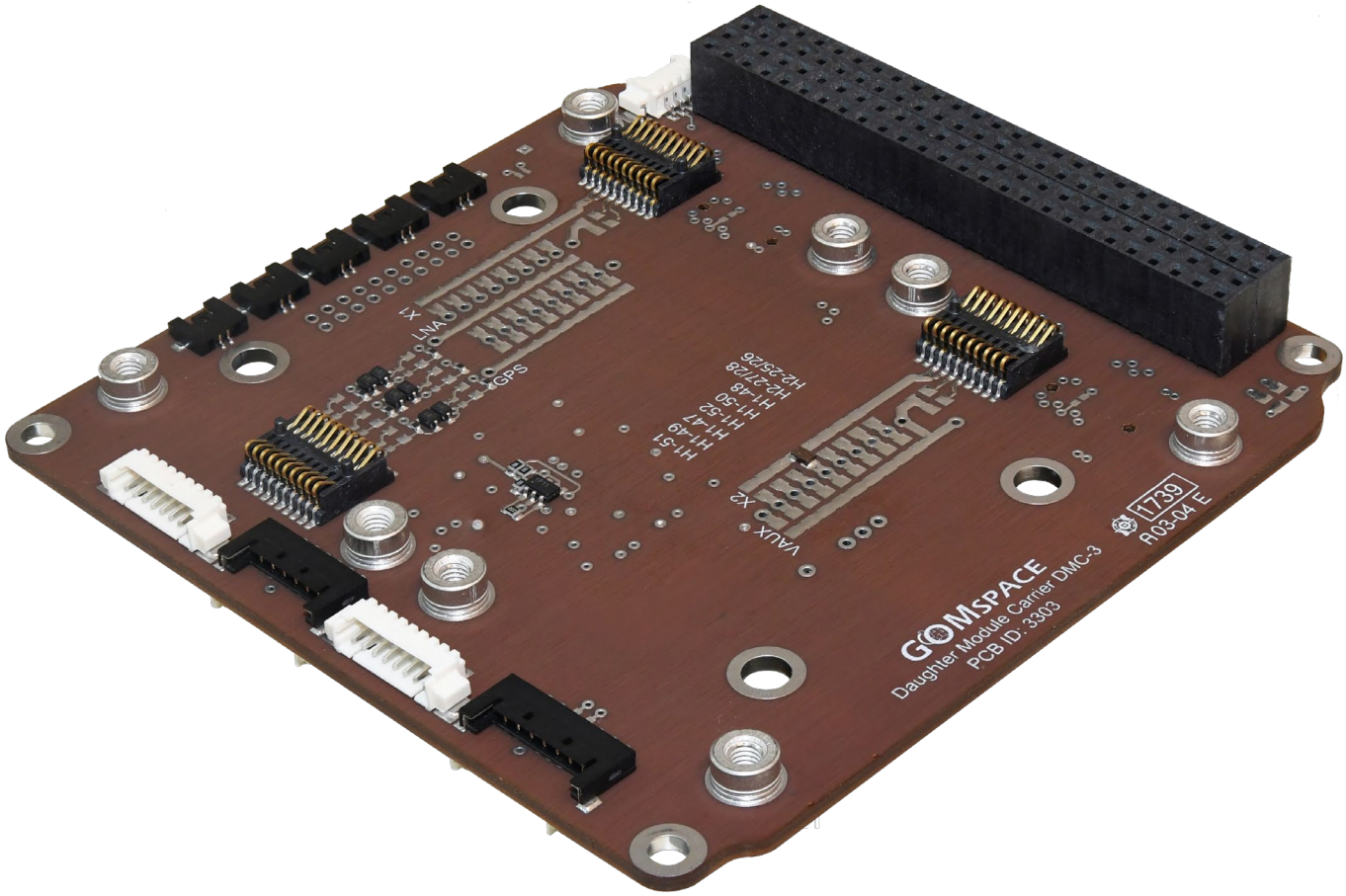

NanoDock
DMC-3

Datasheet

Daughter module carrier 4 daughterboards

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Confidentiality Notice

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2 Overview

The GomSpace NanoDock DMC-3 is designed to carry up to four daughterboards (not included) or up to two while also providing mounting for a GPS receiver. Each daughterboard connector has communication interfaces (I^2C and CAN) and configurable supply lines routed to the stack connector, and thus allow the DMC-3 to effectively host four subsystems.

To facilitate easy tabletop debugging access to the daughterboards, a USB to 4 UARTs interface can be mounted on the DMC-3 giving the ability access UART0 on each of the daughterboards through USB.

If only the two top daughterboard mounts are used, then the entire system will remain within the envelope of a single PC104 stacking height.

2.1 Highlighted Features

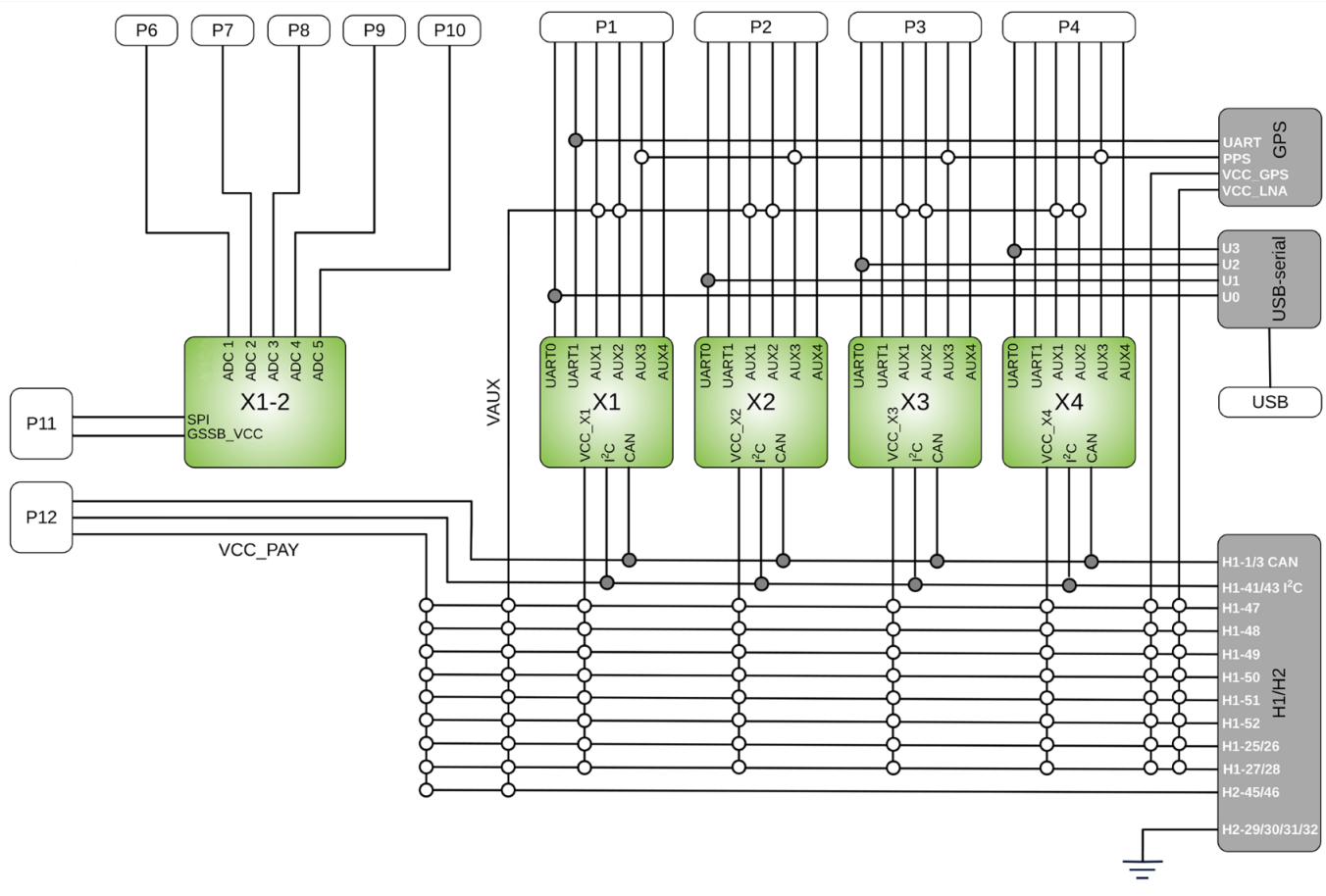
- Carrier for up to 4 daughterboards
- Provision for mounting a GPS receiver (in place of 2 daughterboards)
- Operational temperature: -40°C to +85°C
- Dimensions: 91.9 x 88.7 x 8.6 mm
- Mass: 51 grams (without 4 daughterboards)
- 4x 20-position FSI one-piece connector for daughterboards
- USB to UART console interface for easy use in lab setup
- PCB material: Glass/Polyimide
- IPC-A-610 Class 3 assembly

2.2 GPS Receiver

Instead of accommodating two daughterboards on the bottom side, it is possible to mount a GPS receiver. The GPS connects to a 20-pin header that provides a permanent UART connection to the daughterboard on X1. This is designed to use a GomSpace NanoMind A3200 on-board computer to interface to the GPS.

2.3 Block diagram

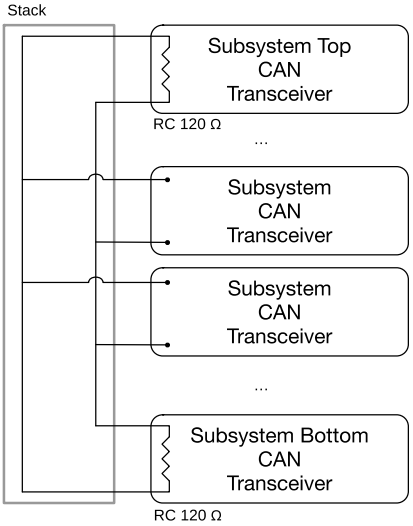
The block diagram below illustrates all the connections on the DMC-3. The board is designed to be very flexible allowing any daughterboard to be supplied from any of the power supply pins used in GomSpace's CubeSat products.



The white dots show configurable connections. Gray dots show permanent connections.

2.4 CAN Stack Termination Recommendation

GomSpace recommends having a 120 Ω termination resistor in the top and bottom of the CAN bus, to mitigate reflections. The total bus resistance should be 60 Ω. On the NanoDock DMC-3 option sheet there is an option to install a 120 Ω termination resistor.



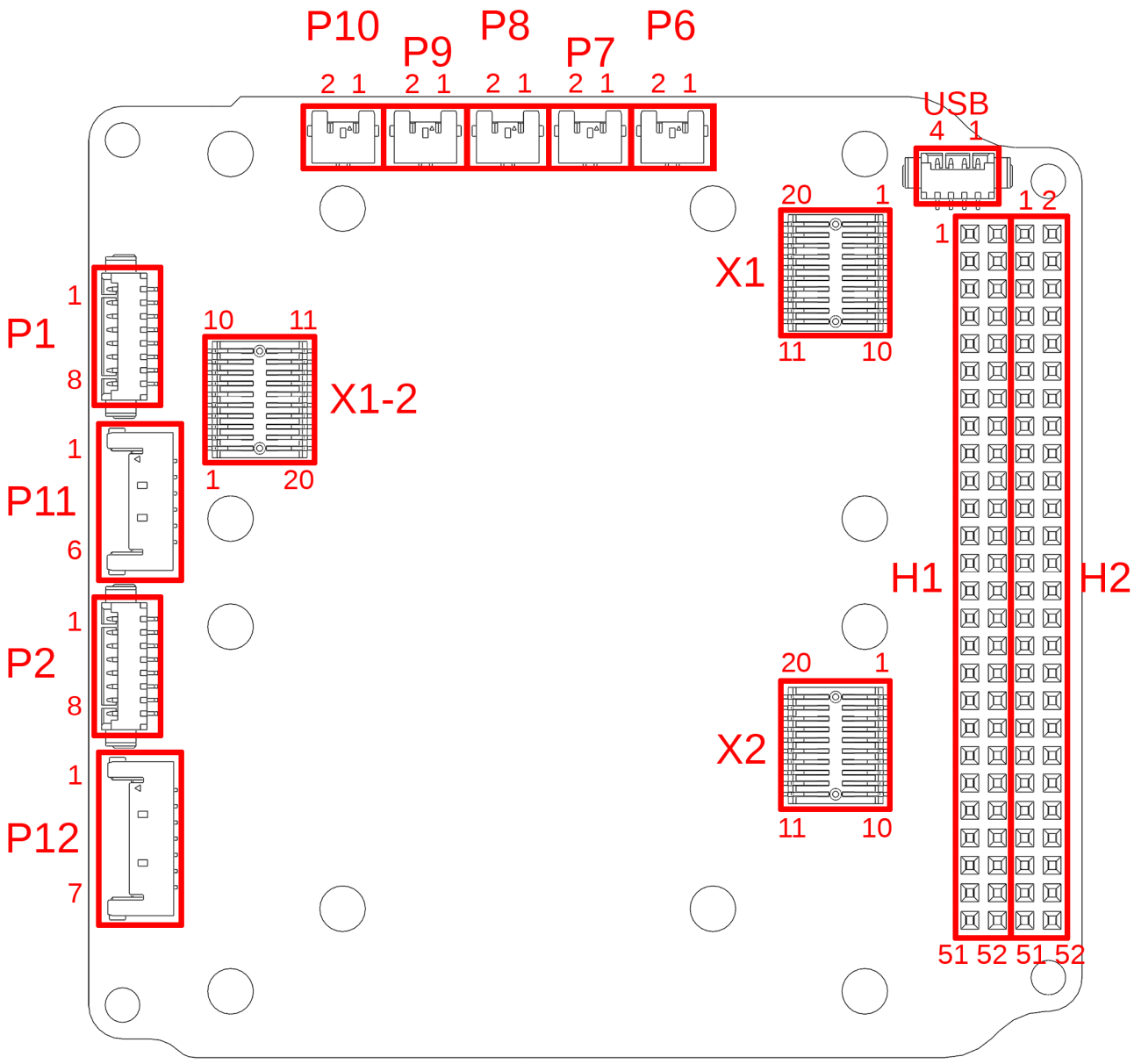
3 Connector Pinout

The NanoDock DMC-3 is mainly a passive circuit board that provides a physical platform for the daughterboards and electrical connections to the stack connector. The only active electronics circuit is the USB to serial circuit on the bottom side of the PCB, which is powered by USB and provides a serial connection to the daughterboards.

The two FSI connectors X3 and X4 can be chosen not to be installed.

3.1 DMC-3 Top

Top placement of connectors.



3.1.1 Stack Connector H1/H2

The stack connector H1/H2 connects the daughterboard supplies and interfaces out to the PC104 CubeSat bus. The table below shows the used pins in the stack connector. GND, CAN and I²C are permanently routed to each daughterboard connector, and all supply lines can be individually configured using the option sheet.

H1

Pin	Description
H1-1	CAN Low
H1-3	CAN High
H1-41	SDA
H1-43	SCL
H1-47	User supply (option)
H1-48	User supply (option)
H1-49	User supply (option)
H1-50	User supply (option)
H1-51	User supply (option)
H1-52	User supply (option)

H2

Pin	Description
H2-25/26	5 V (option)
H2-27/28	3,3 V (option)
H2-29	GND
H2-30	GND
H2-32	GND
H2-45/46	VBAT (option)
H2-48	User GND (option)
H2-52	User GND (option)

3.1.2 X1 – FSI

SAMTEC FSI-110-D

Pin	Description	Pin	Description
1	GND	20	GND
2	GND	19	GND
3	VCC_X1	18	VCC_X1
4	VCC_X1	17	VCC_X1
5	SCL	16	AUX 1
6	SDA	15	AUX 2
7	CAN high	14	AUX 3
8	CAN low	13	AUX 4
9	UART0 RX	12	UART1 RX
10	UART0 TX	11	UART1 TX

3.1.3 X1-2 – FSI

SAMTEC FSI-110-D

Pin	Description	Pin	Description
10	AD3	11	AD7 *
9	AD2	12	AD6 *
8	AD1	13	AD5
7	AD0	14	AD4
6	VAUX *	15	SPIO CS2 *
5	GSSB_VCC2 *	16	SPIO CS1
4	GND	17	SPIO CS0 *
3	GSSB_VCC	18	SPIO MISO
2	I²C SCL2 *	19	SPIO MOSI
1	I²C SDA2 *	20	SPIO SCK

* Not routed to any connector on the DMC-3

3.1.4 X2 - FSI

SAMTEC FSI-110-D

Pin	Description	Pin	Description
1	GND	20	GND
2	GND	19	GND
3	VCC_X2	18	VCC_X2
4	VCC_X2	17	VCC_X2
5	SCL	16	AUX 1
6	SDA	15	AUX 2
7	CAN high	14	AUX 3
8	CAN low	13	AUX 4
9	UART0 RX	12	UART1 RX
10	UART0 TX	11	UART1 TX

3.1.5 P1 - Breakout Connector

Molex PicoBlade 53261-0871

Each daughterboard connector is associated with a breakout connector with matching numbering, so X1 is paired with P1, etc.

UART0 is permanently connected to the USB to the serial circuit, see block diagram chapter 2.3.

Pin	Description
1	UART0 RX
2	UART0 TX
3	UART1 RX
4	UART1 TX
5	AUX 1
6	AUX 2
7	AUX 3
8	AUX 4

3.1.6 P2 - Breakout Connector

Molex PicoBlade 53261-0871

Each daughterboard connector is associated with a breakout connector with matching numbering, so X2 is paired with P2, etc.

UART0 is permanently connected to the USB to the serial circuit, see block diagram chapter 2.3.

Pin	Description
1	UART0 RX
2	UART0 TX
3	UART1 RX
4	UART1 TX
5	AUX 1
6	AUX 2
7	AUX 3
8	AUX 4

3.1.7 P6-P10

Molex PicoLock 503763-0291

Headers P6-P10 provide five individual ADC inputs directly to five of the ADC inputs present on the NanoMind A3200. The tables below describe the connection to the A3200 used by each header, and the pinout for each header.

Connector	NanoMind A3200 I/O Pin
P6	ADC 1 (PA05)
P7	ADC 2 (PA06)
P8	ADC 3 (PA07)
P9	ADC 4 (PA08)
P10	ADC 5 (PA09)

Pin	Description
1	Analog In / GPIO
2	GND

Voltage division and smoothing circuitry for analog input signals is available on request. The circuit used can be seen in Figure 1. If not specified, all analog signals are directly connected to the NanoMind A3200 ADC inputs through a 0 Ω resistor at position R1, and a single 3.6 V Zener diode to prevent overvoltage to the A3200 inputs. R2 and C1 are left unpopulated. If required, custom value resistors and capacitors may be installed at positions R1, R2 and C1.

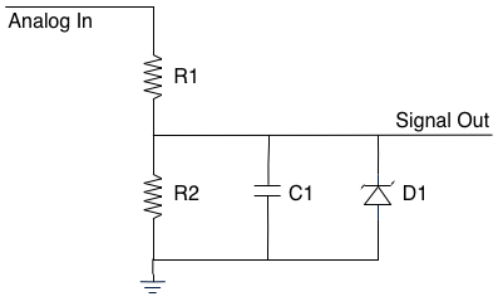


Figure 1: Analog input voltage division and smoothing circuit

3.1.8 P11- SPI to A3200

Molex PicoLock 504050-0691

P11 provides an additional SPI connection to the NanoMind A3200.

Pin	Description
1	SPI0 CS1
2	SPI0 MISO
3	SPI0 MOSI
4	SPI0 SCK
5	GSSB_VCC
6	GND

3.1.9 P12 – I²C and CAN

Molex PicoLock 504050-0791

P12 provides an additional connection to the main I²C and CAN buses present on the PC104 stack for peripheral payloads.

The power supply VCC_PAY is configurable by the user in the hardware option sheet for the DMC-3.

Pin	Description
1	SCL
2	SDA
3	CANL
4	CANH
5	GND
6	VCC_PAY
7	GND

3.1.10 USB Connector

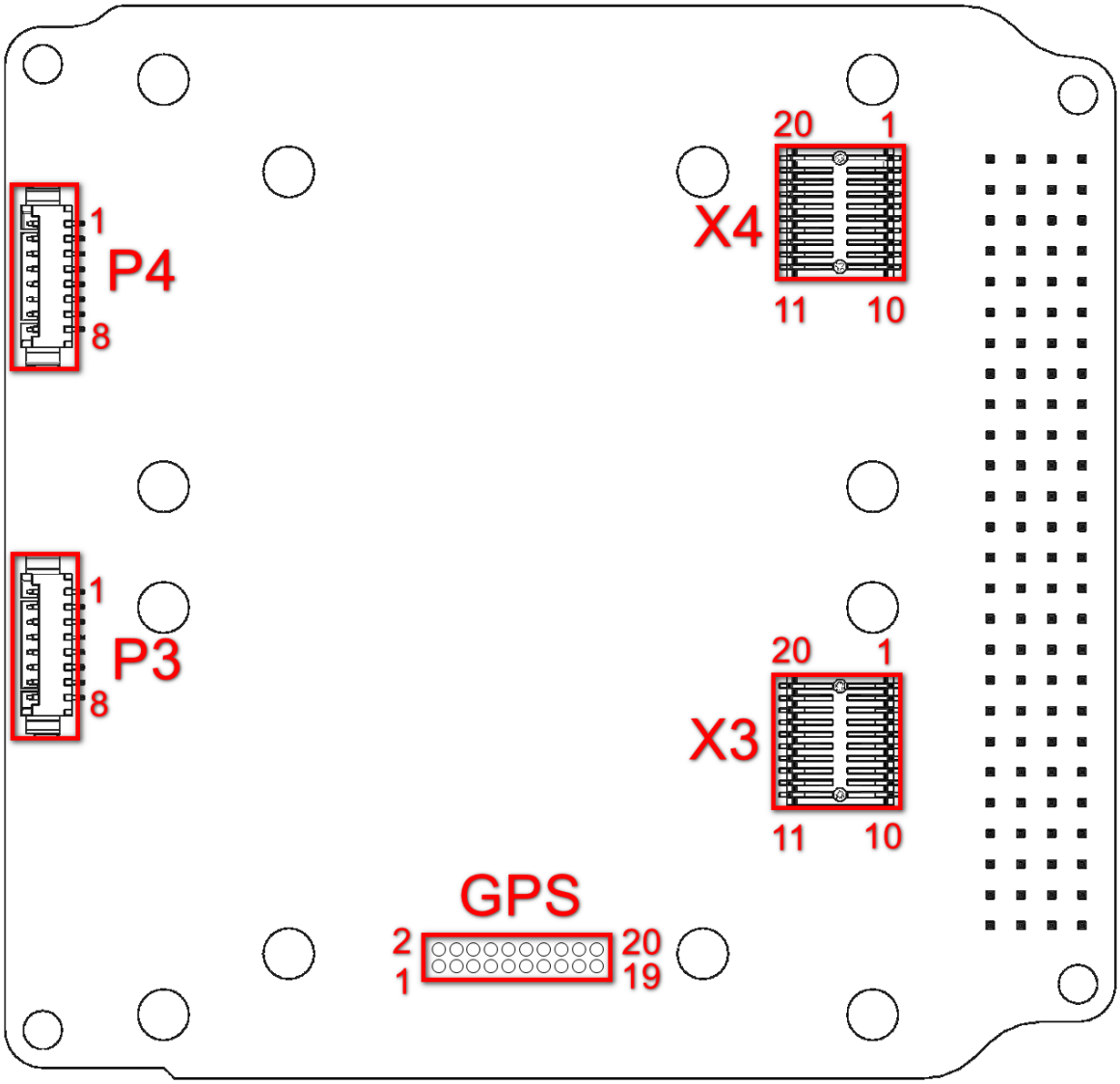
Molex PicoBlade 53261-0471

The USB connector provides USB connection to the USB to Serial circuit on the DMC-3. The pin out is shown in the table below.

Pin	Description
1	GND
2	5 V
3	DN
4	DP

3.2 DMC-3 Bottom

Bottom placement of connectors.



3.2.1 X3 – FSI

SAMTEC FSI-110-D

Pin	Description	Pin	Description
1	GND	20	GND
2	GND	19	GND
3	VCC_X3	18	VCC_X3
4	VCC_X3	17	VCC_X3
5	SCL	16	AUX 1
6	SDA	15	AUX 2
7	CAN high	14	AUX 3
8	CAN low	13	AUX 4
9	UART0 RX	12	UART1 RX
10	UART0 TX	11	UART1 TX

3.2.2 X4 - FSI

SAMTEC FSI-110-D

Pin	Description	Pin	Description
1	GND	20	GND
2	GND	19	GND
3	VCC_X4	18	VCC_X4
4	VCC_X4	17	VCC_X4
5	SCL	16	AUX 1
6	SDA	15	AUX 2
7	CAN high	14	AUX 3
8	CAN low	13	AUX 4
9	UART0 RX	12	UART1 RX
10	UART0 TX	11	UART1 TX

3.2.3 P3 - Breakout Connector

Molex PicoBlade 53261-0871

Each daughterboard connector is associated with a breakout connector with matching numbering, so X3 is paired with P3, etc.

UART0 is permanently connected to the USB to the serial circuit, see block diagram chapter 2.3.

Pin	Description
1	UART0 RX
2	UART0 TX
3	UART1 RX
4	UART1 TX
5	AUX 1
6	AUX 2
7	AUX 3
8	AUX 4

3.2.4 P4 - Breakout Connector

Molex PicoBlade 53261-0871

Each daughterboard connector is associated with a breakout connector with matching numbering, so X4 is paired with P4, etc.

UART0 is permanently connected to the USB to the serial circuit, see block diagram chapter 2.3.

Pin	Description
1	UART0 RX
2	UART0 TX
3	UART1 RX
4	UART1 TX
5	AUX 1
6	AUX 2
7	AUX 3
8	AUX 4

3.2.5 GPS - Connection to NanoDock

Samtec MMS-110-01-L-DV

Pin	Description	Pin	Description
1	VCC_LNA (3.3 V)	**2**	VCC_GPS (3.3 V)
3	Not connected	**4**	GPS RX3
5	Not connected	**6**	VARF
7	Not connected	**8**	Not connected
9	GPS TX3	**10**	GND
11	GPS TX	**12**	GPS RX
13	GND	**14**	GPS TX 2
15	GPS RX 2	**16**	GND
17	Not connected	**18**	GND
19	PPS	**20**	Not connected

The connector is intended for the NovAtel OEM719 GPS module.
When choosing to prepare for a GPS module, via the options sheet, please make sure to choose a power channel for the GPS module, i.e., VCC_GPS and VCC_LNA.
VCC_GPS is for the operating the GPS module and VCC_LNA is for powering the active GPS antenna.
In a normal setup the VCC_GPS and VCC_LNA are connected to the same power channel.

4 Absolute maximum Ratings

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the NanoDock DMC-3. Exposure to absolute maximum rating conditions for extended periods may affect the reliability.

Symbol	Description	Min.	Max.	Unit
V_USB_5V	FTDI supply voltage	4.3	6.0	V
T_{space}	Operating Temperature	-40	85	ºC

5 Electrical Characteristics

The active electronics circuit on the NanoDock DMC-3 is the USB to serial which is powered from the USB connector.

6 Physical Characteristics

Description	Value	Unit
Mass – without daughter boards	51	g
Size	Standard PC104 fit 91.9 x 88.7 x 8.6	mm

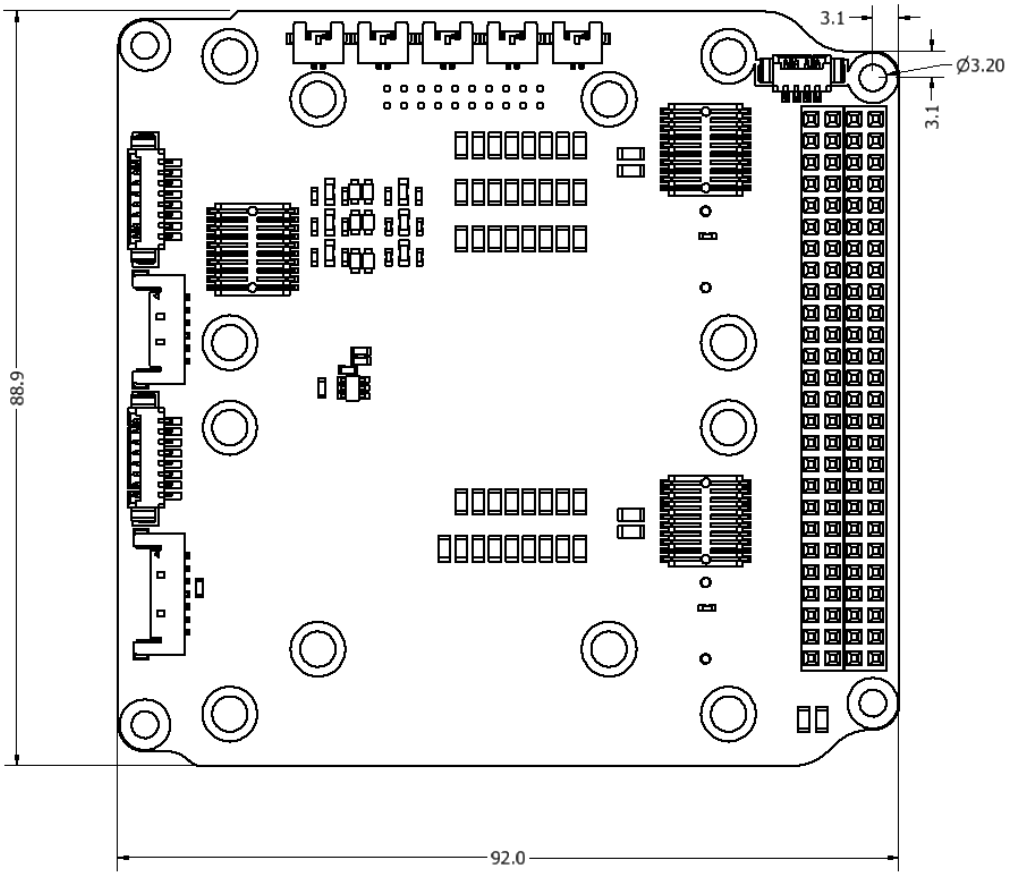
7 Environment Testing

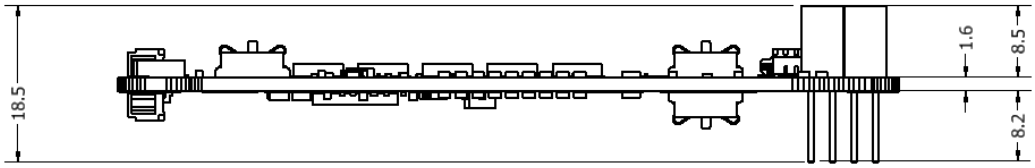
To simulate the harsh conditions of launch and space, the NanoDock DMC-3 has been exposed to a number of environment tests. For detailed information about the tests please contact GomSpace.

The NanoDock DMC-3 has been in space and performed perfectly.

8 Mechanical Drawing

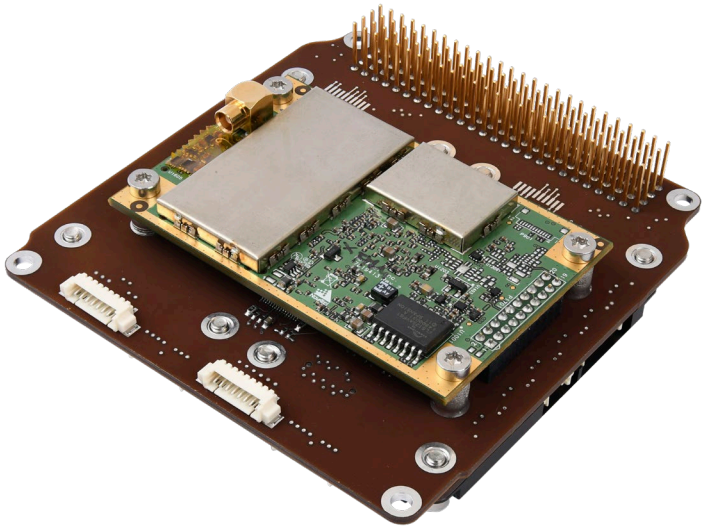
All dimensions in mm.





9 Adaption Examples

NanoMind A3200 Computer and NanoCom AX100 transceiver



GPS on bottom

10 Disclaimer

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