iChidori-Crest

Hardware Reference Manual

Applicable variants: P1 | P3 | P3H | P6

Raspberry Pi 4/5 HAT integrating the Septentrio GNSS mosaic-G5 receiver + LTE mPCIe Modem Slot

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1. Introduction

The iChidori-Crest is a compact Raspberry Pi HAT board that integrates a Septentrio GNSS mosaic-G5 receiver, an LTE mPCIe modem slot, and the supporting power, logging and expansion circuitry required for high-precision positioning applications. The board is designed to stack directly on a Raspberry Pi 4 / 5 and is offered in variants — P1, P3, P3H and P6 — built on the same physical hardware (see Section 2).

Typical applications include RTK/PPK survey, MADOCA, autonomous navigation, and robotics — systems that require centimeter-level positioning together with cellular (LTE) connectivity. The LTE link supports NTRIP and TCP/IP client/server operation for RTCM3 correction exchange, remote streaming of SBF/NMEA data for logging or PPK post-processing, as well as remote access, configuration, and monitoring of the deployed system via Septentrio RxTools software.

1.1 Functional Block Diagram

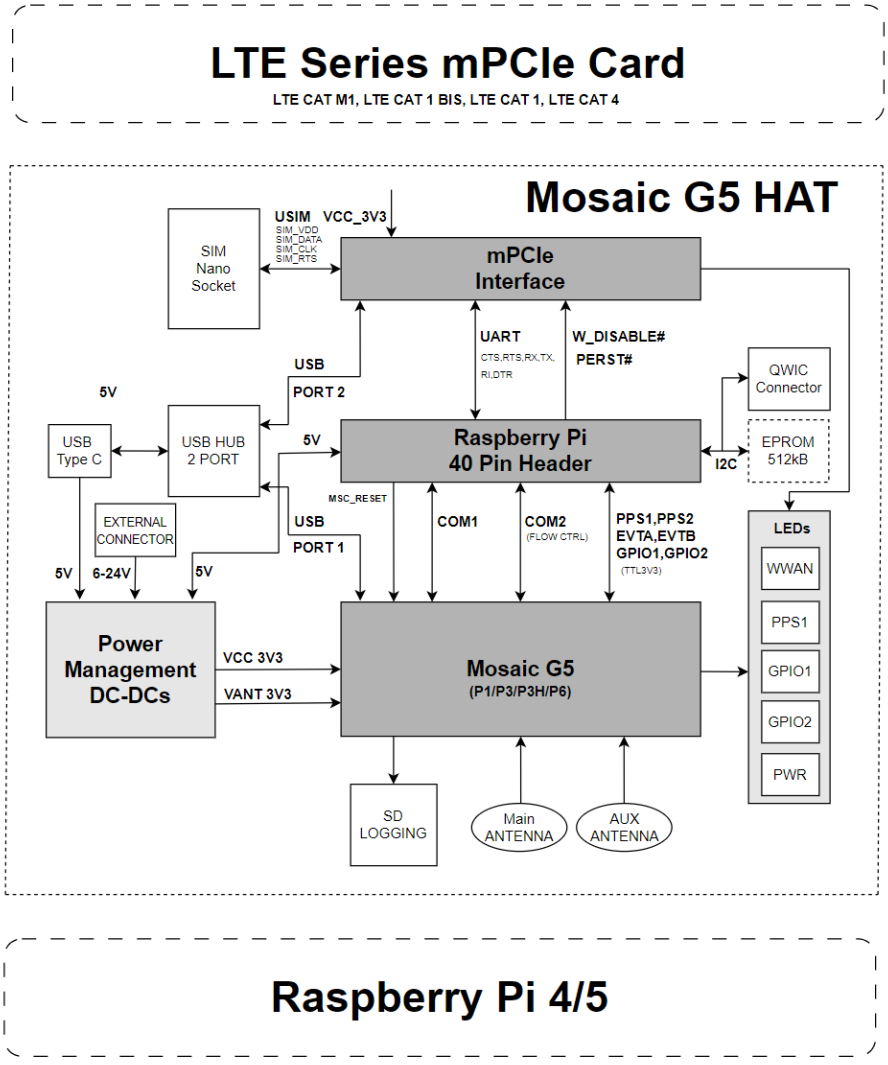


Figure 1. mosaic_G5_HAT_EVM functional block diagram

1.2 Overview

- Mosaic-G5 receiver: the GNSS engine of the board (P1, P3, P3H or P6 variants); interfaces to the Raspberry Pi via COM1, COM2 and USB, drives status LEDs, connects to the MAIN and AUX antenna and the on-board SD logging slot.

- Raspberry Pi 40-pin GPIO header: central interconnect carrying COM1, COM2, USB, PPS1/PPS2, EVTA/EVTB and GPIO1/GPIO2 between the Raspberry Pi and the mosaic G5 receiver/LTE modem.
- USB Hub (2-ports): Port 1 connects to the mosaic G5 USB device interface; Port 2 connects to the LTE mPCIe interface.
- LTE mPCIe interface: hosts an LTE Cat M1 / Cat 1bis / Cat 1 / Cat 4 mPCIe card, a Nano SIM socket, and control signals (W_DISABLE#, PERST#) plus USB and UART data paths.
- QWIIC connector + EEPROM (512 kb): I2C expansion port and an on-board identification/configuration EEPROM.
- LED indicators: WWAN, PPS1, GPIO1, GPIO2 and PWR status LEDs.

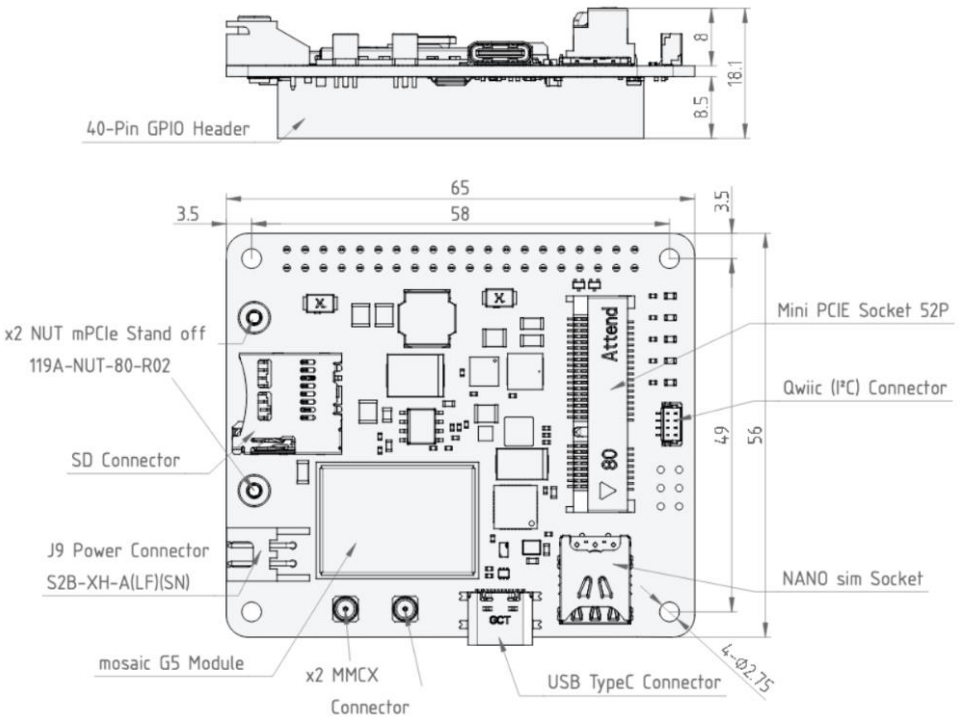
2. Variant Selection Guide

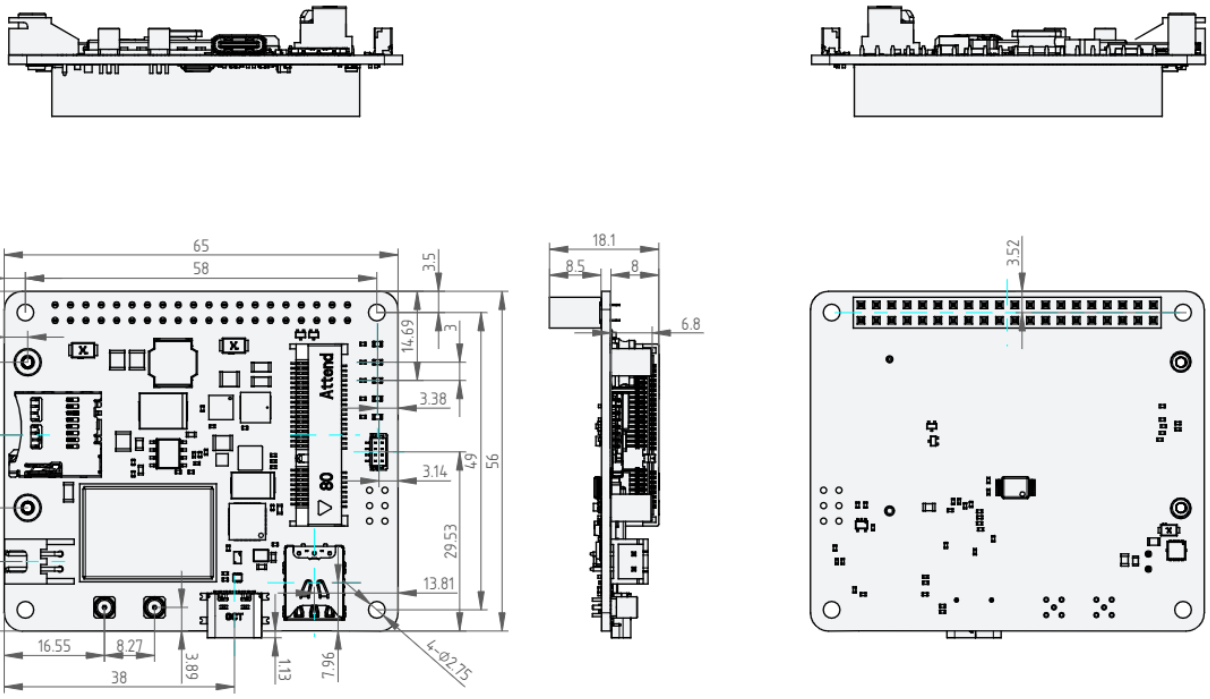
The iChidori-Crest is available in variants that share an identical PCB, mechanical footprint, and interface set. The variants differ only in the mosaic-G5 module fitted (P1, P3, P3H or P6). GNSS constellation coverage, signal tracking and GNSS+ (anti-jam/anti-spoof) feature differences between variants are documented in the product datasheet, not in this manual.

Hardware-level item	P1 variant	P6 variant
Antenna configuration	Single antenna only (Main Antenna). The AUX antenna on the iChidori-Crest is not functional with P1.	Single or dual antenna, selectable by configuration command. Dual mode requires both Main and AUX antennas connected.
Event marker inputs (EVTA/EVTB)	Not supported by the module.	Supported.
Maximum output update rate	Up to 5 Hz (position).	Up to 100 Hz with position, 50 Hz with RTK + attitude.

3. Mechanical Specifications

This section describes the physical dimensions and mounting requirements of the iChidori-Crest.





All dimensions in millimeters.
Weight = 25 g

Note: the above pictures and mechanical diagrams show x2 MMCX antenna connectors. In reality, only one or both of MMCX connector is available depending on the board variant.

4. Power Supply

The board can be powered through three independent paths:

1. On-board USB Type-C connector
2. On-board external power connector
3. From the Raspberry Pi's 5V rail, via the 2 dedicated 5V power pins on the 40-pin GPIO header.

⚠ **Note on powering from the Raspberry Pi (path 3):** the quality of the 5V rail delivered to the HAT depends on the Pi's own load and power supply headroom — a heavily loaded Raspberry Pi may degrade the voltage seen by the iChidori-Crest. This path should be validated through long-duration testing before relying on it in the field. For system reliability, powering the iChidori-Crest from the **6-24 V external connector (path 2)** is recommended.

Input	Nominal voltage	Connector
USB Type-C (on board)	5 V	USB Type C Connector
External power connector (on board)	6-24 V	2-pin XH Connector
Raspberry Pi 5V rail	5 V	40-pin header (2× 5V pins)

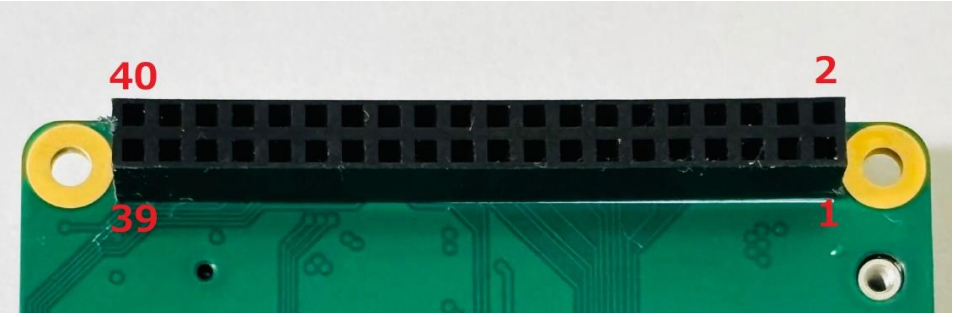
Internal rail	Nominal voltage	Destination
VCC 3V3	3.3 V	mosaic-G5 core supply
VANT 3V3	3.3 V	mosaic-G5 antenna supply

LTE module power control: power to the LTE modem can be managed at levels:

1. Modem power saving (PSM / eDRX, via AT commands): support depends on the installed modem (Cat M1, Cat 1 bis, Cat 1, Cat 4) and the network operator. Refer to the modem manufacturer’s documentation.
2. Radio disable: the W_DISABLE# signal switches off the modem radio without removing power.
3. Hard power-off: the Raspberry Pi can turn off the modem’s DC-DC supply via PWR_CTRL_P (pin 36, see Section 5.1). The modem must re-register on the network after power is restored.

5. Interface Reference

5.1 40-Pin Header



Connector type: 2×20, 2.54 mm Pin socket
Mating connector: Raspberry Pi 4/5 Model B+ built-in 40-pin GPIO header

Pin#	Name	Type	Level	Description	Comment
1	3V3	—	—	Not connected	Not used
3	SDA	I/O	I2C (3V3)	I2C data line — shared bus (QWIC and EEPROM)	See Section 5.6
5	SCL	I/O	I2C (3V3)	I2C clock line	See Section 5.6
7	LTE_UART_RXD	I	LVTTL	LTE modem UART RXD	See Section 5.4
9	GND	Gnd	0	Ground	
11	LTE_W_DISABLE_P	I	LVTTL	LTE mPCIe W_DISABLE# control	See Section 5.4
13	MSC_GPIO2	I/O	LVTTL	Mosaic GPIO2	See Section 5.7
15	MSC_PPS1	O	LVTTL	Mosaic PPS1 output	See Section 5.7
17	3V3	—	—	Not connected	Not used
19	COM2_RTS	O	LVTTL	Mosaic COM2 RTS	Flow control
21	COM2_TX	O	LVTTL	Mosaic COM2 TX	
23	COM2_buffer_CTS	I	LVTTL	Mosaic COM2 CTS	Flow control
25	GND	Gnd	0	Ground	
27	ID_SD	I/O	I2C (3V3)	HAT ID EEPROM data line	See Section 5.6
29	LTE_UART_TXD	O	LVTTL	LTE modem UART TXD	See Section 5.4
31	LTE_UART_RTS	O	LVTTL	LTE modem UART RTS	See Section 5.4
33	PI_GPIO13	I/O	LVTTL	General-purpose, exposed to Pi	
35	MSC_RESET_P	I	LVTTL	Mosaic receiver reset control	
37	MSC_GPIO1	I/O	LVTTL	Mosaic GPIO1	See Section 5.7
39	GND	Gnd	0	Ground	

Pin#	Name	Type	Level	Description	Comment
2	PI_5V	P	5V	5V supply from Raspberry Pi to HAT	Power path 3 — see Section 4.
4	PI_5V	P	5V	5V supply from Raspberry Pi to HAT	Power path 3 — see Section 4.
6	GND	Gnd	0	Ground	
8	COM1_buffer_RX	I	LVTTL	Mosaic COM1 RX	
10	COM1_TX	O	LVTTL	Mosaic COM1 TX	
12	LTE_PERST_P	I	LVTTL	LTE mPCIe reset control	See Section 5.4
14	GND	Gnd	0	Ground	
16	MSC_PPS2	O	LVTTL	Mosaic PPS2 output	
18	MSC_EVTA	I	LVTTL	Mosaic Event A input	
20	GND	Gnd	0	Ground	
22	MSC_EVTB	I	LVTTL	Mosaic Event B input	
24	COM2_buffer_RX	I	LVTTL	Mosaic COM2 RX line	
26	LTE_UART_CTS	I	LVTTL	LTE modem UART CTS	See Section 5.4
28		I/O	I2C (3V3)	HAT ID EEPROM clock line	See Section 5.6
30	GND	Gnd	0	Ground	
32	PI_GPIO12	I/O	LVTTL	General-purpose, exposed to Pi	
34	GND	Gnd	0	Ground	
36	PWR_CTRL_P	O	LVTTL	Enable control for the DC-DC regulator	Driven by Raspberry Pi to power the LTE module on/off See Section 4

				supplying the LTE mPCIe module	
38	LTE_UART_DTR	I	LVTTL	LTE modem UART DTR	See Section 5.4
40	LTE_UART_RI	O	LVTTL	LTE modem UART RI	See Section 5.4

UART routing summary:

- Mosaic G5 COM1 ↔ Raspberry Pi UART0/1 (GPIO14/15)
- Mosaic G5 COM2 (flow control) ↔ Raspberry Pi UART4 (GPIO8/9/10/11)
- LTE modem UART ↔ Raspberry Pi UART3 (GPIO4/5/6/7)

5.2 GNSS Antenna Connectors

Antenna	Purpose	Connector type
Main	Primary GNSS antenna input.	MMCX
AUX	Secondary antenna input for dual-antenna / heading mode.	MMCX

5.3 SD Logging

A physical SD card slot is provided for direct on-board logging by the mosaic-G5 receiver.

⚠ Note:

This SD logging capability is intended for evaluation and debugging purposes only; it is not recommended for use in production/deployed systems.

5.4 LTE mPCIe Interface

Hosts a standard mPCIe LTE modem card. Supported cellular categories: LTE Cat M1, Cat 1bis, Cat 1, and Cat 4 (e.g. Quectel BG96 Cat M1, EC21-J Cat 1 have been tested, as validated in the Configuration & Example Guide).

Connector type: J2, 52-pin mPCIe card edge connector (119A-92A00-R02)

Pin#	Name	Type	Level	Description	Comment
1	LTE_WAKE	O	LVTTL	Wake request output from the modem	
2	VCC_3V3	P	3.3V	Power supply to the modem card	
3	RESERVED	—	—	Not connected on this board	
4	GND	Gnd	0	Ground	
5	RESERVED	—	—	Not connected on this board	
6	NC	—	—	Not connected	
7	RESERVED	—	—	Not connected on this board	
8	LTE_SIM_VDD	O	—	SIM supply, routed to the Nano SIM socket	See Section 5.4
9	GND	Gnd	0	Ground	
10	LTE_SIM_DATA	I/O	LVTTL	SIM data, routed to the Nano SIM socket	
11	LTE_UART_RXD	I	LVTTL	UART RXD, input to the modem	Routed to Pi — see Section 5.1
12	LTE_SIM_CLK	O	LVTTL	SIM clock, routed to the Nano SIM socket	
13	LTE_UART_TXD	O	LVTTL	UART TXD, output from the modem	Routed to Pi — see Section 5.1

14	LTE_SIM_RST	O	LVTTL	SIM reset, routed to the Nano SIM socket	
15	GND	Gnd	0	Ground	
16	RESERVED	—	—	Not connected on this board	
17	LTE_UART_RI	O	LVTTL	Ring indicator output from the modem	Routed to Pi — see Section 5.1
18	GND	Gnd	0	Ground	
19	RESERVED	—	—	Not connected on this board	
20	LTE_W_DISABLE	I	LVTTL	Radio disable control, input to the modem	Routed to Pi — see Section 5.1
21	GND	Gnd	0	Ground	
22	LTE_PERST	I	LVTTL	mPCIe reset control, input to the modem	Routed to Pi — see Section 5.1
23	LTE_UART_CTS	I	LVTTL	UART CTS, input to the modem	Routed to Pi — see Section 5.1
24	VCC_3V3	P	3.3V	Power supply to the modem card	
25	LTE_UART_RTS	O	LVTTL	UART RTS, output from the modem	Routed to Pi — see Section 5.1
26	GND	Gnd	0	Ground	
27	GND	Gnd	0	Ground	
28	NC	—	—	Not connected	
29	GND	Gnd	0	Ground	
30	SCL	I/O	I2C (3V3)	I2C clock, shared bus	See Section 5.6 (QWIC)
31	LTE_UART_DTR	I	LVTTL	UART DTR, input to the modem	Routed to Pi — see Section 5.1
32	SDA	I/O	I2C (3V3)	I2C data, shared bus	See Section 5.6 (QWIC)
33	RESERVED	—	—	Not connected on this board	
34	GND	Gnd	0	Ground	
35	GND	Gnd	0	Ground	
36	LTE_USBD–	I/O	USB	USB D– data line to the modem	
37	GND	Gnd	0	Ground	
38	LTE_USBD+	I/O	USB	USB D+ data line to the modem	
39	VCC_3V3	P	3.3V	Power supply to the modem card	
40	GND	Gnd	0	Ground	
41	VCC_3V3	P	3.3V	Power supply to the modem card	
42	LTE_LED_WWAN	O	LVTTL	WWAN status LED drive, output from the modem	Drives WWAN LED — see Section 5.7
43	GND	Gnd	0	Ground	
44	RESERVED	—	—	Not connected on this board	
45	RESERVED	—	—	Not connected on this board	
46	RESERVED	—	—	Not connected on this board	
47	RESERVED	—	—	Not connected on this board	
48	NC	—	—	Not connected	
49	RESERVED	—	—	Not connected on this board	
50	GND	Gnd	0	Ground	
51	RESERVED	—	—	Not connected on this board	
52	VCC_3V3	P	3.3V	Power supply to the modem card	

5.5 SIM Card

The board provides a Nano SIM socket for the LTE modem.

SIM slot on the LTE card

If the installed LTE card has its own SIM slot, the SIM can be inserted directly into that slot instead of the Nano SIM socket on the HAT. This allows SIM sizes other than Nano (for example Micro or Mini, depending on the card) to be used. The supported SIM types therefore depend on the LTE card in use.

5.6 QWIIC Connector and EEPROM

A QWIIC (I2C) connector is provided for expansion sensors/modules. A 512 kb EEPROM is present on the same I2C bus for board identification and configuration storage.

5.7 LED Indicators

LED	Driven by	Indicates
WWAN	LTE modem via mPCIe interface	LTE modem activity status
PPS1	mosaic G5	Pulse-per-second output
GPIO1	mosaic G5	Can be programmed
GPIO2	mosaic G5	Can be programmed
PWR	Power management	Board power status

6. Ordering Information

Variant	Part number	GNSS module fitted	Notes
iChidori-Crest – P1		Mosaic G5 P1	
iChidori-Crest – P6		Mosaic G5 P6	