

BL-M1603DL1

LTE Cat.1bis Mobile Communication Module Specification

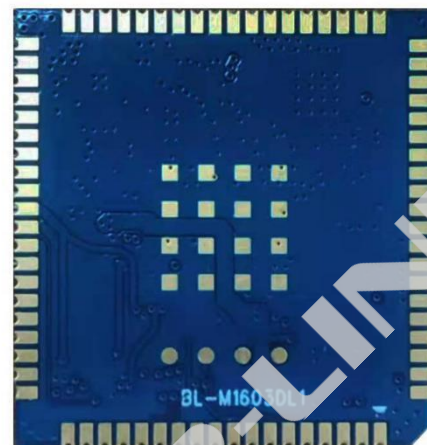
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Top view



Bottom view

Module Name: BL-M1603DL1	
Module Type: LTE Cat.1bis FDD+TDD Mobile Communication Module	
Revision: V1.0	
Customer Approval:	
Company:	
Title:	
Signature:	Date:
BL-link Approval:	
Title:	
Signature:	Date:

Revision History

Revision	Summary	Release Date
0.1	Preliminary	2022-3-18
1.0	First Release	2022-4-16

B-LINK BL-M1603DL1 is a small size LTE Cat 1 Mobile communication module that supports Mobile Communication Mode of LTE-TDD/LTE-FDD, It also supports maximum 10Mbps downlink rate and 5Mbps uplink rate.

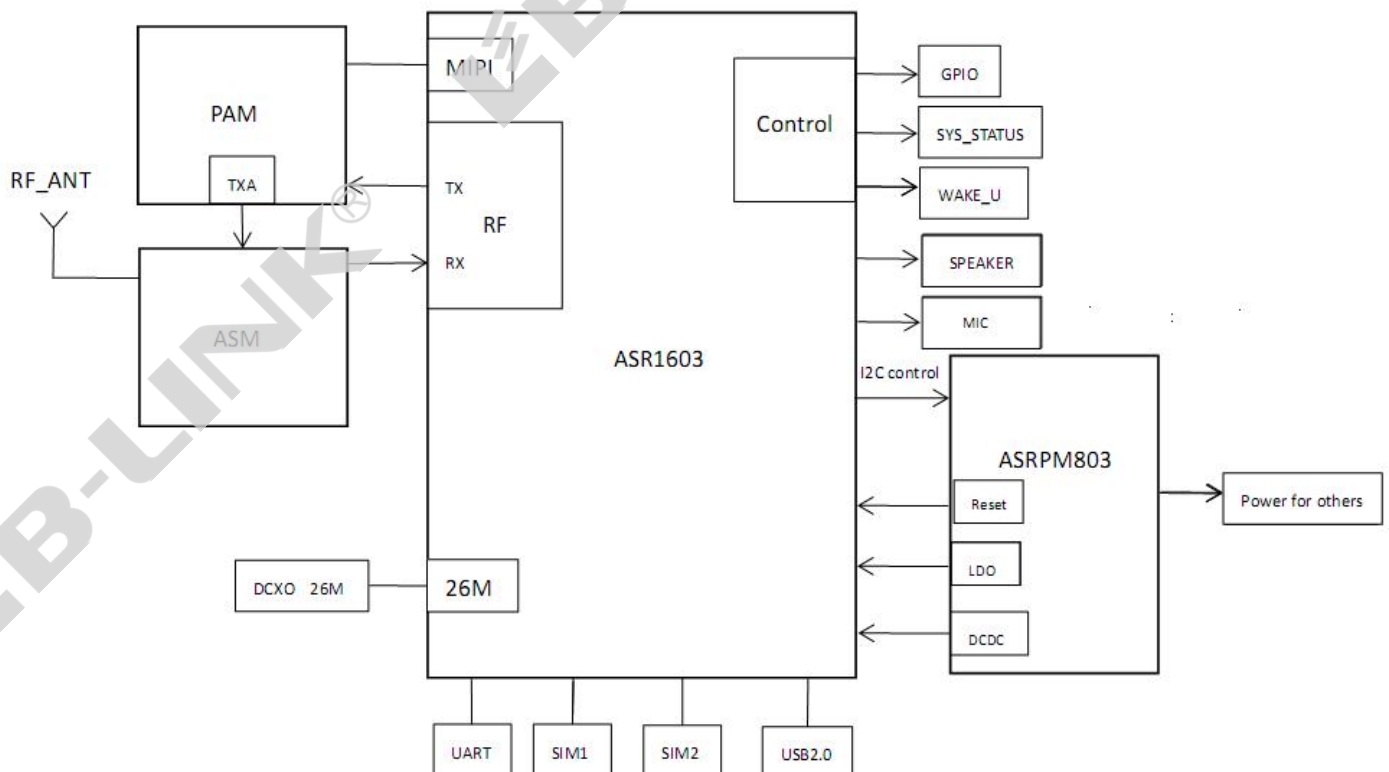
BL-M1603DL1 provides prolific functions and interfaces with ultra-small package size, Ultra-low power consumption, low latency, good mobility. It can effectively compatible the 2G / 3G network and is an ideal alternative product for various 2G and 3G modules. It's widely used in vehicle tracking, sharing economy, public network intercom, mobile payment, wireless POS, smart energy and other M2M and IOT fields.

1.1 Feature

- The standard: LTE 3GPP R13 Cat.1bis;
- Functions: Built in prolific network communication protocol, and support a variety of drivers and software function;
- Interfaces: Dual SIM(1.8V/3V)、USB2.0、UART、I2S、I2C、ADC、Analog audio、PCM、GPIO;
- Ultra-Size: 22.9*23.9*2.4mm;
- Easy Use: LCC packaging;
- Frequency Band: support LTE-FDD Bands B1/B3/B5/B8 + LTE-TDD Bands B34/B38/B39/B40/B41;
- FOTA: Support online Firmware upgrade function, reduce maintenance costs.

1.2 Block Diagram

The block diagram of the module is shown in the figure below:



2. Pin Assignments

[illegible]

Top View

2.1 Pin Definition

- ◆ Pin: Power input
- ◆ Pout: Power output
- ◆ GND: Grounds
- ◆ I/O: Signal input or output
- ◆ AI: Analog input
- ◆ AO: Analog output
- ◆ AI/O: Analog I/O
- ◆ DI: Digital input
- ◆ DO: Digital output
- ◆ PU: Pull up
- ◆ PD: Pull down

Pin Name	Pin No.	Type	After Reset	Level	Pin Description	Note
Power: Using a single VBAT as power input. VBAT_BB and VBAT_RF are connected together in the module, so don't need to distinguish them.						
VBAT_BB	29	Pin		3.5~4.3 V	VBAT Power Input of Baseband Circuits.	Module input voltage ranges from 3.5V to 4.3V, and the peak current value can reach to 2A.
VBAT_RF	36,37	Pin		3.5~4.3 V	VBAT Power Input of RF Circuits	
VDD1_8_EXT	76	Pout		1.8V, IO max = 50 mA	Module 1.8V Power Output	It only be used for Module's I/O External Pull-up application, and don't be used for other Circuits,if unused, keep it open.
GND	18,30,35,38,68,70	GND			Ground of Power and I/O.	
GND	77~92(16 Pin)	GND			Ground of Module	Module Ground to increase heat dissipation
(U)SIM Interface: The SIM interface is compatible USIM (T0 only). The default USIM_VDD is 1.8V which is configured by software.						
SIM1 Interface						
USIM1_CLK	5	I/O		1.8/3V	SIM_Card1 Clock (Out);	
USIM1_DIO	6	I/O		1.8/3V	SIM_Card1 Data(I/O);	

USIM1_RST	7	I/O		1.8/3V	SIM Card 1 Reset	
USIM1_DET	9	I/O		1.8V	SIM_Card1 Detect input signal with GPIO10 which is active Low	SIM1 card hot swap detection,if unused, keep it open.
USIM1_VDD	8	Pout		1.8/3V	SIM_Card1 VDD Power Output for External SIM Card.	
SIM2 Interface if unused, keep it open.						
USIM2_CLK	12	I/O		1.8/3V	SIM_Card2 Clock (Out);	
USIM2_DIO	13	I/O		1.8/3V	SIM_Card2 Data(I/O);	
USIM2_RST	14	I/O		1.8/3V	SIM Card2 Reset	
USIM2_DET	16	I/O		1.8V	SIM_Card2 Detect input signal with GPIO11 which is active Low	SIM2 card hot swap detection,if unused, keep it open.
USIM2_VDD	15	Pout		1.8/3V	SIM_Card2 VDD Power Output for External SIM Card.	
ADC Interface:						
ADC2	19	AI		1.8V	Aux ADC input channel 2.	If unused, keep it open.
Analog Audio Interface:						
SPK_N	21	AO		1.8V	Speaker negative output.	If unused, keep it open.
SPK_P	22	AO		1.8V	Speaker positive output.	
MIC_N	23	AI		1.8V	Microphone1 negative input.	
MIC_P	24	AI		1.8V	Microphone1 positive input.	
MIC_BIAS	25	AO		1.8V	Microphone Bias LDO output.	
USB Interface: Support USB2.0 Device mode, now don't support USB Host function.						
USB_DP	26	AI/O			USB High Speed Data+	
USB_DN	27	AI/O			USB High Speed Data-	
USB_VBUS	28	AI			Valid USB detection input, active High	Vmin=3.0V,Vmax=5.2V
UART Interface:						
UART1 is used for AT command & communication. It supports hardware flow control and the maximum baud rate up to 3.6Mbit/S.						
UART3 share Pin with another I/O Interface. maximum baud rate up to 3.6Mbit/S;						
UART1						
UART1_RXD	31	DI		1.8V	FUN0: GPIO51(I/O) FUN1: UART1 RX	If unused, keep it open.
UART1_TXD	32	DO		1.8V	FUN0: GPIO52(I/O) FUN1: UART1 TX	
UART1_CTS	33	DO		1.8V	FUN0: GPIO53(I/O) FUN1: UART1 CTS	

UART1_RTS	34	DI		1.8V	FUN0: GPIO54(I/O) FUN1: UART1 RTS	
UART3						
UART3_TXD	41	D0		1.8V	FUN0:GPIO36(I/O) FUN1: UART3 TX Data (Out)	If unused, keep it open.
UART3_RXD	42	DI		1.8V	FUN0:GPIO35(I/O) FUN1: UART3 RX Data (Out)	
Miscellaneous items: Support low power mode.						
WAKEUP_IN	49	I/O		1.8V	FUN0: GPIO04(I/O), External wake up input for Module use. Active high(In)	If unused, keep it open.
AP_READY	50	I/O		1.8V	FUN0: GPIO02(I/O), Sleep Mode Status Detect for external device (Out).	If unused, keep it open.
W_DISABLE	51	I/O		1.8V	FUN0: GPIO03(I/O), Flight Mode control input. Active Low	If unused, keep it open.
NET_MODE	52	I/O		1.8V	FUN5: GPIO00(I/O), Network Mode Status output (Out).	If unused, keep it open.
SLEEP_MODE	54	I/O		1.8V	FUN5: GPIO01(I/O), Module Sleep Mode Status output (Out).	If unused, keep it open.
FDL_BOOT_C FG	55	I/O		1.8V	Force download mode	If unused, keep it open,this Pin cannot be pulled down before the module powered up, otherwise it will affect the normal start-up of the module.
PB_INT	74	I/O		1.8V	Power on Key input. Pull Low to power on/off, .Active Low(Internal pulled high).	
EXT_RSTN	75	I/O		1.8V	System reset control input. Active Low (Internal pulled high).	If unused, keep it open.
I2C Interface: It includes three I2C master.I2C 2 and 4 are used for interface of customer.						
I2C_SDA2	56	I/O		1.8V	FUN0: GPIO50(I/O)	If unused, keep it

					FUN1: I2C Master2 SDA(I/O).	open.
I2C_SCL2	57	I/O		1.8V	FUN0: GPIO49(I/O) FUN1: I2C Master2 SCL(Out).	
I2C_SDA4	72	I/O		1.8V	FUN0: GPIO26(I/O) FUN2: I2C Master4 SDA(I/O).	If unused, keep it open.
I2C_SCL4	73	I/O		1.8V	FUN0: GPIO25(I/O) FUN2: I2C Master4 SCL(Out).	
I2S/PCM Interface: Supports I2S and PCM data format, compliant with the I2S/PCM standard, and support Master and slave mode.						
PCM_SYNC	58	I/O		1.8V	FUN0: GPIO17(I/O) FUN3: I2S2 Strobe clock /PCM_SYNC(I/O).	If unused, keep it open.
PCM_RX	59	I/O		1.8V	FUN0: GPIO19(I/O) FUN3: I2S2 data in / PCM_IN(In).	
PCM_TX	60	I/O		1.8V	FUN0: GPIO18(I/O) FUN3: I2S2 data out / PCM_OUT(Out).	
PCM_CLK	61	I/O		1.8V	FUN0: GPIO16(I/O) FUN3: I2S2 bit clock / PCM_CLK(I/O).	
RF Antenna Interface:						
ANT_4G	46	RF			Main ANT interface	LTE RF Signal (Trace impedance is 50Ω) which connect to external Antenna
RF_GND	45,47	RF			GND for LTE RF	
Reserved pin:						
Reserved/NC	1,2,3,4,10,11,17,20,39,40,43,44,48,53,62,63,64,65,66,67,69,71,93,94,95,96	/		/	No connect,keep floating	

3. Electrical and Thermal Specifications

3.1 Recommended Operating Conditions

The module is recommended to work in the environment of - 30 ~ + 75 °C. We suggest application terminal to use the temperature control measures under harsh conditions. The limited working temperature

range of the module is provided. Under this temperature condition, some RF indexes may exceed the standard. At the same time, it is suggested that the application terminal should be stored at a certain temperature. Beyond this range, the module may not work properly or be damaged.

Parameters		Min	Typ	Max	Units
Work temperature		-30	25	75	°C
limited working temperature		-35	-	80	°C
Storage temperature		-40	-	85	°C
Supply Voltage	VBAT	3.5	3.8	4.3	V

3.2 Current Consumption

Current Consumption			
Conditions: VBAT=3.8V ; Temperature: 25°C			
LTE Use Case	Work Current		
	Typ	Max	Units
Standby mode	25	/	mA
Idle mode(With AT+cfun=0)	10	/	mA
The connection CMW500 works@10M bandwidth(FDD Mode)	568	650	mA
The connection CMW500 works@10M bandwidth(TDD Mode)	240	270	mA

4. RF Specifications

4.1 LTE RF Specification

Conditions : VBAT=3.8V ; Temperature: 25℃			
Features	Description		
LTE Standard	3GPP TS 36.521 CAT1		
Frequency Bands	LTE-FDD:Band1/3/5/8 LTE-TDD:Band34/38/39/40/41		
Data Rate	LTE: 10 Mbps (DL)/ 5 Mbps (UL) Max		
LTE Transmitter Specifications@ All Bandwidth			
TX Rate	Max TX Power (dBm)	TX Power Tolerance (dB)	Note
FDD	23	±2.7	power level: 3 (23dBm±2.7dB)
TDD	23	±2.7	power level: 3 (23dBm±2.7dB)

LTE Receiver Specifications @10MHz Bandwidth

RX Rate	Min Input Level (dBm)	Max Input Level (dBm)	Note
FDD	< -98	-25	
TDD	< -98	-25	

5. RF antenna design guide

BL-M1603DL1 module need one antennas. Antenna is a sensitive device which is easily affected by external environment. For example, antenna location, occupied space and surrounding grounding may affect antenna performance. In addition, the RF cable and antenna fixed position also affects antenna performance.

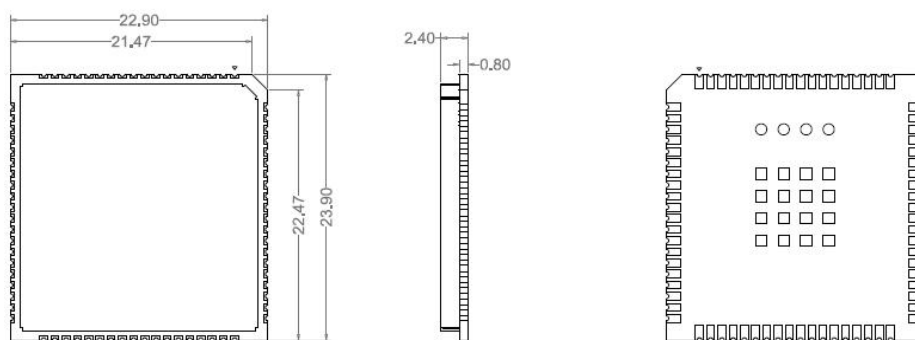
- ◆ Need to put a match circuit(PI type) between antenna and module RF port. The match circuit need close to antenna.
- ◆ The characteristic impedance of the transmission line is 50 ohm.
- ◆ The PCB wiring should be keep as short as possible.
- ◆ The PCB layout should be straight as far as possible to avoid through hole and lamination, as well as right angle and acute angle wiring.
- ◆ There should be a good reference ground around the PCB wiring to avoid other signal lines close to the antenna.
- ◆ It is recommended to use complete strata as reference ground.
- ◆ The connection between the ground around the antenna and the main ground is strengthened.

Antenna requirements:

Frequency	The most suitable antenna must be used to fit the relevant frequency band
antenna Bandwidth	LTE BAND1(2100): 250MHz
	LTE BAND3(1800): 170MHz
	LTE BAND5(850): 70MHz
	LTE BAND8(900): 80MHz
	LTE BAND34(2100): 15MHz
	LTE BAND39(1900): 40MHz
	LTE BAND40(2300): 100MHz
	LTE BAND38(2500): 100MHz
	LTE BAND41(2500): 120MHz
impedance	50 ohm
Input power	>25dBm average power; >35dBm peak power
VSWR	<= 2:1

6. Mechanical Specifications

6.1 Module Outline Drawing

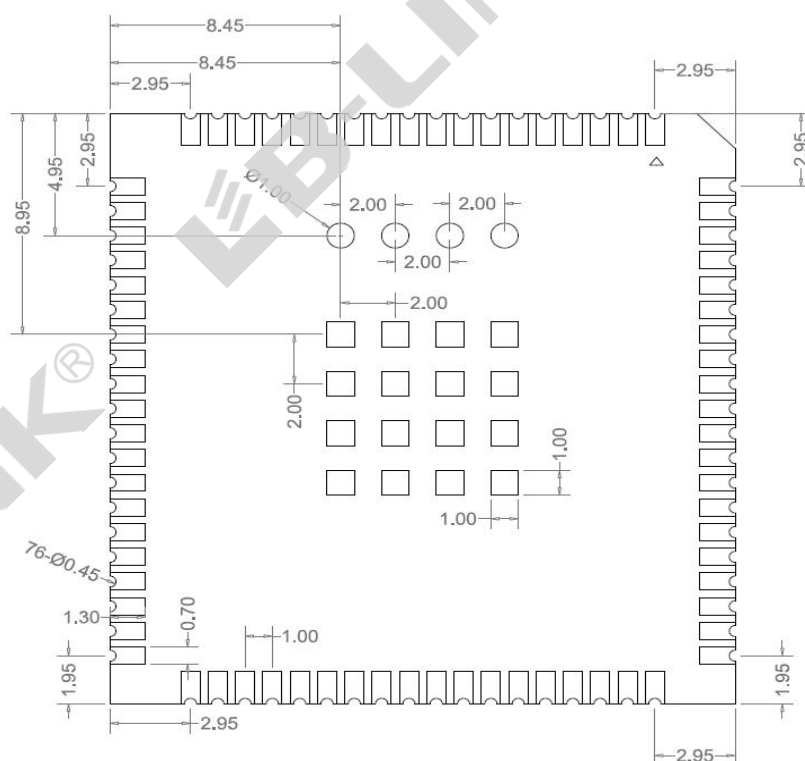


Module dimension: 22.9*23.9*2.4mm (L*W*H; Tolerance: $\pm 0.15\text{mm}$)

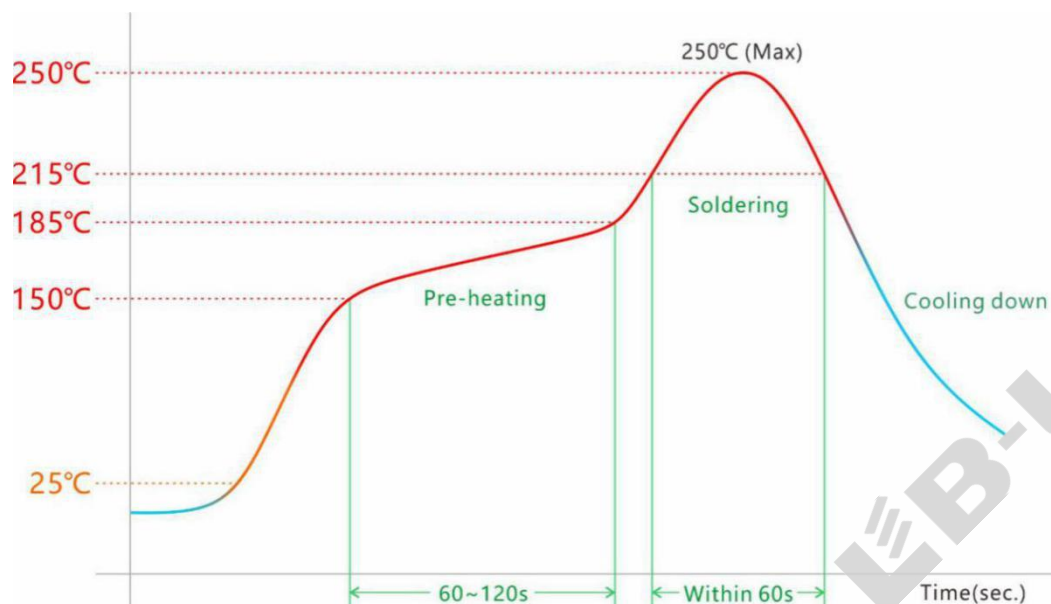


Module Bow and Twist: $\leq 0.1\text{mm}$

6.2 Mechanical Dimensions



6.3 Reflow Soldering Standard Conditions



Please use the reflow within 2 times.
Set up the highest temperature within 250°C.

7. Application Information

7.1 Structural design

The material that around the module should be plastic. In order to get stable high-rate wireless connectivity, keep the module away from metal and metallic components as far as possible especially around the antenna, antenna far away from metal at least 15cm is suggested.

8. Key Components of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	ASR1603S	ASR Microelectronic	
		ASRPM803	ASR Microelectronic	
			Guangdong KINGSHINE ELECTRONICS CO. LTD	
			Quzhou Sunlord Electronics CO. LTD	
3	Crystal	26MHz-DCXO	HOSONIC ELECTRONIC CO.LTD.	
			Lucki Electronics Co.LTD	
4	PA	PAM-4.0*4mm	Nantong NOVACO Microelectronics Technology Co.LTD	
5	Duplex	Duplex B1/B3/B5/B8	Shoulder Electronics Limited.	
			Wisol	
			HTX CO. LTD.	

9. Package and Storage Information

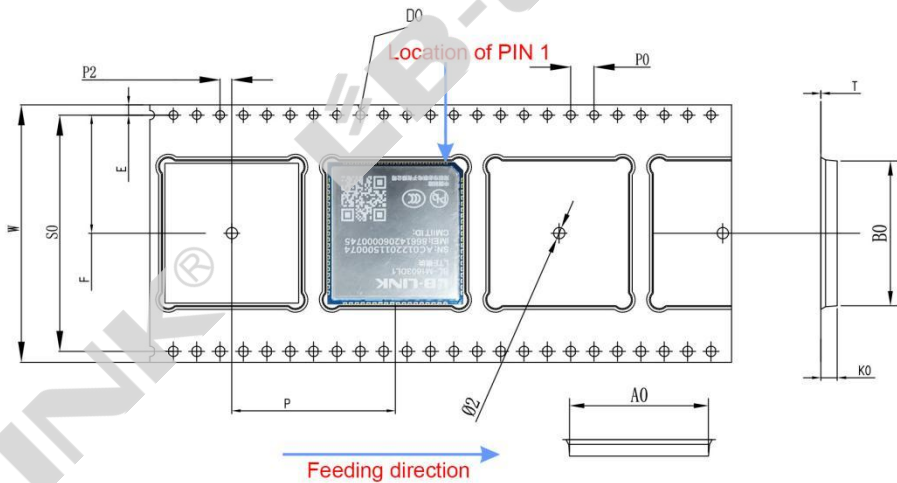
9.1 Package Dimensions



9.2 Module 1 foot position and feed direction

Packaging steps and diagram diagram:

- 1. The module is loaded in the position and direction of the figure below.
- 2. Seal the upper belt and involve it in the tape plate.



ITEM	W	A0	B0	K0	E	F	P	P0	P2	D0	T
DIM	44.00±0.3	23.30±0.1	24.30±0.1	2.90±0.1	1.75±0.1	20.2±0.1	28.00±0.1	4.00±0.1	2.00±0.1	Ø1.5±0.1	0.40±0.05

9.3 Package specification

- 1. 800 modules per roll and 3200 modules per box.
- 2. Outer box size: 39.5*38*35cm.
- 3. The diameter of the blue environment-friendly rubber plate is 13 inches,

with a total thickness of 48mm (with a width of 44mm carrying belt).

4. Put 1 package of dry agent (20g) and humidity card in each anti-static vacuum bag.
5. Each carton is packed with 4 boxes.

9.4 Storage Conditions

Absolute Maximum Ratings:

Storage temperature: -40℃ to +85℃,
Storage humidity: 10% to 95 (Non-Condensing)

Recommended Storage Conditions:

Storage temperature: 5℃ to +40℃,
Storage humidity: 20% to 90% RH

Please use this Module within 12month after vacuum-packaged.
The Module shall be stored without opening the packing.
After the packing opened, the Module shall be used within 72hours.
When the color of the humidity indicator in the packing changed,
The Module shall be baked before soldering.
Baking condition: 90℃, 24hours, 1time.

ESD Sensitivity:

The Module is a static-sensitive electronic device.
Do not operate or store near strong electrostatic fields.
Take proper ESD precautions!
The electrostatic ESD performance parameters of the module are as follows:
ESD@HBM Mode :RF Antenna port ±2KV, The others Module pin pad ±1kV!



ESD CAUTION