HARDWARE DESIGN GUIDE
FOR
ARTAFLEX WIRELESS MODULES

For Models:

AWP24S
AWS24S
AWP24U
AWAC24U
AWA24S
AW24MCHL-SM
AW24MCHL-H2
AW24MUFL-SM

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1. Introduction

This document provides information on designing Artaflex wireless modules into products that require 2.4 GHz ISM band wireless data transmission. A brief description is provided for all the modules to aid in assisting the designer on selecting the right model for the design. For more detailed information, please refer to engineering datasheets or contact Artaflex technical sales/support.
To ensure optimal RF performance, suggested design guidelines are provided for placement on PCB. Information on mating connectors on host board, solder reflow temperature profiles for assembly and reworking information are also provided. manufacturing are also provided.

Artaflex wireless modules operate in the 2.4 GHZ ISM band. The Falcon series modules are based on Cypress Semiconductor CyFi chipset and offer seamless compliance to the CyFi protocol. The modules are low power with transmitting data rates up to 1Mb/s and operating range from 50 meters for embedded antenna devices to 1 kilometer for devices equipped with a power amplifier. All modules are FCC/EU/ETS/Industry Canada agency certified.

2. Main Features

- Low operating current
- Transmit power from 4dBm up to +21 dBm
- Receive sensitivity up to –97 dBm
- Sleep current <1-10 μA
- Operating range from 10m to 1km or more depending on model and conditions
- DSSS data rates up to 250 kbps, GFSK data rate of 1 Mbps
- Auto Transaction Sequencer (ATS) - no micro controller intervention
- Framing, Length, CRC16, and Auto ACK
- Fast startup and fast channel changes
- Separate 16-byte transmit and receive FIFOs
- AutoRate™ - dynamic data rate reception
- Receive Signal Strength Indication (RSSI)
- 4-MHz SPI microcontroller interface
- No proprietary software required
- Serial Peripheral Interface (SPI) control while in sleep mode
- Operating voltage from 2.4 to 3.6 volts
- Operating temperature from 0 to 70°C
- Size: as small as 15mm(L) x 13.5(W) x 1.8mm(H)

- Weight: 5 - 27 grams
- FCC Modular Approval Grant to meet FCC Part 15, EN 300 328-1, EN 301 489-1, EN 301 489-7 and Industry Canada RSS-210 standards

3. Module Types

There are many packaging options available.
The following is a list of available modules with a brief description.

1) **AWP24S** has an integrated PCB print antenna. It is a first generation module.

2) **AWS24S** has a co-axial U.FL connector for attaching an external antenna. It is a first generation module.

3) **AWP24U** is a USB dongle version allowing it to plug into computers.

4) **AWA24S** has a power amplifier for longest operating range

5) **AWAC24U** is a USB dongle with a power amplifier that offers longest range and a computer interface

6) **AW24MCHL-H2** has a chip antenna and header connector. It is a second generation module that offers high performance in the smallest available package.

7) **AW24MCHL-HR** is the same as AW24MCHL-H2 but has a right angle connector allowing the module to be mounted perpendicular to host PCB.

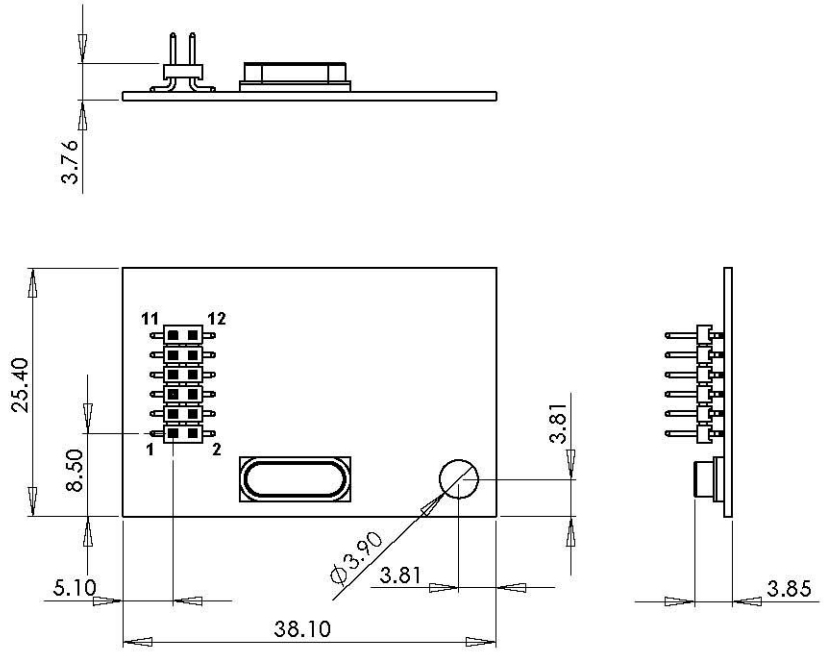
8) **AW24MCHL-SM** is a surface mount version that has the lowest profile since there is no header connector.

9) **AW24MUFL** has a header connector and has a U.FL connector for connecting an external antenna.

4. Mechanical Dimensions

a. AWP24S - Integrated PCB Antenna Module

Size: 38.1 mm x 25.4 mm (1.5” x 1.0”)

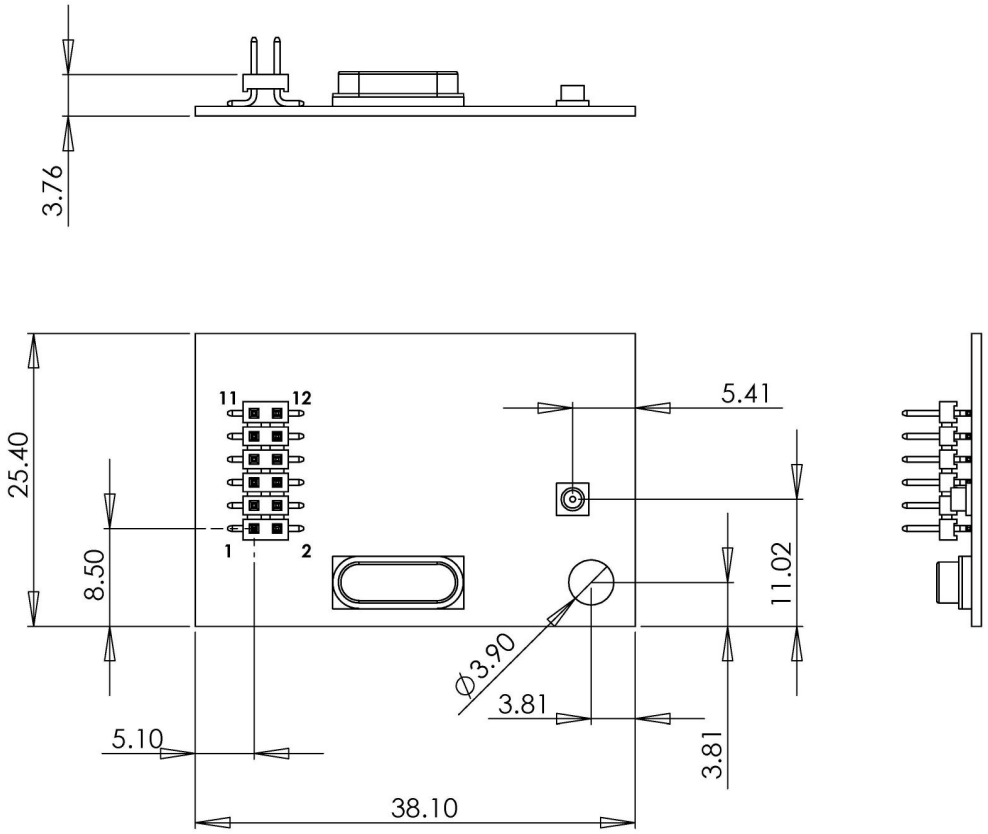


AWP24S **Connector Pin Information**

Pin	Name	Type	Default	Description
1	GND	Power	GND	Ground
2	VCC	Power	VCC	Main Supply 2.4 to 3.6 volts
3	IRQ	I/O	-	Interrupt output (configurable active high or low), or GPIO
4	RST	Input	Input	Module Reset. Internal on Chip 10k-ohm pull-down resistor. Active HIGH
5	MOSI	I/O	Input	SPI data input, or SDAT
6	$\overline{SS}$	Input	Pull Up	SPI Interface enable, Active LOW
7	SCK	Input	Input	SPI Clock
8	MISO	I/O	Hi Z	SPI data output pin or GPIO in 3-pin SPI mode.
9	GND	Power	GND	Ground
10	PACTL	NC		No Connect
11	TXPA	NC		No Connect
12	RXPA	NC		No Connect

b. AWS24S - Co-axial External Antenna Module

Size: 38.1 mm x 25.4 mm (1.5” x 1.0”)

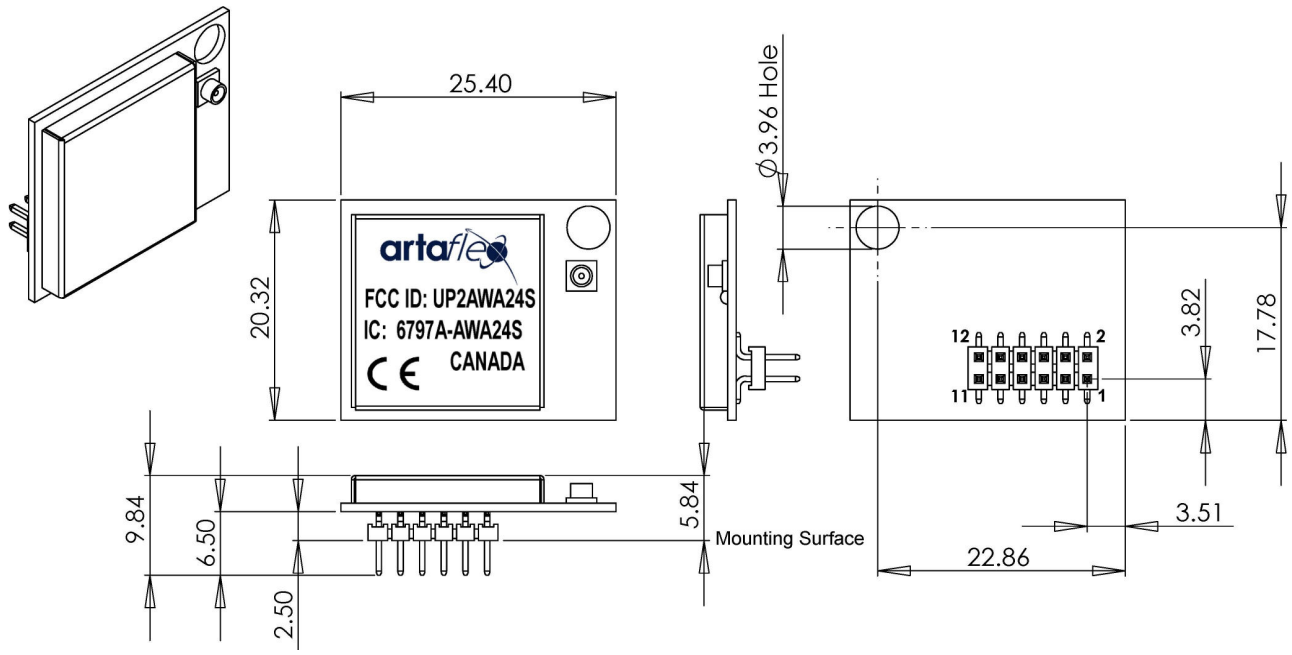


AWS24S **Connector Pin Information**

Pin	Name	Type	Default	Description
1	GND	Power	GND	Ground
2	VCC	Power	VCC	Main Supply 2.4 to 3.6 volts
3	IRQ	I/O	-	Interrupt output (configurable active high or low), or GPIO
4	RST	Input	Input	Module Reset. Internal on Chip 10k-ohm pull-down resistor. Active HIGH
5	MOSI	I/O	Input	SPI data input, or SDAT
6	$\overline{SS}$	Input	Pull Up	SPI Interface enable, Active LOW
7	SCK	Input	Input	SPI Clock
8	MISO	I/O	Hi Z	SPI data output pin or GPIO in 3-pin SPI mode.
9	GND	Power	GND	Ground
10	PACTL	NC		No Connect
11	TXPA	NC		No Connect
12	RXPA	NC		No Connect

c. AWA24S - Power Amplifier Module

Size: 25.4 mm x 20.32 mm

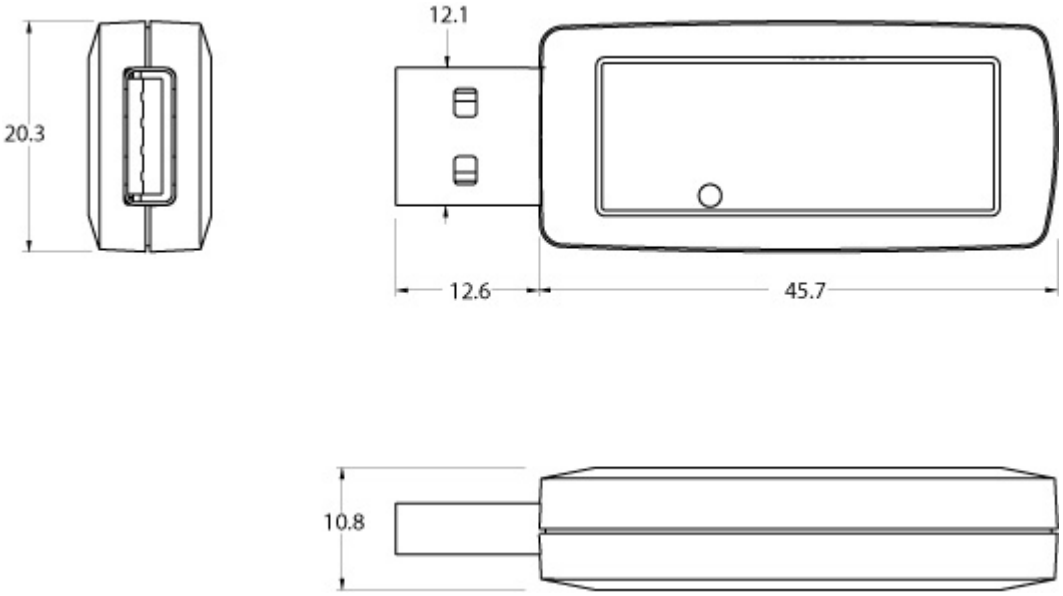


AWA24S **Connector Pin Information**

Pin	Name	Type	Default	Description
1	GND	Power	GND	Ground
2	VCC	Power	VCC	Main Supply 2.4 to 3.6 volts
3	IRQ	I/O	-	Interrupt output (configurable active high or low), or GPIO
4	RST	Input	Input	Module Reset. Internal on Chip 10k-ohm pull-down resistor. Active HIGH
5	MOSI	I/O	Input	SPI data input, or SDAT
6	$\overline{SS}$	Input	Pull Up	SPI Interface enable, Active LOW
7	SCK	Input	Input	SPI Clock
8	MISO	I/O	Hi Z	SPI data output pin or GPIO in 3-pin SPI mode.
9	GND	Power	GND	Ground
10	*PACTL	Input		Power Control – max power at 3.3V - Shut down “0V”
11	TXPA	Input		Active High to set Module into a Transmit mode (RXPA = Low)
12	RXPA	Input		Active High to set the Module into a Receive mode (TXPA = Low)

d. AWP24U - Wireless USB Dongle

Size: 45.7 mm x 20.3 mm

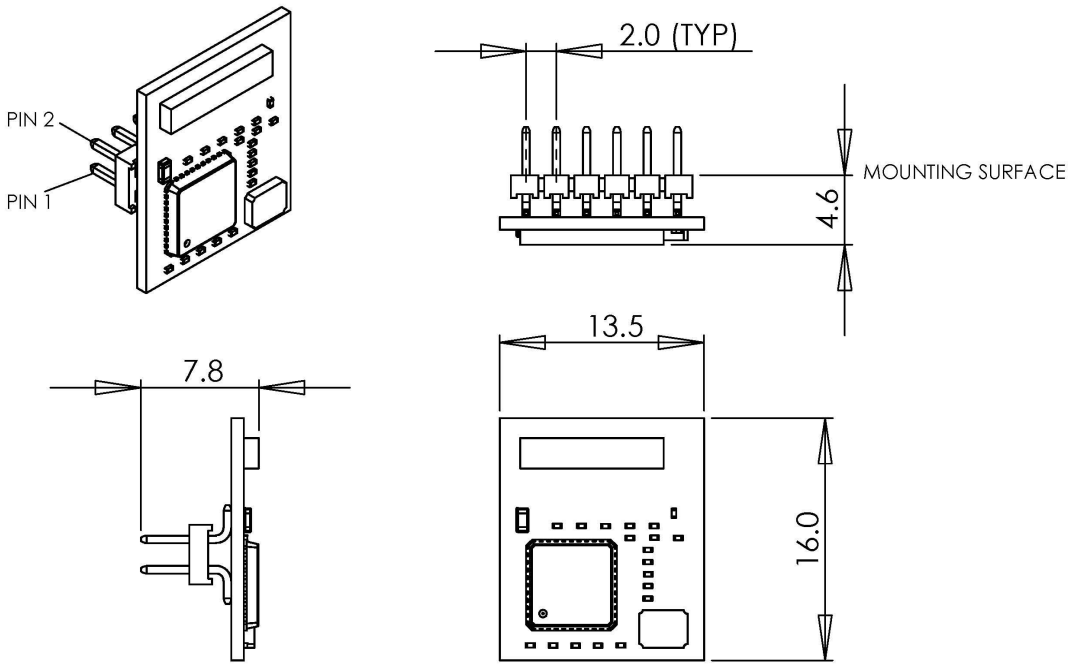


e. AWAC24U – Wireless USB Dongle with PA

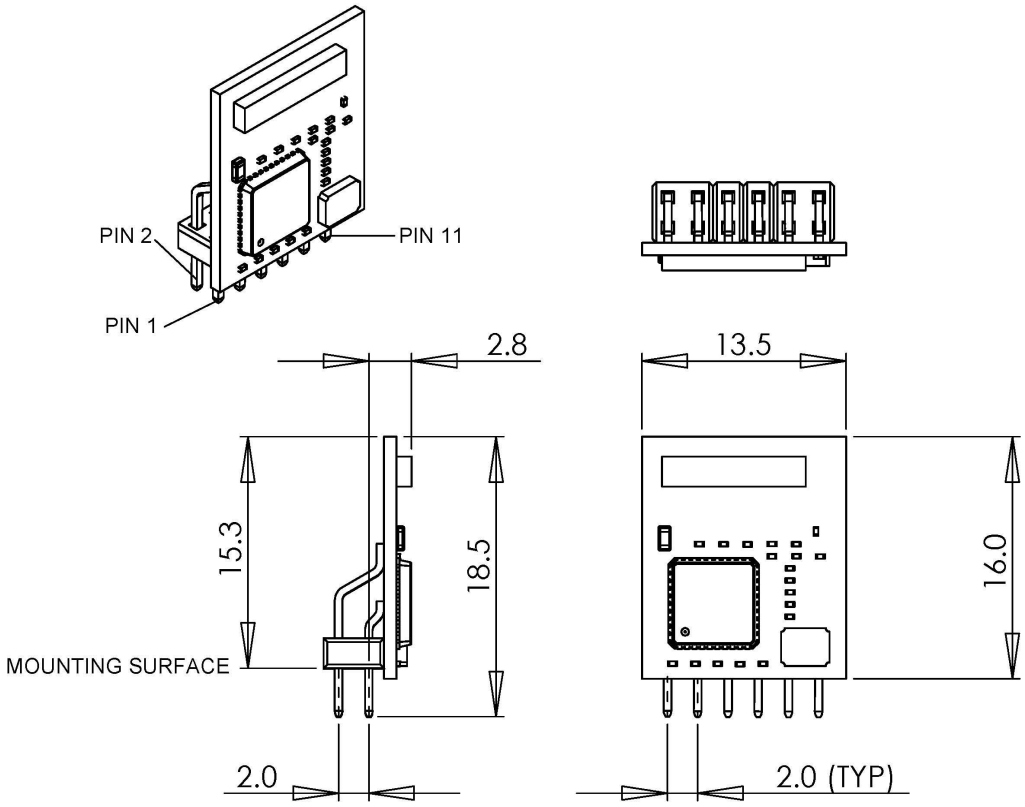
No Drawing Available. Mechanical Specifications Pending Release.

f. AW24MCHL-H2 - Micro Module with Chip Antenna

Size: 16 mm x 13.5 mm



g. AW24MCHL-HR - Micro Module with Chip Antenna and RA Connector

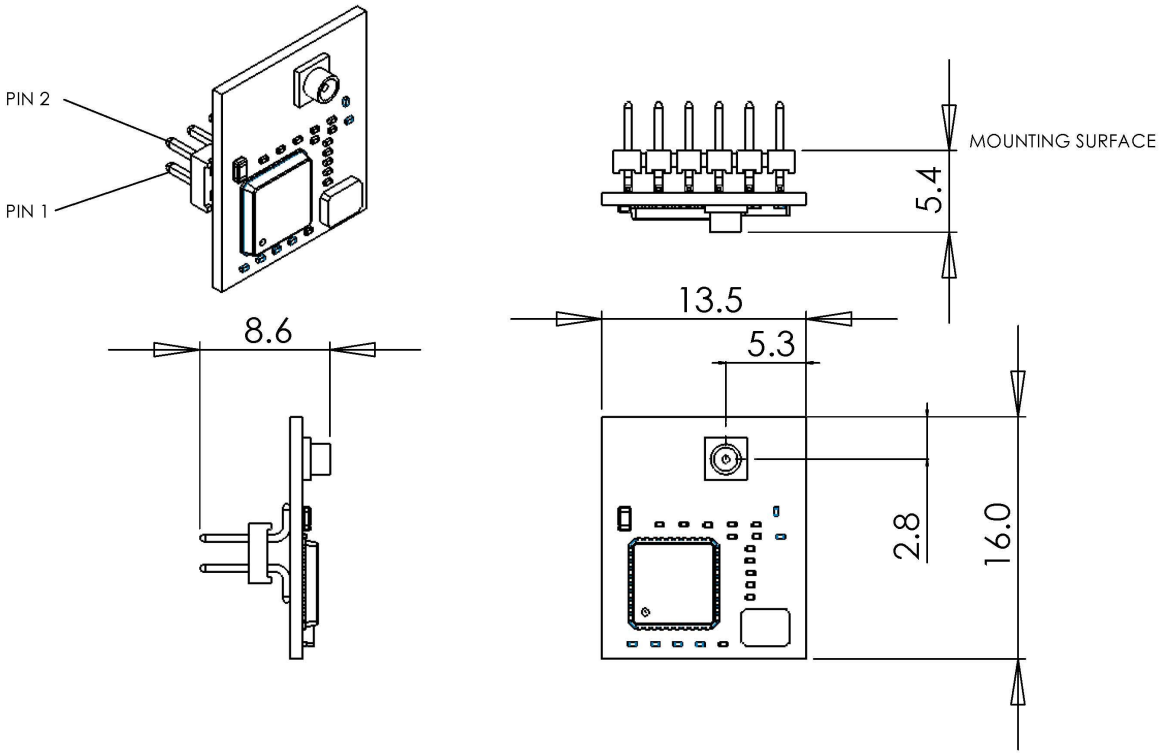


AW24MCHL-H2 / HR **Connector Pin Information**

Header Pin No	Name	Type	Default	Description
1	GND	Power	GND	Ground
2	VCC	Power	VCC	Main Supply 2.4 to 3.6 volts
3	IRQ	I/O	-	Interrupt output (configurable active high or low), or GPIO
4	RST	Input	Input	Module Reset. Internal on Chip 10k-ohm pull-down resistor. Active HIGH
5	MOSI	I/O	Input	SPI data input, or SDAT
6	$\overline{SS}$	Input	Pull Up	SPI Interface enable, Active LOW
7	SCK	Input	Input	SPI Clock
8	MISO	I/O	Hi Z	SPI data output pin or GPIO in 3-pin SPI mode.
9	GND	Power	GND	Ground
10		NC		No Connect .
11	TXPA	NC		No Connect
12	RXPA	NC		No Connect

h. AW24MUFL-H2 - Micro Module with UFL connector

Size: 16 mm x 13.5 mm

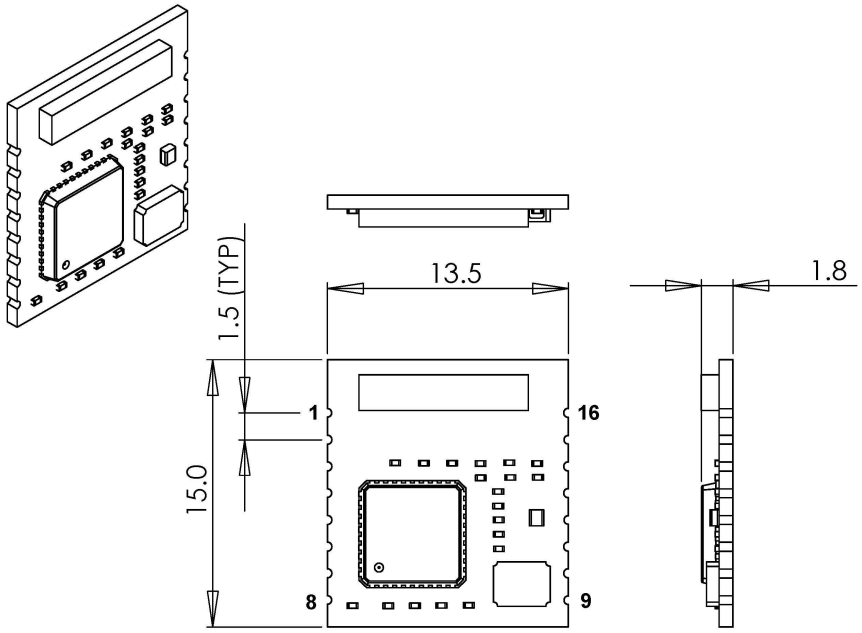


AW24MUFL-H2 **Connector Pin Information**

Header Pin No	Name	Type	Default	Description
1	GND	Power	GND	Ground
2	VCC	Power	VCC	Main Supply 2.4 to 3.6 volts
3	IRQ	I/O	-	Interrupt output (configurable active high or low), or GPIO
4	RST	Input	Input	Module Reset. Internal on Chip 10k-ohm pull-down resistor. Active HIGH
5	MOSI	I/O	Input	SPI data input, or SDAT
6	$\overline{SS}$	Input	Pull Up	SPI Interface enable, Active LOW
7	SCK	Input	Input	SPI Clock
8	MISO	I/O	Hi Z	SPI data output pin or GPIO in 3-pin SPI mode.
9	GND	Power	GND	Ground
10		NC		No Connect
11	TXPA	NC		No Connect
12	RXPA	NC		No Connect

i. AW24MCHL-SM - Micro Module with Surface Mount Connections

Size: 15 mm x 13.5 mm



AW24MCHL-SM Connector Pin out Information

SMT Pin No	Name	Type	Default	Description
12	GND	Power	GND	Ground
11	VCC	Power	VCC	Main Supply 2.4 to 3.6 volts
5	IRQ	I/O	-	Interrupt output (configurable active high or low), or GPIO
9	RST	Input	Input	Module Reset. Internal on Chip 10k-ohm pull-down resistor. Active HIGH
3	MOSI	I/O	Input	SPI data input, or SDAT
4	$\overline{SS}$	Input	Pull Up	SPI Interface enable, Active LOW
2	SCK	Input	Input	SPI Clock
6	MISO	I/O	Hi Z	SPI data output pin or GPIO in 3-pin SPI mode.
13	GND	Power	GND	Ground
1,14,15,16,10		NC		No Connect.
7	XOUT	I/O	O	Buffered 0.75, 1.5, 3, 6, or 12 MHz clock, PACTL, or GPIO. Tri-states in sleep mode (configure as GPIO drive LOW).
8	PACTL	I/O	O	CYRF7936 Control signal for external PA, T/R switch, or GPIO.

5.0 Design Guidelines

5.1 PCB Design

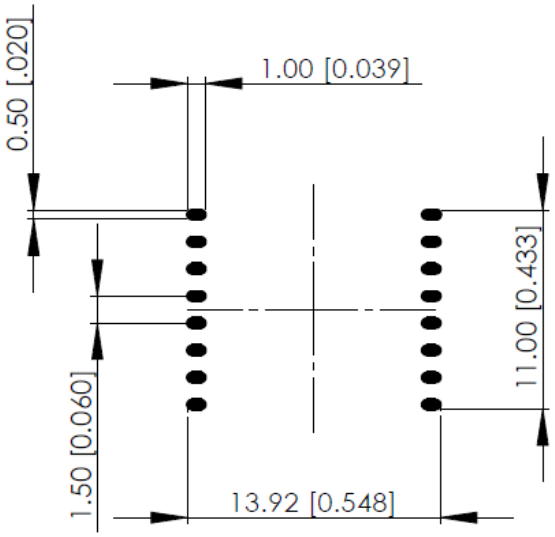
All Falcon wireless modules except the surface mount version require a mating receptacle connector on the host PCB. The following are recommended connectors manufactured by FCI that will mate to the modules. Equivalents from other manufacturers can also be used.
These are available as surface mount versions or through-hole:

FCI part number 55508-112TRLF (12 pin dual row 2mm vertical SM receptacle)
http://portal.fciconnect.com/portal/page/portal/FcicntPublic/ComergentConnect?appname=catDisplayStyle$domProductQueryName=55508-112TRLF*$OP=search

FCI part number 63453-112LF (12 pin dual row 2mm vertical through hole receptacle)
http://portal.fciconnect.com/portal/page/portal/FcicntPublic/ComergentConnect?appname=catDisplayStyle$domProductQueryName=63453-112lf*$OP=search

For Artaflex wireless module AW24MCHL-SM, there is no mating connector required since it is mounted directly onto the host PCB. See below for recommended land pattern.

RECOMMENDED LAND PATTERN



NOTES:

1. DIMENSIONS ARE IN mm, DIMENSIONS IN [ ] ARE IN INCHES
2. UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE +/- 0.13 [0.005]

5.2 Module Placement Strategy

Artaflex wireless modules are RF devices that require proper placement on PCB to ensure optimal performance. The antenna on the PCB has an omni-directional radiation pattern. To maximize antenna efficiency, an adequate grounding plane must be provided under the module. However, the areas underneath and surrounding the antenna area must be free of copper. The position of the module on the host board and overall design of the product enclosure contribute to antenna performance. Poor design effects radiation patterns and can result in reflection, diffraction, and/or scattering of the transmitted signal thus limiting the range. Measured radiation patterns of these modules are available from Artaflex and can be used to benchmark design performance. In summary:

i. Never place the ground plane or route copper traces directly underneath the antenna portion of the module.

ii. Never place the antenna close to metallic objects.

iii. Keep wiring, components and objects away from antenna.

iv. Do not place the antenna in a metallic or metalized plastic enclosure.

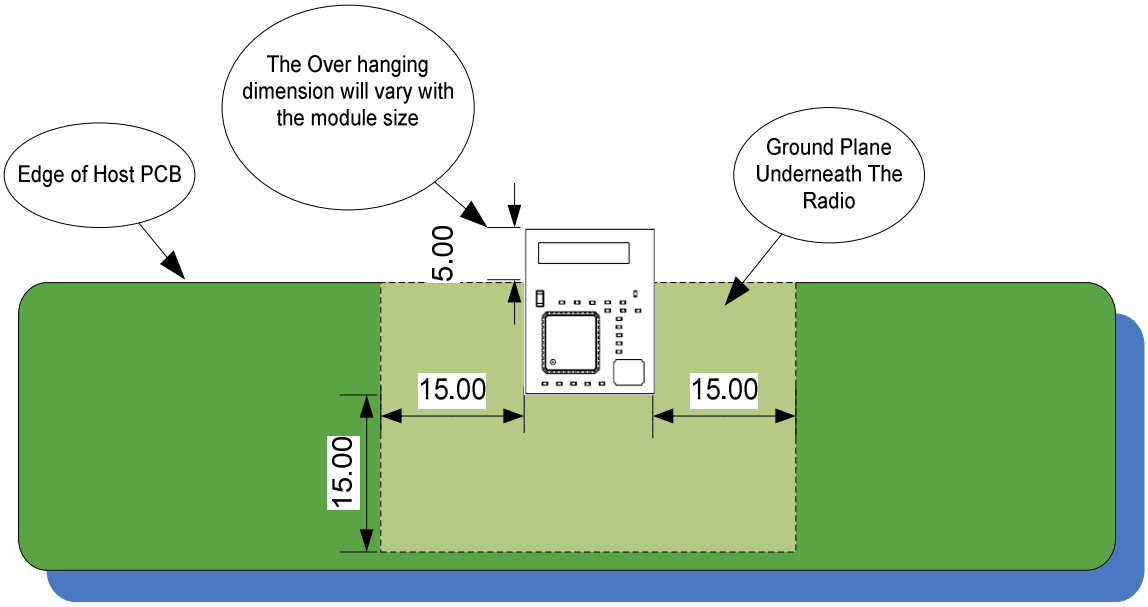
v. Enclosure walls should be 1cm or more away from the antenna in all directions.

vi. If possible, mount antenna overhanging the edge of the host board. Add an uninterrupted ground plane on host board, directly underneath the module, up to the PCB edge. Adding a ground plane will allow traces to be run on the on the bottom side of the host board if required. See diagram following.

vii. If antenna cannot be mounted in overhanging position, then provisions must be made to keep area clear of copper as recommended in diagram.

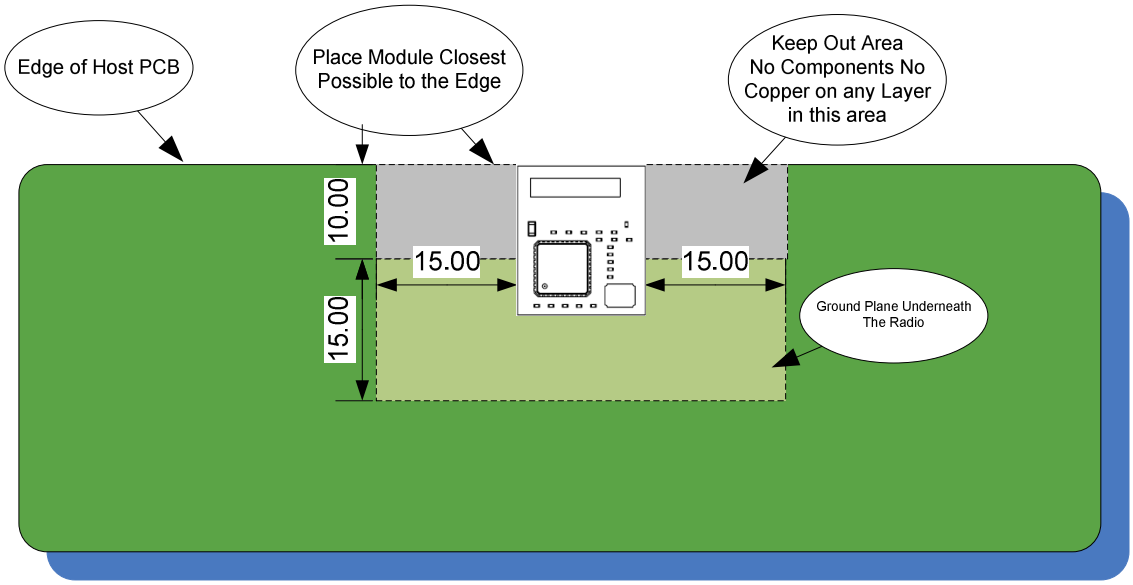
viii. For designs that require external antenna and U.FL connector, use recommended antenna. The rules for placement on edge are not required. However, a ground plane is necessary underneath the module.

If required, please contact Artaflex for assistance for PCB layout and RF design.



General Guideline for Placing Micro Module
Recommended Overhanging Antenna

*dimensions in mm



General Guideline for Placing Micro Module
If Antenna can't be overhang

*dimensions in mm

5.3 External Antenna Applications

Artaflex recommends using Centurion antenna WRR2400-IP04-B for modules that require an external antenna. This antenna has been qualified and approved for use by regulatory agencies in the US, Canada and European Union under the Modular Approval certification. It is compatible with the RF impedance and frequency range of all Artaflex models that have an external antenna with U.FL connector. The use of any antenna that does not meet the same parameters as the antenna recommended voids the Modular Approval grant.

Follow the recommended rules for optimal performance:

i. Place antenna vertically for longest range and best communication
ii. Allow 75-130 mm clearance from antenna to any metallic objects
iii.

6. SMT Assembly Guidelines for AW24MCHL-SM

j. Solder Reflow Profiles

Package Reflow Parameters
J-STD-020
Convention 220 +/- Reflow Profile

Average ramp-up rate (183° C to peak)	3° C/second max
Preheat temperature 125° C (+/- 25° C)	120 seconds max
Temperature maintained above 183° C	60~150 seconds
Time within 5° C of actual peak temperature	10~20 seconds
Peak temperature range	220 +5/-0° C
Ramp-down rate	6° C/second max
Time 25° C to peak temperature	6 minutes max

Package Reflow Parameters
J-STD-020
Convention 235 +5/-0° C Reflow Profile

Average ramp-up rate (183° C to peak)	3° C/second max
Preheat temperature 125° C (+/- 25° C)	120 seconds max
Temperature maintained above 183° C	60 ~150 seconds
Time within 5° C of actual peak temperature	10 ~ 20 seconds
Peak temperature range	235 +5/-0° C
Ramp-down rate	6° C/second max
Time 25° C to peak temperature	6 minutes max

Package Reflow Parameters
NEMI Recommended
Convection or IR 260° C Reflow Profile

Ramp-up rate (217° C to peak)	3° C/second max
Preheat temperature 125° C (+/- 25° C)	60 to 120 seconds max
Time 50° C to peak temperature	3.5 minutes, 6 minutes max
Temperature maintained above 217° C	60 to 150 seconds
Time within 5° C of actual peak temperature	10 ~ 20 seconds
Peak temperature range	260° C -5/+0° C
Ramp-down rate	6° C/second max

k. Pb-Free Soldering Paste

Use of “No Clean” soldering paste is strongly recommended, as it does not require cleaning after the soldering process.

Note: The quality of the solder joints on the castellations (‘half vias’) where they contact the host board should meet the appropriate IPC specification. See IPC-A-610-D Acceptability of Electronic Assemblies, section 8.2.4 Castellated Terminations.

l. Cleaning

In general, cleaning the populated modules is strongly discouraged. Residuals under the module cannot be easily removed with any cleaning process.

Cleaning with water can lead to capillary effects where water is absorbed into the gap between the host board and the module. The combination of soldering flux residuals and encapsulated water could lead to short circuits between neighboring pads. Water could also damage any stickers or labels.

Cleaning with alcohol or a similar organic solvent will likely flood soldering flux residuals into the two housings, which is not accessible for post-washing inspection. The solvent could also damage any stickers or labels.

Ultrasonic cleaning could damage the module permanently.

The best approach is to consider using a “no clean” soldering paste and eliminate the post-soldering cleaning step.

m. Optical Inspection

After soldering the Module to the host board, consider optical inspection to check the following:

Proper alignment and centering of the module over the pads.

Proper solder joints on all pads.

Excessive solder or contacts to neighboring pads, or vias.

n. Repeating Reflow Soldering

Only a single reflow soldering process is encouraged for host boards.

o. Wave Soldering

If a wave soldering process is required on the host boards due to the presence of leaded components, only a single wave soldering process should be used.

p. Hand Soldering

Hand soldering is possible. Use a soldering iron temperature setting equivalent to 350°C, follow IPC recommendations/reference document IPC-7711.

q. Rework

The SMT Module can be unsoldered from the host board. Use of a hot air re-work tool and hot plate for pre-heating from underneath is recommended. Avoid overheating.

Warning!

Never attempt a rework on the module itself, e.g. replacing individual components. Such actions will void warranty coverage.

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