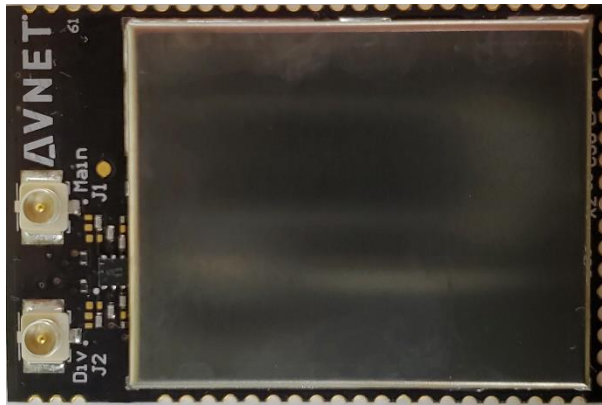




AES-MS-MT3620-UFL-M-G-2

Azure Sphere

MT3620 module

(with dual U.FL antenna ports)

Features

- Microsoft Azure Sphere SoC based module solution for advanced end-to-end IOT security
- Based on MediaTek MT3620AN Wi-Fi SoC
 - 1x 500MHz Arm Cortex A7 application processor with 4MB SRAM
 - 2x 200MHz Arm Cortex M4F cores, each with 64KB SRAM
 - 4MB embedded RAM (shared)
 - 16MB QSPI flash memory
 - Dual-band 2.4/5GHz 802.11 b/g/n Wi-Fi
- Module I/O peripheral support
 - 3x ISU interfaces, pre-configured for UART, SPI, I2C
 - ADC/GPIO: 3x 12-bit ADC inputs (or GPIOs)
 - PWM/GPIO: 9x PWM outputs (or up to 24 GPIOs)
 - RTC (requires VBAT supply)
 - Programming & recovery interface
- Microsoft Visual Studio IDE for accelerated application software development & debug
- OTA authentication & updates (device lifetime)
- Dimensions: 33mm x 22mm x 3.5mm
 - Dual U.FL Antenna Ports
- Operating temperature:
 - -40C to +85°C
- Certifications:
 - FCC (pending), IC (pending)

Applications

- IoT edge devices
- Smart home appliances / security
- Smart retail
- Remote access
- Building automation
- Factory automation

For more info on Azure Sphere MT3620 modules, visit: <http://avnet.me/mt3620-modules>

For the summarized Product Brief, visit: <http://avnet.me/mt3620-module-pb>

To purchase an Azure Sphere MT3620 Starter Kit visit: <http://avnet.me/mt3620-kit>

Note: For the latest MT3620 support status, visit: <https://docs.microsoft.com/en-us/azuresphere/hardware/mt3620-product-status>

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1.0	05/07/2019	Initial release, new document scope, photos, pinout detail and content
1.1	05/07/2019	Added FCC Module Statement (USA)
1.2	05/16/2019	Updated OEM instructions
1.3	09/19/2019	Added Note 3 to page 22 for DFS.
1.4	07/22/2020	Removed references to 802.11a
1.4.1	08/04/2021	Revised for Rev2 U.FL Module Variant

Ordering Information

Part Number	Description
AES-MS-MT3620-M-G-2 AES-MS-MT3620-UFL-M-G-2	Azure Sphere MT3620 Module (U.FL antenna ports) Product Page: http://avnet.me/mt3620-modules
AES-MS-MT3620-SK-G-2	Azure Sphere MT3620 Starter Kit Product Page: http://avnet.me/mt3620-kit

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Overview

The AES-MS-MT3620-UFL-M-G-2 is a small form-factor, tri-core Wi-Fi SoC module, intended for use as a secure Wi-Fi client, in internet-connected IoT applications. Avnet's production-ready, certified module comes fitted with two U.FL antenna ports allowing for 2.4 GHz or 5GHz Wi-Fi network connections with approved external antennae that can take advantage of full Tx/Rx diversity.

Based on the MediaTek MT3620AN SoC, this is a new class of connected SoC IoT device that facilitates "end-to-end security". User applications can target it's 500 MHz ARM Cortex-A7 core as well as two general purpose 200 MHz ARM Cortex-M4F I/O subsystem cores designed to support real-time requirements. The on-chip peripherals (GPIO, UART, I2C, SPI, I2S, PWM and ADC) can be mapped to any of these three user-accessible processor cores.

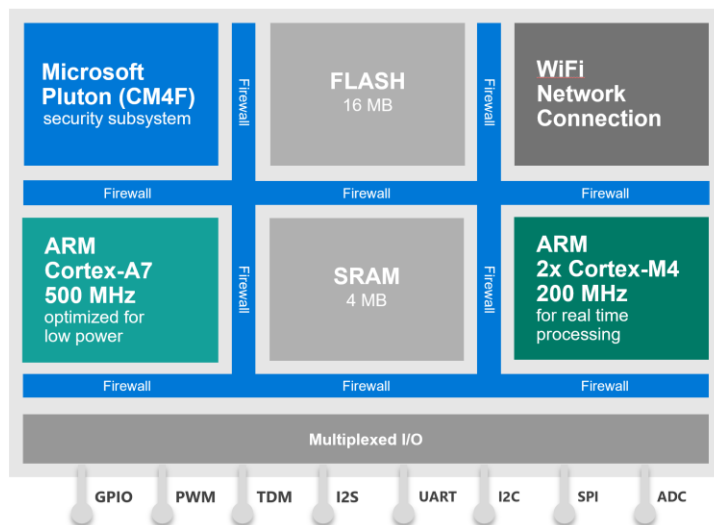


Figure 1 – Simplified MT3620 SoC Block Diagram

Further differentiators of the MT3620 device are its built-in Pluton security subsystem (with dedicated CM4F core) for secure boot and secure system operation, its dual-band 802.11 b/g/n Wi-Fi connectivity, as well as integration of on-chip PMU, RTC plus FLASH and SRAM memory. Wi-Fi based OTA firmware and user application updates (using certificate-based authentication) are hosted by Microsoft for the device lifetime

The Cortex-A7 application processor runs Microsoft's Azure Sphere Secure OS. Custom user applications are developed in C using Microsoft's Visual Studio IDE, which includes user-friendly debugging features such as single-step execution, breakpoints and watch-points (supported via a dedicated service UART)

The module allows easy design migration and end-product enhancements. By integrating all necessary support and RF front end circuitry onto a small 33 mm x 22 mm module, Avnet has reduced the design time for implementing Sphere-based solutions. Developers can leverage the module's wireless regulatory certifications (pending) for their end product, saving considerable certification costs and testing time.

The Avnet Azure Sphere MT3620 U.FL module has a 33mm x 22mm form-factor, with 66 pad castellated "stamp-hole" footprints. It has dual U.FL antenna ports with a 26MHz crystal oscillator.

Microsoft Visual Studio IDE is used for software development of applications that target this Azure Sphere MT3620 Module. Instructions for installing this Integrated Development Environment, as well as it's Azure Sphere SDK companion application and necessary drivers, are detailed (with examples) in the User Guide for Avnet's Azure MT3620 Sphere Starter Kit

Online authentication and firmware updates are supported for the MT3620 device lifetime.

Module Block Diagram

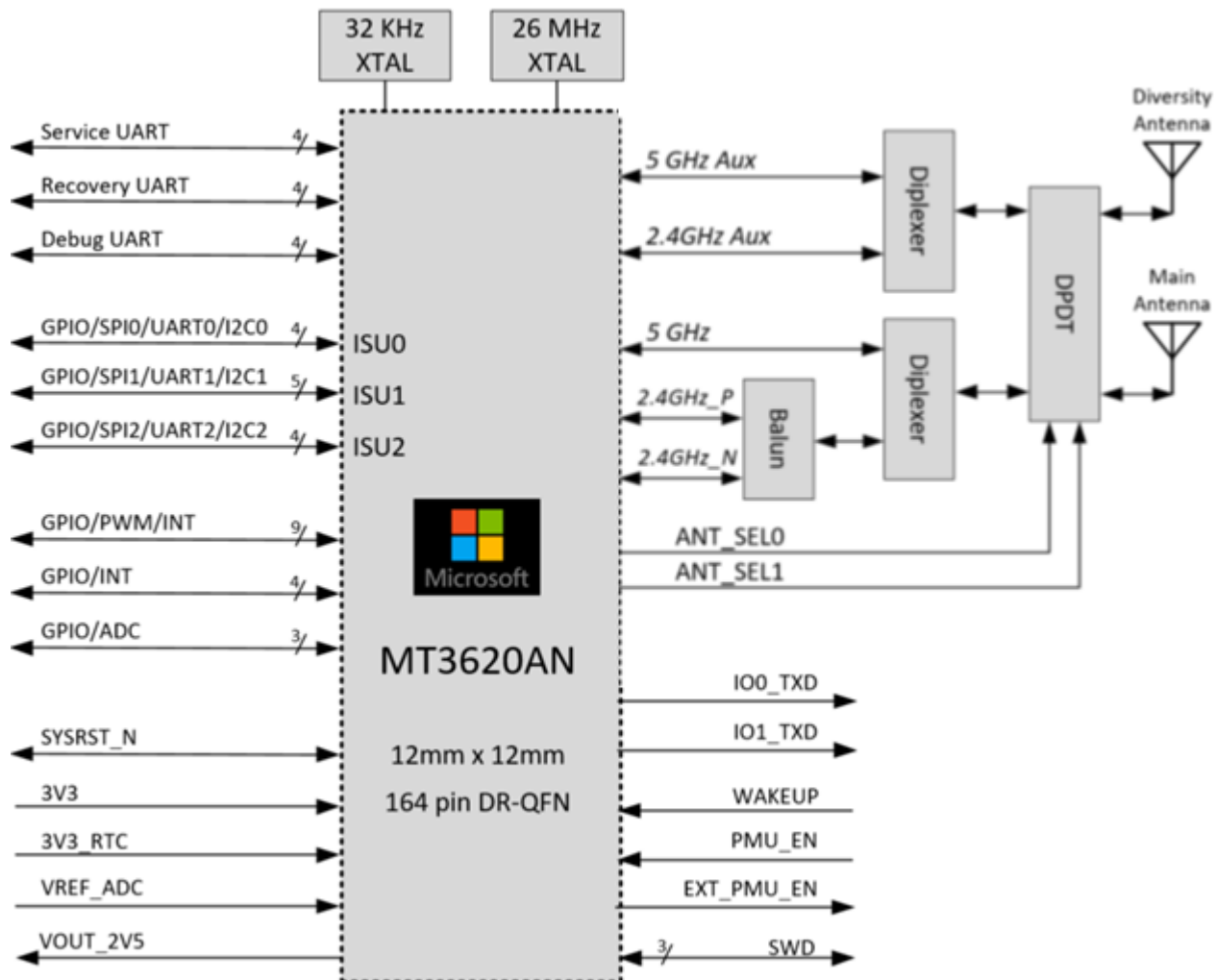


Figure 2 – AES-MS-MT3620-UFL-M-G-2 Module Block Diagram

Module Application Development and Programming

Development Computer Software Installation

In depth instructions are provided at the Microsoft **Getting started with Azure Sphere** webpage:
<https://aka.ms/AzureSphereSDK>

Microsoft's **Getting Started with Azure Sphere** page details the download & install of two software items:

- 1) [Azure Sphere SDK Preview for Visual Studio](#) from the Visual Studio Marketplace
- 2) [Visual Studio 2017 version 15.7 or later](#) (free Community edition is sufficient)

as well as USB driver installation for a wired interface between a development computer and the module

Microsoft's **Azure Sphere SDK** provides the following:

- The azsphere command-line utility for managing devices, images, and deployments
- Libraries for application development
- Visual Studio extensions to support Azure Sphere development, debug and flash programming

Microsoft's **Visual Studio IDE** provides a sophisticated development environment for editing, building and debugging custom embedded C applications (a GCC cross-compiler and GDB debugger provide the underlying build and debug tools)

For application development targeting this module, it is recommended that hardware and software prototyping be done using the Avnet **Azure Sphere MT3620 Starter Kit** <http://avnet.me/mt3620-kit>)

Module Interfaces with the Development Computer

The module is designed to support up to four wired interfaces with the development computer.

- Three 4-wire UART interfaces (SERVICE, RECOVERY and DEBUG) dedicated for connection with the host development computer are pinned-out, each with hardware flow-control.
- A 3-wire SWD interface is also pinned-out
- RESET and RECOVERY (via DEBUG_RTS during boot) signals determine the module operating mode
- Further information regarding these interfaces and how to use them can be found here: [Appendix-A: Programming Adaptor Footprint](#)

Module Integration onto an OEM Board

Module Power Interfaces

To power this module, the OEM board must be able to supply a maximum of 2.5 Watts at 3.3V.

Prior to power-up of the module, the following interfaces need to be attended to:

Interface Pins	Description	Notes
3V3	Main input voltage to the module. 3.3V (+/- 10%)	Powered by an external PMU or DC/DC convertor
3V3_RTC	Real Time Clock power input to module	Powered by external battery, or connect this to the 3V3 rail
VREF_ADC	Reference voltage for on-chip A/D convertor	Powered by external reference voltage, or connect to the MT3620 2.5V LDO output
EXT_PMU_EN	MT3630 output to enable / disable external PMU or DC/DC convertor	May be left unconnected
PMU_EN	MT3630 input to enable / disable the internal PMU	May be left unconnected
WAKEUP	MT3630 input to wake-up the A7 processor from power-saving sleep mode	May be left unconnected

Wi-Fi Network Settings

For Wi-Fi connected user applications, the module's Wi-Fi network settings need to be configured by one of the following methods:

- In the application software (using #define statements), OEM factory-programmed into the module
- Via a companion BLE device integrated onto the OEM's end-product board (Microsoft provides an example based on the Nordic nRF52840 device)
- Via the SERVICE UART interface with a Windows-10 development computer running the azsphere command-line utility (See separate App Note that details suggested PCB footprint to support temporary attachment of an FTDI FT4232HQ based USB to serial adaptor)

Upon power-up and connection to the designated Wi-Fi network, the module will communicate with the Microsoft Azure Sphere Security Service, which authenticates and manages one or more of the following downloads/uploads with the module:

- Push of Azure Sphere OS firmware updates to the module
- Deployment of custom application software to the module
- Reporting of Sphere OS and application versions plus error information to the Azure Sphere Server

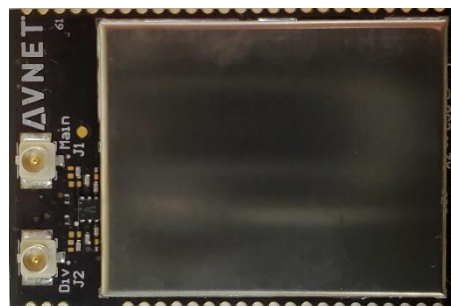
The Microsoft Azure Sphere Security Service will also authenticate data transfers between the custom user application executing on the module and Microsoft Azure (or other) cloud services

Wi-Fi Subsystem

- Dual-band 2.4/5GHz 802.11 b/g/n Wi-Fi (20 MHz channels only)
- Has an N968 Andes 32bit MCU
- Uses an external 26 MHz crystal oscillator on the module
- Integrated 5GHz Balun, Diplexers, DPDT switch, and matching components allow performance at all supported frequencies for single or dual antenna configurations.

Wi-Fi Antenna Ports

- Dual U.FL antenna ports allow connection of approved external antennae. Refer to [Antenna Compliance](#) for regulatory compliance information



**Figure 3 – Module with
U.FL Antenna Ports**

A7 Application Processor

- 1x 500MHz Arm Cortex A7 application processor core, with 4MB SRAM (shared)

M4F IO Processors

- 2x 200MHz Arm Cortex M4F IO processor cores, each with 64KB SRAM
- The module pins-out the IO0_TXD and IO1_TXD pins from their dedicated UARTs
- SWD interface based debug and programming of M4F IO MCU cores may at later date be enabled

Flash Memory

- 16MB 100MHz (on-die) QSPI flash memory

Pluton Security Subsystem

- 1x Cortex M4F MCU, dedicated RAM, ROM and GP timers, system control outputs

Real Time Clock (RTC)

- Low-power RTC with timer/time of day control over system power (32KHz crystal oscillator)

Peripheral Serial Interfaces

Three ISU serial interfaces are pinned-out. Their operating mode is user-configurable for SPI, UART, I2C or GPIO operation. Maximum data-rates in their serial peripheral modes are as follows:

- UART : max rate of 3 Mbps
- SPI : max rate of 40 MHz
- I2C : max rate of 1 MHz

Other I/O Interfaces

All pinned-out I/O pins (including ISU interfaces listed above) can be individually configured as GPIO pins. A subset of these can be configured as:

- PWM outputs
- ADC inputs
- EXT INT inputs

MT3620 Bootstrap Pins

Note! Six of the seven bootstrap pins are already strapped on the module.

The **DEBUG_RTS** signal **must** however be strapped on the OEM board with a 2K2 pull-down resistor, to ensure that RECOVERY mode remains disabled (This signal gets driven high to select RECOVERY via an FTDI device based interface with the development computer when a Debug-Programmer cable is attached)

Function	Pin Name	Strapping	Recommendation
Normal/Test mode	DEBUG_TXD	Pull-Down	Pull-down resistor is on module Mode = Normal
Recovery mode	DEBUG_RTS	Pull-Down	Pull-down resistor <u>required</u> on OEM board! Controlled via PC interface, - if present
RTC mode	RECOVERY_TXD	Pull-Up	Pull-up resistor is on module RTC oscillator = 32 kHz crystal
26MHz	IO0_RTS	Pull-Up	MT3620 internal pull-up on module Oscillator frequency = 26 MHz
26MHz	IO0_TXD	Pull-Down	Pull-down resistor is on module Oscillator frequency = 26 MHz
N9 JTAG	IO1_TXD	Pull-Down	Pull-down resistor is on module N9 JTAG = OFF
A7 JTAG	RECOVERY_RTS	Pull-Down	Pull-down resistor is on module A7 JTAG = OFF

See the **MT3620 Product Brief** at the Mediatek webpage for more detail on the **MT3620AN** SoC device...
<https://www.mediatek.com/products/azureSphere/mt3620>

Module Placement and Ground plane requirements

- For optimum antenna performance the Ground plane of the OEM board (on which the module is fitted) needs to be maximized
- The GND pads in the antenna area of the module must be connected to this Ground plane
- Placement of the module should be 6 mm or more from any corner of the OEM carrier board
- A PCB cutout is recommended in the host carrier board beneath the antenna connectors and radio circuitry (17mm x 7mm)

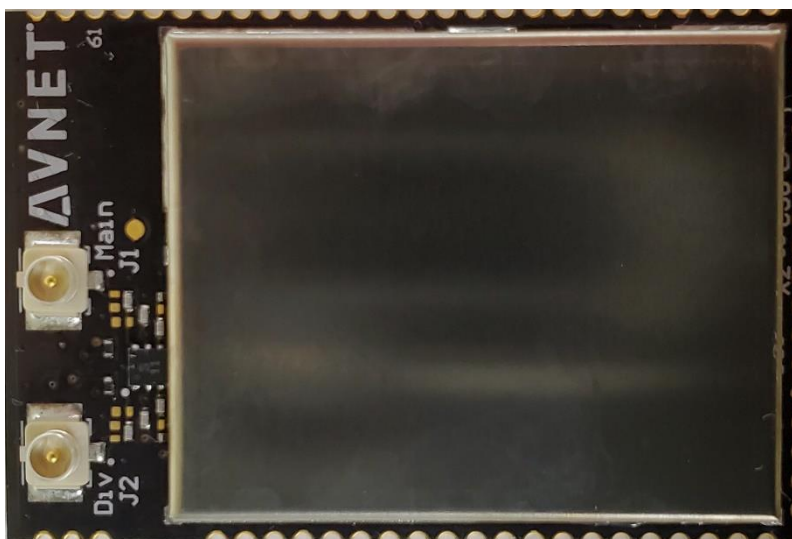
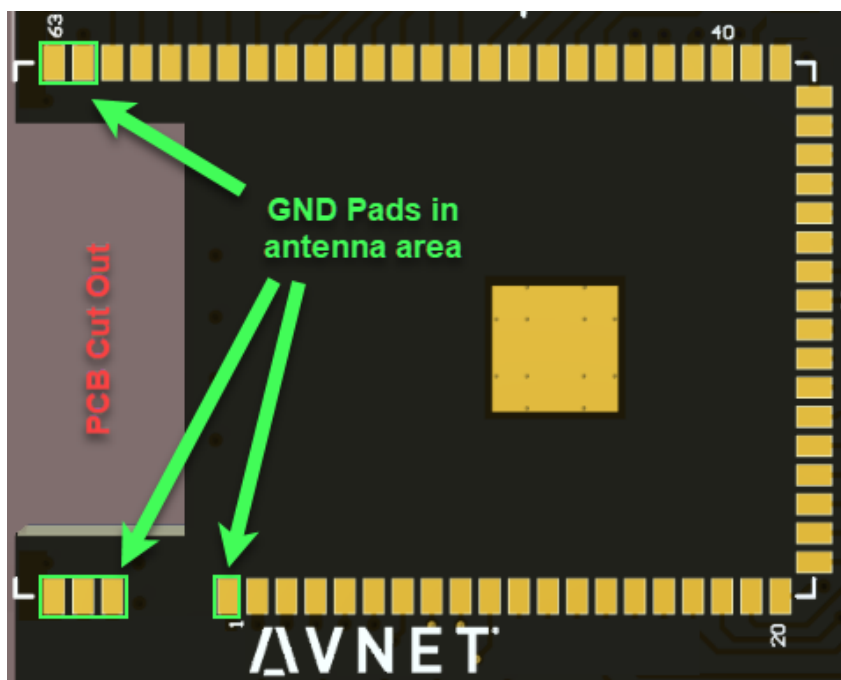


Figure 4 – OEM board Footprint for AES-MS-MT3620-UFL-M-G-2 Module

64	GND
65	GND
66	GND
67	GND
68	GND
69	GND
70	GND
71	GND
72	GND
73	GND
74	GND
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269	GND
270	GND
271	GND
272	GND

Figure 5 – AES-MS-MT3620-UFL-M-G-2 Module Pinout

Pad 17: Changed to **GPIO36** on Rev.2 modules (was GPIO17 on Rev.1 modules)

Module Pinout Table

Module Pad	MT3620 Pad	MT3620 Net Name	I/O	Pin Function	Pre-Assigned Starter Kit Function=BLUE
1		GND	GND		
2	2,3	3V3	Power		
3	2,3	3V3	Power		
4			GND		
5	13	GPIO0_PWM0	I/O	GPIO / INT in / PWM out	PWM CLICK1 and GPIO LED_WIFI
6	14	GPIO1_PWM1	I/O	GPIO / INT in / PWM out	PWM CLICK2 Pmod Pin 9 (DFU)
7	15	GPIO2_PWM2	I/O	GPIO / INT in / PWM out	RST CLICK1
8	17	GPIO4_PWM4	I/O	GPIO / INT in / PWM out	GPIO4_LED_APP
9	18	GPIO5_PWM5	I/O	GPIO / INT in / PWM out	INT CLICK1
10	19	GPIO6_PWM6	I/O	GPIO / INT in / PWM out	INT_LSM6DSO
11	21	GPIO8_PWM8	I/O	GPIO / INT in / PWM out	GPIO8_LED_USER_RED
12	22	GPIO9_PWM9	I/O	GPIO / INT in / PWM out	GPIO9_LED_USER_GRN
13	25	GPIO10_PWM10	I/O	GPIO / INT in / PWM out	GPIO10_LED_USER_BLU
14	27	GPIO12	I/O	GPIO / INT in	GPIO12_SW_A
15	28	GPIO13	I/O	GPIO / INT in	GPIO13_SW_B
16	54	GPIO39_CSA2_CTS2	I/O	GPIO / ISU2	Pmod Pin 7 (Status/Int)
17	51	GPIO36_SCLK2_TXD2	I/O	GPIO / ISU2	Grove Pin 1 (TX2)
18	39	GPIO26_SCLK0_TXD0	I/O	GPIO / ISU0	SCLK0 / TX0
19	40	GPIO27_MOSI0_RTS0_SCL0	I/O	GPIO / ISU0	MOSI0 / RTS0 / SCL0
20	42	GPIO28_MISO0_RXD0_SDA0	I/O	GPIO / ISU0	MISO0 / RX0 / SDA0
21	43	GPIO29_CSA0_CTS0	I/O	GPIO / ISU0	CSA0 / CTS0
22	46	GPIO31_SCLK1_TXD1	I/O	GPIO / ISU1	TX1 / SCLK1
23	47	GPIO32_MOSI1_RTS1_SCL1	I/O	GPIO / ISU1	RTS1 / MOSI1 / SCL1
24	48	GPIO33_MISO1_RXD1_SDA1	I/O	GPIO / ISU1	RXD1 / MISO1 / SDA1
25	49	GPIO34_CSA1_CTS1	I/O	GPIO / ISU1	CTS1 / CSA1
26	50	GPIO35_CSB1	I/O	GPIO / ISU1	RST Click2, Pmod Pin 8
27	52	GPIO37_MOSI2_RTS2_SCL2	I/O	GPIO / ISU2	SCL2 / RTS2
28	53	GPIO38_MISO2_RXD2_SDA2	I/O	GPIO / ISU2	SDA2 / RX2
29	58	GPIO41_ADC0	I/O	GPIO / ADC in	AMBIENT LIGHT SENSOR
30	59	GPIO42_ADC1	I/O	GPIO / ADC in	AN CLICK1
31	60	GPIO43_ADC2	I/O	GPIO / ADC in	AN CLICK2
32	66	VOUT_2V5	AO		
33	67	VREF_ADC	AI		min 1.8V, max 2.5V
34	81	PMU_EN	I		pull-up on module
35	70	WAKEUP	I	Ext. Wakeup Input	pull-up on module
36	69	EXT_PMU_EN	O	Ext. 3V3 regulator enable	
37		GND	GND		

Note! Highlighted items indicate changes from Rev.1 Azure Sphere Starter Kit hardware

Pad 16: Changed to **GPIO39** on Rev.2 modules (was GPIO16 on Rev.1 modules)

Pad 17: Changed to **GPIO36** on Rev.2 modules (was GPIO17 on Rev.1 modules)

Module Pinout Table (continued)

Module Pad	MT3620 Pad	MT3620 Net Name	I/O	Pin Function	Pre-Assigned Starter Kit Function=BLUE
38		GND	GND		
39	71	3V3_RTC	Power		min 2.50 V, max 3.63V
40		GND	GND		
41		GND	GND		
42	88,89	3V3	Power		
43	88,89	3V3	Power		
44	94	DEBUG_RXD	I	Debug UART	DEBUG_RXD
45	96	DEBUG_RTS	O	Debug UART (pulled-down / FTDI controlled strapping state on Starter Kit)	DEBUG_RTS
46	95	DEBUG_TXD	O	Debug UART (pulled-down on module)	DEBUG_TXD
47	97	DEBUG_CTS	I	Debug UART	DEBUG_CTS
48	98	SWD_DIO	I/O	CM4F SWD	SWD_DIO
49	99	SWD_CLK	I	CM4F SWD	SWD_CLK
50	100	SWO	O	CM4F SWD	SWO
51	125	SYSRST_N	I		SYSRST_N
52	127	SERVICE_TXD	O	Service UART	SERVICE_TXD
53	129	SERVICE_RXD	I	Service UART	SERVICE_RXD
54	128	SERVICE_RTS	O	Service UART	SERVICE_RTS
55	130	SERVICE_CTS	I	Service UART	SERVICE_CTS
56	134	RECOVERY_RXD	I	Recovery UART	RECOVERY_RXD
57	135	RECOVERY_TXD	O	Recovery UART (PU on module)	RECOVERY_TXD
58	136	RECOVERY_RTS	O	Recovery UART (pulled-down on module)	RECOVERY_RTS
59	137	RECOVERY_CTS	I	Recovery UART	RECOVERY_CTS
60	139	IO0_GPIO86/IO0_TXD	O	IO0_GPIO / IO0_TXD (pulled-down on module)	IO0_TXD
61	143	IO1_GPIO90/IO1_TXD	O	IO1_GPIO / IO1_TXD (pulled-down on module)	IO1_TXD
62 - 66		GND	GND	GND pour	
67		PADGND	GND	Thermal pad for MT3620	

Note! Azure Sphere OS support for some MT3620 features is still to be released by Microsoft.
eg. GPIO, UART, I2C and SPI peripherals are now supported, but support for the ARM Cortex-M4F cores, ADC and PWM and functions is at this time still pending.

Electrical Specifications

Note! The electrical characteristics documented here are for the MT3620AN SoC device only, as defined in the Mediatek MT3620AN Datasheet and Product Brief documents

Absolute Maximum Ratings

Symbol	Parameter	Max	Unit
3V3	3.3V Supply Voltage	-0.3 to 3.63	V
T_{STG}	Storage Temperature	-40 to +125	°C
V_{ESD}	ESD protection (human body model)	2000	V

Recommended Operating Conditions

Symbol	Rating	Min	Typ	Max	Unit
3V3	3.3V supply	2.97	3.3	3.63	V
3V3_RTC	RTC supply	2.5	3.3	3.63	V
T_{AMBIENT}	Ambient Temperature	-40	-	+85	°C

DC Characteristics

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IL}	Input Low Voltage	LVTTL	-0.28	0.8	V
V_{IH}	Input High Voltage		2.0	3.63	V
V_{OL}	Output Low Voltage	I _{OL} = 4 to 16 mA	-0.28	0.4	V
V_{OH}	Output High Voltage	I _{OH} = 4 to 16 mA	2.4	VDD33+0.33	V
R_{PU}	Input Pull-Up Resistance	PU=high, PD=low	40	190	kΩ
R_{PD}	Input Pull-Down Resistance	PU=low, PD=high	40	190	kΩ

Current Consumption

Power mode	Description	Details		Typical current consumption	Hardware wake-up latency
		Subsystem	Power State		
RTC mode	Only RTC domain is on. Memory is not retained. Requires a cold boot to resume	Pluton CM4 subsystem	Off	0.01mA or 0.02mA (*1)	24ms (crystal and PLL lock, PMU time)
		CA7 subsystem	Off		
		CM4F I/O subsystems	Off		
		Wi-Fi subsystem	Off		
		Buses/peripherals	Off		
Worst case power consumption no Wi-Fi	All subsystems apart from Wi-Fi running at full speed	Pluton CM4 subsystem	On	220mA Worst case 380mA (*2)	N/A, 650us WiFi subsystem resume latency
		CA7 subsystem	On		
		IO 0/1 CM4 subsystems	On		
		Wi-Fi subsystem	Light sleep		
		Buses/peripherals (*3)	On		
Worst case power consumption with Wi-Fi (*2)	All subsystems running at full speed, Wi-Fi very active	Pluton CM4 subsystem	On	520mA (*4) Worst case 750mA (*2)	N/A
		CA7 subsystem	On		
		IO 0/1 CM4 subsystems	On		
		Wi-Fi subsystem	On		
		Buses/peripherals (*3)	On		
		RF (A or G Band)	On		
		Flash (*5)	On		

Note *1: 0.01mA/0.02mA with/without external 3.3v source PMIC control switch respectively.

Note *2: The current values are measured under typical case (TT silicon and 25C/1.15V) and the TDP (max thermal design power) includes simulation worst case condition (TT/125C/1.15V/MC99 ,MC99 is PTPX power simulation library).

Note *3: It depends on how busy the peripherals are and how they are configured.

Note *4: This data is based on 100% Wi-Fi transmission on the 5GHz band at 14dBm.

Note *5: It depends on the I/O loading and flash power consumption.

RF Characteristics

Wi-Fi 2.4GHz Band RF Receiver Specifications

The specification in table below is measured at the antenna port, which includes the front-end loss.

Parameter	Description	Performance				
		Min	Typical		Max	Unit
			Main	Aux		
Frequency range	Center channel frequency	2412			2484	MHz
RX sensitivity	DBPSF, 1 Mbps DSSS	-	-94.6	-97.1	-90.0	dBm
	DQPSF, 2 Mbps DSSS	-	-91.6	-94.1	-87.0	dBm
	DQPSF, 5.5 Mbps CCK	-	-89.6	-92.1	-85.0	dBm
	DQPSF, 11 Mbps CCK	-	-86.6	-89.1	-82.0	dBm
	BPSK rate 1/2, 6 Mbps OFDM	-	-91.6	-94.1	-87.0	dBm
	BPSK rate 3/4, 9 Mbps OFDM	-	-89.3	-91.8	-86.0	dBm
	QPSK rate 1/2, 12 Mbps OFDM	-	-88.5	-91.0	-84.0	dBm
	QPSK rate 3/4, 18 Mbps OFDM	-	-86.1	-88.6	-82.0	dBm
	16QAM rate 1/2, 24 Mbps OFDM	-	-82.8	-85.3	-81.0	dBm
	16QAM rate 3/4, 36 Mbps OFDM	-	-79.4	-81.9	-78.0	dBm
	64QAM rate 1/2, 48 Mbps OFDM	-	-75.2	-77.7	-73.0	dBm
	64QAM rate 3/4, 54 Mbps OFDM	-	-73.9	-76.4	-71.0	dBm
RX sensitivity BW=20MHz, Mixed mode 800ns guard interval, Non-STBC	MCS 0, BPSK rate 1/2	-	-90.9	-93.4	-87.0	dBm
Maximum Receive Level	MCS 1, QPSK rate 1/2	-	-87.7	-90.2	-86.0	dBm
	MCS 2, QPSK rate 3/4	-	-85.3	-87.8	-84.0	dBm
	MCS 3, 16QAM rate 1/2	-	-82.3	-84.8	-81.0	dBm
	MCS 4, 16QAM rate 3/4	-	-78.8	-81.3	-77.0	dBm
	MCS 5, 64QAM rate 2/3	-	-74.4	-76.9	-74.0	dBm
	MCS 6, 64QAM rate 3/4	-	-73.0	-75.5	-71.0	dBm
	MCS 7, 64QAM rate 5/6	-	-71.8	-74.3	-69.0	dBm
	1 Mbps DSSS	-20	-10	-	-	dBm
	11 Mbps CCK	-20	-10	-	-	dBm
	6 Mbps OFDM	-20	-10	-	-	dBm
	54 Mbps OFDM	-20	-10	-	-	dBm
	HT20 MCS0	-20	-10	-	-	dBm
	HT20 MCS7	-20	-20	-	-	dBm

Wi-Fi 2.4GHz Band RF Receiver Specifications (continued)

Parameter	Description	Performance			
		Min	Typical		Unit
			Main	Aux	
Receive adjacent channel rejection	BPSK rate 1/2, 6 Mbps OFDM	16	34	-	dBm
	BPSK rate 3/4, 9 Mbps OFDM	15	31	-	dBm
	QPSK rate 1/2, 12 Mbps OFDM	13	30	-	dBm
	QPSK rate 3/4, 18 Mbps OFDM	11	27	-	dBm
	16QAM rate 1/2, 24 Mbps OFDM	8	25	-	dBm
	16QAM rate 3/4, 36 Mbps OFDM	4	23	-	dBm
	64QAM rate 1/2, 48 Mbps OFDM	0	22	-	dBm
	64QAM rate 3/4, 54 Mbps OFDM	-1	22	-	dBm
	MCS 0, BPSK rate 1/2	16	33	-	dBm
	MCS 1, QPSK rate 1/2	13	29	-	dBm
	MCS 2, QPSK rate 3/4	11	26	-	dBm
	MCS 3, 16QAM rate 1/2	8	24	-	dBm
	MCS 4, 16QAM rate 3/4	4	20	-	dBm
	MCS 5, 64QAM rate 2/3	0	18	-	dBm
	MCS 6, 64QAM rate 3/4	-1	17	-	dBm
	MCS 7, 64QAM rate 5/6	-2	15	-	dBm
Receiver residual PER	All rates, -50dBm input power	-	-	0.005	%

Wi-Fi 2.4GHz Band RF Transmitter Specifications

The specification in table below is measured at the antenna port, which includes the front-end loss.

Parameter	Description	Performance			
		Min	Typical	Max	Unit
Frequency range	Center channel frequency	2412	-	2484	MHz
Output power with spectral mask and EVM compliance	1 Mbps DSSS	- x	16(1)	-	dBm
	11 Mbps CCK	-	16(1)	-	dBm
	6 Mbps OFDM	-	16(1)	-	dBm
	54 Mbps OFDM	-	16(1)	-	dBm
	HT20 MCS 0	-	16(1)	-	dBm
	HT20 MCS 7	-	16(1)	-	dBm
Output power with spectral mask and EVM compliance (at -40°C and 85°C)	1 Mbps DSSS	-	15(1)	-	dBm
	11 Mbps CCK	-	15(1)	-	dBm
	6 Mbps OFDM	-	15(1)	-	dBm
	54 Mbps OFDM	-	15(1)	-	dBm
	HT20 MCS 0	-	15(1)	-	dBm
	HT20 MCS 7	-	15(1)	-	dBm
TX EVM	1 Mbps DSSS	-	-	-10	dB
	11 Mbps CCK	-	-	-10	dB
	6 Mbps OFDM	-	-	-5	dB
	54 Mbps OFDM	-	-	-25	dB
	HT20 MCS 0	-	-	-5	dB
	HT20 MCS 7	-	-	-28	dB
Output power variation(2)	TSSI closed-loop control across all temperature range and channels and VSWR $\leq 1.5:1$.	-1.5	-	1.5	dB
Carrier suppression	-	-	-	-30	dBc
Harmonic output power	2nd Harmonic	-	-45	-43	dBm/MHz
	3rd Harmonic	-	-45	-43	dBm/MHz

Note 1: Low power PA.

Note 2: VDD33 voltage is within $\pm 5\%$ of typical value.

Wi-Fi 5GHz Band RF Receiver Specifications

Specifications in the table below are measured at the antenna port, which includes the front-end loss.

Parameter	Description	Performance				
		Min	Typical		Max	Unit
			Main	Aux		
Frequency range	Center channel frequency	5180	-		5825	MHz
RX sensitivity	BPSK rate 1/2, 6 Mbps OFDM	-	-90.0	-91.5	-86.0	dBm
	BPSK rate 3/4, 9 Mbps OFDM	-	-87.7	-89.2	-85.0	dBm
	QPSK rate 1/2, 12 Mbps OFDM	-	-87.0	-88.5	-83.0	dBm
	QPSK rate 3/4, 18 Mbps OFDM	-	-84.5	-86.0	-81.0	dBm
	16QAM rate 1/2, 24 Mbps OFDM	-	-81.3	-82.8	-75.0	dBm
	16QAM rate 3/4, 36 Mbps OFDM	-	-78.0	-79.5	-72.0	dBm
	64QAM rate 1/2, 48 Mbps OFDM	-	-73.6	-75.1	-70.0	dBm
	64QAM rate 3/4, 54 Mbps OFDM	-	-72.2	-73.7	-68.0	dBm
RX sensitivity BW=20MHz HT Mixed mode 800ns guard interval non-STBC	MCS 0, BPSK rate 1/2	-	-89.3	-90.8	-86.0	dBm
	MCS 1, QPSK rate 1/2	-	-86.3	-87.8	-84.0	dBm
	MCS 2, QPSK rate 3/4	-	-83.8	-85.3	-82.0	dBm
	MCS 3, 16QAM rate 1/2	-	-80.8	-82.3	-76.0	dBm
	MCS 4, 16QAM rate 3/4	-	-77.3	-78.8	-74.0	dBm
	MCS 5, 64QAM rate 2/3	-	-72.8	-74.3	-72.0	dBm
	MCS 6, 64QAM rate 3/4	-	-71.4	-72.9	-70.0	dBm
	MCS 7, 64QAM rate 5/6	-	-70.2	-71.7	-66.0	dBm
Maximum receive level	6 Mbps OFDM	-30	-10		-	dBm
	54 Mbps OFDM	-30	-20		-	dBm
	MCS0	-30	-15		-	dBm
	MCS7	-30	-20		-	dBm
Receive adjacent channel rejection	BPSK rate 1/2, 6 Mbps OFDM	16	24		-	dBm
	BPSK rate 3/4, 9 Mbps OFDM	15	23		-	dBm
	QPSK rate 1/2, 12 Mbps OFDM	13	21		-	dBm
	QPSK rate 3/4, 18 Mbps OFDM	11	19		-	dBm
	16QAM rate 1/2, 24 Mbps OFDM	8	15		-	dBm
	16QAM rate 3/4, 36 Mbps OFDM	4	10		-	dBm
	64QAM rate 1/2, 48 Mbps OFDM	0	5		-	dBm
	64QAM rate 3/4, 54 Mbps OFDM	-1	3		-	dBm
	MCS 0, BPSK rate 1/2	16	24		-	dBm
	MCS 1, QPSK rate 1/2	13	21		-	dBm
	MCS 2, QPSK rate 3/4	11	19		-	dBm
	MCS 3, 16QAM rate 1/2	8	16		-	dBm

Wi-Fi 2.4GHz Band RF Receiver Specifications (continued)

Parameter	Description	Performance			
		Min	Typical		Unit
			Main	Aux	
	MCS 4, 16QAM rate 3/4	4	12		dBm
	MCS 5, 64QAM rate 2/3	0	7		dBm
	MCS 6, 64QAM rate 3/4	-1	5		dBm
Receiver residual PER	MCS 7, 64QAM rate 5/6	-2	3		dBm

Wi-Fi 5GHz Band RF Transmitter Specifications

The specification in table below is measured at the antenna port, which includes the front-end loss.

Parameter	Description	Performance			
		Min	Typical	Max	Unit
Frequency range	Center channel frequency	5180	-	5825	MHz
Output power with spectral mask and EVM compliance	6 Mbps OFDM	-	14(1)	-	dBm
	54 Mbps OFDM	-	14(1)	-	dBm
	HT20 MCS 0	-	14(1)	-	dBm
	HT20 MCS 7	-	14(1)	-	dBm
Output power with spectral mask and EVM compliance (at -40°C and 85°C)	6 Mbps OFDM	-	13(1)	-	dBm
	54 Mbps OFDM	-	13(1)	-	dBm
	HT20 MCS 0	-	13(1)	-	dBm
	HT20 MCS 7	-	13(1)	-	dBm
TX EVM	6 Mbps OFDM	-	-	-5	dB
	54 Mbps OFDM	-	-	-25	dB
	HT20 MCS 0	-	-	-5	dB
	HT20 MCS 7	-	-	-28	dB
Output power variation(2)	TSSI closed-loop control across all temperature range and channels and VSWR $\leq 1.5:1$.	-1.5	-	1.5	dB
Carrier suppression		-	-	-30	dBc
Harmonic output power	2nd Harmonic	-	-45	-43	dBm/MHz
	3rd Harmonic	-	-45	-43	dBm/MHz

Note 1: Low power PA

Note 2: VDD33 voltage is within $\pm 5\%$ of typical value.

Wi-Fi RF Receiver Blocking Specifications

The specifications in table below are measured at the antenna port, which includes the front-end loss.

Parameter	Description	Performance			
		Min	Typical	Max	Unit
Receiver in-band blocking(1) CW and BT interferers	2.4 GHz CW and BT interfering signal @ ± 20 MHz offset	-47	-	-	dBm
	2.4 GHz CW and BT interfering signal @ ± 25 MHz offset	-40	-	-	dBm
	5 GHz CW interfering signal @ ± 20 MHz offset	-35	-	-	dBm
Receiver out-band blocking(1) CW interferer	$25 \leq f < 2300$ MHz	-28	-	-	dBm
	$2300 \leq f < 2395$ MHz	-40	-	-	dBm
	$2483.5 < f \leq 2583.5$ MHz	-45	-	-	dBm
Receiver out-band blocking(1) CDMA, GSM, DCS and PCS interferers(2)	CDMA UL: 824 – 849 MHz	-20	-	-	dBm
	CDMA DL: 869 – 894 MHz	-10	-	-	dBm
	GSM UL: 880 – 915 MHz	-10	-	-	dBm
	GSM DL: 925 – 960 MHz	-10	-	-	dBm
	DCS UL: 1710 – 1785 MHz	-13	-	-	dBm
	DCS DL: 1805 – 1880 MHz	-20	-	-	dBm
	PCS UL: 1850 – 1910 MHz	-20	-	-	dBm
Receiver out-band blocking(1) WiFi interferers	5G receiver only, interfering signal: $2400 < f \leq 2483.5$ MHz	-20	-	-	dBm
	2G receiver only, interfering signal: $5125 < f \leq 5850$ MHz	-20	-	-	dBm

Note 1: The desired signal's strength is 3 dB above the Maximum RX sensitivity. **PER** $\leq$ 10%.

Note 2: Except harmonic mixing.

Tape and Reel Packaging

AES-MS-MT3620 Azure Sphere Modules are available in tape and reel packaging at quantities of 600 units. The reel dimensions are 13 inches (reel diameter) x 56 mm (tape-width). The 56 mm tape-width conforms to the Electronic Components Association Standard EIA-481-D.

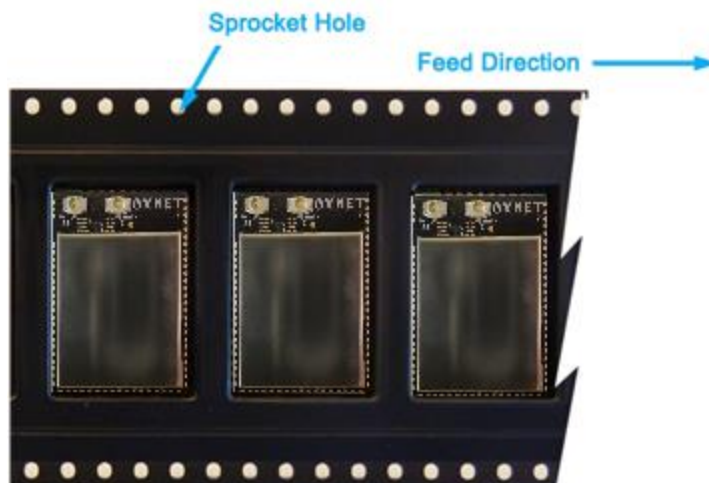
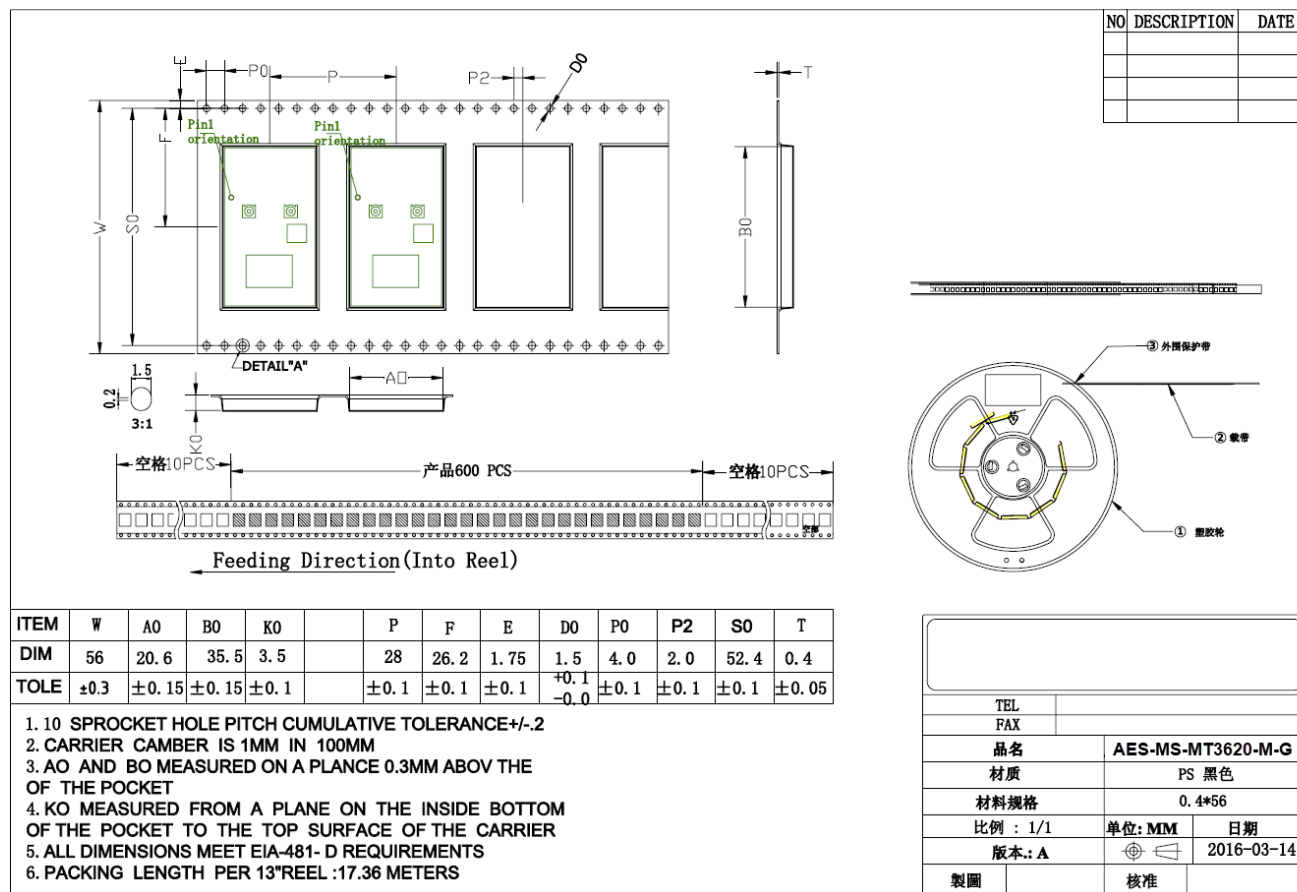


Figure 7 – Tape and Reel Details

Soldering and Cleaning Recommendations

Optimum Soldering Reflow Profile

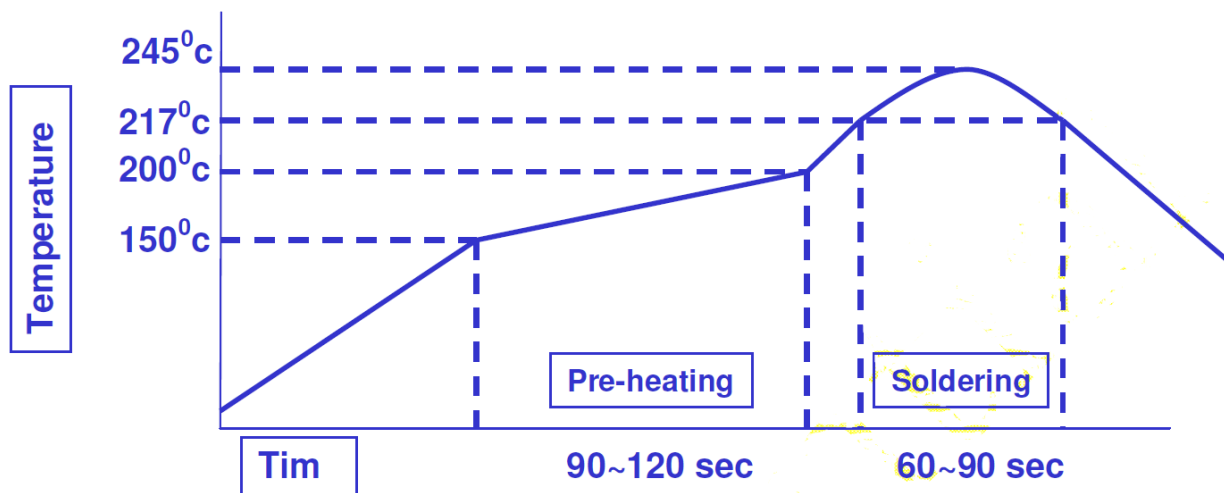


Figure 8 – Recommended Soldering Profile for Lead-Free Solder

- Solder joint quality between the AES-MS-MT3620 Azure Sphere Module's surface mount pads and their bonding with the host board should meet the appropriate IPC Specification.
(See *IPC-A-610-D Acceptability of Electronic Assemblies*, section 8.2.1 "Bottom Only Terminations")
- It is recommended that only a single reflow soldering process be permitted for the host board
- Any attempts at reworking the module will invalidate warranty coverage and regulatory certifications

Cleaning

- Cleaning of the populated module is not recommended!
- Residuals under the module cannot be easily removed by any cleaning process
(Water / Solvents / Ultrasonic)

Certifications and Compliance

RoHS Compliance

AES-MS-MT3620 Azure Sphere Modules are lead-free and RoHS compliant.

Regulatory Compliance

FCC, IC certifications are currently pending

(Once the certification process has been concluded, this note will be removed from the datasheet)

AES-MS-MT3620 Azure Sphere Module certification applies to operation in various regulatory domains. This section outlines certification information specific to the following countries and regions:

Region	Regulatory Body	Status
United States	FCC	2AF62-AVT3620U (Pending)
Canada	ISED (IC)	21571-AVT3620U (Pending)
All	RoHS	Compliant

Should regulatory certification be required in a specific country or region not already covered, please contact your local Avnet sales office or create a support request at <http://avnet.me/mt3620-forums>

Antenna Compliance

This radio transmitter 21571-AVT3620U has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio 21571-AVT3620U a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Approved Antenna: **Galtronics 02102140-07341U1**

Galtronics 02102140-07341U1 Antenna Specifications	
Standard	Wi-Fi Dual Band
Frequency Range	2400-2500 MHz and 5150-5925 MHz
Peak Gain	1.9 dBi in the 2.4GHz band 2.7dBi for 5GHz band
VSWR	2:1
Feed Impedance	50Ω
Power Handling	30 dBm
Interface	U.FL
Cable Length	770 mm
Temperature Range	Operating: -20°C to +60°C (-4°F to +140°F) Storage: -20°C to +60°C (-4°F to +140°F)
Humidity Range	Operating: 10% to 85% non-condensing Storage: 5% to 90% non-condensing

FCC/IC Certification Testing was performed using the Galtronics 02102140-07341U1 patch antenna and was found to meet all FCC/IC requirements with the antenna specifications listed above for this specific patch antenna. The Galtronics 02102140-07341U1 connects directly to the U.FL ports on the module.

To use any antenna other than the Galtronics 02102140-07341U1, refer to the [Section 2.1043, Permissive Changes](#) policy guidelines from the FCC or the similar [ISED RSP-100](#) guidelines to determine if your antenna qualifies for a Class I or Class II Permissive Change for your product. No alternate antenna can be used without approval by the proper authoritative regulatory bodies. Please also keep in mind that this module is certified as a *Single Modular Transmitter* by the FCC, and thus any alternate antenna must also comply with the requirements laid out in [§15.212\(a\)\(1\)\(IV\)](#).

FCC and ISED Regulatory Notices (USA and Canada)

Modification statement

Avnet has not approved any changes or modifications to this device by the user.

Any changes or modifications could void the user's authority to operate the equipment!

Interference statement

This device complies with Part 15 of the FCC Rules and Industry Canada's license-exempt RSS standards. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

RF Radiation Exposure Statement

This equipment complies with FCC and ISED radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Class B Digital Device Notice (USA)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Module Statement (USA)

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1)(IV) as summarized below.

- 1) The radio elements have the radio frequency circuitry shielded.
- 2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.
- 3) The module contains power supply regulation on the module.
- 4) The module contains two unique U.FL antenna ports. Only the antenna described in [Antenna Compliance](#) can be used with this device, and any efforts to use a different antenna must be approved specifically by the FCC/IC regulatory bodies.
- 5) The module demonstrates compliance in a stand-alone configuration.
- 6) The module is labelled with its permanently affixed FCC ID label
- 7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.
- 8) The module complies with RF exposure requirements.

CAN ICES-003 (B)

This Class B digital apparatus complies with Canadian standard ICES-003.

Labeling Requirements for the OEM Host Board

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the FCC ID and IC of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains FCC ID: 2AF62-AVT3620U

Contains IC: 21571-AVT3620U

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received,
including interference that may cause undesired operation.

FCC Requirements for User Manual of the OEM Host Board:

The OEM integrator may not provide any information to the end user on how to install or remove this RF module or change RF related parameters in the user manual of the end product.

The following statement must be included as a CAUTION statement in manuals for the OEM products, to alert users of FCC RF exposure compliance:

“WARNING: To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operations at closer distances than this are not recommended”

The user manual for the final end product should include the following statement:

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

IC Requirements for User Manual of the OEM Host Board:

The user manual for the final end product shall display the following Industry Canada notices in a conspicuous location:

Industry Canada Statements

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

FCC Host 15B and 15C Compliance Statement and SDoC (USA)

The OEM integrator is responsible for testing their end-product for any additional compliance requirements needed with this module installed (eg. digital device emissions, PC peripheral requirements, etc).

The OEM is responsible for properly following requirements set forth by the FCC in [47 CFR § 2.906 - Supplier's Declaration of Conformity](#) to provide the required documentation and test reports confirming that conformity with regulations to use this module in the end product are met. Investigative measurements and spot checking are strongly recommended to verify that full system compliance is maintained when the module is integrated, in accordance with the "Host Product Testing Guidance" in FCC's [KDB 996369 D04 Module Integration Guide V01](#).

OEM Instructions

This module is certified for installation into OEM end-products under the following conditions:

- 1) The intended use of this AES-MS-MT3620-UFL-M-G-2 module is for **indoor locations**. If the end product using this module is able to operate in the band 5150-5250 MHz within Canada, it is **only** allowed to be used indoors (to reduce potential harmful interference to co-channel mobile satellite systems)
The label of the end product in this case **must** include the text "**For indoor use only**"
- 2) It's intended use is as a **Wi-Fi client** only (not a Wi-Fi access point or used in point-to-point mode)
- 3) The AES-MS-MT3620-UFL-M-G-2 module and external antennae connection is for OEM installation only.

The requirement for software security of UNII devices, is fully met by Microsoft Azure Sphere's advanced security. Software updates require certificate-based authentication using hardware-based root of trust.

The modules are delivered in the "**Module1Complete**" manufacturing state which blocks changes to RF related parameters and functions that could violate the RF usage limits of the module. OEMs can further lock the device against changes to software by setting the manufacturing state to "**DeviceComplete**":
<https://docs.microsoft.com/en-us/azure-sphere/hardware/factory-floor-tasks#set-the-device-manufacturing-state-to-manufacturing-complete>

Shipping, Handling and Storage

Shipping

Bulk orders of Avnet AES-MS-MT3620 Azure Sphere Modules are delivered in reels of 600.
(See detail under the section on Tape & Reel Packaging)

Handling

AES-MS-MT3620 Azure Sphere Modules contain sensitive electronic circuitry that require proper ESD protection when handling. Failure to follow these ESD procedures may result in permanent damage to the module.

The module should not be subjected to excessive mechanical shock.

Moisture Sensitivity (MSL)

Modules that have been exposed to moisture and environmental conditions exceeding the prescribed packaging and storage conditions detailed in J-STD-020 (eg. not continuously in a sealed bag with a desiccant pack) **MUST** be baked before mounting! (Failure to meet the packaging and storage conditions described, will result in irreparable damage to modules during solder reflow soldering).

For devices that are packaged in a Moisture Barrier Bag with a desiccant pack and HIC (Humidity Indicator Card), the HIC card should be referenced and J-STD-033 consulted to determine if baking is required prior to reflow soldering.

In cases where baking is required, refer to J-STD-033 for details of the bake procedure.

“Broken reel” module quantities (under 600 units) typically require baking before reflow soldering

Storage

Per J-STD-033, the shelf life of devices in a Moisture Barrier Bag is 12 months at <40°C and <90% room humidity (RH).

Do not store in salty air or an environment where there is a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO_x.

Do not store in direct sunlight.

Contact Information

For further details, contact your local Avnet representative or e-mail us at:

Region	Organization	Email	Address & Phone
North America	Avnet Americas	eval.kits@avnet.com	AVNET - Americas 2211 South 47th Street Phoenix, AZ 85034 USA Phone: 1-800-585-1602
Europe	Avnet Silica	Microsoft@silica.com	Avnet Silica Gruber Str. 60c 85586 Poing, Germany Phone: +49-8121-77702

Legal Information

Limitations

This product is not intended for use in safety-critical applications (such as life support or automotive) where a failure of the Avnet product could be expected to cause severe personal injury or death. Please refer to the final section of this document for additional restrictions to Avnet's legal liability

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Appendix-A: Programming Adaptor Footprint

A key aspect of the operation of the MT3620 device are the Over-the-Air (OTA) updates of the Azure Sphere OS firmware and the application software. There are however specific use cases where wired device interfaces are needed (see table below). It is therefore recommended that a 10-pin connector footprint be added to the OEM host board to interface with the module signals tabled below:

#	Use Case	MT3620 Interface
1	Wi-Fi network settings are missing or incorrectly configured	SERVICE UART
2	A7 DEBUG UART access is required	DEBUG UART
3	M4 IO0 and IO1 TXD output are needed (eg. for debug of M4 code)	M4F IO0 and IO1 TXD pins
4	Specific firmware must be loaded.	RECOVERY UART

Notes:

- 1) There is currently a need to facilitate the configuration of the Wi-Fi network settings via the SERVICE UART interface (the need for this will be reduced when Microsoft at later date adds support for configuration of Wi-Fi settings via Wi-Fi A/P mode).
- 2) Once Wi-Fi has been configured, the Sphere OS can be “recovered” to latest version OTA via Wi-Fi.
- 3) Access to the DEBUG UART output (of the A7 core) provides valued log-file status information that can prove useful during software development debugging.
- 4) Access to the M4 TXD outputs can likewise provide status information to the software developer.
- 5) Local firmware files are needed to utilize the RECOVERY interface to load specific operating system versions. Otherwise, the RECOVERY interface can only load the newest available OS version hosted on Microsoft’s Azure Sphere servers, which is already performed automatically via OTA updates to the module.

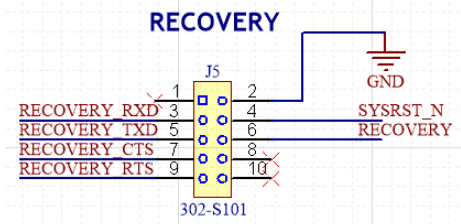
The [Azure Sphere CLI](#) tool included with the [development SDK](#) from Microsoft is available to facilitate using these interfaces via software. To support these interfaces via hardware, an FTDI-based USB to serial adaptor based on the [Microsoft-supplied example design](#) is soon to be available for purchase from Avnet, with 2x5 0.1” pitch and 2x10 0.05” pitch pin header connectors available for interfacing to a board containing the Azure Sphere module.



Figure 9 – Sphere Programming Interface Dongle

The dongle comes with four board-interfacing headers:

Recovery:

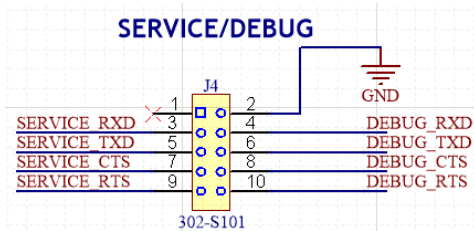


Header: 302-S101 by On Shore Technology Inc., 0.1" pitch

Recommended Cable: TC2050-IDC by Tag-Connect LLC

The Recovery header allows for operating system firmware images to be loaded onto the Azure Sphere device.

Service/Debug:

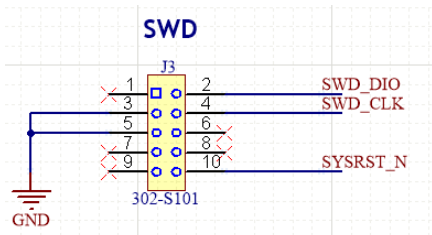


Header: 302-S101 by On Shore Technology Inc., 0.1" pitch

Recommended Cable: TC2050-IDC by Tag-Connect LLC

The Service UART allows for in-field application updates and device management such as Wi-Fi configuration and other settings specific to the A7 subsystem to be changed. The Debug UART allows for debugging user applications on the A7 subsystem via a Microsoft-supplied gdb-based mechanism in Visual Studio.

SWD:

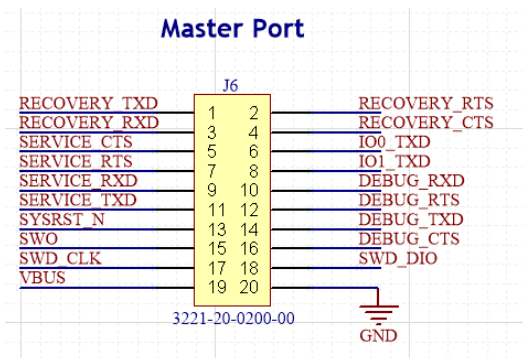


Header: 302-S101 by On Shore Technology Inc., 0.1" pitch

Recommended Cable: TC2050-IDC by Tag-Connect LLC

The SWD (Serial Wire Debug) header allows for the debugging of real-time applications on the M4 cores of the Sphere device using standard Serial Wire Debug protocol along with a Microsoft-supplied gdb-based mechanism in Visual Studio. If not developing M4 core applications, this header is optional.

Master Port:



Header: 3221-20-0200-00 by CNC Tech, 0.05" pitch

Recommended Cable: FFSD-10-D-10.00-01-N-R by Samtec Inc.

The Master Port combines the Recovery, Service/Debug, and SWD signals into a single header. Additionally, the Master Port also brings the M4 core UART signals (IO0_TXD and IO1_TXD) and SWO (Serial Wire Output) signals to the dongle and are routed to the dongle's M4 Debug header for easy interfacing to a separate serial port adapter. These M4 signals are only re-routed, no USB protocol conversion is performed on them.

To gain the full functionality of each of these available header configurations, all desired signals should be routed on the target board to the Azure Sphere module.

For the 10-pin headers, board interfacing can be accomplished using a connector-less tag-connect footprint and the [TC2050-IDC adapter cable](#) available from Tag-Connect LLC, requiring minimal board space and no additional components populated onto the target board.

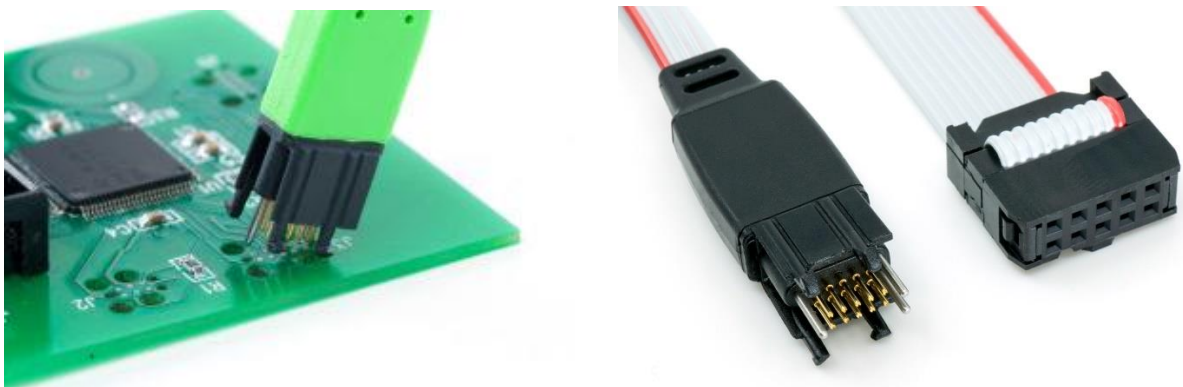


Figure 10 – Tag-Connect TC2050-IDC Cable Adapter