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A Global Leading IoT Terminals And Wireless Data Solutions Provider

SLM130-NA NB-IOT Hardware Design Manual

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Hereby, MEIG SMART TECHNOLOGY Co. , LTD declares that the radio equipment type SLM130-NA is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: https://en.mergsmart.com/.

Revised History

serial number	Version number	Time	Author	Content
1	V1.0	2024.06.12	Hardware Department	initial version

Content

1 Module Introduction

The SLM130-NA is a high-performance, low-power NB-iot wireless communication module with a highly integrated design. It integrates radio frequency and baseband in an LCC package, supports baseband signal processing, wireless transmission and reception, and meets the design requirements of Internet of Things customers for small size terminals, helping customers reduce product size and optimize cost.

The module adopts single-side layout design, and the structure size is 17.7mm*15.8mm*2.0mm, which can meet the application requirements of most iot products, including intelligent smoke sensor, wireless meter reading, shared bikes, intelligent parking, smart city, security, asset tracking, smart home appliances, wearable devices, agriculture and environmental monitoring and many other industries.

2 Performance

The following table describes the main performance of SLM130-NA module in detail.

Table 2 .1 SLM130-NA main performance parameter

NBIOT Module	SLM130-NA
Dimensions	17.7mm*15.8mm*2.0mm
Packaging	44 Pin LCC, 14 Pin LGA
Temperature Range	
Operating temp-range	-30℃ ~ +75℃
Extended temp-range	-40℃ ~ +85℃
Storage temp-range	-40℃ ~ +90℃
Frequency Bands	

LTE FDD	B1*/B2/B3/B4/B5/B8/B12/B13/B20*/B28*/B71*

Transfer Rate

CAT NB2	Single Tone DL 25.5Kbps(Max), UL 16.7Kbps(Max) Multi Tone DL 127Kbps(Max) , UL 159Kbps(Max)

Interfaces

Power interface	Supported
RESET interface	Supported
SIM interface	3.0V/1.8V
UART interface	*3
Light	Supported
ADC interface	Supported
SPI interface	Supported
I2C interface	Supported
GPIO interface	Supported
RING interface	Supported
Antenna interface	Supported

Electrical Characteristi

Power Supply	VBAT Supply voltage：2.0V～4.5V
Power Consumption	PSM：3.3uA

Ambient Humidity	5%~95%

3 Functional Diagram

SLM130-NA module is based on XY1200(S) platform, power supply module, baseband module, storage module and rf module integrated in a chip, greatly simplifies the peripheral circuit.

The Functional block diagram is as follows:

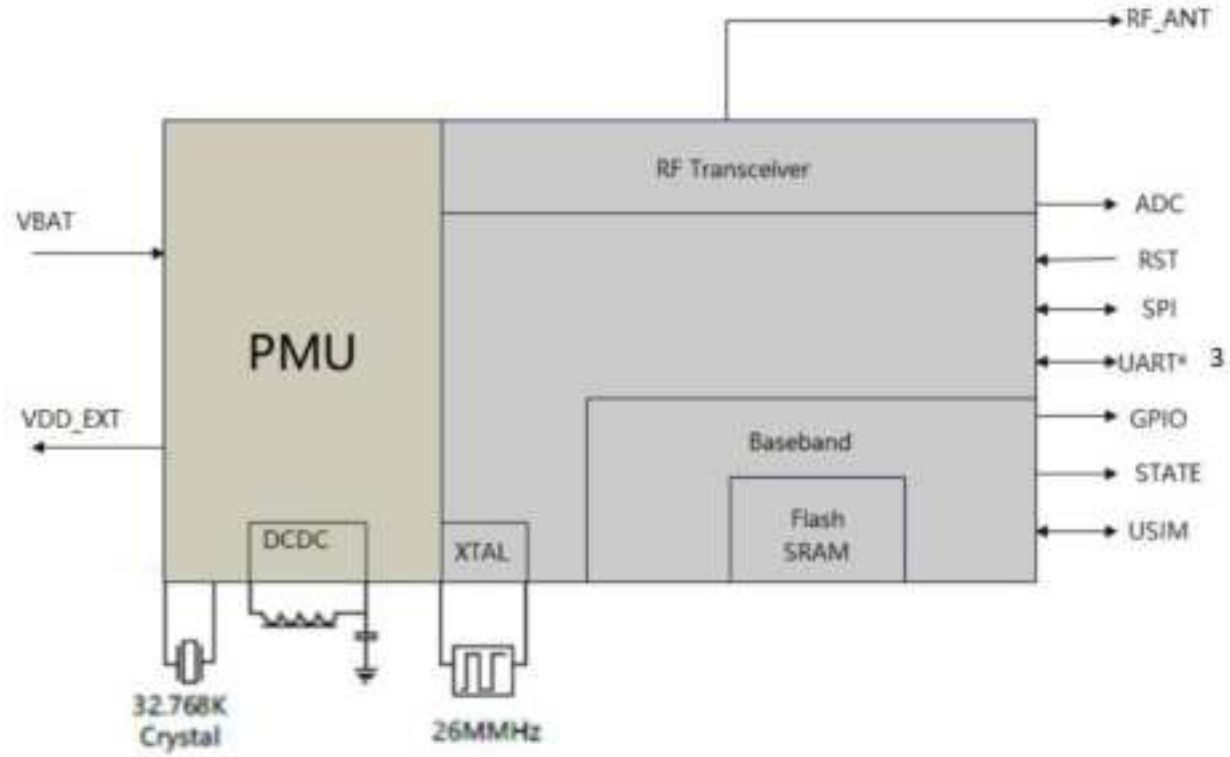


Figure 3.1 Functional block diagram

4 Interfaces

4.1 Interface Definition

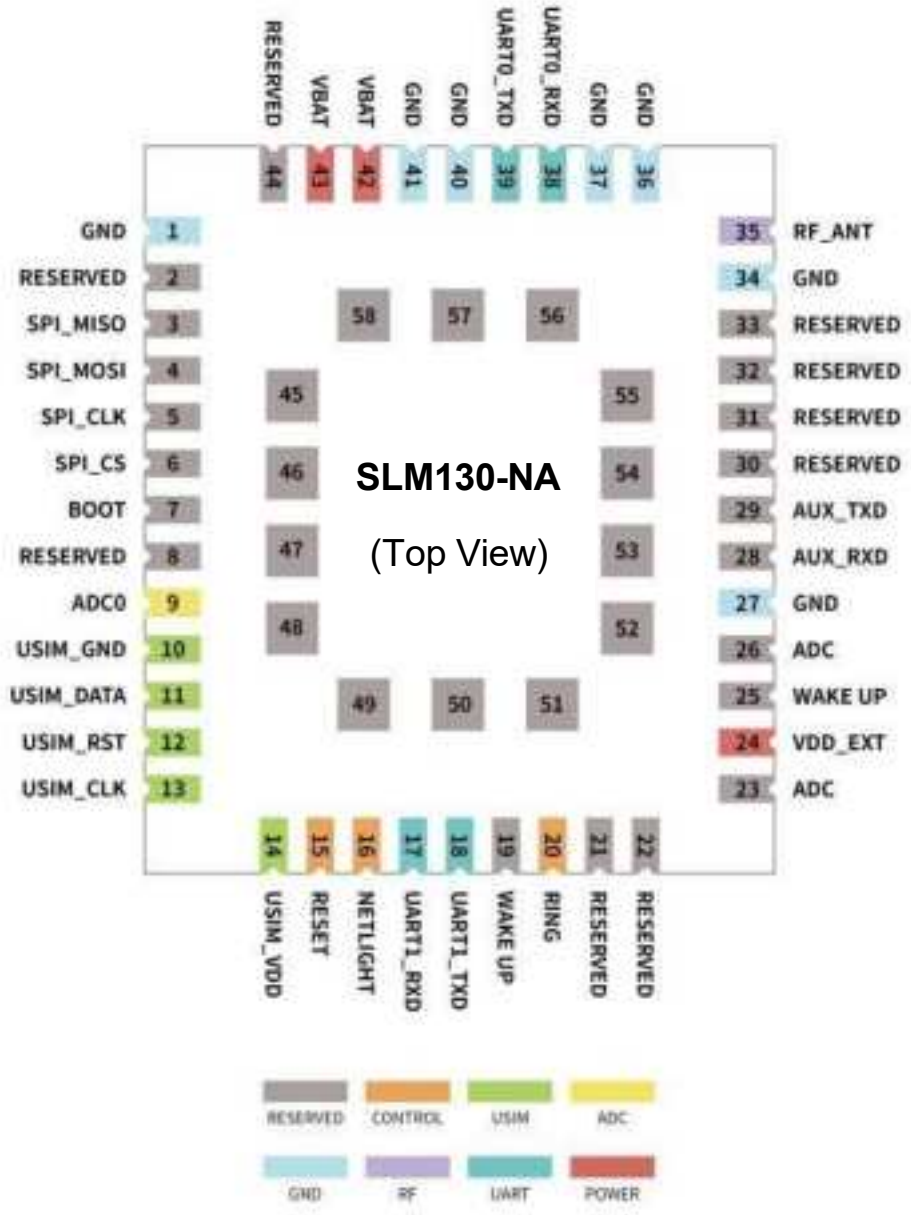


Figure 4.1 SLM130-NA TOP VIEW

Note: the distance between modules and other components on the PCB should be at least 3mm.All reserved pins are suspended and do not grounding;

4.2 PIN

Table 4.1 Definition of I/O Parameters

Type	Description
IO	INPUT/OUTPUT
DI	Digital Input
PI	Power input
PO	Power output
AI	Analog Input
AO	Analog output
OD	Open Drain

Table 4.2 SLM130-NA Pin Definition Parameters

FP	Pin Name	Pin No.	I/O	Description	DC characteristic	Comment
Power	VBAT	42，43	PI	Power supply	V max=4.5V V min=2.0V V norm=3.3V	Current >= 0.5A
	VDD_EXT	24	PO	Power supply	V norm=3V I max=80mA	Same power domain as GPIO
	GND	1,10,27,34, 36,37,40,41		Power output	0	Ensure that the GND signal is reliably grounded
reset pin	RESET	15	DI	Module reset	Plus pulling	Low level pulse active

				signal	time:: VILmax =0.3V VIHmin =VBAT-0.3V	
downloading	BOOT	7	DI	Download mode		Forced download mode, active high
status indicator	NETLIGHT	16	DO	Instructs the module The network running		If not, hang
USIM	USIM_DATA	11	IO	USIM,data card	1.8V USIM: V_{IL}max =0.3V V_{IH}min =1.62V V_{OL}max=0.3V V_{OH}min =1.62V 3.0V USIM: V_{IL}max =0.3V V_{IH}min =2.7V V_{OL}max =0.3V V_{OH}min =1.62V	Connect 10K pull-up resistor to USIM_VDD.
	USIM_CLK	13	DO	USIM card clock line	1.8V USIM: V_{IL}max =0.3V V_{IH}min =1.62V V_{OL}max=0.3V V_{OH}min =1.62V 3.0V USIM: V_{IL}max =0.3V V_{IH}min =2.7V V_{OL}max =0.3V V_{OH}min =1.62V	
	USIM_RST	12	DO	USIM card resets the cable	1.8V USIM: V_{OL}max=0.3V V_{OH}min =1.62V 3.0V USIM: V_{OL}max =0.3V V_{OH}min =1.62V	
	USIM_VDD	14	PO	The USIM card power	1.8V USIM: V_{OL}max=0.3V V_{OH}min =1.62V 3.0V USIM: V_{OL}max =0.3V V_{OH}min =1.62V	1.8V or 3.0V USIM card is adaptive
UART0	UART0_TX	39	DO	Module data transmission		1.8/3V voltage range can be configured, not suspended

	UART0_RX	38	DI	Module data reception		1.8/3V voltage range can be configured, not suspended
UART1	RXD	17	DI	Module data reception		1.8/3V voltage range can be configured, not suspended
	TXD	18	DO	Module data transmission		1.8/3V voltage range can be configured, not suspended
UART2	AUX_TXD	29	DO	Module data transmission		1.8/3V voltage range can be configured, not suspended
	AUX_RXD	28	DI	Module data reception		1.8/3V voltage range can be configured, not suspended
RF	RF_ANT	35	IO	Main antenna interface	50 ohm characteristic impedance	
ADC	ADC0	9	AI	General digital-analog conversion		No use is suspended;
Others	WAKEUP	19		External interrupt pin	V_{IL}max =0.3V V_{IH}min =VBAT-0.3V	PSM condition awaken module, low level pulse effectively
Reserved	RESERVED	21,22,23,25,26,31~33,44~58		RESERVED		No use is suspended; Part leads to GPIO

4.3 Operating Mode

Module support three work modes, corresponding to different business scenarios and requirements, in order to achieve optimal performance; - 4 specific mode switching the default parameters, issued by the carrier network configuration.

Table 4.3 Module working mode list

Mode	Features	

Normal operating mode	Active	The module is active, All functions available, can send and receive data; Modules can switch to Standby mode in this mode or PSM mode.
	Standby	The module is in the light sleep state. The network is in the DRX/eDRX state and can receive pager messages. The module can switch to Active or PSM mode in this mode.
	PSM	Only UTC works in the module. The network is not connected, downlink data cannot be received, and AT commands cannot be passed. At this point, the module can enter a deep sleep state; TAU (associated with periodic network updates) timeout or WAKEUP pin low pulse can wake the module.

4.4 Power Supply

4.4.1 PIN Introduction

SLM130-NA has 2 VBAT pins for connecting to external power supplies. The following table describes the VBAT pins and ground pins of the module.

Table 4.4 Module VBAT and GND pins

Pin Name	Pin No.	Description	Min.	Typ.	Max.	Unit
VBAT	42、43	Module power input	2.0	3.3	4.5	V
GND	1、10、27、34、36、37、40、41	ground				

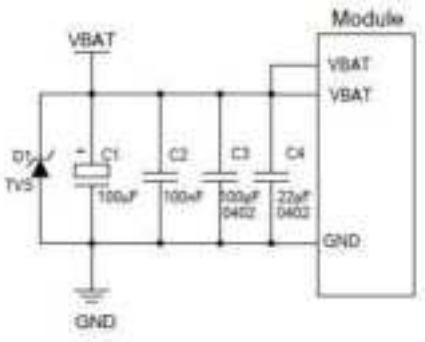
4.4.2 Power Supply Reference Circuit

The power supply design of a module is critical to its performance. SLM130-NA can use low static current LDO or DC-DC as the power supply. To ensure stable operation, it is recommended that the output current capacity be greater than 0.5A. It also supports Li-MNO2/2s battery power supply. Power supply sag must meet the following requirements:

The input voltage of the power supply ranges from 2.0V to 4.5V. During data transmission, ensure that the drop of the power supply is not lower than 2.0V. Otherwise, the module may work abnormally.

To ensure better power supply performance, it is recommended that a 100uF tantalum capacitor with low ESR (ESR=0.7 ω) and filter capacitors with 100nF, 10pF (0402 package) and 33pF (0402 package) be connected in parallel near the VBAT input of the module. At the same time, it is recommended to add a TVS tube near the VBAT input terminal to improve the surge voltage withstand capacity of the module. In principle, the longer the VBAT cable is, the wider the cable width is.

Figure 4.2 VBAT input reference circuit



4.4.3 BOOT

Power-on mode: The module is powered on automatically.

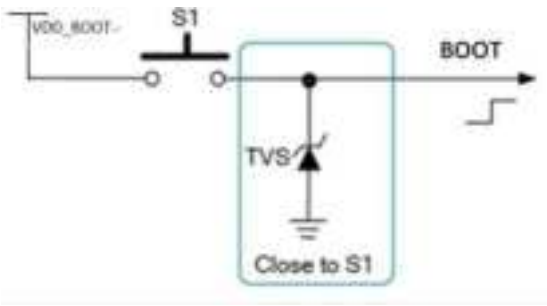
Download mode: You can enter the program download mode by lowering the PWRKEY for at least 1S and then raising it.。

Table 4.5 Module BOOT pins

Pin name	Pin No.	Description	The BOOT up time
BOOT	7	Pull up BOOT to enter the forced download mode	Keep pulling up during download

BOOT is connected directly through a self-locking button switch, and a TVS tube should be placed near the button for ESD protection. The reference circuit is shown in the figure below:

Figure 4.3 BOOT key reference circuit



4.4.4 Power ON/OFF

After the module is powered on and started, the initial VBAT state must be smaller than 0V. If the value is greater than 0V and less than 2.1V, the power-on may be abnormal.

The module can be shut down in the following ways:

The module can be shut down by disconnecting the VBAT power supply. (In circuit design, attention should be paid to whether the external circuit will pour voltage from the GPIO port of the module after VBAT is powered off, so as not to meet the conditions of powering on and starting up.)

When the power supply of the module is lower than the minimum power supply voltage, the module automatically shuts down.

4.4.5 Reset the Module

The wake pin and the reset pin are the same pin. The pin has an internal pull-up, and the external input of effective low level pulse can realize the wake or reset function. Reset wake low-level pulse duration can be configured by software. There are two configurations, one for button reset wake and one for user software wake.

Button wake reset (default for power-on) : When the pulse width of low level signal is greater than 100us and less than 6s, it is the wake signal. When the pulse width of the low level signal is greater than 6 seconds, it is the reset signal.

User software wake reset: when the pulse width of low level signal is greater than 20ms, it is reset signal; When the pulse width of the low level signal is greater than 100us and less than 20ms, it is the wake signal. The hardware reset reference circuit is shown in the figure below.

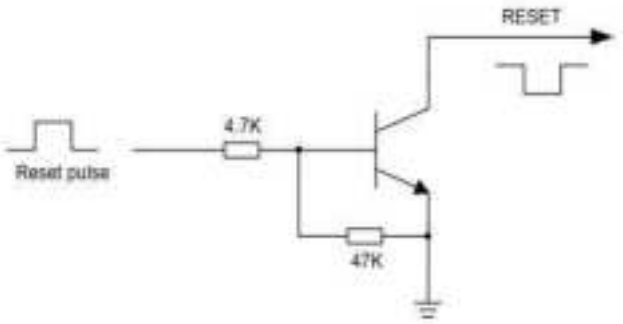


Figure 4.4 Open set drive reset reference circuit

You can control the RESET pin by pressing the button:：

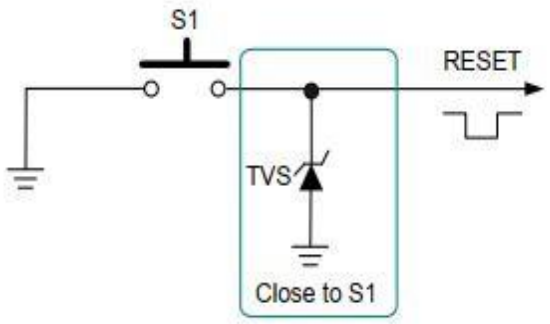


Figure 4.5 Key reset reference circuit

4.5 UART

The module has three serial ports: main serial port and debugging serial port. The module functions as Data Communication Equipment (DCE) and is connected in traditional DCE-DTE mode.

Table 4.6 Module serial port pin definition

Interfaces	Pin name	Pin No.	Description	Comment
Main UART	UART1_TXD	18	The primary serial port sends data to the RXD terminal of the DTE device	3V voltage domain
	UART1_RXD	17	The primary serial port receives data from the TXD terminal of the DTE	
Debug UART	UART0_RX	38	The downloading serial port receives data from the TXD terminal of the DTE	
	UART0_TX	39	The downloading serial port sends data to the RXD terminal of the DTE device	
Reserved UART	AUX_TXD	29	Reserved UART	
Reserved UART	AUX_RXD	28	Reserved UART	

4.5.1 Main UART

The main serial port can be used for AT command communication and data transmission. When used for AT command communication and data transfer, it supports various baud rates, and the default is 9600bps. The main serial port can work in Active and Standby modes

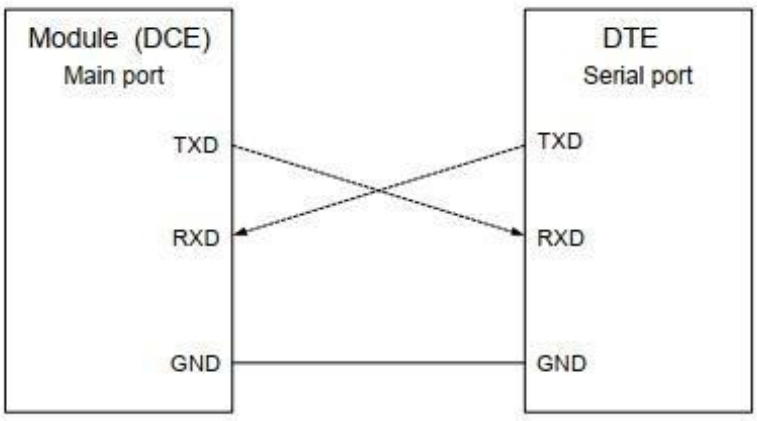


Figure 4.6 Connection between DCE and DTE

4.5.2 Debug UART

Debug Serial Port can be used to view underlying log information for software debugging and software upgrades through the Log Viewer tool. Its supported baud rate is 3Mbps. The reference design of the debug serial port is shown below:

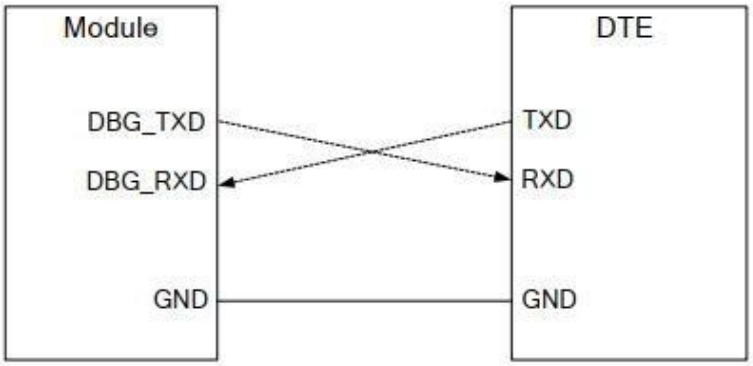


Figure 4.7 Debugging serial port reference design

4.5.3 UART Application

The serial port voltage range of the module is 3V. If the customer application system has a voltage range of 1.8V, add a level converter to the serial port connection between the module and the customer application system. TXS0108EPWR from Texas Instruments (for more information, visit http://www.ti.com) is recommended. The reference circuit design using the level switching chip is shown below:

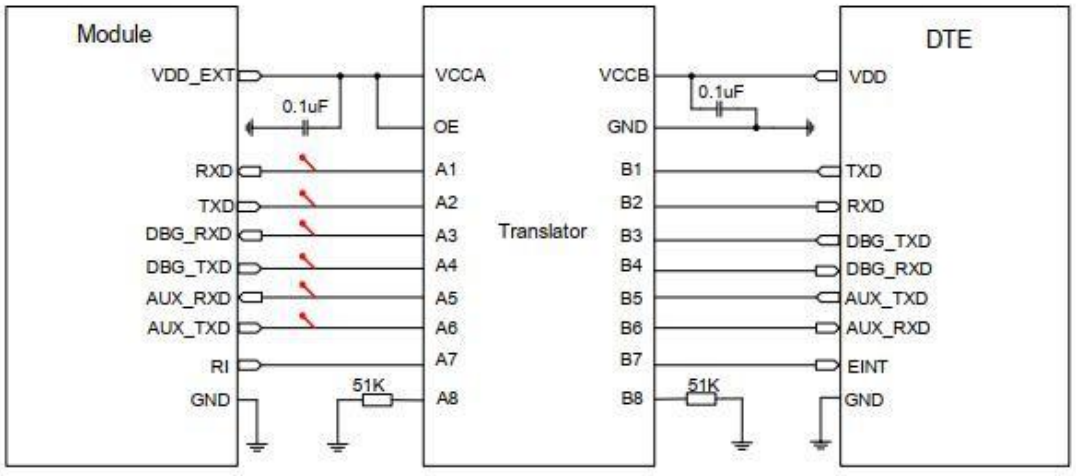


FIG. 4.8 Level switching reference circuit (level switching chip)

)

Another voltage switching circuit is shown below.The input and output circuit design of the dashed line section below can be referred to the solid line section, but attention should be paid to the connection direction, and the transistor voltage switch reference circuit is not suitable for baud rate above 460kbps.

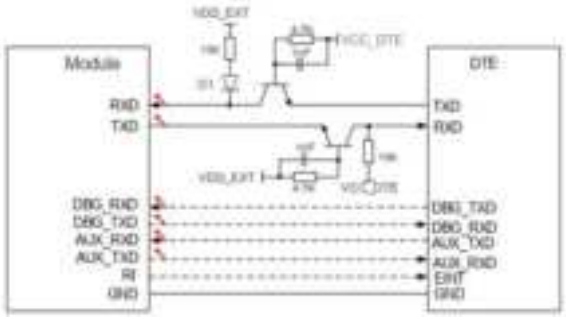


FIG. 4.9 Level switching reference circuit (transistor)

Important Note -- for the circuit whose UART level of the module is consistent with that of the microcontroller: If the standby current (PSM) requirement is very strict, the level conversion circuit with D1 device should be added between module RXD (PIN17) and MCU TXD (as shown in the figure above) to avoid the possibility of current backflow in the circuit in PSM mode, so as to achieve the lowest current consumption; If the mode of module power failure is adopted to reduce the power consumption of the device, the level conversion circuit can also be omitted. At the same time, it is recommended that the serial port level corresponding to the single chip microcomputer be configured as 0V to save unnecessary leakage.

The following diagram shows the connection between the standard RS-232 interface and the module. The customer needs to ensure that the LEVEL switch chip is connected to the module at 3V I/O voltage.

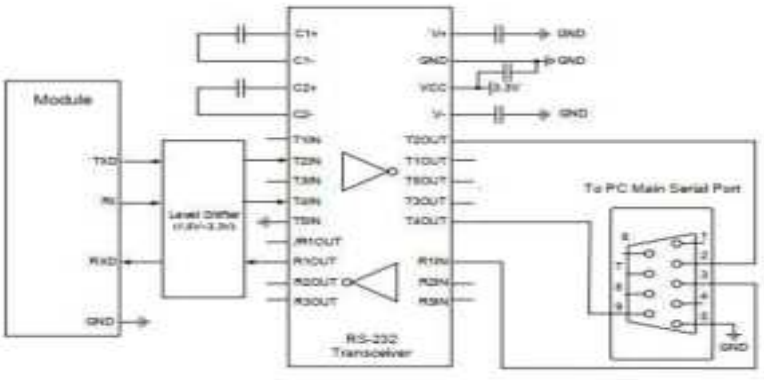


FIG. 4.9 Level switching reference circuit (transistor)

4.6 SPI interfaces

SLM130-NA provides an SPI interface (custom) (module as host). The following table lists pin definitions for the SPI interface

Table 4.7 Module SPI pins

Pin name	Pin No.	I/O	Description	Comment
SPI_MISO	3	DI	Master input/slave output signal	1.8V and 3.0V voltage range available
SPI_MOSI	4	DO	The master output/slave input signal	
SPI_CLK	5	DO	Serial clock signal	
SPI_CS	6	DO	Piece of optional signal	

The SPI interface voltage domain of this module is 3V. If the system voltage domain of the slave device is 1.8V, a level converter should be added between the module and the slave device. A level converter that supports SPI data rates is recommended. The reference circuit is shown in the figure below:

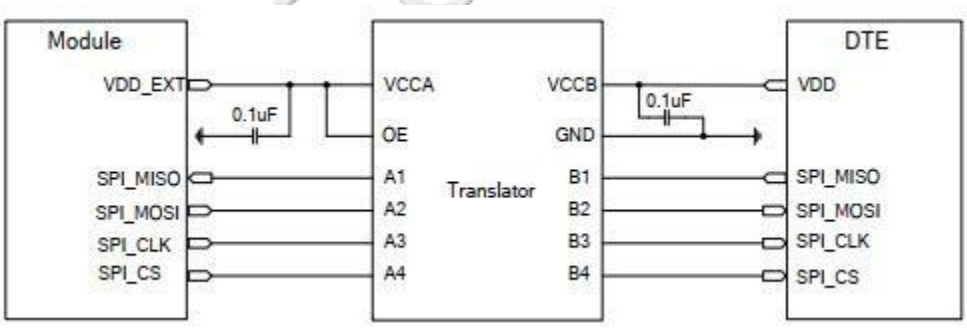


Figure 4.11 SPI interface level conversion reference circuit

4.7 USIM interfaces

The USIM interface of the SLM130-NA module complies with ISO/IEC 7816-3 and supports 1.8V/3.0V external USIM cards. The external USIM card is powered by a power supply inside the module.

Table 4.8 Module USIM pins

Pin name	Pin No.	Description	Comment
USIM_VDD	14	External USIM card power supply	Voltage: 1.8 V / 3.0 V The module automatically identifies USIM card voltage
USIM_CLK	13	External USIM card clock signal	
USIM_DATA	11	External USIM card data signal	Connect the 10K resistor to the USIM_VDD
USIM_RST	12	External USIM card reset signal	

Below is a reference design for the 6-pin external USIM holder::

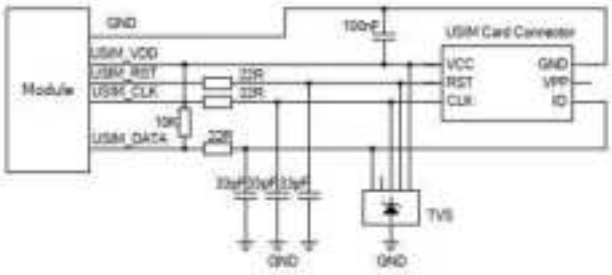


Figure 4.12 reference circuit diagram of the 6-pin external USIM card

In the circuit design of the USIM interface, to ensure the good performance of the external USIM card and prevent the external USIM card from being damaged, it is recommended to follow the following design principles in the circuit design:

- the external USIM card base is placed close to the module. Ensure that the cable length of the signal cable for the external USIM card base does not exceed 200mm.

- USIM_VDD Indicates a high level of 3.0V that lasts for a period of time before the card is identified, and the external USIM card socket signal cable is routed away from RF cable and VBAT power cable.

- The GND wiring between the ground of the external USIM card holder and the module should be short and thick. To ensure the same potential, ensure that the cabling width is not less than 0.5mm. The decoupling capacitor of USIM_VDD shall not exceed 1uF, and the capacitor shall be placed close to the external USIM holder.

- To prevent crosstalk between USIM_CLK signals and USIM_DATA signals, the two cables should not be too close to each other, and additional ground shielding should be added between the two cables. In addition, the USIM_RST signal also needs to be protected.

- To ensure good ESD protection performance, it is recommended to add TVS to the pins of the external USIM card. The parasitic capacitance of the TVS tube should not be greater than 50pF. Visit http://www.onsemi.com to select the appropriate TVS device. The ESD protection device should be placed as close as possible to the external USIM card holder. The signal cable of the external USIM card holder should be connected from the external USIM card holder to

the ESD protection device and then to the module. A series resistor of 22 OHms is required between the module and the external USIM card to suppress stray EMI and enhance ESD protection. The peripheral components of the external USIM card should be placed as close as possible to the external USIM card holder.

- Reserve shunt capacitors on USIM_DATA, USIM_CLK, and USIM_RST lines to filter out potential RF interference.

4.8 ADC interface

The module provides a 9-bit analog-to-digital input interface to measure voltage values

Table 4.9 Module ADC pins

Pin Name	Pin No.	Description
ADC	9	Universal analog-to-digital conversion interface, detection voltage range: 0~1V;

4.9 Network Status Indication

NETLIGHT signals can be used to indicate the network status of a module.

The connection reference circuit of the network status indicator is shown in the figure below:

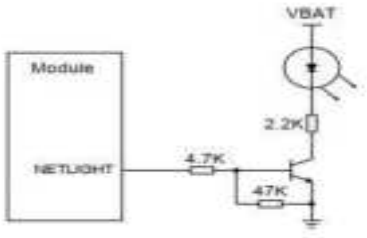


FIG. 4.13 Network status indicator reference circuit

5 Antenna interface

5.1 NB-IOT Antenna

SLM130-NA provides 1 antenna pin RF_ANT.

You are advised to use an antenna with a 50-ohm impedance that matches the RF connector on the module end.

Table 5.1 Module RF pins

Pin Name	Pin No.	Description
RF_ANT	35	NB_IoT Antenna Interface
GND	34, 36, 37	Ground

You are advised to carefully select RF adapter cables on the application terminal. Select RF adapter cables with minimum loss.

It is recommended to use the following RF adapter cables for RF loss requirements:

TDD-LTE<1.5dB

FDD-LTE<1.5dB

5.1.1 NB-IOT Antenna Reference Design

In order to better adjust the rf performance, it is recommended to reserve the π matching circuit for the peripheral circuit design of the antenna interface. The elements of the π matching circuit should be placed close to the antenna as far as possible, and should be selected according to the actual situation. RF_ANT connects slM130-NA module. By default, L102 and L100 are not attached, but only 0R capacitor is attached in C160. In addition, TVS tube T234 can be connected in parallel at L100 to absorb static electricity (the lectotype junction capacitance of TVS device cannot exceed 0.1PF). The impedance of RF wiring should be controlled at about 50 ω, and the shorter the wiring, the better.

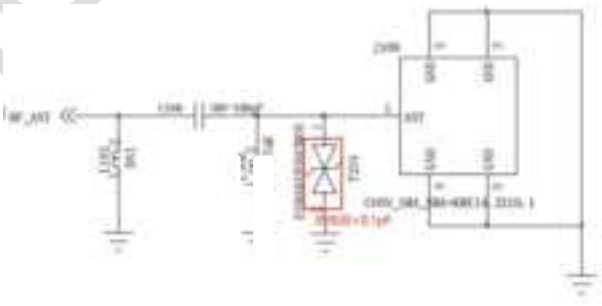


Figure 5.1 NB-iot antenna reference circuit

5.1.2 NB_IOT Antenna Specifications

Table 5.2 Antenna parameter requirements of the module

Parameter	Conditions
Band	B1*/B2/B3/B4/B5/B8/B12/B13/B20*/B28*/B71*
VSWR	<=2
efficiency	>30%
Maximum input power（W）	50
input impedance（Ω）	50

5.1.3 Power Input

Table 5.3 Module conducted power

Frequency Bands	Max. RF Output Power	Min. RF Output Power
B1	23dBm±2dB	<-40dBm
B2	23dBm±2dB	<-40dBm
B3	23dBm±2dB	<-40dBm
B4	23dBm±2dB	<-40dBm
B5	23dBm±2dB	<-40dBm
B8	23dBm±2dB	<-40dBm
B12	23dBm±2dB	<-40dBm
B13	23dBm±2dB	<-40dBm
B20	23dBm±2dB	<-40dBm
B28	23dBm±2dB	<-40dBm

B71	23dBm±2dB	<-40dBm

5.2 Operating Frequency

Table 5.4 Frequency bands supported by the module

Frequency Bands	UL/FrequencyRange(MHz)	DL/FrequencyRange(MHz)
Band1	1920-1980	2110-2170
Band2	1850-1910	1930-1990
Band3	1710-1785	1805-1880
Band4	1710-1755	2110-2155
Band5	824-849	869-894
Band8	880-915	925-960
Band12	699-716	729-746
Band13	777-787	746-756
Band20	832-862	791-821
Band28	703-748	758-803
Band71	663-698	617-652

Support for different frequency bands can be customized according to customer needs, and specific sub-models can be distinguished.

5.3 Reference Design of RF Layout

For the consumer PCB, all rf signal lines should have a characteristic impedance of 50 ω. In general, the impedance of the RF signal line is determined by the dielectric constant of the material, the width of the line (W), the ground clearance (S), and the height of the reference ground plane (H). PCB characteristic impedance is usually controlled by microstrip line and coplanar waveguide. In order to demonstrate the design principles, the following figures show the structure design of the microstrip line and coplanar waveguide when the impedance line control is 50 ω.

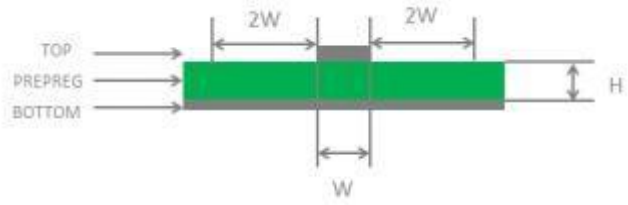


Figure 5.2 Microstrip line structure of two-layer PCB board

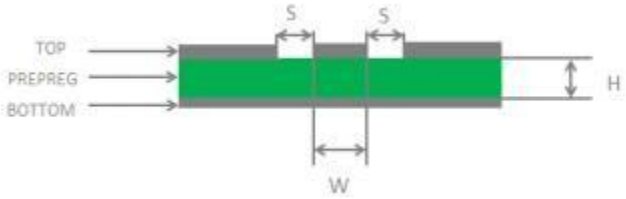


FIG. 5.3 Coplanar waveguide structure of two-layer PCB board

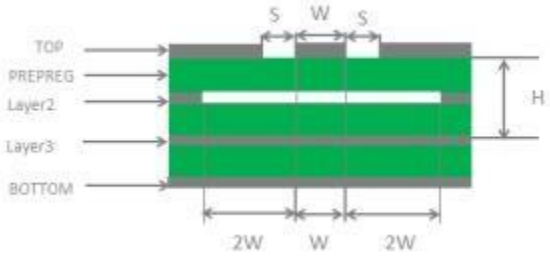


FIG. 5.4 Coplanar waveguide structure of four-layer PCB board (reference is the third layer)

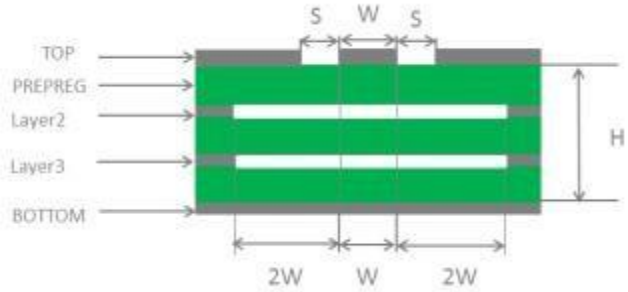


FIG. 5.5 Coplanar waveguide structure of four-layer PCB board (reference ground is the fourth layer)

In order to ensure good performance and reliability of rf signals, it is recommended to follow the following design principles in circuit design of rf antenna interface:

- Accurate 50 ω impedance control of rf signal line should be performed using impedance simulation calculation tool.

- The GND pins adjacent to the RF pins should not be hot pads and should be fully in contact with the ground.

- The distance between the RF pin and RF connector should be as short as possible; Avoid right-angle cabling. The recommended cabling Angle is 135 degrees.

- Automatically set up a connected device package by keeping the signal pin at a certain distance from the ground.

- Rf signal line reference ground plane should be complete; Adding a certain amount of ground holes around the signal line and reference ground can help improve rf performance; The distance between the ground hole and the signal cable should be at least twice the line width (2 x W).

The RF signal cable must be far away from the interference source and must not cross or parallel with any signal cable at the adjacent layer

6 Electrical characteristics

6.1 Operating and Storage Temperatures

Table 6.1 Module operating and storage temperatures

Mode	Min	Typ.	Max	Unit
Normal working temperature	-30	25	75	°C
Extended operating temperature	-40		85	°C
Storage	-40		90	°C

Temperature				

6.2 Current Consumption

Table 6.2 Current status of SLM130-NA(3.6V at room temperature, test data for reference)

Parameter	Mode	Description		Average	Max
I (VBAT)	PSM	sleep mode		3.347uA	121.023uA
	eDRX	idle mode		1104uA	43.128mA
	Active @Single-tone (3.75kHz/15kHz)	Radio frequency emission state, 23dBm	B1	262.52	298.77
			B2	271.37	308.41
			B3	244.81	277.25
			B4	197.80	219.30
			B5	291.31	308.99
			B8	332.01	349.40
			B12	207.34	222.12
			B13	244.17	261.48
			B20	291.14	307.01
			B28	216.65	231.07
			B71	234.03	247.98
			B1	21.57	23.50
			B2	21.59	23.47

		Rf receiving state	B3	21.52	23.39
			B4	21.34	23.08
			B5	20.05	21.52
			B8	20.02	21.52
			B12	20.03	21.53
			B13	20.07	21.57
			B20	20.11	21.62
			B28	20.00	21.63
			B71	20.09	21.66

6.3 Electrostatic Discharge

In module application, the static electricity generated by static electricity of human body and charged friction between micro-electronics will discharge to the module through various ways, which may cause certain damage to the module. Therefore, ESD protection should be paid attention to. ESD protection measures should be taken in the process of r&d, production, assembly and testing, especially in product design. For example, in the circuit design interface and vulnerable to electrostatic discharge damage or influence points, should add anti-static protection; Wear esd gloves during production.

The ESD of the module pin can withstand voltage ≧2KV without protection;

6.4 RF Receiving Sensitivity

Table 6.3 Module reception sensitivity (reference)

Band	Primary	NB IoT Receiving	Unit

		Sensitivity/3GPP	
B1	-115	-107.5	dBm
B2	-116	-107.5	dBm
B3	-115	-107.5	dBm
B4	-116	-107.5	dBm
B5	-117	-107.5	dBm
B8	-116	-107.5	dBm
B12	-116	-107.5	dBm
B13	-116	-107.5	dBm
B20	-116	-107.5	dBm
B28	-116	-107.5	dBm
B71	-115	-107.5	dBm

7 Mechanical Dimensions

7.1 Top and Bottom Views

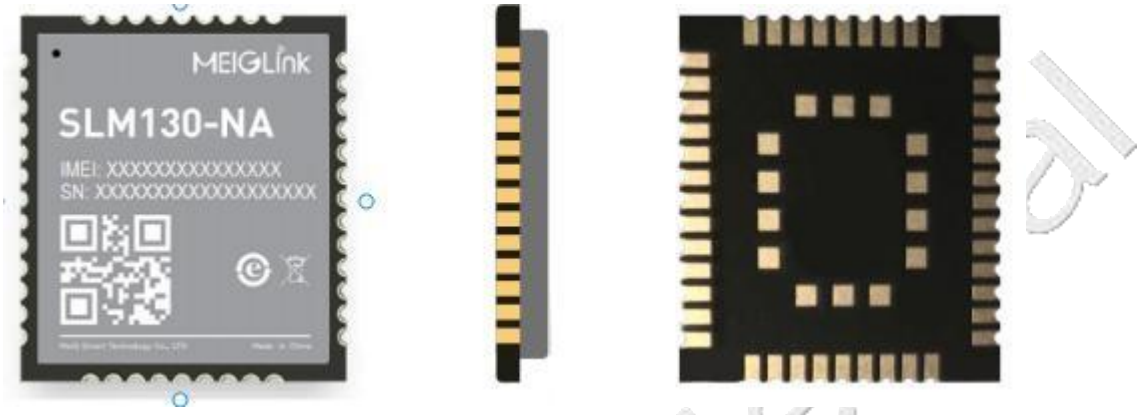


Figure 7.1 SLM130-NAoverlooking and side view dimensions (mm)

7.2 Mechanical Dimensions

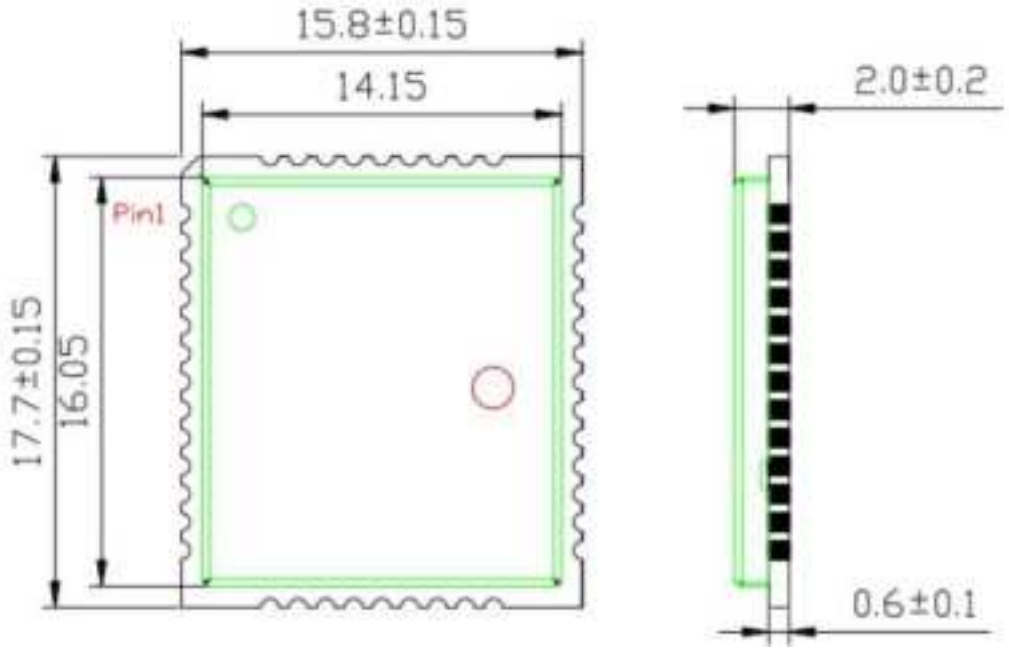


Figure 7.2 SLM130-NA overlooking and side view dimensions (mm)

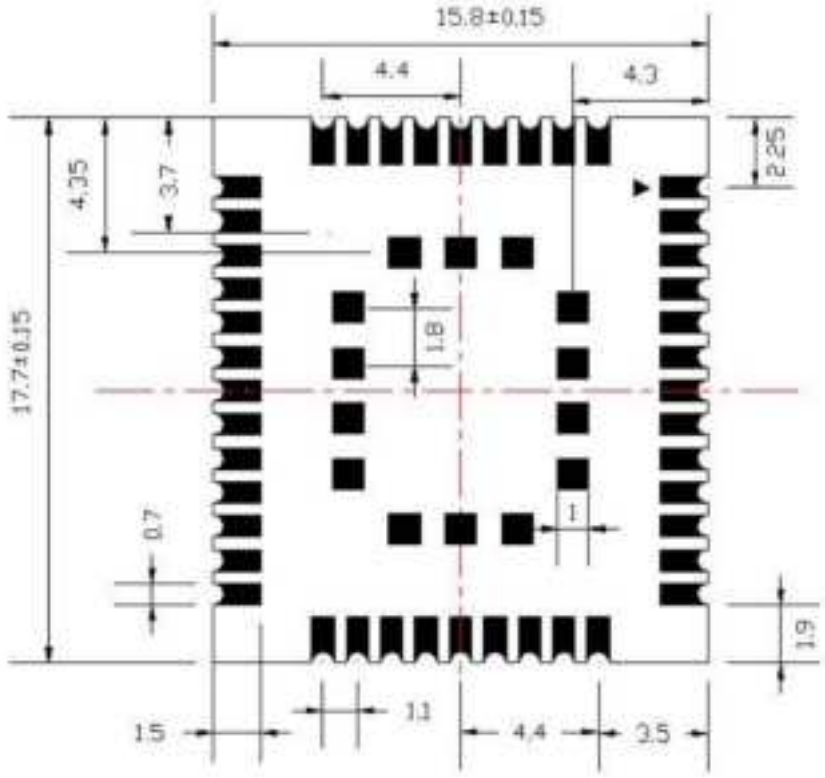


Figure 7.3 SLM130-NA Bottom view Size (mm)

7.3 Recommended PCB Packaging Size

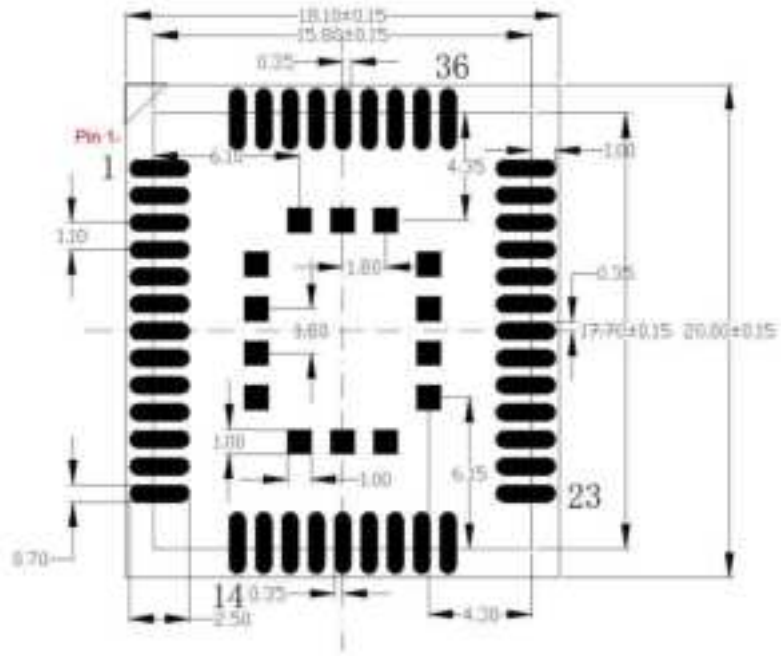


Figure 7.4 Recommended package top view (mm)

8 Storage and Manufacturing

8.1 Storage

SLM130-NAshould be vacuum sealed before shipment and stored in accordance with the following conditions:

Table 8.1 Storage Environment requirements

Notes	Descriptions
Ambient temperature	The module can be stored in a vacuum-sealed bag for 12 months at ambient temperature below 40 ° C and air humidity below 90%
Reheating requirements after opening	When the vacuum seal bag is opened, the module can be reflow directly if the following conditions are met Or other high-temperature processes -The air humidity in the module is less than 10% -Module ambient temperature less than 30 degrees Celsius, air humidity less than 60%, factory to complete the patch within 72 hours
Baking conditions before patch	- When the ambient temperature is 23 ° C (5 ° C fluctuation is allowed), the humidity indicator card shows the humidity is greater than 10% - After opening the module, the ambient temperature is below 30 degrees Celsius and the air humidity is less than 60%, but the factory fails to complete the patch within 72 hours - After opening, the air humidity of the module is greater than 10%
Baking Precautions	If the modules need to be baked, bake at 80° C (-5) for 48 hours. Note: Module packaging must be removed before modules are baked

8.2 Manufacturing and Soldering

The recommended reflow temperature is 235~245ºC and cannot exceed 260ºC.

In order to avoid repeated heat damage to the module, it is recommended that customers attach the module after reflow welding on the first side of PCB board.The recommended furnace temperature curve is as follows:

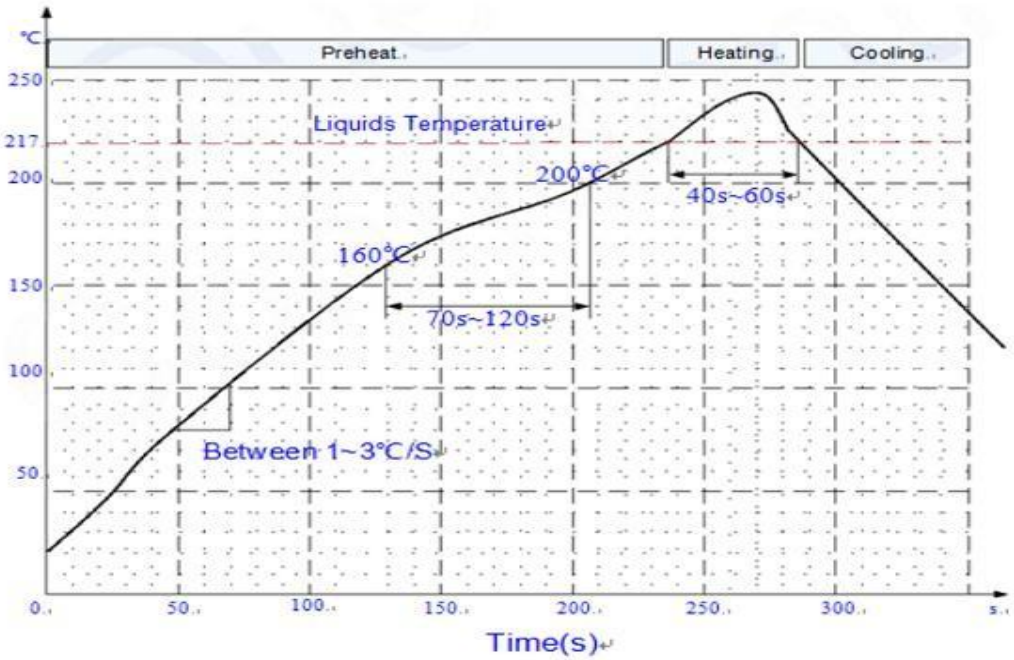


FIG. 8.1 Furnace temperature curve reference

9 Attachment

9.1Abbreviations and Abbreviations

Table 9.1 Abbreviations and Abbreviations

Abb	English Description	Chinese Description
IO	input/output	
DI	digital input	
PI	power input	
AMR	Adaptive Multi-rate	自适应多速率
BER	Bit Error Rate	误码率
BTS	Base Transceiver Station	基站收发信台
PCI	Peripheral Component Interconnect	外设部件互连
CS	Circuit Switched (CS) domain	电路域
CSD	Circuit Switched Data	电路交换数据
DCE	Data communication equipment	数据电路终端设备
DTE	Data terminal equipment	数据终端设备
DTR	Data Terminal Ready	数据终端就绪
EFR	Enhanced Full Rate	增强型全速率
EMC	Electromagnetic Compatibility	电磁兼容性

ESD	Electrostatic Discharge	静电释放

FR	Frame Relay	帧中继
GMSK	Gaussian Minimum Shift Keying	高斯最小移频键控
GPIO	General Purpose Input Output	通用输入/输出
HR	Half Rate	半速
HSDPA	High Speed Downlink Packet Access	高速下行分组接入
HSUPA	High Speed Uplink Packet Access	高速上行分组接入
HSPA	HSPA High-Speed Packet Access	高速分组接入
HSPA+	HSPA High-Speed Packet Access+	增强型高速分组接入
IEC	International Electro-technical Commission	国际电工技术委员会
IMEI	International Mobile Equipment Identity	国际移动设备标识
MEID	Mobile Equipment Identifier	CDMA 终端的身份识别码
I/O	Input/Output	输入/输出
ISO	International Standards Organization	国际标准化组织
ITU	International Telecommunications Union	国际电信联盟
bps	bits per second	比特每秒

LED	Light Emitting Diode	发光二极管
M2M	Machine to machine	机器到机器
MO	Mobile Originated	移动台发起的
MT	Mobile Terminated	移动台终止的
NTC	Negative Temperature Coefficient	负温度系数
PC	Personal Computer	个人计算机
PCB	Printed Circuit Board	印制电路板
PDU	Packet Data Unit	分组数据单元
PPP	Point-to-point protocol	点到点协议
PS	Packet Switched	分组交换
QPSK	Quadrate Phase Shift Keying	正交相位移频键控
SIM	Subscriber Identity Module	用户识别模块
TCP/IP	Transmission Control Protocol/ Internet Protocol	传输控制协议/互联网协议
UART	Universal asynchronous receiver-transmitter	通用异步收/发器（机）
USIM	Universal Subscriber Identity Module	通用用户识别模块
UMTS	Universal Mobile Telecommunications System	通用移动通信系统
USB	Universal Serial Bus	通用串行总线

WCDMA	Wideband Code Division Multiple Access	宽带码分多址
TD-SCDMA	Time Division-Synchronous Code Division Multiple Access	时分同步码分多址
TDD LTE	Time Division Long Term Evolution	时分长期演进
FDD LTE	Frequency Division Duplexing Long Term Evolution	频分长期演进
Vmax	Maximum Voltage Value	最大电压值
Vnorm	Normal Voltage Value	典型电压值
Vmin	Minimum Voltage Value	最小电压值
$V_{IH}max$	Maximum Input High Level Voltage Value	输入高电平的最大电压
$V_{IH}min$	Minimum Input High Level Voltage Value	输入高电平的最小电压
$V_{IL}max$	Maximum Input Low Level Voltage Value	输入低电平的最大电压
$V_{IL}min$	Minimum Input Low Level Voltage Value	输入低电平的最小电压
$V_{OH}max$	Maximum Output High Level Voltage Value	输出高电平的最大电压
$V_{OH}min$	Minimum Output High Level Voltage Value	输出高电平的最小电压
$V_{OL}max$	Maximum Output Low Level Voltage Value	输出低电平的最大电压

$V_{OL}min$	Minimum Output Low Level Voltage Value	输出低电平的最小电压

9.2 Referenced Document

- SLM130-NA_-SPEC
- SLM130-NA_-AT Command Manual

10 FCC warning

According to the FCC KDB 996369 D03 OEM Manual v01r01 guidance, the following conditions must be strictly followed when using this certified module:KDB 996369 D03 OEM Manual v01r01

List of applicable FCC rules

This module has been tested for compliance with FCC Part 22/24/27/90R.

Summarize the specific operational use conditions.

The module is tested for standalone mobile RF exposure use conditions. Any other usage conditions such as co-location with other transmitter(s) or in a portable condition will need to be separate reassessment through a class II permissive change application or new certification.

Limited module procedures

Not applicable

Trace antenna designs

See the Section 5

RF exposure considerations

Exposure to Radio Frequency Radiation. This equipment must be installed and operated in accordance with provided instructions, and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RFexposure compliance.

Antennas

External Antenna, Max Antenna Gain 3.35dBi， model number: N19-0740-R0A

Label and compliance information

if the host is marketed so that end users do not have straight forward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: Contains Transmitter Module FCC ID: 2APJ4-SLM130-NA or Contains FCC ID: 2APJ4-SLM130-NA must be used.

Information on test modes and additional testing requirements

Not applicable

Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rule requirement applicable to the final host. The final host will sill need comply with Part 15 Subpart B rule requirement if applicable.

FCC Regulations:

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.

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.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. To comply with FCC RF Exposure compliance requirements, this grant is applicable to only Mobile Configurations. The antennas

used for the transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.