

## General Description

The MAX34417 evaluation kit (EV kit) provides the hardware and software graphical user interface (GUI) necessary to evaluate the MAX34417 SMBus Four-Channel, High Dynamic Range Power Accumulator. The EV Kit includes a MAX34417ENE+ installed EV board, as well as a micro-USB cable to communicate with a PC.

Ordering Information appears at end of data sheet.

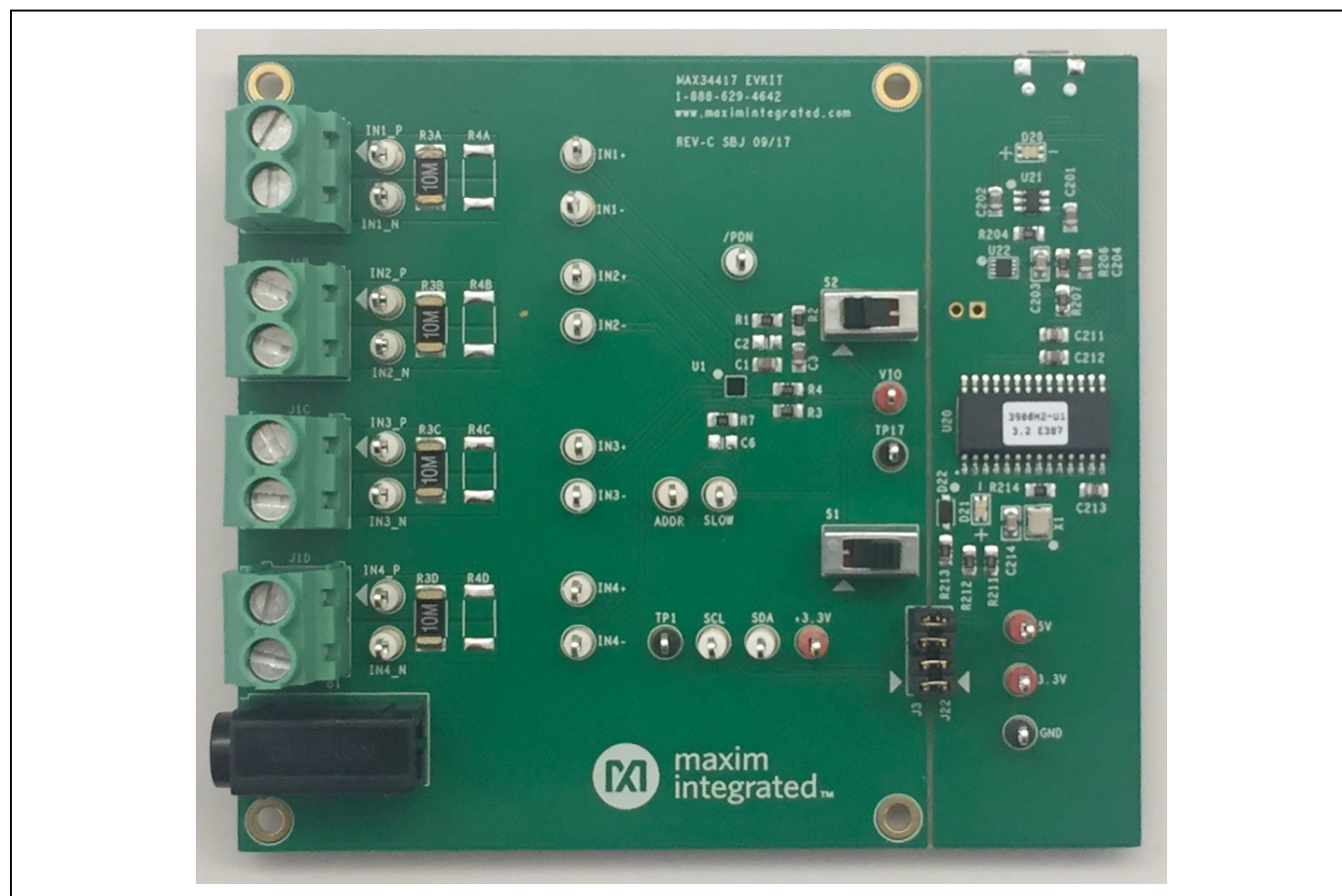
## Features

- Easy Evaluation of the MAX34417
- USB-12C/SMBus Interface
- PC, Laptop, or Tablet with Windows XP®, Windows® 7, 8, and 10 Compatible Software
- Proven PCB Layout
- Fully Assembled and Tested

## EV Kit Contents

- Assembled circuit board including MAX34417ENE+
- Micro-USB cable

## MAX34417 EV Kit Photo



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Windows is a registered trademark and registered service mark of Microsoft Corporation.

## MAX34417 EV Kit Files

| FILE                                       | DESCRIPTION         |
|--------------------------------------------|---------------------|
| MAX34417 Power Accumulator EV Kit Software | Application program |

## Quick Start

### Required Equipment

- One high-current DC power supply capable of supplying +3V to 15V up to at least 3A
- One digital multimeter for measuring the voltage
- PC, laptop, or tablet with Microsoft Windows XP, Windows 7, 8, and 10 compatible software
- Micro-USB cable (included in the EV kit box)
- Variable power resistor for measuring the power
- MAX34417 EV kit

### Procedure

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

- 1) Place the EV Kit hardware on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
- 2) Ensure that all four jumpers on **J3/J22** are installed.
- 3) Prior to starting the GUI, connect the **J20** connector of the EV kit to a PC using the supplied micro-USB cable, the **POWER LED (D20)** should be green, and the **COM LED (D21)** should be red and slowly flash orange.
- 4) Visit [www.maximintegrated.com/evkitsoftware](http://www.maximintegrated.com/evkitsoftware) to download the latest version of the MAX34417 power accumulator EV kit software. Save the EV kit software to a temporary folder.
- 5) Install and open the MAX34417 power accumulator EV kit Software.
- 6) When the GUI appears, the text at the bottom-right corner of the window should display **EV Kit Connected** and the text at the bottom-left corner of the window should display **Connected Mode**. The **COM LED (D21)** changes to green.
- 7) Measure the potential from **3.3V** and **+3.3V** test points to Ground and verify that it is within the range of 3.2V to 3.4V.
- 8) Measure the potential from **5V** test point to Ground and verify that it is within the range of 4.8V to 5.2V.
- 9) Set the **S1 switch** to right side (fast position) and **S2 switch** to left side (power-on position).
- 10) Make sure that the **RSENSE (mΩ)**, on **Control/Registers** page under **Sense Resistors**, shows 10.00.
- 11) With the output set to +3.8V and disabled, connect the positive terminal of the power supply to the **IN1\_P** (SOURCE pin of the J1A) of the EV kit and connect the ground terminal to the **GND** header.
- 12) Tune variable **Power Resistor** to 38Ω and then connect it between the **IN1\_N** (RETURN pin of the J1A) of the EV kit and **GND** connector of the EV kit.
- 13) On **Monitor/Graph** page of the GUI, under **Read Options**, set the **Polling Rate** to 2.5 seconds.
- 14) Turn on the power supply. Click **Auto Poll** and verify the voltage and average power.
- 15) Repeat steps 11 to 14 for IN2, IN3, and IN4.  
**Note:** All 4 channels could be tested simultaneously by connecting four +3.8V DC supplies to the **IN1\_P**, **IN2\_P**, **IN3\_P**, and **IN4\_P**, and connecting four power resistors to **IN1\_N**, **IN2\_N**, **IN3\_N**, and **IN4\_N**. If using one DC power source for all 4 channels, make sure that the DC power supply is capable of supplying the total current.
- 16) Change the position of **S1 switch** to left side (slow position) or slide the **Slow Enable**, on the **Modes** window of the GUI, for Slow mode verification.
- 17) Slide **Park Enable**, on the **Modes** window of the GUI, for park on any of the four channels measurement.
- 18) Change the position of **S2 switch** to right side (power-off position) and verify that the **Auto Poll** stops polling.

## Detailed Description

The MAX34417 automatically sequences through the channels to collect samples from the common-mode voltage and the current-sense amplifiers. The 16-bit current value and the 14-bit voltage value are then multiplied to create a 30-bit power value that is then written to the power accumulator. The MAX34417 contains a 56-bit power accumulator for each channel. This accumulator is updated 1024 times per second. When the host is ready to pull the latest accumulation data, it first sends the UPDATE command that causes the MAX34417 to load the latest accumulation data and accumulation count into the internal MAX34417 registers so the host can read them at any time. This type of operation allows the host to control the accumulation period. The only constraint is that the host should access the data before the accumulators can overflow. If the accumulators overflow, they do not roll over.

The MAX34417 contains a 14-bit ADC for voltage and a 13-bit ADC for current. During each sample time, a 14-bit voltage sample and a 16-bit current sample are resolved. To create a 16-bit current value from the 13-bit ADC, the device takes two current samples; one with the current sense amplifier in a high-gain mode and another with the amplifier in a low-gain mode. The high gain setting is 8 times the low-gain setting. Based on the two current-sense ADC results, the device determines which result provides the best accuracy and fills the 16-bit current sample accordingly.

## Detailed Description of Software

### Software Startup

If the MAX34417 EV kit is connected when the software is opened, the software first detects the hardware to communicate. Next, the software searches for all slave addresses on the I<sup>2</sup>C bus and connects to the first slave address that is valid. Then, the GUI displays **EV Kit Connected** at the bottom-right corner of the window and **Connected Mode** at the bottom-left of the window. If the EV kit is not connected on software startup, the GUI populates with default GUI configuration and displays **EV Kit not detected** at the bottom-right corner and **Demo Mode** at the bottom-left corner of the window. Once the EV kit is connected, the GUI searches for slave addresses.

### Menu Items

The **Device** menu item allows the user to connect to a desired device. **Find Slave Addresses** searches for all slave addresses connected to the I<sup>2</sup>C bus. To select a device, click **Select Slave Address** and all the slave addresses found are shown and are selectable. The GUI

detects the slave address and automatically checks the first slave address it finds, and since the EV kit has only one device, user doesn't have to worry about the selection. The File menu is used to save measured data while Help menu can link users to the Maxim website.

### Status Log

The status log below the tabs displays all the actions the GUI performs. Whenever a SMBus command is read or written, the action is confirmed by the log. The log can be cleared by clicking on the **Clear Log** button.

### Monitor/Graph Tab

The **Monitor/Graph** tab (Figure 1) displays all the accumulator values. In the **Monitor** group box table, the **Polled** values are the Accumulator values read from PWR\_ACC\_1 to PWR\_ACC\_4 that are converted to amps using the **RSENSE** value in the **Sense Resistors** table on **Control/Registers** tab of the GUI (Figure 2). The **Sampled Voltage** and **Average Power** columns track the voltage and average power of the **Polled** value for each channel. All values on the tab are read when the tab is selected or when the **Read** button is clicked. The **OC** status bits are cleared after every read. Check the **Auto Poll** checkbox to continuously read with the **Polling Rate**.

The **Data Log Controls** group box contains the graph-related controls. **Graph Points** displays the number of reads that have been tracked in the data log. To reset the **Poll Count**, click on the **Data Log Reset** button. The Data log reset button clears the graph log which includes the graph points recorded and the data logged for the graph thus far. The **Average Power/Voltage** button selects the average power or voltage to be graphed.

### Control/RegistersTab

The **Control/Registers** tab (Figure 2) displays all the SMBus commands and their current values. In the **Control** group box table, the **RSENSE (mΩ)** column is the value of the resistor (R3X–R4X) between IN\_P and IN\_N signals. The **Max Current (A)** column displays the maximum current threshold converted to amps using the **RSENSE** value.

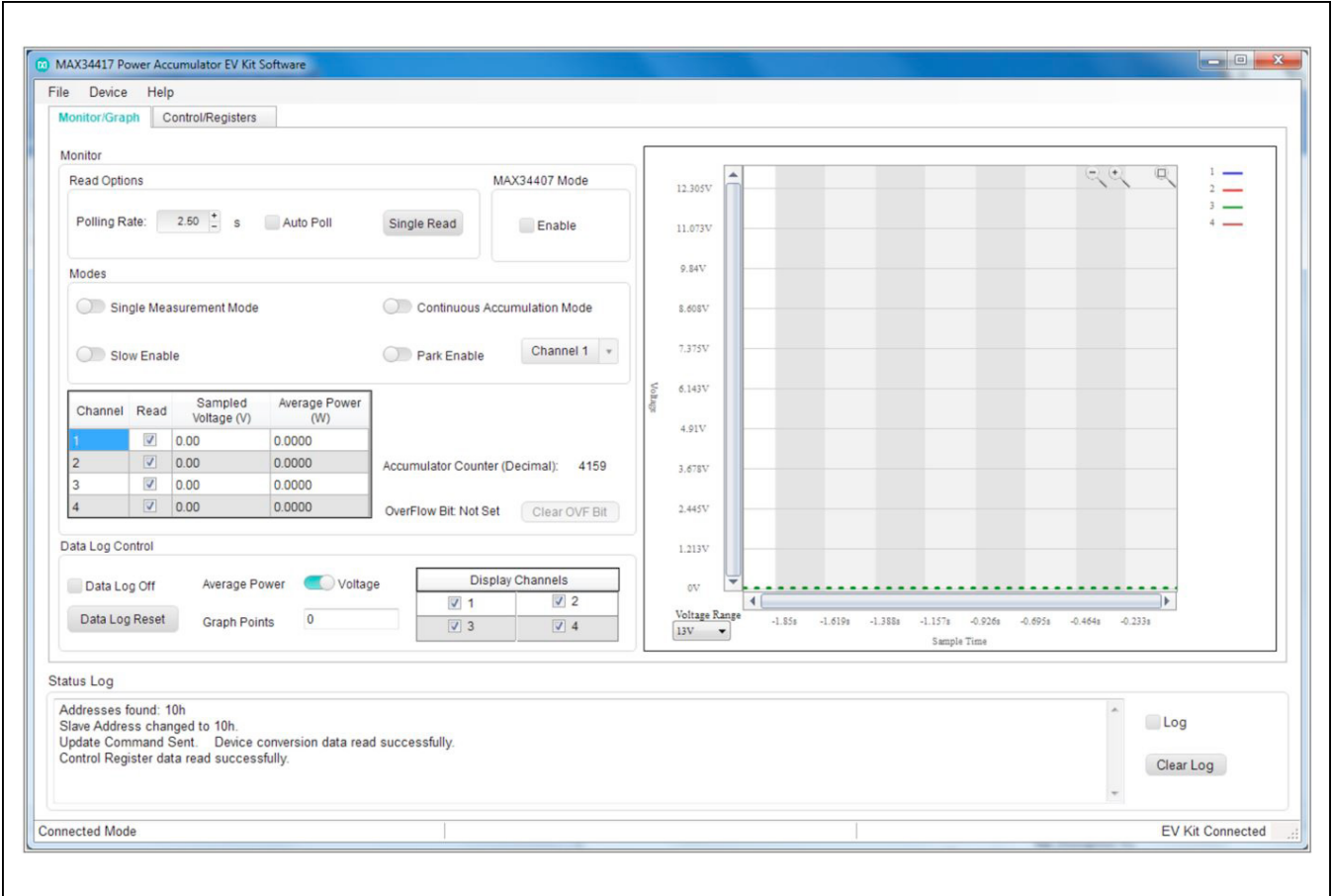


Figure 1. MAX34417EV Kit Software—Monitor/Graph Tab

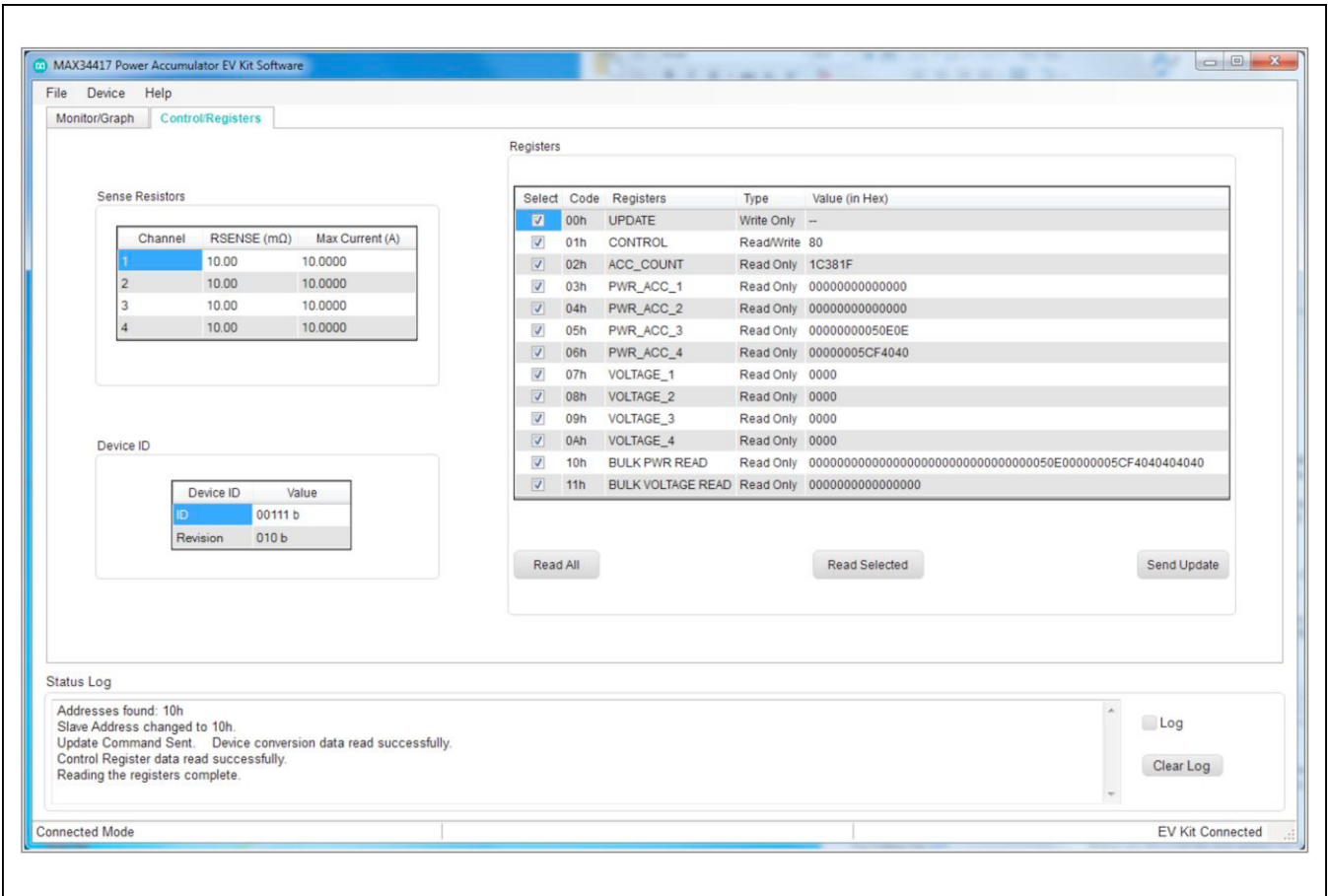


Figure 2. MAX34417EV Kit Software—Control/Registers Tab

## Troubleshooting

All efforts were made to ensure that each EV kit works on the first try, right out-of-the-box. In the rare occasion that a problem is suspected, see [Table 2](#) to help troubleshoot the issue.

**Table 1. Description of LEDs (D20, D21)**

| LED         | COLOR | DESCRIPTION                                                                                                                        |
|-------------|-------|------------------------------------------------------------------------------------------------------------------------------------|
| D20 (POWER) | Red   | <b>USB Power Fault:</b> A fault occurred due to overvoltage limit, current limit, or thermal limit.                                |
|             | Green | <b>USB Power:</b> USB power supply is on.                                                                                          |
| D21 (COM)   | Red   | <b>Communication:</b> After the software has initialized the hardware, the LED flashes red when a command from the PC is received. |
|             | Green | <b>Initialized:</b> Hardware has been initialized by software.                                                                     |

**Table 2. Troubleshooting**

| SYMPTOM                                                                                  | CHECK                                                        | SOLUTION                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GUI indicates:<br><b>EV Kit Not Connected</b><br><b>Device not found.</b>                | Is the LED labeled D20 red?                                  | If yes, then the electronic fuse is in a fault state. Inspect for electrical shorts on the PCB and make sure that the PCB is not sitting on a conductive surface.                                                                                                          |
|                                                                                          | Does the LED labeled D21 turn green when the GUI is running? | If not, then exit the GUI and try running it again. If D21 still does not turn green, then exit the GUI and try connecting the USB cable to a different USB port on the PC and wait for a Windows message indicating that the hardware is ready to use. Run the GUI again. |
|                                                                                          | Are any of the LEDs illuminated?                             | If not, then the PCB may not be getting power from the USB. Try a different USB cable or a different USB port.                                                                                                                                                             |
| GUI indicates:<br><b>Read Failed!</b><br><b>and all slave addresses are being found.</b> | J23/22                                                       | Make sure all four jumpers on J3/J22 are populated.                                                                                                                                                                                                                        |

## Component Suppliers

| SUPPLIER                   | WEBSITE                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------|
| TDK                        | <a href="http://www.tdk.com/">http://www.tdk.com/</a>                                   |
| Taiyo Yuden                | <a href="http://www.t-yuden.com/">http://www.t-yuden.com/</a>                           |
| Murata                     | <a href="http://www.murata.com/">http://www.murata.com/</a>                             |
| Vishay Dale                | <a href="http://www.vishay.com/">http://www.vishay.com/</a>                             |
| Koa Speer Electronics Inc. | <a href="http://www.koaspeer.com/">http://www.koaspeer.com/</a>                         |
| Keystone Electronics       | <a href="http://www.keyelco.com/">http://www.keyelco.com/</a>                           |
| Del-Tron                   | <a href="http://deltron.com/">http://deltron.com/</a>                                   |
| King bright                | <a href="http://www.kingbrightusa.com/">http://www.kingbrightusa.com/</a>               |
| Panasonic                  | <a href="https://na.industrial.panasonic.com/">https://na.industrial.panasonic.com/</a> |
| Phoenix Contact            | <a href="http://www.phoenixcontact.com/">http://www.phoenixcontact.com/</a>             |
| 3M                         | <a href="http://www.3m.com/">http://www.3m.com/</a>                                     |
| Molex                      | <a href="http://www.molex.com/">http://www.molex.com/</a>                               |
| TE Connectivity            | <a href="http://www.te.com/usa-en/home.html">http://www.te.com/usa-en/home.html</a>     |
| Microchip                  | <a href="http://www.microchip.com/">http://www.microchip.com/</a>                       |
| Kyocera                    | <a href="http://www.kyocera.com/">http://www.kyocera.com/</a>                           |

## Ordering Information

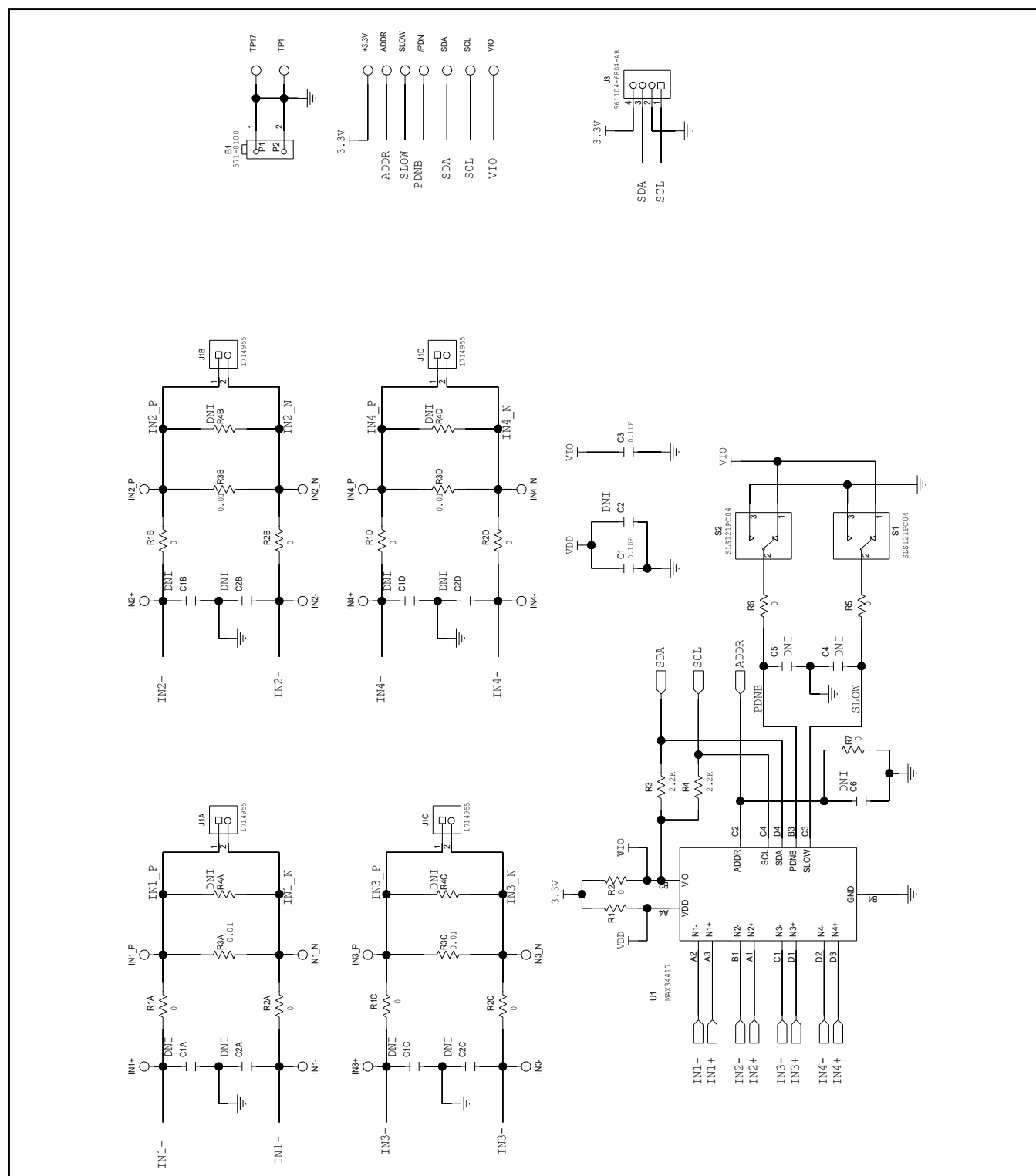
| PART           | TYPE   |
|----------------|--------|
| MAX34417EVKIT# | EV Kit |

#Denotes RoHS compliant.

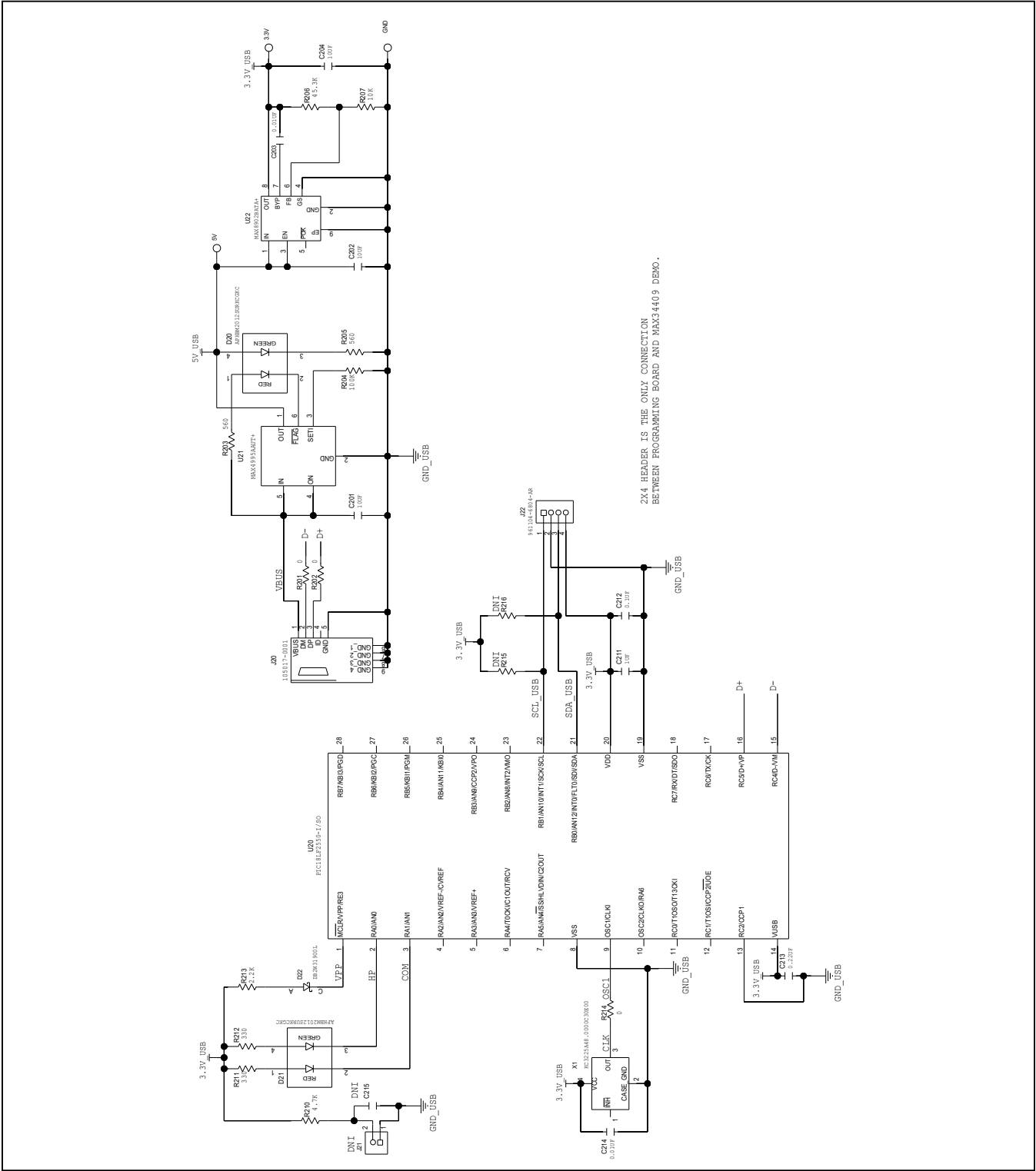
Evaluates: MAX34417

| Item | Reference                                                                                              | Quantity | Value  | Description                                                                                                                                                                        | MAXINV                  | Manufacturer Part Number | Manufacturer              | Digi-Key Part Number | Comments |
|------|--------------------------------------------------------------------------------------------------------|----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------|---------------------------|----------------------|----------|
| 1    | 5V, VIO, 3.3V, +3.3V<br>SCL, SDA, I2C, PDI,<br>INT_0-14; IN_A, SLOW;<br>IN_1-IN_4, N, INT_P,<br>IN_4_P | 4        | N/A    | TEST POINT WITH 1.80MM HOLE DIA. RED.<br>MULTIPURPOSE, NOT FOR COLD TEST                                                                                                           | 02-TFMINI5010-00        | 5010                     | KEystone                  | 36-5010-ND           |          |
| 2    | C1, C2, C212                                                                                           | 21       | N/A    | TEST POINT: PIN DIA=0.125IN; TOTAL<br>LENGTH=0.44IN.; BOARD HOLE=0.083IN; WHITE;<br>RECOMMENDED FOR BOARD<br>THICKNESS=0.062IN.                                                    | 02-TFMINI5012-00        | 5012                     | KEystone                  | 36-5012-ND           |          |
| 3    | B1                                                                                                     | 1        | N/A    | CONNECTOR, FEMALE, THROUGH-HOLE;<br>BANYAN 4MM SOCKET, RIGHT ANGLE; 2PINS                                                                                                          | 01-57101002P-80         | 571-0100                 | DELTRON                   |                      |          |
| 4    | C1, C3, C212                                                                                           | 3        | 0.1UF  | CAPACITOR, SMT (0805); CERAMIC CHIP; 0.1UF;<br>100V; TOL=10%; TG=-55 DEGC TO +125 DEGC;<br>TC=XTR, AUTO                                                                            | 20-000UJ-CAB2           | CGA4J2X7R2A104K125AA     | TDK                       | 445-5872-2-ND        |          |
| 5    | C2, C4-Q6, G1A,<br>G1B, C1C, C1D, C2A,<br>C2B, C2C, C2D,<br>C215                                       | 13       | DNP    | PACKAGE OUTLINE 0805 NON-POLAR<br>CAPACITOR - EVKIT                                                                                                                                | N/A                     | N/A                      | N/A                       |                      |          |
| 6    | C201, C202, C204                                                                                       | 3        | 10UF   | CAPACITOR, SMT (0805); CERAMIC CHIP; 10UF;<br>16V; TOL=10%; TG=-55 DEGC TO +85 DEGC;                                                                                               | 20-0010U-23A            | EKM212ABJ106KD-T         | TAYO YUDEN                | 587-2980-2-ND        |          |
| 7    | C203, C214                                                                                             | 2        | 0.01UF | CAPACITOR, SMT (0805); CERAMIC CHIP;<br>0.01UF; 100V; TOL=10%; MODEL=*, TG=-55 DEGC<br>TO +125 DEGC; TC=XTR                                                                        | 20-000U01-E9            | GRM21BR2A103KA01         | MURATA                    | 490-1652-2-ND        |          |
| 8    | C211                                                                                                   | 1        | 1UF    | CAPACITOR, SMT (0805); CERAMIC CHIP;<br>50V; TOL=10%; TG=-55 DEGC TO +125 DEGC;<br>TC=XTR                                                                                          | 20-0001U-04             | C2012XR7H105K085AC       | TDK                       | 445-14539-2-ND       |          |
| 9    | C213                                                                                                   | 1        | 0.22UF | CAPACITOR, SMT (0805); CERAMIC CHIP;<br>TO +125 DEGC; TC=XTR                                                                                                                       | 20-000U2-04             | C2012XR7H122AK125AA      | TDK                       | 445-1350-2-ND        |          |
| 10   | D20, D21                                                                                               | 2        | N/A    | DIODE, LED, SMD CHIP LED LAMP, RED-GREEN;<br>SMT; VF=2.5V, IF=0.02A                                                                                                                | 30-APBHM2012SURKCGKC-00 | APHBM2012SURKCGKC        | KINGBRIGHT                | 754-1085-2-ND        |          |
| 11   | D22                                                                                                    | 1        | N/A    | DIODE, SCH. SMT (MINI2-F3-B), PIV=30V, IF=3A                                                                                                                                       | 30-DB2W31900L-00        | DB2W31900L               | PANASONIC                 | DB2W31900L-TR-ND     |          |
| 12   | GND, TP1, TP17                                                                                         | 3        | N/A    | TEST POINT: PIN DIA=0.125IN; TOTAL<br>LENGTH=0.44IN.; BOARD HOLE=0.083IN; BLACK;<br>RECOMMENDED FOR BOARD<br>FINISH; RECOMMENDED FOR BOARD<br>THICKNESS=0.062IN; NOT FOR COLD TEST | 02-TFMINI5011-00        | 5011                     | KEystone                  | 36-5011-ND           |          |
| 13   | J1A, J1B, J1C, J1D                                                                                     | 4        | N/A    | CONNECTOR, FEMALE, THROUGH-HOLE; PCB<br>TERMINAL BLOCK; RIGHT ANGLE; 2PINS                                                                                                         | 01-17149552P-25         | 1714955                  | PHOENIX CONTACT           | 277-1269-ND          |          |
| 14   | J3, J22                                                                                                | 2        | N/A    | CONNECTOR, MALE, THROUGH-HOLE; 961<br>SERIES 2.54MM PITCH; 2.54 MM X 2.54 MM;                                                                                                      | 01-9611046804AR4P-19    | 961104-6804-AR           | 3M                        | 961104-6804-AR-ND    |          |
| 15   | J20                                                                                                    | 1        | N/A    | SOLDER TAIL; STRAIGHT; 4PINS                                                                                                                                                       | 01-1080170001SP-26      | 105017-0001              | MOLEX                     | WM1399TR-ND          |          |
| 16   | J21                                                                                                    | 1        | DNP    | CONNECTOR, FEMALE, THROUGH-HOLE; PIN<br>STRIP, HEADER, STRAIGHT; 2PINS                                                                                                             | N/A                     | N/A                      | N/A                       |                      |          |
| 17   | R1, R2, R5-R7, R1A,<br>R1B, R1C, R1D, R2A,<br>R2B, R2C, R2D,<br>R201, R202, R214                       | 16       | 0      | RESISTOR, 0805; 0 OHM; 0%, JUMPER; 0.5W;<br>THICK FILM                                                                                                                             | 80-0000R-BA47           | CRCW0805000Z0EAHP        | VISHAY DALE               | 541-0-0TBTNR-ND      |          |
| 18   | R3, R4, R213                                                                                           | 3        | 2.2K   | RESISTOR, 0805; 2.2K OHM; 1%; 100PPM;<br>0.125W; THICK FILM                                                                                                                        | 80-002K2-AA28           | CRCW08052K20FK           | VISHAY DALE               | 541-2-20KCTNR-ND     |          |
| 19   | R3A, R3B, R3C, R3D                                                                                     | 4        | 0.01   | METAL STRIP                                                                                                                                                                        | 80-00R01-BA88           | ERJM1WSF10M              | PANASONIC                 | P10MTR-ND            |          |
| 20   | R4A, R4B, R4C, R4D                                                                                     | 4        | DNP    | PACKAGE OUTLINE 2512 RESISTOR - EVKIT                                                                                                                                              | N/A                     | N/A                      | N/A                       | 541-560CTR-ND        |          |
| 21   | R203, R205                                                                                             | 2        | 560    | RESISTOR, 0805; 560 OHM; 1%; 100PPM; 0.125W;<br>THICK FILM                                                                                                                         | 80-0050R-25             | CRCW0805560RFK           | VISHAY DALE               | 541-100KCTNR-ND      |          |
| 22   | R204                                                                                                   | 1        | 100K   | RESISTOR, 0805; 100K; 1%; 100PPM; 0.125W;<br>THICK FILM                                                                                                                            | 80-0100K-25             | CRCW0805100KF            | VISHAY DALE               | 541-45-3KCTNR-ND     |          |
| 23   | R206                                                                                                   | 1        | 45.3K  | RESISTOR, 0805; 45.3K OHM; 1%; 100PPM;<br>THICK FILM                                                                                                                               | 80-045K3-25             | CRCW080545K3FK           | VISHAY DALE               | 541-10.0KCTNR-ND     |          |
| 24   | R207                                                                                                   | 1        | 10K    | RESISTOR, 0805; 10K; 1%; 100PPM; 0.125W;<br>THICK FILM                                                                                                                             | 80-0010K-25             | CRCW080510K0FK           | VISHAY DALE               | 541-4-70KTTNR-ND     |          |
| 25   | R210                                                                                                   | 1        | 4.7K   | RESISTOR, 0805; 4.7K OHM; 1%; 100PPM;<br>THICK FILM                                                                                                                                | 80-004K7-AA28           | CRCW08054K70FK           | VISHAY DALE               |                      |          |
| 26   | R211, R212                                                                                             | 2        | 330    | RESISTOR, 0805; 330 OHM; 1%; 100PPM; 0.25W;<br>THICK FILM                                                                                                                          | 80-0330R-BA89           | RK73HA2TDD3300F          | KOA SPEER ELECTRONICS INC |                      |          |
| 27   | R215, R216                                                                                             | 2        | DNP    | PACKAGE OUTLINE 0805 RESISTOR - EVKIT                                                                                                                                              | N/A                     | N/A                      | N/A                       |                      |          |
| 28   | S1, S2                                                                                                 | 2        | N/A    | SWITCH, SPDT; THROUGH-HOLE, VERTICAL;<br>125V; 0.25A; SLIDE SWITCH; ROOIL=0.08 OHM;<br>RINSULATION=500M OHM                                                                        | 11-SLS121PC04-00        | 1825115-1                | TE CONNECTIVITY           | 450-1598-ND          |          |
| 29   | U1                                                                                                     | 1        | N/A    | MAX34417ENE+                                                                                                                                                                       | MAX34417                | MAX34417ENE*             | MAXIM                     |                      |          |
| 30   | U20<br><i>Should be programmed</i>                                                                     | 1        | N/A    | SOIC12P1030X285-28N<br><i>(C+ PRGM 89-3900HK02, U20)</i>                                                                                                                           | 88-390                  |                          |                           |                      |          |

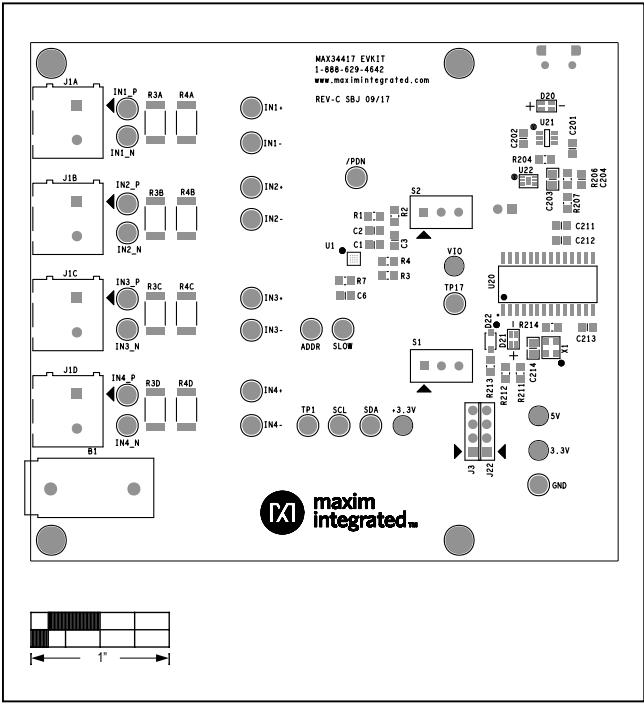
## MAX34417 EV Kit Schematic



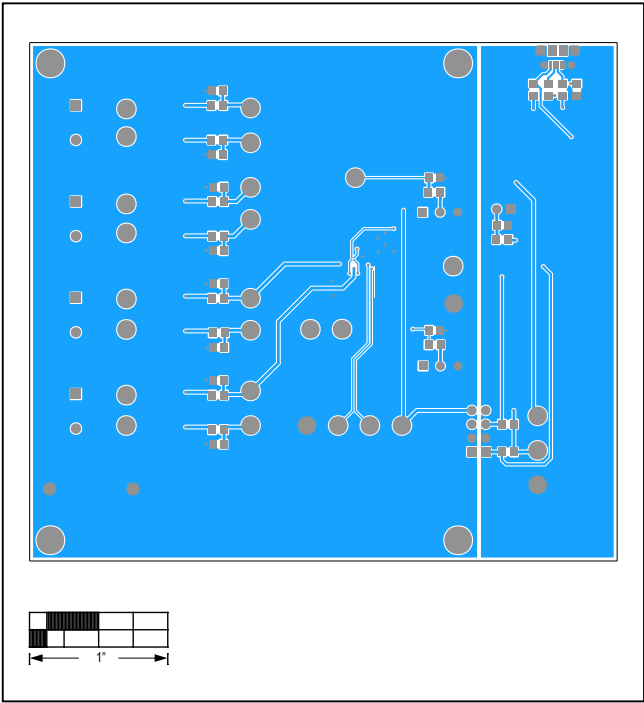
MAX34417 EV Kit Schematic (continued)



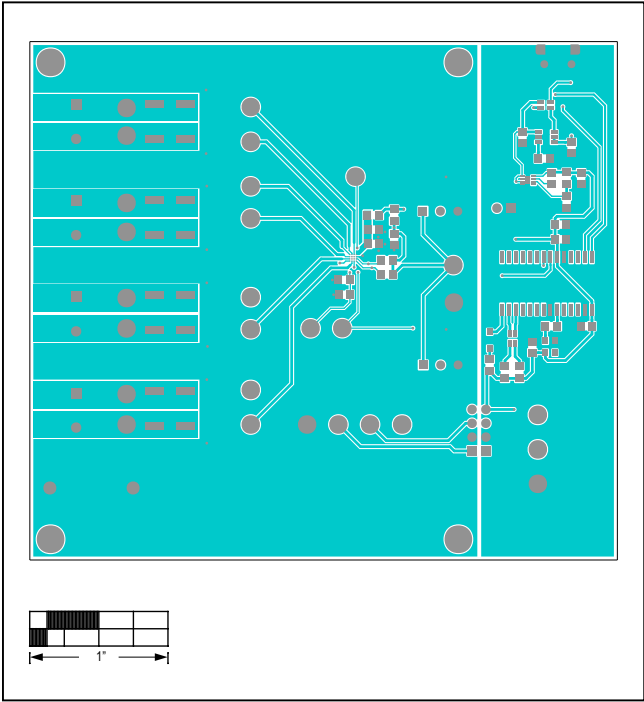
MAX34417 EV Kit PCB Layout Diagrams



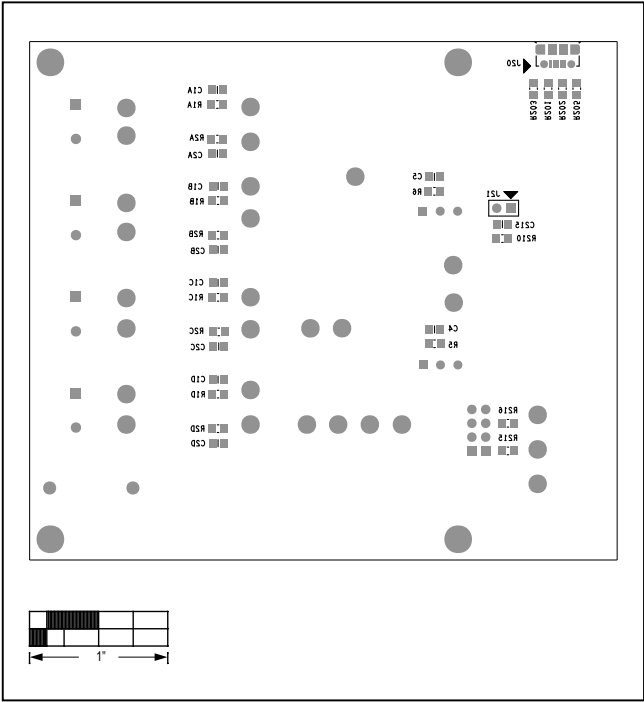
MAX34417 EV Kit—Top Silkscreen



MAX34417 EV Kit—Bottom



MAX34417 EV Kit—Top



MAX34417 EV Kit—Bottom Silkscreen

**Revision History**

| REVISION<br>NUMBER | REVISION<br>DATE | DESCRIPTION     | PAGES<br>CHANGED |
|--------------------|------------------|-----------------|------------------|
| 0                  | 2/18             | 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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