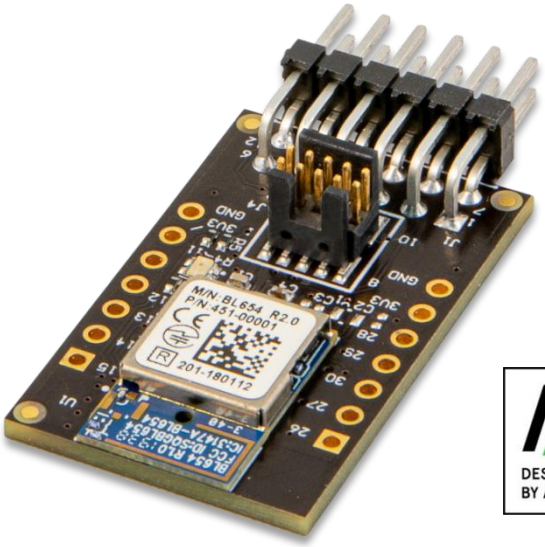
BLE-Pmod

Azure Sphere Starter Kit Accessory



DESIGNED BY AVNET

OVERVIEW

BLE-Pmod is an optional wireless communication accessory for Avnet Azure Sphere MT3620 Starter Kits It is fitted with a Laird BL654 module (with integrated antenna) that is based on a Laird BL654 module, designed-around the popular Nordic nRF52840 2.4 GHz wireless SoC. It supports a range of low-power wireless protocols, including Bluetooth 5.1 BLE, Bluetooth Mesh, Thread, Zigbee, and more.

With an Arm Cortex M4F core, substantial memory plus pinned-out peripheral interfaces, this accessory opens-up a range of new use cases, including significant system-level implementations such as:

- Setup of Azure Sphere Starter Kit's Wi-Fi network credentials from a BLE-connected Smartphone
- System expansion via BLE, BLE Mesh or 802.15.4 based wireless sensors or peripheral devices

TARGET APPLICATIONS

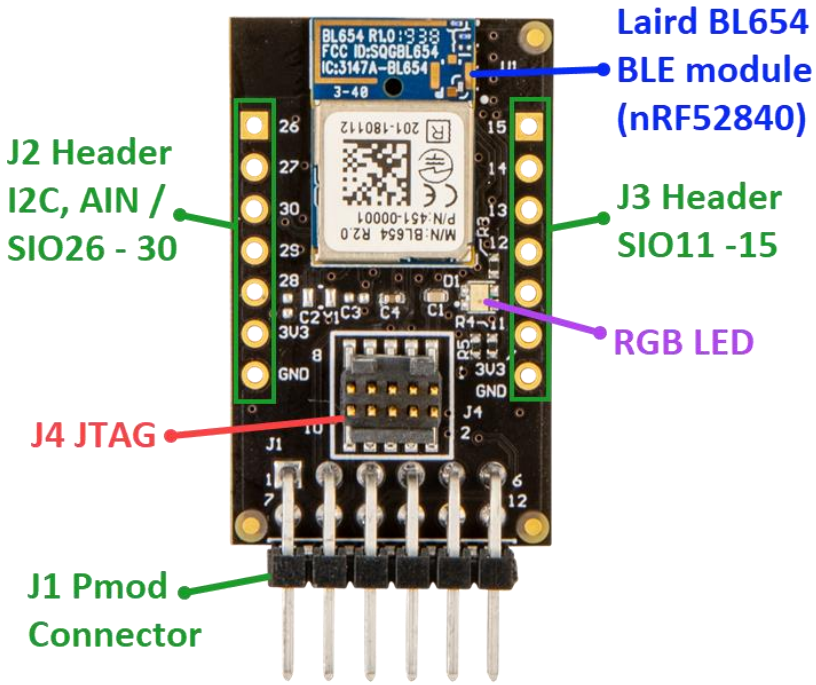
- Medical equipment and fitness applications
- Industrial-monitoring
- IoT devices
- Smart home automation
- Smart energy

FEATURES

- ARM® Cortex™-M4F CPU @ 64 MHz (1MB Flash, 256k RAM). Allows hostless operation
- Bluetooth v5.1 BLE / Bluetooth mesh. BLE Peripheral/Central roles with DTM embedded
- Thread/Zigbee 802.15.4 functionality (via Nordic SDK)
- Transmit Power: +8 dBm (max) configurable down to -40 dBm. Integrated PCB Trace antenna
- Receive Sensitivity: -95 dBm (typical @ BLE 1 Mpbs), -103 dBm (typical @ BLE 125 kbps)
- Link Budget 103 dB (@ BLE 1 Mbps), 111 dB (@ BLE 125kpbs)
- 2Mbps & LE Long Range. Support for 2Mbps, 1Mbps, & 125kps coded
- User configurable RGB LED
- Pmod 2x6 pin interface: Supports UART (4-pin) and GPIOs (4)
  GPIOs map to MT3620 WAKEUP, nRF RESET, nRF AUTORUN, nRF OTA functions
- Configurable I/O expansion headers (2x 7pin headers). J2: GPIO/I2C/AIN, J3: GPIO
- Application Development: Laird smartBASIC, or Nordic SDK, or simple AT Command Set

- Optional RTOS: Zephyr RTOS or FreeRTOS
- Firmware upgrade via UART (Pmod connector) or JTAG (mini 10-pin header)
- Temperature Rating: Industrial (-40º to +85º C)
- PCB dimensions: 32mm x 20mm
- Supply Voltage: 1.7V – 5.5V operation (power connection via Pmod interface or I/O headers)

INTERFACE DETAIL



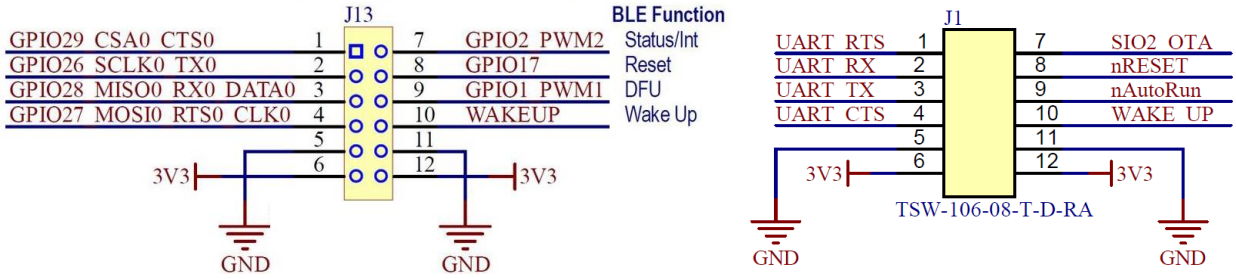
J1 Pmod Connector

Pin #	BL654 Pin / nRF52 Port	MT3620 Signal	Pin #	BL654 Pin / nRF52 Port	MT3620 Signal
1	SIO_05 / **P0.05** **(RTS)**	GPIO29_**CTS0**	7	SIO_02 / **P0.02** **(OTA)**	GPIO2_PWM2
2	SIO_08 / **P0.08** **(RXD)**	GPIO26_**TXD0**	8	SIO_18 / **P0.18** **(nRESET)**	GPIO17
3	SIO_06 / **P0.06** **(TXD)**	GPIO28_**RXD0**	9	SIO_35 / **P1.03** **(nAutoRun)**	GPIO1_PWM1
4	SIO_07 / **P0.07** **(CTS)**	GPIO27_**RTS0**	10	SIO_31 / **P0.31** **(GPIO)**	WAKEUP
5	GND	GND	11	GND	GND
6	3V3	3V3	12	3V3	3V3

1) In the above table, only the relevant section of the lengthy MT3620 signal names are shown
2) A right-angle 2x6 Pmod female connector is shipped with the BLE Pmod. This needs to be fitted by the user, soldering this onto the provided footprint, under Click #2 socket of the Starter Kit.
3) A full 4-signal UART is supported (Digilent Pmod Type 3A interface compatible), plus 4 GPIOs
   - **GPIO/RESET** (nRF52 nRESET input, controlled by MT3620 GPIO)
   - **GPIO/OTA** (nRF52 GPIO, MT3620 GPIO control of OTA in smartBASIC mode)
   - **GPIO/AUTORUN** (nRF52 GPIO, MT3620 control of AUTORUN in smartBASIC mode)
   - **GPIO/AIN/WAKEUP** (nRF52 GPIO output, controls the MT3620 WAKEUP input)

4) Connector signal-name schematic detail of the Pmod interface is shown below for:
   a) Azure Sphere MT3620 Starter Kit
   b) BLE Pmod

Pmod Connector (Azure Sphere Starter Kit)



5) Tabled below is GPIO detail of the **J2** and **J3** Expansion headers, plus the onboard **RGB LED**

J2 GPIO / I2C / AIN Header (SIO26 - SIO30)

Pin #	BL654 Signal / nRF52 Port Pin	Alternative nRF52 Function
1	SIO_26 / **P0.26**	I2C_SDA*
2	SIO_27 / **P0.27**	I2C_SCL*
3	SIO_28 / **P0.28**	AIN4
4	SIO_29 / **P0.29**	AIN5
5	SIO_30 / **P0.30**	AIN6
6	3V3	3V3
7	GND	GND

*Note: If implementing I2C interface using **J2**, external pullup resistors are required on pins 1 and 2

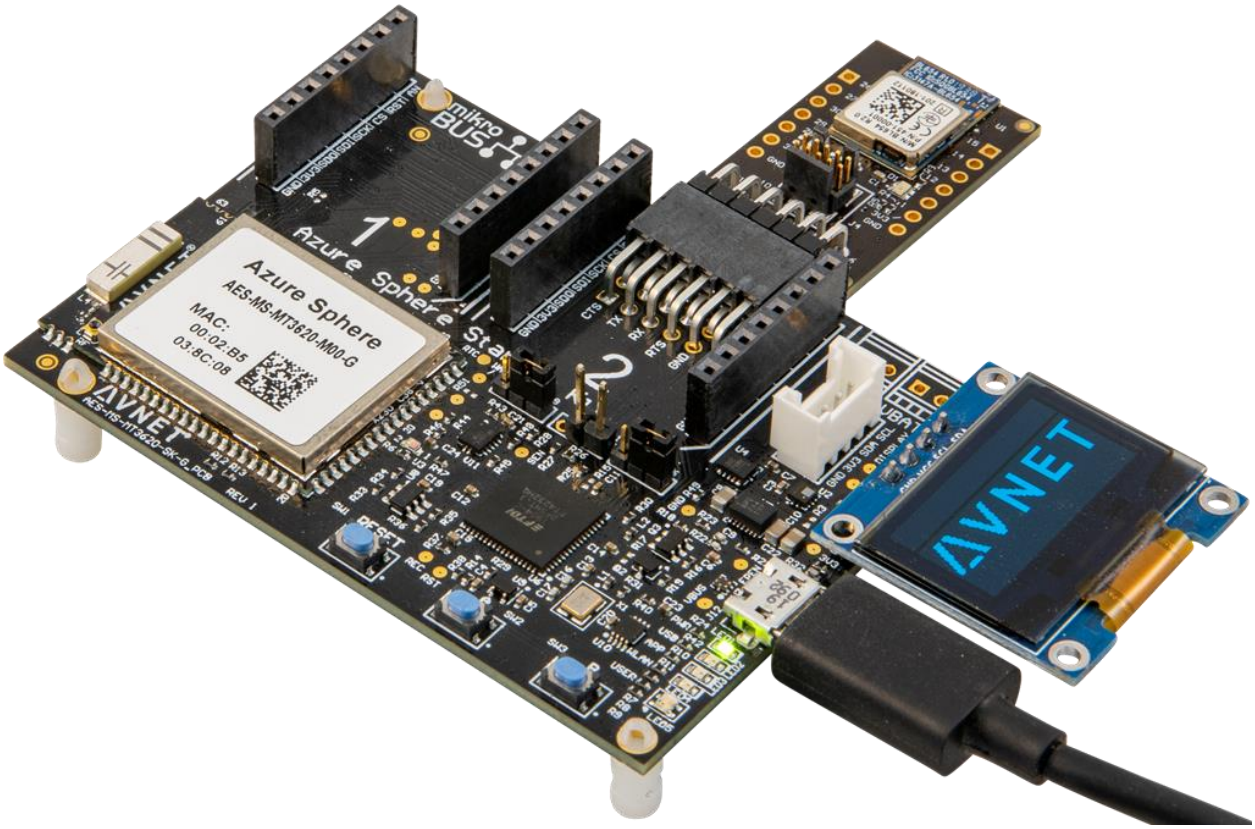
J3 GPIO Header (SIO11 – SIO15)

Pin #	BL654 Signal / nRF52 Port Pin	nRF52 Function
1	SIO_11 / **P0.11**	GPIO
2	SIO_12 / **P0.12**	GPIO
3	SIO_13 / **P0.13**	GPIO
4	SIO_14 / **P0.14**	GPIO
5	SIO_15 / **P0.15**	GPIO
6	3V3	3V3
7	GND	GND

RGB LED

Pin #	BL654 Signal / nRF52 Port Pin	nRF52 Function	BLE-Pmod Function
1	SIO_44 / **P1.12**	GPIO	RGB-RED LED
2	SIO_43 / **P1.11**	GPIO	RGB-GRN LED
3	SIO_42 / **P1.10**	GPIO	RGB-BLU LED

APPLICATION DEVELOPMENT WITH AZURE SPHERE STARTER KIT



1) The above photo shows a typical expansion example, where functionality of the Starter Kit is enhanced using optional add-on hardware. A wide range of inexpensive MikroE Click boards and Grove I2C based sensors are available to further build-out advanced prototyping platforms.

2) Application development flexibility allows for different approaches:
   - Nordic SDK plus 3rd-party IDEs (Segger, Keil, IAR, etc)
   - Laird smartBASIC (more info here)
   - Simple AT command set

3) Firmware updates can be done via:
   - JTAG interface (mini-10pin header)
   - UART interface (ie from a Azure Sphere application, via the Pmod connector)
   - OTA from a Smartphone (requires pre-installation of relevant BLE application)

4) As shipped, the BL654 module on BLE-Pmod is pre-programmed with Laird's smartBASIC runtime engine firmware. This facilitates rapid, simplified development of applications. Sample smartBASIC application scripts can be downloaded from the Laird GitHub repo at https://github.com/LairdCP/BL654-Applications

5) Use of a Nordic nRF52 SDK together with 3rd-party IDEs will appeal to advanced developers with experience in implementing more complex embedded applications.

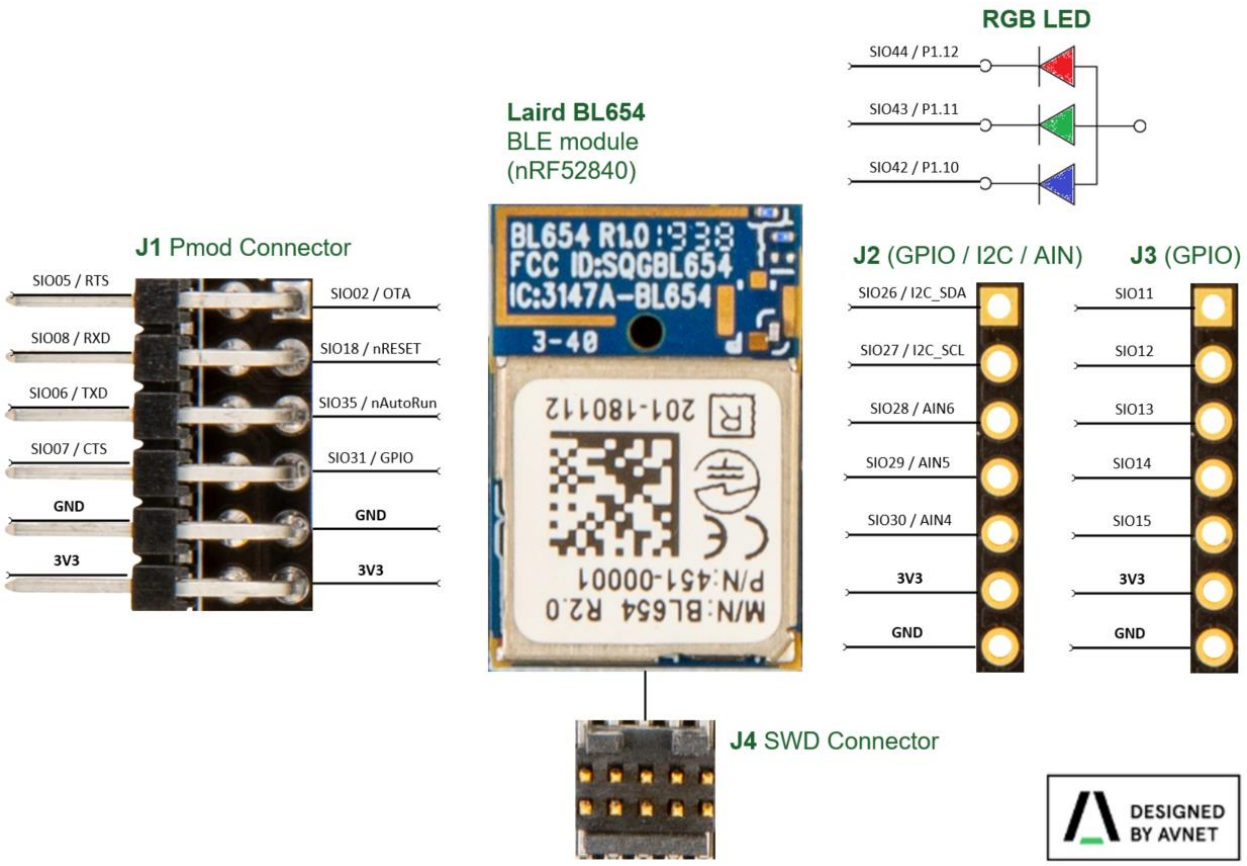
   Nordic currently provide two nRF52 SDKs:
   - nRF Connect SDK (new, supports nRF52 and nRF91 devices)
   - nRF5 SDK (mainstream support for nRF52, includes SoftDevice BLE protocol stacks, etc)

   plus two application-specific SDKs:
   - nRF5 SDK for MESH
   - nRF5 SDK for THREAD & ZIGBEE

6) For embedded software development using an IDE and Nordic SDK, use of **J4** SWD JTAG header interface on the BLE-Pmod is recommended for debug and programming.

7) SWD debugger adapters typically used to connect with this mini 10-pin header include the following:
   - J-Link compatible debugger on a Nordic nRF52 Dev Kit (use **P19** connector on nRF52840-DK)
   - J-Link Segger Debug Probes (eg. J-Link EDU mini, J-Link Base Compact)
   - Keil ULINK series Debug & Trace adapters http://www2.keil.com/mdk5/ulink

BLOCK DIAGRAM



FEATURED SUPPLIERS

Laird Connectivity, Nordic Semiconductor, Microsoft, Arm Keil (IDE and debug cables)

ORDERABLE PARTS

Part Number	Description	Resale
AES-PMOD-NRF-BLE-G	BLE-PMOD Azure Sphere Starter Kit Accessory	$49

RELATED PARTS

Part Number	Description	Resale
AES-MS-MT3620-SK	Azure Sphere MT3620 Starter Kit	$75
AES-MS-MT3620-M-G	Azure Sphere MT3620 Module (Certified)	Contact Avnet

SHIPS WITH

- BLE-Pmod wireless multi-protocol SoC communication board
- Pmod 2x6 right-angle female connector (must be soldered onto Avnet Azure Sphere Starter Kit)

BLOGS AND REFERENCE DESIGNS

- Check for latest blogs and downloadable reference designs at http://avnet.me/mt3620-kit
- To purchase the BLE-Pmod, visit http://avnet.me/ble-pmod