MAX14922 Evaluation Kit

Evaluates: MAX14922

General Description

The MAX14922 evaluation kit (EV kit) provides a proven design to evaluate the MAX14922 industrial-grade high-side switch controller for ground connected resistive, inductive, and capacitive loads with diagnostics.

The MAX14922 EV kit must be powered from an external +24V power supply and can draw more than 10A when fully loaded.

The EV kit PCB comes with the MAX14922ATE+ (16 TQFN, 3mm x 3mm) device installed, and includes Si7322DN, n-channel FET and PCB space for a power FET in a TO-252/DPAK/SOT428 package, enabling easy and simple evaluation of the device with loads.

Features

- Robust Operation with Wide Range of Input Voltages and Load Conditions
- Safety and Protection Device Included for +24V Supply Evaluation with Up To ±1.2kV IEC 61000-4-5 at Source to Ground
- Fast Inductive Load Demagnetization
- LED Indication of Status and Fault Conditions
  - Overvoltage
  - Overcurrent
  - Ready
  - Thermal warning Fault Condition Indication
- Included Si7322DN FET with Placement Option to Include TO-252 Package FETs
- Autoretry Option Using a t_{BLANK} Feature During Overcurrent Conditions
- Optional On-Chip +5V Logic from MAX14922
- +2.5V to +5.5V Wide Logic-Voltage Range
- Proven PCB Layout
- Fully Assembled and Tested

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

Quick Start

Required Equipment

- MAX14922 EV kit
- Up to +60V DC power supply
- Optional +2.5V to +5.5V DC power supply
- Optional signal generator
- Load

Procedure

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

1) Verify that all jumpers are in default positions (Table 1).
2) Connect the EV kit to the external DC power supply through V_{DD} banana plugs. Do not turn on the power supply.
3) Connect the load through LOAD banana plug and connect the load return to the GND (ground return) banana plug.
4) Verify shunt positions for required operation.
5) The default shunt position on J1 connects the internal 5V output to the logic supply V_L input. An external 5V supply is not required in this case.
6) The default shunt position on J4 ties the IN input to 5V, forcing the Gate high to turn on the external FET.
7) When using a signal generator to turn on/off the external FET, remove shunt J4 and connect the signal generator output using the BNC input J12 or SWITCH CONTROL connector input.
8) Jumpers J2, J3, J9, J10, and J11 are diagnostic outputs. Verify the default positions in Table 1 and install the shunts when fault indication is required.
9) Set the desired resistive load and turn on the power supply.

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Table 1. MAX14922 EV Kit Shunt Positions and Settings

HEADER	SHUNT POSITION	FUNCTION DESCRIPTION
J1	1-2*	V$_5$ 5V output connected to V$_L$ logic supply input.
	Not Installed	V$_L$ logic supply must be externally provided using the V$_{LOGIC}$ connector.
J2	1-2	Connects LO logic output to the pull-down resistor and RED fault indication LED. Use when undervoltage V$_{DD}$/ LOAD-output detection is needed. Populate R5, R6, and R7 resistors appropriately.
	Not Installed*	Disconnects the pull-down resistor. LED not in use. Use this mode when the V$_{DD}$/LOAD-detection function is not in use (R5, R6, and R7 resistors are DNI/default mode).
J3	1-2*	Connects the RDY logic output to the pull-up resistor and RED fault indication LED. The RDY status output indicates RED when the Gate output of MAX14922 is forced off, turning the external switch OFF. This indicates fault.
	Not Installed	Disconnects the pull-up resistor. The fault indication function is not in use.
J4	1-2*	IN input is pulled High. Turns-on the FET.
	Not Installed	IN input is pulled low by R4 pull-down resistor. Use J12 BNC input to apply toggling input from signal generator to turn on/off external FET.
J5		V$_{DD}$ to external FETs drain test point or V$_{DRAIN}$
J6		Gate test point
J7		Load/Source test point
J8	Not Installed*	The COMP input is left unconnected.
	1-2	Connects the V$_{DD}$/DRAIN to the COMP input. Choose R5 and R6 resistors appropriately to reduce power dissipation.
	2-3	Connects the SOURCE to the COMP input. Choose R5 and R7 resistors appropriately to reduce power dissipation.
J9	1-2*	Connects OV logic output to pull-up resistor and RED fault indication LED. Overvoltage at V$_{DD}$/Drain turns on RED LED indicating fault.
	Not Installed	Disconnects the pull-up resistor. The fault indication function is not in use.
J10	1-2*	Connects THW logic output to the pull-up resistor and RED fault indication LED. Thermal warning indication turns on RED LED.
	Not Installed	Disconnects the pull-up resistor. The fault indication function is not in use
J11	1-2*	Connects the OVCURR logic output to the pull-up resistor and RED fault indication LED. The overcurrent indication turns on the RED LED.
	Not Installed	Disconnects the pull-up resistor. The fault indication function is not in use.

Default position.

Detailed Description of Hardware

MAX14922EV kit provides an easy-to-use and flexible solution for evaluating the MAX14922, high-side switch controller for industrial applications. The EV kit comes with the MAX14922 device and Si7322DN MOSFET included to enable users to easily connect the loads and evaluate the device and the system. Also, the kit comes preinstalled with protection devices enabling evaluation of the device with a standard +24V industrial supply with up to 1.2kV surge protection at source/load output to ground.

The kit also provides space to add and evaluate higher power MOSFETs with TO-252 (DPAK)/SOT28 package. When replacing the MOSFET at M2 space (TO-252 device), make sure the M1 FET (Si7322DN) device is removed.

Optional Logic Supply

The MAX14922 EV kit comes with an on-board 5V supply from the MAX14922 integrated regulator. The logic supply input (V_L) can either be powered from the V_5 on-board integrated supply or externally. When enabling the on-board integrated 5V supply, jumper J1 should be installed. By removing the J1 jumper, the external logic supply must be provided at the V_{LOGIC} supply pad input.

IN Configuration to

Control External Switch

The EV kit offers the following configuration to control external switches M1 or M2. Jumper J4 when installed, pulls the IN input to V_L (V) high, enabling the switch ON. When the J4 jumper shunt is removed, the R4 100k pulldown resistor pulls down the IN input to GND (low) thereby turning Off the switch. Alternatively, if it is desired to provide a time varying signal to the IN input, the SWITCH_CONTROL input provides an option to control the switch when input is supplied either from a signal generator or from a controller.

Diagnostic Features

The MAX14922 EV kit features on-board diagnostics to monitor faults. Jumpers J9 through J12 allow the user the option to view the diagnostic outputs through status RED LEDs. Alternatively, test points are provided for each diagnostic output for probe (measurement). When the functions of the LED are not needed by the user, removing any of the jumper shunts J9–J11, J2–J3 disables the LED with its corresponding diagnostic output. Table 2 shows the feature of the diagnostic outputs.

Table 2. MAX14922 EV kit Diagnostic Output Features

DIAGNOSTIC FEATURE	JUMPER	TEST POINT	FUNCTION DESCRIPTION
Overvoltage Detection	J9	OVER_VOLTAGE	Active Low Output. During an overvoltage fault at the V_{DD} input, output goes LOW. When J9 is installed, the RED status is ON indicating the fault.
Thermal Warning	J10	TH_WARNING	Active Low Output. When the temperature is above 110°C, the thermal warning status output goes LOW. When J10 is installed, the RED status is ON indicating the fault
Overcurrent	J11	OVERCURRENT	Active Low Output. Output goes LOW when an overcurrent condition is detected. When J11 is installed, the RED status LED is ON indicating the fault. Changing the R1 resistor value changes the overcurrent threshold. Refer to the MAX14922 data sheet for more information.
Ready	J3	RDY	Active Low Output. At normal operation when the device is powered ON, the RDY output is HIGH, indicating that the Gate output can turn on the external FET. When the RDY output is LOW, there is a fault present, which forces the output LOW. When J3 is installed, the RED status LED indicates a fault.
Voltage Monitor	J2	LO	Active Low Output Monitors. The COMP input provides an option to monitor the supply to the chip or to monitor the high-side output voltage. The device compares the COMP input with an internal 1.025V bias. When using the COMP input, use Jumper J8 to choose to monitor either source or drain. When monitoring the source/load, use the R7 and R5 resistors to divide down the voltage. When monitoring V_{DD} or drain, use R6 and R5 resistors to divide down the voltage. Refer to Table 1 for EV kit shunt positions and settings.

Current Limit Autoretry Timing

The MAX14922 EV kit comes with a default 1nF C8 capacitor connected to the t_{BLANK} input that determines the blanking and autoretry timing in case of an overcurrent scenario. A 1nF capacitor provides 33µs of current limit time (t_{ON_CL}) and 9ms of off time (t_{OFF_CL}) based on a short-circuit of the S pin to GND and a $\overline{V}_{DD}$ supply voltage of +24V. After 9ms, the device autoretries turning on the external FET. For more information regarding current limit and autoretry timing, refer to the IC data sheet. The EV kit features a 12mΩ sense resistor at R1, which sets the current limit threshold to 2.5A. Current limiting is enabled when the load current is more than the threshold.

Working with Different Supply Inputs

The MAX14922 EV kit comes with a default supply clamps to handle up to +60V supply input at V_{DD}. Although when working with standard +24V supply providing power to V_{DD} of the EV kit, the current components can still be used for evaluation. Replacing D5 with SM30T35CAY and D1 with SBMJ33A changes the protection parameters necessary for a +24V supply environment evaluation.
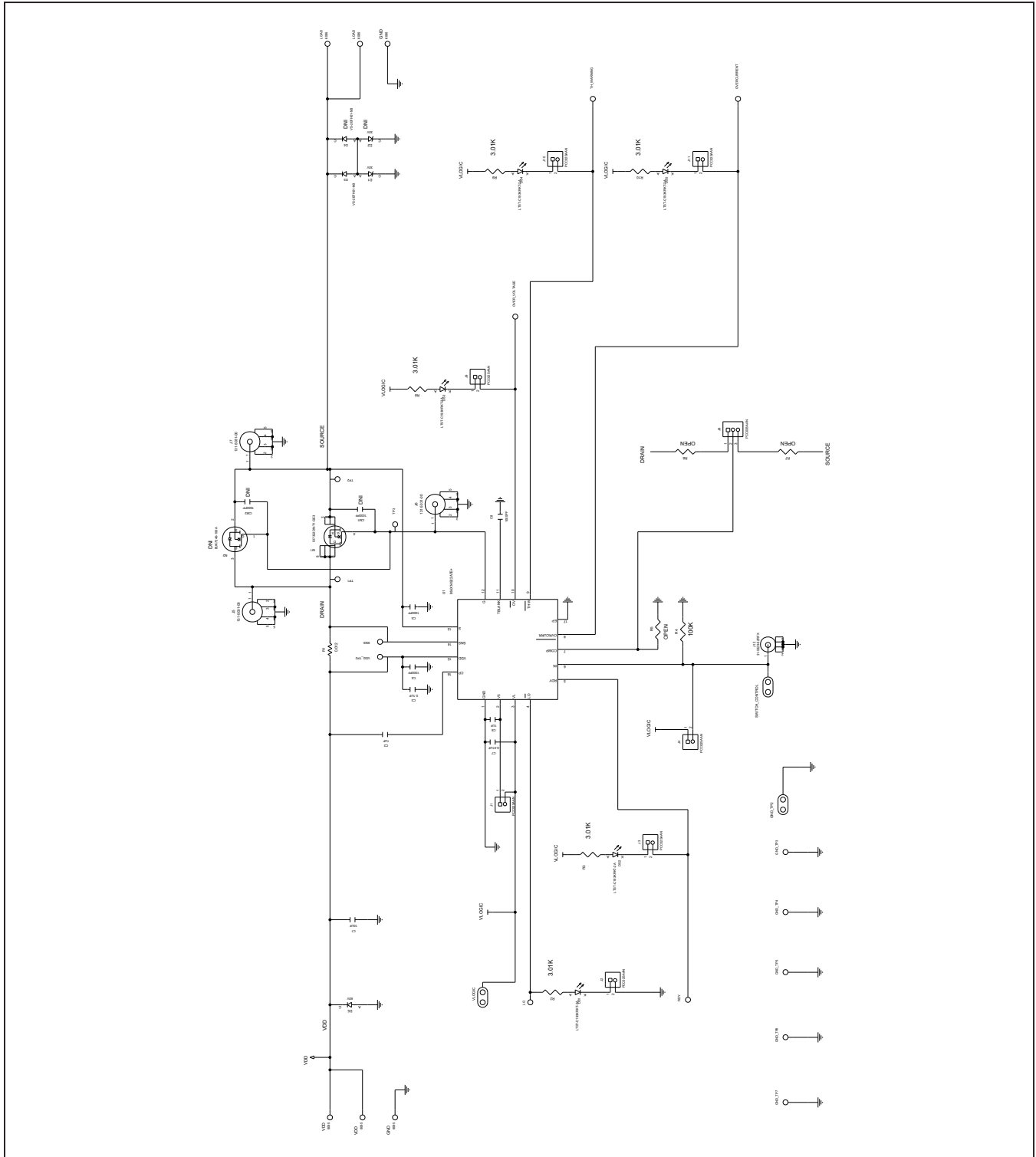
Ordering Information

PART	TYPE
MAX14922EVKIT#	EV Kit

#Denotes an RoHS-compliant part.

MAX14922 EV Kit Bill of Materials

| ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1	-	1	C5750X7S2A106M230KB	TDK	10UF	CAPACITOR; SMT (2220); CERAMIC CHIP; 10UF; 100V; TOL=20%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7S	
2	C2	-	1	GRM31CR72A105KA01; C3216X7R2A105K160AA; GCH31CR72A105KE01; HMK316B7105KLH	MURATA;TDK;MURATA; TAIYO YUDEN	1UF	CAPACITOR; SMT; 1206; CERAMIC; 1uF; 100V; 10%; X7R; -55 DEGC TO +125 DEGC	
3	C3	-	1	C3216C0G2A104J160; CGA5L1C0G2A104J160AC	TDK;TDK	0.1UF	CAPACITOR; SMT (1206); CERAMIC CHIP; 0.1UF; 100V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
4	C4, C5	-	2	C0603C102K1GAC; C1608C0G2A102K080AA	KEMET;TDK	1000PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1000PF; 100V; TOL=10%; MODEL=C0G; TG=-55 DEGC TO +125 DEGC; TC=	
5	C6	-	1	GRM188R71E105KA12; CGA3E1X7R1E105K; TMK107B7105KA; 06033C105KAT2A; GCM188R71E105KA64; C1608X7R1E105K080AE; CGA3E1X7R1E105K080AC	MURATA;TDK;TAIYO YUDEN;AVX;MURATA; TAIYO YUDEN;TDK	1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
6	C7	-	1	C1608C0G1E103J080AA	TDK	0.01UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 25V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=C0G	
7	C8	-	1	GRM1885C1H102JA01; C1608C0G1H102J080AA; GCM1885C1H102JA16	MURATA;TDK;MURATA	1000PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1000PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC	
8	D1	-	1	SMBJ30A	LITTELFUSE	30V	DIODE; TVS; SMB (DO-214AA); VRM=30V; IPP=12.4A	
9	D3	-	1	VS-2EFH01-M3	VISHAY	VS-2EFH01-M3	DIODE; SWT; SMT (DO-219AB); PIV=100V; IF=2A	
10	D5	-	1	SMCJ60A	FAIRCHILD SEMICONDUCTOR	60V	DIODE; TVS; SMC (DO-214AB); VRM=60V; IPP=15.5A	
11	DS1-DS5	-	5	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	
12	GND_TP2, SWITCH_CONTROL, VLOGIC	-	3	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
13	GND_TP3-GND_TP7	-	5	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;	
14	GND_TP8, GND_TP10, LOAD, LOAD_2, VDD, VDD_TP1	-	6	6095	KEYSTONE	6095	CONNECTOR; FEMALE; PANELMOUNT; NON-INSULATED RECESSED HEAD BANANA JACK; STRAIGHT THROUGH; 1PIN	
15	J1-J4, J9-J11	-	7	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC	
16	J5-J7	-	3	131-5031-00	TEKTRONIX	131-5031-00	CONNECTOR; WIREMOUNT; 3 GHZ 20X LOW CAPACITANCE PROBE; STRAIGHT; 5PINS	
17	J8	-	1	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	
18	J12	-	1	31-5329-52RFX	AMPHENOL	31-5329-52RFX	CONNECTOR; FEMALE; THROUGH HOLE; BNC 50OHM PCB RECEPTACLE; STRAIGHT; 5PINS	
19	LO, OVERCURRENT, OVER_VOLTAGE, RDY, SNS, TH_WARNING, TP1-TP3, VDD_TP2	-	10	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;	
20	M1	-	1	SI7322DN-T1-GE3	VISHAY	SI7322DN-T1-GE3	TRAN; NCH; MOSFET; POWERPAK1212-8; PD-(52W); I-(18A); V-(100V)	
21	R1	-	1	PRL1632-R012-F	SUSUMU CO LTD	0.012	RES; SMT (0612); 0.012; 1%; 0 TO +200PPM/DEGC; 1W	
22	R2, R3, R8-R10	-	5	CRCW06033K01FK	VISHAY DALE	3.01K	RESISTOR; 0603; 3.01K; 1%; 100PPM; 0.10W; THICK FILM	
23	R4	-	1	TNPU0603100KAZEN00	VISHAY DRALORIC	100K	RESISTOR; 0603; 100K OHM; 0.05%; 5PPM; 0.10W; THIN FILM	
24	SPACER1-SPACER4	-	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	
25	SU1-SU8	-	8	NPC02SXON-RC	SULLINS ELECTRONICS CORP.	NPC02SXON-RC	CONNECTOR; FEMALE; MINI SHUNT; 0.100IN CC; OPEN TOP; JUMPER; STRAIGHT; 2PINS	
26	U1	-	1	MAX14922ATE+	MAXIM	MAX14922ATE+	EVKIT PART-IC; MAX14922ATE+; PACKAGE OUTLINE DRAWING: 21-0136; LAND PATTERN DRAWING: 90-0032	
27	PCB	-	1	MAX14922	MAXIM	PCB	PCB:MAX14922	-
28	CM1, CM2	DNP	0	C0603C102K1GAC; C1608C0G2A102K080AA	KEMET;TDK	1000PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1000PF; 100V; TOL=10%; MODEL=C0G; TG=-55 DEGC TO +125 DEGC; TC=	
29	D2	DNP	0	SMBJ30A	LITTELFUSE	30V	DIODE; TVS; SMB (DO-214AA); VRM=30V; IPP=12.4A	
30	D4	DNP	0	VS-2EFH01-M3	VISHAY	VS-2EFH01-M3	DIODE; SWT; SMT (DO-219AB); PIV=100V; IF=2A	
31	M2	DNP	0	BUK7240-100A	NEXPERIA	BUK7240-100A	TRAN; NCH; TO-252-3; PD-(114W); I-(34A); V-(100V)	
32	R5-R7	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 RESISTOR	
TOTAL			74					

MAX14922 EV Kit Schematic Diagrams
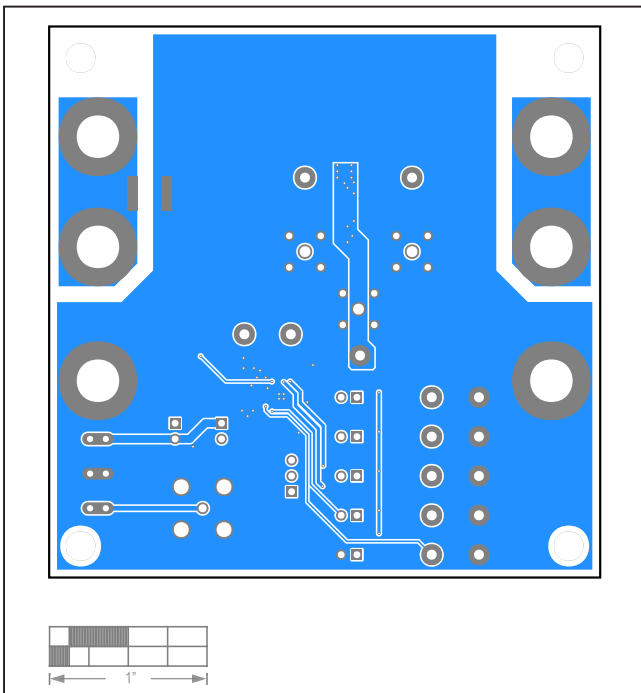
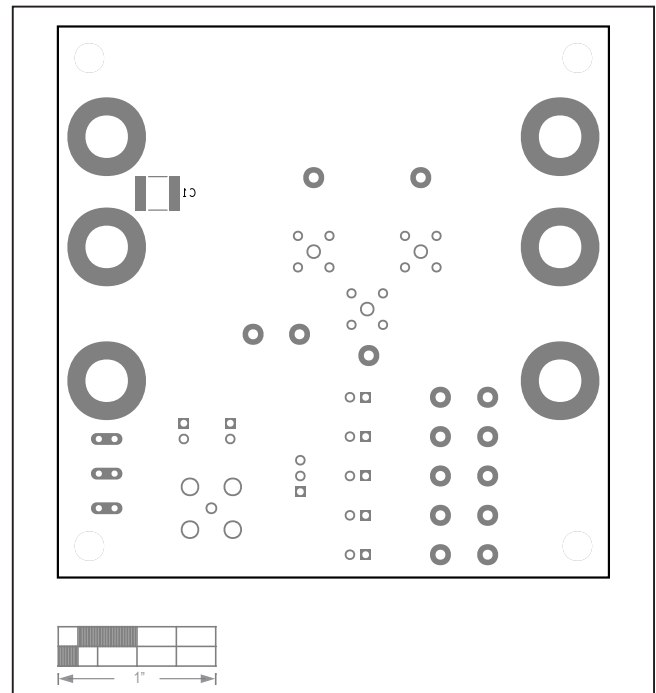## MAX14922 EV Kit PCB Layout Diagrams
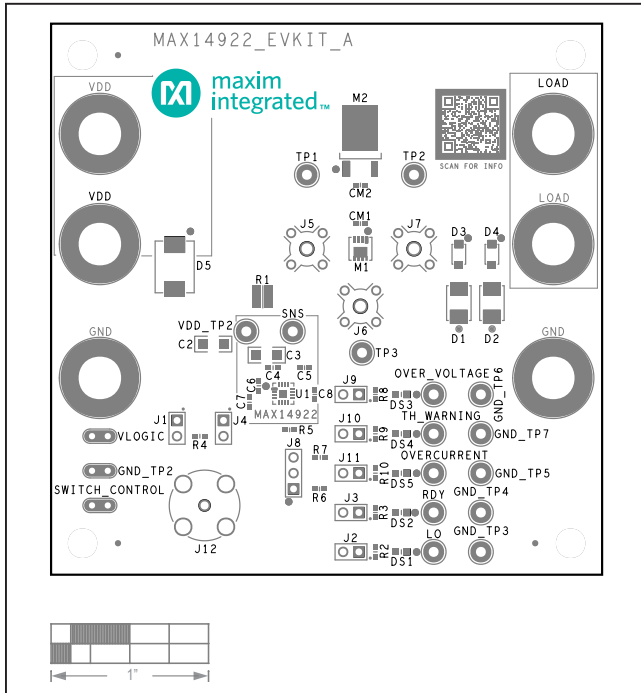
MAX14922 EV Kit PCB Layout—Top Silkscreen
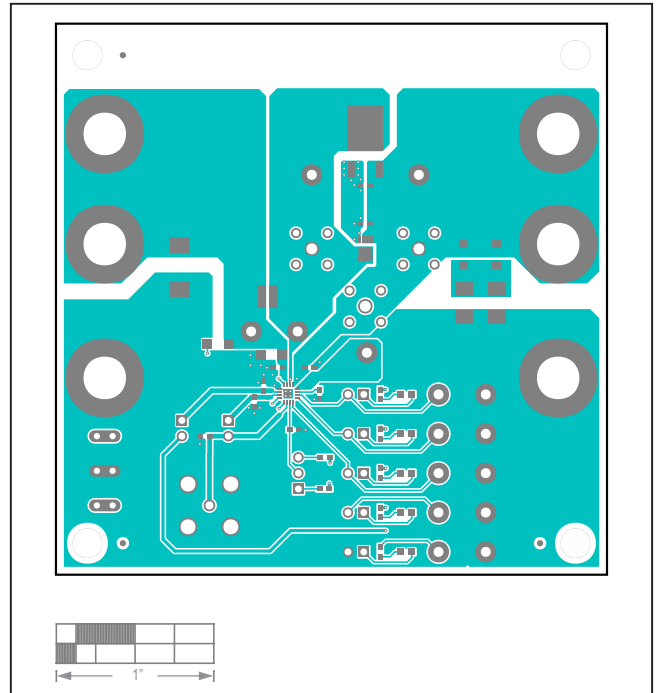
MAX14922 EV Kit PCB Layout—Top View

MAX14922 EV Kit PCB Layout—Bottom View

MAX14922 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/20	Initial release	—
1	6/20	Removed repetitive PCB Assembly diagrams	8–9

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