Click here to ask an associate for production status of specific part numbers.

MAXM86146 Evaluation System

General Description

The MAXM86146 evaluation system (EV system) allows for the quick evaluation of the MAXM86146 optical module for applications at various sites on the body, particularly the wrist. MAXM86146 supports UART, I^2C, and SPI compatible interfaces. MAXM86146 has two optical readout channels that operate simultaneously. The EV system allows flexible configurations to optimize measurement signal quality at minimal power consumption. It helps the user quickly learn about how to configure and use the MAXM86146.

The EV system consists of two boards. MAXSensor BLE# is the main data acquisition board while MAXM86146_OSB# is the sensor daughter board for MAXM86146. The EV system can be powered using the USB-C supply or LiPo Battery. The EV system comes with a MAXM86146CFU+.

Features

- Quick Evaluation of the MAXM86146
- Supports Optimization of Configurations
- Facilitates Understanding MAXM86146 Architecture and Solution Strategy
- Real-Time Monitoring
- Data Logging Capabilities
- On-Board Accelerometer
- Bluetooth LE

Quick Start

Required Equipment

- MAXM86146 EV system
- Data Acquisition EV system Micro-PCB (MAXSensorBLE#)
- MAXM86146 EV system sensor PCB (MAXM86146_OSB#)
- Flex cable
- USB-C cable
- MAXM86146 EV system GUI software
- MAXM86146 parser and user guide (included in MAXM86146GUISetupVxxx.ZIP)
- Windows system with a USB port and Bluetooth 4 with BLE supported on its hardware (Win BLE)
- Optional LiPo battery (LP-401230 suggested, not shipped with EV system)

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

Windows are registered trademarks and registered service marks of Microsoft Corporation.

Procedure

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

1) Visit **www.maximintegrated.com/evkit-software** to download the most recent version of the EV system software, MAXM86146GUISetupVxxx_Web.ZIP. Save the EV system software to a temporary folder and uncompress the ZIP file.
2) Enable bluetooth on user's Windows system/PC.
3) Open up MAXM86146GUISetupVxxx.exe and follow the instructions from the pop-up windows as shown in Figure 1 to Figure 7.
4) If the MAXM86146 EV system flex cable is not already connecting the data acquisition EV system micro PCB to the MAXM86146 sensor PCB, then connect the two PCBs with the cable as shown in Figure 8 and Figure 9.

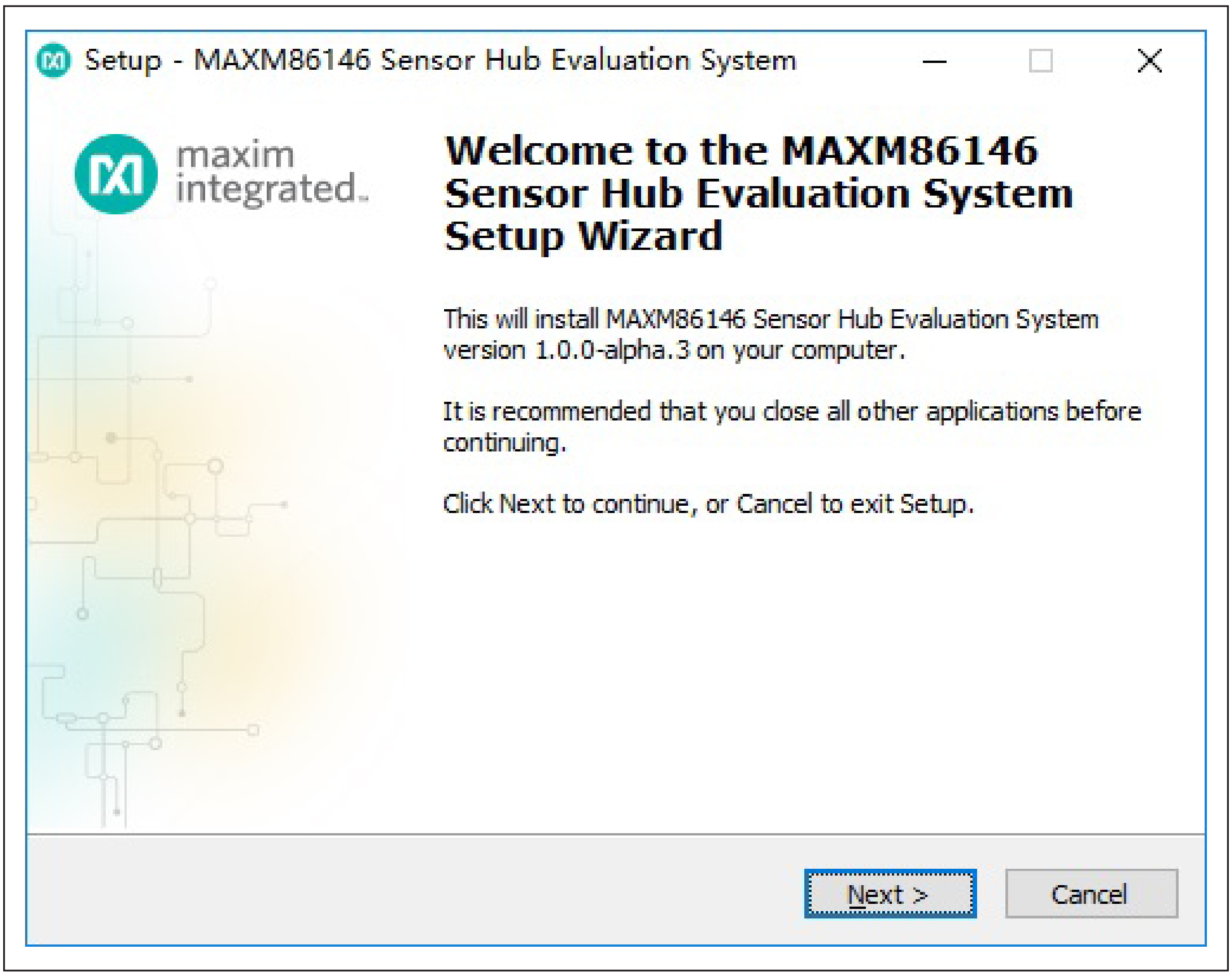


Figure 1. Setup MAXM86146 EV System GUI Software Step 1

5) Connect USB-C cable or LiPo battery to the data acquisition board to power up the EV system. If the LiPo battery is used, press the power switch (SW) to turn on/off the device. The green LED toggles, when the power is on.
6) Start the MAXM86146 EVSYS GUI program to open the **Connect to Device** window. Select a device and press the **Connect** button as shown in Figure 10.
7) The GUI then launches as shown in Figure 11.
8) Configure the EV system on the GUI and click the **Start** button on the bottom right side to start the data acquisition.
9) When running, the LEDs on the micro PCB should illuminate and the plots on the GUI should stream with data as shown in Figure 12 and Figure 13.

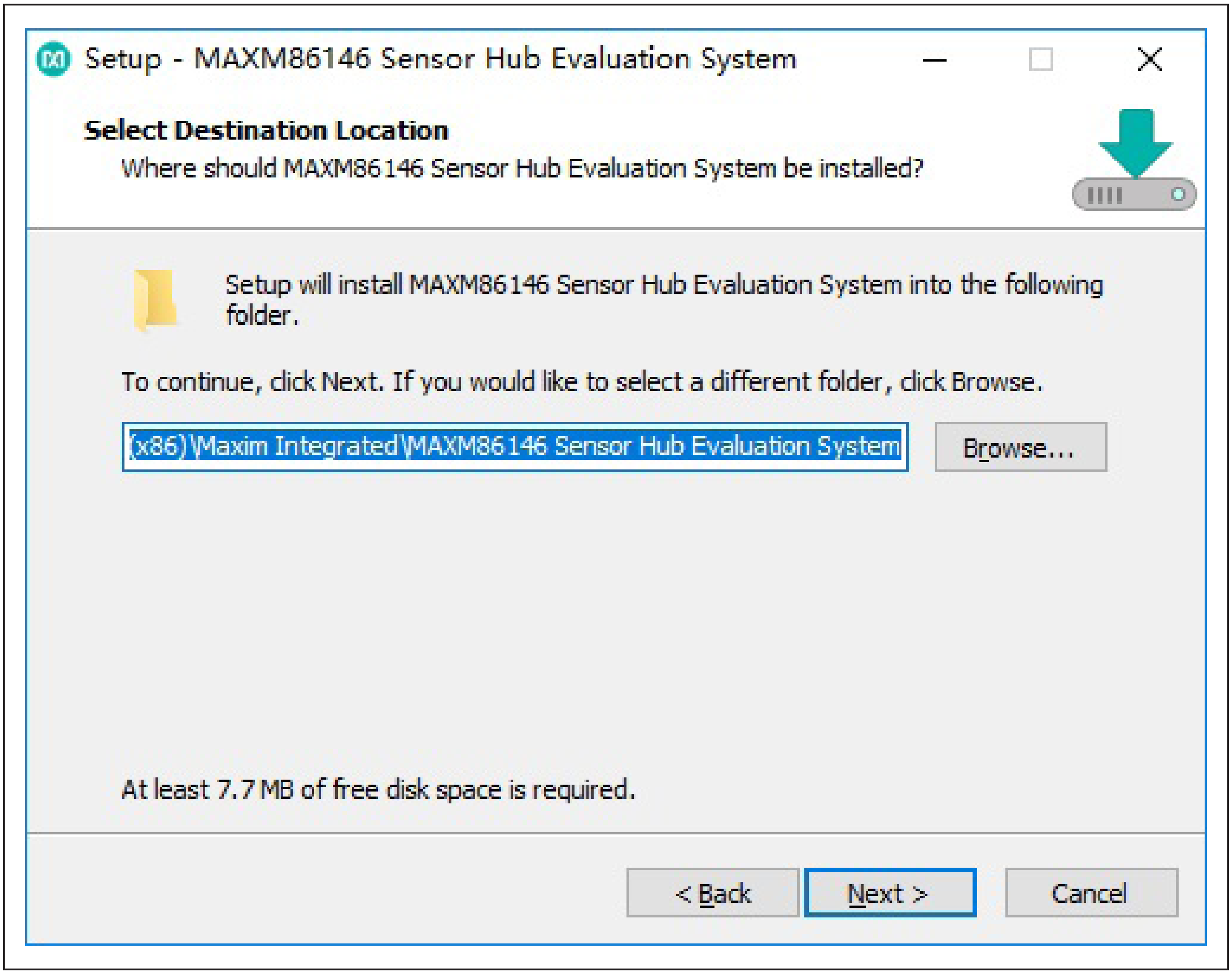


Figure 2. Setup MAXM86146 EV System GUI Software Step 2

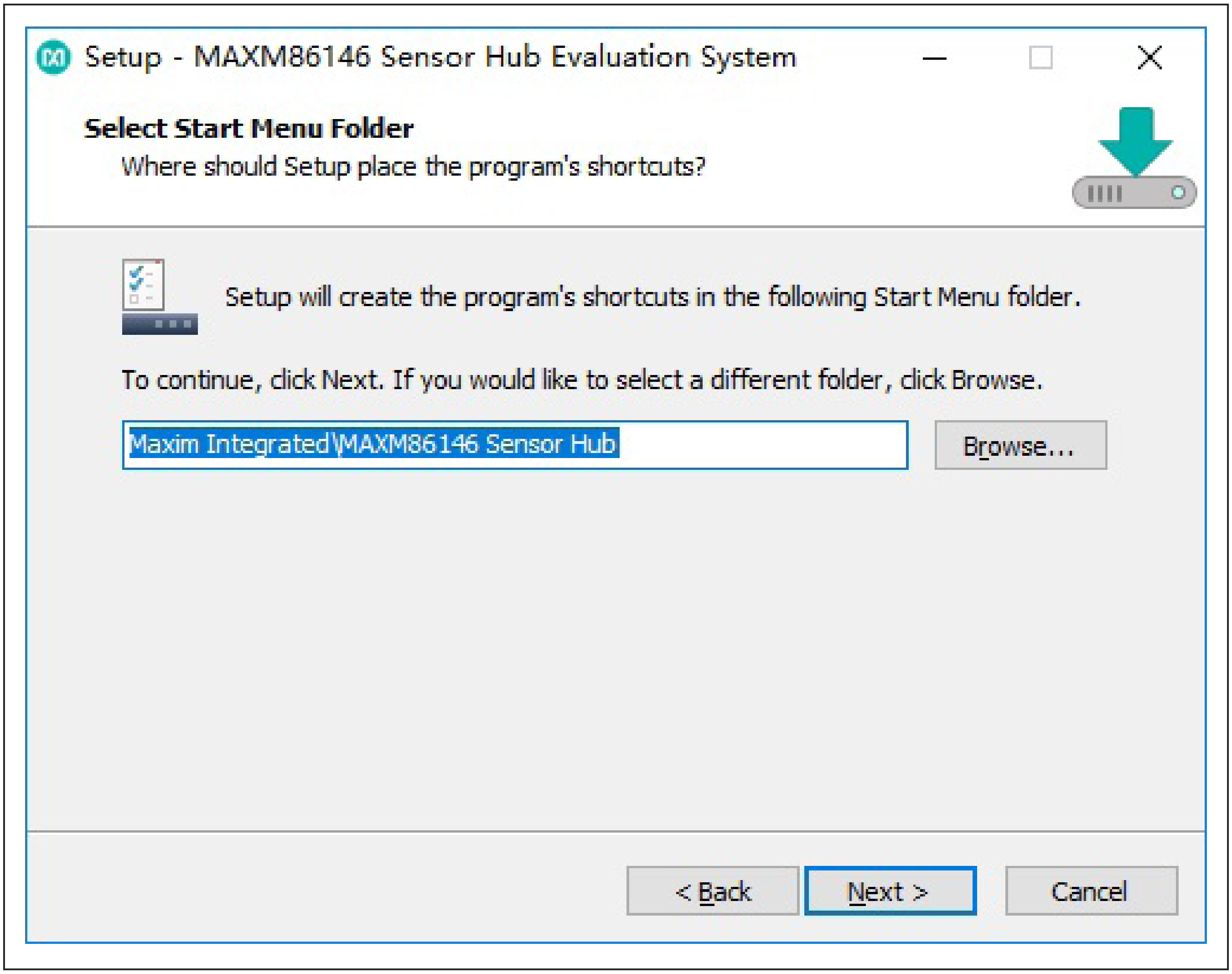


Figure 3. Setup MAXM86146 EV System GUI Software Step 3

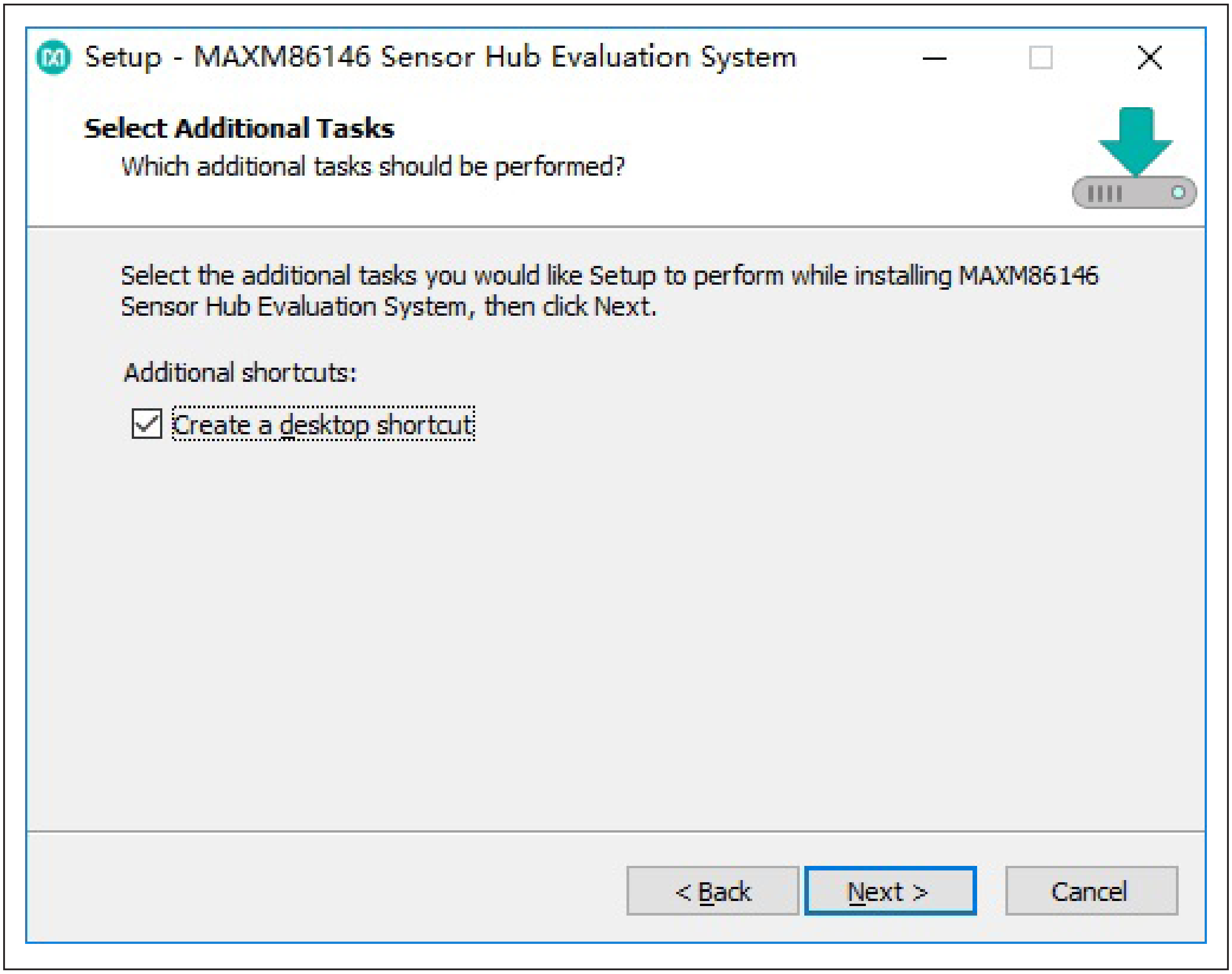


Figure 4. Setup MAXM86146 EV System GUI Software Step 4

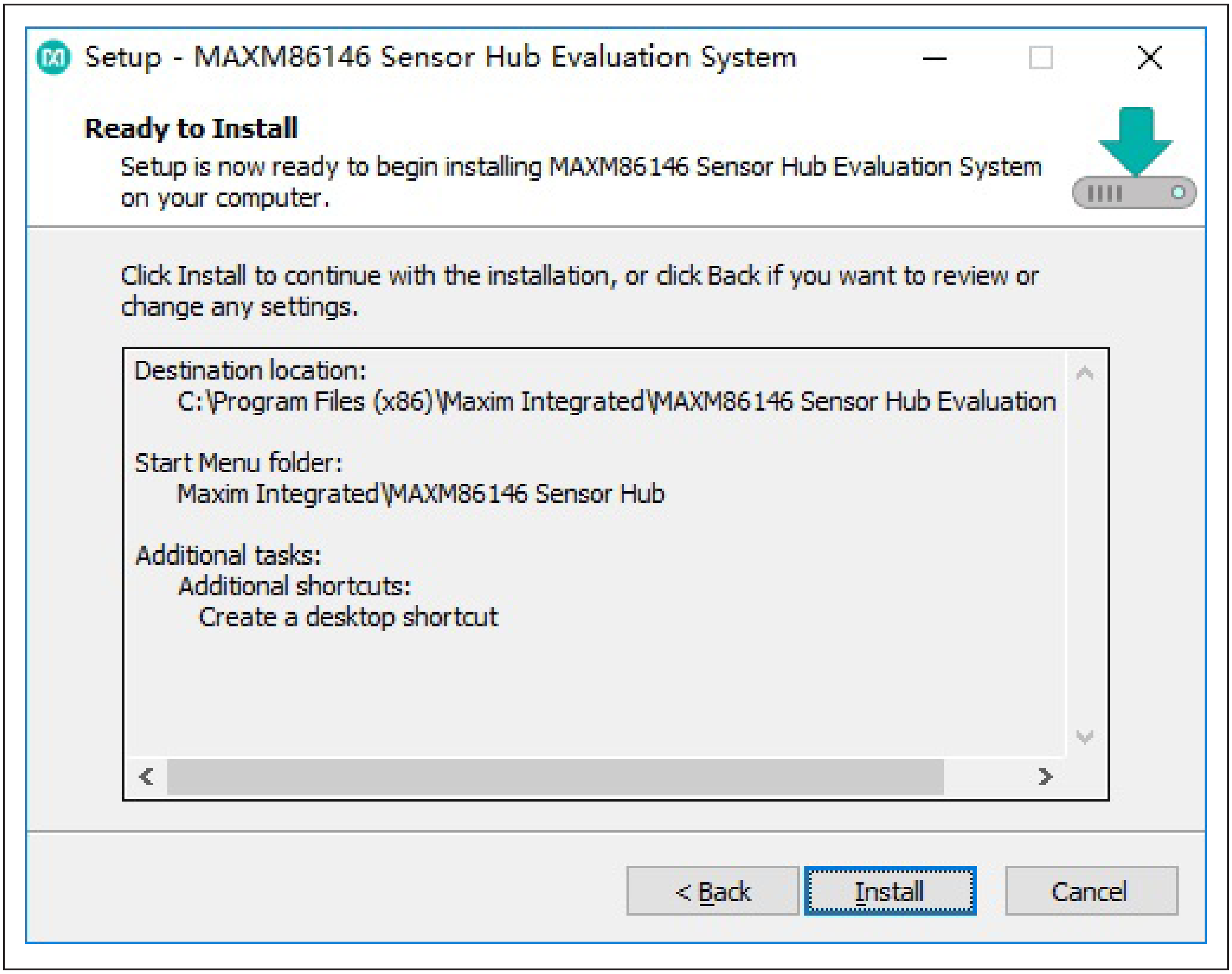


Figure 5. Setup MAXM86146 EV System GUI Software Step 5

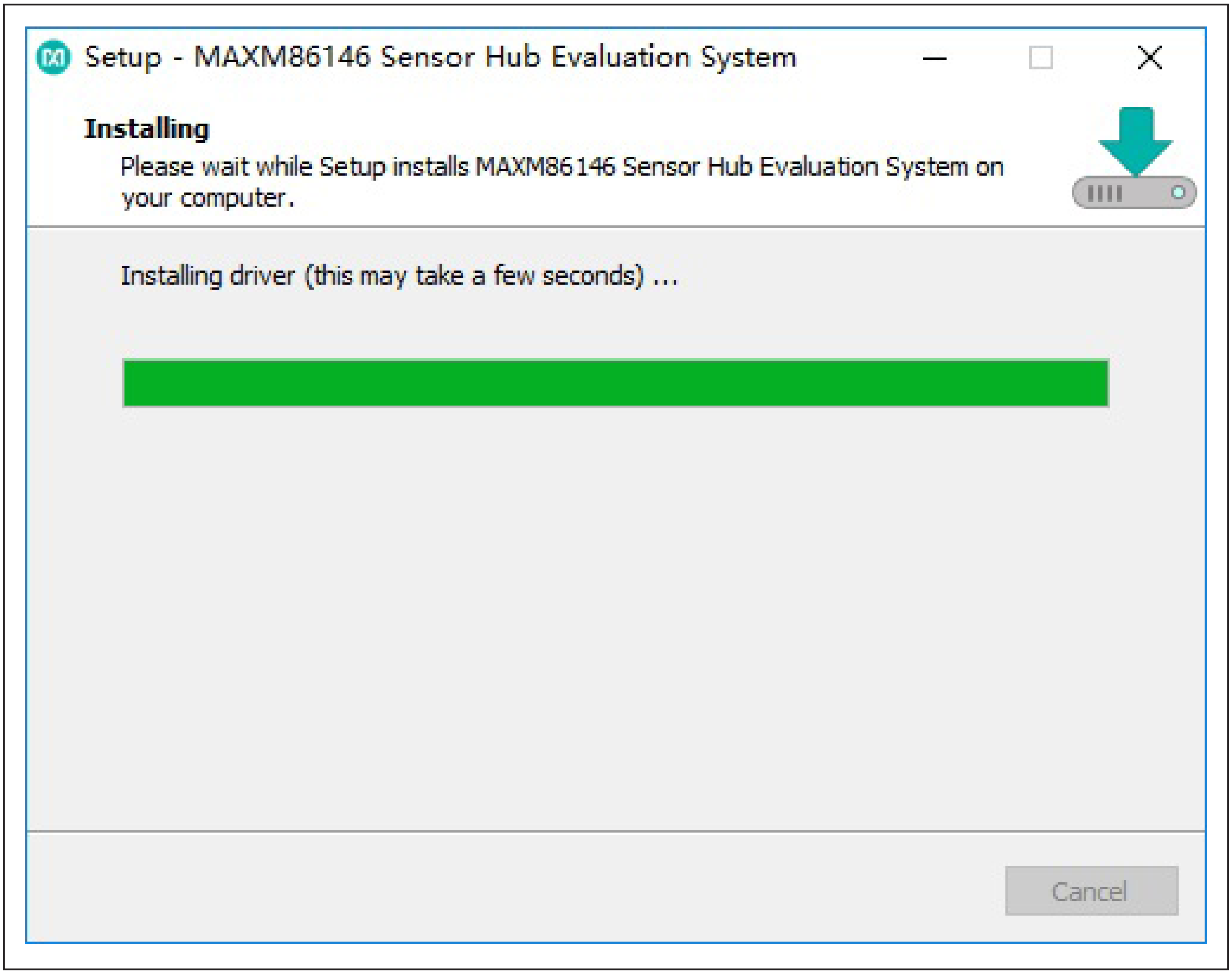


Figure 6. Setup MAX86140 EV System GUI Software Step 6

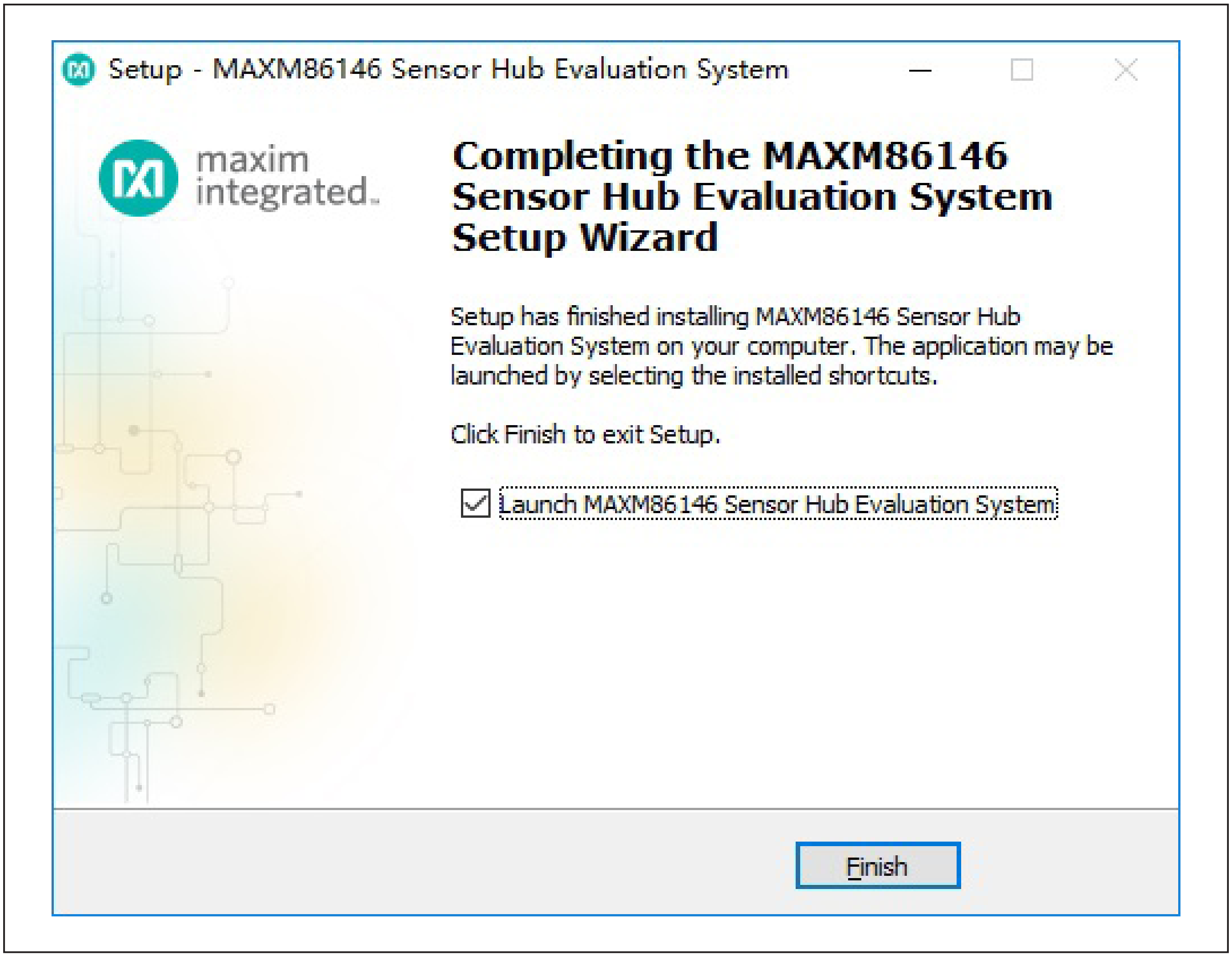


Figure 7. Setup MAXM86146 EV System GUI Software Step 7

Figure 8. Hardware Setup (MAXM86146 EV System Micro PCB)

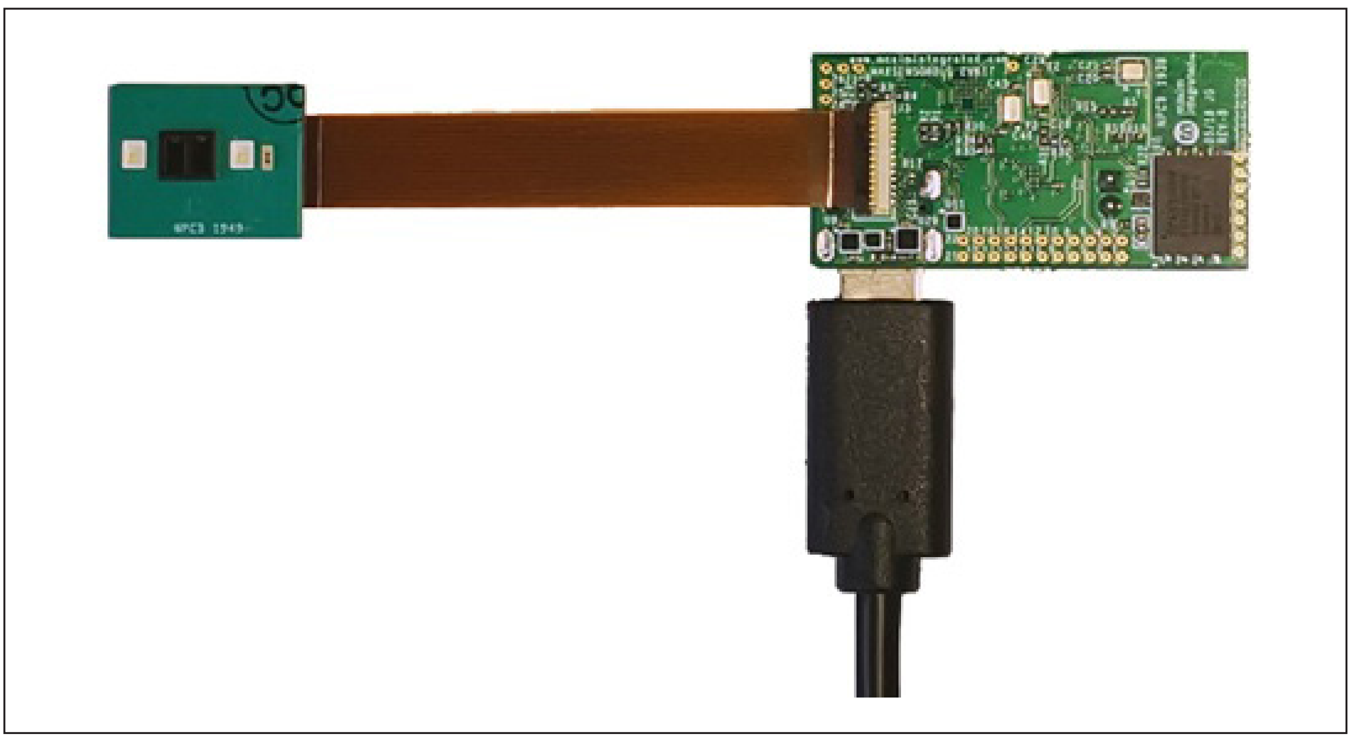


Figure 9. Hardware Setup (MAXM86146 EV System Sensor PCB)

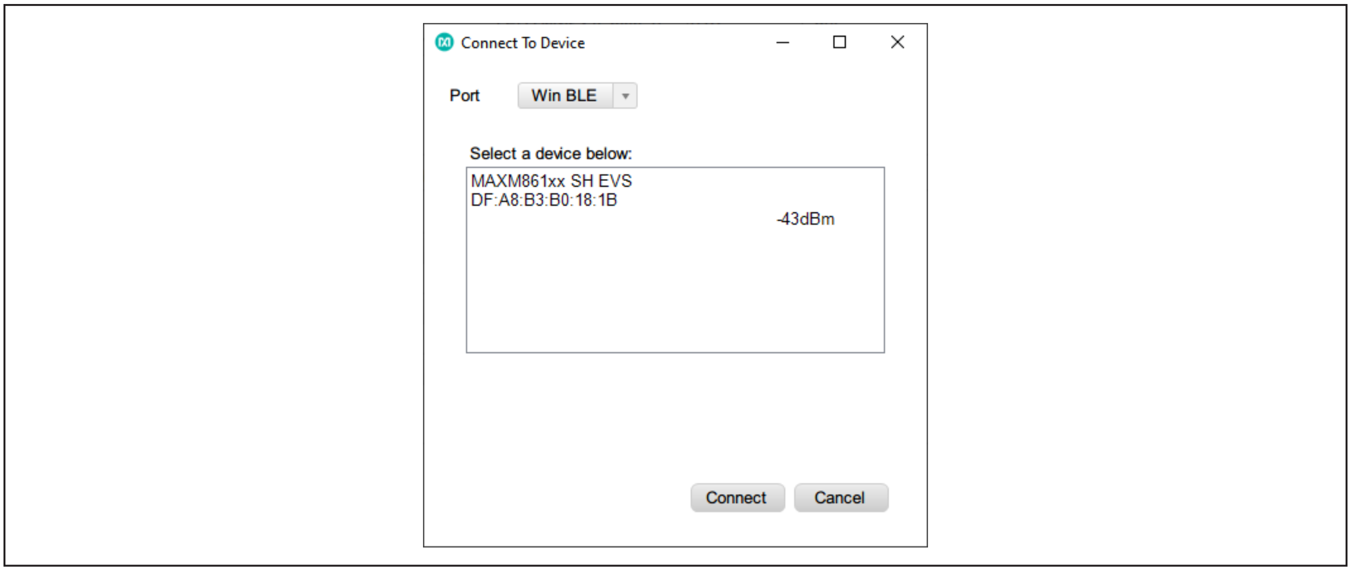


Figure 10. Connect to BLE Device

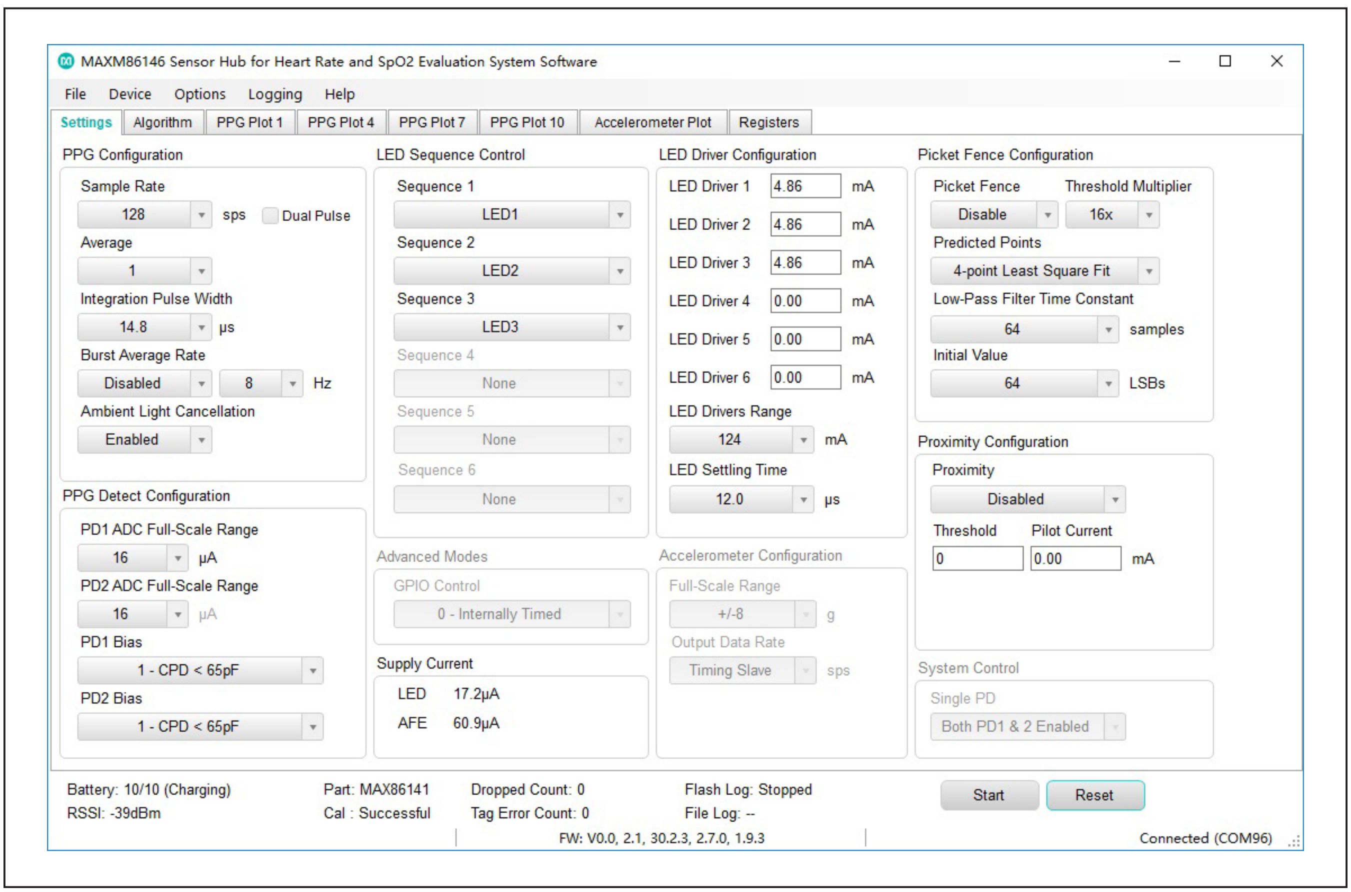


Figure 11. MAXM86146 EV System GUI Settings

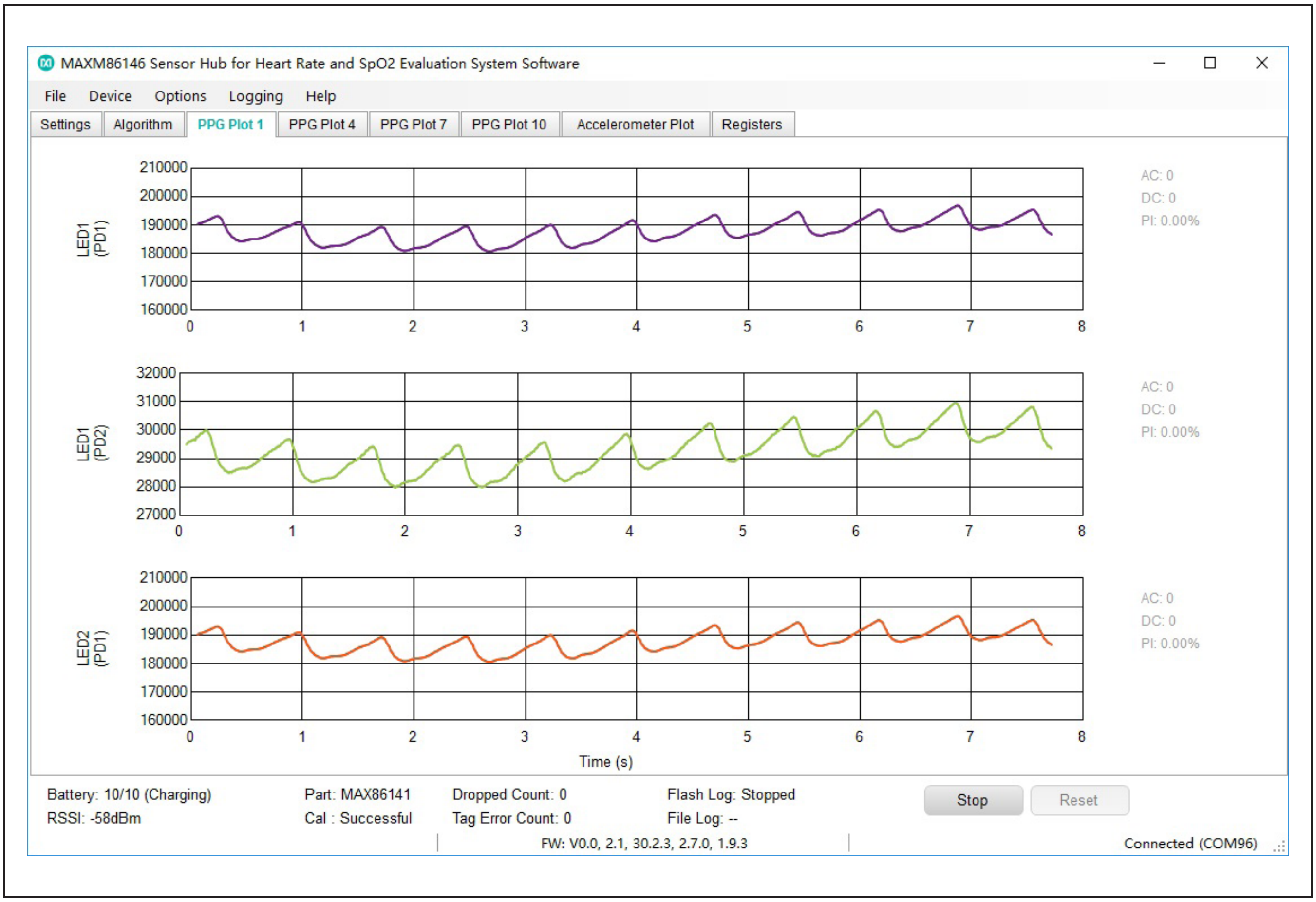


Figure 12. MAXM86146 EV System GUI (PPG Plots)

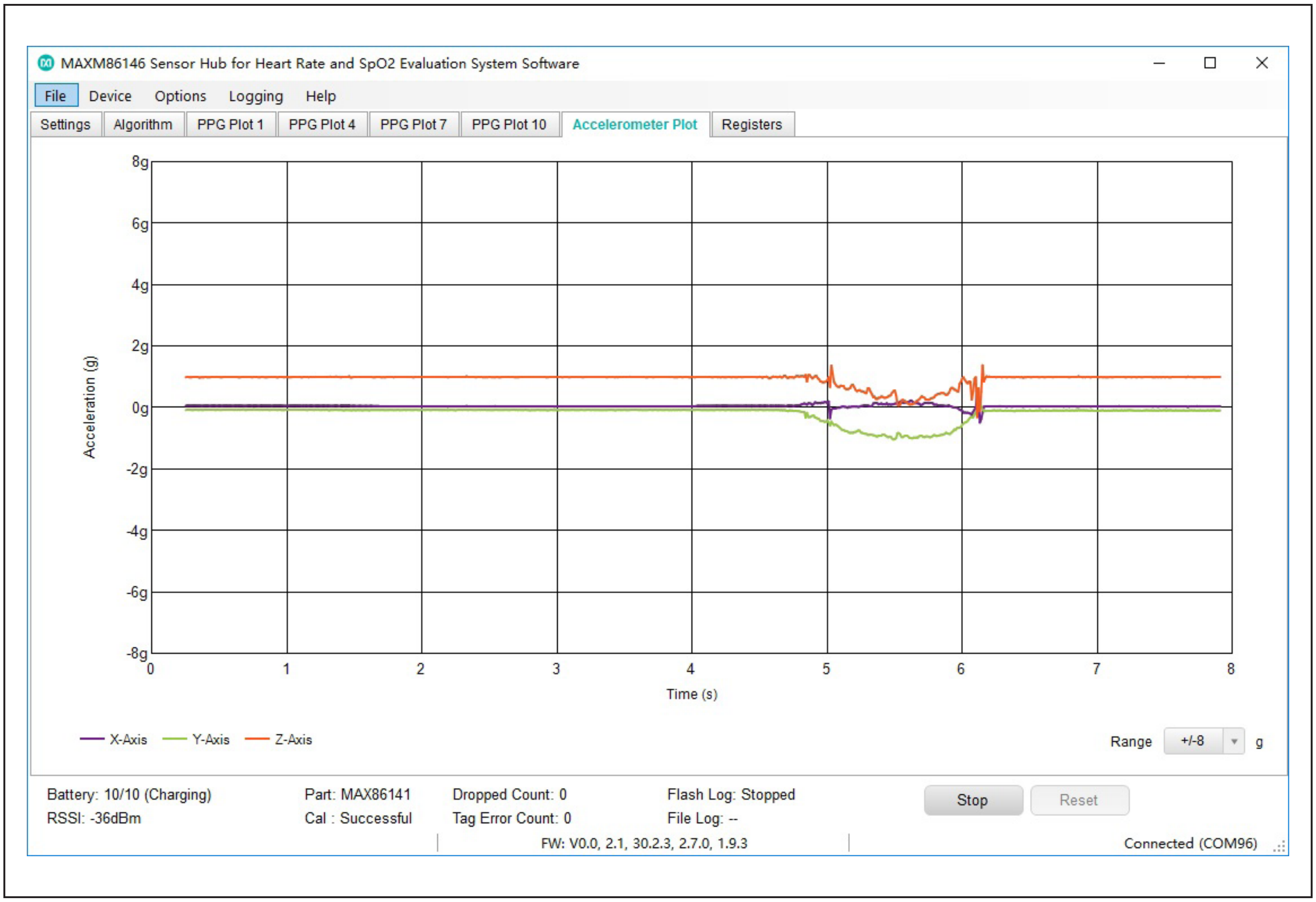


Figure 13. MAXM86146 EV System GUI (Accelerometer Plots)

Detailed Description of Software

The EV system includes one sensor PCB. It contains MAXM86146 optical module, a 3-axis accelerometer together, and 4 LEDs (in 3 LED packages). MAXM86146_OSB# comes with 1 Red/IR LED package (Osram SFH 7015) and 2 green LEDs (Osram CT DBLP31.12-6C5D-56-J6U6). The EV system allows raw optical and accelerometer data to be sampled and transferred to the GUI for both dynamic viewing and logging for later analysis. The EV system microcontroller PCB is used to do SPI to BLE communication, transporting the raw optical, and accelerometer data to the PC through BLE.

Most functionality of the MAXM86146 has been mapped to the GUI so the wide variety of applications supported by the MAXM86146 can be rapidly explored. The following is a brief description of this functionality options.

Sample Rate

The sample rate can take on values between 8sps to 4096sps. The dual pulse mode option are modes where the samples are unevenly spaced and averaged to improve the ambient rejection of mains line rate ambient signals.

Table 1 shows the maximum supported sampling rates (in sps) for the MAXM86146 for the given number of exposure sequences and use of accelerometer. The maximum sample rate is limited by the BLE protocol, not the AFE itself.

For a given sample rate, the number listed can be increased to the next available MAXM86146 sample rate (i.e., 500sps–512sps).

Table 1. MAXM86146 Max Sample Rates (sps)

ACCELEROMETER	WITH	WITHOUT
NUMBER OF SEQUENCES		
1	500	1000
2	250	500
3	125	250
4	125	125
5	125	125
6	62.5	125

Integration Pulse Width

The pulse width setting adjusts the integration time of an exposure. The MAXM86146 supports exposure integration times of 14.8μs, 29.4μs, 58.7μs, and 117.3μs. The exposure pulse width is a critical parameter in any optical measurement. The Longer exposures allow for more optical photons to be integrated but also increase the system power and reduce the ambient rejection capability.

Burst Rate

When burst mode is disabled, PPG data conversions are continuous at the sample rate defined by PPG_SR register. When Burst mode is enabled, a burst of PPG data conversions occurs at the sample rate defined by sample rate (PPG_SR) register. Number of conversion in the burst is defined by the SMP_AVE register. Average data from the burst of data conversions are pushed to the FIFO at the rate of burst average rate. The burst repeats at the rate of 8Hz, 32Hz, 84Hz, or 256Hz can be configured in burst average field. The burst average rate field defines the rate at which data is pushed into the FIFO. If the number of conversions cannot be accommodated, the device uses the next highest number of conversions. If the effective sample rate is too slow to accommodate the burst rate programmed, BURST_EN is automatically set to 0, and the device runs in continuous mode.

Ambient Light Cancellation

The on-chip ambient light cancellation incorporates a proprietary scheme to cancel ambient light generated photo diode current, allowing the sensor to work in high ambient light conditions.

ADC Full-Scale Range

The MAXM86146 optical channel has 4 full-scale ranges. These ranges are 4μA, 8μA, 16μA, and 32μA.

Sample Average

The MAXM86146 has the capability to do sample averaging of 2 ~ 128 samples internally. This feature is useful if more optical energy is needed to make a low perfusion measurement but the data rate across the interface or the processing power in a host micro is not desirable. This mode is also useful to further suppress the mains line noises in indoor lighting conditions.

PD Bias

The MAXM86146 provides multiple photo diode biasing options. These options allow the MAXM86146 to operate with a large range of photo diode capacitance. The PDBIAS values adjust the PD_IN bias point impedance to ensure that the photo diode settles rapidly enough to support the sample timing. PDBIAS is configured depending on the capacitance (CPD) of the photodiode used.

LED Sequence Control (FIFO Time Slots)

The LED sequence control specifies the data acquisition sequence that the internal state machine controller follows and where the converted data is mapped into the FIFO.

Each FIFO field can be applied to one measurement. acquired data can be from LED1, LED2, or LED3 (optical exposure from LED1~3) illuminated independently. The LED1 & LED2, LED1 & LED3, LED2 & LED3, and LED1 & LED2 & LED3 are optical exposures from LEDs illuminated simultaneously. The other options are Ambient (optical data with no exposure, just ambient illumination) or None (skip this acquisition). The LED4–6 (Mux Control) are not supported with the sensor PCB. If a custom sensor board with MUX is used, LED4, LED5, and LED6 can also be configured. Only LED1, LED2, and LED3 are available in this EV system.

The exposure sequence is the entry in sequence 1 (LEDC1) slot, sequence 2 (LEDC 2) slot, sequence 3 (LEDC3), sequence 4 (LEDC4), sequence 5 (LEDC5) slot then sequence 6 (LEDC6) slot. This sequence repeats for each sample instance. Each Sequence if programmed, will be plot in the PPG Plot x tabs respectively as shown in Figure 12.

Refer to the MAXM86146 data sheet under *FIFO Configuration* section for details.

LED Driver Configurations

Each of the three LED drivers has a range and peak LED current setting. There are 4 full-scale range settings 31mA, 62mA, 93mA, and 124mA. Each range has an 8-bit current source DAC. The peak LED current box allows for an actual current to be entered. The nearest available DAC current is selected and displayed in the field.

LED Settling Time

The LED settling time is the time prior to the start of integration (pulse-width setting) that the LED is turned on. There are four settlings, 12μs, 8μs, 6μs, and 4μs. This time is necessary to allow the LED driver to settle before integrating the exposure photo current.

GPIO Control

Various options of GPIO controls are available on MAXM86146. For the EV system, when set to GPIO options 2, the sample rate is triggered by the on-board accelerometer.

Please refer to the MAXM86146 data sheet under *GPIO Configuration* section for details.

Accelerometer Configuration

The on-board accelerometer can be enabled or disabled by using the GUI. Supported accelerometer full-scale range are ±2g, ±4g, ±8g, and ±16g. The output data of the accelerometer can also be configured from 15.63Hz to 2000Hz when used with GPIO control option 2.

Picket Fence Configuration

Under typical situations, the rate of change of ambient light is such that the ambient signal level during exposure can be accurately predicted and high levels of ambient rejection are obtained. However, it is possible to have situations where the ambient light level changes extremely rapidly, for example when in a car with direct sunlight exposure passes under a bridge and into a dark shadow. In these situations, it is possible for the on-chip ambient light correction (ALC) circuit to fail and produce and erroneous estimation of the ambient light during the exposure interval. The optical controller has a built-in algorithm, call the picket fence function, that can correct for these extreme conditions resultant failure of the ALC circuit.

Refer to the MAXM86146 data sheet under *Picket Fence Detect-and-Replace Function* section for details.

Proximity Configuration

The optical controller also includes an optical proximity function which could significantly reduce energy consumption and extend battery life when the sensor is not in contact with the skin.

Refer to the MAXM86146 data sheet under *Proximity Mode* section for details.

System Control

When the MAXM86146 is used, it uses Dual PD simultaneously (PD1 and PD2). The data log shows data from both PD for each configured sequence.

Start and Stop Button

The **Start Monitor** button is used to start data acquisition from the demo. The **Start Monitor** button is only effective when the EV system is connected and detected. Once the Start has been pushed the **Stop** button appears, which can be used to stop the acquisition. Once the acquisition has started, all settings are locked. Terminate the acquisition to change any settling.

Reset Button

The **Reset** button clears out all register settlings back to the programs start up.

Data Logging

Raw optical and accelerometer data can be logged from the **Logging** pulldown menu item. There are two options available: Data saved to file or in the flash. When file data logging is selected, the GUI asks for a folder location where the logging file is saved. Create a new folder or accept the default. Data logging starts on the next **Start** button and continues until the **Stop** button is pressed. The final file write is only done when the **File** pulldown menu item is accessed and the data-logging button is pressed.

Flash logging allows raw sensor data to be stored to the integrated 32MB flash memory chip in a binary file format. The max duration for flash logging is dependent on: sample rate, number of optical channels, and use of accelerometer.

The GUI enables/disables flash logging. It can be disconnected while flash logging, allowing for remote operation (PPG plots not available). Preparing the flash memory can take up to 30s after enabling. If the flash memory fills or battery power drops too low, flash logging automatically stops and the file closes. Only one file can be saved at a time. The file must be downloaded since it is erased on the next log request.

If a log has completed, a binary file is found on the device. The binary log file must be downloaded via the USB-C cable; it cannot be downloaded through BLE. When the device is plugged into the PC, it enumerates as a USB mass storage device. However, the file can only be copied from this device. No other operations (such as deleting or saving other files) works on this device. Copy the file to a local PC volume. Then run the parser to generate a CSV file.

Refer to the Evaluation Kit Parser User Guide (MAX8614x demo + eval kit parser user guide 20170719.pdf) for the details operation.

Register Map Access

Under the **Registers** tab the user can access to sensor register map as shown in Figure 14. Click the **Read All** button, to read all the register value currently in configured in the Optical AFE. Bolded font bits are logic one. Normal font bits are logic zero. Click on the bits to toggle their value and click on **W** to write the value to the device. The register value does not change until **W** is clicked. Click **R** to read the register value to verify the write.

Detailed Description of Hardware

Status LED Indicators

The on-board tri-color LEDs are use as status indicator.

LED Green

Toggling (1Hz 50% duty cycle) = BLE advertising

Toggling (1Hz 10% duty cycle) = BLE connected

LED Red

USB-C cable connected to charger

On = charging

Off = charge complete

Flash Logging

On = busy preparing the flash memory or flash memory is full toggling (synchronously with the green LED) = logging

Off = not logging

Note that flash logging indication takes precedence over the charging indication. I.e., if the device is plugged into a charger, the red LED indicates charge status. If flash logging is enabled while plugged into the charger, the red LED indicates flash log status.

Power Switch

Press the power switch (SW) to turn on/off the device. When powered on, the green LED toggles per the LED indicator section. When powered off, the green LED goes out. The red LED may light temporarily, indicating that the flash log is closing. Plugging in the USB-C cable is also power up the device.

Battery/Charging

Use the USB-C cable to charge the integrated single-cell LiPo battery. The integrated PMIC initiates and stops charging automatically. Charge status is indicated through the red LED and GUI.

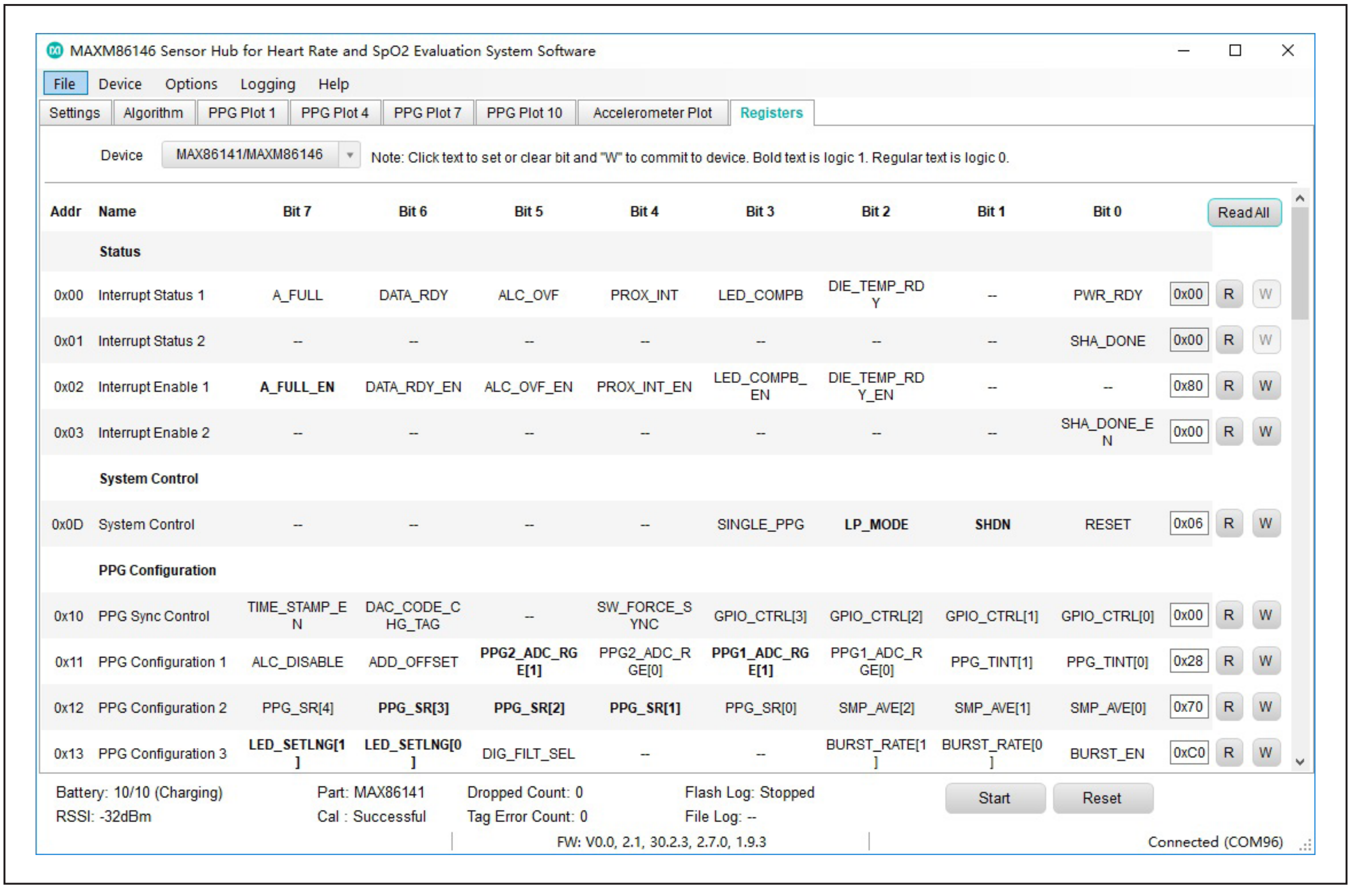


Figure 14. Register Map Access

Ordering Information

PART	TYPE
MAXM86146EVSYS#	EV system

#Denotes RoHS compliance.

Component List

MAXM86146 EV System

PART	QTY	DESCRIPTION
MAXSensorBLE#	1	MAXM86146 EV System µC PCB
MAXM86146_OSB#	1	MAXM86146 EV System sensor PCB
150150225	1	Molex, flex cable, 25 pin
101181XX-000XXX	1	USB-C to USB-A cable, 3ft

MAXM86146 EV System Bill of Materials

MAXSensorBLE#

ITEM	QTY	REF DES	DNI/DNP	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	1	A1	—	2450AT18A100	JOHANSON TECHNOLOGY	2450AT18A100	ANTENNA; 2450AT SERIES; BOARDMOUNT; MINI 2.45 GHZ ANTENNA; 2450MHz
2	1	BAT	—	B2B-PH-K-S(LF)(SN)	JST MANUFACTURING	B2B-PH-K-S(LF)(SN)	CONNECTOR; MALE; THROUGH HOLE; PH CONNECTOR; 2MM PITCH; SHROUDED HEADER; STRAIGHT; 2PINS
3	11	C1, C22, C26, C30-C37	—	GRM033R61A104KE15; LMK063BJ104KP	MURATA;TAIYO YUDEN	0.1μF	CAPACITOR; SMT (0201); CERAMIC CHIP; 0.1μF; 10V; TOL=10%; MODEL = ; TG = -55°C TO +125°C; TC = X5R
4	9	C2, C15, C25, C38-C43	—	GRM033R61A105ME15	MURATA	1μF	CAPACITOR; SMT (0201); CERAMIC CHIP; 1μF; 10V; TOL = 20%; TG = -55°C TO +85°C; TC = X5R
5	7	C3, C4, C8, C9, C12, C16, C27	—	ZRB15XR61A475ME01; CL05A475MP5NRN; GRM155R61A475MEAA; C1005X5R1A475M050BC	MURATA;SAMSUNG; MURATA;TDK	4.7μF	CAPACITOR; SMT (0402); CERAMIC CHIP; 4.7μF; 10V; TOL=20%; TG = -55°C TO +85°C; TC = X5R
6	7	C5-C7, C10, C13, C14, C47	—	GRM155R60J226ME11	MURATA	22μF	CAPACITOR; SMT (0402); CERAMIC CHIP; 22μF; 6.3V; TOL = 20%; TC = X5R ; NOTE: THESE PARTS HAVE 52 WEEKS LEAD TIME; MANUFACTURING DELAYS HAVE BEEN REPORTED ON THIS PRODUCT
7	1	C19	—	GJM0335C1E1R0WB01	MURATA	1PF	CAPACITOR; SMT (0201); CERAMIC CHIP; 1PF; 25V; TOL = 0.05PF; TG = -55°C TO +125°C; TC = C0G
8	7	C20, C21, C28, C29, C45, C46, Z44	—	GRM0335C1H120GA01	MURATA	12PF	CAPACITOR; SMT (0201); CERAMIC CHIP; 12PF; 50V; TOL = 2%; TG = -55°C TO +125°C; TC = C0G
9	2	C23, C24	—	GRM0335C1H101JA01	MURATA	100PF	CAPACITOR; SMT (0201); CERAMIC CHIP; 100PF; 50V; TOL = 5%; TG = -55°C TO +125°C; TC = C0G
10	1	CN1	—	DX07S024JJ3R1300	JAE ELECTRONIC INDUSTRY	DX07S024JJ3	CONNECTOR; FEMALE; SMT; USB TYPE-C CONNECTOR; DX07 SERIES RECEPTACLE; RIGHT ANGLE; 24PINS
11	2	DS1, DS2	—	SML-P11UTT86	ROHM	SML-P11UTT86	DIODE; LED; SMT; PIV = 1.8V; IF = 0.02A
12	1	J3	—	5035662500	MOLEX	5035662500	CONNECTOR; FEMALE; SMT; EASY-ON TYPE HOUSING ASSEMBLY; RIGHT ANGLE; 25PINS
13	2	L1, L2	—	DFE18SBN2R2MELL	MURATA	2.2UH	EVKIT PART - INDUCTOR; SMT (0603); SHIELDED; 2.2μH; 20%; 1.2A
14	1	L3	—	DFE201610E-4R7M=P2	MURATA	4.7UH	INDUCTOR; SMT (2016); METAL ALLOY CHIP; 4.7μH; TOL = ±20%; 1.3A
15	1	L4	—	LQP03HQ3N3B02	MURATA	3.3NH	INDUCTOR; SMT (0201); FILM TYPE; 3.3NH; TOL = ±0.1nH; 0.5A
16	1	LED	—	SML-LX0404SIUPGUSB	LUMEX OPTO COMPONENTS INC	SML-LX0404SIUPGUSB	DIODE; LED; SML; FULL COLOR; WATER CLEAR LENS; RED-GREEN-BLUE; SMT; VF = 2 95V; IF = 0.1A
17	11	R2, R3, R11, R15, R24, R27-R31, R34	—	ERJ-2GE0R00	PANASONIC	0	RESISTOR; 0402; 0Ω; 0%; JUMPER; 0.10W; THICK FILM

MAXM86146 EV System Bill of Materials (continued)

MAXSensorBLE#

ITEM	QTY	REF DES	DNI/DNP	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
18	2	R5, R9	—	ERJ-1GEF1002	PANASONIC	10K	RESISTOR; 0201; 10KΩ; 1%; 200PPM; 0.05W; THICK FILM
19	7	R6, R7, R16, R17, R23, R25, R26	—	ERJ-1GEF4701C	PANASONIC	4.7K	RESISTOR; 0201; 4.7KΩ; 1%; 100PPM; 0.05W; THICK FILM 3-LAYER ELECTRODE
20	1	R8	—	ERJ-1GEF3902	PANASONIC	39K	RESISTOR; 0201; 39KΩ; 1%; 100PPM; 0.05W; THICK FILM 3-LAYER ELECTRODE
21	1	R10	—	NCP15XH103F03	MURATA	10K	THERMISTOR; SMT (0402); THICK FILM (NICKEL PLATED); 10K; TOL = ±1%
22	1	R13	—	ERJ-1GEF2613C	PANASONIC	261K	RESISTOR; 0201; 261KΩ; 1%; 200PPM; 0.05W; THICK FILM
23	1	R14	—	CRCW0201100KFK	VISHAY DALE	100K	RESISTOR; 0201; 100KΩ; 1%; 100PPM; 0.05W; THICK FILM
24	2	R18, R19	—	ERJ-1GEF2000C	PANASONIC	200	RESISTOR; 0201; 200Ω; 1%; 200PPM; 0.05W; THICK FILM
25	4	RA1-RA4	—	ERJ-1GEF33R0C	PANASONIC	33	RESISTOR; 0201; 33Ω; 1%; 100PPM; 0.05W; THICK FILM 3-LAYER ELECTRODE
26	1	SW	—	EVP-AWCD2A	PANASONIC	EVP-AWCD2A	SWITCH; SPST; SMT; STRAIGHT; 15V; 0.02A; EVP-AW SERIES
27	1	U1	—	MAX20303KEWN+	MAXIM	MAX20303KEWN+	EVKIT PART- IC; WEARABLE POWER NAMAGEMENT SOLUTION; PACKAGE OUTLINE; WLP 56 PINS; 0.5MM PITCH; PKG. CODE: W563A4+1; PKG. OUTLINE: 21-100104
28	1	U2	—	NRF52832-CIAA	NORDIC SEMICONDUCTOR	NRF52832-CIAA	IC; SOC; MULTIPROTOCOL BLUETOOTH LOW ENERGY; ANT; 2.4GHZ RF SOC; WLCSP50
29	5	U3-U6, U9	—	MAX14689EWL+	MAXIM	MAX14689EWL+	IC; ASW; 0.125A; FREQUENCY-SELECTSBLE; SWITCHED-CAPACITOR VOLTAGE CONVERTER; WLP9 1.2X1.2
30	1	U7	—	IP4221CZ6-S	NXP	IP4221CZ6-S	IC; PROT; ESD PROTECTION FOR HIGH-SPEED INTERFACE; XSON6
31	1	U8	—	S25FS256SAGNFI001	SPANSION	S25FS256SAGNFI001	IC; MMRY; MIRRORBIT FLASH; NON-VOLATILE MEMORY; 1.8V SINGLE SUPPLY WITH CMOS I/O; SERIAL PERIPHERAL INTERFACE WITH MULTI-I/O; WSON8-EP
32	2	U10, U11	—	MAX9062EBS+G45	MAXIM	MAX9062EBS+G45	IC; COMP; ULTRA-SMALL; LOW-POWER SINGLE COMPARATOR; UCSP4
33	1	U12	—	MAX32620IWG+	MAXIM	MAX32620IWG+	IC; UCON; HIGH-PERFORMANCE; ULTRA-LOW POWER CORTEX-M4F MICROCONTROLLER FOR RECHARGEABLE DEVICES; WLP81

MAXM86146 EV System Bill of Materials (continued)

MAXSensorBLE#

ITEM	QTY	REF DES	DNI/DNP	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
34	1	U13	—	74AUP1G97GF	NXP	74AUP1G97GF	IC; LOGC; LOW-POWER CONFIGURABLE MULTIPLE FUNCTION GATE; XSON6
35	1	U29	—	MAX1819EBL33+	MAXIM	MAX1819EBL33+	IC; VREG; 500MA LOW-DROPOUT LINEAR REGULATOR IN UCSP; UCSP6
36	2	X2, Y2	—	ECS-.327-6-12	ECS INC	32.768KHZ	CRYSTAL; SMT 2.0 MM X 1.2 MM; 6PF; 32.768KHZ; ±20PPM; -0.03PPM/°C2
37	1	Y1	—	US3200005Z	PERICOM SEMICONDUCTOR	32MHZ	CRYSTAL; SMT 1.6 MM X 1.2MM; 8PF; 32MHZ; ±10PPM; ±10PPM
38	1	PCB	—	MAXSENSORBLE	MAXIM	PCB	PCB:MAXSENSORBLE
39	0	R1, R4, R12, R20-R22, R32, R33	DNP	ERJ-2GE0R00	PANASONIC	0	RESISTOR; 0402; 0Ω; 0%; JUMPER; 0.10W; THICK FILM
40	0	Z17	DNP	GJM0335C1E1R0WB01	MURATA	1PF	CAPACITOR; SMT (0201); CERAMIC CHIP; 1PF; 25V; TOL = 0.05PF; TG = -55°C TO +125°C; TC = C0G
41	0	Z18	DNP	250R05L1R8AV4	JOHANSON TECHNOLOGY	1.8PF	CAPACITOR; SMT (0201); MICROWAVE; 1.8PF; 25V; TOL=0.05PF; TG = -55°C TO +125°C; TC = C0G
42	0	Jan-36	DNP	N/A	N/A	N/A	TEST POINT; PAD DIA = 0.762MM; BOARD HOLE = 0.381MM
TOTAL	104						

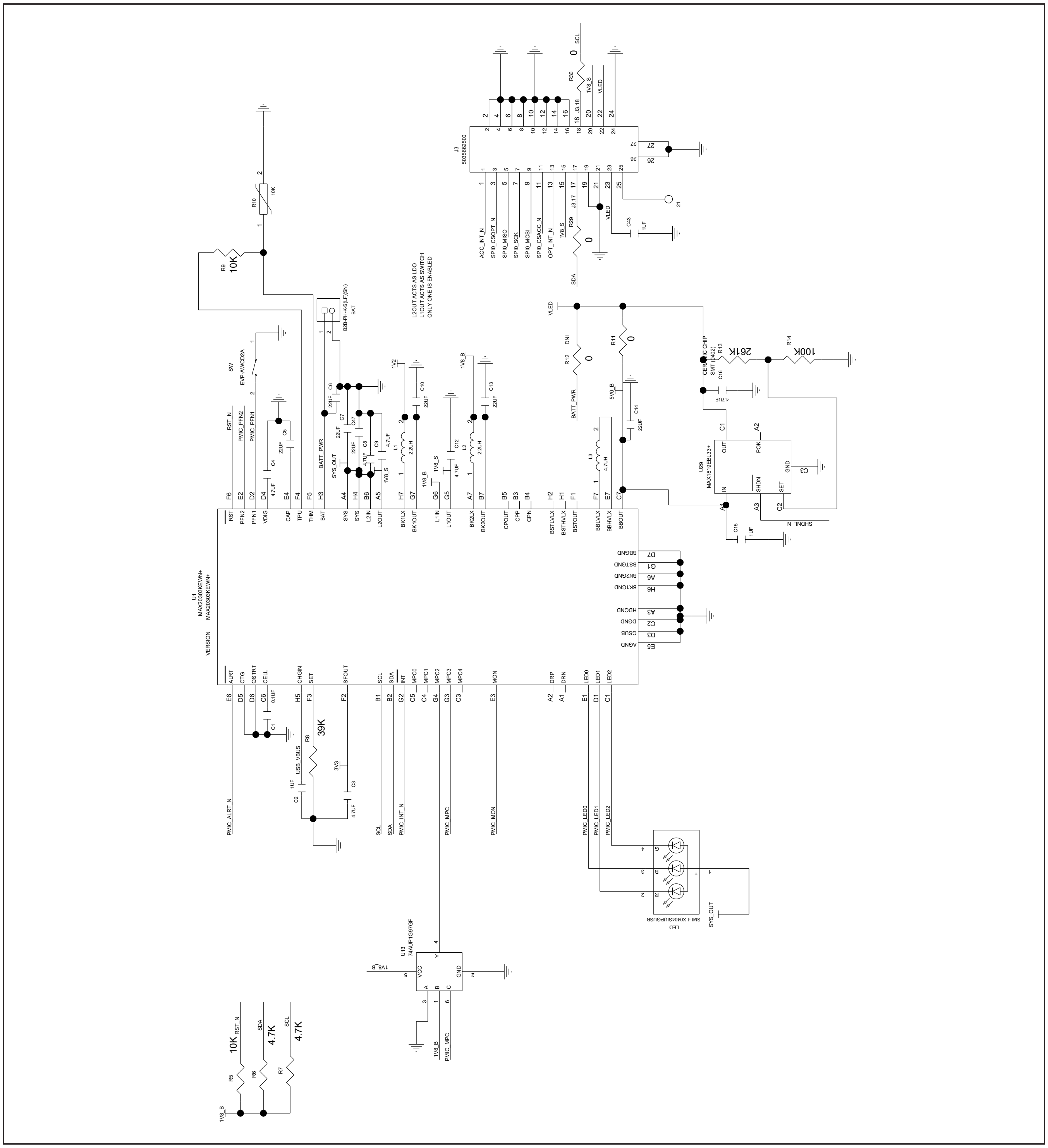
MAXM86146 EV System Bill of Materials (continued)

MAXM86146_OSB#

ITEM	QTY	REF DES	DNI/DNP	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	6	C1-C3, C13 C15, C17	—	GRM033R61A105ME15	MURATA	1uF	CAPACITOR; SMT (0201); CERAMIC CHIP; 1UF; 10V; TOL=20%; TG=-55 DEGC TO +85 DEGC; TC=X5R
2	1	C4	—	GRM155R61A106ME44 GRM155R61A106ME11 0402ZD106MAT2A CL05A106MP5NUNC	MURATA	10uF	CAPACITOR; SMT (0402); CERAMIC CHIP; 10UF; 10V; TOL=20%; TG=-55 DEGC TO +85 DEGC; TC=X5R
3	8	C5-C10 C12, C16	—	GRM155R60J226ME11	MURATA	22uF	CAPACITOR; SMT (0402); CERAMIC CHIP; 22UF; 6.3V; TOL=20%; TC=X5R ;NOTE: THESE PARTS HAVE 52 WEEKS LEAD TIME; MANUFACTURING DELAYS HAVE BEEN REPORTED ON THIS PRODUCT
4	1	D1	—	SFH 7015	OSRAM	SFH 7015	EVKIT PART -DIODE; LED; RED-INFRARED; SMT
5	2	DS1, DS2	—	CT DBLP31.12-6C5D-56-J6U6	OSRAM	CT DBLP31.12-6C5D-56-J6U6	DIODE; LED; GREEN; SMT; VF=2.3V; IF=0.02A
6	1	J1	—	5016162575	MOLEX	5016162575	CONNECTOR; FEMALE; SMT; EASY-ON TYPE FPC CONNECTOR; RIGHT ANGLE; 25PINS
7	1	R1	—	CRCW02010000ZS;ERJ-1GN0R00	VISHAY DALE PANASONIC	0	RESISTOR; 0201; 0 OHM; 0%; JUMPER; 0.05W; THICK FILM
8	2	R7, R8	—	ERJ-1GNF1003	PANASONIC	100K	RESISTOR; 0201; 100K OHM; 1%; 200PPM; 0.05W; THICK FILM
9	1	U1	—	MAXM86146	MAXIM	MAXM86146	EVKIT PART - IC; MOD; OPTICAL BIO-SENSING MODULE WITH LOW-POWER ARM CORTEX-M4; OLG38; DIE TYPE: OB07; PACKAGE OUTLINE: 21-100323; PACKAGE LAND PATTERN: 90-100112
10	1	U2	—	KX122-1037	KIONIX	KX122-1037	IC; SNSR; +/-2G/4G/8G TRI-AXIS DIGITAL ACCELEROMETER; LGA12
11	1	U4	—	MAX14689EWL+	MAXIM	MAX14689EWL+	IC; ASW; ULTRA-SMALL LOW-RON BEYOND-THE-RAILS DPDT ANALOG SWITCHES; WLP9
12	1	Y1	—	CM1610H32768DZB	CITIZEN	32.7680KHZ	CRYSTAL; SMT 1.6MMX1MM; 6PF; 32.7680KHZ; +/-20PPM
13	1	PCB	—	MAXM86146OSB	MAXIM	PCB	PCB:MAXM86146OSB
1	1	R2	DNP	CRCW02010000ZS;ERJ-1GN0R00	VISHAY DALE;PANASONIC	0	RESISTOR; 0201; 0 OHM; 0%; JUMPER; 0.05W; THICK FILM
TOTAL	28						

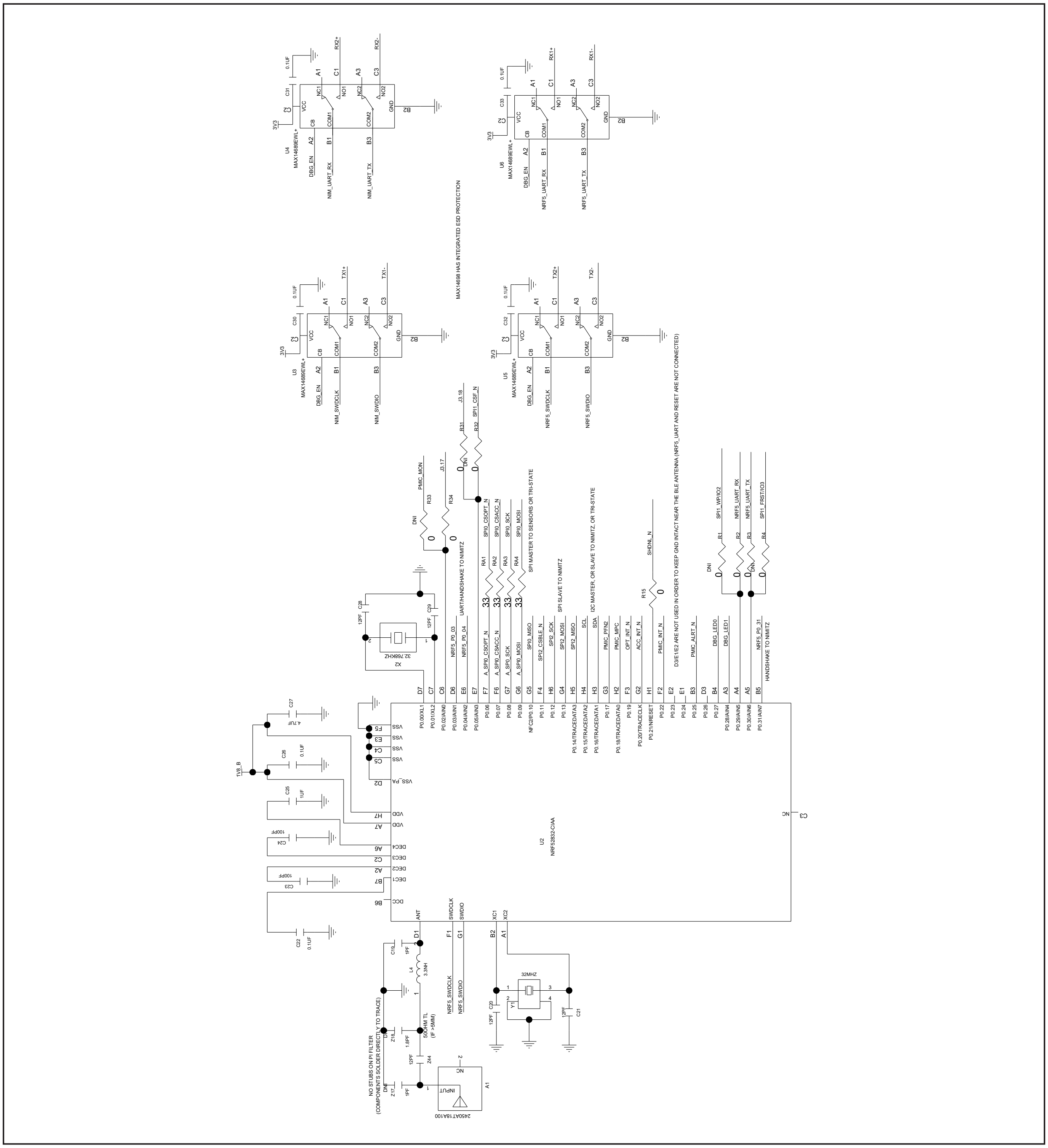
MAXM86146 EV System Schematics

MAXSensorBLE#



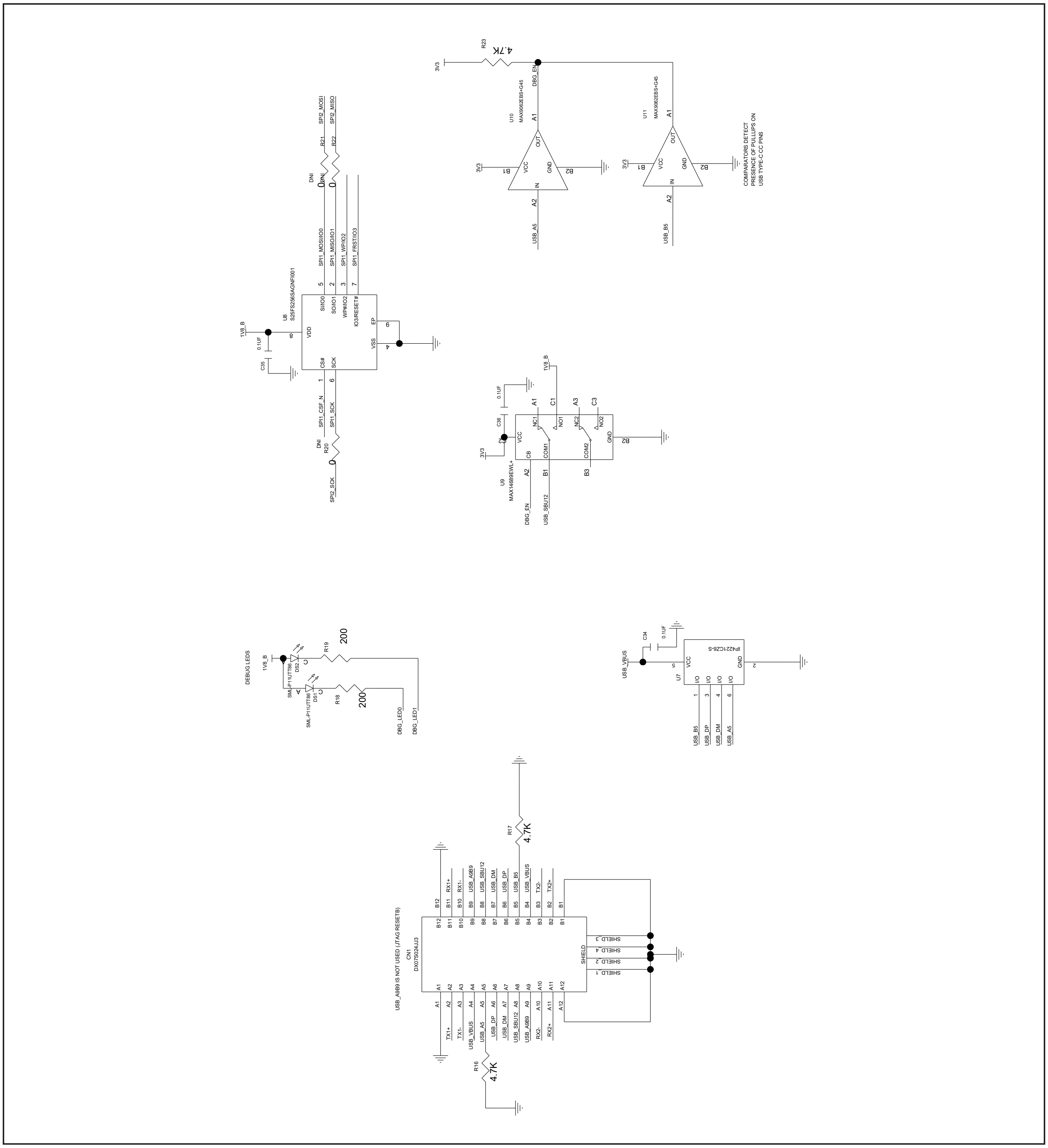
MAXM86146 EV System Schematics (continued)

MAXSensorBLE#



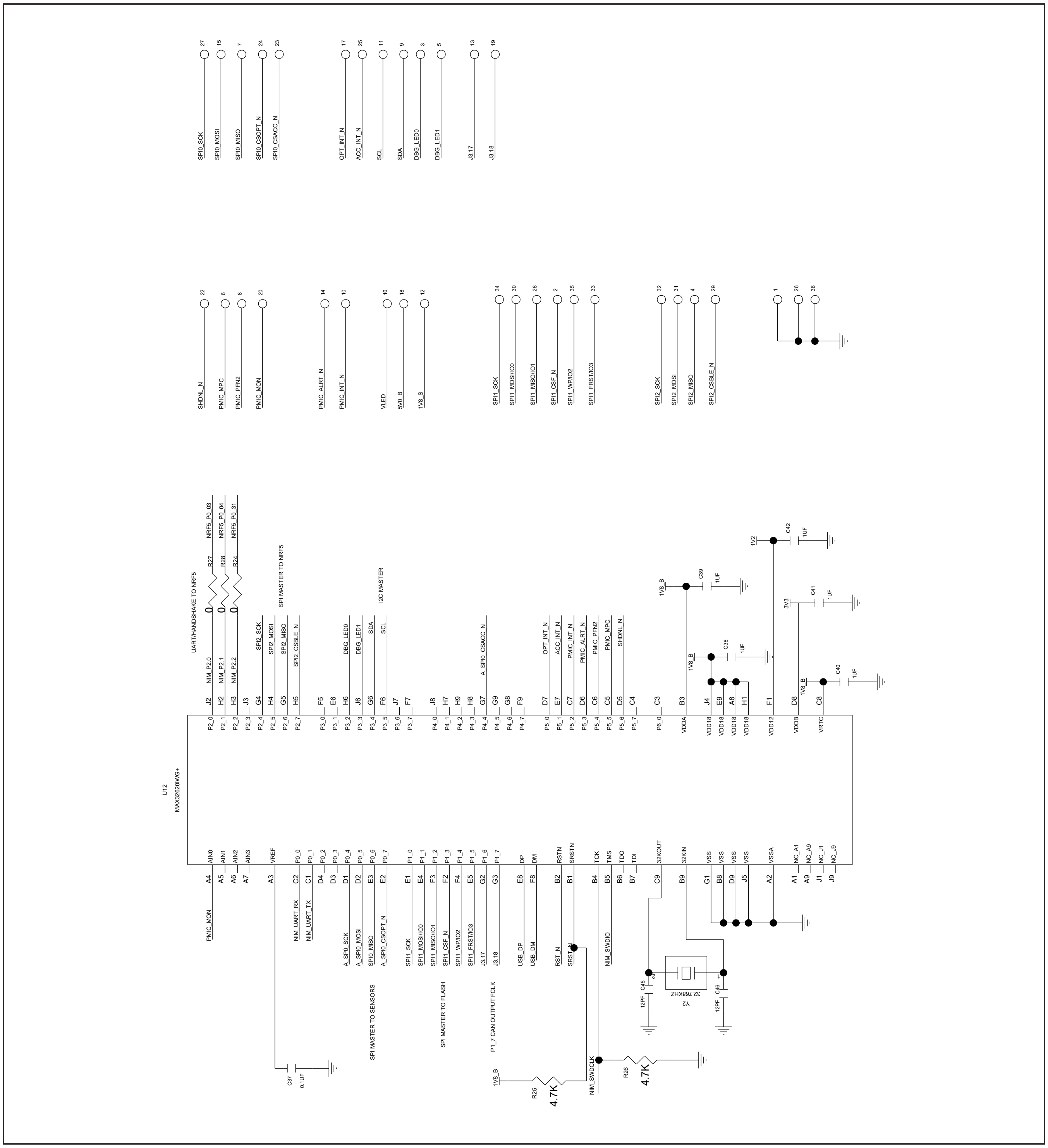
MAXM86146 EV System Schematics (continued)

MAXSensorBLE#



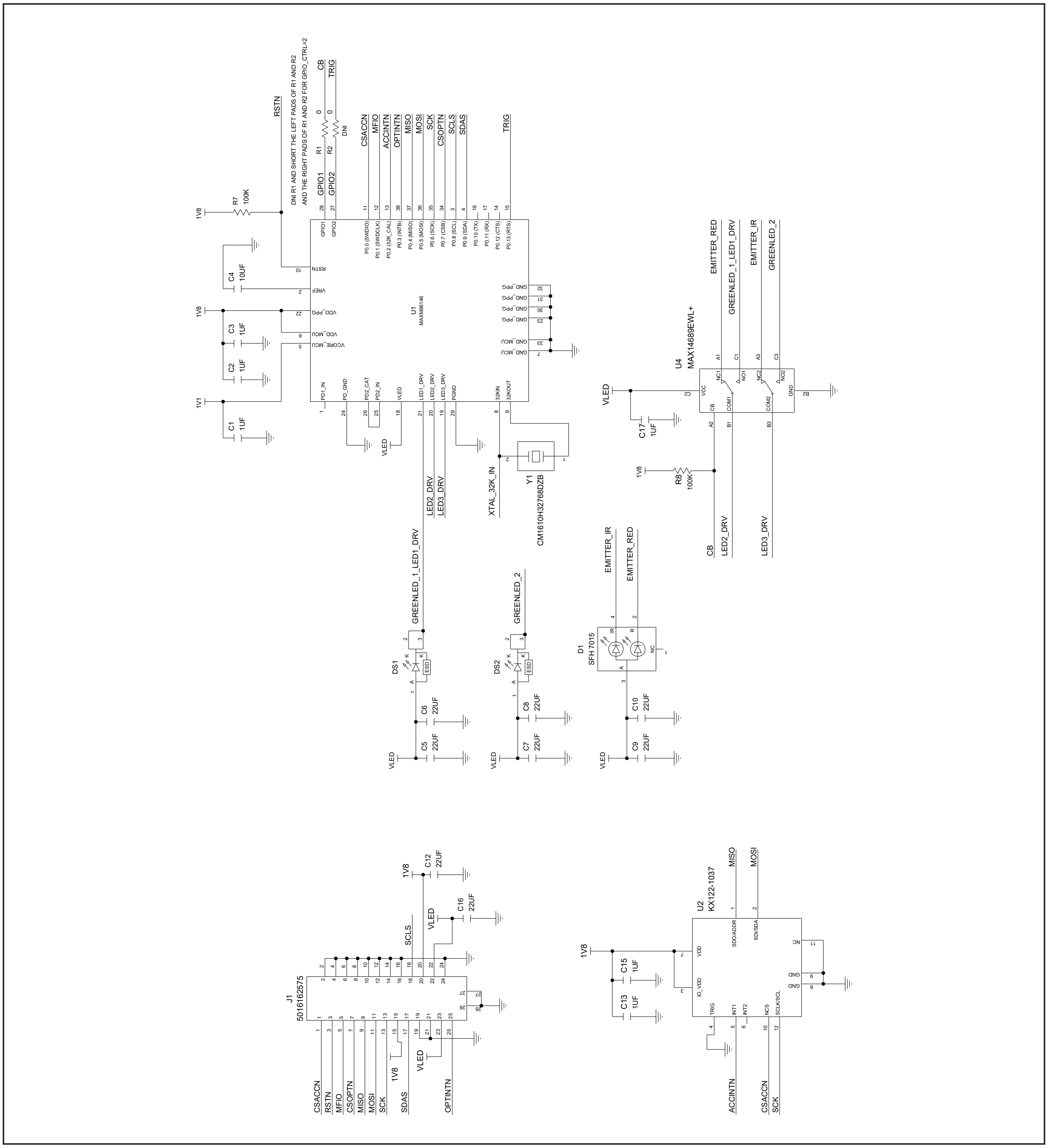
MAXM86146 EV System Schematics (continued)

MAXSensorBLE#



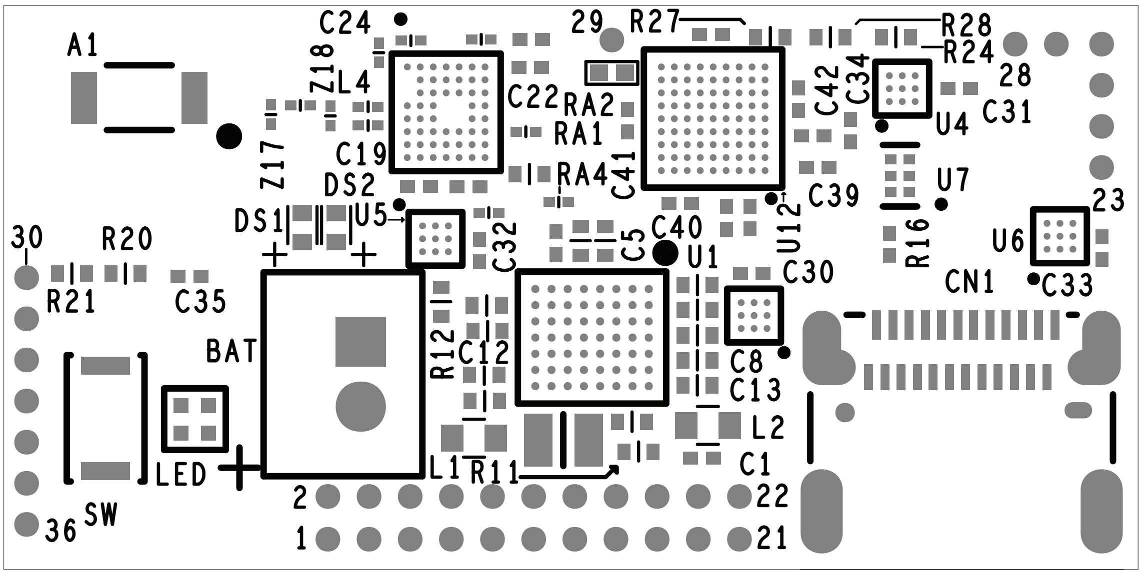
MAXM86146 EV System Schematics (continued)

MAXM86146_OSB#

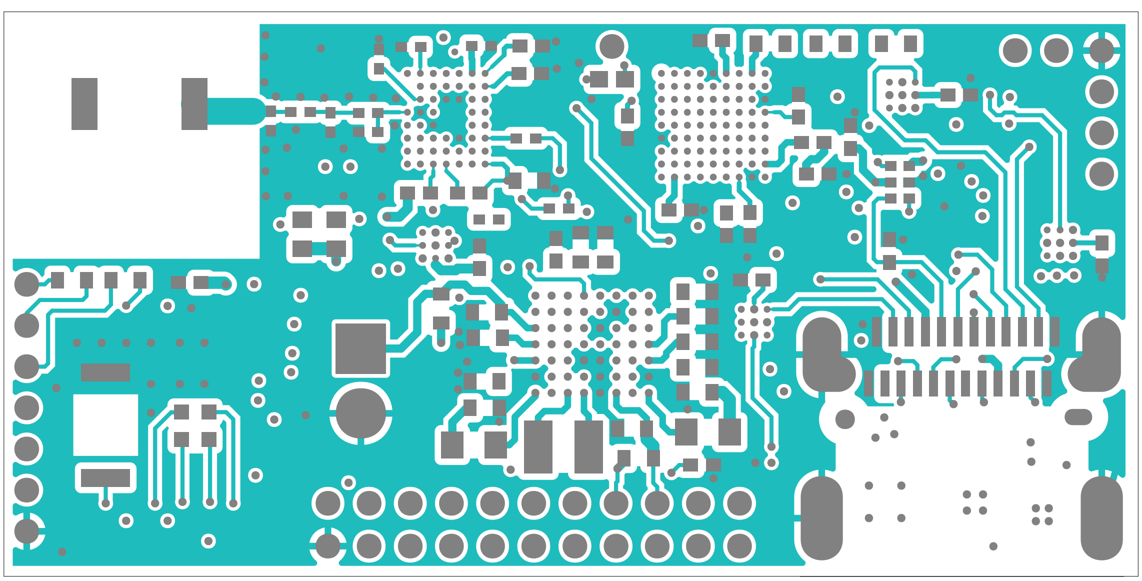


MAXM86146 EV System PCB Layouts

MAXSensorBLE#



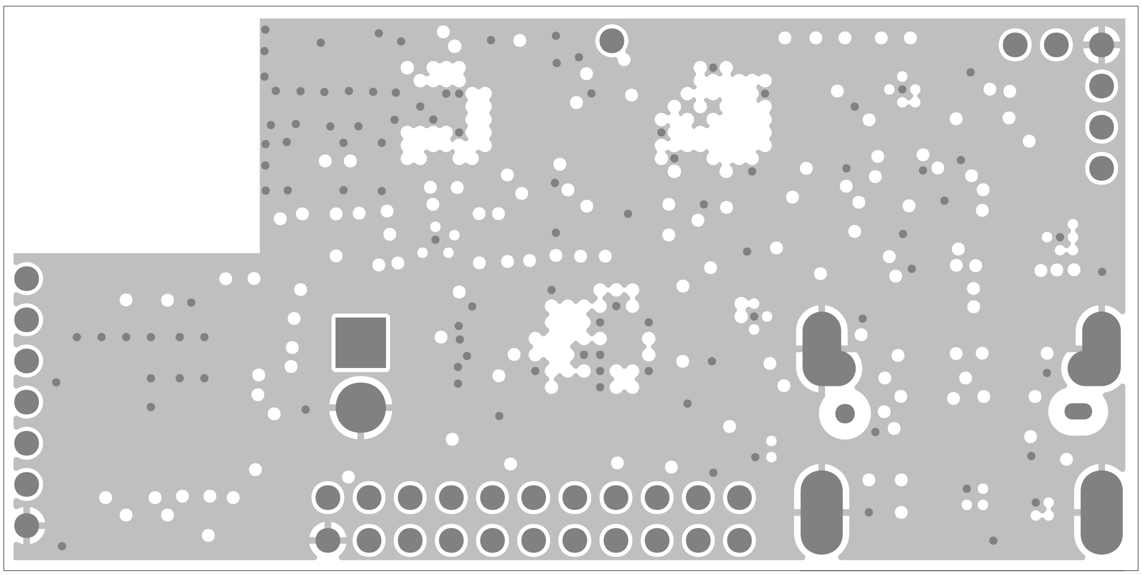
MAXSensorBLE EV System—Top Silkscreen



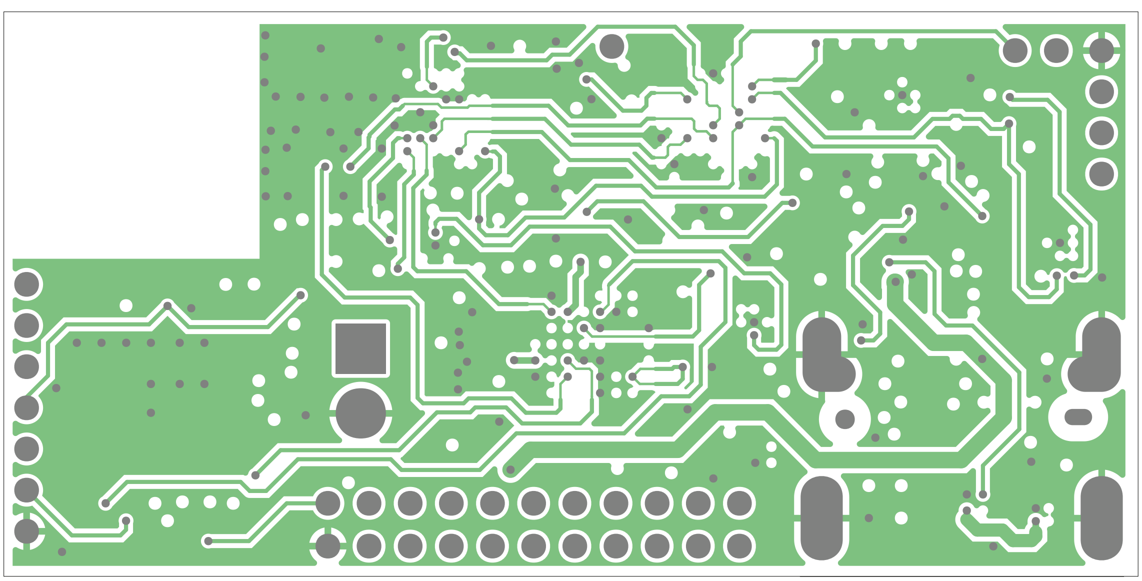
MAXSensorBLE EV System—Top

MAXM86146 EV System PCB Layouts (continued)

MAXSensorBLE#



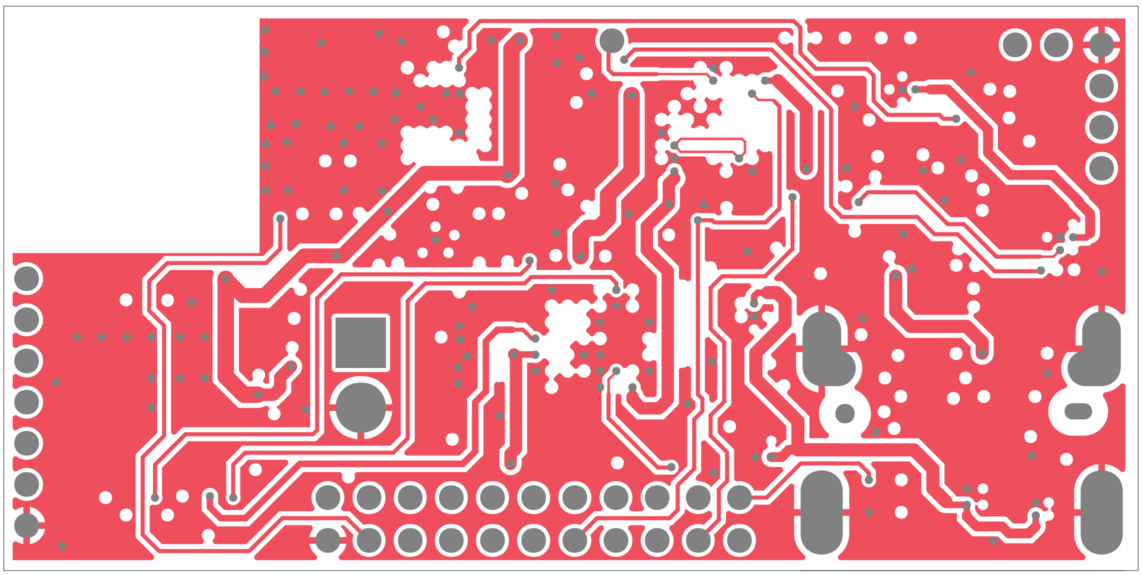
MAXSensorBLE EV System—L02_GND



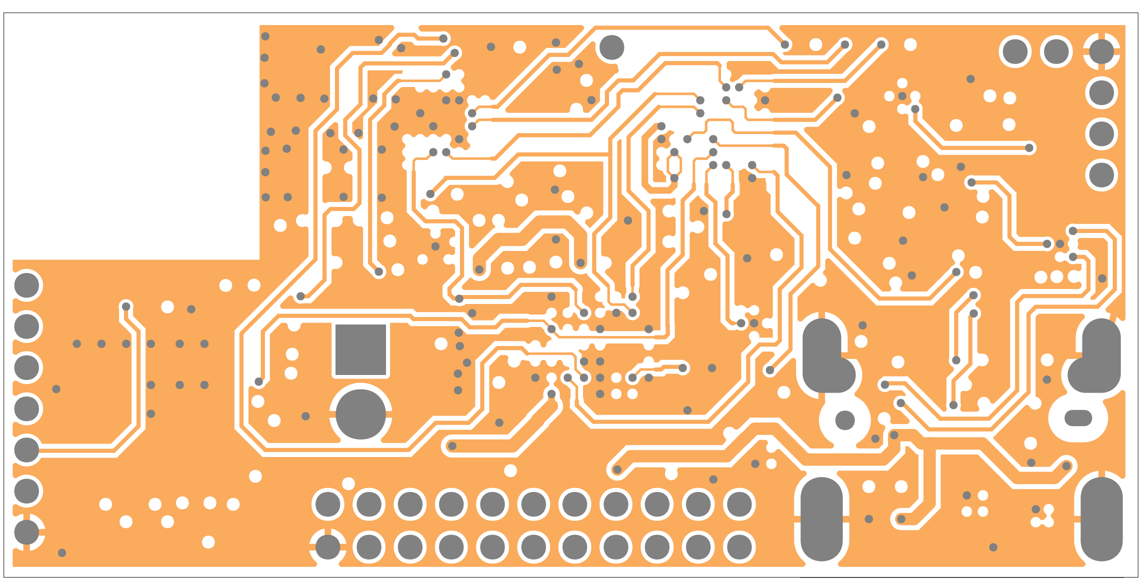
MAXSensorBLE EV System—L03_SIGS

MAXM86146 EV System PCB Layouts (continued)

MAXSensorBLE#



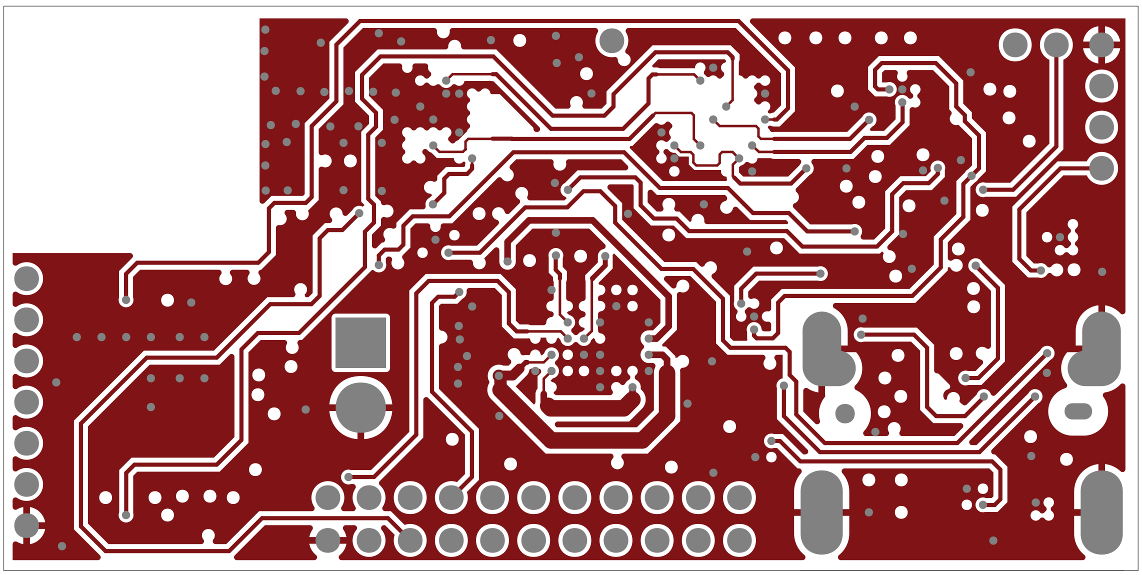
MAXSensorBLE EV System—L04_SIGS



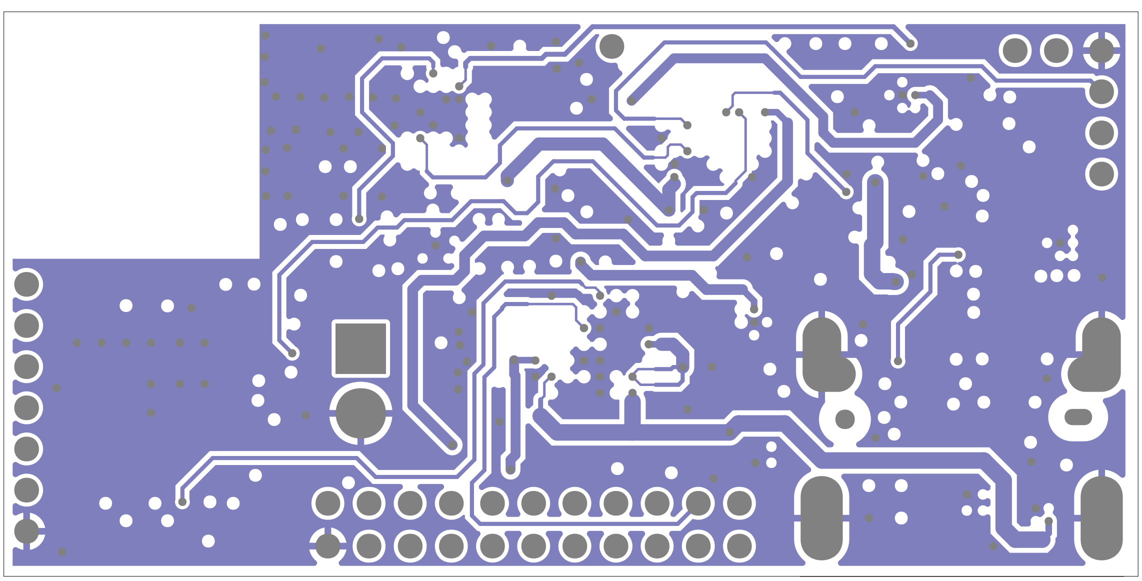
MAXSensorBLE EV System—L05_SIGS

MAXM86146 EV System PCB Layouts (continued)

MAXSensorBLE#



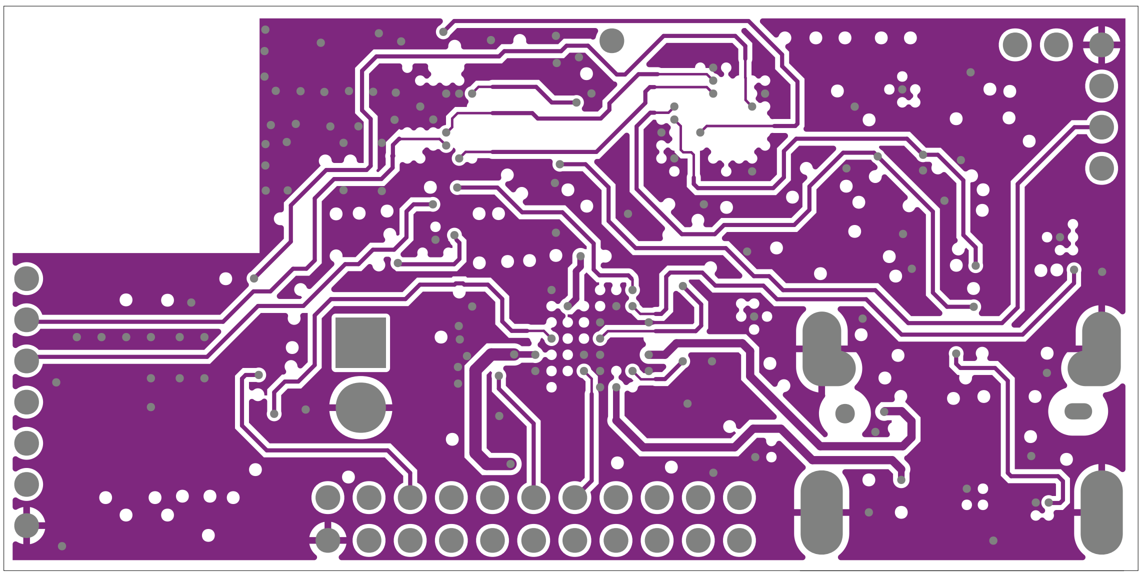
MAXSensorBLE EV System—L06_SIGS



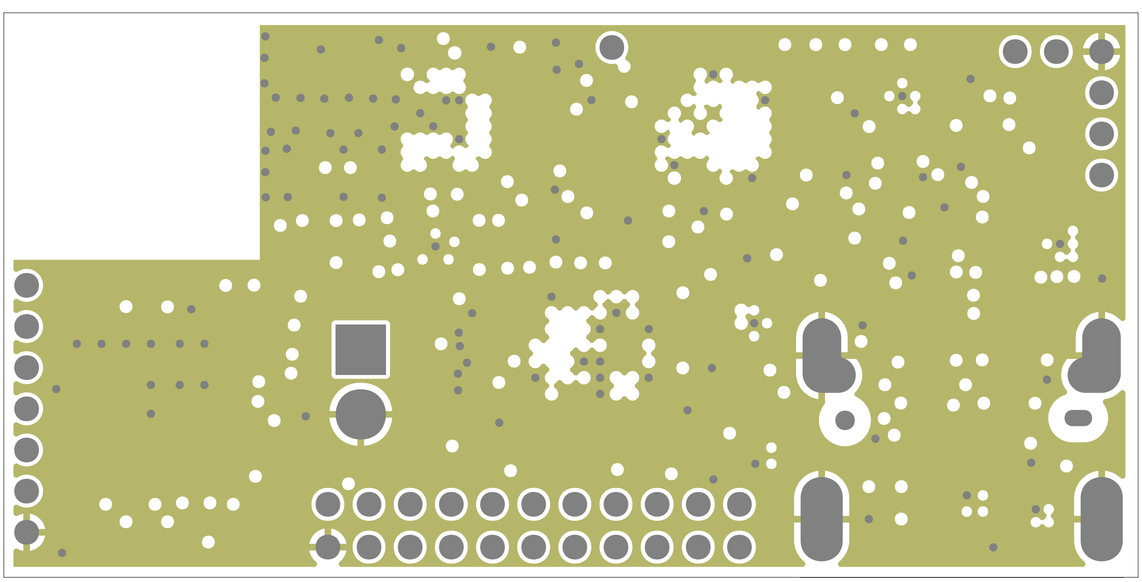
MAXSensorBLE EV System—L07_SIGS

MAXM86146 EV System PCB Layouts (continued)

MAXSensorBLE#



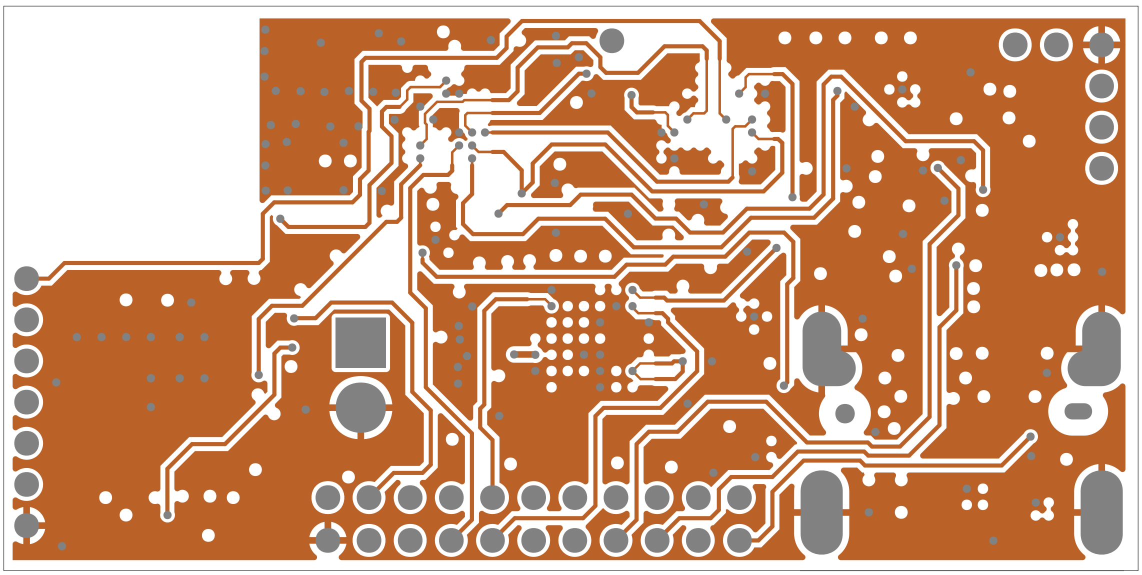
MAXSensorBLE EV System—L08_SIGS



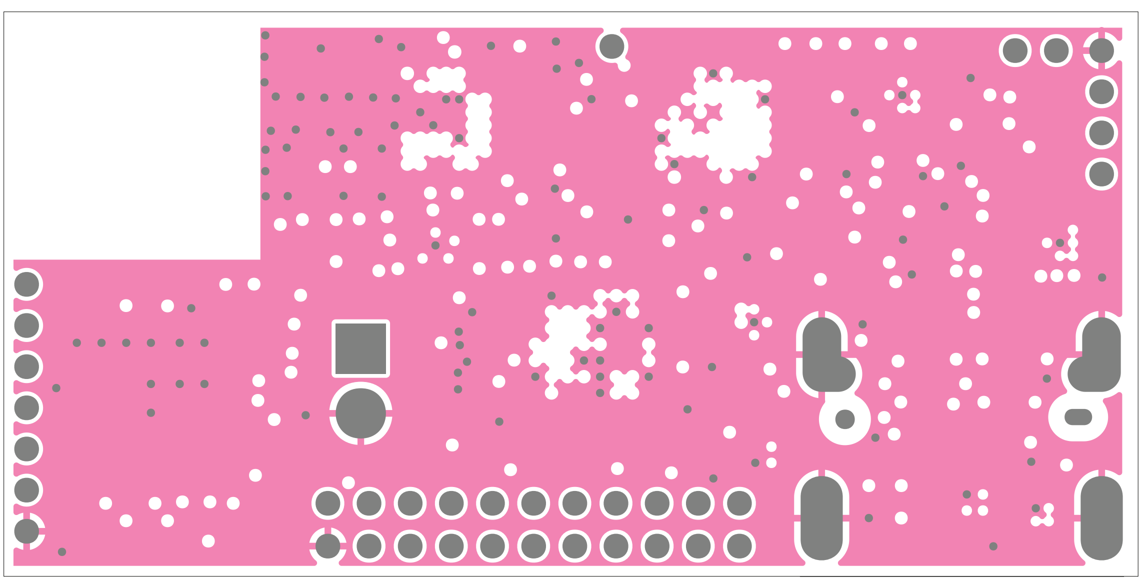
MAXSensorBLE EV System—L09_GND

MAXM86146 EV System PCB Layouts (continued)

MAXSensorBLE#



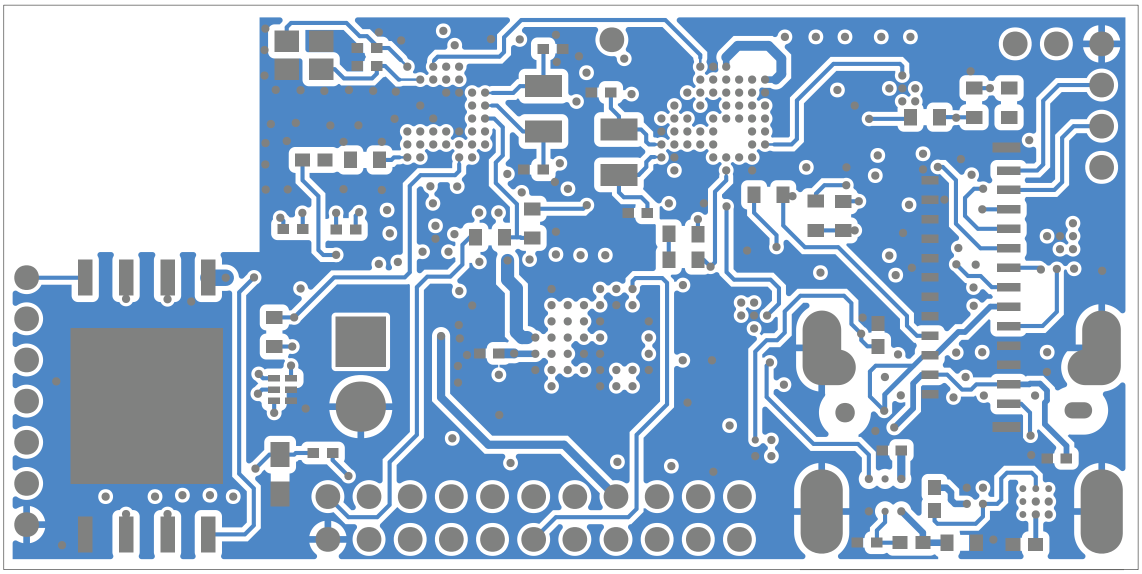
MAXSensorBLE EV System—L10_SIGS



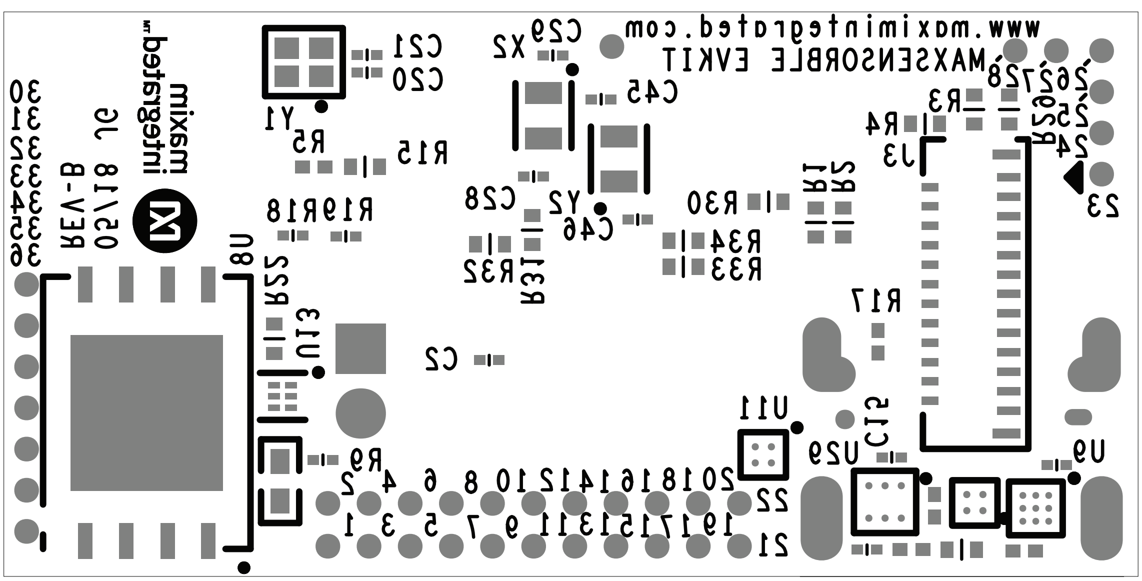
MAXSensorBLE EV System—L11_GND

MAXM86146 EV System PCB Layouts (continued)

MAXSensorBLE#



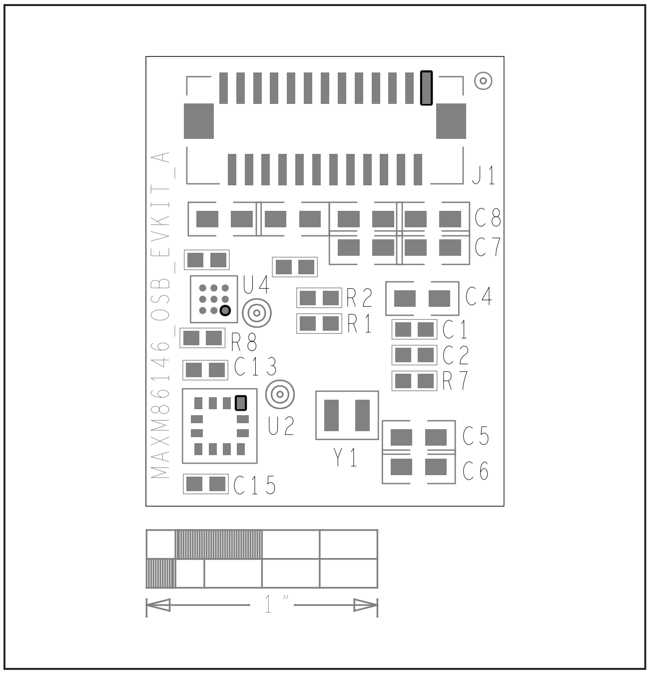
MAXSensorBLE EV System—BOTTOM



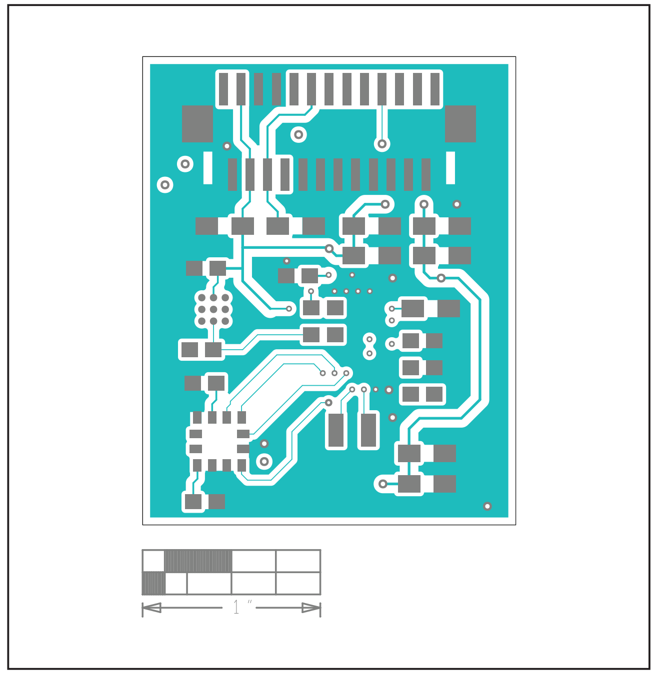
MAXSensorBLE EV System—Bottom Silkscreen

MAXM86146 EV System PCB Layouts

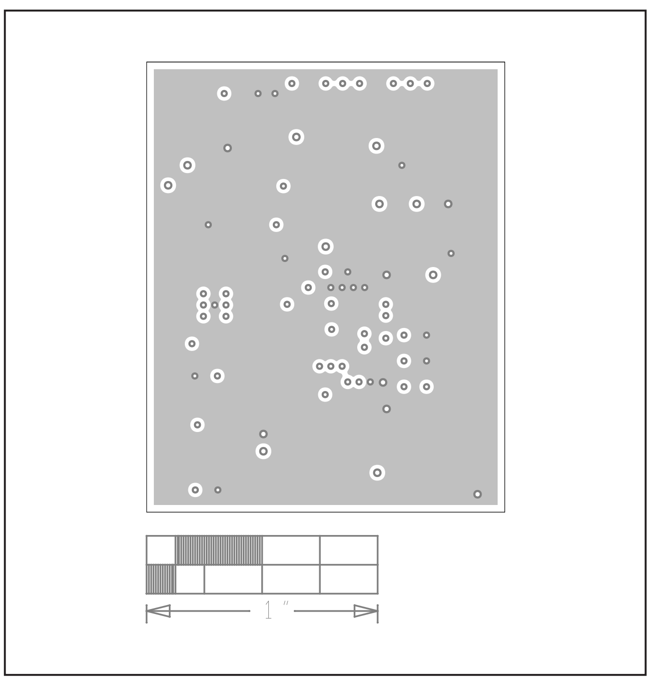
MAXM86146_OSB#



MAXM86146OSBEK#—Top Silkscreen



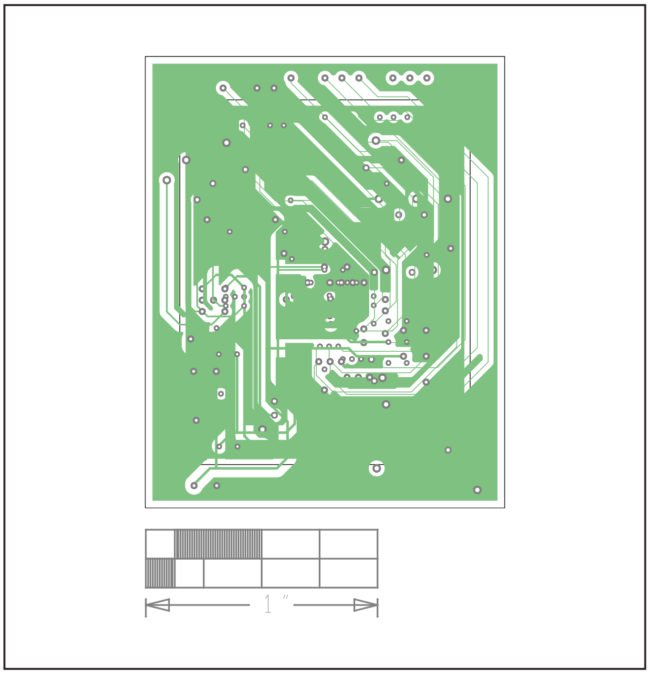
MAXM86146OSBEK#—Top



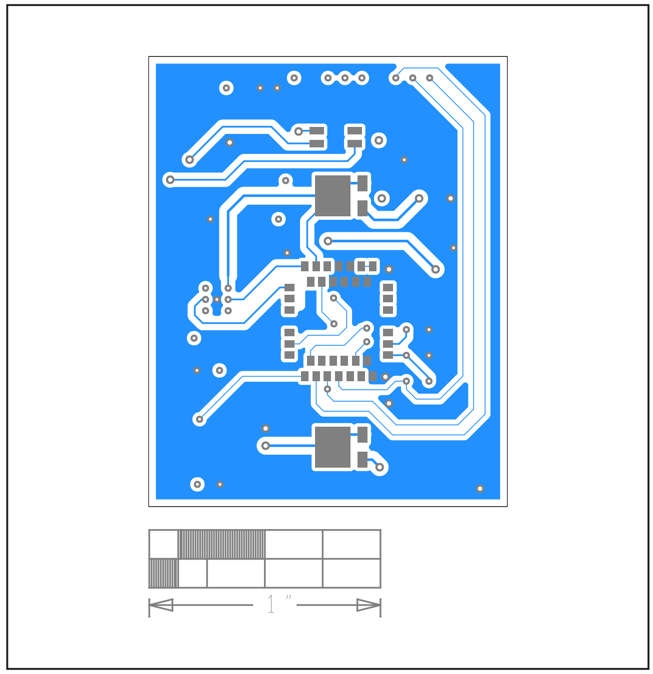
MAXM86146OSBEK#—L02_GND

MAXM86146 EV System PCB Layouts (continued)

MAXM86146_OSB#



MAXM86146OSBEK#— L03_SIG



MAXM86146OSBEK#—Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/20	Initial release	—
1	4/22	Updated *Required Equipment* and *Procedure* sections, removed Figure 8, replaced Figure 10, and updated Component List	1, 2, 8, 10, 16