WE935B00 Datasheet

Single-Band (2.4 GHz) Embedded Wi-Fi b/g/n module
with Integrated antenna

Revision 1.1
Aug 29, 2018

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Revision History:

Revision	Revision Date	Originator	Changes
1.0	Aug 22, 2017	Wi2Wi	Initial version Datasheet
1.1	Aug 29, 2018	SF	Power number updates & formatting corrections

1. Overview

WE935B00 module from Wi2Wi's EM series is a best in class single-band (2.4GHz) high performance embedded Wi-Fi module. This highly integrated plug and play, embedded Wi-Fi module with chip antenna and MHF4 IPEX connector includes dedicated microcontroller, MAC, baseband, RF transceiver, power amplifier, crystal, Tx/Rx switch, filter and OTP memory for calibration data and MAC address. WE935B00 (serial to Wi-Fi module) is a complete wireless subsystem in a small form factor, featuring full 802.11 b/g/n capabilities with embedded Wireless LAN (WLAN) stack, supplicant and TCP/IP stack. By completely off-loading the external Microcontroller (MCU) from wireless activities, user can dedicate the external host for application development and significantly reduce their time to market and R&D cost. This WLAN module supports UART and SPI host interfaces and comes in various operating temperatures and certified to FCC, CE and IC.

1.1 Features

- Small footprint: 15 mm x 16.5 mm x 1.86 mm
- Compliant to IEEE 802.11b/g/n Wi-Fi, 1x1 SISO
- 20 MHz Channel Bandwidth
- UART & SPI Host Interfaces
- UART host interface 4 wire including RTS/CTS.
- Simple UART commands to configure Wi-Fi
- Support for Station/Client Mode, Access Point Mode and Concurrent Mode
- Supports 4 clients in AP Mode
- Embedded TCP/IP stack, WLAN stack and security supplicant.
- Supports open, WPA-PSK, WPA2-PSK & WEP Security (TKIP and AES-CCMP Encryption)
- Supports 10 TCP/UDP sockets which includes 2 SSL Sockets, 1 dedicated Web server and 1 dedicated HTTP Client
- Onboard chip Antenna + MHF4 IPEX connector
- Support for Antenna Diversity
- Maximum transmit power up to 18 dBm
- Internal 38.4 MHz, 26 MHz crystal clock and 32.768 KHz crystal Clock.
- Low power operation: Deep Sleep and IEEE Power Save modes
- OTP memory for calibrating the module during production
- Internal memory for firmware
- Single power supply of 3.3V
- Firmware upgrade through Wireless and UART
- Available in industrial (-40℃ to +85℃), extended (-30℃ to +85℃) and commercial (0℃ to +70℃) operating temperature variants
- Certifications: FCC, IC, CE (Ongoing)
- Green/ROHS compliant

1.2 IEEE 802.11 Standards

- 802.11b data rates of 1, 2, 5.5 and 11Mbps (DSSS/CCK Modulation)
- 802.11g data rates of 6, 9, 12, 18, 24, 36, 48 and 54 Mbps (OFDM Modulation) for multimedia content transmission
- 802.11n compliant with maximum data rates up to72.2 Mbps (20 MHz channel)
- MCS Rate Adaptation (b/g/n)

1.3 TCP/IP Stack features

- Passive Scan
- Active Scan
- 10 Sockets (UDP/TCP)
- HTTP Client
- HTTP Post
- HTTP Get
- SSL Sockets
- Secured HTTP (HTTPS)
- FTP Client
- DNS Client
- mDNS
- DNS-SD
- Static IP configuration
- DHCP Client/Server
- IPv4 Support
- IPv4 Ping
- Software API's to support host interface application
- Tx power Configuration

2. Block Diagram

WE935B00 core block includes a high performance IEEE 802.11b/g/n SOC with integrated antenna. This module requires host MCU/MPU to drive it through high performance UART/SPI interface. This highly integrated module has multiple digital GPIO's and Interrupts. A master Reset pin can be used to completely reset the module. It requires a single power source of 3.3V. This module has chip antenna and MHF4 IPEX connector supporting antenna diversity. An external RF pad is also available on the module exclusively for user convenience.

Figure 1 shows a block diagram of WE935B00 module.

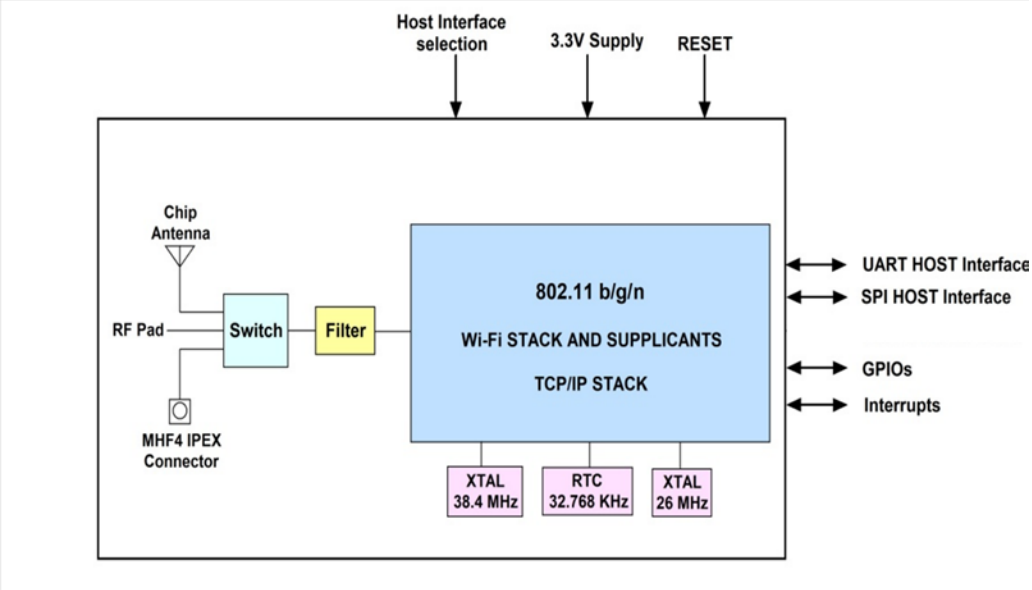

Figure 1 : Block Diagram

2.1 Pin Diagram and Description

Figure 2 shows the pin assignments for the 64-pin QFN package.

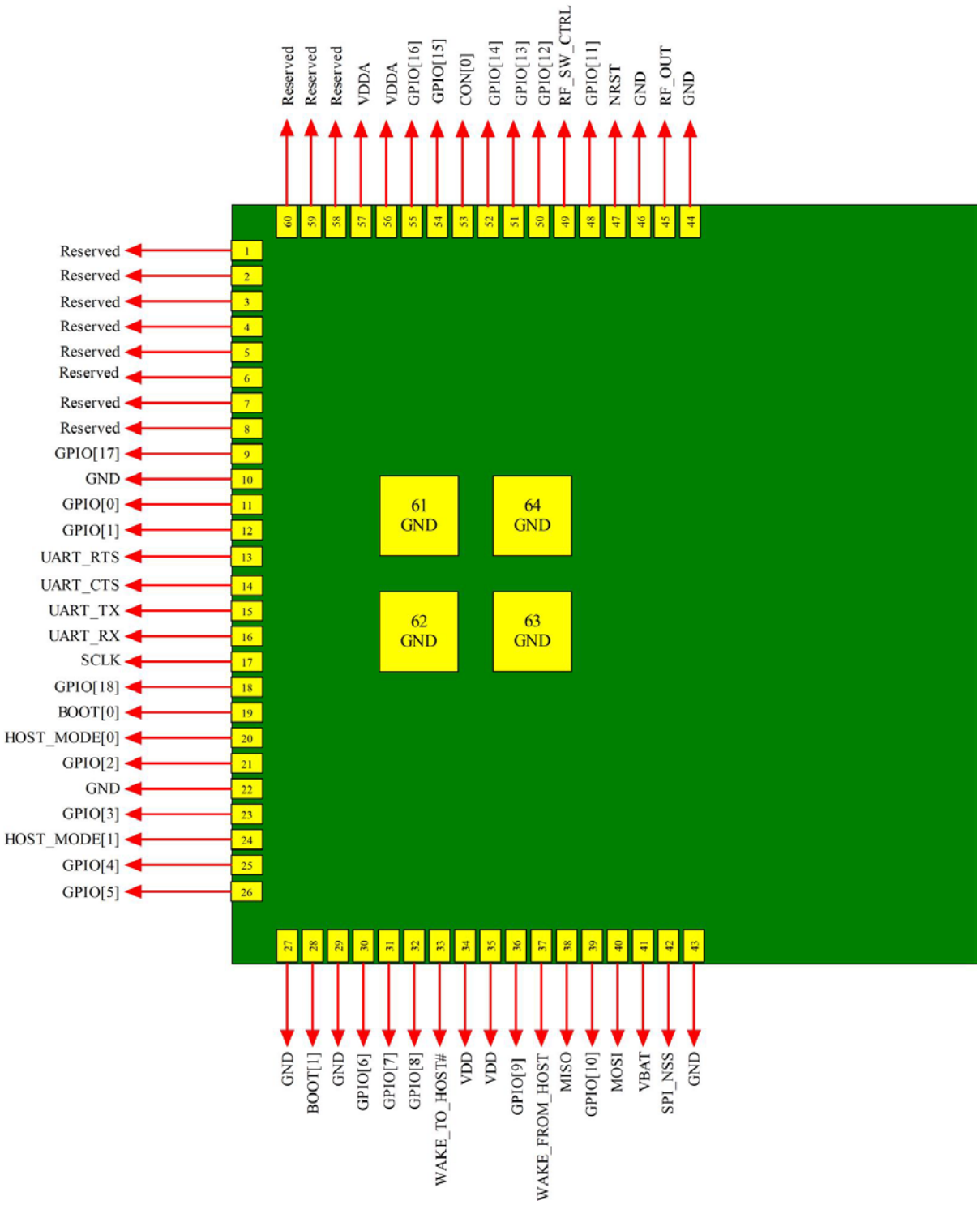

Figure 2 : WE935B00 Module Pin Diagram – Top View

Pin No	Pin Name	Type	Supply	Description
HOST MODE CONFIGURATION				
20	HOST_MODE[0]	I	VDD	<table><tr><th>HOST_MODE[1:0]</th><th>Host Mode</th></tr><tr><td>00</td><td>Reserved</td></tr><tr><td>01</td><td>Reserved</td></tr><tr><td>10</td><td>SPI</td></tr><tr><td>11</td><td>UART (Default)</td></tr></table> Internally Pulled high, pin can be left open for logic one.
24	HOST_MODE[1]	I	VDD	
HOST MODE - UART				
13	HOST_UART_RTS	O	VDD	Host UART handshake signals RTS
14	HOST_UART_CTS	I	VDD	Host UART handshake signals CTS
15	HOST_UART_TX	O	VDD	Host UART Transmit
16	HOST_UART_RX	I	VDD	Host UART receive
HOST MODE - SPI				
17	SCLK	I	VDD	SPI clock to the module
38	MISO	O	VDD	Master-IN-Slave-OUT
40	MOSI	I	VDD	Master-OUT-Slave-IN
42	SPI_NSS	I	VDD	Slave Select for SPI
GPIO				
11	GPIO[0]	I/O	VDD	General Purpose I/O
12	GPIO[1]	I/O	VDD	General Purpose I/O
21	GPIO[2]	I/O	VDD	General Purpose I/O
23	GPIO[3]	I/O	VDD	General Purpose I/O
25	GPIO[4]	I/O	VDD	General Purpose I/O
26	GPIO[5]	I/O	VDD	General Purpose I/O
30	GPIO[6]	I/O	VDD	General Purpose I/O
31	GPIO[7]	I/O	VDD	General Purpose I/O
32	GPIO[8]	I/O	VDD	General Purpose I/O
36	GPIO[9]	I/O	VDD	General Purpose I/O

39	GPIO[10]	I/O	VDD	General Purpose I/O
48	GPIO[11]	I/O	VDD	General Purpose I/O
50	GPIO[12]	I/O	VDD	General Purpose I/O
51	GPIO[13]	I/O	VDD	General Purpose I/O
52	GPIO[14]	I/O	VDD	General Purpose I/O
54	GPIO[15]	I/O	VDD	General Purpose I/O
55	GPIO[16]	I/O	VDD	General Purpose I/O
9	GPIO[17]	I/O	VDD	General Purpose I/O
18	GPIO[18]	I/O	VDD	General Purpose I/O
RESET				
47	NRST	I	VDD	Reset the Module (Active Low)
CONFIGURATION				
53	CON[0]	I	VDDA	Pulled down to Ground with 4.7K resistor.
BOOT MODES				
19	BOOT[0]	I	VDD	BOOT[1:0] / Boot Mode: X0 – Functional Mode (default); 01 – Flashing Mode; 11 – RESERVED. Should be controlled from Host (or) using jumper.
28	BOOT[1]	I	VDD	
RF				
45	RF_OUT	I/O	VDDA	External RF Pad
49	RF_SW_CTRL	I	VDDA	Pull Low to Ground for RF OUT selection. Open to use Antenna diversity feature.
INTERRUPTS				
33	WAKE_TO_HOST#	O	VDD	Interrupt to external Host (MCU/MPU)
37	WAKE_FROM_HOST	I	VDD	Interrupt from external Host (MCU/MPU)

POWER				
34, 35	VDD	Power	3.3V	Power to the Digital section
41	VBAT	Power	3.3V	VBAT for RTC
56, 57	VDDA	Power	3.3V	Power to the RF section
GROUND				
10, 22, 27, 29, 43, 44, 46	GND	Ground	GROUND	Connect to Ground
61, 62, 63, 64	EPAD - GND	Ground	GROUND	Connect to Ground
RESERVED				
1, 2, 3, 4, 5, 6, 7, 8, 58, 59, 60	Reserved	-	VDD	Do not connect; Leave Floating, internally used.

Table 1: Pin Description

2.2 Physical Dimensions and Pad Locations

- 64-pins with pads on 3 sides of the module and 4 ground pads in the middle of the module on the bottom side.
- Module Physical Size: 16.5 x 15 x 1.86 mm (including shield)
- Solder Pad Size: 0.25 x 0.40 mm
- Pad Pitch: 0.5 mm
- Pad Center to Module Edge: 0.6 mm
- Pad Finish: ENIG (Electro-less Nickel Immersion Gold)
- Pads: [(Three sides (26 + 17 + 17) + 4 Ground Pads in the middle)]

☞ For Hardware Application notes, module dimensions and symbol library files please contact Wi2Wi sales or send an email to sales@wi2wi.com

2.3 Host Mode Configuration

HOST_MODE [1:0] are host interface selection pins. By default these pins are pulled HIGH which selects UART interface. These pins can be externally pulled LOW to ground.
Pin#20 HOST_MODE [0] and Pin#24 HOST_MODE [1] are Internally Pulled HIGH by default.

HOST_MODE[1:0]	Host Mode
00	Reserved
01	Reserved
10	SPI
11	UART (Default)

Table 2 : HOST MODE

2.3.1 UART interface

UART is a very simple and effective interface universally supported by most of the host MCU's. This interface supports Auto baud rate detection. It also has RTS/CTS pins for hardware flow control. The maximum Baud Rate supported is 12.5 Mbps. A unique set of commands are described in the software user guide.

2.3.2 SPI interface

This module acts as SPI slave with a maximum of 25 MHz clock from the master. A unique set of commands are described in the software user guide.

2.4 General Purpose Input/output

Each of the GPIO pins can be configured by software as output or as input. All GPIOs are high-current-capable and have speed selection to better manage internal noise, power consumption and electromagnetic emission. Software handles for each GPIO will be available in software user guide in detail.

2.5 Reset

The NRST (pin# 47) is an active low input pin to reset the module. It has a weak pull-up equivalent resistor of 40k Ω internally. A LOW pulse of 10ms generated on this pin will reset the module.

2.6 Configuration Pins

The module has a special configuration pin which requires a pull down of 4.7K to Ground. This pin cannot be left as no connect and is mandatory.

2.7 Boot Modes

Based on the boot mode pins configuration the module will start execution of the firmware after reset. Below is the description of each mode.

- BOOT [1:0] -X0
  - Functional mode (default) - Main Flash memory
- BOOT [1:0] -01
  - Flashing mode - System memory (Firmware upgrade through UART)
- BOOT [1:0] -11 Reserved.
- These pins can be connected to external jumper (or) can be controlled from a host controller GPIO pins.

2.8 Antenna

WE935B00 module has a chip antenna on the module. It also has MHF4 IPEX connector on the module to connect an external antenna. The chip antenna and MHF4 IPEX connector have antenna diversity between them. The module also has RF_OUT on pin number Pin#45. This can be selected through RF_SW_CTRL pin as shown below.

RF_SW_CTRL	Antenna Selected
Pull high (Internal, Default)	Diversity between chip antenna and MHF4 IPEX connector
Pull Low	RF_OUT pin selected.

Table 3 : RF Control

2.9 Power Pins

WE935B00 module has VDD which is Power supply to the Digital section on the module. VBAT pin is a supply pin to the RTC and the backup registers. VDDA is a supply to 802.11 b/g/n analog RF Section. All the three power supply rails need a tightly regulated supply of 3.3V.

3. Electrical Characteristics

Parameter	Test Condition	MIN	TYP	MAX	UNITS
Absolute Maximum Ratings					
Storage Temperature		-55	-	125	°C
VDD, VDDA, VBAT		2.7	3.3	4.0	V
Recommended Operating Conditions					
Operating Temperature	Commercial	0	-	+70	°C
	Extended	-30	-	+85	°C
	Industrial	-40	-	+85	°C
VDD, VDDA, VBAT		3.0	3.3	3.6	V
Current Consumption UART Mode					
Transmit Mode current Consumption	Measurements during Iperf TX with 11Mbps data rate and max TX power dBm	-	210.67	-	µA
Receive Mode current consumption	Measurements during Iperf RX with 11Mbps data rate	-	111	-	µA
Current consumption in IEEE 802.11 Power Save Mode	Deep Sleep Mode	-	189.434	-	µA
Current Consumption USB Mode					
Transmit Mode current Consumption	Measurements during Iperf TX with 11Mbps data rate and max TX power dBm	-	TBD	-	-
Receive Mode current consumption	Measurements during Iperf RX with 11Mbps data rate	-	TBD	-	-
Current consumption in IEEE 802.11 Power Save Mode	Deep Sleep Mode	-	TBD	-	-
Current Consumption SPI Mode					
Transmit Mode current Consumption	Measurements during Iperf TX with 11Mbps data rate and max TX power dBm	-	TBD	-	-
Receive Mode current consumption	Measurements during Iperf RX with 11Mbps data rate	-	TBD	-	-
Current consumption in IEEE 802.11 Power Save Mode	Deep Sleep Mode	-	TBD	-	-
802.11 RF System Specifications					
Transmit Power Output	FCC Complaint (ongoing)	-	-	18	dBm
Receive Sensitivity	1 Mbps	-	-	-97	dBm

Table 4 : Electrical Characteristics

4. Voltage Domains

Voltage domains and limits of all the signal pins are listed below.

	Min	Typ	Max	Units
VIH	2	-	3.6	V
VIL	-0.3	-	1	V
VIHYS	300	-	-	mV
VOH	2.3	-	-	V
VOL	-	-	0.4	V

Table 5 : 3.3V Voltage Domain Signal Limits

5. WLAN Power-Save Modes

Two types of power save modes can be used by the WE935B00. They are IEEE Power Save mode and Deep Sleep mode. The key difference between the two modes is the current consumption and the time it takes to the transition from the power save mode to normal Wi-Fi operation.

5.1 IEEE Power Save

This mode puts sections of the Wi-Fi into “sleep with periodic wake” by the appropriate command available in software user guide. The device automatically wakes up to receive beacons periodically, and if there is no traffic indicated for the device, it will go back to sleep. Power consumption is dependent on the DTIM value of the AP it is connected to. When DTIM=1, the device wakes up every 100ms to receive and acknowledge the beacon from AP to maintain association.

5.2 Deep Sleep

This mode puts the complete Wi-Fi section into deep sleep mode, which is the same as the IEEE mode above except there are no periodic wake-ups to receive beacons. Thus it offers lower power consumption than IEEE mode. This mode is entered when the host processor sends the appropriate command. In deep sleep mode, the device is not listening for packets or beacons from the AP, so it cannot maintain an association with it. When the host processor sends a command to take the device out of deep sleep mode, the device will have to re-associate with the AP.

6. Software Specifications

Wi2Wi provides all the handles required to operate WE935B00. It provides instructions in the form of commands to configure and control the module. These commands are proprietary to Wi2Wi and can be easily executed from a small MCU with a minimum memory requirement to store the commands and the data.

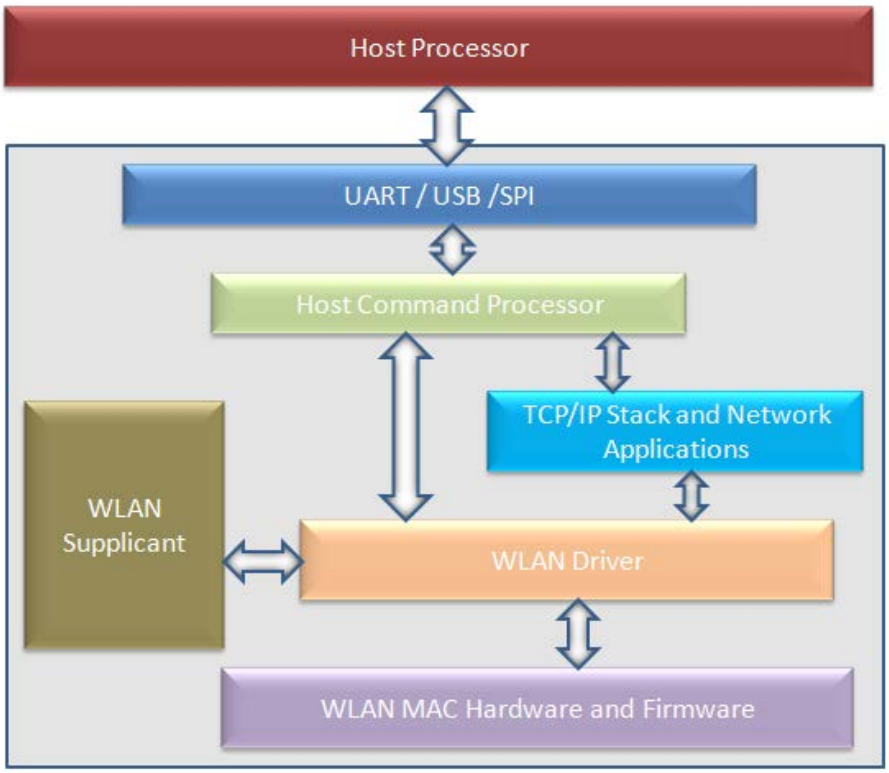

Figure 3 : Software Architecture

7. Reference Schematics

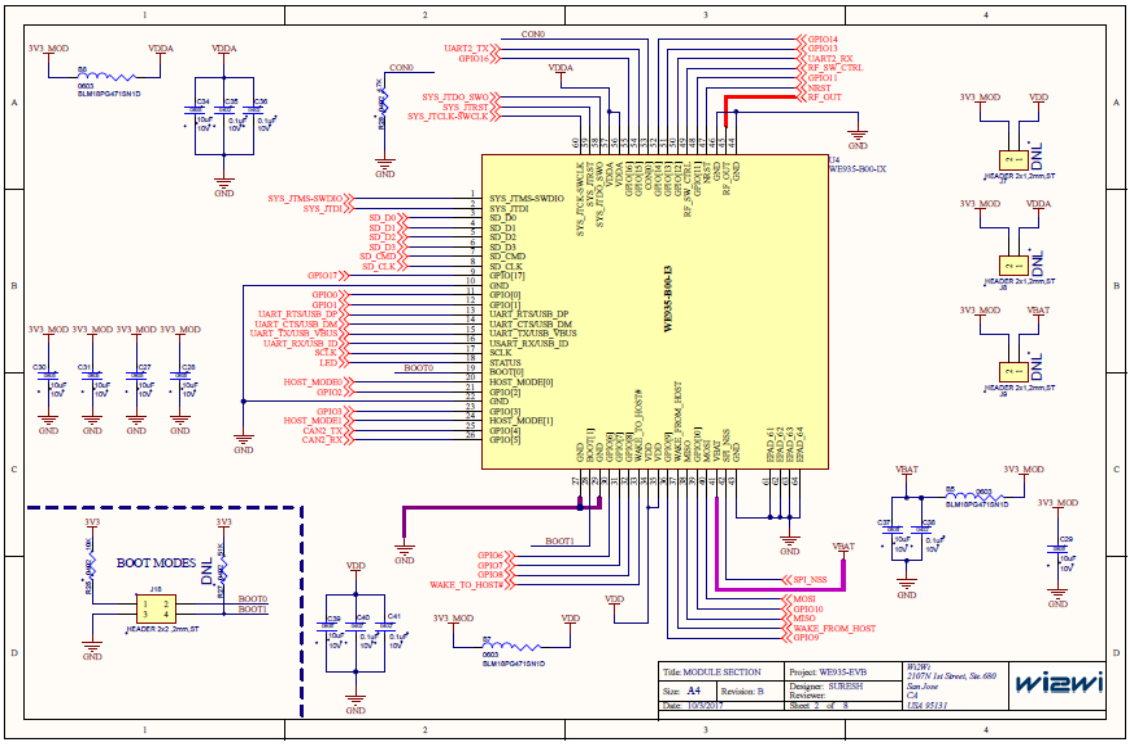

Figure 4 : Reference Schematics Page 1

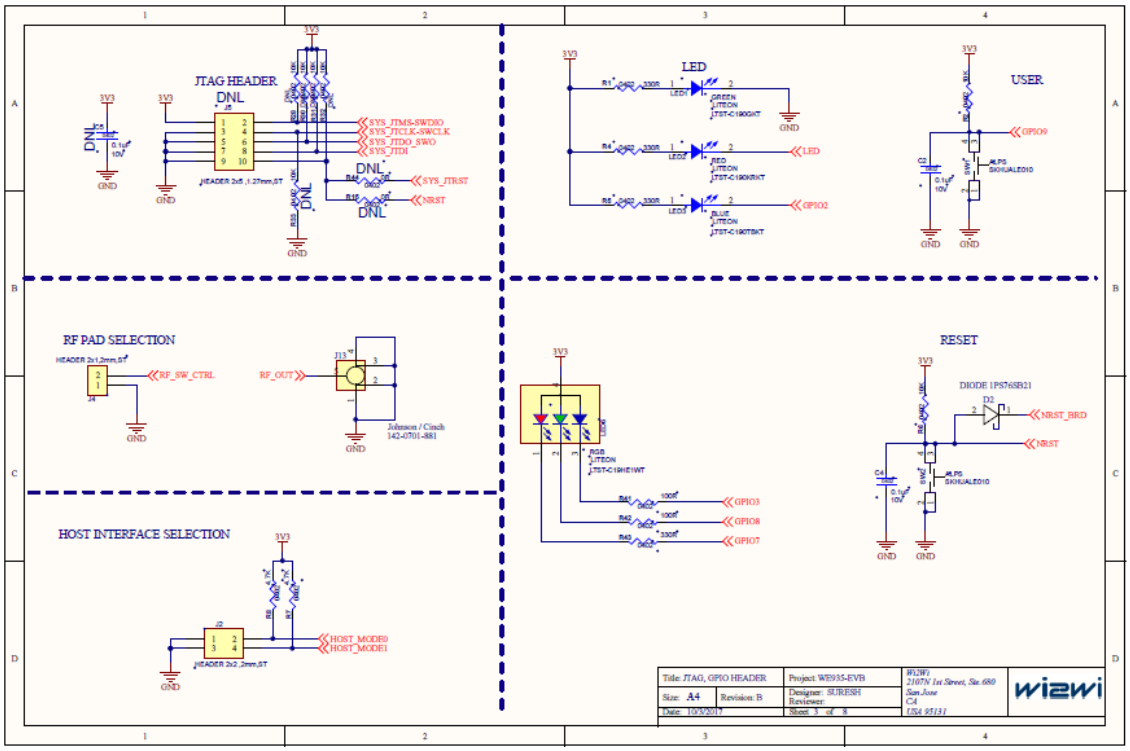

Figure 5 : Reference Schematics Page 2

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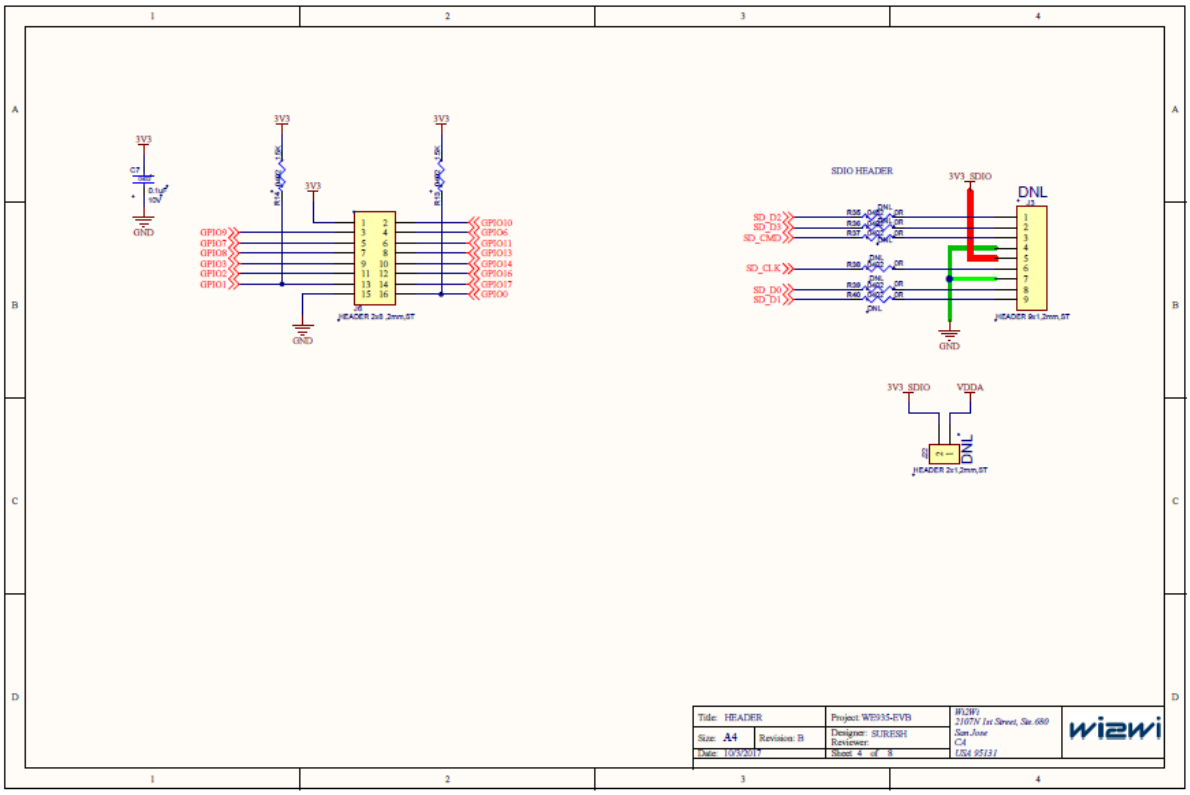

Figure 6 : Reference Schematics Page 3

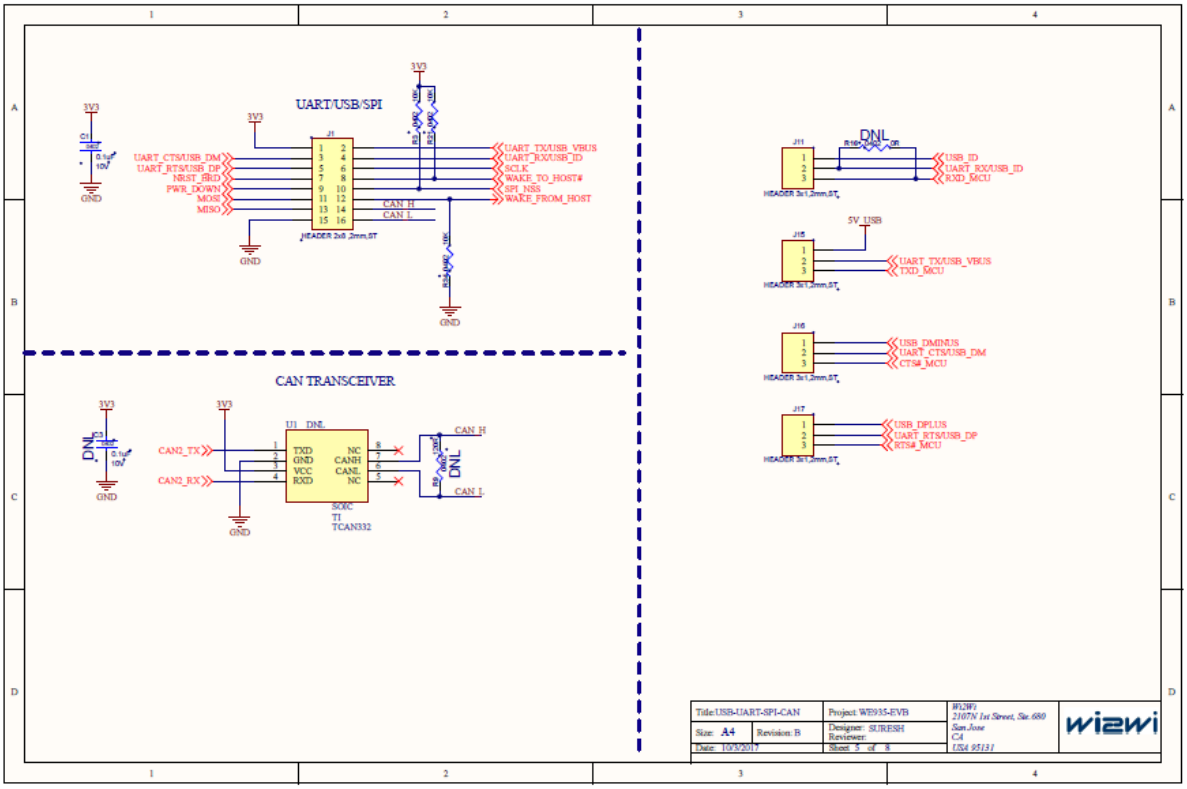

Figure 7 : Reference Schematics Page 4

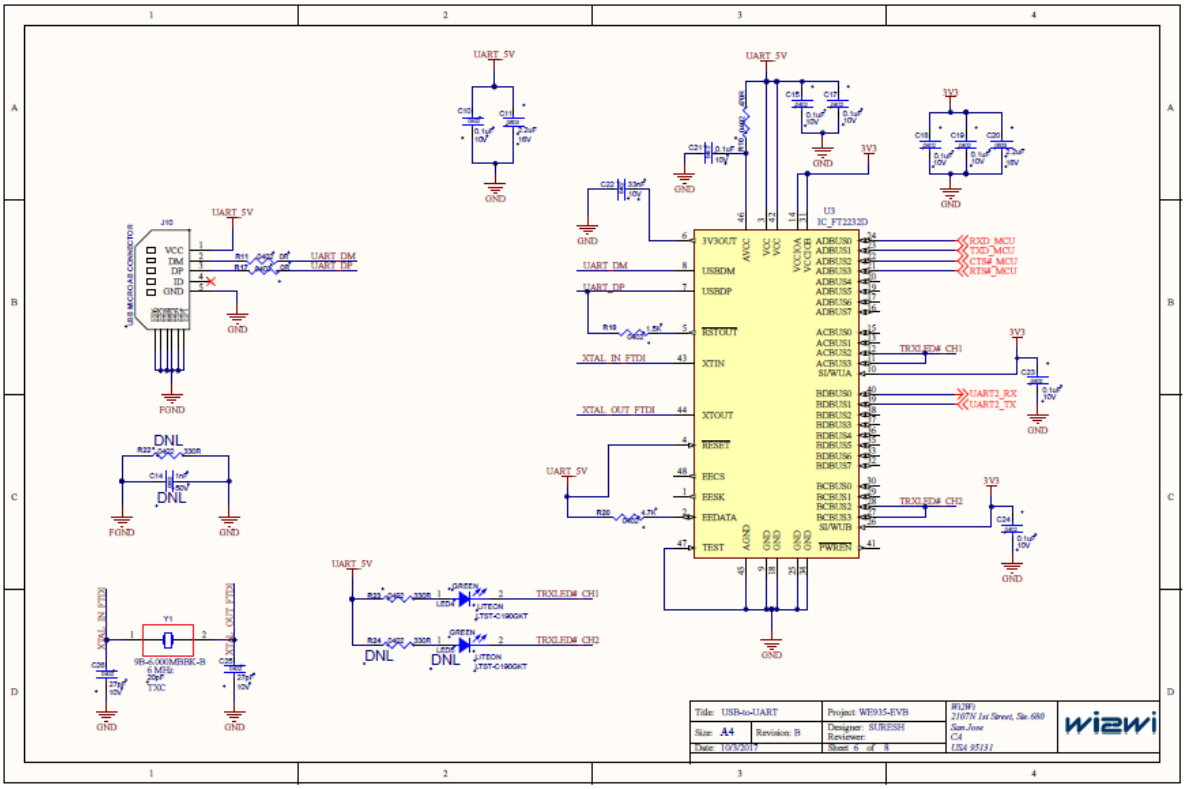

Figure 8 : Reference Schematics Page 5

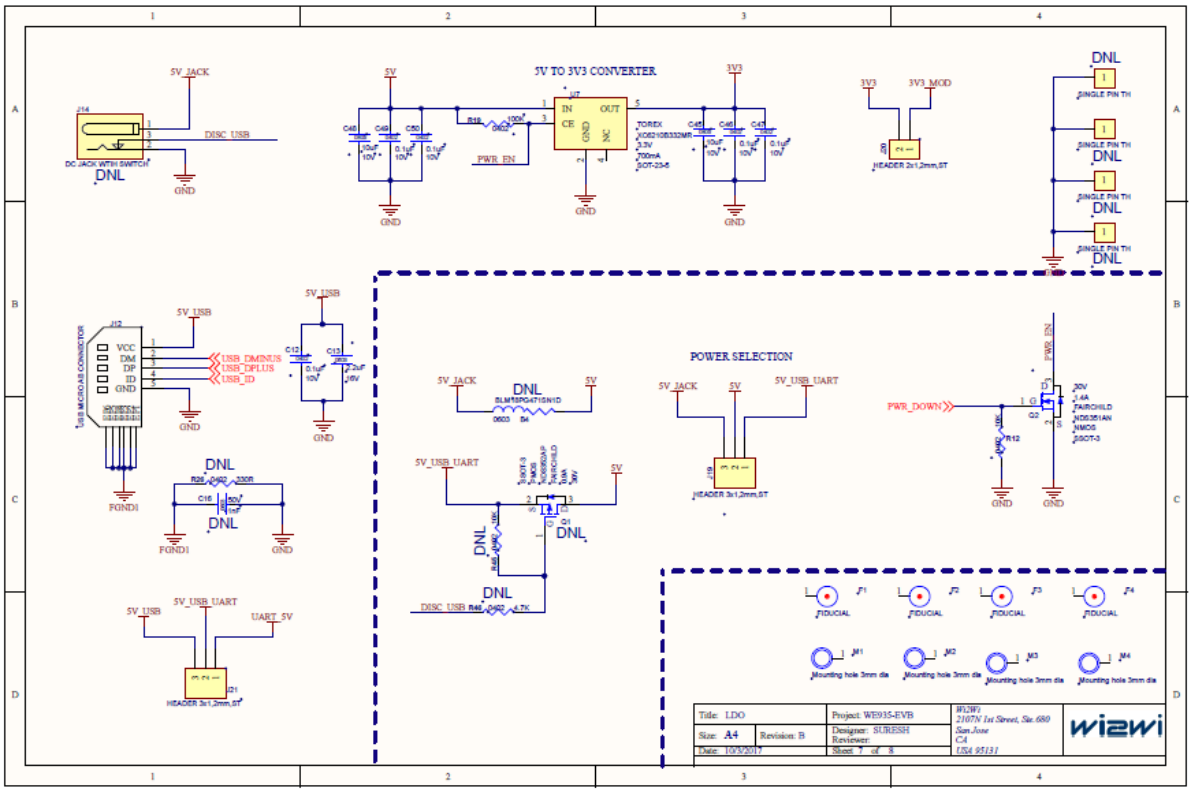

Figure 9 : Reference Schematics Page 6

8. Manufacturing Notes

8.1 Shield Marking

Figure 10 : Shield Marking (Top View)

YY indicates Year
WW indicates Work Week

- -I indicates Industrial operating temperature range (-40°C to +85°C)
- -E indicates Extended operating temperature range (-30°C to +85°C)
- -C indicates Commercial operating temperature range (0°C to +70°C)
- 3 indicates Chip Antenna and MHF4 IPEX connector

8.2 Storage and Baking Instructions

WE935B00 is an MSL3 qualified package.

- After opening the bag, the parts should be stored as per J-STD-033 standard, and mounted within 168 hours of factory conditions (≤ 30°C, 60% RH)
- If the parts have been exposed in transit, they need to be baked at 125°C for 16 hours

8.3 Recommended Reflow Profile

Assembly Guidelines:

1. Follow solder paste manufacturers recommended profile
   a. All RoHS solder pastes contain the same basic chemistry; however, each manufacturer may have a recommended reflow profile that performs best for their product
2. The profile illustrated below is for reference only
   a. There is no one profile that fits all scenarios
3. Profiles must be dialed in to the specific assembly type
4. ENIG finishes are more susceptible to voids and air entrapment
   a. Selecting a RoHS solder paste that is “ENIG” compatible is recommended

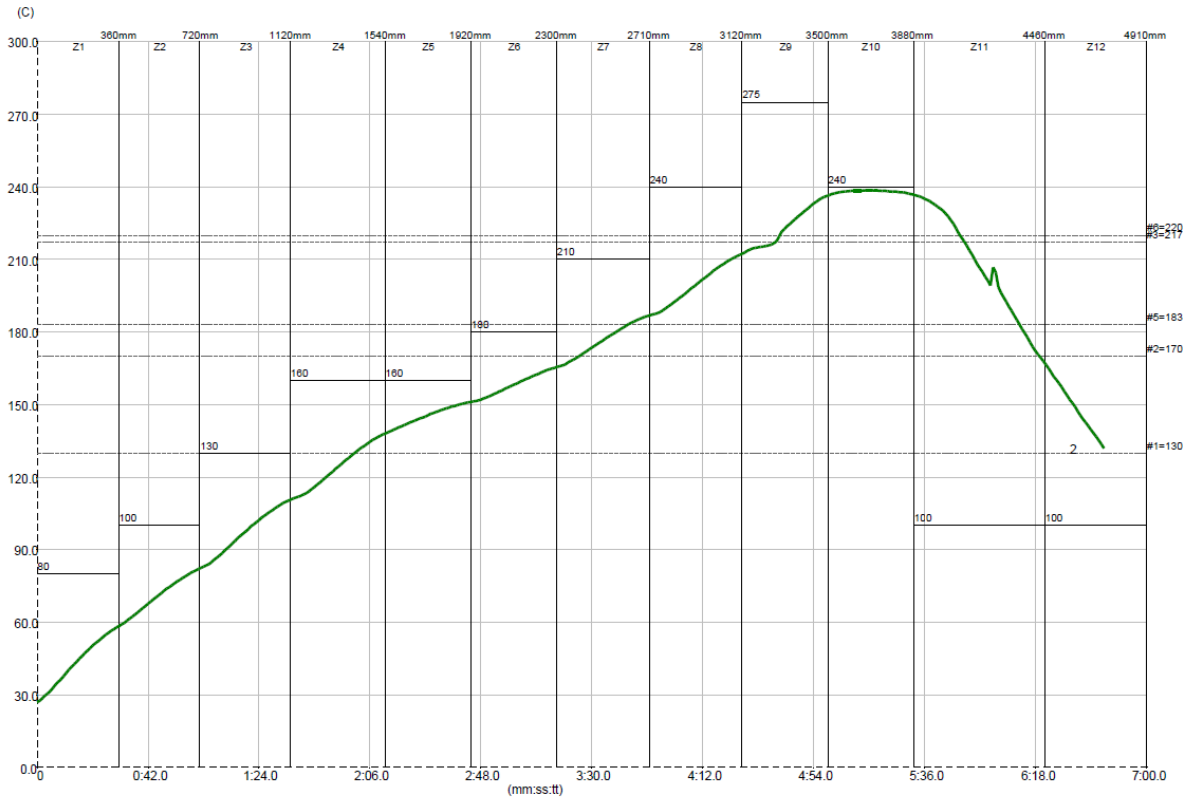

Figure 11 : Recommended Reflow Profile

9. Ordering Information

Table 6 : Ordering Information for Modules

Part Order Number	Operating Temperature Range	Packaging Method
WE935B00-I3QT	Industrial: -40°C to +85°C	Tray
WE935B00-I3QR	Industrial: -40°C to +85°C	Tape & Reel
WE935B00-E3QT	Extended: -30°C to +85°C	Tray
WE935B00-E3QR	Extended: -30°C to +85°C	Tape & Reel
WE935B00-C3QT	Commercial: 0°C to +70°C	Tray
WE935B00-C3QR	Commercial: 0°C to +70°C	Tape & Reel

Table 7 : Ordering Information for Evaluation Kits

Part Order Number	Contents of the Evaluation Kit	Packaging Method
WE935B00-EVK3	WE935B00-I3 Module on Evaluation Board, 2.4 GHz Rubber Duck Antenna, MHF4 IPEX connector cable and USB-A / Micro-AB Cable	Box

10. Data Sheet Status

Wi2Wi, Inc. reserves the right to change the specification without prior notice in order to improve the design and supply the best possible product. Updated information, firmware and release notes will be made available on www.wi2wi.com. Please check with Wi2Wi Inc. for the most recent data before initiating or completing a design.

11. Certifications

WE935B00 will comply with the following standards:
FCC: 15C
IC: RSS-247
CE: EN 300 328 v1.9.1, EN 301 489-1 v1.9.2
EN 301 489-17 v2.2.1, EN 60950-1

☞ Certification testing is ongoing

12. References

12.1 Specifications

IEEE 802.11 b/g/n Wireless LAN Specification
SDIO HS 4-bit Specification

12.2 Trademarks, Patents and Licenses

Trademarks: Wi-Fi

12.3 Disclosures

WE935B00-EVK3: Evaluation Kit
The specification maximum and minimum limits presented herein are those guaranteed when the unit is integrated into the Wi2Wi'sDevelopment System. These limits are to serve as representative performance characteristics of the WE935B00 when properly designed into a customer's product. Wi2Wi makes no warranty, implied or otherwise specified, with respect to design and performance characteristics presented in this specification when used in customer designs.

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