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Evaluates: MAX66301 and MAX66250

MAX66301-25x Evaluation System

General Description

The MAX66301-25x evaluation system (EV system) comprises a MAX66301 evaluation kit (EV kit) and a MAX66250 tag. The MAX66301 EV kit combines an RFID reader for contactless communication at 13.56MHz and a SHA-3 secure authenticator coprocessor. The RFID reader covers the ISO 15693 standard and the authenticator coprocessor is based on the FIPS 202-compliant standard. The MAX66250 tag operates as a solution covering the ISO 15693 standard and combines FIPS 202-compliant Secure Hash Algorithm (SHA-3) challenge and response authentication with secured EEPROM. By pairing the MAX66301 with the MAX66250 into an EV system, the EV kit software can operate to show a secure challenge and response authentication and other part specific functionality.

The MAX66301NFC# is an enclosed version of the MAX66301 EV kit that is suitable for use in a manufacturing environment. The included antenna can be connected by the 50Ω coaxial cable provided with the MAX66301NFC# kit, or a custom antenna and cable may be connected for optimal performance in the targeted environment.

Analog Devices provides a simple graphical user interface (GUI) to invoke commands and create scripts that generate combinations of these commands for reading and writing the memory of the MAX66250 and setting memory protections. The operator selects input data and operations to perform, and the software handles the details.

MAX66301-25x EV System Content List

QTY	DESCRIPTION
1	MAX66301 evaluation kit plus antenna
1	MAX66250 tag
1	USB Type A to USB Mini-Type B cable

***Ordering Information* appears at end of data sheet.**

Features

- Secure, Contactless RFID Reader (MAX66301)
  - UART and SPI Interface Ports
  - Power-Down Mode by an Input Pin (Low, Standby Power)
  - Antenna Short-Circuit Protection
  - Compatible with 3.3V or 5V Supply Voltages
  - Pushbuttons for Board Reset and MAX66301 Reset
  - Port Select Switch Control
  - Jumpers for SPI, UART, and Control Signals
  - ISO/IEC 15693 and 14443 Type A Standard Compliant
  - SHA-3 Engine to Run a Symmetric Key-Based Bidirectional Secure Authentication
  - Four 32-Byte Pages of User Memory
  - Four Host Secrets with Multiple Programmable Protection Options
  - 76-Byte Scratchpad in SRAM
  - True Hardware Random-Number Generator
  - Unique 64-Bit Serial Number
- Protected Tag Solution (MAX66250)
  - HF Interface at 13.56MHz
  - User EEPROM Authenticated Memory Page Read/Write Transactions
  - User EEPROM Page Read/Write Transactions
  - All Stored Data Cryptographically Protected from Discovery
  - FIPS 202-Compliant SHA-3 Algorithm for Challenge/Response Authentication
  - FIPS 198-Compliant Keyed-Hash Message Authentication Code (HMAC)
  - 17-Bit One-Time Settable, Nonvolatile Decrement-Only Counter with Authenticated Read
  - Secure Storage for Secrets
  - 256 Bits of Secure EEPROM for User Data
  - ISO/IEC 18000-3 Mode1: up to 52.97kbps
- MAX66301-25x EV System Software Available
- Mobile NFC Tag Application Available for Download

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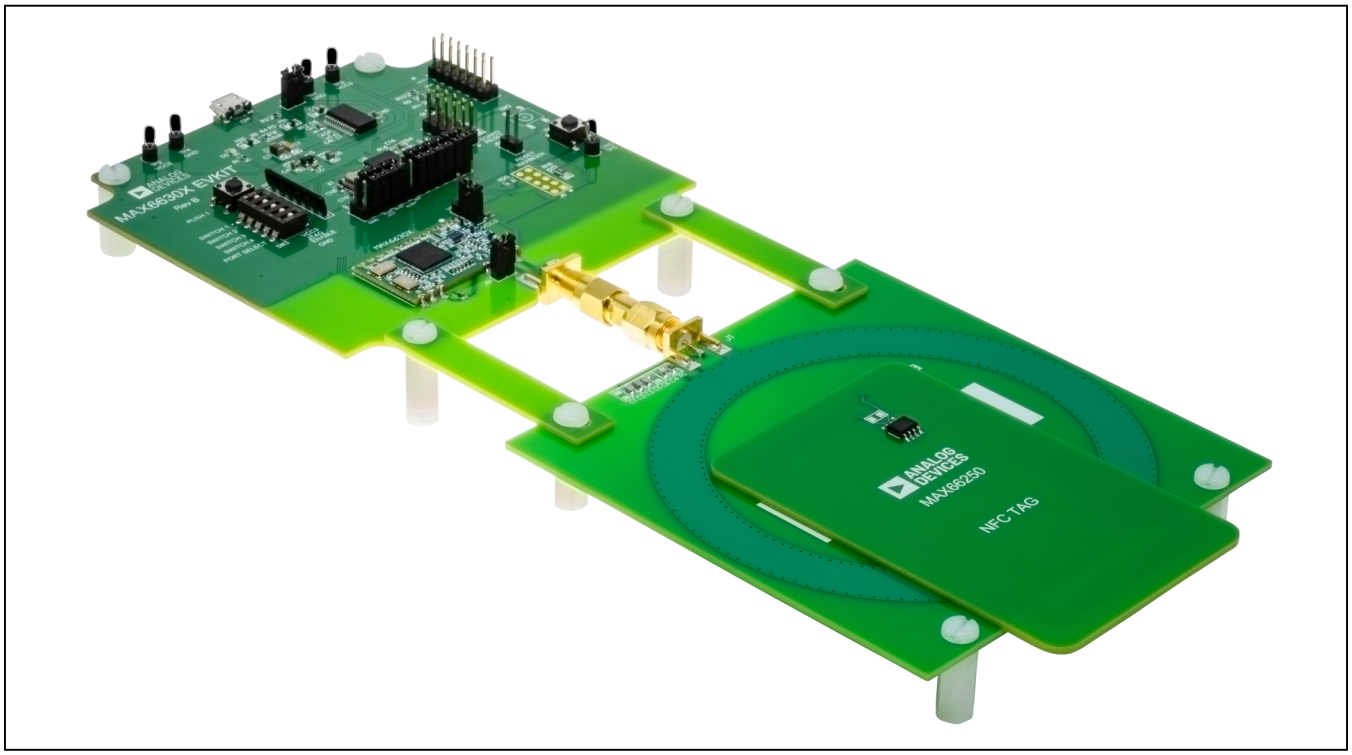
MAX66301-25x Evaluation Systems





Quick Start

Required Equipment

- MAX66301 EV kit plus antenna (included)
- MAX66250 tag (included)
- USB Type A to USB Mini Type B cable (included)
- PC with Windows® 10 or Windows 7 and a spare USB port

Note: In the following sections, software-related items are identified by bolding. Text in **bold** only refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows OS.

Setup Procedure

1) Perform the following to install the PL-2303 prolific driver:
   a) Download the driver file called PL2303_Prolific_DriverInstaller.zip from https://prolificusa.com/product/pl2303gc-usb-full-uart-bridge-controller-gpio/.
   b) Unzip, **Open** and **Run** the file.
   c) Follow the directions of the **Install Wizard** until **Finish** is reached.
2) Proceed by setting up the MAX66301 EV kit hardware by doing the following:
   a) Configure the jumpers per Table 1 and Figure 6 for 3.3V operation.
   b) Set the switch SW3 per Table 2 for UART operation when the MAX66301 powers up.
   c) Using the USB type A to USB type Mini B cable, connect the MAX66301 EV kit's CN1 port into a spare USB port of a PC.
3) Set up the MAX66250 tag hardware by doing the following:
   a) Position the MAX66250 tag over the MAX66301 EV kit antenna.
4) The MAX66301 EV kit uses both the Prolific PL-2303 and a MAXQ610 microcontroller to provide SPI or UART connectivity to the MAX66301 device. Verify the correct installation of the virtual COM port by selecting **Control Panel→System→Hardware→Device Manager** and expanding the **Ports (COM & LPT)**. If the driver is installed properly, the Port lists as in Figure 1. Note that your COM port number can be different.
5) Unzip the **MAX66301-25x_EV_Kit.zip** in a known location. **Note:** If you have not already obtained the software with this data sheet, request it from applications support through the following link: https://support.analog.com/en-US/technical-support/.

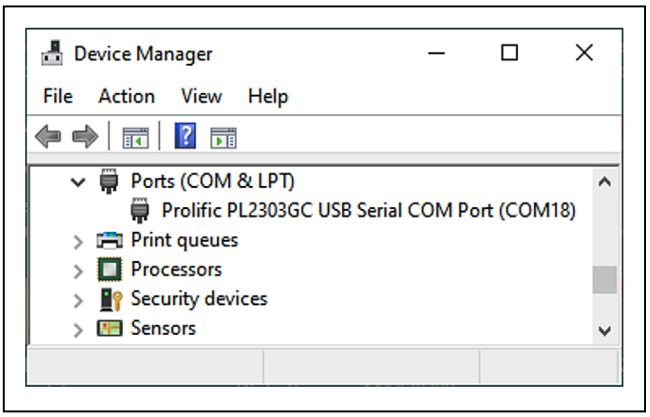


Figure 1. MAX66301 EV Kit Virtual COM Port

Windows is a registered trademark of Microsoft Corporation

6) Open the **MAX66301-25x EV kit** folder, as shown in Figure 2, and double-click the **setup.exe**.
7) Now, double-click the **Install** button as shown in Figure 3.
8) The evaluation program GUI appears as shown in Figure 4.

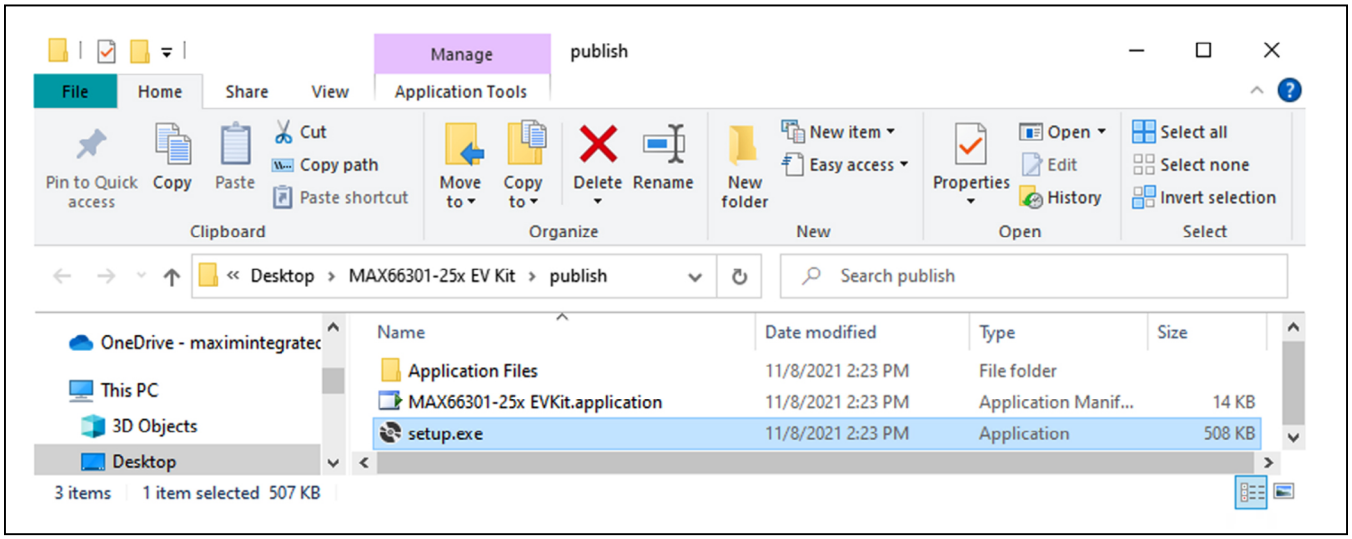


Figure 2. MAX66301-25x EV kit Setup

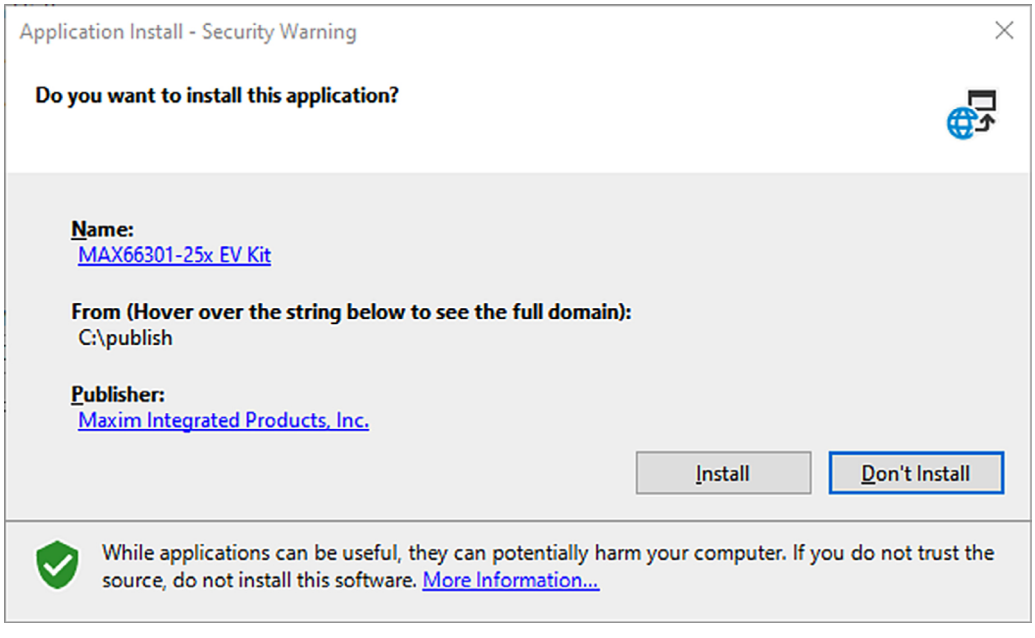


Figure 3. Application Install–Security Warning

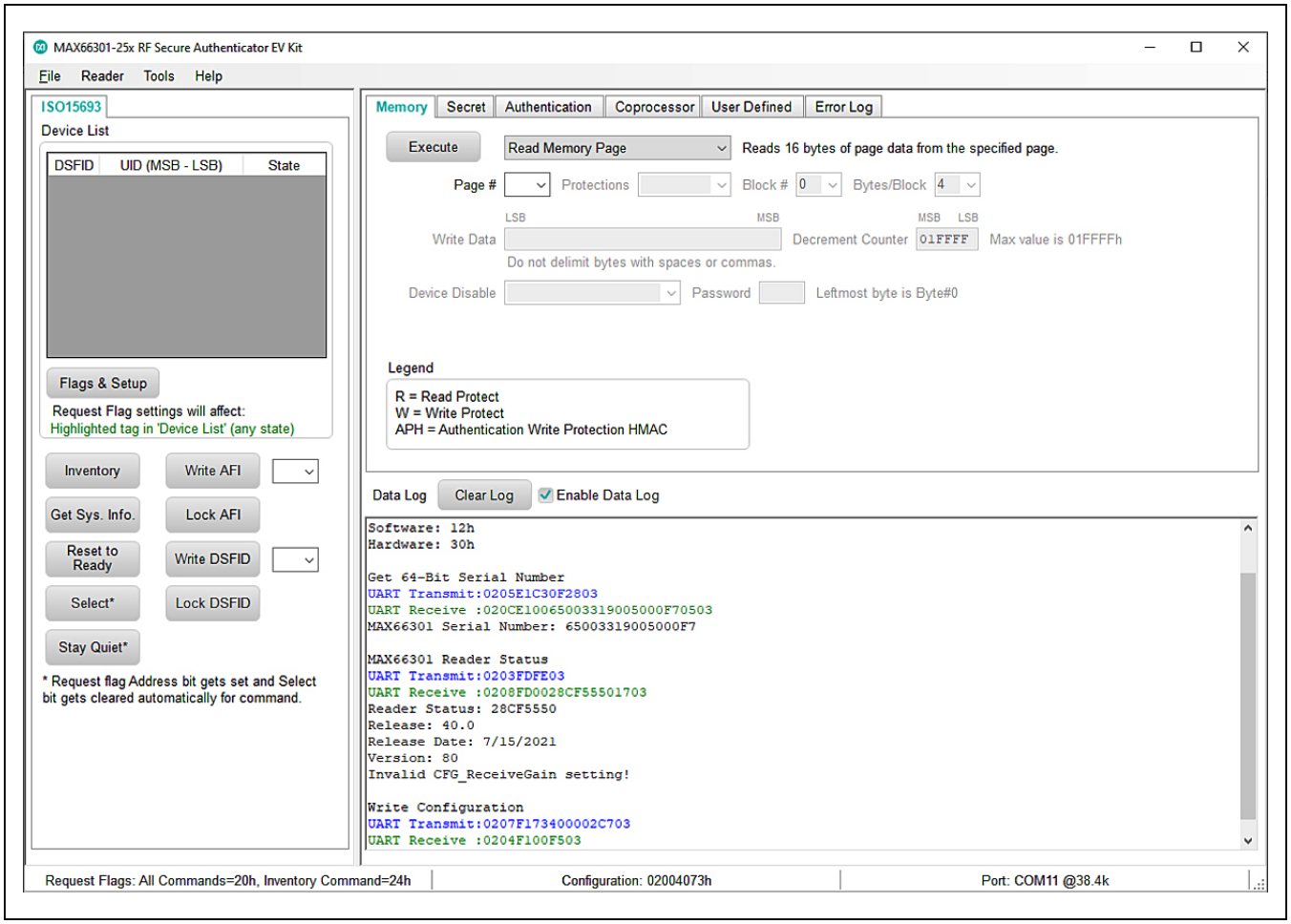


Figure 4. MAX66301-25x EV Kit GUI

Detailed Description of Hardware

The MAX66301-25x EV system block diagram in Figure 5 is a functional representation. Starting from the left side, the prolific device provides a virtual COM port to link the PC to the MAXQ610 and is fully compatible with USB 2.0 specification. The MAXQ610 is preloaded with firmware that either passes the UART protocol along or converts the UART protocol to SPI with a SCLK at 2.667MHz. The MAX66301 provides the RFID reader processing per ISO 15693 and the secure coprocessor functionality is based on FIPS 202-compliant standard. The AFE in the MAX66301 drives a PCB antenna in a 100mW configuration. Lastly, the MAX66250 is the tag in the system-supporting authentication (i.e., clone prevention).

Jumpers and Switches

The MAX66301 EV kit has jumpers that allow configuration options and contains switches for more configuration options.

Table 1 and Figure 6 describe the MAX66301 EV kit and the function of the jumpers. Default settings from Table 1, in summary, support UART or SPI linking, USB power, and 3.3V operation.

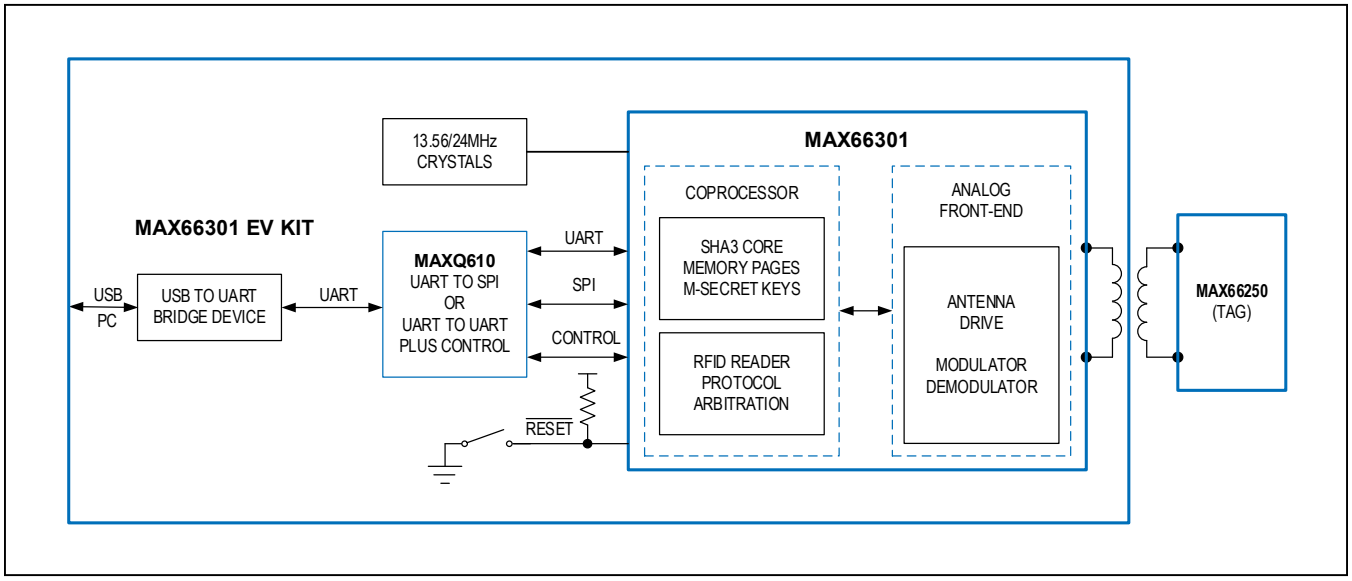


Figure 5. MAX66301-25x EV System Block Diagram

Table 1. MAX66301 EV Kit Jumpers

REFERENCE DESIGNATOR	MAX66301 DESCRIPTION	DEFAULT SETTING	FUNCTION
JB1	AGD—Reference Voltage Output	Close (1-2)	Pullup enabled for 3.3V operation
JB2	TXD—UART Transmit RXD—UART Receive MISO—Master In-Slave Out MOSI—Master Out-Slave In SCLK—Serial Clock SSEL—Slave Select IRQ—Interrupt Out SLEEP—Sleep Mode In BUSY—Busy Out PORTSLCT—Port Select In TP (EN)—Test Pin GND—Ground Probe	Close (1-2), Close (3-4), Close (5-6), Close (7-8), Close (9-10), Close (11-12), Open (13-14), Close (15-16), Close (17-18), Close (19-20), Close (21-22), Open (23-24)	Link to MAXQ610 UART receive Link to MAXQ610 UART transmit Link to MAXQ610 SPI MISO Link to MAXQ610 SPI MOSI Link to MAXQ610 SPI SCLK Link to MAXQ610 SPI SSEL Link to MAXQ610 P1.6 PIO (not used) Link to MAXQ610 P1.5 Out for sleep control Link to MAXQ610 P1.4 In detect SPI busy Link to MAXQ610 P3.5 and switch 5 (SW3) Link to MAXQ610 P1.7 out high Ground connect for probing
JB3	VCC5—5V Supply Rail	Close (1-2)	Link to 5V USB power from the PC
J3	3.3V/5V VDD_AFE_DIG Select	Close (1-2)	Select AFE digital voltage to be 3.3V

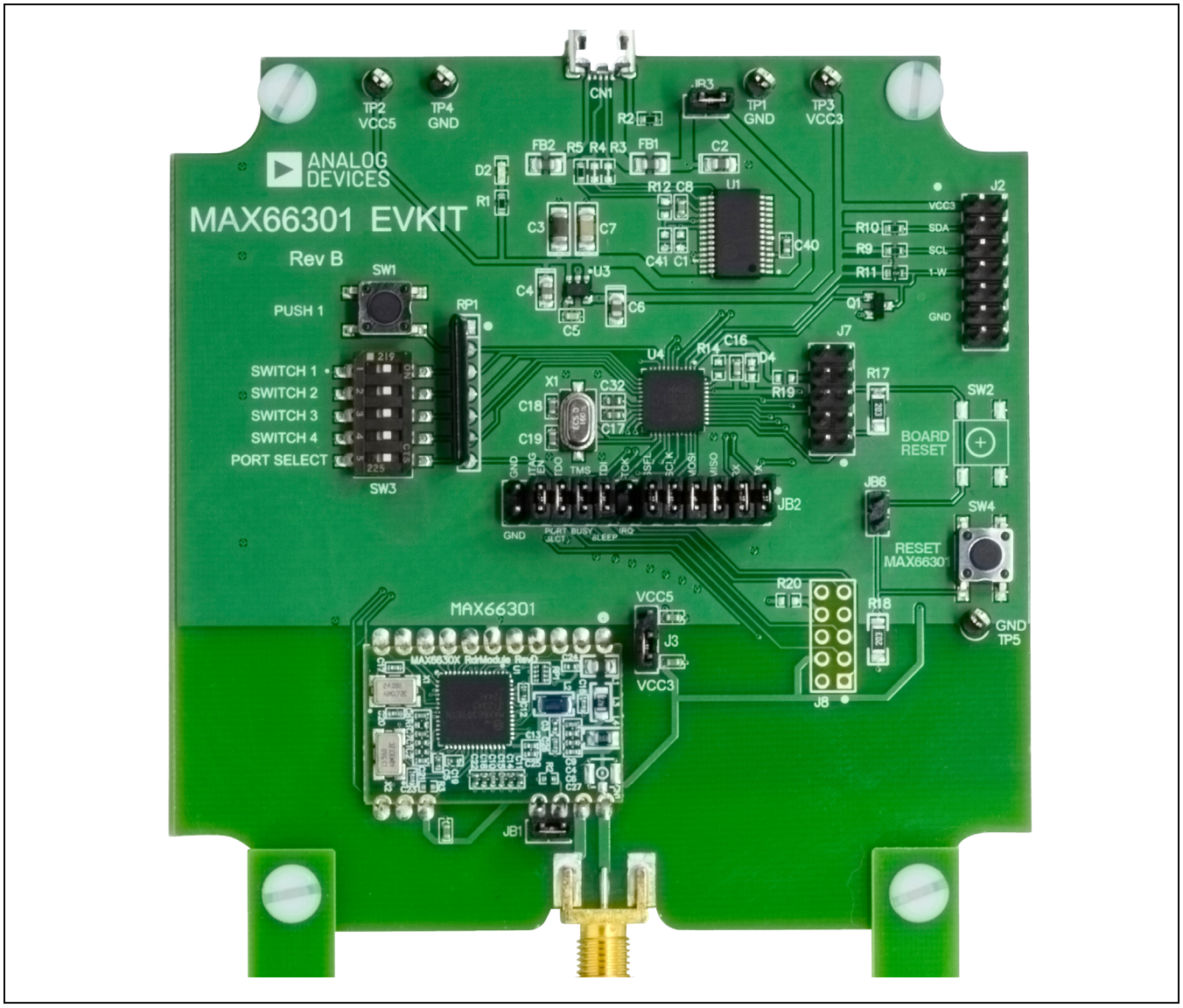


Figure 6. MAX66301 EV Kit Jumpers

Table 2 describes the switch settings for MAX66301 EV kit. SW1 is reserved for future use. SW3 switch positions 1 to 4 are reserved for future use and position 5 selects between UART or SPI port selection. SW4 resets the MAX66301 during evaluation if needed.

Table 2. MAX66301 EV Kit Switches

REFERENCE DESIGNATOR	POSITION	ON POSITION (SIGNAL IS GROUNDED)	OFF POSITION (SIGNAL IS PULLED UP)
SW1	PUSH 1	Not used	Not used
SW3	Switch 1	Not used	Not used
SW3	Switch 2	Not used	Not used
SW3	Switch 3	Not used	Not used
SW3	Switch 4	Not used	Not used
SW3	Port select	UART port selection	SPI port selection
SW4	Reset MAX66301	Push—MAX66301 in reset	MAX66301 normal

Ordering Information

PART	TYPE
MAX66301-25XEVKIT#	EV System
MAX66301NFC#	Boxed Reader EV System
MAX66250EVKIT#	NFC Tag

#Denotes RoHS compliant.

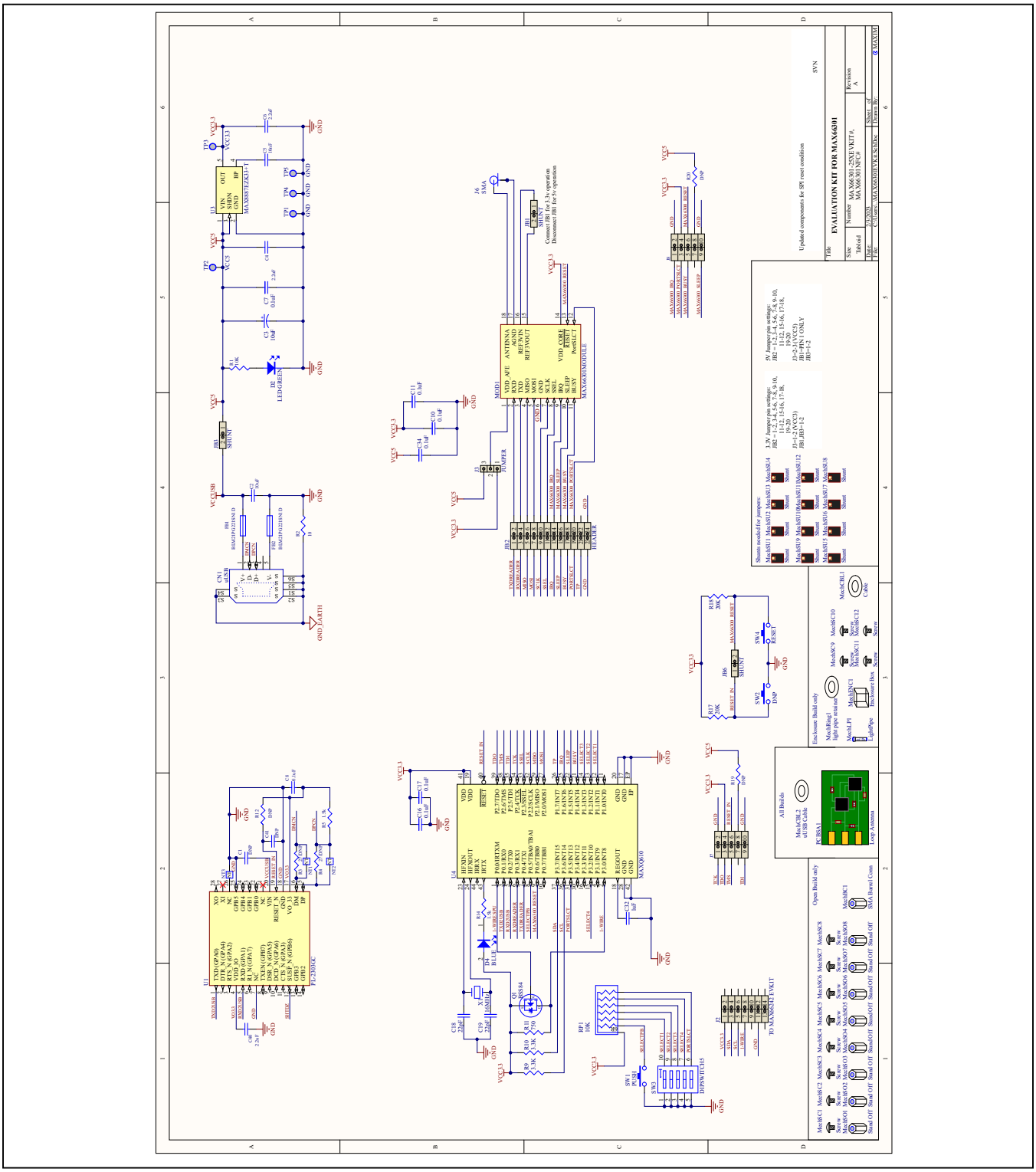
MAX66301 EV Kit Bill of Materials

COMMENT	DESCRIPTION	DESIGNATOR	FOOTPRINT	QTY	PART NUMBER
10uF	CAP CER 10UF 10V X5R 0805	C2	CAP0805-3D	1	C2012X5R1A106K085AB
10uF	CAP CER 10UF 16V X5R 0805	C3	CAP1206-3D	1	CL21A106KOQNNNE
2.2uF	CAP CER 2.2UF 10V X7R 0805	C4, C6	CAP0805-3D	2	CL21B225KPFNNNE
10nF	CAP CER 10000PF 50V X7R 0603	C5	CAP0603-3D	1	CL10B103KB8NCNC
0.1uF	CAP CER 0.1UF 50V X7R 1206	C7	CAP1206-3D	1	CL31B104KBCNNNC
0.1uF	CAP CER 0.1UF 16V X7R 0603	C8, C9, C10, C11, C12, C13, C14, C16, C17, C34	CAP0603-3D	10	CL10B104KO8NNNC
1uF	CAP CER 1UF 25V X7R 1206	C15	CAP1206-3D	1	CL31B105KAHNNNE
22pF	CAP CER 22PF 50V C0G/NP0 0603	C18, C19, C25, C29, C30, C33	CAP0603-3D	6	CL10C220JB8NNNC
680pF	CAP CER 680PF 200V C0G/NP0 1206	C20, C21	CAP1206-3D	2	12062A681JAT2A
33pF	CAP CER 33PF 50V C0G/NP0 1206	C22	CAP1206-3D	1	12065A330KAT2A
820pF	CAP CER 820PF 50V C0G/NP0 0603	C23	CAP0603-3D	1	CL10C821JB8NNNC
560pF	CAP CER 560PF 50V C0G/NP0 1206	C24	CAP1206-3D	1	12065A561JAT2A
1nF	CAP CER 1000PF 50V C0G/NP0 0603	C26	CAP0603-3D	1	06035A102FAT2A
680pF	CAP CER 680PF 50V C0G/NP0 0603	C27	CAP0603-3D	1	CL10C681FB8NNNC
820pF	CAP CER 820PF 50V NP0 1206	C28	CAP1206-3D	1	12065A821FAT2A
1uF	CAP CER 1UF 10V X7R 0603	C31, C32, C41	CAP0603-3D	3	LMK107B7105KA-T
3.3uF	CAP CER 3.3UF 16V X7R 1206	C35, C37	CAP1206-3D	2	C1206C335K4RAC7800
10nF	CAP CER 10000PF 50V X7R 1206	C36, C38, C39	CAP1206-3D	3	C1206C103J5RAC7800
2.2uF	CAP CER 2.2UF 16V X5R 0603	C40	CAP0603-3D	1	CC0603KRX5R7BB225
uUSB	CONN USB MICRO B RECPT SMT R/A	CN1	USBMICROB2-3D	1	10118193-0001LF
LED GREEN	LED GREEN CLEAR 0603 SMD	D2	0603LED-3DGREEN	1	5988081102F
BLM21PG221SN1D	FERRITE BEAD 220 OHM 0805 1LN	FB1, FB2	0805-3D	2	MH2029-221Y
JUMPER	CONN HEADER VERT 14POS 2.54MM	J2	DIH7X2-3D	1	PREC007DAAN-RC
JUMPER	CONN HEADER VERT 3POS 2.54MM	J3	SIP3-3D	3	77311-424-03LF
SMA	CONN SMA RCPT STR 50OHM EDGE MNT	J6	SMA2-3D	1	132289
JTAG CONNECTOR #1	CONN HEADER VERT 14POS 2.54MM	J7	DIH5X2-3D	1	M20-9720745
Interface	2 x 10 dual row 0.100mil male conn	J8	DIH5X2-3D	1	M20-9760546
SHUNT	CONN HEADER VERT 2POS 2.54MM	JB1, JB3, JB6	SIP2-3D	3	77311-424-02LF
HEADER	CONN HEADER VERT 24POS 2.54MM	JB2	DIH12X2-3D	1	M20-9981246
270nH	FIXED IND 270NH 630MA 400MOHM SM	L1	1210INDUCTOR	1	AISC-1210-R27J-T
180nH	INDUCTOR 1206 180NH UNSHLD 2% 700mA 430mOhms	L2	1210INDUCTOR	1	1206CS-181XGLB

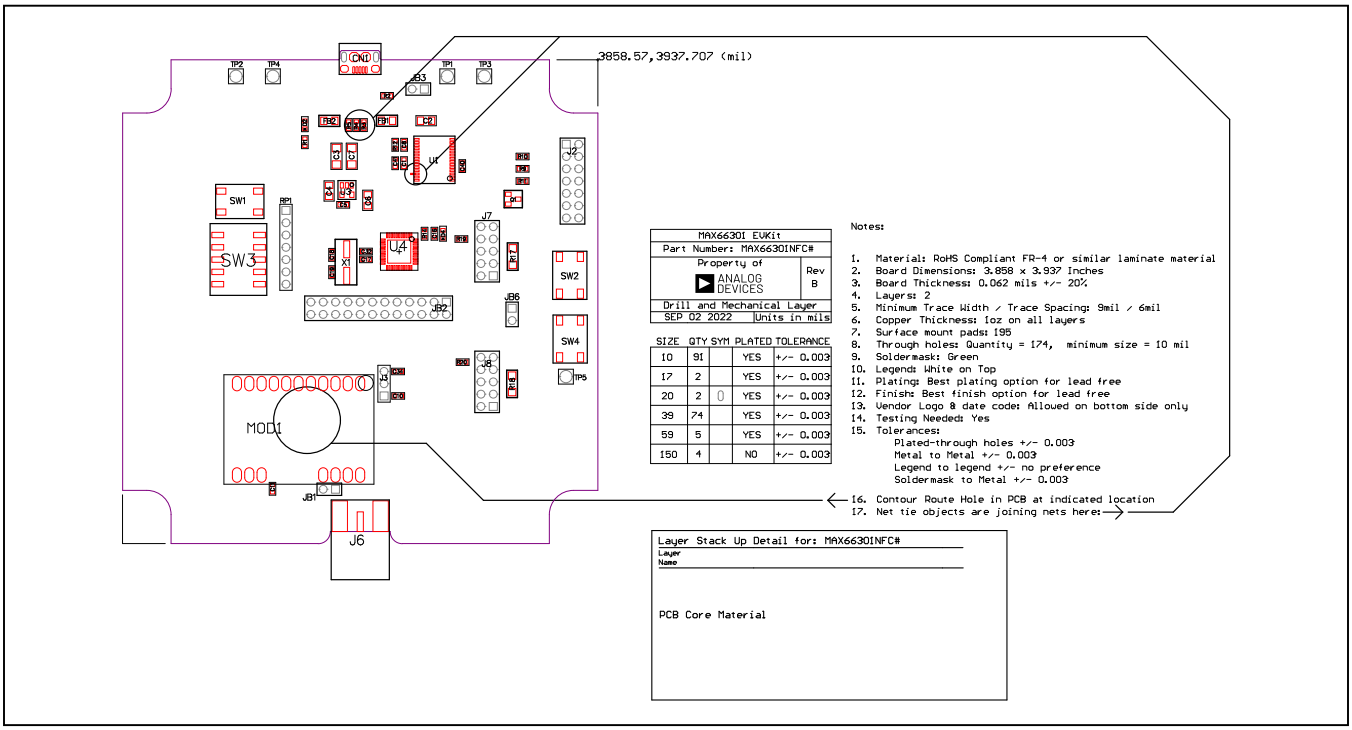
MAX66301 EV Kit Bill of Materials (continued)

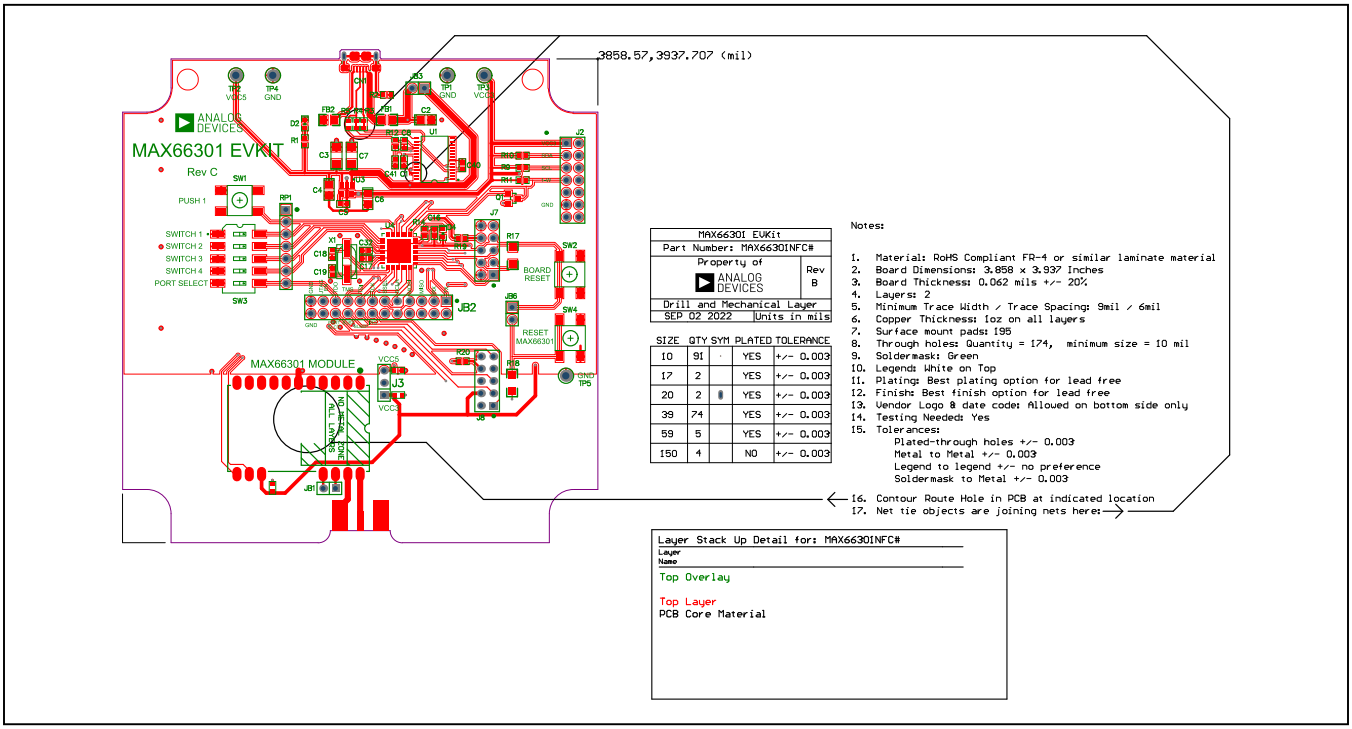
COMMENT	DESCRIPTION	DESIGNATOR	FOOTPRINT	QTY	PART NUMBER
10uH	FIXED IND 10UH 100MA 3.25OHM SMD	L4, L5	1206INDUCTOR-3D	2	LQH31MN100J03L
INDUCTOR	RES 0 OHM JUMPER 1/4W 1206	L6, L7, L8	1206INDUCTOR-3D	3	RMCF1206ZT0R00
BSS84	MOSFET P-CH 50V 180MA TO236AB	Q1	16001-3D	1	BSS84AK,215
10K	RES 10K OHM 1% 1/10W 0603	R1, R15, R16, R25	0603-3D	4	RC0603FR-0710KL
10	RES SMD 10 OHM 1% 1/10W 0603	R2	0603-3D	1	ERJ-3EKF10R0V
1.5k	RES 1.5K OHM 1% 1/10W 0603	R5	0603-3D	1	RC0603FR-071K5L
50 Ohm	RES SMD 49.9 OHM 1% 1/4W 1206	R6	1206-3D	1	CR1206-FX-49R9ELF
1.8k	RES 1.8K OHM 1% 1/4W 1206	R7	1206-3D	1	RMCF1206FT1K80
3.3K	RES 3.3K OHM 1% 1/10W 0603	R9, R10	0603-3D	2	RC0603FR-073K3L
750	RES 750 OHM 1% 1/8W 0603	R11	0603-3D	1	RNCP0603FTD750R
4.7k	RES 4.7K OHM 1% 1/10W 0603	R12	0603-3D	1	RC0603FR-074K7L
20K	RES SMD 20K OHM 1% 1/4W 1206	R18	1206-3D	2	ERJ-8ENF2002V
20k	RES 20K OHM 1% 1/10W 0603	R24	0603-3D	1	RC0603FR-0720KL
22	RES SMD 22 OHM 1% 1/10W 0603	R26, R27, R28, R29, R30	0603-3D	5	ERJ-3EKF22R0V
10K	RES ARRAY 6 RES 10K OHM 7SIP	RP1	SIP7-3D	1	CSC07A0110K0GEK
PUSH	SWITCH TACTILE SPST-NO 3VA 28V	SW1	RESET2-3D	1	HP0315AFKP2-R
RESET	SWITCH TACTILE SPST-NO 3VA 28V	SW4	RESET2-3D	2	HP0315AFKP2-R
DIPSWITCH5	SWITCH SLIDE DIP SPST 100MA 20V	SW3	DIPSWITCH5 SMT	1	219-5LPST
GND	PC TEST POINT MULTIPURPOSE BLACK	TP1, TP4, TP5	TP-3D	3	5011
VCC5	PC TEST POINT MULTIPURPOSE BLACK	TP2	TP-3D	1	5011
VCC3.3	PC TEST POINT MULTIPURPOSE BLACK	TP3	TP-3D	1	5011
PL-2303GC	USB to Full UART with GPIO	U1	TSSOP28-3D	1	PL-2303GC
MAX8887EZK33+T	IC REG LIN 3.3V 300MA TSOT23-5	U3	SOT23-5-3D	1	MAX8887EZK33+
MAXQ610	Multi I/O Processor w/ IR support	U4	TQFN44 7MM	1	MAXQ610J-0000+
MAX66301	DeepCover Secure Authenticator with SHA3-256 and RFID Reader	U5	TQFN56 8MM	1	MAX66301ETN+
16MHz	CRYSTAL 16.0000MHZ 20PF SMD	X1	CRYSTAL-CSM-3X-3D	1	ECS-160-20-3X-TR
24.00MHz	CRYSTAL 24.0000MHZ 20PF SMD	X2	CRYSTAL-ECX-64	1	ECS-240-20-20A-TR
13.56MHz	CRYSTAL 13.5600MHZ 20PF SMD	X3	CRYSTAL-CSM-3X-3D	1	ECS-135.6-20-3X-TR
Screw	MACH SCREW PAN HEAD SLOTTED 6-32 1/2 inch	MechSC1, MechSC2, MechSC3, MechSC4	-	4	9336
Stand Off	HEX STANDOFF #6-32 NYLON 5/8"	MechSO1, MechSO2, MechSO3, MechSO4	-	4	1903F
Jumper	CONN+,JUMPER,SHORTING,TIN	SB2 -10POS, S3-S5, S9, SB1, SB3	-	16	SPC02SXIN-RC

MAX66301 EV Kit Schematic Diagram

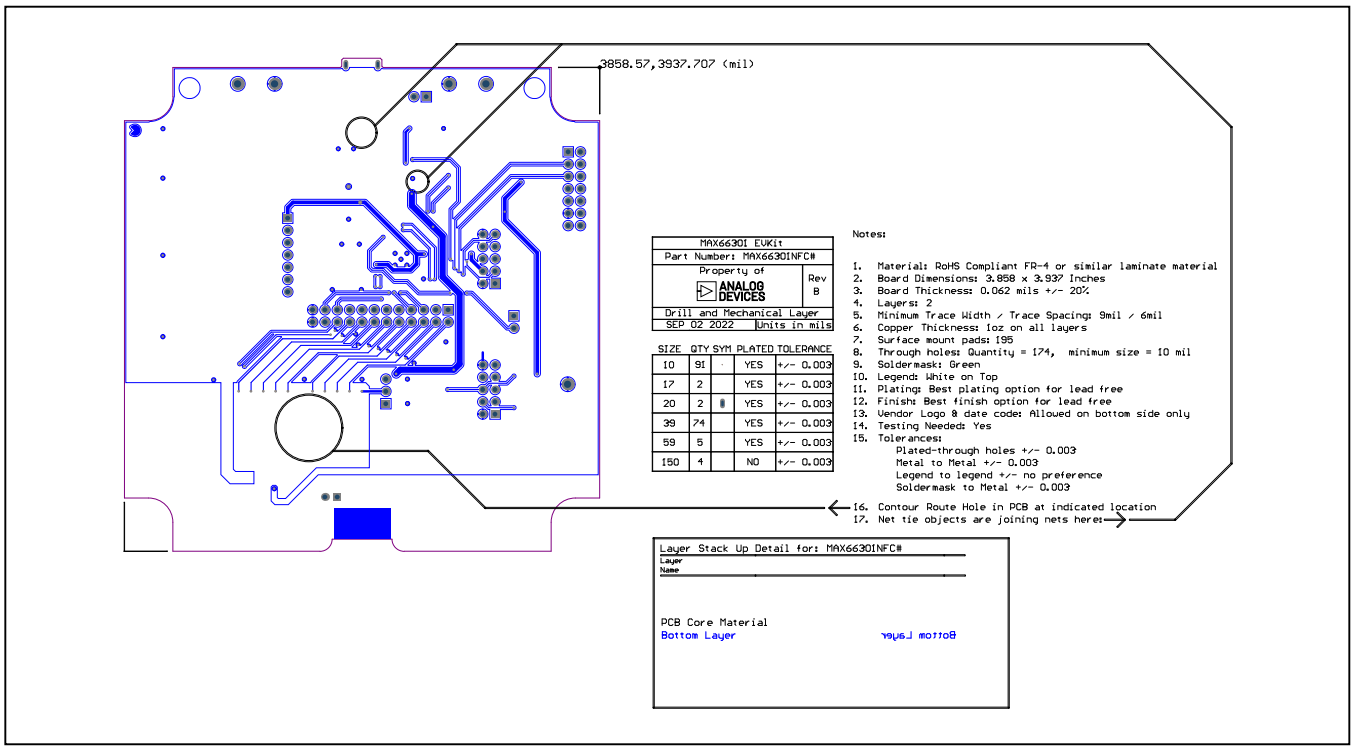


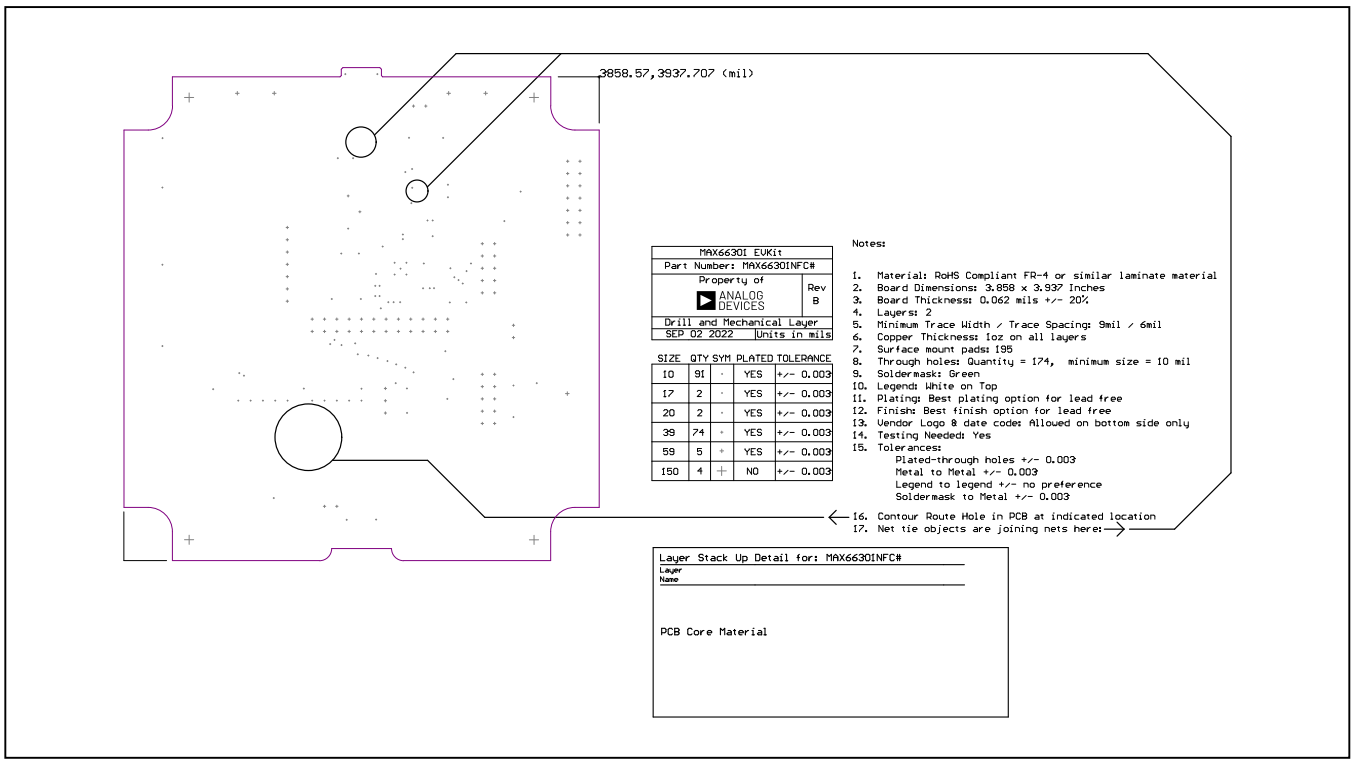
MAX66301 EV Kit PCB Layout Diagrams



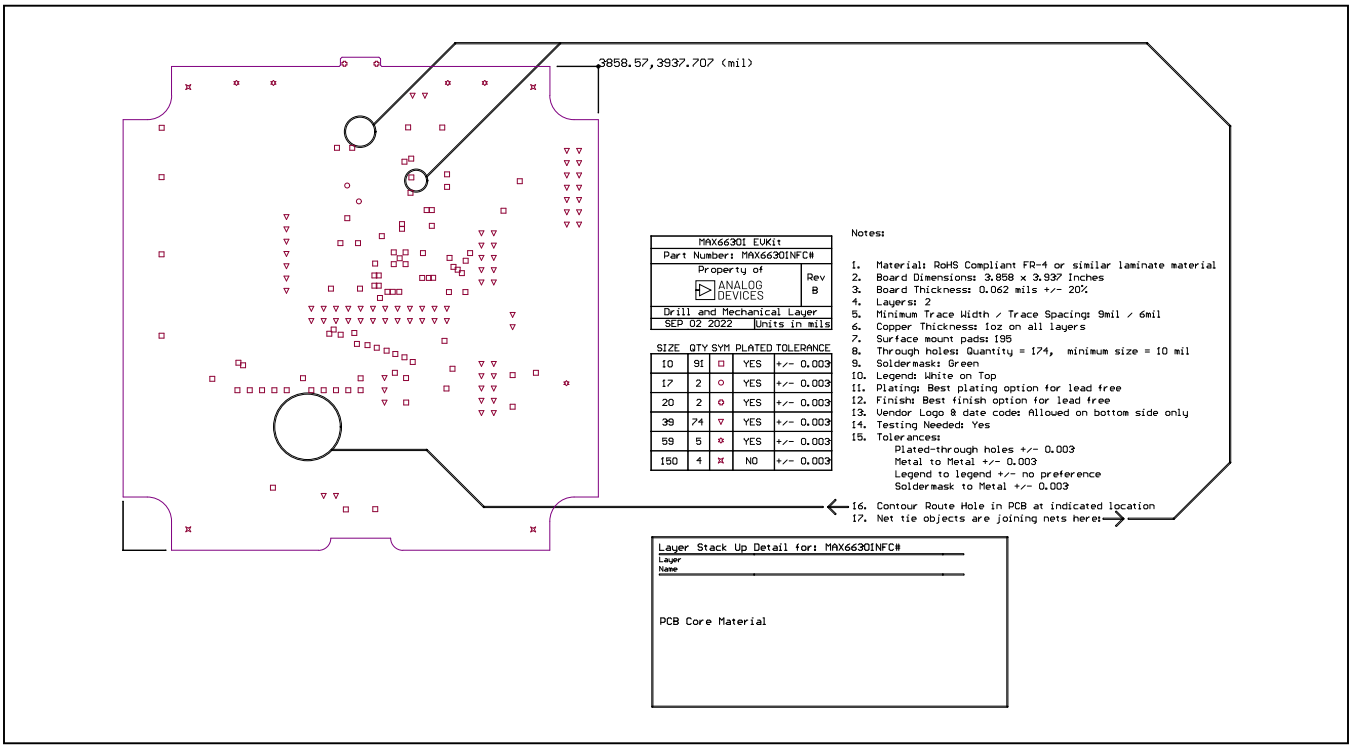


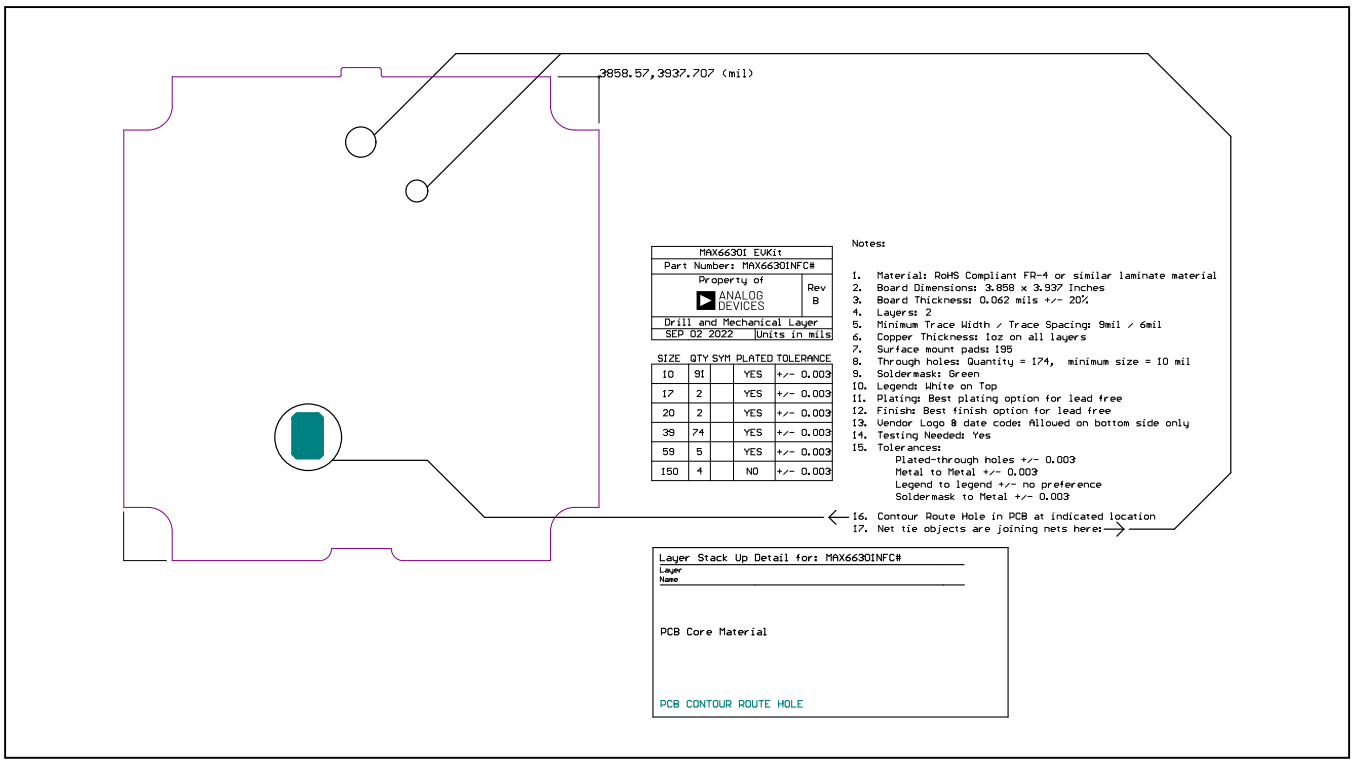
MAX66301 EV Kit PCB Layout Diagrams (continued)





MAX66301 EV Kit PCB Layout Diagrams (continued)

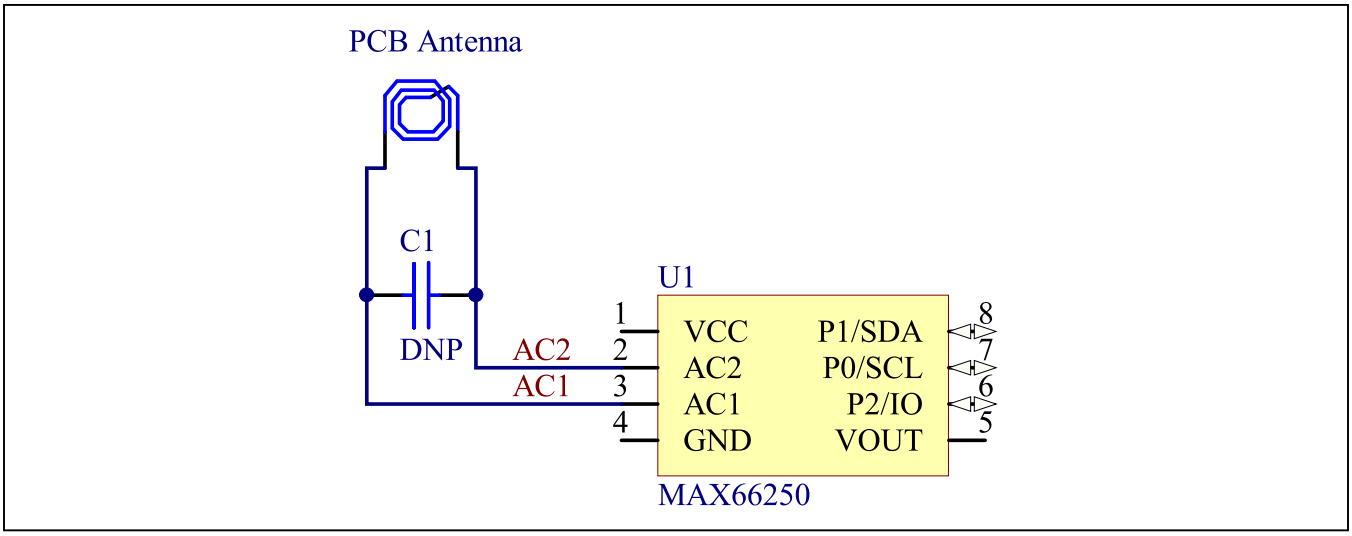




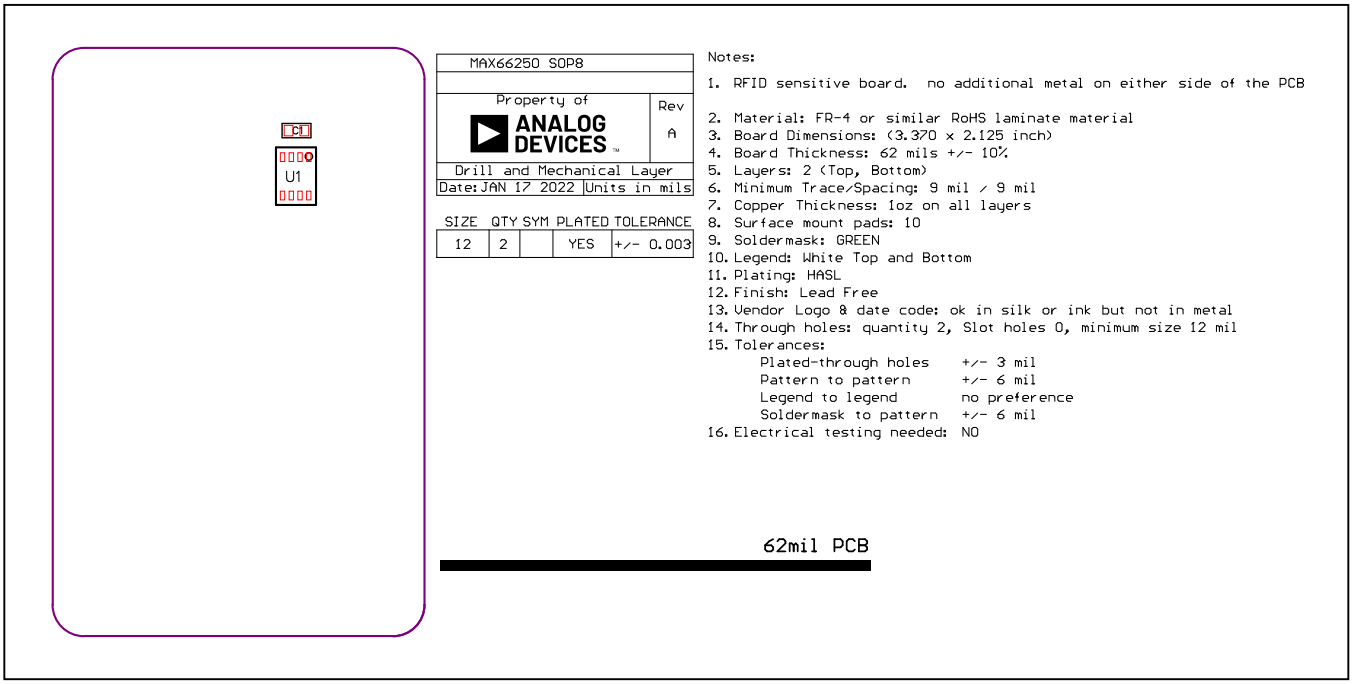
MAX66250 Tag Bill of Materials

COMMENT	DESCRIPTION	DESIGNATOR	FOOTPRINT	QTY	PART NUMBER
MAX66250	DeepCover Secure Authenticator with ISO 15693, SHA3-256 and 256b User EEPROM	U5	SOIC8-3D	1	MAX66250ESA+

MAX66250 Tag Schematic Diagram



MAX66250 Tag PCB Layout Diagram



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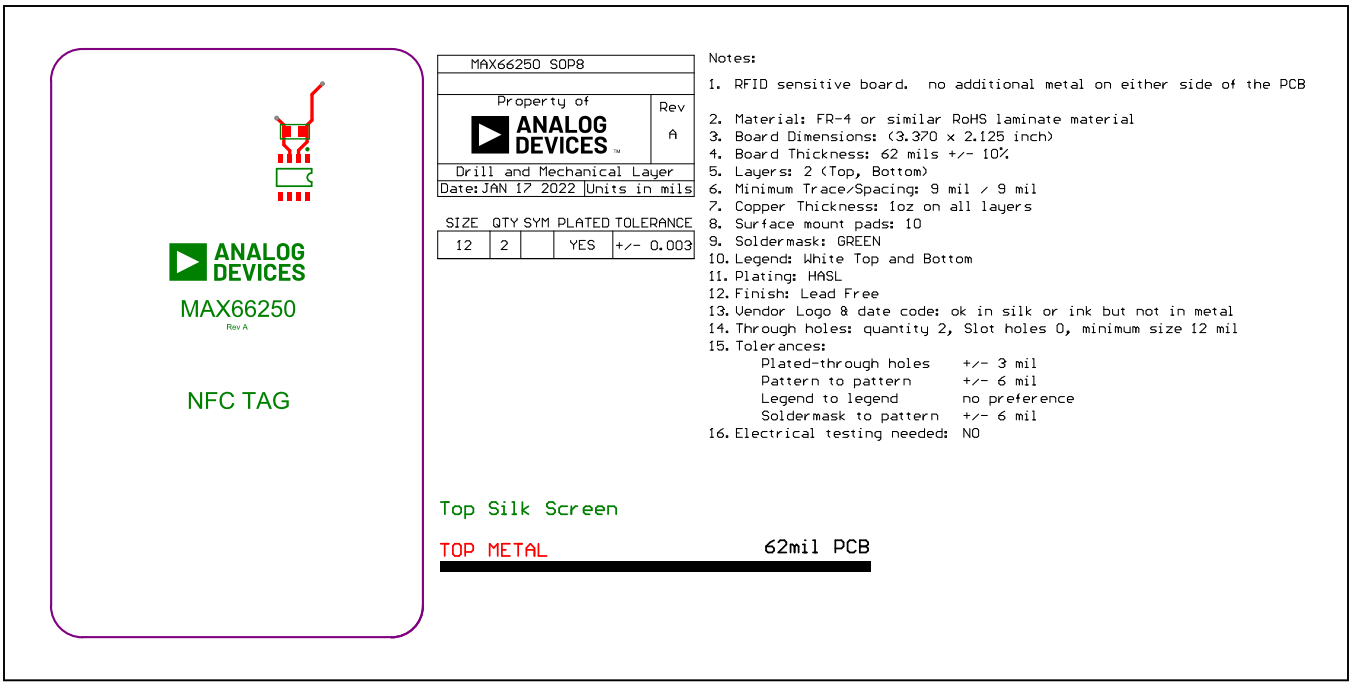
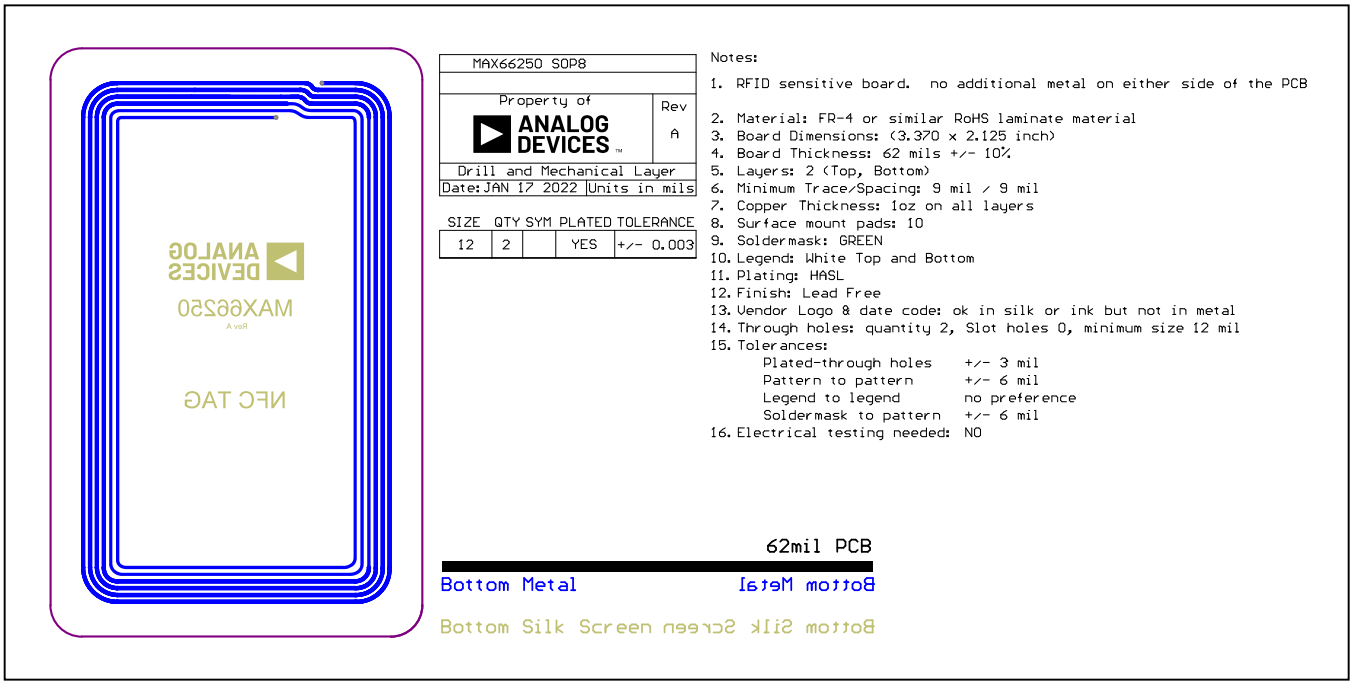
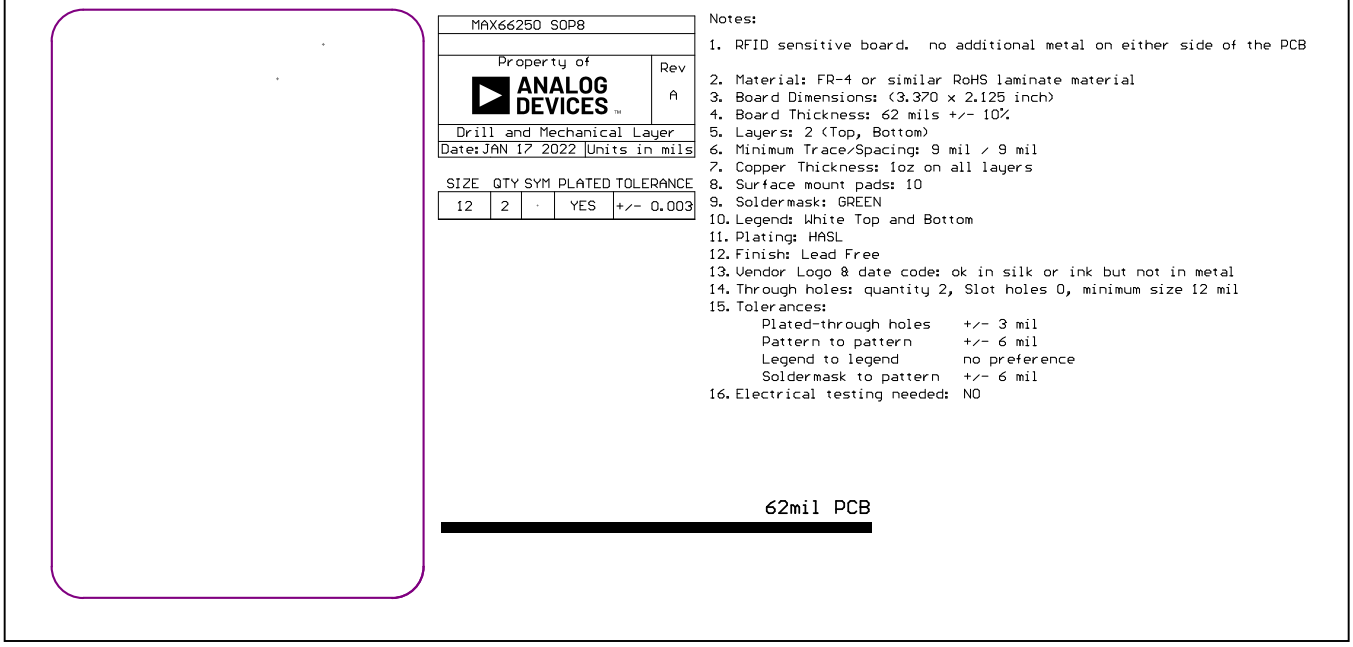
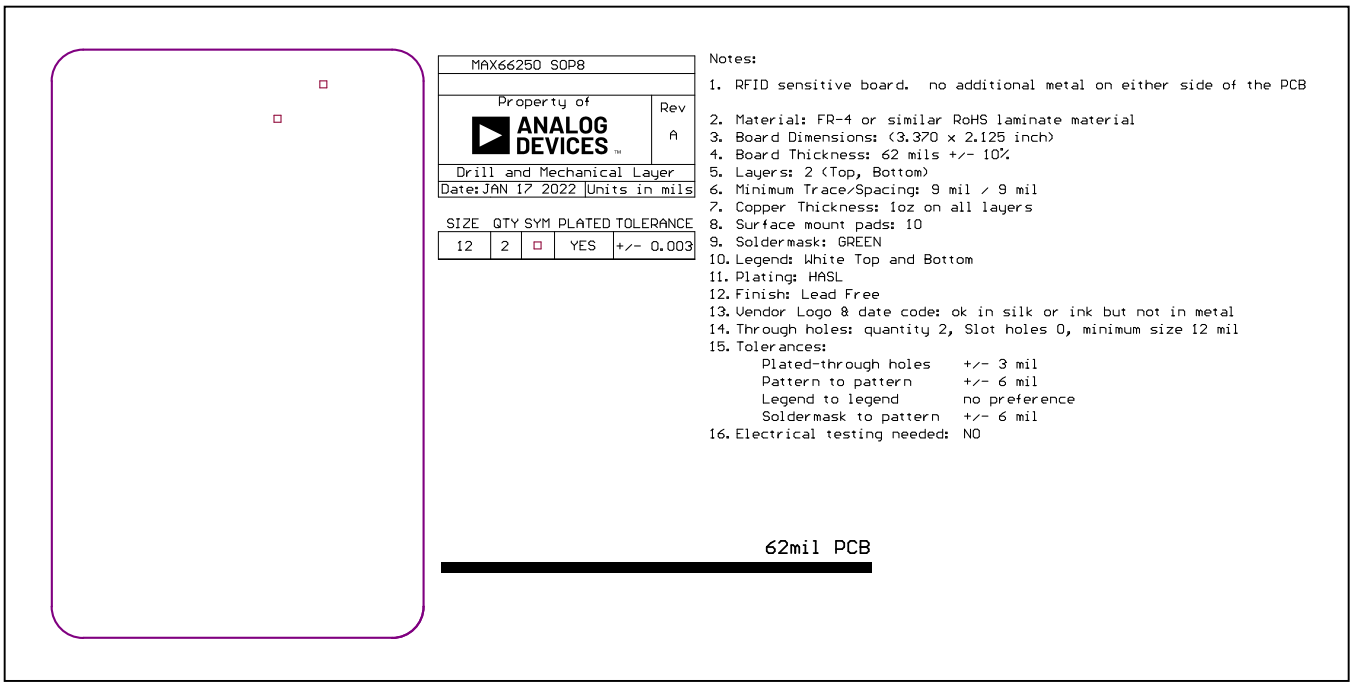




MAX66250 Tag PCB Layout Diagram (continued)

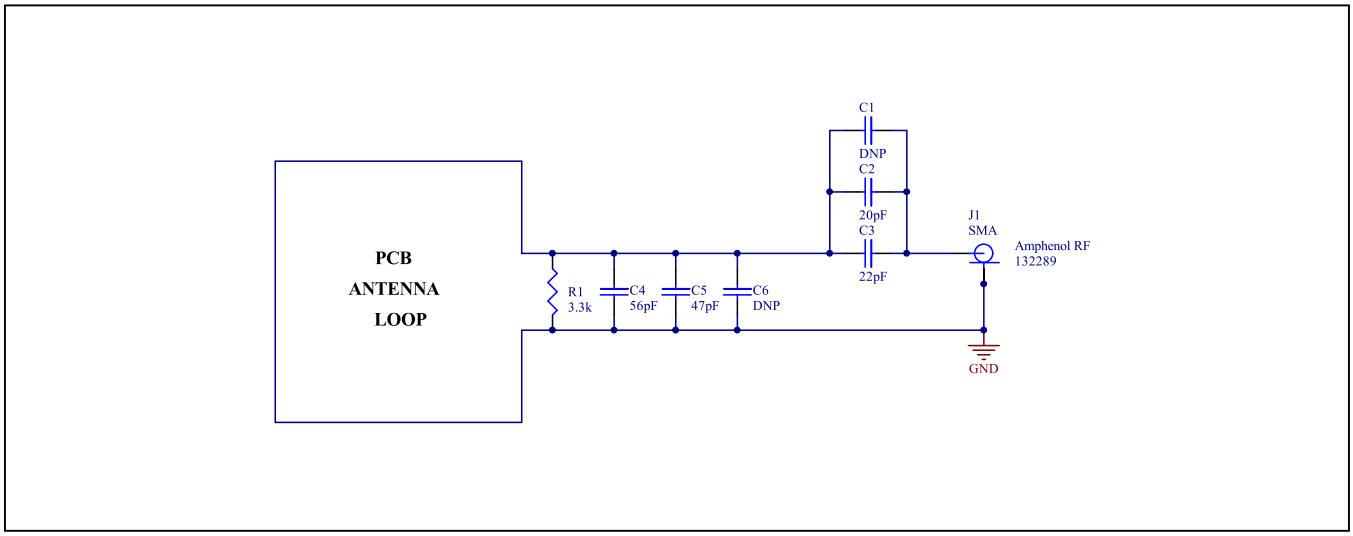




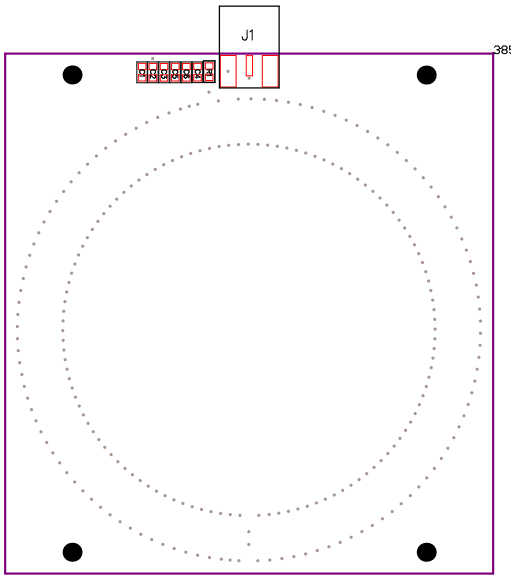
50Ω Shielded Antenna PCB Bill of Materials

COMMENT	DESCRIPTION	DESIGNATOR	FOOTPRINT	QTY	PART NUMBER
20pF	CAP CER 20PF 100V NP0 0805	C2	CAP0805-3D	1	08051U200FAT2A
22pF	CAP CER 22PF 250V NP0 0805	C3	CAP0805-3D	1	251R15S220FV4E
56pF	CAP CER 56PF 100V NP0 0805	C4	CAP0805-3D	1	08051U560FAT2A
47pF	CAP CER 47PF 200V C0G/NP0 0805	C5	CAP0805-3D	1	08052U470FAT2A
SMA	CONN SMA RCPT STR 50OHM EDGE MNT	J1	SMA2MALE-3D	1	132289
3.3k	RES SMD 3.3K OHM 1% 1/8W 0805	R1	0805-3D	1	CR0805-FX-3301ELF
Screw	MACH SCREW PAN HEAD SLOTTED 6-32 1/2 inch	MechSC5, MechSC6, MechSC7, MechSC8	—	4	9336
Stand Off	HEX STANDOFF #6-32 NYLON 5/8"	MechSO5, MechSO6, MechSO7, MechSO8	—	4	1903F

50Ω Shielded Antenna PCB Schematic Diagram



50Ω Shielded Antenna PCB Layout Diagrams



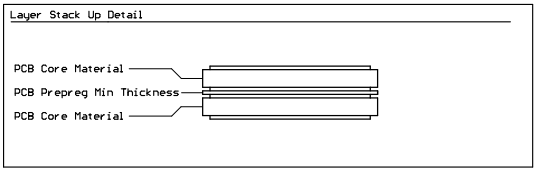
3858.268,4121 (mil)

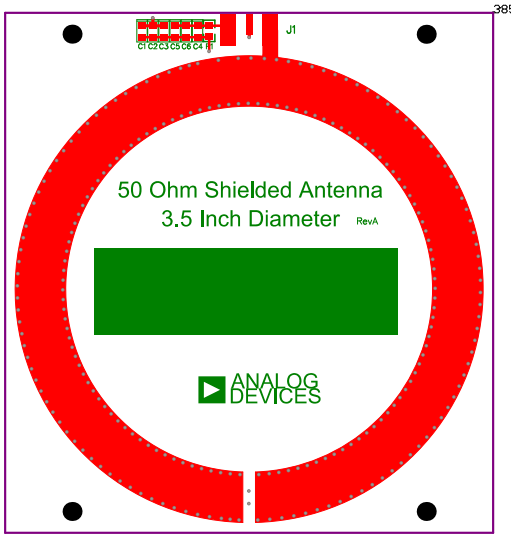
3.5 Inch RFID Antenna		
Property of ANALOG DEVICES		Rev A
Drill and Mechanical Layer		
JAN 10 2022	Units in mils	

SIZE	QTY	SYM	PLATED	TOLERANCE
18	244	*	YES	+/- 0.003
150	4		NO	+/- 0.003

Notes:

1. Material: RoHS Compliant FR-4 or similar laminate material
2. Board Dimensions: 3.858 x 4.121 Inches
3. Board Thickness: 0.062 mils +/- 20%
3a. PCB prepreg thickness minimal standard thickness. (nothing experimental)
Purpose is to space layer 1 and 4 as far from the two inner layers as far as possible
4. Layers: 4
5. Minimum Trace Width / Trace Spacing: 20mil / 8mil
6. Copper Thickness: 1oz on all layers
7. Surface mount pads: 17
8. Through holes: Quantity = 248, minimum size = 0.018 mil
9. Soldermask: Green
10. Legend: White on Top and Bottom
11. Plating: Best plating option for lead free
12. Finish: Best finish option for lead free
13. Vendor Logo & date code: Allowed on bottom side
14. Testing Needed: NO
15. Tolerances:
Plated-through holes +/- 0.003
Metal to Metal +/- 0.003
Legend to legend +/- no preference
Soldermask to Metal +/- 0.003





3858.268,4121 (mil)

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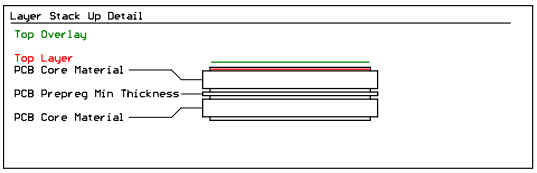
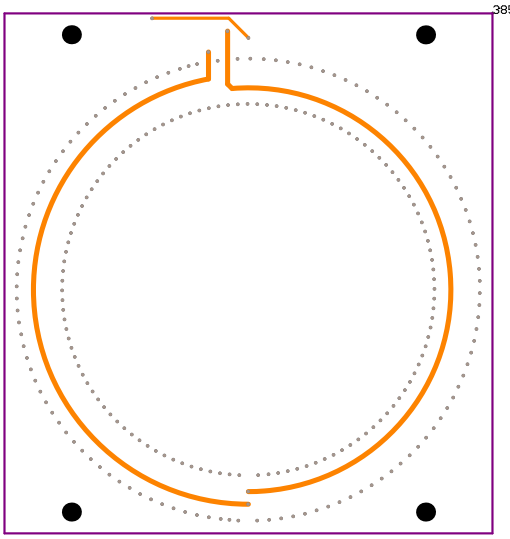


50Ω Shielded Antenna PCB Layout Diagrams (continued)



3858.268,4121 (mil)

3.5 Inch RFID Antenna				
Property of ANALOG DEVICES				Rev A
Drill and Mechanical Layer				
JAN 10 2022			Units in mils	

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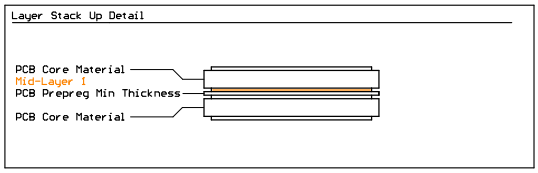

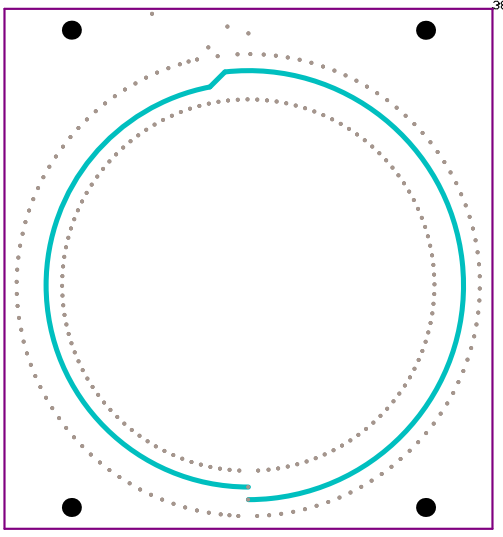

3858.268,4121 (mil)

3.5 Inch RFID Antenna				
Property of ANALOG DEVICES				Rev A
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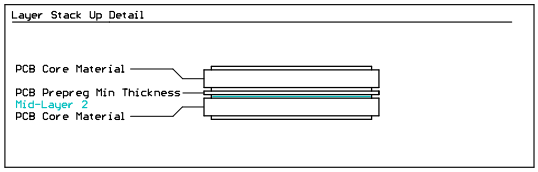
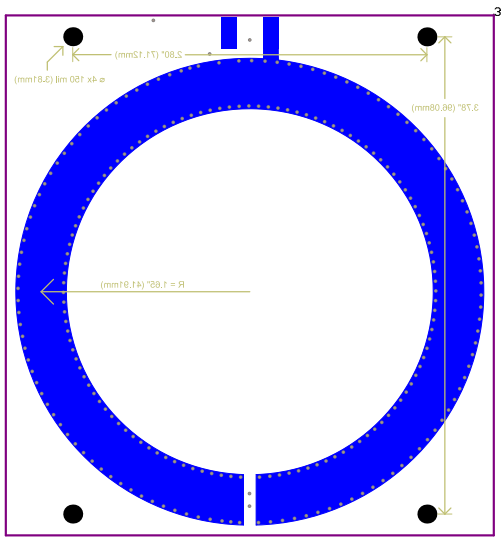


50Ω Shielded Antenna PCB Layout Diagrams (continued)



3858.268,4121 (mil)

3.5 Inch RFID Antenna		
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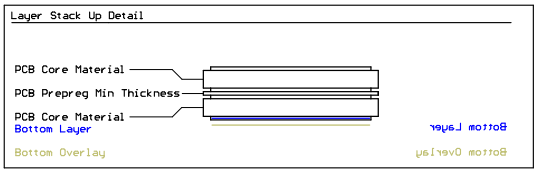

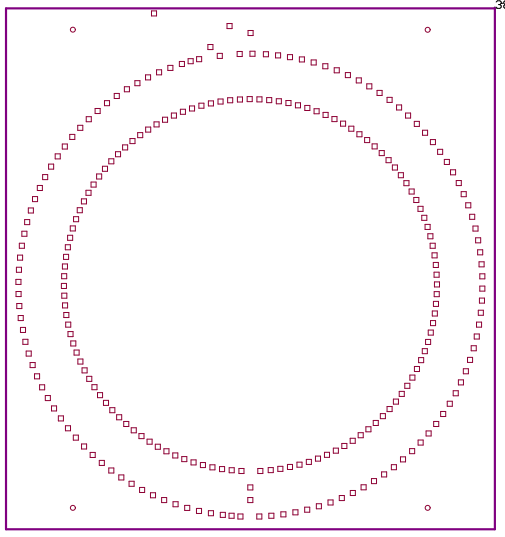

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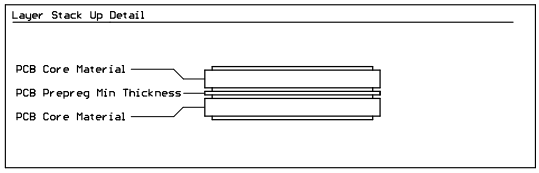
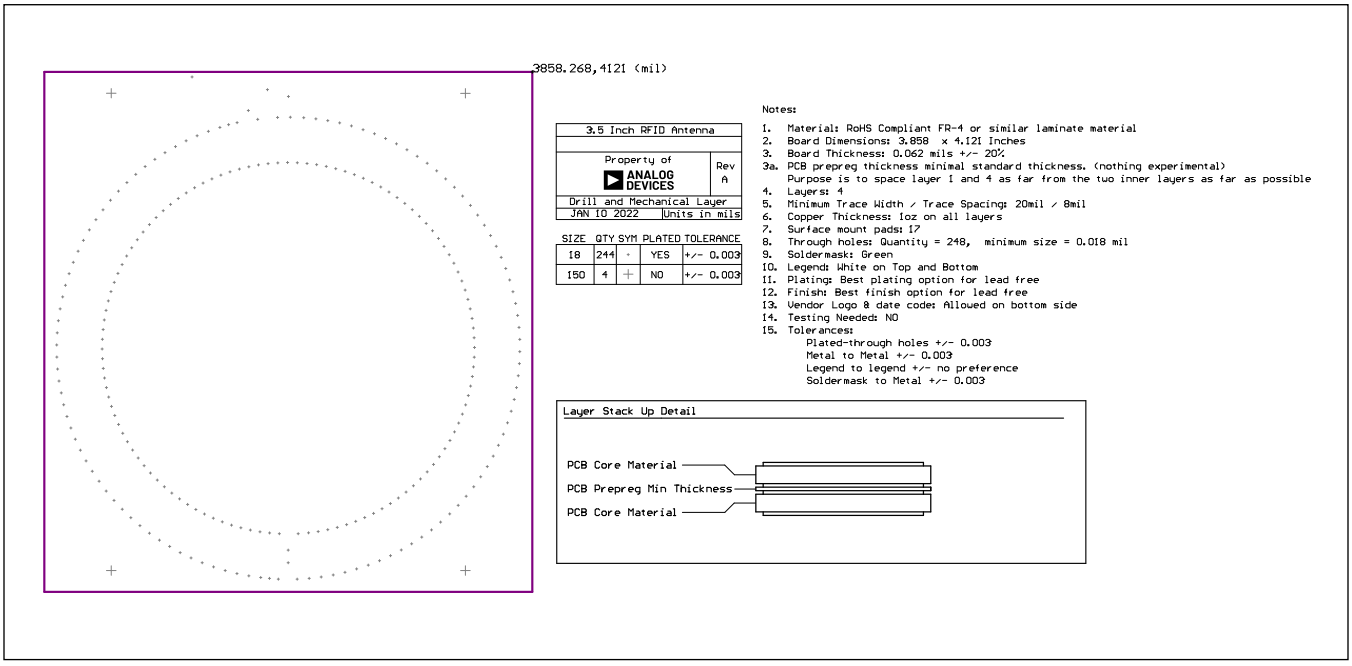


50Ω Shielded Antenna PCB Layout Diagrams (continued)



Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/22	Initial release	—
1	4/23	Updated kit images, reader PCB schematic, jumpers, and BOM	1–3, 7–18
2	8/23	Added link to mobile app and NFC tag ordering part number	1, 9

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