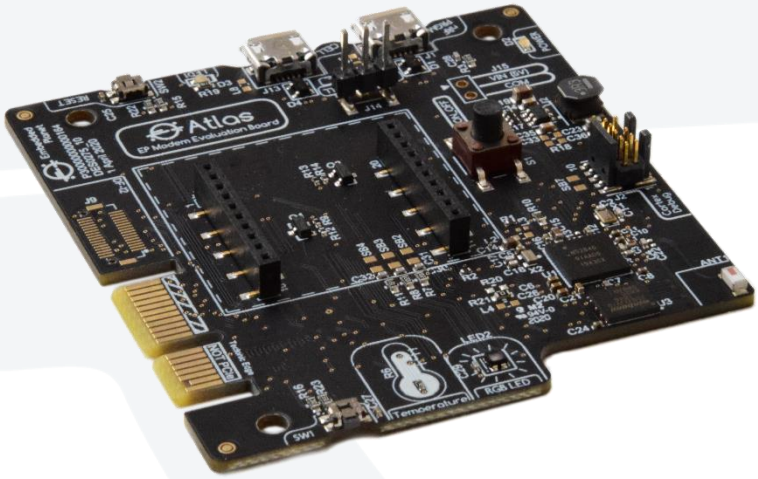
Atlas

Modem Development Board with MCU + Bluetooth + Interactive Elements

Product User Manual

Embedded Planet Inc. | v1.0.2 | 25 Mar 2024



www.embeddedplanet.com

About This Manual

The **Atlas User Manual** provides detailed information encompassing the design, description, and integration of the Atlas device by Embedded Planet. For elaboration on drawings, software, or other specific product details there may be other sources of information to which this document points as reference. For the latest documentation, including document & certification updates, please always refer to the Embedded Planet documentation page: https://www.embeddedplanet.com/product-documentation

Product Web Page

The **Atlas product page** by Embedded Planet provides description & resources related to this product. This page can be located at https://www.embeddedplanet.com/chronos/#atlas

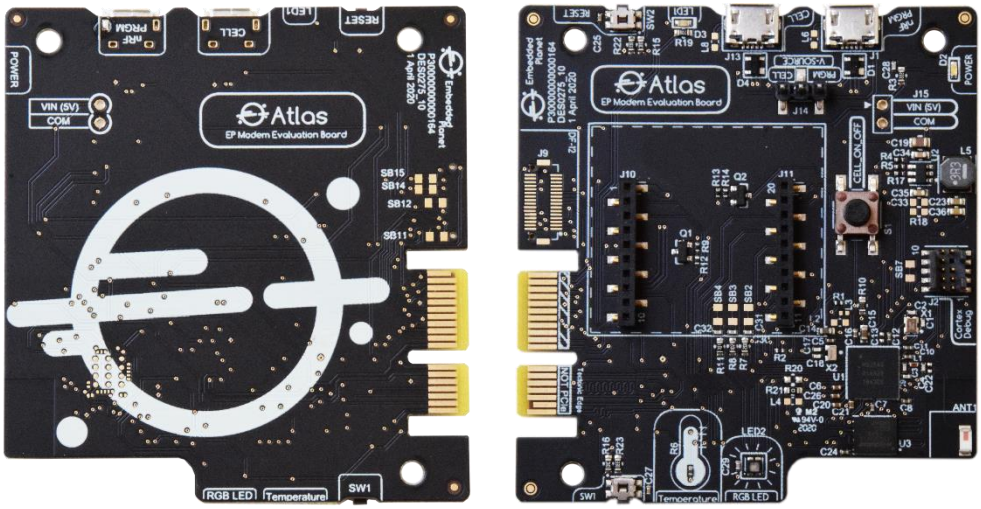
Acrynyms & Abbreviations

Term	Description
EP / EPI	Embedded Planet Inc.
ToF	Time-of-Flight
IoT	Internet of Things
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
I/O	Inputs/Outputs
GPIO	General Purpose Inputs / Outputs
IC	Integrated Circuit [component]
BT	Bluetooth
BLE	Bluetooth Low Energy
IMU	Inertial Measurement Unit [sensor]
LiPo	Lithium-Ion Polymer
SW	Software
FW	Firmware
HW	Hardware
NC	No connect (unconnected)

Contents

1. Introduction

Atlas is a modem development board that assist in programming, debugging, and testing embedded cell modem products from Embedded Planet. An nRF52840 MCU acts as the host processor that can manage the attached cellular modem and act as a programming/debugging interface. This MCU module also includes a Bluetooth function that is leveraged on this product using an onboard chip antenna. Additional onboard prototyping features include an onboard resistive temperature sensor, GPIO-connected pushbutton input, GPIO-controlled RGB LED, programming/debugging USB-micro connector, cell module passthrough USB-micro connector, power selection header, Cortex debug header, and more. The Tectonic Edge™ connector on the Atlas board itself allows it to be programmed by Flidor or integrated with other EP development tools & adapters. The Atlas board can also be programmed/accessed using the Cortex debug/programming header.



Power your modem devices

Designed with the Chronos embedded cellular modem by Embedded Planet in mind, the Atlas board features a 2×10 modem header for seamless connection to Chronos. Atlas is also capable of operating with the 2x10 modem header configuration of the Agora module.

Agora is an IoT solution platform that incorporates the processing power of an onboard MCU with the wireless connectivity of cellular, Bluetooth, & LoRa while collecting sensor data. Onboard sensors can include 6-axis IMU, 9-axis IMU, Time-of-Flight (ToF) distance, temperature/humidity, temperature/humidity/pressure/VOC gas, and sound/microphone. The cellular module is available in configurations that include GNSS capabilities. Some configurations of Agora include custom plastics & a LiPo battery with recharging capabilities. Agora can operate as a standalone module or be integrated into new or existing hardware designs. To learn more about Agora & how to leverage its capabilities, visit https://www.embeddedplanet.com/agora.

2. Additional Resources

- Atlas:
  https://www.embeddedplanet.com/chronos/#atlas

- Chronos module:
  https://www.embeddedplanet.com/chronos

- Embedded Planet Documentation:
  - Atlas
    - https://www.embeddedplanet.com/product-documentation/#atlas
  - Chronos Development Kit (includes Atlas)
    - https://www.embeddedplanet.com/product-documentation/#chronoskit

3. Feature Callouts

3.1. Feature Callouts | Connectors & Hardware

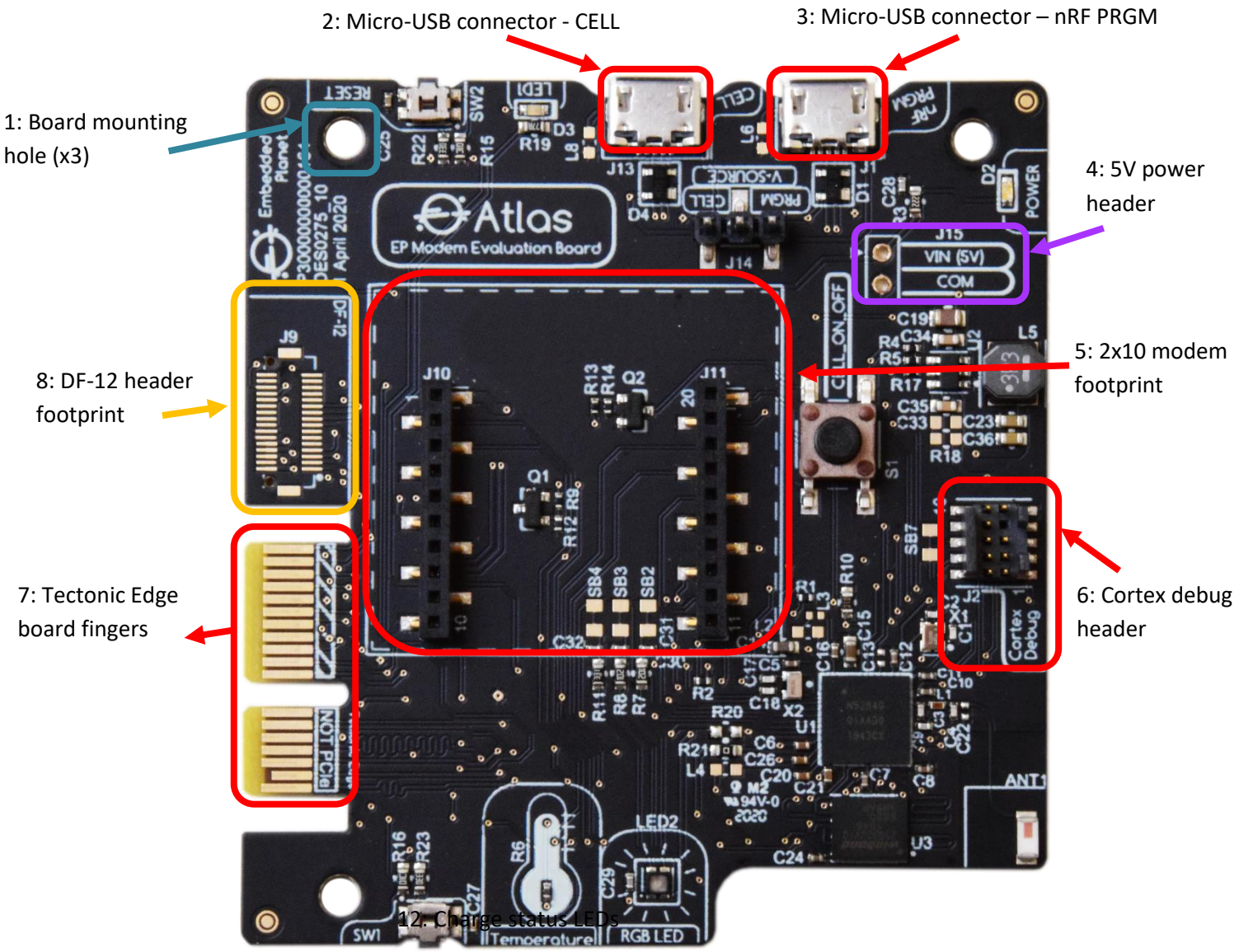


TABLE 1 - BOARD CONNECTORS & HARDWARE

Category	Reference	Part	Component Type	Description / Purpose
Mechanical	1	MH1-3	Board mounting holes	Mounting holes for use with mounting hardware
Connector	2	J13	USB-Micro connector	To cell module: pass-through (debug console)
Connector	3	J1	USB-Micro connector	To nRF MCU: target FW image (programming)
Connector	4	J15	Through-hole header	Taps into 5Vdc input. Tied to VBUS.
Connector	5	J10-11	2x10 modem footprint	Modem footprint. Chronos & Agora compatible
Connector	6	J2	Pin header	Cortex debug header
Connector	7	TE1	Tectonic Edge™	Board Edge/Finger interface for Agora
Connector	8	J9	DF-12 header	For use with DF-12 sensor boards. Pin configurable.

3.2. Feature Callouts | Development Features

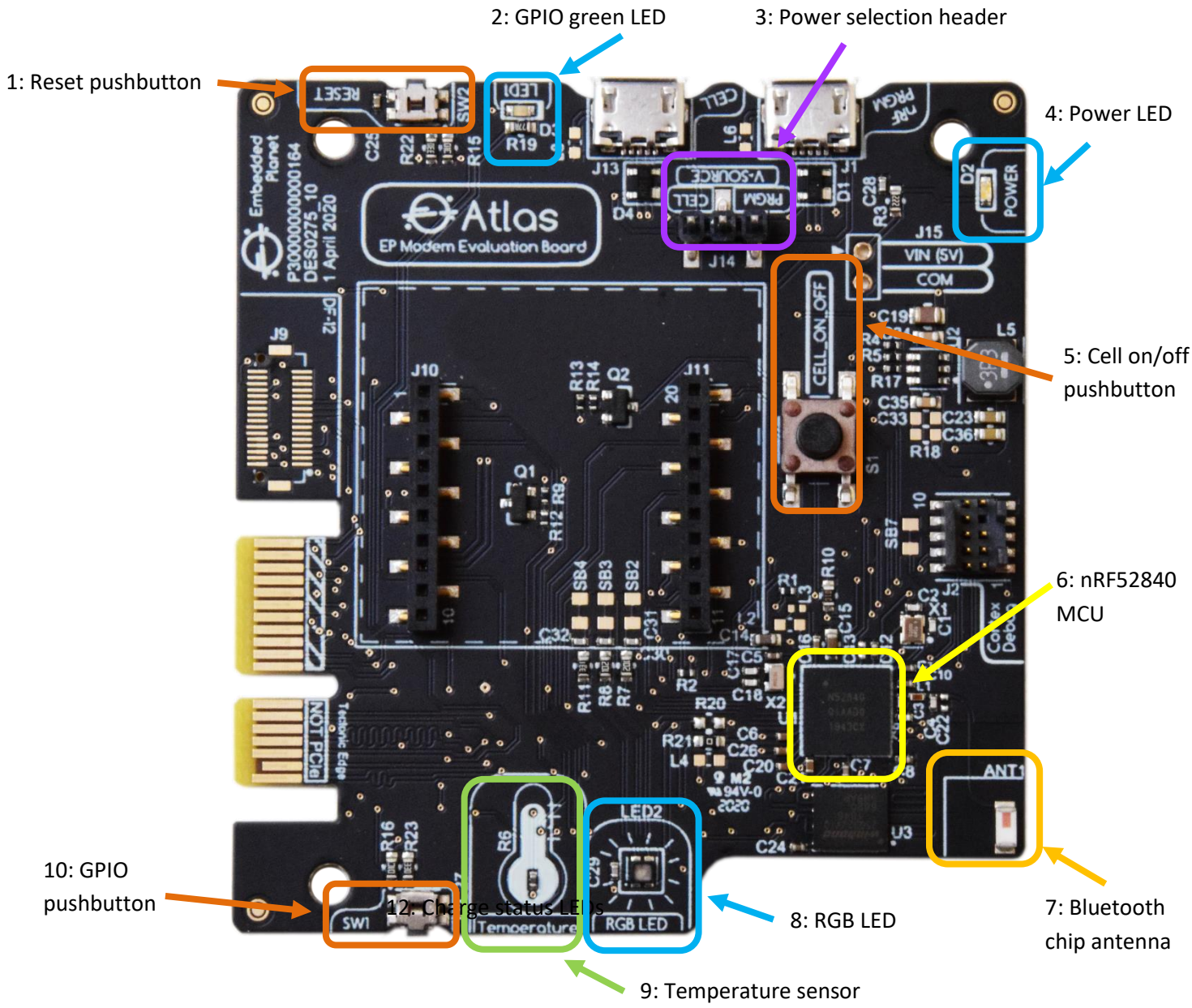
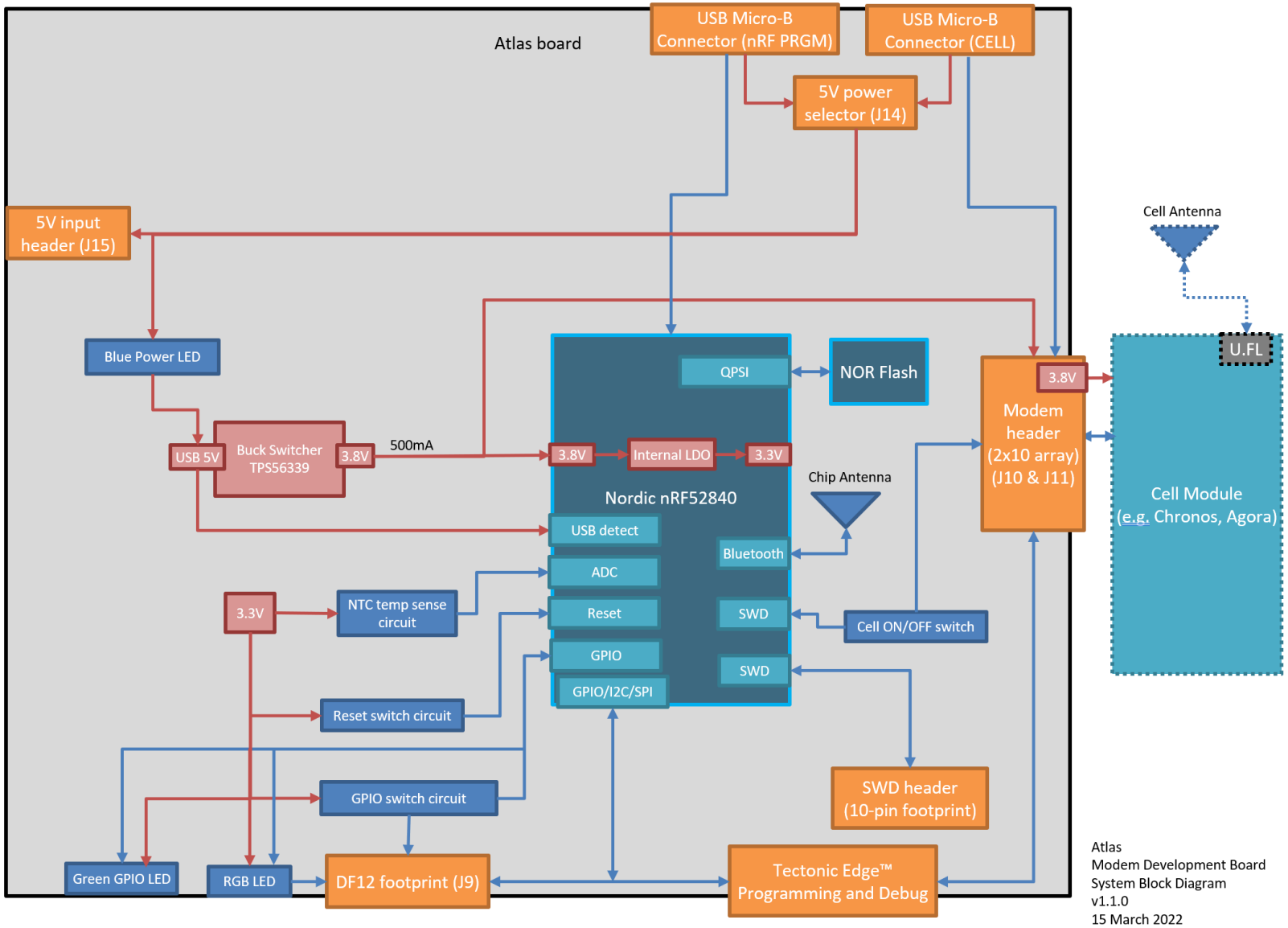


TABLE 2 - BOARD CONNECTORS & HARDWARE

Category	Reference	Part	Component Type	Description / Purpose
Connector	1	SW2	RESET pushbutton	Press to reset the nRF52 MCU. Tied to TE1
Pushbutton	2	LED1	Green LED	GPIO-controlled indicator. Active-low, P0.06
Connector	3	J14	Power selection header	Use shunt to select USB power input source
Connector	4	D2	Power LED	Blue LED – illuminates while system is powered
Connector	5	S1	CELL_ON_OFF button	Pushbutton that can change the modem's mode
Pushbutton	6	U1	Host MCU	nRF52840
Mechanical	7	ANT1	Bluetooth chip antenna	See antenna section for spatial recommendations
Mechanical	8	LED2	RGB LED	3-channel colored GPIO LED. P0.08, P1.09, P0.12
Connector	9	R6	Temperature sensor	Resistive temp sensor. AIN0
Connector	10	SW1	GPIO pushbutton	GPIO input. Active-low. P1.06

4. System Block Diagram



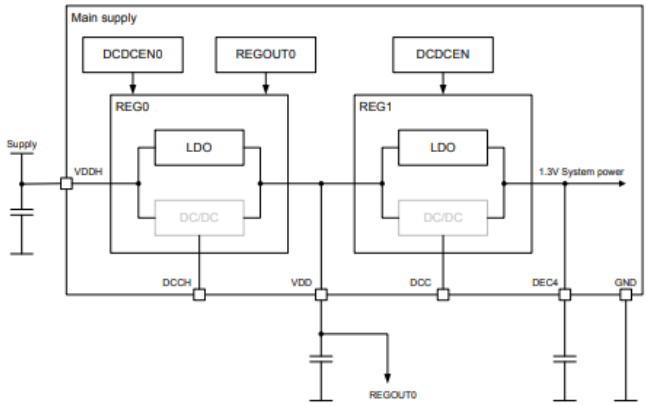
5. Device Specifications

TABLE 3 – DEVICE SPECIFICATIONS

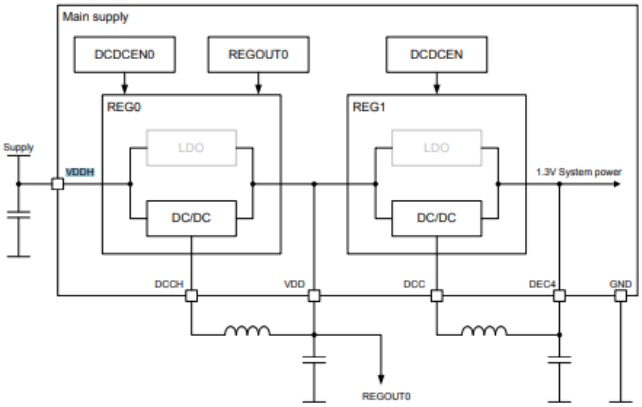
Feature/Specification	Description
Wireless Capability	**Bluetooth** (nRF52840)
Programming Interfaces	2x5 Cortex debug header USB-micro connector Tectonic Edge connector
DC Input Voltage	**5V** (input voltage range: 4.5V-5.5V)
Dimensions	**2.73 in x 2.52 in x 0.45 in** (69.28 mm x 64 mm x 11.33 mm)
Environmental	**Operating Temperature Range**: -25°C to +75°C
Sensors/Input	**Temperature:** NTC resistive element **Pushbutton:** GPIO-connected, active-low` **DF-12 connector**: For 3rd-party sensor platforms
Indicators/Output	**Green LED:** GPIO-controlled **Red/Green/Blue LED:** GPIO-controlled (3-channel) **DF-12 connector footprint**: For 3rd-party sensor platforms – footprint only

6. Power

The Atlas board is designed to accept a 5Vdc input which it then regulates down to 3.8V for the target cellular module (U2: TPS56x209). The 5Vdc input also directly powers the nRF52840 MCU, leveraging its internal regulator functionality to achieve a system voltage of 3.3V (VDD_nRF). The nRF52840 is set up to operate in High Voltage mode; this operation mode supports both an LDO configuration and a DC/DC configuration. The Atlas board is designed to accommodate the hardware for using either of these two configurations in the High Voltage mode. For more on the nRF52840's regulators, please see https://www.nordicsemi.com/Products/nRF52840.

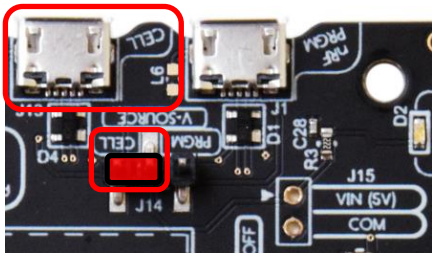


LDO only configuration

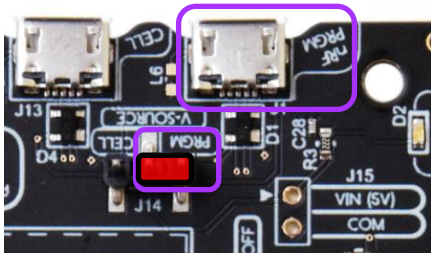


DC/DC for REG0 and REG1 enabled

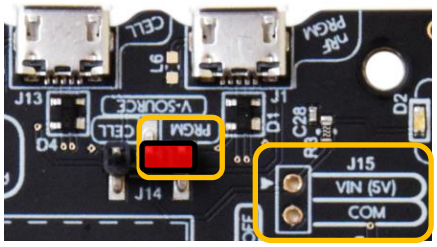
Power to the Atlas board can be supplied through either USB-micro connector, through the Tectonic Edge™ connector, or through the VIN header (J15). The voltage source selection header (J14), labeled "V-SOURCE", is used to select which input will supply power to the board. For power to be sourced from the CELL USB connector, the shunt jumper should be positioned to connect the middle pin with the pin labeled, "CELL". For power to be sourced from the nRF PRGM USB connector OR via the Tectonic Edge™ connector, the shunt jumper should be positioned to connect the middle pin with the pin labeled, "PRGM".



USB power on "CELL" connector



USB power for "nRF PRGM" connector

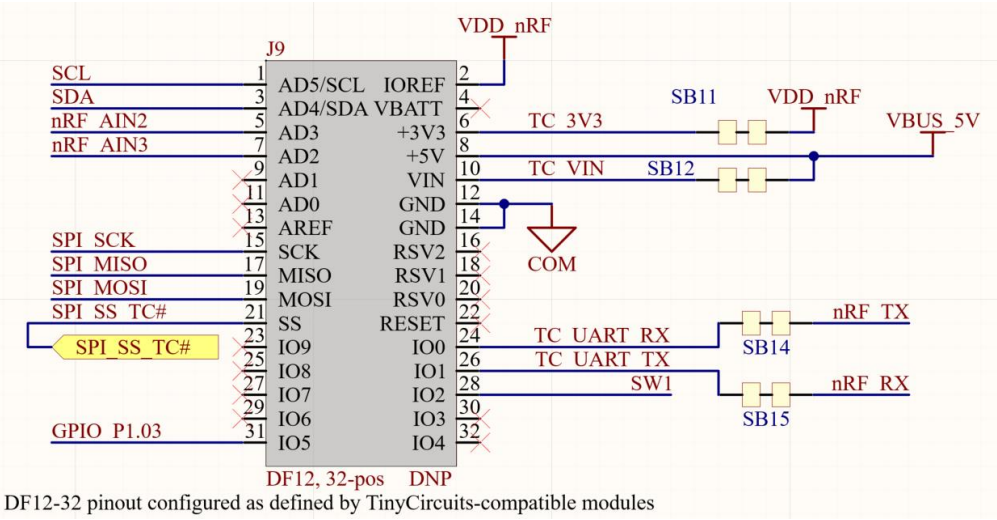


5V power for J15 header

LED D2 ("POWER") illuminates blue when 5V power is supplied to the system voltage input.

7. DF-12 Footprint

The Atlas device features a DF-12 footprint for use with connectors for 3rd party sensors & peripheral hardware. An example type of peripheral hardware would be the sensors collection offered by TinyCircuits™ (https://tinycircuits.com/collections/sensors). The pinout for the footprint is depicted below. The default configuration of Atlas accommodates the *footprint only* and does not include the connector itself. Some signals have solder bridge connections for various configuration options. These solder bridges are denoted by the prefix "SB" in the schematic element below. For more information on using solder bridges, refer to the "Development" section of this manual.



DF12-32 pinout configured as defined by TinyCircuits-compatible modules

TABLE 4 – DF-12 FOOTPRINT PINOUT (J9)

Signal	Pin	Name	Option
SCL	1	SCL	-
SDA	3	SDA	-
nRF_AIN2	5	AD3	-
nRF_AIN3	7	AD2	-
nc	9	AD1	-
nc	11	AD0	-
nc	13	AREF	-
SPI_SCK	15	SCK	-
SPI_MISO	17	MISO	-
SPI_MOSI	19	MOSI	-
SPI_SS_TC#	21	SS	-
nc	23	IO9	-
nc	25	IO8	-
nc	27	IO7	-
nc	29	IO6	-
GPIO_P1.03	31	IO5	-

Signal	Pin	Name	Option
VCC_nRF	2	IOREF	-
nc	4	VBATT	-
VDD_nRF	6	+3V3	SB11
VBUS_5V	8	+5V	-
VBUS_5V	10	VIN	SB12
COM	12	GND	-
COM	14	GND	-
nc	16	RSV2	-
nc	18	RSV1	-
nc	20	RSV0	-
nc	22	RESET	-
nRF_TX	24	IO0	SB14
nRF_RX	26	IO1	SB15
SW1	28	IO2	-
nc	30	IO3	-
nc	32	IO4	-

*Signals named "nc" are unconnected signals

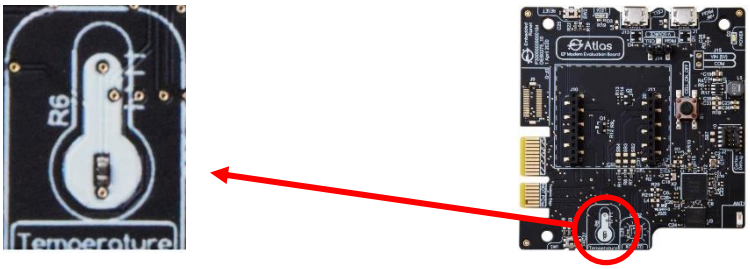
8. Input

8.1. Input | Temperature

The Atlas board has a basic resistive temperature sensor using an NTC thermistor. The nominal 10k ohm thermistor (R6) is placed between power net VDD_nRF and the analog pin input (nRF52840: A12, P0.02/AIN0). It is balanced by a 10k oh 0.1% SMD resistor (R10) placed between the analog input pin (AIN0) and COM. The temperature sensor can be used as part of a functional application, or it could be used for simple development purposes to test/trigger the behavior of the nRF or cell modem (via the nRF). An easy way to elicit a fast response from an application leveraging the temperature can be to place a finger on it and see the system react to the change in temperature as programmed.

The thermistor component has the following specifications:

- 25°C rating of 10k ohms
- ±1% resistance tolerance at 25°C
- B-constant value of 3380K (25°C/50°C)
- Operating temperature range of -40°C to 120°C



8.2. Input | Buttons

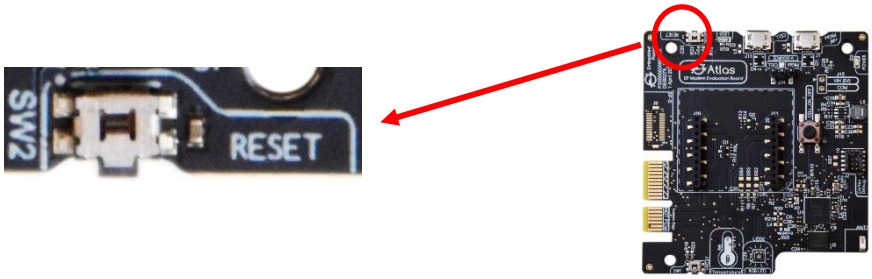
The Atlas board features 3 different pushbutton inputs.

1. **GPIO (SW1)**

   SW1 is a side-action GPIO pushbutton input. It is directly connected to nRF52840 GPIO pin R24/P1.06. The input signal line is tied high by a 10k resistor and debounced with a small capacitor. Pushing the button is an active-low signal.

2. RESET (SW2)

The RESET pushbutton is a side-action button with a structure similar to the GPIO pushbutton. It is directly connected to nRF52840 GPIO pin AC13/P0.018/RESET. The input signal line is tied high by a 10k resistor and debounced with a small capacitor. Pushing the button is an active-low signal.



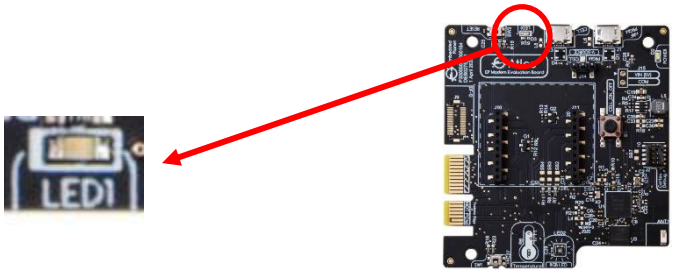
3. CELL_ON_OFF (S1)

The CELL_ON_OFF top-action pushbutton is often essential to manually operating the cell modem. This signal can command the cell modem, such as a Chronos, to turn on or off. The signal is connected from nRF52840 GPIO pin A8/P0.31 to an NPN transistor with driving hardware (open-collector cell modem pin input) to pushbutton S1 to the connected cell module. Pushing the button drives the CELL_ON_OFF line to 0V and is an active-low signal.

9. Indicators

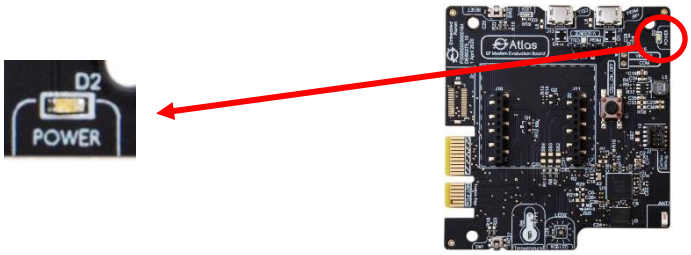
9.1. Indicators | LED1

The GPIO LED on the Atlas board (“LED1”, D2) is a simple GPIO-controlled indicator for use with development, debug, and gene application use. The LED is green and is driven by nRF52840 pin L1 (P0.06). Illuminating the LED is an active-low signal. With a system voltage of 3.3V the LED is designed to draw about 5mA of current.



9.2. Indicators | Power LED

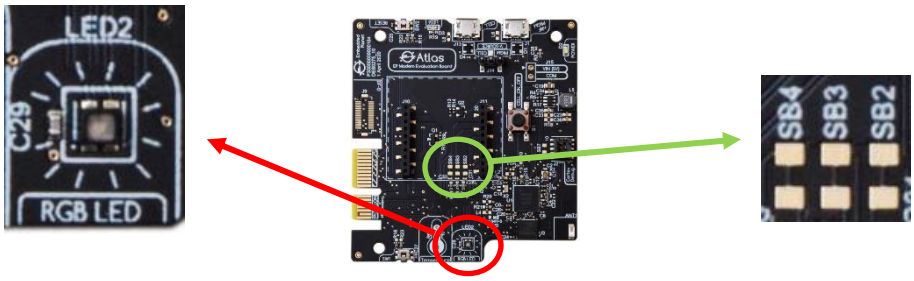
LED D2 (“POWER”) illuminates blue when power is supplied to the 5V system voltage input. This power net is connected to pin 2 of J14, the input of 3.8V regulator U2 (pin 3), and the high voltage input VDDH of the nRF52840.



9.3. Indicators | RGB LED

The RGB LED on Atlas provides a simple way to develop, debug, and operate applications by using combinations of on/off states, colors, & blinking/fading patterns. The LED uses 3 color channels (Red, Green, Blue). Each color channel is controlled by a separate GPIO pin on the nRF52840:

- Red: N1 (P0.08)
- Green: R1 (P1.09)
- Blue: U1 (P0.12)

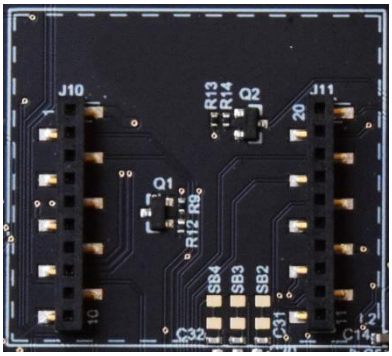


Each color channel signal is active-low. It is possible to use the RGB LED lines as GPIO by soldering connections to the solder bridges SB2, SB3, and SB4. Additionally, the LEDs can be cut off from these signals by carefully severing the trace for each channel between the normally closed solder bridge pads corresponding to that channel: Red = SB2, Green = SB3, Blue = SB4.

10. Modem Pin Header

TBD

Signal	Pin	Notes
Vcell	1	
DOUT	2	
DIN	3	
GND	4	
RSVD	5	
VUSB	6	
USB_DP	7	
USB_DN	8	
DTR	9	
GND	10	



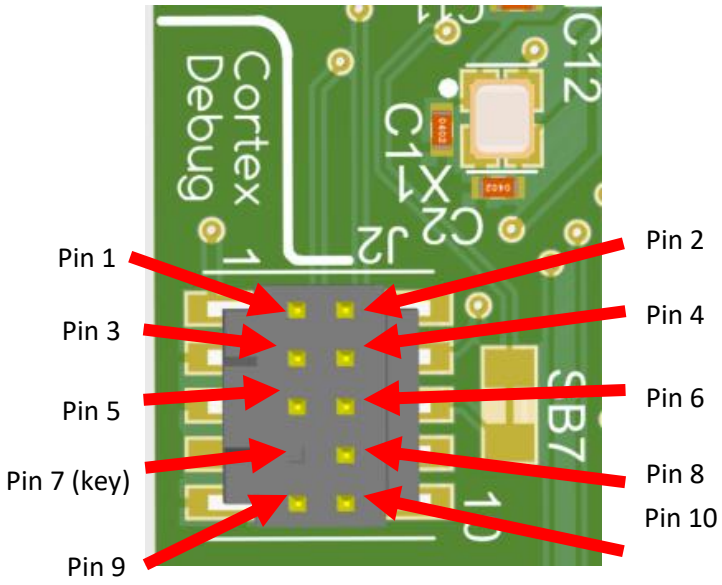
Signal	Pin	Notes
ON_OFF	1	
RING	2	
RX_AUX	3	
TX_AUX	4	
RTS	5	
GND	6	
Vcell_ref	7	
PWR_MON	8	
CTS	9	
GND	10	

11. Cortex Debug Header

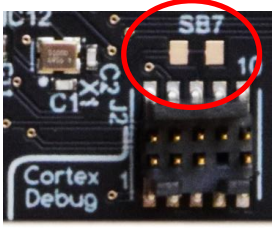
Header J2 provides SWD/JTAG access to the nRF52840 on the Atlas board. The signal lines of this connector are also tied to the Tectonic Edge™ board fingers so that the Atlas nRF52840 can also be programmed using a Flidor board by Embedded Planet.

TABLE 5 – PROGRAMMING HEADER PINOUT (J6)

Signal	Pin	Notes
Vcc	1	+3.3V
SWDIO/TMS	2	+3.3V
GND	3	0V
SWDCLK/TCK	4	+3.3V
GND	5	0V
SWO/TDO	6	+3.3V
KEY	7	*Key pin*
NC/TDI	8	+3.3V
GNDDetect	9	0V
RESET#	10	0V – 3.3V



Solder Bridge SB7 is a normally closed pad connection that can allow the SWO signal to J2 to be broken by cutting the trace between the footprint pads. The connection can be re-established by soldering a 0-ohm, 0805 SMD resistor to the footprint pads.



12. Tectonic Edge™

The Atlas board is able to interface with other devices by Embedded Planet using the Tectonic Edge™ board connection ecosystem. This allows easy programming & debugging of the Atlas board using a Flidor programmer board, or the expansion of data signals using Tectonic Edge™ adapter boards. The signals that are routed over the Tectonic Edge™ connector are depicted in the following pages.

For more detail on the Tectonic Edge™ connection system, please refer to the Agora product user manual: https://www.embeddedplanet.com/product-documentation/#agora.

Tectonic Edge™: Top View

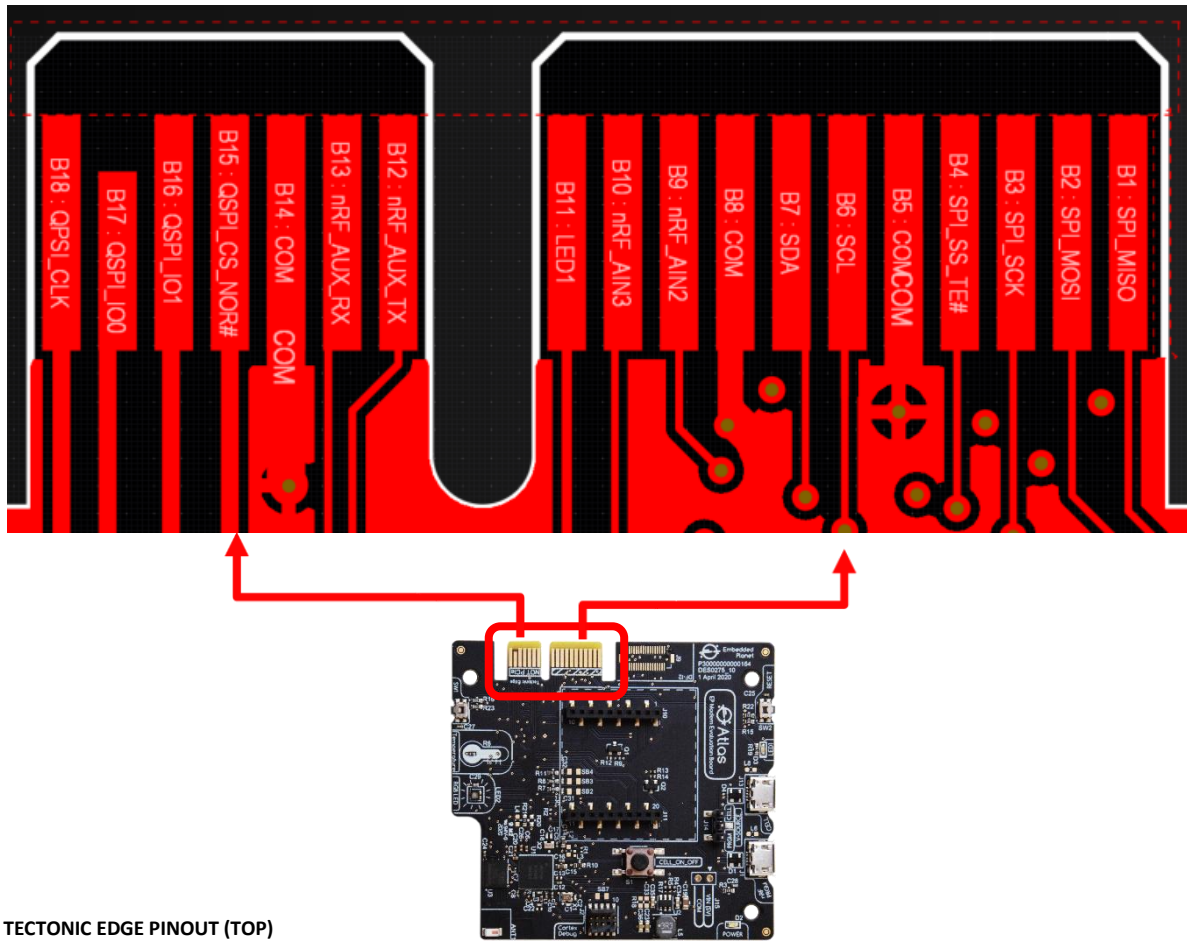


TABLE 6 – TECTONIC EDGE PINOUT (TOP)

Tectonic Edge™ Pin	Function	Connected to	nRF52840 Pin	Voltage
B1	SPI_MISO	SPI data in (nRF)	P1.13	3.3 VDC
B2	SPI_MOSI	SPI data out (nRF)	P1.12	3.3 VDC
B3	SPI_SCK	SPI clock	P1.14	3.3 VDC
B4	SPI_SS_TE#	SPI select for TE target (active-low)	P0.07	3.3 VDC
B5	**Common**	**COM**	**n/a**	**COM**
B6	SCL	I2C	P0.27	3.3 VDC
B7	SDA	I2C	P0.26	3.3 VDC
B8	**Common**	**COM**	**n/a**	**COM**
B9	nRF_AIN2	Unassigned. Tied to DF-12 connector	P0.04/AIN2	3.3 VDC
B10	nRF_AIN3	Unassigned. Tied to DF-12 connector	P0.05/AIN3	3.3 VDC
B11	LED1	Green GPIO LED (active-low)	P0.06	3.3 VDC
B12	nRF_AUX_TX	Aux UART for nRF52840	P0.13	3.3 VDC
B13	nRF_AUX_RX	Aux UART for nRF52840	P0.16	3.3 VDC
B14	**Common**	**COM**	**n/a**	**COM**
B15	QSPI_CS_NOR#	QPSI Flash select (active-low)	P0.17	3.3 VDC
B16	QSPI_IO1	QPSI Flash data	P0.21	3.3 VDC
B17	QSPI_IO0	QPSI Flash data	P0.20	3.3 VDC
B18	QSPI_CLK	QPSI Flash clock	P0.19	3.3 VDC

Tectonic Edge™: Bottom View

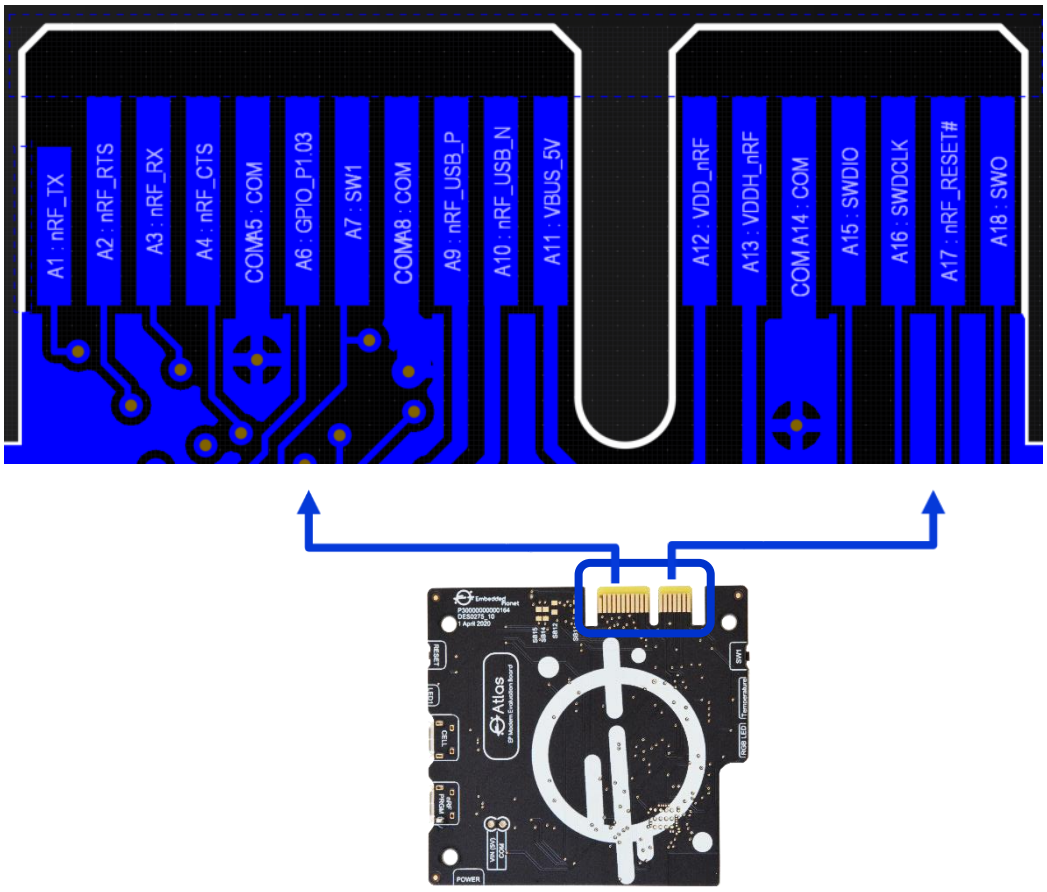


TABLE 7 – TECTONIC EDGE PINOUT (BOTTOM)

Tectonic Edge™ Pin	Function	Connected to	nRF52840 Pin	Voltage
A1	nRF_TX	nRF UART TX	P1.02	3.3 VDC
A2	nRF_RTS	nRF UART RTS	P0.11	3.3 VDC
A3	nRF_RX	nRF UART RX	P1.01	3.3 VDC
A4	nRF_CTS	nRF UART CTS	P1.08	3.3 VDC
A5	**Common**	**COM**	**n/a**	**COM**
A6	GPIO_P1.03	General Purpose	P1.03	3.3 VDC
A7	SW1	GPIO pushbutton	P1.06	3.3 VDC
A8	**Common**	**COM**	**n/a**	**COM**
A9	nRF_USB_P	USB D+ (nRF52840)	D+	3.3 VDC
A10	nRF_USB_N	USB D- (nRF52840)	D-	3.3 VDC
A11	VBUS_5V	VBUS (nRF52840)	VBUS	5 VDC
A12	VDD_nRF	System voltage	VDD	3.3 VDC
A13	VDDH_nRF	High input voltage	VDDH	1.7-5 VDC
A14	**Common**	**COM**	**n/a**	**COM**
A15	SWDIO	Cortex Debug Header	SWDIO	3.3 VDC
A16	SWDCLK	Cortex Debug Header	SWDCLK	3.3 VDC
A17	nRF_RESET#	Cortex Debug Header	P0.18/RESET	3.3 VDC
A18	SWO	Cortex Debug Header	P1.00	3.3 VDC

13. Pinouts

13.1. Pinouts: MCU Pinout

TABLE 8 – MCU PINOUT (NRF52840)

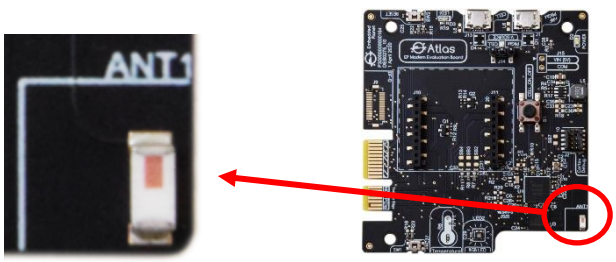
nRF52840 pin	Function	Connected to
P0.26/SDA	SDA	Sensors
P0.27/SCL	SCL	Sensors
P0.00/XL1	32.768kHz	Crystal
P0.01/XL2	32.768kHz	Crystal
P0.02/AIN0	Battery Voltage ADC	Battery Voltage Monitor
P0.03/AIN1	Board ID ADC	Board ID resistor divider
P0.09/NFC1	NFC	JST connector
P0.10/NFC2	NFC	JST connector
VDD	Power	Vin
GND	Common	COM
P0.11/TRACEDATA2	LoRa_MOSI/TRACEDATA2	LoRa Module
P1.00/TRACEDATA0	SWO/TRACEDATA0	EP Debug Header
P0.13	Debug_TX	EP Debug Header and cell aux UART
P0.18/nRESET	BT840 Reset	EP Debug Header
SWCLK	SWD clock	EP Debug Header
SWDIO	SWD data	EP Debug Header
VSS	Common	COM
P0.28/AIN4	CELL_PWR_EN	Telit cell module
P0.29/AIN5	PB	Pushbutton
P0.04/AIN2	INT_LIGHT_TOF	Light sensor INT and ToF sensor INT
P0.05/AIN3	LED_RED	LED
P0.07/TRACECLK	LoRa_SCLK/TRACECLK	LoRa Module
P1.08	CELL_CTS	Telit cell module
VSS	Common	COM
P0.25	I2S_SD	Microphone
P0.30/AIN6	CELL_ON_OFF	Telit cell module
P0.31/AIN7	SENSOR_PWR_EN	Load Switch
P0.06	I2S_SCK	Microphone
P0.08	I2S_WS	Microphone
P1.03	CELL_DSR	Telit cell module
VSS	Common	COM
P0.24	CELL_HW_SHUTDOWN	Telit cell module
P0.22	QSPI IO2	QPSI Flash
P0.17	QSPI CS#	QPSI Flash
P0.15	CELL_DCD	Telit cell module
P1.02	CELL_TX	Telit cell module
P1.04	CELL_DTR	Telit cell module
VSS	Common	COM
P0.23	QSPI IO3	QPSI Flash

P0.19	QSPI CLK	QPSI Flash
P0.16	Debug_RX	EP Debug Header and cell aux UART
P0.14	CELL_RTS	Telit cell module
P1.01	CELL_RX	Telit cell module
P1.05	INT_ACCEL	6-axis or 9-axid INT
P1.07	LoRa_DIO0	LoRa Module
P0.20	QSPI IO0	QPSI Flash
P0.21	QSPI IO1	QPSI Flash
P1.09/TRACEDATA3	LoRa_SS#/TRACEDATA3	LoRa Module
D+	USB	EP Debug Header
D-	USB	EP Debug Header
P0.12/TRACEDATA1	LoRa_MISO/TRACEDATA1	LoRa Module
VSS	Common	COM
VSS	Common	COM
VSS	Common	COM
VSS	Common	COM
VDDH	Power	Vin
DCCH	Power	NC
VBUS	USB	EP Debug Header
P1.11	BATT_MON_EN	Battery Voltage Monitor
P1.12	LoRa_DIO1	LoRa Module
P1.13	LoRa_DIO2	LoRa Module
P1.14	LoRa_DIO3	LoRa Module
P1.15	LoRa_DIO4	LoRa Module and cell module PWRMON
P1.10	LoRa_RESET#	LoRa Module
P1.06	Board ID EN#	Board ID resistor divider

For more complete detail on the **nRF52840** MCU please refer to: https://www.nordicsemi.com/Products/nRF52840.

14. Antennae

The Atlas board features one onboard Bluetooth antenna for the nRF52840 and no external antenna connections. The Bluetooth chip antenna is the 2450AT18B100 model by Johanson.



For more on the 2450AT18B100, please refer to https://www.johansontechnology.com/antennas.

15. Electrical Specifications

15.1. Connector Pin Map + Maximum/Minimum Operation Ratings

TABLE 9 – PIN MAP + MAXIMUM/MINIMUM OPERATION RATINGS

Category	Signal	Header	Pin	nRF52840	Min (V)	Typ (V)	Max (V)	Notes
Power	VDD_nRF	J1	1	VDD	1.8	3.3*	3.3	nRF output
		J9	2					
SWD	SWDIO	J1	2	SWDIO	0	3.3*	3.3*	
Power	COM	J1	3	COM	-	0	-	COMMON
SWD	SWDCLK	J1	4	SWDCLK	0	3.3*	3.3*	
Power	COM	J1	5	COM	-	0	-	COMMON
SWO	SWO	J1	6	P1.00	0	3.3*	3.3*	
Mechanical	NC (key)	J1	7	n/a	-	-	-	Conn orientation
NC	NC	J1	8	n/a	-	-	-	Not connected
Power	COM	J1	9	COM	-	0	-	COMMON
RESET	nRF_RESET#	J1	10	P0.18	0	3.3*	3.3*	Active-low
Power	V-SOURCE: PRGM	J14	1	VDDH	4.5	5	5.5	From PRGM USB
Power	V-SOURCE: CELL	J14	3	VDDH	4.5	5	5.5	From CELL USB
Power	V-SOURCE: Pin 2	J14	2	VDDH	4.5	5	5.5	System 5V power input
		J15	1					
Power	COM	J15	2	COM	-	0V	-	COMMON
I2C	SCL	J9	1	P0.27	0	3.3*	3.3*	
I2C	SDA	J9	3	P0.26	0	3.3*	3.3*	
NC	NC	J9	4,9,11,13,16,18,20, 22,23,25,27,29,30,32	-	-	-	-	Not connected
GPIO	nRF_AIN2	J9	5	P0.04	0	3.3*	3.3*	
Power	TC_3V3	J9	6	VDD	1.8	3.3*	3.3	SB11 to VDD_nRF
GPIO	nRF_AIN3	J9	7	P0.05	0	3.3*	3.3*	J1
Power	VBUS_5V	J9	8	n/a	4.5	5	5.5	PRGM USB VBUS†
Power	TC_VIN	J9	10	n/a	4.5	5	5.5	SB12 to VBUS_5V
Power	COM	J9	12, 14	COM	-	0	-	COMMON
SPI	SPI_SCK	J9	15	P1.14	0	3.3*	3.3*	B15
SPI	SPI_MISO	J9	17	P1.13	0	3.3*	3.3*	A16
SPI	SPI_MOSI	J9	19	P1.12	0	3.3*	3.3*	B17
SPI	SPI_SS_TC#	J9	21	P1.11	0	3.3*	3.3*	B19
UART	TC_UART_RX	J9	24	P1.02	0	3.3*	3.3*	SB14 to nRF_TX
UART	TC_UART_TX	J9	26	P1.01	0	3.3*	3.3*	SB15 to nRF_RX
GPIO	SW1	J9	28	P1.06	0	3.3*	3.3*	GPIO pushbutton
GPIO	GPIO_P1.03	J9	31	P1.03	0	3.3*	3.3*	V23

†Set the shunt jumper on J14 to the "PRGM" position

**In high voltage mode (default), the GPIO high level voltage of the nRF52840 is as specified in register REGOUT0*

16. Development

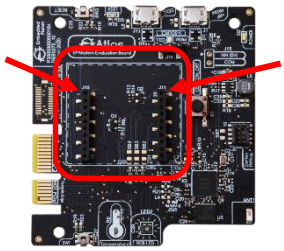
16.1. Development | Programming Atlas

The Atlas boards are shipped with a pre-programmed bootloader that allows them to be programmed with nRF applications from the first time the operator connects to the board.

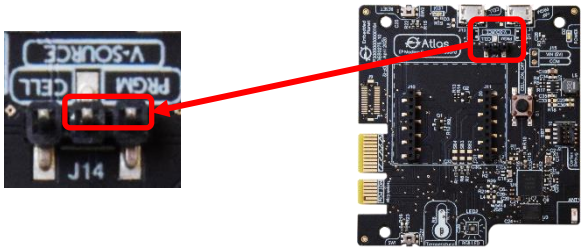
The nRF Connect app is recommended for programming applications to the Atlas board. The app can be obtained here: https://www.nordicsemi.com/Products/Development-tools/nRF-Connect-for-desktop.

To program an Atlas with a demo application, follow the steps below:

1. Start with an unpowered Atlas board.
2. Connect the target modem device to the Atlas board's 20-pin modem header array (J10, J11) - Make sure the pin orientation is correct.

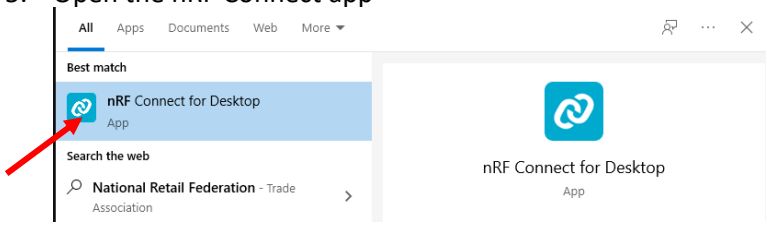


3. Set the shunt jumper for J14 to the "PRGM" position.

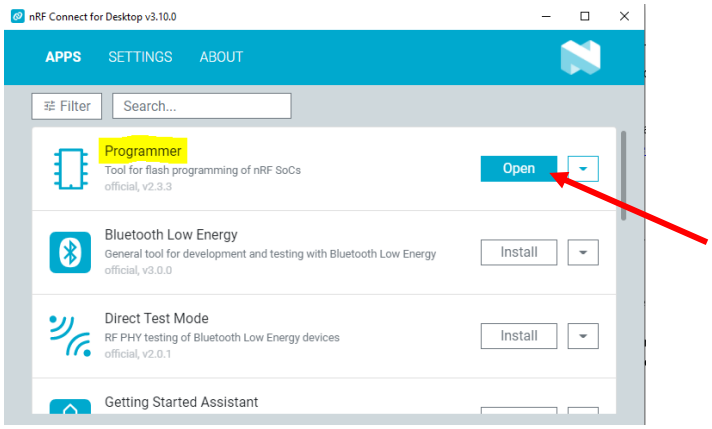


4. Connect a USB-micro cable to the USB port labeled "nRF PRGM" (J13) and connect the other end of the USB cable to the computer.

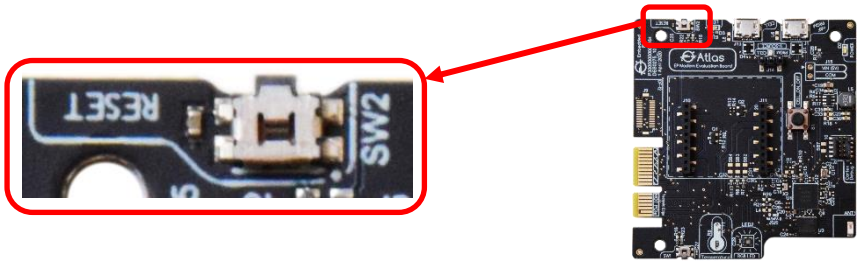
5. Open the nRF Connect app



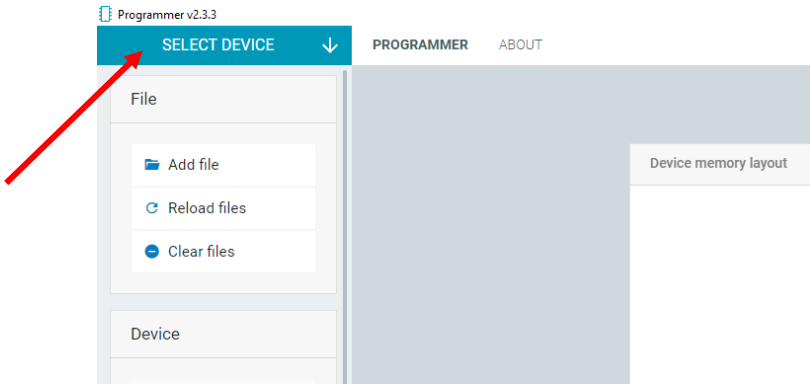
6. Open the Programmer tool



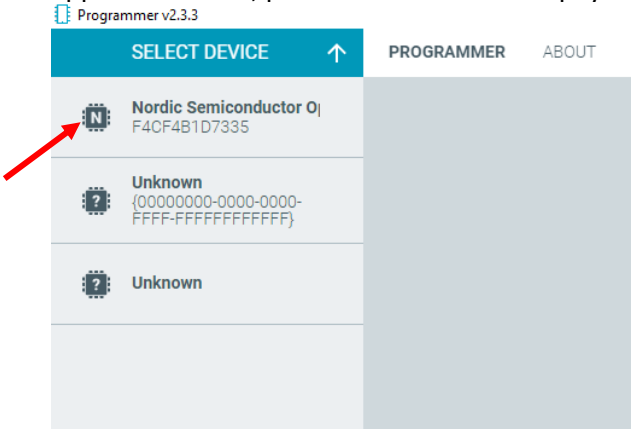
7. Press the “RESET” button on the Atlas board (SW2). This will enumerate the device on the computer.



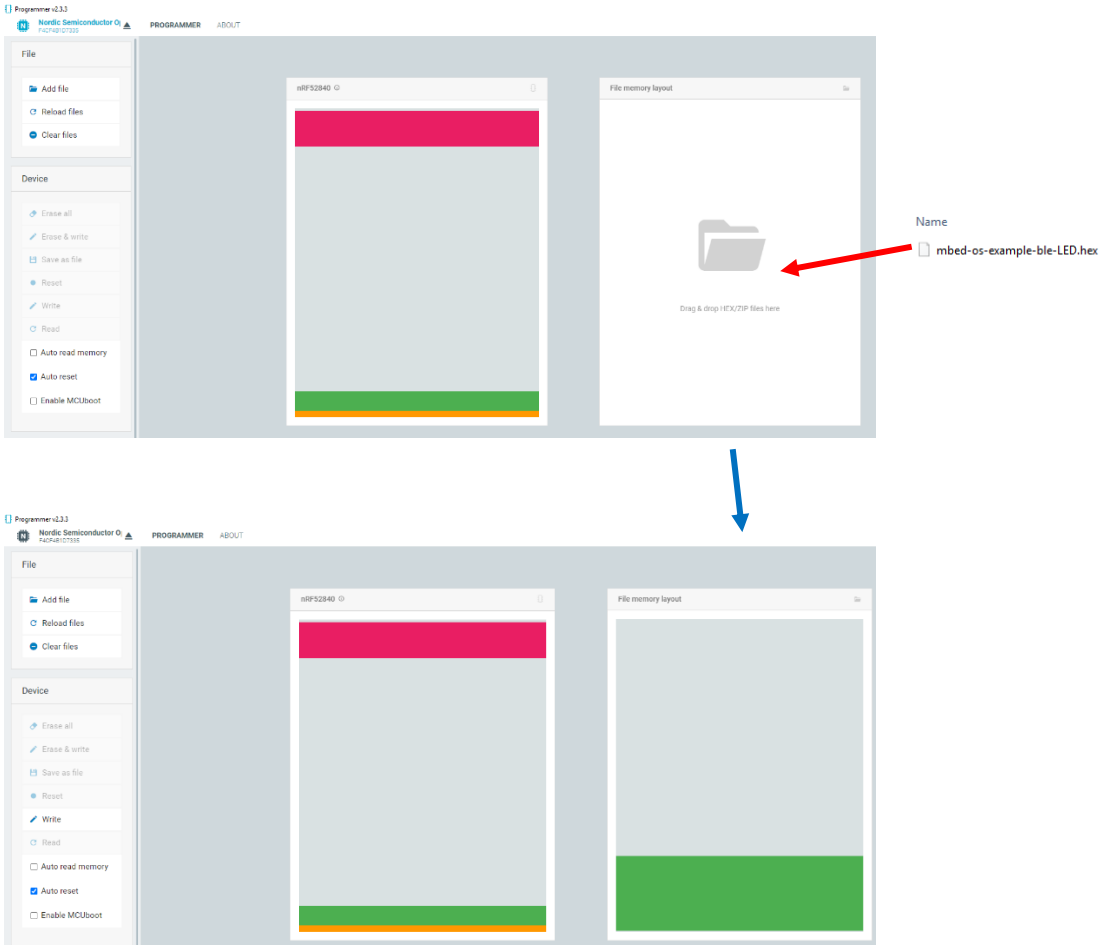
8. Navigate to “Select Device”



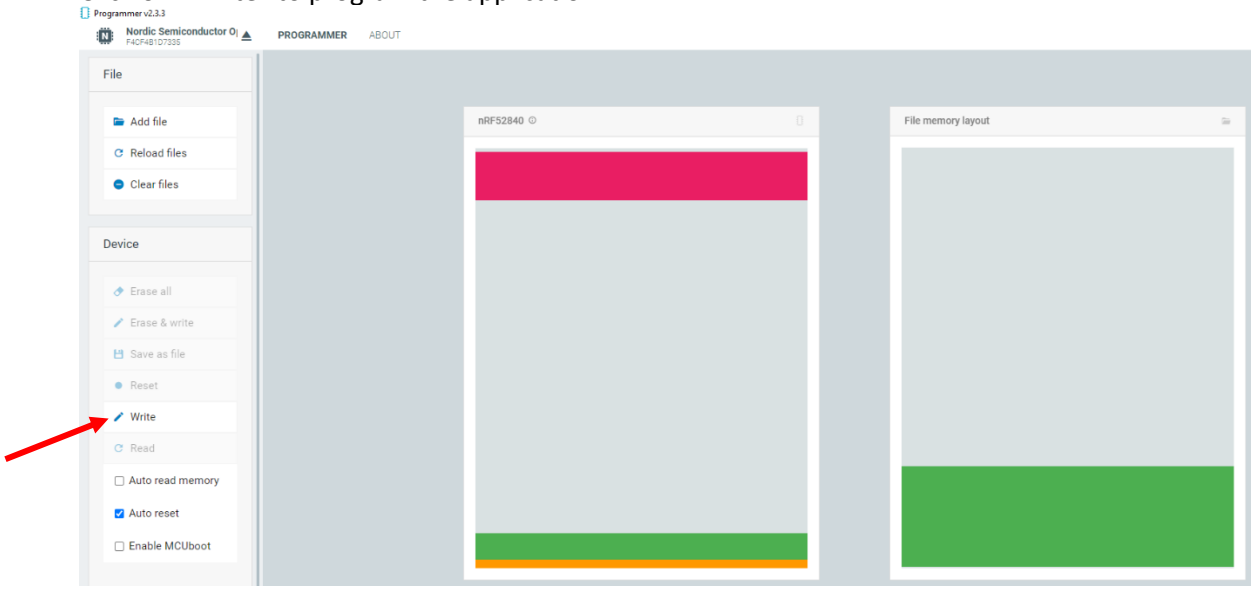
9. Select the “Nordic Semiconductor” entity that appears. If any other Nordic Semiconductor devices appear in the list, please disconnect those physical devices from the computer.



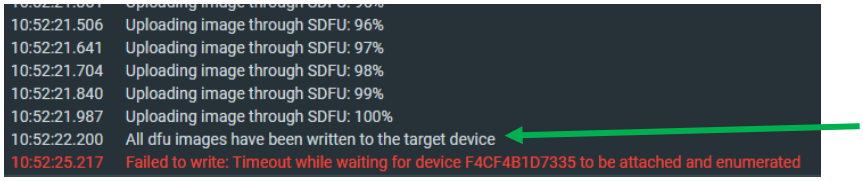
10. Drag and drop the desired application hex file into the “File memory layout” zone



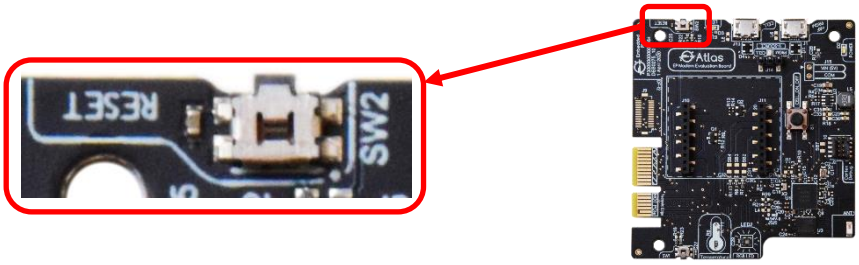
11. Click on “Write” to program the application



12. The application is done programming when the message “All dfu images have been written to the target device”. *Note that an error may follow that says, “Failed to write: Timeout while waiting for device {device id} to be attached and enumerated”. This does NOT mean that the application wasn’t successfully written; the desktop application attempts to trigger a reset of the board, and it is the lack of successful automatic reset that causes the desktop application to flag the operation.*



13. Manually reset the board by pressing the “RESET” button



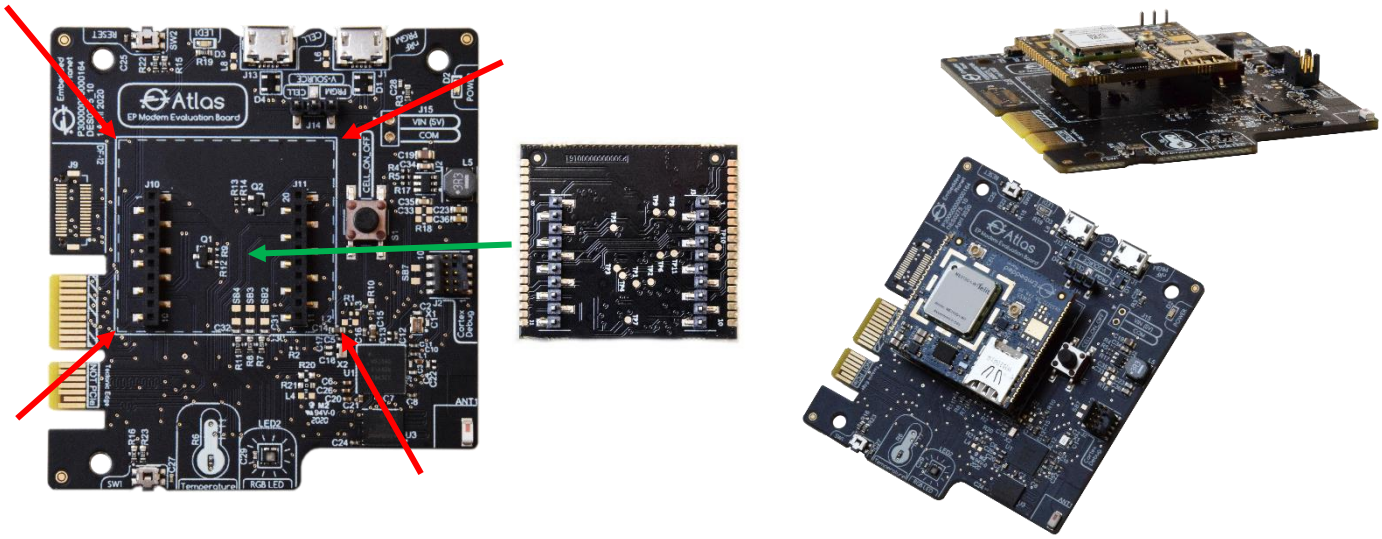
The board is now programmed and running the new application

16.2. Development | Chronos

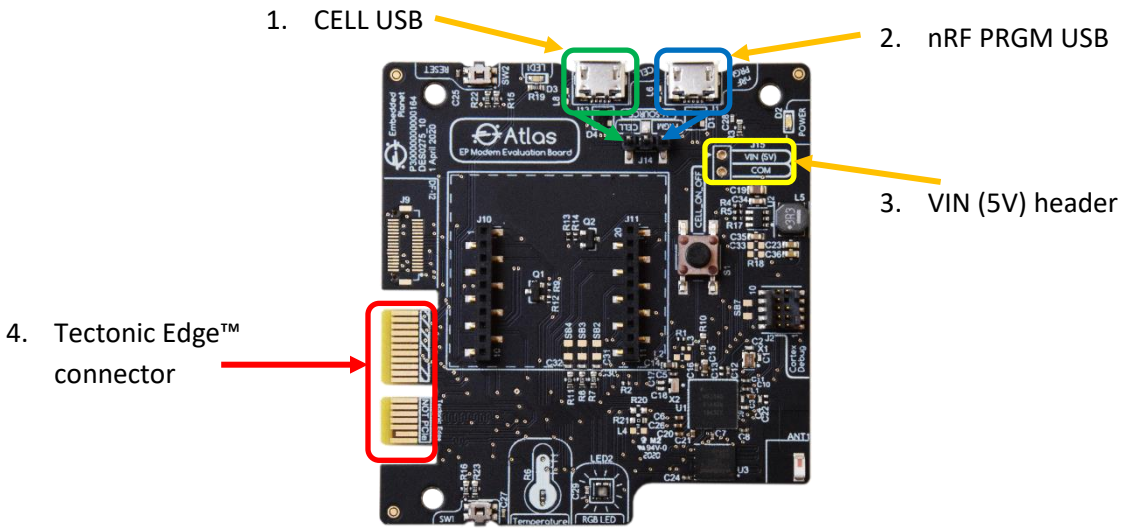
While the Atlas board can be used for most modem devices that have a compatible footprint and pinout, using it with the Chronos cell modem by Embedded Planet provides the most streamlined development experience. Conversely, the Atlas board is the development platform of choice for developing with the Chronos cell modem.

The Atlas board features an outline of the Chronos board in white silkscreen to assist as easy pin orientation reference. The outer border of the outline is a solid line white the inner border of the outline is a dashed line. The Chronos has an asymmetric geometry relative to the location of the pin headers underneath it; lining up the Chronos with the outline on Atlas will ensure the correct pin orientation.

For information on programming Atlas or communicating AT commands with the Chronos module, see the other sub-sections of this Development section of the manual.



16.3. Development | Power



The Atlas board can be powered by 5V DC (operational range 4.5V-5.5V) from the following options:

1. 5 Vdc: "CELL" USB connector (J13) with V-SOURCE (J14) set to "CELL" *
2. 5 Vdc: "nRF PRGM" USB connector (J1) with V-SOURCE (J14) set to "PRGM" *
   **Both USB ports may be used at the same time if needed, but only one should supply power via J14*
3. 5 Vdc: Through-hole option J15 | VIN (5V) header
4. Tectonic Edge™ connector (pin A13/VBAT)

The default method is to the nRF PRGM USB connector with V-SOURCE (J14) set to "PRGM".

16.4. Development | AT Commands

The Atlas board can be used for testing AT commands by communicating the commands between a computer and the attached cell module. There are two ways to communicate AT commands from a computer: the first is modem USB link, and the second is nRF pass-through.

Using the CELL USB port:

To communicate AT commands using a direct modem USB link, start with an unpowered Atlas board. An application is not needed for this procedure since the nRF is not powered. Connect the modem to the Atlas board's 20-pin modem header array (J10, J11) - Make sure the pin orientation is correct. Set the shunt jumper for J14 to the "CELL" position. Connect a USB-micro cable to the USB port labeled "CELL" (J13) and connect the other end of the USB cable to the computer. Press and hold the "CELL_ON_OFF" button on the Atlas for about 5 seconds, then release – this turns on the cell modem*. You should see/hear the modem device enumerate on the computer. Open a terminal program and connect to the modem device. Set the baud rate to 115200. You should now be able to communicate AT commands with the cell modem device. *Note that for the Chronos device, which uses a Telit ME310 cell module, may show a "Telit Diagnostics" COM port as one of its COM port options. Do not use this COM port when working with Chronos – either of the other two COM ports associated with the device will be suitable.*

**It is recommended that the cell modem be properly turned off before power to the Atlas board (and modem) is removed. To properly shut down the cell modem, press and hold the "CELL_ON_OFF" button for about 5 seconds while the modem is turned on. This will turn the modem off.*

Using the PRGM USB port (pass-through):

Not all cell modem devices are able to communicate directly using USB to test AT commands. In this case, it can be useful to use the nRF has a pass-through device to communicate AT commands from a computer to the target cell model device. To communicate AT commands using the UART, start by programming an Atlas with the *pass-through* application available in the Atlas applications resource repository (see the *Applications* section below). With a programmed, unpowered Atlas board, connect the target modem device to the Atlas board's 20-pin modem header array (J10, J11) - Make sure the pin orientation is correct. Set the shunt jumper for J14 to the "PRGM" position. Connect a USB-micro cable to the USB port labeled "nRF PRGM" (J1) and connect the other end of the USB cable to the computer. Press and hold the "CELL_ON_OFF" button on the Atlas for about 5 seconds, then release – this turns on the cell modem*. You should see/hear the modem device enumerate on the computer. Open a terminal program and connect to the modem device. Set the baud rate to 115200. You should now be able to communicate AT commands with the cell modem device. *Note that for the Chronos device, which uses a Telit ME310 cell module, may show a "Telit Diagnostics" COM port as one of its COM port options. Do not use this COM port when working with Chronos – either of the other two COM ports associated with the device will be suitable.*

16.5. Development | Applications

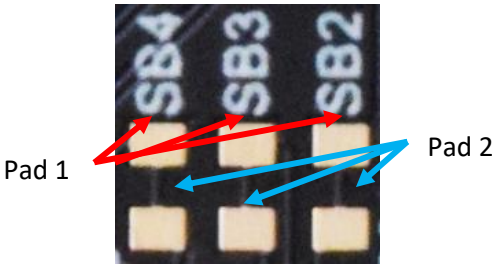
Any available application materials, including demo programs and bootloaders, are available at https://www.embeddedplanet.com/product-documentation/#atlas.

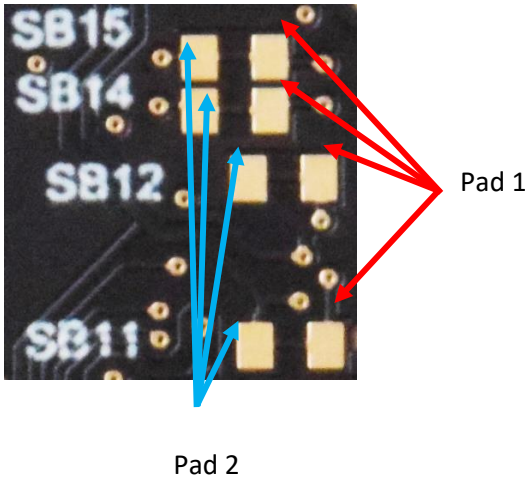
16.6. Development | Solder Bridges

Atlas features a number of solder bridge options for desired user configuration. Each solder bridge footprint has a default closed (connected) state. The solder bridge footprint consists of two exposed metal pads in an SMD 0805 arrangement with a thin, exposed trace between the pads. The trace can be cut with a precise instrument to cut the signal path. If the signal path is to be re-established, an 0805 surface-mount 0-ohm resistor can be placed across the pads, reconnecting the signal path.

TABLE 10 – SOLDER BRIDGE REFERENCES

Reference	Signal Description	Signal: Pad 1	Signal: Pad 2
SB2	RGB LED | RED	nRF | P0.08	R7 -> Red LED
SB3	RGB LED | GREEN	nRF | P1.09	R8 -> Green LED
SB4	RGB LED | BLUE	nRF | 0.12	R11 -> Blue LED
SB11	DF-12 | 3.3V	DF-12 connector, pin 6	VDD_nRF (3.3V)
SB12	DF-12 | 5V	DF-12 connector, pin 8	VBUS (PRGM USB 5V)
SB14	DF-12 | UART RX	TC_UART_RX	nRF_TX
SB15	DF-12 | UART TX	TC_UART_TX	nRF_RX





16.7. Development | Portal Recommendations

Thingsboard is the current nominally recommended portal for setting up & viewing IoT data.

An simple example dashboard instance of Thingsboard using Agora-collected sensor data in real-time can be viewed here: https://demo.thingsboard.io/dashboard/0f3c20a0-3bde-11ec-a0a8-5356543a831d?publicId=62c6b9c0-58f7-11ec-8f43-1d800e6c37b6

For more on Thingsboard please refer to https://thingsboard.io/.

For more on the Atlas board, please refer to:
https://www.embeddedplanet.com/product-documentation/#atlas.

For further detail on programming, debugging, and developing on Chronos, please refer to the Chronos documentation at: https://www.embeddedplanet.com/product-documentation/#chronos.

For further detail on programming, debugging, and developing on Agora, please refer to the Agora documentation at: https://www.embeddedplanet.com/product-documentation/#agora.

For information about developing applications beyond the scope of this manual, please contact the Embedded Planet team at info@embeddedplanet.com.

17. Mechanical

17.1. Mechanical | Physical Parameters

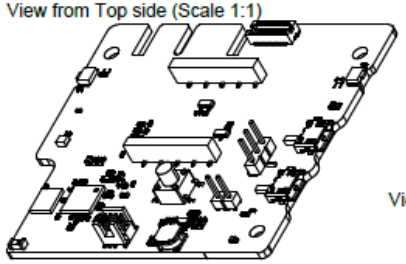
TABLE 11 – PHYSICAL PARAMETERS

Parameter (enclosure)	Value (in)	Value (mm)
Length	2.73	69.28
Width	2.52	64.00
Height	0.45	11.33

17.2. Mechanical | Drawings

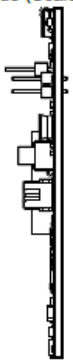
Within this section are mechanical drawings provided for the purpose of understanding the general size, shape, and layout of the Atlas board. For the most complete & up-to-date documentation on mechanical drawings, along with more on the Atlas device, please refer to the materials provided at https://www.embeddedplanet.com/product-documentation/#atlas.

View from Top side (Scale 1:1)

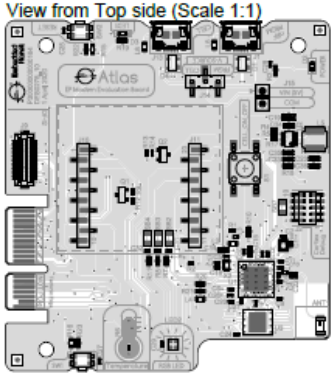


View from Front side (Scale 1:1)

View from Right side (Scale 1:1)

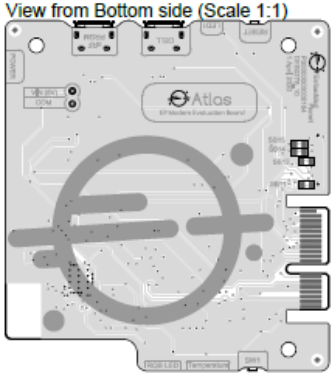


View from Top side (Scale 1:1)

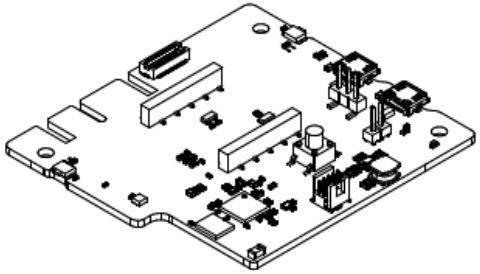


View from Left side (Scale 1:1)

View from Bottom side (Scale 1:1)



View from Front side (Scale 1:1)

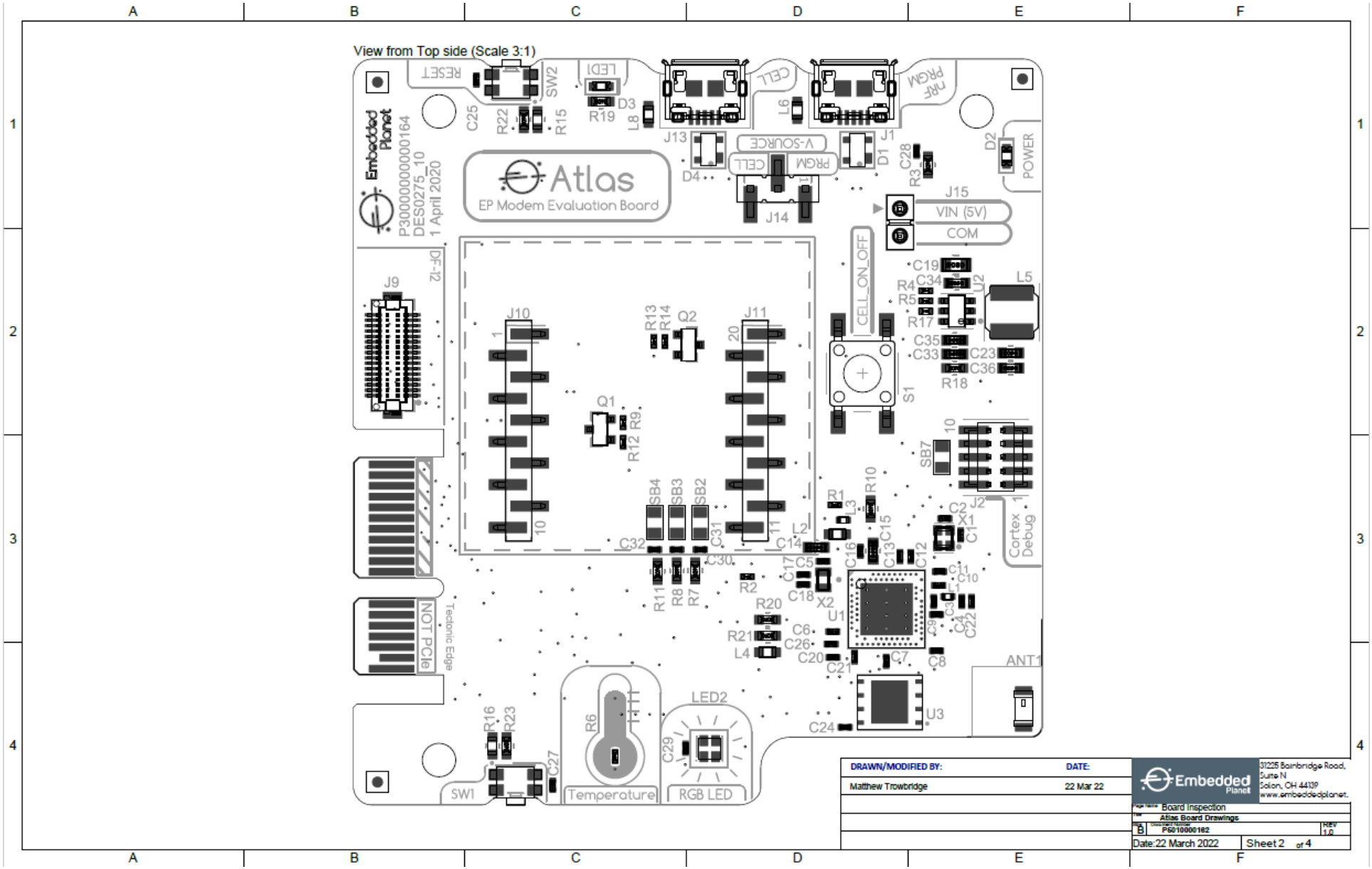


View from Back side (Scale 1:1)

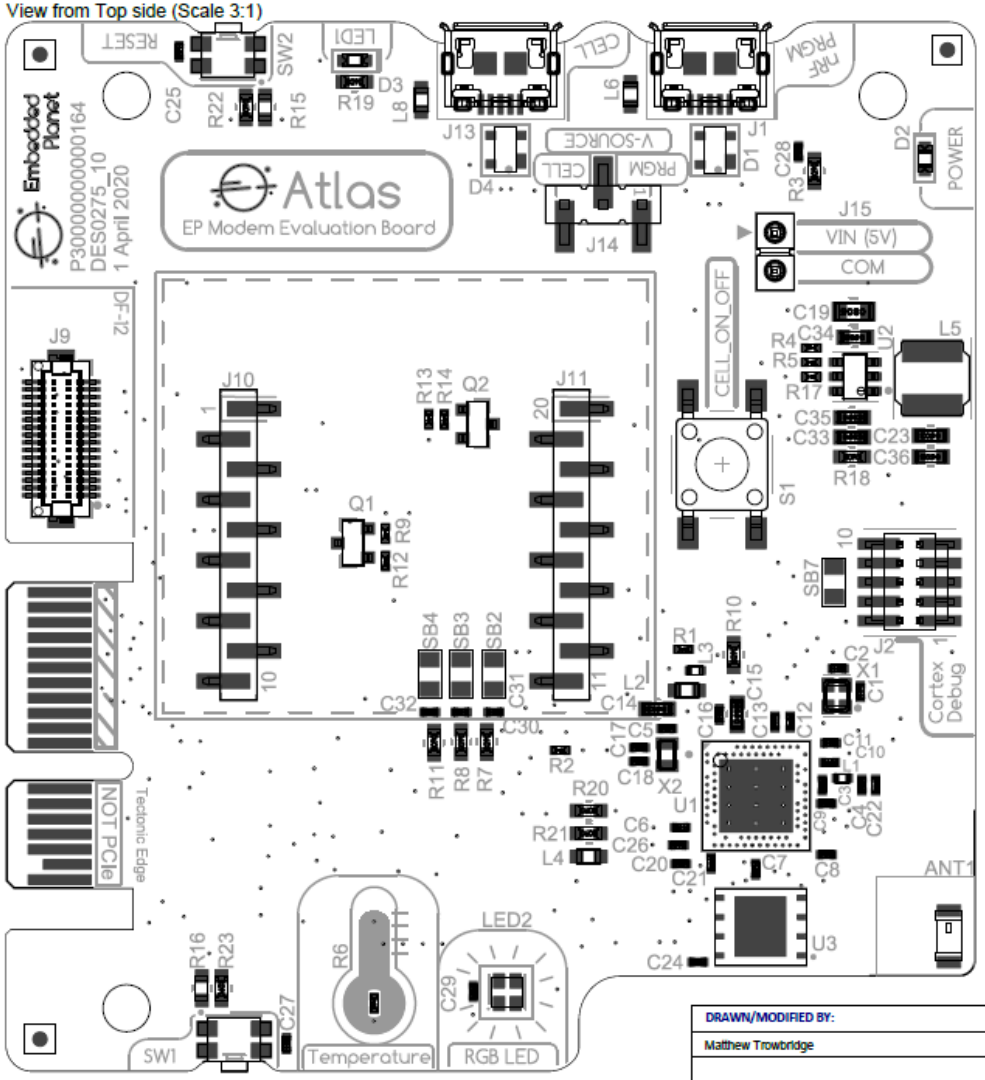
DRAWN/MODIFIED BY:	DATE:
Matthew Trowbridge	22 Mar 22

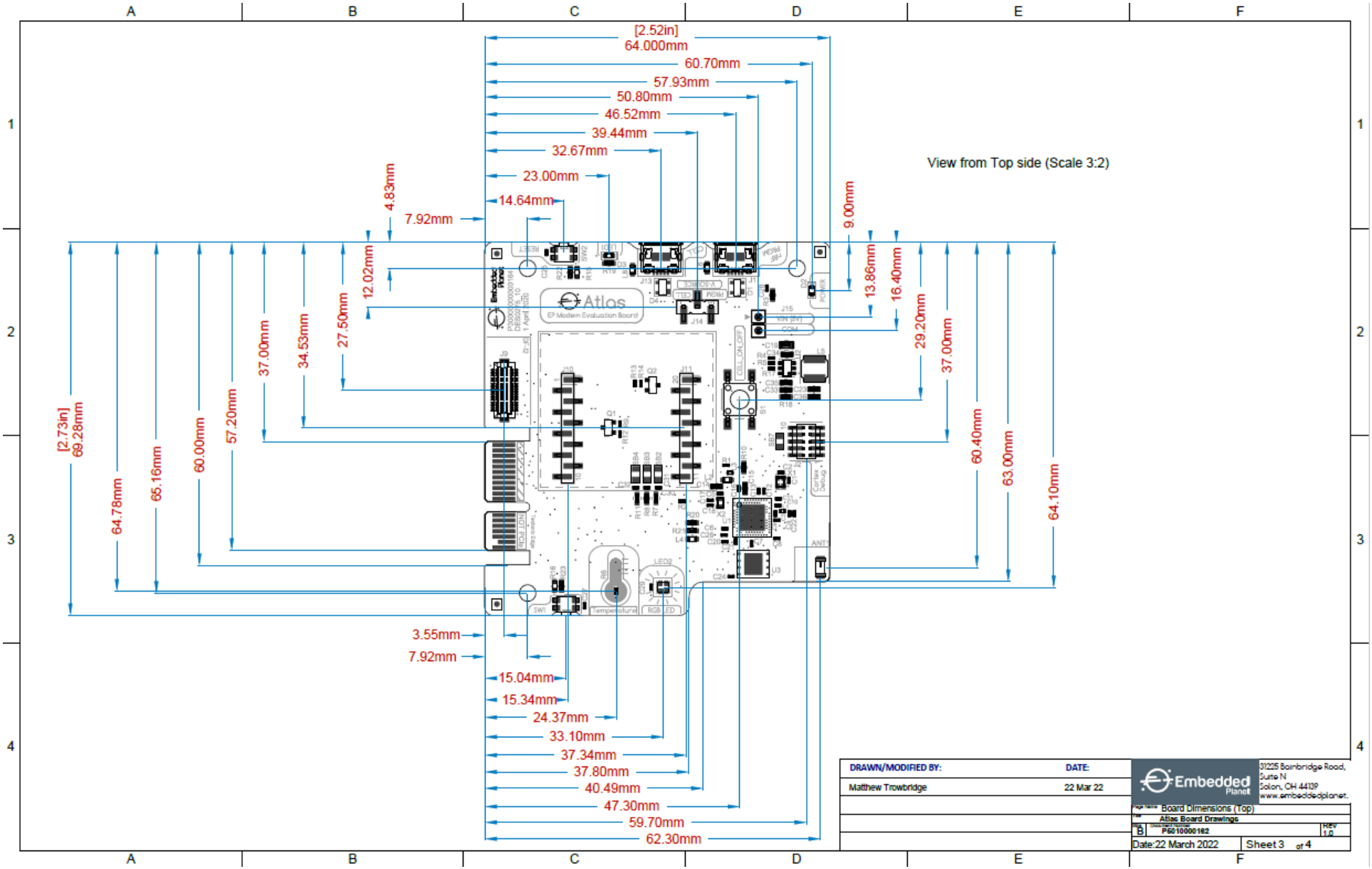
Embedded Planet
31225 Bainbridge Road, Suite N
Solon, OH 44139
www.embeddedplanet.

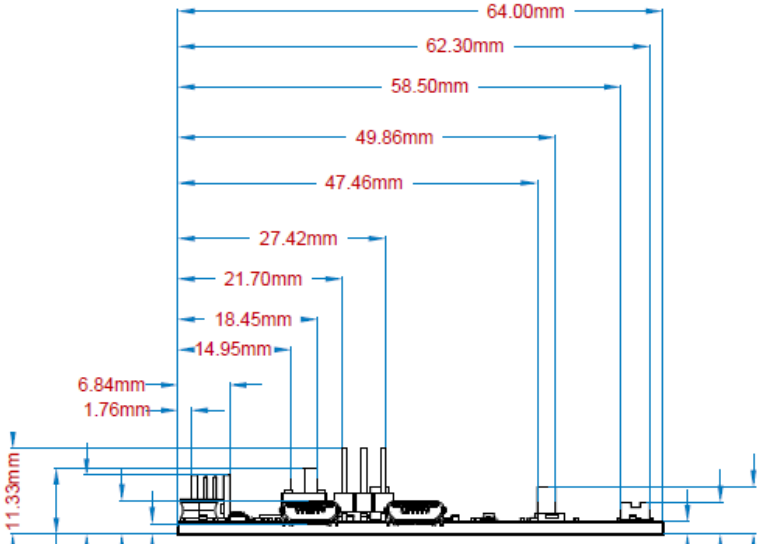
Page Name: Board Perspectives
Title: Atlas Board Drawings
Size: B | Drawing No: P5010000182 | REV: 1.0
Date:22 March 2022 | Sheet 1 of 4


View from Top side (Scale 3:1)
Atlas
EP Modem Evaluation Board
P3000000000164
DES0275_10
1 April 2020
RESET
SW2
LED1
D3
R19
R15
R22
C25
L8
L6
CELL
PRGM
J13
J1
D1
D2
POWER
D4
J14
V-SOURCE
C28
R3
J15
VIN (5V)
COM
CELL_ON_OFF
S1
C19
C34
U2
L5
R4
R5
R17
C35
C33
C23
C36
R18
J9
J10
J11
Q1
Q2
R13
R14
R9
R12
SB4
SB3
SB2
C31
C32
C30
SB7
10
R1
L3
R10
C2
X1
C1
J2
Cortex Debug
L2
C14
C15
C16
C13
C12
C17
C5
C18
X2
U1
C11
C10
R2
R11
R8
R7
R20
R21
L4
C6
C26
C20
C21
C7
C8
ANT1
U3
C24
NOT PCIe
Tectonic Edge
R16
R23
C27
SW1
R6
C29
LED2
Temperature
RGB LED
DRAWN/MODIFIED BY:
Matthew Trowbridge
DATE:
22 Mar 22
Embedded Planet
31225 Bainbridge Road, Suite N
Solon, OH 44139
www.embeddedplanet.com
Board Inspection
Atlas Board Drawings
P5010000162
REV 1.0
Date:22 March 2022
Sheet 2 of 4

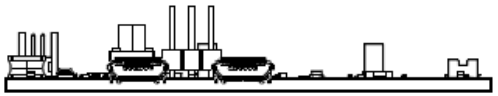
View from Top side (Scale 3:1)



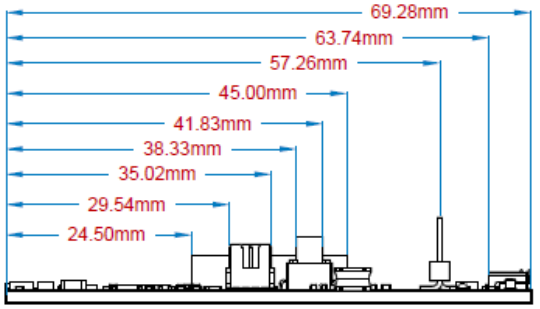

View from Top side (Scale 3:2)
[2.52in]
64.000mm
60.70mm
57.93mm
50.80mm
46.52mm
39.44mm
32.67mm
23.00mm
14.64mm
7.92mm
4.83mm
9.00mm
13.86mm
16.40mm
29.20mm
37.00mm
60.40mm
63.00mm
64.10mm
12.02mm
27.50mm
34.53mm
37.00mm
57.20mm
60.00mm
65.16mm
64.78mm
[2.73in]
69.28mm
3.55mm
7.92mm
15.04mm
15.34mm
24.37mm
33.10mm
37.34mm
37.80mm
40.49mm
47.30mm
59.70mm
62.30mm
Atlas
EP Modem Evaluation Board
DRAWN/MODIFIED BY:
Matthew Trowbridge
DATE:
22 Mar 22
Embedded Planet
31225 Bainbridge Road, Suite N Solon, OH 44139 www.embeddedplanet.
Board Dimensions (Top)
Atlas Board Drawings
P5010000182
REV 1.0
Date:22 March 2022
Sheet 3 of 4



View from Back side (Scale 3:2)



View from Back side (Scale 3:2)



View from Right side (Scale 3:2)

DRAWN/MODIFIED BY:	DATE:
Matthew Trowbridge	22 Mar 22

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31225 Bainbridge Road, Suite N
Solon, OH 44139
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Page Name: Board Dimensions (Sides)
Title: Atlas Board Drawings
Size: B | Drawing No: P5010000182 | REV: 1.0
Date: 22 March 2022 | Sheet 4 of 4

18. Environmental Specifications

TABLE 12 – ENVIRONMENTAL SPECIFICATIONS

Parameter	Min	Max
Operating Temperature	-20°C TBD	+85°C TBD
Storage Temperature	-20°C TBD	+85°C TBD

19. RoHS Compliance

This device complies with the RoHS (Reduction of Hazardous Substances) directive of the European Union, EU Directive 2011/65/EU.

20. Revision History

TABLE 13 – REVISION HISTORY

Revision	Author	Description	Date
1.0.0	M. Trowbridge	Initial Release	31 March 2022
1.0.1	A. Halverson	Added modem pinout	13 April 2022
1.0.2	M. Timieski	Updated references	01 MAY 2024

Contact Embedded Planet

Embedded Planet
31225 Bainbridge Rd, Suite N
Solon, OH 44139
Phone:216.245.4180
Fax: 216.292.0561
www.embeddedplanet.com

Company Email

Sales: sales@embeddedplanet.com
Information Requests: info@embeddedplanet.com
Technical Support: support@embeddedplanet.com