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MAX77962 Evaluation Kit

Evaluates: MAX77962

General Description

The MAX77962 evaluation kit (EV kit) is a fully assembled and tested surface-mount printed circuit board (PCB) that evaluates the MAX77962, a 3.2A USB Type-C® buck-boost charger.

The MAX77962 EV kit includes the IC evaluation board with integrated I²C communication interface and USB micro-B cable. Windows®-based graphical user interface (GUI) software is available for use with the EV kit and can be downloaded from Maxim's website at www.maximintegrated.com/products/MAX77962 (under the *Design Resources* tab). Windows 7 or newer is required to use with the EV kit GUI software.

Features

- Evaluates the MAX77962 USB Type-C Buck-Boost Charger with Integrated FETs for 2S Li-Ion Batteries
- Demonstrates 3.5V to 23V Input Operating Range
- Demonstrates Charging Up to 3.2A
- Demonstrates USB-OTG Functionality
- Demonstrates JEITA Compliance with On-Board Dummy Thermistors
- Assembled and Tested
- I²C Serial Interface

[Ordering Information](#) appears at end of data sheet.

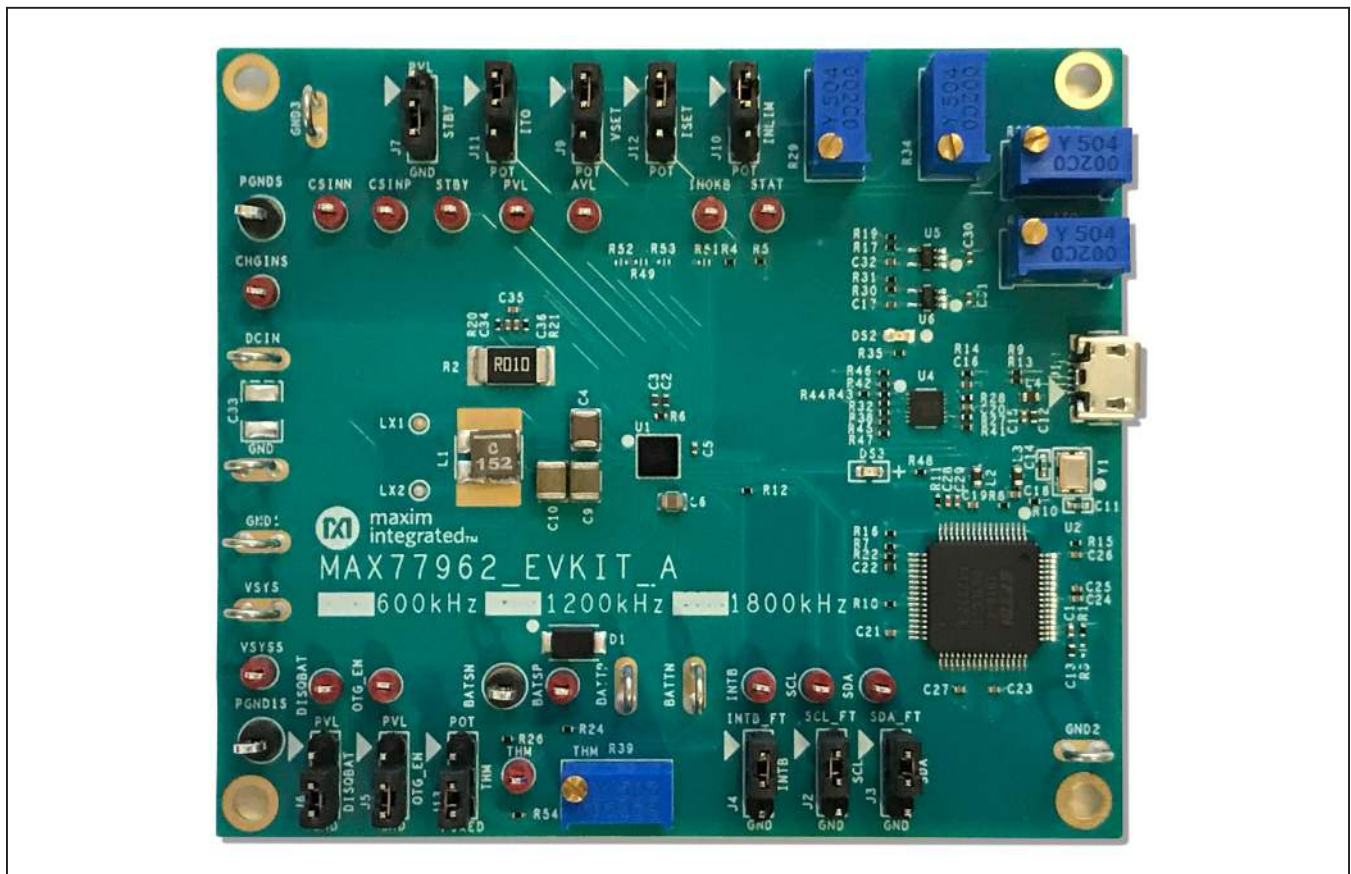


Figure 1. MAX77962 EV Kit Photo

USB Type-C® is a registered trademark of USB Implementers Forum.
Windows is a registered trademark and registered service mark of Microsoft Corporation.



MAX77962 EV Kit Files

FILE	DESCRIPTION
MAX77962GUISetupX.X.X.exe	Installs all EV kit files on PC

MAX77962 EV Kit Component List

PART	QTY	DESCRIPTION
MAX77962EVKIT	1	MAX77962 evaluation kit
USB high-speed A-to-B cables, 6ft	1	USB Micro-B cable

Quick Start

Required Equipment

- MAX77962 EV kit
- Adjustable DC power supply
- Battery or simulated battery
 - 2-cell Li-ion protected battery
 - Simulated battery or preloaded power supply
- Oscilloscope
- Two voltmeters
- Two ammeters
- Lab cables with appropriate current rating
- USB Micro-B cable
- PC with Windows 7 or newer operating system and USB port

Setup Overview

A typical bench setup for the MAX77962 EV Kit is shown in [Figure 2](#).

Procedure

The EV kit is fully assembled and tested. Follow the steps below to install the EV kit software, make required hardware connections, and start operation of the kit. The EV kit software can be run without hardware attached. Note that after communication is established the IC must still be configured correctly for desired operation mode. Make sure the PC is connected to the internet throughout the process so that the USB driver can be automatically installed.

Note: Do not turn on the DC power supply until all connections are made.

- 1) Visit www.maximintegrated.com/products/MAX77962 under the *Design Resources* tab to download the latest version of the MAX77962 EV kit GUI software. Save the software to a temporary folder and unpack the zip file.
- 2) Install the EV kit software on your computer by running the MAX77962GUISetupX.X.X.exe program inside the temporary folder. The program files are copied, and icons are created in the Windows **Start** menu. The software requires the .NET Framework 4.5 or later. If you are connected to the Internet, Windows automatically updates the .NET framework as needed.
- 3) The EV kit software launches automatically after installation, or alternatively, it can be launched by clicking on the icon in the Windows **Start** menu.
- 4) Use the USB cable provided with the EV kit to connect the EV kit to the PC's USB port.
- 5) Make jumper connections based on the Default Position column in [Table 1](#). Change it later when evaluating more features.

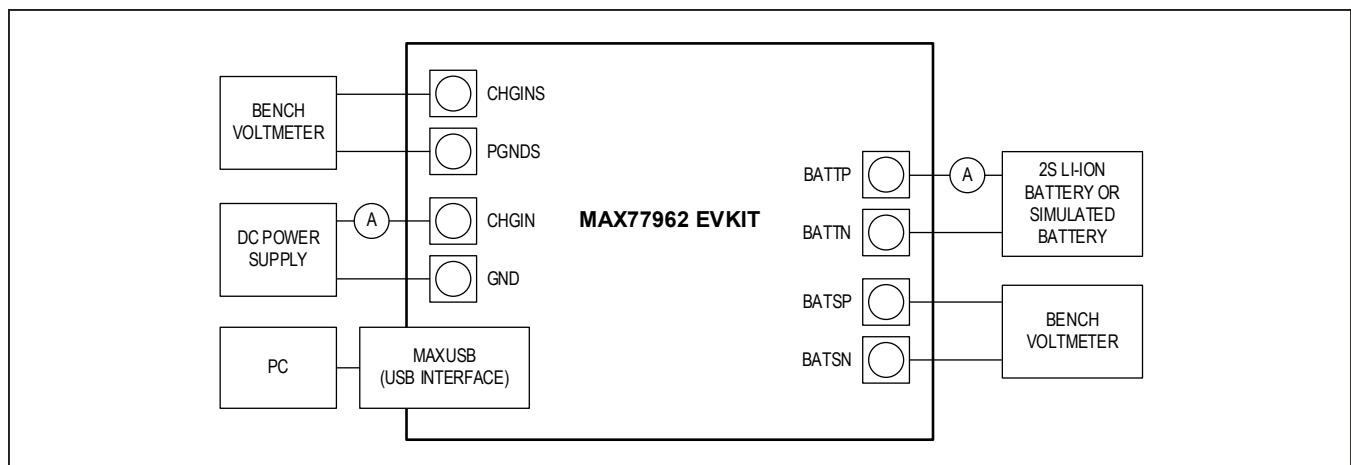


Figure 2. EV Kit Simple Block Diagram

- 6) Connect a 2-cell Li-ion battery or simulated battery to the connectors labeled BATTTP and BATTN.
- 7) Connect a DC power supply to the connectors labeled DCIN and GND.
- 8) Launch the MAX77962 GUI software.
- 9) Select **Device > Connect** from the window options to connect to the EV kit.

Table 1. Jumper Connection Guide

JUMPER NUMBER	PCB SILKSCREEN	DEFAULT POSITION	FUNCTION
J2	SCL	1-2	1-2: Connects SCL with the on-board MAXUSB (USB-to-I ² C interface) to allow communication with the GUI software. 2-3: Disconnects SCL from the on-board MAXUSB.
J3	SDA	1-2	1-2: Connects SDA with the on-board MAXUSB to allow communication with the GUI software. 2-3: Disconnects SDA from the on-board MAXUSB.
J4	INTB	1-2	1-2: Connects INTB with the on-board MAXUSB to allow communication with the GUI software. 2-3: Disconnects INTB from the on-board MAXUSB.
J5	OTG_EN	2-3	1-2: Connects OTG_EN to PVL. OTG function is enabled. 2-3: Connects OTG_EN to GND. OTG function enable is controlled by MODE[3:0] bitfield.
J6	DISQBAT	2-3	1-2: Connects DISQBAT to PVL. Q _{BAT} FET is disabled. 2-3: Connects DISQBAT to GND. Q _{BAT} FET is controlled by the DISIBS bit and power-path state machine/internal logic control.
J7	STBY	2-3	1-2: Connects STBY to PVL. DC-DC is disabled. 2-3: Connects STBY to GND. DC-DC is controlled by STBY_EN bit and power-path state machine/internal logic control.
J9	VSET	1-2	1-2: Connects VSET to PVL. Default charge termination voltage is same as decode of reset value of CHG_CV_PRM[6:0]. 2-3: Connects VSET to potentiometer R25. Default charge termination voltage is programmed by R25.
J10	INLIM	1-2	1-2: Connects INLIM to PVL. Default input current limit is same as decode of reset value of CHGIN_ILIM[6:0]. 2-3: Connects INLIM to potentiometer R29. Default input current limit is programmed by R29.
J11	ITO	1-2	1-2: Connects ITO to PVL. Default top-off charge current is same as decode of reset value of TO_ITH[2:0]. 2-3: Connects ITO to potentiometer R33. Default top-off charge current is programmed by R33.
J12	ISET	1-2	1-2: Connects ISET to PVL. Default fast-charge current is same as decode of reset value of CHGCC_MSB and CHGCC[7:0]. 2-3: Connects ISET to potentiometer R34. Default fast-charge current is programmed by R34.
J13	THM	2-3	1-2: Connects THM to potentiometer R39. Adjust resistance of R39 to emulate resistance change of a 10kΩ thermistor at different temperature. 2-3: Connects THM to a fixed 10kΩ resistor. This emulates resistance of a 10kΩ thermistor at 25°C.

Detailed Description of Software

The MAX77962 GUI software provides an easy-to-use interface to control the function blocks of the IC.

Software Installation

Double-click the **MAX77962GUISetupX.X.X.exe** icon to begin the installation process. Follow the prompts to complete the installation. The evaluation software can be uninstalled in the **Add/Remove Programs** tool in the **Control Panel**. After the installation is complete, open the **Maxim Integrated/MAX77962** folder and run **MAX77962.exe** or select it from the program menu. **Figure 3** shows a splash screen containing information about the evaluation kit that appears while the program is loading.

Establish Communication

Power up the MAX77962 by connecting a 2-cell Li-ion battery or simulated battery at BATT/P/BATTN. Open the GUI software and select **Device > Connect**. A window should pop up showing that a slave address 0x69 (7-bit address) has been found. If not, check the USB connection and power. Choose **Connect and Read** and the status bar displays “MAXUSB is Connected” to signify active communication. An example of a successful connection is shown in **Figure 4**.

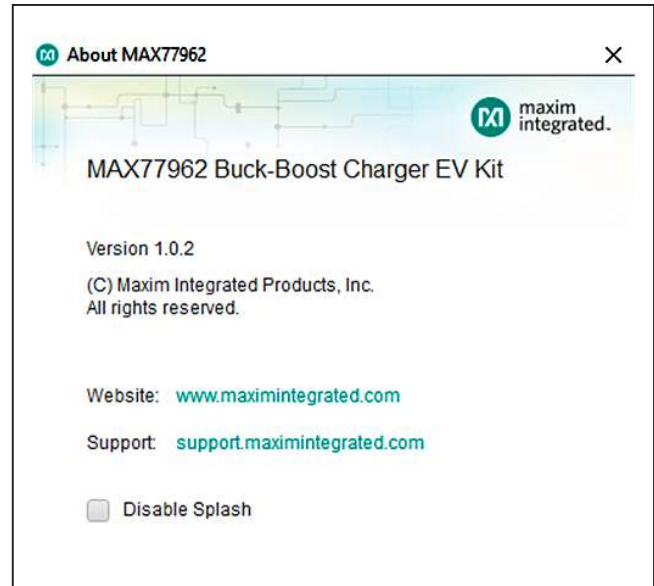


Figure 3. EV Kit Splash Screen

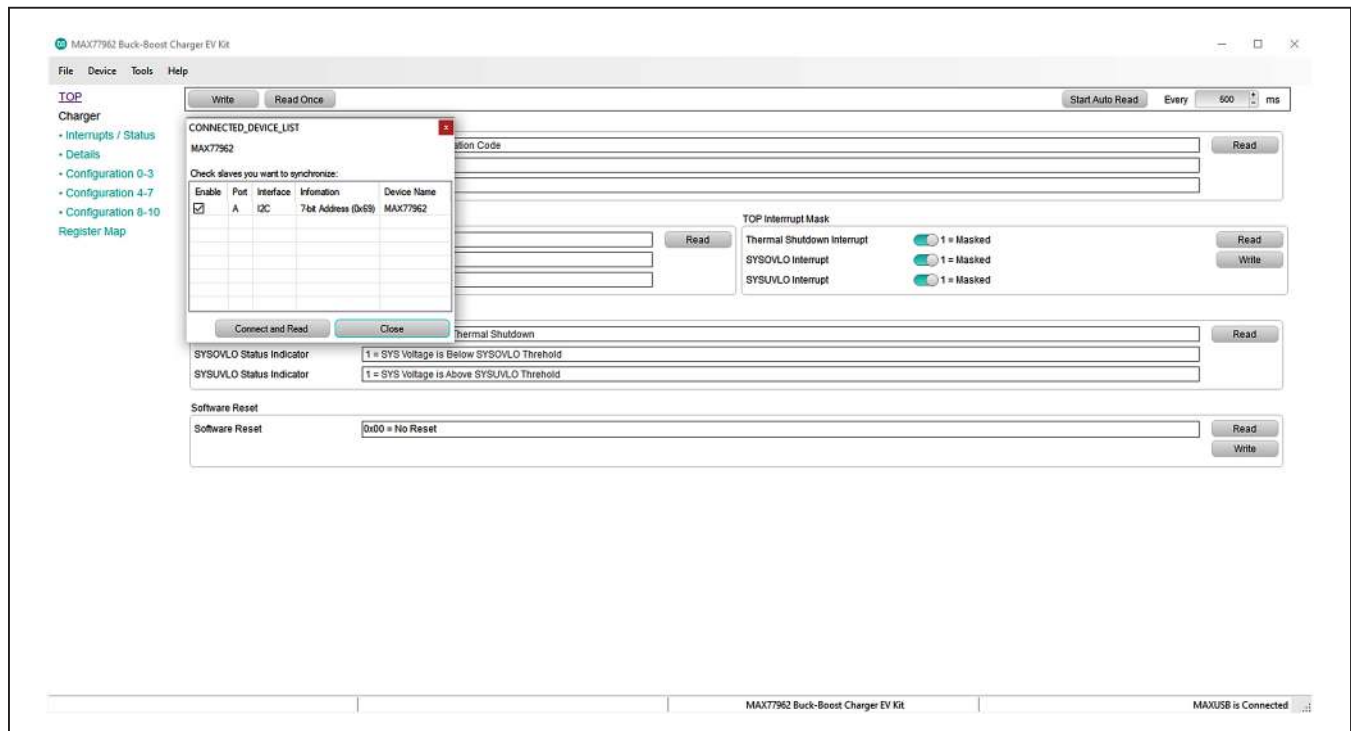


Figure 4. MAX77962 Top-Level Registers

Main Display

Status bits and programmable functions of the charger can be accessed through the interface tabs in the left column of the window (Figure 5).

Register Write Access

Modification of the charger registers are locked by default to prevent arbitrary changes. Therefore, changes made to the charger registers in the locked state are not applied to the EV kit. To unlock register writing, select the **0x3 = Unlocked** option in the **Charger Settings Protection**

dropdown menu from the **Charger Configurations 6** register in the **Configuration 4-7** tab, and then click **Write** (Figure 6). Read the register and the **Charger Settings Protection** setting should remain in the **0x3 = Unlocked** state to signify open register access.

From this point onwards, modifications written to any of the registers apply to the EV kit. For example, the **CHGIN Input Current Limit** can be changed in the **Charger Configurations 8** register by selecting the required value and clicking **Write** (Figure 7), but only after the registers have been unlocked.

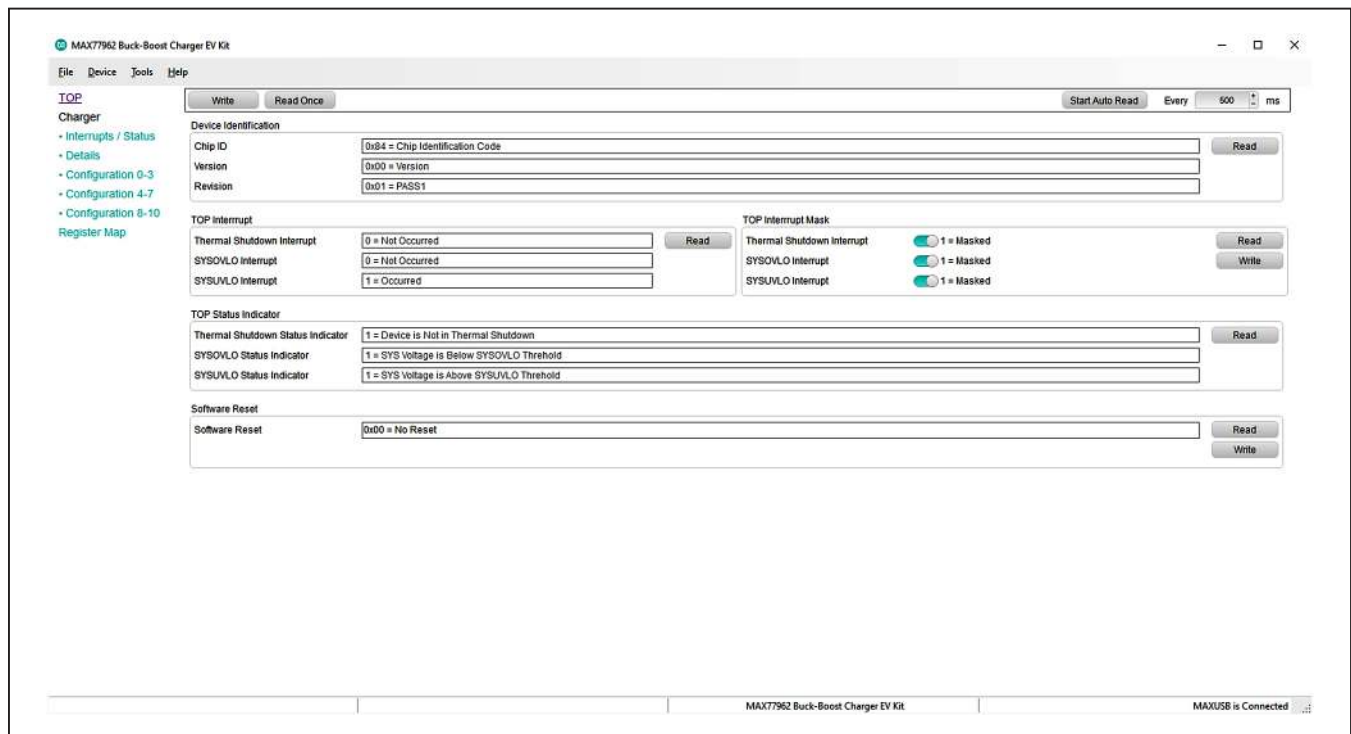


Figure 5. MAX77962 Top-Level Registers

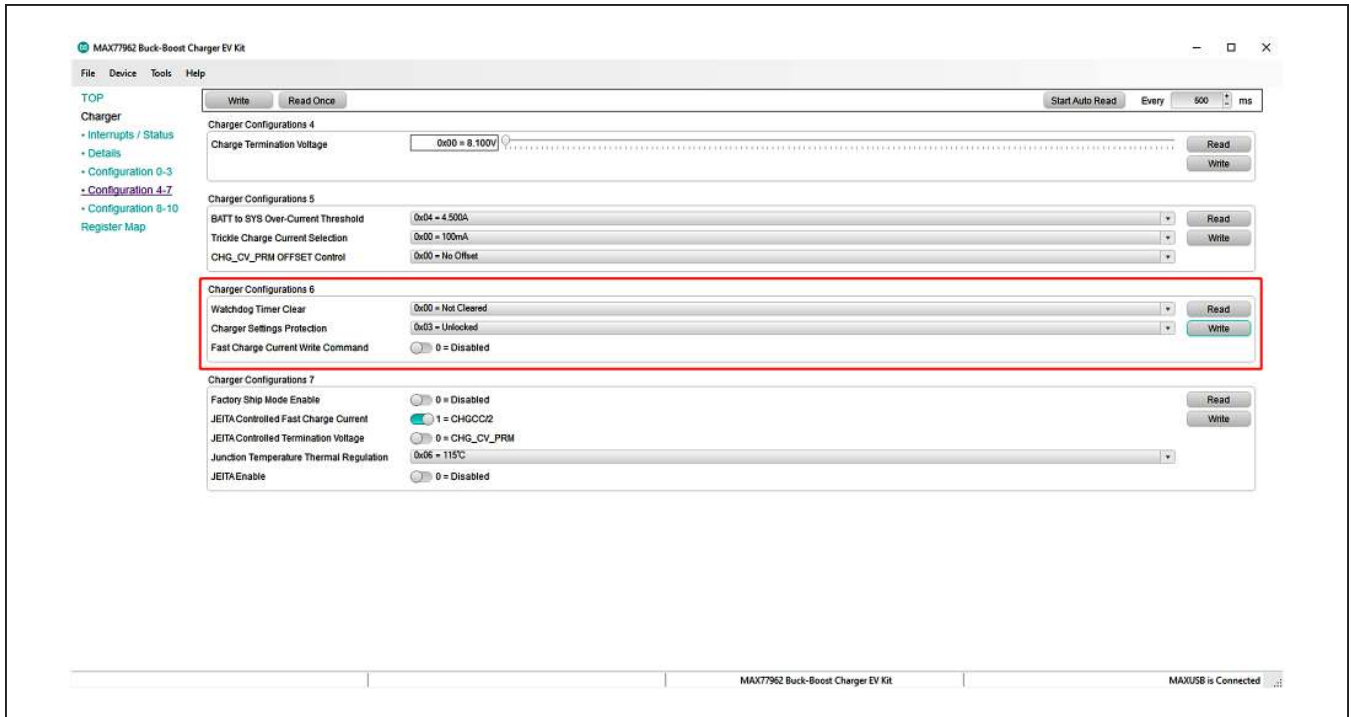


Figure 6. Charger Register Write Access

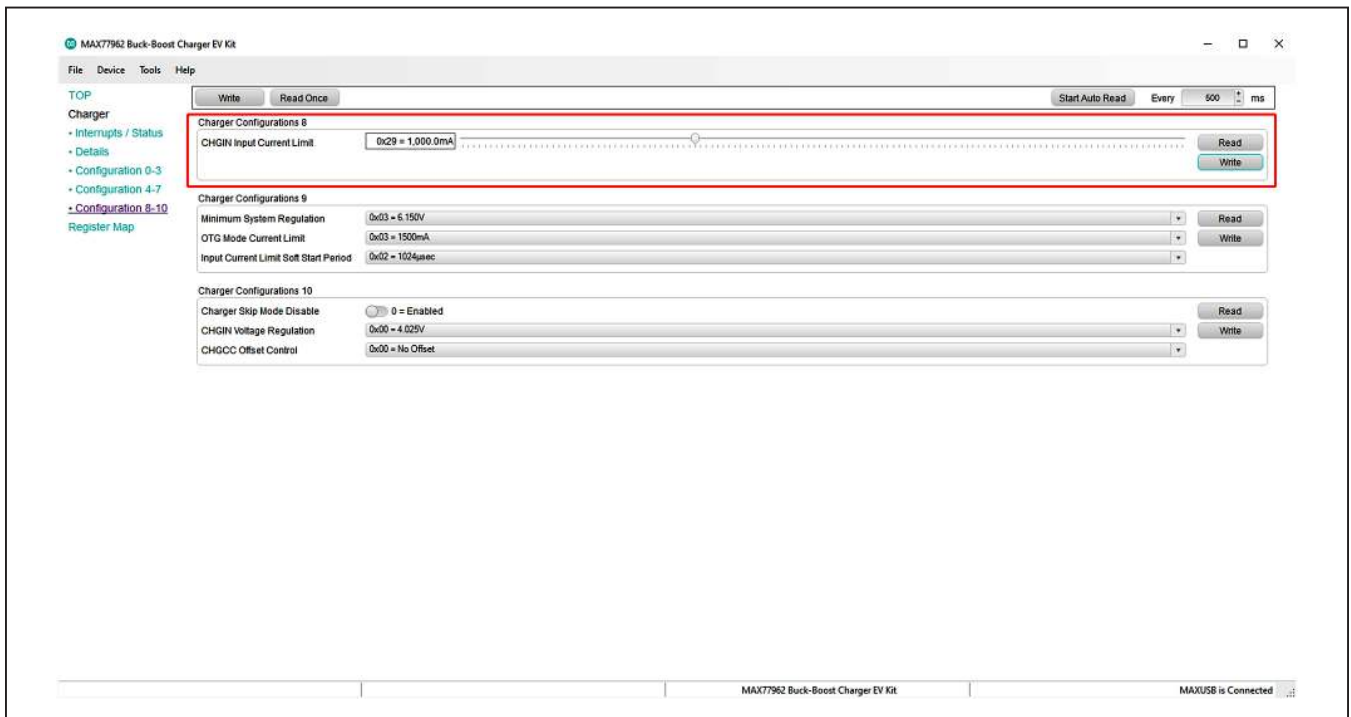


Figure 7. Change CHGIN Input Current Limit after Unlocking Charger Settings Protection

Detailed Description of Hardware

Battery Charger Test Setup

- 1) Connect a 2-cell Li-Ion battery or simulated battery between BATT+ and BATTN.
- 2) Adjust voltage and current limits of the DC power supply to 5.0V and 3.0A. Output of the power supply is off.
- 3) Connect the power supply between DCIN and GND on the EV kit board.
- 4) Open the EV kit GUI and connect to the EV kit.
- 5) In the **Configuration 4-7** tab, set **Charger Settings Protection** in the **Charger Configurations 6** register to **0x3 = Unlocked**. Click **Write** to send the command to the charger.
- 6) Program the appropriate charger settings for your system. In the **Configuration 8-10** tab, set **CHGIN Input Current Limit** in the **Charger Configurations 8** register. Press **Write** to send the command to the charger.
- 7) The 9-bit **Fast Charge Current** bitfield resides in two registers (**CHGCC_MSB** of the **CHG_CNFG_04** register and **CHGCC[7:0]** of the **CHG_CNFG_02** register). To guarantee an atomic operation, a write-enable bit **CHGCC_WR_EN** is provided in the **CHG_CNFG_06**

register. Writing 1 to this bit makes the value of the **Fast Charge Current** take effect. For changing the fast-charge current, perform the following steps ([Figure 8](#)):

- a. The EV kit GUI has been optimized by concatenating **CHGCC_MSB** and **CHGCC[7:0]** in the same setting. In the **Configuration 0-3** tab, set **Fast Charge Current** in the **Charger Configurations 2** register. Click **Write** to send the command to the charger.
 - b. To apply the fast-charge current, enable **Fast Charge Current Write Command** in the **Charger Configurations 6** register under the **Configuration 4-7** tab. Toggle the button to **Enabled** and click **Write**.
- 8) In the **Charger Configuration 0** register of the **Configuration 0-3** tab, set **Smart Power Selector** to **0x5 = Charger = On, OTG = Off, and DCDC = On** and click **Write** to enable charger mode.
 - 9) Turn on the DC power supply's output to enable charging.
 - 10) Use data log equipment to log the charge current and battery voltage profile while charging a 2-cell Li-ion battery.

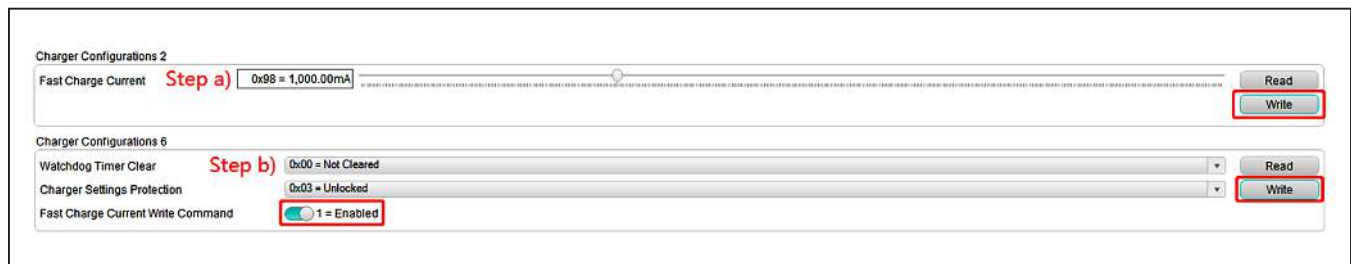


Figure 8. Write Fast-Charge Current

Component Suppliers

SUPPLIER	PHONE	WEBSITE
MURATA	770-436-1300	www.murata-northamerica.com
SAMTEC	800-726-8329	www.samtec.com
SULLINS ELECTRONICS CORP	760-774-0125	www.sullinselectronics.com
TAIYO-YUDEN	603-669-7587	www.t-yuden.com
TDK	847-803-6100	www.tdk.com
VISHAY	408-970-5852	www.vishay.com
COILCRAFT	847-639-6400	www.coilcraft.com
PANASONIC	800-344-2112	https://na.industrial.panasonic.com
FUTURE TECHNOLOGY DEVICES INTL LTD	503-547-0988	www.ftdichip.com

Note: Indicate that you are using the MAX77962 when contacting these component suppliers.

Ordering Information

PART	TYPE
MAX77962EVKIT-06#	EV Kit
MAX77962EVKIT-12#	EV Kit

#Denotes RoHS compliant.

MAX77962_06 EV Kit Bill of Materials

REF_DES	QTY	MFG PART #	DESCRIPTION
AVL, BATSP, CHGINS, CSINN, CSINP, DISQBAT, INOKB, INTB, OTG_EN, PVL, SCL, SDA, STAT, STBY, THM, VSYSS	16	5000	RED MINI TESTPOINTS
BATTN, BATTP, DCIN, GND, GND1-GND3, VSYS	8	9020 BUSS	WIRE, BUSS 20G PLATED SOLID COPPER
BATSN, PGND1S, PGNDS	3	5011	BLACK BIG TESTPOINTS
C1, C15, C18-C21, C23-C29, C35	14	GRM155R71A104JA01	CAP+, 0.1 μ F, 10%, 6.3V, X5R, 0402
C2, C3, C12, C13, C22	5	GRM155R61A475MEAA	CAP+, 4.7 μ F, 20%, 10V, X5R, 0402
C4	1	GRM32ER7YA106KA12	CAP+, 10 μ F, 10%, 35V, X7R, 1210
C5	1	GRM155C81E105KE11	CAP+, 1 μ F, 10%, 25V, X6S, 0402
C6	1	TMK212BBJ106KG-T	CAP+, 10 μ F, 10%, 25V, X5R, 0805
C7, C8	2	GRM155R71C224KA12	CAP+, 0.22 μ F, 10%, 16V, X7R, 0402
C9, C10	2	TMK325ABJ476MM	CAP+, 47 μ F, 20%, 25V, X5R, 1210
C11, C14	2	GRM1555C1H270JA01	CAP+, 27pF, 5%, 50V, COG, 0402
C16, C17, C30-C32	5	C0402C105K8PAC	CAP+, 1 μ F, 10%, 10V, X5R, 0402
C34, C36	2	GRM155R71H153KA12	CAP+, 0.015 μ F, 20%, 50V, X7R, 0402
D1	1	PMEG4050EP	DIODE+, SCH, 40V, 5A, SOD-128
DS2	1	LTST-C190CKT	LED+, SURFACE MOUNT, RED OSLO 2.2V, 350mA, 3X3MM
DS3	1	LTST-C190KFK	LED+, SURFACE MOUNT, ORANGE
J1	1	10118193-0001LF	RCPT+, MICRO B USB 2.0, 5 POS
J2-J7, J9-J13	11	PEC03SAAN	HEADER+, 3POS, .100", SNGL, TIN R/A, TH
L1	1	XAL5030-332ME	INDUCTOR+, 3.3 μ H, 20%, 5.9A
L2-L4	3	BLM18AG601SN1	FERRITE-BEAD, 600nH, 0.5A, 0603 μ H, 20%, 5.8A, 4.1X4.1MM
R1, R7, R14-R16, R18, R22, R24, R26, R32, R43, R44, R46, R47	14	ERJ-2GE0R00	RES+, 0 Ω , 0%, 0402
R2	1	CRA2512-FZ-R010ELF	RES+, 0.01 Ω , 1%, 3W, 2512
R4, R5	2	CRCW0402200KFK	RES+, 200K Ω , 1%, 0402
R6	1	CRCW04024R70FK	RES+, 4.7 Ω , 1%, 0402
R8	1	CRCW040212K0FK	RES+, 12K Ω , 1%, 0402

MAX77962_06 EV Kit Bill of Materials (continued)

REF_DES	QTY	MFG PART #	DESCRIPTION
R9, R13	2	CRCW040227R0FK	RES+, 27Ω, 1%, 0402
R10	1	CRCW04021M00FK	RES+, 1MΩ, 1%, 0402
R11	1	CRCW04021K00FK	RES+, 1KΩ, 1%, 0402
R12, R54	2	CRCW040210K0FK	RES+, 10KΩ, 1%, 0402
R17	1	CRCW04024752FK	RES+, 47.5KΩ, 1%, 0402
R19, R31, R41, R45	4	CRCW0402100KFK	RES+, 100KΩ, 1%, 0402
R20, R21	2	CRCW04024752FK	RES+, 10Ω, 1%, 0402
R25, R29, R33, R34	4	3296Y-1-504LF	RES+, POT, 500KΩ
R27, R28	2	CRCW04024K70FK	RES+, 4.7KΩ, 1%, 0402
R30	1	CRCW0402169KFK	RES+, 169KΩ, 1%, 0402
R35	1	CRCW0402470RFK	RES+, 470Ω, 1%, 0402
R38, R42	2	CRCW04022K20FK	RES+, 2.2KΩ, 1%, 0402
R39	1	3296Y-1-503LF	RES+, POT, 50K OHM
R48	1	ERJ-2GEJ132	RES+, 1.3K OHM, 5%, 0402
U1	1	MAX77962EWJ06+	MAX77962EWJ06+
U2	1	FT2232HL	FT2232HL
U4	1	MAX14611	MAX14611ETD+
U5, U6	2	MAX8512	MAX8512EXK+
Y1	1	7M-12.000MAAJ	CRYSTAL+, SMT, 12MHz, ±30PPM
C33, C37, C38, C40, C41	5	OPEN	N/A
R3, R49, R51-R53	5	OPEN	N/A

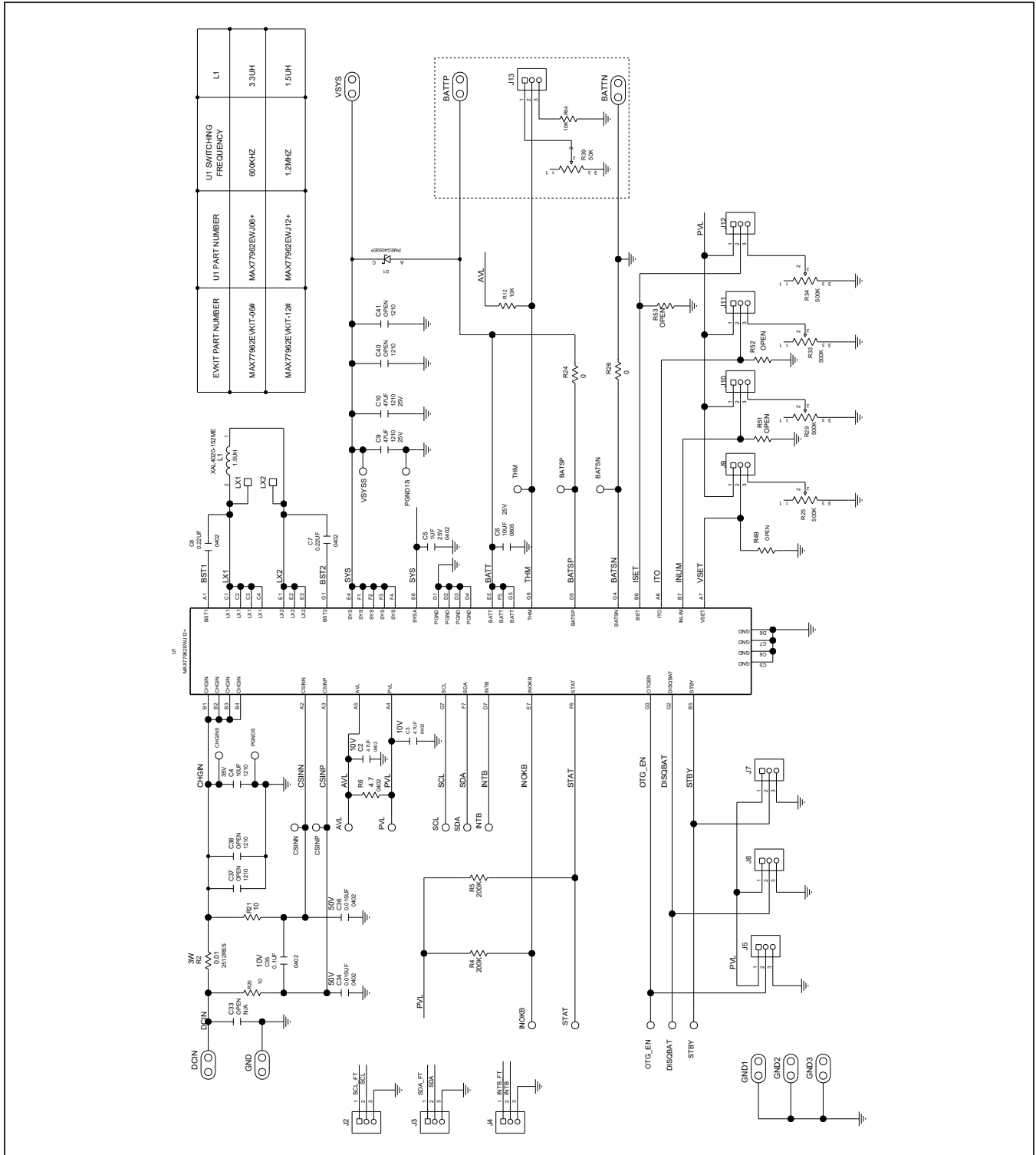
MAX77962_12 EV Kit Bill of Materials

REF_DES	QTY	MFG PART #	DESCRIPTION
AVL, BATSP, CHGINS, CSINN, CSINP, DISQBAT, INOKB, INTB, OTG_EN, PVL, SCL, SDA, STAT, STBY, THM, VSYSS	16	5000	RED MINI TESTPOINTS
BATTN, BATTP, DCIN, GND, GND1-GND3, VSYS	8	9020 BUSS	WIRE, BUSS 20G PLATED SOLID COPPER
BATSN, PGND1S, PGNDS	3	5011	BLACK BIG TESTPOINTS
C1, C15, C18-C21, C23-C29, C35	14	GRM155R71A104JA01	CAP+, 0.1 μ F, 10%, 6.3V, X5R, 0402
C2, C3, C12, C13, C22	5	GRM155R61A475MEAA	CAP+, 4.7 μ F, 20%, 10V, X5R, 0402
C4	1	GRM32ER7YA106KA12	CAP+, 10 μ F, 10%, 35V, X7R, 1210
C5	1	GRM155C81E105KE11	CAP+, 1 μ F, 10%, 25V, X6S, 0402
C6	1	TMK212BBJ106KG-T	CAP+, 10 μ F, 10%, 25V, X5R, 0805
C7, C8	2	GRM155R71C224KA12	CAP+, 0.22 μ F, 10%, 16V, X7R, 0402
C9, C10	2	TMK325ABJ476MM	CAP+, 47 μ F, 20%, 25V, X5R, 1210
C11, C14	2	GRM1555C1H270JA01	CAP+, 27pF, 5%, 50V, COG, 0402
C16, C17, C30-C32	5	C0402C105K8PAC	CAP+, 1 μ F, 10%, 10V, X5R, 0402
C34, C36	2	GRM155R71H153KA12	CAP+, 0.015 μ F, 20%, 50V, X7R, 0402
D1	1	PMEG4050EP	DIODE+, SCH, 40V, 5A, SOD-128
DS2	1	LTST-C190CKT	LED+, SURFACE MOUNT, RED OSLO 2.2V, 350mA, 3X3MM
DS3	1	LTST-C190KFK	LED+, SURFACE MOUNT, ORANGE
J1	1	10118193-0001LF	RCPT+, MICRO B USB 2.0, 5 POS
J2-J7, J9-J13	11	PEC03SAAN	HEADER+, 3POS, .100", SNGL, TIN R/A, TH
L1	1	XAL4020-152ME	INDUCTOR+, 1.5 μ H, 20%, 5.2A
L2-L4	3	BLM18AG601SN1	FERRITE-BEAD, 600nH, 0.5A, 0603 μ H, 20%, 5.8A, 4.1X4.1MM
R1, R7, R14-R16, R18, R22, R24, R26, R32, R43, R44, R46, R47	14	ERJ-2GE0R00	RES+, 0 Ω , 0%, 0402
R2	1	CRA2512-FZ-R010ELF	RES+, 0.01 Ω , 1%, 3W, 2512
R4, R5	2	CRCW0402200KFK	RES+, 200K Ω , 1%, 0402

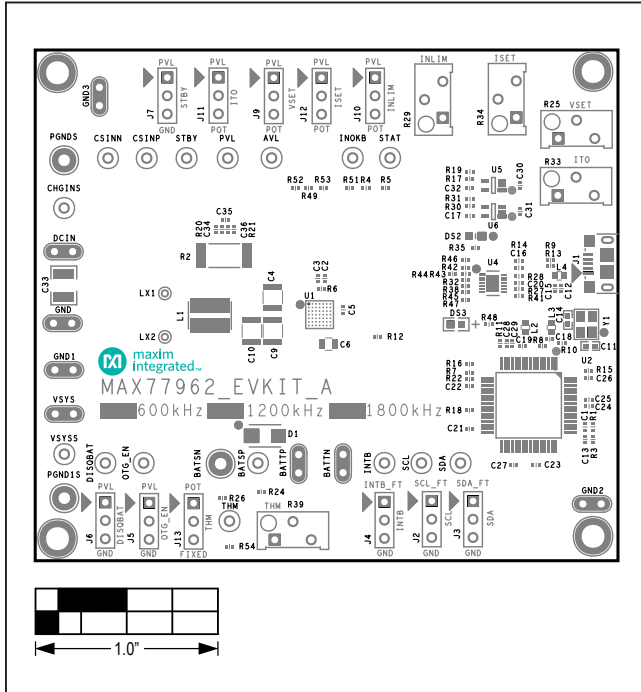
MAX77962_12 EV Kit Bill of Materials (continued)

REF_DES	QTY	MFG PART #	DESCRIPTION
R6	1	CRCW04024R70FK	RES+, 4.7Ω, 1%, 0402
R8	1	CRCW040212K0FK	RES+, 12KΩ, 1%, 0402
R9, R13	2	CRCW040227R0FK	RES+, 27Ω, 1%, 0402
R10	1	CRCW04021M00FK	RES+, 1MΩ, 1%, 0402
R11	1	CRCW04021K00FK	RES+, 1KΩ, 1%, 0402
R12, R54	2	CRCW040210K0FK	RES+, 10KΩ, 1%, 0402
R17	1	CRCW04024752FK	RES+, 47.5KΩ, 1%, 0402
R19, R31, R41, R45	4	CRCW0402100KFK	RES+, 100KΩ, 1%, 0402
R20, R21	2	CRCW04024752FK	RES+, 10Ω, 1%, 0402
R25, R29, R33, R34	4	3296Y-1-504LF	RES+, POT, 500KΩ
R27, R28	2	CRCW04024K70FK	RES+, 4.7KΩ, 1%, 0402
R30	1	CRCW0402169KFK	RES+, 169KΩ, 1%, 0402
R35	1	CRCW0402470RFK	RES+, 470Ω, 1%, 0402
R38, R42	2	CRCW04022K20FK	RES+, 2.2KΩ, 1%, 0402
R39	1	3296Y-1-503LF	RES+, POT, 50KΩ
R48	1	ERJ-2GEJ132	RES+, 1.3KΩ, 5%, 0402
U1	1	MAX77962EWJ12+	MAX77962EWJ12+
U2	1	FT2232HL	FT2232HL
U4	1	MAX14611	MAX14611ETD+
U5, U6	2	MAX8512	MAX8512EXK+
Y1	1	7M-12.000MAAJ	CRYSTAL+, SMT, 12MHz, ±30PPM
C33, C37, C38, C40, C41	5	OPEN	N/A
R3, R49, R51-R53	5	OPEN	N/A

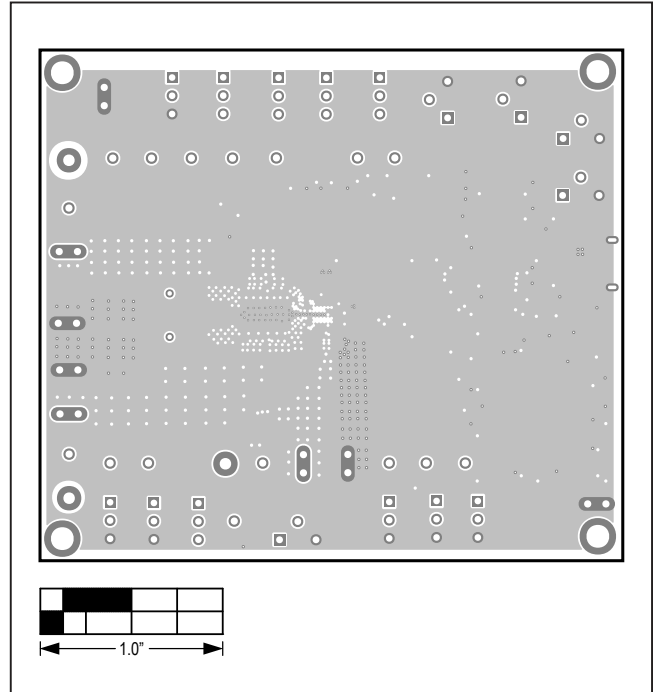
MAX77962 EV Kit Schematic Diagram – Charger



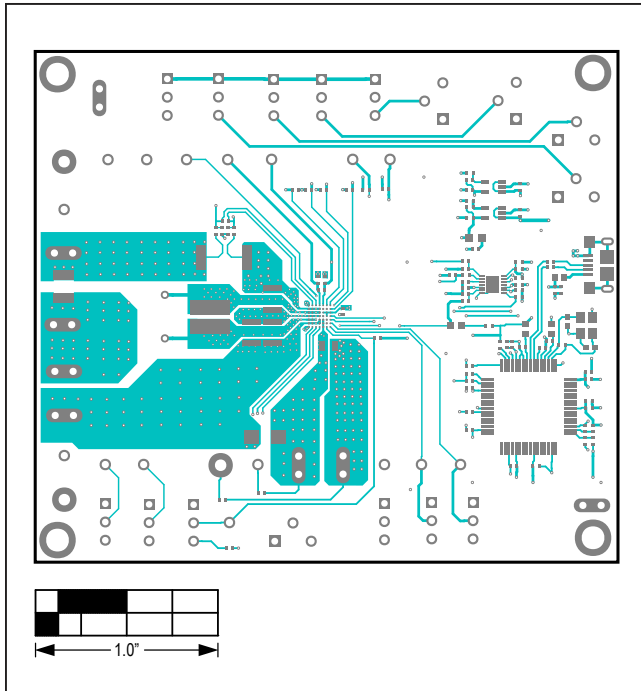
MAX77962 EV Kit PCB Layout Diagrams



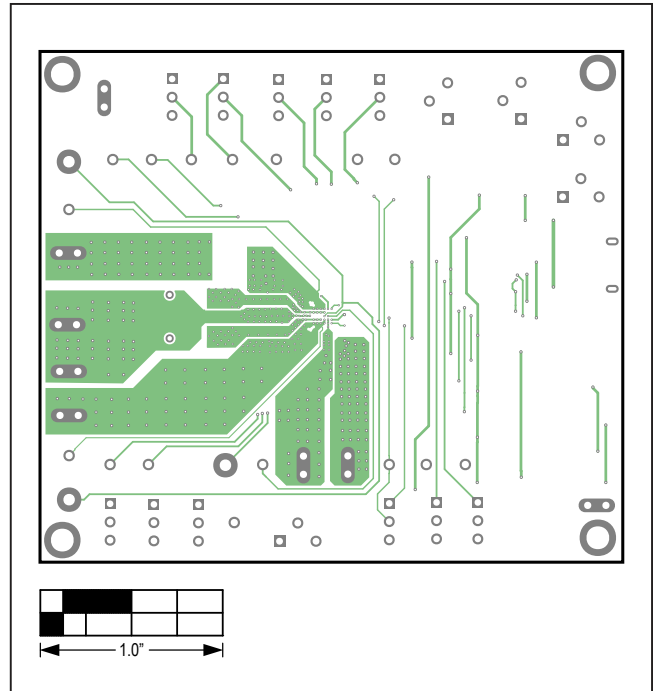
MAX77962 EV Kit PCB Layout – Silkscreen Top



MAX77962 EV Kit PCB Layout – Inner Layer 2

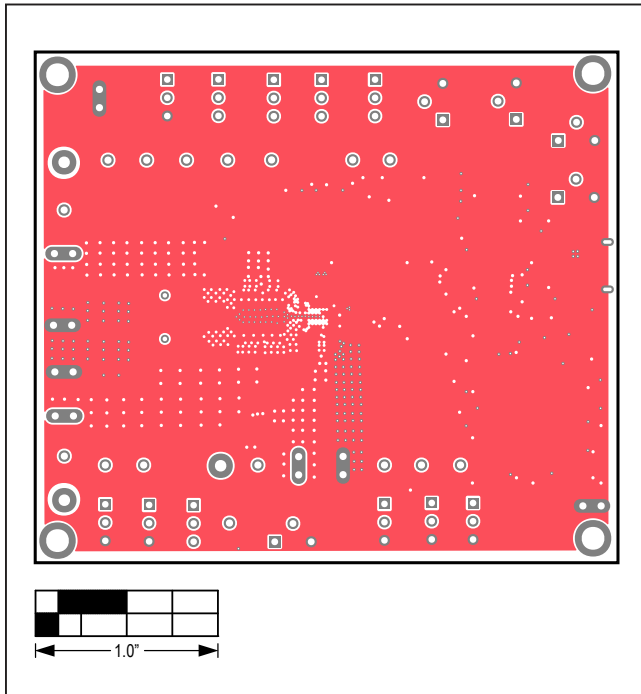


MAX77962 EV Kit PCB Layout – Top Layer

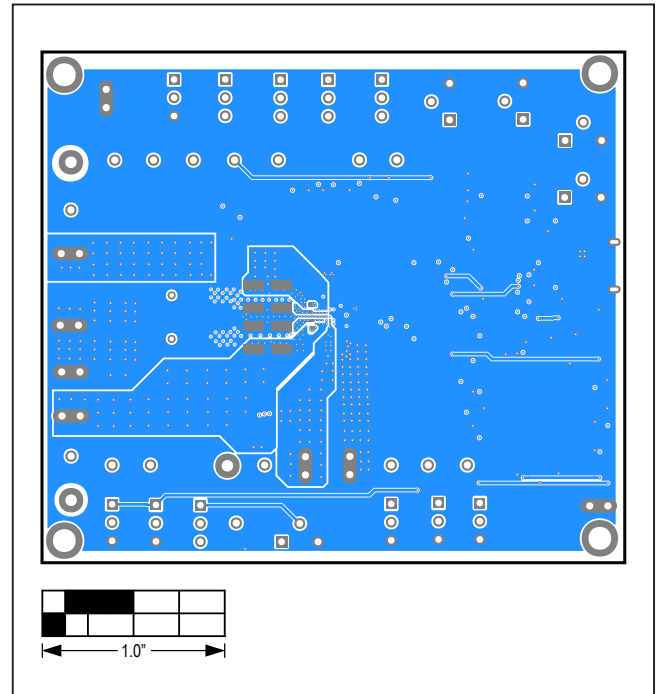


MAX77962 EV Kit PCB Layout – Inner Layer 3

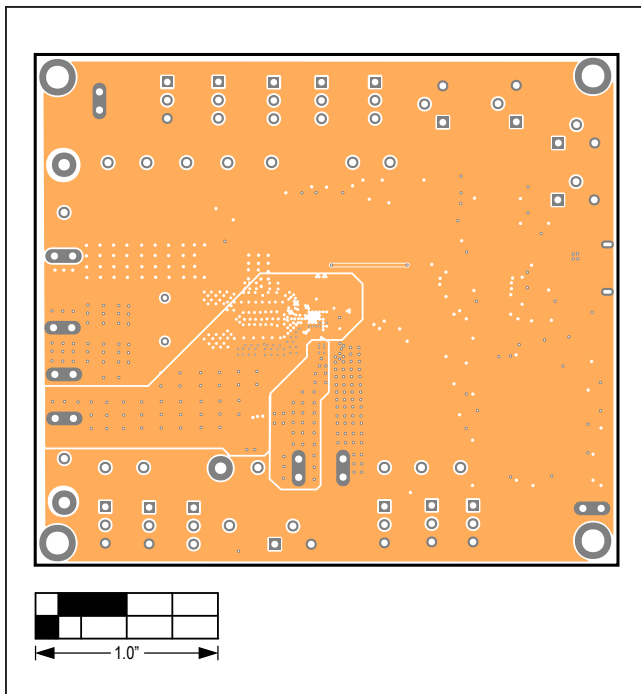
MAX77962 EV Kit PCB Layout Diagrams (continued)



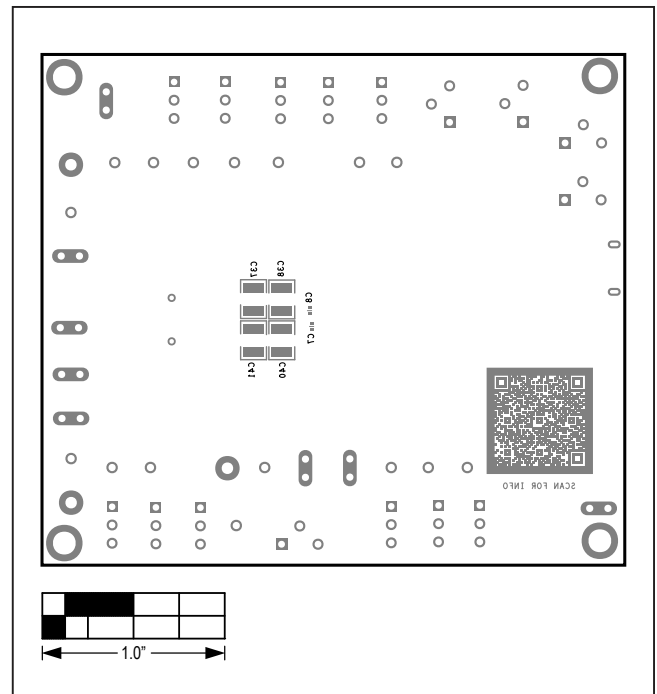
MAX77962 EV Kit PCB Layout – Inner Layer 4



MAX77962 EV Kit PCB Layout – Bottom Layer



MAX77962 EV Kit PCB Layout – Inner Layer 5



MAX77962 EV Kit PCB Layout – Silkscreen Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/20	Initial release	—

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

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