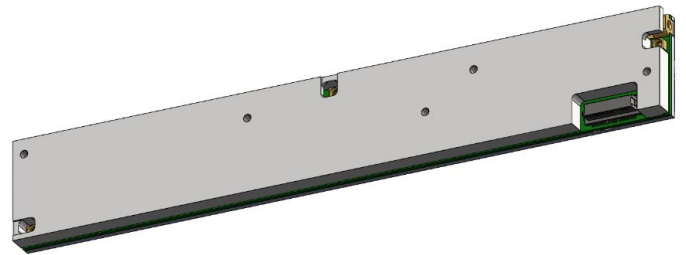**mercury**

AM9029 – Wideband Downconverter
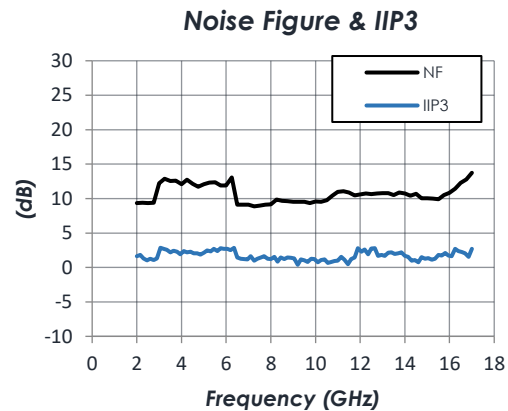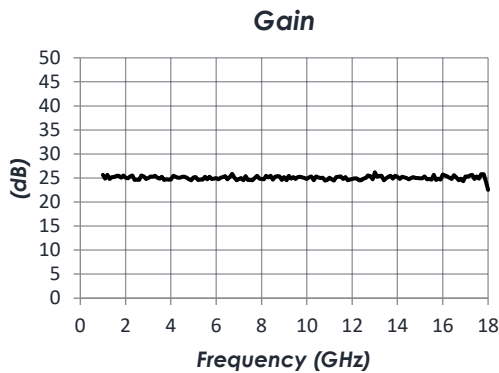## 1.0 GHz to 18 GHz Miniature Tuner Module

AM9029 is a high-performance tuner module covering the 1.0 GHz to 18 GHz frequency range. The AM9029 supports an instantaneous bandwidth of 2 GHz, with a center frequency of 3.8 GHz. The super-heterodyne tuner module is designed for high performance and low size, weight, and power (low SWaP) and is easily mounted to a host circuit board for use in multi-channel receiver applications. Includes sub-octave preselectors, low-noise pre-amplifiers, PLL synthesizers, frequency converters, power and control line filtering, and integrated SPI control are included. Interfacing to the tuner is accomplished by simply providing an RF input, DC voltages, frequency reference, SPI control, and connecting to the ADC.

FEATURES

- 1.0 GHz to 18 GHz Frequency Range
- 2 GHz Instantaneous Bandwidth
- 3.8 GHz IF Output Frequency
- Sub-Octave Preselection
- 14 dB Noise Figure, +2 dBm IIP

- 100 MHz external reference
- +3.3V and +5.0V DC Operation
- 6.5 W Power Consumption
- –40C to +85C Operation
- 5.1" x 0.77" (128mm x 19.5mm)

PERFORMANCE

Gain

Noise Figure & IIP3

CONTENTS

REVISION HISTORY

Date	Revision	Notes
November 10, 2022	0.1	Preliminary Release.
November 1, 2023	0.2	Mechanical & spec changes.
March 4, 2024	0.3	Miscellaneous updates.
September 9, 2024	1	Changed to Mercury branding. No content changes.

SPECIFICATIONS

Absolute Maximum Ratings

	Minimum	Maximum
RF Input Power		+20 dBm
Operating Temperature	–40 C	+85 C
Storage Temperature Range	–50 C	+150 C

Note: Any device operation beyond the Absolute Maximum Ratings may result in permanent damage to the device. The values listed in this table are extremes and do not imply functional operation of the device at these or any other conditions beyond what is listed under Recommended Operating Conditions. Any part subjected to conditions outside of what is recommended for an extended amount of time may suffer from reliability concerns.

Handling Information

	Minimum	Maximum
Storage Temperature Range (Recommended)	–50 C	+125 C

Mercury products are electrostatic sensitive.
Follow safe handling practices to avoid damage.

Recommended Operating Conditions

	Minimum	Typical	Maximum
Operating Case Temperature	–40 C		+75 C

PERFORMANCE SPECIFICATIONS

DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

Parameter	Testing Conditions	Min	Typical	Max
+3.6 VDC Supply		+3.4 V		+3.7 V
+5.2 VD Supply		+5.1 V		5.4V
+3.3 VDC Current			1.06 A	

DC Electrical Characteristics (Continued)
(T = 25 °C unless otherwise specified)

Parameter	Testing Conditions	Min	Typical	Max
+5 VDC Current			1.01 A	
Power Dissipated (<6 GHz)			6.36 W	
Power Dissipated (6-to-18 GHz)			6.48 W	
Logic Level Low		0 V		+0.8 V
Logic Level High		+2.0 V		+3.5 V

RF Performance
(T = 25 °C unless otherwise specified)

Parameter	Notes	Min	Typical	Max
Frequency Range		1 GHz		18 GHz
Bandwidth			2 GHz	
Tune Frequency Range		2 GHz		19 GHz
Frequency Reference	External Ref. Req.		100 MHz, 0 dBm	
Tuning Resolution			25 MHz	
Input IP3			+2 dBm	
Input IP2			+50 dBm	
Noise Figure			14 dB	
Output Power			+16 dBm	
Image Rejection			80 dB	
IF Rejection			80 dB	
LO Leakage			–80 dBm	
Gain[1]			25 dB	
Gain Control / Attenuation Range[1]			38 dB (1dB Steps)	
Tuning Speed			100 µs	500 µs

Note: Uncalibrated gain varies approximately 25 to 35 dB. Attenuators are adjusted for optimum performance with a gain of approximately 25 dB.

## PARTS ORDERING DETAILS

The AM9029 is sold as a module. All evaluation boards come with the Windows GUI control software and a user's guide. The ordering options are:

Part Number	Description
AM9029	Stand-alone Tuner Module
AM9029-EVAL	Tuner module on eval board

TYPICAL PERFORMANCE

(T = 25°C unless otherwise specified)

Gain

Noise Figure

IIP3

LO Radiation - Input

LO Radiation - Output
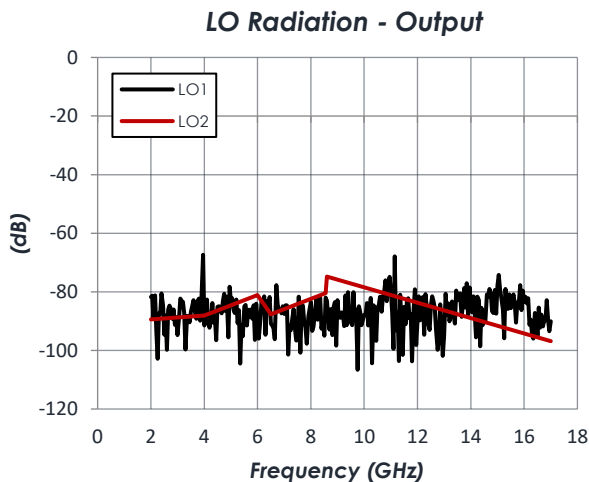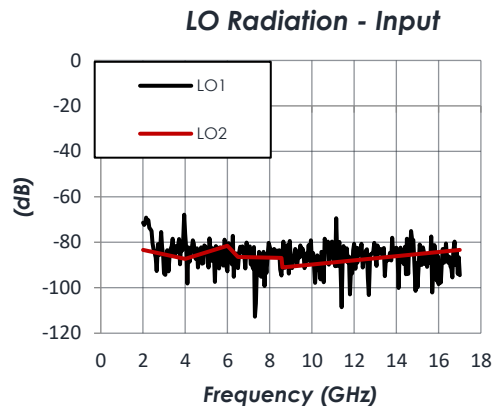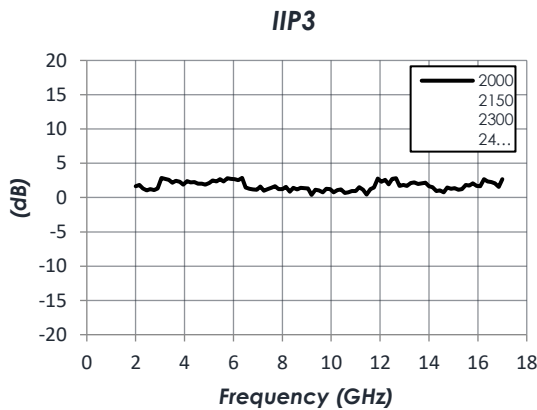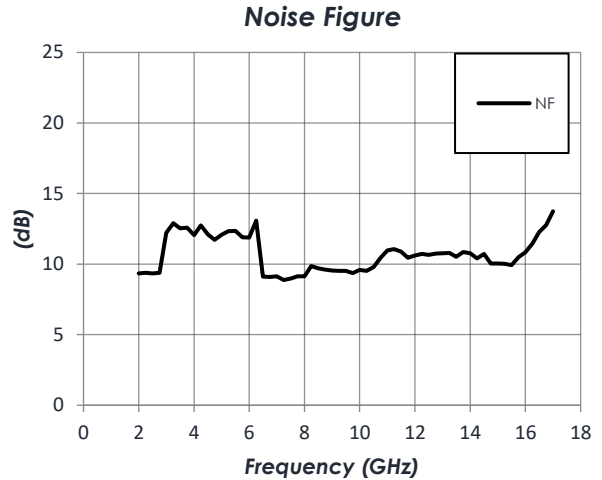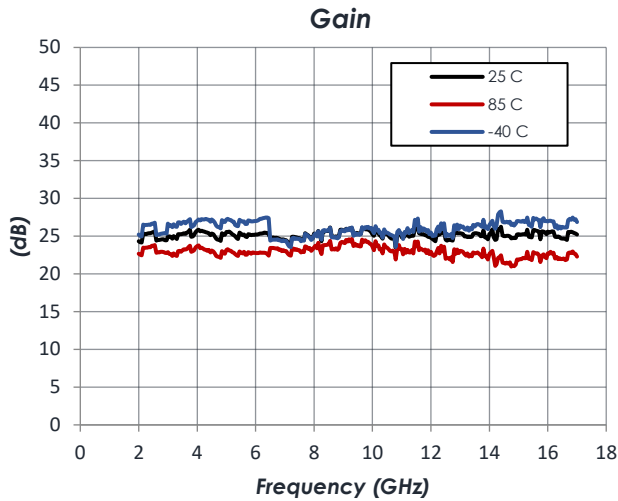
MODULE CONNECTOR AND PIN DEFINITIONS

Module Connector Layout

Required Component List (moved below)
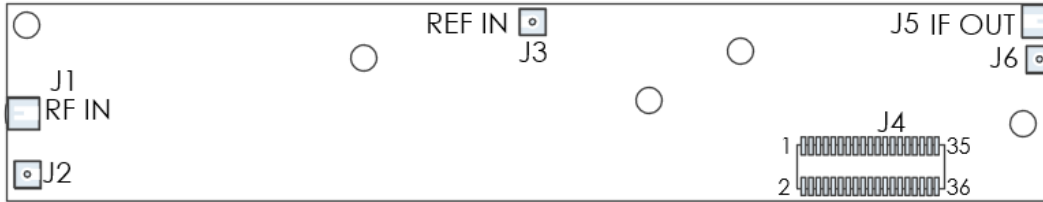
Connector	Name	Function
J1	RF IN	1 to 18 GHz RF Input Edge Launch Connector (optional)
J2	RF IN	1 to 18 GHz RF Input Vertical Launch Connector
J3	REF IN	100 MHz Reference Input Signal
J4	PWR/CTL	Reference, Power, and Control Multi-pin Connector
J5	IF OUT	3.75 GHz IF Output Edge Launch Connector (optional)
J6	IF OUT	3.75 GHz IF Output Vertical Launch Connector

Required Component List

Connector	Mating Connector Par Number	Manufacturer
J2, J3, J6	55057-006J	Southwest Microwave
Bullet (3)	54033-002B	Southwest Microwave
J4	DF12NB(4.0)-36DP-0.5V(51)	Hirose

/Mercury Proprietary/No Tech Data/

mrcy.com

This document is ITAR controlled. See page 1.   Rev. 2

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Required Component List (Continued)

J4 Pin #	J4 Pin Name	J4 Pin Function
1 – 4	+5.5 V	+5.5V DC Power Input
5 – 8	GND	Ground – Common
9 – 14	+3.8 V	+3.8V DC Power Input
15 – 20	GND	Ground – Common
21	NC	No connect
22	POP	Power On Pin – Active High. Low Logic Turns Off Tuner
23	CMD_CSn	SPI Bus Select Line for Sending Tuner Commands – Active Low
24	PROG CSn1	SPI Bus Select Line to Allow On-Board Programming Updates – Active Low
25	LD	Lock Detect – logic level high = locked, low = unlocked
26	SPI MOSI	SPI Bus Data Input to Master Controller
27	SYNC2	Tuner LO2 Sync Line for Coherency
28	SPI MISO	SPI Bus Data Output to Master Controller
29	JTAG TMS	JTAG TMS
30	SPI_CLK	SPI Bus Clock Input
31	JTAG_TCK	JTAG TCK
32	TRIGGER	
33	JTAG_TDI	JTAG TDI
34	SYNC1	Tuner LO1 Sync Line for Coherency
35	JTAG_TDO	JTAG TDO
36	NC	No Connect

Note: Contact Mercury for an API that describes the software interface and commands necessary to control the tuner.
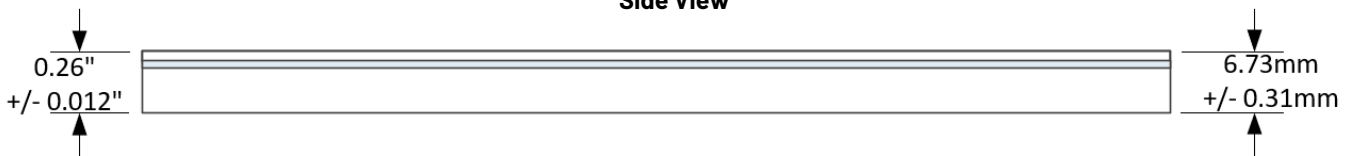
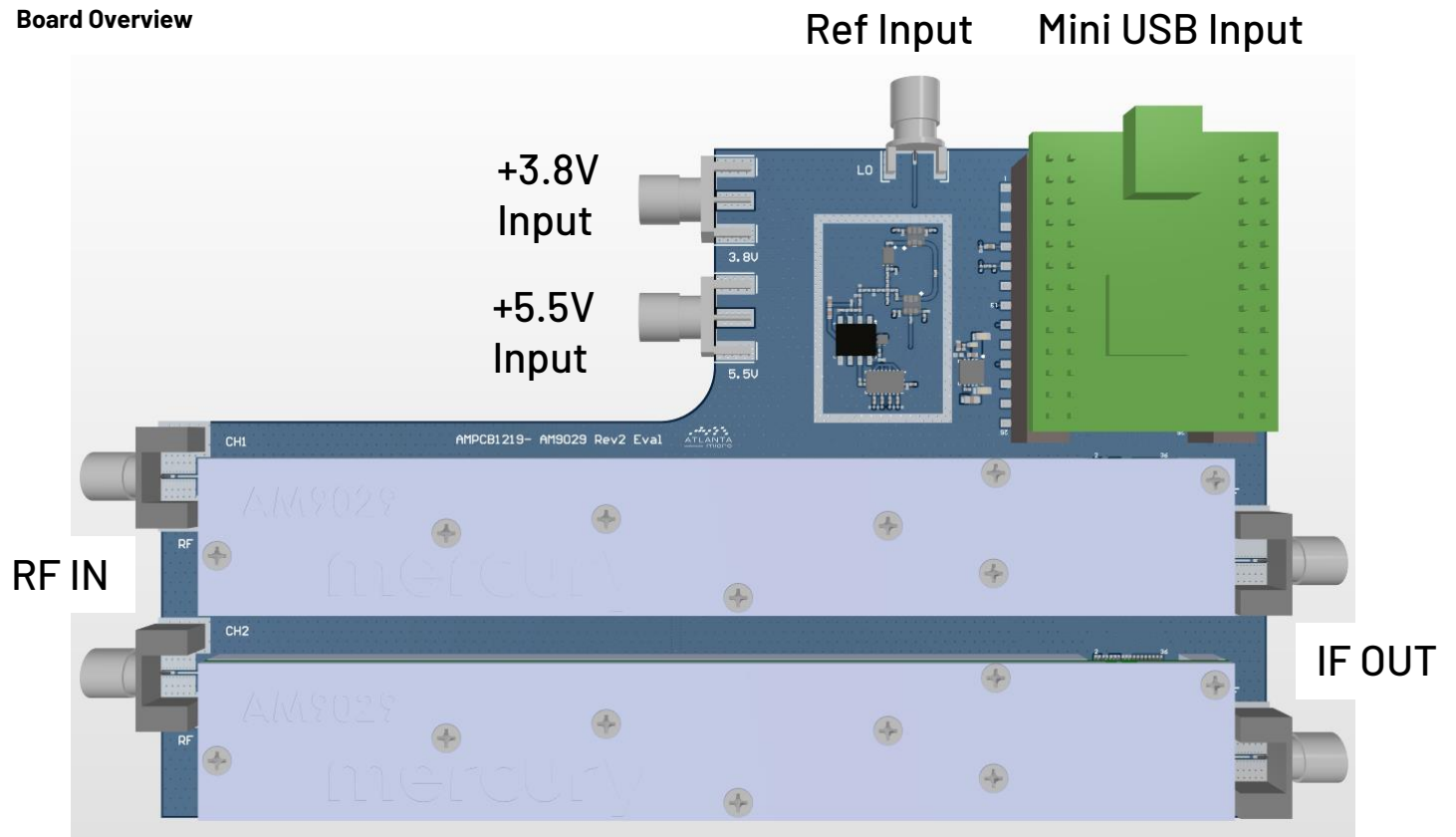## MECHANICAL DRAWINGS

Mechanical Drawings

Bottom View
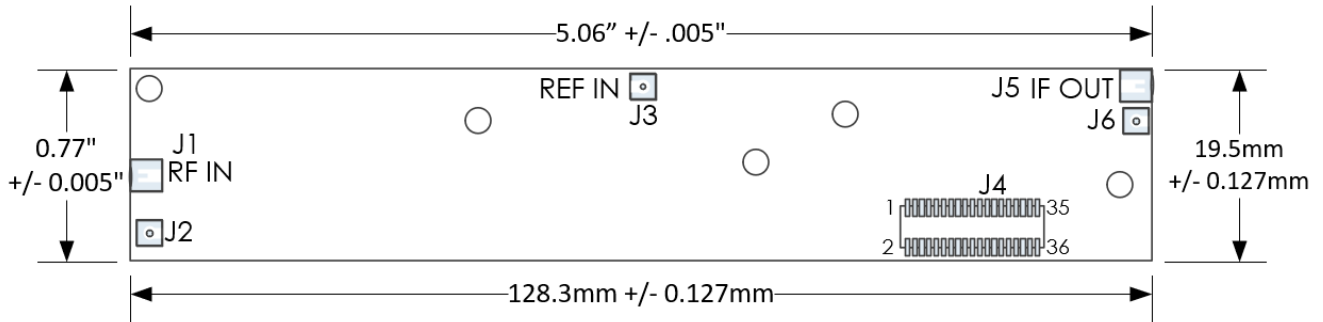
Side View

Top View

Note: Includes one AM9029 Tuner Module.

EVALUATION PC BOARDS

Board Overview

Ref Input

Mini USB Input

+3.8V Input

+5.5V Input

RF IN

IF OUT

EVALUATION PC BOARDS (CONTINUED)

Connection Diagram
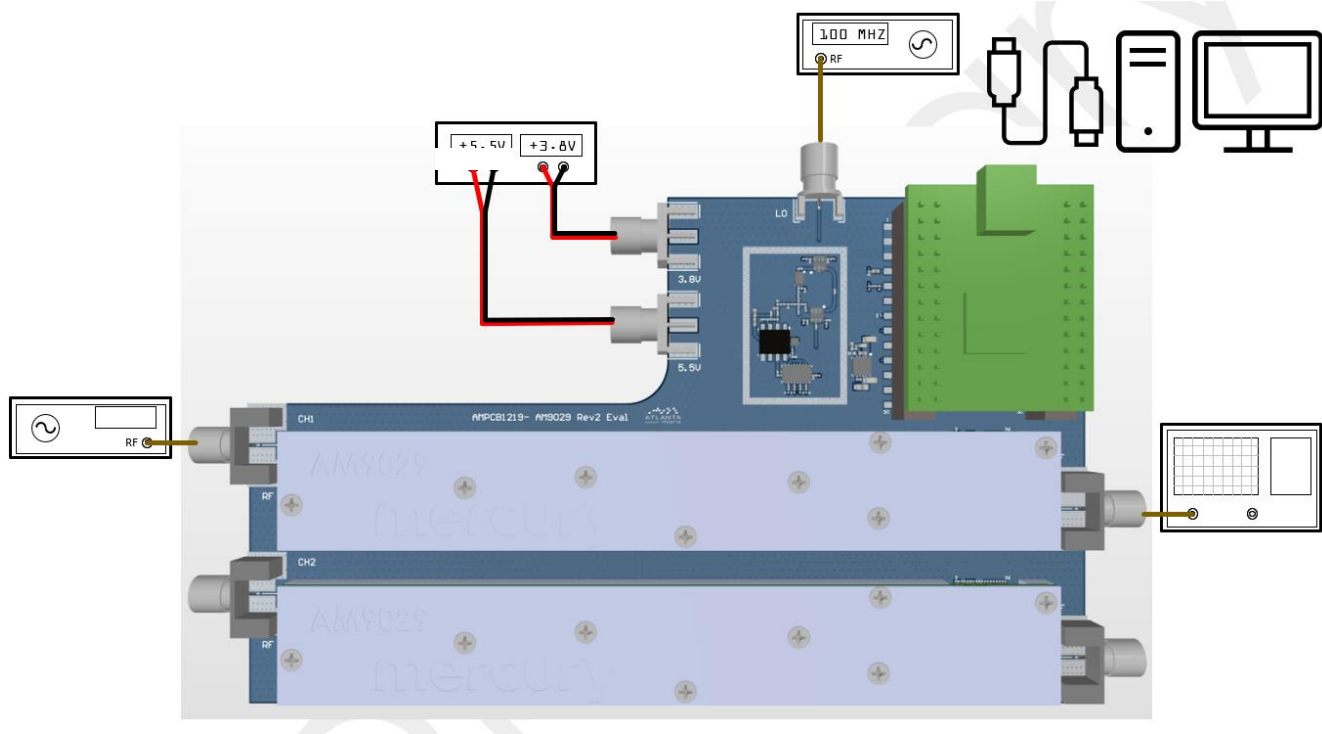
Setup

1. Connect power supply to +5.5V input and +3.8V input connectors on AM9B evaluation board.
   a. When connecting, have power supplies turned off until both voltages are connected.
   b. Set current limit of +3.8V channel to 1.3A (single module)
   c. Set current limit of +5.5V channel to 1.3A (single module)
   d. Due to current draw while on, voltages from power supply may need to be higher than +3.8V and +5.5V. Adjust voltages until +3.8V and +5.5V are measured at connector pin on AMPCB9029 evaluation board.
2. Connect reference signal to "REF IN" port on AMPCB9029 evaluation board. This may be either a 100 MHz, 0 dBm.
3. Connect a mini-B USB cable to the USB connector on the provided FTDI communication board.
   a. If the PC is connected to the internet, the drivers for the FTDI board should automatically install. Wait for the automatic install to complete before proceeding.
   b. If the drivers do not install automatically, manual installation of the FTDI driver is covered in the below section.
4. Connect a signal source to the "RF In"
5. Connect a measurement device to "IF Out".
6. Install software provided with AM9029 evaluation board.
   a. Copy the "AM9029 Control Installer" to a folder with admin privileges.
   b. Open the copied folder, then run "setup.exe".
   c. Complete the installer prompts to install the control software. If you do no install the AM9029 controls to the default directory, note the specified directory so you can browse to the executables. It will also install National

Instruments Labview Run-Time engine if it is not already on the PC. Once the installer is finished, the AM9029 controls will be installed.

Setup (Continued)

Manual FTDI Driver Installation

If the FTDI driver installed automatically, skip this section.

To determine if the FTDI drivers have already be installed, check that the following files are located in C:\Windows\System32\

- ftbusui.dll
- ftcserco.dll
- ftd2xx.dll
- ftLang.dll
- ftserui2.dll

Verify the following files are in C:\Windows\System32\Drivers

- ftdibus.sys
- ftser2k.sys

If the files are missing, the FTDI driver has not been installed. The drivers should be automatically installed when the FTDI Mini-module is first connected to the computer. If this does not occur, manual installation can be performed.

FTDI instructions for Windows installation is here:

http://www.ftdichip.com/Support/Documents/InstallGuides.htm

The drivers can be manually downloaded here:

http://www.ftdichip.com/Drivers/D2XX.htm

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