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Evaluates: MAX22213

MAX22213 Evaluation Kit

General Description

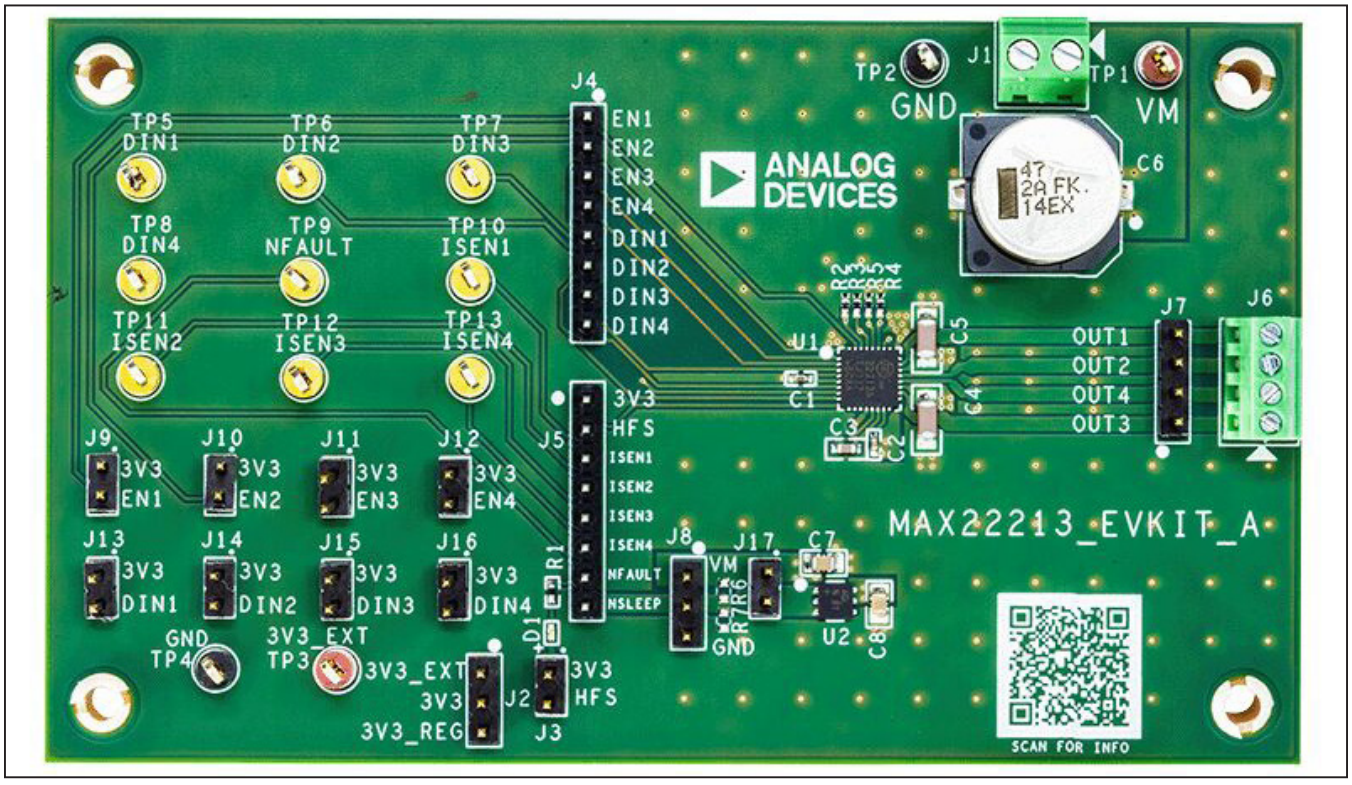
The MAX22213 evaluation kit (EV kit) provides a proven design to evaluate the +36V, 3.8A quad half H-bridge MAX22213 motor drivers. The MAX22213 can drive four solenoids, two brushed DC motors, one single stepper motor, or a combination of different loads. The MAX22213 IC integrates very low-impedance FETs in a quad H-bridge configuration with a typical R_{ON} (high-side plus low-side) of 0.25Ω. The EV kit features headers, test points, and terminal blocks to provide an interface to the MAX22213 motor drivers. The MAX22213 integrated current-sense output ISEN_ can be monitored using test points or can be connected to an external ADC using header J5. The MAX22213 EV kit operates from an input voltage of +4.5V to +36V (V_M). An on-board +3.3V regulator U2 (MAX6765TTSD2+) provides a regulated +3.3V to drive the MAX22213 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 MAX22213
- On-Board +3.3V Regulator to Drive the MAX22213 Logic Inputs
- Test Points and Headers to Interface with the MAX22213 Logic Inputs and Current-Sense Outputs
- Fully Assembled and Tested
- Proven PCB Layout

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

MAX22213 EV Kit Board Photo



319-101015; Rev 0; 8/23

Quick Start

Required Equipment

- MAX22213 EV kit
- +36V 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. Use the following steps 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 (+36V), 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 +36V supply to the 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 brushed DC motor connected to outputs 1 and 2. To drive a 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 MAX22213 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 MAX22213 features an on-board +3.3V LDO that operates from +4.5V to +36V. The input voltage to the LDO is supplied by the V_M voltage. To provide 3.3V to the MAX22213 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 positions 1-2 of header J2.

PWM Controls

Each MAX22213 half H-bridge can be controlled by two logic inputs (DIN_ and EN_) applied to either headers J4 or J13 to J16, or test points TP5 to TP8. Table 1 below 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 when HFS is logic low and 3840A/A when HFS is logic high. For instance, if the instantaneous output current is 1.8A and HFS is logic low, then 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 (R2 to R5) installed from ISEN_ to GND.

Table 1. MAX22213 Truth Table

EN_	DIN_	OUT_	DESCRIPTION
0	X	High-impedance	Half H-bridge is 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 MAX22213 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*	Set HFS to logic low
	1-2	Set HFS to logic high
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
J17	Not installed	Disable 3.3V voltage regulator
	1-2*	Enable 3.3V voltage regulator

**Indicates default position.*

Ordering Information

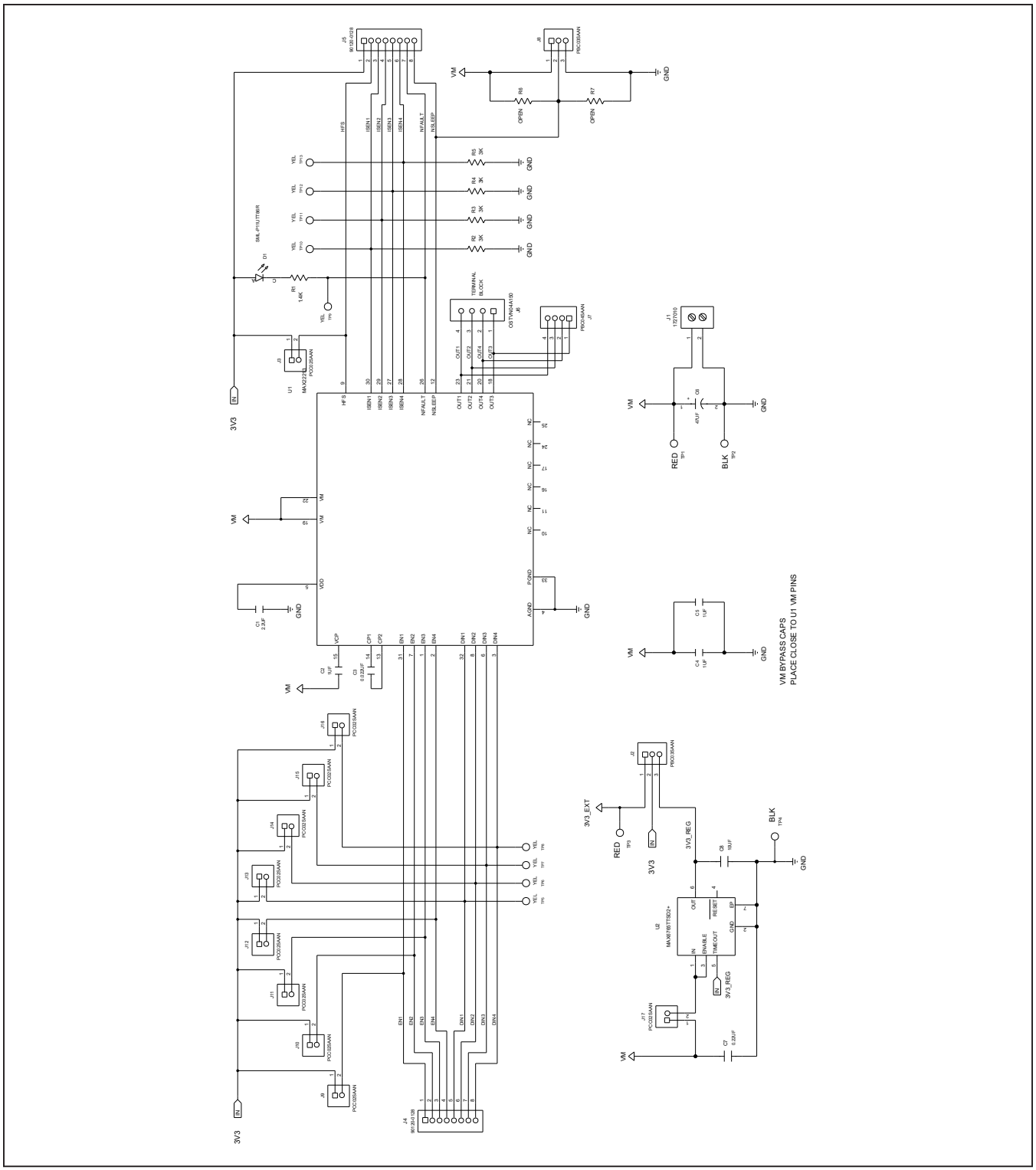
PART	TYPE
MAX22213EVKIT#	EV Kit

#Denotes RoHS compliance.

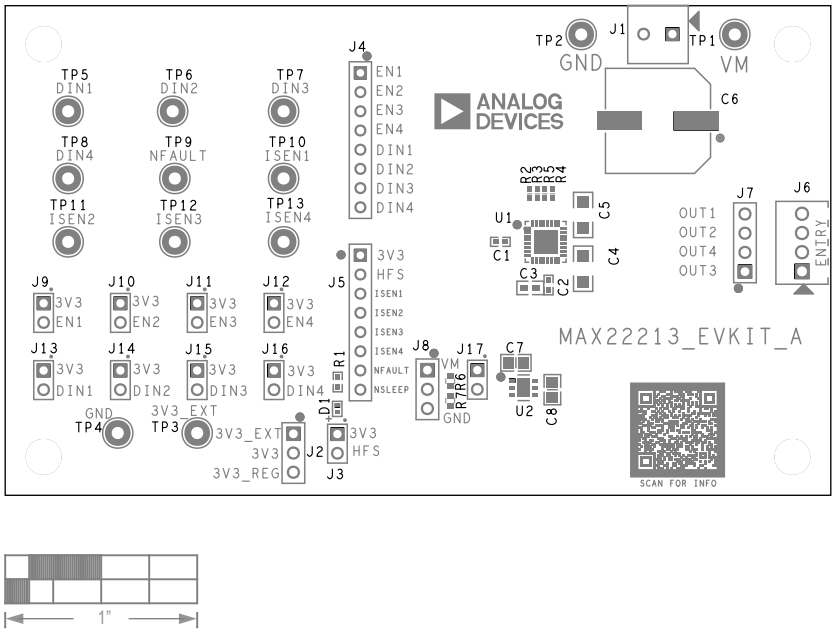
MAX22213 EV Kit Bill of Materials

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	CGA3E2X7R2A223K080AA	TDK	0.022UF	CAP; SMT (0603); 0.022UF; 10%; 100V; X7R; CERAMIC	
4	C4, C5		2	C3216X7R2A105K160AA; GCH31CR72A105KE01; HMK316B7105KLH	TDK;MURATA;TAIYO YUDEN	1UF	CAP; SMT (1206); 1UF; 10%; 100V; X7R; CERAMIC	
5	C6		1	EEE-FK2A470AQ	PANASONIC	47UF	CAP; SMT (CASE_H13); 47UF; 20%; 100V; ALUMINUM-ELECTROLYTIC	
6	C7		1	C0805C224K1RAC; GRM21AR72A224KAC5	KEMET;MURATA	0.22UF	CAP; SMT (0805); 0.22UF; 10%; 100V; X7R; CERAMIC	
7	C8		1	GRM21BR70J106K; C2012X7R0J106K125AB; CGA4J1X7R0J106K125AC	MURATA;TDK;TDK	10UF	CAP; SMT (0805); 10UF; 10%; 6.3V; X7R; CERAMIC	
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-J17		10	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	R2-R5		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;	YEL
21	U1		1	MAX22213	ANALOG DEVICES	MAX22213	EVKIT PART; IC; MAX22213; 36V 3.8A QUAD HALF H-BRIDGE WITH INTEGRATED CURRENT SENSE; PACKAGE OUTLINE DRAWING 21-0140; LAND PATTERN DRAWING: 90-0013; PACKAGE CODE: T3255-8C	
22	U2		1	MAX6765TTSD2+	ANALOG DEVICES	MAX6765TTSD2+	IC; VREG; AUTOMOTIVE MICROPOWER LINEAR REGULATOR WITH SUPERVISOR; TDFN6-EP	
23	PCB		1	MAX22213	ANALOG DEVICES	PCB	PCB:MAX22213	-
24	R6, R7	DNP	0	N/A	N/A	OPEN	RESISTOR; 0603; OPEN; FORMFACTOR	
TOTAL			51					

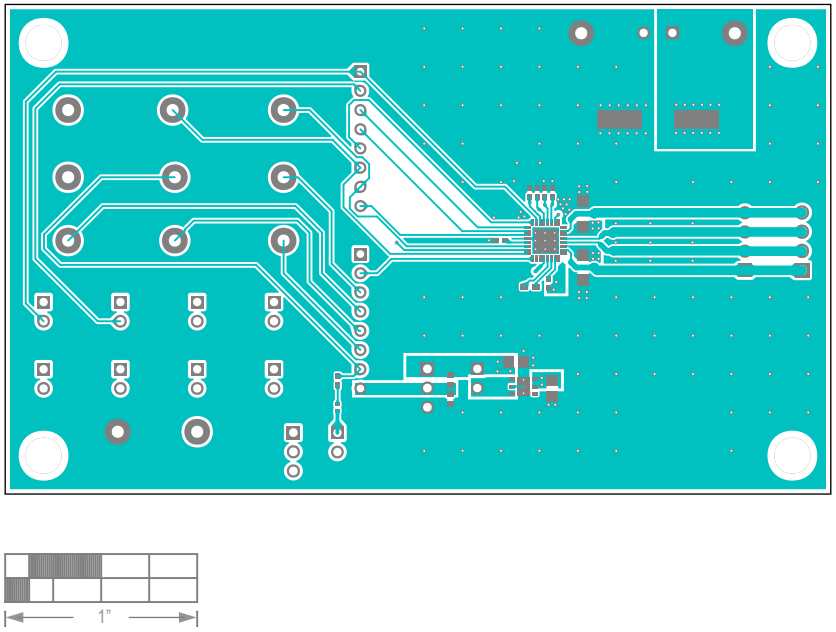
MAX22213 EV Kit Schematic Diagram



MAX22213 EV Kit PCB Layouts

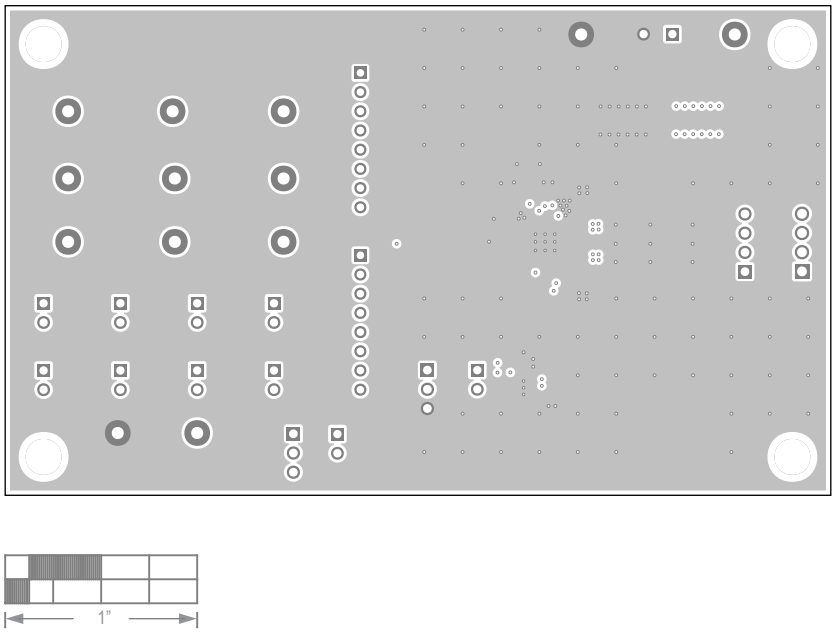


MAX22213 EV Kit—Silkscreen Top Layer

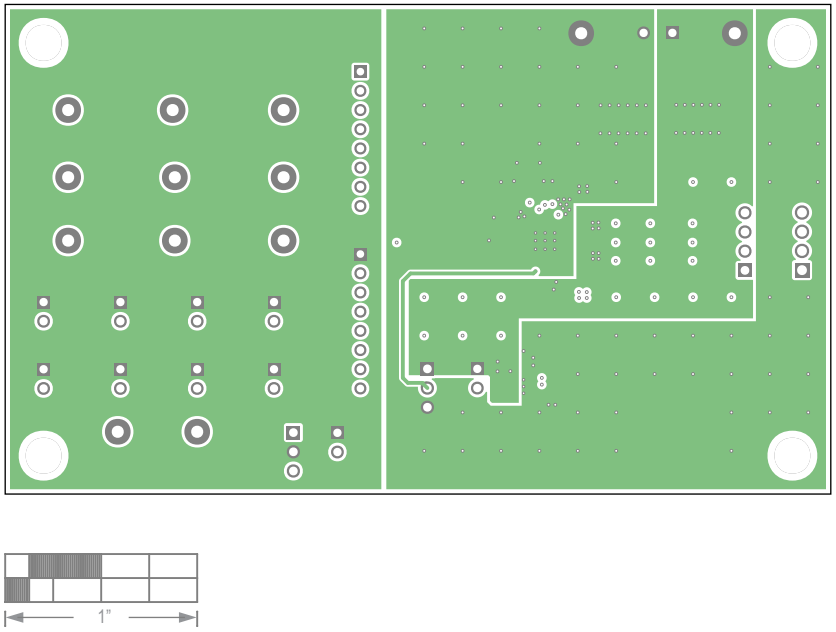


MAX22213 EV Kit—Top Layer

MAX22213 EV Kit PCB Layouts (continued)

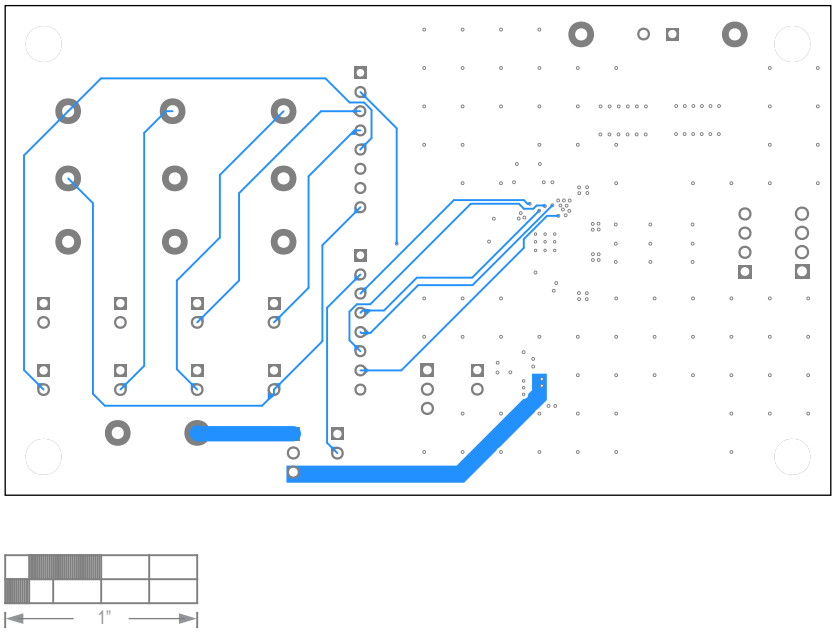


MAX22213 EV Kit—Layer 2



MAX22213 EV Kit—Layer 3

MAX22213 EV Kit PCB Layouts (continued)



MAX22213 EV Kit—Bottom Layer

Revision History

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