QBoard-II

User Manual

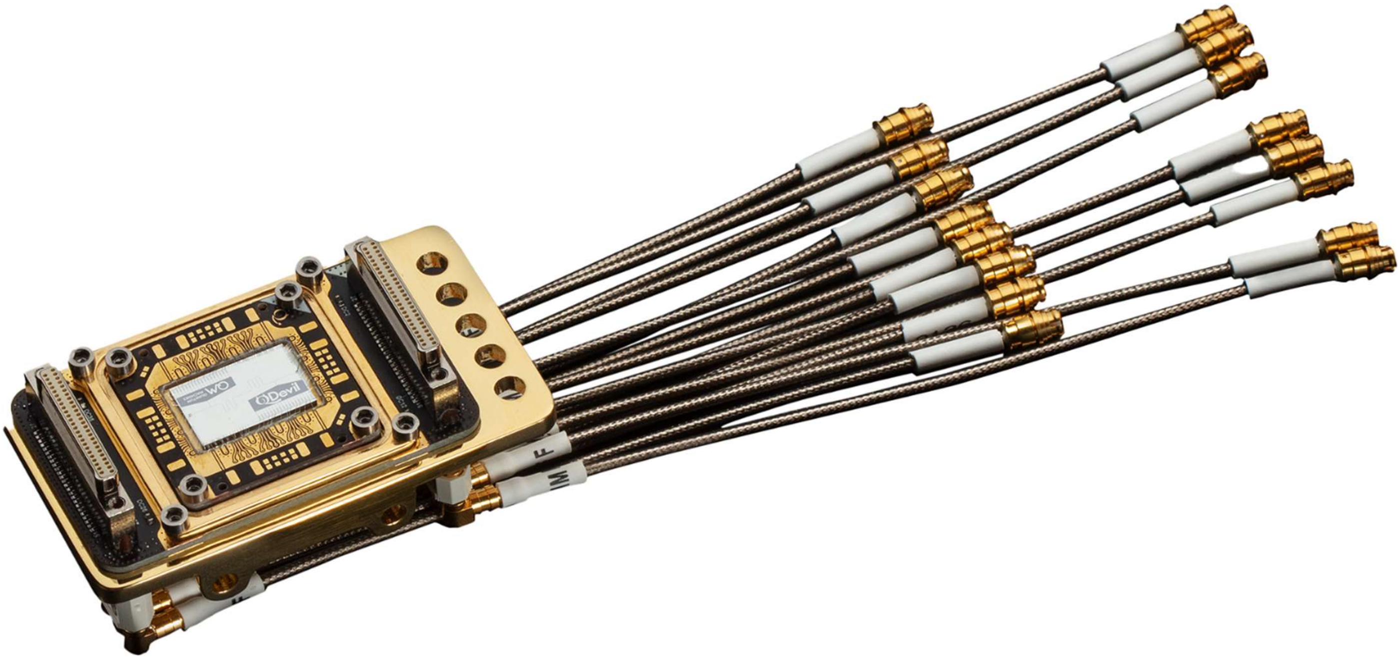

Figure 1 - QBoard-II

Product details and updated information are available at:

https://www.quantum-machines.co/products/qboard/

Made in Denmark - Patent pending.

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Contents

1. Safe Handling

The QBoard-II is a delicate piece of equipment, designed for use in vacuum environments at extremely low temperatures. It is therefore of utmost importance to keep it clean and avoid shocks or impacts that may damage its mechanical integrity. All parts of the product shall be stored at normal indoor ambient conditions, avoiding exposure to temperatures and humidity levels higher than 45°C and 60% RH (non-condensing). Long-term storage of the sample boards (with or without chips mounted) should be done in a dry passive environment, e.g., dry nitrogen storage or sealed bags.

In case the QBoard-II hardware needs to be cleaned, we recommend blowing with dry air. If rinsing is needed, only use isopropanol or deionized water and avoid heating or blowing with hot air for drying. All handling should be done wearing gloves, preferably on a clean-covered tabletop. Care should be taken to avoid scratching or denting by handling with tools. Should there be a need for disposing of the QBoard-II product, all parts should be handled as electronic waste.

	Wear gloves to avoid contamination by fingerprints etc.
	Keep dry and away from high temperatures
	Not for general waste, recycle as electronic waste
	The gold-plated metal parts contain small amounts of beryllium. The QBoard-II is safe to use and handle in its unmodified form. DO NOT cut or grind the metal parts, to avoid exposure to dust or fumes.

2. QBoard-II Product parts

The QBoard-II is a PCB-based sample holder system for low-temperature transport experiments on devices like spin-qubits and superconducting circuits. The system provides 48 DC (audio frequency) channels and 16 high-frequency channels (GHz bandwidth) and offers excellent sample thermalization at millikelvin temperatures.

- Q150 - Mainboard

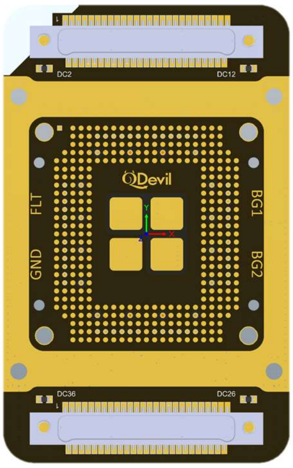


Figure 2 - Mainboard (Q150)

- Q158 - Interposer

This non-magnetic QBoard-II interposer can be rotated for different sample board cavity (back-gate) connections (Ground, Float, or one of the two dedicated high-voltage DC lines). For further details, please go to Section *7.1.*

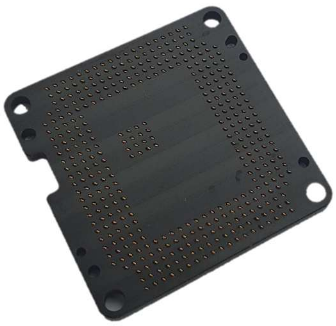


Figure 3 - Interposer(Q158) for QBoard-II

- RF Cables:

The eight right-angled coaxial cables shall be clicked carefully into the 8-channel block, fitting the unevenly numbered sockets 1, 3, 5, and 7 with male connectors and the evenly numbered sockets 2, 4, 6, and 8 with female connectors. In case of the need to remove the RF connectors from the multi-port assembly, use the extraction tool from Rosenberger PN 23W100-000 (sleeve supplied as Q114) as the connectors are otherwise easily damaged. Multiple cable variants are available, e.g. right-angled or straight with SMP jacks in lengths of 20 or 30 cm or with SMA plugs in lengths of 30, 40, or 50cm.

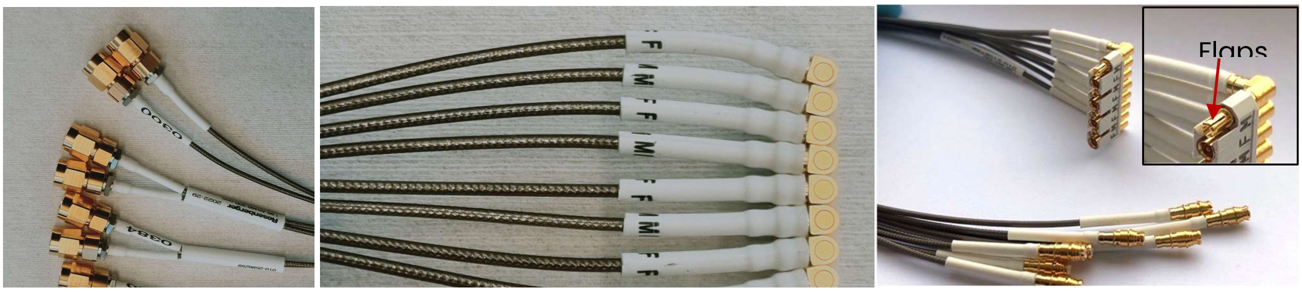


Figure 4 - Coaxial cables. Left) Eight-way SMA plugs. Middle) Eight-way right-angled Mini-Coax. Right) Eight-way right-angled coaxial cables clicked into the 8-channel block.

- DC Cables:

DC cable assemblies connect to either of the two Nano-D connectors on the mainboard and to the connectors in the fridge/sample puck. Multiple cable variants are available, terminating in Nano-D or Micro-D cables, up to 40 cm in length.

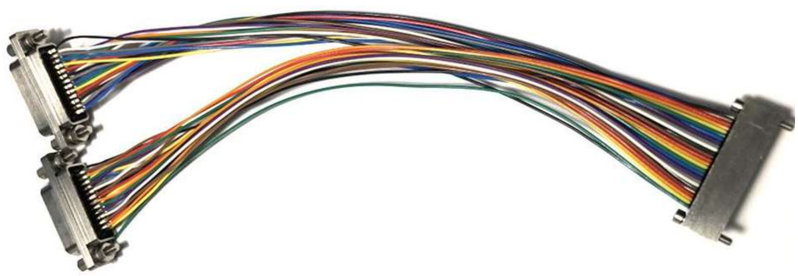


Figure 5 - DC Cable (QN51M25x2)

- (Q160) (Q161) (Q162) – Sample boards - 3 standard options:

For advanced sample board functionality, please go to section *5.*

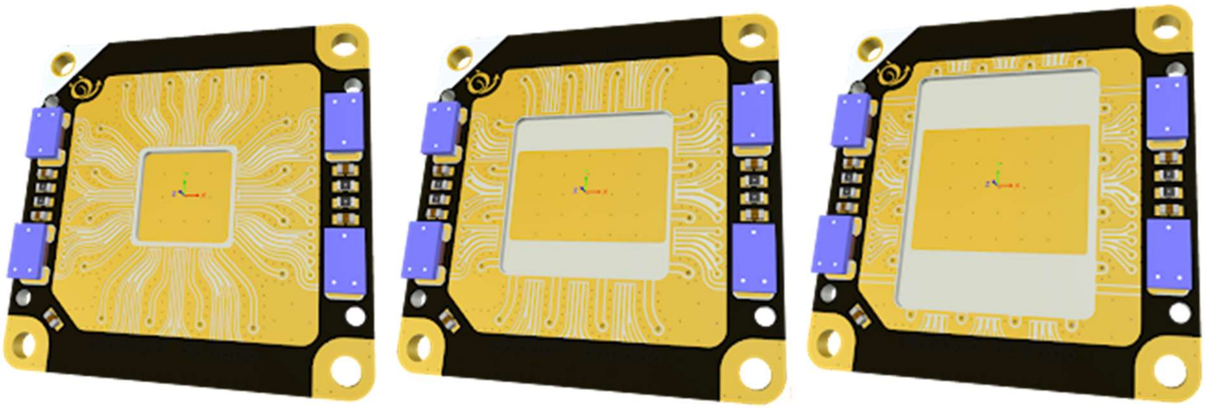


Figure 6 - Sample boards for chip with different sizes: Left) 6mm x 6mm (Q160), Middle) 10mm x 10mm (Q161), Right) 11mm x 14mm(Q162).

- Q180 - Shielding lid and frame:

The QBoard-II offers a carefully designed shielding (Q180) which completely protects both the quantum chip and the sample board components.

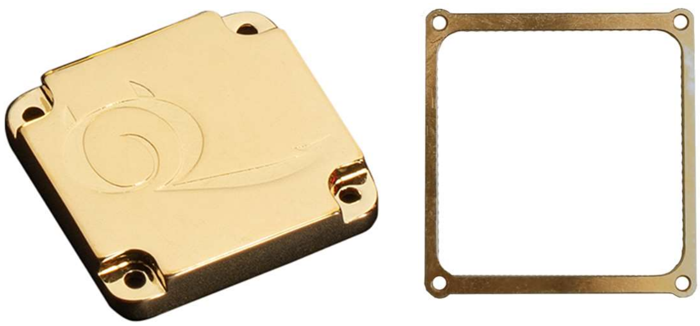


Figure 7 - QBoard-II Shielding lid (Left) and shielding frame (right) (Q180)

- (Q170) (Q171) (Q172) (Q173) (Q175) (Q176) (Q177) (Q178) – Brackets:

Brackets for all common dilution refrigerators are available as stock items. Upon request, it is possible to customize brackets for a specific system if it is not covered by one of the standardized brackets. For all example pictures in the manual, bracket Q178 is used. Your QBoard-II system might look different depending on the type of bracket ordered.

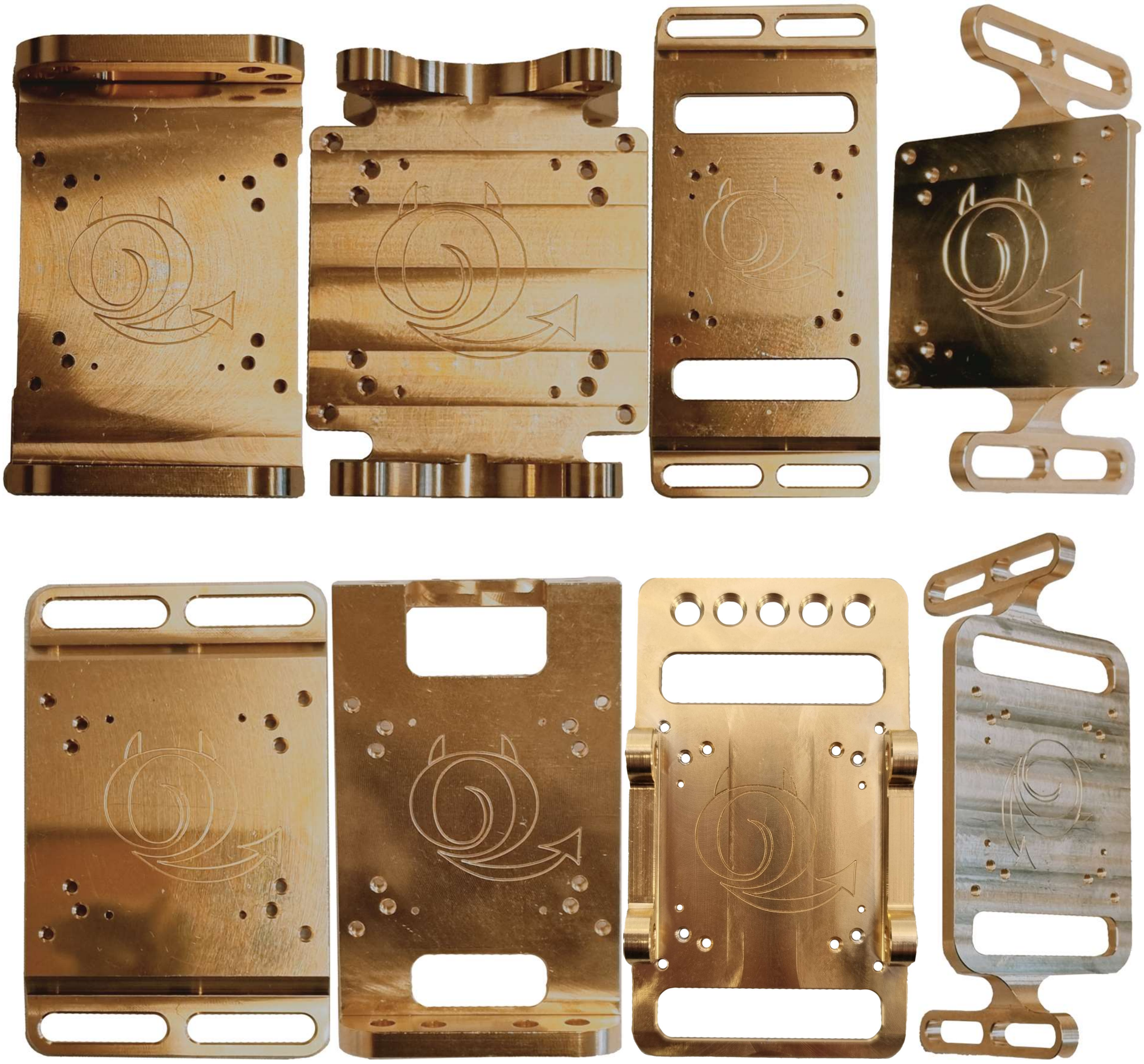


Figure 8 - Standardized brackets: from top left) A) Q178, B) Q176, C) Q173, D) Q170, from bottom left) E) Q171, F) Q175, G) Q177, H) Q172.

- Q182 - Grounding plate for wire bonding

The grounding plate is used for securing the sample board during wire bonding. For sample grounding and ESD protection during wire bonding an interposer is required.

Figure 9 - Grounding plate for wire bonders (Q182)

3. Disassembling the QBoard-II system

The QBoard-II is delivered assembled. The sample board and interposer are accessed by unscrewing the 4 corner screws of the shielding lid as indicated by the green screws in the figure below. It is not necessary to unscrew the mainboard from the bracket indicated by the red screws (unless you wish to change to another bracket). The bracket in the picture below is one of the eight standardized brackets. Your setup might look slightly different.

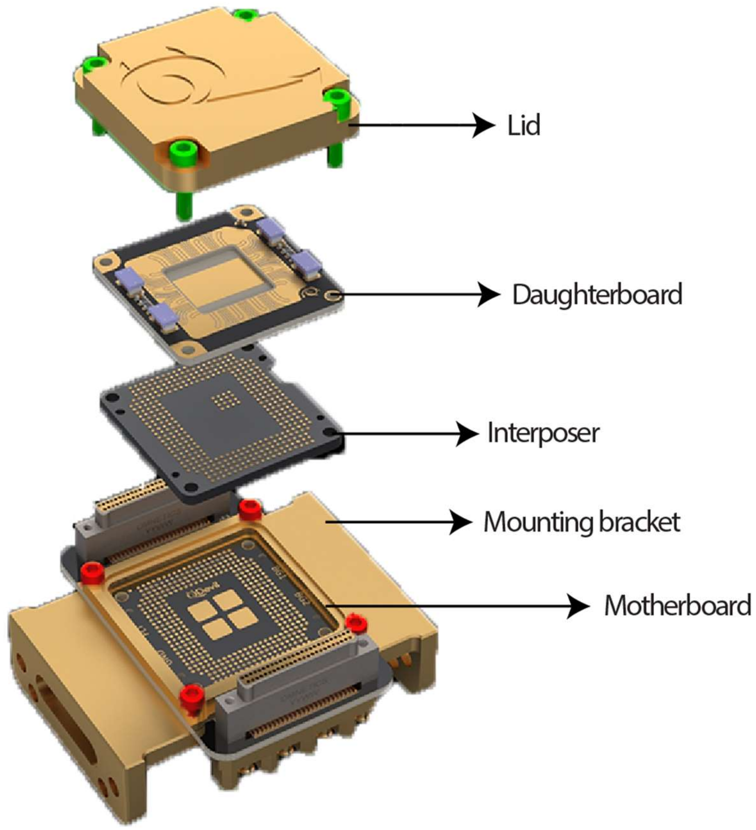


Figure 10 - Overview of each constituent part of the assembled QBoard-II

4. Mainboard Overview

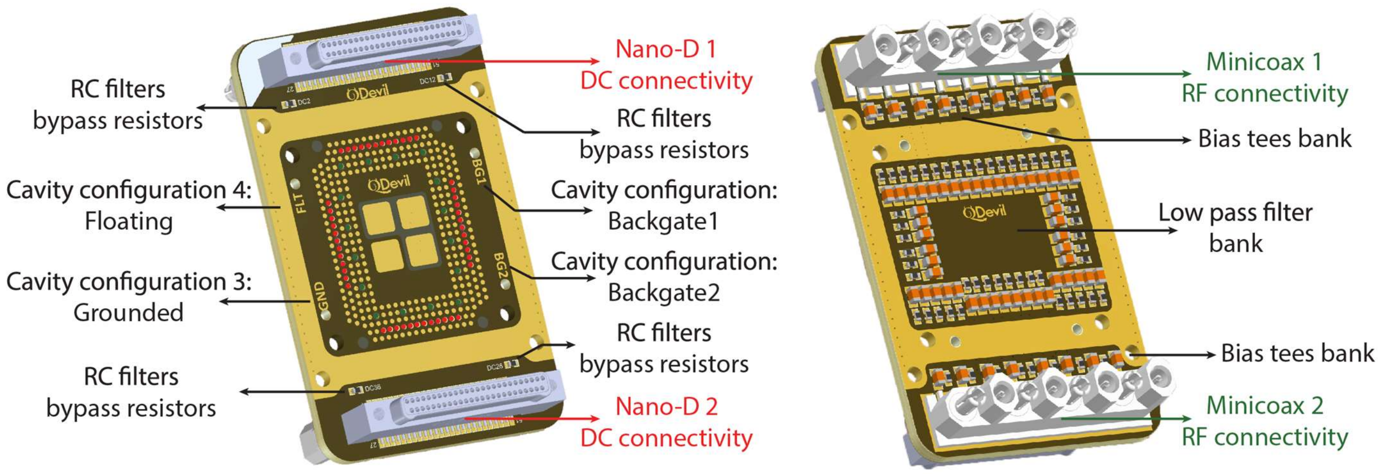


Figure 11 - Mainboard overview of the mainboard: Top view (Left), Bottom view (Right)

The mainboard features DC signal connectivity (audio frequencies) with low pass filters, RF connectivity (GHz bandwidth) with bias tees, and interposer connectivity to the sample boards. These are described in detail in the following sections. Nano-D connectors are wired in parallel for ESD protection while loading the QBoard-II in a dilution refrigerator. The DC lines are RC filtered, with bypassing options for four lines (DC2, DC12, DC26, DC36). The RF lines are connected to the sample board through Bias Tees.

The sample board cavity connectivity is configured through the orientation of the interposer with four options: Ground, Floating, or Backgating through lines DC1 or DC25. (ground float, or one of the two dedicated high voltage DC lines). For more information on the interposer configuration, go to the section: *Assembling the QBoard-II system.*

4.1. Main board functionalities

4.1.1. DC / low frequency lines

The QBoard-II has been designed for use with 51-pin double-row Nano-D connectors, of which 48 DC/low-frequency signals can be supplied to the sample board. The mainboard is equipped with two Nano-D connectors wired in parallel. This allows for the continuous grounding of the sample during sample loading or transfers, protecting against ESD damage of the sample. For bottom-loader cryostats, this also allows for measurements of the sample in the load-lock before and during loading, and later through the fridge wiring, once the sample insert makes electrical contact with the cold-finger connectors of the cryostat.

Low pass filtering

All 48 DC lines from the Nano-D connectors are low pass filtered by an RC stage on the mainboard, with RLF = 1.2kΩ, and CLF = 1.0nF.

Special functionalities

High voltage lines (DC1, DC25)

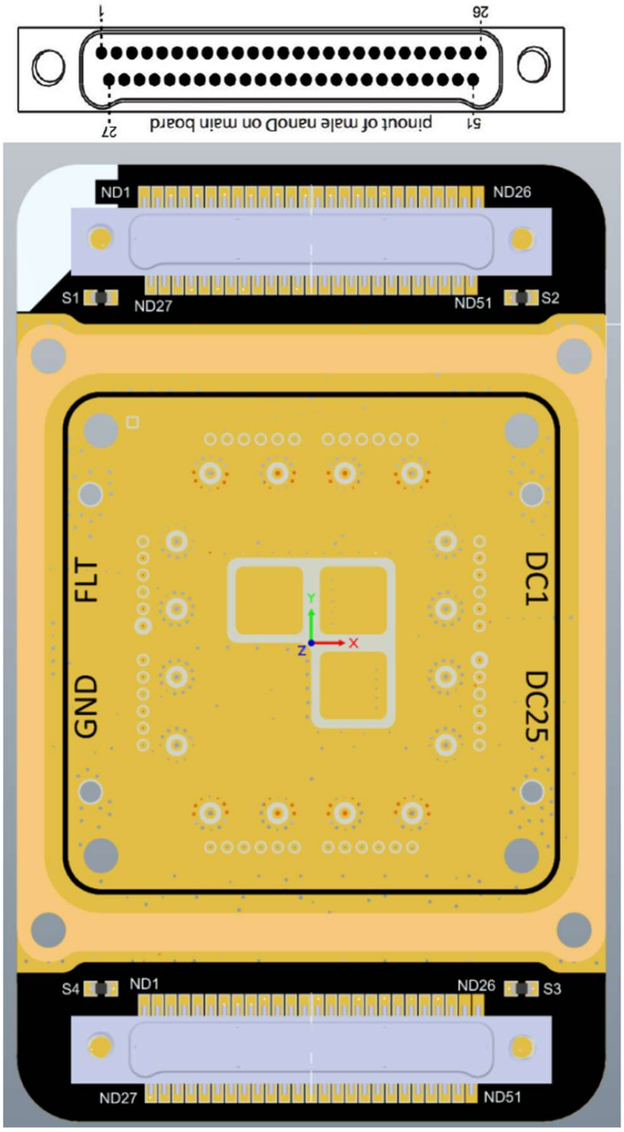
The mainboard design accommodates two 'high voltage' lines (DC1, DC25) which have increased isolation towards other signals and ground within the board. Furthermore, these are routed to the backgate configuration of the interposer.

High current lines (DC2, DC12, DC26, DC36)

The mainboard design accommodates four 'high current' lines (DC2, DC12, DC26, DC36) with an option to bypass the RC low pass filters. This can be modified by the customer with a bit of solder or 0-ohm resistors connecting the pads on the top of the mainboard (marked as RC bypass resistors). Leaded solder is recommended for cryogenic applications.

DC bias for RF lines (DC3, DC6, DC7, DC10, DC15, DC18, DC19, DC22, DC27, DC30, DC31, DC34, DC39, DC42, DC43, DC46)

The mainboard includes 16 bias tees for the RF lines, each connected to a DC line through RBT = 50kΩ.



Daughterboard	Nano-D	Secondary use	Note
1	ND1	Backgate1 - High voltage design	
2	ND2	RC filter bypass - High current design	Optional
3	ND3	RF1	
4	ND4	TC1	Optional
5	ND5		
6	ND6	RF2	
7	ND7	RF3	
8	ND8		
9	ND9		
10	ND10	RF4	
11	ND11		
12	ND12	RC filter bypass - High current design	Optional
13	ND13		
14	ND14		
15	ND15	RF5	
16	ND16		
17	ND17		
18	ND18	RF6	
19	ND19	RF7	
20	ND20		
21	ND21	TC2	Optional
22	ND22	RF8	
23	ND23		
24	ND24		
25	ND27	Backgate2 - High voltage design	
26	ND28	RC filter bypass - High current design	Optional
27	ND29	RF9	
28	ND30	TC3	Optional
29	ND31		
30	ND32	RF10	
31	ND33	RF11	
32	ND34		
33	ND35		
34	ND36	RF12	
35	ND37		
36	ND38	RC filter bypass - High current design	Optional
37	ND39		
38	ND40		
39	ND41	RF13	
40	ND42		
41	ND43		
42	ND44	RF14 - RFCOM for tank circuits	Optional
43	ND45	RF15	
44	ND46		
45	ND47	TC4	Optional
46	ND48	RF16	
47	ND49		
48	ND50		

Figure 12 - DC pinout overview. The 48 DC lines connected to the daughterboard are numbered 1-48 and convert to the Nano-D pinout according to the table. Indicated are the secondary uses of the DC lines for Bias to RF lines, Tank circuits, high voltage, and high current lines.

4.2. RF / high frequency lines

The QBoard-II has been designed with 2 x 8-way Mini-Coax connectors to supply high-frequency signals to the sample board. All 16 RF lines are connected to the sample board through a capacitor C_{BT} of 22nF. A bias tee resistor R_{BT} of 50kΩ connects each RF line to a DC line.

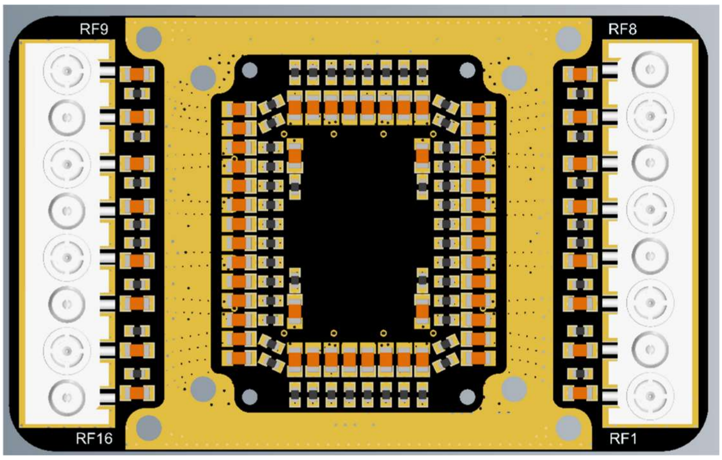


Figure 13 - RF connectors on the back side of the QBoard-II main board

4.3. Grounding and back-gating through interposer configuration

The sample cavity is directly connected to the bottom side of the sample board, and through the interposer to one of four pads on the mainboard. This allows for grounding, floating, or back gating of the sample through a re-orientation of the interposer.

Interposer configuration

GND: The cavity is connected to the *cold ground* of the fridge through the mainboard and bracket.

FLT: The cavity is connected to an isolated pad on the mainboard, thus floating.

DC1: The cavity is connected to DC line DC1 (Marked as **BG1** in previous version).

DC25: The cavity is connected to DC line DC25 (Marked as **BG2** in previous version).

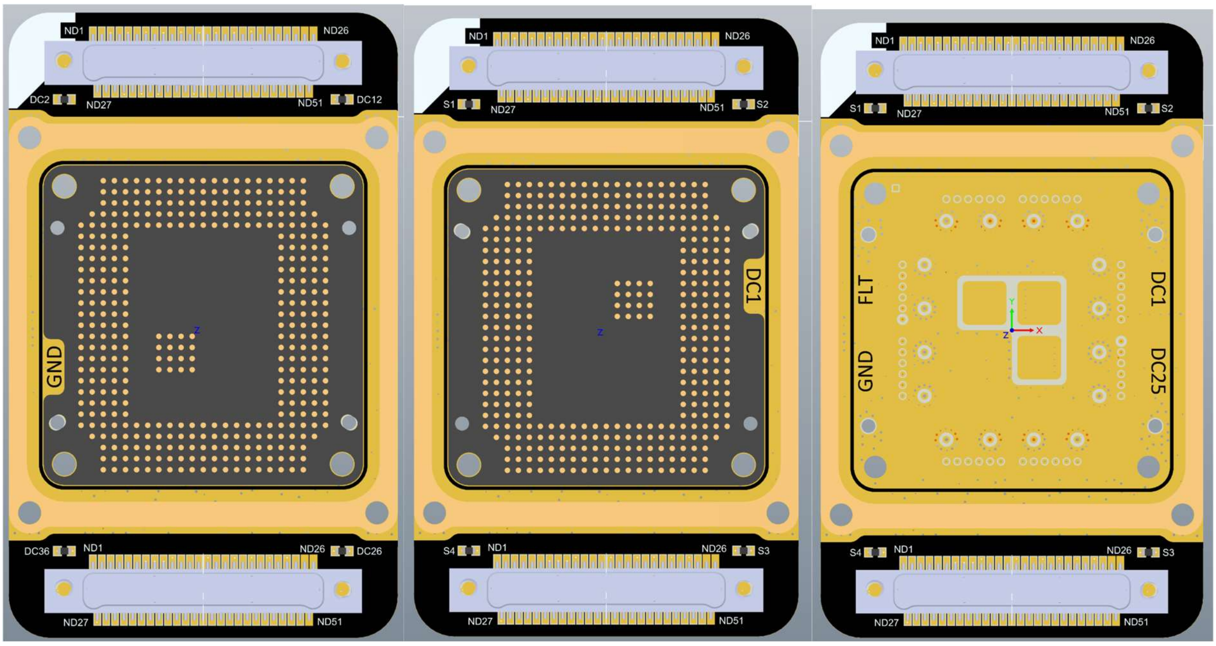


Figure 14 - The interposer can be rotated and flipped to connect the back gate pad of the sample board to the fridge ground (GND), keep it floating (FLT) or to one of the two dedicated high voltage lines (DC1, DC25) for back gating. The cutout in the interposer opens the description to the configured connectivity.

5. Sample board overview

The QBoard-II sample boards are currently available in three versions designed for different sample sizes. The sample boards are consumables used to hold samples and facilitate connectivity to the mainboard by bringing the DC and RF signals close to the sample for wire bonding. With this, the samples can easily be moved to different measurement setups or facilities. Furthermore, the modularity allows for long-term storage with the option to re-measure a device without re-bonding.

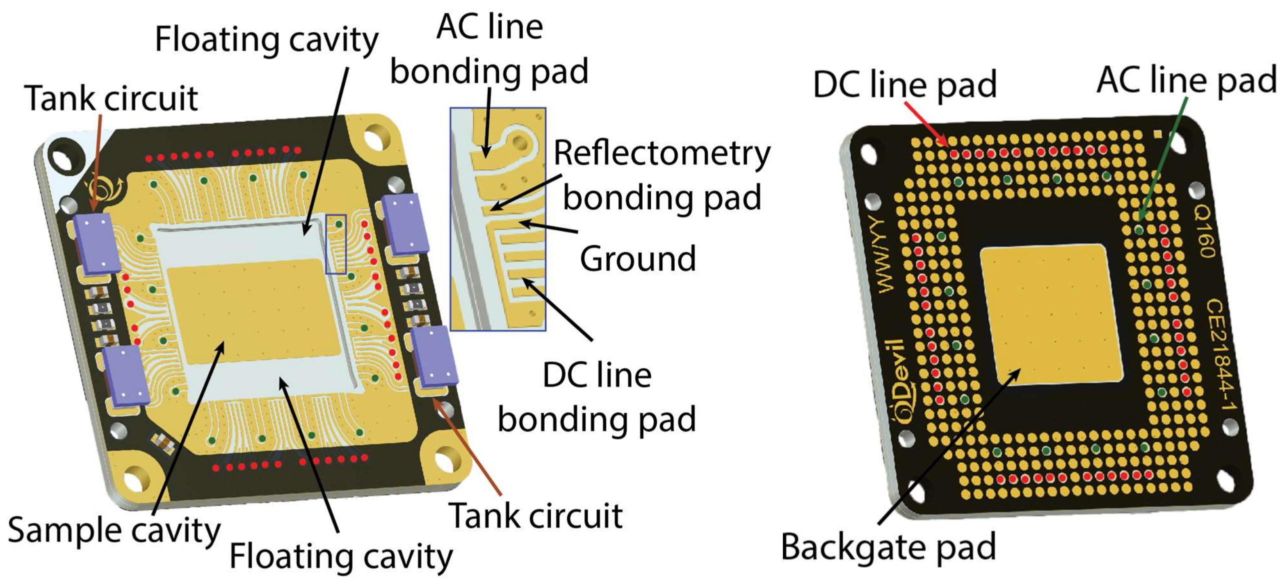


Figure 15 - Overview of the sample board with (Left) a cavity for mounting samples, bonding pads for DC and RF lines, areas for grounding wire bonds and optional integration of tank circuits, and (right) an overview of the signal line configuration.

5.1. Sample board layout and schematic

The sample board brings together low-frequency (DC) and high-frequency (RF) lines for wire bonding to the sample. Several lines have multiple functionalities for bias-tees, high voltage, and high current applications, as well as advanced functionalities for RF readout through tank-circuits.

Sample boards are usually supplied without SMD components, and hence none of the components associated with reflectometry exist on the sample board. For advanced configurations with tank circuits see in the next section.

The simplified schematic in figure 16 shows the standard functionality when no components are mounted on the sample boards. When including components for reflectometry readout, refer to section *5.2* for details.

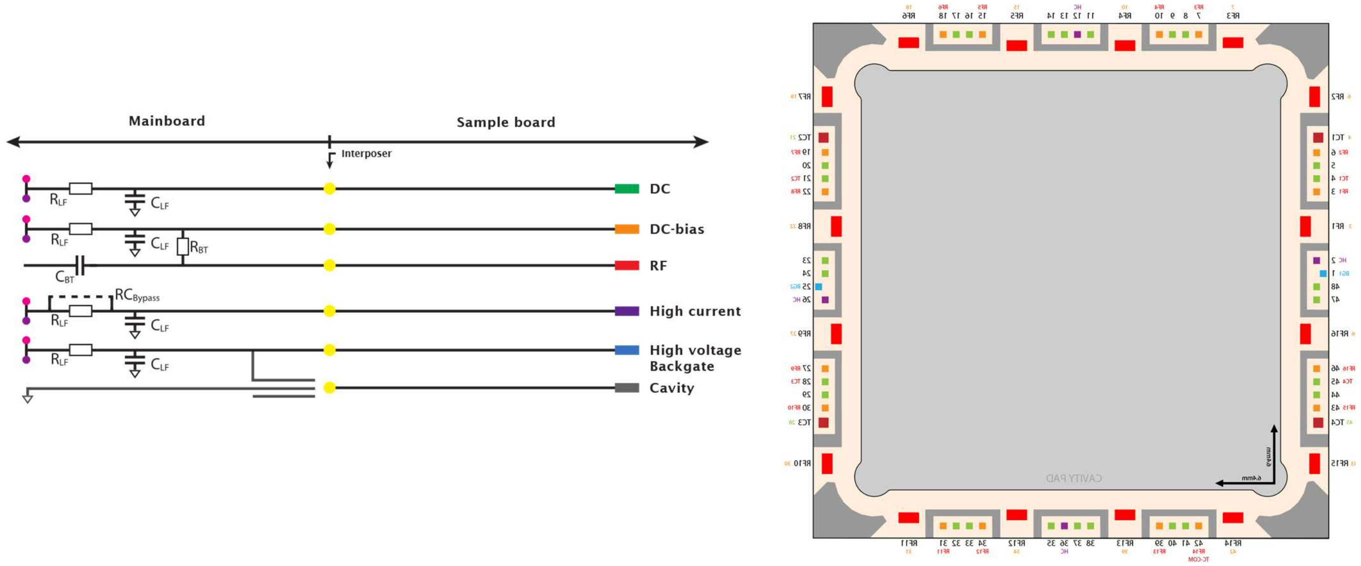


Figure 16 - Left: Schematic of the sample board mounted on the mainboard. The standard RC filter component values are R_{LF} = 1.2kΩ, and C_{LF} = 1nF. The bias tee components have values of C_{BT} *= 22nF* and R_{BT} = 50kΩ. *Right: Simplified drawing of the bonding pad layout on the Q160 sample board. The DC-line numbers correspond to the DC line numbers, refer to the pinout in section 4 for a reference to the corresponding Nano-D connector pin numbers. The RF-line numbers refer to the RF Mini-Coax connectors. The orange bonding pads are connected to the red RF pads through bias tee resistors on the main board.*

The narrow bonding pads (**green**, **orange, blue, and purple**) are used for DC signals. They are labeled with the DC line number, refer to the pinout in figure 12, for a reference to the corresponding Nano-D connector pin numbers. The **green** lines have no secondary use. The **orange** lines are used as DC bias lines for the bias tees on the mainboard. The **blue** lines are designed for higher voltages and connect to the backgated pads on the mainboard. The **purple** lines have the option to bypass the RC filters on the mainboard; see section 4.1 and may be used for larger currents or unfiltered digital signals.

Note: Due to the use of DC lines for the bias-tees, both the DC line (**orange**) and corresponding RF pad carry the same DC signal.

The wider bonding pads (**red**) are used for RF signals, they are AC coupled to the Mini-Coax connectors via bias-tees, and the orange numbers refer to DC lines connected to these through the bias-tees.

The RF lines are separated from the DC lines through a ground shield, which may be used for extensive grounding of the sample for proper RF signal integrity.

Table 1 - Overview of bonding pad configuration in the simplified sample board use.

	Pad name	qty	Usage
	#	26	DC/low frequency lines
	#	16	DC/low frequency lines connected to RF lines through 50kΩ bias resistors.
	#	2	DC/low frequency lines optionally used for high voltage / backgate
	#	4	DC/low frequency lines optionally used for high current
	RF#	16	RF/high frequency lines
	Cavity plane	1	Connected to the bottom side of the daughterboard
	GND		Connected to the system ground.
	TC#	4	Tank circuit line

Notes on different types of bonding pads

To decide which pads to use during wire bonding understand their numbers and colors.

Green = "low-frequency pad". The number corresponds to the DC signal line that provides the DC voltage via an RC stage on the main board. The pin numbers are not the same as the pin numbers on the Nano-D connectors see section 12 for pinout details.

Red = "fast pad". The # number corresponds to the DC signal line connected through the bias-tee. The RF# corresponds to the RF line number that provides the AC signal. The DC and AC signals are combined on the main board via a bias-tee.

Important: If the reflectometry capabilities are used, be aware that the corresponding line RF14 is connected to the readout line of the setup. If RF14 is used for reflectometry, DO NOT use the corresponding fast pad for connecting to the sample.

Orange = restricted “low-frequency pad”. These pads are connected to nearby fast pads with a 50kΩ resistor on the main board. If the fast pads are not used, they function as normal “low-frequency pads”. When the fast pad is used, this pad carries the DC voltage applied to the bias tee of the corresponding fast pad. For example, pad 22 and RF8 carry the same DC voltage. In other words: If RF8 is wire bonded as a fast gate, you cannot use pad 22 as an independent DC line. OPTIONAL: If the resistor of bias tee is removed on the mainboard, the orange pad behaves as the green low-frequency pads, whereas the red pad becomes a purely AC-coupled high-frequency line.

Blue = these pads function as DC pads and as backgate pads. If the backgate configuration is used the DC pad carries the same signal.

Purple = these pads have the option to supply larger currents when the mainboard RC resistors are bypassed.

5.2. Configuration with tank circuits

The sample board is prepared for advanced reflectometry measurements using tank circuits. This section can be skipped if tank circuits are not going to be used.

The figures below present the extended functionality when components are mounted on the sample board.

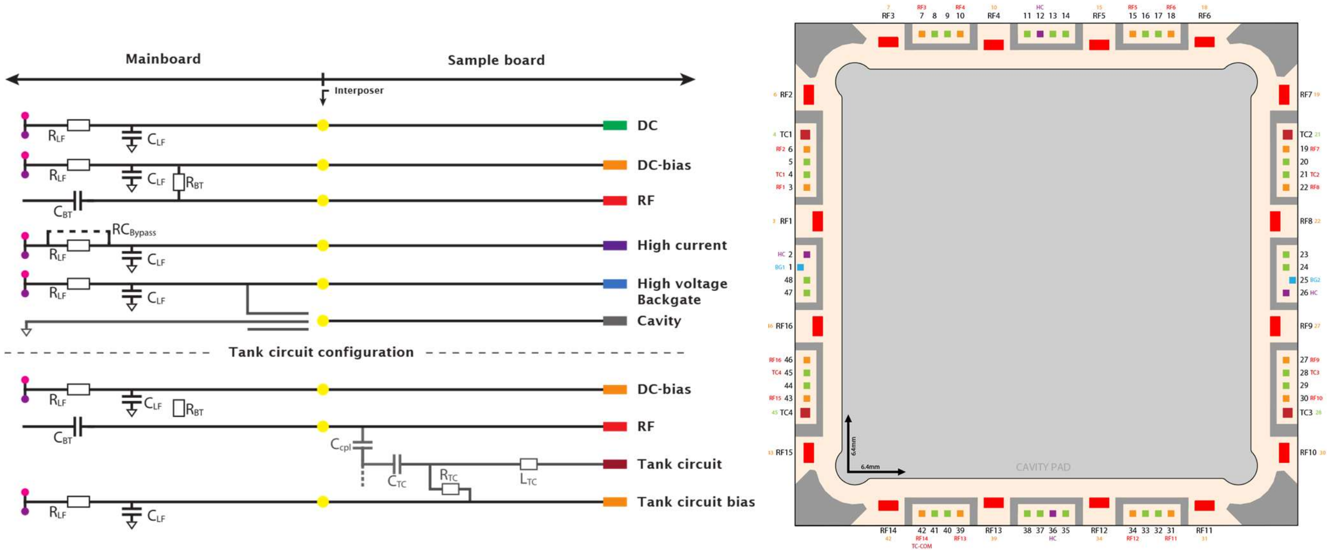


Figure 17 - Left) Extended schematic of the sample board mounted on the mainboard. The standard RC filter component values are RLF = 1.2kΩ, and CLF = 1.0nF. The bias tee components have values of CBT = 22nF and RBT = 50kΩ. The grey circuitry is populated by the user. Right) Extended drawing of the bonding pad layout on the standard sample board Q102. The numbers refer to the pins on the Nano-D connectors. The MC# numbers refer to the RF Mini-Coax connectors. The orange and blue bonding pads are connected to the red RF pads through bias tee resistors on the main board. The blue pads are furthermore connected to the tank circuitry as shown in the schematic diagram above.

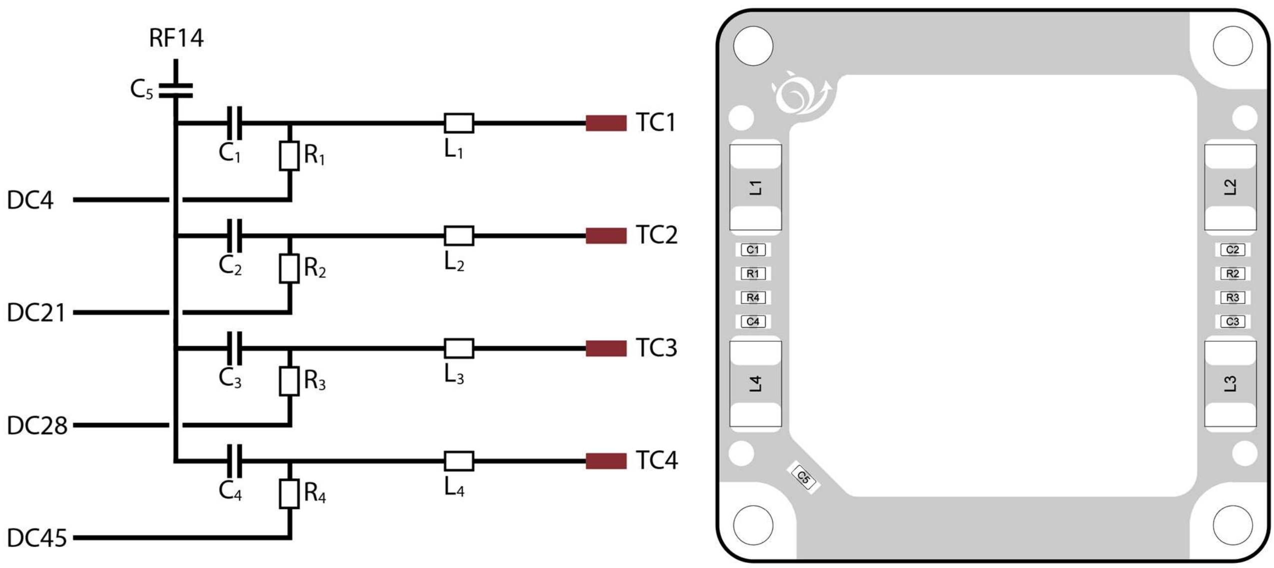


Figure 18 The circuit schematic of the sample board reflectometry circuits is shown on the left. Line RF14 is used to address all 4 resonators with L1, L2, L3, and L4, which are each biased by an individual DC line (4, 21, 28, 45). These can be connected to a quantum device via wire bonding pads TC1, TC2, TC3, and TC4 respectively. When using the tank circuits, line RF14 should not be used for other high-frequency lines on the device.

6. Wire bonding a sample

The sample is electrically connected to the sample board by wire bonding and typically mounted using silver paste. The mainboard and the sample board are electrically and thermally connected through the spring contacts of the interposer. Before you start mounting and wire bonding a sample on a sample board, you should get familiar with the different types of bonding pads on your specific sample board, and how they connect to the different options on the main board (low-frequency connectors, high-frequency connectors, back gating, and tank circuits).

Placing a chip in a sample board

To get a good electrical connection between the chip and the sample board, it is recommended to mount the chip using silver paste or other conducting glue.

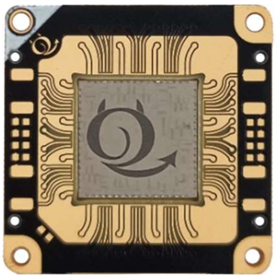


Figure 19 - Chip inside sample board

Securing good grounding

For proper ESD protection, we recommend mounting the daughterboard with an interposer to a dedicated wire bonding plate. This allows for proper ground contact to all signal lines.

Place the interposer (Q158) on the grounding plane (Q182) using the 4 guiding pins.

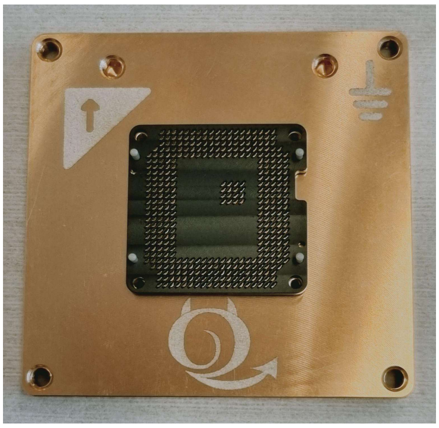


Figure 20 - Interposer (Q158) on top of the QBoard-II grounding plate (Q182)

Aligning the sample board to the grounding plate

Align the sample board to the grounding plate using the white triangle as a guideline.

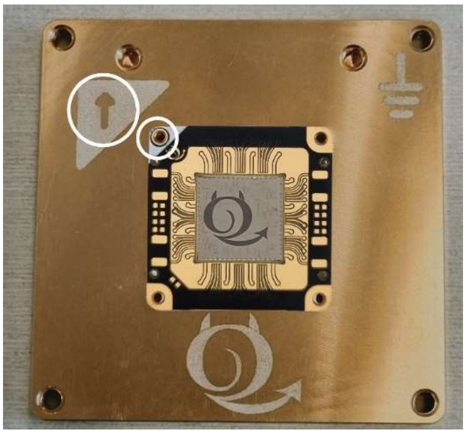


Figure 21 - The sample board is aligned by a white triangle to the grounding plate(Q182)

6.1. Wire bonding

Depending on the wire bonder model, holes may need to be drilled in the grounding plate (Q182) to fit the mounting holes on the wire bonder (The wire bonding plate is made of gold-plated brass and should be easy to machine). Alternatively, clamping clips may be used to keep the wire bonding plate in place. In all cases, ensure the grounding plate (Q182) is securely mounted in the wire bonder and electrically connected to the ground of the wire bonder, through the included banana cable or other means.

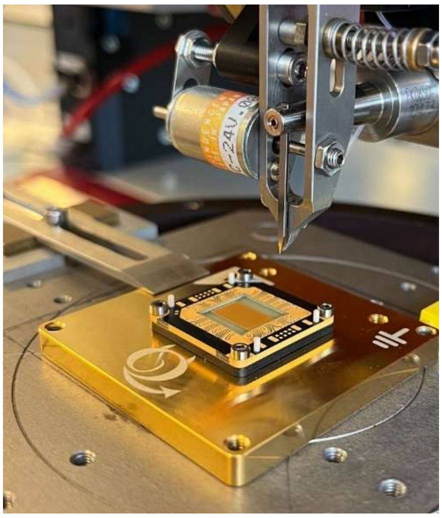


Figure 22 - Utilizing the grounding plate (Q182) with the interposer (Q158) and the sample board containing a chip. Mounted in an aluminum wedge wire bonder.

The grounding plate (Q182) and the sample holder have been designed and verified to provide a solid anchoring of the ultrasonic agitation from the wire bonding wedge. As a result, we have found that the optimal bonding parameters are achieved with only slightly higher ultrasonic power and bond force than what works for conventional chip carriers. The exact optimal settings will depend on the particular wire bonder model and wedge head that is used.

General tips for wire bonding:

Golden Rule: **Use each number only once**. Some numbers occur more than once. This usually occurs when a DC line is used on the bias-tee of a fast line. For example – the pad '18' is also labeled 'RF6' as they are connected through a bias tee. RF6 is a fast pad, if you choose to use RF6 then you should not bond anything to the pad '18' (and vice versa).

Bonding up: Use software like 'Inkscape' (or even PowerPoint or Paint) to copy and paste an optical image of your device into the 'sample space' of the pinout. If you use the correct scale (cavity is ~ 6.4 x 6.4mm) you will be able to get a good idea about the angle of each bond, and any potentially unavoidable crossings. Bonding plans/forms are available from QDevil for each type of sample board.

Keep bonding wires of fast gates and RF sensing bonds as short as possible: Avoid routing them parallel and near other bonds (or crossing other bonds) to reduce mutual capacitance. Different surfaces need different settings on the wire bonder. Sometimes a setting working well for some surfaces will not work for others at all. Here is a general procedure for how to adjust the bonding machine:

1. Reduce bonding force to zero. This is to prevent the wire from being pulled out of the needle.
2. Increase bonding time to double what you expect. This will give better bonding quality.
3. Reduce ultrasound power to zero. Just to get this out of the equation.

With this, you can pull the wire out of the bonder for a few centimeters, and it will never rip off and pull out of the needle. But also, it will not bond at all. When you bond you can just continue with bonding on the surface until you get decent results. Always pull a bit on the wire to get a fresh piece under the needle. Then you follow these steps to get good bonding results:

4. Increase force until the bonding wire is deformed to double its width / half its height.
5. Decrease time until the deformation does not look the same anymore.
6. Increase US bonding power to make it stick better.

7. Assembling the QBoard-II system

After establishing the connections by wire bonding, the chip-holding package is ready to be transferred to the QBoard-II assembly. A CAD overview of the QBoard-II assembly can be found below.

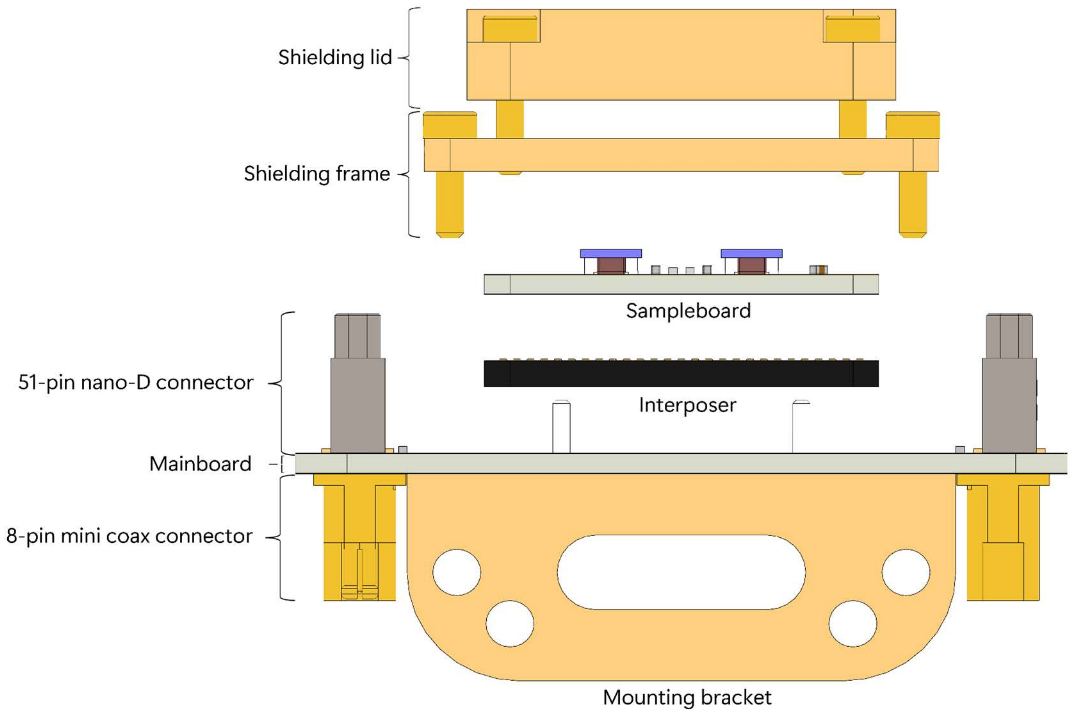


Figure 23 - The QBoard-II assembly consists of six parts which are assembled in a stack using the provided screws: The mounting bracket, the mainboard, the interposer, the sample board, the shielding frame, and the shielding lid.

As the QBoard-II is delivered assembled, the mainboard should already be mounted to a bracket. If not, this should be done before proceeding to the next step.

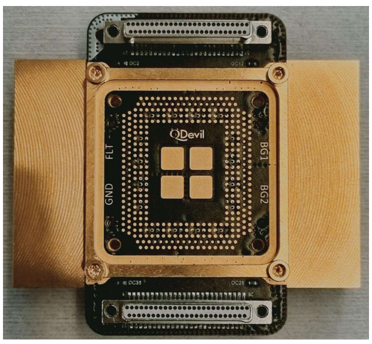


Figure 24 - The QBoard-II mainboard with shielding frame screwed onto a mounting bracket

7.1. Aligning the interposer (Q158) on the main board (Q150)

The interposer should be stored in a protective storage case at any time when not in use. When handling the interposer take great care of the spring contacts and guiding pins. If one of the pins breaks, the interposer should be replaced. The interposer can be oriented in 4 different ways (2 options for back gating, 1 option for floating design and 1 for grounding). Place the interposer on top of the mainboard in one of the 4 configurations with the corresponding holes in the mainboard. The interposer orientation defines the sample board cavity connectivity (ground float, or one of the two dedicated high-voltage DC lines).

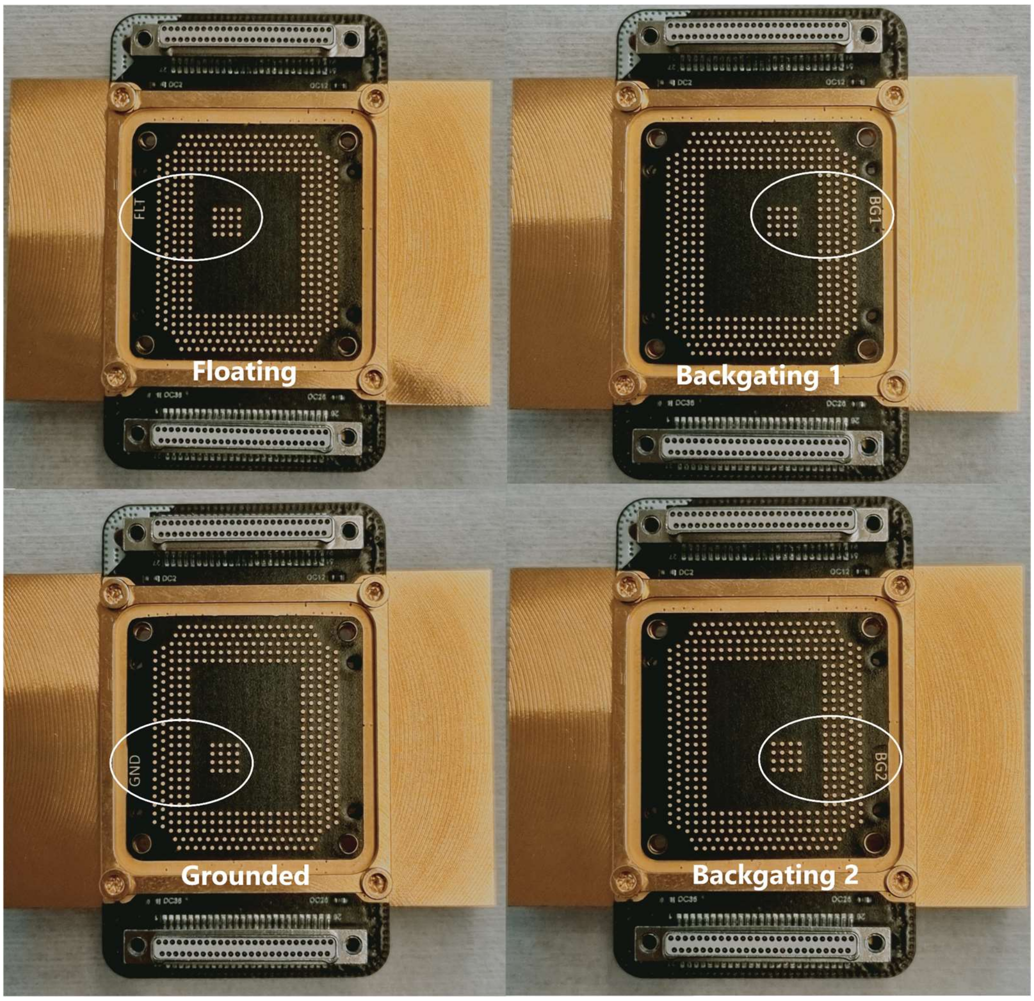


Figure 25 - The 4 configurations of the interposer (Q158)

7.2. Place the sample board in the assembly

Place the sample board on top of the interposer using the white triangles as guidance.

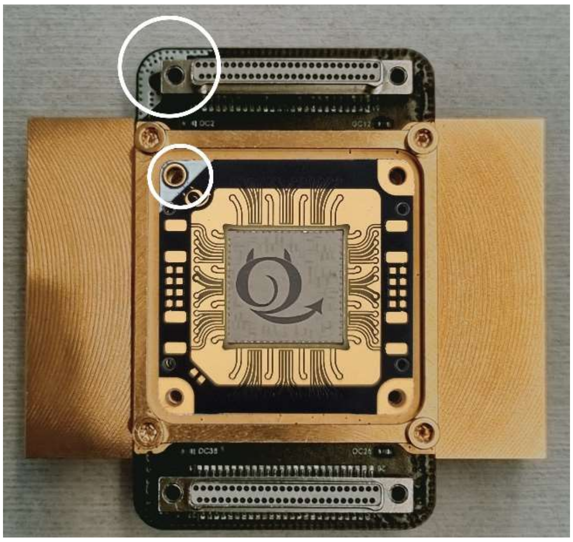


Figure 26 - Highlighting the white triangle guidance when placing the sample board into the mainboard.

7.3. Fix the sample board down to the mainboard

Finally mount the sample board with four 6mm M1.6 screws. The Interposer does not need to be visibly compressed for good contact, but one should get a feeling of contact when tightening the screws. <u>No more than 0.12 Nm should be applied</u>. If the shielding is used, this should be placed on top of the sample board before the four screws.

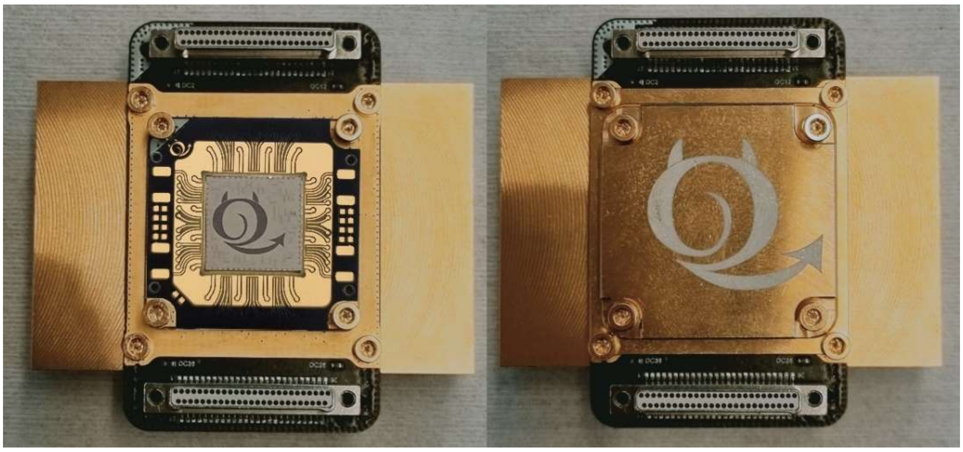


Figure 27 - Fix the sample board down either without (left) or with (right) shielding

8. Mounting and Connecting QBoard-II

8.1. Mechanical

For good thermal contact, the QBoard-II bracket must be mounted firmly onto cold metal parts of the sample insert. Due to the many fridge options available, a total of eight standard brackets are currently available. We refer to our QM bracket catalog for further information on how the different standard brackets fit into different fridge configurations. As an example, we here show the bracket (Q178), which is optimized for Ox-73.

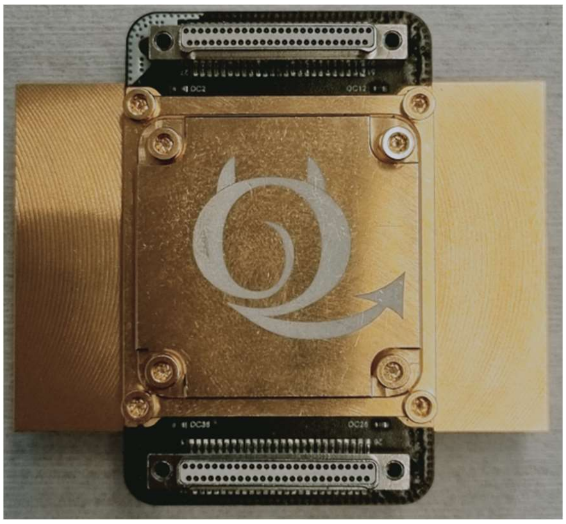


Figure 28 - Assembled QBoard-II with bracket.

8.2. Electrical

The QBoard-II is usually delivered with DC cable assemblies connecting to either of the two Nano-D connectors on the mainboard and to the connectors in the fridge/puck. Make sure to insert the Nano-D jumper cable fully into the connectors on the mainboard, as seen in figure 29. Use the screws in the cable connector to force the cable connector into place by applying turns to each of the screws repetitively until the connector is in place. The screws can also be used for releasing the connector again, by reversing the scheme.

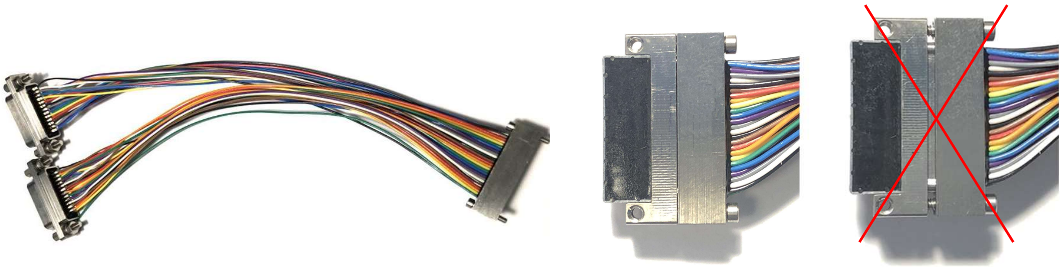


Figure 29 - Left) 51-pin Nano-D to 2x 25 pin Micro-D jumper cable. Right) The connectors must be inserted fully into each other. The screws can be used for mating and separating them.

For the RF connection, usually, two 8-way Mini-Coax cable assemblies are supplied. These are delivered unassembled so that the pin order can be arranged either way. For narrow sample spaces, one is often installed with reversed pin order so that the cables point in the same direction.

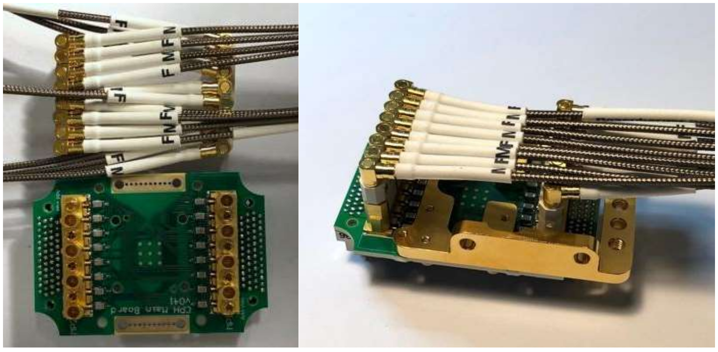


Figure 30 - Left) 8-way Mini-Coax cable assembly. NOTE, that the male Mini-Coax connectors have small flaps which bend slightly when inserted into the tube of the female connectors. Take care to insert the connector straight, so that one flap does not accidentally go outside the tube of the female connector.

Middle: Back side of QBoard-II mounted on a Type C bracket with two Mini-Coax cable assemblies leaving in the same direction: This is possible only if the pin order of one of the two cable assemblies has been reversed. In case of needing to remove the RF connectors from the multi-port assembly, the extraction tool from Rosenberger PN 23W100-000 can be used. We supply the sleeve used in the tool as Q114, which is sufficient for removing the connectors.

Please be very cautious when connecting the RF- and DC-cables to the QBoard-II and the fridge as the cables and the board connectors are very delicate.

9. Troubleshooting

If you have any problem getting our Products to work and you cannot find the answer in this manual, or if anything is broken, please do not hesitate to contact:

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2750 Ballerup

Denmark

https://www.quantum-machines.co/

e-mail: info@qdevil.com

Phone: +45 3699 2145 or +1 650 543 3192

We will do our best to Help You Succeed!

10. Product and warranty information

QBoard-II is designed and manufactured in Denmark by QDevil ApS (QDevil), a subsidiary of Quantum Machines (Q.M. Technologies Inc.). Patent pending.

All QDevil Products fulfill strict quality requirements. In order to ensure the quality, our products go through detailed quality tests. If, all precautionary measures notwithstanding, problems should occur, please make appeal to our warranty: Unless otherwise separately agreed in writing, QDevil warrants for a period of 12 months following the date of passing of the risk to Customer ("Warranty Period") that the Products will be free from material defects and thus will perform substantially in accordance with the applicable specifications for the Products.

In case of a complaint, the Customer should contact QDevil with a clear description of the flaw. In order to save cost and time, please re-read the manual and check if the flaw is caused by obvious causes prior to presenting the Product for repair.

In some cases, problems can be solved remotely, for example through detailed use instructions or a software upgrade, in which case the Customer is required to cooperate to a reasonable degree.

If judged by QDevil that the Product should be returned to QDevil for repairs in order to solve the problem, the Customer is responsible for packing the Product safely and solid, and submitting the Product to a carrier selected by QDevil (for example FedEx or UPS), using QDevil's carrier account number or a waybill provided by QDevil, so that QDevil in this way pays the transportation costs.

QDevil is responsible for the insurance during transportation to and from repairs. QDevil will attempt to repair the Product free of charge within the warranty period and will return the repaired item to the Customer as quickly as possible. Note that returning a non-defective Products can also involve handling costs.

Within the Warranty Period, QDevil will in its sole discretion decide whether to (i) repair Products, and/or (ii) replace Products, and/or (iii) in whole or in part refund the purchase price, with respect to Products that fail to conform to the warranty.

The warranty set out shall not apply in the event that any Products fails to conform to the warranty due to matters not solely attributable to QDevil including (i) normal wear and tear, (ii) lack of or improper maintenance, (iii) use contrary to specifications and guidelines accompanying Products, (iv) any use with Customer and/or third party products and services, and/or (iv) other matters beyond the reasonable control of QDevil.

QDevil expressly disclaims any other warranties - whether express or implied - and the remedies set out in this section shall constitute the sole and exclusive remedies of Customer in the event of any breach of warranty by QDevil.

The warranties are subject to the exclusions and limitations of liability set out in QDevil's Standard Terms & Conditions.

Appendix – Sample board bonding planes

Sheets with bonding planes for each type of sample board attached:

- Q160 – 6mm x 6mm cavity size
- Q161 – 10mm x 10mm cativy size
- Q162 – 11mm x 14mm cavity size