

## Evaluates: MAX22208

## MAX22208 Evaluation Kit

### General Description

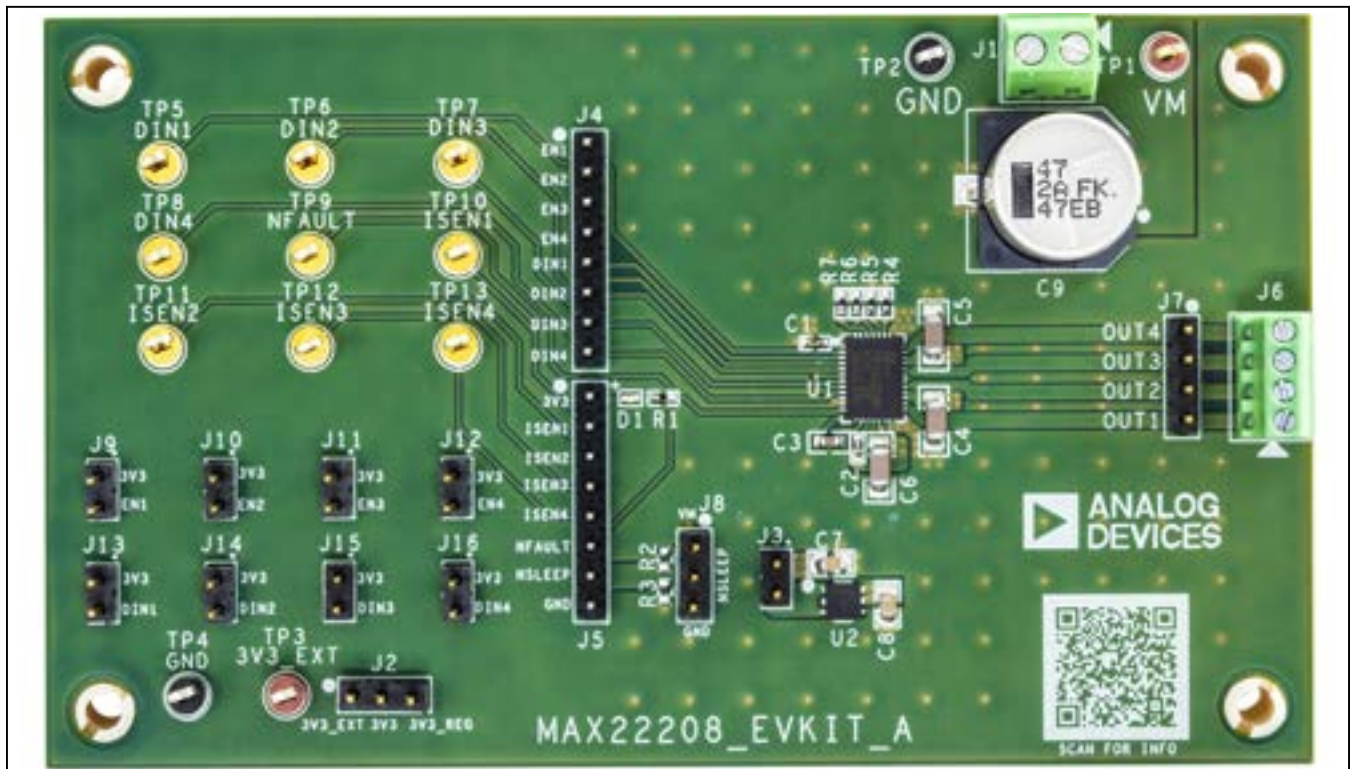
The MAX22208 evaluation kit (EV kit) provides a proven design to evaluate the +65V, 3.8A quad half H-bridge MAX22208 motor drivers. The MAX22208 can drive four solenoids, two brushed DC motors, one single stepper motor, or a combination of different loads. The MAX22208 IC integrates very low impedance FETs in a quad H-bridge configuration with a typical  $R_{ON}$  (high side plus low side) of  $0.3\Omega$ . The EV kit features headers, test points, and terminal blocks to provide an interface to the MAX22208 motor drivers. The MAX22208 integrated current-sense output  $ISEN_{-}$  can be monitored using test points or can be connected to an external ADC using header J5. The MAX22208 EV kit operates from an input voltage of +4.5V to +65V ( $V_M$ ). An on-board +3.3V regulator U2 (MAX6765TTSD2+) provides a regulated +3.3V to drive the MAX22208 logic inputs. Terminal blocks J1 and J6 are installed to provide an interface for the high voltage, high current  $V_M$  inputs and motor driver outputs  $OUT_{-}$ .

### Features

- Easy Evaluation of the MAX22208
- On-Board +3.3V Regulator to Drive the MAX22208 Logic Inputs
- Test Points and Headers to Interface with the MAX22208 Logic Inputs and Current-Sense Outputs
- Fully Assembled and Tested
- Proven PCB Layout

[Ordering Information](#) appears at end of data sheet.

### MAX22208 EV Kit Board



319-101016; Rev 0; 8/23

## Quick Start

### Required Equipment

- MAX22208 EV kit
- +65V DC, 3.8A power supply
- 100kHz square-wave generator (optional)
- Brushed DC motor or load

### Quick Start Procedure

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

- 1) As with all motor drive applications, stopping or braking the motor can cause a back EMF (BEMF) current and voltage spike. At high supply voltages (+65V), this can cause the supply to rise above the absolute maximum allowable voltage to the supply pins of a motor-drive IC. It is highly recommended that the power supply be clamped appropriately to avoid damage to the motor-driver IC.
- 2) Verify that shunts are installed in the default position.
- 3) Connect a +65V supply to  $V_M$  and adjust the  $V_M$  voltage to the desired operating voltage.
- 4) Apply a PWM signal to the  $DIN_$  inputs as desired to drive the load. For example, a +3.3V to 0V, 20kHz PWM signal with a 20% duty cycle can be used to drive a 24V or 48V brushed DC motor connected to outputs 1 and 2. To drive load with current flowing from OUT2 to OUT1,  $DIN1$  is driven to logic low (GND) and the PWM signal is applied to  $DIN2$ .

## Detailed Description of Hardware

### Enable Controls

The MAX22208 enable pins (EN1–EN4) are controlled by installing shunts on headers J9 to J12 or the pins can be connected to a microcontroller using header J4.

### On-Board +3.3V Control

The MAX22208 features an on-board +3.3V LDO that operates from +4.5V to +65V. The input voltage to the LDO is supplied by the  $V_M$  voltage. To provide 3.3V to the MAX22208 logic pins from the LDO, install a shunt in position 2-3 of header J2. An external +3.3V supply can be used, which can be connected to TP3, and in this case, a shunt should be installed in position 1-2 of header J2.

### PWM Controls

Each MAX22208 half H-bridge can be controlled by two logic inputs ( $DIN_$  and  $EN_$ ). The logic input  $DIN_$  can be applied to either headers J4 or J13 to J16, or test points TP5 to TP8. [Table 1](#) describes the behavior of the half H-bridge output pins  $OUT_$  with respect to the input signals  $EN_$  and  $DIN_$ . PWM techniques can be used to control the output duty cycle and implement motor-speed control.

### Current-Sense Output ( $ISEN_$ ) – Current Monitor

Currents proportional to the internally sensed motor current are output to the  $ISEN_$  pins for each  $OUT_$  pin. The current is sensed when one of the four low-side FETs sinks the output current, and it is therefore meaningful when the low-side FET is on. The following equation shows the relationship between the current sourced at  $ISEN_$  and the output current:

$$I_{ISEN}(A) = \frac{I_{OUT}(A)}{K_{ISEN}}$$

$K_{ISEN}$  represents the current scaling factor between the output current and its replica at the  $ISEN_$  pin.  $K_{ISEN}$  is typically 7500A/A. For instance, if the instantaneous output current is 1.8A, the current sourced at  $ISEN_$  is 240μA. By connecting an external signal resistor ( $R_{ISEN}$ ) between  $ISEN_$  and GND, a voltage proportional to the motor current is generated. The EV kit is shipped with 3kΩ resistors ( $R4$  to  $R7$ ) installed from  $ISEN_$  to GND.

**Table 1. MAX22208 Truth Table**

EN <sub>-</sub>	DIN <sub>-</sub>	OUT <sub>-</sub>	DESCRIPTION
0	X	High impedance	Half H-bridge disabled.
1	0	Low	Low-side FET is driven.
1	1	High	High-side FET is driven.

## Default Header Position

The following table describes the default position of the headers to operate the MAX22208 EV kit as described in the [Quick Start Procedure](#) section.

**Table 2. Default Header Position**

HEADER	SHUNT POSITION	DESCRIPTION
J2	1-2	Use external +3.3V supply
	2-3*	Use on-board +3.3V regulator
J3	Not installed	Disable 3.3V voltage regulator
	1-2*	Enable 3.3V voltage regulator
J8	1-2*	Drive $\overline{\text{SLEEP}}$ high to keep the part in wake status
	2-3	Drive $\overline{\text{SLEEP}}$ low to enter lowest power-consumption mode
J9	Not installed	OUT1 disabled
	1-2*	Drive EN1 high to enable OUT1
J10	Not installed	OUT2 disabled
	1-2*	Drive EN2 high to enable OUT2
J11	Not installed	OUT3 disabled
	1-2*	Drive EN3 high to enable OUT3
J12	Not installed	OUT4 disabled
	1-2*	Drive EN4 high to enable OUT4

\*Indicates default position.

## Ordering Information

PART	TYPE
MAX22208EVKIT#	EV Kit

#Denotes RoHS compliance.

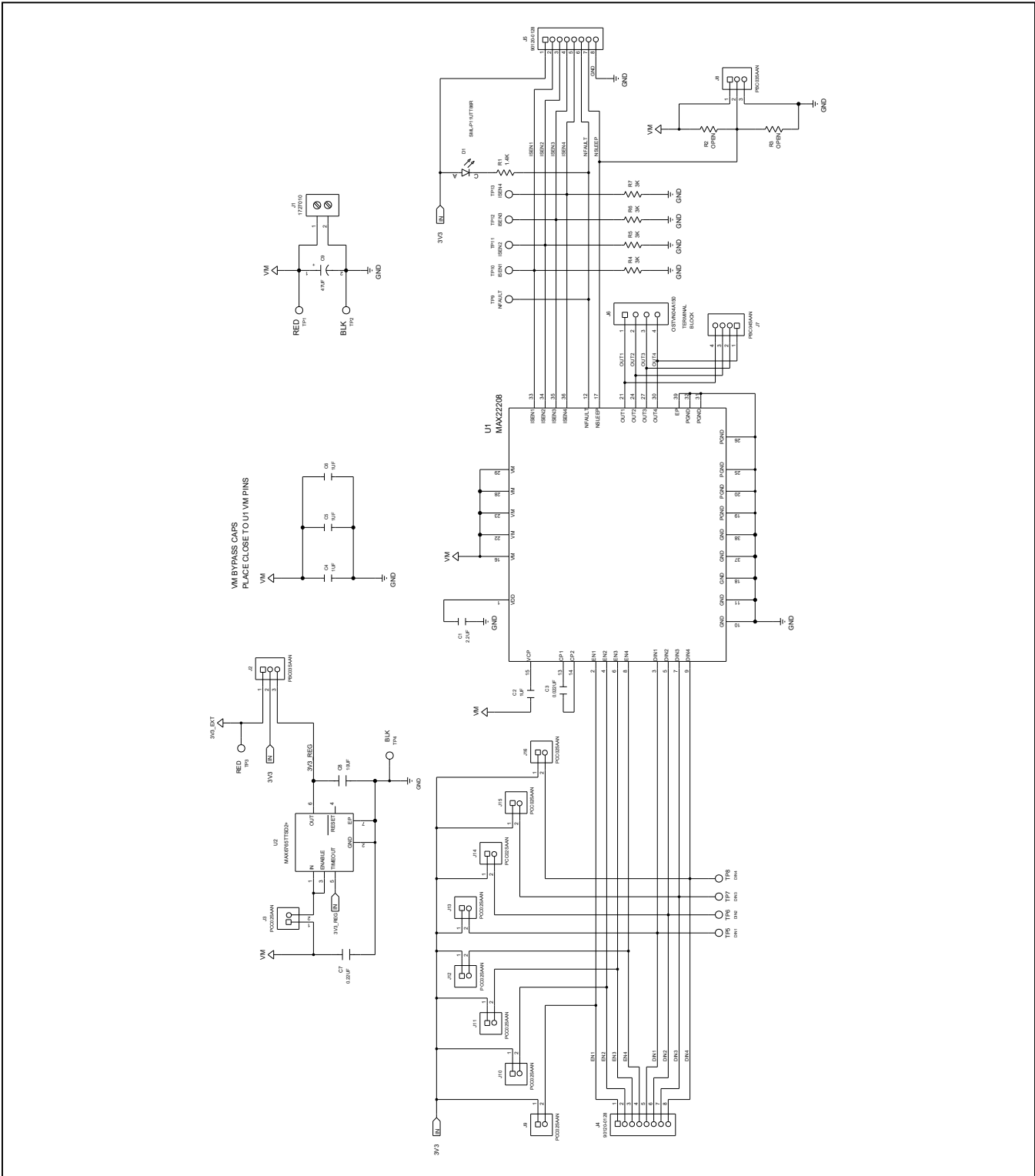
# MAX22208 Evaluation Kit

Evaluates: MAX22208

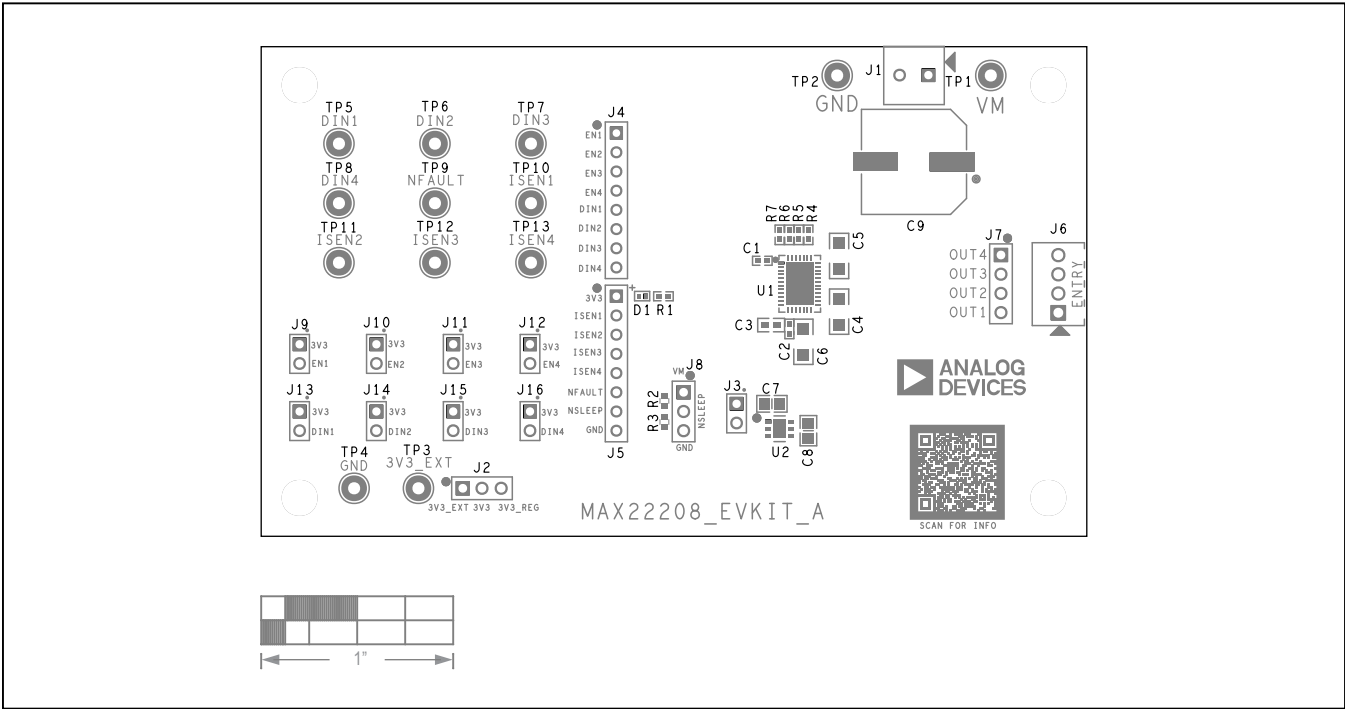
## MAX22208 EV Kit Bill of Materials

ITEM	REF_DES	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1	1	GRM155R61C225KE44; GRM155R61C225KE11	MURATA;MURATA	2.2UF	CAP; SMT (0402); 2.2UF; 10%; 16V; X5R; CERAMIC	
2	C2	1	CL05A105KO5NNN	SAMSUNG	1UF	CAP; SMT (0402); 1UF; 10%; 16V; X5R; CERAMIC	
3	C3	1	CGA3E2XR2A223K080AA	TDK	0.022UF	CAP; SMT (0603); 0.022UF; 10%; 100V; X7R; CERAMIC	
4	C4-C6	3	C3216X7R2A105K160AA; GCH31CR72A105KE01; HMK316B7105KLH	TDK;MURATA;TAIYO YUDEN	1UF	CAP; SMT (1206); 1UF; 10%; 100V; X7R; CERAMIC	
5	C7	1	C0805C224K1RAC; GRM21AR72A224KAC5	KEMET;MURATA	0.22UF	CAP; SMT (0805); 0.22UF; 10%; 100V; X7R; CERAMIC	
6	C8	1	GRM21BR70J106K; C2012X7R0J106K125AB; CGA4J1X7R0J106K125AC	MURATA;TDK;TDK	10UF	CAP; SMT (0805); 10UF; 10%; 6.3V; X7R; CERAMIC	
7	C9	1	EEE-FK2A470AQ	PANASONIC	47UF	CAP; SMT (CASE_H13); 47UF; 20%; 100V; ALUMINUM-ELECTROLYTIC	
8	D1	1	SML-P11UTT86R	ROHM SEMICONDUCTOR	SML-P11UTT86R	DIODE; LED; RED CLEAR; PICOLED; SMT; VF=1.8V; IF=0.001A	
9	J1	1	1727010	PHOENIX CONTACT	1727010	CONNECTOR; FEMALE; THROUGH HOLE; GREEN TERMINAL BLOCK; RIGHT ANGLE; 2PINS	
10	J2, J8	2	PBC03SAAN	SULLINS	PBC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC	
11	J3, J9-J16	9	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC	
12	J4, J5	2	90120-0128	MOLEX	90120-0128	CONNECTOR; THROUGH HOLE; C-GRID III SINGLE ROW STRAIGHT PIN HEADER; STRAIGHT THROUGH; 8PINS	
13	J6	1	OSTVN04A150	ON-SHORE TECHNOLOGY INC	OSTVN04A150	CONNECTOR; TERMINAL BLOCK; FEMALE; THROUGH HOLE; STRAIGHT; 4PINS	
14	J7	1	PBC04SAAN	SULLINS ELECTRONICS CORP.	PBC04SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 4PINS; -65 DEGC TO +125 DEGC	
15	R1	1	CRCW04021K40FK; RC0402FR-071K4L	VISHAY DALE;YAGEO PHICOMP	1.4K	RES; SMT (0402); 1.4K; 1%; +/-100PPM/DEGC; 0.0630W	
16	R4-R7	4	CRCW04023K00FK	VISHAY DALE	3K	RES; SMT (0402); 3K; 1%; +/-100PPM/DEGC; 0.0630W	
17	SPACER1-SPACER4	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	
18	TP1, TP3	2	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;	RED
19	TP2, TP4	2	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;	BLK
20	TP5-TP13	9	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;	
21	U1	1	MAX22208	ANALOG DEVICES	MAX22208	EVKIT PART; IC; MAX22208; 65V 3.8A QUAD HALF H-BRIDGE WITH INTEGRATED CURRENT-SENSE; PACKAGE OUTLINE DRAWING 21-0172; LAND PATTERN DRAWING: 90-0076; PACKAGE CODE: T3857-1C	
22	U2	1	MAX6765TTS2D+	ANALOG DEVICES	MAX6765TTS2D+	IC; VREG; AUTOMOTIVE MICROPOWER LINEAR REGULATOR WITH SUPERVISOR; TDFN6-EP	
23	PCB	1	MAX22208	ANALOG DEVICES	PCB	PCB;MAX22208	-
24	R2, R3	DNP	0	N/A	OPEN	RESISTOR; 0603; OPEN; FORMFACTOR	
TOTAL			51				

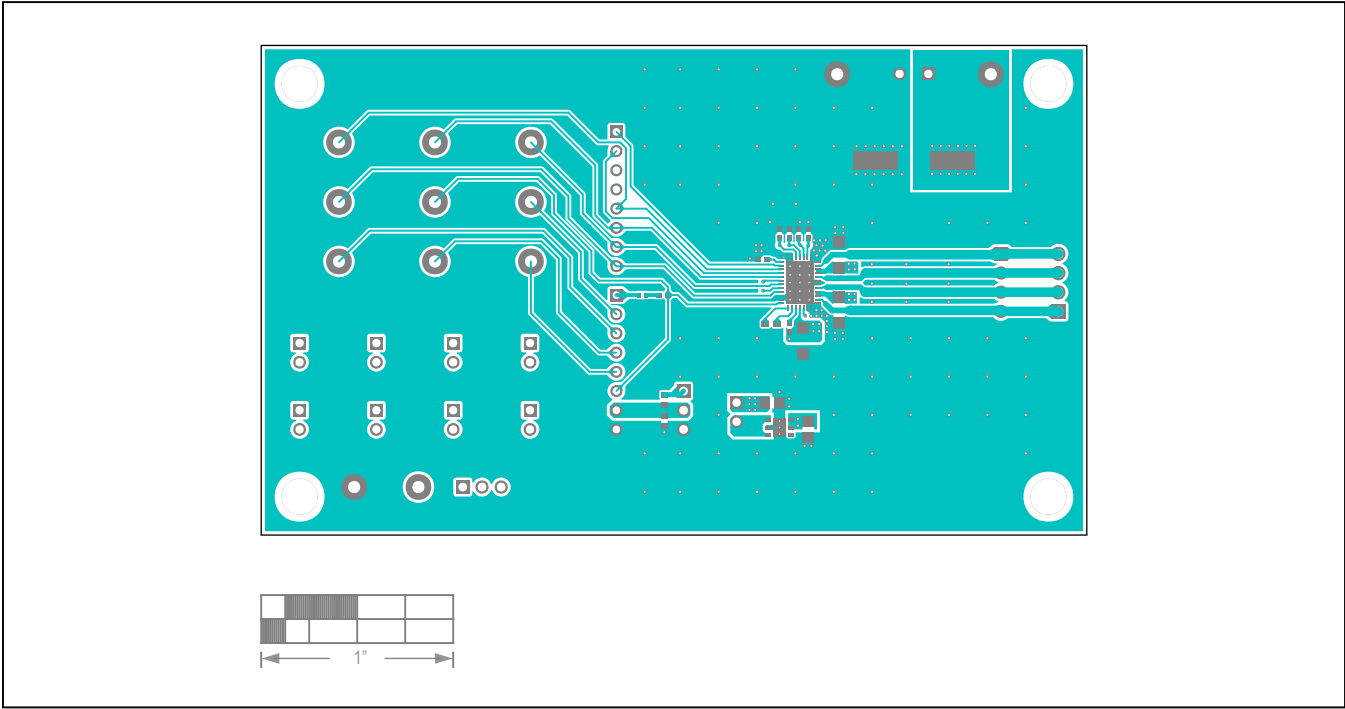
MAX22208 EV Kit Schematic



MAX22208 EV Kit PCB Layouts

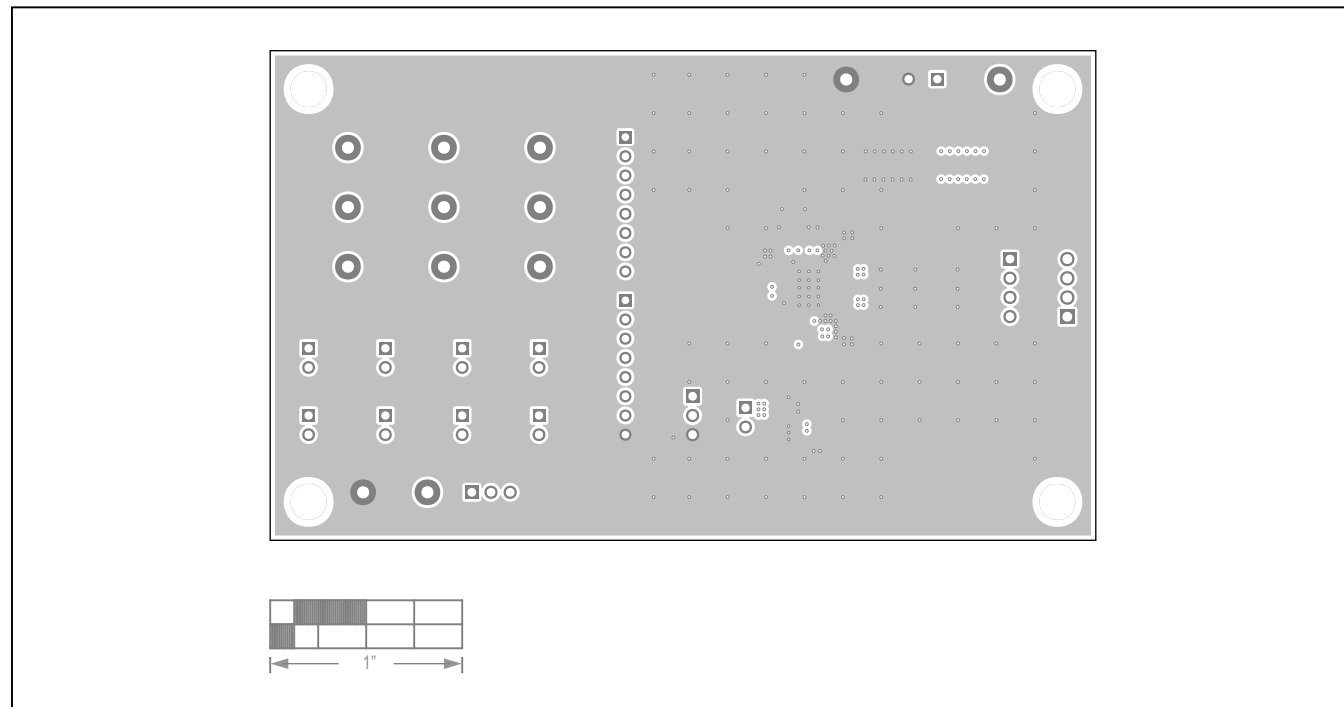


MAX22208 EV Kit—Silkscreen Top Layer

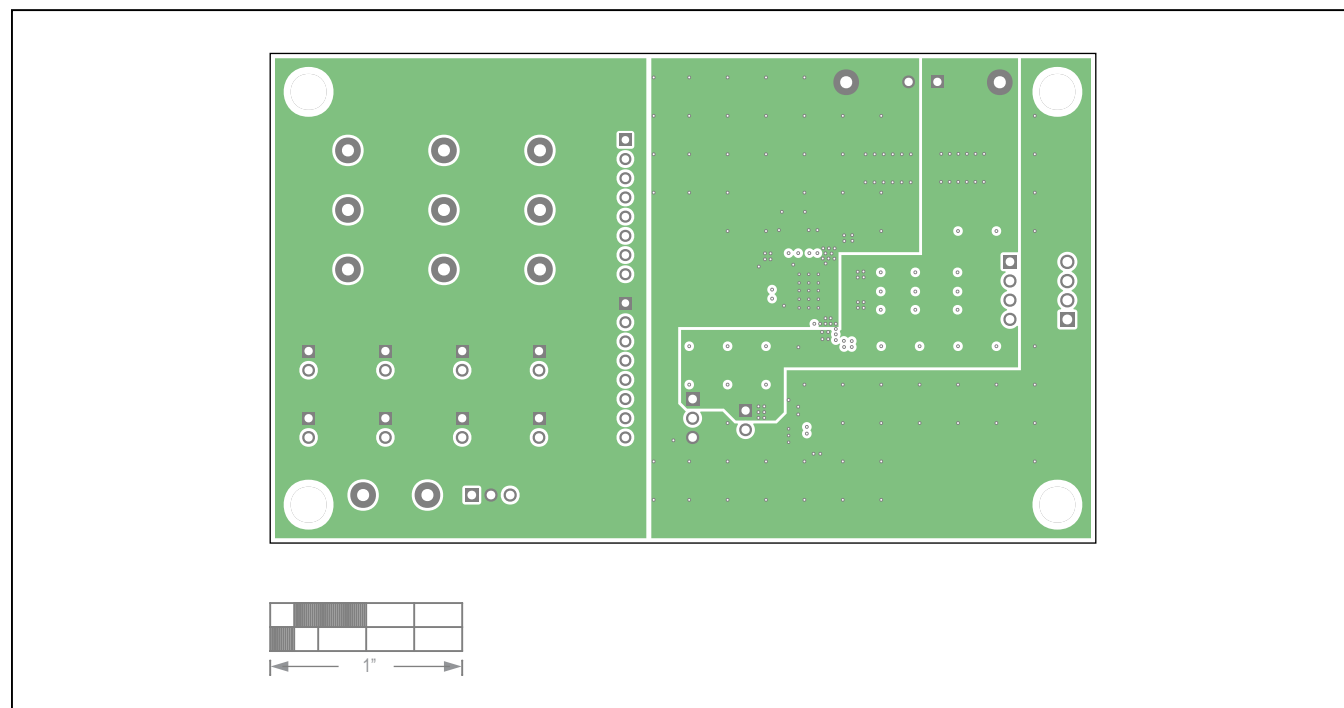


MAX22208 EV Kit—Top Layer

## MAX22208 EV Kit PCB Layouts (continued)

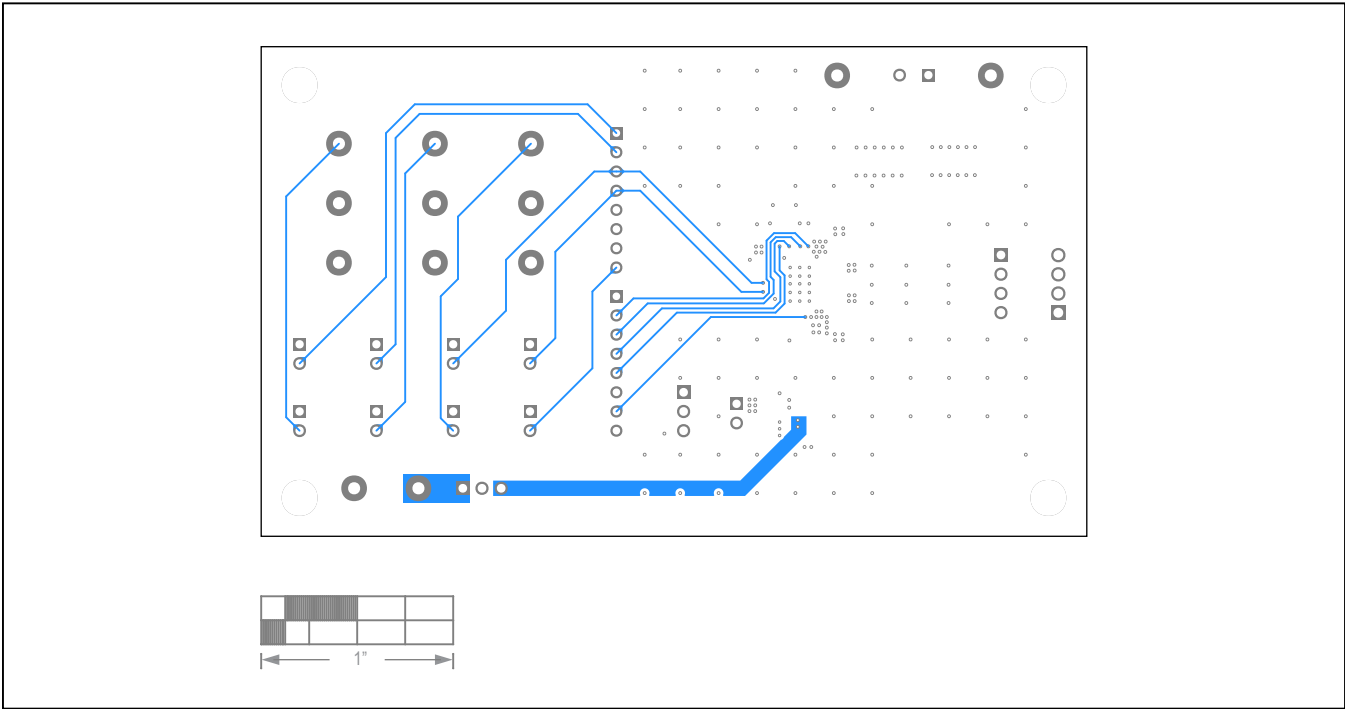


MAX22208 EV Kit—Layer 2

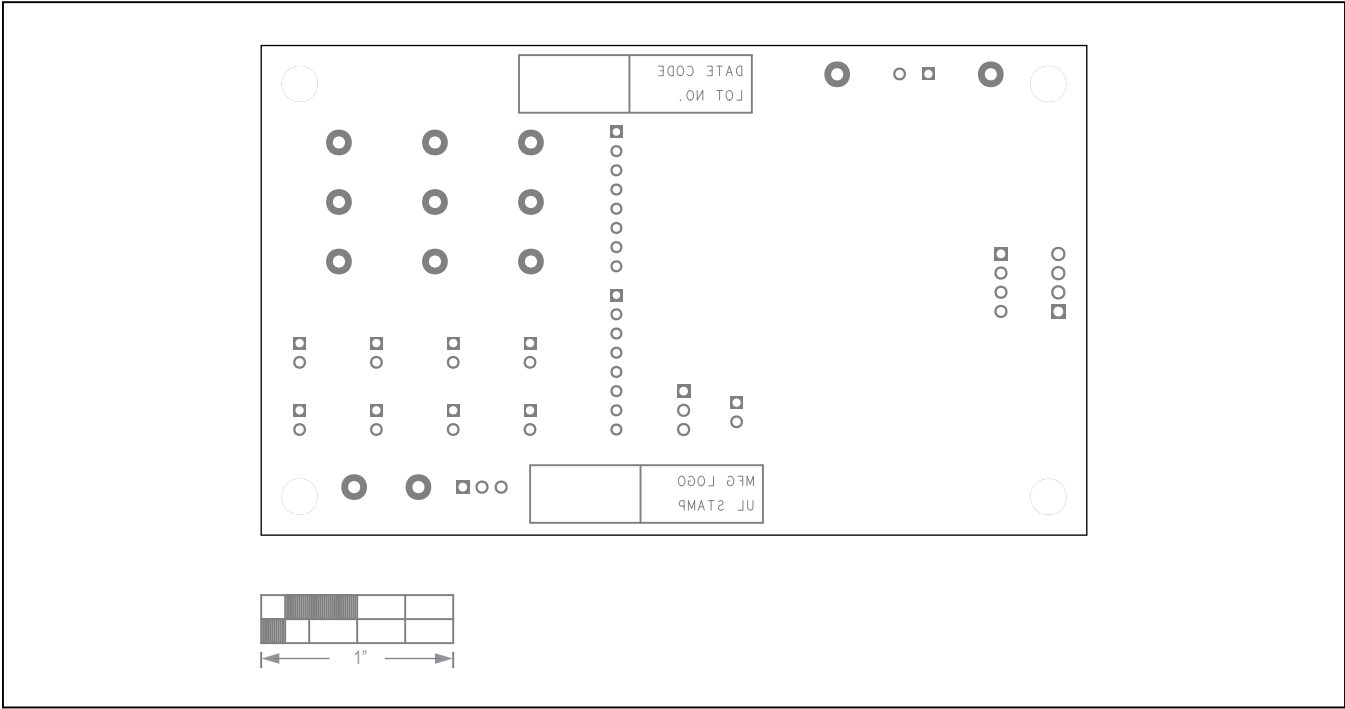


MAX22208 EV Kit—Layer 3

MAX22208 EV Kit PCB Layouts (continued)



MAX22208 EV Kit—Bottom Layer



MAX22208 EV Kit—Silkscreen Bottom Layer



**Revision History**

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/23	Initial release	—



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