Semiconductors

AN10287

PN531 Demo Board

Rev. 1.3 — 2006-02-02 Application note

tocument information

Info	Content
Keywords	NFC, PN531 C2, USB, HSU, I²C, SPI
Abstract	PN531 C2 Demo board Application note. How to use PN531 C2 Demo board

PHILIPS

Revision history

Rev	Date	Description
1.0	2004 March 1	- Initial release for PCB 1293-3
1.1	2004 June 14	- Udated for PCB 1293-4
1.2	2004 Dec 6	- Udated for PCB1296-1 & PCB1402-2
1.3	2006 Jan 16	- Udated for PCB1648-1 & PCB1643-1

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1. Contents

Date of release:16 Jan 2006
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Published in The Netherlands

2. Introduction

PN531 is a Near Field Communication device that embeds a contact-less front end, a contact-less UART and an 80C51 micro controller. It supports Mifare and Felica standards as well as ISO14443 type A devices and uses several links with the host (USB, High Speed Uart, I2C and SPI).

References

Document name	*Please refer to:*
PN531 v4.2 user manual	(UM0501-02)
PN531 C2 Datasheet	111903.pdf
Mifare specification	www.semiconductors.philips.com/markets/identification/datasheets/
DESfire specification	M075031.pdf
ISO14443 specification (T=CL)	ISO14443-3 specification ISO14443-4 specification
NFCIP-1 specification	ISO18092 specification

Glossary

NFC	Near Field Communication
HSU	High Speed UART
SMX	Philips SmartMX (Memory Extension)

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3. Demo Boards Description

Two different host interface interfaces are proposed with the PN531 demo board.
One is using the USB interface and the other one use the HSU interface.
Both demo boards are composed of 4 parts, the antenna, the matching circuit, the PN531 and the interface.

The USB demo board is bus powered and VBUS should stay between 4.4V and 5.25V.

With the HSU demo board, an external +5V supply voltage is needed (figure 1).

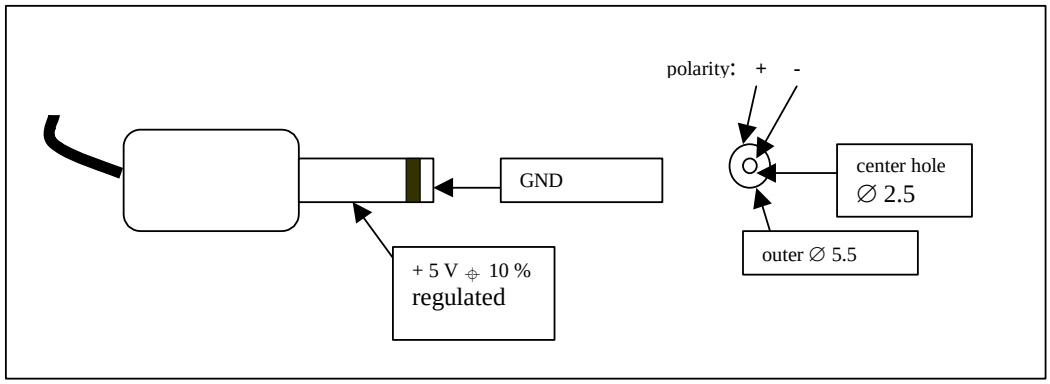

Figure 1

3.1 Host interfaces

The host interface selection is done by a hardware configuration (interface mode lines I0 and I1) during the power up sequence of the chip.
The PN531 firmware reads I0, I1 ports during power up sequence and sets the ConfigIO_I[1..0] bits with the right configuration.

HOST interface selection	I0 pin	I1 pin
HSU (High Speed UART)	0	0
I2C	1	0
SPI	0	1
USB	1	1

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The MATX IC block is an analog module for host communication supporting/acting either as USB transceivers or standard interface for SPI, I2C or high speed RS-232 interface.

HOST interface	NSS pin	MOSI pin	MISO pin	SCK pin
HSU (High Speed UART)	RX	TX	P71	P72
I2C	SCL	SDA	P71	P72
SPI	NSS	MOSI	MISO	SCK
USB	D+	D-	P71	P72

For example, when HSU is configured (I0=I1=0), NSS pin is RX, MOSI pin is TX, MISO and SCK pins are GPIOs P71 and P72.

When using the HSU demo board, it is still possible to change the configuration for either the I2C interface or the SPI interface.
The following table shows you how to configure the board:

Strapp purpose:

PCB1643-1 HSU:

INTERFACE	STRAPP CONNECTED	STRAPP NOT CONNECTED
HSU	ST2, ST5, ST6, ST9	ST3, ST7, ST8
I2C	ST2, ST6, ST9	ST3, ST5, ST7, ST8
SPI mode 0	ST3, ST5, ST9	ST2, ST6, ST7, ST8
SPI mode 1	ST3, ST8, ST9	ST2, ST5, ST6, ST7
SPI mode 2	ST3, ST7, ST9	ST2, ST5, ST6, ST8
SPI mode 3	ST3, ST7, ST8, ST9	ST2, ST5, ST6

ST2: Select**s HREQ** signal when using handshake mode.
As handshake mode is only available for I2C interface and HSU interface, do not connect ST2 when using either SPI or USB interface.

ST3: Select**s MOSI** signal when using SPI mode.
Connect ST3 when using SPI interface.

ST4: This switch is for test purpose and should not be connected in any of the operating modes.

ST5, ST6: These switches are respectively connected to I0 and I1.
Use ST5 and ST6 to change the host interface.

ST7: selects the handshake mode or the SPI mode.
When using SPI interface, use ST7 together with ST8 to configure the SPI mode.
ST7 selects the handshake mode when using either the I2C interface or the HSU interface.

ST8: selects the SPI mode.

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Remark: R1 to R4 are not populated, those resistors may be required in case of either the SPI interface or the I2C interface when the host processor does not include internal pull-up resistor.
ST9: Connects PVDD at the same potential as DVDD.
In case the host processor is using a different voltage, don't connect ST9 and provide PVDD with the processor power supply.

ST10: This switch is for test purpose and should not be connected in any of the operating modes.

PCB1648-1 USB:
The USB demo board does not allow the host interface modification.

ST2: Selects the PID/VID within the USB device descriptor.
When connected, it selects the Sony descriptor otherwise it selects the Philips one..

ST4: This switch is for test purpose and should not be connected in any of the operating modes.

ST10: This switch is for test purpose and should not be connected in any of the operating modes.

3.2 Electrical diagrams

The following figures give the electrical diagram of the central part with NFC device, of the antenna and of the USB and serial interface, are given on the next pages.

1 -HSU Demo board

2 - USB Demo Board

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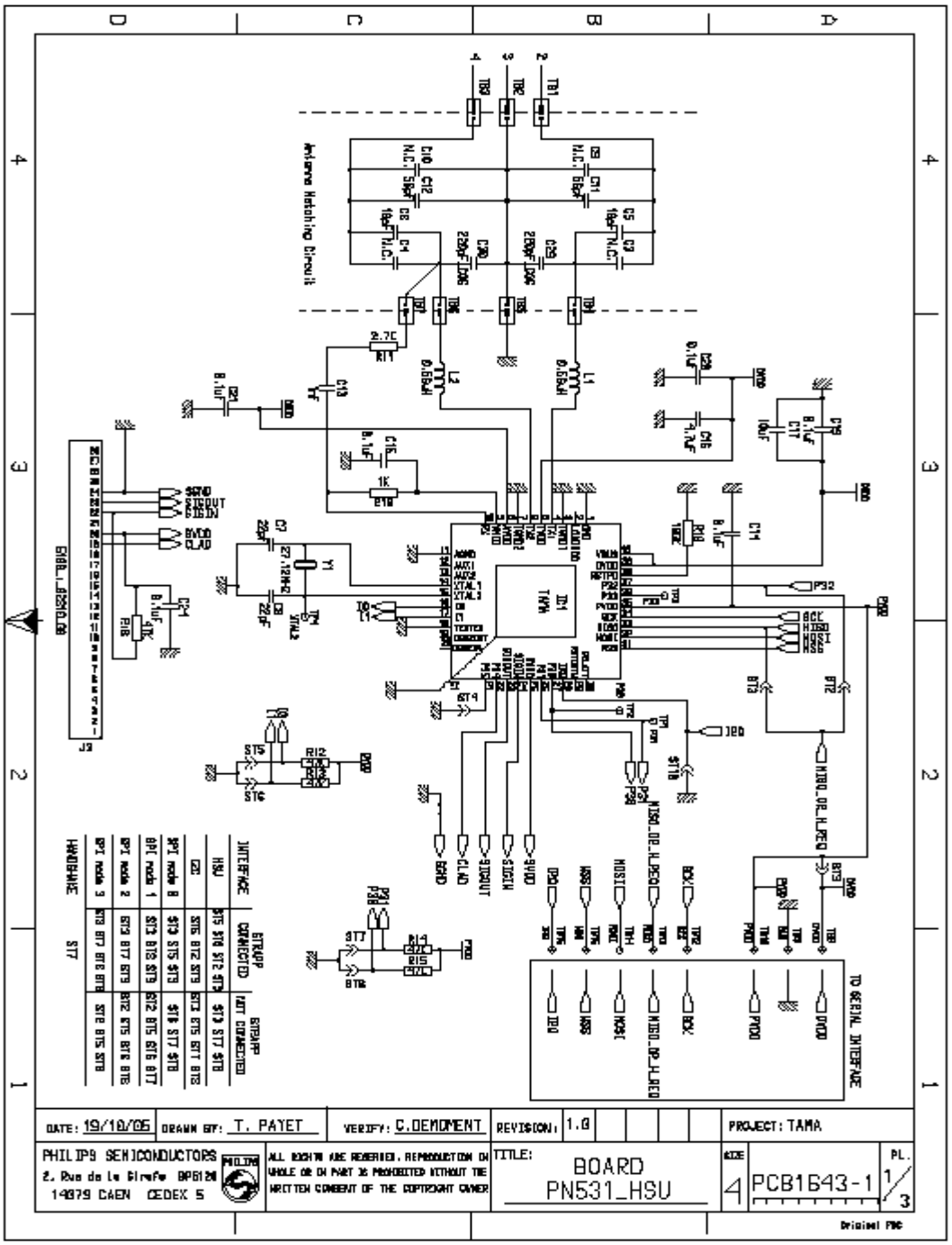

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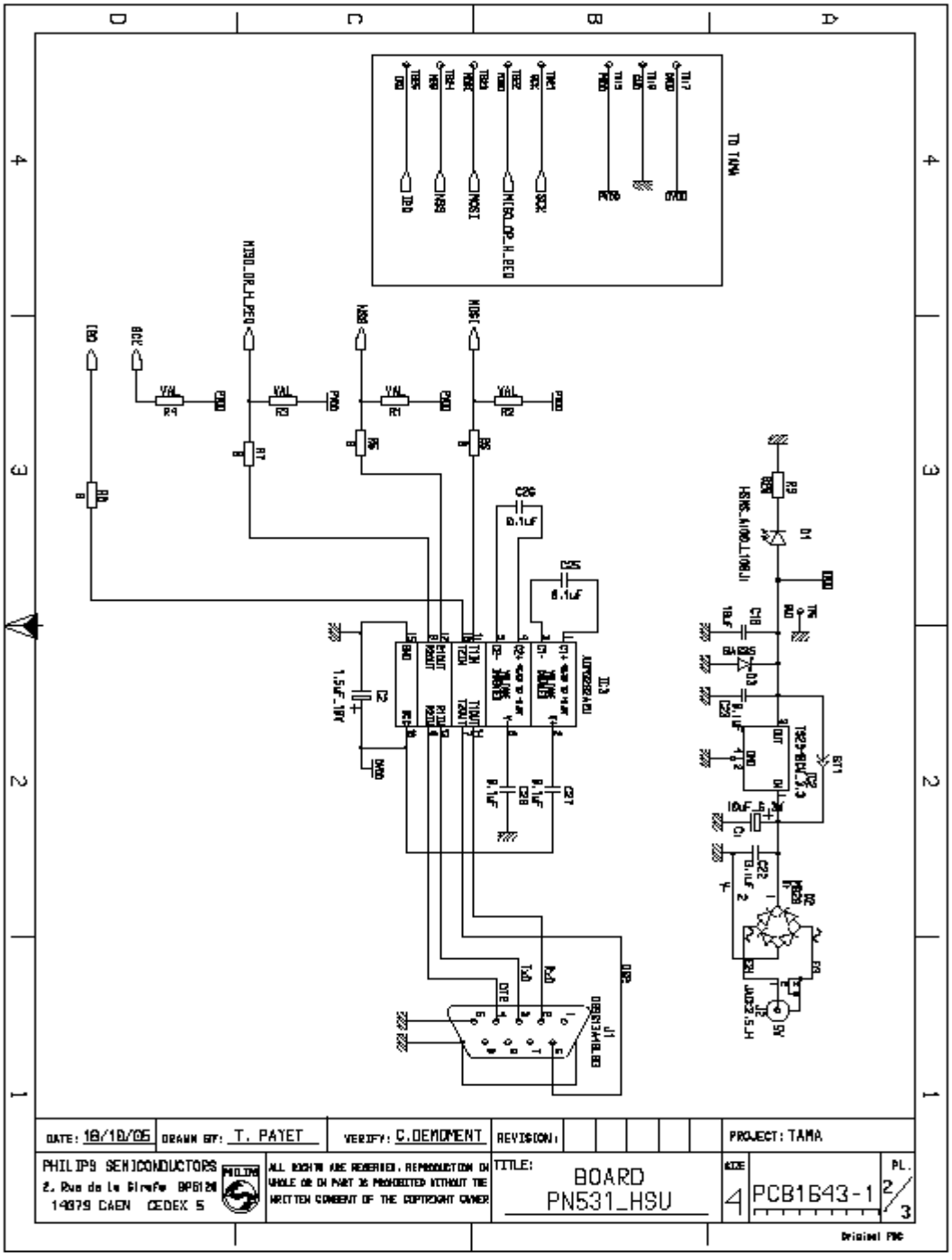

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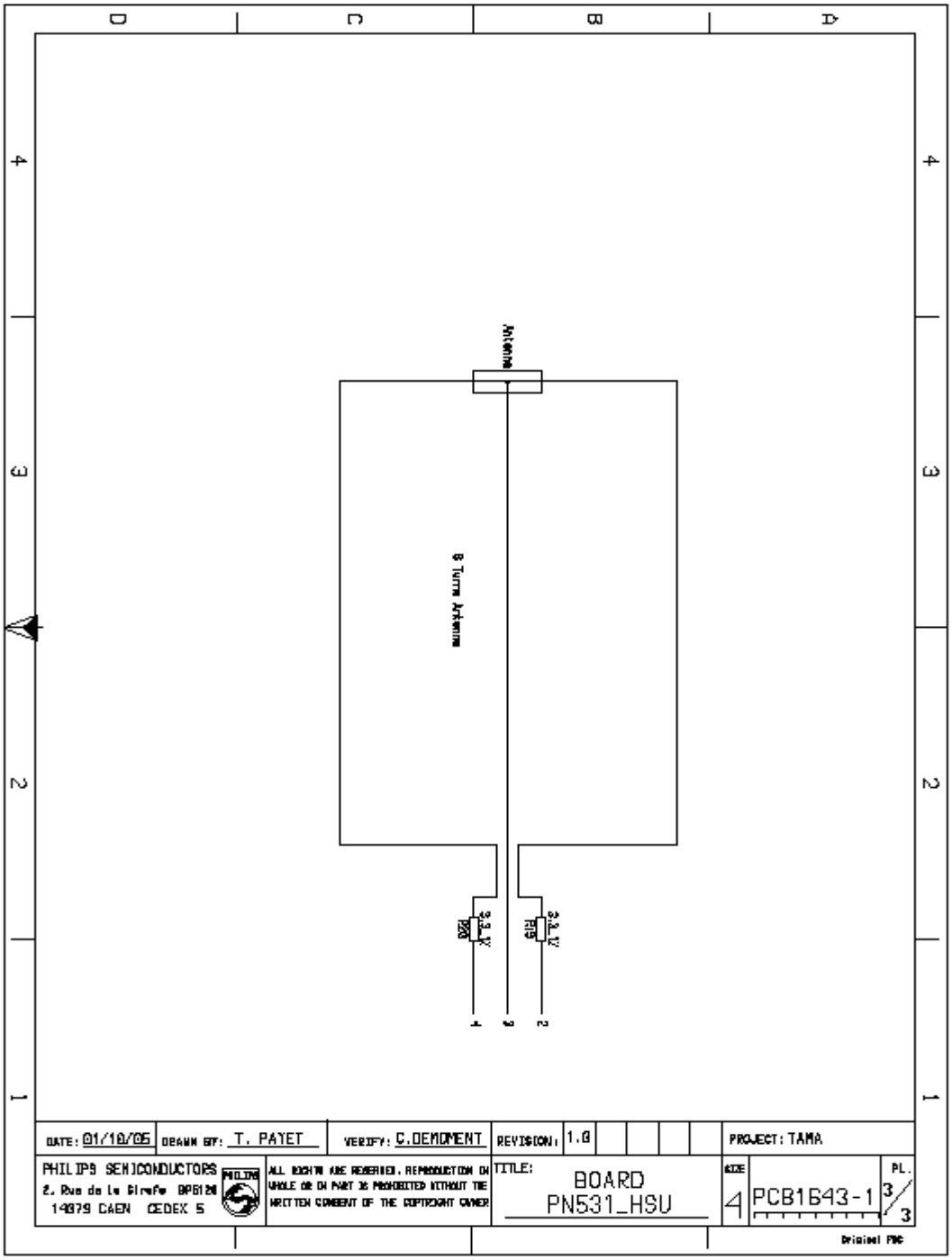

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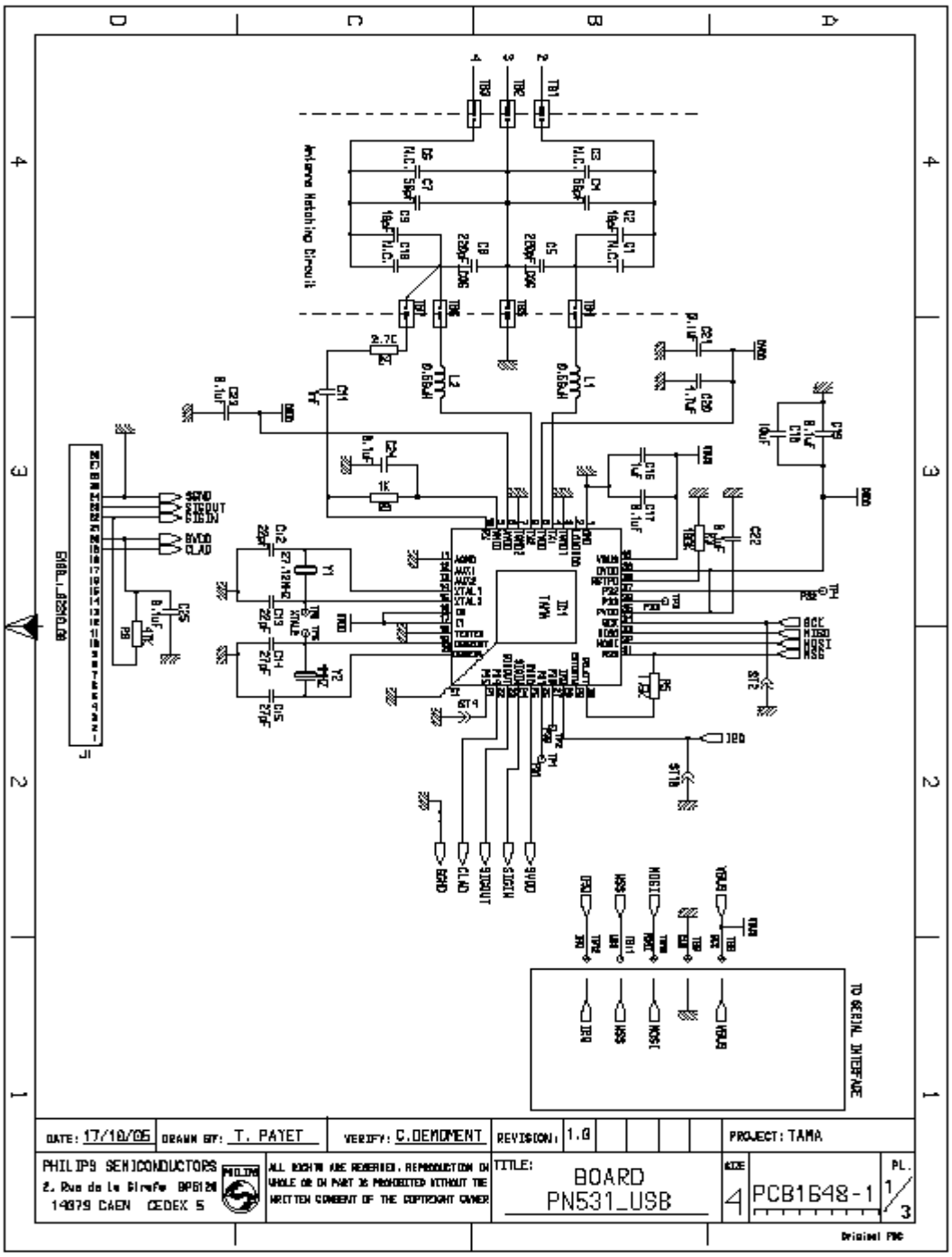

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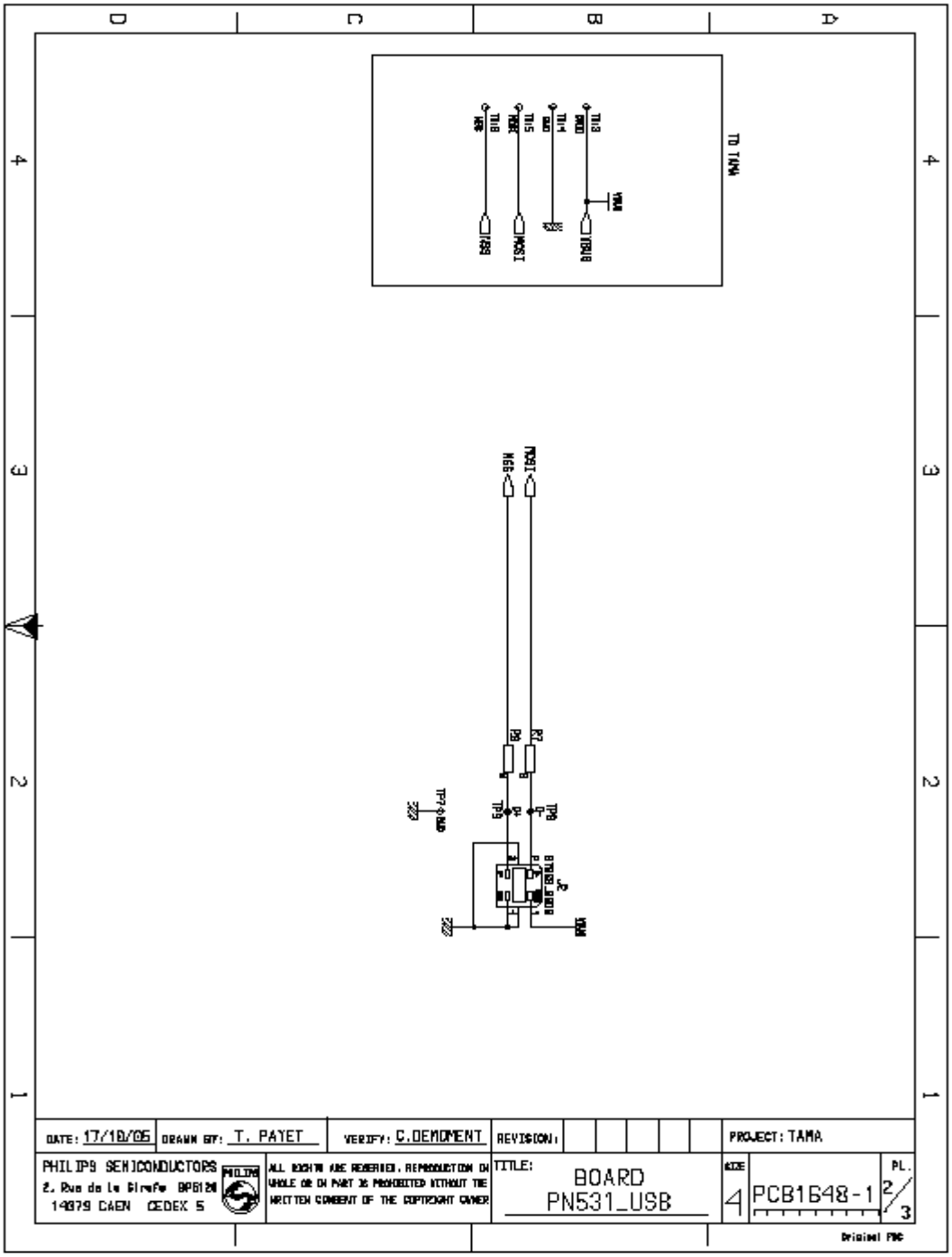

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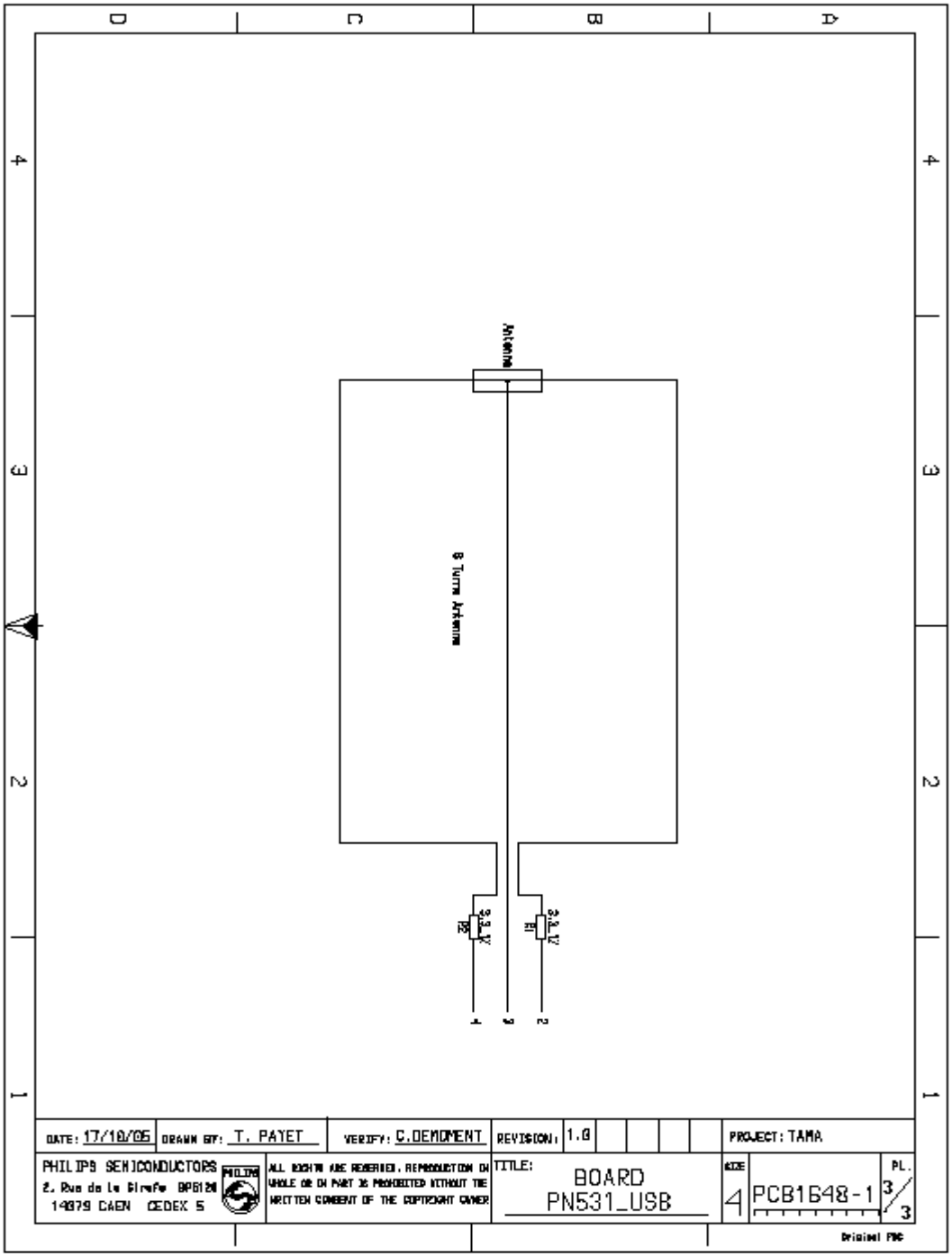

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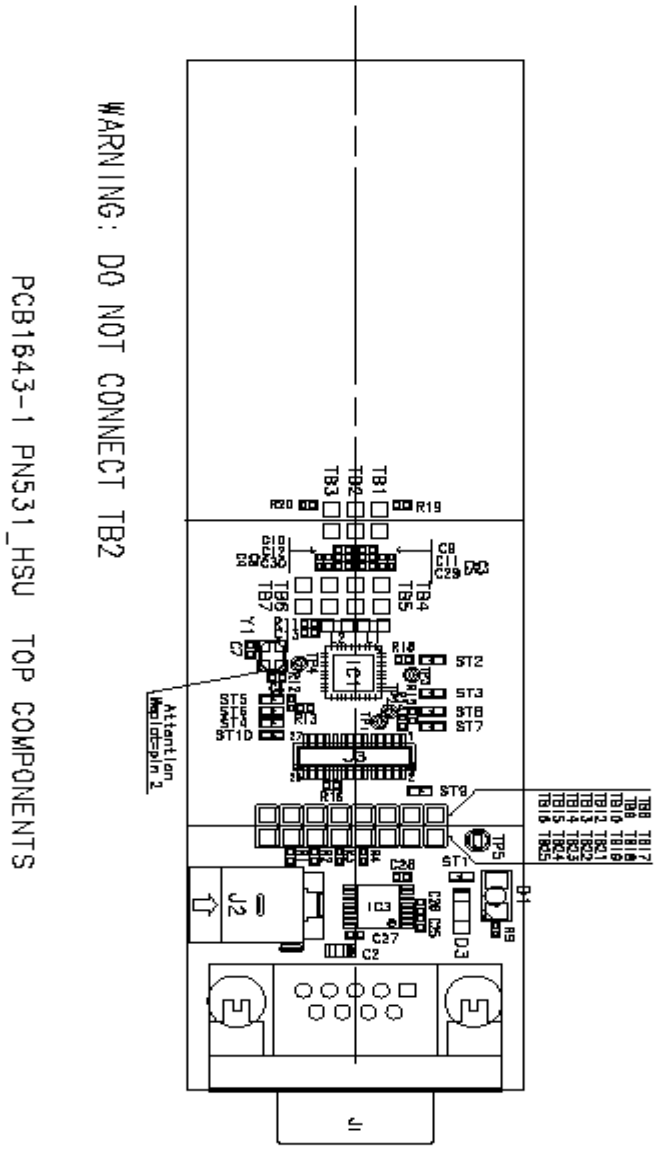
3.3 Layout



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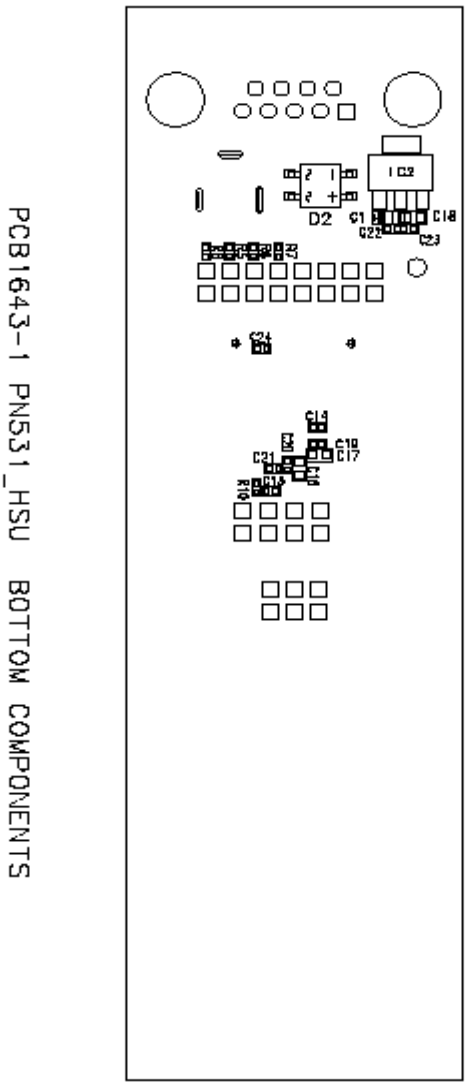

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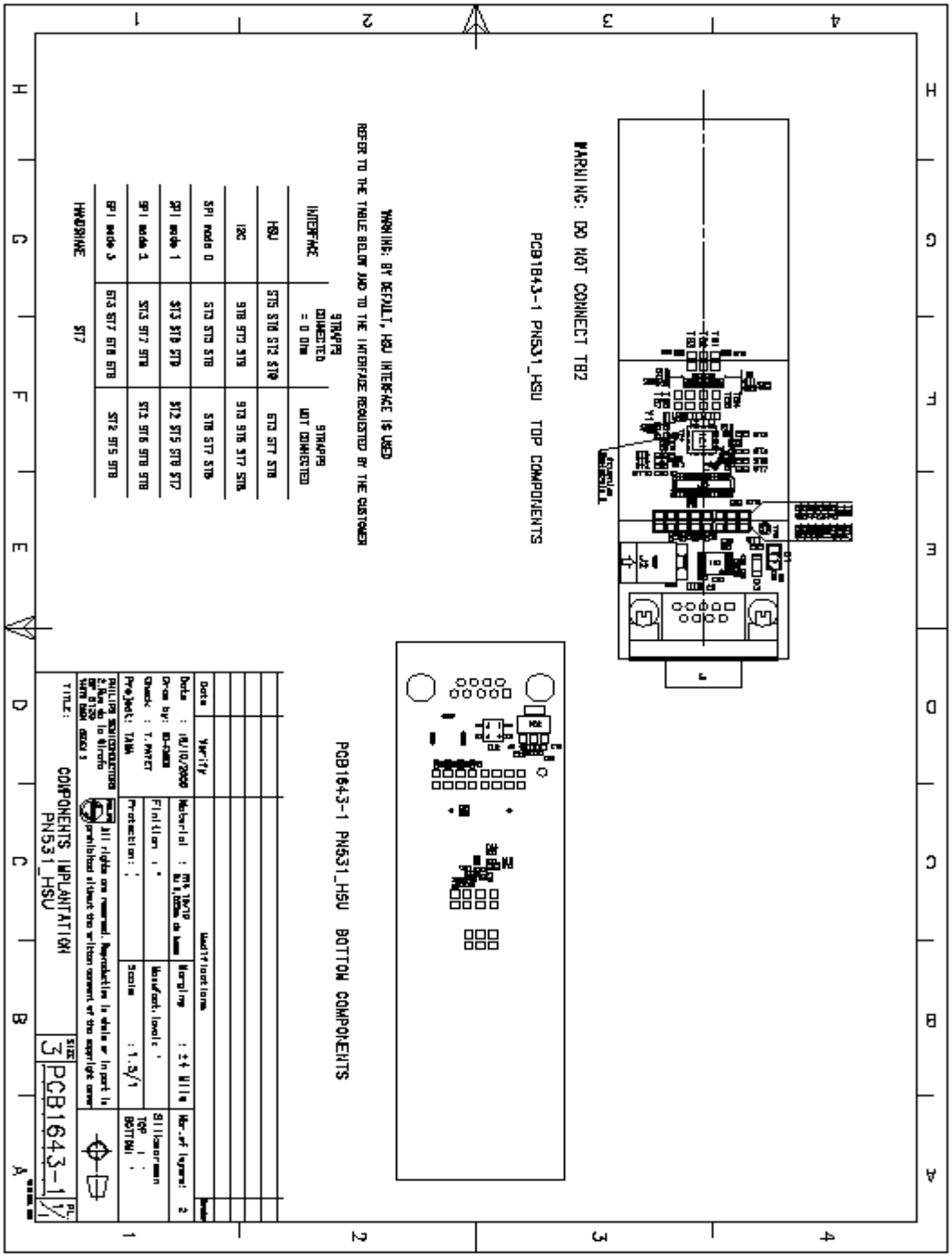

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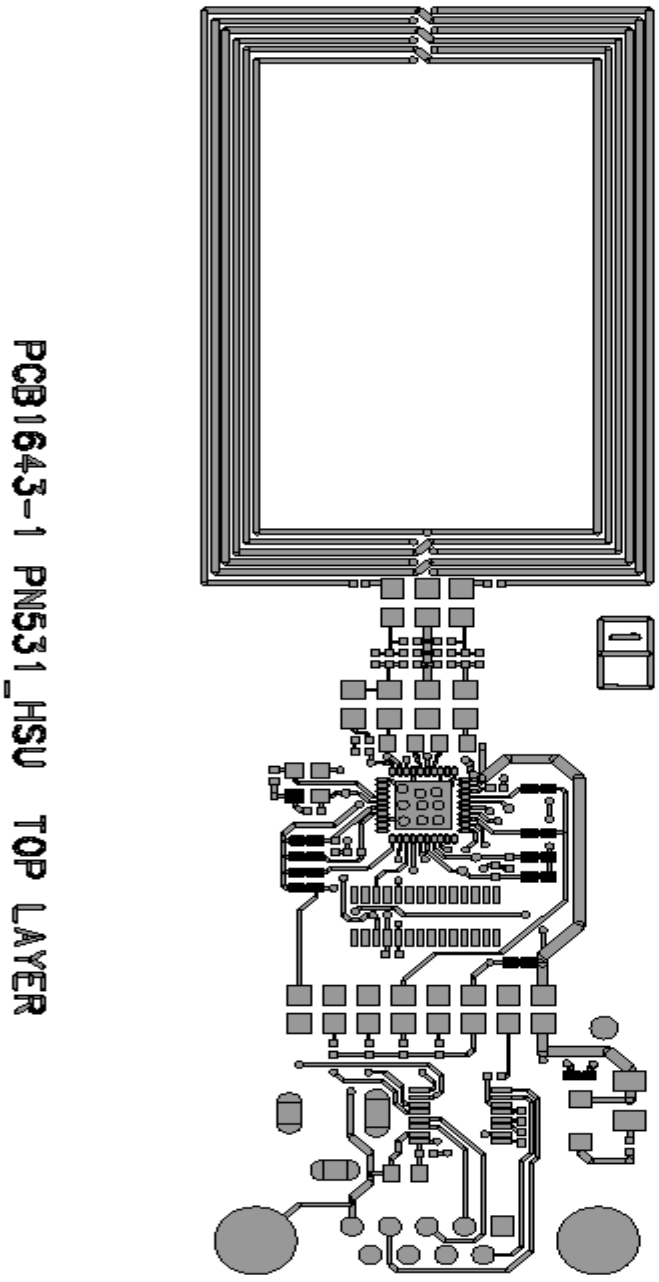

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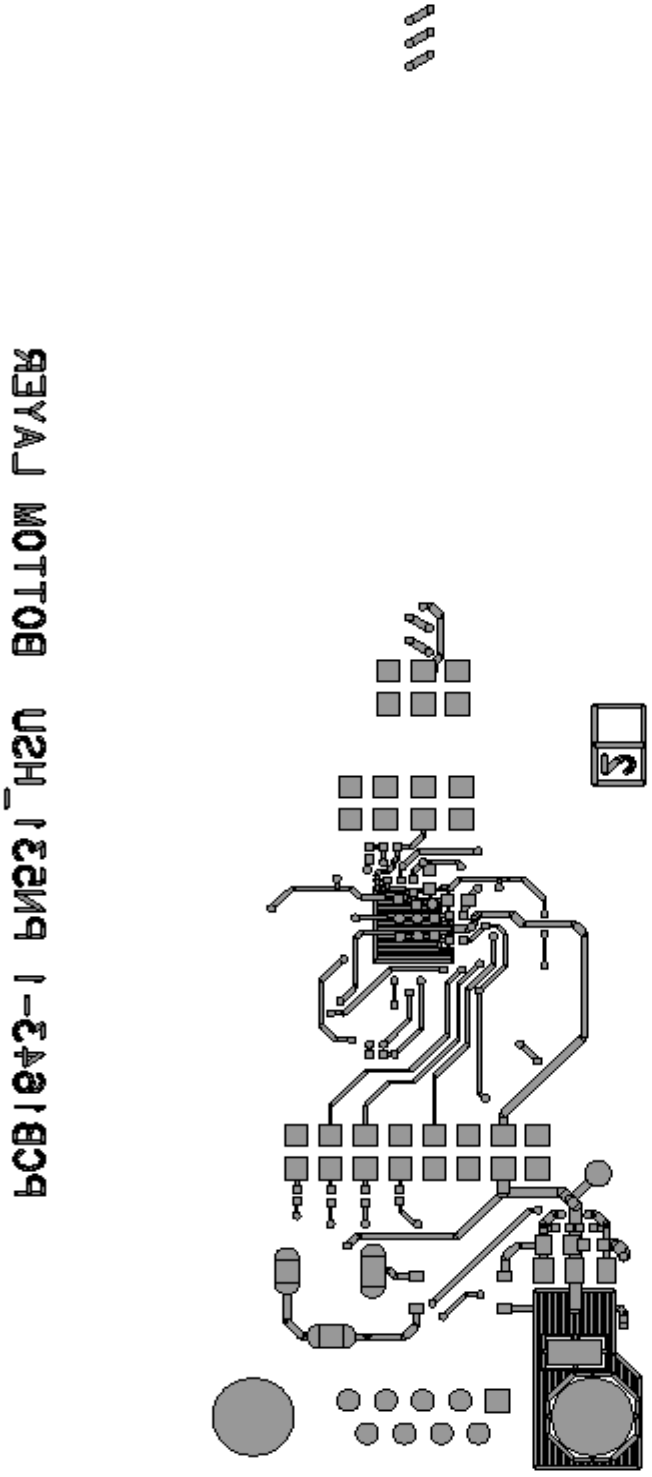

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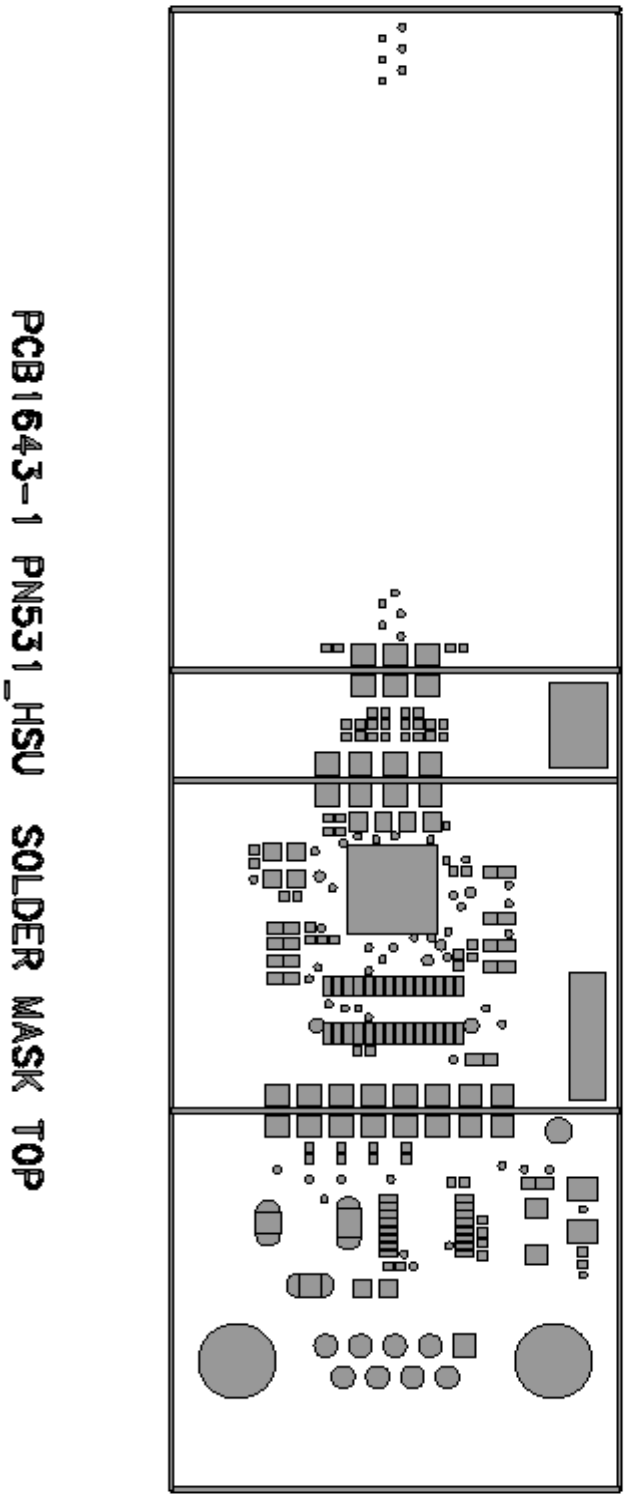

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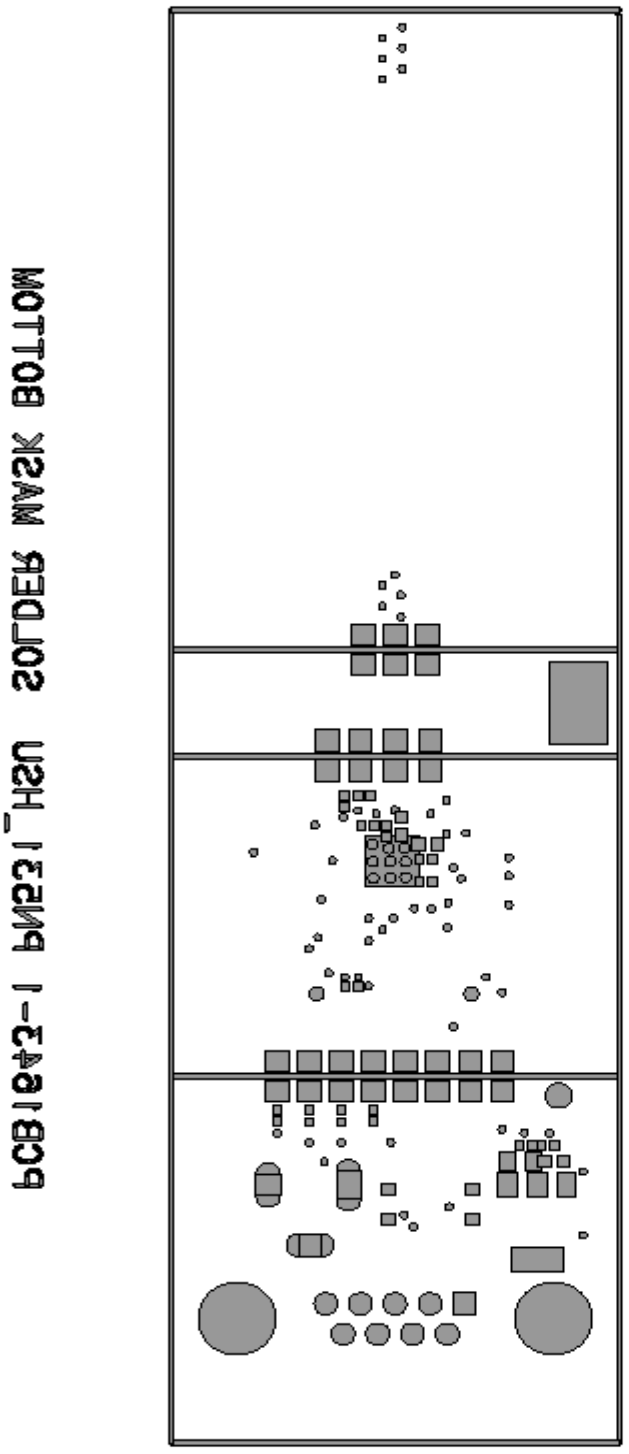

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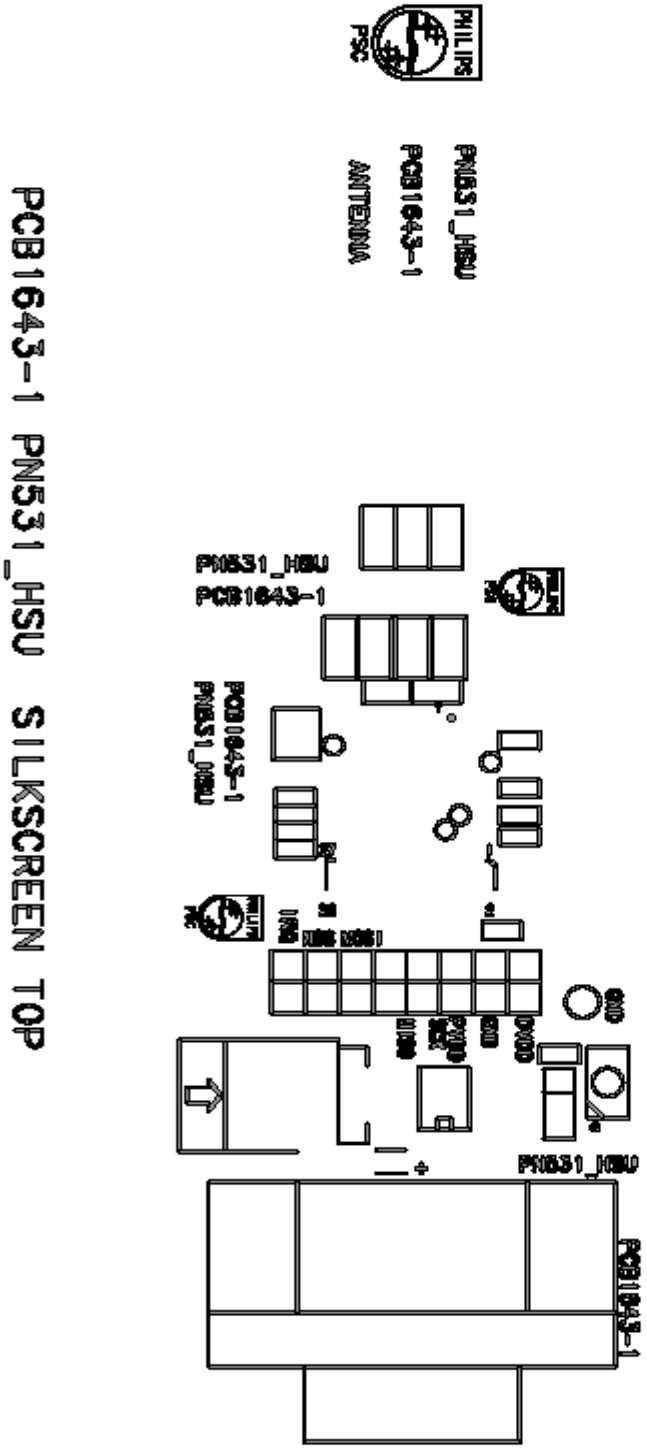

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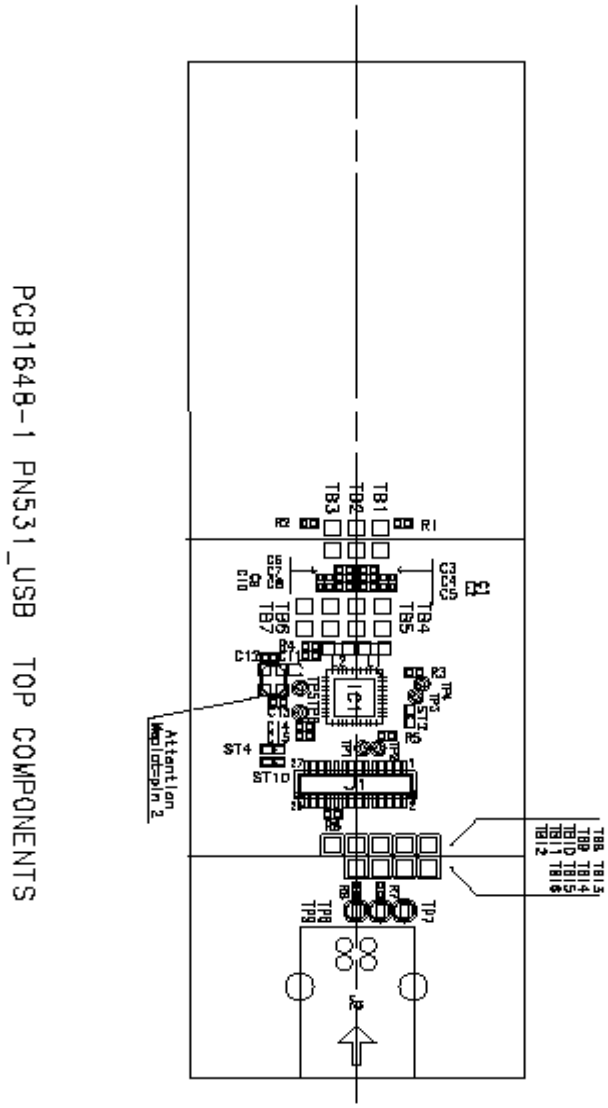

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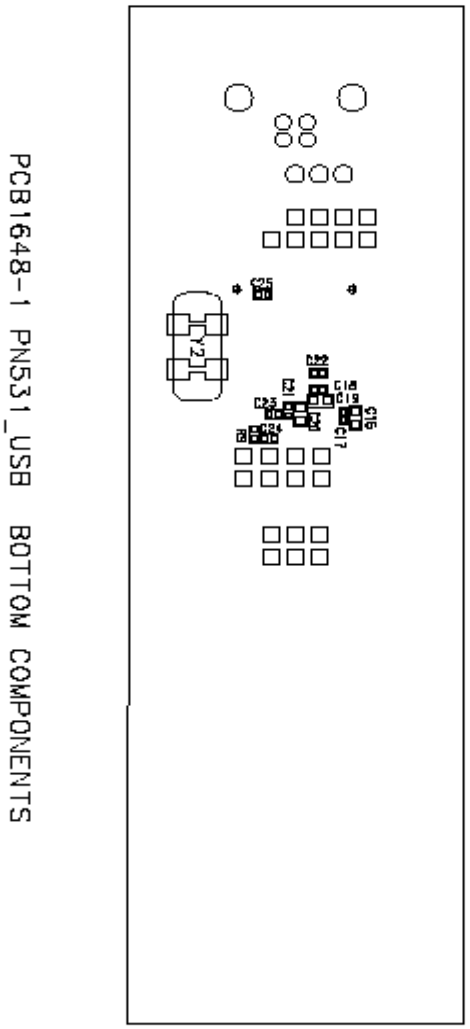

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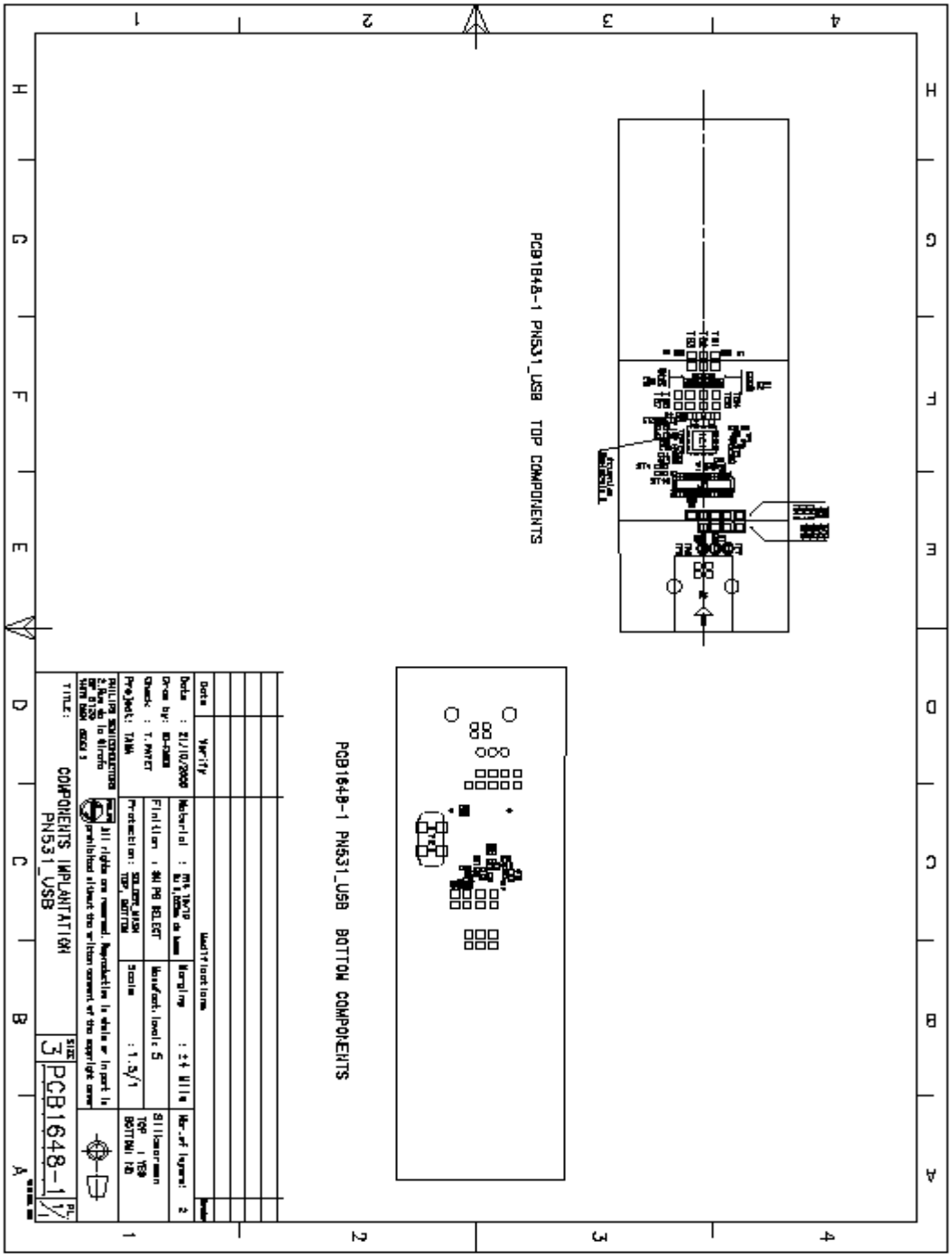

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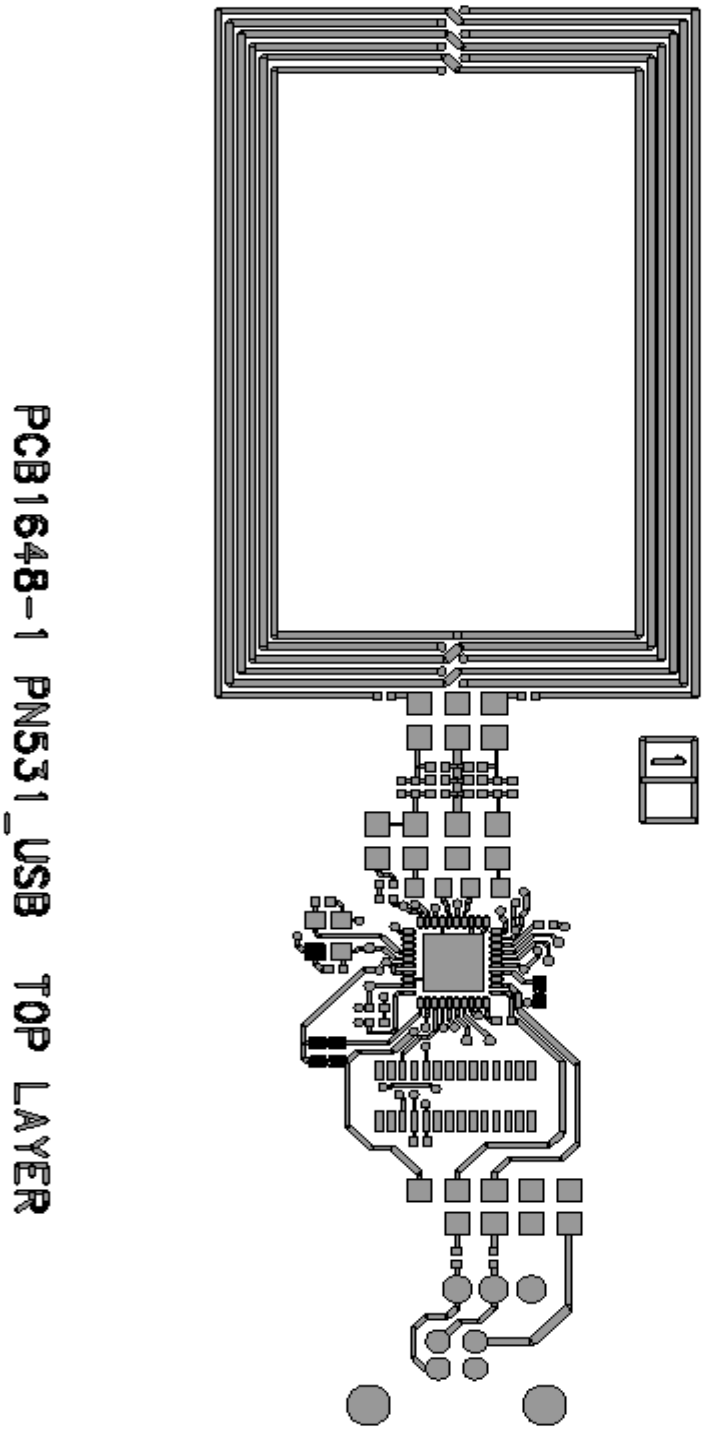

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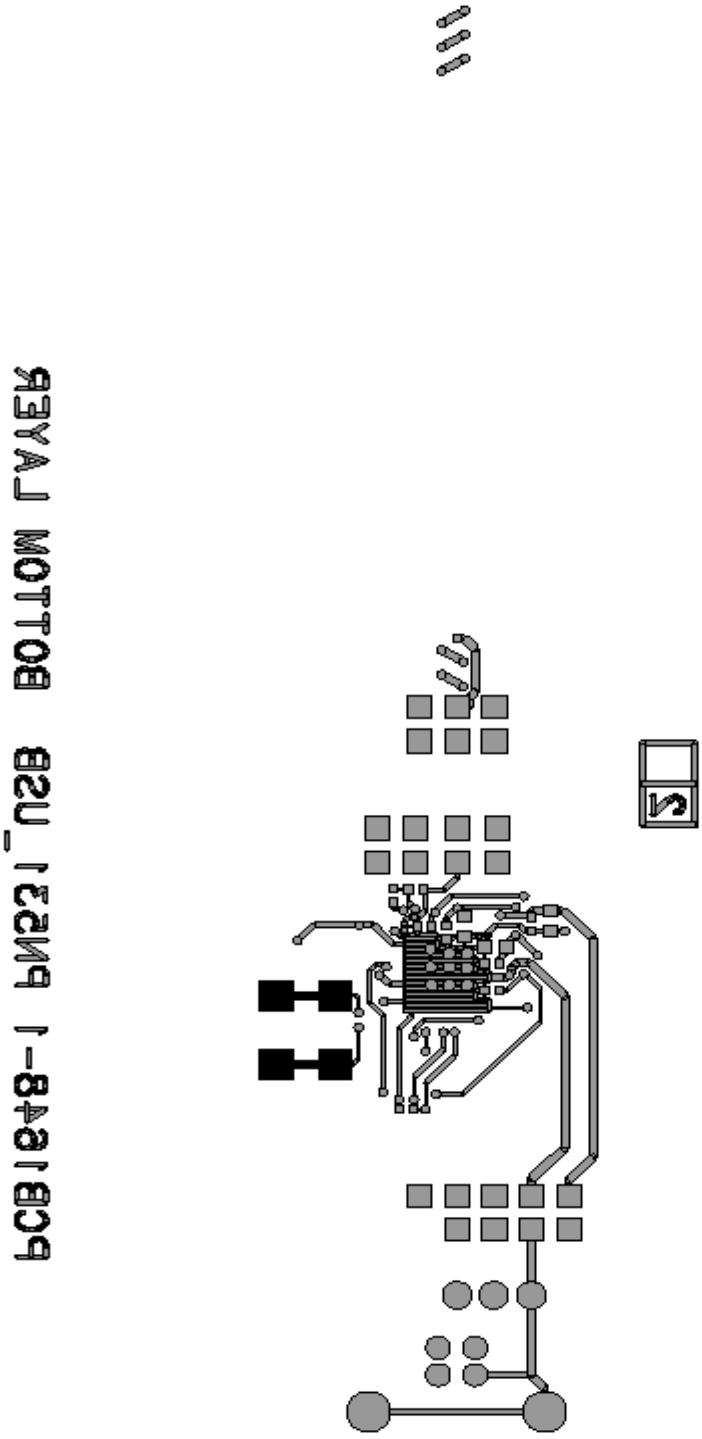

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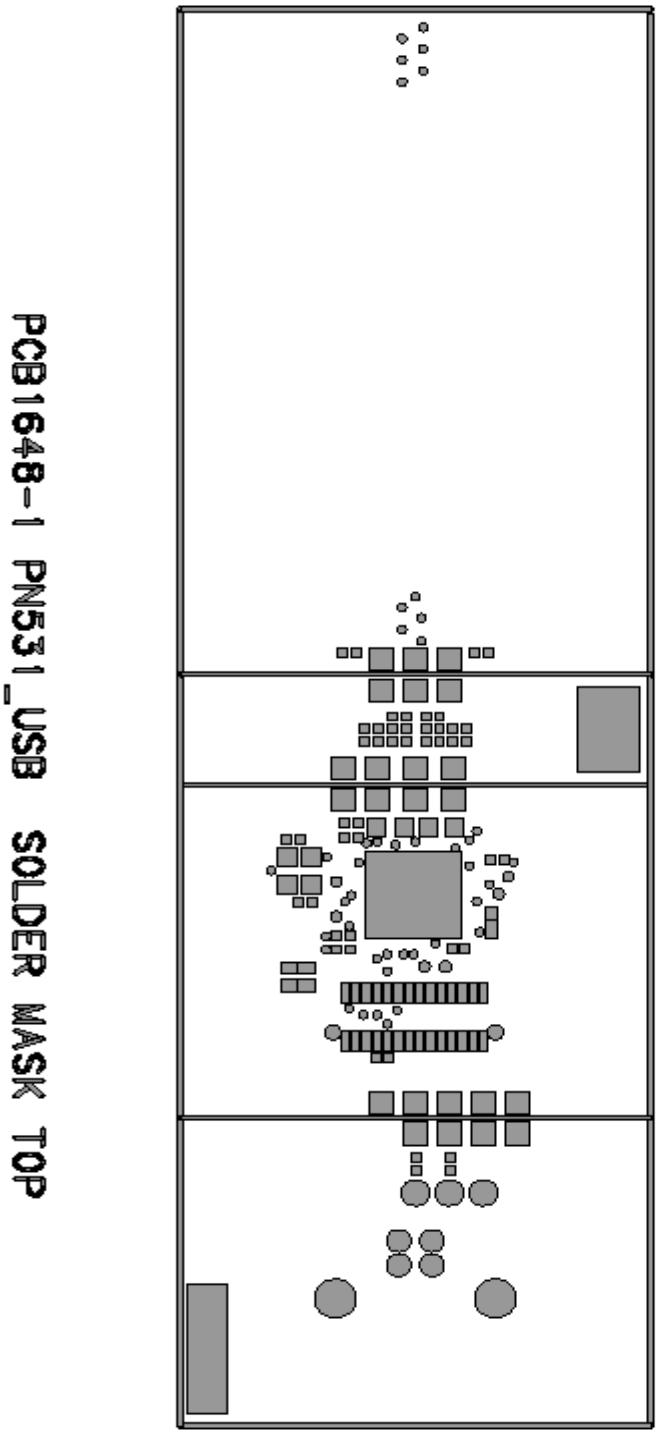

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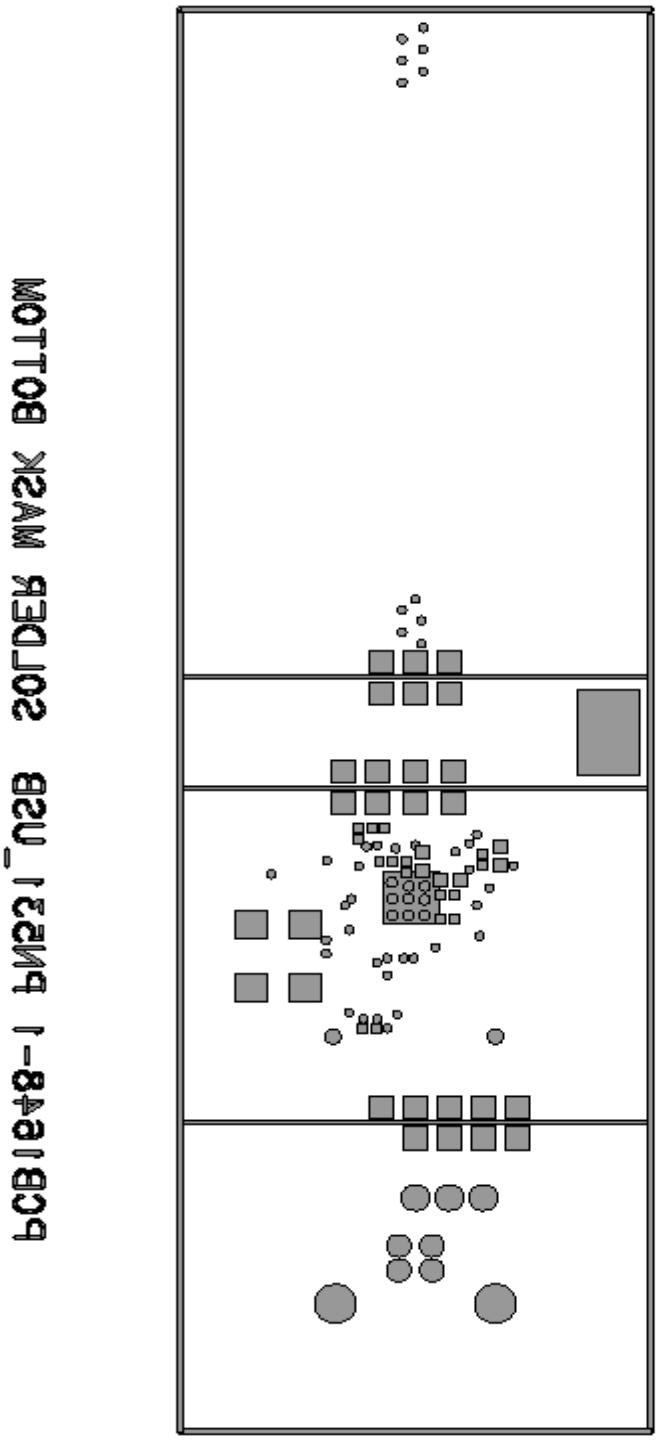

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3.4 Component list

Demo board HSU – PCB1643-1

REFERENCE	GEOMETRY	VALUE	SPECIFICATION
C1	taj_r	10uF_6.3V	AVX:TAJR106K006,Tantal,Capacitor,Package:R,10%
C2	taj_r	1.5uF_10V	AVX:TAJR155K010,Tantal,Capacitor,Package:R,10%
C3	c0402	N.C.	Capacitor,CER2,0402,***NOT,CONNECTED***
C4	c0402	N.C.	Capacitor,CER2,0402,***NOT,CONNECTED***
C5	c0402	18pF	Capacitor,CER2,0402,C0G,50V,5%
C6	c0402	18pF	Capacitor,CER2,0402,C0G,50V,5%
C7	c0402	22pF	Capacitor,CER2,0402,C0G,50V,5%
C8	c0402	22pF	Capacitor,CER2,0402,C0G,50V,5%
C9	c0402	N.C	Capacitor,CER2,0402,***NOT,CONNECTED***
C10	c0402	N.C.	Capacitor,CER2,0402,***NOT,CONNECTED***
C11	c0402	56pF	Capacitor,CER2,0402,C0G,50V,5%
C12	c0402	56pF	Capacitor,CER2,0402,C0G,50V,5%
C13	c0402	1nF	Capacitor,CER2,0402,X7R,50V,10%
C14	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C15	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C16	c0603	4.7uF	Capacitor,CER2,0603,X5R,6.3V,10%
C17	c0603	10uF	Capacitor,CER2,0603,X5R,4V,10%
C18	c0603	10uF	Capacitor,CER2,0603,X5R,4V,10%
C19	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C20	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C21	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C22	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C23	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C24	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C25	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC

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REFERENCE	GEOMETRY	VALUE	SPECIFICATION
C26	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C27	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C28	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C29	c0402	220pF_C0G	Capacitor,CER2,0402,C0G,50V,GPR15_5C_1H_221
C30	c0402	220pF_C0G	Capacitor,CER2,0402,C0G,50V,GPR15_5C_1H_221
D1	topled	HSMS_A100_L100J1	AGILENT:Red,LED,Topled,30mA
D2	to269aa	MB2S	GENERAL_SEMICONDUTOR:SMD,Bridge,Rectifier,200V,0.5A
D3	sod80	BAS85	PHILIPS:Schottky,Barrier,Diode,30V,0.2A
IC1	mlf6x40_0.5	PN531	PN531
IC2	sot223	TS2940CW_3.3	TSC:Ultra-Low,Dropout,Fixed,Positive,voltage,Regulator,3.3V,1A,SOT223
IC3	sot403_1	ADM3202ARU	ANALOG-DEVICES:Low,Power,3.3V,RS232,Line-Driver, Package: TSSOP16
J1	subd_09fc	D09S13A4GL00	FCI:Delta-D,Connector,Right-Angle,Female,Norm,HE5
J2	jack2.5_h	JACK2.5_H	CLIFF:DC10B,Power,Connector,Horizontal,2.5mm
J3	5108_2x14s_0.8md	5108_1_02810_00	WP-PRODUCTS:5108,Serie,SMT,Connector,Straight,Male,2x14pins,0.8mm
L1	self_mlf2012	0.56uH	TDK:MLF2012DR56K,Chip,Inductor,SMD,0.15A,10%
L2	self_mlf2012	0.56uH	TDK:MLF2012DR56K,Chip,Inductor,SMD,0.15A,10%
R1	r0402	NC	Resistor,Package:0402,***TO,BE,DEFINE***
R2	r0402	NC	Resistor,Package:0402,***TO,BE,DEFINE***
R3	r0402	NC	Resistor,Package:0402,***TO,BE,DEFINE***
R4	r0402	NC	Resistor,Package:0402,***TO,BE,DEFINE***
R5	r0402	0	Resistor,Package:0402,5%,1/16W
R6	r0402	0	Resistor,Package:0402,5%,1/16W
R7	r0402	0	Resistor,Package:0402,5%,1/16W
R8	r0402	0	Resistor,Package:0402,5%,1/16W
R9	r0402	820	Resistor,Package:0402,5%,1/16W
R10	r0402	1K	Resistor,Package:0402,5%,1/16W
R11	r0402	2.7K	Resistor,Package:0402,5%,1/16W
R12	r0402	47K	Resistor,Package:0402,5%,1/16W
R13	r0402	47K	Resistor,Package:0402,5%,1/16W
R14	r0402	47K	Resistor,Package:0402,5%,1/16W
R15	r0402	47K	Resistor,Package:0402,5%,1/16W

REFERENCE	GEOMETRY	VALUE	SPECIFICATION
R16	r0402	47K	Resistor,Package:0402,5%,1/16W
R18	r0402	100K	Resistor,Package:0402,5%,1/16W
R19	r0402	3.3_1%	Resistor,Package:0402,1%,1/16W
R20	r0402	3.3_1%	Resistor,Package:0402,1%,1/16W
ST1	chevron_a	CHEVRON	***NOT,CONNECTED***
ST2	chevron_a	CHEVRON	***NOT,CONNECTED***
ST3	chevron_a	CHEVRON	***NOT,CONNECTED***
ST4	chevron_a	CHEVRON	***NOT,CONNECTED***
ST5	chevron_a	CHEVRON	***NOT,CONNECTED***
ST6	chevron_a	CHEVRON	***NOT,CONNECTED***
ST7	chevron_a	CHEVRON	***NOT,CONNECTED***
ST8	chevron_a	CHEVRON	***NOT,CONNECTED***
ST9	chevron_a	CHEVRON	***NOT,CONNECTED***
ST10	chevron_a	CHEVRON	***NOT,CONNECTED***
TB1	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB2	bar2sp	Empr_CAVAL_2.54	Pattern,Single,Row,2,pin
TB3	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB4	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB5	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB6	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB7	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB8	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB9	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB10	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB12	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB13	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB14	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB15	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB16	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB17	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB18	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin

REFERENCE	GEOMETRY	VALUE	SPECIFICATION
TB19	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB21	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB22	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB23	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB24	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB25	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TP1	plage.75	PLAGE.75	***NOT,CONNECTED***
TP2	plage.75	PLAGE.75	***NOT,CONNECTED***
TP3	plage.75	PLAGE.75	***NOT,CONNECTED***
TP4	plage.75	PLAGE.75	***NOT,CONNECTED***
TP5	tpboucle1.0	5001	KEYSTONE:Black,Testpoint,Type1
Y1	tas3225	27.12MHZ	TOKYO-DENPA:TAS-3225A,Type,Quartz,Crystal,SMD

Demo board USB – PCB1648-1

REFERENCE	GEOMETRY	VALUE	SPECIFICATION
C1	c0402	N.C.	Capacitor,CER2,0402,***NOT,CONNECTED***
C2	c0402	18pF	Capacitor,CER2,0402,C0G,50V,5%
C3	c0402	N.C.	Capacitor,CER2,0402,***NOT,CONNECTED***
C4	c0402	56pF	Capacitor,CER2,0402,C0G,50V,5%
C5	c0402	220pF_C0G	Capacitor,CER2,0402,C0G,50V,GPR15_5C_1H_221
C6	c0402	N.C.	Capacitor,CER2,0402,***NOT,CONNECTED***
C7	c0402	56pF	Capacitor,CER2,0402,C0G,50V,5%
C8	c0402	220pF_C0G	Capacitor,CER2,0402,C0G,50V,GPR15_5C_1H_221
C9	c0402	18pF	Capacitor,CER2,0402,C0G,50V,5%
C10	c0402	N.C.	Capacitor,CER2,0402,***NOT,CONNECTED***
C11	c0402	1nF	Capacitor,CER2,0402,X7R,50V,10%
C12	c0402	22pF	Capacitor,CER2,0402,C0G,50V,5%
C13	c0402	22pF	Capacitor,CER2,0402,C0G,50V,5%
C14	c0402	27pF	Capacitor,CER2,0402,C0G,50V,5%
C15	c0402	27pF	Capacitor,CER2,0402,C0G,50V,5%
C16	c0603	1uF	Capacitor,CER2,0603,X5R,16V,10%
C17	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C18	c0603	10uF	Capacitor,CER2,0603,X5R,4V,10%
C19	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C20	c0603	4.7uF	Capacitor,CER2,0603,X5R,6.3V,10%
C21	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C22	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C23	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C24	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
C25	c0402	0.1uF	Capacitor,CER2,0402,X7R,16V,-10+10%,PDC
IC1	mlf6x40_0.5	PN531	PN531
J1	5108_2x14s_0.8md	5108_1_02810_00	WP-PRODUCTS:5108,Serie,SMT,Connector,Straight,Male,2x14pins,0.8mm
J2	usb_b	67068_0000	MOLEX:USB,Type,B,Receptacle

REFERENCE	GEOMETRY	VALUE	SPECIFICATION
L1	self_mlf2012	0.56uH	TDK:MLF2012DR56K,Chip,Inductor,SMD,0.15A,10%
L2	self_mlf2012	0.56uH	TDK:MLF2012DR56K,Chip,Inductor,SMD,0.15A,10%
R1	r0402	3.3_1%	Resistor,Package:0402,1%,1/16W
R2	r0402	3.3_1%	Resistor,Package:0402,1%,1/16W
R3	r0402	100K	Resistor,Package:0402,5%,1/16W
R4	r0402	2.7K	Resistor,Package:0402,5%,1/16W
R5	r0402	1.5K	Resistor,Package:0402,5%,1/16W
R6	r0402	47K	Resistor,Package:0402,5%,1/16W
R7	r0402	0	Resistor,Package:0402,5%,1/16W
R8	r0402	0	Resistor,Package:0402,5%,1/16W
R9	r0402	1K	Resistor,Package:0402,5%,1/16W
ST2	chevron_a	CHEVRON	***NOT,CONNECTED***
ST4	chevron_a	CHEVRON	***NOT,CONNECTED***
ST10	chevron_a	CHEVRON	***NOT,CONNECTED***
TB1	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB2	bar2sp	Empr_CAVAL_2.54	Pattern,Single,Row,2,pin
TB3	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB4	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB5	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB6	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB7	bar2sp	CAVAL_2.54	Pattern,Single,Row,2,pin,+,ANTELEC,CCM1D
TB8	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB9	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB10	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB11	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB12	tp0.9	CAVAL_2.54	Pattern,Single,Row,1,pin,+,ANTELEC,CCM1D
TB13	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB14	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB15	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TB16	tp0.9	Empr_CAVAL_2.54	Pattern,Single,Row,1,pin
TP1	plage.75	PLAGE.75	***NOT,CONNECTED***

REFERENCE	GEOMETRY	VALUE	SPECIFICATION
TP2	plage.75	PLAGE.75	***NOT,CONNECTED***
TP3	plage.75	PLAGE.75	***NOT,CONNECTED***
TP4	plage.75	PLAGE.75	***NOT,CONNECTED***
TP5	plage.75	PLAGE.75	***NOT,CONNECTED***
TP6	plage.75	PLAGE.75	***NOT,CONNECTED***
TP7	tpboucle1.0	5001	KEYSTONE:Black,Testpoint,Type1
TP8	tpboucle1.0	5001	KEYSTONE:Black,Testpoint,Type1
TP9	tpboucle1.0	5001	KEYSTONE:Black,Testpoint,Type1
Y1	tas3225	27.12MHZ	TOKYO-DENPA:TAS-3225A,Type,Quartz,Crystal,SMD
Y2	xe	4MHZ	TAITIEN:XE,Type,Quartz,Crystal,SMD

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