PADI IoT Stamp

Datasheet

Revision 1.0

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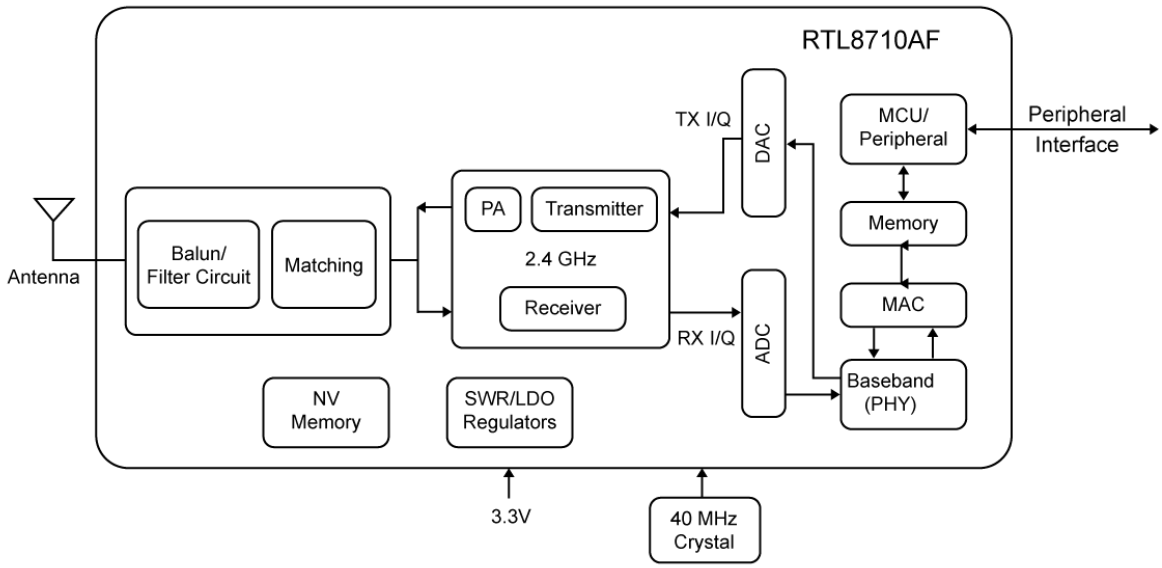
1. Introduction

PADI IoT Stamp, powered by Realtek RTL8710AF, is a highly integrated, single-chip, low power WiFi controller with built-in antenna. The stamp combines an ARM Cortex M3, integrated Flash and RAM, WLAN MAC, WLAN baseband, RF balun, PA, LNA receiver, SAW filter and power management module. Designed for makers with high speed SPI/I2C/UART interfaces for IoT applications with minimum Printed Circuit Board (PCB) area requirement. The PADI IoT Stamp is even smaller than a US stamp.

Realtek RTL8710AF high performance wireless SOC provides endless possibilities in designing mobile, low power IoT devices at the lowest cost. It can be used as a standalone self-contained WiFi device solution and can also be run as slave module with other MCU as host.



RTL8710AF built-in cache improves system performance and reduces memory requirements. With on board 1MB Flash, PADI IoT stamp can be programmed to run custom firmware that can communicate with external sensors or chipset through various interface ports such as SPI, UART, I2C, PWM and GPIO.

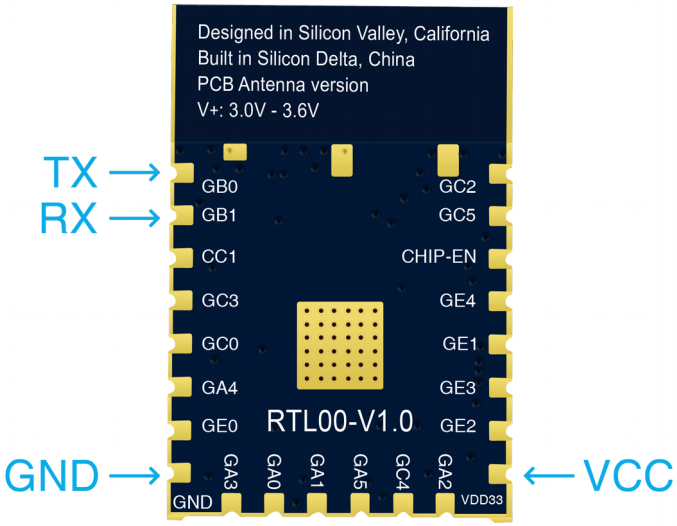
1.1 Characteristics

- 802.11 b/g/n, CMOS MAC, Baseband PHY
- Built-in low power 32-bit CPU as application processor
- Built-in TCP/IP protocol stack
- Built-in TR Switch, balun, LN, Power Amplifier and Matching Network
- Built-in PLL, VLDO and Power Management Components
- MO, 2x1 MIMO
- A-MPDU, A-MSDU aggregation and 0.4s Guard Interval
- WiFi @ 2.4 GHz, Support WPA/WPA2 Security Mode
- Support STA/AP/STA+AP Module
- Support Smart Config function (include Android and iOS devices)
- SPI , UART, I2C, PWM, GPIO
- Deep Sleep current 10uA, Shutdown current below 5uA
- Wake up, connect and transfer data packets within 2ms
- 802.11b mode +17dBm Output Power
- Standby power below 1.0mW (DTIM3)
- Operating Temperature Range: -20ºC ~ 85ºC

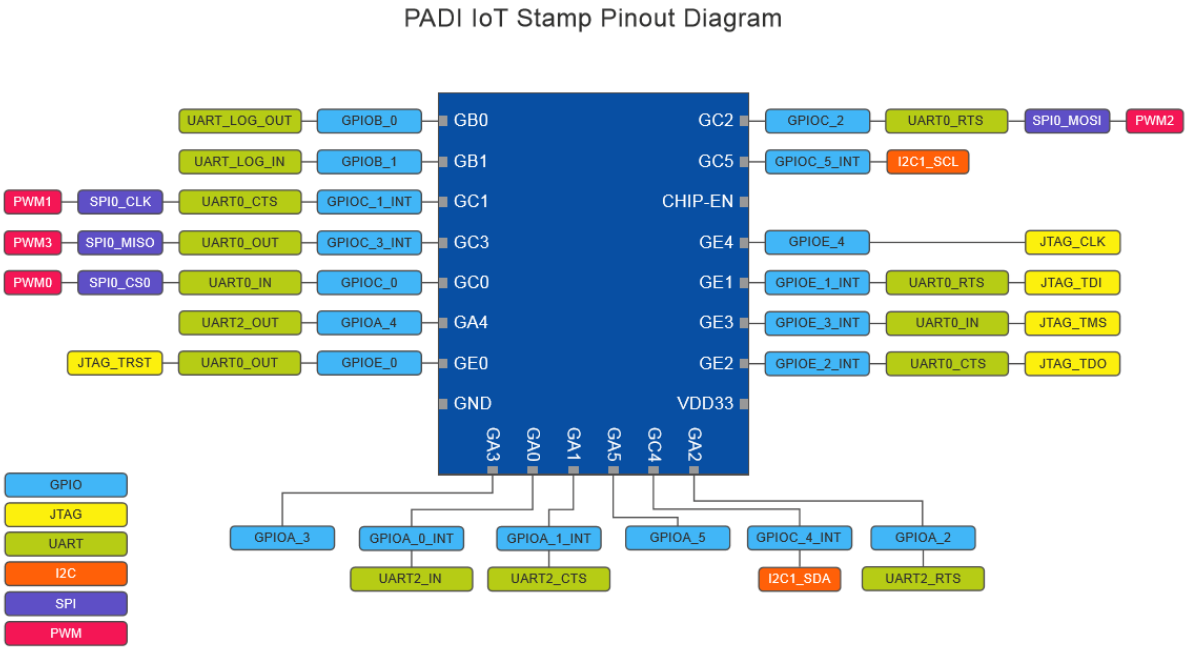
1.2 Specifications

Wireless	WiFi Standard: Frequency Range:	802.11 b/g/n 2.4 GHz - 2.5 GHz (2400 MHz - 2483.5 MHz)
Hardware	SoC : CPU : ROM / RAM / FLASH : SPI : UART : PWM : I2C : GPIO : Operating Voltage : Operating Temperature : Dimensions : Wireless Network Mode :	Realtek RTL8710AF ARM Cortex M3 (83 MHz) 1MB / 512KB / 1MB Up to 1 (41.5 Mbps) Up to 3 (2 x 4 Mbps + 1 x 38400 bps) Up to 4 Up to 1 (3.4 Mbps) Up to 19 (including 10 GPIO_INT) 3.0 V ~ 3.6 V (recommended 3.3 V) -20 ℃ ~ 85 ℃ 24 mm x 16 mm x 0.8 mm Station / SoftAP / SoftAP + Station
Software	Bitrate : Hash : Security Standard : Encryption : Firmware Update : OS : Development Tools: Network Protocol : User Configuration :	802.11b: 11 Mbps , 802.11g: 54 Mbps , 802.11n: 150 Mbps MD5 / SHA / HMAC-SHA WPA / WPA2 WEP / TKIP / AES UART / OTA / JTAG FreeRTOS, ARM® mbed™ (future planning) IAR, openOCD, J-Link TCP / UDP / HTTP / FTP AT Commands, Cloud Server, Android / iOS APP

2. Pinout



Note: GC2 means GPIOC_2 and all others follow the same naming convention.

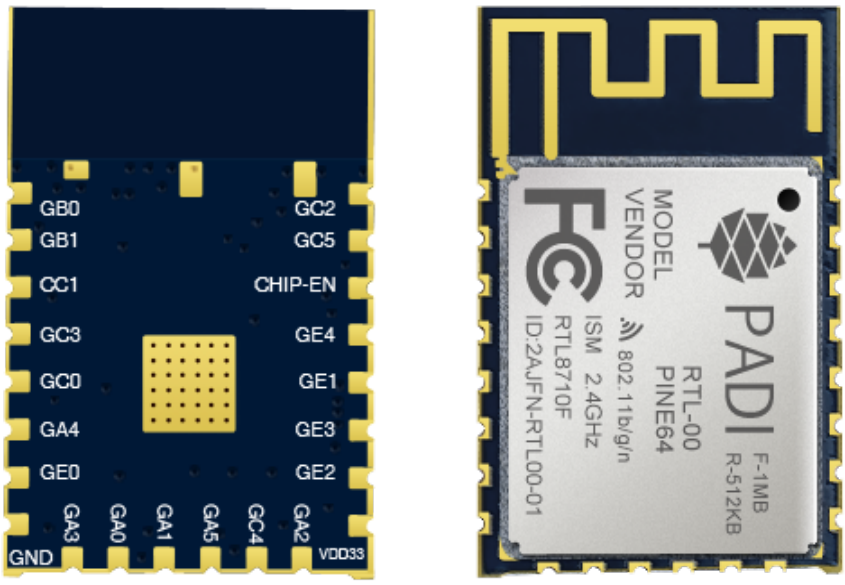


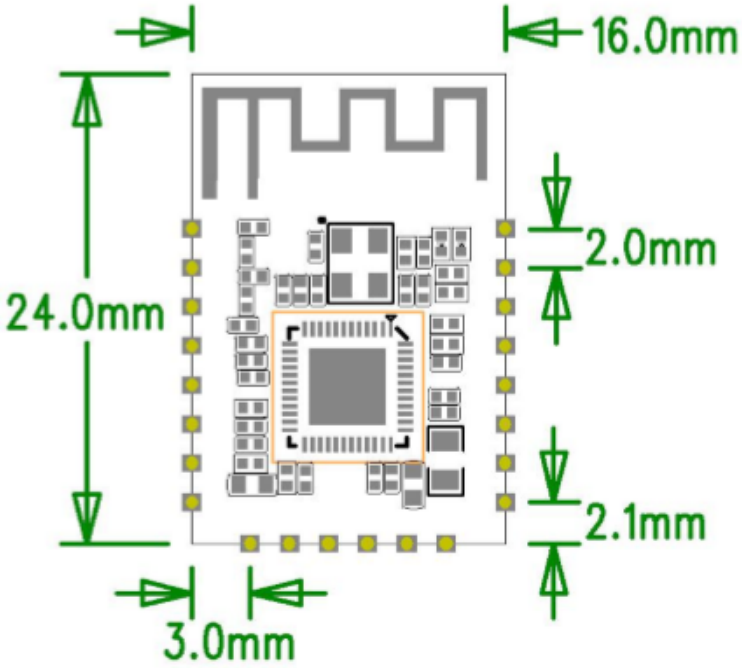
High resolution pinout diagram can be downloaded from

http://files.pine64.org/doc/PADI/documentation/padi-pinout-diagram.pdf

3. Dimension

PADI IoT Stamp dimensions are 24 mm x 16 mm x 3 mm with 3 dBi on-board PCB antenna. The soldering pad size on the bottom layer is 0.9 mm x 1.0 mm.





4. Functional Description

4.1 MCU

Realtek RTL8710AF is a highly integrated, single-chip, low power WiFi 802.11 b/g/n controller with ARM Cortex M3. It also provides some peripheral interface with configurable GPIO.

4.2. Memory

4.2.1 SRAM and ROM

Realtek RTL8710AF has a built-in memory controller for ROM and SRAM. The MCU can access the memory controller by iBus, dBus and AHB interface. These interfaces can access the ROM or SRAM unit as memory arbiters to determine the access sequence. Based on current SDK SRAM usage, the usable SRAM space is more 48 KB.

4.2.2 SPI Flash

PADI IoT Stamp has integrated 1 MB of SPI Flash for custom firmware. External SPI Flash is not supported.

4.3 Maximum Operating Conditions

Operating Conditions	***Standard***	***Value***	***Units***
Storage Temperature		-40 to 125	°C
Soldering Temperature		260	°C
Voltage Supply	IPC/JEDEC J-STD-020	+3.0 to +3.6	V

4.4 Recommended Operating Conditions

Operating Conditions	***Label***	***Min***	***Typical***	***Max***	***Units***
Operating Temperature		-20	20	85	°C
Voltage Supply	VDD	3.0	3.3	3.6	V

4.5 Digital Port Characteristics

Port	*Label*	*Min*	*Typical*	*Max*	*Units*
Input Logic Level Low	V_{IL}	-0.3		0.25VDD	V
Input Logic Level High	V_{IH}	0.75VDD		VDD+0.3	V
Output Logic Level Low	V_{OL}	N		0.1VDD	V
Output Logic Level High	V_{OH}	0.8VDD		N	V

Note: If not specified, the default test condition is VDD = 3.3V, Operating Temperature = 20 ºC

5. RF Parameters

Parameters	*Typical*		*Units*
Input Frequency	2412 – 2483.5		MHz
Input Resistance	50		Ω
Output Power	802.11b	>17	dBm
	802.11g	> 15	dBm
	802.11n (HT20)	> 14	dBm
	802.11 (HT40)	> 14	dBm
Rx Sensitivity	11M	≤ -76	dBm
	54M	≤ -65	dBm
	65M (HT20)	≤ -64	dBm
	150M (HT40)	≤ -61	dBm

6. Power Consumption

The following power consumption data was measured based on a 3.3 V power supply operating in 25ºC using an internal voltage regulator.

All measurements were performed in the absence of the SAW filter, at antenna interface.

All transmitted data is based on a 90% duty cycle, measured in continuous transmission mode.

Mode	***Min***	***Typical***	***Max***	***Units***
Transmitting 802.11b, CCK 11Mbps, P_{OUT}= +17dBm		87		mA
Transmitting 802.11g, OFDM 54Mbps, P_{OUT}= +15dBm		180		mA
Transmitting 802.11n (HT20), MCS7, P_{OUT}= +14dBm		168		mA
Transmitting 802.11n (HT40), MCS7, P_{OUT}= +14dBm		148		mA
Receiving 802.11b, packet size 1024 bytes, -76dBm		68		mA
Receiving 802.11g, packet size 1024 bytes, -65dBm		68		mA
Receiving 802.11n, packet size 1024 bytes, -64dBm		68		mA
Modem-Sleep[1]		15		mA
Light-Sleep[2]		0.9		mA
Deep-Sleep[3]		10		µA
Normal Standby		30		mA

Note 1: Modem - Sleep is applied to applications that require CPU in continuous working condition, such as PWM or I2S applications and etc. When WiFi is connected, if there are no data transfer activities, WiFi Modem circuit will be shut down according to 802.11 standards (such as U – APSD) to save power. For example, in DTIM3, which awakens 3ms after every 300 ms sleep time to receive AP Beacon packets and so on, the overall average current consumption is about 15 mA.

Note 2: Light - Sleep is applied to applications where the CPU can be suspended, such as the WiFi switch. When WiFi is connected, if there are no data transfer activities, WiFi Modem circuit will be

shut down according to 802.11 standards (such as U - APSD) and CPU will be suspended to save power. For example, in DTIM3, awake 3ms after every 300 ms sleep time to receive AP Beacon packets and so on, the overall average current consumption is about 0.9 mA.

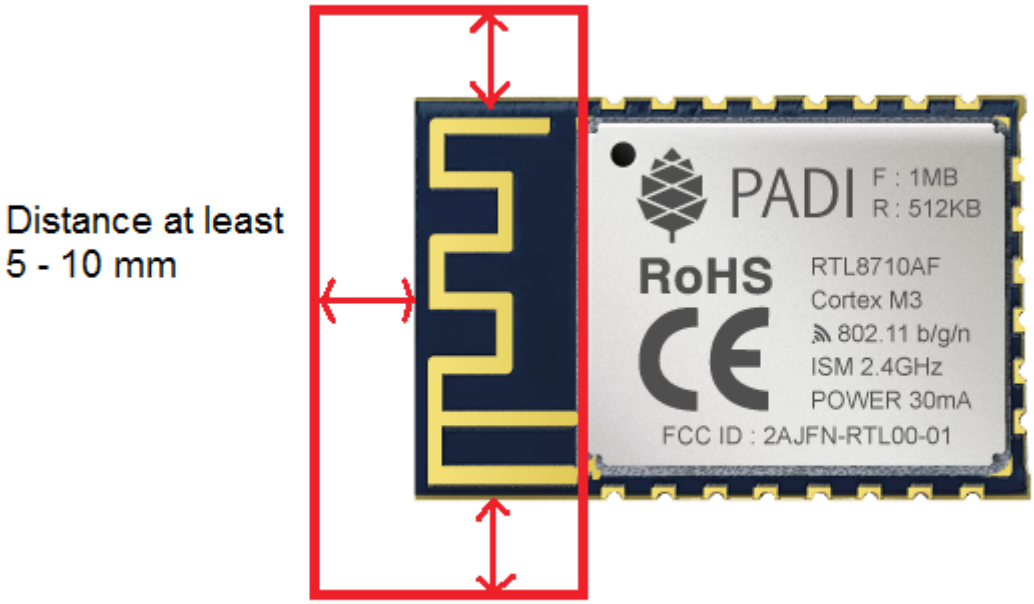
Note 3: Deep - Sleep is applied to applications that do not require WiFi connection to be active all the time. The application only sends a packet after long time interval, such as in a measurement temperature sensor that only needs to connect every 100 seconds. For example, with the application awake 0.3 s – 1 s to connect AP after every 300 s sleep time, the overall average current consumption can be much lower than 1 mA.

7. Temperature Drift

Temperature Drift T_S Max - T_L	Max 3°C / sec
Preheat T_S Min T_S Typical T_S Max T	 150°C 175°C 200°C 60 ~ 180 sec
Drift Up (T_L to T_P)	Max 3°C / sec
Temperature (T_L) / Time (T)	217°C / 60 ~ 150 sec
Temperature Peak (T_P)	Max 260°C, duration 10 sec
Target Temperature Peak (Target T_P)	260°C +0/-5°C
Actual Peak (t_P) 5°C Duration	20 ~ 40 sec
Drift Down	Max 6°C / sec
Duration to drift up from 25°C to T_P (t)	Max 8 minutes

8. Installation Notes

Antenna radiation space is very important. The quality of the environment will affect the transmission distance. Metal or other objects such as motors, cameras, speakers and etc. will directly affect the performance of the antenna, which is equivalent to shielding. PADI IoT Stamp uses on-board PCB antenna which has design requirements depending on the surrounding environment. Don't place any components that will affect antenna performance within 5-10 mm around the antenna and 3 - 5 mm below the antenna. Don’t lay out high frequency signal lines and placing components under the IoT Stamp.



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