# PKM8721DCM-E10-F32 Module

## DATASHEET

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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 PKM8721DCM-E10-F32 is a multi-radio MCU module. With the open CPU architecture, customers can develop advanced applications running on the dual RISC cores. In addition, the embedded 8MB PSRAM can support running basic AI algorithms. It supports Wi-Fi 802.11 a/b/g/n wireless LAN(WLAN) network with 40MHz bandwidth and BLE 5.0 communications. The rich set of peripherals and high performance make it an ideal choice for AI toys, consumer electronics, etc.

## 1.2 Features

**Chipset and Memory:**

- RTL8721DCM chipset embedded, dual-core processor: KM4 up to 345MHz, KM0 up to 115MHz
- on-chip memory: 512KB + 160KB SRAM
- 8MB MCM PSRAM
- 16MB Flash

**Wi-Fi:**

- 802.11 a/b/g/n 1x1, 2.4GHz & 5GHz
- Center frequency range of operating channel: 2412MHz ~ 2484MHz, 5180MHz ~ 5825MHz
- Support 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
- Power-saving mechanism
- Channel management and co-existence

**Bluetooth Low Energy:**

- Bluetooth 5.0 (LE-1M/LE-2M/LE-Coded PHY (long range))
- Supports piconets in a scatter-net (up to 8 master roles and 3 slave roles)
- Supports LE data length extension
- Supports Link Layer privacy
- Supports LE advertising extensions
- Co-existence RF design between Wi-Fi and Bluetooth

**Peripherals:**

- 2 x I2S interface
- 4 x UART interface, baud rate up to 8Mbps within high-speed mode (40MHz)
- 2 x I2C, three speed modes: standard up to 100Kbps, fast up to 400Kbps, high to 3.4Mbps
- SDIO Device, Default speed mode (25MHz) and high-speed mode (50MHz)
- 2 x SPI, up to 50Mbps in master and slave modes, in half-duplex, full-duplex and simplex modes.
- 8 x PWM with configurable duration and duty cycle from 0 ~ 100%
- Cap touch x 4 channels
- ADC x (7+1) channels
- Programmable GPIOs
- USB 2.0 Device (Full Speed)
- IR

**Antenna Option:**

- On-board PCB Antenna

**Operating Conditions:**

- Operating input voltage: (3.3 ± 10%)V
- Operating ambient temperature: -20°C to 85°C

# 2 Module Block Diagram

This module includes the chipset, crystal component, R/L/C components for RF matching, decoupling and RF radio antenna.

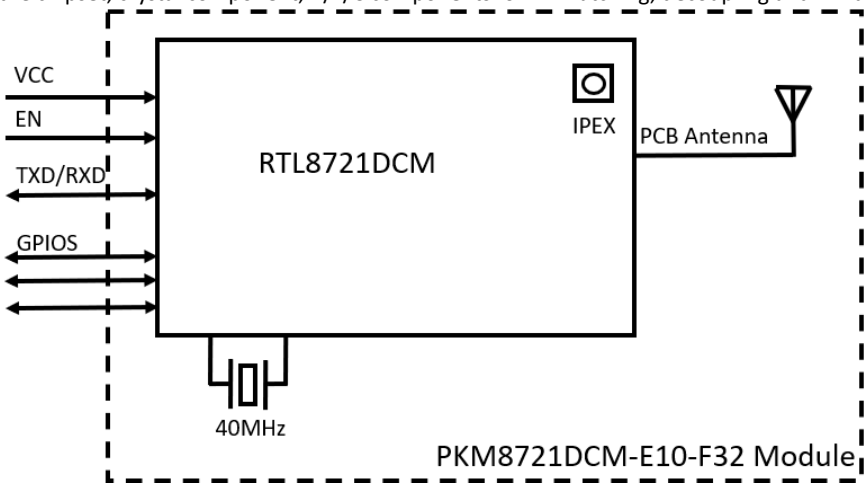



Figure 1. Block Diagram

# 3 Module Pin Definition

## 3.1 Module Pin Layout

This module has 54 pins.

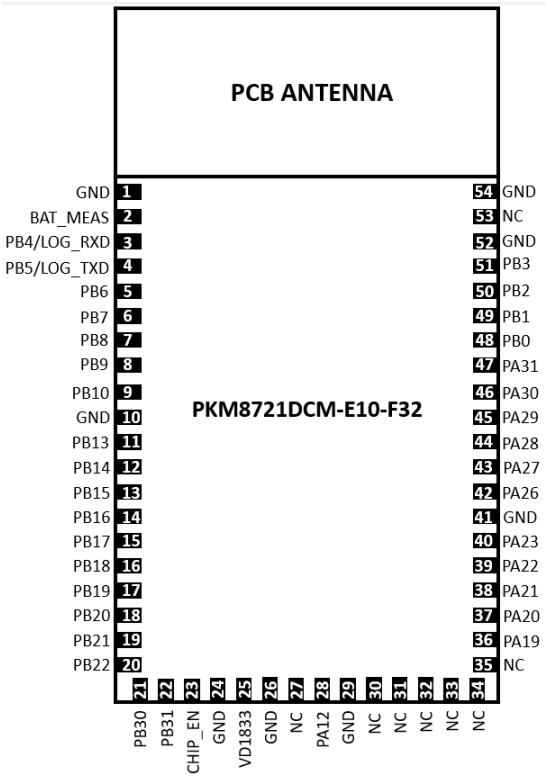



Figure 2. Module Pin Layout (Top View)

## 3.2 Module Pin Description

### 3.2.1 Pin Description

Table 1. Pin Description

| Pin Name | Pin No. | Type | Description | UART is available | I2C is available | PWM is available |
|---|---|---|---|---|---|---|
| GND | 1 | P | Ground | NA | NA | NA |
| BAT_MEAS | 2 | I/O | BAT_MEAS | NA | NA | NA |
| PB4 | 3 | I/O | UART_LOG_RXD | NA | NA | NA |
| PB5 | 4 | I/O | UART_LOG_TXD | NA | NA | NA |
| PB6 | 5 | I/O | GPIOB_6 | √ | √ | √ |
| PB7 | 6 | I/O | GPIOB_7 | √ | √ | √ |
| PB8 | 7 | I/O | GPIOB_8 | √ | √ | √ |
| PB9 | 8 | I/O | GPIOB_9 | √ | √ | √ |
| PB10 | 9 | I/O | GPIOB_10 | √ | √ | √ |
| GND | 10 | P | Ground | NA | NA | NA |
| PB13 | 11 | I/O | GPIOB_13 | √ | √ | √ |
| PB14 | 12 | I/O | GPIOB_14 | √ | √ | √ |
| PB15 | 13 | I/O | GPIOB_15 | √ | √ | √ |
| PB16 | 14 | I/O | GPIOB_16 | √ | √ | √ |
| PB17 | 15 | I/O | GPIOB_17 / SPI1_CS | √ | √ | √ |

| | | | | | | |
|---|---|---|---|---|---|---|
| PB18 | 16 | I/O | GPIOB_18 / SPI1_CLK | √ | √ | √ |
| PB19 | 17 | I/O | GPIOB_19 / SPI1_MOSI | √ | √ | √ |
| PB20 | 18 | I/O | GPIOB_20 / SPI1_MISO | √ | √ | √ |
| PB21 | 19 | I/O | GPIOB_21 | √ | √ | √ |
| PB22 | 20 | I/O | GPIOB_22 | √ | √ | √ |
| PB30 | 21 | I/O | GPIOB_30 | √ | √ | √ |
| PB31 | 22 | I/O | GPIOB_31 | √ | √ | √ |
| EN | 23 | I | ● High: Enable the chip.<br>● Low: Module power off. | NA | NA | NA |
| GND | 24 | P | Ground | NA | NA | NA |
| VD1833 | 25 | P | Power Supply | NA | NA | NA |
| GND | 26 | P | Ground | NA | NA | NA |
| NC | 27 | NC | NC | NA | NA | NA |
| PA12 | 28 | I/O | GPIOA_12 | √ | √ | √ |
| GND | 29 | P | Ground | NA | NA | NA |
| NC | 30 | NC | NC | NA | NA | NA |
| NC | 31 | NC | NC | NA | NA | NA |
| NC | 32 | NC | NC | NA | NA | NA |
| NC | 33 | NC | NC | NA | NA | NA |
| NC | 34 | NC | NC | NA | NA | NA |
| NC | 35 | NC | NC | NA | NA | NA |
| PA19 | 36 | I/O | GPIOA_19 | √ | √ | √ |
| PA20 | 37 | I/O | GPIOA_20 | √ | √ | √ |
| PA21 | 38 | I/O | GPIOA_21 | √ | √ | √ |
| PA22 | 39 | I/O | GPIOA_22 | √ | √ | √ |
| PA23 | 40 | I/O | GPIOA_23 | √ | √ | √ |
| GND | 41 | P | Ground | NA | NA | NA |
| PA26 | 42 | I/O | GPIOA_26 / D2 | √ | √ | √ |
| PA27 | 43 | I/O | GPIOA_27 / D3 | √ | √ | √ |
| PA28 | 44 | I/O | GPIOA_28 / CMD / DM | √ | √ | √ |
| PA29 | 45 | I/O | GPIOA_29 / CLK / DP | √ | √ | √ |
| PA30 | 46 | I/O | GPIOA_30 / D0 | √ | √ | √ |
| PA31 | 47 | I/O | GPIOA_31 / D1 | √ | √ | √ |
| PB0 | 48 | I/O | GPIOB_0 | √ | √ | √ |
| PB1 | 49 | I/O | GPIOB_1 | √ | √ | √ |
| PB2 | 50 | I/O | GPIOB_2 | √ | √ | √ |
| PB3 | 51 | I/O | GPIOB_3 | √ | √ | √ |
| GND | 52 | P | Ground | NA | NA | NA |
| NC | 53 | NC | NC | NA | NA | NA |
| GND | 54 | P | Ground | NA | NA | NA |

NOTE

- ***P**: power supply*
- ***I**: input*
- *I/**O**: input / output*
- *Detail Available pin refer to "PKM8721DCM_pin_mux" table*

## 3.2.2 Strapping Pins

This module has 2 strapping pins.

Table 2. Strapping Pin

| Pin Name | Pin No. | Default State | Description |
|---|---|---|---|
| PB5 | 4 | Pull up | 1: Normal mode (default)<br>0: Flash download mode |
| PB31 | 22 | Pull up | 1: Normal mode (default)<br>0: Test 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 ~ 2484MHz (2.4GHz ISM Band)<br>● 5180MHz ~ 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 | Center channel frequency | 2412 | | 2484 | MHz |
| Output power with spectral mask and EVM compliance[1] | 1 Mbps DSSS | | 20 | | dBm |
| | 11 Mbps DSSS | | 20 | | dBm |
| | 6 Mbps OFDM | | 19 | | dBm |
| | 54 Mbps OFDM | | 19 | | dBm |
| | HT20 MCS0 | | 19 | | dBm |
| | HT20 MCS7 | | 19 | | dBm |
| | HT40 MCS0 | | 19 | | dBm |
| | HT40 MCS7 | | 18 | | dBm |
| Tx EVM | 6 Mbps OFDM | | -30 | -5 | dB |
| | 54 Mbps OFDM | | -34 | -25 | dB |
| | HT20 MCS0 | | -30 | -5 | dB |
| | HT20 MCS7 | | -34 | -27 | dB |
| | HT40 MCS0 | | -29 | -5 | dB |
| | HT40 MCS7 | | -33 | -27 | dB |
| Output power variation | | -1.5 | | 1.5 | dB |
| Carrier Suppression | | | -40 | -30 | dBc |
| Harmonic Output Power[2] | 2nd Harmonic | | -18 | | dBm/MHz |
| | 3rd Harmonic | | -22 | | dBm/MHz |
| Harmonic Output Power[3] | 2nd Harmonic | | | -50 | dBm/MHz |
| | 3rd Harmonic | | | -50 | dBm/MHz |

NOTE

- *[1] Power level is tested after Digital Pre-Distortion (DPD) enable.*
- *[2] Harmonic output power is tested at IC port.*
- *[3] Harmonic output power is measured at RF connector with diplexer (RFDIP1606LB598D1T) and appropriate matching.*

### 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 | Center channel frequency | 2412 | | 2484 | MHz |
| 802.11b Rx Sensitivity | 1 Mbps DSSS | | -100 | | dBm |
| | 2 Mbps DSSS | | -97 | | dBm |

| | | | | | |
|---|---|---|---|---|---|
| | 5.5 Mbps DSSS | | -94 | | dBm |
| | 11 Mbps DSSS | | -90.5 | | dBm |
| 802.11g Rx Sensitivity | 6 Mbps OFDM | | -95 | | dBm |
| | 9 Mbps OFDM | | -93.5 | | dBm |
| | 12 Mbps OFDM | | -92.5 | | dBm |
| | 18 Mbps OFDM | | -90.5 | | dBm |
| | 24 Mbps OFDM | | -87 | | dBm |
| | 36 Mbps OFDM | | -84 | | dBm |
| | 48 Mbps OFDM | | -79.5 | | dBm |
| | 54 Mbps OFDM | | -78 | | dBm |
| 802.11n Rx Sensitivity | HT20 MCS0 | | -95 | | dBm |
| | HT20 MCS1 | | -92 | | dBm |
| | HT20 MCS2 | | -90 | | dBm |
| | HT20 MCS3 | | -87 | | dBm |
| | HT20 MCS4 | | -83.5 | | dBm |
| | HT20 MCS5 | | -79 | | dBm |
| | HT20 MCS6 | | -77.5 | | dBm |
| | HT20 MCS7 | | -76 | | dBm |
| | HT40 MCS0 | | -92 | | dBm |
| | HT40 MCS1 | | -89 | | dBm |
| | HT40 MCS2 | | -87 | | dBm |
| | HT40 MCS3 | | -83.5 | | dBm |
| | HT40 MCS4 | | -80.5 | | dBm |
| | HT40 MCS5 | | -75.5 | | dBm |
| | HT40 MCS6 | | -74 | | dBm |
| | HT40 MCS7 | | -73 | | dBm |
| Maximum Receive Level | 6Mbps OFDM | | 0 | | dBm |
| | 54Mbps OFDM | | 0 | | dBm |
| | HT20 MCS 0 | | 0 | | dBm |
| | HT20 MCS 7 | | 0 | | dBm |
| | HT40 MCS 0 | | 0 | | dBm |
| | HT40 MCS 7 | | 0 | | dBm |
| Adjacent Channel Rejection | 11Mbps DSSS | | 43 | | dB |
| | 6 Mbps OFDM | | 44 | | dB |
| | 54Mbps OFDM | | 26 | | dB |
| | HT20 MCS 0 | | 43 | | dB |
| | HT20 MCS 7 | | 23 | | dB |
| | HT40 MCS 0 | | 32 | | dB |
| | HT40 MCS 7 | | 14 | | dB |

### 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 | Center channel frequency | 5180 | | 5885 | MHz |
| Output power with spectral mask and EVM compliance[1] | 6 Mbps OFDM | | 18 | | dBm |
| | 54 Mbps OFDM | | 18 | | dBm |
| | HT20 MCS0 | | 18 | | dBm |
| | HT20 MCS7 | | 17 | | dBm |
| | HT40 MCS0 | | 18 | | dBm |
| | HT40 MCS7 | | 16 | | dBm |
| Tx EVM | 6 Mbps OFDM | | -30 | -5 | dB |
| | 54 Mbps OFDM | | -32 | -25 | dB |
| | HT20 MCS0 | | -30 | -5 | dB |
| | HT20 MCS7 | | -33 | -27 | dB |
| | HT40 MCS0 | | -30 | -5 | dB |
| | HT40 MCS7 | | -32 | -27 | dB |

| | | | | | |
|---|---|---|---|---|---|
| Output power variation | | -1.5 | | 1.5 | dB |
| Carrier Suppression | | | -40 | -30 | dBc |
| Harmonic output power[2] | 2nd Harmonic | | -28 | | dBm/MHz |
| | 3rd Harmonic | | -30 | | dBm/MHz |
| Harmonic output power[3] | 2nd Harmonic | | | -50 | dBm/MHz |
| | 3rd Harmonic | | | -50 | dBm/MHz |

NOTE

- *[1] Power level is tested after Digital Pre-Distortion (DPD) enable.*
- *[2] Harmonic output power is tested at IC port.*
- *[3] Harmonic output power is measured at RF connector with diplexer (RFDIP1606LB598D1T) and appropriate matching.*

### 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 | Center channel frequency | 5180 | | 5885 | MHz |
| 802.11a Rx Sensitivity | 6 Mbps OFDM | | -94.5 | | dBm |
| | 9 Mbps OFDM | | -92.5 | | dBm |
| | 12 Mbps OFDM | | -91.5 | | dBm |
| | 18 Mbps OFDM | | -89.5 | | dBm |
| | 24 Mbps OFDM | | -86.5 | | dBm |
| | 36 Mbps OFDM | | -83 | | dBm |
| | 48 Mbps OFDM | | -78.5 | | dBm |
| | 54 Mbps OFDM | | -77 | | dBm |
| 802.11n Rx Sensitivity | HT20 MCS0 | | -94 | | dBm |
| | HT20 MCS1 | | -91.5 | | dBm |
| | HT20 MCS2 | | -89 | | dBm |
| | HT20 MCS3 | | -86 | | dBm |
| | HT20 MCS4 | | -82.5 | | dBm |
| | HT20 MCS5 | | -78 | | dBm |
| | HT20 MCS6 | | -76.5 | | dBm |
| | HT20 MCS7 | | -75 | | dBm |
| | HT40 MCS0 | | -91 | | dBm |
| | HT40 MCS1 | | -88.5 | | dBm |
| | HT40 MCS2 | | -85.5 | | dBm |
| | HT40 MCS3 | | -82.5 | | dBm |
| | HT40 MCS4 | | -79 | | dBm |
| | HT40 MCS5 | | -74.5 | | dBm |
| | HT40 MCS6 | | -73 | | dBm |
| | HT40 MCS7 | | -71.5 | | dBm |
| Maximum Receive Level | 6Mbps OFDM | | 0 | | dBm |
| | 54Mbps OFDM | | 0 | | dBm |
| | HT20 MCS0 | | 0 | | dBm |
| | HT20 MCS7 | | 0 | | dBm |
| | HT40 MCS0 | | 0 | | dBm |
| | HT40 MCS7 | | 0 | | dBm |
| Adjacent Channel Rejection | 6Mbps OFDM | | 33 | | dB |
| | 54Mbps OFDM | | 10 | | dB |
| | HT20 MCS0 | | 29 | | dB |
| | HT20 MCS7 | | 10 | | dB |
| | HT40 MCS0 | | 29 | | dB |
| | HT40 MCS7 | | 11 | | dB |

# 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 | Center channel frequency | 2402 | 2440 | 2480 | MHz |
| Output Power | At max. power output level | | 8 | | dBm |
| Bluetooth LE 1Mbps | | | | | |
| Carrier Frequency Offset and Drift | Frequency offset[1] | | ±10 | | kHz |
| | Frequency drift | | ±10 | | kHz |
| | Max. drift rate | | ±10 | | kHz/50us |
| Modulation characteristics | Δf1 avg. | | 250 | | kHz |
| | Δf2 max. | 185 | | | kHz |
| | Δf1 avg./Δf2 avg. | | 0.92 | | |
| In-Band Spurious Emission | ±2MHz offset | | -46 | | dBm |
| | >±3MHz offset | | -49 | | dBm |
| Bluetooth LE 2Mbps | | | | | |
| Carrier Frequency Offset and Drift | Frequency offset[1] | | ±30 | | kHz |
| | Frequency drift | | ±10 | | kHz |
| | Max. drift rate | | ±10 | | kHz/50us |
| Modulation characteristics | Δf1 avg. | | 500 | | kHz |
| | Δf2 max. | 370 | | | kHz |
| | Δf1 avg./Δf2 avg. | | 0.93 | | |
| In-Band Spurious Emission | ±4MHz offset | | -48 | | dBm |
| | ±5MHz offset | | -50 | | dBm |
| | >±3MHz offset | | -50 | | dBm |
| Bluetooth LE 125kbps | | | | | |
| Carrier Frequency Offset and Drift | Frequency offset[1] | | ±15 | | kHz |
| | Frequency drift | | ±10 | | kHz |
| | Max. drift rate | | ±10 | | kHz/50us |
| Modulation characteristics | Δf1 avg. | | 250 | | kHz |
| | Δf2 max. | 185 | | | kHz |

NOTE

*[1] Initial carrier frequency offset should be calibrated in MP process in the customer side.*

## 4.2.2 Bluetooth LE RF Receiver Specification

Table 9. Bluetooth LE Receiver Performance Specification

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | Center channel frequency | 2402 | 2440 | 2480 | MHz |
| Bluetooth LE 1Mbps | | | | | |
| Receiver Sensitivity | PER<30.8% | | -99[1] | | dBm |
| Max. Usable Signal | PER<30.8% | | 0 | | dBm |
| C/I co-channel (PER<30.8%) | Co-channel sensitivity | | 6 | | dB |
| C/I 1MHz (PER<30.8%) | Adjacent channel selectivity | | -5 | | dB |
| C/I 2MHz (PER<30.8%) | 2nd adjacent channel selectivity | | -48 | | dB |
| C/I >= 3MHz (PER<30.8%) | 3rd adjacent channel selectivity | | -55 | | dB |
| C/I Image Channel (PER<30.8%) | Image channel selectivity | | -25 | | dB |
| C/I Image 1MHz (PER<30.8%) | 1MHz adjacent to image channel selectivity | | -26 | | dB |
| Inter-modulation | | | -30 | | dBm |
| Out-of-band blocking[2] | 30MHz to 2000MHz | -30 | | | dBm |
| | 2003MHz to 2399MHz | -35 | | | dBm |
| | 2484MHz to 2997MHz | -35 | | | dBm |

| | | | | | |
|---|---|---|---|---|---|
| | 3000MHz to 12.75GHz | -30 | | | dBm |
| Bluetooth LE 2Mbps | | | | | |
| Receiver Sensitivity | PER<30.8% | | -95[1] | | dBm |
| Max. Usable Signal | PER<30.8% | | 0 | | dBm |
| C/I co-channel (PER<30.8%) | Co-channel sensitivity | | 6 | | dB |
| C/I 2MHz (PER<30.8%) | Adjacent channel selectivity | | -2 | | dB |
| C/I 4MHz (PER<30.8%) | 2nd adjacent channel selectivity | | -43 | | dB |
| C/I >= 6MHz (PER<30.8%) | 3rd adjacent channel selectivity | | -53 | | dB |
| C/I Image Channel (PER<30.8%) | Image channel selectivity | | -25 | | dB |
| C/I Image 2MHz (PER<30.8%) | 1MHz adjacent to image channel selectivity | | -23 | | dB |
| Inter-modulation | | | -28 | | dBm |
| Out-of-band blocking[2] | 30MHz to 2000MHz | -30 | | | dBm |
| | 2003MHz to 2399MHz | -35 | | | dBm |
| | 2484MHz to 2997MHz | -35 | | | dBm |
| | 3000MHz to 12.75GHz | -30 | | | dBm |
| Bluetooth LE 125kbps | | | | | |
| Receiver Sensitivity | PER<30.8% | | -106[1] | | dBm |
| C/I co-channel (PER<30.8%) | Co-channel sensitivity | | 3 | | dB |
| C/I 1MHz (PER<30.8%) | Adjacent channel selectivity | | -15 | | dB |
| C/I 2MHz (PER<30.8%) | 2nd adjacent channel selectivity | | -53 | | dB |
| C/I >= 3MHz (PER<30.8%) | 3rd adjacent channel selectivity | | -62 | | dB |
| C/I Image Channel (PER<30.8%) | Image channel selectivity | | -33 | | dB |
| C/I Image 1MHz (PER<30.8%) | 1MHz adjacent to image channel selectivity | | -35 | | dB |
| Bluetooth LE 500kbps | | | | | |
| Receiver Sensitivity | PER<30.8% | | -101[1] | | dBm |
| C/I co-channel (PER<30.8%) | Co-channel sensitivity | | 4 | | dB |
| C/I 1MHz (PER<30.8%) | Adjacent channel selectivity | | -9 | | dB |
| C/I 2MHz (PER<30.8%) | 2nd adjacent channel selectivity | | -50 | | dB |
| C/I >= 3MHz (PER<30.8%) | 3rd adjacent channel selectivity | | -58 | | dB |
| C/I Image Channel (PER<30.8%) | Image channel selectivity | | -31 | | dB |
| C/I Image 1MHz (PER<30.8%) | 1MHz adjacent to image channel selectivity | | -29 | | dB |

NOTE

- *[1] The receiver sensitivity is measured at the chip out, and channels 2440MHz and 2480MHz may have extra degradation due to spurs interference.*
- *[2] Frequencies where the requirements are not met are called "spurious response frequencies". The number of spurs must not exceed 10 if blocking signal power level is as specified above, and must not exceed 3 if it is reduced to -50dBm.*

# 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 |
| $T_A$ | Ambient operating temperature | -20 | | 85 | ℃ |
| $T_S$ | Storage temperature range | -65 | | 150 | ℃ |

## 5.2 Module DC Characteristics

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

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{IH}$ | Input-High Voltage | LVTTL | 2.0 | | | V |
| $V_{IL}$ | Input-Low Voltage | LVTTL | -0.3 | | 0.8 | V |
| $V_{OH}$ | Output-High Voltage | LVTTL | 0.85*$V_{IO}$ | | | V |
| $V_{OL}$ | Output-Low Voltage | LVTTL | - | | 0.15*$V_{IO}$ | V |

# 6 Module Schematics

## 6.1 Module Internal Schematics

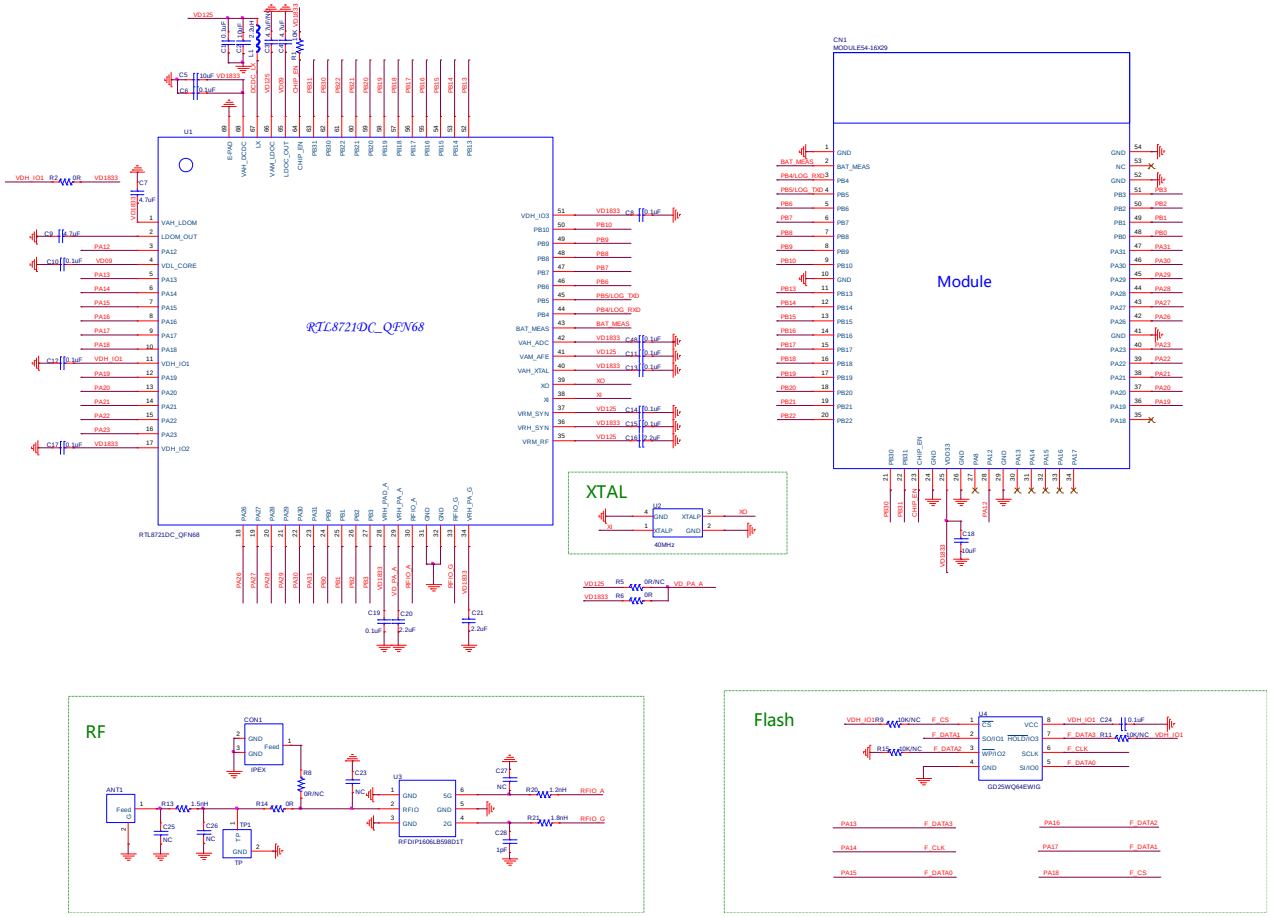



Figure 3. Module Internal Schematics

# 7 Physical Dimensions

Module dimension: 29 ± 0.2mm (L) x 16 ± 0.2mm (W) x 2.8 ± 0.1mm (H)

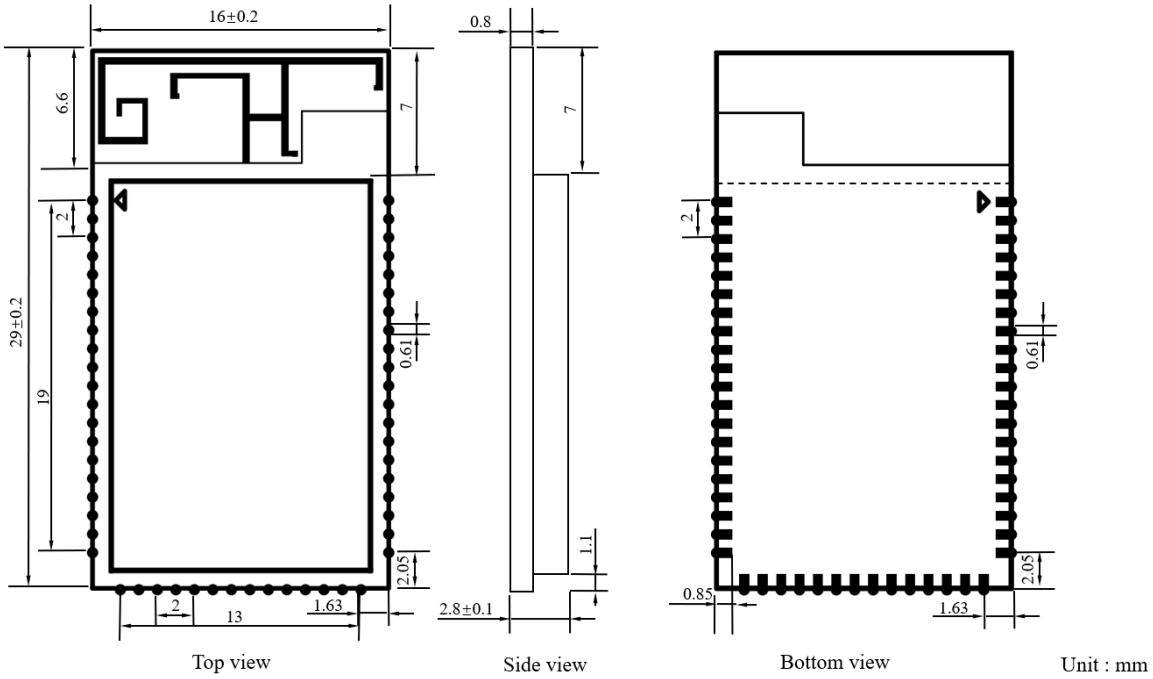


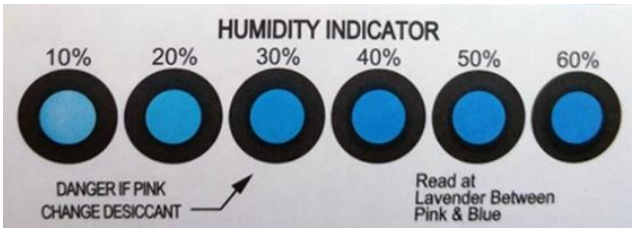

Figure 4. Module Physical Dimensions

# 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 PKM8721DCM-E10-F32 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 5.

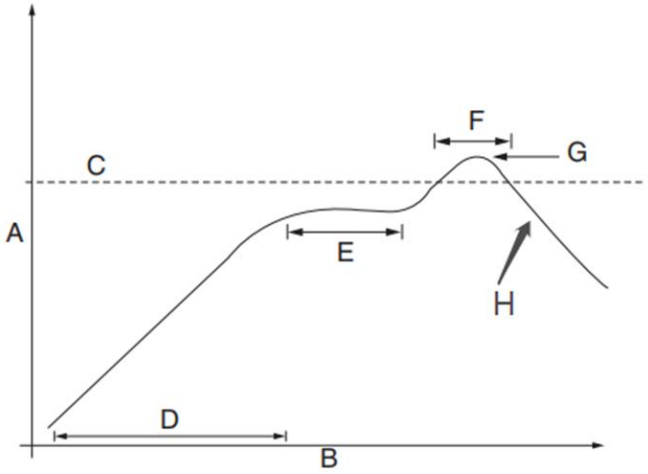



Figure 5. Reflow Soldering Curve Diagram

- 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.*

# 9 Revision History

| Data | Revision | Change Note |
|---|---|---|
| 2025-07-03 | 1.0 | Initial release |
| 2025-07-18 | 1.1 | Update RF characteristics |
| 2025-09-25 | 1.2 | Correct some formats |