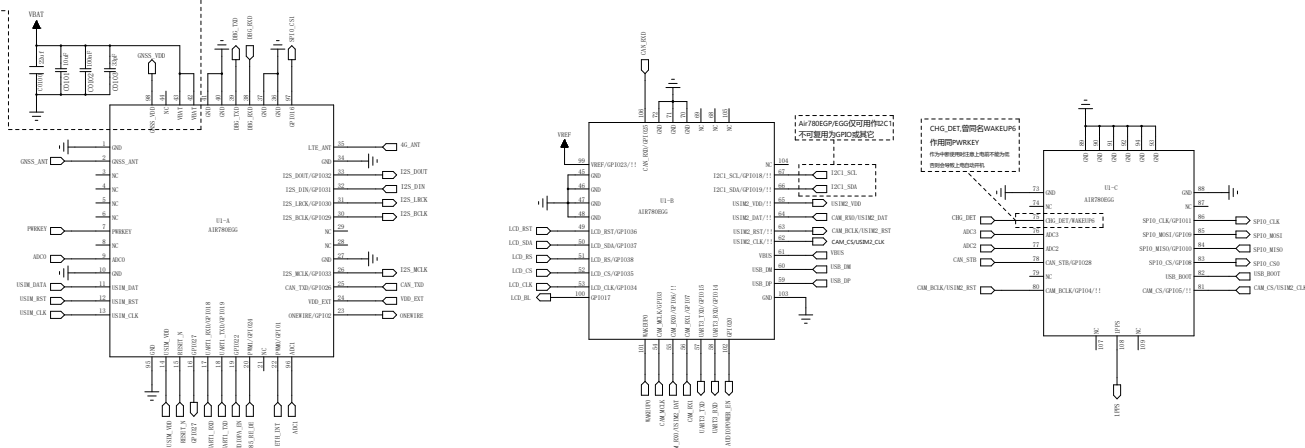


REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

Air780EGG参考设计

- 1.VBAT电压输入范围为3.3V~4.3V
- 2.建议VBAT的PCB走线尽量短且足够宽，宽度不少于1.2mm
- 3.电容摆件按照容值从小到大的顺序靠近模组VBAT管脚排列



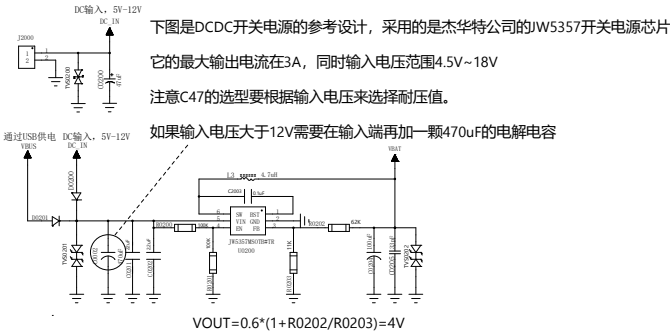
特别提醒!

- 1,仅Air780EGG和Air780EGH支持Audio功能;
- 2,Air780EGG相对Air780EGH新增内置了G-Sensor,可协助抑制静态飘逸/低功耗控制;
- 3,Air780EGP虽然也内置了G-Sensor,但是不支持Audio功能,不能驱动Audio Codec;
- 4,如果选择Air780EGH,需要外置G-Sensor以协助抑制静态飘逸和低功耗控制;
- 5,优先推荐选择Air780EGP(Flash:4MB+RAM:4MB)或Air780EGG(Flash:8MB+RAM:8MB);

NAME: ZhaFangjun		DATE: 2025-5-8		COMPANY: 合宙Luat0S	
GID: laolu		DATE: 2025-5-8		TITLE: Air780EGG开发板	
QUALITY CONTROL: laolu		DATE: 2025-5-8		CODE: laolu	SIZE: 2025-11-11
RELEASED: laolu		DATE: 2025-5-8		SCALE: G	HEET: 1 of 17

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

DC-DC 方案



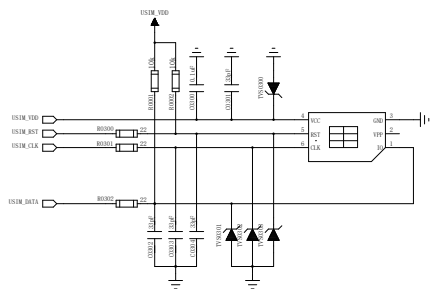
COMPANY: 合宙LuatOS

TITLE: Air780EGG开发板

DESIGN: ZhuPingJun	DATE: 2025-5-8				
DRAWN: laolu	DATE: 2025-5-8	CHECK:	SIZE:	DRAWING NO:	REV:
QUALITY CONTROL: laolu	DATE: 2025-5-8	laolu	A1	2025-11-11	4
RELEASED: laolu	DATE: 2025-5-8				

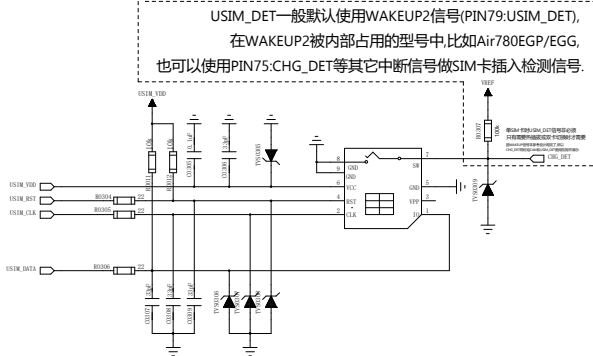
REVISION RECORD			
LINE	REV NO.	APP/REVISED	DATE

6-PIN SIM1接口参考电路



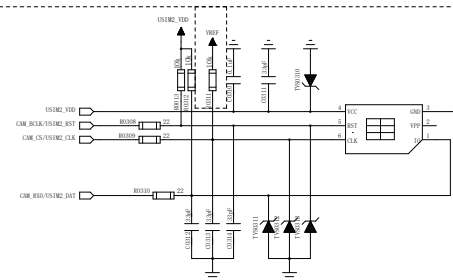
- 1.SIM卡座与模块距离摆件不能太远，越近越好，尽量保证SIM卡信号线布线不超过20cm；
- 2.SIM卡信号线布线远离RF线和VBAT电源线；
- 3.为了防止可能存在的USIM_CLK信号对USIM_DATA信号的串扰，两者布线不要太靠近，在两条走线之间增加地屏蔽。
且对USIM_RST_N信号也需要地保护；
- 4.为了保证良好的ESD保护，建议加TVS管，并靠近SIM卡座摆放。选择的ESD器件寄生电容不大于50pF。
在模块和SIM卡之间也可以串联22欧姆的电阻用以抑制杂散EMI，增强ESD防护。
SIM卡的外围电路必须尽量靠近SIM卡座。

带检测PIN SIM1卡座参考电路



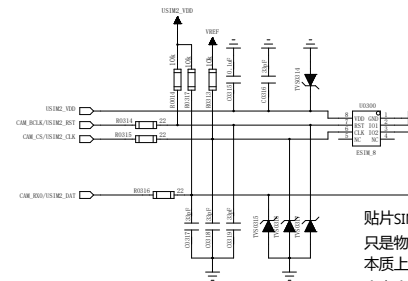
6-PIN SIM2接口参考电路

SIM2_CLK需要上拉至Vref，以保证SIM2_CLK在Stop状态下保持高电平；
SIM_CLK在Stop状态下保持高电平是SIM卡规范的要求



- 1.如果需要使用SIM2，需要注意！
SIM2，无论电源还是信号(CLK/DATA/RST)，均为复用模组的其它管脚；
当使用SIM2通道时，模组的PIN55/PIN80/PIN81三个管脚需务必悬空；
PIN55/PIN80/PIN81的默认功能是SPI Camera，这意味着使用SIM2便无法使用Camera；
- 2.在我们的描述中，有时候使用SIM0 vs SIM1，有时候使用SIM1 vs SIM2，请大家灵活理解；
- 3.插拔卡和贴片SIM卡没有本质区别，只是物理介质不同，Air780Exx系列都可以支持；

SIM2贴片SIM卡参考电路

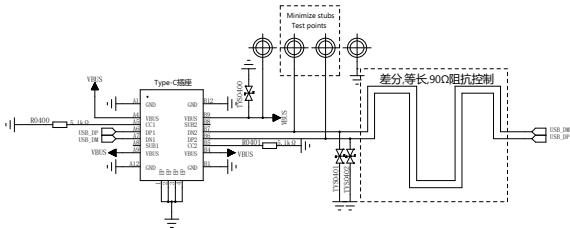


贴片SIM卡，也常被称为ESIM
只是物理表现形式上与插拔卡不同
本质上与插拔卡没有任何区别
合宙全系4G模组都支持ESIM

DESIGN:		COMPANY:		合宙LuatOS			
DRAWN:		TITLE:		Air780EGG开发板			
CHECKED:		CODE:		SIZE:		DRAWING NO.:	
QUALITY CONTROL:		laolu		A1		2025-11-11	
RELEASED:		laolu		2025-5-8		4	
DATE:		2025-5-8		SCALE: G		SHEET: 3 of 17	

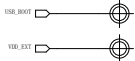
REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

USB

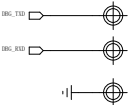


- 1.USB走线需要严格按照差分线控制，做到平行和等长；
- 2.USB走线的阻抗需要控制到差分90欧姆；
- 3.需要尽可能的减少USB走线的stubs，减少信号反射；USB信号的测试点最好直接放在走线上以减少stub
- 4.在靠近USB连接器或者测试点的地方添加TVS保护管，由于USB的速率较高，需保证选用的TVS保护管的寄生电容小于1pF
- 5.VBUS作为USB插入检测，必须连接USB电源或者外接电源，否则USB无法被检测到，VBUS的检测电压要大于3.3V

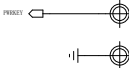
测试点



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



DGB_UART，也常备称为UART0，用作底层日志的抓取
波特率921600bps，不可更改
不可作为通用UART使用



开机键测试点，设计批量升级夹具时会用到



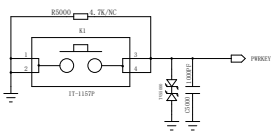
VBAT供电测试点，设计批量升级夹具时会用到

DESIGN:		DATE:		COMPANY:			
ZhuPingJun		2025-5-8		合街LutOS			
CHECKED:		DATE:		TITLE:			
laolu		2025-5-8		Air780EGG开发板			
QUALITY CONTROL:		DATE:		COD:	SIZE:	DESIGNING NO:	REV:
laolu		2025-5-8		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2025-5-8		SHEET: 4 of 17			

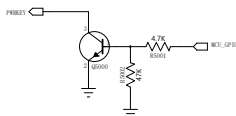
REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

开机PWRKEY/复位RESET/下载BOOT/WAKEUP

按键开机

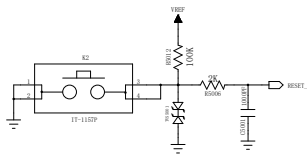


单片机控制开机

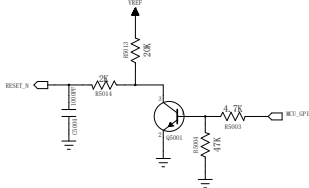


- 1.把PWRKEY管脚拉低0.5s后开机，开机成功后PWRKEY管脚可以释放。
- 2.按键附近需放置一个TVS管用作ESD防护。
- 3.PWRKEY 的电压域是VBAT，如果用单片机控制开机的话需要加一个三极管。
- 4.可以通过一颗不超过10KΩ的电阻直接将PWRKEY拉低，实现上电自动开机。

RESET_N 复位

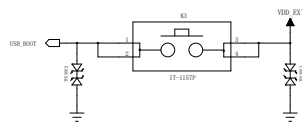


单片机控制重启



- 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

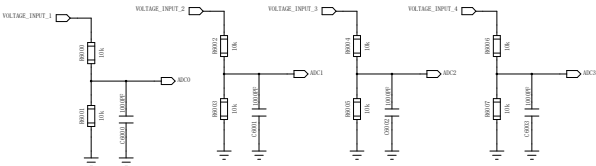


同时按下开机键和BOOT键,然后再上电,即可通过USB下载软件;

DESIGN:		DATE:		COMPANY:			
ZhuPingJun		2025-5-8		合宙LuatOS			
CHECKED:		DATE:		TITLE:			
laolu		2025-5-8		Air780EGG开发板			
QUALITY CONTROL:		DATE:		CORE:	SIZE:	DESIGNING NO.:	REV:
laolu		2025-5-8		laolu	A1	2025-11-11	4
RELEASED:		DATE:		SCALE: G			
laolu		2025-5-8		SHEET: 5 of 17			

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

ADC参考电路

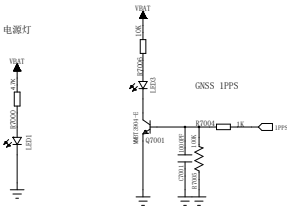


- 1.四路对外ADC,分辨率12bit;
- 2.分压电阻请选用1%精密电阻。阻值要高(10K级以上)，减少耗流及避免灌电。
- 3.模块的VBAT管脚内部也连接到了ADC，可以读取VBAT管脚的电压。
- 4.更多介绍 <https://docs.openluat.com/air780epm/product/air780exxpins/>

DESIGN: ZhuPingJun		DATE: 2025-5-8		COMPANY: 合宙LuatOS			
CHECKED: laolu		DATE: 2025-5-8		TITLE: Air780EGG开发板			
QUALITY CONTROL: laolu		DATE: 2025-5-8		CORE: laolu	SIZE: A1	DRAWING NO: 2025-11-11	REV: 4
RELEASED: laolu		DATE: 2025-5-8		SCALE: G			SHEET: 6 of 17

REVISION RECORD			
REV	REV NO.	APPROVED:	DATE

LED状态灯

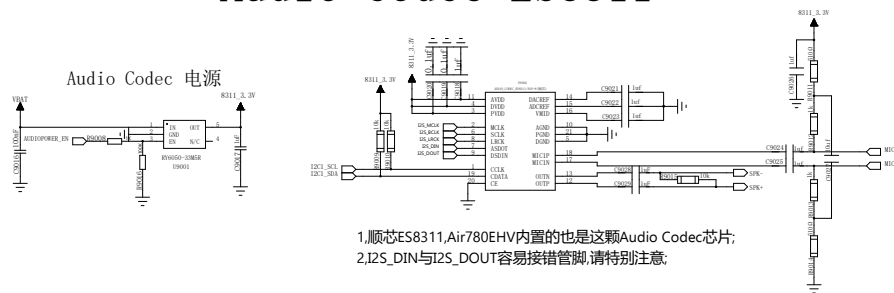


两种典型状态灯, 大家根据实际需要增加或减少.
低功耗工作模式下, LED的功耗往往是被忽略的耗电大户, 请特别注意!

DRAWN: ZhuPingJun		DATED: 2025-5-8		COMPANY: 合宙LuatOS			
CHECKED: laolu		DATED: 2025-5-8		TITLE: Air780EGG开发板			
QUALITY CONTROL: laolu		DATED: 2025-5-8		CODE: laolu	SIZE: A1	DRAWING NO: 2025-11-11	REV: 4
RELEASED: laolu		DATED: 2025-5-8		SCALE: G			SHEET: 7 of 17

REVISION RECORD			
LINE	REV. NO.	APPROVED:	DATE

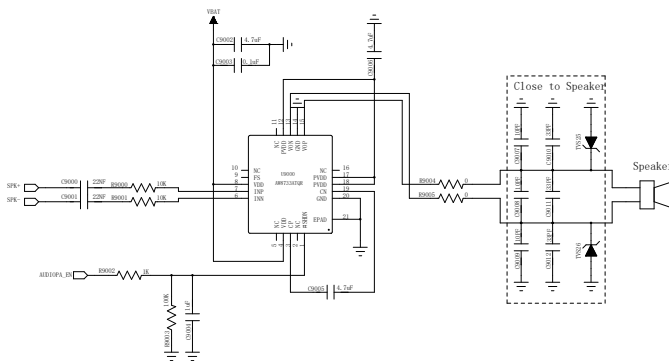
Audio Codec ES8311



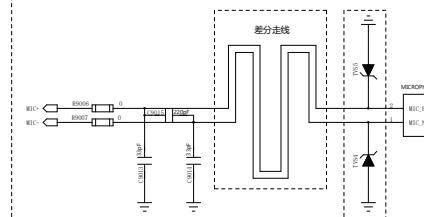
特别提醒!

- 1,仅Air780EGG和Air780EGH支持Audio功能;
- 2,Air780EGG相对Air780EGH新增内置了G-Sensor,可协助抑制静态飘逸/低功耗控制;
- 3,Air780EGP虽然也内置了G-Sensor,但是不支持Audio功能,不能驱动Audio Codec;
- 4,如果选择Air780EGH,需要外置G-Sensor以协助抑制静态飘逸和低功耗控制;
- 5,优先推荐选择Air780EGP(Flash:4MB+RAM:4MB)或Air780EGG(Flash:8MB+RAM:8MB);

音频输出(喇叭)参考电路



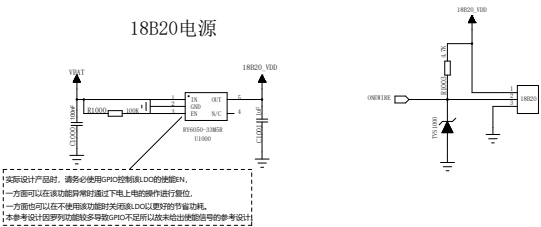
驻极体麦克风



COMPANY: 合宙LuoOS			
TITLE: Air780EGG开发板			
DESIGN: ZhuPingJun	DATE: 2025-5-8	CODE: A1	
CHECKED: laolu	DATE: 2025-5-8	DRAWING NO: 2025-11-11	
QUALITY CONTROL: laolu	DATE: 2025-5-8	REV: 4	
RELEASED: laolu	DATE: 2025-5-8	SCALE: G	
SHEET: 8 of 17			

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE:

ONEWIRE

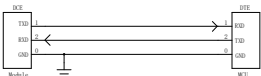


更多信息 <https://docs.openluat.com/air780epm/product/air780expins/>

				COMPANY: 合宙LuatOS			
				TITLE: Air780EGG开发板			
DESIGN: ZhuPingJun	DATE: 2025-5-8						
CHECKED: laolu	DATE: 2025-5-8						
QUALITY CONTROL: laolu	DATE: 2025-5-8		CORE: laolu	SIZE: A1	DRAWING NO: 2025-11-11	REV: 4	
RELEASED: laolu	DATE: 2025-5-8						
			SCALE: G			SHEET: 9 of 17	

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

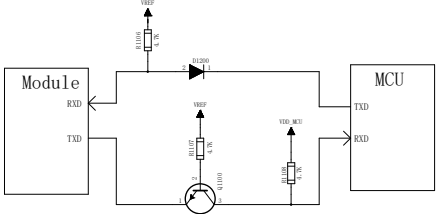
三线制串口参考设计



请注意串口的电平匹配

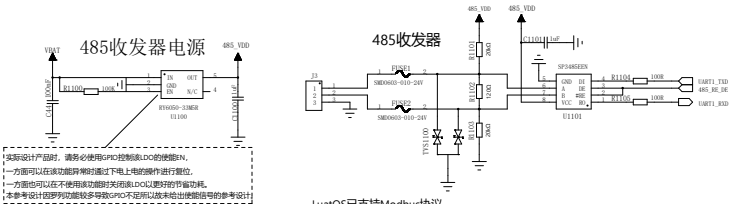
- 1,DBG_UART(UART0)仅可用于调试,不可用作通用UART;
- 2,UART1/2/3均可作为通用UART;
- 3,详细信息 <https://docs.openluat.com/air780epm/product/air780expins/>

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



实际设计产品时, 请务必使用GPIO控制该DC的使能N,
一方面可以在该功能异常时通过下电上电的操作进行复位,
一方面也可以在不使用该功能时关闭该DC以节省功耗。
本参考设计仅罗列原理较多导致GPIO不足所以尚未经过详细信号的参考设计

LuatoS已支持Modbus协议
详见扩展库exmodbus中的介绍

DRAWN: ZhuPingJun DATE: 2025-5-8				COMPANY: 合宙LuatOS							
				TITLE: Air780EGG开发板							
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: 10 17			

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

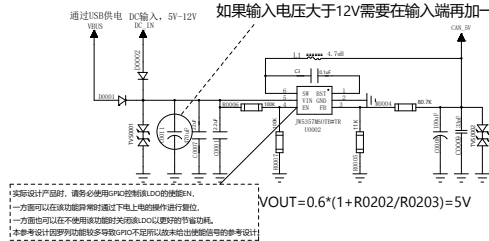
CAN 收发器 5V 电源

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

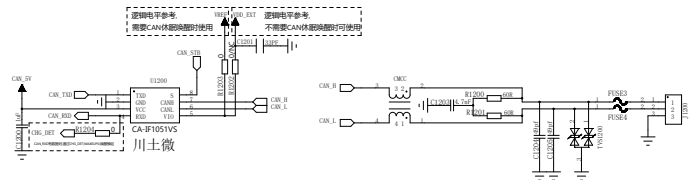
注意C47的选型要根据输入电压来选择耐压值

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,也可以直接使用DC IN或VBUS为CAN1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

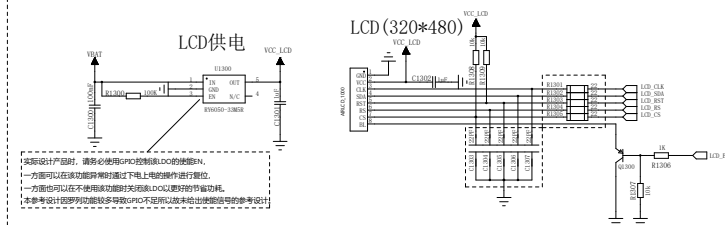
1,CMCC,共模扼流圈,推荐型号共模扼流线圈ACT45B-101-2P;

2,TVSS1200,推荐型号PESD1CAN;

		IMPRESS: 合亩Luat0S			
		TITLE: Air780EGG开发板			
DESIGN: ZhuFangjun	DATE: 2025-5-8				
laolu	2025-5-8	CODE:	SIZE:	DATEING NO:	REV:
QUALITY CONTROL	laolu	laolu	A1	2025-11-11	4
RELEASED:	DATE: 2025-5-8	SCALE: G		SHEET: 11th 17	

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

LCD



1. 预留电阻电容，对射频干扰有一定的抑制效果；
2. LCD_B1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_1000 驱动IC是ST7796；

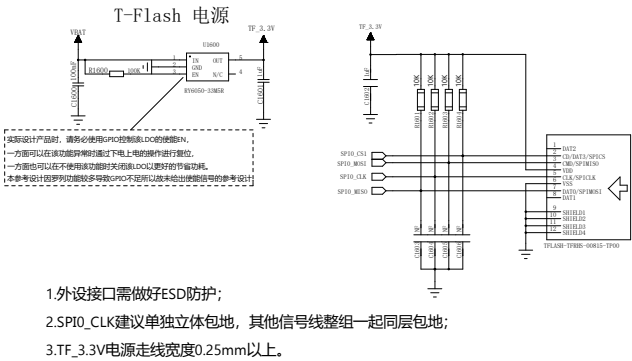
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		TITLE:		Air780EGG开发板	
DESIGN:	ZhuFangJun	DATE:	2025-5-8		
DESIGN:	laolu	DATE:	2025-5-8		
DESIGN:	laolu	DATE:	2025-5-8		
RELEASED:	laolu	DATE:	2025-5-8		
		CODE:	SIZE:	DRAWING NO:	REV:
		laolu	A1	2025-11-11	4
		SCALE: G	SHEET: 12		17

REVISION RECORD			
LV	REV NO.	APPROVED:	DATE

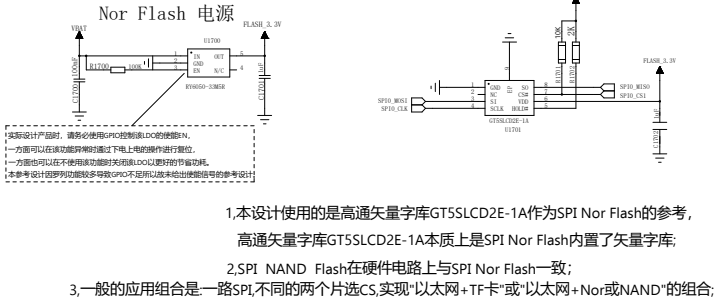
本参考电路中T-Flash和Nor Flash都是使用的SPIO_CS1， 仅为参考示例

实际使用中要么使用T-Flash， 要么使用Nor Flash， 不要同时使用SPIO_CS1

TF接口参考电路



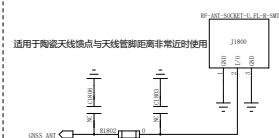
SPI Nor Flash



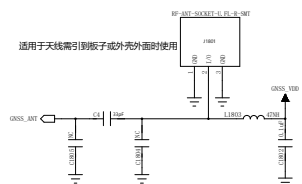
				COMPANY:			
				合宙Luat0S			
				TITLE:			
				Air780EGG开发板			
DESIGN:	ZhuPingJun	DATE:	2025-5-8				
CHECKED:	laolu	DATE:	2025-5-8	CODE:	SIZE:	DRAWING NO:	REV:
QUALITY CONTROL:	laolu	DATE:	2025-5-8	laolu	A1	2025-11-11	4
RELEASED:	laolu	DATE:	2025-5-8	SCALE: G		SHEET: 15 17	

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

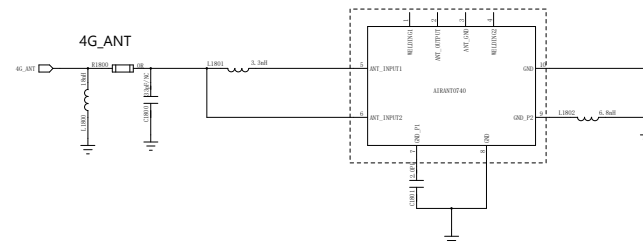
GNSS无源天线



GNSS有源天线



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;

		COMPANY:		合宙LuatOS	
		TITLE:		Air780UEG开发板	
DESIGN:	ZhuFangjun	DATE:	2025-5-8		
DESIGN:	laolu	DATE:	2025-5-8		
QUALITY CONTROL:	laolu	DATE:	2025-5-8		
RELEASE:	laolu	DATE:	2025-5-8		
		CODE:	SIZE:	DESIGN NO:	REV:
		laolu	AI	2025-11-11	4
SCALE: G				SHEET: 17	17