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

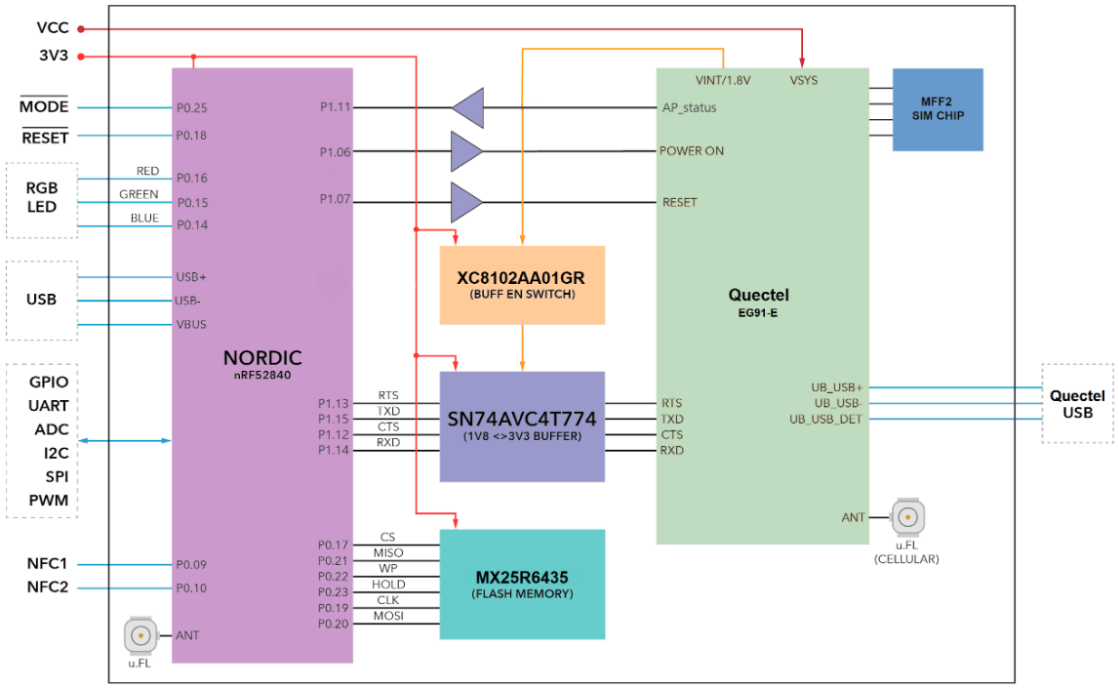
- Quectel EG91-E modem
- LTE category 1 module for EMEAA region
- 3GPP E-UTRA Release 13
- Cat 1 bands supported: 1, 3, 7, 8, 20, 28A
- 2G and 3G fallback (900, 1800, and 2100 MHz)
- Embedded Particle SIM (B523)
- Support for Europe only

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)

Interfaces

BLOCK DIAGRAM



POWER

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 4.3V DC. Make sure that the supply can handle currents of at least 2 A.

Note: The limit on the B402 (u-blox LTE Cat M1) is 4.2V, so you should limit VCC to 4.2V to preserve compatibility with both modules.

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 at least 150 mA, however it may need to be larger than that if you have additional 3.3V peripherals on your base board.

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.

ANTENNA

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

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

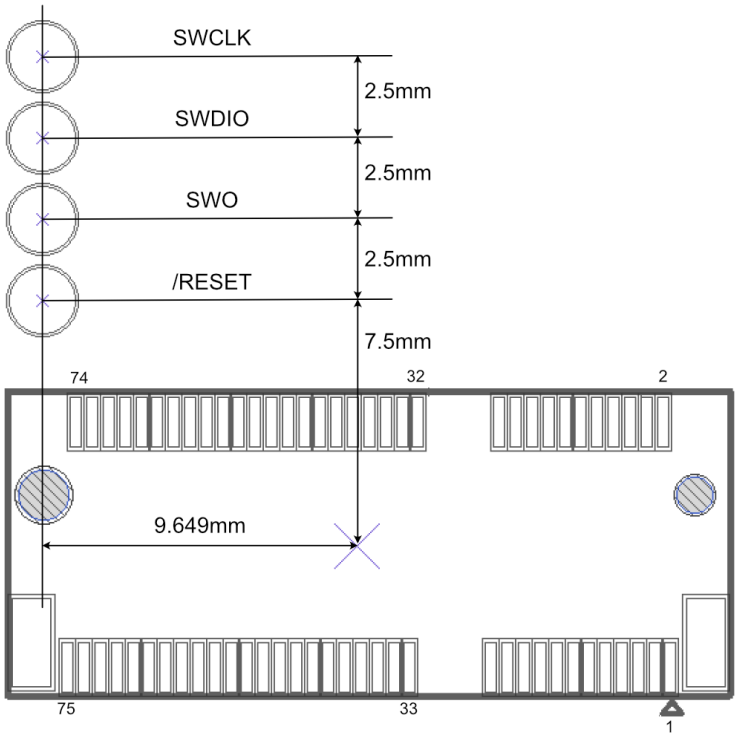
There are some optional B523 module specific I/O:

- 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
2.5mm
SWDIO
2.5mm
SWO
2.5mm
/RESET
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

EG91-E CAT-1 SOM			
	H1	H3	
	H5		
VCC	2	1	GND
VCC	4	3	GND
VCC	6	5	GND
VCC	8	7	GND
3V3	10	9	GND
3V3	12	11	USB D+
RESERVED	14	13	USB D-
VUSB	16	15	GND
	18	17	NFC1
SCL	20	19	NFC2
SDA	22	21	GND
	KEY	23	ADC0
MODE	32	33	ADC1
RESET	34	35	ADC2
TX	36	37	ADC3
RX	38	39	AGND
CTS	40	41	ADC4
RTS	42	43	ADC5
EG91 USB+	44	45	ADC6
EG91 USB-	46	47	ADC7
CS	48	49	AGND
MISO	50	51	RESERVED
MOSI	52	53	RESERVED
SCK	54	55	RESERVED
GND	56	57	RESERVED
RESERVED	58	59	RESERVED
RESERVED	60	61	RED
GPIO0	62	63	GREEN
GPIO1	64	65	BLUE
PWM0	66	67	SIM_VCC
PWM1	68	69	SIM_RST
PWM2	70	71	SIM_CLK
PWM3	72	73	SIM_DATA
EG91 VBUS	74	75	EG91_RI
	H2	H4	

Pins SOM0 to SOM9 will vary across various SoM modules. For example, cellular-specific pins exists in this range.

Additionally there are RESERVED[3] pins, whose functions vary depending on the SoM. For example, nRF52 MCU-based modules use some of these pins for additional ADC and GPIO. They are able to be used as described on the B523, but their function may be be different on future modules.

For maximum cross-module flexibility, you should try to use only the common pins when possible.

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	P0.9	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	P0.3	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	P0.4	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	P0.6	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	P0.5	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	P0.2	Analog input ADC7[2], and digital GPIO.
48	D8	CS	IO	P0.7	SPI interface CS, and digital only GPIO.
49	AGND	AGND	POWER		System analog ground.
50	D11	MISO	IO	P1.8	SPI interface MISO, and digital only GPIO.
51	NC	RESERVED[3]	NC		Leave unconnected.
52	D12	MOSI	IO	P1.9	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	P1.1	GPIO0, digital only.
63	RGBG	GREEN	IO	P0.15	Green pin of the RGB LED.
64	D23	GPIO1	IO	P1.3	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	P1.4	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

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.

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.

RADIO SPECIFICATIONS

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

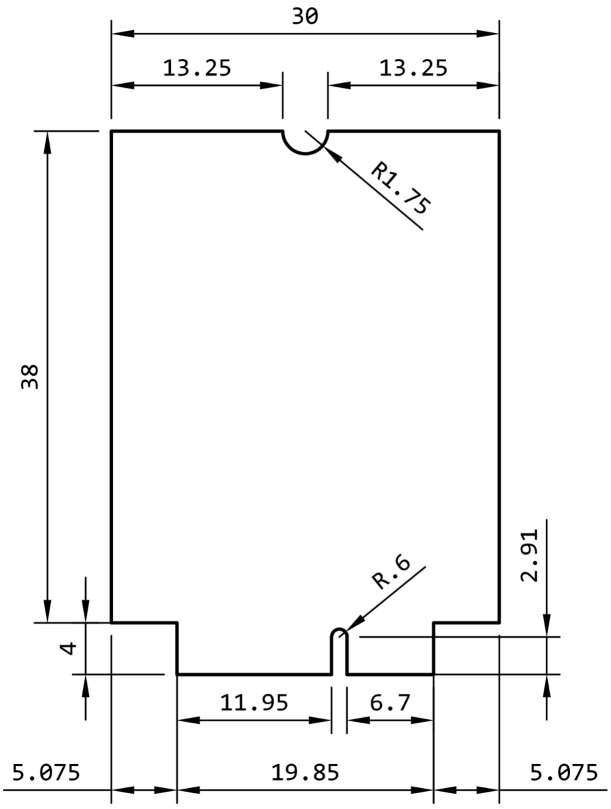
- Rise and fall times based on simulations
- GPIO default to standard drive (2mA) but can be reconfigured to high drive (9mA) in Device OS 2.0.0 and later using the `pinSetDriveStrength()` function.

Mechanical specifications

DIMENSIONS AND WEIGHT

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

MECHANICAL DRAWING

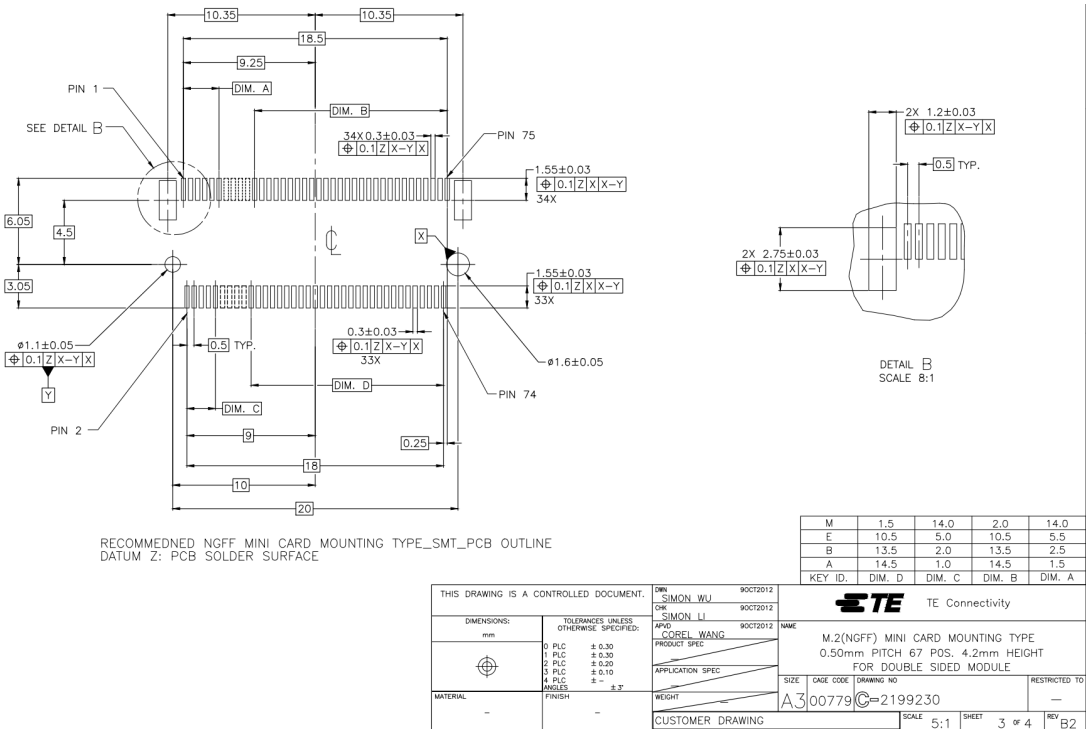


Dimensions are in millimeters.

MATING CONNECTOR AND LAND PATTERN

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.



RECOMMEDNED NGFF MINI CARD MOUNTING TYPE_SMT_PCB OUTLINE
DATUM Z: PCB SOLDER SURFACE

M	1.5	14.0	2.0	14.0
E	10.5	5.0	10.5	5.5
B	13.5	2.0	13.5	2.5
A	14.5	1.0	14.5	1.5
KEY ID.	DIM. D	DIM. C	DIM. B	DIM. A

THIS DRAWING IS A CONTROLLED DOCUMENT.

DIMENSIONS: mm

TOLERANCES UNLESS OTHERWISE SPECIFIED:
0 PLC ± 0.30
1 PLC ± 0.30
2 PLC ± 0.20
3 PLC ± 0.10
4 PLC ± –
ANGLES ± 3°

MATERIAL –
FINISH –

DWN SIMON WU 90CT2012
CHK SIMON LI 90CT2012
APVD COREL WANG 90CT2012
PRODUCT SPEC —
APPLICATION SPEC —
WEIGHT —

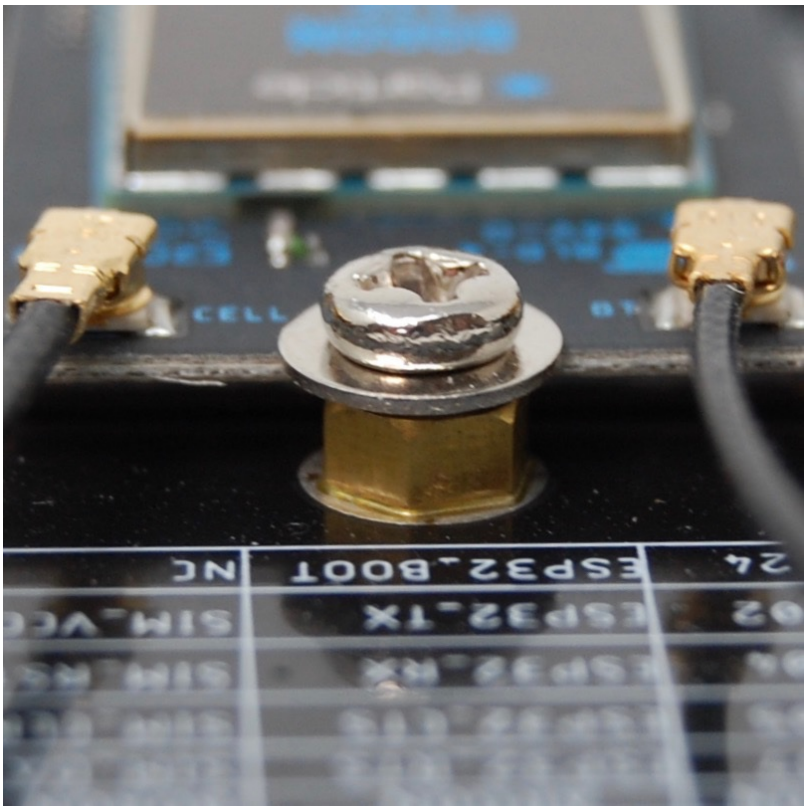
TE Connectivity

NAME
M.2(NGFF) MINI CARD MOUNTING TYPE
0.50mm PITCH 67 POS. 4.2mm HEIGHT
FOR DOUBLE SIDED MODULE

SIZE	CAGE CODE	DRAWING NO	RESTRICTED TO
A3	00779	C-2199230	—

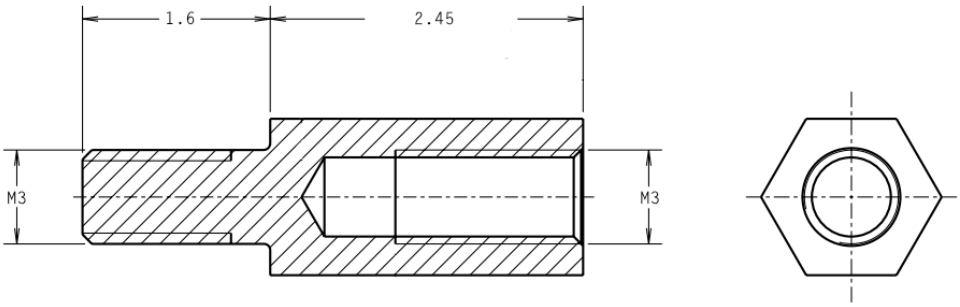
CUSTOMER DRAWING | SCALE 5:1 | SHEET 3 OF 4 | REV B2

SCREW ASSEMBLY



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

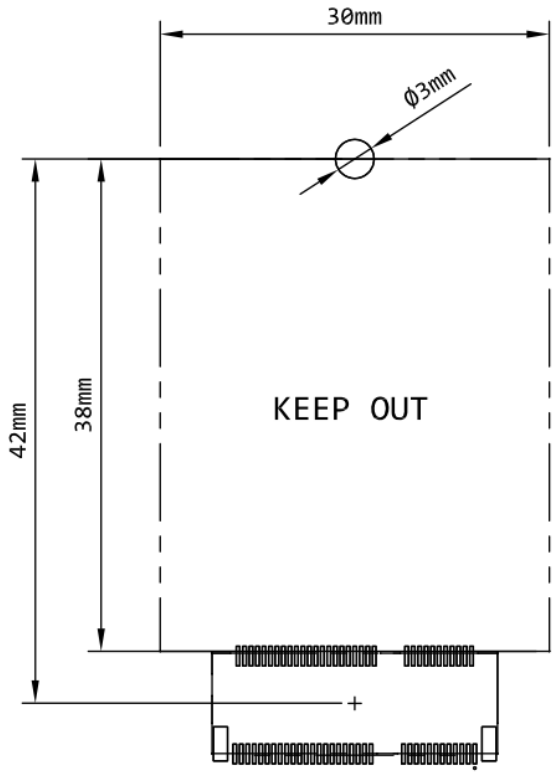


- Mounting hole, 2.6 mm metal hole, 3.1mm metal ring diameter (picture is of the bottom side of the circuit board)

- 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.

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!

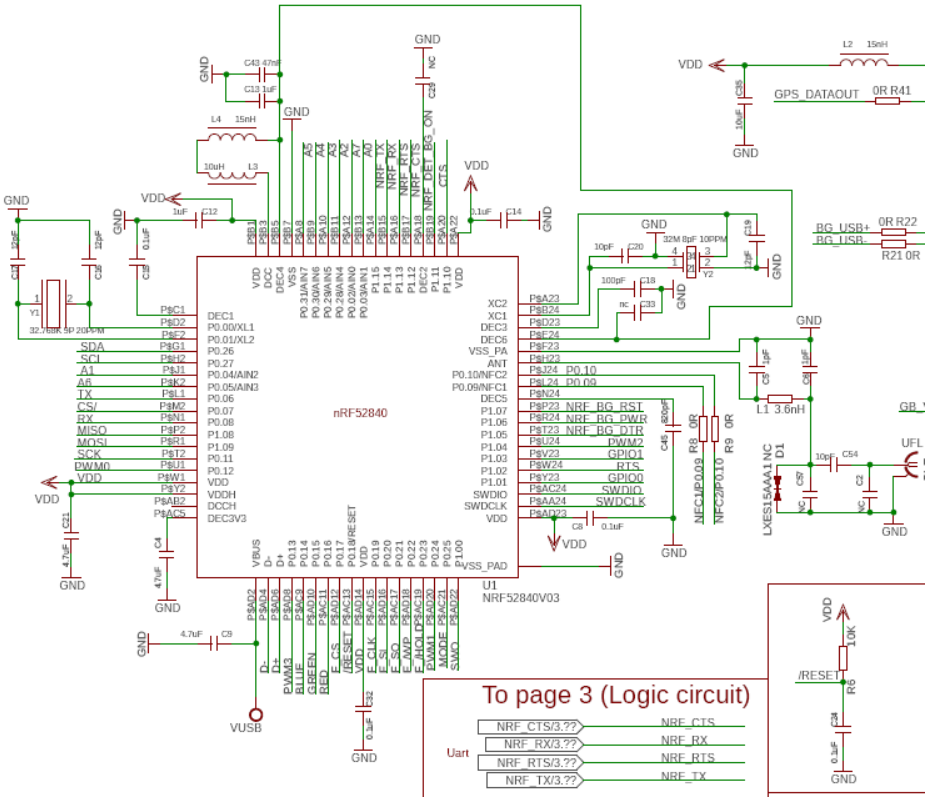
CONNECTORS

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.

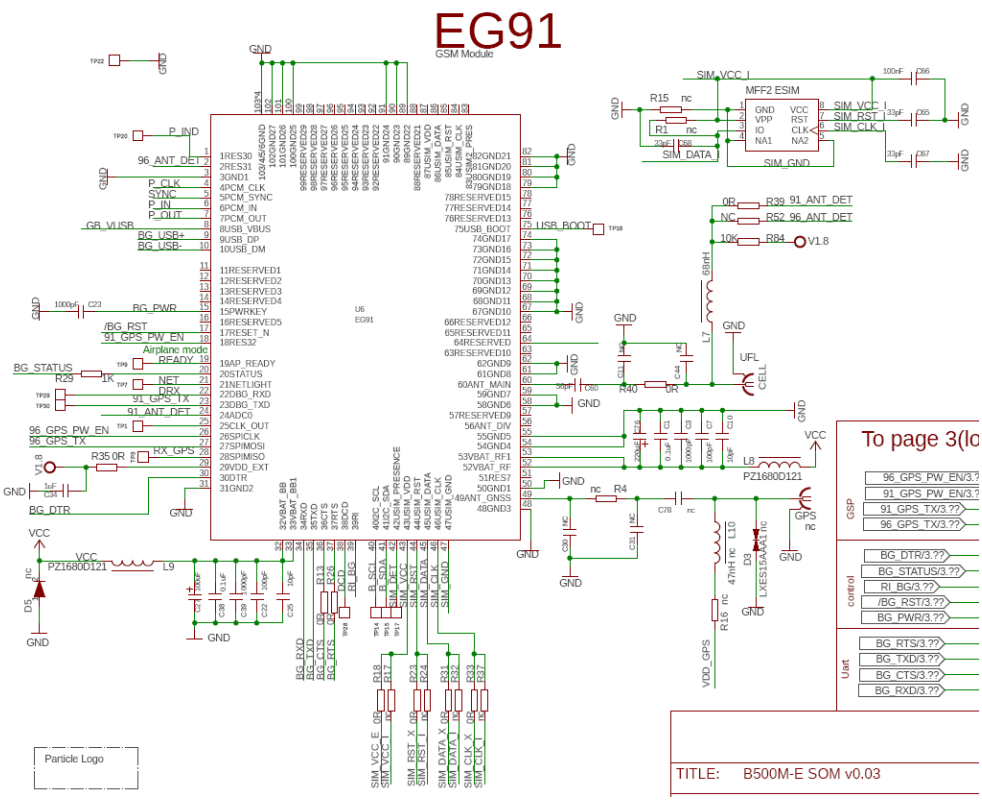
The M.2 edge connector is static sensitive and should be handled carefully. The M.2 connector is not designed for repeated removal and insertion of the module.

Schematics

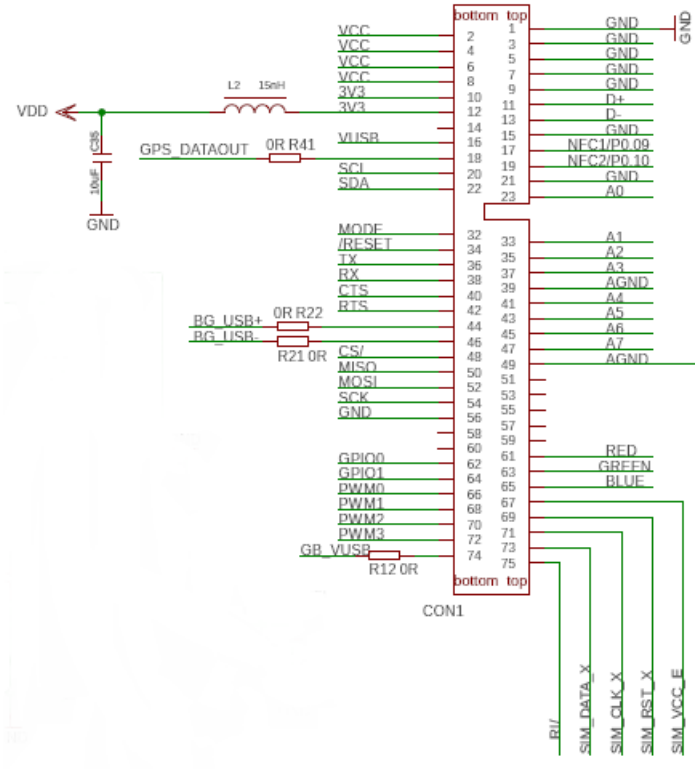
MICROCONTROLLER



QUECTEL CELLULAR MODEM

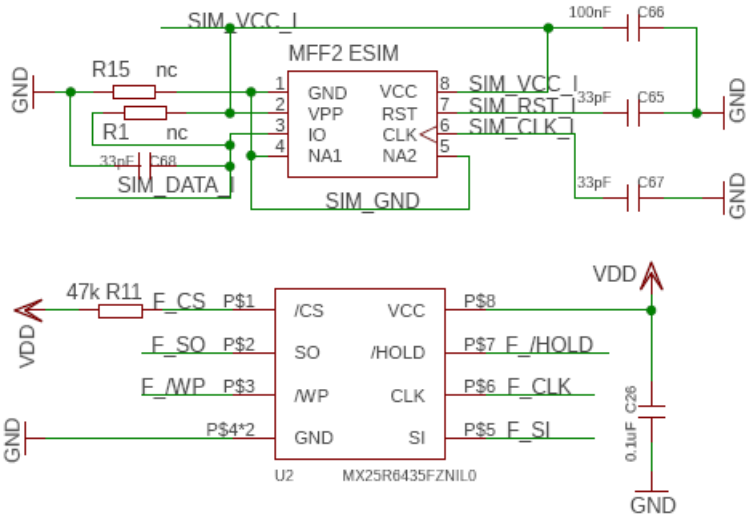


M.2 CONNECTOR

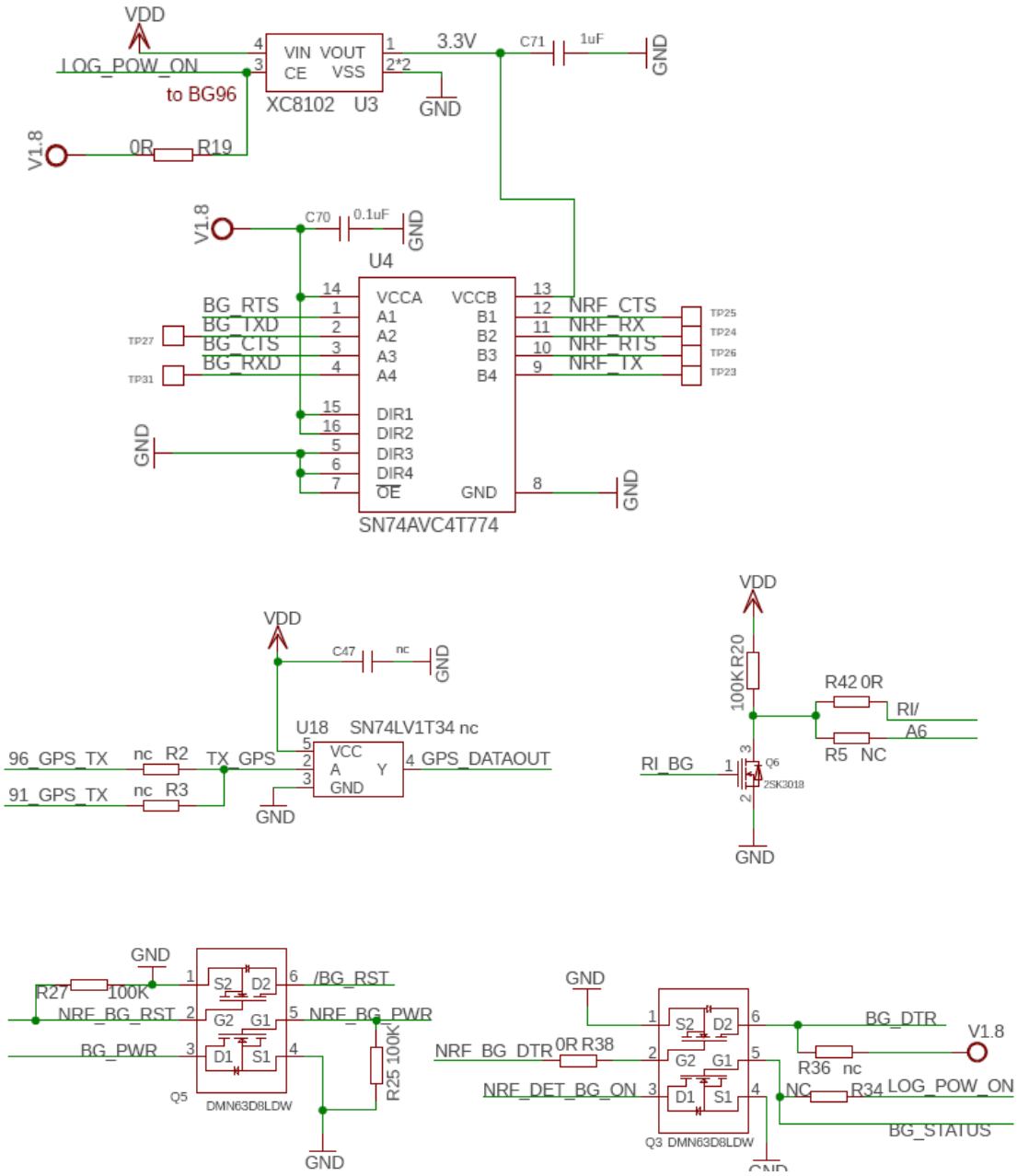


Note: The labels for CTS and RTS are reversed in this schematic.

SIM AND FLASH



BUFFERS


VDD
LOG_POW_ON
to BG96
VIN VOUT
CE VSS
XC8102 U3
3.3V
C71
1uF
GND
V1.8
0R
R19
C70
0.1uF
U4
VCCA
VCCB
A1
B1
A2
B2
A3
B3
A4
B4
DIR1
DIR2
DIR3
DIR4
OE
BG_RTS
BG_TXD
BG_CTS
BG_RXD
NRF_CTS
NRF_RX
NRF_RTS
NRF_TX
TP25
TP24
TP26
TP23
TP27
TP31
SN74AVC4T774
C47
nc
U18
SN74LV1T34 nc
96_GPS_TX
91_GPS_TX
R2
R3
TX_GPS
GPS_DATAOUT
100K R20
R42 0R
RI/
A6
R5 NC
RI_BG
Q6
2SK3018
R27
100K
NRF_BG_RST
BG_PWR
/BG_RST
NRF_BG_PWR
R25 100K
Q5
DMN63D8LDW
NRF_BG_DTR
0R R38
NRF_DET_BG_ON
BG_DTR
R36 nc
NC
R34
LOG_POW_ON
BG_STATUS
Q3 DMN63D8LDW

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 B1 B3 B7 B8 B20 B28 704.5-959.3MHz 1710.7-2687.5 MHz, 25dBm
- WCDMA 882.4-957.6 MHz 1922.6-2167.4 MHz, 25dBm
- EGSM900 880-915 925-960 MHz (35dBm)
- DCS1800 1710-1785 1805-1880 MHz (32dBm)

UNITED KINGDOM

UKCA Conformity:

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

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	2G, 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, 3G, 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, 3G, Cat1	Cosmote, Vodafone, Wind
Guadeloupe	B524	2G, 3G	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
Oman	B524	2G, 3G, Cat1	Ooredoo
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	DigiMobil, 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 (EMEAA) [x1]	EMEAA	EG91-E	✓	GA	
B524MTY	B Series LTE CAT-1/3G/2G (EMEAA), Tray [x50]	EMEAA	EG91-E	✓	GA	
B523MEA	B Series LTE CAT-1/3G/2G (Europe) [x1]	EMEAA	EG91-E		NRND	B524MEA
B523MTY	B Series LTE CAT-1/3G/2G (Europe), Tray [x50]	EMEAA	EG91-E		Deprecated	B524MTY

- 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