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Preliminary

SG901-1091 Miniature Wi-Fi Radio

Overview

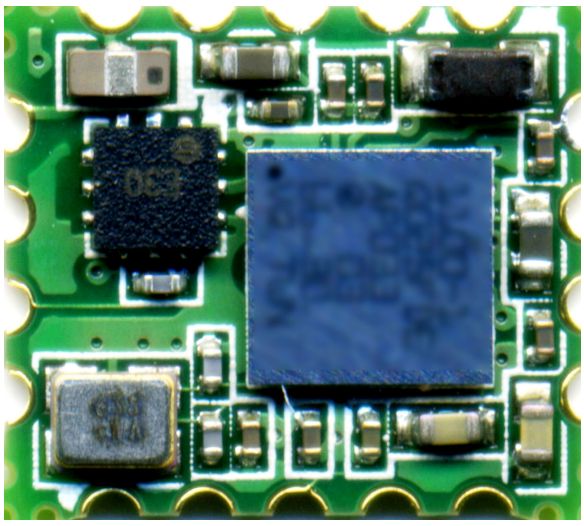
The SG901-1091 WiFi module is optimized to simplify successful integration into systems requiring the latest performance with small size. This module is a highly integrated single chip based 802.11b/g/n WLAN radio for embedded, low-power and extremely small form factor mobile applications. The product conforms to the IEEE 802.11b, g, and n protocols operating in the 2.45GHz ISM frequency band supporting 802.11g/n modulations from 6 to 65Mbps, and 802.11b modulations.

The SG901-1091 is a fully integrated wireless radio including RF Synthesizer/VCO, high-speed data converters, digital baseband processor, onboard MAC and PHY processors, Power Management, and Power Amplifier.

On-chip auto-calibration eliminates unit specific and customer calibration.

An on-board crystal and filter simplify system integration. The addition of 2.3 to 4.8V and 1.8V supplies, Antenna, and host communication provides a complete WiFi solution.

Host control is provided by either an SDIO or SPI interface at 1.8V.



Features

- Ultra Low Current Consumption
- Very Small Footprint (8.5 x 9.5mm)
- Self Calibrated
- RoHs Compliant
- Fully Integrated 802.11 System Solution
- Fully Compliant with the IEEE 802.11B,G, and N WLAN Standards
- Support for 802.11g/n Modulations up to 65Mbps, and Mandatory 802.11b Modulations
- Intelligent Power Control, Including 802.11 Power Save Mode
- Supports SPI Interface and SDIO Interface
- Factory Support for Linux 2.6/Android, Windows CE, Symbian
- Source Code Available for porting to RTOS or Custom OS
- Hardware driver is provided under GPL
- Industrial Temperature -40 to +85C
- Contact Factory for FCC compliant applications

Applications

- Hand-held Devices
- Embedded Systems
- Portable Systems
- Point of Sale terminals
- Personal Digital Assistants (PDA)
- Cameras
- Cable Replacement

Ordering Information

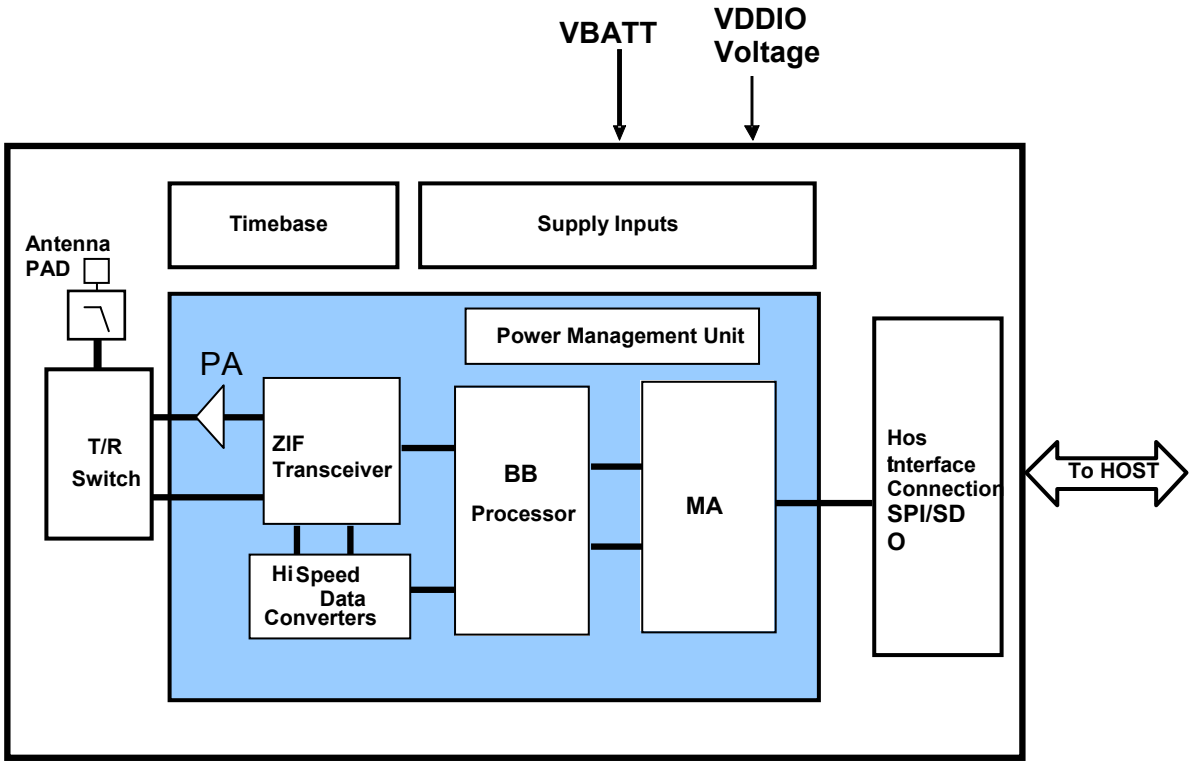
Packaging	Temp Range	Part Number
Tape and Reel	Industrial	SG901-1091-ET-TR
Bulk	Industrial	SG901-1091-ET-BLK
Tape and Reel	Commercial	SG901-1091-CT-TR
Bulk	Commercial	SG901-1091-CT-BLK

Evaluation Kit Available

This EVK supports embedded software development.

EVK for 1091	SG923-0010

Block Diagram



Standards Performance

Target Regulatory Domains	
US – FCC	Yes
Canada – IC	Yes
EU – ETSI	Soon
Japan – TELEC	Optional
Standards Support	
Modulations	a/b/g/n Modulations
Power Save	802.11e/WMM/WMM-PS
Encryption	802.11i/WPA/WPA2
Resources	802.11k
Regulatory Support	802.11d
Fast BSS Transition	802.11r
Protected Frames	802.11w
Direct Connect	Wi-Fi Direct

General Electrical Specifications

Parameter		Test Condition / Comment	Min.	Typ.	Max.	Units
Absolute Maximum Ratings						
VBAT Supply			-0.3		5.5	V
VDDIO Supply			-0.3		2.5	V
Operating Conditions and Input Power Specifications						
Operating Temperature Range			-40		85	°C
VBAT Supply	Input Supply Voltage		2.3	3.6	4.8	V
	Sleep Mode Current			80		uA
	Power Save Mode Current	DTIM = 1		0.87		mA
	Peak TX Current	14.5dBm		294		mA
	Peak RX Current	Processing OFDM		75		mA
VDDIO Supply	Input Supply Voltage	VHIO input supply determines Host CMOS logic levels	1.65	1.8	1.95	V
	Input Supply Current	RX Active, processing OFDM		0.87		mA
	Sleep Mode Current			25		uA
Input Voltage Levels	VIL		-0.3		0.35VDDIO	V
	VIH		0.625VDDIO			V
Output Voltage Levels	VOL	IOL = 100uA			0.2	V
	VOH	IOH = -100uA	VDDIO-0.2		VDDIO	V

RF Characteristics

Parameter		Test Condition / Comment	Min.	Typ.	Max.	Units
Antenna Port Impedance				50		Ohms
Antenna Input Return Loss		CH1 to CH14		-11		dB
RX Sensitivity	11b, 1Mbps			-96		dBm
	11b, 2 Mbps			-93		dBm
	11b, 5.5 Mbps			-91		dBm
	11b, 11 Mbps			-87		dBm
	11g, 9Mbps			-89.5		dBm
	11g, 18Mbps			-86		dBm
	11g, 36Mbps			-80		dBm
	11g, 54Mbps			-74.5		dBm
	11n, MCS1, 13Mbps			-86.5		dBm
	11n, MCS3, 26Mbps			-81.5		dBm
	11n, MCS5, 52Mbps			-74		dBm
	11n, MCS7, 65Mbps			-71		dBm
Channel to Channel De-sensitivity	CH1 to 14	11g, 54Mbps 10% PER		1		dB
Maximum Input Signal	CH7	11g, 54Mbps		-20		dBm

RF Characteristics cont,

Parameter		Test Condition / Comment	Min.	Typ.	Max.	Units
Adjacent Channel Rejection	11Mbps			38		dBc
	9Mbps			20		dBc
	54Mbps			4		dBc
	MCS1			24		dBc
	MCS7			3		dBc
TX Output Power	11b, 1Mbps	@802.11b spectral mask		18.3		dBm
	11b, 11Mbps			18.3		dBm
	11g, 9Mbps	@802.11g spectral mask		18.3		dBm
	11g, 54Mbps	EVM = -27dB, 4.5%		13.7		dBm
	802.11n MCS1	@802.11n spectral mask		18.3		dBm
	802.11n MCS7	EVM = -27dB		13.5		dBm

Pinout List

SIGNAL NAME	PIN NUMBER	DESCRIPTION		NOTES
RF Pin				
2G4_RF	6	Wi-Fi / Bluetooth Antenna Port, 50 ohms		Careful RF design is needed for this and nearby ground
Serial Interface Pins (VDDIO Domain, logic levels compatible with the VDDIO (Pin 18) input voltage)				
CMD_MOSI	11	SPI MOSI (input)	SDIO CMD	VDDIO Domain
CLK	10	SPI Clock Input	SDIO CLK	VDDIO Domain
SDD0_MISO	4	SPI MISO (output)	SDIO Data 0	VDDIO Domain
SDD1_IRQ	3	SPI: Interrupt Output	SDIO Data 1	VDDIO Domain
SDD2_HSEL1	1		SDIO Data 2	VDDIO Domain- at reset, low selects SPI, high SDIO
SDD3_CS	13	SPI Chip Select Input	SDIO Data 3	VDDIO Domain
Control Pins				
POWERUP	14	Power Up Enable (from Host)		VDDIO Domain with internal pull up High = operating, Low = off
RSTn	2	Reset Input		VDDIO Domain – Active Low reset
SLEEPCLK	16	32.768 kHz Sleep Clock Input		VDDIO Domain
FEM_CTRL1	12	programmable		diversity switch control
FEM_CTRL2	9	programmable		diversity switch control
DBG_RXD	15	Debug UART		VDDIO Domain
DBG_TXD	17	Debug UART		VDDIO Domain
Power and Ground Pins				
VDDIO	18	Supply Voltage for I/O's		1.8V, Internally decoupled with a 0.1uF capacitor
VBAT	8	RF supply		2.3 to 4.8V, Internally decoupled with a 4.7uF capacitor
GND	5, 7, 19	Ground Connections		

Software Support

The 1091 module is supported through highly portable software. The hardware drivers and Wi-Fi stack as provided is compatible with Linux kernel 2.6. The source code for the hardware abstraction is available under a GPL license and is available from Sagrad. The licensed Wi-Fi licensed stack available from Sagrad is provided in binary form without a license. Source code for the Wi-Fi stack is available to the customer. To obtain source code for the stack contact Sagrad sales at www.sagrad.com. Software and source code are available free of charge but require a software license agreement for the Wi-Fi stack source.

In almost all cases the GPL driver will need to be modified for the customer's specific hardware. The Wi-Fi stack will only need to be modified for compatibility to the customers OS and compiler. In many cases such as Linux near zero modification of the Wi-Fi stack will be required.

The Wi-Fi module/stack currently is only tested in client mode and is compatible with any access point that meets 802.11 standards. An access point mode code base is planned in the future.

The complete 802.11 stack requires about 350KB of space for the implementation of the entire specification. Extremely small versions can be created by knowledgeable customers but is a considerable task and requires detailed understanding of 802.11.

As a service to customers, Sagrad offers extended technical support on a fee basis.

Software Details:

MAC

■ Comprehensive MAC functionality according to IEEE 802.11-2007, including QoS traffic scheduling

■ Supports the following optional IEEE 802.11n features:
- MPDU aggregation
- MSDU aggregation
- Immediate Block Acknowledgement
- PSMP
- MTBA
- RIFS
- L-SIG TXOP protection

Link adaptation using MCS feedback

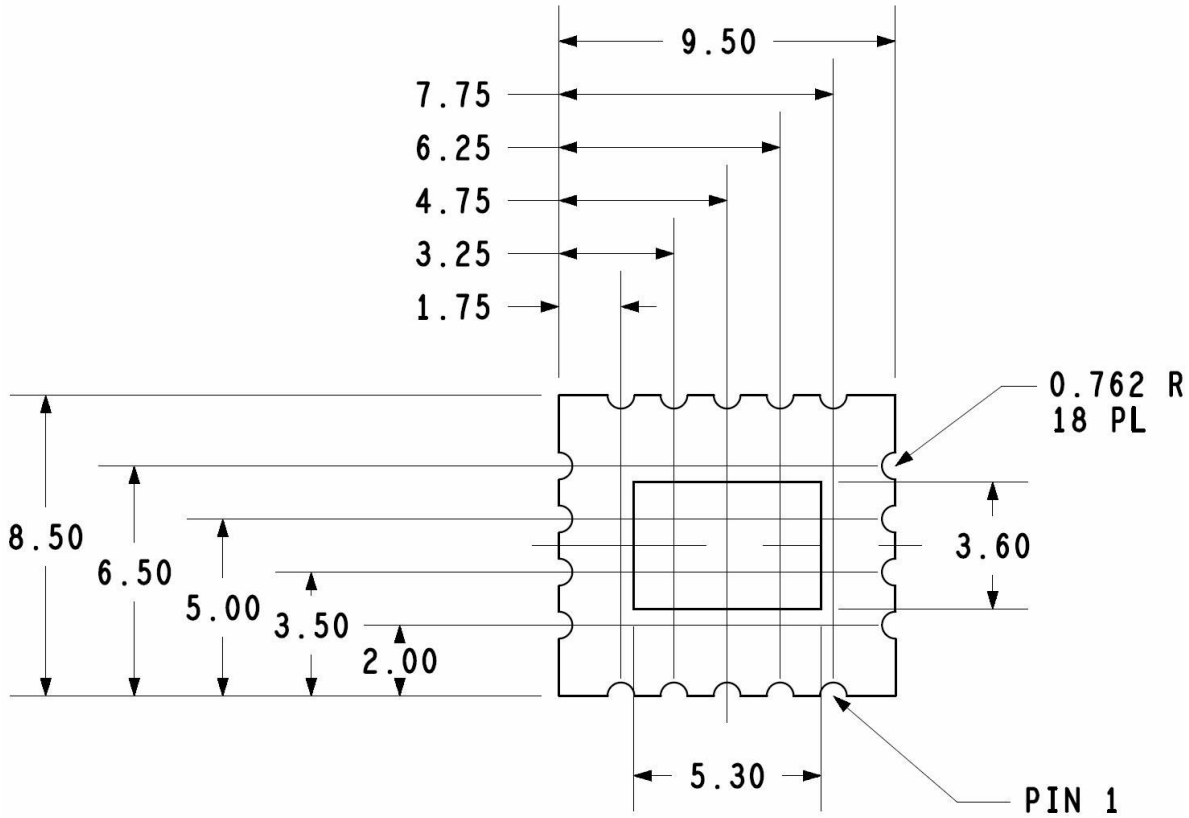
Encryption

■ Hardware encryption according to IEEE 802.11-2007 and IEEE 802.11w/D10.0:
- WEP40/64
- WEP104/128
- CCMP (AES)
- TKIP
- BIP

OS Support:

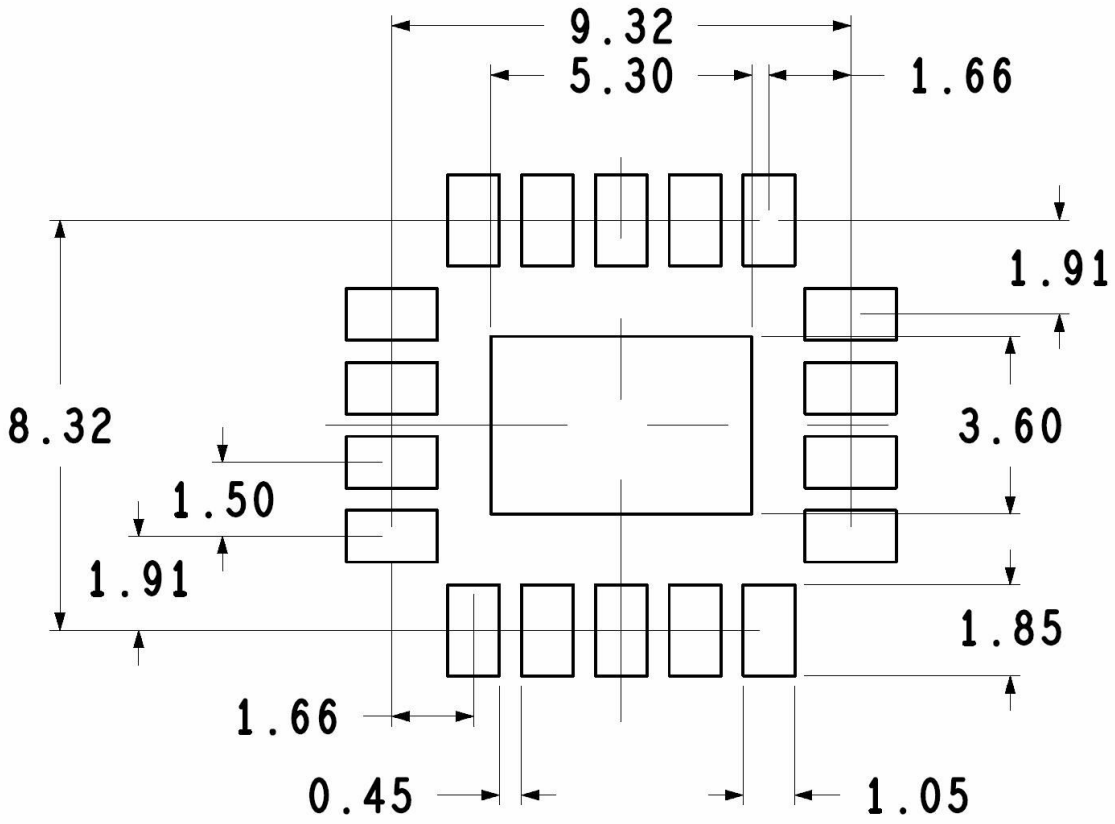
Windows Mobile 7 and 6.x, Windows CE 6.1 and 5, Linux v2.6, Android, Symbian

Mechanical (Bottom View)



The nominal size of the part is 8.5x9.5mm with a height of 1.3 mm

Recommended Layout Pads (Top View)



PCB design requires detailed review of the 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 solder 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 around 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 insure vias and solder paste designs will result in satisfactory performance.

Packaging

The part comes packaged in Tape and Reel or Bulk.