19-6062; Rev 0; 10/11

# MAX1454 Evaluation System
# Evaluates: MAX1454

## General Description

The MAX1454 evaluation system (EV system) includes one MAX1454 master board and one MAX1454 evaluation kit (EV board). The MAX1454 daughter board system (DB system) includes one MAX1454 daughter board and one MAX1454 EV board. The EV system, when combined with the DB system, provides a proven design to evaluate up to 15 MAX1454 precision sensor signal conditioners. The EV system also includes Windows XP®-, Windows Vista®-, and Windows® 7-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the IC. The master board includes interface circuitry to communicate between the IC and the host computer, circuitry to address each of the 15 devices in a fully loaded system, and circuitry to connect to the EV board in position 1. The EV board comes installed with a MAX1454AUE/V+ in a 16-pin TSSOP package. The daughter board includes circuitry and relays to connect to the EV board. Each position in the system, with the exception of position 1, requires a daughter board and an EV board. Therefore, to evaluate 15 MAX1454 devices, one EV system and 14 DB systems are required. Figure 1 shows a partially expanded system, for four positions.

## Features

- **USB Powered**
- **Evaluates Up to 15 MAX1454 Devices**
- **Daughter Board and EV Board Powered by the Master Board**
- **Sensor Socket on the EV Board**
- **On-Board ADC to Read the OUT Voltage of the MAX1454**
- **Windows XP-, Windows Vista-, and Windows 7-Compatible Software**
- **User-Friendly Graphical User Interface (GUI)**
- **Proven PCB Layout**
- **Fully Assembled and Tested**

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

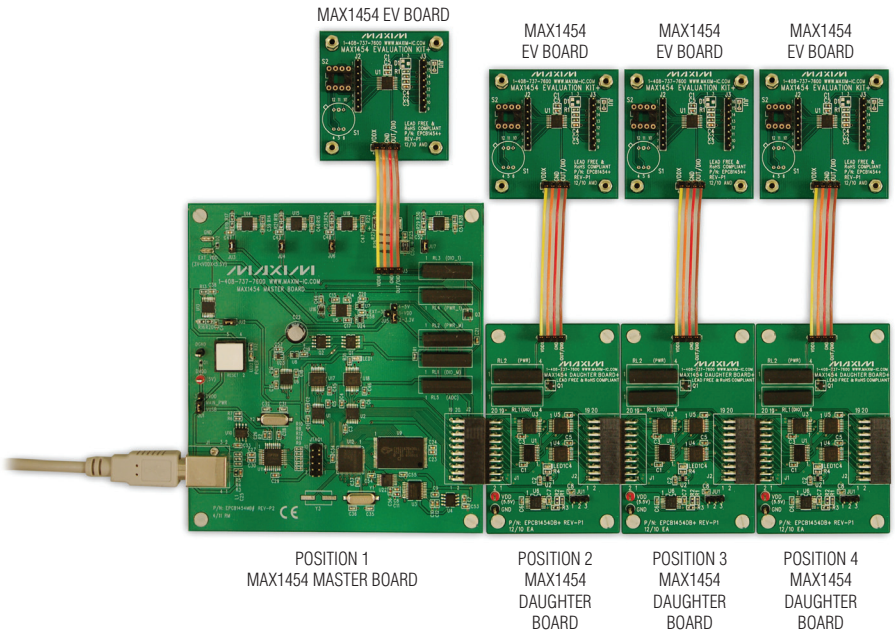


*Figure 1. MAX1454 EV System (4-Position System, Expandable to 15 Positions)*

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**For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.**

## Component Lists

### MAX1454 Master Board

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| C1–C4, C13–C16, C19, C20, C21, C24, C41–C44, C48, C52, C54, C55, C58 | 21 | 10µF ±20%, 6.3V X5R ceramic capacitors (0603) Murata GRM188R60J106M |
| C5, C6, C11, C17, C18, C45, C46, C56, C57 | 9 | 1µF 10%, 16V X5R ceramic capacitors (0603) Murata GRM188R61C105K |
| C7, C8,C9, C12, C23, C25–C29, C33, C34, C37, C53 | 14 | 0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K |
| C10, C38, C39, C40, C47, C51 | 6 | 4.7µF ±10%, 6.3V X5R ceramic capacitors (0603) Murata GRM188R60J475K |
| C22 | 1 | 220µF, 10V electrolytic capacitor Panasonic ECE-A1AKA221 |
| C30 | 1 | 0.033µF ±10%, 16V X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA |
| C31, C32 | 2 | 22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J |
| C35, C36 | 2 | 10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J |
| C49, C50 | 2 | 47µF ±20%, 6.3V capacitors (B1) SANYO 6TPC47MB |
| D1, D2 | 2 | 20V, 500mA Schottky diodes (SOD882) |
| DGND | 1 | Black test point |
| DVDD | 1 | Red test point |
| J1 | 1 | USB type-B right-angle PC-mount receptacle |
| J2 | 1 | 2 x 10 right-angle female connector |
| J3 | 1 | Single-row, 4-pin header |
| JTAG1 | 1 | Dual-row, 10-pin (2 x 5) JTAG header |
| JU1 | 1 | 3-pin header |
| JU2, JU3, JU4, JU6, JU7 | 5 | 2-pin headers |
| JU5 | 1 | 4-pin header |

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| L1 | 1 | Ferrite bead (0603) TDK MMZ1608R301A |
| L2 | 1 | 22µH, 0.11Ω, 300mA inductor Coilcraft DS1608C-223ML |
| LED1, LED2 | 2 | Red LEDs (0603) Panasonic LNJ208R8ARA |
| Q1, Q2 | 2 | Power MOSFETs (8 SO) Fairchild FDS8958B |
| Q3 | 1 | 60V, 200mA n-channel MOSFET (3 SOT23) |
| R1 | 1 | 390kΩ ±5% resistor (0603) |
| R2 | 1 | 470Ω ±5% resistor (0603) |
| R3, R4 | 2 | 27Ω ±5% resistors (0603) |
| R5 | 1 | 1.5kΩ ±5% resistor (0603) |
| R6 | 1 | 2.2kΩ ±5% resistor (0603) |
| R7 | 1 | 10kΩ ±5% resistor (0603) |
| R8–R12 | 0 | Not installed, resistors—short (PC trace) (0603) |
| R13, R14, R15, R22, R28 | 5 | 100kΩ ±5% resistors (0603) |
| R16–R19, R24, R27, R30 | 7 | 10kΩ ±1% resistors (0603) |
| R20 | 1 | 14kΩ ±1% resistor (0603) |
| R23 | 1 | 16.5kΩ ±1% resistor (0603) |
| R21, R29 | 2 | 30kΩ ±1% resistors (0603) |
| R25 | 1 | 1MΩ ±5% resistor (0603) |
| R26 | 1 | 34kΩ ±1% resistor (0603) |
| R31, R32 | 2 | 1kΩ ±5% resistors (0603) |
| R33 | 1 | 510Ω ±5% resistor (0603) |
| RESET | 1 | Normally closed pushbutton |
| RL1–RL5 | 5 | Ultra-reed relays |
| U1, U2, U5 | 3 | Level translators (14 TSSOP) Maxim MAX3379EEUD+ |
| U3 | 1 | 16-bit ADC (20 SSOP) Maxim MAX1134BCAP+ |
| U4 | 1 | 2.048V voltage reference (8 SO) Maxim MAX6126AASA21+ |
| U6, U22 | 2 | Level translators (14 TSSOP) Maxim MAX3390EEUD+ |

## Component Lists (continued)

### MAX1454 Master Board (continued)

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| U7, U8, U16, U24 | 4 | Logic inverters (SOT363) |
| U9 | 1 | SRAM (48 TSOP) |
| U11 | 1 | USB-to-UART converter (32 TQFP) |
| U10 | 1 | 93C46-type 3-wire EEPROM (8 SO) |
| U12 | 1 | Microcontroller (68 QFN-EP) Maxim MAXQ2000-RAX+ |
| U13, U14, U15, U19, U21 | 5 | LDOs (16 TSSOP-EP) Maxim MAX1793EUE50+ |
| U17, U18 | 2 | 4-bit comparators (16 SSOP) |
| U20 | 1 | Step-up regulator (8 µMAX®) Maxim MAX1795EUA+ |
| U23 | 1 | Logic buffer (5 SC70) |

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| Y1 | 1 | 20MHz crystal Hong Kong X'tals SSM20000N1HK188F0-0 |
| Y2 | 1 | 6MHz crystal Hong Kong X'tals SSL60000N1HK188F0-0 |
| Y3 | 0 | Not installed, crystal |
| — | 4 | 0.250in x 0.625in 4-40 round nylon spacers |
| — | 4 | 4-40 x 0.375in nylon machine screws |
| — | 1 | USB high-speed A-to-B cables 5ft (1.5m) |
| — | 7 | Shunts |
| — | 1 | PCB: MAX1454 MASTER BOARD |

### MAX1454 Daughter Board

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| C1, C3, C4, C5 | 4 | 1µF ±10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C105K |
| C2, C7, C8 | 3 | 10µF ±20%, 6.3V X5R ceramic capacitors (0603) Murata GRM188R60J106M |
| C6 | 1 | 4.7µF ±10%, 6.3V X5R ceramic capacitor (0603) Murata GRM188R60J475K |
| DVDD | 1 | Red test point |
| GND | 1 | Black test point |
| J1 | 1 | 2 x 10 right-angle male header |
| J2 | 1 | 2 x 10 right-angle female receptacle |
| J3 | 1 | Single-row 4-pin header |
| JU1 | 1 | 3-pin header Sullins PEC36SAAN |
| LED1 | 1 | Red LED (0603) Panasonic LNJ208R8ARA |
| Q1 | 1 | 60V, 200mA n-channel MOSFET (3 SOT23) |

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| R1 | 1 | 100kΩ ±5% resistor (0603) |
| R2 | 1 | 30kΩ ±1% resistor (0603) |
| R3 | 1 | 10kΩ ±1% resistor (0603) |
| R4 | 1 | 1kΩ ±5% resistor (0603) |
| RL1, RL2 | 2 | Ultra-reed relays |
| U1 | 1 | Logic buffer (20 TSSOP) Fairchild 74VHCT244AMTCX |
| U2 | 1 | Logic inverter (6 SC70) NXP Semi 74LVC2G04GW |
| U3 | 1 | 4-bit adder (16 SSOP) NXP Semi 74HC283 |
| U4, U5 | 2 | 4-bit comparators (16 SSOP) NXP Semi 74HCT85DB |
| U6 | 1 | LDO (16 TSSOP-EP) Maxim MAX1793EUE18+ |
| — | 4 | 0.250in x 0.625in, 4-40 round nylon spacers |
| — | 4 | 4-40 x 0.375in nylon machine screws |
| — | 1 | Shunts |
| — | 1 | PCB: MAX1454 DAUGHTER BOARD |

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## Component Lists (continued)

### MAX1454 EV Board

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| C1 | 1 | 1µF ±10%, 16V X7R ceramic capacitor (0603) TDK C1608X7R1C105K |
| C2 | 0 | Not installed, ceramic capacitor (0603) |
| C3 | 1 | 0.01µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C103K |
| C4, C5 | 2 | 0.1µF ±10%, 50V X7R ceramic capacitors (0603) TDK C1608X7R1H104K |
| D1 | 0 | Not installed, Schottky diode |
| J1 | 1 | Single-row 4-pin header |
| J2, J3 | 2 | Single-row 8-pin headers |
| JU1 | 0 | Not installed, 2-pin header—Short (PC trace) |

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| R1 | 0 | Not installed, resistor—short (PC trace) (0603) |
| S1 | 0 | Not installed, pressure sensor |
| S2 | 1 | 8-pin DIL header |
| U1 | 1 | Precision sensor signal conditioner with overvoltage protection (16 TSSOP) Maxim MAX1454AUE/V+ |
| — | 1 | 3ft cable (4 pin) |
| — | 4 | 0.250in x 0.625in, 4-40 Aluminum spacers |
| — | 4 | 4-40 x 0.375in steel jack screws |
| — | 1 | PCB: MAX1454 EVALUATION KIT |

## Component Suppliers

| SUPPLIER | PHONE | WEBSITE |
|---|---|---|
| Coilcraft, Inc. | 847-639-6400 | www.coicraft.com |
| Fairchild Semiconductor | 888-522-5372 | www.fairchildsemi.com |
| Hong Kong X'tals Ltd. | 852-35112388 | www.hongkongcrystal.com |
| Murata Electronics North America, Inc. | 770-436-1300 | www.murata-northamerica.com |
| Panasonic Corp. | 800-344-2112 | www.panasonic.com |
| SANYO Electric Co., Ltd. | 619-661-6835 | www.sanyo.com |
| Taiyo Yuden | 800-348-2496 | www.t-yuden.com |
| TDK Corp. | 847-803-6100 | www.component.tdk.com |

***Note:*** *Indicate that you are using the MAX1454 when contacting these component suppliers.*

## MAX1454 EV System Files

| FILE | DESCRIPTION |
|---|---|
| INSTALL.EXE | Installs the EV system files on your computer |
| MAX1454.EXE | Application program |
| MAX1454_DLL.dll | MAX1454 DLL library file |
| CMODCOMM.dll | CMODCOMM library file |
| CDM20600.EXE | Installs the USB device driver |
| UNINSTALL.EXE | Uninstalls the EV system software |
| USB_Driver_Help_200.PDF | USB driver installation help file |

## Quick Start

### Required Equipment

- MAX1454 EV system (USB cable included)
- Windows XP, Windows Vista, or Windows 7 PC with a spare USB port

**Note:** In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV system software. Text in **bold and underlined** refers to items from the Windows operating system.

### Procedure

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

1) Visit **www.maxim-ic.com/evkitsoftware** to download the latest version of the EV system software, 1454Rxx.ZIP. Save the EV system software to a temporary folder and uncompress the ZIP file.
2) Install the EV system software and USB driver on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied to your PC and icons are created in the Windows **Start | Programs | Maxim EVKIT Software | MAX1454** menu. During software installation, some versions of Windows may show a warning message indicating that this software is from an unknown publisher. This is not an error condition and it is safe to proceed with installation. Administrator privileges are required to install the USB device driver on Windows.
3) Verify that all jumpers (JU1–JU7) are in their default positions, as shown in Table 1.
4) Connect the J3 connector of the master board to the J1 connector of the EV board with the provided flex cable.
5) Connect the USB cable from the PC to the master board. A Windows message appears when connecting the master board to the PC for the first time. Each version of Windows has a slightly different message. If you see a Windows message stating **ready to use**, then proceed to the next step. Otherwise, open the USB_Driver_Help_200.PDF document in the Windows **Start | Programs | Maxim EVKIT Software | MAX1454** menu to verify that the USB driver was installed successfully.
6) Start the EV system software by opening its icon in the **Start | Programs | Maxim EVKIT Software | MAX1454** menu. The EV system software main window appears, as shown in Figure 2.
7) The EV system software automatically detects the MAX1454, and a ✔ is displayed under **Device #1**.
8) In the **Output MUX** group box (Figure 2), select **VDD** from the **Signal** drop-down list.
9) Press the **Read Output** button and verify that the returned value that appears next to the button is approximately 2.5V.

## Table 1. Master Board Jumper Settings (JU1–JU7)

| JUMPER | SHUNT POSITION | DESCRIPTION |
|---|---|---|
| JU1 | 1-2* | EV system powered by the USB. |
| | 2-3 | Connect an external 5V supply to the DVDD and DGND connector. |
| JU2 | 1-2* | The on-board LDO (U13) provides 3V output to the EV system. |
| | Open | Disconnects the output of the on-board LDO (U13). |
| JU3 | 1-2* | The on-board LDO (U14) provides 2.5V output to the EV system. |
| | Open | Disconnects the output of the on-board LDO (U14). |
| JU4 | 1-2* | The on-board LDO (U15) provides 5V output to the EV system. |
| | Open | Disconnects the output of the on-board LDO (U15). |
| JU5 | 1-2 | Selects 3.3V to connect to the VDDX of the active device. |
| | 1-3 | Selects EXT_VDD to connect to the VDDX of the active device. |
| | 1-4* | Selects 5V to connect to the VDDX of the active device. |
| JU6 | 1-2* | The 3.3V output of the on-board LDO (U19) connects to pin 2 of jumper JU5. |
| | Open | Disconnects the output of the on-board LDO (U19). |
| JU7 | 1-2* | The 5V output of the on-board LDO (U21) connects to pin 1 of jumper JU5. |
| | 2-3 | Disconnects the output of the on-board LDO (U21). |

**Default position.*

## Table 2. Daughter Board Jumper Settings (JU1)

| JUMPER | SHUNT POSITION | DESCRIPTION |
|---|---|---|
| JU1 | 1-2* | Daughter board powered by master board |
| | 2-3 | Connect an external 5.5V supply to the DVDD and GND connector |

**Default position.*

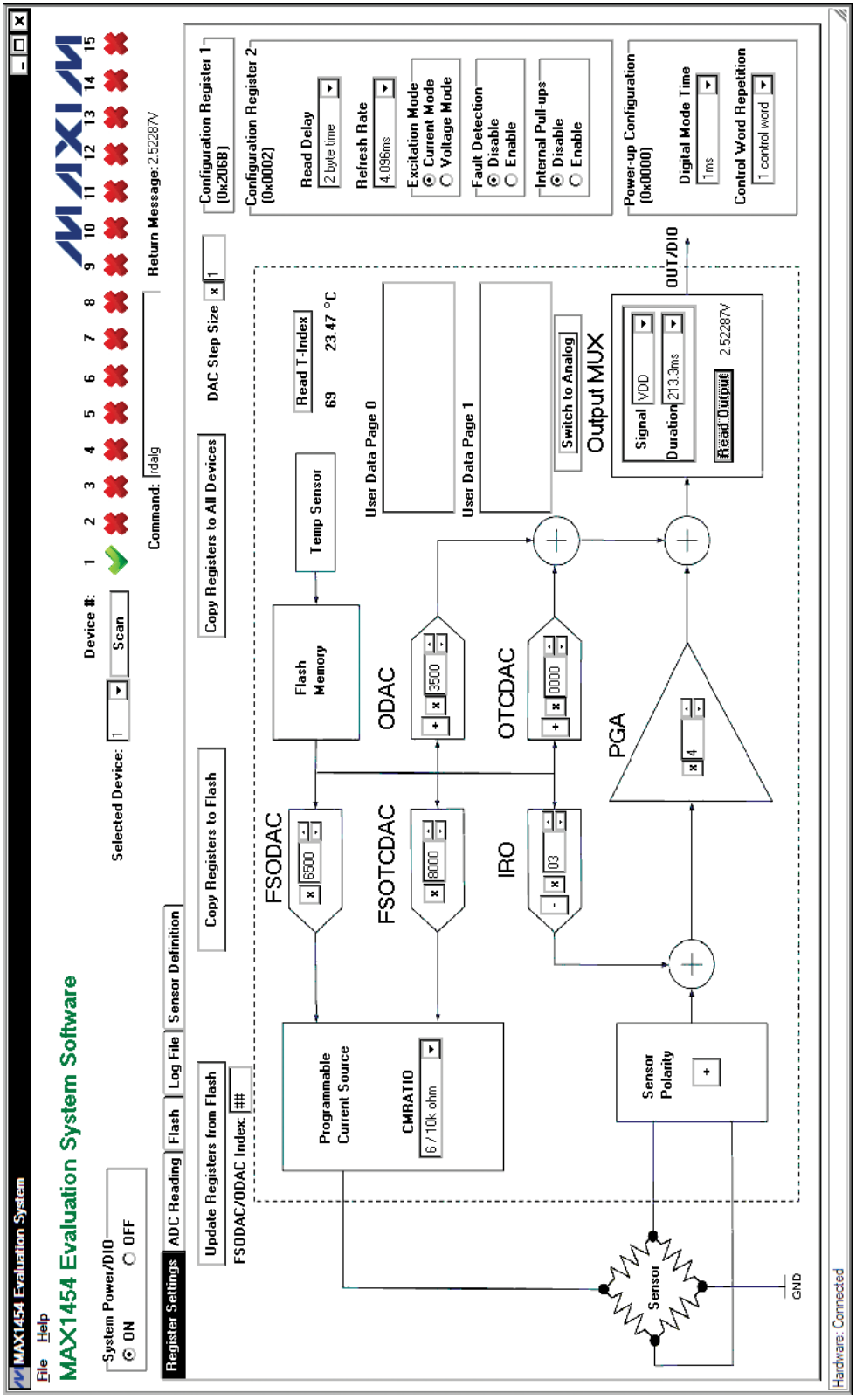


*Figure 2. MAX1454 EV System Software Main Window (Register Settings Tab)*

## Detailed Description of Software

The MAX1454 EV system software (Figure 2) has all the functions to configure the MAX1454. When the software starts up, it scans the system and determines the number and position of operational MAX1454 present in the system. The first operational MAX1454 device is selected, powered up, and initialized to communicate in digital mode.

### Scan

If the number or the positions of the operational devices on the system is changed, press the **Scan** button. After the **Scan** button is pressed, the EV system checks every position of the system (1 through 15) and identifies all positions with operating devices. If the device is present, the software displays a ✔. Otherwise, the software displays a ✖. The value in the **Selected Device** drop-down list identifies the active device-under-test (DUT).

### System Power/DIO

To power off the system, press the **OFF** radio button in the **System Power/DIO** group box. Press the **ON** radio button to power up the system and the previously selected MAX1454 device. The selected device is initialized to communicate in digital mode.

### Command

The **Command** edit box can be used to enter and execute any of the commands listed in the *Interpreter Definition* section. The **Return Message** is shown at the right of the **Command** edit box.

### Register Settings Tab

After the software starts up and is connected to an active device selected in the **Selected Device** drop-down list, the default register values on the **Register Settings** tab sheet (Figure 2) are written in the active MAX1454 registers. Through the software, all parameters with a white window area can be edited by the user. The parameters can be edited by typing a new value in the edit box, selecting from a drop-down list, or by pressing a button. The revised value is automatically written to the corresponding MAX1454 register. All entries can be in hexadecimal or decimal format, except the **FSODAC/ODAC Index**, which must be in decimal format.

### FSODAC, FSOTCDAC, ODAC, and OTCDAC

Values in each one of the **FSODAC**, **FSOTCDAC**, **ODAC**, and **OTCDAC** registers can be changed by its corresponding block, as explained in Figure 3. The sign bit does not apply to FSODAC and FSOTCDAC. The **Configuration Register 1** register (CONFIG1) value is updated automatically as the ODAC and OTCDAC sign bits are changed. Values for these parameters can be selected to be in decimal or hexadecimal format. Refer to the MAX1454 IC data sheet for acceptable values.

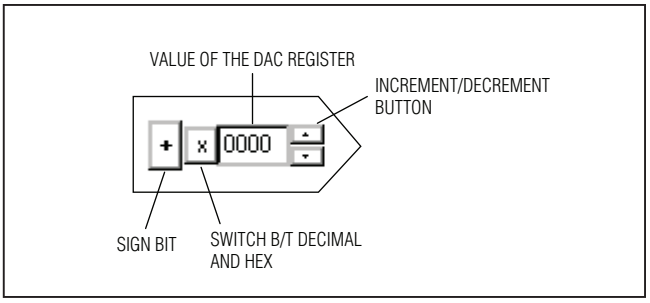


*Figure 3. Register Controls*

### IRO and PGA

The **IRO** and **PGA** control block set values of IRO (including IRO sign) and PGA values. **Configuration Register 1** (CONFIG1) value is updated automatically as these parameters are updated. Values for these parameters can be selected to be in decimal or hexadecimal format. Refer to the MAX1454 IC data sheet for acceptable values.

### Sensor Polarity

This button corresponds to the **PGA Sign** bit in the **Configuration Register 1** (CONFIG1). To invert the polarity of the input signal, press to switch to negative. The **Configuration Register 1** (CONFIG1) value is updated automatically as the PGA sign bit is changed.

### Functional Buttons

The **Update Registers from Flash** button updates all DAC and configuration registers from the flash memory of the active DUT. **FSODAC** and **ODAC** are updated from the lookup tables' locations pointed to by the **FSODAC/ODAC** index.

The **Copy Registers to Flash** button copies the register values shown on the GUI to the flash memory of the active DUT. All 176 locations of the FSODAC lookup table in the flash memory are filled with the value in the **FSODAC** register shown on the GUI. All 176 locations of the ODAC lookup table in the flash memory are filled with the value in the **ODAC** register shown on the GUI.

The **Copy Registers to All Devices** button does the same as the **Copy Registers to Flash**, except that action is performed on all operational DUTs in the system.

The **Read T-Index** button reads the internal temperature ADC and displays the return value in decimal format. The **T-Index** value is applied to the temperature conversion formula given in the MAX1454 IC data sheet and the resulting value (in °C) is displayed.

#### *Programmable Current Source*

The **CMRATIO** drop-down list in the **Programmable Current Source** box selects the desired current-mirror ratio for sensor excitation. It corresponds to the CMRATIO bits in the **Configuration Register 1**. Refer to the MAX1454 IC data sheet for details.

#### *Output MUX*

Select the IC output signal from the **Signal** drop-down list within the **Output MUX** group box. Refer to Table 19 (ALOC definition) in the MAX1454 IC data sheet for more information about the available signals.

Select the duration for which the selected **Signal** remains available on the OUT/DIO pin from the **Duration** drop-down list. A readout device (e.g., voltmeter) is required to read the output.

Press the **Read Output** button to execute the read analog command that outputs the selected **Signal** onto the OUT/DIO pin.

#### *Switch to Analog*

Press the **Switch to Analog** button to put the active DUT into fixed analog mode. In this mode, the device does not respond to commands. Press the **Scan** button to return to the digital programming mode.

#### *User Data*

The general-purpose user data is diplayed in the **User Data Page 0** and **User Data Page 1** memo boxes.

#### *Configuration Register 1 (CONFIG1)*

The **Configuration Register 1** group box displays the current value of the CONFIG1 register.

#### *Configuration Register 2 (CONFIG2)*

Items in this group box correspond to parameters in the CONFIG2 register. Refer to the MAX1454 IC data sheet for the definition of each parameter.

#### *Power-Up Configuration (PWRUPCFG)*

Items in this group box correspond to parameters in the PWRUPCFG register. Refer to the MAX1454 IC data sheet for the definition of each parameter.

### *ADC Reading Tab*

The master board has an on-board 16-bit ADC device (MAX1134) to read the voltage of the OUT/DIO signal of the MAX1454. The **ADC Reading** tab sheet (Figure 4) has a **Scope** to display the output of the ADC. When the IC is operating in analog mode, check the **Auto Read OUT/DIO** checkbox to start the ADC conversion. The **Scope** receives new ADC values approximately every 300ms. If the IC is operating in digital mode, when the **Auto Read OUT/DIO** checkbox is checked the software triggers the **Read Output** button approximately every 300ms on the **Register Settings** tab sheet and displays the ADC return values on the **Scope**. The **Scope** displays the last 250 readings. Check the **Save Data to File** checkbox to start saving the ADC data along with the message in the **Note** edit box to a file. The user is prompted for a file name.

### *Flash Tab*

The **Flash** tab sheet (Figure 5) is used to read or modify the contents of the internal flash memory of the active IC.

To read the flash memory, press the **Read from DUT Flash** button. The contents of the FSODAC and ODAC lookup tables are shown in the **FSODAC/ODAC Lookup Table**. The user can use the **DEC** button to switch the values in the **FSODAC/ODAC Lookup Table** between hexadecimal format and decimal format. The CONFIG1, CONFIG2, PWRUPCFG, OTCDAC, and the FSOTCDAC flash memory values are shown in the corresponding edit boxes at the right. The general-purpose user data is displayed in the **User Data Page 0** and **User Data Page 1** memo boxes.

Press the **Save Flash to File** button to save the contents of the flash to a file. The user is prompted for a file name.

There are two ways to modify the contents of the flash memory:

1) Manually change the contents on this tab sheet and press the **Write to DUT Flash** button to write the contents to the active device. The **Write to All Devices** button does the same thing except that it writes to all devices on the EV system.
2) Press the **Load Flash from File** button to copy the contents of a file to the flash memory of the active device. The user is prompted for a file name.

Press the **Read from File** button to update the contents of the **Flash** tab sheet from a file. The user is prompted for a file name.

### *Log File Tab*

In the **Log File** tab sheet (Figure 6), the **Command Log** memo box logs the interpreter commands (see the *Interpreter Definition* section) that were executed. When the user checks the **Save Command Log to File** checkbox, the software begins to record the commands to a file specified by the user until the **Save Command Log to File** checkbox is unchecked. To execute the commands from a file, press the **Execute Commands from File** button. To clear the **Command Log** memo box, press the **Clear Command Log** button.

The **Communication Log** memo box is very similar to the **Command Log** memo box. The difference is that the **Communication Log** logs both the executed interpreter commands and the return messages from the EV system. Check the **Save Communication Log to File** checkbox to start saving the commands and return messages to a file. Press the **Clear Communication Log** button to clear the **Communication Log**. Uncheck the **Save Communication Log to File** checkbox to stop saving the commands and return messages to a file.

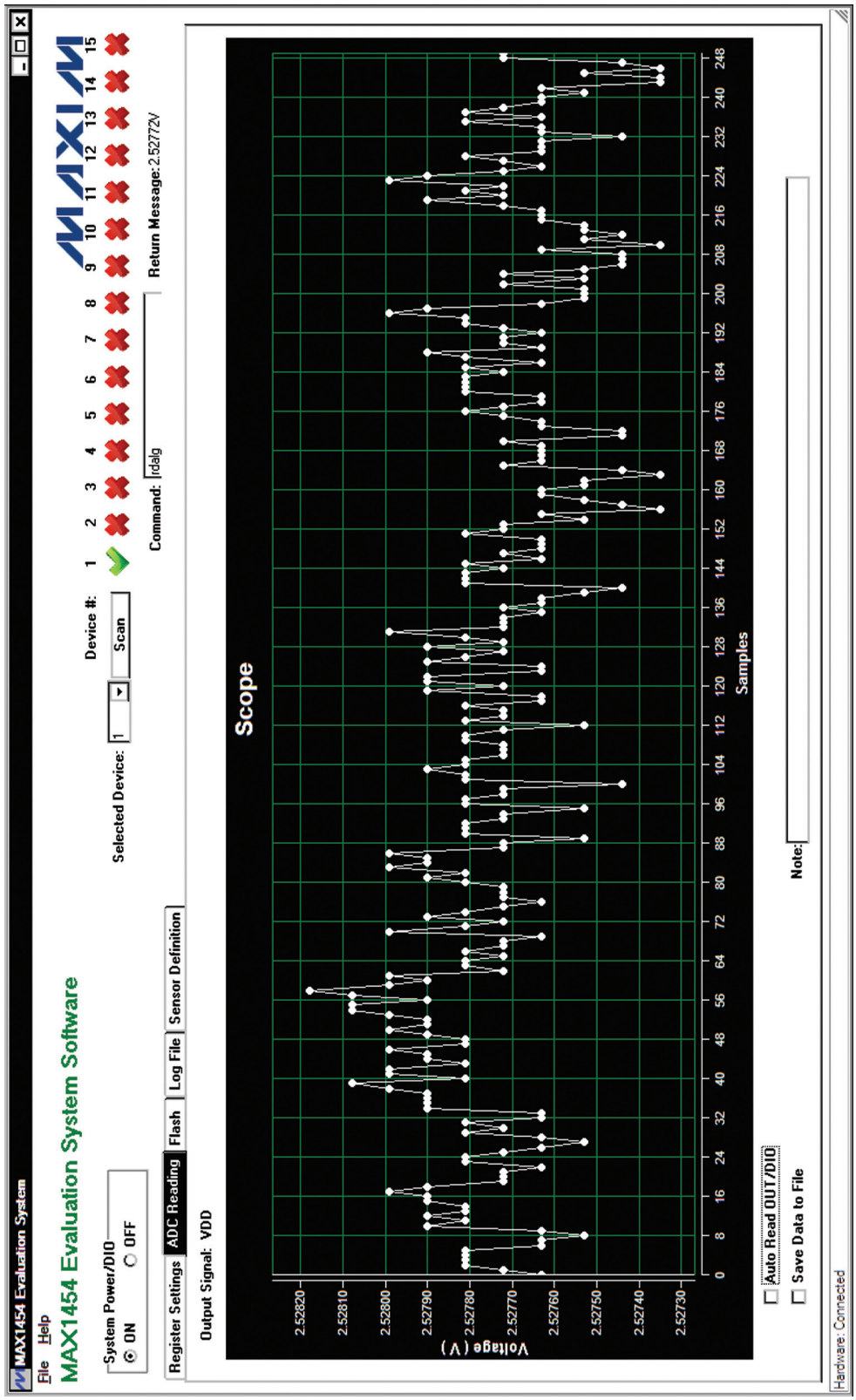


*Figure 4. MAX1454 EV System Software Main Window (ADC Reading Tab)*

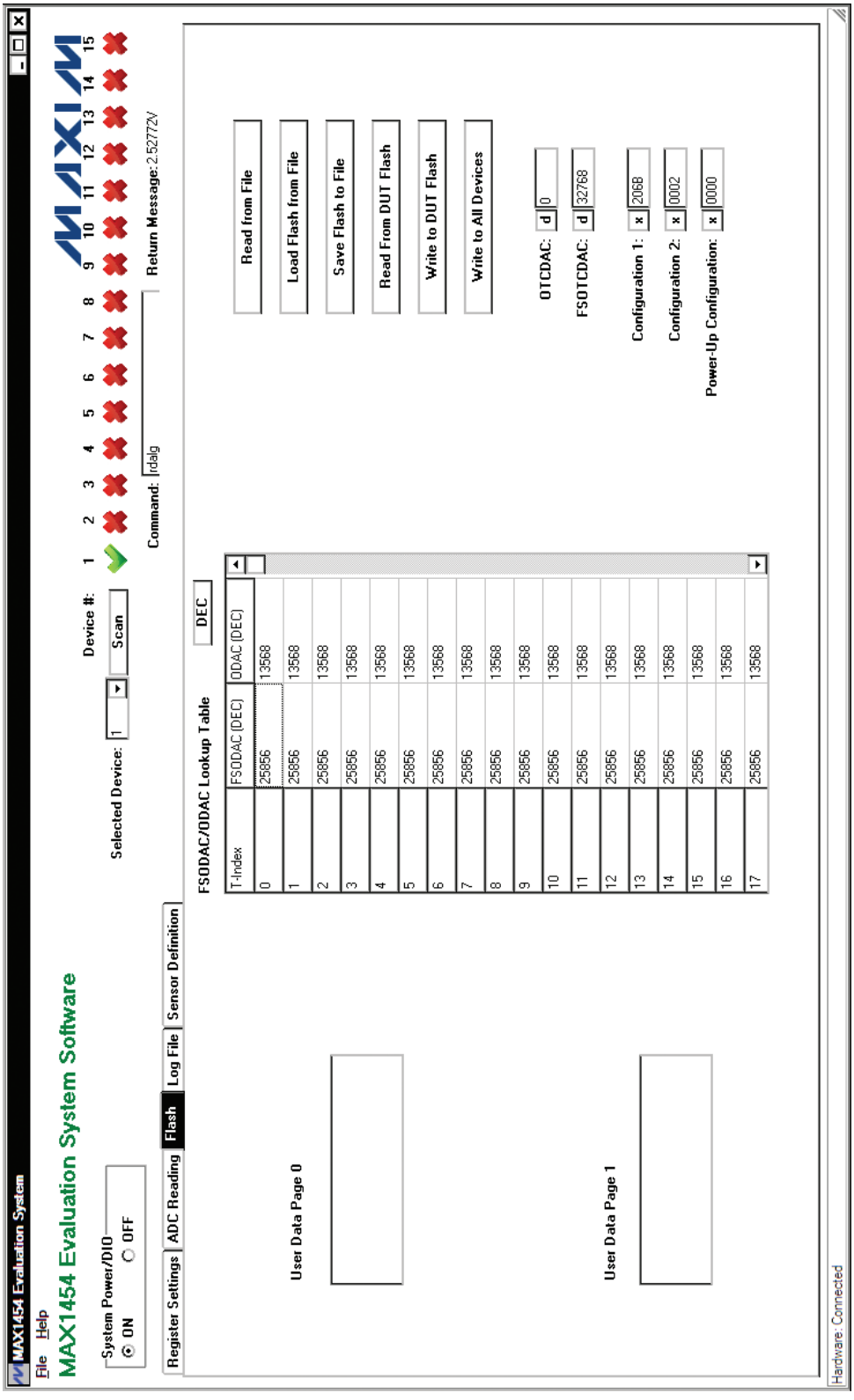


*Figure 5. MAX1454 EV System Software Main Window (Flash Tab)*

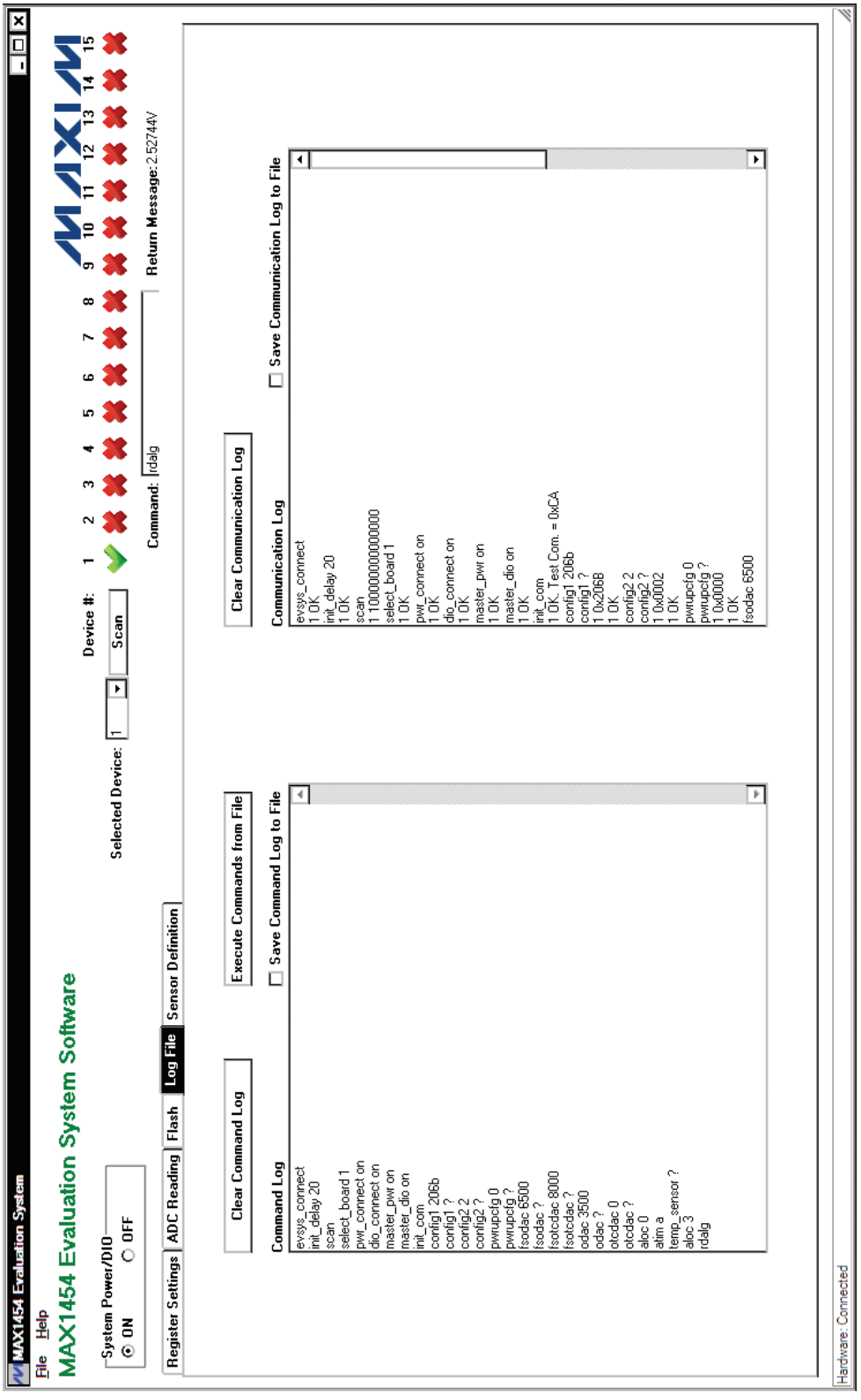


*Figure 6. MAX1454 EV System Software Main Window (Log File Tab)*

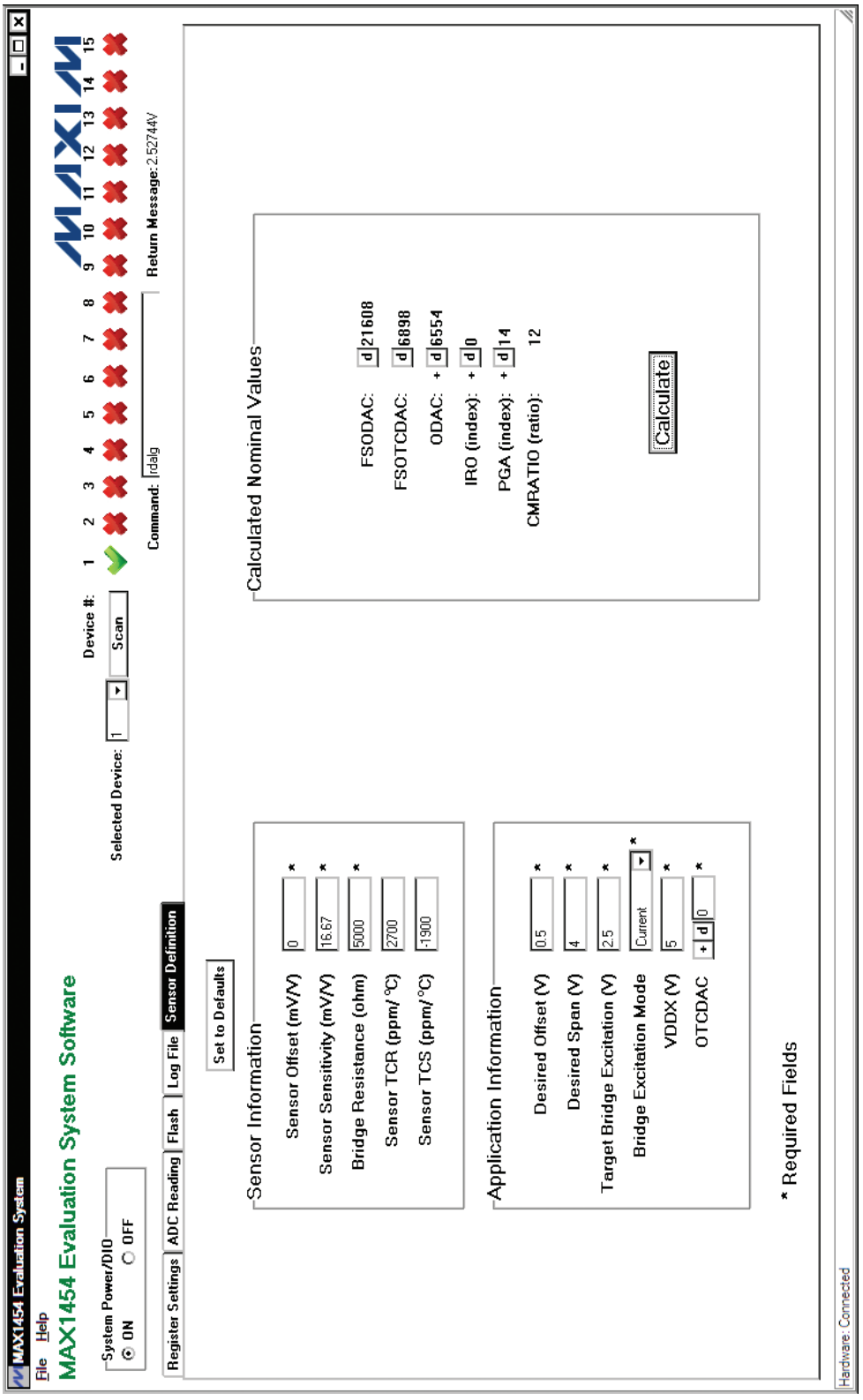


*Figure 7. MAX1454 EV System Software Main Window (Sensor Definition Tab)*

### *Sensor Definition Tab*

On the **Sensor Definition** tab sheet (Figure 7), fill out the required information in the **Sensor Information** and **Application Information** group boxes, then press the **Calculate** button. The software calculates the appropriate FSODAC, ODAC, FSOTCDAC, IRO, PGA, and CMRATIO values based on the given information. The calculated values are intended to bring the MAX1454 in the linear range and produce an output around the specified offset and span. The calculated values should be appropriate as starting values for the compensation process. In some instances, it may be required to adjust the PGA and/or DAC value. Sensor definition equations are listed in Table 3.

## Table 3. Sensor Definition Equations

| PARAMETER | EQUATION |
|---|---|
| FSODAC | In Voltage Excitation Mode:<br>$FSODAC = 65535 \times \frac{VBDR}{VDDX}$<br>In Current Excitation Mode:<br>$FSODAC = \frac{CMRATIO \times (FSOTCDAC \times VBDR + 3.5 \times 10^4) \times RBDR + 3.9321 \times 10^9 \times VBDR}{2 \times CMRATIO \times RBDR \times VDDX}$<br>If the calculated FSODAC is negative, set FSODAC = 0.<br>If the calculated FSODAC is greater than 65535, set FSODAC = 65535.<br>CMRATIO: See CMRATIO equation<br>FSOTCDAC: See FSOTCDAC equation<br>VBDR (V) is the Target Bridge Excitation voltage specified by user<br>RBDR (Ω) is the sensor Bridge Resistance specified by user<br>VDDX (V) is the External Supply Voltage specified by user |
| FSOTCDAC | In Voltage Excitation Mode:<br>$FSOTCDAC = 0$<br>In Current Excitation Mode:<br>$FSOTCDAC = \left(\frac{TCi - TCR}{TCS} - 1\right) \times \frac{393210 \times Ri}{CMRATIO \times RBDR}$<br>If TCS and/or TCR is not specified, set FSOTCDAC = 0<br>If the calculated FSOTCDAC is negative, set FSOTCDAC = 0.<br>If the calculated FSOTCDAC is greater than 65535, set FSOTCDAC = 65535.<br>TCi = 600 ppm/°C<br>Ri = 10kΩ<br>CMRATIO: See CMRATIO equation<br>RBDR (Ω) is the sensor Bridge Resistance specified by user<br>TCR (ppm/°C) and TCS (ppm/°C ) are sensor's temperature coefficient of the sensor Bridge Resistance and Sensitivity, respectively, specified by user |

## Table 3. Sensor Definition Equations (continued)

| PARAMETER | EQUATION |
|---|---|
| ODAC | $Virodac = 0.744 \times IRO_Index \times VDDX$<br>$input_offset = sensor_offset \times VBDR$<br>$ODAC = \left(65535 \times \frac{desired_offset}{VDDX}\right) \times \left(65535 \times \frac{(input_offset + Virodac) \times PGA_gain}{VDDX \times 1000}\right) - \left(OTCDAC \times \left(\frac{VBDR}{VDDX}\right)\right)$<br>If the calculated ODAC is negative, set ODAC = 0.<br>If the calculated ODAC is greater than 65535, set ODAC = 65535.<br>IRO_index: See IRO Index equation<br>VDDX (V) is External Supply Voltage specified by user<br>Sensor_Offset (mV/V) is sensor offset specified by user<br>Desired_Offset (V) is the target calibrated offset specified by user<br>OTCDAC is value of OTCDAC specified by user<br>VBDR (V) is the Target Bridge Excitation voltage specified by user<br>PGA_gain (V/V) is calculated signal path gain |
| IRO Index | $input_offset = sensor_offset \times VBDR$<br>$IRO\% = \frac{input_offset}{VDDX \times 1000} \times 100$<br>$IRO_index = (-1) \times ROUND\left(\frac{IRO\%}{0.0744}\right)$<br>If the calculated IIRO_indexI is greater than 15, set IIRO_indexI to 15.<br>VDDX (V) is External Supply Voltage specified by user<br>Sensor_Offset (mV/V) is sensor offset specified by user<br>VBDR (V) is the Target Bridge Excitation voltage specified by user<br>ROUND() function rounds the input value to the nearest integer |
| PGA Index | $gain = Desired_Span \times \frac{1000}{Sensitivity \times VBDR}$<br>PGA_Index = Select index of first value larger than gain from Table 7 in MAX1454 IC data sheet<br>Desired_Span (V) is the target calibrated output span, specified by user<br>Sensitivity (mV/V) is the sensor sensitivity, specified by user |
| CMRATIO | Select CMRATIO from below, based on the value of RBDR<br>CMRATIO — Range<br>6 — RBDR ≥ 8k<br>12 — 4k ≤ RBDR < 8k<br>18 — 2.7k ≤ RBDR < 4k<br>30 — RBDR < 2.7k<br>RBDR (Ω) is the sensor Bridge Resistance specified by user |

## Detailed Description of Hardware

The MAX1454 EV system includes one MAX1454 master board and one MAX1454 EV board. The EV system provides a proven design to evaluate up to 15 MAX1454 precision sensor signal conditioners. The EV system also includes Windows XP-, Windows Vista-, and Windows 7-compatible software that provide a simple graphical user interface (GUI) for exercising the features of the IC. The master board includes interface circuitry to communicate between the IC and the host computer, circuitry to address each of the 15 devices in a fully loaded system, and circuitry to connect to the EV board in position 1. The EV board comes installed with a MAX1454AUE/V+ in a 16-pin TSSOP package. The daughter board includes circuitry and relays to connect to the EV board. Each position in the system, with the exception of position 1, requires a daughter board and an EV board. Figure 1 shows how the EV system and DB system should be connected.

### Connections

To connect the EV board to the master board, connect the J3 connector on the master board to the J1 connector on the EV board with the flex cable. Similarly, to connect the EV board to the daughter board, connect the J3 connector on the daughter board to the J1 connector on the EV board with the flex cable.

Carefully connect the master board and the daughter board by aligning the 20-pin right-angle header (J1) on the daughter board with the 20-pin right-angle connector (J2) on the master board. Gently press them together. If more daughter boards need to be cascaded to the EV system, connect the 20-pin connector (J2) on the last daughter board with the 20-pin connector (J1) on the additional daughter board. Use the USB AB cable to connect the EV system to the computer.

### Power Supply

By default, the master board and the EV board are USB powered. To use an external power supply for the digital circuits, connect a 5V supply to the DVDD and DGND terminals, and place the shunt on jumper JU1 on the master board in the 2-3 position. The digital circuitry of the daughter board is powered by the master board. To use an external power supply for a daughter board, connect a 5.5V supply to the DVDD and GND terminals, and place the shunt on jumper JU1 on the daughter board in the 2-3 position.

To use an external power supply for the MAX1454 (on the EV board), apply power to the EXT_VDD and GND terminals on the master board and place the shunt on jumper JU5 in the 1-3 position. The power-supply voltage should be set between 3V and 5.5V.

### Power LED

The master board has a power indicator. When the master board is powered up, LED2 (next to the RESET switch) lights up.

### Active Device LED

Only one MAX1454 device can be powered and in communication with the controller at a time. The active device is selected in the EV system software, and the corresponding selected device LED1 on the master board or daughter board lights up.

### Sensors

The EV board has an on-board S2 socket and an S1 footprint for the user to install the sensor.

## Interpreter Definition

The interpreter is a DLL function that the user can import to his software to communicate with the EV system

### Function Definition

// *cmd* = Command string

// *msg* = Return message string

extern “C” int __stdcall __declspec(dllexport) interpreter (char *cmd, char *msg);

**Table 4. Interpreter Return Values**

| FUNCTION RETURN VALUE | DESCRIPTION |
|---|---|
| 0 | Board-connection error |
| 1 | Command executed successfully |
| 2 | Syntax error |
| 3 | Communication error |

## Table 5. EV System-Related Commands

| COMMAND (char *cmd) | RETURN MESSAGE (char *msg) | DESCRIPTION | EXAMPLE |
|---|---|---|---|
| evsys_connect | "OK"/"Failed" | Connect to the EV system | evsys_connect |
| evsys_disconnect | "OK"/"Failed" | Disconnect from the EV system | evsys_disconnect |
| select_board *board#* | "OK"/"Failed" | Selects the active board<br>*board#* (in decimal)<br>board# 1 = master board<br>board# 2 = first cascaded daughter board<br>etc. | select_board 15 |
| pwr_connect *on/off* | "OK"/"Failed" | Turn on/off the power relay on the selected active board | pwr_connect on |
| dio_connect *on/off* | "OK"/"Failed" | Turn on/off the DIO relay on the selected active board | dio_connect on |
| master_pwr *on/off* | "OK"/"Failed" | Turn on/off the master power relay on the master board | master_pwr on |
| master_dio *on/off* | "OK"/"Failed" | Turn on/off the master DIO relay on the master board | master_dio on |

## Table 6. Read/Write Commands

| COMMAND (char *cmd) | RETURN MESSAGE (char *msg) | DESCRIPTION | EXAMPLE |
|---|---|---|---|
| flash_read_byte *addr* | *value*/"Failed" | Read a byte from flash at address *addr* (11-bit hex) | flash_read_byte 3ff |
| flash_write_byte *addr value* | "OK"/"Failed" | Write 1 byte of data (*value*) to the flash at address *addr* (11-bit hex) | flash_write_byte 016a ff |
| flash_read_page *page_num* | *512-byte data*/"Failed" | Read a page of data from flash | flash_read_page 1 |
| flash_write_page *page_num 512_byte_data* | "OK"/"Failed" | Write 512 bytes of data to the flash on page *page_num* | flash_wrt_page 1 0123456789abcdef... |
| flash_page_erase *page_num* | "OK"/"Failed" | Erase a page on the flash | flash_page_erase 1 |
| flash_erase | "OK"/"Failed" | Erase the whole flash | flash_erase |

## Table 7. Register Read/Write Commands

| COMMAND (char *cmd) | RETURN MESSAGE (char *msg) | DESCRIPTION | EXAMPLE |
|---|---|---|---|
| config1 *value* | "OK"/"Failed" | Write 16-bit hex (*value*) to the CONFIG1 register | config1 abcd |
| config1 ? | *value*/"Failed" | Read CONFIG1 register | config1 ? |
| pga *value* | "OK"/"Failed" | Write 5-bit hex (*value*) to the PGA[4:0] bit field of the CONFIG1 register | pga 1a |
| pga ? | *value*/"Failed" | Read PGA[4:0] value from the CONFIG1 register | pga ? |
| pga_sign *value* | "OK"/"Failed" | Write 1-bit hex (*value*) to the PGA Sign bit field of the CONFIG1 register | pga_sign 0 |
| pga_sign ? | *value*/"Failed" | Read PGA Sign value from the CONFIG1 register | pga_sign ? |
| iro_sign *value* | "OK"/"Failed" | Write 1-bit hex (*value*) to the IRO Sign bit field of the CONFIG1 register | iro_sign 0 |
| iro_sign ? | *value*/"Failed" | Read IRO Sign value from the CONFIG1 register | iro_sign ? |
| iro *value* | "OK"/"Failed" | Write 4-bit hex (*value*) to the IRO[3:0] bit field of the CONFIG1 register | iro a |
| iro ? | *value*/"Failed" | Read IRO[3:0] value from the CONFIG1 register | iro ? |
| cmratio *value* | "OK"/"Failed" | Write 2-bit hex (*value*) to the CMRATIO[1:0] bit field of the CONFIG1 register | cmratio a |
| cmratio ? | *value*/"Failed" | Read CMRATIO[1:0] value from the CONFIG1 register | cmratio ? |
| odac_sign *value* | "OK"/"Failed" | Write 1-bit hex (*value*) to the ODAC Sign bit field of the CONFIG1 register | odac_sign 0 |
| odac_sign ? | *value*/"Failed" | Read ODAC Sign value from the CONFIG1 register | odac_sign ? |
| otcdac_sign *value* | "OK"/"Failed" | Write 1-bit hex (*value*) to the OTCDAC Sign bit field of the CONFIG1 register | otcdac_sign 0 |
| otcdac_sign ? | *value*/"Failed" | Read OTCDAC Sign value from the CONFIG1 register | otcdac_sign ? |
| config2 *value* | "OK"/"Failed" | Write 16-bit hex (*value*) to the CONFIG2 register | config2 abcd |
| config2 ? | *value*/"Failed" | Read CONFIG2 register | config2 ? |
| enfdet *value* | "OK"/"Failed" | Write 1-bit hex (*value*) to the ENFDET bit field of the CONFIG2 register | enfdet 0 |
| enfdet ? | *value*/"Failed" | Read ENFDET value from the CONFIG2 register | enfdet ? |
| refrate *value* | "OK"/"Failed" | Write 2-bit hex (*value*) to the REFRATE[1:0] bit field of the CONFIG2 register | refrate 2 |
| refrate ? | *value*/"Failed" | Read REFRATE[1:0] value from the CONFIG2 register | refrate ? |
| enpullup *value* | "OK"/"Failed" | Write 1-bit hex (*value*) to the ENPULLUP bit field of the CONFIG2 register | enpullup 0 |
| enpullup ? | *value*/"Failed" | Read ENPULLUP value from the CONFIG2 register | enpullup ? |
| readdly *value* | "OK"/"Failed" | Write 2-bit hex (*value*) to the READDLY[1:0] bit field of the CONFIG2 register | readdly 2 |
| readdly ? | *value*/"Failed" | Read READDLY[1:0] value from the CONFIG2 register | readdly ? |
| excimode *value* | "OK"/"Failed" | Write 1-bit hex (*value*) to the EXCIMODE bit field of the CONFIG2 register | excimode 0 |
| excimode ? | *value*/"Failed" | Read EXCIMODE value from the CONFIG2 register | excimode ? |
| odac *value* | "OK"/"Failed" | Write 16-bit hex (*value*) to the ODAC register | odac 0 |
| odac ? | *value*/"Failed" | Read ODAC register | odac ? |
| otcdac *value* | "OK"/"Failed" | Write 16-bit hex (*value*) to the OTCDAC register | otcdac abcd |
| otcdac ? | *value*/"Failed" | Read OTCDAC register | otcdac ? |

## Table 7. Register Read/Write Commands (continued)

| COMMAND (char *cmd) | RETURN MESSAGE (char *msg) | DESCRIPTION | EXAMPLE |
|---|---|---|---|
| fsodac *value* | "OK"/"Failed" | Write 16-bit hex (*value*) to the FSODAC register | fsodac 0 |
| fsodac ? | *value*/"Failed" | Read FSODAC register | fsodac ? |
| fsotcdac *value* | "OK"/"Failed" | Write 16-bit hex (*value*) to the FSOTCDAC register | fsotcdac abcd |
| fsotcdac ? | *value*/"Failed" | Read FSOTCDAC register | fsotcdac ? |
| pwrupcfg *value* | "OK"/"Failed" | Write 16-bit hex (*value*) to the PWRUPCFG register | pwrupcfg abcd |
| pwrupcfg ? | *value*/"Failed" | Read PWRUPCFG register | pwrupcfg ? |
| digmodetime *value* | "OK"/"Failed" | Write 4-bit hex (*value*) to the DIGMODETIME[3:0] bit field of the PWRUPCFG register | digmodetime a |
| digmodetime ? | *value*/"Failed" | Read DIGMODETIME[3:0] value from the PWRUPCFG register | digmodetime ? |
| ctrlrep *value* | "OK"/"Failed" | Write 3-bit hex (*value*) to the CTRLREP[2:0] bit field of the PWRUPCFG register | ctrlrep 7 |
| ctrlrep ? | *value*/"Failed" | Read CTRLREP[2:0] value from the PWRUPCFG register | ctrlrep ? |

## Table 8. Additional Commands

| COMMAND (char *cmd) | RETURN MESSAGE (char *msg) | DESCRIPTION | EXAMPLE |
|---|---|---|---|
| init_com | "OK"/"Failed" | Power cycle and initialize communication | init_com |
| init_delay *8bit_value* | "OK"/"Failed" | Insert delay between closing the power relay and sending the initial byte to the device.<br>Delay = 0.5ms+*8bit_value* x 0.1ms | init_delay 20 |
| init_delay ? | *value*/"Failed" | Read initial delay parameter | init_delay ? |
| read_test_com_reg | "CA"/"Failed" | Read the test communication register. It should return CAhex | read_test_com_reg |
| rdalg | OUT/DIO Voltage + "V"/"Failed" | Output the multiplexed analog signal onto OUT/DIO. The on-board ADC automatically reads the voltage on the OUT/DIO pin and returns the data to the PC. | rdalg |
| swtoana | "OK"/"Failed" | Switch to fixed analog mode | swtoana |
| read_adc | OUT/DIO Voltage + "V"/"Failed" | On-board ADC conversion | read_adc |
| relearn_baud | "OK"/"Failed" | relearn the baud rate | relearn_baud |
| temp_sensor ? | *value*/"Failed" | Read temperature sensor register | temp_sensor ? |
| aloc *value* | "OK"/"Failed" | Write 5-bit hex (*value*) to the ALOC register | aloc 15 |
| aloc ? | *value*/"Failed" | Read ALOC register | aloc ? |
| atim *value* | "OK"/"Failed" | Write 4-bit hex (*value*) to the ATIM register | atim f |
| atim ? | *value*/"Failed" | Read ATIM register | atim ? |
| scan | a string of 1/0/"Failed" | Send test communication command to all 15 devices. Return a character string of 1/0 that indicates which devices are functioning.<br>e.g., "101111111111111"<br>this means the 2nd device doesn't respond to the test communication command | scan |
| dll_version ? | "DLL version =" #.##/"Failed" | Return the DLL version | dll_version ? |
| maxq_version ? | "MAXQ version =" #.##/"Failed" | Return the MAXQ FW version | maxq_version ? |

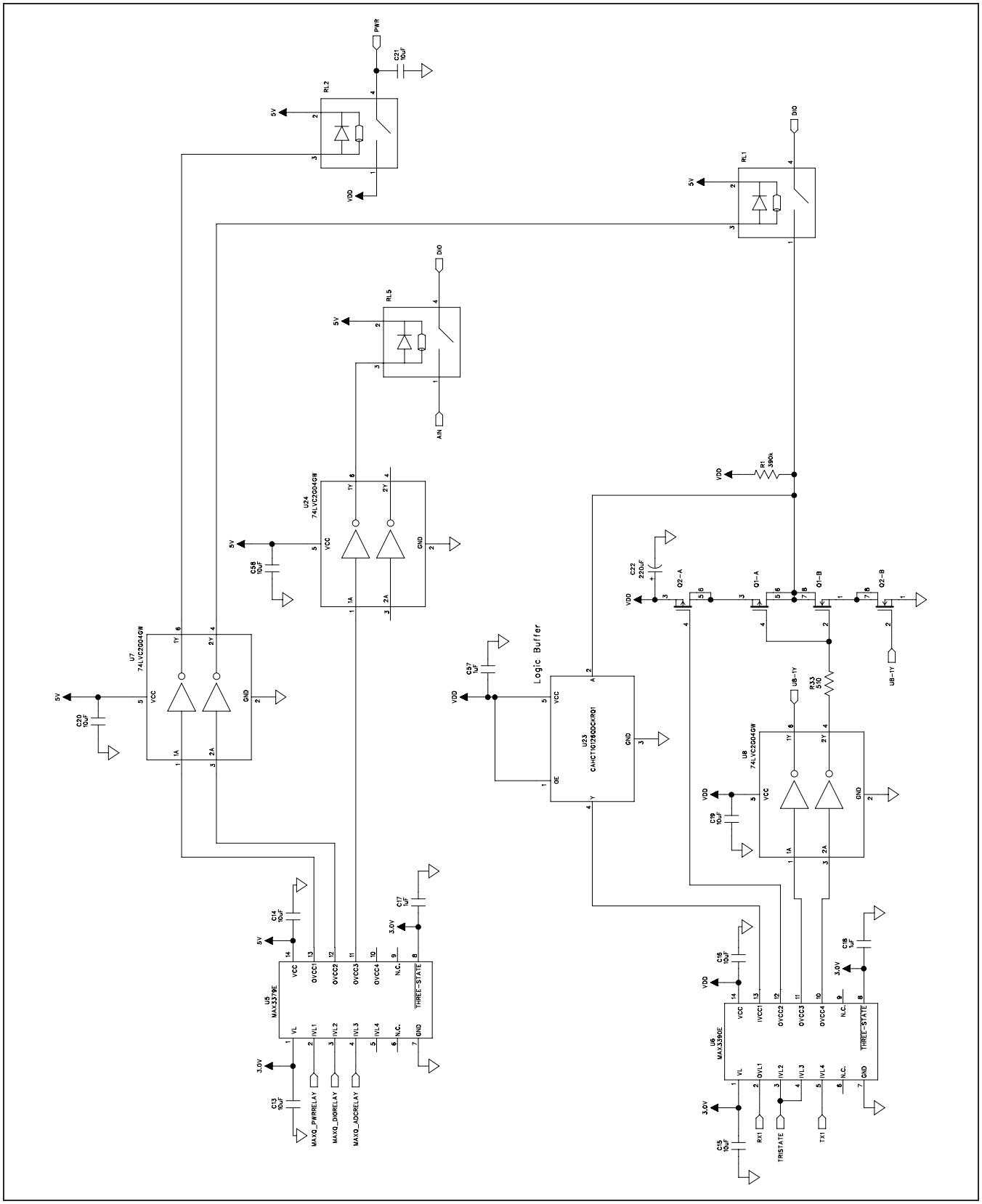


*Figure 8a. MAX1454 Master Board Schematic (Sheet 1 of 6)*

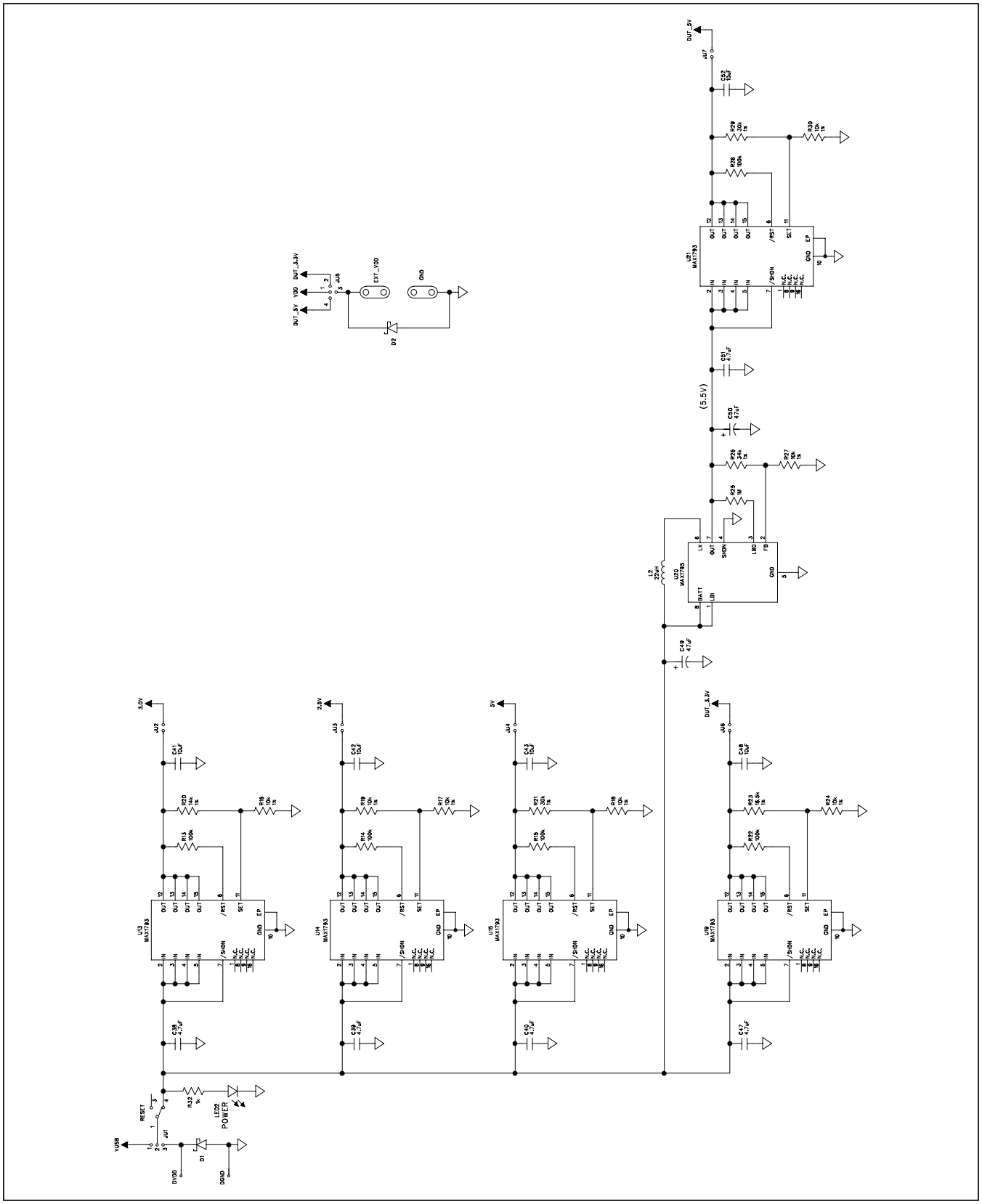

*Figure 8b. MAX1454 Master Board Schematic (Sheet 2 of 6)*

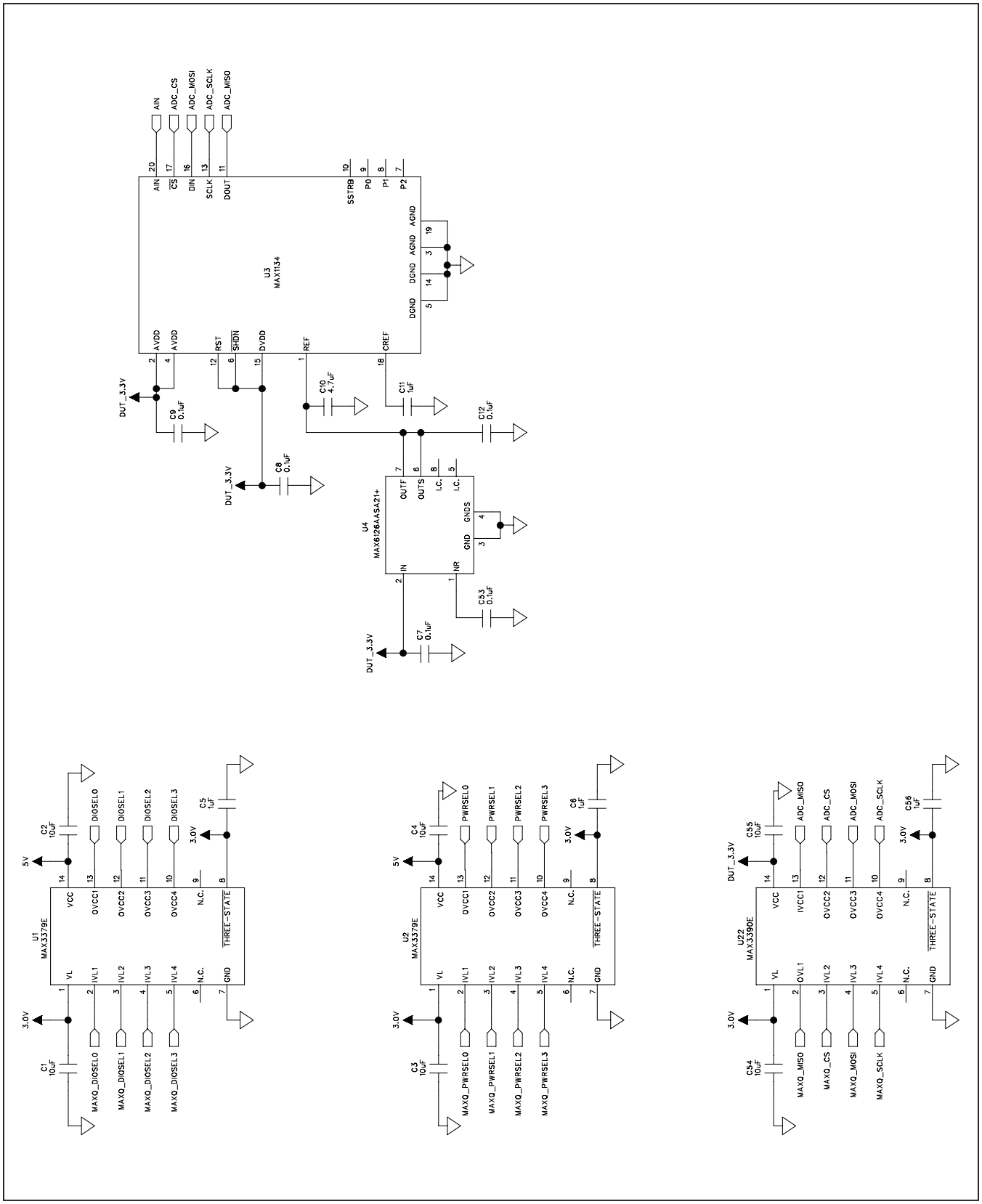


*Figure 8c. MAX1454 Master Board Schematic (Sheet 3 of 6)*

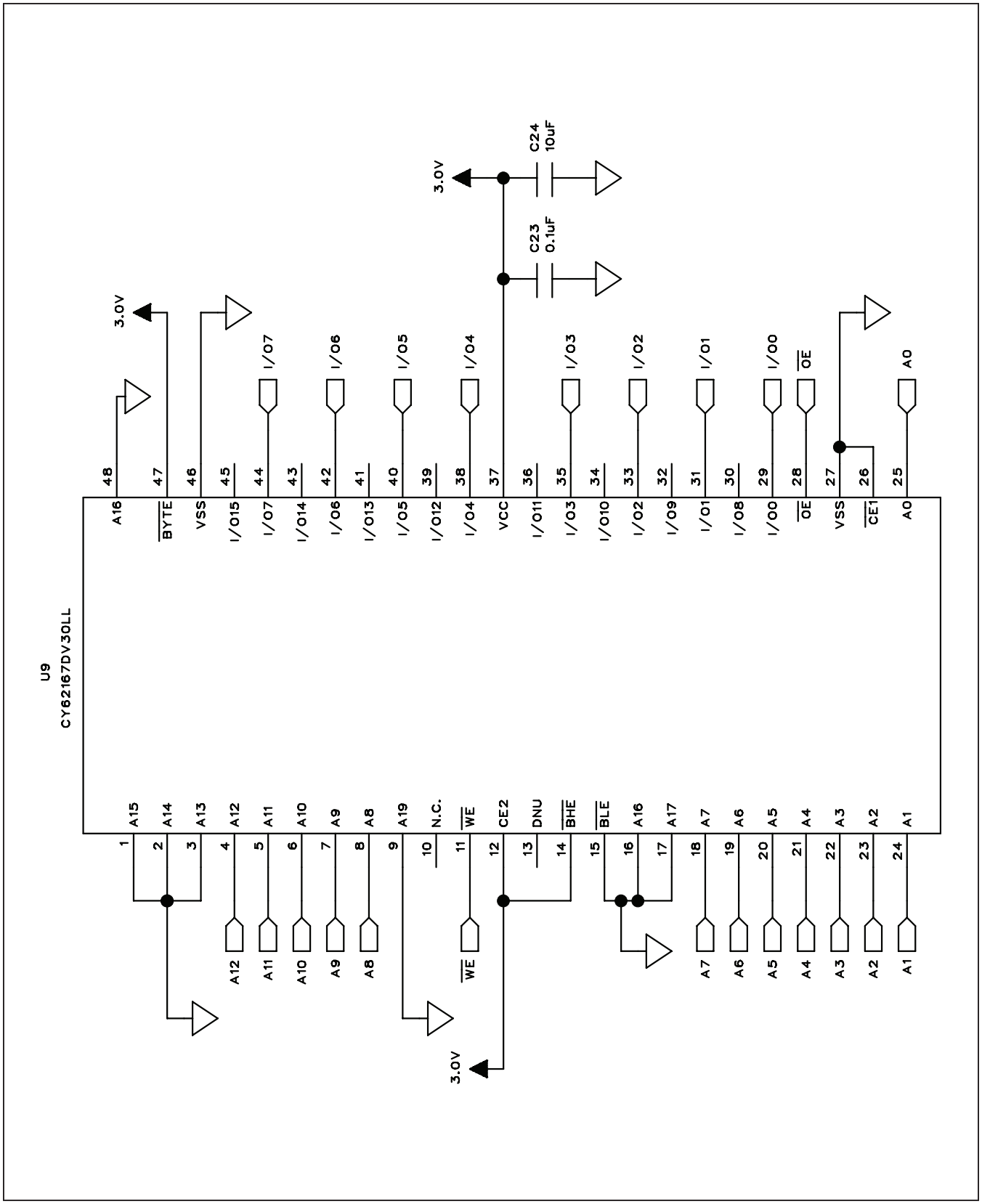


*Figure 8d. MAX1454 Master Board Schematic (Sheet 4 of 6)*

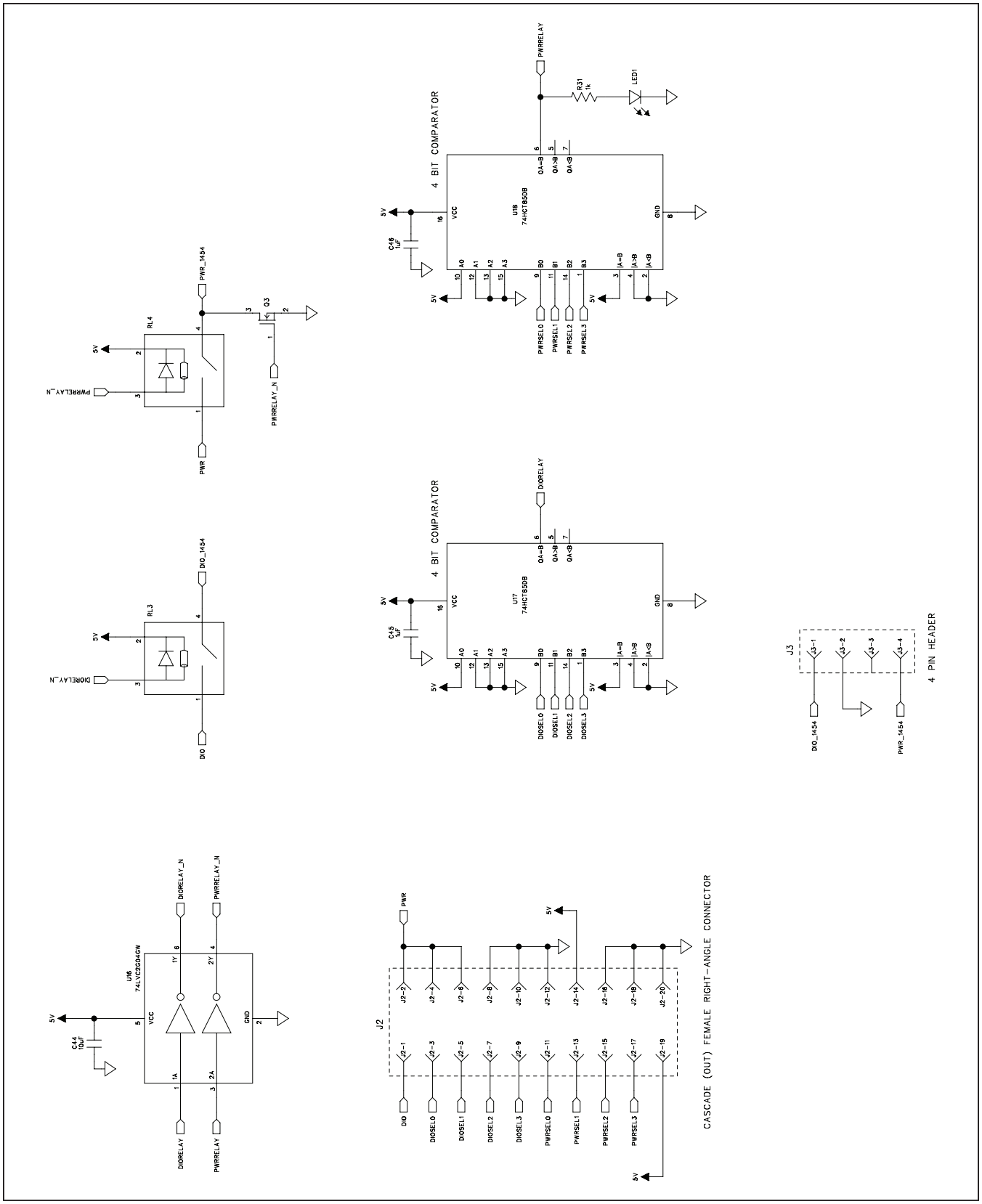


*Figure 8e. MAX1454 Master Board Schematic (Sheet 5 of 6)*

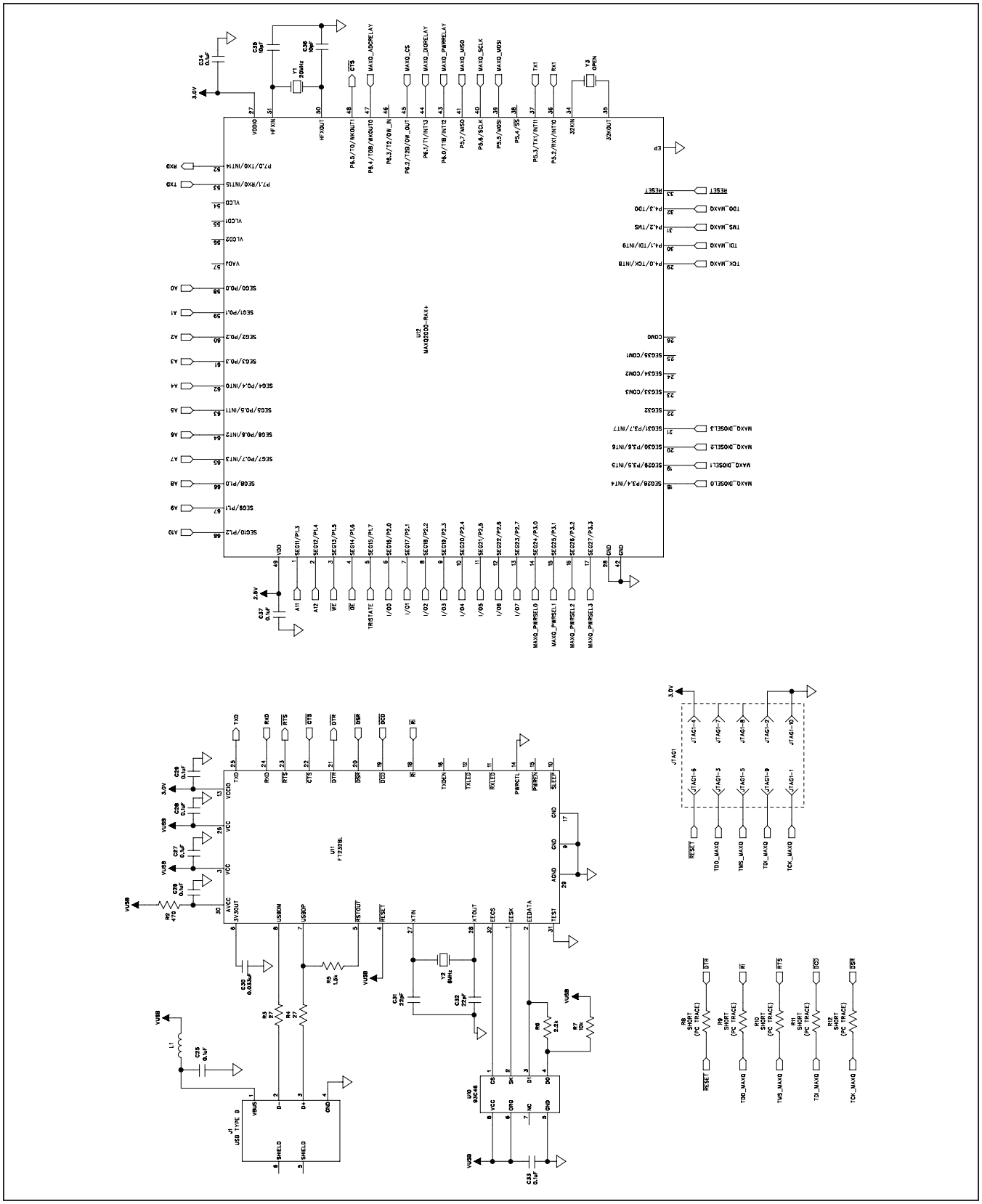

*Figure 8f. MAX1454 Master Board Schematic (Sheet 6 of 6)*

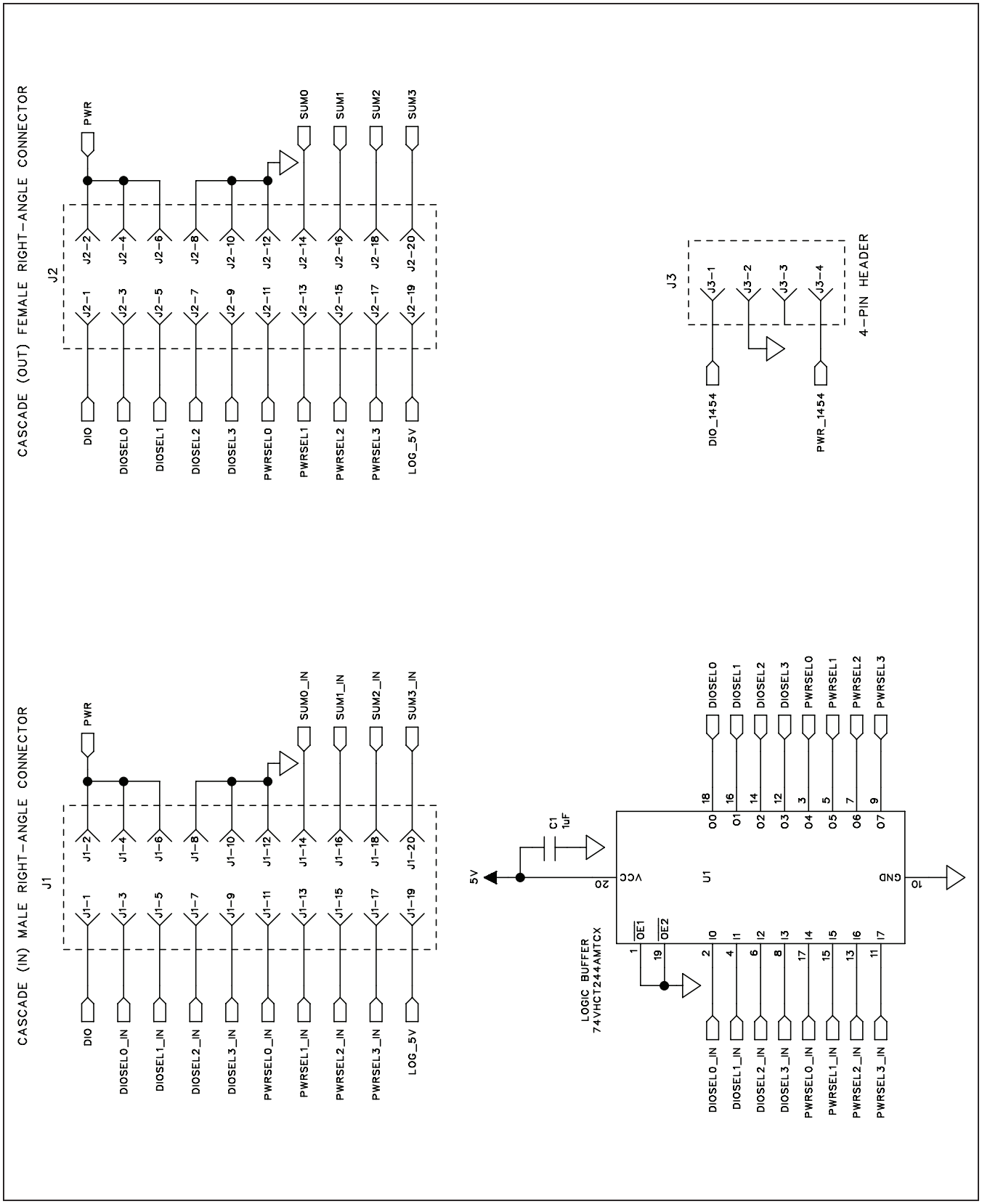


*Figure 9a. MAX1454 Daughter Board Schematic (Sheet 1 of 2)*

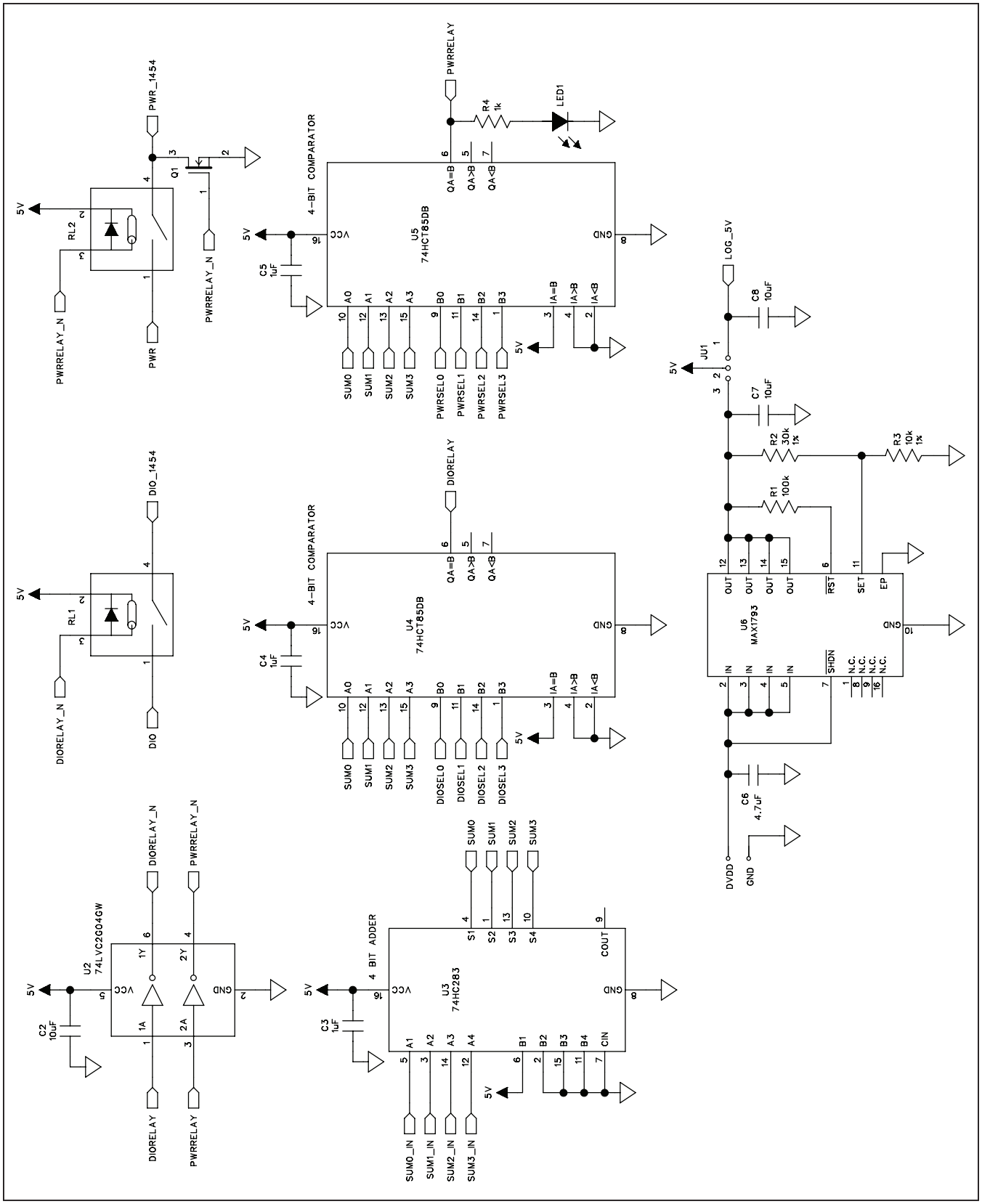


*Figure 9b. MAX1454 Daughter Board Schematic (Sheet 2 of 2)*

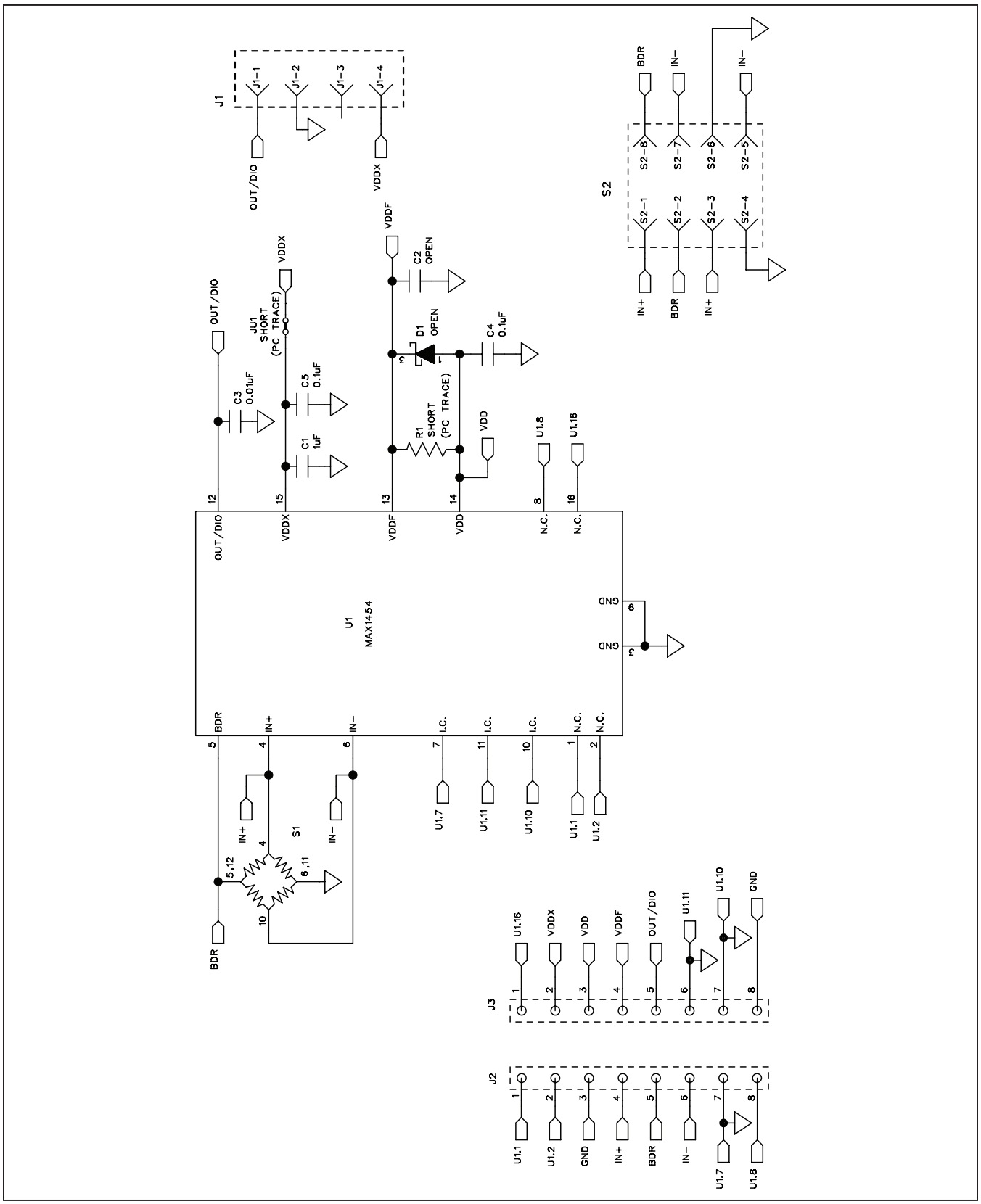


*Figure 10. MAX1454 EV Kit Schematic*

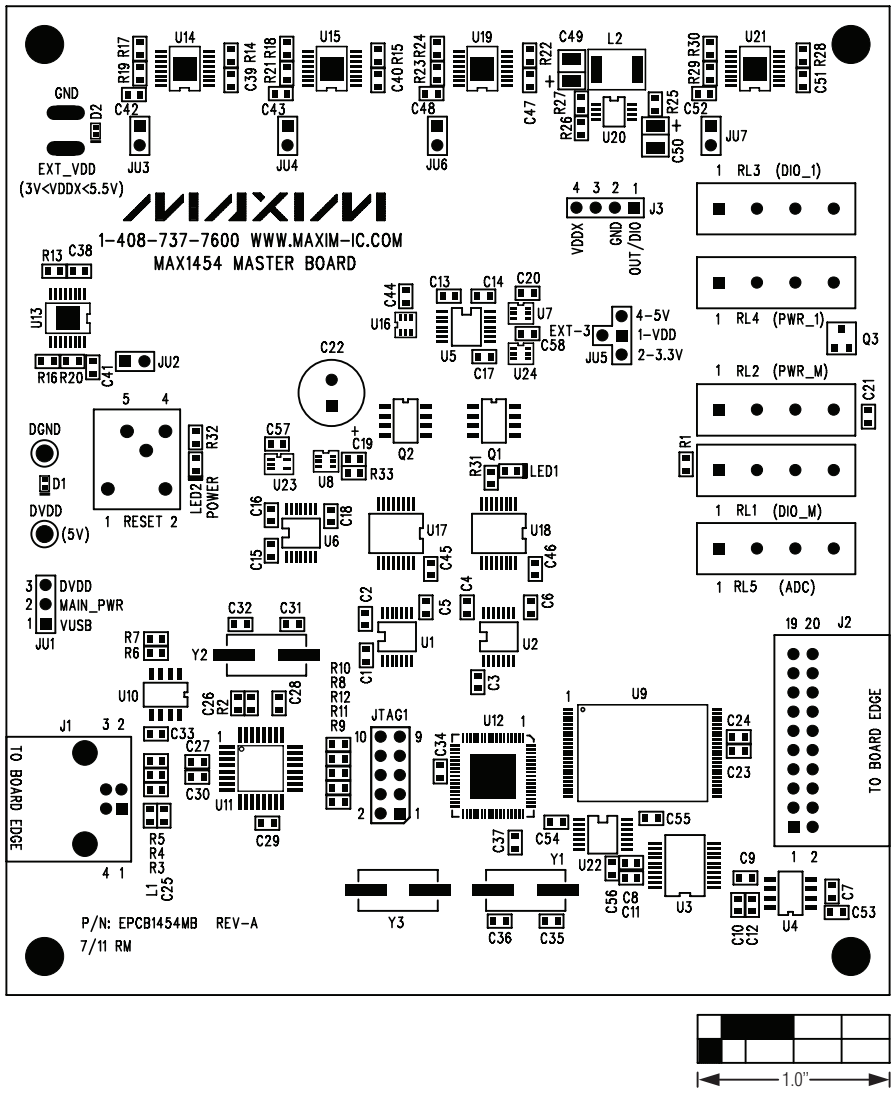


*Figure 11. MAX1454 Master Board Component Placement Guide—Component Side*

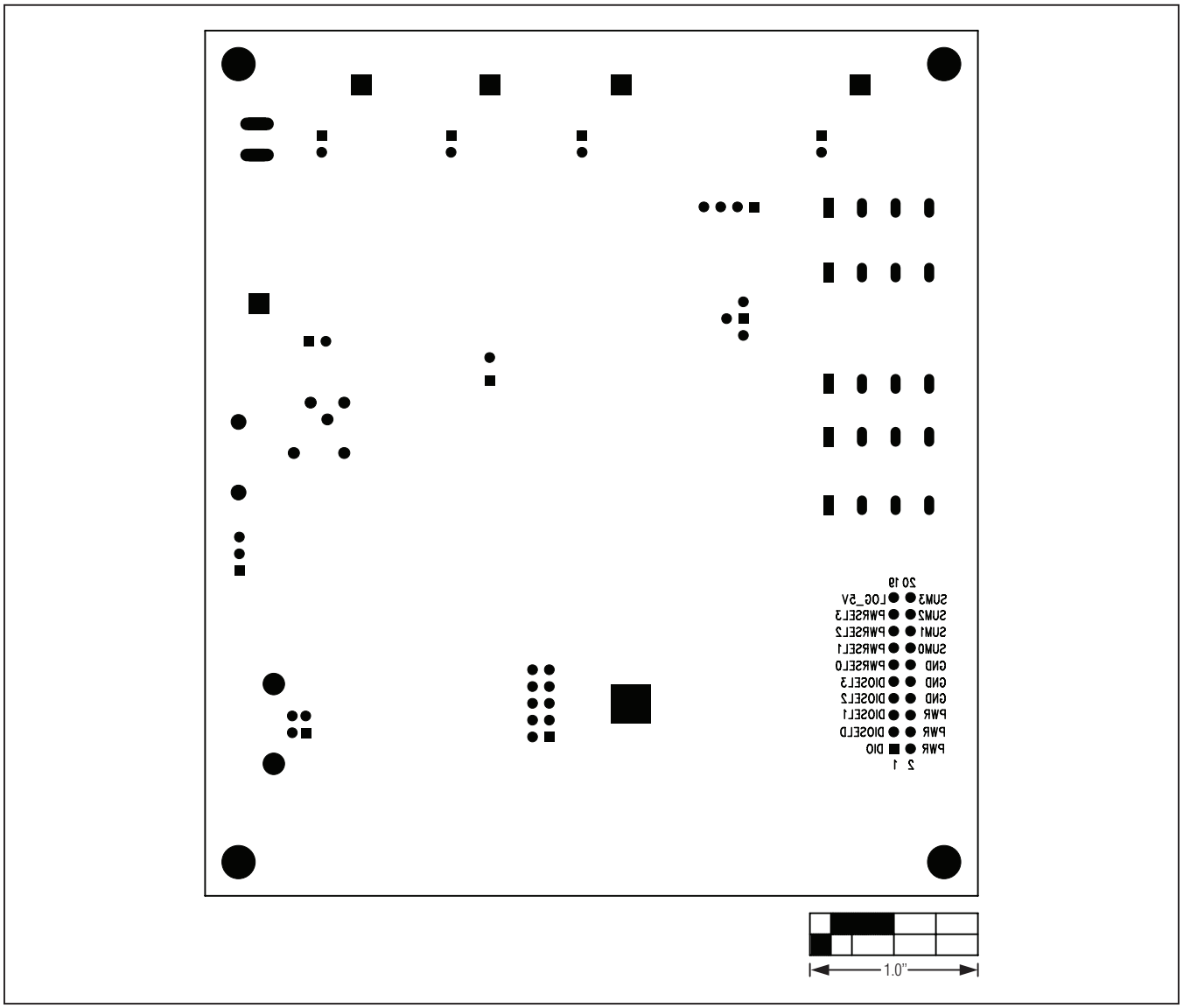


*Figure 12. MAX1454 Master Board Component Placement Guide—Bottom Side*

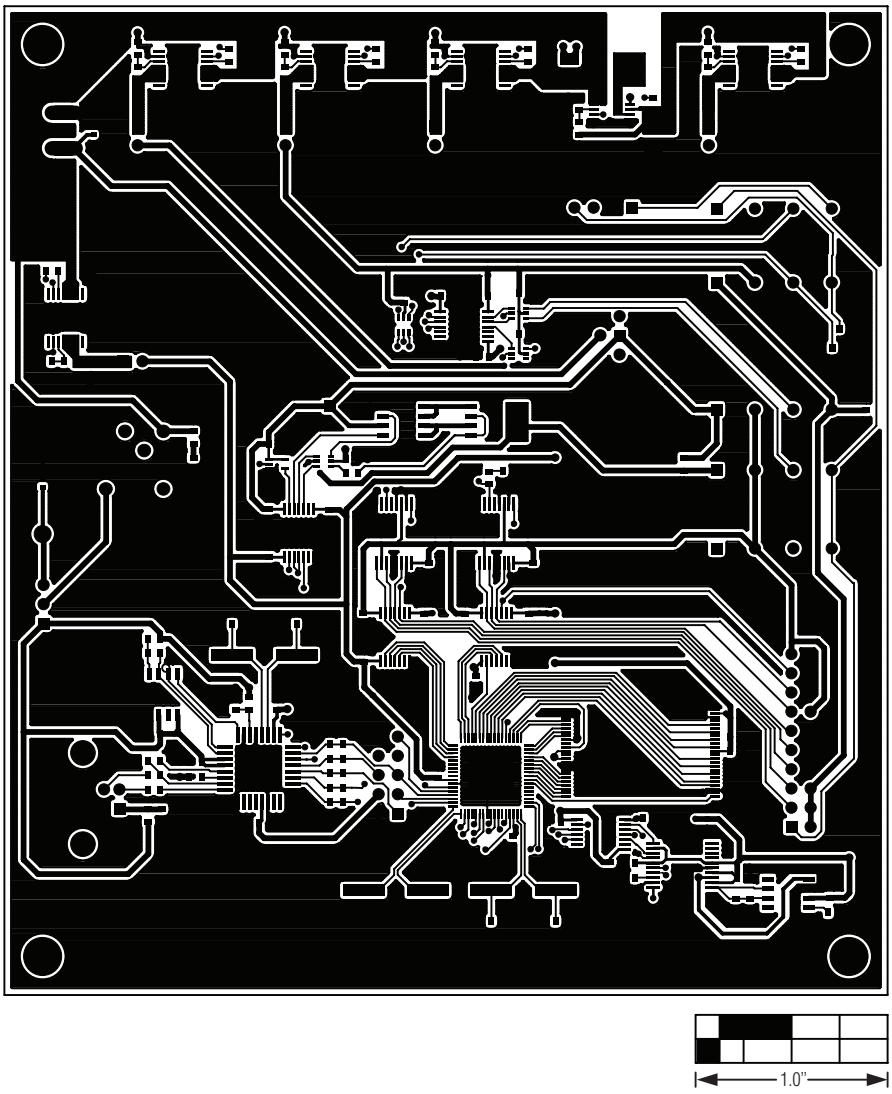


*Figure 13. MAX1454 Master Board PCB Layout—Component Side*

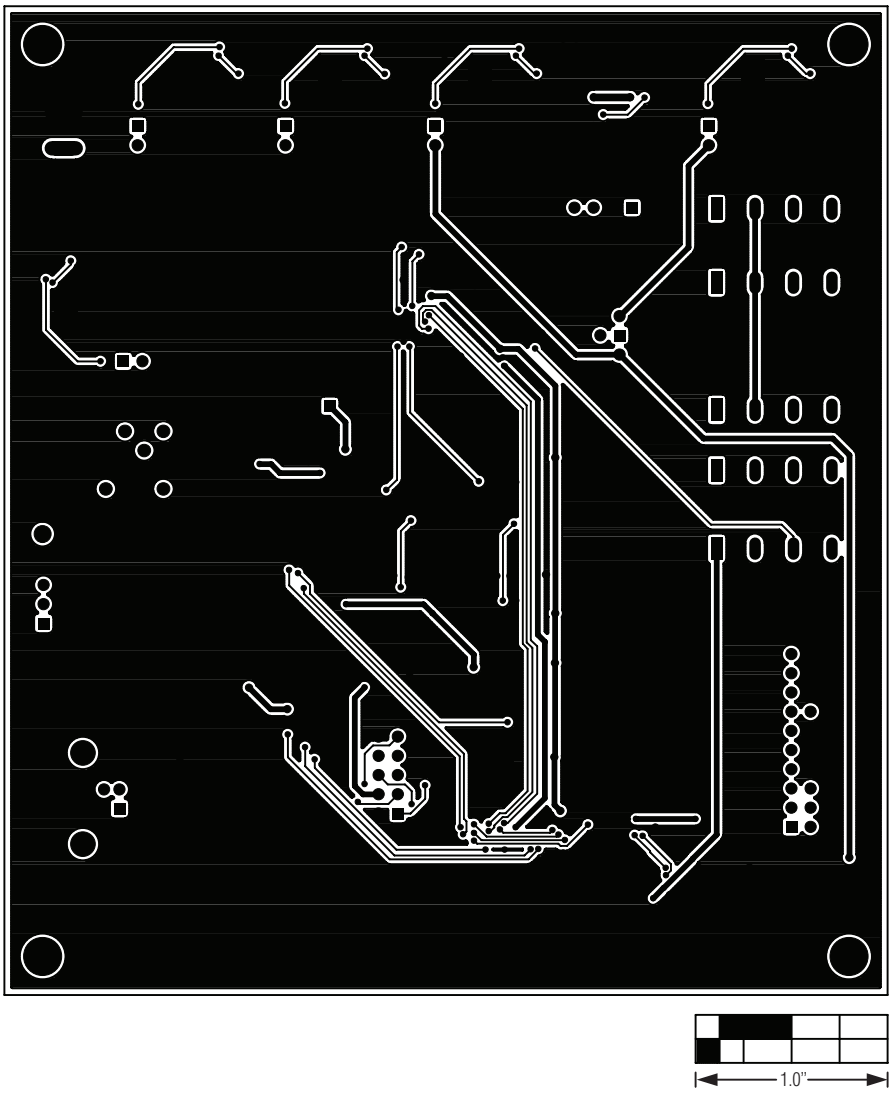


*Figure 14. MAX1454 Master Board PCB Layout—Bottom Side*

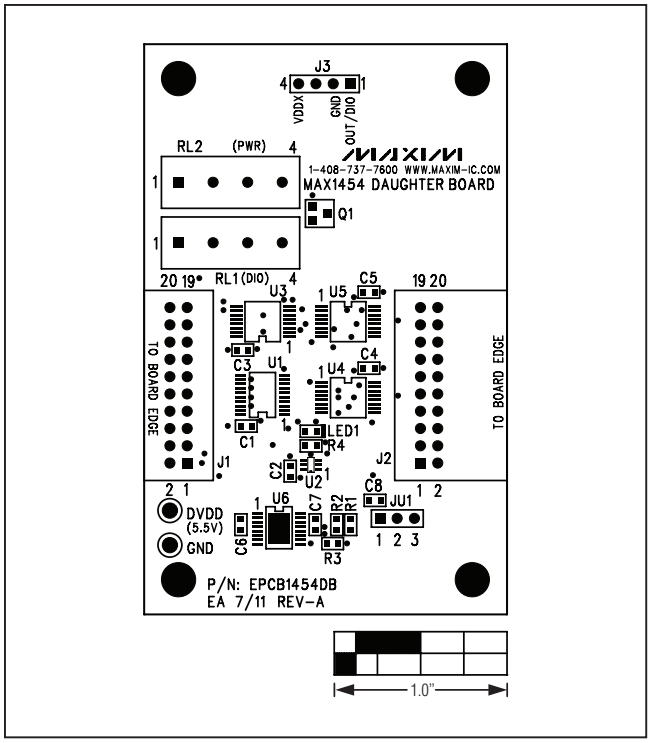


*Figure 15. MAX1454 Daughter Board Component Placement Guide—Component Side*

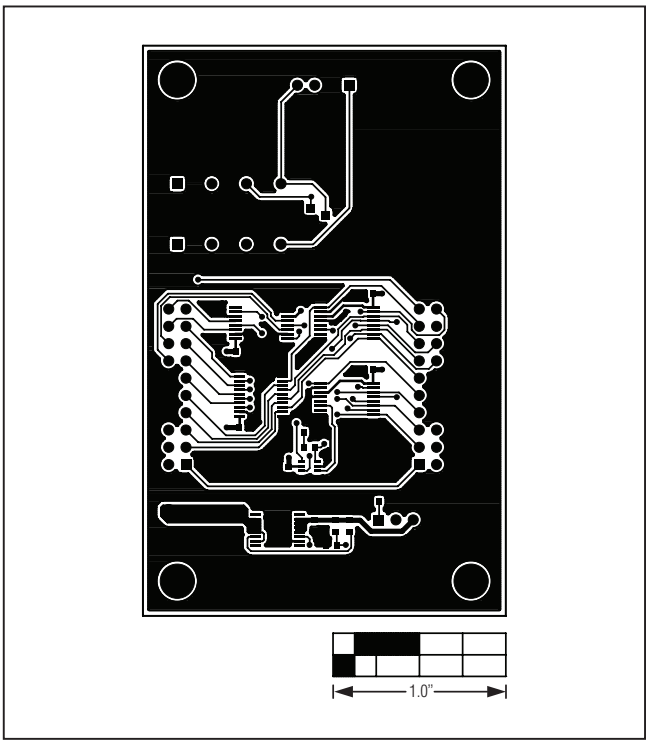


*Figure 16. MAX1454 Daughter Board PCB Layout—Component Side*

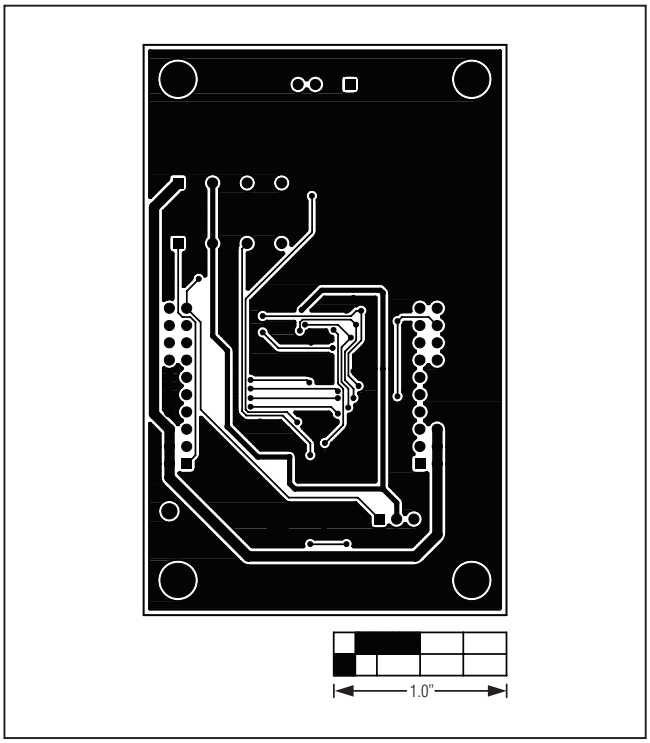


*Figure 17. MAX1454 Daughter Board PCB Layout—Bottom Side*

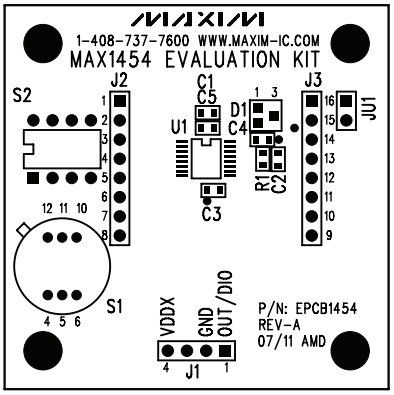


Figure 18. MAX1454 EV Kit Component Placement Guide—Component Side

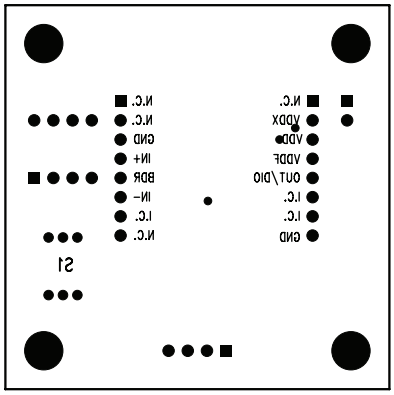


Figure 20. MAX1454 EV Kit Component Placement Guide—Bottom Side

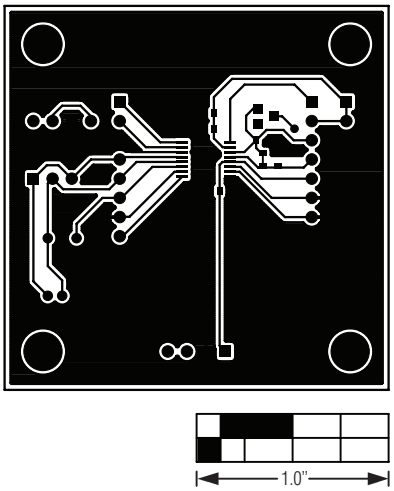


Figure 19. MAX1454 EV Kit PCB Layout—Component Side

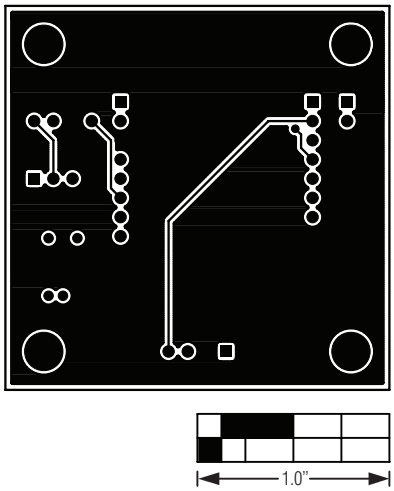


Figure 21. MAX1454 EV Kit PCB Layout—Bottom Side

## Ordering Information

| PART | TYPE | INCLUDES |
|---|---|---|
| **MAX1454EVSYS#** | EV System | MAX1454 Master Board, MAX1454 EV Board |
| **MAX1454DBSYS#** | DB System | MAX1454 Daughter Board, MAX1454 EV Board |

*#Denotes RoHS compliant.*

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|---|---|---|---|
| 0 | 10/11 | Initial release | — |

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