

Integrated Transceiver Modules for WLAN 802.11 b/g/n, Bluetooth, Bluetooth Low Energy (BLE), and ANT

FEATURES

- IEEE 802.11b,g,n,d,e,i compliant
- Typical WLAN Transmit Power:
 - o 20.0dBm, 11 Mbps,CCK (b)
 - o 14.5dBm, 54 Mbps,OFDM (g)
 - o 12.5dBm, 65 Mbps,OFDM (n)
- Typical WLAN Sensitivity:
 - o -89dBm, 8% PER, 11 Mbps
 - o -76dBm, 10% PER, 54 Mbps
 - o -73dBm, 10% PER, 65 Mbps
- Bluetooth 2.1+EDR, Power Class 1.5
- Full support for BLE 4.0 and ANT
- Miniature footprint: 18 mm x 13 mm
- Low height profile: 1.9 mm
- U.FL connector for external antenna
- Terminal for PCB/Chip antenna feeds
- Integrated band-pass filter
- Compact design based on Texas Instruments WL1271L Transceiver
- Seamless integration with TI OMAP™ application processors
- SDIO Host data path interfaces
- Bluetooth Advanced Audio Interfaces
- Low power operation mode
- RoHS compliant

APPLICATIONS

- Security
- HVAC Control, Smart Energy
- Sensor Networks
- Medical

DESCRIPTION

The W1001 module is a high performance 2.4 GHz IEEE 802.11 b/g/n, Bluetooth 2.1+EDR, and Bluetooth Low Energy (BLE) 4.0 radio in a cost effective, pre-certified footprint.

The module realizes the necessary PHY/MAC layers to support WLAN applications in conjunction with a host processor over a SDIO interface.

The module also provides a Bluetooth platform through the HCI transport layer. Both WLAN and Bluetooth share the same antenna port.

W1001 MODULE FOOTPRINT AND PIN DEFINITIONS

To apply the W1001 module, it is important to use the module pins in your application as they are designated in below and in the corresponding pin definition table found on pages 7 and 8. Not all the pins on the W1001 module may be used, as some are reserved for future functionality.

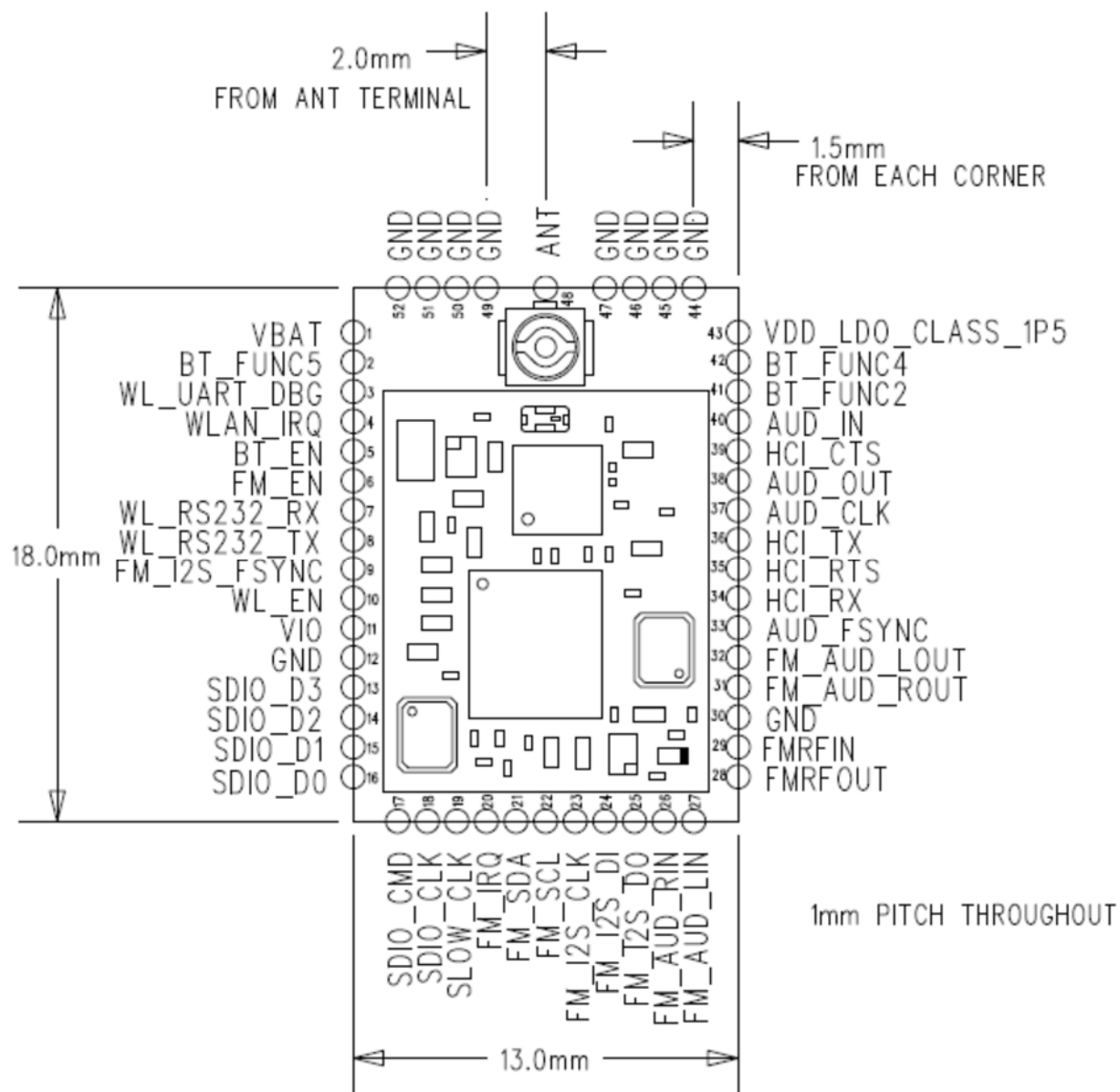


Figure 1 W1001 Pinout (Top View)

PIN DESCRIPTIONS

ModulePin	Name	I/O Type	Buffer Type	Logic Level	Description
1	VBAT	PI	-	-	Battery Voltage 3.6 VDC Nominal (3.0-4.8 VDC)
2	BT_FUNC5	DO	4 mA	1.8 VDC	HOST_WU (*)
3	WL_UART_DBG	DIO	4 mA	1.8 VDC	WL_UART_DBG
4	WLAN_IRQ	DO	4 mA	1.8 VDC	WLAN Interrupt Request
5	BT_EN	DI	-	1.8 VDC	Bluetooth Enable
6	FM_EN	DI	-	1.8 VDC	NOT SUPPORTED, CONNECT TO GND
7	WL_RS232_RX	DI	-	1.8 VDC	WLAN TEST UART RX (*)
8	WL_RS232_TX	DO	4 mA	1.8 VDC	WLAN TEST UART TX (*)
9	FM_I2S_FSYNC	DO	4 mA	1.8 VDC	NOT SUPPORTED, NO CONNECT
10	WL_EN	DI	-	1.8 VDC	WLAN Enable
11	VIO	PI	-	-	POWER SUPPLY FOR 1.8 VDC DIGITAL DOMAIN
12	GND	GND	-	-	Ground
13	SDIO_D3	DIO	8 mA	1.8 VDC	SDIO INTERFACE, HOST PULL UP
14	SDIO_D2	DIO	8 mA	1.8 VDC	SDIO INTERFACE, HOST PULL UP
15	SDIO_D1	DIO	8 mA	1.8 VDC	SDIO INTERFACE, HOST PULL UP
16	SDIO_D0	DIO	8 mA	1.8 VDC	SDIO INTERFACE, HOST PULL UP
17	SDIO_CMD	DIO	8 mA	1.8 VDC	HOST PULL UP
18	SDIO_CLK	DI	-	1.8 VDC	HOST PULL UP
19	SLOW_CLK	DI	-	1.8 VDC	SLEEP CLOCK (32 kHz)
20	FM_IRQ	DO	4 mA	1.8 VDC	NOT SUPPORTED, NO CONNECT
21	FM_SDA	DO	4 mA	1.8 VDC	NOT SUPPORTED, NO CONNECT
22	FM_SCL	DO	4 mA	1.8 VDC	NOT SUPPORTED, NO CONNECT
23	FM_I2S_CLK	DO	4 mA	1.8 VDC	NOT SUPPORTED, NO CONNECT
24	FM_I2S_DI	DI	4 mA	1.8 VDC	NOT SUPPORTED, CONNECT TO GND
25	FM_I2S_DO	DO	4 mA	1.8 VDC	NOT SUPPORTED, NO CONNECT
26	FM_AUD_RIN	AI	-	-	NOT SUPPORTED, CONNECT TO GND
27	FM_AUD_LIN	AI	-	-	NOT SUPPORTED, CONNECT TO GND
28	FMRFOUT	AO	-	-	NOT SUPPORTED, NO CONNECT
29	FMRFIN	AI	-	-	NOT SUPPORTED, CONNECT TO GND
30	GND	GND	-	-	Ground
31	FM_AUD_ROUT	AO	-	-	NOT SUPPORTED, NO CONNECT

ModulePin	Name	I/O Type	Buffer Type	Logic Level	Description
32	FM_AUD_LOUT	AO	-	-	NOT SUPPORTED, NO CONNECT
33	AUD_FSYNC	DIO	4 mA	1.8 VDC	PCM I/F
34	HCI_RX	DI	8 mA	1.8 VDC	Bluetooth HCI UART RX (*)
35	HCI_RTS	DO	4 mA	1.8 VDC	Bluetooth HCI UART RTS (*)
36	HCI_TX	DIO	8 mA	1.8 VDC	Bluetooth HCI UART TX
37	AUD_CLK	DO	4 mA	1.8 VDC	PCM I/F (*)
38	AUD_OUT	DO	4 mA	1.8 VDC	PCM I/F (*)
39	HCI_CTS	DI	4 mA	1.8 VDC	Bluetooth HCI UART CTS (*)
40	AUD_IN	DI	4 mA	1.8 VDC	PCM I/F (*)
41	BT_FUNC2	DO	4 mA	1.8 VDC	Bluetooth Wakeup / DC2DC Mode (*)
42	BT_FUNC4	DO	4 mA	1.8 VDC	BT_UARTD (DEBUG) (*)
43	VDD_LDO_CLASS_1P5	NC	-	-	VBAT VOLTAGE PRESENT, NO CONNECT
44	GND	GND	-	-	Ground
45	GND	GND	-	-	Ground
46	GND	GND	-	-	Ground
47	GND	GND	-	-	Ground
48	ANT	RF		-	Antenna terminal for WLAN and Bluetooth (Note [1])
49	GND	GND	-	-	Ground
50	GND	GND	-	-	Ground
51	GND	GND	-	-	Ground
52	GND	GND	-	-	Ground

PI = Power Input PO = Power Output DI = Digital Input (1.8 VDC Logic Level) DO=Digital Output (1.8 VDC Logic Level)

AI = Analog Input AO = Analog Output AIO = Analog Input/Output RF = RF Port GND = Ground

Note[1]: Antenna terminal presents d.c. short circuit to ground.

(*) indicates that pin is capable of bidirectional operation, but is used as the type shown.

Table 1 W1001 Module Pin Descriptions

All digital I/O signals use 1.8V logic. If the host microcontroller does not support 1.8V logic, then level shifters MUST be used.

ELECTRICAL SPECIFICATIONS

The majority of these characteristics are based on controlling and conditioning the tests using the W1001 control software application. Other control conditions may require these values to be re-characterized by the customer.

Absolute Maximum Ratings

Parameter	Min	Max	Unit
Power supply voltage (VBAT) ⁽⁴⁾⁽⁵⁾	-0.5	+5.5	V
Digital supply voltage (VIO)	-0.5	2.1	V
Voltage on any GPIO	-0.5	VIO + 0.5	V
Voltage on any Analog Pins ⁽³⁾	-0.5	2.1	V
RF input power, antenna port		+10	dBm
Operating temperature ⁽⁶⁾	-40	+85	°C
Storage temperature	-55	+125	°C

1. Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device and are not covered by the warranty. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. All parameters are measured as follows unless stated otherwise: VDD_IN=1.8V, VDDIO_1.8V=1.8V, VDD_LDO_CLASS1P5=3.6V
3. Analog pins: XTALP, XTALM, RFIOBT, DRPWRXBM, DRPWRXBP, DRPWTXB, and also FMRFINP, FMRFINM, FMRFINM, FMAUDLIN, FMAUDRIN, FMAUDLOUT, FMAUDROUT
4. The following signals are from the VBAT group, PMS_VBAT and VDD_LDO_CLASS1P5 (if BT class 1.5 direct VBAT is used).
5. Maximum allowed depends on accumulated time at that voltage; 4.8V for 7 years lifetime, 5.5V for 6 hours cumulative.
6. The device can be reliably operated for 5,000 active-WLAN cumulative hours at T_A of 85°C.

Table 2 Absolute Maximum Ratings

Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
V _{BAT}	3.0	3.6	4.8	V
V _{IO}	1.62	1.8	1.92	V
V _{IH}	0.65 x V _{IO}	-	V _{IO}	V
V _{IL}	0	-	0.35 x V _{IO}	V
V _{OH} @ 4, 8 mA	V _{IO} - 0.45	-	V _{IO}	V
V _{OL} @ 4, 8 mA	0	-	0.45	V
Ambient temperature range	-40	25	85	°C

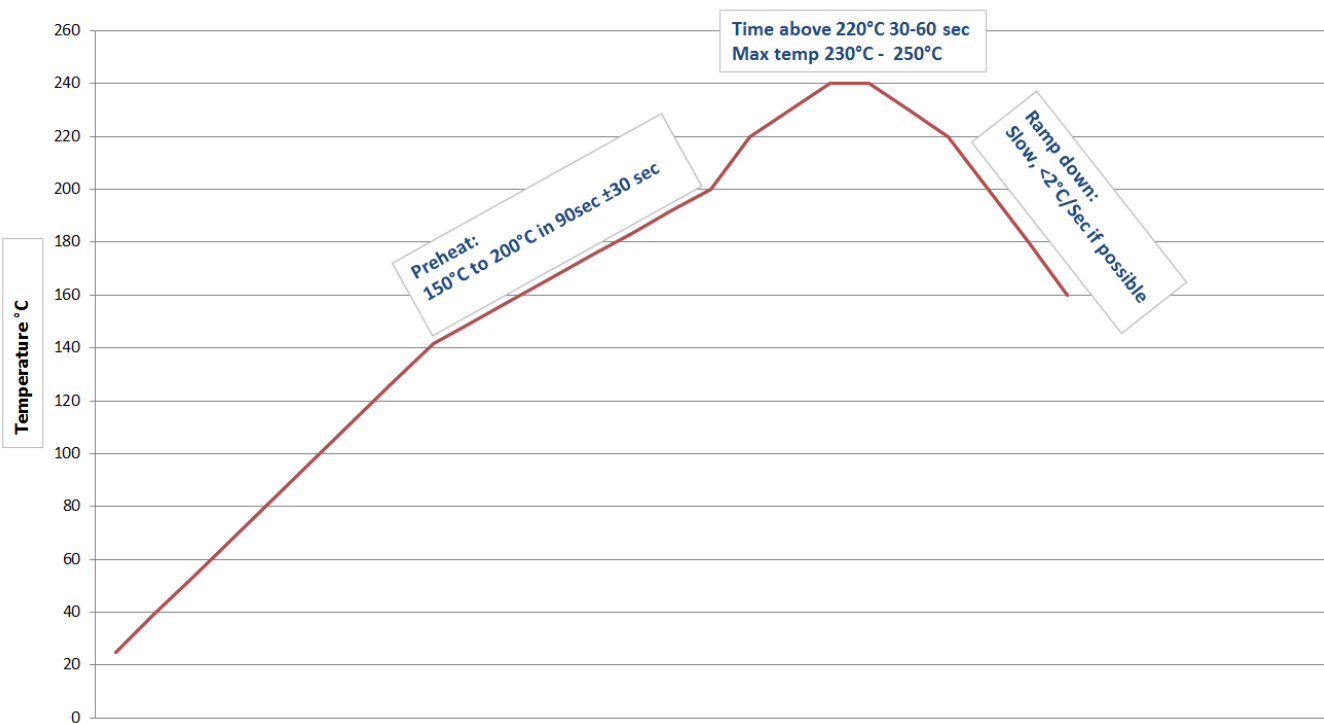
Table 3 Recommended Operating Conditions

General Characteristics

Parameter	Min	Typ	Max	Unit
WLAN RF frequency range	2412		2472	MHz
WLAN RF data rate	1	802.11 b/g/n rates supported	65	Mbps
BT RF frequency Range	2402		2480	MHz

Table 4 General CharacteristicsSoldering Recommendations

Recommended Reflow Profile for Lead Free Solder



Note: The quality of solder joints on the castellations ('half vias') where they contact the host board should meet the appropriate IPC Specification. See IPC-A-610-D Acceptability of Electronic Assemblies, section 8.2.4 Castellated Terminations."

Figure 2 Reflow Profile

Repeating Reflow Soldering

Only a single reflow soldering process is encouraged for host boards.

Cleaning

In general, cleaning the populated modules is strongly discouraged. Residuals under the module cannot be easily removed with any cleaning process.

- Cleaning with water can lead to capillary effects where water is absorbed into the gap between the host board and the module. The combination of soldering flux residuals and encapsulated water could lead to short circuits between neighboring pads. Water could also damage any stickers or labels.
- Cleaning with alcohol or a similar organic solvent will likely flood soldering flux residuals into the RF shield, which is not accessible for post-washing inspection. The solvent could also damage any stickers or labels.
- Ultrasonic cleaning could damage the module permanently.

OPTICAL INSPECTION

After soldering the Module to the host board, consider optical inspection to check the following:

- Proper alignment and centering of the module over the pads.
- Proper solder joints on all pads.
- Excessive solder or contacts to neighboring pads, or vias.

REWORK

The module can be unsoldered from the host board if the Moisture Sensitivity Level (MSL) requirements are met as described in this datasheet.

Never attempt a rework on the module itself, e.g. replacing individual components. Such actions will terminate warranty coverage.

HANDLING AND STORAGE

Handling

The W1001 modules contain a highly sensitive electronic circuitry. Handling without proper ESD protection may destroy or damage the module permanently. ESD protection may destroy or damage the module permanently.

Moisture Sensitivity Level (MSL)

Per J-STD-020, devices rated as MSL 4 and not stored in a sealed bag with desiccant pack should be baked prior to use.

After opening packaging, devices that will be subjected to reflow must be mounted within 72 hours of factory conditions (<30°C and 60% RH) or stored at <10% RH.

Bake devices for 48 hours at 125°C.

Storage

Please use this product within 6 months after receipt. Any product used after 6 months of receipt needs to have solderability confirmed before use.

The product shall be stored without opening the packing under the ambient temperature from 5 to 35deg.C and humidity from 20 to 70%RH. (Packing materials, in particular, may be deformed at the temperatures above this range.)

Do not store in salty air or in an environment with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO_x.

Do not store in direct sunlight.

The product should not be subject to excessive mechanical shock.

AGENCY CERTIFICATIONS

FCC ID: Z4H-W1001

IC: 9812A-W1001

AGENCY STATEMENTS

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. 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 will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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.

<u>FCC CAUTION:</u> Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
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To comply with FCC and Industry Canada RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

Industry Canada Statements

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: 1) this device may not cause interference, and 2) this device must accept any interference, including interference that may cause undesired operation of the device.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of 4.3 dBi (LSR Dipole) and -0.6dBi (Ethertronics Presetta). Antennas not included in this list or having a gain greater than 4.3 dBi and -0.6dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

List of all Antennas Acceptable for use with the Transmitter

- 1) LS Research 001-0001 center-fed dipole antenna and LS Research 080-0001 U.FL to Reverse Polarity SMA connector cable.
- 2) Ethertronics Presetta 1000423 and Johnson Emerson U.FL. to U.FL coaxial cable 415-0088-150.
- 3) LS Research 001-0014 2.4 GHz FlexPIFA Antenna w/U.FL Cable.

Cet appareil est conforme avec Industrie Canada, exempts de licence standard RSS (s). Son fonctionnement est soumis aux deux conditions suivantes: 1) ce dispositif ne peut pas causer d'interférences, et 2) ce dispositif doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

En vertu des règlements d'Industrie Canada, cet émetteur de radio ne peut fonctionner en utilisant une antenne d'un type et maximale (ou moins) Gain approuvé pour l'émetteur par Industrie Canada. Pour réduire les interférences radio potentielles pour les autres utilisateurs, le type d'antenne et son gain doivent être choisis afin que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas ce qui est nécessaire pour une communication réussie.

Cet appareil a été conçu pour fonctionner avec l'antenne (s) ci-dessous, et ayant un gain maximum de 4,3 dBi (LSR dipôle) et -0.6dBi (Ethertronics Presetta). Antennes pas inclus danscette liste ou d'avoir un gain supérieur à 4,3 dBi et -0.6dBi sont strictement interdites pour l'utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

Liste de toutes les antennes acceptables pour une utilisation avec l'émetteur

- 1) LS Research 001-0001 alimenté par le centre antenne dipôle et LS Research 080-0001 U.FL d'inversion de polarité du câble connecteur SMA.
 - 2) Ethertronics Presetta 1000423 et Johnson Emerson U.FL d'un câble coaxial U.FL 415-0088-150.
 - 3) LS Research 001-0014 2,4 GHz antenne FlexPIFA w/U.FL Cable.
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OEM RESPONSIBILITIES TO COMPLY WITH FCC AND INDUSTRY CANADA REGULATIONS

The W1001 Module has been certified for integration into products only by OEM integrators under the following condition:

To comply with FCC and Industry Canada RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.

Le module de W1001 a été certifié pour l'intégration dans des produits uniquement par des intégrateurs OEM dans les conditions suivante:

Pour se conformer aux limites d'exposition aux RF de la FCC et d'Industrie Canada pour la population générale / exposition non contrôlée, l'antenne(s) utilisée pour ce transmetteur doit être installée pour fournir une distance de séparation d'au moins 20cm de toutes les personnes et fonctionnant conjointement avec une autre antenne ou émetteur, sauf en conformité avec les procédures de produits multi-émetteur FCC.

Toutefois, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires requis avec ce module installé (par exemple, les émissions appareil numérique, les exigences de périphériques PC, etc.)

NOTE IMPORTANTE: Dans le cas où ces conditions ne peuvent être satisfaites (pour certaines configurations ou de co-implantation avec un autre émetteur), puis la FCC et Industrie autorisations Canada ne sont plus considérés comme valides et l'ID de la FCC et IC numéro de certification ne peut pas être utilisé sur la produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'un distincte de la FCC et Industrie Canada l'autorisation.

OEM LABELING REQUIREMENTS FOR END-PRODUCT

The W1001 module is labeled with its own FCC ID and IC Certification Number. The FCC ID and IC certification numbers are not visible when the module is installed inside another device, as such the end device into which the module is installed must display a label referring to the enclosed module. The final end product must be labeled in a visible area with the following:

“Contains Transmitter Module FCC ID: Z4H-W1001”

“Contains Transmitter Module IC: 9812A-W1001”

or

“Contains FCC ID: Z4H-W1001”

“Contains IC: 9812A-W1001”

The OEM of the W1001 Module must only use the approved antenna(s) listed above, which have been certified with this module.

Le module de W1001 est étiqueté avec son propre ID de la FCC et IC numéro de certification. L'ID de la FCC et IC numéros de certification ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre appareil, comme par exemple le terminal dans lequel le module est installé doit afficher une étiquette faisant référence au module ci-joint. Le produit final doit être étiqueté dans un endroit visible par le suivant:

“Contient Module émetteur FCC ID: Z4H-W1001”

“Contient Module émetteur IC: 9812A-W1001”

ou

“Contient FCC ID: Z4H-W1001”

“Contient IC: 9812A-W1001”

L'OEM du module W1001 ne doit utiliser l'antenne approuvée (s) ci-dessus, qui ont été certifiés avec ce module.

OEM END PRODUCT USER MANUAL STATEMENTS

The OEM integrator should not provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

The user manual for the end product must include the following information in a prominent location:

To comply with FCC and Industry Canada RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

Other user manual statements may apply.

L'intégrateur OEM ne devrait pas fournir des informations à l'utilisateur final en ce qui concerne la façon d'installer ou de retirer ce module RF ou modifier les paramètres RF connexes dans le manuel utilisateur du produit final.

Le manuel d'utilisation pour le produit final doit comporter les informations suivantes dans un endroit bien en vue:

Pour se conformer aux limites d'exposition aux RF de la FCC et d'Industrie Canada pour la population générale / exposition non contrôlée, l'antenne(s) utilisée pour ce transmetteur doit être installée pour fournir une distance de séparation d'au moins 20cm de toutes les personnes et fonctionnant conjointement avec une autre antenne ou émetteur, sauf en conformité avec les procédures de produits multi-émetteur FCC.

Autres déclarations manuel de l'utilisateur peuvent s'appliquer.

MECHANICAL DATA

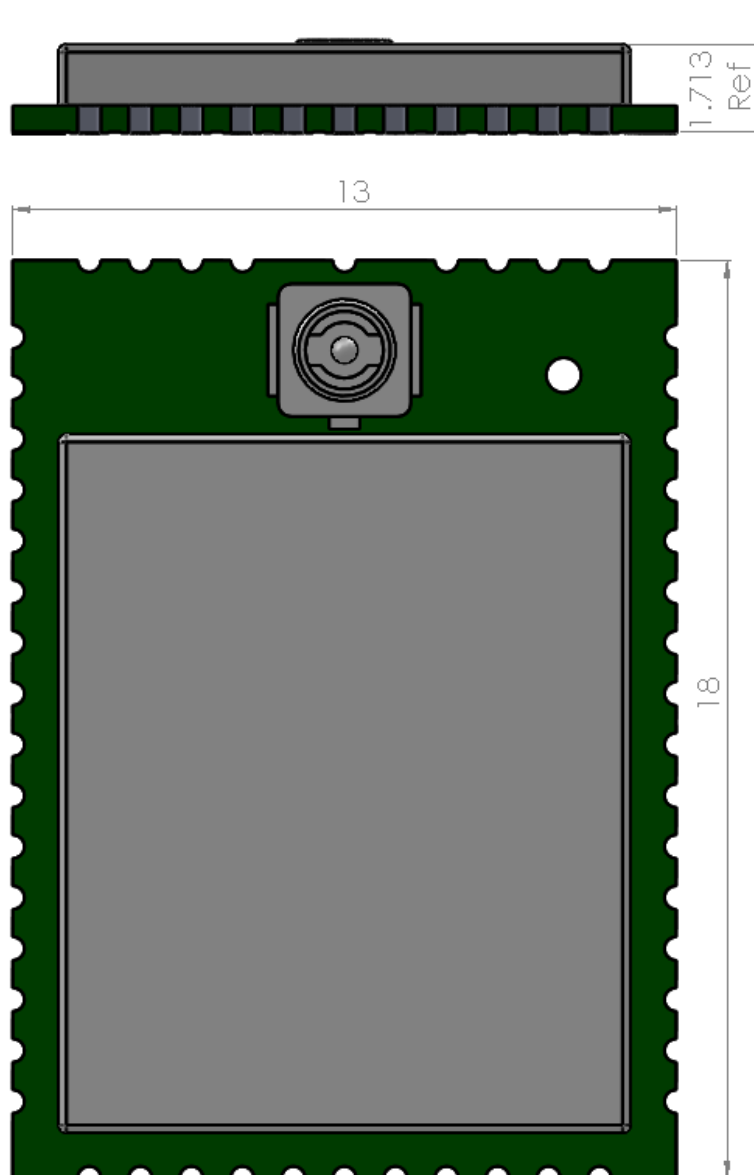
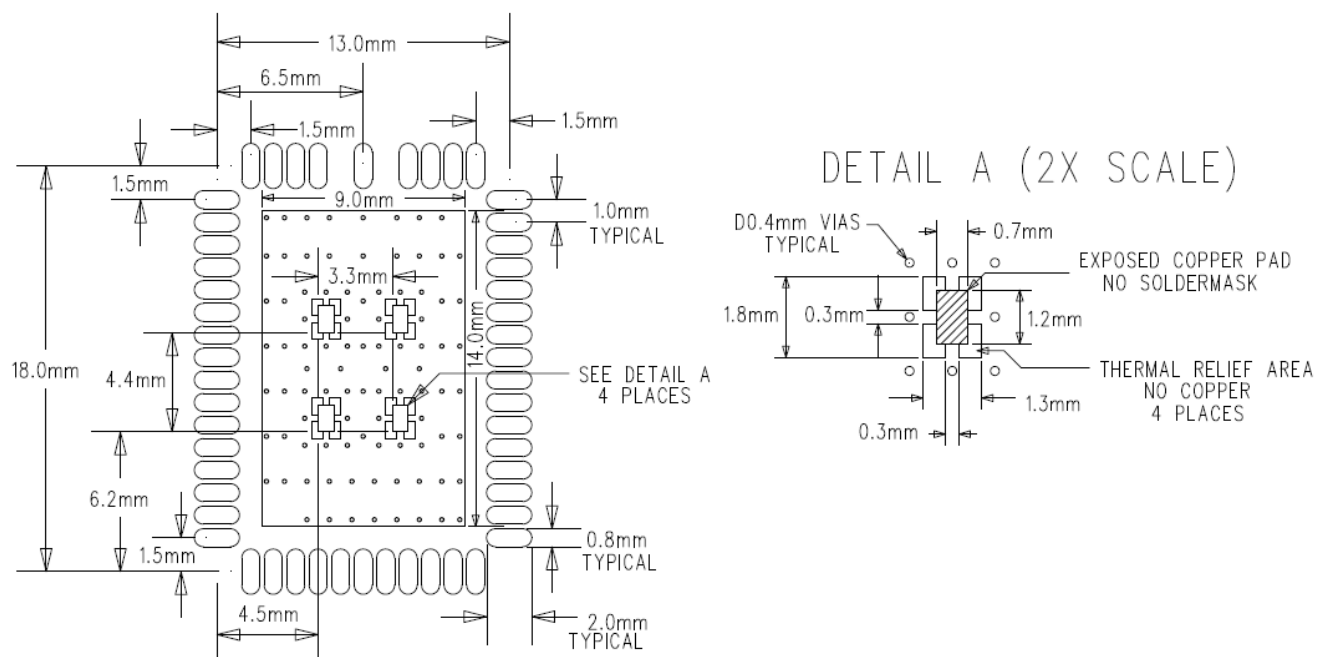


Figure 3 Module Mechanical Dimensions (Maximum Module Height = 1.9 mm)



LAYOUT NOTES:

- 1 - MINIMUM 4-LAYER PCB WITH SECOND LAYER GROUND PLANE
- 2 - FOUR GROUND PADS BENEATH MODULE TO BE THERMALLY TIED TO TOP LAYER GROUND POUR (SEE DETAIL A).
CONNECT TOP SIDE POUR TO LAYER 2 GROUND PLANE USING AMPLE VIAS.
- 3 - AVOID LONG ROUTES ON TOP LAYER BENEATH MODULE. VIA FANOUT BENEATH MODULE IS ACCEPTABLE.

Figure 4 W1001 Recommended PCB Footprint (Top View)