ZWG3M

DATASHEET

2.4GHz IoT Wi-Fi Module

September 30, 2019

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1. Module Descriptions

1.1 Features

The ZWG3M is a Wi-Fi module that consists of the MT7686 Wi-Fi chip and G3 security chip. This module includes 2.4GHz chip antenna, Clock sources, and all RF components.
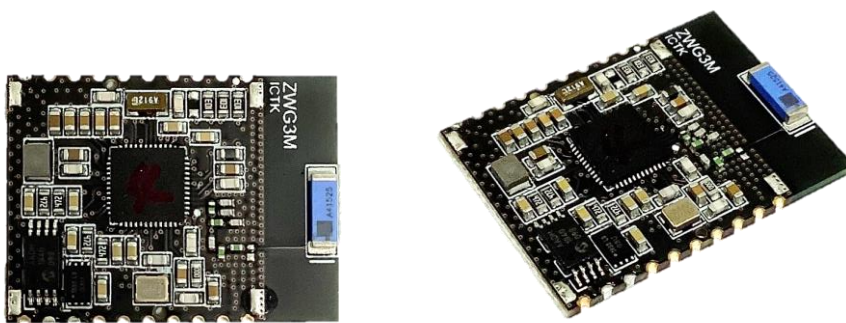
■ Wi-Fi

- IEEE 802.11 b/g/n (2.4GHz, 1x1)

- Supports 20MHz, 40MHz channels

- Wi-Fi security WEP, WPA2 and WPS

- Integrated 2.4GHz PA/LNA and RF switch

■ Platform

- 192MHz ARM Cortex-M4 with FPU

- Up to 384KB SRAM, with zero-wait state, max frequency 96MHz

- Up to 32KB L1 cache, with high hit rate, zero-wait state, maximum frequency at 192MHz

- Embedded 32Mbits flash, with less than 0.1uA (typical) and 80MHz maximum frequency
   Deep power-down current

- Embedded 32Mbits pseudo SRAM with half sleep mode current:
      10uA (PASR 1/8 at 25℃, 1x Refresh) and 96MHz maximum frequency

■ Module

- Integrated 2.4GHz Antenna

- Interfaces: UART, I2C, PWM, ADC, GPIO

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- 26MHz crystal oscillator / 32KHz crystal oscillator for RTC

- Size: 27 mm x 20 mm x 2.4 mm, 20-Pin

- Operating temperature range :   -30℃ ~ 85℃

- Integrated PUF based security chip for secure authentication
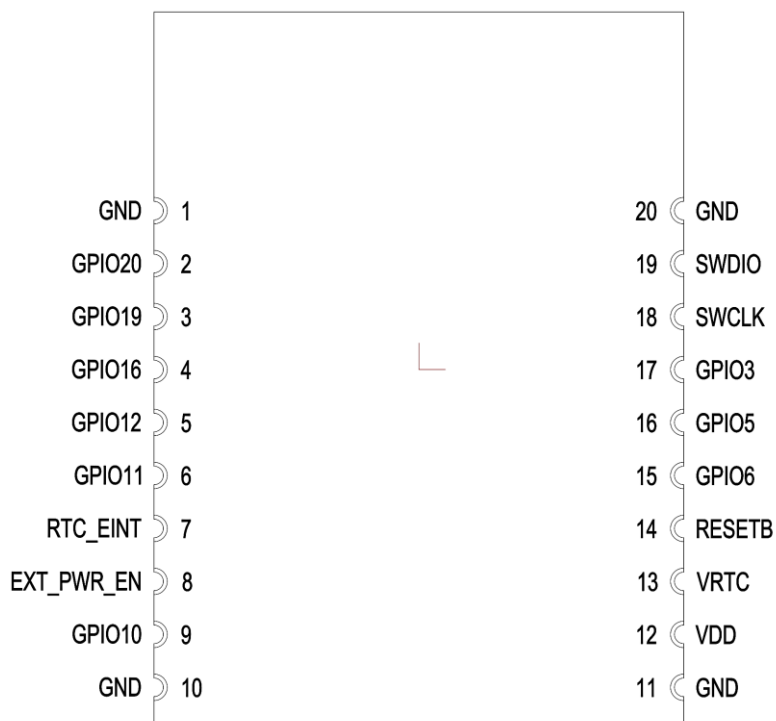
1.2 Application

- IoT (Internet of Things)

- Home Appliances

- Sensor Networks

- Security/Access Control

- Smart Energy

1.3 Block Diagram
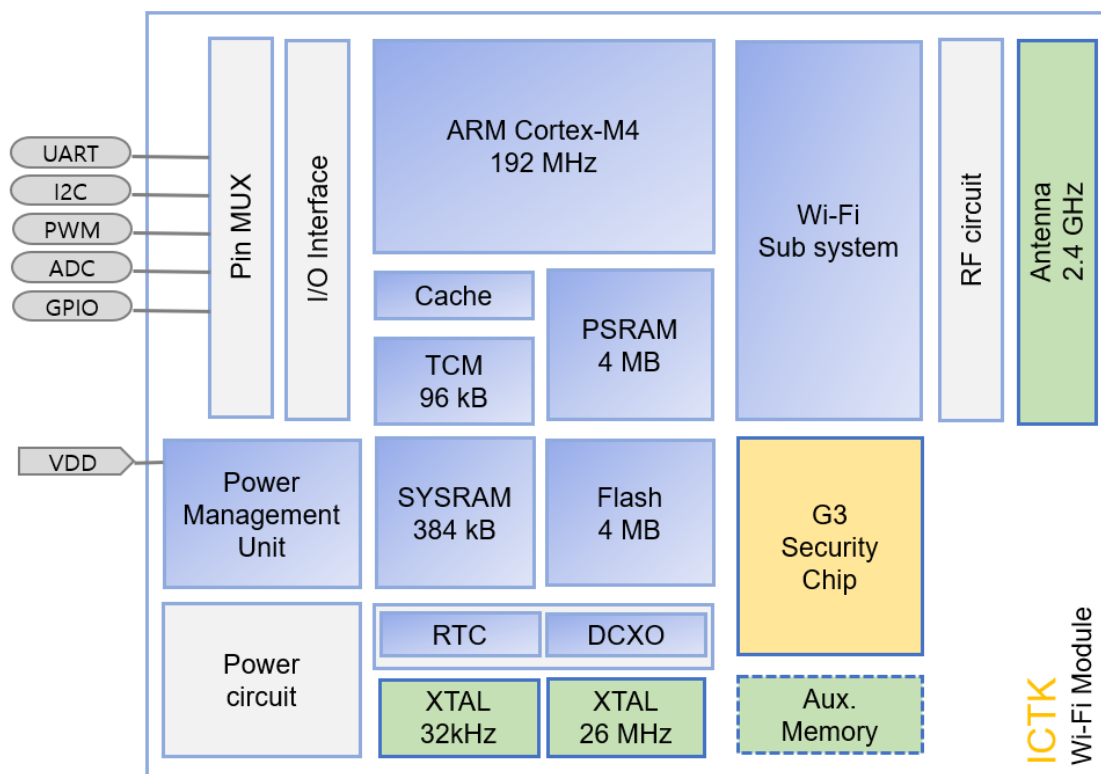
Module block diagram

1.4 Pin map

Pinout (Top view)

Pin	Pin Name	Pin Type	Pin Description	Alternate Pin Functions
1	GND	Power	Ground	--
2	GPIO20	Digital In/Out	General purpose IO Boot mode UART	EINT20, UART0 TXD, AUXADC3
3	GPIO19	Digital In/Out	General purpose IO Boot mode UART	EINT19, UART0 RXD, SCL1, AUXADC2
4	GPIO16	Digital In/Out	General purpose IO	EINT16, SDA1
5	GPIO12	Digital In/Out	General purpose IO	EINT12, UART2 TXD,
6	GPIO11	Digital In/Out	General purpose IO	EINT11, UART2 RXD, PWM3
7	RTC_EINT	Digital In/Out	Dedicate EINT input in RTC	--
8	EXT_PWR_EN	Analog Out	External PMU enable	--
9	GPIO10		General purpose IO	EINT10, PWM2
10	GND	Power	Ground	--
11	GND	Power	Ground	--
12	VCC	Power	Power input	--
13	VRTC	Power	Power input for RTC	--

14	RESETB	Analog In	Module Enable	--
15	GPIO6	Digital In/Out	General purpose IO	EINT6, UART0 TXD, SCL0
16	GPIO5	Digital In/Out	General purpose IO	EINT5, UART0 RXD, SDA0
17	GPIO3	Digital In/Out	General purpose IO	EINT3, PWM1,
18	SWCLK	SWD Debug	Cortex M4 Debug	--
19	SWDIO	SWD Debug	Cortex M4 Debug	--
20	GND	Power	Ground	--

1.5 Module Dimension and Land Pattern

	Typical	Unit
Size(LxWxH)	27 x 20 x 2.4	mm
Tolerances	±0.2	mm
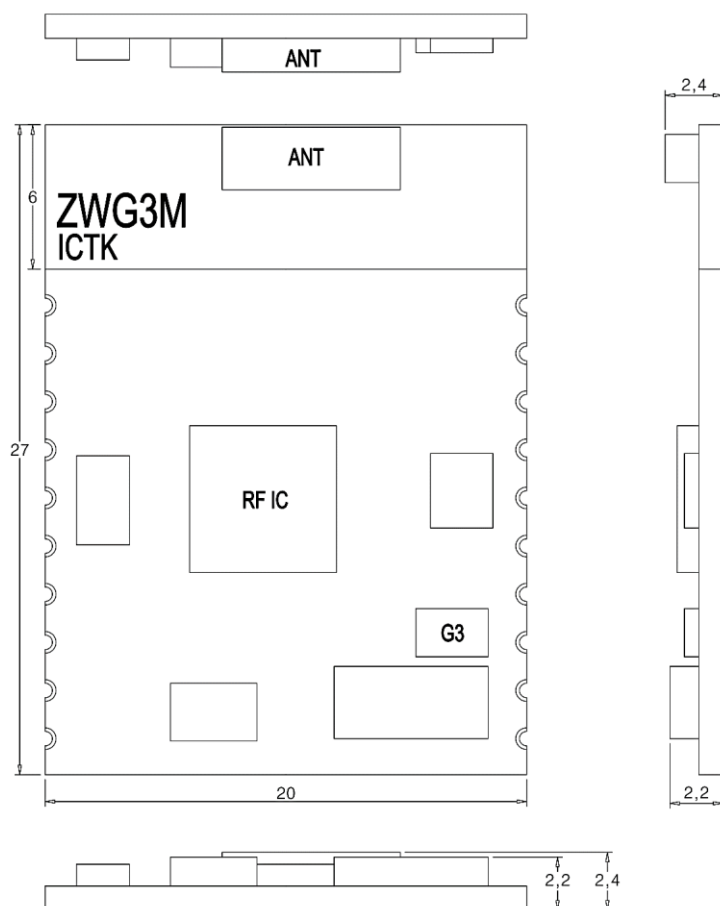
Module Dimension, Top view, Unit: mm
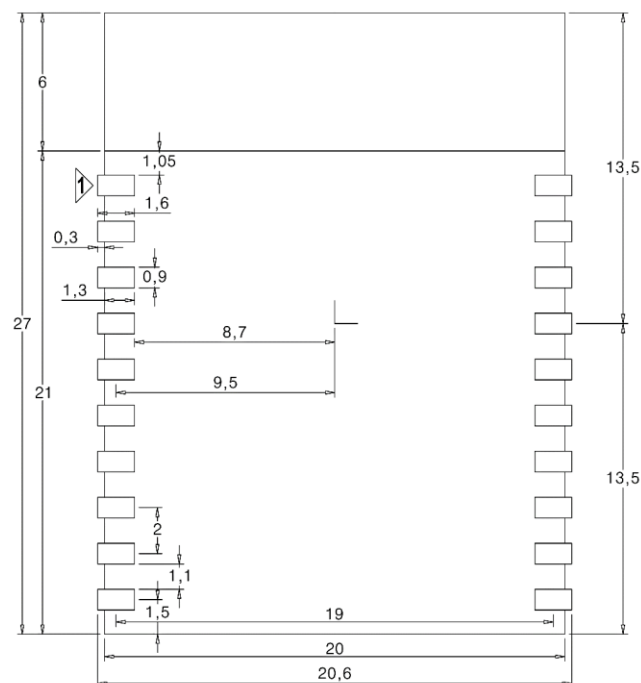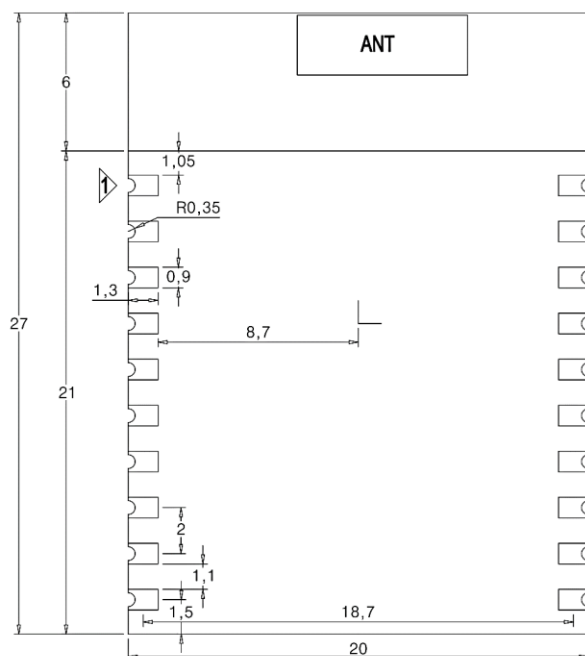
Module land pattern and recommended footprint, Top view, Unit: mm

All dimensions are in millimeters. The drawing is subject to change without notice.

2. Electrical Characteristics

2.1 Absolute maximum ratings

	Min.	Max.	Unit
Storage temperature	-40	85	℃
VDD, VRTC	-0.3	3.63	V
Other terminal voltages	-0.3	3.63	V

2.2 Recommended Operating Conditions

	Min.	Typ.	Max.	Unit
Operating temperature range	-30		85	℃

VDD, VRTC	3.0	3.3	3.6	V
Other terminal voltages	-0.3		VDD+0.3	V

2.3 Terminal Electrical Characteristics

Symbol	Description	Condition	Min.	Typ.	Max.	Unit
Input Voltage Levels						
V_{IL}	Input logic level low	VDD=3.3V	0	-	0.8	V
V_{IH}	Input logic level high	VDD=3.3V	2.0	-	VDD	V
Output Voltage Levels						
V_{OL}	Output logic level low	VDD = 3.3V	-	-	0.495	V
V_{OH}	Output logic level high	VDD = 3.3V	2.4	-	-	V

2.4 Power consumption

Test conditions : Ta=25℃, VDD=3.3V, VRTC=3.3V

Power Mode		Test Conditions	Current (Typical)	Unit
Off mode	Off	RESETB keeps low	< 1	uA
Sleep mode	Sleep	Cortex M4 in sleep state TCM 96kB SRAM retained SYSRAM 384kB SRAM retained External 32kHz XTAL	120	uA
Active mode	Wi-Fi TX	Cortex M4 in active state External 32kHz XTAL CCK 19 dBm	250	mA
		Cortex M4 in active state External 32kHz XTAL OFDM 16.5 dBm	220	mA
	Wi-Fi RX	HT20 MCS 7 Cortex-M4 in active state External 32kHz XTAL	42	mA

2.5 ESD electrical sensitivity

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Test conditions : Ta=25℃

	Description	Min.	Max.	Unit
HBM	All pins except RF pins	-2000	2000	V
(JESD22-A114-F)	RF pins	-1000	1000	V
CDM	All pins except RF pins	-500	500	dBm
(JESD22-C101-D)	RF pins	-250	250	dBm

3. RF Characteristics

3.1 RF receiver specifications

Test conditions : Ta=25℃, VDD=3.3V, VRTC=3.3V

Description		Min.	Typ.	Max	Unit
Frequency range	Channel center frequency	2412	-	2484	MHz
Receiver sensitivity	1 Mbps CCK	-	-97.5	-	dBm
	2 Mbps CCK	-	-94.5	-	dBm
	5.5 Mbps CCK	-	-92.5	-	dBm
	11 Mbps CCK	-	-89.5	-	dBm
	BPSK rate 1/2, 6 Mbps OFDM	-	-94.5	-	dBm
	BPSK rate 3/4, 9 Mbps OFDM	-	-93.3	-	dBm
	QPSK rate 1/2, 12 Mbps OFDM	-	-91.5	-	dBm
	QPSK rate 3/4, 18 Mbps OFDM	-	-89.1	-	dBm
	16QAM rate 1/2, 24 Mbps OFDM	-	-85.8	-	dBm
	16QAM rate 3/4, 36 Mbps OFDM	-	-82.4	-	dBm
	64QAM rate 1/2, 48 Mbps OFDM	-	-78.2	-	dBm
	64QAM rate 3/4, 54 Mbps OFDM	-	-77.0	-	dBm
Receive sensitivity 20MHz bandwidth Mixed mode 800ns guard interval Non-STBC	MCS 0, BPSK rate 1/2	-	-93.9	-	dBm
	MCS 1, QPSK rate 1/2	-	-90.7	-	dBm
	MCS 2, QPSK rate 3/4	-	-88.3	-	dBm
	MCS 3, 16QAM rate 1/2	-	-85.3	-	dBm
	MCS 4, 16QAM rate 3/4	-	-81.8	-	dBm
	MCS 5, 64QAM rate 2/3	-	-77.4	-	dBm
	MCS 6, 64QAM rate 3/4	-	-76.0	-	dBm
	MCS 7, 64QAM rate 5/6	-	-74.8	-	dBm
Receive sensitivity 40MHz	MCS 0, BPSK rate 1/2	-	-90.5	-	dBm

bandwidth Mixed mode 800ns guard interval Non-STBC	MCS 1, QPSK rate 1/2	-	-87.7	-	dBm
	MCS 2, QPSK rate 3/4	-	-85.2	-	dBm
	MCS 3, 16QAM rate 1/2	-	-81.7	-	dBm
	MCS 4, 16QAM rate 3/4	-	-78.6	-	dBm
	MCS 5, 64QAM rate 2/3	-	-74.0	-	dBm
	MCS 6, 64QAM rate 3/4	-	-72.7	-	dBm
	MCS 7, 64QAM rate 5/6	-	-71.5	-	dBm
Maximum receive level	6 Mbps OFDM	-	-10	-	dBm
	54 Mbps OFDM	-	-10	-	dBm
	MCS 0	-	-10	-	dBm
	MCS 7	-	-20	-	dBm
Receive adjacent channel rejection	1 Mbps CCK	-	40	-	dBm
	11 Mbps CCK	-	40	-	dBm
	BPSK rate 1/2, 6 Mbps OFDM	-	34	-	dBm
	64QAM rate 3/4, 54 Mbps OFDM	-	22	-	dBm
	HT20, MCS 0, BPSK rate 1/2	-	33	-	dBm
	HT20, MCS 7, 64QAM rate 5/6	-	15	-	dBm
	HT40, MCS 0, BPSK rate 1/2	-	29	-	dBm
	HT40, MCS 7, 64QAM rate 5/6	-	9	-	dBm

3.2 RF transmitter specifications

Test conditions : Ta=25℃, VDD=3.3V, VRTC=3.3V

	Description	Min.	Typ.	Max	Unit
Frequency range	Channel center frequency	2412	-	2484	MHz
Output power	1 Mbps CCK	-	19	-	dBm
	11 Mbps CCK	-	19	-	dBm
	6 Mbps OFDM	-	18.5	-	dBm
	54 Mbps OFDM	-	16.5	-	dBm
	HT20, MCS 0	-	17.5	-	dBm
	HT20, MCS 7	-	15.5	-	dBm
	HT40, MCS 0	-	15.5	-	dBm
	HT40, MCS 7	-	14.5	-	dBm
Transmitter EVM	6 Mbps OFDM	-	-	-5	dB
	54 Mbps OFDM	-	-	-25	dB
	HT20, MCS 0	-	-	-5	dB

	HT20, MCS 7	-	-	-28	dB
	HT40, MCS 0	-	-	-5	dB
	HT40, MCS 7	-	-	-28	dB

4. G3 Security IC

4.1 G3 Overview

The G3 is an ICTK's PUF based-security chip that performs authentication and cryptography operations. It is suited for performing secure authentication, protecting firmware, preventing counterfeiting, and storing secure data. With ICTK's PUF technology, the G3 can generate more secure and reliable crypto key.

4.2 G3 Key features

Physical Unclonable Function (PUF):

- The PUF supports key generation.

- The data stored in G3 is encrypted using a PUF key and it is decrypted when using the data.

- The private key of ECC is generated by PUF and a key received from external site can be used.

- When using AES and SM4 algorithms, a PUF key supports encryption and decryption.

Supported cryptographic algorithms:

- Symmetric key algorithm: AES and SM4

- Asymmetric key algorithm:

    - ECC (ECDSA and ECDH) with secp256r1 (NIST P256)

    - ECC sm2p256 curve and SM2 signature algorithm

- Hash algorithm: SHA256

- TLS 1.2

4.3 G3 Applications

- Secure Authentication

    Identifies and authenticates devices with strong cryptographic algorithms and PKI(Public Key Infrastructure)

- Protecting Firmware

    Protects the firmware copy of devices not to manufacture counterfeit products

    Performs secure boot function that protects against attacks by changing firmware codes

- Preventing Counterfeiting

    Prevents the counterfeiting of electronic devices

- Secure Data

    Encrypts data with a random key and store it in a non-secure memory when the random key is stored in G3, the encrypted

    data can be kept confidential even if the non-secure memory is lost or stolen.
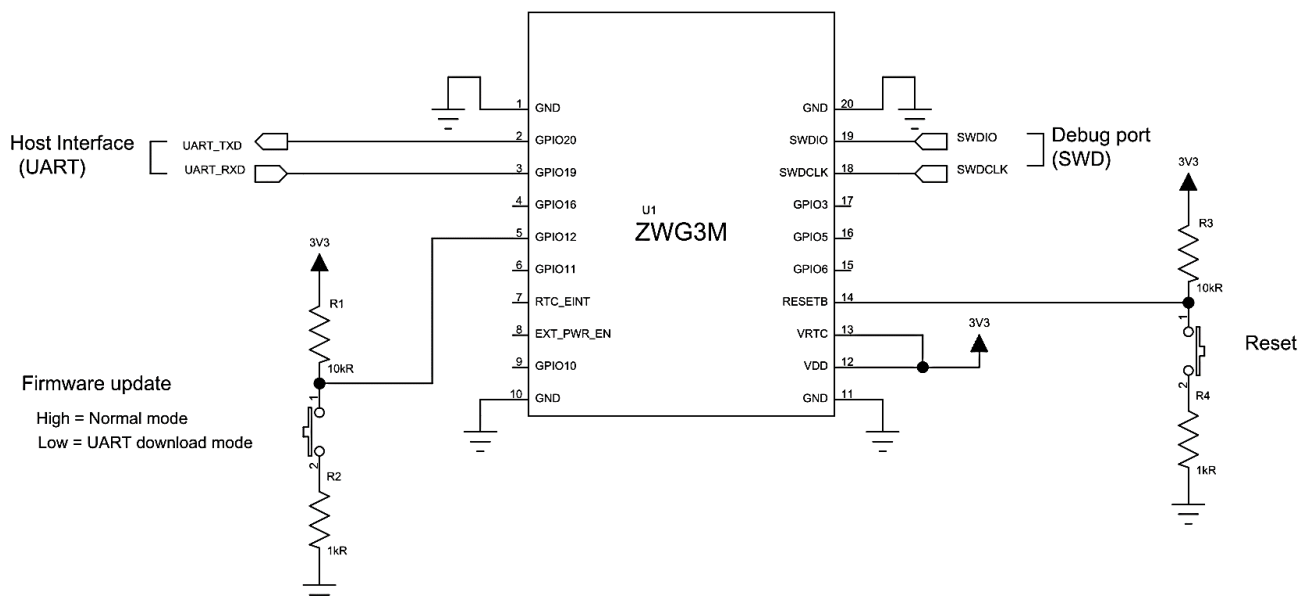
4.4 G3 Internal connection
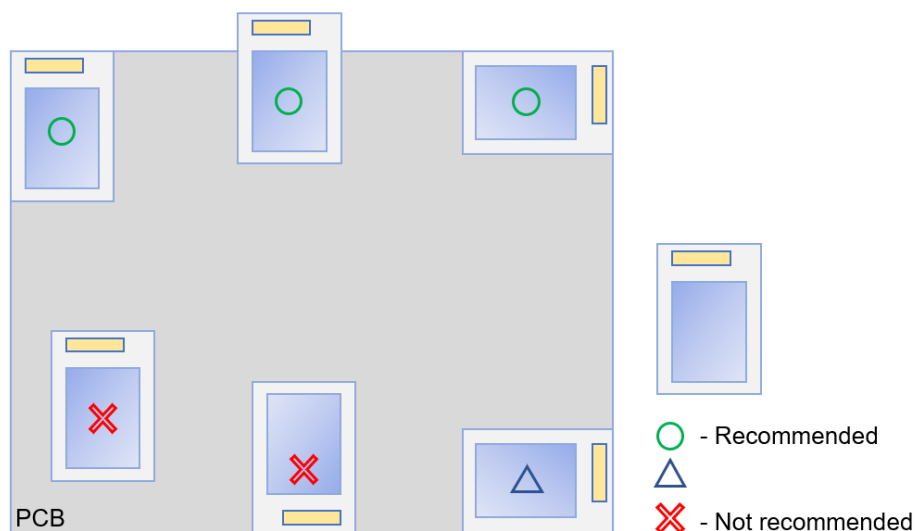
G3 is internally connected to MT7686 via I2C interface.

G3 pin	MT7686 pin	
SCL	GPIO8	
SDA	GPIO9	

5. Application

5.1 Application schematic

5.2 Recommended application PCB layout

Recommended application PCB layout

- There must be no signal traces or metallic components under the antenna area.

- Ensure that all ground is cleared on all layers of the PCB where the module is mounted.

- Do not route signal traces underneath the module

6. Reflow Profile

6.1 Reflow profile

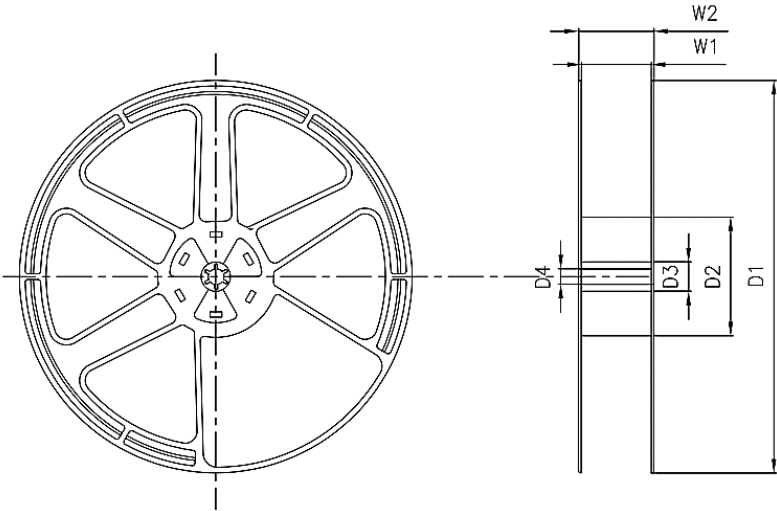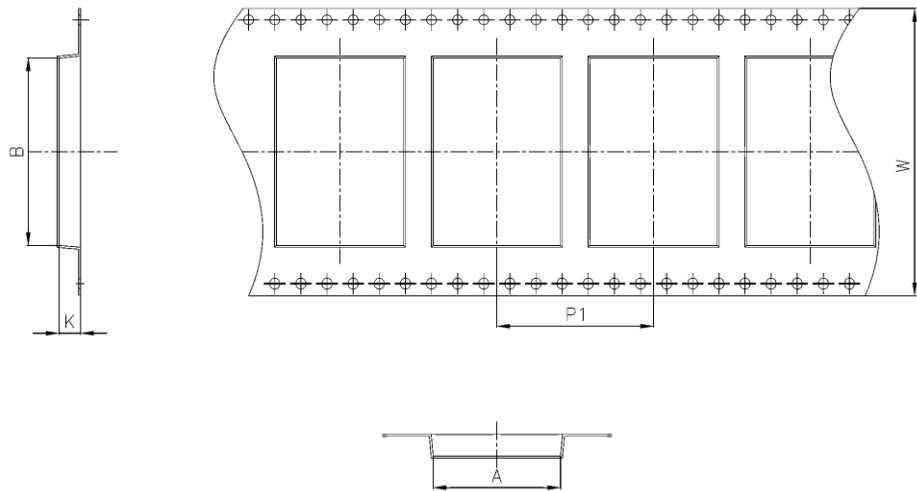| Ramp up rate	3℃/second max
Maximum time maintained above 217 ℃	120 seconds
Peak temperature	250℃
Maximum time within 5 ℃ of peak temperature	20 seconds
Ramp down rate	6℃/second max

Reflow profile recommendation
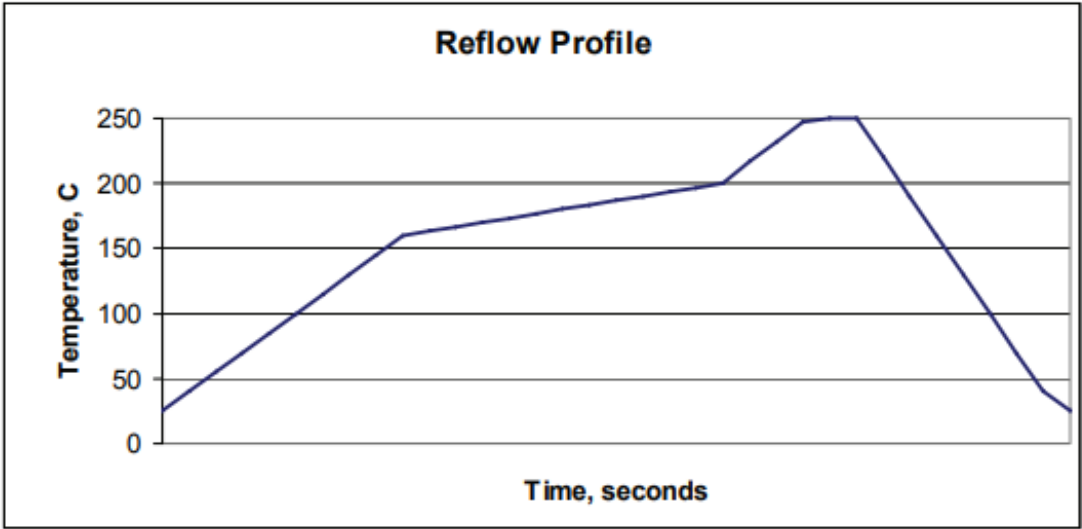
Reflow profile pattern
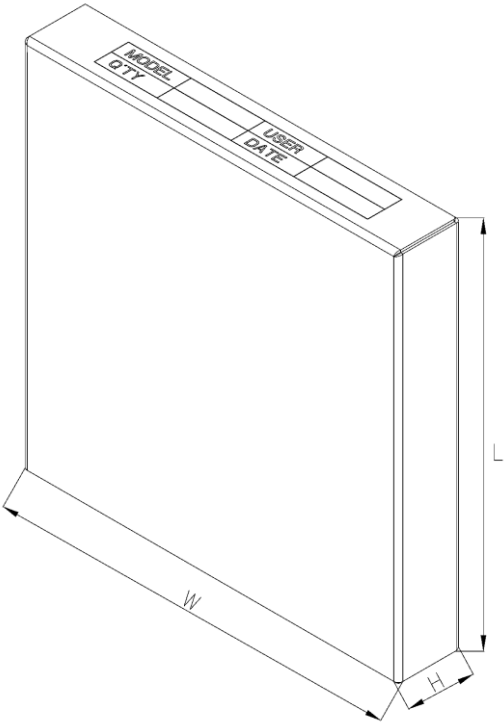
7. Packaging

7.1 Reel Tape / Reel / Reel Box

D1(mm)	D2(mm)	D3(mm)	D4(mm)	W1(mm)	W2(mm)
Φ330±2.0	Φ80	Φ20	Φ13±0.5	48	46

Reel dimensions

A(mm)	B(mm)	K(mm)	W(mm)	P1(mm)
20.3	27.3	2.9	43	24

Tape dimensions

L(mm)	W(mm)	H(mm)
360	360	70

Box dimensions

8. Document Version History

Version	Date	Description
V1.0	2019.09.30	Initial Release

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