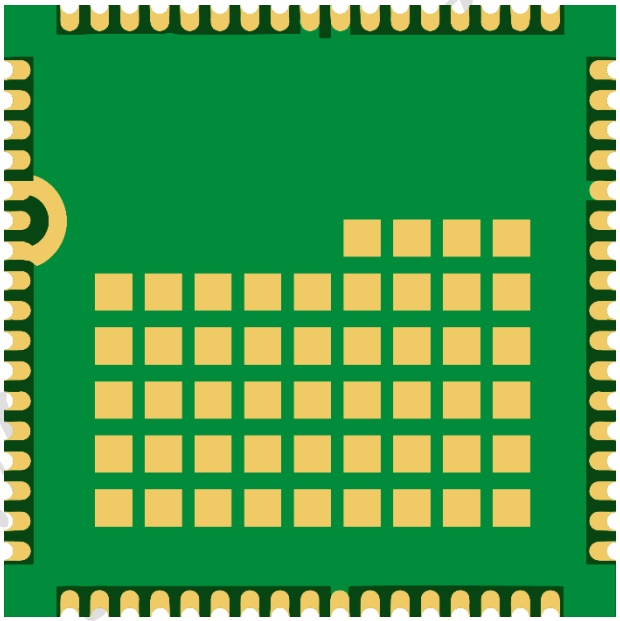
Air724UG_Air723UG_Module Hardware Design Manual



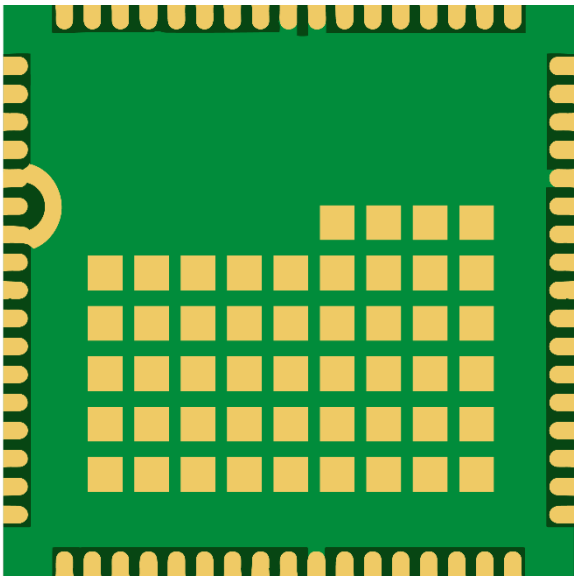


Table of contents

1.introduction

This document definesAir724UG_Air723UGThis document details the module and its hardware interface specifications, electrical characteristics, and mechanical details. Combined with our application manuals and user guides, customers can quickly apply these features.Air724UG_Air723UGModules for wireless applications.

2.Overview

2.1Model Information

sheet2Module Supported Frequency Band List

model	Air724UG-NA	Air724UG-MA	Air723UG-NA	Air723UG-MA
LTE-FDD	B1/B3/B5/B8	B1/B3/B5/B8	B1/B3/B5/B8	B1/B3/B5/B8
LTE-TDD	B34/B38/B39/B40/B41	B34/B38/B39/B40/B41	B34/B38/B39/B40/B41	B34/B38/B39/B40/B41
VoLTE	support	support	support	support
Camera	support	support	support	support
Analog speech	support	support	support	support
SIM card with patch	No built-in SIM card	Built-in mobile patch SIM card	No built-in SIM card	Built-in mobile patch SIM card
Module size	24*24mm	24*24mm	23*23mm	23*23mm
Packaging	Stamp perforation + LGA	Stamp perforation + LGA	LGA	LGA

2.2Main performance

sheet1Module main performance

feature	illustrate
Supported frequency bands	See table2Module model information introduction
Transmit power	- LTE-TDD:Class 3 (23dBm +1/-3dB) - LTE-FDD:Class 3 (23dBm ± 2dB)
powered by	-VBAT 3.3V ~ 4.3VTypical value3.8V
LTE features	- Maximum supportnon-CA CAT1 - supportVoLTE - support1.4~20MHzRF bandwidth - LTE-FDDMaximum uplink speed5MbpsMaximum downlink rate10Mbps LTE-TDD - Uplink and downlink configuration2 Maximum uplink rate2MbpsMaximum downlink rate8Mbps LTE-TDD - Uplink and downlink configuration1 Maximum uplink rate4MbpsMaximum downlink rate6Mbps
Network protocol characteristics	- Supported TCP/UDP/PPP/FTP/HTTP/NITZ/CMUX/NDIS/NTP/HTTPS/PING/FTPS/FILE/MQTT SMTP/ - SMTPS/MMS/DTMFUnder development
USIM card interface	-supportUSIM/SIMCard:1.8Vand3V
USB interface	- compatibleUSB 2.0(Slave mode only), maximum data transfer rate up to480Mbps ForAT - Commands, data transmission, software debugging, software upgrades - USBVirtual serial port driver: SupportedWindows 7/8.1/10,Linux 2.6.x/3.x/4.1,Android 4.x/5.x/6.x/7.xOperating systemUSBdrive
serial port	UART1: - ForATCommands and data transfer - Maximum baud rate921600bps,default115200bps - Supports hardware flow control (CTS/RTS) UART2: -Used for downloading software and RF calibration, as well as for communicating with the internal Bluetooth. HOST UART: -Used to output debugging information ZSP UART: -Used to output debugging information
SPI Camera	-support
SPI LCD	-support

keyboard	-support6*6Scan keyboard
Antenna Interface	-Characteristic impedance50ohm
physical properties	- size: Air724UG:24mm*24mm*2.3mm Air723UG :23mm*23mm*2.3mm Weight: - Approximately2.6g
Temperature range	- Normal operating temperature: -35°C~+70°C - Extreme operating temperature: -40°C~+85°C
RoHS	-All components are fully compliant.RoHSstandard
Packaging	-117One pin; see the pin diagram for actual usable pins.

2.3Functional block diagram

The image below isAir724UG_Air723UGThe module functional block diagram illustrates its main functions:

- memory
- Radio frequency section
- Power Management
- Interface part

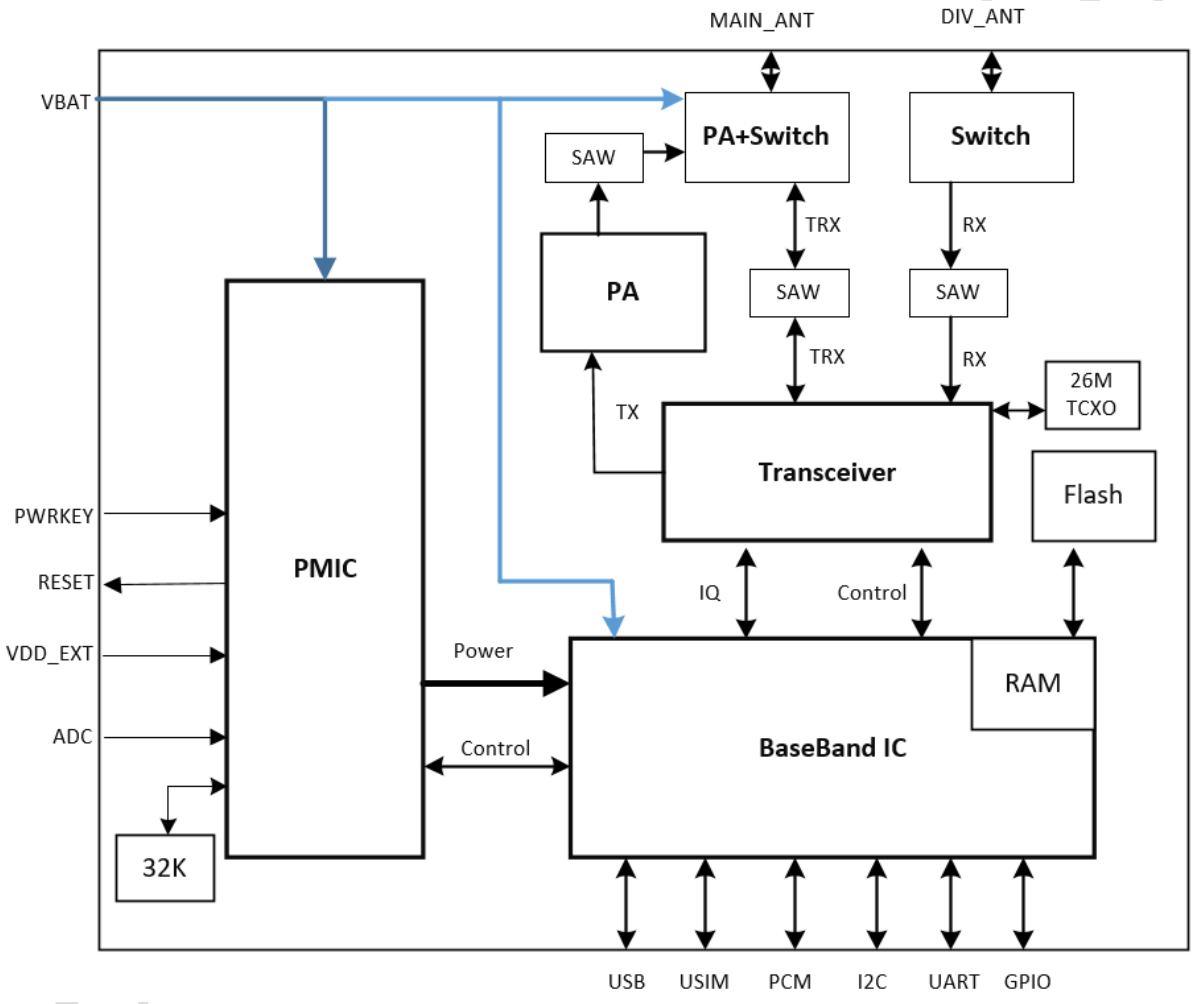


chart1Functional block diagram

2.4Evaluation board

To facilitate testing and use of the modules, HeZoo provides an evaluation board. The evaluation board documentation link is:

3.Application Interface

The module adoptsLCCPackaging,117indivualSMTThe solder pads and pins will be explained in detail in the following sections.Air724UG_Air723UGFunctions of each interface

3.1.Pin Description

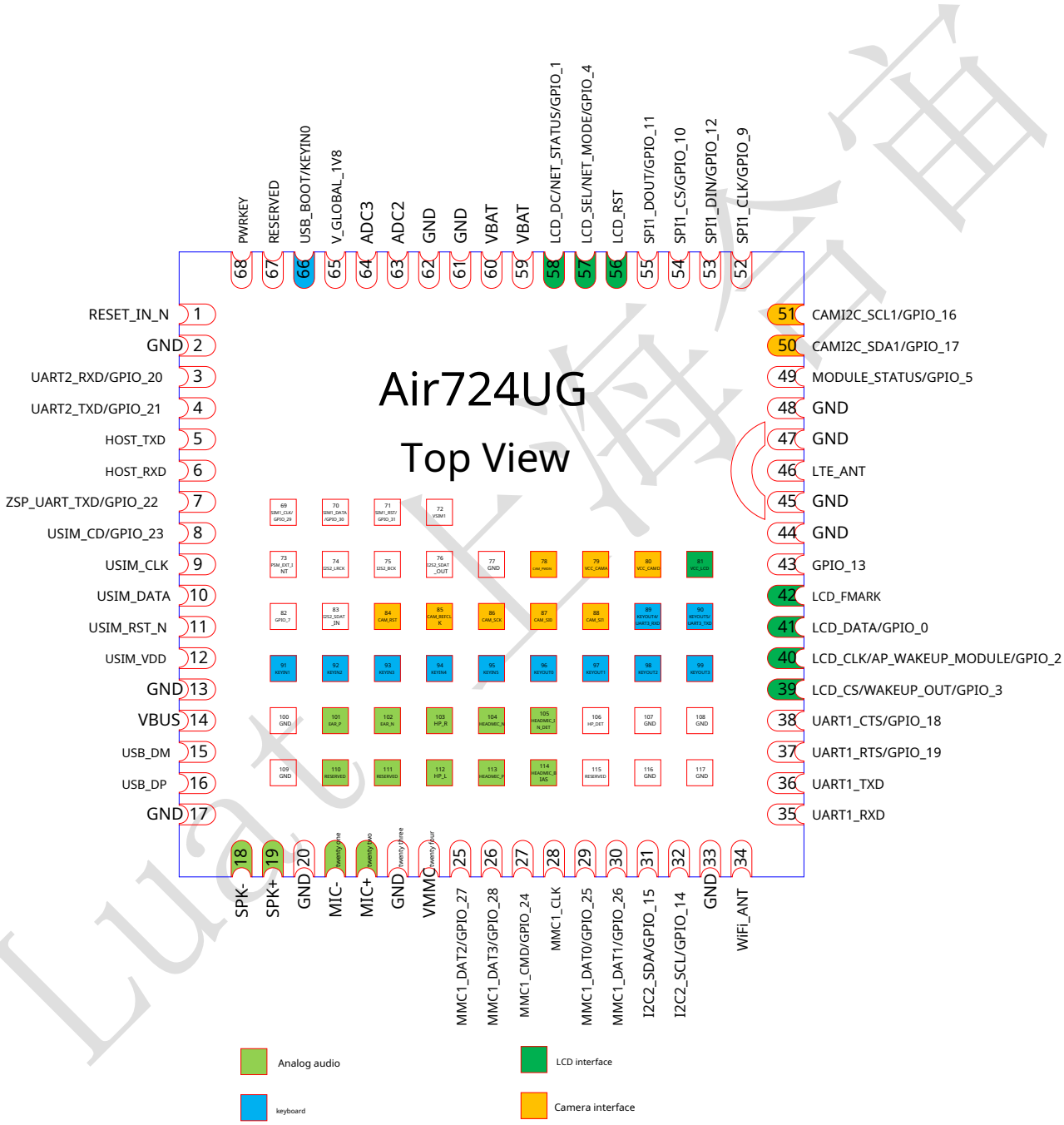


chart2:Air724UGPin arrangement diagram (front view)

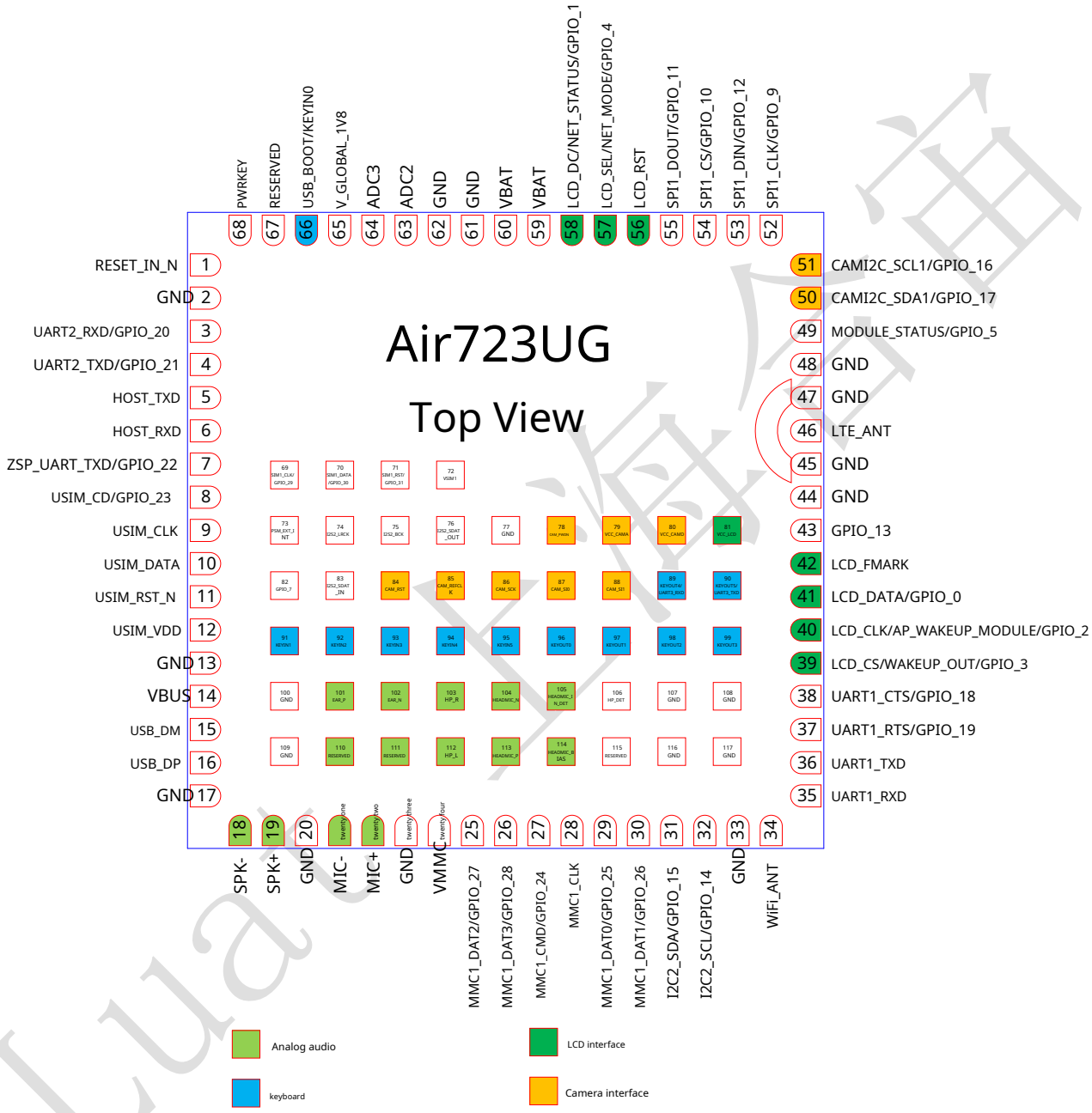


chart3:Air723UGPin arrangement diagram (front view)

sheet2Pin Description

power supply						
pin name	pin	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
VBAT	59,60		PI	Module main power supply VBAT = 3.3V~4.3V	Vmax=4.3V Vmin=3.3V Vnorm=3.8V	1.Maximum load of the module in burst mode Current carrying capacity1.8A 2.Voltage lower than3.3VRadio frequency performance will deteriorate.
V_GLOBAL_1V8	65		PO	Output1.8V	Vnorm=1.8V Iomax=50mA	1.If not used, it will remain suspended. 2.If this pin is used to supply power to the outside... For electricity, I recommend connecting one in parallel.2~4.7uFto go Coupling capacitor, load current should not exceed 50mA
VMMC	twenty four		PO	Output1.6-3.2VDefault electricity Pressure is3.1V		GiveMMCpowered by
VCC_CAMA	79		PO	Output1.6-3.2V,Give CameraProvide analog electricity Compression, the default is1.8V		GiveCamerapowered by
VCC_CAMD	80		PO	Output1.4-2.1V,Give CameraProvide digital electricity Compression, the default is1.8V		
VCC_LCD	81		PO	Output1.6-3.3VDefault electricity Pressure is1.8V		GiveLCDpowered by
GND	2,13,17, 20,23,3 3,44,45, 47,48,6 1,62,77, 100,107 , 108,10 9,116,1 17		GND	Modular		
Power on/off						
pin name	pin	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
PWRKEY	68	INPUT PULL_UP	I	Module power on/off; Pull up insideVBAT	VILmax=0.5V	1. VBATVoltage domain 2.Internal pull-up 3.Pull the pin low while the device is off1.5s Power on the above modules 4.Pull the pin low while the device is powered on.1.5s The above modules must be powered off (please refer to the power-on instructions for details). Machine timing diagram)

Reset						
pin name	pin	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
RESET_IN_N	1	INPUT PULL_UP	I	Module reset; Pull up insideVBAT	VILmax=0.45V	1.Please note the internal pull-up of this reset pin. arriveVBATInstead of pulling up V_Globale_1V8 2.Internal pull-up, pull the pins down.1sReset of the above modules 3.If you don't use it, it's recommended to add...1ufcapacitor to ground
Module status indicator						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
NET_STATUS (GPIO_1)	58	INPUT PULL_DOWN	O	Network status indication	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin=VCC_LCD*0.7 VOLmax=VCC_LCD*0.3	Note that the voltage domain is...VCC_LCD If not in use, it will remain suspended.
NET_MODE (GPIO_4)	57	INPUT PULL_DOWN	O	4GNetwork instructions		
MODULE_STATUS (GPIO_5)	49	INPUT PULL_DOWN	O	Module running status indicator	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin=V_GLOBAL_1V8*0.7 VOLmax=V_GLOBAL_1V8*0.3	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
USB interface						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
USB_VBUS	14	INPUT PULL_DOWN	I	USBpower supply,USBinsert Detection	Vmax=5.25V Vmin=3.0V Vnorm=5.0V	
USB_DP	16		IO	USBDifferential data+	USB 2.0	90-ohm differential impedance control
USB_DM	15		IO	USBDifferential data -	USB 2.0	90-ohm differential impedance control
Main serial port UART1, used forAT						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
UART1_TXD	36		O	Module sends data	VILmin=-0.3V VILmax=0.6V	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.

UART1_RXD	35		I	Module receives data	VIHmin=1.2V VIHmax=2.0V VOHmin= V_GLOBAL_1V8* 0.7 VOLmax= V_GLOBAL_1V8*	
UART1_RTS (GPIO_19)	37	INPUT PULL_DOWN	O	Module clear sending		
UART1_CTS (GPIO_18)	38	INPUT PULL_DOWN	I	DTERequest to send data to Module		
The auxiliary serial port UART2 is used for RF calibration and also connects to the internal Bluetooth.						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
UART2_TXD (GPIO_21)	4	INPUT PULL_DOWN	O	Module sends data	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin= V_GLOBAL_1V8* 0.7 VOLmax= V_GLOBAL_1V8* 0.3	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
UART2_RXD (GPIO_20)	3	INPUT PULL_DOWN	I	Module receives data		
Debug serial port						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
HOST_TXD	5		O	OutputAP log	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin= V_GLOBAL_1V8* 0.7 VOLmax= V_GLOBAL_1V8* 0.3	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
HOST_RXD	6		I			
ZSP_UART_TXD (GPIO_22)	7	INPUT PULL_DOWN	O	OutputCP log		
I2C						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
I2C2_SCL (GPIO_14)	32	INPUT PULL_DOWN	O	I2Cinterface	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin= V_GLOBAL_1V8* 0.7 VOLmax= V_GLOBAL_1V8* 0.3	**Used asI2CExternal1.8VPull up** Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
I2C2_SDA (GPIO_15)	31	INPUT PULL_DOWN	O			
Analog speech						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark

SPK-	18		O	SpeakerDifferential signal input Output, can be directly driven8 ohmSpeaker,maximum Output power1W		
SPK+	19		O			
EAR_P	101		O	Handpiece output		
EAR_N	102		O			
HP_R	103		O	Headphone output		
HP_L	112		O			
MIC-	twenty one		I	Microphone input, with built-in bias Set circuit		
MIC+	twenty two		I			
HEADMIC_N	104		I	Microphone input requires additional input. Partial bias circuit		
HEADMIC_P	113		I			
HEADMIC_BIAS	114		I	GiveHEADMICProvide bias Set voltage		
HEADMIC_IN_DET	105		I	Headphone button testing		
HP_DET	106		I	Headphone insertion detection		
I2Sinterface						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
I2S2_LRCK	74	INPUT PULL_DOWN	P		VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin= V_GLOBAL_1V8* 0.7 VOLmax= V_GLOBAL_1V8* 0.3	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
I2S2_BCK	75	INPUT PULL_DOWN	I/O			
I2S2_SDAT_OUT	76	INPUT PULL_DOWN	O			
I2S2_SDAT_IN	83	INPUT PULL_DOWN	O			
SIM card interface0						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
USIM_VDD	12		P	USIMCard power supply	**3V:** VOLmax=0.4V VOHmin=2.7V **1.8V:**	The module can automatically recognize1.8Vor 3V(U)SIMCard
USIM_DATA	10		I/O	USIMCard data cable		

USIM_CLK	9		O	USIMCard clock line	VOLmax=0.36V VOHmin=1.62V	
USIM_RST_N	11		O	USIMCard reset line		
USIM_CD (GPIO_23)	8		I	USIMCard in place detection	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
SIM card interface1						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
VSIM1	72	OFF	P	USIMCard power supply	**3V:** VOLmax=0.4V VOHmin=2.7V **1.8V:** VOLmax=0.36V VOHmin=1.62V	The module can automatically recognize1.8Vor 3V(U)SIMCard Please note that becauseAir724UG-MAand Air723UG-MAAlreadySIM1The interface has a built-in patch.SIMCard, therefore SIM1The interface can no longer be externalized.SIM The card cannot be used as a card.GPIO
SIM1_DATA (GPIO_30)	70	INPUT PULL_DOWN	I/O	USIMCard data cable		
SIM1_CLK (GPIO_29)	69	OUTPUT LOW	O	USIMCard clock line		
SIM1_RST (GPIO_31)	71	OUTPUT LOW	O	USIMCard reset line		
ADC						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
ADC2	63		I	Analog-to-digital converter	Input range **0~VBAT**	ADCresolution12 bits If not in use, it will remain suspended.
ADC3	64		I	Analog-to-digital converter	Input range **0~VBAT**	ADCresolution12 bits If not in use, it will remain suspended.
RF interface						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
LTE_ANT	46		I/O	LTEAntenna Interface	50Ohmic characteristic resistance anti-	
WiFi_ANT	34		I/O	WiFiAntenna Interface	50Ohmic characteristic resistance anti-	
USB_BOOT						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
USB_BOOT KEYIN0	66	INPUT PULL_DOWN	I	Pull up before powering on V_GLOBAL_1V8Module Will force entryUSBdownload model		Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
LCDinterface						

pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
LCD_CS WAKEUP_OUT (GPIO_3)	39	INPUT PULL_DOWN	O	SPI LCDFilm Selection	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin=VCC_LCD*0.7 VOLmax=VCC_LCD*0.3	Note that the voltage domain is...VCC_LCD If not in use, it will remain suspended.
LCD_CLK AP_WAKEUP_ MODULE (GPIO_2)	40	INPUT PULL_DOWN	O	SPI LCDclock signal		
LCD_DATA (GPIO_0)	41	INPUT PULL_DOWN	O	SPI LCDData signals		
LCD_FMARK	42	INPUT PULL_DOWN	O	SPI LCDFrame synchronization signal		
LCD_RST	56	INPUT PULL_DOWN	O	SPI LCDReset signal		
LCD_SEL NET_MODE (GPIO_4)	57	INPUT PULL_DOWN	O	SPI LCDchoose		
LCD_DC NET_STATUS (GPIO_1)	58	INPUT PULL_DOWN	O	SPI LCDData command selection select		
Keyboard Array						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
KEYIN0 USB_BOOT	66		I	Scan keyboard input0	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin=V_GLOBAL_1V8*0.7 VOLmax=V_GLOBAL_1V8*0.3	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
KEYIN1	91		I	Scan keyboard input1		
KEYIN2	92		I	Scan keyboard input2		
KEYIN3	93		I	Scan keyboard input3		
KEYIN4	94		I	Scan keyboard input4		
KEYIN5	95		I	Scan keyboard input5		
KEYOUT0	96		O	Scan keyboard output0		
KEYOUT1	97		O	Scan keyboard output1		
KEYOUT2	98		O	Scan keyboard output2		
KEYOUT3	99		O	Scan keyboard output3		
KEYOUT4 UART3_RXD	89		O	Scan keyboard output4		
KEYOUT5 UART3_TXD	90		O	Scan keyboard output5		

Camerainterface						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
CAM_PWDN	78	INPUT PULL_DOWN	O	closureCamera	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin=V_GLOBAL_1V8*0.7 VOLmax=V_GLOBAL_1V8*0.3	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
CAM_RST	84	INPUT PULL_DOWN	O	RestartCamera		
CAM_REFCLK	85	INPUT PULL_DOWN	O	CameraReference clock		
CAM_SCK	86	INPUT PULL_DOWN	I	SPI CameraClock input		
CAM_SI0	87	INPUT PULL_DOWN	I	SPI CamerData input0		
CAM_SI1	88	INPUT PULL_DOWN	I	SPI CamerData input1		
CAMI2C_SDA1 (GPIO_17)	50	INPUT PULL_UP	I/O	Camera I2C		
CAMI2C_SCL1 (GPIO_16)	51	INPUT PULL_UP	O			
SPI						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
SPI1_DOUT (GPIO_11)	55	INPUT PULL_DOWN	IO	SPIinterface	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin=V_GLOBAL_1V8*0.7 VOLmax=V_GLOBAL_1V8*0.3	Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
SPI1_DIN (GPIO_12)	53	INPUT PULL_DOWN	IO			
SPI1_CLK (GPIO_9)	52	INPUT PULL_DOWN	IO			
SPI1_CS (GPIO_10)	54	INPUT PULL_DOWN	IO			
MMCinterface						
pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
MMC1_DAT2 (GPIO_27)	25	INPUT PULL_UP	IO	GeneralGPIO Currently not supported.SDIOinterface	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin=VMMC*0.7 VOLmax=VMMC*0.3	Note that the voltage domain is...VMMC If not in use, it will remain suspended.
MMC1_DAT3 (GPIO_28)	26	INPUT PULL_UP	IO			
MMC1_CMD (GPIO_24)	27	INPUT PULL_UP	IO			
MMC1_CLK	28	OUTPUT CLK	IO			
MMC1_DAT0 (GPIO_25)	29	INPUT PULL_UP	IO			
MMC1_DAT1 (GPIO_26)	30	INPUT PULL_UP	IO			
GPIO						

pin name	pin number	Power-on state	I/O	Pin Description	Electrical characteristics	Remark
AP_WAKEUP_MODULE LCD_CLK (GPIO_2)	40	INPUT PULL_DOWN	I	Wake-up module	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V VOHmin= V_GLOBAL_1V8* 0.7 VOLmax= V_GLOBAL_1V8*	Voltage domain isV_GLOBAL_1V8 Pull low wake-up module
WAKEUP_OUT LCD_CS (GPIO_3)	39	INPUT PULL_DOWN	O	wakeAP		For detailed functions, please refer to [link/reference]. 3.10 WAKEUP_OUT Voltage domain isV_GLOBAL_1V8
GPIO_7	82	INPUT PULL_DOWN	I	GeneralGPIO		Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
GPIO_13	43	INPUT PULL_DOWN	IO	Please note that when powering on, do not... ToGPIO_13Raise to V_GLOBAL_1V8, If it is pulled high when powered on arriveV_GLOBAL_1V8, The module will enter calibration mode Abnormal power-on		Voltage domain isV_GLOBAL_1V8 If not in use, it will remain suspended.
Reserved pins						
RESERVED	67,110,111,115			Suspended treatment		Suspended treatment
PSM_EXT_INT	73			Used internally within the module, suspended deal with		Suspended treatment

3.2.Work mode

The table below briefly describes the various working modes mentioned in the following chapters.

sheet3Work Mode

model	Function	
Normal work	SLEEP	When the module is not processing any tasks, it will automatically enter sleep mode. In sleep mode, the module's power consumption will drop to a very low level, but the module can still send and receive data, text messages, and incoming calls.
	IDLE	The software is running normally. The module is registered on the network, but there is no data transmission, and voice and SMS interactions are not possible.
	TALK/Data	The connection is working normally. Data, voice, or SMS interactions are possible. In this mode, the module's power consumption dynamically depends on the strength of the ambient signal.DTXControl and radio frequency operating frequency.
Power off mode	In this modePMUWhen power is stopped to the baseband and RF components, the software stops working, and the serial port becomes unreachable.VBATThe pins are still powered.	
Minimum Functional Mode (Preserve) **(Sustaining power supply voltage)**	In this mode, radio frequency andSIMThe cards are not working, but the serial port is still accessible.	
Flight mode	AT+CFUN=4The module can be set to flight mode, in which the module's radio frequency is disabled.	

3.3.Power supply

3.3.1. Module power supply operating characteristics

In modular application design, power supply design is a crucial aspect. During RF transmission, there is a brief burst of high current. During this burst, the power supply must be able to provide high peak current; otherwise, a voltage drop may occur.2GNetwork voltage drop ratio3Gand4GThe network is vast.

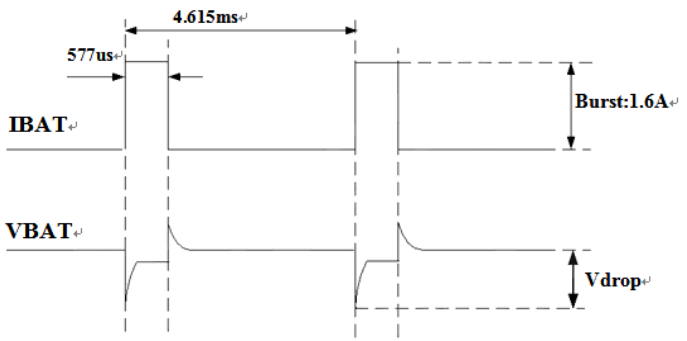


chart4Module2GVoltage and current waveforms during transmission

3.3.2. Reduce voltage drop

Modular power supplyVBATVoltage input range is3.3V~4.3VHowever, the module typically operates during radio frequency transmission.VBATVoltage drops in the power supply are caused by impedance issues in the power supply or wiring paths, and are generally difficult to avoid. Therefore, special attention must be paid to the power supply design of the module.VBATFor the input, it is recommended to connect a low voltage input in parallel.ESR (ESR=0.7Ω)of100uFtantalum capacitors, and100nF,33pF,10pFFilter capacitor (0603(encapsulation)VBATThe input reference circuit is shown in the figure.4As shown. And it is recommended.VBATofPCBKeep traces as short and wide as possible to reduce...VBATThe equivalent impedance of the traces ensures that there is no excessive voltage drop under high current at maximum transmit power. RecommendationVBATThe wiring width is not less than2mmFurthermore, the longer the line, the wider the line width.

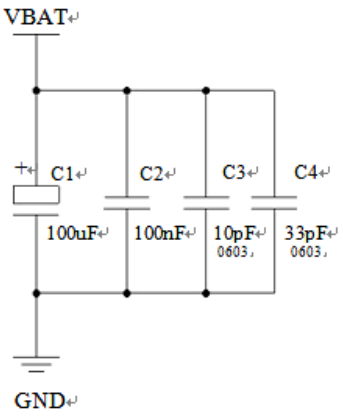


chart5:VBATInput reference circuit

3.3.3. Power supply reference circuit

Power supply design is crucial for the module's power supply; a power supply capable of providing at least [amount missing] power must be selected.2AA power supply with sufficient current capability. If the voltage difference between the input voltage and the module's supply voltage is not significant, it is recommended to select...LDOAs a power supply. If there is a large voltage difference between the input and output, a switching power supply converter is used.

LDOpowered by:

The image below is5VThe power supply reference design adopts...MicrelThe companyLDOModel numberMIC29302WUIts output voltage is4.16Vpeak load current to3ATo ensure stable output power, it is recommended to install a Zener diode at the output terminal and place it close to the module.VBATPin placement. It is recommended to select a pin with a reverse breakdown voltage of [value missing].5.1VThe power dissipation is1WThe above are Zener diodes.

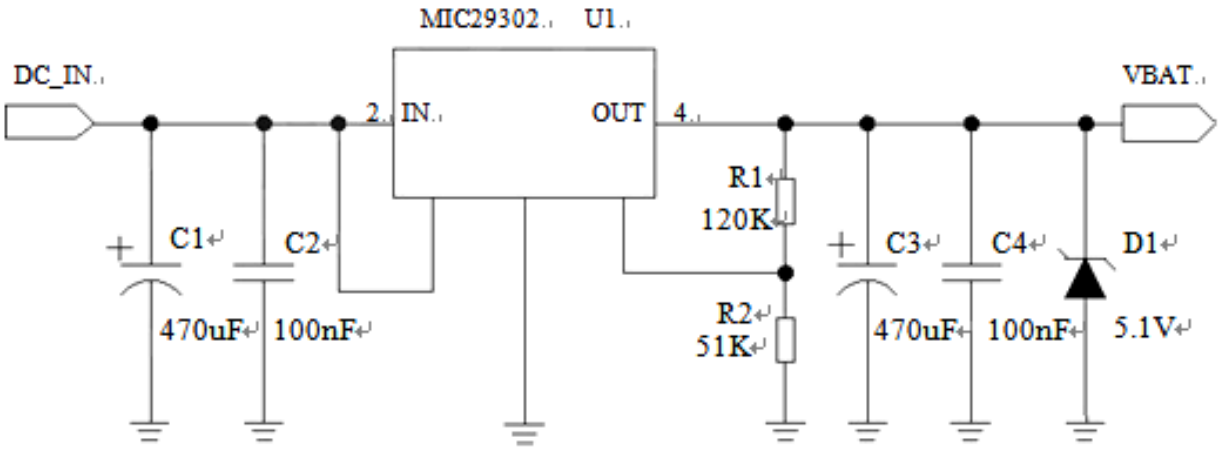


chart6Power input reference design

DCDCpowered by:

The image below isDCDCThe reference design for the switching power supply uses that of Jewart.JW5033SThe maximum output current of the switching power supply chip is...2ASimultaneously, the input voltage range4.7V~20V.NoticeC25The selection of the model should be based on the input voltage to choose the withstand voltage value.

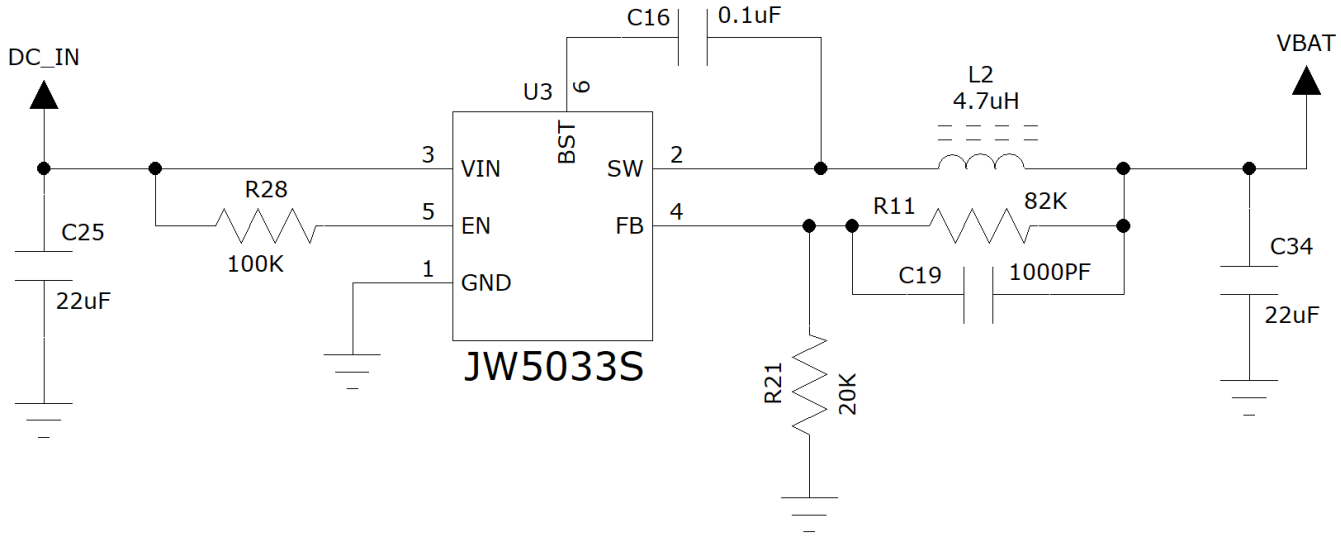


chart6:DCDCPower input reference design

becauseDC-DCChips have specific requirements for layout and routing. To simplify the design, technologies developed by Universe can also be used.JW5033SPower module: Air5033S Come give4GModule power supply:

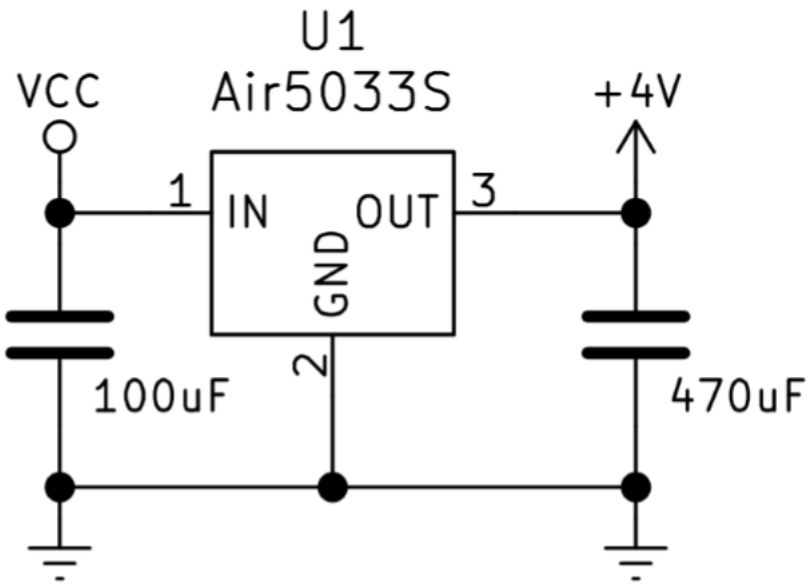


chart6:Air5033SPower input reference design

3.4.Power on/off

3.4.1. Power on

Air724UG_Air723UGxSeries modules can be accessed throughPWRKEYPower on via pin. With the module powered off, press and hold the power button for a period of time; the module will then enter the power-on process, and the software will perform a detection.VBATIf the pin voltage isVBATThe pin voltage is greater than the power-on voltage set in the software.3.1VIf the system fails to boot, it will continue the boot process until the system boots up completely; otherwise, it will stop the boot process and shut down the system.

3.4.1.1 PWRKEYPin power-on

VBATAfter powering on,PWRKEYThe pin can start the module, puttingPWRKEYAfter the pin is pulled low for a period of time (please refer to the timing diagram), the device is powered on. After successful power-on...PWRKEYThe pin can be released. This can be detected.V_GLOBAL_1V8The voltage level of the pins determines whether the module is powered on. An open-collector driver circuit is recommended for control.PWRKEYPinout. The following diagram shows a reference circuit:

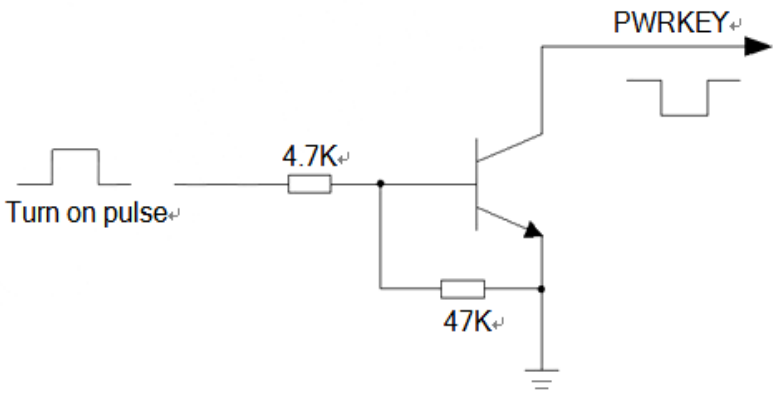


chart7Open set driver reference power-on circuit

Another controlPWRKEYThe pinned method uses a push-button switch directly. A [unclear - possibly a device or component] needs to be placed near the button.TVSEffectiveESDProtection. The following diagram shows a reference circuit:

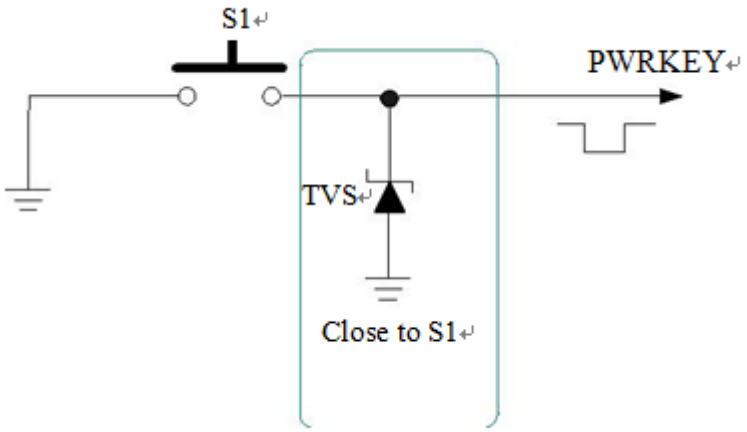
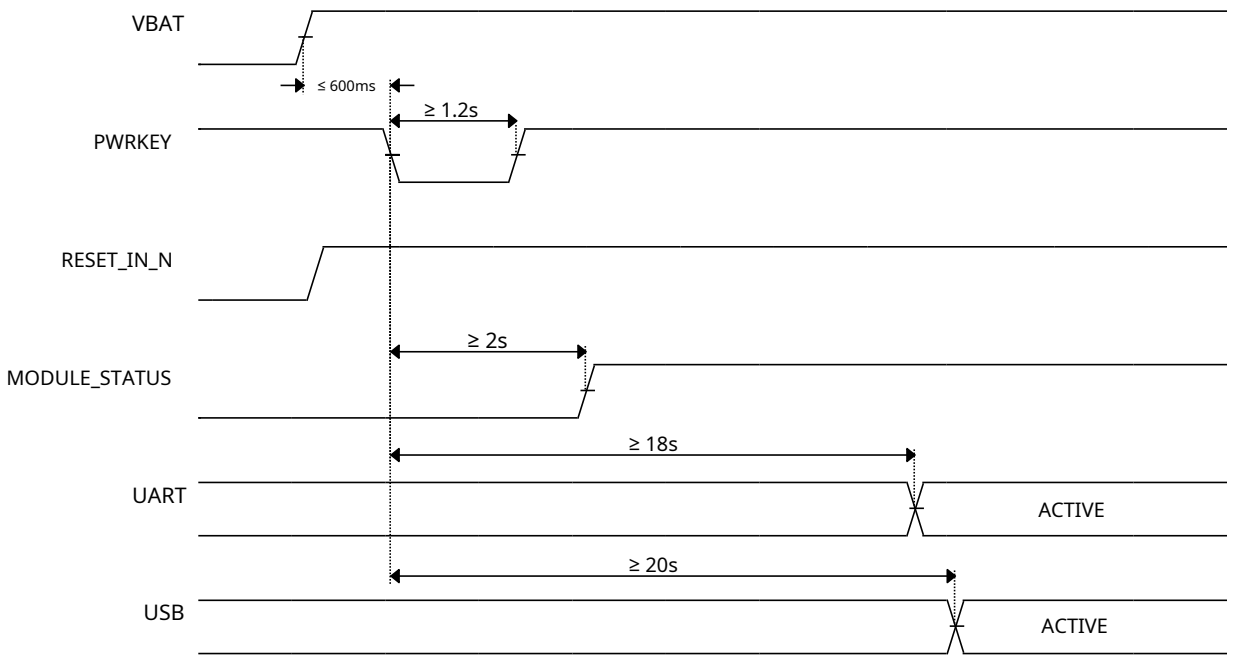


chart8: Keypad power-on reference circuit

Power-on sequence diagram:



Note: After the module is powered on...600msThe internal system will check the power on/off status.600msLowering within a time periodPWRKEYand greater than1.2sIt can boot up stably. Power on.600msIf no boot event is detected, the software will then proceed.

The process of closing the process will continue.1arrive2sIf it is lowered at this timePWRKEYIt will not be detected. Therefore, if it cannot be guaranteed that it will not be detected upon power-on.600mspull lowPWRKEYTo ensure stable operation

Machine RecommendationPWRKEYIt is recommended to extend the time appropriately.4Sabove.

3.4.1.2Power on

ModulePWRKEYDirect grounding enables automatic power-on. Note that in power-on mode, the device cannot be turned off; only...VBATEven if the software calls the shutdown interface, the module will still power on if the voltage at the pin is greater than the power-on voltage. Additionally, in this mode, successful power-on requires...VBAT The pin voltage must still be greater than the power-on voltage value set in the software.3.1VIf the conditions are not met, the module will shut down, resulting in repeated power-on and power-off cycles.

3.4.2. Power off

The following methods can be used to disable the module:

- Normal shutdown: usingPWRKEYPin shutdown
- Normal shutdown: viaATinstructionAT+CPOWDAutomatic shutdown due to low voltage: The module
- detects low voltage (3.1V(The following) When turning off the device

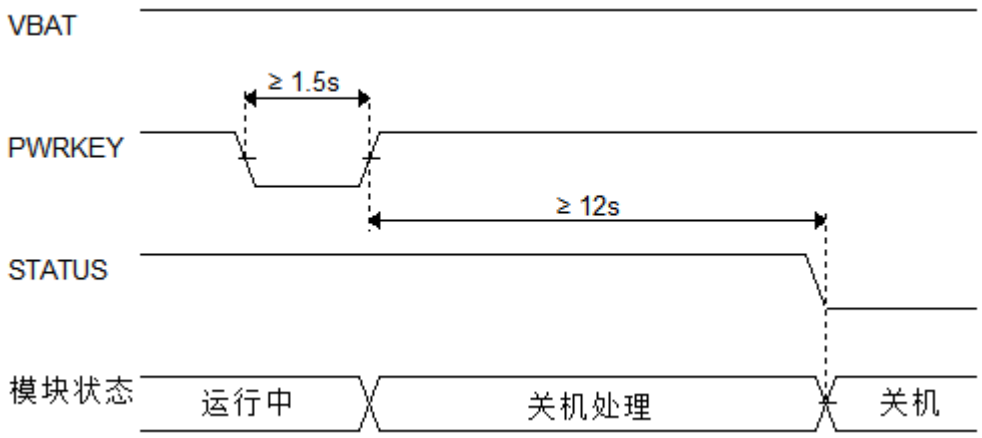
3.4.2.1 PWRKEYPin shutdown

PWRKEYPin pull-down1.5sDuring the above time period, the module will perform a shutdown action.

During the shutdown process, the module needs to deregister from the network. The deregistration time depends on the current network status, and it has been measured to take approximately [time missing].2s~12s

Therefore, it is recommended to extend 12sThen perform a power outage or restart to ensure that the software saves important data before a complete power outage.

The timing diagram is as follows:



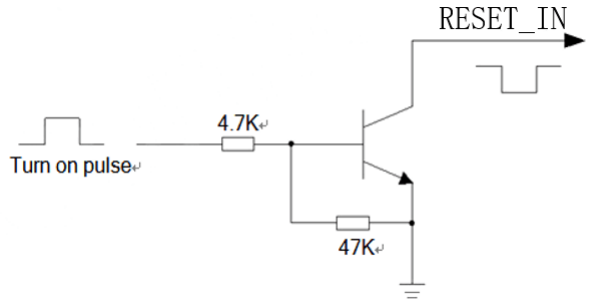
3.4.2.2Automatic shutdown due to low voltage

When the module is runningVBATWhen the pin voltage is lower than the software-set shutdown voltage (default setting)3VThe software will perform a shutdown action to close the module in order to prevent various abnormalities from occurring when operating under low voltage conditions.

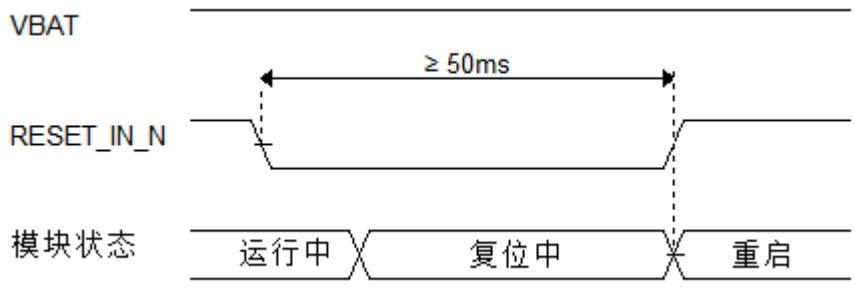
3.4.3Reset

RESET_IN_NThe pin can be used to reset the module. Pull low.RESET_IN_Npin150msThe above steps can reset the module. RESET_IN_NSignals are sensitive to interference, so it is recommended that the traces on the module interface board be as short as possible and be grounded.

Reference circuit:



Time series diagram:



Remark:

1.The reset function is recommended only whenAT+CPOWDandPWRKEYUse this if shutdown fails.

2.make surePWRKEYandRESET_IN_NThe pins do not have large load capacitors.

3.If not usedRESET_IN_NParallel connection is recommended.1ufThe capacitor is connected to ground.

3.5.Power saving function

Depending on system requirements, there are two ways to put a module into a low-power state. ForATVersion uses "AT+CFUNCommands can put a module into a minimum functional state.

3.5.1. Minimal Functionality Mode/Flight Mode

The minimum functionality mode reduces the module's functionality to a minimum. This mode can be achieved by sending "AT+CFUN=<fun>"Use commands to set it.fun> Parameters can be selected0,1,4.

- 0Minimal features (off)RFandSIMCard); 1
- Full functionality (default);
- 4:closureRFSending and receiving functions;

If using "AT+CFUN=0"Set the module to minimum functionality mode, RF section andSIMThe card's functionality will be disabled. The serial port will remain active, but its connection to the RF section will be lost.SIMCard-relatedATThe command is unavailable.

If using "AT+CFUN=4"Settings module,RFSome functions will be disabled, but the serial port will remain active. All related to...RFSome relatedATThe command is unavailable.

The module is accessed through "AT+CFUN=0"or"AT+CFUN=4"After setting it up, you can use "AT+CFUN=1"The command settings have been restored to full functionality.

3.5.2. Sleep mode (slow clock mode)

forLUATThe version and module automatically enable sleep control by default upon startup, automatically entering sleep mode when the system is idle. This can be achieved through a timer.IO Wake-up is caused by interruptions such as network message interruptions or alarm clock interruptions.

For the standardATThe version provides the following control method for sleep mode:

3.5.2.1Serial port application

Two sleep modes are supported in serial port applications:

- Sleep mode1:passAP_WAKEUP_MODULEPin level control module to enter sleep mode
- Sleep mode2The module automatically enters sleep mode after the serial port has been idle for a period of time.

3.5.2.1.1Sleep mode1

Activation conditions:

sendATinstructionAT+CSCLK=1

Module enters sleep mode:

controlAP_WAKEUP_MODULERaise your feet, and the module will enter sleep mode.1

Module exits sleep:

pull downAP_WAKEUP_MODULEfoot50msThe module will exit sleep mode, which is acceptable.ATinstruction

Module in sleep mode1Software features at that time:

No responseATInstructions, but there will be data/SMS/call received.URCReport

HOSTHow to wake the module when it receives data/SMS/call during sleep?HOST:

WAKEUP_OUTSignal

3.5.2.1.2Sleep mode2

Activation conditions:

sendATinstructionAT+CSLCK=2

Module enters sleep mode:

Serial port idle timeAT+WAKETIMConfigured time (default)5sThe module automatically enters sleep mode.2

Module exits sleep:

Serial port continuous transmissionATExit sleep mode when the module responds.2

Module in sleep mode2Software features at that time:

No responseATInstructions, but there will be data/SMS/call received.URCReport

HOSTHow to wake the module when it receives data/SMS/call during sleep?HOST:

WAKEUP_OUTSignal

3.5.2.2 USBapplication

Activation conditions:

HOST USBMust supportUSB suspend/resume

Module enters sleep mode:

HOSTInitiateUSB suspend

Module exits sleep:

HOSTInitiateUSB resume

HOSTHow to wake the module when it receives data/SMS/call during sleep?HOST

: WAKEUP_OUTSignal

3.6.Mode Switching Summary

sheet4Mode Switching Summary

Current mode	Next mode		
	Power off	Normal mode	Sleep mode
Power off		usePWRKEYPower on	
Normal mode	usePWRKEYpins, orVBATVoltage lower than shutdown voltage		The software calls the sleep interface.ATVersion not Perform actions30sAutomatic sleep
Sleep mode	usePWRKEYorVBATVoltage lower than shutdown voltage	GPIOPin interrupt, timer, receive SMS or network data	

3.7.serial port

The module provides five general-purpose asynchronous transceivers: main serial portUART1Download and calibrate serial portUART2General serial portUART3Debug serial port HOST UARTandZSP UART.

3.7.1 UART1

interface	name	pin	effect
Main serial port UART1	UART1_TXD	36	Send data toDTEequipmentRXDend
	UART1_RXD	35	fromDTEequipmentTXDEnd receives data
	UART1_RTS	37	DTERequest to send data toDCE
	UART1_CTS	38	Clear Send

sheet5:UART1Pin Definitions

UART1It is usually used to communicate with modules.ATCommand communication.UART1Supports fixed baud rate and adaptive baud rate. Adaptive baud rate support range...9600bpsarrive115200bps.

By default, hardware flow control for the module is disabled. When a customer requires hardware flow control, the pins...**RTS, CTS**A connection to the client is required.**AT** Order **"AT+IFC=2,2"**It can be used to enable hardware flow control.**AT**Order**"AT+IFC=0,0"**It can be used to disable flow control. Please refer to the following for details:AirM2Mwireless moduleAT Command Manual.

UART1The characteristics are as follows:

- Including data cableTXDandRXDHardware flow control lineRTSandCTS.
- 8One data bit, no parity check, and one stop bit.
- Hardware flow control is disabled by default.
- ForATCommand transmission, data transmission, etc.
- Supported baud rates are as follows:1200,2400,4800,9600,14400,19200,28800,38400,57600,115200,230400,460800,921600bps ATBy default, the module is adaptive to baud rate.
- AT+IPR=0)In adaptive baud rate mode, the initialization information after power-on (starting with "...")RDY"It will not send a response back to the main control unit. This occurs during module startup.2-3After a few seconds, you can send a message to the module.ATCommand. The main control unit must first send "AT"The user sends a character to the module to train the host computer's baud rate. The module will then report initialization information, indicating successful training. The user can send a... "AT+IPR=x :&W"Command to module (xIt's the baud rate, for example...9600This command sets a fixed baud rate and saves it. After these configurations are completed, the module will automatically return a serial port response each time it powers on.URCInitialization information (starting with "RDY").

To better utilize the adaptive baud rate feature, the following usage conditions should be noted:

Modules and host computer Synchronization between them:

With adaptive baud rate enabled, when the module powers on, it sends "AT"It's best to wait before the character.2~3Seconds. When the module reports the power-on initialization information, it indicates that the baud rate training was successful and synchronization with the host computer was completed.

In adaptive baud rate mode, if the master controller needs power-on information, it must first synchronize. Otherwise, power-on initialization information will not be reported.

Adaptive baud rate operation configuration:

- Serial port configuration as8Data bits, no parity bits.1The module only has the string "" at startup (factory configuration).AT"The baud rate can be trained.at""At"or"aT"
- (Unrecognizable) After successful baud rate training, it can recognize uppercase, lowercase, or combinations of uppercase and lowercase.ATCommand. In adaptive baud
- rate mode, if the module is not synchronized before power-on, such as "RDY""+CFUN: 1"and "+"CPIN: READYSuchURCThe information will not be reported.
-

- Switching to adaptive baud rate mode is not recommended when in fixed baud rate mode. Switching to
- software multiplexing mode is also not recommended when in adaptive baud rate mode.

3.7.2 UART2

interface	name	pin	effect
UART2	UART2_RXD	3	fromDTEequipmentTXDEnd receives data
	UART2_TXD	4	Send data toDTEequipmentRXDend

sheet6:UART2Pin Definitions

UART2It can be used to download software and perform RF calibration, whileUART2It is also used to communicate with the internal Bluetooth; if Bluetooth functionality is used, then... UART2It cannot be used for any other purpose.

Notice:UART2A message will be automatically printed after powering on.logbaud rate921600This sectionlogIt cannot be disabled by modifying the software; it is recommended to use [the software/method] instead.

UART3

UART2PrintedLogas follows:

```
RDA8910m Boot_ROM V1.0-17b887ec
HW_CFG: 36
SW_CFG: 0
SE_CFG: 0
check flash img
Load complete! Checking...
Security Disabled
Check uImage Done
Run ...
```

3.7.3 UART3

interface	name	pin	effect
UART3	UART3_RXD	89	fromDTEequipmentTXDEnd receives data
	UART3_TXD	90	Send data toDTEequipmentRXDend

UART3It is a general-purpose serial port that can be used as an external connection.GPSperipherals, etc.

3.7.4 HOST UART

interface	name	pin	effect
HOST UART	HOST_RXD	6	fromDTEequipmentTXDEnd receives data
	HOST_TXD	5	Send data toDTEequipmentRXDend

HOST UARTUsed for output during software debuggingAP trace

3.7.5 ZSP UART

interface	name	pin	effect
ZSP UART	ZSP_UART_RXD	7	Send data toDTEequipmentRXDend

ZSP UARTUsed for output during software debuggingCP trace

3.7.6Serial port connection method

Serial port connections are quite flexible; the following are three commonly used connection methods.

For three-wire serial ports, please refer to the following connection method:

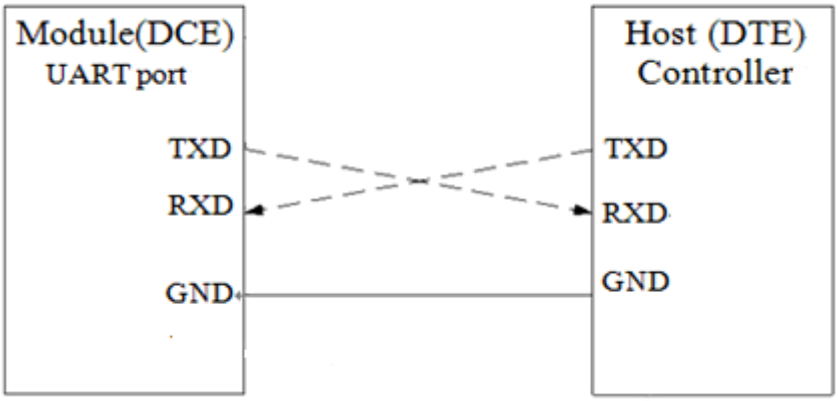


chart9: Schematic diagram of serial port three-wire connection method

For serial port connections with flow control, please refer to the following circuit connection. This connection method can improve the reliability of large data transmission and prevent data loss.

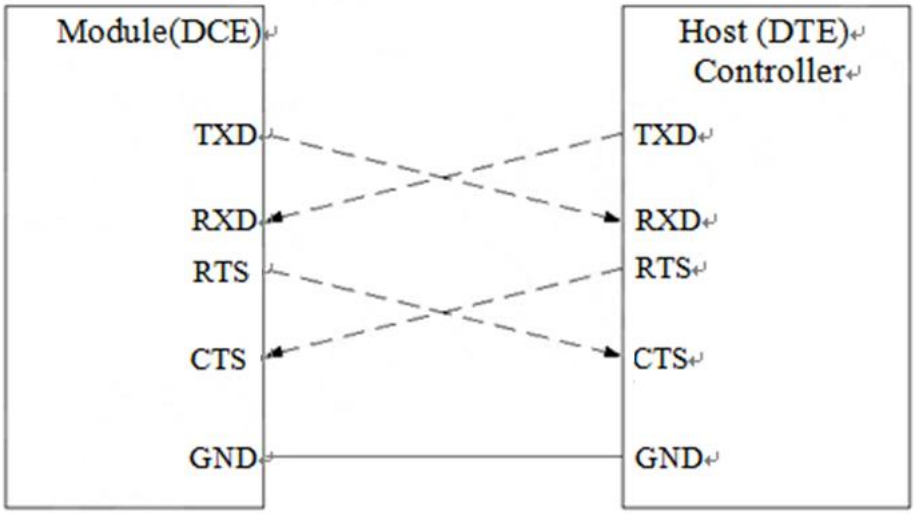


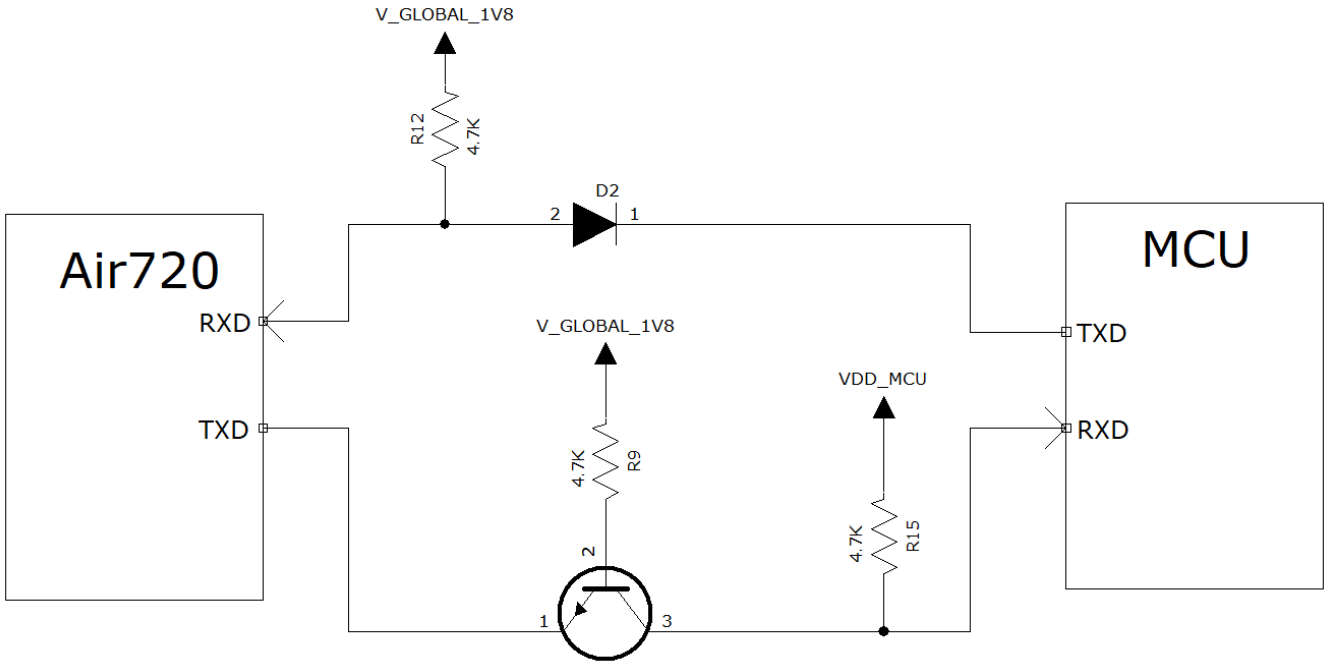
chart10Schematic diagram of serial port connection with flow control

3.7.7Serial voltage conversion

Air724UG_Air723UGThe serial port level of the module is1.8VYes, if you want to and3.3V/5VofMCUCommunication requires a level conversion circuit.

The level conversion circuit is as follows:

V_GLOBAL_1V8It is the output of the module.I/OLevel voltage.VDD_MCUIt's a client-side application.I/OLevel voltage.D2Select a Schottky diode with low forward voltage drop.



Voltage conversion can also be achieved by adding an external level conversion chip.

3.8.USBinterface

Air724UG_Air723UGofUSBconform toUSB 2.0Standardized, supports high speed (480Mbps) and full speed (12MbpsThis interface can be used in the following mode:AT Command transmission, data transmission, software debugging, and software upgrades

sheet7:USBPin Definitions

interface	name	pin	effect
USB	USB_DP	16	USBThe difference data is positive and needs to be...90Ohmic differential impedance
	USB_DM	15	USBNegative difference data requires90Ohmic differential impedance
	VBUS	14	USBPower supply, forUSBInsertion detection.
	GND	17	land

USBThe interface reference design circuit is as follows:

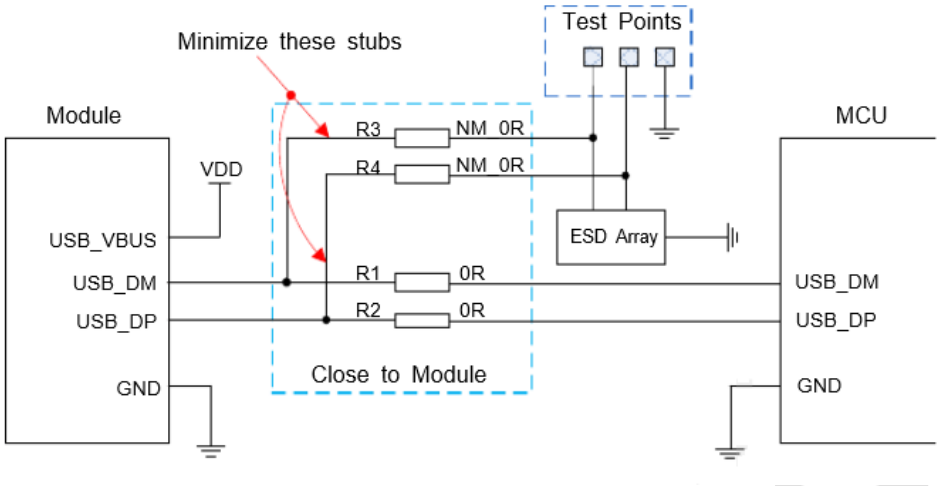


chart11:USBInterface Reference Design

3.9.SIMCard interface

SIMCard interface supportETSIandIMT-2000Kafan's support1.8Vand3.0V USIMCard.

3.9.1. SIMinterface

The following table introducesSIMThe interface pin definitions.

sheet8:SIM0Card interface pin definitions

pin name	pin number	effect
USIM_VDD	12	USIMCard power supply. Automatic detection.SIMCard operating voltage. Accuracy.3.0V±10%and 1.8V±10%Maximum supply current10mA.
USIM_RST_N	11	USIMCard reset pin
USIM_DATA	10	USIMCard data cable
USIM_CLK	9	USIMCard clock line
USIM_CD	8	USIMCard insertion and removal detection

sheet9:SIM1Card interface pin definitions

pin name	pin number	effect
VSIM1	72	SIM1Card power supply. Automatic detection.SIMCard operating voltage. Accuracy.3.0V±10%and 1.8V±10%Maximum supply current10mA.
SIM1_RST_N	71	SIM1Card reset pin
SIM1_DATA	70	SIM1Card data cable
SIM1_CLK	69	SIM1Card clock line

3.9.2. SIM0andSIM1(or built-in patch)SIMCard switching logic

Air724UG-NAandAir723UG-NAsupportSIM0andSIM1Dual SIM single standby;

Air724UG-MAandAir723UG-MABecause the module already hasSIM1The interface has a built-in patch.SIMCard, thereforeSIM1The interface can no longer be externalized.SIM The card cannot be used as a card.GPIO;

After the module is powered on, it will first query...SIM0Is there an insertion point on the interface?SIMCard, if detectedSIM0On the interfaceSIMThe card will be read.SIM0 The interface card information is used to connect to the network; ifSIM0No detection was found on the interface.SIMIf the card is damaged, it will be tested again.SIM1Does the interface haveSIMCard (or built-in patch)SIM(card), if detectedSIM1On the interfaceSIMCard (or built-in patch)SIM(card), will readSIM1 The interface card information is used to connect to the network; ifSIM1No detection was found on the interface.SIMIf the card is not inserted, an error message will appear: "Not inserted".SIMCard;

SIM0Interface andSIM1If the interface is inserted at the same timeSIMThe card will be used by default.SIM0On the interfaceSIMCard, and can also be used AT+SIMCROSSThis command is used to switch;

	SIM0	SIM1	Default use
Air724UG-NA/ Air723UG-NA	insertSIMCard0	insertSIMCard1	SIM0
	insertSIMCard0	Not insertedSIMCard	SIM0
	Not insertedSIMCard	insertSIMCard1	SIM1
	Not insertedSIMCard	Not insertedSIMCard	Error, not insertedSIMCard
Air724UG-MA/ Air723UG-MA	insertSIMCard0	Built-in patchSIMCard, no It can be connected externally, otherwise it will cause problems. wrong!	SIM0
	Not insertedSIMCard		Internal patchSIMCard

3.9.3. SIMInterface reference circuit

The image below isSIMThe reference circuit for the interface is used.6pinofSIMBooth seating.

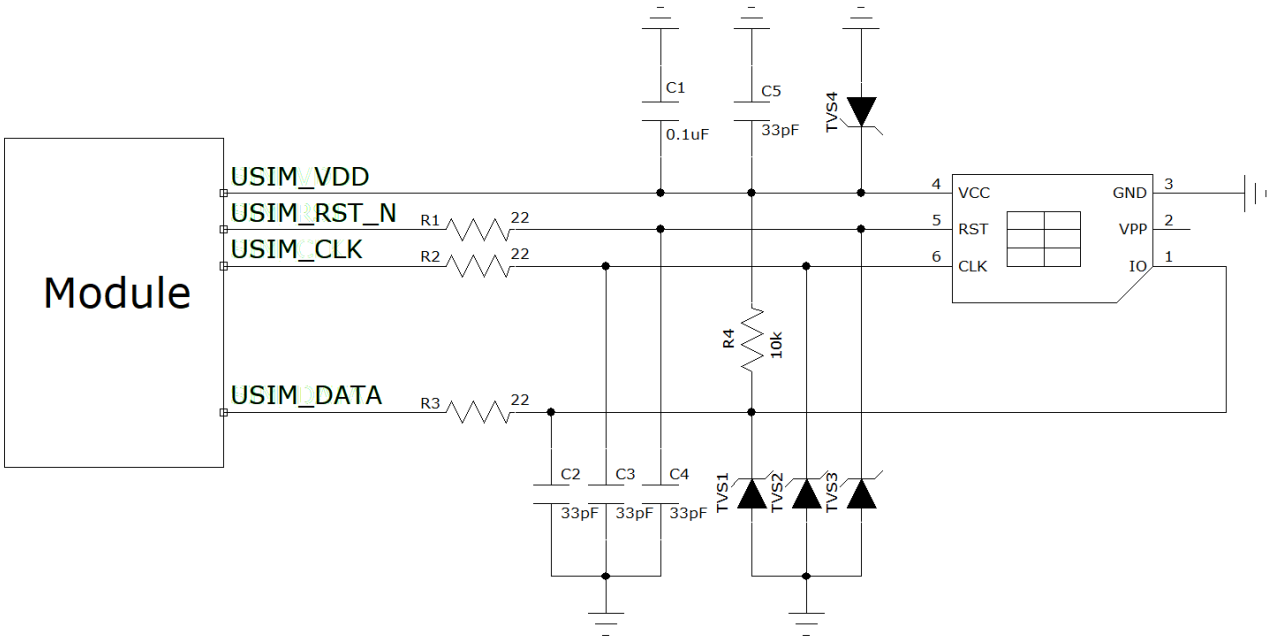


chart12:use6-pin SIMCard slot reference circuit diagram (SIM)

If neededsimFor card-in-place detection, the recommended circuit is as follows.

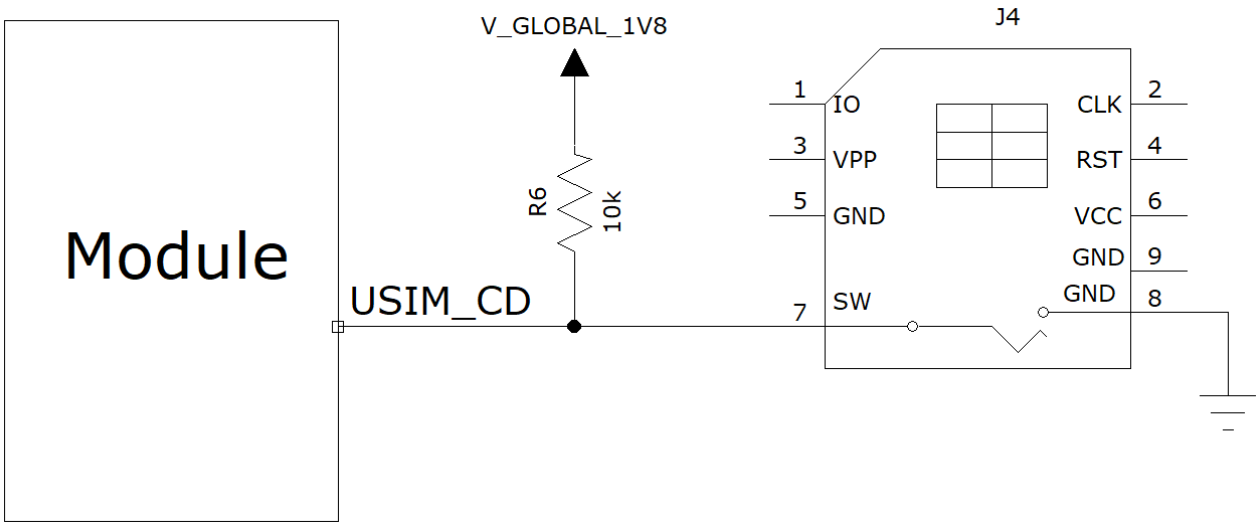


chart13Use with detectionPIN SIMCard slot reference circuit diagram

existSIMIn the circuit design of the card interface, in order to ensureSIMTo ensure the card's good functionality and prevent damage, the following design principles are recommended in circuit design:

- SIMThe distance between the card slot and the module and the ornament should not be too far; the closer the better. Try to ensure...SIMCard signal cable wiring should not
- exceed20cm. SIMCard signal cable wiring away fromRFlines andVBATPower cord.
- To prevent any potentialUSIM_CLKsignal pairUSIM_DATATo prevent signal crosstalk, avoid placing the two traces too close together and add ground shielding between them.USIM_RST_NSignals also need protection.
- To ensure goodESDProtection is recommended.TVSpipe, and close toSIMBooth seating arrangement. Selection.ESDThe parasitic capacitance of the device is not greater than50pFIn modules andSIMCards can also be connected in series.twenty twoAn ohm resistor is used to suppress stray light.EMIEnhanceESDProtection.SIMThe card's peripheral circuitry must be placed as close as possible to...SIMBooth seating.

3.10.WAKEUP_OUT

pin name	pin number	effect
WAKEUP_OUT	39	wakeAP

sheet10:WAKEUP_OUTSignal Action

state	WAKEUP_OUTanswer
standby	high level
voice call	After it goes low, then: (1) The signal level goes high when the call is established. (2) useATOrderATHHang up the call.WAKEUP_OUTWhen the caller hangs up, the signal changes (3) to a high level.WAKEUP_OUTFirst it goes high, then it goes low and stays there. URC 120msReceived an automatic reply information"NO CARRIERThen it goes high again when receiving a text message. (4)
Data transmission	After it goes low, then: (1) The signal goes high when the data connection is established. (2) useATOrderATHDisconnect the data connection.WAKEUP_OUTWhen the caller hangs up, the signal (3) changes to a high level.WAKEUP_OUTFirst it goes high, then it goes low and stays there. URC 120msReceived an automatic reply information"NO CARRIERThen it goes high again when receiving a text message. (4)
Short message	When a new text message is receivedWAKEUP_OUTGoes low and remains low.120msThen it becomes high level.
URC	someURCInformation can triggerWAKEUP_OUTpull down120ms

If the module is used as the calling partyWAKEUP_OUTIt will remain high upon receipt.URCExcept when sending messages or text messages. When the module is used as the called party,WAKEUP_OUTThe timing sequence is as follows:

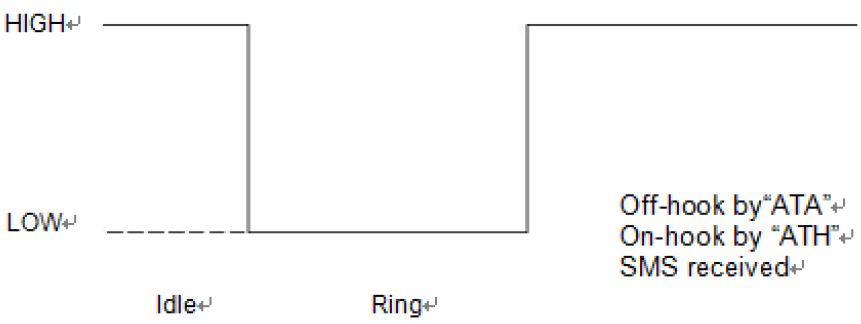


chart14The module acts as the called party during a voice call.WAKEUP_OUTTime series

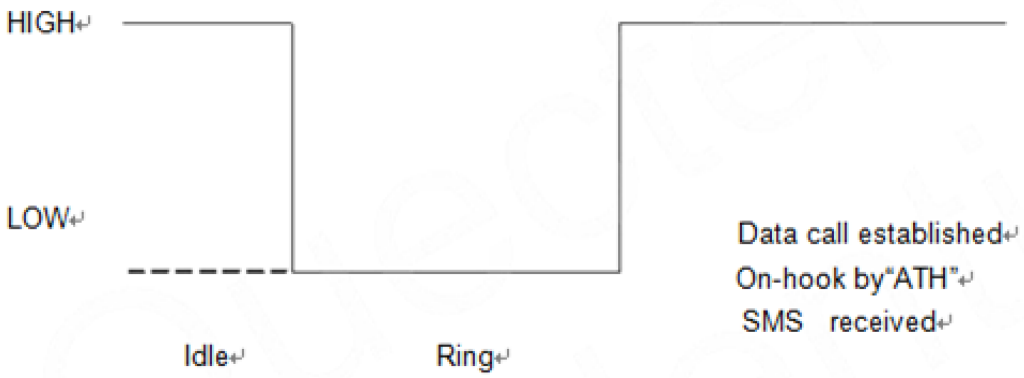


chart15The module acts as the called party during a data call.WAKEUP_OUTTime series

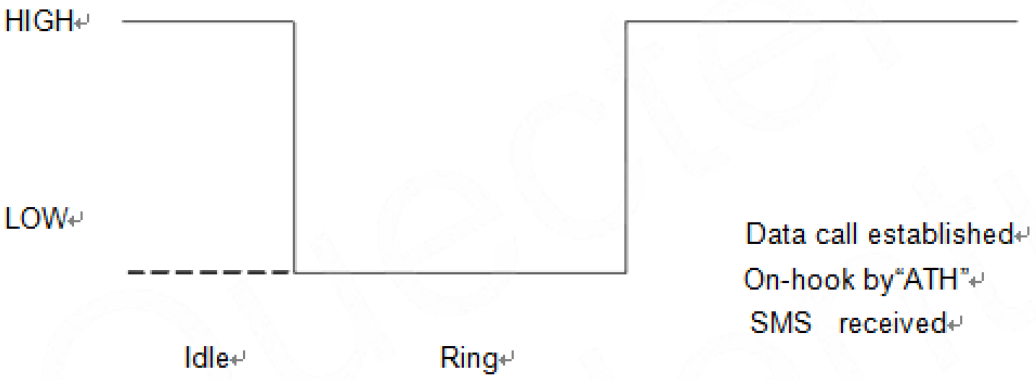


chart16When the module initiates a callWAKEUP_OUTTime series

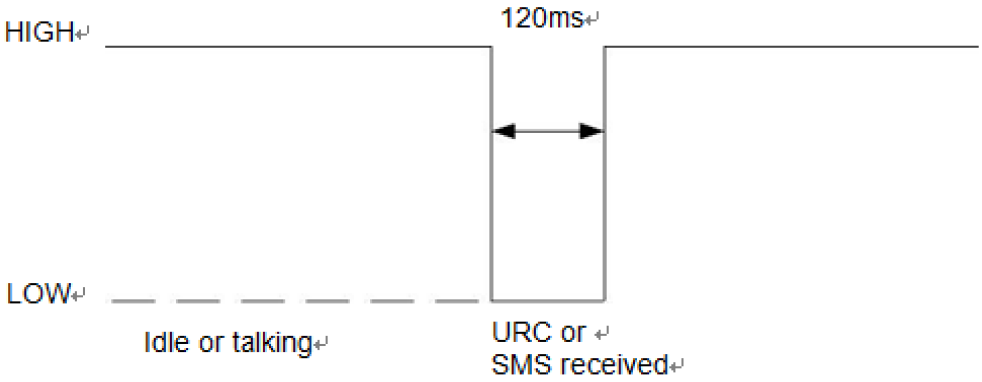


chart17:receiveURCWhen sending messages or text messagesWAKEUP_OUTTime series

3.11.Network status indication

Air724UG_Air723UGTwo pin signals are used to indicate the network status. The following two tables describe the pin definitions and logic level changes under different network states:

sheet11Network indicator pin definitions

pin name	pin number	effect
NET_MODE	57	Indicator module4GNetwork status
NET_STATUS	58	Indicator module network operating status

sheet12: Indicates the working status of network pins

state	Pin working status	Network status
NET_MODE	high	registerLTEnetwork
	Low	other
NET_STATUS	Bright0.2Seconds, extinguish1.8Second	Search status
	Bright1.8Seconds, extinguish0.2Second	standby
	Bright0.125Seconds, extinguish0.125 Second	Data transmission status Note: This status notification is only valid for...PPPDialing successful orATCommand to activatePDP success,RNDISConnection successful

The reference circuit is shown in the figure below:

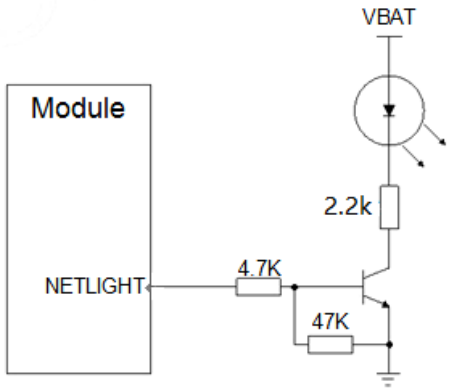


chart18:NET_LEDReference circuit

3.12.audio interface

The module provides two analog audio input channels and three analog output channels, supporting functions such as calls, recording, and playback.

sheet13Audio interface pin definitions

interface	Interface name	Interface number	effect
Microphone Simulation InputAIN	MIC+	twenty two	Audio input channel1The microphone bias circuit is already built in.
	MIC-	twenty one	
Headphone microphone analog inputAIN	HEADMIC_P	113	The headphone microphone input channel requires an external microphone bias circuit.
	HEADMIC_N	104	
Headphone outputAIN	HP_R	103	Right channel output of headphones
	HP_L	112	Headphone left channel output
Handpiece outputAIN	EAR_P	101	Positive output terminal of earpiece
	EAR_N	102	earpiece output negative terminal
Speaker outputAOUT	SPK+	19	Speaker output positive terminal
	SPK-	18	Speaker output negative terminal

AINIt can be used as a microphone input or an analog audio signal input. An electret microphone is typically chosen.AINIt is a differential input.

AOUTChannels can be driven directly8Ohm's horn.AOUTThe channel is a differential output.

3.12.1.preventTDDNoise and other noise

For handheld and hands-free microphones, it is recommended to use dual capacitors with built-in RF filtering (such as...).10pFand33pFAn electret microphone, by filtering out radio frequency interference at its source, can significantly improve coupling.TDDnoise.33pFCapacitors are used in the filter module to operate at900MHzHigh-frequency interference at certain frequencies. Without this capacitor, it's possible to hear [something] during a call.TDDNoise. Meanwhile...10pFThe capacitor is used to filter out the operating conditions.1800MHzHigh-frequency interference at certain frequencies. It's important to note that since the resonant point of a capacitor largely depends on its materials and manufacturing process, it's necessary to consult the capacitor supplier to select the most suitable capacitance value to filter out high-frequency interference.GSM850MHz,GSM900MHz,DCS1800MHzandPCS1900MHzHigh-frequency noise at that time.

GSMThe severity of high-frequency interference during transmission typically depends primarily on the customer's application design. In some cases,GSM900ofTDDThe noise is quite severe, and in some cases,DCS1800ofTDDThe noise level is quite high. Therefore, customers can select the necessary filter capacitors based on the test results, or sometimes they may not even need to install this type of filter capacitor.

PCBThe RF filter capacitors on the board should be placed as close as possible to audio devices or audio interfaces, and the traces should be as short as possible, passing through the filter capacitors before reaching other points.

The antenna should be positioned as far away from audio components and audio traces as possible to reduce radiation interference. Power traces and audio traces should not be parallel, and power lines should be kept as far away from audio lines as possible.

Differential audio traces must follow the differential signal routing rules.Layoutrule.

3.12.2.Microphone Interface Reference Circuit

AINThe channel incorporates the bias voltage for the electret microphone. The microphone channel reference circuit is shown in the diagram below:

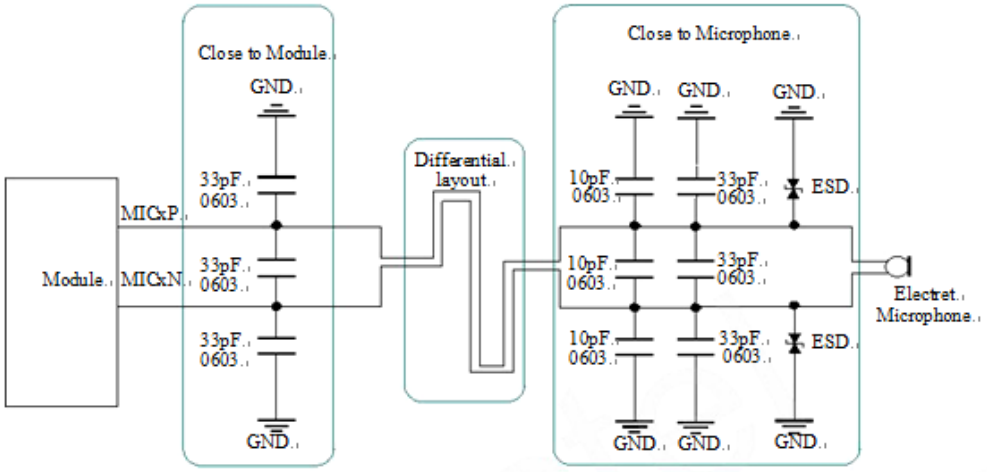


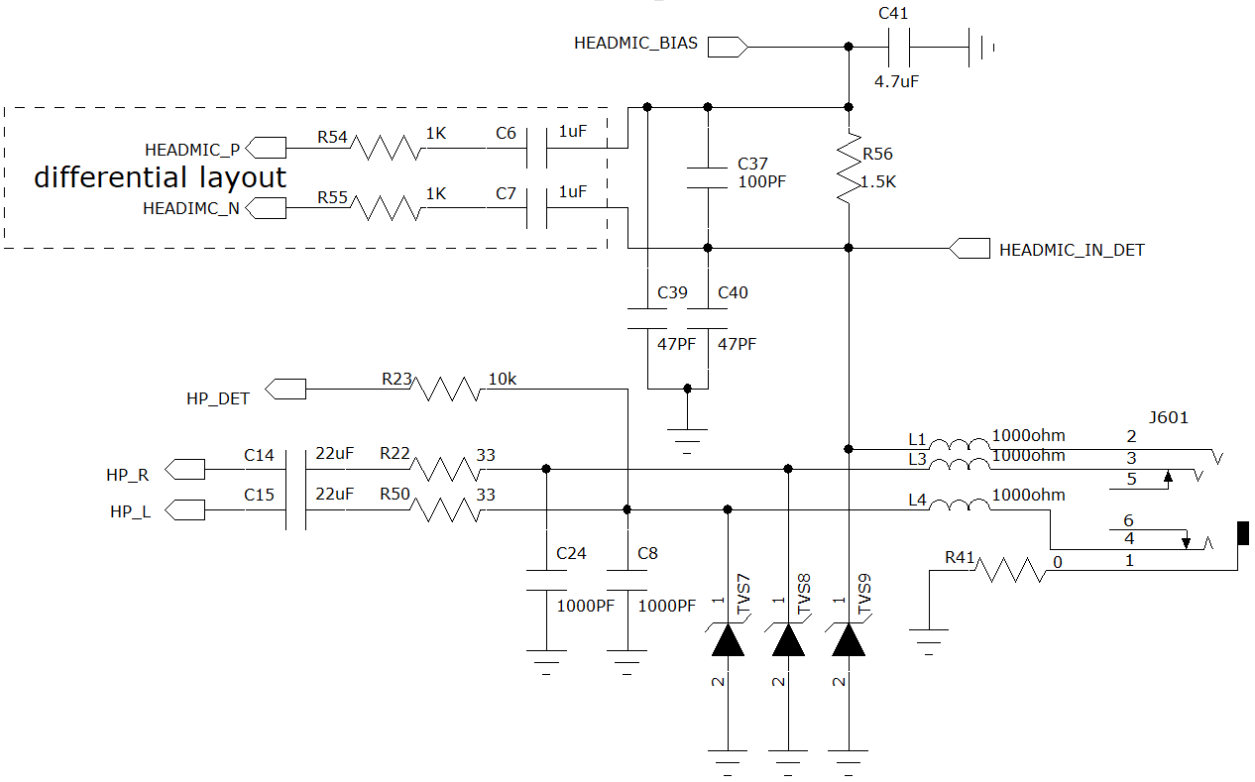
chart19:AINMicrophone channel interface circuit

3.12.3.Headphone jack reference circuit

HEADMIC_BIASProvide a reference voltage for the headset microphone;

HP_DETUsed to detect when headphones are plugged in;

HEADMIC_IN_DETUsed to detect headphone buttons;



3.12.4.Audio output interface reference circuit

SPKThe audio output interface can be directly connected to the driver.8Ohm horn.

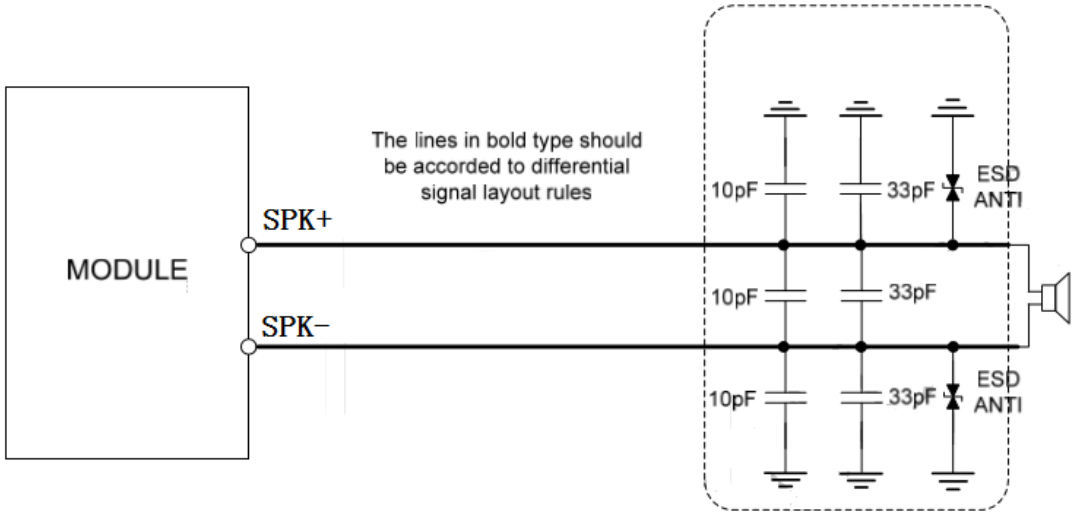


chart20Reference route

3.12.5.Audio electrical characteristics

sheet14Typical characteristic parameters of electret microphones

parameter	Minimum	typical	maximum	unit
Operating voltage	1.0	1.25	2.0	V
Operating current			500	μA
impedance		2.2		KΩ

sheet15Typical characteristics of audio output interface

parameter			Minimum	typical	maximum	unit
AOUT	Single-ended output	load		8		Ω
		Reference level	0		2.4	Vpp
	Differential output	load		8		Ω
		Reference level	0		4.8	Vpp

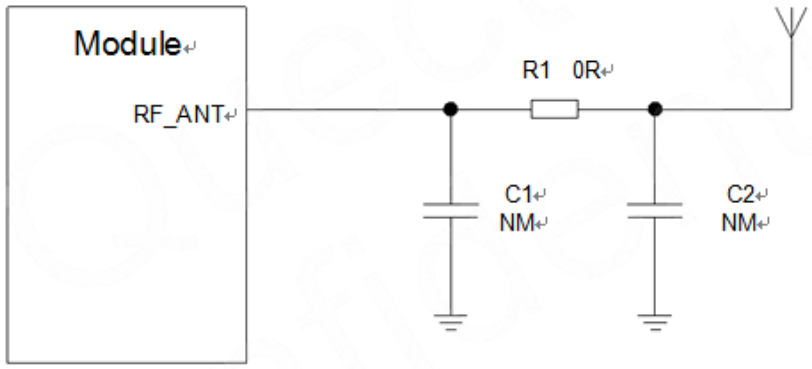
4.RF interface

The antenna interface pin definitions are as follows:

sheet16:RF_ANTPin Definitions

Pin name	pin number	effect
LTE_ANT	46	LTEAntenna Interface
WiFi_ANT	34	WiFiAntenna Interface

4.1.RF reference circuit



charttwenty oneRF reference circuit

Notice:

- Connect to moduleRFAntenna padsRFThe wiring must use microstrip lines or other types.RFThe impedance of the traces must be controlled within a certain range.50Around ohms.

4.2.RFOutput power

sheet17:RFConducted power

frequency band	maximum	Minimum
LTE FDD B1/B3/B5/B8	23dBm ±2dB	<-44dBm
LTE TDD B34/B38/B39/B40/B41	23dBm ±2dB	<-42dBm

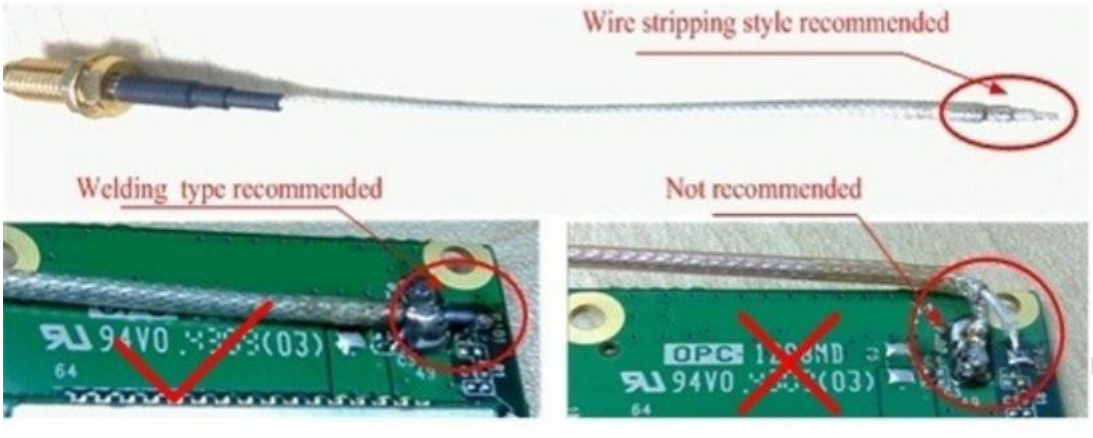
4.3.RFConductivity

sheet18:RFConductivity

frequency band	Receiver sensitivity
LTE FDD B1(10M)	< -96.5dBm
LTE FDD B3(10M)	< -97dBm
LTE FDD B5(10M)	< -97dBm
LTE FDD B8(10M)	< -96.5dBm
LTE TDD B34(10M)	< -96dBm
LTE TDD B38(10M)	< -96dBm
LTE TDD B39(10M)	< -97dBm
LTE TDD B40(10M)	< -96.5Bm
LTE TDD B41(10M)	< -96dBm

4.4.recommendRFWelding method

If the RF connector for the external antenna is connected to the module via soldering, please pay close attention to the wire stripping method and soldering method, especially ensuring that the ground wire is fully soldered. Please follow the correct soldering method shown in the diagram below to avoid increased line loss due to poor soldering.



charttwenty twoRecommendations for RF soldering methods

5.Electrical characteristics, reliability, radio frequency characteristics

5.1.Absolute maximum value

The table below shows the maximum withstand values of power supply voltage and current for the module's digital and analog pins.

sheet19Absolute maximum value

parameter	Minimum	maximum	unit
V_{BAT}	- 0.3	4.7	V
USB_VBUS	- 0.3	5.5	V
Peak current of power supply	0	2	A
Average power supply current (TDMA(one frame time)	0	0.7	A
Voltage at digital pin	- 0.3	VDDIO+0.3	V
Simulated pin voltage (GPADC)	- 0.3	6	V

5.2.Recommended working conditions

sheet20Recommended working conditions

parameter	Minimum	typical	maximum	unit
V_{BAT}	3.3	3.8	4.3	V

USB_VBUS	3.0	5.0	5.25	V
Peak current of power supply		1.8	2	A

5.3. Operating temperature

sheettwenty oneOperating temperature

temperature	lowest	typical	Highest	unit
Normal operating temperature	- 35	25	75	℃
Limited operating temperature	- 40~-35		75~85	℃
Storage temperature	- 45		90	℃

5.4.Power rating

sheettwenty twoModule power rating

parameter	describe	condition		Minimum	typical	maximum	unit
VBAT	Power supply voltage	The voltage must be within this range, including voltage dips. Falling, ripples and spikes		3.3	3.8	4.3	V
IVBAT	Average supply current	Leakage current	First time powering on		30		uA
			Power on and then power off (RTCjust (Regular work)		220		uA
		standby current	LTE-TDD Pagingcycle=128		1.78		mA
			LTE-FDD Pagingcycle=128		1.8		mA
		Flight mode	AT+CFUN=4		1.39		mA
		LTE-FDD B1	TX power = 23dBm CH300, BW=20M		470		mA
			TX power = -42dBm CH300, BW=20M		151		mA
		LTE-FDD B3	TX power = 23dBm CH1575, BW=20M		514		mA
			TX power = -42dBm CH1575, BW=20M		152		mA
		LTE-FDD B5	TX power = 23dBm CH2525, BW=20M		522		mA
			TX power = -42dBm CH2525, BW=20M		138		mA
		LTE-FDD B8	TX power = 23dBm CH3625, BW=20M		624		mA
			TX power = -42dBm CH3625, BW=20M		138		mA
		LTE-TDD B34	TX power = 23dBm CH36275, BW=20M		275		mA
			TX power = -42dBm CH36275, BW=20M		115.4		mA
		LTE-TDD B38	TX power = 23dBm CH38000, BW=20M		290		mA

			TX power = -42dBm CH38000, BW=20M		119.5		mA
		LTE-TDD B39	TX power = 23dBm CH38450, BW=20M		250.4		mA
			TX power = -42dBm CH38450, BW=20M		100		mA
		LTE-TDD B40	TX power = 23dBm CH39150, BW=20M		316		mA
			TX power = -42dBm CH39150, BW=20M		116		mA
		LTE-TDD B41	TX power = 23dBm CH40620, BW=20M		291		mA
			TX power = -42dBm CH40620, BW=20M		119		mA

5.5.Electrostatic protection

In modular applications, static electricity generated by human body static electricity, electrical friction between microelectronic components, etc., can discharge to the module through various pathways, potentially causing some damage.ESDProtection must be taken seriously, whether in production, assembly, testing, research and development, or especially in product design; preventative measures should be taken at all times.ESDProtective measures. For example, circuit design at interfaces or vulnerable points.ESDAdd pointsESDProtection, with protective measures during productionESDGloves, etc.

The following table highlights the key points of the module.PINfeetESDVoltage tolerance.

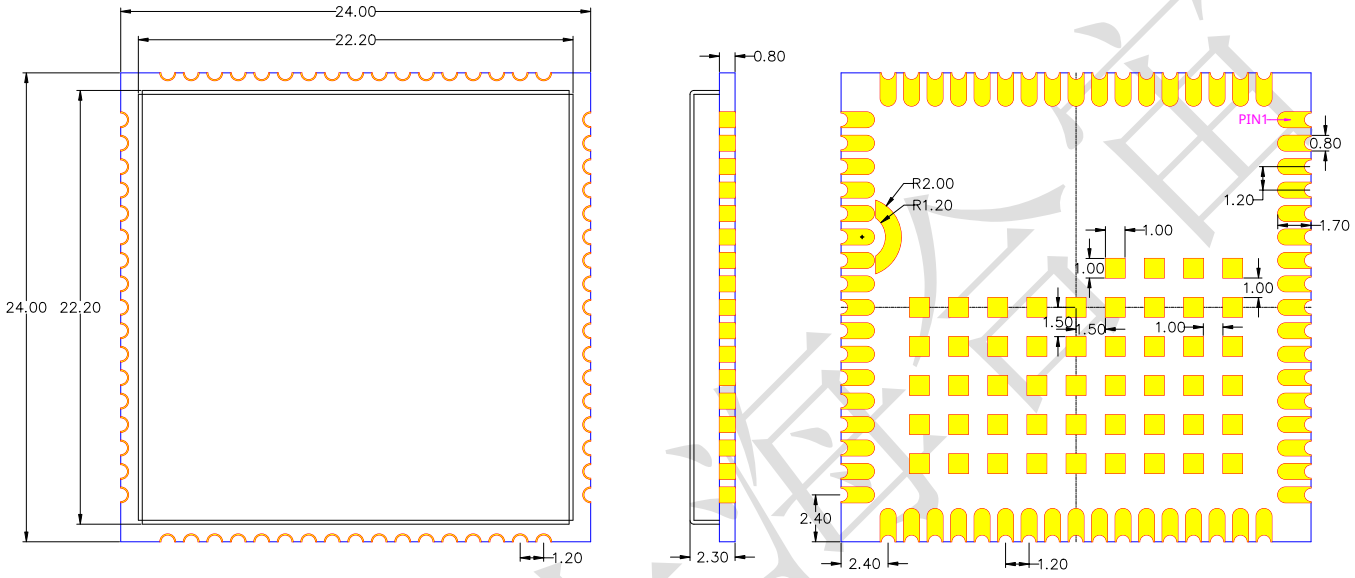
sheettwenty three:ESDPerformance parameters (temperature:25℃,humidity:45%)

pin name	Contact discharge	air discharge
VBAT, GND	±5KV	±10KV
ANT_MAIN	±5KV	±10KV
TXD, RXD	±2KV	±4KV
Others	±0.5KV	±1KV

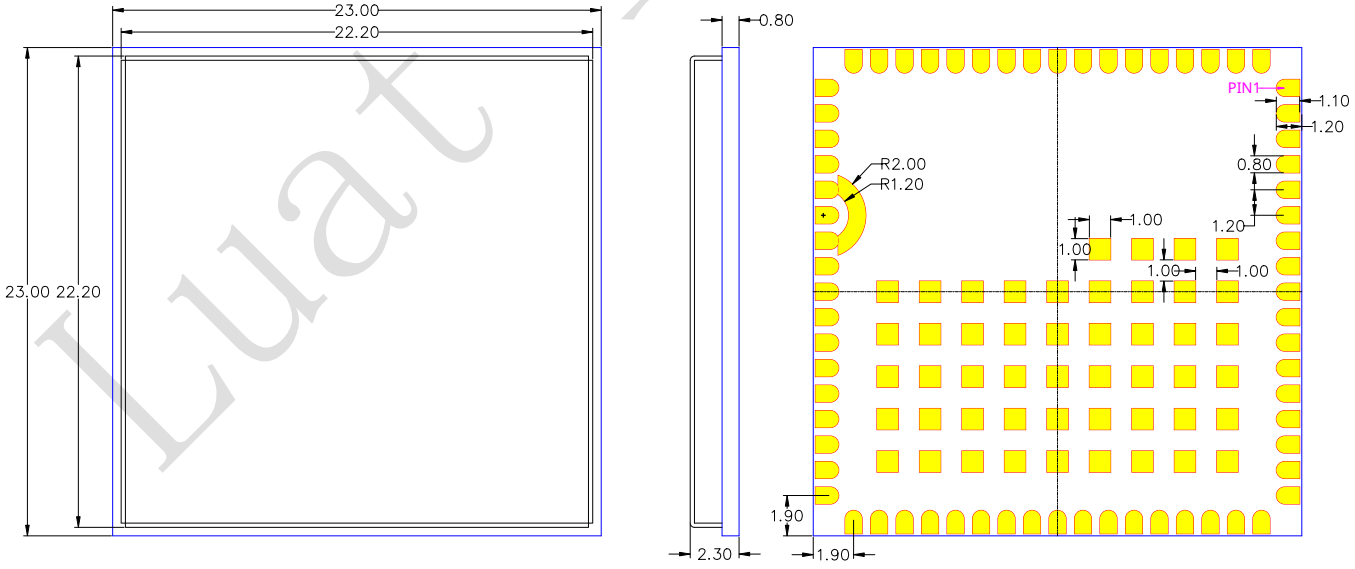
6.Mechanical dimensions

This section describes the module's mechanical dimensions and the recommended package size for customer designs using the module.

6.1.Module mechanical dimensions



charttwenty three:Air724UGDimensions (unit: millimeters)



charttwenty four:Air723UGDimensions (unit: millimeters)

6.2.recommendPCBPackaging

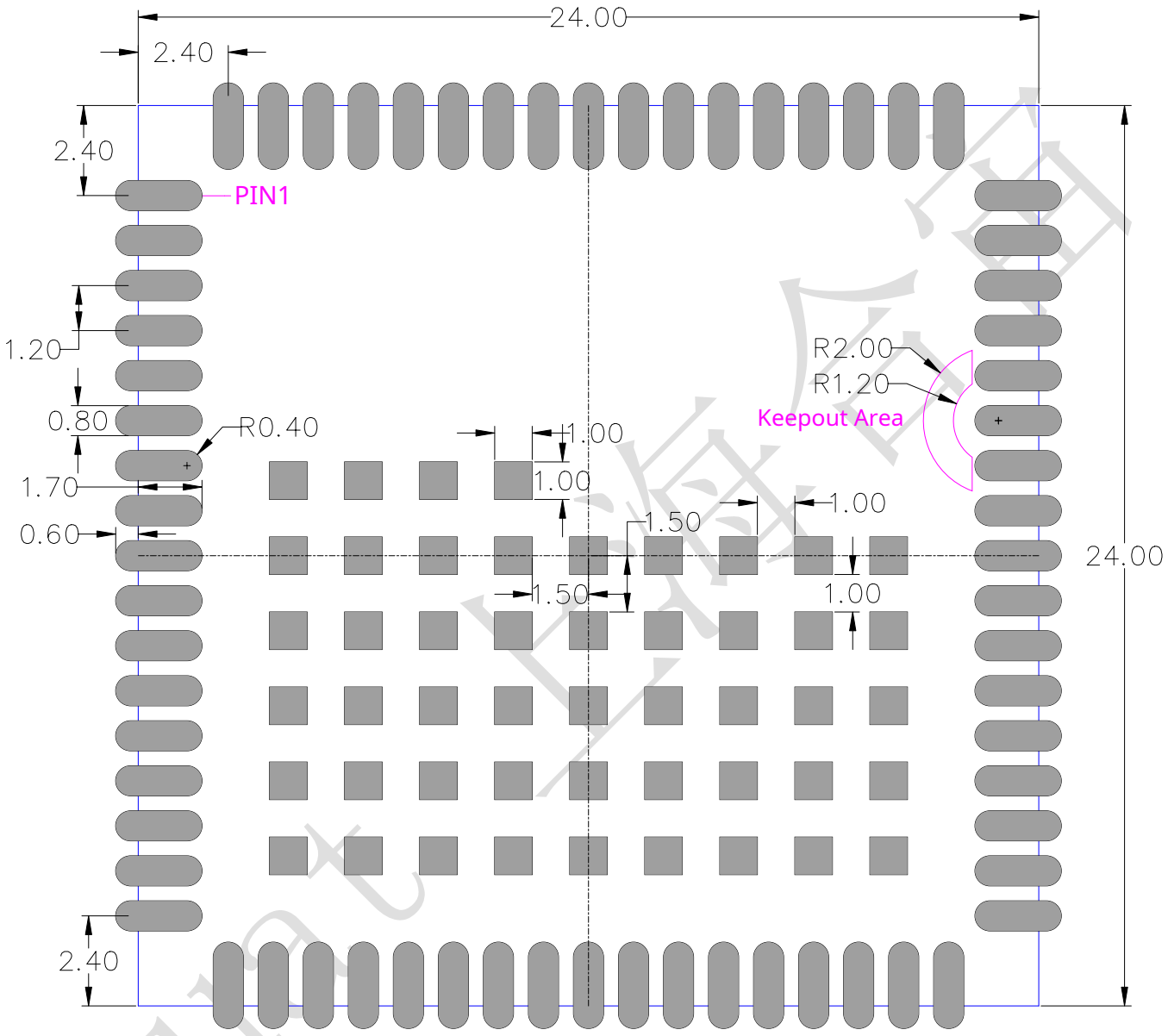


chart25Front view,Air724UG/PCBPackage size (unit: millimeters)

Notice:

1.**PCB**The recommended spacing between modules and other components on the board is at least [missing information].**3mm;**

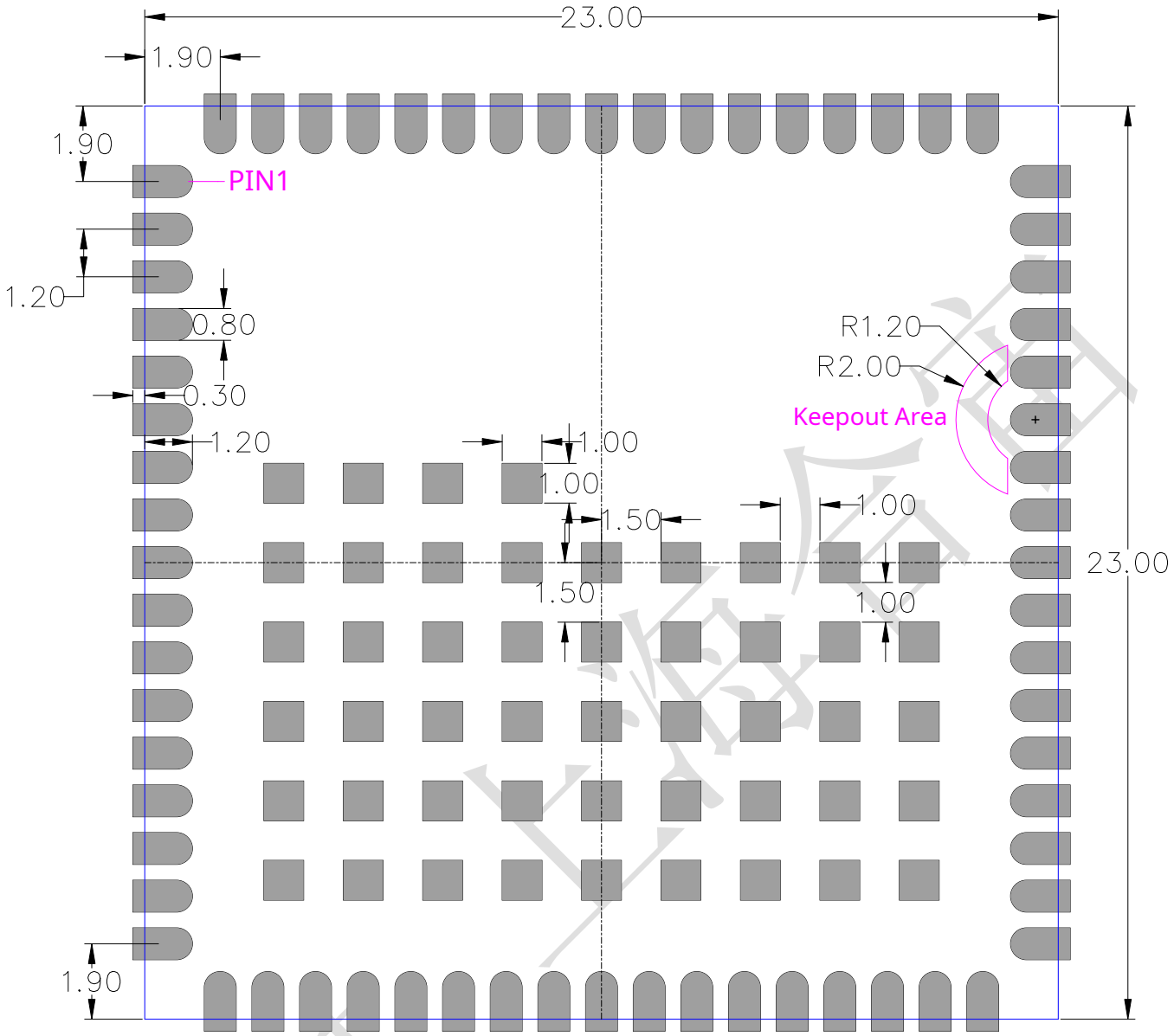


chart26Front view,Air723UGrecommendPCBPackage size (unit: millimeters)

Notice:

1.ifPCBIf there is enough space,Air723UGCan be shared directlyAir724UGofPCBEncapsulation has the advantage of allowing measurement of all peripheral components of the module.LGAPins facilitate software upgrades and debugging.

PCBIf space is limited, be sure to leave test points for the pins used for software upgrades and debugging.

7.Storage and production

7.1.storage

Air724UG_Air723UGShipped in vacuum-sealed bags. Module storage must adhere to the following conditions: Ambient temperature below [temperature missing].40

Temperature: Celsius, air humidity: less than90%Under certain circumstances, the module can be stored in a vacuum-sealed bag.12Months. Once the vacuum-sealed bag is opened, the module can be directly subjected to reflow soldering or other high-temperature processes if the following conditions are met:

- The module's ambient temperature is lower than30Temperature: Celsius, air humidity: less than60%The factory is72The patch application must be completed within one hour. Air humidity is less
- than [missing information].10%

If the module is under the following conditions, it needs to be baked before surface mount technology (SMT):

- When the ambient temperature istwenty threeCelsius (allowed to vary slightly)5When the temperature fluctuates by degrees Celsius, the humidity indicator card displays a humidity level greater than [value missing].10% When the vacuum-sealed bag is
- opened, the module's ambient temperature is lower than...30Temperature: Celsius, air humidity: less than60%However, the factory failed to...72Complete the patch application within 24 hours

- When the vacuum-sealed bag is opened, the humidity of the air stored in the module is greater than [a certain value].10%

If the module needs to be baked, please125Below Celsius (allowing for fluctuations)5Baking (fluctuations in Celsius)48Hour.

Note: The module packaging cannot withstand such high temperatures. Please remove the module packaging before baking. If only a short baking time is required, please refer to [the instructions].**IPC/JEDECJ-STD-033**specification.

7.2.Production Welding

Solder paste is printed onto a stencil using a stencil, allowing the solder paste to be printed through the stencil openings onto the surface.PCBOn the other hand, the pressure of the printing squeegee needs to be adjusted appropriately to ensure the quality of the printing paste in the module.Air724UG_Air723UGThe thickness of the stencil corresponding to the module pads should be:0.2mm.

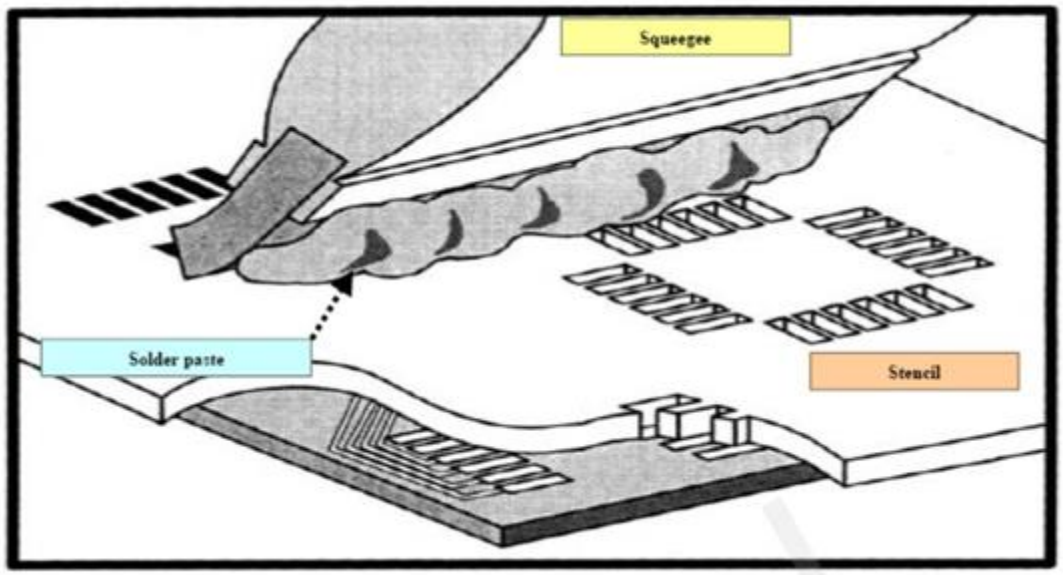


chart27: Inkjet printing

To avoid repeated heat damage to the module, it is recommended that customers...PCBThe modules are then mounted after the first side of the board has been reflow soldered. The recommended oven temperature profile is shown in the figure below.

Show:

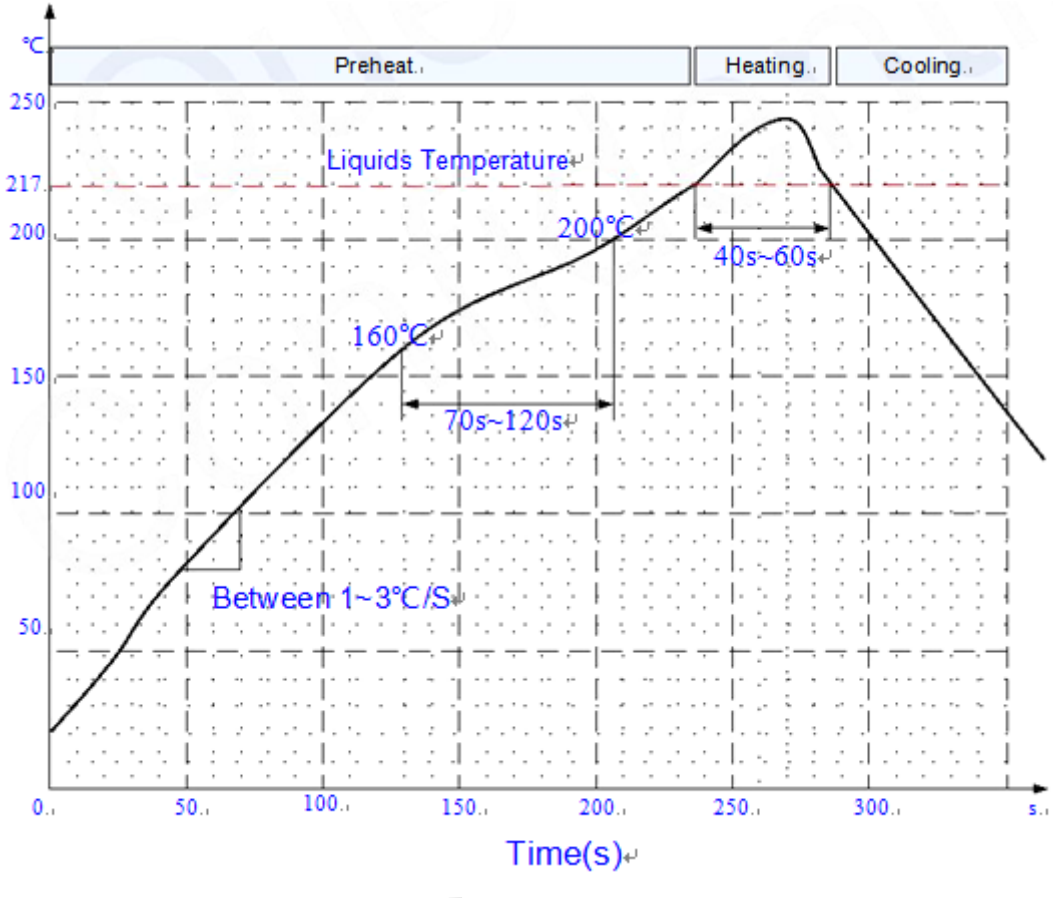


chart28Furnace temperature curve

Version number	Modification history	date	author
V0.1	New	2020-02-14	Loukanghua
V1.0	First version released	2020-02-26	Loukanghua
V1.1	Update pin diagram	2020-3-4	Loukanghua
V1.2	IncreaseSIM0andSIM1Interface usage instructions	2020-3-19	Loukanghua
V1.3	renewGPIOPower-on state	2020-03-31	Loukanghua
V1.4	IncreaseUART2Power onlogExplanation	2020-4-7	Loukanghua
V1.5	No.56Feet can only be used asLCD_RSTIt cannot be used asGPIOOr flight mode control	2020-4-16	Loukanghua
V1.6	Added power consumption data and corrected some bugs.	2020-5-7	Loukanghua
V1.7	IncreasedGPIO_13Instructions for use	2020-5-8	Loukanghua