HLib
An Arm-based
Hardware Library

CONNECTOR INTERFACE
SPECIFICATION

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Ho Chi Minh City, 2013-SEP-04

Version	Description	Editor	Date
1.0	Initial release	Bui Van Hieu	2013-05-14
1.1	Correct errors in SPI	Bui Van Hieu	2013-07-08
1.2	Refine and reorganize documents. Exchange male/female header role	Bui Van Hieu	2013-09-04

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CHAPTER 1. HARDWARE DESIGN RULES

1. Connector rules

1) Headers of MBoard must be *female* or *stackable* headers
2) Headers of SBoard must be *stackable* headers
3) Headers of EBoard must be *male* headers and *optional identical female* headers
4) All single row connectors must have 3V3 and Gnd pins. Pin 1 is 3V3, and Pin 2 is GND as below figure

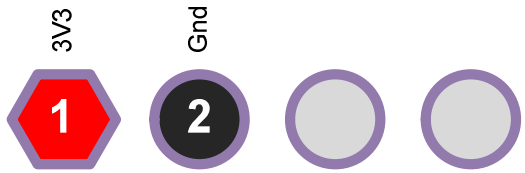

Figure 1. Position of 3V3 and Gnd pins in single-row connector

5) In double-row connector: pins are assigned in zig-zag schema and position of 3V3 and GND as below figure

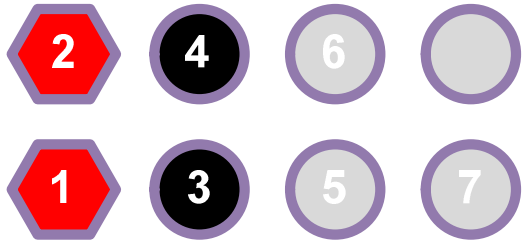

Figure 2. Position of 3V3 and Gnd pins in double-row connector

6) All connectors uses 2.54 mm (100 mil) pitch

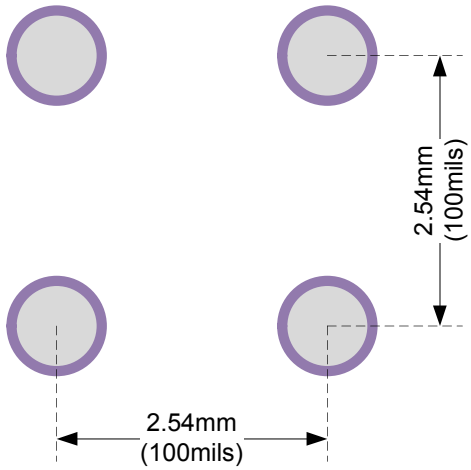

Figure 3. Pin space of connectors

2. Direction of MBoard connector

Whenever you place a connector in an MBoard, you have to ensure its direction follow rule in this section.

2.1. Single-row connector direction

Depending on relative position of connectors in a PCB, they must be arranged as below figure

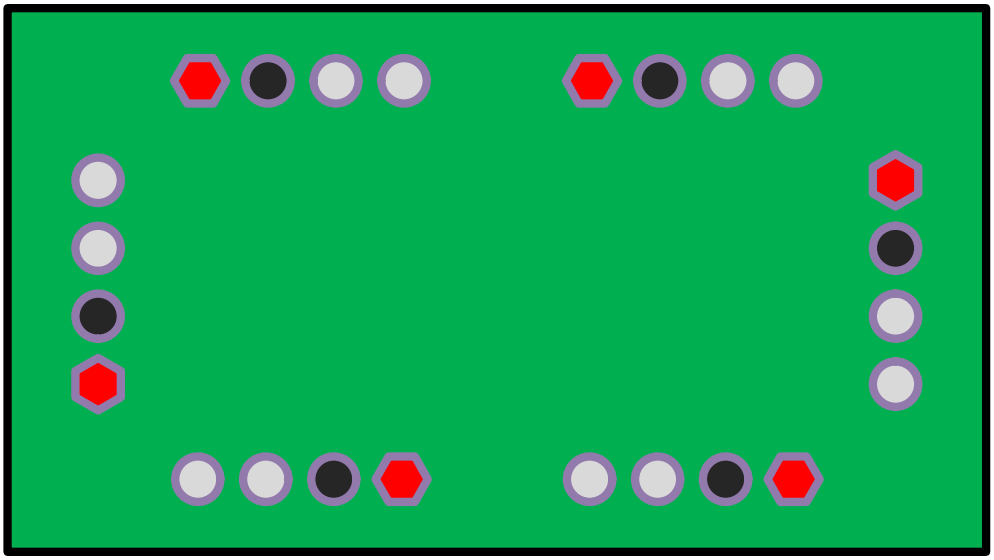

Figure 4. Direction of single-row in MBoard at different sides (look from top)

2.2. Double-row connector direction

Depending on relative position of connectors in a PCB, they must be arranged as below figure

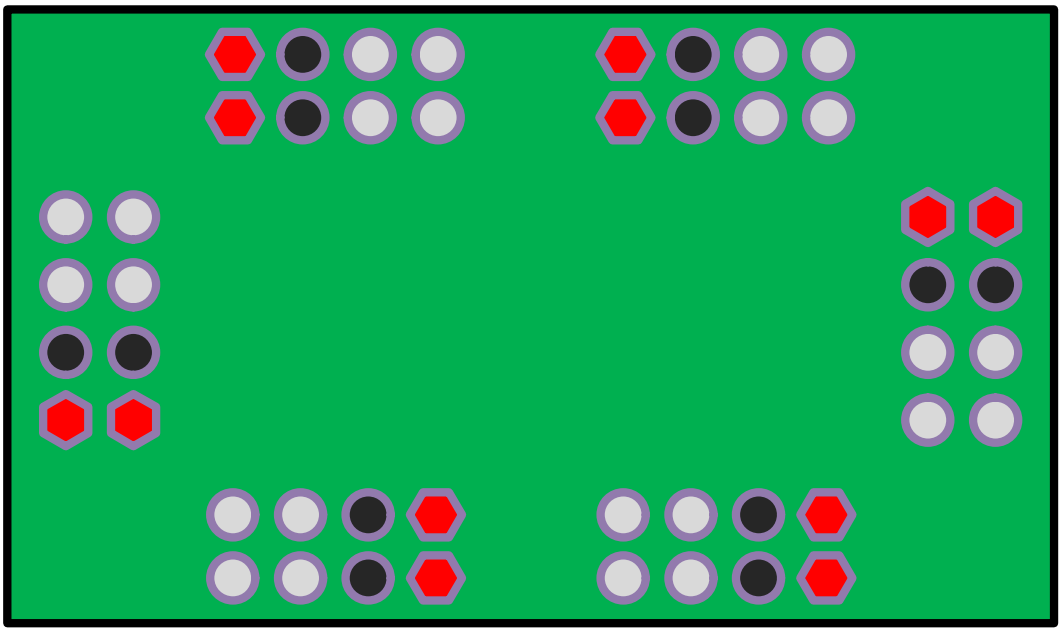

Figure 5. Direction of double-row in MBoard at different sides

3. Board hole rules

1) Drill hole is 3mm
2) No pad over drill hole
3) Clearance area around drill hole is 5mm

CHAPTER 2. M-BOARD INTERFACES

1. MBoad – Connector terminology

There are four types of connector used in MBoard and called as: simple connector, standard connector, extended connector, and universal connector.

Simple connectors have 4 pins with 2 signal pins as below

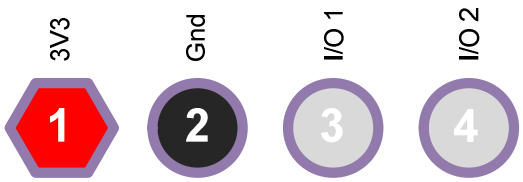

Figure 6. Simple connector

Standard connectors have 6 pins with 4 signal pins as below

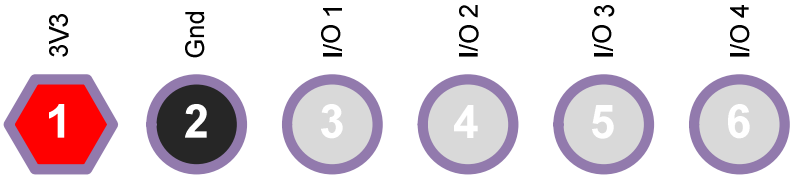

Figure 7. Standard connector

Extended connectors have 10 pins with 8 signal pins as below

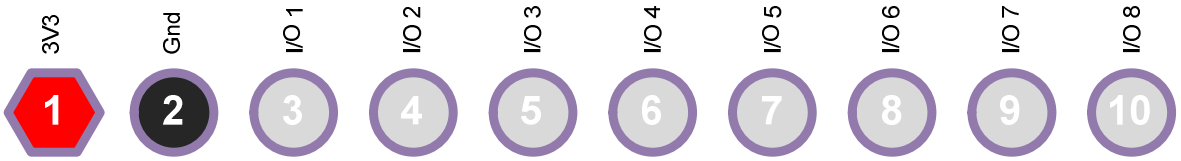

Figure 8. Extended connector

Universal connectors have 8 pin with 5 signal pins and 5V power supply as below

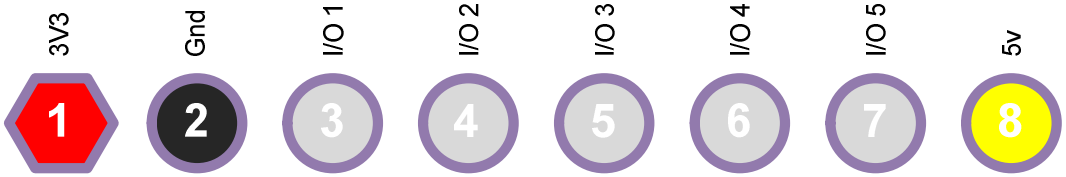

Figure 9. Universal connector

2. MBoard - UART interface

Figure 10. MBoard - Simple UART

Figure 11. MBoard – Standard UART

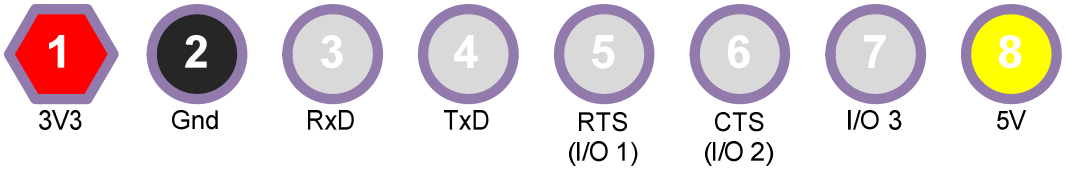

Figure 12. MBoard – Universal UART

3. MBoard - I2C interface

I2C of MBoards do not have pull-up resistors

Figure 13. MBoard – Simple I2C

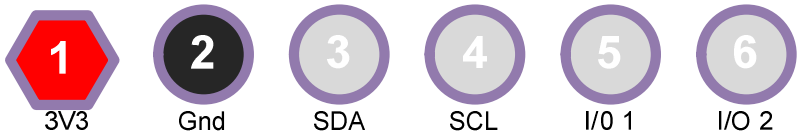

Figure 14. MBoard – Standard I2C

Figure 15. MBoard – Universal I2C

4. MBoard - SPI interface

Figure 16. MBoard – Standard SPI

Figure 17. MBoard –Universal SPI

5. MBoard - CAN interface

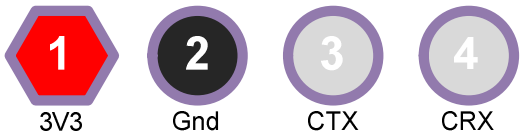

Figure 18. MBoard – Simple CAN

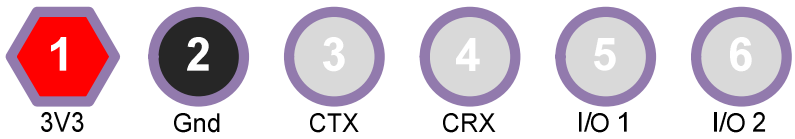

Figure 19. MBoard – Standard CAN

Figure 20. Universal CAN

6. MBoard - TIMER interface

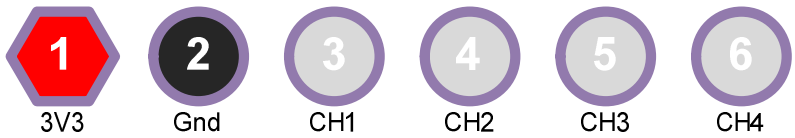

Figure 21. MBoard – Standard TIMER

Figure 22. MBoard – Universal TIMER

Figure 23. MBoard – Extended TIMER

7. MBoard - ADC interface

Figure 24. MBoard – Standard ADC

Figure 25. MBoard – Universal ADC

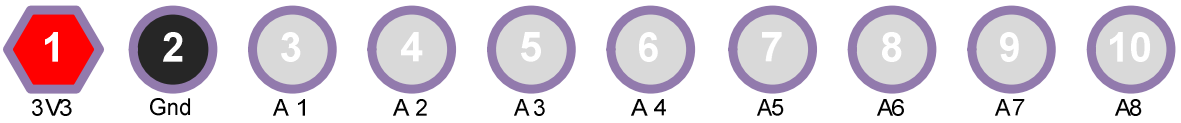

Figure 26. MBoard – Extended ADC

8. MBoard - Power inteface

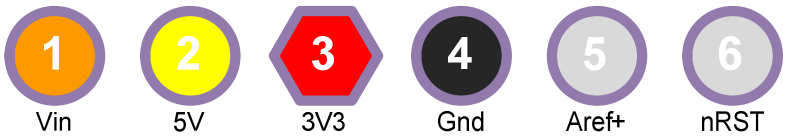

Figure 27. MBoard – Power interface

CHAPTER 3. SBOARD/EBOARD INTERFACES

1. SBoard/EBoard - UART interface

1.1. SBoard/EBoard – UART level translation interface

Figure 28. SBoard/EBoard – Simple UART level translation

Figure 29. SBoard/EBoard – Standard UART level translation

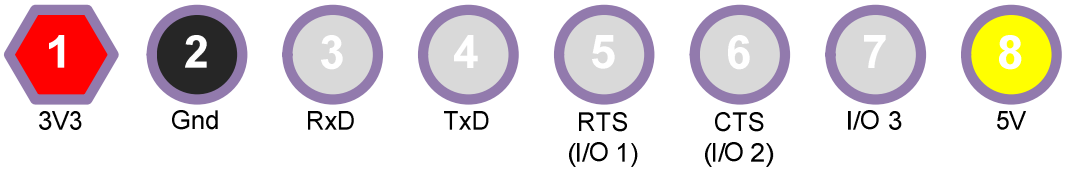

Figure 30. SBoard/EBoard – Universal UART level translation

1.2. SBoard/EBoard – UART data communication interface

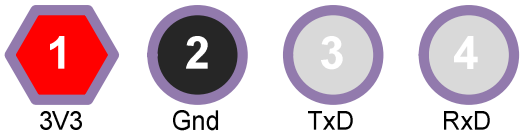

Figure 31. SBoard/EBoard – Simple UART data communication

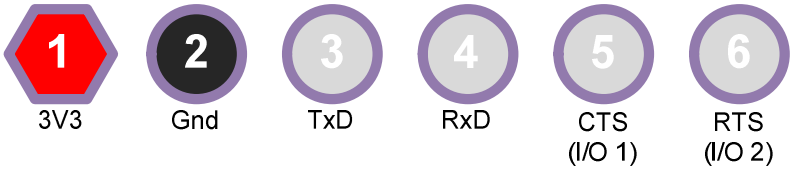

Figure 32. SBoard/EBoard – Standard UART data communication

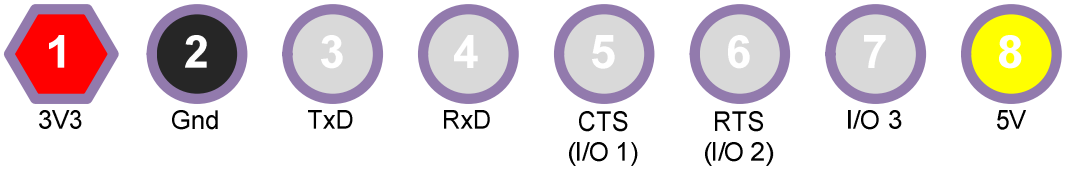

Figure 33. SBoard/EBoard – Universal UART data communication

2. SBoard/EBoard - I2C interface

I2C of SBoard/EBoard must have pull-up resistors

Figure 34. SBoard/EBoard – Simple I2C

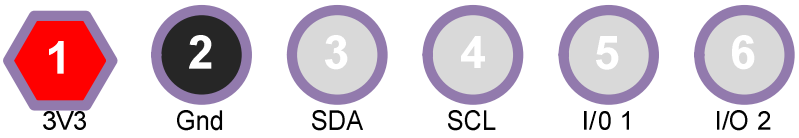

Figure 35. SBoard/EBoard – Standard I2C

Figure 36. SBoard/EBoard – Universal I2C

3. SBoard/EBoard - SPI interface

Figure 37. SBoard/EBoard – Standard SPI

Figure 38. SBoard/EBoard – Universal SPI

4. SBoard/EBoard - CAN interface

4.1. SBoard/EBoard – CAN level translation interface

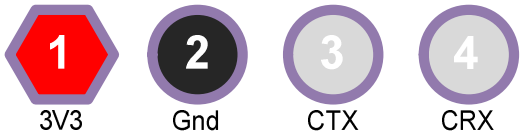

Figure 39. SBoard/EBoard – Simple CAN level translation

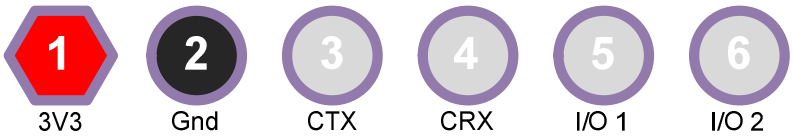

Figure 40. SBoard/EBoard – Standard CAN level translation

Figure 41. SBoard/EBoard – Universal CAN level translation

4.2. SBoard/EBoard – CAN data communication interface

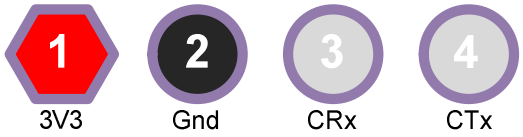

Figure 42. SBoard/EBoard – Simple CAN data communication

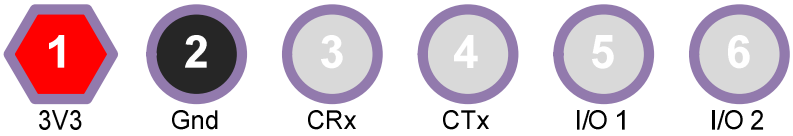

Figure 43. Board/EBoard – Standard CAN data communication

Figure 44. SBoard/EBoard – Universal CAN data communication

5. SBoard/EBoard - TIMER interface

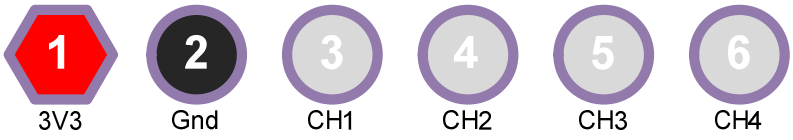

Figure 45. SBoard/EBoard – Standard TIMER

Figure 46. SBoard/EBoard – Universal TIMER

Figure 47. SBoard/EBoard – Extended TIMER

6. SBoard/EBoard - ADC interface

Figure 48. SBoard/EBoard – Standard ADC

Figure 49. SBoard/EBoard – Universal ADC

Figure 50. SBoard/EBoard – Extended ADC

7. SBoard/EBoard power interface

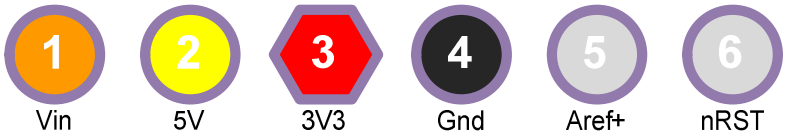

Figure 51. SBoard/EBoard – Power interface

CHAPTER 4. SOME EXPLAINATION

1. Why SBoard headers must be stackable headers?

All SBoards have to support stacked-board connecting. Only stackable headers can make it reliable.

2. Why EBoard headers must have male headers?

In order to plug EBoard into an MBoard or an SBoard.

3. Why EBoard headers may have identical female headers?

Identical header means a header has same number of pins, same signal assignment, same placement direction as referenced header – another male header in this case. It support connect EBoard to MBoard or SBoard by bus or project board.

4. Why need 3V3 and Gnd in all connectors?

One apparent disadvantage is that this requires more pins for connector. In other word, it requires wider bus or PCB space. We accept this disadvantage because we get more advantages as

- Design SBoard and EBoard is easier. If a SBoard or EBoard need power supply, it just needs connect to 3V3.
- A SBoard/EBoard can plug into MBoard and run. It needs not a separated wire for power supply or extend PCB board to reach a 3V3 pin in another location.

5. Why need double 3V3 and Gnd in double-row connectors?

It makes one row of a double-row connector compatible with a single-row connector. And you can see that all simple, standard, extended, and universal interfaces are always downgrade compatible.

6. Why use 2.54mm connectors/ Why not use 2.0 or 1.27mm connectors?

2.54mm connectors make PCB bigger but we choose it due to below reasons

- It is easy for fast testing. A board can be plugged into a project board and then connect to other parts.
- It is easy for bus connecting in Vietnam at this state. Almost all cheap buses available in Vietnam are compatible with 2.54mm but not 2.0mm or 1.27mm.
- It is easy for students to make a single-layer PCB by themselves. A wide space of 2.54mm connectors is more convenient than short space of 2.0mm or 1.27mm connectors.

7. Could I violate a rule when design a new MBoard?

NO. You can not violate any rule specified in this document. These rules ensure all boards in HLib are compatible. Therefore, please follow all rules when you design a new board.

8. Rules make me layout slower and PCB bigger?

Yes, sometimes. Sometimes you can layout faster and PCB smaller if you change some signal position or connector direction. However, please think about your saved time from schematic design, board compatible connection, reusable boards. Is it amazing advantage HLib bring to you. Hence, please come down, be patient, and spend little more time.

9. Why do you often use 6-pin or 8-pin connector?

It is the balance number with make connector clear and still flexible enough.