



LDOs
CONNECTORS / SWITCHES
DIGITAL IC
ANALOG / MIXED IC

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TITLE Block Diagrams		PRODUCT NAME / P/N CaribouLite / CARIBOULITE-V2		<div> <a href="http://www.cariboulabs.co">www.cariboulabs.co</a> Open Source RF Tools</div>
DESIGNER: DM				
REVIEWER: -				
DATE: 6/27/2021		REV: B		
SIZE A3	DRAWING NO. DN00001	SHT 1	OF 7	

U\_DIG\_INTERFACES  
DIG\_INTERFACES.SchDoc

VCC\_5V0\_RPI  
VCC\_3V3  
VCC\_2V5

VCC\_5V0 VCC\_3V3 VCC\_2V5

VCC\_1V2 VCC\_2V5 VCC\_3V3

VCC\_1V2  
RPI\_GP26  
RPI\_GP24  
RPI\_GP27  
RPI\_SPL\_SS0  
USR\_SW

ICE\_IRQ  
ICE\_CRESET  
ICE\_CDONE  
RPI\_SS\_FPGA  
USR\_SW

RPI\_MOSI  
RPI\_SCK  
RPI\_MISO

ICE\_FP\_IRQ  
ICE\_FP\_CRESET  
ICE\_FP\_CDONE  
ICE\_FP\_SS\_B  
USR\_SW

RPI\_GP25  
RPI\_SPL\_SS2

MXR\_RESET  
RPI\_SS\_MXR

RPI\_GP22  
RPI\_GP23  
RPI\_SPL\_SS1

AT86\_IRQ  
AT86\_RESET  
RPI\_SS\_AT86

R10  
R11  
R12  
102k 102k 102k  
GND

all power hungry components are reset

SML\_SA0/IRQ  
SML\_SA1  
RPI\_GP3  
RPI\_GP2

SML\_SA0/IRQ  
SML\_SA1  
SML\_SA2  
SML\_SA3

SML\_SD0  
SML\_SD1  
SML\_SD2  
SML\_SD3  
SML\_SD4  
SML\_SD5  
SML\_SD6  
SML\_SD7  
SML\_SOE\_SE  
SML\_SWE\_SRW

SML\_SD0  
SML\_SD1  
SML\_SD2  
SML\_SD3  
SML\_SD4  
SML\_SD5  
SML\_SD6  
SML\_SD7  
SML\_SOE\_SE  
SML\_SWE\_SRW

MXR\_FM  
MXR\_ENBL

SHDN\_RX\_LNA  
SHDN\_TX\_LNA  
RX\_H\_TX\_L\_B  
RX\_H\_TX\_L  
TR\_VC2  
TR\_VC1  
TR\_VC1\_B

SHDN\_RX\_LNA  
SHDN\_TX\_LNA  
RX\_H\_TX\_L\_B  
RX\_H\_TX\_L  
TR\_VC2  
TR\_VC1  
TR\_VC1\_B

U\_AT86RF  
AT86RF.SchDoc

VCC\_ANA

VCC\_3V3  
R3  
10k  
AT86\_RESET  
AT86\_IRQ  
RPI\_SS\_AT86  
RPI\_SCK  
RPI\_MISO  
RPI\_MOSI

AT86\_RSTN  
AT86\_IRQ  
AT86\_CS  
AT86\_SCK  
AT86\_MISO  
AT86\_MOSI

AT86\_LVDS

AT86\_RF\_09

AT86\_CLKOUT  
AT86\_RF\_24

both LNAs are in shutdown mode

VCC\_3V3  
R8  
R9  
102k 102k

VCC\_3V3 VCC\_5V0

TR\_VC1  
TR\_VC2

RX\_H\_TX\_L  
RX\_H\_TX\_L\_B

RX\_H\_TX\_L  
RX\_H\_TX\_L\_B

SHDN\_RX\_LNA  
SHDN\_TX\_LNA

SHDN\_RX\_LNA  
SHDN\_TX\_LNA

U\_MIXER  
MIXER.SchDoc

REF\_CLK\_IN  
MODEM\_RFIO

TX\_OUT

RX\_IN

RF\_BYPASS

MXR\_FM  
MXR\_ENBL

TR\_VC1  
TR\_VC1\_B  
TR\_VC2

TR\_VC1  
TR\_VC2

VCC\_ANA

VCC\_3V3

VCC\_3V3

R5  
10k

MXR\_RESET  
RPI\_SS\_MXR  
RPI\_MOSI  
RPI\_MISO  
RPI\_SCK

MXR\_CS  
MXR\_SO\_SI  
MXR\_SO\_GP4  
MXR\_SCK

U\_RFFE  
RFFE.SchDoc

VCC\_5V  
VCC\_ANA

TR\_VC1  
TR\_VC2

DPDT\_1\_VC1  
DPDT\_1\_VC2

DPDT\_2\_VC1  
DPDT\_2\_VC2

SHDN\_RX\_LNA  
SHDN\_TX\_LNA

SHDN\_RX\_LNA  
SHDN\_TX\_LNA

TX\_IN

RX\_OUT

RF\_IN

RF\_BYPASS

J2 CON-SMA-EDGE-S

LXES15AAA1-153  
D3  
GND

J3 CON-SMA-EDGE-S

LXES15AAA1-153  
D4  
GND


MF3 MF2 MF1  
FIDUCIAL FIDUCIAL FIDUCIAL  
MF6 MF5 MF4  
FIDUCIAL FIDUCIAL FIDUCIAL

U\_TITLE  
TITLE.SchDoc

RFFE MODE	TR_VC1	TR_VC2	RX_H_TX_L	~RX_H_TX_L	RX_H_TX_L	~RX_H_TX_L	MXRMODE	TR_VC1	TR_VC2	~TR_VC1	TR_VC1	TR_VC2
MODE	TR_VC1	TR_VC2	DPDT_1_VC1	DPDT_1_VC2	DPDT_2_VC1	DPDT_2_VC2	MODE	TR_VC1	TR_VC2	RXMODE	TXMODE	MXR_RESET
OFF	'0'	'0'	'X'	'X'	'X'	'X'	OFF	'0'	'0'	'X'	'X'	'0'
BYPASS	'1'	'0'	'X'	'X'	'X'	'X'	BYPASS	'1'	'0'	'X'	'X'	'0'
RX LOWPASS	'0'	'1'	'1'	'0'	'1'	'0'	RX	'0'	'1'	'1'	'0'	'1'
RX HIPASS	'0'	'1'	'0'	'1'	'0'	'1'	RX	'0'	'1'	'1'	'0'	'1'
TX LOWPASS	'1'	'1'	'0'	'1'	'0'	'1'	TX	'1'	'1'	'0'	'1'	'1'
TX HIPASS	'1'	'1'	'1'	'0'	'1'	'0'	TX	'1'	'1'	'0'	'1'	'1'



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TITLE		PRODUCT NAME / P/N	
Top Level Design		CaribouLite / CARIBOULITE-V2	
DESIGNER: DM		REVIEWER: -	
DATE: 6/21/2021		REV: B	
SIZE A3	DRAWING NO. DN00001	SHT 2	OF 7
			
		www.cariboulabs.co Open Source RF Tools	

## A



## B




## C

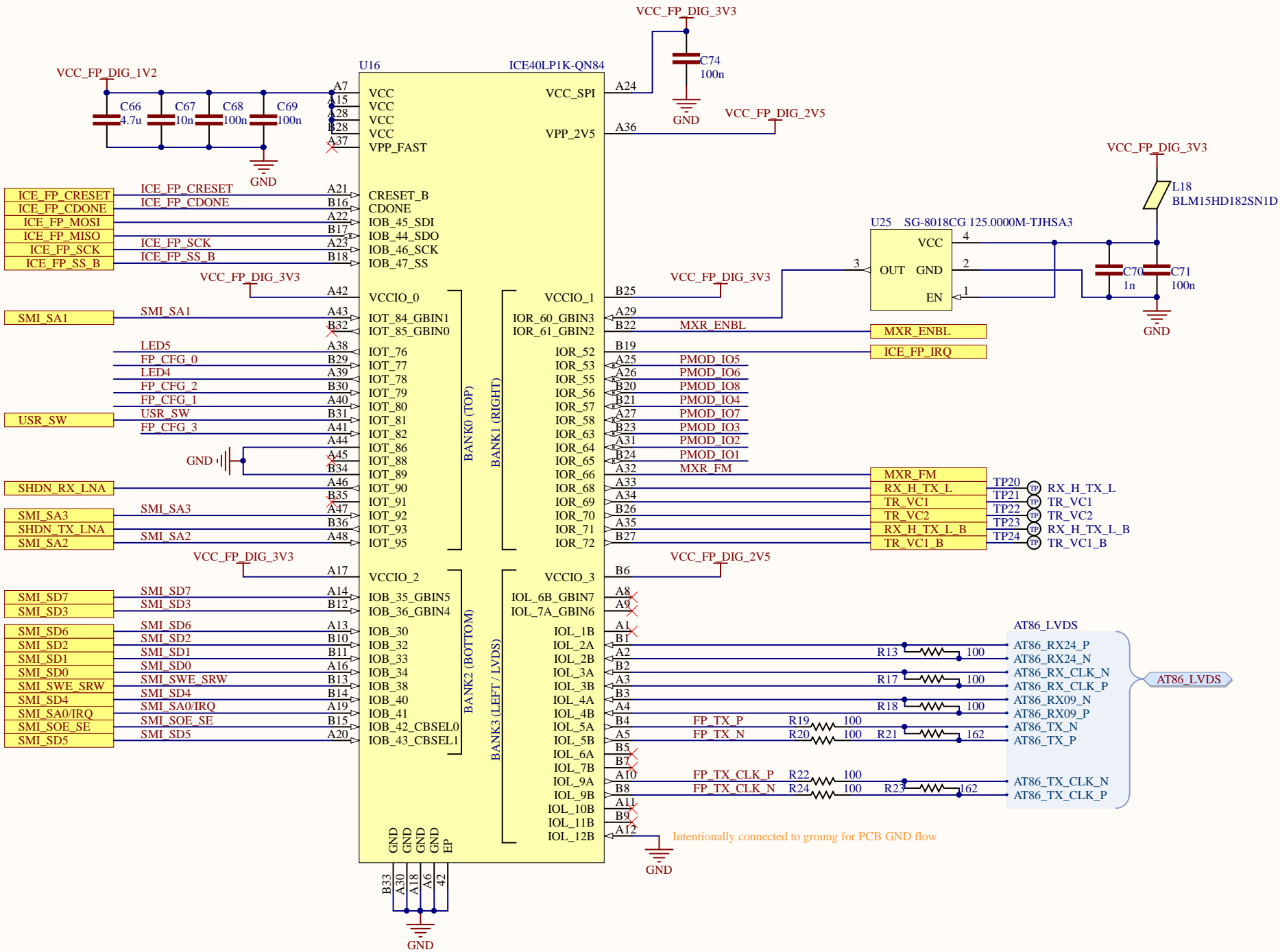


## C



TITLE Connectors and Power		PRODUCT NAME / P/N CaribouLite / CARIBOULITE-V2		 <a href="http://www.cariboulabs.co">www.cariboulabs.co</a> Open Source RF Tools
DESIGNER: DM				
REVIEWER: -				
DATE: 6/20/2021		REV: B		
SIZE A3	DRAWING NO. DN00001	SHT 3	OF 7	

FPGA



LVDS Negated Pairs

AT86\_TX  
AT86\_RX09  
AT86\_TX\_CLK

The other two are direct logic.

PROGRAMMING

POR=> Check SS  
1. if SS='1' => if NVCM programmed, use NVCM, otherwise use external flash (SPI MASTER).  
2. if SS='0', wait to be configured from external controller through SPI

RESET - restarts the configuration  
CDONE - before configuration finished is '0', When done turns '1'

Calculation of differential lines

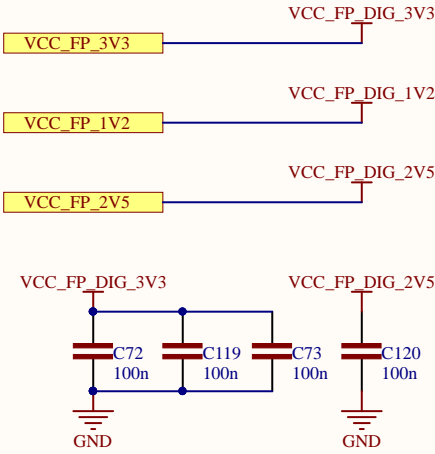
VCCIO = 2.5V  
VOD = 0.5V (this is the differential swing nominal)  
Rouput = 30 Ohms (given by ICE40 Specs)

The parallel output resistor:  
 $VCCIO = 2.5V \Rightarrow R_p = 2 * (50 * 2.5 / (2.5 - (2 * 0.5))) = 250 / 1.5 = 166 \text{ Ohms} \Rightarrow R_p / 2 = 83.3 \text{ Ohms}$   
The series output resistors:  
 $VCCIO = 2.5V \Rightarrow R_s = (50 * 83.3) / (83.3 - 50) - 30 = 4165 / 33.3 - 30 = 95 \text{ Ohms}$

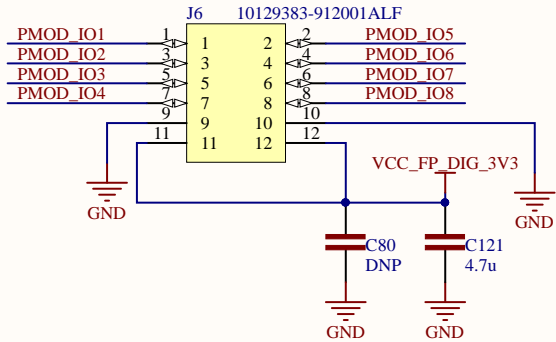
But, we want to make Rs a 100 Ohms to minimize BOM =>  
 $R_s = 100 \Rightarrow R_p = 162.5 \text{ Ohms} \Rightarrow V_{od} = 0.48 \text{ Vdiff} \Rightarrow \text{Looks good enough!}$

Connect the positive or true polarity side of the differential pair to the DPxxA input and the negative or complementary side of the pair to the DPxxB input.  
==== If it is easier to route the differential pair, the input pins can be swapped, which produces an inverted input value. ====  
====The inverted input value can subsequently be inverted by logic within the FPGA. ====

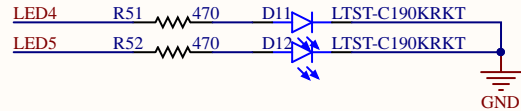
POWER TERMINALS



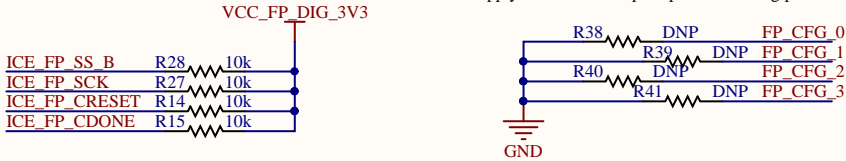
PMOD





LEDS



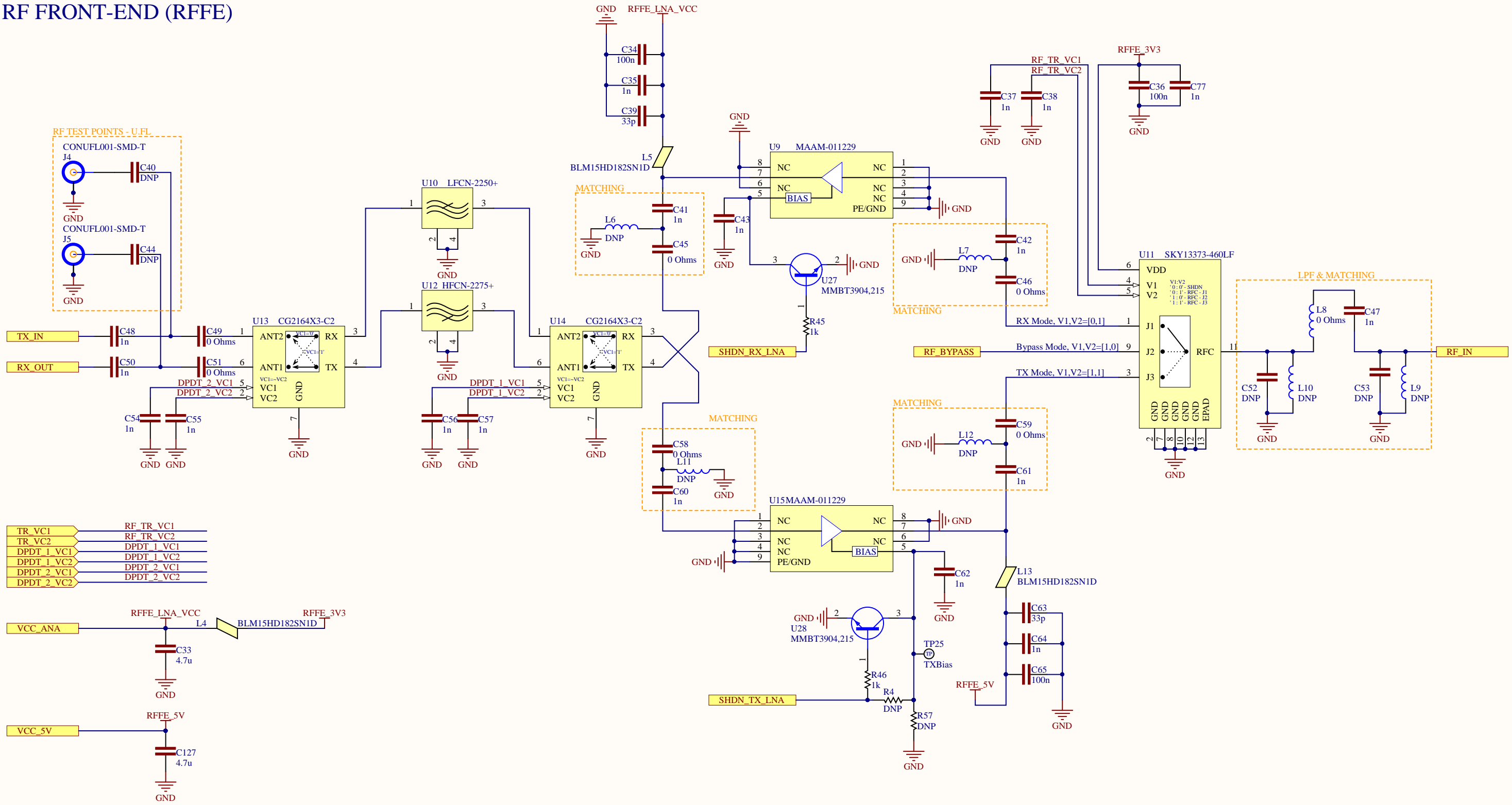
Configuration Resistors - Place 10k for pulldown as needed  
Apply internal FPGA pullups on all config pins



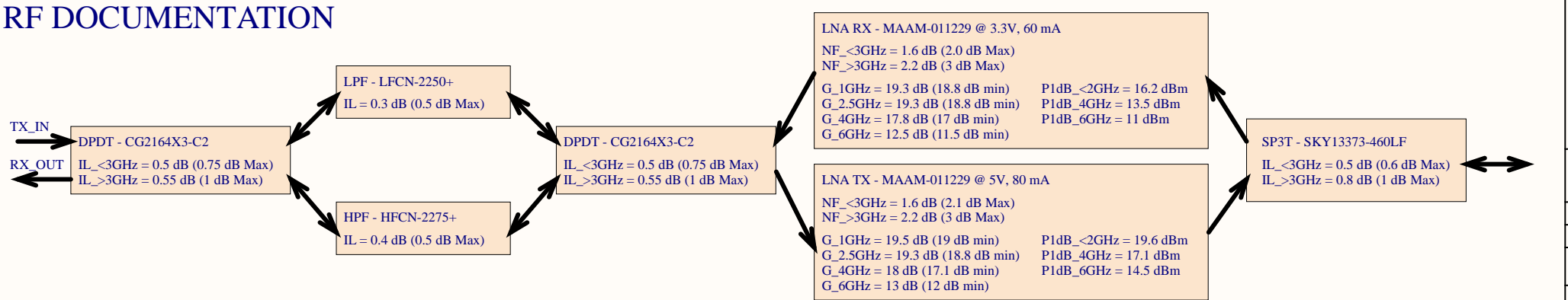
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TITLE FPGA ICE40LP		PRODUCT NAME / P/N CaribouLite / CARIBOULITE-V2		 <a href="http://www.cariboulabs.co">www.cariboulabs.co</a> Open Source RF Tools
DESIGNER: DM				
REVIEWER: -				
DATE: 6/28/2021		REV: B		
SIZE A3	DRAWING NO. DN00001	SHT 4	OF 7	
		 open source hardware		

RF FRONT-END (RFFE)




RF DOCUMENTATION





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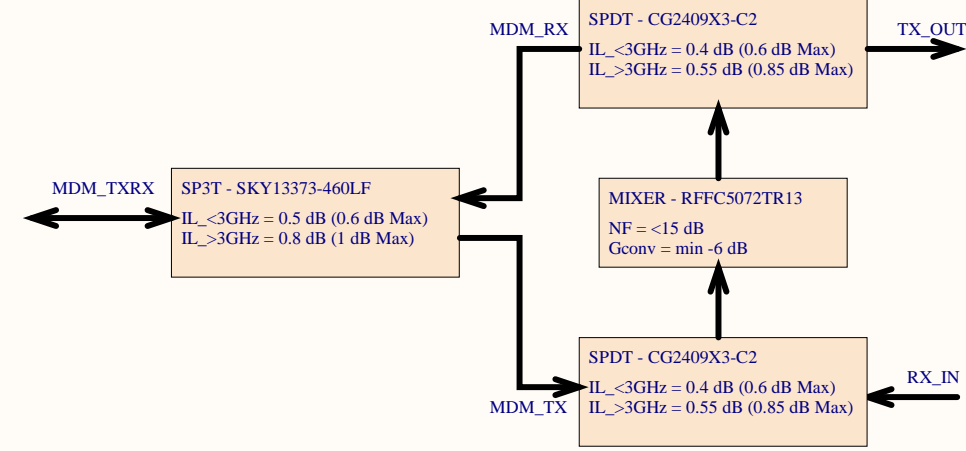
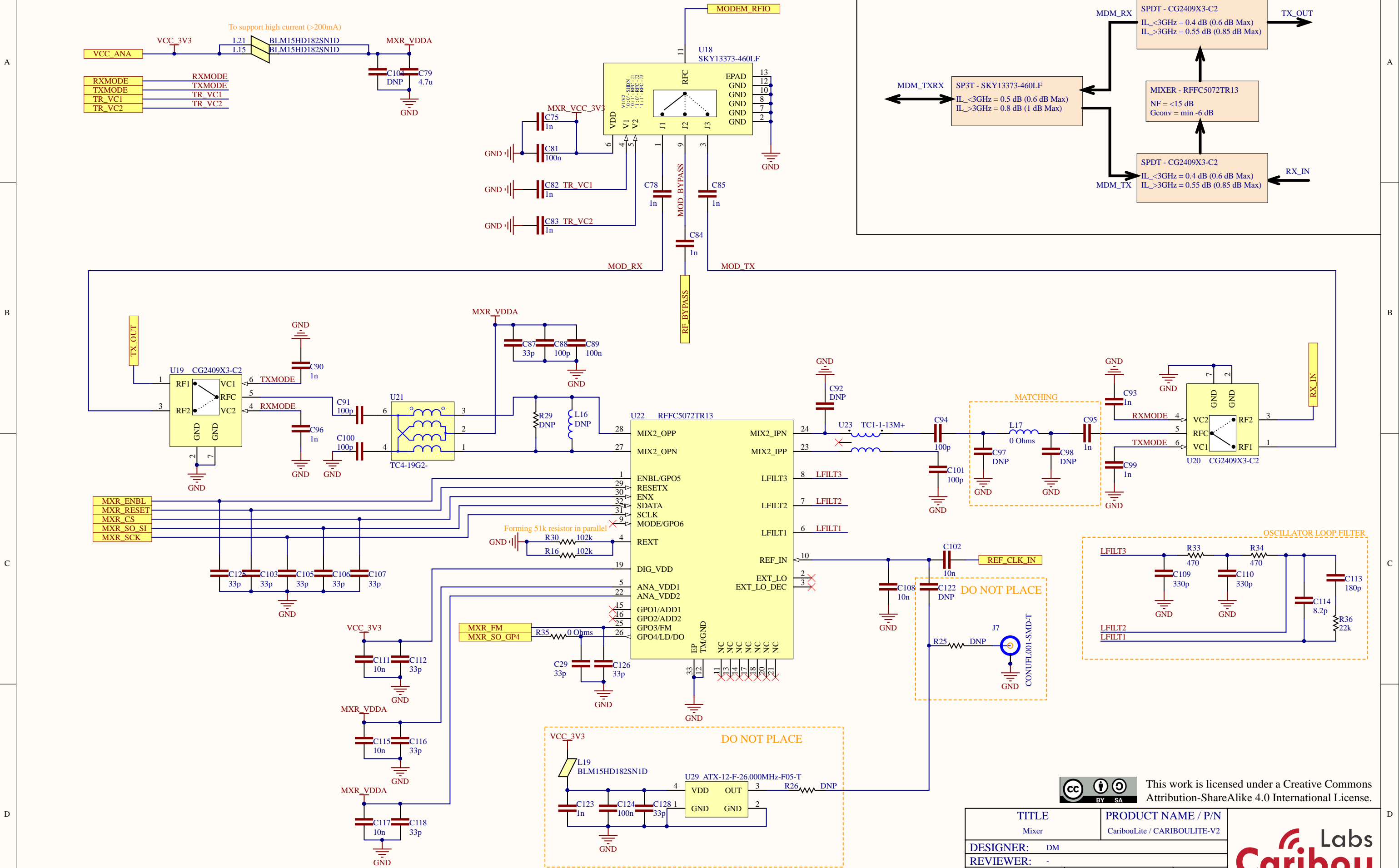
TITLE RF Front-End		PRODUCT NAME / P/N CaribouLite / CARIBOULITE-V2	
DESIGNER: DM			
REVIEWER: -			
DATE: 6/27/2021		REV: B	
SIZE A3	DRAWING NO. DN00001	SHT 5	OF 7





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MIXER - QORVO RFFC5072

RF DOCUMENTATION

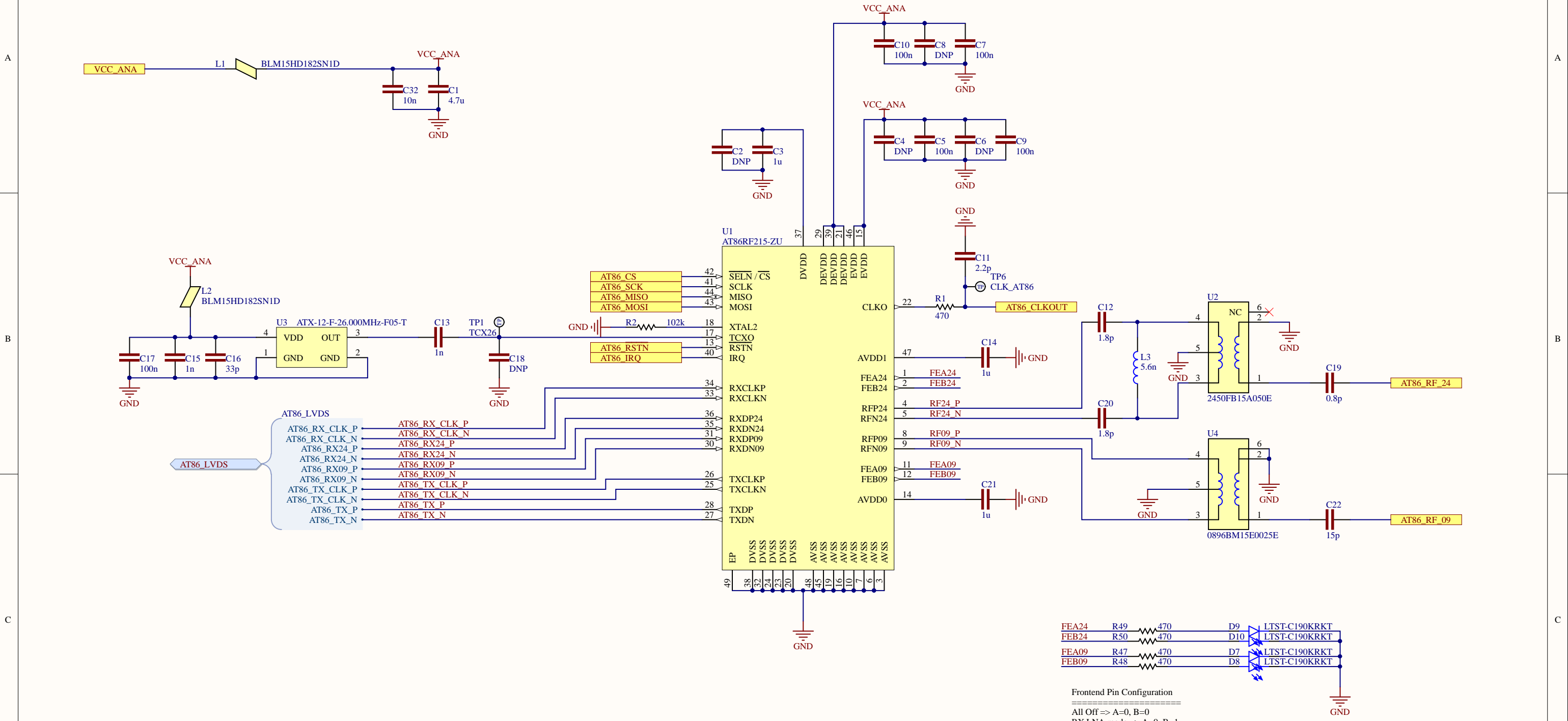


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TITLE Mixer		PRODUCT NAME / P/N CaribouLite / CARIBOULITE-V2		<div><p>www.cariboulabs.co Open Source RF Tools</p></div>
DESIGNER:     DM				
REVIEWER:    -				
DATE:   6/28/2021		REV:    B		
SIZE A3	DRAWING NO. DN00001	SHT 6	OF 7	
				



MODEM - AT86RF215



RF DOCUMENTATION

