

# User Manual

Product Name: BLE Cloud Module

Main Model: DSM-05D

Series Model: DSM-05D-IPEX

## Revision History

Specification		Sect.	Update Description	By
Rev	Date			
1.0	2021-12-30		New version release	Alpha

## Approvals

Organization	Name	Title	Date

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# 1 Introduction

## 1.1 Purpose& Description

DSM-05D is a low power-consuming embedded BT module developed By Dusun. It consists of the highly integrated wireless radio processor chip, EFR32BG21A020F768IM32-B, and several peripherals, with a built-in BLE protocol stack and robust library functions.

This data terminal device is embedded with the high-performance 32-bit 80 MHz ARM Cortex®-M33 CPU with DSP instructions and floating point unit for efficient signal processing, 768 KB flash memory, 64 KB RAM data memory, and robust peripheral resources. It is mainly used for BLE coordinator device to support BLE 5.1 protocol stack.

## 1.2 Product Feature Summary

- High-performance 32-bit 80 MHz ARM Cortex®-M33 with DSP instructions and floating point unit for efficient signal processing
- Up to 768kB Flash programming memory
- Up to 64kB RAM data memory
- Working voltage: 1.71 V to 3.8 V
- BLE operating feature
  - Bluetooth Mesh supported
  - Working channel: 0~39 @2.402 GHz to 2.480 GHz, with an air interface, rate of 1Mbps
- Dimension: 17 x 22 x 2.8 mm
- Working temperature: -40°C to +85°C
- Certification CE, FCC, SRRC

## 1.3 Scenario

- Intelligent Building
- Intelligent Home And Household Applications
- Industrial Wireless Control
- Intelligent Public Traffic

## 2 Mechanical Requirement

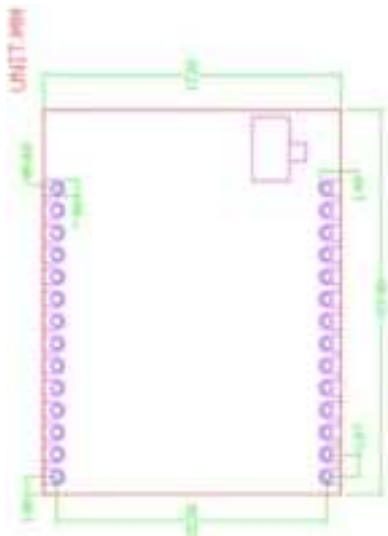
### 2.1 Drawing



### 2.2 Dimensions

DSM-05D provides two rows of pins(2 \* 14) with the pin pitch of  $1.27 \pm 0.1 \text{ mm}$

Dimensions:  $17 \pm 0.35 \text{ mm}$  (W) x  $22 \pm 0.35 \text{ mm}$  (L) x  $2.8 \pm 0.15 \text{ mm}$  (H).



### 2.3 Pin Definition

Pin Number	Symbol	IO Type	Function
1	GND	P	Power supply reference ground pin
2	ANT	RF	RF signal input/output port, which corresponds to ANT of IC
3	GND	P	Power supply reference ground pin
4	NC		Not connect

5	PA0	I/O	Corresponding to PA0 of IC
6	PC5	I/O	Corresponding to PC5 of IC
7	PC4	I/O	Corresponding to PC4 of IC
8	PA3	I/O	Corresponding to PA3 of IC
9	PA4	I/O	Corresponding to PA4 of IC
10	PC1	I/O	Corresponding to PC1 of IC
11	PC0	I/O	Corresponding to PC0 of IC
12	PD4	I/O	Corresponding to PD4 of IC
13	PD3	I/O	Corresponding to PD3 of IC
14	PD2	I/O	Corresponding to PD2 of IC
15	NC		Not connect
16	NC		Not connect
17	PB0	I/O	Corresponding to PB0 of IC
18	PB1	I/O	Corresponding to PB1 of IC
19	NC		Not connect
20	GND	P	Power supply reference ground pin
21	VCC	P	Power supply pin (3.3V)
22	RX0	I	Corresponding to internal RXD0 of IC
23	TX0	O	Corresponding to internal TXD0 of IC
24	SWDIO	I/O	Corresponding to internal SWDIO of IC
25	SWCLK	I/O	Corresponding to PF2 of IC
26	PC3	I/O	Corresponding to PF3 of IC
27	PC2	I/O	Not connect
28	nRESET	I	Hardware reset pin, which is at a high level by default and is active at a low level

- P indicates power supply pins, I/O indicates input/output pins

### 3 Electrical parameters

#### 3.1 Absolute electrical parameters

Parameter	Description	Typical value	Minimum value	Maximum value	Unit
Ts	Storage temperature		-50	105	°C
VCC	Power supply voltage		1.71	3.8	V
Static electricity voltage (human body model)	TAMB-25°C		-		KV
Static electricity voltage (machine model)	TAMB-25°C		-		KV

#### 3.2 Working conditions

Parameter	Description	Minimum value	Maximum value	Typical Value	Unit
Ta	Working temperature	-40	125	-	°C
VCC	Power supply voltage	1.71	3.8	3.3	V
VIL	I/O low-level input	-	$IOVDD \times 0.3$		V
VIH	I/O high-level input	$IOVDD \times 0.7$	-	-	V
VOL	I/O low-level output	-	$IOVDD \times 0.2$	-	V
VOH	I/O high-level output	$IOVDD \times 0.8$	-	-	V

## 4 RF features

### 4.1 Basic RF feature

Parameter	Description
Frequency band	2.402~2.480GHz
Wireless technology	BLE
Data transmission rate	1Mbps max
Antenna port	IPEX interface

### 4.2 TX performance (Performance during constant transmission)

Parameter	Minimum value	Typical value	Maximum value	Unit
Maximum output power	-	-	5	dBm
Minimum output power	-	4.32	-	dBm
Output power adjustment step	-	0.5		dBm
Output spectrum adjacent-channel rejection ratio	-	-47	-	dBc
Frequency error	-15	-	15	ppm

### 4.3 RX performance (RX sensitivity)

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<1%, RX sensitivity(BLE 250Kbps)	-95	-94	-93	dBm

## **5 Antenna**

### **5.1 Antenna type**

This product uses IPEX interface connect to stick antenna.

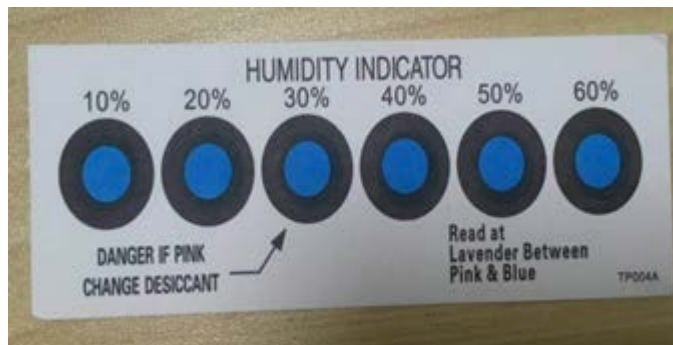
### **5.2 Antenna interference reduction**

To ensure optimal RF performance, it is recommended that the antenna be at least 15 mm away from other metal parts. If metal materials are wrapped around the antenna, the wireless signals will be reduced greatly, deteriorating the RF performance.



## 6 Production instructions

1. Use an SMT placement machine to mount components to the stamp hole module that DUSUN produces within 24 hours after the module is unpacked and the firmware is burned. If not, vacuum packs the module again. Bake the module before mounting components to the module.
  - SMT placement equipment:
    - Reflow soldering machine
    - Automated optical inspection (AOI) equipment
    - Nozzle with a 6 mm to 8 mm diameter
  - Baking equipment:
    - Cabinet oven
    - Anti-static heat-resistant trays
    - Anti-static heat-resistant gloves
2. Storage conditions for a delivered module are as follows:
  - The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
  - The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed.
  - The package contains a humidity indicator card (HIC).



3. Bake a module based on HIC status as follows when you unpack the module package:
  - If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours.
  - If the 30% circle is pink, bake the module for 4 consecutive hours.
  - If the 30% and 40% circles are pink, bake the module for 6 consecutive hours.
  - If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.
4. Baking settings:
  - Baking temperature: 125±5°C

- Alarm temperature: 130°C
  - SMT placement ready temperature after natural cooling: < 36°C
  - Number of drying times: 1
  - Rebaking condition: The module is not soldered within 12 hours after baking.
5. Do not use SMT to process modules that have been unpacked for over three months.

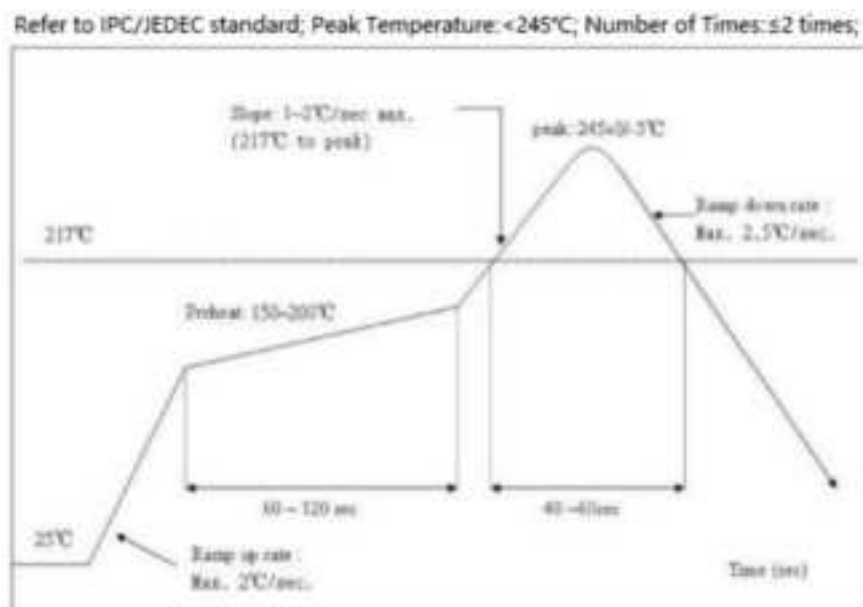
Electroless nickel immersion gold (ENIG) is used for the PCBs. If the solder pads are exposed to the air for over three months, they will be oxidized severely and dry joints or solder skips may occur. Dusun is not liable for such problems and consequences.

6. Before SMT placement, take electrostatic discharge (ESD) protective measures.
7. To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before first SMT placement to determine a proper oven temperature and component placement method. Draw 5 to 10 modules every hour from subsequent batches for visual inspection and AOI.

### 6.1 Recommended oven temperature curve

Perform SMT placement based on the following reflow oven temperature curve. The highest temperature is 245°C.

Based on the IPC/JEDEC standard, perform reflow soldering on a module at most twice.



## 6.2 Storage conditions

	<b>CAUTION</b> This bag contains <b>MOISTURE-SENSITIVE DEVICES</b>	LEVEL <div style="border: 1px solid black; padding: 5px; display: inline-block; font-size: 24px; font-weight: bold;">3</div>
If Blank, see adjacent bar code label		
1. Calculated shelf life in sealed bag: 12 months at $< 40^{\circ}\text{C}$ and $< 90\%$ relative humidity (RH)		
2. Peak package body temperature: <u>260</u> $^{\circ}\text{C}$ <span style="font-size: 10px; display: block; text-align: right;">If Blank, see adjacent bar code label</span>		
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must		
a) Mounted within: <u>168</u> hrs. of factory conditions <span style="font-size: 10px; display: block; text-align: right;">If Blank, see adjacent bar code label</span>		
$\leq 30^{\circ}\text{C}/60\%\text{RH}$ , OR		
b) Stored at $<10\%$ RH		
4. Devices require bake, before mounting, if:		
a) Humidity Indicator Card is $> 10\%$ when read at $23 \pm 5^{\circ}\text{C}$		
b) 3a or 3b not met.		
5. If baking is required, devices may be baked for 48 hrs. at $125 \pm 5^{\circ}\text{C}$		
Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure		
Bag Seal Date: _____ <span style="font-size: 10px; display: block; text-align: right;">If Blank, see adjacent bar code label</span>		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

## 7 MOQ and packing

Product model	MOQ (pcs)	Packing method	Number of Modules in each reel pack	Number of reel packs in each box
DSM-05D	4000	Carrier tape and reel packing	1000	4

## 8 FCC

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

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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Radiation Exposure Statement:

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.

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.

**Integration instructions for host product manufacturers according to KDB 996369 D03  
OEM Manual v01**

**2.2**List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular.

**2.3**Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

**2.4** Limited module procedures

Not applicable

**2.5** Trace antenna designs

Not applicable

**2.6** RF exposure considerations

To maintain compliance with FCC's RF Exposure guidelines, this equipment should be installed and operated with minimum distance of 20cm from your body.

**2.7** Antennas

This radio transmitter FCC ID: 2AWWF-DSM-05D has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna type	Maximum Antenna gain
Stick Antenna	2.38dBi

**2.8** Label and compliance information

The final end product must be labeled in a visible area with the following "Contains FCC ID: 2AWWF-DSM-05D".

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

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

**2.10** Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B