

CMM-9301-SDT

Bluetooth Low Energy

Serial Data Bridge Module

C-MAX



This module is limited to OEM installation ONLY

1.0 Description

The CMM-9301-SDT module is a Bluetooth 4.0 Single Mode (Bluetooth Low Energy) module for implementing Bluetooth functionality into various electronic devices. Standalone as a Bluetooth Low Energy End Product, it is embedded with a proprietary data exchange profile allowing the bridging of data from an external host by means of UART link via Bluetooth 4.0 protocol to a Bluetooth 4.0 Dual Mode device.

Inclusive of dedicated hardware for the Physical and Link Layer implementation of Bluetooth Smart from EM Microelectronics and a high performance interface MCU, this SDT module is optimized for embedded applications such as health monitoring, sports devices, human sensing devices, home appliances etc. Without any additional study of the Bluetooth protocol, customers are able to develop and test their own applications.

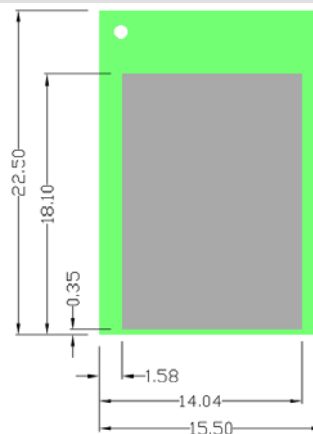
1.1 Features

- Bluetooth Low Energy (BLE) (Single Mode) full corestack embedded module in slave mode
- Enables application with Bluetooth connectivity with no Bluetooth knowledge required whatsoever
- Embedded with BT4.0 GATT profile and Device Information Service
- 1Mbps on-air data rate
- Programmable BLE parameters such as: Device Information, connection interval and more...
- UART interface with external host via AT command set
- Dimension: 15.5 x 22.5 x 3.2 mm
- No tuning necessary
- Operational Temperature Range -20 / +60° C
- Tape and Reel packaged ready for SMT assembly

1.2 Pin Assignments and Dimensions



Top View



Detailed Dimensions

All dimensions are in mm.
 Connection pin pitch = 2.54 mm +/- 0.1mm
 Module Thickness = 3.2mm max.

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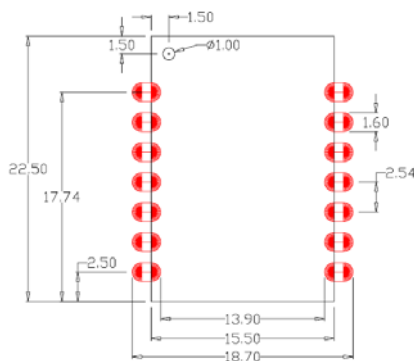
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Pin Number	Pin Name	Input to / Output from Module	Pin Description
1	RXD	I	RXD pin of UART communication with Host
2	Reserved	I/O	Reserved pin for future use
3	Reserved	I/O	Reserved pin for future use
4	Reserved	I/O	Reserved pin for future use
5	Reserved	I/O	Reserved pin for future use
6	GND	GND	Ground connection for module
7	TXD	O	TXD pin of UART communication with Host
8	UART_EN	I	Connect to VCC for UART serial data transfer mode
9	SLEEP	I	Module wake up pin to wake module from low power sleep mode (Wake-up = LO, Sleep = HI) . In Sleep mode UART interface will be disabled.
10	VDD	VDD	2.3 ~ 3.6 V voltage supply pin to module
11	IRQ	O	Interrupt Request Pin to signal host when data received in buffer and ready to poll
12	RST	I	Reset (Active LO)
13	LINK	O	Module Link Indication signal (Bluetooth Disconnected = LO; Bluetooth Connected = HI)
14	RESERVED	I/O	Reserved pin for future use

1.3 Recommended PCB layout and foot print

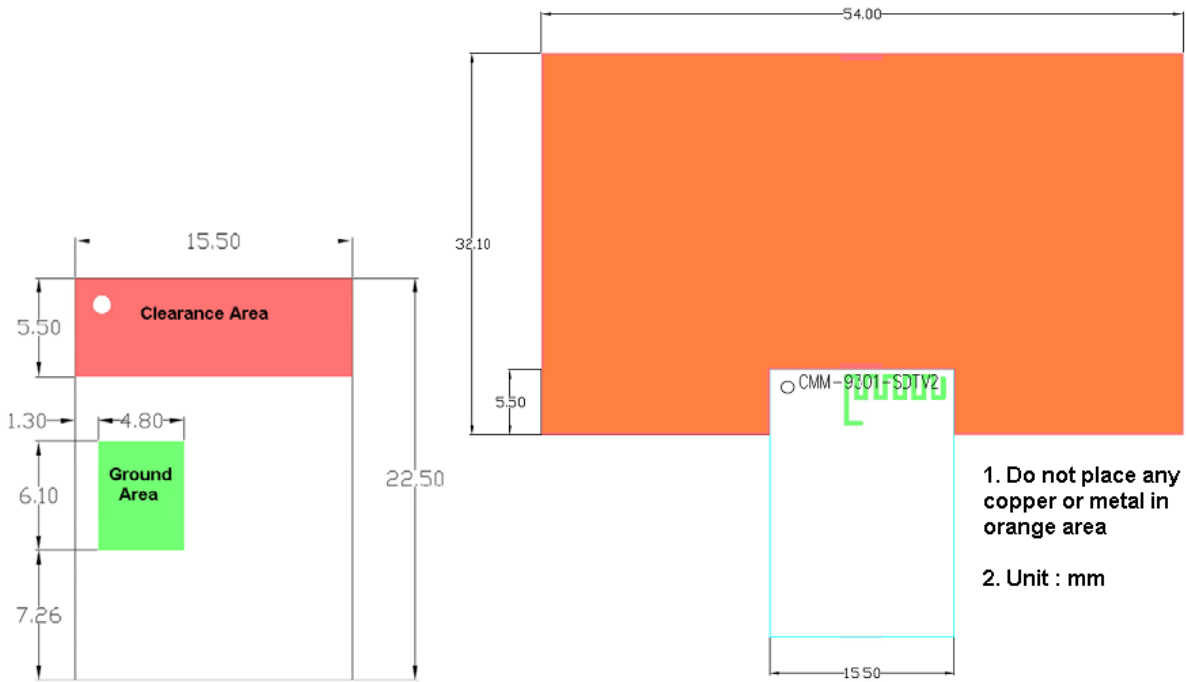


Recommended module contact pads footprint

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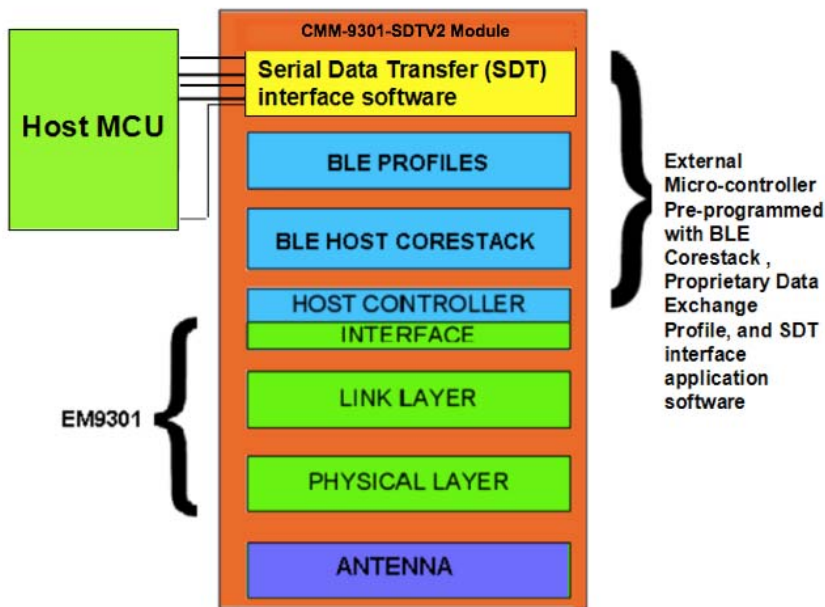


Recommended Clearance and Ground Plane Area under Module

Recommended Keepout area around Module

1. Do not place any copper or metal in orange area
2. Unit : mm

1.4 Module Block Diagram



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1.5 Functional Modes

In general, the module has three functional modes of operation:

A. Sleep Mode: A HI state on the SLEEP pin will put the module into this mode, where the processor in the module is in low power sleep mode. In this mode, the module cannot communicate with the Host via UART communication. However, Bluetooth can be kept on and connected in this mode to listen for any incoming data packets. The module will only be waken by a LO enable signal on the SLEEP pin .

B. On Mode: A LO state on the SLEEP pin will put the module into this mode. In this mode, the processor in the module is awake and ready to communicate with the Host via UART communication. UART communication is possible for all AT command operations. Once SLEEP pin is set back to HI, the module will enter into Sleep Mode.

C. Test Mode: This mode is used for RF testing purposes only. By sending an AT command from HOST to module (making sure that the SLEEP pin is set to LO first), the module will start RF Test mode. By sending different test data to the SDT, the HOST can control the module to transmit on different frequencies, in two different transmission modes : unmodulated carrier or modulated carrier with test data pattern alternating 1s and 0s.

2. HOST Interface specification

2.1 Overview

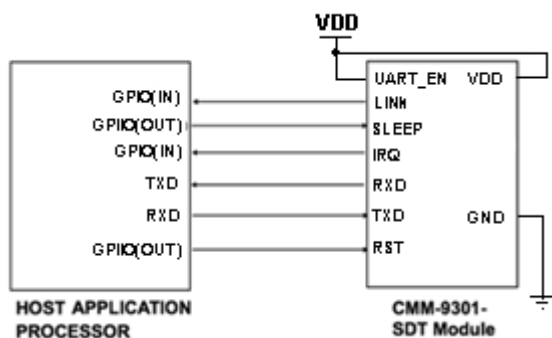
UART interface is used for data transfer between host and SDT module.

The HOST system can send command/data or receive event information/data via UART interface.

2.2 Connection with HOST systems

Connection with HOST system consist of the UART interface and 3 control pins.

The below is a reference diagram for the connection of the CMM-9301-SDTV2 module with an external host processor:



The 3 control pins have the following functionality.

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LINK: This pin indicates to HOST system the Bluetooth connectivity state of the SDT module. LINK signal will be asserted to LOW at power up and in the event of Bluetooth disconnected. During Bluetooth connected phase, LINK signal will be stay HIGH.

SLEEP: Control signal by HOST to wake module and start UART communication. It has to be asserted Low before start serial communication. Asserting this pin back to High will put module into low power sleep mode. Note that this pin does not control the Bluetooth connectivity. Bluetooth connectivity has to be controlled via AT commands.

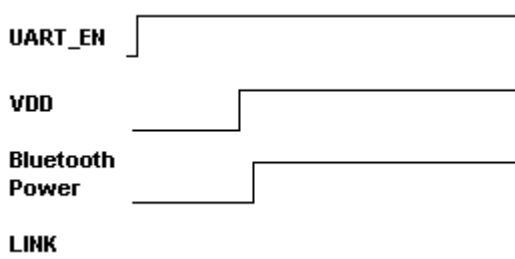
IRQ: IRQ indicates Bluetooth Data Received status from SDT module to HOST system. Regardless of SLEEP pin status, when Bluetooth is turned on, once Bluetooth data is received, module will assert IRQ signal to High . Hereafter, upon more received data packet (up to a maximum buffer of 64 packets @ 20 bytes each), IRQ will be kept High until the received packet buffer is all cleared or if received packets \geq 64 packets, then IRQ will be asserted Low to indicate an empty buffer.

Behavior of each pins are described below.

Default status of LINK and IRQ signal is Low.

Host upon initialisation:

1. Set UART_EN = VDD
2. Power up module by applying power to VDD
3. Bluetooth is turned on automatically
4. If no data is expected to be transferred via Bluetooth, Bluetooth can be turned off by first asserting SLEEP signal to Lo (to wake up module ready for UART communication), then issue AT Command : AT+BTOFF.
5. To save power, keep SLEEP signal at High state when there is no UART communication.



For host to send data over Bluetooth:

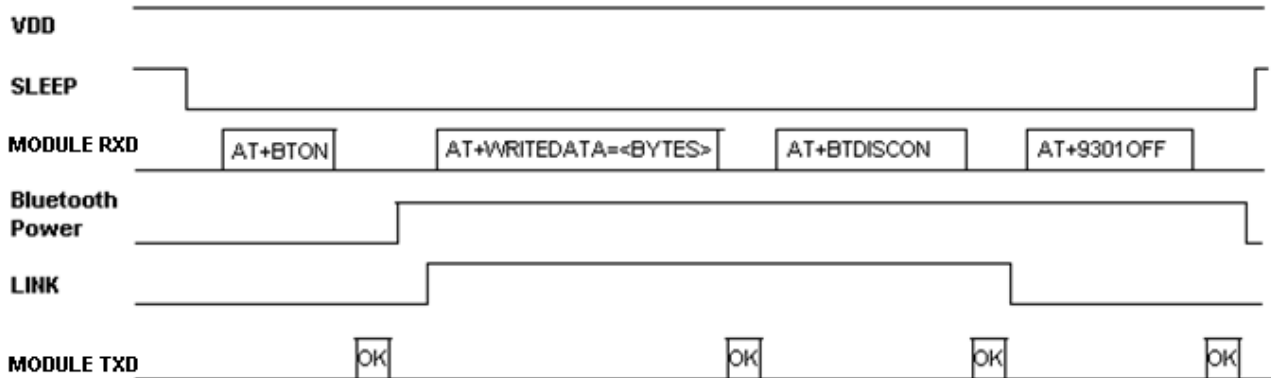
1. HOST system assert SLEEP signal to Low (to wake up module ready for UART communication)
2. Issue AT command AT+BTON
3. Wait for peer device to connect to module. Once Bluetooth link with peer device is established, SDT module asserts LINK signal to HIGH.
4. Send data by issuing AT Command AT+WRITEDATA = <Param>.
5. To disconnect Bluetooth, issue AT command : AT+BTDISCON, This will put module into discoverable and connectable mode.

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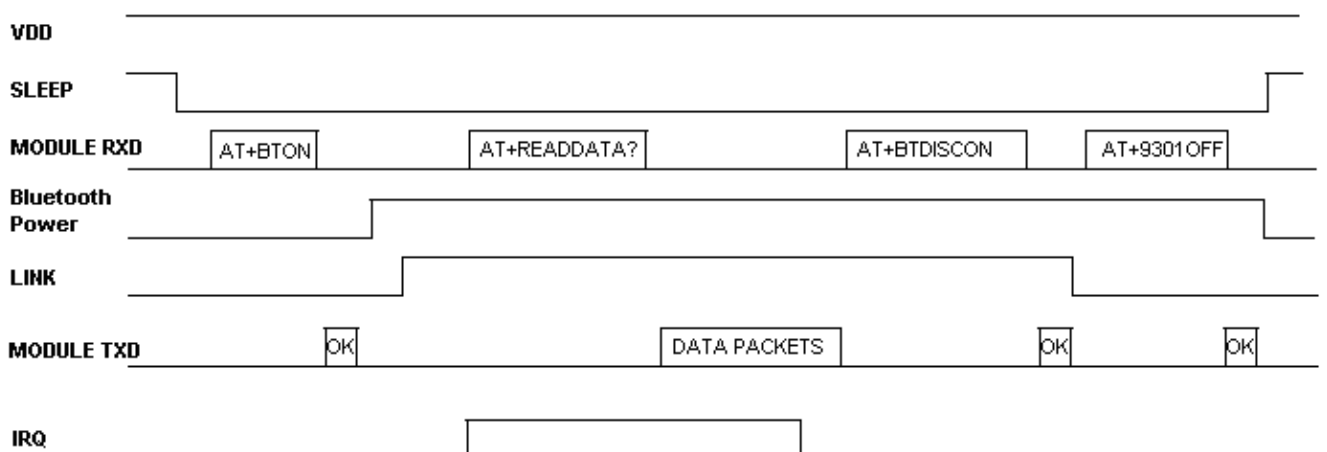


6. To turn off Bluetooth completely, issue AT command AT+BTOFF
7. HOST system asserts SLEEP signal to HIGH after finishing UART communication



For host to receive data from peer device via Bluetooth:

1. Assert SLEEP signal to Low (to wake up module ready for UART communication)
2. Issue AT command AT+BTON
3. Wait for peer device to connect to module. Once Bluetooth link with peer device is established, SDT module asserts LINK signal to HIGH
4. When data is received via Bluetooth, SDT module asserts IRQ signal to HIGH
5. HOST system detects IRQ
6. Issue AT command AT+READDATA? to read received data stored in buffer
7. To keep module in connected mode, just put module into low power mode by asserting SLEEP signal to HIGH
8. To disconnect from Bluetooth but to remain discoverable and connectable, issue AT command : AT+BTDISCON, then put module into low power mode by asserting SLEEP signal to HIGH
9. To turn off Bluetooth completely, issue AT command AT+BTOFF
10. Assert SLEEP signal to HIGH after finishing UART communication



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2.3 UART physical interface specification

UART bridge interface between CMM-9301-SDT module and the host controller is enable by setting the pin UART_EN to HIGH. Under UART mode, command transaction from host to module must be in AT command format.

UART Settings:

Parameter	Configuration	Default
Baud Rate	300 - 115200 bps settable over UART	1200 bps (note early samples have default of 115200 bps)
Data size	8 bits	
Parity bit	No Parity	
Stop bit	1 stop bit	
Flow control	Not supported	

3 AT Command List

Operations	Descriptions	AT Commands (UART mode)
Operational		
Reset	Reset both MCU and EM9301	AT+RESET
Test	Test mode start/exit	AT+TEST=<Param>
BT_On	Turn on Bluetooth in advertising mode	AT+BTON
BT_DisCon	Disconnect Bluetooth, EM9301 in advertising mode	AT+BTDISCON
BT_Off	Turn off Bluetooth and power down EM9301	AT+BTOFF
Read_EE	Restore Settings from eeprom	AT+READEE?
Write_EE	Save Settings into eeprom	AT+WRITEE2
Read_Data	Read Oldest Received Data via Bluetooth stored in buffer	AT+READDATA?
Write_Data	Write Data to SDT module to be sent via Bluetooth	AT+WRITEDATA=<Param>
Read_Packets	Read number of packets in buffer unread (20 bytes per packet)	AT+PACKETS?
Setting Configurations		
Set_Name	Set BLE Device Name	AT+NAME=<Param>
Set_UART_BaudRate	Set communication baud rate of UART interface	AT+BAUDRATE=<Param>

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Set_ModelNum	Set Local Device Model Number in Device Information Service	AT+MODEL=<Param>
Set_SerialNum	Set Local Device Serial Number in Device Information Service	AT+SERIAL=<Param>
Set_HardVer	Set Local Device Hardware Version Number in Device Information Service	AT+HWVER=<Param>
Set_SoftVer	Set Local Device Software Version Number in Device Information Service	AT+VERSION=<Param>
Set_Manufacturer	Set Local Device Manufacturer Name in Device Information Service	AT+OEM=<Param>
Set_ConnInt	Set Connection Interval related parameters. (Note that setting of these parameters must be in line with the conditions set by Bluetooth SIG and Apple)	AT+CONN=<SET><SPACE><MinConnInt><SPACE><MaxConnInt><SPACE><ConnLatency><SPACE><ConnTimeout>
Set_AdvData	Set Manufacturer Specific Advertising Data	AT+ADVDATA=<Param>
Pair	Enable Pairing when connecting via Bluetooth	AT+PAIR=<Param>
Set_Power	Set Bluetooth transmission output power	AT+POWER=<Param>
Reading Configurations		
Read_Name	Read BLE Device Name	AT+NAME?
Read_Addr	Read Local Device Address	AT+ADDR?
Read_DeviceInfo	Read Local Device Information including – ModelNum, Serial Num, HardVer, SoftVer, Manufacturer	AT+DEVICEINFO?
Read_ConnInt	Read Connection Interval	AT+CONN?
Read_AdvData	Read data to advertise	AT+ADVDATA?
Read_Power	Read set Bluetooth transmission output power	AT+POWER?

Important Note:

All changes performed in setting configurations are saved into RAM, in order for changes to take effect and preserved, changes should be saved into eeprom via the command Write_EE, then re-power on or reset the module.

For detailed AT command list and examples, please refer to documentation CMM-9301-SDT-suppl_20141215.pdf

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4. Default Settings

Parameter	System Defaults upon power on
UART Baud rate	1200 bps
Bluetooth Status	Bluetooth turned on as peripheral in advertising broadcast mode
BLE Device Name	C-MAX
Local Device Address	Unique for each module, starting with C-MAX identifier 90:2C:C7
Local Device Information	Model Num: CMM9301-SDT Serial Num: 2ABBXCM9301SDT Hardware Version: V2 Software Version: R2.00 Manufacturer: C-MAX Asia Ltd
Connection interval	125 ms
Advertising interval	125 ms
Output Power	0 dBm
Pairing Option	Pairing and Bonding Enabled
Manufacturer Specific Advertising Data	0000 0000 0000 0000 0000 0000 00

5.1 Mobile APP Data Exchange Service

In order to allow your APP to receive data from and transmit data to the CMM-9301-SDT module, your APP will have to link up to our proprietary data exchange profile with the following service UUID:

0x00005301-0000-0041-4C50-574953450000

And the following characteristics UUID:

0x00005302-0000-0041-4C50-574953450000 >
Properties: Write

0x00005303-0000-0041-4C50-574953450000 >
Properties: Notify Indicate

The 5302 characteristic allows the mobile APP to write data (maximum 20 bytes per transmission) to the module and the 5303 characteristic allows the mobile APP to receive data as both notification or indication data from the module.

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5.2 Mobile APP Device Information Service

Device Information of the module can be acquired by an APP via discovering the standard Bluetooth SIG service: Device Information Service. This service has the UUID of 0x180A, and has the module has the following characteristics (with their respective UUID on the right) available:

```
// DEVICE INFORMATION Service Model number UUID
#define BLEUUID_DEVICEINFORMATION_MODEL_NUMBER           0x2A24

// DEVICE INFORMATION Service Serial Number UUID
#define BLEUUID_DEVICEINFORMATION_SERIAL_NUMBER         0x2A25

// DEVICE INFORMATION Service Hardware Revision UUID
#define BLEUUID_DEVICEINFORMATION_HARDWARE_REVISION     0x2A27

// DEVICE INFORMATION Service Software Revision UUID
#define BLEUUID_DEVICEINFORMATION_SOFTWARE_REVISION     0x2A28

// DEVICE INFORMATION Service manufacturer name UUID
#define BLEUUID_DEVICEINFORMATION_MANUFACTURER_NAME    0x2A29
```

6. Module Electrical Specifications

Specification	CMM-9301-SDTV2		
Storage Temperature Range	- 40 to + 85 degrees C		
Operating Temperature Range	- 20 to + 60 degrees C		
Voltage Range	2.3V to 3.6V		
Frequency Range	2.400 to 2.484 GHz		
Modulation	GFSK		
On-air data rate	1Mbps		
RF channels	40		
Average Current Consumption, Conditions: Bluetooth Broadcast Interval and Connection interval on default 30 ms, Vcc = 3.0, output power = 0 dBm			
SLEEP pin status	Bluetooth Status	Bluetooth Connection	Typical Average Current (mA)
LO	OFF	DISCONNECTED	2.34
HI	ON	CONNECTED	0.39
HI	ON	DISCONNECTED	0.39
HI	OFF	DISCONNECTED	0.007

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7. FCC Statement

NOTICE: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

The Grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

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 or more 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

Radio frequency radiation exposure information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. Please see the RF Exposure information. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device should be installed and operated with a minimum distance of 20cm between the antenna and all persons.

Label requirements:

Contains: FCC ID: 2ABBXCM9301SDT2014

FCC RF Exposure Requirement:

- At least 20cm separation distance between the antenna and the user's body must be maintained at all times. And must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC multi transmitter product procedures.
- To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 0dBi in the 2.4GHz band.

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- A user manual with the end product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

Note: If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093.

Please be noted that the following information and instructions should be placed in the end-user's operating manual.

The CMM-9301-SDT Module must be installed in the designated host as specified in this manual.

- Separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.
- The CMM-9301-SDT Module and its antenna must not be co-located or operating in conjunction with any other transmitter or antenna within a host device. This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.
- A label must be affixed to the outside of the end product into which the CMM-9301-SDT Module is incorporated, with a statement similar to the following: For CMM-9301-SDT: This device contains FCC ID: 2ABBXCM9301SDT2014.
- The module shall be in non-detachable construction protection into the finished products, so that the end-user has to destroy the module while remove or install it.
- This module is to be installed only in mobile or fixed applications. According to FCC part 2.1091(b) definition of mobile and fixed devices is:

Mobile Device:

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location.

Portable Device:

For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

- Separate approval is required for all other operating configurations, including portable configurations with respect to FCC Part 2.1093 and different antenna configurations.
- A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently affixed label, the module must be labeled with an FCC ID: 2ABBXCM9301SDT2014. The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required.
- For a host using this FCC certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains: FCC ID : 2ABBXCM9301SDT2014" must be used. The host OEM user manual must

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also contain clear instructions on how end users can find and/or access the module and the FCC ID.

- Host product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15B). To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. If a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, the grantee (the party responsible for the module grant) shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

OEM RESPONSIBILITIES TO COMPLY WITH FCC REGULATIONS

The CMM-9301-SDT Module has been certified for integration into products only by OEM integrators under the following conditions: This device is granted for use in Mobile only configurations in which the antennas used for this transmitter must be installed to provide a separation distance of at least 20 centimeters from all persons and not be co-located with any other transmitters except in accordance with FCC and Industry Canada multi-transmitter product procedures.

As long as the two conditions above are met, further transmitter testing will not be required. 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.

OEM LABELING REQUIREMENTS FOR END-PRODUCT

The CMM-9301-SDT module is labeled with its own FCC ID Certification Number. The FCC ID 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: FCC ID: 2ABBXCM9301SDT2014".

The OEM of the CMM-9301-SDT Module must only use the approved antenna(s) listed above, which have been certified with this module. The device carries FCC authorization and is marked with the FCC ID Number. Whilst any device into which this authorized module is installed will not normally be required to obtain FCC authorization, this does not preclude the possibility that some other form of

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authorization or testing may be required for the finished device.

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.

If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093.

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

This device is granted for use in mobile only configurations in which the antennas used for this transmitter must be installed to provide a separation distance of at least 20 centimeters from all persons and not be co-located with any other transmitters except in accordance with FCC and Industry Canada multi-transmitter product procedures.

The end product with an embedded FCC ID: 2ABBXCM9301SDT2014 Module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

The labeling instructions of finished products refer to following requirements:

A certified module has the option to use a permanently affixed label, or an electronic label (see Electronic Labeling below). For a permanently affixed label, the module must be labeled with an FCC ID - Section 2.926 (see Certification labeling requirements above). The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required (see next paragraph).

For a host using a certified module with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straight forward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains FCC ID: 2ABBXCM9301SDT2014" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

Other user manual statements may apply.

8. R&TTE Statement

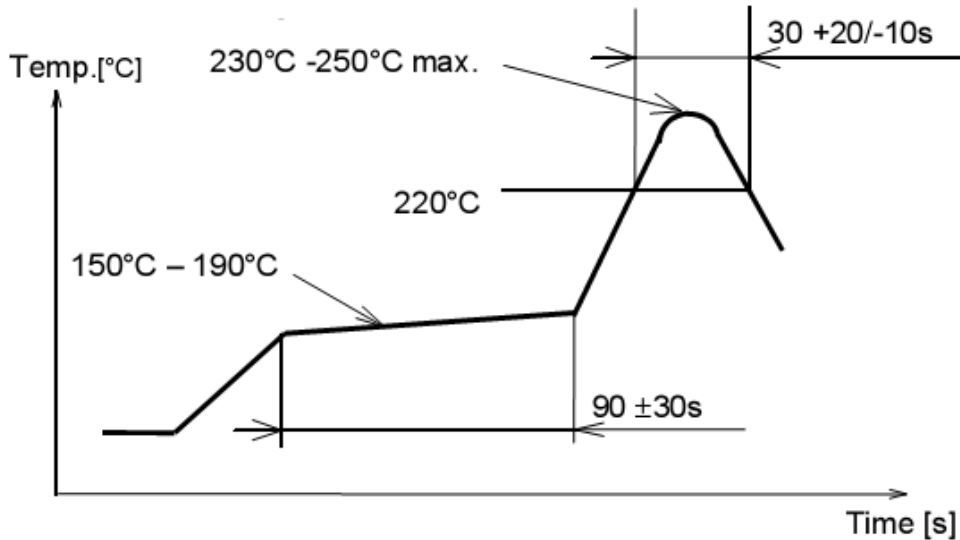
Hereby, C-MAX Asia Limited declares that this CMM-9301-SDT module is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

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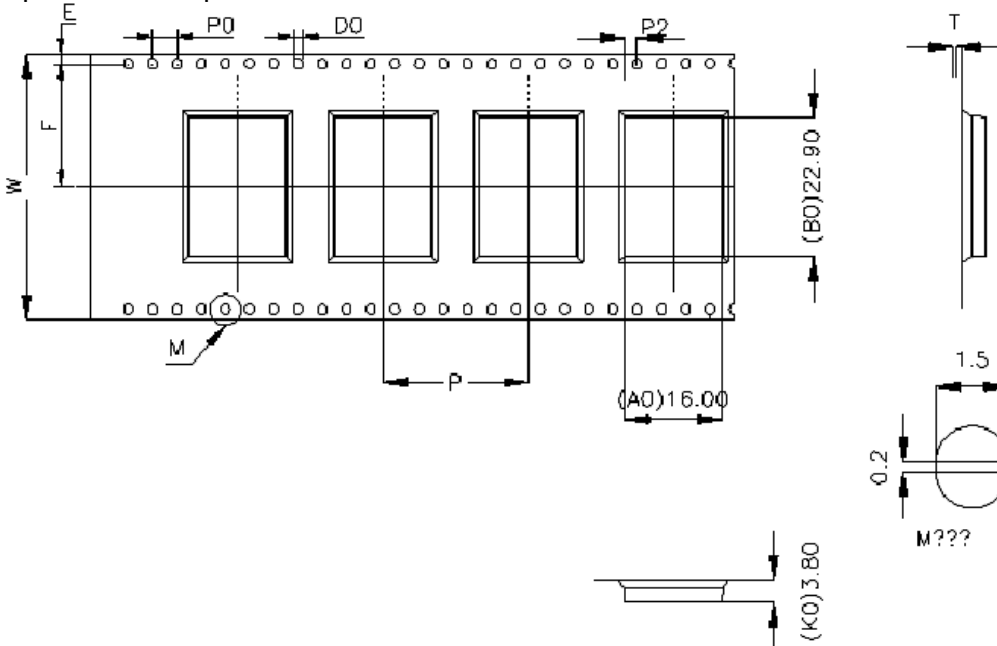


9. Temperature Profile for Lead-free Reflow Soldering



10. Packaging Information

Tape & Reel: 1Kpcs/reel



Item	D_0	D_1	P_0	P_2	E	W	A_0	A_1
Dimension	1.50 +0.10-0.00	0.00 +0.00-0.00	4.00 +0.10-0.10	2.00 +0.10-0.10	1.75 +0.10-0.10	44.0 +0.30-0.30	16.0 +0.10-0.10	0.00 +0.10-0.10

Item	B_0	B_1	K_0	K_1	P	F	T
Dimension	22.9 +0.10-0.10	0.00 +0.00-0.00	3.80 +0.10-0.10	0.00 +0.10-0.10	24.0 +0.10-0.10	20.2 +0.10-0.10	0.35 +0.05-0.05

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11. Ordering Information

C-MAX Module Part Number	Delivery Form	Size (mm)	Typical Operating Voltage (V)
CMM-9301-SDTV2-DEX	Shielded, no pin connectors, Tape and Reel	22.5 x 15.5	2.3 ~ 3.6

Disclaimer of Warranty

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