

## General Description

The MAX11960 evaluation kit (EV kit) demonstrates the device's, 20-bit, 1.0MSPS, dual-channel, fully differential SAR ADC with internal reference buffers. The EV kit includes a graphical user interface (GUI) that provides communication from Avnet's ZedBoard™ development board for the Xilinx Zynq®-7000 SoC. The ZedBoard is not included with the EV kit and must be purchased through Avnet.

The ZedBoard communicates with the PC through an Ethernet cable using Windows® 7, or Windows 8/8.1-compatible software.

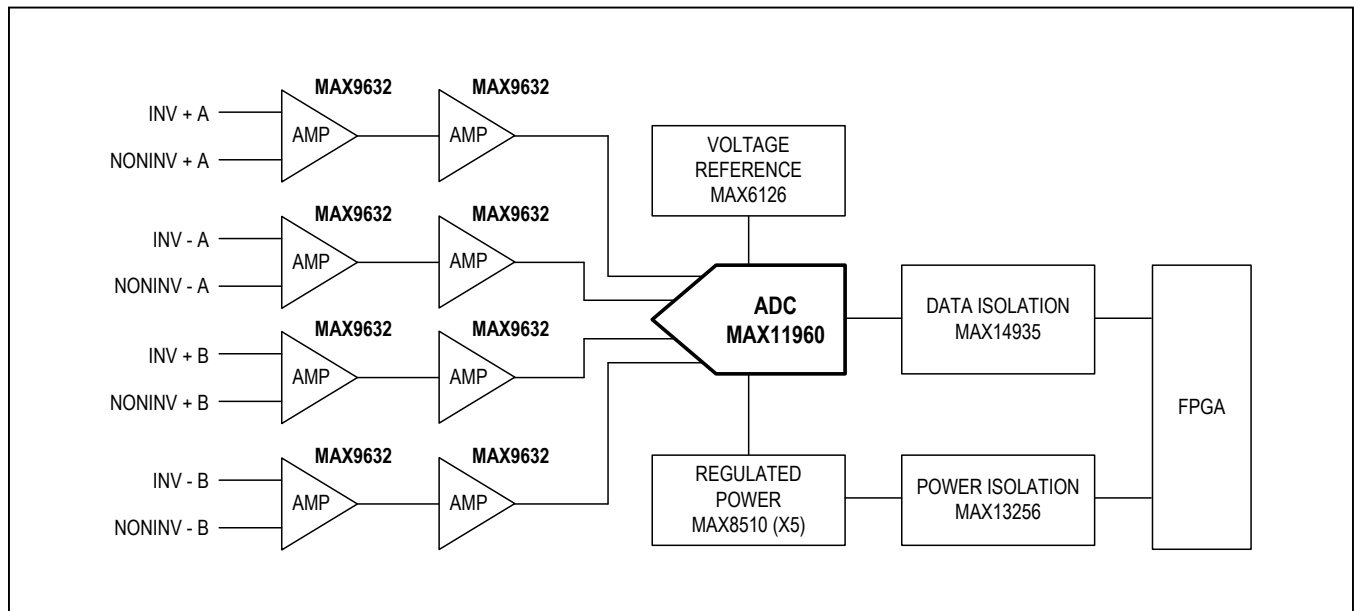
The EV kit comes with the MAX11960ETP+ installed.

## Benefits and Features

- FMC Connector for Interface
- 75MHz SPI Clock Capability through FMC Connector
- Sync In and Sync Out for Coherent Sampling
- On-Board Input Buffers (MAX9632)
- On-Board +3.0V Reference Voltage (MAX6126)
- Windows 7, and Windows 8/8.1-Compatible Software

*Ordering Information appears at end of data sheet.*

## System Block Diagram



*ZedBoard is a trademark of ZedBoard.org.*

*Zynq is a registered trademark of Xilinx, Inc.*

*Windows, Windows XP, and Windows Vista are registered trademarks and registered service marks of Microsoft Corporation.*

## Quick Start

### Required Equipment

- MAX11960 differential EV kit with SD card
- ZedBoard development board
- Windows PC
- Ethernet cable
- +20V/1A DC power supply or equivalent wall plug
- Signal generator with differential outputs (e.g., Audio Precision 2700 series)
- Soldering iron and 2-pin 2.54mm header

**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 below to verify board operation:

- 1) Visit <http://www.maximintegrated.com/en/design/tools/applications/evkit-software/> to download the latest version of the EV kit software, 11960EVKit.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
- 2) Solder the 2-pin header on J18-3V3 of the ZedBoard.
- 3) Connect the Ethernet cable from the PC to the ZedBoard and configure the **Internet Protocol Version 4 (TCP/IPv4)** properties in the local area connection to IP address **192.168.1.2** and subnet mask to **255.255.255.0**.  
**Note:** If an ethernet port is not available on the PC, please use the option of ethernet to USB port adapter.
- 4) Verify that the ZedBoard's jumpers JP7, JP8, and JP11 have shunts installed at the GND position, and JP9 and JP10 at the 3V3 position.
- 5) Move the shunt of J18 of the ZedBoard to the 3V3 position from 1V8.
- 6) Insert the SD card with the boot image (BOOT.bin).
- 7) Verify that all jumpers on the EV kit are in their default positions, as shown in [Table 1](#).
- 8) Connect the ZedBoard to J2 on the EV kit for FMC connection.
- 9) Connect the +20V DC power supply between +20V and GNDA4 test points. If the power supply is unavailable, a +20V wall plug can be inserted into the J3 connector of the MAX11960 EV kit.
- 10) Insert the +12V wall plug into the connect J20 of the ZedBoard. Turn on the power to the ZedBoard.
- 11) Verify that the OLED screen on the ZedBoard displays "MAX11960".
- 12) Apply differential signals at test points INV+A and INV-A, and at INV+B and INV-B.
- 13) Enable the function generators.
- 14) Open the EV kit GUI, MAX11960EVKit.exe and verify that the status bar at the lower right corner displays **EV Kit Hardware Connected**.
- 15) Select **MAX11960** from the **Device** Dropdown list within the **System** tab sheet ([Figure 1](#)).
- 16) Click on the **Scope** ([Figure 2](#)) or **FFT** ([Figure 6](#)) tab sheet and start capturing data by clicking the **Capture** button.

**Table 1. Jumper Descriptions**

| JUMPER | SHUNT POSITION | DESCRIPTION  |
|--------|----------------|--|
| JU1    | 1-2            | Connects INV+A to GND for noninverting configuration on channel A of the MAX11960. |
|        | 3-4            | Connects to the output of the op amp (U12).  |
|        | 5-6*           | Connects NONINV+A to GND for inverting configuration on channel A of the MAX11960. |
| JU2    | 1-2            | Connects output of the op amp (U10) to the negative input of the op amp (U8).      |
|        | 3-4            | GND the negative input of the op amp (U8).   |
|        | 5-6*           | Connects output of the op amp (U10) to positive input of the op amp (U8).          |
|        | 7-8            | GND the positive input of the op amp (U8).   |
|        | 9-10           | Connects REFA2 to positive input of the op amp (U8).                               |
| JU3    | 1-2*           | Connects output of the op amp (U8) to AIN+A.                                       |
|        | 3-4            | Connects output of the op amp (U13) to AIN+A.                                      |
|        | 5-6*           | Connects output of the op amp (U7) to AIN-A.                                       |
|        | 7-8            | Connects output of the op amp (U14) to AIN-A.                                      |
|        | 9-10*          | Connects output of the op amp (U13) to AIN+B.                                      |
|        | 11-12          | Connects output of the op amp (U8) to AIN+B.                                       |
|        | 13-14*         | Connects output of the op amp (U14) to AIN-B.                                      |
|        | 15-16          | Connects output of the op amp (U7) to AIN-B.                                       |
| JU4    | 1-2            | Connects to REF offset.  |
|        | 3-4*           | Connects to REF/2 offset.  |
|        | 5-6            | Connects to GND.   |

| JUMPER | SHUNT POSITION | DESCRIPTION  |
|--------|----------------|--|
| JU5    | 1-2            | Connects NONINV-A to GND for inverting configuration on channel A of the MAX11960. |
|        | 3-4            | Connects to the output of the op amp (U10).  |
|        | 5-6*           | Connects INV-A to GND for noninverting configuration on channel A of the MAX11960. |
| JU6    | 1-2            | Connects REFA2 to positive input of the op amp (U7).                               |
|        | 3-4            | GND the positive input of the op amp (U7).   |
|        | 5-6*           | Connects output of the op amp (U12) to positive input of the op amp (U7).          |
|        | 7-8            | GND the negative input of the op amp (U7).   |
|        | 9-10           | Connects output of the op amp (U12) to the negative input of the op amp (U7).      |
| JU8    | 1-2            | Connects INV+B to GND for noninverting configuration on channel B of the MAX11960. |
|        | 3-4            | Connects to the output of the op amp (U16).  |
|        | 5-6*           | Connects NONINV+B to GND for inverting configuration on channel B of the MAX11960. |
| JU9    | 1-2            | Connects output of the op amp (U15) to the negative input of the op amp (U3).      |
|        | 3-4            | GND the negative input of the op amp (U3).   |
|        | 5-6*           | Connects output of the op amp (U15) to positive input of the op amp (U13).         |
|        | 7-8            | GND the positive input of the op amp (U13).  |
|        | 9-10           | Connects REFB2 to positive input of the op amp (U13).                              |

**Table 1. Jumper Descriptions (continued)**

| JUMPER | SHUNT POSITION                             | DESCRIPTION  |
|--------|--|--|
| JU11   | 1-2  | Connects to REF offset.  |
|        | 3-4*                                       | Connects to REF/2 offset.  |
|        | 5-6  | Connects to GND.   |
| JU12   | 1-2  | Connects NONINV-B to GND for inverting configuration on channel B of the MAX11960.                       |
|        | 3-4  | Connects to the output of the op amp (U15).  |
|        | 5-6*                                       | Connects INV-B to GND for noninverting configuration on channel B of the MAX11960.                       |
| JU13   | 1-2  | Connects REFB2 to positive input of the op amp (U14).  |
|        | 3-4  | GND the positive input of the op amp (U14).  |
|        | 5-6*                                       | Connects output of the op amp (U16) to positive input of the op amp (U14).                               |
|        | 7-8  | GND the negative input of the op amp (U14).  |
|        | 9-10                                       | Connects output of the op amp (U16) to the negative input of the op amp (U14).                           |
| JU16   | 1-2*                                       | REFINAB connects to on-board +3.0V reference.  |
|        | 2-3  | User-supplied REFINAB. Apply reference voltage at the EXT_REFINAB test point.                            |
| JU17   | 1-2*                                       | Set isolator's voltage level to OVDDA  |
|        | 2-3  | Set isolator's voltage level to OVDDB  |
| JU18   | 1-2, 4-5, 7-8, 16-17, 19-20, 22-23, 25-26* | Connects the SPI signals coming from the FMC connectors to the MAX11960.                                 |
|        | Not installed                              | User-supplied SPI. Connect SPI signals at SCLK, CNVSTA, CNVSTB, DINA, DINB, DOUA, and DOUTB test points. |

| JUMPER | SHUNT POSITION | DESCRIPTION   |
|--------|----------------|---|
| JU20   | Not installed* | Enables line driver.  |
|        | Installed      | Disables line driver.   |
| JU22   | 1-2, 3-4*      | DVDDA and DVDDB supplies connects to on-board +1.8V LDO.                                |
|        | Not installed  | User-supplied DVDDA and DVDDB. Apply +1.8V at the DVDDA and DVDDB test points.          |
| JU23   | 1-3, 2-4*      | OVDDA and OVDDB supplies connects to on-board +1.8V LDO.                                |
|        | 3-5, 4-6       | OVDDA and OVDDB supplies connects to on-board +3.3V LDO.                                |
|        | Not installed  | User-supplied OVDDA and OVDDB. Apply +1.8V to +3.3V at the OVDDA and OVDDB test points. |
| JU24   | 1-2, 3-4*      | AVDDA and AVDDB supplies connects to on-board +1.8V LDO.                                |
|        | Not installed  | User-supplied AVDDA and AVDDB. Apply +1.8V at the AVDDA and AVDDB test points.          |
| JU25   | 1-2, 3-4*      | REFVDDA and REFVDDB supplies connects to on-board +3.3V LDO.                            |
|        | Not installed  | User-supplied REFVDDA and REFVDDB. Apply +3.3V at the REFVDDA and REFVDDB test points.  |
| JU30   | Install        | Do not use.   |
|        | Not installed* | User-supplied +20V power-supply header connection.                                      |
| JU31   | 1-2*           | Enabled MAX13256 (U2)   |
|        | 2-3            | Disable MAX13256 (U2)   |

**Table 1. Jumper Descriptions (continued)**

| JUMPER | SHUNT POSITION | DESCRIPTION   |
|--------|----------------|---|
| JU32   | 1-2            | User-supplied +24V power-supply connection.               |
|        | 3-4*           | Isolated +24V from MAX13256                               |
| JU33   | 1-2            | User-supplied -24V power-supply connection.               |
|        | 3-4*           | Isolated -24V from MAX13256                               |
| JU34   | 1-2, 7-8       | User-supplied +15V supply to analog front-end op amps.    |
|        | 3-4, 5-6*      | Isolated +15V supply to analog front-end op amps and LDO. |

| JUMPER | SHUNT POSITION | DESCRIPTION   |
|--------|----------------|---|
| JU35   | 1-2            | GND the negative supply of the analog front-end op amps.            |
|        | 3-4            | User-supplied -15V supply to analog front-end op amps.              |
|        | 5-6*           | Isolated -15V supply to analog front-end op amps.                   |
| JU36   | 1-2            | User-Supplied +5V to LDOs that powers the supplies on the MAX11960. |
|        | 3-4*           | +5V supply to LDOs that powers the supplies on the MAX11960.        |

\*Default position.

### General Description of Software

The main window of the MAX11960 EV kit software contains six tabs: **System**, **Scope**, **DMM**, **Histogram**, **FFT**, and **Register Settings**.

#### System Tab

The System tab is an overview of the evaluation system. The left side displays Sampling Rate, Number of Samples, Clock Source, and Sync-Out CLK for the coherent sampling feature. For the Clock Source selection, the ZedBoard internal clock is always a valid option. If the External Sync-In is selected, then an external clock must be applied at the DCLK\_IN SMA on the EV kit. The Sync-Out CLK selection is used to synchronize the signal generator with a 10MHz input. See the [Sync Input and Sync Output](#) section for more information.

The center of the tab sheet displays a block diagram and the description of the installed ADC: Device, Resolution, Input Range, Reference Voltage, and Max Sampling Rate. The Device dropdown list provides the selection between Maxim’s 16-, 18-, and 20-bit parts. Once appro-

riately selected, the description of the ADC will change accordingly. The Reference Voltage dropdown list is adjustable. Please see the MAX11960 data sheet for detailed specification of the reference voltage range.

The right-side of the tab sheet reads a single conversion in LSB and decimal. An additional feature is the ADC calibration.

#### Scope Tab

The **Scope** tab sheet is used to capture data and display it in the time domain. Sampling rate and number of samples can also be set in this tab if they were not adjusted appropriately in other tabs. The **Display Unit** drop-down list allows counts and voltages. Below the graph, the user can select to display **Channel A** and/or **Channel B**. Once the desired configuration is set, click on the **Capture** button. The right-side of the tab sheet displays details of the waveform, such as **Average**, **Standard Deviation**, **Maximum**, **Minimum**, and **Fundamental Frequency**.

[Figure 2](#) displays data of both ADCs when differential sinusoidal are applied at the inputs on the EV kit.

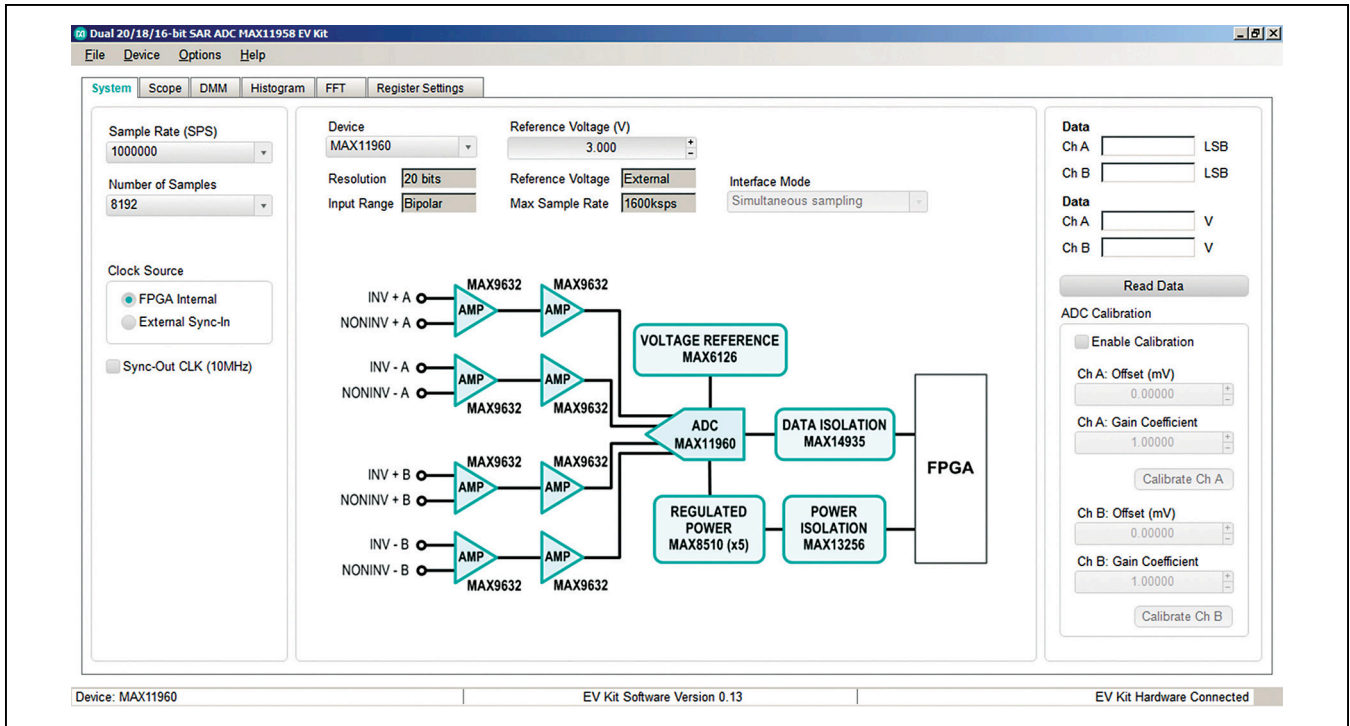


Figure 1. MAX11960 EV Kit Main Window (System Tab)

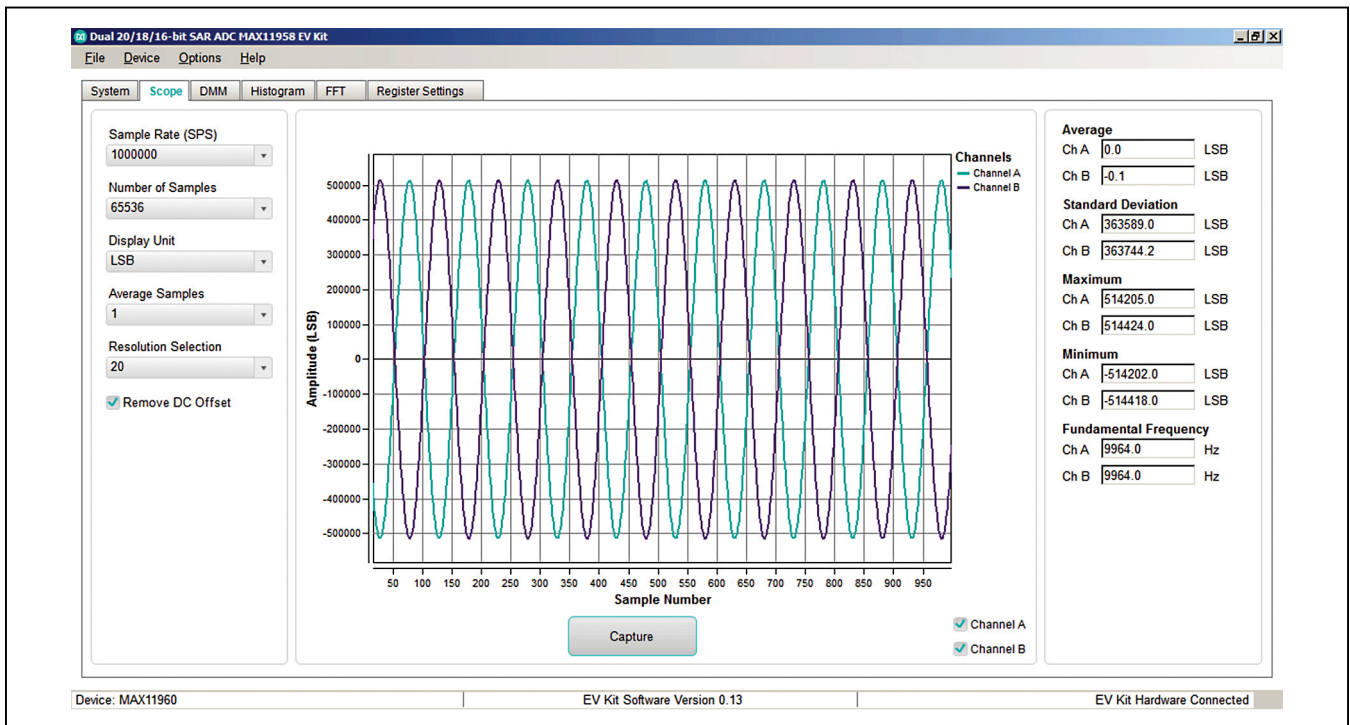


Figure 2. MAX11960 EV Kit Main Window (Scope Tab)

**DMM Tab**

The DMM tab sheet provides the typical information as a digital multimeter. Once the desired configuration is set, click on the **Capture** button.

Figure 3 displays the numerical value when the inputs on the EV kit are shorted to ground using the jumpers. See Table 1 for shunt settings.

**Histogram Tab**

The **Histogram** tab sheet is used to capture the histogram of the data. Sampling rate and number of samples can also be set in this tab if they were not adjusted appropriately in other tabs. Make sure that the number of samples do not exceed 524288. Otherwise, data capturing is longer than expected. Below the graph, the user can select to display **Channel A** and/or **Channel B**. Once the desired configuration is set, click on the **Capture** button. The right side of the tab sheet displays details of the histogram such as **Average**, **Standard Deviation**, **Maximum**, **Minimum**, **Peak to Peak Noise**, **Effective Resolution**, and **Noise Free Resolution**.

To use this histogram feature, apply a DC voltage at the input of channel A and/or B. Figure 4 displays the results when the input of the EV kit are shorted to ground. See Table 1 for placement of shunt positions.

**FFT Tab**

The **FFT** tab is used to display the FFT of the data. Sampling rate and number of samples can also be set in this tab if they were not adjusted appropriately in other tabs. When coherent sampling is needed, this tab sheet allows the user to calculate the input frequency or the master clock coming into the board. Either adjust the input frequency applied to the signal generator or adjust the master clock applied to the DCLK\_IN SMA connector. See the *Sync Input and Sync Output* section before using this feature. Once the desired configuration is set, click on the **Capture** button. The right side of the tab sheet displays the performance based on the FFT, such as **Fundamental Frequency**, **THD**, **SNR**, **SINAD**, **SFDR**, **ENOB**, and **Noise Floor**.

Figure 5 is the setup Maxim Integrated uses to capture data for coherent sampling.

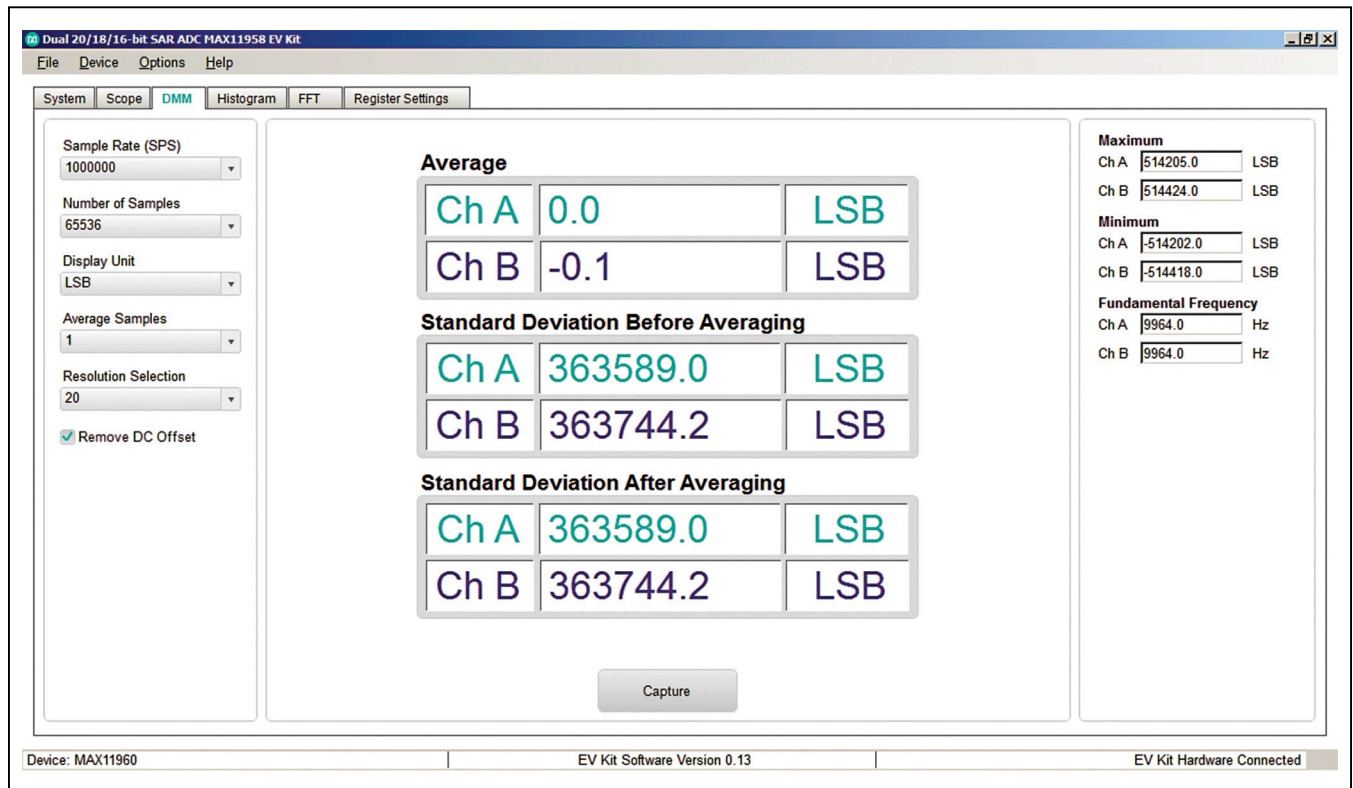


Figure 3. MAX11960 EV Kit Main Window (DMM Tab)

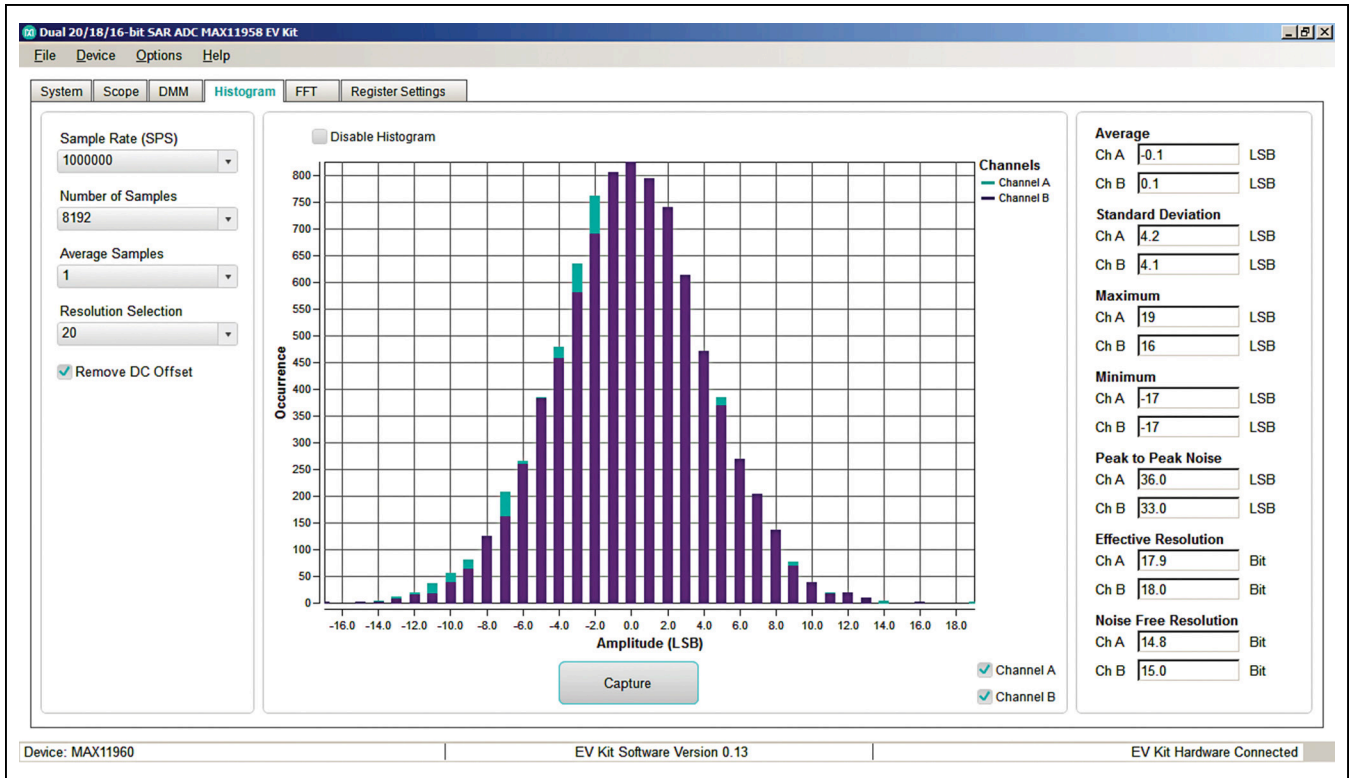


Figure 4. MAX11960 EV Kit Main Window (Histogram Tab)

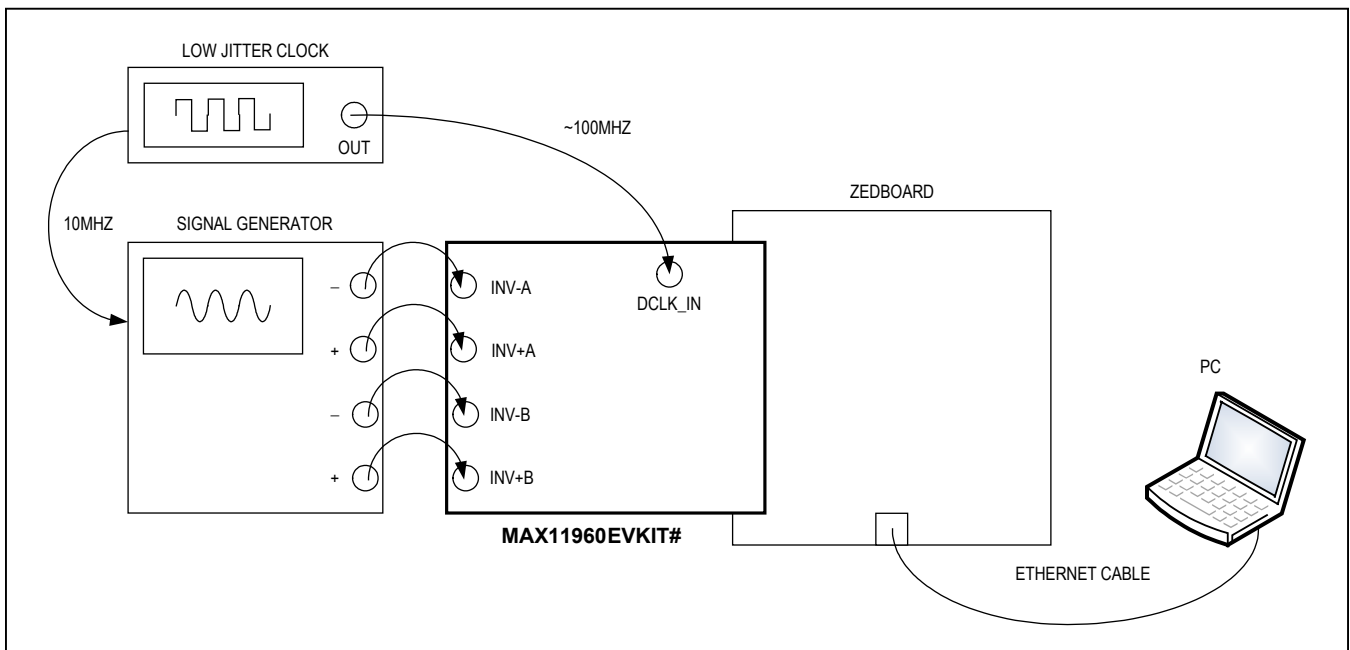


Figure 5. MAX11960 Differential EV Kit Coherent Sampling Setup



The input signal from the signal generator must be exactly **10000.000000Hz**. The low-jitter clock is synchronized with the signal generator. The master clock was initially set to **100000000 Hz** but to achieve coherent sampling, then user must click on the **Calculate** button and use the **Adjusted(Hz)** frequency. **99523158.694 Hz** was entered into our low-jitter clock. The master clock is fed back to the ZedBoard and multiplied by 3/2, then generates a system clock that drives the Xilinx FPGA. All SPI timing and sampling rate are based off the system clock.

If the results do not look similar to [Figure 6](#) and more similar to [Figure 7](#), then check all connections in [Figure 5](#) to make sure the setup is synchronizing properly.

### Register Settings Tab

The **Register Settings** tab allows the user to read and write to the appropriate registers at a bit level. Each bit(s) in each register contains the **Value**, **Setting**, and **Description**.

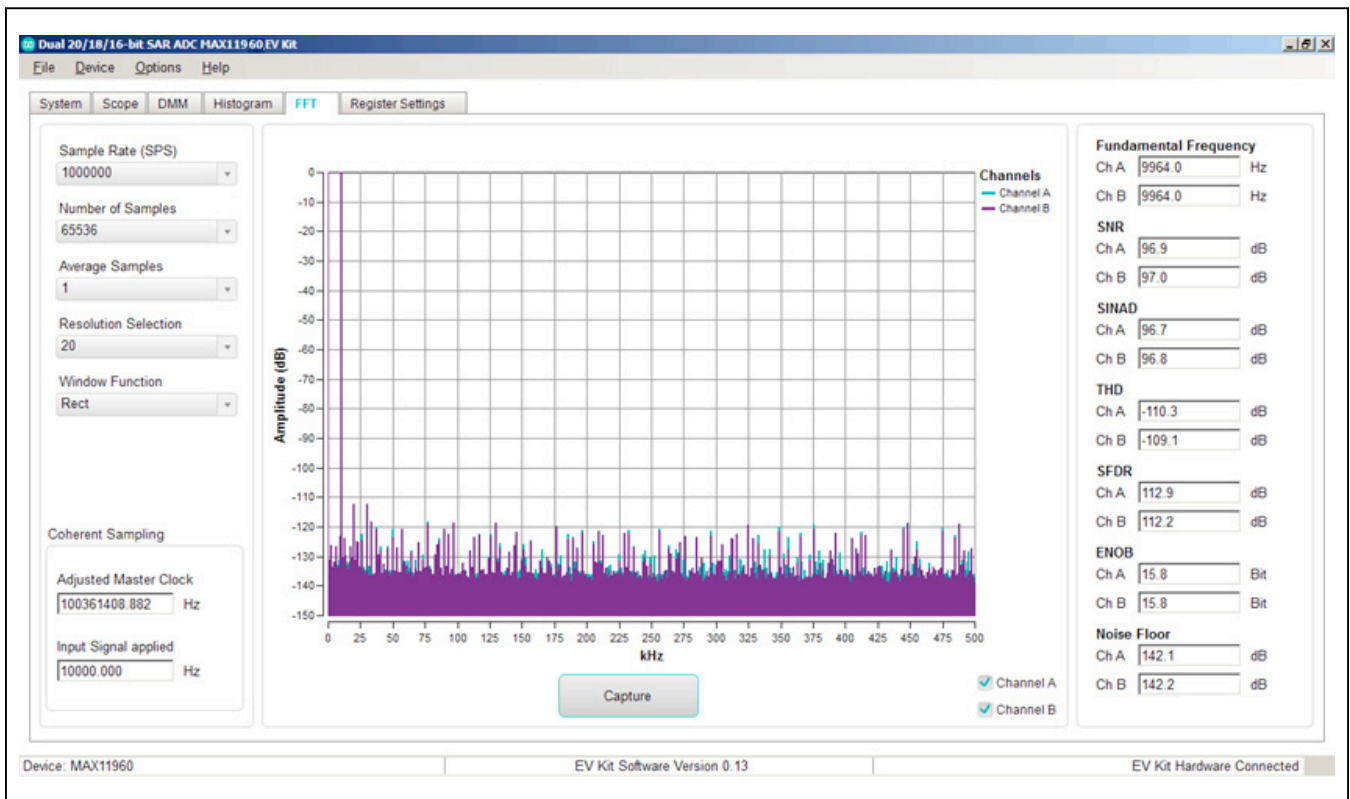


Figure 6. MAX11960 EV Kit Main Window, Coherent Sampling Results (FFT Tab)

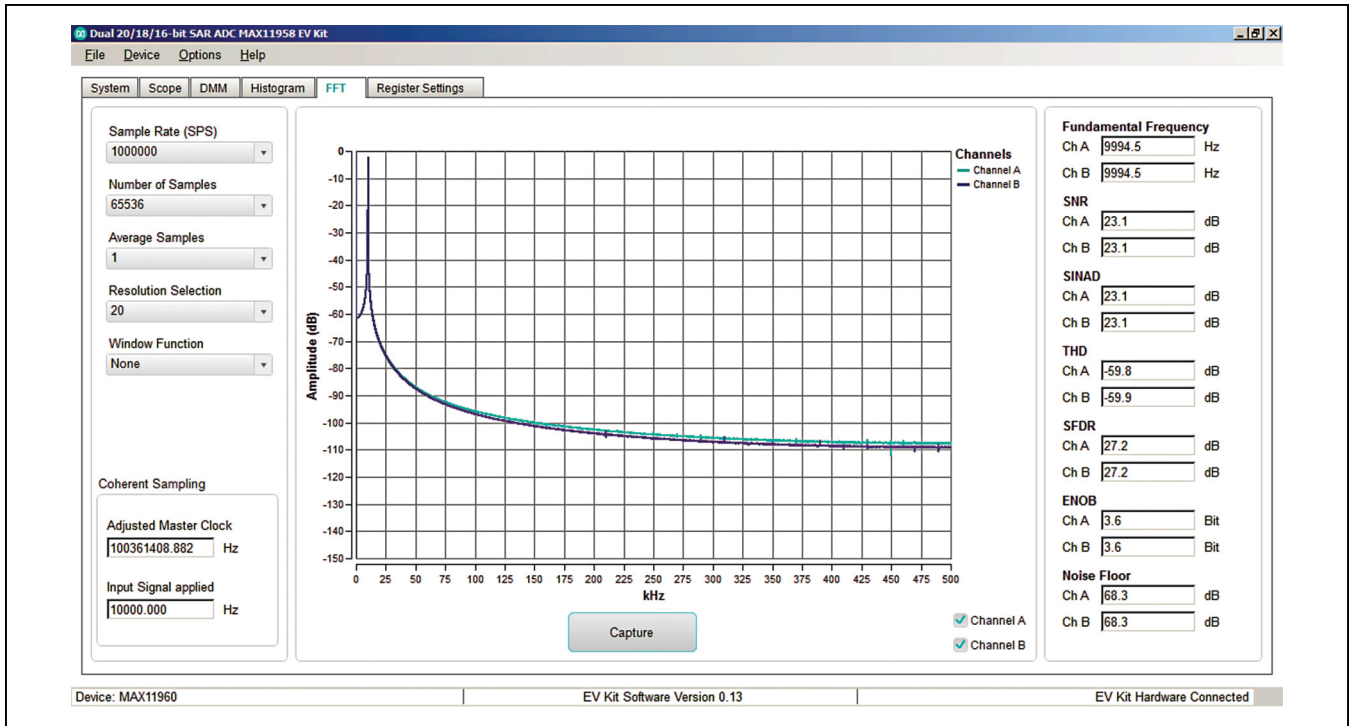


Figure 7. MAX11960 EV Kit Main Window, Non-coherent Sampling Results (FFT Tab)

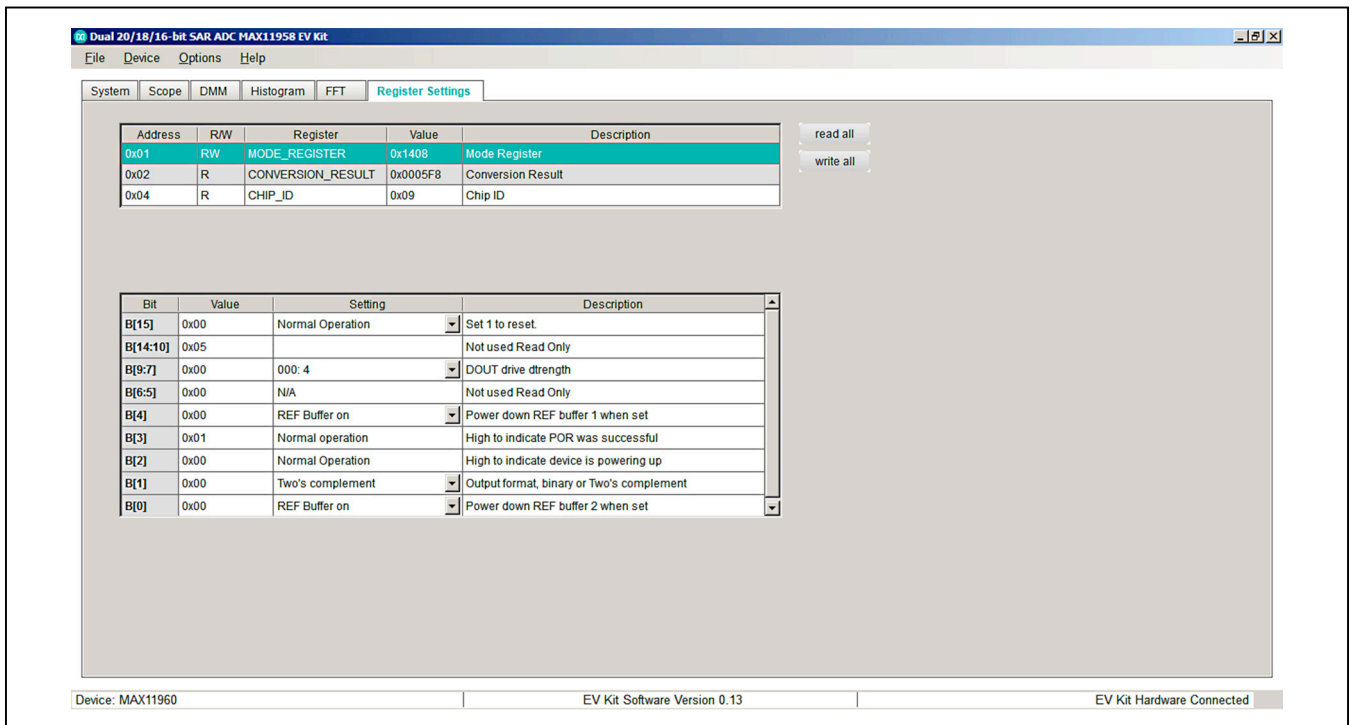


Figure 8. MAX11960 EV Kit Main Window, Register Settings (FFT Tab)

## General Description of Hardware

This EV kit provides a proven layout to demonstrate the performance of the MAX11960 18-bit, dual-channel SAR ADC. Included in the EV kit are digital isolators (MAX14935), ultra low-noise LDOs (MAX8510) to all MAX11960 supply pins, on-board reference (MAX6126), precision amplifiers (MAX9632) for the analog inputs, and sync in and sync out signals for coherent sampling.

### User-Supplied SPI

To evaluate the EV kit with a user-supplied SPI bus, remove shunts from jumper JU18. Apply the user-supplied SPI signals to the SCLK, CNVSTA, CNVSTB, DINA, DINB, DOUTA, and DOUTB test points. Make sure the return ground is the same as the MAX11960's ground.

### User-Supplied REFVDD

The REFVDD supply is powered through a +3.3V LDO by default. For user-supplied REFVDD, remove the shunt of the jumper JU25 and apply +2.7V to +3.6V at the REFVDDA and REFVDDB test points.

### User-Supplied AVDD

The AVDD supply is powered through a +1.8V LDO by default. For user-supplied AVDD, remove the shunt of the jumper JU24 and apply +1.7V to +1.9V at the AVDDA and AVDDB test points.

### User-Supplied DVDD

The DVDD supply is powered through a +1.8V LDO by default. For user-supplied DVDD, remove the shunt of the jumper JU22 and apply +1.7V to +1.9V at the DVDDA and DVDDB test points.

### User-Supplied OVDD

The OVDD supply is powered through a +1.8V LDO by default. Move the shunt to the 2-3 position of jumper JU23 to use the +3.3V LDO. For user-supplied OVDD, remove the shunt of the jumper JU23 and apply +1.5V to +3.6V at the OVDDA and OVDDB test points.

### User-Supplied REFINAB

The MAX11960 uses an on-board +3V reference MAX6126 by default. For user-supplied REFINAB, move the shunt of jumper JU16 to the 2-3 position. Make sure that REFINAB is 300mV below REFVDD before applying the reference.

## Analog Inputs

For simplicity, channel A will be discussed but will apply to channel B as well. Both analog inputs, AIN+A and AIN-A, range from 0V to V<sub>REF</sub>. The differential input range is from -V<sub>REF</sub> to +V<sub>REF</sub> and the full-scale range is 2 times the V<sub>REF</sub>. The desired input signals are applied at the INV+ and INV- SMAs for inverting configuration, and NONINV+A and NONINV-A SMAs for noninverting configuration.

## Sync Input and Sync Output

The DCLK\_IN SMA accepts an approximate 100MHz waveform signal to generate the system clock of the ZedBoard. For maximum performance, use a low-jitter clock that syncs to the user's analog function generator. The SYNC\_OUT SMA outputs a 10MHz square waveform that syncs to the user's analog function generator. Both options are used for coherent sampling of the IC. Only one option should be used at a time. The relationship between f<sub>IN</sub>, f<sub>S</sub>, N<sub>CYCLES</sub>, and M<sub>SAMPLES</sub> is given as follows:

$$\frac{f_{IN}}{f_S} = \frac{N_{CYCLES}}{M_{SAMPLES}}$$

where,

f<sub>IN</sub> = Input frequency

f<sub>S</sub> = Sampling frequency

N<sub>CYCLES</sub> = Prime number of cycles in the sampled set

M<sub>SAMPLES</sub> = Total number of samples

**Table 2. Analog Input Configurations**

| JUMPER | INVERTING | NONINVERTING |
|--------|-----------|--------------|
| JU1    | 5-6       | 1-2          |
| JU2    | 5-6       | 5-6          |
| JU4    | 3-4       | 3-4          |
| JU5    | 1-2       | 5-6          |
| JU6    | 5-6       | 5-6          |
| JU8    | 5-6       | 1-2          |
| JU9    | 5-6       | 5-6          |
| JU11   | 3-4       | 3-4          |
| JU12   | 1-2       | 5-6          |
| JU13   | 5-6       | 5-6          |

### Component Information, PCB Layout, and Schematics

See the following links for component information, PCB layout diagrams and schematics.

- [MAX11960 EV BOM](#)
- [MAX11960 EV PCB Layout](#)
- [MAX11960 EV Schematics](#)

### Ordering Information

| PART           | TYPE  |
|----------------|-------|
| MAX11960EVKIT# | EVKIT |

#Denotes RoHS compliant.

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION     | PAGES CHANGED |
|-----------------|---------------|-----------------|---------------|
| 0               | 3/16          | Initial release | —             |

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at [www.maximintegrated.com](http://www.maximintegrated.com).

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TITLE: Bill of Materials

DATE: 05/13/2015

DESIGN: max119xx\_evkit\_a

| ITEM | QTY | REF DES  | MFG PART #  | MANUFACTURE R                  | VALUE     | DESCRIPTION   |
|------|-----|--|---|--------------------------------|-----------|---|
| 1    | 6   | +20V, +3.3V_A, EXT_+5V,<br>U23_VCC, EXT_+15V,<br>EXT_+24V  | 5005  | KEystone                       | N/A       | TESTPOINT WITH 1.80MM HOLE DIA, RED, COMPACT;<br>NOT FOR COLD TEST  |
| 2    | 7   | AVDDA, AVDDDB, OVDDA,<br>OVDDDB, CNVSTA, CNVSTB,<br>EXT_REFINB   | PEC01SAAN   | SULLINS<br>ELECTRONICS<br>CORP | PEC01SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 1PIN   |
| 3    | 36  | C1, C2, C45, C48, C51, C54,<br>C61, C64, C67, C70, C74,<br>C77, C80, C83, C90, C93,<br>C96, C99, C115, C117,<br>C119, C121, C124, C127,<br>C130, C133, C138, C139,<br>C151, C155, C156, C160,<br>C165, C177, C179, C188                                      | C2012X5R1V106K085   | TDK                            | 10UF      | CAPACITOR; SMT (0805); CERAMIC CHIP; 10UF; 35V;<br>TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R                         |
| 4    | 45  | C3, C4, C8, C9, C46, C47,<br>C52, C53, C62, C63, C68,<br>C69, C75, C76, C81, C82,<br>C91, C92, C97, C98, C101-<br>C104, C107, C110-C112,<br>C116, C118, C120, C122,<br>C125, C128, C131, C134,<br>C136, C137, C152, C154,<br>C157, C159, C171, C173,<br>C187 | GRM188R72A104KA35   | MURATA                         | 0.1UF     | CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 100V;<br>TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R                      |
| 5    | 6   | C5, C7, C105, C106, C108,<br>C109  | UMK107BJ105KA-T;<br>C1608X5R1H105K080AB                       | TAIYO<br>YUDEN/TKD             | 1UF       | CAPACITOR; SMT (0603); CERAMIC CHIP; 1UF; 50V;<br>TOL=10%; MODEL=_MK SERIES; TG=-55 DEGC TO +85<br>DEGC             |
| 6    | 7   | C10, C59, C86, C113, C114,<br>C153, C158   | GRM32ER72A225KA35;<br>CGA6N3X7R2A225K230                      | MURATA/TKD                     | 2.2UF     | CAPACITOR; SMT (1210); CERAMIC CHIP; 2.2UF; 100V;<br>TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC to<br>+125 DEGC; TC=X7R |
| 7    | 1   | C11  | C1608X5R1V225K080AC;<br>GRM188R6YA225KA12                     | TKD/MURATA                     | 2.2UF     | CAPACITOR; SMT (0805); CERAMIC CHIP; 2.2UF; 50V;<br>TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R                       |
| 8    | 13  | C12, C14, C16, C18, C20,<br>C28, C29, C31, C33, C35,<br>C37, C39, C42  | CGA2B3X7R1H104K;<br>C1005X7R1H104K050BB;<br>GRM155R71H104KE14 | TKD; MURATA                    | 0.1UF     | CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 50V;<br>TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R                       |
| 9    | 12  | C13, C15, C17, C19, C27,<br>C30, C32, C34, C36, C38,<br>C40, C41   | C2012X5R1V106K085   | TDK                            | 10UF      | CAPACITOR; SMT (0805); CERAMIC CHIP; 10UF; 35V;<br>TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R                         |

|    |    |   |                                 |                         |                  |  |
|----|----|---|---------------------------------|-------------------------|------------------|--|
| 10 | 4  | C23, C26  | CGA4F3C0G2E102J                 | TDK                     | 1000PF           | CAPACITOR; SMT (0805); CERAMIC CHIP; 1000PF; 250V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=C0G  |
| 11 | 8  | C43, C49, C60, C66, C78, C95, C163, C164  | C0603C102K1GAC                  | KEMET                   | 1000PF           | CAPACITOR; SMT (0603); CERAMIC CHIP; 1000PF; 100V; TOL=10%; MODEL=C0G; TG=-55 DEGC TO +125 DEGC; TC=   |
| 12 | 10 | C44, C50, C56, C65, C71, C73, C79, C85, C94, C100                                     | CGA4F3C0G2E102J                 | TDK                     | 1000PF           | CAPACITOR; SMT (0805); CERAMIC CHIP; 1000PF; 250V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=C0G  |
| 13 | 2  | C55, C84  | CGA5L4C0G2J332J; CL31C332JHHNFN | TDK/SAMSUNG ELECTRONICS | 3300PF           | CAPACITOR; SMT (1206); CERAMIC CHIP; 3300PF; 630V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=C0G  |
| 14 | 9  | C123, C126, C129, C132, C135, C175, C176, C178, C189                                  | C0603C103K2RAC                  | KEMET                   | 0.01UF           | CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 200V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R   |
| 15 | 1  | C166  | GRM188R71E474KA12               | MURATA                  | 0.47UF           | CAPACITOR; SMT (0603); CERAMIC CHIP; 0.47UF; 25V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R  |
| 16 | 4  | C167-C170   | C2012X7R1E475K125AB             | TDK                     | 4.7UF            | CAPACITOR; SMT (0805); CERAMIC CHIP; 4.7UF; 25V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R   |
| 17 | 3  | C172, C174, C186  | 08053C105JAT2A                  | AVX                     | 1UF              | CAPACITOR; SMT (0805); CERAMIC CHIP; 1UF; 25V; TOL=5%; MODEL=X7R; TG=-55 DEGC TO +85 DEGC; TC=+/-  |
| 18 | 1  | D1  | MBR0520L                        | FAIRCHILD SEMICONDUCTOR | MBR0520L         | DIODE, SCHOTTKY, SOD-123, PIV=20V, Vf=0.385V@If=0.5A, If(ave)=0.5A   |
| 19 | 1  | D2  | LGL29K-G2J1-24-Z                | OSRAM                   | LGL29K-G2J1-24-Z | DIODE; LED; SMARTLED; GREEN; SMT; PIV=1.7V; IF=0.02A   |
| 20 | 1  | D3  | LS L29K-G1J2-1-Z                | OSRAM                   | LS L29K-G1J2-1-Z | DIODE; LED; SMART; RED; SMT (0603); PIV=1.8V; IF=0.02A; -40 DEGC TO +100 DEGC  |
| 21 | 2  | D4, D5  | BAS4002A-RPP                    | INFINEON                | BAS4002A-RPP     | DIODE; SCH; LOW VF SCHOTTKY DIODE ARRAY; SMT (SOT-143); PIV=40V; IF=0.2A   |
| 22 | 10 | INV+A, INV+B, INV-A, INV-B, DCLK_IN, NONINV+A, NONINV+B, NONINV-A, NONINV-B, SYNC_OUT | 5-1814832-1                     | TYCO                    | 5-1814832-1      | CONNECTOR; FEMALE; THROUGH HOLE; CONN SOCKET SMA STR DIE CAST PCB; STRAIGHT; 5PINS   |
| 23 | 2  | EXT_-15V, EXT_-24V  | 5008                            | KEYSTONE                | N/A              | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; ORANGE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN; NOT FOR COLD TEST |

|    |    |  |                   |                                 |                       |  |
|----|----|--|-------------------|---------------------------------|-----------------------|--|
| 24 | 13 | TP8, GND1-GND6, TP27,<br>TP28, TP36, GNDD1-GNDD3 | 5006              | KEYSTONE                        | N/A                   | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN;<br>BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE<br>WIRE SILVER PLATE FINISH; RECOMMENDED FOR<br>BOARD THICKNESS=0.062IN; NOT FOR COLD TEST |
| 25 | 1  | GNDD   | 5123              | KEYSTONE                        | N/A                   | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN;<br>BOARD HOLE=0.063IN; GRAY; PHOSPHOR BRONZE<br>WIRE SILVER PLATE FINISH; RECOMMENDED FOR<br>BOARD THICKNESS=0.062IN; NOT FOR COLD TEST  |
| 26 | 1  | J1   | TSW-106-08-S-D-RA | SAMTEC                          | TSW-106-08-<br>S-D-RA | CONNECTOR; THROUGH HOLE; DOUBLE ROW; RIGHT<br>ANGLE; 12PINS; THIS PART IS DEDICATED FOR<br>PMOD PERIPHERAL BOARD   |
| 27 | 1  | J2   | ASP-134604-01     | SAMTEC                          | ASP-134604-<br>01     | CONNECTOR; MALE; SMT; HIGH SPEED/HIGH<br>DENSITY OPEN PIN FIELD TERMINAL ARRAY;<br>STRAIGHT; 160PINS   |
| 28 | 1  | J3   | KLDX-0202-B       | KYCON                           | KLDX-0202-<br>B       | CONNECTOR; FEMALE; THROUGH HOLE; DC POWER<br>JACK; RIGHT ANGLE; 3PINS  |
| 29 | 8  | JU1, JU4, JU5, JU8, JU11,<br>JU12, JU23, JU35    | PEC03DAAN         | SULLINS<br>ELECTRONICS<br>CORP. | PEC03DAAN             | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT THROUGH; 6PINS; -65 DEGC TO +125<br>DEGC   |
| 30 | 4  | JU2, JU6, JU9, JU13                              | PEC05DAAN         | SULLINS<br>ELECTRONICS<br>CORP. | PEC05DAAN             | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 10PINS; -65 DEGC TO +125 DEGC   |
| 31 | 1  | JU3  | PEC08DAAN         | SULLINS<br>ELECTRONICS<br>CORP. | PEC08DAAN             | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 16PINS; -65 DEGC TO +125 DEGC   |
| 32 | 3  | JU16, JU17, JU31                                 | PCC03SAAN         | SULLINS                         | PCC03SAAN             | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125<br>DEGC   |
| 33 | 1  | JU18   | TSW-110-26-T-T    | SAMTEC                          | TSW-110-26-<br>T-T    | CONNECTOR; MALE; THROUGH HOLE; TSW SERIES;<br>STRAIGHT; 30PINS   |
| 34 | 1  | JU20   | PEC02SAAN         | SULLINS                         | PEC02SAAN             | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 2PINS   |
| 35 | 4  | JU22, JU24, JU25, JU36                           | PEC02DAAN         | SULLINS<br>ELECTRONIC<br>CORP.  | PEC02DAAN             | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 4PINS   |
| 36 | 1  | JU30   | 282834-2          | TE<br>CONNECTIVITY              | 282834-2              | CONNECTOR; FEMALE; THROUGH HOLE; 2.54MM<br>PITCH; SIDE WIRE ENTRY STACKING TERMINAL<br>BLOCK ; STRAIGHT; 2PINS; -40 DEGC TO + 105 DEGC   |
| 37 | 2  | JU32, JU33                                       | PBC02DAAN         | SULLINS<br>ELECTRONIC<br>CORP.  | PBC02DAAN             | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 4PINS   |



|    |    |   |  |                            |           |  |
|----|----|---|--|----------------------------|-----------|--|
| 38 | 1  | JU34  | PEC04DAAN                                  | SULLINS ELECTRONICS CORP.  | PEC04DAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 8PINS    |
| 39 | 4  | L1-L4   | LBC3225T330KR                              | TAIYO YUDEN                | 33UH      | INDUCTOR; SMT (1210); WIREWOUND CHIP; 33UH; TOL=+/-10%; 0.3A |
| 40 | 15 | R1-R4, R37, R38, R50, R53, R92, R97, R105, R111, R121-R123          | CRCW06030000ZS; MCR03EZPJ000; ERJ-3GEY0R00 | VISHAY DALE/ROHM/PANASONIC | 0         | RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM         |
| 41 | 1  | R5  | RG1608N-101-W-T1                           | SUSUMU CO LTD.             | 100       | RESISTOR; 0603; 100 OHM; 0.05%; 10PPM; 0.10W; THICK FILM     |
| 42 | 4  | R7-R10  | RNCF0603BKC2R21                            | STACKPOLE ELECTRONICS INC. | 2.21      | RESISTOR; 0603; 2.21 OHM; 0.1%; 50PPM; 0.063W; THIN FILM     |
| 43 | 15 | R11, R12, R36, R39-R41, R48, R49, R51, R52, R54, R61, R62, R84, R85 | SEE NOTES                                  | VISHAY DALE                | 33        | RESISTOR; 0603; 33 OHM; 1%; 100PPM; 0.10W; THICK FILM        |
| 44 | 16 | R13-R16, R20-R22, R25-R27, R31-R33, R71-R73                         | RN73C1J2K0B; 5-1614352-1                   | TE CONNECTIVITY            | 2K        | RESISTOR; 0603; 2K OHM; 0.1%; 10PPM; 0.063W; METAL FILM      |
| 45 | 12 | R17, R23, R28, R34, R75, R76, R80, R81, R93, R94, R104, R112        | 288-0603-1.0K-RC                           | XICON                      | 1K        | RESISTOR, 0603, 1K, 0.1%, 10PPM, 1/16W, THIN FILM            |
| 46 | 12 | R18, R24, R29, R35, R90, R91, R95, R96, R106, R107, R109, R110      | PCF0603R-2K0B                              | TT ELECTRONICS             | 2K        | RESISTOR; 0603; 2K OHM; 0.1%; 25PPM; 0.063W; METAL FILM      |
| 47 | 1  | R19   | CRCW0603330KFK                             | VISHAY DALE                | 330K      | RESISTOR, 0603, 330K OHM, 1%, 100PPM, 0.10W, THICK FILM      |
| 48 | 1  | R30   | CRCW06031M50FK                             | VISHAY DALE                | 1.5M      | RESISTOR, 0603, 1.5M OHM, 1%, 100PPM, 0.10W, THICK FILM      |
| 49 | 13 | R42-R45, R47, R56-R59, R63-R66                                      | CRCW06031003FK; ERJ-3EKF1003               | VISHAY DALE/PANASONIC      | 100K      | RESISTOR; 0603; 100K; 1%; 100PPM; 0.10W; THICK FILM          |
| 50 | 1  | R46   | CRCW060349R9FK                             | VISHAY DALE                | 49.9      | RESISTOR; 0603; 49.9 OHM; 1%; 100PPM; 0.10W; THICK FILM      |
| 51 | 16 | R55, R60, R67-R70, R74, R77-R79, R82, R83, R98, R99, R108, R113     | RN73C1J10RBTG; 1614350-2                   | TE CONNECTIVITY            | 10        | RESISTOR; 0603; 10 OHM; 0.1%; 10PPM; 0.063W; THICK FILM      |
| 52 | 8  | R86-R89, R100-R103  | CRCW060375R0FK                             | VISHAY DALE                | 75        | RESISTOR; 0603; 75 OHM; 1%; 100PPM; 0.10W; THICK FILM        |
| 53 | 2  | R114, R115  | MCR03EZPFX2002; ERJ-3EKF2002               | ROHM; PANASONIC            | 20K       | RESISTOR; 0603; 20K OHM; 1%; 100PPM; 0.10W; THICK FILM       |
| 54 | 1  | R116  | CRCW06031001FK; ERJ-3EKF1001V              | VISHAY DALE; PANASONIC     | 1K        | RESISTOR; 0603; 1K; 1%; 100PPM; 0.10W; THICK FILM            |
| 55 | 2  | R117, R119  | CRCW0603820KFK                             | VISHAY DALE                | 820K      | RESISTOR, 0603, 820K OHM, 1%, 100PPM, 0.10W, THICK FILM      |
| 56 | 2  | R118, R120  | RC0603FR-0771K5L                           | YAGEO PHYCOMP              | 71.5K     | RESISTOR; 0603; 71.5K OHM; 1%; 100PPM; 0.10W; THICK FILM     |

|    |    |  |               |                           |               |  |
|----|----|--|---------------|---------------------------|---------------|--|
| 57 | 14 | SU1, SU2, SU4-SU6, SU8, SU9, SU11-SU13, SU3_1-SU3_4  | STC02SYAN     | SULLINS ELECTRONICS CORP. | STC02SYAN     | TEST POINT; JUMPER; STR; TOTAL LENGTH=0.256IN; BLACK; INSULATION=PBT CONTACT=PHOSPHOR BRONZE; COPPER PLATED TIN OVERALL  |
| 58 | 15 | SU16, SU17, SU32-SU36, SU22_1, SU22_2, SU23_1, SU23_2, SU24_1, SU24_2, SU25_1, SU25_2                                  | 2012J-CR      | JAMECO VALUEPRO           | 2012J-CR      | CONNECTOR; FEMALE; WIREMOUNT; SOCKET SHORTING BLOCK; CLOSED TOP; RED; STRAIGHT; 2PINS  |
| 59 | 8  | SU31, SU18_1-SU18_7  | GJWCL-B-R     | JAMECO VALUEPRO           | GJWCL-B-R     | CONNECTOR; FEMALE; WIREMOUNT; SOCKET SHORTING BLOCK; CLOSED TOP; BLUE; STRAIGHT; 2PINS   |
| 60 | 1  | T1   | TGM-H240V8LF  | HALO ELECTRONICS, INC     | TGM-H240V8LF  | TRANSFORMER; SMT; 1:1:1.3:1.3; DC/DC CONVERTER   |
| 61 | 12 | U10_6, U12_6, U15_6, U16_6, TP_INV+A, TP_INV+B, TP_INV-A, TP_INV-B, TP_NONINV+A, TP_NONINV+B, TP_NONINV-A, TP_NONINV-B | 5009          | KEYSTONE                  | N/A           | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN; NOT FOR COLD TEST |
| 62 | 1  | U1   | MAX11958ETP+  | MAXIM                     | MAX11958ETP+  | EVKIT PART - IC; MAX11958; AZ10A; PACKAGE CODE T3255MK-2   |
| 63 | 1  | U2   | MAX13256ATB+  | MAXIM                     | MAX13256ATB+  | IC; DRV; 36V H-BRIDGE TRANSFORMER DRIVER FOR ISOLATED SUPPLIES; TDFN10-EP 3X3  |
| 64 | 3  | U3, U18, U22   | MAX14935FAWE+ | MAXIM                     | MAX14935FAWE+ | IC; DISO; FOUR-CHANNEL; 150MBPS; 5KV DIGITAL ISOLATOR; WSOIC16 300MIL  |
| 65 | 1  | U4   | TPS7A4901DGN  | TEXAS INSTRUMENTS         | TPS7A4901DGN  | IC; VREG; ULTRALOW-NOISE, POSITIVE LINEAR REGULATOR; MSOP8-EP 300MIL   |
| 66 | 1  | U6   | TPS7A3001DGN  | TEXAS INSTRUMENTS         | TPS7A3001DGN  | IC; VREG; ULTRALOW-NOISE, NEGATIVE LINEAR REGULATOR; MSOP8-EP 300MIL   |
| 67 | 10 | U7, U8, U10-U16, U20   | MAX9632AUA+   | MAXIM                     | MAX9632AUA+   | IC; OPAMP; PRECISION, LOW-NOISE, WIDE-BAND AMPLIFIER; UMAX8 ; -40 DEGC TO +125 DEGC  |
| 68 | 2  | U9, U19  | MAX9632AUA+   | MAXIM                     | MAX9632AUA+   | IC; OPAMP; PRECISION, LOW-NOISE, WIDE-BAND AMPLIFIER; UMAX8 ; -40 DEGC TO +125 DEGC  |
| 69 | 1  | U17  | 93LC66BT-I/OT | MICROCHIP                 | 93LC66BT-I/OT | IC; EPROM; 4K MICROWIRE SERIAL EEPROM; SOT23-6   |
| 70 | 1  | U21  | 74LVC1G126GV  | NXP                       | 74LVC1G126GV  | IC; DRV; SINGLE BUS BUFFER/LINE DRIVER; 3-STATE; SOT753  |
| 71 | 1  | U23  | MAX15006BATT+ | MAXIM                     | MAX15006BATT+ | IC; VREG; ULTRA-LOW QUIESCENT-CURRENT LINEAR REGULATOR; TDFN6-EP 3X3   |
| 72 | 3  | U26, U27, U29  | MAX8510EXK18  | MAXIM                     | MAX8510EXK18  | IC; VREG; ULTRA-LOW-NOISE; HIGH PSRR; LOW-DROPOUT; 0.12A LINEAR REGULATOR; SC70-5  |
| 73 | 2  | U28, U30   | MAX8510EXK33+ | MAXIM                     | MAX8510EXK33+ | IC; VREG; ULTRA-LOW-NOISE; HIGH PSRR; LOW-DROPOUT; 0.12A LINEAR REGULATOR; SC70-5  |

|       |     |     |                |       |                   |                          |
|-------|-----|-----|----------------|-------|-------------------|--------------------------|
| 74    | 1   | U36 | MAX6126AASA30+ | MAXIM | MAX6126AA<br>SA30 | SERIES VOLTAGE REFERENCE |
| 75    | 1   |     | MAX119XX       | MAXIM | PCB               | PCB: MAX119XX            |
| TOTAL | 437 |     |                |       |                   |                          |

DO NOT PURCHASE(DNP)

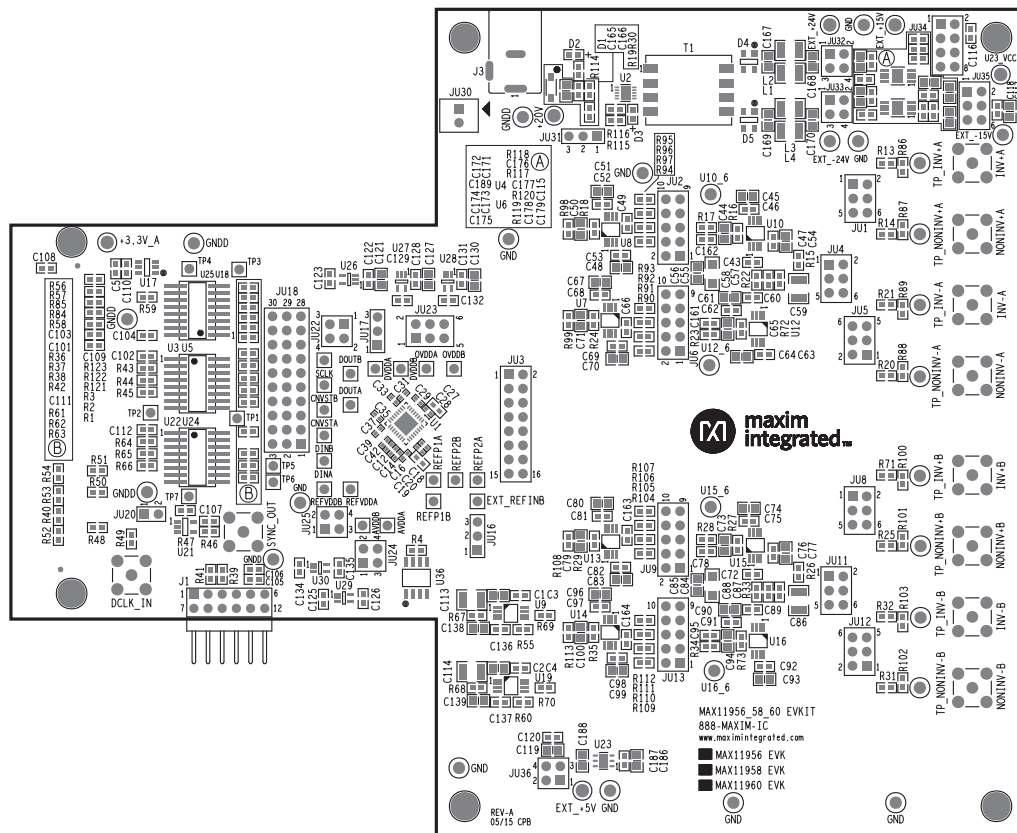
| ITEM  | QTY | REF DES   | MFG PART # | MANUFACTURE<br>R               | VALUE     | DESCRIPTION   |
|-------|-----|---|------------|--------------------------------|-----------|---|
| 1     | 12  | C21, C22, C24, C25, C57,<br>C58, C72, C87-C89, C161,<br>C162  | N/A        | N/A                            | ?         | CAPACITOR; 0603 PACKAGE; GENERIC                            |
| 2     | 20  | TP1-TP7, DINA, DINB,<br>SCLK, DOUTA, DOUTB,<br>DVDDA, DVddb, REFP1A,<br>REFP1B, REFP2A, REFP2B,<br>REFVDDA, REFVddb | PEC01SAAN  | SULLINS<br>ELECTRONICS<br>CORP | PEC01SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 1PIN |
| 3     | 1   | R6  | N/A        | N/A                            | ?         | RESISTOR; 0603 PACKAGE; GENERIC                             |
| TOTAL | 33  |   |            |                                |           |   |

PACKOUT (These are DO NOT INSTALL parts and will be shipped with PCB)

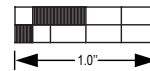
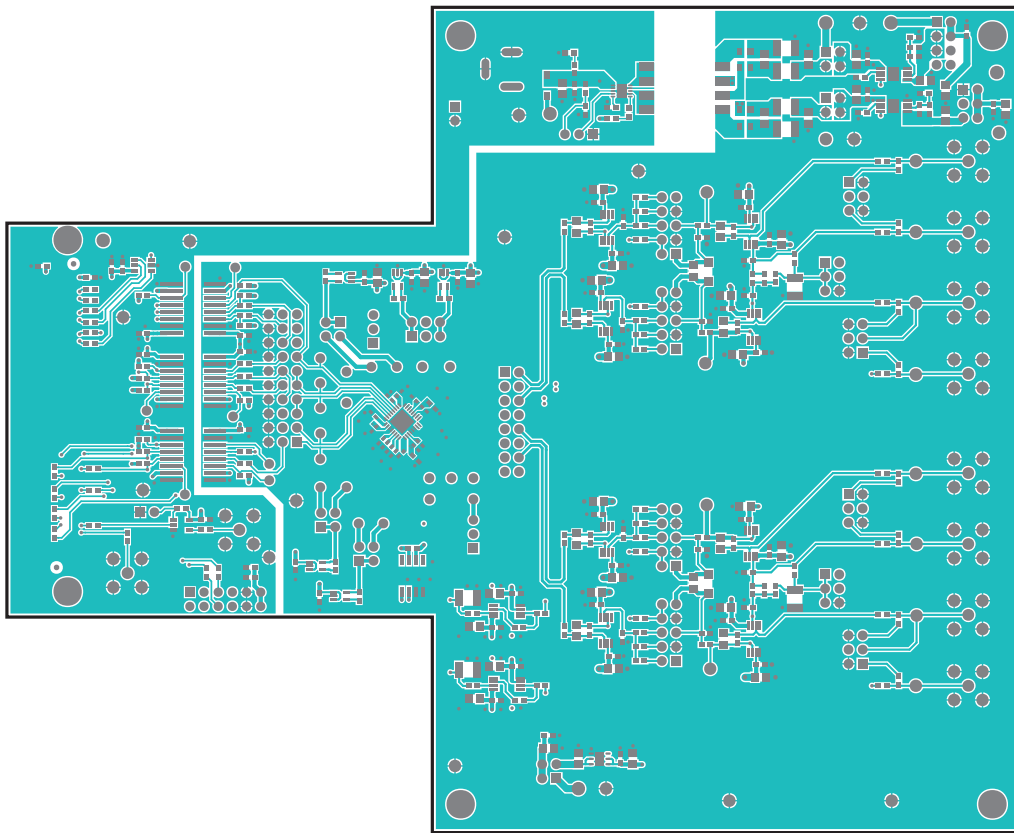
| ITEM | QTY | REF DES | MANUFACTURER | VALUE | DESCRIPTI<br>ON  | STATUS             |
|------|-----|---------|--------------|-------|--|--------------------|
| 1    | 1   | PACKOUT | N/A          | ?     | BOX;SMALL<br>BROWN 9<br>3/16"X7"X1<br>1/4" -<br>PACKOUT                    | EVKIT-NOT FOR TEST |
| 2    | 1   | PACKOUT | N/A          | ?     | ESD<br>BAG;+;BAG;<br>STATIC<br>SHIELD ZIP<br>8"X10"; W/<br>ESD LOGO        | EVKIT-NOT FOR TEST |
| 3    | 1   | PACKOUT | N/A          | ?     | PINK<br>FOAM;FOA<br>M;ANTI-<br>STATIC PE<br>12inX12inX5<br>MM -<br>PACKOUT | EVKIT-NOT FOR TEST |

|   |   |         |                     |               |   |                    |
|---|---|---------|---------------------|---------------|---|--------------------|
| 4 | 1 | PACKOUT | N/A                 | ?             | WEB INSTRUCTIONS FOR MAXIM DATA SHEET                 | EVKIT-NOT FOR TEST |
| 5 | 1 | PACKOUT | N/A                 | ?             | LABEL(EV KIT BOX) - PACKOUT                           | EVKIT-NOT FOR TEST |
| 6 | 1 | MEM1    | KINGSTON TECHNOLOGY | SDC4/4GB      | ACCESSORY; MEMORY CARD; 4GB; MICROSDHC SERIES; CLASS4 | EVKIT-NOT FOR TEST |
| 7 | 1 |         | B00ET4KHJ2          | CABLE MATTERS | USB 2.0 TO 10/100 ETHERNET ADAPTER                    |                    |

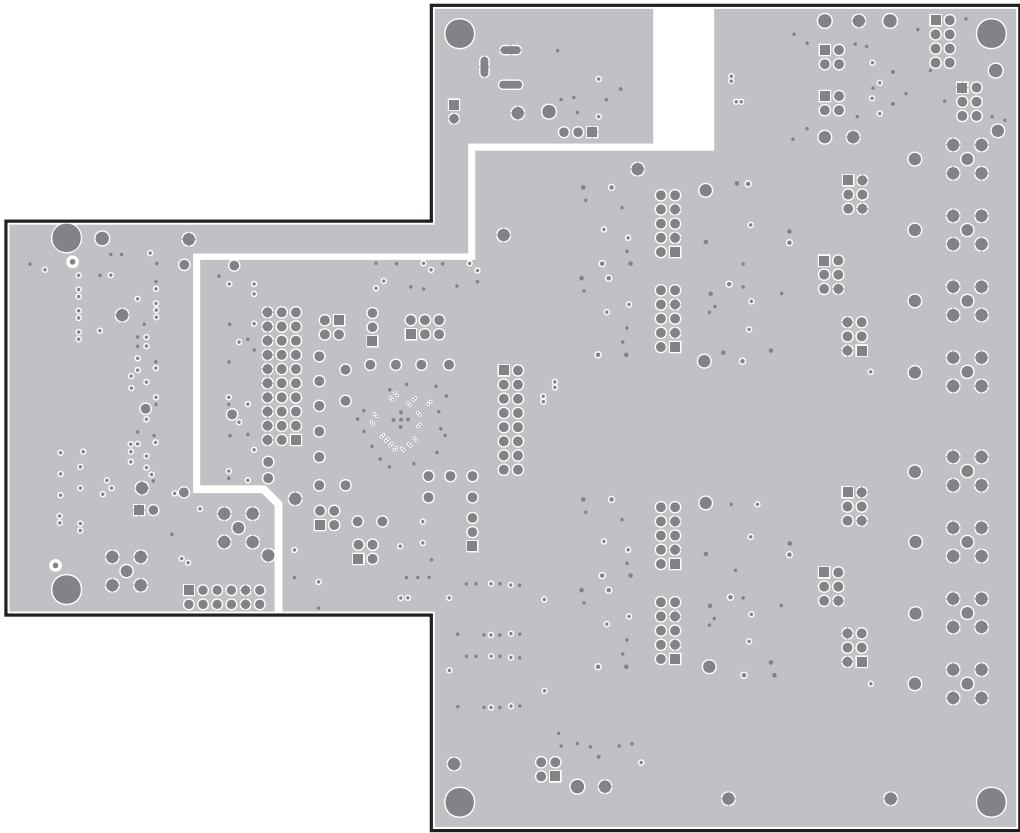
TOTAL 7



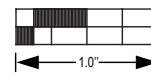
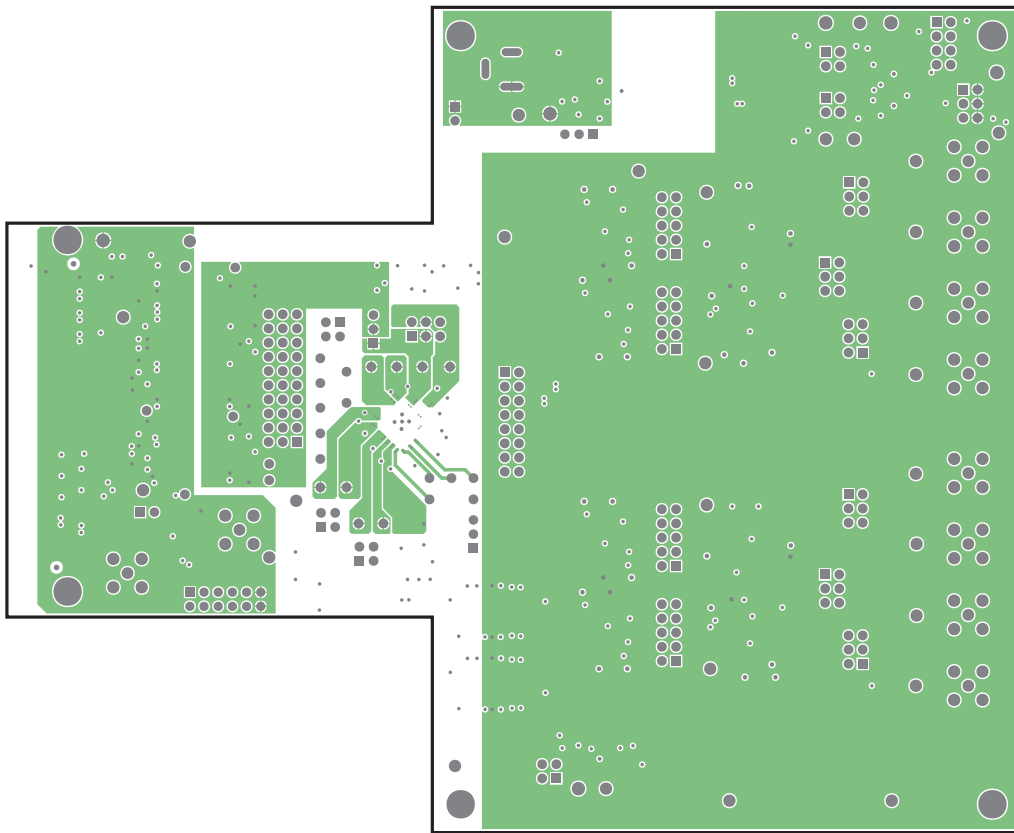
**Component Placement Guide—Component Side**



**PCB Layout—Component Side**

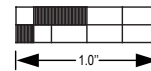
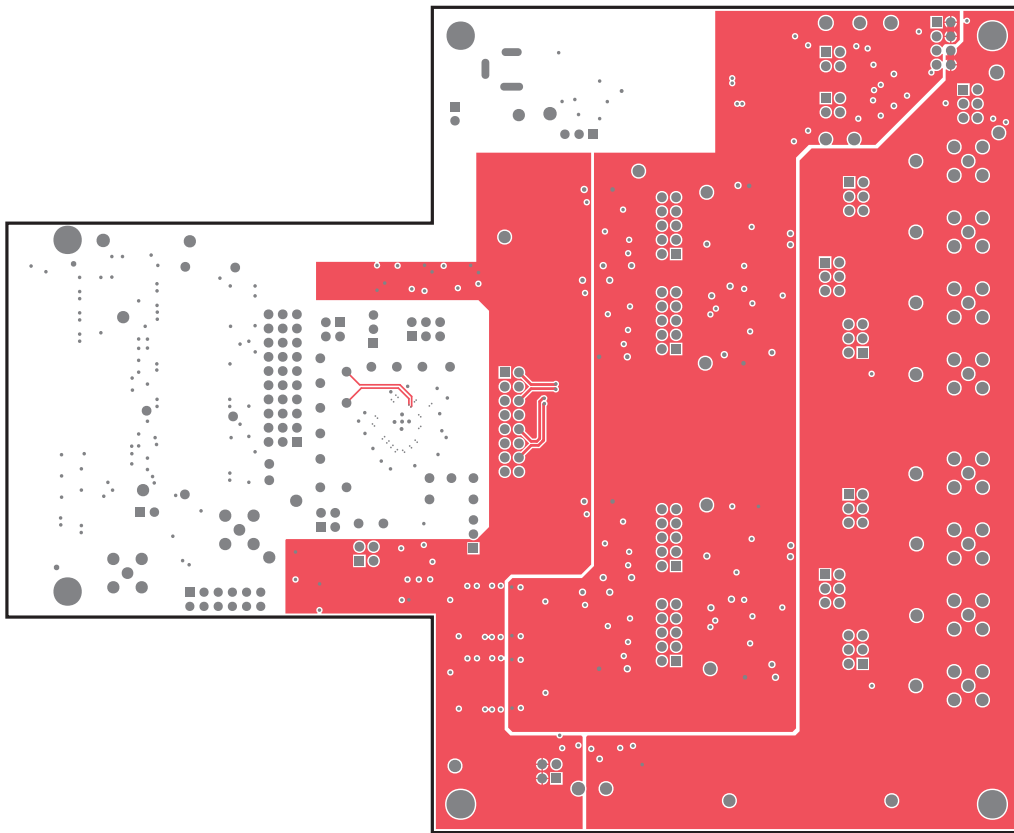


PCB Layout—Layer 2

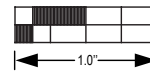
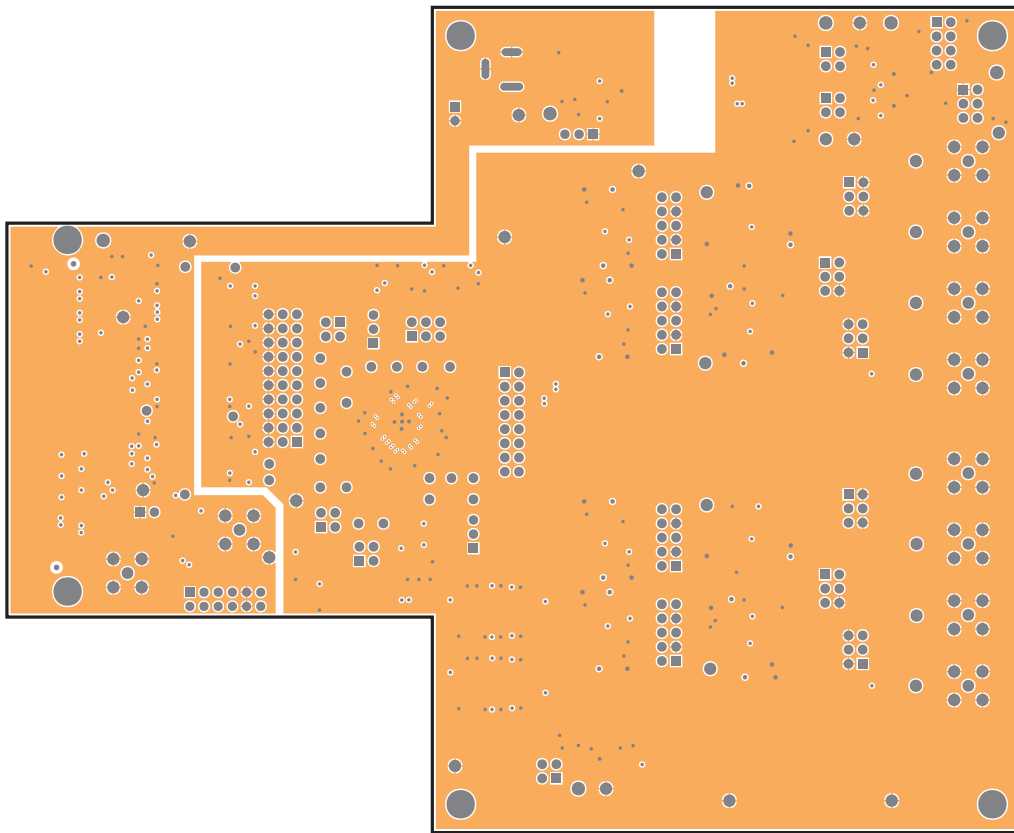


**PCB Layout—Layer 3**

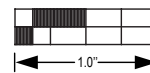
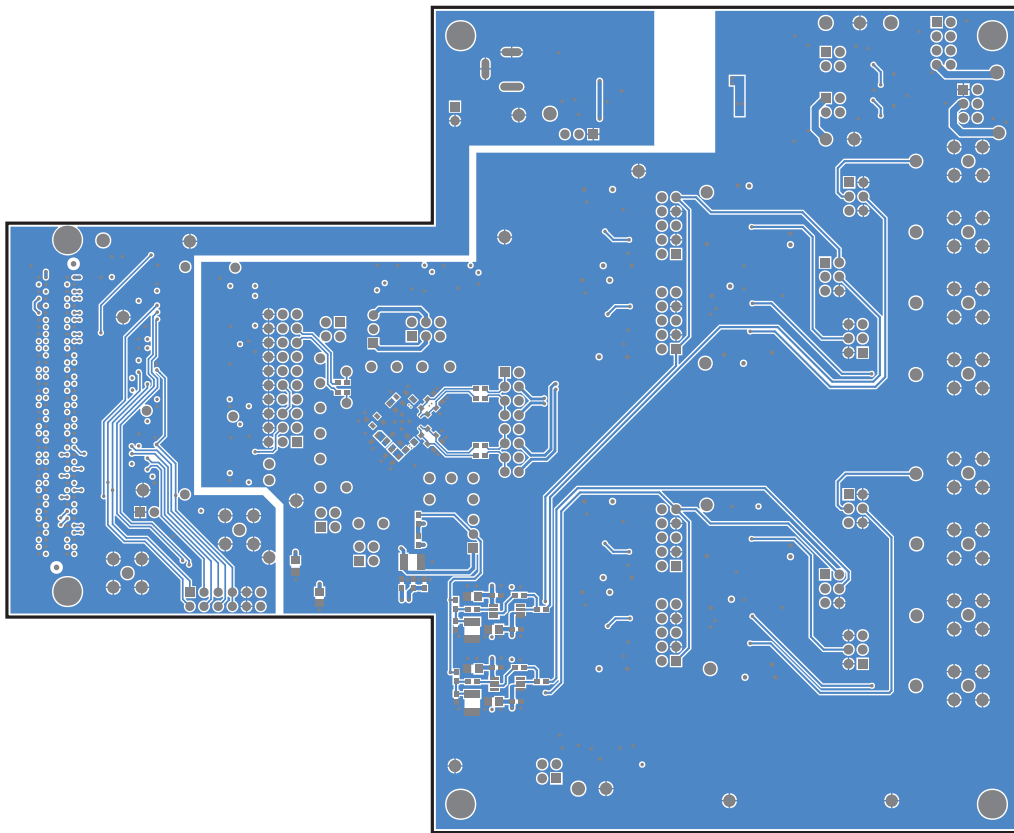




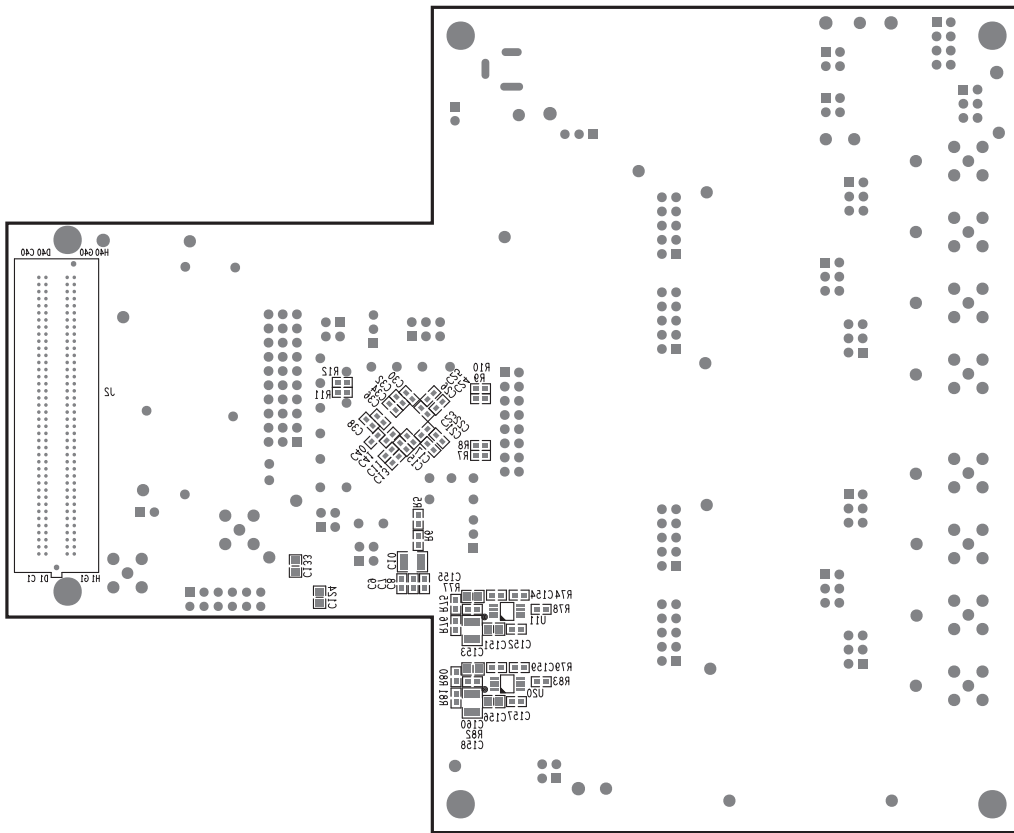
**PCB Layout—Layer 4**



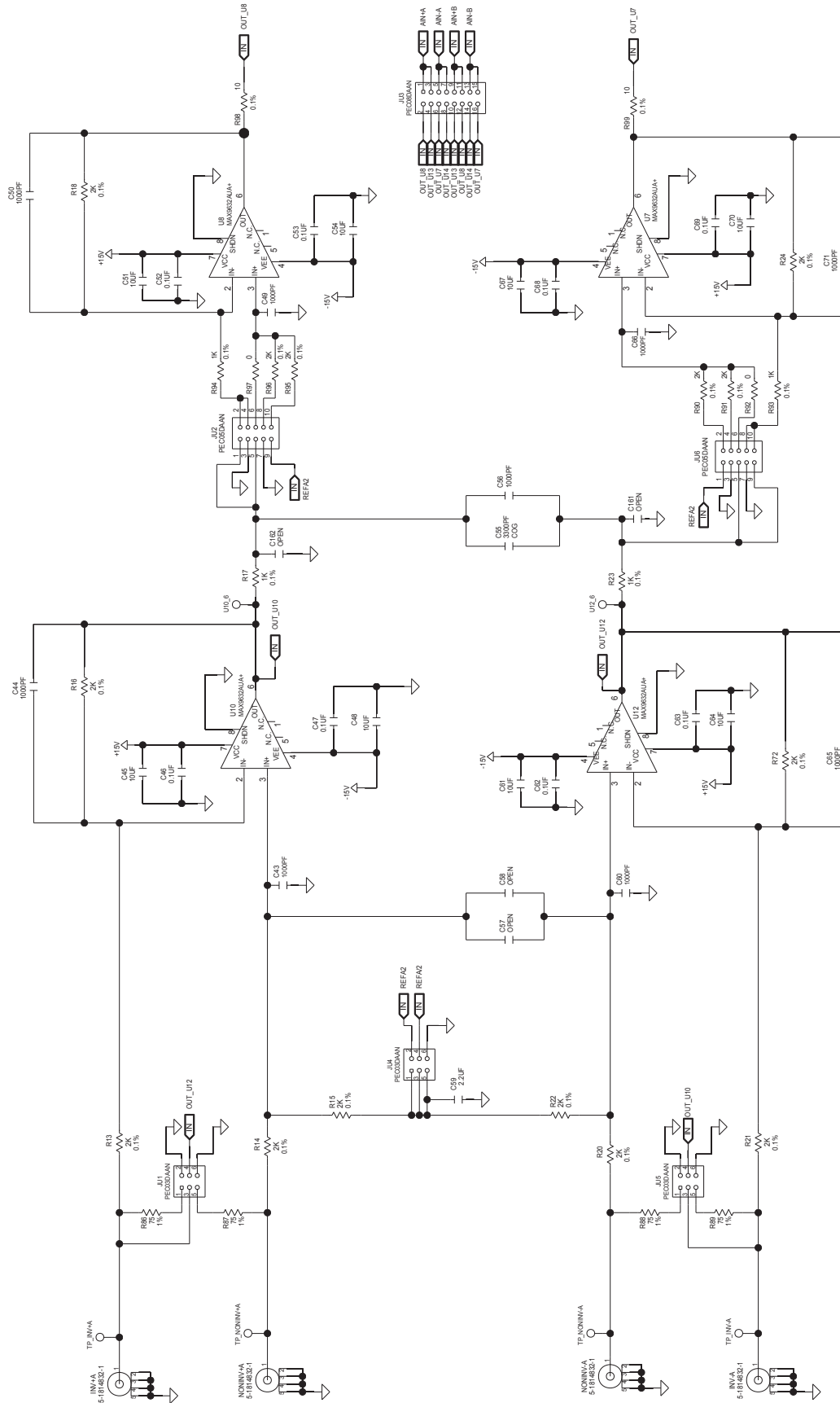
**PCB Layout—Layer 5**

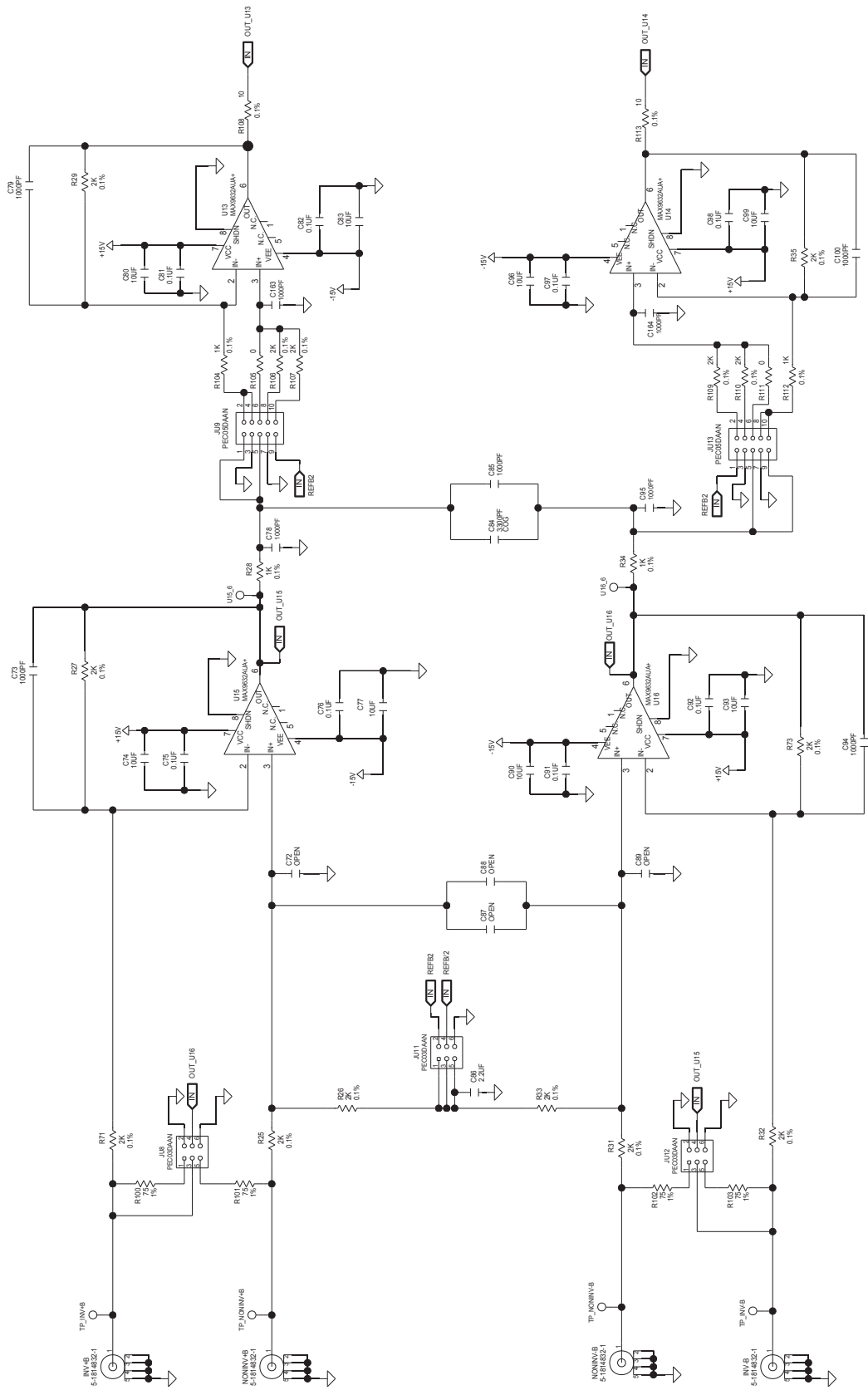


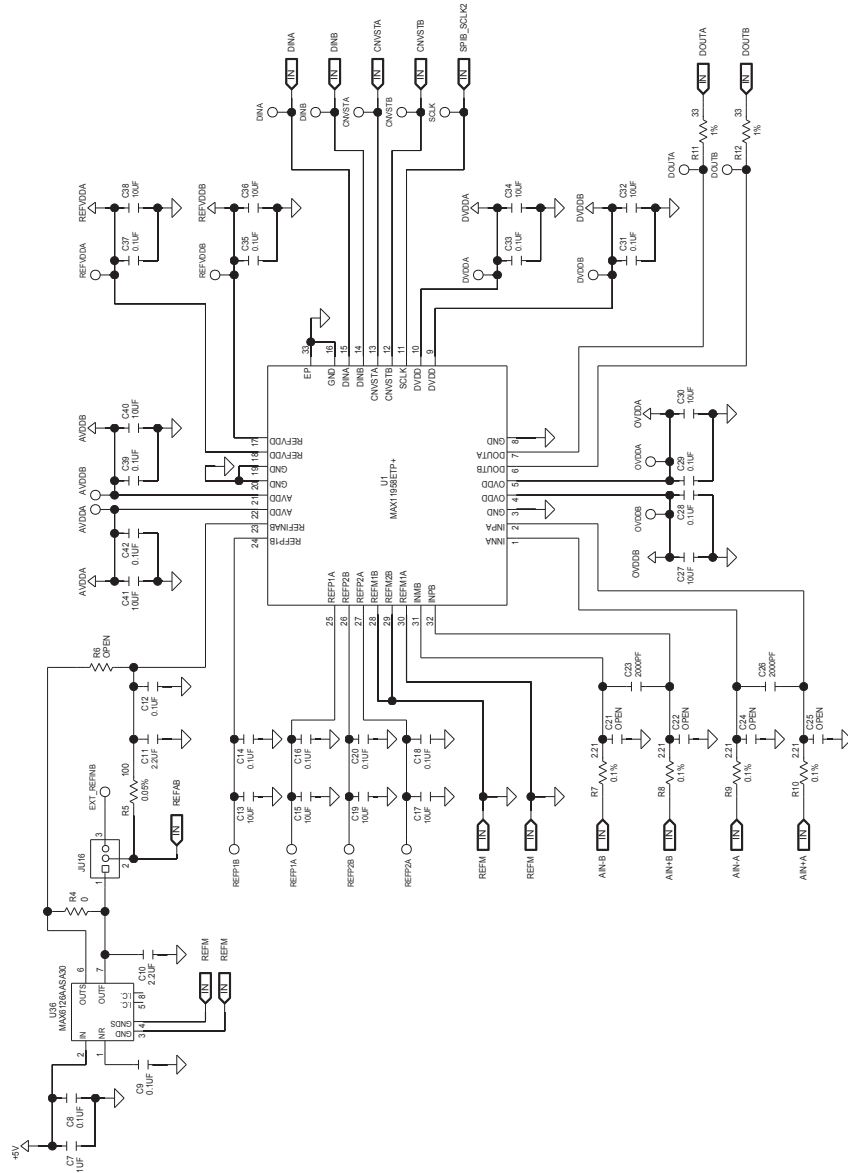
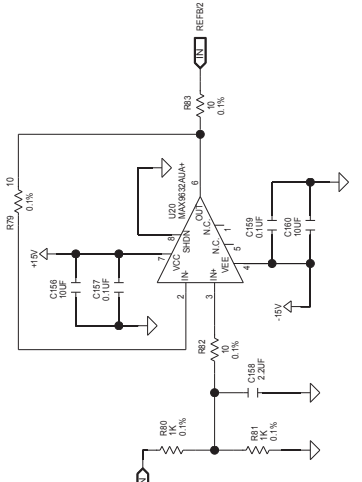
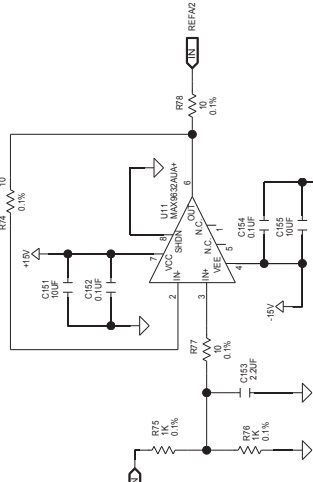
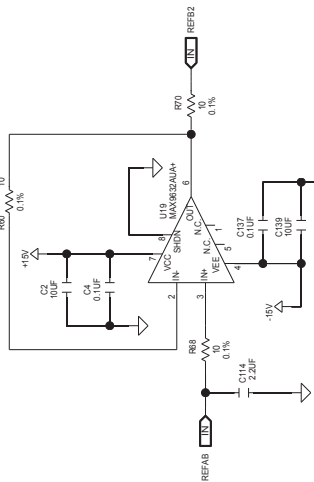
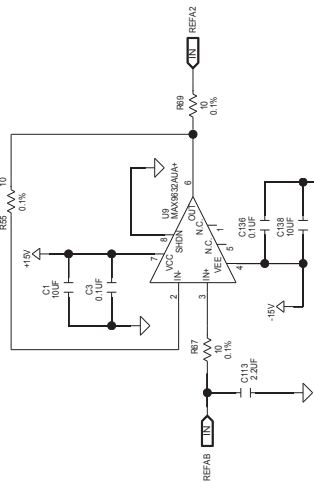
**PCB Layout—Solder Side**



**Component Placement Guide—Solder Side**

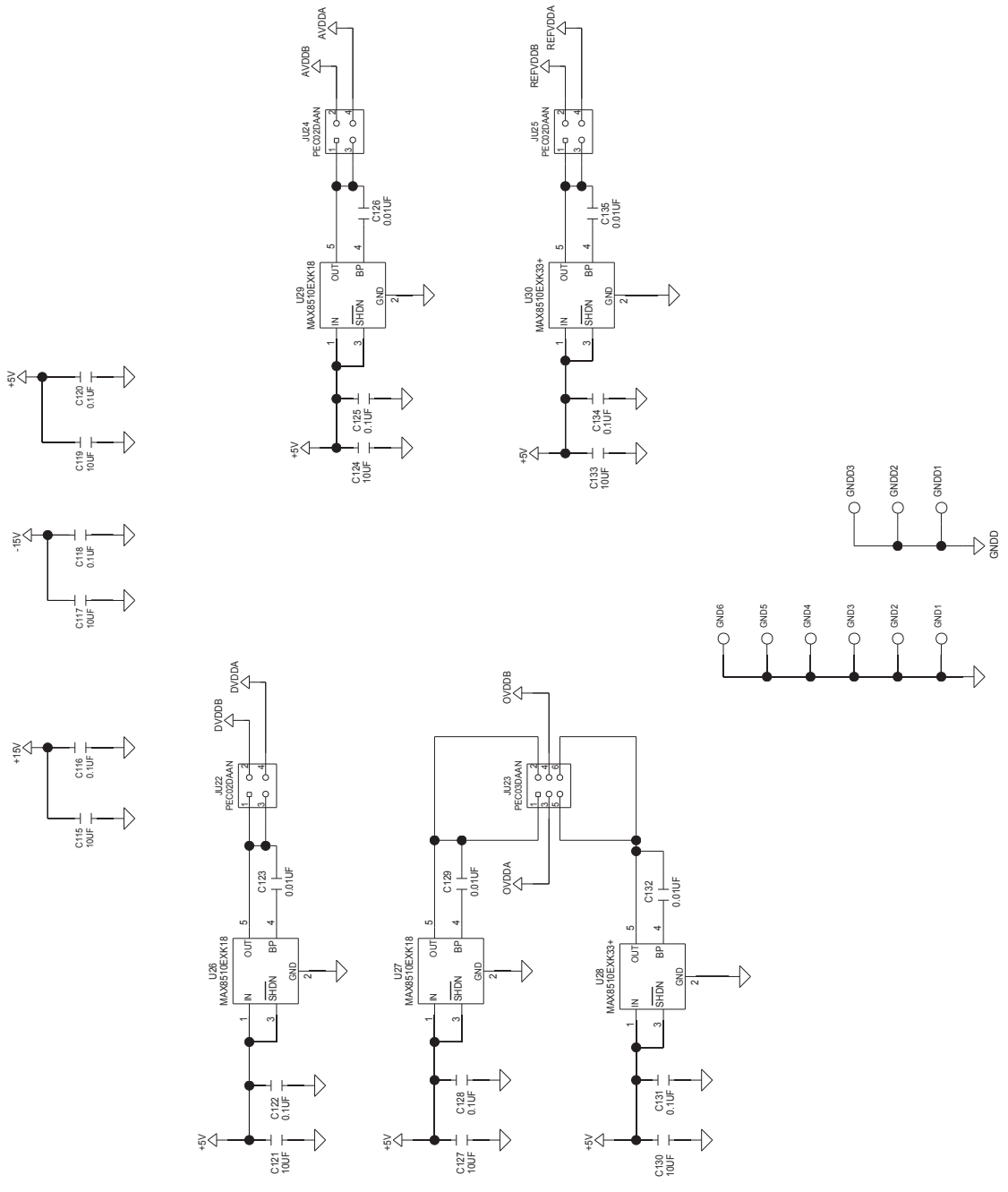


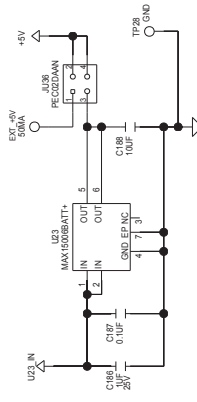
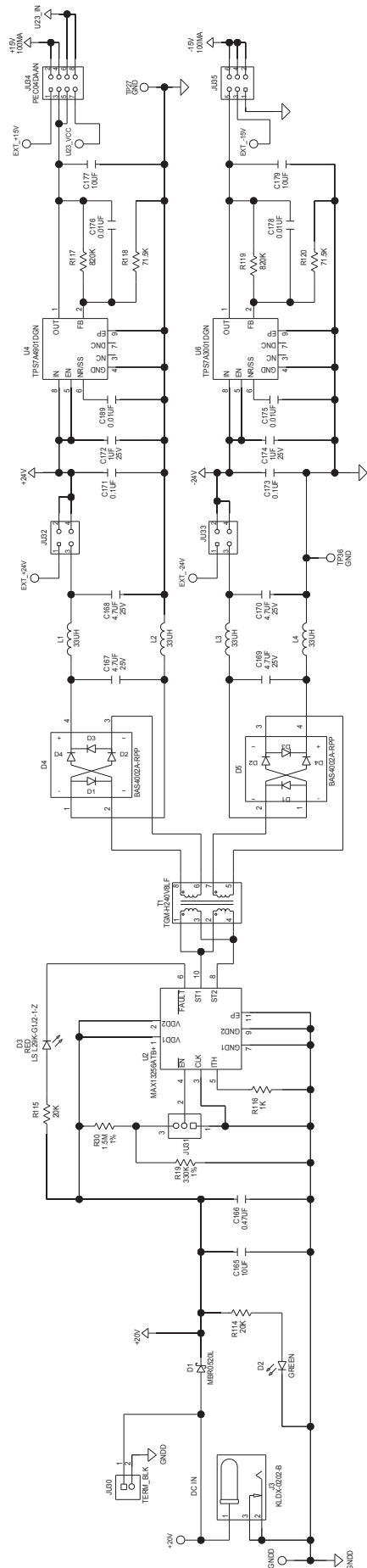












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