ANALOG DEVICES MAX77972 Evaluation Board User Guide

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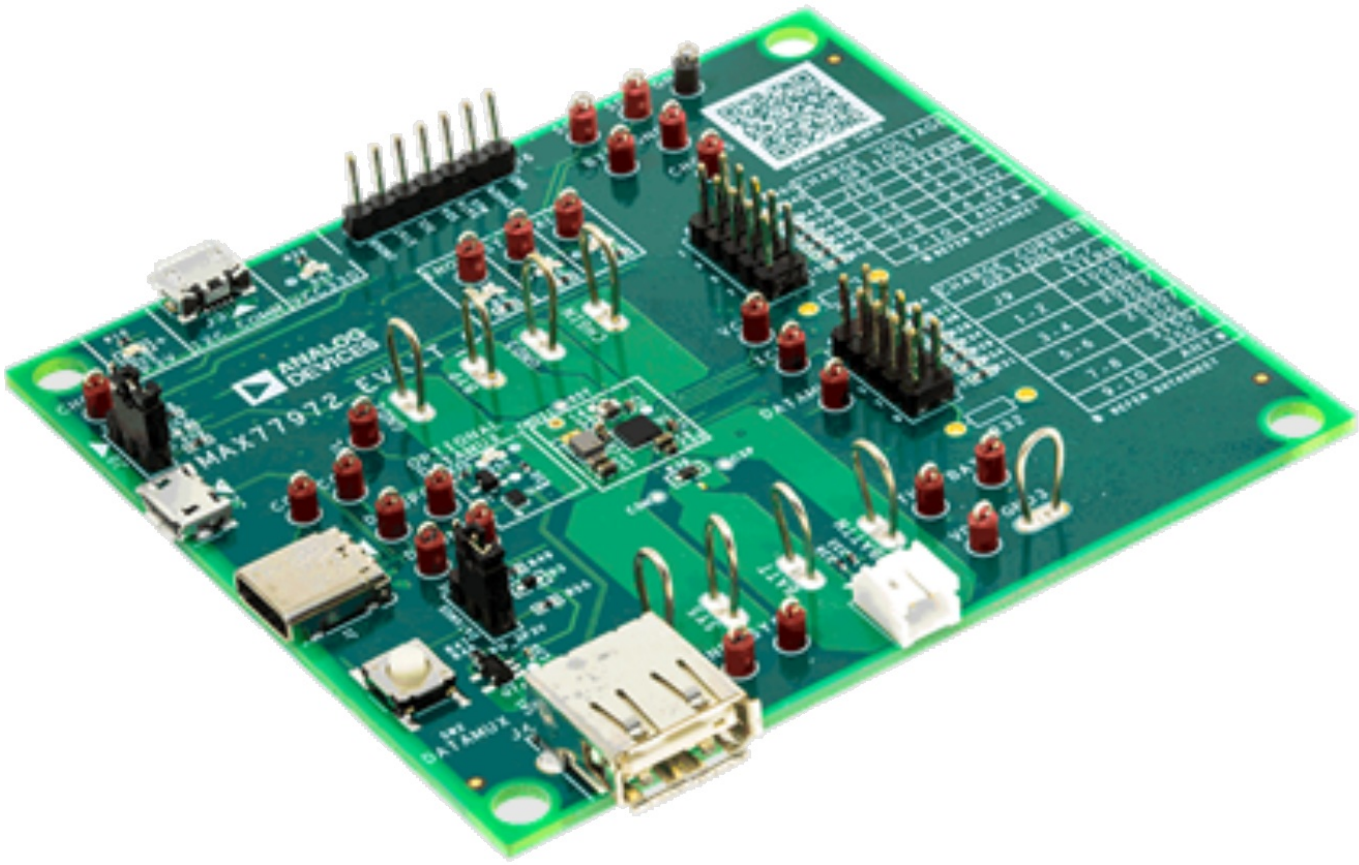


Contents

General Description

The MAX77972 evaluation kit (EV kit) is a fully assembled and tested surface-mount Printed Circuit Board (PCB) that evaluates the autonomous integrated FET charger with an integrated fuel gauge, Universal Serial Bus (USB) Type-C, and BC1.2 detection.

The EV kit includes the IC evaluation board with an integrated I2C 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 the https://www.analog.com/products/MAX77972 product page under the Design Resources tab. Windows 7 or newer Windows operating system is required to use with the EV kit GUI software.

MAX77972 EV Kit File

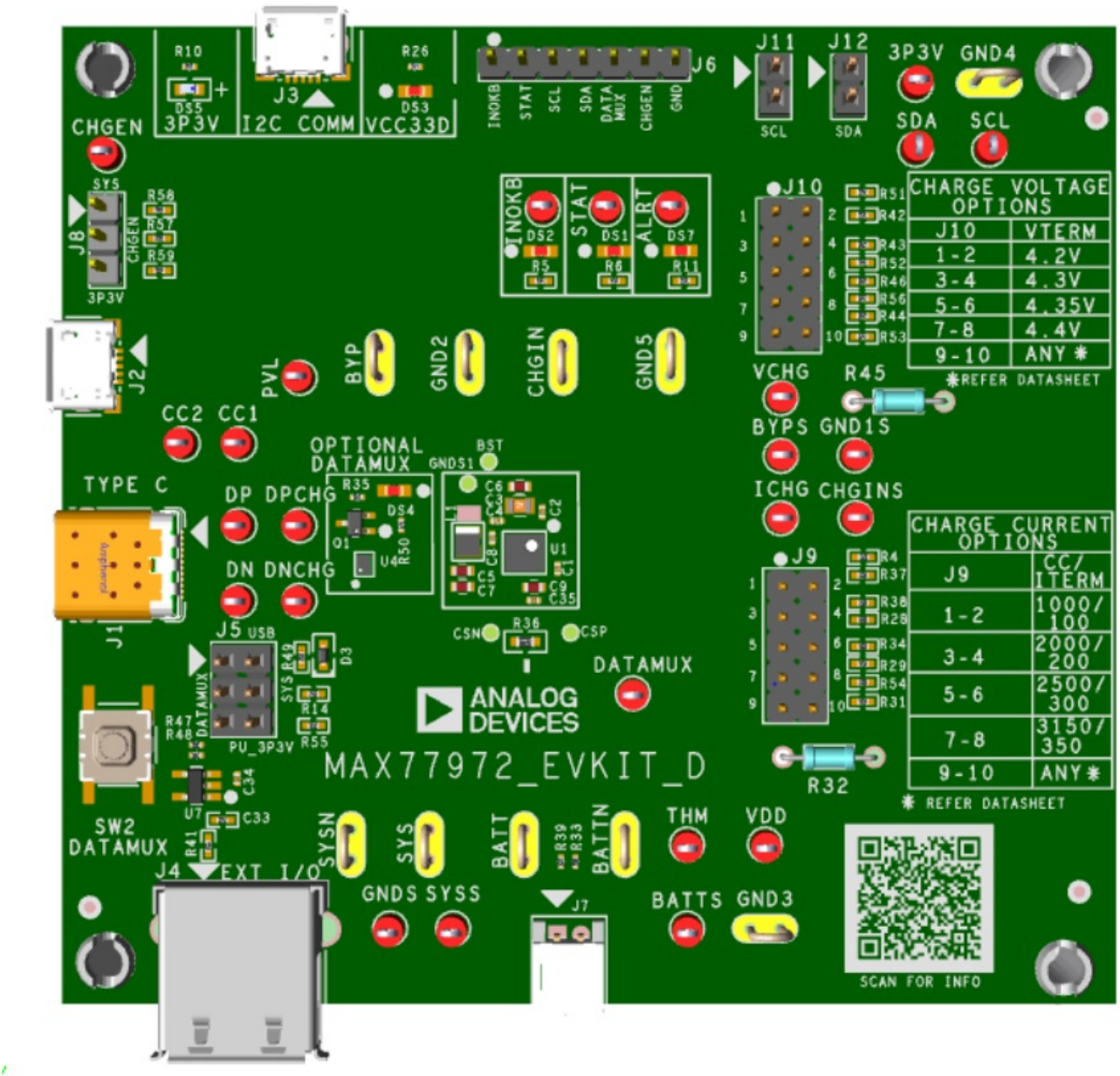
FILE	DESCRIPTION
MAX77972GUISetup1.0.6.exe	Installs EV kit files onto the computer

Features

- Stand-Alone AccuCharge™ Buck Charger
- 13.7V Input Operating Voltage, up to 16V protection
- I2C or Resistor Configured Fast Charge Current 100mA to 3150mA
- I2C or Resistor Configured Charge Termination Voltage 3.45V to 4.5V
- ModelGauge m5 EZ Algorithm
- Percent, Capacity, Time-to-Empty/Full, Age
- Cycle+™ Age Forecast
- Full Protection Solution On-Board for Evaluation
- Precision Measurement Without Calibration
- On-Board I2C Communication Interface with Built-In MAXUSB Interface
- Integrated USB Detection
- Windows 7 or Newer Compatible Software
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information appears at end of data sheet.

MAX77972 EV Kit Photo



Quick Start

Required Equipment

- MAX77972 Evaluation kit
- Lithium-ion/Polymer cell/Battery simulator
- Voltage source/Power supply
- Load circuit
- USB Micro-B cable
- PC with Windows 7 or newer Windows OS and USB port.

Procedure

Follow the steps to install the EV kit software, make the required hardware connections, and start operating the kits. The EV kit software can be launched without the hardware attached. When connections are made, it automatically recognizes the hardware. Note that after communication is established with the IC, it must be configured correctly for proper operation.

1. Visit the **https://www.analog.com/products/MAX77972** page under the Design Resources tab to download the latest version of the MAX77972 EV kit software. Save the EV kit software to a temporary folder and unpack the ZIP file.
2. Install the EV kit software on the computer by running the MAX77972GUISetupX.X.X.exe program inside the temporary folder. This copies the program files and creates an icon in the Windows Start menu. The software requires the .NET Framework 4.5 or later. If connected to the internet, Windows automatically updates the .NET Framework as needed.
3. Follow the prompts to complete the installation. The evaluation software can be uninstalled in the Add/Remove Programs tool in the Control Panel.
4. The EV kit software launches automatically after installation, or alternatively, it can be launched by clicking on its icon in the Windows Start menu.
5. Make connections to the EV kit board based on Figure 1. The cell connects between the BATT/ BATTN pads. The charger or power supply can be connected between the CHGIN and GND pads at this time as well.
6. Connect the EV kit to a USB port on the PC using the USB cable. The GUI software establishes communication automatically. If the USB port is not powered through the USB cable, connect Pin 3 and Pin 4 of the J5 to avoid falsely entering ship mode.
7. At startup, the IC defaults to EZ Configuration. If a custom .INI file for the application is available, it should be loaded at this time.
8. To begin charging, connect a source at CHGIN/GND, and connect Pin 2 of J8 to Pin 1/Pin 3. The MAX77972 regulates the voltage and current based on the settings in the Charging Configuration.
9. To begin discharging, first disconnect the adapter or remove the power source from the CHGIN/GND. Then, connect a resistor or an E-Load on SYS/SYSN to begin discharging the battery.
10. If the USB cable is not connected from step#5 to the CHGEN pin, connect Pin 1 and Pin 2 to pull up the CHGEN to SYS or supply a separate 3.3V to the CHGEN pin. This will prevent the charging feature from being disabled.

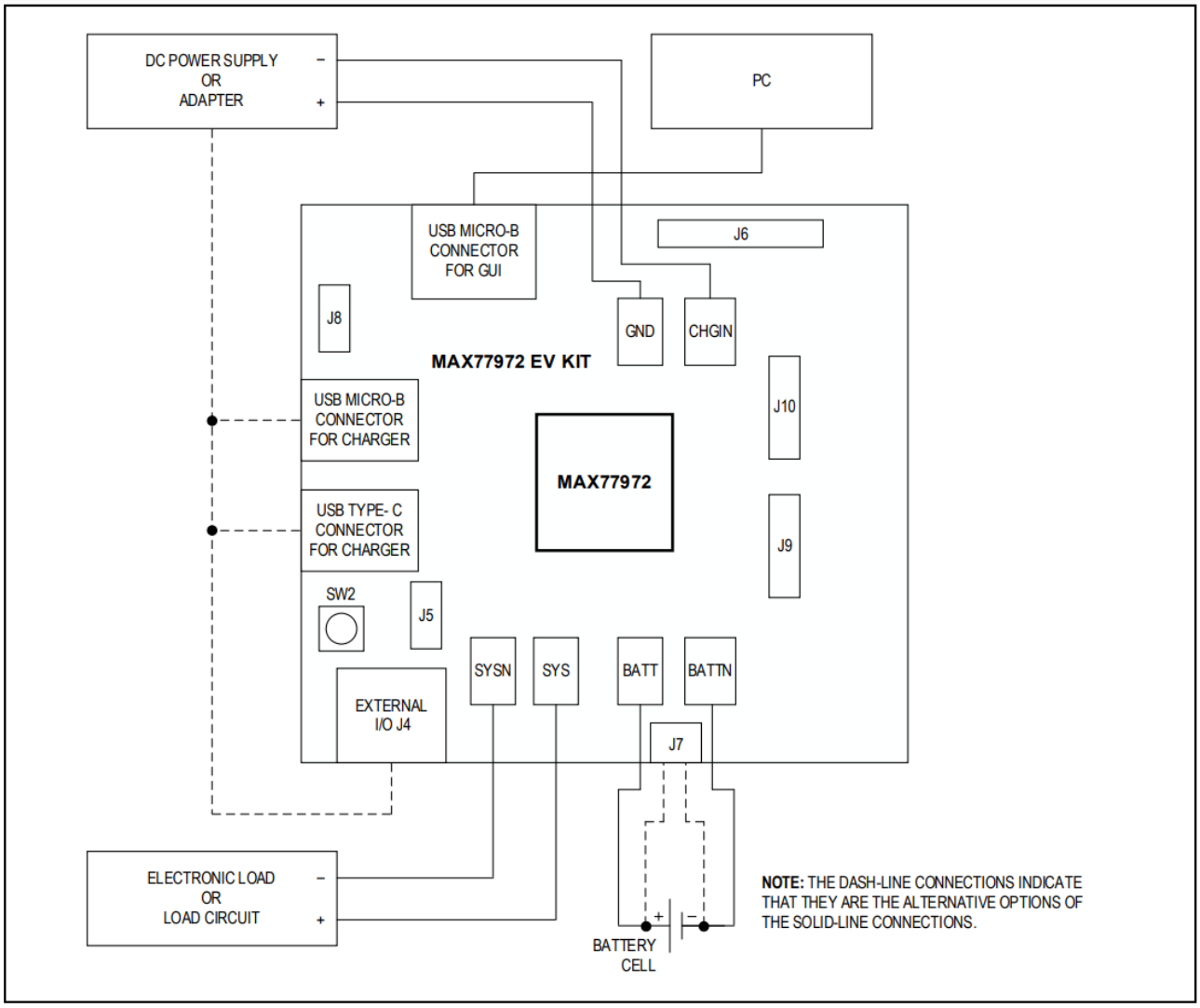


Figure 1. Board Connections

Setup and Operation

The MAX77972 offers flexibility in power connections. See Table 2 for a detailed description.

Table 1. Power Options

PORT	SETUP	DESCRIPTION
Battery	BATT/BATTN	Connect battery simulator or 1-Cell Li+ battery to BATT and BATTN.
	Connector J7	Connect 1-Cell Li+ battery with **JST-PH-2P** to connector J7.
Charger Input	CHGIN/GND	Connect external DC power supply to CHGIN and GND.
	USB Type C connector J1	Connect the USB Type C cable with an external source to connector J1.
	USB Micro B connector J2	Connect the USB Micro B cable with an external source to connector J2.
	USB A connector J4	Connect the USB A cable with an external source to connector J4.

Detailed Description of Hardware

The MAX77972 EV kit board provides various features that highlight the functionality of the IC. The following

sections detail the most important aspects of the EV kit board.

Table 2. Jumper Connection Guide

JUMPER	DEFAULT CONNECTION	FEATURE
J5	5-6	1-2: Enables external USB Data Mux. Only valid when nChgConfig4.DATAMUX = 0x1. 3-4: Pull up DATAMUX through a 2.2kΩ resistor to SYS. Only valid when nChgConfig4.DATAMUX = 0x0. 5-6: Pull up DATAMUX through a 2.2kΩ resistor to 3.3V from Micro-USB J3. Only valid when nChgConfig4.DATAMUX = 0x0
J6	Uninstalled	Connects to: INOKB STAT SCL SDA DATAMUX CHGEN GND
J8	2-3	1-2: Connects CHGEN to SYS voltage. 2-3: Connects CHGEN to 3P3V from I2C Communication USB Micro-B connector .
J9	Uninstalled	Connects different resistors to configure desired charging current.
J10	Uninstalled	Connects different resistors to configure desired charge termination voltage.
J11	1-2	Connects to SCL from Micro USB J3.
J12	1-2	Connects to SDA from Micro USB J3.

Communication Connections

The USB interface J3 on the PCB establishes I2C communication between the IC and the software GUI interface. When developing application code separately, connections to the communication lines can be made directly to the board's SDA and SCL pins. When not using the built-in MAXUSB interface, the user must apply the appropriate external pullup resistors to the communication lines.

External I2C Interface

J6-3 and J6-4 are header pins that can be used to interface the MAX77972 I2C interface to a custom board or to interface a custom I2C controller to the MAX77972 on the EV kit. To interface to the MAX77972 IC on another PCB using **www.analog.com** the MAXUSB and EV kit GUI, use the USB Micro-B connector. To connect to a different I2C controller, use the pins J6-3/J6-4/J6-7 for the SCL/SDA/GND. An external pullup must be supplied on SDA and SCL when interfacing with a different controller.

Sense Resistor Options
The MAX77972 uses an internal sense resistor by default configuration. All EV kit boards are shipped with a 10mΩ 0805- size chip sense resistor installed and shorted with a copper pad. Oversized land pattern pads allow different sizes of sense resistors to be used if desired.

External Thermistor/Battery ID
The MAX77972 can be configured to use temperature measurements from an external thermistor. All EV kit boards have thermistors installed as surface-mount components R33, close to the battery cell.

Optional Data Mux
The MAX77972 EV kit equips an optional data mux that allows the MAX77972 to automatically borrow DP/DN data lines in case it is sharing them with an external device. Connect J5 1-2 on the MAX77972 EV kit to enable data mux. When a valid USB charging cable is inserted, and a valid power source is present, the data mux toggles output based on the USB selection.

Pushbutton Reset/Ship Mode (DATAMUX)
The MAX77972 DATAMUX pin can also be used to reset SYS power or enter ship mode. Connect J5 2-3 MAX77972 EV kit to disable USB data mux features and enable control of SYS power cycle or ship mode. Hold SW2 low to pull the DATAMUX pin of MAX77972 low. Holding SW2 for 6s cycles SYS power and holding SW2 for 12s to enter ship mode. When MAX77972 is in ship mode, with valid CHGIN voltage, hold SW2 low for 1s to exit ship mode. **Charge Voltage**

Options Configuration Resistors
Connecting J10 allows the selection of charge voltage options. See Table 3 for a detailed connection guide.

Table 3. Charge Voltage Options

J10	**VTERM (V)**
1-2	4.2
3-4	4.3
5-6	4.35
7-8	4.4
9-10	Any (Refer to the MAX77972 Data sheet)
Unconnected	Default Value (4.3)

Charge Current Options Configuration Resistors
Connecting J9 allows the selection of charge current options. See Table 4 for a detailed connection guide.

Table 4. Charge Current Options

J9	**CC/I_term (mA)**
1-2	1000/100
3-4	2000/200
5-6	2500/300
7-8	3150/350
9-10	Any (Refer to the MAX77972 Data sheet)
Unconnected	Default Value (1600)

EV Kit Package

This package contains useful documentation and links that serve as a guide for evaluation and development. The package includes examples and basic C code drivers. For further information, refer to the MAX77972 EV kit software user's guide.

Detailed Description of Software

The MAX77972 EV kit software gives the user complete control of all MAX77972 functions and the ability to load a custom model into the IC. Separate control tabs allow the user access to view real-time updates of all monitored parameters. The software also incorporates a data-logging feature to monitor a cell over time.

After the installation is complete, open the Program Files (x86)\Maxim Integrated\MAX77972 folder and run MAX77972.exe or select it from the Program menu. Figure 2 shows a splash screen containing information about the EV kit that appears as the program is being loaded.

Figure 2. Splash Screen

Communication Port

The EV kit software needs to connect with the EV kit manually by clicking the Connect button on the left-hand side of the extra menu section shown in Figure 3. If the EV kit cannot be found, an I/O Error message box is displayed. If the EV Kit is found, then click the Read and Close button at the bottom of the displayed Synchronize window. Figure 4 shows that if the communication is valid, Connected is displayed on the right-bottom corner of the EV kit software.

Figure 3. Window of MAX77972 Software Connection

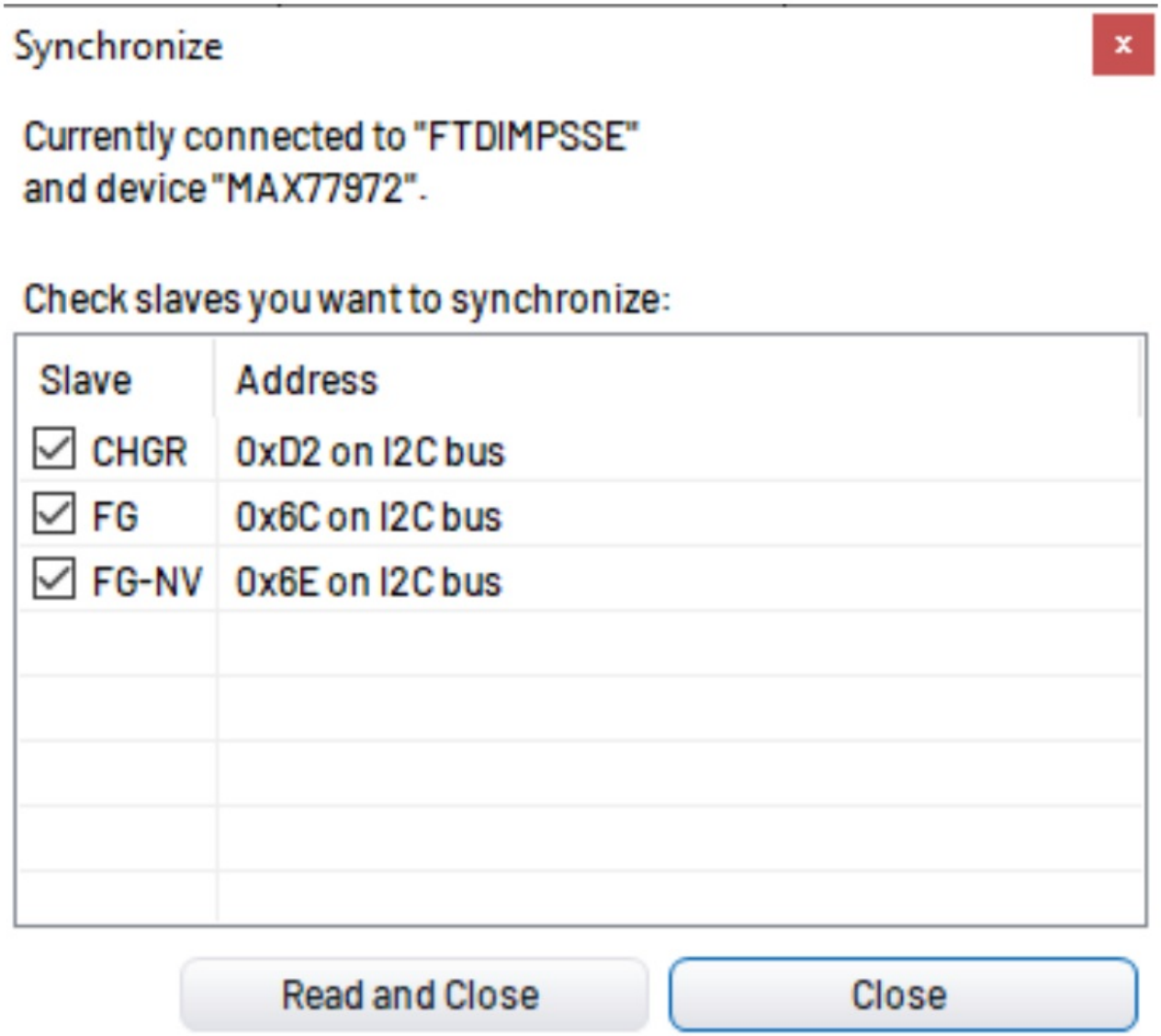
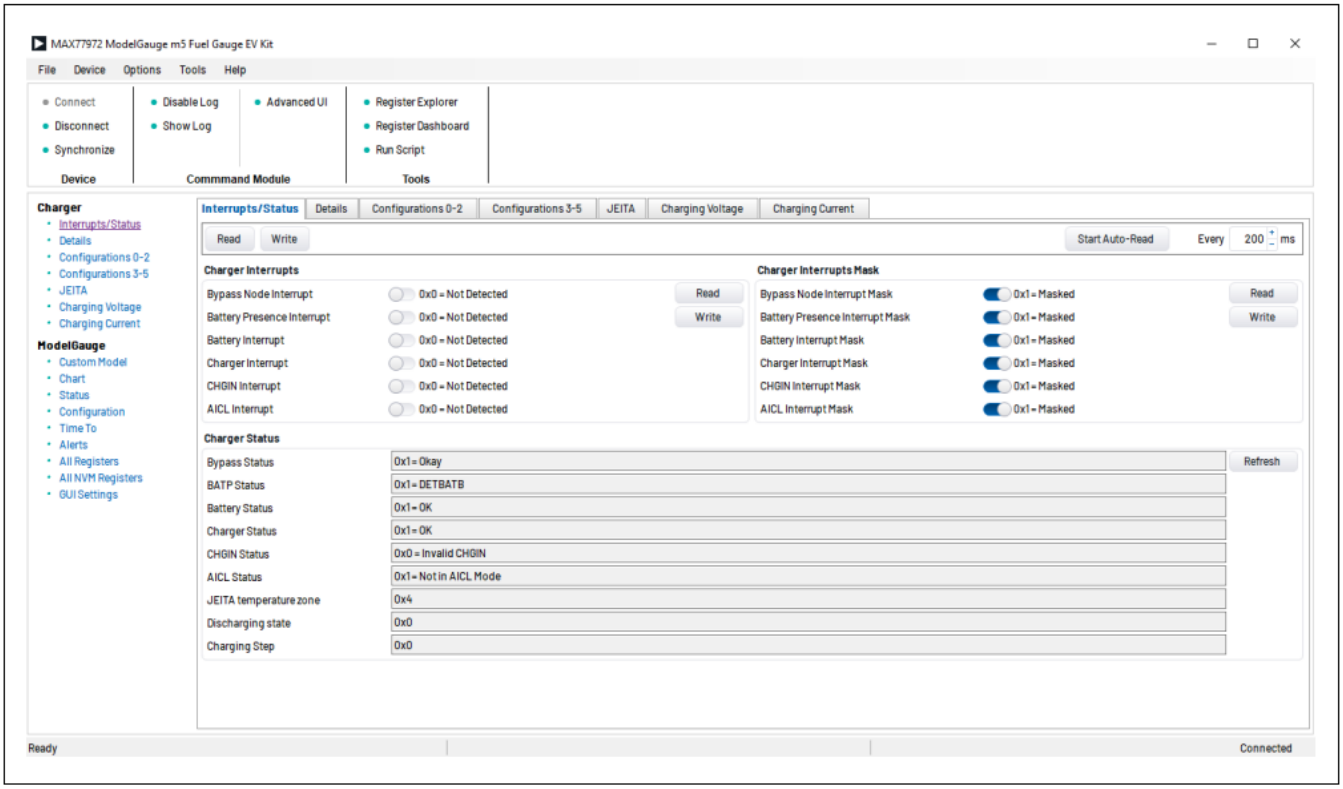


Figure 4. MAX77972 Software Main Window



Charger Section

All functions of the charger are distributed under various tabs in the Charger section. Click on the appropriate tab to move to the desired function page.

Interrupts/Status Tab

All the charger interrupts and statuses are displayed in the Interrupts/Status tab.

- The Charger Interrupts group box displays the status of each interrupt. Each interrupt can be cleared manually in this group box.
- The status of each mask for each interrupt is displayed in the Charger Interrupts Mask group box. Each mask can be enabled or disabled in this group box.
- The Charger Status group box displays the main information of the charger. This group box is read-only.

Chg/USB Details Tab

All the detailed information of the charger is displayed in the Details tab. All the group boxes in this tab are read-only.

- The Charger Details 0 group box displays the detailed information of the CHGIN pin.
- The Charger Details 1 group box displays detailed information about the charger, the battery, and the temperature regulation.
- The Charger Details 2 group box displays the detailed information of the Bypass Node.
- The USB Details 0 group box displays the USB input current limit, the detected constant current capability, the detected type of proprietary adaptor, and the detection of the BC1.2 standard adaptor.

Chg Config 0-2 Tab
The charger features can be configured in the Configuration 0-2 tab, which includes the Watchdog Timer, the Top Off state, the minimum system regulation voltage, overcurrent protection denounce time, etc.

Chg/USB Config 3-5 Tab

The charger and USB features can be configured in the Configuration 3-5 tab, which includes the CHGIN Current Limit, VByp target voltage, BC1.2 detection, Charger detection, DeepShip mode, CC pin detection, etc.

JEITA

The JEITA tab provides information on the step charging and the temperature zones.

- The Step Charging Mode group box displays the current temperature zone, discharging status or charging step. The JEITA step charging mode can be modified in this group box.
- The JEITA Region 0 group box shows the current setting of the room and cold temperature zones for step charging. Temperature zones can be modified in this group box.
- The JEITA Region 1 group box shows the current setting of the warm and hot temperature zones for step charging. Temperature zones can be modified in this group box.

Charging Voltage

The Charging Voltage tab provides information on the current JEITA step charging voltage setting. The charging voltage can be modified in this tab.

- The Charging Voltage group box displays the current charge voltage of the (Constant Voltage) CV state.
- The charge voltage of the CV state under different temperature zones can be modified in the Charge Voltage (Temperature Zones) group box.
- The charge voltage for each charging step can be modified in the Step-Charging Voltage group box.
- The result charge voltage for each charging step under each temperature zone is displayed in the Step-Charging Voltage (Warm/Hot1/Hot2/Cool/Cold1/Cold2).

Charging Current

The Charging Current tab provides information on the current JEITA step charging current setting. The charging current can be modified in this tab.

- The Charging Current group box displays the current charge voltage of the Constant Current (CC) state.
- The charge current of the CC state under different temperature zones can be modified in the Charge Current (Temperature Zones) group box.
- The charge current for each charging step can be modified in the Step-Charging Current group box.
- The result charge current for each charging step under each temperature zone is displayed in the Step-Charging Current (Warm/Hot1/Hot2/Cool/Cold1/Cold2).

ModelGauge Section

All functions of the fuel gauge are distributed under various tabs in the ModelGauge section. Click on the

appropriate tab to move to the desired function page.

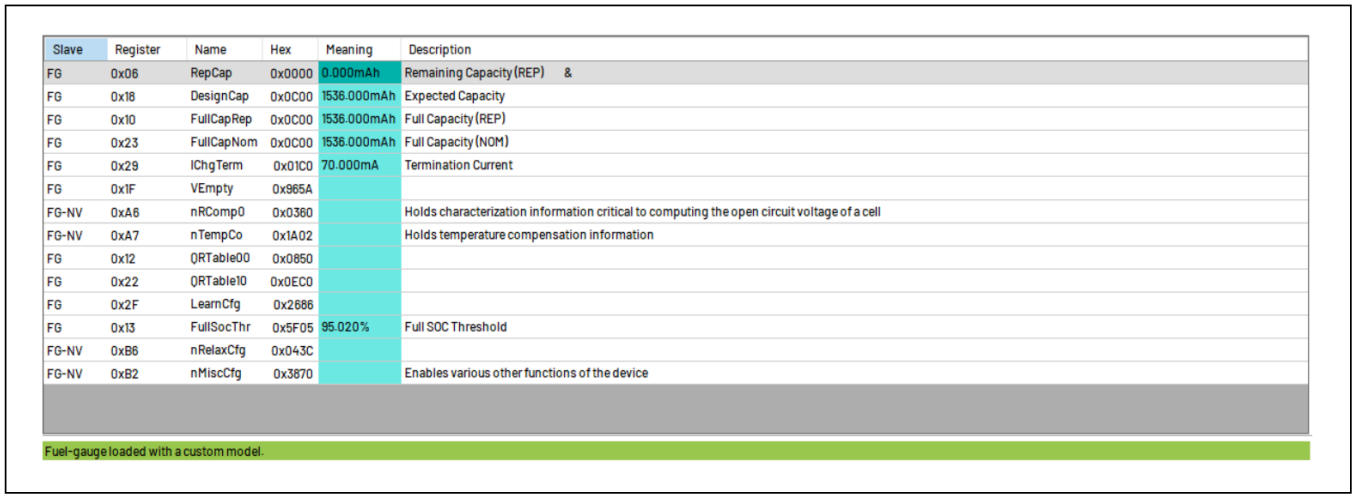
Figure 5 shows an extra function bar in the ModelGauge section that can be used to constantly read the fuel gauge registers by using the Read button and Every check box and log the registers to a file by checking the Log check box, which can be saved as an excel file to a specified folder by pressing the Save button.

Figure 5. Log Feature Function Bar

Custom Model

The Custom Model tab provides the model loading feature with a custom INI file. Pressing the Load button inside the group box to select a custom INI file, then programming starts automatically. If the loading process is successful, the custom parameters, including its Device, Register Address, Name, Hexadecimal(hex) value, translated Decimal Meaning, and Description of the register, are displayed in the group box after the programming is finished. A green status bar is also displayed under the group box if the fuel gauge successfully loaded the custom model shown in Figure 6.

Figure 6. Custom INI Loading Tab



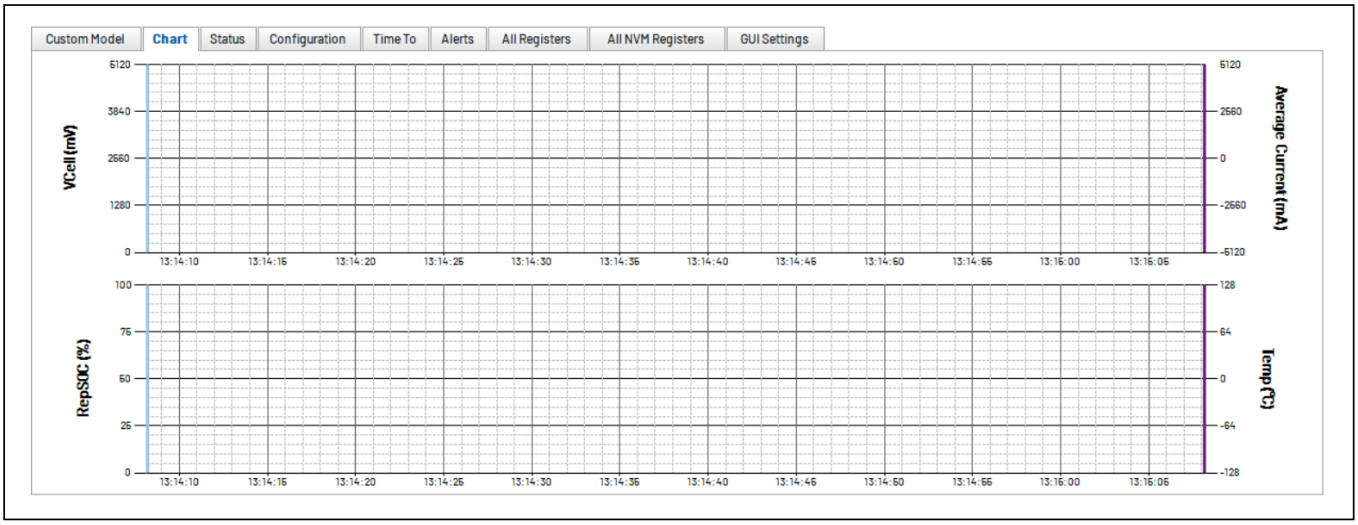
Slave	Register	Name	Hex	Meaning	Description
FG	0x06	RepCap	0x0000	0.000mAh	Remaining Capacity (REP) &
FG	0x18	DesignCap	0x0C00	1536.000mAh	Expected Capacity
FG	0x10	FullCapRep	0x0C00	1536.000mAh	Full Capacity (REP)
FG	0x23	FullCapNom	0x0C00	1536.000mAh	Full Capacity (NOM)
FG	0x29	IChgTerm	0x01C0	70.000mA	Termination Current
FG	0x1F	VEmpty	0x965A		
FG-NV	0xA6	nRComp0	0x0360		Holds characterization information critical to computing the open circuit voltage of a cell
FG-NV	0xA7	nTempCo	0x1A02		Holds temperature compensation information
FG	0x12	QRTable00	0x0850		
FG	0x22	QRTable10	0x0EC0		
FG	0x2F	LearnCfg	0x2686		
FG	0x13	FullSocThr	0x5F05	95.020%	Full SOC Threshold
FG-NV	0xB6	nRelaxCfg	0x043C		
FG-NV	0xB2	nMiscCfg	0x3870		Enables various other functions of the device

Fuel-gauge loaded with a custom model.

Chart

Figure 7 shows the format of the Chart Tab. Graph information is grouped into two categories: VCell/Average Current and RepSOC/Temp. The software begins plotting after checking the Every box and pressing the Read button. The graph visible viewing area can be adjusted from 1 second to 27 hours. The plot can be zoomed in by scrolling the mouse wheel up and zoomed out by scrolling the mouse wheel down.

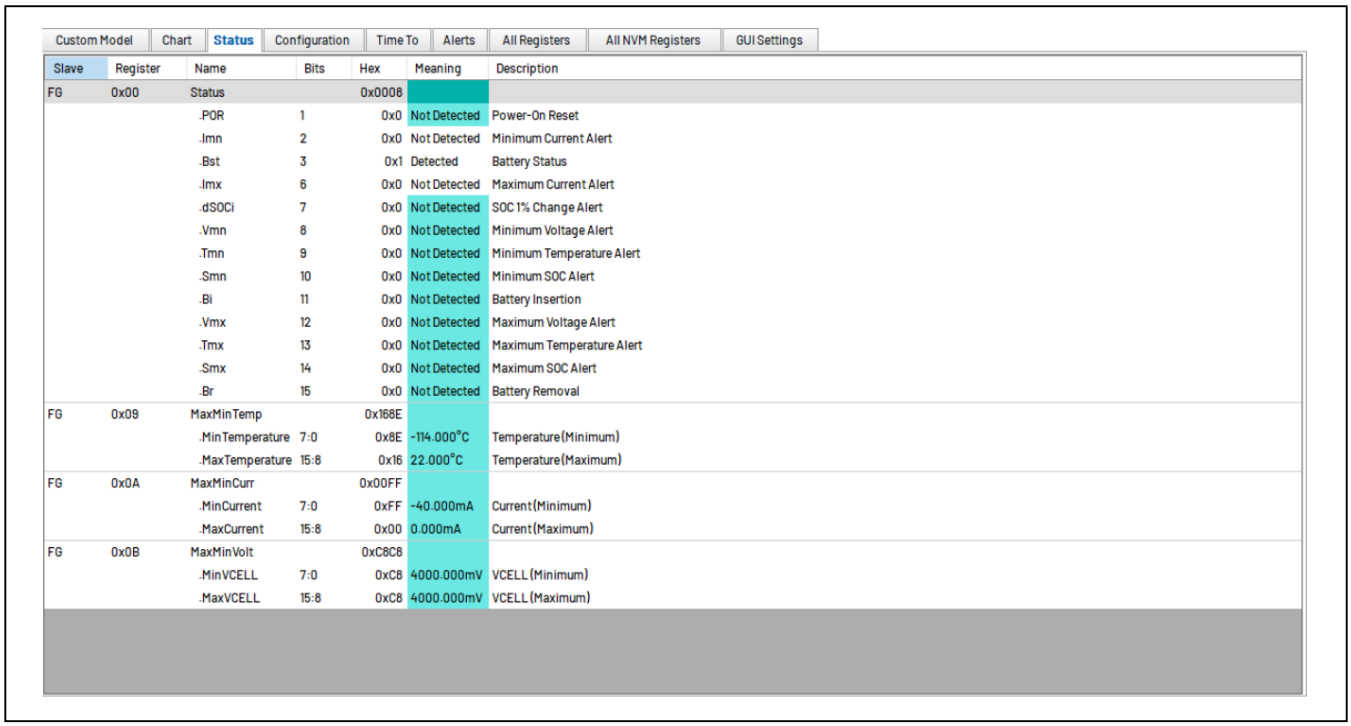
Figure 7. Chart Tab



Status

Figure 8 shows the format of the Status tab. This is similar to the Custom Model tab, and it also shows the bit fields of each status-related register. The battery status and the alerts' status are displayed in the Status group box. Alerts can be cleared by double-clicking or right-clicking the corresponding bit field. The Max Min Temp, MaxMinCurr, and MaxMinVolt group boxes display the maximum and minimum values of the temperature, current, and voltage after the battery is detected.

Figure 8. Status Tab

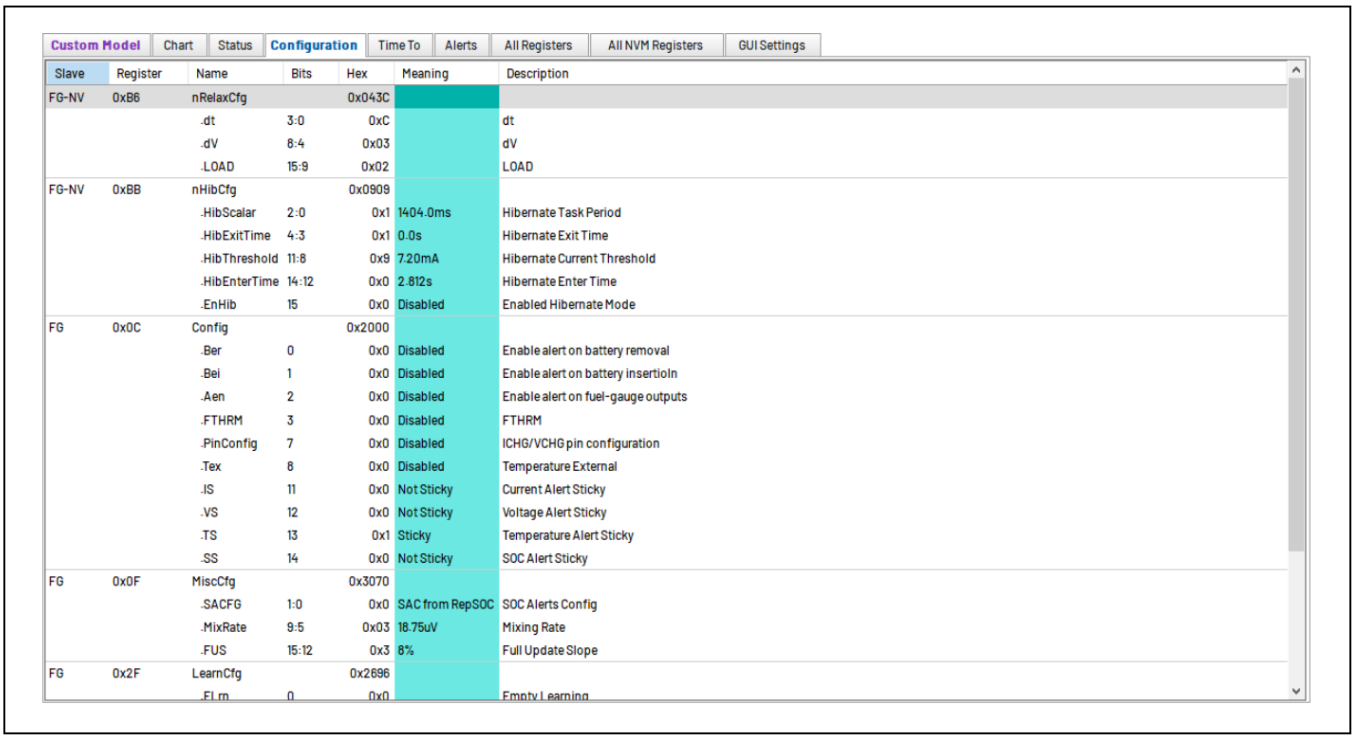


Slave	Register	Name	Bits	Hex	Meaning	Description
FG	0x00	Status		0x0008		
		.POR	1	0x0	Not Detected	Power-On Reset
		.Imn	2	0x0	Not Detected	Minimum Current Alert
		.Bst	3	0x1	Detected	Battery Status
		.Imx	6	0x0	Not Detected	Maximum Current Alert
		.dSOCi	7	0x0	Not Detected	SOC 1% Change Alert
		.Vmn	8	0x0	Not Detected	Minimum Voltage Alert
		.Tmn	9	0x0	Not Detected	Minimum Temperature Alert
		.Smn	10	0x0	Not Detected	Minimum SOC Alert
		.Bi	11	0x0	Not Detected	Battery Insertion
		.Vmx	12	0x0	Not Detected	Maximum Voltage Alert
		.Tmx	13	0x0	Not Detected	Maximum Temperature Alert
		.Smx	14	0x0	Not Detected	Maximum SOC Alert
		.Br	15	0x0	Not Detected	Battery Removal
FG	0x09	MaxMinTemp		0x168E		
		.MinTemperature	7:0	0x8E	-114.000°C	Temperature(Minimum)
		.MaxTemperature	15:8	0x16	22.000°C	Temperature(Maximum)
FG	0x0A	MaxMinCurr		0x00FF		
		.MinCurrent	7:0	0xFF	-40.000mA	Current(Minimum)
		.MaxCurrent	15:8	0x00	0.000mA	Current(Maximum)
FG	0x0B	MaxMinVolt		0xC8C8		
		.MinVCELL	7:0	0xC8	4000.000mV	VCELL(Minimum)
		.MaxVCELL	15:8	0xC8	4000.000mV	VCELL(Maximum)

Configuration

Figure 9 shows the format of the Configuration tab, which is the same with the Status tab. It contained several key fuel gauge configuration registers, which included the cell relaxation, hibernate mode, alert, servo mixing algorithm, and fuel gauge learning feature configurations. The bit fields of each configuration register can be modified separately.

Figure 9. Configuration Tab



Slave	Register	Name	Bits	Hex	Meaning	Description
FG-NV	0xB6	nRelaxCfg		0x043C		
		.dt	3:0	0xC		dt
		.dV	8:4	0x03		dV
		.LOAD	15:9	0x02		LOAD
FG-NV	0xBB	nHibCfg		0x0909		
		.HibScalar	2:0	0x1	1404.0ms	Hibernate Task Period
		.HibExitTime	4:3	0x1	0.0s	Hibernate Exit Time
		.HibThreshold	11:8	0x9	7.20mA	Hibernate Current Threshold
		.HibEnterTime	14:12	0x0	2.812s	Hibernate Enter Time
		.EnHib	15	0x0	Disabled	Enabled Hibernate Mode
FG	0x0C	Config		0x2000		
		.Ber	0	0x0	Disabled	Enable alert on battery removal
		.Bei	1	0x0	Disabled	Enable alert on battery insertioln
		.Aen	2	0x0	Disabled	Enable alert on fuel-gauge outputs
		.FTHRM	3	0x0	Disabled	FTHRM
		.PinConfig	7	0x0	Disabled	ICHG/VCHG pin configuration
		.Tex	8	0x0	Disabled	Temperature External
		.IS	11	0x0	Not Sticky	Current Alert Sticky
		.VS	12	0x0	Not Sticky	Voltage Alert Sticky
		.TS	13	0x1	Sticky	Temperature Alert Sticky
		.SS	14	0x0	Not Sticky	SOC Alert Sticky
FG	0x0F	MiscCfg		0x3070		
		.SACFG	1:0	0x0	SAC from RepSOC	SOC Alerts Config
		.MixRate	9:5	0x03	18.75uV	Mixing Rate
		.FUS	15:12	0x3	8%	Full Update Slope
FG	0x2F	LearnCfg		0x2696		
		.FLrn	0	0x0		Empty Learning

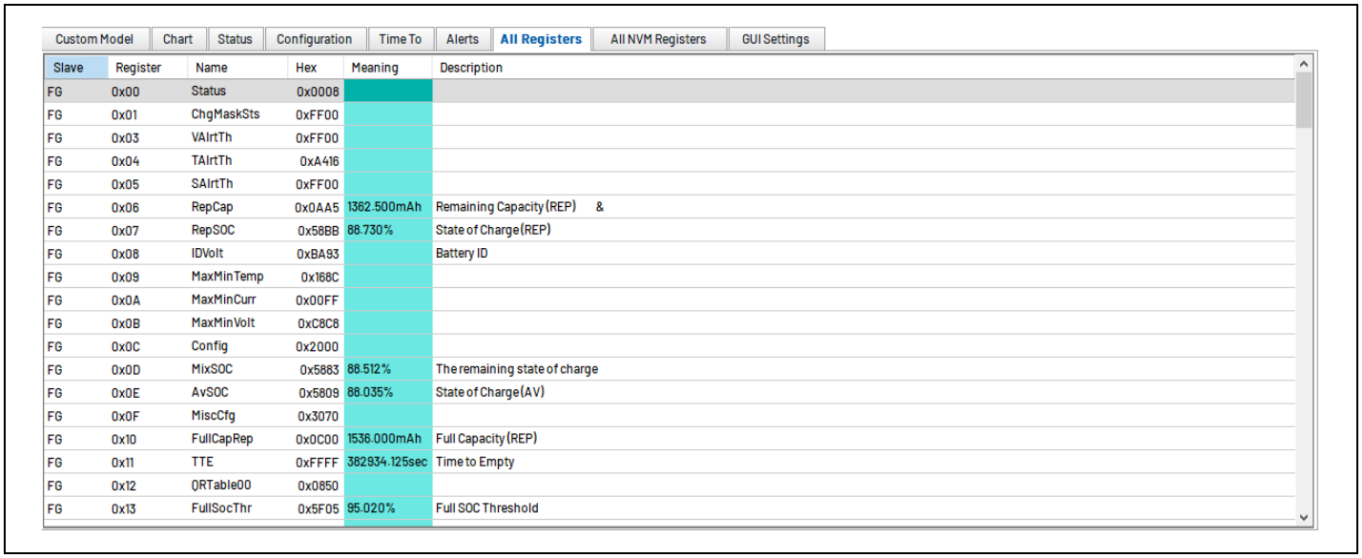
Alerts

The Alerts tab has the same format as the Configuration tab. The upper and lower threshold of voltage, temperature, SOC and current alert thresholds can be modified separately in this tab.

All Registers

The All Registers tab has the same format as the Custom Model tab shown in Figure 10. Scrolling the tab up and down to view the registers. Each register displayed in this tab can be modified separately by double clicking or right clicking the register.

Figure 10. All Registers Tab



Slave	Register	Name	Hex	Meaning	Description
FG	0x00	Status	0x0008		
FG	0x01	ChgMaskSts	0xFF00		
FG	0x03	VAlrtTh	0xFF00		
FG	0x04	TAlrtTh	0xA416		
FG	0x05	SAlrtTh	0xFF00		
FG	0x06	RepCap	0x0AA5	1362.500mAh	Remaining Capacity (REP) &
FG	0x07	RepSOC	0x58BB	88.730%	State of Charge (REP)
FG	0x08	IDVolt	0xBA93		Battery ID
FG	0x09	MaxMinTemp	0x168C		
FG	0x0A	MaxMinCurr	0x00FF		
FG	0x0B	MaxMinVolt	0xC8C8		
FG	0x0C	Config	0x2000		
FG	0x0D	MixSOC	0x5883	88.512%	The remaining state of charge
FG	0x0E	AvSOC	0x5809	88.035%	State of Charge (AV)
FG	0x0F	MiscCfg	0x3070		
FG	0x10	FullCapRep	0x0C00	1536.000mAh	Full Capacity (REP)
FG	0x11	TTE	0xFFFF	382934.125sec	Time to Empty
FG	0x12	QRTable00	0x0850		
FG	0x13	FullSocThr	0x5F05	95.020%	Full SOC Threshold

All NVM Registers

The All NVM Registers tab has the same format as the All Registers tab. Scroll the tab up and down to view the registers. Each register displayed in this tab can be modified separately by double-clicking or right-clicking the

register.

GUI Setting

Inside the GUI Setting tab, the external sense resistor value can be selected in the Model Configurations group box, and displays the task period for the MAX77972 firmware running once. The standard register resolutions calculated from the selected sense resistor value are displayed in the Data Registers Unit/LSB group box. The Chart Properties group box shows the resolution of the time axis.

Ordering Information

PART	TYPE
MAX77972EVKIT#	EV Kit

#Denotes RoHS-compliant.

MAX77972 EV Kit Bill of Materials

ITEM	REF_DES	QTY	MFG PART #	VALUE	DESCRIPTION
1	3P3V, ALRT, BATTS, BYPS, CC1, CC2, CHGEN, CHGINS, DATAMUX, DN, DNCHG, DP, DPCHG, GND1S, GNDS, ICHG, INOKB, PVL, SCL, SDA, STAT, SYSS, THM, VCHG, VDD	25	5000	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
2	BATT, BATTN, BYP, CHGIN, GND2-GND5, SYS, SYSN	10	9020 BUSS	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG
3	C1, C8	2	C1005X5R1A225K050BC	2.2UF	CAP; SMT (0402); 2.2UF; 10%; 10V; X5R; CERAMIC
4	C2	1	EMK105ABJ225MV; GRM155R61C225ME11	2.2UF	CAP; SMT (0402); 2.2UF; 20%; 16V; X5R; CERAMIC
5	C3	1	ANY	22UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 22UF; 16V; TOL=10%; MODEL=C SERIES; TG=-55 DEGC TO +85 DEGC; TC=X5R; FORMFACTOR
6	C4	1	GRM155R61C104KA88	0.1UF	CAP; SMT (0402); 0.1UF; 10%; 16V; X5R; CERAMIC
7	C5, C7, C9	3	C1608X5R1A106K080AC	10UF	CAP; SMT (0603); 10UF; 10%; 10V; X5R; CERAMIC
8	C10, C13	2	C0402C0G500270JNP; GRM1555C1H270JA01	27PF	CAP; SMT (0402); 27PF; 5%; 50V; C0G; CERAMIC

9	C11,C17, C19	3	ZRB15XR61A475ME01; CL05A475MP5NRN; GRM155R61A475MEAA; C1005X5R1A475M050BC	4.7UF	CAP; SMT (0402); 4.7UF; 20%; 10V; X5R; CERAMIC
10	C12, C14-C16, C18, C20-C26, C32	13	GRM155R71A104JA01	0.1UF	CAP; SMT (0402); 0.1UF; 5%; 10V; X7R; CERAMIC
11	C27-C31, C34	6	C0402C105K8PAC; CC0402KRX5R6BB105	1UF	CAP; SMT (0402); 1UF; 10%; 10V; X5R; CERAMIC
12	C33	1	TMK105BJ105MV	1UF	CAP; SMT (0402); 1UF; 20%; 25V; X5R; CERAMIC
13	C35	1	ZRB157R61A225KE11; GRM155R61A225KE95; CL05A225KP5NSN; GRM155R61A225KE01	2.2UF	CAP; SMT (0402); 2.2UF; 10%; 10V; X5R; CERAMIC
14	D2, D3	2	RB751S40	RB751S40	DIODE; SCH; SMT (SOD-523F); PIV=40V; IF=0.03A
15	DS1, DS2, DS4	3	LTST-C190GKT	LTST-C190GKT	DIODE; LED; WATER CLEAR GREEN; SMT (0603); VF=2.1V; IF=0.03A; -55 DEGC TO +85 DEGC
16	DS3, DS7	2	LTST-C190YKT	LTST-C190YKT	DIODE; LED; STANDARD; YELLOW; SMT (0603); PIV=5.0V; IF=0.02A; -55 DEGC TO +85 DEGC
17	DS5	1	LTST-C191TBKT	LTST-C191TBKT	DIODE; LED; ; SMT (0603); PIV=5V; IF=0.02A; BLUE
18	J1	1	12401598E4#2A	12401598E4#2A	CONNECTOR; FEMALE; THROUGH HOLE; USB 3.1; GEN2; TYPE C RECEPTACLE; RIGHT ANGLE; 24PINS
19	J2, J3	2	10118193-0001LF	10118193-0001LF	CONNECTOR; FEMALE; SMT; MICRO USB B TYPE RECEPTACLE; RIGHT ANGLE; 5PINS
20	J4	1	87520-0010BLF	87520-0010BLF	CONNECTOR; FEMALE; THROUGH HOLE; USB RECEPTACLE; RIGHT ANGLE; 4PINS
21	J5	1	PBC03DAAN	PBC03DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 6PINS; -65 DEGC TO +125 DEGC
22	J6	1	PEC07SAAN	PEC07SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 7PINS; -65 DEGC TO +125 DEGC

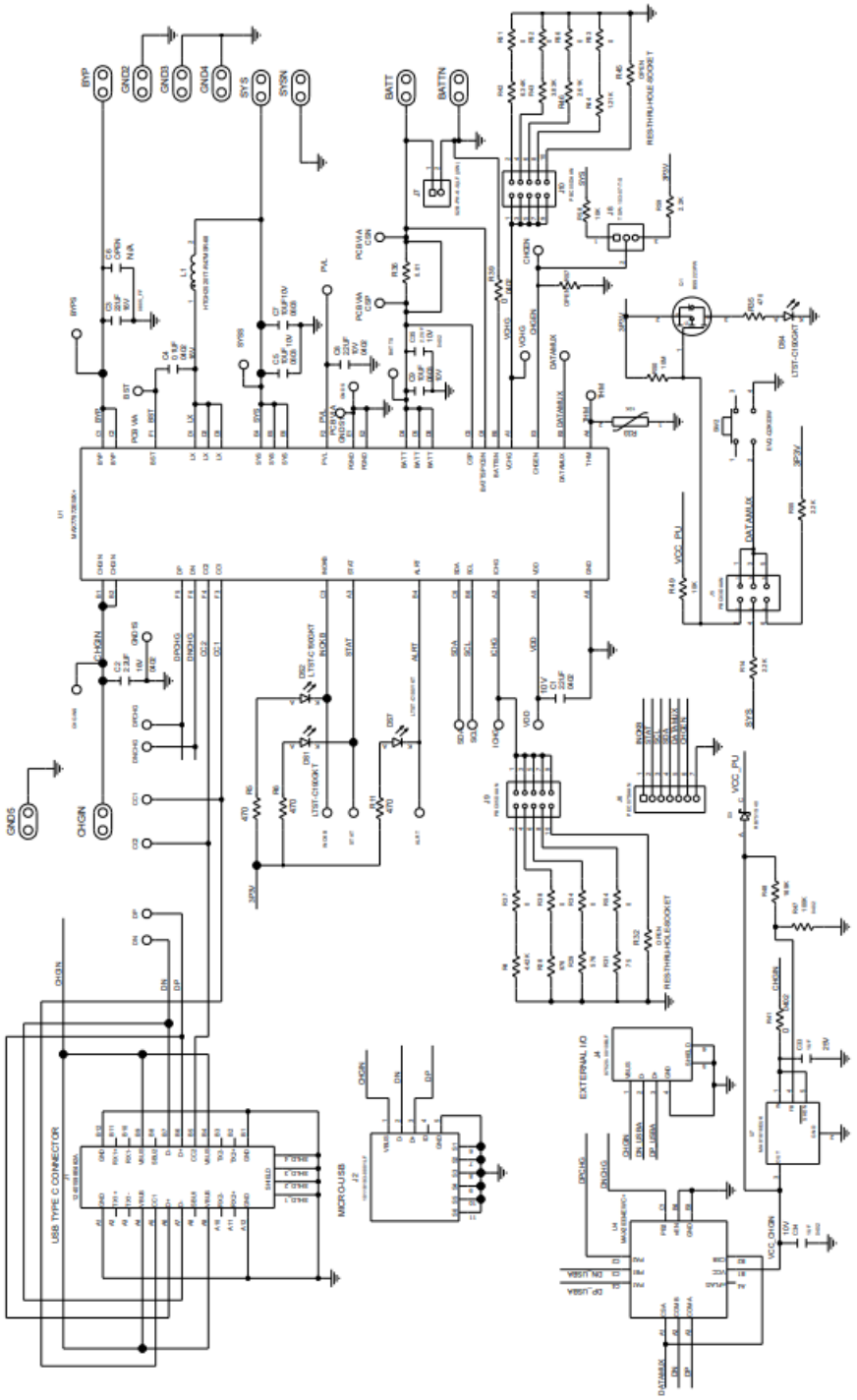
23	J7	1	S2B-PH-K-S(LF)(SN)	S2B-PH-K-S(LF)(SN)	CONNECTOR; MALE; THROUGH HOLE; 2.0MM PITCH; DISCONNECTABLE CRIMP STYLE CONNECTOR; SIDE ENTRY TYPE; RIGHT ANGLE; 2 PINS
24	J8	1	TSW-103-07-T-S	TSW-103-07-T-S	CONNECTOR; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 3PINS
25	J9, J10	2	PBC05DAAN	PBC05DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 10PINS; -65 DEGC TO +125 DEGC
26	J11, J12	2	PBC02SAAN	PBC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS
27	L1	1	HTGH25201T-R47MSR-68	HTGH25201T-R47MSR-68	EVKIT PART – INDUCTOR; SMT (2520); POWER CHOKE COIL; TOL=+/-20%; 5.6A
28	L2-L4	3	BLM18AG601SN1	600	INDUCTOR; SMT (0603); FERRITE-BEAD; 600; TOL=+/-; 0.5A
29	MH1-MH4	4	9032	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON
30	MISC1	1	AK67421-2	AK67421-2	CABLE; MALE; USB; USB2.0 MICRO CONNECTION CABLE; USB B MICRO MALE TO USB A MALE; 2000 MILLIMETERS; 5PINS-4PINS
31	Q1	1	BSS223PW	BSS223PW	TRAN; OPTIMOS SMALL-SIGNAL-TRANSISTOR; PCH; SOT323-3; PD-(0.25W); I-(-0.39A); V-(-20V)
32	R1, R2	2	RC0402FR-0727RL	27	RES; SMT (0402); 27; 1%; +/-100PPM/DEGC; 0.0630W
33	R3, R12, R13, R15, R21, R24, R34, R37-R39, R41, R51-R54, R56	16	ERJ-2GE0R00	0	RES; SMT (0402); 0; JUMPER; JUMPER; 0.1000W
34	R4	1	CR0402-16W-4421FT; D1004020B4421F	4.42K	RES; SMT (0402); 4.42K; 1%; +/-100PPM/DEGC; 0.0630W
35	R5, R6, R11, R35	4	CRCW0402470RFK	470	RES; SMT (0402); 470; 1%; +/-100PPM/DEGC; 0.0630W
36	R7	1	CRCW040212K0FK; MCR01MZPF1202	12K	RES; SMT (0402); 12K; 1%; +/-100PPM/DEGC; 0.0630W
37	R8	1	CRCW04021M00FK	1M	RES; SMT (0402); 1M; 1%; +/-100PPM/DEGC; 0.0630W

38	R9	1	RC0402FR-071KL; MCR01MZPF1001	1K	RES; SMT (0402); 1K; 1%; +/-100PPM/DEGC; 0.0630W
39	R10	1	CRCW04023K40FK	3.4k	RES; SMT (0402); 3.4K; 1%; +/-100PPM/DEGC; 0.0630W
40	R14, R27, R30, R55, R59	5	CRCW04022K20JN	2.2K	RES; SMT (0402); 2.2K; 5%; +/-200PPM/DEGK; 0.0630W
41	R17, R18	2	CRCW04024K70FK; MCR01MZPF4701	4.7K	RES; SMT (0402); 4.7K; 1%; +/-100PPM/DEGC; 0.0630W
42	R19, R22, R48	3	CRCW0402169KFK	169K	RES; SMT (0402); 169K; 1%; +/-100PPM/DEGK; 0.0630W
43	R20, R23, R47	3	CRCW0402100KFK; RC0402FR-07100KL	100K	RES; SMT (0402); 100K; 1%; +/-100PPM/DEGC; 0.0630W
44	R26	1	CRCW0402270RFK	270	RES; SMT (0402); 270; 1%; +/-100PPM/DEGC; 0.0630W
45	R28	1	CRCW0402976RFK	976	RES; SMT (0402); 976; 1%; +/-100PPM/DEGC; 0.0630W
46	R29	1	ERJ-2RKF5760	576	RES; SMT (0402); 576; 1%; +/-100PPM/DEGC; 0.1000W
47	R31	1	CRCW040275R0FK	75	RES; SMT (0402); 75; 1%; +/-100PPM/DEGC; 0.0630W
48	R33	1	NCP15XH103F03RC	10K	THERMISTOR; SMT (0402); THICK FILM (NICKEL PLATED); 10K; TOL=+/-1%;
49	R36	1	PF0603FRE7T0R01Z	0.01	RES; SMT (0603); 0.01; 1%; +/-50PPM/DEGC; 0.3300W
50	R42	1	CRCW04026K34FK	6.34K	RES; SMT (0402); 6.34K; 1%; +/-100PPM/DEGK; 0.0630W
51	R43	1	CRCW04023K83FK	3.83K	RES; SMT (0402); 3.83K; 1%; +/-100PPM/DEGC; 0.0630W
52	R44	1	CRCW04021K21FK	1.21K	RES; SMT (0402); 1.21K; 1%; +/-100PPM/DEGK; 0.0630W
53	R46	1	ERA-2AEB2611	2.61K	RES; SMT (0402); 2.61K; 0.1%; +/-100PPM/DEGC; 0.0630W
54	R49, R58	2	RC0402FR-0710KL; CR0402-FX-1002GLF	10K	RES; SMT (0402); 10K; 1%; +/-100PPM/DEGC; 0.0630W
55	R50	1	CRCW040210M0FK	10M	RES; SMT (0402); 10M; 1%; +/-100PPM/DEGC; 0.0630W
56	SW2	1	EVQ-Q2K03W	EVQ-Q2K03W	SWITCH; SPST; SMT; 15V; 0.02A; LIGHT TOUCH SWITCH; RCOIL= OHM; RINSULATION= OHM; PANASONIC
57	U1	1	MAX77972EWX+	MAX77972EWX +	EVKIT PART – IC; CHGR; 3A STAND ALONE CHARGER WITH FUEL GAUGE AND USB-C DETECTION; WLP36

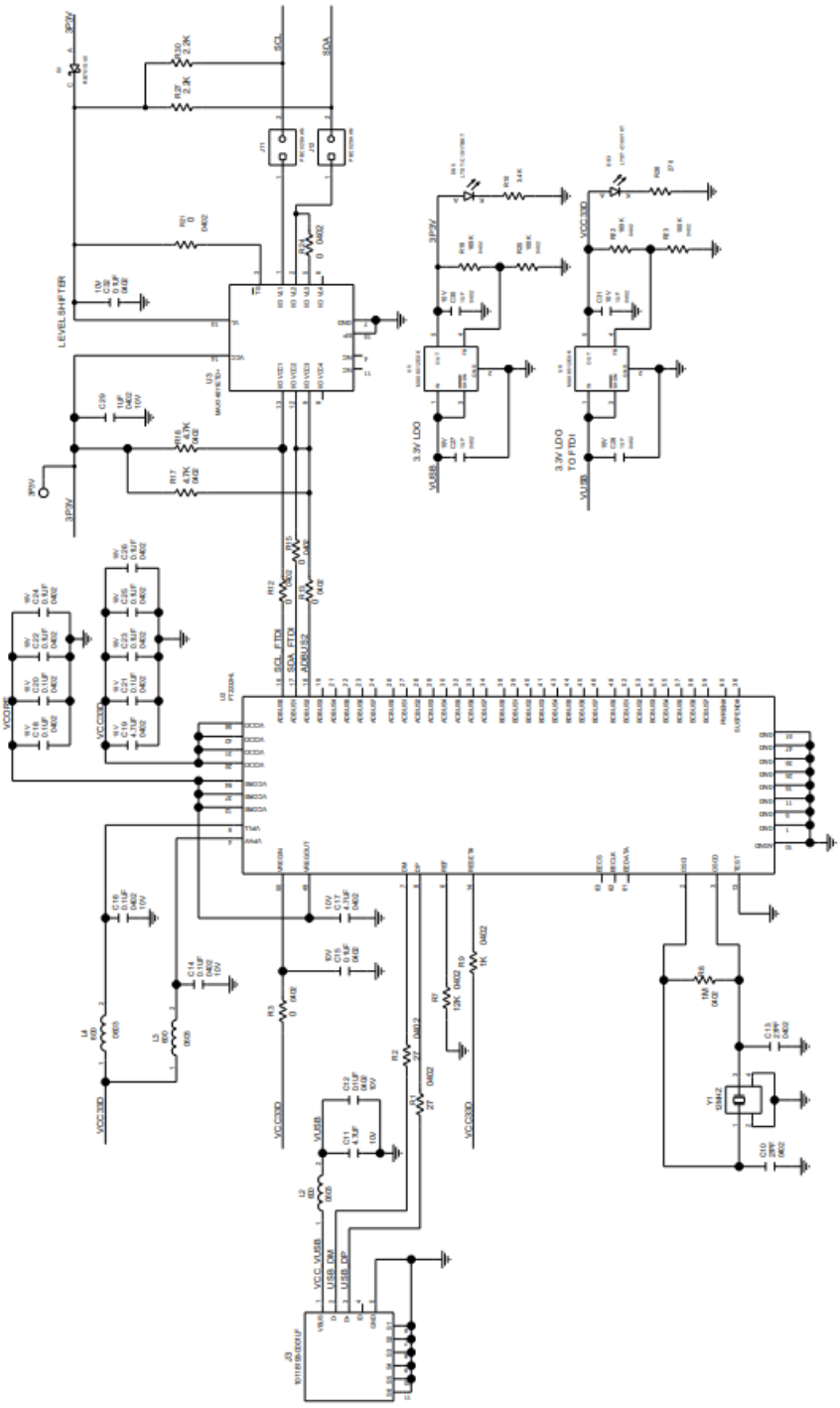
58	U2	1	FT2232HL	FT2232HL	IC; MMRY; DUAL HIGH SPEED USB TO MULTIPURPOSE UART/FIFO; LQFP64

59	U3	1	MAX14611ETD+	MAX14611ETD+	IC; TRANS; QUAD BIDIRECTIONAL LOW- VOLTAGE LOGIC LEVEL TRANSLATOR; TDFN14-EP
60	U4	1	MAX20334EWC+	MAX20334EWC+	EVKIT PART-IC; ASW; OVERVOLTAGE AND SURGE-PROTECTED; DUAL SPDT DATA LINE SWITCH; PACKAGE OUTLINE DRAWING: 21-100286; PACKAGE CODE: W121C1+1; WLP12
61	U5, U6	2	MAX8512EXK+	MAX8512EXK	IC, VREG, Ultra-Low-Noise, High PSRR, Adjustable Vout, SC70-5
62	U7	1	MAX1616EUK+	MAX1616EUK	IC, VREG; HIGH-VOLTAGE; LOW-POWER LINEAR REGULATOR, SOT23-5
63	Y1	1	7M-12.000MAAJ	12MHZ	CRYSTAL; SMT; 12MHZ; 18PF; TOL = +/-30PPM; STABILITY = +/-30PPM
64	PCB	1	MAX77972	PCB	PCB:MAX77972
65	EV_KIT_BOX1	6	NPC02SXON-RC		CONNECTOR; FEMALE; MINI SHUNT; 0.100IN CC; OPEN TOP; JUMPER; STRAIGHT; 2PINS
66	R32, R45	4	0667-0-15-01-30-27-10-0	N/A	PIN RECEPTACLE; PIN DIA=0.025IN; TOTAL LENGTH=0.161IN; BOARD HOLE=0.057IN; GOLD OVER NICKEL PLATE FINISH
6	R32, R45	0	N/A	OPEN	RES; THROUGH HOLE-RADIAL LEAD; OPEN; N/A; N/A; N/A
68	R57	0	N/A	OPEN	RESISTOR; 0402; OPEN; FORMFACTOR
69	C6	0	N/A	OPEN	CAPACITOR; SMT (0603); OPEN; FORMFACTOR

MAX77972 EV Kit Schematic



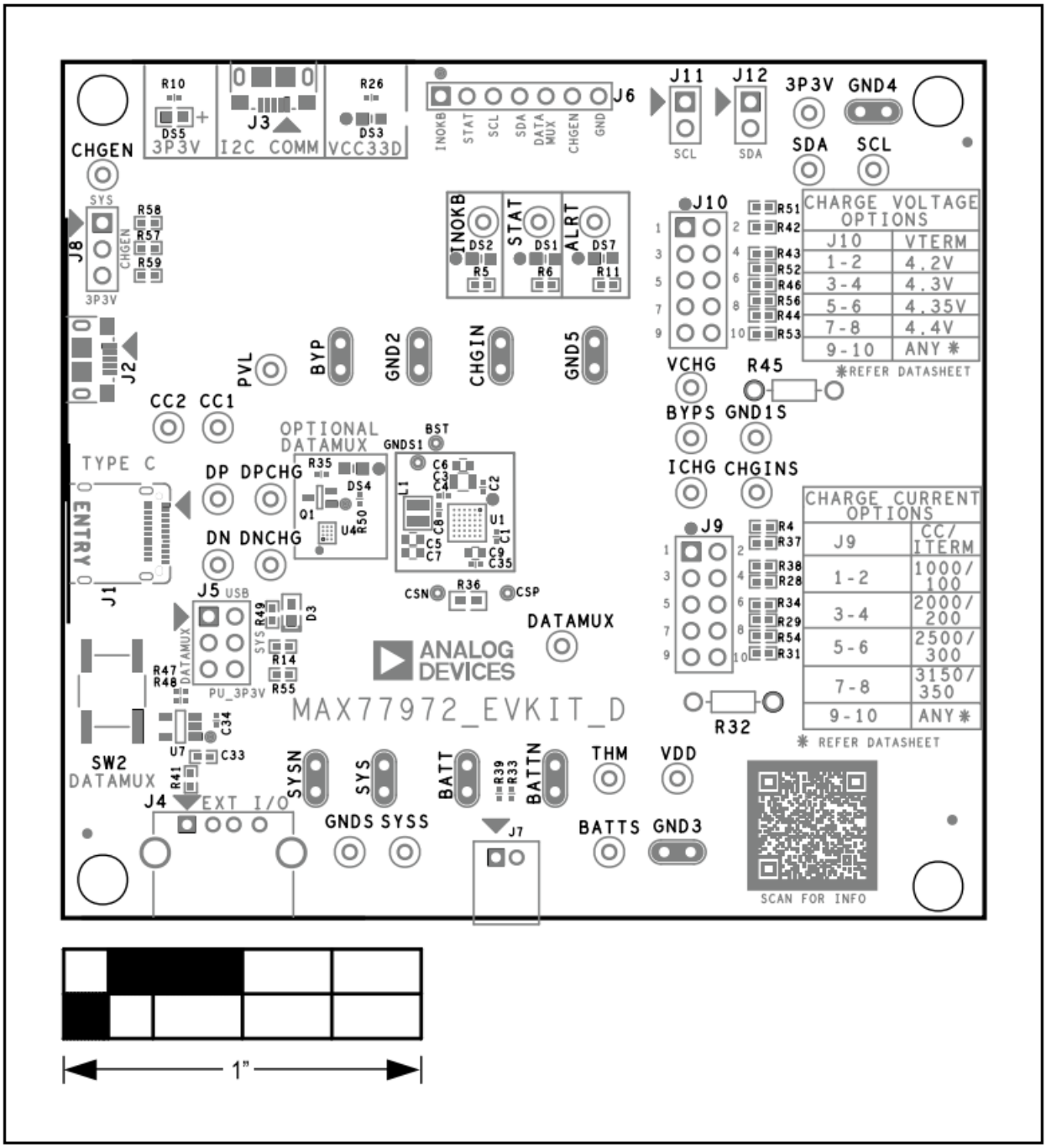
MAX77972 Charger Part



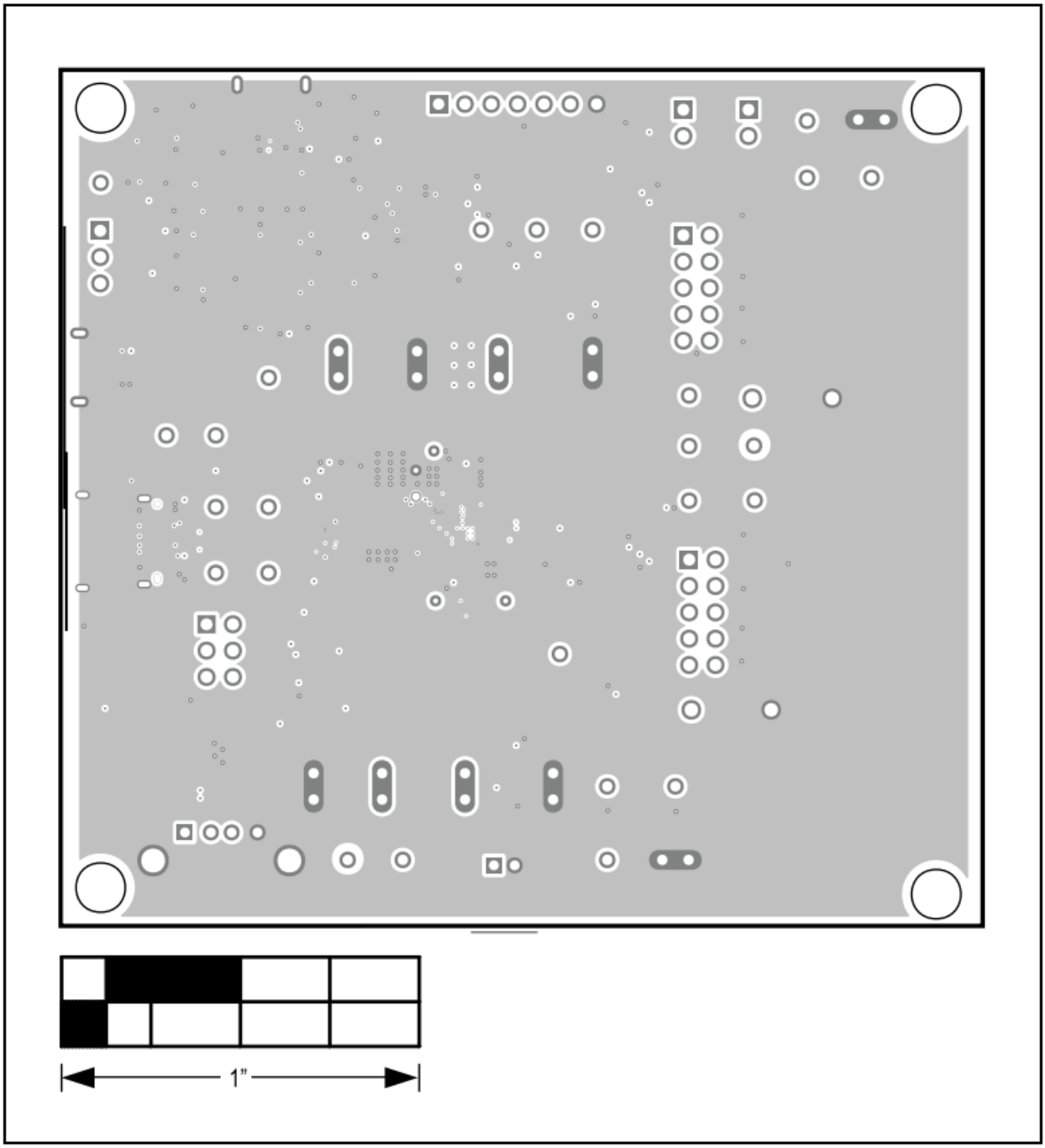
MAXUSB, USB to I2C Translator

MAX77972 EV Kit PCB Layout

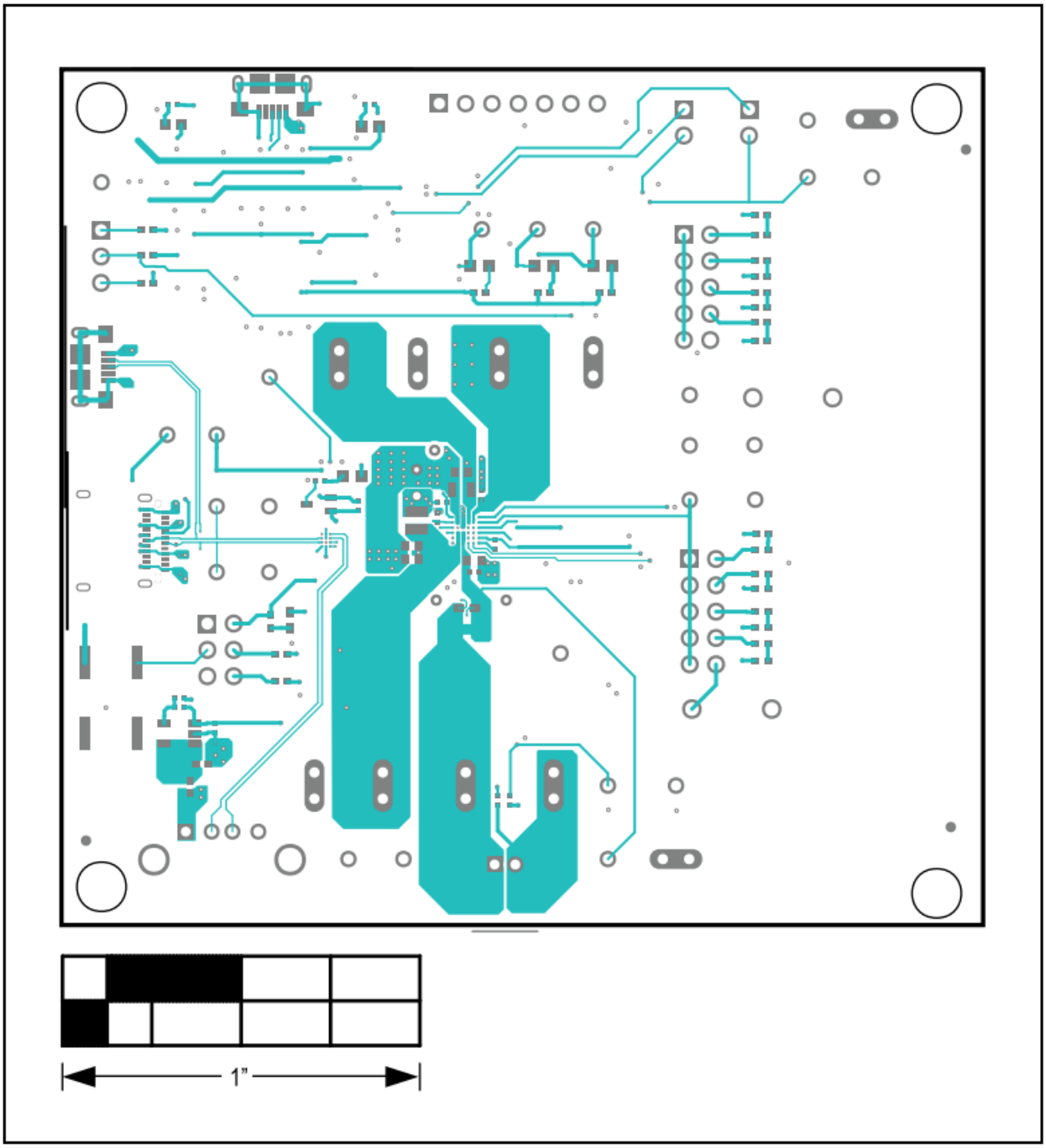
- MAX77972 EV Kit Component Placement Guide—Top Silkscreen



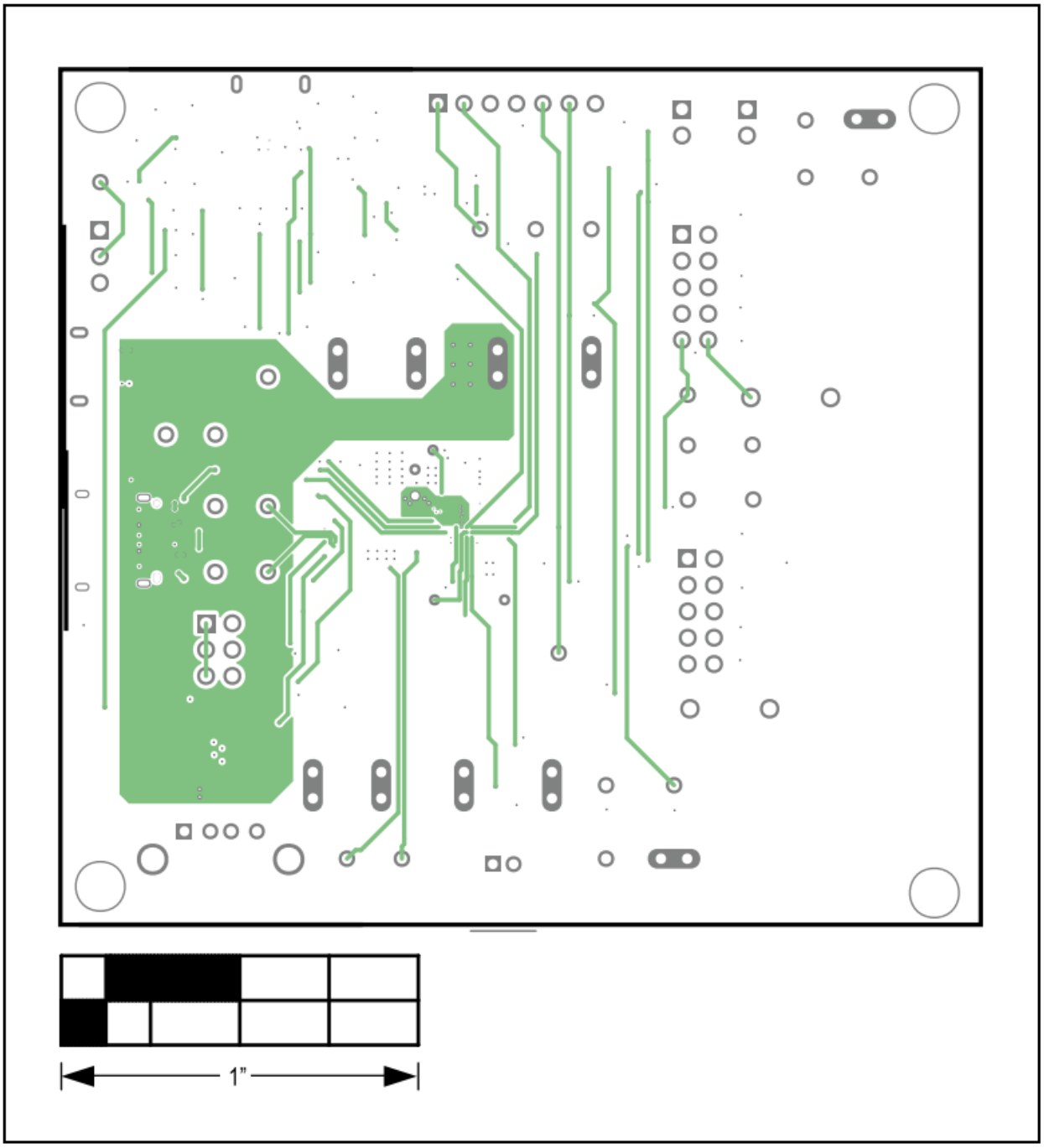
- MAX77972 EV Kit PCB Layout—Layer 2



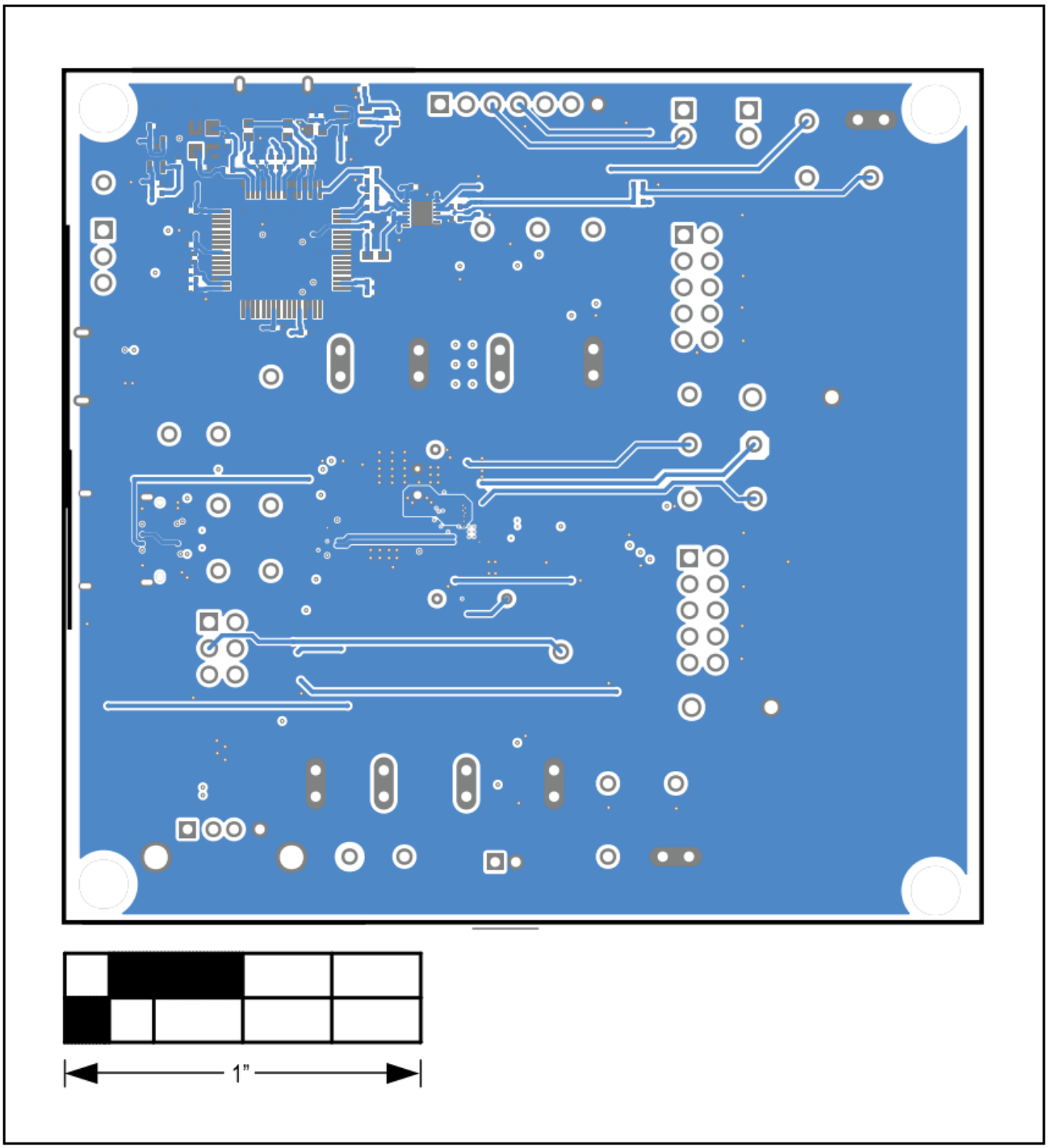
- MAX77972 EV Kit PCB Layout—Top View



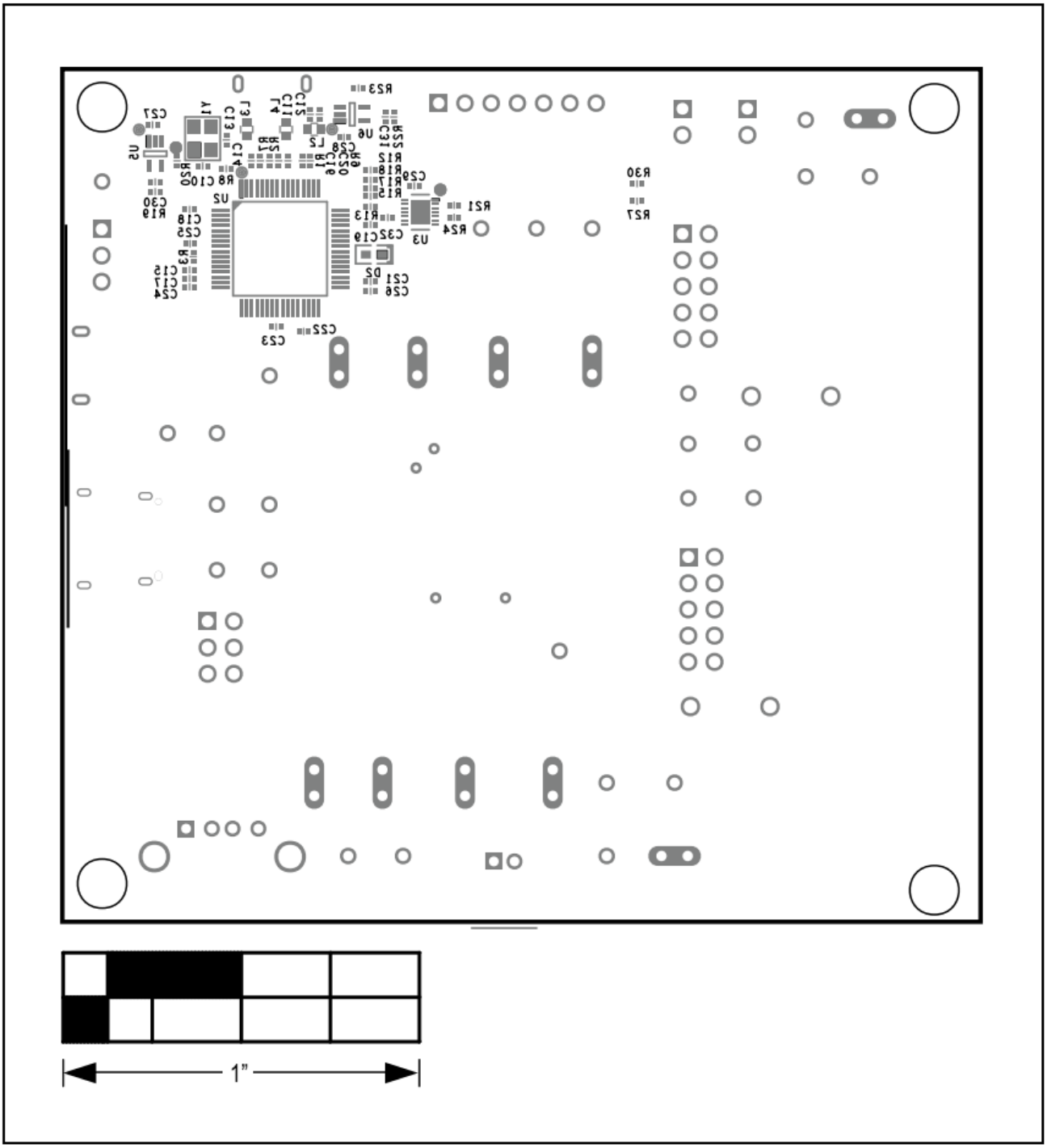
- MAX77972 EV Kit PCB Layout—Layer 3



- MAX77972 EV Kit PCB Layout—Bottom View



- MAX77972 EV Kit Component Placement Guide—Bottom Silkscreen



Documents / Resources

	ANALOG DEVICES MAX77972 Evaluation Board [pdf] User Guide MAX77972 Evaluation Board, MAX77972, Evaluation Board, Board

References

- Mixed-signal and digital signal processing ICs | Analog Devices
- Document Feedback Form | Analog Devices
- Mixed-signal and digital signal processing ICs | Analog Devices
- User Manual