Evaluation Board User Guide

MAX20362 Evaluation Kit

Evaluates: MAX20362

General Description

The MAX20362 evaluation kit (EV kit) is a fully assembled and tested circuit board that evaluates the MAX20362, an integrated power management for optical sensor analog front end (AFE) in microbattery systems.

The device is configurable through an I^2C interface that allows for programming various functions and reading the device status. The EV kit GUI application sends commands to the MAXPICO2PMB# adapter board to configure the device.

The EV kit comes standard with the MAX20362A IC installed.

Features and Benefits

- Ultra-Fast Dynamic Voltage Scaling (DVS)
- USB Power Option
- Flexible Configuration
- Sense Test Point for Output-Voltage Measurement
- Windows® 8/Windows 10-Compatible GUI Software
- Fully Assembled and Tested

EV Kit Contents

- MAX20362_EVKIT_A system
- MAXPICO2PMB# board
- Two USB A to USB micro-B cables

MAX20362 EV Kit Files

FILE	DESCRIPTION
MAX20362GUI_SetupX.X.X.exe	PC GUI program

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

Quick Start

Required Equipment

- MAX20362 EV kit
- Windows PC with USB ports
- One USB A to USB micro-B cable and a PICO2PMB adapter board with the latest firmware
- One USB A to USB micro-B cable or power supply (for battery voltage)
- One voltmeter

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.

Procedure

The EV kit is fully assembled and tested. Follow the steps to install the EV kit software, make the required hardware connections, and start operation of the kit.

1. Visit *www.analog.com* under the *Tools & Simulations* tab to download the latest version of the MAX20362 EV kit software. Save the software to a temporary folder and unpack the zip file.
2. Install the EV kit software on the computer by running the **MAX20362GUI_SetupX.X.X.exe** program located 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.

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MAX20362 EV Kit Board

Figure 1. Top View of the MAX20362 EV Kit Board

3. The EV kit software launches automatically after installation, and it can be launched by clicking its icon in the Windows **Start** menu.
4. Verify that all jumpers are in their default positions, as shown in *Table 1*.
5. Connect the Type-A end of the cable to the PC and the micro-USB end to the MAXPICO2PMB# board. Then, connect the MAXPICO2PMB# to J38, located on the lower right of the EV kit board. Verify that LED DS10 is illuminated.
6. To use USB VBUS to power the MAX20362, connect a USB A to micro-B cable from the computer to J42, located at the upper right corner of the EV kit board. Place a shunt on JU2. Verify that LED DS1 is illuminated. Use a voltmeter to check the TP BAT voltage; it should be about 5V.
7. On the computer, open the MAX20362 GUI. The status bar at the bottom shows **Connected to MAX20362**, as shown in *Figure 2*).
8. To adjust BAT voltage, disconnect the micro-B port at J42 and remove the shunt on JU2. Connect the positive terminal of the DC power supply or battery to TP BAT and the negative terminal to TP GND.
9. To test the Buck-Boost, enable the Buck-Boost Enable (BBstEna bit) on the MAX20362 GUI. (Buck-Boost Enable is in the CAP_BBOUT tab.)
10. The BBstVSet is locked by default. To unlock the BBstVSet register, write BBLck = 0 in register 0x50, then write 0x55 in register 0x51. (Use the Buck-Boost Lock in the CAP_BBOUT tab or the Register Map tab.)
11. To test the LDO, connect the LDO input voltage to TP LIN, or use jumper J15, J16 or J17 to connect LIN to BBOUT, BBIN, or BAT. On the MA20362 GUI, set the desired LDOVset, then enable the LDOEna. Note that the LDO voltage change is only effective after toggling the LDO Enable (LDOEna bit). (LDO Enable is in the LDO tab.)

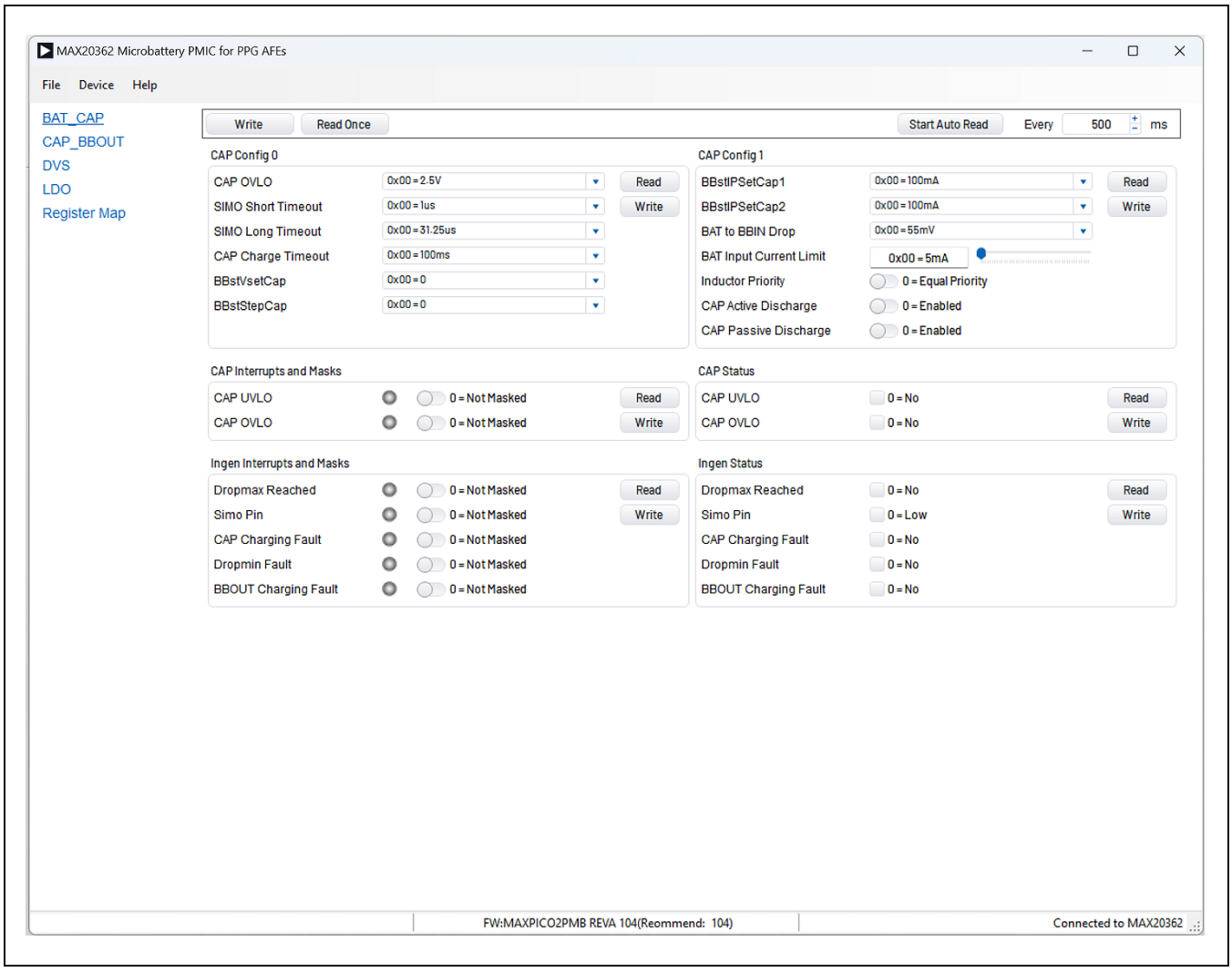


Figure 2. MAX20362 EV Kit Board Connections

Table 1. Jumper Connection Guide

JUMPER	SHUNT POSITION	FEATURE
J1	1-2*	EN pull up to VIO
	2-3	EN pull down ground
J2	1-2*	$\overline{INT}$ pull up to VIO
J3	1-2*	SIMO pull up to VIO
	2-3	SIMO pull down ground
J4	1-2	DVSIN pull up to VIO
	2-3*	DVSIN pull down ground
J5	1-2	CLKIN pull up to VIO
	2-3*	CLKIN pull down ground
J15	1-2	Connects BBOUT to LIN
J16	1-2	Connects BBIN to LIN
J17	1-2	Connects BAT to LIN
J18	1-2	Connect BAT to BATR
J19	1-2	Connect BAT to 100µF
J20	1-2	Connects BAT to BBIN
J21	1-2	Connects BBIN to LOAD
J34	1-2	Connects VCAP to C11 capacitor
J39	1-2	Connects LOUT to LOAD
J40	1-2	Connects VDDA to LOAD
J41	1-2	Connects VDDP to LOAD
J44	1-2	Connects VCAP to LOAD
JU1	1-2	Connects DVSIN to GPIO2
JU2	1-2	Connects VBUS to BAT
JU3	1-2	Connects BBOUT to LOAD
JU6	1-2*	Connects VIO to VIO_PMOD
JU8	1-2	Connects CLKIN to GPIO4

**Default position.*

Table 2. Connector Description

CONNECTOR	DESCRIPTION	
J7	1	Connects to BBOUT
	2	Connects to GND
J8	Connects to signal generator for load test	
J9	1	Connects to LOUT
	2	Connects to GND
J38	Connects to MAXPICO2PMB#	
J42	Connects to USB cable for 5V VBUS as battery input	
JU9	1	Connects to SDA
	2	Connects to GND
	3	Connects to SCL
SPI	1	Connects to DVSIN
	2	Connects to GND
	3	Connects to CLKIN

Detailed Description of Hardware

This evaluation kit should be used with the following documents:

- MAX20362 data sheet
- MAX20362 EV kit data sheet (this document)

These documents, or links to them, are included on the MAX20362 EV kit package. For the latest versions of the documents listed above, visit *www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits*.

The MAX20362 EV kit evaluates the MAX20362 micro-battery PMIC for PPG AFEs, which communicates over the I^2C interface. The EV kit demonstrates the buck-boost, LDO, and DVS features. The EV kit uses the IC in a 24-bump wafer-level package on a proven, four-layer PCB design. The EV kit can use USB VBUS 5V DC for battery input power source. Alternatively, the EV kit can be powered from an external power supply.

Hardware Setup

To use the EV kit with the EV kit software, connect the MAXPICO2PMB# to the PMOD connector J38, located at the lower right corner of the board (see *Figure 1*). On the MAXPICO2PMB# board, both J1 and J2 have pin 1 and pin 2 connected. The MAXPICO2PMB# also provides 3.3V to the logic voltage VIO of the EV kit by shunting pin 1 and pin 2 at JU6. The LED indicator DS10 on the EV kit illuminates when the JU6 shunt is installed.

On the EV kit, use the J42 USB VBUS to supply the BAT of the IC with JU2 shunted. The LED indicator DS1 illuminates in this case. Alternatively, instead of using the J42 USB on the board, remove JU2 and connect a Li-ion battery or DC power supply to BAT.

To test DVS mode, remove the shunts on J4 and J5. To test pseudo-SPI DVS mode with the GUI, shunt JU1 and JU8. To test round-robin DVS mode with the GUI, shunt JU8.

To use Q2 FET on the EV kit, gate can be accessed at test point VG, drain can be accessed at pin1 of JU3, and source can be accessed at test point VIL.

Detailed Description of Software

The MAX20362 evaluation kit tool is a GUI that provides a simple and quick way to test different configuration settings for the MAX20362. The GUI contains several tabs to configure different parameters of the MAX20362 and includes a register map to access all registers.

Software Startup

Upon starting the program, the EV kit software automatically searches for the USB interface circuit and then for the IC device address. The EV kit enters normal operating mode when the connection is established and the address is found. If the USB connection is not detected, the status bar displays Not Connected. If the USB connection is detected but the MAX20362 is not found, the status bar shows Connected to the Interface Board.

ToolStrip Menu Bar

The ToolStrip menu bar (see *Figure 3*) is located at the top of the GUI window. This bar comprises **File**, **Device**, and **Help** menus; each function is detailed in the following sections.

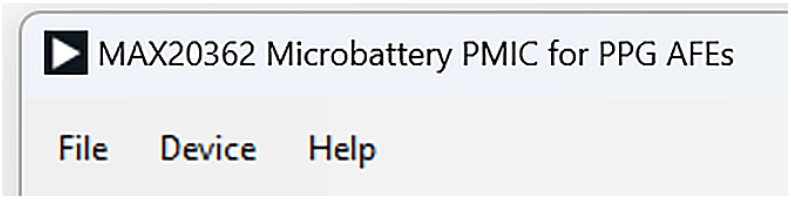


Figure 3. ToolStrip Menu Bar

File Menu

The **File** menu contains options to restart or exit the GUI program.

Device Menu

The **Device** menu provides the ability to connect/disconnect the EV kit to the GUI. The **MAX20362** menu allows to select peripheral address of the device. The default peripheral address is 0xD0.

Help Menu

The **Help** menu contains the **About** option, which displays the GUI splash screen indicative of the GUI version being used.

Tab Controls

The MAX20362 EV kit software GUI provides a convenient way to test the features of the MAX20362. Each tab contains controls relevant to various blocks of the device. Set the desired settings and use the **Write** button to write to the corresponding register bits. The **Read Once** and **Read All** buttons read all the configuration registers visible on the current tab page.

BAT_CAP Tab

The **BAT_CAP** tab (see *Figure 4*) provides options to test BAT, BBIN, and CAP-related functions. The **Status** section shows the state of the status registers. The **Interrupts and Masks** section has toggle switches to control which interrupts cause the $\overline{INT}$ output to be pulled low when asserted. Click the **Read** button to read and clear the interrupts visible in the section. Asserted interrupts are denoted by a red light in the **Interrupts and Masks** section.

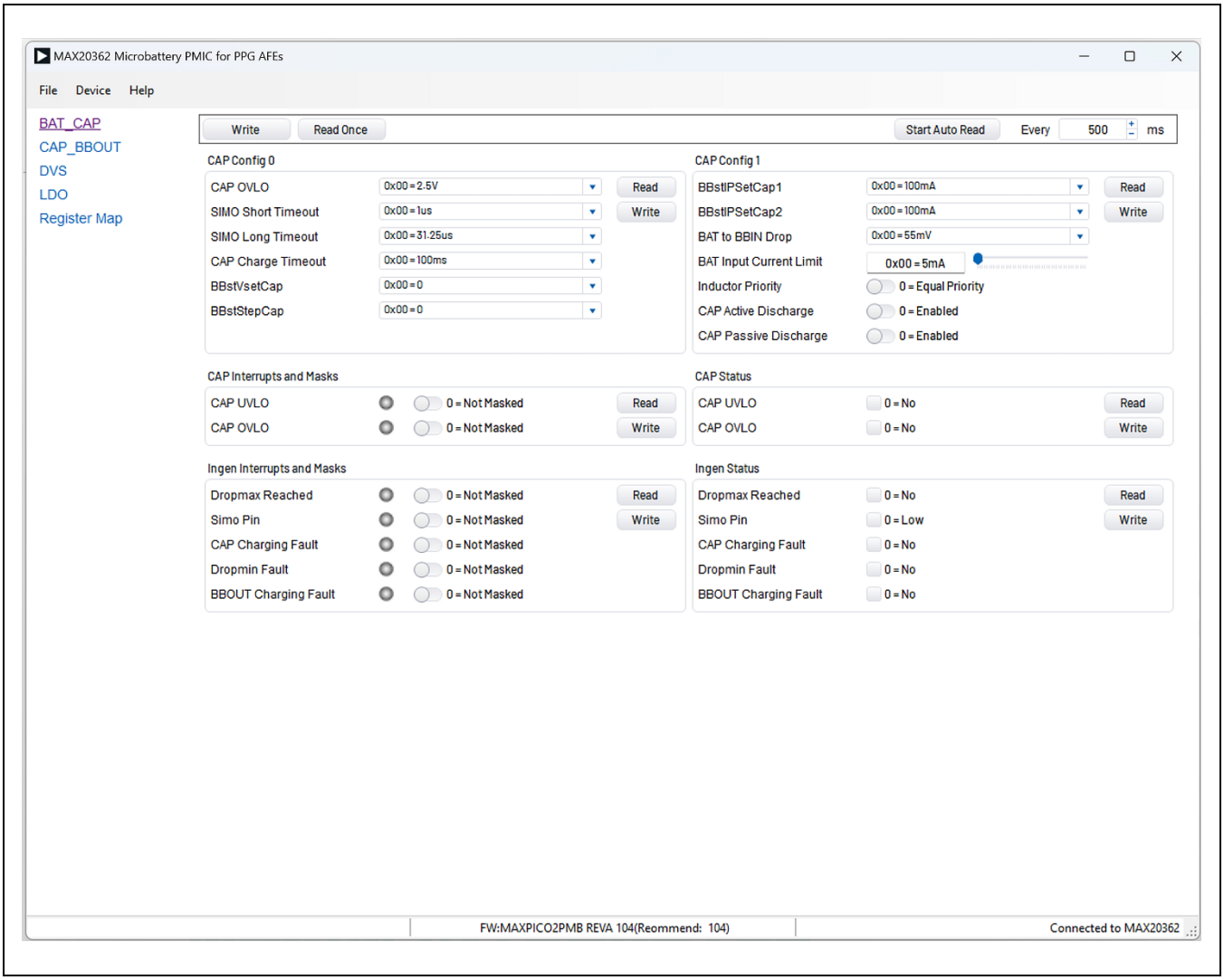


Figure 4. BAT_CAP Tab

CAP_BBOUT Tab

The **CAP_BBOUT** tab (see *Figure 5*) provides options to set configurations for buck-boost. The buck-boost can be enabled by **Buck-Boost Enable** = 1 in the **Buck Boost Config 0** section. The buck-boost voltage is locked by default. The buck-boost voltage can be unlocked by writing **Lock Mask** = 0 and then **Lock/Unlock Password** = 0x55 in **Buck-Boost Lock** section. The buck-boost voltage can be set with the output voltage track bar value and click **Write** in the **Buck Boost Voltage Config** section. The **Status** section shows the state of the status registers. The **Interrupts and Masks** section has toggle switches to control which interrupts cause the $\overline{INT}$ output to be pulled low when asserted. Click the **Read** button to read and clear the interrupts visible in the section. Asserted interrupts are denoted by a red light in the **Interrupts and Masks** section.

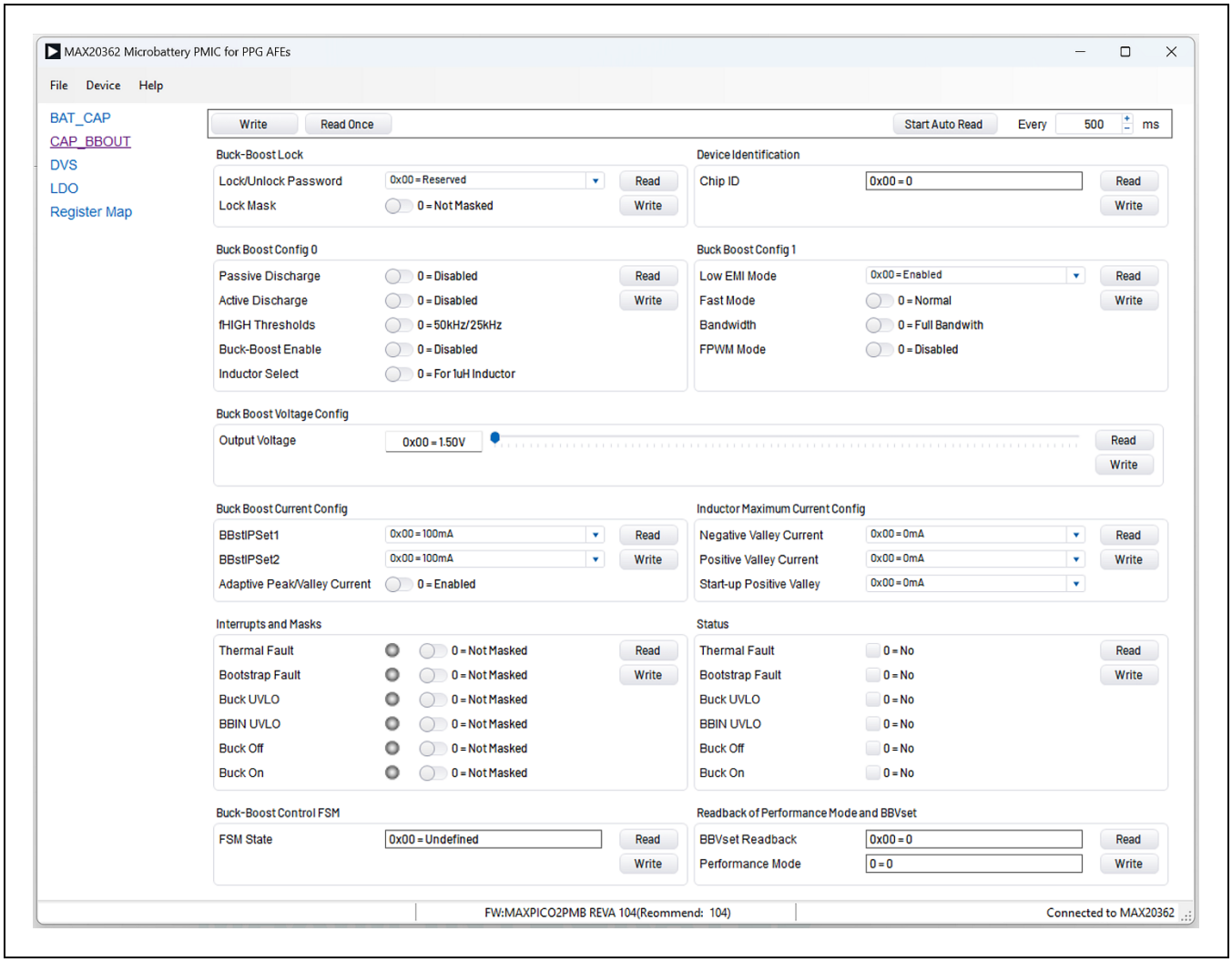


Figure 5. CAP_BBOUT Tab

DVS Tab

The **DVS** tab (see *Figure 6*) provides options to run DVS in pseudo-SPI or round-robin control mode. In these two modes, only FPWM or FAST can be enabled. To choose which one, set the FpwmFast bit (0 = Fast, 1 = FPWM).

To test pseudo-SPI DVS mode in the GUI, the pseudo-SPI timeout should be disabled by setting the **pSPI Timeout** toggle switch to 0 = Disabled. In the **DVS Config 0** section, change the **DVS Source** value to 1 = Pseudo-SPI and click the **Write** button. In the **Pseudo-SPI and CLKIN-Pin** section, set the **Voltage** track bar value and click the **Write pSPI** button to get target BBOUT voltage. By clicking the **Write pSPI** button, the firmware generates CLKIN and DVSIN signals for the MAX20362 device. Pseudo-SPI DVS can also operate with compatible Analog Devices AFEs, such as the MAX86181. Refer to the AFE data sheet for additional information.

The round-robin DVS mode allows to preprogram multiple DVS output voltages cycled through on the rising/falling edge of the CLKIN signal (see the RRClkPolarity bit in the register map). This mode enables fast DVS output capability on Analog Devices AFEs that do not feature the DVS controller function. To run DVS in round-robin mode, first set the DVS voltages in the **Round-Robin Voltages** section (up to 20 values) and click the **Write** button. In the **Round-Robin Config** section, set the **Timeout Reset** toggle switch to 1 = Reset Pointer and **Clock Polarity**, and click the **Write** button. Set the **Number of Steps** to the last voltage position used in the **Round-Robin Voltages** section and click the **Write** button. Use the **Timeout Duration** drop down menu to set the timeout duration, then click the **Write** button. Note that the timeout duration should be smaller than the time duration between the last CLKIN signal of the current frame and the first CLKIN signal of the next frame if operated with AFEs. Set **Round-Robin** in the **DVS Config 1** section to 1 = Enabled to enable round-robin mode. In the **Pseudo-SPI and CLKIN-Pin** section, set the CLKIN counts, period, and duty cycle, then click the **Write CLKIN** button to generate the CLKIN signal in the firmware. The BBOUT voltage changes according to the preprogrammed voltage values. Refer to the MAX20362 data sheet for more details.

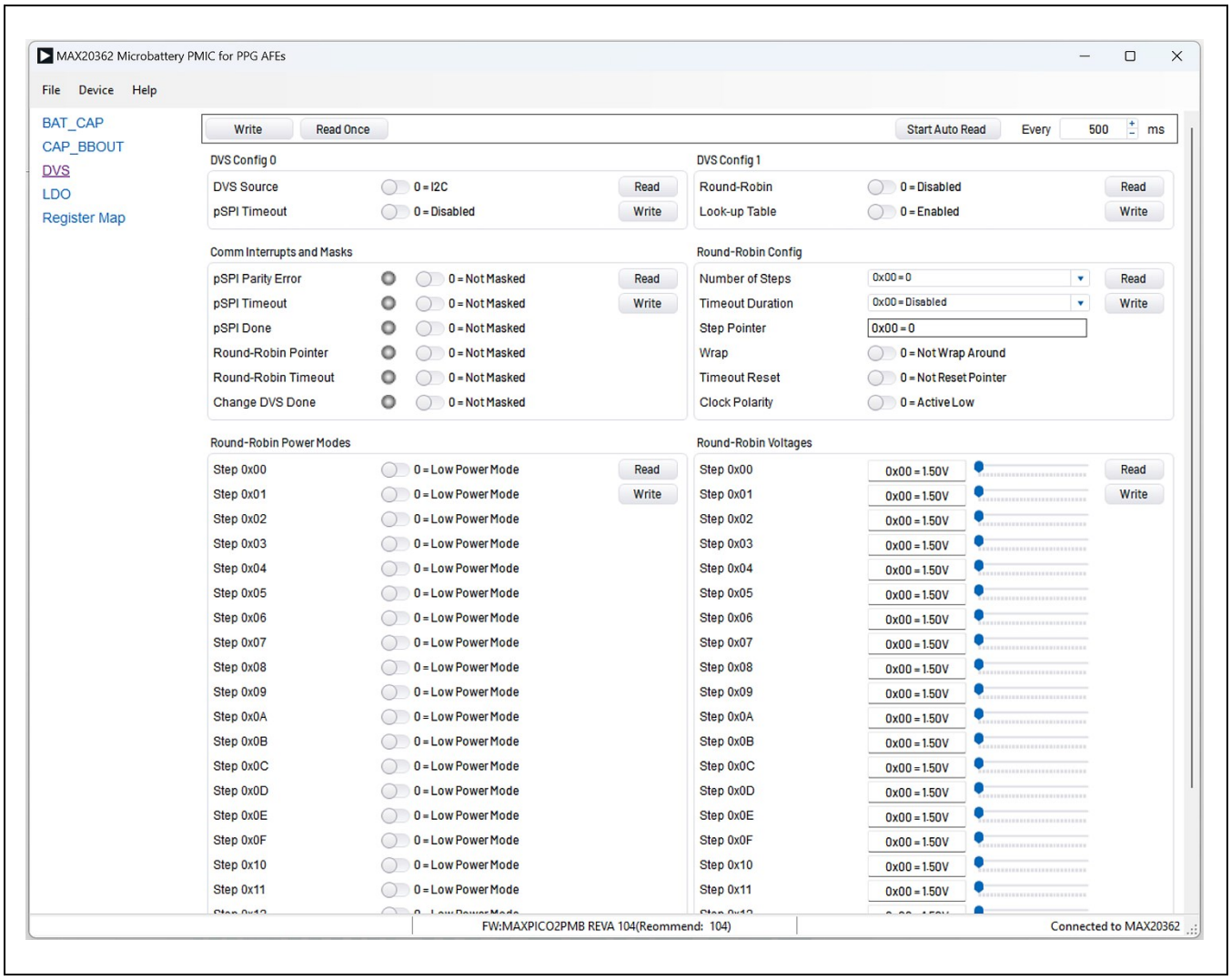


Figure 6. DVS Tab

LDO Tab

The **LDO** tab (see *Figure 7*) provides option to view the LDO status and change LDO configurations. The LDO voltage change is only effective after toggling the LDO Enable (LDOEna bit). The **Status** section shows the state of the status registers. The **Interrupts and Masks** section has toggle switches to control which interrupts cause the $\overline{INT}$ output to be pulled low when asserted. Click the **Read** button to read and clear the interrupts visible in the section. Asserted interrupts are denoted by a red light in the **Interrupts and Masks** section.

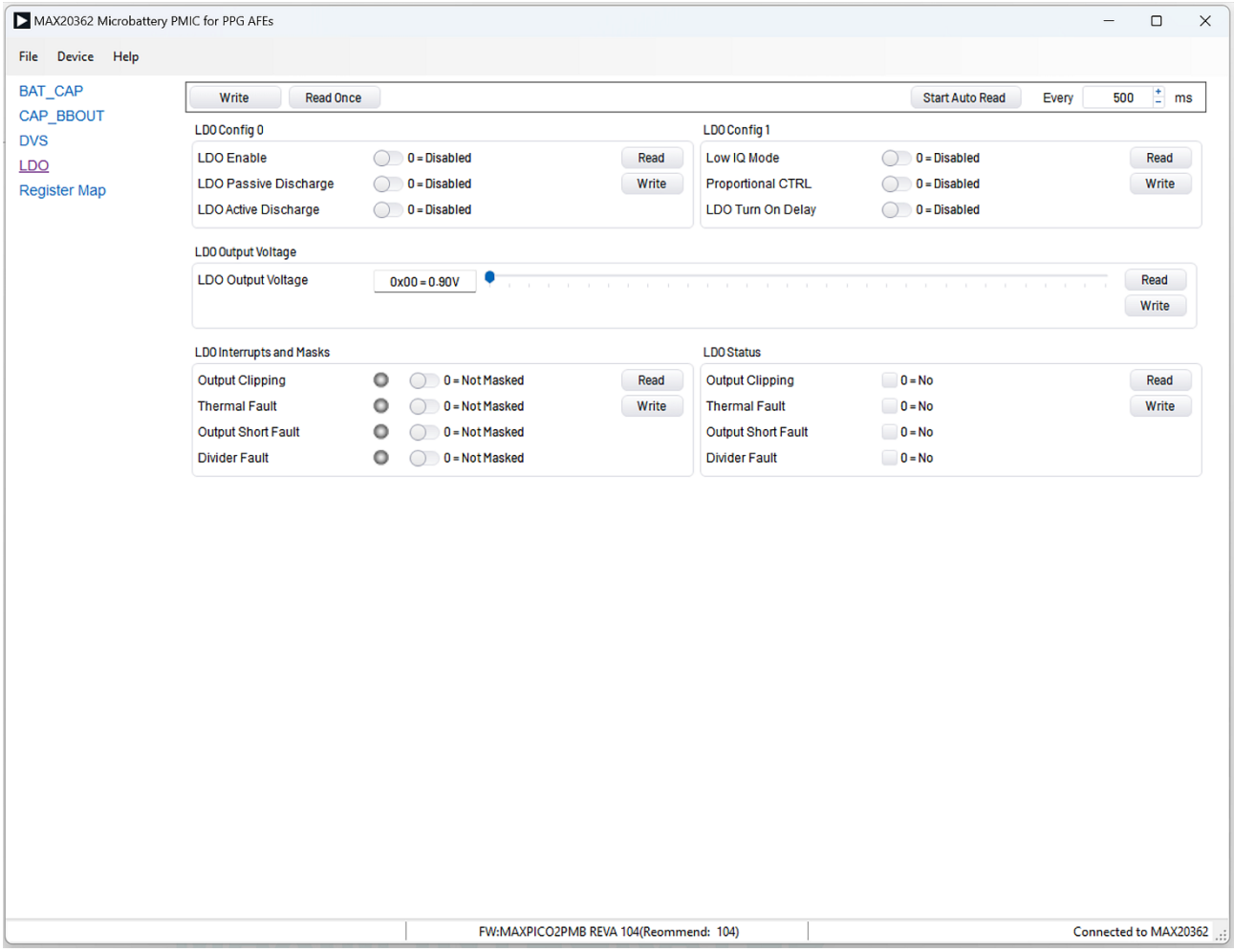


Figure 7. LDO Tab

Register Map Tab

The **Register Map** tab (see *Figure 8*) provides all names and values of MAX20362 registers. Click **Read All** on the top right corner to perform a burst read of all registers. The left table shows the register to be read from or written to. The right table contains descriptions for each register field of the selected 8-bit register. All bits, along with their field names, are displayed at the bottom of the page. To set a bit, click the bit label. **Bold** text represents logic 1, and regular text represents logic 0. To configure the changes to the device, click the **Write** button at the bottom right.

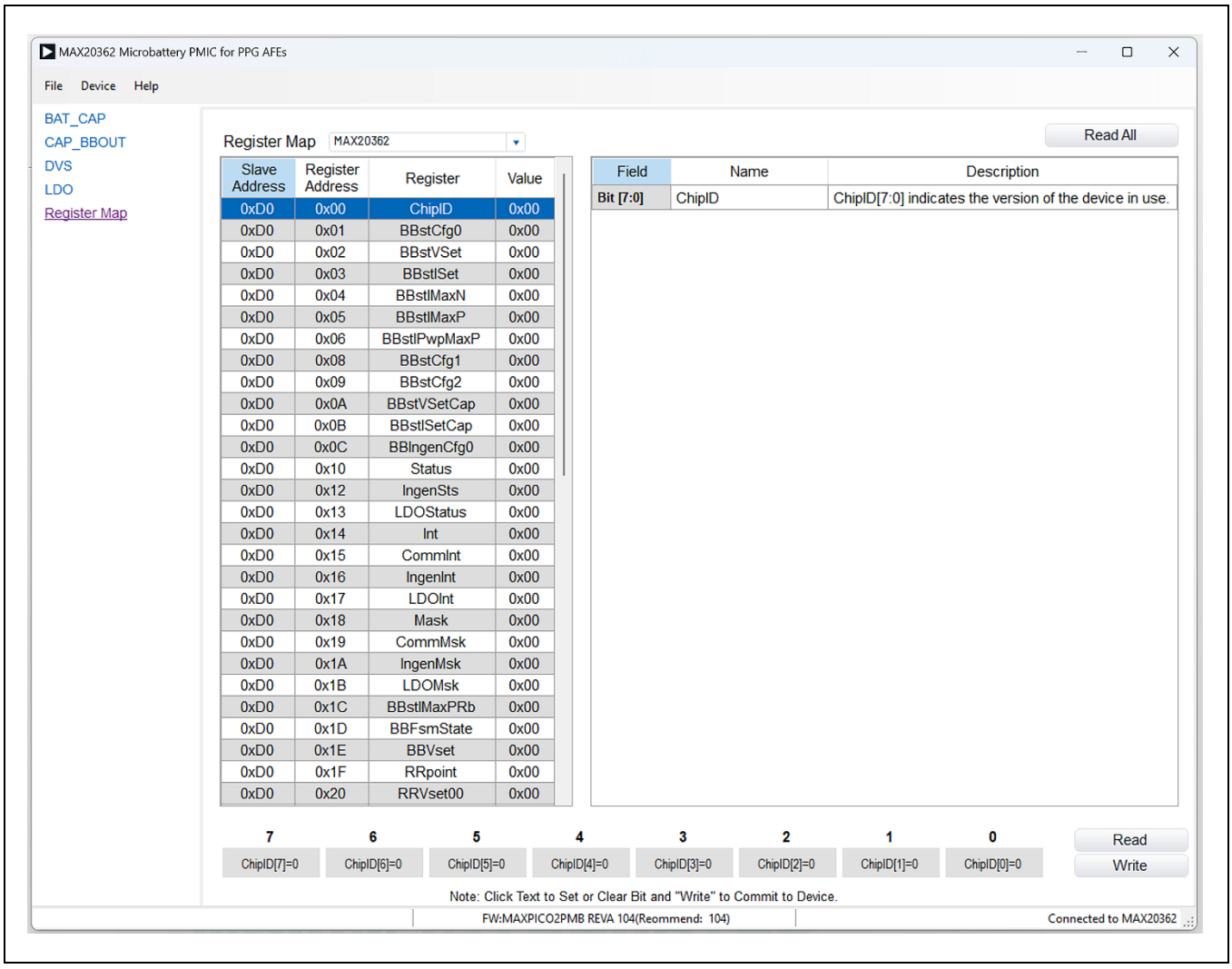


Figure 8. Register Map Tab

MAXPICO2PMB Firmware Update

This section covers the procedure to update the MAXPICO2PMB adapter board with the latest firmware by programming a firmware image file (**.bin**) onto the on-board MAX32625PICO microcontroller.

1) Put the board in maintenance mode by holding the button while the board is connecting to the computer. It can be easier to hold the button while inserting the USB cable at the computer end rather than the micro-USB connector end (see *Figure 9*).
2) If the board enters bootloader mode successfully, the LED on the board turns red, and the board appears to the computer as a USB drive named **MAINTENANCE**.
3) Drag and drop the firmware image file (**.bin**) into the **MAINTENANCE** drive, and the board then installs the new firmware.

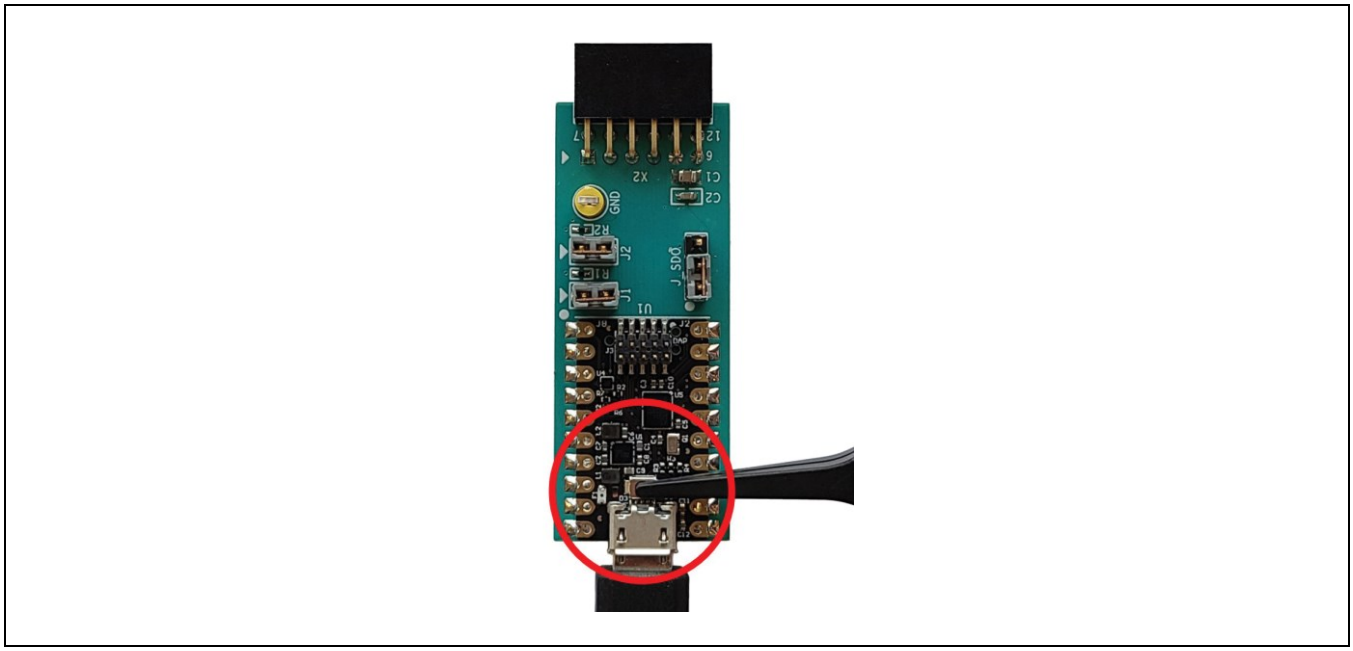


Figure 9. Enter Maintenance Mode

Ordering Information

PART	TYPE
MAX20362EVKIT#	EV Kit

#Denotes RoHS-compliance.

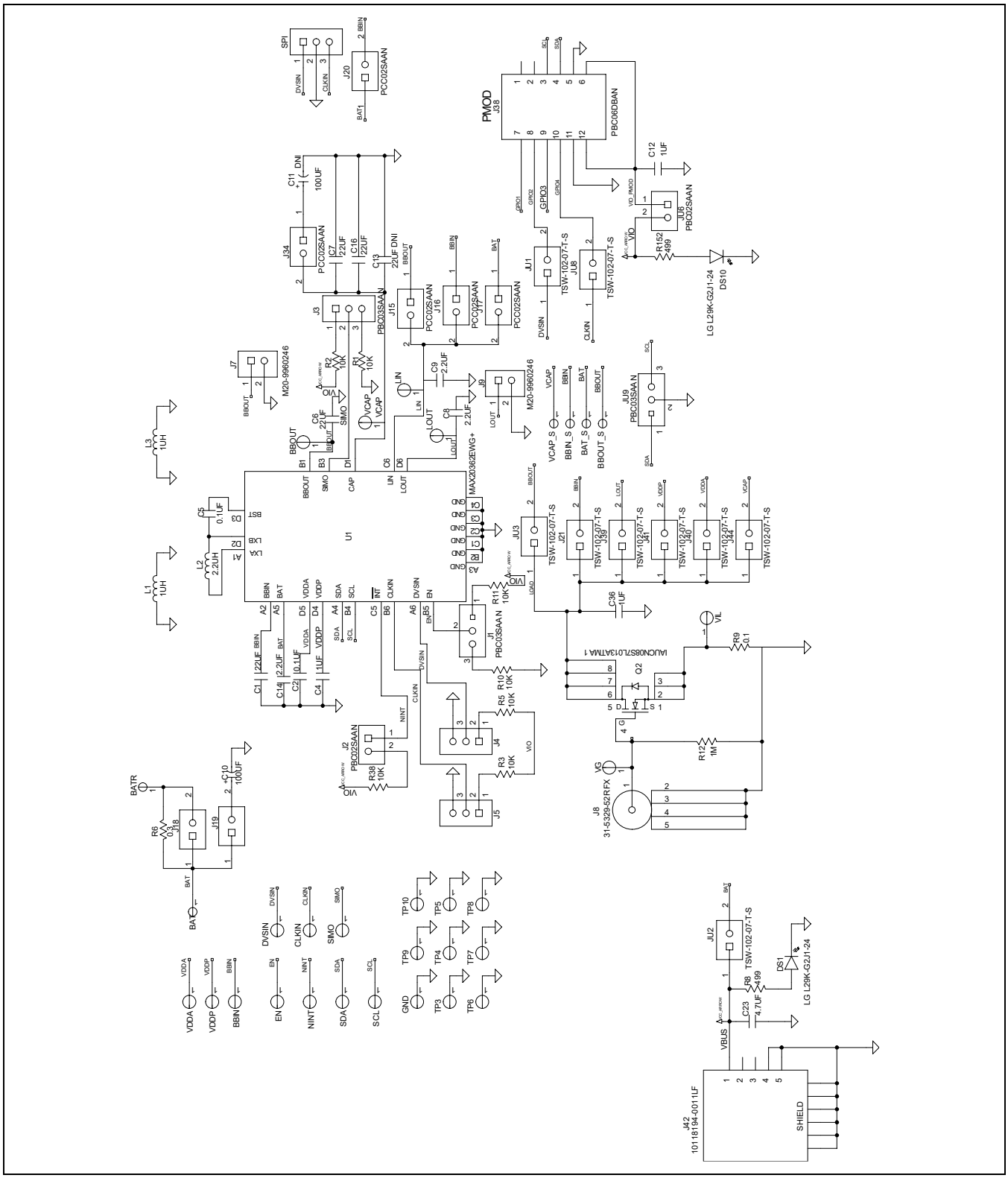
MAX20362 EV Kit Bill of Materials

ITEM	QTY	REF_DES	MFG PART NUMBER	MANUFACTURER	DESCRIPTION	VALUE
1	1	N/A	N/A	PCB MANUFACTURING	PCB	N/A
2	5	BAT, BBOUT, LIN, LOUT, VCAP	5005	KEYSTONE	TEST POINT; PIN DIAMETER = 0.125"; TOTAL LENGTH = 0.35"; BOARD HOLE = 0.063"; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH	5005
3	13	BATR, BBIN, CLKIN, DVSIN, EN, NINT, SCL, SDA, SIMO, VDDA, VDDP, VG, VIL	5002	KEYSTONE ELECTRONICS	CONN-PCB TEST POINT WHITE	WHT
4	4	BAT_S, BBIN_S, BBOUT_S, VCAP_S	5003	KEYSTONE	CONN-PCB TEST POINT; ORANGE	ORG
5	2	C1, C6	GRM155R60J226ME11D	MURATA	CAPACITORS; SMT (0402); 22µF; 20%; 6.3V; X5R; CERAMIC	22UF
6	1	C10	16TQC100MYF	PANASONIC	CAPACITOR; SMT (7343); 100µF; 20%; 16V; TANTALUM	100UF
7	1	C12	GRM188R60J105KA01D	MURATA	CAPACITOR; SMT (0603); 1µF; 10%; 6.3V; X5R; CERAMIC	1UF
8	2	C7, C16	GRM158R61A226ME15D	MURATA	CAPACITORS; SMT (0402); 22µF; 20%; 10V; X5R; CERAMIC	22UF
9	3	C8, C9, C14	GRM033R60J225ME47J	MURATA	CAPACITORS CERAMIC, 2.2µF; 6.3V; 20%; X5R; 0201	2.2UF
10	2	C2, C5	GRM011R60G104ME01L	MURATA	CAPACITORS; SMD; 008004; 0.1µF; 20%; 4V; X5R; CERAMIC	0.1UF
11	1	C23	GRM31CR71H475KA12	MURATA	CAPACITOR; SMT (1206); 4.7µF; 10%; 50V; X7R; CERAMIC	4.7UF
12	1	C36	CC0402KRX5R6BB105	YAGEO	CAPACITOR CERAMIC; 1µF; 10V; 10%; X5R; 0402	1UF
13	1	C4	GRM033C80G105ME05D	MURATA	CAPACITOR; SMD; 0201; 1µF; 20%; 4V; X6S; CERAMIC	1UF
14	2	DS1, DS10	LG L29K-G2J1-24	OSRAM	DIODE; LED; SMT (0603); Vf = 1.7V; If(test) = 0.002A; -40° TO +100°	LG L29K-G2J1-24
15	9	GND, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	5011	KEYSTONE ELECTRONICS	CONN-PCB TEST POINT BLACK	BLK

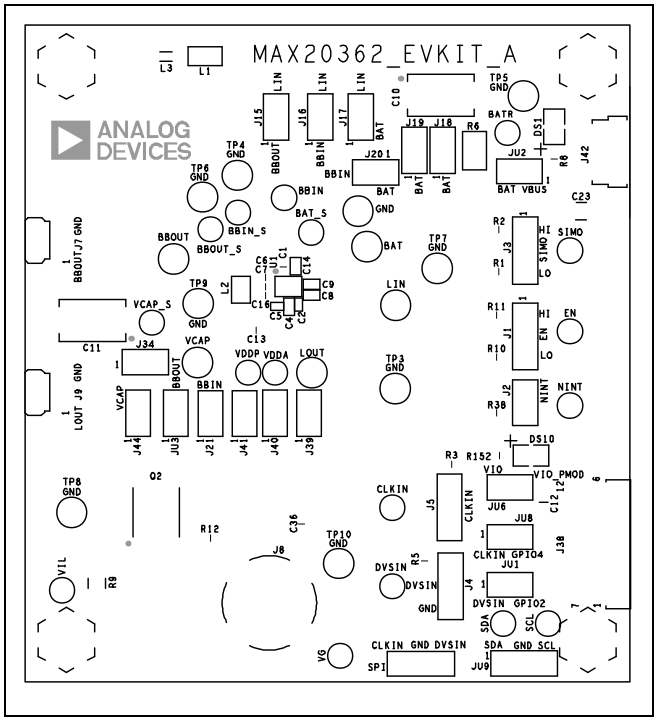
ITEM	QTY	REF_DES	MFG PART NUMBER	MANUFACTURER	DESCRIPTION	VALUE
16	3	J1, J3, JU9	PBC03SAAN	SULLINS	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS	PBC03SAAN
17	7	J15, J16, J17, J18, J19, J20, J34	PCC02SAAN	SULLINS	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS	PCC02SAAN
18	2	J2, JU6	PBC02SAAN	SULLINS	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	PBC02SAAN
19	9	J21, J39, J40, J41, J44, JU1, JU2, JU3, JU8	TSW-102-07-T-S	SAMTEC INC.	CONNECTOR; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 2P	TSW-102-07-T-S
20	1	J38	PBC06DBAN	SULLINS	CONNECTOR; MALE; THROUGH HOLE; PCB HEADER; RIGHT ANGLE; 12PINS	PBC06DBAN
21	3	J4, J5, SPI	PREC003SAAN-RC	SULLINS	CONNECTOR; MALE; THROUGH HOLE; HEADER; STRAIGHT; 3PINS	PREC003SAAN-RC
22	1	J42	10118194-0011LF	AMPHENOL	CONNECTOR; FEMALE; SMT; MICRO USB; INPUT OUTPUT CONNECTORS; B TYPE RECEPTACLE WITHOUT FLANGE; RIGHT ANGLE; 5PINS	10118194-0011LF
23	2	J7, J9	M20-9960246	HARWIN	CONNECTOR; MALE; THROUGH HOLE; PIN HEADER ASSEMBLY; M20 SERIES; RIGHT ANGLE; 2PINS	M20-9960246
24	1	J8	31-5329-52RFX	AMPHENOL	CONNECTOR; FEMALE; THROUGH HOLE; BNC 50OHM PCB RECEPTACLE; STRAIGHT; 5P	31-5329-52RFX
25	1	L1	DFE201210U-1R0M=P2	MURATA	INDUCTOR; SMD; 0805; 1µH; 20%; 2A; METAL ALLOY	1UH
26	1	L2	DFE201610E-2R2M	TOKO	INDUCTOR; SMT (2016); METAL ALLOY CHIP; 2.2µH; TOL = ±20%; 2.6A	2.2UH
27	1	L3	PLEA67BBA1R0M-1PT00	TDK	INDUCTOR; SMD; 0402; 1µH; 20%; 0.265 DCR	1UH
28	1	Q2	IAUCN08S7L013ATMA1	INFINEON TECHNOLOGIES	TRAN; NCH; SMD; PG-TDSON-8-53; 8P; OPTIMOS TM 7 POWER-TRANSISTOR; 219W; 80V; 293A; AEC-Q101	IAUCN08S7L013ATMA1
29	5	R1, R2, R10, R11, R38	RC0402FR-0710KL	YAGEO	RESISTORSI; SMD;10KΩ; 1%; 1/16W; 0402	10K
30	1	R12	CRCW04021M00FK	VISHAY DALE	RESISTOR; SMT (0402); 1M; 1%; ±100PPM/°C; 0.0630W	1M

ITEM	QTY	REF_DES	MFG PART NUMBER	MANUFACTURER	DESCRIPTION	VALUE
31	2	R8, R152	CRCW0402499RFK	VISHAY DALE	RESISTORS; SMT (0402); 499; 1%; ±100PPM/°C; 0.0630W	499
32	2	R3, R5	ERA-2AED103X	PANASONIC	RESISTORS; SMT (0402); 10K; 0.5%; ±25PPM/°K; 0.0630W	10K
33	1	R6	RCWE0805R300FK	VISHAY	RESISTOR; SMT (0805); 0.3; 1%; ±100PPM/°C; 0.2500W	0.3
34	1	R9	CRL1206-JW-R100ELF	BOURNS	RESISTOR; SMT (1206); 0.1; 1%; ±200PPM/°C; 0.2500W	0.1
35	1	U1	MAX20362AEWG+	ANALOG DEVICES	CUSTOM; IC; MICRO-BATTERY PMIC FOR PPG AFES; PACKAGE OUTLINE DRAWING: 21-100741; PACKAGE CODE: W241L2+1; WLP24	MAX20362AEWG+
TOTAL		93				

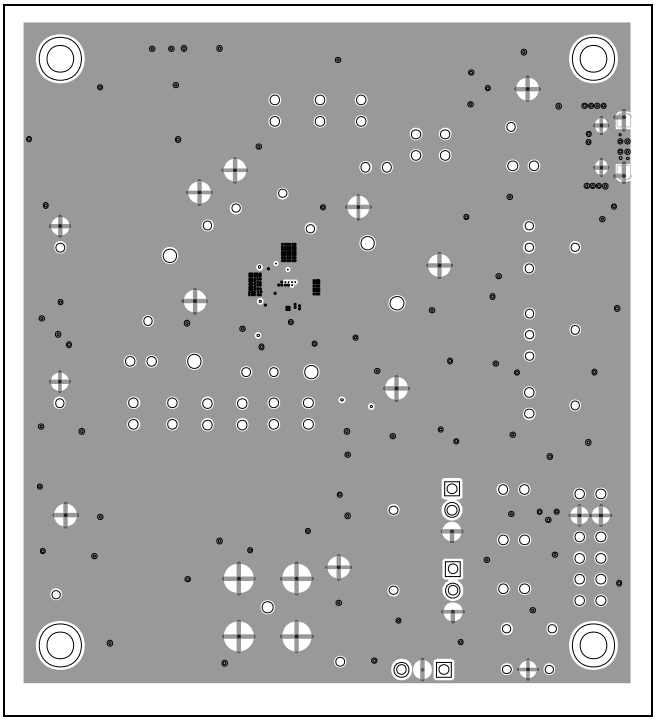
MAX20362 EV Kit Schematic



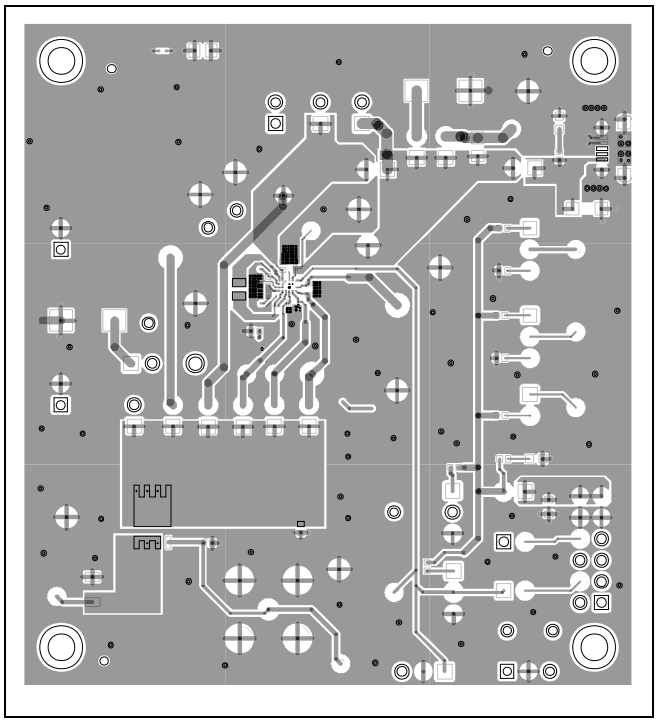
MAX20362 EV Kit PCB Layout



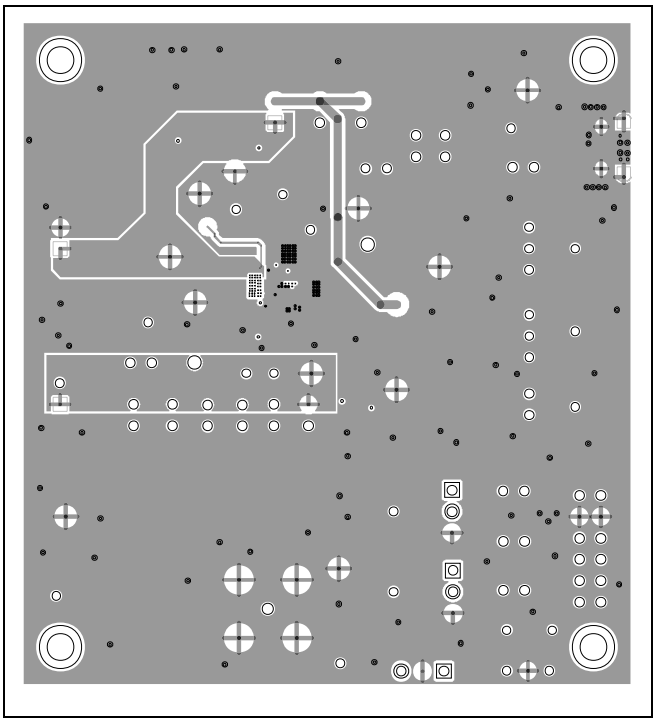
MAX20362 EV Kit Component Placement Guide—Top Silkscreen



MAX20362 EV Kit PCB Layout—Layer 2

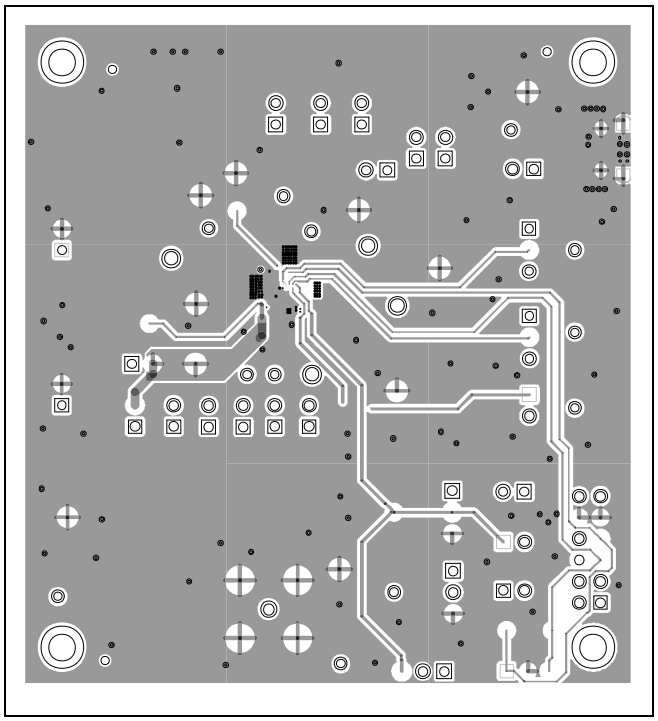


MAX20362 EV Kit PCB Layout—Top

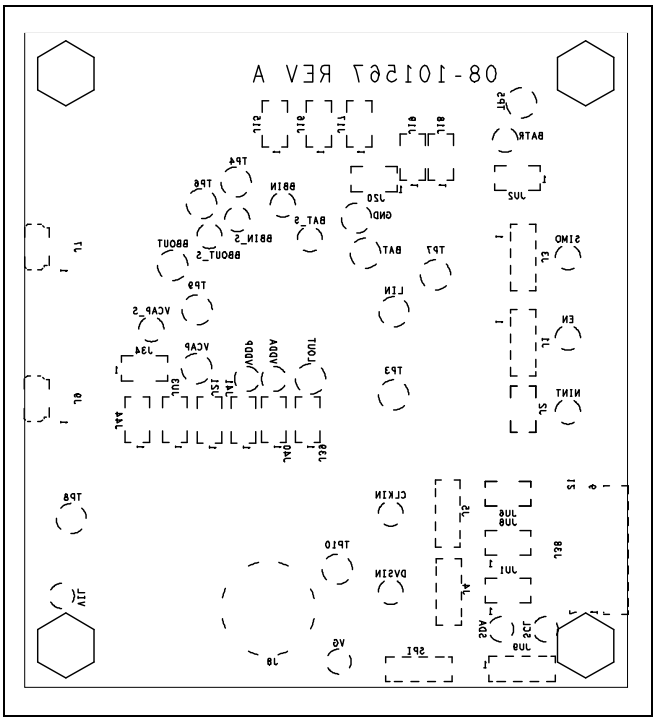


MAX20362 EV Kit PCB Layout—Layer 3

MAX20362 EV Kit PCB Layout (continued)



MAX20362 EV Kit PCB Layout—Bottom



MAX20362 EV Kit Component Placement Guide—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/26	Initial release	—

Notes