# PKM8720DF-A00-F10 Module

## DATASHEET

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This document is intended for the software engineer's reference and provides detailed programming information.

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

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# Contents

# 1    Module Overview

## 1.1    General Description

The PKM8720DF-A00-F10 is a multi-radio MCU Module. With the open CPU architecture, customers can develop advanced applications running on the dual-core 32-bit MCU. The radio provides support for Wi-Fi 802.11 a/b/g/n in the 2.4GHz/5GHz band and BLE 5.0 communications. The rich set of peripherals and high performance make it an ideal choice for smart homes, industrial automation, consumer electronics, etc.

## 1.2    Features

**Chipset and Memory:**

- RTL8720DF-VA1-CG (named RTL8720DF thereafter) chipset embedded, dual-core processor: KM4 up to 200MHz, KM0 up to 20MHz
- KM4 on-chip memory: up to 512KB SRAM
- KM0 on-chip memory: up to 64KB SRAM
- 4MB Flash

**Wi-Fi:**

- 802.11 a/b/g/n 1x1, 2.4GHz & 5GHz
- Center frequency range of operating channel: 2412MHz ~ 2462MHz, 5180-5240MHz and 5745-5825MHz
- Support 20MHz/40MHz bandwidth, up to the data rate of MCS7
- Wi-Fi WEP, WPA, WPA2, WPA3, WPS; open, shared key, and pair-wise key authentication services
- Support low power Tx/Rx for short-range application
- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)

**Bluetooth Low Energy:**

- Bluetooth LE: Bluetooth 5.0
- Speed: 125Kbps, 500Kbps, 1Mbps
- Supports LE secure connections
- Supports LE scatternet
- Supports 3 Master links/1 Slave link
- Co-existence RF design between Wi-Fi and Bluetooth

**Peripherals:**

- 4x UART interface, baud rate up to 6MHz
- 2 x I2C, two speed modes: standard up to 10Kbps, fast up to 400Kbps
- 2 x SDIO Host/SDIO 2.0 Device, clock up to 50MHz
- 3 x SPI Master/Slave, baud rate up to 50MHz
- 13 x PWM with configurable duration and duty cycle from 0 ~ 100%
- 20 x programmable GPIOs
- KM4 and KM0 both have a GDMA controller, each with 6 channels

**Antenna Option:**

- External antenna

**Operating Conditions:**

- Operating input voltage: (3.3 ± 10%)V
- Operating ambient temperature: -20°C to 85°C
- Green certification: RoHS/REACH

# 2    Module Block Diagram

This module includes the chipset, crystal component, R/L/C components, etc.
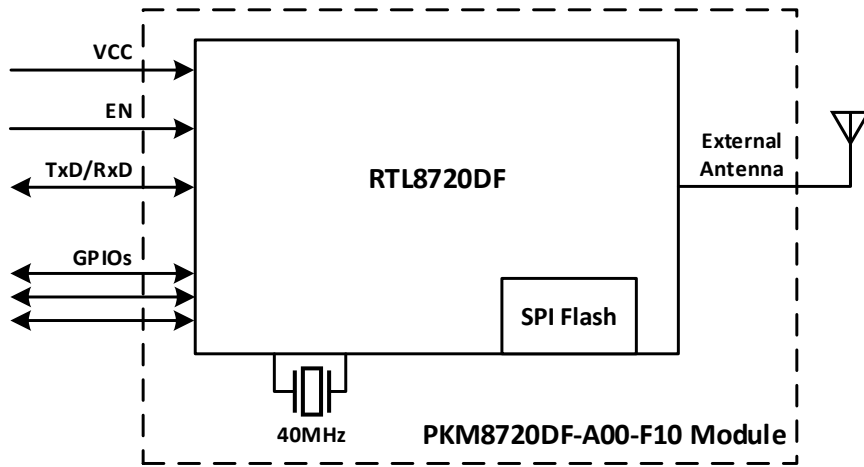


Figure 1.    Block Diagram

# 3　Module Pin Definition

## 3.1　Module Pin Layout

This module has 44 pins.
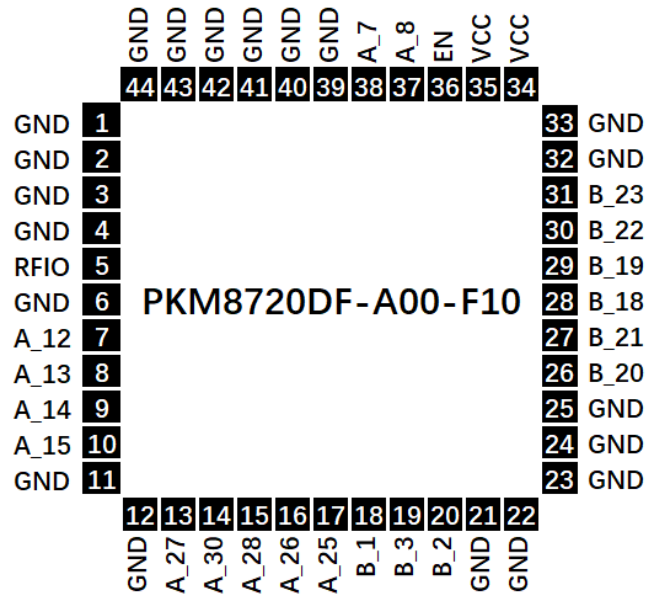


Figure 2.　Module Pin Layout (Top View)

## 3.2　Module Pin Description

### 3.2.1　Pin Description

Table 1.　Pin Description

| Pin Name | Pin No. | Type | Description |
|---|---|---|---|
| GND | 1 | P | Ground |
| GND | 2 | P | Ground |
| GND | 3 | P | Ground |
| GND | 4 | P | Ground |
| RFIO | 5 | I/O | Wi-Fi/BT External Antenna Interface |
| GND | 6 | P | Ground |
| A_12 | 7 | I/O | GPIOA_12/SPI_MOSI |
| A_13 | 8 | I/O | GPIOA_13/SPI_MISO |
| A_14 | 9 | I/O | GPIOA_14/SPI_CLK/UART_RTS |
| A_15 | 10 | I/O | GPIOA_15/SPI_CS/UART_CTS |
| GND | 11 | P | Ground |
| GND | 12 | P | Ground |
| A_27 | 13 | I/O | GPIOA_27/SWD_DAT |
| A_30 | 14 | I/O | GPIOA_30/PWM |
| A_28 | 15 | I/O | GPIOA_28/RREF |
| A_26 | 16 | I/O | GPIOA_26/HSDP |
| A_25 | 17 | I/O | GPIOA_25/HSDM |
| B_1 | 18 | I/O | GPIOB_1/UART_TXD |
| B_3 | 19 | I/O | GPIOB_3/SWD_CLK |
| B_2 | 20 | I/O | GPIOB_2/UART_RXD |
| GND | 21 | P | Ground |

| | | | |
|---|---|---|---|
| GND | 22 | P | Ground |
| GND | 23 | P | Ground |
| GND | 24 | P | Ground |
| GND | 25 | P | Ground |
| B_20 | 26 | I/O | GPIOB_20/SDIO_CMD |
| B_21 | 27 | I/O | GPIOB_21/SDIO_CLK |
| B_18 | 28 | I/O | GPIOB_18/SDIO_D2 |
| B_19 | 29 | I/O | GPIOB_19/SDIO_D3 |
| B_22 | 30 | I/O | GPIOB_22/SDIO_D0 |
| B_23 | 31 | I/O | GPIOB_23/SDIO_D1 |
| GND | 32 | P | Ground |
| GND | 33 | P | Ground |
| VCC | 34 | P | Power Supply |
| VCC | 35 | P | Power Supply |
| EN | 36 | I | • High: Enables the chip.<br>• Low: Module power off. |
| A_8 | 37 | I/O | GPIOA_8/UART_LOG_RXD |
| A_7 | 38 | I/O | GPIOA_7/UART_LOG_TXD |
| GND | 39 | P | Ground |
| GND | 40 | P | Ground |
| GND | 41 | P | Ground |
| GND | 42 | P | Ground |
| GND | 43 | P | Ground |
| GND | 44 | P | Ground |

ⓘ NOTE

- ■ *P: power supply*
- ■ *I: input*
- ■ *O: output*

## 3.2.2  Strapping Pins

This module has 3 strapping pins.

Table 2.    Strapping Pin

| Pin Name | Pin No. | Default State | Description |
|---|---|---|---|
| A_7 | 38 | Pull up | 1: Normal mode (default)<br>0: Flash download mode |
| A_27 | 13 | Pull up | 1: Normal mode (default)<br>0: Test mode |
| A_30 | 14 | Pull up | 1: Internal 1.1V regulator works at SPS mode (default)<br>0: Internal 1.1V regulator works at LDO mode |

# 4　RF Characteristic

## 4.1　Wi-Fi Radio Standard

Table 3.　Wi-Fi Radio Standard

| Wi-Fi Wireless Standard | Description |
|---|---|
| Wi-Fi frequency range | ● 2412MHz ~ 2462MHz (2.4GHz ISM Band)<br>● 5180-5240MHz and 5745-5825MHz(5GHz) |
| Wi-Fi wireless standard | IEEE 802.11 a/b/g/n |
| Wi-Fi wireless standard Modulation | DSSS, DBPSK, DQPSK, CCK and OFDM<br>(BPSK/QPSK/16-QAM/64-QAM) |
| Wi-Fi wireless data rate | ● 802.11a: 6/9/12/18/24/36/48/54 Mbps<br>● 802.11b: 1/2/5.5/11 Mbps<br>● 802.11g: 6/9/12/18/24/36/48/54 Mbps<br>● 802.11n: HT20 MCS0-7, HT40 MCS0-7 |

### 4.1.1　Wi-Fi 2.4GHz Band RF Transmitter Specification

Table 4.　Wi-Fi 2.4GHz Transmitter Performance Specification

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | - | 2412 | - | 2484 | MHz |
| Tx power at the antenna port for the highest power level (25°C) | 1 Mbps DSSS | - | 20 | - | dBm |
| | 11 Mbps DSSS | - | 18 | - | dBm |
| | 6 Mbps OFDM | - | 19 | - | dBm |
| | 54 Mbps OFDM | - | 17 | - | dBm |
| | HT20 MCS0 | - | 18 | - | dBm |
| | HT20 MCS7 | - | 16 | - | dBm |
| | HT40 MCS0 | - | 18 | - | dBm |
| | HT40 MCS7 | - | 16 | - | dBm |
| Tx EVM | 1 Mbps DSSS | - | 8 | - | % |
| | 11 Mbps DSSS | - | 8 | - | % |
| | 6 Mbps OFDM | - | -5 | - | dB |
| | 54 Mbps OFDM | - | -25 | - | dB |
| | HT20 MCS0 | - | -5 | - | dB |
| | HT20 MCS7 | - | -28 | - | dB |
| | HT40 MCS0 | - | -5 | - | dB |
| | HT40 MCS7 | - | -28 | - | dB |
| Carrier Suppression | | - | - | -30 | dBc |
| Harmonic Output Power | 2nd Harmonic | - | - | -45 | dBm/MHz |
| | 3rd Harmonic | - | - | -45 | dBm/MHz |

### 4.1.2　Wi-Fi 2.4GHz Band RF Receiver Specification

Table 5.　Wi-Fi 2.4GHz Receiver Performance Specification

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | - | 2412 | - | 2484 | MHz |
| 802.11b<br>Rx Sensitivity (8% PER) | 1 Mbps DSSS | - | -96 | - | dBm |
| | 2 Mbps DSSS | - | -94 | - | dBm |
| | 5.5 Mbps DSSS | - | -92 | - | dBm |
| | 11 Mbps DSSS | - | -89 | - | dBm |
| 802.11g<br>Rx Sensitivity (10% PER) | 6 Mbps OFDM | - | -93 | - | dBm |
| | 9 Mbps OFDM | - | -92 | - | dBm |
| | 12 Mbps OFDM | - | -91 | - | dBm |
| | 18 Mbps OFDM | - | -88 | - | dBm |

| | | | | | |
|---|---|---|---|---|---|
| | 24 Mbps OFDM | - | -85 | - | dBm |
| | 36 Mbps OFDM | - | -82 | - | dBm |
| | 48 Mbps OFDM | - | -77 | - | dBm |
| | 54 Mbps OFDM | - | -75 | - | dBm |
| 802.11n<br>Rx Sensitivity (10% PER) | HT20 MCS0 | - | -93 | - | dBm |
| | HT20 MCS1 | - | -90 | - | dBm |
| | HT20 MCS2 | - | -87 | - | dBm |
| | HT20 MCS3 | - | -84 | - | dBm |
| | HT20 MCS4 | - | -81 | - | dBm |
| | HT20 MCS5 | - | -76 | - | dBm |
| | HT20 MCS6 | - | -75 | - | dBm |
| | HT20 MCS7 | - | -73 | - | dBm |
| | HT40 MCS0 | - | -91 | - | dBm |
| | HT40 MCS1 | - | -87 | - | dBm |
| | HT40 MCS2 | - | -84 | - | dBm |
| | HT40 MCS3 | - | -81 | - | dBm |
| | HT40 MCS4 | - | -78 | - | dBm |
| | HT40 MCS5 | - | -73 | - | dBm |
| | HT40 MCS6 | - | -72 | - | dBm |
| | HT40 MCS7 | - | -70 | - | dBm |
| Maximum Receive Level | 1 Mbps DSSS | - | - | 0 | dBm |
| | 11 Mbps DSSS | - | - | 0 | dBm |
| | 6Mbps OFDM | - | - | 0 | dBm |
| | 54Mbps OFDM | - | - | 0 | dBm |
| | MCS 0 | - | - | 0 | dBm |
| | MCS 7 | - | - | 0 | dBm |

## 4.1.3   Wi-Fi 5GHz Band RF Transmitter Specification

Table 6.    Wi-Fi 5GHz Transmitter Performance Specification

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | - | 5180 | - | 5825 | MHz |
| Tx power at the antenna port for the highest power level (25°C) | 6 Mbps OFDM | - | 17 | - | dBm |
| | 54 Mbps OFDM | - | 13 | - | dBm |
| | HT20 MCS0 | - | 15 | - | dBm |
| | HT20 MCS7 | - | 12 | - | dBm |
| | HT40 MCS0 | - | 15 | - | dBm |
| | HT40 MCS7 | - | 12 | - | dBm |
| Tx EVM | 6 Mbps OFDM | - | -5 | - | dB |
| | 54 Mbps OFDM | - | -25 | - | dB |
| | HT20 MCS0 | - | -5 | - | dB |
| | HT20 MCS7 | - | -28 | - | dB |
| | HT40 MCS0 | - | -5 | - | dB |
| | HT40 MCS7 | - | -28 | - | dB |
| Carrier Suppression | | - | - | -30 | dBc |

## 4.1.4   Wi-Fi 5GHz Band RF Receiver Specification

Table 7.    Wi-Fi 5GHz Receiver Performance Specification

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | - | 5180 | - | 5825 | MHz |
| 802.11a<br>Rx Sensitivity (10% PER) | 6 Mbps OFDM | - | -91 | - | dBm |
| | 9 Mbps OFDM | - | -91 | - | dBm |
| | 12 Mbps OFDM | - | -90 | - | dBm |
| | 18 Mbps OFDM | - | -87 | - | dBm |
| | 24 Mbps OFDM | - | -84 | - | dBm |

| | | | | | |
|---|---|---|---|---|---|
| | 36 Mbps OFDM | - | -81 | - | dBm |
| | 48 Mbps OFDM | - | -76 | - | dBm |
| | 54 Mbps OFDM | - | -74 | - | dBm |
| 802.11n<br>Rx Sensitivity (10% PER) | HT20 MCS0 | - | -91 | - | dBm |
| | HT20 MCS1 | - | -89 | - | dBm |
| | HT20 MCS2 | - | -86 | - | dBm |
| | HT20 MCS3 | - | -83 | - | dBm |
| | HT20 MCS4 | - | -80 | - | dBm |
| | HT20 MCS5 | - | -75 | - | dBm |
| | HT20 MCS6 | - | -73 | - | dBm |
| | HT20 MCS7 | - | -72 | - | dBm |
| | HT40 MCS0 | - | -89 | - | dBm |
| | HT40 MCS1 | - | -86 | - | dBm |
| | HT40 MCS2 | - | -83 | - | dBm |
| | HT40 MCS3 | - | -80 | - | dBm |
| | HT40 MCS4 | - | -77 | - | dBm |
| | HT40 MCS5 | - | -72 | - | dBm |
| | HT40 MCS6 | - | -71 | - | dBm |
| | HT40 MCS7 | - | -69 | - | dBm |
| Maximum Receive Level | 6Mbps OFDM | - | - | 0 | dBm |
| | 54Mbps OFDM | - | - | 0 | dBm |
| | MCS 0 | - | - | 0 | dBm |
| | MCS 7 | - | - | 0 | dBm |

# 4.2    Bluetooth LE Radio Standard

## 4.2.1    Bluetooth LE RF Transmitter Specification

Table 8.    Bluetooth LE Transmitter Performance Specification

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | - | 2402 | - | 2480 | MHz |
| Tx Output Power | LE1M | -10 | 4.5 | 10 | dBm |
| | | | | | |
| Modulation Characteristics (LE1M) | ΔF1 Avg. | 225 | - | 275 | kHz |
| | ΔF2 Max. | 185 | - | - | kHz |
| | Modulation Index (ΔF2 Avg./ΔF1 Avg.) | 0.8 | - | - | |
| | ΔF1 Avg. | 450 | - | 550 | kHz |
| | ΔF2 Max. | 370 | - | - | kHz |
| | Modulation Index (ΔF2 Avg./ΔF1 Avg.) | 0.8 | - | - | |
| Modulation Characteristics Stable Modulation (LE1M) | ΔF1 Avg. | 247.5 | - | 252.5 | kHz |
| | ΔF2 Max. | 185 | - | - | kHz |
| | Modulation Index (ΔF2 Avg./ΔF1 Avg.) | 0.8 | - | - | |

## 4.2.2    Bluetooth LE RF Receiver Specification

Table 9.    Bluetooth LE Receiver Performance Specification

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | - | 2402 | - | 2480 | MHz |
| Rx Sensitivity @30.8% PER | LE1M | - | -99 | - | dBm |
| | | | | | |

# 5 Module Electrical Characteristics

## 5.1 Module Operating Conditions

Table 10.    Module Operating Conditions

| Symbol | Parameter | Min. | Typ. | Max. | Units |
|--------|-----------|------|------|------|-------|
| VCC | Power supply voltage | 3.0 | 3.3 | 3.6 | V |
| Ta | Ambient operating temperature | -20 | - | 85 | °C |
| Ts | Storage temperature | -40 | - | 125 | °C |

## 5.2 Module DC Characteristics

Table 11.    DC Characteristic (3.3V, 25°C)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|------------|------|------|------|-------|
| VIH | Input-High Voltage | LVTTL | 2.0 | - | - | V |
| VIL | Input-Low Voltage | LVTTL | - | - | 0.8 | V |
| VOH | Output-High Voltage | LVTTL | 2.4 | - | - | V |
| VOL | Output-Low Voltage | LVTTL | - | - | 0.4 | V |
| VT+ | Schmitt-trigger High Level | - | 1.78 | 1.87 | 1.97 | V |
| VT- | Schmitt-trigger Low Level | - | 1.36 | 1.45 | 1.56 | V |
| IIL | Input-Leakage Current | VIN=3.3V or 0 | -10 | $\pm1$ | 10 | $\mu$A |

# 6　Module Schematics

## 6.1　Module Internal Schematics



Figure 3.　Module internal schematics

## 6.2　Module Reference Schematics
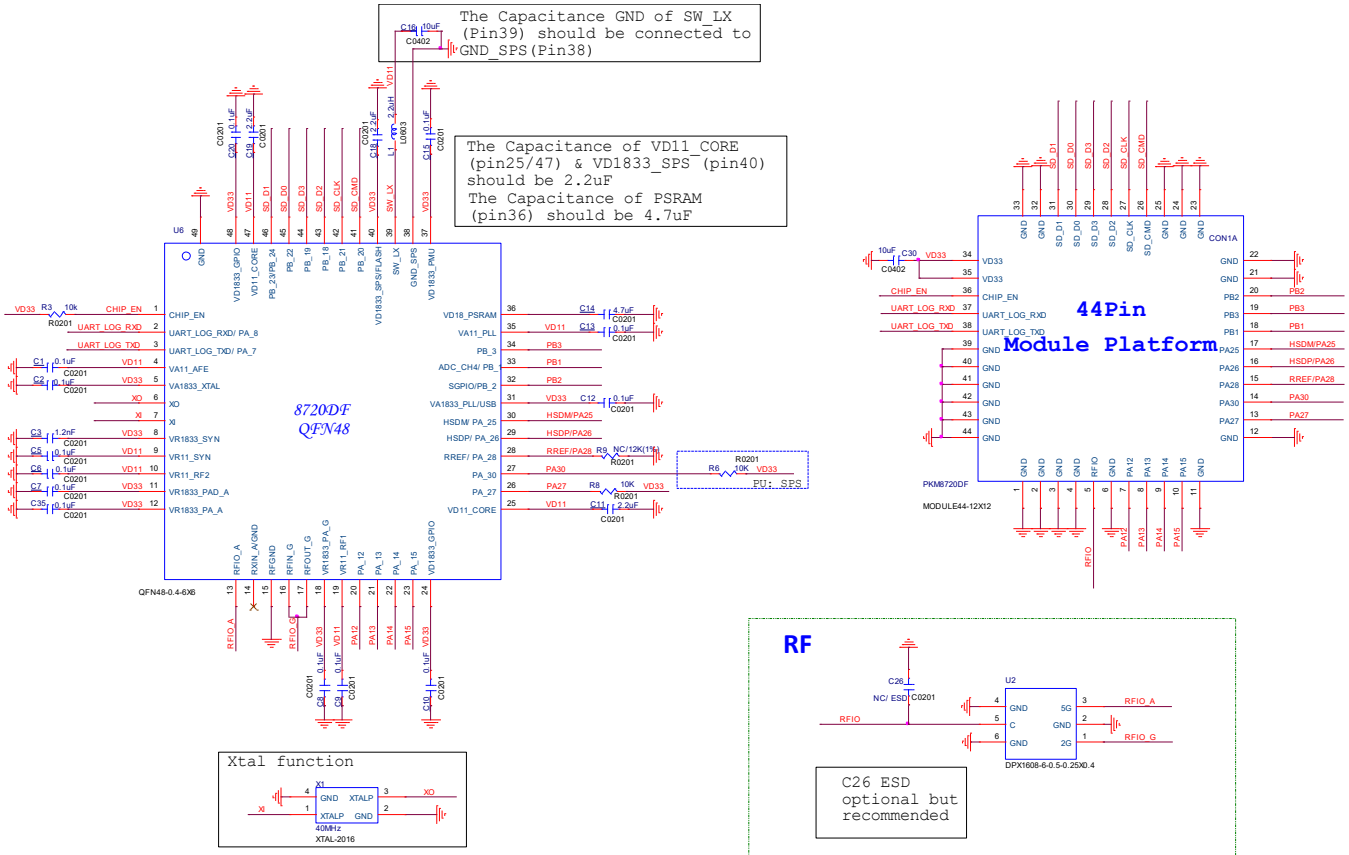


Figure 4.　Module Reference schematics
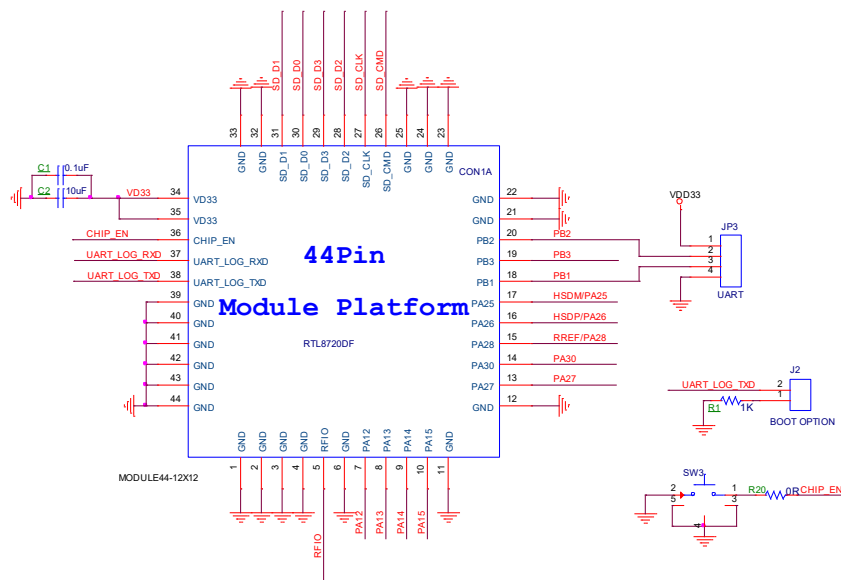
# 7 Physical Dimensions

Module dimension: 12 ± 0.2mm (L) x 12 ± 0.2mm (W) x 2.5 ± 0.1mm (H)
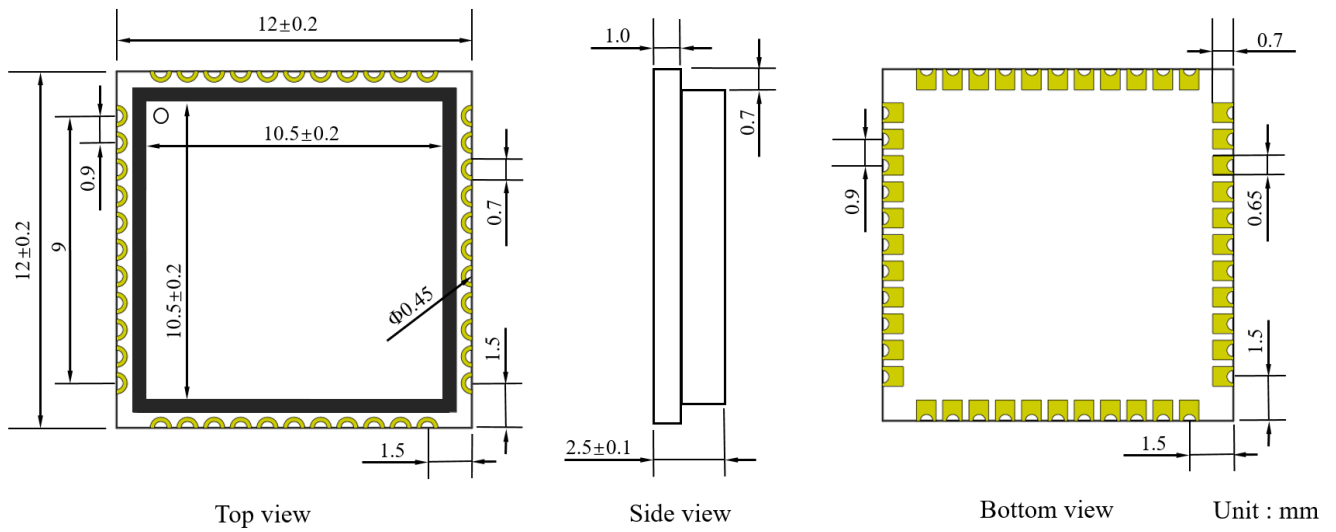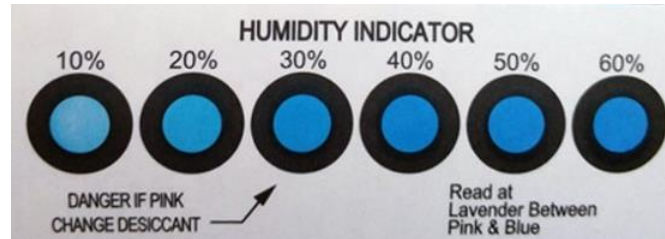


Top view                Side view                Bottom view      Unit : mm

Figure 5.    Module Physical Dimensions

# 8 Product Handling

## 8.1 Storage Conditions

The 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 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 ≤30°C/60% 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.

🛈 NOTE

*Level and body temperature are defined by IPC/JEDECJ-STD-020.*

## 8.2 Production Instructions

- The PKM8720F-A00-F10 module can be packaged with the SMT process according to the customer's PCB designed to be SMT-packaged. After being unpacked, the module must be soldered within 24 hours. Otherwise, it needs to be put into the drying cupboard where the relative humidity is not greater than 10%; or it needs to be packaged again under vacuum and the exposure time needs to be recorded (the total exposure time cannot exceed 168 hours).
  - SMT devices needed:
    - ◆ Mounter
    - ◆ SPI
    - ◆ Reflow soldering machine
    - ◆ Thermal profiler
    - ◆ Automated optical inspection (AOI) equipment
  - Baking devices needed:
    - ◆ Cabinet oven
    - ◆ Anti-electrostatic and heat-resistant trays
    - ◆ Anti-electrostatic and heat-resistant gloves
- Baking settings:
  - Temperature: 40°C and ≤ 5% RH for reel package and 125°C and ≤5% RH for tray package (use the heat-resistant tray rather than a plastic container)
  - Time: 168 hours for reel package and 12 hours for tray package
  - Alarm temperature: 50°C for reel package and 135°C for tray package
  - Production-ready temperature after natural cooling: < 36°C
  - Re-baking situation: 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, do not use the wave soldering to solder them. Because these modules are Level-3 moisture-sensitive devices, they are very likely to get damp when exposed beyond the allowable time. In this case, if they are soldered at high temperatures, it may result in device failure or poor soldering.
- In the whole production process, take electrostatic discharge (ESD) protective measures.

- To guarantee the passing rate, it is recommended to use the SPI and AOI to monitor the quality of solder paste printing and mounting.

## 8.3    Recommended Oven Temperature Curve

There are some differences between the set temperatures and the actual temperatures. All the temperatures listed in this datasheet are obtained through actual measurements.

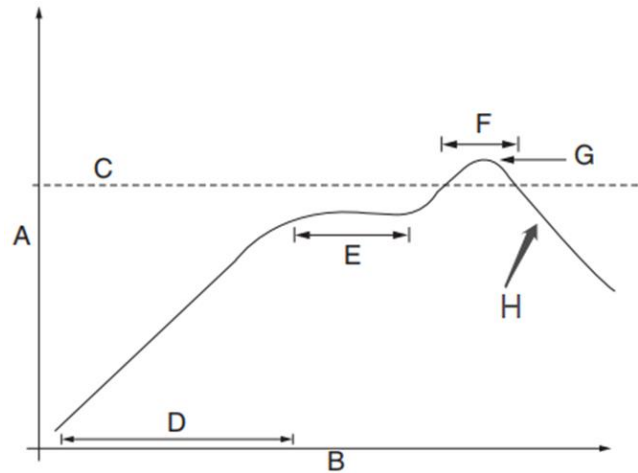For the SMT process, set oven temperatures according to Figure 6.

Figure 6.    Reflow Soldering Curve Diagram

- 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

ⓘ NOTE

*Adjust the balance time to ensure the rationalization treatment of gas when tin paste solves. If there are too much gaps on the PCB board, increase the balance time. Considering that the product is long placed in the welding area, to prevent components and bottom plate from damage.*

# Revision History

| Data | Revision | Change Note |
|------|----------|-------------|
| 2022-11-04 | 1.0 | Initial release |

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ææ⯑)[ơ@¦Á´ᵈ⯑ᵃ⯑{ ãᵒơ^¦ᵈℤ¸@ᵒⲁⲁ)Áơ@¸Áơ@ÁꝎⵌⵌÔᵈơ@¦ãⲁææⲁ}À&ⲁÁ¦Á{}*^¦Á&⯑}•ãⲁ^¦^åÁ¸ ⲁⲁㄿⲅⲁ&ⲁⲁⲁᵈⲁơ@¸ÁꝎⵌⵌÔ¦ℤⵌⵌⲅ&ⲁⲁ⯑)[ơⲁ^Á•^•åⲁ}Á
ơ@¸Á ⲁ⯑ ꜳⲁÀ¦[åˇ &ⓏQ¸Áơ@¸•^¦&ã&^{ •œⲁ)&•⯑ℤ¸@¸ÁꝎÒⵜÁᵈⲁc^*¦ æⲁ[¦Á⯑ⲁ|¦ⲁ^Á^•⯑][}•ãⲁ^¦À[¦^ ‑ evaluating the end product
(including the transmitter) and obtaining a separate FCC authorization.
Radiation Exposure Statement:
This module support BT(2402-2480MHz) ,WIFI2412~2462MHz,5180~5240MHz,5745~5825MHz

which compliance with part 15.249,15.247,15.407 and apply for Limited Single Modular Approval .
The module is limited to OEM installation only.
The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.
OEM integrator shall equipped the antenna to compliance with antenna requirement part 15.203& 15.204 and must not be co-located or operating in conjunction with any other antenna or transmitters. And OEM host shall implement a Class II Permissive Change (C2PC) or a new FCC ID to demonstrate complied with FCC standard.
The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.
The final end product must be labelled in a visible area with the following: "Contains FCC ID:2A94W-PKM8720DF"

ANT
The antenna is PCB antenna, and is permanent connection antenna. the antenna is 2.4G 3.7dBi, 5G 3.1dBi ,This antenna is permanently paired with a product to sell.

Module operation instructions

1.	According to the following requirements of the power supply, power up, about 3 seconds to to complete the initial。
2.	Iphone/Android mobile phone BT/WIFI  function to open, search to the corresponding Wireless module name (name can be changed according to customer production requirements), click the name of the BT/WIFI and select the connection.
3.	open application software (need to install the company's specific application software development, application software interface can be customized according to customer's product requirements), click on the interface to see the scene。
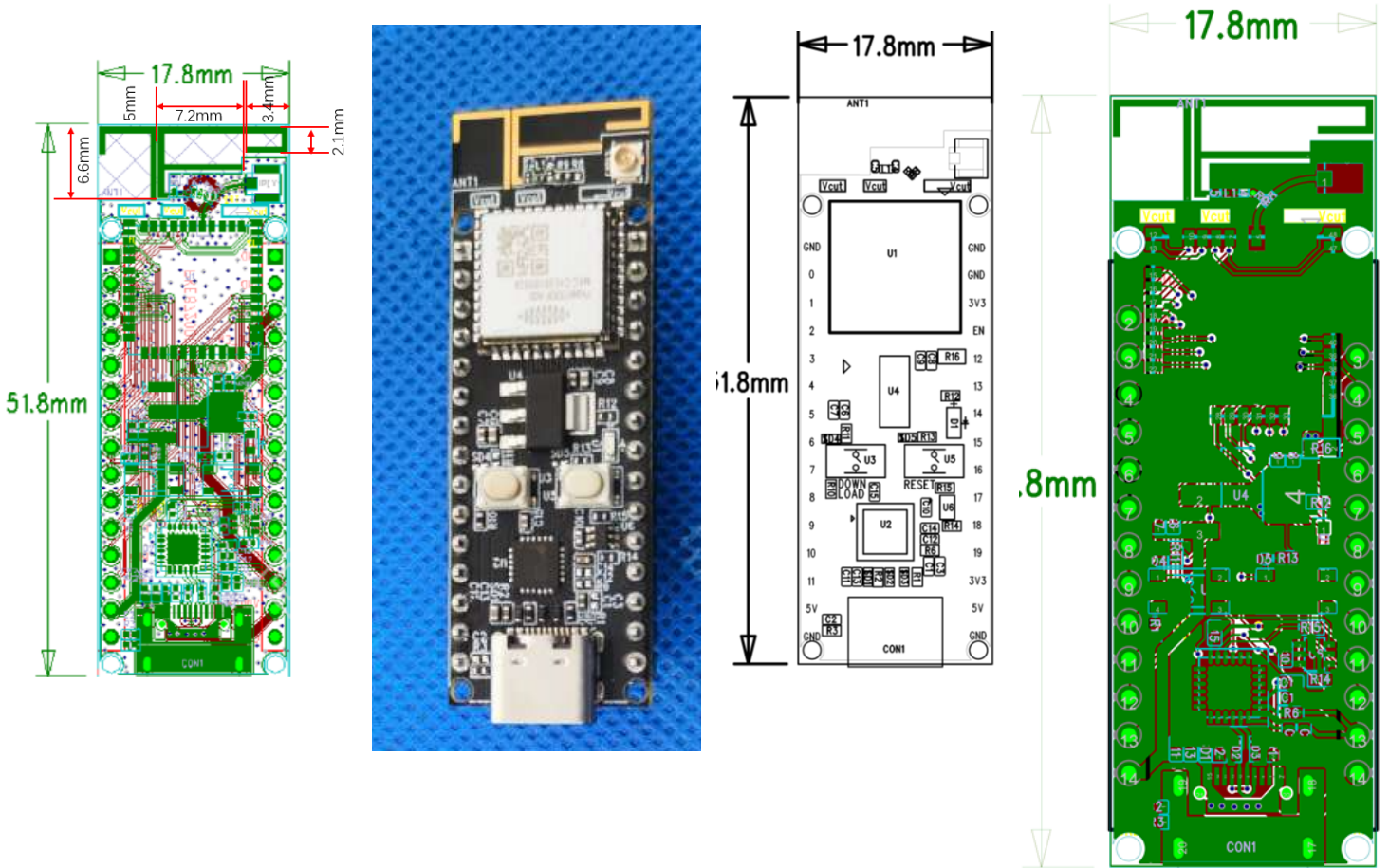
**44 Pin module**
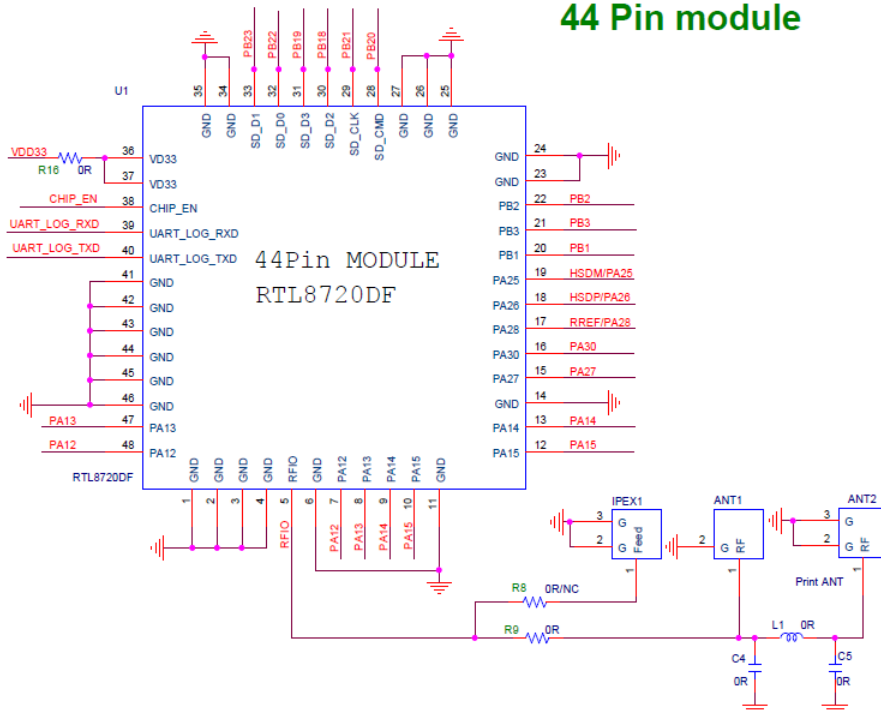
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

**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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.