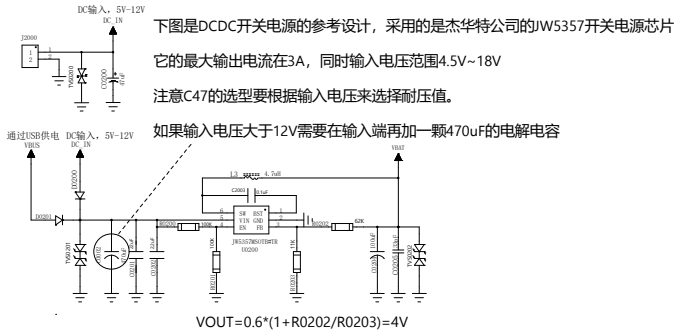


REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

DC-DC 方案



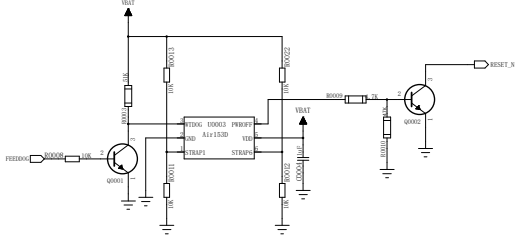
Air153D WatchDog

下图是使用合宙看门狗芯片Air153D设计的看门狗电路

设计原理是：喂狗不正常时，拉高PIN4:ON/OFF管脚500ms，
通过NPN三极管反向，拉低主控RESET信号，重启主控；

注意！使用此看门狗电路时开机键PWRKEY需接地，以使模组上电自动开机

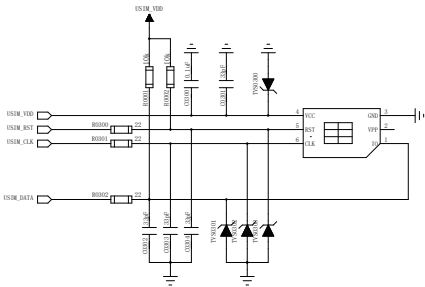
LuatOS扩展库：exair153x_wdt.lua



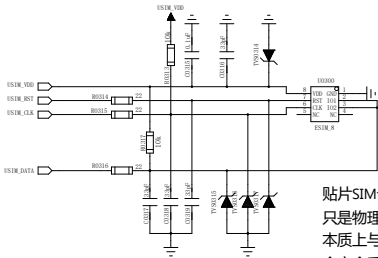
				COMPANY: 合宙LuatOS			
				TITLE: Air8000A/U/N/AB/W参考设计			
DRAWN: ZhuPingJun		DATE: 2026-3-6					
CHECKED: laolu		DATE: 2026-3-6		CORE: laolu		SIZE: A1	
QUALITY CONTROL: laolu		DATE: 2026-3-6		DRAWING NO: 2025-11-11		REV: 4	
RELEASED: laolu		DATE: 2026-3-6		SCALE: G		SHEET: 2 of 15	

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，也常被称为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；

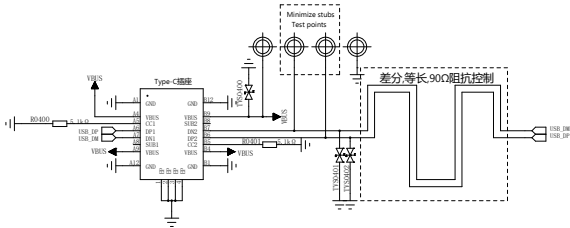
3.为了防止可能存在的USIM_CLK信号对USIM_DATA信号的串扰，两者布线不要太靠近，在两条走线之间增加地屏蔽。
且对USIM_RST_N信号也需要地保护；

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		2026-3-6		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2026-3-6		Air8000A/U/N/AB/W参考设计			
QUALITY CONTROL:		DATE:		CORE:	SIZE:	DRAWING NO.:	REV:
laolu		2026-3-6		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2026-3-6		SHEET: 3 of 15			

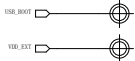
REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

USB

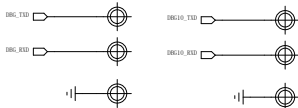


- 1.USB走线需要严格按照差分线控制，做到平行和等长；
- 2.USB走线的阻抗需要控制到差分90欧姆；
- 3.需要尽可能的减少USB走线的stubs，减少信号反射；USB信号的测试点最好直接放在走线上以减少stub
- 4.在靠近USB连接器或者测试点的地方添加TVS保护管，由于USB的速率较高，需保证选用的TVS保护管的寄生电容小于1pF
- 5.VBUS作为USB插入检测，必须连接USB电源或者外接电源，否则USB无法被检测到，VBUS的检测电压要大于3.3V

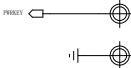
测试点



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
DBG10_UART，也常被称作UART10，用作WiFi芯片底层日志的抓取
波特率固定2Mbps，不可更改
DBG_UART和DBG10_UART都不可作为通用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



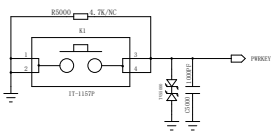
VBAT供电测试点，设计批量升级夹具时会用到

DRAWN:		DATE:		COMPANY:			
ZhuPingJun		2026-3-6		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2026-3-6		Air8000A/U/N/AB/W参考设计			
QUALITY CONTROL:		DATE:		CHECK:	SIZE:	DRAWING NO.:	REV:
laolu		2026-3-6		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2026-3-6		SHEET: 4 of 15			

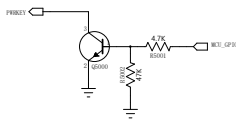
REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

开机PWRKEY/复位RESET/下载BOOT

按键开机

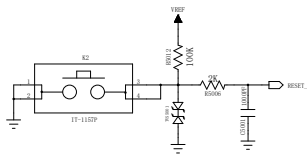


单片机控制开机

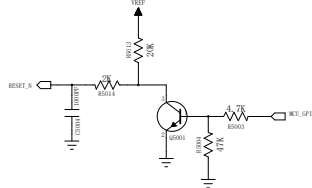


- 1.把PWRKEY管脚拉低0.5s后开机，开机成功后PWRKEY管脚可以释放。
- 2.按键附近需放置一个TVS管用作ESD防护。
- 3.PWRKEY 的电压域是VBAT，如果用单片机控制开机的话需要加一个三极管。
- 4.可以通过一颗不超过10KΩ的电阻直接将PWRKEY拉低，实现上电自动开机。

RESET_N 复位

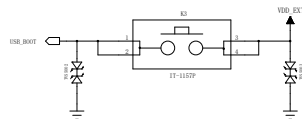


单片机控制重启



- 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

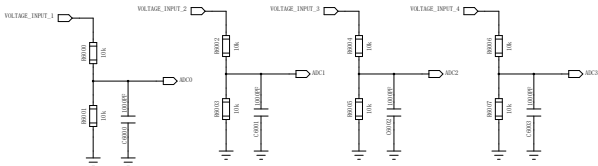


同时按下开机键和BOOT键,然后再上电,即可通过USB下载软件;

DRAWN: ZhuPingJun		DATE: 2026-3-6		COMPANY: 合宙LuatOS			
				TITLE: Air8000A/U/N/AB/W参考设计			
CHECKED: laolu	DATE: 2026-3-6		CORE: laolu	SIZE: A1	DRAWING NO: 2025-11-11		REV: 4
QUALITY CONTROL: laolu	DATE: 2026-3-6		SCALE: G			SHEET: 5 of 15	
RELEASED: laolu	DATE: 2026-3-6						

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

ADC参考电路

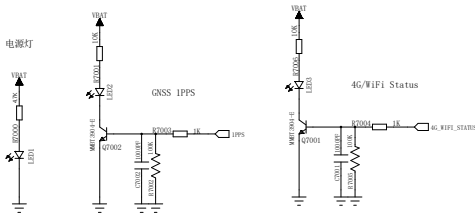


- 1.四路对外ADC,分辨率12bit;
- 2.分压电阻请选用1%精密电阻。阻值要高(10K级以上)，减少耗流及避免灌电。
- 3.模块的VBAT管脚内部也连接到了ADC，可以读取VBAT管脚的电压。
- 4.更多介绍 <https://docs.openluat.com/air780epm/product/air780exxpins/>

DESIGN: ZhnPingJun DATE: 2025-3-6				COMPANY: 合宙Luat0S			
				TITLE: Air8000A/U/N/AB/W参考设计			
CHECKED: laolu		DATE: 2025-3-6		CORE: laolu	SIZE: A1	DRAWING NO: 2025-11-11	REV: 4
QUALITY CONTROL: laolu		DATE: 2025-3-6		SCALE: G			SHEET: 6 of 15
RELEASED: laolu		DATE: 2025-3-6					

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

LED状态灯

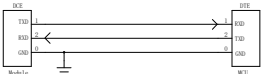


两种典型状态灯, 大家根据实际需要增加或减少.
低功耗工作模式下, LED的功耗往往是被忽略的耗电大户, 请特别注意!

DRAWN: ZhuPingJun		DATE: 2026-3-6		COMPANY: 合宙LuatOS			
CHECKED: laolu		DATE: 2026-3-6		TITLE: Air8000A/U/N/AB/W参考设计			
QUALITY CONTROL: laolu		DATE: 2026-3-6		CODE: laolu	SIZE: A1	DRAWING NO.: 2025-11-11	REV.: 4
RELEASED: laolu		DATE: 2026-3-6		SCALE: G			SHEET: 7 of 15

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

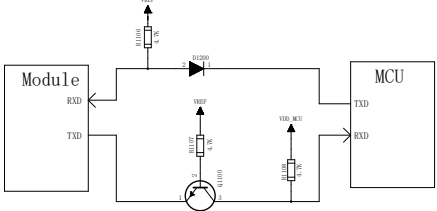
三线制串口参考设计



请注意串口的电平匹配

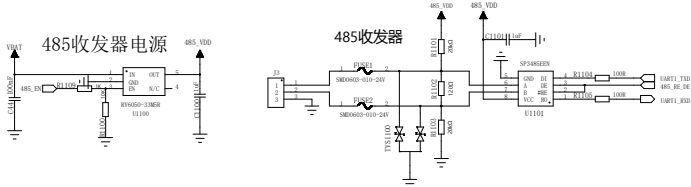
- 1,DBG_UART(UART0)和DBG10_UART(UART10)仅可用于调试,不可用作通用UART;
2,UART1/2/3/11/12均可作为通用UART;
3,详细信息 <https://docs.openluat.com/air8000/product/air8000pins/>

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

DRAWN:		DATE:		COMPANY:			
ZhuPingJun		2026-3-6		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2026-3-6		Air8000A/U/N/AB/W参考设计			
QUALITY CONTROL:		DATE:		CORE:	SIZE:	DRAWING NO.:	REV.:
laolu		2026-3-6		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2026-3-6		SHEET: 9 of 15			

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

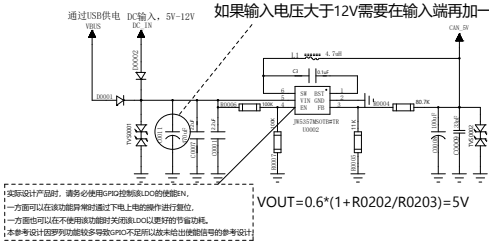
CAN 收发器 5V 电源

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

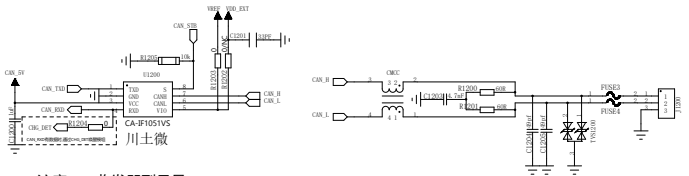
注意C47的选型要根据输入电压来选择耐压值

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



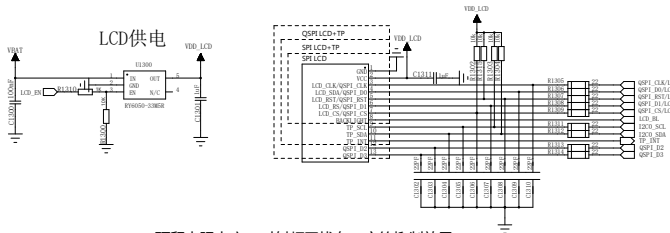
注意CAN收发器型号是CA-IF1051VS
不是CA-IF1051S,切勿弄混

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

COMPANY: 合宙LuatOS			
TITLE: Air8000A/U/N/AB/W参考设计			
DESIGN: ZhuPingJun	DATE: 2026-3-6	DRAWING NO:	
CHECKED: laolu	DATE: 2026-3-6	REV:	
QUALITY CONTROL: laolu	DATE: 2026-3-6	2025-11-11	
RELEASED: laolu	DATE: 2026-3-6	4	

REVISION RECORD			
REV	REV NO.	APPROVED:	DATE:

SPI LCD/SPI LCD+TP/QSPI LCD+TP

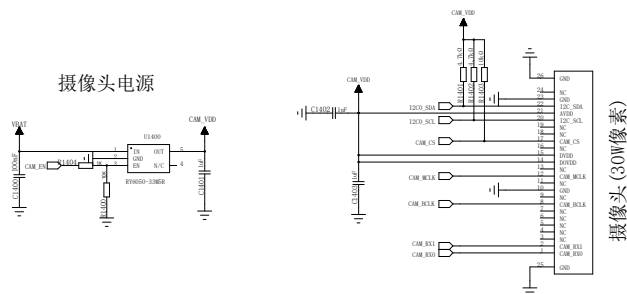


- 1.预留电阻电容，对射频干扰有一定的抑制效果；
- 2.LCD_BL为控制LCD背光的控制管脚，低电平灭，高电平亮；
- 3.本参考设计使用的是合宙配件AirLCD_10XX配件系列 驱动芯片ST7796;

DESIGN:		DATE:		COMPANY: 合宙LuatOS			
DRAWN:		2026-3-6		TITLE: Air8000A/U/N/AB/W参考设计			
CHECKED:	laolu	DATE:	2026-3-6	CORE:	SIZE:	DRAWING NO:	REV:
QUALITY CONTROL:	laolu	DATE:	2026-3-6	laolu	A1	2025-11-11	4
RELEASED:	laolu	DATE:	2026-3-6	SCALE: G			SHEET: 1 of 15

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

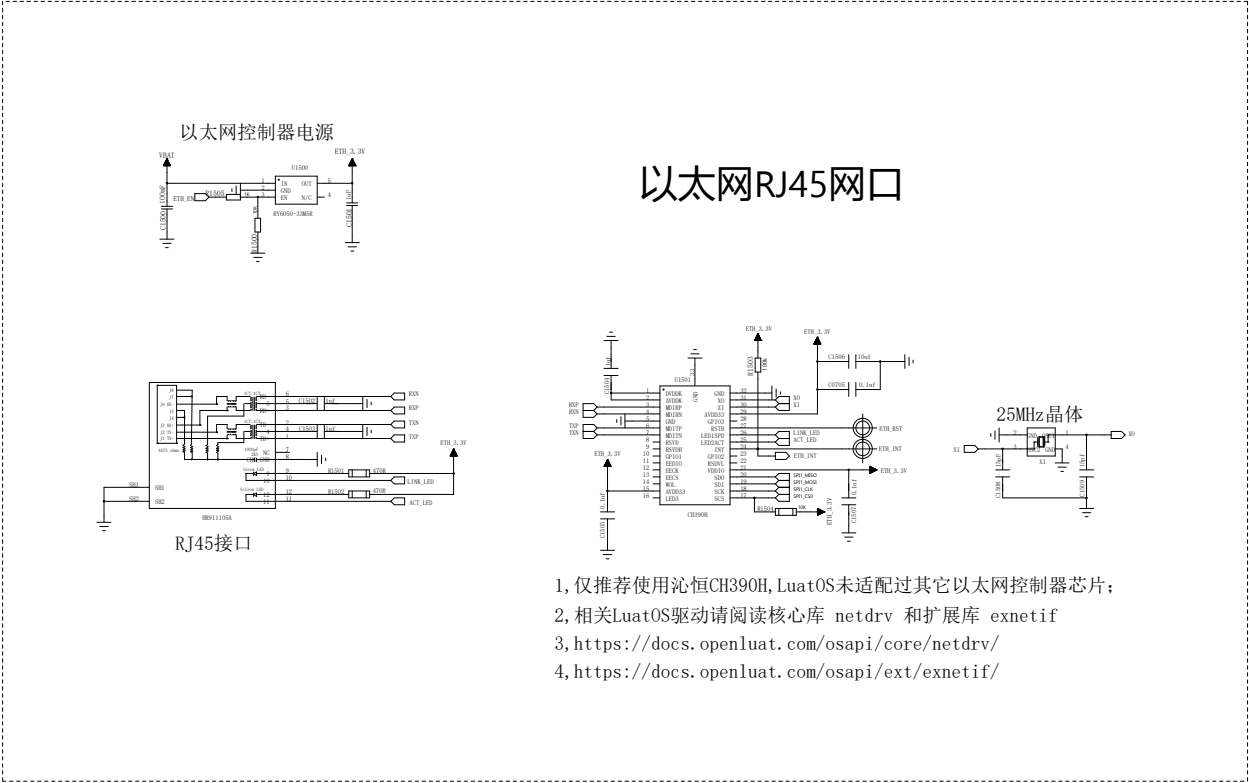
Camera 30W像素



- 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;

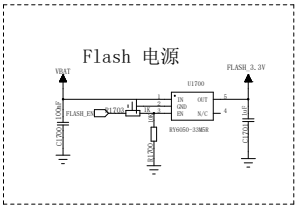
		COMPANY:		合宙LuatOS	
		TITLE:		Air8000A/U/N/AB/W参考设计	
DESIGN:	ZhuFangjun	DATE:	2026-3-6		
DESIGN:	laolu	DATE:	2026-3-6		
QUALITY CONTROL:	laolu	DATE:	2026-3-6		
RELEASE:	laolu	DATE:	2026-3-6		
		CODE:		SIZE:	DRAWING NO:
		laolu		A1	2025-11-11
		SCALE: G		SHEET: 129 15	
				REV: 4	

REVISION RECORD			
LINE	REV NO.	APPROVED:	DATE:



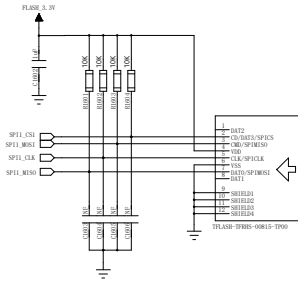
DESIGN:		DATE:		COMPANY:			
ZhuPingJun		2026-3-6		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2026-3-6		Air8000A/U/N/AB/W参考设计			
QUALITY CONTROL:		DATE:		CORE:	SIZE:	DRAWING NO.:	REV:
laolu		2026-3-6		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2026-3-6		SHEET: 13 15			

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE



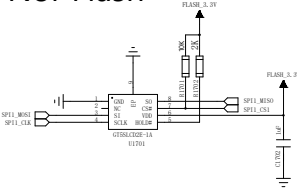
SPI T-Flash/SPI Nor Flash/SPI NAND Flash 三选一

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

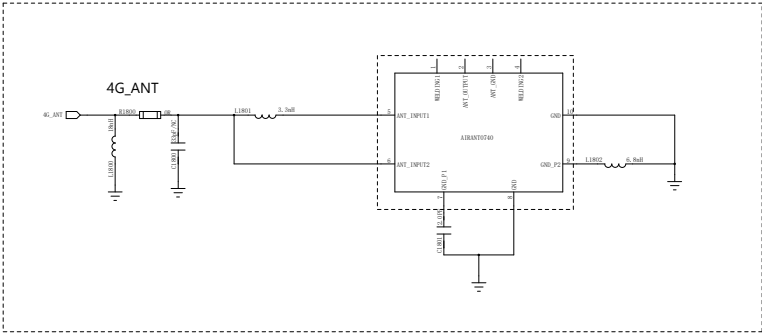


- 1.本设计使用的是高通矢量字库GT5SLCD2E-1A作为SPI Nor Flash的参考, 高通矢量字库GT5SLCD2E-1A本质上是SPI Nor Flash内置了矢量字库;
- 2.SPI NAND Flash在硬件电路上与SPI Nor Flash一致;
- 3, 一般的应用组合是一路SPI,不同的两个片选CS,实现"以太网+TF卡"或"以太网+Nor或NAND"的组合;

DRAWN: ZhuPingJun		DATE: 2026-3-6		COMPANY: 合宙LuatOS			
CHECKED: laolu		DATE: 2026-3-6		TITLE: Air8000A/U/N/AB/W参考设计			
QUALITY CONTROL: laolu		DATE: 2026-3-6		CHECK: laolu	SIZE: A1	DRAWING NO: 2025-11-11	REV: 4
RELEASED: laolu		DATE: 2026-3-6		SCALE: G SHEET: 14# 15			

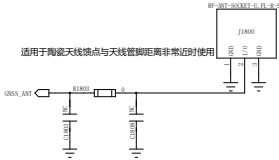
REVISION RECORD			
LV	REV NO.	APP/REVISED:	DATE

4G天线

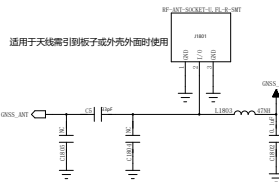


- 1,本参考设计使用的是合宙贴片式PCB天线,AirANT4073,尺寸40*7*3mm;
- 2,合宙还有多款尺寸不同、封装各异的贴片式PCB天线可供选择;
- 3,匹配电路已调试好,PCB封装(含匹配电路)已做成标准封装,欢迎咨询;

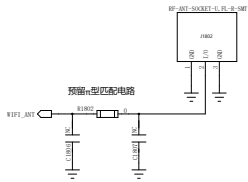
GNSS无源天线



GNSS有源天线



WiFi/BLE 天线



COMPANY: 合宙Luat0S			
TITLE: Air8000A/U/N/AB/W参考设计			
DESIGN: ZhuPingJun	DATE: 2025-3-6	DRAWING NO: 2025-11-11	
CHECKED: laolu	DATE: 2025-3-6	SCALE: G	REV: 4
QUALITY CONTROL: laolu	DATE: 2025-3-6	SHEET: 15 15	
RELEASED: laolu	DATE: 2025-3-6		