



# BLE Module

**Data sheet**

**BLE Module**

**DFBM-NW726-DT0R**

*A Bluetooth Low Energy module with Antenna  
on Package.*



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## Revision History

Rev.	Date	Reason of change	Maker	Approval
S01	2018/01/22	Update FCC / NCC / TELEC Certification Number	Ryan	Josh
0.6	2018/01/10	1. Modify description in 6.Pin Description section Pin3 → P0.20 / TRACECLK Pin5 → P0.18 / TRACEDATA[0] / SWO Pin11 → P0.16 / TRACEDATA[1] Pin13 → P0.15 / TRACEDATA[2] Pin15 → SWDIO, remove reset description Pin16 → P0.14 / TRACEDATA[3] 2.Update detail dimension of footprint in 11.Recommended Stencil Aperture section 3.Modify C3 from 10UF to NC in 7.Reference Design section	Ryan	Josh
0.5	2017/12/14	Certification based on BT4.2	Ryan	Josh
0.4	2017/12/08	Modify Laser marking information	Ryan	Josh
0.3	2017/11/07	Update Package information	Ryan	Josh
0.2	2017/10/20	Modify ESD (HBM/CDM) specification	Ryan	Josh
0.1	2017/07/03	Initial release	Ryan	Josh

## DFBM-NW726-DT0R

### BLE Module with Antenna on Package

This document describes the DFBM-NW726-DT0R wireless BLE module hardware specification. The modules provide cost effective, low power, and flexible platform to add BLE for embedded devices for a variety of applications, such as wireless sensors and thermostats. It uses BLE SoC, which integrating the 2.4GHz transceiver, a 32 bit ARM® Cortex M4F CPU, flash memory, and analog and digital peripherals.

## 1. Features

### 1-1. General

- BLE chip with a single chip antenna or an external RF connector
- Integrate a 32 bit ARM® Cortex M4F CPU, 512KB flash memory and 64KB RAM
- 12-bit 200kspc ADC - 8 configurable channels with programmable gain
- 30 General Purpose I/O Pins
- Two-wire Master (I2C compatible) support 100K bps and 400K bps
- UART baud rate up to 921600 bps
- SPI bit rate up to 4M bps
- Quadrature Decoder (QDEC)
- LGA 48 pin package
- Dimension 6.5mm(L) x 6.5mm(W) x 1.5 mm(H)
- RoHS compliant

### 1-2. Bluetooth

- Bluetooth 4.2 specification compliant
- AES HW encryption

## 2. Block Diagram

### 2-1. Use Antenna on Package

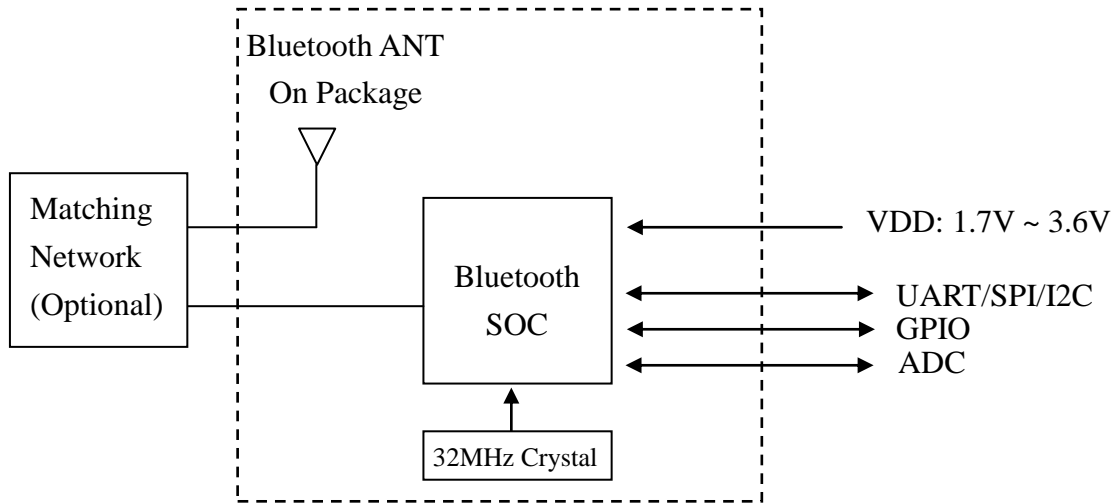


Figure 2-1. DFBM-NW726-DT0R Block Diagram (AOP)

### 2-2. Use RF connector or External Antenna

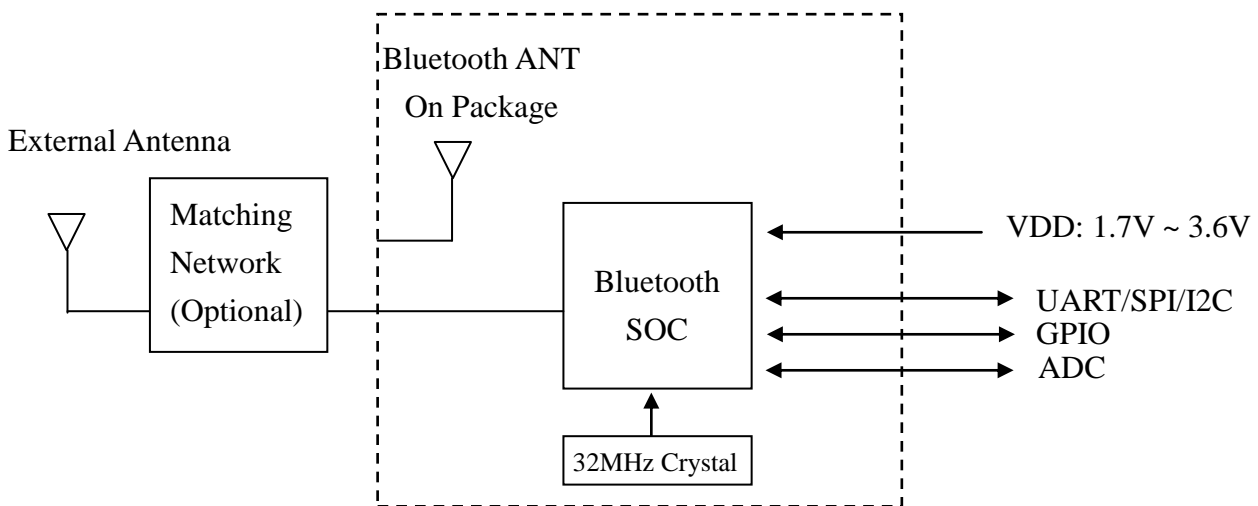


Figure 2-2. DFBM-NW726-DT0R Block Diagram (External RF)

### 3. General Specification

<b>MCU</b>	ARM® Cortex®-M4 32-bit processor with FPU, 64MHz
<b>Standard</b>	Bluetooth: V4.2
<b>Frequency</b>	2.402 ~ 2.48 GHz
<b>Modulation</b>	GFSK
<b>Data Rate</b>	BLE: 0.25, 1, 2 Mbps
<b>Operating Temperature</b>	-40°C ~ +85 °C
<b>Storage Temperature</b>	-40°C ~ +85 °C
<b>Antenna Impedance</b>	50 ohm
<b>Package Size</b>	6.5 x 6.5 x 1.5 mm <sup>3</sup>
<b>Host Interface</b>	UART, SPI, I2C, ADC
<b>Certification</b>	FCC: H79DFBM-NW726 CE Compliant NCC: CCAM18LP0130T8 TELEC: 201-180008

Table 3-1. General Specification

## 4. Electrical Characteristics

### 4-1. Absolute Maximum Rating

Symbol	Min.	Max.	Units
VDD_3V3	-0.3	3.9	V
V <sub>GPIO</sub>	-0.3	3.9	V
ESD-HBM		2	KV
ESD-CDM		500	V

Table 4-1. Absolute Maximum Rating

### 4-2. Recommended Operating Conditions & Power Consumption

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD_3V3	Supply Voltage	1.7	3.3	3.6	V
	System On, Standby mode		50		uA
	TX Current at POUT = +0 dBm (LDO)		11.6		mA
	TX Current at POUT = +0 dBm (DCDC)		5.3		mA
	RX Current (LDO)		12.9		mA
	RX Current (DCDC)		5.8		mA
	Current in SYSTEM OFF, no RAM retention.	0.7	1.2	1.9	uA
	Current in SYSTEM OFF mode 32 kB RAM retention.		1.0		uA
	SYSTEM-ON base current with 32 kB RAM enabled.		1.5		uA

Table 4-2. Bluetooth Power Consumption



## 5. RF Characteristics

### 5-1. Bluetooth RF characteristics

Condition: VDD\_3V3=VIO=3.3V, T=25°C

Item	Condition	Min.	Typ.	Max.	Unit
<b>RF Characteristics</b>					
Output Power		-20	0	4	dBm
Initial Frequency Offset		-75		75	KHz
Carrier Frequency Offset and Drift	CFOD	-150		150	KHz
Modulation Characteristics	Modulation Index (F1 / F2)	0.8			N/A
	F1 Average	225		275	KHz
	F2 Maximum	185			KHz
Sensitivity	PER < 30.8%		-96		dBm
Maximum Input Level	PER < 30.8%		-10		dBm

Table 5-1. Bluetooth RF Characteristics

### 5-2. Antenna characteristics

There is no antenna on module. Only RF pad is used for antenna. Below table shows antenna list used for certification testing.

<b>Antenna Designation for Certification</b>	1. Dipole Antenna, Gain: 2.23dBi Part No.:RFDPA8780900SMAB801, Supplier: Walsin 2. Chip Antenna, Gain: 2.12dBi Part No.:RFANT3216120A5T, Supplier: Walsin 3. PCB Antenna, Gain: 2dBi Part No.:DFAM-NW726-DT0R, Supplier: Delta
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## 6. Pin Description

Pin	Definition	Function	Description
1	GND	Gnd	Ground
2	P0.21 nRESET	Digital I/O	Bluetooth general purpose I/O pin Configurable as pin reset
3	P0.20 TRACECLK	Digital I/O	Bluetooth general purpose I/O pin Trace port clock output
4	P0.19	Digital I/O	Bluetooth general purpose I/O pin
5	P0.18 TRACEDATA[0] / SWO	Digital I/O	Bluetooth general purpose I/O pin Single wire output Trace port output
6	GND	Gnd	Ground
7	RF_OUT	RF_OUT	Bluetooth RF input/output from IC
8	AOP	AOP_IN	Bluetooth RF input/output to antenna on package
9	GND	Gnd	Ground
10	P0.17	Digital I/O	Bluetooth general purpose I/O pin
11	P0.16 TRACEDATA[1]	Digital I/O	Bluetooth general purpose I/O pin Trace port output
12	GND	Gnd	Ground
13	P0.15 TRACEDATA[2]	Digital I/O	Bluetooth general purpose I/O pin Trace port output
14	SWDCLK	Digital input	Serial wire debug clock input for debug and programming
15	SWDIO	Digital I/O	Serial wire debug I/O for debug and programming
16	P0.14 TRACEDATA[3]	Digital I/O	Bluetooth general purpose I/O pin Trace port output
17	P0.13	Digital I/O	Bluetooth general purpose I/O pin



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Pin	Definition	Function	Description
18	P0.12	Digital I/O	Bluetooth general purpose I/O pin
19	P0.11	Digital I/O	Bluetooth general purpose I/O pin
20	P0.10 NFC2	Digital I/O NFC input	Bluetooth general purpose I/O pin NFC antenna connection
21	P0.09 NFC1	D Digital I/O NFC input	Bluetooth general purpose I/O pin NFC antenna connection
22	P0.08	Digital I/O	Bluetooth general purpose I/O pin
23	GND	Gnd	Ground
24	P0.07	Digital I/O	Bluetooth general purpose I/O pin
25	P0.06	Digital I/O	Bluetooth general purpose I/O pin
26	P0.05 AIN3	Digital I/O Analog input	Bluetooth general purpose I/O pin SAADC/COMP/LPCOMP input
27	P0.04 AIN2	Digital I/O Analog input	Bluetooth general purpose I/O pin SAADC/COMP/LPCOMP input
28	P0.03 AIN1	Digital I/O Analog input	Bluetooth general purpose I/O pin SAADC/COMP/LPCOMP input
29	VDD	Power	Power supply input
30	DCC	Power	DC/DC regulator output
31	DEC4	Power	1.3 V regulator supply decoupling Input from DC/DC regulator Output from 1.3 V LDO
32	P0.02 AIN0	Digital I/O Analog input	Bluetooth general purpose I/O pin SAADC/COMP/LPCOMP input
33	P0.01 XL2	Digital I/O Analog input	Bluetooth general purpose I/O pin Connection for 32.768 kHz crystal (LFXO)
34	P0.00 XL1	Digital I/O Analog input	Bluetooth general purpose I/O pin Connection for 32.768 kHz crystal (LFXO)
35	P0.31	Digital I/O	Bluetooth general purpose I/O pin
36	P0.30	Digital I/O	Bluetooth general purpose I/O pin



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Pin	Definition	Function	Description
37	P0.29	Digital I/O	Bluetooth general purpose I/O pin
38	P0.28	Digital I/O	Bluetooth general purpose I/O pin
39	P0.27	Digital I/O	Bluetooth general purpose I/O pin
40	P0.26	Digital I/O	Bluetooth general purpose I/O pin
41	P0.25	Digital I/O	Bluetooth general purpose I/O pin
42	P0.24	Digital I/O	Bluetooth general purpose I/O pin
43	P0.23	Digital I/O	Bluetooth general purpose I/O pin
44	P0.22	Digital I/O	Bluetooth general purpose I/O pin
45	GND	Gnd	Ground
46	GND	Gnd	Ground
47	GND	Gnd	Ground
48	GND	Gnd	Ground

## 7. Reference Circuit

### 7-1. Use Antenna on Package

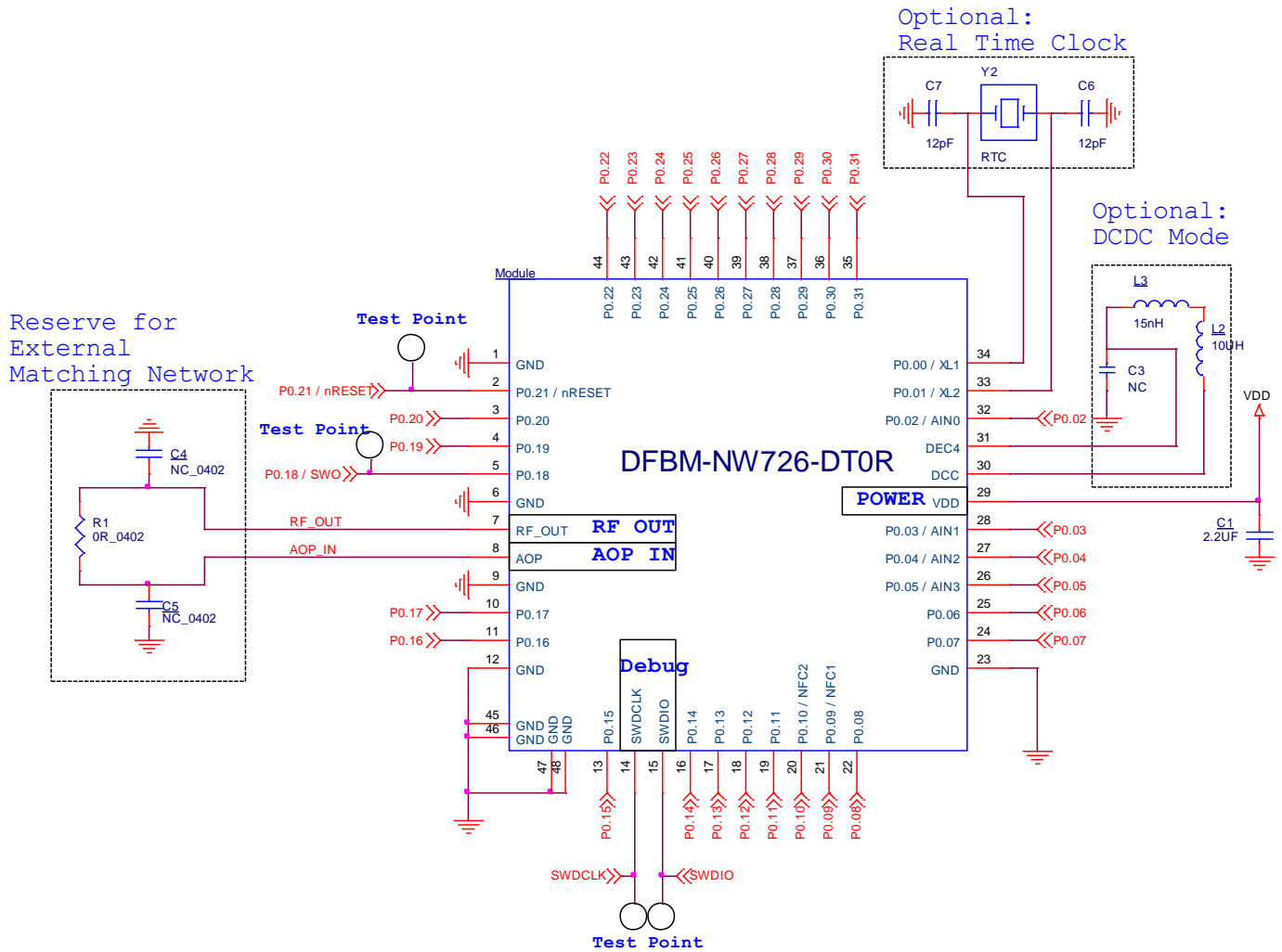


Figure 7-1. Reference Design Circuit for DFBM-NW726-DT0R (AOP)

## 7-2. Use RF connector or External Antenna

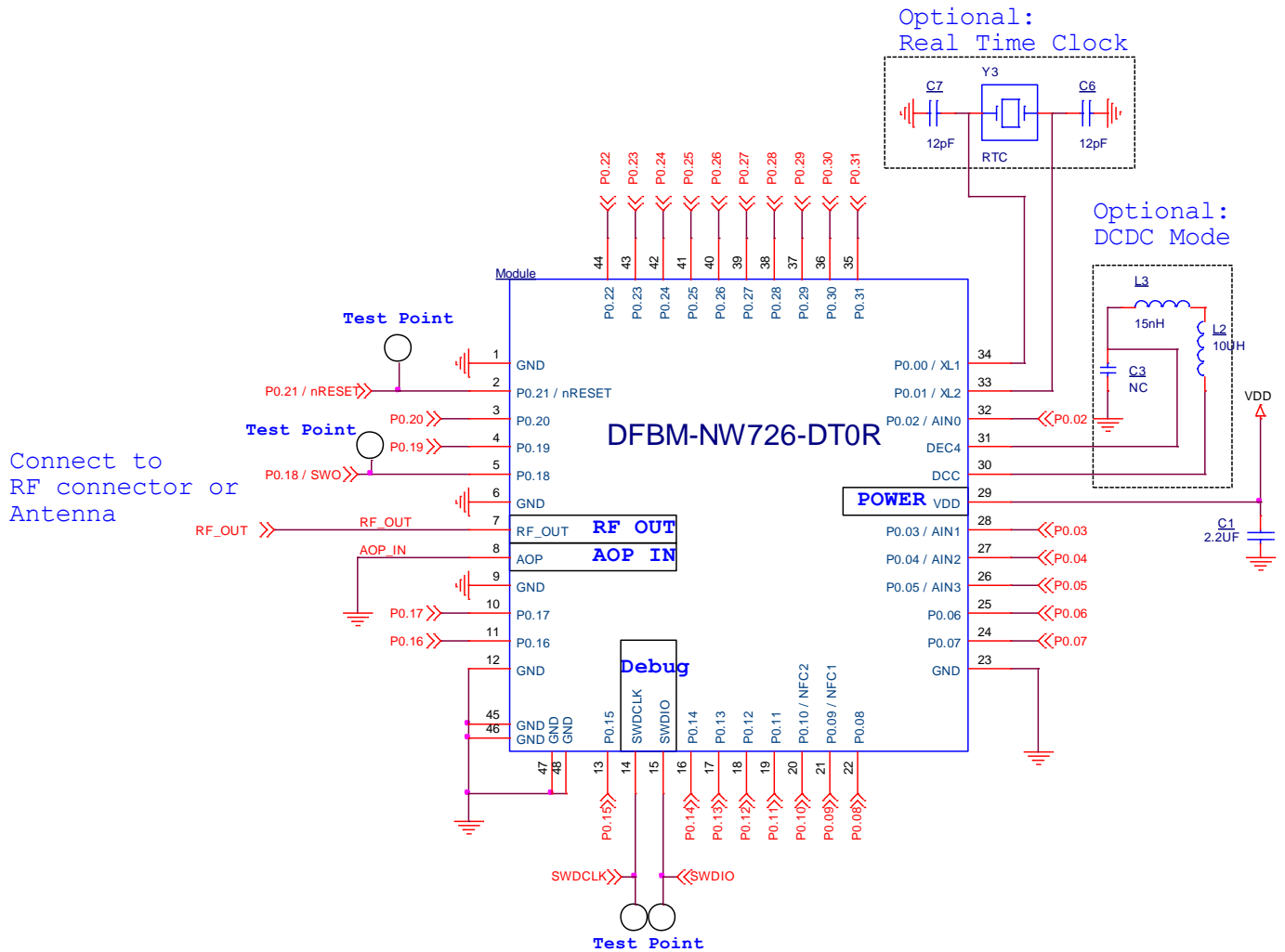


Figure 7-2. Reference Design Circuit for DFBM-NW726-DT0R (External Antenna)

## 8. Module Dimensions (mm)

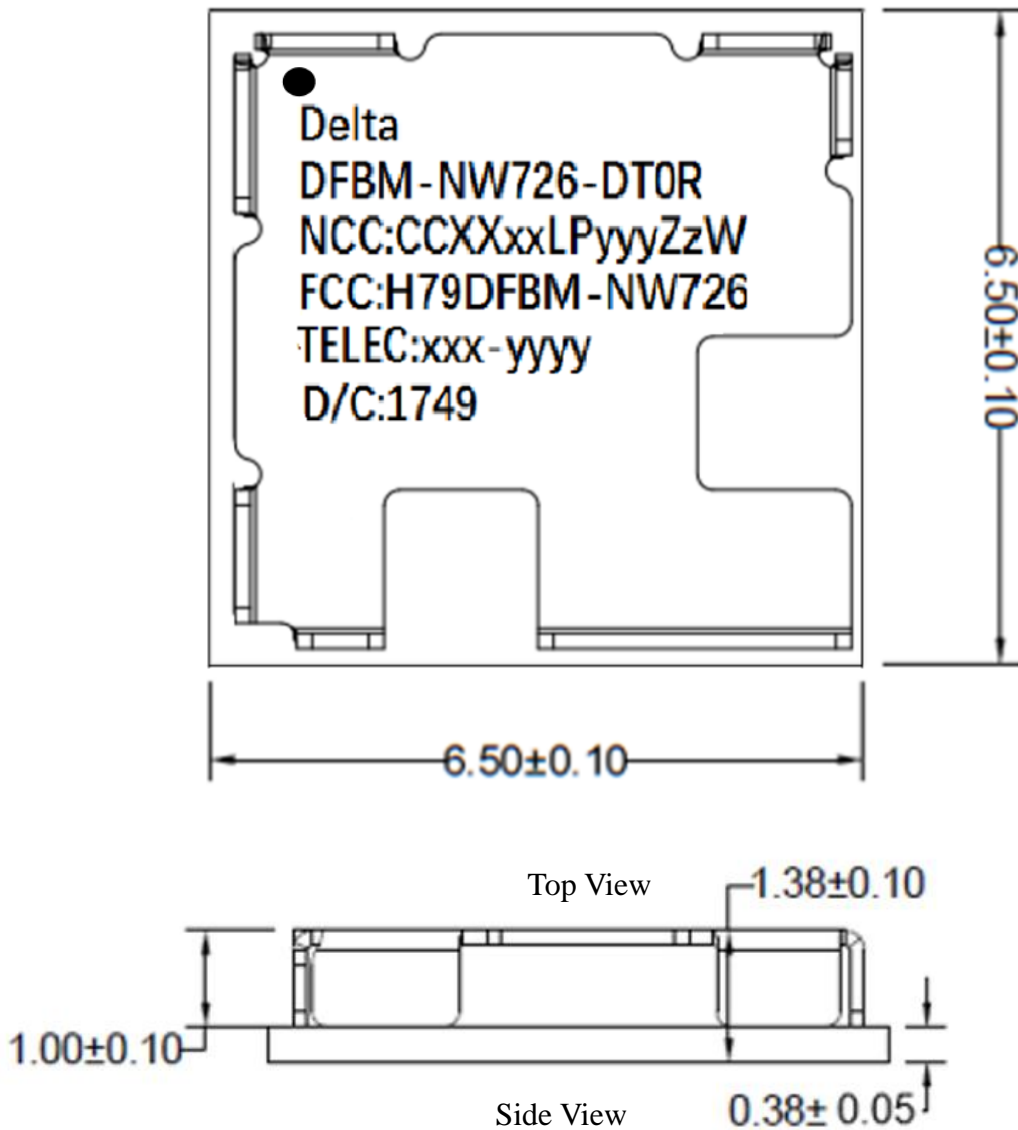


Figure 8-1. DFBM-NW726-DT0R Module Dimension

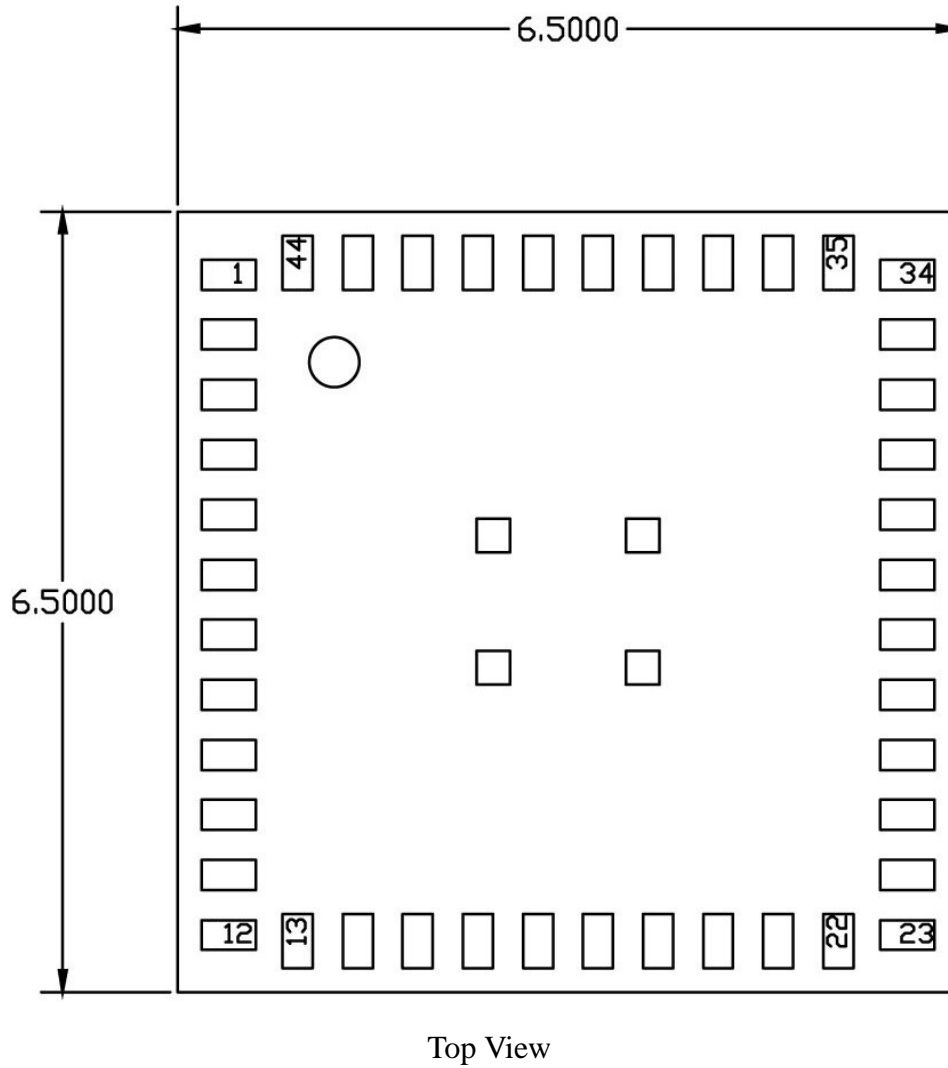


Figure 8-2. DFBM-NW726-DT0R Module Pin Number



## 9. Recommend Soldering Conditions

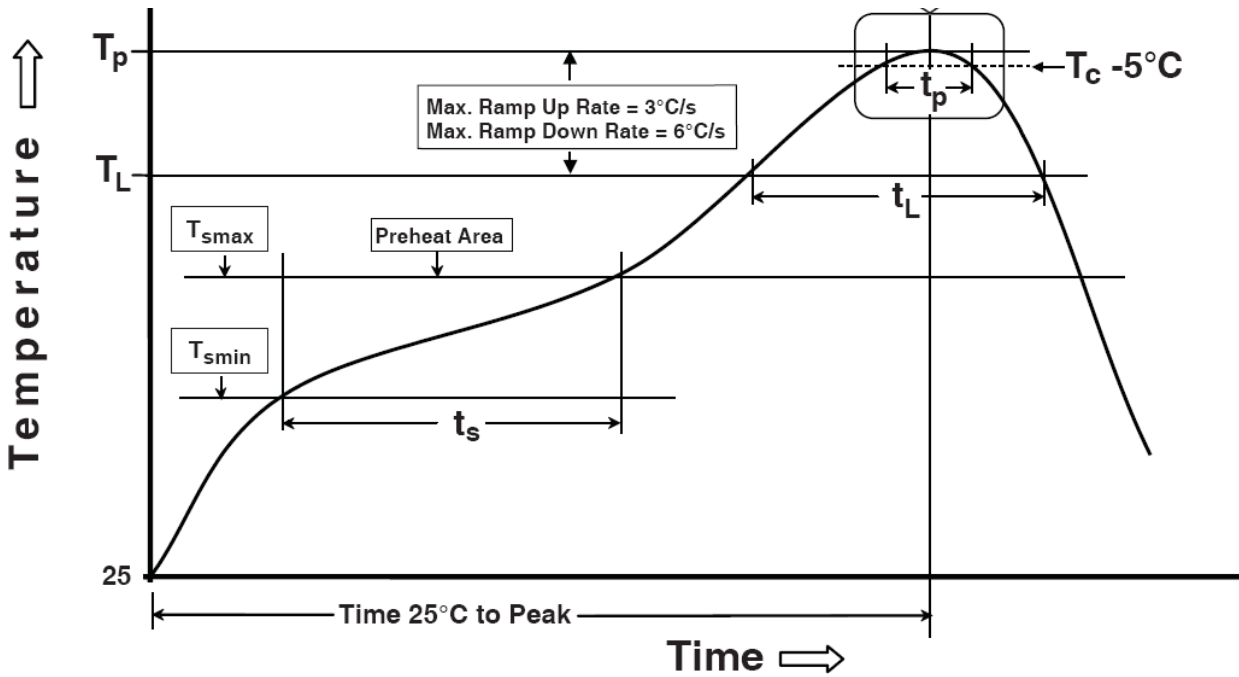


Figure 9-1. Reflow temperature Profile

No.	Item	Temperature (°C)	Time (sec)
1	Pre-heat	$T_{smin}: 150\text{ °C} \sim T_{smax}: 200\text{ °C}$	$t_s: 60 \sim 120$
2	Soldering	$T_L: \geq 217\text{ °C}$	$t_L: 60\sim 150$
3	Peak-Temp.	$T_p: 260\text{ °C}$	$t_p: 30$

Table 9-1. Reflow temperature Profile Parameters

## 10. Layout Guide (mm)

### 10-1. Use Antenna on Package

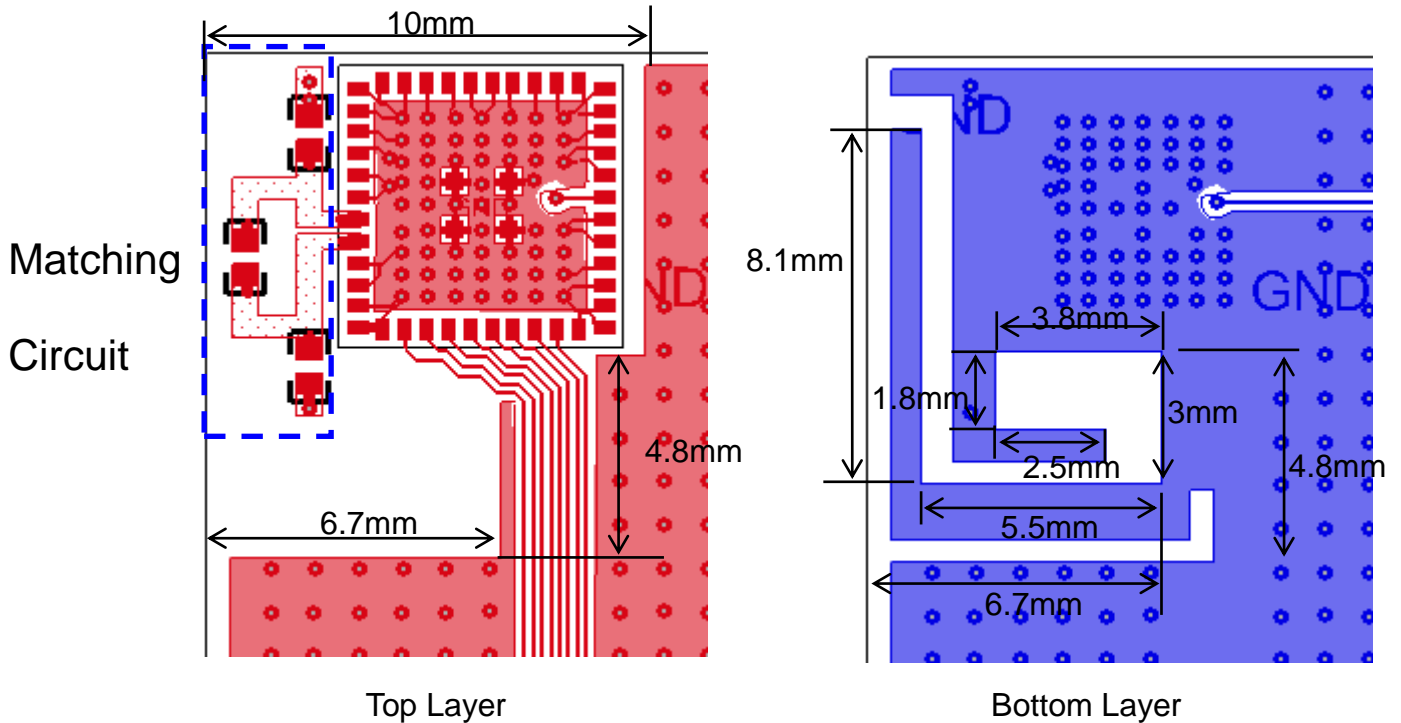
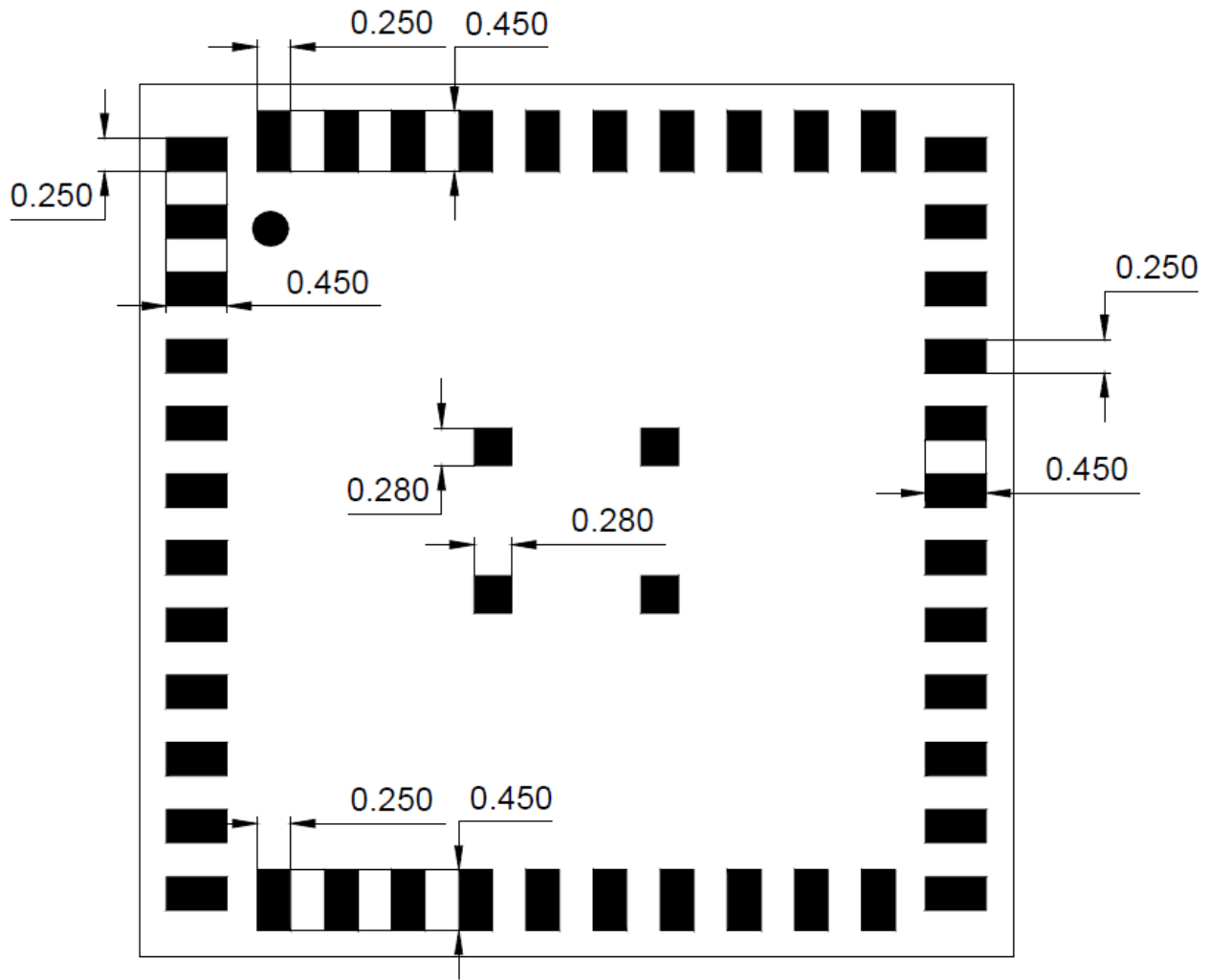


Figure 10-1. Layout Guide

### 10-2. Use RF connector or External Antenna

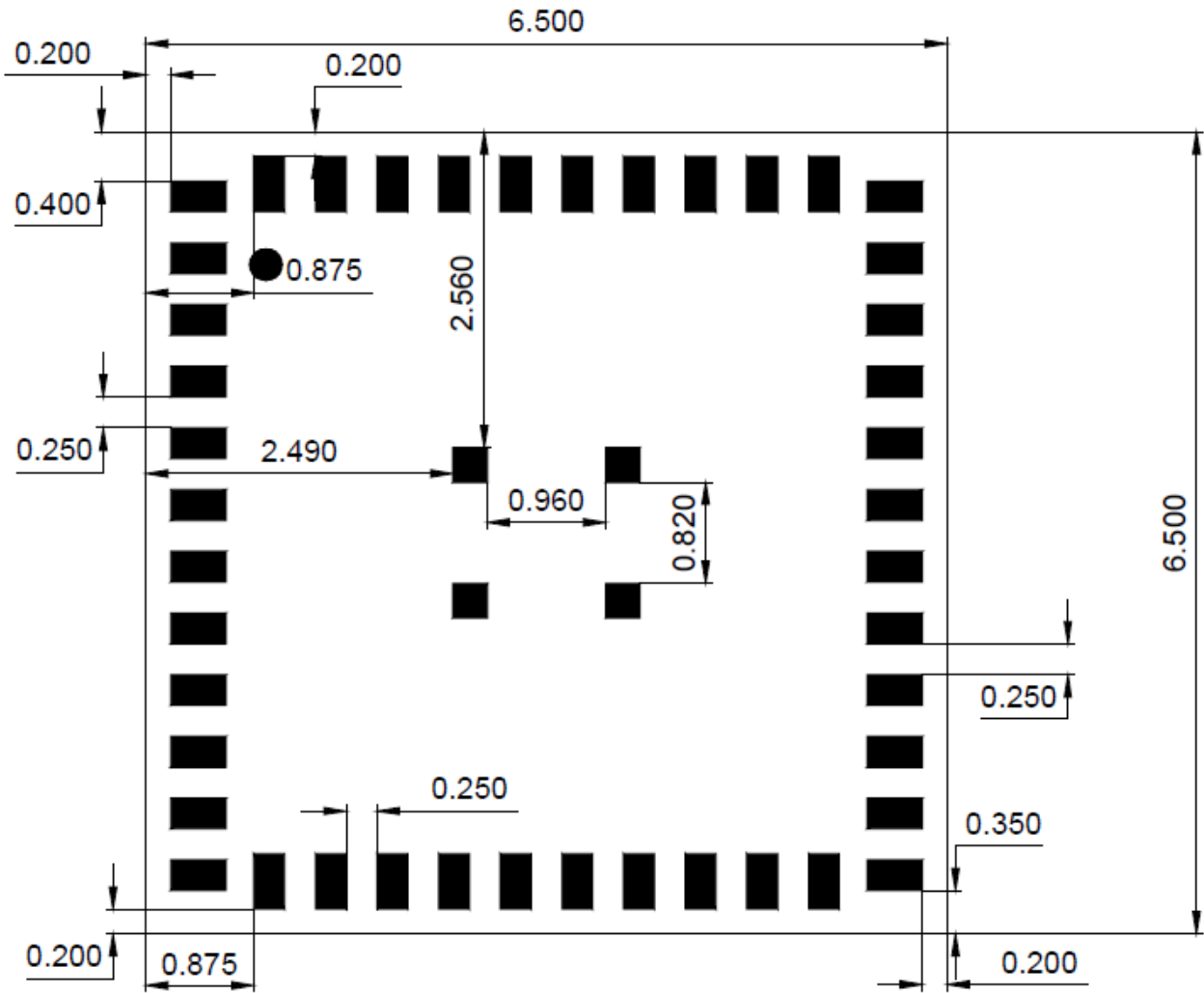
Trace of RF\_OUT should be controlled as 50 Ohm stripline or micro-stripline design.

## 11. Recommended Stencil Aperture



Top View

Figure 11-1. Recommended Stencil Aperture



Top View

Figure 11-2. Recommended Stencil Aperture

## 12. Packages

### 12-1. Tape and Reel Specification

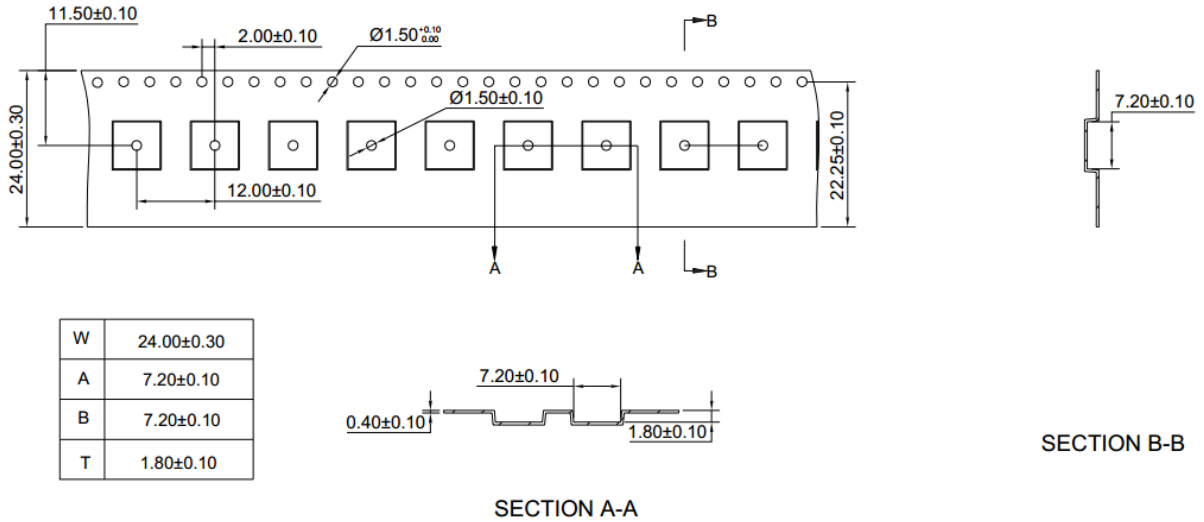


Figure 12-1. Information of Tape specification

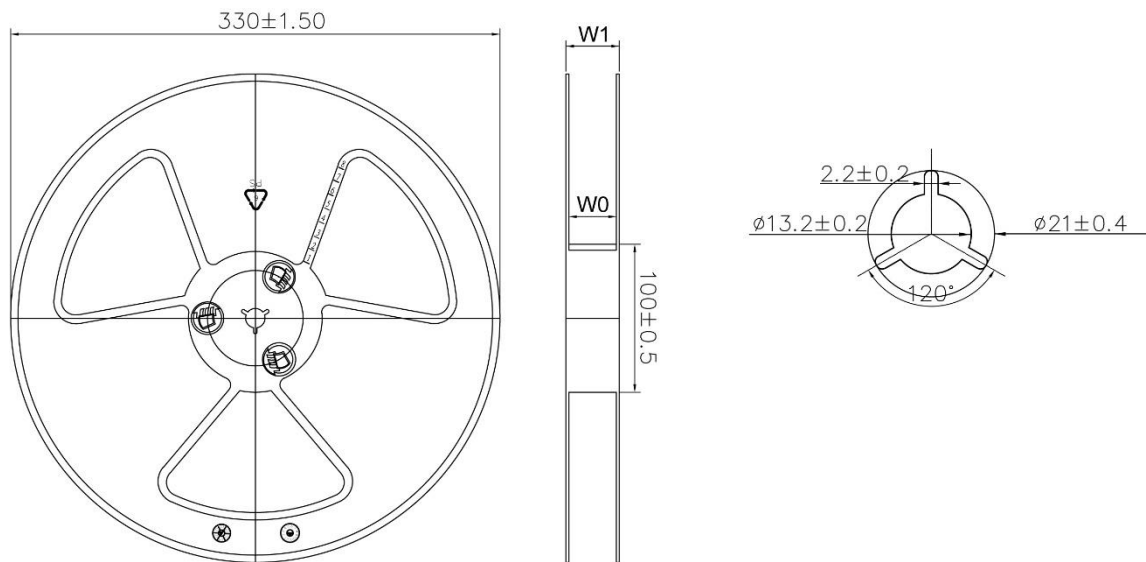



Figure 12-2. Information of Reel specification

## 12-2. Storage Specification



**CAUTION**

This bag contains

**MOISTURE-SENSITIVE DEVICES**

**LEVEL**

3

1. Calculated shelf life in sealed bag: 12 months at < 40 °C and < 90 % relative humidity (RH)
2. Peak package body temperature: 260 °C
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must
  - a) Mounted within: 168 hours of factory conditions ? 30°C/60 % RH .OR
  - b) Stored at <10% RH
4. Devices require bake, before mounting, if:
  - a) Humidity Indicator Card is > 10% when read at 23±5° C
  - b) 3a or 3b not met.
5. If baking is required, devices may be baked for 48 hours at 125±5° 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: 20121204 ←

If Blank, see adjacent bar code label

Note: Level and body temperature defined by IPC/JEDEC J-STD-020

Figure 12-4. MSL3 definition



## 13. Required End Product Labeling

Any device incorporating this module must include an external, visible, permanent marking or label which states: "Contains FCC ID: H79DFBM-NW726."

## 14. Manual Information to the End User

The OEM integrator 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 shown in this manual.

## 15. Federal Communications Commission (FCC)

### Statement

#### 15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

#### 15.105(b)

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:



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- 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 device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) this device may not cause interference and
- 2) this device must accept any interference, including interference that may cause undesired operation of the device.

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

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

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