General Description

The MAX77950 evaluation kit (EV kit) is a fully assembled and tested PCB that evaluates the MAX77950 advanced wireless power receiver IC. The IC meets the specification requirements for WPC low-power (v1.2) and PMA SR1 (v2.0) communication protocols and operates using near-field magnetic induction when coupled with WPC or PMA transmitters, providing up to 12W of output power.

The EV kit comes with a planar coil to receive or transmit power wirelessly, as well as Windows®-based software that provides a graphical user interface (GUI) to evaluate the functions of the device.

Benefits and Features

- Ready-to-Go EV Kit with Receiver Coil
- Multiple Test Points to Measure Output Voltage (V_{OUT}), Rectifier Output Voltage (V_{RECT}), and AC Voltage
- Graphical User Interface (GUI) Software for the Multifunction Test
- LED Indication to Monitor Operation
- RoHS Compliant
- Proven PCB Layout
- Fully Assembled and Tested

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

Windows is a registered trademark and registered service mark of Microsoft Corporation.

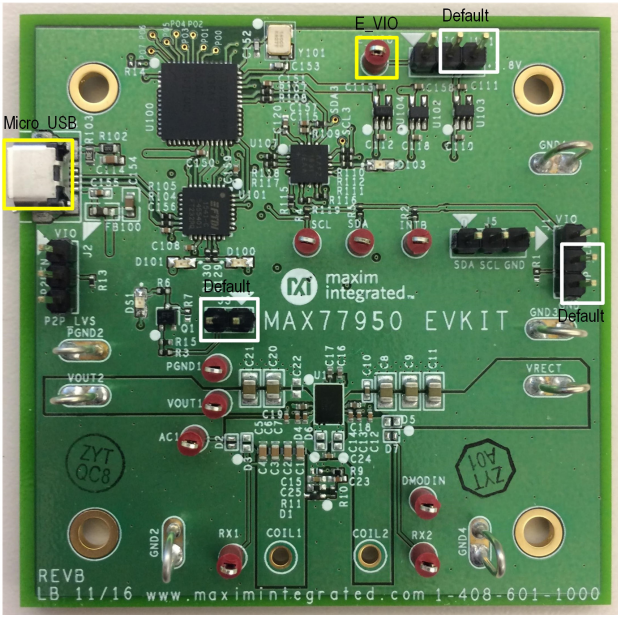
Quick Start

Required Equipment

- MAX77950 EV kit
- Wireless power transmitter with WPC/PMA compliance
- Micro-USB cable
- Digital multimeter (DVM)
- Windows-based PC
- Optional: DC power supply
- Optional: Electronic load

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

MAX77950 EV Kit Photo



Procedures

The EV kit is fully assembled and tested. The following steps are used to verify board operation.

Install the EV Kit GUI

The EV kit GUI allows the user to communicate with the EV kit. The GUI connects to the EV kit through an I2C and USB interface to monitor and control the IC by changing the register-related functions such as FOD coefficient, V_{RECT} target for WPC/PMA, and LDO output voltage.

1) Visit **www.maximintegrated.com/evkitsoftware** to download the latest version of the EV kit software, MAX77950_EVKIT_GUI_1.70207.0D-x86.zip. Save the EV kit software to a temporary folder and uncompress the file.
2) Unzip and run the execution file and follow the instructions to finish the installation.

Startup

3) Ensure that the EV kit has the desired jumper settings, as shown in Table 1.
4) Connect to a PC using the Micro-USB cable (see the *MAX77950 EV Kit Photo*).
5) Turn on the WPC/PMA transmitter to provide power to the EV kit.
6) Place the EV kit on the transmitter and align properly.
7) Check that the power-good indicator LED (DS1) is on.
8) Launch the EV kit GUI. Press **Connect** under the **Device** menu to initiate the link with the EV kit as shown in Figure 1.

PeerPower

Follow the steps below to operate the EV kit in PeerPower™ mode:

9) Disconnect all power supplies from the EV kit.
10) Make a jumper connection on P2P_EN (J2) to VIO pins (1-2) to enable PeerPower mode.
11) Set J101 to pins 1-2 if an external voltage source is used to supply 1.8V to VIO; otherwise, set to pins 2-3 to use the on-board 1.8V.
12) Preset a DC power supply to 5V (if you choose to use an external source to VIO, preset the other DC power supply to 1.8V).
13) Connect the 5V DC power supply to V_{OUT} and 1.8V to E_VIO (see the *MAX77950 EV Kit Photo*)
14) Turn on the power supply.
15) The EV kit is now ready to operate as a transmitter.

*For VIO to use on-board 1.8V from LDO (U103), connect to a 5V source through the Micro-USB cable (J4).

Table 1. Default Jumper Settings

JUMPER	NODE OR FUNCTION	SHUNT POSITION	FUNCTION
J1	WP_EN	1-2	The device is disabled.
		2-3*	The device is enabled.
J2	P2P_EN	1-2	Connecting P2P_EN to VIO.
		2-3	Not in use.
		OPEN*	PeerPower is disabled.
J3	WP_DET	1-2*	Connect WP_DET to LED.
J101	VIO	1-2	An external source (1.8V) supplies VIO.
		2-3*	On-board 1.8V LDO (U103) supplies VIO.

**Default position.*

PeerPower is a trademark of Maxim Integrated Products, Inc.

Detailed Description of Software

The MAX77950 EV kit GUI (Figure 2) is a convenient tool to control the IC through the I²C communication. The GUI consists of six tabs, and each one combines the related functions. For example, in the **RXMODE** tab, the registers related to receiver mode of the IC are shown and controlled by using a slidebar if they are writable registers. The registers load the data from OTP when the IC restarts. The current register values are presented by clicking the **Read** button.

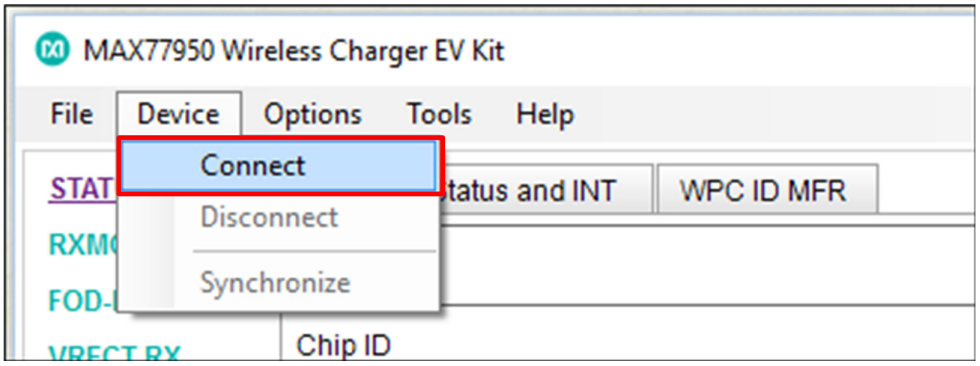


Figure 1. MAX77950 EV Kit GUI (Device Connect)

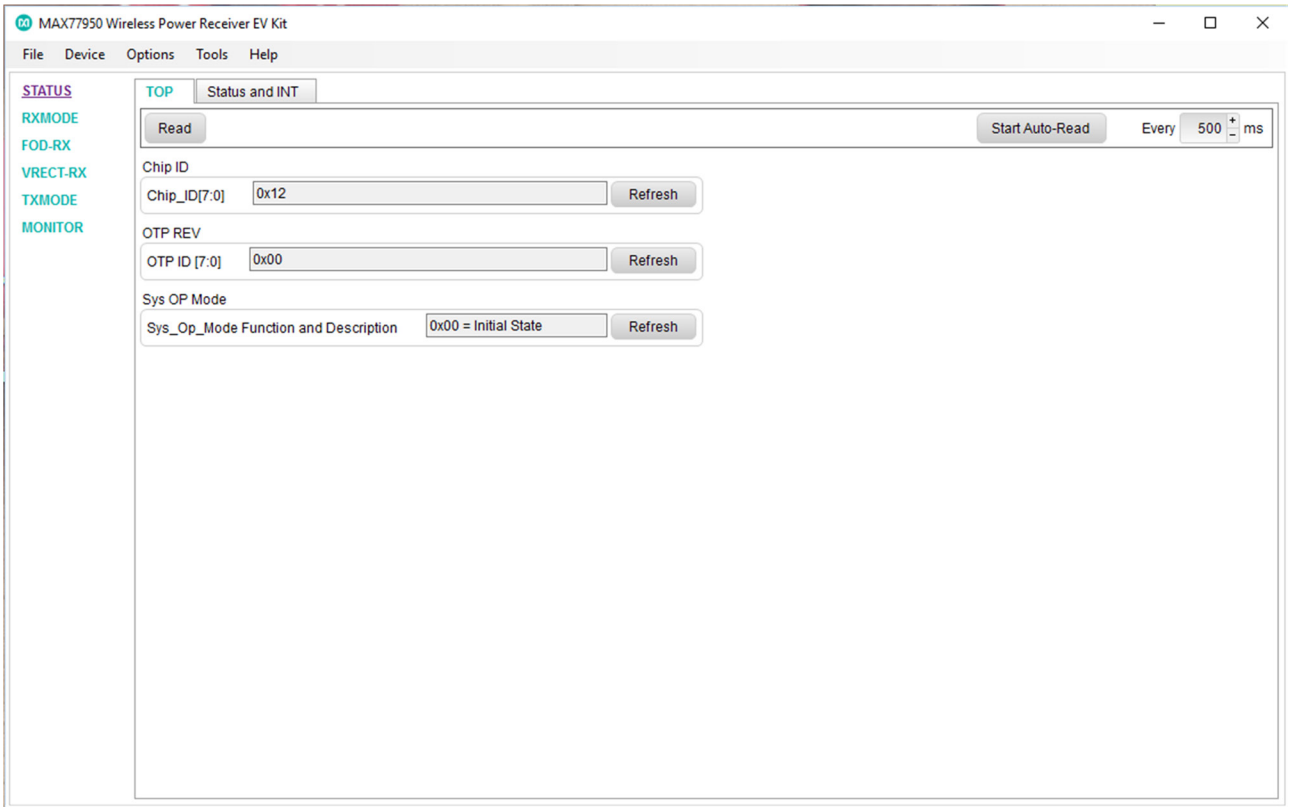


Figure 2. MAX77950 EV Kit GUI (STATUS Tab)

RXMODE

In the **RXMODE** tab, the registers associated with the receiver mode function can be examined. Some registers are writable and can be changed by the user.

- The LDO output voltage (V_{OUTSET}) and the LDO current limit (LDO_ILMITSET) can be changed by the user. As seen in box #1 in Figure 3, the default value of V_{OUT} is 5V.
  - Click **Read** to ensure that the current value in the register is properly displayed.
  - Adjust the slide bar to set the value desired and send the changes to the IC by clicking the **Write** button next to the slide bar.
  - Repeat the steps to change the LDO current limit (box #2).
- The end-power-transfer (EPT) packet can be sent manually by the GUI along with the reason for EPT. The reason for EPT must be set before sending the EPT packet (Figure 3).
  - By sliding the cursor, the reason for EPT can be selected. Click **Write** to fix the values of EPT reason on the EPT_REASON register (box #3).
  - To send the EPT packet, toggle the switch next to the **Send EPT** in box #4 and then click the **Write** button (#5) in the **RX_COM** group box.
- The proprietary packet (PPP) can also be sent by the IC. The user can practice sending a PPP using the GUI. In WPC specifications, several PPPs are defined and they have a message length up to 20 bytes. The IC supports the PPP that supports up to 5 bytes of the message.

The following example procedure is for sending a PPP with the GUI:

- Decide on the PPP with the designed message length (in this example, it is 3)
- Write the PPP_HEADER as 0x38 because the PPP that starts with the 0x38 header is defined to have 3 bytes of the message in the specification (box #6).
- Write 3 bytes of message in the RX_DATA_VALUE0/1/2 (box #7).
- Toggle on the SEND_RX_DATA bit (box #8) and send by clicking the **Write** button (box #5).

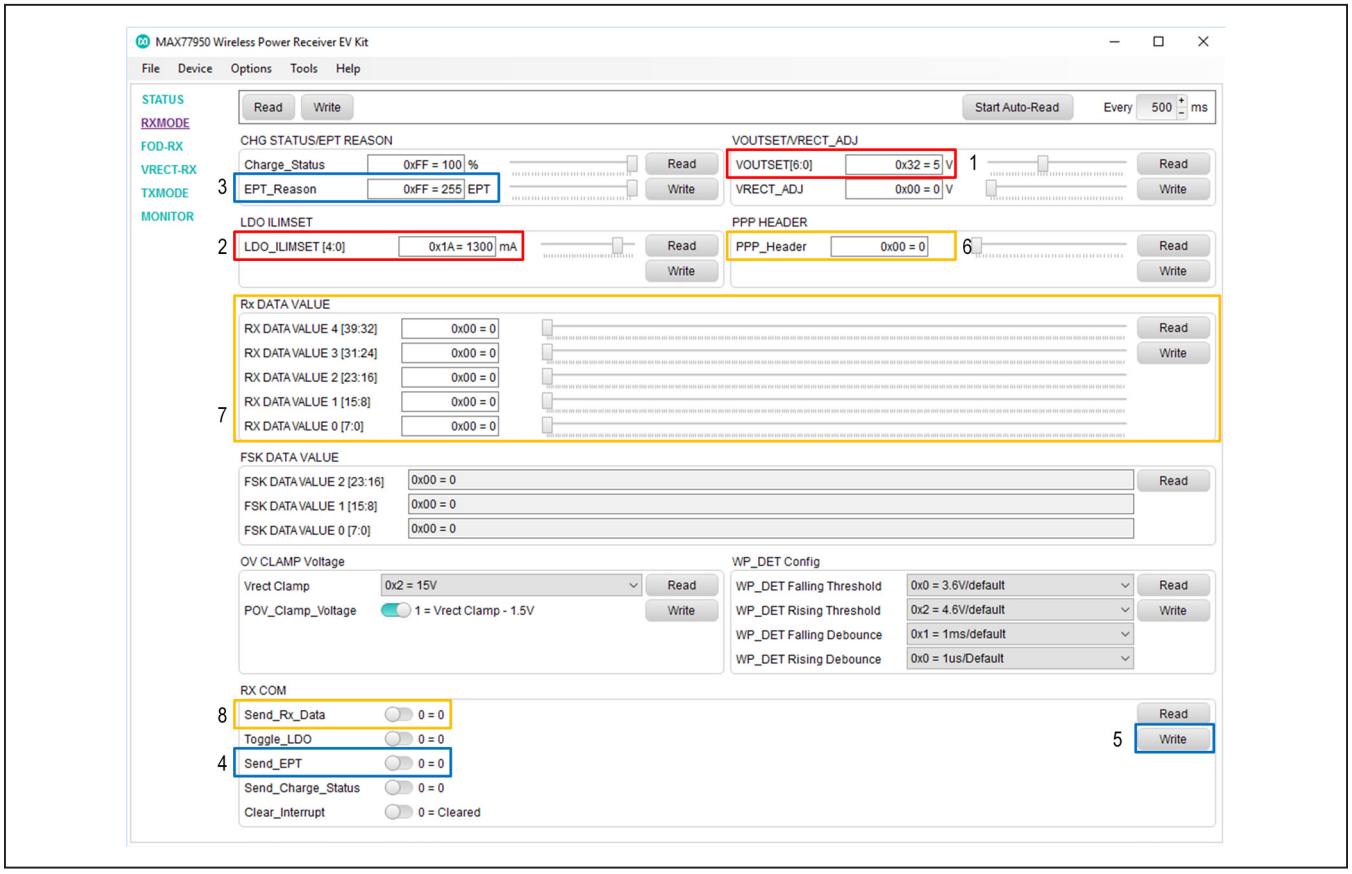


Figure 3. MAX77950 EV Kit GUI (RXMODE Tab)

FOD-RX

As required by the WPC specifications, foreign object detection (FOD) is a function of the IC. The coefficient for the FOD can be modified in the **FOD-RX** tab (Figure 4).

- Click the **FOD-RX** tab in the left sidebar. Read the registers to see the current FOD coefficients.
- Adjust the coefficients as desired by dragging the cursor on the slide bars. Then, click the **Write** button to send the changes to the IC (to decide the FOD coefficients, refer to the MAX77950 IC data sheet).

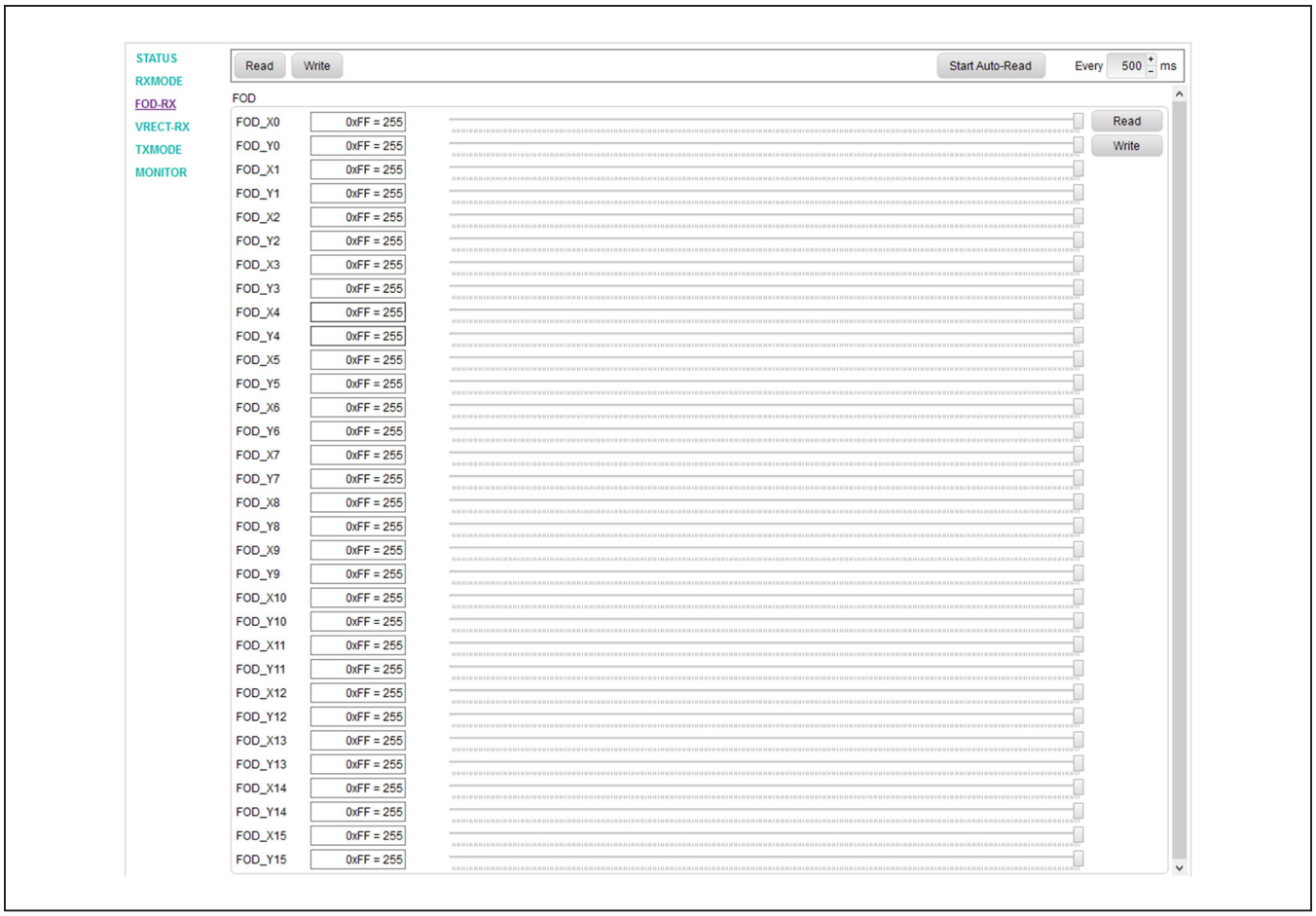


Figure 4. MAX77950 EV Kit GUI (FOD-RX Tab)

VRECT-RX

The EV kit GUI offers a way to adjust the targeted V_{RECT} values. In the **VRECT-RX** tab (Figure 5), four sub-tabs can be found. The purpose of these tabs are to control the V_{RECT} values only, such as V_{RECT} X, V_{RECT} Y for WPC, and V_{RECT} Y for PMA respectively. The targeted values are to be set either in the V_{RECT} tab or the specific V_{RECT} tabs. The following procedures are to set the V_{RECT} target for the IC.

1) Change the target values by moving the cursor on the slide bars. In the specific V_{RECT} tab, shown in Figure 6, the user can check the actual electrical representation translated from hexadecimal (Figure 6). The MAX77950 data sheet provides detailed information about the V_{RECT} target values.
2) To apply the change, click the **Write** button.

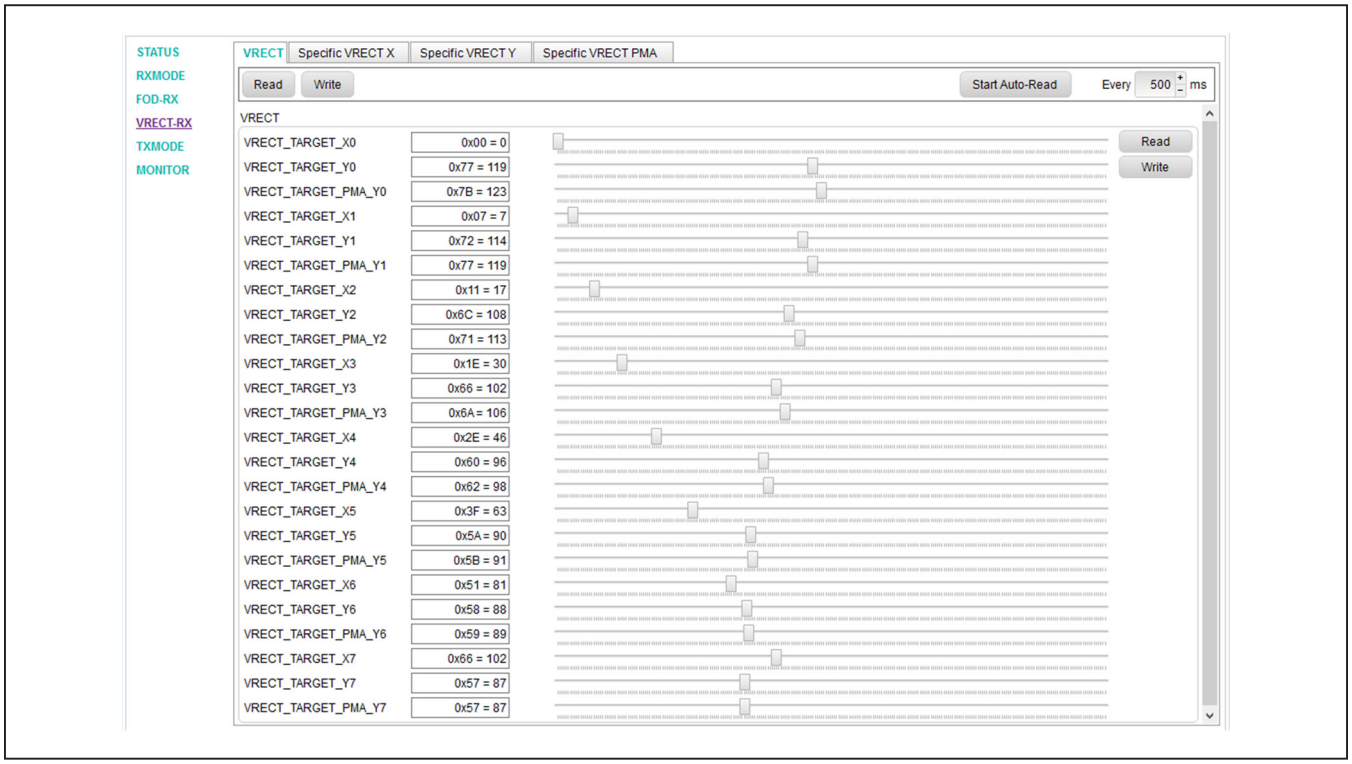


Figure 5. MAX77950 EV Kit GUI (VRECT-RX Tab)

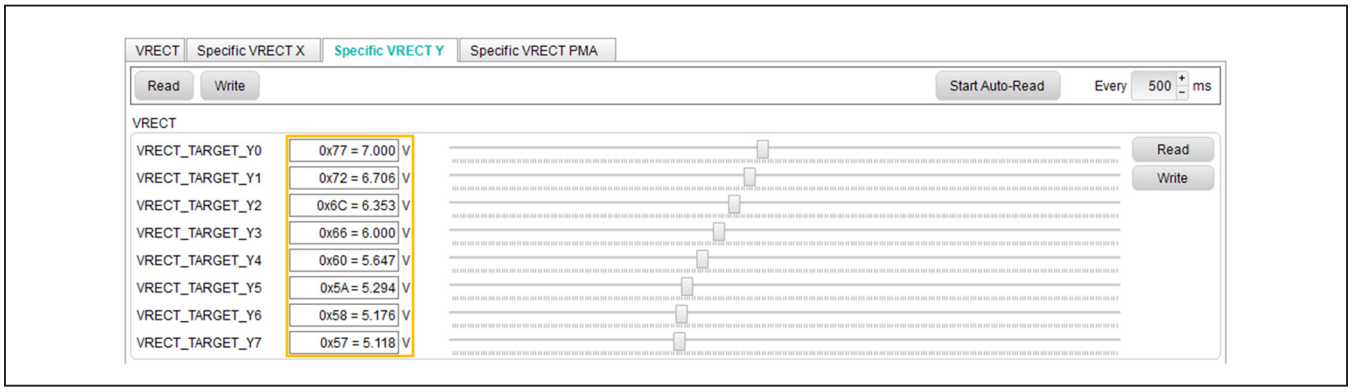


Figure 6. MAX77950 EV Kit GUI (VRECT-RX Tab)

TXMODE

The TXMODE tab is dedicated to PeerPower mode in which the IC operates as a transmitter. In this tab, the current limit and the ping operating frequency can be defined by the GUI. In addition, the user can check the packets delivered from a receiver. As shown in Figure 7, the current limit (box #1) and the ping operation frequency (box #2) can be set by sliding cursors, respectively. The detailed description on PeerPower can be found in the MAX77950 IC data sheet.

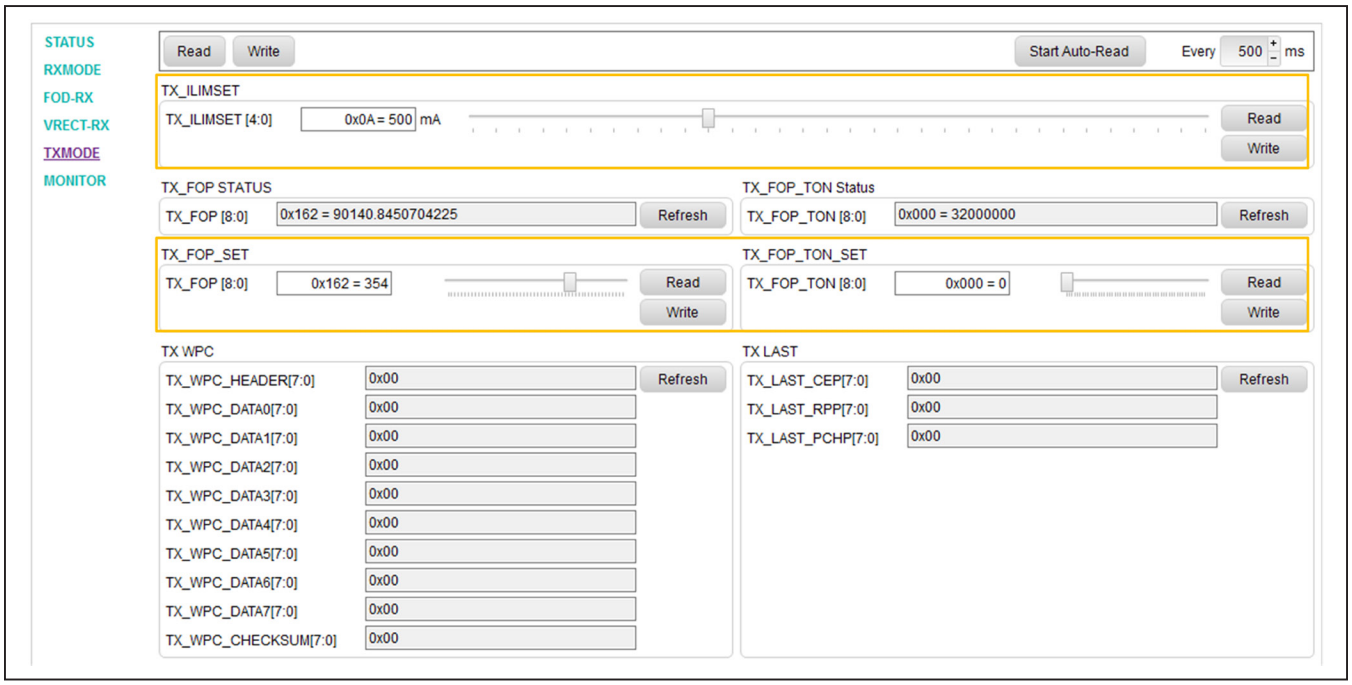


Figure 7. MAX77950 EV Kit GUI (TXMODE Tab)

MONITOR

The EV kit GUI provides the user with the **MONITOR** tab to see the current information of the IC during its operation. The information includes V_{OUT}, V_{RECT}, die temperature, load current read by ADC, and operating frequency. Click the **Refresh** or **Read** button to update the readings.

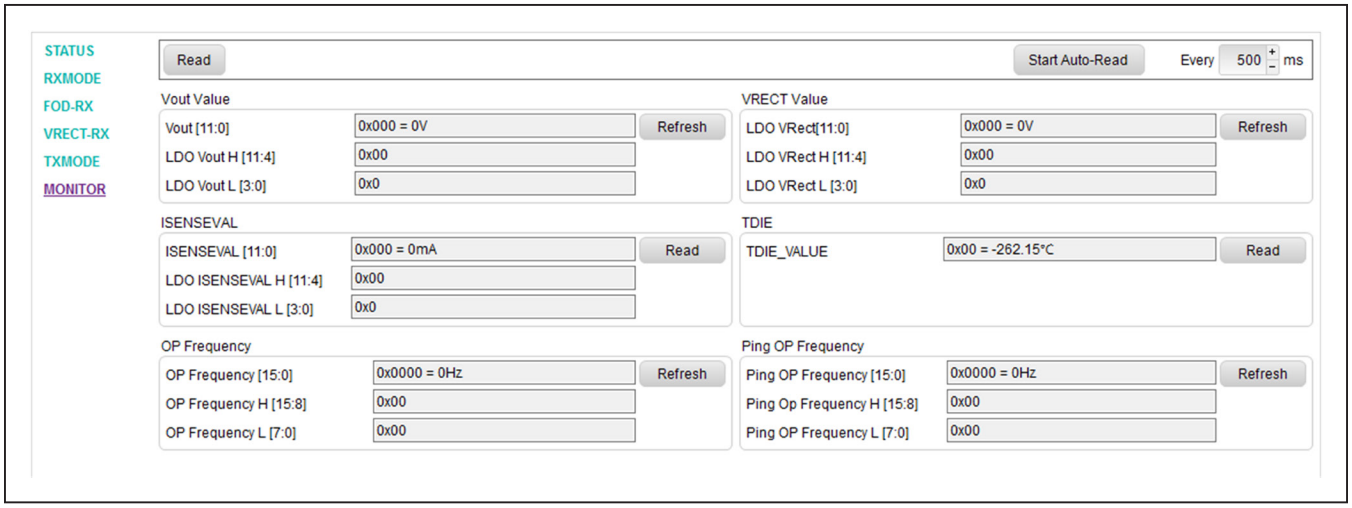


Figure 8. MAX77950 EV Kit GUI (MONITOR Tab)

Ordering Information

PART	TYPE
MAX77950EVKIT#	EV Kit

#Denotes RoHS compliant.

MAX77950 EV Kit Bill of Materials

PART	QTY	DESCRIPTION
C1-C4	4	SMT (0603); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; Kemet C0603C104K5RAC; TDK C1608X7R1H104K
C5, C6, C12, C13	4	SMT (0402); CERAMIC CHIP; 0.047UF; 50V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R; TDK C1005X5R1H473K050
C7, C14	2	SMT (0402); CERAMIC CHIP; 0.015UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; Murata GRM155R71H153KA12
C8, C9, C11, C20, C21	5	SMT (0805); CERAMIC CHIP; 10UF; 25V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R; Taiyo-Yuden TMK212BBJ106KG-T
C10	1	SMT (0402); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; TDK CGA2B3X7R1H104K
C15	1	CAPACITOR; SMT (0402); OPEN
C16-C19	4	SMT (0402); CERAMIC CHIP; 1UF; 10V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R; Murata GRM155R61A105KE15
C22	1	CAPACITOR; SMT (0603); OPEN
C23	1	SMT (0402); CERAMIC CHIP; 0.01UF; 50V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R; TDK C1005X5R1H103K050
C24	1	SMT (0402); CERAMIC CHIP; 2200PF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; Murata GRM155R71H222KA01
C25	1	SMT (0402); CERAMIC CHIP; 1000PF; 50V; TOL=10%; MODEL=C0G; TG=-55 DEGC TO +125 DEGC; TC=+; Kemet C0402C102K5GAC
C108, C150, C151, C155-C157, C159	7	SMT (0402); CERAMIC CHIP; 0.1UF; 25V; TOL=10%; MODEL=C SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R; TDK C1005X7R1E104K050BB
C110-C113, C115, C118, C158	7	SMT (0402); CERAMIC CHIP; 1UF; 6.3V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R;
C114	1	CAPACITOR; SMT; 0603; CERAMIC; 0.47uF; 10V; 10%; X5R; -55DEGC to + 125DEGC; Kemet C0603C474K8PAC
C120	1	SMT (0402); CERAMIC CHIP; 1UF; 6.3V; TOL=20%; MODEL=C SERIES; TG=-55 DEGC TO +85 DEGC; TC=X5R; TDK C1005X5R0J105M050BB
C152, C153	2	SMT; 0402; CERAMIC; 8.2pF; 50V; 0.25%; C0G; -55DEGC to + 125DEGC; 0 +/- 30PPM/DEGC; Kemet C0402C829C5GAC

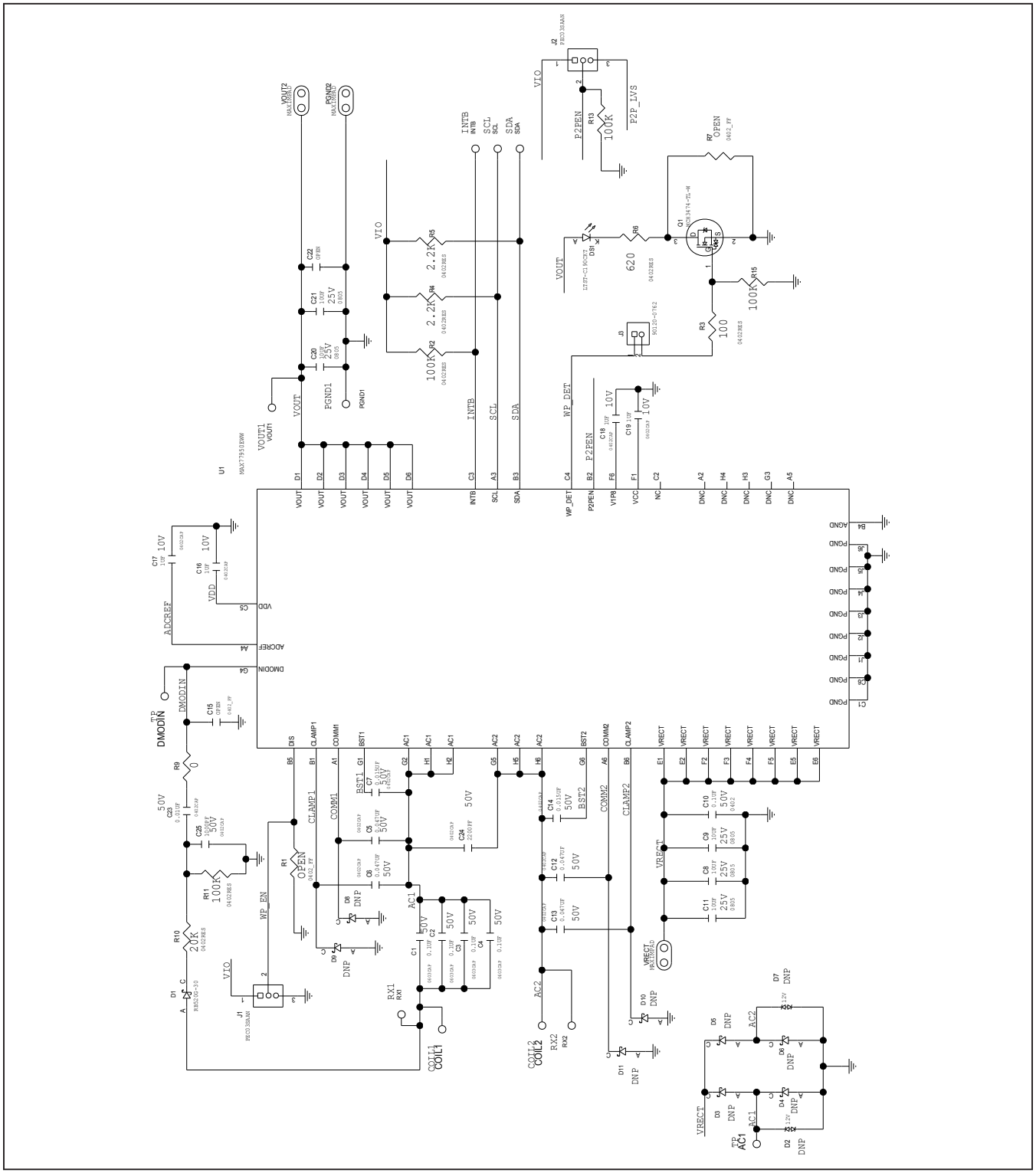
MAX77950 EV Kit Bill of Materials (continued)

PART	QTY	DESCRIPTION
C154	1	SMT (0603); CERAMIC CHIP; 4.7UF; 16V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R; TDK C1608X5R1C475K080AC
D1	1	SCH; SCHOTTKY BARRIER DIODE; SMT (SOD-723); PIV=30V; IF=0.1A; RB520G-30
D2, D7	2	TVS; SMT (SOD882); VRM=12V; IPP=7.8A; NXP PESD12VV1BL; OPEN
D3-D6	4	SCH; SCHOTTKY BARIER DIODE; SMT; OPEN
D8-D11	4	SCH; SCHOTTKY BARIER DIODE; SMT; OPEN
D100, D101	2	LED; STANDARD; YELLOW; SMT (0603); PIV=5.0V; IF=0.02A; -55 DEGC TO +85 DEGC; Lite-On Electronics LTST-C190YKT
DS1, D103	2	LED; STANDARD; RED; SMT (0603); PIV=5.0V; IF=0.04A; -55 DEGC TO +85 DEGC; Lite-On Electronics LTST-C190CKT
FB100	1	INDUCTOR; SMT (0603); FERRITE-BEAD; 220; TOL=+/-25%; 1.4A; -55 DEGC TO +125 DEGC; Murata BLM18PG221SN1
GND1-GND4	4	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG; Weico Wire 9020 BUSS
J1, J2	2	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC; Sullins Electronics Corp. PEC03SAAN
J3	1	THROUGH HOLE; C-GRID III SINGLE ROW STRAIGHT PIN HEADER; STRAIGHT THROUGH; Molex 90120-0762
J4	1	CONNECTOR; FEMALE; SMT; MICRO USB B-TYPE REVERSE; RIGHT ANGLE; 5PINS FCI Connect 10103592-0001LF
J5, J101	2	THROUGH HOLE; SINGLE ROW; STRAIGHT; 3PINS Samtec TSW-103-07-L-S
PGND2, VOUT2, VRECT	3	EVK KIT PARTS; MAXIM PAD; NO WIRE TO BE SOLDERED ON THE MAXIMPAD
Q1	1	POWER MOSFET; SINGLE N-CHANNEL; NCH; SC70; PD-(1W); I-(4A); V-(30V) ON Semiconductor MCH3474-TL-W
R1,R7	2	RESISTOR; 0402; OPEN
R2, R11, R13, R15	4	RESISTOR; 0402; 100K; 1%; 100PPM; 0.0625W; THICK FILM Vishay Dale CRCW0402100KFK
R3, R129, R130	3	RESISTOR; 0402; 100 OHM; 1%; 100PPM; 0.063W; THICK FILM; Vishay Dale CRCW0402100RFK

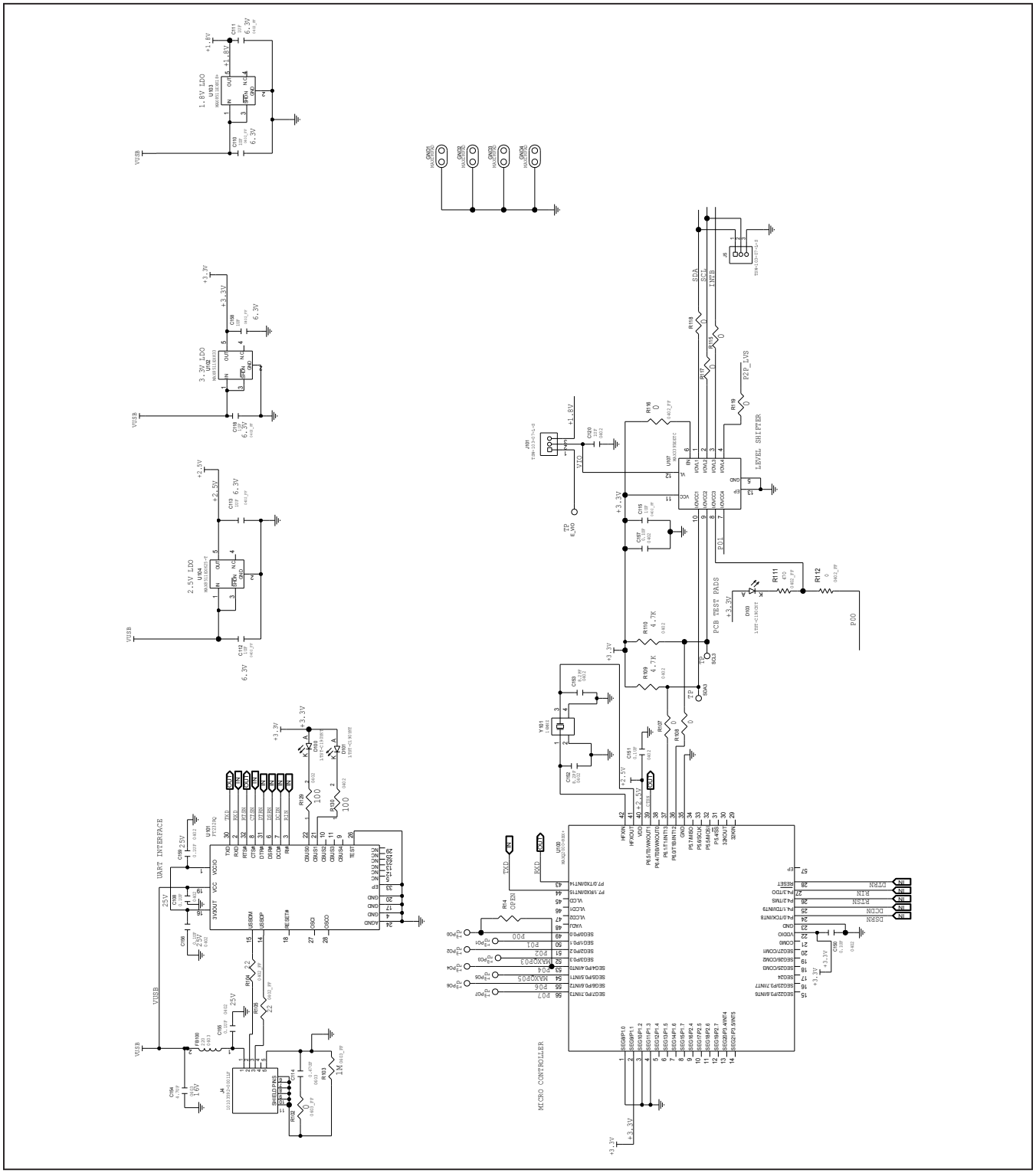
MAX77950 EV Kit Bill of Materials (continued)

PART	QTY	DESCRIPTION
R4, R5	2	RESISTOR, 0402, 2.2K OHM, 1%, 100PPM, 0.0625W, THICK FILM; Vishay Dale CRCW04022K20FK
R6	1	RESISTOR; 0402; 620 OHM; 1%; 100PPM; 0.063W; THICK FILM; Vishay Dale CRCW0402620RFK
R9	1	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.063W; THICK FILM; Vishay Dale CRCW04020000ZS
R10	1	RESISTOR; 0402; 20K OHM; 1%; 100PPM; 0.063W; THICK FILM; Vishay Dale CRCW040220K0FK
R14	1	RESISTOR; 0402; OPEN
R102	1	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM
R103	1	RESISTOR; 0603; 1M; 1%; 100PPM; 0.10W; THICK FILM
R104, R105	2	RESISTOR, 0402, 22 OHM, 1%, 100PPM, 0.0625W, THICK FILM
R107, R108, R112, R115-R119	8	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM
R109, R110	2	RESISTOR, 0402, 4.7K OHM, 1%, 100PPM, 0.0625W, THICK FILM Vishay Dale CRCW04024K70FK
R111	1	RESISTOR, 0402, 470 OHM, 1%, 100PPM, 0.0625W, THICK FILM
Coil	1	COIL; 760308102207; Wurth
U1	1	IC; MAX77950; PACKAGE OUTLINE 52 BUMPS WLP PKG. 0.40MM PITCH; W546A9+1; PKG. DWG. NO.: 21-100082; Maxim Integrated MAX77950EWW
U100	1	IC; CTRL; LOW-POWER LCD MICROCONTROLLER; TQFN56-EP 8X8 Maxim Integrated MAXQ2000-RBX+
U101	1	IC; INFC; UART INTERFACE IC USB TO SERIAL; QFN32-EP 5X5 Future Technology Devices International LTD.FT232RQ
U102	1	IC; VREG; ULTRA-LOW-NOISE, HIGH PSRR, LOW-DROPOUT, LINEAR REGULATOR; SC70-5; -40 DEGC TO +85 DEGC; Maxim Integrated MAX8511EXK33+
U103	1	IC; VREG; ULTRA-LOW-NOISE; HIGH PSRR; LOW=DROPOUT; LINEAR REGULATOR; SC70-5 Maxim Integrated MAX8511EXK18+
U104	1	IC; VREG; ULTRA-LOW-NOISE HIGH PSRR LOW-DROPOUT LINEAR REGULATOR; SC70-5; -40 DEGC TO +85 DEGC; Maxim Integrated MAX8511EXK25+
U107	1	IC; TRANS; 15KV ESD-PROTECTED HIGH-DRIVE CURRENT QUAD-LEVEL TRANSLATOR WITH SPEED-UP CIRCUITRY; TQFN12 4X4 Maxim Integrated MAX3395EETC
Y101	1	CRYSTAL; SMT (3225) 3.2X2.5; 8PF; 16MHZ; +/-10PPM; +/-15PPM Kyocera-Kinseki CX3225SB16000D0FLJZZ
PCB	1	PCB: MAX77950 EVKIT

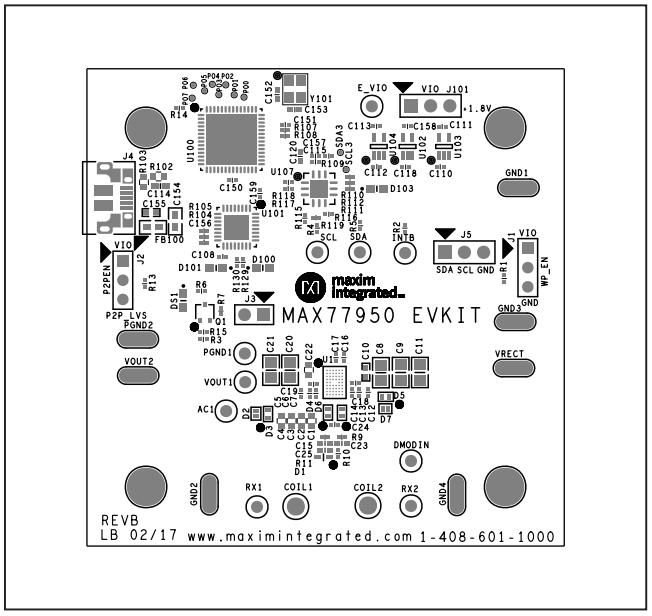
MAX77950 EV Kit Schematic



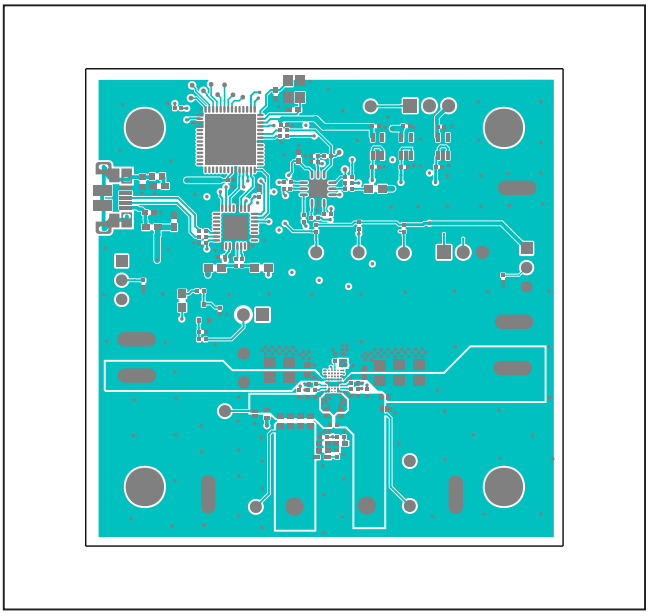
MAX77950 EV Kit Schematic (continued)



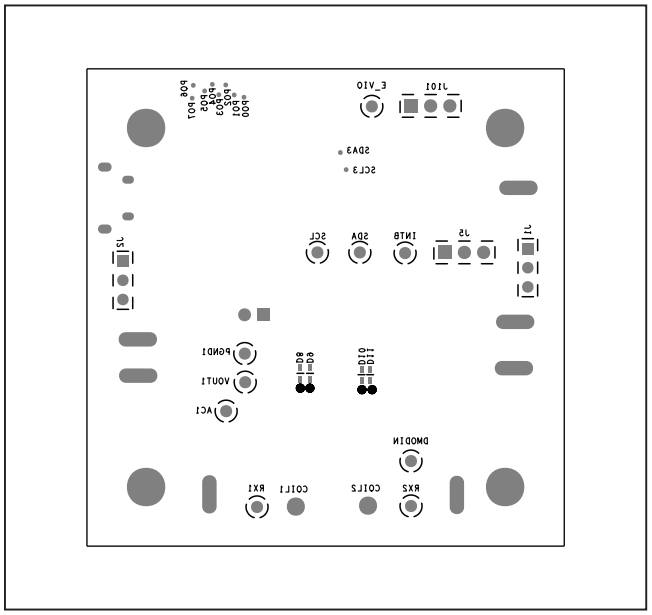
MAX77950 EV Kit PCB Layouts



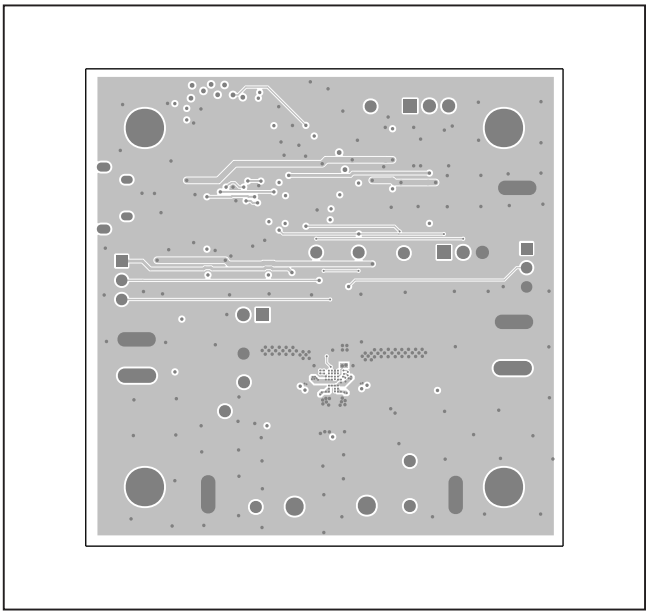
MAX77950 EV Kit Component Placement Guide—Top Silkscreen



MAX77950 EV Kit PCB Layout—Top Layer

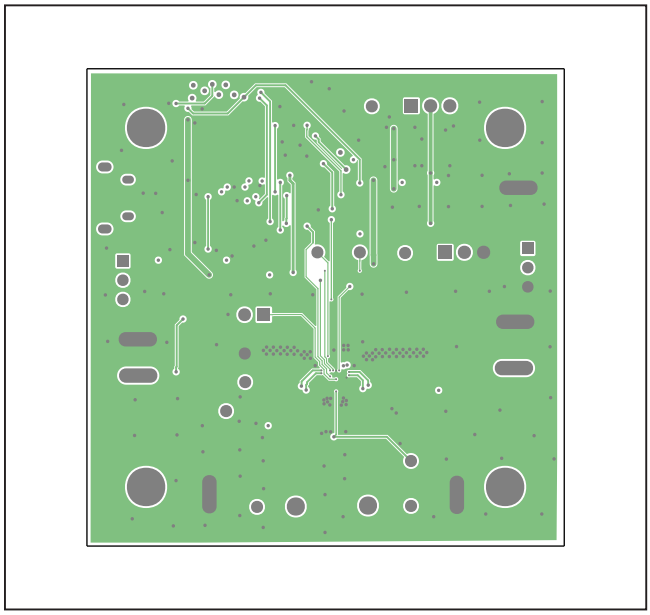


MAX77950 EV Kit Component Placement Guide—Bottom Silkscreen

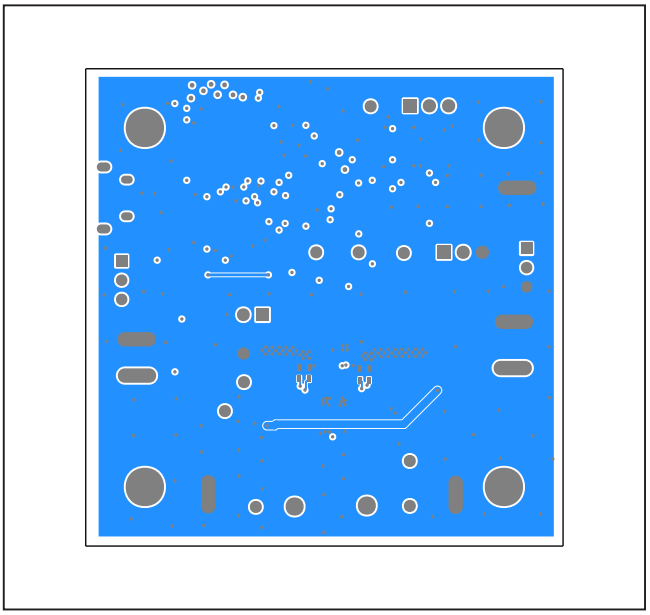


MAX77950 EV Kit PCB Layout—Internal Layer 2

MAX77950 EV Kit PCB Layouts (continued)



MAX77950 EV Kit PCB Layout—Internal Layer 3



MAX77950 EV Kit PCB Layout—Bottom Layer

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/17	Initial release	—

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

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