

## 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.

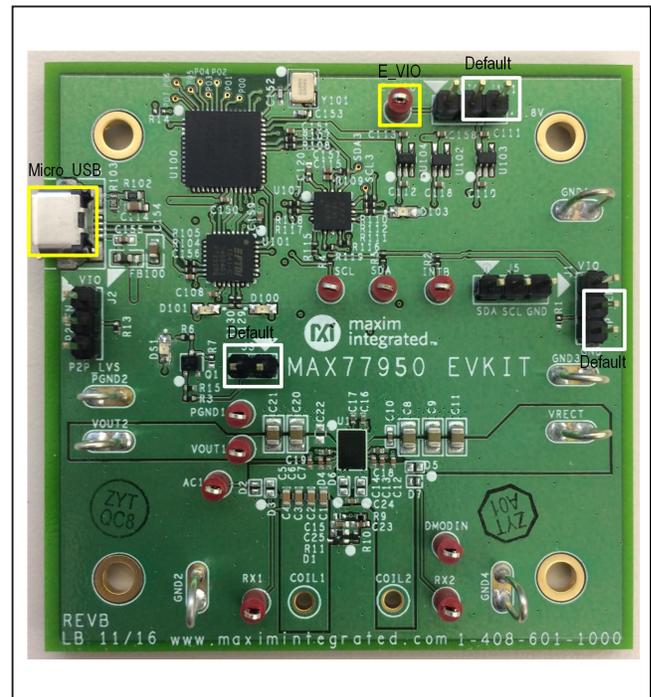
## Quick Start

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 I<sup>2</sup>C and USB interface to monitor and control the IC by changing the register-related functions such as FOD coefficient, VRECT target for WPC/PMA, and LDO output voltage.

- 1) Visit [www.maximintegrated.com/evkitsoftware](http://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<sub>OUT</sub> 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 I<sup>2</sup>C 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 sidebar 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.

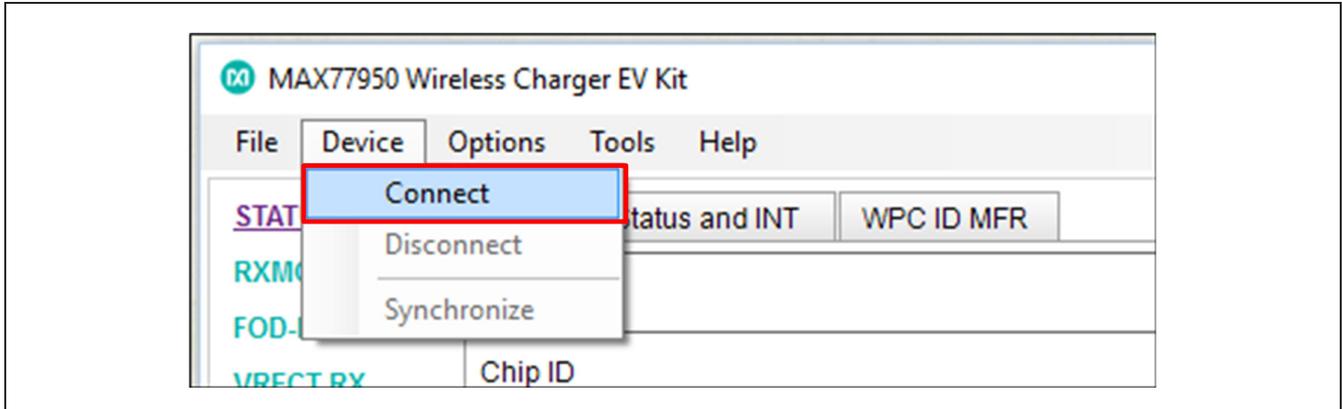


Figure 1. MAX77950 EV Kit GUI (Device Connect)

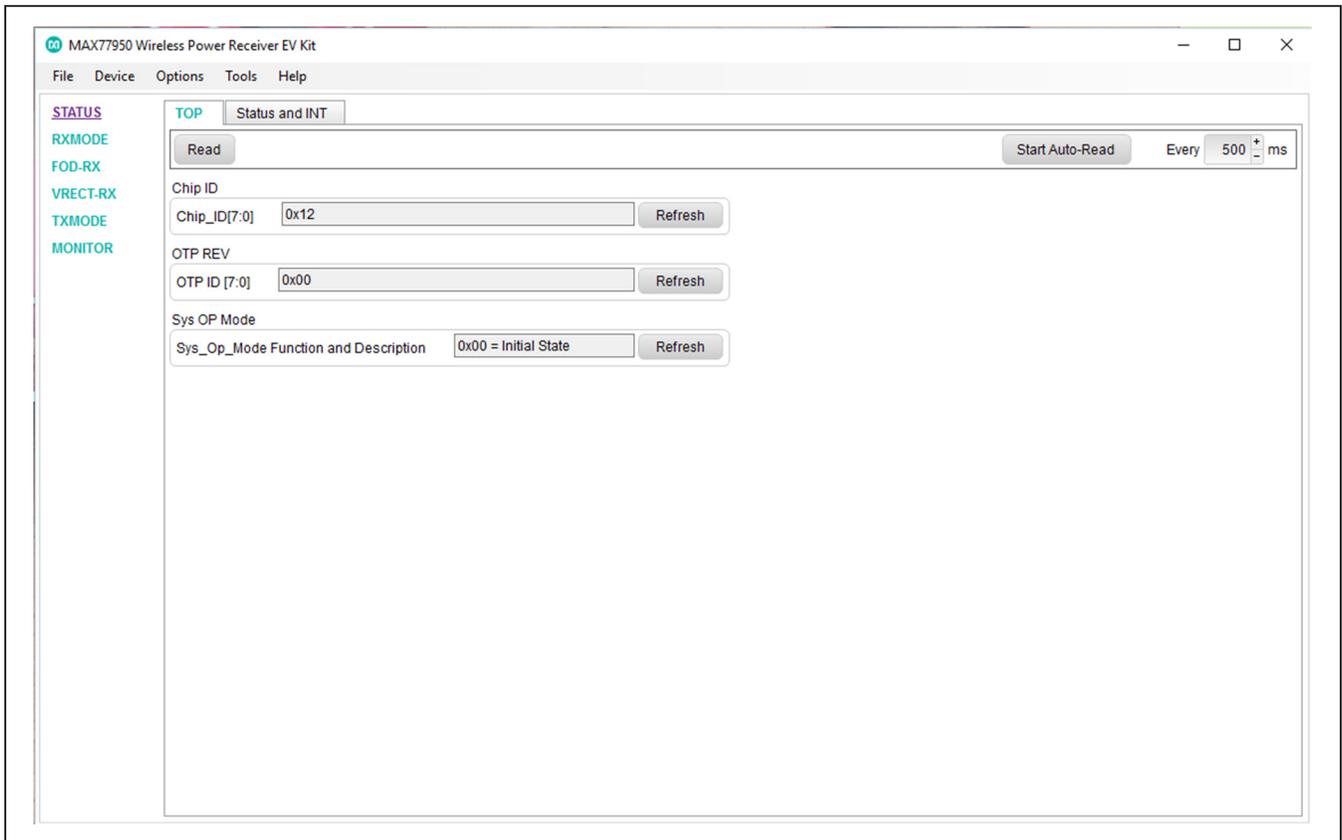


Figure 2. MAX77950 EV Kit GUI (STATUS Tab)

**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<sub>OUTSET</sub>) and the LDO current limit (LDO\_ILIMITSET) can be changed by the user. As seen in box #1 in Figure 3, the default value of V<sub>OUT</sub> 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).

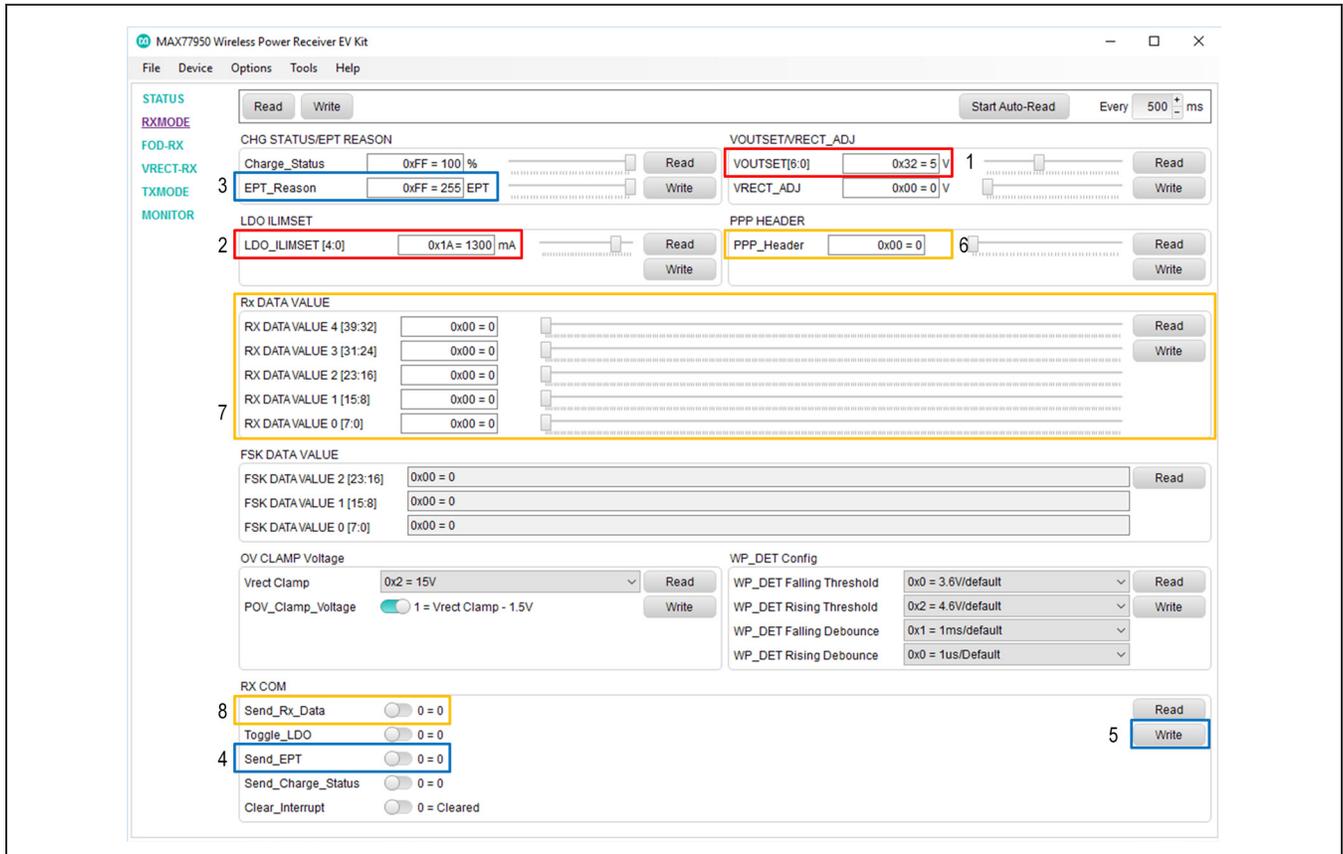


Figure 3. MAX77950 EV Kit GUI (RXMODE Tab)

### 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).

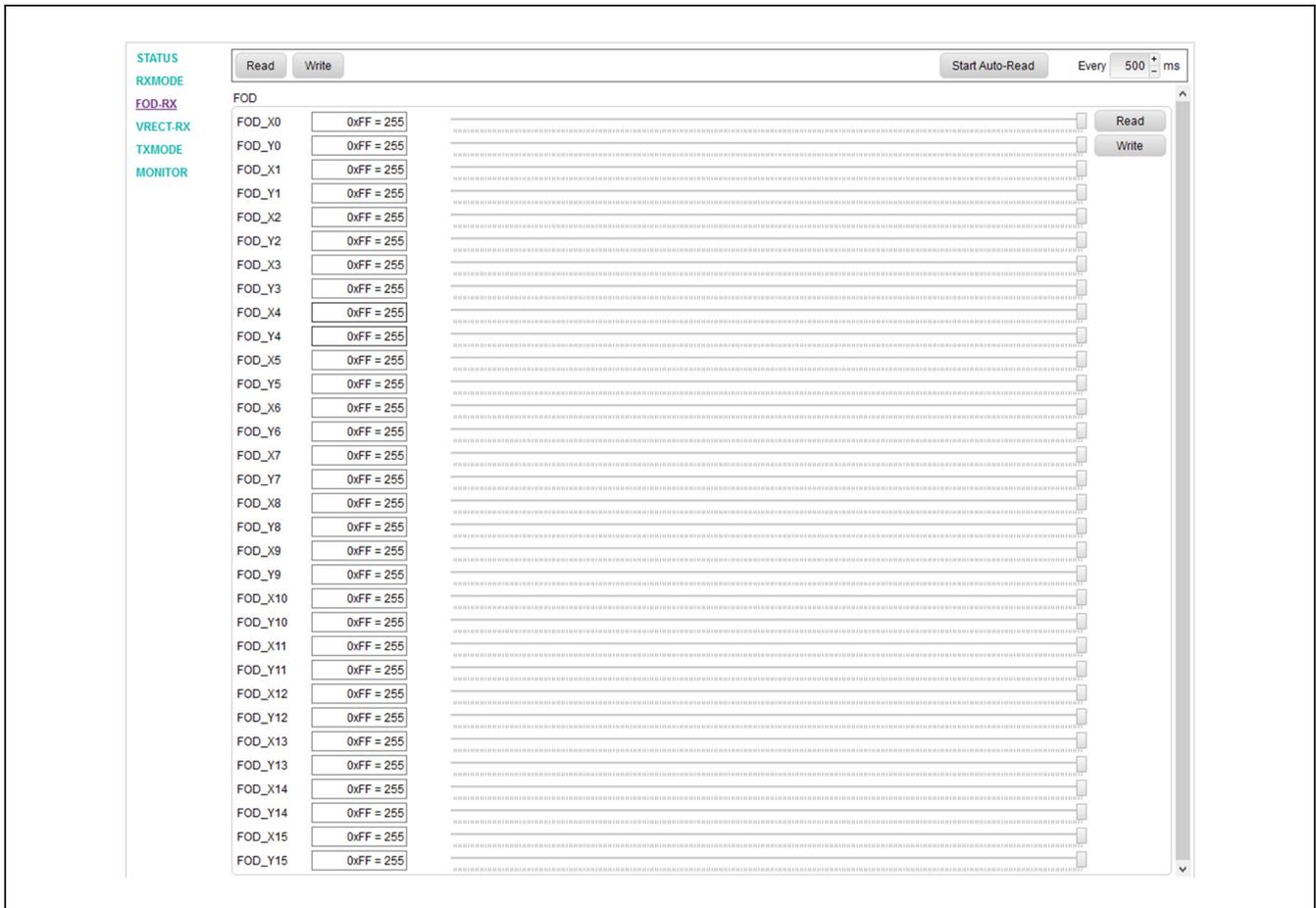


Figure 4. MAX77950 EV Kit GUI (FOD-RX Tab)

**VRECT-RX**

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

- 1) Change the target values by moving the cursor on the slide bars. In the specific VRECT 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 VRECT target values.
- 2) To apply the change, click the **Write** button.

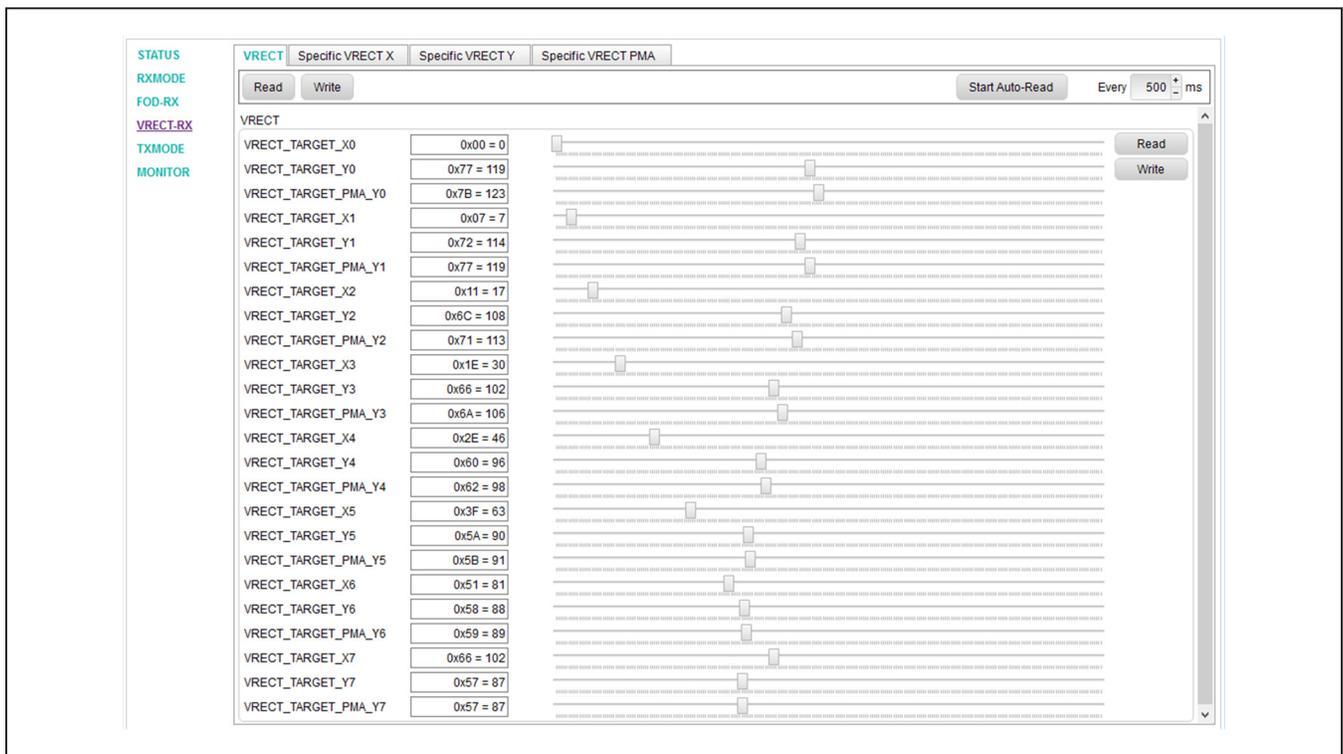


Figure 5. MAX77950 EV Kit GUI (VRECT-RX Tab)

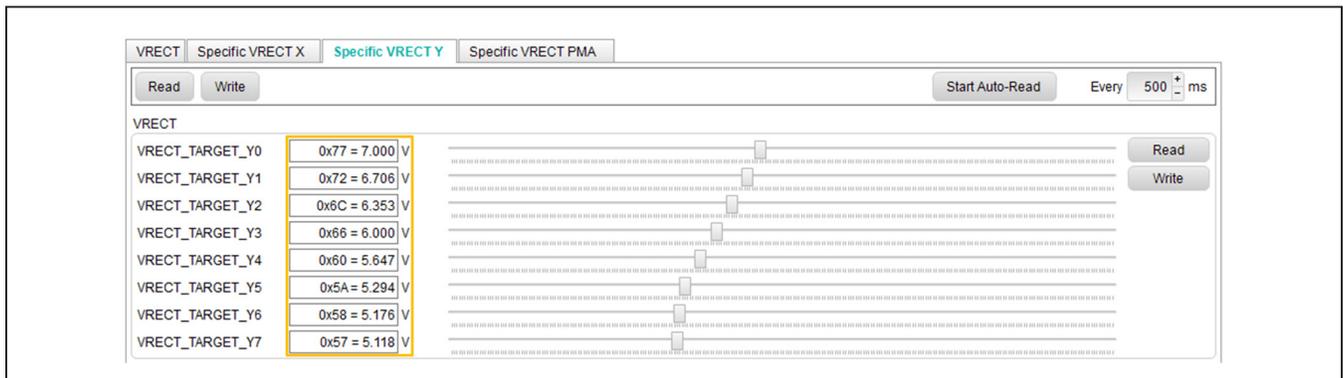


Figure 6. MAX77950 EV Kit GUI (VRECT-RX Tab)

### 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.

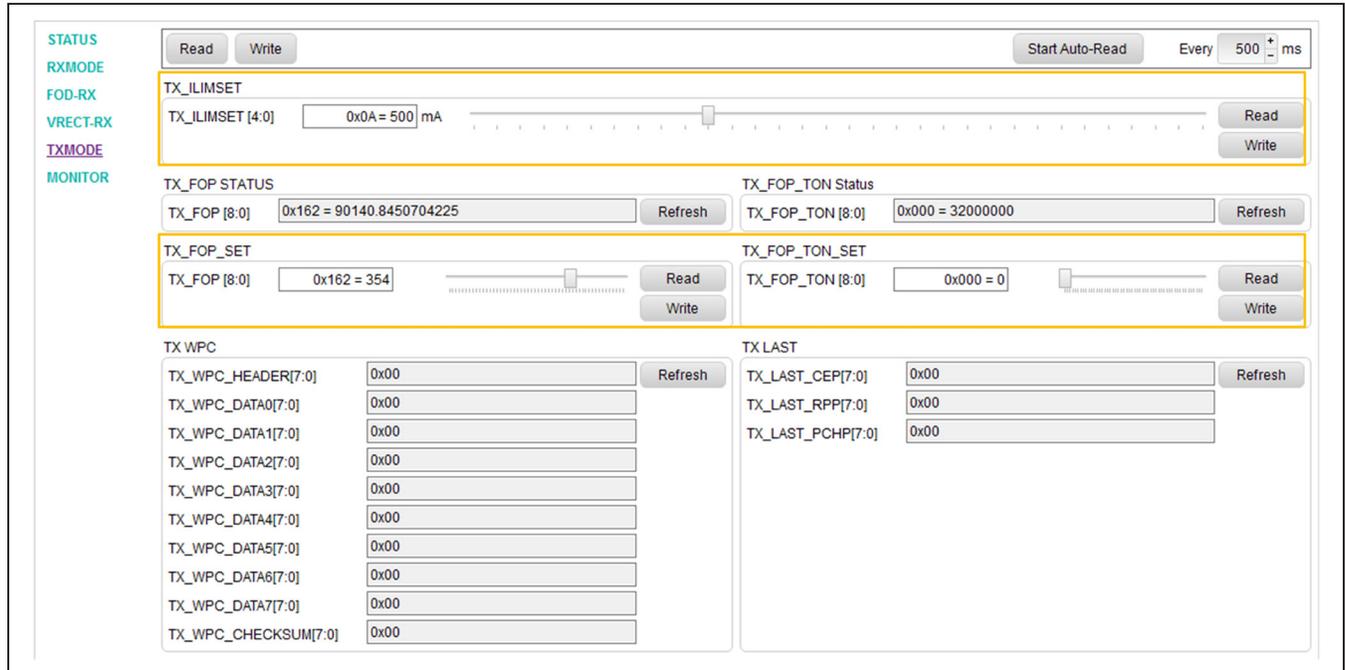


Figure 7. MAX77950 EV Kit GUI (TXMODE Tab)

**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 temper-

ature, load current read by ADC, and operating frequency. Click the **Refresh** or **Read** button to update the readings.

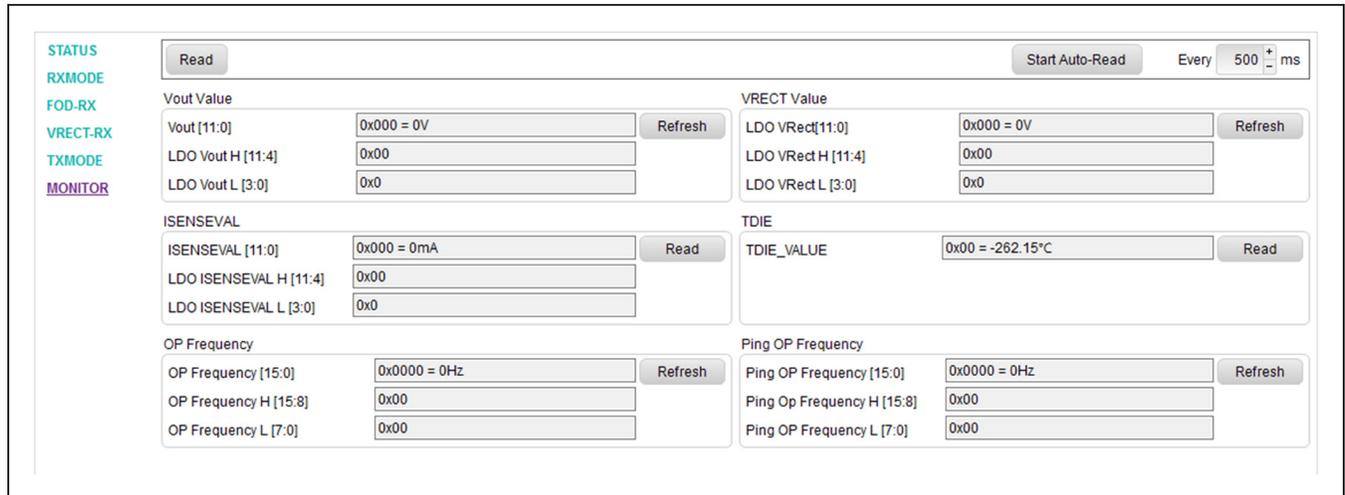


Figure 8. MAX77950 EV Kit GUI (MONITOR Tab)

**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;<br>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;<br>TDK C1005X5R1H473K050                   |
| C7, C14                              | 2   | SMT (0402); CERAMIC CHIP; 0.015UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R;<br>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;<br>Taiyo-Yuden TMK212BBJ106KG-T       |
| C10                                  | 1   | SMT (0402); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R;<br>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;<br>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;<br>TDK C1005X5R1H103K050                    |
| C24                                  | 1   | SMT (0402); CERAMIC CHIP; 2200PF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R;<br>Murata GRM155R71H222KA01                |
| C25                                  | 1   | SMT (0402); CERAMIC CHIP; 1000PF; 50V; TOL=10%; MODEL=C0G; TG=-55 DEGC TO +125 DEGC; TC=+;<br>Kemet C0402C102K5GAC           |
| C108, C150, C151,<br>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,<br>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;<br>Kemet C0603C474K8PAC                           |
| C120                                 | 1   | SMT (0402); CERAMIC CHIP; 1UF; 6.3V; TOL=20%; MODEL=C SERIES; TG=-55 DEGC TO +85 DEGC; TC=X5R;<br>TDK C1005X5R0J105M050BB    |
| C152, C153                           | 2   | SMT; 0402; CERAMIC; 8.2pF; 50V; 0.25%; C0G; -55DEGC to + 125DEGC; 0 +/- 30PPM/DEGC;<br>Kemet C0402C829C5GAC                  |

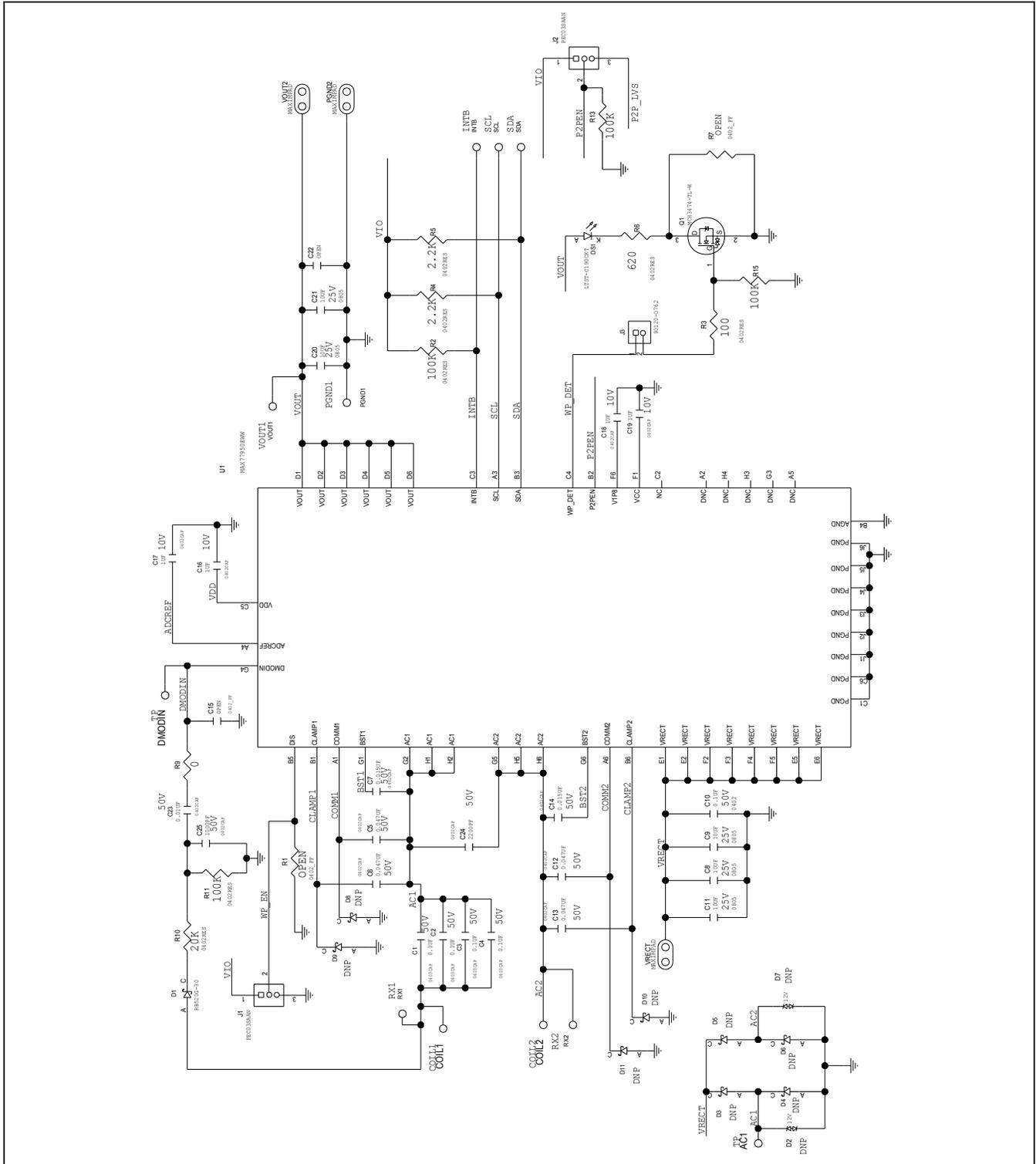
## MAX77950 EV Kit Bill of Materials (continued)

| PART                | QTY | DESCRIPTION   |
|---------------------|-----|---|
| C154                | 1   | SMT (0603); CERAMIC CHIP; 4.7UF; 16V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R;<br>TDK C1608X5R1C475K080AC                  |
| D1                  | 1   | SCH; SCHOTTKY BARRIER DIODE; SMT (SOD-723); PIV=30V; IF=0.1A;<br>RB520G-30  |
| D2, D7              | 2   | TVS; SMT (SOD882); VRM=12V; IPP=7.8A;<br>NXP PESD12VV1BL; OPEN  |
| D3-D6               | 4   | SCH; SCHOTTKY BARRIER DIODE; SMT; OPEN  |
| D8-D11              | 4   | SCH; SCHOTTKY BARRIER DIODE; SMT; OPEN  |
| D100, D101          | 2   | LED; STANDARD; YELLOW; SMT (0603); PIV=5.0V; IF=0.02A; -55 DEGC TO +85 DEGC;<br>Lite-On Electronics LTST-C190YKT                    |
| DS1, D103           | 2   | LED; STANDARD; RED; SMT (0603); PIV=5.0V; IF=0.04A; -55 DEGC TO +85 DEGC;<br>Lite-On Electronics LTST-C190CKT                       |
| FB100               | 1   | INDUCTOR; SMT (0603); FERRITE-BEAD; 220; TOL=+/-25%; 1.4A; -55 DEGC TO +125 DEGC;<br>Murata BLM18PG221SN1                           |
| GND1-GND4           | 4   | EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG;<br>Weico Wire 9020 BUSS                   |
| J1, J2              | 2   | EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC;<br>Sullins Electronics Corp. PEC03SAAN |
| J3                  | 1   | THROUGH HOLE; C-GRID III SINGLE ROW STRAIGHT PIN HEADER; STRAIGHT THROUGH;<br>Molex 90120-0762                                      |
| J4                  | 1   | CONNECTOR; FEMALE; SMT; MICRO USB B-TYPE REVERSE; RIGHT ANGLE; 5PINS<br>FCI Connect 10103592-0001LF                                 |
| J5, J101            | 2   | THROUGH HOLE; SINGLE ROW; STRAIGHT; 3PINS<br>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)<br>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<br>Vishay Dale CRCW0402100KFK   |
| R3, R129, R130      | 3   | RESISTOR; 0402; 100 OHM; 1%; 100PPM; 0.063W; THICK FILM;<br>Vishay Dale CRCW0402100RFK  |

## MAX77950 EV Kit Bill of Materials (continued)

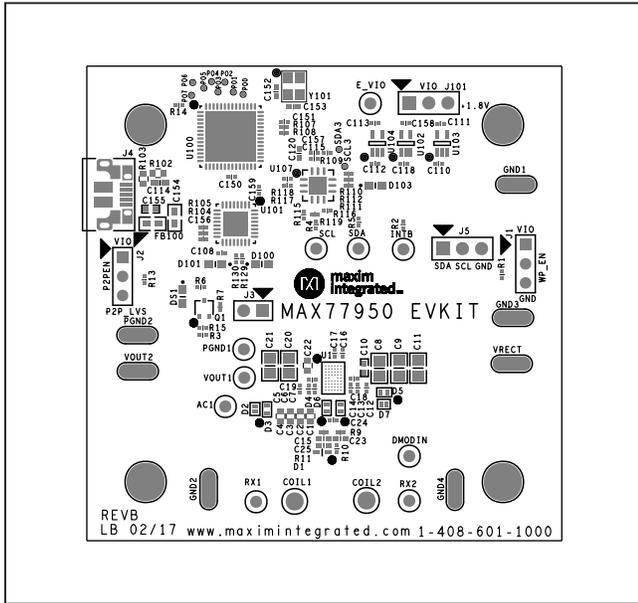
| PART                           | QTY | DESCRIPTION   |
|--------------------------------|-----|---|
| R4, R5                         | 2   | RESISTOR, 0402, 2.2K OHM, 1%, 100PPM, 0.0625W, THICK FILM;<br>Vishay Dale CRCW04022K20FK  |
| R6                             | 1   | RESISTOR; 0402; 620 OHM; 1%; 100PPM; 0.063W; THICK FILM;<br>Vishay Dale CRCW0402620RFK  |
| R9                             | 1   | RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.063W; THICK FILM;<br>Vishay Dale CRCW04020000ZS  |
| R10                            | 1   | RESISTOR; 0402; 20K OHM; 1%; 100PPM; 0.063W; THICK FILM;<br>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,<br>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<br>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;<br>W546A9+1; PKG. DWG. NO.: 21-100082;<br>Maxim Integrated MAX77950EWW          |
| U100                           | 1   | IC; CTRL; LOW-POWER LCD MICROCONTROLLER; TQFN56-EP 8X8<br>Maxim Integrated MAXQ2000-RBX+  |
| U101                           | 1   | IC; INFC; UART INTERFACE IC USB TO SERIAL; QFN32-EP 5X5<br>Future Technology Devices International LTD.FT232RQ                                |
| U102                           | 1   | IC; VREG; ULTRA-LOW-NOISE, HIGH PSRR, LOW-DROPOUT, LINEAR<br>REGULATOR; SC70-5; -40 DEGC TO +85 DEGC;<br>Maxim Integrated MAX8511EXK33+       |
| U103                           | 1   | IC; VREG; ULTRA-LOW-NOISE; HIGH PSRR; LOW=DROPOUT; LINEAR<br>REGULATOR; SC70-5<br>Maxim Integrated MAX8511EXK18+                              |
| U104                           | 1   | IC; VREG; ULTRA-LOW-NOISE HIGH PSRR LOW-DROPOUT LINEAR<br>REGULATOR; SC70-5; -40 DEGC TO +85 DEGC;<br>Maxim Integrated MAX8511EXK25+          |
| U107                           | 1   | IC; TRANS; 15KV ESD-PROTECTED HIGH-DRIVE CURRENT QUAD-LEVEL<br>TRANSLATOR WITH SPEED-UP CIRCUITRY; TQFN12 4X4<br>Maxim Integrated MAX3395EETC |
| Y101                           | 1   | CRYSTAL; SMT (3225) 3.2X2.5; 8PF; 16MHZ; +/-10PPM; +/-15PPM<br>Kyocera-Kinseki CX3225SB16000D0FLJZZ   |
| PCB                            | 1   | PCB: MAX77950 EVKIT   |

MAX77950 EV Kit Schematic

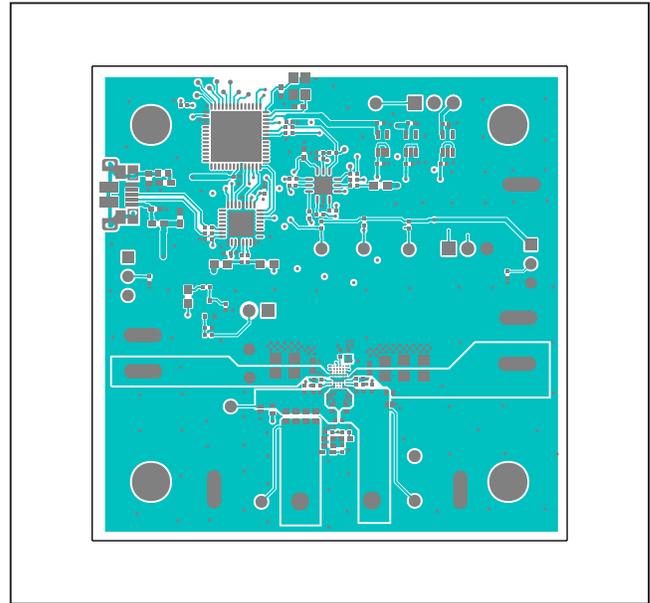




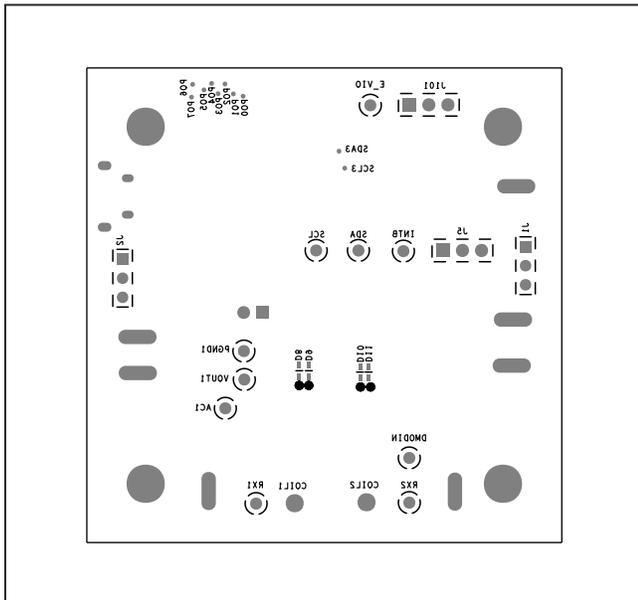
MAX77950 EV Kit PCB Layouts



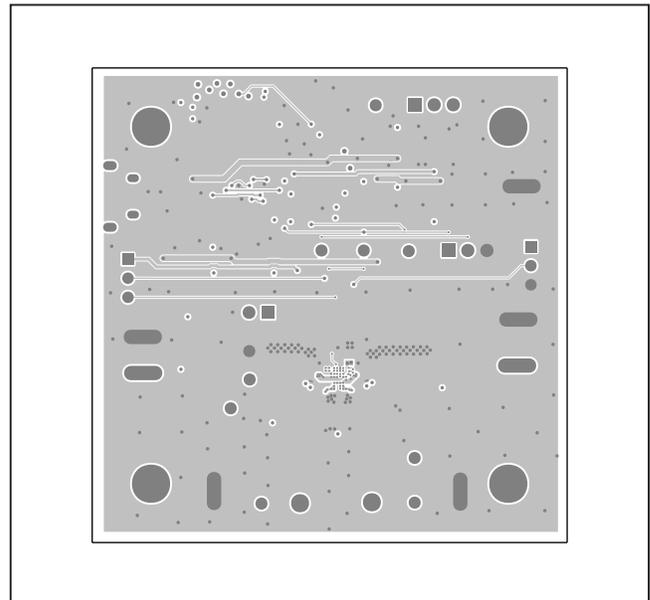
MAX77950 EV Kit Component Placement Guide—Top Silkscreen



MAX77950 EV Kit PCB Layout—Top Layer

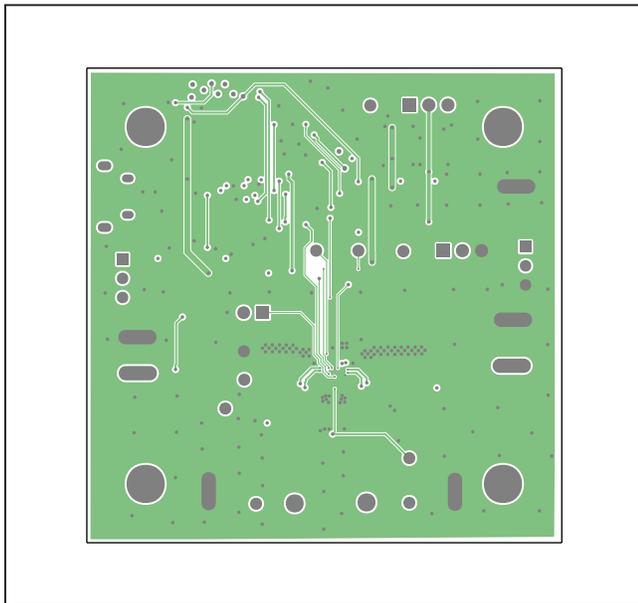


MAX77950 EV Kit Component Placement Guide—Bottom Silkscreen

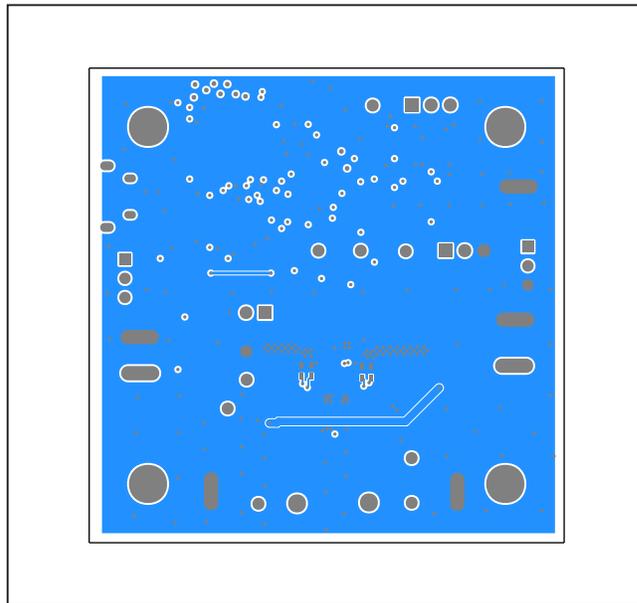


MAX77950 EV Kit PCB Layout—Internal Layer 2

**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](http://www.maximintegrated.com).

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- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
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- Работу по проектам и поставку образцов.
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- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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