

## General Description

The MAX15068 evaluation kit (EV kit) provides a proven design to evaluate the MAX15068 dual ORing, single hot-swap controller. The EV kit operates from a 4.8V to 18V range and provides a solution for evaluating two input supply rail applications requiring the safe insertion and removal of circuit line cards from a live backplane. Each rail has an individual ideal diode and is connected to the load through a single hot-swap MOSFET. The EV kit uses the MAX15068ATP+ in a 4mm x 5mm, 20-pin TQFN package on a proven four-layer PCB design.

## Features and Benefits

- 4.8V to 18V Operating Voltage Range
- Banana Jacks for Input and Output Voltage
- Current Monitoring
- Programmable Slew-Rate Control
- Selectable Circuit-Breaker Threshold
- Configurable Undervoltage Lockout
- Adjustable Current-Limit Fault Delay
- FAULT and PG Outputs
- Enable Input
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information appears at end of data sheet.

## Quick Start

### Required Equipment

- MAX15068 EV kit
- Two 4.8V to 18V DC power supplies (PS1, PS2)
- Voltmeter

### Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supply until all connections are completed.**

- 1) Verify that a shunt is installed across jumper JP1.
- 2) Verify that a shunt is installed across pins 1-2 on jumper JP2.
- 3) Turn on power-supply PS1 and set the supply to 12V, then disable the power supply.
- 4) Turn on power-supply PS2 and set the supply to 12V, then disable the power supply.
- 5) Connect the positive terminal of power-supply PS1 to the IN1 banana jack on the EV kit. Connect the negative terminal of the power supply to the GND banana jack.
- 6) Connect the positive terminal of power-supply PS2 to the IN2 banana jack on the EV kit. Connect the negative terminal of the power supply to the GND banana jack.
- 7) Enable the power supplies.
- 8) Verify that the voltage between the OUT and GND banana jacks is 12V.
- 9) The EV kit is now ready for additional evaluation.

### Detailed Description of Hardware

The MAX15068 EV kit provides a proven design to evaluate the MAX15068 dual ORing, single hot-swap controller. The EV kit can be easily connected between two system power inputs and the load using the banana jacks provided for the input and output. PCB pads are provided to monitor and control the device signals. The EV kit operates between 4.8V and 18V.

#### Enable Input ( $\overline{EN}$ )

The device's enable input is controlled by jumper JP1. If a shunt is installed across JP1, a 10 $\mu$ A current source pulls the  $\overline{EN}$  pin up to a diode drop below  $V_S$  and the MOSFETs are not allowed to turn on. With this setting, a test point ( $\overline{EN}$ ) is also provided to drive the  $\overline{EN}$  pin. If no shunt is installed across jumper JP1, the  $\overline{EN}$  pin is forced to GND and hot-swap control is enabled. See [Table 1](#) for JP1 settings.

#### Priority Control Input (PC)

The device features a priority control input pin to give priority to IN1 when the IN1 and IN2 supplies are equal. To enable priority control for IN1, set JP2 to pins 2-3 to connect the IN1 supply to a resistive divider to the PC pin of the device. To disable IN1 priority control and allow the IN2 ideal diode controller to operate normally, connect JP2 to pins 1-2 to connect the PC pin to GND. See [Table 2](#) for JP2 settings.

**Table 1. JP1 Jumper Selection ( $\overline{EN}$ )**

SHUNT POSITION	EN PIN	HOT-SWAP CONTROL
Installed*	Connected to GND	Enabled
Not installed	Internal 10 $\mu$ A pullup	Disabled unless driven low externally

\*Default position.

**Table 2. JP2 Jumper Selection (PC)**

SHUNT POSITION	ON PIN	IN1 PRIORITY CONTROL
1-2	Connected to GND	Disabled
2-3*	Connected to IN1 through resistor-divider R7/R8	Enabled

\*Default position.

#### ON Control Input

Jumper JP3 controls the ON input of the device. By installing a shunt on JP3, the CSP node connects to the ON pin through resistive divider R3/R4. A rising edge above 1.235V on the ON pin turns on the external hot-swap MOSFET and a falling edge below 1.155V turns it off. If no shunt is installed across JP3, the ON pin is pulled to GND through resistor R3 and the EV kit is disabled. See [Table 3](#) and the [Undervoltage Lockout](#) section for JP3 settings.

#### Circuit Breaker (CB)

The device features a programmable current limit with a circuit-breaker function that protects the external MOSFETs against short circuits or excessive load current. The voltage across external sense resistor R51 is monitored by an electronic circuit breaker and active current-limit amplifier. Jumper JP4 sets the current-limit threshold for the internal circuit breaker (CB) of the device. See [Table 4](#) for JP4 settings.

#### Timer Capacitor (CDLY)

Capacitor C4 is used to set the time-out delay for current limit before the external hot-swap MOSFET is turned off at a rate of 12ms/ $\mu$ F, with the duration of the off time set at 617msec/ $\mu$ F. As configured, the EV kit has a current-limit delay of 1.2ms and a turn-off time of 61.7ms.

**Table 3. JP3 Jumper Selection (ON)**

SHUNT POSITION	ON PIN	UVLO
Installed*	Connected to CSP through resistive divider R3/R4	Configured through R3/R4 resistive divider
Not installed	Connected to GND through R3	EV kit disabled

\*Default position.

**Table 4. JP4 Jumper Selection (CB)**

SHUNT POSITION	CB PIN CONNECTED TO	CIRCUIT BREAKER THRESHOLD (mV)
1-2*	VS	65
Not connected	Open	50
2-3	GND	35

\*Default position.

### Setting the Output Slew Rate

An external capacitor (C5) is connected from GATE to GND of the IC to reduce the output slew-rate during startup. During start-up, a 10 $\mu$ A (typ) current is sourced to enhance the MOSFET. C5 can be calculated according to the formula below:

$$C5 = (I_{GATE} \times \Delta t) / \Delta V_{GATE}$$

where  $I_{GATE}$  is 10 $\mu$ A (typ),  $\Delta t$  is the desired rise time, and  $\Delta V_{GATE}$  is the voltage at the source of the hot-swap MOSFET after turn-on is complete.

### Undervoltage Lockout

The EV kit provides an option to configure the undervoltage-lockout threshold when a shunt is installed across jumper

JP3. The undervoltage-lockout threshold for the device is configured by the CSP voltage level, divided by R4 and R3 at the ON pin. By default, the undervoltage-lockout threshold is set to 4.8V.

### Analog Current Monitor Output (IPMON)

The device's IPMON pin has a 0 to 1.7V output voltage range and monitors the system input current that is sensed by the current flowing through sense resistor R51.

The voltage at IPMON is proportional to the input current by the following equation:

$$V_{IPMON} = G_{IM} \times (V_{CSP} - V_{CSN})$$

where  $G_{IM} = 71.565$ .

MAX15068 EV Kit Bill of Materials

ITEM	QTY	REF DES	Var Status	ENUMBER	MFG PART #	MFG	VALUE	DESCRIPTION	STATUS	COMMENTS
1	1	C1- C4,C6,C7,C10,C11,C13	Pref	20-000U1-91	N/A	?	0.1UF	CAPACTOR; SMT (0603); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; MODEL=-; TG=-55 DEGC TO +125 DEGC; TC=X7R; NOT RECOMMENDED FOR NEW DESIGN USE 20-000U1-01	EVKIT-NOT FOR TEST	
2	2	C5	Pref	20-000U15-14	N/A	?	0.015UF	CAPACTOR; SMT; 0603; CERAMIC; 0.015UF; 50V; 10%; X7R; -55degC to +125degC	ACTIVE	
3	2	C8,C9	Pref	20-0100U-01A	N/A	?	100UF	CAPACTOR; SMT (CASE_F); ALUMINUM-ELECTROLYTIC; 100UF; 50V; TOL=20%; MODEL=CE-BS SERIES; TG=40 DEGC TO +85 DEGC	EVKIT-NOT FOR TEST	OPEN
4	1	C12	Pref	20-0100U-01A	N/A	?	100UF	EVKIT USE ONLY; CAPACTOR; SMT (CASE_F); ALUMINUM-ELECTROLYTIC; 100UF; 50V; TOL=20%; MODEL=CE-BS SERIES; TG=40 DEGC TO +85 DEGC	EVKIT-CUSTOM	
5	1	C14	Pref	20-0001U-63	N/A	?	1UF	CAPACTOR; SMT (0603); CERAMIC CHIP; 1UF; 16V; TOL=10%; MODEL=X7R; TG=-55 DEGC TO +125 DEGC; TC=+/-	ACTIVE	
6	1	C15	Pref	20-000U1-03	N/A	?	0.1UF	CAPACTOR; SMT; 0603; CERAMIC; 0.1UF; 28V; 10%; X7R; -55degC to +125degC; +/-15% from -55degC to +125degC; NOT RECOMMENDED FOR NEW DESIGN USE - 20-000U1-01	RECOMMENDED	
7	1	C16	Pref	20-000U1-R1	N/A	?	0.1UF	CAPACTOR; SMT (0603); CERAMIC CHIP; 0.1UF; 6.3V; TOL=10%; MODEL=-; TG=-55 DEGC TO +125 DEGC; TC=X7R; NOT RECOMMENDED FOR NEW DESIGN USE 20-000U1-01	EVKIT-NOT FOR TEST	
8	10	02- CP1,CP2,OG1, CDLY,GATE,IM ON,SENSE	Pref	TPMINI5000-00	5000	?	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	ACTIVE	
9	2	D1,D2	Pref	30-SMAJ17A-3F-00	SMAJ17A-13-F	DIODES INCORPORATED	17V	DIODE; TVS; SMA; PIV=17V; IF=40A; -55 DEGC TO +150 DEGC	EVKIT-NOT FOR TEST	
10	1	D3	Pref	LN1351CTR-30	LN1351CTR	PANASONIC	LN1351CTR	DIODE; LED; J-TYPE SERIES; YELLOWGREEN; SMD; PIV=4.0V; IF=0.015A	EVKIT-NOT FOR TEST	
11	1	D4	Pref	LN1261CTR-00	LN1261CTR	PANASONIC	LN1261CTR	DIODE; LED; GW-TYPE SERIES; RED; SMD; PIV=4.0V; IF=0.015A	EVKIT-NOT FOR TEST	
12	1	E1	Pref	02-57541P-01	575-4	KEYSTONE	575-4	RECEPTACLE; JACK; BANANA; 0.203IN [5.2MM] DIA X 0.218IN [5.5MM] L; 0.203D/0.218L; NICKEL PLATED BRASS	EVKIT-NOT FOR TEST	IN1
13	5	E5,E6,E10,PROBE GND	Pref	02-57541P-01	575-4	KEYSTONE	2501-2-00-80-00-00-07-0	TERMINAL; TURRET; PIN DIA=0.090IN; TOTAL LENGTH=0.328IN; BOARD HOLE=0.094IN; TIN OVER NICKEL MATTE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	EVKIT-NOT FOR TEST	GND
14	1	E3	Pref	02-57541P-01	575-4	KEYSTONE	575-4	RECEPTACLE; JACK; BANANA; 0.203IN [5.2MM] DIA X 0.218IN [5.5MM] L; 0.203D/0.218L; NICKEL PLATED BRASS	EVKIT-NOT FOR TEST	IN2
15	3	E4,E9,GND	Pref	02-57541P-01	575-4	KEYSTONE	575-4	RECEPTACLE; JACK; BANANA; 0.203IN [5.2MM] DIA X 0.218IN [5.5MM] L; 0.203D/0.218L; NICKEL PLATED BRASS	EVKIT-NOT FOR TEST	GND
16	1	E7	Pref	02-57541P-01	575-4	KEYSTONE	575-4	RECEPTACLE; JACK; BANANA; 0.203IN [5.2MM] DIA X 0.218IN [5.5MM] L; 0.203D/0.218L; NICKEL PLATED BRASS	EVKIT-NOT FOR TEST	SENSEP
17	1	E8	Pref	02-57541P-01	575-4	KEYSTONE	575-4	RECEPTACLE; JACK; BANANA; 0.203IN [5.2MM] DIA X 0.218IN [5.5MM] L; 0.203D/0.218L; NICKEL PLATED BRASS	EVKIT-NOT FOR TEST	OUT
18	4	EN,ON,PC,SENSEP	Pref	02-57541P-01	575-4	KEYSTONE	2501-2-00-80-00-00-07-0	TERMINAL; TURRET; PIN DIA=0.090IN; TOTAL LENGTH=0.328IN; BOARD HOLE=0.094IN; TIN OVER NICKEL MATTE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	EVKIT-NOT FOR TEST	
19	2	PG,FAULT	Pref	02-57541P-01	575-4	KEYSTONE	2308-2-00-80-00-00-07-0	TERMINAL; TURRET; PIN DIA=0.061IN; TOTAL LENGTH=0.240IN; BOARD HOLE=0.064IN; TIN OVER NICKEL MATTE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	EVKIT-NOT FOR TEST	

MAX15068 EV Kit Bill of Materials (continued)

ITEM	QTY	REF DES	Var Status	ENUMBER	MFG PART #	MFG	VALUE	DESCRIPTION	STATUS	COMMENTS
20	1	GDRV	Pref	N/A	N/A	?	N/A	TEST POINT: PAD DIA=0.06IN	EVKIT-CUSTOM	
21	1	IN1	Pref	02-2501200800000 0070-00	2501-2-00-80-00-00-07-0	?	2501-2-00-80-00-00-07-0	TERMINAL; TURRET; PIN DIA=0.090IN; TOTAL LENGTH=0.328IN; BOARD HOLE=0.094IN; TIN OVER NICKEL MATTE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	EVKIT-NOT FOR TEST	IN1
22	1	IN2	Pref	02-2501200800000 0070-00	2501-2-00-80-00-00-07-0	?	2501-2-00-80-00-00-07-0	TERMINAL; TURRET; PIN DIA=0.090IN; TOTAL LENGTH=0.328IN; BOARD HOLE=0.094IN; TIN OVER NICKEL MATTE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	EVKIT-NOT FOR TEST	IN2
23	2	JP1,JP3	Pref	PEC02SAAN2 P-21	PEC02SAAN	SULLINS	PEC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS; -65 DEGC TO +125 DEGC	ACTIVE	
24	2	JP2,JP4	Pref	PEC03SAAN3 P-21	PEC03SAAN	SULLINS	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC	ACTIVE	
25	1	OUT	Pref	02-2501200800000 0070-00	2501-2-00-80-00-00-07-0	?	2501-2-00-80-00-00-07-0	TERMINAL; TURRET; PIN DIA=0.090IN; TOTAL LENGTH=0.328IN; BOARD HOLE=0.094IN; TIN OVER NICKEL MATTE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	EVKIT-NOT FOR TEST	OUT
26	2	Q1,Q2	Pref	PSMN2R230Y LC-21	PSMN2R2-30YLC	NXP	PSMN2R2-30YLC	TRAN; N-CHANNEL; 2.15 MILLIOHM LOGIC LEVEL MOSFET; NCH; LFPAK; PD-(141W); I-(100A); V-(30V)	EVKIT-NOT FOR TEST	
27	2	Q3,Q4	Pref	PSMN1R030Y LC-21	PSMN1R0-30YLC	NXP	PSMN1R0-30YLC	TRAN; N-CHANNEL; 1.15 MILLIOHM LOGIC LEVEL MOSFET; NCH; LFPAK; PD-(137W); I-(100A); V-(30V)	EVKIT-NOT FOR TEST	
28	3	R1,R9,R10	Pref	80-0010R-24 N/A	N/A	?	10	RESISTOR; 0603; 10 OHM; 1%; 100PPM; 0.10W; THICK FILM	ACTIVE	
29	1	R2	Pref	80-0047R-24 N/A	N/A	?	47	RESISTOR; 0603; 47 OHM; 1%; 100PPM; 0.10W; THICK FILM	ACTIVE	
30	2	R3,R7	Pref	80-0200K-24 N/A	N/A	?	200K	RESISTOR; 0603; 200K; 1%; 100PPM; 0.10W; THICK FILM	ACTIVE	
31	1	R4	Pref	80-0560K-24 N/A	N/A	?	560K	RESISTOR; 0603; 560K OHM; 1%; 100PPM; 0.10W; THICK FILM	ACTIVE	
32	2	R5,R6	Pref	80-0003K-25 N/A	N/A	?	3K	RESISTOR; 0805; 3K; 1%; 100PPM; 0.125W; THICK FILM	ACTIVE	
33	1	R8	Pref	80-0287K-24 N/A	N/A	?	287K	RESISTOR; 0603; 287K OHM; 1%; 100PPM; 0.10W; METAL FILM	EVKIT-NOT FOR TEST	
34	1	R11	Pref	80-0020K-24 N/A	N/A	?	20K	RESISTOR; 0603; 20K; 1%; 100PPM; 0.10W; THICK FILM	ACTIVE	
35	1	R12	Pref	80-0007K-25 N/A	N/A	?	7K	RESISTOR; 0805; 7K; 1%; 100PPM; 0.125W; THICK FILM	ACTIVE	
36	1	R13	Pref	80-049R9-24 N/A	N/A	?	49.9	RESISTOR; 0603; 49.9 OHM; 1%; 100PPM; 0.10W; THICK FILM	ACTIVE	
37	2	R14,R15	Pref	80-0000R-27 N/A	N/A	?	0	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM	TEMPLEATE	
38	1	RS1	Pref	80-0R003-17 N/A	N/A	?	0.003	RESISTOR; 2010; 0.003 OHM; 1%; 75PPM; 1.0W; METAL FILM	EVKIT-NOT FOR TEST	
39	4	SJP1-SJP4	Pref	JMPFS1100B-02-00	SX1100-B	KYCON	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT; PHOSPHOR BRONZE CONTACT=GOLD PLATED	EVKIT-NOT FOR TEST	
40	4	STANDOFF1- STANDOFF4	Pref	SONA012RNT-00	88333	KEYSTONE	88333	MACHINE FABRICATED; ROUND-STACKING SPACER NO THREAD; : NONE; 1/2IN; NYLON	EVKIT-NOT FOR TEST	
41	1	U1	Pref	MAX15068AT P+	MAX15068	MAXIM	MAX15068	EVKIT PART; IC; DUAL ORING; SINGLE HOT-SWAP CONTROLLER WITH ACCURATE POWER MONITORING	EVKIT-CUSTOM	MAX15068ATP+
42	1		Pref	EPCB15068	PCB	MAXIM	PCB	PCB; EPCB15068		
TOTAL	86									

MAX15068 EV Kit Bill of Materials (continued)

DO NOT PURCHASE									
PACKOUT									
ITEM	QTY	REF DES	ENUMBER	MFG PART #	MFG	VALUE	DESCRIPTION	STATUS	COMMENTS
1	1	PACKOUT	88-00711-SML	88-00711-	N/A	?	BOX:SMALL BROWN 9 3/16"X7"X1 1/4" - PACKOUT	ACTIVE	
2	1	PACKOUT	87-02163-000	87-02163-	N/A	?	ESD BAG:+BAG; STATIC SHIELD ZIP 8"X10"-W/ ESD LOGO	ACTIVE	
3	1	PACKOUT	85-MAXKIT-	MAXKIT-	N/A	?	PINK FOAM;FOAM;ANTI-STATIC PE 12inX12inX5MM - PACKOUT	ACTIVE	
4	1	PACKOUT	EVINSERT	EVINSER	N/A	?	WEB INSTRUCTIONS FOR MAXIM DATA SHEET	ACTIVE	
5	1	PACKOUT	85-84003-006	85-84003-	N/A	?	LABEL(EV KIT BOX) - PACKOUT	ACTIVE	
TOTAL	5								



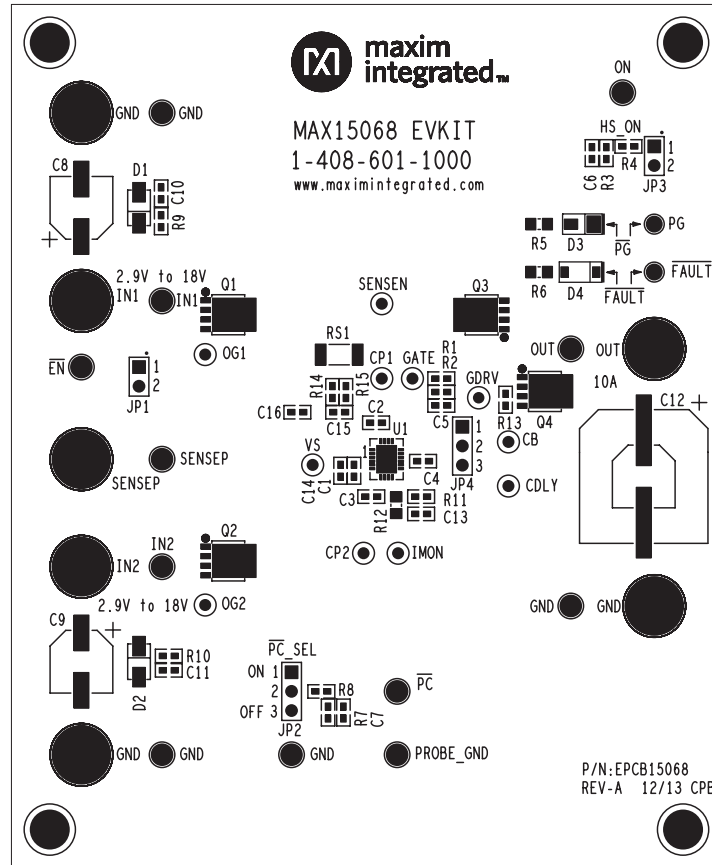


Figure 2. MAX15068 EV Kit Component Placement Guide—Component Side



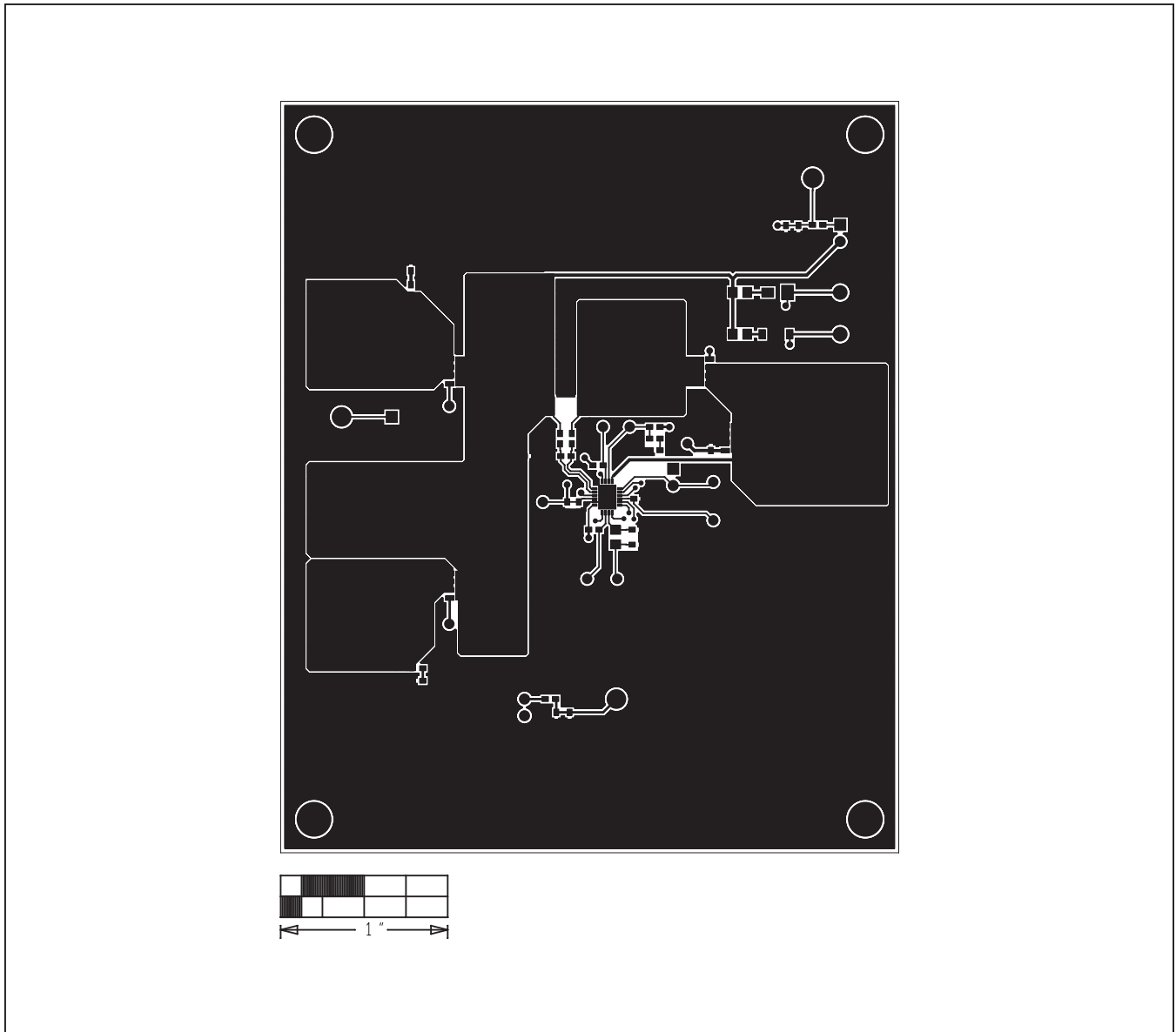


Figure 3. MAX15068 EV Kit PCB Layout—Component Side

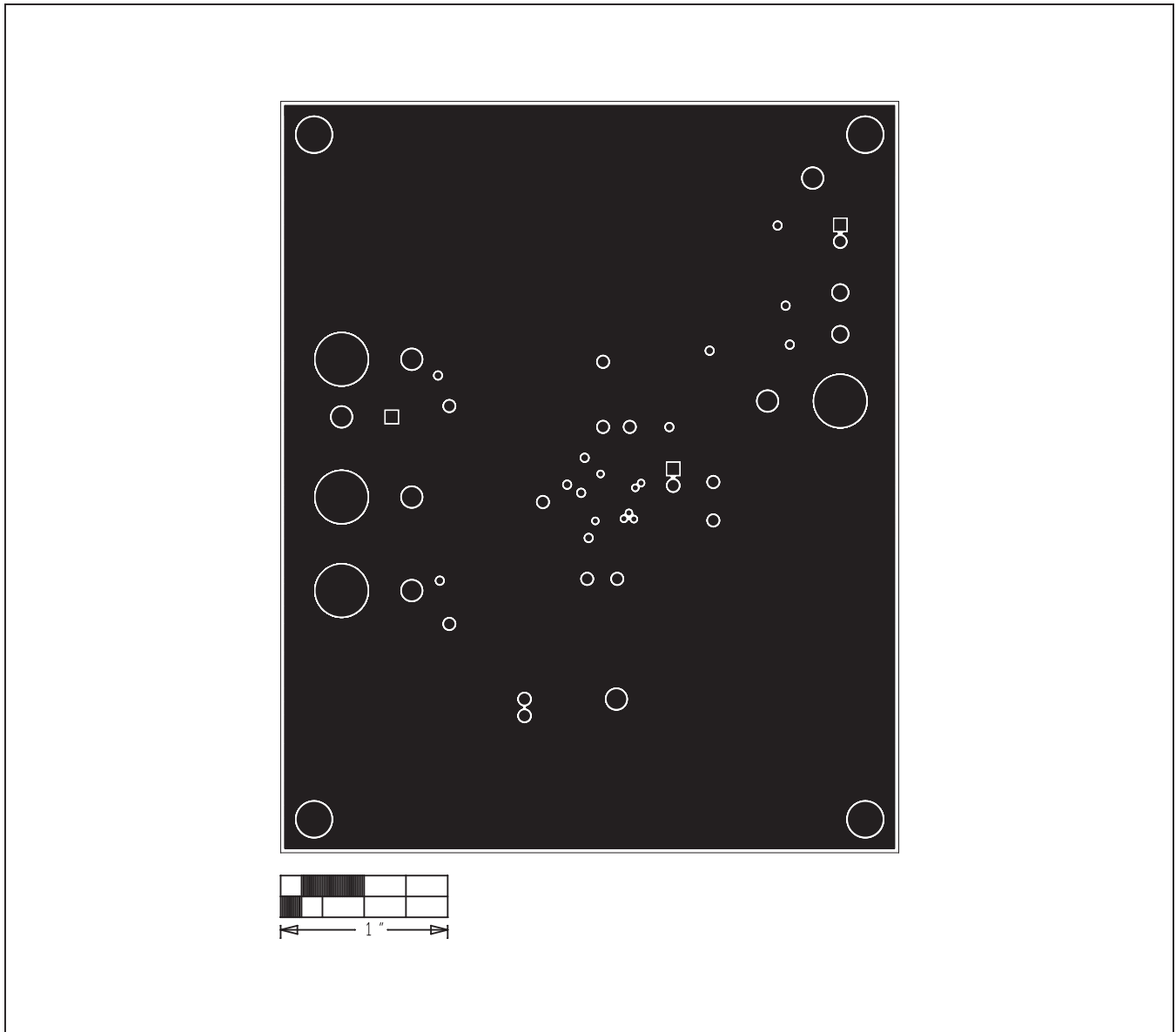


Figure 4. MAX15068 EV Kit PCB Layout—GND Layer 2

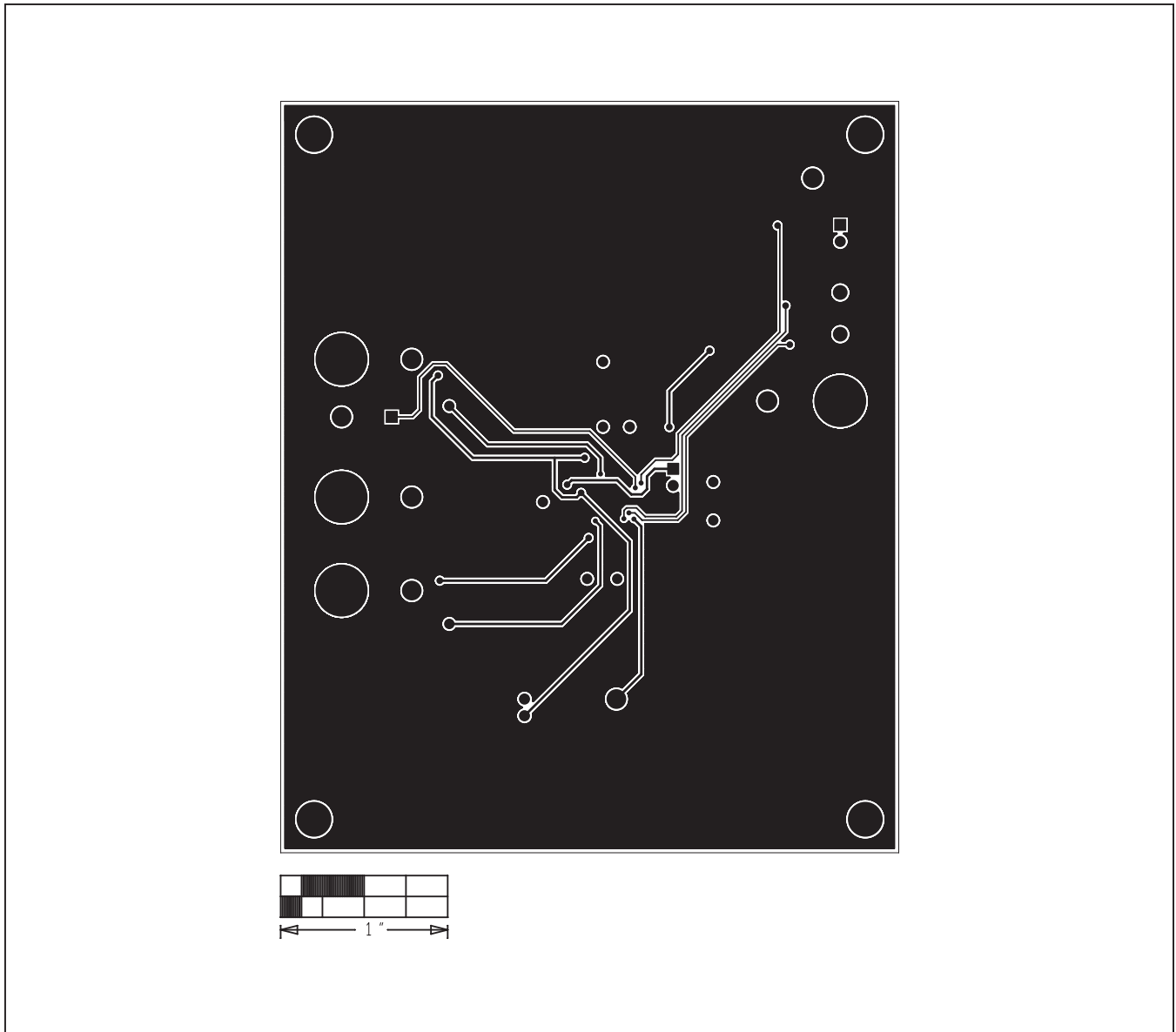


Figure 5. MAX15068 EV Kit PCB Layout—Signal/GND Layer 3

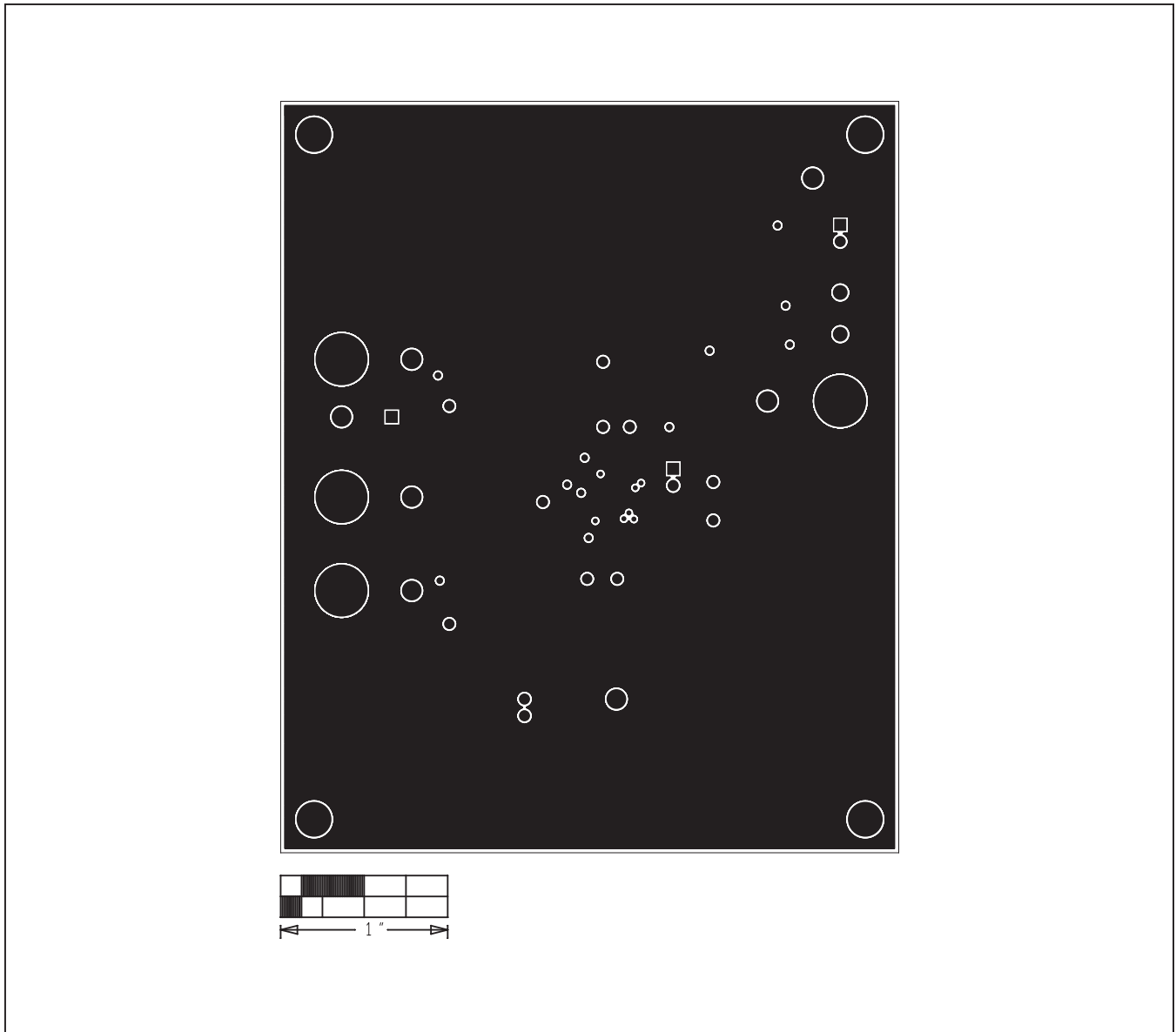


Figure 6. MAX15068 EV Kit PCB Layout—Solder Side

### Ordering Information

PART	TYPE
MAX15068EVKIT#	EV Kit

#Denotes RoHS compliant.

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/14	Initial release	—
1	10/19	Corrected Procedure, equations, and description.	All

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at <https://www.maximintegrated.com/en/storefront/storefront.html>.

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