General Description

The MAX14828 evaluation kit (EV kit) consists of a MAX14828 evaluation board is a fully assembled and tested circuit board that evaluates the MAX14828 IO-Link® device transceiver.

Features

- IO-Link-Compliant Device Transceiver
- IO and SPI™ Interface Terminals
- Proven PCB Layout
- Fully Assembled and Tested

Quick Start

Recommended Equipment

- MAX14828 EV kit
- USB A-to-micro B cable
- User supplied Windows 7/Windows 10 PC with spare USB port
- 24V, 500mA DC power supply
- Multimeter
- Function generator
- Oscilloscope

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

Procedure

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

1) Visit www.maximintegrated.com/evkitsoftware to download the latest version of the EV kit software, 14827_8EVKITSetupVxxx.EXE. Save the EV kit software to the PC.

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

2) Install the EV kit software by clicking on the file. The GUI files are created in the Windows **Start | Programs | Maxim Integrated** 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.
3) Verify that all the jumpers are in their default positions, as shown in Table 1.
2) Ensure that SW1 is set to position 1 (to the far left).
3) Ensure that all switches on SW2 and SW3 are on (to the right).
4) Connect the 24V DC power supply on the VCC and GND connectors of the EV kit board.
5) Connect the oscilloscope to the C/Q test point (TP8).
6) Connect the multimeter to the VL testpoint (TP3)
7) Turn on the power supply.
8) Verify that the voltage on the multimeter is 3.3V.
9) Connect the USB cable from the PC to the EV kit board.
10) Start the EV kit software by opening the MAX14828 EV Kit software icon on the desktop or in the **Start | Programs | Maxim Integrated** menu. The EV kit software splash screen appears and then the main window appears, as shown in Figure 1.
11) Verify that **Connected** is displayed on the status bar at the bottom of the main window (Figure 1).
12) Set the function generator to generate a 0 to 3.3V square wave at 10kHz.
13) Connect the oscilloscope to the TX (TP19) and CQ (TP8) test points.
13) Disable the TX switch on SW3 by setting it to the right. Connect the function generator to the TX test point (TP19).
14) Enable the function generator.
15) Check the Auto-write to MAX14828 box on the GUI.
16) Enable the CQ driver by setting the CQDis bit B[0] in the CQConfig register to 0. See Figure 2.
17) Verify that the CQ output switches with the TX input.

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Detailed Description of Hardware

The MAX14828 EV kit provides a proven layout for the MAX14828 IO-Link device transceiver.

All the power-supply and regulator input and output pins are connected to convenient connectors for easy probing. The device logic input and output pins are also provided with convenient connectors for logic testing.

The C/Q pin are protected by TVS diodes.

See Table 1 for a description of all the EV kit jumper configurations.

Regulators

The MAX14828 includes two regulators V5 for 5V and V33 for 3.3V. Use the on-board switch (SW1) to set the configuration for the V5 regulator: setting the switch to position 1 connects the REG pin to V5 and the internal 5V regulator is enabled. In this configuration, the V5 regulator is capable of driving external loads up to 30mA total external load current.

Set SW1 to position 2 to configure V5 as an input. When the internal 5V regulator is not used, V5 becomes the supply input for the internal analog and digital functions and must be supplied externally so that the device operates normally. Connect an external 5V supply to the V5 test point when SW1 is in position 2. 5V must be present on V5 for normal operation.

To drive larger loads, an external pass transistor can be used to generate the required 5V. For this mode of operation, set SW1 to position 3. This switch setting connects REG to the base of the transistor to regulate the voltage and connects V5 to the emitter.

Use jumper J4 to set the logic supply voltage. Connect J4 to 1-2 to set VL = V5 (5V). Connect J4 to 2-3 to set VL = V33 (3.3V).

Mode Selection (Pin-Mode or SPI Mode)

The MAX14828 operates with either pin-mode control or through an SPI interface. The GUI can be used to evaluate the device in either mode.

Use the mode-selection jumper, J1, or set the SPI/PIN switch on the GUI to set the mode of operation.

Pin-Mode (Standalone Operation)

To operate the MAX14828 EV kit in stand-alone pin-mode, leave the J1 jumper open. In this configuration, the J5, J6, and J7 jumpers are used to configure C/Q (Table 2).

Pin-Mode (With the GUI)

To use the GUI to operate the MAX14828 EV kit in pin-mode, leave the J1 jumper open and set the SPI/PIN button on the GUI to the left. All of the registers in the Register Table will be greyed out in this mode. Click on the associated button for each of the $\overline{CS}$/PP, SDI/TX/NPN, and CLK/TXEN inputs to configure C/Q (Table 2).

SPI-Mode

To operate the MAX14828 EV kit in SPI-mode, close the J1 jumper and ensure that all SW2 and SW3 switches are ON. Set the SPI/PIN button on the GUI to the right. Use the registers to configure the MAX14828.

Evaluating the MAX14828 in Pin-Mode

Configuring the C/Q Driver

In standalone pin mode, C/Q is configured by setting the J5, J6, and J7 (see Table 2).

Set J5 to 1-2 (SDI/TX/NPN is high) to set the C/Q driver in NPN mode. Set J6 to 1-2 ($\overline{CS}$/PP is high) to set C/Q in push-pull mode. C/Q operates in PNP mode when J5 and J6 are both set to 2-3 (SDI/TX/NPN and $\overline{CS}$/PP are low).

The C/Q driver is enabled/disabled by setting the TXEN input. Set J3 to 1-2 (TXEN is high) to enable the C/Q driver. Apply a signal at the TX input (TP19) to set the C/Q output. C/Q is an input when J3 is 2-3 (TXEN is low).

The GUI can also be used to configure C/Q in pin-mode. Click on the SPI/PIN button on the GUI so that Pin-mode is selected (register table is greyed out). Set the switches next to the CSB/PP and SDI/TX/NPN lines to configure C/Q. C/Q is PP when CSB/PP is set to the right. C/Q is NPN when SDI/TX/NPN is set to the right (and CSB/PP is set to the left). C/Q is PNP when both CSB/PP and SDI/TX/NPN are set to the left.

Setting the C/Q Driver Current

In stand-alone pin mode, the C/Q driver current limit is set with the CLK/TXEN/200MA input. Set J7 to 2-3 to set the driver current limit to 100mA (typ). Set J7 to 1-2 to set the driver current limit to 200mA (typ).

LED Driver (LED1IN)

Close J2 to pull the LED1IN input high and turn on LED1. LED1IN is low and LED1 is off when J2 is open.

LED1 can also be turned on/off in the GUI. Click on the LED1IN switch on the GUI to set it to the left (LED1 is off) or right (LED1 is on).

Evaluating the MAX14828 in SPI-Mode

Set the bits in the register table in the GUI to configure the MAX14828 through the SPI interface. Click on a register in the upper table and set the bits to the desired value by using the pull-down menu for each bit in the lower table. Click on the Write Modified button to write the changes to the MAX14828.

Alternatively, check the Auto-Write box to automatically send the changes to the device after a bit has been changed.

Configuring the C/Q Driver

Click on the CQConfig_Register in the upper table to see the available bits and bit settings in the lower table. Use this register to enable/disable the C/Q driver, configure the C/Q driver, and enable/disable the RX glitch filter.

Setting the C/Q Driver Current

Click on the CURRLIM_Reigster to set the current limit and associated current limit timing parameters for C/Q.

Interrupt and Status Information

The IRQ LED (LED2) turns on when a bit in the Interrupt register is set. Check the Include Interrupt Register to read the Interrupt register when the Read All button is pressed. Click on the INTERRUPT_Register in the upper table to see which bit was set in the lower table, after an interrupt has occurred.

To monitor or check the status of the device during operation, click on the STATUS_Register and click the Read All button to see the status bits.

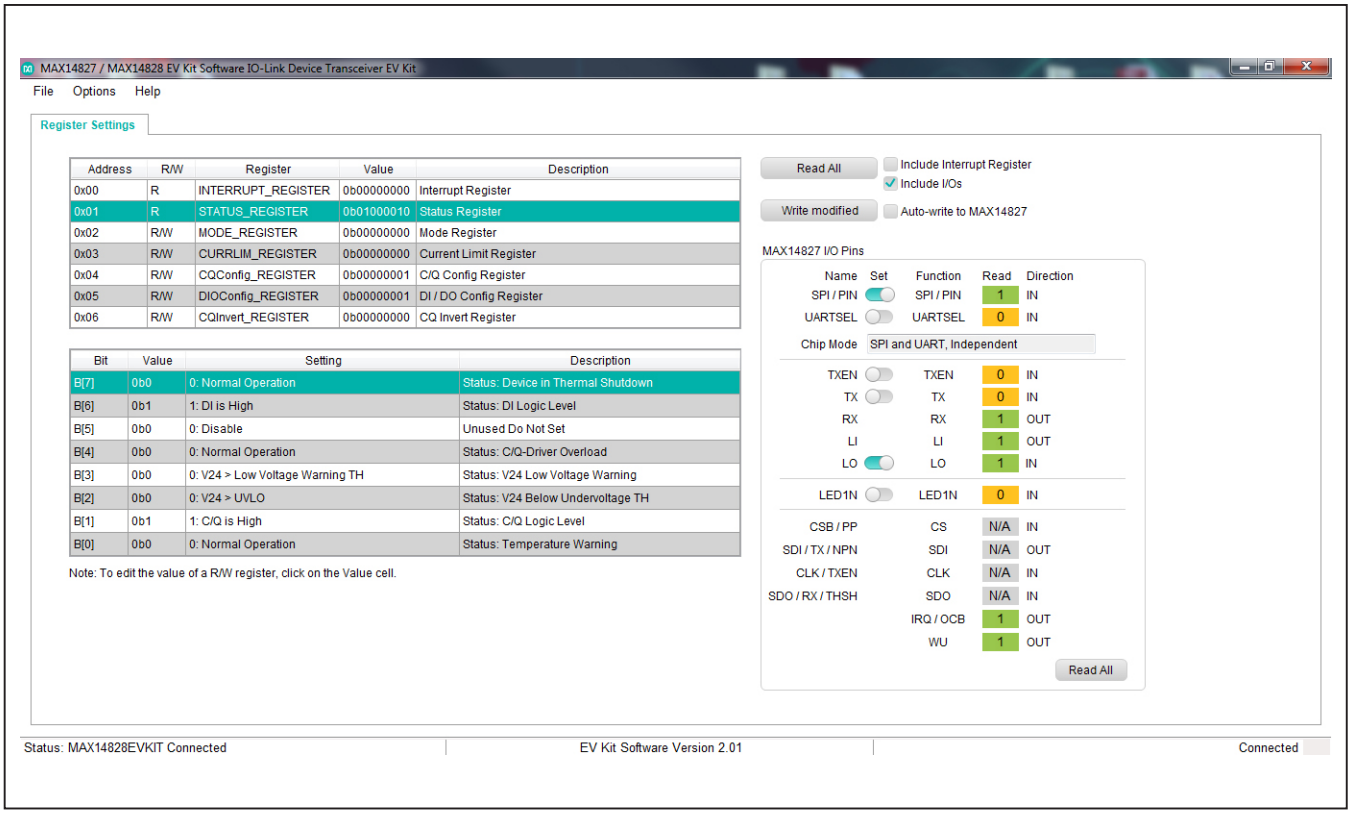


Figure 1. MAX14828 EV Kit Software–EV Kit Connected

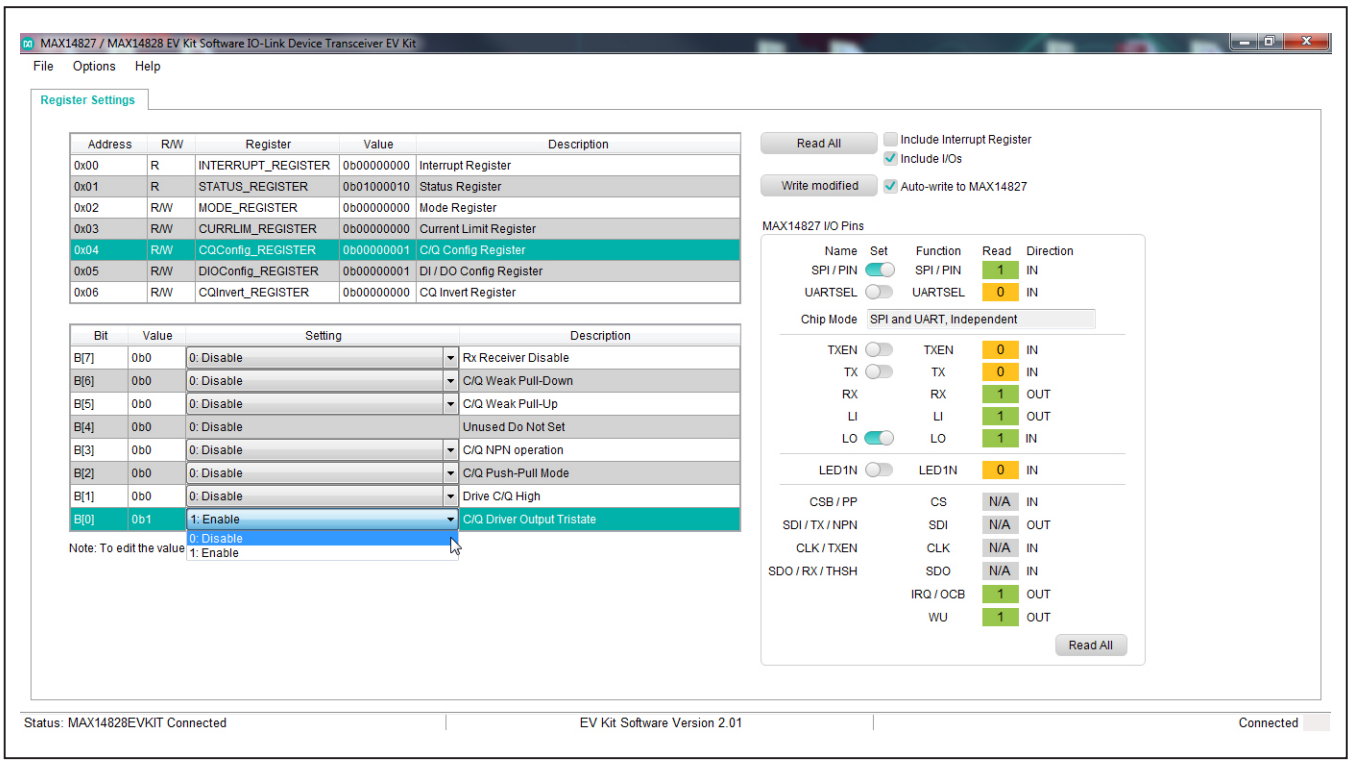


Figure 2. MAX14828 EV Kit Software–Setting a Bit

Table 1. Jumper Descriptions

JUMPER	SHUNT POSITON	DESCRIPTION
J1	Closed*	SPI/$\overline{PIN}$ is connected to VL. The MAX14828 is in SPI-mode.
	Open	SPI/$\overline{PIN}$ is connected GND. The MAX14828A is in pin-mode.
J2	Closed	LED1IN is connected to VL. LED1 turns on.
	Open*	LED1IN is connected to GND. LED1 turns off.
J3	Closed	TXEN is high. C/Q driver is enabled.
	Open*	TXEN is low. C/Q driver is disabled.
J4	1-2	VL is connected to V5
	2-3*	VL is connected to V33
J5	1-2	SDI/TX/NPN is high (connected to VL).
	2-3*	SDI/TX/NPN is low (connected to GND).
J6	1-2	$\overline{CS}$/PP is high (connected to VL).
	2-3*	$\overline{CS}$/PP is low (connected to GND).
J7	1-2	CLK/TXEN/200MA is high (connected to VL).
	2-3*	CLK/TXEN/200MA is low (connected to GND).

**Default position.*

Table 2. Configuring and Setting C/Q

SPI/$\overline{PIN}$	TXEN	TX	CQ_Dis	CQ_Q	C/Q OUTPUT		
					NPN MODE	PNP MODE	PP MODE
L	L	X	-	-	Z	Z	Z
	H	L	-	-	Z	H	H
		H	-	-	L	Z	L
H	L	X	0	0	Z	Z	Z
		X	0	1	Z	H	H
	H	L	0	X	Z	H	H
		H	0	0	L	Z	L
		H	0	1	Z	H	H
	X	X	1	X	Z	Z	Z

Ordering Information

PART	TYPE
MAX14828EVKIT#	EV Kit

#Denotes RoHS compliant.

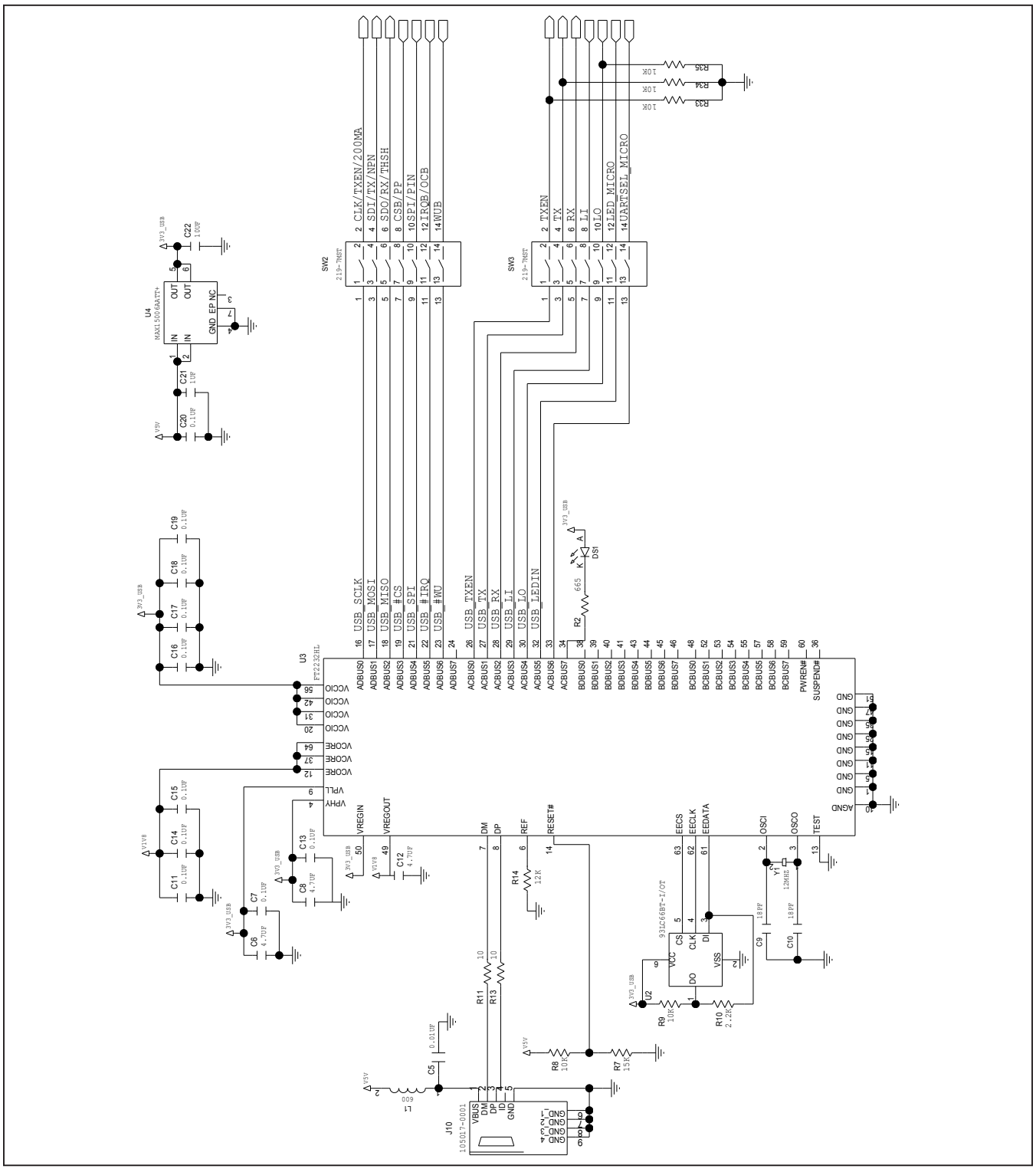
MAX14828 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1, C2	-	2	C0603C105K4RAC; GRM188R71C105KA12; C1608X7R1C105K; EMK107B7105KA	KEMET/MURATA/TDK/TAIYO YUDEN	1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1UF; 16V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R	
2	C3, C4	-	2	GRM188R72A104KA35; CC0603KRX7R0BB104	MURATA; TDK	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 100V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
3	C5	-	1	C1005X7R1V103K050BB	TDK	0.01UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.01UF; 35V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
4	C6, C8, C12	-	3	C0603C475K8PAC; LMK107BJ475KA-T; CGB3B1X5R1A475K;C1608X5R1A475K080; CL10A475KP8NNN	KEMET; TAIYO YUDEN; TDK; SAMSUNG ELECTRONICS	4.7UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 4.7UF; 10V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
5	C7, C11, C13-C20	-	10	C0402C104J4RAC	KEMET	0.1UF	CAPACITOR; SMT; 0402; CERAMIC; 0.1uF; 16V; 5%; X7R; -55degC to + 125degC; 0 +/-15% degC MAX.	
6	C9, C10	-	2	C0402C180J5GAC; GRM1555C1H180JA01J; C1005C0G1H180J050	KEMET/MURATA/TDK	18PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 18PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
7	C21	-	1	C0402C105K8PAC	KEMET	1UF	CAPACITOR; SMT; 0402; CERAMIC;1uF; 10V; 10%; X7R; -55degC to + 125degC	
8	C22	-	1	C1608X5R1A106K	TDK	10UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 10UF; 10V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R	
9	D1	-	1	SPT02-236DDB	ST MICROELECTRONICS	SPT02-236DDB	DIODE; TVS; UQFN-2L; PIV=38V; IF=0.3A	
10	D2	-	1	SPT01-335DEE	ST MICROELECTRONICS	SPT01-335DEE	DIODE; TVS; QFN6; PIV=38V; IF=0.3A	
11	D5	-	1	ZHCS506TA	DIODES INCORPORATED	ZHCS506TA	DIODE; SCH; SMT (SOT-23); PIV=60V; IF=0.5A	
12	DS1	-	1	LG L29K-G2J1-24	OSRAM	LG L29K-G2J1-24	DIODE; LED; SMT (0603); Vf=1.7V; If(test)=0.002A; -40 DEGC TO +100 DEGC	
13	J1, J2	-	2	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC	
14	J3-J7	-	5	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	
15	J10	-	1	105017-0001	MOLEX	105017-0001	CONNECTOR; FEMALE; SMT; MICRO-USB B RECEPTACLE; RIGHT ANGLE; 5PINS	
16	L1	-	1	BLM21AG601SN1D	MURATA	600	INDUCTOR; SMT (0805); FERRITE-BEAD; 600; TOL=+/-25%; 0.2A	
17	LED1	-	1	LTST-C193KGKT-5A	LITE-ON ELECTRONICS; INC.	LTST-C193KGKT-5A	DIODE; LED; STANDARD; YELLOW-GREEN; SMT (0603); PIV=1.9V; IF=0.005A; -55 DEGC TO +85 DEGC	
18	LED2	-	1	LTST-C193KRKT-2A	LITE-ON ELECTRONICS; INC.	LTST-C193KRKT-2A	DIODE; LED; EXTRA THIN; EXTRA BRIGHT; RED; SMT (0603); VF=2.2V; IF=0.002A	
19	Q1	-	1	BCP56TA	DIODES INCORPORATED	BCP56TA	TRAN; NPN SILICON PLANAR MEDUIM POWER TRANSISTOR; NPN; SOT-223 ; PD-(2.0W); I-(1A); V-(80V)	
20	R1	-	1	CRCW0603680RFK	VISHAY DALE	680	RESISTOR, 0603, 680 OHM, 1%, 100PPM, 0.10W, THICK FILM	

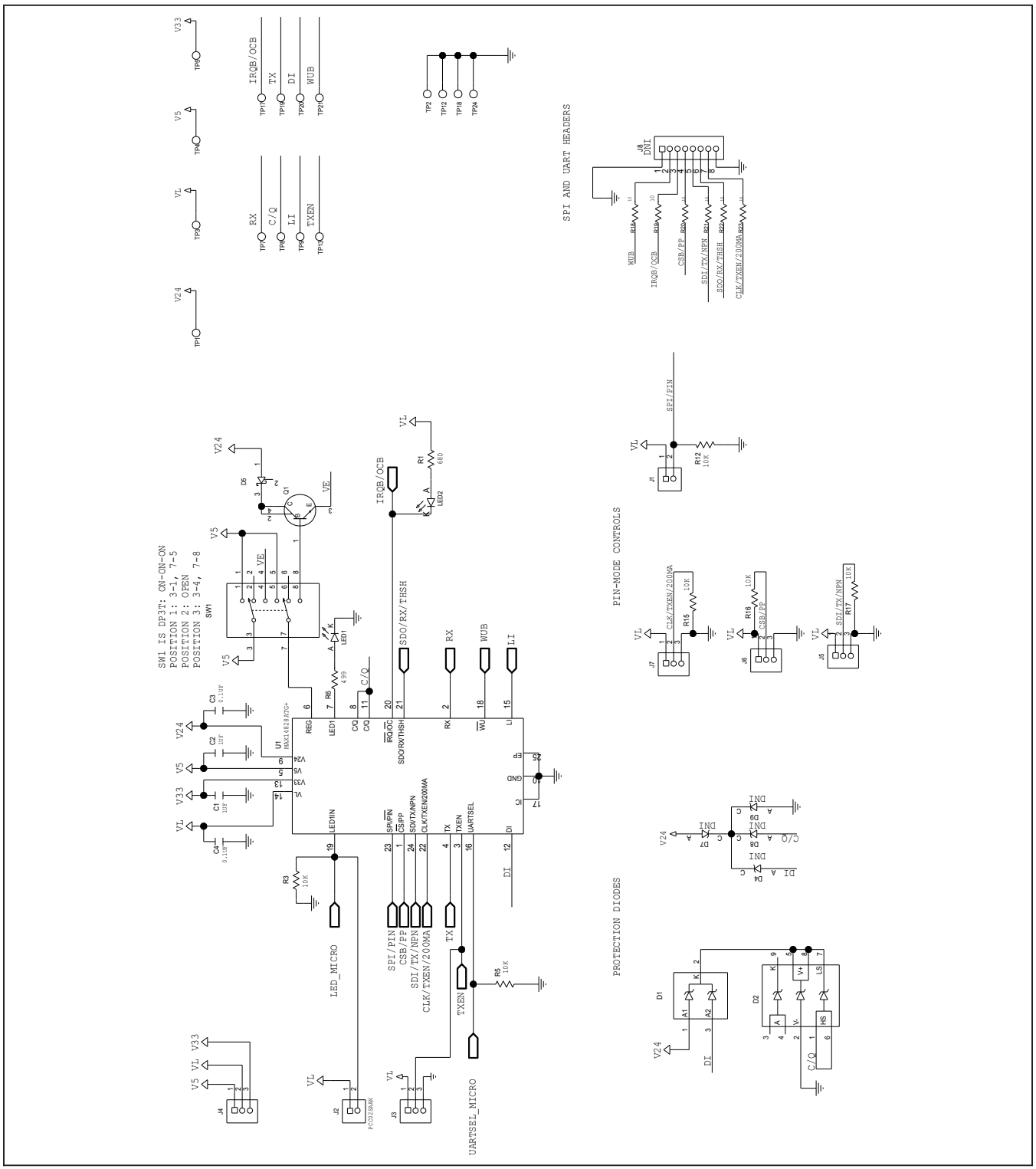
MAX14828 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
21	R2	-	1	CRCW0603665RFK	VISHAY DALE	665	RESISTOR; 0603; 665 OHM; 1%; 100PPM; 0.10W; THICK FILM	
22	R3, R5, R8, R12, R15-R17, R33-R35	-	10	CRCW060310K0FK; ERJ-3EKF1002	VISHAY DALE; PANASONIC	10K	RESISTOR; 0603; 10K; 1%; 100PPM; 0.10W; THICK FILM	
23	R6	-	1	CRCW0603499RFK; RK73H1J4990FT; ERJ-3EKF4990V; RC1608F4990	KOA; VISHAY; PANASONIC; SAMSUNG	499	RESISTOR; 0603; 499 OHM; 1%; 100PPM; 0.10W; THICK FILM	
24	R7	-	1	CRCW060315K0FK	VISHAY DALE	15K	RESISTOR, 0603, 15K OHM, 1%, 100PPM, 0.10W, THICK FILM	
25	R9	-	1	CRCW040210K0FK; RC0402FR-0710K	VISHAY DALE; YAGEO PHICOMP	10K	RESISTOR; 0402; 10K; 1%; 100PPM; 0.0625W; THICK FILM	
26	R10	-	1	CRCW04022K20FK; RC0402FR-072K2L	VISHAY DALE/YAGEO PHICOMP	2.2K	RESISTOR, 0402, 2.2K OHM, 1%, 100PPM, 0.0625W, THICK FILM	
27	R11, R13, R18-R23	-	8	CRCW040210R0FK; 9C04021A10R0FL	VISHAY DALE	10	RESISTOR; 0402; 10 OHM; 1%; 100PPM; 0.0625W; THICK FILM	
28	R14	-	1	CRCW060312K0FK	VISHAY DALE	12K	RESISTOR, 0603, 12K OHM, 1%, 100PPM, 0.10W, THICK FILM	
29	SW1	-	1	MHS231	COPAL ELECTRONICS INC	MHS231	SWITCH; DP3T; THROUGH HOLE; STRAIGHT; 12V; 0.2A; MHS SERIES; HYPER-MINIATURE SLIDE SWITCH; RCOIL=0 OHM; RINSULATION=100M OHM	
30	SW2, SW3	-	2	219-7MST	CTS	219-7MST	SWITCH; SPST; SMT; STRAIGHT; 20V; 0.1A; SURFACE MOUNT DIP SWITCH-AUTO PLACEABLE; RINSULATION=1000M OHM	
31	TP1, TP3-TP5	-	4	5010	KEYSTONE	N/A	TESTPOINT WITH 1.80MM HOLE DIA, RED, MULTIPURPOSE;	
32	TP2, TP12, TP18, TP24	-	4	5011	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
33	TP7-TP9, TP13, TP17, TP19-TP21	-	8	5014	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
34	U1	-	1	MAX14828ATG+	MAXIM	MAX14828ATG+	EVKIT PART-IC; TXRX; IO-LINK DEVICE TRANSCEIVER; TQFN24-EP 4X4	
35	U2	-	1	93LC66BT-I/OT	MICROCHIP	93LC66BT-I/OT	IC; EPROM; 4K MICROWIRE SERIAL EEPROM; SOT23-6	
36	U3	-	1	FT2232HL	FUTURE TECHNOLOGY DEVICES INTL LTD.	FT2232HL	IC; MMRY; DUAL HIGH SPEED USB TO MULTIPURPOSE UART/FIFO; LQFP64	
37	U4	-	1	MAX15006AATT+	MAXIM	MAX15006AATT+	IC; VREG; ULTRA-LOW QUIESCENT-CURRENT LINEAR REGULATOR; TDFN6-EP 3X3	
38	Y1	-	1	ABM7-12.000MHZ-D2Y-T	ABRACON	12MHZ	CRYSTAL; SMT ; 18PF; 12MHZ; +/-20PPM; +/-30PPM	
39	PCB	-	1	MAX14828	MAXIM	PCB	PCB:MAX14828	-
40	D4, D7-D9	DNP	0	SMBJ33A	ST MICROELECTRONICS	33V	DIODE; TVS; SMB (DO-214AA); VRM=33V; IPP=11.8A	
41	J8	DNP	0	PBC08SAAN	SULLINS ELECTRONICS CORP.	PBC08SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 8PINS; -65 DEGC TO +125 DEGC	
TOTAL			88					

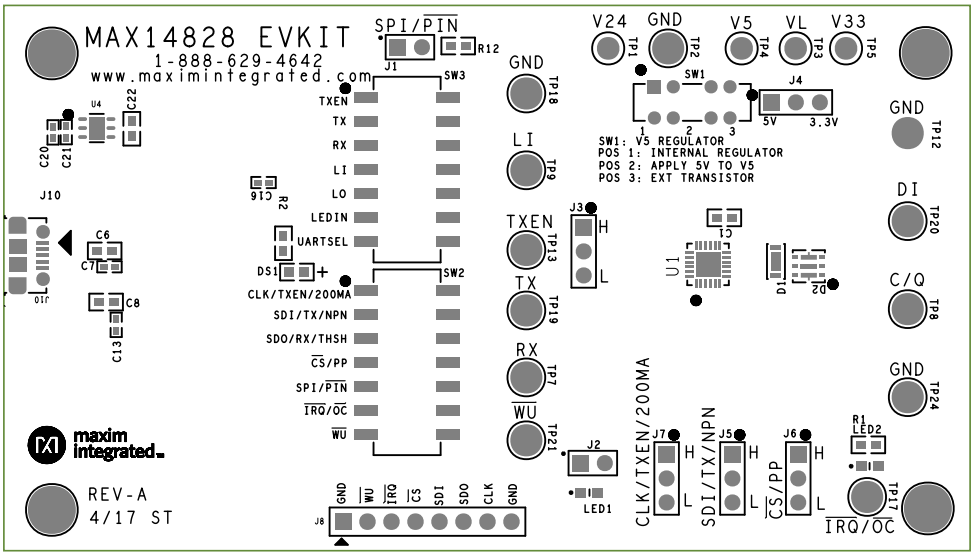
MAX14828 EV Kit Schematic



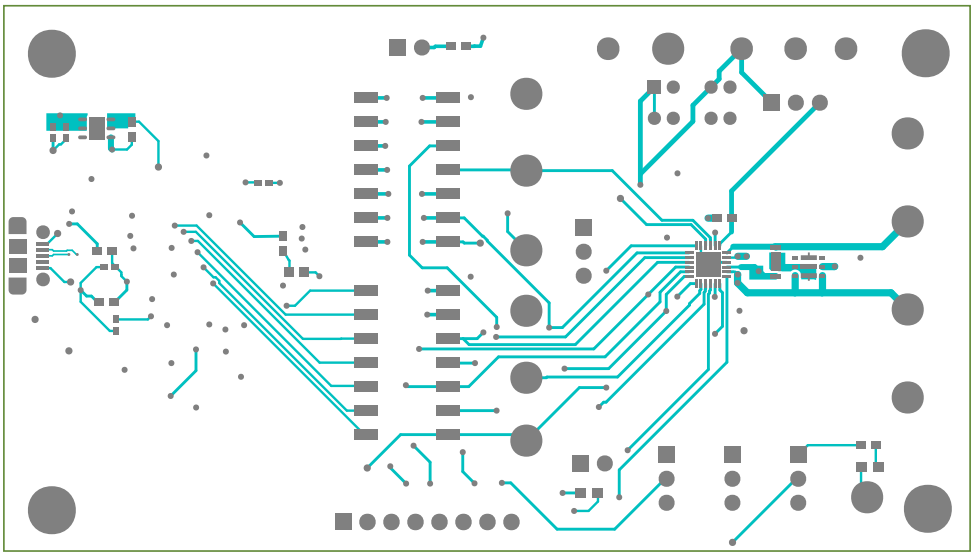
MAX14828 EV Kit Schematic (continued)



MAX14828 EV Kit PCB Layout Diagrams

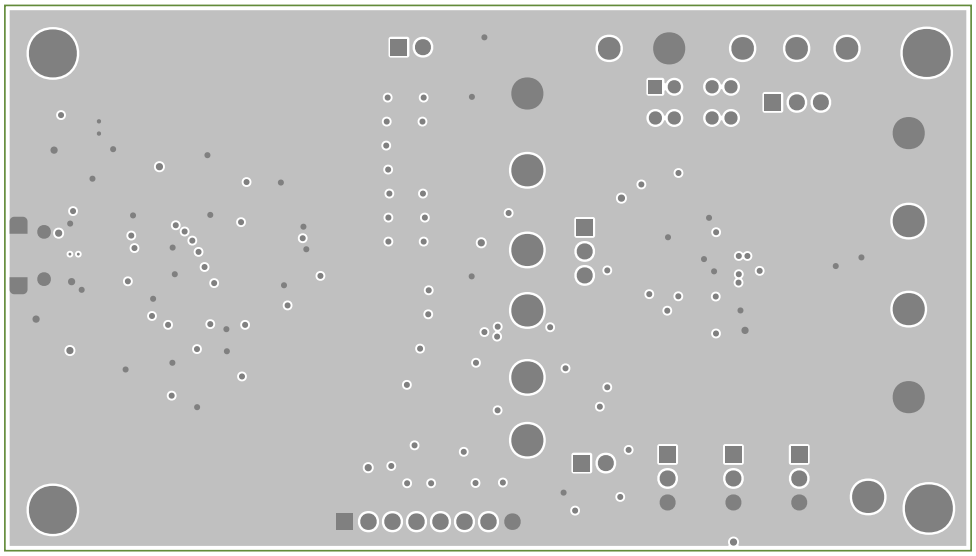


MAX14828 EV Kit—Top Silkscreen

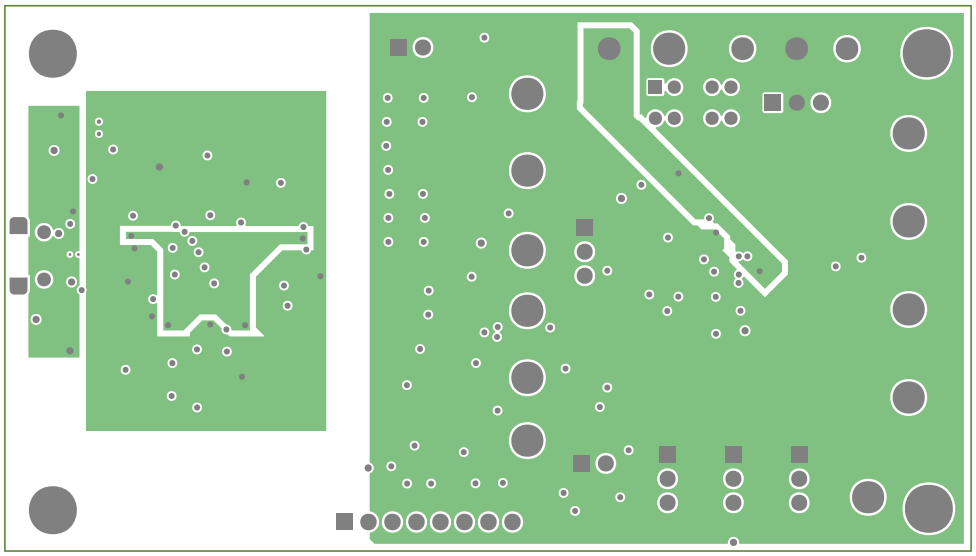


MAX14828 EV Kit—Top

MAX14828 EV Kit PCB Layout Diagrams (continued)

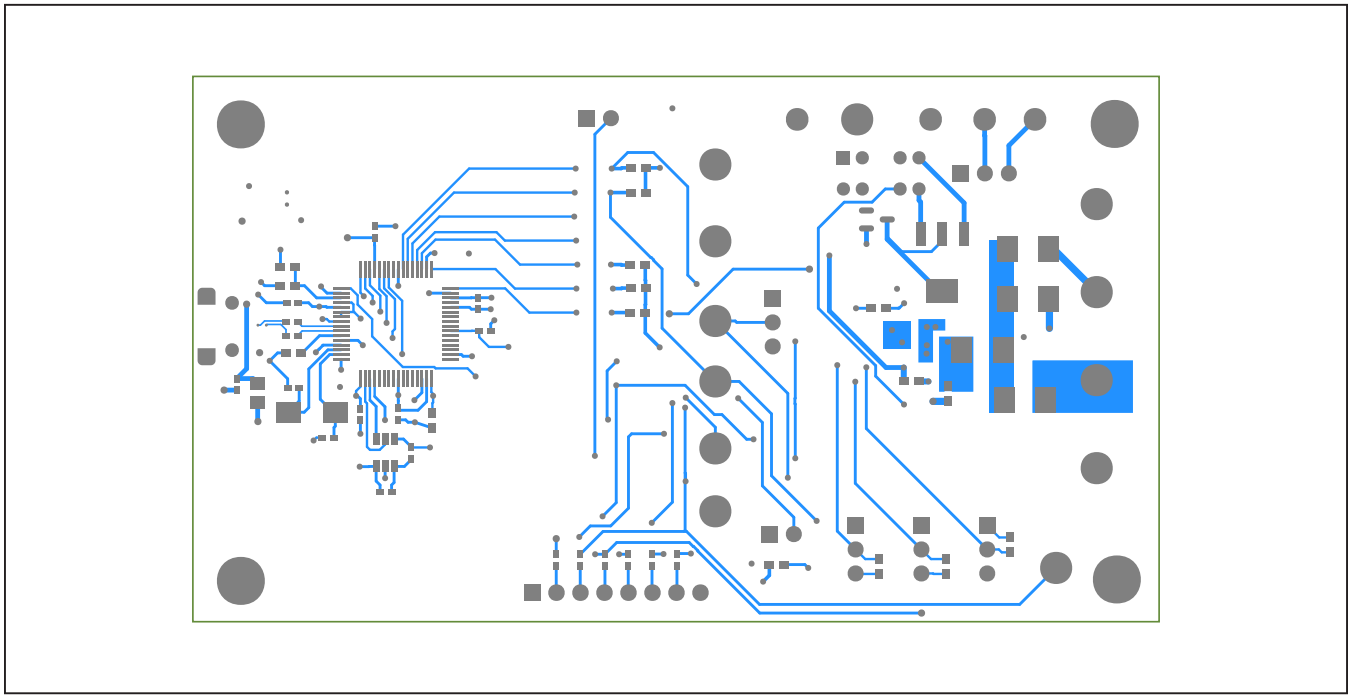


MAX14828 EV Kit—Internal 2

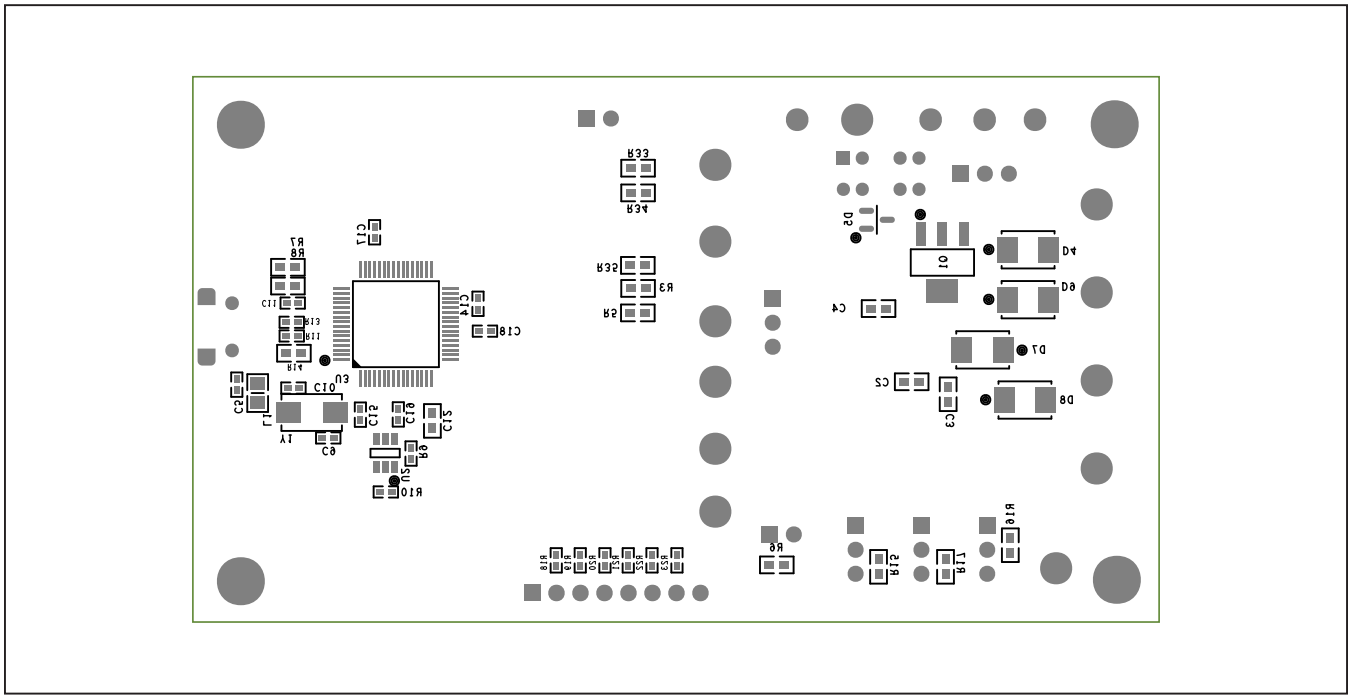


MAX14828 EV Kit—Internal 3

MAX14828 EV Kit PCB Layout Diagrams (continued)



MAX14828 EV Kit—Bottom



MAX14828 EV Kit—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/17	Initial release	—

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