does not care	**5Vdc from U31** (use with small LCD choice #1)
1-2	+12Vdc	2-3	2-3	Does not care	**NOT ALLOWED**
1-2	+12Vdc	1-2	1-2	1-2 (default)	**5Vdc from U34** (use with small LCD choice #2)
1-2	> 16Vdc	1-2	1-2	1-2 (default)	**5Vdc from U34** (use with small LCD choice #2)
1-2	**> 16Vdc**	**1-2**	**1-2**	**2-3**	**NOT ALLOWED**

Fig. 18 Possible combinations for JLCD7_P3 jumper (C2 Full only)

3.3.2.7 JLCD7_P1 and JLCD7_P2 (C2 Full only)

These jumpers simply choose which TTL 7” LCD panel can be connected to the C2 (Full).

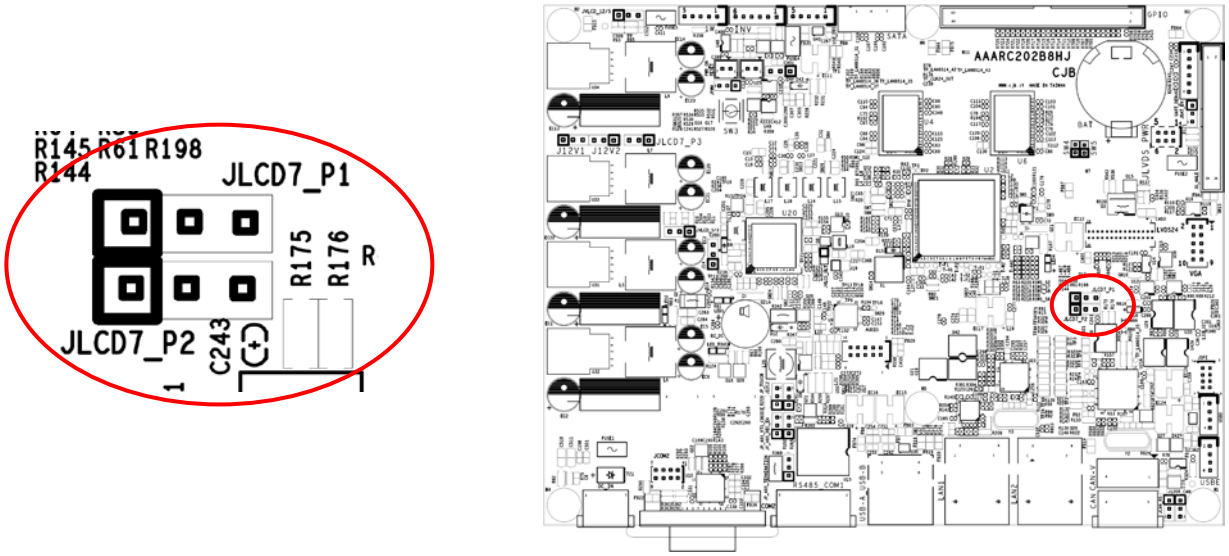


Fig. 19 JLCD7_P1 and JLCD7_P2 (C2 Full only)

The setting of these jumpers is not affected by the setting of any other jumpers described before. There are only two allowed settings:

JLCD7_P1 and JLCD7_P2	**Selected TTL 7” LCD Panel**
1-2 Both (default)	LCD with onboard LED driver which needs 5Vdc (like Data Image TTL 7” LCD)
2-3 Both	LCD without onboard LED driver (like Chimei TTL 7” LCD)

Fig. 20 Combinations for JLCD7_P1 and JLCD7_P2 jumpers (C2 Full only)

Usually, 7” TTL LCD panels which don’t have onboard LED driver are the cheapest ones and often they have bonded 4W resistive touch.

3.3.3 POWER SUPPLY ROUTING FOR DEPOPULATED C2

The DEPOPULATED version of the C2 CPU board has only 2 onboard DCDC subsystems (U31 and U32). This version of the C2 has been designed to support small LCD panels, typically just only 7" TTL panels (or also 7" LVDS), which power can be supplied by U31 and U32 with no problem of overload.

U33 and U34, and also J12V1, J12V2, JVLCD_12/5, JVLCD_5/3 are not stuffed.

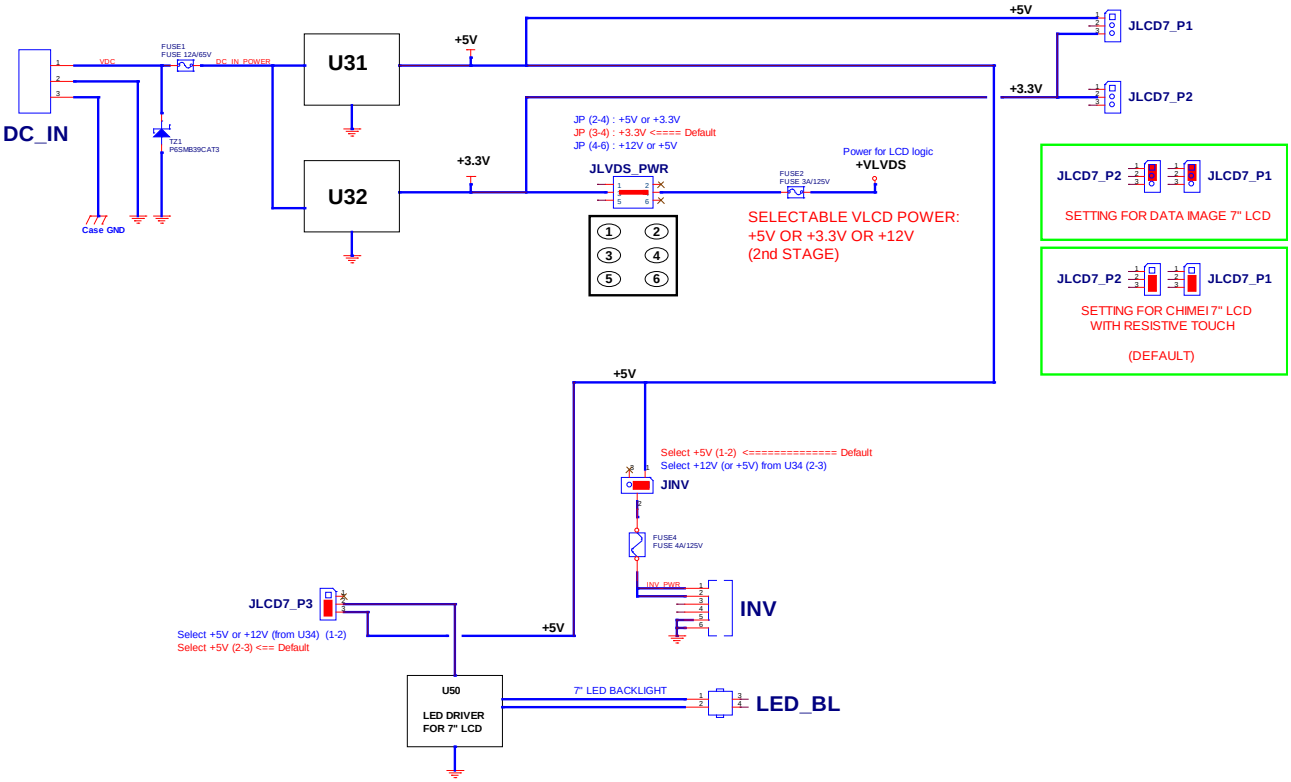


Fig. 21 Power Supply Routing Schematic of the Depopulated C2

Notice that JLCD7_P3 is 2-3 by default, but if removed or set 1-2 then U50 will not be driven. This can save onboard power and minimize emissions if you don't use the **LED_BL** connector.
JINV must be 1-2 and the only backlight power available from **INV** connector is +5Vdc.

Basically, the Depopulated C2 has been manufactured for small systems with 7" panels only.

3.3.3.1 JLVDS_PWR (DEPOPULATED C2 only)

This is a 6-pin header which allows selecting the correct voltage for the LVDS LCD electronic. You can **only** select +3.3Vdc. The default 2-3 setting is already what you need. It's only valid for small LVDS panels. The TTL interface is not affected by this jumper setting.

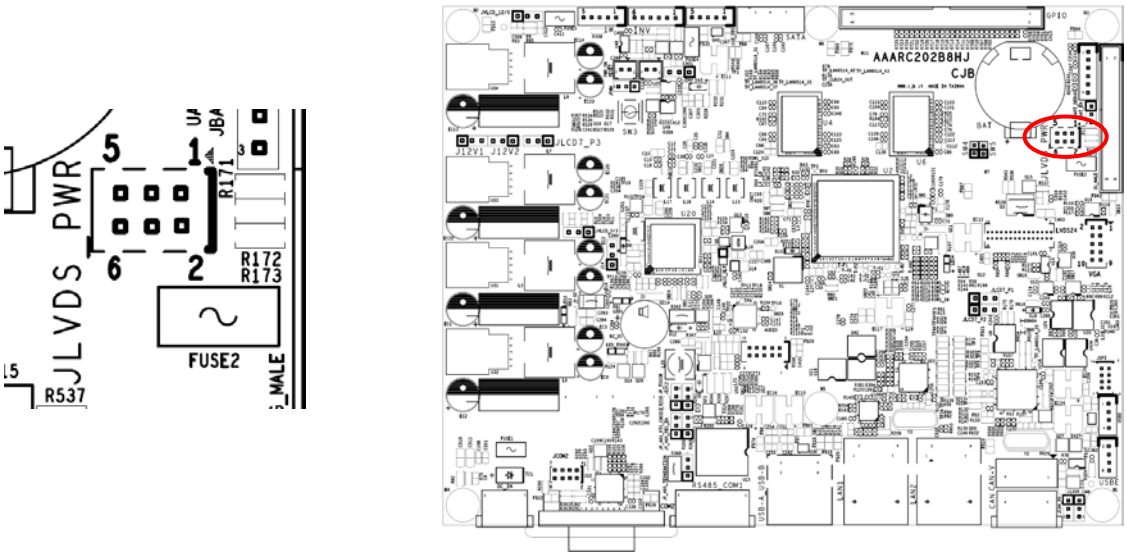
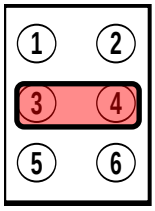


Fig. 22 JLVDS_PWR (Depopulated C2 only)



default

Fig. 23 JLVDS_PWR jumper pin assignment and the only setting (C2 Depopulated)

3.3.3.2 BACKLIGHT SELECTION (DEPOPULATED C2)

The choice of the supply for the LCD's backlight still involves jumpers **JINV** and **JLCD7_P3**.
The first simply selects the +5Vdc and forwards to the **INV** connector, where you will connect the LED driver or the CCFL inverter of the 7" panel.

The second jumper does the same selection for the onboard LED driver U50 which can be used for the LED backlight of 7" panels which don't have any LED driver onboard. The unique allowed setting is 1-2 (default), unless you don't want to power up U50. Next chapters will detail the settings.

3.3.3.3 JINV

This jumper will bring the backlight power to pins 1 and 2 of the **INV** connector. The LCD's LED Driver or CCFL Inverter will be connected to this **INV** connector. For 7" LCD panels, the INV connector is used mainly to supply the +5Vdc for LVDS version of the 7" LCD panels.
In fact, many 7" LCD panels which have onboard LED driver are TTL, and the onboard driver gets the +5V from the same 40 pin cable of the TTL signals.
If the 7" LCD is LVDS, the main cable from the LVDS connector of the C2 cannot give both voltages (3.3Vdc and 5Vdc) so you have to get the backlight voltage from the INV connector. And here pins 1 and 2 get the +5Vdc selected by JINV (set for 1-2).

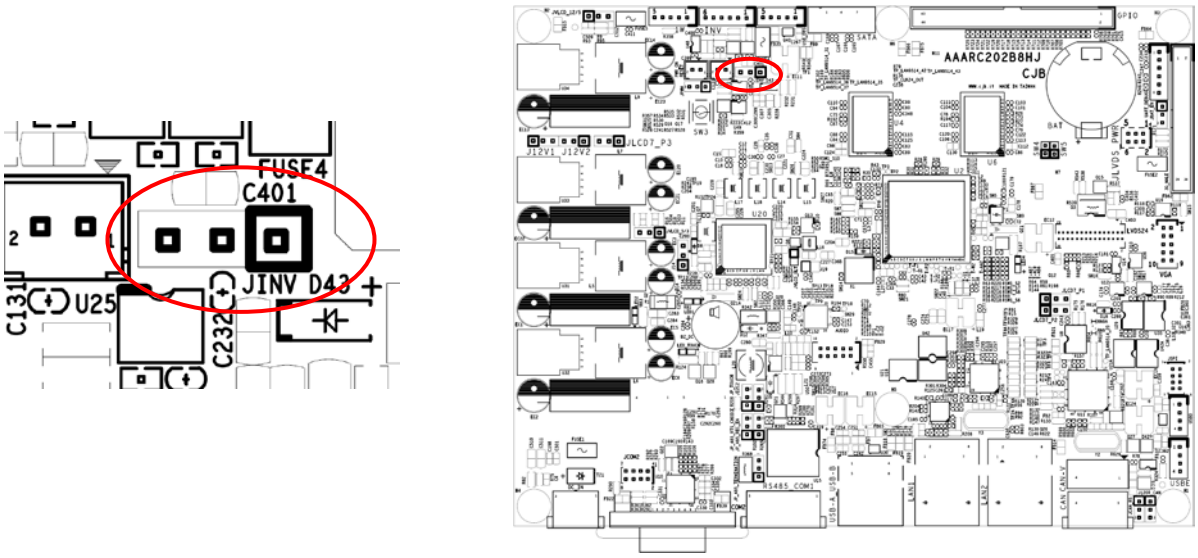


Fig. 24 JINV (Depopulated C2)

JINV	DC_IN Power Supply	J12V1	J12V2	JVLCD_12/5	Available Backlight Power to INV connector
1-2 (default)	Does not care	Does not care	Does not care	Does not care	**5Vdc from U31** (use with small LCD)
OPEN	Does not care	Does not care	Does not care	Does not care	**No power to INV connector**

Fig. 25 Unique combination allowed for JINV jumper (Depopulated C2)

3.3.3.4 JLCD7_P3

This jumper's name reminds its usage is for 7" LCD panels only. Its setting selects the voltage for the onboard LED driver (U50) which is used to power the LED backlight of the 7" LCD panels which don't have onboard LED driver.

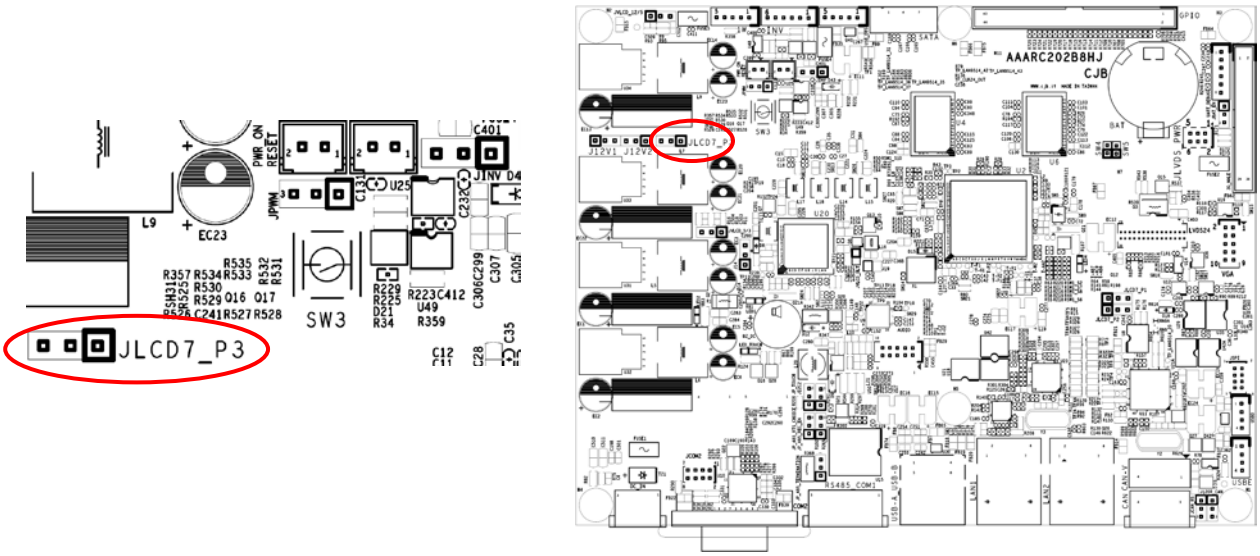


Fig. 26 JLCD7_P3 (Depopulated C2)

The onboard LED driver of the C2 can only run from +5Vdc. The **JLCD7_P3** setting can be only 2-3. If **JLCD7_P3** is set 1-2 in the Depopulated C2, the onboard LED driver U50 will not be active.

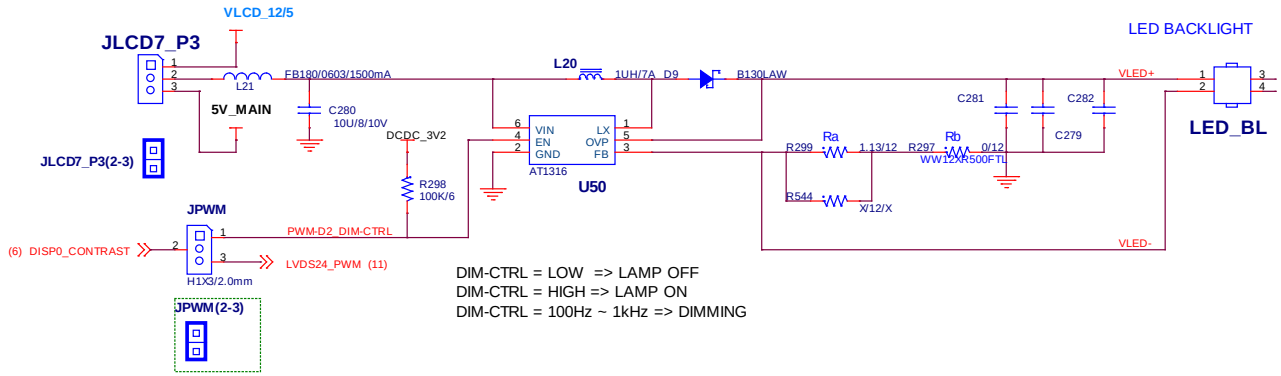


Fig. 27 Onboard LED Driver (for 7" small LCD panels)

JLCD7_P3	Available Backlight Power
2-3	**5Vdc from U31** (use with small LCD choice #1)
OPEN	**Onboard LED Driver (U50) is disabled** (remove cap from Jumper JLCD7_P3 if using LVDS 7" LCD panel)

Fig. 28 Combinations permitted for JLCD7_P3 jumper (Depopulated C2)

3.3.3.5 JLCD7_P1 and JLCD7_P2

These jumpers simply choose which TTL 7” LCD panel can be connected to the C2 (Depopulated).

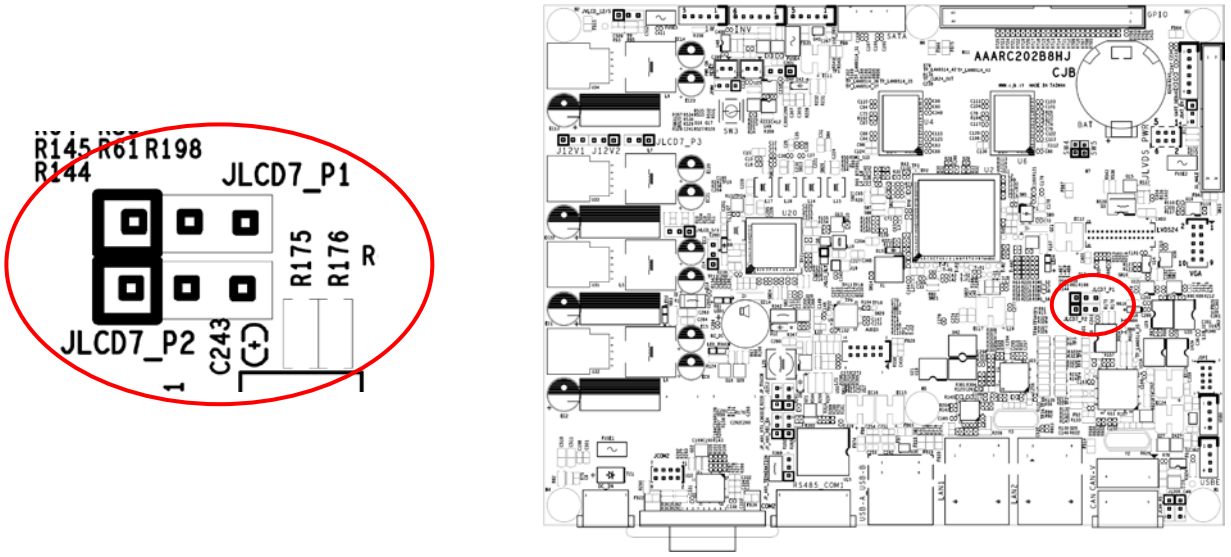


Fig. 29 JLCD7_P1 and JLCD7_P2 (C2 Full)

The setting of these jumpers is not affected by the setting of any other jumpers described before. There are only two allowed settings:

JLCD7_P1 and JLCD7_P2	Selected TTL 7” LCD Panel
1-2 Both (default)	LCD with onboard LED driver which needs 5Vdc (like Data Image TTL 7” LCD)
2-3 Both	LCD without onboard LED driver (like ChiMei TTL 7” LCD)

Fig. 30 Combinations for JLCD7_P1 and JLCD7_P2 jumpers (Depopulated C2)

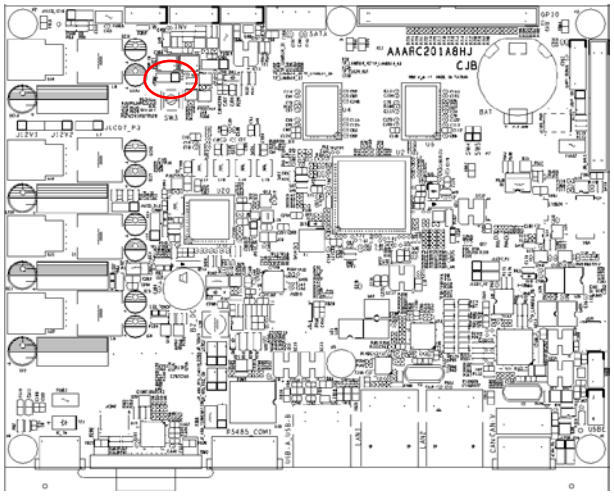
Usually, 7” TTL LCD panels which don’t have onboard LED driver are the cheapest ones and often they have bonded 4W resistive touch.

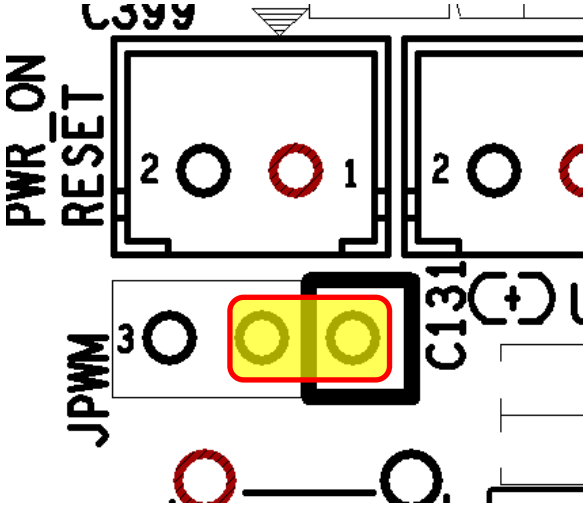
3.4 OTHER JUMPERS (Full & Depopulated C2)

There are other jumpers on the C2, which will be described here below. **The jumper setting is valid for both the FULL version and the DEPOPULATED version. The images here below show the Default Setting of each Jumper.**

3.4.1 JPWM

Default 1-2 **➔ GPIO_1 (PIN B7 uP) controls the Backlight of TTL LCD**

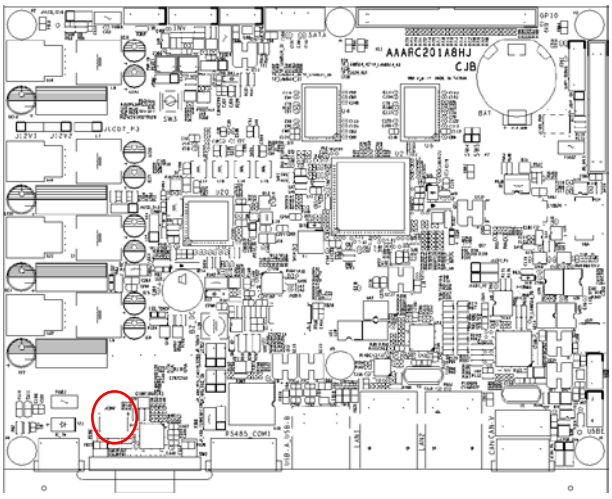


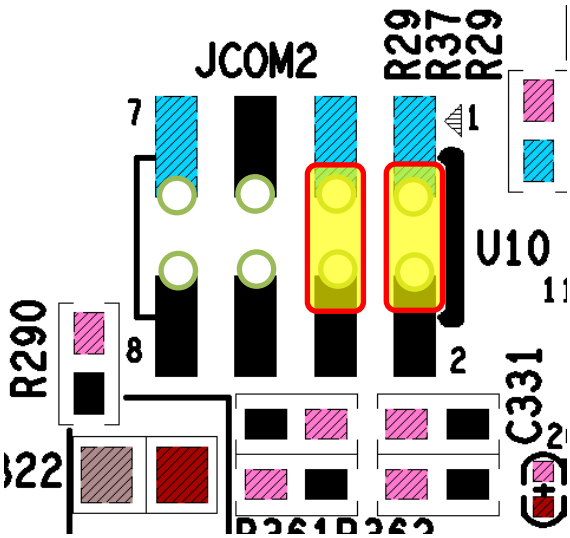


If **JPWM** is set 1-2 then GPIO_1 (pin B7 of iMX53) can control the brightness of the TTL 7" panel (both LCD models: with onboard and without onboard LED driver).
If **JPWM** is set 2-3 then GPIO_1 (pin B7 of iMX53) will be connected to the **INV** connector (pin 4).
If **JPWM** is OPEN, brightness control will be always pulled up to Vcc, hence set to maximum (see also the requirements of the CCFL Inverter or LED-Driver, since some CCFL inverters give max brightness when this signal is close to GND and not to Vcc).

3.4.2 JCOM2

Default 1-2 and 3-4 **Set COM2 for RS422**





This header allows selecting the behavior of the COM2 serial port. See the relevant chapter.

3.4.3 JP_485_REC_EN

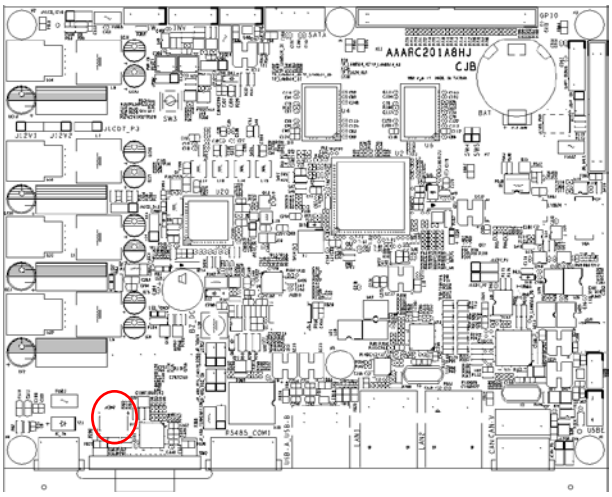
Default 2-3 (RECEIVER ALWAYS ENABLED)

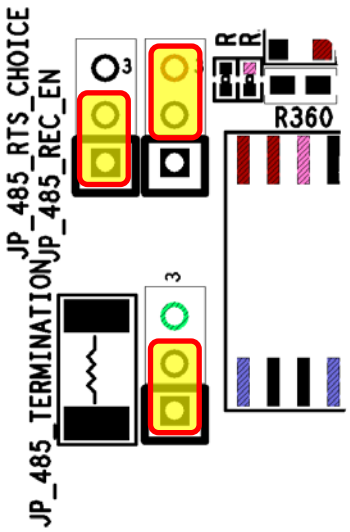
3.4.4 JP_485_TERMINATION

Default 1-2 (RS485 LINE TERMINATED)

3.4.5 JP_485_RTS_CHOICE

Default 1-2 (INVERTED RTS TO CHIP)





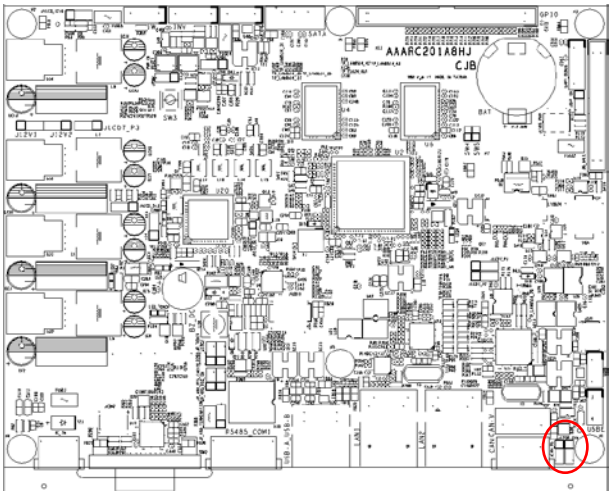
These three jumpers set the behavior of the COM1 serial port interface. See the relevant chapter.

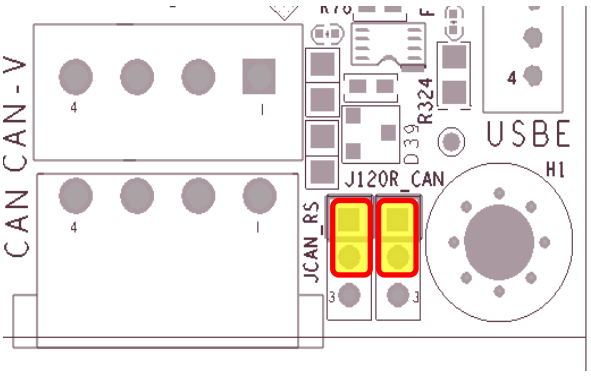
3.4.6 JCAN_RS

Default 1-2 CAN Slew Rate limited to 500kb/s

3.4.7 J120R_CAN

Default 1-2 CAN Line Termination Enabled

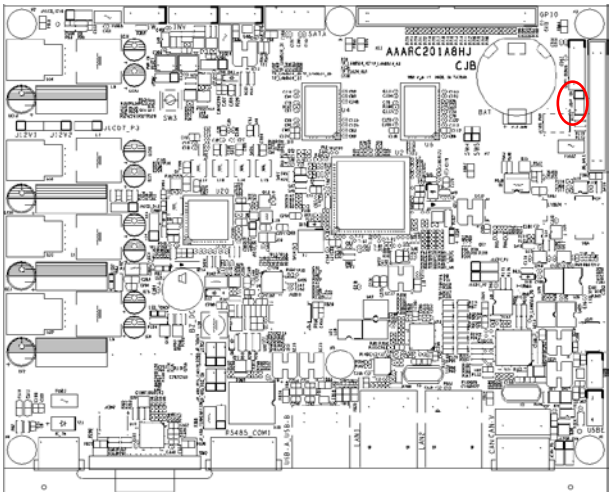


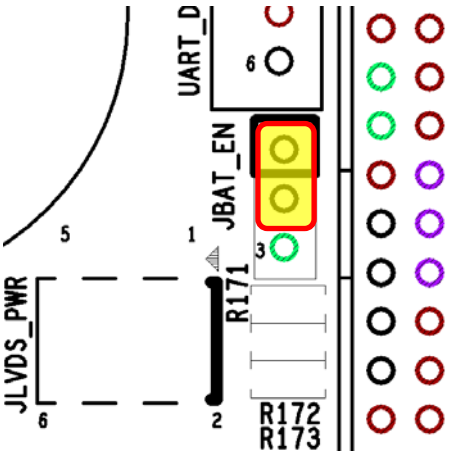


These two jumpers set the behavior of the CANbus interface. See the relevant chapter.

3.4.8 JBAT_EN

Default 2-3 (battery off)





This jumper connects/disconnects the onboard 3V coin battery.

Image shows the in-usage position. Restore to parking position (2-3) if the board is in the shelf or not used for a long period.

4 CONNECTORS

4.1 CONNECTOR TOPOLOGY of the C2 CPU Board (TOP)

Please always refer to the board TOP topology as from below drawing.

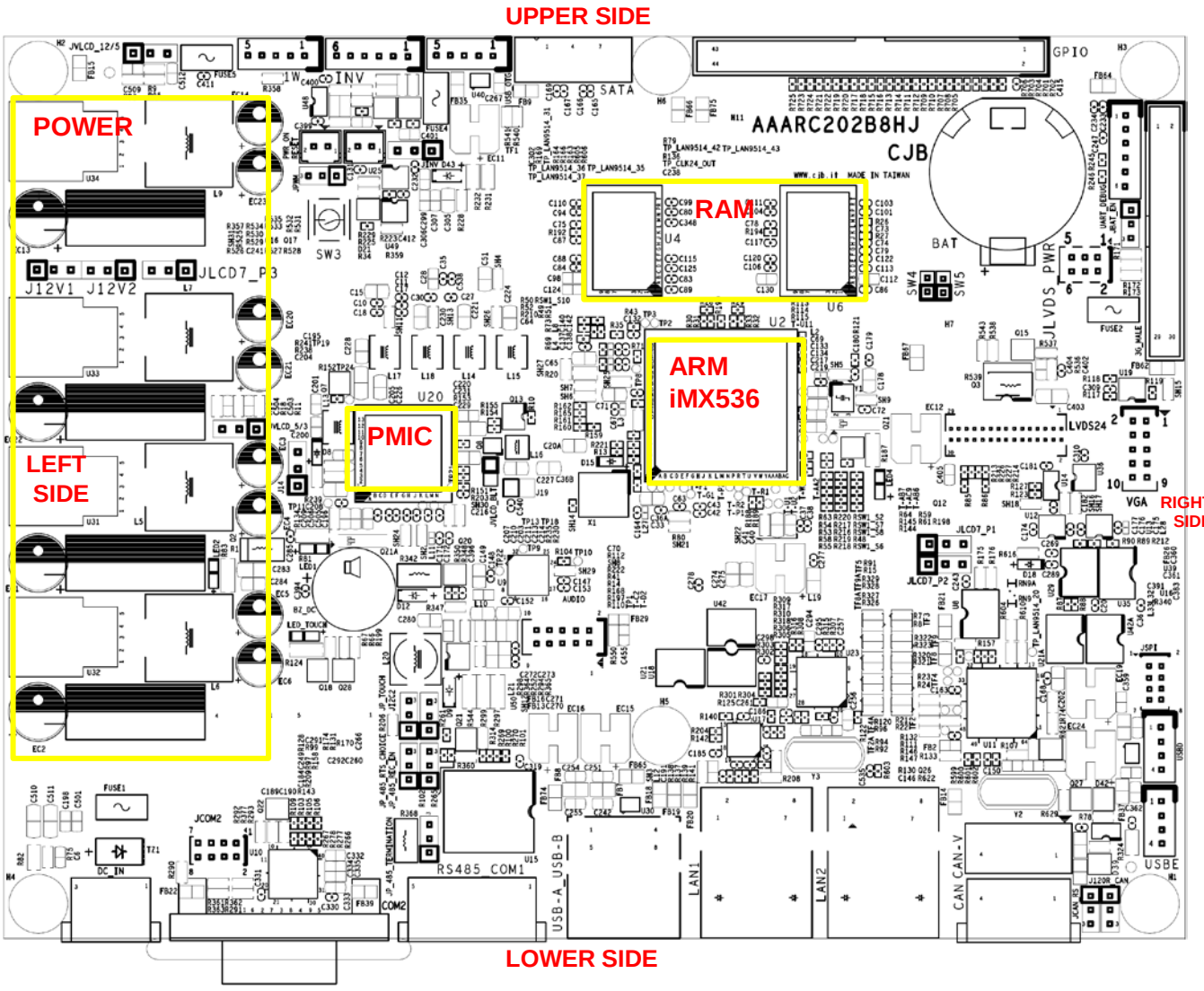


Fig. 31 Topology of the Board (TOP). Lower Side is the Connector Area.

4.2 TOPOLOGY of the C2 CPU Board (BOTTOM)

Please always refer to the board BOTTOM topology as from below drawing. Since we're looking at the board from bottom side, LEFT and RIGHT sides are reversed.

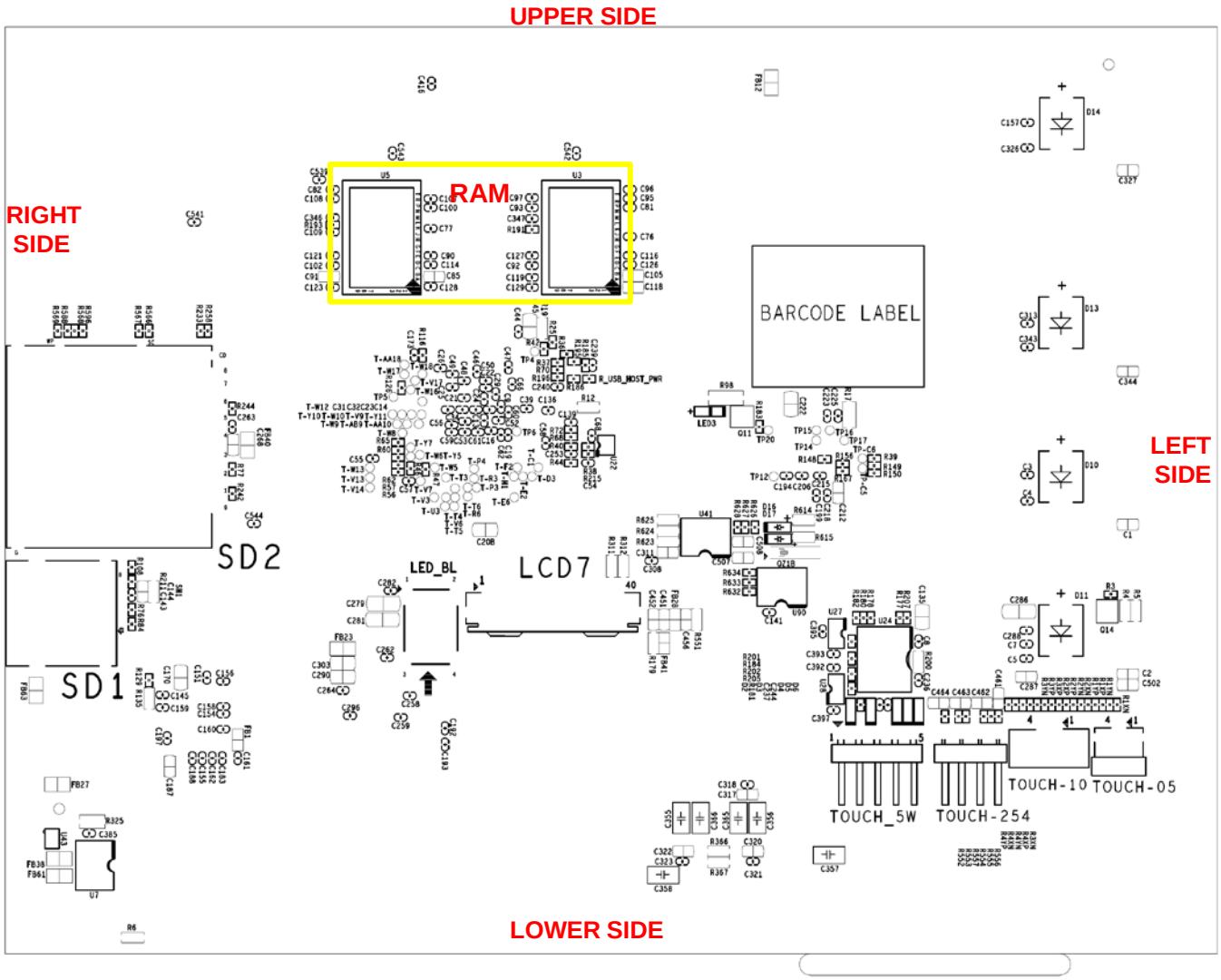


Fig. 32 Topology of the Board (BOTTOM). Lower Side is the Connector Area.

4.2.1 HOW TO RECOGNIZE PIN 1 (CONNECTORS & JUMPERS)

To recognize Pin 1 of Connectors & Jumpers, the rules are the following:

5) Pin 1 of Jumpers is evidenced by a **bold square** around
6) Pin 1 of Connectors is evidenced by a **bold marking** at side of Pin 1
7) Underneath (BOTTOM Side) Pin 1 has always a **square pad** (others have round pads)
8) In most cases, where there is room, pins are numbered.

Fig. 33 Examples of Silk-Screen figures to recognize Pin 1

4.3 DC_IN POWER SUPPLY CONNECTOR

The DC_IN connector is placed near the Lower Left corner.

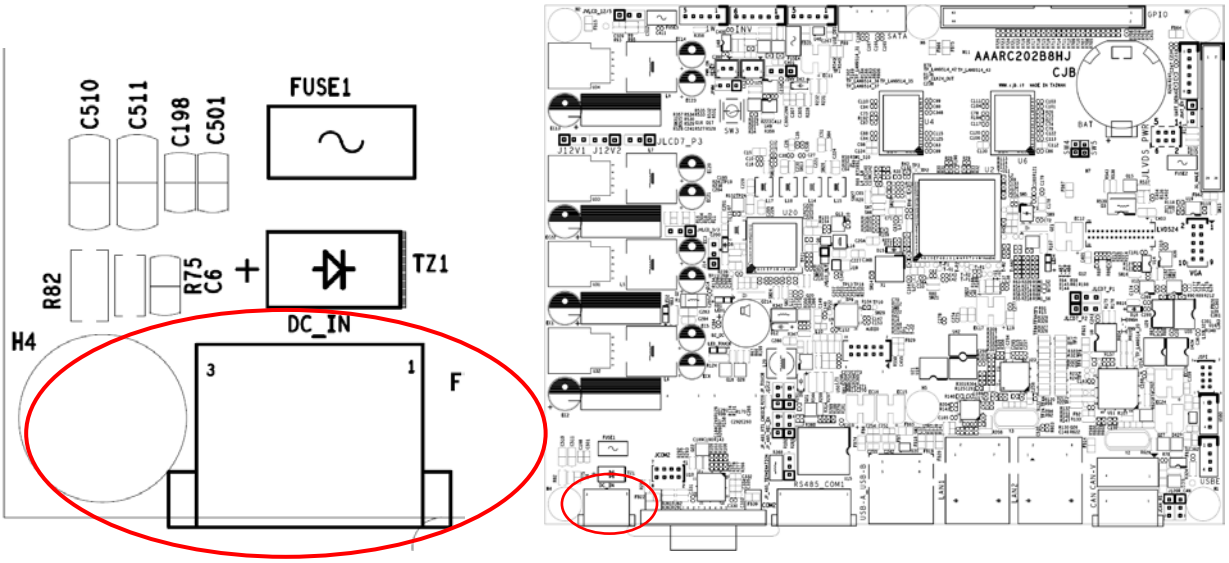


Fig. 34 Power Supply Connector: DC_IN

Pin assignment is **from right to left** (looking from front):

1 = +12Vdc~36Vdc
2 = GND
3 = Frame Ground

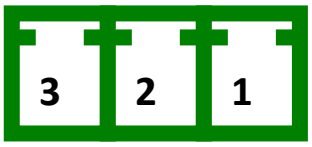


Fig. 35 DC_IN Connector: pin assignment

This is the schematic portion. Notice the soldered fuse (Fuse 1) near the connector.

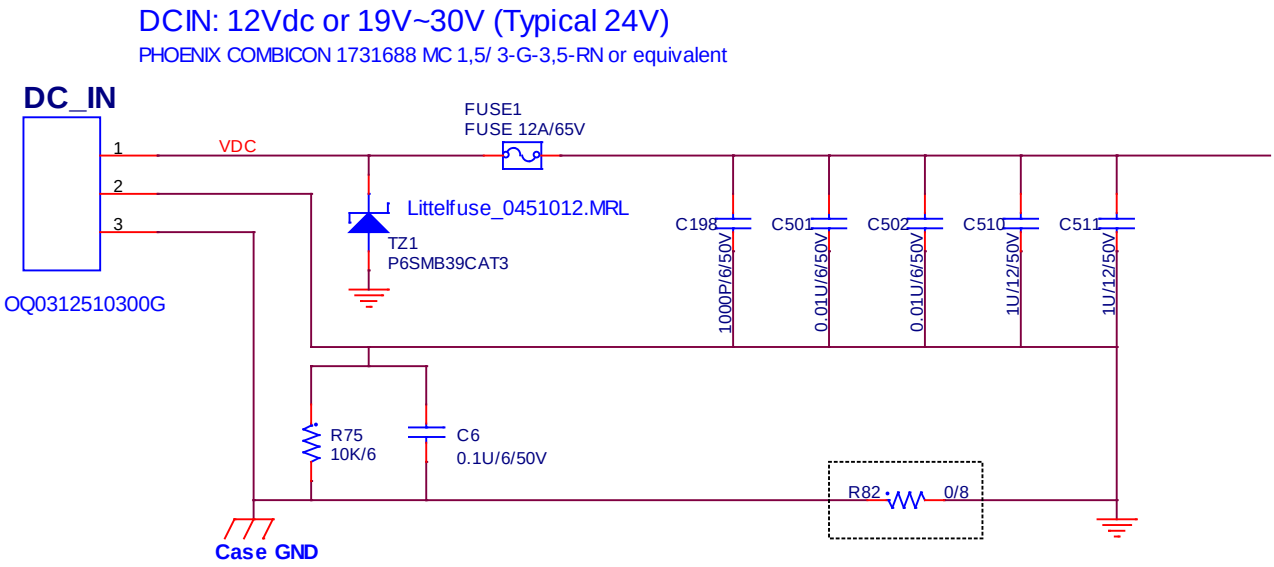


Fig. 36 Schematic of DC_IN circuitry

Be careful to avoid any DC_IN polarity inversion.
R82 normally keeps Case_GND and GND connected together.

4.4 COM2 DSUB9M SERIAL PORT (RS232/422/485) CONNECTOR

This is placed at right of DC_IN connector, lower left edge of the board.

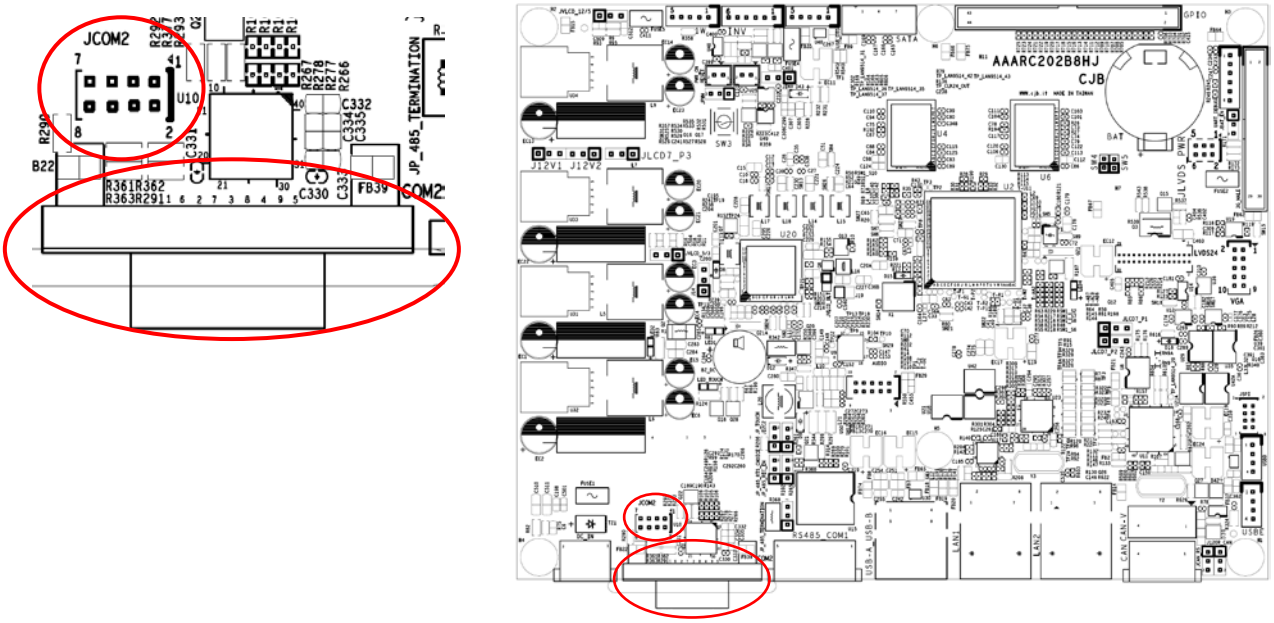


Fig. 37 The COM2 Connector. Notice the JCOM2 pin-header

Pin assignment is defined here below:

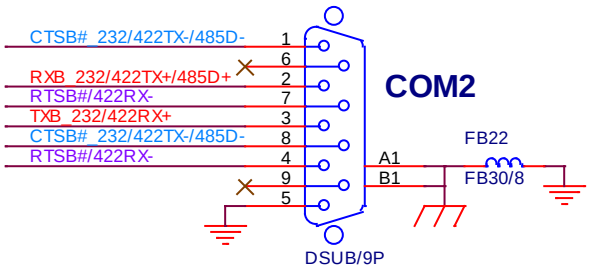


Fig. 38 Signals of the COM2 Connector

Pin function depends on jumper setting of the U10 (SP339E) interface chipset. This one gets the rough signals directly from the ARM iMX53x processor (UART3 port).

U10 allows choosing between RS232 or RS485 or RS422 according to **JCOM2** pin-header.

See next page for Jumper settings for: SLEW, TERM, MODE0 and MODE1.

4.4.1 COM2 JUMPER SETTINGS: the JCOM2 pin header

These jumpers are just above the DSUB9M connectors:

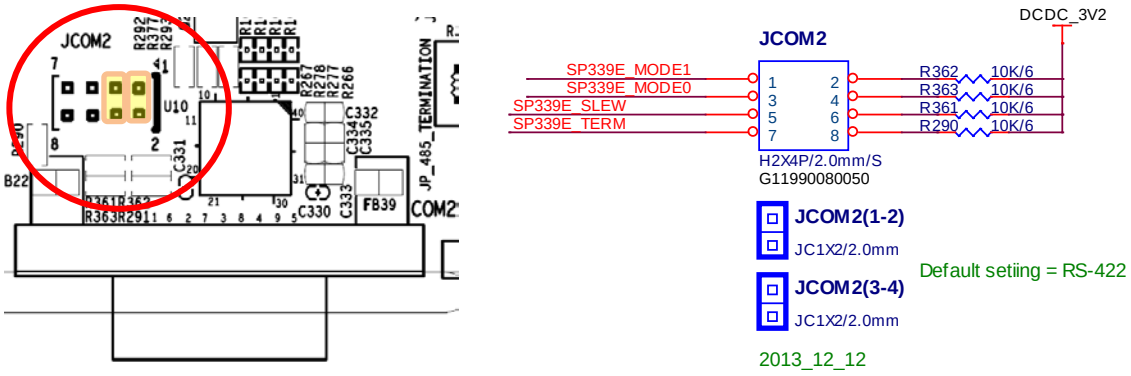


Fig. 39 The "JCOM2" pin-header for COM2 (notice default settings)

4.4.1.1 SETTING JUMPERS TERMINATION & SLEW-RATE:

- TERM JUMPER (7+8)
  - CLOSED ➔ SETS TERMINATION 120 OHM *FOR RS485 OR RS422 ONLY*
  - OPEN ➔ NO TERMINATION
- SLEW JUMPER (5+6)
  - CLOSED ➔ ENABLES 250kbps SLEW LIMITING
  - OPEN ➔ disables slew limiting

4.4.1.2 SETTING JUMPERS FOR RS232 or RS485 or RS422 COM2 MODE

Here is the table for the correct jumper setting of JCOM2 header. The jumpers have 2.0mm pitch.

Mode	JUMPER MODE-1 Pins 1-2	JUMPER MODE-0 Pins 3-4	SELECTED MODE	RESULTING COM2 FUNCTION ASSIGNMENT
-	OPEN	OPEN	X	NOT ALLOWED
1	OPEN	CLOSED	**RS232**	1=DCD, 2=RX, 3=TX, 4=DTR, 5=GND 6=DSR, 7=RTS, 8=CTS, 9=RI
2	CLOSED	OPEN	**RS-485** HALF DUPLEX	1=DATA- 2=DATA+ 3=GND
3a	CLOSED	CLOSED	**RS-422** FULL DUPLEX **DEFAULT**	1=TX- 2=TX+ 3=RX+ 4=RX- 5=GND
3b	CLOSED	CLOSED	**RS-485** With TX read-back **DEFAULT**	1=TX- ↔ **DATA-** 4=RX- 2=TX+ ↔ **DATA+** 3=RX+ 5=GND **This setting is used to have the TX'ed data read back at the same time you transmit. Connect pins 1 + 4 and 2 + 3 of COM2 DB9 connector. After this, TX-/RX- become DATA- and TX+/RX+ become DATA+**

Fig. 40 How to set JCOM2 for different COM2 operation

Please notice that you can have 4 different settings for COM2. Next chapter will explain in detail.

4.4.2 Explanation of RS485 Settings

Normally the COM2 port settings allow **3** different modes of operation:

- RS232 **Full duplex**, single-ended signals, RX, TX, RTS and CTS for full handshake. Suitable for short range communications since it can pick up a lot of noise. It's **Mode 1** from above table.

- RS422 **Full-duplex** as the RS232, only TX and RX. Signals are differential (TX- and TX+, RX- and RX+) to allow a very high noise rejection. Allows communication over long distance. It's **Mode 3a** from above table.

- RS485 **Half Duplex** only. When you transmit you cannot receive. Two wires only: Data+ and Data-. Differential signals to allow a very high noise rejection. Allows communication over long distance. It's **Mode 2** from above table.

The major problem of an RS485 communication is that when the transmit driver is on, the receiver is off since they are driven by the same control signal (RTS): direct for TX and inverted for RX.

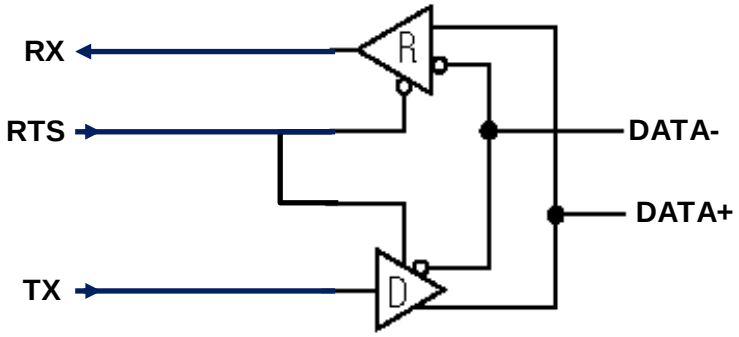


Fig. 41 Typical RS485 Driver/Receiver

This is not so good because you cannot understand when the TX flux has ended and you can exchange the direction of the driver/receiver (changing the level of RTS).
When you set the JCOM2 pin header for Mode 2, you get exactly the circuitry shown above.
In some cases this is enough, but in many others you need to understand quickly when it's time to change the direction. Then, you have to use the circuit below:

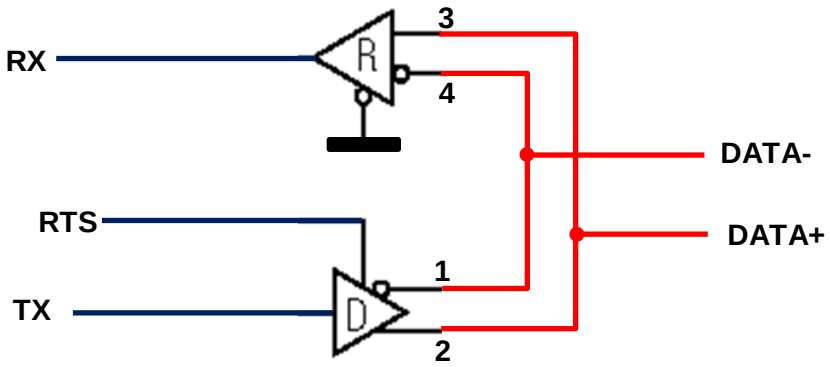


Fig. 42 RS422 modified for RS485 with TX data instant read-back

This is **Mode 3b** and the RX receiver is *always enabled* while you enable the TX driver only when you need to transmit. Since the RX receiver is always enabled, you will read your TX'ed data as soon as it exits from the driver. **This mode needs an external wiring (red wires) to the COM2 DB9 connector: connect pins 1+4 and 2+3 and you get the RS485 DATA+ and DATA-.**

4.5 COM1 ISOLATED SERIAL PORT (RS485) CONNECTOR

This is placed between the DSUB9M connector and the USB connector, lower left edge of the board. There are 3 jumpers which set some features of the COM port.

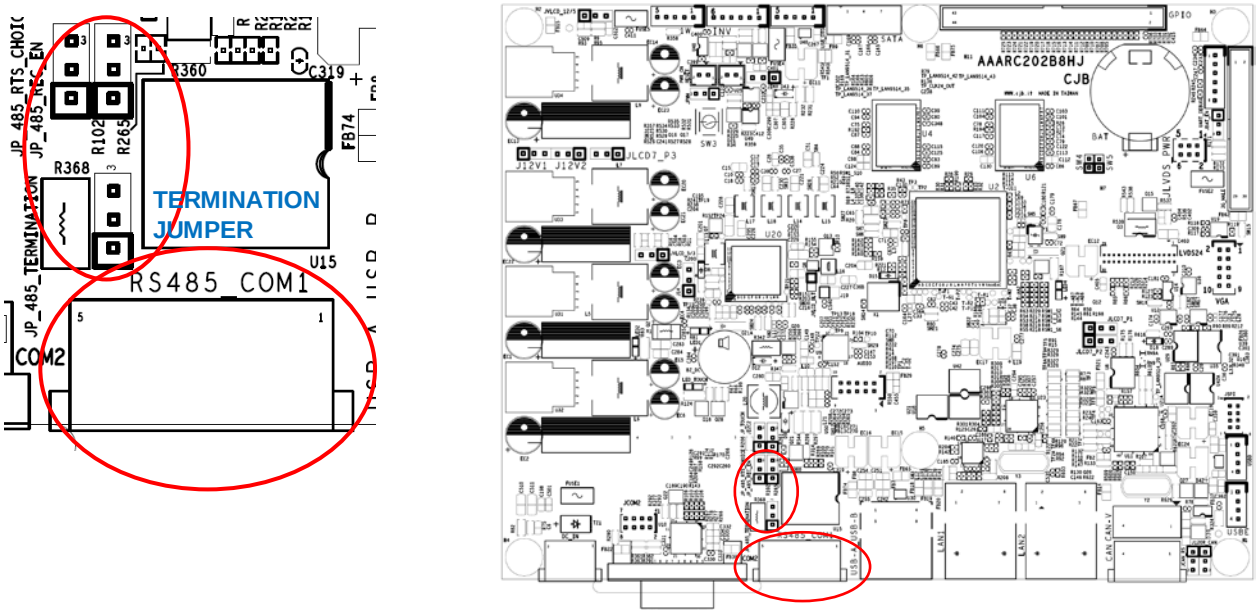
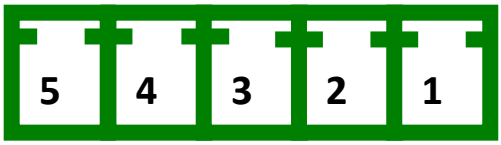


Fig. 43 The COM1 Connector (Isolated RS485 Serial Port)

4.5.1 COM1 Pin Assignment

The COM1 pin assignment for RS485 (isolated) is evidenced here below.



1 or 3	Data+
2 or 4	Data-
5	Isolated GND

Fig. 44 COM1 Connector pin assignment

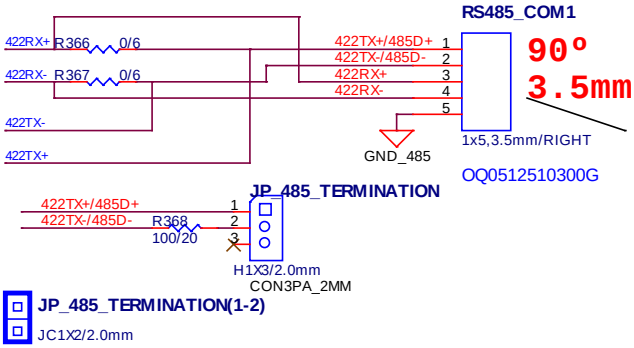


Fig. 45 Schematic of COM1 interface

The COM1 port is an isolated **RS485** by default. Eventually it can be also used as RS422 (isolated) but it needs a small h/w modification which can be only made by CJB.
Pin-Header **JP_485_Termination** (circled in **RED** in upper drawing) allows setting the line termination for the RS485. Setting 1-2 enables the RS-485 termination.

Notice: this RS485 interface is already a TX-read-back interface (like mode 3b for COM2). You don't have to do nothing to set this behaviour which is already by default for COM1.
Next paragraph details the Jumper settings for COM1.

4.5.2 COM1 Settings

There are three jumpers to set COM1 functionality:

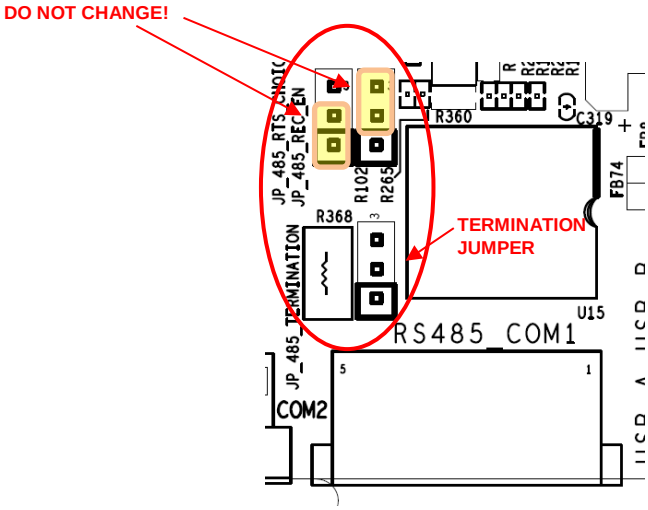


Fig. 46 COM1 Jumper Setting. Notice the two jumpers which must never be changed

The only jumper you are allowed to change is the **Termination Jumper**. Never change the other two jumpers nearby.

4.5.2.1 Termination Jumper Setting for COM1

The settings are the following:

- **1+2 Termination enabled**

To be set when the C2 is at one <u>end</u> of the daisy-chain of RS485 boards connected each other

- **2+3 Termination disabled**

To be set when the C2 is in a <u>middle position</u> of the daisy-chain of RS485 boards connected each other

4.6 USB_A, USB_B USB TYPE_A HOST CONNECTORS

They are placed between the COM1 and the LAN1 connectors, lower centre edge of the board.

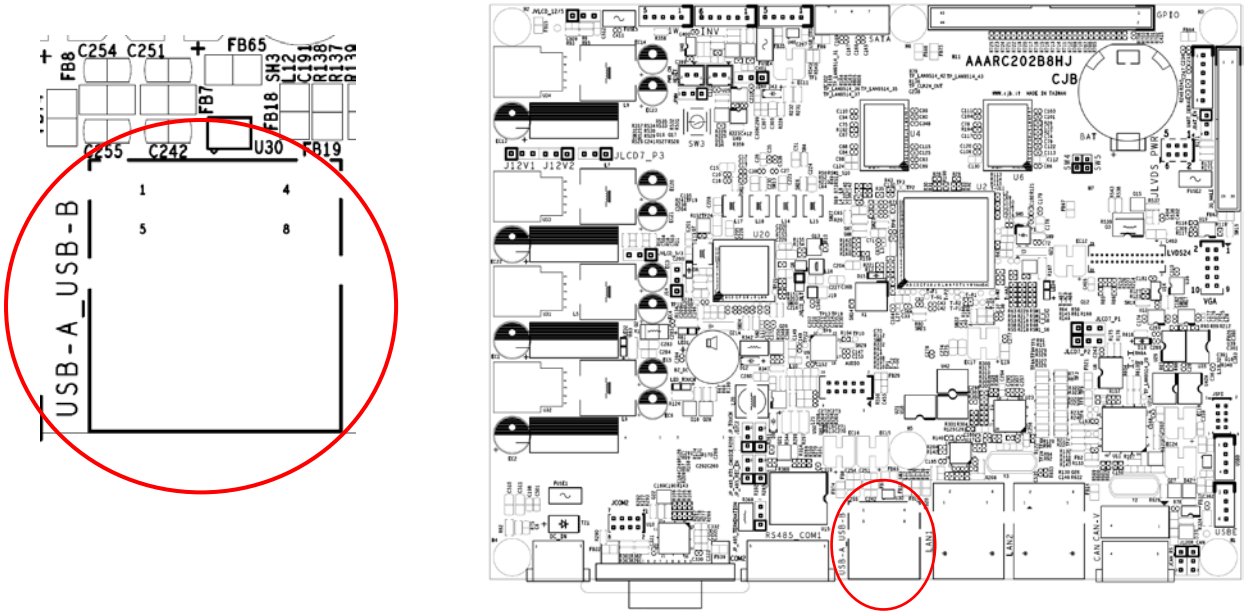


Fig. 47 The USB_A and USB_B Type_A USB ports

These are common Type_A host connectors. Inside the CPU board circuitry, these are USB Channels 1 and 2.

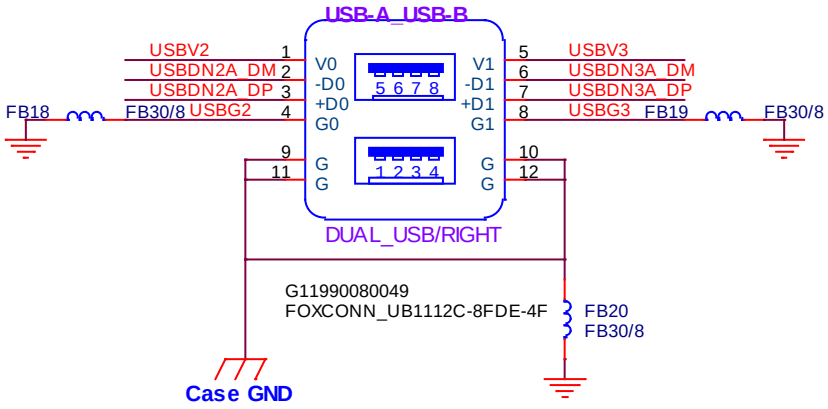


Fig. 48 Schematic of the Connector used for USB_A and USB_B

4.7 USB_D, USB_E USB AUX HOST PIN HEADER CONNECTORS

They are placed near the lower right corner of the board.

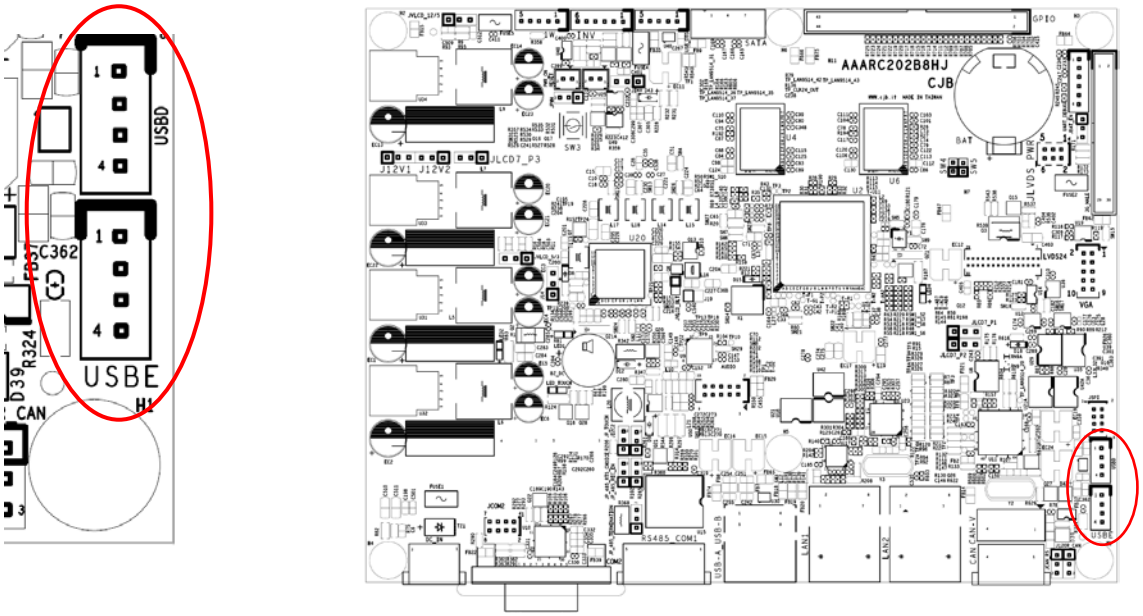
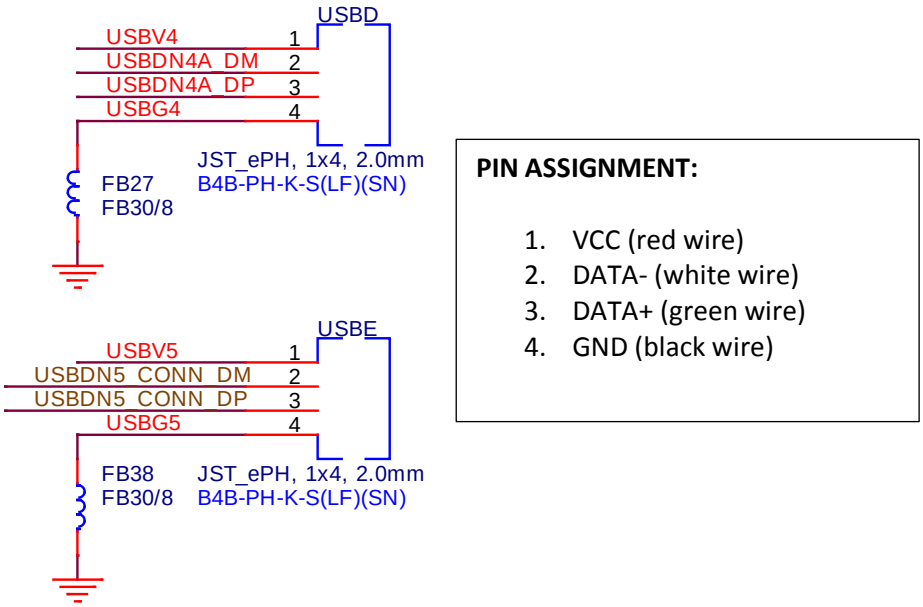


Fig. 49 The USB_D and USB_E Pin-headers for onboard additional USB ports

These are 4-pin headers wired as below.



PIN ASSIGNMENT:

1. VCC (red wire)
2. DATA- (white wire)
3. DATA+ (green wire)
4. GND (black wire)

Fig. 50 USB_D and USB_E wiring

4.8 LAN1, LAN2 FAST ETHERNET #1 & #2 CONNECTORS, RJ45

These are two RJ45 connector for onboard Ethernet channel #0 (left) and #1 (right). They are placed in the lower edge of the CPU board, side-to-side each other.

Notice: ETH1 (right connector) is stuffed only in the fully populated version of the board.

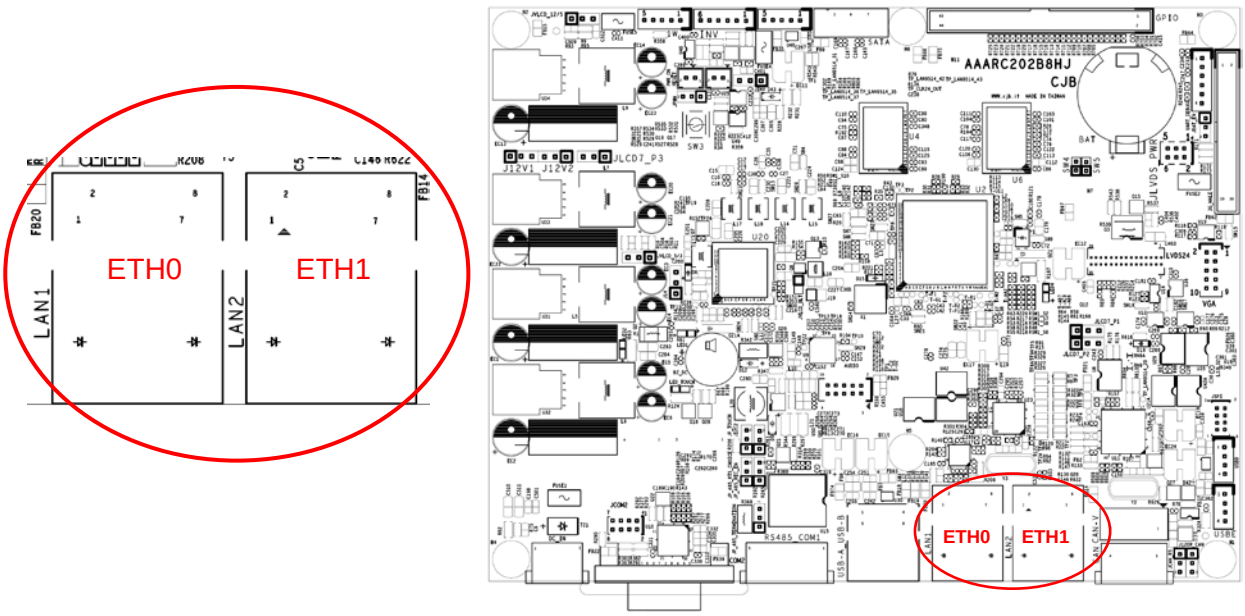


Fig. 51 RJ45 Ethernet Ports

The signals of each of these ports follow the standard assignment, as you can see here below.

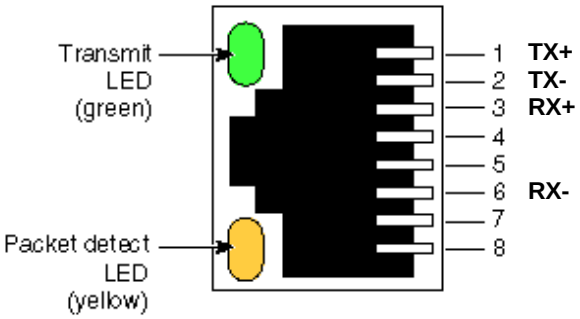


Fig. 52 Pin Assignment of ETH0 and ETH1 RJ45 Ethernet ports

The MACaddress for each port has been programmed in factory; the value is the label stuck onto each RJ45 connector block.

4.9 CAN, CAN-V CANBUS interface CONNECTORS

These are placed at right of rightmost Ethernet connector (ETH1), lower right edge of the board. The two connectors have the same pinout, and are in parallel, to allow an easy connection when the C2 is eventually placed in the middle of the daisy-chain of CANbus modules.

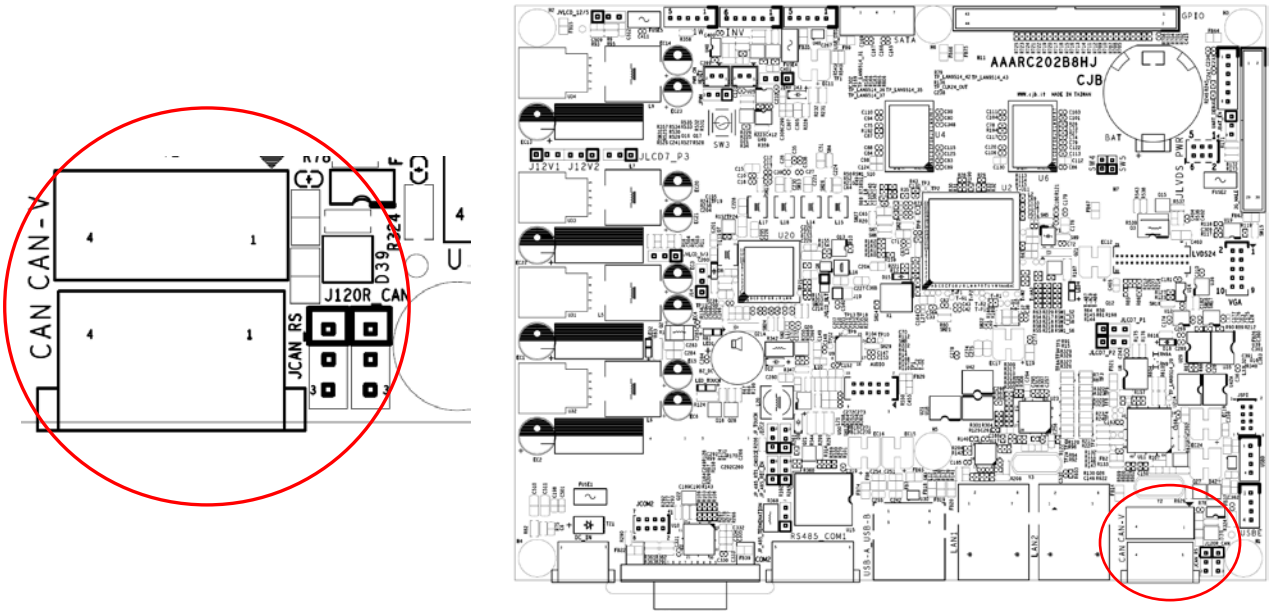


Fig. 53 CANbus twin connectors

The connectors have the following pin assignment:

1. **GROUND_CAN (NOT ISOLATED)**
2. **CAN_H**
3. **CAN_L**
4. **n.c.**

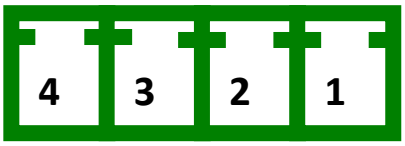


Fig. 54 Pin Assignment of CANbus connector

There are two connectors because this makes easy the usage of the board amid a “daisy chain” of CANbus connections. In other words, when the C2 is used not as ending node, but in the mid of the fieldbus, you will have one cable connected from connector **CAN** (90º connector) to an I/O module and another cable connected from connector **CAN-V** (vertical) to another module.

IMPORTANT NOTICE: if you are using the C2 inside the fieldbus, make sure the termination resistor (J120R_CAN) is not enabled. See following chapter which details the settings of the CANbus interface.

4.9.1 CANbus Interface Settings

There are two jumpers near the 90º CAN connector. They allow for the Line Termination insertion, and for the bus speed limiting.

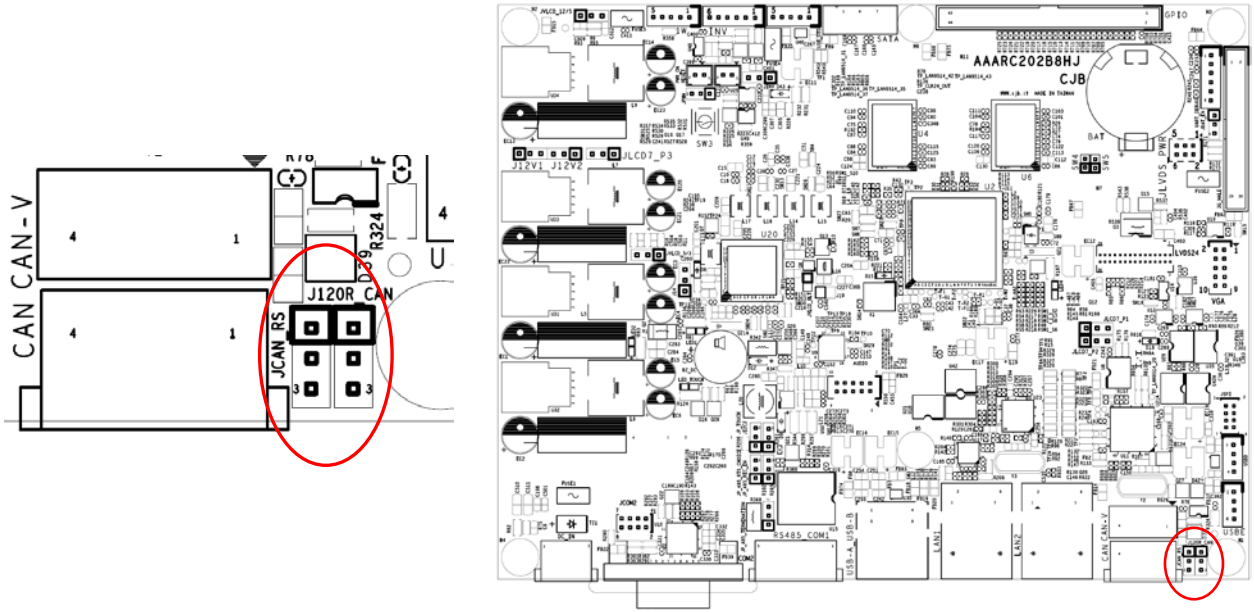


Fig. 55 CANbus Settings Jumpers

The schematic here below shows the circuitry of the CANbus interface. The Line Termination resistor must be inserted when the board is at one end of the daisy-chain connection between the CANbus modules. It can be set with Jumper J120R_CAN (the rightmost of the two jumpers): closing 1-2 sets the termination resistor.

The JCAN_RS pin header (placed nearby the connector) allows selection of CANbus speed limiting.

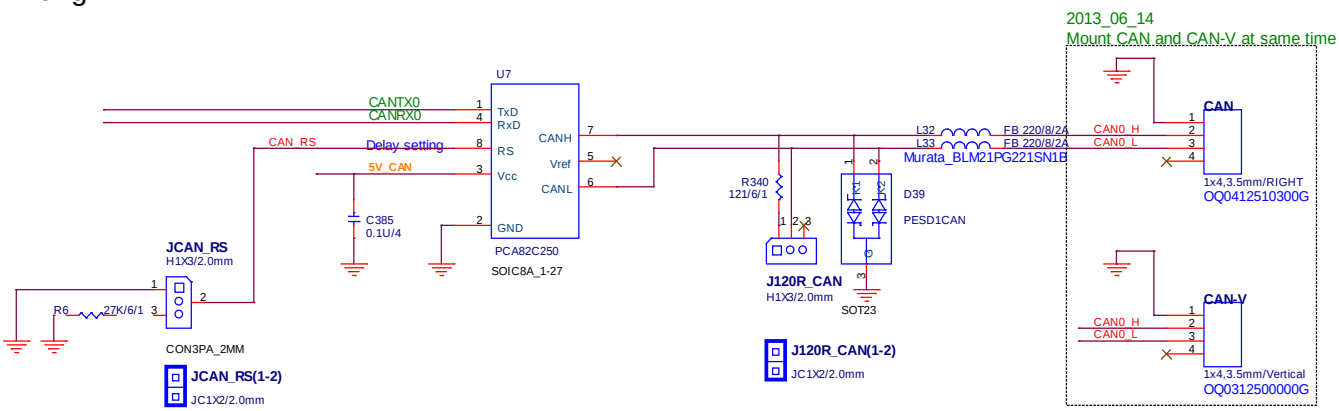
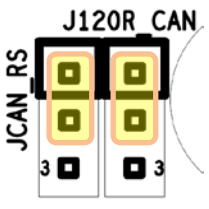


Fig. 56 Schematic of CANbus interface

JCAN_RS

1-2	High Speed
2-3	Low Speed



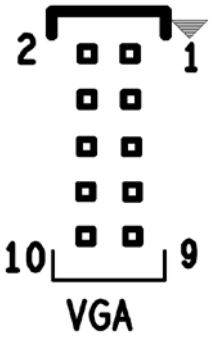
J120R_CAN

1-2	Termination Inserted
2-3	No Termination

Fig. 57 Jumper Setting for CANbus interface (default setting is displayed)

4.10 VGA (VGA Pin Header CONNECTOR)

The VGA interface is made of a 10 (2x5) pin header, 2.0mm pitch, and it's placed near the mid centre right side of the board.



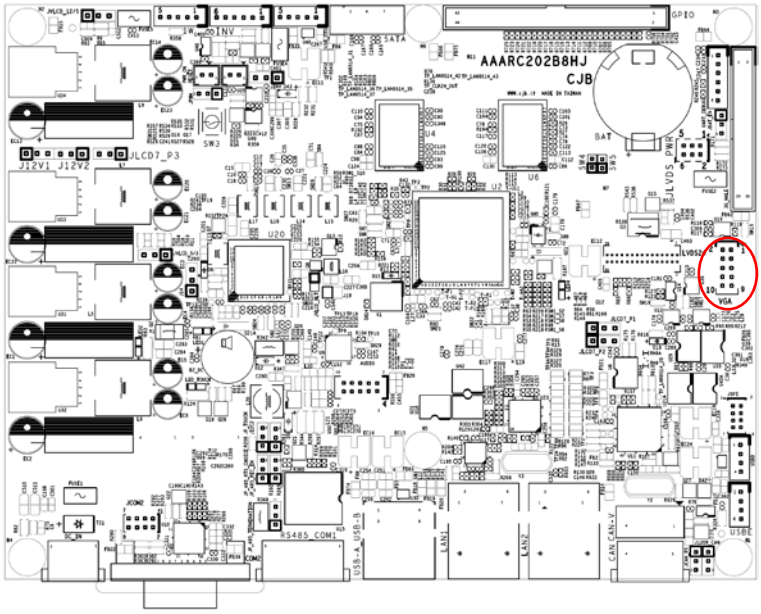


Fig. 58 VGA Connector (Pin Header)

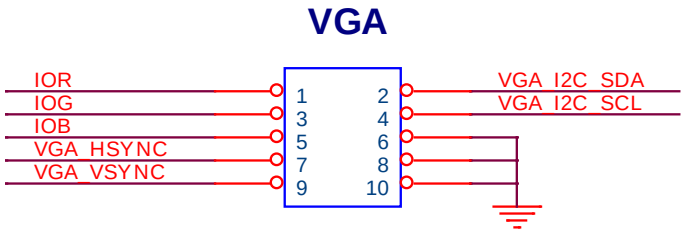


Fig. 59 Signals of the VGA Pin Header

You can wire a short cable from this pin-header to a common female DSUB15F, to obtain the common VGA connector like any PC. Connections are the following, **seen from the REAR SIDE (solder wire side)** of the DSUB15F Female connector:

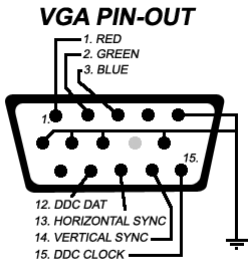


Fig. 60 VGA DSUB15F seen from rear side (wire solder side)

SIGNAL NAME	C2 VGA PIN Header	DSUB15F PIN
RED	1	1
GREEN	3	2
BLUE	5	3
HORIZONTAL	7	13
VERTICAL	9	14
GND	6,8,10	5,6,7,8,10
DATA VGA_I2C_SDA	2	12
CLOCK VGA_I2C_SCL	4	15

Fig. 61 The wiring of the VGA port

4.11 LVDS CONNECTOR

This is one 40 pin (2x20) header, and its location is near the left of the VGA connector pin header. The LVDS Port can support 2-Channels, 24-bits LCD panels with resolution up to 1920x1080 (1080p).

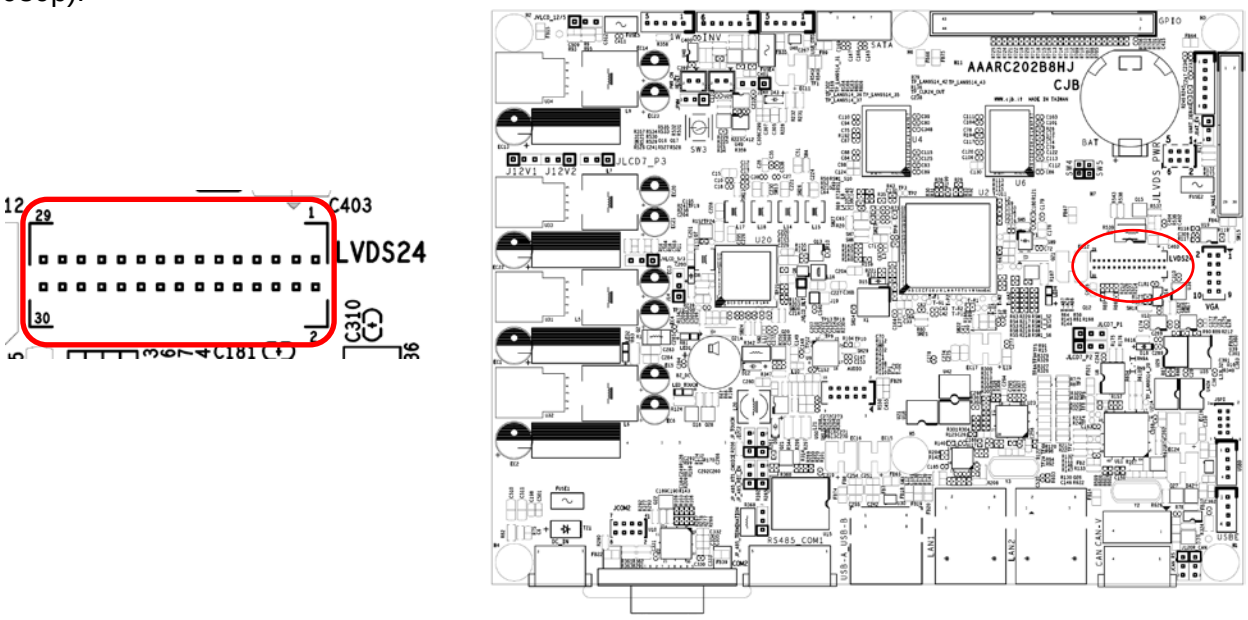


Fig. 62 The LVDS Connector

Since LCD panels may require different power supplies, you have to check the correct jumper settings for LVDS Power before connecting an LCD. The details of the LCD jumper settings are covered in next paragraphs. Ask CJB for pin assignment between the C2 LVDS connector and your panel. Since R213 + R214 are not stuffed and R226 + R227 are, pins 25 and 26 are two ground pins.

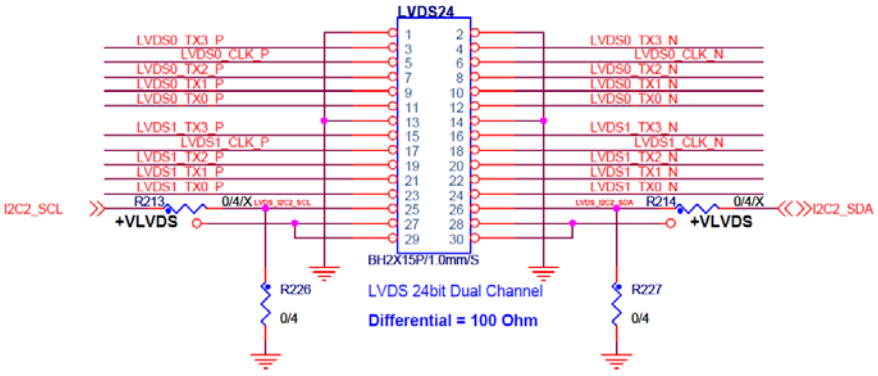


Fig. 63 Signals of the LVDS Connector

The power rail called **+VLVDS** is the power for the LCD electronics, and the voltage can be selected by the **JLVDS_PWR** pin header. Default setting is 3.3Vdc (3-4).

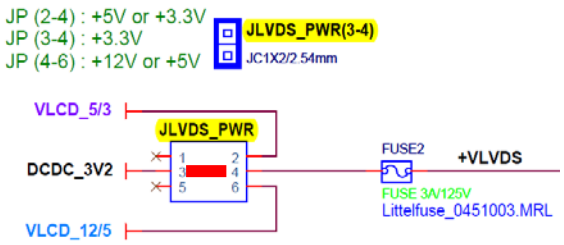


Figure 1 The Pin Header JLVDS_PWR allows selection of voltage for the LCD

Each panel also needs power for the backlight. Details of the relevant connector (**INV**) are described in next paragraph.

4.12 INV (INVERTER / LED DRIVER POWER CONNECTOR)

This 6 pin 2.5mm pitch male header is the central of the three connectors on upper left edge of the board. *Notice that the leftmost connector ("**1W**") is optional and it's never stuffed by factory*. The INV connector is used to bring power to LCD's inverter or LED backlight driver. Usually brings 12Vdc which is the most common voltage for powering Inverters or LED drivers.

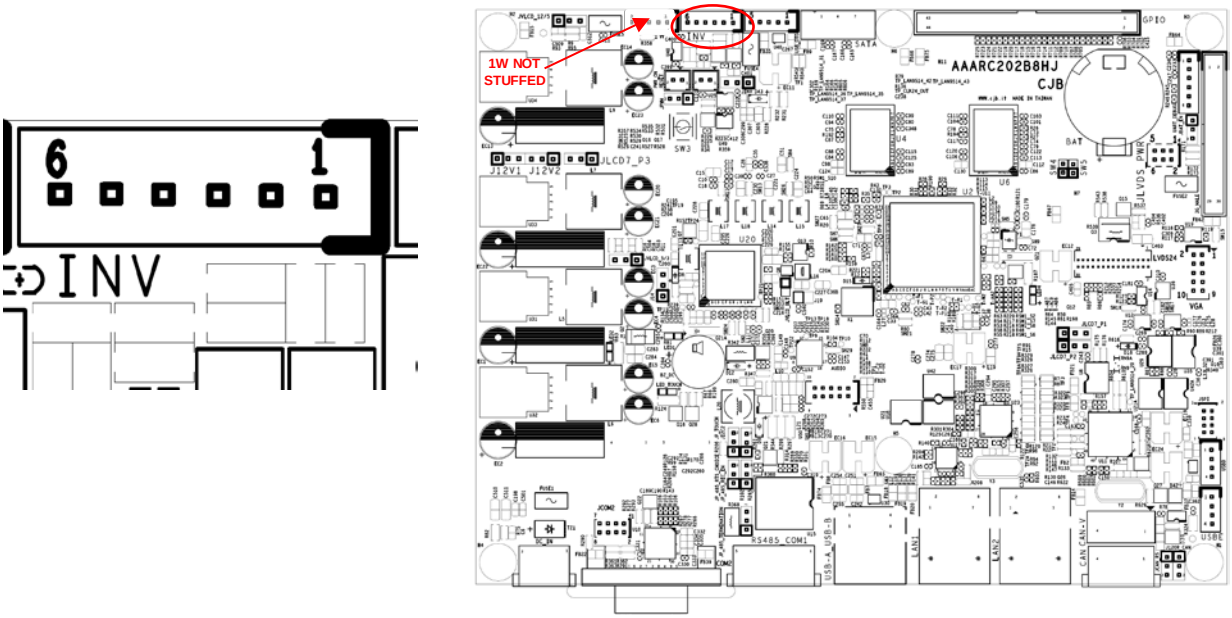


Fig. 64 The INV Connector (for Inverter/LED-driver Power)

The schematic here below details how the INV connector has been wired to the typical signals and power rails used for Inverters and for LED drivers.

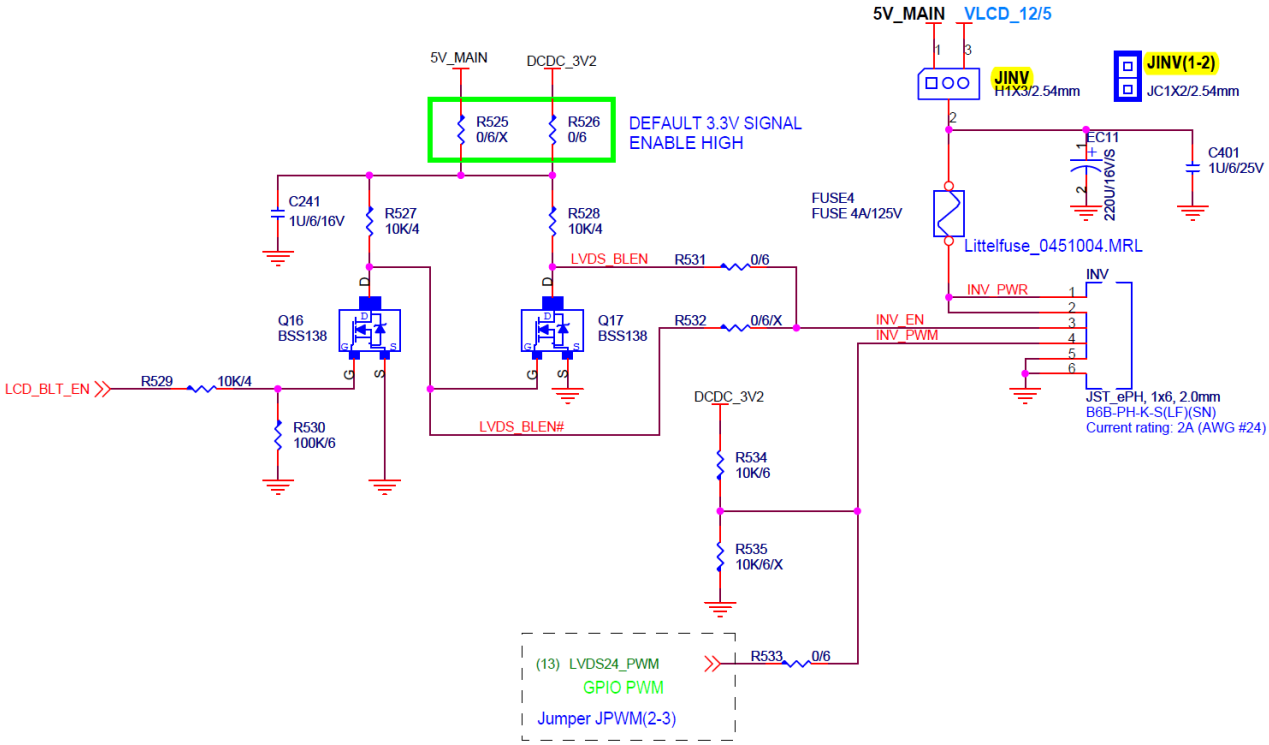


Fig. 65 Schematic of the circuit around the INV connector

A detailed discussion of the signals and power rails is in the following paragraph.

4.12.1 Analysis of the INV Connector's signals

Looking at the schematic of the previous paragraph, you can recognize that:

1. **Power Selection: +12/+5**
   The Inverter/LED-driver power (for pins 1 and 2) can be selected between +5Vdc and +12Vdc by setting the jumper of **JINV** pin header.

2. **Backlight ON/OFF**
   Since usually either an Inverter or a LED-driver need a positive signal for Enable, the **INV_EN** signal to pin 3 is kept at positive (high) level by default. To shut off the lamps, the GPIO signal "**LCD_BLT_EN**" must be forced to low level.

3. **Dimming for CCFL Inverters**
   Usually CCFL Inverters have limited dimming capabilities: they usually need 0Vdc for max brightness, and 5Vdc (or 3.3Vdc) for min brightness, which usually is only 70% of the max brightness. In this case you can drive the GPIO signal "**LVDS24_PWM**" either low or high, to have the max or min brightness for the CCFL inverter.
   Notice that default is min brightness by the pull-up resistor R534.

4. **Dimming for LED Drivers**
   LED Drivers often have similar features (behave like the CCFL inverters), but nowadays the most diffused LED Driver models need a Dimming action managed by PWM. That means you will apply a fixed frequency square wave (1 kHz, for example) but with variable duty factor of the square wave:

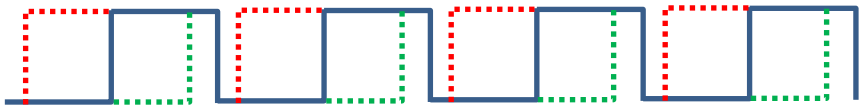


Fig. 66 PWM control by variable duty factor

The figure above shows the solid 50% duty-factor square wave which will drive the backlight 50% of the brightness; the red square wave shows an example of ~85%duty factor, where the wave stays at high level for 85% of the cycle. This will drive the brightness to 85%. The green wave shows the opposite, i.e. one 15|% duty factor only, for a 15% of the available brightness.
If you drive the PWM input with permanently high signal, you get max brightness, like 100% duty factor; if you drive the PWM input with a permanently low signal, you shut off the backlight (0% brightness).
Important: some LED-driver boards do not allow 0% duty factor. They always need a minimal duty factor (like 1% or 2%) otherwise faults can occur. Please get all the needed information for correct drive of your LED-driver board.

4.12.2 Pin Assignment for INV connector

This is the pin assignment of the INV connector:

1. +12Vdc (JINV 2-3) or +5Vdc (JINV 1-2) (fused) **Default is +5Vdc**
2. *Same as above pin 1*
3. Enable also called ON/OFF (High = ON) **Default is High level**
4. PWM (LED) or Brightness (CCFL) **Default is High level**
   a. *Usually High or 100% PWM sets max brightness to LED Driver boards*
   b. *Usually Low or GROUND sets max brightness to CCFL inverter*
5. GND
6. GND

4.13 AUDIO CONNECTOR

There is one pin-header, 10 (2x5) pins, 2.0mm pitch, for the Audio interface signals, almost mid centre of the board, just near the innermost mounting hole.

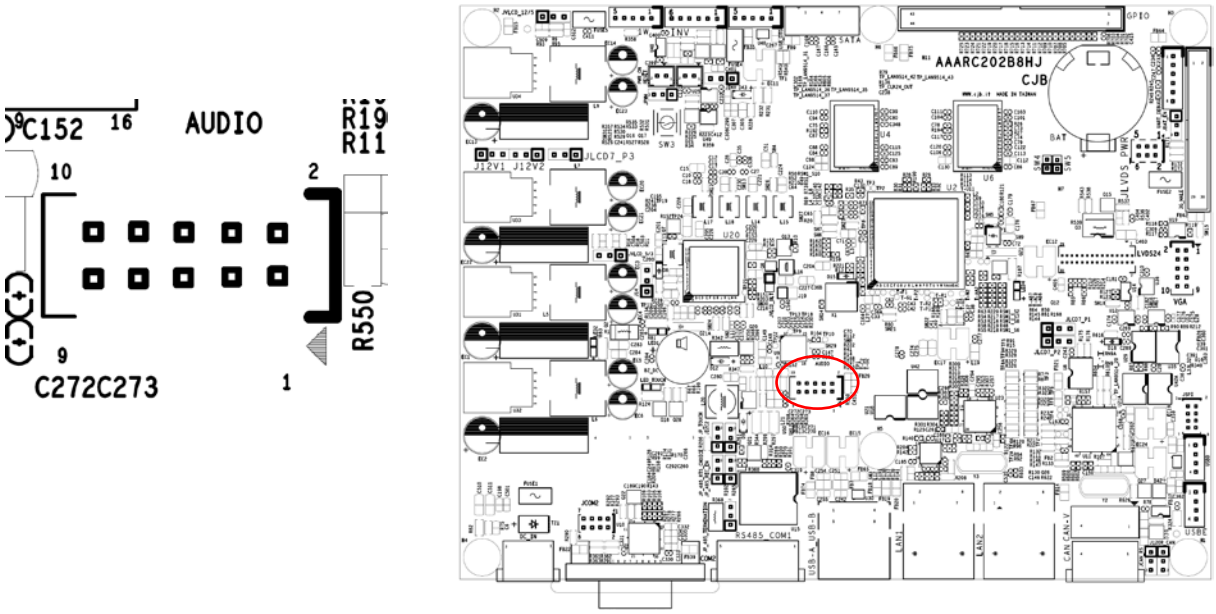


Fig. 67 The Audio Connector

This connector has all the typical signals of a standard Audio Interface:

LINE_OUT	**1 = Line_Out_Left**	**3,5 = GND**	**7 = Line_Out_Right**
LINE_IN	**2 = Line_In_Left**	**4,6 = GND**	**8 = Line_In_Right**
MIC_IN	**10 = MIC_Input**	**9 = GND**	

Fig. 68 Pin Assignment of the Audio Connector

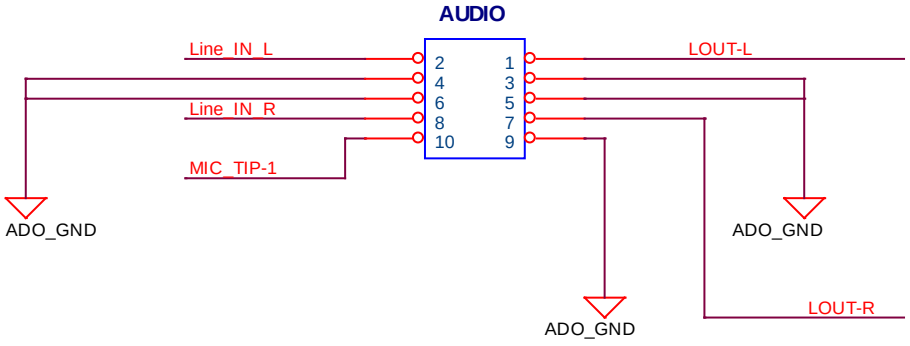


Fig. 69 Circuitry of the Audio Connector; note the orientation and pin numbers!

WARNING: **Never use the Line_OUT signals to drive a speaker or a headphone**. The signals exiting from the C2 are low power and need always to be amplified externally.

The **MIC_IN** should be connected to a common PC electret-condenser mike.

4.14 SPI1 CONNECTOR

The SPI1 connector is one 10-pin header near the USBD header connector, right side of the board. It has the signals which can be used for a high-speed SPI interface, including +3.3V and +5V power supplies (not protected, so be careful when using them to power external devices).

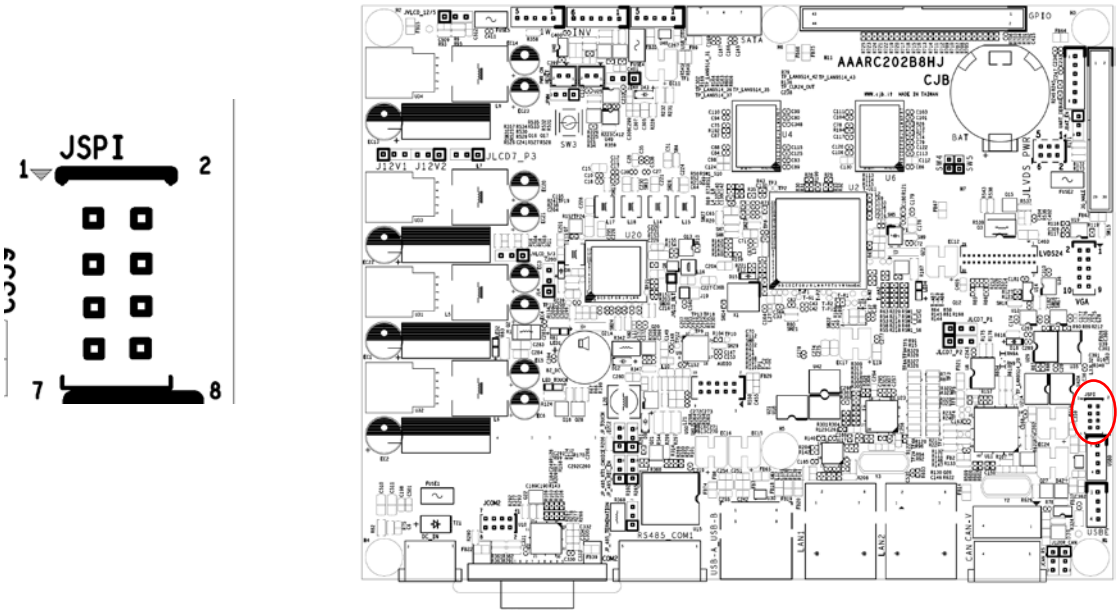


Fig. 70 SPI1 Connector; note the orientation and pin numbers!

From this header you will have the **MOSI** (Master Output to Slave Input), the **MISO** (Master Input from Slave Output), a **Serial Clock**, and a **Chip-Select** (ECSPI1_SS1). All signals have a 5V level (since they are translated by U35). Common Ground is available on Pin 7.

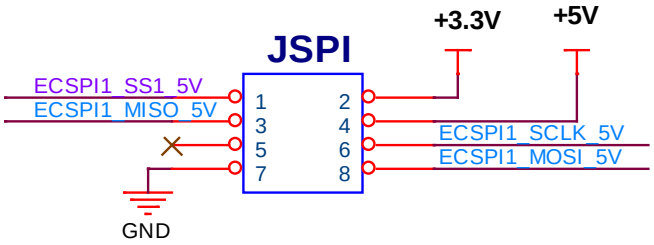


Fig. 71 SPI1 Connector wiring and level translator U35

4.15 UART_DEBUG PORT

To survey the boot up of the board, you must connect the “Debug” port to a PC, where a suitable “Console Simulator” program is running. For example: PUTTY or HyperTerminal or other similar programs.

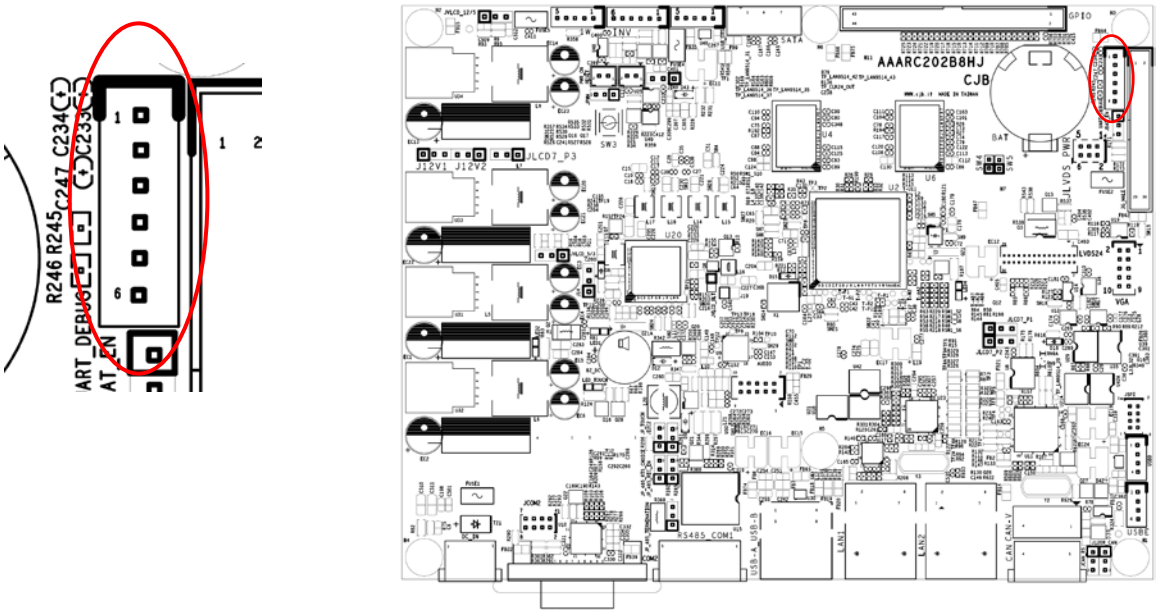
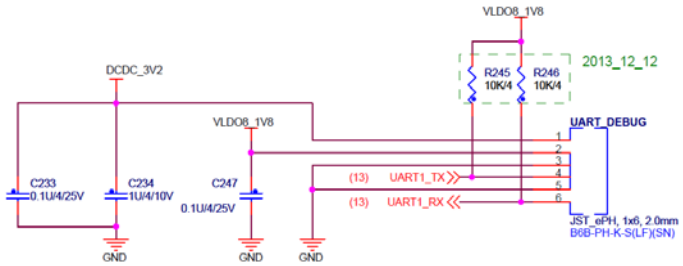


Fig. 72 The “UART_Debug” Connector

Since modern PC’s do not have COM ports, it’s suggested to use an USB⇔COM (TTL1.8V) conversion cable, *like the FTDI model TTL-232RG-VREG1V8-WE*, which TTL signals commit the 1.8Vdc levels required by the C2 Debug Port. Such cable appears like the photo here below (where we have already wired the small white connector for the Debug Port).

Fig. 73 Example of USB⇔COM(TTL1.8V) conversion cable

The schematic of the Debug Port is here below:



1	**Nc**
2	**Nc**
3	**GND**
4	**TX TTL 1.8V**
5	**GND**
6	**RX TTL 1.8V**

Fig. 74 Schematic of the Debug Port Connector

When preparing the cable, wire one JST B6B-PH-K 6-pin female so that the TX wire of the conversion cable is connected to pin 6 (RX), the RX wire of the cable is connected to pin 4 (TX), and the Ground wire is connected to pin 3. The 1.8Vdc wire usually provided by the cable must not be connected.

4.16 USB-OTG CLIENT USB DEBUG CONNECTION

This connector is a 5pin header, 2.0mm pitch, available for debug Client USB port. You have to setup an adaptor cable to match your cable. If you want to plug directly to one Type_A port of your PC, it's a good idea to provide a cable with such 2.0mm 5 pin female at C2 board side, and a male Type_A connector at the opposite side.

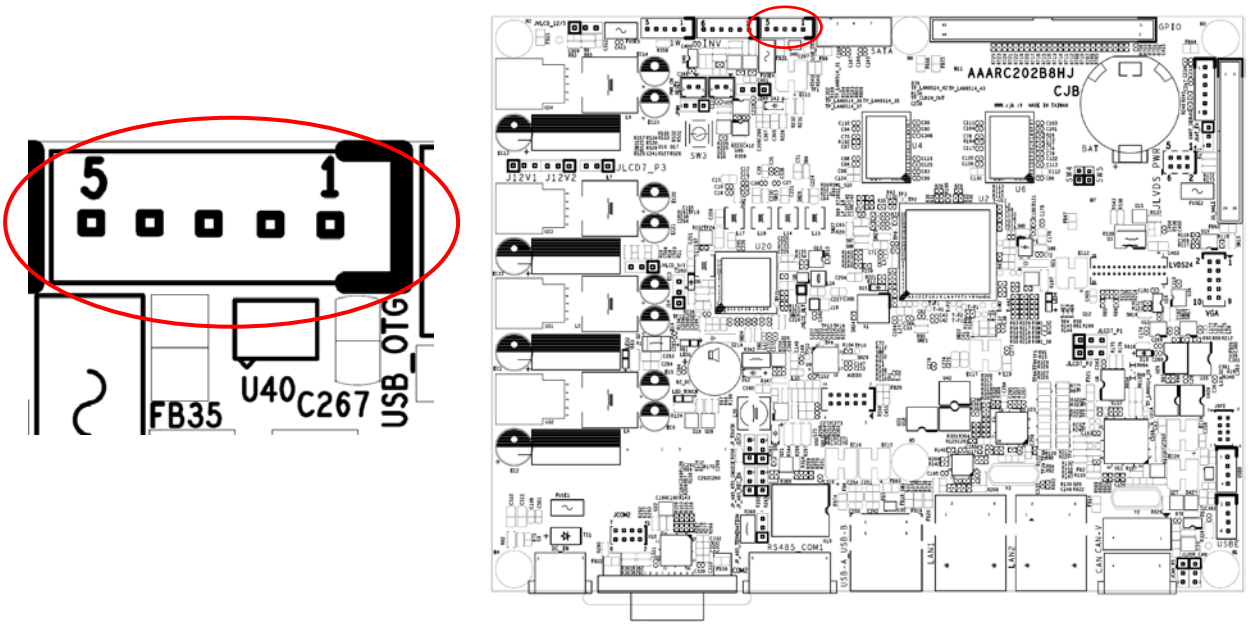


Fig. 75 USB_OTG Connector

Pin assignment:

1. Vcc (usually red wire)
2. Data- (White wire)
3. Data+ (Green wire)
4. GND (Black wire)
5. Shield (shield braid) → or same GND if cable is short

4.16.1 OTG CABLE EXAMPLE:

Here below you can see a simple example of a cable which can support this connection. When wiring the cable, follow the wire colour matching.

Fig. 76 USB_OTG Cable example

4.17 1W 1-WIRE PERIPHERAL CONNECTOR (OPTIONAL)

This connector is a 5pin header, 2.0mm pitch, available for 1-Wire (Dallas) peripherals.
It's upper left edge of the board, near Fuse5, near LCD Inverter (INV) connector.

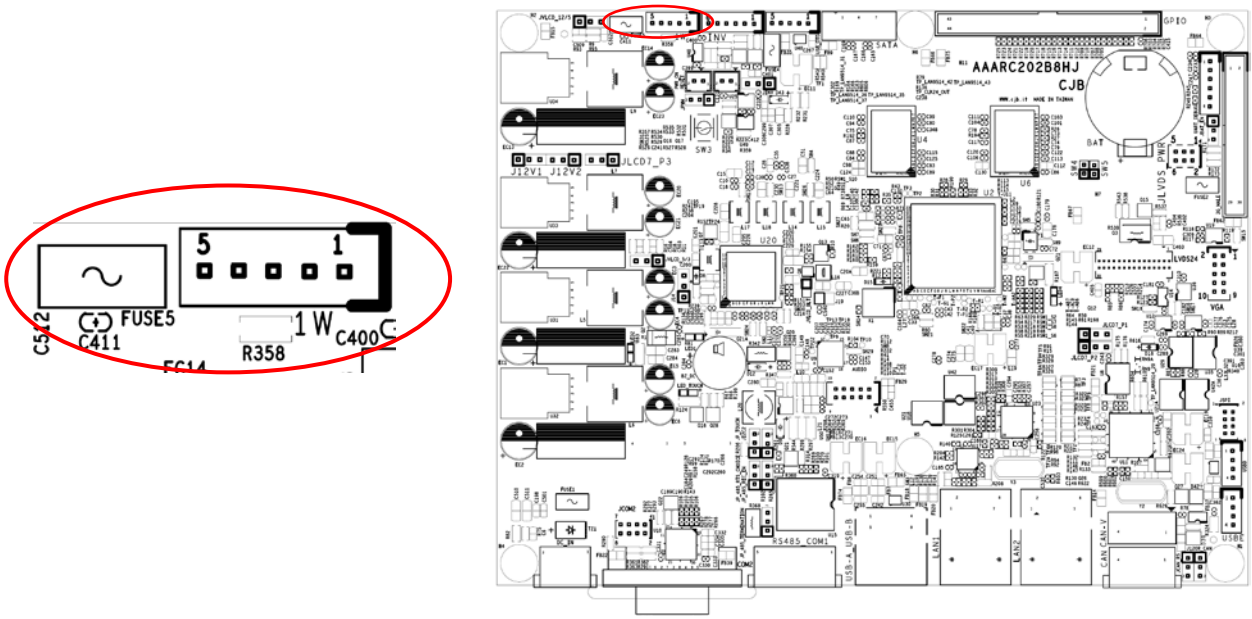


Fig. 77 Optional 1W Connector

The 1-Wire interface can be used for simple peripherals like temperature sensors. It's a Dallas proprietary bus. Peripherals are powered by +5Vdc with 0.1A fuse.

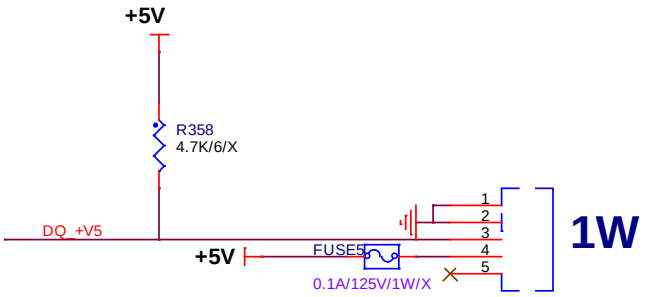


Fig. 78 Optional 1W Connector

4.18 RESET EXTERNAL RESET CONNECTOR

This connector is a 2pin header, 2.0mm pitch, available for external reset. It's near the upper side of the board, below the three white connectors. t's paralleled with the **SW3** pushbutton which can be used for triggering a manual reset to the C2 board.

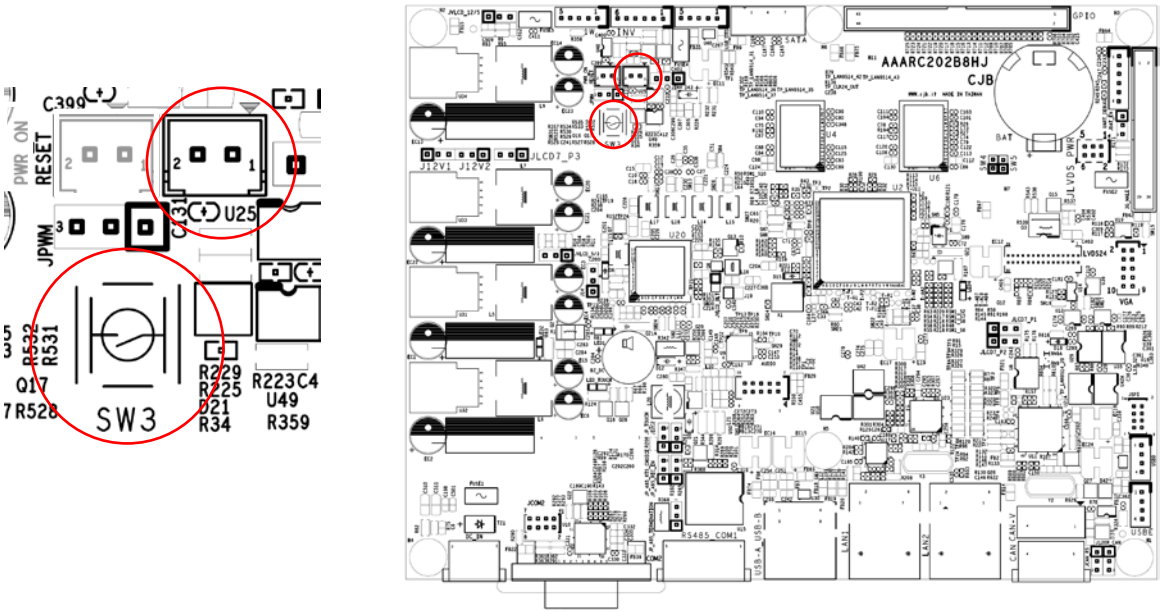


Fig. 79 RESET Connector and Manual Reset Pushbutton (SW3)

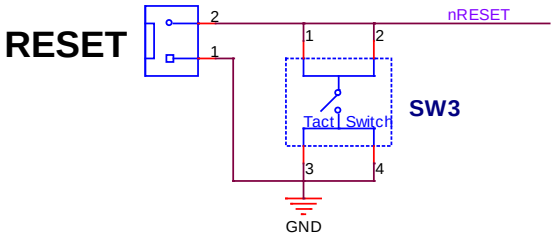


Fig. 80 Schematic of the RESET Connector and SW3 Pushbutton

Shorting the two pins of the RESET connector makes a hardware cold-reset sent immediately to the board. The pin assignment is the following:

Pin 1 = GND **Pin 2 = Reset**

4.19 SW3 MANUAL RESET PUSHBUTTON

Same effect is made just pushing the **SW3** pushbutton.

4.20 SW4 - USER DEFINED INPUT #1 (ONLY FOR C2 Depopulated)

The depopulated version of the C2 has been prepared with a 2.0mm connector (box header), where for example a pushbutton can be connected for issuing external commands to the C2 CPU board.

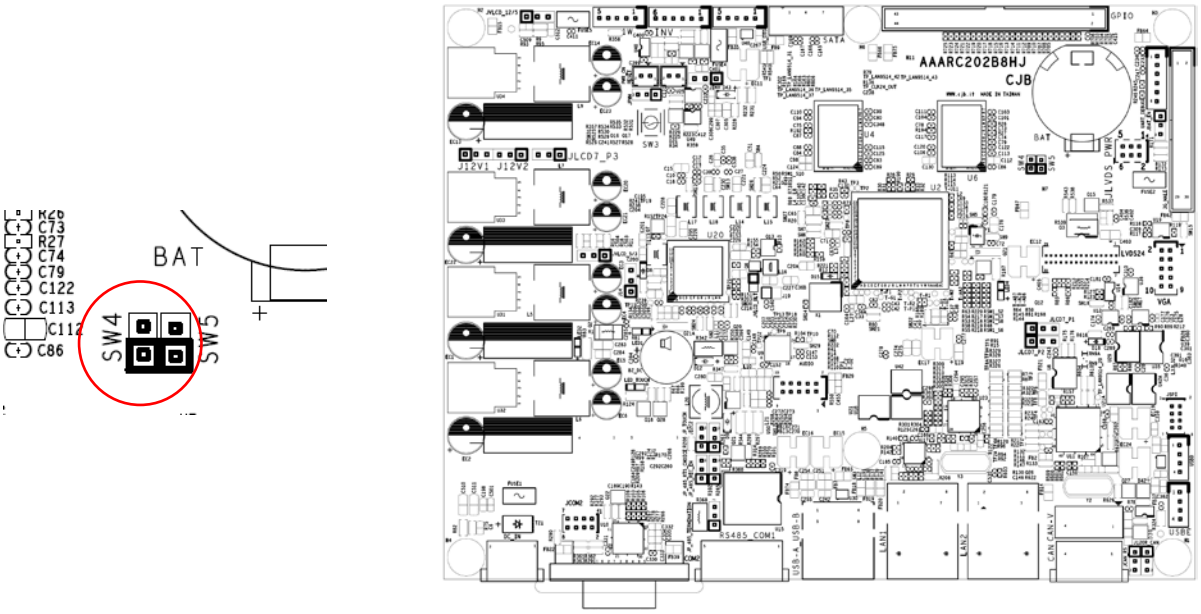


Fig. 81 SW4 Box Header Connector (Depopulated C2 only)

Only SW4 has been upgraded with the box header for room issue on the C2. The signal is the USERDEF1 connected to PATA_DATA14 (pin P6) of the iMX53.
Pin 1 (GND) is the pin nearest to the assembly hole (see the photograph here below).

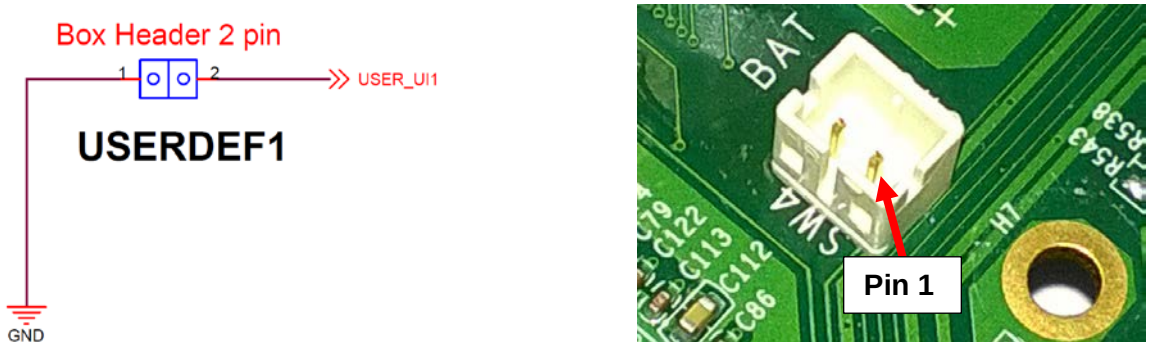


Fig. 82 SW4 Box Header Connector (Depopulated C2 only) – See Pin 1

4.21 GPIO TTL I/O CONNECTOR

This is a 44pin 2.0mm pitch shrouded male header with **25** TTL I/O signals coming from the iMX53 native GPIO resources. The connector is on upper edge, right side of the board, between the two mounting holes nearby.

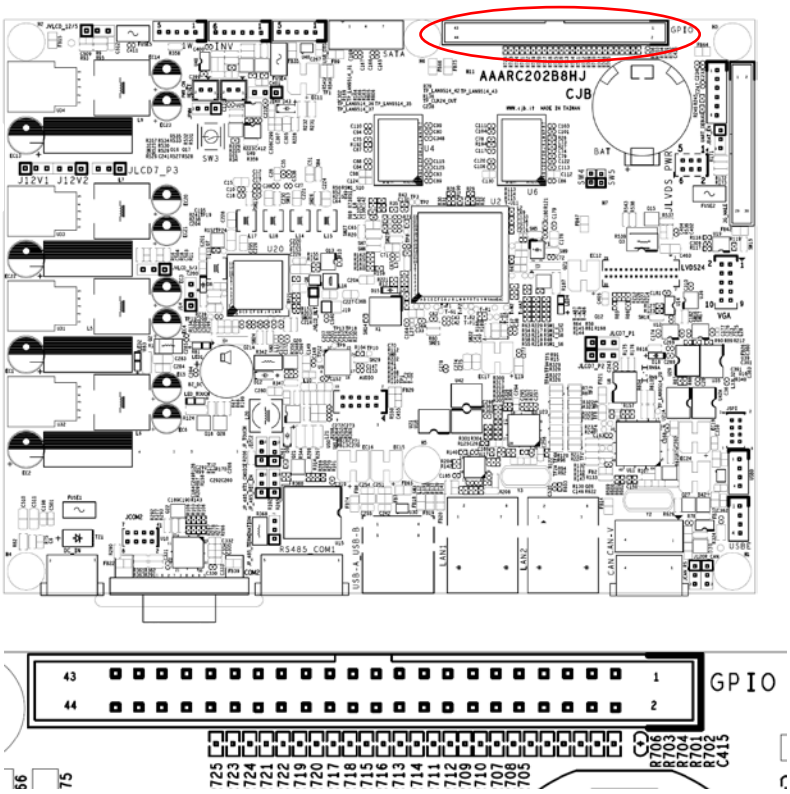


Fig. 83 The GPIO Connector

Pin assignment of the GPIO Connector is the following:

- Pins 1, 2, 41, 42 = +3.3Vdc
- Pins 3, 4, 15, 16, 27, 28, 39, 40, 43, 44 GND
- Pins 5 → 12 = GPIOA_P00 → GPIOA_P07
- Pins 13, 14 = GPIOA_P10, GPIOA_P11
- Pins 17 → 22 = GPIOA_P12 → GPIOA_P17
- Pins 23 → 26 = GPIOA_P20 → GPIOA_P23
- Pins 29 → 32 = GPIOA_P24 → GPIOA_P27

The GPIO signals provide 3.3Vdc levels, and need to be conditioned externally (unless they are connected to TTL devices). All GPIO's have a 10K pull-up resistor to +3.3Vdc.

4.21.1 TTL GPIO WIRING

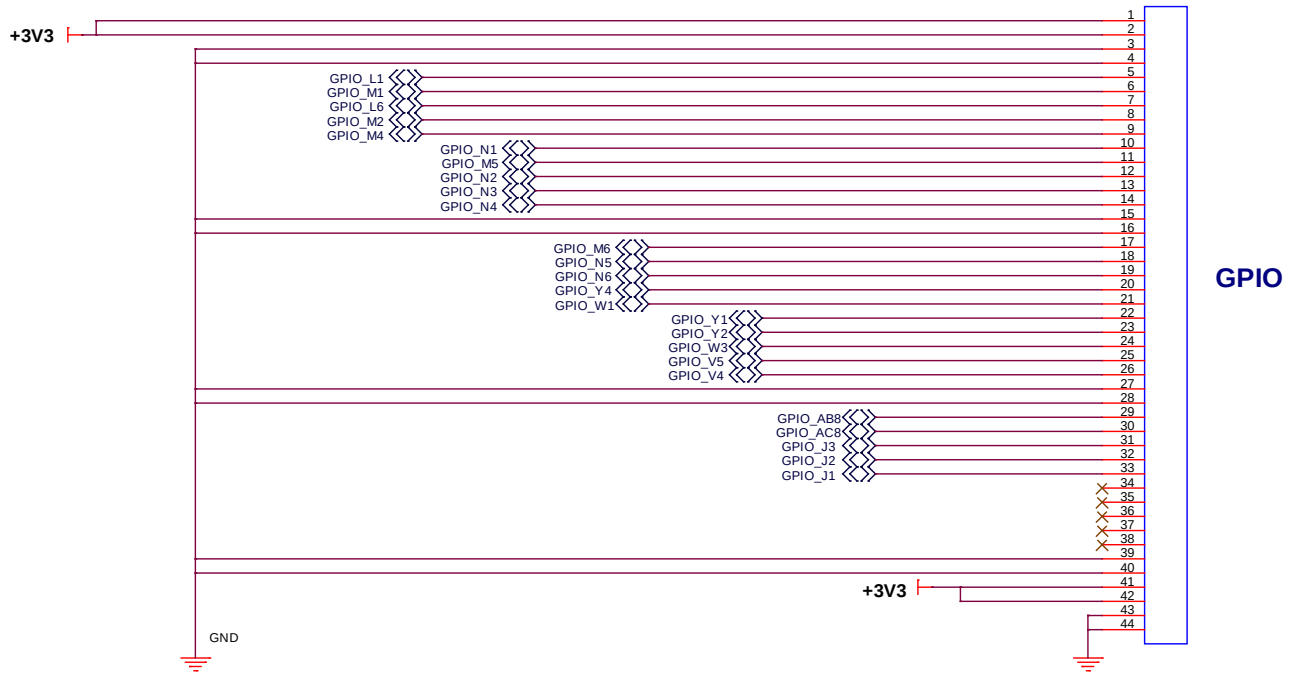


Fig. 84 The GPIO Connector: wiring and signals involved

The following page shows in detail the GPIO mapping from the iMX53.

4.21.2 GPIO Mapping from iMX53

The table which follows shows the mapping of the GPIO resources which come from the iMX53 ARM processor and are brought to the GPIO 44 pin Connector of the C2. Please refer to the iMX53 Programming Manual for the usage of these GPIO signals.

Pin #	Wire Description	CPU PAD	ALT	Bit	Port	Position	Address
1	DCDC_3V2						
2	DCDC_3V2						
3	GND						
4	GND						
5	GPIO_L1	ATA_DATA0	ALT1	GPIO[00]	GPIO_2	(1*32 + 01)	0x21
6	GPIO_M1	ATA_DATA1	ALT1	GPIO[01]	GPIO_2	(1*32 + 02)	0x22
7	GPIO_L6	ATA_DATA2	ALT1	GPIO[02]	GPIO_2	(1*32 + 03)	0x23
8	GPIO_M2	ATA_DATA3	ALT1	GPIO[03]	GPIO_2	(1*32 + 04)	0x24
9	GPIO_M4	ATA_DATA5	ALT1	GPIO[05]	GPIO_2	(1*32 + 05)	0x25
10	GPIO_N1	ATA_DATA6	ALT1	GPIO[06]	GPIO_2	(1*32 + 06)	0x26
11	GPIO_M5	ATA_DATA7	ALT1	GPIO[07]	GPIO_2	(1*32 + 07)	0x27
12	GPIO_N2	ATA_DATA8	ALT1	GPIO[08]	GPIO_2	(1*32 + 08)	0x28
13	GPIO_N3	ATA_DATA9	ALT1	GPIO[09]	GPIO_2	(1*32 + 09)	0x29
14	GPIO_N4	ATA_DATA10	ALT1	GPIO[10]	GPIO_2	(1*32 + 10)	0x2A
15	GND						
16	GND						
17	GPIO_M6	ATA_DATA11	ALT1	GPIO[11]	GPIO_2	(1*32 + 11)	0x2B
18	GPIO_N5	ATA_DATA12	ALT1	GPIO[12]	GPIO_2	(1*32 + 12)	0x2C
19	GPIO_N6	ATA_DATA13	ALT1	GPIO[13]	GPIO_2	(1*32 + 13)	0x2D
20	GPIO_Y4	EIM_EB3	ALT1	GPIO[31]	GPIO_2	(1*32 + 31)	0x3F
21	GPIO_W1	EIM_D20	ALT1	GPIO[20]	GPIO_3	(2*32 + 20)	0x54
22	GPIO_Y1	EIM_D23	ALT1	GPIO[23]	GPIO_3	(2*32 + 23)	0x57
23	GPIO_Y2	EIM_D24	ALT1	GPIO[24]	GPIO_3	(2*32 + 24)	0x58
24	GPIO_W3	EIM_D25	ALT1	GPIO[25]	GPIO_3	(2*32 + 25)	0x59
25	GPIO_V5	EIM_D26	ALT1	GPIO[26]	GPIO_3	(2*32 + 26)	0x5A
26	GPIO_V4	EIM_D27	ALT1	GPIO[27]	GPIO_3	(2*32 + 27)	0x5B
27	GND						
28	GND						
29	GPIO_AB8	NANDF_WE_B	ALT1	GPIO[12]	GPIO_6	(5*32 + 12)	0xAC
30	GPIO_AC8	NANDF_RE_B	ALT1	GPIO[13]	GPIO_6	(5*32 + 13)	0xAD
31	GPIO_J3	ATA_DIOW	ALT1	GPIO[17]	GPIO_6	(5*32 + 17)	0xB1
32	GPIO_J2	ATA_DMACK	ALT1	GPIO[18]	GPIO_6	(5*32 + 18)	0xB2
33	GPIO_J1	ATA_DMARQ	ALT1	GPIO[00]	GPIO_7	(6*32 + 00)	0xC0
34	N.C.						
35	N.C.						
36	N.C.						
37	N.C.						
38	N.C.						
39	GND						
40	GND						
41	DCDC_3V2						
42	DCDC_3V2						
43	GND						
44	GND						

Fig. 85 The GPIO Connector: mapping of the signals involved

4.22 3G_MALE: PIGGYBACK 3G EXPANSION CONNECTOR (OPTIONAL)

This is an optional 30pin 2.0mm pitch male header which has the signals needed for the piggyback 3G module, designed to host one Mini-PCI-express (MPCIe) mini-card holder. The piggyback plugs into this socket and is secured in three points with studs.
The piggy-back board has both the MPCIe socket (USB signals only) and the **SIM** card socket. The SMA connector is for the 3G antenna.
The drawing here below shows the piggyback board layout.

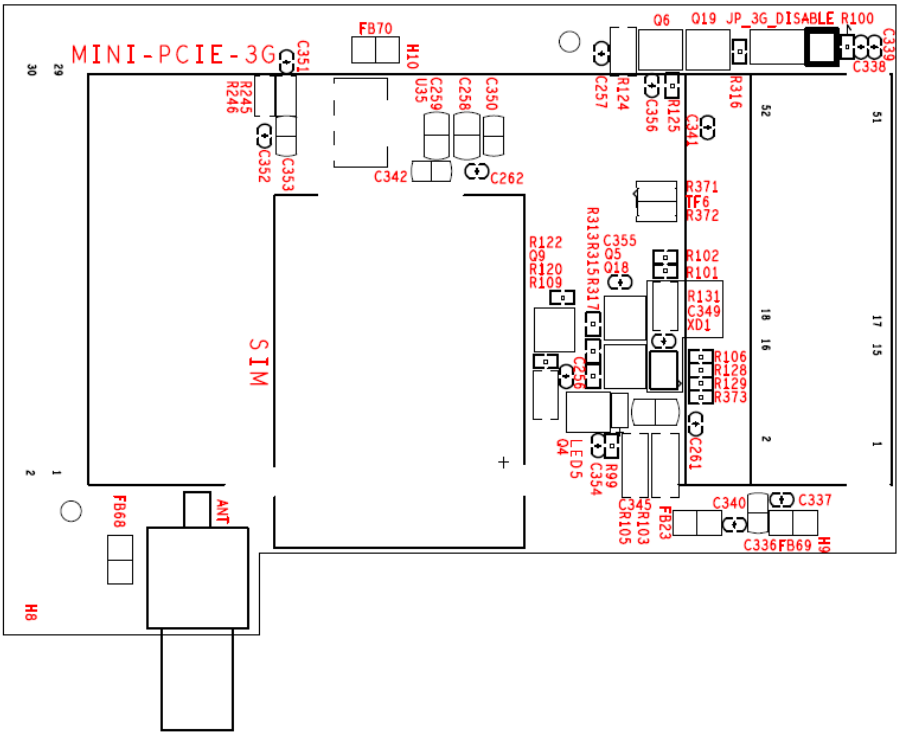


Fig. 86 Layout of the 3G piggyback board

This feature is optional, and even if the **3G_MALE** header is stuffed, by default the USBE connection is not brought to this connector, but used, normally, for the USBE connector.
Here below is the schematic of this male header.

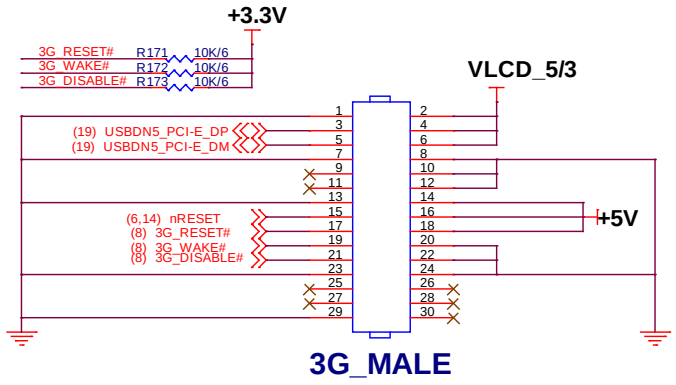


Fig. 87 Schematic of the 3G piggy board interface connector

Normally commercial MPCIe 3G modules require 2A (or more) at 3.3Vdc. That's why to use this board you need the fully populated C2 version, and set the Power Selection for U33 to 3.3V, so you get enough power from the onboard DCDC (U33). This may create conflicts with LCD power requirements, so be careful. See also the Chapter regarding the Power Routing of the C2.

4.23 LCD7 (BOTTOM SIDE) 7" TTL PANEL FLAT CABLE

This is a snap-in 40 pin FPC (flex PCB Cable) connector for a 18-bit RGB TTL 7" 800x480 LCD panel. It's placed at bottom side of PCBA, almost in centre of the board. Its position has been designed so that the FPC Cable can be easily connected to one 7"panel, and stay aligned with the LCD's FPC connector.

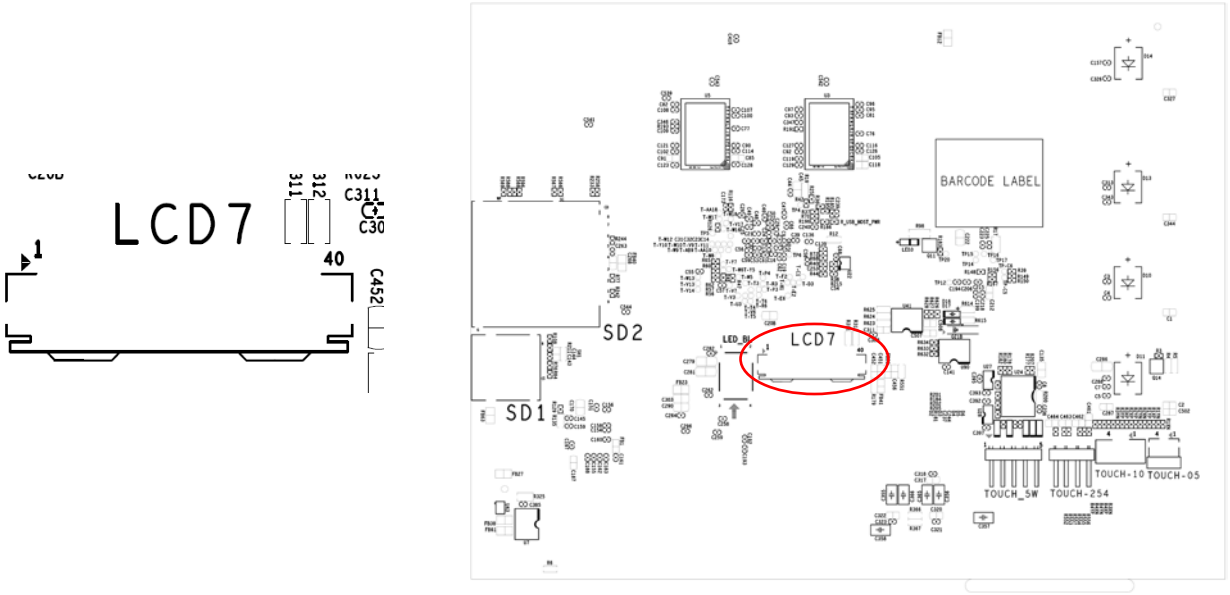


Fig. 88 The LCD7 Connector: designed for instant connection of a 7" LCD

The connector has a hinged brown clip which can be raised (gently) with a fingernail. Then the FPC cable must be carefully slid in the connector with the brown clip kept opened. **The blue side of the FPC cable must stay on top (visible)**. Then the brown clip has to be pushed downward (gently) to keep the FPC cable firmly in place.
The result will look like the image here below (where the LCD panel has been stuffed into a metal frame for ease of assembly in the final customer's configuration).

Fig. 89 The 40pin FPC cable connect the C2 to the TTL 7" LCD

As you can see, the connection is straightforward, and when the C2 is rotated over the LCD (to make a "sandwich") the FPC cable has plenty of ease to bend without any risk of damage, since both TTL connectors (LCD and C2) stay on the same axis.

4.23.1 FLEXIBLE 7” LCD INTERFACE

Two different models of 7” panels can be connected. CJB will suggest the correct models and also provide to you. Basically, you can connect either 7” panel with onboard LED driver, or 7” panels which need an external LED driver. Usually these latter panels are cheaper and are usually bonded with 4W resistive touch-screen.
The C2 can support both the supply for the LED backlight, and the 4W resistive touch interface.

4.23.1.1 Interface for 7” LCD with onboard LED driver

For this models the wiring is the following:

Pin NO.	SYMBOL	DESCRIPTION
1	Vss	Power Ground
2	Vss	Power Ground
3	ADJ	Brightness control for LED B/L
4	VDD	Power Supply for LED Driver circuit
5	VDD	Power Supply for LED Driver circuit
6	VDD	Power Supply for LED Driver circuit
7	Vcc	Power Supply for Digital Circuit
8	Vcc	Power Supply for Digital Circuit
9	DE	Data Enable
10	Vss	Power Ground
11	Vss	Power Ground
12	Vss	Power Ground
13	B5	Blue Data 5 (MSB)
14	B4	Blue Data 4
15	B3	Blue Data 3
16	Vss	Power Ground
17	B2	Blue Data 2
18	B1	Blue Data 1
19	B0	Blue Data 0 (LSB)
20	Vss	Power Ground
21	G5	Green Data 5 (MSB)
22	G4	Green Data 4
23	G3	Green Data 3
24	Vss	Power Ground
25	G2	Green Data 2
26	G1	Green Data 1
27	G0	Green Data 0 (LSB)
28	Vss	Power Ground
29	R5	Red Data 5 (MSB)
30	R4	Red Data 4
31	R3	Red Data 3
32	Vss	Power Ground
33	R2	Red Data 2
34	R1	Red Data 1
35	R0	Red Data 0 (LSB)
36	Vss	Power Ground
37	Vss	Power Ground
38	DCLK	Clock Signals ; Latch Data at the Falling Edge
39	Vss	Power Ground
40	Vss	Power Ground

Fig. 90 Typical 40 pin connector of a 7” LCD with onboard LED driver

Notice that Pins 4, 5 and 6 are the supply for the LED backlight (usually +5Vdc) while Pin 3 is the dimming control: PWM, if fixed at high level (3.3Vdc) the brightness is max., if fixed at low level (GND) the backlight is off. Vcc is the LCD power (3.3Vdc).

4.23.1.2 Interface for 7” LCD with external LED driver

Most cheap 7”TTL panels with onboard bonded resistive touch don’t have any onboard LED backlight driver, so the power for the backlight must be provided from outside.
The C2 can do that (see following chapters), but care must be taken because for such panels the 40 pin TTL interface is different, as you can see from the table here below.

Pin No.	Symbol	Description	Remark
1	GND	Power Ground	
2	GND	Power Ground	
3	NC	Not Connect	
4	Vcc	Power Supply for Digital Circuit	
5	Vcc	Power Supply for Digital Circuit	
6	Vcc	Power Supply for Digital Circuit	
7	Vcc	Power Supply for Digital Circuit	
8	NC	Not Connect	
9	DE	Data Enable	
10	GND	Power Ground	
11	GND	Power Ground	
12	GND	Power Ground	
13	B5	Blue Data 5 (MSB)	
14	B4	Blue Data 4	
15	B3	Blue Data 3	
16	GND	Power Ground	
17	B2	Blue Data 2	
18	B1	Blue Data 1	
19	B0	Blue Data 0 (LSB)	
20	GND	Power Ground	
21	G5	Green Data 5 (MSB)	
22	G4	Green Data 4	
23	G3	Green Data 3	
24	GND	Power Ground	
25	G2	Green Data 2	
26	G1	Green Data 1	
27	G0	Green Data 0 (LSB)	
28	GND	Power Ground	
29	R5	Red Data 5 (MSB)	
30	R4	Red Data 4	
31	R3	Red Data 3	
32	GND	Power Ground	
34	R1	Red Data 1	
33	R2	Red Data 2	
35	R0	Red Data 0 (LSB)	
36	GND	Power Ground	
37	GND	Power Ground	
38	CLK	Clock Signals ; Latch Data at the Falling Edge	
39	GND	Power Ground	
40	GND	Power Ground	

Fig. 91 Typical 40 pin connector of a 7” LCD without onboard LED driver

As you can see, the signal connection is almost same as that of the other model of panel described before, but Pins 3, 4, 5 and 6 are different. In fact, Pin 3 is not connected like Pin 8, while Pins 4, 5, 6 and 7 all bring the power supply for the LCD (3.3Vdc).
The LED backlight has a separate, independent connector, where the suitable Power must be supplied. The C2 has been designed to supply such power for the LCD’s LED backlight.

4.23.2 LED_BL CONNECTOR FOR 7”LCD LED BACKLIGHT

Just aside the LCD7 7” FPC connector there is the **LED_BL** connector, which is a special 2-pin socket (horizontal) which will fit the LED Backlight connector of the 7” LCD. This is only used when you have to connect a 7” LCD which does not have an onboard LED driver. The onboard LED driver of the C2 (U50) has been designed to feed the correct current for the LED backlight of such 7” panels.

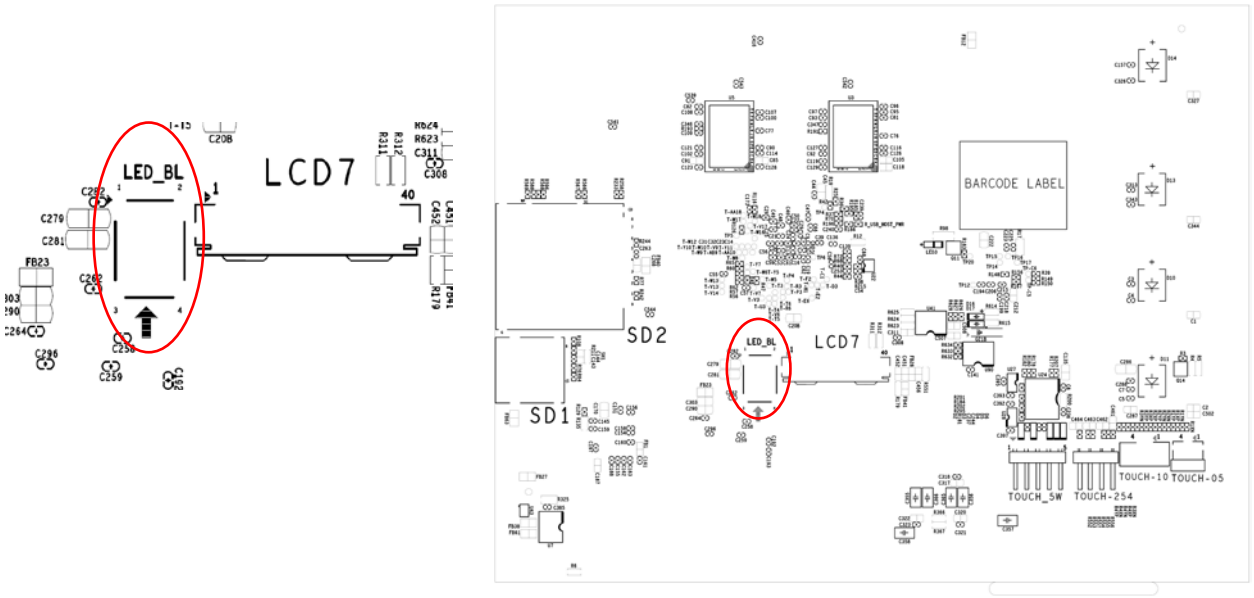


Fig. 92 The LED_BL connector for powering 7” backlight

Notice that if you design your assembly so that the C2 will stay as a “sandwich” together with the 7”LCD, the position of this connector has been chosen so that you can directly connect the original LCD backlight cable directly, and this saves costs. See, for example, the assembly below.

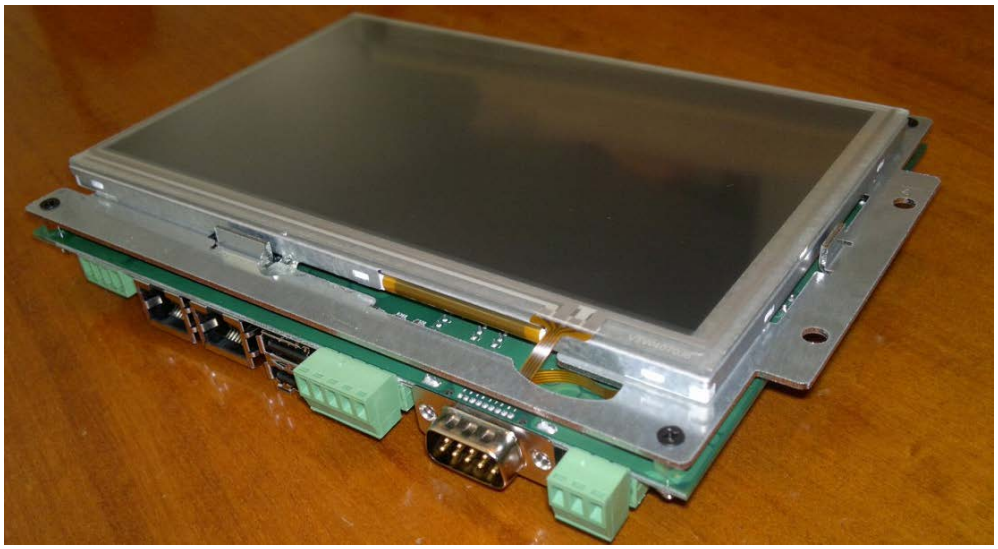


Fig. 93 The 7” LCD and the C2 assembled together

If you need to stuff the C2 far away from the LCD, you need special extension cables (see dedicated chapter which follows).

4.24 TOUCH (BOTTOM) CONNECTORS FOR 4W TOUCH SCRTEEN

There are 3 connectors for easy instant connection of a 4W (4 Wire) touch-screen. They are placed at bottom side of the board, opposite side of the SD sockets.

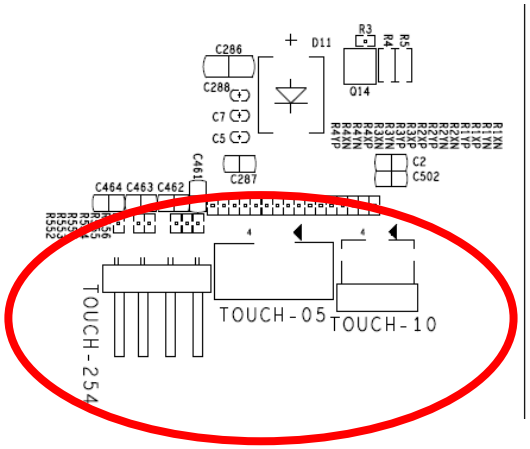


Fig. 94 The 3 types of 4W touch-screen connectors: 2.54mm header, 1.0mm and 0.5mm FPC

Three connectors have been provided in order to accommodate any typical solution coming from the bonded touch of the 7" panel: from left to right of the above image you see the 2.54mm header, the FPC connector with 1.0mm pitch and the FPC connector with 0.5mm pitch. They are wired in parallel. You will choose the one which fits the cable of the resistive touch-screen which you are using.

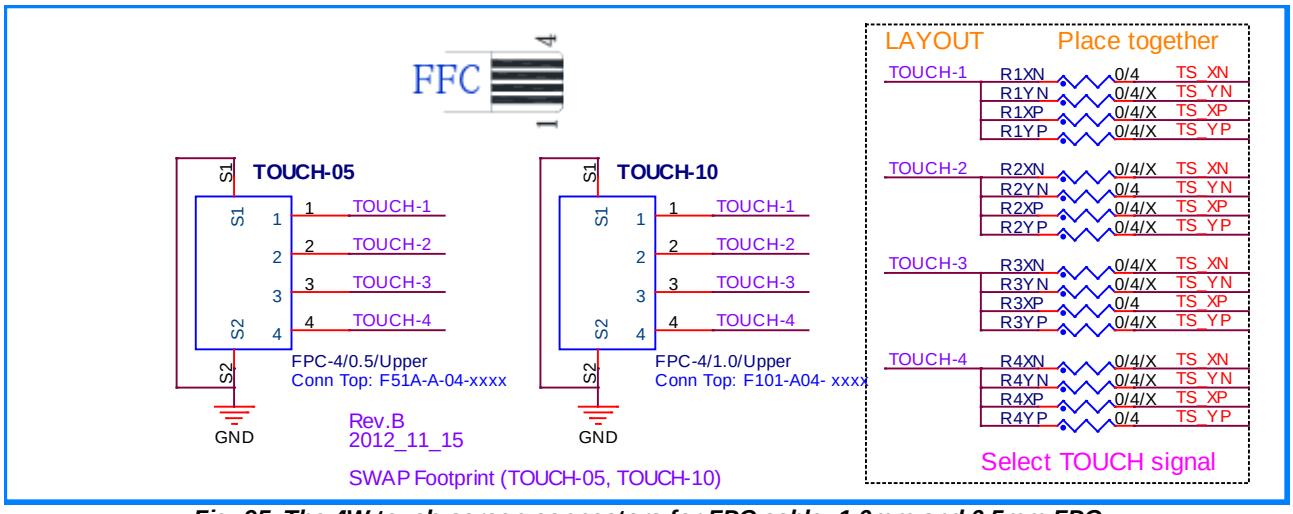


Fig. 95 The 4W touch-screen connectors for FPC cable: 1.0mm and 0.5mm FPC

The X/Y assignment can be changed thanks to an array of micro-resistors. The default configuration connects the following:

1. X negative → TOUCH-1
2. X positive → TOUCH-3
3. Y negative → TOUCH-2
4. Y positive → TOUCH-4

Also the 90º pin header **TOUCH-254** has a default configuration:

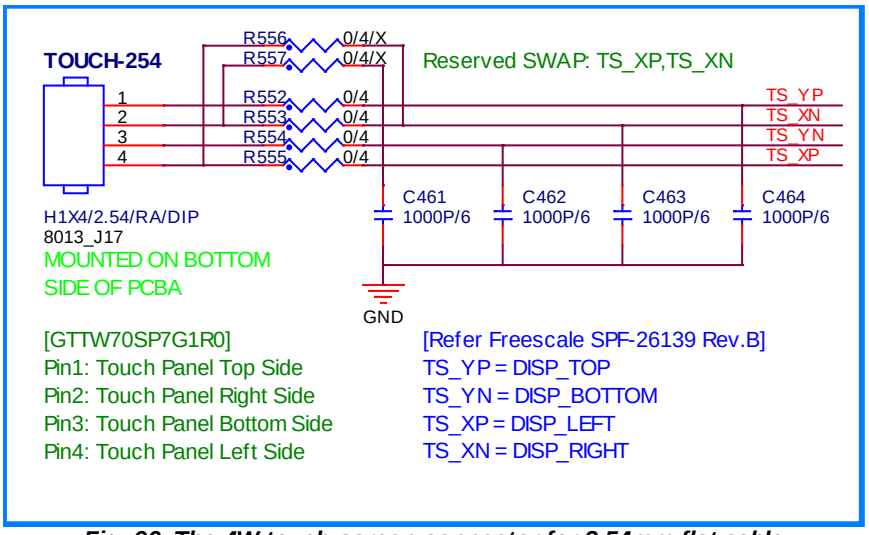


Fig. 96 The 4W touch-screen connector for 2.54mm flat cable

4.24.1 EXTENSION CABLES

CJB can provide suitable extension cables for both the 4W touch and the LED backlight, in case you need to place the C2 away of the LCD panel. For a minimum quantity, the extension cable length can be customized.

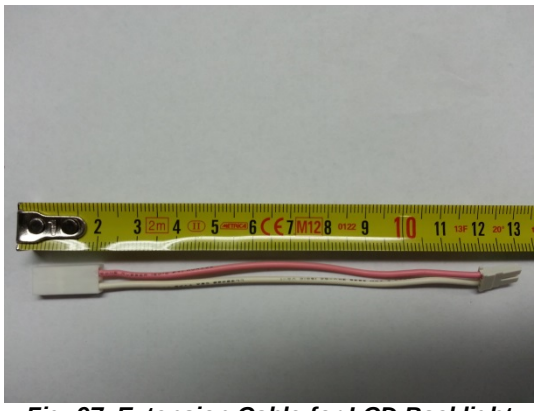


Fig. 97 Extension Cable for LCD Backlight

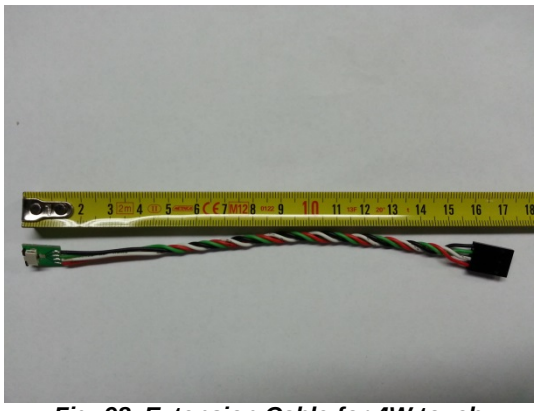


Fig. 98 Extension Cable for 4W touch

4.25 SD1 (BOTTOM SIDE) uSD MEMORY CARD SOCKET

This socket can host one µSD flash memory card positioned under the right edge of the board in a plug-plug spring socket. The µSD is self-recognized and can be plugged-in or removed even if the C2 board is powered on.

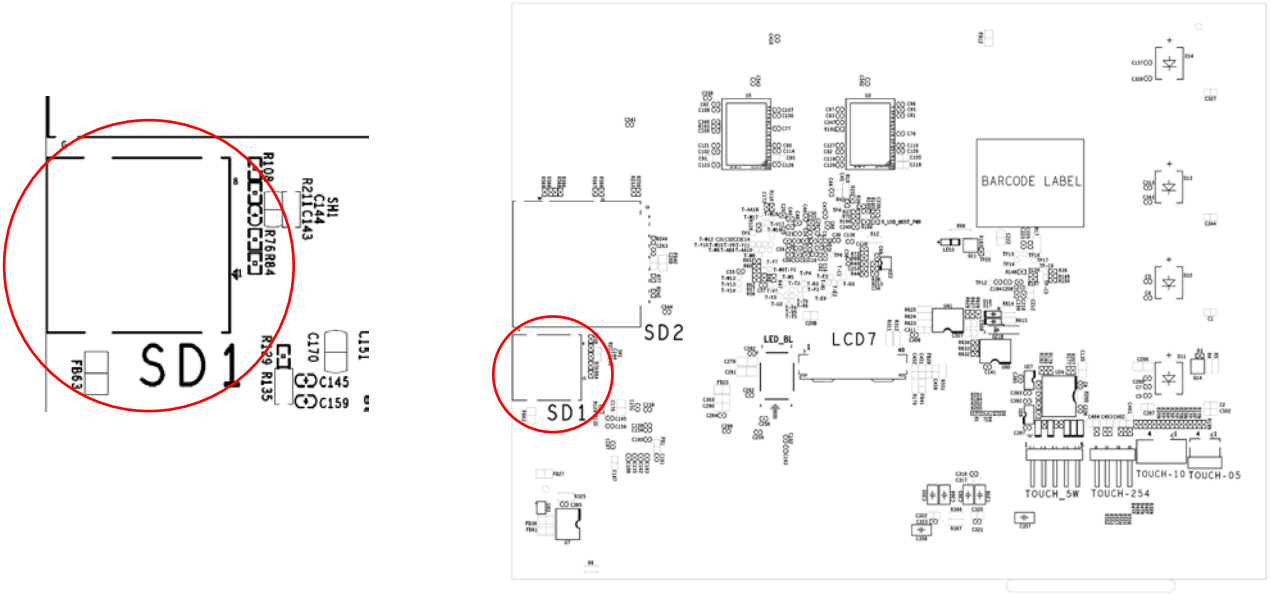


Fig. 99 µSD Flash Card Socket (Bottom Side)

4.26 SD2 (BOTTOM SIDE) SD MEMORY CARD SOCKET

This socket can host one SD flash memory card positioned under the right edge of the board in a plug-plug spring socket. The SD is self-recognized and can be plugged-in or removed even if the C2 board is powered on. The SD is managed as mass memory “hard disk like” device.

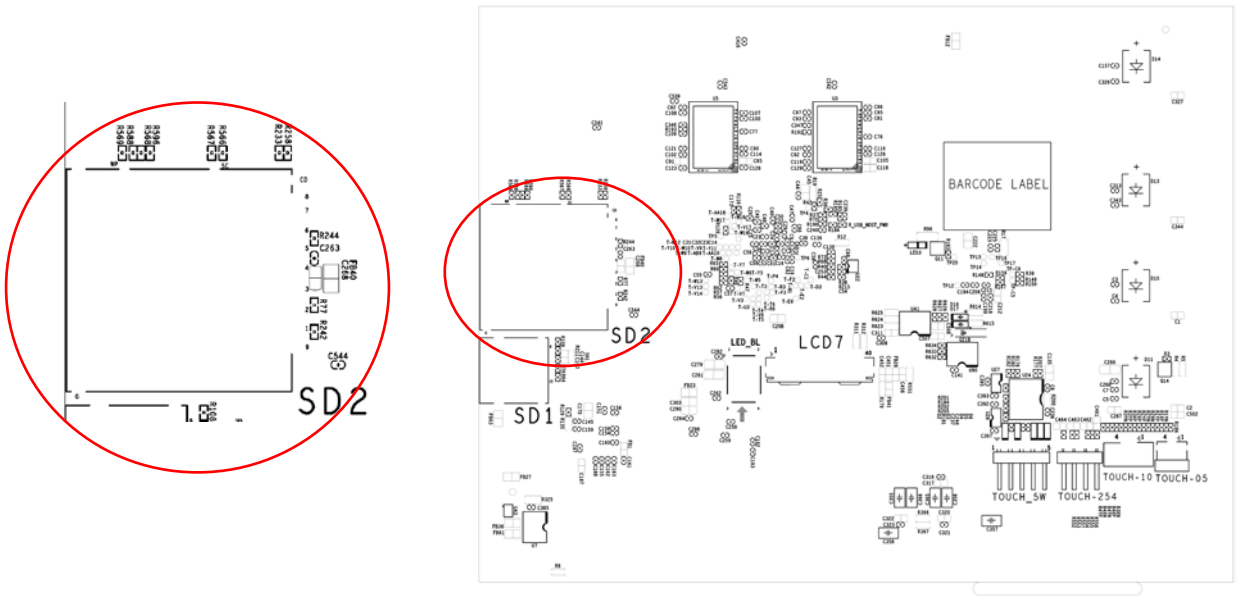


Fig. 100 SD Flash Card Socket (Bottom Side)

We suggest using the µSD for the Operating System, and the SD for data logging.

5 APPENDIX A: THE DEPOPULATED C2

Here below you see some photographs which show the depopulated C2, which is also **"CNC Coated"** with UL-recognized resins from manufacturer company "Peters" (Made in Germany).
The depopulated C2 is pre-treated with some special glue to protect sensible parts (e.g.: connectors) to prevent the coating chemicals penetrate the connector and isolate the contacts.

Fig. 101 3D view of the Depopulated & Coated C2

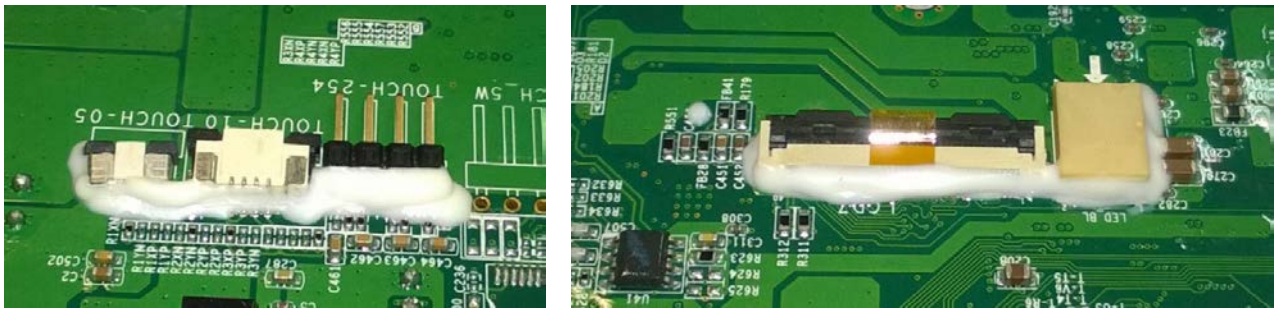


Fig. 102 Coating Protection for Touch (left) and TTL LCD (right) connectors

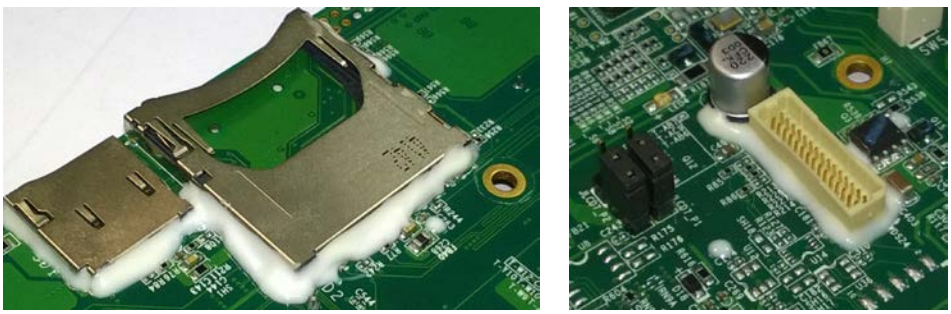


Fig. 103 Coating Protection for uSD/SD (left) and LVDS LCD (right) connectors

5.1 FEATURES OF THE DEPOPULATED C2

The depopulated C2 is manufactured for applications which require the connection of small 7”LCD panels, either TTL or LVDS.
These are the main features of the depopulated C2 compared to the “Full” version:

1. Has one Ethernet port only (ETH0)
2. Can’t support big-sized LCD panels since U33 and U34 onboard DC/DC are not stuffed
3. Has a special tropicalization coating

Ask CJB for suggestions about the best usage of the C2 board, either Full or Depopulated. The choice has to be made according which LCD panel you need to connect.

6 APPENDIX B: QUICK JUMPER SETTING CONFIGURATIONS

The following chapters show some typical jumper settings which can be used as guideline when using the C2 (Full, Depopulated) in your application. For any further question, contact CJB.

- C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD (Data Image)
- C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD (Chi Mei Resistive)
- C2 DEPOPULATED, +24V DC_IN, 7" LVDS LCD (Data Image)

- C2 FULL, +24V DC_IN, 7" TTL LCD (Data Image)
- C2 FULL, +24V DC_IN, 7" TTL LCD (Chi Mei Resistive)
- C2 FULL, +24V DC_IN, 7" LVDS LCD (Data Image)

- C2 FULL, +24V DC_IN, 15" LVDS LCD (LCD with Vcc = 3.3V)
- C2 FULL, +24V DC_IN, 15" LVDS LCD (LCD with Vcc = 5V)

Notes about following Jumper Setting schemes:

1) It is assumed that the system power is always 24Vdc or anyway over 16Vdc.
2) Above statement means the C2 Full can always use U33 and U34.

3) For Data Image 7" LCD (TTL) the LCD power is 3.3Vdc while the backlight power is 5Vdc and is fed to the LCD through the same 40 pin FPC cable from LCD7 connector (bottom side).
4) For Chi Mei 7" LCD (TTL) the LCD power is also 3.3Vdc, but the backlight power is generated onboard the C2 (by U50) and is fed to the LCD through the LED_BL connector (bottom side).
5) For Data Image 7" LCD (LVDS) the LCD power is 3.3Vdc while the backlight power is 5Vdc and is fed to the LCD through the INV connector of the C2.
6) For other LVDS LCD panels which require either 3.3Vdc or 5Vdc power the backlight power is assumed to be always 12Vdc (for the LED driver board or the CCFL inverter: which is used does not matter); the power for the backlight comes from the INV connector of the C2, and the LCD power must be set accordingly to the LCD specs (3.3V or 5V). Usually 3.3V are used up to 15" panels, while 17" and over need 5V.
7) The pin assignment of the LVDS connection must be customized according to the LCD which must be connected. Ask CJB for support. CJB can also provide custom made cables.
8) Never feed the backlight through the LVDS connector, since the LVDS24 connector has been designed only to support the LCD panel's Vcc.
9) For the usage of other types of LCD panels, which require different voltages (like 12Vdc for example) contact CJB for more3 details about jumper settings.

6.1 C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD (Data Image)

Notice: a **RED CROSS** over a jumper means the jumper cap position is "don't care", or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

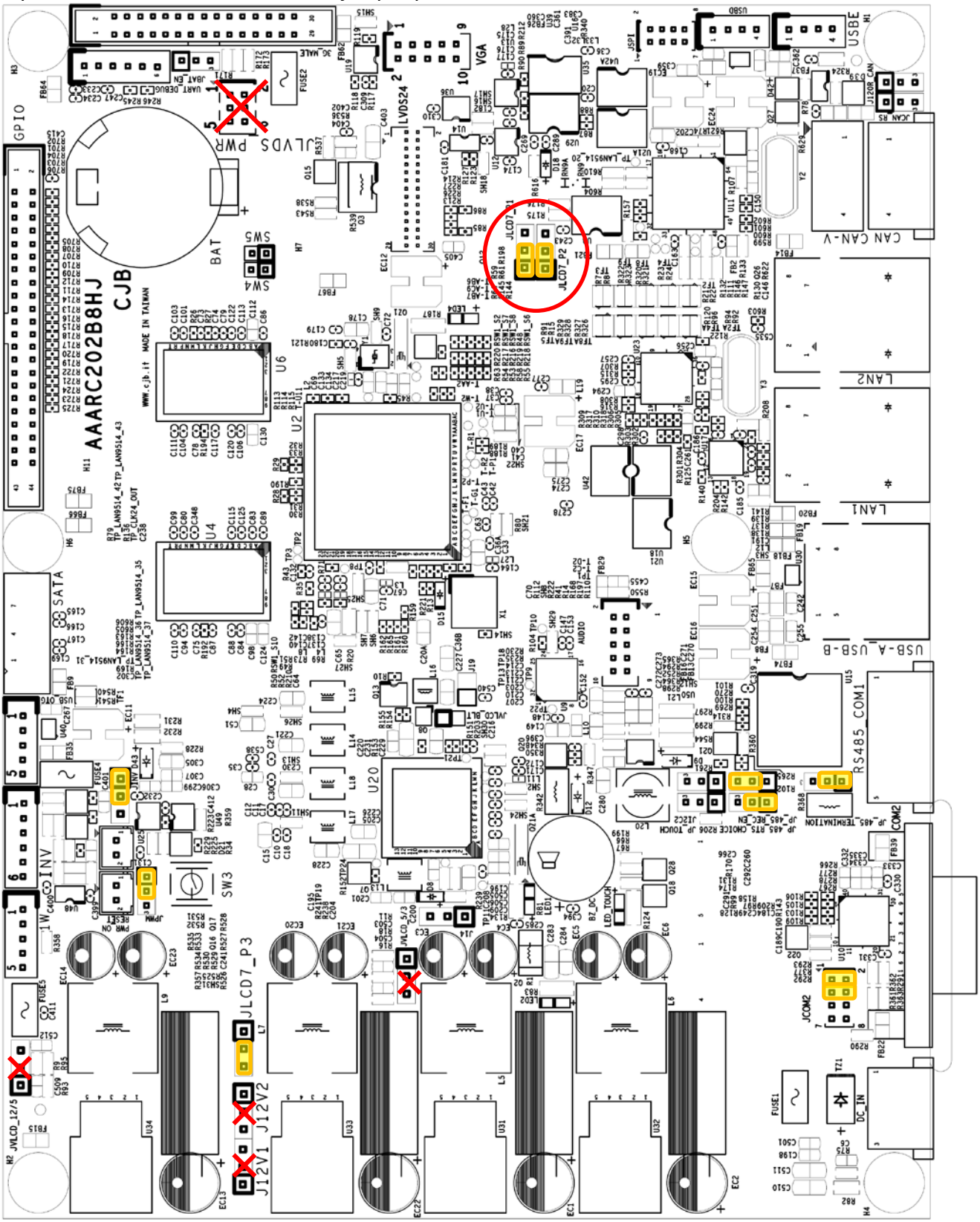


Fig. 104 C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD Data Image

JVLCD_12/5, J12V1, J12V2, JLVLCD_5/3: not stuffed	**JLVDS_PWR open or 3-4**
JINV: 1-2	**JLCD7_P3: 2-3 (or open)**
JLCD7_P1, JLCD7_P2: 1-2 both	**JPWM: 1-2**

(Backlight power = 5Vdc from FPC Cable 40 pin)

6.2 C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD (Chi Mei Resistive)

Notice: a **RED CROSS** over a jumper means the jumper cap position is "don't care", or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

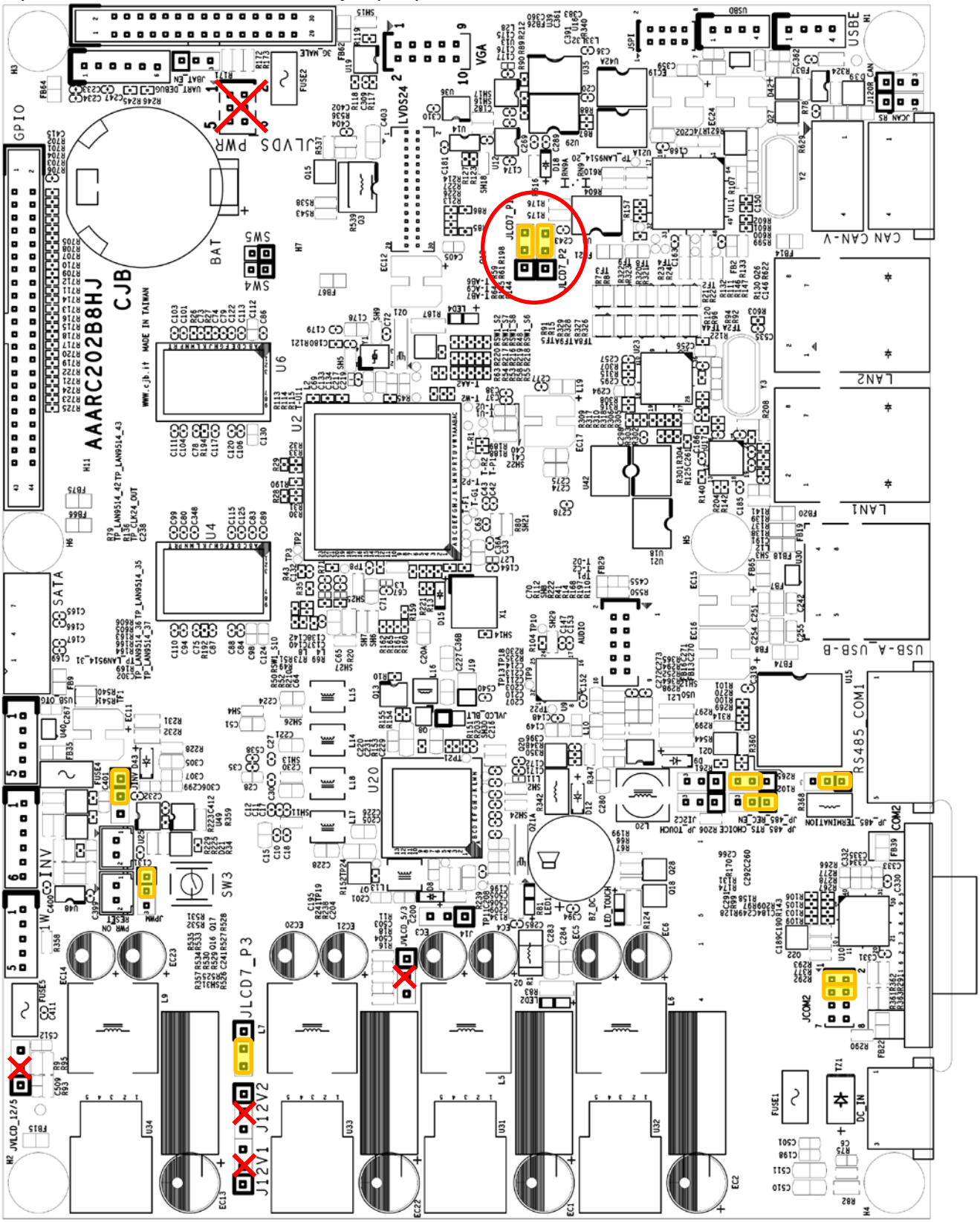


Fig. 105 C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD Chi Mei (Resistive Touch)

JVLCD_12/5, J12V1, J12V2, JLVLCD_5/3: not stuffed	**JLVDS_PWR open or 3-4**
JINV: 1-2	**JLCD7_P3: 2-3**
JLCD7_P1, JLCD7_P2: 2-3 both	**JPWM: 1-2**

(Backlight power from onboard LED Driver)

6.3 C2 DEPOPULATED, +24V DC_IN, 7" LVDS LCD (Data Image)

Notice: a **RED CROSS** over a jumper means the jumper cap position is "don't care", or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

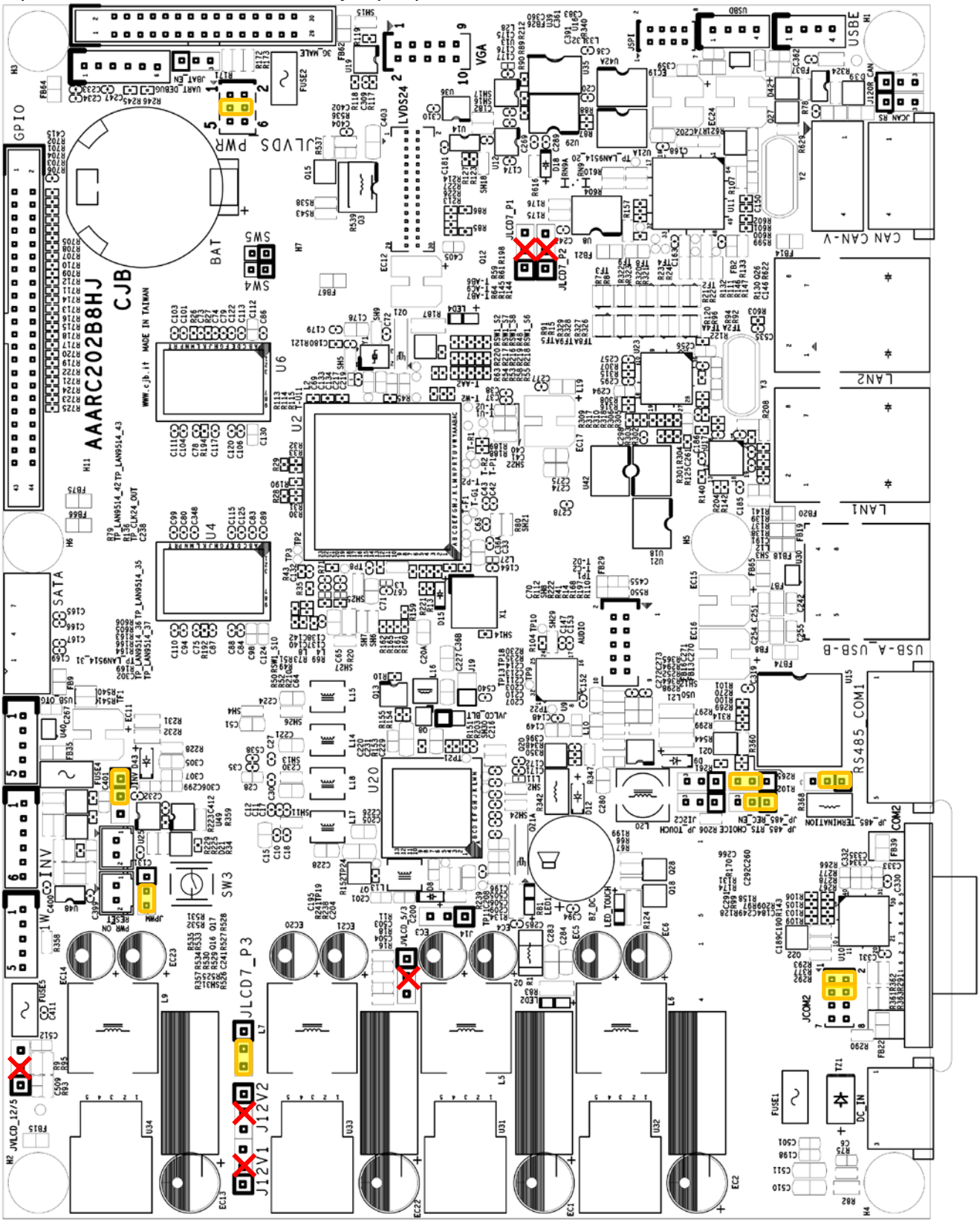


Fig. 106 C2 DEPOPULATED, +24V DC_IN, 7" LVDS LCD Data Image

JVLCD_12/5, J12V1, J12V2, JLVLCD_5/3: not stuffed	**JLVDS_PWR: 3-4**
JINV: 1-2	**JLCD7_P3: 2-3 or open**
JLCD7_P1, JLCD7_P2: 2-3 or open	**JPWM: 2-3**

(Backlight power = 5Vdc from INV Connector)

6.4 C2 FULL, +24V DC_IN, 7" TTL LCD (Data Image)

Notice: a **RED CROSS** over a jumper means the jumper cap position is "don't care", or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

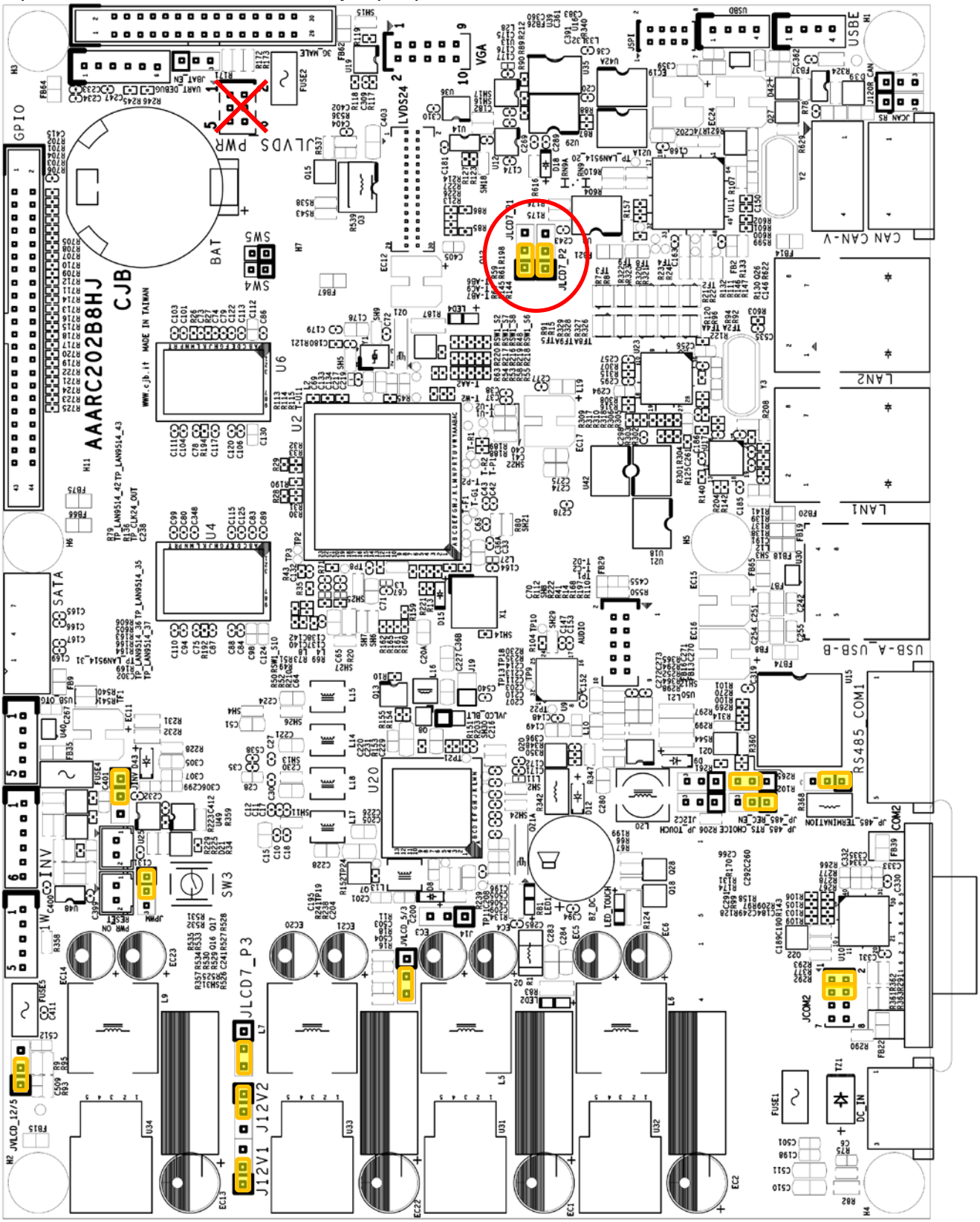


Fig. 107 C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD Data Image

JVLCD_12/5: 1-2	**J12V1, J12V2: 1-2**	**JLVDS_PWR: 3-4 or open**
JINV: 1-2	**JPWM: 1-2**	**JVLCD_5/3: 2-3**
JLCD7_P1, JLCD7_P2: 1-2		**JLCD7_P3: 2-3 or open**

(Backlight power = 5Vdc from FPC cable 40 pin)

6.5 C2 FULL, +24V DC_IN, 7" TTL LCD (Chi Mei Resistive))

Notice: a **RED CROSS** over a jumper means the jumper cap position is "don't care", or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

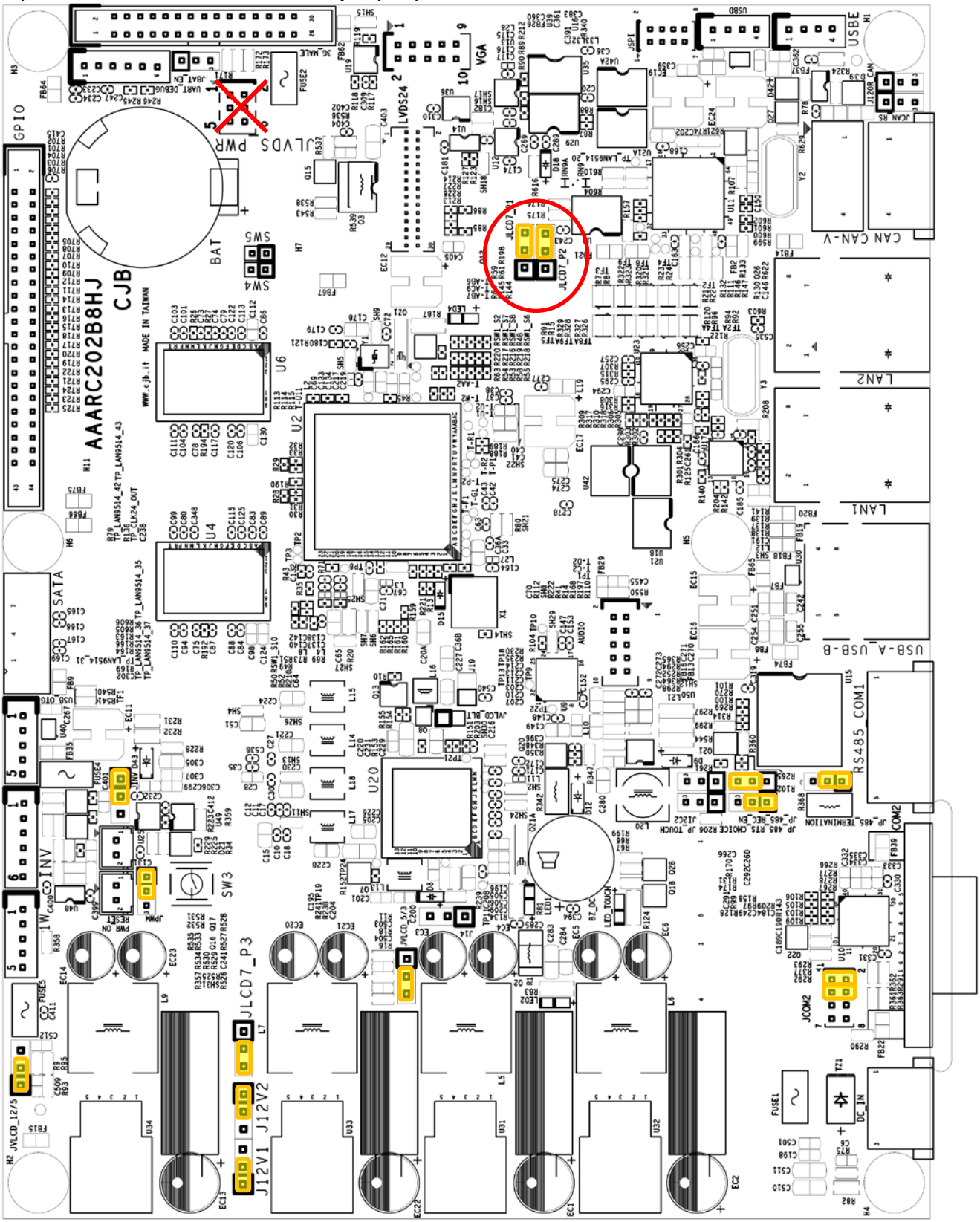


Fig. 108 C2 DEPOPULATED, +24V DC_IN, 7" TTL LCD Chi Mei Resistive

JVLCD_12/5: 1-2	**J12V1, J12V2: 1-2**	**JLVDS_PWR: 3-4 or open**
JINV: 1-2	**JPWM: 1-2**	**JVLCD_5/3: 2-3**
JLCD7_P1, JLCD7_P2: 2-3		**JLCD7_P3: 2-3 or open**

(Backlight power from onboard LED Driver)

6.6 C2 FULL, +24V DC_IN, 7" LVDS LCD (Data Image)

Notice: a **RED CROSS** over a jumper means the jumper cap position is "don't care", or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

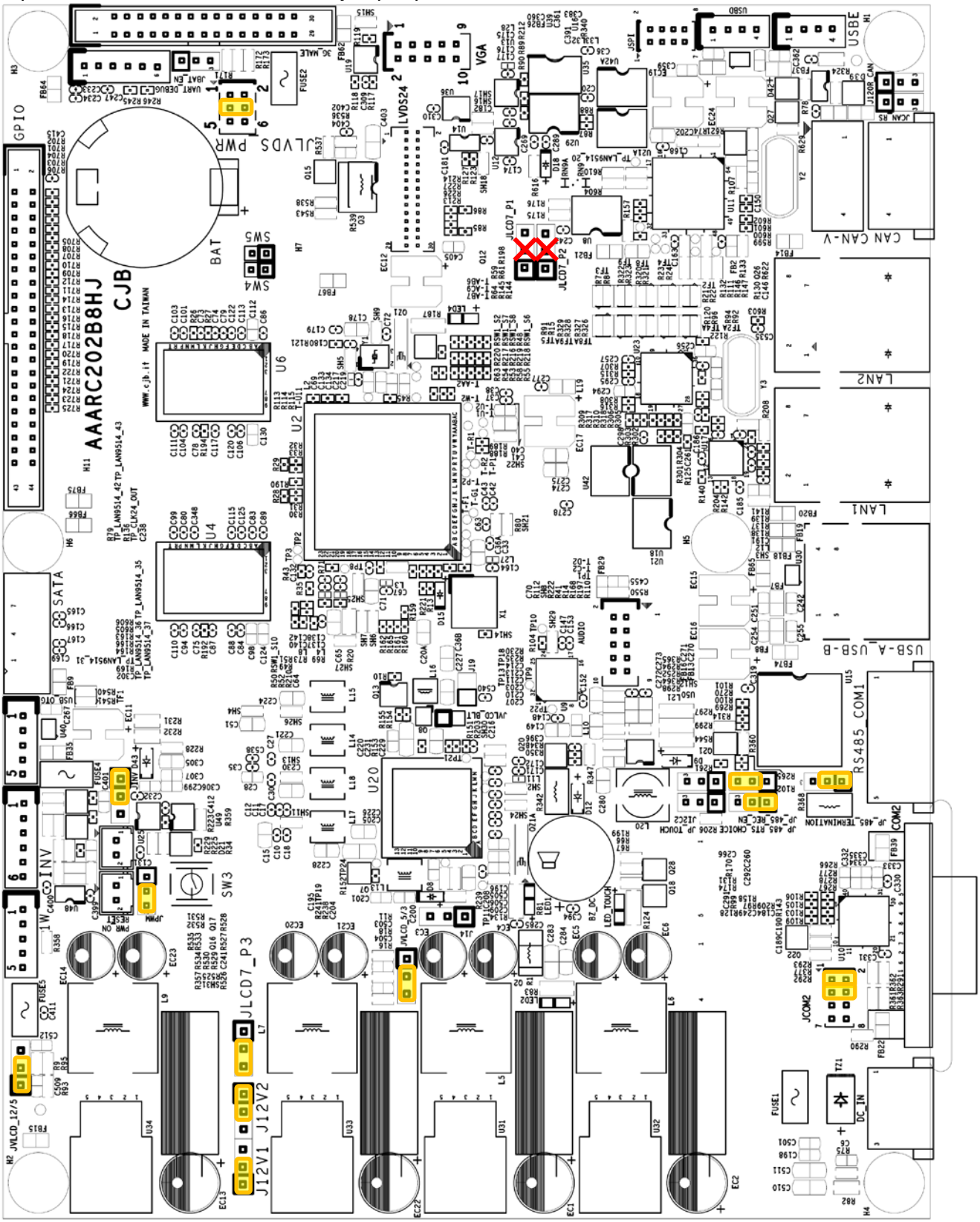


Fig. 109 C2 FULL, +24V DC_IN, 7" LVDS LCD Data Image

JVLCD_12/5: 1-2	**J12V1, J12V2: 1-2**	**JLVDS_PWR: 3-4**
JINV: 1-2	**JPWM: 2-3**	**JVLCD_5/3: 2-3**
JLCD7_P1, JLCD7_P2: 2-3 or open		**JLCD7_P3: 2-3 or open**

(Backlight power = 5Vdc from INV Connector)

6.7 C2 FULL, +24V DC_IN, 3.3V LVDS LCD (LCD with Vcc = 3.3V)

Notice: a **RED CROSS** over a jumper means the jumper cap position is “don’t care”, or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

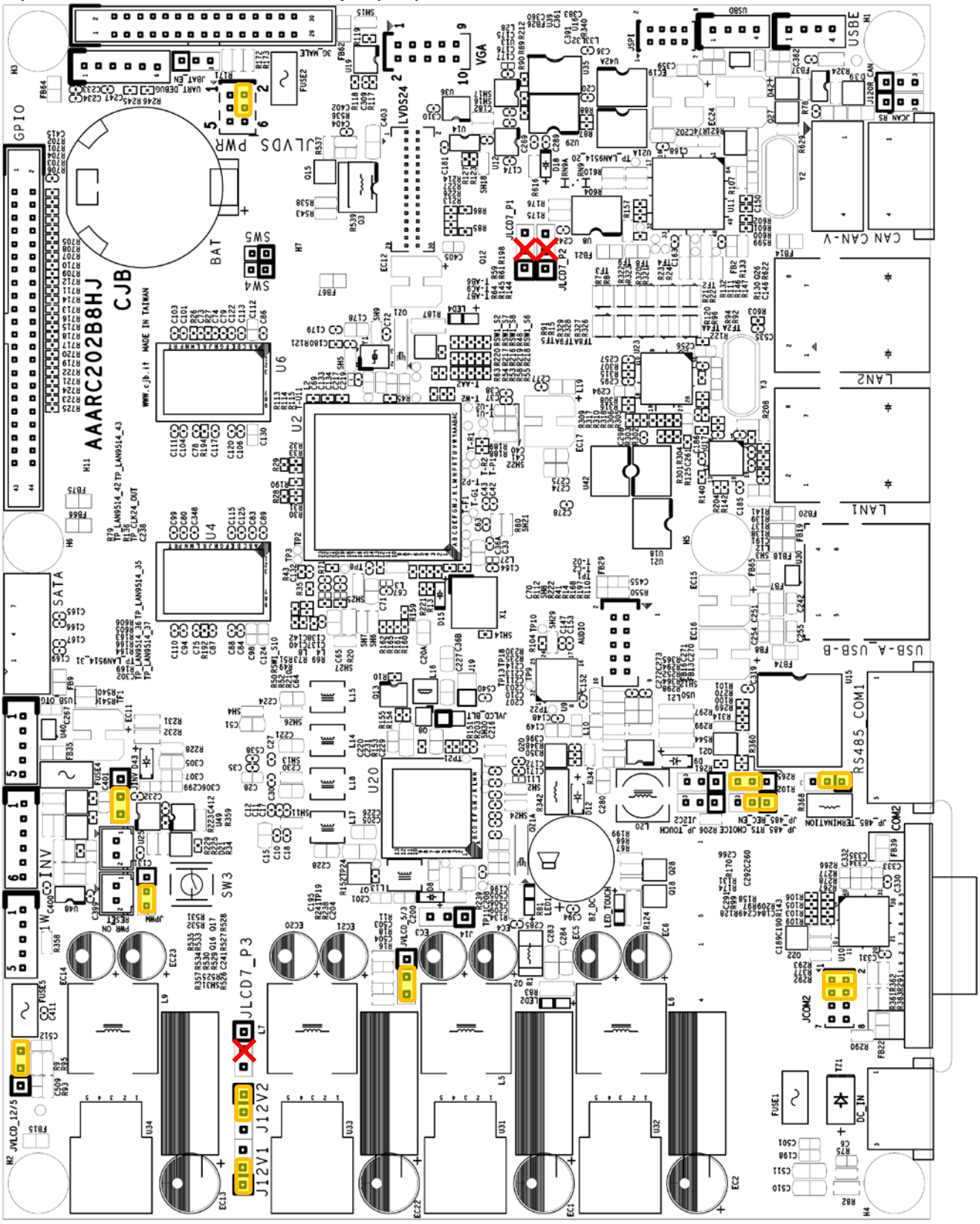


Fig. 110 C2 FULL, +24V DC_IN, 7” LVDS LCD (with Vcc = 3.3Vdc)

JVLCD_12/5: 2-3	**J12V1, J12V2: 1-2**	**JLVDS_PWR: 2-4**
JINV: 2-3	**JPWM: 2-3**	**JVLCD_5/3: 2-3**
JLCD7_P1, JLCD7_P2: 1-2 or open		**JLCD7_P3: open**

(Backlight power = 12Vdc from INV Connector)

6.8 C2 FULL, +24V DC_IN, 5V LVDS LCD (LCD with Vcc = 5V)

Notice: a **RED CROSS** over a jumper means the jumper cap position is “don’t care”, or the jumper-cap can be removed as well, or the jumper pin header is not stuffed.

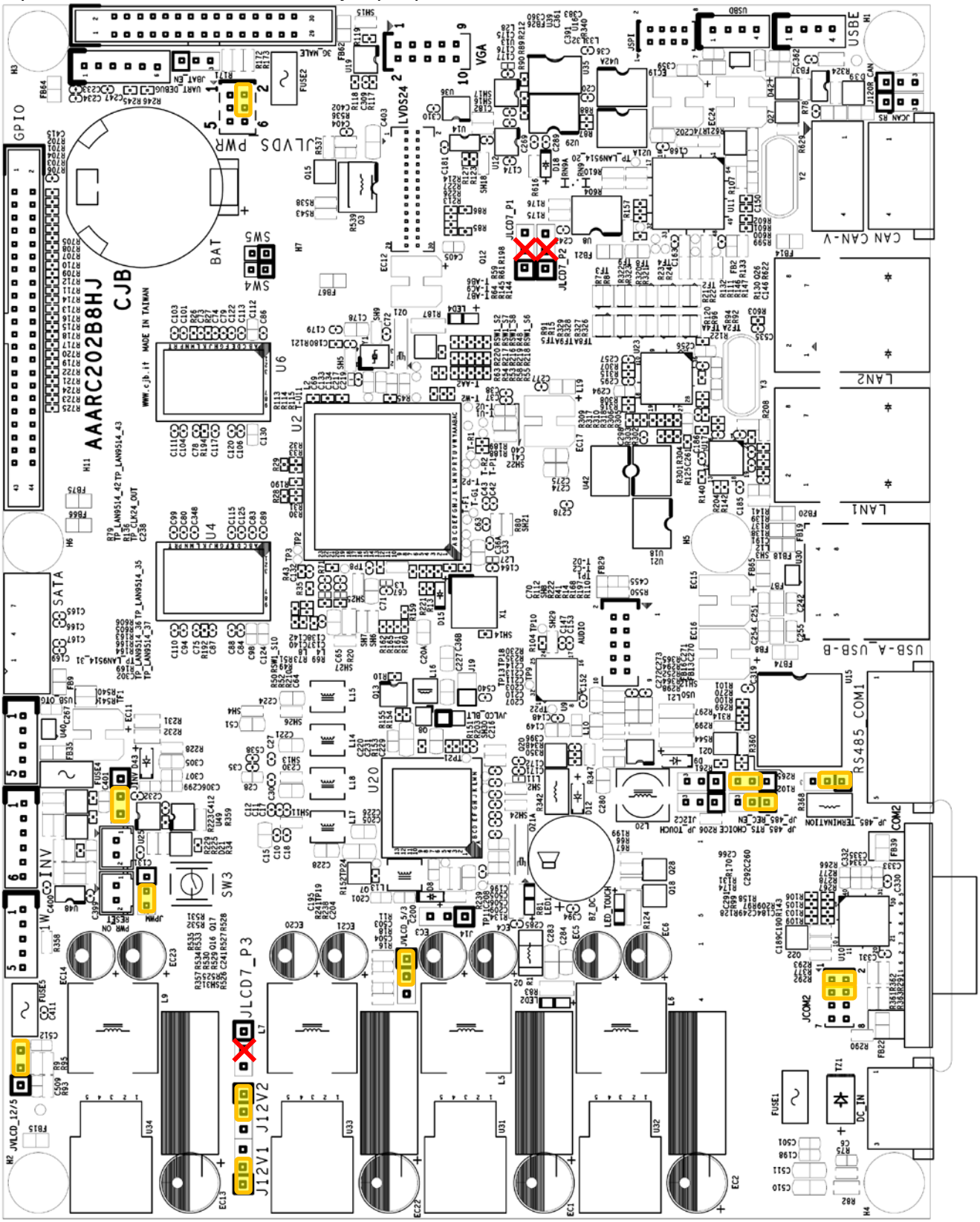


Fig. 111 C2 FULL, +24V DC_IN, 7” LVDS LCD (with Vcc = 5Vdc)

JVLCD_12/5: 2-3	**J12V1, J12V2: 1-2**	**JLVDS_PWR: 2-4**
JINV: 2-3	**JPWM: 2-3**	**JVLCD_5/3: 1-2**
JLCD7_P1, JLCD7_P2: 1-2 or open		**JLCD7_P3: open**

(Backlight power = 12Vdc from INV Connector)