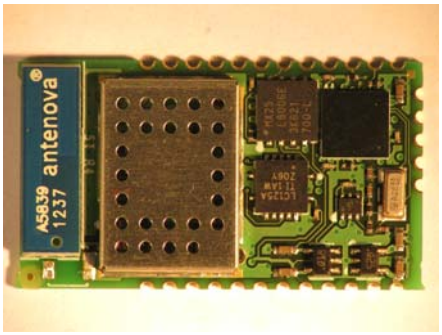
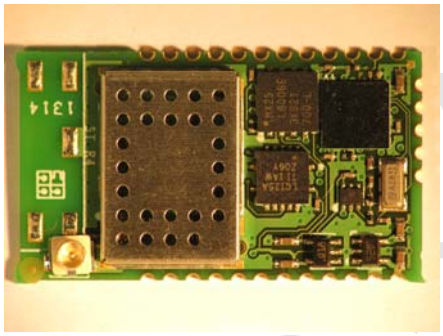
SPWF01SA
SPWF01SC

TBD

Datasheet - preliminary data



SPWF01SA



SPWF01SC

Features

- Integrated 2.4 GHz IEEE 802.11 b/g/n transceiver
- Integrated STM32 ARM Cortex-M3
- Integrated 1.5 MB flash memory
- Integrated 64 KB RAM memory
- Integrated 32kHz XTAL to support low power modes
- 16 GPIOs, JTAG and serial port (UART, SPI, I2C) interfaces available
- Small form factor: 26.92 x 15.24 x 2.35 mm
- Up to +18 dBm output power
- Single voltage supply (3.3 V typ)
- Multiple antenna options available: integrated antenna or integrated u.FL connector
- Industrial operating temperature range
- FCC/CE/IC certified
- RoHS compliant
- Surface mount PCB module

Applications

- Smart appliances
- Industrial control and data acquisition
- Home automation & home energy
- Home security systems
- Wireless sensors
- Cable replacement
- Medical equipments

Description

The SPWF01SA and the SPWF01SC intelligent Wi-Fi modules represent a plug and play and standalone 802.11 b/g/n solution for an easy integration of wireless Internet connectivity features into existing or new products.

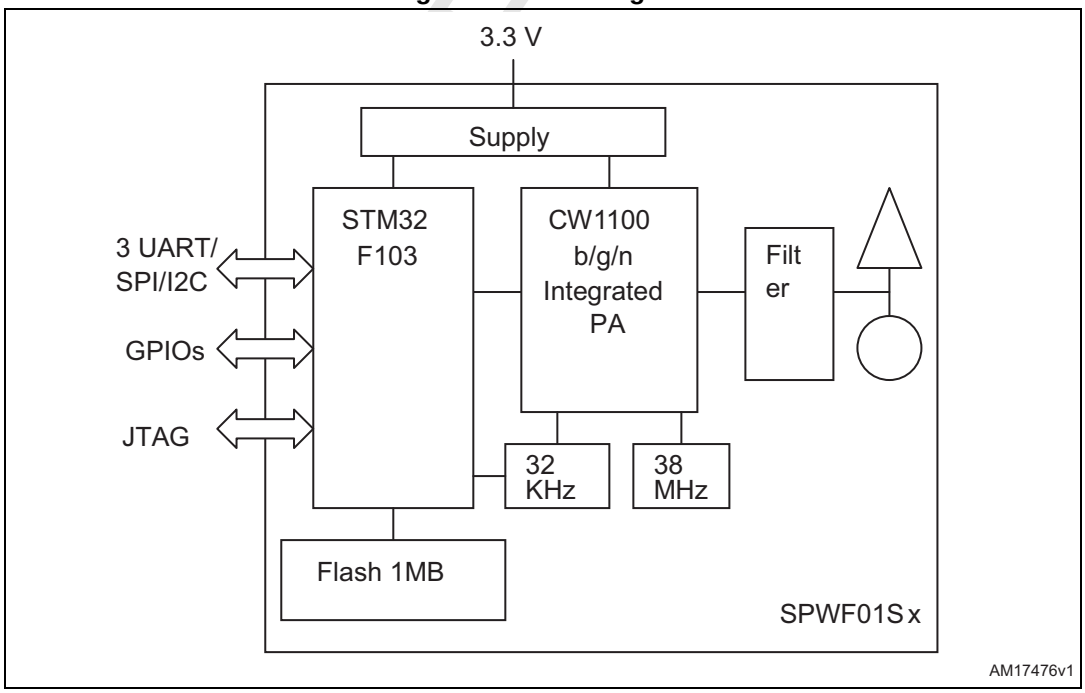
Configured around a single-chip 802.11 transceiver with integrated PA and an STM32 32-bit microcontroller with extensive GPIO suite, the modules also incorporate timing clocks and voltage regulators.

The module is available either configured with an embedded micro 2.45 GHz ISM band antenna (SPWF01SA), or with an u.FL connector for external antenna connection (SPWF01SC).

With low power consumption and small form factor, the modules are ideal for fixed and mobile wireless applications, as well as challenging battery operated applications.

The SPWF01SA.11 and SPWF01SC.11 orderable parts are released with an integrated full featured TCP/IP protocol stack with added web server and additional application services capabilities. The SW package also includes an AT command layer interface for a friendly access to the stack functionalities via the UART serial port.

Figure 1. Block diagram



1 General electrical specifications

1.1 Typical results are at room temperature only

Table 1. Absolute maximum ratings

Parameter	Test condition/comment	Min.	Typ.	Max.	Unit
3.3 V supply		-0.3		4.0	V
Vin for 5V tolerant pins		-0.3		5.5	V
Vin for all other pins		-0.3		2.8	V

Table 2. Operating conditions and input power specifications

Parameter		Test condition/comment	Min.	Typ.	Max.	Unit
Operating temperature range		Industrial	-40		85	°C
3.3 V supply	Input supply voltage	3.3V Supply input	3.1	3.3	3.6	V
	Power save mode current	100mS beacon period, 75 byte beacons @ 1Mbps, short Preamble, DTIM = 3		20		mA
	Sleep current	3.3V 25°C, no data retention, wakeup on events		200		µA
	Active RX w/power save	DTIM 1, All beacons Received, no active data (average value)		900		µA
	TX current	Peak, transmitting packets, 3.3V, 25°C		330		mA
	RX current	Peak, Receiving packets 3.3V, 25°C		125		mA

2 Digital interface specifications

Table 3. Digital Interface Specifications, I/O pins

Parameter		Test condition/comment	Min.	Typ.	Max.	Unit
Inputs	VIH		1.4			V
	VIL		0.6			V
Outputs	VOH	IOH=4mA	1.8			V
	VOL	IOL=4mA			0.4	V
Programmable			80		120	kΩ
Pull up or down resistor						

3 RF characteristics

Table 4.

Parameter		Test condition/comment	Min.	Typ.	Max.	Unit
RX Sensitivity(1)	11b, 1 Mbps			-96		dBm
	11b, 2 Mbps			-93		dBm
	11b, 5.5 Mbps			-91		dBm
	11b, 11 Mbps			-87		dBm
	11g, 9 Mbps			-89.5		dBm
	11g, 18 Mbps			-86		dBm
	11g, 36 Mbps			-80		dBm
	11g, 54 Mbps			-74.5		dBm
	11n, MCS1, 13 Mbps			-86.5		dBm
	11n, MCS3, 26 Mbps			-81.5		dBm
	11n, MCS5, 52 Mbps			-74		dBm
	11n, MCS7, 65 Mbps			-71		dBm
Channel to channel de-sensitivity	CH1 to 14	11g, 54 Mbps, 10%PER		1		dB
Maximum input signal	CH7	11g, 54 Mbps		-20		dBm
Adjacent channel rejection	11Mbps			38		dBc
	9 Mbps			20		dBc
	54 Mbps			4		dBc
	MCS1			24		dBc
	MCS7			3		dBc
TX Output power (1)	11b, 1 Mbps	@802.11b spectral mask		18.3		dBm
	11b, 11 Mbps			18.3		dBm
	11g, 9 Mbps	@802.11g spectral mask		18.3		dBm
	11g, 54Mbps	EVM=-27dB, 4.5%		13.7		dBm
	11n, MCS1	@802.11n spectral mask		18.3		dBm
	11n, MCS7	EVM=-27 dB		13.5		dBm
On board antenna gain		Average		-1.2		dBi
External antenna gain		SG901-1066 average including cable loss		2.8		dBi

1. Output power and sensitivities are measured with a 50 Ω connection at the antenna port.

4 Pin out description

Table 5. Pin out

Signal name	Pin number	Description/alternate function	Notes
GPIO Pins and alternate SPI functions			
GPIO0_MISO	16	Alternate SPI MISO pin. Pull high on powerup to reset settings	Input pull down and 5 V tolerant
GPIO1_MOS1	17	Alternate SPI MOSI	Input pull down and 5 V tolerant
GPIO2_SPICS	19	Alternate SPI chip select	Floating and 5 V tolerant
GPIO3_SCLK	1	Alternate SPI clock	Input pull down and 5 V tolerant
GPIO6_ADC0	22	Wake up/sleep inhibit	Input pull down and 5 V tolerant
Reserved Pins for future use			
GPIO4_RXD3	18	Alternate UART3 receive data input	
GPIO5_TXD3	20	Alternate UART3 transmit data output	
GPIO7_ADC1	13		
GPIO8_ADC2	4	Alternate UART2 transmit data output	
GPIO9_ADC3	7	Alternate UART2 receive data input	
I2C Pins			
GPIO11_SCL	11		
GPIO12_SDA	12		
GPIO15_DAC	21		
Monitoring purpose with no alternate function			
GPIO10	5	LED drive, blinking while run	
GPIO13	15	LED drive, wifi link	
GPIO14	14	LED drive, power up	
UART Pins			
RXD1	8	UART1 receive data input	5 V tolerant
TXD1	6	UART1 transmit data output	5 V tolerant
CTS1_DN	9	UART1 clear to send input	Active low, 5 V tolerant
RTS1_DP	10	UART1 request to send output	Active low, 5 V tolerant
Reset			
RESETn	3	Reset input	Active low for 5 ms with pull up to 2.5 V DC. Not 5 V tolerant
JTAG test pins (1)			
TRST_MISO3	28	JTAG TRST_N, Used for 1M Flash	5 V tolerant

Table 5. Pin out (continued)

Signal name	Pin number	Description/alternate function	Notes
TDI	27	JTAG TDI	5 V tolerant
TMS	26	JTAG TMS	5 V tolerant
TCK	29	JTAG TCK	5 V tolerant
TDO_SCK3	30	JTAG TDO, Used for 1M Flash	5 V tolerant
Supply pins and paddle			
3.3 V	24	Voltage supply	Decouple with 10 uF capacitor
Ground	23	Ground	
Ground Paddle	25	Ground	Add plenty of ground vias for thermal dissipation and ground return
Firmware load pin access			
BOOT0	2	(See firmware load description)	

1. To enable the firmware download, Pin BOOT0 needs to be high during power up. RESETn need to be pulled low at least 5 ms to initiate the firmware download sequence.

5 Module reflow

The SPWF01SA and SPWF01SC are surface mount modules with a 6-layer PCB. The final assembly recommended reflow profiles are indicated here below.

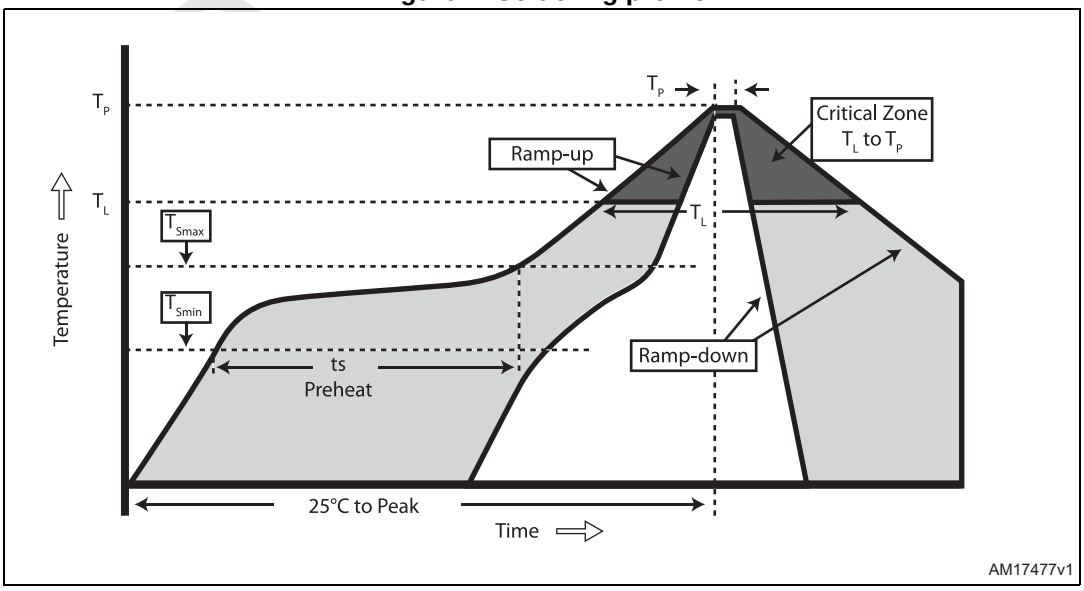
The soldering phase must be executed with care: in order to avoid undesired melting phenomenon, particular attention must be paid to the setup of the peak temperature.

The following are some suggestions for the temperature profile based on IPC/JEDEC J-STD-020C, July 2004 recommendations.

Table 6. Soldering values

Profile feature	PB-free assembly
Average ramp-up rate (T_{SMAX} to T_P)	3 °C/sec max
Preheat: – Temperature min. (T_S min.) – Temperature max. (T_S max.) – Time (T_S min. to T_S max) (ts)	 150 °C 200 °C 60-100 sec
Critical zone: Temperature T_L Time T_L	 217 °C 60-70 sec
Peak temperature (T_P)	240 + 0 °C
Time within 5 °C of actual peak temperature (T_P)	10-20 sec
Ramp-down rate	6 °C/sec
Time from 25 °C to peak temperature	8 minutes max.

Figure 2. Soldering profile



6 Regulatory compliance

RF compliance

The RF certifications in Table 7 have been obtained.

Table 7. RF certification summary

		Comment
FCC ID	VRA-SG9011203	On board antenna and external SG901-1066 with connector version
IC ID	7420A-SG9011203	On board antenna and external SG901-1066 with connector version
ETSI	Compliant	Approved with on board antenna and connector version

Note: Sagrad SG901-1066 is the only approved antenna usingthe UFL connector version.

FCC and IC

This module has been tested and found to comply with the FCC part 15 and IC RSS-210 rules. These limits are designed to provide reasonable protection against harmful interference in approved installations. 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 may not occur in a particular installation.

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.

Modifications or changes to this equipment not expressly approved by the part responsible for compliance may render void the user's authority to operate this equipment.

Modular approval, FCC and IC

FCC ID: VRA-SG9011203

IC: 7420A-SG9011203

In accordance with FCC part 15, the modules SPWF01SA and SPWF01SC are listed above as a modular transmitter device.

Label instructions

When integrating the SPWF01SA and SPWF01Sc into the final product, it must be ensured that the FCC labelling requirements, as specified below, are satisfied. Based on the Public Notice from FCC, the product into which the ST transmitter module is installed must display a label referring to the enclosed module. The label should use wording such as the following:

Contains Transmitter Module

FCC ID: VRA-SG90112013

IC: 7420A-SG9011203

Any similar wording that expresses the same meaning may be used.

CE

CE Expert opinion: xxxxxxxxxxx

- Measurements have been performed in accordance with (report available on request):
- EN 300 328 V 1.7.1 (2006-10) (a)
- EN 301 489-17 V 2.1.1 (2009) (b)
- EN60950-1:2006 +A11:2009+A1:2010 (c)

Figure 3. CE certified

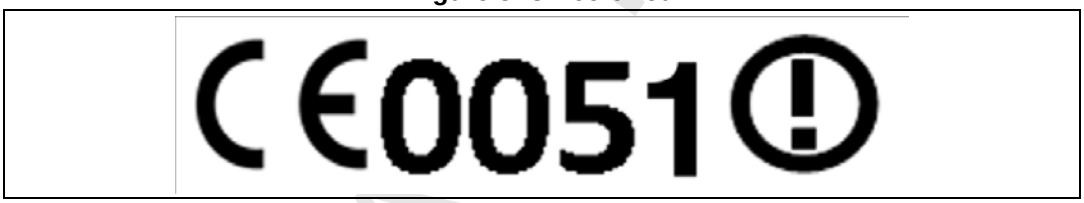


Figure 4. Top view of the module shield

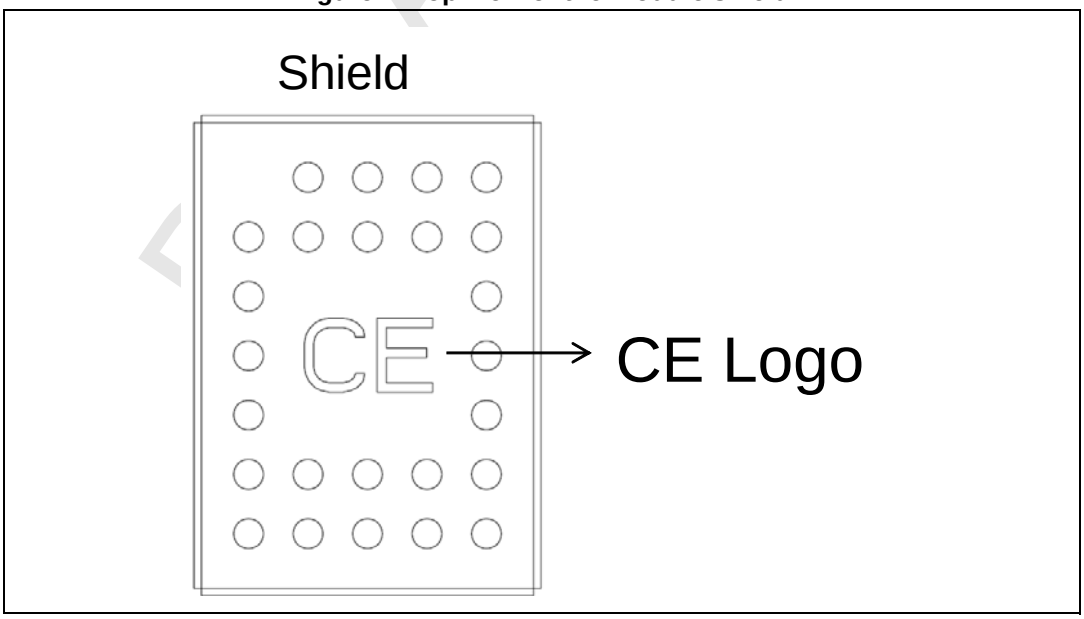
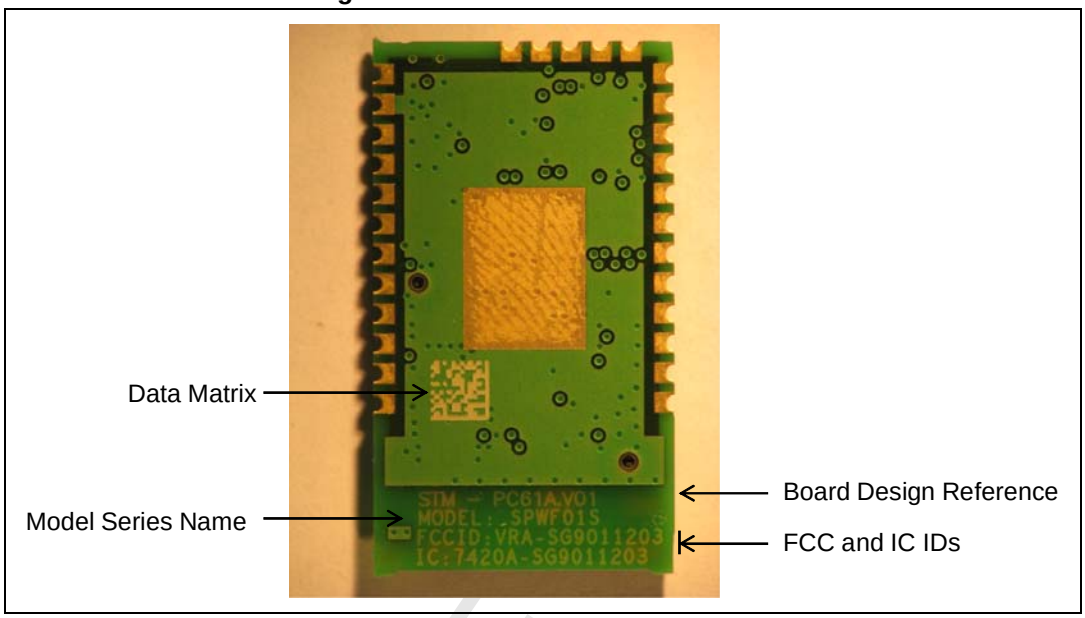


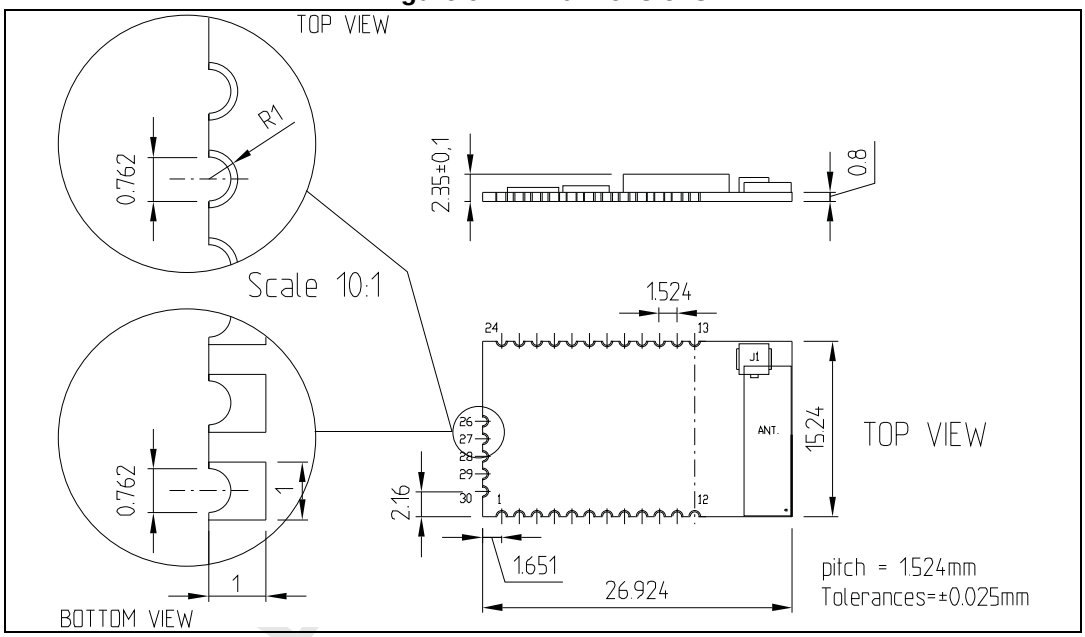
Figure 5. Bottom view of the module



7 Package mechanical data

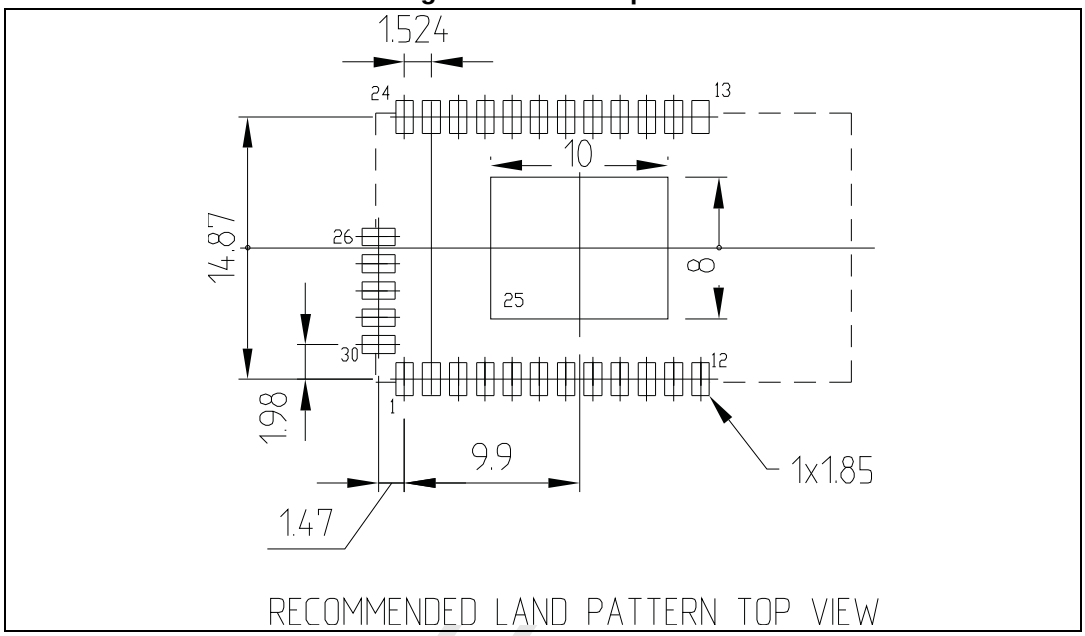
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® is an ST trademark.

Figure 6. Wi-fi dimensions



Note: An antenna area of 217X520 mils need to be free of any ground metallization or traces under the unit. The area extending away from the antenna should be free from metal on the PCB and housing to meet expected performance. Pin 25 is the required paddle ground and is not shown in this diagram.

Figure 7. Wi-fi footprint



PCB design requires detailed review of center exposed pad. This pad requires good thermal conductivity. Soldering coverage should be maximized and checked via x-ray for proper design. There is a trade off in providing enough soldering for conductivity and too much which allows the module to "float" on the paddle creating reliability issues. Sagrad recommends two approaches, a large center via that allows excess soldering to flow down into the host PCB with smaller vias arount it. Or many smaller vias with just enough space for the viscosity of the chosen solder/flux to allow some solder to flow into the smaller vias.

Each of these approaches need to result in 60% or more full contact solder coverage on the paddle after reflow. Sagrad strongly encourages PCB layout teams to work with their EMS providers to ensure vias and solder paste designs will result in satisfactory performance.

Note: Pin 1 is on the top left corner of this diagram. See note on the top view pin out for antenna to PCB interference requirements for the layout.

8 Ordering information

Table 8. Ordering information

Order codes	Description
SPWF01SA.11	Wifi module with integrated antenna and WiFi full stack
SPWF01SC.11	Wifi module with integrated u.FL connector and WiFi full stack

Note: Refer to the user guide for a complete list of features and commands available in the WiFi full stack.

9 Revision history

Table 9. Document revision history

Date	Revision	Changes
30-May-2013	1a	Initial release.

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