Rev 0; 2/09

MAXQ1850 Evaluation Kit

Evaluates: MAXQ1850

General Description

The MAXQ1850 evaluation kit (EV kit) is a proven platform to conveniently evaluate the capabilities of the MAXQ1850 secure microcontroller. The kit contains the MAXQ1850 EV kit board, which has two smart card sockets, a PIN pad, and all the communication connectors needed to develop a financial terminal design. With the included power supply, software, serial-to-JTAG board, and a serial cable connected to a personal computer, the EV kit also provides a complete, functional system ideal for software development and debugging of applications targeted for the MAXQ1850 processor.

EV Kit Contents

- **MAXQ1850 EV Kit Board**
- **MAXQ1850 EV Kit CD**
  - **Includes Evaluation Installation of Rowley CrossWorks Compiler for the MAXQ1103 (MAXQ1850)**
  - **Includes MAXQ Family User's Guide, MAXQ1850 Supplement, MAXQ1850 IC Data Sheet, Application Notes, and Example Programs Including Source Code**
- **Serial Cable**
- **Power Supply**
- **Serial-to-JTAG Board**

Ordering Information

PART	TEMP RANGE	SIZE
MAXQ1850-KIT	Room	7.25in x 5.75in

Features

- **Easily Load and Debug Code with the Supplied JTAG Board**
- **JTAG Interface Provides In-Application Debugging Features**
  - **Step-by-Step Execution Tracing**
  - **Breakpointing by Code Address, Data Memory Address, or Register Access**
  - **Data Memory View and Edit**
- **Includes Two-Line by 20-Character LCD Module for Rapid Product Development and Debugging**
- **Single 5V Power-Supply Input and On-Board 3.3V and 1.8V Voltage Regulators**
- **4 x 4 Keypad Matrix**
- **Self-Destruct Inputs Available on Headers for Connecting to External Trigger Circuits**
- **Battery for Memory Backup and Real-Time Clock Operation**
- **Level-Shifted RS-232 Interface Included for Serial Port**
- **Test/Expansion Headers**
- **Two Smart Card Sockets (One Full-Size Socket and One SIM Socket) for Prototyping IC Card Applications**
- **USB Connector (Type B)**
- **Included Board Schematics Provide a Convenient Reference Design**

Component List

DESIGNATION	QTY	DESCRIPTION
B1	1	Lithium battery, CR1632-based with leads 1632-J56
C1, C56	2	10µF, 16V X5R ceramic capacitors (0805) GRM21BR61C106KE15L
C2, C4, C5, C23–C26, C57	8	1µF, 16V Y5V ceramic capacitors (0805) ECJ-2VF1C105Z

DESIGNATION	QTY	DESCRIPTION
C3, C47	2	10000pF, 25V X7R ceramic capacitors (0603) ECJ-1VB1E103K
C6, C7, C8	3	0.1µF, 10V X5R ceramic capacitors (0402) ECJ-0EB1A104K
C9, C10, C11, C13, C14, C27, C28, C49, C60	9	100nF ±10%, 10V capacitors

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MAXQ1850 Evaluation Kit

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C12, C18	2	10pF ±10%, 50V capacitors Panasonic ECJ2VC1H100D
C15, C16	2	22pF, 50V SMD capacitors (0603) ECJ-1VC1H220J
C17, C19, C20, C42, C54, C59, C61, C64, C65	9	0.1µF, 16V Y5V ceramic capacitors (0603) ECJ-1VF1C104Z
C22	1	4.7µF, 16V Y5V ceramic capacitors (0805) ECJ-GVF1C475Z
C40, C52	2	10µF, 10V Y5V ceramic capacitors (1206) ECJ-3YF1A106Z
C41, C53, C62 C63	4	0.1µF ±10%, 50V X7R ceramic capacitors (1206) GRM319R71H104KA01D
C43, C45, C46, C50, C51	5	0.1µF, 16V X7R ceramic capacitors (0603) ECJ-1VB1C104K
C44, C48, C55 C58	4	15pF, 50V SMD ceramic capacitors (0603) ECJ-1VC1H150J
D1	1	1500W, 5.0V SMC TVS Zener Unidir 1SMC5.0AT3G
DS1, DS2, DS3	3	2mm x 3mm surface mount with reflector, 660nm super red LEDs (clear lens) SML-LX23SRC-TR
F1	1	1A, 125V fast PICO-SMD fuse 0459001.UR
J1	1	DC power jack (2.5mm center) CUI Inc. PJ-102B
J2	1	Right-angle, 9-position connector, female socket receptacle (gold) 5745781-3
J3	1	Wiping contact, EMV full smart card connector Amphenol C702-10M008-272-4
J4	1	Connector, receptacle (Type B USB) PCB 897-43-004-90-000000
J5	1	6-pin SMD hinged connector, smart card Amphenol C707-10M006-049-2
J6	1	2x5 header Sullins Electronics Corp. S2012E-36 (breakaway 12 pins)
JH2	1	6-pin header Sullins Electronics Corp. S1012E-36 (breakaway 6 pins)
JH3, JH4	1	1x8 header Sullins Electronics Corp. S1012E-36 (breakaway 6 pins)
JU1–JU4, JU9, JU10, JU11, JU17, JU18, JU19, JU26, JU37, JU30, JU102, JU103, JU104	16	2-pin jumpers NO Sullins Electronics Corp. S1012E-36 (breakaway 6 pins)
JU5–JU8, JU12–JU16, JU20–JU25, JU28, JU29	17	3-pin jumpers NO Sullins Electronics Corp. S1012E-36 (breakaway 6 pins)
R1, R2, R3	3	390Ω ±1%, 1/8W SMD resistors (0805) MCR10EZPF3900
R4, R45, R46	3	10kΩ, 1/8W resistors (0805)
R5, R7, R9, R17	4	330Ω ±1%, 1/8W SMD resistors (0805) MCR10EZHF3300
R6	1	10kΩ trim potentiometer, 3mm carbon SMD Panasonic EVN-5CSX50B14
R8, R10–R16, R18, R20–R23, R29, R30, R40, R42, R43	18	10kΩ ±1%, 1/8W SMD resistors (0805) MCR10EZHF1002
R19	1	100kΩ ±1%, 1/8W SMD resistors (0805) MCR10EZHF1003
R24, R25, R37 R38	4	100Ω ±5%, 1/8W SMD resistors (0805) ERJ-6GEYJ101V
R26	1	47kΩ ±1%, 1/8W SMD resistor (0805) MCR10EZHF4702

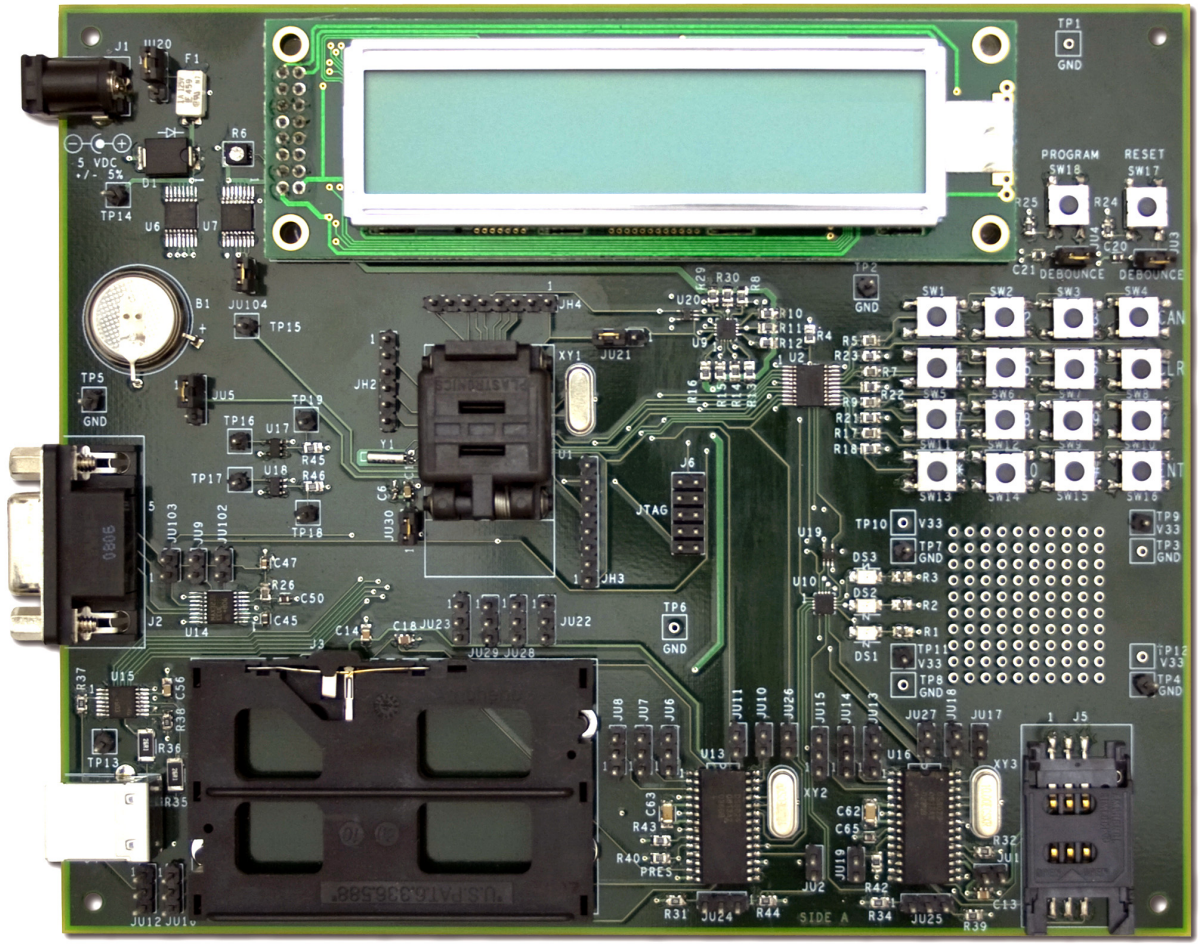
Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R27, R31, R32, R34, R39, R41, R44	7	1kΩ ±1%, 1/8W SMD resistors (0805) ERJ-6ENF1001V
R35, R36	2	26.1Ω ±1%, 1/2W SMD resistors (2010) ERJ-12SF26R1U
SW1–SW18	18	100gf tactile switches, 6mm momentary SMD B3FS-1000P
TP1–TP19	19	0.100in strip headers, single row, 1-position Sullins Electronics Corp. S1012E-36 (breakaway 1 pin)
U1	1	High-performance secure RISC microcontroller (40 TQFN) Maxim MAXQ1850-BNS+
U2	1	Octal buffer/line driver with three-state outputs (20 TSSOP) Fairchild Semiconductor 74VHC244MTCX
U4	1	LCD character module (20x2) Lumex LCM-S02002DSF
U6	1	1A, MicroCap®, low-dropout, linear regulator (3.3V) (16 TSSOP) Maxim MAX8869EUE33
U7	1	1A, MicroCap, low-dropout, linear regulator (1.8V) (16 TSSOP) Maxim MAX8869EUE18
U9, U10	2	10-port SPI™ I/O expander (16 TQFN) Maxim MAX7317ATE+
U13, U16	2	Smart card interface (28 SO) Maxim DS8024-RRX+
U14	1	5V RS-232 Tx2/Rx2 transceiver Maxim MAX3232EEUE+
U15	1	±15kV ESD-protected USB transceiver (14 TSSOP) Maxim MAX3346EEUD
U17, U18	2	Low-voltage single inverter gates (5 SOT23) 296-11599-1-ND
U19, U20	2	Low-voltage, single-supply, 10Ω SPST CMOS analog switches (5 SC70) Maxim MAX4597EXK+
XY1	1	12.000MHz, 20pF HC-49/US crystal (Socket: 0.100in single-strip 36-position connector) ECS ECS-120-20-4X
XY2, XY3	2	10.000MHz, 18pF HC-49/US crystals (Socket: 0.100in single-strip 36-position connector) ECS ECS-100-18-4X
Y1	1	32.768kHz, 12.5pF cylinder crystal ECS ECS-327-12.5-13X
None	1	PCB: MAXQ1850 EV Kit Circuit Board

MicroCap is a registered trademark of American Technical Ceramics Corp.

SPI is a trademark of Motorola, Inc.

MAXQ1850 Evaluation Kit



NOTE THAT MORE RECENT VERSIONS OF THE EV KIT BOARD DO NOT CONTAIN A SOCKET FOR THE MAXQ1850 MICROCONTROLLER, BUT INSTEAD THE MICROCONTROLLER IS SOLDERED DIRECTLY TO THE BOARD.

Figure 1. MAXQ1850 EV Kit Board

Detailed Description

This EV kit must be used in conjunction with the following documents, which are included with the EV kit's software CD:

- MAXQ Family User's Guide
- MAXQ Family User's Guide: MAXQ1850 Supplement
- MAXQ1850 Data Sheet
- MAXQ1850 EV Kit Data Sheet (this document)

Because the MAXQ1850 is an export-controlled device due to its strong cryptographic accelerators, some of these documents are not available on the web and are protected by a nondisclosure agreement (NDA). Visit **www.maxim-ic.com/secure** to learn more about the NDA process.

The MAXQ1850 EV kit board is fully defined in the included schematic (Figure 3) and the *Component List*. However, a short description of the major components of the board follows.

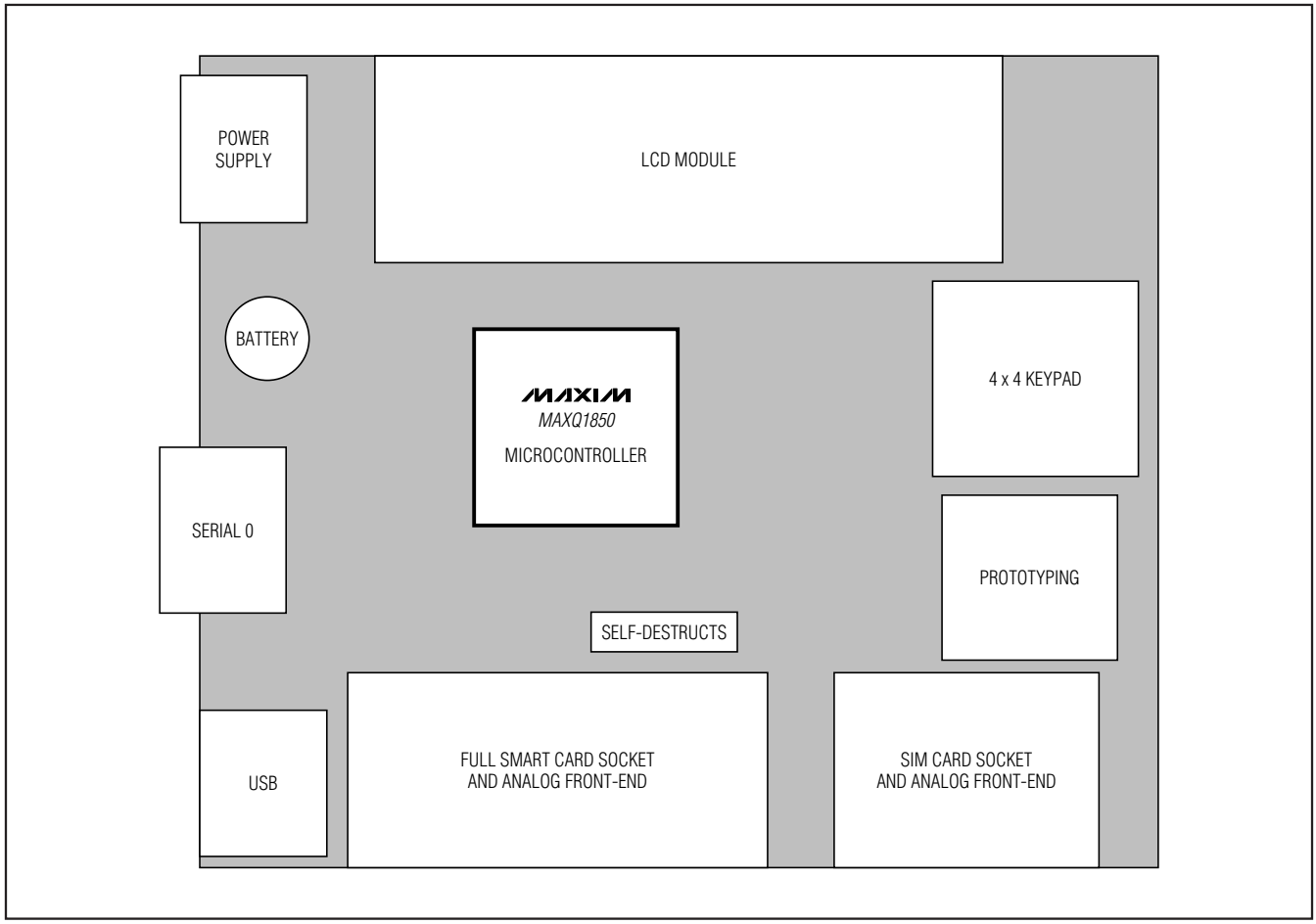


Figure 2. MAXQ1850 EV Kit Board Functional Layout

For a step-by-step guide to using your MAXQ1850 EV kit for the first time, refer to Application Note 4312: *Getting Started with the MAXQ1850 Evaluation Kit (EV Kit) and the CrossWorks Compiler for the MAXQ30*, included on the EV kit CD. This application note covers jumper settings, cable connections, software installation and configuration, and the steps needed to run and debug programs on the EV kit board.

Power Supply

The MAXQ1850 EV kit board can be powered directly using the DC power supply (included with the EV kit) connected to J1. The provided supply is a regulated 5V (±5%), 300mA, center-post positive device with a 2.5mm power connector. The MAXQ1850 EV kit board contains two on-board regulators to supply 3.3V and 1.8V power.

As indicated in Table 1, jumper JU20 selects the source of the board's 5V power. When pins 1 and 2 of JU20 are connected, 5V power is sourced by connector J1. When pins 2 and 3 are connected, power is sourced by the USB connector J4. Regardless which of these sources is selected, the board is protected by surface-mount fuse F1 (1A) and clamping diode (6.4V) D1.

When the serial-to-JTAG board is connected and its JH3 is installed, it too can supply 5V power to the EV kit board. In this case, however, the fuse protection is provided by F1 on the serial-to-JTAG board. When this board is providing power, neither of the other two sources should be connected.

Memory

The MAXQ1850 EV kit board does not contain any additional memory to that contained in the MAXQ1850

processor. The processor installed in the board contains 256KB of flash program memory and 8KB of battery-backed SRAM data memory with "rapid zeroization."

Jumper Functions

The MAXQ1850 EV kit board contains a number of jumpers to configure its operation. Table 1 describes the jumpers and their functions.

SPI-to-Parallel Port Expansion

The MAXQ1850 EV kit board contains two MAX7317 10-port SPI-to-I/O port expanders labeled U9 and U10. Each of these devices is serially interfaced to the processor directly through the processor's port pins, and each provides an additional 10 ports that can be individually programmed through software as either an input or output. Most of these ports are programmed as outputs providing enables and drive signals to various on-board components. The device's I/O pins can also be programmed as inputs when it is desirable to read data into the processor, such as status information from the LCD module.

LCD Module

The LCD display module included on the MAXQ1850 EV kit board is a two-line, 20-character display. The module contains the LCD driver and is communicated with through U9's P0–P9 I/O pins. An example program demonstrating this LCD module is provided on the EV kit CD.

Before using the LCD module, make sure the LCD screen contrast is adjusted properly. If not properly adjusted, the characters can be difficult or impossible to see on the display. To adjust the contrast, use a Philips head screwdriver on R6 on the upper-left side of the EV kit board near the LCD module. With power applied to the board, turn the adjustment until all the pixels darkened, and then turn back until the dark pixels just disappear. Doing so provides optimum readability of the display.

Smart Card Interface

Two smart card sockets are included on the MAXQ1850 EV kit board. A full-sized smart card socket labeled J3 brings all smart card contacts out from an 8024-style analog smart card interface. It also provides a switch to indicate the presence (S1, S2 open) of a card in the socket. The SIM-sized socket labeled J5 brings out six smart card contacts generally used for SIM or SAM card communication. These lines are also driven by an 8024-style analog smart card interface.

Several jumpers around the smart card sockets allow the user to configure various inputs and outputs as indicated in Table 1.

Universal Serial Bus (USB)

The MAXQ1850 EV kit board contains a USB interface at J4 for prototyping USB slave applications. An external transceiver (MAX3346) is connected to the serial interface engine of the MAXQ1850 to provide the USB interface. Jumpers JU12 and JU16 allow the user to configure the mode and speed inputs of the MAX3346. Jumper JU12 selects differential mode (1 to 2) or single-ended mode (2 to 3), and jumper JU16 selects 12Mbps (1 to 2) or 1.5Mbps (2 to 3) communication speed.

Serial Port Interface

The MAXQ1850's serial port 0 is brought out to RS-232 levels on the DB-9 connector labeled J2 located on the left side of the EV kit board. Jumper JU9 allows the user to connect the serial port's DTR signal to the MAXQ1850 programming input signal $\overline{PROG}$. If this pin is held low for at least four system clock cycles, it activates the processor's serial bootloader contained in the device's internal ROM. With JU9 installed, the user's terminal emulator program (or similar software) can control the processor's entire loading process through a serial cable connected to a PC.

Keypad

The MAXQ1850 EV kit board provides 16 momentary contact pushbutton switches intended for user input. The switches are arranged in a 4 x 4 matrix, and a button press is identified as a row to column connection. One side of the switch is connected to one of four buffered processor output port pins (P1.4–P1.7) through a resistor (row0–row3), and the other side of the switch is connected to one of four buffered processor input port pins (col0–col3). Each column line is connected to the 3.3V supply through a pullup resistor. Therefore, the switch matrix can be scanned to identify a particular switch when it is pressed. Software to perform this key scanning function is provided by several of the example programs contained on the EV kit CD.

JTAG Interface

A serial-to-JTAG board provided with the EV kit is used to program and debug applications running on the MAXQ1850 EV kit board. The 10-pin ribbon cable from the JTAG board (P2) should be connected to J6 on the MAXQ1850 EV kit board. Tools such as the Microcontroller Tool Kit (MTK) and Rowley's CrossStudio Integrated Development Environment have built-in support for loading applications through the JTAG interface and using all the MAXQ1850's debug functionality (breakpoints, register and memory reading, etc.).

Table 1. Jumper Functions

NAME	FUNCTION
JU1	Connects U16's (DS8024) N.C. pin (18) to GND. Unused.
JU2	Connects U13's (DS8024) N.C. pin (18) to GND. Unused.
JU3	Connects the reset switch (SW17) nRST pin to the 3.3V supply through a 100kΩ pullup resistor.
JU4	Connects program switch (SW18) nPROG pin to the 3.3V supply through a 100kΩ pullup resistor.
JU5	Connects the board's VBAT signal to the lithium battery (1 to 2) or to GND (2 to 3).
JU6	Connects U13's (DS8024) CLKDIV1 pin (1) to the 3.3V supply (1 to 2) or to GND (2 to 3).
JU7	Connects U13's (DS8024) CLKDIV2 pin (2) to the 3.3V supply (1 to 2) or to GND (2 to 3).
JU8	Connects U13's (DS8024) 5V/$\overline{3V}$ pin (3) to GND (1 to 2) or to the board's nLED2 signal (2 to 3).
JU9	Connects U14's (MAX3232E) R2OUT pin (9) to board's nPROG signal.
JU10	Connects U13's (DS8024) AUX1IN pin (27) to GND.
JU11	Connects U13's (DS8024) AUX2IN pin (28) to GND.
JU12	Connects U15's (MAX3346) MODE pin (3) through a 100Ω resistor to 3.3V (1 to 2 = differential mode) or to GND (2 to 3 = single-ended mode).
JU13	Connects U16's (DS8024) CLKDIV1 pin (1) to the 3.3V supply (1 to 2) or to GND (2 to 3).
JU14	Connects U16's (DS8024) CLKDIV2 pin (2) to the 3.3V supply (1 to 2) or to GND (2 to 3).
JU15	Connects U16's (DS8024) 5V/$\overline{3V}$ pin (3) to GND (1 to 2) or to the board's nLED1 signal (2 to 3).
JU16	Connects U15's (MAX3346) SPEED pin (8) through a 100Ω resistor to the board's 3.3V supply (1 to 2 = 12Mbps) or to GND (2 to 3 = 1.5Mbps).
JU17	Connects U16's (DS8024) AUX1IN pin (27) to GND.
JU18	Connects U16's (DS8024) AUX2IN pin (28) to GND.
JU19	Connects U16's (DS8024) $\overline{PRES}$ pin (9) to GND.
JU20	Connects the board's 5.0V supply to the power input J1 (1 to 2) or to the VBUS signal of USB connector J4 pin 1 (2 to 3).
JU21	Connects U9's (MAX7317) $\overline{CS}$ pin (16) to the board's nLED signal (1 to 2) or to the MAXQ1850's P1.0 pin (11) (2 to 3).
JU22	Connects U1's (MAXQ1850) SDI4 pin (35) to GND (1 to 2) or to the 3.3V supply (2 to 3).
JU23	Connects U1's (MAXQ1850) SDI3 pin (36) to GND (1 to 2) or to the 3.3V supply (2 to 3).
JU24	Connects U13's (DS8024) RSTIN pin (20) to the board's RSTIN1 signal (1 to 2) or to a 1kΩ resistor to GND (2 to 3).
JU25	Connects U16's (DS8024) RSTIN pin (20) to the board's RSTIN2 signal (1 to 2) or to a 1kΩ resistor to GND (2 to 3).
JU26	Connects U13's (DS8024) $\overline{OFF}$ pin (23) to U1's (MAXQ1850) P0.0 pin (1) and U10's P3 output pin (4).
JU27	Connects U16's (DS8024) $\overline{OFF}$ pin (23) to U1's (MAXQ1850) P0.1 pin (2) and U10's P6 output pin (8).
JU28	Connects U1's (MAXQ1850) SDI2 pin (37) to GND (1 to 2) or to the 3.3V supply (2 to 3).
JU29	Connects U1's (MAXQ1850) SDI1 pin (38) to GND (1 to 2) or to the 3.3V supply (2 to 3).
JU30	Connects U1's (MAXQ1850) V_{DD} pin (33) to the board's 3.3V supply.
JU102	Connects U14's (MAX3232E) T1IN pin (11) to U1's (MAXQ1850) P1.1 pin (12).
JU103	Connects U14's (MAX3232E) R1OUT pin (12) to U1's (MAXQ1850) P1.0 pin (11).
JU104	Connects U7's (MAX8869) OUT pins (12, 13, 14, 15) to the board's 1.8V supply.

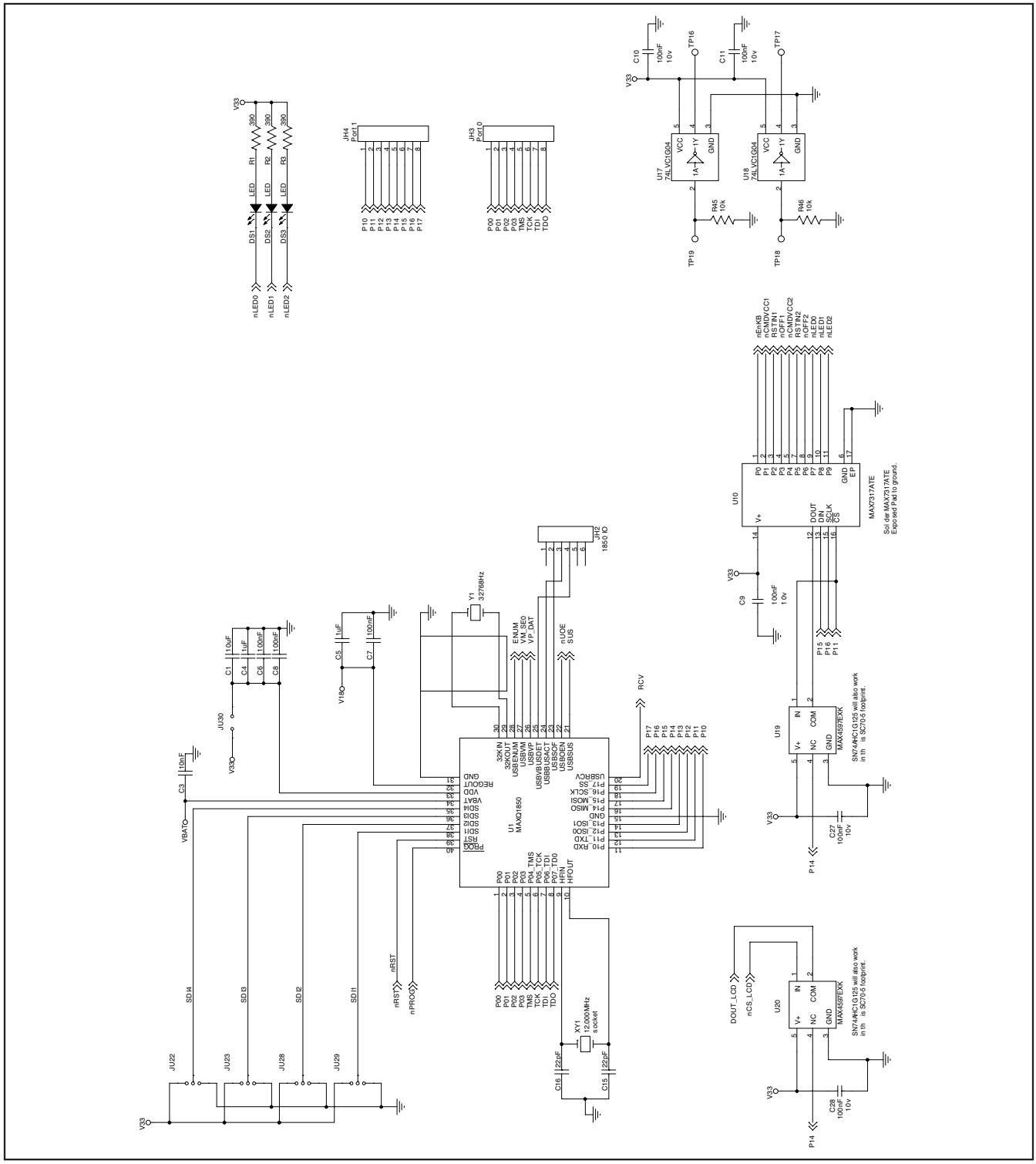


Figure 3a. MAXQ1850 EV Kit Board Schematics—MAXQ1850 (Sheet 1 of 3)

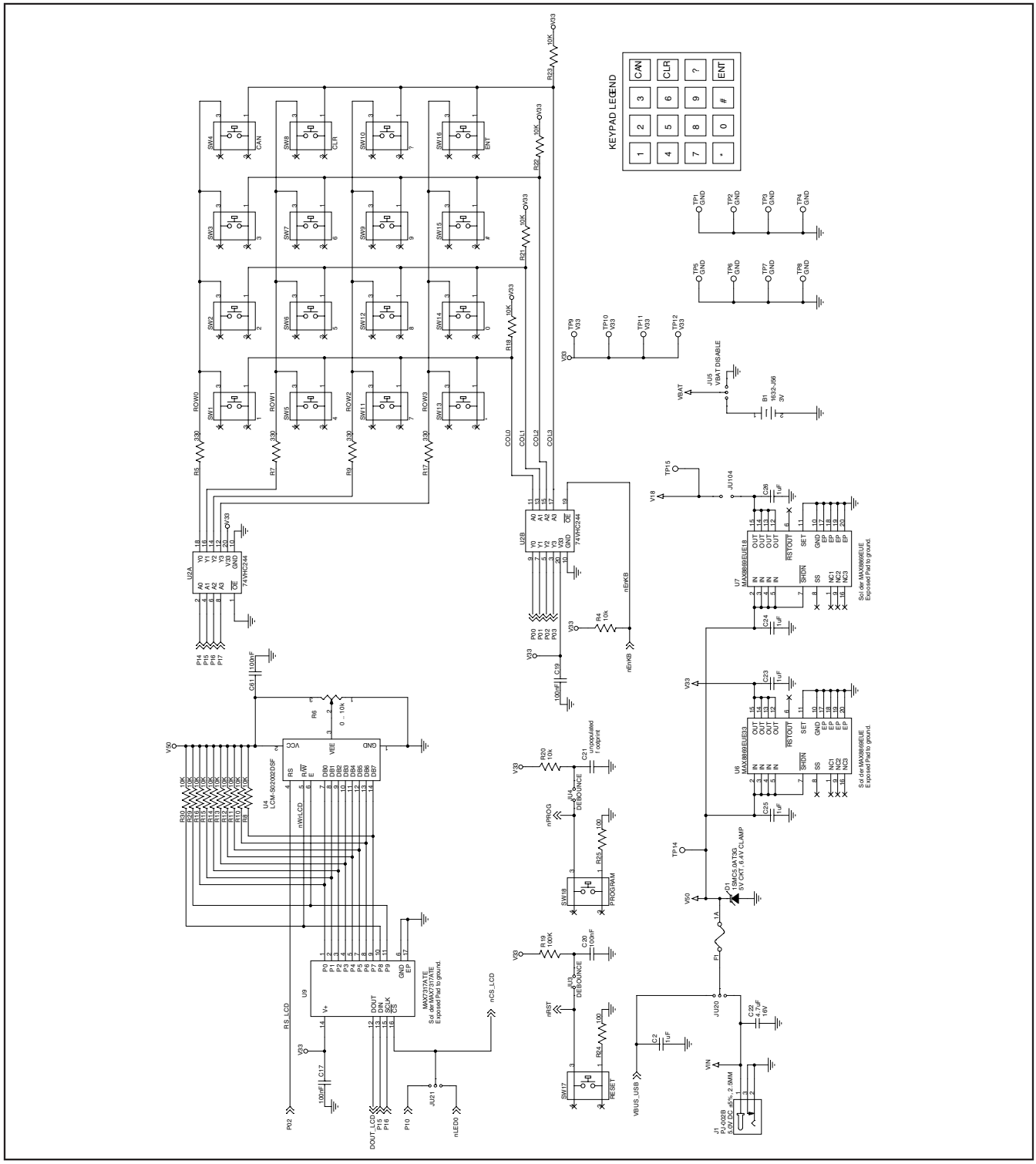


Figure 3b. MAXQ1850 EV Kit Board Schematics—Keypad, LCD, Power (Sheet 2 of 3)

MAXQ1850 Evaluation Kit

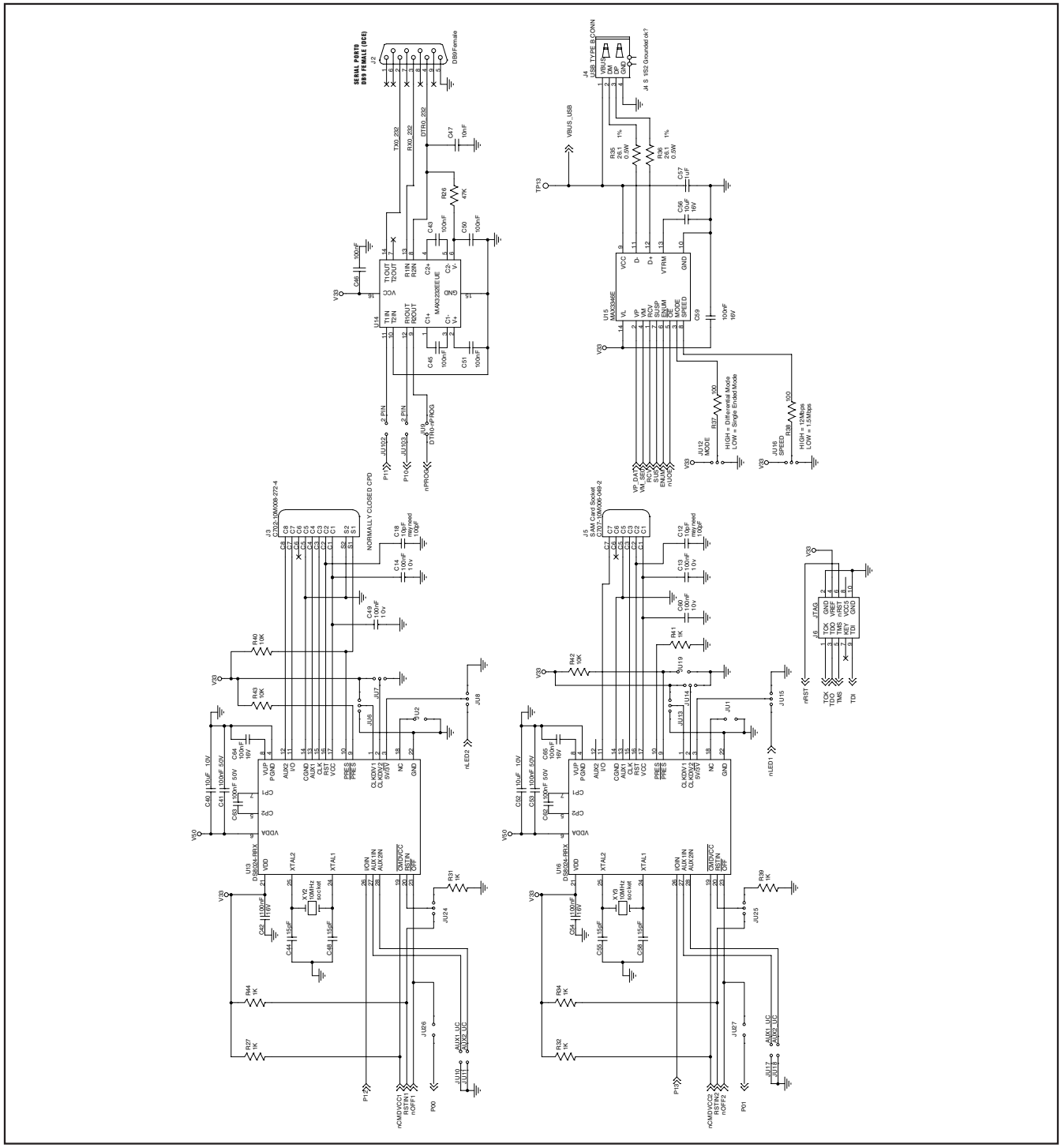


Figure 3c. MAXQ1850 EV Kit Board Schematics—Smart Card, USB, JTAG, RS-232 (Sheet 3 of 3)

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