



## SG901-1049 Indigo Miniature Wi-Fi Radio

### Overview

The SG901-1049 Indigo is a single chip based 802.11b/g WLAN radio for embedded, low-power and very small form factor mobile applications. The product conforms to the IEEE 802.11b and 802.11g protocols operating in the 2.45GHz ISM frequency band supporting OFDM data rates of 54, 48, 36, 24, 18, 12, 9, and 6Mbps. It also supports CCK data rates of 11 and 5.5Mbps and legacy data rates of 2 and 1Mbps.

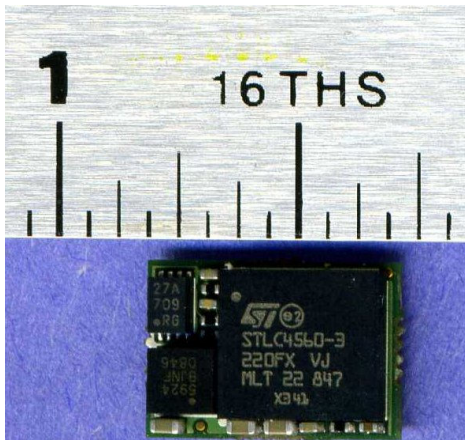
The SG901-1049 Indigo is a fully integrated wireless radio including a ZIF transceiver, RF Synthesizer/VCO, high-speed data converters, an OFDM/CCK digital baseband processor, an ARM9-based MAC and a complete Power Management Unit. The on module Power Amplifier completes a highly integrated chip set solution.

The on-board EEPROM stores calibration data for alignment-free integration.

Bluetooth integration features of the radio are made available.

Host control is provided by either an SDIO or SPI interface. For maximum flexibility, the SG901-1049 accepts system reference clock frequencies of 19.2, 26, 38.4 and 40MHz.

This complete design allows quick integration into a number of different applications.



### Features

- RoHs Compliant
- Fully integrated 802.11 Solution
- Custom drivers available for your host
- Extremely small footprint (9.5x13.5mm)
- Ultra Low Current consumption
- Fully compliant with the IEEE 802.11b and 802.11g WLAN standards
- Support for 54, 48, 36, 24, 18, 12, 9, and 6Mbps OFDM, 11 and 5.5Mbps CCK and Legacy 2 and 1Mbps data rates
- Single Chip 802.11b/g WLAN solution with fully integrated:
  - Zero IF (ZIF) transceiver,
  - Voltage Controlled Oscillator (VCO),
  - High-Speed A/D and D/A Converters,
  - Radio Power Management Unit (PMU) with on-board supply regulators,
  - OFDM and CCK baseband processor,
  - ARM9 Media Access Controller (MAC),
  - SPI serial host interface (up to 48MHz)
  - SDIO serial host interface (up to 50MHz)
- Intelligent Power Control, Including 802.11 Power Save Mode
- Supports SPI interface
- Supports SDIO interface

### Applications

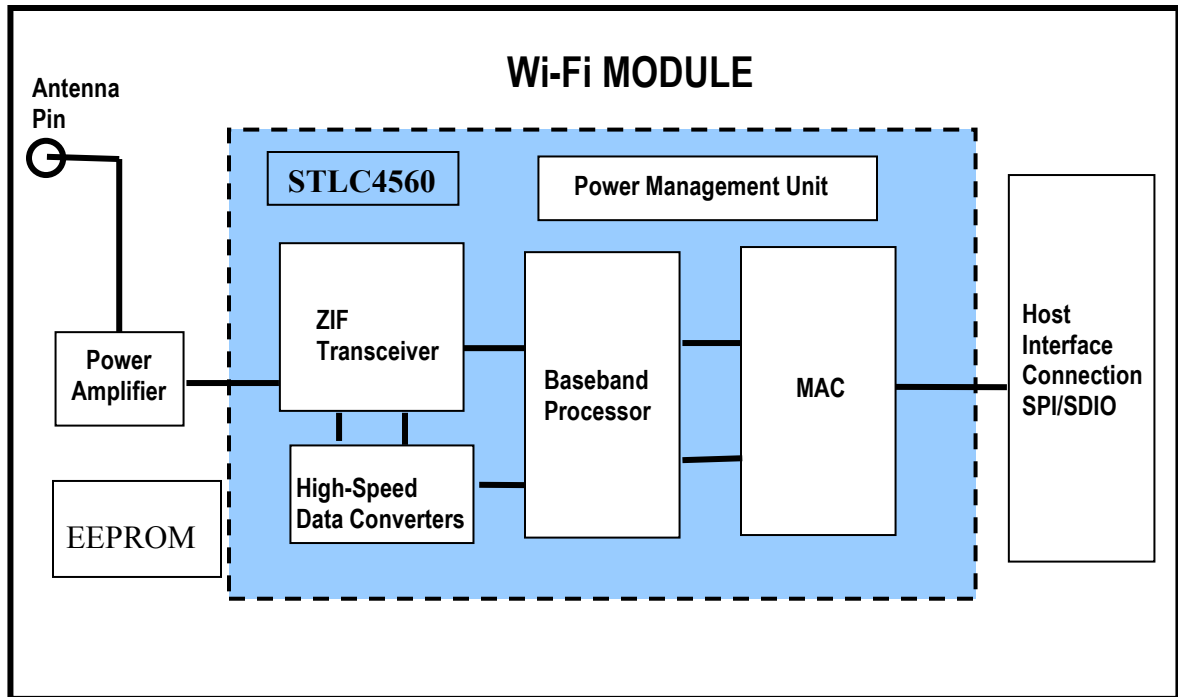
- Personal Digital Assistants (PDA)
- Portable Computers
- Hand-held Data Transfer Devices
- Cameras
- Computer Peripherals
- Cable Replacement
- Cellular Phones

### Ordering Information

Tape and Reel	SG901-1049-TR
Bulk	SG901-1049-BLK



## Block Diagram





## General Electrical Specifications

Parameter	Test Condition / Comment	Min.	Typ.	Max.	Units		
Absolute Maximum Ratings							
3.3V Supply		-0.3		5.3	V		
Operating Conditions and Input Power Specifications							
Operating Temperature Range		-30		85	°C		
3.3V Supply	Input Supply Voltage	Power Management Unit 3.3V Supply input		3.1	3.3	4.5	V
	Standby Mode Current	3.3V, 25°C, POWERUP=1.8V, Sleep clock 32.768kHz				0.5	mA
	Power Save Mode Current	100mS beacon period, 75 byte beacons @ 1Mbps, short Preamble, DTIM = 3				2	mA
	Shutdown Current	3.3V 25°C, POWERUP=0V				8	uA
	Average TX Current	Transmitting packets, 3.3V, 25°C			252		mA
	Average RX Current	Receiving packets, 3.3V, 25°C			253		mA
VHIO Supply	Input Supply Voltage	VHIO input supply determines Host CMOS logic levels		1.62	1.8	1.98	V
	Input Supply Current	VHIO = 1.8V			0.5	6	mA
	Standby Mode Current	VHIO = 1.8V			10		uA

## Digital Interface Specifications

Parameter	Test Condition / Comment	Min.	Typ.	Max.	Units	
Digital Interface Specifications						
POWER UP Input	VIH	PMU Power up control. Active High		0.8	1.98	V
	VIL			0	0.3	V
	Pull-Down				500	kΩ
Host CMOS Inputs	VIH	VHIO supply domain		0.7*VHIO	VHIO	V
	VIL			0	0.3*VHIO	V
Host CMOS Outputs	VOH	IOH = 0.2mA, VHIO supply domain		VHIO - 0.2	VHIO	V
	VOL	IOL = 2mA, VHIO supply domain		0	0.4	V
	Input Current	VHIO supply domain		-1.0	+1.0	uA
SLEEP_CLK Input	Frequency	VHIO supply domain			32.768	kHz
	Accuracy				500	ppm
	Duty Cycle			30	70	%

## RF Characteristics

Parameter	Test Condition / Comment	Min.	Typ.	Max.	Units	
RF Frequency Range		2400		2500	MHz	
RF Output Power	802.11 G 54Meg	Meeting FCC and 802.11 EVM		12		dBm
	802.11 G 6Meg	Meeting FCC and 802.11 EVM			15	dBm
	802.11 B 11Meg	Meeting FCC and 802.11 EVM			15	dBm
Receiver Sensitivity	802.11 G 54Meg	10% PER		-68		dBm
	802.11 G 6Meg			-88		dBm
FCC Compliance	Certified as part of customer equipment					

Note 1: Output Power is measured at the RF Antenna



## Connector Pin List

SIGNAL NAME	PIN NUMBER	DESCRIPTION	NOTES										
Reference Clock Pins													
OSC_EN	1	Oscillator Enable Output											
REF_CLK	2	Reference Oscillator Input	Frequency must match MODE4:1 selection										
MODE4	3	Oscillator Select Input	<table border="0"> <tr> <td style="text-align: center;">MODE[4:1]</td> <td style="text-align: center;">REF_CLK</td> </tr> <tr> <td style="text-align: center;">0010</td> <td style="text-align: center;">19.2MHz</td> </tr> <tr> <td style="text-align: center;">1110</td> <td style="text-align: center;">26.0MHz</td> </tr> <tr> <td style="text-align: center;">1101</td> <td style="text-align: center;">38.4MHz</td> </tr> <tr> <td style="text-align: center;">1010</td> <td style="text-align: center;">40.0MHz</td> </tr> </table>	MODE[4:1]	REF_CLK	0010	19.2MHz	1110	26.0MHz	1101	38.4MHz	1010	40.0MHz
MODE[4:1]	REF_CLK												
0010	19.2MHz												
1110	26.0MHz												
1101	38.4MHz												
1010	40.0MHz												
MODE1	4	Oscillator Select Input											
MODE2	5	Oscillator Select Input											
MODE3	6	Oscillator Select Input											
RF Pins													
BTH	15	Bluetooth RF Interface											
RF_IN_OUT	17	Wi-Fi / Bluetooth Antenna											
Serial Interface Pins (VHIO Domain)													
SPI_CS <sub>n</sub>	26	SPI Chip Select Input	SDIO Data 3										
SPI_DI	33	SPI MISO (output)	SDIO Data 0										
SPI_CLK	25	SPI Clock Input	SDIO CLK										
SPI_DO	24	SPI MOSI (input)	SDIO CMD										
SDIO_SDAT2	34		SDIO Data 2										
IRQ	32	SPI: Interrupt Output	SDIO Data 1										
Control Pins													
SERHOSTMODE	38	SPI / SDIO Select	1.86V Domain - High = SPI, Low = SDIO										
POWER UP	7	Power Up Enable (from host)	1.86V Domain - High = normal mode, Low = Sleep Mode										
SLEEPCLK	21	32.768 kHz Sleep Clock	VHIO Domain										
UARTSOUT	22	Debug UART Output	VHIO Domain										
UARTSIN	29	Debug UART Input	VHIO Domain										
DIVP	37	Diversity Switch Positive Control Output	1.86V Domain										
DIVN	36	Diversity Switch Negative Control Output	VHIO Domain										
Bluetooth Coexistence Pins (VHIO Domain)													
RFACTIVE	27	Bluetooth Coexistence	Connect to GND if not used										
STATUS	28	Bluetooth Coexistence	Connect to GND if not used										
FREQ	35	Bluetooth Coexistence	Connect to GND if not used										
TXCONF	30	Bluetooth Coexistence	Leave Unconnected if not used										
Power and Ground Pins													
VHIO	31	Supply Voltage for I/O's	Recommended I/O voltage range 1.62V to 1.98V (nominal 1.8V) (see note 1).										
1.2V	23	1.2V Internal regulator and core supply	>20uF decoupling cap recommended										
3.3V	20	Input Supply											
GND	8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 39	Ground Connections											

Note 1: This I/O supply operates to 3.3V. It is recommended that a level translator to 1.8V be used on host applications beyond 1.98V (e.g. TI-TXS0108 for SDIO).



## Encryption Support

Feature	Windows	Linux	CE
<b>Security</b>			
WEP	Yes	Yes	Yes
TKIP	Yes	Yes	Yes
AES/CCMP (HW accel)	Yes	Yes	Yes
WPA	Yes-WZC	Third Party Supplicant	WZC (shared key), Third party suppl.
WPA2	Yes	Third Party Supplicant	Third Party Supplicant
<b>QoS</b>			
HCF (Q1/2006)	Q1/06	Q1/06	Q1/06
WMM	Yes	Yes	Yes
WMM U-APSD	Yes	Yes	Yes
EDCF	Yes	Yes	Yes
WMM-SA (Q1/2006)	Q1/06	Q1/06	Q1/06
<b>Cisco Standards</b>			
CCX v1	Yes	Third Party Supplicant	Third Party Supplicant
CCX v2	Yes	Third Party Supplicant	Third Party Supplicant
<b>Certifications</b>			
802.11d Support	Yes	Yes	Yes
WiFi Certification	Yes	Yes*	Yes* (XP certification transfers)
WHQL	NA	NA	NA
<b>Bluetooth Coexistence</b>			
PTA (802.15.2)	Yes	Yes	Yes
802.11/BT on same Antenna	Yes	Yes	Yes
802.11/BT on 2 Antennas	Yes	Yes	Yes
Data and Voice Simultaneously	Yes	Yes	Yes
Data and Data Simultaneously	Yes	Yes	Yes
Voice and Voice Simultaneously	Yes	Yes	Yes

\*Throughput depends on SPI speed. We recommend a 33Mhz SPI to pass WiFi PDA Throughput requirements



## Software Support

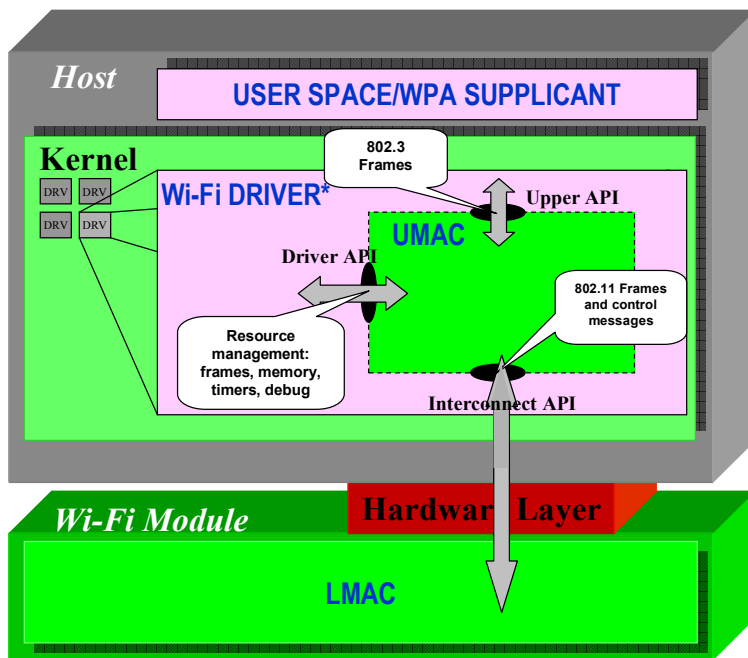
	Little Endian	Big Endian
Arm	X	
Arm4	X	
Arm9e	X	
Armi	X	
i386	X	
mips	X	X
powerpc		X
sh		X
sh4	X	
thumb	X	
xscale	X	X



# HW/SW Overview - SoftMAC Architecture



- **User Space, WPA Supplicant**
  - Supplicant required to:
    - Handle user input/configuration
  - WPA handshaking
    - Transport protocol (EAP/PEAP)
    - Handle certificates
    - Install keys in UMAC
- **Wi-Fi DRIVER**
  - Allows for porting to custom embedded OS and Processor
- **UMAC**
  - Binary Library file
    - Links with driver
    - Provides configuration API to:
      - Select encryption type
      - Set Key
    - Handles initial Authentication/Association to the AP
    - Configures LMAC for the correct encryption
- **LMAC**
  - Binary file, contains ARM executable code
  - Hardware encryption/decryption of data according to configured encryption type and key.



Customer responsible for porting the WiFi Driver and any user space applications such as the supplicant.

## SG923-0004 Indigo Evaluation Kit



- (1) SG901-1049 Wi-Fi module soldered on a carrier board
- (1) PCMCIA board for SPI applications
- (1) Interposer board
- (1) Software Driver CD
- (1) Data sheet for the SG901-1049
- (1) Schematics of carrier board
- (1) Schematics of PCMCIA board

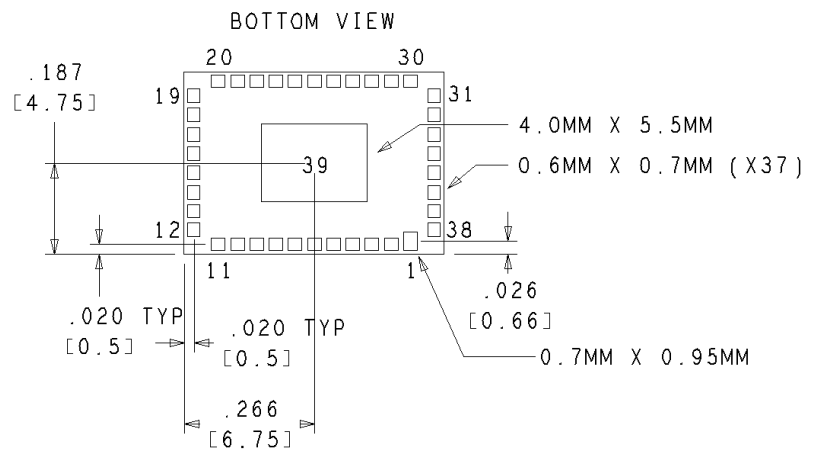
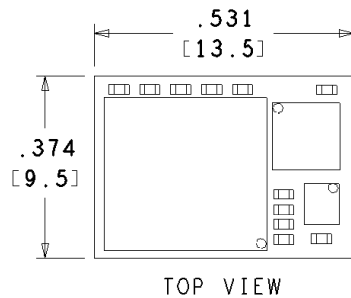


## Mechanical

- Maximum Peak Reflow Temperature: 240°C
- Moisture Level Sensitivity : 3

Module Dimensions:

Parameter		Min.	Typ.	Max.	Units
Dimension	Length		13.50		mm
	Width		9.50		mm
	Height		2.40		mm







## Revision List

Rev 2.1      Corrected Pins 17 and 18 assignment (affects RF\_IN\_OUT)  
                 Corrected Pins 24 and 33 descriptions (affects SPI data in and out)