B524/B523 datasheet

Functional description

OVERVIEW

The B-Series System-on-a-Module (SoM) is a LTE Cat 1 cellular device with support for BLE (Bluetooth LE). It is based on the Nordic nRF52840 microcontroller.

The B-Series is designed to be integrated into your circuit board design, plugging into a M.2 NGFF connector on your board, allowing the module to be changed or upgraded easily.

FEATURES

Features - B524

- Quectel EG91-E modem
- LTE category 1 module for EMEAA region
- 3GPP E-UTRA Release 13
- Cat 1 bands supported: 1, 3, 7, 8, 20, 28A
- 2G and 3G fallback (900, 1800, and 2100 MHz)
- Embedded Particle EtherSIM (B524)
- Support for selected countries in Europe, Middle East, Africa, and Asia, including Australia and New Zealand. See the cellular carrier list for more information.

Features - B523

- Quectel EG91-E modem
- LTE category 1 module for EMEAA region
- 3GPP E-UTRA Release 13
- Cat 1 bands supported: 1, 3, 7, 8, 20, 28A
- 2G and 3G fallback (900, 1800, and 2100 MHz)
- Embedded Particle SIM (B523)
- Support for Europe only

Features - all models

- Nordic Semiconductor nRF52840 SoC
- ARM Cortex-M4F 32-bit processor @ 64MHz
- 1MB flash, 256KB RAM
- Bluetooth 5: 2 Mbps, 1 Mbps, 500 Kbps, 125 Kbps
- Supports DSP instructions, HW accelerated Floating Point Unit (FPU) and encryption functions
- Up to +8 dBm TX power (down to -20 dBm in 4 dB steps)
- NFC-A tag
- On-module additional 8MB SPI flash
- 24 mixed signal GPIO (8 x Analog, 8 x PWM), UART, I2C, SPI
- USB 2.0 full speed (12 Mbps)
- JTAG (SWD) pins
- RGB status pins for LED
- Reset and Mode pins for buttons
- On-module MFF2 Particle SIM
- Two on-module U.FL connectors for external antennas
- M.2 interface
- CE certified
- RoHS compliant (lead-free)

MODEL COMPARISON

	B404X	B404	B402	B524	B523	B504
Region	NorAm	NorAm	NorAm	EMEAA	Europe	Americas
EtherSIM	✓	✓		✓		✓
Supply Secure	✓			✓		✓
Lowest power (LTE Cat M1)	✓	✓	✓			
Fastest speed (LTE Cat 1)				✓	✓	✓
Lifecycle	GA	NRND	Deprecated	GA	Deprecated	In development

- EtherSIM devices generally have a larger number of carriers and more may be added in the future
- NorAm: North America (United States, Canada, and Mexico)
- Americas: North America, Central, and South America (not all countries supported)
- LTE Cat M1: Low-power cellular intended for IoT devices
- LTE Cat 1: Available in more countries and has higher data rates
- EMEAA: Europe, Middle East, Africa, and Asia (not all countries supported)
- NRND: Not recommended for new designs
- See the Carrier list for specific carrier and country compatibility
- See the Supply secure FAQ for more information
- See Lifestyle stages for more information

DEVICE OS SUPPORT

It is recommended that you use the latest version in the 4.x LTS release line with the B524 and B523.

The B524 and B523 are compatible with Device OS 2.x LTS, however the 2.x LTS release line is in the Extended Support and Maintenance (ESM) window and will stop being supported in 2024.

For information on upgrading Device OS, see Version information. For the latest version shipped from the factory, see Manufacturing firmware versions page. See also Long Term Support (LTS) releases.

Interfaces

VCC

VCC is used to supply power to the Quectel EG91-E cellular module. The recommended input voltage range on this pin is between 3.6V to 4.2V DC. This can be connected directly to a 3.7V LiPo battery. Make sure that the supply can handle currents of at least 2 A.

If you are not using a battery, or using a battery of a different voltage, you should use a regulator to supply 3.7V to 4.2V at 2A. You may want to add additional bulk capacitors to handle the short, high current peak usage when the cellular modem is transmitting.

3V3

3V3 is used to supply power to nRF52840, logic ICs, memory, etc.. The 3V3 input voltage range is between 3V to 3.6V DC, but 3.3V is recommended. Make sure that the supply can handle a minimum of 150 mA, however we recommend a minimum of 500 mA supplied from your base board to allow for compatibility with future modules.

These limits do not include any 3.3V peripherals on your base board, so that may increase the current requirements.

Power supply requirements:

- 3.3V output
- Maximum 5% voltage drop
- 100 mV peak-to-peak ripple maximum
- 500 mA minimum output current at 3.3V recommended for future compatibility
- Maintain these values at no-load as well as maximum load

We do not recommend using a single 3.6V supply for both VCC and 3V3 as the cellular modem performance may be lower below 3.7V. Use two separate regulators for best results.

VBus

VBus is connected to the USB detect pin of nRF52840 to enables the USB interface. The recommended input voltage range is between 4.35V to 5.5V DC.

There are two radios on the B523 module. A BLE radio (nRF52840) and a cellular radio (Quectel). We have provided two u.FL connectors to plug in the cellular and BLE antenna. These are required if you wish to use the cellular and BLE. If you do not need BLE, you do not need to connect the BLE antenna.
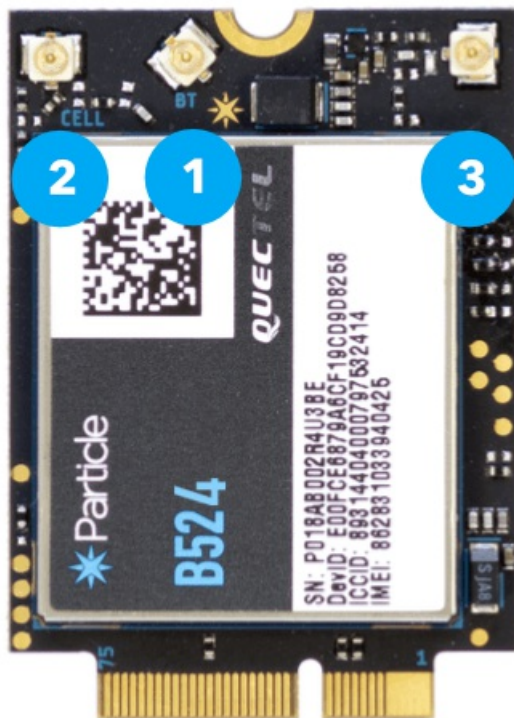
Number	Label	Purpose
1	BT	Bluetooth antenna (optional)
2	CELL	Quectel cellular modem antenna
3	ANT_DIV	LTE cellular receive diversity antenna

The third connector is the LTE cellular receive diversity antenna. A second cellular antenna can be connected to this connector to improve performance when the device will be moving at high speeds. It is only used for LTE Cat 1 connections and is not supported when in 2G or 3G mode. This antenna is not necessary in most cases and is not included in evaluation kits. (The B402 does not have this connector as receive diversity is not supported in LTE Cat M1 mode.)

Certified cellular antenna

SKU	Description
ANTCW2EA	Particle Cellular Flex Antenna 2G/3G/LTE [x1]
ANTCW2TY	Particle Cellular Flex Antenna 2G/3G/LTE Tray of 50 [x50]

- Type: LTE Ultra Wide Band Flex Antenna
- Frequency/band: 698 MHz-2690 MHz
- RoHS Compliant
- Mechanical Specs:
  - Dimensions: 97 x 21 x 0.2 mm
  - Mounting: 3M adhesive backed for application on non-metallic surfaces
  - Connector type: FPC + IPEX connector
  - Cable length: 210 mm
  - Gain: 4.71 dBi

Particle devices are certified for use only with the designated antenna specified above. The use of alternative antennas with our modules could necessitate a recertification process. To fully understand the potential consequences of using a non-certified antenna, Particle strongly advises seeking consultation with a qualified RF expert.

General antenna guidance

- The antenna placement needs to follow some basic rules, as any antenna is sensitive to its environment. Mount the antenna at least 10mm from metal components or surfaces, ideally 20mm for best radiation efficiency, and try to maintain a minimum of three directions free from obstructions to be able to operate effectively.
- Needs tuning with actual product enclosure and all components.
- For the BLE antenna, it is recommended to use a 2.4 GHz single-frequency antenna and not a 2.4 GHz + 5 GHz antenna, so as to avoid large gain at the frequency twice of 2.4 GHz which can cause the second harmonic radiation of 2.4 GHz to exceed standards.

PERIPHERALS AND GPIO

Peripheral Type	Qty	Input(I) / Output(O)
Digital	24 (max)	I/O
Analog (ADC)	8 (max)	I
UART	1	I/O
SPI	2	I/O
I2C	2	I/O
USB	1	I/O
PWM	8 (max)	O
NFC	1	O

There are some optional B523 module specific I/O:

- Quectel USB and VBUS (for modem firmware upgrades)
- Quectel Ring Indicator (RI) output

Note: All GPIOs are only rated at 3.3VDC max.

JTAG AND SWD

The B523 module has 4 pads at the bottom exposing the SWD interface of the nRF52840. This interface can be used to debug your code or reprogram your B523 bootloader, device OS, or the user firmware. We use 4 pogo-pins connecting to these pads during production for firmware flashing.

SWCLK

SWDIO

2.5mm

SWO

2.5mm

/RESET

2.5mm

7.5mm

74   32   2

9.649mm

75   33   1
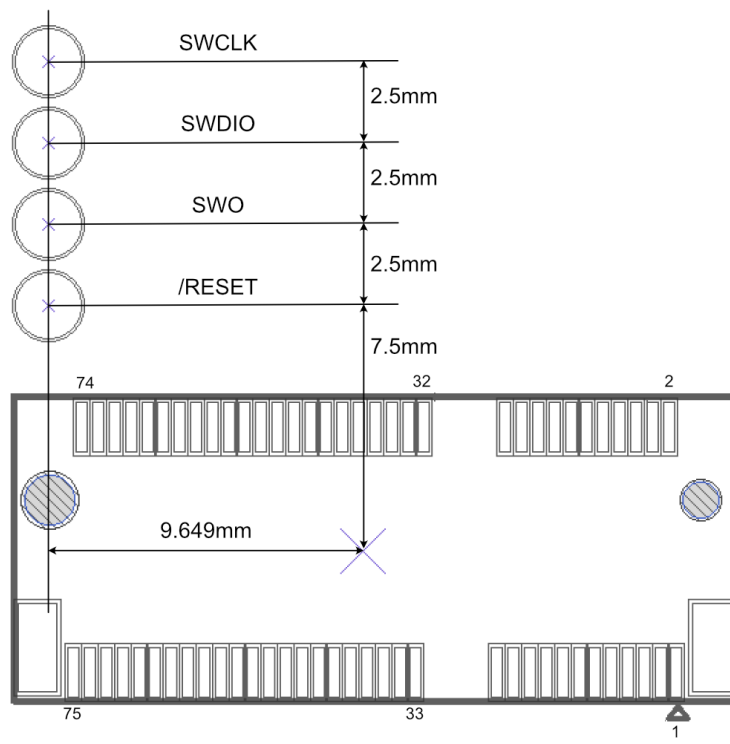
Memory map

NRF52840 FLASH LAYOUT OVERVIEW

- Bootloader (48KB, @0xF4000)
- User Application
    - 256KB @ 0xB4000 (Device OS 3.1 and later)
    - 128KB @ 0xD4000 (Device OS 3.0 and earlier)
- System (656KB, @0x30000)
- SoftDevice (192KB)

EXTERNAL SPI FLASH LAYOUT OVERVIEW (DFU OFFSET: 0X80000000)

- Reserved (4MB, @0x0040000)
- OTA (1500KB, @0x00289000)
- Reserved (420KB, @0x00220000)
- FAC (128KB, @0x00200000)
- LittleFS (2M, @0x00000000)

Pins and button definitions

PINOUT DIAGRAM
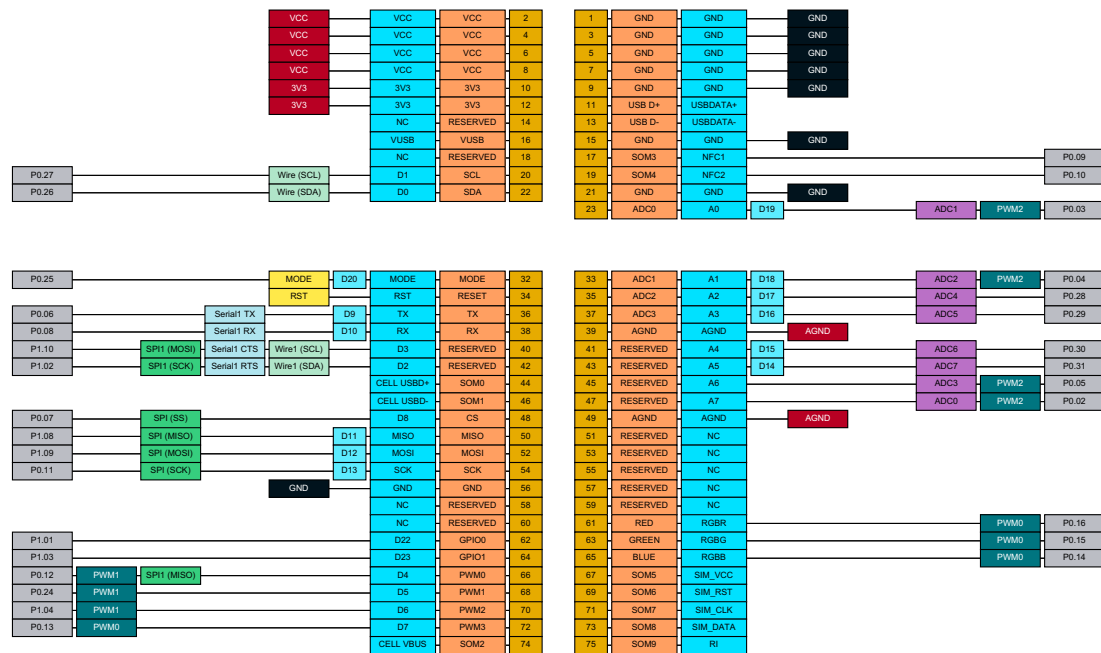
COMMON SOM PINS

RESERVED and SOM pins may vary across different SoM models. If you are designing for this specific module, or similar modules, you can use the indicated functions even if the pin is marked RESERVED. Most nRF52840-based modules will have the same pin functions on the RESERVED pins

Future modules with a different MCU may have different pin functions. An effort will be made to assign all of the listed functions for ADC, PWM, SPI, etc. from the set of common SoM pin functions in future modules, but the functions on RESERVED and SOM pins will likely vary.

PIN DESCRIPTION

#	Pin	Common	Function	nRF52	Description
1	GND	GND	POWER		System ground.
2	VCC	VCC[5]	POWER		System power in, connect to the +LiPo or supply a fixed 3.6-4.3v power.
3	GND	GND	POWER		System ground.
4	VCC	VCC	POWER		System power in, connect to the +LiPo or supply a fixed 3.6-4.3v power.
5	GND	GND	POWER		System ground.
6	VCC	VCC	POWER		System power in, connect to the +LiPo or supply a fixed 3.6-4.3v power.
7	GND	GND	POWER		System ground.
8	VCC	VCC	POWER		System power in, connect to the +LiPo or supply a fixed 3.6-4.3v power.
9	GND	GND	POWER		System ground.
10	3V3	3V3	POWER		System power in, supply a fixed 3.0-3.6v power.
11	USB D+	USB D+	IO		Data+ pin of the NRF52840 USB port.

12	3V3	3V3	POWER		System power in, supply a fixed 3.0-3.6v power.
13	USB D-	USB D-	IO		Data- pin of the NRF52840 USB port.
14	NC	RESERVED[3]	NC		Leave unconnected.
15	GND	GND	POWER		System ground.
16	VUSB	VUSB	POWER		System power in, USB detect pin for nRF52840. 5V on this pin enables the USB interface.
17	NFC1	SOM3[3]	NFC input	P0.09	NFC antenna connection.
18	NC	RESERVED[3]	NC		Leave unconnected.
19	NFC2	SOM4[3]	NFC input	P0.10	NFC antenna connection.
20	D1	SCL	IO	P0.27	I2C SCL, and digital only GPIO.
21	GND	GND	POWER		System ground.
22	D0	SDA	IO	P0.26	I2C SDA, and digital only GPIO.
23	A0	ADC0	IO	P0.03	Analog input ADC0[2], and digital GPIO.
32	MODE	MODE	IO	P0.25	Connected to the MODE button input, and digital only GPIO.
33	A1	ADC1	IO	P0.04	Analog input ADC1[2], and digital GPIO.
34	RESET	RESET	I		Active-low reset input.
35	A2	ADC2	IO	P0.28	Analog input ADC2[2], and digital GPIO.
36	D9	TX	IO	P0.06	Primarily used as UART TX, but can also be used as a digital GPIO.
37	A3	ADC3	IO	P0.29	Analog input ADC3[2], and digital GPIO.
38	D10	RX	IO	P0.08	Primarily used as UART RX, but can also be used as a digital GPIO.
39	AGND	AGND	POWER		System analog ground.
40	D3	RESERVED[3]	IO	P1.10	UART flow control CTS, SCL1 (Wire1), SPI1 MOSI, digital only GPIO.
41	A4	RESERVED[3]	IO	P0.30	Analog input ADC4[2], and digital GPIO.
42	D2	RESERVED[3]	IO	P1.02	UART flow control RTS, SDA1 (Wire1), SPI1 SCK, digital only GPIO.
43	A5	RESERVED[3]	IO	P0.31	Analog input ADC5[2], and digital GPIO.
44	Quectel USB D+	SOM0	IO		Data+ pin of the cellular modem USB port.
45	A6	RESERVED[3]	IO	P0.05	Analog input ADC6[2], and digital GPIO.
46	Quectel USB D-	SOM1	IO		Data- pin of the cellular modem USB port.
47	A7	RESERVED[3]	IO	P0.02	Analog input ADC7[2], and digital GPIO.
48	D8	CS	IO	P0.07	SPI interface CS, and digital only GPIO.
49	AGND	AGND	POWER		System analog ground.
50	D11	MISO	IO	P1.08	SPI interface MISO, and digital only GPIO.
51	NC	RESERVED[3]	NC		Leave unconnected.
52	D12	MOSI	IO	P1.09	SPI interface MOSI, and digital only GPIO.
53	NC	RESERVED[3]	NC		Leave unconnected.
54	D13	SCK	IO	P0.11	SPI interface SCK, and digital only GPIO.
55	NC	RESERVED[3]	NC		Leave unconnected.
56	GND	GND	POWER		System analog ground.
57	NC	RESERVED[3]	NC		Leave unconnected.

58	NC	RESERVED[3]	NC		Leave unconnected.
59	NC	RESERVED[3]	NC		Leave unconnected.
60	NC	RESERVED[3]	NC		Leave unconnected.
61	RGBR	RED	IO	P0.16	Red pin of the RGB LED.
62	D22	GPIO0	IO	P1.01	GPIO0, digital only.
63	RGBG	GREEN	IO	P0.15	Green pin of the RGB LED.
64	D23	GPIO1	IO	P1.03	GPIO1, digital only.
65	RGBB	BLUE	IO	P0.14	Blue pin of the RGB LED.
66	D4	PWM0	IO	P0.12	SPI1 MISO, Digital only GPIO, and PWM0.
67	SIM_VCC[1]	SOM5[3]	POWER		Leave unconnected, 1.8V/3V SIM Supply Output from cellular modem.
68	D5	PWM1	IO	P0.24	Digital only GPIO, and PWM1.
69	SIM_RST[1]	SOM6[3]	IO		Leave unconnected, 1.8V/3V SIM Reset Output from cellular modem.
70	D6	PWM2	IO	P1.04	Digital only GPIO, and PWM2.
71	SIM_CLK[1]	SOM7[3]	IO		Leave unconnected, 1.8V/3V SIM Clock Output from cellular modem.
72	D7	PWM3	IO	P0.13	Digital only GPIO, and PWM3.
73	SIM_DATA[1]	SOM8[3]	IO		Leave unconnected, 1.8V/3V SIM Data I/O of cellular modem with internal 4.7 k pull-up.
74	Quectel VBUS	SOM2[3]	IO		USB detect pin for cellular modem. 5V on this pin enables the Quectel USB interface.
75	Quectel RI	SOM9[4]	IO		Ring indicator

[1]These pins are connected to the internal MFF2 SIM and should be left open.

[2]A0-A7 are 12-bit Analog-to-Digital (A/D) inputs (0-4095).

[3]SoM-specific and Reserved pins will vary depending on module. They are able to be used on the B523, but their function may be be different on future modules.

[4]RI is available on the B523 (Quectel) but not on the B402 (u-blox LTE M1)

[5]The VCC maximum is 4.3V on the B523 (Quectel) but is 4.2V on the B402 (u-blox LTE M1). For compatibility across modules, limit this to 4.2V.

By default, the Tinker application firmware enables the use of the bq24195 PMIC and MAX17043 fuel gauge. This in turn uses I2C (D0 and D1) and pin A6 (PM_INT). If you are not using the PMIC and fuel gauge and with to use these pins for other purposes, be sure to disable system power configuration. This setting is persistent, so you may want to disable it with your manufacturing firmware only.

```
System.setPowerConfiguration(SystemPowerConfiguration());
```

If you are using Ethernet with the B-Series SoM, the following pins are used by Ethernet:

Device OS Pin	M.2 Pin	Ethernet Pin
MISO	50	SPI MISO
MOSI	52	SPI MOSI
SCK	54	SPI SCK

A7	47	nRESET
D22	62	nINTERRUPT
D8	48	nCHIP SELECT

COMPLETE MODULE PIN DETAILS

1 GND

Details	
Pin Number	1
Pin Name	GND
Description	Ground.

2 VCC

Details	
Pin Number	2
Pin Name	VCC
Description	System power in, connect to the +LiPo or supply a fixed 3.6-4.2v power.

3 GND

Details	
Pin Number	3
Pin Name	GND
Description	Ground.

4 VCC

Details	
Pin Number	4
Pin Name	VCC
Description	System power in, connect to the +LiPo or supply a fixed 3.6-4.2v power.

5 GND

Details	
Pin Number	5
Pin Name	GND
Description	Ground.

6 VCC

Details	
Pin Number	6
Pin Name	VCC
Description	System power in, connect to the +LiPo or supply a fixed 3.6-4.2v power.

7 GND

Details	
Pin Number	7

Pin Name	GND
Description	Ground.

8 VCC

Details	
Pin Number	8
Pin Name	VCC
Description	System power in, connect to the +LiPo or supply a fixed 3.6-4.2v power.

9 GND

Details	
Pin Number	9
Pin Name	GND
Description	Ground.

10 3V3

Details	
Pin Number	10
Pin Name	3V3
Description	System power in, supply a fixed 3.0-3.6v power.

11 USBDATA+

Details	
Pin Number	11
Pin Name	USBDATA+
Description	USB Data+
Input is 5V Tolerant	Yes

12 3V3

Details	
Pin Number	12
Pin Name	3V3
Description	System power in, supply a fixed 3.0-3.6v power.

13 USBDATA-

Details	
Pin Number	13
Pin Name	USBDATA-
Description	USB Data-
Input is 5V Tolerant	Yes

14 NC

Details	
Pin Number	14
Pin Name	NC

15 GND

Details	
Pin Number	15
Pin Name	GND
Description	Ground.

16 VUSB

Details	
Pin Number	16
Pin Name	VUSB
Description	USB VUSB power pin
Input is 5V Tolerant	Yes

17 NFC1

Details	
Pin Number	17
Pin Name	NFC1
Description	NFC Antenna 1
MCU Pin	P0.09

18 NC

Details	
Pin Number	18
Pin Name	NC

19 NFC2

Details	
Pin Number	19
Pin Name	NFC2
Description	NFC Antenna 2
MCU Pin	P0.10

20 D1

Details	
Pin Number	20
Pin Name	D1
Description	I2C SCL, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
I2C interface	SCL. Use Wire object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.27

21 GND

Details	
Pin Number	21
Pin Name	GND
Description	Ground.

22 D0

Details	
Pin Number	22
Pin Name	D0
Description	I2C SDA, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
I2C interface	SDA. Use Wire object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.26

23 A0

Details	
Pin Number	23
Pin Name	A0
Pin Alternate Name	D19
Description	A0 Analog in, GPIO, PWM
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports analogWrite (PWM)	Yes
Supports tone	A0, A1, A6, and A7 must have the same frequency.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.03

32 MODE

Details	
Pin Number	32
Pin Name	MODE
Pin Alternate Name	D20
Description	MODE button, has internal pull-up
MCU Pin	P0.25

33 A1

Details	
Pin Number	33
Pin Name	A1
Pin Alternate Name	D18

Description	A1 Analog in, GPIO, PWM
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports analogWrite (PWM)	Yes
Supports tone	A0, A1, A6, and A7 must have the same frequency.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.04

34 RST

Details	
Pin Number	34
Pin Name	RST
Description	Hardware reset, active low. External pull-up required.

35 A2

Details	
Pin Number	35
Pin Name	A2
Pin Alternate Name	D17
Description	A2 Analog in, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.28

36 TX

Details	
Pin Number	36
Pin Name	TX
Pin Alternate Name	D9
Description	Serial TX, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
UART serial	TX. Use Serial1 object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.06

37 A3

Details	
Pin Number	37

Pin Name	A3
Pin Alternate Name	D16
Description	A3 Analog in, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.29

38 RX

	Details
Pin Number	38
Pin Name	RX
Pin Alternate Name	D10
Description	Serial RX, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
UART serial	RX. Use Serial1 object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.08

39 AGND

	Details
Pin Number	39
Pin Name	AGND
Description	Analog Ground.

40 D3

	Details
Pin Number	40
Pin Name	D3
Description	SPI1 MOSI, Serial1 CTS, GPIO, Wire1 SCL
Supports digitalRead	Yes
Supports digitalWrite	Yes
UART serial	CTS. Use Serial1 object.
SPI interface	MOSI. Use SPI1 object.
I2C interface	SCL. Use Wire1 object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P1.10

41 A4

	Details

Pin Number	41
Pin Name	A4
Pin Alternate Name	D15
Description	A4 Analog in, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.30

42 D2

	Details
Pin Number	42
Pin Name	D2
Description	SPI1 SCK, Serial1 RTS, PWM, GPIO, Wire1 SDA
Supports digitalRead	Yes
Supports digitalWrite	Yes
UART serial	RTS. Use Serial1 object.
SPI interface	SCK. Use SPI1 object.
I2C interface	SDA. Use Wire1 object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P1.02

43 A5

	Details
Pin Number	43
Pin Name	A5
Pin Alternate Name	D14
Description	A5 Analog in, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.31

44 CELL USBD+

	Details
Pin Number	44
Pin Name	CELL USBD+
Description	Cellular Modem USB Data+
Input is 5V Tolerant	Yes

45 A6

Details	
Pin Number	45
Pin Name	A6
Description	A6 Analog in, PWM, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports analogWrite (PWM)	Yes
Supports tone	A0, A1, A6, and A7 must have the same frequency.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.05

46 CELL USBD-

Details	
Pin Number	46
Pin Name	CELL USBD-
Description	Cellular Modem USB Data-
Input is 5V Tolerant	Yes

47 A7

Details	
Pin Number	47
Pin Name	A7
Description	A7 Analog in, GPIO, Ethernet Reset
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogRead	Yes
Supports analogWrite (PWM)	Yes
Supports tone	A0, A1, A6, and A7 must have the same frequency.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.02

48 D8

Details	
Pin Number	48
Pin Name	D8
Description	GPIO, SPI SS, Ethernet CS
Supports digitalRead	Yes
Supports digitalWrite	Yes
SPI interface	SS. Use SPI object. This is only the default SS/CS pin, you can use any GPIO instead.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K

MCU Pin	P0.07

49 AGND

Details	
Pin Number	49
Pin Name	AGND
Description	Analog Ground.

50 MISO

Details	
Pin Number	50
Pin Name	MISO
Pin Alternate Name	D11
Description	SPI MISO, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
SPI interface	MISO. Use SPI object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P1.08

51 NC

Details	
Pin Number	51
Pin Name	NC

52 MOSI

Details	
Pin Number	52
Pin Name	MOSI
Pin Alternate Name	D12
Description	SPI MOSI, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
SPI interface	MOSI. Use SPI object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P1.09

53 NC

Details	
Pin Number	53
Pin Name	NC

54 SCK

	Details
Pin Number	54
Pin Name	SCK
Pin Alternate Name	D13
Description	SPI SCK, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
SPI interface	SCK. Use SPI object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.11

55 NC

	Details
Pin Number	55
Pin Name	NC

56 GND

	Details
Pin Number	56
Pin Name	GND
Description	Ground.

57 NC

	Details
Pin Number	57
Pin Name	NC

58 NC

	Details
Pin Number	58
Pin Name	NC

59 NC

	Details
Pin Number	59
Pin Name	NC

60 NC

	Details
Pin Number	60
Pin Name	NC

61 RGBR

	Details

Pin Number	61
Pin Name	RGBR
Description	RGB LED Red
MCU Pin	P0.16

62 D22

Details	
Pin Number	62
Pin Name	D22
Description	GPIO, Ethernet INT
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P1.01

63 RGBG

Details	
Pin Number	63
Pin Name	RGBG
Description	RGB LED Green
MCU Pin	P0.15

64 D23

Details	
Pin Number	64
Pin Name	D23
Description	GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P1.03

65 RGBB

Details	
Pin Number	65
Pin Name	RGBB
Description	RGB LED Blue
MCU Pin	P0.14

66 D4

Details	
Pin Number	66
Pin Name	D4

Description	SPI1 MISO, PWM, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogWrite (PWM)	Yes
Supports tone	D4, D5, and D6 must have the same frequency.
SPI interface	MISO. Use SPI1 object.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.12

67 SIM_VCC

Details	
Pin Number	67
Pin Name	SIM_VCC
Description	Leave unconnected, 1.8V/3V SIM Supply Output from R410M.

68 D5

Details	
Pin Number	68
Pin Name	D5
Description	PWM, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogWrite (PWM)	Yes
Supports tone	D4, D5, and D6 must have the same frequency.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.24

69 SIM_RST

Details	
Pin Number	69
Pin Name	SIM_RST
Description	Leave unconnected, 1.8V/3V SIM Reset Output from R410M.

70 D6

Details	
Pin Number	70
Pin Name	D6
Description	PWM, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogWrite (PWM)	Yes
Supports tone	D4, D5, and D6 must have the same frequency.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.

Internal pull resistance	13K
MCU Pin	P1.04

71 SIM_CLK

Details	
Pin Number	71
Pin Name	SIM_CLK
Description	Leave unconnected, 1.8V/3V SIM Clock Output from R410M.

72 D7

Details	
Pin Number	72
Pin Name	D7
Description	PWM, GPIO
Supports digitalRead	Yes
Supports digitalWrite	Yes
Supports analogWrite (PWM)	PWM is shared with the RGB LED, you can specify a different duty cycle but should not change the frequency.
Supports attachInterrupt	Yes. You can only have 8 active interrupt pins.
Internal pull resistance	13K
MCU Pin	P0.13

73 SIM_DATA

Details	
Pin Number	73
Pin Name	SIM_DATA
Description	Leave unconnected, 1.8V/3V SIM Data I/O of R410m with internal 4.7 k pull-up.

74 CELL VBUS

Details	
Pin Number	74
Pin Name	CELL VBUS
Description	USB detect pin for R410M. 5V on this pin enables the Cellular Modem USB interface.
Input is 5V Tolerant	Yes

75 RI

Details	
Pin Number	75
Pin Name	RI
Description	Ring Indicator for cellular modem

LED STATUS

System RGB LED

Unlike the Boron, the B523 module does not have an on-module RGB system status LED. We have provided its individual control pins for you to connect an LED of your liking. This will allow greater

flexibility in the end design of your products.

A detailed explanation of different color codes of the RGB system LED can be found here.

PMIC NOTES

When using the B-Series SoM with a bq24195 PMIC, note the following:

By default, the bq24195 sets the input current limit, which affects powering by VIN and VUSB, to 100 mA. This affects the VSYS output of the PMIC, which powers both the cellular modem and 3V3 supply, and is not enough to power the B-Series SoM in normal operation.

If your device has the default firmware (Tinker), it will attempt to connect to the cloud, brown out due to insufficient current, then the device will reset. This may result in what appears to be the status LED blinking white, but is actually rolling reboot caused by brownout.

A factory new B-Series SoM does not enable the PMIC setup. To enable the use of the bq21415, you must enable the system power feature PMIC_DETECTION in your code. This defaults to off because the B-Series SoM can be used without a PMIC, or with a different PMIC, and also requires I2C on D0/D1, and some base boards may use those pins as GPIO.

Because the input current limit does not affect the battery input (Li+), for troubleshooting purposes it can be helpful to attach a battery to help rule out input current limit issues. It's also possible to supply 3.7V via a bench power supply to the battery input, instead of VIN.

The input current limit can result in a situation where you can't bring up a B-Series SoM because it browns out continuously, but also cannot flash code to it to stop if from browning out. There are two general solutions:

- Attach a battery or supply by Li+ when bringing up a board.
- Use SWD/JTAG and reset halt the MCU. This will prevent it from connecting to the cloud, so you can flash Device OS and firmware to it by SWD.

The input current limit is actually controlled by three factors:

- The power source max current setting in the PMIC. The default is 900 mA. It can be set to 100, 150, 500, 900, 1200, 1500, 2000, or 3000 mA.
- It is also limited by the hardware ILIM resistor. On Particle devices with a built-in PMIC, this is set to 1590 mA, but if you are implementing your own PMIC hardware, you can adjust this higher.
- When connected by USB, it will use DPDM, current negotiation via the USB DP (D+) and DM (D-) lines.

Note that some 2A tablet chargers and multi-port USB power supplies supply 2A but do not implement DPDM; these will be treated as if VIN was used, and you must set the power source current, otherwise the input current will be limited to 900 mA, which is not enough to power a 2G/3G cellular modem without an attached battery.

Technical specifications

ABSOLUTE MAXIMUM RATINGS [1]

Supply voltages

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltages					
Supply Input Voltage	VCC	-0.3		+4.7	V
Supply Input Voltage	3V3	-0.3		+3.9	V
VBUS USB supply voltage	VUSB	-0.3		+5.8	V
I/O pin voltage					
VI/O, VDD ≤ 3.6 V	IO	-0.3		VDD + 0.3	V
VI/O, VDD > 3.6 V	IO	-0.3		+3.9	V
NFC antenna pin current					
$I_{NFC1/2}$	NFC1/NFC2			80	mA
Radio					
BT RF input level (52840)				10	dBm
Environmental					
Storage temperature		-40		+85	°C

[1] Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltages					
Supply Input Voltage	VCC	+3.6	+3.8	+4.3	V
Supply Input Voltage	3V3	+3.0	+3.3	+3.6	V
VBUS USB supply voltage	VUSB	+4.35	+5.0	+5.5	V
Environmental					
Normal operating temperature[1]		-20	+25	+75[3]	°C
Extended operating temperature[2]		-40		+85	°C
Humidity Range Non condensing, relative humidity				95	%

Notes:

[1] Normal operating temperature range (fully functional and meet 3GPP specifications).

[2] Extended operating temperature range (RF performance may be affected outside normal operating range, though module is fully functional)

[3] The maximum operating temperature is 75°C on the B523 (Quectel) but is 65°C on the B402 (u-blox LTE M1). For compatibility across modules, limit this to 65°C.

POWER CONSUMPTION

Parameter	Symbol	Min	Typ	Peak	Unit
Operating Current (uC on, peripherals and radio disabled)	I_{idle}	4.47	4.48	4.51	mA
Operating Current (uC on, cellular on but not connected)	I_{cell_idle}	17.5	34.2	744	mA
Operating Current (uC on, cellular connecting to tower)	$I_{cell\_conn\_twr}$	17.9	72.3	711	mA
Operating Current (uC on, cellular connecting to cloud)	$I_{cell\_conn\_cloud}$	23.0	93.6	669	mA
Operating Current (uC on, cellular connected but idle)	$I_{cell\_cloud\_idle}$	22.9	26.8	149	mA
Operating Current (uC on, cellular connected and transmitting)	$I_{cell\_cloud\_tx}$	113	139	519	mA
STOP mode sleep, GPIO wake-up	I_{stop_gpio}	323	538	916	uA
STOP mode sleep, analog wake-up	I_{stop_analog}	272	537	948	uA
STOP mode sleep, RTC wake-up	I_{stop_intrtc}	264	537	947	uA
STOP mode sleep, BLE wake-up, advertising	$I_{stop\_ble\_adv}$		604	2260	uA
STOP mode sleep, BLE wake-up, connected	$I_{stop\_ble\_conn}$		619	1700	uA
STOP mode sleep, serial wake-up	I_{stop_usart}	327	537	912	uA
STOP mode sleep, cellular wake-up	I_{stop_cell}	18.7	23.1	140	mA
ULP mode sleep, GPIO wake-up	I_{ulp_gpio}		53.6	446	uA
ULP mode sleep, analog wake-up	I_{ulp_analog}		55.8	420	uA
ULP mode sleep, RTC wake-up	I_{ulp_intrtc}		54.8	444	uA
ULP mode sleep, BLE wake-up, advertising	$I_{ulp\_ble\_adv}$		139	2430	uA
ULP mode sleep, BLE wake-up, connected	$I_{ulp\_ble\_conn}$		162	1090	uA
ULP mode sleep, serial wake-up	I_{ulp_usart}	317	537	938	uA
ULP mode sleep, cellular wake-up	I_{ulp_cell}	18.4	22.8	149	mA
HIBERNATE mode sleep, GPIO wake-up	I_{hib_gpio}		29.7	430	uA
HIBERNATE mode sleep, analog wake-up	I_{hib_analog}		30.8	441	uA

[1]The min, and particularly peak, values may consist of very short transients. The typical (typ) values are the best indicator of overall power consumption over time. The peak values indicate the absolute minimum capacity of the power supply necessary, not overall consumption.

Boron has two radio modules.

nRF52840

- Bluetooth® 5, 2.4 GHz
  - 95 dBm sensitivity in 1 Mbps Bluetooth® low energy mode
  - 103 dBm sensitivity in 125 kbps Bluetooth® low energy mode (long range)
  - 20 to +8 dBm TX power, configurable in 4 dB steps

4G LTE cellular characteristics for EG91-E

Parameter	Value
Protocol stack	3GPP Release 13
RAT	LTE Cat 1
LTE FDD Bands	Band 28A (700 MHz)
	Band 20 (800 MHz)
	Band 8 (900 MHz)
	Band 3 (1800 MHz)
	Band 1 (2100 MHz)
	Band 7 (2600 MHz)
WCDMA Bands	Band 8 (900 MHz)
	Band 1 (2100)
GSM Bands	EGSM900 (900 MHz)
	DCS1800 (1800 MHz)
Power class	Class 4 (33dBm ± 2dB) for EGSM900
	Class 1 (30dBm ± 2dB) for DCS1800
	Class E2 (27dBm ± 3dB) for EGSM900 8-PSK
	Class E2 (26dBm ± 3dB) for DCS1800 8-PSK
	Class 3 (24dBm ± 3dB) for WCDMA bands
	Class 3 (23dBm ± 2dB) for LTE FDD bands

I/O CHARACTERISTICS

These specifications are based on the nRF52840 datasheet.

| Symbol	Parameter	Min	Typ	Max	Unit
VIH	Input high voltage	0.7 xVDD		VDD	V
VIL	Input low voltage	VSS		0.3 xVDD	V
VOH,SD	Output high voltage, standard drive, 0.5 mA, VDD ≥1.7	VDD - 0.4		VDD	V
VOH,HDH	Output high voltage, high drive, 5 mA, VDD >= 2.7 V	VDD - 0.4		VDD	V
VOH,HDL	Output high voltage, high drive, 3 mA, VDD >= 1.7 V	VDD - 0.4		VDD	V
VOL,SD	Output low voltage, standard drive, 0.5 mA, VDD ≥1.7	VSS		VSS + 0.4	V
VOL,HDH	Output low voltage, high drive, 5 mA, VDD >= 2.7 V	VSS		VSS + 0.4	V
VOL,HDL	Output low voltage, high drive,3 mA, VDD >= 1.7 V	VSS		VSS + 0.4	V
IOL,SD	Current at VSS+0.4 V, output set low, standard drive, VDD≥1.7	1	2	4	mA
IOL,HDH	Current at VSS+0.4 V, output set low, high drive, VDD >= 2.7V	6	10	15	mA
IOL,HDL	Current at VSS+0.4 V, output set low, high drive, VDD >= 1.7V	3			mA
IOH,SD	Current at VDD-0.4 V, output set high, standard drive, VDD≥1.7	1	2	4	mA
IOH,HDH	Current at VDD-0.4 V, output set high, high drive, VDD >= 2.7V	6	9	14	mA
IOH,HDL	Current at VDD-0.4 V, output set high, high drive, VDD >= 1.7V	3			mA
tRF,15pF	Rise/fall time, standard drivemode, 10-90%, 15 pF load[1]		9		ns
tRF,25pF	Rise/fall time, standard drive mode, 10-90%, 25 pF load[1]		13		ns
tRF,50pF	Rise/fall time, standard drive mode, 10-90%, 50 pF load[1]		25		ns
tHRF,15pF	Rise/Fall time, high drive mode, 10-90%, 15 pF load[1]		4		ns
tHRF,25pF	Rise/Fall time, high drive mode, 10-90%, 25 pF load[1]		5		ns
tHRF,50pF	Rise/Fall time, high drive mode, 10-90%, 50 pF load[1]		8		ns
RPU	Pull-up resistance	11	13	16	kΩ
RPD	Pull-down resistance	11	13	16	kΩ
CPAD	Pad capacitance		3		pF
CPAD_NFC	Pad capacitance on NFC pads		4		pF
INFC_LEAK	Leakage current between NFC pads when driven to different states		1	10	µA

- Rise and fall times based on simulations

- GPIO default to standard drive (2mA) but can be reconfigured to high drive (9mA) in Device OS 2.0.0 and later using the `pinSetDriveStrength()` function.

Mechanical specifications

DIMENSIONS AND WEIGHT

Parameters	Value	Unit
Width	30	mm
Height	42	mm
Thickness	5.5	mm
Weight	6.2	grams

MECHANICAL DRAWING
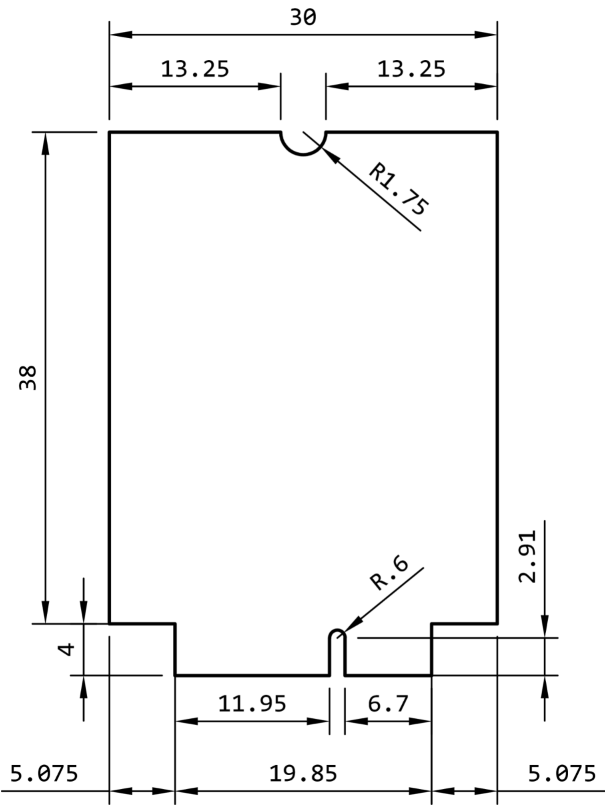
Dimensions are in millimeters.

3D MODELS

3D models of the B-Series SoM module are available in the hardware-libraries Github in formats including step, iges, stl, and f3d.

The 3D models are the same for the B524 and B523, as the only changes are the SIM card, which is not visible.

The mating connector is a an M.2 (NGFF) type 4. Note that there are several different key configurations for the M.2, and type 4 is different than is commonly used on SSDs.
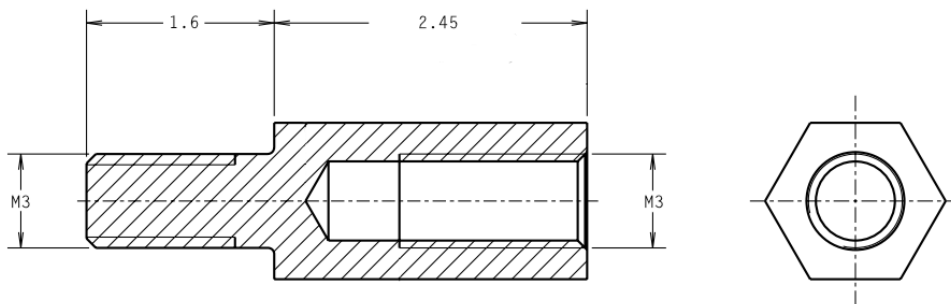
One compatible connector is the TE 2199230-4. It is widely available including at suppliers such as DigiKey.
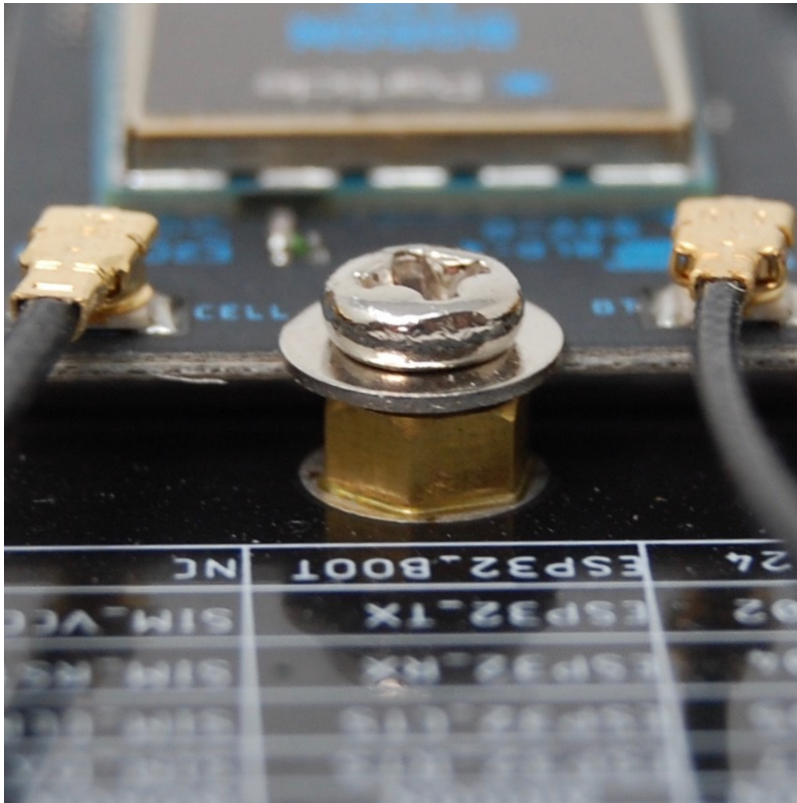
We recommend this screw assembly to securely affix the B series SoM to your circuit board. From top to bottom:

- M3 screw, 3mm long
- M3 washer
- M3 standoff, 2.45mm

- Mounting hole, 2.6 mm metal hole, 3.1mm metal ring diameter (picture is of the bottom side of the circuit board)

- An alternative design uses a JAE SM3ZS067U410-NUT1-R1200 standoff. It's reflow soldered to your base board and has a threaded hole for a M2*3 screw to hold down the SoM. This may be easier to obtain.

- Note that a hold-down screw is required because the M.2 connector does not have integrated locks and the SoM will pop up if not attached to the base board.

- The screw should be connected to the ground plane on your base board.

DESIGN CONSIDERATIONS

We strongly recommend against placing components under the SOM board because there is not enough height.

30mm

Ø3mm

42mm

38mm

KEEP OUT
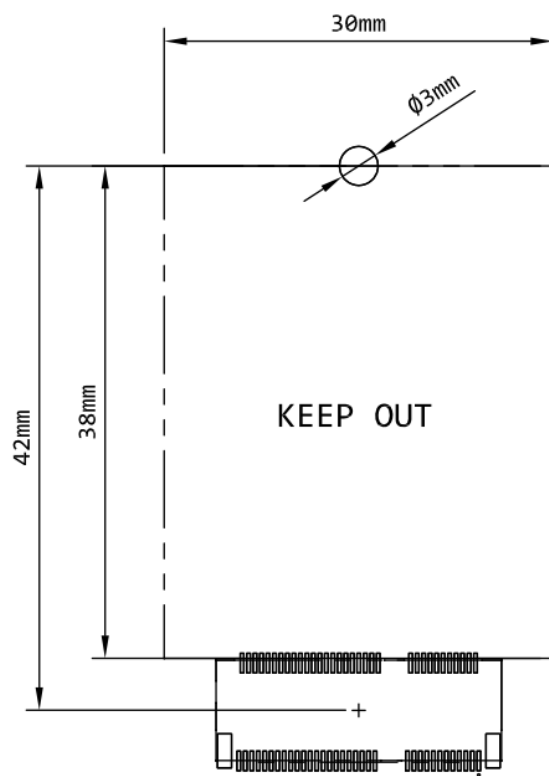
Product handling

ESD PRECAUTIONS

The B series contains highly sensitive electronic circuitry and is an Electrostatic Sensitive Device (ESD). Handling an B series 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 B series 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 B series!

CONNECTORS

The U.FL antenna connector is 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.
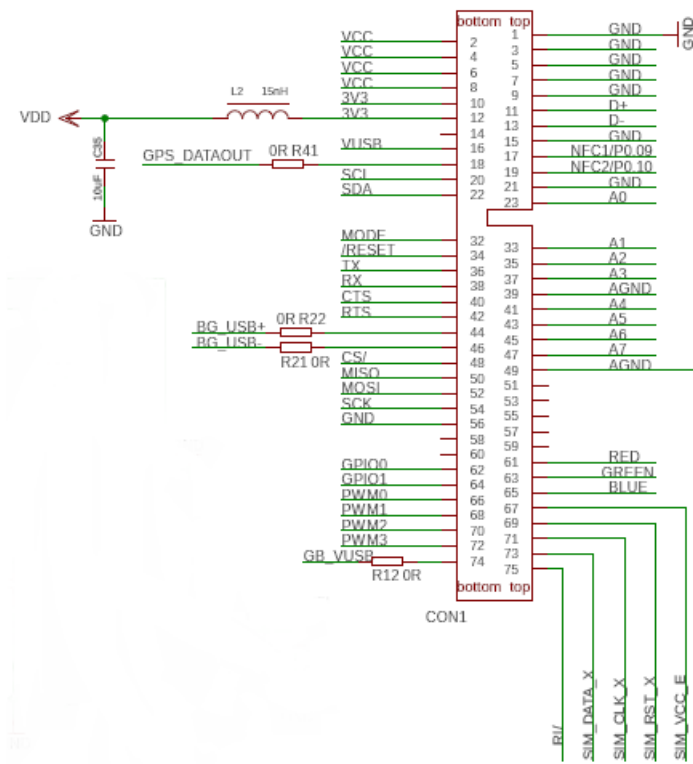
The M.2 edge connector is static sensitive and should be handled carefully. The M.2 connector is not designed for repeated removal and insertion of the module.

Schematics

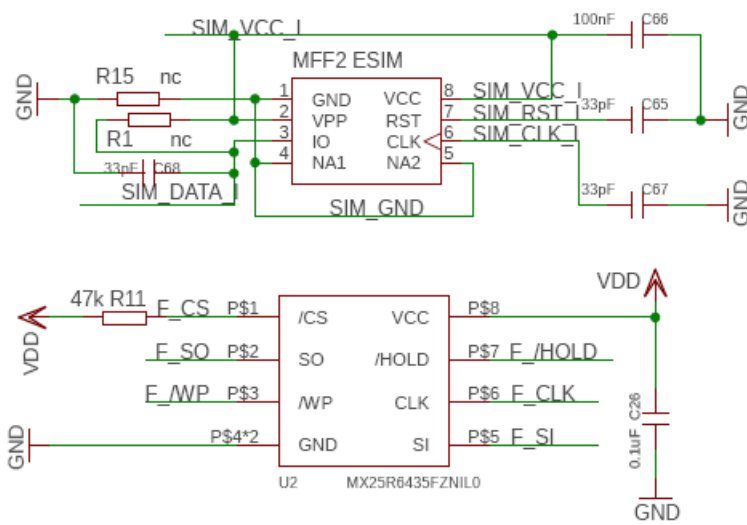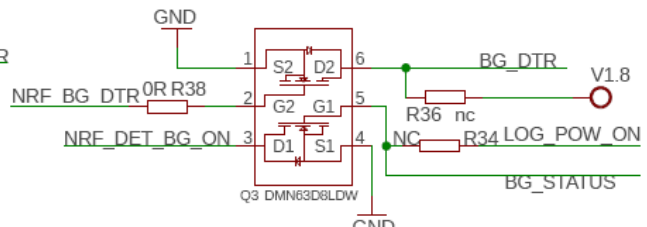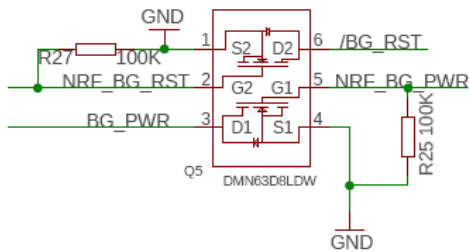## MICROCONTROLLER

QUECTEL CELLULAR MODEM

EG91
GSM Module

TITLE: B500M-E SOM v0.03

Particle Logo

M.2 CONNECTOR

CON1

bottom top		
VCC	2	1	GND
VCC	4	3	GND
VCC	6	5	GND
VCC	8	7	GND
3V3	10	9	GND
3V3	12	11	D+
	14	13	D-
VUSB	16	15	GND
	18	17	NFC1/P0.09
SCL	20	19	NFC2/P0.10
SDA	22	21	GND
		23	A0
MODE	32	33	A1
/RESET	34	35	A2
TX	36	37	A3
RX	38	39	AGND
CTS	40	41	A4
RTS	42	43	A5
	44	45	A6
	46	47	A7
CS/	48	49	AGND
MISO	50	51	
MOSI	52	53	
SCK	54	55	
GND	56	57	
	58	59	
	60	61	RED
GPIO0	62	63	GREEN
GPIO1	64	65	BLUE
PWM0	66	67	
PWM1	68	69	
PWM2	70	71	
PWM3	72	73	
GB_VUSB	74	75	
bottom top		

VDD — L2 15nH — 3V3

C35 10nF

GND

GPS_DATAOUT — 0R R41

BG_USB+ — 0R R22
BG_USB- — R21 0R

R12 0R

GND

RI/
SIM_DATA_X
SIM_CLK_X
SIM_RST_X
SIM_VCC_E

SIM AND FLASH

SIM_VCC_I   100nF C66

MFF2 ESIM

1	GND	VCC	8	SIM_VCC_I
2	VPP	RST	7	SIM_RST_I	33pF C65
3	IO	CLK	6	SIM_CLK_I
4	NA1	NA2	5	

GND

R15 nc

R1 nc

33pF C68

SIM_DATA_I

SIM_GND

33pF C67

GND

U2 MX25R6435FZNIL0

VDD

47k R11 F_CS P$1

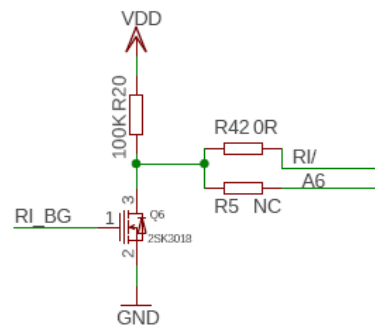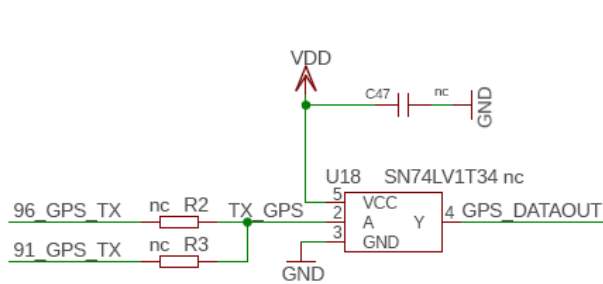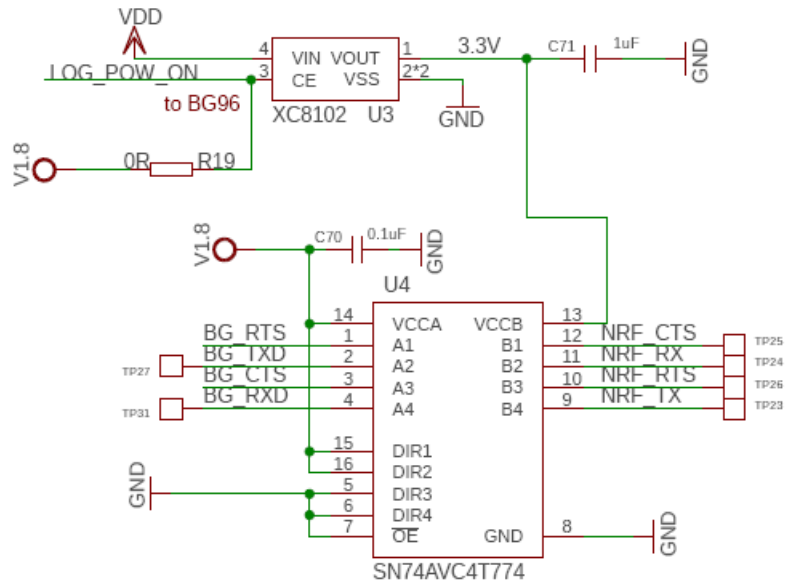|		
/CS	VCC	P$8
SO	/HOLD	P$7 F_/HOLD
/WP	CLK	P$6 F_CLK
GND	SI	P$5 F_SI

F_SO P$2
F_/WP P$3
P$4*2

VDD

GND

0.1uF C26

GND

BUFFERS

Assembly

CONFORMAL COATINGS

B-Series SoM modules should not use a conformal coating to protect the module from water. Some components on the SoM cannot be coated and would need to be masked off during coating. This will make the coating process difficult to implement and test.

Furthermore, you cannot safely protect the the connection between the M.2 SoM and the M.2 NGFF connector by using a coating. Using an enclosure that protects both your base board and the B-Series SoM as a single waterproof assembly is recommended instead.

Default settings

The B series comes pre-programmed with a bootloader and a user application called Tinker. This application works with an iOS and Android app also named Tinker that allows you to very easily toggle digital pins, take analog and digital readings and drive variable PWM outputs.

The bootloader allows you to easily update the user application via several different methods, USB, OTA, Serial Y-Modem, and also internally via the Factory Reset procedure. All of these methods have multiple tools associated with them as well.

Certification

EU DECLARATION OF CONFORMITY

We, Particle Industries, Inc., declare under our sole responsibility that the product, B524 and B523, to which this declaration relates, is in conformity with RED Directive 2014/53/EU and (EU) 2015/863 RoHS Directive 2011/65/EU (Recast).

The full text of the EU declaration of conformity is available at the following Internet address https://www.particle.io/.

Radiation Exposure Statement: This equipment complies with radiation exposure limits set forth for an uncontrolled environment.

The operating frequency bands and the maximum transmitted power limit are listed below:

- BLE 2402-2480MHz, 10dBm
- LTE (CAT-1 bands B1 B3 B7 B8 B20 B28), Frequency Ranges: 703-960MHz, 1710-2170MHz, 2550-2690MHz, Max TX Power: 25dBm
- 3G (WCDMA sits on LTE B1, B8), Frequency Ranges: 880-960MHz, 1920-2170 MHz, Max TX Power: 25dBm
- 2G (EGSM900 sits on LTE B8), Frequency Ranges: 880-915MHz, 925-960 MHz, Max TX Power: 35dBm
- 2G (DCS1800 sits on LTE B3), Frequency Ranges: 1710.2-1784.8MHz, 1805.2-1879.8MHz, Max TX Power: 32dBm

UNITED KINGDOM

UKCA Conformity:

Radio Equipment Regulations 2017 (S.I. 2017/1206)

Certification documents

CE (EUROPE) - B523 B524 B-SERIES SOM

- Summary (updated 2021-09-16)
- EMC Test Report (updated 2021-09-16)
- RED BLE Test Report (updated 2022-11-09)
- RED Cellular Test Report (updated 2021-09-16)
- EN 300 328 Test Report (2.4 GHz ISM band) (updated 2022-11-09)
- EN 300 330 Test Report (NFC) (updated 2022-11-09)
- EN 301 489 Test Report (updated 2022-11-09)
- EN 301 511 Test Report (GSM) (updated 2022-11-09)
- EN 301 908 Variant Radio Test Report (updated 2022-11-09)
- EN-62311 Test Report (updated 2022-11-09)
- EN-62368 Test Report (supersedes EN-60950) (updated 2022-11-09)
- RoHS 3.0 Test Report (updated 2021-09-16)

FCC (UNITED STATES) - B523 B524 B-SERIES SOM

The B523 and B524 are not FCC certified as it does not support any cellular bands used in the United States. The B404X should be used instead.

ISED (CANADA) - B523 B524 B-SERIES SOM

The B523 and B524 are not ISED certified as it does not support any cellular bands used in the Canada. The B404X should be used instead.

ROHS - B523 B524 B-SERIES SOM

- RoHS 3.0 Test Report

UKCA (UNITED KINGDOM) - B523 B524 B-SERIES SOM

- UKCA Certification (updated 2022-11-09)

JAPAN - B524 B-SERIES SOM

- Japan D 24 0029 201
- Japan 201 240198

Country compatibility

Country	Model	Technologies	Carriers
Albania	B524	2G, 3G, Cat1	ALBtelecom, Telekom, Vodafone
Algeria	B524	2G, 3G, Cat1	Mobilis, Ooredoo
Aruba	B524	2G, 3G, Cat1	Setar
Australia	B524	3G, Cat1	Optus, Telstra, Vodafone
Austria	B524	2G, 3G, Cat1	3 (Drei), A1, T-Mobile
Bahrain	B524	2G, 3G, Cat1	Zain
Bangladesh	B524	2G, 3G, Cat1	Bangalink, GrameenPhone
Belarus	B524	2G, 3G, Cat1	A1
Belgium	B524	2G, 3G, Cat1	Base, Orange, Proximus
Bosnia and Herzegovina	B524	2G, 3G	BH Telecom, HT Eronet
Botswana	B524	2G, 3G, Cat1	BeMobile
Brunei	B524	3G, Cat1	DST
Bulgaria	B524	2G, 3G	A1, Telenor, Vivacom
Burkina Faso	B524	2G, 3G, Cat1	Orange
Cabo Verde	B524	2G, 3G, Cat1	CVMóvel, Unitel T+
Cambodia	B524	2G, 3G	Metfone
Chad	B524	2G, 3G, Cat1	Airtel
Chile	B524	2G, 3G, Cat1	Claro, Entel, Movistar
Congo (Brazzaville)	B524	2G, 3G, Cat1	Airtel
Congo (Kinshasa)	B524	2G, 3G, Cat1	Airtel
Côte d'Ivoire	B524	2G, 3G, Cat1	MTN
Croatia	B524	2G, 3G, Cat1	Hrvatski Telekom, Tele2
Cyprus	B524	2G, 3G, Cat1	Cytamobile-Vodafone, MTN, PrimeTel
Czechia	B524	2G, Cat1	O2, T-Mobile, Vodafone
Denmark	B524	2G, 3G, Cat1	3 (Tre), TDC, Telenor, Telia
Egypt	B524	2G, 3G, Cat1	Etisalat, Orange
Estonia	B524	2G, 3G, Cat1	Elisa, Tele2, Telia
eSwatini	B524	2G, 3G, Cat1	MTN
Ethiopia	B524	2G, 3G, Cat1	Ethio Telecom
Faroe Islands	B524	2G, 3G	Faroese Telecom, Vodafone
Finland	B524	2G, 3G, Cat1	DNA, Elisa, Telia
France	B524	2G, 3G, Cat1	Bouygues, Free Mobile, Orange, SFR
French Guiana	B524	2G, 3G	Digicel
Gabon	B524	2G, 3G, Cat1	Airtel
Germany	B524	2G, 3G, Cat1	O2, Telekom, Vodafone
Ghana	B524	2G, 3G, Cat1	AirtelTigo, MTN, Vodafone
Gibraltar	B524	2G, 3G, Cat1	Gibtel
Greece	B524	2G, Cat1	Cosmote, Vodafone, Wind
Guadeloupe	B524	2G, 3G, Cat1	Orange
Guinea	B524	2G, 3G, Cat1	MTN
Guinea-Bissau	B524	2G, 3G, Cat1	MTN
Guyana	B524	2G	Digicel

Haiti	B524	2G, 3G	Digicel
Hong Kong	B524	2G, 3G, Cat1	CMHK, CSL, SmarTone
Hungary	B524	2G, 3G, Cat1	Magyar Telekom, Telenor, Vodafone
Iceland	B524	2G, 3G, Cat1	Nova, Siminn, Vodafone
Indonesia	B524	2G, 3G, Cat1	Indosat, Telkomsel, XL Axiata
Ireland	B524	2G, 3G, Cat1	3 (Tre), Meteor, O2, Vodafone
Israel	B524	2G, 3G, Cat1	Hot Mobile, Orange, Pelephone
Italy	B524	2G, 3G, Cat1	TIM, Vodafone, Wind
Jordan	B524	2G, 3G, Cat1	Zain
Kazakhstan	B524	2G, 3G, Cat1	Beeline, K-Cell
Kenya	B524	2G, 3G, Cat1	Airtel
Kuwait	B524	2G, 3G, Cat1	Viva, Zain
Latvia	B524	2G, 3G, Cat1	Bite, LMT, Tele2
Liechtenstein	B524	2G, 3G, Cat1	Mobilkom, Orange
Lithuania	B524	2G, 3G, Cat1	Bite, Omnitel, Tele2
Luxembourg	B524	2G, 3G, Cat1	Orange, POST, Tango
Macao	B524	2G, 3G, Cat1	CTM
Madagascar	B524	2G, 3G, Cat1	Airtel
Malawi	B524	2G, 3G, Cat1	Airtel
Malaysia	B524	2G, 3G, Cat1	Celcom, DiGi, Maxis
Malta	B524	2G, 3G, Cat1	Go Mobile, Vodafone
Moldova	B524	2G, 3G, Cat1	Moldcell, Orange
Mongolia	B524	2G, 3G	Mobicom, Unitel
Montenegro	B524	2G, 3G, Cat1	Mtel, T-Mobile, Telenor
Morocco	B524	2G, 3G, Cat1	Inwi, Medi Telecom
Mozambique	B524	2G, 3G, Cat1	Vodacom
Myanmar	B524	2G, 3G, Cat1	MPT, Telenor
Namibia	B524	2G, 3G, Cat1	Telecom Namibia
Netherlands	B524	2G, 3G, Cat1	KPN, T-Mobile, Vodafone
New Zealand	B524	2G, 3G, Cat1	2degrees, Spark, Vodafone
Nigeria	B524	2G, 3G, Cat1	9mobile, Airtel, Glo, MTN
Norway	B524	2G, 3G, Cat1	TDC, Telenor, Telia
Pakistan	B524	2G, 3G, Cat1	Mobilink, Telenor, Ufone, Warid
Palestine	B524	2G, 3G	Jawwal
Papua New Guinea	B524	2G, 3G	bmobile
Poland	B524	2G, 3G, Cat1	Orange, Play, Plus, T-Mobile
Portugal	B524	2G, 3G, Cat1	NOS, TMN, Vodafone
Qatar	B524	2G, 3G, Cat1	Ooredoo, Vodafone
Romania	B524	2G, 3G, Cat1	Orange, Telekom Romania, Vodafone
Rwanda	B524	2G, 3G, Cat1	Airtel, MTN
Serbia	B524	2G, 3G, Cat1	Telenor, VIP
Seychelles	B524	2G, 3G, Cat1	Airtel
Sint Maarten	B524	2G, 3G, Cat1	TelCell
Slovakia	B524	2G, 3G, Cat1	O2, Orange, Telekom
Slovenia	B524	2G, 3G, Cat1	A1, Mobitel

South Africa	B524	2G, 3G, Cat1	Cell C, MTN, Vodacom
South Korea	B524	3G, Cat1	KT, LG U+, SK Telecom
South Sudan	B524	2G, 3G, Cat1	MTN
Spain	B524	2G, 3G, Cat1	Orange, Telefonica, Vodafone, Yoigo
Sri Lanka	B524	2G, 3G, Cat1	Dialog, Mobitel
Suriname	B524	2G, 3G	Telesur
Sweden	B524	2G, 3G, Cat1	3 (Tre), Tele2, Telenor, Telia
Switzerland	B524	3G, Cat1	Salt, Sunrise, Swisscom
Taiwan	B524	3G, Cat1	Chunghwa, FarEasTone, T Star, Taiwan Mobile
Tanzania	B524	2G, 3G, Cat1	Airtel
Thailand	B524	2G, 3G, Cat1	AIS, DTAC, True Move
Tunisia	B524	2G, 3G, Cat1	Orange Tunisie, Tunisie Telecom
Uganda	B524	2G, 3G, Cat1	Africell, Airtel, MTN
United Kingdom	B524	2G, 3G, Cat1	3, EE, Manx, O2, Sure, Vodafone
Vietnam	B524	2G, 3G, Cat1	MobiFone, Viettel, Vinaphone
Zambia	B524	2G, 3G, Cat1	Airtel

Ordering information

SKU	Description	Region	Modem	EtherSIM	Lifecycle	Replacement
B524MEA	B-Series LTE CAT-1/3G/2G (Europe, EtherSIM) [x1]	EMEAA	EG91-E	✓	GA	
B524MTY	B-Series LTE CAT-1/3G/2G (Europe, EtherSIM), Tray [x50]	EMEAA	EG91-E	✓	GA	
B523MTY	B-Series LTE CAT-1/3G/2G (Europe), Tray [x50]	EMEAA	EG91-E		NRND	B524MTY
B523MEA	B-Series LTE CAT-1/3G/2G (Europe) [x1]	EMEAA	EG91-E		Deprecated	B524MEA

- EMEAA: Selected countries in Europe, Middle East, Africa, and Asia, including Australia and New Zealand. See the cellular carrier list for more information.

Revision history

Revision	Date	Author	Comments
001	27 Apr 2020	RK	First Release
002	30 Jul 2020	RK	Added explanation of DIV connector
003	16-Sep-2020	RK	Added power consumption information
004	04-Jan-2021	RK	Fix incorrect pin number on pogo pin diagram
005	15-Mar-2021	RK	Updated model, carrier, ordering information
006	23-Mar-2021	RK	Pins 40 and 42 functions were reversed
007	26-Apr-2021	RK	Added B524 model number
008	14-May-2021	RK	Pins 40 and 42 were not actually reversed
009	19-May-2021	RK	List Ethernet reserved pins
010	28-Jun-2021	RK	Added Device OS 3.1 memory map information
011	10-Sep-2021	RK	Changed wording of peak vs. max current
012	05-May-2022	RK	Corrected number of PWM outputs (8)
013	11-Aug-2022	RK	Correct typo in 3V3 explanation
014	29-Aug-2022	RK	Added EU declaration of conformity
015	16-Sep-2022	RK	Added UKCA conformity
016	31-Oct-2022	RK	Updated EU operating frequencies
017	10-Dec-2022	RK	Added PMIC notes
018	06-Jan-2022	RK	Clarify power supply notes for VCC and 3V3
019	31-Jan-2023	RK	Add Device OS versions
020	28-Apr-2023	RK	Add conformal coating warning
021	13-Nov-2023	RK	Add full pin details
022	20-Dec-2023	RK	Clarified band power information table
023	20-Feb-2024	RK	M.2 screw assembly should be connected to ground
024	23-Apr-2024	RK	Added links to certification documents