



NoiseTech Microwaves Ltd.

Product Technical Specifications of Cryogenic SPDT Switch Matrix

Technical Specifications (Version 2) – July 11, 2022

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2. General

NoiseTech Microwave Ltd. (NoiseTech) switch (SW) matrix consists of two independent USB-driven SPDT switches and a controller, which is located outside the cryostat. Optional temperature sensor can be installed inside one of the switches.

On-board memory stores the manual, technical specifications and can be used to store other information.

The switch can be used for multitude of different applications where wideband USB-controlled cryogenically cooled SPDT switches are needed.



Fig. 1: C-SW00160-S2-T Switch Matrix.

3. Ordering information

Typical part number: C-SW[flfuu]-S[N]-controller-temp

In this part number:

- “fl” specifies the lower-frequency range, e.g. for 0.01GHz specify 001.
- “fuu” specifies the upper-frequency range, e.g. for 20.0GHz specify 200.
- Replace “N” with 1 or 2 to specify the number of switches
- Replace “controller” with “NC” if the controller is not required, otherwise omit
- Replace “temp” with “T” to specify an optional temperature sensor. Note that when the controller is not required, temperature reading from the sensor will require additional hardware.

Verified frequency ranges are: 0.01 to 6GHz, and 0.01 to 20GHz. Contact NoiseTech for other frequency ranges.

Example part numbers: C-SW0160-S2, C-SW00135-S1-NC, C-SW001200-S2-T

NoiseTech Microwaves Ltd. (www.NoiseTechMicrowaves.com)

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4. Specifications

4.1 Physical specifications

Controller

Parameter	Specification	Note	Comment
Housing/Enclosure Dimensions			
Width	4cm		Excluding connectors.
Length	8cm		
Height	2.5cm		
Non-RF connectors	USB-A (controller) Mini USB (controller) Three low-speed SMA (controller) Temperature sensor (controller)	Fig. 1	For control other devices Power and control input Control of the RF part Temperature sensor is optional
Total weight	125 g typ.		

Cryogenic RF Part

Parameter	Specification	Note	Comment
Housing/Enclosure Dimensions			
Width	57mm		Excluding connectors.
Length	37.53mm		
Height	16mm		
RF connectors	3 RF connectors	Fig. 1	- SMA standard
Non-RF connectors	3 low-frequency feedthroughs		
Total weight	80 g typ.		
Mounting options	- Top side through mounting slots - Bottom side mounting threaded holes		For dimensions see Fig. 2
Power consumption	27 μ W typ (0.35mW max)		
Thermal resistance	0.1 K/W max		From the circuit ground plane to the bottom of the enclosure

4.2 Electrical performance at 25C

4.2.1 RF

C-SW00160

Parameter	Specification	Ref	Comment
Reflection coefficient	8 dB min		All RF inputs/outputs
Insertion loss	2.5 dB max		
Isolation	30 dB min		
Bandwidth	0.01GHz to 6GHz		
Turn ON/OFF time	1 ms max		Contact NoiseTech if faster switch time is required
Input P1dB	33 dBm min		
Self-generated interference	-100 dBm max		Integrated over any 10MHz band
Temperature measurement range	1.4K to 325K		Optional temperature sensor
Temperature measurement accuracy	<1K typ. below 60K <2K typ. above 60K		

C-SW001200

Parameter	Specification	Ref	Comment
Reflection coefficient <6 GHz 6 to 10GH 10 to 20GHz	10 dB min 8 dB min 4.5 dB min		All RF inputs/outputs
Insertion loss <6GHz 6 to 10GH 10 to 20GHz	2 dB max 3.5 dB max 7 dB max		All RF inputs/outputs
Isolation <6GHz 6 to 10GH 10 to 20GHz	30 dB min 30 dB min 30 dB min		All RF inputs/outputs
Bandwidth	0.01GHz to 20GHz		
Turn ON/OFF time	1 ms max		Contact NoiseTech if faster switch time is required
Input P1dB	33 dBm min		
Self-generated interference	-100 dBm max		Integrated over any 10MHz band
Temperature measurement range	1.4K to 325K		Optional temperature sensor
Temperature measurement accuracy	<1K typ. below 60K <2K typ. above 60K		

4.2.2 Digital

Parameter	Specification	Note	Comment
Communication protocol	USB 2.0		Connection thru micro-B USB
On-board RAM	192kB min.		
FLASH memory	5 MB min.		
Maximum COM Baud Rate	115.2 kbps typ		
Cryo Temp. Sensor error	0.5K max		Requires calibration

4.2.3 Power supply

Parameter	Specification	Ref	Comment
Power supply voltage (typ)	5V		Supplied by host computer
Power supply voltage (min)	4.75V		Supplied by host computer
Power supply voltage (max)	5.25V		Supplied by host computer
Controller current consumption	55mA max from 5V supply 100 mA max from 5V supply		Supplied by host computer. -Noise Source not connected -Noise source connected
RF-part current consumption	8µA typ (0.11mA max) from a -5V supply		Supplied by the controller or user's equipment

4.2.4 Environmental

Parameter	Specification	Ref	Comment
Ambient temperature Operating	0C to 40C 4K to 300K		Controller RF part
Storage	Not specified		
Operating relative humidity	20% to 80% non-condensing		
Storage relative humidity	20% to 80% non-condensing		
Shock resistance	Not specified		
Vibration resistance	Not specified		
ESD	2kV HBM		
EMC	Not specified		

4.2.5 Regulatory

Parameter	Specification	Ref	Comment
FCC part 15 ICES-3	Compliant		

4.3 Interface specifications

4.3.1 RF interface (for each RF Part)

Connector (V port): Field-replaceable female (SMA, 3.5mm)

Pin	Name	Description
Inner	V	RF input port 50Ω (nominal)

Connector (N port): Field-replaceable female (SMA, 3.5mm)

Pin	Name	Description
Inner	N	RF input port 50Ω (nominal)

Connector (common port): Field-replaceable female (SMA, 3.5mm)

Pin	Name	Description
Inner	C	RF input port 50Ω (nominal)

4.3.2 Non-RF interface (Controller)

Connector: micro-B USB receptacle

Pin	Name	Specification	Description
1	Vbus	Power supply to C-SW001100 controller	Power supply
2	D-	USB 2.0 compatible data line	USB 2.0 differential pair
3	D+	USB 2.0 compatible data line	
4	NC		NC
5	GND	Ground	Ground

Connector: USB-A

Pin	Name	Specification	Note	Description
1	Vbus	Same as pin 1 on micro-B USB Output current: 50 mA max		Output
2	D+	Noise source control V _{OL} =0.4Vmax V _{OH} =3.0Vmin		Output from the controller
3	D-	Noise source temperature output (0V to 3V) Internal 10k pull up to 3.3V.		Input to the controller
4	GND	Ground		

Connector (Vdd): SMA female

Pin	Name	Description
Inner	Vdd = -5V typ -5.5V<Vdd<-4.5V Max. current source: 0.1mA min	Power supply for the RF part Typically supplied by the controller

Connector (S1): SMA female

Pin	Name	Description
Inner	Switch 1 control V _{OL} >-4.5V V _{OH} >-0.5V Max. current source: 50μA min	Control of the RF part

Connector (S2): SMA female

Pin	Name	Description
Inner	Switch 2 control $V_{OL} > -4.5V$ $V_{OH} > -0.5V$ Max. current source: 50 μ A min	Control of the RF part

Connector (Temp): SMA female

Pin	Name	Description
Inner	RF part temperature Analog voltage between 0.4V and 1.75V Current source: 10 μ A typ	Sense temperature of an RF part

4.3.3 Non-RF interface (RF part)

Connector (Vdd): Feedthrough

Pin	Name	Description
Inner	Vdd = -5V typ $-5.5V < V_{dd} < -4.5V$ Current draw: 2 μ A max	Power supply to the RF part Typically supplied by the controller

Connector (S1): Feedthrough

Pin	Name	Description
Inner	Switch 1 control $-0.5V < V_{IL} < 0.1V$ $-5.5V < V_{IH} < -4.5V$ Current: 3 μ A typ (50 μ A max)	Typically supplied by the controller

Connector (S2): Feedthrough

Pin	Name	Description
Inner	Switch 2 control $-0.5V < V_{IL} < 0.1V$ $-5.5V < V_{IH} < -4.5V$ Current: 3 μ A typ (50 μ A max)	Typically supplied by the controller

Connector (T): Feedthrough

Pin	Name	Description
Inner	RF-part temperature Analog operating voltage: 0.5V to 1.75V Current sink: 10 μ A typ	RF-part temperature sensor output

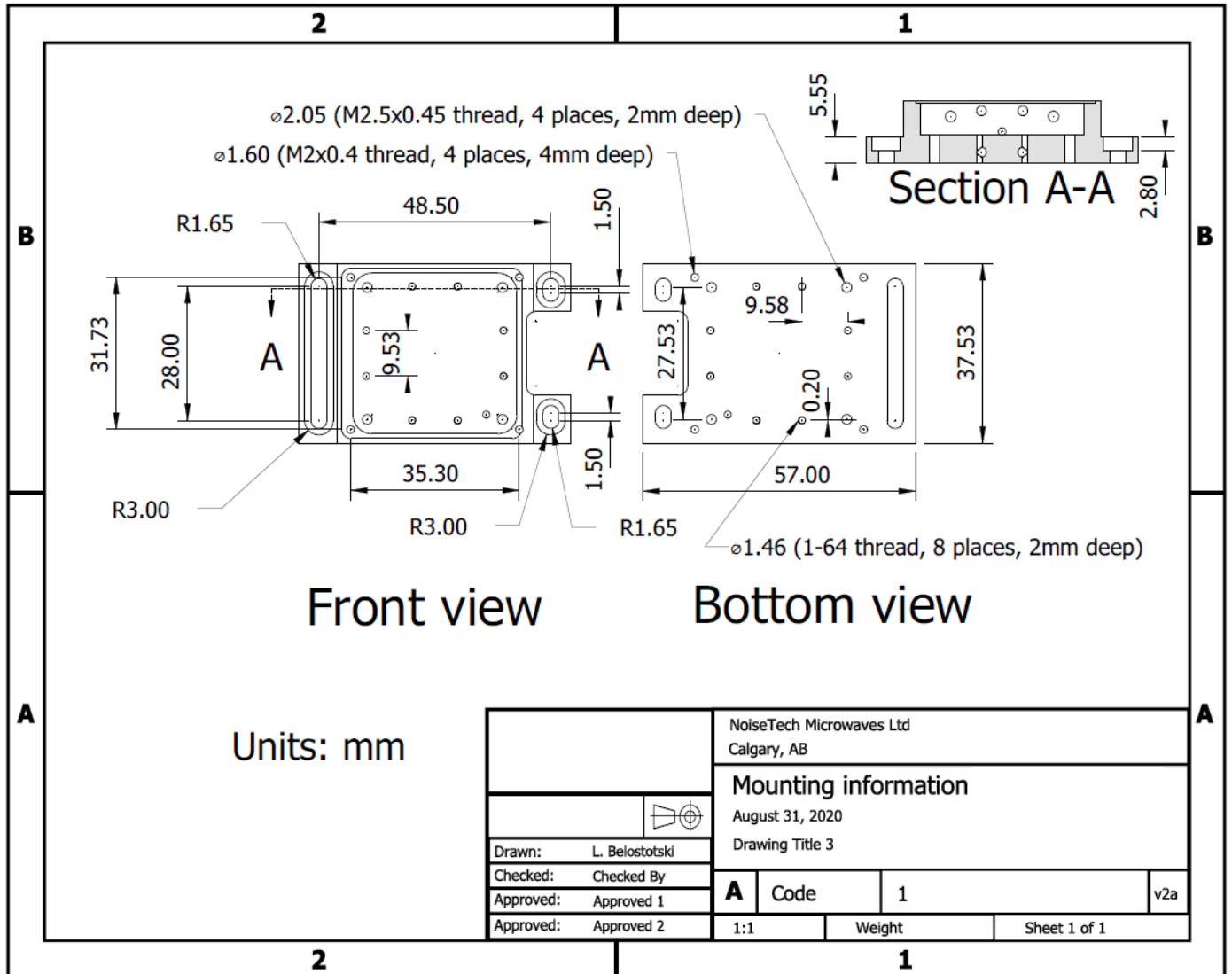


Fig. 2. Mounting information. For details contact NoiseTech Microwaves

5. Revision notes

July 11, 2022: Updated Non-RF interface voltages (V_{dd} , V_{OL} , V_{OH} , V_{IL} , V_{IH}) of the RF and controller parts to the nominal -5V levels.