

TRUEWAVE TW450 / MMT45
4G LTE Cat 1 bis. Module
Datasheet

MoMAGIC
Data Driven Intelligence

TW450 / MMT45 Datasheet
Version 1.2.0

Version	Note	Date
1.0.1	Initial Release	Nov-23
1.0.2	Product part number update	Feb-24
1.0.3	Module Dimension Update	Apr-24
1.0.4	Memory Information Update	Sep-24
1.0.5	Product Features Added, Pin Description updated	Jan-25
1.0.6	Memory Information Update	Jan-25
1.2.0	FCC Details Added	Apr-25

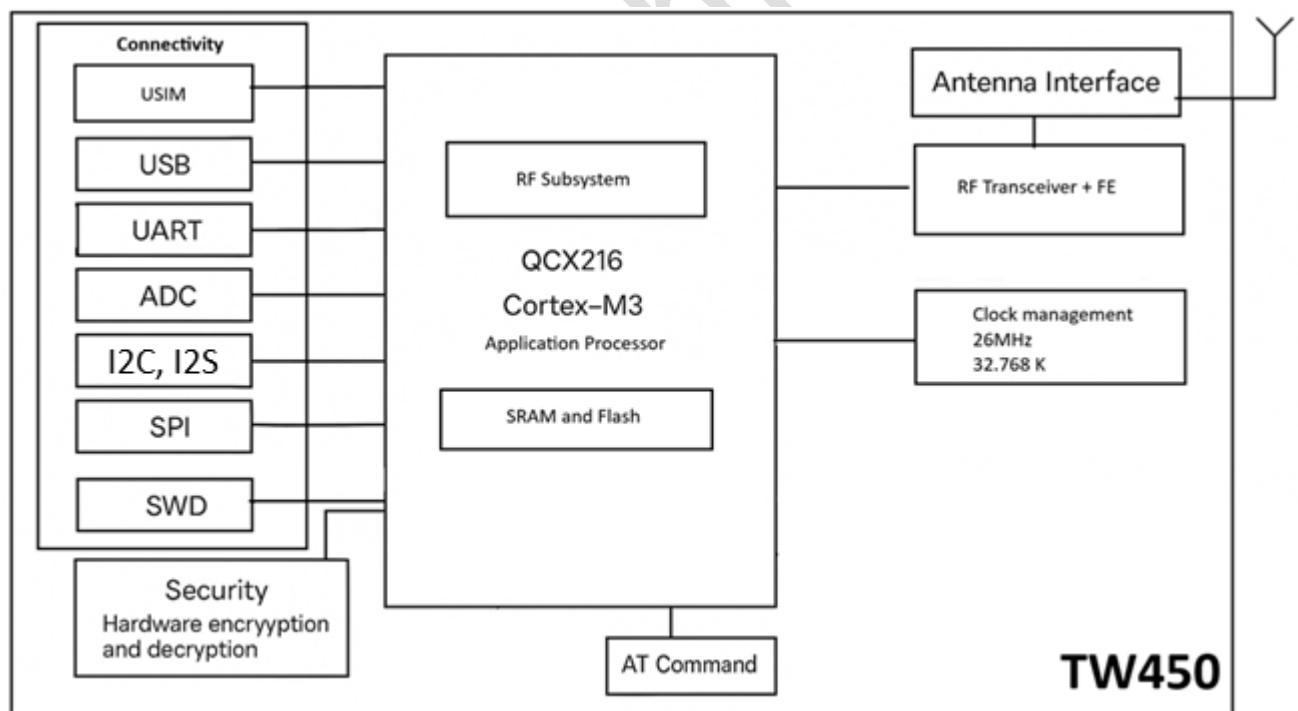
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1. Introduction

The TW450 / MMT45 module offers an all-in-one solution for IoT needs. It incorporates Qualcomm QCX216 chipset based on 4G LTE CAT.1bis. technology and supports a range of essential components and functionalities such as:

- ❖ **Application Processing Subsystem:** The module features an application processing subsystem that handles various tasks and operations. It is powered by a single ARM Cortex M3 processor operating at a frequency of 204MHz. The application subsystem includes integrated peripherals specifically designed for connectivity and multimedia purposes.
- ❖ **Communication Subsystem:** TW450 / MMT45 integrates a comprehensive communication subsystem to enable seamless connectivity. It incorporates LTE CAT.1bis technology, a high-speed cellular communication standard. The module's RF transceiver ensures compatibility with multiple frequency bands, including 1/3/5/8/40/41 (For INDIA). This wide band coverage facilitates roaming capabilities, allowing the module to function across different regions.



The Block diagram which shows the functionality of TW450 module, is shown below:

2. Implementation / Memory Details

There is a 4MB Memory on board, this 4MB is divided into space for Binary, ROM, RAM and reserved area for FOTA. The available memory available for Client Application is as below

RAM: ~380Kb

ROM: ~ 700Kb

D-FOTA: ~500Kb

3. Features of the module

Here are the characteristics and descriptions of the TW450 / MMT45 module:

- ❖ Physical Characteristics : Dimensions: 18mm x 16mm x 2.5mm
: Package: LGA (Land Grid Array) package, suitable for patch mounting
- ❖ Operating Voltage : Range: 3.4V - 4.2V
: Typical Voltage: 3.7V
- ❖ Application Processor : ARM Cortex M3 processor
: Clock Frequency: 204MHz
- ❖ Application Interface : USIM Card: Supports 3.0V/1.8V
- ❖ USB : USB2.0 (High-Speed)
: Supports Slave mode
: Data transfer rate of up to 480Mbps
- ❖ UART : UART0, UART1 and UART2
: Supports AT commands and data transfer.
: Baud rate up to 921600bps, with a default of 115200bps
- ❖ ADC : Two Analog-to-Digital converters
- ❖ I2S : Compliant with I2S bus protocol
- ❖ I2C : High-speed mode supports a rate of 3.3Mbps
- ❖ LTE Band Supported : Low band (FDD): 5, 8
: Mid band (FDD): 1, 3
: High band (TDD): 40, 41
- ❖ Network Indication : WWAN_STATE: Indication of network status
: STATUS: Module status indication
- ❖ GPIO : Four GPIO (General Purpose Input/Output) interfaces
- ❖ SPI : Standard SPI (Serial Peripheral Interface) interface
- ❖ Security : Hardware encryption and decryption
: Secure boot *
: Flash encryption
- ❖ SWD : Standard SWD (Serial Wire Debug) interface with 2 lines
- ❖ Data Network : Supports FDD/TDD LTE CAT 1.bis.
: Peak Downlink speed of 10Mbps and Uplink speed of 5Mbps (CAT 1.bis)
- ❖ AT Command : Supports standard AT instruction sets such as Hayes 3GPP TS 27.007 and 27.005
- ❖ OS : FREE-RTOS, Open-CPU
- ❖ Network Protocol : Supports TCP, HTTP(S), and MQTT(S) protocols.
: Supports TLS (Transport Layer Security) versions.
- ❖ Antenna Interface : One interface for the main antenna

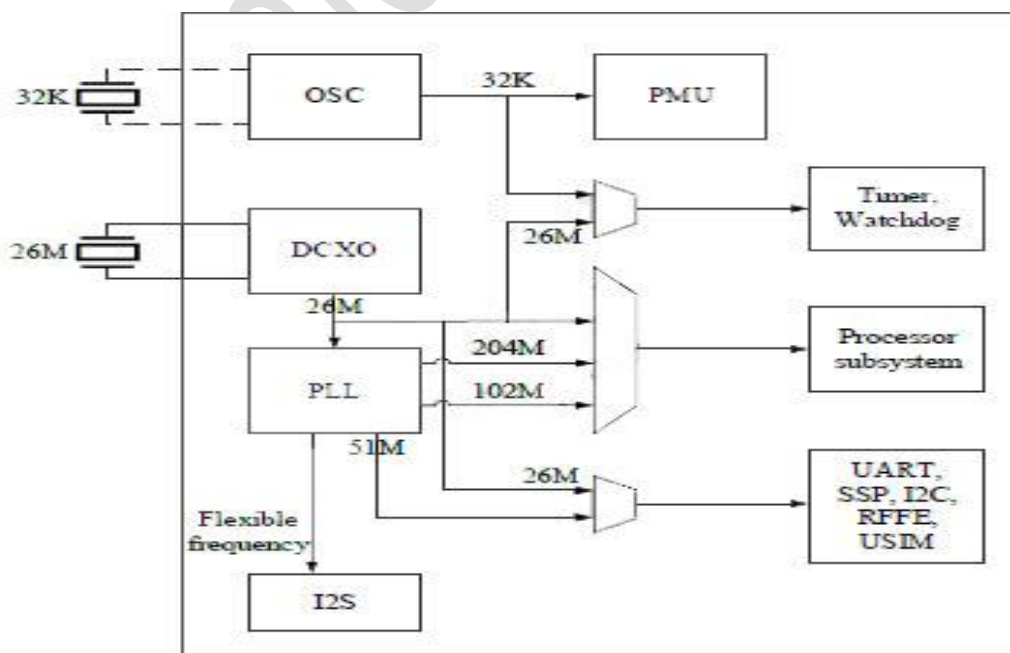
- ❖ Virtual Network Card : Supports USB virtual network card functionality.
- ❖ Temperature Range : Normal working temperature: -40°C to +85°C
: Storage temperature: -50°C to +150°C
- ❖ Humidity : RH (Relative Humidity): 5% to 95%

** To enable Secure Boot contact MoMagic Support Team*

4. Application area

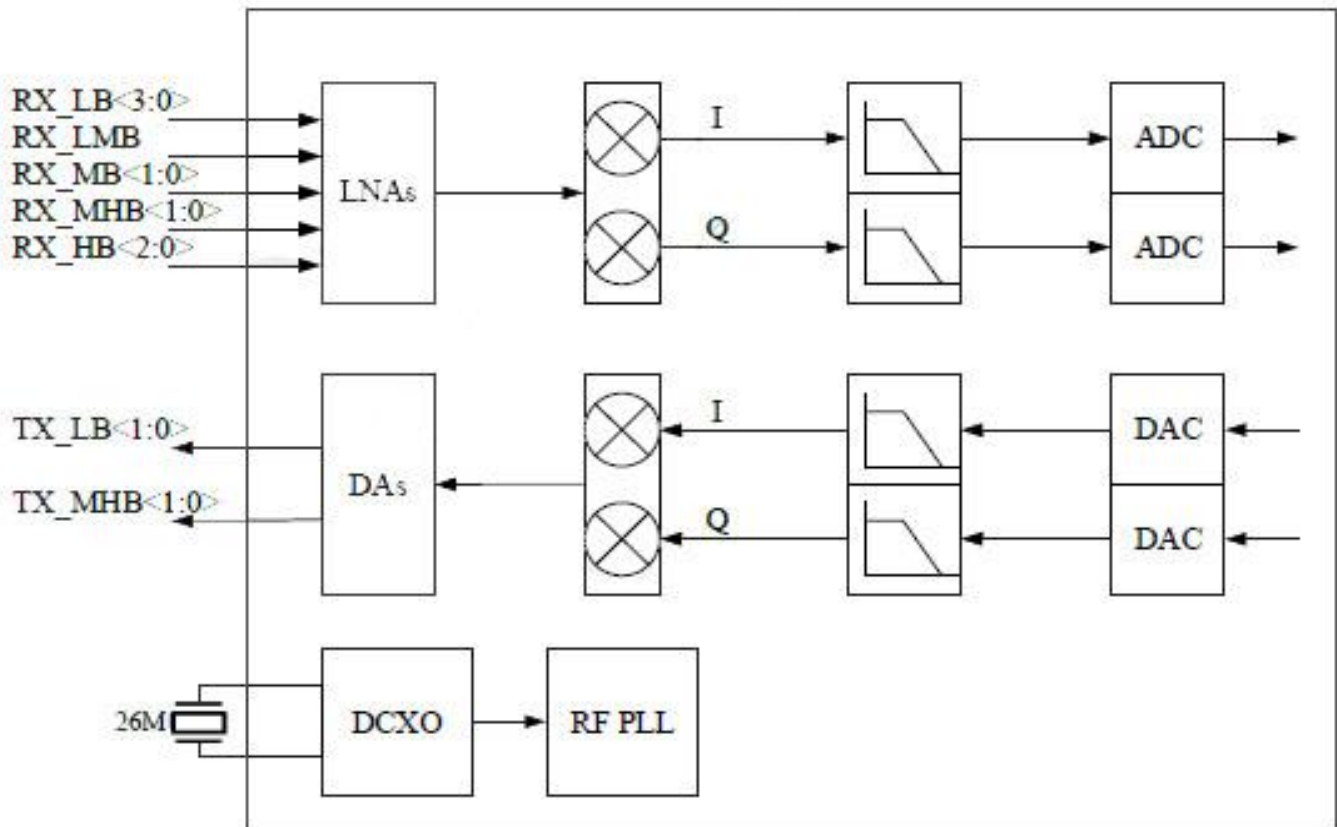
- ❖ Smart homes
- ❖ Smart sensor networks
- ❖ Industrial IoT sensors and controllers
- ❖ Health / fitness sensor and Monitor device
- ❖ Medical devices and Connected Health
- ❖ Advanced remote controls
- ❖ Automotive Industries
- ❖ Wearables
- ❖ Personal fitness devices
- ❖ Security/ Proximity
- ❖ PC Peripherals
- ❖ Assisted Living

5. Clock Subsystem



TW450 has two clock sources, 26 MHz DCXO and integrated 32.768 KHz, 26 MHz DCXO provides clock for RF and SoC, 32.768 KHz provides clock for MPU and timer within SoC. Audio interface supports flexible frequency as shown in the above figure which represents the clock subsystem.

RF clock subsystem is represented in below block diagram.



6. Pin Assignment

Power Supply

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
VBAT	42,43	PI	Power supply for the module	V _{max} = 4.3V V _{min} = 3.3V V _{nom} = 3.8V	It must be provided with sufficient current up to 2A. It is recommended to add an external TVS.
VDD EXT	24	PO	Provide 3.3V for external circuit	I _{omax} = 50 mA	It is recommended to reserve test points.
GND	1,10,27,34,36,37,40,41,45-48,70-73,88-95				

Reset & Turn On/Off

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
PWRKEY	7	AI	Turn on/off the module	V _o = 1.8 V	Active low
RESET_N	15	AI	Reset the module	V _o = 1.2 V	

Indicating Pins

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
STATUS	25	DO	Indicate the module's operation status	VDD_EXT	
NET_STATUS	16	DO	Indicate the module's network activity status		

USB PINS

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USB_DETECT	61	AI	USB connection detect, use appropriate Voltage divider	V _{max} = 2.1 V V _{min} = 1.9 V V _{nom} = 2.0 V	
USB_DP	59	AIO	USB differential data (+)		
USB_DM	60	AIO	USB differential data (-)		

Auxiliary UART Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
AUX_TXD	29	DO	Auxiliary UART transmit	VDD_EXT	
AUX_RXD	28	DI	Auxiliary UART receive		

Main UART Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
MAIN_CTS	22	DO	DTE clear to send signal from DCE	VDD_EXT	
MAIN_RTS	23	DI	DTE request to send signal to DCE		
MAIN_RXD	17	DI	Main UART receive		
MAIN_DCD	21	DO	Main UART data carrier detects		
MAIN_TXD	18	DO	Main UART transmit		
MAIN_RI	20	DO	Main UART ring indication		
MAIN_DTR	19	DI	Main UART data		

Debug UART Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics
DBG_RXD	38	DI	Debug UART receive	VDD_EXT
DBG_TXD	39	DO	Debug UART transmit	

I2C Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
I2C_SCL	67	DO	I2C serial clock	VDD_EXT	External pull-up resistor is required.
I2C_SDA	66	DIO	I2C serial data		

PCM Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics
PCM_SYNC	31	DO	PCM data frame sync	VDD_EXT
PCM_CLK	30	DO	PCM clock	

PCM_DIN	32	DI	PCM data input
PCM_DOUT	33	DO	PCM data output

USIM Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USIM_VDD	14	PO	USIM card power supply	I _{Omax} = 50 mA Low voltage: V _{max} = 1.85 V V _{min} = 1.75 V High voltage: V _{max} = 3.05 V V _{min} = 2.95 V	Either 1.8 V or 3.0 V USIM card is supported and can be identified automatically by the module.
USIM_DATA	11	DIO	USIM card data	USIM_VDD	
USIM_CLK	13	DO	USIM card clock		
USIM_RST	12	DO	USIM card reset		
USIM_DET	79	DI	USIM card hot-plug Detect, use appropriate voltage divider	1.9 V- 2.1V	

RF Antenna Interface

Pin Name	Pin No.	I/O	Description	Comment
ANT_MAIN	35	AI O	Main antenna interface	50 Ω impedance.

ADC Interfaces

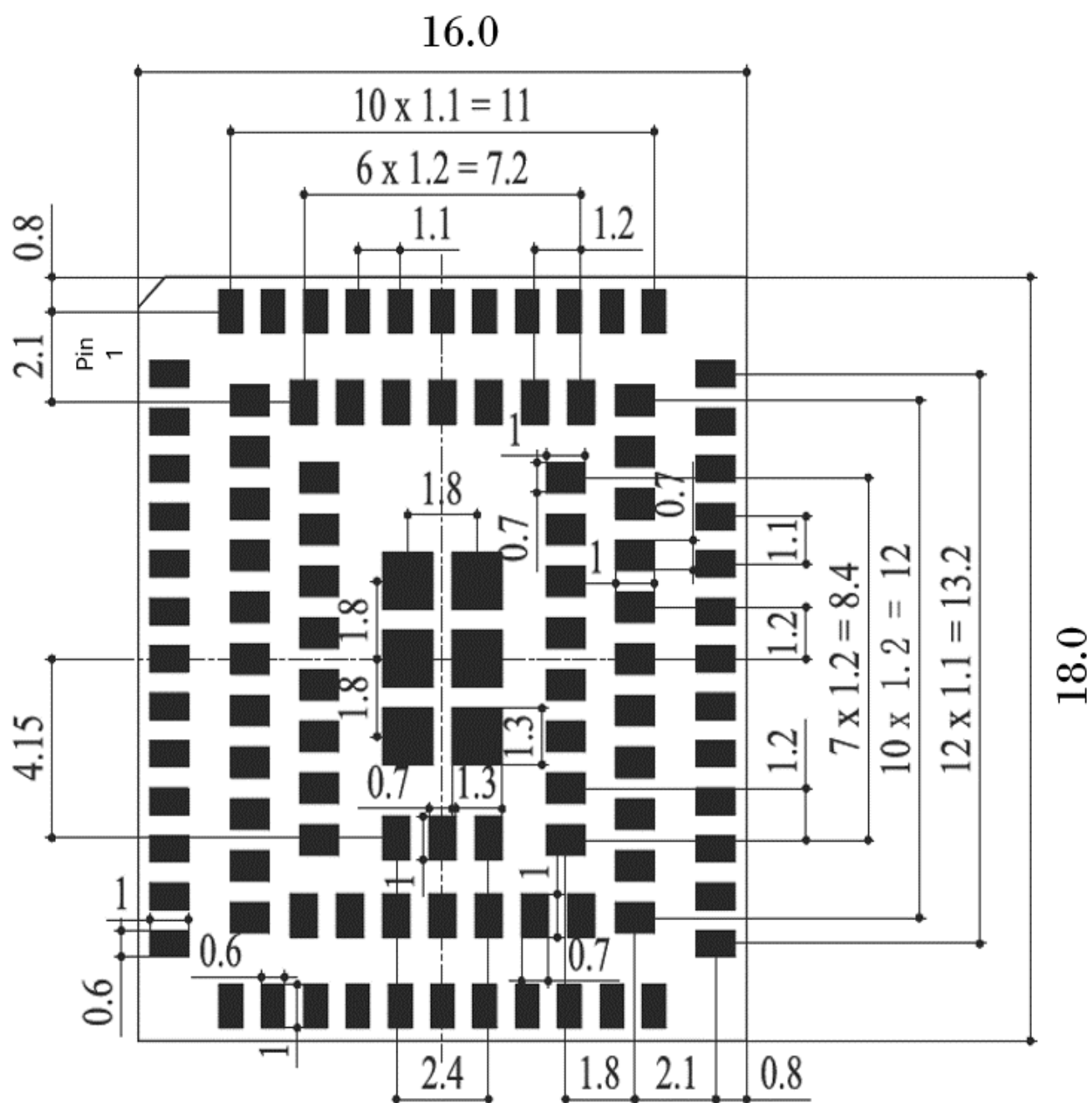
Pin Name	Pin No.	I/O	Description	DC Characteristics
ADC0	9	AI	General-purpose ADC interface	Voltage range: 0-1.2 V
ADC1	96	AI		

Other Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
USB_BOOT	82	DI	Force the module into emergency download mode	VDD_EXT	Active low.
PSM_IND	83	DO	Indicate the module power saving mode	VDD_EXT	FW configurable
PSM_INT	87	DI	External interrupt; wake up the module from power saving mode	1.9 V- 2.1V	Externally pulling up this pin can make the module exit power saving mode.
GPIO1/LCD_RST	80	DI/O	General Purpose	VDD_EXT	
GPIO2	107	DI/O			
GPIO4	109	DI/O			
GPIO5	62	DI/O			
RESERVED	2-6, 8, 26, 44, 49-58, 63-65, 68, 69, 74-78, 81, 84-86, 97-103, 104,105,106,108				

A 13x13 grid of numbers from 1 to 169. The numbers are arranged in a grid where the top row contains numbers 97 to 98, the bottom row contains 96 to 95, the left column contains 35 to 23, and the right column contains 1 to 13. The center of the grid features a 3x3 magic square with the following numbers: 90, 92, 94, 89, 91, 93, 88, 86, and 84. The numbers 90, 92, and 94 are circled in red.

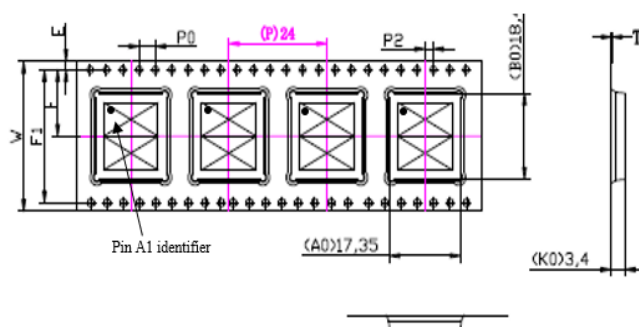
8. Recommended PCB footprint



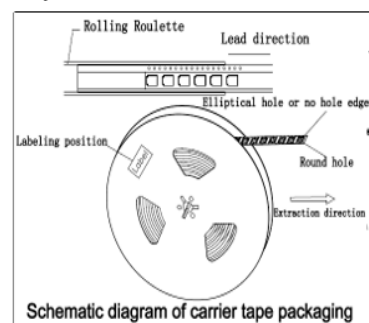
All size in mm

9. Ordering Information

symbol	AO	BO	KO	PO	P	P2	
Spec	17.35±0.10	18.40±0.10	3.40±0.10	4.00±0.10	24.0±0.10	2.00±0.10	
symbol	W	T	E	F	DO	F1	
Spec	32.0±0.30	0.30±0.05	1.75±0.10	14.20±0.10	1.50±0.10	28.40±0.10	



SPQ: 700 Unit

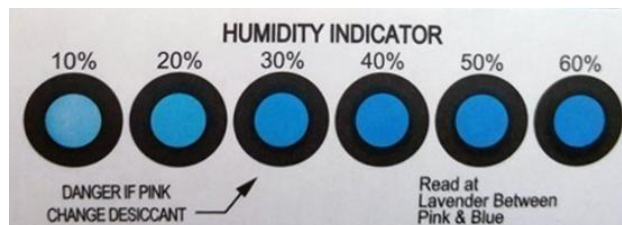


10. Product Handling

Storage Conditions

Storage conditions for a delivered module:

- Moisture sensitive level (MSL): 3
- Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)
- Peak package body temperature: 260°C
- A humidity indicator card (HIC) in the packaging bag.



- After the bag is opened, the module that will be subjected to reflow solder or other high temperature process must be:
 - Mounted within 168 hours of factory conditions $\leq 30^{\circ}\text{C}/60\% \text{ RH}$, or
 - Stored per J-STD-033
- The module needs to be baked in the following cases:
 - The packaging bag is damaged before unpacking.
- There is no humidity indicator card (HIC) in the packaging bag.
- After unpacking, circles of 10% and above on the HIC become pink.
- The total exposure time has lasted for over 168 hours since unpacking.
- More than 12 months have passed since the sealing of the bag.
- If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure.

Production Instruction

TW450 / MMT45 module can be surface mount technology (SMT) packaged according to the customer's PCB design. However, once unpacked, the module must be soldered within 24 hours. If this is not possible, it should be placed in a drying cupboard with a relative humidity of no greater than 10%. Alternatively, it can be vacuum packaged again, with the exposure time recorded, but the total exposure time cannot exceed 168 hours. To complete the SMT assembly process, the following devices are required: a mounter, an SPI, a reflow soldering machine, a thermal profiler, and automated optical

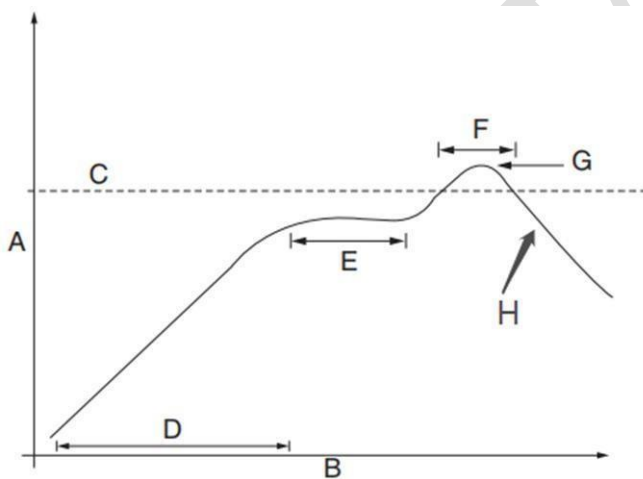
inspection (AOI) equipment. Additionally, baking devices such as a cabinet oven, anti-electrostatic and heat-resistant trays, and anti-electrostatic and heat-resistant gloves are needed.

During baking, the temperature settings for the reel package should be 40°C and ≤5% RH, while for tray packages, the temperature should be 125°C and ≤5% RH, and heat-resistant trays should be used instead of plastic containers. The recommended time for baking is 168 hours for reel packages and 12 hours for tray packages, with an alarm temperature of 50°C for reel packages and 135°C for tray packages.

After cooling naturally, the production-ready temperature should be below 36°C, and if a module remains unused for over 168 hours after being baked, it needs to be baked again. If a batch of modules is not baked within 168 hours, wave soldering should not be used because these modules are Level-3 moisture-sensitive devices, and if they are exposed beyond the allowable time, they are very likely to get damp, which may result in device failure or poor soldering.

Throughout the entire production process, it is important to take electrostatic discharge (ESD) protective measures to prevent any damage to the devices.

11. Reflow Profile



- **D:** Rising speed = (1 ~ 3) °C/s, 20°C ~ 150°C, 60s ~ 90s
- **E:** Average preheating temperature = 150°C ~ 200°C, 60s ~ 120s
- **F:** Temperature fluctuation > 217°C, 50s to 70s; peak temperature = 235°C ~ 245°C
- **H:** Drop speed = (1 ~ 4) °C/s

12.FCC Regulatory Compliance

FCC ID: 2A2OT-TW450-MMT45

§15.19 Statement

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.

§15.21 Information to user

Warning: changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

- **List of applicable FCC rules:**

CFR Part 22, 27

- **Summarize the specific operational use conditions**

This module can be used in IOT devices, the input voltage to the module is nominally 3.7V.

- **Limited module procedures**

This module is a single module.

- **Trace antenna designs**

The antenna is not a trace antenna.

- **RF exposure considerations**

This Module complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

- **Antennas**

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by host manufacturer, can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

- **Label and compliance information**

Please notice that if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC ID: **2A2OT-TW450-MMT45**" any similar wording that expresses the same meaning may be used.

§ 15.19 Labelling requirements shall be complied on end user device.

Labelling rules for special device, please refer to §2.925, § 15.19 (a)(5) and relevant KDB publications. For E-label, please refer to §2.935.

- **Information on test modes and additional testing requirements**

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module. The module is limited to installation in IoT/Mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to §2.1093 and difference antenna configurations.

- **FCC other Parts, Part 15B Compliance Requirements for Host product manufacturer**

This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.

Please note that For a Class B or Class A digital device or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in §15.105 Information to the user or such similar statement and place it in a prominent location in the text of host product manual. Original texts as following:

For Class B

Note: 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.

- **RF Exposure Compliance**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body

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