

General Description

The MAX14890E evaluation kit (EV kit) is a fully assembled and tested PCB that contains the MAX14890E incremental encoder interface. The MAX14890E incremental encoder receiver contains four differential receivers and two single-ended receivers for RS-422, HTL, TTL, and digital signals.

Power for the transceiver can be provided from a single +5V source or from an on-board 24V to 5V step-down circuit. The MAX14890E EV kit includes terminal blocks for motor and power connections.

On-board switches and jumpers are included to configure the MAX14890E in pin-control mode. The evaluation board is also designed with the Arduino® form-factor for easy software evaluation and development.

Features

- Four Configurable Differential or Single-Ended Receivers
- SPI or Pin-Controlled Operation USB-PC Connection
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information appears at end of data sheet.

Quick Start

Recommended Equipment

- MAX14890E EV kit
- 5V, 500mA power supply
- Function generator or logic signal generator
- Oscilloscope

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation before exercising the full features of the device:

- 1) Verify that all the jumpers are in their default positions, as shown in [Table 1](#).
- 2) Set the DC power supply to +5V and connect between the VCC and GND test points on the EV kit.
- 3) Connect the function generator to the Z input on the T3 block terminator. Connect the \bar{Z} input to ground. Set the function generator to generate a $\pm 2V$ 100kHz signal.
- 4) Connect the oscilloscope to the ZO output.
- 5) Turn on the power supply.
- 6) Turn on the function generator.
- 7) Verify that ZO is switching as expected.
- 8) Repeat with the A, \bar{A} , B, \bar{B} , DIY, and \bar{Y} inputs.

Arduino is a registered trademark of Arduino, LLC.

Detailed Description

The MAX14890E EV kit is a fully tested circuit board demonstrating the capabilities of the MAX14890E incremental encoder interface.

The EV kit includes an on-board 24V-to-5V step-down supply, fault indicator LEDs, jumpers for pin-mode control, and SPI-connections. The board is designed to operate either as a stand-alone board or with an external mbed® or Arduino board (Figure 2).

Powering the Board

The MAX14890E operates from a single +5V supply. A separate logic-supply (V_L) is also available. Apply +5V to VCC (TP1) to power the board using a single supply. Shunt the J1 jumper to connect V_L to VCC, or apply a separate voltage as low as 1.62V to V_L (TP2) for a separate logic-supply.

The EV kit also includes a 24V step-down circuit. To power the board from an external +24V source, ensure that the J1 jumper is open and connect the +24V supply and GND lead to the T6 terminal block. Put a shunt across the J2 jumper to power VCC with the +5V generated from the step-down circuit.

Table 1. Jumper Descriptions

| JUMPER | SHUNT POSITON | DESCRIPTION |
|--------|---------------|--|
| J1 | Open | V_L is not connected to VCC |
| | Closed* | V_L is connected to VCC |
| J2 | Open* | Output of 24V step-down circuit is not connected to VCC |
| | Closed | Output of 24V step-down circuit is connected to VCC |
| J4 | Open | 220 Ω termination is connected between A and \bar{A} |
| | Closed* | 220 Ω termination is not connected between A and \bar{A} |
| J5 | Open | 220 Ω termination is connected between B and \bar{B} |
| | Closed* | 220 Ω termination is not connected between B and \bar{B} |
| J6 | Open | 220 Ω termination is connected between Z and \bar{Z} |
| | Closed* | 220 Ω termination is not connected between Z and \bar{Z} |
| J7 | Open | 220 Ω termination is connected between DI/Y and \bar{Y} |
| | Closed* | 220 Ω termination is not connected between DI/Y and \bar{Y} |
| J8 | 1-2 | DI/TTL1 is high. See Table 2. |
| | 2-3* | DI/TTL1 is low. See Table 2. |
| J9 | 1-2 | DI/TTL2 is high. RxD2 is in TTL mode. |
| | 2-3* | DI/TTL2 is low. RxD2 is in DI mode. |
| J10 | 1-2 | DI/TTL3 is high. RxD3 is in TTL mode. |
| | 2-3* | DI/TTL3 is low. RxD3 is in DI mode. |
| J11 | 1-2 | HITH/CSB is high. |
| | 2-3* | HITH/CSB is low |
| J12 | 1-2 | SNGL/CLK is high. See Table 2. |
| | 2-3* | SNGL/CLK is low. See Table 2. |
| J13 | 1-2* | TTL/SDI is high. See Table 2. |
| | 2-3 | TTL/SDI is low. See Table 2. |

*Default position.

mbed is a registered trademark of ARM Limited LLC.

Mode Selection

The MAX14890E operates in either pin-control or SPI mode. The MAX14890E EV kit is designed to operate as a stand-alone board in pin-control mode, but can also be evaluated in SPI mode. Pin-control mode is the default state of the board.

Ensure that all switches are in the off state (to the left) for pin-control mode.

To evaluate the board in SPI mode, set all of the switches on the S1 switch to the on state (to the right). The MAX14890E EV kit has been designed to connect directly to an Arduino or mbed LPC1549Xpress board for easy software evaluation. See Maxim Integrated’s website for sample code and application notes.

Pin-Control Mode

Configuring the RxA, RxB, RxZ, and RxY Receivers

On-board jumpers are available for pin-control mode configuration. J12 sets the SNGL/CLK input. J13 sets the TTL/SDI input. J8 sets the DI/TTL input. See [Table 2](#) for receiver configuration settings.

Configuring the RxD2 and RxD3 Receivers

On-board jumpers are used to set the DI/TTL2 (J9) and DI/TTL3 (J10) inputs in pin-control mode. These inputs configure the D2 and D3 receivers, respectively ([Table 3](#)).

Cable Termination

Transmission line termination is required for RS-422, HTL, and TTL high-speed signals on long cables. The EV kit includes selectable termination for each of the the RxA, RxB, RxZ, and RxY receivers. For HTL signals, 100pF/270Ω AC-termination with a series RC is available. For RS-422 and TTL signal levels, close the associated jumper ([Table 4](#)) to enable the on-board 200Ω termination for each receiver.

Fault Indicators

The MAX14890E detects common RS-422/HTL/TTL/DI faults. These faults include low differential input signals, open-wire, short-circuits, and inputs voltages that are outside the normal operating voltage range (below -18V and +18V). The EV kit includes on-board LEDs for visual indicators when a fault condition occurs on any of the RxA, RxB, RxZ, RxY, RxD2, and RxD3 receivers. LEDs turn on when a fault condition occurs.

Table 2. RxA, RxB, RxZ, RxY Receiver Mode Settings (Pin-Control Mode)

| INPUTS | | | RECEIVER OPERATION | |
|--------|-----|---------|--------------------|--------|
| SINGL | TTL | DI/TTLY | RxA, RxB, RxZ | RxY |
| L | L | L | D-HTL | TTL |
| L | L | H | D-HTL | DI |
| L | H | L | RS-422 | RS-422 |
| L | H | H | RS-422 | DI |
| H | L | L | SE-HTL | TTL |
| H | L | H | SE-HTL | DI |
| H | H | L | TTL | TTL |
| H | H | H | TTL | DI |

Table 3. RxD2/RxD3 Receiver Input Modes

| DI/TTL2 | RxD2 MODE OF OPERATION |
|---------|------------------------|
| L | TTL |
| H | DI |

Table 4. Enable Receiver Input Termination

| JUMPER | RECEIVER |
|--------|----------|
| J4 | RxA |
| J5 | RxB |
| J6 | RxZ |
| J7 | RxY |

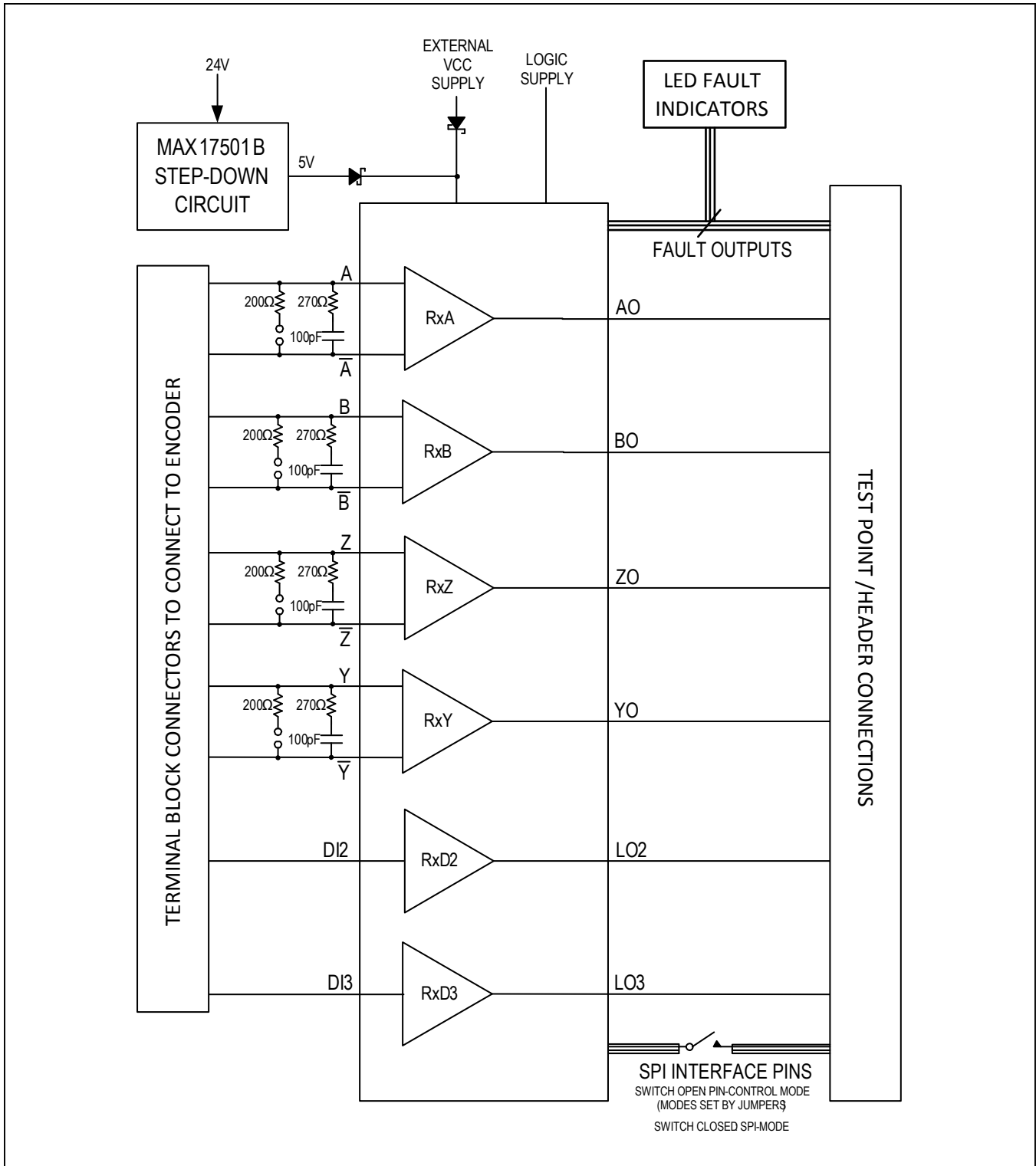


Figure 1. MAX14890E EV Kit Block Diagram

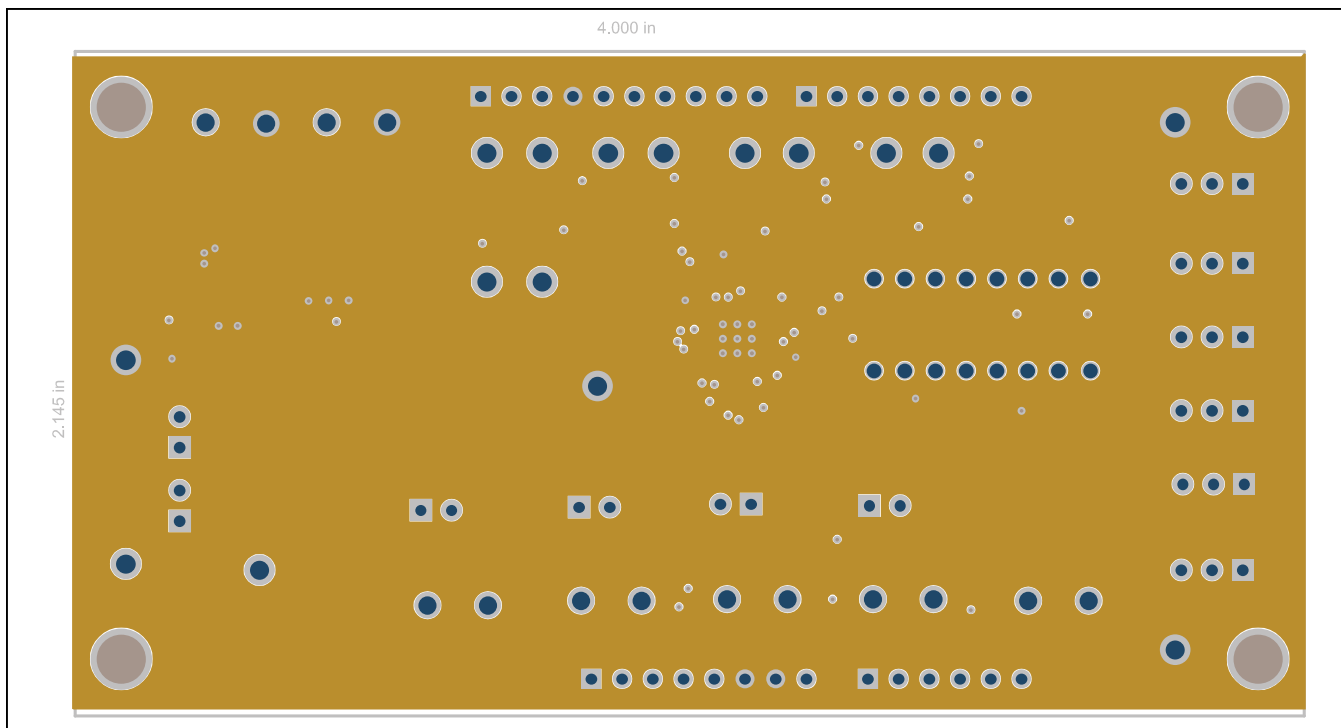


Figure 4. MAX14890E EV Kit PCB Layout—Ground

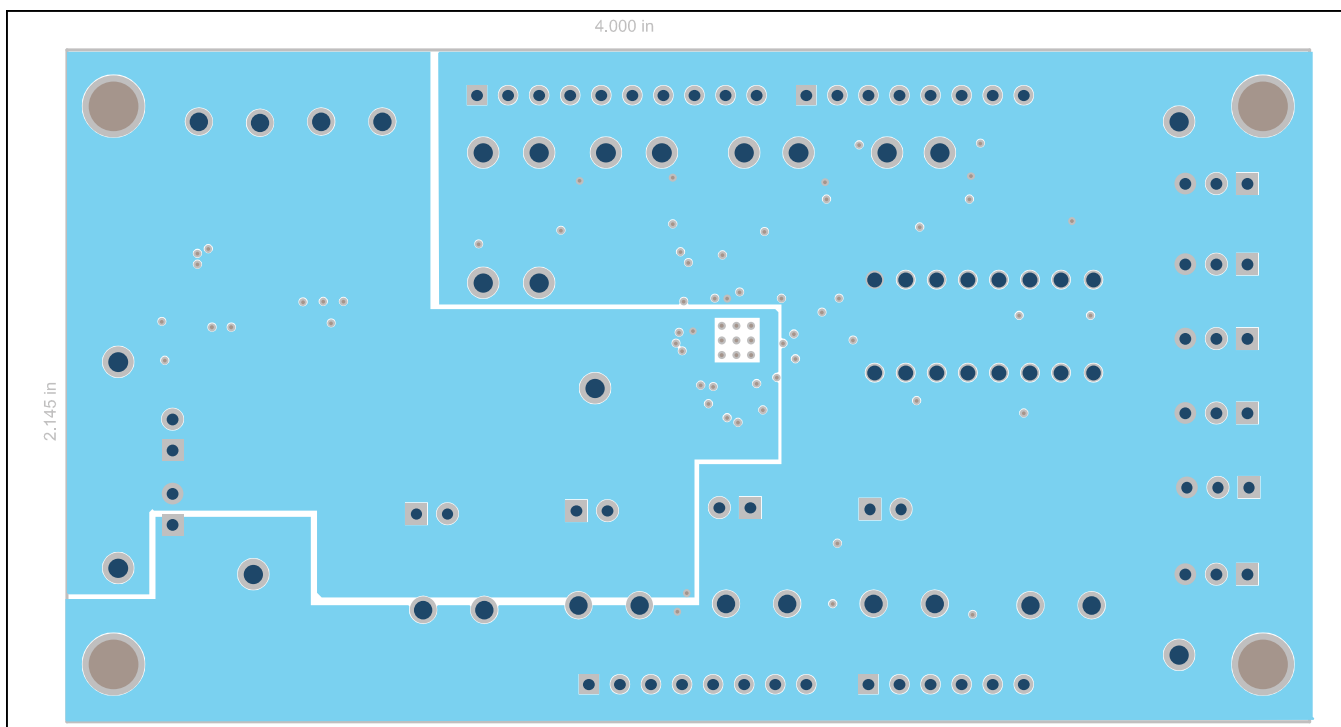


Figure 5. MAX14890E EV Kit PCB Layout—Power

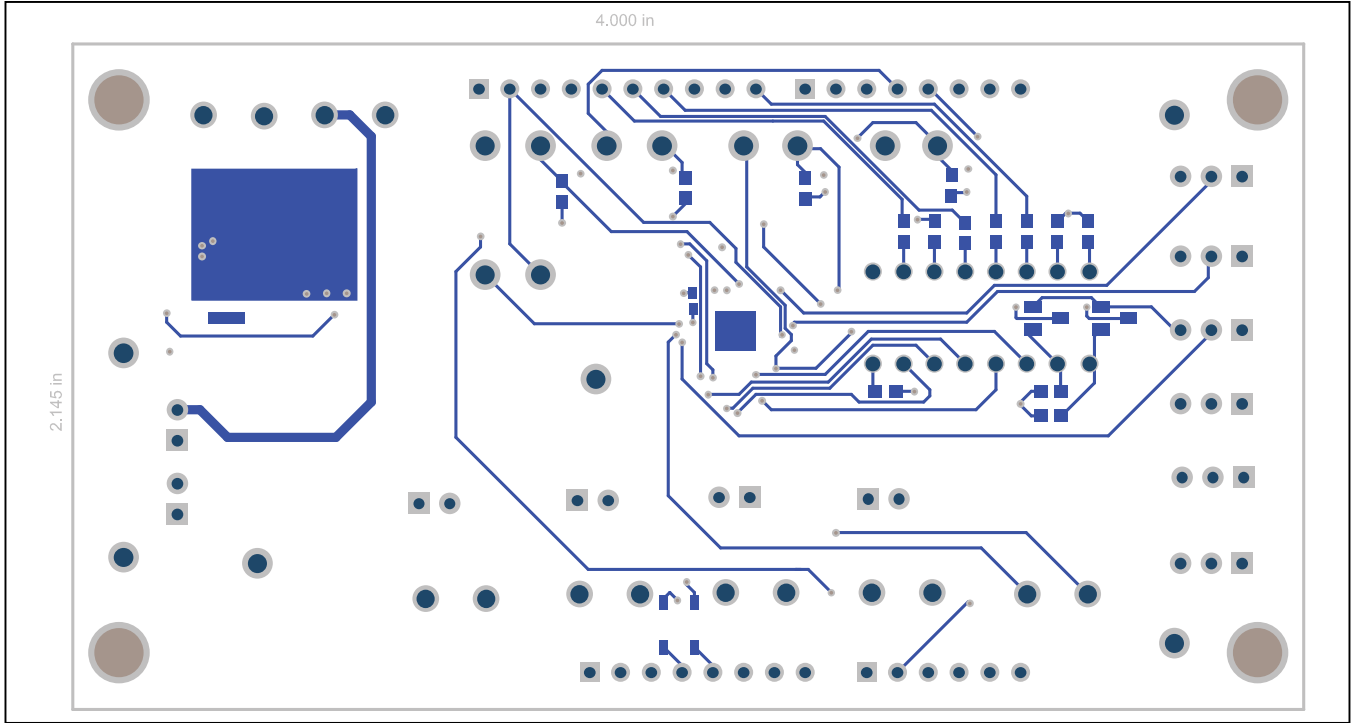


Figure 6. MAX14890E EV Kit PCB Layout—Bottom Layer

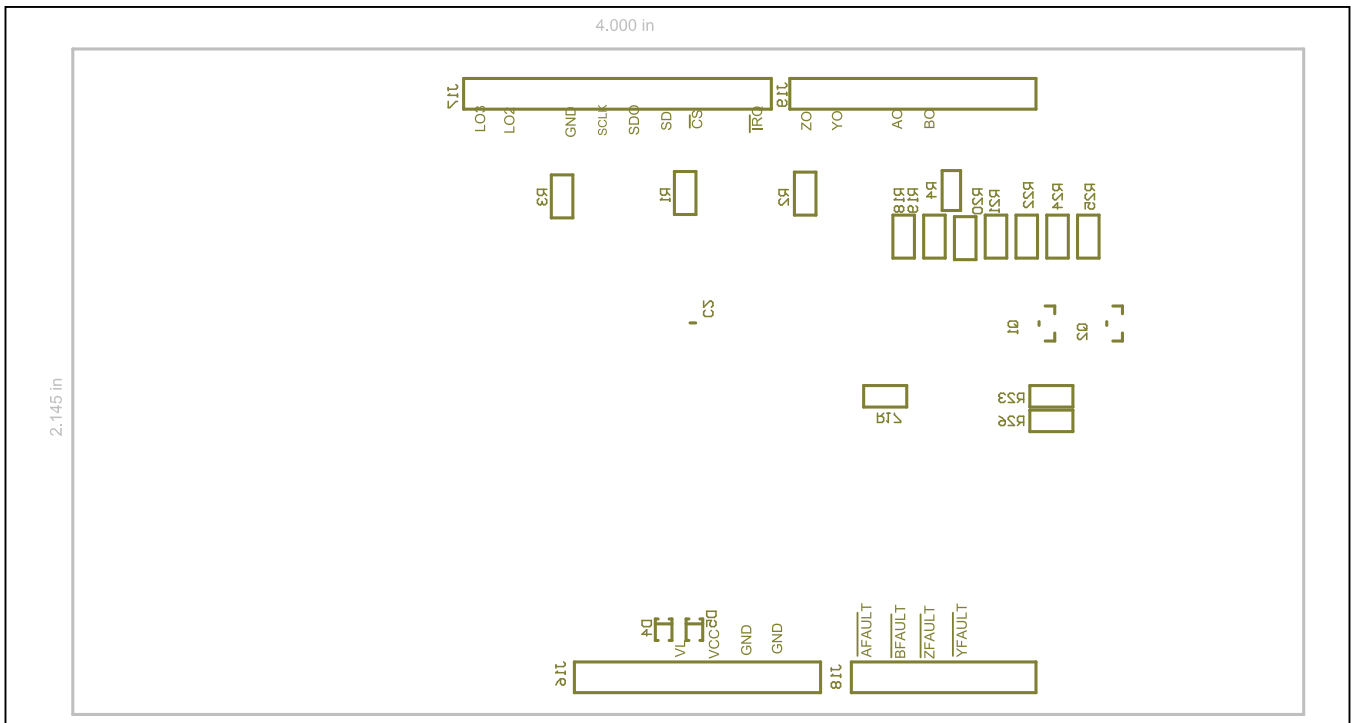


Figure 7. MAX14890E EV Kit Component Placement Guide—Bottom Silkscreen

Component Information and Schematic

See the following links for component information and schematic:

- [MAX14890E EV BOM](#)
- [MAX14890E EV Schematic](#)

Ordering Information

| PART | TYPE |
|-----------------|--------|
| MAX14890EEVKIT# | EV Kit |

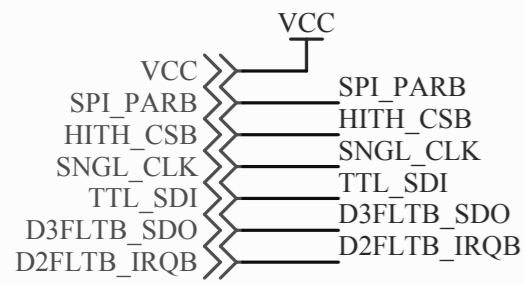
#Denotes RoHS compliant.

Revision History

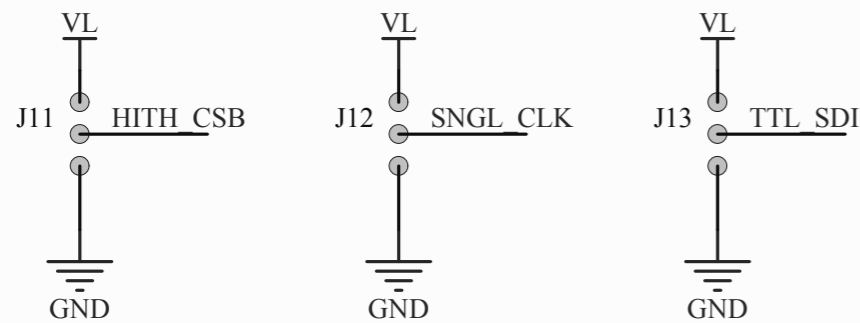
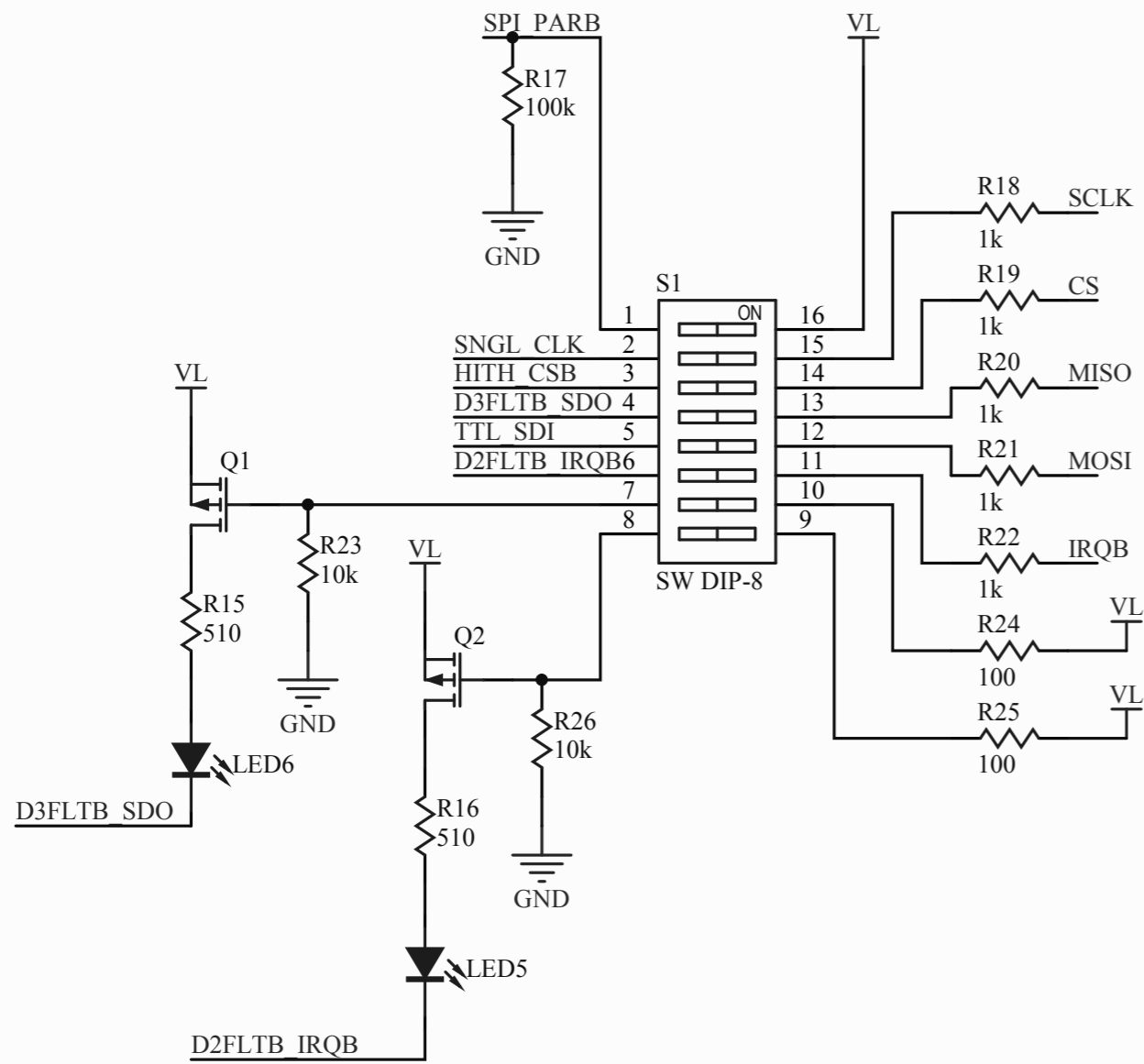
| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|-----------------|---------------|-----------------|---------------|
| 0 | 3/15 | Initial release | — |

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.

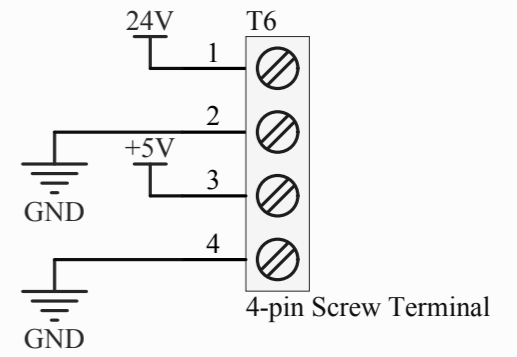
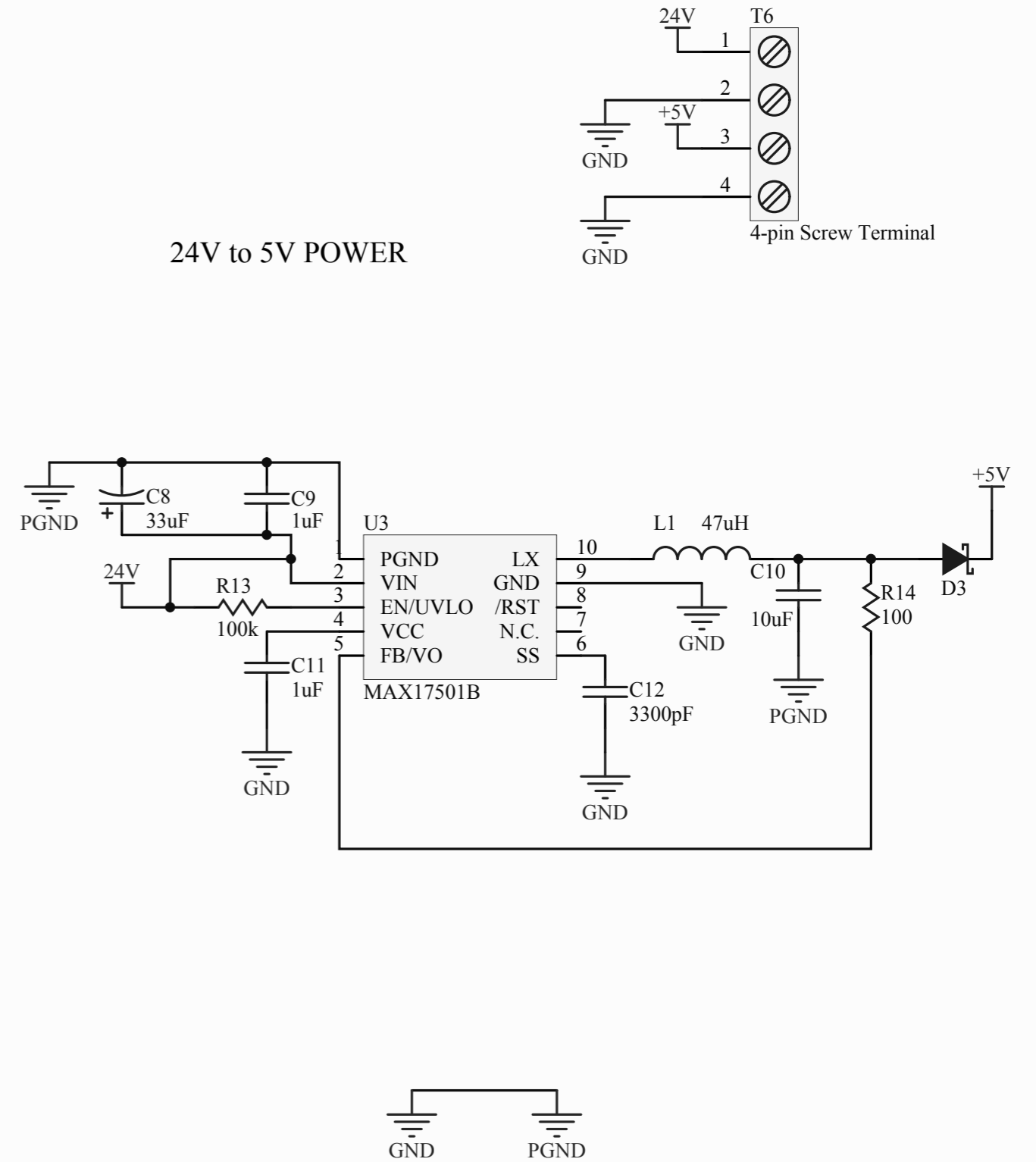
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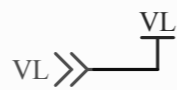
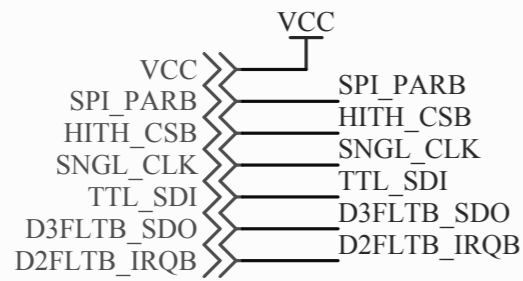
LOGIC CIRCUITRY



24V to 5V POWER

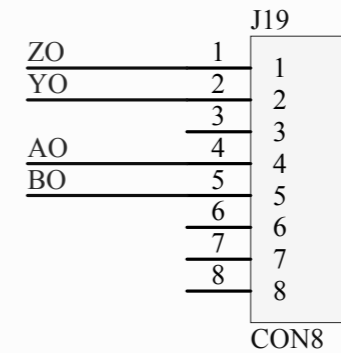
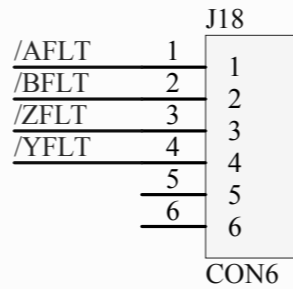
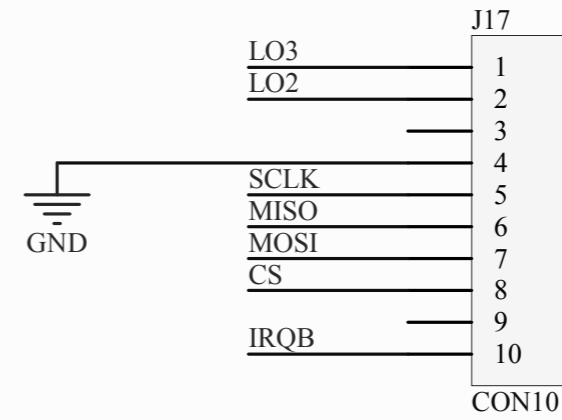
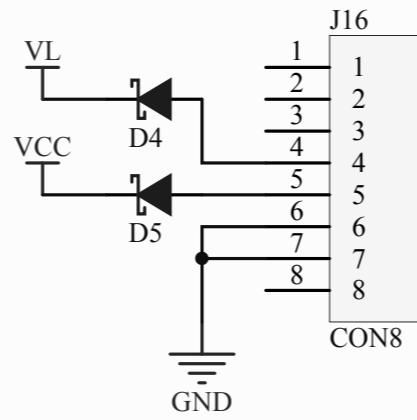
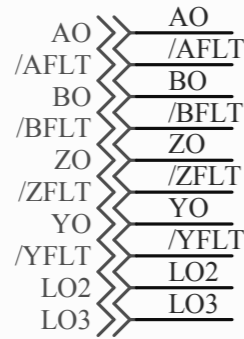


| | | |
|--------------------------------|--|-----------------|
| Title | | |
| MAX14890EVKIT, LOGIC and POWER | | |
| Size | Number | Revision |
| A | MAX14890 | 1.0 |
| Date: | 12/1/2014 | Sheet of 2 of 3 |
| File: | C:\Users\...\MAX14890E EV Kit Logic Selection Doc ST | |

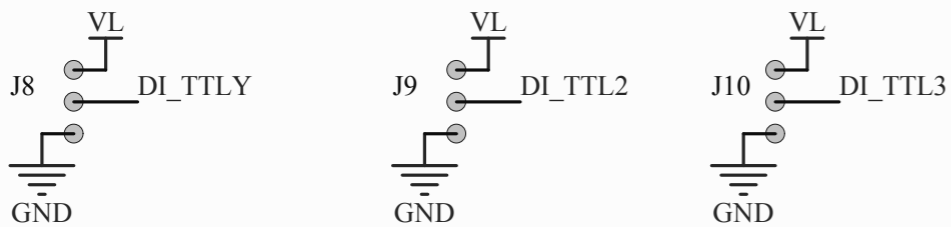
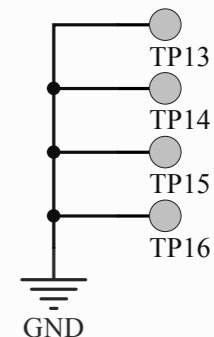
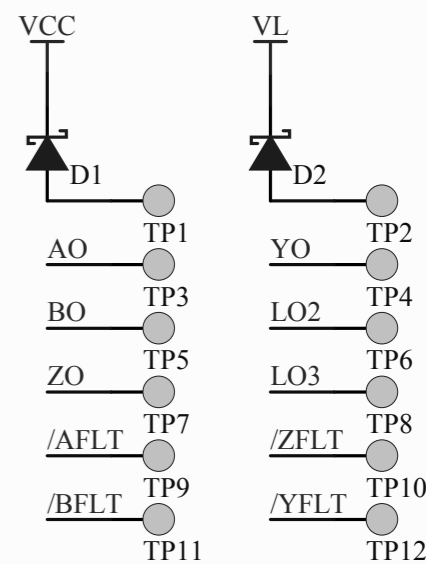
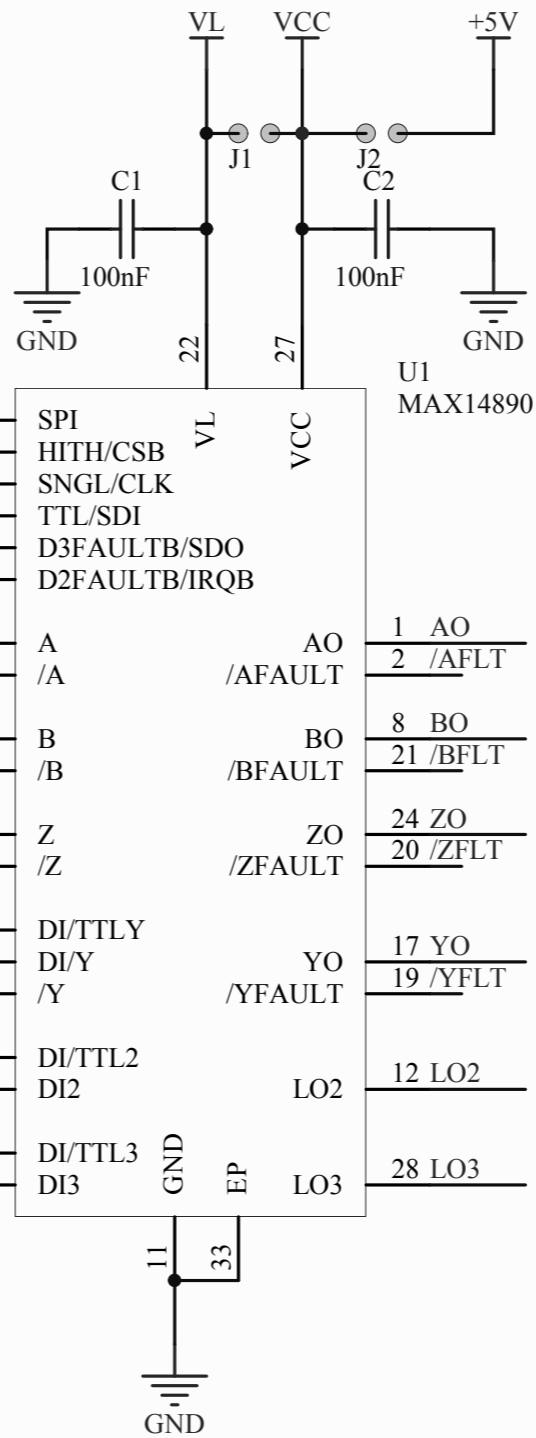
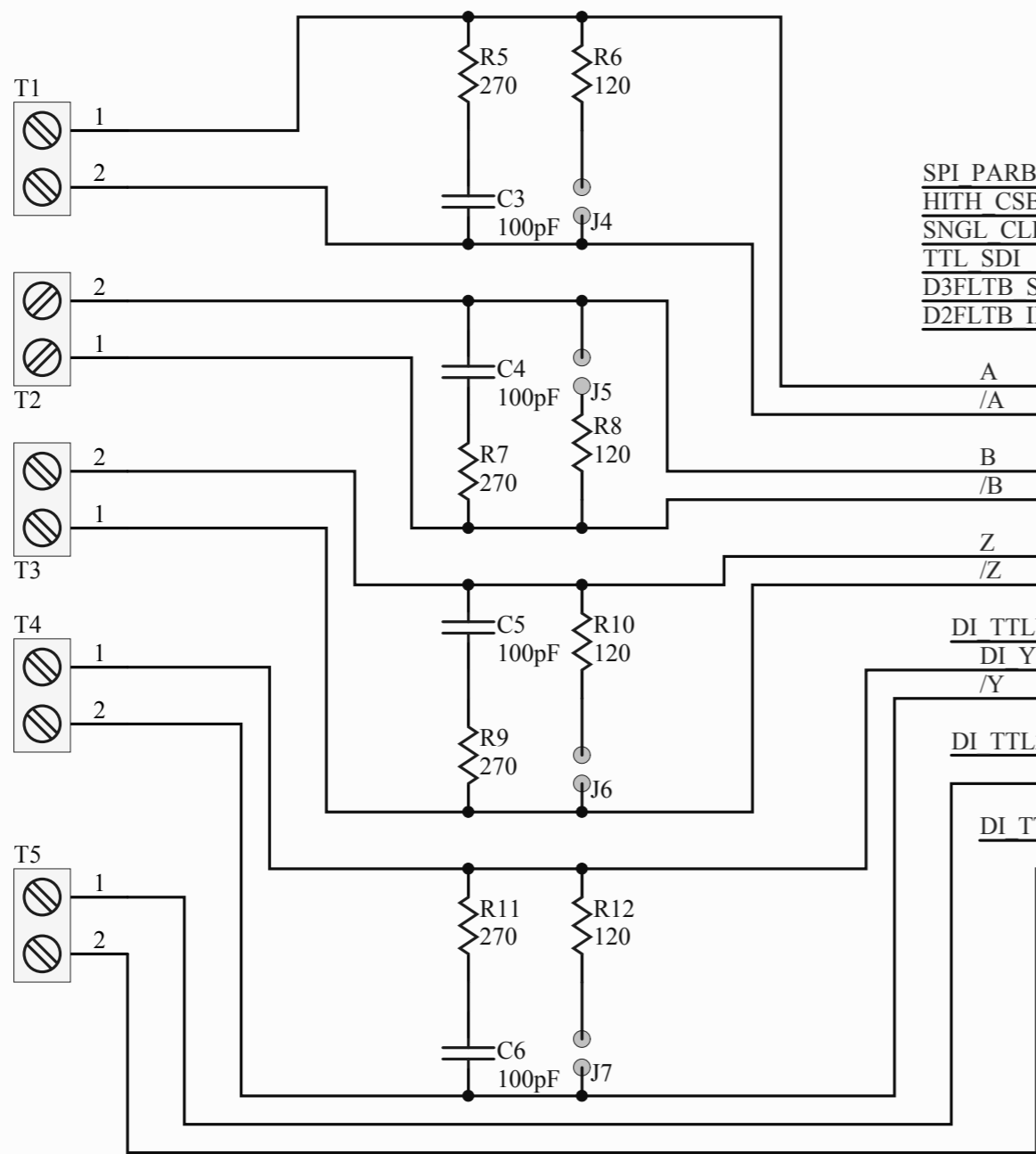
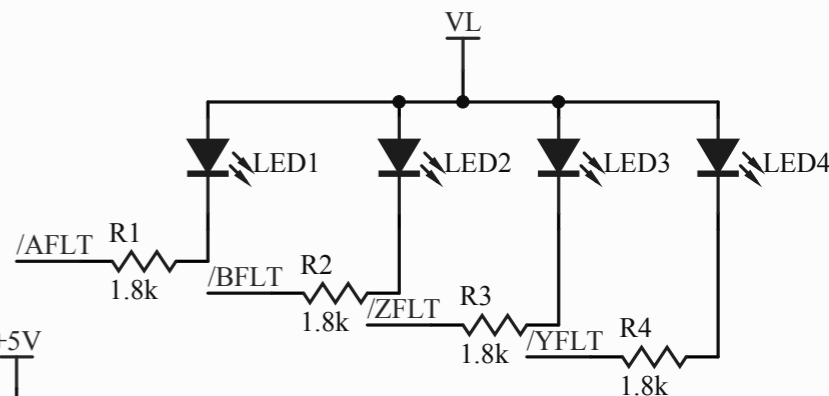
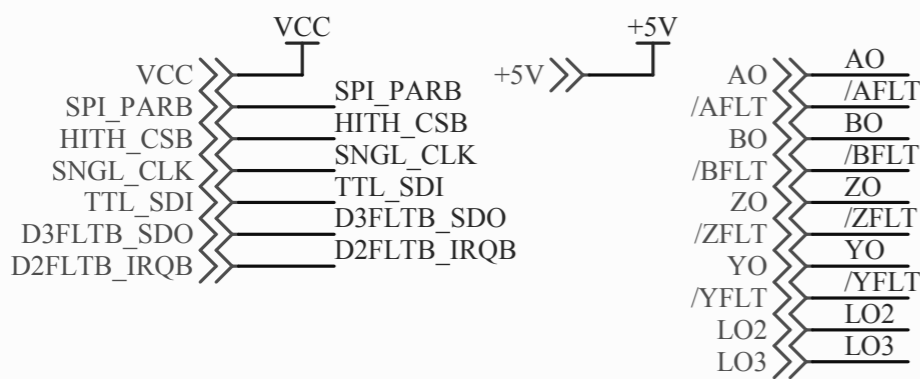


ARDUINO/LPCXPRESS CONNECTIONS

J16 aligns with J6 on the LPCXpresso1549 board
 J17 aligns with J1 on the LPCXpresso1549 board
 J18 aligns with J7 on the LPCXpresso1549 board
 J19 aligns with J2 on the LPCXpresso1549 board



| | | |
|---|---------------------------------------|-----------------|
| Title | | |
| MAX14890EVKIT, LPCXpresso1549 Connections | | |
| Size | Number | Revision |
| A | MAX14890 | 1.0 |
| Date: | 12/1/2014 | Sheet of 3 of 3 |
| File: | C:\Users\...\MAX14890E EV Kit LPC1549 | Drawn By: ST |



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| Title | | |
| MAX14890EVKIT | | |
| Size | Number | Revision |
| A | MAX14890 | 1.0 |
| Date: | 12/1/2014 | Sheet of 1 of 3 |
| File: | C:\Users\...\MAX14890E EV Kit.SchDoc | Drawn By: ST |

Bill of Materials (BOM)

DATE: 1/17/2015

DESIGN: max14890_evkit_A

CALLOUT:

Revision_Type : PROTOTYPE

| ITEM | QTY | REF DES | MFG PART # | MANUFACTURER | VALUE | DESCRIPTION |
|------|-----|------------------------------------|---------------------|-----------------------------|-----------|---|
| 1 | 2 | C1,C2 | C1005X7R1E104K050BB | TDK | 0.1UF | (0402); CERAMIC CHIP; 0.1UF; 25V; |
| 2 | 4 | C3, C4, C5, C6 | C1608C0G1H101J080AA | TDK | 100PF | (0603); CERAMIC CHIP; 100PF; 50V; |
| 3 | 1 | C8 | UQT1H330MCL1GS | NICHICON | 33UF | ALUM ELECT; 33UF; 50V; TOL=20%; TG=- |
| 4 | 2 | C9, C11 | C1608X5R1H105K080AB | TDK | 1UF | (0603); CERAMIC CHIP; 1UF; 50V; |
| 5 | 1 | C10 | C1608X5R1A106K | TDK | 10UF | (0603); CERAMIC CHIP; 10UF; 10V; |
| 6 | 1 | C12 | C0603C332K1RAC | KEMET | 3300PF | (0603); CERAMIC CHIP; 3300PF; |
| 7 | 5 | D1, D2, D3, D4, D5 | MBRX120 | MICRO COMMERCIAL COMPONENTS | | STANDARD; 20V,1A; SMT (SOD- |
| 8 | 6 | J1, J2, J4, J5, J6, J7 | PEC02SAAN | SULLINS ELECTRONICS CORP | | MALE; THROUGH HOLE; BREAKAWAY; |
| 9 | 6 | J8, J9, J10, J11, J12, J13 | PCC03SAAN | SULLINS ELECTRONICS CORP | | MALE; THROUGH HOLE; BREAKAWAY; |
| 10 | 1 | L1 | VLP6045LT-470M | TDK | | FERRITE; 200mohm; TOL=+/-20%; 1.4A |
| 11 | 6 | LED1, LED2, LED3, LED4, LED5, LED6 | LTST-C193KRKT-2A | Lite-On Technology | | LED; RED; SMT (603); PIV=1.9V; SIGNAL SURFACE |
| 12 | 2 | Q1, Q2 | NTR1P02LT1-D | On Semi | | MOUNT |
| 13 | 4 | R1, R2, R3, R4 | | | 1.8k | 1.8K OHM; 1%; 100PPM; 0.0125W; |
| 14 | 4 | R5, R7, R9, R11 | | | 270 | 270 OHM; 1%; 100PPM; 0.0125W; |
| 15 | 4 | R6, R8, R10, R12 | | | 220 | OHM; 1%; 100PPM; 0.0125W; THICK |
| 16 | 2 | R13, R17 | | | 100k | 100K OHM; 1%; 100PPM; 0.0125W; |
| 17 | 3 | R14, R24, R25 | | | 100 | 100 OHM; 1%; 100PPM; 0.0125W; |
| 18 | 2 | R15, R16 | | | 510 | 510 OHM; 1%; 100PPM; 0.0125W; |
| 19 | 5 | R18, R19, R20, R21, R22 | | | 1k | OHM; 1%; 100PPM; 0.0125W; THICK |
| 20 | 2 | R23, R26 | | | 10k | 10K OHM; 1%; 100PPM; 0.0125W; |
| 21 | 1 | S1 | 1825057-7 | TE CONNECTIVITY | | SPST; 24V; 0.1A; SLIDE-ACTUATED |
| 22 | 12 | SU1-SU12 | STC02SYAN | SULLINS ELECTRONICS CORP. | STC02SYAN | JUMPER; STR; TOTAL |
| 23 | 5 | T1, T2, T3, T4, T5 | 1935161 | PHOENIX CONTACT | | CONNECTER; TERM; FEMALE; 2-PIN |
| 24 | 1 | T6 | 1935187 | PHOENIX CONTACT | | TERM; FEMALE; 4-PIN |
| 25 | 2 | TP1, TP2 | 5010 | KEYSTONE | | 0.125D; 0.445L; 0.063 BOARD HOLE; |
| 26 | 10 | TP3-TP12 | 5014 | KEYSTONE | | 0.125D; 0.445L; 0.063 BOARD HOLE; |

| | | | | | |
|----|-----|---------------------------|---------------|----------|--------------------------------------|
| 27 | 4 | TP13, TP14, TP15, TP16 | 5011 | KEYSTONE | 0.125D; 0.445L; 0.063 BOARD HOLE; |
| 28 | 1 | U1 | MAX14890EATJ+ | MAXIM | INCREMENTAL ENCODER |
| 29 | 1 | U3 | MAX17501BATB+ | MAXIM | CONVERTER; 10 TDFN-EP; MAXIM |
| 30 | 100 | | | | |

PURCHASE(DNP)

| TOTAL | QTY | REF DES | Var Status | MAXINV | MFG PART # | MANUFACTURER | VALUE |
|-------|-----|----------|------------|--------|------------|--------------|-------|
| | 2 | J16, J19 | DNP | | | | |
| | 1 | J17 | DNP | | | | |
| | 1 | J18 | DNP | | | | |
| | 4 | | | | | | |

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