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# BK7236S-WIZ-MINI Datasheet

DS-BK7236S-WIZ-MINI-E01 V1.0

2024/8/28

# Contents

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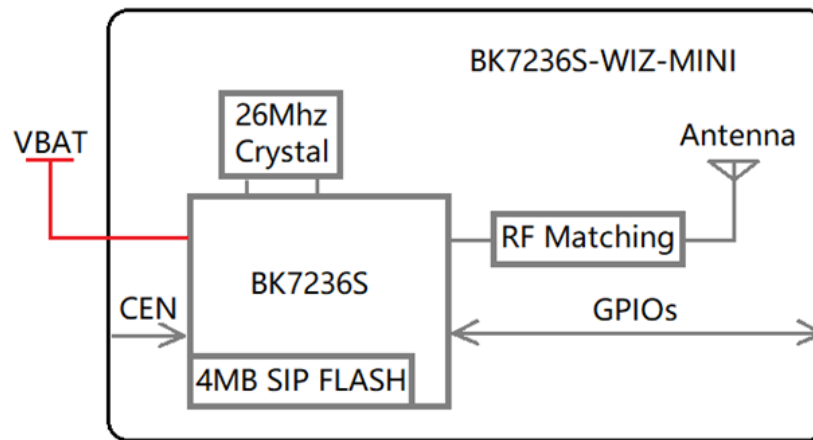
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# 1. Module Overview

The BK7236S-WIZ-MINI is a low-power, high-performance Wi-Fi + Bluetooth LE module. It consists of the BK7236S SoC and peripheral resistors and capacitors, crystal oscillators, buck inductors, and onboard PCB antenna. It features a 1x1 single-band 2.4G Wi-Fi 6 and Bluetooth 5.2 combo solution. The module also has a simple and easy-to-use interface targeted for lighting applications. A variety of products can be developed based on this module.

The BK7236S integrates a 32-bit Armv8-M STAR-MC1 MCU that can operate at up to 160 MHz. It also incorporates 4 MB flash and 640 KB RAM.

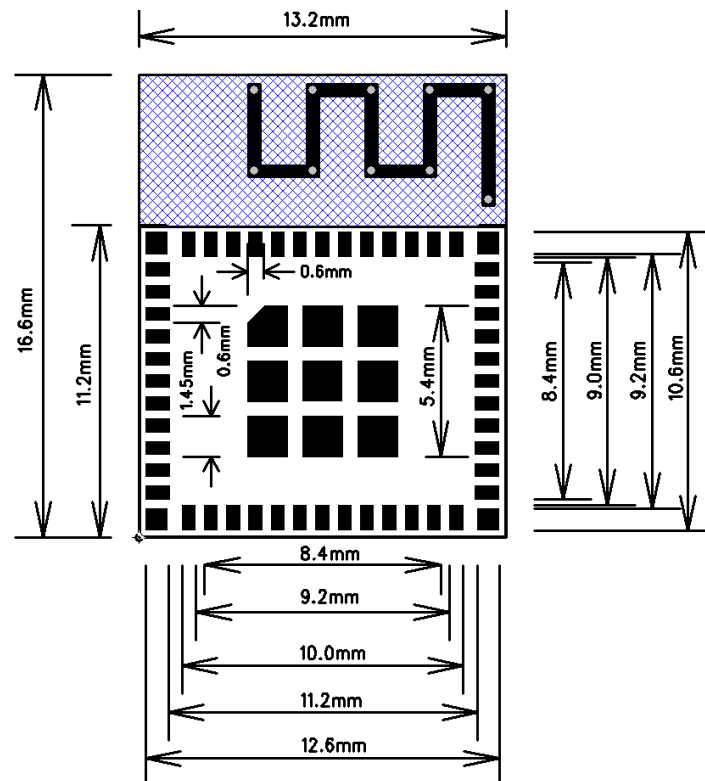
**Figure 1-1 BK7236S-WIZ-MINI Block Diagram**



## 2. Module Outline

### 2.1 Module Dimensions

Figure 2-1 Module Dimensions (Bottom Layer, Top View)



The module dimensions are as below:

- Length: 16.6 mm
- Width: 13.2 mm
- Board thickness: 0.8 mm
- Maximum overall thickness: 3.2 mm



### Figure 2-3 BK7236S-WIZ-MINI Schematic



## 3. Pin Descriptions

Figure 3-1 shows the pin assignments of the module.

**Figure 3-1 Pin Assignments (Bottom Layer, Top View)**

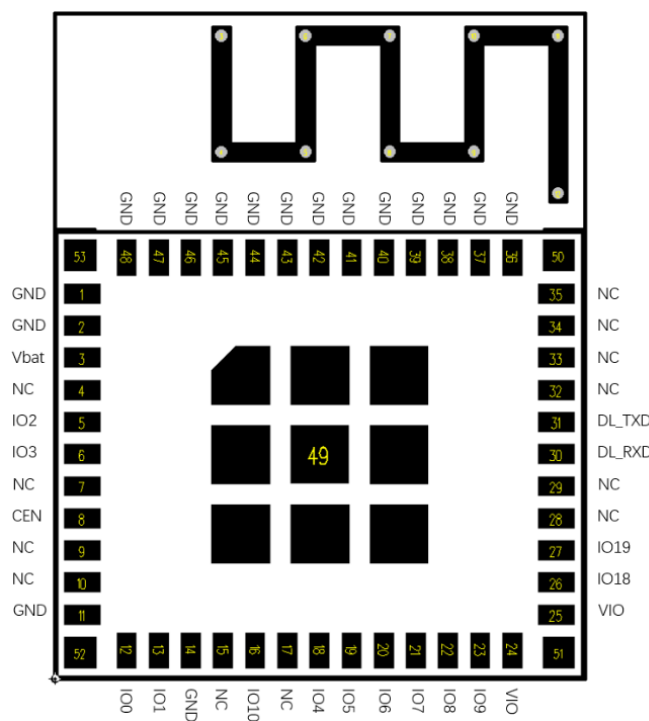


Table 3-1 shows the pin descriptions of the module.

**Table 3-1 Pin Descriptions**

| Pin # | Name | Type | Default State After Power-on | Description                      |
|-------|------|------|------------------------------|----------------------------------|
| 1     | GND  | P    | -                            | Ground                           |
| 2     | GND  | P    | -                            | Ground                           |
| 3     | VBAT | P    | -                            | Chip external power supply input |
| 4     | NC   | -    | -                            | No connect                       |
| 5     | IO2  | IO   | Hi-Z, no pull-up/down        | GPIO28, ADC4                     |
| 6     | IO3  | IO   | Hi-Z, no pull-up/down        | GPIO19, PWM0_1                   |
| 7     | NC   | -    | -                            | No connect                       |
| 8     | CEN  | I    | 10 kΩ pulled up to VIO       | Chip enable, active high         |

| Pin # | Name   | Type | Default State After Power-on       | Description                      |
|-------|--------|------|------------------------------------|----------------------------------|
| 9     | NC     | -    | -                                  | No connect                       |
| 10    | NC     | -    | -                                  | No connect                       |
| 11    | GND    | P    | -                                  | Ground                           |
| 12    | IO0    | IO   | Hi-Z, no pull-up/down              | GPIO8, ADC10, 32K_XO             |
| 13    | IO1    | IO   | Hi-Z, no pull-up/down              | GPIO16                           |
| 14    | GND    | P    | -                                  | Ground                           |
| 15    | NC     | -    | -                                  | No connect                       |
| 16    | IO10   | IO   | Hi-Z, no pull-up/down              | GPIO1, UART1_RX, I2C1_SDA, ADC13 |
| 17    | NC     | -    | -                                  | No connect                       |
| 18    | IO4    | IO   | Hi-Z, no pull-up/down              | GPIO24, PWM0_4, ADC2             |
| 19    | IO5    | IO   | Hi-Z, no pull-up/down              | GPIO32, PWM1_0, ADC2             |
| 20    | IO6    | IO   | Hi-Z, no pull-up/down              | GPIO34, PWM1_2                   |
| 21    | IO7    | IO   | Hi-Z, no pull-up/down              | GPIO0, UART1_TX, I2C1_SCL        |
| 22    | IO8    | IO   | Hi-Z, no pull-up/down              | GPIO36, PWM1_4                   |
| 23    | IO9    | IO   | Hi-Z, no pull-up/down              | GPIO9, PWM0_3                    |
| 24    | VIO    | P    | -                                  | IO LDO output                    |
| 25    | VIO    | P    | -                                  | IO LDO output                    |
| 26    | IO18   | IO   | Hi-Z, no pull-up/down              | GPIO40, UART2_RX                 |
| 27    | IO19   | IO   | Hi-Z, no pull-up/down              | GPIO41, UART2_TX                 |
| 28    | NC     | -    | -                                  | No connect                       |
| 29    | NC     | -    | -                                  | No connect                       |
| 30    | DL_RXD | IO   | High level, 50 kΩ pulled up to VIO | GPIO10, DL_UART_RX, UART0_RX     |
| 31    | DL_TXD | IO   | High level, 50 kΩ pulled up to VIO | GPIO11, DL_UART_TX, UART0_TX     |
| 32    | NC     | -    | -                                  | No connect                       |
| 33    | NC     | -    | -                                  | No connect                       |
| 34    | NC     | -    | -                                  | No connect                       |





| Pin # | Name | Type | Default State After Power-on | Description                  |
|-------|------|------|------------------------------|------------------------------|
| 35    | NC   | -    | -                            | No connect                   |
| 36-48 | GND  | P    | -                            | Ground                       |
| 49    | PAD  | P    | -                            | Ground pad, connected to GND |
| 50-53 | GND  | -    | -                            | Ground                       |

## 4. Electrical Characteristics

### 4.1 Absolute Maximum Ratings

| Parameter          | Description                                               | Min. | Max.                 | Unit |
|--------------------|-----------------------------------------------------------|------|----------------------|------|
| V <sub>BAT</sub>   | Power supply input                                        | -0.3 | 4.5                  | V    |
| I <sub>max</sub>   | V <sub>BAT</sub> maximum current                          | -    | 400                  | mA   |
| V <sub>DIG_A</sub> | Voltage on any digital pin                                | -0.3 | V <sub>IO</sub> +0.3 | V    |
| T <sub>STR</sub>   | Storage temperature range                                 | -55  | 150                  | ℃    |
| T <sub>OPR</sub>   | Operating temperature range (shielding cover temperature) | -40  | 105                  | ℃    |

### 4.2 Recommended Operating Conditions

| Parameter        | Description                    | Min. | Typ. | Max. | Unit |
|------------------|--------------------------------|------|------|------|------|
| V <sub>BAT</sub> | Power supply input             | 2.4  | 3.3  | 3.6  | V    |
| V <sub>IO</sub>  | I/O voltage                    | 2.4  | 3.0  | 3.6  | V    |
| V <sub>pp</sub>  | Ripple on the V <sub>BAT</sub> | -    | -    | 200  | mV   |

### 4.3 Digital I/O Characteristics

| Symbol           | Parameter                 | Conditions                                                                    | Min.                | Typ. | Max.                  | Unit |
|------------------|---------------------------|-------------------------------------------------------------------------------|---------------------|------|-----------------------|------|
| V <sub>IH</sub>  | High-level input voltage  | -                                                                             | 0.7 V <sub>IO</sub> | -    | V <sub>IO</sub> + 0.3 | V    |
| V <sub>IL</sub>  | Low-level input voltage   | -                                                                             | -0.3                | -    | 0.3 V <sub>IO</sub>   | V    |
| V <sub>OH</sub>  | High-level output voltage | -                                                                             | 0.9 V <sub>IO</sub> | -    | -                     | V    |
| V <sub>OL</sub>  | Low-level output voltage  | -                                                                             | -                   | -    | 0.1 V <sub>IO</sub>   | V    |
| I <sub>DRV</sub> | I/O output drive strength | V <sub>IH</sub> : 0.3 V <sub>IO</sub> ; V <sub>IL</sub> : 0.7 V <sub>IO</sub> | 4                   | -    | 18                    | mA   |
| R <sub>PU</sub>  | Weak pull-up resistor     | -                                                                             | -                   | 40   | -                     | kΩ   |
| R <sub>PD</sub>  | Weak pull-down resistor   | -                                                                             | -                   | 44   | -                     | kΩ   |

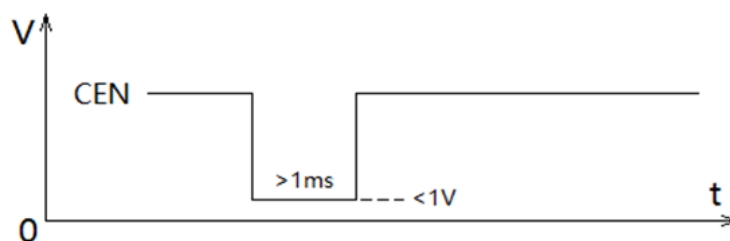
## 4.4 Current Consumption

| Parameter            | Condition                                                                                                      | Min. | Typ. | Max. | Unit |
|----------------------|----------------------------------------------------------------------------------------------------------------|------|------|------|------|
| <b>Active Mode</b>   |                                                                                                                |      |      |      |      |
| RX current           | 11b, continuous receive, buck                                                                                  | -    | 13   | -    | mA   |
|                      | 11b, continuous receive, LDO                                                                                   | -    | 26   | -    | mA   |
|                      | 11b/g/n/ax, 20 MHz, mixed mode, continuous receive, buck                                                       | -    | 25   | -    | mA   |
|                      | 11n/ax 40 MHz, mixed mode, continuous receive, buck                                                            | -    | 27   | -    | mA   |
|                      | 11b/g/n/ax, 20 MHz, mixed mode, continuous receive, LDO                                                        | -    | 42   | -    | mA   |
|                      | 11n/ax, 40 MHz, mixed mode, continuous receive, LDO                                                            | -    | 44   | -    | mA   |
| TX current           | 11b: 1 Mbps DSSS @ 19 dBm                                                                                      | -    | 235  | -    | mA   |
|                      | 11b: 1 Mbps DSSS @ 20 dBm                                                                                      | -    | 255  | -    | mA   |
|                      | 11g: 54 Mbps OFDM @ 17 dBm                                                                                     | -    | 200  | -    | mA   |
|                      | 11n: MCS7, HT20 @ 16 dBm                                                                                       | -    | 189  | -    | mA   |
|                      | 11n: MCS7, HT40 @ 15 dBm                                                                                       | -    | 182  | -    | mA   |
|                      | 11ax: MCS7, HE20 @ 16 dBm                                                                                      | -    | 188  | -    | mA   |
|                      | 11ax: MCS7, HE40 @ 15 dBm                                                                                      | -    | 182  | -    | mA   |
| <b>Sleep Mode</b>    |                                                                                                                |      |      |      |      |
| Normal sleep         | CPU active(60Mhz), Wi-Fi MAC on, Wi-Fi PHY off, Bluetooth off, multimedia (audio, video) off, encryption off   | -    | 3.8  | -    | mA   |
| Low-voltage sleep    | CPU halted, Wi-Fi MAC halted, Wi-Fi PHY off, Bluetooth off, encryption off, SMEM3 off, XTALH off, VDDDIG=0.6 V | 40   | 55   | 80   | μA   |
| Deep sleep           | Only the AON domain is active.                                                                                 | -    | 13.7 | -    | μA   |
| <b>Shutdown Mode</b> |                                                                                                                |      |      |      |      |
| Shutdown             | CEN low                                                                                                        | -    | 3.1  | -    | μA   |

## 4.5 CEN Timing

| Parameter      | Description                         | Min. | Max. | Unit |
|----------------|-------------------------------------|------|------|------|
| $T_{CEN\_Min}$ | minimum pull-low time for CEN reset | 1    | -    | ms   |
| $V_{CEN\_IL}$  | CEN input low level                 | -    | 1    | V    |

Figure 4-1 CEN Signal Waveform Requirements



## 4.6 ESD Ratings

| Parameter | Description                                                                       | Test Condition | Value | Unit |
|-----------|-----------------------------------------------------------------------------------|----------------|-------|------|
| ESD HBM   | Electrostatic discharge voltage (human body model), per ANSI/ESDA/JEDEC JS-001    | ANT pin        | ±2000 | V    |
|           |                                                                                   | Other pins     | ±3000 | V    |
| ESD CDM   | Electrostatic discharge voltage (charge device model), per ANSI/ESDA/JEDEC JS-002 | All pins       | ±500  | V    |

## 4.7 WLAN RF Receiver Characteristics

Measured with  $T = 25^{\circ}\text{C}$ ,  $V_{BAT} = 3.3\text{ V}$  unless otherwise stated.

| Parameter                                       | Condition    | Min. | Typ. | Max. | Unit |
|-------------------------------------------------|--------------|------|------|------|------|
| <b>General</b>                                  |              |      |      |      |      |
| Frequency range                                 | -            | 2412 | -    | 2484 | MHz  |
| <b>Sensitivity</b>                              |              |      |      |      |      |
| Sensitivity - IEEE 802.11b<br>(8% PER for PSDU) | 1 Mbps DSSS  | -    | -98  | -    | dBm  |
|                                                 | 11 Mbps DSSS | -    | -89  | -    | dBm  |
| Sensitivity - IEEE 802.11g                      | 6 Mbps OFDM  | -    | -92  | -    | dBm  |

| Parameter                                                                                                                                            | Condition                               |         | Min. | Typ.  | Max. | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------|------|-------|------|------|
| (10% PER for PSDU)                                                                                                                                   | 54 Mbps OFDM                            |         | -    | -76.5 | -    | dBm  |
| Sensitivity - IEEE 802.11n, 20 MHz<br>(10% PER for PSDU, BCC)                                                                                        | HT20, MCS0                              |         | -    | -92   | -    | dBm  |
|                                                                                                                                                      | HT20, MCS7                              |         | -    | -73   | -    | dBm  |
| Sensitivity - IEEE 802.11n, 40 MHz<br>(10% PER for PSDU, BCC)                                                                                        | HT40, MCS0                              |         | -    | -87.5 | -    | dBm  |
|                                                                                                                                                      | HT40, MCS7                              |         | -    | -71.5 | -    | dBm  |
| Sensitivity - IEEE 802.11ax, 20 MHz<br>(10% PER for PSDU, LDPC)                                                                                      | HE20, MCS0                              |         | -    | -92   | -    | dBm  |
|                                                                                                                                                      | HE20, MCS7                              |         | -    | -74   | -    | dBm  |
| Sensitivity - IEEE 802.11ax, 40 MHz<br>(10% PER for PSDU, LDPC)                                                                                      | HE40, MCS0                              |         | -    | -88.5 | -    | dBm  |
|                                                                                                                                                      | HE40, MCS7                              |         | -    | -72   | -    | dBm  |
| Maximum Receive Level                                                                                                                                |                                         |         |      |       |      |      |
| Maximum receive level @ 2.4 GHz                                                                                                                      | 11b: 1, 2 Mbps (8% PER, 1024 octets)    |         | -    | 10    | -    | dBm  |
|                                                                                                                                                      | 11b: 5.5, 11 Mbps (8% PER, 1024 octets) |         | -    | 10    | -    | dBm  |
|                                                                                                                                                      | 11g: 6–54 Mbps (10% PER, 1000 octets)   |         | -    | 0     | -    | dBm  |
|                                                                                                                                                      | 11n: MCS0–7 (10% PER, 4096 octets)      |         | -    | 0     | -    | dBm  |
|                                                                                                                                                      | 11ax: MCS0–7 (10% PER, 4096 octets)     |         | -    | 0     | -    | dBm  |
| Adjacent Channel Rejection                                                                                                                           |                                         |         |      |       |      |      |
| Adjacent channel (±30 MHz)<br>rejection - IEEE 802.11b<br><br>(8% PER for 1024 octet PSDU with<br>desired signal level as specified in<br>Condition) | 1 Mbps DSSS                             | -74 dBm | -    | 50    | -    | dB   |
|                                                                                                                                                      | 2 Mbps DSSS                             | -74 dBm | -    | 45    | -    | dB   |
| Adjacent channel (±25 MHz)<br>rejection - IEEE 802.11b<br><br>(8% PER for 1024 octet PSDU with<br>desired signal level as specified in<br>Condition) | 5.5 Mbps DSSS                           | -70 dBm | -    | 43    | -    | dB   |
|                                                                                                                                                      | 11 Mbps DSSS                            | -70 dBm | -    | 40    | -    | dB   |
| Adjacent channel (±25 MHz)<br>rejection - IEEE 802.11g                                                                                               | 6 Mbps OFDM                             | -79 dBm | -    | 43    | -    | dB   |

| Parameter                                                                         | Condition    |         | Min. | Typ. | Max. | Unit |
|-----------------------------------------------------------------------------------|--------------|---------|------|------|------|------|
| (10% PER for 1000 octet PSDU with desired signal level as specified in Condition) | 54 Mbps OFDM | -62 dBm | -    | 27   | -    | dB   |
| Adjacent channel ( $\pm 25$ MHz) rejection - IEEE 802.11n                         | HT20, MCS0   | -79 dBm | -    | 43   | -    | dB   |
| (10% PER for 4096 octet PSDU with desired signal level as specified in Condition) | HT20, MCS7   | -61 dBm | -    | 21   | -    | dB   |
| <b>Spurious Emissions</b>                                                         |              |         |      |      |      |      |
| Spurious emissions                                                                | < 1 GHz      |         | -    | -60  | -    | dBm  |
|                                                                                   | > 1 GHz      |         | -    | -50  | -    | dBm  |

## 4.8 WLAN RF Transmitter Characteristics

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

| Parameter                                   | Condition    | Min. | Typ. | Max. | Unit |
|---------------------------------------------|--------------|------|------|------|------|
| <b>General</b>                              |              |      |      |      |      |
| Frequency range                             | -            | 2412 | -    | 2484 | MHz  |
| <b>TX Power</b>                             |              |      |      |      |      |
| TX power - IEEE 802.11b<br>(SEM compliant)  | 1 Mbps DSSS  | -    | 20   | -    | dBm  |
|                                             | 11 Mbps DSSS | -    | 20   | -    | dBm  |
| TX power - IEEE 802.11g<br>(EVM compliant)  | 6 Mbps OFDM  | -    | 18   | -    | dBm  |
|                                             | 54 Mbps OFDM | -    | 18   | -    | dBm  |
| TX power - IEEE 802.11n<br>(EVM compliant)  | HT20, MCS0   | -    | 17   | -    | dBm  |
|                                             | HT20, MCS7   | -    | 17   | -    | dBm  |
|                                             | HT40, MCS0   | -    | 16   | -    | dBm  |
|                                             | HT40, MCS7   | -    | 16   | -    | dBm  |
| TX power - IEEE 802.11ax<br>(EVM compliant) | HE20, MCS0   | -    | 17   | -    | dBm  |
|                                             | HE20, MCS7   | -    | 17   | -    | dBm  |
|                                             | HE40, MCS0   | -    | 16   | -    | dBm  |
|                                             | HE40, MCS7   | -    | 16   | -    | dBm  |

| Parameter                                    | Condition            | Min. | Typ. | Max. | Unit |
|----------------------------------------------|----------------------|------|------|------|------|
| TX EVM                                       |                      |      |      |      |      |
| TX EVM - IEEE 802.11b<br>(SEM compliant)     | 1 Mbps DSSS, @20dBm  | -    | -15  | -    | dB   |
|                                              | 11 Mbps DSSS, @20dBm | -    | -15  | -    | dB   |
| TX EVM - IEEE 802.11g                        | 6 Mbps OFDM, @18dBm  | -    | -27  | -    | dB   |
|                                              | 54 Mbps OFDM, @18dBm | -    | -27  | -    | dB   |
| TX EVM - IEEE 802.11n                        | HT20, MCS0, @17dBm   | -    | -29  | -    | dB   |
|                                              | HT20, MCS7, @17dBm   | -    | -29  | -    | dB   |
|                                              | HT40, MCS0, @16dBm   | -    | -29  | -    | dB   |
|                                              | HT40, MCS7, @16dBm   | -    | -29  | -    | dB   |
| TX EVM - IEEE 802.11ax                       | HE20, MCS0, @17dBm   | -    | -30  | -    | dB   |
|                                              | HE20, MCS7, @17dBm   | -    | -30  | -    | dB   |
|                                              | HE40, MCS0, @16dBm   | -    | -30  | -    | dB   |
|                                              | HE40, MCS7, @16dBm   | -    | -30  | -    | dB   |
| Spurious Emissions                           |                      |      |      |      |      |
| Spurious emissions (at maximum output power) | < 1 GHz              | -    | -50  | -    | dBm  |
|                                              | > 1 GHz              | -    | -45  | -    | dBm  |

## 4.9 Bluetooth LE RF Receiver Characteristics

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

| Parameter                  | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|-----------|------|------|------|------|
| General                    |           |      |      |      |      |
| Frequency range            | -         | 2402 | -    | 2480 | MHz  |
| Bluetooth LE 1 Mbps        |           |      |      |      |      |
| Sensitivity                | 30.8% PER | -    | -97  | -    | dBm  |
| Maximum input level        | 30.8% PER | -    | 0    | -    | dBm  |
| C/I co-channel             | -         | -    | 8    | -    | dB   |
| C/I 1 MHz adjacent channel | -         | -    | 0    | -    | dB   |

| Parameter                     | Condition          | Min. | Typ. | Max. | Unit |
|-------------------------------|--------------------|------|------|------|------|
| C/I -1 MHz adjacent channel   | -                  | -    | 0    | -    | dB   |
| C/I 2 MHz adjacent channel    | -                  | -    | -26  | -    | dB   |
| C/I -2 MHz adjacent channel   | -                  | -    | -27  | -    | dB   |
| C/I 3 MHz adjacent channel    | -                  | -    | -28  | -    | dB   |
| C/I -3 MHz adjacent channel   | -                  | -    | -29  | -    | dB   |
| C/I > 3 MHz adjacent channel  | -                  | -    | -50  | -    | dB   |
| C/I < -3 MHz adjacent channel | -                  | -    | -50  | -    | dB   |
| Out-of-band blocking          | 30–2000 MHz        | -10  | -    | -    | dBm  |
|                               | 2003–2399 MHz      | -12  | -    | -    | dBm  |
|                               | 2484–2997 MHz      | -12  | -    | -    | dBm  |
|                               | 3000 MHz–12.75 GHz | -2   | -    | -    | dBm  |
| <b>Bluetooth LE 2 Mbps</b>    |                    |      |      |      |      |
| Sensitivity                   | 30.8% PER          | -    | -94  | -    | dBm  |
| Maximum input level           | 30.8% PER          | -    | 0    | -    | dBm  |
| C/I co-channel                | -                  | -    | 7    | -    | dB   |
| C/I 2 MHz adjacent channel    | -                  | -    | 0    | -    | dB   |
| C/I -2 MHz adjacent channel   | -                  | -    | 3    | -    | dB   |
| C/I 4 MHz adjacent channel    | -                  | -    | -26  | -    | dB   |
| C/I -4 MHz adjacent channel   | -                  | -    | -30  | -    | dB   |
| C/I 6 MHz adjacent channel    | -                  | -    | -30  | -    | dB   |
| C/I -6 MHz adjacent channel   | -                  | -    | -39  | -    | dB   |
| C/I > 6 MHz adjacent channel  | -                  | -    | -22  | -    | dB   |
| C/I < -6 MHz adjacent channel | -                  | -    | -22  | -    | dB   |
| Out-of-band blocking          | 30–2000 MHz        | -    | -30  | -    | dBm  |
|                               | 2003–2399 MHz      | -    | -35  | -    | dBm  |
|                               | 2484–2997 MHz      | -    | -35  | -    | dBm  |
|                               | 3000 MHz–12.75 GHz | -    | -17  | -    | dBm  |



| Parameter                     | Condition | Min. | Typ. | Max. | Unit |
|-------------------------------|-----------|------|------|------|------|
| <b>Bluetooth LE 125 kbps</b>  |           |      |      |      |      |
| Sensitivity                   | 30.8% PER | -    | -102 | -    | dBm  |
| Maximum input level           | 30.8% PER | -    | 0    | -    | dBm  |
| C/I co-channel                | -         | -    | 3    | -    | dB   |
| C/I 1 MHz adjacent channel    | -         | -    | -15  | -    | dB   |
| C/I -1 MHz adjacent channel   | -         | -    | -16  | -    | dB   |
| C/I 2 MHz adjacent channel    | -         | -    | -34  | -    | dB   |
| C/I -2 MHz adjacent channel   | -         | -    | -40  | -    | dB   |
| C/I 3 MHz adjacent channel    | -         | -    | -42  | -    | dB   |
| C/I -3 MHz adjacent channel   | -         | -    | -43  | -    | dB   |
| C/I > 3 MHz adjacent channel  | -         | -    | -41  | -    | dB   |
| C/I < -3 MHz adjacent channel | -         | -    | -42  | -    | dB   |
| <b>Bluetooth LE 500 kbps</b>  |           |      |      |      |      |
| Sensitivity                   | 30.8% PER | -    | -99  | -    | dBm  |
| Maximum input level           | 30.8% PER | -    | 0    | -    | dBm  |
| C/I co-channel                | -         | -    | 5    | -    | dB   |
| C/I 1 MHz adjacent channel    | -         | -    | -2   | -    | dB   |
| C/I -1 MHz adjacent channel   | -         | -    | -3   | -    | dB   |
| C/I 2 MHz adjacent channel    | -         | -    | -30  | -    | dB   |
| C/I -2 MHz adjacent channel   | -         | -    | -31  | -    | dB   |
| C/I 3 MHz adjacent channel    | -         | -    | -31  | -    | dB   |
| C/I -3 MHz adjacent channel   | -         | -    | -40  | -    | dB   |
| C/I > 3 MHz adjacent channel  | -         | -    | -36  | -    | dB   |
| C/I < -3 MHz adjacent channel | -         | -    | -36  | -    | dB   |

## 4.10 Bluetooth LE RF Transmitter Characteristics

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

| Parameter                          |                                                          | Condition | Min. | Typ. | Max. | Unit      |
|------------------------------------|----------------------------------------------------------|-----------|------|------|------|-----------|
| <b>General</b>                     |                                                          |           |      |      |      |           |
| Frequency range                    |                                                          | -         | 2402 | -    | 2480 | MHz       |
| TX power                           |                                                          | -         | -20  | 6    | 15   | dBm       |
| <b>Bluetooth LE 1 Mbps</b>         |                                                          |           |      |      |      |           |
| In-band emissions                  | ±2 MHz offset                                            | -         | -    | -47  | -    | dBm       |
|                                    | ±3 MHz offset                                            | -         | -    | -49  | -    | dBm       |
|                                    | > ±3 MHz offset                                          | -         | -    | -50  | -    | dBm       |
| Modulation characteristics         | Δf <sub>lavg</sub>                                       | -         | -    | 245  | -    | kHz       |
|                                    | Δf <sub>2max</sub>                                       | -         | -    | 235  | -    | kHz       |
|                                    | Δf <sub>2avg</sub> /Δf <sub>lavg</sub>                   | -         | -    | 0.93 | -    | -         |
| Carrier frequency offset and drift | Max  f <sub>n</sub>   n = 0, 1, 2, 3...k                 | -         | -    | 3    | -    | kHz       |
|                                    | Max  f <sub>0</sub> - f <sub>n</sub>   n = 2, 3, 4...k   | -         | -    | 2.5  | -    | kHz       |
|                                    | f <sub>1</sub> - f <sub>0</sub>                          | -         | -    | 2    | -    | kHz       |
|                                    | Max  f <sub>n</sub> - f <sub>n-5</sub>   n = 6, 7, 8...k | -         | -    | 2.5  | -    | kHz/50 μs |
| <b>Bluetooth LE 2 Mbps</b>         |                                                          |           |      |      |      |           |
| In-band emissions                  | ±4 MHz offset                                            | -         | -    | -50  | -    | dBm       |
|                                    | ±5 MHz offset                                            | -         | -    | -51  | -    | dBm       |
|                                    | > ±5 MHz offset                                          | -         | -    | -52  | -    | dBm       |
| Modulation characteristics         | Δf <sub>lavg</sub>                                       | -         | -    | 488  | -    | kHz       |
|                                    | Δf <sub>2max</sub>                                       | -         | -    | 469  | -    | kHz       |
|                                    | Δf <sub>2avg</sub> /Δf <sub>lavg</sub>                   | -         | -    | 0.93 | -    | -         |
| Carrier frequency offset and drift | Max  f <sub>n</sub>   n = 0, 1, 2, 3...k                 | -         | -    | 3    | -    | kHz       |
|                                    | Max  f <sub>0</sub> - f <sub>n</sub>   n = 2, 3, 4...k   | -         | -    | 2.5  | -    | kHz       |
|                                    | f <sub>1</sub> - f <sub>0</sub>                          | -         | -    | 1.5  | -    | kHz       |

| Parameter                          |                                                   | Condition | Min. | Typ. | Max. | Unit           |
|------------------------------------|---------------------------------------------------|-----------|------|------|------|----------------|
|                                    | $\text{Max }  f_n - f_{n-5} _{n=6, 7, 8 \dots k}$ | -         | -    | 2.5  | -    | kHz/50 $\mu$ s |
| <b>Bluetooth LE 125 kbps</b>       |                                                   |           |      |      |      |                |
| In-band emissions                  | $\pm 2$ MHz offset                                | -         | -    | -47  | -    | dBm            |
|                                    | $\pm 3$ MHz offset                                | -         | -    | -49  | -    | dBm            |
|                                    | $> \pm 3$ MHz offset                              | -         | -    | -50  | -    | dBm            |
| Modulation characteristics         | $\Delta f_{lavg}$                                 | -         | -    | 245  | -    | kHz            |
|                                    | $\Delta f_{lmax}$                                 | -         | -    | 246  | -    | kHz            |
| Carrier frequency offset and drift | $\text{Max }  f_n _{n=0, 1, 2, 3 \dots k}$        | -         | -    | 1.5  | -    | kHz            |
|                                    | $\text{Max }  f_0 - f_n _{n=1, 2, 3 \dots k}$     | -         | -    | 1.5  | -    | kHz            |
|                                    | $ f_0 - f_3 $                                     | -         | -    | 1.5  | -    | kHz            |
|                                    | $ f_n - f_{n-3} _{n=7, 8, 9 \dots k}$             | -         | -    | 1.5  | -    | kHz/48 $\mu$ s |
| <b>Bluetooth LE 500 kbps</b>       |                                                   |           |      |      |      |                |
| In-band emissions                  | $\pm 2$ MHz offset                                | -         | -    | -47  | -    | dBm            |
|                                    | $\pm 3$ MHz offset                                | -         | -    | -49  | -    | dBm            |
|                                    | $> \pm 3$ MHz offset                              | -         | -    | -50  | -    | dBm            |

## 4.11 AUX ADC Characteristics

| Parameter                           | Condition | Min. | Typ. | Max.             | Unit       |
|-------------------------------------|-----------|------|------|------------------|------------|
| Conversion clock                    | -         | -    | -    | 13               | MHz        |
| Conversion time                     | -         | -    | 16   | -                | Cycle      |
| $V_{REF}$                           | Internal  | -    | 1.2  | -                | V          |
| Input voltage range                 | -         | 0    | -    | V <sub>BAT</sub> | V          |
| Input impedance                     | -         | 10   | -    | -                | M $\Omega$ |
| Input capacitance (C <sub>s</sub> ) | -         | -    | 1    | -                | pF         |
| DNL                                 | -         | -1   | -    | 3                | LSB        |
| INL                                 | -         | -5   | -    | 5                | LSB        |

| Parameter | Condition             | Min. | Typ. | Max. | Unit |
|-----------|-----------------------|------|------|------|------|
| Precision | Internal (> 500 mV)   | -    | -    | 1    | %    |
|           | Internal (400–500 mV) | -    | 2    | 4    | %    |
|           | Internal (300–400 mV) | -    | 3    | 6    | %    |
|           | Internal (200–300 mV) | -    | -    | 8    | %    |
|           | Internal (100–200 mV) | -    | -    | 20   | %    |
|           | Internal (50–100 mV)  | -    | -    | 40   | %    |
|           | Internal (<50 mV)     | -    | -    | 100  | %    |

## 4.12 I2C Characteristics

| Parameter                                            | Condition                         | Min. | Typ. | Max. | Unit |
|------------------------------------------------------|-----------------------------------|------|------|------|------|
| Clock                                                | -                                 | -    | 400  | 400  | kHz  |
| Pull-up resistor                                     | -                                 | 1.5  | 4.7  | 10   | kΩ   |
| Capacitive load drive strength (enhanced drive mode) | Ceramic capacitor added to ground | 20   | -    | -    | nF   |

## 4.13 PWM Characteristics

| Parameter                      | Condition | Min. | Typ. | Max. | Unit |
|--------------------------------|-----------|------|------|------|------|
| Frequency                      | -         | -    | -    | 8    | MHz  |
| Recommended pull-down resistor | -         | -    | 51K  | -    | KΩ   |

## 5. Certification

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The module has passed the following certifications:

- FCC
- SRRC
- WFA
- BQB

**Notes:**

- Due to the optimization of chip and module design, module parameters may change. Please pay attention to the update of the module datasheet.
- During certification, the transmit power is appropriately adjusted due to the specific application and certification requirements.
- Test conditions for RF transceiver performance: supply voltage = 3.3 V, ambient temperature = 25 °C.



# Revision History

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| Version | Date      | Description     |
|---------|-----------|-----------------|
| 1.0     | 2024/8/28 | Initial release |

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## **FCC Warning**

### **15.19 Labeling requirements.**

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.**

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

### **15.105 Information to the user.**

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.

### **FCC RF Radiation Exposure Statement:**

1.This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2.This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Additional Section: Integration instructions for host product manufacturers  
according to KDB 996369 D03 OEM Manual v01

### **2.1 Conditions on using Shenzhen Shi Xinzhongxin Technology Co., Ltd regulatory approvals:**

A.Customer must ensure that its product (The "CUSTOMER Product") is electrically identical to Shenzhen Shi Xinzhongxin Technology Co., Ltd reference designs. Customer acknowledges that any modifications to Shenzhen Shi Xinzhongxin Technology Co., Ltd reference designs may invalidate regulatory approvals in relation to the CUSTOMER Product, or may necessitate notifications to the relevant regulatory authorities.

B.Customer is responsible for ensuring that antennas used with the product are of the same type, with same or lower gains as approved and providing antenna reports to Shenzhen Shi Xinzhongxin Technology Co., Ltd

C.Customer is responsible for regression testing to accommodate changes to Shenzhen Shi Xinzhongxin Technology Co., Ltd reference designs, new antennas, and portable RF exposure safety testing/apprvls.

D.Appropriate labels must be affixed to the CUSTOMER Product that comply with applicable regulations in all respects.

E.A user's manual or instruction manual must be included with the customer product that contains the text as required by applicable law. Without limitation of the foregoing, an example (for illustration purposes only) of possible text to include is set forth below:



## 2.2 List of applicable FCC rules (customers' product must also compliant with these rules)

FCC Part 15 Subpart C 15.247

### 2.3 Specific operational use conditions

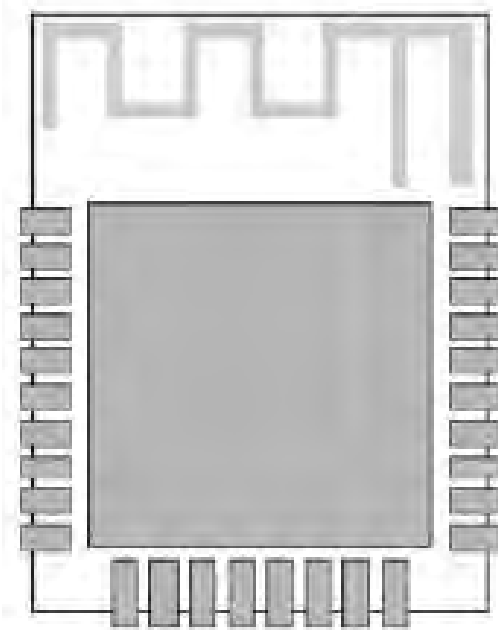
Operation Frequency: 2402MHz to 2480MHz  
Number of Channels: 40  
Modulation Type: GFSK  
Antenna Type: PCB Antenna  
Antenna Gain#: -0.71dBi

The module can be used for mobile applications with the same ant. type with maximum -0.71dBi antenna. The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual. If the end product manufacturer use it to a portable product, please provide the SAR compliance.

### 2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

### 2.5 Trace antenna designs



### 2.6 RF exposure considerations

The device can be used in mobile exposure condition without restriction and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

## 2.7 Antennas

Antenna Type: PCB antenna

Antenna Gain: -0.71 dBi

This device is intended only for host manufacturers under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the PCB antenna that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler. As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end product for any additional compliance requirements required with this module installed.

## 2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "**Contains FCC ID:2BKIMBK7236SWIZMINI**" With their finished product.

## 2.9 Information on test modes and additional testing requirements

Operation Frequency: 2402MHz to 2480MHz

Number of Channels: 40

Modulation Type: GFSK

Antenna Type: PCB Antenna

Antenna Gain#: -0.71dBi

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. If no other module used and no change to this module, the product can only to compliance with FCC part 15 B to meet the sale requirement. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

## 2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 that the 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. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.