



**Unigen Corp. Wireless Module Products**

**802.11b/g/n WiFi Radio Module  
UGWDS82NSM33-U (San Gabriel-SMT-USB)  
UGWDS82NSM33-S (San Gabriel-SMT-SDIO)**

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Re-Tek - xxx

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## REVISION HISTORY

Rev. No.	History	Issue Date	Remarks
1.0	Draft	Sept. 10, 2009	Advanced information; Author: Allen B. Cabrerros
1.1		Oct. 23, 2009	Added part number ordering information
1.2		Dec. 14, 2009	Updated temperature limits
1.3		Feb. 05, 2010	Added module layout landing pattern
1.4		Apr. 12, 2010	FCC ID, CE ID added
1.5		May 25, 2010	Power Consumption figures added

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## PRODUCT INTRODUCTION

Unigen's San Gabriel SMT module supports 802.11b/g/n radio technology. 802.11 Wireless Ethernet standards known as WLAN are currently the most popular, short range, unlicensed radio technology. With reliable transmissions, protocol stack with use of the OSI model, and over-the-air PHY data throughput up to 300Mbps. WLAN is a radio technology for transferring large amounts of data within a short range and period of time reliably.

## FEATURES AND BENEFITS

### General Features

- 32-pin 16mm x 14mm module dimensions
- SDIO2.0 or USB2.0 interfaces
- Compliant to IEEE 802.11b/g/n radio standards; IEEE 802.11e/h/l standards
- PHY data rates up to 300Mbps
- WMM QoS
- IEEE 802.11i encryption, 64/128-bit WEP, TKIP, and AES
- WiFi Alliance WPA and WPA2 security; WiFi Protected Setup (WPS) with Push Button or PIN method
- Embedded LDOs, EEPROM, 40MHz and 32.768KHz crystals
- 1 x 2 MIMO; 1 transmitter and 2 receivers allowing up to 150Mbps transmit upstream PHY rates and 300Mbps receive downstream PHY rates
- Single 3.3V power supply
- Wake-On-LAN (WOL), remote wake-up
- Ready for embedded OS such as Windows CE, Linux, and more
- Configurable Bluetooth coexistence Interface
- Two configurable LED pins
- 150Mbps UDP throughput in 40MHz mode.
- Backward compatible with 802.11b/g devices while operating at 802.11n data rates
- Internal CPU to offload 802.11 protocol and perform dynamic control functions

## Host Interface

- Complies with USB Specification 2.0
  - Supports Full-speed (12Mbps) and High-speed (480Mbps)
- Complies with SDIO Specification 2.0
  - Support SDIO 1.1 (SDIO clock up to 25MHz)
  - Support SDIO 2.0 (SDIO clock up to 50MHz)

## Peripheral Interfaces

- General Purpose Input/Output (8 pins)
  - Can be used for WPS push button application support
- Two configurable LED pins
- Configurable Bluetooth coexistence Interface (4 wire)

## MAC Features

- Multiple BSSID feature allows the RTL8712 to assume multiple MAC identities when used as a wireless bridge
- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)
- Channel management and co-existence
- MIMO power saving mechanism
- Low latency immediate High-Throughput Block Acknowledgement (HT-BA)
- Long NAV for media reservation with CF-End for NAV release
- PHY-level spoofing to enhance legacy compatibility
- Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth

## PHY Features

- IEEE 802.11n draft 2.0 MIMO OFDM
- 20MHz and 40MHz bandwidth transmission
- Short Guard Interval (400ns)
- One Transmit and Two Receive paths (1T2R)
- One spatial stream STBC transmission for extended coverage
- Sounding packet

- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
- OFDM with BPSK, QPSK, 16QAM, 64QAM, and 256QAM modulation Convolutional Coding Rate: 1/2, 2/3, 3/4, and 5/
- Maximum data rate 54Mbps in 802.11g, and 300Mbps in 802.11n
- OFDM receive diversity with MRC using up to 4 receive paths. Switch diversity used for DSSS/CCK
- Selectable digital transmit and receive FIR filters
- Programmable scaling in transmitter and receiver to trade quantization noise against increased
- probability of clipping
- Fast receiver Automatic Gain Control (AGC)
- On-chip ADC and DAC

## APPLICATIONS

Personal computers, laptops, PDA's, mobile phones, portable devices, WLAN clients, embedded systems, robotics and remote controls.

## PRODUCT DESCRIPTION

### San Gabriel SMT Module

The San Gabriel SMT module features the Realtek RTL8712 IEEE 802.11 b/g/n transceiver. San Gabriel SMT modules support the 802.11b/g/n radio technology for wireless Ethernet transmissions and WLAN applications. The San Gabriel SMT versions support either USB or SDIO interface for communications with a host controller. The module supports 1TX/2RX MIMO RF ports to support up to 300Mbps downstream receive PHY rate and 150Mbps upstream transmit PHY rate. A host controller is required to support the full 802.11 protocol. Realtek supports protocol stacks for systems running Linux, WinCE6.0 or Windows OS.

**RealTek RTL8712 802.11b/g/n IC**

The Realtek RTL8712 is a highly integrated MIMO (Multiple In, Multiple Out) Wireless LAN (WLAN) USB 2.0/ SDIO2.0 network interface controller complying with the IEEE 802.11n Draft specification 2.0. It combines a MAC, 1T2R capable baseband and RF in a single chip, the RTL8712 provides a complete solution for a high-performance wireless client. The USB or SDIO interface can be flexibly selected by an external jumper.

The RTL8712 baseband implements MIMO Orthogonal Frequency Division Multiplexing (OFDM) with one transmit and two receive paths (1T2R). Features include one spatial stream transmissions, short Guard Interval (GI) of 400ns, spatial spreading, and support for both 20MHz and 40MHz channel bandwidth. The RTL8712 provides spatial stream Space-Time Block Code (STBC) to extend transmission range. As a receiver, extended range and good minimum sensitivity is achieved by having receiver diversity via 2 antennas.

For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all IEEE 802.11b, 802.11g data rates. Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability are available, and CCK provides support for legacy data rates, with long or short preamble. The high speed FFT/IFFT paths, combined with BPSK, QPSK, 16QAM, and 64QAM modulation of the individual subcarriers, and rate compatible punctured convolutional coding with coding rate of 1/2, 2/3, 3/4, and 5/6, provide the higher data rates of 54Mbps and 300Mbps for IEEE 802.11g and 802.11n MIMO OFDM respectively.

The RTL8712 builds in an enhanced signal detector, an adaptive frequency domain equalizer, and a soft-decision Viterbi decoder to alleviate severe multi-path effects and mutual interference in the reception of multiple streams. For better detection quality, receive diversity with Maximal-Ratio-Combine (MRC) applying up to two receive paths is implemented. Robust interference detection and suppression are provided to protect against Bluetooth, cordless phone, and microwave oven interference.

Receive vector diversity for multi-stream application is implemented for efficient utilization of the MIMO channel. Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for the radio frequency front-end. Selectable digital transmit and receive FIR filters are provided to meet transmit spectrum mask requirements and to reject adjacent channel interference, respectively.



The RTL8712 supports fast receiver Automatic Gain Control (AGC) with synchronous and asynchronous control loops among antennas, antenna diversity functions, and adaptive transmit power control functions to obtain better performance in the analog portions of the transceiver.

The RTL8712 MAC supports 802.11e for multimedia applications, 802.11i for security, and 802.11n for enhanced MAC protocol efficiency. Using packet aggregation techniques such as A-MPDU with BA and A-MSDU, protocol efficiency is significantly improved. Power saving mechanisms such as U-APSD, APSD, and MIMO power saving reduces power wasted during idle time, and compensates for the extra power required to transmit MIMO OFDM. The RTL8712 provides simple legacy and 20MHz/40MHz co-existence mechanisms to ensure backward and network compatibility.

## FUNCTIONAL BLOCK DIAGRAMS

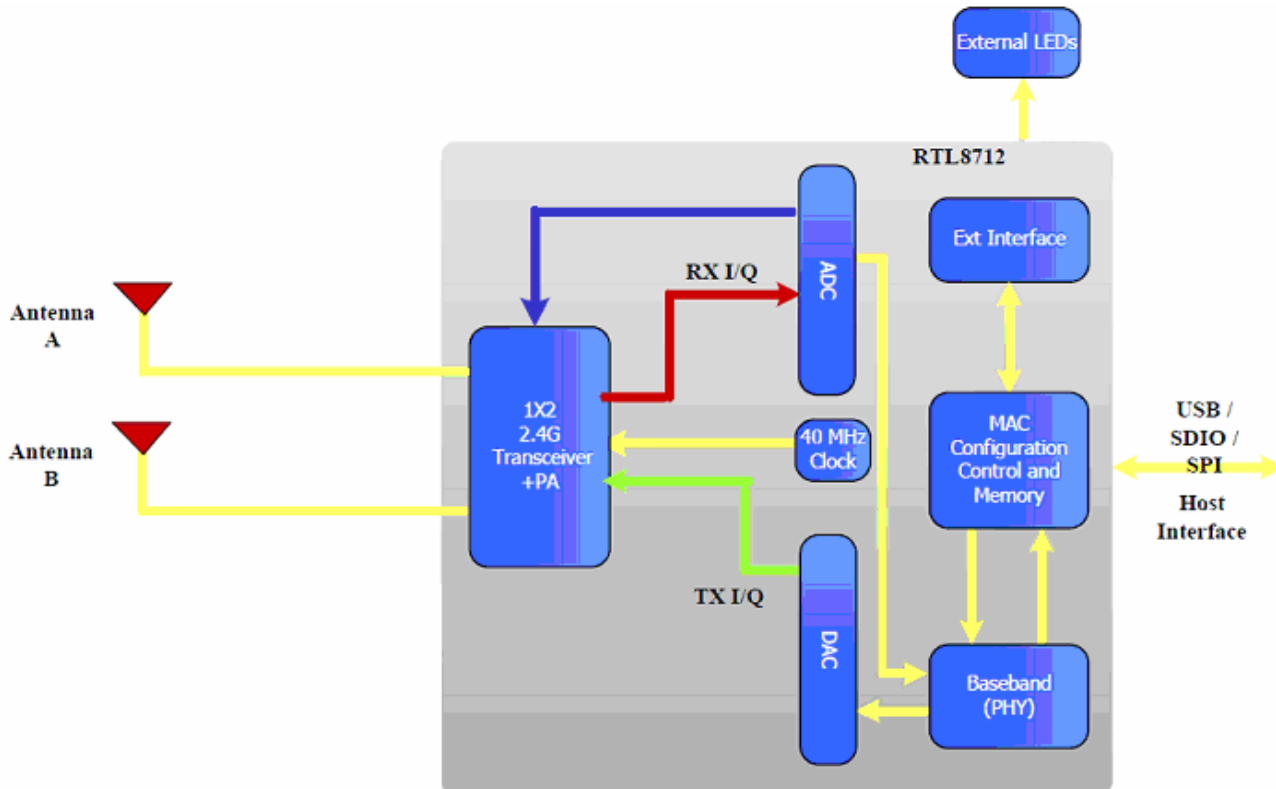


Figure 1: Module Block Diagram

## MODULE PINOUT

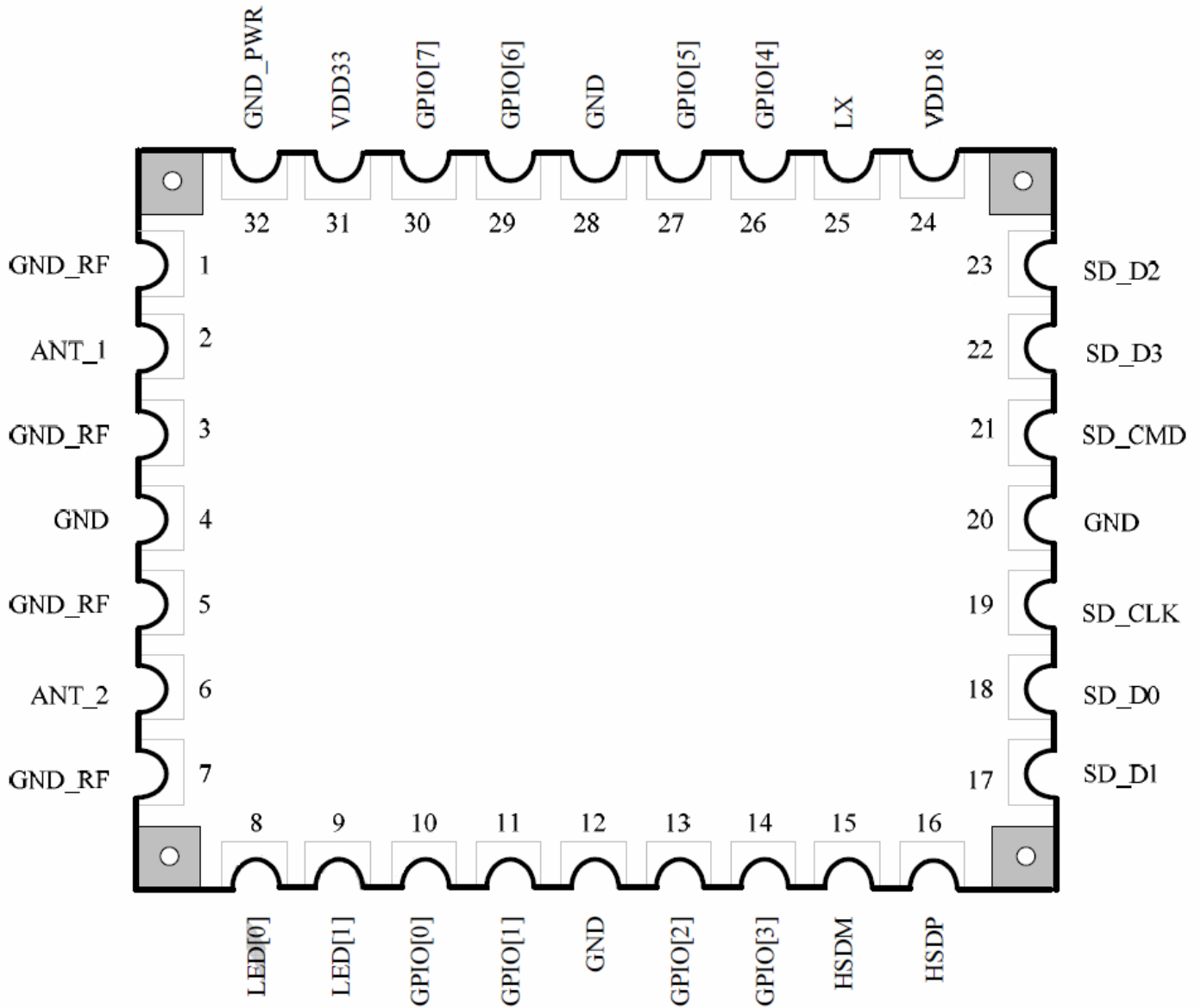


Figure 2: Module Pinout

## PIN ASSIGNMENT

Table 1: Pin Assignment SDIO

Pin No	Signal	Type	Description
1	GND_RF	P	Module RF Ground
2	ANT_1	RF	1 <sup>st</sup> antenna port
3	GND_RF	P	Module RF ground
4	GND	G	Module ground
5	GND_RF	G	Module RF ground
6	ANT_2	RF	2 <sup>nd</sup> antenna port
7	GND_RF	DO	Module RF ground
8	LED[0]	O	LED pin (active low)
9	LED[1]	I/O	LED pin (active low)
10	GPIO[0]/ WLAN_ACT	I/O	General Purpose Input/Output pin and also the WLAN_ACT signal indicates when WLAN is either transmitting or receiving in the 2.4GHz ISM band.
11	GPIO[1]/ WLAN_RX	I/O	General Purpose Input/Output pin and also WLAN_RX indicates wireless LAN RX activity
12	GND	G	Module ground
13	GPIO[2]/ BT_STAT	I/O	General Purpose Input/Output pin and also the BT_STAT signal indicates when normal Bluetooth packets are being transmitted or received by co-located Bluetooth device
14	GPIO[3]/ BT_PRI	I/O	General Purpose Input/Output pin and also the BT_PRI signal indicates when a high priority Bluetooth packet is being transmitted or received
15	HSDM	I/O	High Speed USB D- Signal
16	HSDP	I/O	High Speed USB D+ Signal
17	SD_D1	I/O	SDIO data line 1 or interrupt output
18	SD_D[0]	I/O	SDIO data line 0
19	SD_CLK	I	SDIO clock
20	GND	G	Module ground
21	SD_CMD	I/O	SDIO command line
22	SD_D3	I/O	SDIO data line 3

23	SD_D2	I/O	SDIO data line 2 or read wait
24	VDD18	P	1.8V supply to the module
25	LX	P	Internal switching regulator output
26	GPIO[4]	I/O	General Purpose Input/Output pin
27	GPIO[5]	I/O	General Purpose Input/Output pin
28	GND	G	Module Ground
29	GPIO[6]	I/O	General Purpose Input/Output pin
30	GPIO[7]	I/O	General Purpose Input/Output pin
31	VDD33	P	3.3V power supply to the module
32	GND_PWR	G	Module ground

## TEMPERATURE LIMIT RATINGS

Table 2: Temperature Limit Ratings

Symbol	Definition	Min.	Max.	Unit
Ts	Storage Temperature Range	-55	+125	°C
Tap	Ambient Operating Temperature	0	+70	°C

## DC ELECTRICAL CHARACTERISTICS

Table 3: DC Electrical Characteristics

Symbol	Description	Conditions	Value			
			Min	Typ	Max	Unit
VDD33	Supply Voltages		3.1	3.3	3.63	V
Voh	Min. high level output voltage	IOH = -8mA	0.9 * VDD33		VDD33	V
Vol	Max. low level output voltage	IOL = 8mA			0.1 * VDD33	V
Vih	Min. high level input voltage		0.5 * VDD33		VDD33 + 0.5	V

Vil	Max. low level input voltage		-0.5		0.3 * VDD33	V
Iin	Input current	Vin = VDD33 or GND	-1.0		+1.0	μA
Ioz	Tri-state output leakage current	Vout = VDD33 or GND	-10		10	m A
Icc	Average operating supply current	Iout = 0mA			160	m A

## POWER CONSUMPTION CHARACTERISTICS

Table 4: Power Consumption Characteristics

SDIO Interface		
Conditions	Specifications @ 3.3V	Units
Associated and Idle	198	mA
Unassociated and Idle	195	mA
Associated and Idle (Enable Power Saving)	33	mA
Unassociated and Idle (Enable Power Saving)	29	mA
Continuous TX G-Mode @ +15dBm	303	mA
Continuous TX N-Mode @ +13dBm	293	mA
Continuous RX	190	mA
Radio Off (SDIO only)	6.25	mA
Power Save Mode (CPU clock 32KHz)	4	mA
Deep Power Save Mode (Memory and SDIO Only)	2.5	mA
Continuous TX @ 16.7Mbps	298	mA
Continuous TX @ 20Mbps	218	mA
USB Interface		
Conditions	Specifications @ 5V	Units
Associated and Idle	168	mA
Unassociated and Idle	152	mA
Associated and Idle (Enable Power Saving)	39.5	mA
Unassociated and Idle (Enable Power Saving)	37.5	mA
Continuous TX G-Mode @ +15dBm	246	mA
Continuous TX N-Mode @ +13dBm	235	mA
Continuous RX	166	mA
Radio Off (SDIO only)	37.5	mA
USB Disable	2.1	mA
USB Suspend	1.82	mA
Continuous TX @ 31Mbps	252	mA
Continuous TX @ 84.4Mbps	203	mA

### Test Environment:

Notebook: Toshiba T5600

- CPU : 1.83GHz

- Memory : 2GB

- OS : Linux & Windows XP Professional SP2

## RF CHARACTERISTICS

Table 5: RF Characteristics

Parameter	Conditions	Specifications	Units
RF channel support		2412, 2417, 2422, 2427, 2432, 2437, 2442, 2447, 2452, 2457, 2462, 2467, 2472, 2482	MHz
RF output power	802.11b 11Mbps	17	dBm
	802.11g 54Mbps	15	dBm
	802.11n MCS7	13	dBm
Receiver sensitivity	802.11b	-84	dBm
	802.11g (1R)	-73	dBm
	802.11n (2R)	-71dBm (MCS 7_HT20) -68dBm (MCS 15_HT20) -68dBm (MCS 7_HT40) -65dBm (MCS 15_HT40)	dBm
Frequency offset		±25	ppm
Transmit Spectrum Mask		Conform to IEEE 802.11b/g Spectrum Mask	



## INTERFACE CHARACTERISTICS

### SDIO Interface Timing

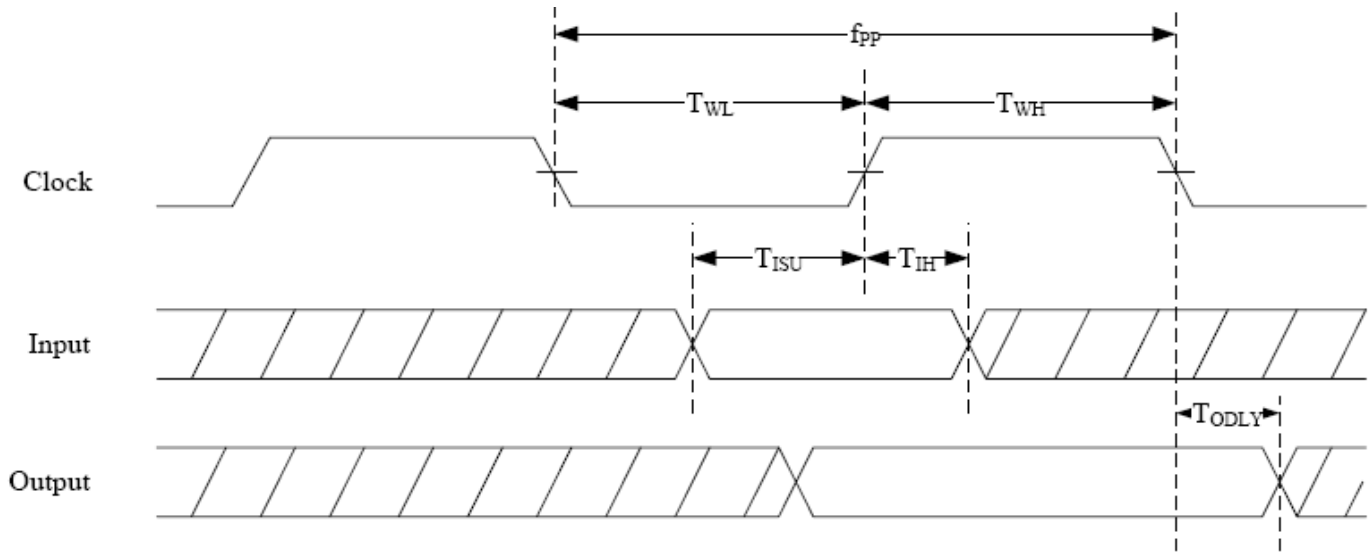


Figure 3: SDIO Interface Timing

Table 6: SDIO Timing

Symbol	Parameter	Mode	MIN	MAX	Unit
$F_{pp}$	Clock frequency	Default	0	25	MHz
		High Speed	0	50	MHz
$T_{WL}$	Clock low time	Default	10		ns
		High Speed	7		ns
$T_{WH}$	Clock high time	Default	10		ns
		High Speed	7		
$T_{ISU}$	Input setup time	Default	5		ns
		High Speed	6		
$T_{IH}$	Input hold time	Default	5		ns
		High Speed	2		
$T_{ODLY}$	Output delay time	Default		14	ns
		High Speed		14	

## APPLICATION SCHEMATIC

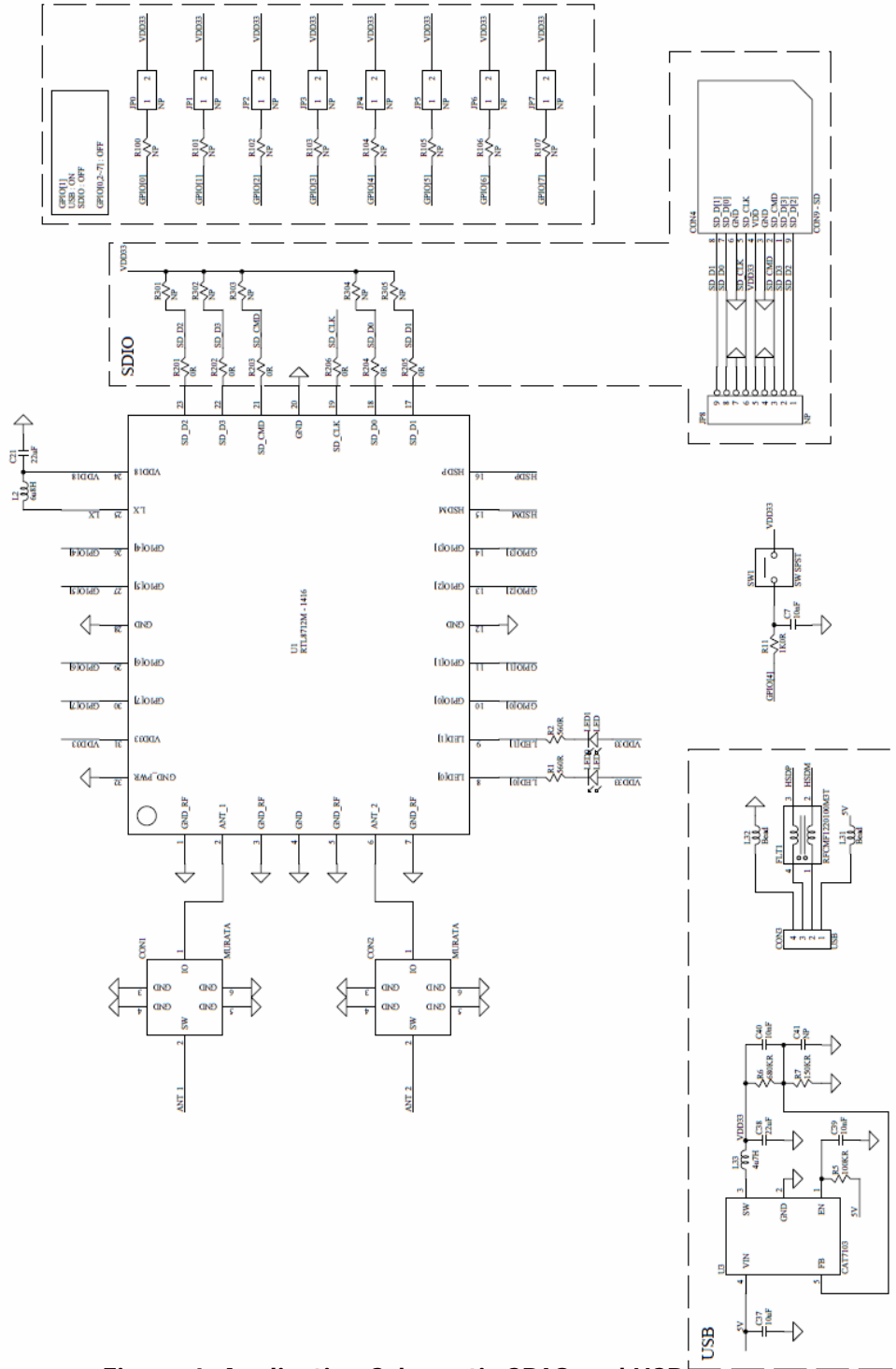


Figure 4: Application Schematic SDIO and USB



# **San Gabriel SMT - UGWDS82NSM33.X.X**

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## **AGENCY CERTIFICATIONS**

FCC ID – R8KUGWDS82

IC: 5125A-UGWDS82

**MECHANICAL DRAWINGS**

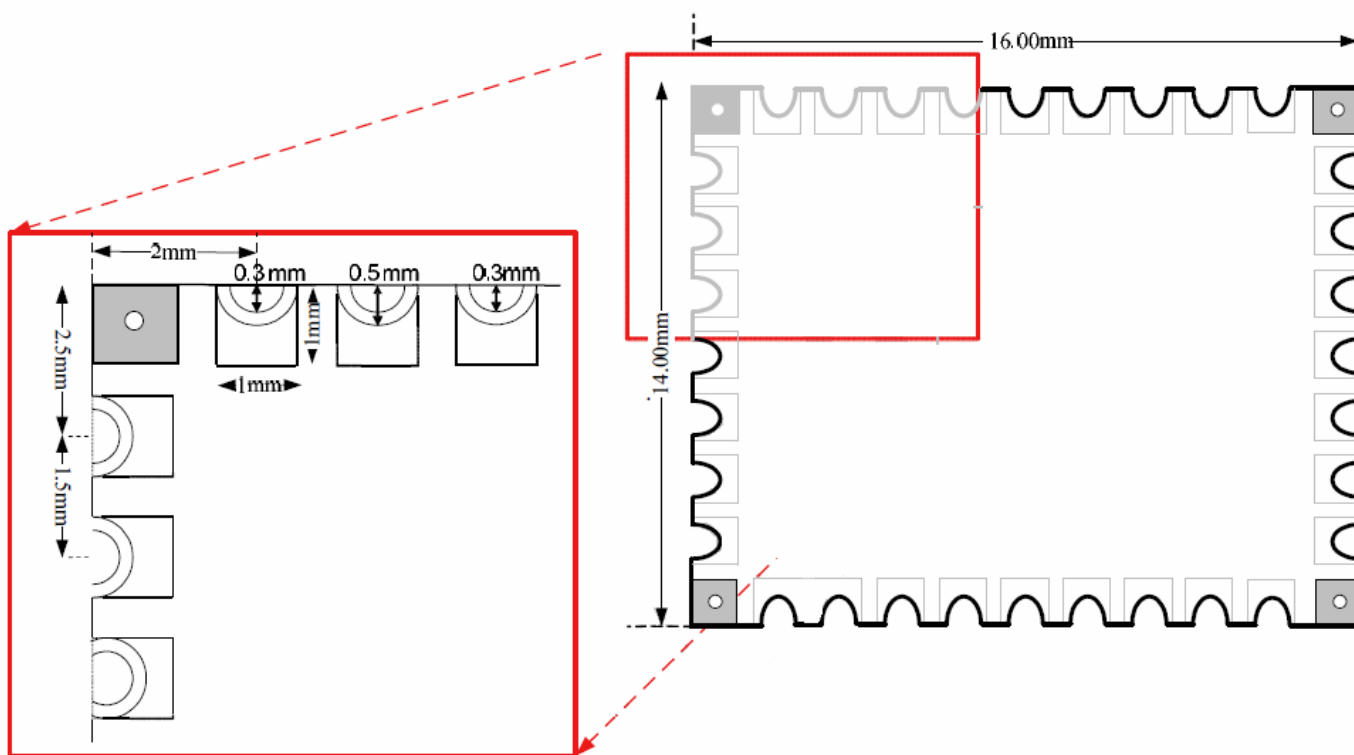


Figure 5: Mechanical Drawing 1

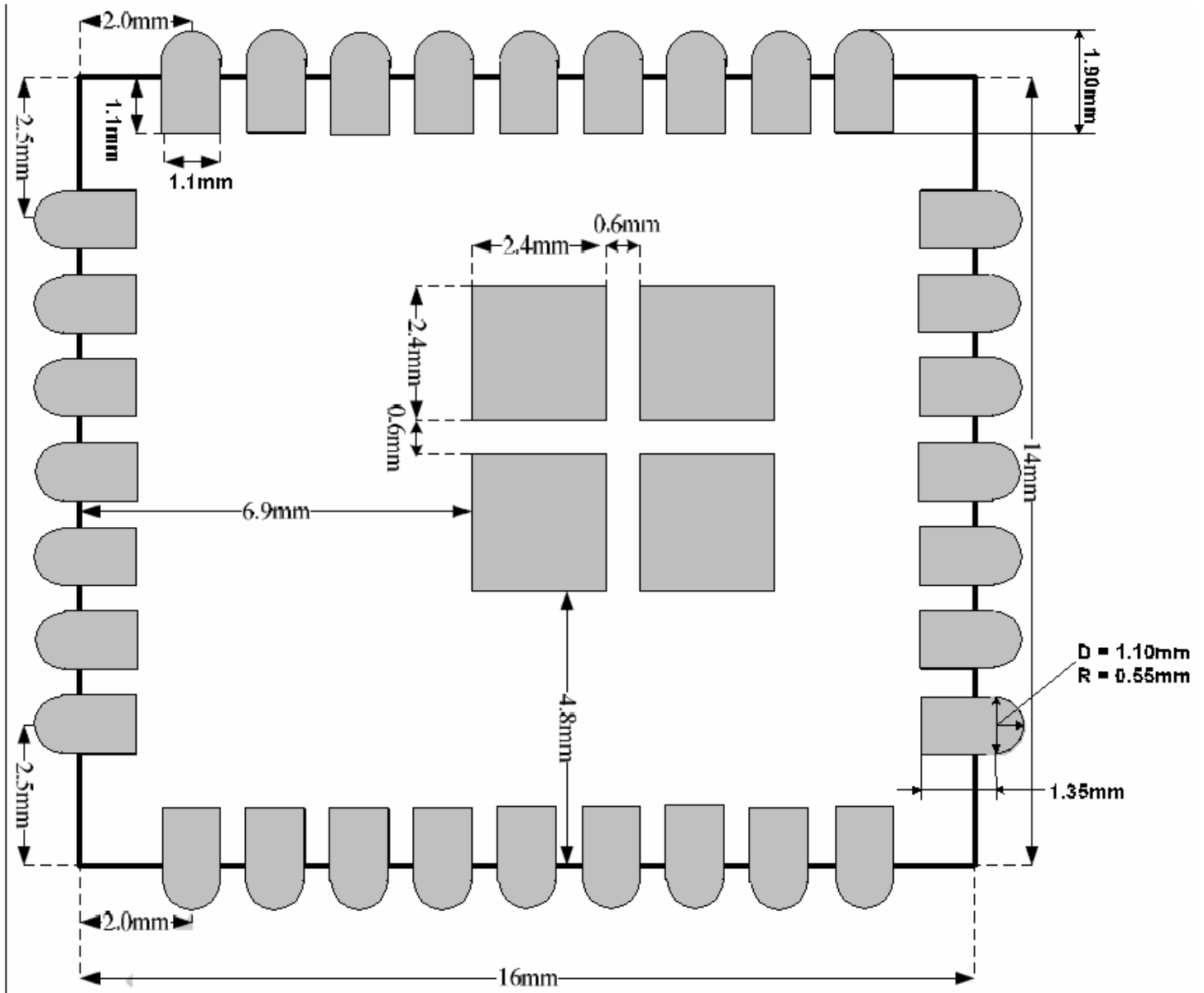


Figure 6: Mechanical Drawing 2



# **San Gabriel SMT - UGWDS82NSM33.X.X**

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## **ORDERING INFORMATION**

### **San Gabriel SMT for USB interface**

UGWDS82NSM33-U

### **San Gabriel SMT for SDIO interface**

UGWDS82NSM33-S

## **CONTACT INFORMATION**

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