Click here for production status of specific part numbers.

MAX77501 Evaluation Kit

Evaluates: MAX77501

General Description

The MAX77501 evaluation kit (EV kit) is a fully assembled and tested printed circuit board (PCB) that demonstrates the MAX77501 piezo driver. The EV kit allows for easy evaluation of the MAX77501 and its ability to drive a large haptic signal through a ceramic piezo actuator.

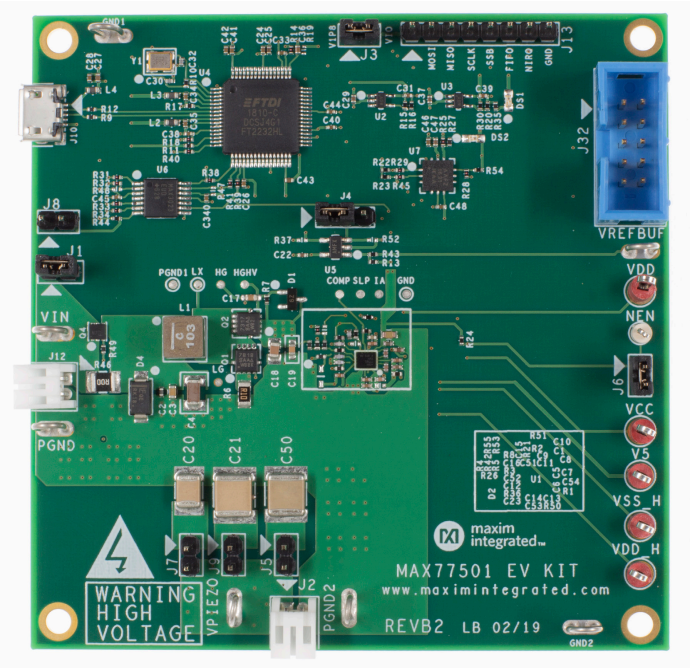
The MAX77501 is a boost controller that drives the gates of a pair of low-side and high-side MOSFETs to step up an input haptic signal to a level suitable for piezo haptics. It includes all necessary external components to operate the IC. The MAX77501 takes digital input signals in one of two forms: data stored on internal RAM or fed through the internal FIFO (First-In, First-Out) system. The EV kit supports both formats of input. Windows-based GUI software provides a user-friendly graphical interface as well as a detailed register-based interface to exercise the features of the MAX77501.

Features

- Easy to Use
  - GUI Drives SPI Interface
  - Access to the Digital Engine through Software GUI
  - Assembled and Fully Tested
- Selectable Headers for Quick Testing of Different Output Capacitors (J7 for 330nF, J9 for 680nF, or J5 for 1µF)
- Buffer-Configured Operational Amplifier Attached to Feedback of Converter for Measuring a Scaled-Down Version of the Output Voltage or the Output of the DAC
- Test Points to Measure All Outputs of the Boost Converter and Charge Pumps

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

MAX77501 EV Kit Board Photo



Windows is a registered trademark of Microsoft Corp.

maxim integrated™

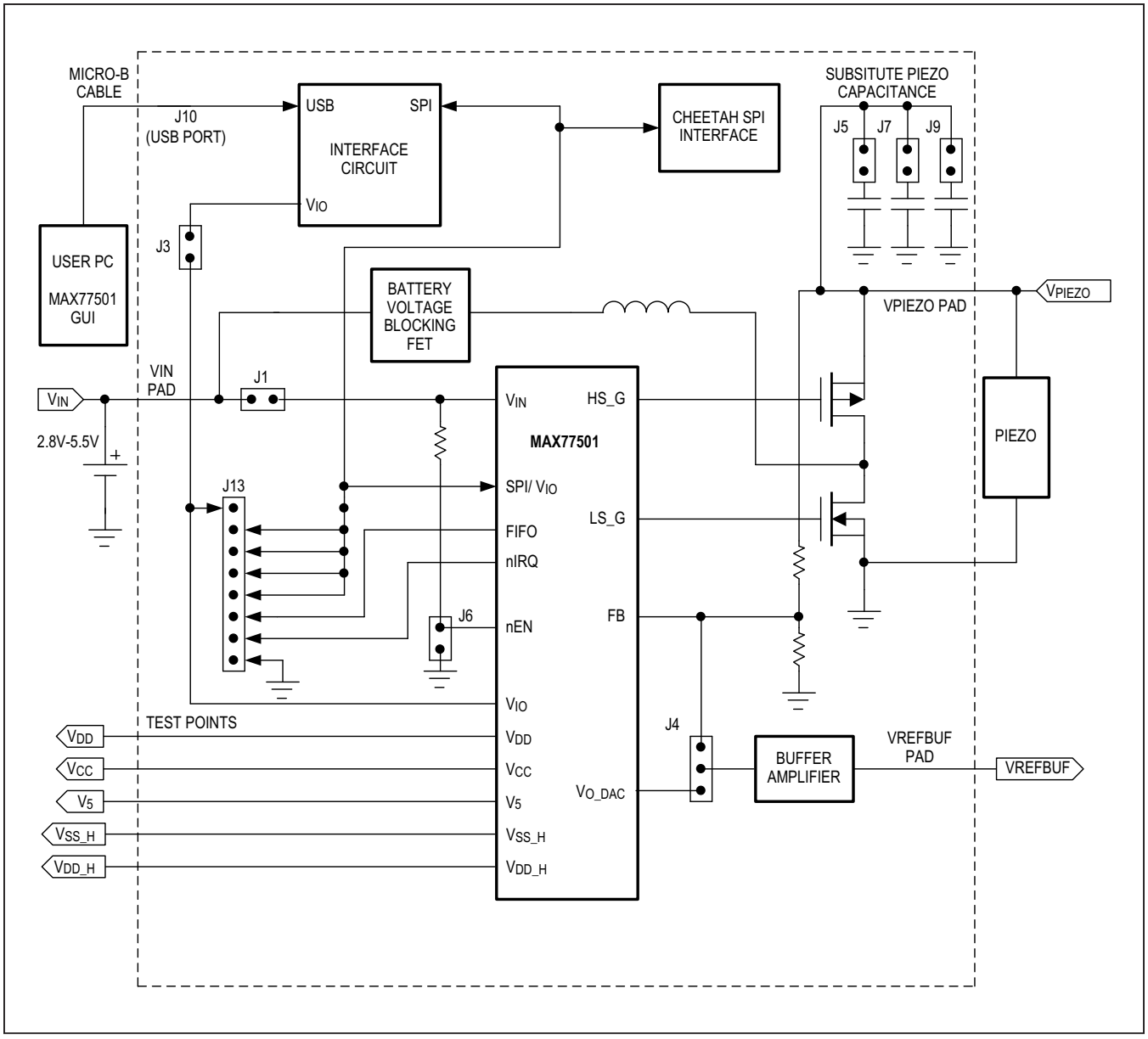


Figure 1. EV Kit Block Diagram

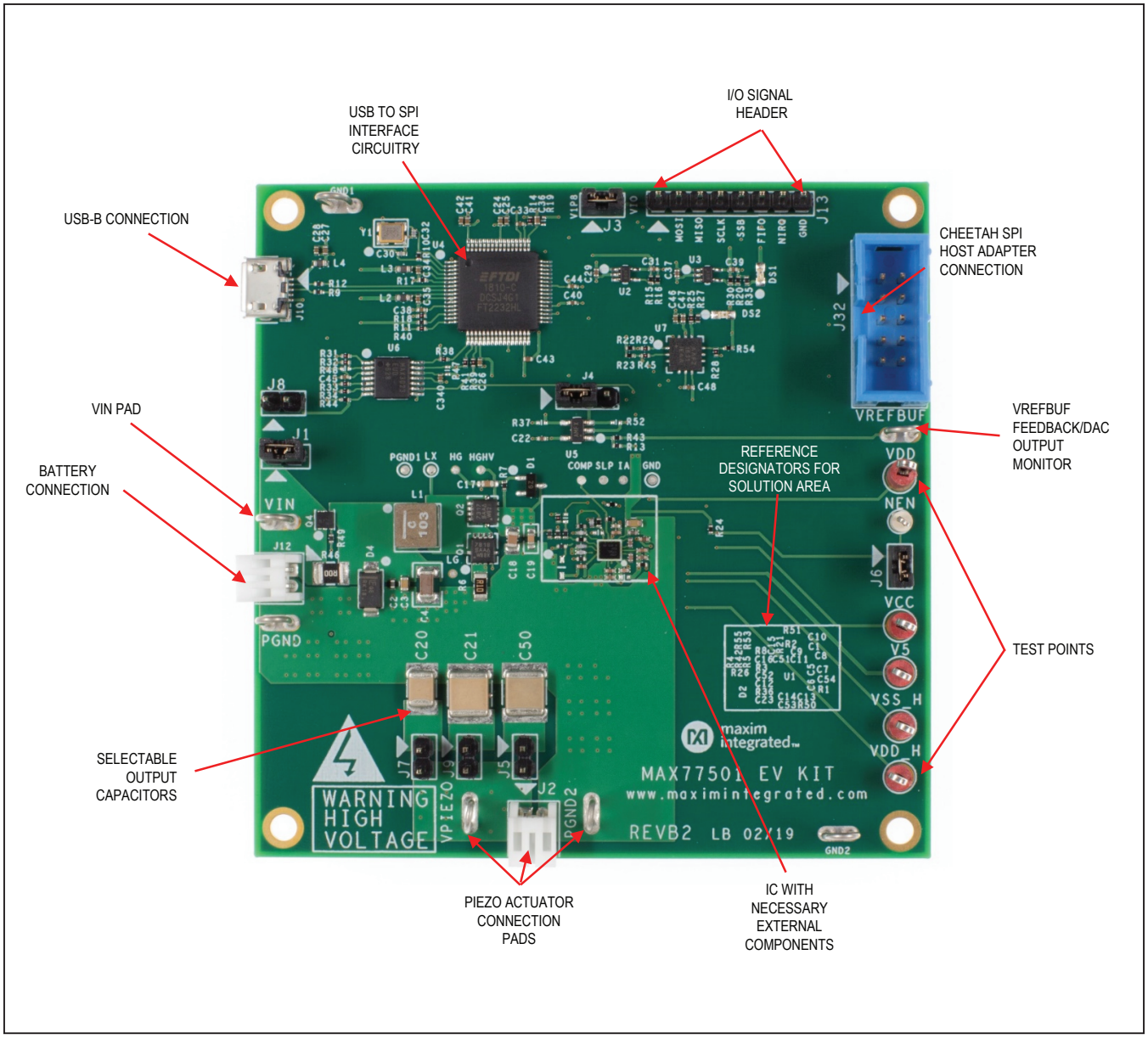


Figure 2. MAX77501 EV Kit Top View

EV Kit Default Configuration

- V_{IN} = 2.8V to 5.5V
- V_{OUT} = 10V to 120V (up to 110V_{PK-PK} haptic waveform generation)
- 330nF, 680nF, or 1µF selectable output capacitor
- Default enabled into 70µA standby mode

Quick Start

Follow this procedure to familiarize yourself with the EVKIT.

Required Equipment

- MAX77501 EV kit
- Windows-based PC
- Power supply with 5.5V and 1A capability
- Oscilloscope
- Micro-B USB cable
- GUI

Table 1. Default Shunt Positions and Jumper Descriptions

REFERENCE DESIGNATOR	DEFAULT POSITION	FUNCTION
J1	1-2	**Not Installed**: The inductor is not connected to V_{IN} of the IC. Connect a power source to the inductor through either the V_{IN} and PGND test points or J12. Power the IC through pin 2 of the J1 header. **1-2**: V_{IN} to the inductor and to the IC are shorted together. Connect a power supply to the V_{IN} header or a battery to J12 to power both the IC and the inductor path.
J3	1-2	**1-2**: Connects the 1.8V LDO output of the USB interface circuit to the V_{IO} pin on the MAX77501 IC.
J4	1-2	**Not Installed**: Nothing is connected to the input of the buffer amplifier. **1-2**: The FB pin is connected to the input of the buffer amplifier. Measure the VREFBUF pin to measure the signal at the FB pin. **2-3**: The output of the DAC (V_{O_DAC}) is connected to the input of the buffer amplifier. Measure the VREFBUF pin to measure the output of the DAC.
J6	1-2	**Not Installed**: Pulls nEN high and disables the IC. **1-2**: Pulls nEN low and enables the IC.
J5	Not Installed	**1-2:** Connects a 1µF capacitor from V_{PIEZO} to PGND.
J7	Not Installed	**1-2:** Connects a 330nF capacitor from V_{PIEZO} to PGND.
J9	Not Installed	**1-2:** Connects a 680nF capacitor from V_{PIEZO} to PGND.
J8	Not Installed	**1-2**: Disables the level translator between the GUI circuit SPI pins and the SPI pins of the IC.

Procedure

The EV kit is fully assembled and tested. Use the following steps to verify board operation:

1) Install the GUI software. Navigate to the product webpage (**www.maximintegrated.com/MAX77501**), click on the Design Resources tab, and download the latest version of the EV kit software. Save the EV kit software to a temporary folder and decompress the ZIP file.
2) In the same folder as the GUI software, download the example RAM and FIFO data files. Save the example files “130Hz_80Vpp_32kHz.ram” and “130Hz_80Vpp_32kHz.fifo” to a known location on your PC.
3) Install the EV kit shunts per Table 1.
4) Insert a shunt on J7 to connect the 330nF output capacitor to the output of the device. This capacitor serves as a substitute for a piezo capacitance.
5) Connect a micro-B USB cable between the EV kit’s J10 and your Windows-based PC.
6) Apply a 3.7V supply across the VIN and PGND terminals of the EV kit.
7) Install a shunt on J6 to pull nEN low and enable the part.
8) Open the GUI and press the ‘Connect’ button in the ‘Device’ drop-down menu. Wait for the device to respond, and in the ‘CONNECTED_DEVICE_LIST’ window press the ‘Connect’ button.
9) Attach an oscilloscope probe to the output (between test points V_{PIEZO} and PGND2) and set it up to measure a 130Hz sine wave from 10V to 90V. At this point the output should be sitting a few hundred millivolts below the input voltage.
10) Under the “Interrupts” tab, press “Read Once” at the top of the window. This reads the interrupts register of the IC and clears the SPI Ready Interrupt. Haptic playback cannot happen until the SPI Ready Interrupt clears.
11) Under the “RAM Control” tab, press “Open” under the “RAM Data File” Section. Navigate through your file system to the folder where the file “130Hz_80Vpp_32kHz.ram” is saved and press open. Press the ‘Write’ button.
    a. After completing the next couple steps, if you see a noisy signal on your oscilloscope, make sure you pressed ‘Write’ on the RAM file loader.
12) In the “Number of Waveforms to Play” box, type 1 and press enter on your keyboard (note that pressing enter causes Windows to play a sound; this is normal and not indicative of an error). This box programs the “NUM_WAVEFORMS_PLAY” register that sets the number of waveforms that will be played from the RAM. In the “Number of Waveforms in RAM” box, type 1 and press enter on your keyboard. This box programs the “NUM_WAVEFORM_RAM register that sets the number of waveforms that are being stored in the RAM. **Press the “Write” button to write to these registers.**
13) In the “Play 0 Waveform ID” box, type 0 and press enter. This box signifies that waveform 0 shall be played first. In the “Play 0 Repeat” box, type 0 and press enter. Typing a one means the waveform will be played once, a two means it will play twice, etc. Typing zero means that the waveform will be repeated infinitely. Under “Waveform 0 Ending Address,” type 0x20F5 and press enter. This signifies the address that the last data point for the waveform is stored in. **Press the “Write” button to write to these registers.**
14) Under the “RAM Play Control” tab, toggle the “Play” button from “Stop” to “Start.” Now press the write button. A 130 Hz sine wave should appear on the output of the converter.
    a. Do not change the output capacitance in the middle of haptic playback. Stop the output waveform before changing an output capacitance or piezo element.

15) Under the “RAM Play Control” tab, toggle the “Play” button from “Start” to “Stop.” Now press the write button. This stops the 130 hz sine wave on the output of the converter and transitions the device to standby mode.
16) We will now play a waveform from the FIFO. Under the “FIFO control” tab, press “Open” under the “FIFO Data File Section.” Navigate through your file system to the folder where the file “130Hz_80Vpp_32kHz.fifo” is saved and press open.
17) Toggle the “FIFO Data Play” button from “Stop” to “Start” and press “Write.” This plays a couple cycles of a 130hz sine wave on the output of the piezo before transitioning the part back to standby mode.
18) Consult the device data sheet for more information on the RAM playback registers.

This concludes the Quick Start procedure. Users are now encouraged to explore the device and its register settings with the GUI.

For more information on the GUI, see the *Software* section.

EV Kit Features

Cheetah SPI Host Adapter Connection

On the EV kit, there is a connection (J32) for the Cheetah SPI Host Adapter. This tool allows the user to send manual SPI commands to the MAX77501 for quick debugging. In order to use the Cheetah SPI Host Adapter, the user must remove R38, R39, R40, and R41 and install a 20kΩ resistor on R47. In addition, the micro-B USB cable must be connected to J10.

VREFBUF Feedback and DAC Measurement Amplifier

The MAX77501 EV kit includes an on-board buffer amplifier used for measuring the FB pin and the output of the IC’s DAC without overloading them. As shown in Table 1, jumper J4 sends either the FB pin or the DAC output to the VREFBUF test point. Set J4 in the 1-2 position to measure a scaled down version of the output waveform, which allows for easy measuring of critical parameters like THD+N. Set J4 in the 2-3 position to measure VO_DAC (the output of the internal DAC). Attempting to measure either of these voltages directly (without the buffer) may result in distorted measurements, since both are high-impedance outputs.

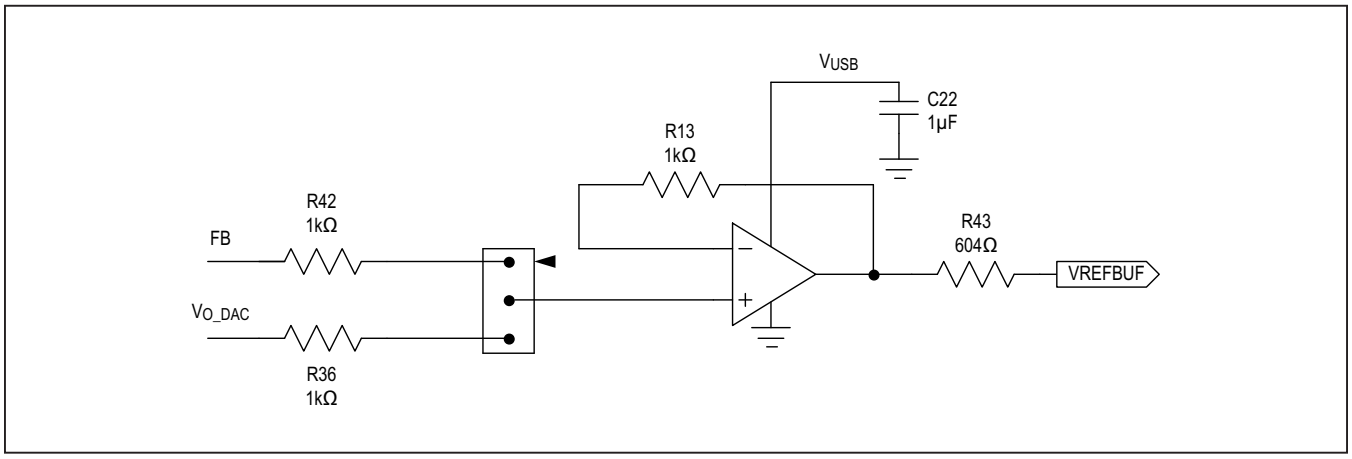


Figure 3. VREFBUF Feedback and DAC Measurement Amplifier Diagram

Input Battery Voltage Blocking FET

By default, when the MAX77501 is in either standby or shutdown modes (consult the device data sheet for a full description of the MAX77501 state diagram), the output voltage of the system sits at the battery voltage minus the body diode voltage of the high-side PFET (Q2). Some applications desire the output voltage to sit at 0V while the part is in standby or shutdown mode. The EV kit comes installed with Q4 to accomplish this. Q4 is an NFET between V_{IN} and the inductor. The gate of Q4 is attached to V_{DD_H} such that Q4 only turns on after V_{DD_H} is enabled during a haptic event (providing a path from V_{IN} to the inductor). When the haptic event finishes, Q4 opens and disconnects the battery from the power stage, and the output voltage on the piezo falls to 0V through the feedback resistors to ground. *If your application requires V_{OUT} to sit at 0V, follow these instructions:*

- Ensure R55 is installed (0Ω) and R53 is open (this is the default configuration of the EV kit)
  - If R53 is populated by some value, the feedback node connects to FB_SW and not directly to ground. R53 must be open for the output to fully discharge to ground
  - Refer to the EV kit schematic in this document for a full view of the circuit.
- Remove R46 so it is open
  - R46 provides a path from the input to the inductor even if the device is off and Q4 is open. Removing R46 ensures true disconnection between the input and the inductor.

The NFET used for Q4 is DMN1019UFDE from Diodes Incorporated.

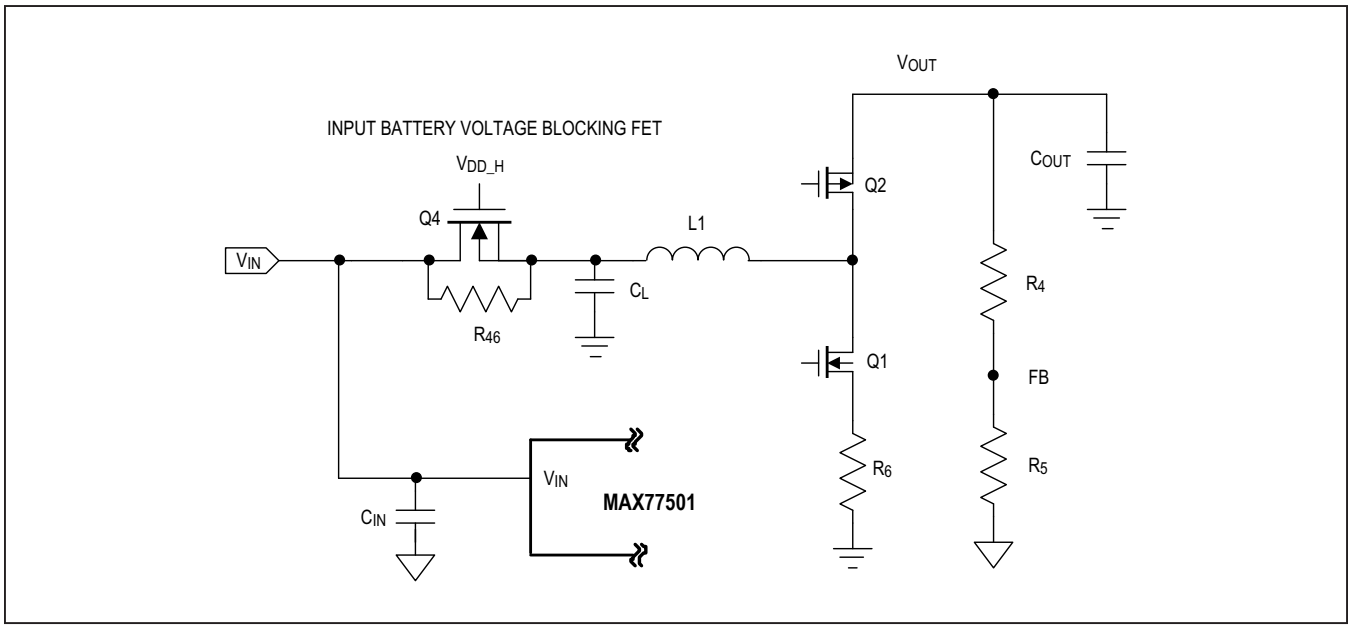


Figure 4. Input Battery Voltage Blocking Diagram

Software

The graphical user interface (GUI) software allows for quick, easy, and thorough evaluation of the MAX77501.

The GUI is designed to have individual tabs for multiple parts of the IC (Global Resources, Interrupts, FIFO Control, RAM Control, and the Register Map).

Installation

If you haven't already, navigate to the product webpage (**www.maximintegrated.com/MAX77501**), click on the Design Resources tab, and download the latest version of the EV kit software. Save the EV kit software to a temporary folder and uncompress the ZIP file. Run the executable and follow the prompts.

Windows Drivers

Upon connection of a micro-USB cable between your PC and the EV kit for the first time, you will need to wait a few minutes for Windows to automatically install the necessary drivers.

Graphical User Interface Details (GUI)

The GUI drives SPI communication with the EV kit. Every control in the GUI corresponds directly to a register within the MAX77501. Refer to the register map in the device data sheet for a complete description of the registers.

Global Resources Tab

The Global Resources tab allows the user to write to and read from the various status registers that configure the MAX77501 and its functionality. Refer to the data sheet for a full description of the registers.

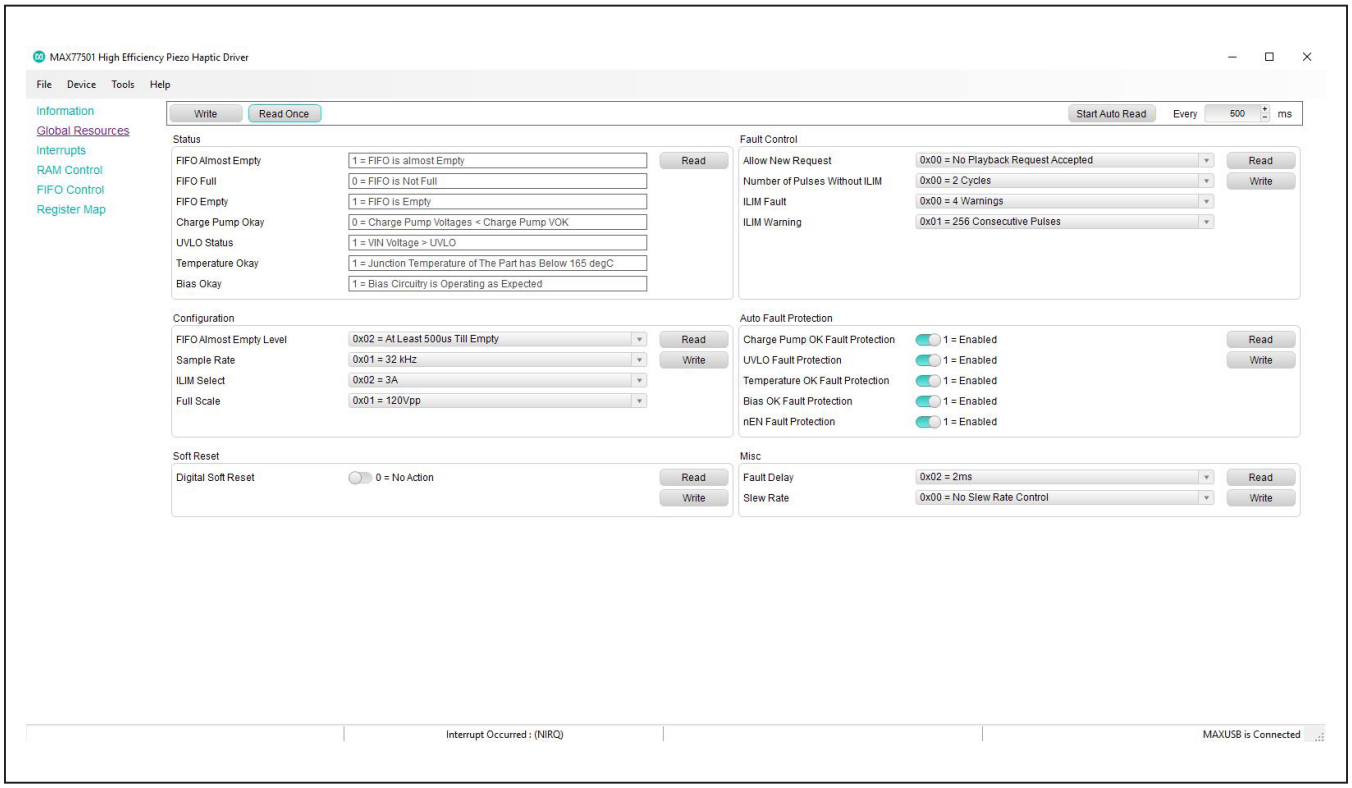


Figure 5. EV Kit GUI Global Resources Tab

Interrupts Tab

The Interrupts tab allows the user to check to see if an interrupt has triggered. To read an interrupt, write the IMR bit to 0 to unmask the interrupt. Any unmasked interrupt in the Interrupts box can then be read using the ‘Read’ button. Refer to the MAX77501 data sheet for more detailed information on the interrupt registers.

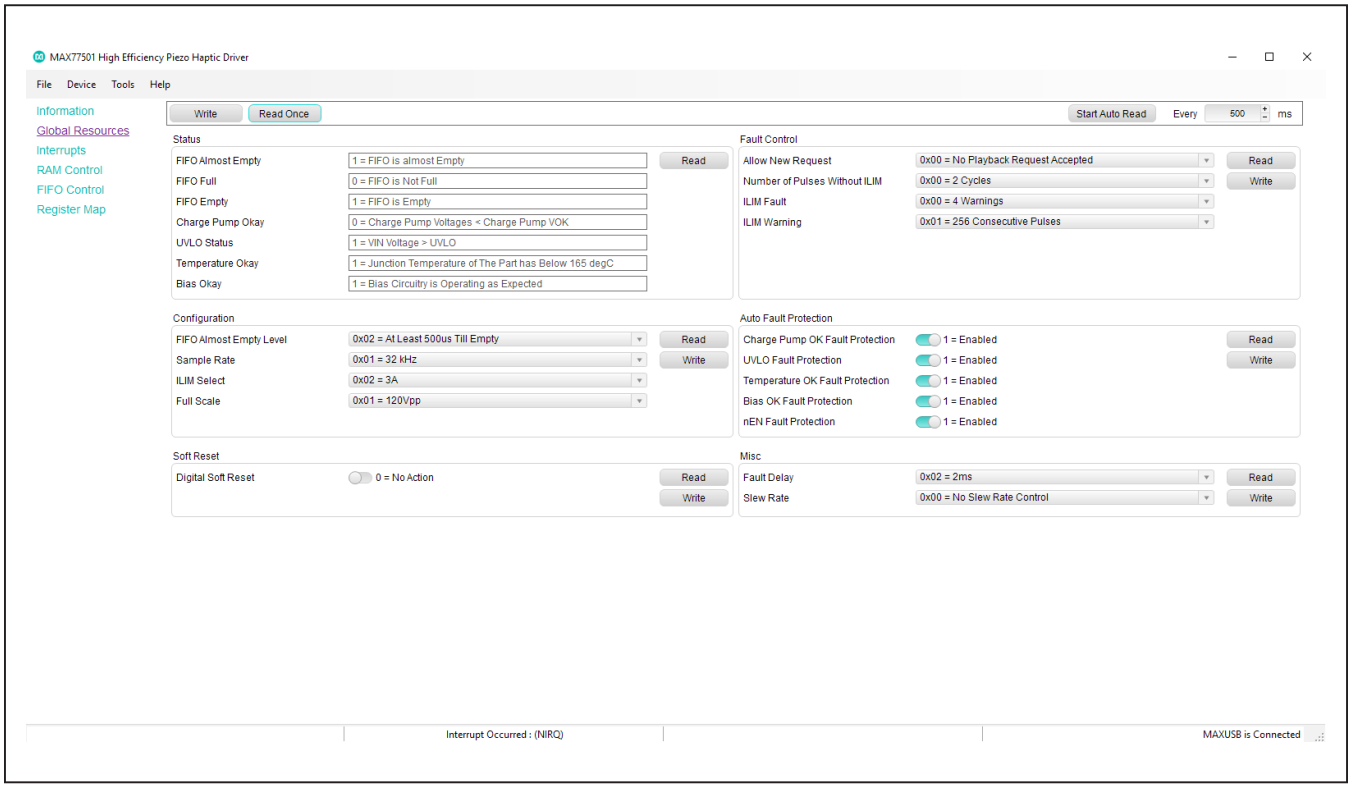


Figure 6. EV kit GUI Interrupts Tab

RAM Control Tab

The RAM control tab allows the user to to load data into the RAM and configure the register settings to dictate which waveforms stored in the RAM are played back at the piezo output. The GUI takes input in the form of .RAM files that list the contents of each RAM register. After creating or downloading the file, the user can load it into the GUI and play it back at the output of the EV kit. Beyond loading and playing the file, the GUI provides controls for the number of waveforms to be played, the number of waveforms in the RAM, the ending address of each waveform, and the playlist of waveforms to be played. In order to fill a data point into one of the input fields, make sure to press enter before pressing the 'Write' button to write to the register. For more information on RAM playback, see the MAX77501 data sheet.

Follow these steps to play a waveform from RAM:

1) Create a RAM playback file where each datapoint to be stored in each RAM address is a new line in the file. The data for address 0x2000 is on line 1, address 0x2001 is on line 2, address 0x2002 is on line 3, etc. The extension of this file must be .RAM.
2) Set the correct configuration registers in the 'Global Resources' tab. For more information on these registers, see the IC datasheet.
3) Read the interrupt status register on the 'Interrupts' tab in order to read and clear the 'SPI Ready Interrupt'. This register must be read after enabling the IC prior to starting haptic playback.
4) Open the RAM playback file in the 'RAM Data File' section and press 'Write'.
5) Fill in the Number of Waveforms to Play text box and press enter. Fill in the Number of Waveforms in RAM and press enter. Press the 'Write' button to write to these registers.
6) Fill in the Ending Address registers for each waveform and press enter. Fill out the Waveform ID registers and the Repeat registers to setup a playlist and press enter. Press the 'Write' button to write to these registers. For more information on these registers and creating a waveform playlist, consult the device data sheet.
7) Toggle the 'Play' button from 'Stop' to 'Start'. Press the 'Write' button to start a RAM playback.

Figure 7. Example RAM Write File

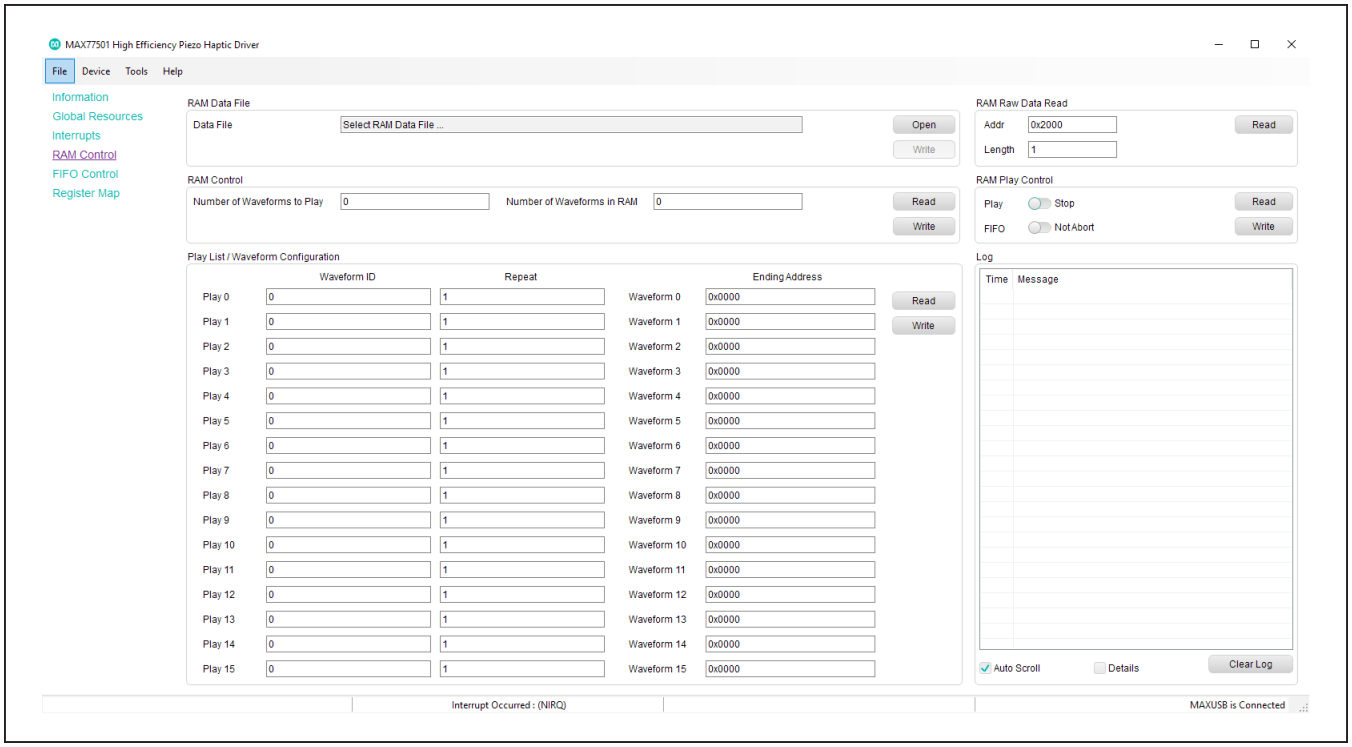


Figure 8. EV Kit GUI RAM Control Tab

FIFO Control Tab

The FIFO Control Tab allows the user to stream data in to the FIFO_WRITE_PORT register using a stream of SPI commands. First, the user must create a file with the extension .FIFO with the contents that the user wants to stream into the FIFO port. The user should have each line represent the data that they want written to the FIFO port. After the user opens the file, they can presss FIFO Data Play, which will cause the GUI to start writing the data file to the FIFO_WRITE_PORT. For more information on the FIFO buffer, refer to the MAX77501 data sheet.

Follow these steps to play a waveform through the FIFO:

1) Create a FIFO file where each datapoint to be stored in the FIFO queue is stored on a new line in the file. Each line will be written to the FIFO_WRITE_PORT register in succession. The extension of this file must be .FIFO.
2) Set the correct configuration registers in the ‘Global Resources’ tab. For more information on these registers, see the IC data sheet.
3) Read the interrupt status register on the ‘Interrupts’ tab in order to read and clear the ‘SPI Ready Interrupt’. This register must be read after enabling the IC prior to starting haptic playback.
4) Open the FIFO playback file in the ‘FIFO Data File’ section and press ‘Write’.

Register Map Tab

The MAX77501 EV kit GUI contains a Register Map tab. This tab allows the user to read all of the registers by using the ‘Read’ or ‘Read All’ buttons. In addition, if the user wants to manually change a register bit, they can click on the bit in the register map and it flips the bit and writes it to the corresponding register of the part.

Figure 9. Example FIFO Write File

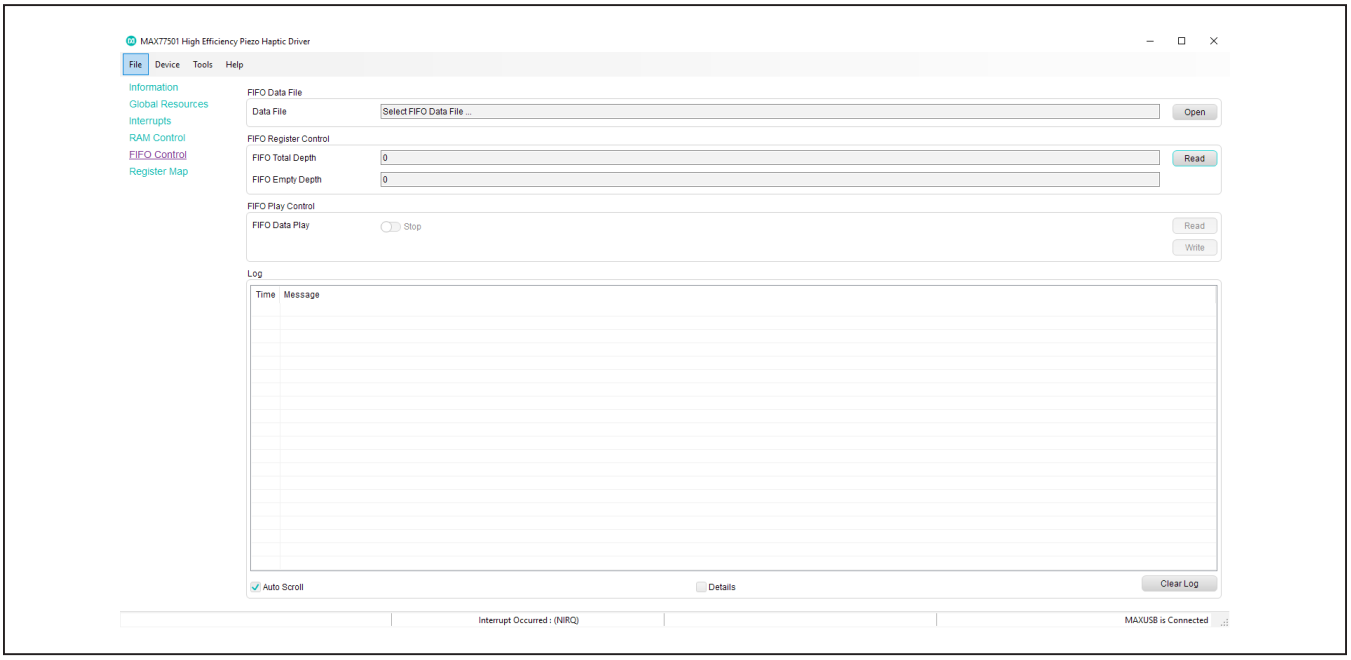
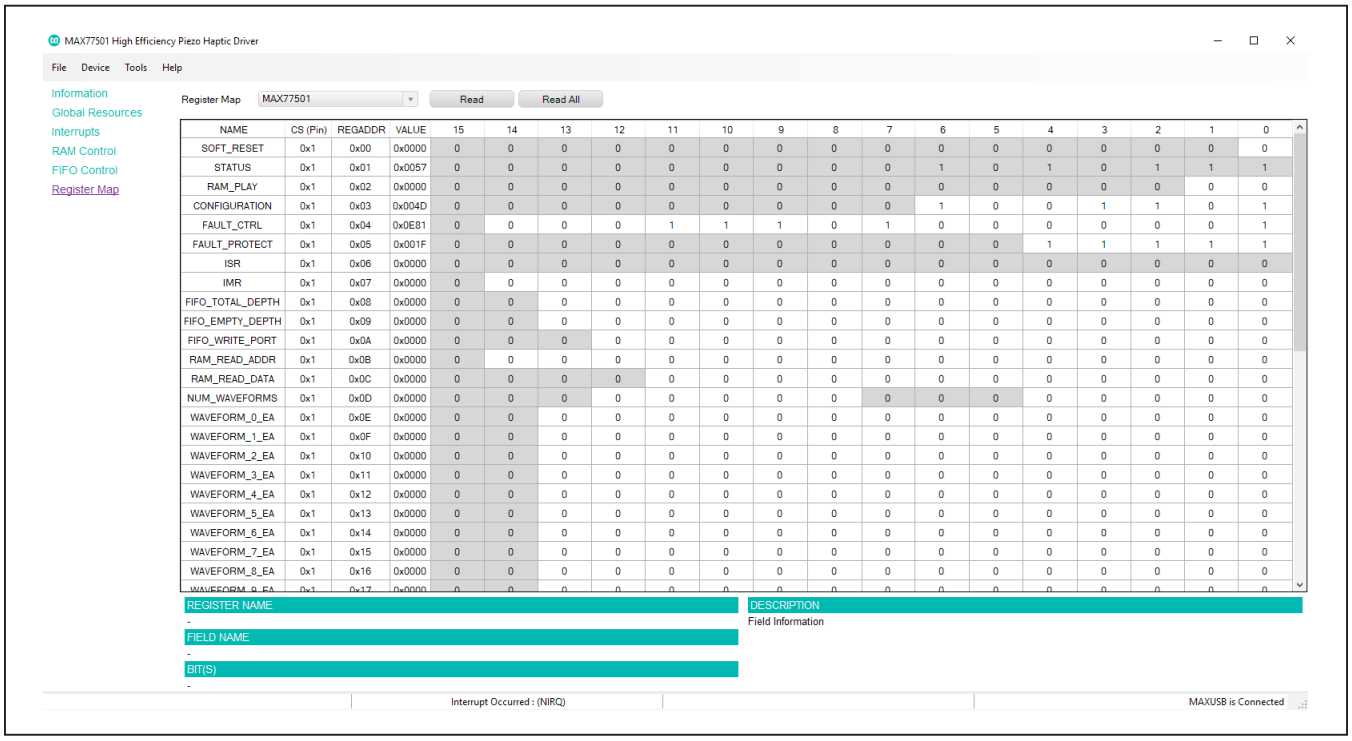


Figure 10. EV kit GUI FIFO Control Tab

Register Map Tab

The MAX77501 EV kit GUI contains a Register Map tab. This tab allows the user to read all of the registers by using the ‘Read’ or ‘Read All’ buttons. In addition, if the user wants to manually change a register bit, they can click on the bit in the register map and it flips the bit and writes it to the corresponding register of the part.



NAME	CS (Pin)	REGADDR	VALUE	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SOFT_RESET	0x1	0x00	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STATUS	0x1	0x01	0x0057	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	1
RAM_PLAY	0x1	0x02	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONFIGURATION	0x1	0x03	0x004D	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1
FAULT_CTRL	0x1	0x04	0x0E81	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	1
FAULT_PROTECT	0x1	0x05	0x001F	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
ISR	0x1	0x06	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IMR	0x1	0x07	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIFO_TOTAL_DEPTH	0x1	0x08	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIFO_EMPTY_DEPTH	0x1	0x09	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIFO_WRITE_PORT	0x1	0x0A	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAM_READ_ADDR	0x1	0x0B	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAM_READ_DATA	0x1	0x0C	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NUM_WAVEFORMS	0x1	0x0D	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_0_EA	0x1	0x0E	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_1_EA	0x1	0x0F	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_2_EA	0x1	0x10	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_3_EA	0x1	0x11	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_4_EA	0x1	0x12	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_5_EA	0x1	0x13	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_6_EA	0x1	0x14	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_7_EA	0x1	0x15	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAVEFORM_8_EA	0x1	0x16	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 11. EV kit GUI Register Map Tab

Ordering Information

PART	TYPE
MAX77501EVKIT#	EV Kit

Note: +Denotes lead-free and RoHS compliant

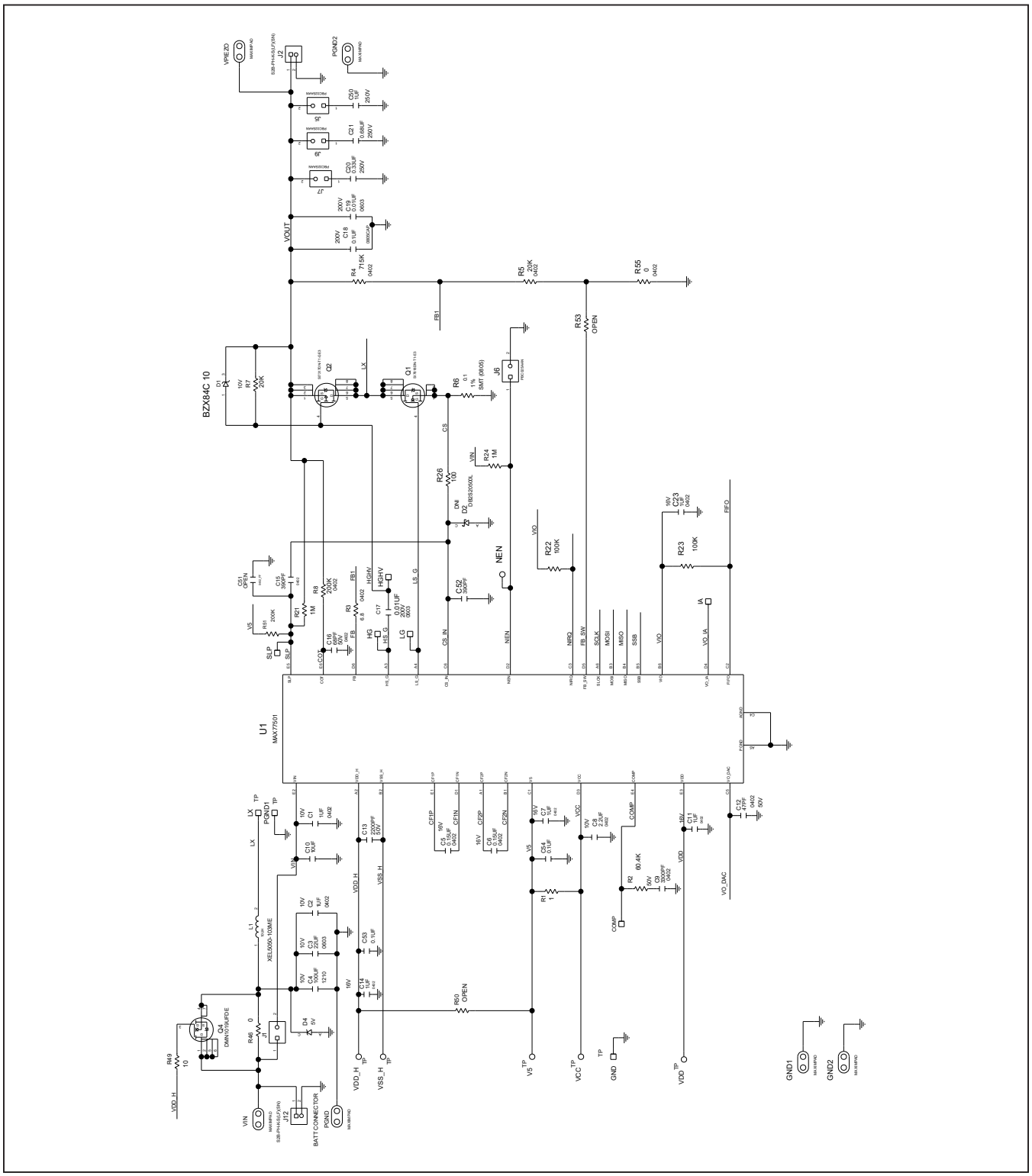
MAX77501 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	TYPICAL APPS CIRCUIT	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1, C2	-	YES	2	C0402X5R100-105KNE; GRM155R61A105KE15	VENKEL LTD.;MURATA	1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1UF; 10V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R	
2	C3	-	YES	1	C1608X5R1A226M080AC; GRM188R61A226ME15	TDK;MURATA	22UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 22UF; 10V; TOL=20%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
3	C4	-	YES	1	CL32A107MPVNNN; C1210C107M8PAC; LMK325BJ107MM	SAMSUNG ELECTRONICS;KEMET; TAIYO YUDEN	100UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 100UF; 10V; TOL=20%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
4	C5, C6	-	YES	2	C1005X7R1C154K050BC	TDK	0.15UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.15UF; 16V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
5	C7, C11, C14, C23	-	YES	4	EMK105BJ105KV	TAIYO YUDEN	1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1UF; 16V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R ;	
6	C8	-	YES	1	ZRB157R61A225KE11; GRM155R61A225KE95; CL05A225KP5NSN	MURATA;MURATA;SAMSUNG ELECTRONICS	2.2UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 2.2UF; 10V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
7	C9	-	YES	1	GRM155R71H332KA01	MURATA	3300PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 3300PF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
8	C10	-	YES	1	C1608X5R1A106K080AC	TDK	10UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 10UF; 10V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R	
9	C12	-	YES	1	C0402C0G500-470JNE; CC0402JRNPO9BN470; GRM1555C1H470JA01; CL05C470JB5NNN	VENKEL LTD.;YAGEO PHYCOMP;MURATA;SAMSUNG ELECTRONICS	47PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 47PF; 50V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=C0G	
10	C13	-	YES	1	C0402X7R500-222KNE; GRM155R71H222KA01	VENKEL LTD.;MURATA	2200PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 2200PF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
11	C15, C52	-	YES	2	C0402C0G500-391JNE; GRM1555C1H391JA01; CGA2B2C0G1H391J050BA	VENKEL LTD.;MURATA;TDK	390PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 390PF; 50V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=C0G	
12	C16	-	YES	1	C0402C680J5GAC; GRM1555C1H680JA01	KEMET;MURATA	68PF	CAPACITOR; SMT; 0402; CERAMIC; 68pF; 50V; 5%; C0G; -55degC to + 125degC; 0 +/-30PPM/degC	
13	C17, C19	-	YES	2	C0603C103K2RAC	KEMET	0.01UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 200V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R	
14	C18	-	YES	1	CGJ4J3X7T2D104K125	TDK	0.1UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 0.1UF; 200V; TOL=10%; MODEL=CGJ SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7T	
15	C53, C54	-	YES	2	GRM155R61C104KA88	MURATA	0.1UF	CAPACITOR; SMT (0402); CERAMIC; 0.1UF; 16V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC to +85 DEGC; TC=X5R	
16	D1	-	YES	1	BZX84C 10	FAIRCHILD SEMICONDUCTOR	10V	DIODE; ZNR; SMT (SOT-23); PIV=10V; IF=0.25A	
17	D4	-	YES	1	1SMA5.0AT3G	ON SEMICONDUCTOR	5V	DIODE; TVS; SMA; VRM=5V; IPP=43.5A	
18	L1	-	YES	1	XEL5050-103ME	COILCRAFT	10UH	INDUCTOR; SMT; COMPOSITE; 10UH; 20%; 4.9A ;	
19	Q1	-	YES	1	SI7818DN-T1-E3	VISHAY SILICONIX	SI7818DN-T1-E3	TRAN; N-CHANNEL 150V (D-S) MOSFET; NCH; POWERPAK1212-8; PD-(1.5W); I-(2.2A); V-(150V)	
20	Q2	-	YES	1	SI7317DN-T1-GE3	VISHAY SILICONIX	SI7317DN-T1-GE3	TRAN; P-CHANNEL 150V MOSFET; PCH; POWERPAK1212-8; PD-(19.8W); I-(-2.8A); V-(-150V)	
21	Q4	-	YES	1	DMN1019UFDE	DIODES INCORPORATED	DMN1019UFDE	TRAN; N-CHANNEL ENHANCEMENT MODE MOSFET; NCH; U-DFN2020-6 (TYPE E); PD-(0.69W); I-(11A); V-(12V)	
22	R1	-	YES	1	CRCW04021R00FK	VISHAY DALE	1	RESISTOR, 0402, 1 OHM, 1%, 100PPM, 0.0625W, THICK FILM	
23	R2	-	YES	1	CRCW040260K4FK	VISHAY DALE	60.4K	RESISTOR; 0402; 60.4K OHM; 1%; 100PPM; 0.063W; THICK FILM	
24	R4	-	YES	1	ERJ-2RKF7153	PANASONIC	715K	RES; SMT (0402); 715K; 1%; +/-100PPM/DEGC; 0.10W	
25	R5	-	YES	1	CRCW040220K0FK	VISHAY DALE	20K	RESISTOR; 0402; 20K OHM; 1%; 100PPM; 0.063W; THICK FILM	
26	R6	-	YES	1	RL1220S-R10-F	SUSUMU CO LTD.	0.1	RESISTOR; 0805; 0.1 OHM; 1%; 200PPM; 0.33W; THICK FILM	
27	R7	-	YES	1	ERJ-2GEJ203	PANASONIC	20K	RESISTOR; 0402; 20K OHM; 5%; 200PPM; 0.10W; THICK FILM	
28	R8	-	YES	1	CRCW0402200KFK; RF73H1ELTP2003	VISHAY DALE;KOA SPEER ELECTRONICS	200K	RESISTOR; 0402; 200K; 1%; 100PPM; 0.0625W; THICK FILM	
29	R21, R24	-	YES	2	CRCW04021M00FK	VISHAY DALE	1M	RESISTOR; 0402; 1M; 1%; 100PPM; 0.0625W; THICK FILM	
30	R22, R23	-	YES	2	ANY	ANY	100K	RESISTOR; 0402; 100K; 1%; 100PPM; 0.0625W; THICK FILM; FORMFACTOR	
31	R26	-	YES	1	ERJ-2RKF1000	PANASONIC	100	RESISTOR; 0402; 100 OHM; 1%; 100PPM; 0.10W; THICK FILM	
32	R49	-	YES	1	ERJ-2RKF10R0	PANASONIC	10	RESISTOR; 0402; 10 OHM; 1%; 100PPM; 0.10W; THICK FILM	
33	U1	-	YES	1	MAX77501	MAXIM	MAX77501	EVKIT PART-IC; MAX77501; HIGH EFFICIENCY PIEZO HAPTICS DRIVER; PACKAGE DRAWING NUMBER: 21-100276B; PACKAGE CODE: W302M2+1	
34	D2	DNP	YES	0	DB2S20500L	PANASONIC	DB2S20500L	DIODE; SCH; SMT (SOD-523); PIV=20V; IF=0.2A	
35	R51	-	YES	1	CRCW0402200KFK; RF73H1ELTP2003	VISHAY DALE;KOA SPEER ELECTRONICS	200K	RESISTOR; 0402; 200K; 1%; 100PPM; 0.0625W; THICK FILM	
36	R50, R53	DNP	NO	0	N/A	N/A	OPEN	RESISTOR; 0402; OPEN; FORMFACTOR	
37	C51	DNP	NO	0	N/A	N/A	OPEN	CAPACITOR; SMT (0402); OPEN; FORMFACTOR	
38	R55	-	NO	15	ERJ-2GE0R00	PANASONIC	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM	
39	R46	-	NO	1	CRCW12100000Z0	VISHAY DALE	0	RESISTOR; 1210; 0 OHM; 0%; JUMPER; 0.5W; THICK FILM	
40	R3	-	NO	1	CRCW04026R80FK	VISHAY DALE	6.8	RESISTOR, 0402, 6.8 OHM, 1%, 100PPM, 0.0625W, THICK FILM	

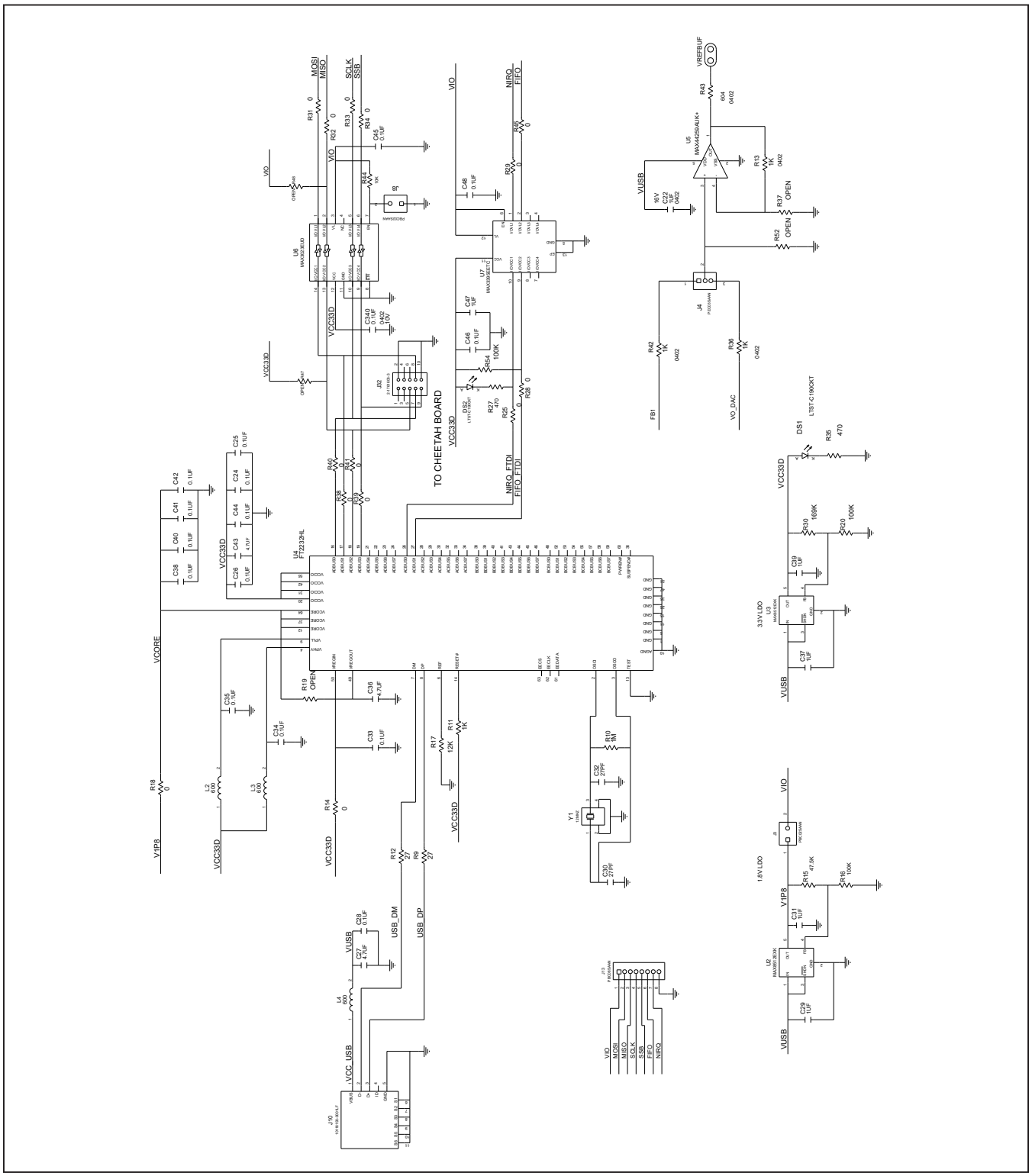
MAX77501 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	TYPICAL APPS CIRCUIT	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
Components below this line are outside of the immediate MAX77501 solution and power train components (i.e. FETs, inductor, etc.).									
41	C20	-	NO	1	GRM43DR72E334KW01	MURATA	FT2232HL	CAPACITOR; SMT (1812); CERAMIC CHIP; 0.33UF; 250V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
42	C21	-	NO	1	GRM55DR72E684KW01; C5750X7R2E684K230KA	MURATA;TDK	0.68UF	CAP; SMT (2220); 0.68UF; 10%; 250V; X7R; CERAMIC CHIP	
43	C22, C29, C31, C37, C39, C47	-	NO	6	GRM155R61C105ME01	MURATA	1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1UF; 16V; TOL=20%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
44	C24-C26, C28, C33-C35, C38, C40-C42, C44	-	NO	12	GRM155R71A104JA01	MURATA	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 10V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
45	C27, C36, C43	-	NO	3	C1005X5R1A475K050	TDK	4.7UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 4.7UF; 10V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
46	C30, C32	-	NO	2	ECJ-0EC1H270J	PANASONIC	27PF	CAPACITOR; SMT (0402); CERAMIC; 27PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
47	C45, C46, C48, C340	-	NO	4	GRM155R61A104KA01	MURATA	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 10V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R;	
48	C50	-	NO	1	GRM55DR72E105KW01L	MURATA	1UF	CAPACITOR; SMT (2220); CERAMIC CHIP; 1UF; 250V; TOL=10%; MODEL=X7R; TG=-55 DEGC TO +125 DEGC; TC=+/-	
49	DS1, DS2	-	NO	2	LTST-C190CKT	LITE-ON ELECTRONICS INC.	LTST-C190CKT	DIODE; LED; STANDARD; RED; SMT (0603); PIV=5.0V; IF=0.04A; -55 DEGC TO +85 DEGC	
50	GND1, GND2, PGND, PGND2, VIN, VPIEZO, VREFBUF	-	NO	7	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
51	J1	-	NO	1	PPPC021LFBN-RC	SULLINS ELECTRONICS CORP	PPPC021LFBN-RC	CONNECTOR; FEMALE; THROUGH HOLE; LFB SERIES; 2.54MM CONTACT CENTER; STRAIGHT; 2PINS	
52	J2, J12	-	NO	2	S2B-PH-K-S(LF)(SN)	JST MANUFACTURING	S2B-PH-K-S(LF)(SN)	CONNECTOR; MALE; THROUGH HOLE; 2.0MM PITCH; DISCONNECTABLE CRIMP STYLE CONNECTOR; SIDE ENTRY TYPE; RIGHT ANGLE; 2PINS	
53	J3, J5-J9	-	NO	6	PBC02SAAN	SULLINS ELECTRONICS CORP.	PBC02SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS; -65 DEGC TO +125 DEGC;	
54	J4	-	NO	1	PEC03SAAN	SULLINS ELECTRONICS CORP.	PEC03SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC;	
55	J10	-	NO	1	10118193-0001LF	FCI CONNECT	10118193-0001LF	CONNECTOR; FEMALE; SMT; MICRO USB B TYPE RECEPTACLE; RIGHT ANGLE; 5PINS	
56	J13	-	NO	1	PBC08SAAN	SULLINS ELECTRONICS CORP.	PBC08SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 8PINS; -65 DEGC TO +125 DEGC	
57	J32	-	NO	1	2-1761603-3	TE CONNECTIVITY	2-1761603-3	CONNECTOR; MALE; THROUGH HOLE; BLUE HEADER ASSEMBLY; LOW PROFILE; STRAIGHT; 10PINS	
58	L2-L4	-	NO	3	BLM18AG601SN1	MURATA	600	INDUCTOR; SMT (0603); FERRITE-BEAD; 600; TOL=+/-; 0.5A	
59	NEN	-	NO	1	5002	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER;	
60	R9, R12	-	NO	2	ERJ-2RKF27R0X;RC0402FR-0727RL;CRCW040227R0FK	PANASONIC;YAGEO PHICOMP;VISHAY DALE	27	RESISTOR, 0402, 27 OHM, 1%, 100PPM, 0.0625W, THICK FILM	
61	R10	-	NO	1	CRCW04021M00FK	VISHAY DALE	1M	RESISTOR; 0402; 1M; 1%; 100PPM; 0.0625W; THICK FILM	
62	R11, R13, R36, R42	-	NO	4	CRCW04021K00FK; RC0402FR-071KL;MCR01MZPF1001	VISHAY DALE;YAGEO PHICOMP;ROHM SEMI	1K	RESISTOR; 0402; 1K; 1%; 100PPM; 0.0625W; THICK FILM	
63	R14, R18, R25, R28, R29, R31-R34, R38-R41, R45	-	NO	15	ERJ-2GE0R00	PANASONIC	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM	
64	R15	-	NO	1	CRCW04024752FK; 9C04021A4752FLHF3; CRCW040247K5FK	VISHAY DALE;YAGEO;VISHAY DALE	47.5K	RESISTOR; 0402; 47.5K; 1%; 100PPM; 0.0625W; THICK FILM	
65	R17	-	NO	1	CRCW040212K0FK; MCR01MZPF1202	VISHAY DALE;ROHM SEMICONDUCTOR	12K	RESISTOR, 0402, 12K OHM, 1%, 100PPM, 0.0625W, THICK FILM	
66	R16, R20, R54	-	NO	3	ANY	ANY	100K	RESISTOR; 0402; 100K; 1%; 100PPM; 0.0625W; THICK FILM; FORMFACTOR	
67	R27, R35	-	NO	2	CRCW0402470RFK	VISHAY DALE	470	RESISTOR, 0402, 470 OHM, 1%, 100PPM, 0.0625W, THICK FILM	
68	R30	-	NO	1	CRCW0402169KFK	VISHAY DALE	169K	RESISTOR; 0402; 169K OHM; 1%; 100PPM; 0.063W; THICK FILM	
69	R43	-	NO	1	ERJ-2RKF6040	PANASONIC	604	RESISTOR; 0402; 604 OHM; 1%; 100PPM; 0.1W; THICK FILM	
70	R44	-	NO	1	CRCW040210K0FK;RC0402FR-0710KL	VISHAY DALE;YAGEO PHICOMP	10K	RESISTOR; 0402; 10K; 1%; 100PPM; 0.0625W; THICK FILM	
71	U2, U3	-	NO	2	MAX8512EXK+	MAXIM	MAX8512EXK	IC, VREG, Ultra-Low-Noise, High PSRR, Adjustable Vout, SC70-5	
72	U4	-	NO	1	FT2232HL	FUTURE TECHNOLOGY DEVICES INTL LTD.	FT2232HL	IC; MMRY; DUAL HIGH SPEED USB TO MULTIPURPOSE UART/FIFO; LQFP64	
73	U5	-	NO	1	MAX44259AUK+	MAXIM	MAX44259AUK+	IC; OPAMP; 1.8V; 15MHZ LOW OFFSET; LOW POWER; RAIL TO RAIL I/O OP AMP; SOT23-5	
74	U6	-	NO	1	MAX3023EUD+	MAXIM	MAX3023EUD	IC; TRANS; QUAD-LEVEL TRANSLATOR; TSSOP14	
75	U7	-	NO	1	MAX3395EETC+	MAXIM	MAX3395EETC	IC; TRANS; 15KV ESD-PROTECTED HIGH-DRIVE CURRENT QUAD-LEVEL TRANSLATOR WITH SPEED-UP CIRCUITRY; TQFN12 4X4	
76	V5, VCC, VDD, VDD_H, VSS_H	-	NO	5	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;	
77	Y1	-	NO	1	7M-12.000MAAJ	TXC CORPORATION	12MHZ	CRYSTAL; SMT; 18PF; 12MHZ; +/-30PPM; +/-30PPM	
78	PCB	-	NO	1	MAX77501	MAXIM	PCB	PCB:MAX77501	-
79	R19, R37, R47, R48, R52	DNP	NO	0	N/A	N/A	OPEN	RESISTOR; 0402; OPEN; FORMFACTOR	
TOTAL				146					

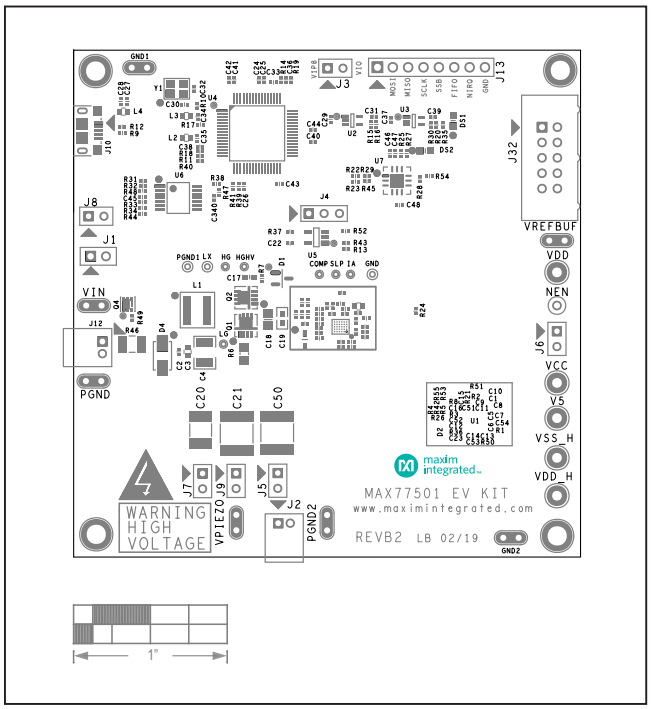
MAX77501 EV Kit Schematic



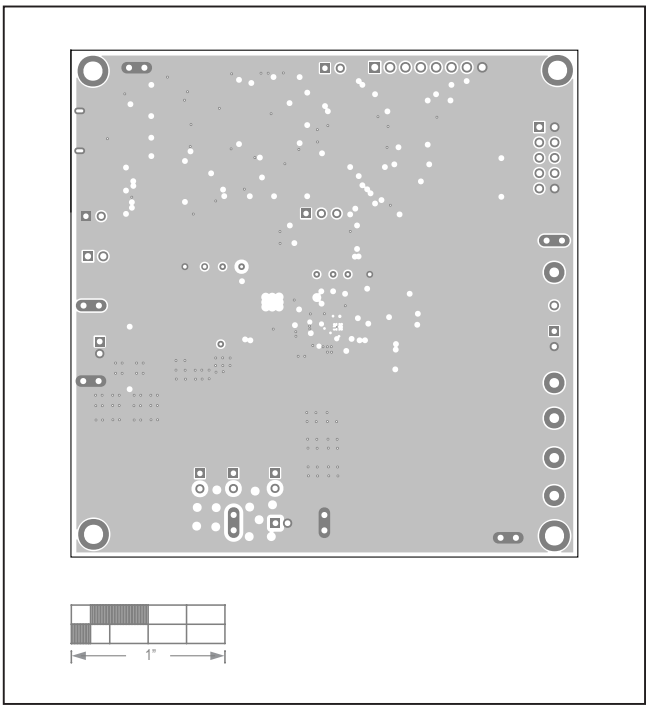
MAX77501 EV Kit Schematic (continued)



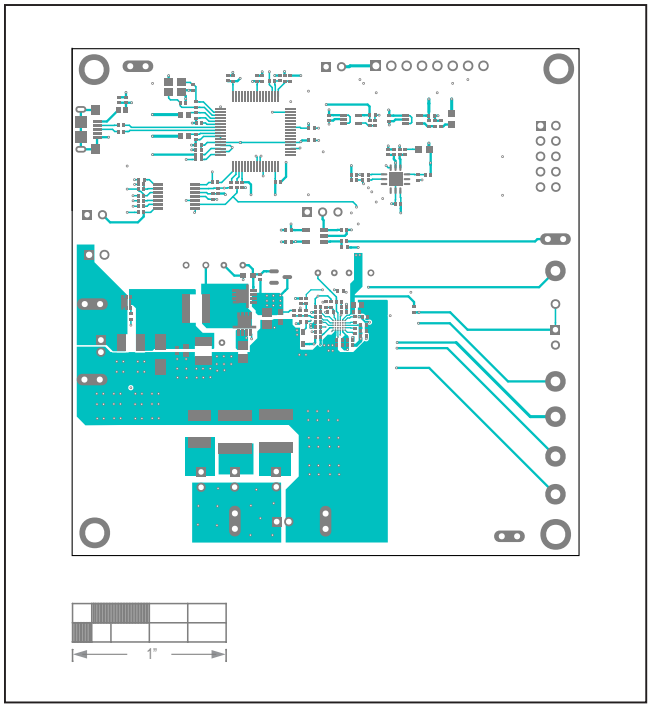
MAX77501 EV PCB Layout



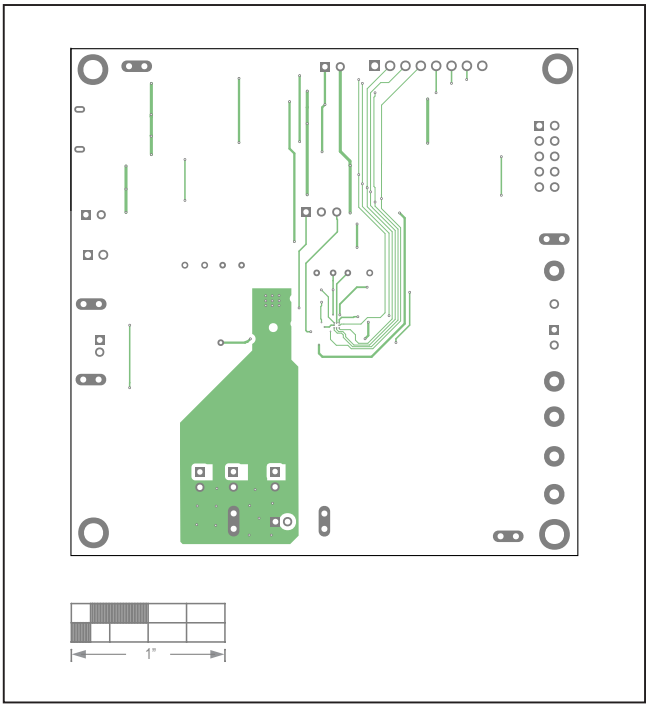
MAX77501 EV Kit—Top Silkscreen



MAX77501 EV Kit—Layer2

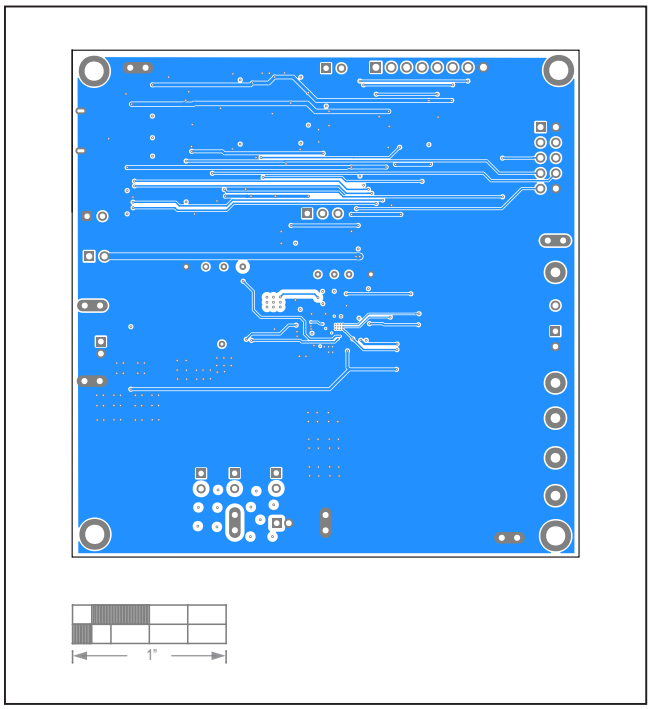


MAX77501 EV Kit—Top

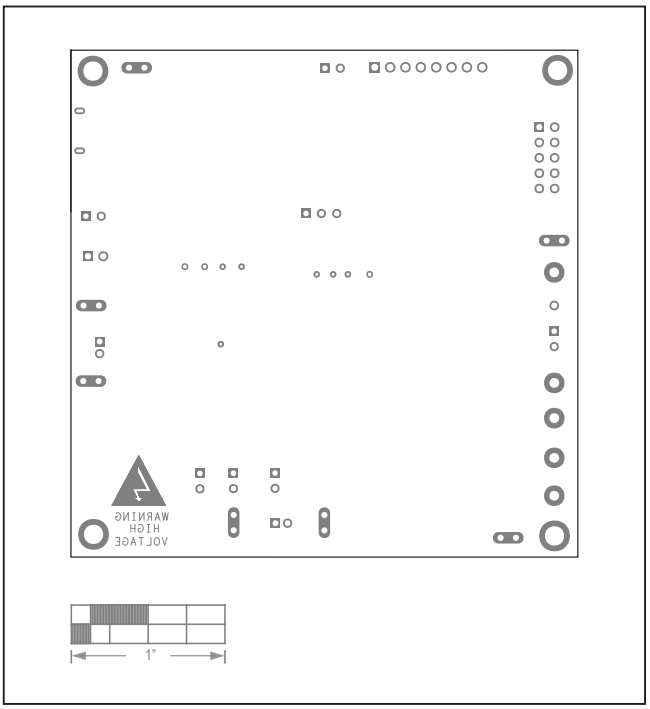


MAX77501 EV Kit—Layer3

MAX77501 EV PCB Layout (continued)



MAX77501 EV Kit—Bottom



MAX77501 EV Kit—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/19	Initial release	—

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at https://www.maximintegrated.com/en/storefront/storefront.html.