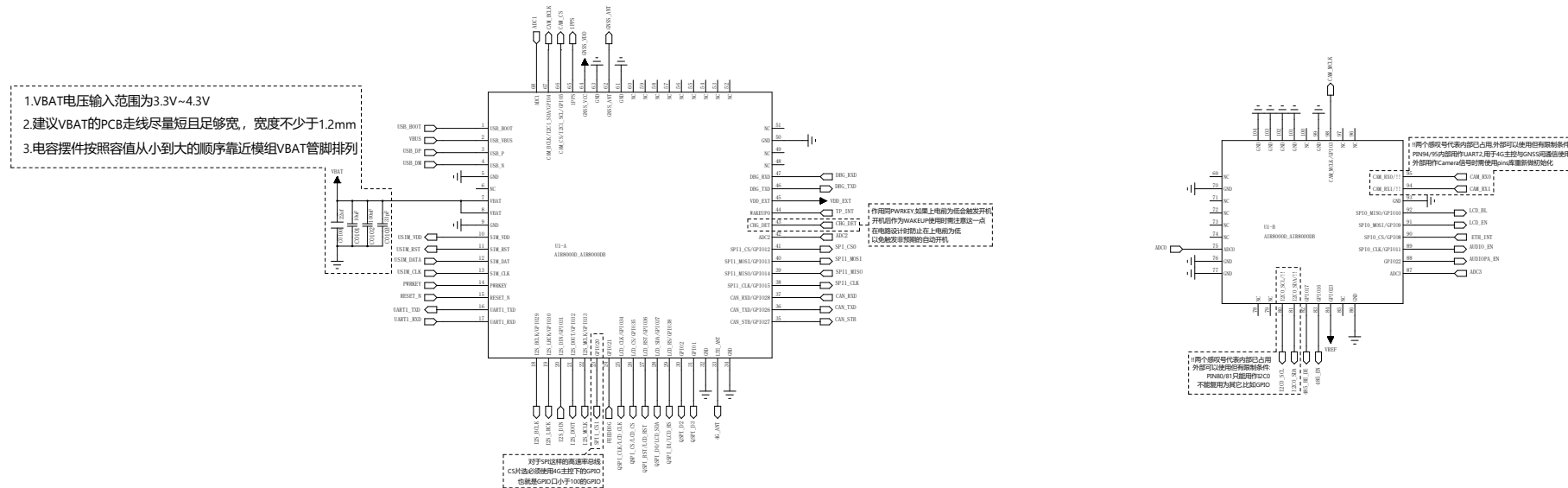


REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

Air8000D/Air8000DB参考设计



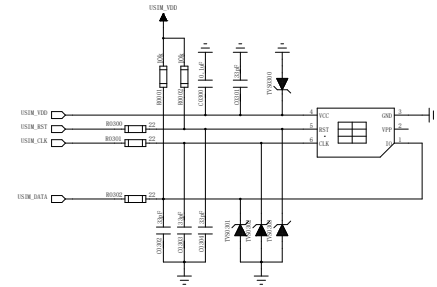
特别说明!

- 1,本参考设计适用于Air8000D/DB四个全功能型号(4G/GNSS);
- 2,相对于Air8000A/U/N/W/AB,D/DB最大的区别是不再支持WiFi/BLE,相应的,也就不再支持WiFi/BLE芯片下的GPIO(GPIO口大于100这些);
- 3,Air8000T也可以参考本原理图,少了GNSS,多了UART2和一些GPIO,具体请参考Air8000T封装,以及Air8000系列模组GPIO复用表;

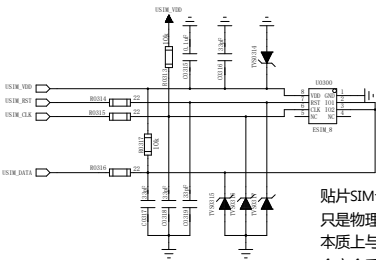
		IMPORT:		合亩LuoTOS	
		TITLE:		Air8000D/DB参考设计	
DESIGN:	ZhuFangjun	DATE:	2025-5-8		
DESIGN:	laolu	DATE:	2025-5-8		
DESIGN:	laolu	DATE:	2025-5-8		
RELEASE:	laolu	DATE:	2025-5-8		
		CODE:	SIZE:	DRAWING NO:	REV:
		laolu	A1	2025-11-11	4
		SCALE: G	SHEET: 1 OF 15		

REVISION RECORD			
REV	REV NO.	APPROVED:	DATE

插拔SIM接口参考电路



贴片SIM卡参考电路



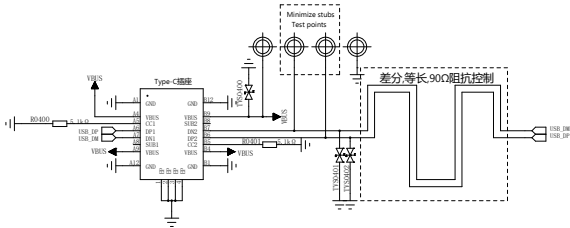
贴片SIM卡，也常称为ESIM
只是物理表现形式上与插拔卡不同
本质上与插拔卡没有任何区别
合宙全系4G模组都支持ESIM

- 1.SIM卡座与模块距离摆件不能太远，越近越好，尽量保证SIM卡信号线布线不超过20cm；
- 2.SIM卡信号线布线远离RF线和VBAT电源线；
- 3.为了防止可能存在的USIM_CLK信号对USIM_DATA信号的串扰，两者布线不要太靠近，在两条走线之间增加地屏蔽。
且对USIM_RST_N信号也需要地保护；
- 4.为了保证良好的ESD保护，建议加TVS管，并靠近SIM卡座摆放。选择的ESD器件寄生电容不大于50pF。
在模块和SIM卡之间也可以串联22欧姆的电阻用以抑制杂散EMI，增强ESD防护。
SIM卡的外围电路必须尽量靠近SIM卡座。

DESIGN:		DATE:		COMPANY:			
ZhuPingJun		2025-5-8		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2025-5-8		Air8000D/DB参考设计			
QUALITY CONTROL:		DATE:		CORE:	SIZE:	DRAWING NO.:	REV:
laolu		2025-5-8		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2025-5-8		SHEET: 3 of 15			

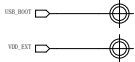
REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

USB

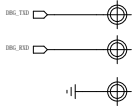


- 1.USB走线需要严格按照差分线控制，做到平行和等长；
- 2.USB走线的阻抗需要控制到差分90欧姆；
- 3.需要尽可能的减少USB走线的stubs，减少信号反射；USB信号的测试点最好直接放在走线上以减少stubs
- 4.在靠近USB连接器或者测试点的地方添加TVS保护管，由于USB的速率较高，需保证选用的TVS保护管的寄生电容小于1pF
- 5.VBUS作为USB插入检测，必须连接USB电源或者外接电源，否则USB无法被检测到，VBUS的检测电压要大于3.3V

测试点

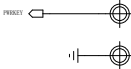


USB_BOOT 在开机过程中拉高可以进入USB下载模式
建议预留测试点



DBG_UART，也常被称作UART0，用作4G主控芯片底层日志的抓取
波特率开机时为115200bps，日志开始输出后为6Mbps，不可更改

DBG_UART不可作为通用UART，也不可复用为GPIO使用



开机键测试点，设计批量升级夹具时会用到



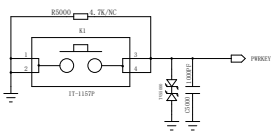
VBAT供电测试点，设计批量升级夹具时会用到

DESIGN:		DATE:		COMPANY:			
ZhuPingJun		2025-5-8		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2025-5-8		Air8000D/DB参考设计			
QUALITY CONTROL:		DATE:		COD:	SIZE:	DRAWING NO:	REV:
laolu		2025-5-8		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2025-5-8		SHEET: 4 of 15			

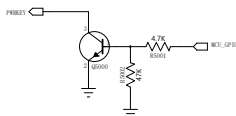
REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

开机PWRKEY/复位RESET/下载BOOT

按键开机

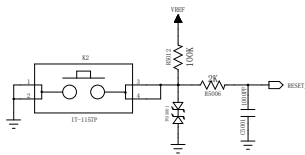


单片机控制开机

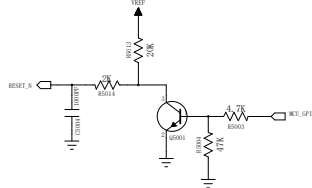


- 1.把PWRKEY管脚拉低0.5s后开机，开机成功后PWRKEY管脚可以释放。
- 2.按键附近需放置一个TVS管用作ESD防护。
- 3.PWRKEY 的电压域是VBAT，如果用单片机控制开机的话需要加一个三极管。
- 4.可以通过一颗不超过10KΩ的电阻直接将PWRKEY拉低，实现上电自动开机。

RESET_N 复位

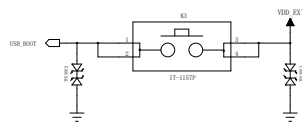


单片机控制重启



- 1.拉低 RESET_N 引脚 0.5S 可使模块复位。
- 2.RESET_N信号对干扰比较敏感，因此建议在模块接口板上的走线应尽可能的短，且需包地处理。
- 3.RESET_N 的电压域是模组芯片内部LDO_1.8V,实测电压在1.3V以上都为正常,如果用单片机控制重启的话需要加一个三极管。

USB下载使能

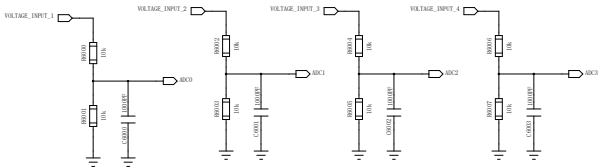


同时按下开机键和BOOT键,然后再上电,即可通过USB下载软件;

DESIGN:		DATE:		COMPANY:			
ZhuPingJun		2025-5-8		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2025-5-8		Air8000D/DB参考设计			
QUALITY CONTROL:		DATE:		CHECK:	SIZE:	DRAWING NO.:	REV.:
laolu		2025-5-8		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2025-5-8		SHEET: 5 of 15			

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

ADC参考电路

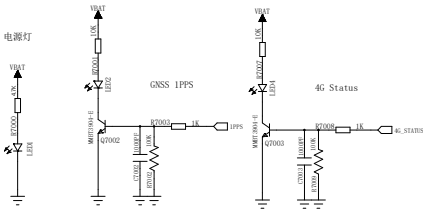


- 1.四路对外ADC,分辨率12bit;
- 2.分压电阻请选用1%精密电阻。阻值要高(10K级以上)，减少耗流及避免灌电。
- 3.模块的VBAT管脚内部也连接到了ADC，可以读取VBAT管脚的电压。
- 4.更多介绍 <https://docs.openluat.com/air780epm/product/air780exxpins/>

DRAWN: ZhnPingJun DATE: 2025-5-8		COMPANY: 合宙LuatOS					
		TITLE: Air8000D/DB参考设计					
CHECKED: laolu	DATE: 2025-5-8	CORE: laolu	SIZE: A1	DRAWING NO: 2025-11-11		REV: 4	
QUALITY CONTROL: laolu	DATE: 2025-5-8	SCALE: G				SHEET: 6 of 15	
RELEASED: laolu	DATE: 2025-5-8						

REVISION RECORD			
REV	REV NO.	APPROVED:	DATE

LED状态灯

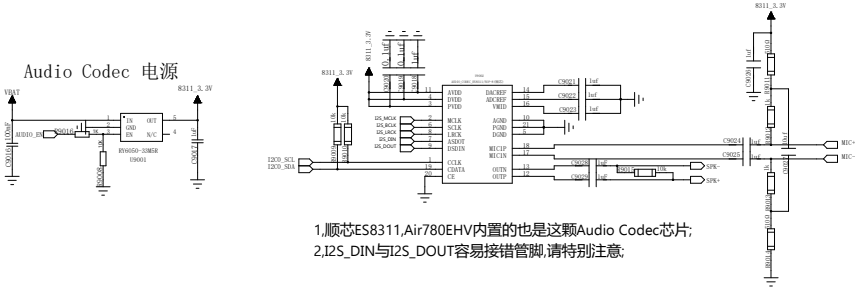


两种典型状态灯, 大家根据实际需要增加或减少.
低功耗工作模式下, LED的功耗往往是被忽略的耗电大户, 请特别注意!

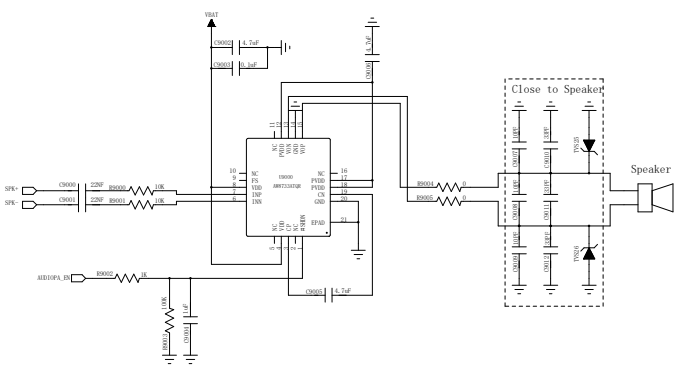
DRAWN: ZhuPingJun		DATE: 2025-5-8		COMPANY: 合宙LuatOS			
CHECKED: laolu		DATE: 2025-5-8		TITLE: Air8000D/DB参考设计			
QUALITY CONTROL: laolu		DATE: 2025-5-8		CODE: laolu	SIZE: A1	DRAWING NO: 2025-11-11	REV: 4
RELEASED: laolu		DATE: 2025-5-8		SCALE: G			SHEET: 7 of 15

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

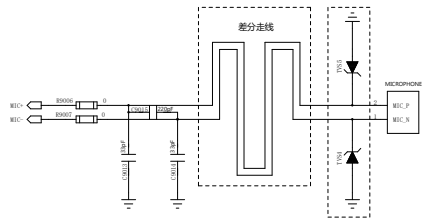
Audio Codec ES8311



音频输出(喇叭)参考电路



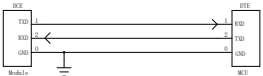
驻极体麦克风



DESIGN: ZhuPingJun		DATE: 2025-5-8		COMPANY: 合宙LuatOS			
CHECKED: laolu		DATE: 2025-5-8		TITLE: Air8000D/DB参考设计			
QUALITY CONTROL: laolu		DATE: 2025-5-8		CHECK: laolu	SIZE: A1	DRAWING NO: 2025-11-11	REV: 4
RELEASED: laolu		DATE: 2025-5-8		SCALE: G		SHEET: 8 of 15	

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

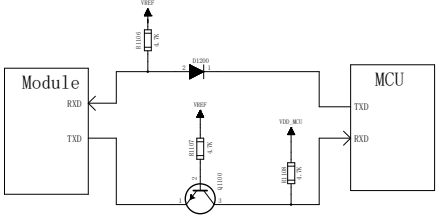
三线制串口参考设计



请注意串口的电平匹配

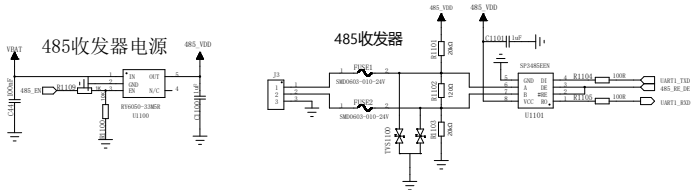
- 1,DBG_UART(UART0)和DBG10_UART(UART10)仅可用于调试,不可用作通用UART;
- 2,UART1/2/3/11/12均可作为通用UART;
- 3,详细信息 <https://docs.openluat.com/air8000/product/air8000pins/>

串口电压转换参考设计



Vref是模块输出的I/O电平电压，VDD_MCU是客户端的I/O电平电压。
D1200 选低导通压降的肖特基二极管。
注意！使用Vref，不可使用VDD_EXT！
VDD_EXT休眠状态下的间歇性输出会导致模组唤醒而频繁退出低功耗模式；
这个转换电路最多支持460800bps的波特率
超过460800bps的波特率需要外加电平转换芯片来实现电压转换。

UART TO 485



LuatOS已支持Modbus协议
详见扩展库exmodbus中的介绍

				COMPANY: 合宙LuatOS							
				TITLE: Air8000D/DB参考设计							
DRAWN: ZhuPingJun		DATE: 2025-5-8									
CHECKED: laolu		DATE: 2025-5-8		CORE: laolu		SIZE: A1		DRAWING NO: 2025-11-11		REV: 4	
QUALITY CONTROL: laolu		DATE: 2025-5-8									
RELEASED: laolu		DATE: 2025-5-8		SCALE: G				SHEET: 9 of 15			

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

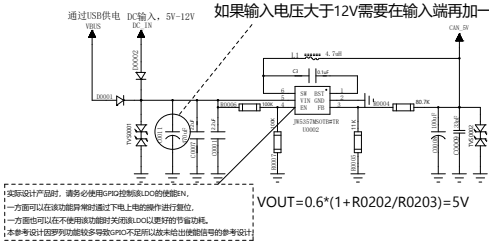
CAN 收发器 5V 电源

下图降压DCDC方案，与系统供电一样使用的是杰华特JW5357

CAN收发器供电电压范围4.5V-5.5V，典型值5V

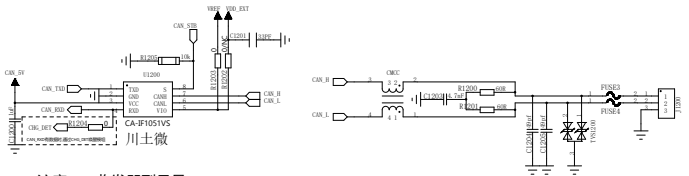
注意C47的选型要根据输入电压来选择耐压值

如果输入电压大于12V需要在输入端再加一颗470uf的电解电容



DC_IN或VBUS输入范围在4.5V-5.5V之间时，也可以使用DC_IN或VBUS为CAN收发器供电

CAN接口



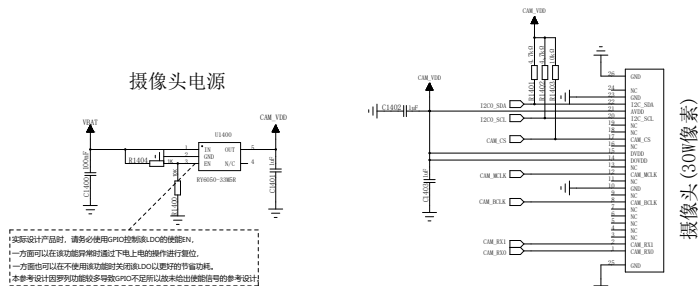
注意CAN收发器型号是CA-IF1051VS
不是CA-IF1051S,切勿弄混

- 1,CMCC,共模扼流圈,推荐型号共模扼流线圈ACT45B-101-2P;
- 2,TVSS1200,推荐型号PESD1CAN;

				COMPANY: 合宙LuatOS							
				TITLE: Air8000D/DB参考设计							
DRAWN: ZhuPingJun		DATE: 2025-5-8									
CHECKED: laolu		DATE: 2025-5-8		CODE: laolu		SIZE: A1		DRAWING NO: 2025-11-11		REV: 4	
QUALITY CONTROL: laolu		DATE: 2025-5-8									
RELEASED: laolu		DATE: 2025-5-8		SCALE: G				SHEET: 10/ 15			

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

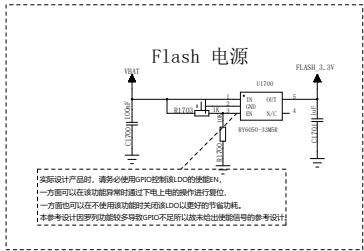
Camera 30W像素



- 1.本参考设计适用于合宙配件AirCAMERA_1040/AirCAMERA_1050,官方淘宝店 Luat.taobao.com 有售;
- 2.CAM_RX0/CAM_RX1在使用时需要使用pins库重新初始化,详见管脚复用表说明;
- 3,AirCAMERA_1040的驱动IC为GC032A,AirCAMERA_1050的驱动IC是GC0310,调试时请注意;

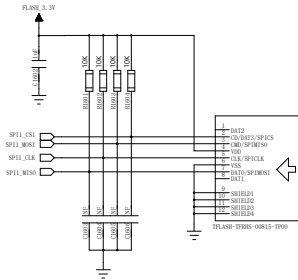
		COMPANY: 合宙LuatOS			
		TITLE: Air8000D/DB参考设计			
DESIGN: ZhuPingJun	DATE: 2025-5-8	CODE:	SIZE:	DESIGNING NO:	REV:
CATEGORY: laolu	DATE: 2025-5-8	laolu	A1	2025-11-11	4
QUALITY CONTROL:	DATE: 2025-5-8				
RELEASED: laolu	DATE: 2025-5-8				
		SCALE: 1:G	SHEET: 126		15

REVISION RECORD			
REV	REV NO.	APPROVED:	DATE



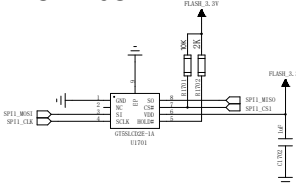
SPI T-Flash/SPI Nor Flash/SPI NAND Flash 三选一

SPI T-Flash Card



- 1.外设接口需做好ESD防护;
- 2.SPI0_CLK建议单独立体包地, 其他信号线整组一起同层包地;
- 3.TF_3.3V电源走线宽度0.25mm以上。

SPI Nor Flash

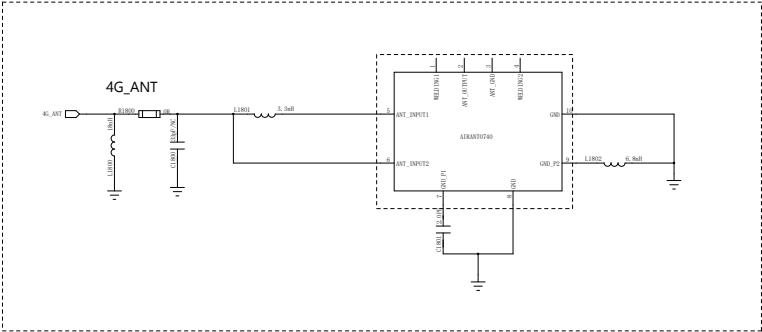


- 1.本设计使用的是高通矢量字库GT5SLCD2E-1A作为SPI Nor Flash的参考, 高通矢量字库GT5SLCD2E-1A本质上是SPI Nor Flash内置了矢量字库;
- 2.SPI NAND Flash在硬件电路上与SPI Nor Flash一致;
- 3.一般的应用组合是一路SPI,不同的两个片选CS,实现"以太网+TF卡"或"以太网+Nor或NAND"的组合;

				COMPANY: 合宙LuatOS							
				TITLE: Air8000D/DB参考设计							
DRAWN: ZhuPingJun		DATE: 2025-5-8									
CHECKED: laolu		DATE: 2025-5-8		CODE: laolu		SIZE: A1		DRAWING NO: 2025-11-11		REV: 4	
QUALITY CONTROL: laolu		DATE: 2025-5-8									
RELEASED: laolu		DATE: 2025-5-8		SCALE: G				SHEET: 14# 15			

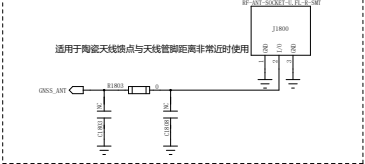
REVISION RECORD			
LINE	REV NO.	APP/REVISED:	DATE

4G天线

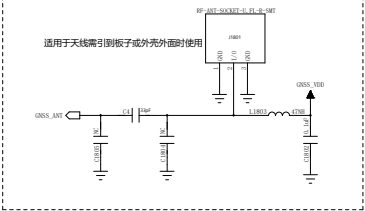


- 1,本参考设计使用的是合宙贴片式PCB天线,AirANT4073,尺寸40*7*3mm;
- 2,合宙还有多款尺寸不同、封装各异的贴片式PCB天线可供选择;
- 3,匹配电路已调试好,PCB封装(含匹配电路)已做成标准封装 欢迎咨询;

GNSS无源天线



GNSS有源天线



COMPANY:		合宙LuatOS	
TITLE:		Air8000D/DB参考设计	
CODE:	SIZE:	DRAWING NO:	REV:
laolu	A1	2025-11-11	4
SCALE: G		SHEET: 15# 15	