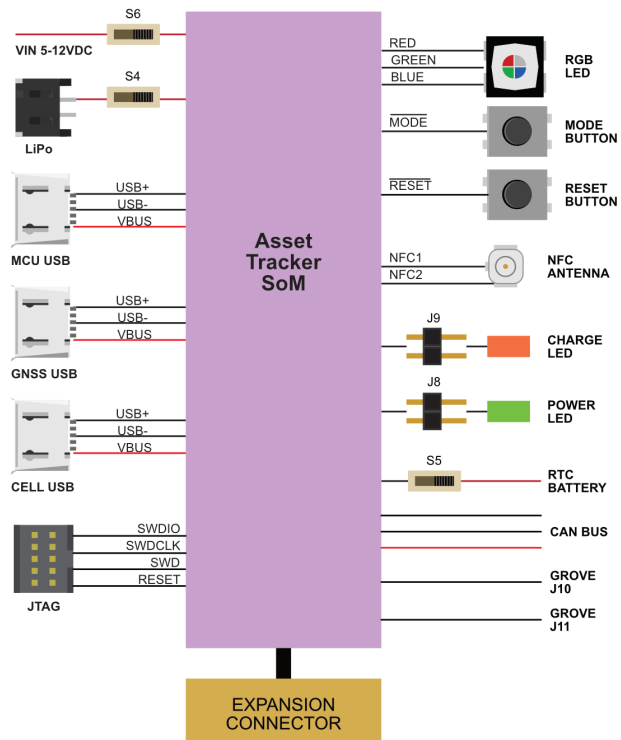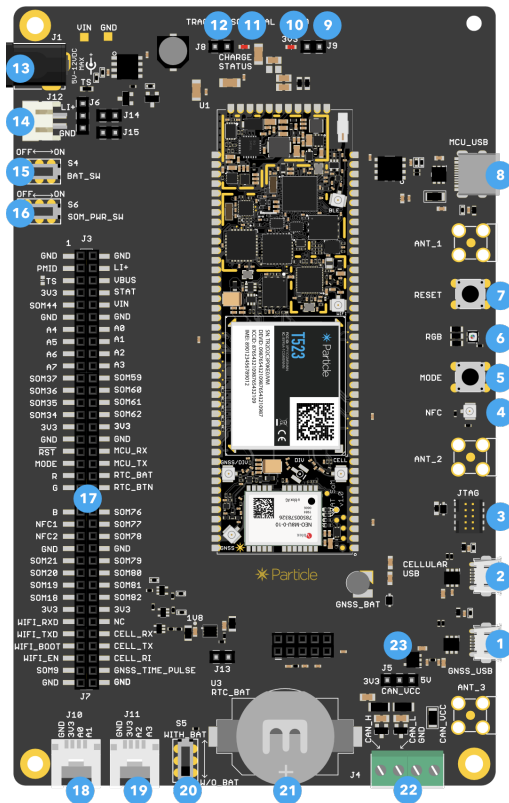# Tracker SoM Evaluation Board⁽⁰⁰¹⁾

This is a breakout board for Particle's Tracker SoM. The Tracker SoM Cellular GNSS module is a castellated system-on-a-module that can either be reflow soldered to your own custom base board, or can be used in this evaluation board, or the carrier board.

Block Diagram

S6

VIN 5-12VDC

S4

LiPo

USB+
USB-
VBUS

MCU USB

USB+
USB-
VBUS

GNSS USB

USB+
USB-
VBUS

CELL USB

SWDIO
SWDCLK
SWD
RESET

JTAG

**Asset
Tracker
SoM**

RED
GREEN
BLUE

RGB
LED

MODE

MODE
BUTTON

RESET

RESET
BUTTON

NFC1
NFC2

NFC
ANTENNA

J9

CHARGE
LED

J8

POWER
LED

S5

RTC
BATTERY

CAN BUS

GROVE
J10

GROVE
J11

EXPANSION
CONNECTOR

Description

Num	ID	Description
1	GNSS USB	u-blox GNSS USB connection
2	CELL USB	Quectel cellular modem USB connection
3	JTAG	JTAG/SWD debugging connector for nRF52 MCU
4	NFC	NFC antenna connection for NFC tag feature
5	MODE	MODE button
6	RGB	RGB status LED
7	RESET	RESET button
8	MCU USB	nRF52 MCU USB-C for debugging or power.
9	J8	3V3 LED jumper. Normally installed, remove to disable 3V3 LED.
10	3V3 LED	Power LED, indicates 3.3V supply is enabled.
11	STAT LED	Charge status indicator.
12	J9	STAT LED jumper. Normally installed, remove to disable STAT LED.
13	VIN	External power 3.9-17 VDC
14	LiPo	JST-PH connector for LiPo battery
15	S4	Battery switch
16	S6	SoM power switch
17		Expansion connector
18	J10	Grove connector (A0, A1 or I2C)
19	J11	Grove connector (A2, A3)
20	S5	RTC battery switch
21	RTC battery	Optional battery
22	J4	CAN data connection and 3.3V power output
23	J5	CAN power jumper (selects 3.3V or 5V)

POWERING THE TRACKER SOM EVALUATION BOARD

There are several options for powering the evaluation board:

The **MCU USB** connector. If using a laptop with a 500 mA USB port, you should also use the LiPo battery. With a 2A tablet charger, you can power only by USB.

The **VIN** connector (3.9 to 17 VDC). This is useful with an external power supply. Switch **S6** is the power switch.

The **LiPo** connector. This is typically used with a LiPo battery. Use switch **S4** to enable the battery.

USB CONNECTORS

There are three USB connectors on the evaluation board, however you most commonly will only use the **MCU USB** connector.

The **MCU USB** connector is connected to the nRF52 MCU and can be used for Serial debugging, flashing code, and setup by USB. It can also power the AssetTracker SoM. If using a laptop with a 500 mA USB port, you should also use the LiPo battery. With a 2A tablet charger, you can power only by USB.

The **GNSS USB** connector is connected to the u-blox NEO-M8U GNSS. It can be used for firmware upgrades or with the u-blox u-center application.

The **CELL USB** connector is connected to the Quectel cellular modem. It can be used for firmware upgrades.

LED INDICATORS

The **STAT** LED indicates the charge status:

- Off: Not charging or no power
- On: Charging
- Blinking: Charge fault
- Flickering: No battery

Jumper **J9** disconnects the charge status LED.

The **3V3** LED indicates that the 3.3V MCU power supply is enabled. Jumper **J8** disconnects the power LED.

CAN CONNECTOR

The four-position screw terminal connector (J4) allows connection to CAN bus devices.

Pin	Label	Description
1	CAN_H	CAN Bus H or +
2	CAN_L	CAN Bus L or -
3	GND	Ground
4	CAN_VCC	3.3V or 5V

The CAN bus connection includes the 120 ohm termination resistor and ESD protection.

The CAN_VCC jumper (J5) allows the selection of the voltage on the CAN connector.

- Left position: 3.3V
- Right position: 5V

The 5V power supply is powered by a boost converter and can be turned on and off by software.

EXPANSION CONNECTOR

Left Description	Left	Right	Right Description
Ground	GND	GND	Ground
PMIC power out	PMID	LI+	LiPo battery
PMIC thermistor	TS	VBUS	nRF52 USB power
3.3V Out	3V3	STAT	PMIC charge status
Unused	SOM44	VIN	Power input 3.9 - 17 VDC
Ground	GND	GND	Ground
A4, D4, SPI MOSI	A4	A0	A0, D0, Wire SDA
A5, D5, SPI MISO	A5	A1	A1, D1, Wire SCL
A6, D6, SPI SCK	A6	A2	A2, D2, Serial1 CTS
A7, D7, SS, WKP	A7	A3	A3, D3, Serial1 RTS
Unused	SOM37	SOM59	Unused
Unused	SOM36	SOM60	Unused
Unused	SOM35	SOM61	Unused
Unused	SOM34	SOM62	Unused
3.3V Out	3V3	3V3	3.3V Out
Ground	GND	AGND	Analog Ground
RESET button	RESET	MCU_RX	Serial1 RX, GPIO D9
MODE button	MODE	MCU_TX	Serial1 TX, GPIO D8
RGB Status LED Red	R	RTC_BAT	RTC battery
RGB Status LED Green	G	RTC_BTN	RTC wake button
RGB Status LED Blue	B	SOM76	Unused
NFC Tag Antenna	NFC1	SOM77	Unused
NFC Tag Antenna	NFC2	SOM78	Unused
Unused	SOM21	SOM79	Unused
Unused	SOM20	SOM80	Unused
Unused	SOM19	SOM81	Unused
Unused	SOM18	SOM82	Unused
3.3V Out	3V3	3V3	3.3V Out
ESP32 Serial RX	WIFI_RXD	NC	
ESP32 Serial TX	WIFI_TXD	CELL_RX	Cellular serial RX
ESP32 boot mode	WIFI_BOOT	CELL_TX	Cellular serial TX
ESP32 enable	WIFI_EN	CELL_RI	Cellular ring indicator
Unused	SOM9	GNSS_TIME_PULSE	GNSS time pulse or fix indicator
Ground	GND	GND	Ground

Basic Setup

The basic setup for the Tracker SoM Eval Board to be operational is shown below:

- Plug the cellular antenna into the U.FL connector labeled **CELL** on the SoM. Remember never to power up this board without the antenna being connected. There is potential to damage the transmitter of the cellular module if no antenna is connected.
- Connect power the **MCU USB** (8), **VIN** (13), or a LiPo battery (14).
- Turn on the appropriate power switches (15 and/or 16).

Evaluation Board Schematics

Tracker SoM

TRACKER SOM

Pin	Signal		Signal	Pin
54	GND		GND	42
55	A0		A4	41
56	A1		A5	40
57	A2		A6	39
58	A3		A7	38
59	SOM59 / NC		NC / SOM37	37
60	SOM60 / NC		NC / SOM36	36
61	SOM61 / NC		NC / SOM35	35
62	SOM62 / NC		NC / SOM34	34
63	GND / AGND/GND		RESET	33
64	CAN_N		MODE	32
65	CAN_P		GND	31
66	CAN_5V		RED / R	30
67	GND		GREEN / G	29
68	MCU_N / MCU_D-		BLUE / B	28
69	MCU_P / MCU_D+		NFC1	27
70	GND		NFC2	26
71	MCU_RX		GND	25
72	MCU_TX / MUC_TX		SWO	24
73	RTC_BAT		SWDCLK	23
74	RTC_BTN		SWDIO	22
75	GND		NC / SOM21	21
76	SOM76 / NC		NC / SOM20	20
77	SOM77 / NC		NC / SOM19	19
78	SOM78 / NC		NC / SOM18	18
79	SOM79 / NC		CELL_N / CELL_D-	17
80	SOM80 / NC		CELL_P / CELL_D+	16
81	SOM81 / NC		CELL_VBUS	15
82	SOM82 / NC		WIFI_RXD	14
83	CELL_RX / CELL_GPS_RX		WIFI_TXD	13
84	CELL_TX / CELL_GPS_TX		WIFI_BOOT	12
85	CELL_RI		WIFI_EN	11
86	GND		NC	10
87	CELL_GPS_RF		NC / SOM9	9
88	GND		GND	8
89	GND		GNSS_TIME_PULSE	7
90	GNSS_BOOT		GNSS_N	6
91	GNSS_ANT_PWR		GNSS_P	5
92	GNSS_LAN_EN / GNSS_LNA_EN		GNSS_VBUS	4
93	GND		GNSS_RESET	3
94	GNSS_RF		GNSS_BAT	2
95	GND		GND	1

Top pins: 53 L1+, 52 GND, 51 VBUS, 50 STAT, 49 VIN_SOM, 48 GND, 47 PMID, 46 TS, 45 +3V3, 44 SOM4, 43 GND

Bottom pins: 96 MOSI1, 97 MISO1, 98 CLK1, 99 Y5, 100 Y1, 101 SIM_VCC, 102 SIM_RST, 103 SIM_DATA, 104 SIM_CLK, 105 GND, 106 GND, 107 GND, 108 GND, 109 GND, 110 GND

+3V3, 20k R9, S2 MODE MOMENTARY-SWITCH, S1 RESET MOMENTARY-SWITCH, GND

C37 NC, C39 NC, C36 NC, C38 NC, GND

GNSS_ANT_PWR, D1 1N5711WS-7-F, R20 3.3K, R37 0R, GNSS_BAT, ML414H-IV01E, C11, GND

C20 NC, GND

PMID, C23 1uF 16V, C24 1uF 16V, GND, GND

R27 NC, NFC2, UFL NFC1, NFC1, R26 NC, GND

J2: GND 1, MOSI1 2, SIM_DATA 3, MISO1 4, SIM_CLK 5, CLK1 6, SIM_RST 7, Y5 8, SIM_VCC 9, Y1 10

SIM_VCC, SIM_RST, SIM_CLK, SIM_DATA, R7 15k

C24 NC, GND, C35 NC, GND

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USB

MCU USB

USB2 USB-C: VBUS, D+, D-, CC1, CC2, SHLD, GND
VBUS1*2, A6*2, A7*2, A5, R30, R36
RF1512-000 F1, GND, C21 0.1uF 16V, C4 10uF 16V, VBUS
0R MCU_P, 0R MCU_N
D3 USBLC6-4SC6Y: I/O1, I/O4, GND, VBUS, I/O2, I/O3
R14 1M, C17 0.1uF 16V, L13 NC

CELL USB

SHIELD, USB1 MICRO_USB_5P: VBUS, D-, D+, ID, GND
GND, C12 0.1uF 16V, C8 10uF 16V
R21 0R CELL_N, R25 0R CELL_P, CELL_VBUS
D5 USBLC6-4SC6Y: I/O1, I/O4, GND, VBUS, I/O2, I/O3
R34 1M, C9 0.1uF 16V, L11 NC

GNSS USB

SHIELD, USB3 MICRO_USB_5P: VBUS, D-, D+, ID, GND
GND, C26 0.1uF 16V, C5 10uF 16V
R23 0R GNSS_N, R24 0R GNSS_P, R28 0R
C23 0.1uF 16V, GND
D4 USBLC6-4SC6Y: I/O1, I/O4, GND, VBUS, I/O2, I/O3
R32 1M, C22 0.1uF 16V, L12 NC
U6 TLV70433DBVR: GND 1, IN 2, OUT 3, NC, NC
GNSS_VBUS, C33 1uF 16V, GND

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Power Switches

Battery and switch

SOM power switch

POWER SWITCH

POWER SWITCH

LiPo Connector

SMA ANTENNA

Expansion Connector

CONN_20X2_ZHU

CONN_15X2_ZHU

Misc

RTC Battery

CR2032_HOLDER

RTC_BAT S5 R5 1.5k U3 GND

RTC_BAT short to GND when there is
no button battery.

CAN Bus

CAN_N

C0805C470J2GACTU

R1 60.4R

C10 4700pF,100V

C2 47pF,200V

ESD1 MMBZ27VCLT1

GND   GND   GND

C2012X7R2A472K

C3 47pF,200V

ESD2 MMBZ27VCLT1

R10 60.4R

CAN_P

C0805C470J2GACTU

GND   CAN_VCC   J4

CAN_5V

CAN_VCC   1206L035YR   F2

6V, Ihold=350mA,Itrip=750mA, 1.3R

+3V3   +3V3

J5

JTAG

+3V3   R33 1k   D2   B5817WS

DEBUG

GND

SWDIO
SWDCLK
SWO
RESET

EG91 UART level conversion

TP

1V8

U5 LP5910

C7 NC

OUT   IN
NC   GND
NC   EN
EP

GND

3V3_UART   GND

R3 100k

C1 1uF 16V   NC

GND

GND

+3V3

+3V3

3V3_UART   U2

CELL_TX   R17 0R   3V3_UART   VCC A GND Y   CELL_GPS_TX

R35 NC

GND

SN74LV1T34

R40 NC

GND

1V8

R43 1M

1V8   U4

1V8   VCC A GND Y   R22 0R   CELL_RX

CELL_GPS_RX   0R   R47

GND

SN74LV1T34

R48 NC

GND

LED

STAT=0, LED up, indicates charge in progress;
STAT=1, LED go off, indicates charge complete or charge disabled;
Any fault condition occurs, LED blinks at 1Hz.

STAT   LED1   R41 1K   +3V3

GND   LED2   R44 1K   +3V3

+3V3   RGB   RED   R12
CA   GREEN   R13
BLUE   R37
1K

R   G   B

1V8

3V3_UART

3V3_UART   U8

CELL_RI   R11 NC   0R   R31   VCC A GND Y   CELL_RI_EXT

GND

SN74LV1T34

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Design Files

The Tracker SoM Evaluation board is open-source and the Eagle CAD design files are available in Github:

https://github.com/particle-iot/tracker-hardware

Mechanical specifications

To be provided at a later date.

DIMENSIONS AND WEIGHT

Parameter	Value	Units
Width	97	mm
Length	164	mm
Thickness	14	mm
Weight		g

Weight will be provided at a later date.

Ordering Information

{{!-- BEGIN do not edit content below, it is automatically generated 698155b6-76d7-11eb-9439-0242ac130002 --}} | SKU | Description | Region | Modem | Lifecycle | Replacement | | :--- | | :--- | :--- | :--- | :--- | :--- | :--- | | T404MKIT | Tracker SoM LTE M1 (NorAm) Evaluation Kit, [x1] | NORAM | BG96-MC | GA | | | T524MKIT | Tracker SoM LTE CAT1/3G/2G (Europe) Evaluation Kit, [x1] | EMEAA | EG91-EX | GA | | | T402MKIT | Tracker SoM LTE M1 (NorAm) Evaluation Kit, [x1] | NORAM | BG96-MC | NRND | T404MKIT| | T523MKIT | Tracker SoM LTE CAT1/3G/2G (Europe) Evaluation Kit, [x1] | EMEAA | EG91-EX | NRND | T524MKIT|

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Product Handling

ESD PRECAUTIONS

The Tracker SoM contains highly sensitive electronic circuitry and is an Electrostatic Sensitive Device (ESD). Handling an module without proper ESD protection may destroy or damage it permanently. Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the module. ESD precautions should be implemented on the application board where the B series is mounted. Failure to observe these precautions can result in severe damage to the module!

CONNECTORS

The U.FL antenna connectors are not designed to be constantly plugged and unplugged. The antenna pin is static sensitive and you can destroy the radio with improper handling. A tiny dab of glue (epoxy, rubber cement, liquid tape or hot glue) on the connector can be used securely hold the plug in place.

DISPOSAL

This device must be treated as Waste Electrical & Electronic Equipment (WEEE) when disposed of.

Any WEEE marked waste products must not be mixed with general household waste, but kept separate for the treatment, recovery and recycling of the materials used. For proper treatment, recovery and recycling; please take all WEEE marked waste to your Local Authority Civic waste site, where it will be accepted free of charge. If all consumers dispose of Waste Electrical & Electronic Equipment correctly, they will be helping to save valuable resources and preventing any potential negative effects upon human health and the environment of any hazardous materials that the waste may contain.

Revision history

Revision	Date	Author	Comments
pre1	31 Mar 2020	RK	Preview Release
pre2	12 May 2020	RK	Added partial dimensions
001	29 Jun 2020	RK	First release