

一、开发板介绍

- 1. 使用 Type-C 5V 供电和 debug, 板载 STM32F103CBT6 实现 USB 转 JTAG 和 UART 功能连接至 HS32F7D377 的 UARTA.
- 2. 自带复位按键。
- 3. 2 个 LED, 使用 GPIO 控制。
- 4. 2 个 5V 的 EQEP 接口。
- 5. 板载 5V CAN 收发器。
- 6. Boot 切换拨码开关。
- 7. 板载差分输入 buffer, 连接至 ADCD.

二、套件包含

- 1. HeliPad 开发板
- 2. Type-C 数据线
- 3. 快速使用指南

三、使用

- 1. 需要安装 jlink 驱动
- 2. 使用 USBA-C 数据线将开发板链接至电脑
 - 1) 电源指示灯 LED3 和 LED4 红灯亮起
 - 2) LED6 和 LED7 交替闪烁
 - 3) 电脑识别 Jlink 和一个 Uart

四、版本

PCB V1.0 版本使用 Type-C 未加入盲插设计,如若开发板接入电脑不识别 jlink 反插 Type-C 数据线即可, 在 V1.1 版本修正此问题实现盲插, 并修改 20pin 排针为加长排母, 增加扩展性。

五、HeliPad 硬件

- 1. 对外接口

表 1 HeliPad 输出引脚以及 MUX 选项-P1

MUX				P1		MUX			
3	2	1	0			0	1	2	3
			3.3V	1	11	5V			
			GPIO44	2	12	GND			
	SCIRXDB		GPIO22	3	13	ADCIN14	CMPIN4P		
	SCITXDB		GPIO23	4	14	ADCINC3	CMPIN6N		
			GPIO66	5	15	ADCINB3	CMPIN3N		
			GPIO67	6	16	ADCINA3	CMPIN1N		
SPICLKA			GPIO60	7	17	ADCINC2	CMPIN6P		
			GPIO68	8	18	ADCINB2	CMPIN3P		
		SCLA	GPIO33	9	19	ADCINA2	CMPIN1P		
		SDAA	GPIO32	10	20	ADCINA0	DACOUTA		

表 2 HeliPad 输出引脚以及 MUX 选项-P2

MUX				P2		MUX			
3	2	1	0			0	1	2	3
		EPWM1A	GPI00	1	11	GND			
		EPWM1B	GPI01	2	12	GPI061			
		EPWM2A	GPI02	3	13	GPI017			SD1_C1
		EPWM2B	GPI03	4	14	GPI016			SD1_D1
		EPWM3A	GPI04	5	15	HS_XRSn			
		EPWM3B	GPI05	6	16	GPI054			SPISIMOA
		OUTPUTXBAR1	GPI091	7	17	GPI059			SPISOMIA
OUTPUTXBAR7			GPI030	8	18	GPI018			SD1_D2
		EPWM8A	GPI014	9	19	GPI019			SD1_C2
		EPWM8B	GPI015	10	20	GPI029			OUTPUTXBAR6

表 3 HeliPad 输出引脚以及 MUX 选项-P3

MUX				P3		MUX			
3	2	1	0			0	1	2	3
		EPWM4A	GPI06	1	11	GND			
		EPWM4B	GPI07	2	12	GND			
		EPWM5A	GPI08	3	13	GPI025			SD2_C1
		EPWM5B	GPI09	4	14	GPI024			SD2_D1
		EPWM6A	GPI010	5	15	HS_XRSn			
		EPWM6B	GPI011	6	16	GPI063			SPISIMOB
OUTPUTXBAR3			GPI034	7	17	GPI064			SPISOMIB
OUTPUTXBAR4			GPI035	8	18	GPI058			SD2_D2
		EPWM7A	GPI012	9	19	GPI0133			SD2_C2
		EPWM7B	GPI013	10	20	GPI092			OUTPUTXBAR2

表 4 HeliPad 输出引脚以及 MUX 选项-P4

MUX				P4		MUX			
3	2	1	0			0	1	2	3
			3.3V	1	11	5V			
			GPI086	2	12	GND			
SCIRXDC			GPI039	3	13	ADCIN15	CMPIN4N		
SCITXDC			GPI056	4	14	ADCIND1	CMPIN7N		
			GPI087	5	15	ADCIND0	CMPIN7P		
			GPI088	6	16	ADCINA5	CMPIN2N		
SPICLKB			GPI065	7	17	ADCINC4	CMPIN5P		
			GPI052	8	18	ADCIND4			

SCLB			GPI041	9	19	ADCINA4	CMPIN2P		
SDAB			GPI040	10	20	ADCINA1	DACOUTB		

表 5 HeliPad 输出引脚以及 MUX 选项-P5

MUX				P5		MUX			
3	2	1	0			0	1	2	3
			GPI045	1	11	GND			
			GPI046	2	12	GPI085			
			GPI047	3	13	GPI036			
			GPI048	4	14	GPI037			
			GPI049	5	15	GPI026			
			GPI050	6	16	GPI027			
			GPI051	7	17	GPI062			
			GPI055	8	18	GND			
			GND	9	19	GPI069			
			GPI057	10	20	GPI070			

表 6 HeliPad 输出引脚以及 MUX 选项-P6

MUX				P6		MUX			
3	2	1	0			0	1	2	3
			GPI071	1	11	GPI089			
			GPI074	2	12	GPI090			
			GPI075	3	13	GPI093			
			GPI076	4	14	GPI094			
			GPI077	5	15	GND			
			GPI080	6	16	GPI0128			
			GPI082	7	17	GPI0129			
			GPI083	8	18	GPI0130			
			ADCINB0	9	19	GND			
		DACOUTC	ADCINB1	10	20	GND			

2. 原理图

2.1 整体框图

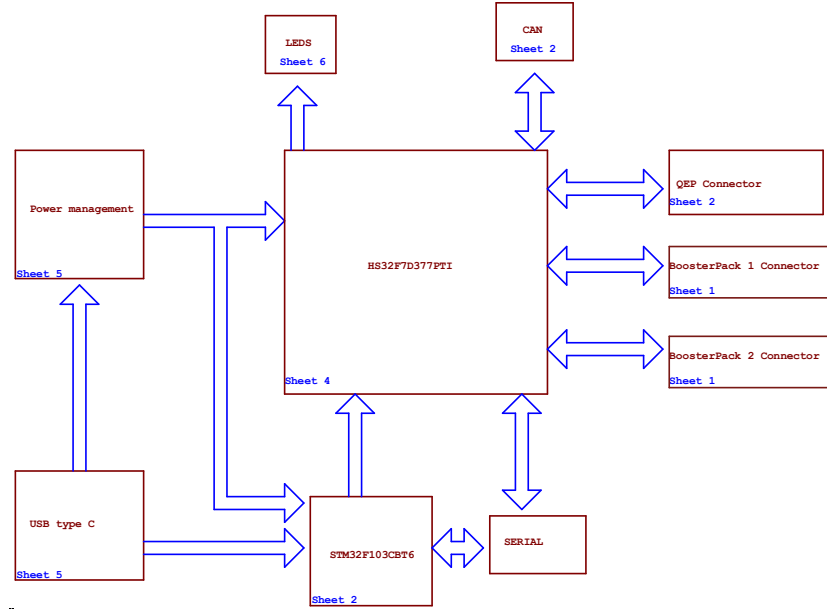


图 1 Block_Diagram

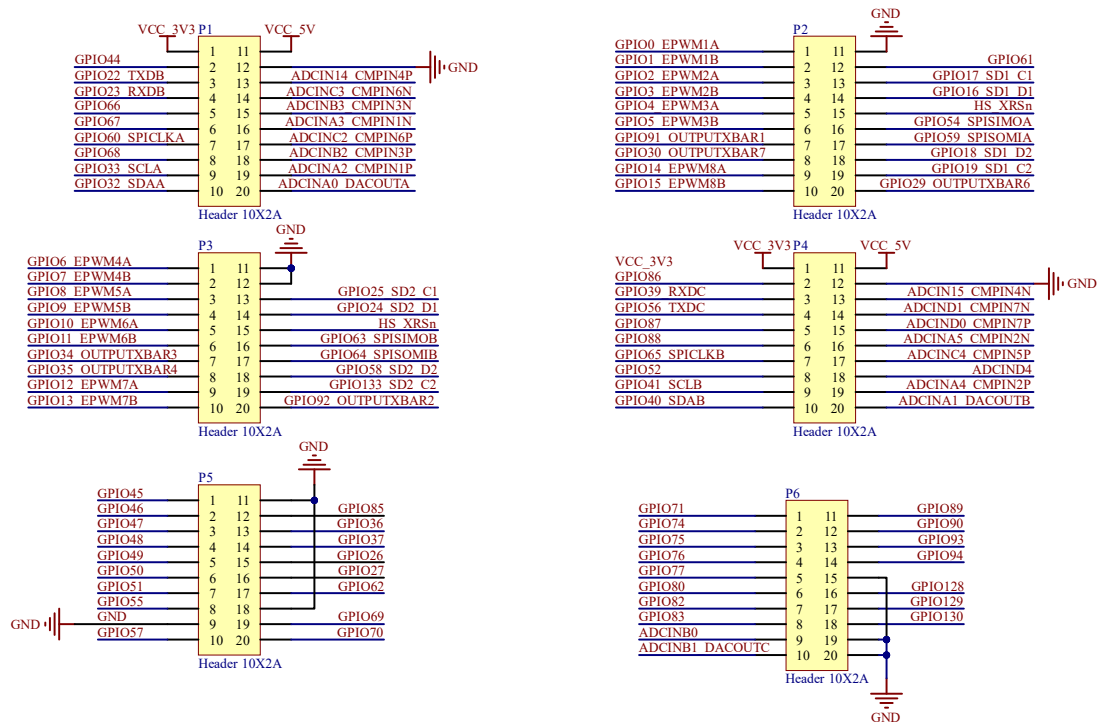


图 2 P2_Headers

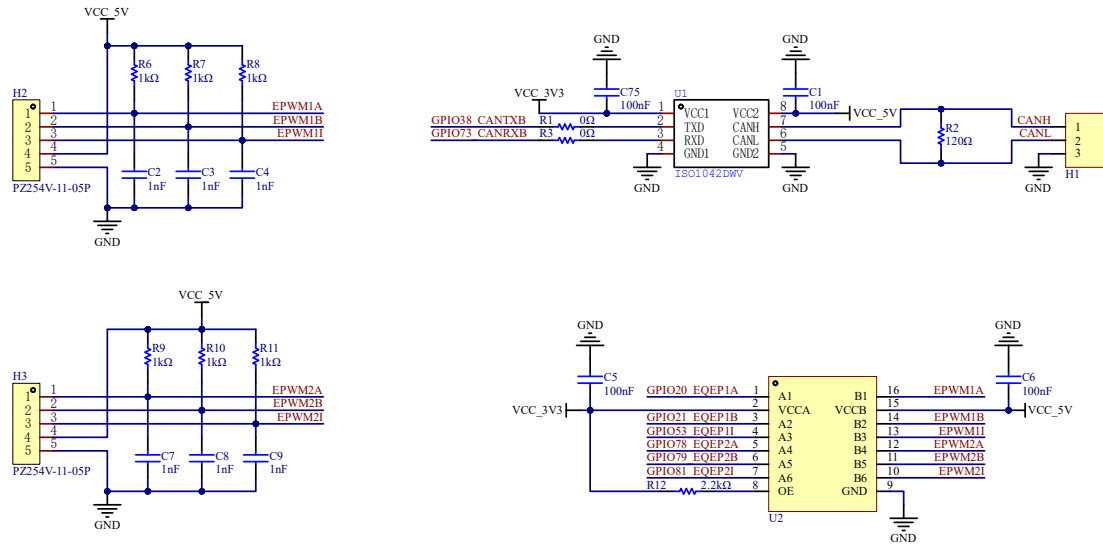


图 3 P3_CAN&QEP_Headers

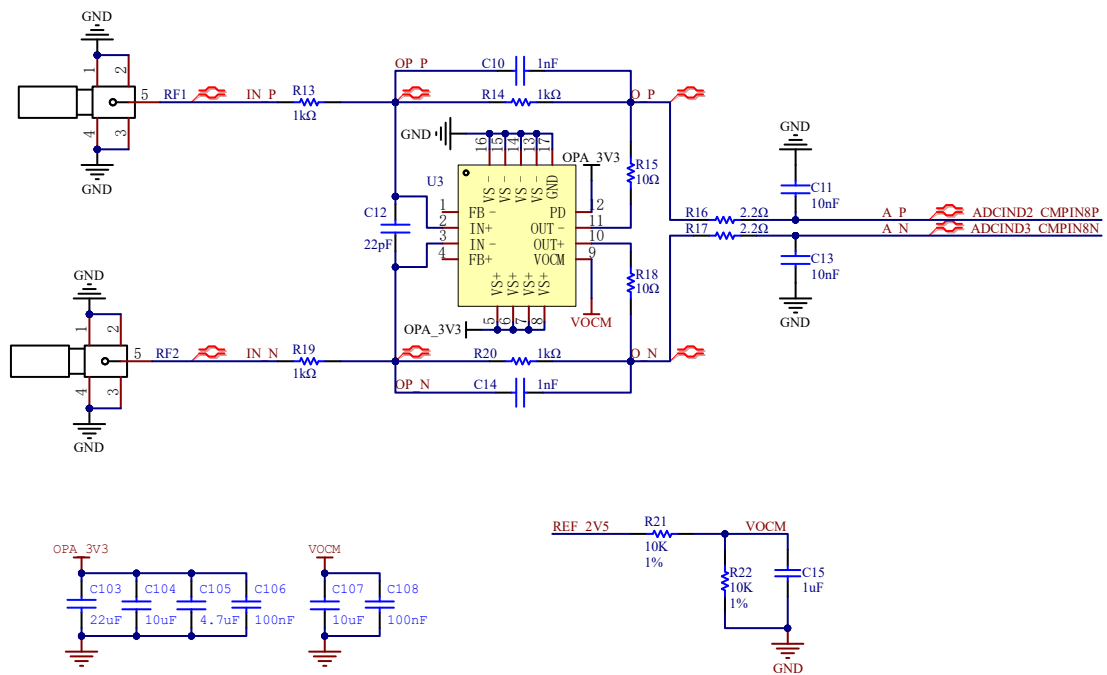
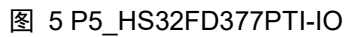


图 4 P4_ADCIND



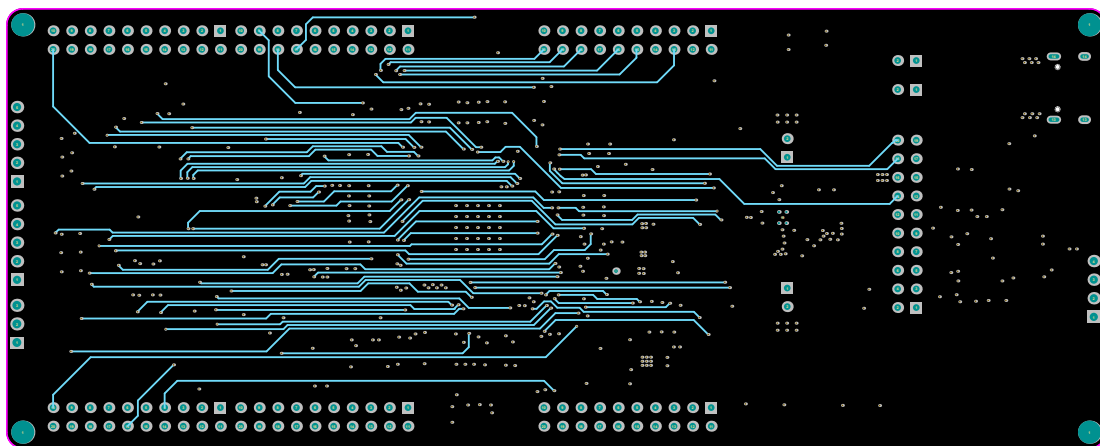


图 10 第三层信号层

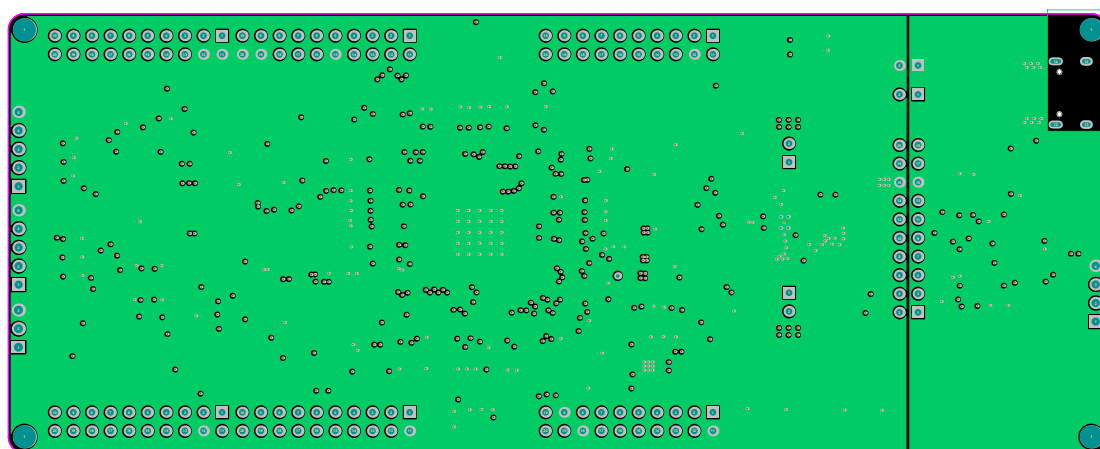


图 11 第四层地层

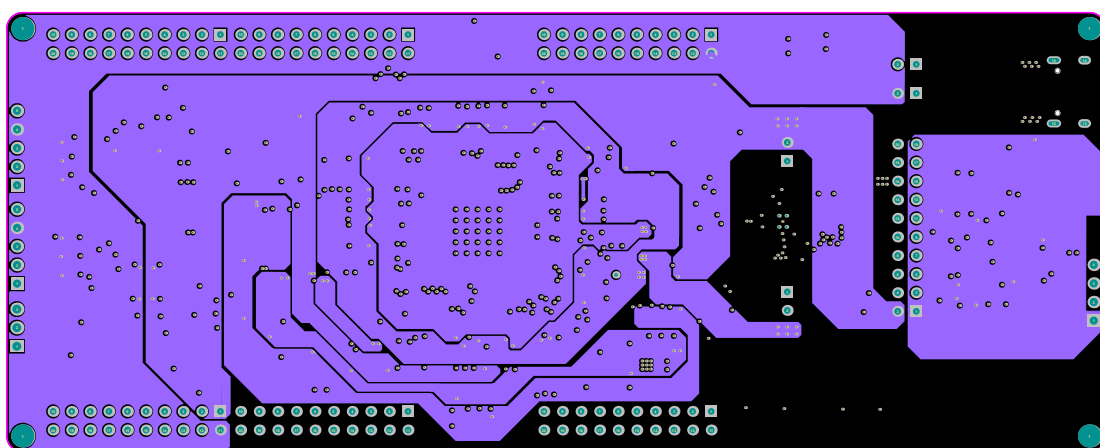


图 12 第五层电源层

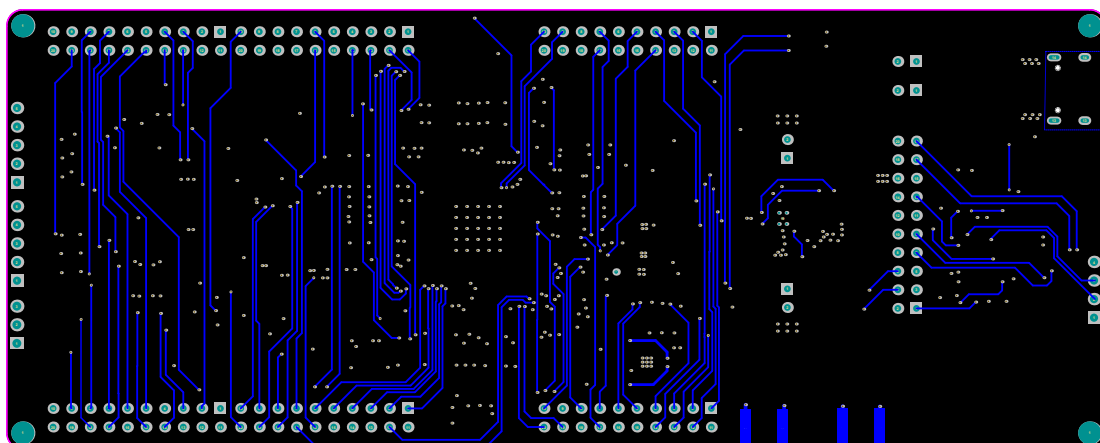


图 13 底层信号层

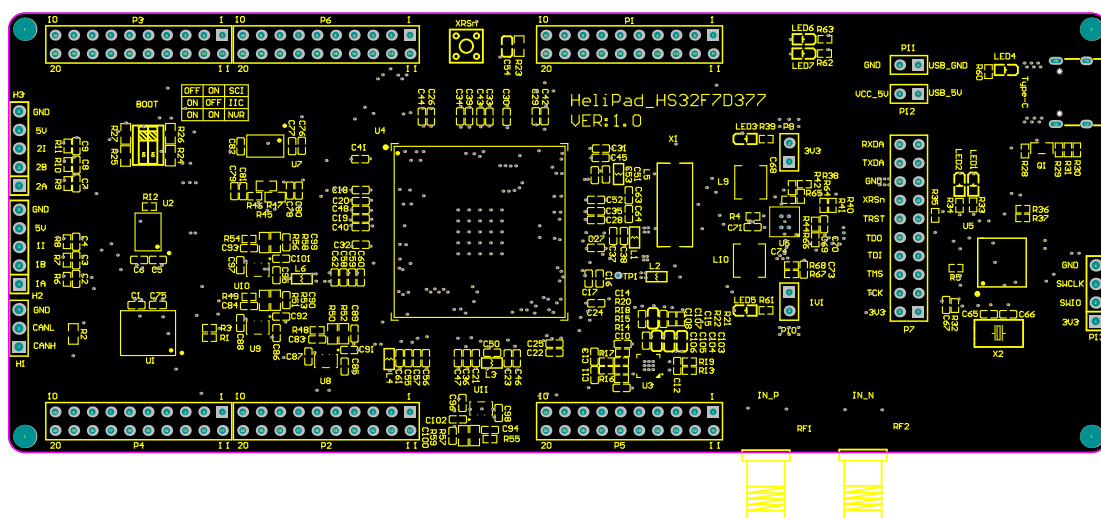


图 14 顶层丝印层

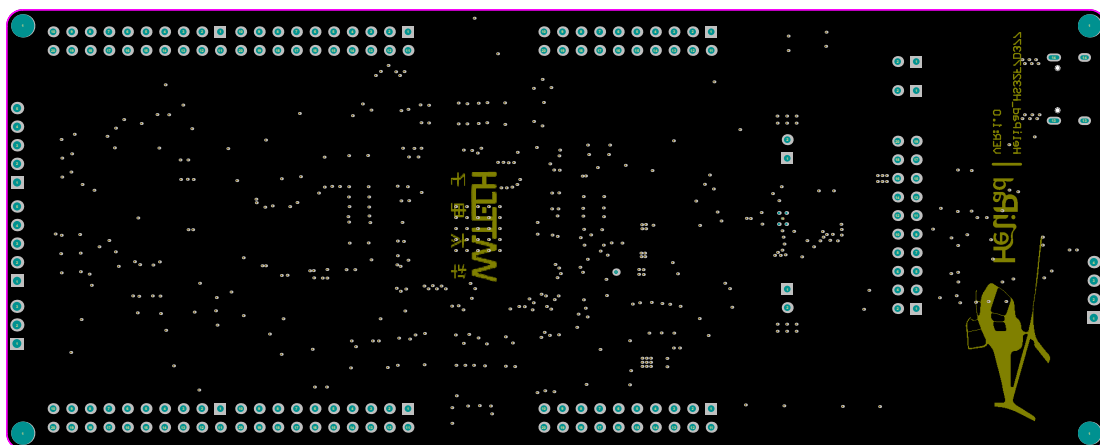


图 15 底层丝印层

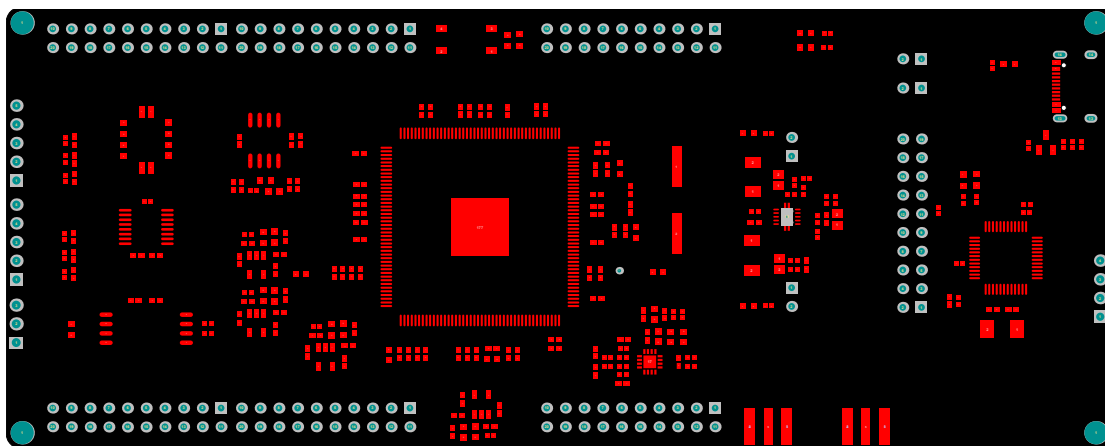


图 16 顶层焊盘

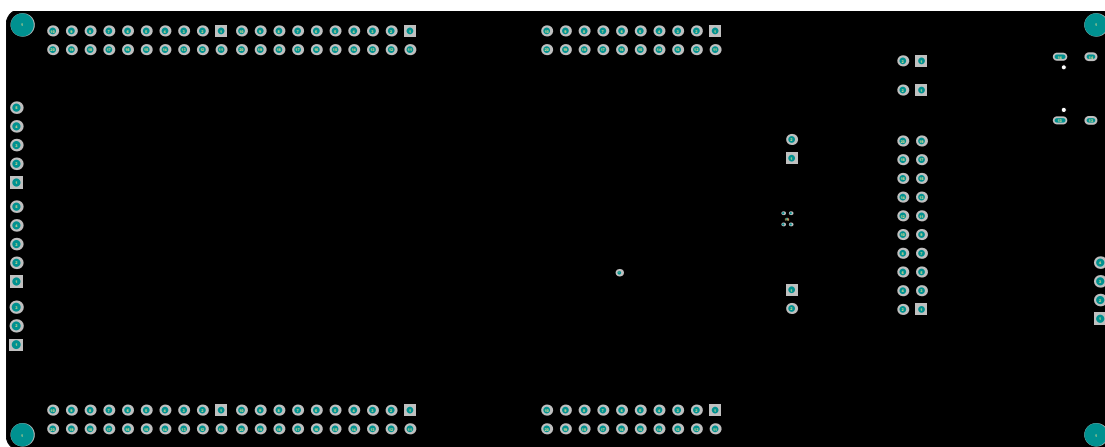


图 17 底层焊盘

4. Bom 清单

Comment	Description	Designator	Footprint	Quantity
100nF	[NoValue], CAP CER 16V 10% X7R 0402	C1, C5, C6, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C50, C51, C52, C53, C55, C56, C57, C58, C59, C60, C61, C62, C67, C69, C75, C83, C84, C85, C86, C93, C94, C95, C96, C106, C108		61
1nF		C2, C3, C4, C7, C8, C9, C10, C14, C89, C90, C99, C100	C0402	12
10nF		C11, C13	C0402	2
22pF		C12	C0402	1
1uF	CAP,1UF,+/-10%,X5R,6.3V,SMD0402, [NoValue]	C15, C77, C81, C82, C87, C88, C97, C98	C0402	8
1uF		C54	C0603	1
20pF		C63, C64, C65, C66	C0402	4
22uF	CAP CER 6.3V 20% X5R 0805	C68, C70, C74	C0805	3
NC	CAP CER 16V 10% X7R 0402	C71	C0402	1
33pF	CAP CER 50V NP0 0402	C73	C0402	1
10uF		C76	C0402	1
22uF		C78, C79, C91, C92, C101, C102	C0402	6
220nF		C80	C0402	1
22uF		C103	C0603	1
10uF		C104, C107	C0603	2
4.7uF		C105	C0603	1
2.54-1*3P		H1	HDR-TH_3P-P2.54-V-M-1	1
P2254V-11-0SP		H2, H3	HDR-TH_5P-P2.54-V-M	2
BLM18PG121SN1D		L1, L2, L3, L4, L5, L6	L0603	6
MWSA0402S-2R2MT		L9	IND-SMD_L4.4-W4.2	1
MWSA0402S-3R3MT		L10	IND-SMD_L4.4-W4.2	1
GREEN		LED1, LED6	LED-SMD_L1.6-W0.8-RD-BLUE	2
BLUE		LED2, LED7	LED-SMD_L1.6-W0.8-RD-BLUE	2
RED		LED3, LED4, LED5	LED-SMD_L1.6-W0.8-RD-BLUE	3
HOLE		MH1, MH2, MH3, MH4	MHOLE	4
Header 10X2A	Header, 10-Pin, Dual row	P1, P2, P3, P4, P5, P6	HDR2X10_CEN	6
Header 10X2	Header, 10-Pin, Dual row	P7	HDR2X10	1
Header 2	Header, 2-Pin	P9, P10, P11, P12	HDR1X2	4
P2254V-11-04P		P13	HDR-TH_4P-P2.54-V-M	1
S8550		Q1	SOT-23-3_L2.9-W1.3-P1.90-LS2.4-BR	1
0Q		R1, R3	R0402	2
120Q		R2	R0603	1
33K	RES 1/16W 5% 0402 SMD	R4	R0402	1
10KQ		R5, R32, R35, R36	R0402	4
1KQ		R6, R7, R8, R9, R10, R11, R13, R14, R19, R20	R0402	10
2.2KQ		R12	R0402	1
10Q		R15, R18	R0402	2
2.2Q		R16, R17	R0402	2
10K	RES,10K,+/-1%,1/16W,SMD0402, RES 1/16W 5% 0402 SMD	R21, R22, R44	R0402	3
100K	0402,1%,resistor	R23, R26, R27	R0603	3
1K	0402,1%,resistor	R24, R25	R0603	2
1.5KQ		R28, R29	R0402	2
22Q		R30, R31	R0402	2
680Q		R33, R34, R39, R60, R61, R62, R63	R0402	7
100Q		R37	R0402	1
0R	RES 1/16W 5% 0402 SMD	R38	R0402	1
100K	RES 1/16W 5% 0402 SMD	R40	R0402	1
22K	RES 1/16W 1% 0402 SMD	R41	R0402	1
340K	RES 1/16W 1% 0402 SMD	R42	R0402	1
50KQ		R45, R47	R0603	2
1Q		R46	R0402	1
20KQ		R48, R49, R54, R55	R0402	4
20Q		R50, R51, R56, R57	R0603	4
220mQ		R52, R53, R58, R59	R0603	4
2K	RES 1/16W 1% 0402 SMD	R64	R0402	1
75K	RES 1/16W 0.5% 0402 SMD	R65	R0402	1
NC	RES 1/10W 5% 0603 SMD	R66	R0402	1
167K	RES 1/16W 1% 0402 SMD	R67	R0402	1
200K	RES 1/16W 0.5% 0402 SMD	R68	R0402	1
NC		RF1, RF2	CONN-SMD_KH-SMA-KE8-G	2
TS-KG09S		SW1	SW-SMD_4P-L4.5-W4.5-P3.00-LS7.5	1
DSHP02TSGT		SW2	SW-SMD_4P_DSHP02TSGT	1
VIA_20_40	Via, 20 ID, 40 OD (mil)	TP1	VIA_20_40	1
TYPE-C 16PIN 2MD(073)		Type-C	USB-C-SMD_TYPE-C-6PIN-2MD-073	1
ISO10420WV		U1	SOIC-8_L7.5-W5.9-P1.27-LS11.5-BL	1
TXB0106PWR		U2	TSSOP-16_L5.0-W4.4-P0.65-LS6.4-BL	1
THS4551IRGTR		U3	QFN-16_L3.0-W3.0-P0.50-BL-EP1.7	1
HS32F7D377PT1		U4	HLQFP-176_L24.0-W24.0-P0.5-LS26.0-BL-EP	1
STM32F103C8T6		U5	LQFP-48_L7.0-W7.0-P0.50-LS9.0-BL	1
TPS62420DRC	IC Dual Step Down Converter, 2.25MHz, 600mA/1A	U6	VSON-10_L3.0-W3.0-P0.50-TL-EP	1
REF502SAIDR		U7	SOIC-8_L4.9-W3.9-P1.27-LS6.0-BL	1
OPA376AIDBVR		U8, U9, U10, U11	SOT-23-5_L3.0-W1.7-P0.95-LS2.8-BR	4
X495M20MSD2SC		X1	HC-49S_L11.4-W4.8	1
8MHz		X2	CRYSTAL-SMD_L5.0-W3.2	1